

Appendix C

Phantom Description

Schmid & Parmer Engineering AG s e

ugheunstresse 43, 8004 Zurich, Switzeller one +41 1 245 9700; Fax +41 1 245 9779 HOGEDING COTT. HITS:/ www.apeag.com

Certificate of Conformity / First Article Inspection

item	SAM Twin Phantom V4.0
Type No	QD 000 P40 C
Series No	TP-1150 and higher
Manufacturer	SPEAG Zeughausstrasse 43 CH-8004 Zürich Switzeriand

Tests The series production process used allows line irmitation to test of first articles.

Complete tests were made on the pre-series Type No. QD 000 P40 AA. Serial No. TP-1001 and on the sories first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series items (called samples) or are tested at each item.

Test	Requirement	Details	Units tested
Dimensions	Compliant with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness of shell	Compliant with the requirements according to the standards	2mm +/- 0.2mm in flat and specific areas of head section	First article, Samples, TP-1314 ff.
Meterial thickness at ERP	Compliant with the requirements according to the standards	6mm +/- 0.2mm at ERP	First article, All items
Material parameters	Delectric parameters for required frequencies	300 MHz - 0 GHz: Relative permittivity < 5. Loss tangent < 0.05	Material samples
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions. Observe technical Note for material compatibility.	DEGMBE based simulating liquids	Pre-series, First article, Material samples
Segging	Compliant with the requirements according to the standards. Sagging of the flat section when filled with fissue simulating liquid.	< 1% typical < 0.8% H tilled with 155mm of HSL000 and without DUT below	Prototypes, Sample testing

Standards

- CENELEC EN 50361 IEEE 8td 1528-2003

- 13]
- IEC 82209 Part 1 FCC OET Buildtin 65, Supplement C, Edition 01-01 The IT1S CAD file is derived from [2] and is also within the tolerance requirements of the shapes of the other documents.

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainity requirements of SAR measurements apacified in standards [1] to [4]

07.07.2005

Date

D a 8 8

Signature / Stamp

nynitt & Pacamir Englinnening AG Byllausaptersa 43, 8004 Zurich, Smither Am ytt 5 Jes Urboy Pacate P 245 9771 NIG-COM

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Titl Page

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System Validation from Original Equipment Supplier

eughausstrasse 43, 8004 Zuric	h, Switzerland	San Star	Swiss Calibration Service
Accredited by the Swiss Accredita The Swiss Accreditation Service Aultilateral Agreement for the re	is one of the signatori		Accreditation No.: SCS 0108
Client SGS		Certificate No.	D2450V2-727_Apr23
Taoyuan City, Taiwar	1		D2450V2-727_Apr23
CALIBRATION C	ERTIFICAT	E	
Object	D2450V2 - SN:7	27	
Calibration procedure(s)	QA CAL-05.v12		
	Calibration Proce	edure for SAR Validation Sources	s between 0.7-3 GHz
Calibration date:	April 25, 2023		
the manual enterne who are anothe			
		robability are given on the following pages an ry facility: environment temperature (22 ± 3) °C	
All calibrations have been conduct Calibration Equipment used (M&TI	ed in the closed laborator		
All calibrations have been conduct Calibration Equipment used (M&TI Primary Standards	ed in the closed laborato E critical for calibration)	ry facility: environment temperature (22 ± 3)°C Cal Datë (Certificate No.)	2 and humidity < 70%. Scheduled Calibration
All calibrations have been conduct Calibration Equipment used (M&TI Primary Standards Power meter NRP2	ed in the closed laborator E critical for calibration)	ry facility: environment temperature (22 ± 3)°C Cal Datë (Certificate No.) 30-Mar-23 (No. 217-03804/03805)	2 and humidity < 70%. Scheduled Calibration Mar-24
NI calibrations have been conduct Calibration Equipment used (M&TI Primary Standards Power meter NRP2 Power sensor NRP-Z91	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244	ry facility: environment temperature (22 ± 3)°C Cal Date (Certificate No.) 30-Mar-23 (No. 217-03604/03805) 30-Mar-23 (No. 217-03604)	C and humidity < 70%. Scheduled Calibration Mar-24 Mar-24
All calibrations have been conduct Calibration Equipment used (M&TI Primary Standards Power sensor NRP-291 Yower sensor NRP-291	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 104244 SN: 103244 SN: 103245	ry facility: environment temperature (22 ± 3)°C Cal Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805)	2 and humidity < 70%. Scheduled Calibration Mar-24 Mar-24 Mar-24
All calibrations have been conduct Calibration Equipment used (M&TI Primary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k)	ry facility: environment temperature (22 ± 3)°C <u>Cal Datë (Certificate No.)</u> 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809)	2 and humidity < 70%. Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24
All calibrations have been conduct Calibration Equipment used (M&TI Primary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Peference 20 dB Attenuator Fype-N mismatch combination	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 104244 SN: 103244 SN: 103245	Cal Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03810)	C and humidity < 70%. Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24
All calibrations have been conduct Calibration Equipment used (M&TI Primary Standards Power sensor NRP-291 Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103244 SN: 3103824 SN: 310382 (06327 SN: 310382 (06327	ry facility: environment temperature (22 ± 3)°C <u>Cal Datë (Certificate No.)</u> 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809)	2 and humidity < 70%. Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24
All calibrations have been conduct Calibration Equipment used (M&TI Primary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Peference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	ed in the closed laborator E critical for calibration) 1D # SN: 104778 SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06527 SN: 3149	Cal Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22)	C and humidity < 70%. Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Mar-24 Jan-24 Jan-24 Dec-23
All calibrations have been conduct Calibration Equipment used (M&TI Primary Standards Power meter NRP2 Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH934 (20k) SN: 310982 / 06327 SN: 7349 SN: 601	Cal Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22) Check Date (in house)	2 and humidity < 70%. Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Jan-24 Jan-24 Jec-23 Scheduled Check
All calibrations have been conduct Calibration Equipment used (M&TI Primary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reterace Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A	ed in the closed laborator E critical for calibration) ID # SN: 104778 SN: 104244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06527 SN: 7349 SN: 601 ID #	Cal Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22)	C and humidity < 70%. Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Mar-24 Jan-24 Jan-24 Dec-23
All calibrations have been conduct Calibration Equipment used (M&TI Primary Standards Power meter NRP2 Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A	ed in the closed laborator E critical for calibration) 1D # SN: 103778 SN: 103244 SN: 103245 SN: 3H9394 (20k) SN: 310982 / 06327 SN: 310982 / 06327 SN: 601 ID # ID # SN: US3752783 SN: US37292783 SN: W141083315	y facility: environment temperature (22 ± 3)°C <u>Cal Datē (Certificate No.)</u> 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03809) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. DAF4-601_Dec22) Check Data (in house) 30-Oct+14 (in house check Oct-22)	2 and humidity < 70%. Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Mar-24 Mar-24 Jan-24 Dec-23 Scheduled Check In house check: Oct-24
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

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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

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: a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020. b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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 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 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: D2450V2-727 Apr23

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Measurement Conditions

DASY system configuration, as far as not given on page	1
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DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.7 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	àna.	

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.1 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	6.28 W/kg

Certificate No: D2450V2-727_Apr23

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.0 Ω + 2.1 jΩ
Return Loss	- 25.8 dB

General Antenna Parameters and Design

1.148 ns	Electrical Delay (one direction)	1.148 ns
----------	----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still constrained to the Standard 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

Certificate No: D2450V2-727_Apr23

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DASY5 Validation Report for Head TSL

Date: 25.04.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:727

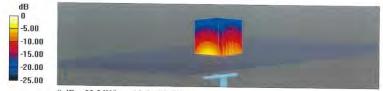
Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz; $\sigma = 1.86 \text{ S/m}$; $\epsilon_r = 37.7$; $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.88, 7.88, 7.88) @ 2450 MHz; Calibrated: 10.01.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 118.5 V/m; Power Drift = -0.07 dB Peak SAR (extrapolated) = 27.1 W/kg SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.28 W/kg Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 50.2%Maximum value of SAR (measured) = 22.5 W/kg



0 dB = 22.5 W/kg = 13.52 dBW/kg

Certificate No: D2450V2-727_Apr23

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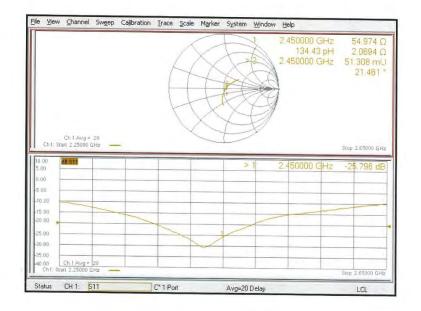
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Impedance Measurement Plot for Head TSL



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	CALIBRATION CE	RTIFICAT	Е	
	Object.	D835V	2 - SN: 4d063	
	Calibration Procedure(s)		-003-01 tion Procedures for dipole validation kits	
	Calibration date:	Septen	nber 20, 2023	
	All calibrations have been humidity<70%. Calibration Equipment used		the closed laboratory facility: environmen	t temperature (22±3)°C and
	Primary Standards	ID#	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
	Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	106277 104291 SN 3617 SN 1556	22-Sep-22 (CTTL, No.J22X09561) 22-Sep-22 (CTTL, No.J22X09561) 31-Mar-23(CTTL-SPEAG,No.Z23-60161) 11-Jan-23(CTTL-SPEAG,No.Z23-60034)	Sep-23 Sep-23 Mar-24
	Secondary Standards	ID#	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
	Signal Generator E4438C NetworkAnalyzer E5071C	MY49071430 MY46110673		Jan-24 Jan-24
		Name	Function	Signature
	Calibrated by:	Zhao Jing	SAR Test Engineer	the
	Reviewed by:	Lin Hao	SAR Test Engineer	WAR 26
	Approved by:	Qi Dianyuan	SAR Project Leader	Rock
	This calibration certificate sh	all not be repro	Issued: Se duced except in full without written approva	ptember 26, 2023

Certificate No: 23J02Z80050

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Glossary:

TSL ConvF N/A

tissue simulating liquid sensitivity in TSL / NORMx,y,z not applicable or not measured

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.2 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	-	

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.53 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.52 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.11 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	52.3Ω+ 4.21jΩ	
Return Loss	- 26.6dB	

General Antenna Parameters and Design

1.298 ns	Electrical Delay (one direction)
1.298	Electrical Delay (one direction)

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL

Date: 2023-09-20

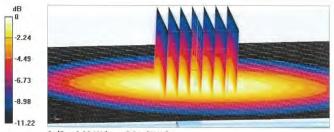
Test Laboratory: CTTL, Beijing, China DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d063 Communication System: UID 0, CW; Frequency: 835 MHz Medium parameters used: f = 835 MHz; $\sigma = 0.892$ S/m; $\varepsilon_r = 41.18$; $\rho = 1000$ kg/m³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(10.1, 10.1, 10.1) @ 835 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11 .
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 57.75 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 3.88 W/kg SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.52 W/kg Smallest distance from peaks to all points 3 dB below = 16.2 mm

Ratio of SAR at M2 to SAR at M1 = 61.6% Maximum value of SAR (measured) = 3.32 W/kg



0 dB = 3.32 W/kg = 5.21 dBW/kg

Certificate No: 23J02Z80050

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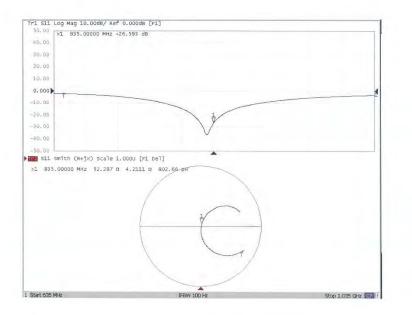






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Impedance Measurement Plot for Head TSL



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lient SGS Taoyuan City, Taiwan		Certificate No.	D1900V2-5d173_Apr23
CALIBRATION CI	ERTIFICATE		
Dbject	D1900V2 - SN:50	1173	
Calibration procedure(s)	QA CAL-05.v12 Calibration Proce	dure for SAR Validation Sources	between 0.7-3 GHz
Calibration date:	April 26, 2023		
All calibrations have been conducte	d in the closed laborator	y facility; environment temperature $(22 \pm 3)^{\circ}$	C and humidity < 70%.
Calibration Equipment used (M&TE		y facility: environment temperature (22 ± 3)°(Cal Date (Certificate No.)	C and humidity < 70%. Scheduled Calibration
Calibration Equipment used (M&TE Primary Standards	critical for calibration)		
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-291	critical for calibration)	Cal Date (Certificate No.)	Scheduled Calibration
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91	critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245	Cal Daté (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805)	Scheduled Calibration Mar-24 Mar-24 Mar-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator	critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k)	Cai Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809)	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-291 Power sensor NRP-291 Perference 20 (B Attenuator Fype-N mismatch combination	critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327	Cal Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810)	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Mar-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Fype-N mismatch combination Reference Probe EXSDV4	critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k)	Cai Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809)	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 BB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4.	critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: 103245 SN: 103245 SN: 2092/06327 SN: 7349	Cal Daté (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03810) 10-Jar-23 (No. 217-03810)	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Mar-24 Jan-24 Jan-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP-2 Power sensor NRP-291 Tower sensor NRP-291 Teference 20 dB Attenuator Type-N mismatch combination Teference Probe EX3DV4 DAE4 Secondary Standards	critical for calibration) ID # SN: 103244 SN: 103245 SN: BH3934 (20k) SN: 310982 / 06327 SN: 7349 SN: 601	Cal Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22)	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Mar-24 Jan-24 Jan-24 Dec-23
Calibration Equipment used (M&TE Primary Standards Power meter NRP-2 Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B	critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 30982 / 06327 SN: 7349 SN: 601 ID #	Cal Daté (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 10-Jar-23 (No. EX3-7349_Jar23) 19-Dec-22 (No. DAE4-601_Dec22) Check Date (in house)	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Jar-24 Jar-24 Jar-24 Dec-23 Scheduled Check
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A	critical for calibration) ID # SN: 104778 SN: 103244 SN: 03245 SN: 810982 / 06327 SN: 310982 / 06327 SN: 30982 / 06327 SN: 601 ID # SN: 0B39512475	Cal Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22) Check Date (in house) 30-Oct-14 (in house check Oct-22)	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Jan-24 Jan-24 Jan-24 Dec-23 Scheduled Check In house check: Oct-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP-29 Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A Pi generator R&S SMT-06	critical for calibration) ID # SN: 104778 SN: 103244 SN: 03245 SN: 310982 / 06327 SN: 310982 / 06327 SN: 310982 / 06327 SN: 30985 / 06327 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: MY41093315	Cal Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX7-7349.Jan23) 19-Dec-22 (No. DAE4-601_Dec22) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 15-Jun-15 (in house check Oct-22)	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Jan-24 Jan-24 Jan-24 Dec-23 Scheduled Check In house check: Oct-24 In house check: Oct-24 In house check: Oct-24 In house check: Oct-24 In house check: Oct-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP-29 Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A Pi generator R&S SMT-06	critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 30982 / 06327 SN: 601 ID # SN: 6B39512475 SN: US37292783 SN: MY41093315	Cal Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. 217-0380) 10-Jan-23 (No. 217-0380)	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Jan-24 Jan-24 Dec-23 Scheduled Check In house check: Oct-24 In house check: Oct-24 In house check: Oct-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference 20 dB Attenuator DAE4. Secondary Standards Power meter E44198 Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	critical for calibration) ID # SN: 104778 SN: 103244 SN: 303245 SN: 3H9394 (20k) SN: 310982 (06327 SN: 310982 (06327 SN: 561 ID # SN: GB39512475 SN: US37292783 SN: W14303315 SN: US41080477 Name	Cai Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03805) 30-Ott-14 (in house check Ott-22) 07-Oct-15 (in house check Ott-22) 07-Oct-15 (in house check Ott-22) 15-Jun-15 (in house check Ott-22) 31-Mar-14 (in house check Ott-22) Function	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Jan-24 Jan-24 Jan-24 Dec-23 Scheduled Check In house check: Oct-24 In house check: Oct-24 In house check: Oct-24 In house check: Oct-24 In house check: Oct-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 30982 / 06327 SN: 601 ID # SN: 6B39512475 SN: US37292783 SN: 400972 SN: US41080477	Cal Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. 217-0380) 10-Jan-23 (No. 217-0380)	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Jar-24 Jar-24 Dec-23 Scheduled Check In house check: Oct-24 In house check: Oct-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E44198 Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	critical for calibration) ID # SN: 104778 SN: 103244 SN: 303245 SN: 3H9394 (20k) SN: 310982 (06327 SN: 310982 (06327 SN: 561 ID # SN: GB39512475 SN: US37292783 SN: W14303315 SN: US41080477 Name	Cai Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03805) 30-Ott-14 (in house check Ott-22) 07-Oct-15 (in house check Ott-22) 07-Oct-15 (in house check Ott-22) 15-Jun-15 (in house check Ott-22) 31-Mar-14 (in house check Ott-22) Function	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Jan-24 Dec-23 Scheduled Check In house check: Oct-24 In house check: Oct-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	critical for calibration) ID # SN: 104778 SN: 103244 SN: 03245 SN: 8H9394 (20k) SN: 310982 / 06827 SN: 501 ID # SN: GB39512475 SN: 0837292783 SN: W141083315 SN: 103972 SN: US41080477 Name Paulo Pina	Cai Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-0380) 10-Jan-23 (No. 217-0380)	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Jan-24 Dec-23 Scheduled Check In house check: Oct-24 In house check: Oct-24

Certificate No: D1900V2-5d173_Apr23

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



Schweizerischer Kalibrierdienst S Service suisse d'étalonnage С Servizio svizzero di taratura S Swiss Calibration Service

Accreditation No.: SCS 0108

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

Glossary:

TSL ConvF N/A

tissue simulating liquid sensitivity in TSL / NORM x,y,z 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-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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 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 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

DAS

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	-
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 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	38.9 ± 6 %	1.39 mho/m ± 6 %
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	10.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.3 W/kg ± 17.0 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 250 mW input power	5.23 W/kg

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.6 Ω + 4.6 jΩ	
Return Loss	- 25.7 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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DASY5 Validation Report for Head TSL

Date: 26.04.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d173

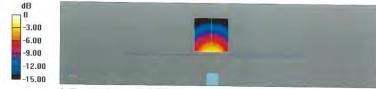
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; σ = 1.39 S/m; ϵ_r = 38.9; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.35, 8.35, 8.35) @ 1900 MHz; Calibrated: 10.01.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001 .
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 110.0 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 18.8 W/kg

SAR(1 g) = 10.09 W/kg; SAR(10 g) = 5.23 W/kgSmallest 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) = 15.8 W/kg



0 dB = 15.8 W/kg = 12.0 dBW/kg

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View Channel Sweep Calibration Irace Scale Marker System Window Help 52.615 Ω 4.6437 Ω 388.98 pH 1,900000 GHz 51.883 mU 58.023 Ch 1 Awg = 20 Ch1: Start 1.70000 GHz 00 5.00 0.00 Ch 1 Avg= 511 C* 1-Port Avg=20 Delay Status CH 1: LCL

Impedance Measurement Plot for Head TSL

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	al standards, which realize the physical ur pability are given on the following pages a	
sed laboratory f	facility: environment temperature (22 \pm 3)	'C and humidity < 70%.
calibration)		
	Cal Date (Certificate No.)	Scheduled Calibration
778	04-Apr-22 (No. 217-03525/03524)	Apr-23
244	04-Apr-22 (No. 217-03524)	Apr-23
245	04-Apr-22 (No. 217-03525)	Apr-23
394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
982 / 06327	04-Apr-22 (No. 217-03528)	Apr-23
3	08-Mar-22 (No. EX3-3503_Mar22)	Mar-23
	31-Aug-22 (No. DAE4-601_Aug22)	Aug-23
	Check Date (in house)	Scheduled Check
9512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
7292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
1093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
1080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24
	Function	Signature
strati	Laboratory Technician	7-1e
nn	Technical Manager	56
	astrati Jhn	astrati Laboratory Technician

ac-MR

Certificate No: D3700V2-1057_Nov22

Calibration Laboratory of

Engineering AG eughausstrasse 43, 8004 Zurich, Switzerland

Schmid & Partner

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



Schweizerischer Kalibrierdienst S Service suisse d'étalonnage С Servizio svizzero di taratura S Swiss Calibration Service

Accreditation No.: SCS 0108

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 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:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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 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 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	n configuration, as	far as not giv	en on page 1.

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
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	3700 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.7	3.12 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.1 ± 6 %	3.08 mho/m ± 6 %
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	100 mW input power	6.63 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	66.6 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 100 mW input power	2.43 W/kg

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.7 Ω + 0.5 jΩ	
Return Loss	- 36.8 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.137 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured b	y
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SPEAG

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DASY5 Validation Report for Head TSL

Date: 22.11.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1057

Communication System: UID 0 - CW; Frequency: 3700 MHz Medium parameters used: f = 3700 MHz; $\sigma = 3.08 \text{ S/m}$; $\varepsilon_r = 38.1$; $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.73, 7.73, 7.73) @ 3700 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 31.08.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501) .

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3700MHz/Zoom Scan, dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 69.62 V/m; Power Drift = -0.08 dB Peak SAR (extrapolated) = 18.4 W/kg SAR(1 g) = 6.63 W/kg; SAR(10 g) = 2.43 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 73.8%Maximum value of SAR (measured) = 12.6 W/kg



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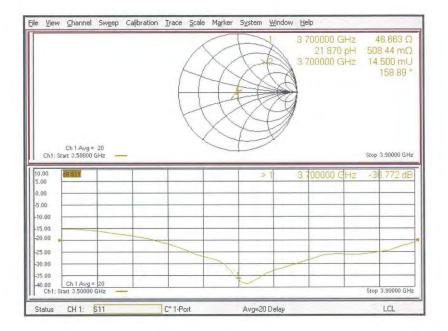
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Impedance Measurement Plot for Head TSL



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