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**DASY5** Validation Report for Body TSL

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: cttl@chinattl.com http://www.chinattl.cn

Date: 08.30.2019

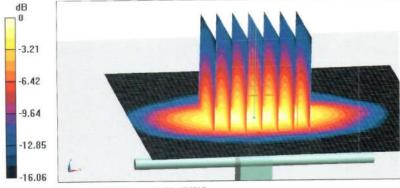
Test Laboratory: CTTL, Beijing, China DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1152 Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz;  $\sigma$  = 1.516 S/m;  $\epsilon_r$  = 53.05;  $\rho$  = 1000 kg/m3 Phantom section: Center Section DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(8.03, 8.03, 8.03) @ 1750 MHz; Calibrated: . 1/31/2019
- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 . (7470)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 87.16 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 17.0 W/kg SAR(1 g) = 9.45 W/kg; SAR(10 g) = 5.05 W/kg

Maximum value of SAR (measured) = 14.4 W/kg



0 dB = 14.4 W/kg = 11.58 dBW/kg

Certificate No: Z19-60292

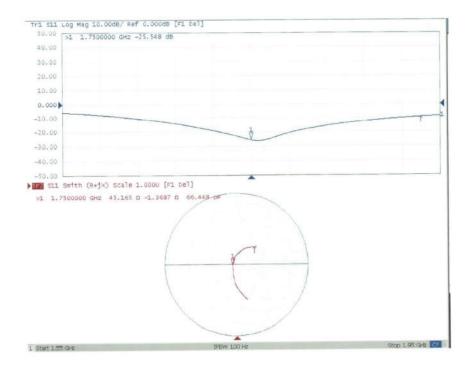
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Impedance Measurement Plot for Body TSL



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# 1750MHz Dipole (2022)

Add: No.52 Hua YuanBei Ro			
Tel: +86-10-62304633-2117 E-mail: emf@caiet.ac.en	http://www.eaic	t ad en	
Client SAIC	And the second s		22-60335
CALIBRATION CI	ERTIFICAT	E	
Object	D1750	/2 - SN: 1152	
Calibration Procedure(s)			
valibiation ritocedure(s)	1. C. C. S.	-003-01	
	Calibra	tion Procedures for dipole validation kits	
Calibration date:	August	22, 2022	
bades and are part of the ce	rtificate.		are given on the following
humidity<70%. Calibration Equipment used	conducted in t	he closed laboratory facility: environment or calibration)	temperature (22±3)℃ an
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards	conducted in t (M&TE critical fo	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.)	temperature (22±3)℃ and Scheduled Calibration
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	Conducted in t (M&TE critical for ID # 106277	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326)	temperature (22±3)℃ an Scheduled Calibration Sep-22
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards	conducted in t (M&TE critical fo	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326)	temperature (22±3)℃ an Scheduled Calibration Sep-22 Sep-22
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S	conducted in t (M&TE critical for ID # 106277 104291	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326)	temperature (22±3)℃ an Scheduled Calibration Sep-22
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	conducted in t (M&TE critical fo ID # 106277 104291 SN 7464 SN 1556	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007)	temperature (22±3)°C an Scheduled Calibration Sep-22 Sep-22 Jan-23 Jan-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards	conducted in t (M&TE critical for ID # 106277 104291 SN 7464	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007) Cal Date (Calibrated by, Certificate No.)	temperature (22±3)°C and Scheduled Calibration Sep-22 Sep-22 Jan-23 Jan-23 Scheduled Calibration
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	conducted in t (M&TE critical fo ID # 106277 104291 SN 7464 SN 1556 ID #	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 26-Jan-22(SPEAG,No.EX3-7464_Jan22) 12-Jan-22(CTTL-SPEAG,No.Z22-60007)	temperature (22±3)°C and Scheduled Calibration Sep-22 Sep-22 Jan-23 Jan-23
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	conducted in t (M&TE critical for ID # 106277 104291 SN 7464 SN 1556 ID # MY49071430	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 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)	temperature (22±3)°C an Scheduled Calibration Sep-22 Sep-22 Jan-23 Jan-23 Scheduled Calibration Jan-23
All calibrations have been numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	conducted in t (M&TE critical fo ID # 106277 104291 SN 7464 SN 1556 ID # MY49071430 MY46110673	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 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)	temperature (22±3)°C an Scheduled Calibration Sep-22 Sep-22 Jan-23 Jan-23 Scheduled Calibration Jan-23 Jan-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C Network Analyzer E5071C	conducted in t (M&TE critical for ID # 106277 104291 SN 7464 SN 1556 ID # MY49071430 MY46110673 Name	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 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 Sep-22 Sep-22 Jan-23 Jan-23 Scheduled Calibration Jan-23 Jan-23
All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	conducted in t (M&TE critical for 106277 104291 SN 7464 SN 1556 ID # MY49071430 MY46110673 Name Zhao Jing	he closed laboratory facility: environment or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 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 SAR Test Engineer	temperature (22±3)°C and Scheduled Calibration Sep-22 Sep-22 Jan-23 Jan-23 Scheduled Calibration Jan-23 Jan-23

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#### Glossary:

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

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

- 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 system configuration, as far as not given on page 1.

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ±1 MHz	

Head TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.3 ±6 %	1.41 mho/m ±6 %
Head TSL temperature change during test	<1.0 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.3 W/kg ±18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.6 W/kg ± 18.7 % (k=2)

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

#### Antenna Parameters with Head TSL

Electrical Delay (one direction)

eneral Antenna Parameters and Design		
Return Loss	- 32.8dB	_
Impedance, transformed to feed point	47.9Ω- 0.71jΩ	

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

1.120 ns

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.

Manufactured by	SPEAG









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

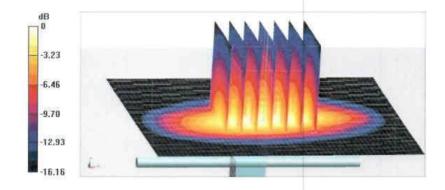
Date: 2022-08-22

Test Laboratory: CTTL, Berjing, China **DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1152** Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium parameters used: f = 1750 MHz;  $\sigma = 1.408$  S/m;  $\varepsilon_r = 41.28$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Right Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(8.52, 8.52, 8.52) @ 1750 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

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Reference Value = 91,44 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 16.5 W/kg
SAR(1 g) = 9.18 W/kg; SAR(10 g) = 4.94 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 56.3%
Maximum value of SAR (measured) = 14.0 W/kg
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0 dB = 14.0 W/kg = 11.46 dBW/kg

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## 1900MHz Dipole

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Add; No.52 HuaYu Tel: #86-10-62304/ E-mail: ettl a chinat	633-2079 Fax: +	District, Beijing, 100191, Chi 86-10-62304633-2504 www.chinatl.en	CALIBRATION CNAS L0570
Client SAI	СТ	Certificate No: Z2	1-60357
CALIBRATION CI	ERTIFICAT	E	
Object	D1900	V2 - SN: 5d088	Garden and
Calibration Procedure(s)	FF-Z11	-003-01	
	Calibra	tion Procedures for dipole validation kits	
Calibration date:	Octobe	r 18, 2021	
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numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	(M&TE critical fe ID # 106277 104291	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326)	Scheduled Calibration Sep-22
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S	(M&TE critical fe ID # 106277 104291	Calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326)	Scheduled Calibration Sep-22 Sep-22
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	(M&TE critical fe ID # 106277 104291 SN 7517	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG.No.Z21-60001)	Scheduled Calibration Sep-22 Sep-22 Feb-22
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	(M&TE critical fe 106277 104291 SN 7517 SN 1556	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG,No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards	(M&TE critical fr 1D # 106277 104291 SN 7517 SN 1556 ID #	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG.No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	(M&TE critical fr 106277 104291 SN 7517 SN 1556 ID # MY49071430	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21 (CTTL-SPEAG.No.Z21-60001) 15-Jan-21(SPEAG,No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	(M&TE critical fr 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG.No.Z21-60001) 15-Jan-21(SPEAG.No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	(M&TE critical fr 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG No.Z21-60001) 15-Jan-21(SPEAG No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
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#### lossary: TSL

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

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

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

#### Additional Documentation:

e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

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

Certificate No: Z21-60357

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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	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

#### Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.9±6%	1.39 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	simos	

#### SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.2 W/kg ± 18.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.5 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	53.7Ω+ 6.80jΩ
Return Loss	- 22.6dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.110 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: 10.18.2021

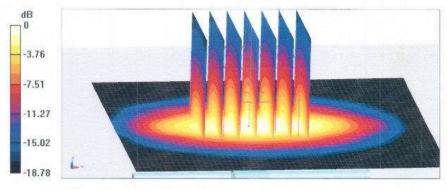
#### Test Laboratory: CTTL, Beijing, China **DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d088** Communication System: UID 0, CW; Frequency: 1900 MHz: Duty Cycle: 1:1 Medium parameters used: f = 1900 MHz; g = 1.387 S/m; g = 30.88; g = 1000

Medium parameters used: f = 1900 MHz;  $\sigma$  = 1.387 S/m;  $c_r$  = 39.88;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Right Section DASY5 Configuration:

- Probe: EX3DV4 SN7517: ConvF(7.81, 7.81, 7.81) @ 1900 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7501)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.6 V/m; Power Drift = 0.00 dB Peak SAR (extrapolated) = 19.2 W/kg SAR(1 g) = 10 W/kg; SAR(10 g) = 5.1 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 52.1% Maximum value of SAR (measured) = 15.8 W/kg



0 dB = 15.8 W/kg = 11.99 dBW/kg

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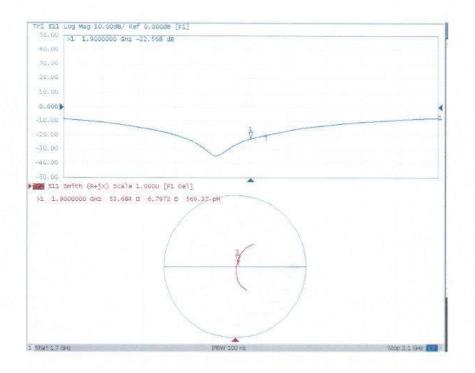


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### Impedance Measurement Plot for Head TSL



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## 2450MHz Dipole

	CALIBRA	TION LABORATORY	NAS BEEN
Tel: +86-10-623046	533-2079 Fax: +	District, Beijing, 100191, Chi 86-10-62304633-2504	CALIBRATIC CNAS L057
E-mail: ettl ä chinat Client SAIC	No. Contraction of the Contracti	www.chinattl.en Certificate No: Z2	1-60358
CALIBRATION CI			
Object	D2450\	v2 - SN: 873	
Calibration Procedure(s)	FF 744	000.04	
		-003-01 tion Procedures for dipole validation kits	
Calibration date:	Octobe	r 21, 2021	
		traceability to national standards, which rea	
All calibrations have been humidity≺70%. Calibration Equipment used		he closed laboratory facility: environment t or calibration)	emperature (22±3)°C ar
humidity<70%. Calibration Equipment used	(M&TE critical fo	or calibration)	
humidity<70%. Calibration Equipment used		or calibration) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
humidity<70%. Calibration Equipment used Primary Standards	I (M&TE critical fo	or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326)	Scheduled Calibration Sep-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	ID# 106277 104291	or calibration) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S	ID# 106277 104291	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326)	Scheduled Calibratio Sep-22 Sep-22
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4	ID# 106277 104291 SN 7517	Cal Date (Calibrated by. Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG.No.Z21-60001)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4	ID # 106277 104291 SN 7517 SN 1556	Cal Date (Calibrated by. Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG.No.Z21-60001) 15-Jan-21(SPEAG.No.DAE4-1556_Jan21)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards	ID # 106277 104291 SN 7517 SN 1556 ID #	Cal Date (Calibrated by. Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG.No.Z21-60001) 15-Jan-21(SPEAG.No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.)	Scheduled Calibratio Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	ID# 106277 104291 SN 7517 SN 1556 ID# MY49071430	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21 (CTTL-No.J21X08326) 03-Feb-21 (CTTL-SPEAG.No.Z21-60001) 15-Jan-21(SPEAG.No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22
numidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG.No.Z21-60001) 15-Jan-21(SPEAG.No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232)	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C	I (M&TE critical fo ID # 106277 104291 SN 7517 SN 1556 ID # MY49071430 MY46110673 Name	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21 (CTTL-SPEAG.No.Z21-60001) 15-Jan-21 (CTTL-SPEAG.No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22
humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2 Power sensor NRP8S Reference Probe EX3DV4 DAE4 Secondary Standards Signal Generator E4438C NetworkAnalyzer E5071C	I (M&TE critical fo ID# 106277 104291 SN 7517 SN 1556 ID# MY49071430 MY46110673 Name Zhao Jing	Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326) 24-Sep-21 (CTTL, No.J21X08326) 03-Feb-21(CTTL-SPEAG.No.Z21-60001) 15-Jan-21(SPEAG.No.DAE4-1556_Jan21) Cal Date (Calibrated by, Certificate No.) 01-Feb-21 (CTTL, No.J21X00593) 14-Jan-21 (CTTL, No.J21X00232) Function SAR Test Engineer	Scheduled Calibration Sep-22 Sep-22 Feb-22 Jan-22 Scheduled Calibration Jan-22 Jan-22

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#### Glossary:

N/A

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

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

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

#### Additional Documentation:

e) 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 system configuration, as far as not given on page 1.

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

### Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.5±6%	1.81 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		12222

## SAR result with Head TSL

SAR averaged over 1 $cm^3$ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.2 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.2 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	53.6Ω+ 1.26jΩ
Return Loss	- 28.8dB

#### General Antenna Parameters and Design

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36 n

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** 

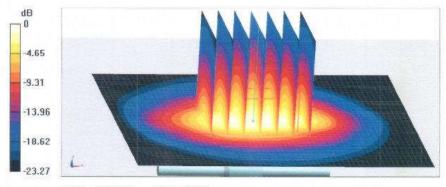
Date: 10.21.2021

#### Test Laboratory: CTTL, Beijing, China **DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 873** Communication System; UID 0, CW: Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz; $\sigma = 1.809$ S/m; $\epsilon_r = 39.51$ ; $\rho = 1000$ kg/m<sup>3</sup> Phantom section: Right Section DASY5 Configuration:

- Probe: EX3DV4 SN7517; ConvF(7.34, 7.34, 7.34) @ 2450 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- Phantom: MFP\_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
   Measurement SW: DASY52, Version 52,10 (4); SEMCAD X Version 14.6.14
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7501)

**Dipole Calibration**/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

```
Reference Value = 108.0 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 28.0 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.05 W/kg
Smallest distance from peaks to all points 3 dB below = 9.2 mm
Ratio of SAR at M2 to SAR at M1 = 46.9\%
Maximum value of SAR (measured) = 22.6 W/kg
```



0 dB = 22.6 W/kg = 13.54 dBW/kg

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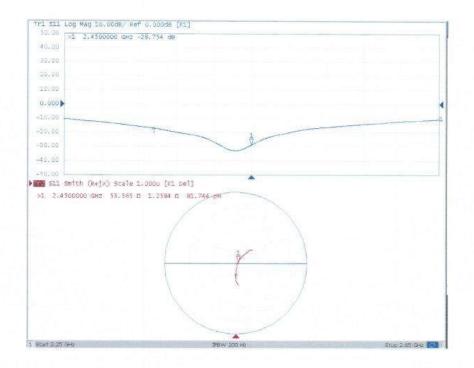


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Impedance Measurement Plot for Head TSL



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## 2550MHz Dipole

credited by the Swiss Accreditation e Swiss Accreditation Service Is	one of the signatories	to the EA	preditation No.: SCS 0108
Itilateral Agreement for the reco lent TMC-SZ (Auden)			D2550V2-1010_May21
ALIBRATION CE	RTIFICATE		
bject	D2550V2 - SN:10	10	
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	dure for SAR Validation Sources	between 0.7-3 GHz
Calibration date:	May 21, 2021		
The measurements and the uncerta	ainties with confidence p	onal standards, which realize the physical un cobability are given on the following pages an y facility: environment temperature (22 ± 3)*(	d are part of the cortilicate.
The measurements and the uncert All catibrations have been conducto Calibration Equipment used (M&TE	ainties with confidence p ad in the closed laborator E critical for calibration)	cobability are given on the following pages an y facility: environment temperature $(22 \pm 3)^{\circ}$	d are part of the cortilicate. C and humidity < 70%.
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The measurements and the uncertain All calibrations have been conductor Calibration Equipment used (M&TE Primary Standards Power meter NRP	ainties with confidence p ad in the closed laborator E critical for calibration)	cobability are given on the following pages an y facility: environment temperature $(22 \pm 3)^{\circ}$	d are part of the contilicate. C and humidity < 70%. Scheduled Calibration
The measurements and the uncerta All calibrations have been conductor Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-291	anties with confidence p ad in the closed laborator critical for calibration) 10 # SN: 104778	cobability are given on the following pages an y facility: environment temperature (22 ± 3)*( Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292)	d are part of the contilicate. C and humidity < 70%. Scheduled Calibration Apr-22
The measurements and the uncerta All calibrations have been conducto Calibration Equipment used IM&TE Primary Standards Power meter NRP Power sensor NRP-291 Power sensor NRP-291	anties with confidence p ad in the closed laborator critical for calibration) 1D # SN: 104778 SN: 104244	Coability are given on the following pages an y facility: environment temperature (22 ± 3)*( Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291)	d are part of the contilicate. C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22
The measurements and the uncerta All catibrations have been conducto Calibration Equipment used (M&TE Primary Standards Prower meter NRP Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator	anties with confidence p ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03292)	d are part of the contilicate. C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22
The measurements and the uncerta All calibrations have been conducto Calibration Equipment used (M&TE Primary Standards Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination	anties with confidence p ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: BH9394 (20k)	Colability are given on the following pages an y facility: environment temperature (22 ± 3)*0 Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 28-Dec-20 (No. EX3-7349, Dec20)	d are part of the contilicate. C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21
The measurements and the uncerta All calibrations have been conductor Calibration Equipment used (M&TE Primary Standards Power sensor NRP-291 Power sensor NRP-291 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	anties with confidence p ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: 9H9394 (20k) SN: 310982 / 06327	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03343)	d are part of the contilicate. C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22
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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura

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Swiss Calibration Service

Accreditation No.: SCS 0108

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

#### Glossary:

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

## Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate
- b) TEC 62209-1, "Measurement procedure for the assessment of Specific Absorption nate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

#### Additional Documentation:

e) 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 system configuration, as far as not given on page 1.

DASY Version	DASY5	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	2550 MHz ± 1 MHz	

#### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.1	1.91 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) "C	37.4 ± 6 %	1.99 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	1440	1000

## SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	55.9 W/kg ± 17.0 % (k=2)
	in a state of	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>a</sup> (10 g) of Head TSL SAR measured	condition 250 mW input power	6.42 W/kg

Body TSL parameters The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.6	2.09 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) "C	50.8 ± 6 %	2.16 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		1.000

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW Input power	13.4 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	52,4 W/kg ± 17.0 % (k=2)
		and the second se
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL SAR measured	condition 250 mW input power	6.04 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	52.8 Ω - 3.8 jΩ	
Return Loss	- 26.8 dB	

## Antenna Parameters with Body TSL

Impedance, transformed to feed point	49,3 Ω - 1,8 jΩ	
Return Loss	- 34.3 dB	

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 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: 21.05.2021

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 2550 MHz; Type: D2550V2; Serial: D2550V2 - SN:1010

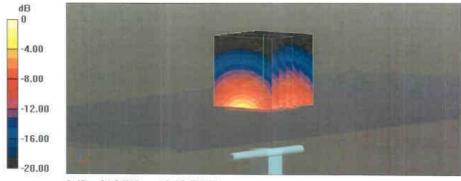
Communication System: UID 0 - CW; Frequency; 2550 MHz Medium parameters used: f = 2550 MHz;  $\sigma = 1.99$  S/m;  $\varepsilon_f = 37.4$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.85, 7.85, 7.85) @ 2550 MHz; Calibrated: 28.12.2020
- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601: Calibrated: 02.11.2020
- · Phantom: Flat Phantom 5.0 (front): Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

#### 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 = 119.0 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 29.6 W/kg SAR(1 g) = 14.4 W/kg; SAR(10 g) = 6.42 W/kg Smallest distance from peaks to all points 3 dB below = 8.9 mm Ratio of SAR at M2 to SAR at M1 = 48.2% Maximum value of SAR (measured) = 24.3 W/kg



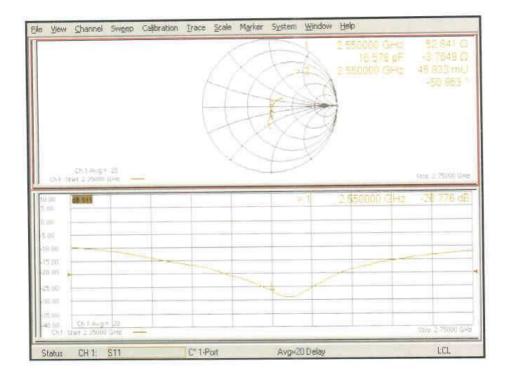
0 dB = 24.3 W/kg = 13.86 dBW/kg

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## Impedance Measurement Plot for Head TSL



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#### DASY5 Validation Report for Body TSL

Date: 21.05.2021

Test Laboratory: SPEAG, Zurich, Switzerland

## DUT: Dipole 2550 MHz; Type: D2550V2; Serial: D2550V2 - SN:1010

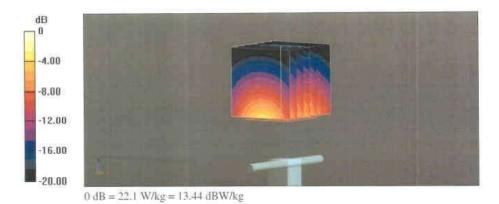
Communication System: UID 0 - CW; Frequency: 2550 MHz Medium parameters used: f = 2550 MHz;  $\sigma = 2.16$  S/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.98, 7.98, 7.98) @ 2550 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- · Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- · Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA: Serial: 1002
- DASY52 52.10.4(1527): SEMCAD X 14.6.14(7483)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 110.2 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 26.1 W/kg SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.04 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 51.9% Maximum value of SAR (measured) = 22.1 W/kg

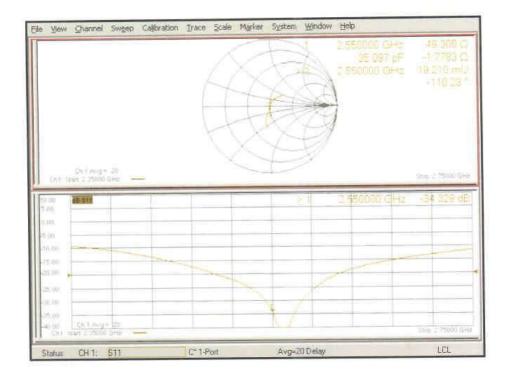


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## Impedance Measurement Plot for Body TSL



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## **5GHz Dipole**

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CALIBRATION CER Object	TIFICAT		19-60293
Object		E	
	D5GHz		
	D5GHz		
Calibration Procedure(s)		V2 - SN: 1238	
	FE-711	-003-01	
		tion Procedures for dipole validation kits	
Calibration date			
Calibration date.	August	29, 2019	
This calibration Certificate doc	uments the	traceability to national standards, which re-	alize the physical units o
measurements(SI). The measur	rements and	the uncertainties with confidence probability	are given on the following
pages and are part of the certific			and grounder the following
All calibrations have been co	nducted in	the closed laboratory facility: environment	temperature(22+3)10 and
humidity<70%.		,,	(active active (active) a contraction
Calibration Equipment used (M8	TE critical fo	or calibration)	
- Dimmedia Contractor a contractor de la c			
Primary Standards ID	) #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
	) # 6276		Scheduled Calibration Apr-20
Power Meter NRP2 10		Cal Date(Calibrated by, Certificate No.)	
Power Meter NRP2 10 Power sensor NRP6A 10	6276	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Power Meter         NRP2         10           Power sensor         NRP6A         10           ReferenceProbe         EX3DV4         SN	6276 1369	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605)	Apr-20 Apr-20
Power Meter         NRP2         10           Power sensor         NRP6A         10           ReferenceProbe         EX3DV4         SN	6276 1369 13617 1555	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Apr-20 Apr-20 Jan-20 Aug-20
Power Meter     NRP2     100       Power sensor     NRP6A     10       ReferenceProbe     EX3DV4     SN       DAE4     SN       Secondary Standards     ID	6276 1369 13617 1555	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.)	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration
Power Meter     NRP2     100       Power sensor     NRP6A     10       ReferenceProbe     EX3DV4     SN       DAE4     SN       Secondary Standards     ID       Signal Generator     E4438C     MY	6276 1369 13617 13555 #	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Apr-20 Apr-20 Jan-20 Aug-20
Power Meter     NRP2     100       Power sensor     NRP6A     10       ReferenceProbe     EX3DV4     SN       DAE4     SN       Secondary Standards     ID       Signal Generator     E438C     MY       NetworkAnalyzerE5071C     MY	6276 1369 13617 1555 # (49071430 (46110673	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547)	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20
Power Meter     NRP2     10       Power sensor     NRP6A     10       ReferenceProbe     EX3DV4     SN       DAE4     SN       Secondary Standards     ID       Signal Generator E4438C     MY       NetworkAnalyzerE5071C     MY	6276 1369 13617 1555 # (49071430	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336)	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20
Power Meter NRP2 100 Power sensor NRP6A 100 ReferenceProbe EX3DV4 SN DAE4 SN Secondary Standards ID Signal Generator E4438C MY NetworkAnalyzerE5071C MY	6276 1369 13617 1555 # (49071430 (46110673	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547)	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20 Jan-20
Power Meter NRP2 100 Power sensor NRP6A 100 ReferenceProbe EX3DV4 SN DAE4 SN Secondary Standards ID Signal Generator E4438C MY NetworkAnalyzerE5071C MY Calibrated by: Zha	6276 1369 I 3617 I 1555 # (49071430 (46110673 ame ao Jing	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function SAR Test Engineer	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20 Jan-20
Power Meter NRP2 10 Power sensor NRP6A 10 ReferenceProbe EX3DV4 SN DAE4 SN Secondary Standards ID Signal Generator E4438C MY NetworkAnalyzerE5071C MY Calibrated by: Zha	6276 1369 13617 11555 # (49071430 (46110673 ame	Cal Date(Calibrated by, Certificate No.) 11-Apr-19 (CTTL, No.J19X02605) 11-Apr-19 (CTTL, No.J19X02605) 31-Jan-19(SPEAG,No.EX3-3617_Jan19) 22-Aug-19(CTTL-SPEAG,No.Z19-60295) Cal Date(Calibrated by, Certificate No.) 23-Jan-19 (CTTL, No.J19X00336) 24-Jan-19 (CTTL, No.J19X00547) Function	Apr-20 Apr-20 Jan-20 Aug-20 Scheduled Calibration Jan-20 Jan-20

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#### Glossary:

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

## Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

#### Additional Documentation:

e) 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 system configuration, as far as not given on page 1.

DASY Version	DASY52	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	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	35.7 ± 6 %	4.69 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

## SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.81 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.0 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.3 W/kg ± 24.2 % (k=2)

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Conductivity



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### Head TSL parameters at 5600 MHz

The following parameters and calculations			
	Temperature	Permittivity	
Nominal Head TSL parameters	22.0 °C	35.5	T

Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	4.99 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

#### 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	7.96 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.5 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.7 W/kg ± 24.2 % (k=2)

### 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	35.1 ± 6 %	5.10 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

#### 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	7.86 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.4 W/kg ± 24.4 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.2 W/kg ± 24.2 % (k=2)

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#### Body TSL parameters at 5250 MHz

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.1 ± 6 %	5.40 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

#### SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	71.5 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.04 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.3 W/kg ± 24.2 % (k=2)

Body TSL parameters at 5600 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.6 ± 6 %	5.70 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

### SAR result with Body TSL at 5600 MHz

Condition	
100 mW input power	7.62 W/kg
normalized to 1W	75.9 W/kg ± 24.4 % (k=2)
Condition	
100 mW input power	2.18 W/kg
normalized to 1W	21.7 W/kg ± 24.2 % (k=2)
	100 mW input power normalized to 1W Condition 100 mW input power

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

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.5 ± 6 %	5.78 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

## SAR result with Body TSL at 5750 MHz

SAR averaged over 1 $cm^3$ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.39 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	73.6 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.9 W/kg ± 24.2 % (k=2)

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

### Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	48.8Ω - 4.65jΩ	
Return Loss	- 26.2dB	

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

Impedance, transformed to feed point	49.2Ω + 0.58jΩ	
Return Loss	- 40.0dB	

#### Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	50.3Ω + 1.08jΩ
Return Loss	- 39.0dB

### Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	48.8Ω - 2.02jΩ
Return Loss	- 32.5dB

#### Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	51.3Ω + 3.94jΩ	
Return Loss	- 27.8dB	

### Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	52.2Ω + 4.77jΩ	
Return Loss	- 25.8dB	

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General Antenna Parameters and Design

Electrical Delay (one direction)	1.059 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

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Date: 08.28.2019





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### DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

### DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1238

Communication System: CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz,

Medium parameters used: f = 5250 MHz;  $\sigma$  = 4.692 S/m;  $\epsilon_r$  = 35.71;  $\rho$  = 1000 kg/m3, Medium parameters used: f = 5600 MHz;  $\sigma$  = 4.992 S/m;  $\epsilon_r$  = 35.42;  $\rho$  = 1000 kg/m3, Medium parameters used: f = 5750 MHz;  $\sigma$  = 5.096 S/m;  $\epsilon_r$  = 35.13;  $\rho$ = 1000 kg/m3,

Phantom section: Center Section

- DASY5 Configuration:
  - Probe: EX3DV4 SN3617; ConvF(5.39, 5.39, 5.39) @ 5250 MHz; ConvF(5.06, 5.06, 5.06) @ 5600 MHz; ConvF(5.07, 5.07, 5.07) @ 5750 MHz; Calibrated: 1/31/2019
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection)
  - Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
  - Phantom: MFP V5.1C ; Type: QD 000 P51CA; Serial: 1062
  - Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

#### Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 69.41 V/m; Power Drift = -0.05 dB Peak SAR (extrapolated) = 32.8 W/kg SAR(1 g) = 7.81 W/kg; SAR(10 g) = 2.23 W/kg Maximum value of SAR (measured) = 18.7 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 70.02 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 35.7 W/kg SAR(1 g) = 7.96 W/kg; SAR(10 g) = 2.27 W/kg

Maximum value of SAR (measured) = 19.2 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 68.55 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 36.5 W/kg SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.23 W/kg Maximum value of SAR (measured) = 18.9 W/kg

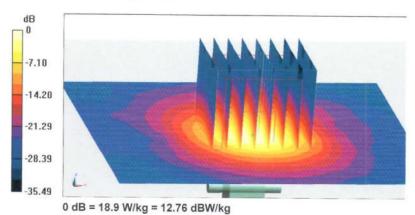
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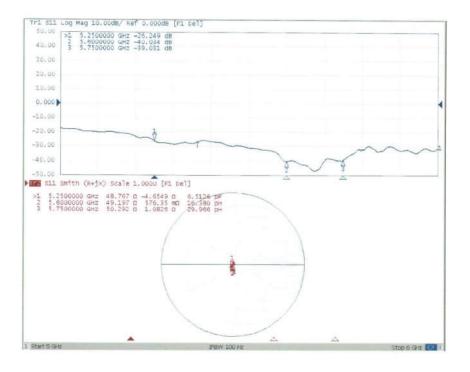


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#### Impedance Measurement Plot for Head TSL



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#### **DASY5 Validation Report for Body TSL** Test Laboratory: CTTL, Beijing, China

Date: 08.29.2019

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1238

Communication System: CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz,

Medium parameters used: f = 5250 MHz;  $\sigma$  = 5.402 S/m;  $\epsilon_r$  = 48.05;  $\rho$  = 1000 kg/m3, Medium parameters used: f = 5600 MHz;  $\sigma$  = 5.703 S/m;  $\epsilon_r$  = 47.61;  $\rho$  = 1000 kg/m3, Medium parameters used: f = 5750 MHz;  $\sigma$  = 5.782 S/m;  $\epsilon_r$  = 47.49;  $\rho$ = 1000 kg/m3,

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 SN3617; ConvF(4.76, 4.76, 4.76) @ 5250 MHz; ConvF(4.23, 4.23, 4.23) @ 5600 MHz; ConvF(4.36, 4.36, 4.36) @ 5750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP\_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 54.85 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 27.5 W/kg SAR(1 g) = 7.17 W/kg; SAR(10 g) = 2.04 W/kg Maximum value of SAR (measured) = 16.4 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 56.17 V/m; Power Drift = 0.07 dB Peak SAR (extrapolated) = 32.3 W/kg SAR(1 g) = 7.62 W/kg; SAR(10 g) = 2.18 W/kg Maximum value of SAR (measured) = 18.4 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan. dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 55.47 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 33.2 W/kg SAR(1 g) = 7.39 W/kg; SAR(10 g) = 2.1 W/kg Maximum value of SAR (measured) = 18.1 W/kg

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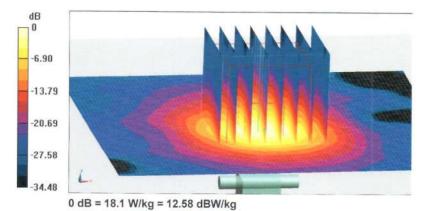




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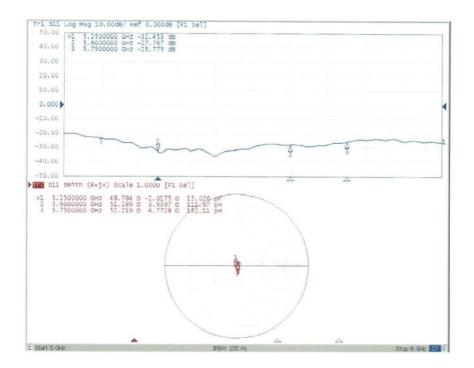
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Impedance Measurement Plot for Body TSL



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# **ANNEX J: Extended Calibration SAR Dipole**

Referring to KDB865664 D01, if dipoles are verified in return loss (<-20dBm, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

### Justification of Extended Calibration SAR Dipole D750V3– serial no.1163

Head									
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (johm)	Delta (johm)			
2019-09-03	-26.9	/	50.5	/	-4.53	/			
2020-09-01	-25.8	4.1	51.2	0.7	-4.29	0.24			
2021-08-30	-25.2	6.3	51.7	1.2	-4.16	0.37			

Justification of Extended Calibration SAR Dipole D1750V2- serial no.1152 (2018)

Head									
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (johm)	Delta (johm)			
2019-08-30	-38.1	/	49.1	/	-0.84	/			
2020-08-28	-36.5	4.2	50.2	1.1	-0.49	0.35			
2021-08-26	-35.7	6.3	50.8	1.7	-0.42	0.42			

Justification of Extended Calibration SAR Dipole D5GHzV2– serial no.1238

Head									
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (johm)	Delta (johm)			
5250MHz									
2019-08-29	-26.2	/	48.8	/	-4.65	/			
2020-08-28	-25.1	4.2	49.7	0.9	-4.26	0.39			
2021-08-26	-24.7	5.7	50.2	1.4	-4.01	0.64			
			5600MHz						
2019-08-29	-40.0	/	49.2	/	0.58	/			
2020-08-28	-38.1	4.8	50.3	1.1	0.85	0.27			
2021-08-26	-37.7	5.7	50.8	1.6	0.92	0.34			
	5750MHz								
2019-08-29	-39.0	/	50.3	/	1.08	/			
2020-08-28	-37.7	3.3	51.1	0.8	1.44	0.36			
2021-08-26	-37.2	4.6	51.6	1.3	1.53	0.45			

The Return-Loss is <-20dB, and within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the value result should support extended cabration.



# **ANNEX K: Spot Check Test**

As the test lab for TA-1429 from HMD Global Oy, we, Shenzhen Academy of Information and Communications Technology, declare on our sole responsibility that, according to "Justification Letter" provided by applicant, only the Spot check test should be performed. The test results are as below.

## K.1. Internal Identification of EUT used during the spot check test

EUT ID*	IMEI	HW Version	SW Version	Receipt Date	
UT06aa	356254720183675	V01	00WW_0_010	2022-08-29	

### K.2. Measurement results

#### WLAN 2.4GHz Head SAR Values

	Frequ	uency		Conductor		Max.	SAR(1g) (W/kg)		
Ch.	MHz	Test Position		Power Power	Spot check data		Original		
		Test Position			Measured	Reported	data		
					(ubiii)	(dBm)	SAR	SAR	uala
	1	2412.0	Head	Left Cheek	15.67	16.0	0.251	0.27	0.43

#### LTE Band 66 Body SAR Values

Frequency				Conducted	Max.	SAR(1g) (W/kg)		
Ch.		Test Position		Power	tune-up Power	Spot check data		Original
	MHz	Test Position	(dBm)	Measured		Reported	data	
				(dDiii)	(dBm)	SAR	SAR	uald
132072	1720.0	Body	Bottom	21.29	22.0	0.947	1.12	1.12



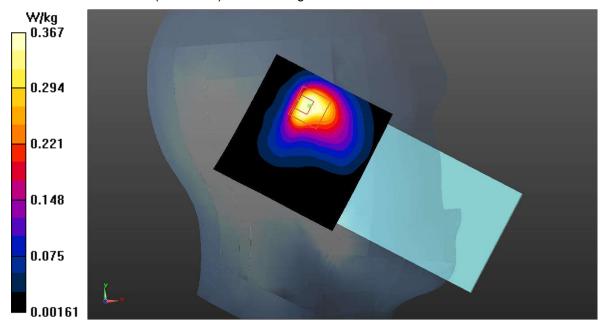
## K.3. Graph Results for Spot Check

### WLAN 2.4GHz Head

Date: 2022-9-26 Electronics: DAE4 Sn1527 Medium: Head 2450MHz Medium parameters used: f = 2412 MHz;  $\sigma$  = 1.786 S/m;  $\epsilon_r$  = 38.678;  $\rho$  = 1000 kg/m<sup>3</sup> Communication System: UID 0, WIFI (0) Frequency: 2412 MHz Duty Cycle: 1:1 Probe: EX3DV4 - SN7683 ConvF (7.85, 7.85, 7.85)

**Left Cheek Ch.1/Area Scan (91x91x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm Maximum value of SAR (interpolated) = 0.434 W/kg

Left Cheek Ch.1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 6.781 V/m; Power Drift = 0.09 dB Peak SAR (extrapolated) = 0.545 W/kg SAR(1 g) = 0.251 W/kg; SAR(10 g) = 0.129 W/kg Maximum value of SAR (measured) = 0.367 W/kg





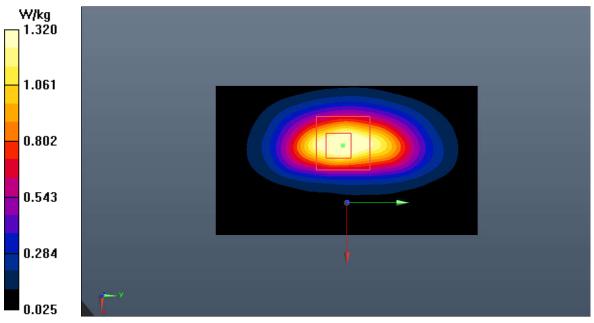
### LTE Band 66 Body

Date: 2022-9-20 Electronics: DAE4 Sn1527 Medium: Head 1750MHz Medium parameters used: f = 1720 MHz;  $\sigma$  = 1.359 S/m;  $\epsilon_r$  = 39.085;  $\rho$  = 1000 kg/m<sup>3</sup> Communication System: UID 0, LTE\_FDD (0) Frequency: 1720 MHz Duty Cycle: 1:1 Probe: EX3DV4 - SN7683 ConvF (8.58, 8.58, 8.58)

**Bottom Side Low 1RB50/Area Scan (61x81x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm Maximum value of SAR (interpolated) = 1.14 W/kg

Bottom Side Low 1RB50/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.980 V/m; Power Drift = -0.06 dB Peak SAR (extrapolated) = 1.64 W/kg SAR(1 g) = 0.947 W/kg; SAR(10 g) = 0.505 W/kg Maximum value of SAR (measured) = 1.32 W/kg





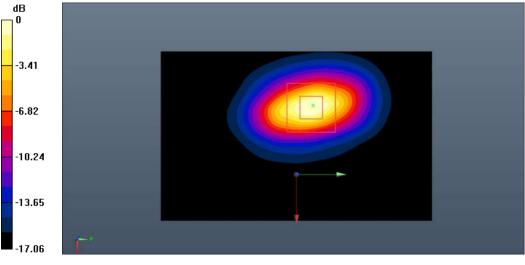
## K.4. System Verification Results for Spot Check

### 1750MHz

Date: 2022-9-20 Electronics: DAE4 Sn1527 Medium: Head 1750MHz Medium parameters used: f = 1750 MHz;  $\sigma$  = 1.385 S/m;  $\epsilon_r$  = 38.969;  $\rho$  = 1000 kg/m<sup>3</sup> Communication System: CW\_TMC Frequency: 1750 MHz Duty Cycle: 1:1 Probe: EX3DV4 - SN7683 ConvF (8.58, 8.58, 8.58)

System Validation/Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm Reference Value = 78.965 V/m; Power Drift = 0.03 dB SAR(1 g) = 9.11 W/kg; SAR(10 g) = 4.85 W/kg Maximum value of SAR (interpolated) = 11.2 W/kg

System Validation/Zoom Scan (7x7x7)/Cube0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 78.965 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 23.9 W/kg SAR(1 g) = 9.34 W/kg; SAR(10 g) = 4.98 W/kg Maximum value of SAR (measured) = 11.4 W/kg



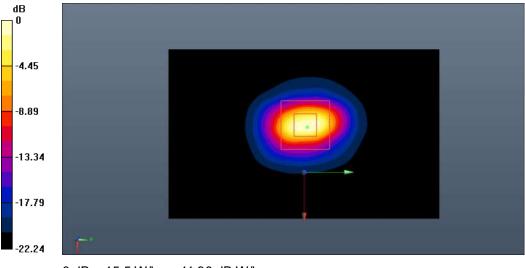
0 dB = 11.4 W/kg = 10.57 dB W/kg



2450MHz Date: 2022-9-26 Electronics: DAE4 Sn1527 Medium: Head 2450MHz Medium parameters used: f = 2450 MHz;  $\sigma$  = 1.831 S/m;  $\epsilon_r$  = 38.553;  $\rho$  = 1000 kg/m<sup>3</sup> Communication System: CW\_TMC Frequency: 2450 MHz Duty Cycle: 1:1 Probe: EX3DV4 - SN7683 ConvF (7.85, 7.85, 7.85)

System Validation/Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm Reference Value = 91.715 V/m; Power Drift = 0.10 dB SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.08 W/kg Maximum value of SAR (interpolated) = 15.3 W/kg

System Validation/Zoom Scan (7x7x7)/Cube0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 91.715 V/m; Power Drift = 0.10 dB Peak SAR (extrapolated) = 34.7 W/kg SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.15 W/kg Maximum value of SAR (measured) = 15.5 W/kg



0 dB = 15.5 W/kg = 11.90 dB W/kg

\*\*\*END OF REPORT\*\*\*