

Appendix C for KSCR220500086301

Calibration Certificate

Object	Apply	No	Model	SN	Calibration Date
Dipole	<input type="checkbox"/>	1	CLA150	4025	2021/04/26
	<input type="checkbox"/>	2	D450V3	1103	2021/04/21
	<input type="checkbox"/>	3	D750V3	1188	2022/03/29
	<input type="checkbox"/>	4	D835V2	4d114	2022/03/31
	<input type="checkbox"/>	5	D900V2	1d079	2022/06/07
	<input type="checkbox"/>	6	D1800V2	2d170	2022/03/31
	<input type="checkbox"/>	7	D1900V2	5d1136	2022/06/07
	<input type="checkbox"/>	8	D2000V2	1041	2022/06/06
	<input type="checkbox"/>	9	D2300V2	1096	2022/03/31
	<input checked="" type="checkbox"/>	10	D2450V2	817	2022/04/01
	<input type="checkbox"/>	11	D2600V2	1158	2022/03/31
	<input type="checkbox"/>	12	D5GHzV2	1095	2022/06/01
DAE	<input checked="" type="checkbox"/>	13	DAE4	1245	2022/05/30
Probe	<input checked="" type="checkbox"/>	14	EX3DV4	7346	2022/03/30



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

1 Dipole

1.1 CLA150 - SN 4025

<p>Calibration Laboratory of Schmid & Partner Engineering AG Ziegelhaustrasse 41, 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: SGS-CN (Auden) Certificate No.: CLA150-4025_Apr21</p> <p style="text-align: right;">Accreditation No.: SCS 0108</p> <hr/> <p style="text-align: center;">CALIBRATION CERTIFICATE</p> <p>Object: CLA150 - SN: 4025</p> <p>Calibration procedure(s): QA CAL-15.9-D Calibration Procedure for SAR Validation Sources below 700 MHz</p> <p>Calibration date: April 26, 2021</p> <p>The calibration certificate documents the traceability to national standards, which reflect the physical units of measurement (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 enclosed laboratory facility; environment temperature (22 ± 3°C and humidity < 70%).</p> <p>Calibration Equipment Used (M&E: critical for calibration)</p> <table border="1" style="width:100%; border-collapse: collapse; font-size: 8px;"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Certificate No.)</th> <th>Schedule / Calibration</th> </tr> </thead> <tbody> <tr> <td>Power meter NRP</td> <td>SN: 10476</td> <td>09-Apr-21 (No. 217-03091.03292)</td> <td>Apr-22</td> </tr> <tr> <td>Power sensor NRP Z01</td> <td>SN: 103344</td> <td>09-Apr-21 (No. 217-03051)</td> <td>Apr-22</td> </tr> <tr> <td>Power sensor NRP Z01</td> <td>SN: 103345</td> <td>09-Apr-21 (No. 217-03052)</td> <td>Apr-22</td> </tr> <tr> <td>Reference 20 dB Attenuator</td> <td>SN: CC2360 (2x)</td> <td>09-Apr-21 (No. 217-03333)</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 EX3004 (1x4)</td> <td>SN: 3877</td> <td>30-Dec-20 (No. 20X3877_Dec20)</td> <td>Dec-21</td> </tr> <tr> <td></td> <td>SN: 663</td> <td>15-Jan-20 (No. 20X5456_Jan20)</td> <td>Jan-21</td> </tr> </tbody> </table> <table border="1" style="width:100%; 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NORM x,y,z</p> <p>ConvF: not applicable or not measured</p> <p>N/A: not applicable or not measured</p> <p>Calibration is Performed According to the Following Standards:</p> <ol style="list-style-type: none"> 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 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz" <p>Additional Documentation:</p> <ol style="list-style-type: none"> DASY4/5 System Handbook <p>Methods Applied and Interpretation of Parameters:</p> <ul style="list-style-type: none"> Measurement Conditions: 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. Antenna Parameters with TSL: The source is mounted in a touch configuration below the center marking of the flat phantom. Return Loss: 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. SAR measured: SAR measured at the stated antenna input power. SAR nominal: 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>The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.</p> <p>Certificate No: CLA150-4025_Apr21 Page 2 of 6</p>		
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<p>Measurement Conditions DASY system configuration, as far as not given on page 1.</p> <table border="1" style="width:100%; border-collapse: collapse; font-size: 8px;"> <thead> <tr> <th>DASY Version</th> <th>DASY5</th> <th>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 = 4.0 mm, dz = 1.4 mm</td> <td>Graded Ratio = 1.4 (Z direction)</td> </tr> <tr> <td>Frequency</td> <td>150 MHz ± 1 MHz</td> <td></td> </tr> </tbody> </table> <p>Head TSL parameters The following parameters and calculations were applied.</p> <table border="1" style="width:100%; border-collapse: collapse; font-size: 8px;"> <thead> <tr> <th></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>< 0.5 °C</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>SAR result with Head TSL</p> <table border="1" style="width:100%; border-collapse: collapse; font-size: 8px;"> <thead> <tr> <th>SAR averaged over 1 cm³ (1 g) of Head TSL</th> <th>Condition</th> <th></th> </tr> </thead> <tbody> <tr> <td>SAR measured</td> <td>1 W input power</td> <td>3.90 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>3.88 W/kg ± 18.4 % (k=2)</td> </tr> </tbody> </table> <table border="1" style="width:100%; border-collapse: collapse; font-size: 8px;"> <thead> <tr> <th>SAR averaged over 10 cm³ (10 g) of Head TSL</th> <th>condition</th> <th></th> </tr> </thead> <tbody> <tr> <td>SAR measured</td> <td>1 W input power</td> <td>2.60 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>2.59 W/kg ± 18.0 % (k=2)</td> </tr> </tbody> </table> <p>Certificate No: CLA150-4025_Apr21 Page 3 of 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 = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)	Frequency	150 MHz ± 1 MHz			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 ³ (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 ³ (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>Appendix (Additional assessments outside the scope of SCS 0108)</p> <p>Antenna Parameters with Head TSL</p> <table border="1" style="width:100%; border-collapse: collapse; font-size: 8px;"> <tbody> <tr> <td>Impedance, transformed to feed point</td> <td>47.9 Ω ± 1.5 Ω</td> </tr> <tr> <td>Return Loss</td> <td>-31.4 dB</td> </tr> </tbody> </table> <p>Additional EUT Data</p> <table border="1" style="width:100%; border-collapse: collapse; font-size: 8px;"> <tbody> <tr> <td>Manufactured by</td> <td>SPEAG</td> </tr> </tbody> </table> <p>Certificate No: CLA150-4025_Apr21 Page 4 of 6</p>	Impedance, transformed to feed point	47.9 Ω ± 1.5 Ω	Return Loss	-31.4 dB	Manufactured by	SPEAG
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 中国·江苏·昆山市留学生创业园伟业路10号 邮编 215300 t(86-512)57355888 f(86-512)57370818 sgs.china@sgs.com

DASY5 Validation Report for Head TSL

Date: 26.04.2021

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UTD 0, CW, Frequency: 150 MHz
 Medium parameters used: $f = 150 \text{ MHz}$; $\sigma = 0.76 \text{ S/m}$; $\epsilon = 51.1$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Flat Section
 Measurement Standard: DASY5 (IEEE/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)/Tube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
 Reference Value = 85.93 W/m; Power Drift = -0.02 dB
 Peak SAR (extrapolated) = 7.36 W/kg
SAR(1 g) = 3.90 W/kg; SAR(10 g) = 2.60 W/kg
 Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 30mm)
 Ratio of SAR at M2 to SAR at M1 = 80.4%
 Maximum value of SAR (measured) = 5.48 W/kg

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

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1.2 D450V3 - SN 1103

Calibration Laboratory of Schmid & Partner Engineering AG
 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 (Aiden)** 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 in 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: environmental temperature (22 ± 2) °C and humidity < 75%.

Calibration Equipment used (MPE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power Meter NRP	SN: 104779	09-Apr-21 (No. 217-0301102030)	Apr-22
Power sensor NRP-291	SN: 103244	09-Apr-21 (No. 217-030211)	Apr-22
Power sensor NRP-291	SN: 103245	09-Apr-21 (No. 217-030209)	Apr-22
Reference 20 dB Attenuator	SN: C02852 (300)	09-Apr-21 (No. 217-03043)	Apr-22
Type-N measurement combination	SN: 310952 / 06307	09-Apr-21 (No. 217-03044)	Apr-22
Reference Probe E3035A	SN: 3077	30-Dec-20 (No. E30-2077_De2020)	Dec-21
DAEA	SN: 604	05-Jun-20 (No. DA54-604_Jun20)	Jun-21

Secondary Standards

ID #	Check Date (in House)	Scheduled Check
Power meter E4418B	SN: GB41200274 09-Apr-19 (In house check Jun-20)	In house check Jun-22
Power sensor E4412A	SN: MY41496097 09-Apr-19 (In house check Jun-20)	In house check Jun-22
Power sensor E4412A	SN: 00010210 09-Apr-19 (In house check Jun-20)	In house check Jun-22
HP generator HP 8448C	SN: US3406011000 09-Apr-19 (In house check Jun-20)	In house check Jun-22
Network Analyzer Agilent E8358A	SN: US41980477 31-Mar-14 (In house check Oct-20)	In house check Oct-21

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

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

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

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Client: **SGS-CN (Aiden)** 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 2015
- 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 605664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Certificate No: D450V3-1103_Apr21 Page 2 of 6



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

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

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

Head TSL parameters
The following parameters and calculations were applied.

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

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	4.55 W/kg ± 18.1 % (k=2)

SAR averaged over 10 cm ³ (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 - j2.6 jΩ
Return Loss	-23.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.346 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured. The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is 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: $f = 450 \text{ MHz}$, $n = 0.87 \text{ Sin}$, $\epsilon_r = 43.1$, $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEE/IEC/ANSI C63.19-2011)

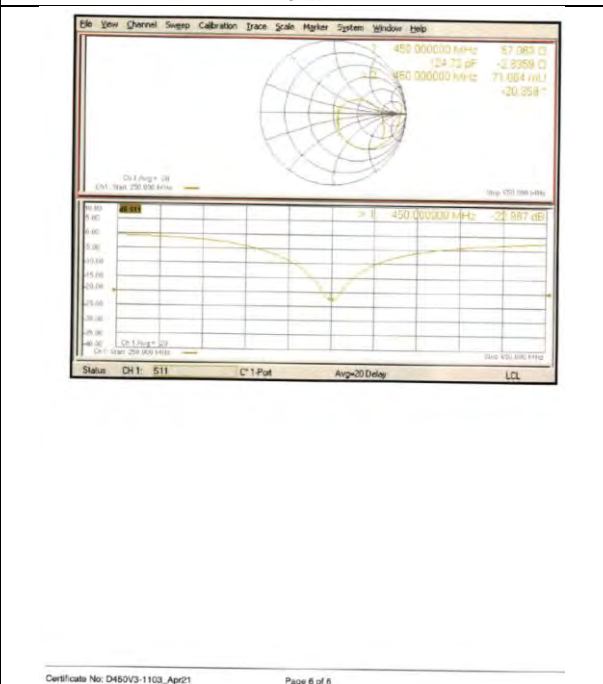
DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF [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: 10.4 (1527); SEMCAD X (4.6.14)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 W/m; Power Diff = -0.08 dB
Peak SAR (extrapolated) = 1.76 W/kg
SAR(1g) = 1.14 W/kg; SAR(10g) = 0.767 W/kg
Smallest distance from peaks to all points: 3 dB below: Larger than measurement grid
Ratio of SAR at M2 to SAR at M1 = 64.9%

Maximum value of SAR (measured) = 1.53 W/kg

Certificate No: D450V3-1103_Apr21 Page 5 of 6



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

1.3 D750V3 - SN 1188

<p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191 Tel: +86-10-4236633-2152 Fax: +86-10-4236633-2564 E-mail: cti@china.ttl.com.cn http://www.china.ttl.com.cn</p> <p>Client: SGS-CN Certificate No: Z22-40103</p> <p>CALIBRATION CERTIFICATE</p> <p>Object: D750V3 - SN: 1188</p> <p>Calibration Procedure(s): FF-Z11-003-01 Calibration Procedures for dipole validation kits</p> <p>Calibration date: March 29, 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±3)°C and humidity <70%.</p> <p>Calibration Equipment used (M&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>104277</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 S4436C</td> <td>MY48071430</td> <td>13-Jan-22 (CITL No.J22X00409)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyzer E5071C</td> <td>MY46110673</td> <td>14-Jan-22 (CITL No.J22X00409)</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 Dianyun 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: Z22-40103 Page 1 of 6</p>	Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Power Meter NRP2	104277	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 S4436C	MY48071430	13-Jan-22 (CITL No.J22X00409)	Jan-23	Network Analyzer E5071C	MY46110673	14-Jan-22 (CITL No.J22X00409)	Jan-23	<p>Address: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191 Tel: +86-10-4236633-2079 Fax: +86-10-4236633-2564 E-mail: cti@china.ttl.com.cn http://www.china.ttl.com.cn</p> <p>Glossary:</p> <p>TSL: Issue simulating liquid ConVf: sensitivity in TSL/ NORMx.yz N/A: not applicable or not measured</p> <p>Calibration is Performed According to the Following Standards:</p> <p>a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices-Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020 b) KDB 855654, "SAR Measurement Requirements for 100 MHz to 6 GHz"</p> <p>Additional Documentation:</p> <p>c) DASy4/5 System Handbook</p> <p>Methods Applied and Interpretation of Parameters:</p> <ul style="list-style-type: none"> 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>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: Z22-40103 Page 2 of 6</p>																												
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E-mail: cti@china.ttl.com http://www.china.ttl.com

DASY5 Validation Report for Head TSL Date: 2022-03-29
 Test Laboratory: CTTL, 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: $f = 750 \text{ MHz}$; $\alpha = 0.888 \text{ S/m}$; $\epsilon_r = 41.36$; $\rho = 1000 \text{ kg/m}^3$
 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
- Sense-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- Phantom: MFP-V5.1C (20kg probe util); Type: QD 000 P51 Cx; Serial: 1062
- DASY52.52.10.4(1535); SEMCAD X (4.6.14(7501))

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

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

Certificate No: Z22-60103 Page 5 of 6

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Impedance Measurement Plot for Head TSL

Certificate No: Z22-60103 Page 6 of 6

1.4 D835V2 - SN 4d114

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Tel: +86-10-42304633-2079 Fax: +86-10-42304633-2504
E-mail: cti@china.ttl.com http://www.china.ttl.com

中国合格评定国家认可委员会
CALIBRATION
CNAS (5070)

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&E 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 NRPBS	104281	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7307	28-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.J22X00409)	Jan-23
Network Analyzer E5071C	MY46110873	14-Jan-22 (CTTL, No.J22X00409)	Jan-23

Calibrated by:	Name	Function	Signature
	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: April 6, 2022
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Certificate No: Z22-60104 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 686664, "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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<p>CAICT</p> <p>Measurement Conditions</p> <table border="1"> <tr> <td>DASY Version</td> <td>DASY52</td> <td>VS2 10.4</td> </tr> <tr> <td>Extrapolation</td> <td>Advanced Extrapolation</td> <td></td> </tr> <tr> <td>Phantom</td> <td>Triple Flat Phantom 5.1C</td> <td></td> </tr> <tr> <td>Distance Dipole Center - TSL</td> <td>15 mm</td> <td>with Spacer</td> </tr> <tr> <td>Zoom Scan Resolution</td> <td>dx, dy, dz = 5 mm</td> <td></td> </tr> <tr> <td>Frequency</td> <td>835 MHz ± 1 MHz</td> <td></td> </tr> </table> <p>Head TSL parameters</p> <table border="1"> <tr> <th>Temperature</th> <th>Permittivity</th> <th>Conductivity</th> </tr> <tr> <td>22.0 °C</td> <td>41.5</td> <td>0.90 mho/m</td> </tr> <tr> <td>Measured Head TSL parameters</td> <td>41.0 ± 8 %</td> <td>0.91 mho/m ± 8 %</td> </tr> <tr> <td>Head TSL temperature change during test</td> <td><+1.0 °C</td> <td>—</td> </tr> </table> <p>SAR result with Head TSL</p> <table border="1"> <tr> <td>SAR averaged over 1 cm³ (1g) of Head TSL</td> <td>Condition</td> <td></td> </tr> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>2.37 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>6.40 W/kg ± 18.8 % (k=2)</td> </tr> <tr> <td>SAR averaged over 10 cm³ (10g) of Head TSL</td> <td>Condition</td> <td></td> </tr> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>1.54 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>6.12 W/kg ± 18.7 % (k=2)</td> </tr> </table> <p>Certificate No: Z22-60104 Page 1 of 6</p>	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		Temperature	Permittivity	Conductivity	22.0 °C	41.5	0.90 mho/m	Measured Head TSL parameters	41.0 ± 8 %	0.91 mho/m ± 8 %	Head TSL temperature change during test	<+1.0 °C	—	SAR averaged over 1 cm ³ (1g) of Head TSL	Condition		SAR measured	250 mW input power	2.37 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	6.40 W/kg ± 18.8 % (k=2)	SAR averaged over 10 cm ³ (10g) of Head TSL	Condition		SAR measured	250 mW input power	1.54 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	6.12 W/kg ± 18.7 % (k=2)	<p>CAICT</p> <p>Appendix (Additional assessments outside the scope of CNAS L0570)</p> <p>Antenna Parameters with Head TSL</p> <table border="1"> <tr> <td>Impedance, transformed to feed point</td> <td>48.7Ω - j22Ω</td> </tr> <tr> <td>Return Loss</td> <td>-25.5dB</td> </tr> </table> <p>General Antenna Parameters and Design</p> <table border="1"> <tr> <td>Electrical Delay (one direction)</td> <td>1.307 ns</td> </tr> </table> <p>After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.</p> <p>The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged.</p> <p>Additional EUT Data</p> <table border="1"> <tr> <td>Manufactured by</td> <td>SPEAG</td> </tr> </table> <p>Certificate No: Z22-60104 Page 1 of 6</p>	Impedance, transformed to feed point	48.7Ω - j22Ω	Return Loss	-25.5dB	Electrical Delay (one direction)	1.307 ns	Manufactured by	SPEAG
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<p>CAICT</p> <p>DASY5 Validation Report for Head TSL</p> <p>Test Laboratory: CTTL, Beijing, China</p> <p>DUT: Dipole 835 MHz; Type: DR35V2; Serial: DR35V2 - SN: 40114</p> <p>Communication System: UFD 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1</p> <p>Medium parameters used: f = 835 MHz; σ = 0.907 S/m; ε_r = 40.98; ρ = 1000 kg/m³</p> <p>Phantom section: Right Section</p> <p>Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)</p> <p>DASY5 Configuration:</p> <ul style="list-style-type: none"> 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 Sn1556; Calibrated: 2022-01-12 Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062 DASY52.52.10.4(153); SEMCAD X 14.6.14(7501) <p>Dipole Calibration/Zoom Scan (7x7x7) (7x7x7) Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm</p> <p>Reference Value = 37.88 V/m; Power Drift = 0.04 dB</p> <p>Peak SAR (extrapolated) = 3.56 W/kg</p> <p>SAR(1g) = 2.37 W/kg; SAR(10g) = 1.54 W/kg</p> <p>Smallest distance from peaks to all points 3 dB below = 15.8 mm</p> <p>Ratio of SAR at M2 to SAR at M1 = 66.2%</p> <p>Maximum value of SAR (measured) = 3.17 W/kg</p> <p>0 dB = 3.17 W/kg = 5.01 dBW/kg</p> <p>Certificate No: Z22-60104 Page 5 of 6</p>	<p>CAICT</p> <p>Impedance Measurement Plot for Head TSL</p> <p>Certificate No: Z22-60104 Page 6 of 6</p>																																																								



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1.5 D900V2 - SN 1d079

<div style="display: flex; justify-content: space-between; align-items: center;"> </div> <p style="font-size: small; margin-top: 5px;"> Add: No.52 HuaYuanRoad, Haidian District, Beijing, 100191 Tel: +86-10-42296323/3117 E-mail: cts@tts.com.cn http://www.tts.com.cn </p> <p style="text-align: center;"> Client: SGS-CN Certificate No: Z22-60184 </p> <h3 style="text-align: center; margin: 5px 0;">CALIBRATION CERTIFICATE</h3> <p> Object: D900V2 - SN: 1d079 Calibration Procedure(s): FF-Z11-003-01 Calibration Procedures for dipole validation kits Calibration date: June 7, 2022 </p> <p style="font-size: x-small;"> 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 style="font-size: x-small;"> All calibrations have been conducted in the closed laboratory facility, environment temperature (22±)°C and humidity<70%. </p> <p style="font-size: x-small;"> Calibration Equipment used (M&TE critical for calibration) </p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <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 NRP8S</td> <td>104291</td> <td>24-Sep-21 (CITL No. J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Reference Probe EX3DV4</td> <td>SN 7464</td> <td>26-Jan-22 (SPEAG No. EX3-7464_Jan22)</td> <td>Jan-23</td> </tr> <tr> <td>DAE4</td> <td>SN 1566</td> <td>12-Jan-22 (CITL-SPEAG No. Z22-60007)</td> <td>Jan-23</td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <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>MV48071430</td> <td>13-Jan-22 (CITL No. J22X00409)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyzer E5071C</td> <td>MY48110473</td> <td>14-Jan-22 (CITL No. J22X00409)</td> <td>Jan-23</td> </tr> </tbody> </table> <div style="margin-top: 10px;"> <table style="width: 100%; border-collapse: collapse; font-size: x-small;"> <tr> <td style="width: 30%;">Calibrated by:</td> <td style="width: 30%;">Name: Zhao Jing</td> <td style="width: 20%;">Function: SAR Test Engineer</td> <td style="width: 20%;">Signature: </td> </tr> <tr> <td>Reviewed by:</td> <td>Name: Lin Hao</td> <td>Function: SAR Test Engineer</td> <td>Signature: </td> </tr> <tr> <td>Approved by:</td> <td>Name: Qi Dianyuan</td> <td>Function: SAR Project Leader</td> <td>Signature: </td> </tr> </table> <p style="text-align: right; font-size: x-small;"> Issued: June 13, 2022 The calibration certificate shall not be reproduced except in full without written approval of the laboratory. </p> </div> <p style="font-size: x-small; margin-top: 10px;"> Certificate No: Z22-60184 Page 1 of 4 </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 NRP8S	104291	24-Sep-21 (CITL No. J21X08326)	Sep-22	Reference Probe EX3DV4	SN 7464	26-Jan-22 (SPEAG No. EX3-7464_Jan22)	Jan-23	DAE4	SN 1566	12-Jan-22 (CITL-SPEAG No. Z22-60007)	Jan-23	Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Signal Generator E4438C	MV48071430	13-Jan-22 (CITL No. J22X00409)	Jan-23	Network Analyzer E5071C	MY48110473	14-Jan-22 (CITL No. J22X00409)	Jan-23	Calibrated by:	Name: Zhao Jing	Function: SAR Test Engineer	Signature:	Reviewed by:	Name: Lin Hao	Function: SAR Test Engineer	Signature:	Approved by:	Name: Qi Dianyuan	Function: SAR Project Leader	Signature:	<div style="display: flex; justify-content: space-between; align-items: center;"> </div> <p style="font-size: small; margin-top: 5px;"> Add: No.52 HuaYuanRoad, Haidian District, Beijing, 100191, China Tel: +86-10-42296323/3117 E-mail: cts@tts.com.cn http://www.tts.com.cn </p> <h3 style="text-align: center; margin: 5px 0;">CALIBRATION CERTIFICATE</h3> <p> Glossary: TSL: Issue simulating liquid ConvF: sensitivity in TSL / NORMx.y.z N/A: not applicable or not measured </p> <p style="font-size: x-small; margin-top: 10px;"> 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 865684, "SAR Measurement Requirements for 100 MHz to 6 GHz" Additional Documentation: c) DASYS4 System Handbook </p> <p style="font-size: x-small;"> Methods Applied and Interpretation of Parameters: <ul style="list-style-type: none"> • Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. 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<div style="display: flex; justify-content: space-between; align-items: center;"> </div> <p style="font-size: small; margin-top: 5px;"> Add: No.52 HuaYuanRoad, Haidian District, Beijing, 100191, China Tel: +86-10-42296323/3117 E-mail: cts@tts.com.cn http://www.tts.com.cn </p> <h3 style="text-align: center; margin: 5px 0;">CALIBRATION CERTIFICATE</h3> <p> Measurement Conditions DASYS system configuration, as far as is given on page 1 </p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <thead> <tr> <th>DASYS Version</th> <th>Configuration</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Extrapolation</td> <td>Advanced Extrapolation</td> <td>52.10.4</td> </tr> <tr> <td>Phantom</td> <td>Triple Flat Phantom 6.1C</td> <td></td> </tr> <tr> <td>Distance Dipole Center - TSL</td> <td>15 mm</td> <td>with Spacer</td> </tr> <tr> <td>Zoom Scan Resolution</td> <td>0x, dy, dz = 5 mm</td> <td></td> </tr> <tr> <td>Frequency</td> <td>300 MHz ± 1 MHz</td> <td></td> </tr> </tbody> </table> <p style="font-size: x-small; margin-top: 5px;"> Head TSL parameters The following parameters and calculations were applied. </p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <thead> <tr> <th>Nominal Head TSL parameters</th> <th>Temperature</th> <th>Permittivity</th> <th>Conductivity</th> </tr> </thead> <tbody> <tr> <td></td> <td>22.0 °C</td> <td>41.5</td> <td>0.97 mho/m</td> </tr> <tr> <td>Measured Head TSL parameters</td> <td>(22.0 ± 0.2) °C</td> <td>42.1 ± 6 %</td> <td>0.98 mho/m ± 6 %</td> </tr> <tr> <td>Head TSL temperature change during test</td> <td><± 0.2 °C</td> <td></td> <td></td> </tr> </tbody> </table> <p style="font-size: x-small; margin-top: 5px;"> SAR result with Head TSL </p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <thead> <tr> <th>SAR averaged over 1 cm³ (1 g) of Head TSL</th> <th>Condition</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>2.76 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>11.0 W/kg ± 18.8 % (k=2)</td> </tr> <tr> <td>SAR averaged over 18 cm³ (10 g) of Head TSL</td> <td>Condition</td> <td></td> </tr> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>1.75 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>7.09 W/kg ± 16.7 % (k=2)</td> </tr> </tbody> </table> <p style="font-size: x-small; margin-top: 10px;"> Certificate No: Z22-60184 Page 1 of 4 </p>	DASYS Version	Configuration	Value	Extrapolation	Advanced Extrapolation	52.10.4	Phantom	Triple Flat Phantom 6.1C		Distance Dipole Center - TSL	15 mm	with Spacer	Zoom Scan Resolution	0x, dy, dz = 5 mm		Frequency	300 MHz ± 1 MHz		Nominal Head TSL parameters	Temperature	Permittivity	Conductivity		22.0 °C	41.5	0.97 mho/m	Measured Head TSL parameters	(22.0 ± 0.2) °C	42.1 ± 6 %	0.98 mho/m ± 6 %	Head TSL temperature change during test	<± 0.2 °C			SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	Value	SAR measured	250 mW input power	2.76 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	11.0 W/kg ± 18.8 % (k=2)	SAR averaged over 18 cm ³ (10 g) of Head TSL	Condition		SAR measured	250 mW input power	1.75 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	7.09 W/kg ± 16.7 % (k=2)	<div style="display: flex; justify-content: space-between; align-items: center;"> </div> <p style="font-size: small; margin-top: 5px;"> Add: No.52 HuaYuanRoad, Haidian District, Beijing, 100191, China Tel: +86-10-42296323/3117 E-mail: cts@tts.com.cn http://www.tts.com.cn </p> <h3 style="text-align: center; margin: 5px 0;">CALIBRATION CERTIFICATE</h3> <p> Appendix (Additional assessments outside the scope of CNAS L6070) </p> <p> Antenna Parameters with Head TSL </p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <tr> <td>Impedance, transformed to feed point</td> <td>48.10 - j8.48Ω</td> </tr> <tr> <td>Return Loss</td> <td>-23.3 dB</td> </tr> </table> <p> General Antenna Parameters and Design </p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <tr> <td>Electrical Delay (one direction)</td> <td>1.312 ns</td> </tr> </table> <p style="font-size: x-small; margin-top: 10px;"> After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured. </p> <p style="font-size: x-small;"> The dipole is made of standard semi-rigid coaxial cable. 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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 style="font-size: x-small; margin-top: 10px;"> Additional EUT Data </p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <tr> <td>Manufactured by</td> <td>SPEAG</td> </tr> </table> <p style="font-size: x-small; margin-top: 10px;"> Certificate No: Z22-60184 Page 1 of 6 </p>	Impedance, transformed to feed point	48.10 - j8.48Ω	Return Loss	-23.3 dB	Electrical Delay (one direction)	1.312 ns	Manufactured by	SPEAG
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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: $f = 900 \text{ MHz}$; $\sigma = 0.98 \text{ S/m}$; $\epsilon = 42.05$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(9.72, 9.72) @ 900 MHz; Calibrated: 2022-01-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronic: DAE4 SN1556; Calibrated: 2022-01-12
- Phantom: MFP_V5.1C (2dlog probe kit); Type: QD 000 P51 Cx; Serial: 1062
- DASY52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7) Cube 0; Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

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

Peak SAR (extrapolated) = 4.20 W/kg

SAR(1g) = 2.79 W/kg; SAR(10g) = 1.78 W/kg

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

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

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

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

Certificate No: Z22-60184 Page 9 of 6

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Impedance Measurement Plot for Head TSL

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1.6 D1800V2 - SN 2d170

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E-mail: cti@china.ttl.com

中国合格评定国家认可委员会
CNAS 1871

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 (23±1)°C and humidity <70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	108277	24-Sep-21 (CTTL No.J21X08326)	Sep-22
Power sensor NRP6S	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	MY48071430	13-Jan-22 (CTTL No.J22X0409)	Jan-23
Network Analyzer E5071C	MY48110673	14-Jan-22 (CTTL No.J22X0409)	Jan-23

Calibrated by: Zhao Jing, SAR Test Engineer, Signature: [Signature]

Reviewed by: Lin Hao, SAR Test Engineer, Signature: [Signature]

Approved by: Qi Diqiyuan, SAR Project Leader, Signature: [Signature]

Issued: April 6, 2022

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

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Glossary:

TSL: tissue simulating liquid

ConvF: sensitivity in TSL / NORM_{x,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 855684, "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.com

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1800 MHz ± 1 MHz	

Head TSL parameters
 The following parameters and calculations were applied:

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

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.73 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	38.9 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.4 W/kg ± 18.7 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

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

General Antenna Parameters and Design

Electrical Delay (one direction)	1.116 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.

The dipole is made of standard semi-rigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, 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: CTIL, 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 = 1.41 S/m; ε = 40.62; ρ = 1000 kg/m³
 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(1 g) = 9.73 W/kg; SAR(10 g) = 5.11 W/kg
 Smallest distance from peaks to all points 3 dB below = 10 mm
 Ratio of SAR at M2 to SAR at M1 = 54%
 Maximum value of SAR (measured) = 15.2 W/kg

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

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Impedance Measurement Plot for Head TSL

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1.7 D1900V2 - SN 5d136

<p>Client: SGS-CN Certificate No: Z22-60185</p> <h3>CALIBRATION CERTIFICATE</h3> <p>Object: D1900V2 - SN 5d136</p> <p>Calibration Procedure(s): FF-Z11-003-01 Calibration Procedures for dipole validation kits</p> <p>Calibration date: June 7, 2022</p> <p>The calibration Certificates 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±0.1) and humidity <math>70\%</math>.</p> <p>Calibration Equipment used (M&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 NRP85</td> <td>104291</td> <td>24-Sep-21 (CTTL No. J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Reference Probe EK3DV4</td> <td>SN 7464</td> <td>28-Jan-22 (SPEAG No. EX3-7464_Jan22)</td> <td>Jan-23</td> </tr> <tr> <td>DAEA</td> <td>SN 1656</td> <td>12-Jan-22 (CTTL-SPEAG No. Z22-60007)</td> <td>Jan-23</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Signal Generator E4438C</td> <td>MY48071430</td> <td>13-Jan-22 (CTTL No. J22X00409)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyser E5071C</td> <td>MY46110073</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>The calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> <p>Certificate No: Z22-60185 Page 1 of 1</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 NRP85	104291	24-Sep-21 (CTTL No. J21X08326)	Sep-22	Reference Probe EK3DV4	SN 7464	28-Jan-22 (SPEAG No. EX3-7464_Jan22)	Jan-23	DAEA	SN 1656	12-Jan-22 (CTTL-SPEAG No. Z22-60007)	Jan-23	Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Signal Generator E4438C	MY48071430	13-Jan-22 (CTTL No. J22X00409)	Jan-23	Network Analyser E5071C	MY46110073	14-Jan-22 (CTTL No. J22X00406)	Jan-23	<p>Glossary:</p> <p>TSL: Issue simulating liquid</p> <p>ConvF: sensitivity in TSL / NORMx.y.z</p> <p>N/A: not applicable or not measured</p> <p>Calibration is Performed According to the Following Standards:</p> <p>a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-Held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020</p> <p>b) KDB 855884, "SAR Measurement Requirements for 100 MHz to 6 GHz"</p> <p>Additional Documentation:</p> <p>c) DAS4/S System Handbook</p> <p>Methods Applied and Interpretation of Parameters:</p> <ul style="list-style-type: none"> 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 status 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>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 8</p>																												
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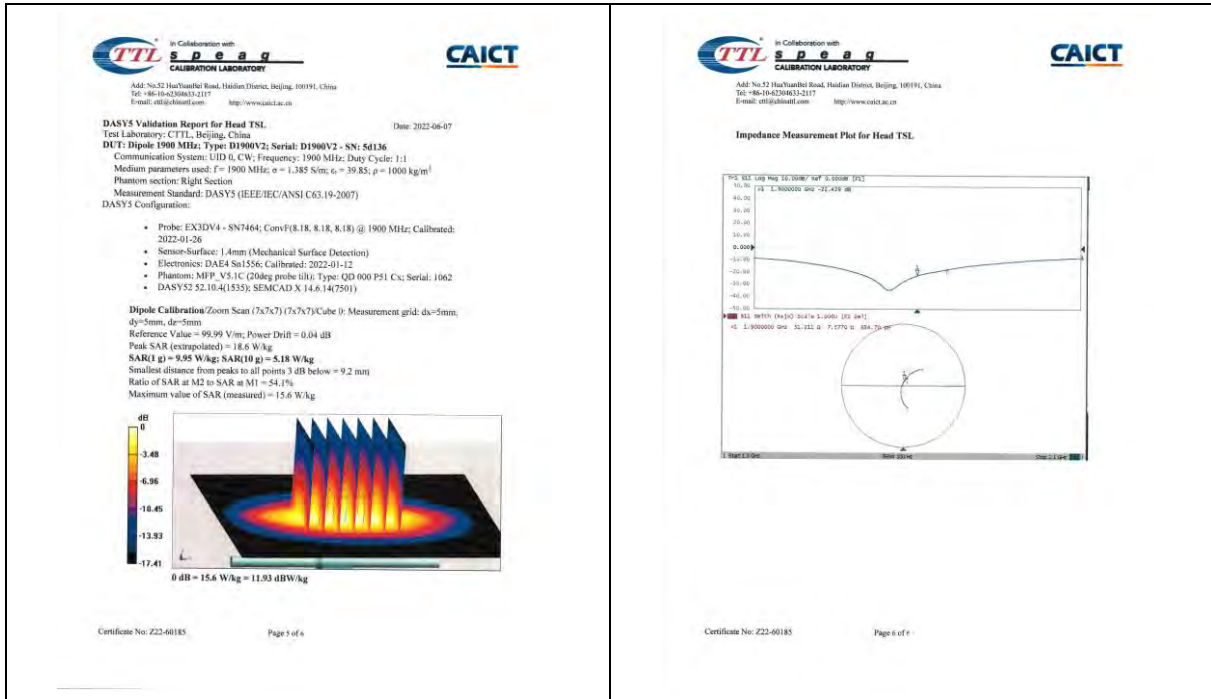


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1.8 D2000V2 - SN 1041

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

CALIBRATION CERTIFICATE

Object: D2000V2 - SN 1041

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

Calibration date: June 6, 2022

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.

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

Calibration Equipment used (M&E critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CITL No. J21X06328)	Sep-22
Power sensor NRP2S	104291	24-Sep-21 (CITL No. J21X06328)	Sep-22
Reference Probe EX3DVA	SN 7464	26-Jan-22 (SPEAG No. EX3-7464-Jan22)	Jan-23
DAAE	SN 1556	12-Jan-22 (CITL-SPEAG No. Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CITL No. J22X00409)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CITL No. J22X00406)	Jan-23

Calibrated by: Zhao Jing, SAR Test Engineer

Reviewed by: Lin Hao, SAR Test Engineer

Approved by: Qi Dianyan, SAR Project Leader

Issued: June 13, 2022

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Address: No. 52 Huayuan Road, Huailin District, Beijing, 101194, China

Glossary:

TSL: Issue simulating liquid

Copy#: sensitivity in TSL / INORMx.y.z

N/A: not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEC/IEEE 62209-1529, Measurement Procedures for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices, Part 1529: 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 measure:** 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: Z22-60186 Page 2 of 6



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CAICT

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom S.I.C	
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	22.9 °C	40.0	1.40 mho/cm
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.2 ± 0.5 %	1.36 mho/cm ± 0.6 %
Head TSL temperature change during test	-1.0 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	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 ³ (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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CAICT

Appendix (Additional assessments outside the scope of CNAS L6570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.40 ± 0.74 Ω
Return Loss	-34 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.086 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.

The dipole is made of standard semi-rigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, 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	BPEAG
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CAICT

DASY5 Validation Report for Head TSL
Date: 2022-06-06
Test Laboratory: CTTI, Beijing, China
DUT: Dipole 2000 MHz; Type: D2000V2; Serial: D2000V2 - SN: 1041
Communication System: UTD 0; CW; Frequency: 2000 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2000 MHz; σ = 1.392 S/m; ε = 40.21; ρ = 1000 kg/m³
Phantom section: Right Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:

- Probe: EX3DV4 - SN7464; Conv(F: 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.I.C (20dkg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY5: 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7); Cube 0; Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 103.4 V/m; Power Dfth = 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

Certificate No: Z23-60186 Page 5 of 6

CAICT

Impedance Measurement Plot for Head TSL

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1.9 D2300V2 - SN 1096

<p>Client: SGS-CN Certificate No: Z22-60106</p> <p>CALIBRATION CERTIFICATE</p> <p>Object: D2300V2 - SN 1096</p> <p>Calibration Procedure(s): FF-Z11-003-01 Calibration Procedures for dipole validation kits</p> <p>Calibration date: March 31, 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 <70%.</p> <p>Calibration Equipment used (M&TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power Meter NRP2</td> <td>108277</td> <td>24-Sep-21 (CTTL No.J21X08328)</td> <td>Sep-22</td> </tr> <tr> <td>Power sensor NRP8S</td> <td>104291</td> <td>24-Sep-21 (CTTL No.J21X08328)</td> <td>Sep-22</td> </tr> <tr> <td>Reference Probe EK30V4</td> <td>SN 7307</td> <td>26-May-21 (SPEAG No.EK3-7307_May21)</td> <td>May-22</td> </tr> <tr> <td>DAA4</td> <td>SN 1556</td> <td>12-Jan-22 (TTL-SPEAG No.Z22-60007)</td> <td>Jan-23</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Signal Generator E4438C</td> <td>MY49071430</td> <td>13-Jan-22 (CTTL No.J22X00408)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyzer E5071C</td> <td>MY46110673</td> <td>14-Jan-22 (CTTL No.J22X00408)</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 Dianyan SAR Project Leader</p> <p>Issued: April 6, 2022</p> <p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> <p>Certificate No: Z22-60106 Page 1 of 6</p>	Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Power Meter NRP2	108277	24-Sep-21 (CTTL No.J21X08328)	Sep-22	Power sensor NRP8S	104291	24-Sep-21 (CTTL No.J21X08328)	Sep-22	Reference Probe EK30V4	SN 7307	26-May-21 (SPEAG No.EK3-7307_May21)	May-22	DAA4	SN 1556	12-Jan-22 (TTL-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.J22X00408)	Jan-23	Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL No.J22X00408)	Jan-23	<p>Glossary:</p> <p>TSL: Issue simulating liquid</p> <p>ConvF: sensitivity in TSL / NCFRM.y.z</p> <p>N/A: not applicable or not measured</p> <p>Calibration is Performed According to the Following Standards:</p> <p>a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020.</p> <p>b) KDB 855664, "SAR Measurement Requirements for 100 MHz to 6 GHz"</p> <p>Additional Documentation:</p> <p>c) DASy4/5 System Handbook</p> <p>Methods Applied and Interpretation of Parameters:</p> <ul style="list-style-type: none"> 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>The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.</p> <p>Certificate No: Z22-60106 Page 2 of 6</p>																												
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<p>Measurement Conditions</p> <p>DASY system configuration, as far as not given on page 1.</p> <table border="1"> <thead> <tr> <th>DASY Version</th> <th>DASY2</th> <th>52.10.4</th> </tr> </thead> <tbody> <tr> <td>Extrapolation</td> <td>Advanced Extrapolation</td> <td></td> </tr> <tr> <td>Phantom</td> <td>Triple Flat Phantom 5.1C</td> <td></td> </tr> <tr> <td>Distance Dipole Center - TSL</td> <td>10 mm</td> <td>with Spacer</td> </tr> <tr> <td>Zoom Scan Resolution</td> <td>($\Delta x, \Delta y, \Delta z = 5$ mm)</td> <td></td> </tr> <tr> <td>Frequency</td> <td>2300 MHz \pm 1 MHz</td> <td></td> </tr> </tbody> </table> <p>Head TSL parameters</p> <p>The following parameters and calculations were applied:</p> <table border="1"> <thead> <tr> <th></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>39.5</td> <td>1.67 mho/m</td> </tr> <tr> <td>Measured Head TSL parameters</td> <td>(22.0 \pm 0.2) °C</td> <td>39.8 \pm 9 %</td> <td>1.70 mho/m \pm 6 %</td> </tr> <tr> <td>Head TSL temperature change during test</td> <td><1.0 °C</td> <td>—</td> <td>—</td> </tr> </tbody> </table> <p>SAR result with Head TSL</p> <table border="1"> <thead> <tr> <th>SAR averaged over 1 cm² (1 g) of Head TSL</th> <th>Condition</th> <th></th> </tr> </thead> <tbody> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>12.4 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>48.2 W/kg \pm 18.8 % (k=2)</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>SAR averaged over 10 cm² (10 g) of Head TSL</th> <th>Condition</th> <th></th> </tr> </thead> <tbody> <tr> <td>SAR measured</td> <td>250 mW input power</td> <td>5.88 W/kg</td> </tr> <tr> <td>SAR for nominal Head TSL parameters</td> <td>normalized to 1W</td> <td>23.4 W/kg \pm 18.7 % (k=2)</td> </tr> </tbody> </table> <p>Certificate No: Z22-60106 Page 3 of 6</p>	DASY Version	DASY2	52.10.4	Extrapolation	Advanced Extrapolation		Phantom	Triple Flat Phantom 5.1C		Distance Dipole Center - TSL	10 mm	with Spacer	Zoom Scan Resolution	($\Delta x, \Delta y, \Delta z = 5$ mm)		Frequency	2300 MHz \pm 1 MHz			Temperature	Permittivity	Conductivity	Nominal Head TSL parameters	22.0 °C	39.5	1.67 mho/m	Measured Head TSL parameters	(22.0 \pm 0.2) °C	39.8 \pm 9 %	1.70 mho/m \pm 6 %	Head TSL temperature change during test	<1.0 °C	—	—	SAR averaged over 1 cm ² (1 g) of Head TSL	Condition		SAR measured	250 mW input power	12.4 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	48.2 W/kg \pm 18.8 % (k=2)	SAR averaged over 10 cm ² (10 g) of Head TSL	Condition		SAR measured	250 mW input power	5.88 W/kg	SAR for nominal Head TSL parameters	normalized to 1W	23.4 W/kg \pm 18.7 % (k=2)	<p>Appendix (Additional assessments outside the scope of CNAS L0570)</p> <p>Antenna Parameters with Head TSL</p> <table border="1"> <thead> <tr> <th>Impedance, transformed to feed point</th> <th>49.20; 4.9(j)</th> </tr> </thead> <tbody> <tr> <td>Return Loss</td> <td>-26.9dB</td> </tr> </tbody> </table> <p>General Antenna Parameters and Design</p> <table border="1"> <thead> <tr> <th>Electrical Delay (one direction)</th> <th>1.083 ns</th> </tr> </thead> </table> <p>After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.</p> <p>The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged.</p> <p>Additional EUT Data</p> <table border="1"> <thead> <tr> <th>Manufactured by</th> <th>SPEAG</th> </tr> </thead> </table> <p>Certificate No: Z22-60106 Page 4 of 6</p>	Impedance, transformed to feed point	49.20; 4.9(j)	Return Loss	-26.9dB	Electrical Delay (one direction)	1.083 ns	Manufactured by	SPEAG
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 E-mail: csl@chinaul.com http://www.chinaul.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
 Medium parameters used: $f = 2300 \text{ MHz}$; $\sigma = 1.702 \text{ S/m}$; $\epsilon = 39.77$; $\rho = 1000 \text{ kg/m}^3$
 Phantom section: Right Section
 Measurement Standard: DASY5 (IEEE/EC/ANSI C63.19-2007)
 DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(8.01, 8.01, 8.01) @ 2300 MHz; Calibrated: 2021-05-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DA4 Ssl 1556; Calibrated: 2022-01-12
- Phantom: MFP V5.1C (2ldag probe kit); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 S2.10.4(1535); SEMCAD X.14.6.1(47501)

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) = 21.8 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

Certificate No: Z22-60106 Page 4 of 6

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Impedance Measurement Plot for Head TSL

Certificate No: Z22-60106 Page 5 of 6

1.10 D2450V2 - SN 817

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 E-mail: csl@chinaul.com http://www.chinaul.com

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

CALIBRATION CERTIFICATE

Object: D2450V2 - SN 817
 Calibration Procedure(s): FF-Z11-003-01
 Calibration Procedures for dipole validation kits
 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.J21X08326)	Sep-22
Power sensor: NRP88	104291	24-Sep-21 (CTTL No.J21X08326)	Sep-22
Reference Probe: EX3DV4	SN 7307	26-May-21(SPEAG.No.EK3-7307_May21)	May-22
DAE4	SN 1556	12-Jan-22(CTTL-SPEAG.No.Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator: E4438C	MY4907430	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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Certificate No: Z22-60107 Page 1 of 6

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Glossary:
 TSL: tissue simulating liquid
 ConvF: sensitivity in TSL / NORMix.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 656684, "SAR Measurement Requirements for 100 MHz to 5 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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1.11 D2600V2 - SN 1158

<p>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191 Tel: +86-10-42364633-2512 Fax: +86-10-42364633-2504 E-mail: cts@ttspeag.com.cn http://www.ttspeag.com</p> <p>Client: SGS-CN Certificate No: Z22-60108</p> <h3>CALIBRATION CERTIFICATE</h3> <p>Object: D2600V2 - SN: 1158</p> <p>Calibration Procedure(s): FF-Z11-003-01 Calibration Procedures for dipole validation kits</p> <p>Calibration date: March 31, 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±3)°C and humidity<70%.</p> <p>Calibration Equipment used (M&TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power Meter NRP2</td> <td>102577</td> <td>24-Sep-21 (CTTL No.J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Power sensor NRP8S</td> <td>104291</td> <td>24-Sep-21 (CTTL No.J21X08326)</td> <td>Sep-22</td> </tr> <tr> <td>Reference Probe EX301VA</td> <td>SN 7307</td> <td>26-May-21(SPEAG.No.EK3-7307_May21)</td> <td>May-22</td> </tr> <tr> <td>DAE4</td> <td>SN 1556</td> <td>12-Jan-22(CTTL-SPEAG.No.Z22-60007)</td> <td>Jan-23</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Cal Date (Calibrated by Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Signal Generator E4438C</td> <td>MY49671430</td> <td>13-Jan-22 (CTTL No.J22X00409)</td> <td>Jan-23</td> </tr> <tr> <td>Network Analyzer E5071C</td> <td>MY48110673</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 Dianyuan SAR Project Leader</p> <p>Issued: April 6, 2022</p> <p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> <p>Certificate No: Z22-60108 Page 1 of 6</p>	Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Power Meter NRP2	102577	24-Sep-21 (CTTL No.J21X08326)	Sep-22	Power sensor NRP8S	104291	24-Sep-21 (CTTL No.J21X08326)	Sep-22	Reference Probe EX301VA	SN 7307	26-May-21(SPEAG.No.EK3-7307_May21)	May-22	DAE4	SN 1556	12-Jan-22(CTTL-SPEAG.No.Z22-60007)	Jan-23	Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration	Signal Generator E4438C	MY49671430	13-Jan-22 (CTTL No.J22X00409)	Jan-23	Network Analyzer E5071C	MY48110673	14-Jan-22 (CTTL No.J22X00406)	Jan-23	<p>Address: No. 52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-42364633-2079 Fax: +86-10-42364633-2504 E-mail: cts@ttspeag.com.cn http://www.ttspeag.com</p> <p>Glossary: TSL: tissue simulating liquid ConvF: sensitivity in TSL / NORM_{x,y,z} N/A: not applicable or not measured</p> <p>Calibration is Performed According to the Following Standards: a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices - Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020 b) KDB 665864, "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: <ul style="list-style-type: none"> 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. 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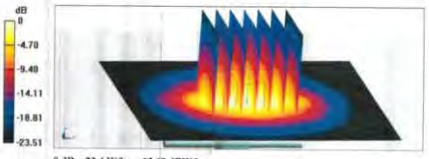
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E-mail: cti@ttspeaq.com http://www.ttspeaq.com

DASY5 Validation Report for Head TSL Date: 2022-03-31

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: $f = 2600$ MHz; $\sigma = 1.955$ S/m; $\epsilon_r = 38.68$; $\rho = 1000$ kg/m³
Phantom section: Right Section
Measurement Standard: DASY5 (IEEE/EC/ANSI C63.19-2007)
DASY5 Configuration:

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

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0; Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 103.3 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 29.0 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



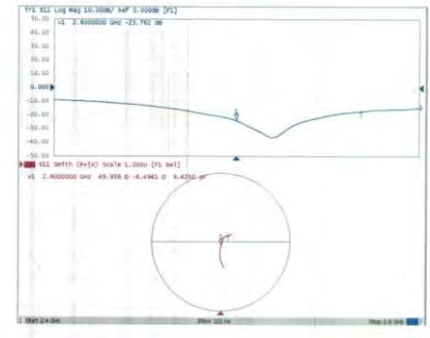
0 dB = 23.4 W/kg = 13.69 dBW/kg

Certificate No: Z22-60108 Page 1 of 6

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Impedance Measurement Plot for Head TSL



Certificate No: Z22-60108 Page 6 of 6

1.12 D5GHZV2 - SN 1095

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

CALIBRATION CERTIFICATE

Object: D5GHZV2 - SN 1095

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

Calibration date: June 1, 2022

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.

All calibrations have been conducted in the closed laboratory facility; environment temperature (23±1)°C and humidity < 70%.

Calibration Equipment used (MSTE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CTTL No.J21008326)	Sep-22
Power sensor NRP68	104291	24-Sep-21 (CTTL No.J21008326)	Sep-22
Reference Probe EX3DV4	SN 7464	26-Jan-22(SPEAG No EX3-7484_Jan22)	Jan-23
DAE4	SN 1556	12-Jan-22(CTTL-SPEAG No.Z22-60007)	Jan-23

Secondary Standards	ID #	Cal Date (Calibrated by Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY46071430	13-Jan-22 (CTTL No. J22000406)	Jan-23
Network Analyzer E5071C	MY46110873	14-Jan-22 (CTTL No. J22000406)	Jan-23

Calibrated by: Zhao Jing, SAR Test Engineer

Reviewed by: Lin Hao, SAR Test Engineer

Approved by: Qi Dianyan, SAR Project Leader

Issued: June 6, 2022

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

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Glossary:

- TSL: Issue simulating liquid
- CompF: sensitivity in TSL: 1 NORM.k.y.z
- N/A: not applicable or not measured

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY5 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 station 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, see for as not given on page 1.

DASY Version	DASY2	32,10,4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom S,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	500 MHz ± 1 MHz 850 MHz ± 1 MHz 1500 MHz ± 1 MHz 5600 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	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	4.73 mho/m ± 6 %
Head TSL temperature change during test	+1.0 °C	—	—

SAR result with Head TSL at 5200MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	7.75 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	17.8 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (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 ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.84 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.1 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (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	35.8	4.88 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.8 ± 6 %	4.84 mho/m ± 6 %
Head TSL temperature change during test	+1.0 °C	—	—

SAR result with Head TSL at 5500MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	82.6 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (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 ³ (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 ³ (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 ³ (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 ³ (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	21.6 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	-23.5dB

Antenna Parameters with Head TSL at 5500MHz

Impedance, transformed to feed point	50.30-4.36jΩ
Return Loss	-27.4dB

Antenna Parameters with Head TSL at 5600MHz

Impedance, transformed to feed point	54.80-4.86jΩ
Return Loss	-24.6dB

Antenna Parameters with Head TSL at 5800MHz

Impedance, transformed to feed point	51.50-5.61jΩ
Return Loss	-24.6dB

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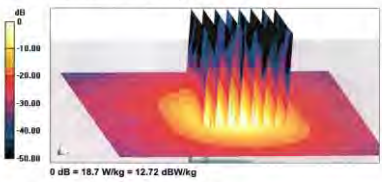
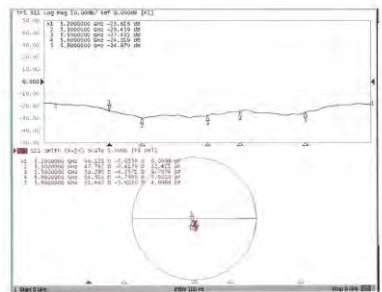


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<p>TTL Calibration Laboratory Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62302117 E-mail: cti@ttsnet.com</p> <p>CAICT</p> <p>General Antenna Parameters and Design</p> <p>Electrical Delay (one direction): 1.501 ns</p> <p>After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.</p> <p>The dipole is made of standard semi-rigid coaxial cable. The carrier conductor of the feeding line is directly connected to the second arm of the dipole. This 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>Additional EUT Data</p> <p>Manufactured by: SPEAQ</p> <p>Certificate No: Z22-60187 Page 1 of 10</p>	<p>TTL Calibration Laboratory Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62302117 E-mail: cti@ttsnet.com</p> <p>CAICT</p> <p>DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1095 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; $\sigma = 4.82$ S/m; $\epsilon = 35.39$; $\rho = 1000$ kg/m³ Medium parameters used: f = 5300 MHz; $\sigma = 4.73$ S/m; $\epsilon = 35.19$; $\rho = 1000$ kg/m³ Medium parameters used: f = 5500 MHz; $\sigma = 4.939$ S/m; $\epsilon = 34.83$; $\rho = 1000$ kg/m³ Medium parameters used: f = 5600 MHz; $\sigma = 5.051$ S/m; $\epsilon = 34.89$; $\rho = 1000$ kg/m³ Medium parameters used: f = 5800 MHz; $\sigma = 5.247$ S/m; $\epsilon = 34.42$; $\rho = 1000$ kg/m³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C38.16-2007) DASY5 Configuration:</p> <ul style="list-style-type: none"> Probe: EX3DV4 - SN7484; ConvF(5, 6, 5, 6) @ 5200 MHz; ConvF(5, 3, 2, 5, 3, 2) @ 5300 MHz; ConvF(5, 11, 5, 11, 5, 11) @ 5500 MHz; ConvF(4, 9, 1, 4, 9, 1) @ 5600 MHz; ConvF(5, 5, 5) @ 5800 MHz; Calibrated: 2022-01-26 Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DA84 Sn1556; Calibrated: 2022-01-12 Phantom: MFP_V5-1C (20deg probe util); Type: QD 000 P51 Cx; Serial: 1062 DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501) <p>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; Reference Value = 60.80 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 29.8 W/kg SAR(1 g) = 7.73 W/kg; SAR(10 g) = 2.22 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 66.8% Maximum value of SAR (measured) = 19.3 W/kg</p> <p>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; Reference Value = 61.08 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 31.5 W/kg SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.27 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 65.5% Maximum value of SAR (measured) = 19.0 W/kg</p> <p>Certificate No: Z22-60187 Page 1 of 10</p>
<p>TTL Calibration Laboratory Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62302117 E-mail: cti@ttsnet.com</p> <p>CAICT</p> <p>Dipole Calibration /Pin=100mW, d=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Reference Value = 61.92 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 34.7 W/kg SAR(1 g) = 8.28 W/kg; SAR(10 g) = 2.34 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 63.9% Maximum value of SAR (measured) = 20.2 W/kg</p> <p>Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Reference Value = 65.08 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 35.3 W/kg SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.3 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 62.5% Maximum value of SAR (measured) = 19.1 W/kg</p> <p>Dipole Calibration /Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0; Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Reference Value = 62.13 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 34.8 W/kg SAR(1 g) = 7.71 W/kg; SAR(10 g) = 2.16 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 61.6% Maximum value of SAR (measured) = 18.7 W/kg</p>  <p>Certificate No: Z22-60187 Page 1 of 10</p>	<p>TTL Calibration Laboratory Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62302117 E-mail: cti@ttsnet.com</p> <p>CAICT</p> <p>Impedance Measurement Plot for Head TSL</p>  <p>Certificate No: Z22-60187 Page 10 of 10</p>



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2 DAE4 - SN 1245

<p>Schmid & Partner Engineering AG Zugzwangstrasse 43, 8004 Zurich, Switzerland Phone: +41 (0)43 930, Fax: +41 (0)43 973, info@sgs.ch, www.sgs.ch</p> <p style="text-align: center;">s p e a g</p> <p style="text-align: center;">IMPORTANT NOTICE</p> <p>USAGE OF THE DAE4</p> <p>The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:</p> <p>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.</p> <p>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.</p> <p>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 DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.</p> <p>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.</p> <p>DASY Configuration Files: 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 500 MOhm is given in the corresponding configuration file.</p> <p>Important Note: Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.</p> <p>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.</p> <p>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 mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.</p> <p>TN_EH160306AE_DAE4.docx 07.03.2019</p>	<p>Calibration Laboratory of Schmid & Partner Engineering AG Zugzwangstrasse 43, 8004 Zurich, Switzerland</p> <p style="text-align: right;">Schweizerischer Kalibrierdienst C Service suisse d'étalonnage S Servizio svizzero di tarature S Swiss Calibration Service</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 style="text-align: right;">Accreditation No.: SCS 0108</p> <p>Client: SGS-CN (Auden) Certificate No.: DAE4-1245_May22</p> <p style="text-align: center;">CALIBRATION CERTIFICATE</p> <p>Object: DAE4 - SD 000 D04 BM - SN: 1245</p> <p>Calibration procedure(s): QA CAL-06 v30 Calibration procedure for the data acquisition electronics (DAE)</p> <p>Calibration date: May 30, 2022</p> <p>This calibration certificate documents the traceability to national standards, which realize the physical units of measurement (SI). The measurement and the uncertainties with confidence probability are given on the following pages and are part of the certificate.</p> <p>All calibrations have been conducted in the closed laboratory facility; environment temperature (22 ± 1)°C and humidity < 70%.</p> <p>Calibration Equipment used (MATE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Due Date (Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Kelvin Multimeter Type 2001</td> <td>SN: SE10276</td> <td>31-Aug-21 (No:31368)</td> <td>Aug-22</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Check Date (in hours)</th> <th>Scheduled Check</th> </tr> </thead> <tbody> <tr> <td>Auto DAE Calibration Unit</td> <td>SE_LMS_05A_AA_1001</td> <td>24-Jan-22 (in house check)</td> <td>In house check: Jan-22</td> </tr> <tr> <td>Calibration box V3.1</td> <td>SE_LMS_006_AA_1002</td> <td>24-Jan-22 (in house check)</td> <td>In house check: Jan-22</td> </tr> </tbody> </table> <p>Calibrated by: Dominique Sellen (Name) Laboratory Technician (Function) <i>[Signature]</i> (Signature)</p> <p>Approved by: Steen Kuhn (Name) Technical Manager (Function) <i>[Signature]</i> (Signature)</p> <p>Issued: May 30, 2022</p> <p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> <p>Certificate No: DAE4-1245_May22 Page 1 of 5</p>	Primary Standards	ID #	Due Date (Certificate No.)	Scheduled Calibration	Kelvin Multimeter Type 2001	SN: SE10276	31-Aug-21 (No:31368)	Aug-22	Secondary Standards	ID #	Check Date (in hours)	Scheduled Check	Auto DAE Calibration Unit	SE_LMS_05A_AA_1001	24-Jan-22 (in house check)	In house check: Jan-22	Calibration box V3.1	SE_LMS_006_AA_1002	24-Jan-22 (in house check)	In house check: Jan-22
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Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	19994.45	1.52	0.00
Channel X + Input	20004.58	2.22	0.01
Channel X - Input	-20000.14	1.12	-0.01
Channel Y + Input	19994.72	1.58	0.00
Channel Y + Input	20001.22	-1.00	-0.00
Channel Y - Input	-20003.05	-1.57	0.01
Channel Z + Input	19992.84	0.19	0.00
Channel Z + Input	20003.09	0.58	0.00
Channel Z - Input	-20001.73	-0.27	0.00

Low Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	2001.91	0.41	0.02
Channel X + Input	202.54	0.65	0.32
Channel X - Input	-197.86	0.07	-0.04
Channel Y + Input	2002.05	0.58	0.03
Channel Y + Input	201.27	-0.57	-0.28
Channel Y - Input	-199.23	-0.06	0.03
Channel Z + Input	2001.36	0.08	0.00
Channel Z + Input	200.09	-1.53	-0.76
Channel Z - Input	-199.89	-1.57	0.79

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	-3.87	-7.69
-200	9.12	7.79
Channel Y	-8.68	-9.28
-200	8.52	6.36
Channel Z	-5.36	-5.80
-200	3.58	3.08

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	-	4.07	-3.14
Channel Y	200	9.36	-	4.27
Channel Z	200	10.11	7.14	-

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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	15984	17040
Channel Y	16562	16768
Channel Z	16035	15668

5. Input Offset Measurement

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

Input 10MΩ	Average (µV)	min. Offset (µV)	max. Offset (µV)	Std. Deviation (µV)
Channel X	1.00	-0.15	1.93	0.45
Channel Y	-0.18	-1.28	0.94	0.45
Channel Z	-0.58	-2.61	0.58	0.60

6. Input Offset Current

Nominal input circuitry offset current on all channels: $-25nA$

7. Input Resistance (Typical values for information)

	Zeroing (MΩm)	Measuring (MΩm)
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	+8	+14
Supply (- Vcc)	-0.01	-8	-9

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3 EX3DV4 - SN 7346

Calibration Laboratory of Schmid & Partner Engineering AG
Zugstrasse 6, 8048 Zurich, Switzerland

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Client: **Auden** Certificate No: **EX3-7346_Mar22**

Accreditation No: **SCS 0108**

CALIBRATION CERTIFICATE

Object: **EX3DV4 - SN 7346**

Customer equipment: **QA CAL-01 v9, QA CAL-14 v6, QA CAL-23 v5, QA CAL-25 v7**
Calibration procedure for domestic E-field probes

Calibration date: **March 30, 2022**

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

All determinations have been conducted in the above laboratory facility: environment temperature (22 ± 0.1°C and humidity = 70%).

Calibration Equipment used (MPE): (value for calibration):

Primary Standards	SI	Cal Date (Certificate No.)	Scheduled Calibration
Power meter M4P	SR 10079	09-Apr-21 (No. 211-0201-0305)	Apr-22
Power source M5P-29	SR 10304	09-Apr-21 (No. 211-0201-0301)	Apr-22
Power source M5P-291	SR 10304	09-Apr-21 (No. 211-0201-0302)	Apr-22
Reference 20M attenuator	SR 02282 (20M)	09-Apr-21 (No. 211-0201-0303)	Apr-22
DAE4	SR 460	13-Dec-21 (No. DAE4-065-0401)	Dec-22
Reference Probe ES202	SR 3913	07-Dec-21 (No. ES3-013-0401)	Dec-22

Secondary Standards	SI	Check Date (in house)	Retested Date
Power source E4418	SR 020126074	08-Apr-21 (in house check Jan-22)	in house check Jan-22
Power source E4418A	SR 1Y4-148487	08-Apr-21 (in house check Jan-22)	in house check Jan-22
Power source E4418A	SR 000-10101	08-Apr-21 (in house check Jan-22)	in house check Jan-22
RF generator HP 8447C	SR 0534031700	04-Apr-20 (in house check Jan-22)	in house check Jan-22
Network Analyzer B 8700A	SR 1541804477	01-Mar-14 (in house check Dec-22)	in house check Dec-22

Calibrated by: **Steven Keller** Function: **Laboratory Technician** Signature: *[Signature]*

Accepted by: **Steven Keller** Function: **Laboratory Manager** Signature: *[Signature]*

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Client: **Auden** Certificate No: **EX3-7346_Mar22**

Accreditation No: **SCS 0108**

Glossary:

- TSL: Issue simulating liquid
- NORM(x,y,z): sensitivity in free space
- DCP: sensitivity in TSL / NORM(x,y,z)
- CF: crest factor (15day cycle) of the RF signal
- A, B, C, D: modulation dependent polarization parameters
- Polarization (α): α rotation around probe axis
- Connector Angle: α rotation around an axis that is in the plane normal to probe axis (in measurement center), i.e. α is 15° normal to probe axis
- Connector Angle: β rotation used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEC 61010-1:2011, Measurement Procedure for the Assessment of Specific Absorption Rate of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices Part 1:001: Human Models, Implementation And Procedures (Frequency Range of 4 MHz to 10 GHz), October 2020
- EN 60564, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM(x,y,z): Assessed for E-field polarization $\beta = 0$ (f = 600 MHz in TEM-cell; f = 1800 MHz: R22 waveguide); NORM(x,y,z) are only intermediate values, i.e. the uncertainties of NORM(x,y,z) does not affect the E-field uncertainty (see TSL, see below ConfF)
- NORM(x,y,z) = NORM(x,y,z) frequency response (see Frequency Response Chart). This linearity is implemented in DASY4 software options (see below A.2). The uncertainty of the frequency response is included in the stated uncertainty of ConfF
- DCP(x,y,z): DCP are numerical characterization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media
- PAR: PAR is the Peak to Average Ratio that is not calculated but determined based on the signal characteristics
- Any (x, y, z): ConfF; DCP; V(x,y,z); A, B, C, D are numerical characterization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. V(x,y,z) is the maximum calibration range assessed in RMS voltage across the probe
- ConfF and Boundary Effect Parameters: Assessed in flat phantom using E-Field or Temperature Transfer Standard for f = 600 MHz) and inside waveguide using analytical field distributions based on power measurements for f = 1800 MHz. The same values are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are not assessed in DASY4 software to reduce the uncertainty. The repeatability in TSL corresponds to NORM(x,y,z) "ConfF" where the uncertainty corresponds to that given for ConfF. A repeatability description ConfF is used in DASY4 version 4.4 and higher which allows assessing the validity (more ± 50 MHz to ± 100 MHz)
- Spurious activity: (20 repetition Aves/second) in a field of low gradients resistant using a flat phantom exposed by a patch antenna
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (in probe axis). No tolerance required
- Connector Angle: The angle is assessed using the information given by minimizing the NORM(x,y,z) uncertainty required

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EX3DV4-SN7346 March 30, 2022

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7346

Basic Calibration Parameters

Norm. U(V/VmV ²)	Sensor X	Sensor Y	Sensor Z	Unc. (k=2)
0.48	0.47	0.61	± 10.1%	
DCP (mV/V)	101.4	106.0	108.9	

Calibration Results for Modulation Response

UID	Communication System Name	dB	dB/μV	dB	dB	VR (mV)	Max (dB)	Min (dB)
T000	Fluke Waveform (200Hz, 10%)	X	0.00	0.00	0.00	0.00	143.8	+3.0%
T000	AAA	X	0.00	0.00	0.00	199.3		+4.1%
T000	AAA	X	3.33	68.99	11.08	19.00	86.0	-6.8%
T000	AAA	Y	4.03	79.70	12.35		56.0	
T000	AAA	Z	1.63	64.25	9.76		56.0	
T000	AAA	X	3.00	79.65	11.31	6.89	80.0	+2.4%
T000	AAA	Y	11.31	81.32	14.72		88.0	
T000	AAA	Z	3.45	69.90	9.11		86.0	
T000	AAA	X	7.41	79.85	12.61	3.88	95.0	+2.7%
T000	AAA	Y	26.90	81.62	16.51		95.0	
T000	AAA	Z	0.18	138.39	0.01		95.0	
T000	AAA	X	0.72	70.13	9.50	2.22	126.9	+11.7%
T000	AAA	Y	20.90	81.58	16.29		120.0	
T000	AAA	Z	1.34	124.51	16.87		120.0	
T000	AAA	X	1.47	84.88	13.82	1.89	150.0	+4.2%
T000	AAA	Y	1.56	68.27	14.65		150.0	
T000	AAA	Z	3.45	61.88	11.05		150.0	
T000	AAA	X	2.08	67.33	13.38		150.0	
T000	AAA	Y	2.24	64.79	13.58		150.0	
T000	AAA	Z	2.63	68.51	13.26	0.01	150.0	+1.1%
T000	AAA	X	0.72	69.43	13.01		150.0	
T000	AAA	Y	1.70	64.72	13.99		150.0	
T000	AAA	Z	1.38	66.82	13.25	0.00	150.0	
T000	AAA	X	1.38	66.82	13.25	0.00	150.0	
T000	AAA	Y	2.70	66.72	14.74		150.0	
T000	AAA	Z	4.11	65.35	12.77	0.00	150.0	+2.0%
T000	AAA	X	4.70	65.54	13.41		150.0	
T000	AAA	Y	3.63	66.16	13.26		150.0	

Note: For details on UID parameters see Appendix.

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%.

1) The uncertainties of Item 1 to 2, do not affect the E field uncertainty within 10% (see Page 6 of 28).

2) Humidity measurement parameter, uncertainty not required.

3) Uncertainty is determined using the most conservative (worst case) possible response (rectangular distribution) which is converted to the square root of the sum of squares.

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EX3DV4-SN7346 March 30, 2022

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7346

Sensor Model Parameters

SI	SI	SI	T1	T2	T3	T4	T5	T6
IP	IP	V ²	ms.V ²	ms.V ²	ms	V ²	V ²	V ²
X	39.2	291.80	35.10	5.63	0.03	5.02	1.42	0.12
Y	37.1	270.84	34.12	6.29	0.00	5.01	1.82	0.05
Z	9.7	69.74	33.37	4.96	0.00	4.94	0.61	0.00

Other Probe Parameters

Parameter	Value
Sensor Arrangement	Triangular
Connector Angle (°)	-166.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	237 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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

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EX3DV4-SN7346 March 30, 2022

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7346

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz)	Relative Permittivity ¹	Conductivity (S/m) ²	CompX	CompY	CompZ	Alpha ³	Depth ⁴ (mm)	Unc. (k=2)
750	41.9	0.69	10.56	10.56	10.56	0.55	0.85	+12.0%
835	41.5	0.90	10.12	10.12	10.12	0.42	0.96	+12.0%
900	41.5	0.97	10.10	10.10	10.10	0.53	0.80	+12.0%
1450	40.5	1.20	9.26	9.26	9.26	0.50	0.80	+12.0%
1750	40.1	1.37	8.83	8.83	8.83	0.34	0.86	+12.0%
1900	40.0	1.40	8.48	8.48	8.48	0.35	0.95	+12.0%
2000	40.0	1.40	8.35	8.35	8.35	0.34	0.88	+12.0%
2300	39.5	1.67	7.86	7.86	7.86	0.39	0.90	+12.0%
2450	39.2	1.80	7.63	7.63	7.63	0.41	0.90	+12.0%
2600	39.0	1.98	7.33	7.33	7.33	0.44	0.90	+12.0%
3300	38.2	2.71	7.15	7.15	7.15	0.30	1.35	+13.1%
3500	37.9	2.91	7.14	7.14	7.14	0.30	1.35	+13.1%
3700	37.7	3.12	6.85	6.85	6.85	0.30	1.35	+13.1%
3900	37.5	3.32	6.71	6.71	6.71	0.40	1.60	+13.1%
4100	37.2	3.53	6.58	6.58	6.58	0.40	1.60	+13.1%
4200	37.1	3.63	6.30	6.30	6.30	0.40	1.70	+13.1%
4400	36.9	3.84	6.24	6.24	6.24	0.40	1.70	+13.1%
4600	36.7	4.04	6.11	6.11	6.11	0.40	1.70	+13.1%
4800	36.4	4.25	6.08	6.08	6.08	0.40	1.80	+13.1%
4900	36.3	4.40	5.84	5.84	5.84	0.40	1.80	+13.1%
5200	36.0	4.66	5.25	5.25	5.25	0.40	1.80	+13.1%
5300	35.9	4.78	5.12	5.12	5.12	0.40	1.80	+13.1%
5500	35.6	4.98	4.85	4.85	4.85	0.40	1.80	+13.1%
5800	35.5	5.07	4.70	4.70	4.70	0.40	1.80	+13.1%
5900	35.3	5.27	4.75	4.75	4.75	0.40	1.80	+13.1%

1) Frequency validity above 300 MHz and ±100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ±50 MHz. The uncertainty is the RSS of the Conf. uncertainty at calibration frequency and the uncertainty for the measured frequency band.

2) As frequencies 0-10 GHz, the validity of tissue parameters (ρ and σ) can be relaxed to ±10% if equal compensation formula is applied to measured DCP values. The uncertainty is the RSS of the Conf. uncertainty for indicated target tissue parameters.

3) Alpha/Depth are determined during calibration. SPACD warrants that the remaining deviation due to the boundary effect after compensation is always less than ±1% for frequencies below 3 GHz, below ±2% for frequencies between 3-6 GHz, and below ±4% for frequencies between 6-10 GHz at any distance larger than half the probe tip diameter from the boundary.

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EX3DV4-SN7346 March 30, 2022

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7346

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz)	Relative Permittivity ¹	Conductivity (S/m) ²	CompX	CompY	CompZ	Alpha ³	Depth ⁴ (mm)	Unc. (k=2)
6500	34.5	6.07	5.30	5.30	5.30	0.20	2.50	+18.0%

1) Frequency validity above 6 GHz is ±100 MHz. The uncertainty is the RSS of the Conf. uncertainty at calibration frequency and the uncertainty for the measured frequency band.

2) As frequencies 0-10 GHz, the validity of tissue parameters (ρ and σ) can be relaxed to ±10% if equal compensation formula is applied to measured DCP values. The uncertainty is the RSS of the Conf. uncertainty for indicated target tissue parameters.

3) Alpha/Depth are determined during calibration. SPACD warrants that the remaining deviation due to the boundary effect after compensation is always less than ±1% for frequencies below 3 GHz, below ±2% for frequencies between 3-6 GHz, and below ±4% for frequencies between 6-10 GHz at any distance larger than half the probe tip diameter from the boundary.

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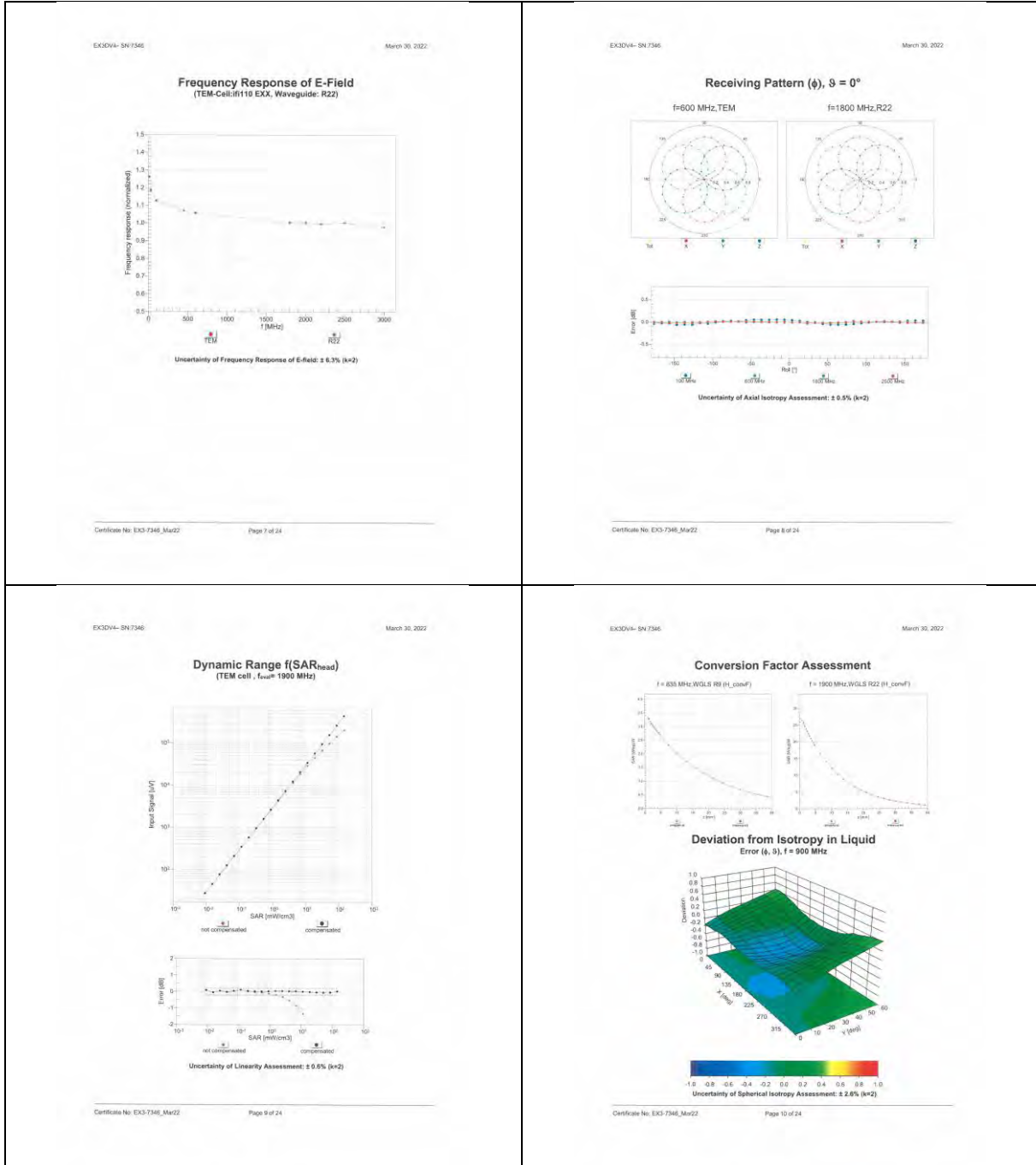
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Table with columns: Appendix: Modulation Calibration Parameters, UID, Rev, Commissioning System Name, Group, Pass (dB), Used (MHz), and various test results.

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Table with columns: Item No., Description, Standard, Result, and Date. Includes items like 10414 AAA, 10415 AAA, etc., under EX3034-SN-7348.

Table with columns: Item No., Description, Standard, Result, and Date. Includes items like 104899 AAF, 104900 AAF, etc., under EX3034-SN-7348.

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Table with columns: Item No., Description, Standard, Result, and Date. Includes items like 10547 AAC, 10548 AAC, etc., under EX3034-SN-7348.

Table with columns: Item No., Description, Standard, Result, and Date. Includes items like 10605 AAC, 10606 AAC, etc., under EX3034-SN-7348.

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<p>EX3D14-SN 7346</p> <p>March 30, 2022</p> <p>15985 AAA 50 NR DL (CP-QPOM, TM 3.1, 40 MHz, 64-QAM, 30 MHz) SG NR FR1 TDD 9.54 ± 9.8 %</p> <p>15986 AAA 50 NR DL (CP-QPOM, TM 3.1, 50 MHz, 64-QAM, 30 MHz) SG NR FR1 TDD 9.50 ± 9.8 %</p> <p>15987 AAA 50 NR DL (CP-QPOM, TM 3.1, 60 MHz, 64-QAM, 30 MHz) SG NR FR1 TDD 9.53 ± 9.8 %</p> <p>15988 AAA 50 NR DL (CP-QPOM, TM 3.1, 70 MHz, 64-QAM, 30 MHz) SG NR FR1 TDD 9.38 ± 9.8 %</p> <p>15989 AAA 50 NR DL (CP-QPOM, TM 3.1, 80 MHz, 64-QAM, 30 MHz) SG NR FR1 TDD 9.33 ± 9.8 %</p> <p>15990 AAA 50 NR DL (CP-QPOM, TM 3.1, 90 MHz, 64-QAM, 30 MHz) SG NR FR1 TDD 9.52 ± 9.8 %</p> <p>¹ Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.</p>	<p>EX3D14-SN 7346</p> <p>March 30, 2022</p> <p>15985 AAA 50 NR DL (CP-QPOM, TM 3.1, 40 MHz, 64-QAM, 30 MHz) SG NR FR1 TDD 9.54 ± 9.8 %</p> <p>15986 AAA 50 NR DL (CP-QPOM, TM 3.1, 50 MHz, 64-QAM, 30 MHz) SG NR FR1 TDD 9.50 ± 9.8 %</p> <p>15987 AAA 50 NR DL (CP-QPOM, TM 3.1, 60 MHz, 64-QAM, 30 MHz) SG NR FR1 TDD 9.53 ± 9.8 %</p> <p>15988 AAA 50 NR DL (CP-QPOM, TM 3.1, 70 MHz, 64-QAM, 30 MHz) SG NR FR1 TDD 9.38 ± 9.8 %</p> <p>15989 AAA 50 NR DL (CP-QPOM, TM 3.1, 80 MHz, 64-QAM, 30 MHz) SG NR FR1 TDD 9.33 ± 9.8 %</p> <p>15990 AAA 50 NR DL (CP-QPOM, TM 3.1, 90 MHz, 64-QAM, 30 MHz) SG NR FR1 TDD 9.52 ± 9.8 %</p> <p>¹ Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.</p>
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4 Impedance and return loss

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



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