

## Appendix C for KSCR230600097509

### 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 checked="" type="checkbox"/>	3	D750V3	1188	2022/03/29	2025/03/28
	<input checked="" type="checkbox"/>	4	D835V2	4d114	2022/03/31	2025/03/30
	<input type="checkbox"/>	5	D900V2	1d079	2022/06/07	2025/06/06
	<input checked="" type="checkbox"/>	6	D1800V2	2d170	2022/03/31	2025/03/30
	<input checked="" 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 checked="" type="checkbox"/>	11	D2600V2	1158	2022/03/31	2025/03/30
	<input checked="" type="checkbox"/>	12	D5GHzV2	1095	2022/06/01	2025/05/31
DAE	<input checked="" type="checkbox"/>	13	DAE4	1245	2023/04/25	2024/04/24
Probe	<input checked="" type="checkbox"/>	14	EX3DV4	7767	2022/10/28	2023/10/27



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## 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-v9 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 (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 (Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power meter NRP</td> <td>SN: 10476</td> <td>09-Apr-21 (No. 217-03201/03202)</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: C22062 (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. EX3077_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</p> <p>ConvF: sensitivity in TSL / NORM x,y,z</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 this 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> <hr/> <p>Certificate No: CLA150-4025_Apr21      Page 2 of 6</p>						
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<p><b>Measurement Conditions</b> DASY system configuration, as far as not given on page 1.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>DASY Version</th> <th>DASY5</th> <th>V52.10.4</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 = 0.4 mm, dz = 1.4 mm</td> <td>Graded Ratio = 1.4 (Z direction)</td> </tr> <tr> <td>Frequency</td> <td>150 MHz ± 1 MHz</td> <td></td> </tr> </tbody> </table> <p><b>Head TSL parameters</b> The following parameters and calculations were applied.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Parameter</th> <th>Temperature</th> <th>Permittivity</th> <th>Conductivity</th> </tr> </thead> <tbody> <tr> <td>Nominal Head TSL parameters</td> <td>22.0 °C</td> <td>52.3</td> <td>0.75 mho/m</td> </tr> <tr> <td>Measured Head TSL parameters</td> <td>(22.0 ± 0.2) °C</td> <td>51.1 ± 6 %</td> <td>0.75 mho/m ± 6 %</td> </tr> <tr> <td>Head TSL temperature change during test</td> <td>&lt; 0.5 °C</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p><b>SAR result with Head TSL</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</th> <th>Condition</th> <th></th> </tr> </thead> <tbody> <tr> <td>SAR measured</td> <td>1 W input power</td> <td>3.90 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>3.88 W/kg ± 18.4 % (k=2)</td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</th> <th>condition</th> <th></th> </tr> </thead> <tbody> <tr> <td>SAR measured</td> <td>1 W input power</td> <td>2.60 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>2.59 W/kg ± 18.0 % (k=2)</td> </tr> </tbody> </table> <hr/> <p>Certificate No: CLA150-4025_Apr21      Page 3 of 6</p>	DASY Version	DASY5	V52.10.4	Extrapolation	Advanced Extrapolation		Phantom	ELN Flat Phantom	Shell thickness: 2 ± 0.2 mm	EUT Positioning	Touch Position		Zoom Scan Resolution	dx, dy = 0.4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)	Frequency	150 MHz ± 1 MHz		Parameter	Temperature	Permittivity	Conductivity	Nominal Head TSL parameters	22.0 °C	52.3	0.75 mho/m	Measured Head TSL parameters	(22.0 ± 0.2) °C	51.1 ± 6 %	0.75 mho/m ± 6 %	Head TSL temperature change during test	< 0.5 °C	---	---	SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition		SAR measured	1 W input power	3.90 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	3.88 W/kg ± 18.4 % (k=2)	SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition		SAR measured	1 W input power	2.60 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	2.59 W/kg ± 18.0 % (k=2)	<p><b>Appendix (Additional assessments outside the scope of SCS 0108)</b></p> <p><b>Antenna Parameters with Head TSL</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Impedance, transformed to feed point</td> <td>47.9 Ω ± 1.5 Ω</td> </tr> <tr> <td>Return Loss</td> <td>-31.4 dB</td> </tr> </tbody> </table> <p><b>Additional EUT Data</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Manufactured by</td> <td>SPEAG</td> </tr> </tbody> </table> <hr/> <p>Certificate No: CLA150-4025_Apr21      Page 4 of 6</p>	Parameter	Value	Impedance, transformed to feed point	47.9 Ω ± 1.5 Ω	Return Loss	-31.4 dB	Parameter	Value	Manufactured by	SPEAG
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 中国·江苏·昆山开发区伟业路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:  $f = 150 \text{ MHz}$ ;  $\sigma = 0.76 \text{ S/m}$ ;  $\epsilon_0 = 51.1$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEE/IEC/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(1g) = 3.90 W/kg; SAR(10g) = 2.60 W/kg**  
 Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 30mm)  
 Ratio of SAR at M2 to SAR at M1 = 80.4%  
 Maximum value of SAR (measured) = 5.48 W/kg

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

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## 1.2 D450V3 - SN 1103

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

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

Client: **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 (MPE 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: 102344	09-Apr-21 (No. 217-03021)	Apr-22
Power sensor NRP-291	SN: 102345	09-Apr-21 (No. 217-03021)	Apr-22
Reference 20 dB Attenuator	SN: CC2502 (200)	09-Apr-21 (No. 217-03345)	Apr-22
Type-N immersion combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe E3030A	SN: 3817	30-Dec-20 (No. E30-2077_De20)	Dec-21
DAEA	SN: 654	05-Jan-20 (No. D454-664_Jan20)	Jan-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4118B	SN: GB41200274	06-Apr-16 (in house check Jun-20)	In house check Jun-22
Power sensor E4112A	SN: MY4149602	06-Apr-16 (in house check Jun-20)	In house check Jun-22
Power sensor E4112A	SN: 00010010	06-Apr-16 (in house check Jun-20)	In house check Jun-22
RF generator HP 8648C	SN: US3406010700	06-Apr-16 (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** (Technical Manager)

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

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

Client: **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:**

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "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%.

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

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

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

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	43.5	0.57 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	43.1 ± 0.6 %	0.57 mho/m ± 0 %
Head TSL temperature change during test	< 0.5 °C	---	---

**SAR result with Head TSL**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	4.56 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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Certificate No: D450V3-1103\_Apr21 Page 4 of 6

**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

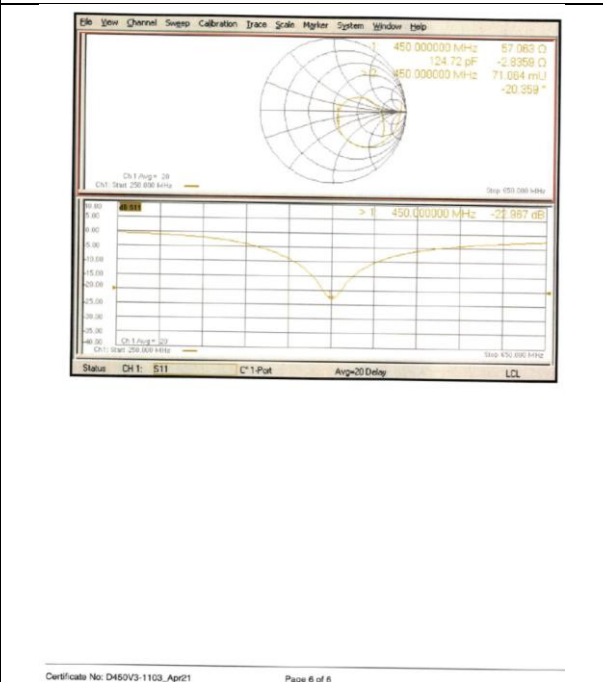
Communication System: UID 0 - CW; Frequency: 450 MHz  
Medium parameters used: f = 450 MHz, α = 0.87 S/m; ε<sub>r</sub> = 43.1; ρ = 1000 kg/m<sup>3</sup>  
Phantom section: Flat Section  
Measurement Standard: DASY5 (IEE/IEC/ANSI C63.19-2011)

**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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## 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> <p><b>CALIBRATION CERTIFICATE</b></p> <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 28, 2022</b></p> <p>This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (22±3)°C and humidity &lt;70%.</p> <p>Calibration Equipment used (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 (CITL No.J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Power sensor NRP88</td> <td>104291</td> <td>24-Sep-21 (CITL 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>DAE4</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"> <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>MY46071430</td> <td>13-Jan-22 (CITL No.J22X00409)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyzer E5071C</td> <td>MY46110973</td> <td>14-Jan-22 (CITL 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	106277	24-Sep-21 (CITL No.J21X08326)	Sep-22	Power sensor NRP88	104291	24-Sep-21 (CITL No.J21X08326)	Sep-22	Reference Probe EX30V4	SN 7307	26-May-21(SPEAG.No.EX3-7307_May21)	May-22	DAE4	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 E4439C	MY46071430	13-Jan-22 (CITL No.J22X00409)	Jan-23	Network Analyzer E5071C	MY46110973	14-Jan-22 (CITL 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> <p><b>Glossary:</b></p> <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> <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 KDB 865684, "SAR Measurement Requirements for 100 MHz to 6 GHz"</p> <p>b) DKB 865684, "SAR Measurement Requirements for 100 MHz to 6 GHz"</p> <p><b>Additional Documentation:</b></p> <p>c) DASY4/5 System Handbook</p> <p><b>Methods Applied and Interpretation of Parameters:</b></p> <ul style="list-style-type: none"> <li>Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. 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**CAICT**

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

- Probe: EX3DV4 - SN7307; ConvF(10.31, 10.31, 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) = 3.07 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

Certificate No: Z22-60103 Page 5 of 6

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**CAICT**

**Impedance Measurement Plot for Head TSL**

Certificate No: Z22-60103 Page 6 of 6

1.4 D835V2 - SN 4d114

**TTL Speaq** Calibration Laboratory  
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**CAICT**

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	104281	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.J22X00409)	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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**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 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**  
 DASYS 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 ± 5 %	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> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.40 W/kg ± 18.6 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.12 W/kg ± 18.7 % (k=2)

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

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	48.70 - 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: 2022-03-21  
 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 Sn 1556; 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(1 g) = 2.37 W/kg; SAR(10 g) = 1.54 W/kg  
 Smallest distance from peaks to all points 3 dB below = 15.8 mm  
 Ratio of SAR at M2 to SAR at M1 = 66.2%  
 Maximum value of SAR (measured) = 3.17 W/kg

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

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**Impedance Measurement Plot for Head TSL**

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 中国·江苏·昆山开发区伟业路10号 邮编: 215300 t(86-512) 57355888 f(86-512) 57370818 sgs.china@sgs.com

## 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 (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>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.EK3-7464_Jan22)</td> <td>Jan-23</td> </tr> <tr> <td>DAE4</td> <td>SN 1856</td> <td>12-Jan-22(CTTL-SPEAG No.Z22-60007)</td> <td>Jan-23</td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Signal Generator E4438C</td> <td>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.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 Diqian</b> SAR Project Leader</p> <p style="text-align: right;">Issued: June 13, 2022</p> <p>The calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> </div> <p style="font-size: small;">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.EK3-7464_Jan22)	Jan-23	DAE4	SN 1856	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.J22X00406)	Jan-23	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">   <small>In Collaboration with</small>  <b>TTL</b>  <small>CAIBRATION LABORATORY</small>  <small>ADD: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191</small>  <small>Tel: +86-10-62968323-2117</small>  <small>E-mail: cti@china.com</small>  <small>http://www.caict.ac.cn</small> </div> <div style="text-align: center;">   <small>中国合格评定</small>  <b>CNAS</b>  <small>校准</small>  <small>CAIBRATION</small>  <small>CMS 1070</small> </div> <div style="text-align: center;">   <small>中国信息通信研究院</small>  <b>CAICT</b> </div> </div> <p style="text-align: center;">Client: <b>SGS-CN</b> Certificate No: <b>Z22-60184</b></p> <div style="border: 1px solid black; padding: 5px;"> <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 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"</p> <p><b>Additional Documentation:</b></p> <p>c) DASY4/5 System Handbook</p> <p><b>Methods Applied and Interpretation of Parameters:</b></p> <ul style="list-style-type: none"> <li>Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. 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E-mail: cti@china.ttl.com http://www.caict.ac.cn

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

Test Laboratory: TTL, 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;  $\sigma = 0.98$  S/m;  $\epsilon_r = 42.05$ ;  $\rho = 1000$  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 (2dmg probe ill); 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) = 2.79 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

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**Impedance Measurement Plot for Head TSL**

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## 1.6 D1800V2 - SN 2d170

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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 (CTTL No.J21X08326)	Sep-22
Power sensor NRP5	104291	24-Sep-21 (CTTL 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(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	MY46110973	14-Jan-22 (CTTL No.J22X00406)	Jan-23

Calibrated by: **Zhao Jing** SAR Test Engineer

Reviewed by: **Lin Hao** SAR Test Engineer

Approved by: **Qi Dianyan** SAR Project Leader

Issued: April 6, 2022

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

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 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

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

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

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E-mail: cti@chinaeui.com http://www.chinaeui.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	1800 MHz ± 1 MHz	

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

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.8 ± 8 %	1.41 mho/m ± 8 %
Head TSL temperature change during test	<1.0 °C	---	---

**SAR result with Head TSL**

SAR averaged over 1 cm <sup>3</sup> (1g) 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> (10g) of Head TSL	Condition	
SAR measured	250 mW input power	5.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.4 W/kg ± 18.7 % (k=2)

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

**Antenna Parameters with Head TSL**

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

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.116 ns
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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: TTL, 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:

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

**Dipole Calibration/Zoom Scan (7x7x7) (7x7x7) Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm**  
Reference Value = 98.14 V/m; Power Drift = 0.03 dB  
Peak SAR (extrapolated) = 18.2 W/kg  
SAR(1g) = 9.73 W/kg; SAR(10g) = 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

Certificate No: Z22-60105 Page 5 of 6

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**Impedance Measurement Plot for Head TSL**

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## 1.7 D1900V2 - SN 5d136

<p>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-42204633-2117 E-mail: vt@china.ttl.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>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±)°C and humidity &lt;70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by, Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power Meter NRP2</td> <td>106277</td> <td>24-Sep-21 (CTTL No. J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Power sensor NRP6S</td> <td>104291</td> <td>24-Sep-21 (CTTL No. J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Reference Probe EXSDV4</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. Z22-90007)</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>MY48071430</td> <td>13-Jan-22 (CTTL No. J22X00409)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyser ES071C</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 sensor NRP6S	104291	24-Sep-21 (CTTL No. J21X08326)	Sep-22	Reference Probe EXSDV4	SN 7484	28-Jan-22 (SPEAG No. EX3-7484_Jan22)	Jan-23	DAE4	SN 1656	12-Jan-22 (CTTL-SPEAG No. Z22-90007)	Jan-23	Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration	Signal Generator E4438C	MY48071430	13-Jan-22 (CTTL No. J22X00409)	Jan-23	Network Analyser ES071C	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@china.ttl.com</p> <p>Glossary: TSL: tissue simulating liquid ComF: 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 1526: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020 b) KDB 865864, "SAR Measurement Requirements for 100 MHz to 6 GHz"</p> <p>Additional Documentation: c) DASY4/S System Handbook</p> <p>Methods Applied and Interpretation of Parameters: • Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. • Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis. • Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required. • Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required. • SAR measured: SAR measured at the stated antenna input power. • SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector. • SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.</p> <p>The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.</p> <p>Certificate No: Z22-60185 Page 2 of 6</p>																												
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**DASY5 Validation Report for Head TSL** Date: 2022-04-07  
Test Laboratory: CCTL, Beijing, China  
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 54136  
Communication System: UTD 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 1900 \text{ MHz}$ ;  $\alpha = 1.385 \text{ S/m}$ ;  $\epsilon_r = 39.85$ ;  $\rho = 1000 \text{ kg/m}^3$   
Phantom section: Right Section  
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(8, 18, 8, 18) @ 1900 MHz; Calibrated: 2022-01-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- Phantom: MFP\_V5\_IC (20kg probe kit); Type: QD 000 P51 Cx; Serial: 1062
- DASY52.52.10.4(1555); SEMCAD X.14.6.14(7501)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7) Cube D: Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 99.99 V/m; Power Drift = 0.04 dB  
Peak SAR (extrapolated) = 18.6 W/kg  
SAR(1g) = 9.95 W/kg; SAR(10g) = 5.18 W/kg  
Smallest distance from peaks to all points 3 dB below = 9.2 mm  
Ratio of SAR at M2 to SAR at M1 = 54.1%

Maximum value of SAR (measured) = 15.6 W/kg

0 dB = 15.6 W/kg = 11.93 dBW/kg

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**Impedance Measurement Plot for Head TSL**

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### 1.8 D2000V2 - SN 1041

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

**CALIBRATION CERTIFICATE**

Object: D2000V2 - SN: 1041  
Calibration Procedure(s): FF-Z11-003-01  
Calibration date: June 8, 2022

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.

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CCTL No.J21X06326)	Sep-22
Power sensor NRP5	104291	24-Sep-21 (CCTL No.J21X06326)	Sep-22
Reference Probe EX3DV4	SN 7464	26-Jan-22(SPEAG No EX3-7464-Jan22)	Jan-23
DAE4	SN 1556	12-Jan-22(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

Issued: June 13, 2022

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Certificate No: Z22-60186 Page 1 of 6

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

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

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

**Methods Applied and Interpretation of Parameters:**

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

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

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	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 ± 0.6 %
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)

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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 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 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: L1D 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, 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(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 = 103.4 V/m; Power Drift = 0.03 dB  
 Peak SAR (extrapolated) = 19.6 W/kg  
 SAR(1 g) = 10.4 W/kg; SAR(10 g) = 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 = 53.0%

Maximum value of SAR (measured) = 16.3 W/kg

0 dB = 16.3 W/kg = 12.12 dBW/kg

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**Impedance Measurement Plot for Head TSL**

Certificate No: Z22-60186 Page 6 of 6



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 中国·江苏·昆山开发区伟业路10号 邮编: 215300 t(86-512) 57355888 f(86-512) 57370818 sgs.china@sgs.com

## 1.9 D2300V2 - SN 1096

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Client: <b>SGS-CN</b>	Certificate No: <b>Z22-60106</b>																																
<b>CALIBRATION CERTIFICATE</b> Object: <b>D2300V2 - SN 1096</b> Calibration Procedure(s): <b>FF-Z11-003-01</b> Calibration date: <b>March 31, 2022</b>																																	
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%.																																	
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Calibrated by: <b>Zhao Jing</b> SAR Test Engineer Reviewed by: <b>Lin Hao</b> SAR Test Engineer Approved by: <b>Qi Diaryuan</b> SAR Project Leader	Issued: April 6, 2022 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.																																
Certificate No: Z22-60106	Page 1 of 6																																

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Certificate No: Z22-60106	Page 3 of 6																		

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<b>Glossary:</b> TSL: Issue simulating liquid ConvF: sensitivity in TSL / NCRMx,y,z N/A: not applicable or not measured	<b>Calibration is Performed According to the Following Standards:</b> 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 1:528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020 b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
<b>Additional Documentation:</b> c) DASY4/5 System Handbook	<b>Methods Applied and Interpretation of Parameters:</b> <ul style="list-style-type: none"> <li>Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.</li> <li>Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.</li> <li>Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.</li> <li>Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.</li> <li>SAR measured: SAR measured at the stated antenna input power.</li> <li>SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.</li> <li>SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.</li> </ul>
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: Z22-60106	Page 2 of 6

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<b>Appendix (Additional assessments outside the scope of CNAS L0570)</b>	<b>Antenna Parameters with Head TSL</b>				
<table border="1"> <tr> <td>Impedance, transformed to feed point</td> <td>49.20 - 4.56jΩ</td> </tr> <tr> <td>Return Loss</td> <td>-26.65dB</td> </tr> </table>	Impedance, transformed to feed point	49.20 - 4.56jΩ	Return Loss	-26.65dB	<b>General Antenna Parameters and Design</b>
Impedance, transformed to feed point	49.20 - 4.56jΩ				
Return Loss	-26.65dB				
<table border="1"> <tr> <td>Electrical Delay (one direction)</td> <td>1.083 ns</td> </tr> </table>	Electrical Delay (one direction)	1.083 ns	After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.  The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small 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.		
Electrical Delay (one direction)	1.083 ns				
<b>Additional EUT Data</b>	<table border="1"> <tr> <td>Manufactured by</td> <td>SPEAG</td> </tr> </table>	Manufactured by	SPEAG		
Manufactured by	SPEAG				
Certificate No: Z22-60106	Page 4 of 6				



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 E-mail: cti@china.ttl.com http://www.china.ttl.com

**DASY5 Validation Report for Head TSL** Date: 2022-03-31  
 Test Laboratory: CTTL, Beijing, China  
 DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN: 1096  
 Communication System: UTD 0, CW; Frequency: 2300 MHz; Duty Cycle: 1:1  
 Phantom parameters used: f = 2300 MHz;  $\sigma = 1.702$  S/m;  $\epsilon = 39.77$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Right Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(8.01, 8.01) @ 2300 MHz; Calibrated: 2021-05-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sst1556; Calibrated: 2022-01-12
- Phantom: MFP V5.1C (2ldag probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 S2.10.4(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 = 102.7 V/m; Power Drift = 0.00 dB  
 Peak SAR (extrapolated) = 24.8 W/kg  
 SAR(1 g) = 12.4 W/kg; SAR(10 g) = 5.88 W/kg  
 Smallest distance from peaks to all points 3 dB below = 9 mm  
 Ratio of SAR at M2 to SAR at M1 = 50.4%  
 Maximum value of SAR (measured) = 20.3 W/kg

0 dB = 20.3 W/kg = 13.07 dBW/kg

Certificate No: Z22-60106 Page 1 of 6

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**Impedance Measurement Plot for Head TSL**

Certificate No: Z22-60106 Page 4 of 6

## 1.10 D2450V2 - SN 817

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

**CALIBRATION CERTIFICATE**

Object: D2450V2 - SN: 817  
 Calibration Procedure(s): FF-Z11-003-01  
 Calibration date: April 1, 2022

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter: NRP2	108277	24-Sep-21 (CTTL No.J21X08320)	Sep-22
Power sensor: NRP8S	104291	24-Sep-21 (CTTL No.J21X08320)	Sep-22
Reference Probe: EX3DV4	SN 7307	26-May-21(SPEAG.No.EX3-7307_May21)	May-22
DAE4	SN 1556	12-Jan-22(CTTL-SPEAG.No.Z22-60007)	Jan-23

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

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

Issued: April 6, 2022

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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 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 585664, "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: Z22-60107 Page 2 of 6



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**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	2450 MHz ± 1 MHz	

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

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.5 ± 6 %	1.79 mho/m ± 6 %
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	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)

Certificate No: Z22-60107 Page 3 of 6

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

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 E-mail: cti@chinaeui.com http://www.chinaeui.cn

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

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	52.10 ± 3.20Ω
Return Loss	-28.5dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.066 ns
----------------------------------	----------

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

The dipole is made of standard 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.

**Additional EUT Data**

Manufactured by	SPEAQ
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**DASY5 Validation Report for Head TSL** Date: 2022-04-01

Test Laboratory: CTTL, Beijing, China  
 DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 817  
 Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1  
 Medium parameters used: f = 2450 MHz; σ = 1.79 S/m; ε = 39.52; 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(7.75, 7.75, 7.75) @ 2450 MHz; Calibrated: 2021-05-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DA14 Sn1556; Calibrated: 2022-01-12
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

**Dipole Calibration** Zoom Scan (7x7x7) (7x7x7)/Cube 0; Measurement grid: dx=5mm, dy=5mm, dz=5mm  
 Reference Value = 104.6 V/m; Power Drift = -0.03 dB  
 Peak SAR (extrapolated) = 27.0 W/kg  
 SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.15 W/kg  
 Smallest distance from peaks to all points 3 dB below = 8.9 mm  
 Ratio of SAR at M2 to SAR at M1 = -49.2%  
 Maximum value of SAR (measured) = 22.1 W/kg

Certificate No: Z22-60107 Page 5 of 6

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**Impedance Measurement Plot for Head TSL**

Certificate No: Z22-60107 Page 6 of 6



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 中国·江苏·昆山开发区伟业路10号 邮编: 215300 t(86-512) 57355888 f(86-512) 57370818 sgs.china@sgs.com



## 1.11 D2600V2 - SN 1158

<div style="text-align: center;"> </div> <p> <small>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China              Tel: +86-10-42304633-2512 Fax: +86-10-42304633-2504              E-mail: cti@china.ttl.com.cn http://www.chinatit.com</small> </p> <p> <b>Client:</b> SGS-CN      <b>Certificate No.:</b> Z22-60108         </p> <h3 style="text-align: center;">CALIBRATION CERTIFICATE</h3> <p> <b>Object:</b> D2600V2 - SN: 1158  <b>Calibration Procedure(s):</b> FF-Z11-003-01  <small>Calibration Procedures for dipole validation kits</small>  <b>Calibration date:</b> March 31, 2022         </p> <p> <small>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.</small> </p> <p> <small>All calibrations have been conducted in the closed laboratory facility: environment temperature (23±3)°C and humidity&lt;70%.</small> </p> <p> <small>Calibration Equipment used (M&amp;TE critical for calibration)</small> </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>108277</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" 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 (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> <b>Calibrated by:</b> Zhao Jing      SAR Test Engineer  <b>Reviewed by:</b> Lin Hao      SAR Test Engineer  <b>Approved by:</b> Qi Dianyuan      SAR Project Leader         </p> <p style="text-align: right;"> <small>Issued: April 6, 2022</small>  <small>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</small> </p> <p style="text-align: center;"> <small>Certificate No: Z22-60108      Page 1 of 6</small> </p>	Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Power Meter NRP2	108277	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	<div style="text-align: center;"> </div> <p> <small>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.cn http://www.chinatit.com</small> </p> <p> <b>Client:</b> SGS-CN      <b>Certificate No.:</b> Z22-60108         </p> <h3 style="text-align: center;">GLOSSARY</h3> <p> <b>TSL:</b> tissue simulating liquid  <b>ConvF:</b> sensitivity in TSL / NORMx,y,z  <b>N/A:</b> not applicable or not measured         </p> <p> <b>Calibration is Performed According to the Following Standards:</b>              a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020              b) KDB 865864, "SAR Measurement Requirements for 100 MHz to 6 GHz"  <b>Additional Documentation:</b>              c) DASY4/S System Handbook         </p> <p> <b>Methods Applied and Interpretation of Parameters:</b> </p> <ul style="list-style-type: none"> <li>Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.</li> <li>Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.</li> <li>Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.</li> <li>Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.</li> <li>SAR measured: SAR measured at the stated antenna input power.</li> <li>SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.</li> <li>SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <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> </div> <p style="text-align: center;"> <small>Certificate No: Z22-60108      Page 2 of 6</small> </p>																																								
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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  
 Medium parameters used:  $f = 2600 \text{ MHz}$ ;  $\sigma = 1.955 \text{ S/m}$ ;  $\epsilon_s = 38.68$ ;  $\rho = 1000 \text{ kg/m}^3$   
 Phantom section: Right Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)  
 DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(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 (2ddeg 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:  $d_x=5\text{mm}$ ,  $d_y=5\text{mm}$ ,  $d_z=5\text{mm}$   
 Reference Value = 103.3 V/m; Power Drift = 0.04 dB  
 Peak SAR (extrapolated) = 29.0 W/kg  
 SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.12 W/kg  
 Smallest distance from peaks to all points 3 dB below = 8.9 mm  
 Ratio of SAR at M2 to SAR at M1 = 47.5%  
 Maximum value of SAR (measured) = 23.4 W/kg

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

Certificate No: Z22-60108 Page 5 of 6

**TTL Speaq** Calibration Laboratory  
 In Collaboration with **CAICT**

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**Impedance Measurement Plot for Head TSL**

Certificate No: Z22-60108 Page 6 of 6

## 1.12 D5GHzV2 - SN 1095

**TTL Speaq** Calibration Laboratory  
 In Collaboration with **CAICT**, **ILAC-MRA**, **CNAS**

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

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±3)°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.J211008326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL No.J211008326)	Sep-22
Reference Probe EX3DV4	SN 7464	26-Jan-22(SPEAG No EX3-7464_Jan22)	Jan-23
DAE4	SN 1556	12-Jan-22(CTTL-SPEAG No.Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by: Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CTTL No. J22X00406)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL No. J22X00406)	Jan-23

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

Issued: June 6, 2022  
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Certificate No: Z22-60187 Page 1 of 10

**TTL Speaq** Calibration Laboratory  
 In Collaboration with **CAICT**

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 Tel: +86-10-62104633 E-mail: cti@china.ttl.com http://www.china.ttl.com

**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:**  
 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 665664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**  
 c) 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**  
 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 = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5200 MHz ± 1 MHz 5500 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
	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
	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
	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
	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
	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	46.10-5.03jΩ
Return Loss	-23.6dB

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

Impedance, transformed to feed point	47.80-2.42jΩ
Return Loss	-28.5dB

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

Impedance, transformed to feed point	50.30-4.26jΩ
Return Loss	-27.4dB

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

Impedance, transformed to feed point	54.50-4.80jΩ
Return Loss	-24.0dB

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

Impedance, transformed to feed point	51.50-5.61jΩ
Return Loss	-24.9dB

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<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">   <small>In Collaboration with</small>  <b>T T L</b>  <small>CAIBRATION LABORATORY</small>  <small>ADD: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China</small>  <small>Tel: +86-10-62302117</small>  <small>E-mail: csl@tstnet.com</small> </div> <div style="text-align: center;">   <small>CAICT</small> </div> </div> <p><b>General Antenna Parameters and Design</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">Electrical Delay (one direction)</td> <td style="width: 20%;">1.101 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.</p> <p>No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged.</p> <p><b>Additional EUT Data</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">Manufactured by</td> <td style="width: 40%;">SPEAG</td> </tr> </table> <p style="font-size: small;">Certificate No: Z22-60187      Page 7 of 10</p>	Electrical Delay (one direction)	1.101 ns	Manufactured by	SPEAG	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">   <small>In Collaboration with</small>  <b>T T L</b>  <small>CAIBRATION LABORATORY</small>  <small>ADD: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China</small>  <small>Tel: +86-10-62302117</small>  <small>E-mail: csl@tstnet.com</small> </div> <div style="text-align: center;">   <small>CAICT</small> </div> </div> <p style="text-align: right; font-size: small;">Date: 2022-06-01</p> <p><b>DASY5 Validation Report for Head TSL</b></p> <p>Test Laboratory: CTTL, Beijing, China  <b>DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1095</b>      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>\alpha = 4.62</math> S/m; <math>\epsilon_r = 35.19</math>; <math>\rho = 1000</math> kg/m<sup>3</sup>      Medium parameters used: f = 5300 MHz; <math>\alpha = 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>\alpha = 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>\alpha = 5.051</math> S/m; <math>\epsilon_r = 34.88</math>; <math>\rho = 1000</math> kg/m<sup>3</sup>      Medium parameters used: f = 5800 MHz; <math>\alpha = 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: DA4 Sn1556; Calibrated: 2022-01-12</li> <li>• Phantom: MFP_V5.1C (20deg probe tilt); Type: GD Q0 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  <b>SAR(1 g) = 7.73 W/kg; SAR(10 g) = 2.22 W/kg</b>      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  <b>SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.27 W/kg</b>      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 style="font-size: small;">Certificate No: Z22-60187      Page 8 of 10</p>
Electrical Delay (one direction)	1.101 ns				
Manufactured by	SPEAG				
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## 2 DAE4 - SN 1245

**s p e a g**

**IMPORTANT NOTICE**

**USAGE OF THE DAE4**

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

**Battery Exchange:** The battery cover of the DAE4 unit is fixed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

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

**E-Stop Failures:** Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE4 carefully and keep the DAE4 unit in a non-dusty environment if not used for measurements.

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

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

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

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

**Important Note:**  
To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

TL\_EH190303AE DAE4.docx 07.03.2019

**Calibration Laboratory of Schmid & Partner Engineering AG**

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Accreditation No.: SCS 0108

Client: **SGS** Certificate No: DAE4-1245\_Apr23

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**CALIBRATION CERTIFICATE**

Object: **DAE4 - SD 000 D04 BM - SN: 1245**

Calibration procedure(s): **QA CAL-06.v30**  
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: **April 25, 2023**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurement results 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 (MATE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Kathley Multimeter Type 2001	SN: 0810279	29-Aug-22 (No. 34389)	Aug-23

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UMS 002 AA 1001	27-Jan-23 (in house check)	In house check: Jan-24
Calibrator Box V2.1	SE UMS 008 AA 1002	27-Jan-23 (in house check)	In house check: Jan-24

Calibrated by: **Dominique Sellen** (Function: Laboratory Technician) Signature:

Approved by: **Steen Kuhn** (Function: Technical Manager) Signature:

Issued: April 25, 2023

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Certificate No: DAE4-1245\_Apr23 Page 1 of 5

**Calibration Laboratory of Schmid & Partner Engineering AG**

Zehngässlistrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 0108

**Glossary**

DAE: data acquisition electronics

Connector angle: information used in DASY system to align probe sensor X to the robot coordinate system.

**Methods Applied and Interpretation of Parameters**

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

Certificate No: DAE4-1245\_Apr23 Page 2 of 5

**DC Voltage Measurement**

AD - Converter Resolution nominal

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

Low Range: 1LSB = 61nV, full range = -1...+30mV

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

Calibration Factors	X	Y	Z
High Range	405.243 ± 0.02% (k=2)	403.938 ± 0.02% (k=2)	405.064 ± 0.02% (k=2)
Low Range	3.99474 ± 1.50% (k=2)	3.99478 ± 1.50% (k=2)	4.00994 ± 1.50% (k=2)

**Connector Angle**

Connector Angle to be used in DASY system	32.0° ± 1°
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Certificate No: DAE4-1245\_Apr23 Page 3 of 5



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**Appendix (Additional assessments outside the scope of SCS0108)**

**1. DC Voltage Linearity**

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

High Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	199998.60	2.90	0.00
Channel X - Input	20005.77	2.75	0.01
Channel X + Input	-19998.65	2.19	-0.01
Channel Y + Input	199996.60	1.08	0.00
Channel Y - Input	20003.12	0.26	0.00
Channel Z + Input	20000.51	-1.06	-0.00
Channel Z - Input	199994.62	-0.70	-0.00
Channel Z + Input	20002.17	-0.70	-0.00
Channel Z - Input	-20001.94	-0.91	0.00

Low Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	2002.91	0.91	0.04
Channel X - Input	203.06	0.73	0.36
Channel X + Input	-196.56	0.88	-0.45
Channel Y + Input	2002.33	0.29	0.01
Channel Y - Input	201.91	-0.39	-0.19
Channel Z + Input	-196.22	-0.79	0.40
Channel Z - Input	2002.29	0.24	0.01
Channel Z + Input	201.28	-0.89	-0.44
Channel Z - Input	-198.03	-1.36	0.69

**2. Common mode sensitivity**

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

Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	-8.42
-200	8.81	-8.27
Channel Y	200	7.04
-200	14.70	-15.29
Channel Z	200	-4.52
-200	3.50	3.52

**3. Channel separation**

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

Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	3.29	-3.29
Channel Y	200	9.00	4.00
Channel Z	200	10.03	7.20

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**4. AD-Converter Values with inputs shorted**

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

	High Range (LSB)	Low Range (LSB)
Channel X	16001	16100
Channel Y	16079	16051
Channel Z	16040	15891

**5. Input Offset Measurement**

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

Input (10mV)

	Average (µV)	min. Offset (µV)	max. Offset (µV)	Std. Deviation (µV)
Channel X	0.77	-0.83	1.89	0.49
Channel Y	-0.24	-1.72	1.19	0.52
Channel Z	-0.85	-2.62	0.59	0.61

**6. Input Offset Current**

Nominal input circuitry offset current on all channels: <math>\lt; 25\mu A</math>

**7. Input Resistance** (Typical values for information)

	Zeroing (kOhm)	Measuring (Mohm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

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

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

**9. Power Consumption** (Typical values for information)

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

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## 3 EX3DV4 - SN 7767

Calibration Laboratory of Schmid & Partner Engineering AG  
 Zugstrasse 43, 8004 Zurich, Switzerland  
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Client: **SGS-CN (Auden)** Certificate No: **EX-7767\_Oct22**

**CALIBRATION CERTIFICATE**

Object: **EX3DV4 - SN:7767**

Calibration procedure(s): **QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v6, QA CAL-23.v5, QA CAL-25.v7**  
 Calibration procedure for dosimetric E-field probes

Calibration date: **October 28, 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 <math>\lt; 70\%</math>. Calibration Equipment used (MATE critical for calibration)

Primary Standards	ID	Cal. Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-22 (No. 21-F2628-03564)	Apr-23
Power sensor NRP201	SN: 103844	04-Apr-22 (No. 21-F2628-03564)	Apr-23
DCP DAK-S3 (Impedance)	SN: 1048	20-Oct-22 (DCP-DAKS3-1716_Oct22)	Oct-23
DCP DAK-12	SN: 1018	20-Oct-22 (DCP-DAKS3-1716_Oct22)	Oct-23
Reference 50 dB Attenuator	SN: 105882 (50dB)	04-Apr-22 (No. 21-F2628-03564)	Apr-23
DAE4	SN: 986	19-Oct-22 (No. DA64-880_Oct22)	Oct-23
Reference Probe E53502	SN: 3013	27-Oct-21 (No. E53-3013_Oct21)	Oct-22

Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4418B	SN: G841298874	05-Apr-18 (in house check Jun-20)	In house check Jun-24
Power sensor E4418A	SN: 014488687	05-Apr-18 (in house check Jun-20)	In house check Jun-24
Power sensor E4415A	SN: 005115210	05-Apr-18 (in house check Jun-20)	In house check Jun-24
RF generator HP 8548C	SN: U88460101705	04-Aug-09 (in house check Jun-20)	In house check Jun-24
Network Analyzer E6556A	SN: S641984947	31-May-14 (in house check Oct-20)	In house check Oct-24

Calibrated by: **Aldona Georgiadiu** (Laboratory Technician) Signature: *[Signature]*

Approved by: **Gven KJhm** (Technical Manager) Signature: *[Signature]*

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Certificate No: EX-7767\_Oct22 Page 1 of 9

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Client: **SGS-CN (Auden)** Certificate No: **EX-7767\_Oct22**

**Glossary**

TSL: Issue simulating liquid  
 NORM<sub>M,y,z</sub>: sensitivity in TSL / NORM<sub>M,y,z</sub>  
 Conf: crest factor (1.414... cycle) of the RF signal  
 DCP: diode compression point  
 CF: crest factor (1.414... cycle) of the RF signal  
 A, B, C, D: modulation dependent linearization parameters  
 Pol: rotation around probe axis  
 Pol: rotation around probe axis that is in the plane normal to probe axis (measurement center), i.e.,  $\theta = 0^\circ$  is normal to probe axis  
 Connector Angle: information used in DASY system to align probe sensor X to the robot coordinate system

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

a) IEC/IEEE 62209-1528: "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.  
 b) KDB 869864: "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Methods Applied and Interpretation of Parameters:**

- NORM<sub>M,y,z</sub>: Assessed for E-field polarization  $\theta = 0^\circ$  ( $f = 900\text{MHz}$  in TEM-cell;  $f = 1800\text{MHz}$ ; R22 waveguide). NORM<sub>M,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>M,y,z</sub> does not affect the E-field uncertainty inside TSL (see below Conf).
- NORM<sub>M,y,z</sub> = NORM<sub>M,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 Conf.
- DCP<sub>M,y,z</sub>: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal. DCP does not depend on frequency nor media.
- Pol: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- A, B, C, D: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signals. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- Conf and Boundary Effect Parameters: Assessed in far field phantom using E-field or Temperature Transfer Standard for  $f = 900\text{MHz}$  and media waveguide using analytical field distributions based on power measurements for  $f = 900\text{MHz}$ . The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>M,y,z</sub> \* Conf whereby the uncertainty corresponds to that given for Conf. A frequency dependent Conf is used in DASY4 version 4.4 and higher which allows extending the validity from  $\pm 50\text{MHz}$  to  $\pm 100\text{MHz}$ .
- Spherical geometry (SD deviation from isotropy): In a field of low gradients realized using a fair phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the NORM<sub>M</sub> (no uncertainty required).

Certificate No: EX-7767\_Oct22 Page 2 of 9



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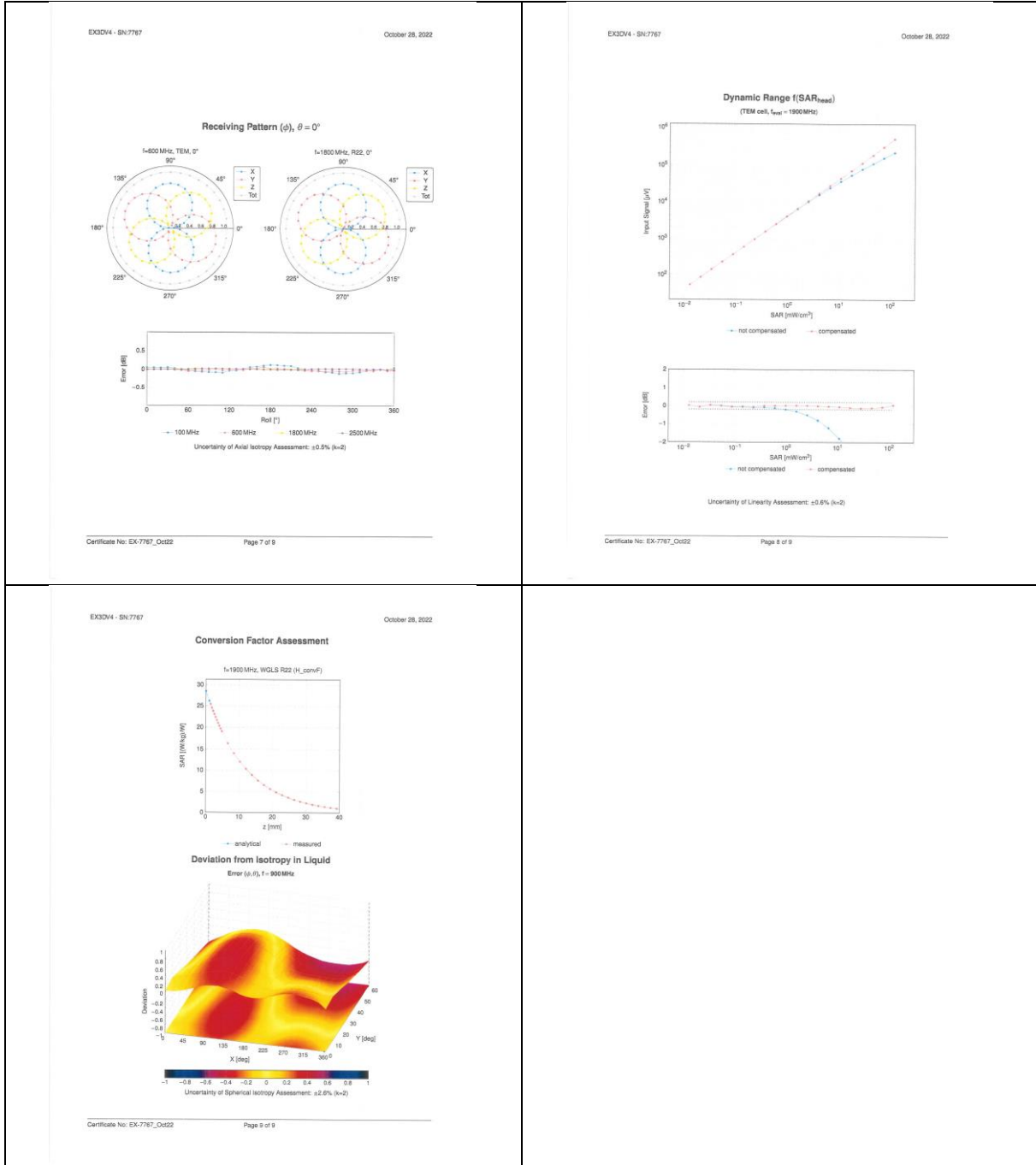
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<p>EX3DV4 - SN:7767 October 28, 2022</p> <p><b>Parameters of Probe: EX3DV4 - SN:7767</b></p> <p><b>Basic Calibration Parameters</b></p> <table border="1"> <thead> <tr> <th></th> <th>Sensor X</th> <th>Sensor Y</th> <th>Sensor Z</th> <th>Unc (k=2)</th> </tr> </thead> <tbody> <tr> <td>Norm. <math>(\mu V/m^2)^A</math></td> <td>0.67</td> <td>0.69</td> <td>0.56</td> <td><math>\pm 10.1\%</math></td> </tr> <tr> <td>DCP (mV)<sup>B</sup></td> <td>103.4</td> <td>107.3</td> <td>105.7</td> <td><math>\pm 4.7\%</math></td> </tr> </tbody> </table> <p><b>Calibration Results for Modulation Response</b></p> <table border="1"> <thead> <tr> <th>UBI</th> <th>Communication System Name</th> <th>A dB</th> <th>B dB/μV</th> <th>C</th> <th>D dB</th> <th>VR mV</th> <th>Max dev.</th> <th>Max Unc<sup>C</sup> (k=2)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>CW</td> <td>X: 0.00 Y: 0.00 Z: 0.00</td> <td>0.00 0.00 0.00</td> <td>1.00 1.00 1.00</td> <td>0.00 184.7 179.3</td> <td>23.5% -4.7%</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 <math>k=2</math>, which for a normal distribution corresponds to a coverage probability of approximately 95%.</p> <p><small>A: The uncertainties of Norm X,Y,Z do not affect the <math>E^2</math>-field uncertainty inside TSS. (see Page 5). B: Uncertainty parameter uncertainty for maximum specified field strength. C: Uncertainty is determined using the max. deviation from three responses applying rectangular distribution and is expressed for the square of the field value.</small></p> <p>Certificate No: EX-7767_Oct22 Page 5 of 9</p>		Sensor X	Sensor Y	Sensor Z	Unc (k=2)	Norm. $(\mu V/m^2)^A$	0.67	0.69	0.56	$\pm 10.1\%$	DCP (mV) <sup>B</sup>	103.4	107.3	105.7	$\pm 4.7\%$	UBI	Communication System Name	A dB	B dB/μV	C	D dB	VR mV	Max dev.	Max Unc <sup>C</sup> (k=2)	0	CW	X: 0.00 Y: 0.00 Z: 0.00	0.00 0.00 0.00	1.00 1.00 1.00	0.00 184.7 179.3	23.5% -4.7%		<p>EX3DV4 - SN:7767 October 28, 2022</p> <p><b>Parameters of Probe: EX3DV4 - SN:7767</b></p> <p><b>Other Probe Parameters</b></p> <table border="1"> <tbody> <tr> <td>Sensor Arrangement</td> <td>Triangular</td> </tr> <tr> <td>Connector Angle</td> <td>144.9°</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>337mm</td> </tr> <tr> <td>Probe Body Diameter</td> <td>10mm</td> </tr> <tr> <td>Tip Length</td> <td>3mm</td> </tr> <tr> <td>Tip Diameter</td> <td>2.5mm</td> </tr> <tr> <td>Probe Tip to Sensor X Calibration Point</td> <td>1mm</td> </tr> <tr> <td>Probe Tip to Sensor Y Calibration Point</td> <td>1mm</td> </tr> <tr> <td>Probe Tip to Sensor Z Calibration Point</td> <td>1mm</td> </tr> <tr> <td>Recommended Measurement Distance from Surface</td> <td>1.4mm</td> </tr> </tbody> </table> <p><small>Note: Measurement distance from surface can be increased to 3-4mm for an Area Scan job.</small></p> <p>Certificate No: EX-7767_Oct22 Page 4 of 9</p>	Sensor Arrangement	Triangular	Connector Angle	144.9°	Mechanical Surface Detection Mode	enabled	Optical Surface Detection Mode	disabled	Probe Overall Length	337mm	Probe Body Diameter	10mm	Tip Length	3mm	Tip Diameter	2.5mm	Probe Tip to Sensor X Calibration Point	1mm	Probe Tip to Sensor Y Calibration Point	1mm	Probe Tip to Sensor Z Calibration Point	1mm	Recommended Measurement Distance from Surface	1.4mm																																																																																																																																																																																		
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<p>EX3DV4 - SN:7767 October 28, 2022</p> <p><b>Parameters of Probe: EX3DV4 - SN:7767</b></p> <p><b>Calibration Parameter Determined in Head Tissue Simulating Media</b></p> <table border="1"> <thead> <tr> <th>f (MHz)<sup>D</sup></th> <th>Relative Permittivity<sup>E</sup></th> <th>Conductivity<sup>F</sup> (S/m)</th> <th>CompF X</th> <th>CompF Y</th> <th>CompF Z</th> <th>Alpha<sup>G</sup></th> <th>Depth<sup>H</sup> (mm)</th> <th>Unc (k=2)</th> </tr> </thead> <tbody> <tr><td>150</td><td>50.3</td><td>0.79</td><td>14.08</td><td>14.08</td><td>14.08</td><td>0.00</td><td>1.00</td><td><math>\pm 13.2\%</math></td></tr> <tr><td>450</td><td>42.3</td><td>0.87</td><td>11.50</td><td>11.50</td><td>11.50</td><td>0.16</td><td>1.20</td><td><math>\pm 13.3\%</math></td></tr> <tr><td>750</td><td>41.8</td><td>0.88</td><td>10.26</td><td>10.26</td><td>10.26</td><td>0.30</td><td>0.80</td><td><math>\pm 12.0\%</math></td></tr> <tr><td>835</td><td>41.5</td><td>0.90</td><td>10.00</td><td>10.00</td><td>10.00</td><td>0.43</td><td>0.80</td><td><math>\pm 12.0\%</math></td></tr> <tr><td>1750</td><td>40.1</td><td>1.37</td><td>9.32</td><td>9.32</td><td>9.32</td><td>0.36</td><td>0.86</td><td><math>\pm 12.0\%</math></td></tr> <tr><td>1900</td><td>40.0</td><td>1.40</td><td>8.91</td><td>8.91</td><td>8.91</td><td>0.33</td><td>0.86</td><td><math>\pm 12.0\%</math></td></tr> <tr><td>2100</td><td>39.8</td><td>1.49</td><td>8.60</td><td>8.60</td><td>8.60</td><td>0.30</td><td>0.86</td><td><math>\pm 12.0\%</math></td></tr> <tr><td>2200</td><td>39.5</td><td>1.67</td><td>8.44</td><td>8.44</td><td>8.44</td><td>0.33</td><td>0.80</td><td><math>\pm 12.0\%</math></td></tr> <tr><td>2450</td><td>39.2</td><td>1.80</td><td>8.24</td><td>8.24</td><td>8.24</td><td>0.32</td><td>0.80</td><td><math>\pm 12.0\%</math></td></tr> <tr><td>2600</td><td>39.0</td><td>1.96</td><td>7.99</td><td>7.99</td><td>7.99</td><td>0.27</td><td>0.80</td><td><math>\pm 12.0\%</math></td></tr> <tr><td>3900</td><td>38.2</td><td>2.71</td><td>7.55</td><td>7.55</td><td>7.55</td><td>0.30</td><td>1.25</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>3600</td><td>37.9</td><td>2.91</td><td>7.45</td><td>7.45</td><td>7.45</td><td>0.30</td><td>1.35</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>3700</td><td>37.7</td><td>3.12</td><td>7.20</td><td>7.20</td><td>7.20</td><td>0.30</td><td>1.25</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>3900</td><td>37.5</td><td>3.32</td><td>6.84</td><td>6.84</td><td>6.84</td><td>0.40</td><td>1.00</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>4100</td><td>37.2</td><td>3.53</td><td>6.63</td><td>6.63</td><td>6.63</td><td>0.40</td><td>1.00</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>4300</td><td>37.1</td><td>3.80</td><td>6.30</td><td>6.30</td><td>6.30</td><td>0.40</td><td>1.70</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>4400</td><td>36.9</td><td>3.84</td><td>6.17</td><td>6.17</td><td>6.17</td><td>0.40</td><td>1.70</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>4600</td><td>36.7</td><td>4.04</td><td>6.15</td><td>6.15</td><td>6.15</td><td>0.40</td><td>1.70</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>4800</td><td>36.4</td><td>4.25</td><td>6.13</td><td>6.13</td><td>6.13</td><td>0.40</td><td>1.90</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>4900</td><td>36.3</td><td>4.40</td><td>6.07</td><td>6.07</td><td>6.07</td><td>0.40</td><td>1.80</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>5200</td><td>36.0</td><td>4.66</td><td>5.65</td><td>5.65</td><td>5.65</td><td>0.40</td><td>1.80</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>5300</td><td>35.9</td><td>4.75</td><td>5.48</td><td>5.48</td><td>5.48</td><td>0.40</td><td>1.80</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>5600</td><td>35.6</td><td>4.99</td><td>5.30</td><td>5.30</td><td>5.30</td><td>0.40</td><td>1.80</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>5800</td><td>35.5</td><td>5.07</td><td>5.14</td><td>5.14</td><td>5.14</td><td>0.40</td><td>1.80</td><td><math>\pm 13.1\%</math></td></tr> <tr><td>5900</td><td>35.3</td><td>5.27</td><td>5.10</td><td>5.10</td><td>5.10</td><td>0.40</td><td>1.80</td><td><math>\pm 13.1\%</math></td></tr> </tbody> </table> <p><small>D: Frequency valid for above 300 MHz at <math>\pm 100</math> MHz only applies for DCP v1.4 and higher (see Page 5), else it is relevant to <math>\pm 50</math> MHz. The uncertainty is the 95% of the CompF uncertainty at calibration frequency and the uncertainty for the relative permittivity and conductivity values below 300 MHz is <math>\pm 15</math>, 25, 40, 50 and 70 MHz for CompF assessments at 30, 40, 125, 175 and 200 MHz, respectively. Validity of CompF assessed at 6 MHz to 4.6 MHz and CompF assessed at 15 MHz to 0.1 MHz. Above 0.1 MHz, the validity of CompF can be extended to <math>\pm 100</math> MHz. E: At frequencies below 3 GHz, the validity of tissue parameters (relative permittivity and conductivity) can be extended to <math>\pm 10\%</math> if a valid comparison formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (relative permittivity and conductivity) is not valid. The uncertainty is the 95% of the CompF uncertainty on individual target tissue parameters. F: Alpha values are determined using calibration. SARAD warns that the remaining residual due to the uncertainty when after compensation is always less than <math>\pm 1\%</math> for frequencies below 3 GHz and below <math>\pm 2\%</math> for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the targets. G: Alpha values are determined using calibration. SARAD warns that the remaining residual due to the uncertainty when after compensation is always less than <math>\pm 1\%</math> for frequencies below 3 GHz and below <math>\pm 2\%</math> for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the targets. H: Alpha values are determined using calibration. 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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	/
2023/6/7	-22.9	-2.23%	51.6	-0.4
Dipole D2000V2 SN 1041				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
2022/6/6	-34.9	/	48.4	/
2023/6/6	-33.5	4.01%	49.1	-0.7



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Dipole D2300V2 SN 1096				
Head Liquid				
Date of Measurement	Return Loss(dB)	$\Delta$ %	Impedance ( $\Omega$ )	$\Delta\Omega$
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	/
2023/6/1	-23.1	2.12%	45.6	0.5
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	/
2023/6/1	-28.8	2.37%	46.9	0.9
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	/
2023/6/1	-27.6	-0.73%	50.8	-0.5
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	/
2023/6/1	-23.6	1.67%	54.9	-0.4
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	/
2023/6/1	-24.3	2.41%	51.0	0.5



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