

93_LTE Band 30_10M_QPSK_1RB_0Offset_Left Side_0mm_Ch27710

Communication System: UID 0, LTE (0); Frequency: 2310 MHz; Duty Cycle: 1:1

Medium: HSL_2300_220612 Medium parameters used: $f = 2310$ MHz; $\sigma = 1.613$ S/m; $\epsilon_r = 39.98$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.3 °C; Liquid Temperature : 22.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7515; ConvF(7.71, 7.71, 7.71); Calibrated: 2021/12/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1664; Calibrated: 2022/5/30
- Phantom: SAM with CRP v5.0(Front); Type: QD000P40CD; Serial: TP-1671
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch27710/Area Scan (51x161x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 12.6 W/kg

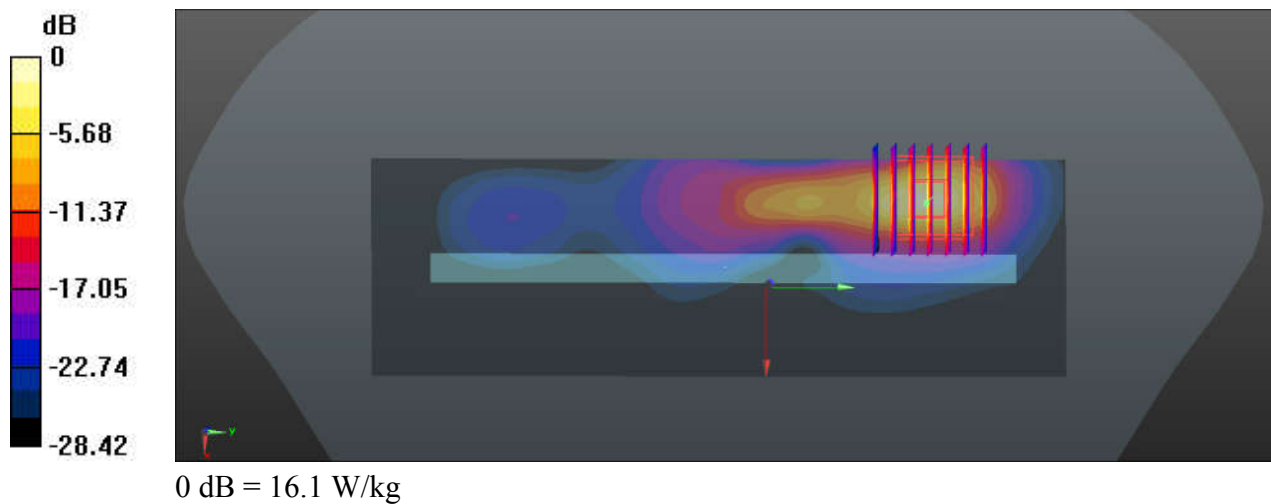
Ch27710/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.433 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 22.6 W/kg

SAR(1 g) = 6.69 W/kg; SAR(10 g) = 2.29 W/kg

Maximum value of SAR (measured) = 16.1 W/kg



94_LTE Band 7_20M_QPSK_50RB_0Offset_Bottom Side_0mm_Ch20850

Communication System: UID 0, LTE (0); Frequency: 2510 MHz; Duty Cycle: 1:1

Medium: HSL_2600_220608 Medium parameters used: $f = 2510$ MHz; $\sigma = 1.841$ S/m; $\epsilon_r = 39.201$;

$\rho = 1000$ kg/m³

Ambient Temperature : 23.2 °C; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7515; ConvF(7.31, 7.31, 7.31); Calibrated: 2021/12/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1664; Calibrated: 2022/5/30
- Phantom: SAM with CRP v5.0(Front); Type: QD000P40CD; Serial: TP-1671
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch20850/Area Scan (51x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 12.6 W/kg

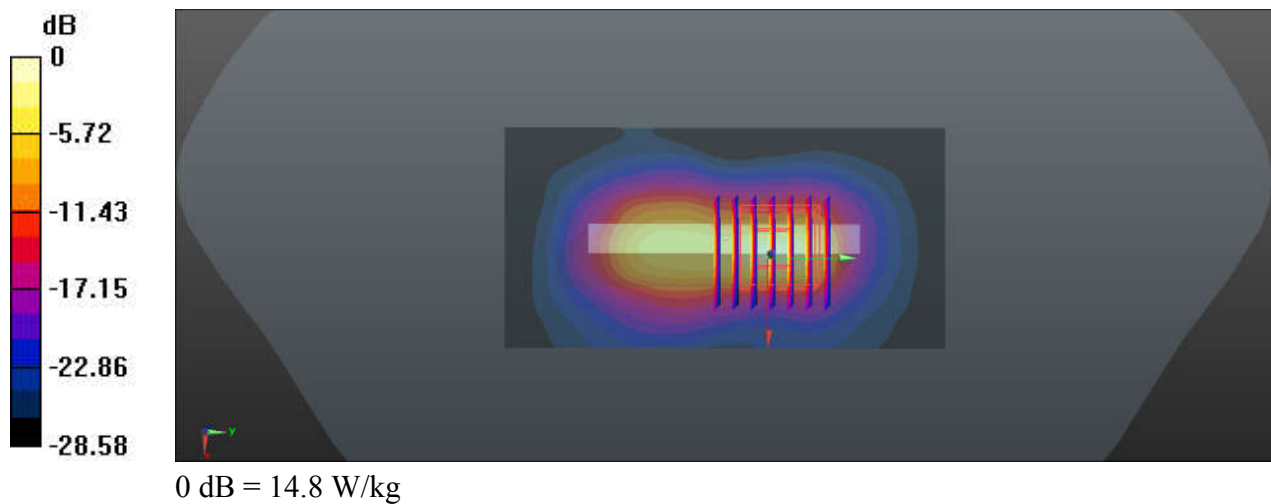
Ch20850/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 61.96 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 23.5 W/kg

SAR(1 g) = 6.79 W/kg; SAR(10 g) = 2.11 W/kg

Maximum value of SAR (measured) = 14.8 W/kg



95_LTE Band 41(HPUE)_20M_QPSK_1RB_0Offset_Left Side_0mm_Ch40620

Communication System: UID 0, LTE (0); Frequency: 2593 MHz; Duty Cycle: 1:2.331
Medium: HSL_2600_220608 Medium parameters used: $f = 2593$ MHz; $\sigma = 1.927$ S/m; $\epsilon_r = 38.834$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.2 °C; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7515; ConvF(7.31, 7.31, 7.31); Calibrated: 2021/12/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1664; Calibrated: 2022/5/30
- Phantom: SAM with CRP v5.0(Front); Type: QD000P40CD; Serial: TP-1671
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch40620/Area Scan (51x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 14.3 W/kg

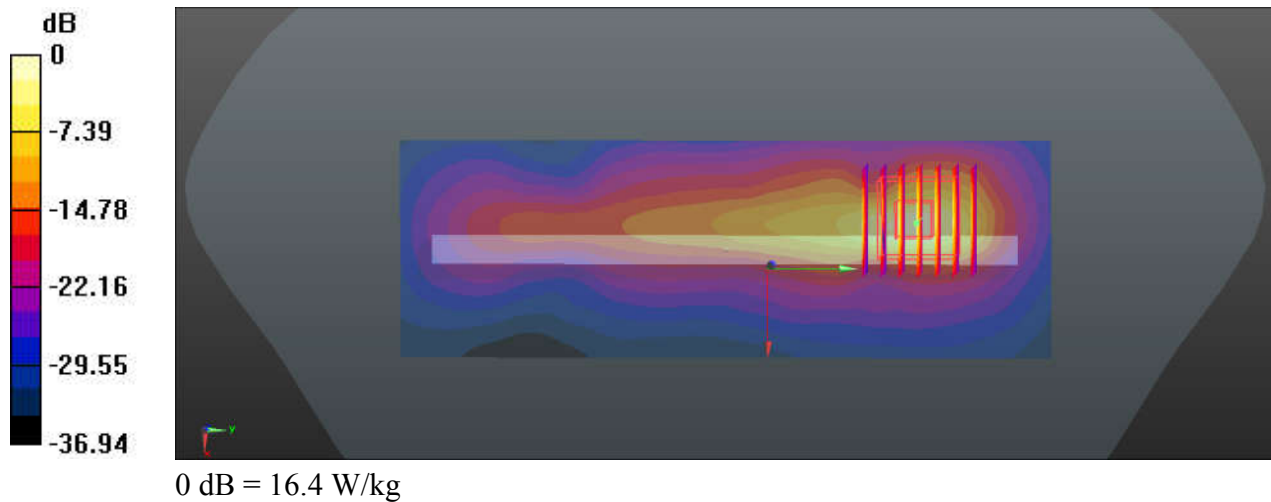
Ch40620/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 17.53 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 22.2 W/kg

SAR(1 g) = 6.92 W/kg; SAR(10 g) = 2.2 W/kg

Maximum value of SAR (measured) = 16.4 W/kg



96_LTE Band 48_20M_QPSK_1RB_0Offset_Back_0mm_Ch55340

Communication System: UID 0, LTE (0); Frequency: 3560 MHz; Duty Cycle: 1:1.59

Medium: HSL_3500_220614 Medium parameters used: $f = 3560$ MHz; $\sigma = 2.9$ S/m; $\epsilon_r = 38.356$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.6 °C; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7515; ConvF(6.87, 6.87, 6.87); Calibrated: 2021/12/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1664; Calibrated: 2022/5/30
- Phantom: SAM with CRP v5.0(Front); Type: QD000P40CD; Serial: TP-1671
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch55340/Area Scan (91x91x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 7.4 W/kg

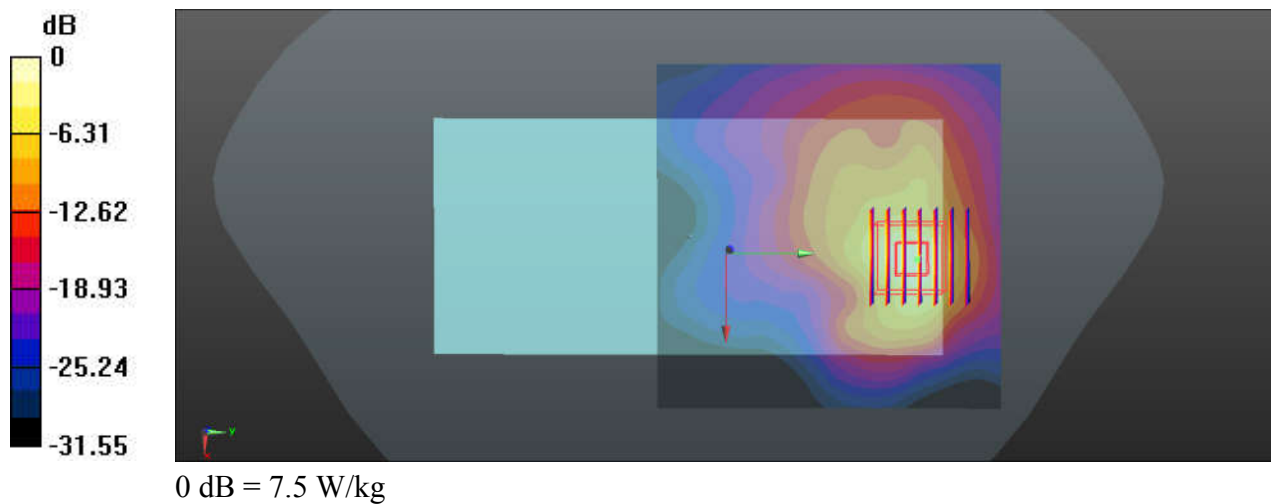
Ch55340/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=1.4mm

Reference Value = 2.070 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 10.5 W/kg

SAR(1 g) = 3.49 W/kg; SAR(10 g) = 1.57 W/kg

Maximum value of SAR (measured) = 7.5 W/kg



97_N66_40M_QPSK_108RB_54Offset_DFT-15_Left Side_0mm_Ch349000

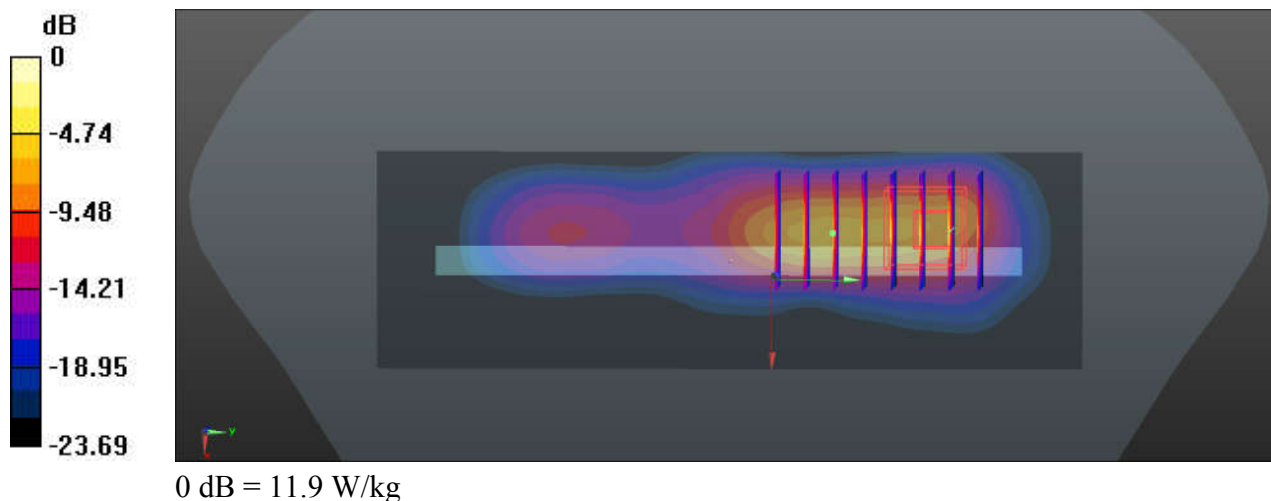
Communication System: UID 0, 5G NR (0); Frequency: 1745 MHz; Duty Cycle: 1:1
Medium: HSL_1750_220610 Medium parameters used: $f = 1745$ MHz; $\sigma = 1.401$ S/m; $\epsilon_r = 41.733$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7515; ConvF(8.4, 8.4, 8.4); Calibrated: 2021/12/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1664; Calibrated: 2022/5/30
- Phantom: SAM with CRP v5.0(Front); Type: QD000P40CD; Serial: TP-1671
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch349000/Area Scan (41x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.54 W/kg

Ch349000/Zoom Scan (5x8x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.10 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 14.1 W/kg
SAR(1 g) = 4.49 W/kg; SAR(10 g) = 1.63 W/kg
Maximum value of SAR (measured) = 11.9 W/kg



98_N25_40M_QPSK_1RB_1Offset_DFT-15_Left Side_0mm_Ch376500

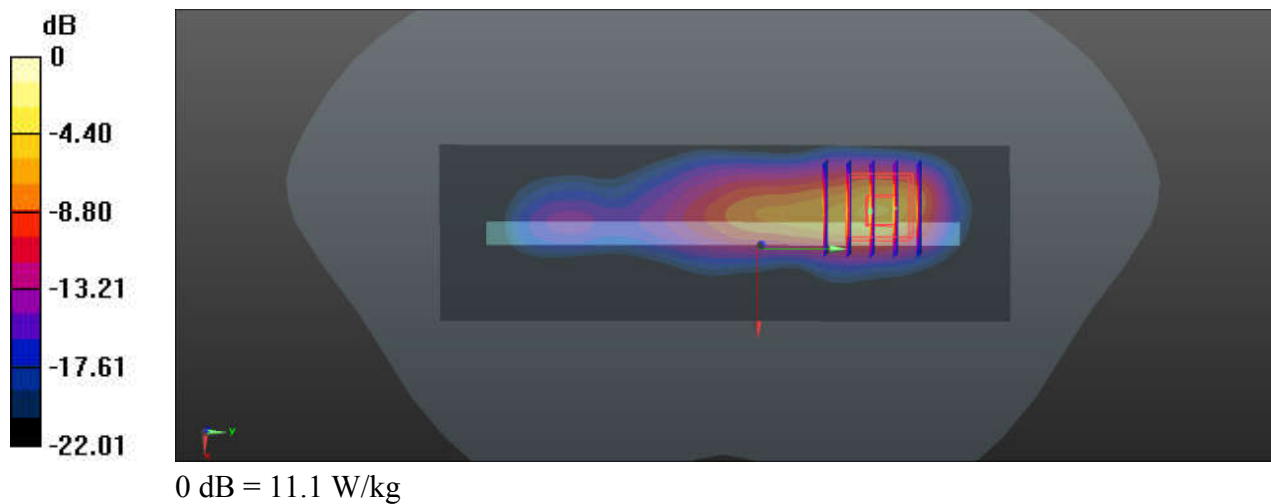
Communication System: UID 0, 5GNR (0); Frequency: 1882.5 MHz; Duty Cycle: 1:1
Medium: HSL_1900_220617 Medium parameters used: $f = 1882.5$ MHz; $\sigma = 1.437$ S/m; $\epsilon_r = 40.149$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.3 °C; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3819; ConvF(8.32, 8.32, 8.32); Calibrated: 2022/5/30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn715; Calibrated: 2021/12/29
- Phantom: SAM (30deg probe tilt) with CRP v4.0; Type: QD000P40CC; Serial: TP: 1500
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch376500/Area Scan (41x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 4.38 W/kg

Ch376500/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 28.01 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 13.1 W/kg
SAR(1 g) = 4.94 W/kg; SAR(10 g) = 1.93 W/kg
Maximum value of SAR (measured) = 11.1 W/kg



99_N30_10M_QPSK_1RB_1Offset_DFT-15_Left Side_0mm_Ch462000

Communication System: UID 0, 5GNR (0); Frequency: 2310 MHz; Duty Cycle: 1:1

Medium: HSL_2300_220614 Medium parameters used: $f = 2310$ MHz; $\sigma = 1.613$ S/m; $\epsilon_r = 39.98$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.4 °C; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3819; ConvF(7.76, 7.76, 7.76); Calibrated: 2022/5/30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn715; Calibrated: 2021/12/29
- Phantom: SAM (30deg probe tilt) with CRP v4.0; Type: QD000P40CC; Serial: TP: 1500
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch462000/Area Scan (41x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 9.01 W/kg

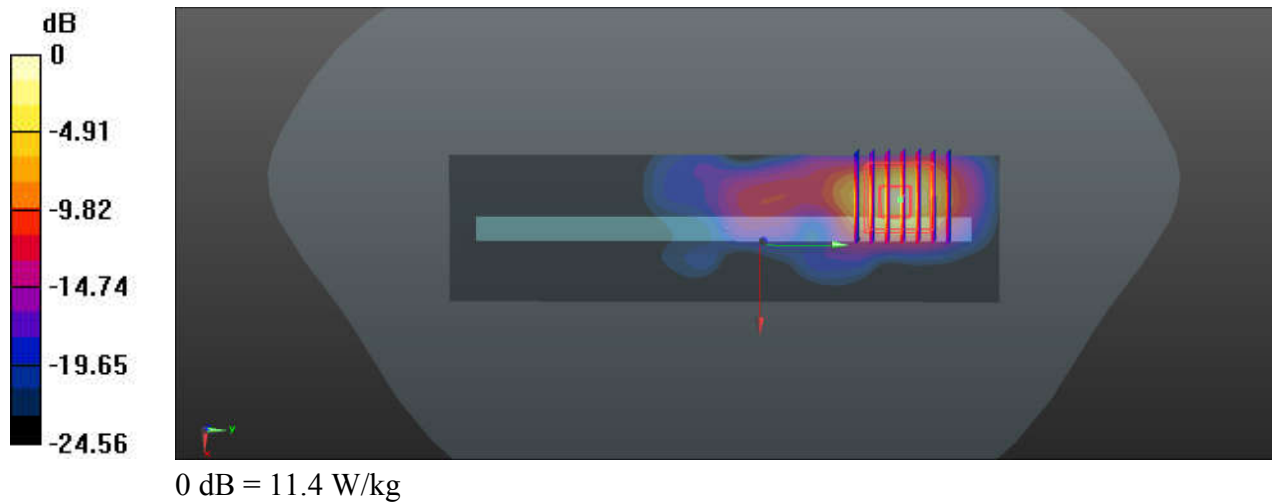
Ch462000/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.13 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 15.3 W/kg

SAR(1 g) = 5.35 W/kg; SAR(10 g) = 1.98 W/kg

Maximum value of SAR (measured) = 11.4 W/kg



100_N7_40M_QPSK_1RB_1Offset_DFT-15_Bottom Side_0mm_Ch507000

Communication System: UID 0, 5GNR (0); Frequency: 2535 MHz; Duty Cycle: 1:1

Medium: HSL_2600_220620 Medium parameters used: $f = 2535$ MHz; $\sigma = 1.866$ S/m; $\epsilon_r = 39.122$;

$\rho = 1000$ kg/m³

Ambient Temperature : 23.2 °C; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3819; ConvF(7.39, 7.39, 7.39); Calibrated: 2022/5/30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn715; Calibrated: 2021/12/29
- Phantom: SAM (30deg probe tilt) with CRP v4.0; Type: QD000P40CC; Serial: TP: 1500
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch507000/Area Scan (51x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 14.7 W/kg

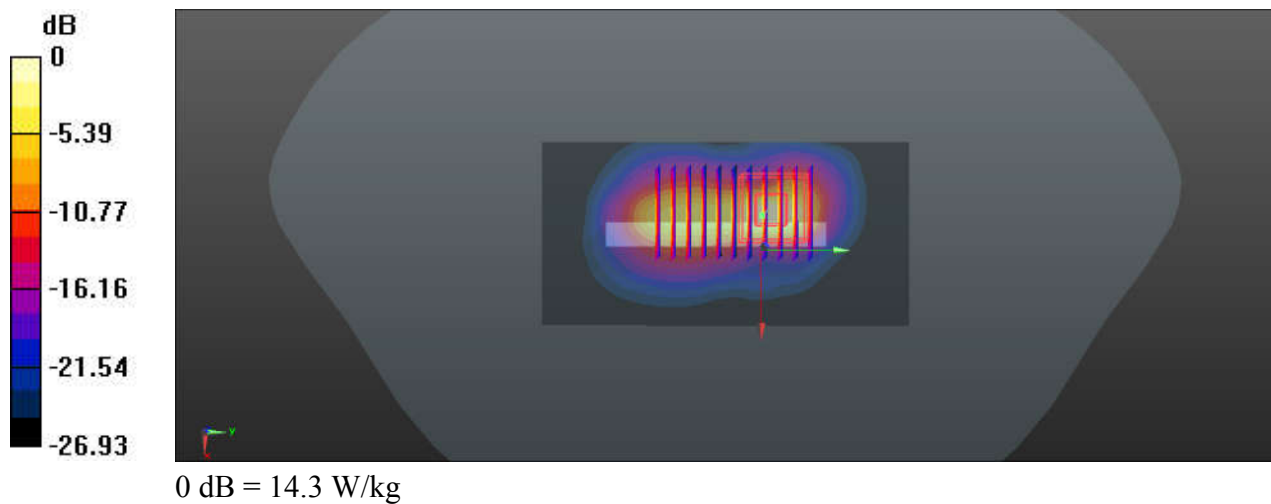
Ch507000/Zoom Scan (7x11x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 35.57 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 20.1 W/kg

SAR(1 g) = 6.9 W/kg; SAR(10 g) = 2.21 W/kg

Maximum value of SAR (measured) = 14.3 W/kg



101_N41_100M_QPSK_1RB_1Offset_DFT-30_Back_0mm_Ch518598

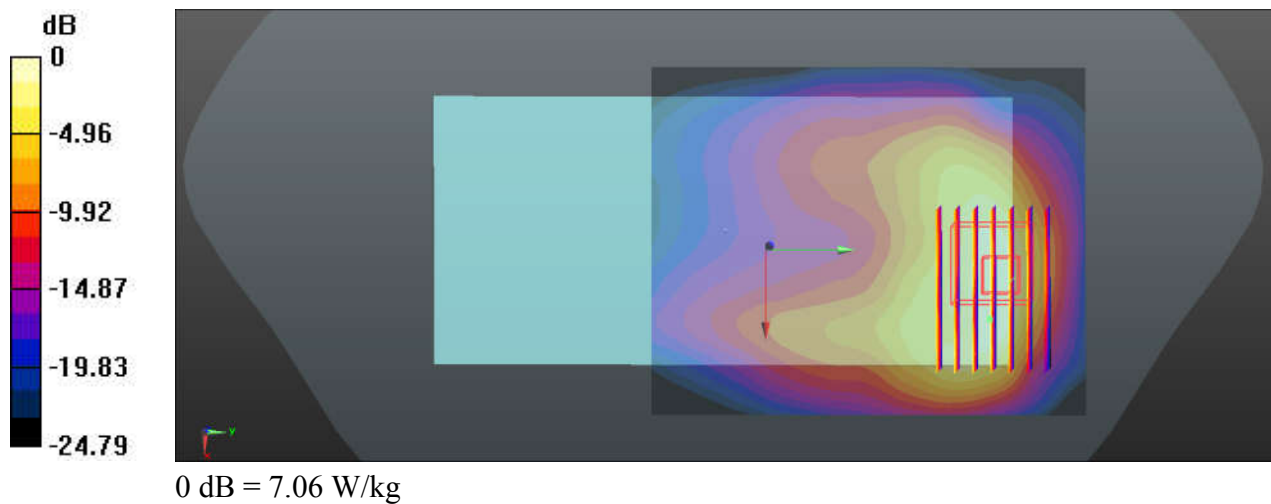
Communication System: UID 0, N41 (0); Frequency: 2592.99 MHz; Duty Cycle: 1:1
Medium: HSL_2600_220608 Medium parameters used: $f = 2593$ MHz; $\sigma = 1.927$ S/m; $\epsilon_r = 38.834$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.2 °C; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7515; ConvF(7.31, 7.31, 7.31); Calibrated: 2021/12/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1664; Calibrated: 2022/5/30
- Phantom: SAM with CRP v5.0(Front); Type: QD000P40CD; Serial: TP-1671
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch518598/Area Scan (81x101x1): Interpolated grid: $dx=1.200$ mm, $dy=1.200$ mm
Maximum value of SAR (interpolated) = 7.71 W/kg

Ch518598/Zoom Scan (10x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm
Reference Value = 8.781 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 9.30 W/kg
SAR(1 g) = 4.03 W/kg; SAR(10 g) = 1.89 W/kg
Maximum value of SAR (measured) = 7.06 W/kg



103_N77_100M_QPSK_1RB_1Offset_DFT-30_Back_0mm_Ch633332

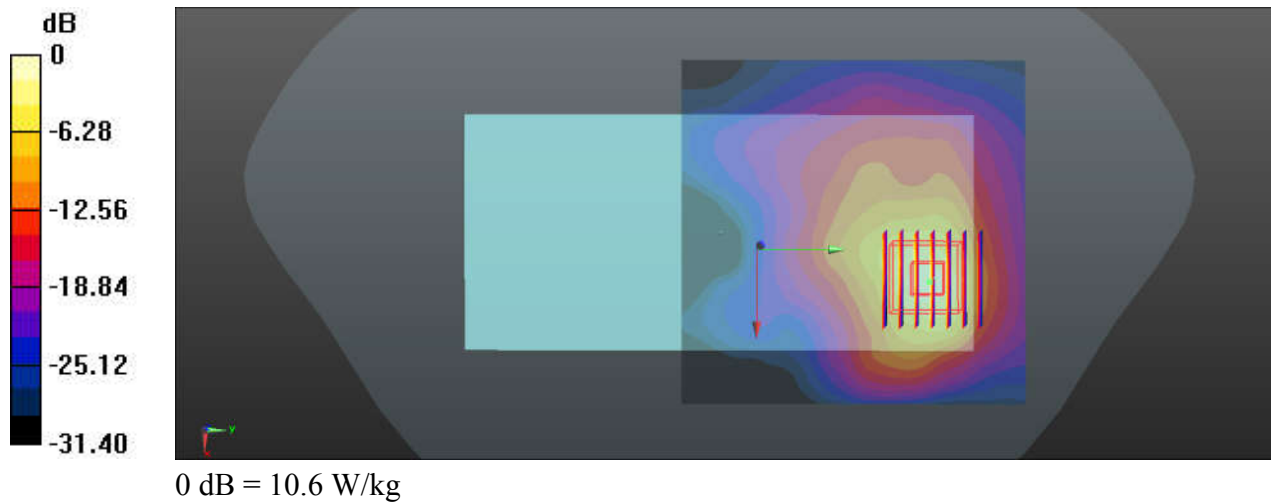
Communication System: UID 0, 5GNR (0); Frequency: 3499.98 MHz; Duty Cycle: 1:1
Medium: HSL_3500_220622 Medium parameters used: $f = 3500$ MHz; $\sigma = 2.999$ S/m; $\epsilon_r = 38.47$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3819; ConvF(6.78, 6.78, 6.78); Calibrated: 2022/5/30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn715; Calibrated: 2021/12/29
- Phantom: SAM (30deg probe tilt) with CRP v4.0; Type: QD000P40CC; Serial: TP: 1500
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch633332/Area Scan (91x91x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 8.30 W/kg

Ch633332/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=1.4mm
Reference Value = 1.953 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 13.9 W/kg
SAR(1 g) = 4.73 W/kg; SAR(10 g) = 1.75 W/kg
Maximum value of SAR (measured) = 10.6 W/kg



104_WLAN5GHz_802.11n-HT40 MCS0_Top Side_0mm_Ch54

Communication System: UID 0, WIFI (0); Frequency: 5270 MHz; Duty Cycle: 1:1.005
Medium: HSL_5250_220620 Medium parameters used: $f = 5270$ MHz; $\sigma = 4.804$ S/m; $\epsilon_r = 36.801$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7515; ConvF(5.46, 5.46, 5.46); Calibrated: 2021/12/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1664; Calibrated: 2022/5/30
- Phantom: SAM with CRP v5.0(Front); Type: QD000P40CD; Serial: TP-1671
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch54/Area Scan (61x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 14.6 W/kg

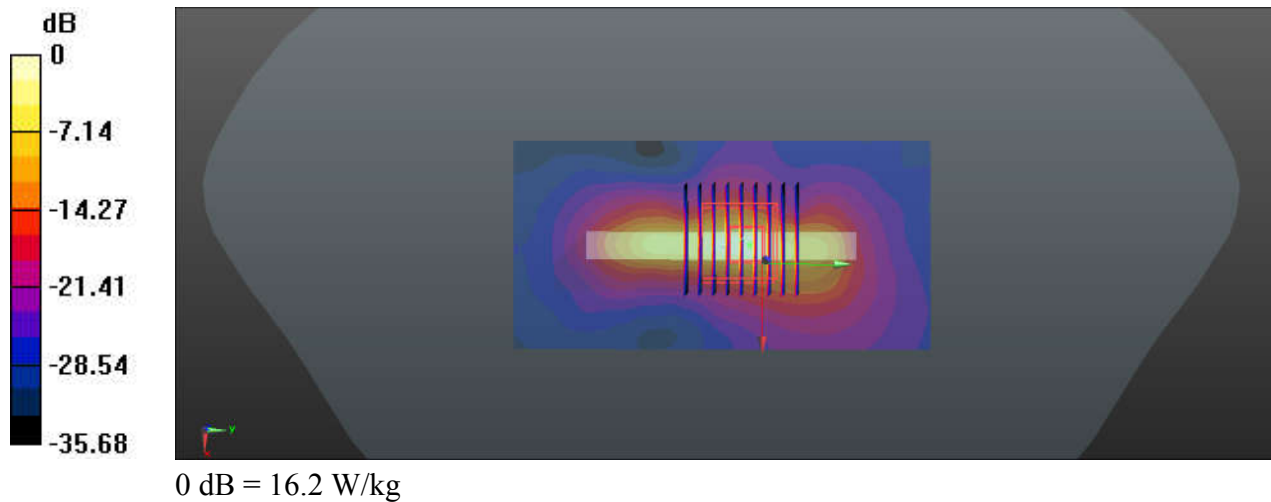
Ch54/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 1.799 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 42.5 W/kg

SAR(1 g) = 4.9 W/kg; SAR(10 g) = 1.12 W/kg

Maximum value of SAR (measured) = 16.2 W/kg



105_WLAN5GHz_802.11ac-VHT80 MCS0_Top Side_0mm_Ch122

Communication System: UID 0, WIFI (0); Frequency: 5610 MHz; Duty Cycle: 1:1.009
Medium: HSL_5600_220621 Medium parameters used: $f = 5610$ MHz; $\sigma = 5.193$ S/m; $\epsilon_r = 36.104$;
 $\rho = 1000$ kg/m³
Ambient Temperature : 23.2 °C; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN7515; ConvF(4.89, 4.89, 4.89); Calibrated: 2021/12/28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1664; Calibrated: 2022/5/30
- Phantom: SAM with CRP v5.0(Front); Type: QD000P40CD; Serial: TP-1671
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch122/Area Scan (61x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 19.5 W/kg

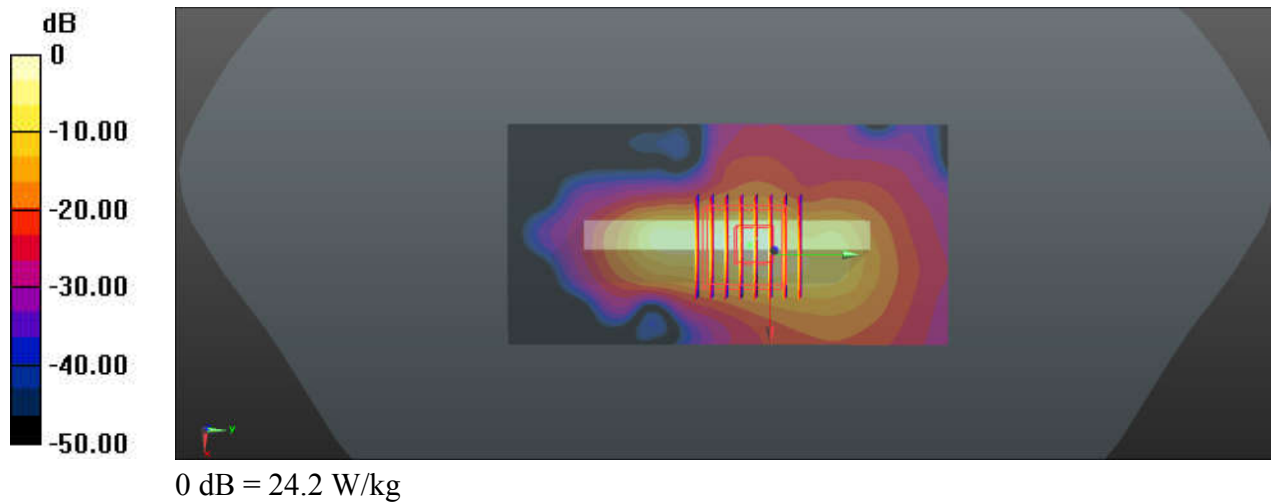
Ch122/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 57.44 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 69.0 W/kg

SAR(1 g) = 6.71 W/kg; SAR(10 g) = 1.57 W/kg

Maximum value of SAR (measured) = 24.2 W/kg





Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.



In Collaboration with
s p e a g
CALIBRATION LABORATORY



中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Add: No.52 HuanYuanBei Road, Haidian District, Beijing, 100191, CI
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Client

Sporton

Certificate No: Z21-60550

CALIBRATION CERTIFICATE

Object

D750V3 - SN: 1099

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

December 15, 2021

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7307	26-May-21(SPEAG,No.EX3-7307_May21)	May-22
DAE4	SN 1556	15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Jan-22
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-21 (CTTL, No.J21X00593)	Jan-22
NetworkAnalyzer E5071C	MY46110673	14-Jan-21 (CTTL, No.J21X00232)	Jan-22

Calibrated by:

Name

Function

Signature

Zhao Jing

SAR Test Engineer

Reviewed by:

Lin Hao

SAR Test Engineer

Approved by:

Qi Dianyuan

SAR Project Leader

Issued: December 24, 2021

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



Add: No.52 HuanYuanBei 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

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:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for 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
- 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
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



Add: No.52 HuanYuanBei 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

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	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	42.0	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.1 $\pm$ 6 %	0.90 mho/m $\pm$ 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	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.54 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.65 W/kg $\pm$ 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	$55.0\Omega + 0.78j\Omega$
Return Loss	- 26.4dB

General Antenna Parameters and Design

Electrical Delay (one direction)	0.942 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: 2021-12-15

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1099

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 750$ MHz; $\sigma = 0.904$ S/m; $\epsilon_r = 41.1$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(10.31, 10.31, 10.31) @ 750 MHz; Calibrated: 2021-05-26
- 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
- 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 = 56.18 V/m; Power Drift = -0.01 dB

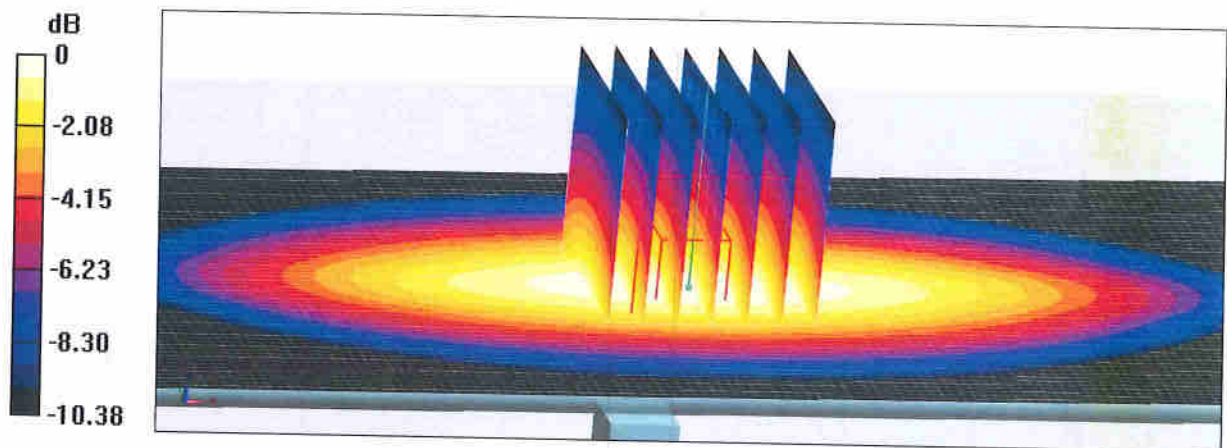
Peak SAR (extrapolated) = 3.25 W/kg

SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.43 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 = 66.5%

Maximum value of SAR (measured) = 2.89 W/kg



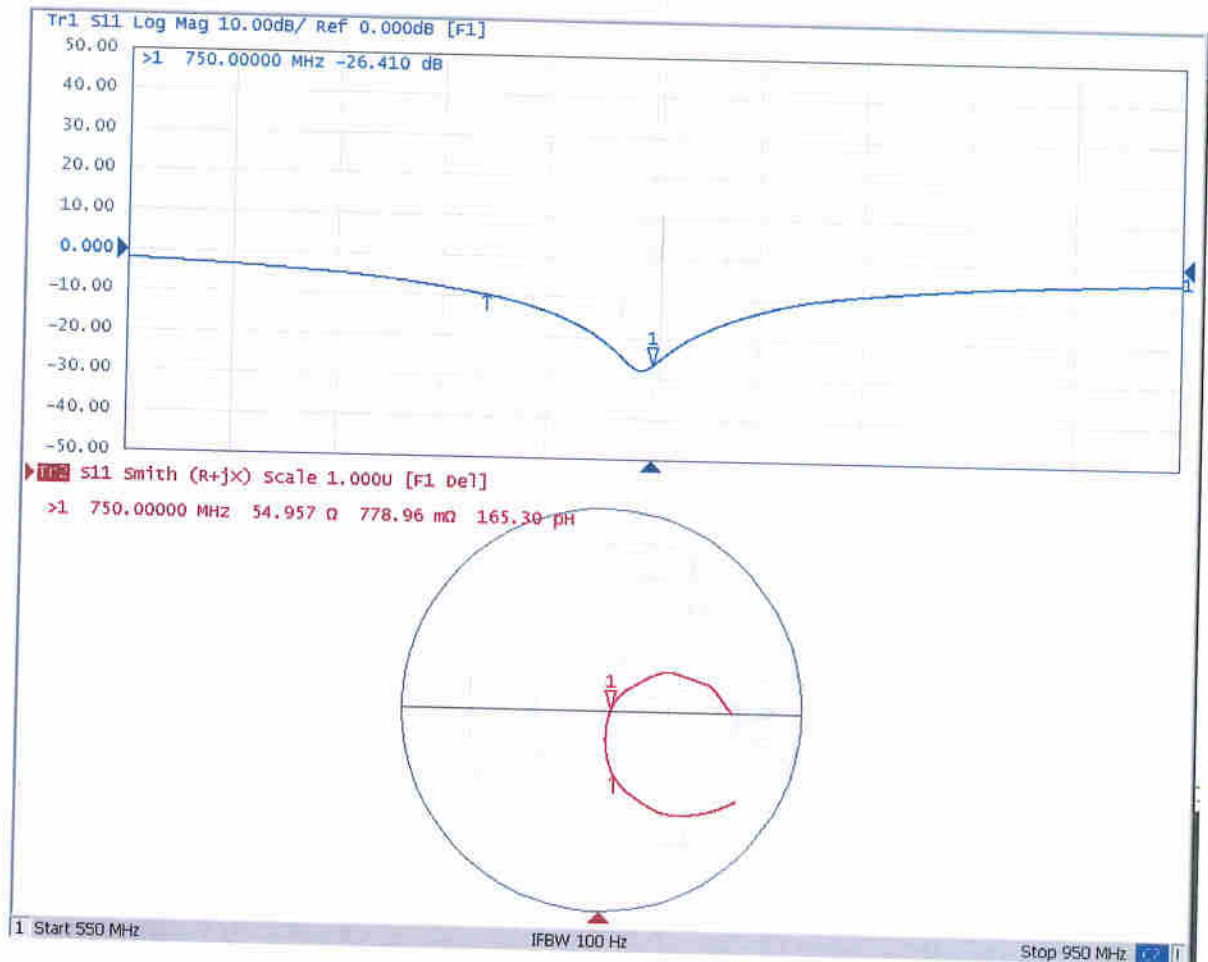
0 dB = 2.89 W/kg = 4.61 dBW/kg



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Impedance Measurement Plot for Head TSL





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Client

Sporton

Certificate No: Z21-60551

CALIBRATION CERTIFICATE

Object

D835V2 - SN: 4d162

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

December 17, 2021

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 $(22\pm3)^{\circ}\text{C}$ and humidity $<70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7307	26-May-21(SPEAG,No.EX3-7307_May21)	May-22
DAE4	SN 1556	15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Jan-22
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-21 (CTTL, No.J21X00593)	Jan-22
NetworkAnalyzer E5071C	MY46110673	14-Jan-21 (CTTL, No.J21X00232)	Jan-22

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

Issued: December 24, 2021

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Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for 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
- 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
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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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	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.8 $\pm$ 6 %	0.91 mho/m $\pm$ 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	2.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.64 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.26 W/kg $\pm$ 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- 2.20jΩ
Return Loss	- 27.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.346 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: 2021-12-17

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d162

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.91 \text{ S/m}$; $\epsilon_r = 40.77$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(10.13, 10.13, 10.13) @ 835 MHz; Calibrated: 2021-05-26
- 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
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

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

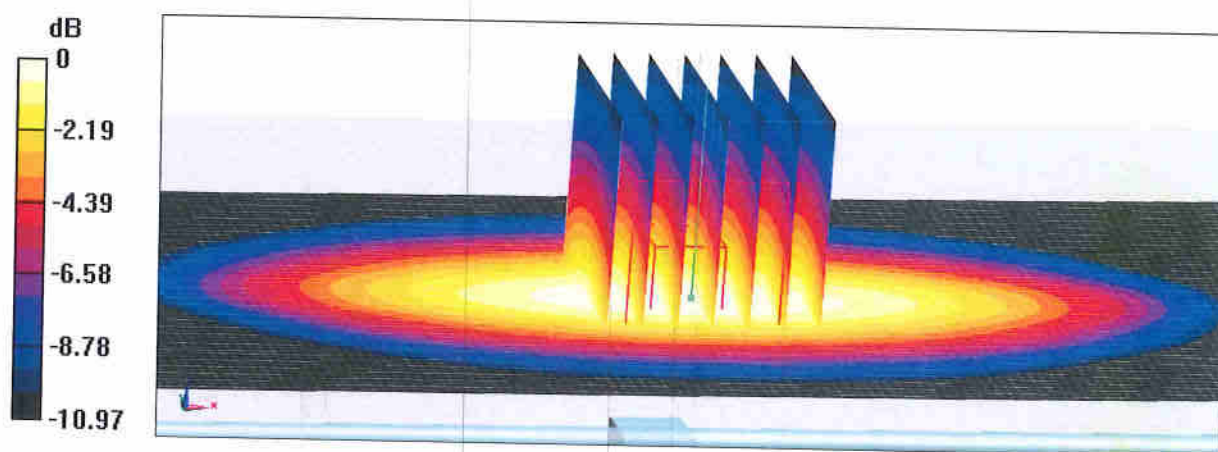
Peak SAR (extrapolated) = 3.70 W/kg

SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.58 W/kg

Smallest distance from peaks to all points 3 dB below = 20.5 mm

Ratio of SAR at M2 to SAR at M1 = 65.7%

Maximum value of SAR (measured) = 3.28 W/kg



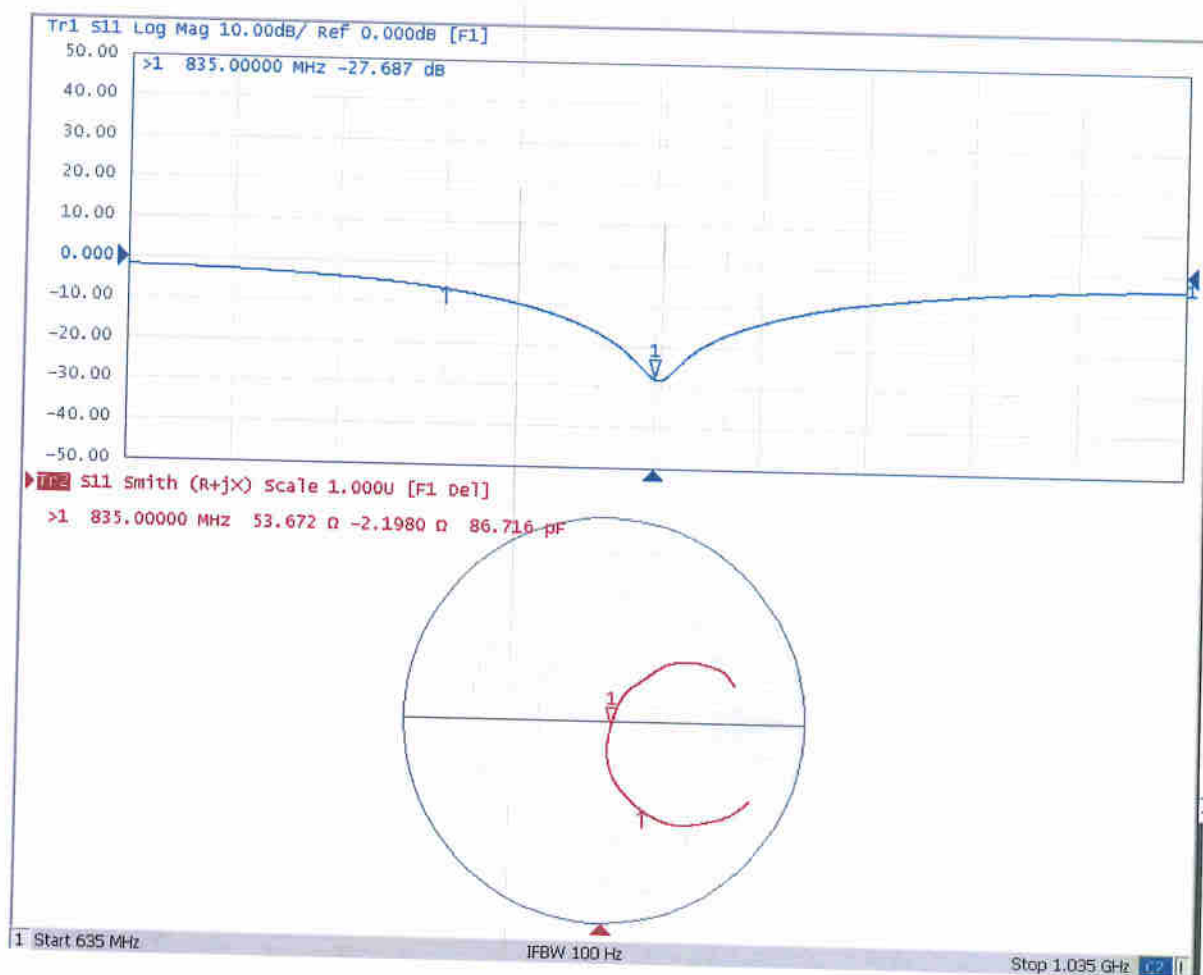
0 dB = 3.28 W/kg = 5.16 dBW/kg



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Impedance Measurement Plot for Head TSL





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Client **sporton**

Certificate No: **Z21-60374**

CALIBRATION CERTIFICATE

Object **D1750V2 - SN: 1137**

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

Calibration date: **October 19, 2021**

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 $(22\pm3)^{\circ}\text{C}$ and humidity $<70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7517	03-Feb-21(CTTL-SPEAG,No.Z21-60001)	Feb-22
DAE4	SN 1556	15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Jan-22
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-21 (CTTL, No.J21X00593)	Jan-22
NetworkAnalyzer E5071C	MY46110673	14-Jan-21 (CTTL, No.J21X00232)	Jan-22

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

Issued: October 24 2021

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Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for 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
- 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
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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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	1750 MHz $\pm$ 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 $\pm$ 0.2) °C	39.8 $\pm$ 6 %	1.38 mho/m $\pm$ 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	9.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.5 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.83 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.2 W/kg $\pm$ 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	51.8Ω+ 0.34jΩ
Return Loss	- 34.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.123 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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DASY5 Validation Report for Head TSL

Date: 10.19.2021

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1137

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.382$ S/m; $\epsilon_r = 39.76$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7517; ConvF(8.22, 8.22, 8.22) @ 1750 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:

$dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 97.97 V/m; Power Drift = -0.01 dB

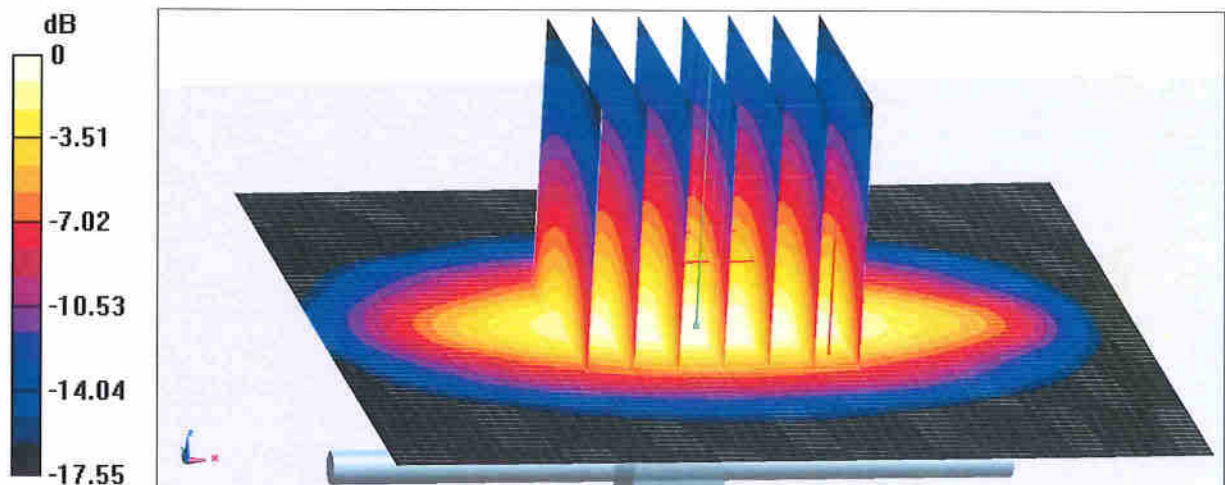
Peak SAR (extrapolated) = 17.3 W/kg

SAR(1 g) = 9.2 W/kg; SAR(10 g) = 4.83 W/kg

Smallest distance from peaks to all points 3 dB below = 10 mm

Ratio of SAR at M2 to SAR at M1 = 53.1%

Maximum value of SAR (measured) = 14.3 W/kg



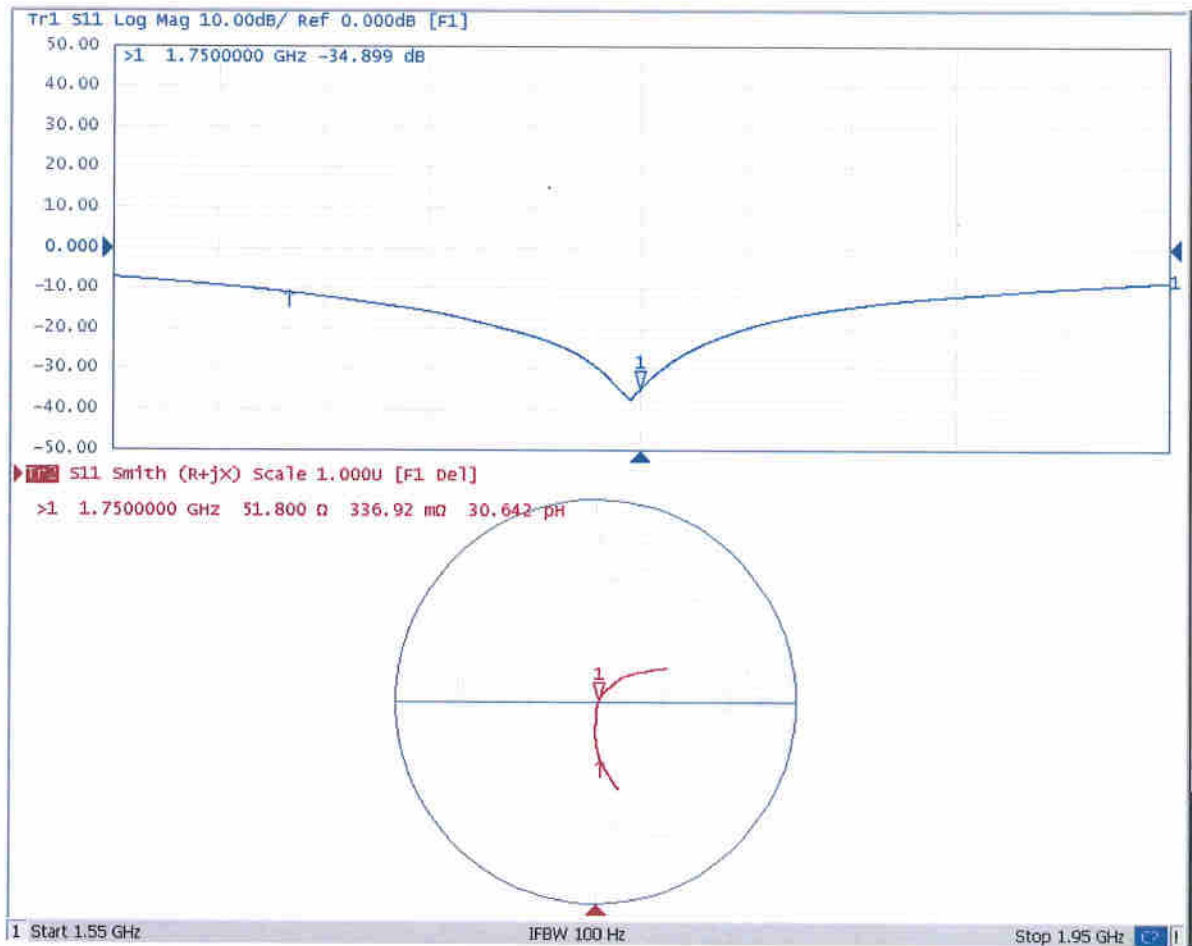
0 dB = 14.3 W/kg = 11.55 dBW/kg



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Impedance Measurement Plot for Head TSL





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Client

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Certificate No: **Z21-60553**

CALIBRATION CERTIFICATE

Object

D1900V2 - SN: 5d182

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

December 20, 2021

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 $(22\pm3)^{\circ}\text{C}$ and humidity $<70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7307	26-May-21(SPEAG,No.EX3-7307_May21)	May-22
DAE4	SN 1556	15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Jan-22
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-21 (CTTL, No.J21X00593)	Jan-22
NetworkAnalyzer E5071C	MY46110673	14-Jan-21 (CTTL, No.J21X00232)	Jan-22

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

Issued: December 27, 2021

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lossary:

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:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for 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
- 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
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
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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 $\pm$ 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 $\pm$ 0.2) °C	39.4 $\pm$ 6 %	1.41 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.6 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.2 W/kg $\pm$ 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	54.3Ω+ 6.57jΩ
Return Loss	- 22.5dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.112 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: 2021-12-20

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d182

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.414$ S/m; $\epsilon_r = 39.36$; $\rho = 1000$ kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(8.32, 8.32, 8.32) @ 1900 MHz; Calibrated: 2021-05-26
- 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
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 101.3 V/m; Power Drift = -0.01 dB

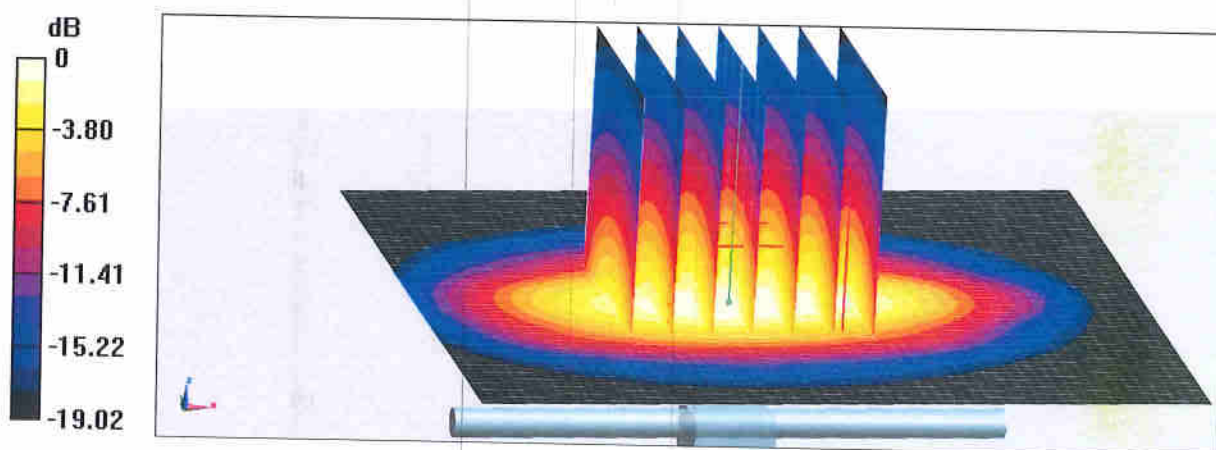
Peak SAR (extrapolated) = 19.6 W/kg

SAR(1 g) = 10 W/kg; SAR(10 g) = 5.07 W/kg

Smallest distance from peaks to all points 3 dB below = 10 mm

Ratio of SAR at M2 to SAR at M1 = 51%

Maximum value of SAR (measured) = 15.9 W/kg



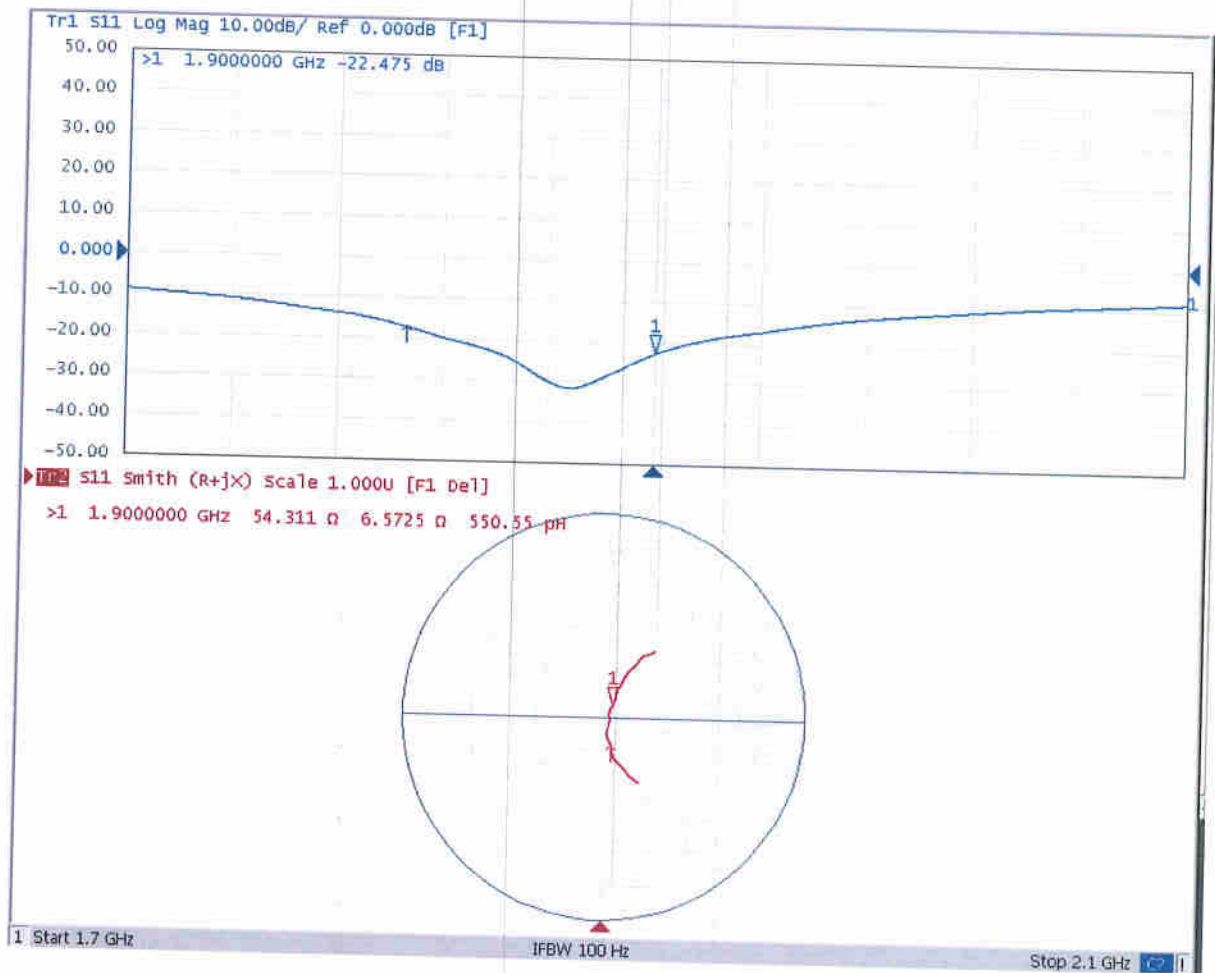
0 dB = 15.9 W/kg = 12.01 dBW/kg



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Impedance Measurement Plot for Head TSL





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Client **sporton**

Certificate No: **Z21-60376**

CALIBRATION CERTIFICATE

Object **D2300V2 - SN: 1056**

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

Calibration date: **October 20, 2021**

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 $(22\pm3)^{\circ}\text{C}$ and humidity $<70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7517	03-Feb-21(CTTL-SPEAG,No.Z21-60001)	Feb-22
DAE4	SN 1556	15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Jan-22
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-21 (CTTL, No.J21X00593)	Jan-22
NetworkAnalyzer E5071C	MY46110673	14-Jan-21 (CTTL, No.J21X00232)	Jan-22

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

Issued: October 27 2021

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Fax: +86-10-62304633-2504

E-mail: cttl@chinattl.com

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Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for 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
- 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
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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	2300 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.5	1.67 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.2 $\pm$ 6 %	1.66 mho/m $\pm$ 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	12.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	48.8 W/kg $\pm$ 18.8 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.71 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.8 W/kg $\pm$ 18.7 % (k=2)



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E-mail: cttl@chinattl.com

http://www.chinattl.cn

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.3Ω- 4.07jΩ
Return Loss	- 27.0dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.076 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: 10.20.2021

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN: 1056

Communication System: UID 0, CW; Frequency: 2300 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2300$ MHz; $\sigma = 1.662$ S/m; $\epsilon_r = 39.17$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7517; ConvF(7.58, 7.58, 7.58) @ 2300 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)

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

Reference Value = 106.3 V/m; Power Drift = -0.01 dB

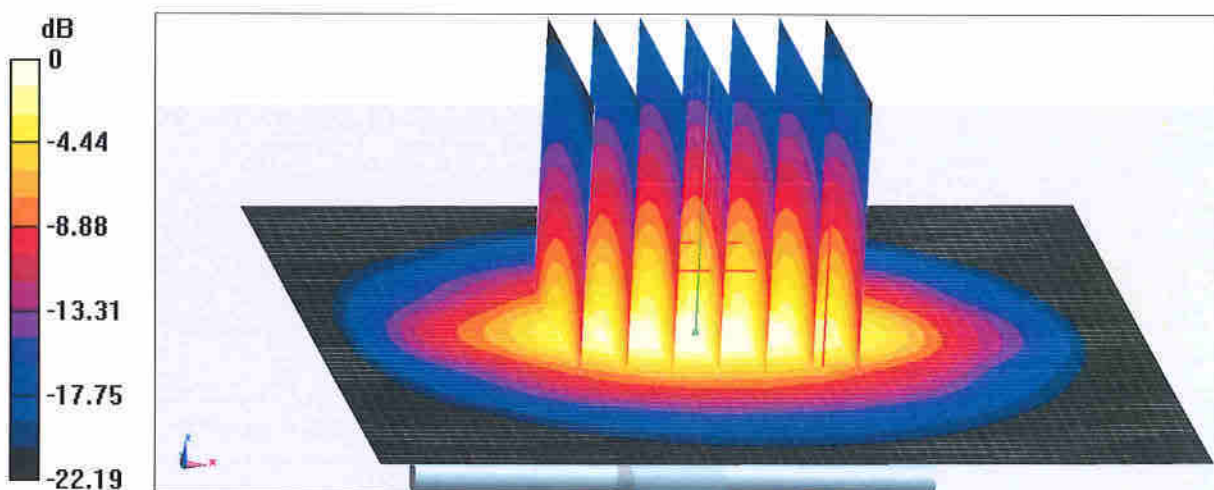
Peak SAR (extrapolated) = 25.2 W/kg

SAR(1 g) = 12.2 W/kg; SAR(10 g) = 5.71 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 48.3%

Maximum value of SAR (measured) = 20.4 W/kg



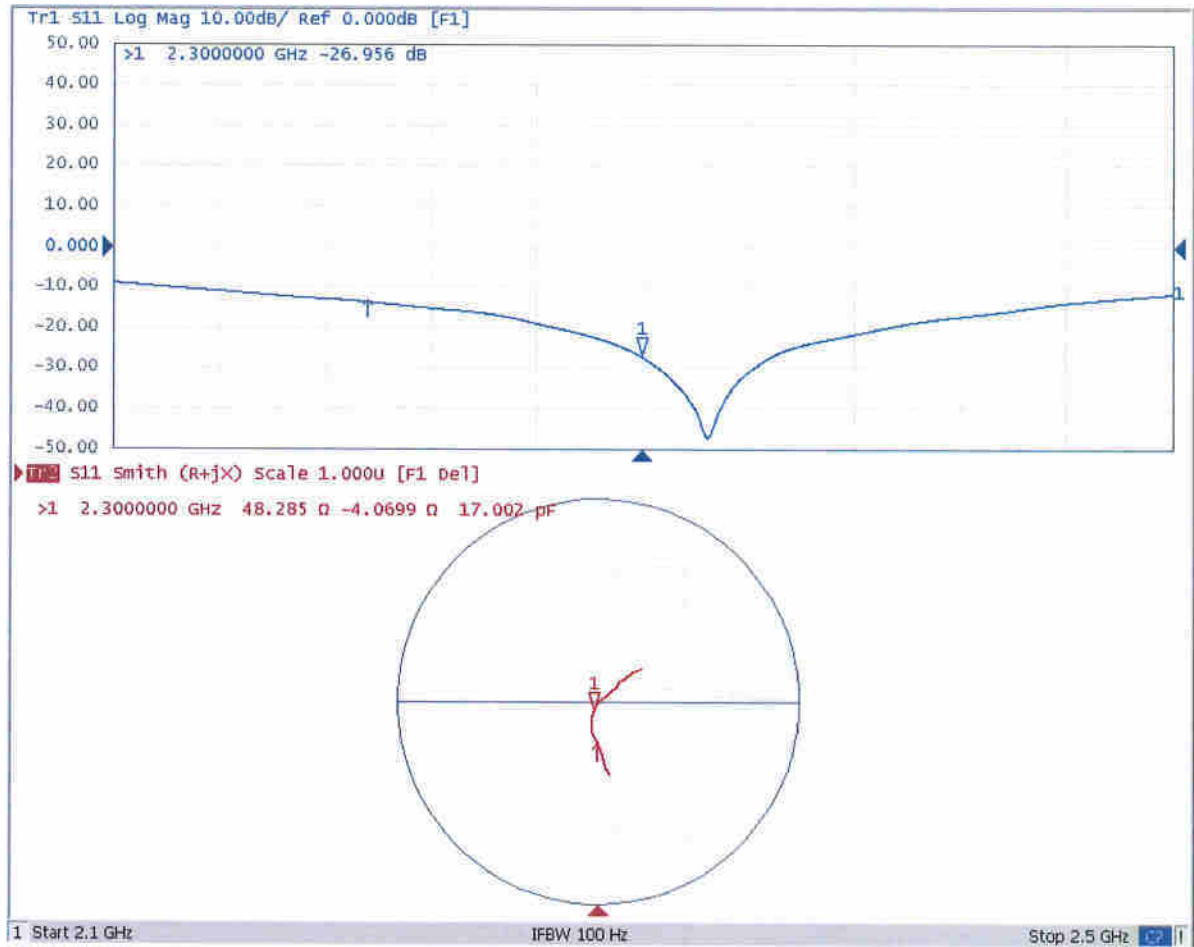
0 dB = 20.4 W/kg = 13.10 dBW/kg



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Impedance Measurement Plot for Head TSL





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton**

Certificate No: **D2450V2-924_Sep20**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN:924**

Calibration procedure(s) **QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **September 02, 2020**

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 $(22 \pm 3)^{\circ}\text{C}$ 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	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Type-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
Reference Probe EX3DV4	SN: 7349	29-Jun-20 (No. EX3-7349_Jun20)	Jun-21
DAE4	SN: 601	27-Dec-19 (No. DAE4-601_Dec19)	Dec-20

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

Calibrated by: **Jeffrey Katzman** **Jeffrey Katzman** **Laboratory Technician**

Approved by: **Katja Pokovic** **Katja Pokovic** **Technical Manager**

Signature

Issued: September 2, 2020

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Accreditation No.: **SCS 0108**

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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:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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	$dx, dy, dz = 5 \text{ mm}$	
Frequency	$2450 \text{ MHz} \pm 1 \text{ MHz}$	

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	$(22.0 \pm 0.2) \text{ °C}$	$38.9 \pm 6 \%$	$1.84 \text{ mho/m} \pm 6 \%$
Head TSL temperature change during test	$< 0.5 \text{ °C}$	---	---

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	$51.4 \text{ W/kg} \pm 17.0 \%$ (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	$24.0 \text{ W/kg} \pm 16.5 \%$ (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.9 Ω + 7.2 j Ω
Return Loss	-22.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.155 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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Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:924

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.84$ S/m; $\epsilon_r = 38.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.74, 7.74, 7.74) @ 2450 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- 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 = 115.2 V/m; Power Drift = -0.05 dB

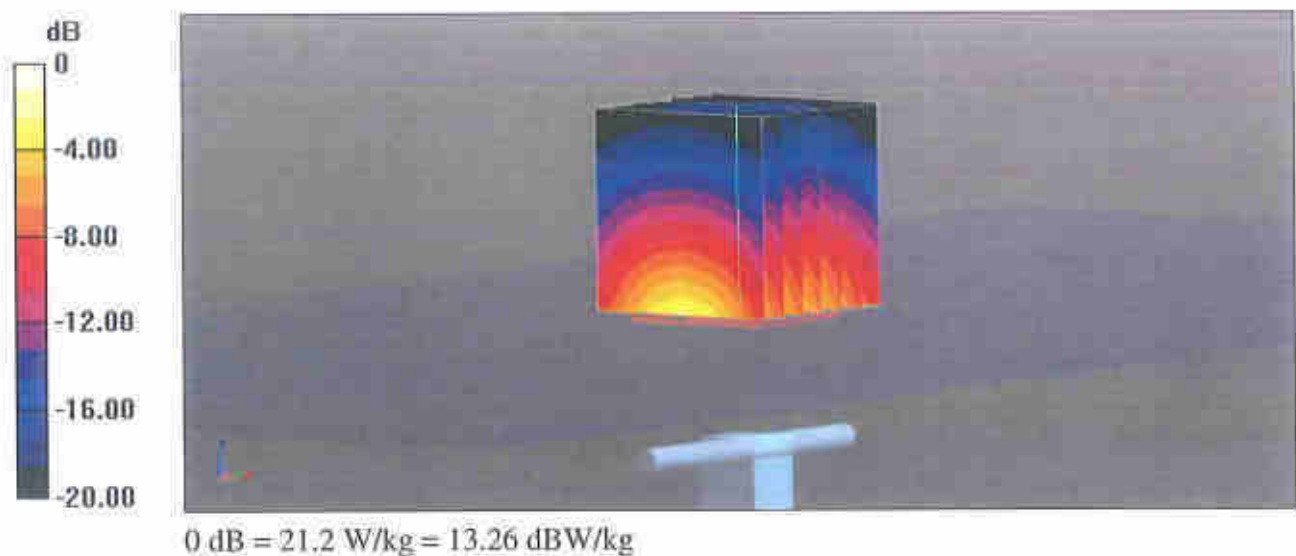
Peak SAR (extrapolated) = 25.4 W/kg

SAR(1 g) = 13.0 W/kg; SAR(10 g) = 6.04 W/kg

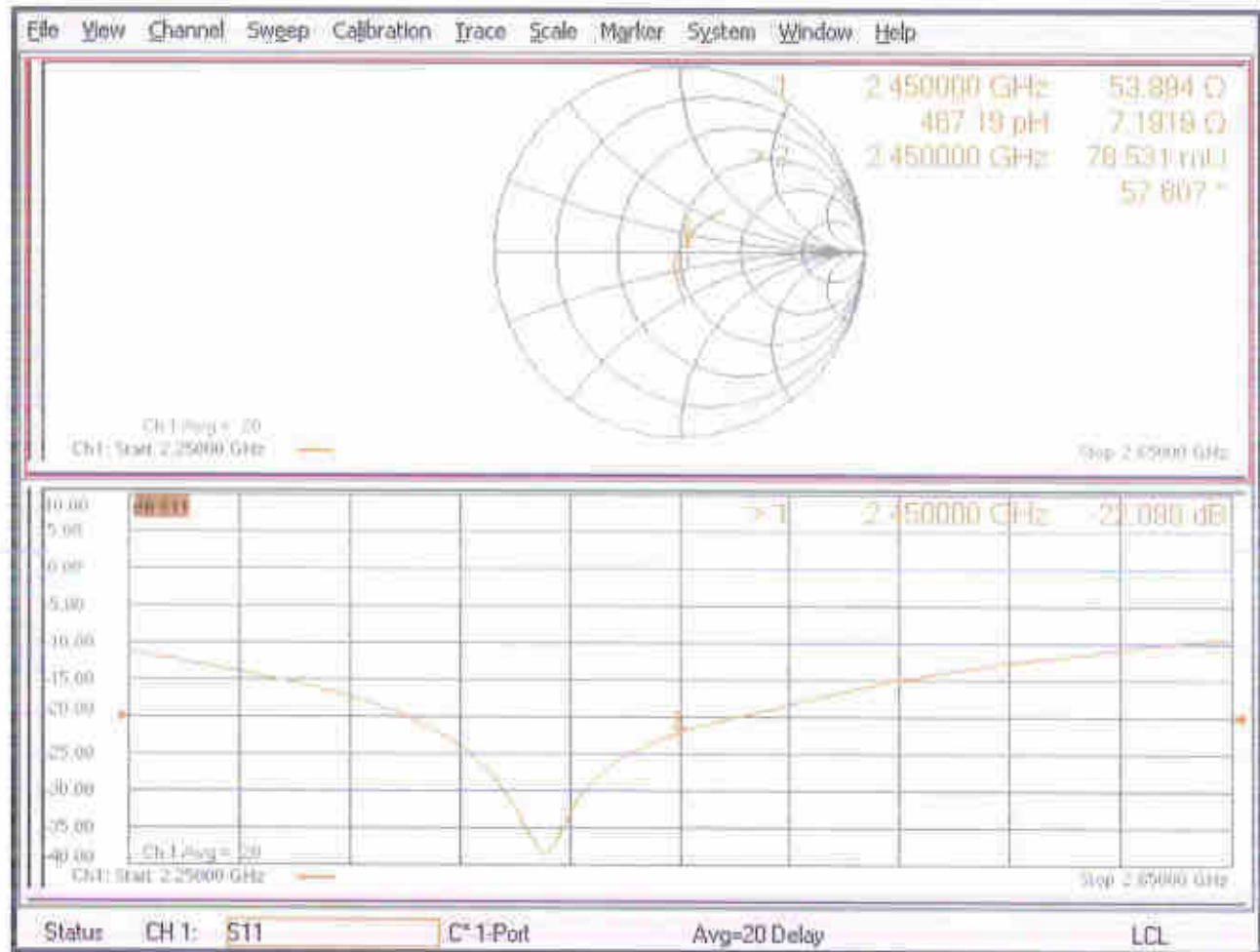
Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 51%

Maximum value of SAR (measured) = 21.2 W/kg



Impedance Measurement Plot for Head TSL



D2450V2, Serial No. 924 Extended Dipole Calibrations

Referring to KDB 865664 D01, if dipoles are verified in return loss ($< -20\text{dB}$, 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.

D2450V2 – serial no. 924												
	2450 Head											
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)						
2020.9.2	-22.1		53.9		7.2							
2021.9.1	-22.1	0.0	51.2	2.7	7.4	-0.2						

<Justification of the extended calibration>

The return loss is $< -20\text{dB}$, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.