

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.7 ± 6 %	6.29 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.42 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	73.9 W/kg ± 19.9 % (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 ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with Head TSL at 5200 MHz**

Impedance, transformed to feed point	48.8 Ω - 6.5 j Ω
Return Loss	- 23.6 dB

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	48.0 Ω - 4.6 j Ω
Return Loss	- 25.7 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	47.2 Ω - 3.5 j Ω
Return Loss	- 26.7 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	49.8 Ω - 3.6 j Ω
Return Loss	- 28.8 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.4 Ω + 0.4 j Ω
Return Loss	- 27.5 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	52.1 Ω - 1.3 j Ω
Return Loss	- 32.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	51.2 Ω - 3.1 j Ω
Return Loss	- 29.6 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	48.4 Ω - 5.5 j Ω
Return Loss	- 24.6 dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	47.2 Ω - 3.2 j Ω
Return Loss	- 27.1 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	47.0 Ω - 2.0 j Ω
Return Loss	- 28.5 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	50.6 Ω - 2.4 j Ω
Return Loss	- 32.3 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	$54.5 \Omega + 0.4 j\Omega$
Return Loss	- 27.3 dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	$52.5 \Omega - 0.8 j\Omega$
Return Loss	- 32.0 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	$52.1 \Omega - 2.4 j\Omega$
Return Loss	- 30.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.200 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: 20.07.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1060

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5250 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz, Frequency: 5800 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.47$ S/m; $\epsilon_r = 35.4$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.52$ S/m; $\epsilon_r = 35.4$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5300$ MHz; $\sigma = 4.57$ S/m; $\epsilon_r = 35.3$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5500$ MHz; $\sigma = 4.77$ S/m; $\epsilon_r = 35$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5600$ MHz; $\sigma = 4.88$ S/m; $\epsilon_r = 34.9$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5750$ MHz; $\sigma = 5.03$ S/m; $\epsilon_r = 34.7$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5800$ MHz; $\sigma = 5.09$ S/m; $\epsilon_r = 34.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.8, 5.8, 5.8) @ 5200 MHz, ConvF(5.5, 5.5, 5.5) @ 5250 MHz, ConvF(5.49, 5.49, 5.49) @ 5300 MHz, ConvF(5.25, 5.25, 5.25) @ 5500 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.08, 5.08, 5.08) @ 5750 MHz, ConvF(5.01, 5.01, 5.01) @ 5800 MHz; Calibrated: 31.12.2019
- 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=100mW, dist=10mm, f=5200 MHz/Zoom Scan,**dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 77.61 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 28.4 W/kg

SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.26 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 68.7%

Maximum value of SAR (measured) = 18.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan,**dist=1.4mm (8x8x7)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 79.07 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 28.2 W/kg

SAR(1 g) = 8.08 W/kg; SAR(10 g) = 2.30 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 69.5%

Maximum value of SAR (measured) = 18.4 W/kg

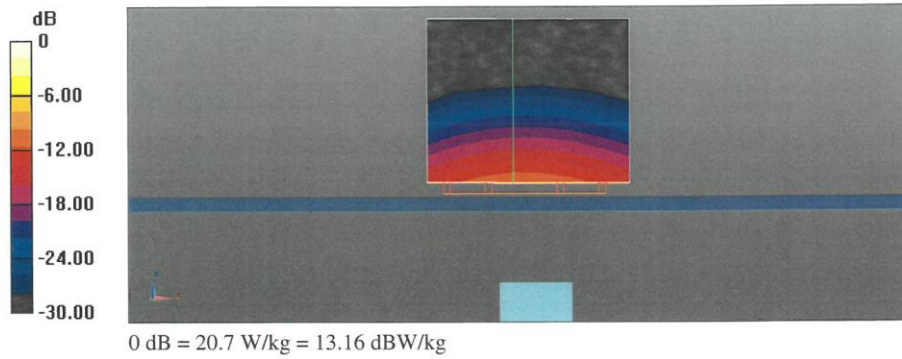
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Reference Value = 78.56 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 29.6 W/kg
SAR(1 g) = 8.22 W/kg; SAR(10 g) = 2.33 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 68.3%
Maximum value of SAR (measured) = 19.0 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 78.44 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 33.9 W/kg
SAR(1 g) = 8.66 W/kg; SAR(10 g) = 2.42 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 65.9%
Maximum value of SAR (measured) = 20.7 W/kg

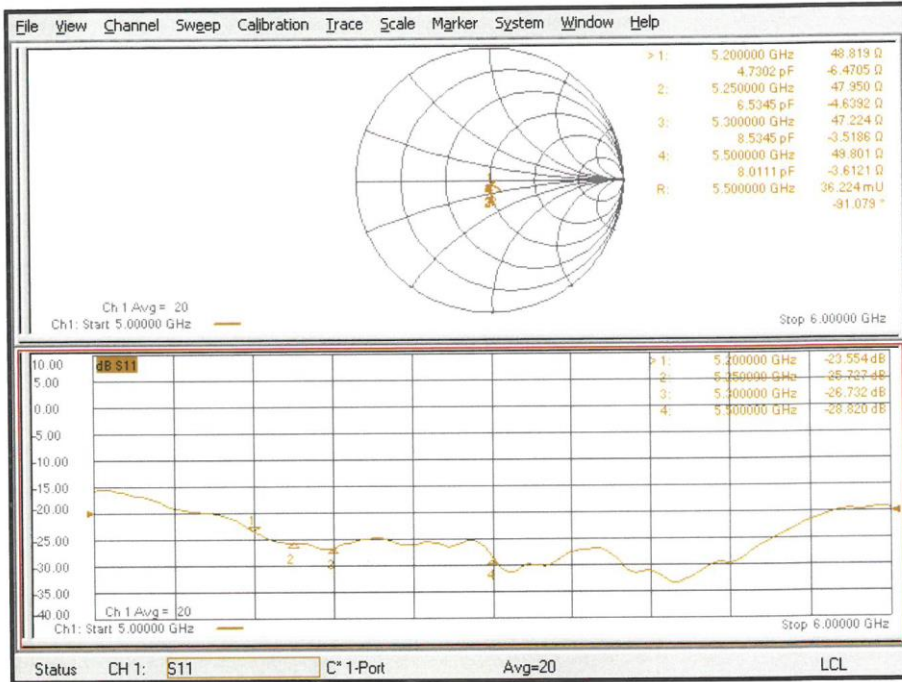
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 78.89 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 31.6 W/kg
SAR(1 g) = 8.37 W/kg; SAR(10 g) = 2.37 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 66.8%
Maximum value of SAR (measured) = 20.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 75.69 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 32.1 W/kg
SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.29 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 65%
Maximum value of SAR (measured) = 19.9 W/kg

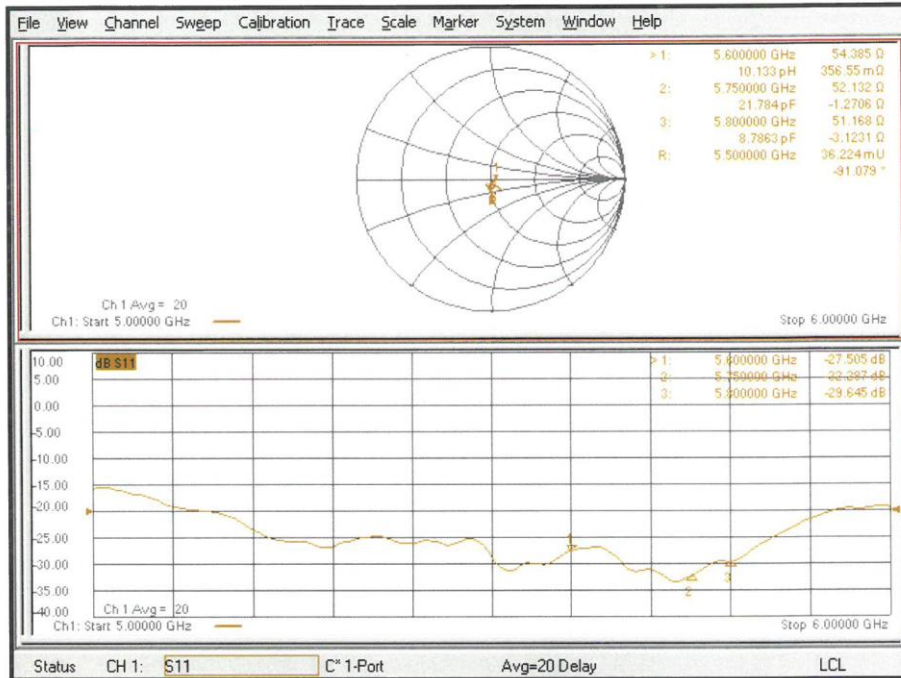
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 75.77 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 32.8 W/kg
SAR(1 g) = 8.16 W/kg; SAR(10 g) = 2.28 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 64.8%
Maximum value of SAR (measured) = 20.1 W/kg



Impedance Measurement Plot for Head TSL (5200, 5250, 5300, 5500 MHz)



Impedance Measurement Plot for Head TSL (5600, 5750, 5800 MHz)



DASY5 Validation Report for Body TSL

Date: 27.07.2020

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1060

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5250 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; $\sigma = 5.46$ S/m; $\epsilon_r = 47.8$; $\rho = 1000$ kg/m³,
Medium parameters used: f = 5250 MHz; $\sigma = 5.53$ S/m; $\epsilon_r = 47.7$; $\rho = 1000$ kg/m³,
Medium parameters used: f = 5300 MHz; $\sigma = 5.6$ S/m; $\epsilon_r = 47.6$; $\rho = 1000$ kg/m³,
Medium parameters used: f = 5500 MHz; $\sigma = 5.87$ S/m; $\epsilon_r = 47.2$; $\rho = 1000$ kg/m³,
Medium parameters used: f = 5600 MHz; $\sigma = 6.01$ S/m; $\epsilon_r = 47$; $\rho = 1000$ kg/m³,
Medium parameters used: f = 5750 MHz; $\sigma = 6.22$ S/m; $\epsilon_r = 46.8$; $\rho = 1000$ kg/m³,
Medium parameters used: f = 5800 MHz; $\sigma = 6.29$ S/m; $\epsilon_r = 46.7$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.29, 5.29, 5.29) @ 5200 MHz, ConvF(5.26, 5.26, 5.26) @ 5250 MHz, ConvF(5.23, 5.23, 5.23) @ 5300 MHz, ConvF(4.84, 4.84, 4.84) @ 5500 MHz, ConvF(4.79, 4.79, 4.79) @ 5600 MHz, ConvF(4.66, 4.66, 4.66) @ 5750 MHz, ConvF(4.62, 4.62, 4.62) @ 5800 MHz; Calibrated: 31.12.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- 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=100mW, dist=10mm, f=5200 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.58 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 27.8 W/kg
SAR(1 g) = 7.3 W/kg; SAR(10 g) = 2.04 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 67.4%
Maximum value of SAR (measured) = 17.0 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.59 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 29.0 W/kg
SAR(1 g) = 7.45 W/kg; SAR(10 g) = 2.09 W/kg
Smallest distance from peaks to all points 3 dB below = 6.9 mm
Ratio of SAR at M2 to SAR at M1 = 66.5%
Maximum value of SAR (measured) = 17.4 W/kg

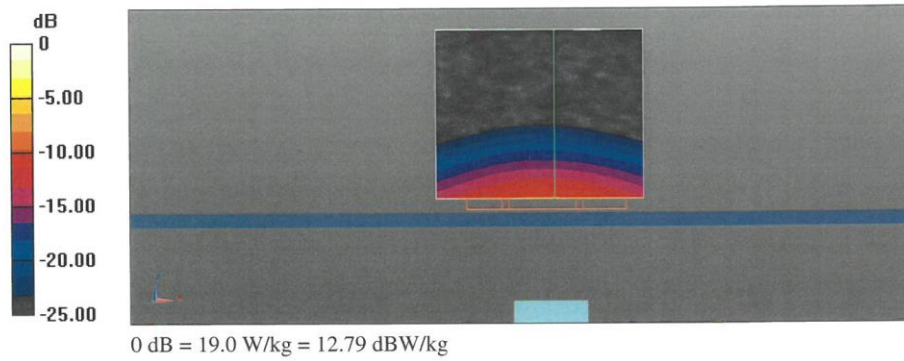
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.12 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 29.1 W/kg
SAR(1 g) = 7.36 W/kg; SAR(10 g) = 2.06 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 66.1%
Maximum value of SAR (measured) = 17.3 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 68.41 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 33.0 W/kg
SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.17 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 64.2%
Maximum value of SAR (measured) = 19.0 W/kg

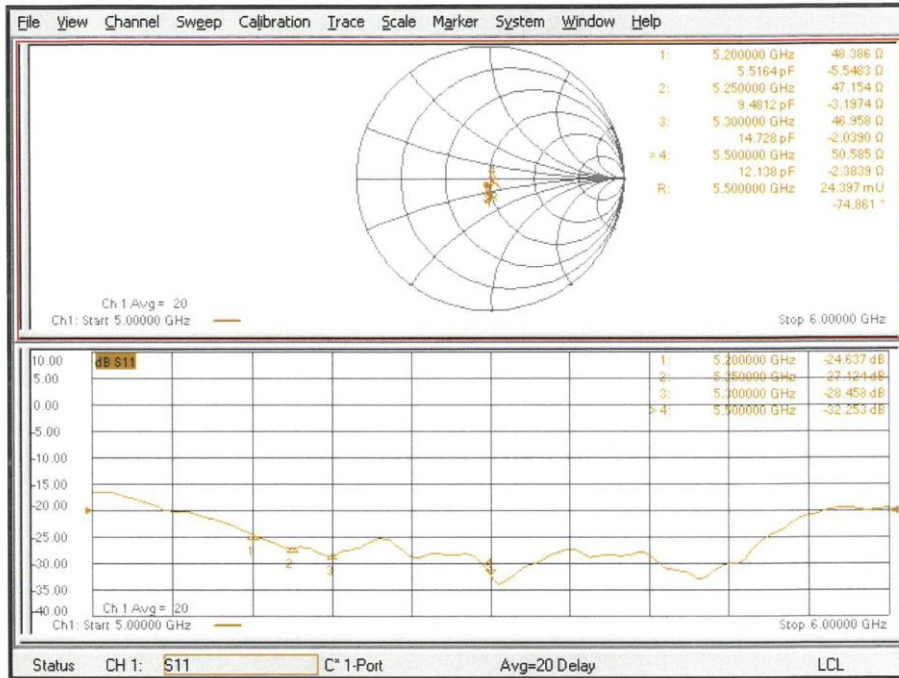
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.25 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 33.2 W/kg
SAR(1 g) = 7.72 W/kg; SAR(10 g) = 2.15 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 63.4%
Maximum value of SAR (measured) = 18.7 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.67 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 34.2 W/kg
SAR(1 g) = 7.61 W/kg; SAR(10 g) = 2.11 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 62%
Maximum value of SAR (measured) = 18.7 W/kg

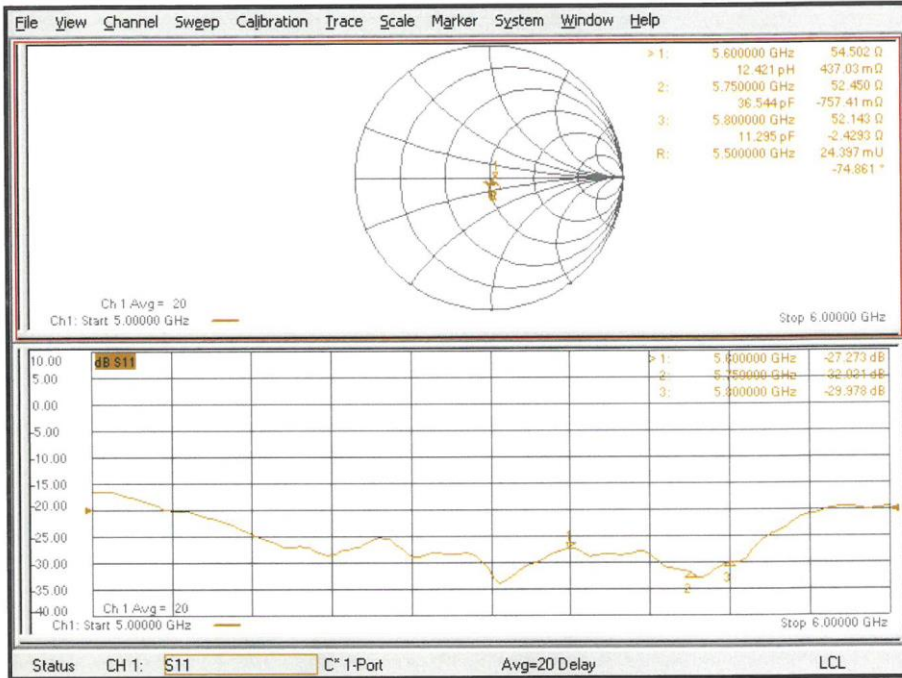
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.55 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 32.7 W/kg
SAR(1 g) = 7.42 W/kg; SAR(10 g) = 2.04 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 62.5%
Maximum value of SAR (measured) = 18.2 W/kg



Impedance Measurement Plot for Body TSL (5200, 5250, 5300, 5500 MHz)



Impedance Measurement Plot for Body TSL (5600, 5750, 5800 MHz)



ANNEX I Sensor Triggering Data Summary

WIFI antenna			Main antenna	
back	11mm		back	25mm
top	7mm		top	27mm
			right	8mm

Per FCC KDB Publication 616217 D04v01r02, this device was tested by the manufacturer to determine the proximity sensor triggering distances for the rear, left edge, right edge and bottom edge of the device. The measured output power within ± 5 mm of the triggering points (or until touching the phantom) is included for rear and each applicable edge.

To ensure all production units are compliant it is necessary to test SAR at a distance 1mm less than the smallest distance from the device and SAR phantom with the device at maximum output power without power reduction.

We tested the power or state and got the different proximity sensor triggering distances for Rear, Right and Top edge. The manufacturer has declared 25mm is the most conservative triggering distance for main antenna with rear. The 27mm distance for top edge. The 8mm distance for right edge. So base on the most conservative triggering distance of 25 / 27 / 8mm, additional SAR measurements were required at 24mm from the highest SAR position for rear of main antenna, and at 26mm for top edge, 7mm for right edge.

Sincerely, the most conservative triggering distance for WIFI antenna is 11mm with rear and 7mm with top edge. So we also test SAR measurements with 10mm at rear, and 6mm at top.

Main antenna

Rear

Moving device toward the phantom:

The power state											
Distance [mm]	30	29	28	27	26	25	24	23	22	21	20
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

Moving device away from the phantom:

The power state											
Distance [mm]	20	21	22	23	24	25	26	27	28	29	30
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

Right Edge

Moving device toward the phantom:

The power state											
Distance [mm]	13	12	11	10	9	8	7	6	5	4	3
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

Moving device away from the phantom:

The power state											
Distance [mm]	3	4	5	6	7	8	9	10	11	12	13
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

Top Edge

Moving device toward the phantom:

The power state											
Distance [mm]	32	31	30	29	28	27	26	25	24	23	22
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

Moving device away from the phantom:

The power state											
Distance [mm]	22	23	24	25	26	27	28	29	30	31	32
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

WIFI antenna

Rear

Moving device toward the phantom:

The power state											
Distance [mm]	16	15	14	13	12	11	10	9	8	7	6
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

Moving device away from the phantom:

The power state											
Distance [mm]	6	7	8	9	10	11	12	13	14	15	16
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

Top Edge

Moving device toward the phantom:

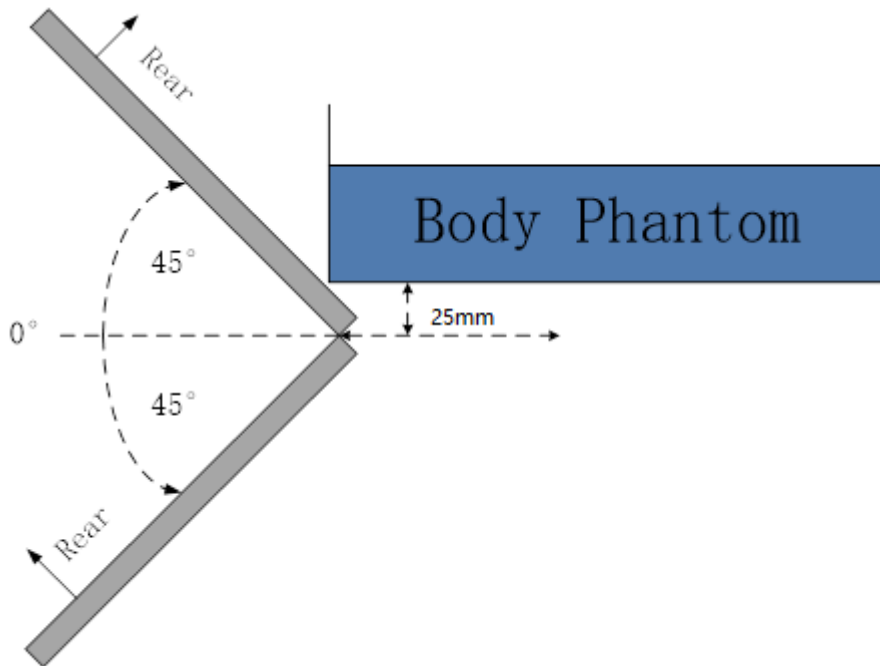
The power state											
Distance [mm]	12	11	10	9	8	7	6	5	4	3	2
Main antenna	Normal	Normal	Normal	Normal	Normal	Low	Low	Low	Low	Low	Low

Moving device away from the phantom:

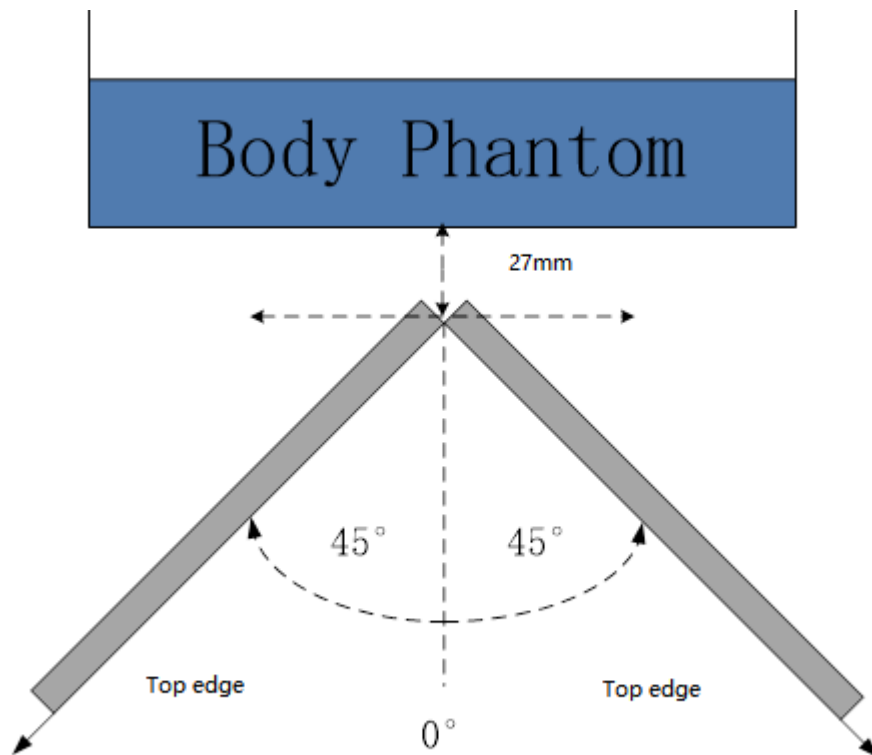
The power state											
Distance [mm]	2	3	4	5	6	7	8	9	10	11	12
Main antenna	Low	Low	Low	Low	Low	Low	Normal	Normal	Normal	Normal	Normal

Per FCC KDB Publication 616217 D04v01r02, the influence of table tilt angles to proximity sensor triggering is determined by positioning each edge that contains a transmitting antenna, perpendicular to the flat phantom, at the smallest sensor triggering test distance by rotating the device around the edge next to the phantom in $\leq 10^\circ$ increments until the tablet is $\pm 45^\circ$ or more from

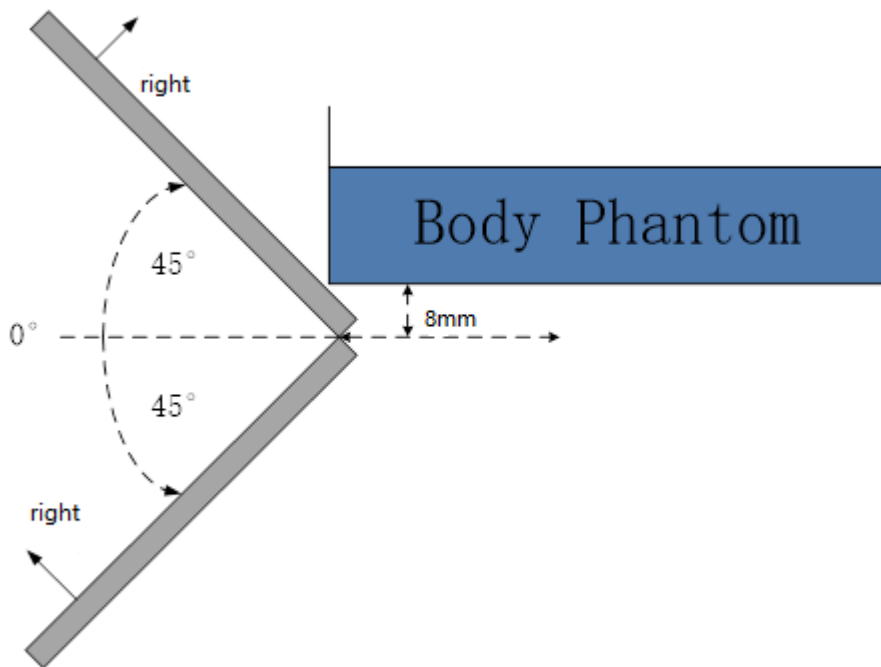
the vertical position at 0°.



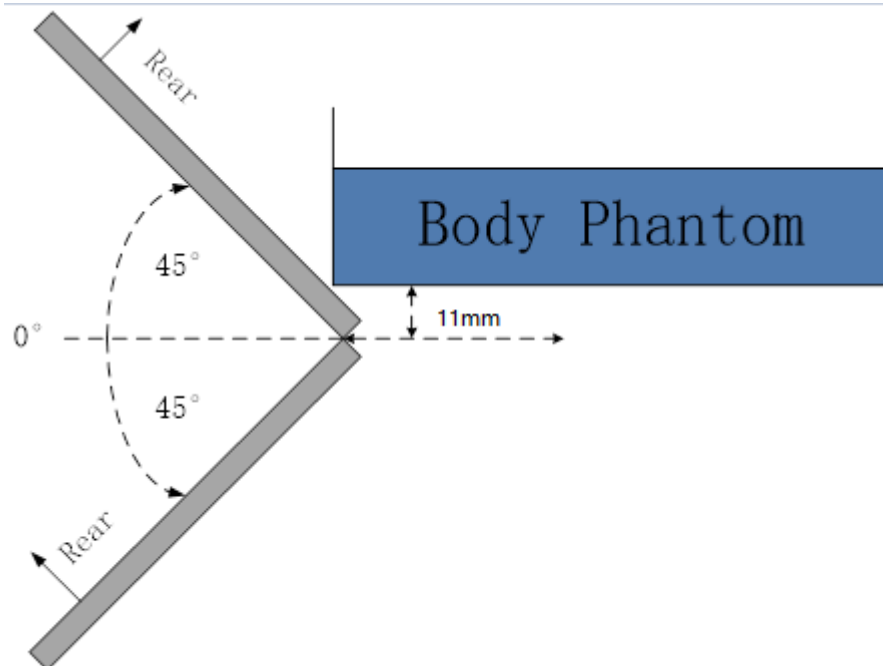
The rear evaluation for main antenna



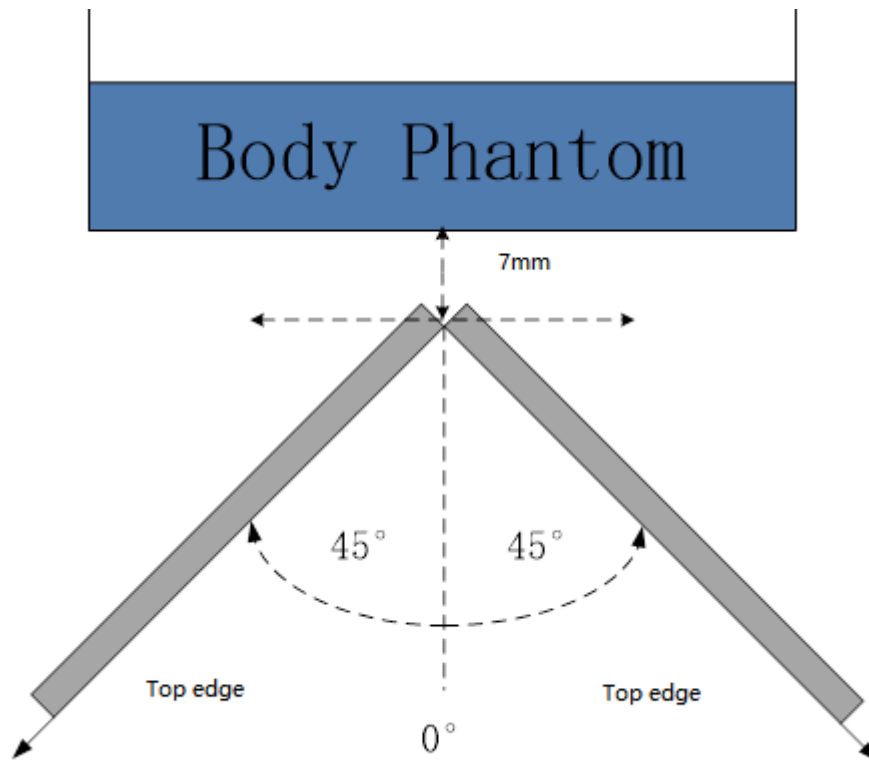
The top edge evaluation for main antenna



The right edge evaluation for main antenna



The rear evaluation for WIFI antenna



The top evaluation for WIFI antenna

Based on the above evaluation, we come to the conclusion that the sensor triggering is not released and normal maximum output power is not restored within the $\pm 45^\circ$ range at the smallest sensor triggering test distance declared by manufacturer.

ANNEX J SPOT CHECK

J.1 Dielectric Performance and System Validation

Table J.1-1: Dielectric Performance of Head Tissue Simulating Liquid

Measurement Date (yyyy-mm-dd)	Type	Frequency	Permittivity ϵ	Drift (%)	Conductivity σ (S/m)	Drift (%)
2021-11-20	Head	2600 MHz	40.17	2.97	2.026	3.37
2021-12-29	Head	2450 MHz	41.28	5.31	1.929	7.17
2021-12-29	Head	5250 MHz	35.31	-1.73	4.862	3.23

Table J.1-2: System Validation of Head

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value(W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2021-11-20	2600 MHz	25.5	57.1	24.5	55.2	-4.00%	-3.33%
2021-12-29	2450 MHz	24.9	53.3	25.6	56.0	2.97%	5.07%
2021-12-29	5250 MHz	22.7	79.5	22.6	78.7	-0.44%	-1.01%

J.2 Measurement results

Test Position	Phantom position L/R/F	Frequency Band	Channel Number	Frequency (MHz)	Test setup	EUT Measured Power (dBm)	Tune up (dBm)	Measured SAR 10g (W/kg)	Calculated SAR 10g (W/kg)	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)	Power Drift
Body	F	LTE Band7	21350	2560	1RB-Middle Right Edge 7mm	23.47	24.00	0.279	0.32	0.562	0.63	0.14
Body	F	WLAN	6	2437	Rear 0mm 1M 9.2db	11.29	12.00	0.207	0.24	0.569	0.67	0.08
Body	F	WLAN	58	5290	11ac-MCS0 80M Top Edge 0mm 6db	9.89	10.50	0.131	0.15	0.617	0.71	-0.03

J.3 Reported SAR Comparison

Exposure Configuration	Technology Band	Reported SAR 1g(W/kg) Original	Reported SAR 1g(W/kg) Spot check
Hotspot (Body)	GSM 850	0.71	/
	PCS 1900	0.75	/
	UMTS FDD 5	0.49	/
	UMTS FDD 2	0.54	/
	LTE Band 2	0.64	/
	LTE Band 4	0.65	/
	LTE Band 5	0.40	/
	LTE Band 7	0.90	0.63
	LTE Band 19	0.43	/
LTE Band 38	0.60	/	

	LTE Band 41	0.65	/
	WLAN 2.4 GHz	0.72	0.67
	WLAN 5 GHz	0.93	0.71

J.4 List of Main Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	E5071C	MY46110673	January 14, 2021	One year
02	Power meter	NRP2	106277	September 23, 2021	One year
03	Power sensor	NRP8S	104291		
04	Signal Generator	E4438C	MY49071430	February 1, 2021	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	E-field Probe	SPEAG EX3DV4	7517	February 03, 2021	One year
07	DAE	SPEAG DAE4	1525	September 1, 2021	One year
08	Dipole Validation Kit	SPEAG D2600V2	1012	July 26,2021	One year
09	Dipole Validation Kit	SPEAG D2450V2	853	July 26,2021	One year
10	Dipole Validation Kit	SPEAG D5GHzV2	1060	June 22,2021	One year

J.5 GRAPH RESULTS

LTE2500-FDD7_CH21350 Right

Date: 11/20/2021

Electronics: DAE4 Sn1525

Medium: H2600

Medium parameters used: $f = 2560$ MHz; $\sigma = 1.995$ S/m; $\epsilon_r = 40.297$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.9oC Liquid Temperature: 22.4oC

Communication System: LTE Band7 Frequency: 2560 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7517 ConvF(7.1, 7.1, 7.1)

Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.938 W/kg

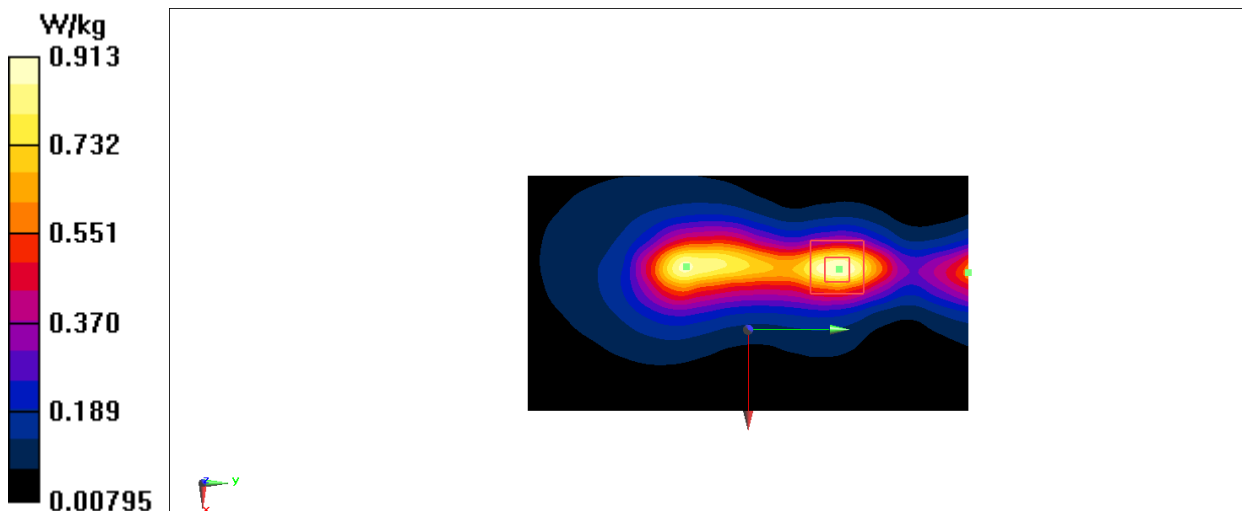
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 15.51 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 1.14 W/kg

SAR(1 g) = 0.562 W/kg; SAR(10 g) = 0.279 W/kg

Maximum value of SAR (measured) = 0.913 W/kg



WLAN2450_CH6 Rear

Date: 12/29/2021

Electronics: DAE4 Sn1525

Medium: h2450

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.92$ S/m; $\epsilon_r = 41.288$; $\rho = 1000$ kg/m³

Ambient Temperature: 23.3oC Liquid Temperature: 22.5oC

Communication System: WIFI 2450 Frequency: 2437 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7517 ConvF(7.34, 7.34, 7.34)

Area Scan (101x201x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 1.19 W/kg

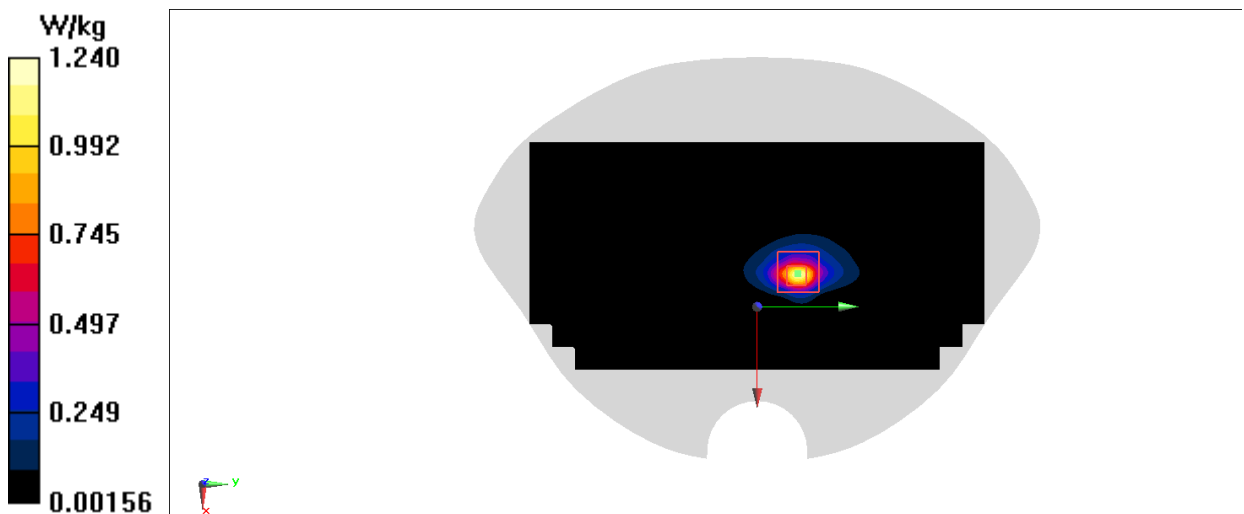
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.630 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 1.96 W/kg

SAR(1 g) = 0.569 W/kg; SAR(10 g) = 0.207 W/kg

Maximum value of SAR (measured) = 1.24 W/kg



WLAN5G_CH58 Top

Date: 12/29/2021

Electronics: DAE4 Sn1525

Medium: h5G

Medium parameters used: $f = 5290$ MHz; $\sigma = 4.908$ S/m; $\epsilon_r = 35.255$; $\rho = 1000$ kg/m³

Ambient Temperature: 23.3oC Liquid Temperature: 22.5oC

Communication System: WLAN 5G Frequency: 5290 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7517 ConvF(5.42, 5.42, 5.42)

Area Scan (121x241x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 2.08 W/kg

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

Reference Value = 3.481 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 3.92 W/kg

SAR(1 g) = 0.617 W/kg; SAR(10 g) = 0.131 W/kg

Maximum value of SAR (measured) = 1.85 W/kg

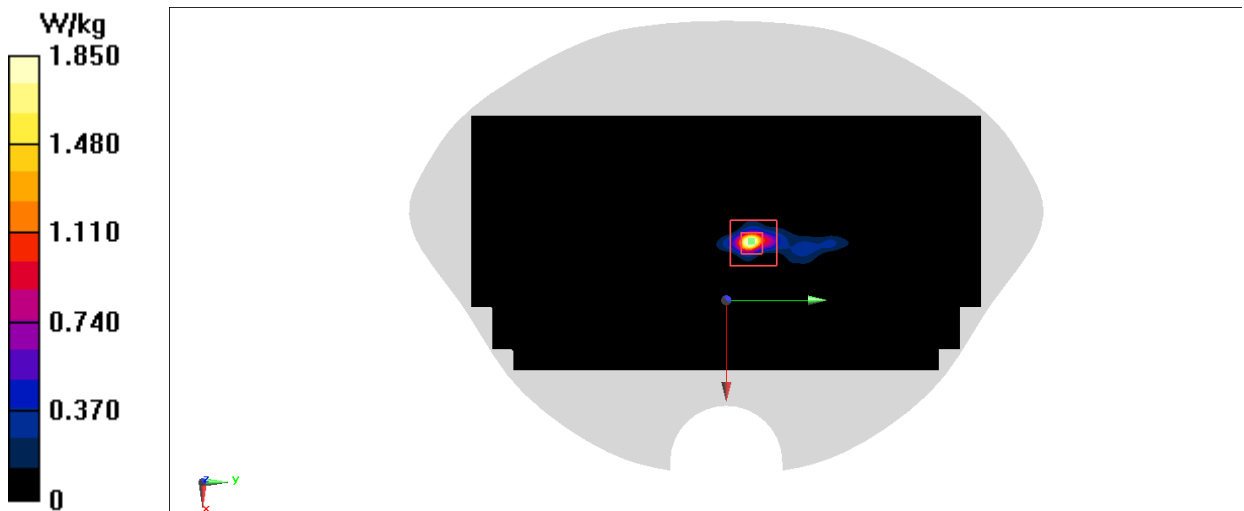


Fig A.13

J.6 System Verification Results

2600 MHz

Date: 11/20/2021

Electronics: DAE4 Sn1525

Medium: H2600

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.026$ S/m; $\epsilon_r = 40.17$; $\rho = 1000$ kg/m³

Ambient Temperature: 22.9°C Liquid Temperature: 22.4°C

Communication System: CW (0) Frequency: 2600 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7517 ConvF(7.1, 7.1, 7.1)

Area Scan 3 (61x81x1): Interpolated grid: $dx=1.200$ mm, $dy=1.200$ mm

Maximum value of SAR (interpolated) = 24.4 W/kg

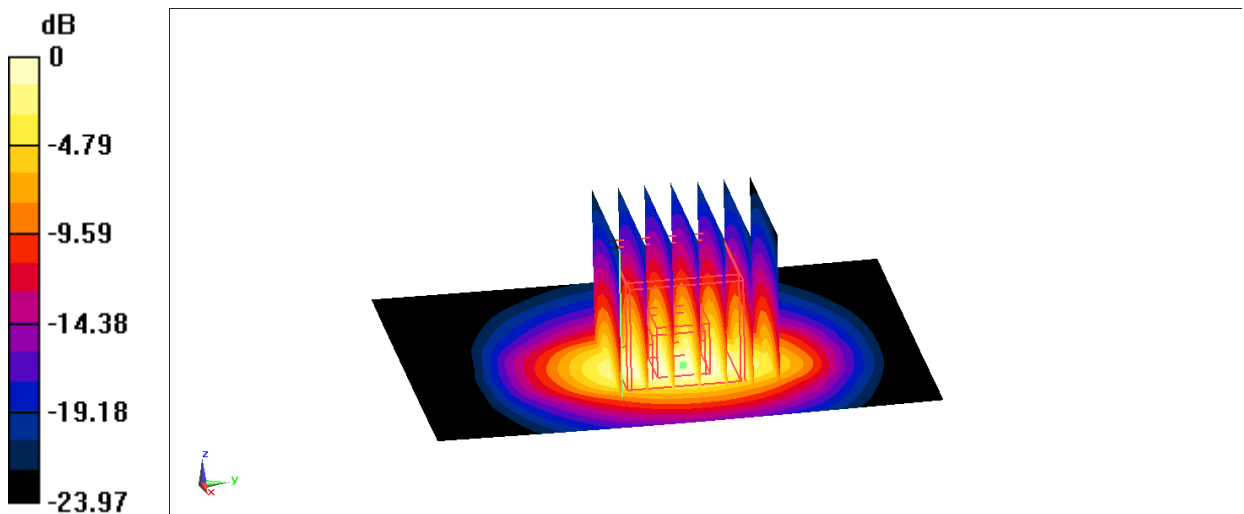
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 108.7 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 30.6 W/kg

SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.12 W/kg

Maximum value of SAR (measured) = 23.2 W/kg



$$0 \text{ dB} = 23.2 \text{ W/kg} = 13.65 \text{ dBW/kg}$$

2450 MHz

Date: 12/29/2021

Electronics: DAE4 Sn1525

Medium: h2450

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.929$ S/m; $\epsilon_r = 41.279$; $\rho = 1000$ kg/m³

Ambient Temperature: 23.3oC Liquid Temperature: 22.5oC

Communication System: CW Frequency: 2450 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7517 ConvF(7.34, 7.34, 7.34)

Area Scan (61x121x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 24.9 W/kg

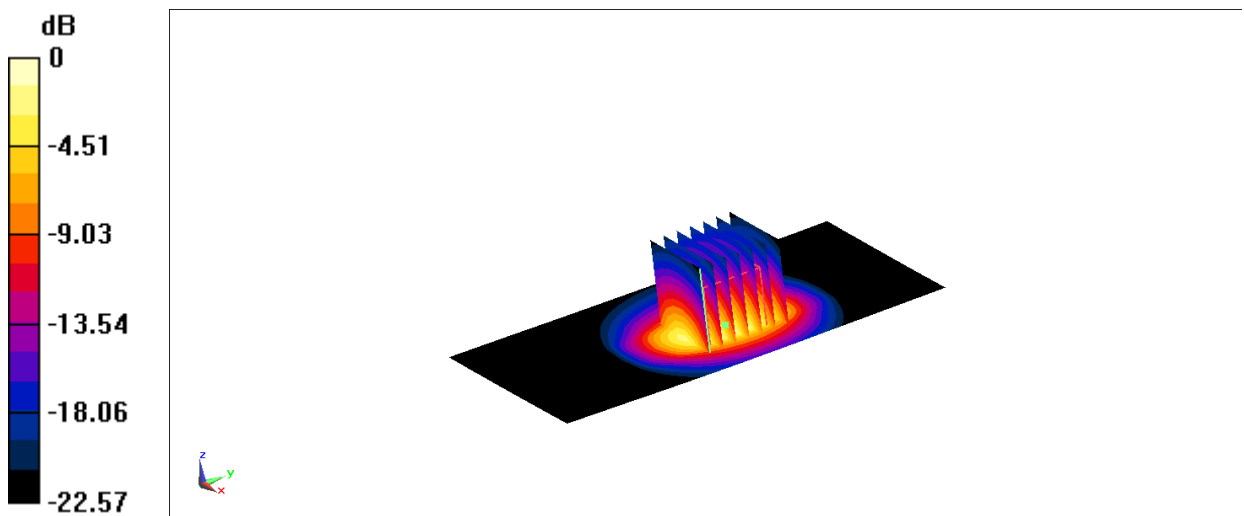
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.59 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 29.8 W/kg

SAR(1 g) = 14 W/kg; SAR(10 g) = 6.41 W/kg

Maximum value of SAR (measured) = 23.8 W/kg



$$0 \text{ dB} = 23.8 \text{ W/kg} = 13.77 \text{ dBW/kg}$$

5250 MHz

Date: 12/29/2021

Electronics: DAE4 Sn1525

Medium: h5G

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.862$ S/m; $\epsilon_r = 35.312$; $\rho = 1000$ kg/m³

Ambient Temperature: 23.3oC Liquid Temperature: 22.5oC

Communication System: CW Frequency: 5250 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7517 ConvF(5.42, 5.42, 5.42)

Area Scan (101x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 19.9 W/kg

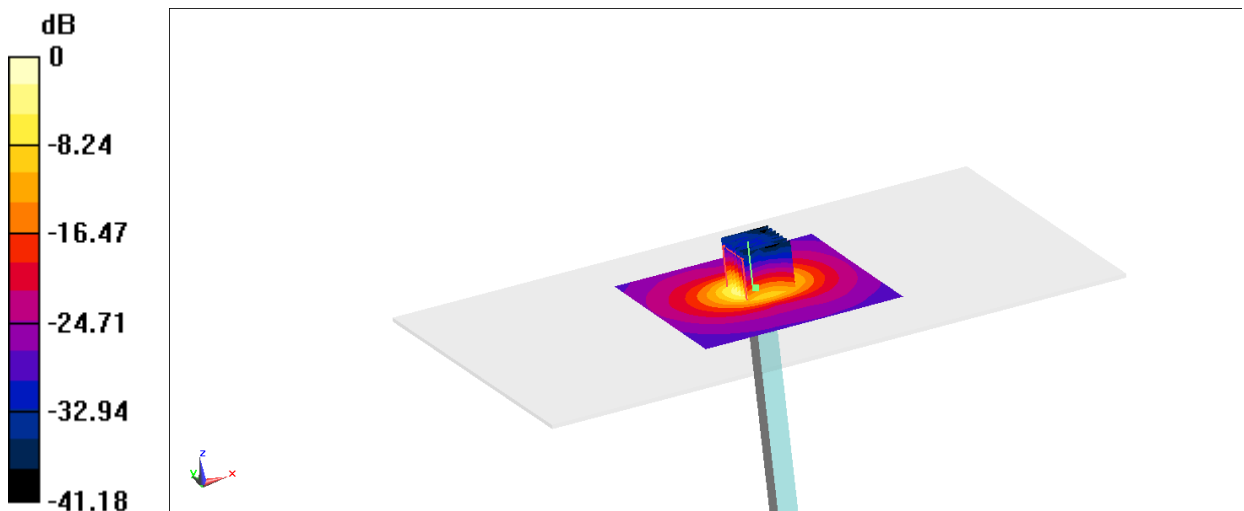
Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (7x7x7)/Cube 0: Measurement grid:
dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 57.96 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 32.9 W/kg

SAR(1 g) = 7.87 W/kg; SAR(10 g) = 2.26 W/kg

Maximum value of SAR (measured) = 18.4 W/kg



0 dB = 18.4 W/kg = 12.65 dBW/kg



J.7 Probe Calibration Certificate

Probe 7517 Calibration Certificate



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中国认可
 国际互认
 校准
 CALIBRATION
 CNAS L0570

Client

CTTL

Certificate No: Z21-60001

CALIBRATION CERTIFICATE			
Object	EX3DV4 - SN : 7517		
Calibration Procedure(s)	FF-Z11-004-02 Calibration Procedures for Dosimetric E-field Probes		
Calibration date:	February 03, 2021		
<p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.</p> <p>Calibration Equipment used (M&TE critical for calibration)</p>			
Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	16-Jun-20(CTTL, No.J20X04344)	Jun-21
Power sensor NRP-Z91	101547	16-Jun-20(CTTL, No.J20X04344)	Jun-21
Power sensor NRP-Z91	101548	16-Jun-20(CTTL, No.J20X04344)	Jun-21
Reference 10dBAttenuator	18N50W-10dB	10-Feb-20(CTTL, No.J20X00525)	Feb-22
Reference 20dBAttenuator	18N50W-20dB	10-Feb-20(CTTL, No.J20X00526)	Feb-22
Reference Probe EX3DV4	SN 7307	29-May-20(SPEAG, No.EX3-7307_May20)	May-21
DAE4	SN 1556	4-Feb-20(SPEAG, No.DAE4-1556_Feb20)	Feb-21
DAE4	SN 1555	25-Aug-20(SPEAG, No.DAE4-1555_Aug20)	Aug-21
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGenerator MG3700A	6201052605	23-Jun-20(CTTL, No.J20X04343)	Jun-21
Network Analyzer E5071C	MY46110673	10-Feb-20(CTTL, No.J20X00515)	Feb-21
Calibrated by:	Name Yu Zongying	Function SAR Test Engineer	Signature
Reviewed by:	Name Lin Hao	Function SAR Test Engineer	Signature
Approved by:	Name Qi Dianyuan	Function SAR Project Leader	Signature
Issued: February 05, 2021			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

Certificate No: Z21-60001

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A,B,C,D	modulation dependent linearization parameters
Polarization Φ	Φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), $\theta=0$ is normal to probe axis

Connector Angle information used in DASY system to align probe sensor X to the robot coordinate system

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"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}:** Assessed for E-field polarization $\theta=0$ ($f \leq 900\text{MHz}$ in TEM-cell; $f > 1800\text{MHz}$: waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}:** DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR:** PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,y,z}:** A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters:** Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800\text{MHz}$) and inside waveguide using analytical field distributions based on power measurements for $f > 800\text{MHz}$. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from $\pm 50\text{MHz}$ to $\pm 100\text{MHz}$.
- Spherical isotropy (3D deviation from isotropy):** in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset:** The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle:** The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).



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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7517

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.48	0.50	0.54	$\pm 10.0\%$
DCP(mV) ^B	101.1	101.7	101.0	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB/ μV	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	162.5	$\pm 2.5\%$
		Y	0.0	0.0	1.0		165.5	
		Z	0.0	0.0	1.0		170.3	

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%.

^A The uncertainties of Norm X, Y, Z do not affect the E^2 -field uncertainty inside TSL (see Page 4).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7517

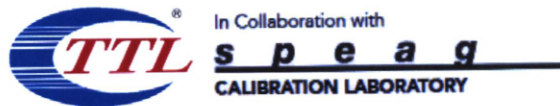
Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz] ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	41.9	0.89	9.81	9.81	9.81	0.40	0.80	±12.1%
900	41.5	0.97	9.40	9.40	9.40	0.19	1.27	±12.1%
1450	40.5	1.20	8.55	8.55	8.55	0.13	1.29	±12.1%
1640	40.3	1.29	8.45	8.45	8.45	0.60	0.67	±12.1%
1750	40.1	1.37	8.22	8.22	8.22	0.25	1.03	±12.1%
1900	40.0	1.40	7.81	7.81	7.81	0.24	1.12	±12.1%
2000	40.0	1.40	7.90	7.90	7.90	0.20	1.24	±12.1%
2300	39.5	1.67	7.58	7.58	7.58	0.65	0.66	±12.1%
2450	39.2	1.80	7.34	7.34	7.34	0.59	0.74	±12.1%
2600	39.0	1.96	7.10	7.10	7.10	0.60	0.72	±12.1%
3300	38.2	2.71	6.90	6.90	6.90	0.44	0.94	±13.3%
3500	37.9	2.91	6.65	6.65	6.65	0.43	0.97	±13.3%
3700	37.7	3.12	6.40	6.40	6.40	0.40	1.03	±13.3%
3900	37.5	3.32	6.36	6.36	6.36	0.40	1.25	±13.3%
4100	37.2	3.53	6.42	6.42	6.42	0.40	1.15	±13.3%
4200	37.1	3.63	6.34	6.34	6.34	0.35	1.35	±13.3%
4400	36.9	3.84	6.22	6.22	6.22	0.35	1.35	±13.3%
4600	36.7	4.04	6.10	6.10	6.10	0.45	1.25	±13.3%
4800	36.4	4.25	6.00	6.00	6.00	0.45	1.25	±13.3%
4950	36.3	4.40	5.70	5.70	5.70	0.45	1.25	±13.3%
5250	35.9	4.71	5.42	5.42	5.42	0.50	1.20	±13.3%
5600	35.5	5.07	4.75	4.75	4.75	0.55	1.20	±13.3%
5750	35.4	5.22	4.82	4.82	4.82	0.55	1.20	±13.3%

^C Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

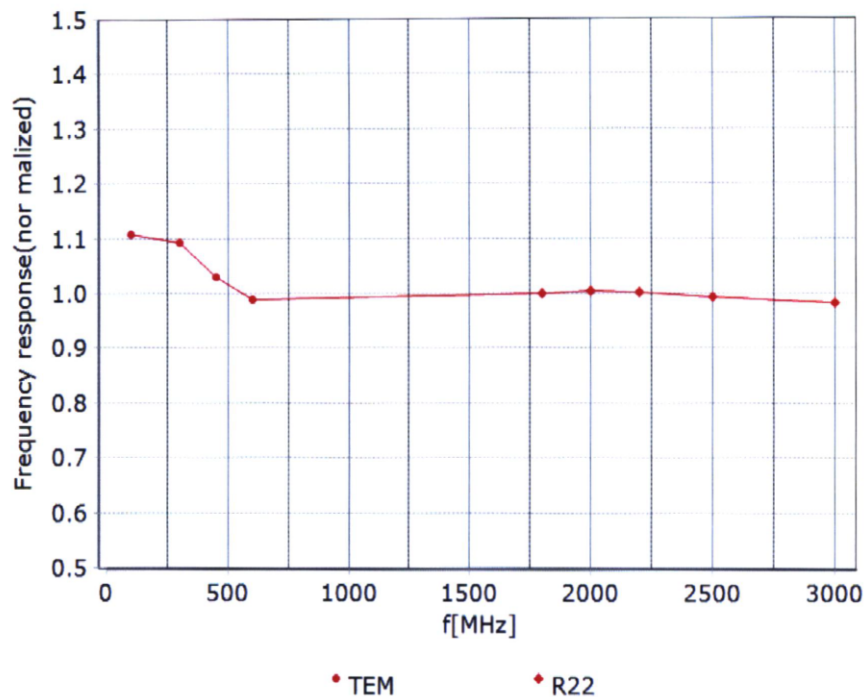
^F At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: $\pm 7.4\%$ ($k=2$)

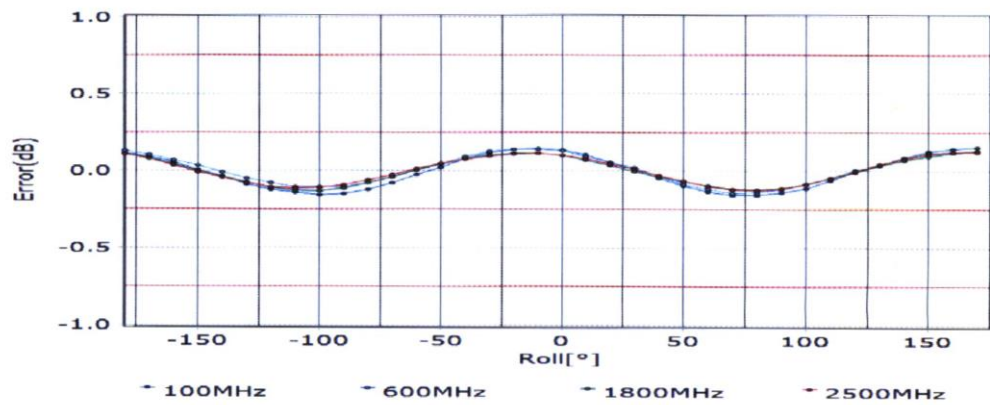
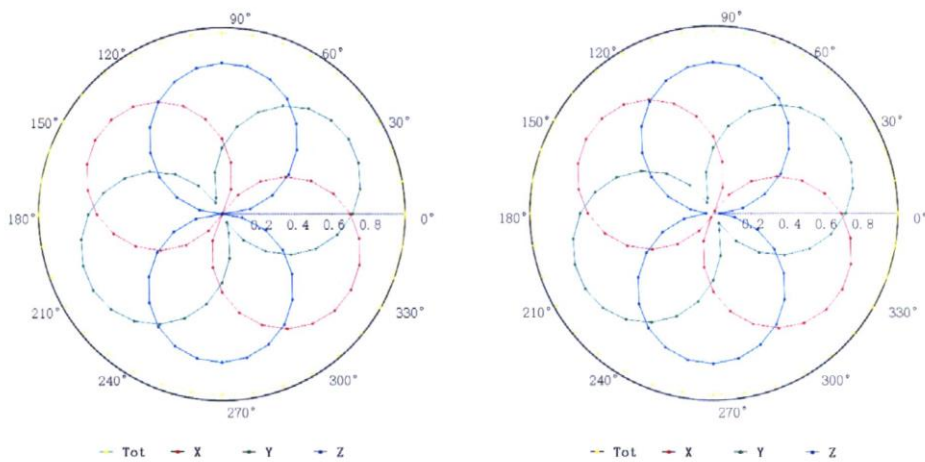


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Receiving Pattern (Φ), $\theta=0^\circ$

f=600 MHz, TEM

f=1800 MHz, R22

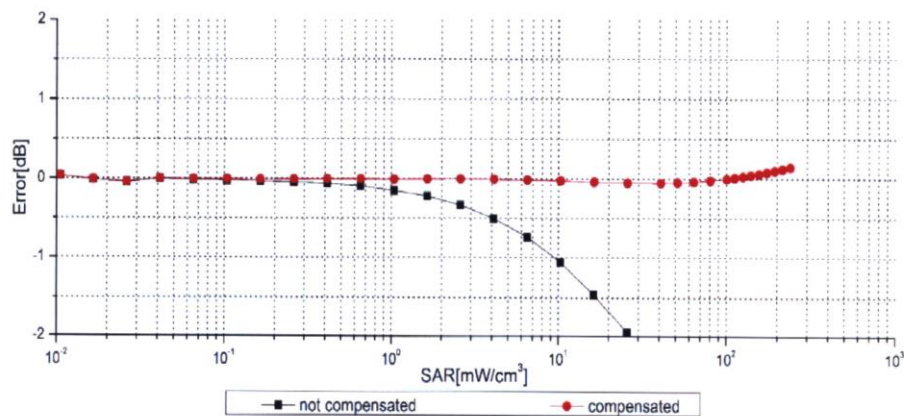
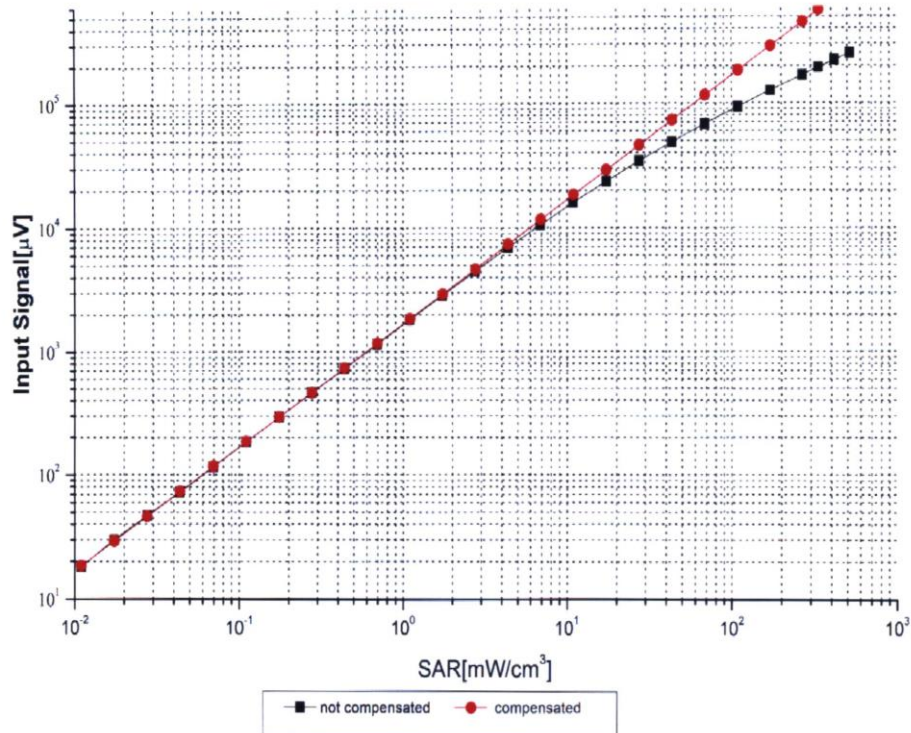


Uncertainty of Axial Isotropy Assessment: $\pm 1.2\%$ ($k=2$)



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Dynamic Range f(SAR_{head}) (TEM cell, f = 900 MHz)



Uncertainty of Linearity Assessment: ±0.9% (k=2)

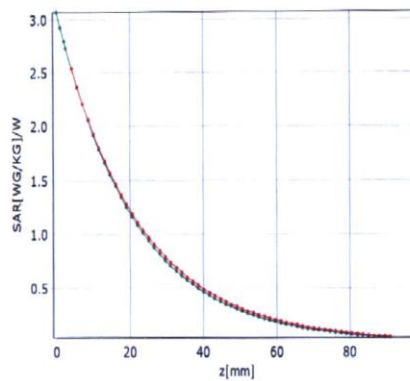


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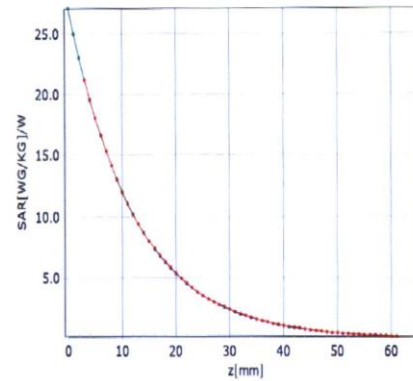
Conversion Factor Assessment

f=750 MHz,WGLS R9(H_convF)

f=1750 MHz,WGLS R22(H_convF)

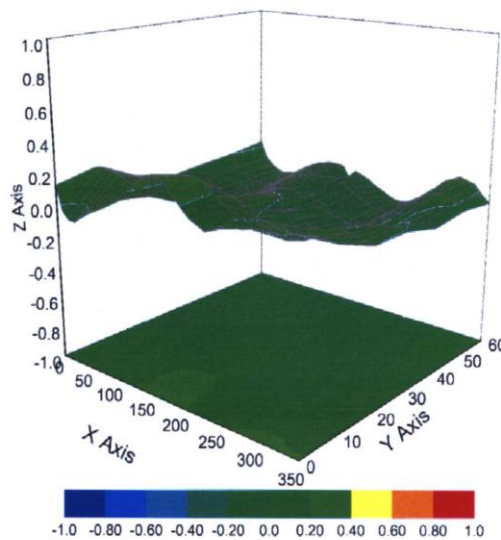


* analytical * measured



* analytical * measured

Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: $\pm 3.2\%$ ($k=2$)