

Appendix C

Phantom Description

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland Phone +41 44 245 9700, Fax +41 44 245 9779 info@speag.com, http://www.speag.com

Certificate of Conformity / First Article Inspection

Item	Oval Flat Phantom ELI 5.0
Type No	QD OVA 002 A
Series No	1108 and higher
Manufacturer	Untersee Composites
	Knebelstrasse 8, CH-8268 Mannenbach, Switzerland

Tests

Complete tests were made on the prototype units QD OVA 001 A, pre-series units QD OVA 001 B as well as on some series units QD OVA 001 B. Some tests are made on all series units QD OVA 002 A.

Test	Requirement	Details	Units tested
Shape	Internal dimensions, depth and sagging are compatible with standards	Bottom elliptical 600 x 400 mm, Depth 190 mm, dimension compliant with [1] for f > 375 MHz	Prototypes
Material thickness	Bottom: 2.0mm +/- 0.2mm	dimension compliant with [3] for f > 800 MHz	all
Material parameters	rel. permittivity 2 – 5, loss tangent ≤ 0.05, at f ≤ 6 GHz	rel. permittivity 3.5 +/- 0.5 loss tangent ≤ 0.05	Material samples
Material resistivity	Compatibility with tissue simulating liquids .	Compatible with SPEAG liquids. **	Phantoms, Material sample
Sagging	Sagging of the flat section in tolerance when filled with tissue simulating liquid.	within tolerance for filling height up to 155 mm	Prototypes, samples

Note: Compatibility restrictions apply certain liquid components mentioned in the standard, containing e.g. DGBE, DGMHE or Triton X-100. Observe technical note on material compatibility

Standards

- OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition 01-01
 IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific
- [2] IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques. December 2003
- [3] IEC 62209–1 ed1.0, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)". 2005-02-18
- proximity to the ear (frequency range of 300 MHz to 3 GHz)*, 2005-02-18
 IEC 62209-2 ed1.0, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices Human models, instrumentation, and procedures Part 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)*, 2010-03-30

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of body-worn SAR measurements and system performance checks as specified in [1 – 4] and further standards.

Date 25.7.2011

Signature / Stamp

t (886-2) 2299-3279

peag hmid & Pertner-Engineering/AG ugbayestrasse 43, 6004 (Auch, Switze) ang/441, 44/245/9708, Few.-44 (Auch 5)

Page 1 (1)

Doc No 881 - QD OVA 002 A - A

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(秋子) 近後音音本性到別風人(後回貢員) 「同時近後回世所留9人)。今報 電子空母 公司音曲子可、个可面切夜貌。 This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com.tw/Terms-and-Conditions and for electronic format documents, subject to to the limitation of fliability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

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System Validation from Original Equipment Supplier

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E-mail: emf@caict.ac.cn Client SGS	http://www.caict		2-60431
CALIBRATION CE	RTIFICAT		
Object	D750V:	3 - SN: 1015	
Calibration Procedure(s)	FE-711	-003-01	
		tion Procedures for dipole validation kits	
Calibration date:	Octobe	r 9, 2022	
pages and are part of the ce All calibrations have been		he closed laboratory facility; environment t	emperature (22±3)°C and
All calibrations have been humidity<70%.	conducted in t	he closed laboratory facility: environment t or calibration)	emperature (22±3)°C and
	conducted in t		emperature (22±3)°C and Scheduled Calibration
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	conducted in t (M&TE critical for ID # 106276	or calibration) Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103)	Scheduled Calibration May-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A	conducted in t (M&TE critical fo ID # 106276 101369	cr calibration) Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103)	Scheduled Calibration May-23 May-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	conducted in t (M&TE critical for ID # 106276	or calibration) Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103)	Scheduled Calibration May-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4	conducted in t (M&TE critical fo ID # 106276 101369 SN 7464	or calibration) Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007)	Scheduled Calibration May-23 May-23 Jan-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4	conducted in ti (M&TE critical fo 10 # 106276 101369 SN 7464 SN 1556	or calibration) Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 26-Jan-22(SPEAG,No.EX3-7464_Jan22)	Scheduled Calibration May-23 May-23 Jan-23 Jan-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards	conducted in ti (M&TE critical fo ID # 106276 101369 SN 7464 SN 1556 ID #	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 26-Jan-22 (CTTL, No.J22X03103) 12-Jan-22 (CTTL-SPEAG,No.Z22-60007) Cal Date (Calibrated by, Certificate No.) 13-Jan-22 (CTTL, No.J22X00409)	Scheduled Calibration May-23 May-23 Jan-23 Jan-23 Scheduled Calibration
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power Sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	conducted in t (M&TE critical fo 106276 101369 SN 7464 SN 1556 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 26-Jan-22 (CTTL, No.J22X03103) 12-Jan-22 (CTTL-SPEAG,No.Z22-60007) Cal Date (Calibrated by, Certificate No.) 13-Jan-22 (CTTL, No.J22X00409)	Scheduled Calibration May-23 May-23 Jan-23 Jan-23 Scheduled Calibration Jan-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	conducted in t (M&TE critical fd 106276 101369 SN 7464 SN 1556 ID # MY49071430 MY46110673	cr calibration) Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007) Cal Date (Calibrated by, Certificate No.) 13-Jan-22 (CTTL, No.J22X00409) 14-Jan-22 (CTTL, No.J22X00406)	Scheduled Calibration May-23 May-23 Jan-23 Jan-23 Scheduled Calibration Jan-23 Jan-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power Sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	conducted in t (M&TE critical fo 106276 101369 SN 7464 SN 1556 ID # MY49071430 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007) Cal Date (Calibrated by, Certificate No.) 13-Jan-22 (CTTL, No.J22X00409) 14-Jan-22 (CTTL, No.J22X00406) Function	Scheduled Calibration May-23 May-23 Jan-23 Jan-23 Scheduled Calibration Jan-23 Jan-23

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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	750 MHz ±1 MHz	

Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	42.0	0.90 mho/m
Measured Head TSL parameters	(22.0 ±0.2) °C	41.5 ±6 %	0.90 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	2.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.56 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.72 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	53.0Ω+ 0.70jΩ	
Return Loss	- 30.4dB	
eneral Antenna Parameters and Design		

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 The dipole is made or standard semingid coards caule. The center conductor of the teeling 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: 2022-10-09

Test Laboratory: CTTL, Beijing, China **DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1015** Communication System: UID 0, CW; Frequency: 750 MHz Medium parameters used: f = 750 MHz; $\sigma = 0.899$ S/m; $\varepsilon_r = 41.5$; $\rho = 1000$ kg/m³ Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(10.26, 10.26, 10.26) @ 750 MHz; Calibrated: 2022-01-26
- 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,

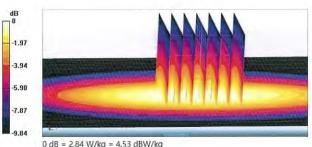
dy=5mm, dz=5mm Reference Value = 54.40 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.15 W/kg

SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.44 W/kg Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 15 mm)

Ratio of SAR at M2 to SAR at M1 = 68.3%

Maximum value of SAR (measured) = 2.84 W/kg



0 ub = 2.04 W/kg = 4.55 ubW/

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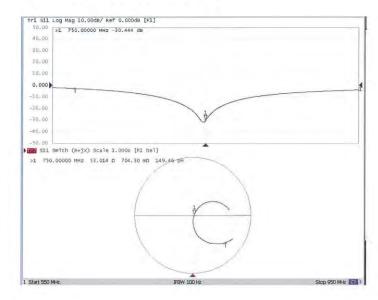






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Impedance Measurement Plot for Head TSL





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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) ℃	42.0 ±6 %	0.91 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	2.47 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.82 W/kg ±18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.60 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.36 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	50.4Ω- 3.34jΩ	
Return Loss	- 29.5dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.313 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly The dipole is made of standard semingid coaxia 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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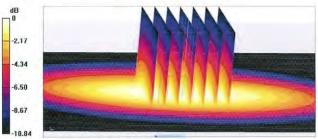
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CAICT spea CALIBRATION LABORATORY Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2117 http://www.caict.ac.cn E-mail: emf@caict.ac.cn Date: 2022-09-26 DASY5 Validation Report for Head TSL Test Laboratory: CTTL, 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; $\sigma = 0.911$ S/m; $\varepsilon_r = 42$; $\rho = 1000$ kg/m³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration: Probe: EX3DV4 - SN3846; ConvF(10.04, 10.04, 10.04) @ 835 MHz; Calibrated: 2022-05-20 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 = 59.56 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.80 W/kg SAR(1 g) = 2.47 W/kg; SAR(10 g) = 1.6 W/kg Smallest distance from peaks to all points 3 dB below = 16.2 mm Ratio of SAR at M2 to SAR at M1 = 64.7% Maximum value of SAR (measured) = 3.35 W/kg



0 dB = 3.35 W/kg = 5.25 dBW/kg

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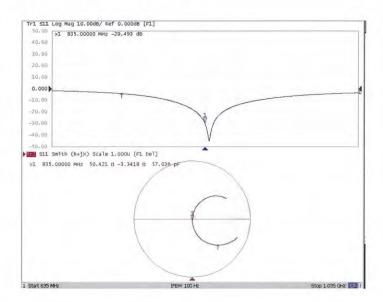
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Impedance Measurement Plot for Head TSL





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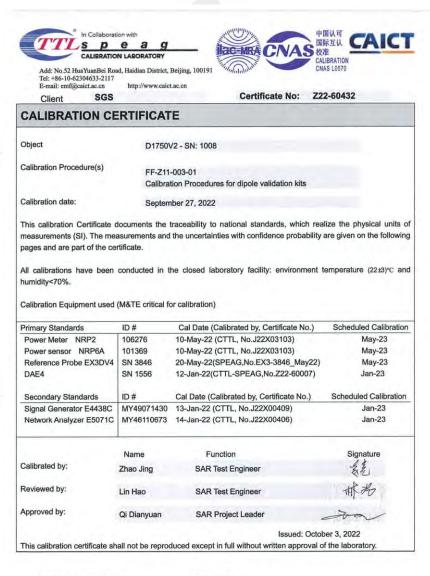
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Glossary: TSI ConvF N/A

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	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	1750 MHz ±1 MHz	

Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ±0.2) ℃	39.9 ±6 %	1.36 mho/m ±6 %
Head TSL temperature change during test	<1.0 °C	_	-

SAR result with Head TSI

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.06 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.4 W/kg ±18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.80 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.3 W/kg ±18.7 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.4Ω+ 0.09jΩ
Return Loss	- 35.5dB

Electrical Delay (one direction)	1.133 ns
----------------------------------	----------

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

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

Additional EUT Data

Manufactured by	SPEAG



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DASY5 Validation Report for Head TSL



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Date: 2022-09-27

Test Laboratory: CTTL, Beijing, China DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1008 Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

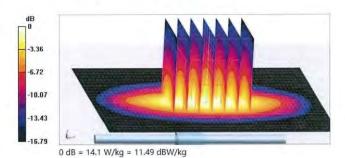
Medium parameters used: f = 1750 MHz; $\sigma = 1.355$ S/m; $\epsilon_r = 39.91$; $\rho = 1000$ kg/m³ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN3846; ConvF(8.29, 8.29, 8.29) @ 1750 MHz; Calibrated: 2022-05-20
- 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 = 93.03 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 16.9 W/kg SAR(1 g) = 9.06 W/kg; SAR(10 g) = 4.8 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 54.1% Maximum value of SAR (measured) = 14.1 W/kg



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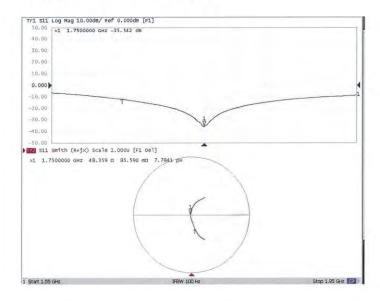






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Impedance Measurement Plot for Head TSL





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Engineering AG eughausstrasse 43, 8004 Zurich	, Switzerland		Service suisse d'étalonnage Servizio svizzero di taratura
Accredited by the Swiss Accreditation Service Multilateral Agreement for the re-	is one of the signatorie	es to the EA	Accreditation No.: SCS 0108
Client SGS-TW (Auder	4		lo: D1900V2-5d173_Apr22
CALIBRATION C	ERTIFICAT	E	
Object	D1900V2 - SN:5	d173	
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	adure for SAR Validation Source	s between 0.7-3 GHz
Calibration date:	April 28, 2022		
The measurements and the uncert All calibrations have been conduct	ed in the closed laborator	ry facility: environment temperature (22 ± 3)*	C and humidity < 70%
All calibrations have been conduct	E critical for calibration)	ry facility: environment temperature (22 ± 3)*	
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards	E critical for calibration)	Cal Date (Certificate No.)	Scheduled Calibration
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP	E critical for calibration)	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524)	Scheduled Calibration Apr-23
NI calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291	E critical for calibration)	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524)	Scheduled Calibration Apr-23 Apr-23
VI calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Drower meter NRP Power sensor NRP-291 Tower sensor NRP-291	E critical for calibration)	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525)	Scheduled Calibration Apr-23 Apr-23 Apr-23
All calibrations have been conduct Calibration Equipment used (M&TE Yrimary Standards Yower meter NRP Yower sensor NRP-201 Yower sensor NRP-201 Reference 20 dB Attenuator Reference 20 dB Attenuator	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524)	Scheduled Calibration Apr-23 Apr-23
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Owner meter NRP Power sensor NRP-291 Vectornos 20 dB Attenuator Vpc-M mismatch combination Veteriono 20 dB Attenuator	Critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 (06327 SN: 7349	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527)	Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23
Il calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Owere meter NRP Power sensor NRP-201 Meteronos 20 dB Attenuator ype-N mismatch combination Reference Probe EX30V4	Critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH3394 (20k) SN: 310982 / 06327	Cai Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528)	Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP- Power sensor NRP-291 Power sensor NRP-293 Power Sensor NRP-293 Power Sensor NRP-294 Power Sensor NRP-294 Power Standards Power Standards	Critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID #	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Doc-21 (No. EX3-7349_Dec:1) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house)	Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Over meter NRP Yower sensor NRP-291 Yower sensor NRP-291 Reference 20 dB Attenuator Yee-N mismatch combination Reference Probe EX3DV4 JAE4 Secondary Standards Over mater E4419B	Critical for calibration) ID # SN: 103245 SN: 103245 SN: 03244 SN: 03245 SN: 03245 SN: 03245 SN: 03245 SN: 03245 SN: 310982 / 06327 SN: 7349 SN: 051 ID # SN: 0639612475	Cai Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Oct-14 (in house check Oct-20)	Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Nov-22 Scheduled Check In house check: Oct-22
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Owner meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 08 Attenuator Reference 20 08 Attenuator Steferance 20 08 Attenuator Steferance 20 08 Attenuator Steferance Probe EX3DV4 DAE4 Secondary Standards Owner meter E44198 Power sensor HP 8461A	Critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 310982 / 06327 SN: 310982 / 06327 SN: 601 ID # SN: 601 SN: 6039012475 SN: US37282783	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 528-7349 Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house heck Oct-20) 07-Qd-15 (in house check Oct-20)	Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22
All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Prover sensor NRP-291 Prover sensor NRP-291 Prover sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Prover melor E44198 Prover melor E44198 Prover sensor HP 2481A Prover Sensor HP 2481A	Critical for calibration) ID # SN: 103245 SN: 103245 SN: BH394 (20k) SN: 310982 / 06327 SN: 7310982 / 06327 SN: 6839612475 SN: CB39512475 SN: US37292783 SN: W141083315	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03526/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Dec-21 (No. 217-03528) 31-Dec-21 (No. 217-03528) 01-Nov-21 (No. 217-03528) 31-Dec-21 (No. 244-901_Nov21) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-16 (in house check Oct-20)	Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
All calibrations have been conduct Calibration Equipment used (MATE Primary Standards Ower meter NRP Power sensor NRP-201 Neerson 20 dB Attenuator Ype-M mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E44198 Power sensor HP 2481A Power sensor HP 2481A Power sensor HP 2481A	Critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 3H9394 (20k) SN: 310982 / 06327 SN: 3N: 601 ID # SN: 601 ID # SN: 0537292783 SN: W741093315 SN: 104772	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Doc 21 (No. DAE4-601_Nov21) Check Date (in house Neck Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20)	Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
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All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 08 Attenuator Type-M mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 481A Power sensor HP 481A Power sensor HP 481A Power Sensor HP 481A Power Sensor HP 481A	Critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 310982 / 06327 SN: 310982 / 06327 SN: 310982 / 06327 SN: 3098612475 SN: 0537282783 SN: W741093315 SN: W741093315 SN: W741093315 SN: W741093315 SN: 1041080477 Name	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Doc 21 (No. EX3-7349 [Doc21) 01-Nov-21 (No. DAE+601_Nov21) Check Date (in house) 38-Qc1+4 (in house check Oct-20) 07-Qc1+5 (in house check Oct-20) 07-Qc1+5 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
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All calibrations have been conduct Calibration Equipment used (M&TE Primary Standards Power meter NRP- Power sensor NRP-291 Power sensor NRP-291 Power sensor NRP-294 Power sensor NRP-294 Aleference 2 00 84 Menuator Type-N mismatch combination Reference 2 Nd Menuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agitent E8358A Calibrated by:	Critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 310982 / 06327 SN: 310982 / 06327 SN: 310982 / 06327 SN: 3098612475 SN: 0537282783 SN: W741093315 SN: W741093315 SN: W741093315 SN: W741093315 SN: 1041080477 Name	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Doc 21 (No. EX3-7349 [Doc21) 01-Nov-21 (No. DAE+601_Nov21) Check Date (in house) 38-Qc1+4 (in house check Oct-20) 07-Qc1+5 (in house check Oct-20) 07-Qc1+5 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22
	ID # ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: 103244 SN: 103245 SN: 103245 SN: 103245 SN: 210982 / 06327 SN: 601 ID # SN: 0539512475 SN: 100972 SN: US37282783 SN: W141060477 Name Aldonia Georgiadou	Cal Date (Certificate No.) 04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03528) 31-Doc 21 (No. EX3-7349 Doc21) 01-Nov-21 (No. EX3-7349 Doc21) 01-Nov-21 (No. EX3-7349 Doc21) 01-Nov-21 (No. DAE4-601_Nov21) 01-Od-15 (in house check Oct-20) 01-Mar-14 (in house check Od-20) Date-15 (in house check Od-20) Date-16 (In Date-1	Scheduled Calibration Apr-23 Apr-23 Apr-23 Apr-23 Dec-22 Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22

Certificate No: D1900V2-5d173_Apr22

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Calibration Laboratory of Schmid & Partne chmid & Partne, Engineering AG

Glossary: TSL



SC izerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura viss Calibration Service

Accreditation No.: SCS 0108

s

tissue simulating liquid sensitivity in TSL / NORM x,y,z not applicable or not measured ConvF N/A

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

- 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: D1900V2-5d173_Apr22

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Measurement Conditions

DASY system configuration, as far as not	given 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, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

	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	39.1 ± 6 %	1.41 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	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.6 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	5.22 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	51.7 Ω + 5.0 jΩ
Return Loss	- 25.7 dB

General Antenna Parameters and Design

ectrical Delay (one direction)	1,198 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 teeding line is directly connected to the second arm of 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	OPENO	
Walldactured by	SPEAG	



Certificate No: D1900V2-5d173_Apr22

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Report No. : TESA2212000671E5 Page: 24 of 56

DASY5 Validation Report for Head TSL

Test Laboratory: SPEAG, Zurich, Switzerland

Date: 28.04.2022

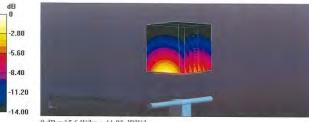
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d173 $\begin{array}{l} \mbox{Communication System: UID 0 - CW; Frequency: 1900 MHz} \\ \mbox{Medium parameters used: } f = 1900 \mbox{ MHz}; \mbox{ } \sigma = 1.41 \mbox{ S/m}; \mbox{ } \epsilon_r = 39.1; \mbox{ } \rho = 1000 \mbox{ kg/m}^3 \end{array}$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.43, 8.43, 8.43) @ 1900 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- 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:

Dipote Calibration for Head Tissue/Pin=250 mW, d=J Measurement grid: dx=5mm, dy=5mm, dz=5mmReference Value = 110.1 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 18.6 W/kg SAR(1 g) = 10 W/kg; SAR(10 g) = 5.22 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 54.3% Maximum value of SAR (measured) = 15.6 W/kg



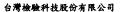
0 dB = 15.6 W/kg = 11.93 dBW/kg

Certificate No: D1900V2-5d173_Apr22

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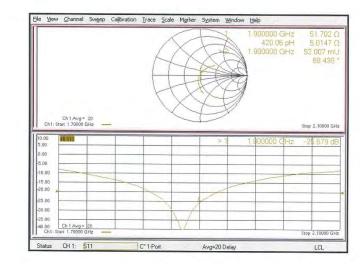
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Impedance Measurement Plot for Head TSL







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Glossary:

TSL ConvF N/A

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

q

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	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2300 MHz ±1 MHz	

Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.5	1.67 mho/m
Measured Head TSL parameters	(22.0 ±0.2) °C	40.2 ±6 %	1.68 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	12.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	48.5 W/kg ±18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.77 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 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	47.8Ω- 1.25jΩ	
Return Loss	- 31.7dB	
eneral Antenna Parameters and Design		

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

G

Manufactured by SPEAG



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DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China

Date: 2022-10-09

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN: 1023 Communication System: UID 0, CW; Frequency: 2300 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2300 MHz; $\sigma = 1.676$ S/m; $\varepsilon_r = 40.21$; p = 1000 kg/m³ Phantom section: Right Section

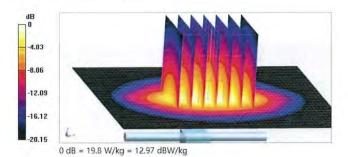
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(8.36, 8.36, 8.36) @ 2300 MHz; Calibrated: 2022-01-26
- 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 = 102.1 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 24.0 W/kg SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.77 W/kg Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 51% Maximum value of SAR (measured) = 19.8 W/kg



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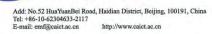
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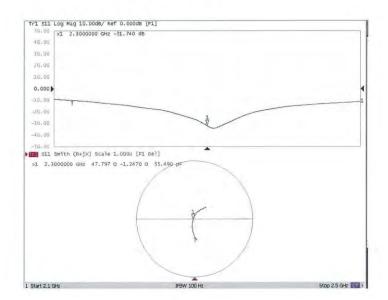
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Impedance Measurement Plot for Head TSL





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Glossary:

TSL tis ConvF se N/A not

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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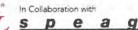
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Measurement Conditions

DASY system configuration, as far as not given on page 1. 52.10.4 **DASY Version** DASY52 Extrapolation Advanced Extrapolation Triple Flat Phantom 5.1C Phantom with Spacer **Distance Dipole Center - TSL** 10 mm dx, dy, dz = 5 mmZoom Scan Resolution 2600 MHz ±1 MHz Frequency

Head TSL parameters

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ±0.2) ℃	38.6 ±6 %	1.95 mho/m ±6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL

Condition	
250 mW input power	13.9 W/kg
normalized to 1W	55.6 W/kg ± 18.8 % (k=2)
Condition	
250 mW input power	6.33 W/kg
normalized to 1W	25.3 W/kg ± 18.7 % (k=2)
	250 mW input power normalized to 1W Condition 250 mW input power

Certificate No: Z22-60353

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.0Ω- 5.76jΩ
Return Loss	- 24.6dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.058 ns
----------------------------------	----------

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

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

Additional EUT Data

Manufactured by	SPEAG
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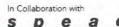
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DASY5 Validation Report for Head TSL

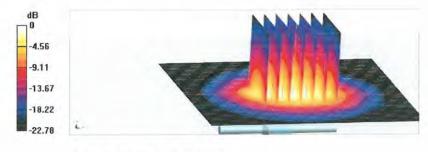
Date: 2022-08-24

Test Laboratory: CTTL, Beijing, China DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1058 Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2600 MHz; $\sigma = 1.95 \text{ S/m}$; $\varepsilon_r = 38.58$; $\rho = 1000 \text{ kg/m}^3$ Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) **DASY5** Configuration:

- Probe: EX3DV4 SN7464; ConvF(7.64, 7.64, 7.64) @ 2600 MHz; Calibrated: . 2022-01-26
- 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 = 103.6 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 29.1 W/kg SAR(1 g) = 13.9 W/kg; SAR(10 g) = 6.33 W/kg Smallest distance from peaks to all points 3 dB below = 8.9 mm Ratio of SAR at M2 to SAR at M1 = 48.7% Maximum value of SAR (measured) = 23.4 W/kg



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

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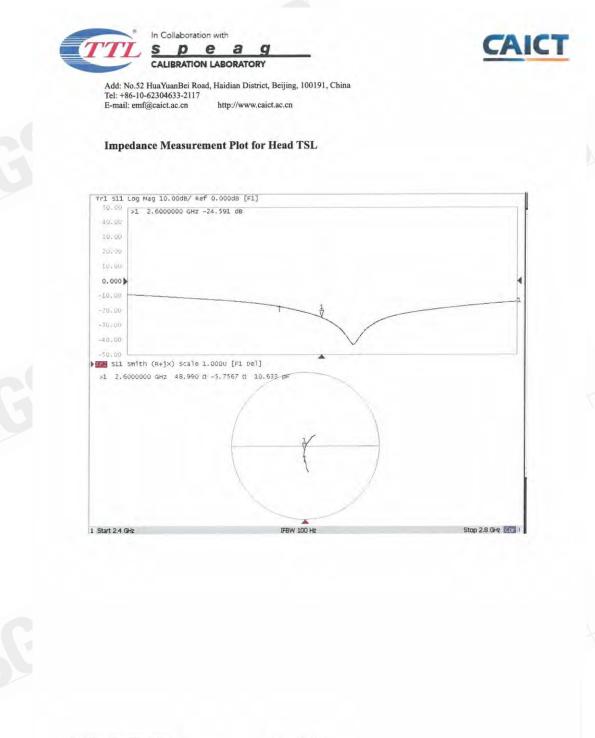
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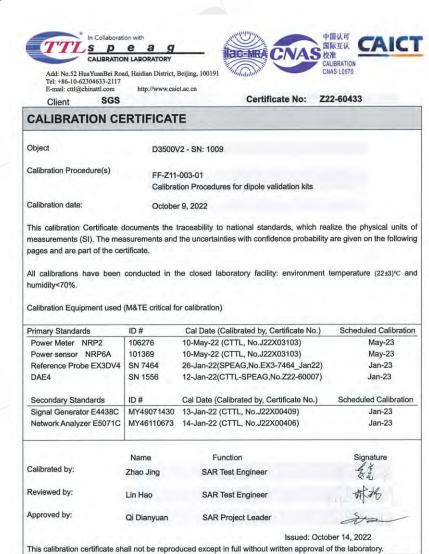
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Glossary:

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	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	3500 MHz ± 1 MHz	

Head TSL parameters

he following parameters and calculations were	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.9	2.91 mho/m
Measured Head TSL parameters	(22.0 ±0.2) °C	38.1 ±6 %	2.93 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	100 mW input power	6.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	65.2 W/kg ±24.4 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.50 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.0 W/kg ±24.2 % (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	56.3Ω- 3.27jΩ	
Return Loss	- 23.5dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.044 ns
Electrical Delay (one direction)	1.044 113

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		
The second second			

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DASY5 Validation Report for Head TSL

Date: 2022-10-09

Test Laboratory: CTTL, Beijing, China **DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN: 1009** Communication System: UID 0, CW; Frequency: 3500 MHz Medium parameters used: f = 3500 MHz; σ = 2.933 S/m; ϵ r = 38.08; ρ = 1000 kg/m³ Phantom section: Right Section

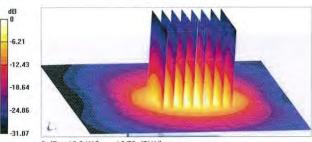
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(7.2, 7.2, 7.2) @ 3500 MHz; Calibrated: 2022-01-26
- · 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 /Pin=100mW, d=10mm, f=3500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 62.29 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 16.7 W/kg SAR(1 g) = 6.53 W/kg; SAR(10 g) = 2.5 W/kg

Smallest distance from peaks to all points 3 dB below = 8.2 mm Ratio of SAR at M2 to SAR at M1 = 76.7% Maximum value of SAR (measured) = 12.0 W/kg



0 dB = 12.0 W/kg = 10.79 dBW/kg

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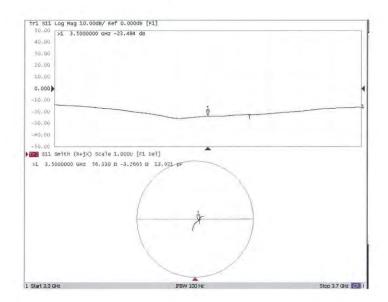
Report No. : TESA2212000671E5 Page: 43 of 56

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Impedance Measurement Plot for Head TSL





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Schweizerischer Kalibrierdienst

Scheduled Calibration

Apr-23

Apr-23

Apr-23

Apr-23

Apr-23

Mar-23

Aug-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

Service suisse d'étalonnage

Servizio svizzero di taratura

Swiss Calibration Service



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	Name	Function	Signature	
alibrated by:	Jeton Kastrati	Laboratory Technician	- Ve	
pproved by:	Sven Kühn	Technical Manager	5.6-	
			Issued: November 25, 2022	
his calibration certificate shall not	be reproduced except i	n full without written approval of the laboratory.		

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TSL Con

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

Accreditation No.: SCS 0108



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 Glossary:

	tissue simulating liquid
vF	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

DASY	system	configuration,	ast	ar as	not g	ven o	n 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 cm3 (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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1.137 ns

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Electrical Delay (one direction)

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

General Antenna Parameters and Design



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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Date: 22.11.2022

DASY5 Validation Report for Head TSL

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)

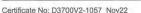
DASY52 Configuration:

- 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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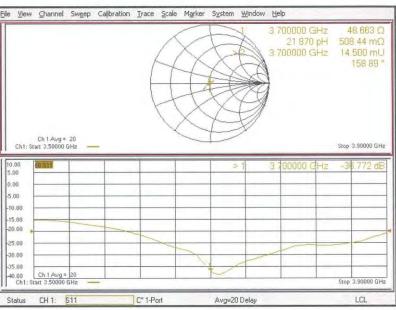
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File Ch 1 Avg = 20 Ch1: Start 3.50000 GHz 0.00 -5.00 10.00 15 00 20.00 25.00 30.00 35.00 40.00 Ch1: Ch 1 Avg = 20 Start 3,50000 GH; 511 CH 1: C* 1-Port Status

Impedance Measurement Plot for Head TSL



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Calibration Laboratory of Schweizerischer Kalibrierdiens S Schmid & Partner Service suisse d'étalonnage C ac-MR Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland Servizio svizzero di taratura S Swiss Calibration Service Accredited by the Swiss Accreditation Service (SAS) Accreditation No.: SCS 0108 The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates Client SGS (Auden) Certificate No: D3900V2-1032 Nov22 **CALIBRATION CERTIFICATE** Object D3900V2 - SN:1032 Calibration procedure(s) QA CAL-22.v6 Calibration Procedure for SAR Validation Sources between 3-10 GHz Calibration date: November 22, 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 (Certificate No.) Scheduled Calibration Power meter NRP SN: 104778 04-Apr-22 (No. 217-03525/03524) Apr-23 Power sensor NRP-Z91 SN: 103244 04-Apr-22 (No. 217-03524) Apr-23 Power sensor NRP-Z91 SN: 103245 04-Apr-22 (No. 217-03525) Apr-23 Reference 20 dB Attenuator SN: BH9394 (20k) 04-Apr-22 (No. 217-03527) Apr-23 Type-N mismatch combination SN: 310982 / 06327 04-Apr-22 (No. 217-03528) Apr-23 Reference Probe EX3DV4 SN: 3503 08-Mar-22 (No. EX3-3503_Mar22) Mar-23 DAE4 SN: 601 31-Aug-22 (No. DAE4-601_Aug22) Aug-23 Secondary Standards ID # Check Date (in house) Scheduled Check Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Oct-22) In house check: Oct-24 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-22) In house check: Oct-24 SN: MY41093315 Power sensor HP 8481A 07-Oct-15 (in house check Oct-22) In house check: Oct-24 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-22) In house check: Oct-24 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-22) In house check: Oct-24 Name Function Signature Calibrated by: Jeton Kastrati Laboratory Technician Approved by Niels Kuster Quality Manager

n.h.S.K Issued: November 24, 2022 This calibration certificate shall not be reproduced except in full without written approval of the laboratory

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

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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates Glossary:

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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	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 V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz. = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	3900 MHz ± 1 MHz 4100 MHz ± 1 MHz	

Head TSL parameters at 3900 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.5	3.32 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.9 ± 6 %	3.25 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 3900 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.91 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	69.5 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	2.42 W/kg

Head TSL parameters at 4100 MHz

The following parameters and calculations were applied Temperature Permittivity

Nominal Head TSL parameters	22.0 °C	37.2	3.53 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.6 ± 6 %	3.44 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 4100 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.85 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	68.8 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	2.38 W/kg

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Conductivity



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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 3900 MHz

Impedance, transformed to feed point	47.4 Ω - 6.3 jΩ
Return Loss	- 23.1 dB

Antenna Parameters with Head TSL at 4100 MHz

pedance, transformed to feed point	59.6 Ω - 1.5 jΩ	
eturn Loss	- 21.0 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.106 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 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

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Manufactured by	SPEAG



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DASY5 Validation Report for Head TSL

Date: 22.11.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3900 MHz; Type: D3900V2; Serial: D3900V2 - SN:1032

 $\begin{array}{l} \mbox{Communication System: UID 0 - CW; Frequency: 3900 MHz, Frequency: 4100 MHz} \\ \mbox{Medium parameters used: } f = 3900 MHz; \mbox{σ} = 3.25 \mbox{S/m; ϵ_r} = 37.9; \mbox{ρ} = 1000 \mbox{kg/m^3}, \\ \mbox{Medium parameters used: } f = 4100 \mbox{ MHz}; \mbox{σ} = 3.44 \mbox{ S/m}; \mbox{ϵ_r} = 37.6; \mbox{ρ} = 1000 \mbox{kg/m^3}, \\ \mbox{Phantom section: Flat Section} \\ \mbox{Measurement Standard: DASY5 (IEEE/IEC/ANS1 C63.19-2011)} \end{array}$

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.39, 7.39, 7.39) @ 3900 MHz, ConvF(7.26, 7.26, 7.26) @ 4100 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=3900MHz/Zoom Scan, dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 67.71 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 19.0 W/kg SAR(1 g) = 6.91 W/kg; SAR(10 g) = 2.42 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 74.9% Maximum value of SAR (measured) = 13.5 W/kg

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=4100MHz/Zoom Scan, dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 65.91 V/m; Power Drift = -0.09 dB Peak SAR (extrapolated) = 18.9 W/kg SAR(1 g) = 6.85 W/kg; SAR(10 g) = 2.38 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 74.9% Maximum value of SAR (measured) = 13.4 W/kg



Certificate No: D3900V2-1032 Nov22

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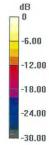
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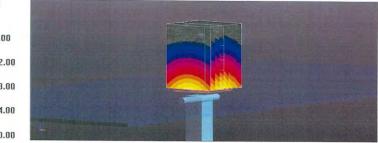
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0 dB = 13.5 W/kg = 11.30 dBW/kg





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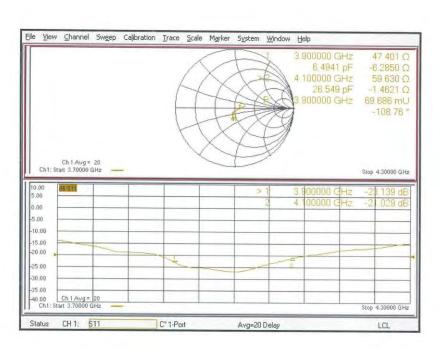
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Impedance Measurement Plot for Head TSL









- End of report -

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