



No.I22N01723-SAR



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
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Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 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

The following parameters and calculations were applied.

	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^3 (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^3 (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

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.62 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.9 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.18 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.7 W/kg ± 24.2 % (k=2)



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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 ³ (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	$48.8\Omega - 4.65j\Omega$
Return Loss	- 26.2dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	$49.2\Omega + 0.58j\Omega$
Return Loss	- 40.0dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	$50.3\Omega + 1.08j\Omega$
Return Loss	- 39.0dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	$48.8\Omega - 2.02j\Omega$
Return Loss	- 32.5dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	$51.3\Omega + 3.94j\Omega$
Return Loss	- 27.8dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	$52.2\Omega + 4.77j\Omega$
Return Loss	- 25.8dB



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General Antenna Parameters and Design

Electrical Delay (one direction)	1.059 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
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DASY5 Validation Report for Head TSL

Date: 08.28.2019

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

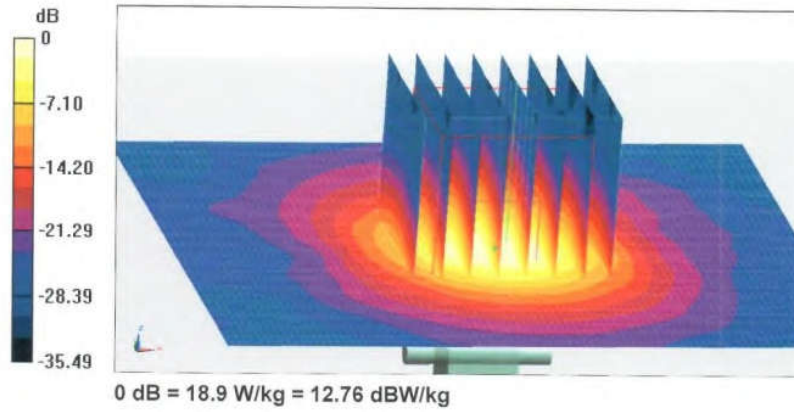
Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 68.55 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 36.5 W/kg
SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.23 W/kg
Maximum value of SAR (measured) = 18.9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



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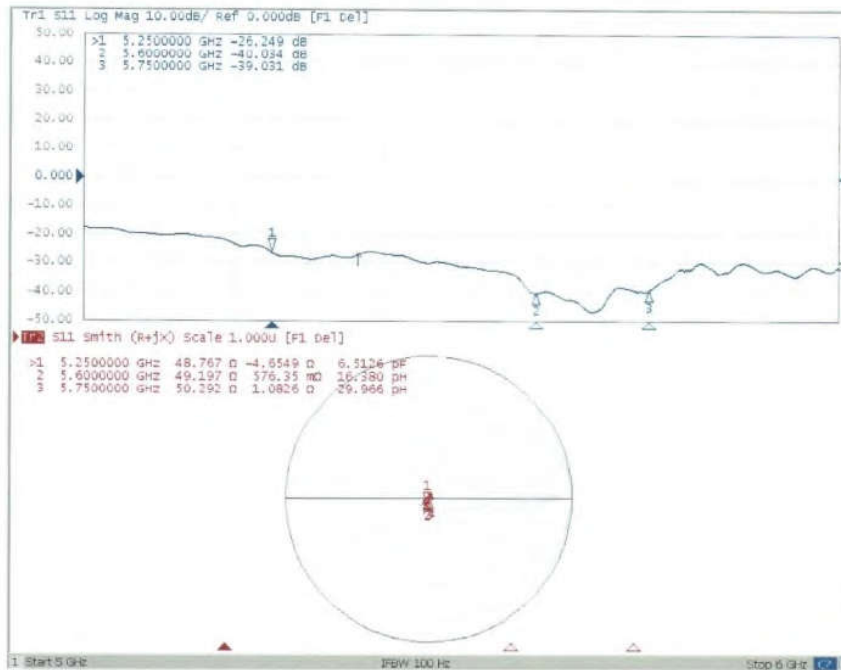


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Impedance Measurement Plot for Head TSL



Certificate No: Z19-60293

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DASY5 Validation Report for Body TSL

Date: 08.29.2019

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; $\sigma = 5.402$ 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

Certificate No: Z19-60293

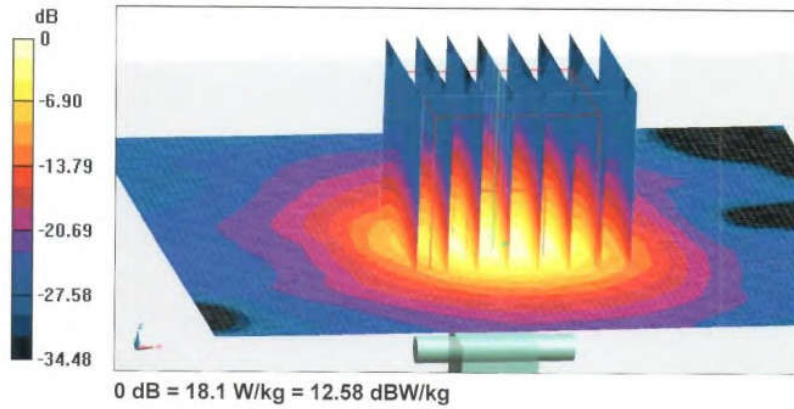
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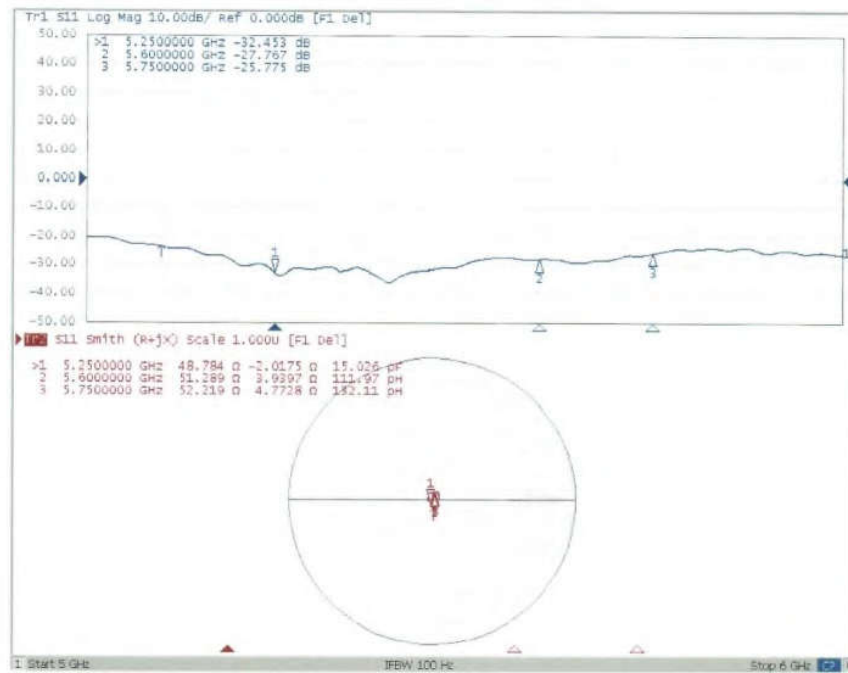


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Impedance Measurement Plot for Body TSL



ANNEX J: Extended Calibration SAR Dipole

Referring to KDB865664 D01, if dipoles are verified in return loss ($<-20\text{dBm}$, 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

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 $<-20\text{dB}$, 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-1413 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
UT03aa	355400570293046	V01	00WW_0_010	2022-08-25

K.2. Measurement results

WLAN 2.4GHz Head SAR Values

Frequency		Test Position		Conducted Power (dBm)	Max. tune-up Power (dBm)	SAR(1g) (W/kg)		
Ch.	MHz					Spot check data		Original data
						Measured SAR	Reported SAR	
1	2412.0	Head	Left Cheek	15.67	16.0	0.219	0.24	0.27

LTE Band 2 Body SAR Values

Frequency		Test Position		Conducted Power (dBm)	Max. tune-up Power (dBm)	SAR(1g) (W/kg)		
Ch.	MHz					Spot check data		Original data
						Measured SAR	Reported SAR	
18900	1880.0	Body	Bottom	23.30	24.0	0.655	0.77	1.17

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/m³

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) = 0.298 W/kg

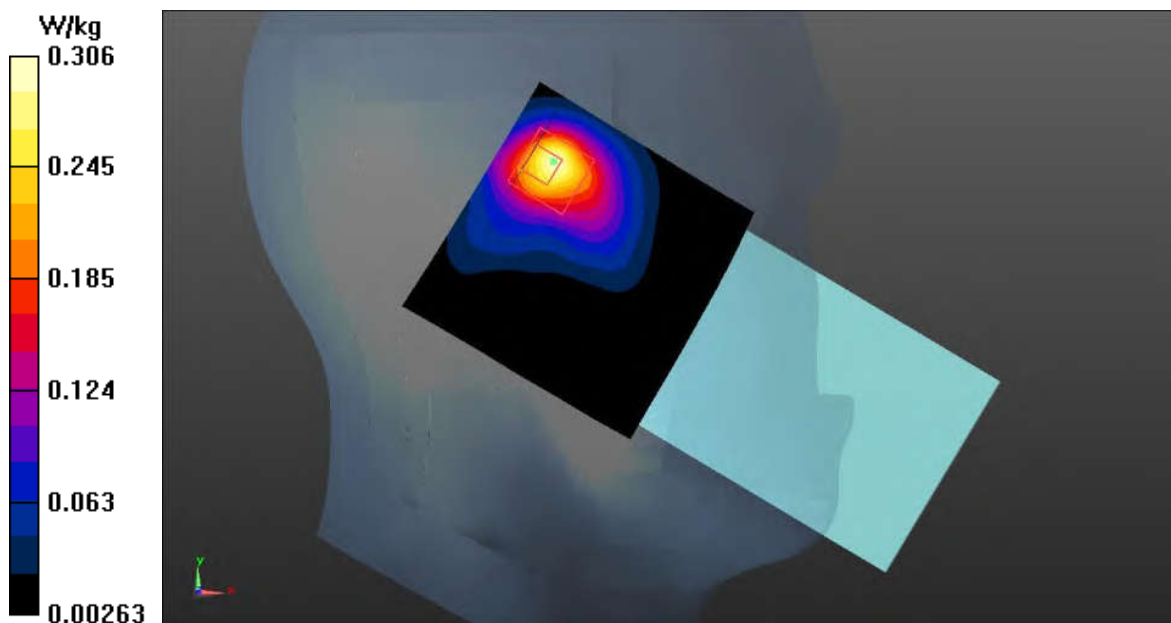
Left Cheek Ch.1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 6.461 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.470 W/kg

SAR(1 g) = 0.219 W/kg; SAR(10 g) = 0.113 W/kg

Maximum value of SAR (measured) = 0.306 W/kg



LTE Band 2 Body

Date: 2022-9-20

Electronics: DAE4 Sn1527

Medium: Head 1900MHz

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.398$ S/m; $\epsilon_r = 38.72$; $\rho = 1000$ kg/m³

Communication System: UID 0, LTE_FDD (0) Frequency: 1880 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7683 ConvF (8.33, 8.33, 8.33)

Bottom Side Middle 1RB99/Area Scan (41x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.835 W/kg

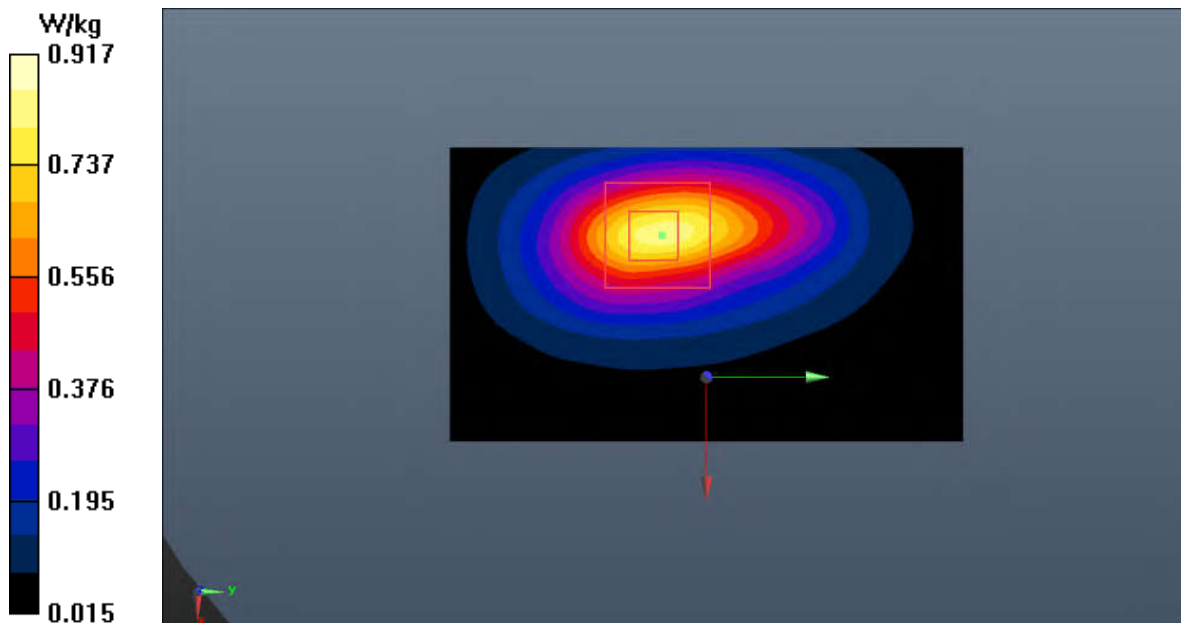
Bottom Side Middle 1RB99/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.23 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.13 W/kg

SAR(1 g) = 0.655 W/kg; SAR(10 g) = 0.349 W/kg

Maximum value of SAR (measured) = 0.917 W/kg



K.4. System Verification Results for Spot Check

1900MHz

Date: 2022-9-20

Electronics: DAE4 Sn1527

Medium: Head 1900MHz

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.416 \text{ S/m}$; $\epsilon_r = 38.642$; $\rho = 1000 \text{ kg/m}^3$

Communication System: CW_TMC Frequency: 1900 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7683 ConvF (8.33, 8.33, 8.33)

System Validation/Area Scan (91x91x1): Interpolated grid: $dx=1.000 \text{ mm}$, $dy=1.000 \text{ mm}$

Reference Value = 84.564 V/m; Power Drift = 0.12 dB

SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.16 W/kg

Maximum value of SAR (interpolated) = 12.3 W/kg

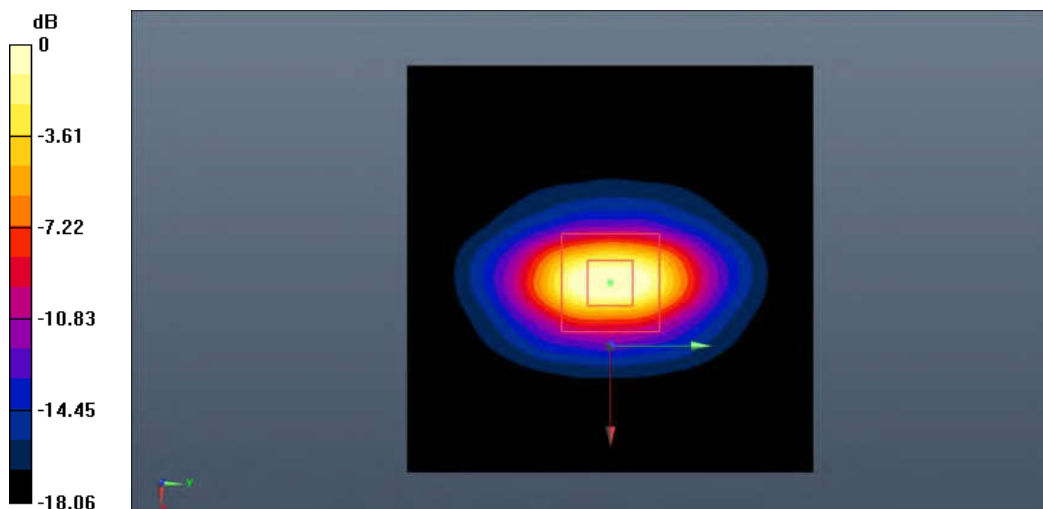
System Validation/Zoom Scan (7x7x7)/Cube0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 84.564 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 28.1 W/kg

SAR(1 g) = 10.5 W/kg; SAR(10 g) = 5.28 W/kg

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



0 dB = 12.6 W/kg = 11.00 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/m³

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

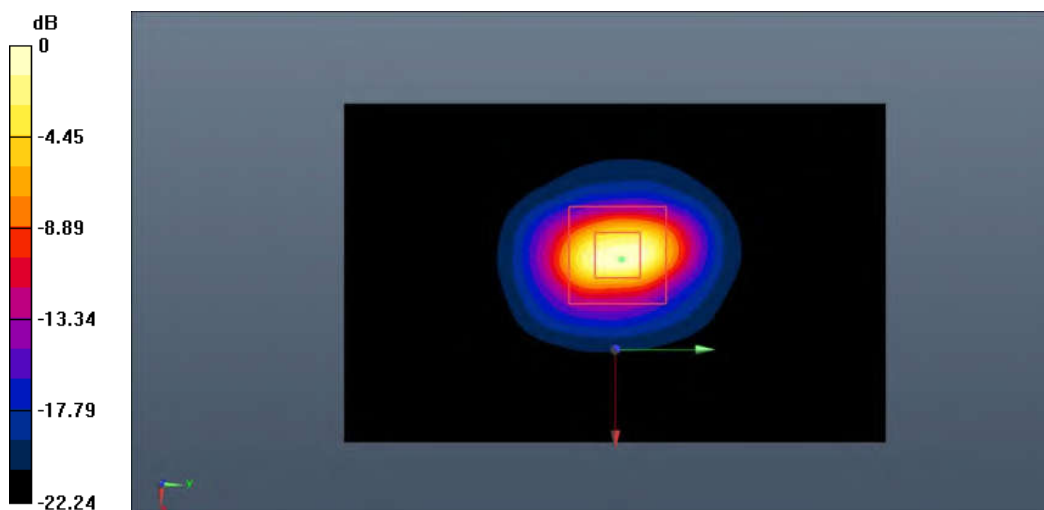
System Validation/Zoom Scan (7x7x7)/Cube0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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*****