

Report No. : TESA2305000259ES Page: 1 of 84

Appendix C

Phantom Description

Schmid & Partner Engineering AG	S	p	e	a	g	_
Zeughausstrasse 43, 8004 Zunch, Switzelland Ptone +41 1 245 9700; Fax +41 1 245 9779 mto©spass.com, http://www.apeeg.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 Switzerland	

Tests

The series production process used allows line limitation 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 (dalled samples) or are tested at each item

Test	Requirement	Details	Units tested
Dimensions	Compliant with the geometry according to the CAD model.	(T'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.
Material thickness at ERP	Compliant with the requirements according to the standards	6mm +/- 0.2mm at ERP	First article, All items
Material parameters	Dielectric parameters for required frequencies	300 MHz - 0 GHz: Relative parmittivity < 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 tissue simulating liquid	< 1% typical < 0.8% if tilled with 155mm of HSL900 and without DUT below	Prototypes, Sample testing

Standards

- CENELEC EN 50361 IEEE Std 1528-2003
- (3)村(7)
- IEC 62209 Part 1 FCC OET Sulletin 65, Supplement C, Edition 01-01 The ITIS 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 uncertainty requirements of SAR measurements apacified in standards [1] to [4]

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	Salgetor & Pagenin Englished and Toroghousgetown 43, 8004 Zonich, Amitowhand Phone you for Unsoftware Mar 75 a 9770 Intel Pageng, com, http://www.stanag.com
	07.07.2005

Doc No. 581 - 00 000 P40 C - =

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System Validation from Original Equipment Supplier

E-mail: emf@caict.ac.cn	http://www.caic		
Client SGS	k	Certificate No: Z2	2-60431
CALIBRATION C	ERTIFICAT	E	
Object	D750V	3 - SN: 1015	
Calibration Procedure(s)		-003-01	
	Calibra	tion Procedures for dipole validation kits	
Calibration date:	Octobe	r 9, 2022	
pages and are part of the c	ertificate.		
numidity<70%.		he closed laboratory facility: environment t	temperature (22±3)°C and
numidity<70%. Calibration Equipment used	d (M&TE critical fo	or calibration)	
numidity<70%.		or calibration) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
numidity<70%. Calibration Equipment used Primary Standards	d (M&TE critical fo	or calibration)	
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	ID# 106276 101369	or calibration) Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103)	Scheduled Calibration May-23
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A	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
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4	ID # 106276 101369 5N 7464	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)	Scheduled Calibration May-23 May-23 Jan-23
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numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 106276 101369 4 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
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numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E50710	d (M&TE critical fo ID # 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	
neral 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

SPEAG

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DASY5 Validation Report for Head TSL

Date: 2022-10-09

Test Laboratory: CTL, 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; σ = 0.899 S/m; ϵ_r = 41.5; ρ = 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) .

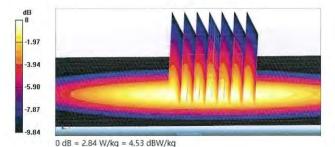
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 54.40 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 3.15 W/kg

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



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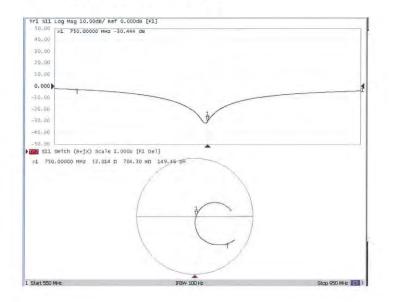






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Impedance Measurement Plot for Head TSL



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Client SGS			22-60428
CALIBRATION CI	ERTIFICAT	E	
Object	D835V	2 - SN: 4d063	
Calibration Procedure(s)	EE 744	-003-01	
		tion Procedures for dipole validation kits	
Calibration date:	Septem	iber 26, 2022	
All calibrations have been	1		
numidity<70%.		he closed laboratory facility: environment	temperature (22±3)°C and
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umidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fo 106276 101369 SN 3846 SN 1556 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 20-May-22 (CTTL, No.J22X03103) 20-May-22 (SPEAG,No.EX3-3846_May22 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) May-23 Jan-23 Scheduled Calibration Jan-23
umidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	(M&TE critical fo ID # 106276 101369 SN 3846 SN 1556 ID # MY49071430 MY46110673	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 20-May-22 (SPEAG,No.EX3-3846_May22 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) May-23 Jan-23 Scheduled Calibration Jan-23 Jan-23
umidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	(M&TE critical fo ID # 106276 101369 SN 3846 SN 1556 ID # MY49071430 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 20-May-22(SPEAG,No.EX3-3846_May22 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) May-23 Jan-23 Scheduled Calibration Jan-23 Jan-23
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C Calibrated by: Reviewed by:	(M&TE critical fo 10 # 106276 101369 SN 3846 SN 1556 ID # MY49071430 MY46110673 Name Zhao Jing	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 20-May-22 (STEAG,No.EX3-3846_May22 12-Jan-22(CTTL-SPEAG,No.EX3-3846_May22 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 SAR Test Engineer	Scheduled Calibration May-23 May-23) May-23 Jan-23 Scheduled Calibration Jan-23 Jan-23
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fo ID # 106276 101369 SN 3846 SN 1556 ID # MY49071430 MY46110673 Name Zhao Jing Lin Hao	Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103) 20-May-22 (STTL, No.J22X03103) 20-May-22 (STTL, No.J22X03103) 20-May-22 (STTL, No.J22X00407) Cal Date (Calibrated by, Certificate No.) 13-Jan-22 (CTTL, No.J22X00409) 14-Jan-22 (CTTL, No.J22X00406) Function SAR Test Engineer SAR Test Engineer SAR Project Leader	Scheduled Calibration May-23 May-23) May-23 Jan-23 Scheduled Calibration Jan-23 Jan-23

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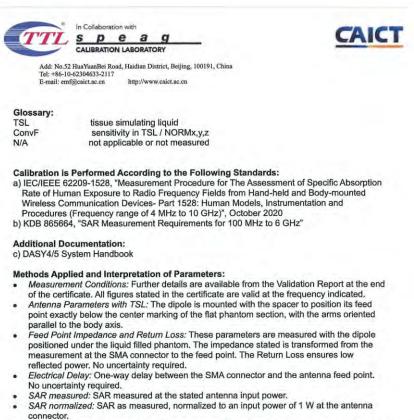
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SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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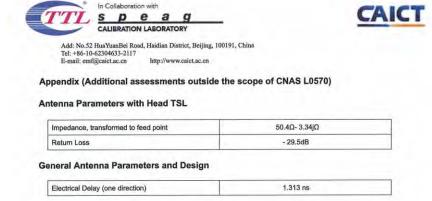
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After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly The dipole is made of standard semingic coaxia cable. The center conductor of the feeding time 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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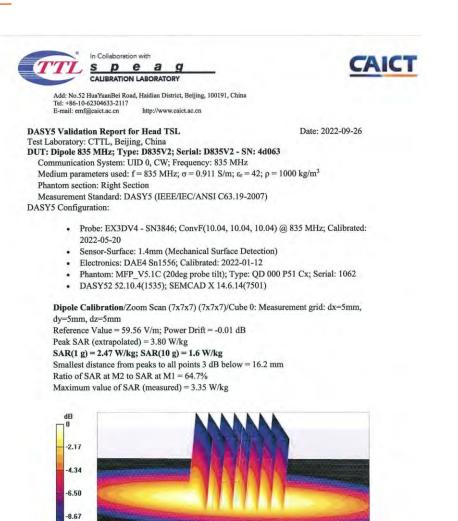
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0 dB = 3.35 W/kg = 5.25 dBW/kg

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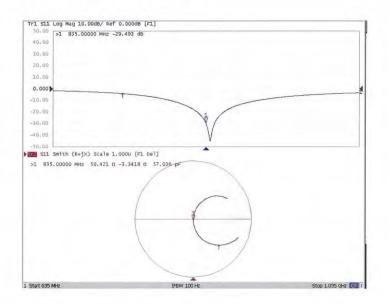






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Impedance Measurement Plot for Head TSL



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Client SGS			2-60432
CALIBRATION CI	ERTIFICAT	E	
Dbject	D1750\	/2 - SN: 1008	
Calibration Procedure(s)			
	FF-Z11	-003-01 tion Procedures for dipole validation kits	
	Calibra	tion Procedures for dipole validation kits	
Calibration date:	Septem	ber 27, 2022	
All calibrations have been numidity<70%. Calibration Equipment used		he closed laboratory facility: environment t	emperature (22±3)°C and
Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	10-May-22 (CTTL, No.J22X03103)	May-23
Power sensor NRP6A	101369	10-May-22 (CTTL, No.J22X03103)	May-23
Reference Probe EX3DV4	1 APR 2 2 2 2 2 2 2	20-May-22(SPEAG,No.EX3-3846_May22)	May-23
DAE4	SN 1556	12-Jan-22(CTTL-SPEAG,No.Z22-60007)	Jan-23
Secondary Standards	ID#	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CTTL, No.J22X00409)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL, No.J22X00406)	Jan-23
		Function	Signature
	Name		13
Calibrated by:	Name Zhao Jing	SAR Test Engineer	教堂
Calibrated by: Reviewed by:		SAR Test Engineer	家儿
	Zhao Jing		教告
		Function	Signature

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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

General Antenna Parameters and Design

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

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)

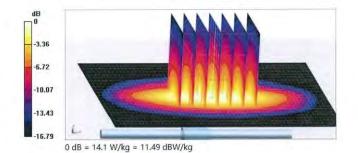
DASY5 Configuration:

- 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



Certificate No: Z22-60432

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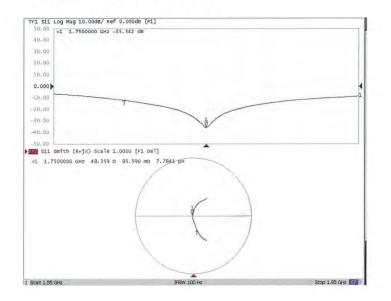






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Impedance Measurement Plot for Head TSL



Certificate No: Z22-60432

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Engineering AG eughausstrasse 43, 8004 Zurich,	Of Switzerland		Service suisse d'étalonnage Servizio svizzero di taratura
ccredited by the Swiss Accreditation he Swiss Accreditation Service i lultilateral Agreement for the rec	s one of the signatorie		Accreditation No.: SCS 0108
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	s between 0.7-3 GHz
Calibration date:	April 26, 2023		
All calibrations have been conducte	ed 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)°0 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 Date (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 ^o rimary Standards ^P ower meter NRP2 ^o ower sensor NRP-291 ^o ower sensor NRP-291 Reference 20 dB Attenuator	critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k)	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)	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 Peference 20 dB 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 Vower sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EXSDV4	critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k)	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)	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 B Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4.	critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: 103245 SN: 219324 (20k) SN: 31992 / 06327 SN: 7349	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-Jar-23 (No. 217-03810)	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Mar-24 Jar-24 Jar-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 Jar-24 Jar-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 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. 217-03810) 10-Jar-23 (No. 217-03810) 10-Jar-23 (No. 21X-03810) 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 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: 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. 217-038010) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-038010) 10-Jan-23 (No. 217-03805) 10-Jan-23 (No. 217-03800) 10-Jan-23 (N	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 In house check: Oct-24
Calibration Equipment used (M&TE Primary Standards Power meter NRP-2 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Heference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A Power Sensor HP 8481A	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)	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Jar-24 Jar-24 Jar-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 Reference 20 dB Attenuator Type-N mismatch combination Heference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A Power sensor HP 8481A Power Sensor HP 8481A	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. 217-038010) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-038010) 10-Jan-23 (No. 217-03805) 10-Jan-23 (No. 217-03800) 10-Jan-23 (N	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 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 Fype-N mismatch combination Reference 20 dB Attenuator Power Srosor NE 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: 303245 SN: 3H9394 (20k) SN: 310982 (06327 SN: 310982 (06327 SN: 561 ID # SN: GB39512475 SN: US37292783 SN: W14303315 SN: US41080477 Name	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. 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) 10-Jan-23 (No. 217-0380) 10-Jan-23 (No. 217-0380) 10-Jan-23 (No. 217-0380) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 31-Mar-14 (in house check Oct-22) Function	Scheduled Calibration Mar-24 Mar-24 Mar-24 Mar-24 Jar-24 Jar-24 Jar-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 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: 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. 217-03810) 10-Jan-23 (No. 217-038010) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-038010) 10-Jan-23 (No. 217-03810) 10-Jan-23 (No. 217-03800) 10-Jan-23 (N	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 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	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. 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) 10-Jan-23 (No. 217-0380) 10-Jan-23 (No. 217-0380) 10-Jan-23 (No. 217-0380) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 31-Mar-14 (in house check Oct-22) Function	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
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP2 Power sensor NRP-291 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 Aglient E8358A Calibrated by: Approved by:	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	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-Jar-23 (No. 217-03810) 10-Jar-23 (No. 217-03810) 10-Jar-23 (No. 217-03810) 10-Jar-23 (No. 217-03810) 10-Jar-23 (No. 217-03810) 10-Jar-23 (No. 217-03805) 30-Oct-14 (In house check Oct-22) 07-Oct-15 (In house check Oct-22) 15-Jun-15 (In house check Oct-22) 15-Jun-15 (In house check Oct-22) 31-Mar-14 (In house check Oct-22) Sunction Laboratory Technician	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

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

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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

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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Certificate No: D1900V2-5d173_Apr23

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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

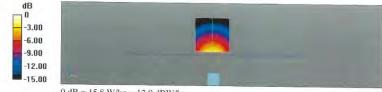
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; σ = 1.39 S/m; ϵ_r = 38.9; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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

Certificate No: D1900V2-5d173_Apr23

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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

Certificate No: D1900V2-5d173_Apr23

Page 6 of 6

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Client SGS		Certificate No: Z2	2-60430
CALIBRATION CI	ERTIFICAT	E	
Object	D2300\	/2 - SN: 1023	
Calibration Procedure(s)	FF-Z11	-003-01	
	Calibra	tion Procedures for dipole validation kits	
Calibration date:	Octobe	r 9, 2022	
	conducted in the	he closed laboratory facility: environment	temperature (22±3)°C and
All calibrations have been humidity<70%. Calibration Equipment used			temperature (22±3)°C and
numidity<70%. Calibration Equipment used			temperature (22±3)°C and Scheduled Calibration
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umidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	(M&TE critical fo	or calibration) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration May-23 May-23
umidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4	(M&TE critical fo ID # 106276 101369 SN 7464	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)	Scheduled Calibration May-23 May-23 Jan-23
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numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards	(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(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration May-23 May-23 Jan-23 Jan-23 Scheduled Calibration
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fo ID # 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 Jan-23
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	(M&TE critical fo 105276 101369 SN 7464 SN 1556 ID # MY49071430 MY46110673	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
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fo 10 # 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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Report No.: TESA2305000259ES Page: 27 of 84





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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, 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

pedance, transformed to feed point	47.8Ω- 1.25jΩ
eturn Loss	- 31.7dB

Electrical Delay (one direction)	1.077 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 control of the dipole dipole dipole dipole arms, because they might bend or the soldered control of the dipole di connections near the feed-point may be damaged.

Additional EUT Data

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; $\varepsilon_r = 40.21$; $\rho = 1000$ kg/m³ Phantom section: Right Section

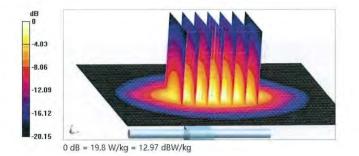
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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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Page 5 of 6

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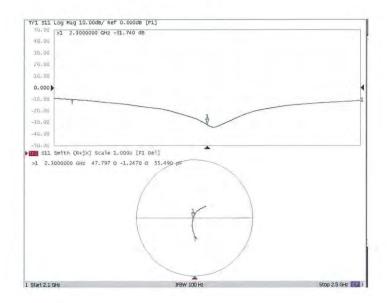






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Impedance Measurement Plot for Head TSL



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ccredited by the Swiss Accreditation he Swiss Accreditation Service in Iultilateral Agreement for the rec	is one of the signatories	s to the EA	creditation No.: SCS 0108
lient SGS (Auden)		Certificate No	: D2600V2-1005_Jan23
CALIBRATION C	ERTIFICATE		
Object	D2600V2 - SN:10	005	1.
Calibration procedure(s)	QA CAL-05.v12 Calibration Proce	dure for SAR Validation Sources	between 0.7-3 GHz
Calibration date:	January 11, 2023	3	
The measurements and the uncertain		robability are given on the following pages an y facility: environment temperature $(22 \pm 3)^{\circ}$ C	
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Certificate No: D2600V2-1005_Jan23

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Calibration Laboratory of Schmid & Partner Engineering AG uphausstrasse 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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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%.

Certificate No: D2600V2-1005 Jan23

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Measurement Conditions

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	2600 MHz ± 1 MHz	

Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.2 ± 6 %	2.03 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	14.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	55.4 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	condition 250 mW input power	6.26 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	48.5 Ω - 4.2 jΩ	
Return Loss	- 26.9 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.156 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: 11.01.2023

Test Laboratory: SPEAG, Zurich, Switzerland

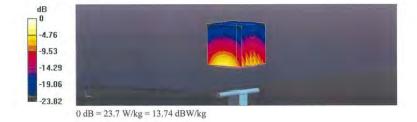
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1005

Communication System: UID 0 - CW; Frequency: 2600 MHz Medium parameters used: f = 2600 MHz; σ = 2.03 S/m; ϵ_r = 38.2; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.84, 7.84, 7.84) @ 2600 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 = 116.7 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 28.1 W/kgSAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.26 W/kgSmallest distance from peaks to all points 3 dB below = 8.9 mm Ratio of SAR at M2 to SAR at M1 = 50.1% Maximum value of SAR (measured) = 23.7 W/kg



Certificate No: D2600V2-1005_Jan23

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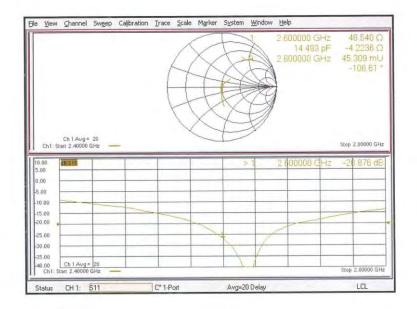
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Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1005_Jan23

Page 6 of 6

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CALIBRATION CE	ERTIFICAT	E	
Object	D3500\	/2 - SN: 1009	
Calibration Procedure(s)	FF 744	000.01	
C. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.		-003-01 tion Procedures for dipole validation kits	
	Galibra		
Calibration date:	Octobe	r 9, 2022	
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	ertificate.	he closed laboratory facility: environment	
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All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A	conducted in the conduc	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 10-May-22 (CTTL, No.J22X03103) 10-May-22 (CTTL, No.J22X03103)	temperature (22±3)°C and Scheduled Calibration May-23 May-23
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All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP6A Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	rtificate. conducted in th (M&TE critical for 106276 101369 SN 7464 SN 1556 ID # MY49071430 MY46110673 Name	he closed laboratory facility: environment 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) Cal Date (Calibrated by, Certificate No.) 13-Jan-22 (CTTL, No.J22X00409) 14-Jan-22 (CTTL, No.J22X00406) Function	temperature (22±3)°C and Scheduled Calibration May-23 May-23 Jan-23 Jan-23 Scheduled Calibration Jan-23 Jan-23
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Page 1 of 6

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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

DASY52	52.10.4
Advanced Extrapolation	
Triple Flat Phantom 5.1C	
10 mm	with Spacer
dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
3500 MHz ±1 MHz	
	Triple Flat Phantom 5.1C 10 mm dx, dy = 4 mm, dz = 1.4 mm

Head TSL parameters

	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
----------------------------------	----------

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

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

Additional EUT Data

Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL

Date: 2022-10-09

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

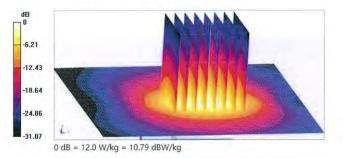
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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



Certificate No: 722-60433

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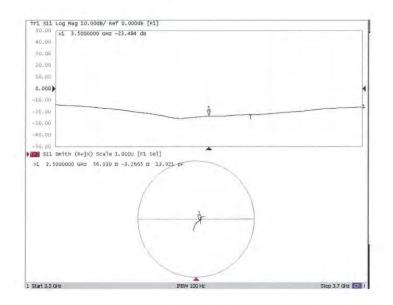






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Impedance Measurement Plot for Head TSL



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AL	IBRATION CI	ERTIFICATE		
bject		D3700V2 - SN:10	57	
alibratio	on procedure(s)	QA CAL-22.v6 Calibration Proce	dure for SAR Validation Sour	rces between 3-10 GHz
alibratio	on date:	November 22, 2022		
			onal standards, which realize the physics obability are given on the following page	
Il calibr	ations have been conducte	d in the closed laborator	y facility: environment temperature (22 :	£ 3)°C and humidity < 70%.
alibrati	on Equipment used (M&TE	critical for calibration)		
rimary	Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
	neter NRP	SN: 104778	04-Apr-22 (No. 217-03525/03524)	Apr-23
	ensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
	ensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)	Apr-23
eferen	ce 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
	mismatch combination	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)	Apr-23
	ce Probe EX3DV4	SN: 3503	08-Mar-22 (No. EX3-3503_Mar22)	Mar-23
AE4		SN: 601	31-Aug-22 (No. DAE4-601_Aug22)	Aug-23
econda	ary Standards	ID #	Check Date (in house)	Scheduled Check
	neter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
ower s	ensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
ower s	ensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
F gene	erator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
letwork	Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24
		Name	Function	Signature
Calibrati	ed by:	Jeton Kastrati	Laboratory Technician	q-le
Approve	ed by:	Sven Kühn	Technical Manager	56
This cal	ibration certificate shall not	be reproduced except ir	full without written approval of the labor	Issued: November 25, 2022

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Certificate No: D3700V2-1057_Nov22

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Engineering AG eughausstrasse 43, 8004 Zurich, Switzerland

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Page 1 of 6

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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:

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

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: D3700V2-1057 Nov22

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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 = 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 by	1
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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



Certificate No: D3700V2-1057 Nov22

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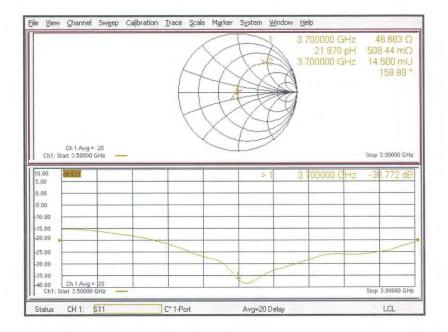
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Impedance Measurement Plot for Head TSL



Certificate No: D3700V2-1057_Nov22

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Accreditation No.: SCS 0108

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Dbject	D3900V2 - SN:10	032	
Calibration procedure(s)	QA CAL-22.v6		
	Calibration Proce	edure for SAR Validation Sources	s between 3-10 GHz
Calibration date:	November 22, 20	022	
This calibration certificate document	te the traceability to nati	onal standards, which realize the physical un	its of measurements (CI)
		robability are given on the following pages an	
All calibrations have been and inte	nd in the classed laboration	a de alle construction de la constru	
All calibrations have been conducte	ed in the closed laborator	y facility: environment temperature (22 \pm 3) $^{\circ}$	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
ower sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
The second second second second	SN: 103244 SN: 103245	04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525)	Apr-23 Apr-23
Power sensor NRP-Z91	0.0000000000000000000000000000000000000		
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination	SN: 103245	04-Apr-22 (No. 217-03525)	Apr-23
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	SN: 103245 SN: BH9394 (20k)	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527)	Apr-23 Apr-23
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528)	Apr-23 Apr-23 Apr-23
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503_Mar22)	Apr-23 Apr-23 Apr-23 Mar-23
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B	SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503_Mar22) 31-Aug-22 (No. DAE4-601_Aug22)	Apr-23 Apr-23 Apr-23 Mar-23 Aug-23
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A	SN: 103245 SN: BH9394 (20k) SN: 310982 / 06827 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503_Mar22) 31-Aug-22 (No. DAE4-601_Aug22) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22)	Apr-23 Apr-23 Apr-23 Mar-23 Aug-23 Scheduled Check
Power sensor NRP-Z91 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	SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37282783 SN: US37282783	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. 2X3-3503_Mar22) 31-Aug-22 (No. DAE4-601_Aug22) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22)	Apr-23 Apr-23 Mar-23 Mar-23 Aug-23 Scheduled Check In house check: Oct-24
Power sensor NRP-Z91 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	SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 310982 / 06327 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503_Mar22) 31-Aug-22 (No. DAE4-601_Aug22) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 15-Jun-15 (in house check Oct-22)	Apr-23 Apr-23 Apr-23 Mar-23 Aug-23 Scheduled Check In house check: Oct-24 In house check: Oct-24
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Power sensor NRP-Z91 Power sensor NRP-Z91 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 Network Analyzer Agilent E8358A	SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 310982 / 06327 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503_Mar22) 31-Aug-22 (No. DAE4-601_Aug22) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 15-Jun-15 (in house check Oct-22)	Apr-23 Apr-23 Apr-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
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Accreditation No.: SCS 0108

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Glossary.	
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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 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 w	ere applied.	
	Temperature	Permittivity
Nominal Head TSL parameters	22.0 °C	37.2

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

Certificate No: D3900V2-1032 Nov22

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Conductivity



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

Impedance, transformed to feed point	59.6 Ω - 1.5 jΩ	
Return Loss	- 21.0 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.106 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

Certificate No: D3900V2-1032 Nov22

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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

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

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.39, 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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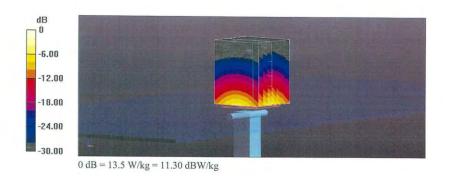
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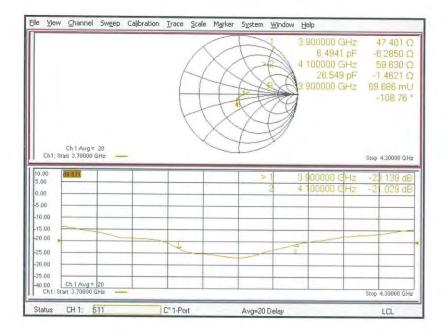
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Impedance Measurement Plot for Head TSL



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Report No. : TESA2305000259ES Page: 57 of 84

Calibration procedure(s) QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz Calibration date: April 25, 2023 This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with contidence probability are given on the following pages and are part of the certificate. All calibration Equipment used (M&TE critical tor calibration) Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration Power meter NRP2 SN: 104778 30-Mar-23 (No. 217-03804) Mar-24 Power sensor NRP-Z91 SN: 103245 30-Mar-23 (No. 217-03805) Mar-24 Power sensor NRP-Z91 SN: 103245 30-Mar-23 (No. 217-03805) Mar-24 Power sensor NRP-Z91 SN: 103245 30-Mar-23 (No. 217-03805) Mar-24 Power sensor NRP-Z91 SN: 103245 30-Mar-23 (No. 217-03805) Mar-24 Power sensor NRP-Z91 SN: 103245 30-Mar-23 (No. 217-03805) Mar-24 Power sensor NRP-Z91 SN: 103245 30-Mar-23 (No. 217-03805) Mar-24 Power sensor NRP-Z91 SN: 103245 30-Mar-23 (No. 217-03805) Mar-24 Power sensor NRP-Z91 SN: 103245 30-Mar-24 (No. 217-	Calibration Procedure for SAR Validation Sources between 0.7-3 GHz Calibration date: April 25, 2023 This calibration conflicate 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 calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration Power sensor NRP-291 SN: 104778 30-Mar-23 (No. 217-03804) Power sensor NRP-291 SN: 103245 30-Mar-23 (No. 217-03805) <th>Calibration Equipment used (M&TE of Primary Standards Power meter NRP2 Power sensor NRP-291 Power sensor NRP-291</th> <th>critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245</th> <th>Cal Date (Certificate No.) 30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805)</th> <th>Scheduled Calibration Mar-24 Mar-24</th>	Calibration Equipment used (M&TE of Primary Standards Power meter NRP2 Power sensor NRP-291 Power sensor NRP-291	critical for calibration) ID # SN: 104778 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)	Scheduled Calibration Mar-24 Mar-24
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz Calibration date: April 25, 2023 This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with contidence probability are given on the following pages and are part of the certificate. All calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration	Calibration procedure(s) QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz Calibration date: April 25, 2023 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 o	critical for calibration)		
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz Calibration Calibration Sources between 0.7-3 GHz Calibration date: April 25, 2023 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.	Calibration procedure(s) QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz Calibration date: April 25, 2023 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.	AU			
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz	Calibration procedure(s) QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz	his calibration certificate documents	s the traceability to nati intles with confidence p	onal standards, which realize the physical u robability are given on the following pages a	inits of measurements (SI). and are part of the certificate.
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



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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%.

Certificate No: D2450V2-727 Apr23

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Measurement Conditions

DASY system configuration, as far as not given on pa	age	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

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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

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 ocaxial 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 recentline the Stendard. 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

Page 4 of 6

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DASY5 Validation Report for Head TSL

Test Laboratory: SPEAG, Zurich, Switzerland

Date: 25.04.2023

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

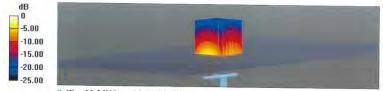
Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz; $\sigma = 1.86 \text{ S/m}$; $\epsilon_r = 37.7$; $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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

Page 5 of 6

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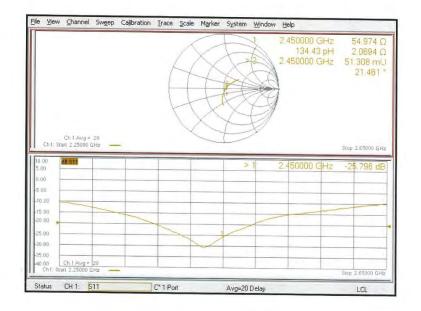
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Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-727_Apr23

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Report No. : TESA2305000259ES Page: 63 of 84

	n, Switzerland	The and the state S	Swiss Calibration Service
accredited by the Swiss Accredita the Swiss Accreditation Service Multilateral Agreement for the re	e is one of the signatori		Accreditation No.: SCS 0108
Client SGS Taoyuan City, Ta	iwan	Certificate No.	D5GHzV2-1349_Mar2
CALIBRATION C	ERTIFICAT	E	
Dbject	D5GHzV2 - SN:	1349	
Calibration procedure(s)	QA CAL-22.v7 Calibration Proce	edure for SAR Validation Sources	between 3-10 GHz
Calibration date:	March 20, 2023		
All calibrations have been conduct	tainties with confidence p	onal standards, which realize the physical unit robability are given on the following pages and ry facility: environment temperature (22 ± 3)°C	are part of the certificate.
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Report No. : TESA2305000259ES Page: 64 of 84

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



Schweizerischer Kalibrierdienst S Service suisse d'étalonnag C 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%.

Certificate No: D5GHzV2-1349 Mar23

Page 2 of 8

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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 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	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.8 ± 6 %	4.71 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.4 W/kg ± 19.9 % (k=2)
	1	
	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 100 mW input power	2.30 W/kg

Head TSL parameters at 5600 MHz

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22,0 ± 0.2) °C	35.6 ± 6 %	5.09 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		تبيد

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	83.1 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	2.36 W/kg

Certificate No: D5GHzV2-1349_Mar23

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Head TSL parameters at 5750 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	5.21 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		1.000

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.4 W/kg ± 19.9 % (k=2)
SAP momenta and the state of the state		
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	2.32 W/kg

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	48.4 Ω - 1.8 jΩ
Return Loss	- 32.1 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	51.2 Ω + 2.5 jΩ	
Return Loss	- 31.3 dB	

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	53.3 Ω + 4.6 jΩ	
Return Loss	- 25.1 dB	

General Antenna Parameters and Design

Electrical 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 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 recording 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
	SI LAG

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Date: 20.03.2023

DASY5 Validation Report for Head TSL

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1349

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.5, 5.5, 5.5) @ 5250 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, . ConvF(5.08, 5.08, 5.08) @ 5750 MHz; Calibrated: 07.03.2023
- 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=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 74.15 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 27.5 W/kg SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.3 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mmRatio of SAR at M2 to SAR at M1 = 70.7%Maximum value of SAR (measured) = 18.3 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 73.50 V/m; Power Drift = -0.02 dBPeak SAR (extrapolated) = 30.7 W/kgSAR(1 g) = 8.3 W/kg; SAR(10 g) = 2.36 W/kgSmallest distance from peaks to all points 3 dB below = 7.4 mm Ratio of SAR at M2 to SAR at M1 = 68.1% Maximum value of SAR (measured) = 19.6 W/kg

Certificate No: D5GHzV2-1349_Mar23

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

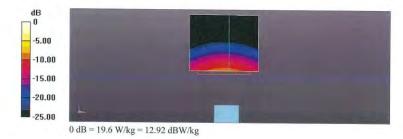
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Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 70.65 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 31.7 W/kg SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.32 W/kg Smallest distance from peaks to all points 3 dB below = 7.4 mm Ratio of SAR at M2 to SAR at M1 = 66.4%Maximum value of SAR (measured) = 19.6 W/kg



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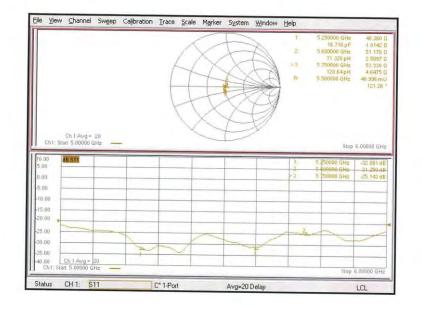
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Impedance Measurement Plot for Head TSL



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Accredited by the Swiss Accreditatio The Swiss Accreditation Service is Multilateral Agreement for the reco	one of the signatorie		Accreditation No.: SCS 0108
client SGS (Auden)	DTIEICAT		cate No: D6.5GHzV2-1006_Aug22
	D6.5GHzV2 - SN		
	QA CAL-22.v6 Calibration Proce	edure for SAR Validation So	urces between 3-10 GHz
Calibration date:	August 23, 2022		
All calibrations have been conducter Calibration Equipment used (M&TE	d in the closed laborato	robability are given on the following party facility: environment temperature (2)	$2\pm 3)^{\rm o} G$ and humidity < 70%.
Primary Standards Power sensor R&S NRP33T	SN: 100967	Cal Date (Certificate No.) 01-Apr-22 (No. 217-03526)	Scheduled Calibration Apr-23
Reference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
Mismatch combination	SN: 84224 / 360D	26-Apr-21 (No. 217-03353)	Apr-24
Reference Probe EX3DV4	SN: 7405	02-Jun-22 (No. EX3-7405_Jun22)	Jun-23
DAE4	SN: 908	27-Jun-22 (No. DAE4-908_Jun22)	Jun-23
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator Anapico APSIN20G Network Analyzer Keysight E5063A	SN: 827 SN:MY54504221	18-Dec-18 (in house check Dec-21 31-Oct-19 (in house check Oct-19)	
	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	Seef The
Approved by:	Sven Kühn	Technical Manager	5.0
This calibration contificate shall not h	e reproduced except in	full without written approval of the lab	Issued: August 28, 2022

Certificate No: D6.5GHzV2-1006_Aug22 Page 1 of 6

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lient SGS (Auden)	gintion of campration		e No: D7GHzV2-1007_Aug2
CALIBRATION CE	RTIFICAT	E	
Dbject	D7GHzV2 - SN:	1007	
	QA CAL-22.v6 Calibration Proce	edure for SAR Validation Sour	ces between 3-10 GHz
Calibration date:	August 24, 2022		
		ional standards, which realize the physica robability are given on the following page	
All calibrations have been conducted	i in the closed laborato	ry facility: environment temperature (22 \pm	3)°C and humidity < 70%.
Calibration Equipment used (M&TE	critical for calibration)		
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power sensor R&S NRP33T	SN: 100967	01-Apr-22 (No. 217-03526)	Apr-23
Reference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
Mismatch combination	SN: 84224 / 360D	26-Apr-21 (No. 217-03353)	Apr-24
Reference Probe EX3DV4	SN: 7405	02-Jun-22 (No. EX3-7405_Jun22)	Jun-23
DAE4	SN: 908	27-Jun-22 (No. DAE4-908_Jun22)	Jun-23
Secondary Standards	D #	Check Date (in house)	Scheduled Check
RF generator Anapico APSIN20G	SN: 827	18-Dec-18 (in house check Dec-21)	In house check: Dec-23
Network Analyzer Keysight E5063A	SN:MY54504221	31-Oct-19 (in house check Oct-19)	In house check: Oct-22
	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	P refer
			2 of light
Approved by:	Sven Kühn	Technical Manager	S.L
			Issued: August 28, 2022
			Issueu, Muyusi 20, 2022

Certificate No: D7GHzV2-1007_Aug22

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Engineering AG eughausstrasse 43, 8004 Zurich, Switzerland

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Report No. : TESA2305000259ES Page: 73 of 84

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



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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

Glossary

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

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

Additional Documentation:

b) 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 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.
- 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 absorbed power density (APD): The absorbed power density is evaluated according to Samaras T, Christ A, Kuster N, "Compliance assessment of the epithelial or absorbed power density above 6 GHz using SAR measurement systems", Bioelectromagnetics, 2021 (submitted). The additional evaluation uncertainty of 0.55 dB (rectangular distribution) is considered.

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: D7GHzV2-1007 Aug22

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Measurement Conditions

DASY Version	DASY6	V16.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	5 mm	with Spacer
Zoom Scan Resolution	dx, dy = 3.0 mm, dz = 1.2 mm	Graded Ratio = 1.2 (Z direction)
Frequency	7000 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	33.9	6.65 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.6 ± 6 %	6.81 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	27.8 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	278 W/kg ± 24.7 % (k=2)	
SAR averaged over 8 cm ³ (8 g) of Head TSL	condition		
SAR measured	100 mW input power	6.03 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	60.2 W/kg ± 24.4 % (k=2)	
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition		
SAR measured	100 mW input power	4.94 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	49.3 W/kg ± 24.4 % (k=2)	

Certificate No: D7GHzV2-1007_Aug22

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Appendix

Antenna Parameters with Head TSL

52.1 Ω - 6.1 jΩ	
- 24.0 dB	

APD (Absorbed Power Density)

APD averaged over 1 cm ²	Condition		
APD measured	100 mW input power	277 W/m ²	
APD measured	normalized to 1W	2770 W/m2 ± 29.2 % (k=2)	
ADD averaged aver 4 am ²	andition		
APD averaged over 4 cm ²	condition		
APD averaged over 4 cm ² APD measured	condition 100 mW input power	121 W/m ²	

*The reported APD values have been derived using psSAR8g.

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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DASY6 Validation Report for Head TSL

Measurement Report for D7GHz-1007, UID 0 -, Channel 7000 (7000.0MHz)

Device under T	Inder Test Properties							
Name, Manufa	acturer Di	imensions	[mm] If	VIEI	DUT Typ	e		
D7GHz	1	4.0 x 6.0 x	297.0 S	N: 1007	-			
Exposure Cond	litions							
Phantom	Position, Test	Band	Group,	Frequency	Conversion	TSL Cond.	TSL	
Section, TSL	Distance [mm]		UID	[MHz]	Factor	[S/m]	Permittivity	
Flat, HSL	5.00	Band	CW,	7000	5.80	6.81	33.6	
Hardware Setu	qu							
Phantom	TS	L		Probe, Calil	bration Date	DAE, Calib	ration Date	
MFP V8.0 Cent	er - 1182 HB	BL600-100	00V6	EX3DV4 - SI	N7405, 2022-06-02	DAE4 Sn9	08, 2022-06-27	
Scan Setup				Measureme	ent Results			
			Zoom Scar	1			Zoom Scan	
Grid Extents [[mm]		22.0 x 22.0 x 22.0	Date		2	022-08-24, 09:46	
Grid Steps [m	im]		3.0 x 3.0 x 1.2 psSAR1g [W/Kg]		27.8			
Sensor Surfac	ce [mm]		1.4				6.03	
Graded Grid			Ye	s psSAR10g	psSAR10g [W/Kg]		4.94	
Grading Ratio	2		1.2 Power Drift [dB]		0.05			
MAIA			N/4	A Power Sca	ling		Disabled	
Surface Detec	ction		VMS + 6	Scaling Fac	ctor [dB]			
Scan Method			Measured	d TSL Correc	tion		No correction	
				M2/M1 [%	6]		52.1	
				Dist 3dB P			4.2	



Certificate No: D7GHzV2-1007_Aug22

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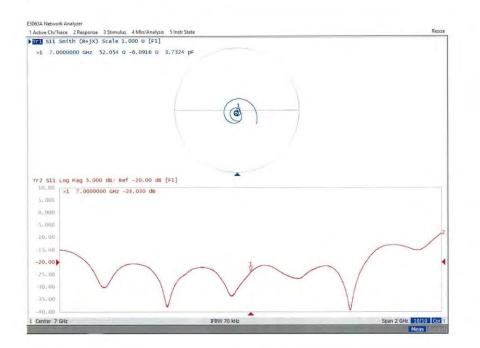
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Impedance Measurement Plot for Head TSL



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ccredited by the Swiss Accredital	h, Switzerland	S Standard S	Servizio svizzero di taratura Swiss Calibration Service
he Swiss Accreditation Service	is one of the signat	ories to the EA	reditation No.: SCS 0108
Aultilateral Agreement for the re	cognition of calibrat	tion certificates	
Client SGS-TW (Aude	n)	Certificate No:	5G-Veri10-1021_Jan23
CALIBRATION (EBTIEICA	TE	
CALIBRATION			
Object	5G Verificatio	n Source 10 GHz - SN: 1021	
Calibration procedure(s)	QA CAL-45.v	4	
and the second second second second		ocedure for sources in air above 6 GH	Iz
Calibration date:	January 19, 2	023	
	, , , , , ,		
This calibration certificate docume	ents the traceability to	national standards, which realize the physical units	of measurements (SI).
	nabilities with confiden	on probability are given on the following process and	are part of the certificate
The measurements and the uncer	namiles with confiden	ce probability are given on the following pages and a	Prest el tria del titlottet.
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All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Reference Probe EUmmWV3	ted in the closed labo	ratory facility: environment temperature (22 ± 3)°C a n) Cal Date (Certificate No.)	und humidity < 70%. Scheduled Calibration
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Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service

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Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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Glossary CW

Continuous wave

Calibration is Performed According to the Following Standards

Internal procedure QA CAL-45, Calibration procedure for sources in air above 6 GHz. IEC/IEEE 63195-1, "Assessment of power density of human exposure to radio frequency fields from wireless devices in close proximity to the head and body (frequency range of 6 GHz to 300 GHz)", May 2022

Methods Applied and Interpretation of Parameters

- Coordinate System: z-axis in the waveguide horn boresight, x-axis is in the direction of the E-field, y-axis normal to the others in the field scanning plane parallel to the horn flare and horn flange.
- Measurement Conditions: (1) 10 GHz: The radiated power is the forward power to the horn antenna minus ohmic and mismatch loss. The forward power is measured prior and after the measurement with a power sensor. During the measurements, the horn is directly connected to the cable and the antenna ohmic and mismatch losses are determined by far-field measurements. (2) 30, 45, 60 and 90 GHz. The verification sources are switched on for at least 30 minutes. Absorbers are used around the probe cub and at the ceiling to minimize reflections
- Hom Positioning: The waveguide horn is mounted vertically on the flange of the waveguide source to allow vertical positioning of the EUmmW probe during the scan. The plane is parallel to the phantom surface. Probe distance is verified using mechanical gauges positioned on the flare of the horn.
- E- field distribution: E field is measured in two x-y-plane (10mm, 10mm + λ /4) with a vectorial E-field probe. The E-field value stated as calibration value represents the E-fieldmaxima and the averaged (1cm² and 4cm²) power density values at 10mm in front of the horn.
- Field polarization: Above the open horn, linear polarization of the field is expected. This is verified graphically in the field representation.

Calibrated Quantity

Local peak E-field (V/m) and average of peak spatial components of the poynting vector (W/m^2) averaged over the surface area of 1 cm² and 4cm² at the nominal operational frequency of the verification source. Both square and circular averaging results are listed.

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	DASY8 Module mmWave	V3.2.2
Phantom	5G Phantom	
Distance Horn Aperture - plane	10 mm	
XY Scan Resolution	dx, dy = 7.5 mm	
Number of measured planes	2 (10mm, 10mm + λ/4)	
Frequency	10 GHz ± 10 MHz	

Calibration Parameters, 10 GHz

Distance Horn Aperture to Measured Plane	Prad ¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density Avg (psPDn+, psPDtol+, psPDmod+) (W/m ²)		Uncertainty (k = 2)
	-			1 cm ²	4 cm ²	
10 mm	86.1	152	1.27 dB	61.5	55.6	1.28 dB
Distance Horn Aperture to Measured Plane	Prad ¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Power Density psPDn+, psPDtot+, psPDmod+ (W/m²)		Uncertainty (k = 2)
				1 cm ²	4 cm ²	
10 mm	86.1	152	1.27 dB	61.4, 61.5, 61.6	55.4, 55.6, 55.9	1.28 dB

Square Averaging

Distance Horn Aperture to Measured Plane	Prad' (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density Avg (psPDn+, psPDtot+, psPDimod+) (W/m ²)		Uncertainty (k = 2)
				1 cm ²	4 cm ²	
10 mm	86.1	152	1.27 dB	61.5	55.5	1.28 dB
Distance Horn Aperture to Measured Plane	Prad ¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Power Density psPDn+, psPDtot+, psPDmod+ (W/m²)		Uncertainty (k = 2)
				1 cm ²	4 cm ²	
10 mm	86.1	152	1.27 dB	61.4, 61.4, 61.6	55.3, 55.4, 55.8	1.28 dB

Max Power Density

Distance Horn Aperture to Measured Plane	Prad ¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Max Power Density Sn, Stot, Stot (W/m ²)	Uncertainty (k = 2)
10 mm	86.1	152	1.27 dB	63.8, 63.9, 63.9	1.28 dB

¹ Assessed ohmic and mismatch loss plus numerical offset: 0.55 dB

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DASY Report

Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

Name, Manufacturer 5G Verification Source 10 G	Dimensions [mn Hz 100.0 x 100.0 x 1	n] 172.0	IMEI SN: 1021	DUT Type	
Exposure Conditions Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	10.0 mm	Validation band	e cw	10000.0, 10000	1.0
Hardware Setup Phantom mmWave Phantom - 1002	Medium Air			bration Date - SN9374_F1-55GHz,	DAE, Calibration Date DAE4ip Sn1602, 2022-06-27
Scan Setup Grid Extents [mm] Grid Steps [lambda] Sensor Surface [mm] MAIA	sPhore (1.0 6.5	120.0 x 1 0.25 x	Scan 120.0 Date 0.25 Avg. Area 10.0 Avg. Type	V/m²] [W/m²] [W/m²] N/m²] [W/m²]]) [W/m²]	56 Scan 2023-01-9, 16-42 1.00 Circular Averaging 61.4 61.5 63.9 63.9 152 0.00

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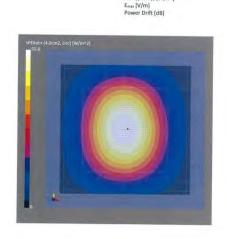


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DASY Report

Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

Device under Test Pr							
Name, Manufacturer	C	Dimensions [mm	1	IMEI		DUT Type	
5G Verification Source 10 (5Hz	100.0 x 100.0 x 1	172.0	SN: 102	21	-	
Exposure Conditions							
Phantom Section	Position, [mm]	Test Distance	Band	Grou	ир,	Frequency [MHz], Channel Number	Conversion Factor
5G -	10.0 mm		Validation band	cw		10000.0, 10000	1.0
Hardware Setup							
Phantom		Medium			Probe, Calibration Da		D.F. 0.11
mmWave Phantom - 1002	A	Nir			EUmmWV3 - SN9374_ 2023-01-03		DAE, Calibration Date DAE4ip Sn1602, 2022-06-27
Scan Setup					Measurement Re	sults	
21/20170000			5G 5				5G Sca
Grid Extents [mm] Grid Steps [lambda]			120.0 x 12		Date		2023-01-19, 16:43
Sensor Surface [mm]			0.25 × 0		Avg. Area [cm ²]		4.00
MAIA				0.0	Avg. Type		Circular Averaging
main			MAIA not us	ed	psPDn+ [W/m ²]		55.4
					psPDtot+ [W/m ²] psPDmod+ [W/m ²]		55.6
					Max(Sn) [W/m ²]		55.9
					Max(Stot) [W/m ²]		63.8
					Max(Stot) [W/m2]		63.9
					Emax [V/m]		63.9
					Power Drift [dB]		0.00



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DASY Report

Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

Device under Test Pro Name, Manufacturer G Verification Source 10 G	Dimensions [mm		IMEI SN: 102	21	DUT Type		
Exposure Conditions Phantom Section	Position, Test Distance [mm]	Band	Grou		Frequency [MHz], Channel Number	Conversion Factor	
-G -	10.0 mm	Validation band	cw		10000.0, 10000	1.0	
lardware Setup							
hantom ImWave Phantom - 1002	Medium Air			Probe, Calibration Date EUmmWV3 - SN9374_F1 2023-01-03	-55GHz,	DAE, Calibration Date DAE4ip Sn1602, 2022-06-27	
can Setup				Measurement Resu	lts		
Grid Extents [mm]		5G S 120.0 x 12		Date			Scan
Grid Steps [lambda]		0.25 x 0		Avg. Area [cm ²]		2023-01-19,	16:42
Sensor Surface [mm]			0.0	Avg. Type		Square Aver	
MAIA		MAIA not u	sed	psPDn+ [W/m ²]			61.4
				psPDtot+ [W/m ²] psPDmod+ [W/m ²]			61.4
				Max(Sn) [W/m ²]			63.8
				Max(Stot) [W/m ²]			63.9
				Max(Stot) [W/m ²] Emax [V/m]			63.9
				Power Drift [dB]			152
	*Potet (1.0	sm2; se) (W/m42]					

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DASY Report

Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

Name, Manufacturer 5G Verification Source 10 G	Dimensions [mr Hz 100.0 x 100.0 x		IMEI 5N: 1021	DUT Type	
Exposure Conditions Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	10.0 mm	Validation band	i cw	10000.0, 10000	1.0
Hardware Setup Phantom mmWave Phantom - 1002	Medium Air		Probe, Calibr EUmmWV3 - 2023-01-03	ation Date SN9374_F1-55GHz,	DAE, Calibration Date DAE4ip Sn1602, 2022-06-27
Scan Setup			Measurem	ent Results	
Grid Extents [mm] Grid Steps [lambda] Sensor Surface [mm] MAIA		120.0 × 1 0.25 ×	0.25 Avg. Area [c 10.0 Avg. Type	m²] //m²] W/m²] V/m²] [W/m²]	56 Sci 2023-01-19, 16:- 4() Square Averagis 55 55 63 63 63 11 11 0.0
	*80ne+ 46.	em2.sd)[10/m2]			

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- End of report -

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