

## Appendix C for KSCR230400071303

### 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	910	2022/07/14	2023/07/13
Probe	<input checked="" type="checkbox"/>	14	EX3DV4	7767	2022/10/28	2023/10/27



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

## 1 Dipole

### 1.1 CLA150 - SN 4025

<p>Calibration Laboratory of Schmid &amp; Partner Engineering AG 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; font-size: 8px;"> <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. 217-0320100292)</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: C22962 (20)</td> <td>09-Apr-21 (No. 217-03343)</td> <td>Apr-22</td> </tr> <tr> <td>Type-N mismatch combination</td> <td>SN: 31095 / 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 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; font-size: 8px;"> <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; font-size: 8px;"> <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; font-size: 8px;"> <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; font-size: 8px;"> <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; font-size: 8px;"> <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; font-size: 8px;"> <tbody> <tr> <td>Manufactured by</td> <td>SPEAG</td> </tr> </tbody> </table> <p>Certificate No: CLA150-4025_Apr21      Page 4 of 8</p>	Impedance, transformed to feed point	47.9 Ω ± 1.5 Ω	Return Loss	-31.4 dB	Manufactured 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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Certificate No: CLA150-4025\_Apr21 Page 6 of 6

## 1.2 D450V3 - SN 1103

**Calibration Laboratory of Schmid & Partner Engineering AG**  
 Zeughausstrasse 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 NRP	SN: 104778	09-Apr-21 (No. 217-03021/03030)	Apr-22
Power sensor NRP-291	SN: 103244	09-Apr-21 (No. 217-03021)	Apr-22
Reference 20 dB Attenuator	SN: C2052 (200)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N immersion connection	SN: 310927 / 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. D454-654_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 E4413A	SN: 00010010	06-Apr-16 (in house check Jun-20)	In house check Jun-22
RF generator HP 8648C	SN: US3406010700	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**  
 Zeughausstrasse 43, 8004 Zurich, Switzerland

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

**Measurement Conditions**  
DASY5 system configuration, as far as not given on page 1.

DASY Version	DASY5	V82.10.4
Extrapolation	Advanced Extrapolation	
Phantom	ELJ 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 - 2.6 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

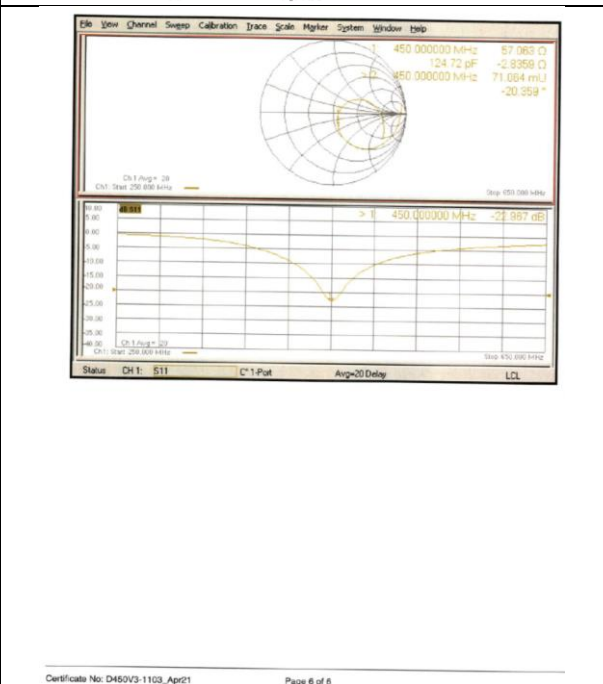
Communication System: UID 0 - CW; Frequency: 450 MHz  
Medium parameters used: f = 450 MHz, α = 0.87 S/m; ε<sub>r</sub> = 43.1; ρ = 1000 kg/m<sup>3</sup>  
Phantom section: Flat Section  
Measurement Standard: DASY5 (IEE/IEC/ANSI C63.19-2011)

**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

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

<p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-82304633-2112 Fax: +86-10-82304633-2504 E-mail: cti@china.ttl.com.cn http://www.china.ttl.com.cn</p> <p>Client: <b>SGS-CN</b> Certificate No: <b>Z22-60103</b></p> <h3>CALIBRATION CERTIFICATE</h3> <p>Object: <b>D750V3 - SN: 1188</b></p> <p>Calibration Procedure(s): <b>FF-Z11-003-01</b> Calibration Procedures for dipole validation kits</p> <p>Calibration date: <b>March 29, 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±1)°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>102277</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: <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 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	102277	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	<p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-82304633-2079 Fax: +86-10-82304633-2504 E-mail: cti@china.ttl.com.cn http://www.china.ttl.com.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>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</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>c) 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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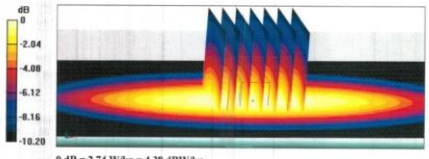
**TTL Speaq** Calibration Laboratory  
 In Collaboration with **CAICT**

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**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 MHz;  $\sigma = 0.888$  S/m;  $\epsilon_r = 41.36$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Right Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(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); SEMCAD X 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



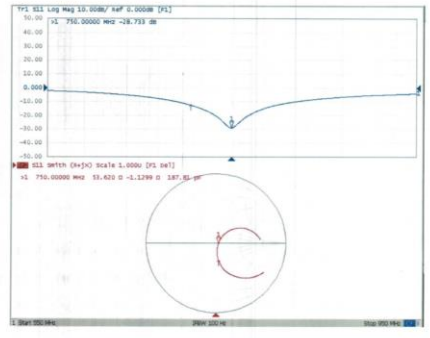
0 dB = 2.74 W/kg = 4.38 dBW/kg

Certificate No: Z22-60103 Page 5 of 6

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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	MY48110673	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.

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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:**  
 a) IEC/IEEE 62208-1528, "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 685664, "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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**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 ± 18.8 % (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)

Certificate No: Z22-60104 Page 3 of 6

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

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	48.70 - 5.22jΩ
Return Loss	-25.3dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.307 ns
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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** Date: 2022-03-31  
 Test Laboratory: CTTL, Beijing, China  
 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

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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;math&gt;70\%&lt;/math&gt;.</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 1956</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 Diqiyuan</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 1956	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: +86-10-42396633-2117 E-mail: cti@china.ttl.com</p> <p>Client: <b>SGS-CN</b> Certificate No: <b>Z22-60184</b></p> <h3>CALIBRATION CERTIFICATE</h3> <p>Object: <b>D900V2 - SN: 1d079</b></p> <p>Calibration Procedure(s): <b>FF-Z11-003-01</b> Calibration Procedures for dipole validation kits</p> <p>Calibration date: <b>June 7, 2022</b></p> <p>The calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). 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E-mail: cti@chinaetl.com

**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 MHz; σ = 0.98 S/m; ε = 42.05; ρ = 1000 kg/m<sup>3</sup>  
 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: dx=5mm, dy=5mm, dz=5mm**  
 Reference Value = 59.81 V/m; Power Drift = -0.01 dB  
 Peak SAR (extrapolated) = 4.20 W/kg  
 SAR(1 g) = 2.78 W/kg; SAR(10 g) = 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

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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CALIBRATION  
CALIBRATION  
CNAS L870

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.JX3-7307_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	MY48110973	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 Dianyan, SAR Project Leader

Issued: April 6, 2022  
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Certificate No: Z22-60105 Page 1 of 6

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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:**  
 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%.

Certificate No: Z22-60105 Page 2 of 6



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<p><b>TTL Speaq</b> CALIBRATION LABORATORY          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@china.ttl.com http://www.chinatst.com</p> <p><b>Measurement Conditions</b>          DASYS 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>1800 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><th></th><th>Temperature</th><th>Permittivity</th><th>Conductivity</th></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>40.8 ± 8 %</td><td>1.41 mho/m ± 8 %</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>9.73 W/kg</td></tr> <tr><td>SAR for nominal Head TSL parameters</td><td>normalized to 1W</td><td>38.9 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>5.11 W/kg</td></tr> <tr><td>SAR for nominal Head TSL parameters</td><td>normalized to 1W</td><td>20.4 W/kg ± 18.7 % (k=2)</td></tr> </table> <p>Certificate No: Z22-60105 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	1800 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	40.8 ± 8 %	1.41 mho/m ± 8 %	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	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)	<p><b>TTL Speaq</b> CALIBRATION LABORATORY          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@china.ttl.com http://www.chinatst.com</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>47.90-2.54jΩ</td></tr> <tr><td>Return Loss</td><td>-29.4dB</td></tr> </table> <p><b>General Antenna Parameters and Design</b></p> <table border="1"> <tr><td>Electrical Delay (one direction)</td><td>1.116 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 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> <table border="1"> <tr><td>Manufactured by</td><td>SPEAG</td></tr> </table> <p>Certificate No: Z22-60105 Page 4 of 6</p>	Impedance, transformed to feed point	47.90-2.54jΩ	Return Loss	-29.4dB	Electrical Delay (one direction)	1.116 ns	Manufactured by	SPEAG
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<p><b>TTL Speaq</b> CALIBRATION LABORATORY          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@china.ttl.com http://www.chinatst.com</p> <p><b>DASY5 Validation Report for Head TSL</b> 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: DASY5 (IEEE/ANSI C63.19-2007)          DASY5 Configuration:</p> <ul style="list-style-type: none"> <li>Probe: EX3DV4 - SN7307; ConvF(8.34, 8.34, 8.34) @ 1800 MHz; Calibrated: 2021-05-26</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 P51 Cx; Serial: 1062</li> <li>DASY52 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>          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</p> <p>0 dB = 15.2 W/kg = 11.82 dBW/kg</p> <p>Certificate No: Z22-60105 Page 5 of 6</p>	<p><b>TTL Speaq</b> CALIBRATION LABORATORY          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@china.ttl.com http://www.chinatst.com</p> <p><b>Impedance Measurement Plot for Head TSL</b></p> <p>Certificate No: Z22-60105 Page 6 of 6</p>																																																												



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

## 1.7 D1900V2 - SN 5d136

<p>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-42204633-2117 E-mail: vt@ttslab.com</p> <p>Client: <b>SGS-CN</b> Certificate No: <b>Z22-60185</b></p> <h3>CALIBRATION CERTIFICATE</h3> <p>Object: D1900V2 - SN: 5d136</p> <p>Calibration Procedure(s): FF-Z11-003-01 Calibration Procedures for dipole validation kits</p> <p>Calibration date: June 7, 2022</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 (23±)°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 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"> <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</p> <p>Reviewed by: Lin Hao, SAR Test Engineer</p> <p>Approved by: Qi Diaryuan, SAR Project Leader</p> <p>Issued: June 13, 2022</p> <p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> <p>Certificate No: Z22-60185 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 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	<p>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-42204633-2117 E-mail: vt@ttslab.com</p> <p>Glossary: TSL: tissue simulating liquid ConvF: sensitivity in TSL / NORMx.y.z NA: 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 865984, "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: • Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. 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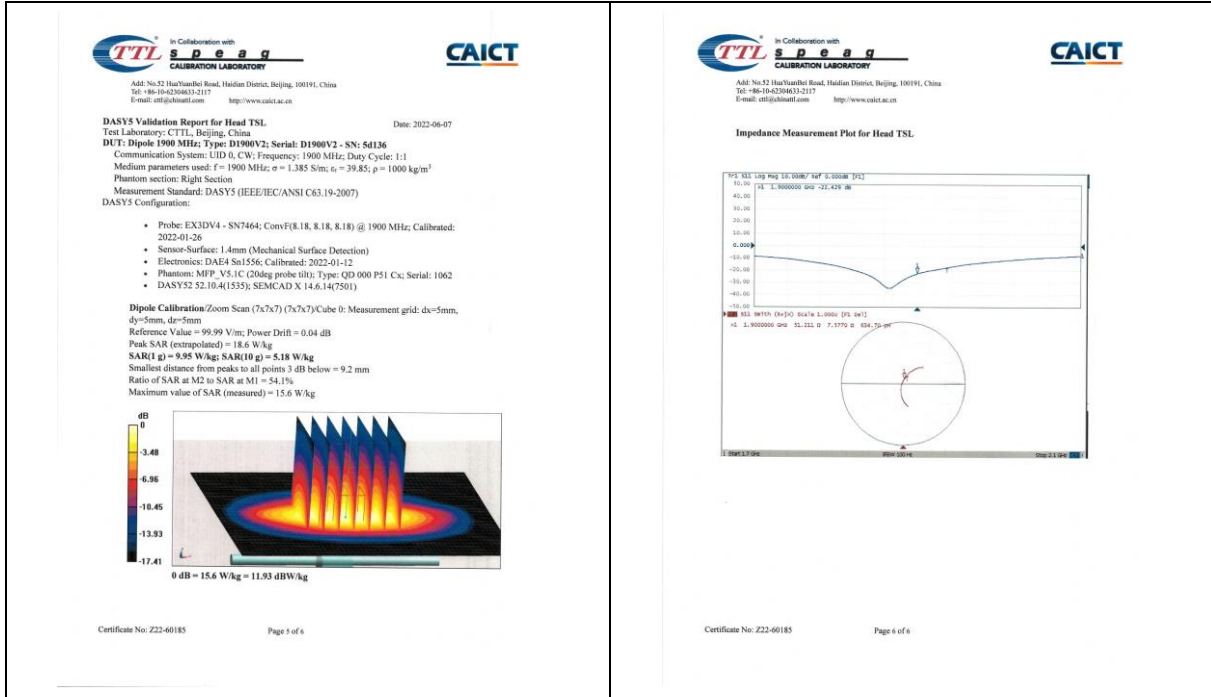


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## 1.8 D2000V2 - SN 1041

<p>Client: <b>SGS-CN</b> Certificate No: <b>Z22-60186</b></p> <p><b>CALIBRATION CERTIFICATE</b></p> <p>Object: D2000V2 - SN: 1041</p> <p>Calibration Procedure(s): FF-Z11-003-01 Calibration Procedures for dipole validation kits</p> <p>Calibration date: June 6, 2022</p> <p>This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (8). 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±)°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 (CITL No. J21X06326)</td> <td>Sep-22</td> </tr> <tr> <td>Power sensor NRP5S</td> <td>104291</td> <td>24-Sep-21 (CITL No. J21X06326)</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>DAEA</td> <td>SN 1556</td> <td>12-Jan-22 (CITL-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>MY49071430</td> <td>13-Jan-22 (CITL No. J22X00409)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyzer E5071C</td> <td>MY48110673</td> <td>14-Jan-22 (CITL No. J22X00406)</td> <td>Jan-23</td> </tr> </tbody> </table> <p>Calibrated by: Zhao Jing, SAR Test Engineer</p> <p>Reviewed by: Lin Hao, SAR Test Engineer</p> <p>Approved by: Qi Dianyuan, SAR Project Leader</p> <p>Issued: June 13, 2022</p> <p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> <p>Certificate No: Z22-60186 Page 1 of 6</p>	Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Power Meter NRP2	106277	24-Sep-21 (CITL No. J21X06326)	Sep-22	Power sensor NRP5S	104291	24-Sep-21 (CITL No. J21X06326)	Sep-22	Reference Probe EX3DV4	SN 7464	26-Jan-22 (SPEAG No. EX3-7464-Jan22)	Jan-23	DAEA	SN 1556	12-Jan-22 (CITL-SPEAG No. Z22-60007)	Jan-23	Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Signal Generator E4438C	MY49071430	13-Jan-22 (CITL No. J22X00409)	Jan-23	Network Analyzer E5071C	MY48110673	14-Jan-22 (CITL No. J22X00406)	Jan-23	<p>Glossary:</p> <p>TSL: Issue simulating liquid</p> <p>ConvF: sensitivity in TSL / NCRMx.y.z</p> <p>N/A: not applicable or not measured</p> <p>Calibration is Performed According to the Following Standards:</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>Additional Documentation:</p> <p>c) DASY4/5 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. 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 (86-512)57355888 (86-512)57370818 sgs.china@sgs.com

In Collaboration with **TTL S P E A G** CALIBRATION LABORATORY and **CAICT**

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

**Measurement Conditions**  
DASY 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	2000 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	40.2 ± 0.5 %	1.39 mho/m ± 0.5 %
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	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)

Certificate No: Z22-60186 Page 3 of 6

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**Appendix (Additional assessments outside the scope of CNAS L6570)**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	48.4Ω ± 0.74jΩ
Return Loss	-34.9dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.088 ns
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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 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.

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** Date: 2022-06-06

Test Laboratory: CCTL, Beijing, China  
DUT: Dipole 2000 MHz; Type: D2000V2; Serial: D2000V2 - SN: 1041  
Communication System: UFD 0; CW; Frequency: 2000 MHz; Duty Cycle: 1:1  
Medium parameters used: f = 2000 MHz; σ = 1.392 S/m; ε<sub>r</sub> = 40.21; ρ = 1000 kg/m<sup>3</sup>  
Phantom section: Right Section  
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(R,2, 8,2) @ 2000 MHz; Calibrated: 2022-01-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DA64 Sn1556; Calibrated: 2022-01-12
- Phantom: MFP\_V5.1C (20dkg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52: S2.10.4(1555); SEMCAD X 14.6.14(7501)

**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7) Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm**  
Reference Value = 103.4 V/m; Power Drift = 0.03 dB  
Peak SAR (extrapolated) = 19.6 W/kg  
SAR(1g) = 10.4 W/kg; SAR(10g) = 5.3 W/kg  
Smallest distance from peaks to all points 3 dB below = 9.1 mm  
Ratio of SAR at M2 to SAR at M1 = 53.6%  
Maximum value of SAR (measured) = 16.3 W/kg

Certificate No: Z22-60186 Page 5 of 6

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**Impedance Measurement Plot for Head TSL**

Certificate No: Z22-60186 Page 6 of 6



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

## 1.9 D2300V2 - SN 1096

<p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191 Tel: +86-10-42304633-2512 Fax: +86-10-42304633-2504 E-mail: cti@china.ttl.com.cn http://www.china.ttl.com.cn</p> <p>Client: <b>SGS-CN</b> Certificate No: <b>Z22-60106</b></p> <h3>CALIBRATION CERTIFICATE</h3> <p>Object: <b>D2300V2 - SN 1096</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 (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>108277</td> <td>24-Sep-21 (CTTL No.J21X08328)</td> <td>Sep-22</td> </tr> <tr> <td>Power sensor NRP8S</td> <td>104291</td> <td>24-Sep-21 (CTTL No.J21X08328)</td> <td>Sep-22</td> </tr> <tr> <td>Reference Probe EX30/VA</td> <td>SN 7307</td> <td>26-May-21 (SPEAG.No.EK3-7307_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.J22X00406)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyzer E5071C</td> <td>MY46110673</td> <td>14-Jan-22 (CTTL No.J22X00406)</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 Diaryuan</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: Z22-60106 Page 1 of 6</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	<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.cn http://www.china.ttl.com.cn</p> <p>Client: <b>SGS-CN</b> Certificate No: <b>Z22-60106</b></p> <h3>Glossary:</h3> <p>TSL: Issue simulating liquid ConvF: sensitivity in TSL / NCRMx,y,z 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>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 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 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. 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: Z22-60106 Page 2 of 6</p>																												
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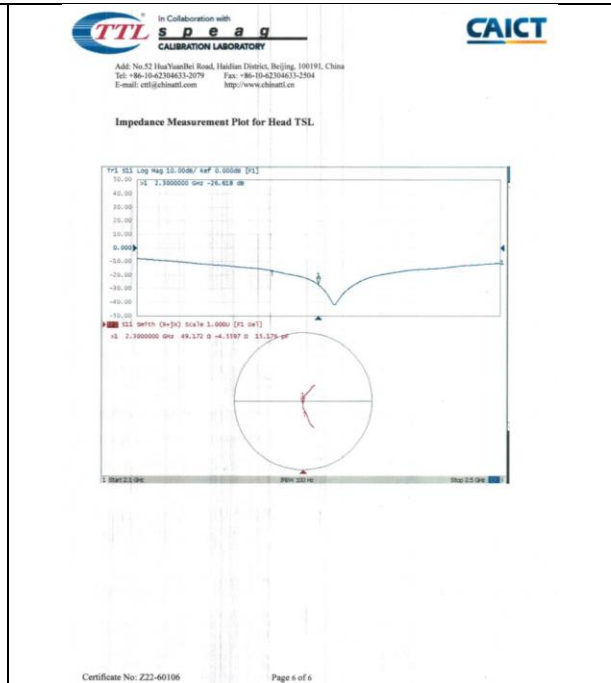
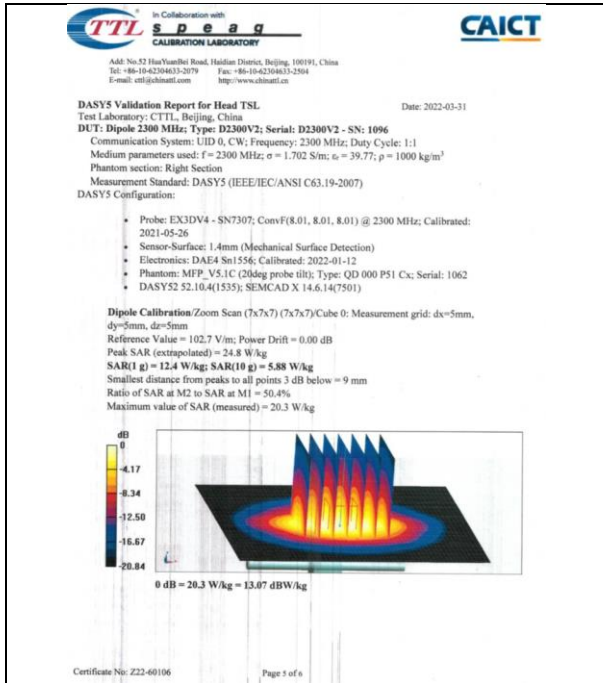


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## 1.10 D2450V2 - SN 817

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

**Client:** SGS-CN **Certificate No.:** Z22-60107

**Object:** D2450V2 - SN 817

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

**Calibration date:** April 1, 2022

**Calibration Equipment used (M&TE critical for calibration):**

**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

**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 855864, "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%.

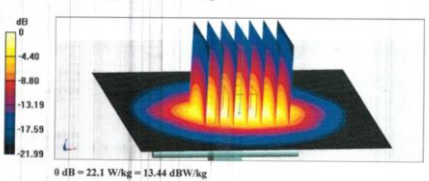
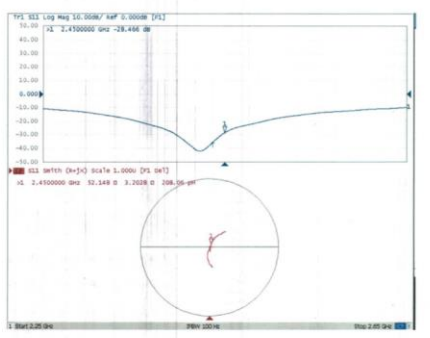


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<p><b>TTL Speaq</b> CALIBRATION LABORATORY          In Collaboration with <b>CAICT</b></p> <p>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China          Tel: +86-10-42304633-2079 Fax: +86-10-42304633-2504          E-mail: cti@china.ttl.com http://www.china.ttl.com</p> <p><b>Measurement Conditions</b>          DASYS 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><th></th><th>Temperature</th><th>Permittivity</th><th>Conductivity</th></tr> <tr><td>Nominal Head TSL parameters</td><td>22.0 °C</td><td>39.2</td><td>1.80 mho/m</td></tr> <tr><td>Measured Head TSL parameters</td><td>(22.0 ± 0.2) °C</td><td>39.5 ± 0.6 %</td><td>1.79 mho/m ± 0.6 %</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>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			Temperature	Permittivity	Conductivity	Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m	Measured Head TSL parameters	(22.0 ± 0.2) °C	39.5 ± 0.6 %	1.79 mho/m ± 0.6 %	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	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          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@china.ttl.com http://www.china.ttl.com</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
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## 1.11 D2600V2 - SN 1158

<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.J22X00406)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyzer E5071C</td> <td>MY46110673</td> <td>14-Jan-22 (CTTL No.J22X00406)</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.J22X00406)	Jan-23	Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL No.J22X00406)	Jan-23	<p><b>Glossary:</b></p> <p>TSL: tissue simulating liquid</p> <p>ConvF: sensitivity in TSL / NORMx.y.z</p> <p>N/A: 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 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020</p> <p>b) KDB 865864, "SAR Measurement Requirements for 100 MHz to 6 GHz"</p> <p><b>Additional Documentation:</b></p> <p>c) DASY4/S 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. 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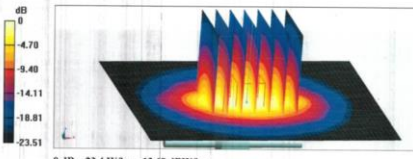
Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China  
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 E-mail: cti@china.ttl.com http://www.china.ttl.com

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;  $\epsilon_s = 38.68$ ;  $\rho = 1000$  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



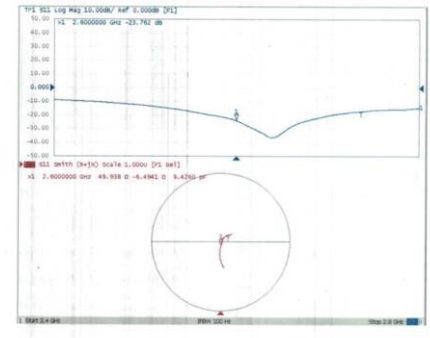
0 dB = 23.4 W/kg = 13.69 dBW/kg

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**Impedance Measurement Plot for Head TSL**



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## 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 (MTE 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. J21008326)	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. J2200406)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL No. J2200406)	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

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

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**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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**Measurement Conditions**  
DAEY system configuration, see for as not given on page 1.

DAEY Version	DAEYS2	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 = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5000 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

**Head TSL parameters at 5200MHz**  
The following parameters and calculations were applied.

Nominal Head TSL parameters	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	4.82 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

**SAR result with Head TSL at 5200MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	7.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	17.6 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.1 W/kg ± 24.2 % (k=2)

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**Head TSL parameters at 5300MHz**  
The following parameters and calculations were applied.

Nominal Head TSL parameters	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.2 ± 6 %	4.73 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

**SAR result with Head TSL at 5300MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.1 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.6 W/kg ± 24.2 % (k=2)

**Head TSL parameters at 5500MHz**  
The following parameters and calculations were applied.

Nominal Head TSL parameters	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.8 ± 6 %	4.94 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

**SAR result with Head TSL at 5500MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	82.6 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.3 W/kg ± 24.2 % (k=2)

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**Head TSL parameters at 5600MHz**  
The following parameters and calculations were applied.

Nominal Head TSL parameters	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.7 ± 6 %	5.05 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

**SAR result with Head TSL at 5600MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.8 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.9 W/kg ± 24.2 % (k=2)

**Head TSL parameters at 5800MHz**  
The following parameters and calculations were applied.

Nominal Head TSL parameters	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	5.25 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	---	---

**SAR result with Head TSL at 5800MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.71 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	76.7 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.8 W/kg ± 24.2 % (k=2)

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

**Antenna Parameters with Head TSL at 5200MHz**

Impedance, transformed to feed point	46.1D-8.03jD
Return Loss	-23.6dB

**Antenna Parameters with Head TSL at 5300MHz**

Impedance, transformed to feed point	47.8D-2.42jD
Return Loss	-28.5dB

**Antenna Parameters with Head TSL at 5500MHz**

Impedance, transformed to feed point	50.3D-4.26jD
Return Loss	-27.4dB

**Antenna Parameters with Head TSL at 5600MHz**

Impedance, transformed to feed point	54.5D-4.80jD
Return Loss	-24.0dB

**Antenna Parameters with Head TSL at 5800MHz**

Impedance, transformed to feed point	51.5D-5.61jD
Return Loss	-24.9dB

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<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@tstlab.com">ott@tstlab.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@tstlab.com">ott@tstlab.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: f = 5200 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: f = 5300 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: f = 5500 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: f = 5600 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: f = 5800 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 P51 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@tstlab.com">ott@tstlab.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@tstlab.com">ott@tstlab.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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## 2 DAE4 - SN 910

<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">   <small>In Collaboration with CALIBRATION LABORATORY</small>  <small>Address: No.52 HuaYuanfei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304033-2117 E-mail: emf@caict.ac.cn <a href="http://www.caict.ac.cn">http://www.caict.ac.cn</a></small> </div> <div style="text-align: center;">   <small>中国合格评定委员会 CALIBRATION CNAS (L187)</small> </div> <div style="text-align: center;">   <small>中国信息通信研究院 CALIBRATION CNAS (L187)</small> </div> </div> <p style="text-align: center;">Client: <b>Auden</b> Certificate No: <b>Z22-60275</b></p> <div style="border: 1px solid black; padding: 5px;"> <p><b>CALIBRATION CERTIFICATE</b></p> <p>Object: DAE4 - SN: 910</p> <p>Calibration Procedure(s): FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAE)</p> <p>Calibration date: July 14, 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" 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>Process Calibrator 753</td> <td>1971018</td> <td>14-Jun-22 (CTTL, No JZ2X04180)</td> <td>Jun-23</td> </tr> </tbody> </table> <p>Calibrated by: Yu Zongying SAR Test Engineer Reviewed by: Lin Hao SAR Test Engineer Approved by: Qi Dianyuan SAR Project Leader</p> <p style="text-align: right;">Issued: July 20, 2022</p> <p style="font-size: small;">This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> </div> <p style="text-align: center; font-size: x-small;">Certificate No: Z22-60275 Page 1 of 3</p>	Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration	Process Calibrator 753	1971018	14-Jun-22 (CTTL, No JZ2X04180)	Jun-23	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">   <small>In Collaboration with CALIBRATION LABORATORY</small>  <small>Address: No.52 HuaYuanfei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304033-2117 E-mail: emf@caict.ac.cn <a href="http://www.caict.ac.cn">http://www.caict.ac.cn</a></small> </div> <div style="text-align: center;">   <small>中国信息通信研究院 CALIBRATION CNAS (L187)</small> </div> </div> <p><b>Glossary:</b></p> <p>DAE: data acquisition electronics 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>DC Voltage Measurement: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.</li> <li>Connector angle: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.</li> <li>The report provide only calibration results for DAE, it does not contain other performance test results.</li> </ul> <p style="text-align: center; font-size: x-small;">Certificate No: Z22-60275 Page 2 of 3</p>						
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## 3 EX3DV4 - SN 7767

<p>Calibration Laboratory of Schmid &amp; Partner Engineering AG Zeughausstrasse 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>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 ± 1) °C and humidity &lt; 70%.</p> <p>Calibration Equipment used (MATEC report for calibration)</p> <table border="1"> <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-291</td> <td>SN: 103244</td> <td>04-Apr-22 (No. 217-02656)</td> <td>Apr-23</td> </tr> <tr> <td>DOF DAK-E3 (imp/imp)</td> <td>SN: 1046</td> <td>28-Oct-22 (DOF-DAK-E3-1249-0222)</td> <td>Oct-23</td> </tr> <tr> <td>DOF DAK-E3 (imp/imp)</td> <td>SN: 1018</td> <td>28-Oct-22 (DOF-DAK-E3-1018-0222)</td> <td>Oct-23</td> </tr> <tr> <td>Reference 25 dB Attenuator</td> <td>SN: 020582 (20)</td> <td>04-Apr-22 (No. 217-02657)</td> <td>Apr-23</td> </tr> <tr> <td>DAK4</td> <td>SN: 166</td> <td>19-Oct-22 (No. 2464-166-0222)</td> <td>Oct-23</td> </tr> <tr> <td>Reference Probe E833V2</td> <td>SN: 3013</td> <td>27-Oct-21 (No. E83-3013-0221)</td> <td>Dec-22</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Secondary Standards</th> <th>ID</th> <th>Check Date (in house)</th> <th>Scheduled Check</th> </tr> </thead> <tbody> <tr> <td>Power meter E4418B</td> <td>SN: 0814393814</td> <td>05-Apr-19 (in house check Jun-20)</td> <td>In house check Jun-24</td> </tr> <tr> <td>Power sensor E4418A</td> <td>SN: J414-486267</td> <td>05-Apr-19 (in house check Jun-20)</td> <td>In house check Jun-24</td> </tr> <tr> <td>Power sensor E4415A</td> <td>SN: 00112910</td> <td>05-Apr-19 (in house check Jun-20)</td> <td>In house check Jun-24</td> </tr> <tr> <td>RF generator HP 8648C</td> <td>SN: U85840101793</td> <td>04-Apr-09 (in house check Jun-20)</td> <td>In house check Jun-24</td> </tr> <tr> <td>Network Analyser E8398A</td> <td>SN: U841084477</td> <td>31-Mar-14 (in house check Oct-22)</td> <td>In house check Oct-24</td> </tr> </tbody> </table> <p>Calibrated by: <b>Alexia Georgiou</b> (Laboratory Technician) Signature: <i>[Signature]</i></p> <p>Approved by: <b>Evan Kijhn</b> (Technical Manager) Signature: <i>[Signature]</i></p> <p>Issued: October 21, 2022</p> <p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> <p>Certificate No: EX-7767_Oct22 Page 1 of 9</p>	Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration	Power meter NRP-291	SN: 103244	04-Apr-22 (No. 217-02656)	Apr-23	DOF DAK-E3 (imp/imp)	SN: 1046	28-Oct-22 (DOF-DAK-E3-1249-0222)	Oct-23	DOF DAK-E3 (imp/imp)	SN: 1018	28-Oct-22 (DOF-DAK-E3-1018-0222)	Oct-23	Reference 25 dB Attenuator	SN: 020582 (20)	04-Apr-22 (No. 217-02657)	Apr-23	DAK4	SN: 166	19-Oct-22 (No. 2464-166-0222)	Oct-23	Reference Probe E833V2	SN: 3013	27-Oct-21 (No. E83-3013-0221)	Dec-22	Secondary Standards	ID	Check Date (in house)	Scheduled Check	Power meter E4418B	SN: 0814393814	05-Apr-19 (in house check Jun-20)	In house check Jun-24	Power sensor E4418A	SN: J414-486267	05-Apr-19 (in house check Jun-20)	In house check Jun-24	Power sensor E4415A	SN: 00112910	05-Apr-19 (in house check Jun-20)	In house check Jun-24	RF generator HP 8648C	SN: U85840101793	04-Apr-09 (in house check Jun-20)	In house check Jun-24	Network Analyser E8398A	SN: U841084477	31-Mar-14 (in house check Oct-22)	In house check Oct-24	<p>Calibration Laboratory of Schmid &amp; Partner Engineering AG Zeughausstrasse 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> <p><b>Glossary</b></p> <p>TSL: <b>Issue simulating liquid</b> sensitivity in time space</p> <p>NORM<sub>x,y,z</sub>: <b>ComF</b> ComF: <b>diode compression point</b></p> <p>CF: <b>crest factor (1 duty cycle) of the RF signal</b></p> <p>A, B, C, D: <b>modulation dependent linearization parameters</b></p> <p>Polarization φ: <b>φ rotation around probe axis</b> if rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., φ = 0 is normal to probe axis</p> <p>Connector Angle: <b>information used in DASY system to align probe sensor X to the robot coordinate system</b></p> <p><b>Calibration is Performed According to the Following Standards:</b></p> <p>a) IEC/IEEE 62209-1:208, "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 1:208: Human Models, Instrumentation And Procedures (Frequency Range of 0.1MHz to 10GHz)", October 2020. b) KDB 865864, "SAR Measurement Requirements for 100MHz to 6 GHz"</p> <p><b>Methods Applied and Interpretation of Parameters:</b></p> <ul style="list-style-type: none"> <li>NORM<sub>x,y,z</sub>: Assessed for E-field polarization φ = 0 (f = 900MHz in TEM-cell; f = 1800MHz: RSI waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not affect the E<sup>2</sup>-field uncertainty inside TSL (see below ComF).</li> <li>NORM<sub>x,y,z</sub> = NORM<sub>x,y,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 ComF.</li> <li>DOF<sub>x,y,z</sub>: DOF are numerical linearization parameters assessed based on the data of power sweep with CW signal. DOF does not depend on frequency nor mode.</li> <li>PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.</li> <li>A, B, C, D: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor mode. V<sub>0</sub> is the maximum calibration range expressed in RMS voltage across the diode.</li> <li>ComF and Boundary Effect Parameters: Assessed in full phantom using E-field for Temperature Transfer Standard for f &gt; 800MHz and inside waveguide using analytical field distributions based on power measurements for f &gt; 800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (shape, 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>x,y,z</sub> * ComF whereby the uncertainty corresponds to that given for ComF. A frequency dependent ComF is used in DASY version 4.4 and higher which allows extending the validity from 0.1MHz to 110.1MHz.</li> <li>Spherical isotropy (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>x,y,z</sub> (no uncertainty required).</li> </ul> <p>Certificate No: EX-7767_Oct22 Page 2 of 9</p>																							
Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration																																																																									
Power meter NRP-291	SN: 103244	04-Apr-22 (No. 217-02656)	Apr-23																																																																									
DOF DAK-E3 (imp/imp)	SN: 1046	28-Oct-22 (DOF-DAK-E3-1249-0222)	Oct-23																																																																									
DOF DAK-E3 (imp/imp)	SN: 1018	28-Oct-22 (DOF-DAK-E3-1018-0222)	Oct-23																																																																									
Reference 25 dB Attenuator	SN: 020582 (20)	04-Apr-22 (No. 217-02657)	Apr-23																																																																									
DAK4	SN: 166	19-Oct-22 (No. 2464-166-0222)	Oct-23																																																																									
Reference Probe E833V2	SN: 3013	27-Oct-21 (No. E83-3013-0221)	Dec-22																																																																									
Secondary Standards	ID	Check Date (in house)	Scheduled Check																																																																									
Power meter E4418B	SN: 0814393814	05-Apr-19 (in house check Jun-20)	In house check Jun-24																																																																									
Power sensor E4418A	SN: J414-486267	05-Apr-19 (in house check Jun-20)	In house check Jun-24																																																																									
Power sensor E4415A	SN: 00112910	05-Apr-19 (in house check Jun-20)	In house check Jun-24																																																																									
RF generator HP 8648C	SN: U85840101793	04-Apr-09 (in house check Jun-20)	In house check Jun-24																																																																									
Network Analyser E8398A	SN: U841084477	31-Mar-14 (in house check Oct-22)	In house check Oct-24																																																																									
<p>EX3DV4 - SN-7767 October 29, 2022</p> <p><b>Parameters of Probe: EX3DV4 - SN-7767</b></p> <p><b>Basic Calibration Parameters</b></p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Sensor X</th> <th>Sensor Y</th> <th>Sensor Z</th> <th>Unc (k = 2)</th> </tr> </thead> <tbody> <tr> <td>Norm (μW/(V/m)<sup>2</sup>)<sup>1</sup></td> <td>0.87</td> <td>0.89</td> <td>0.90</td> <td>+10.1%</td> </tr> <tr> <td>DCP (mV)<sup>2</sup></td> <td>103.4</td> <td>107.3</td> <td>105.7</td> <td>±4.7%</td> </tr> </tbody> </table> <p><b>Calibration Results for Modulation Responses</b></p> <table border="1"> <thead> <tr> <th>Mod</th> <th>Comm. System Name</th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> <th>V<sub>0</sub></th> <th>Max. Dev.</th> <th>Max. Unc<sup>3</sup></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>CW</td> <td>X: 0.50</td> <td>0.00</td> <td>1.00</td> <td>0.30</td> <td>184.7</td> <td>±3.3%</td> <td>±4.7%</td> </tr> <tr> <td></td> <td></td> <td>Y: 0.60</td> <td>0.00</td> <td>1.00</td> <td></td> <td>180.7</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>Z: 0.82</td> <td>0.00</td> <td>1.00</td> <td></td> <td>179.5</td> <td></td> <td></td> </tr> </tbody> </table> <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><sup>1</sup> The uncertainties of Norm X,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 1).</p> <p><sup>2</sup> Uncertainty for specific sensitivity for maximum specified field strength.</p> <p><sup>3</sup> Uncertainty is determined using the max. deviation from three responses applying rectangular distribution and is expressed for the square of the field value.</p> <p>Certificate No: EX-7767_Oct22 Page 3 of 9</p>	Parameter	Sensor X	Sensor Y	Sensor Z	Unc (k = 2)	Norm (μW/(V/m) <sup>2</sup> ) <sup>1</sup>	0.87	0.89	0.90	+10.1%	DCP (mV) <sup>2</sup>	103.4	107.3	105.7	±4.7%	Mod	Comm. System Name	A	B	C	D	V <sub>0</sub>	Max. Dev.	Max. Unc <sup>3</sup>	0	CW	X: 0.50	0.00	1.00	0.30	184.7	±3.3%	±4.7%			Y: 0.60	0.00	1.00		180.7					Z: 0.82	0.00	1.00		179.5			<p>EX3DV4 - SN-7767 October 29, 2022</p> <p><b>Parameters of Probe: EX3DV4 - SN-7767</b></p> <p><b>Other Probe Parameters</b></p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Sensor Arrangement</td> <td>Triangular</td> </tr> <tr> <td>Connector Angle</td> <td>144.8°</td> </tr> <tr> <td>Mechanical Surface Detection Mode</td> <td>enabled</td> </tr> <tr> <td>Optical Surface Detection Mode</td> <td>disabled</td> </tr> <tr> <td>Probe Overall Length</td> <td>337 mm</td> </tr> <tr> <td>Probe Body Diameter</td> <td>10 mm</td> </tr> <tr> <td>Tip Length</td> <td>9 mm</td> </tr> <tr> <td>Tip Diameter</td> <td>2.5 mm</td> </tr> <tr> <td>Probe Tip to Sensor X Calibration Point</td> <td>1 mm</td> </tr> <tr> <td>Probe Tip to Sensor Y Calibration Point</td> <td>1 mm</td> </tr> <tr> <td>Recommended Measurement Distance from Surface</td> <td>1 mm</td> </tr> </tbody> </table> <p>Note: Measurement distance from surface can be increased to 3-4 mm for UN-Asu 2000 ps.</p> <p>Certificate No: EX-7767_Oct22 Page 4 of 9</p>	Parameter	Value	Sensor Arrangement	Triangular	Connector Angle	144.8°	Mechanical Surface Detection Mode	enabled	Optical Surface Detection Mode	disabled	Probe Overall Length	337 mm	Probe Body Diameter	10 mm	Tip Length	9 mm	Tip Diameter	2.5 mm	Probe Tip to Sensor X Calibration Point	1 mm	Probe Tip to Sensor Y Calibration Point	1 mm	Recommended Measurement Distance from Surface	1 mm
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EX3DV4 - SN:7767 October 28, 2022

Parameters of Probe: EX3DV4 - SN:7767

Calibration Parameter Determined in Head Tissue Simulating Media

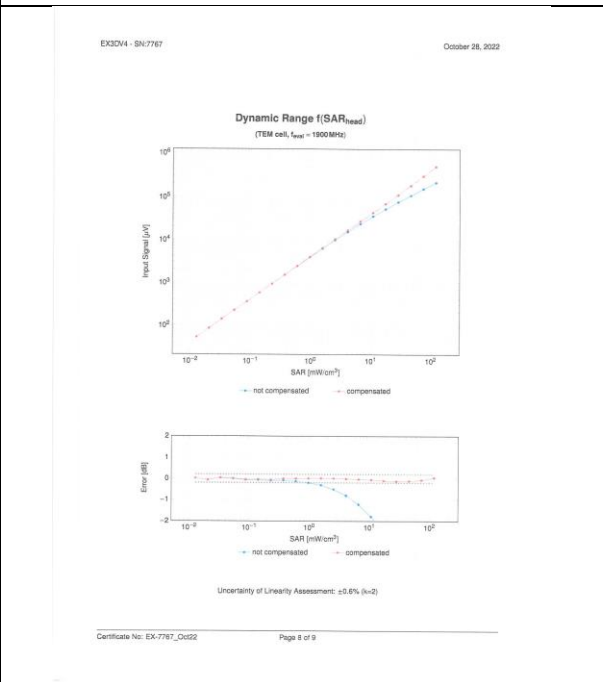
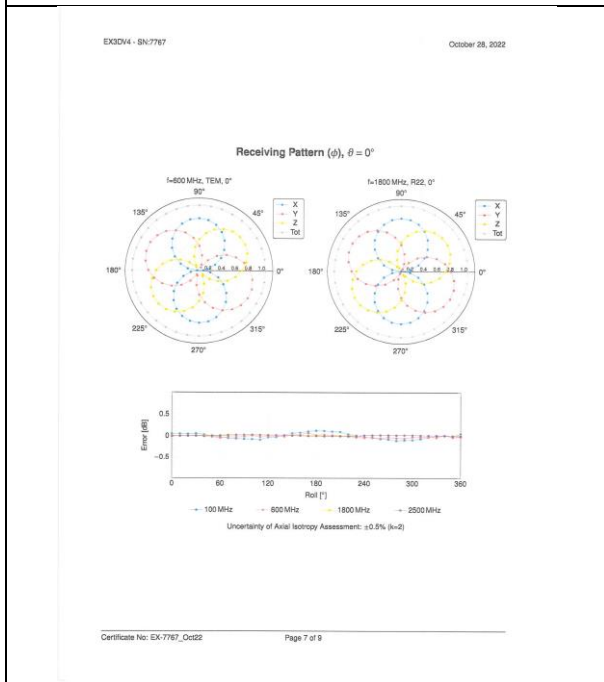
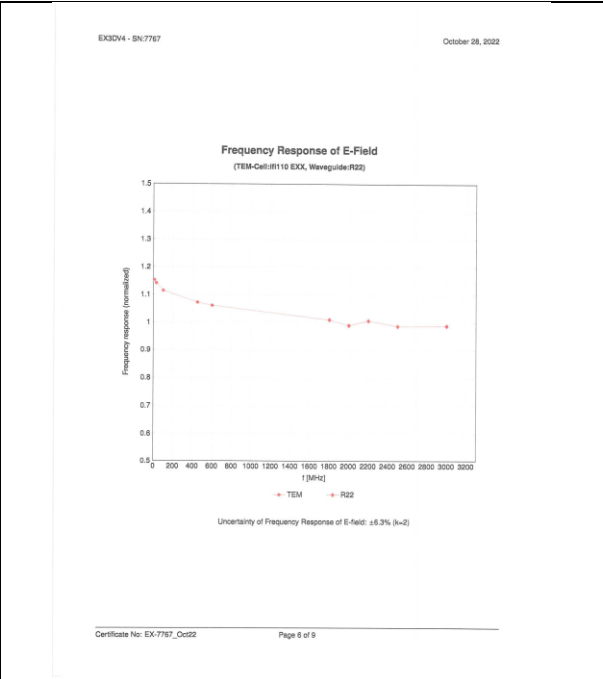
f (MHz)	Relative Permittivity	Conductivity (S/m)	CorrF X	CorrF Y	CorrF Z	Alpha <sup>0</sup>	Depth <sup>0</sup> (mm)	Unc (k=2)
150	53.3	0.78	14.08	14.08	14.08	0.00	1.00	±13.3%
450	43.5	0.87	11.90	11.90	11.90	0.18	1.30	±13.3%
750	41.9	0.89	10.26	10.26	10.26	0.55	0.80	±12.0%
895	41.5	0.90	10.00	10.00	10.00	0.43	0.89	±12.0%
1750	40.1	1.37	9.30	9.30	9.30	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	1.48	8.60	8.60	8.60	0.30	0.85	±12.0%
2900	39.5	1.87	8.44	8.44	8.44	0.33	0.90	±12.0%
2450	39.2	1.80	8.24	8.24	8.24	0.32	0.90	±12.0%
2600	39.0	1.98	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	1.35	±13.1%
3900	37.5	3.32	6.84	6.84	6.84	0.40	1.60	±13.1%
4100	37.2	3.53	6.63	6.63	6.63	0.40	1.60	±13.1%
4300	37.1	3.83	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	1.80	±13.1%
4900	36.3	4.40	6.07	6.07	6.07	0.40	1.80	±13.1%
5000	36.0	4.66	5.85	5.85	5.85	0.40	1.80	±13.1%
5300	35.9	4.76	5.48	5.48	5.48	0.40	1.80	±13.1%
5500	35.6	4.96	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>0</sup> Frequency valid only above 300 MHz and at 100 MHz only region for 0.50" x 4.4" unit for (see Page 2), when it is measured at 20 MHz. The uncertainty is the RSS of the CorrF uncertainty of calibration frequency and the uncertainty of the relative permittivity. Frequency valid below 300 MHz is ±10%, 20, 40, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 410, 420, 430, 440, 450, 460, 470, 480, 490, 500, 510, 520, 530, 540, 550, 560, 570, 580, 590, 600, 610, 620, 630, 640, 650, 660, 670, 680, 690, 700, 710, 720, 730, 740, 750, 760, 770, 780, 790, 800, 810, 820, 830, 840, 850, 860, 870, 880, 890, 900, 910, 920, 930, 940, 950, 960, 970, 980, 990, 1000, 1010, 1020, 1030, 1040, 1050, 1060, 1070, 1080, 1090, 1100, 1110, 1120, 1130, 1140, 1150, 1160, 1170, 1180, 1190, 1200, 1210, 1220, 1230, 1240, 1250, 1260, 1270, 1280, 1290, 1300, 1310, 1320, 1330, 1340, 1350, 1360, 1370, 1380, 1390, 1400, 1410, 1420, 1430, 1440, 1450, 1460, 1470, 1480, 1490, 1500, 1510, 1520, 1530, 1540, 1550, 1560, 1570, 1580, 1590, 1600, 1610, 1620, 1630, 1640, 1650, 1660, 1670, 1680, 1690, 1700, 1710, 1720, 1730, 1740, 1750, 1760, 1770, 1780, 1790, 1800, 1810, 1820, 1830, 1840, 1850, 1860, 1870, 1880, 1890, 1900, 1910, 1920, 1930, 1940, 1950, 1960, 1970, 1980, 1990, 2000, 2010, 2020, 2030, 2040, 2050, 2060, 2070, 2080, 2090, 2100, 2110, 2120, 2130, 2140, 2150, 2160, 2170, 2180, 2190, 2200, 2210, 2220, 2230, 2240, 2250, 2260, 2270, 2280, 2290, 2300, 2310, 2320, 2330, 2340, 2350, 2360, 2370, 2380, 2390, 2400, 2410, 2420, 2430, 2440, 2450, 2460, 2470, 2480, 2490, 2500, 2510, 2520, 2530, 2540, 2550, 2560, 2570, 2580, 2590, 2600, 2610, 2620, 2630, 2640, 2650, 2660, 2670, 2680, 2690, 2700, 2710, 2720, 2730, 2740, 2750, 2760, 2770, 2780, 2790, 2800, 2810, 2820, 2830, 2840, 2850, 2860, 2870, 2880, 2890, 2900, 2910, 2920, 2930, 2940, 2950, 2960, 2970, 2980, 2990, 3000, 3010, 3020, 3030, 3040, 3050, 3060, 3070, 3080, 3090, 3100, 3110, 3120, 3130, 3140, 3150, 3160, 3170, 3180, 3190, 3200, 3210, 3220, 3230, 3240, 3250, 3260, 3270, 3280, 3290, 3300, 3310, 3320, 3330, 3340, 3350, 3360, 3370, 3380, 3390, 3400, 3410, 3420, 3430, 3440, 3450, 3460, 3470, 3480, 3490, 3500, 3510, 3520, 3530, 3540, 3550, 3560, 3570, 3580, 3590, 3600, 3610, 3620, 3630, 3640, 3650, 3660, 3670, 3680, 3690, 3700, 3710, 3720, 3730, 3740, 3750, 3760, 3770, 3780, 3790, 3800, 3810, 3820, 3830, 3840, 3850, 3860, 3870, 3880, 3890, 3900, 3910, 3920, 3930, 3940, 3950, 3960, 3970, 3980, 3990, 4000, 4010, 4020, 4030, 4040, 4050, 4060, 4070, 4080, 4090, 4100, 4110, 4120, 4130, 4140, 4150, 4160, 4170, 4180, 4190, 4200, 4210, 4220, 4230, 4240, 4250, 4260, 4270, 4280, 4290, 4300, 4310, 4320, 4330, 4340, 4350, 4360, 4370, 4380, 4390, 4400, 4410, 4420, 4430, 4440, 4450, 4460, 4470, 4480, 4490, 4500, 4510, 4520, 4530, 4540, 4550, 4560, 4570, 4580, 4590, 4600, 4610, 4620, 4630, 4640, 4650, 4660, 4670, 4680, 4690, 4700, 4710, 4720, 4730, 4740, 4750, 4760, 4770, 4780, 4790, 4800, 4810, 4820, 4830, 4840, 4850, 4860, 4870, 4880, 4890, 4900, 4910, 4920, 4930, 4940, 4950, 4960, 4970, 4980, 4990, 5000, 5010, 5020, 5030, 5040, 5050, 5060, 5070, 5080, 5090, 5100, 5110, 5120, 5130, 5140, 5150, 5160, 5170, 5180, 5190, 5200, 5210, 5220, 5230, 5240, 5250, 5260, 5270, 5280, 5290, 5300, 5310, 5320, 5330, 5340, 5350, 5360, 5370, 5380, 5390, 5400, 5410, 5420, 5430, 5440, 5450, 5460, 5470, 5480, 5490, 5500, 5510, 5520, 5530, 5540, 5550, 5560, 5570, 5580, 5590, 5600, 5610, 5620, 5630, 5640, 5650, 5660, 5670, 5680, 5690, 5700, 5710, 5720, 5730, 5740, 5750, 5760, 5770, 5780, 5790, 5800, 5810, 5820, 5830, 5840, 5850, 5860, 5870, 5880, 5890, 5900, 5910, 5920, 5930, 5940, 5950, 5960, 5970, 5980, 5990, 6000.

<sup>1</sup> All frequencies below 5 GHz, the validity of above parameters (i and α) can be reduced to ±10% if total compensation terms is applied to measured data values. At frequencies above 5 GHz, the validity of above parameters (i and α) is reduced to ±5%. The uncertainty is the RSS of the CorrF uncertainty for individual target tissue parameters.

<sup>2</sup> Alpha depth is determined during calibration. SPRAG warrants that the remaining condition due to the boundary effect after compensation is always less than ±1% for frequencies below 5 GHz and below ±2% for frequencies between 5-6 GHz at any distance larger than half the probe (i.e. diameter) from the boundary.

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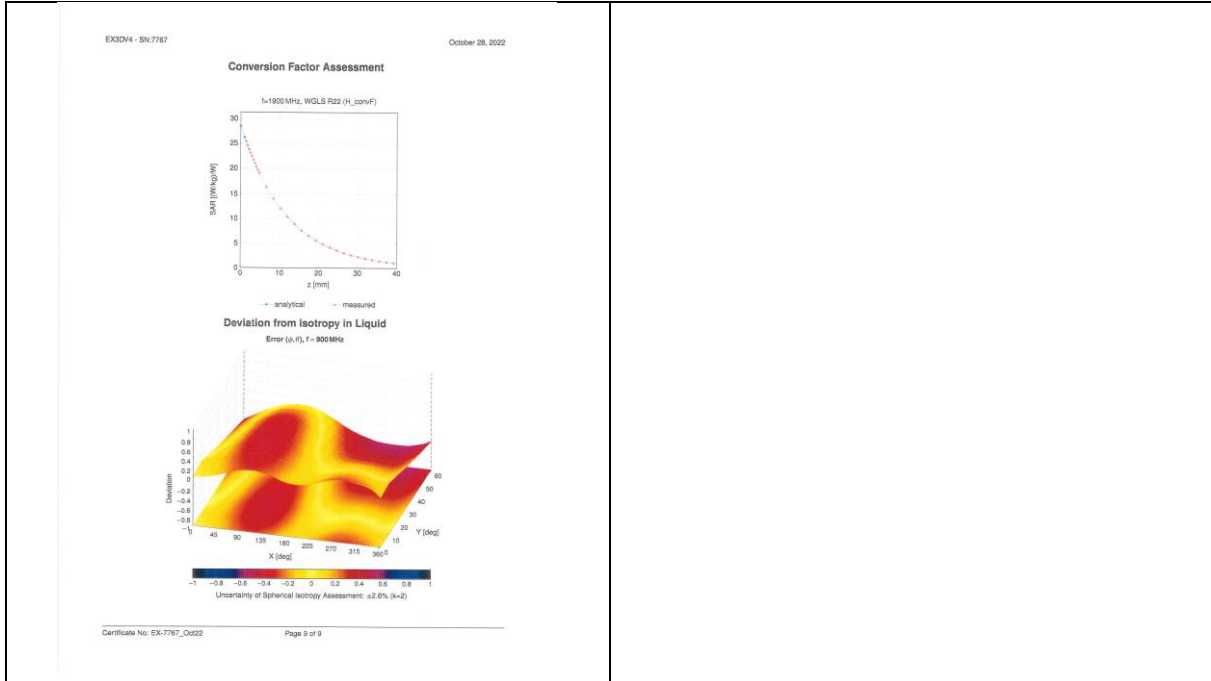


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4 Impedance and return loss

Dipole CLA150 SN 4025				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2021/4/26	-31.4	/	47.8	/
2022/4/26	-32.5	-3.5%	47.1	0.7
2023/4/26	-32.3	-2.87%	46.5	1.3
Dipole D450V3 SN 1103				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2021/4/21	-23	/	57.1	/
2022/4/26	-23.4	-1.74%	56.6	0.5
2023/4/26	-23.9	-3.91%	56.2	0.9
Dipole D750V3 SN 1188				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/3/29	-28.7	/	53.6	/
2023/3/29	-28.3	1.39%	53.2	0.4
Dipole D835V2 SN 4d114				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/3/31	-25.3	/	48.7	/
2023/3/31	-24.6	2.77%	49.1	0.4
Dipole D900V2 SN 1d079				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/6/7	-23.3	/	48.1	/
2023/6/7	-23.6	-1.29%	48.3	0.2
Dipole D1800V2 SN 2d170				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/3/31	-29.4	/	47.9	/
2023/3/31	-28.9	1.70%	47.2	0.7
Dipole D1900V2 SN 5d136				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/6/7	-22.4	/	51.2	/
Dipole D2000V2 SN 1041				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/6/6	-34.9	/	48.4	/
Dipole D2300V2 SN 1096				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$



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2022/3/31	-26.6	/	49.2	/
2023/3/31	-27.1	-1.88%	49.4	0.2
Dipole D2450V2 SN 817				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/4/1	-28.5	/	52.1	/
2023/4/1	-28.0	1.75%	51.6	0.5
Dipole D2600V2 SN 1158				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/3/31	-23.8	/	49.9	/
2023/3/31	-23.3	2.10%	50.3	0.4
Dipole D5GHzV2 SN 1095 for 5200				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/6/1	-23.6	/	46.1	/
Dipole D5GHzV2 SN 1095 for 5300				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/6/1	-29.5	/	47.8	/
Dipole D5GHzV2 SN 1095 for 5500				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/6/1	-27.4	/	50.3	/
Dipole D5GHzV2 SN 1095 for 5600				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/6/1	-24.0	/	54.5	/
Dipole D5GHzV2 SN 1095 for 5800				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/6/1	-24.9	/	51.5	/



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