SAR TEST REPORT

Test report No:	**EMC-FCC-A0021**
Type of Equipment:	**Wi-Fi Portable Phone**
Model Name:	**WP300S**
Applicant:	**Moimstone Co., Ltd.**
FCC ID:	**2AAKFWP300S**
FCC Rule Part:	**CFR §2.1093**
Test standards:	**IEEE 1528, 2003** **ANSI/IEEE C95.1** **KDB Publication**
Max. SAR(1g):	**1.28 W/kg**
Test result:	**Complied**

This report details the results of the testing carried out on one sample, the results contained in this testreport do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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Date of receipt: 2015.05.18

Date of testing: 2015.06.19 ~ 6.28

Issued date: 2015.06.29

Tested by:

Min Kyoung-hoo

Approved by:

Choi Cheon-sig

Contents

1. Applicant information

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Manufacturer:	Moimstone Co., Ltd.
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2. Laboratory information

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Certificate

KOLAS No.: 231

FCC Site Designation No.: KR0040

FCC Site Registration No.: 687132

VCCI Site Registration No.: R-3327, G-198, C-3706, T-1849

IC Site Registration No.: 8035A-2

SITE MAP

3. Identification of Sample

EUT Type	Wi-Fi Portable Phone
Brand Name	Moimstone Co., Ltd.
Mode of Operation	WLAN 802.11a/b/g/n
Model Number	WP300S
Serial Number	N/A
Max. Power	18.12 dBm
Tx Freq.Range	2 412 MHz ~ 2 462 MHz 5 180 MHz ~ 5 825 MHz
Rx Freq.Range	2 412 MHz ~ 2 462 MHz 5 180 MHz ~ 5 825 MHz
Antenna Type	Internal Antenna
Normal Voltage	3.7 V, 1 500 mAh Li-ion
H/W Version	1.0
S/W Version	1.0

4.Test Result Summary

4.1 WLAN 2.4G

Frequency		Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Separation Distance (mm)	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	1 g SAR Limit (W/kg)
MHz	Ch.								
2437	6	18.72	20.00	1.3428	Left Cheek	0	0.324	0.435	1.6
2437	6	18.72	20.00	1.3428	Back	15	0.096	0.129	1.6

* Contain the results of the worst test SAR including battery.

4.2 WLAN 5G

Frequency		Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Separation Distance (mm)	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	1 g SAR Limit (W/kg)
MHz	Ch.								
5825	165	17.61	19.00	1.3772	Right Tilt	0	0.914	1.26	1.6
5825	165	17.61	19.00	1.3772	Back	15	0.930	1.28	1.6

* Contain the results of the worst test SAR including battery.

5. Report Overview

This report details the results of testing carried out on the samples listed in section 3, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this test report is used in any configuration other than that detailed in the test report, the manufacturer must ensure the new configuration complies with all relevant standards and certification requirements. Any mention of EMC compliance Ltd Wireless lab or testing done by EMC compliance Ltd Wireless lab made in connection with the distribution or use of the tested product must be approved in writing by EMC compliance Ltd Wireless lab.

6. Test Lab Declaration or Comments

None

7. Applicant Declaration or Comments

None

8. Measurement Uncertainty

All measurements and results are recorded and maintained at the laboratory performing the tests and measurement uncertainties are taken into account when comparing measurements to pass/ fail criteria.

Uncertainty of SAR equipments for measurement 300 MHz to 3 GHz_HSL

A	b	c	D	e = f(d,k)	g	i = c x g / e	k
Source of Uncertainty	Description IEEE P1528 (0.3 ~ 3 GHz)	Tolerance/ Uncertainty value ± %	Probability Distribution	Div.	Ci (1 g)	Standard uncertainty ± %, (1 g)	Vi or Veff
Measurement System							
Probe calibration(k=1)	E.2.1	6.30	N	1	1	6.30	∞
Axial isotropy	E.2.2	0.50	R	1.73	0.71	0.20	∞
Hemispherical isotropy	E.2.2	2.60	R	1.73	0.71	1.06	∞
Linearity	E.2.4	0.60	R	1.73	1	0.35	∞
Boundary effect	E.2.3	1.00	R	1.73	1	0.58	∞
System detection limits	E.2.5	1.00	R	1.73	1	0.58	∞
Readout electronics	E.2.6	0.30	N	1	1	0.30	∞
Response time	E.2.7	0.80	R	1.73	1	0.46	∞
Integration time	E.2.8	2.60	R	1.73	1	1.50	∞
RF ambient conditions–noise	E.6.1	3.00	R	1.73	1	1.73	∞
RF ambient conditions–reflections	E.6.1	3.00	R	1.73	1	1.73	∞
Probe positioner mechanical tolerance	E.6.2	0.40	R	1.73	1	0.23	∞
Probe positioning with respect to phantom shell	E.6.3	2.90	R	1.73	1	1.67	∞
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	E.5	2.00	R	1.73	1	1.15	∞
Test Sample Related							
Test sample positioning	E.4.2	4.71	N	1	1	4.71	9
Device holder uncertainty	E.4.1	3.60	N	1	1	3.60	5
Output power variation—SAR drift measurement	6.6.2	5.00	R	1.73	1	2.89	∞
Phantom and Tissue Parameters							
Phantom uncertainty (shape and thickness tolerances)	E.3.1	6.10	R	1.73	1	3.52	∞
Liquid conductivity-measurement uncertainty	E.3.3	1.53	N	1	0.64	0.98	5
Liquid permittivity-measurement uncertainty	E.3.3	3.07	N	1	0.6	1.84	5
Liquid conductivity-deviation from target values	E.3.2	5.00	R	1.73	0.64	1.85	∞
Liquid permittivity-deviation from target values	E.3.2	5.00	R	1.73	0.6	1.73	∞
Combined standard uncertainty				RSS		11.00	165
Expanded uncertainty (95% CONFIDENCE INTERVAL)				K=2		22.00	

Uncertainty of SAR equipments for measurement 3 GHz to 6 GHz_HSL

A	b	c	D	e = f(d,k)	g	i = c x g / e	k
Source of Uncertainty	Description IEEE P1528 (3 ~ 6 GHz)	Tolerance/ Uncertainty value ± %	Probability Distribution	Div.	Ci (1 g)	Standard uncertainty ± %, (1 g)	Vi or Veff
Measurement System							
Probe calibration(k=1)	E.2.1	6.30	N	1	1	6.30	∞
Axial isotropy	E.2.2	0.50	R	1.73	0.71	0.20	∞
Hemispherical isotropy	E.2.2	2.60	R	1.73	0.71	1.06	∞
Linearity	E.2.4	0.60	R	1.73	1	0.35	∞
Boundary effect	E.2.3	2.00	R	1.73	1	1.15	∞
System detection limits	E.2.5	1.00	R	1.73	1	0.58	∞
Readout electronics	E.2.6	0.30	N	1	1	0.30	∞
Response time	E.2.7	0.80	R	1.73	1	0.46	∞
Integration time	E.2.8	2.60	R	1.73	1	1.50	∞
RF ambient conditions–noise	E.6.1	3.00	R	1.73	1	1.73	∞
RF ambient conditions–reflections	E.6.1	3.00	R	1.73	1	1.73	∞
Probe positioner mechanical tolerance	E.6.2	0.80	R	1.73	1	0.46	∞
Probe positioning with respect to phantom shell	E.6.3	6.70	R	1.73	1	3.87	∞
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	E.5	4.00	R	1.73	1	2.31	∞
Test Sample Related							
Test sample positioning	E.4.2	4.63	N	1	1	4.63	9
Device holder uncertainty	E.4.1	3.60	N	1	1	3.60	5
Output power variation—SAR drift measurement	6.6.2	5.00	R	1.73	1	2.89	∞
Phantom and Tissue Parameters							
Phantom uncertainty (shape and thickness tolerances)	E.3.1	6.60	R	1.73	1	3.81	∞
Liquid conductivity-measurement uncertainty	E.3.3	1.50	N	1	0.64	0.96	5
Liquid permittivity-measurement uncertainty	E.3.3	2.23	N	1	0.6	1.34	5
Liquid conductivity-deviation from target values	E.3.2	5.00	R	1.73	0.64	1.85	∞
Liquid permittivity-deviation from target values	E.3.2	5.00	R	1.73	0.6	1.73	∞
Combined standard uncertainty				RSS		11.75	225
Expanded uncertainty (95% CONFIDENCE INTERVAL)				K=2		23.50	

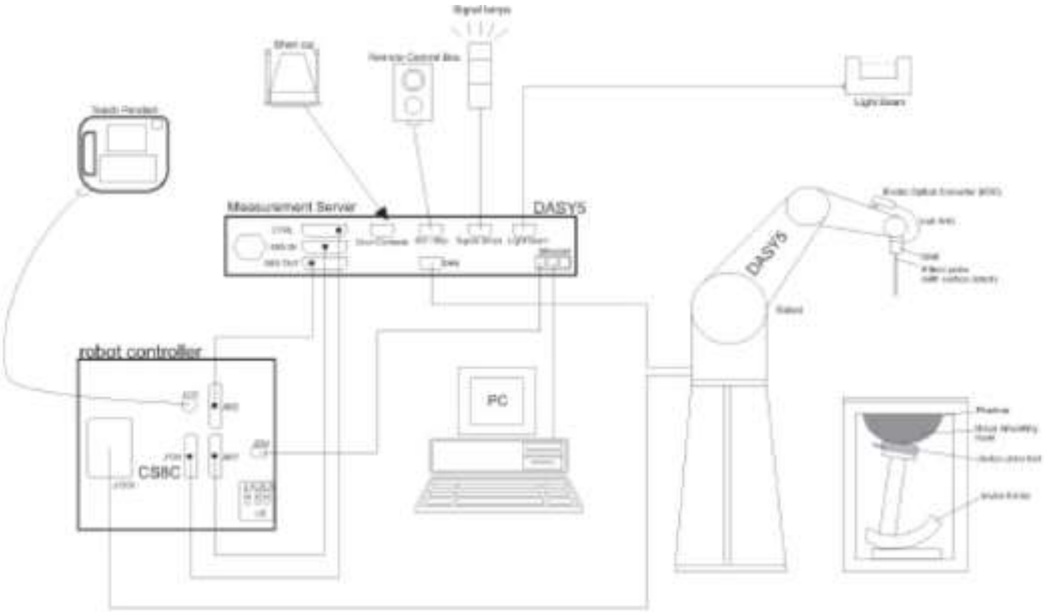
Uncertainty of SAR equipments for measurement 300 MHz to 3 GHz_MSL

A	b	c	D	e = f(d,k)	g	i = c x g / e	k
Source of Uncertainty	Description IEEE P1528	Tolerance/ Uncertainty value	Probability Distribution	Div.	Ci	Standard uncertainty	Vi or Veff
	(0.3 ~ 3 GHz)	± %			(1 g)	± %, (1 g)	
Measurement System							
Probe calibration(k=1)	E.2.1	6.30	N	1	1	6.30	∞
Axial isotropy	E.2.2	0.50	R	1.73	0.71	0.20	∞
Hemispherical isotropy	E.2.2	2.60	R	1.73	0.71	1.06	∞
Linearity	E.2.4	0.60	R	1.73	1	0.35	∞
Boundary effect	E.2.3	1.00	R	1.73	1	0.58	∞
System detection limits	E.2.5	1.00	R	1.73	1	0.58	∞
Readout electronics	E.2.6	0.30	N	1	1	0.30	∞
Response time	E.2.7	0.80	R	1.73	1	0.46	∞
Integration time	E.2.8	2.60	R	1.73	1	1.50	∞
RF ambient conditions–noise	E.6.1	3.00	R	1.73	1	1.73	∞
RF ambient conditions–reflections	E.6.1	3.00	R	1.73	1	1.73	∞
Probe positioner mechanical tolerance	E.6.2	0.40	R	1.73	1	0.23	∞
Probe positioning with respect to phantom shell	E.6.3	2.90	R	1.73	1	1.67	∞
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	E.5	2.00	R	1.73	1	1.15	∞
Test Sample Related							
Test sample positioning	E.4.2	4.71	N	1	1	4.71	9
Device holder uncertainty	E.4.1	3.60	N	1	1	3.60	5
Output power variation—SAR drift measurement	6.6.2	5.00	R	1.73	1	2.89	∞
Phantom and Tissue Parameters							
Phantom uncertainty (shape and thickness tolerances)	E.3.1	7.50	R	1.73	1	4.33	∞
Liquid conductivity-measurement uncertainty	E.3.3	1.53	N	1	0.64	0.98	5
Liquid permittivity-measurement uncertainty	E.3.3	3.07	N	1	0.6	1.84	5
Liquid conductivity-deviation from target values	E.3.2	5.00	R	1.73	0.64	1.85	∞
Liquid permittivity-deviation from target values	E.3.2	5.00	R	1.73	0.6	1.73	∞
Combined standard uncertainty				RSS		11.29	183
Expanded uncertainty (95% CONFIDENCE INTERVAL)				K=2		22.57	

Uncertainty of SAR equipments for measurement 3 GHz to 6 GHz_MSL

A	b	c	D	e = f(d,k)	g	i = c x g / e	k
Source of Uncertainty	Description IEEE P1528	Tolerance/ Uncertainty value	Probability Distribution	Div.	Ci	Standard uncertainty	Vi or Veff
	(3 ~ 6 GHz)	± %			(1 g)	± %, (1 g)	
Measurement System							
Probe calibration(k=1)	E.2.1	6.30	N	1	1	6.30	∞
Axial isotropy	E.2.2	0.50	R	1.73	0.71	0.20	∞
Hemispherical isotropy	E.2.2	2.60	R	1.73	0.71	1.06	∞
Linearity	E.2.4	0.60	R	1.73	1	0.35	∞
Boundary effect	E.2.3	2.00	R	1.73	1	1.15	∞
System detection limits	E.2.5	1.00	R	1.73	1	0.58	∞
Readout electronics	E.2.6	0.30	N	1	1	0.30	∞
Response time	E.2.7	0.80	R	1.73	1	0.46	∞
Integration time	E.2.8	2.60	R	1.73	1	1.50	∞
RF ambient conditions–noise	E.6.1	3.00	R	1.73	1	1.73	∞
RF ambient conditions–reflections	E.6.1	3.00	R	1.73	1	1.73	∞
Probe positioner mechanical tolerance	E.6.2	0.80	R	1.73	1	0.46	∞
Probe positioning with respect to phantom shell	E.6.3	6.70	R	1.73	1	3.87	∞
Extrapolation, interpolation, and integration algorithms for max. SAR evaluation	E.5	4.00	R	1.73	1	2.31	∞
Test Sample Related							
Test sample positioning	E.4.2	4.63	N	1	1	4.63	9
Device holder uncertainty	E.4.1	3.60	N	1	1	3.60	5
Output power variation—SAR drift measurement	6.6.2	5.00	R	1.73	1	2.89	∞
Phantom and Tissue Parameters							
Phantom uncertainty (shape and thickness tolerances)	E.3.1	7.90	R	1.73	1	4.56	∞
Liquid conductivity-measurement uncertainty	E.3.3	1.50	N	1	0.64	0.96	5
Liquid permittivity-measurement uncertainty	E.3.3	2.23	N	1	0.6	1.34	5
Liquid conductivity-deviation from target values	E.3.2	5.00	R	1.73	0.64	1.85	∞
Liquid permittivity-deviation from target values	E.3.2	5.00	R	1.73	0.6	1.73	∞
Combined standard uncertainty				RSS		12.02	246
Expanded uncertainty (95% CONFIDENCE INTERVAL)				K=2		24.03	

9. The SAR Measurement System



<SAR System Configuration>

- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension foraccommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- Data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion,offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered withstandard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digitalcommunication to the DAE. To use optical surface detection, a special version of the EOC is required. TheEOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control ofthe robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

9.1 Isotropic E-field Probe

EX3DV4
Smallest Isotropic E-Field Probe for Dosimetric Measurements (Preliminary Specifications)

	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in TSL (rotation around probe axis) ± 0.5 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 μW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μW/g)
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%.
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

ES3DV3
Isotropic E-Field Probe for Dosimetric Measurements

	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz)
Directivity	± 0.2 dB in TSL (rotation around probe axis) ± 0.3 dB in TSL (rotation normal to probe axis)
Dynamic Range	5 μW/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm
Application	General dosimetry up to 4 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI

9.2 Phantom

Twin SAM	
	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot. Twin SAM V5.0 has the same shell geometry and is manufactured from the same material as Twin SAM V4.0, but has reinforced top structure.
Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)
Dimensions (incl. Wooden Support)	Length: 1000 mm Width: 500 mm Height: adjustable feet
Filling Volume	approx. 25 liters
Wooden Support	SPEAG standard phantom table
Accessories	Mounting Device and Adaptors

ELI	
	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles. ELI V5.0 has the same shell geometry and is manufactured from the same material as ELI4, but has reinforced top structure. ELI V6.0, released in August 2014, has the same shell geometry as ELI4 but offers increased longterm stability.
Material	Vinylester, glass fiber reinforced (VE-GF)
Liquid Compatibility	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
Shell Thickness	2.0 ± 0.2 mm (bottom plate)
Dimensions	Major axis: 600 mm Minor axis: 400 mm
Filling Volume	approx. 30 liters
Wooden Support	SPEAG standard phantom table
Accessories	Mounting Device and Adaptors

9.3 Device Holder for Transmitters

Mounting Devices and Adaptors

Mounting Device for Hand-Held Transmitters

MD4HHTV5 - Mounting Device for Hand-Held Transmitters

In combination with the Twin SAM V5.0/V5.0c or ELI Phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).

Material: Polyoxymethylene (POM)

Mounting Device for Laptops

MD4LAPV5 - Mounting Device for Laptops and other Body-Worn Transmitters

In combination with the Twin SAM V5.0/V5.0c or ELI Phantoms, the Mounting Device (Body-Worn) enables testing of ransmitter devices according to IEC 62209-2 specifications. The device holder can be locked for positioning at flat phantom section.

Material: Polyoxymethylene (POM), PET-G, Foam

10. System Verification

10.1 Tissue Verification

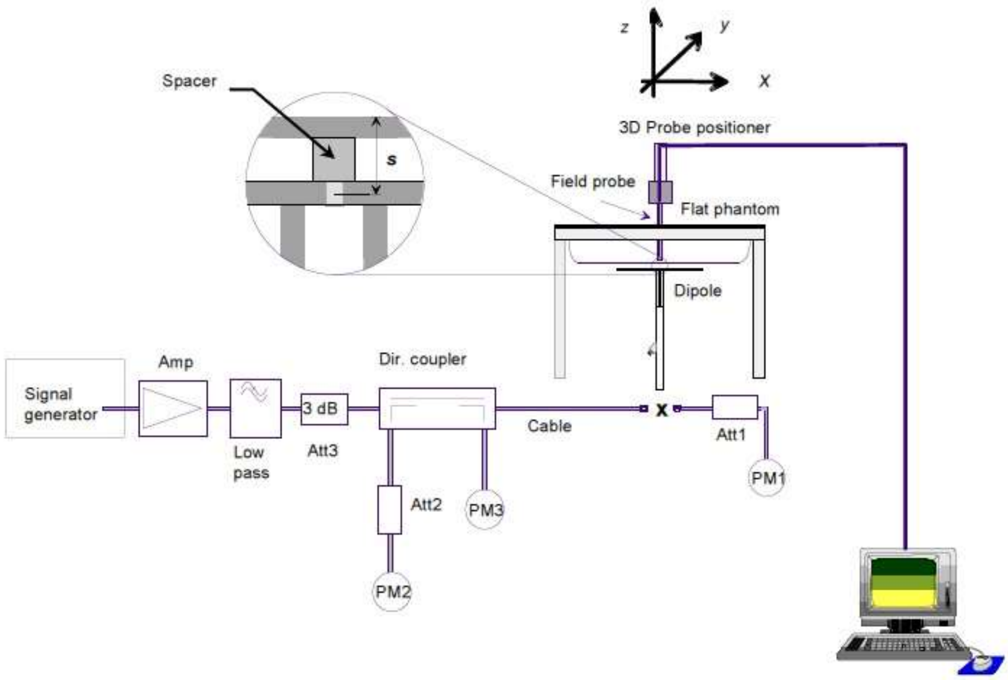
The dielectric properties for this Tissue Simulant Liquids were measured by using the SPEAG Model DAK3.5 Dielectric Probe (rates frequency band 200 MHz to 20 GHz) in conjunction with Agilent E5071B Network Analyzer (300 kHz -8500 MHz). The Conductivity (σ) and Permittivity (ρ) are listed in Table 1.For the SAR measurement given in this report. The temperature variation of the Tissue Simulant Liquids was (22 ± 2) ℃.

Freq. (MHz)	Tissue Type	Limit/Measured	Permittivity (ρ)	Conductivity (σ)	Temp (℃)
2 450	HSL2450	Recommended Limit	39.21 ± 5 % (37.25~41.17)	1.79 ± 5 % (1.70~1.88)	22 ± 2
		Measured, 2015-06-19	39.40	1.86	21.23
5 200	HSL5000	Recommended Limit	36.00 ± 5 % (34.20~37.80)	4.66 ± 5 % (4.43~4.89)	22 ± 2
		Measured, 2015-06-20	36.09	4.74	21.72
5 300	HSL5000	Recommended Limit	35.90 ± 5 % (34.11~37.70)	4.76 ± 5 % (4.52~5.00)	22 ± 2
		Measured, 2015-06-20	35.94	4.83	21.72
5 600	MSL5000	Recommended Limit	48.47 ± 5 % (43.62~53.32)	5.77 ± 5 % (5.19~6.34)	22 ± 2
		Measured, 2015-06-24	47.42	5.85	22.37
5 200	MSL5000	Recommended Limit	49.01 ± 5 % (46.56~51.46)	5.30 ± 5 % (5.04~5.57)	22 ± 2
		Measured, 2015-06-25	48.42	5.11	21.73
5 300	MSL5000	Recommended Limit	48.88 ± 5 % (46.44~51.32)	5.42 ± 5 % (5.15~5.69)	22 ± 2
		Measured, 2015-06-26	48.74	5.25	20.31
5 800	MSL5000	Recommended Limit	48.20 ± 5 % (45.79~50.61)	6.00 ± 5 % (5.70~6.30)	22 ± 2
		Measured, 2015-06-26	47.45	6.16	20.31
5 600	HSL5000	Recommended Limit	35.50 ± 5 % (31.95~39.05)	5.07 ± 5 % (4.56~5.58)	22 ± 2
		Measured, 2015-06-27	35.21	5.23	21.24
5 800	HSL5000	Recommended Limit	35.30 ± 5 % (33.54~37.07)	5.27 ± 5 % (5.01~5.53)	22 ± 2
		Measured, 2015-06-27	34.68	5.49	21.24
2 450	MSL2450	Recommended Limit	52.70 ± 5 % (50.07~55.34)	1.95 ± 5 % (1.85~2.05)	22 ± 2
		Measured, 2015-06-28	52.29	1.98	21.46

<Table 1.Measurement result of Tissue electric parameters>

10.2 Test System Verification

The microwave circuit arrangement for system verification is sketched below picture. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within ± 10% from the target SAR values. The tests were conducted on the same days as the measurement of the EUT. The obtained results from the system accuracy verification are displayed in the table Table 2. During the tests, the ambient temperature of the laboratory was in the range (22 ± 2) ℃,the relative humidity was in the range (50 ± 20) % and the liquid depth above the ear/grid reference points was above 15 cm in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.



Validation Kit	Dipole Ant. S/N	Frequency (MHz)	Tissue Type	Limit/Measurement (Normalized to 1 W)		
					1 g	10 g
D2450V2	895	2 450	HSL2450	Recommended Limit	52.5 ± 10 % (47.25~57.75)	24.5 ± 10 % (22.05~26.95)
				Measured, 2015-06-19	54.40	24.60
D5GHzV2	1134	5 200	HSL5000	Recommended Limit	76.95 ± 10 % (69.26~84.65)	22.1 ± 10 % (18.99~23.21)
				Measured, 2015-06-20	73.70	20.50
D5GHzV2	1134	5 300	HSL5000	Recommended Limit	81.20 ± 10 % (73.08~89.32)	23.50 ± 10 % (21.15~25.85)
				Measured, 2015-06-20	85.00	23.50
D5GHzV2	1134	5 600	MSL5000	Recommended Limit	79.20 ± 10 % (71.28~87.12)	21.9 ± 10 % (19.71~24.09)
				Measured, 2015-06-24	85.50	23.60
D5GHzV2	1134	5 200	MSL5000	Recommended Limit	74.80 ± 10 % (67.32~82.28)	20.9 ± 10 % (18.81~22.99)
				Measured, 2015-06-25	76.70	21.30
D5GHzV2	1134	5 300	MSL5000	Recommended Limit	75.5 ± 10 % (67.95~83.05)	21.0 ± 10 % (18.90~23.10)
				Measured, 2015-06-26	81.90	22.60
D5GHzV2	1134	5 800	MSL5000	Recommended Limit	76.7 ± 10 % (69.03~84.37)	21.1 ± 10 % (18.99~23.21)
				Measured, 2015-06-26	80.60	22.20
D5GHzV2	1134	5 600	HSL5000	Recommended Limit	79.6 ± 10 % (71.64~87.56)	22.8 ± 10 % (20.52~25.08)
				Measured, 2015-06-27	86.10	24.00
D5GHzV2	1134	5 800	HSL5000	Recommended Limit	77.7 ± 10 % (69.93~85.47)	22.2 ± 10 % (19.98~24.42)
				Measured, 2015-06-27	81.20	22.70
D2450V2	895	2 450	MSL2450	Recommended Limit	50.9 ± 10 % (45.81~55.99)	23.6 ± 10 % (21.24~25.96)
				Measured, 2015-06-28	51.60	23.76

<Table 2.Test System Verification Result>

11. Operation Configurations

Measurements were performed at the lowest, middle and highest channels of the operating band. The EUT was set to maximum power level during all tests and at the beginning of each test the battery was fully charged.

12. SAR Measurement Procedures

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift ofthe device under test in the batch process. The Minimum distance of probe sensors to surfacedetermines the closest measurement point to phantom surface. The minimum distance of probe sensorsto surface is 2 mm. This distance cannot be smaller than the Distance of sensor calibration points toprobe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doinga fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASYsoftware can find the maximum locations even in relatively coarse grids. When an Area Scan hasmeasured all reachable points, it computes the field maximal found in the scanned area, within a rangeof the global maximum. The range (in dB) is specified in the standards for compliance testing. Forexample, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is arequirement when compliance is assessed in accordance with the ARIB standard (Japan). If only oneZoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. Forcases where multiple maximums are detected, the number of Zoom Scans has to be increasedaccordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measument 100 MHz to 6 GHz v01r03.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan
Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing1 g and 10 g of simulated tissue. The Zoom Scan measures 5x5x7 points within a cube whose base faces are centered on the maxima found in a preceding area scanjob within the same procedure. When the measurement is done, the Zoom Scan evaluates theaveraged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measument 100 MHz to 6 GHz v01r03.

<table>
<tr><th colspan="3"></th><th>$\leq$ 3 GHz</th><th>$>$ 3 GHz</th></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

Step 4: Power drift measurement
The Power Drift Measurement measures the field at the same location as the most recent powerreference measurement within the same procedure, and with the same settings. The Power DriftMeasurement gives the field difference in dB from the reading conducted within the last PowerReference Measurement. This allows a user to monitor the power drift of the device under test within abatch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan
The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a onedimensionalgrid. In order to get a reasonable extrapolation, the extrapolated distance should not belarger than the step size in Z-direction.

* Z Scan Report on Liquid Measure the height Annex A.4 Liquid Depth photo to replace

13. Test Equipment Information

Test Platform	SPEAG DASY5 System			
Version	DASY5 : Version 52.8.8.1222 SEMCAD : Version 14.6.10 (7331)			
Location	EMC compliance Lab.			
Manufacture	SPEAG			
Hardware Reference				
Equipment	Model	Serial Number	Date of Calibration	Due date of next Calibration
Shield Room	Shield Room	None	N/A	N/A
DASY5 Robot	TX90XL Speag	F12/5L7FA1/A/01	N/A	N/A
DASY5 Controller	TX90XL Speag	F12/5L7FA1/C/01	N/A	N/A
Phantom	SAM Twin Phantom	1724	N/A	N/A
Mounting Device	Mounting Device	None	N/A	N/A
DAE	DAE4	1342	2014-07-24	2015-07-24
Probes	EX3DV4	3928	2015-01-28	2016-01-28
Dipole Validation Kits	D2450V2	895	2014-07-24	2016-07-24
Dipole Validation Kits	D5GHzV2	1134	2015-05-22	2017-05-22
Network Analyzer	E5071B	MY42403524	2014-07-15	2015-07-15
Dual Directional Coupler	772D	2839A00719	2014-08-29	2015-08-29
Signal Generator	E4438C	MY42080486	2015-01-19	2016-01-19
Power Amplifier	2055-BBS3Q7E9I	1005D/C0521	2015.05.22	2016-07-17
Power Amplifier	5190 FE	1012	2014-08-29	2015-08-29
LP Filter	LA-30N	40058	2014-08-28	2015-08-28
LP Filter	LA-60N	40059	2014-08-28	2015-08-28
Dual Power Meter	E4419B	GB43312301	2014-07-17	2015-07-17
Power Sensor	8481H	3318A19377	2014-08-30	2015-08-30
Power Sensor	8481H	3318A19379	2014-08-30	2015-08-30
Dielectric Assessment Kit	DAK-3.5	1078	2014-08-19	2015-08-19
Humidity/Baro/Temp. Data Recorder	MHB-382SD	73871	2014-08-26	2015-08-26

14. RF Average Conducted Output Power

14.1 Average Conducted Output Power

Mode	Conducted Powers (dBm)		
	2412	2437	2462
802.11b_1 Mbps	18.94	18.72	18.68
802.11g_6 Mbps	18.47	18.48	18.61
802.11n(HT-20)_MCS0	18.45	18.49	18.61

Mode	Conducted Powers (dBm)											
	5 180	5 200	5 240	5 260	5 300	5 320	5 500	5 580	5 700	5 745	5 785	5 825
802.11a_6 Mbps	17.93	17.88	17.87	17.74	17.83	17.88	18.12	17.97	17.89	17.75	17.69	17.61
802.11n(HT-20)_MCS0	17.85	17.88	17.91	17.86	17.71	17.77	18.10	17.85	17.82	17.73	17.65	17.53

14.2 Max. tune up power

Mode	Target Power (dBm)	Tolerance(dB)	Max. Allowed Power(dBm)
IEEE 802.11b	18.00	± 2	20.00
IEEE 802.11g	18.00	± 2	20.00
IEEE 802.11n(HT-20)	18.00	± 2	20.00
IEEE 802.11a	18.00	± 1	19.00
IEEE 802.11n(HT-20)	18.00	± 1	19.00

15. SAR Test Results

15.1 WLAN 2.4G Head SAR

Frequency		Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	1 g SAR Limit (W/kg)
MHz	Ch.							
2437	6	18.72	20.00	1.3428	Right Cheek	0.322	0.432	1.6
2437	6	18.72	20.00	1.3428	Right Tilt	0.309	0.415	
2437	6	18.72	20.00	1.3428	Left Cheek	0.324	**0.435**	
2437	6	18.72	20.00	1.3428	Left Tilt	0.291	0.391	

<Note>

* SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498D01v05r02.
* For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

15.2 WLAN 2.4G Body SAR

Frequency		Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Separation Distance (mm)	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	1 g SAR Limit (W/kg)
MHz	Ch.								
2437	6	18.72	20.00	1.3428	Front	15	0.081	0.109	1.6
2437	6	18.72	20.00	1.3428	Back	15	0.096	**0.129**	
2437	6	18.72	20.00	1.3428	Top	15	0.095	0.128	
2437	6	18.72	20.00	1.3428	Left	15	0.059	0.079	
2437	6	18.72	20.00	1.3428	Right	15	0.049	0.066	
2437	6	18.72	20.00	1.3428	Bottom	15	0.006	0.008	

<Note>

* SAR valueswere scaled to the maximum allowed power to determine compliance per KDB Publication 447498D01v05r02.
* For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

15.3 WLAN 5.2G Head SAR

Frequency		Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	1 g SAR Limit (W/kg)
MHz	Ch.							
5200	40	17.88	19.00	1.2942	Right Cheek	0.619	0.801	1.6
5200	40	17.88	19.00	1.2942	Right Tilt	0.607	0.786	
5200	40	17.88	19.00	1.2942	Left Cheek	0.466	0.603	
5200	40	17.88	19.00	1.2942	Left Tilt	0.523	0.677	
5180	36	17.93	19.00	1.2794	Right Cheek	0.476	0.609	
5240	48	17.87	19.00	1.2972	Right Cheek	0.662	**0.859**	

<Note>

* SAR valueswere scaled to the maximum allowed power to determine compliance per KDB Publication 447498D01v05r02.
* For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

15.4 WLAN 5.2G Body SAR

Frequency		Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Separation Distance (mm)	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	1 g SAR Limit (W/kg)
MHz	Ch.								
5200	40	17.88	19.00	1.2942	Front	15	0.083	0.107	1.6
5200	40	17.88	19.00	1.2942	Back	15	0.384	**0.497**	
5200	40	17.88	19.00	1.2942	Top	15	0.234	0.303	
5200	40	17.88	19.00	1.2942	Left	15	0.057	0.074	
5200	40	17.88	19.00	1.2942	Right	15	0.075	0.097	
5200	40	17.88	19.00	1.2942	Bottom	15	0.013	0.017	

<Note>

* SAR valueswere scaled to the maximum allowed power to determine compliance per KDB Publication 447498D01v05r02.
* For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

15.5 WLAN 5.3G Head SAR

Frequency		Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	1 g SAR Limit (W/kg)
MHz	Ch.							
5300	60	17.83	19.00	1.3092	Right Cheek	0.663	0.868	1.6
5300	60	17.83	19.00	1.3092	Right Tilt	0.741	0.970	
5300	60	17.83	19.00	1.3092	Left Cheek	0.581	0.761	
5300	60	17.83	19.00	1.3092	Left Tilt	0.642	0.841	
5260	52	17.74	19.00	1.3366	Right Tilt	0.653	0.873	
5320	64	17.88	19.00	1.2942	Right Tilt	0.794	**1.03**	

<Note>

* SAR valueswere scaled to the maximum allowed power to determine compliance per KDB Publication 447498D01v05r02.
* For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

15.6 WLAN 5.3G Body SAR

Frequency		Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Separation Distance (mm)	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	1 g SAR Limit (W/kg)
MHz	Ch.								
5300	60	17.83	19.00	1.3092	Front	15	0.109	0.143	1.6
5300	60	17.83	19.00	1.3092	Back	15	0.566	**0.741**	
5300	60	17.83	19.00	1.3092	Top	15	0.310	0.406	
5300	60	17.83	19.00	1.3092	Left	15	0.055	0.072	
5300	60	17.83	19.00	1.3092	Right	15	0.087	0.114	
5300	60	17.83	19.00	1.3092	Bottom	15	0.012	0.016	

<Note>

* SAR valueswere scaled to the maximum allowed power to determine compliance per KDB Publication 447498D01v05r02.
* For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

15.7 WLAN 5.5G Head SAR

Frequency		Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	1 g SAR Limit (W/kg)
MHz	Ch.							
5580	116	17.97	19.00	1.2677	Right Cheek	0.822	1.04	1.6
5580	116	17.97	19.00	1.2677	Right Tilt	0.942	**1.19**	
5580	116	17.97	19.00	1.2677	Left Cheek	0.780	0.989	
5580	116	17.97	19.00	1.2677	Left Tilt	0.889	1.13	
5500	100	18.12	19.00	1.2246	Right Tilt	0.799	0.978	
5700	140	17.89	19.00	1.2912	Right Tilt	0.827	1.07	

<Note>

* SAR valueswere scaled to the maximum allowed power to determine compliance per KDB Publication 447498D01v05r02.
* For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

15.8 WLAN 5.5G Body SAR

Frequency		Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Separation Distance (mm)	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	1 g SAR Limit (W/kg)
MHz	Ch.								
5580	116	17.97	19.00	1.2677	Front	15	0.166	0.210	1.6
5580	116	17.97	19.00	1.2677	Back	15	0.934	**1.18**	
5580	116	17.97	19.00	1.2677	Top	15	0.536	0.679	
5580	116	17.97	19.00	1.2677	Left	15	0.057	0.072	
5580	116	17.97	19.00	1.2677	Right	15	0.108	0.137	
5580	116	17.97	19.00	1.2677	Bottom	15	0.020	0.025	
5500	100	18.12	19.00	1.2246	Back	15	0.827	1.01	
5700	140	17.89	19.00	1.2912	Back	15	0.778	1.01	

<Note>

* SAR valueswere scaled to the maximum allowed power to determine compliance per KDB Publication 447498D01v05r02.
* For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

15.9 WLAN 5.8G Head SAR

Frequency		Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	1 g SAR Limit (W/kg)
MHz	Ch.							
5785	157	17.69	19.00	1.3521	Right Cheek	0.661	0.894	1.6
5785	157	17.69	19.00	1.3521	Right Tilt	0.782	1.06	
5785	157	17.69	19.00	1.3521	Left Cheek	0.574	0.776	
5785	157	17.69	19.00	1.3521	Left Tilt	0.666	0.900	
5745	149	17.75	19.00	1.3335	Right Tilt	0.939	1.25	
5825	165	17.61	19.00	1.3772	Right Tilt	0.914	**1.26**	

<Note>

* SAR valueswere scaled to the maximum allowed power to determine compliance per KDB Publication 447498D01v05r02.
* For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

15.10 WLAN 5.8G Body SAR

Frequency		Average Power (dBm)	Max. tune up power (dBm)	Scaling Factor	EUT Position	Separation Distance (mm)	Measured 1 g SAR (W/kg)	Scaled 1 g SAR (W/kg)	1 g SAR Limit (W/kg)
MHz	Ch.								
5785	157	17.69	19.00	1.3521	Front	15	0.141	0.191	1.6
5785	157	17.69	19.00	1.3521	Back	15	0.745	1.01	
5785	157	17.69	19.00	1.3521	Top	15	0.432	0.584	
5785	157	17.69	19.00	1.3521	Left	15	0.020	0.027	
5785	157	17.69	19.00	1.3521	Right	15	0.096	0.130	
5785	157	17.69	19.00	1.3521	Bottom	15	0.019	0.026	
5745	149	17.75	19.00	1.3335	Back	15	0.845	1.13	
5825	165	17.61	19.00	1.3772	Back	15	0.930	**1.28**	

<Note>

* SAR valueswere scaled to the maximum allowed power to determine compliance per KDB Publication 447498D01v05r02.
* For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

16. Test System Verification Results

System check for Head 2450 MHz(2015-06-19)

Procedure Name: d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)

Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz; σ = 1.861 S/m; ε_r = 39.397; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(7.06, 7.06, 7.06); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe) 2 2/Area Scan (51x61x1): Interpolated grid: dx=2.000 mm, dy=2.000 mm

Maximum value of SAR (interpolated) = 19.1 W/kg

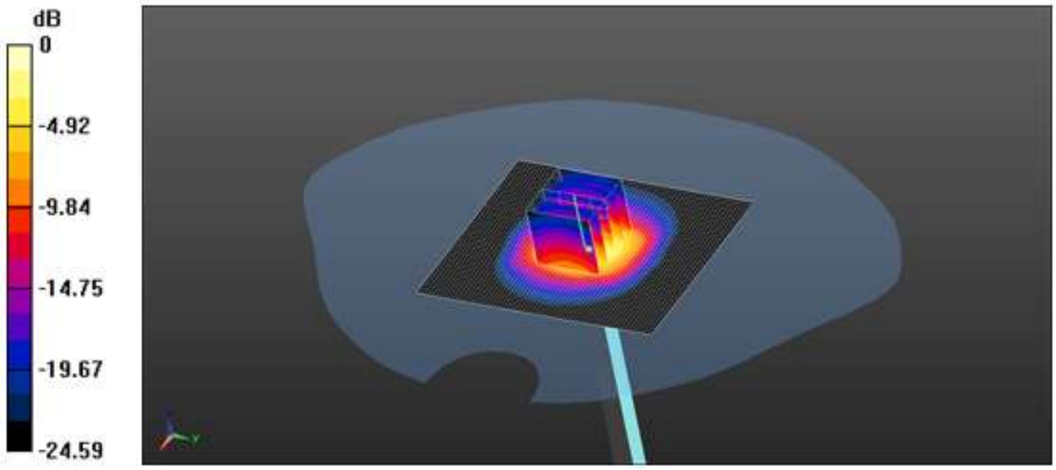
System Performance Check at Frequencies/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe) 2 2/Zoom Scan (7x7x7) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 108.4 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 29.2 W/kg

SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.15 W/kg

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



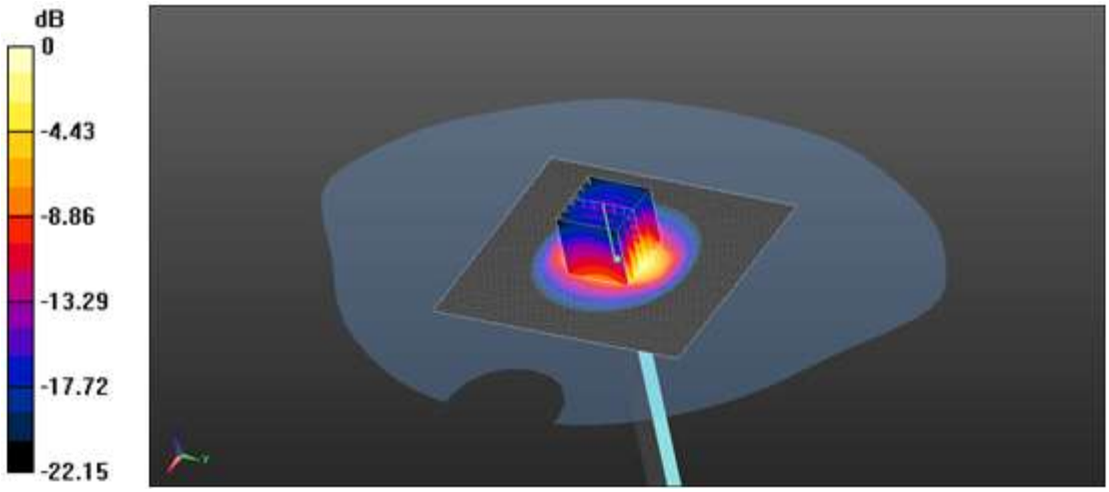
System check for Body 2450 MHz(2015-06-28)
Procedure Name: d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe)

Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.976 S/m; ε_r = 52.295; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(7.15, 7.15, 7.15); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequencies/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe) 2/Area Scan (91x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 20.3 W/kg

System Performance Check at Frequencies/d=10mm, Pin=250 mW, dist=2.0mm (EX-Probe) 2/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.4 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.94 W/kg
Maximum value of SAR (measured) = 19.9 W/kg



System check for Head 5200 MHz(2015-06-20)

Procedure Name: d=10mm, Pin=100mW, f=5200MHz

Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5200 MHz; σ = 4.743 S/m; ε_r = 36.087; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(5.02, 5.02, 5.02); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/d=10mm, Pin=100mW, f=5200MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 15.7 W/kg

Configuration/d=10mm, Pin=100mW, f=5200MHz/Zoom Scan (7x7x12)/Cube 0:

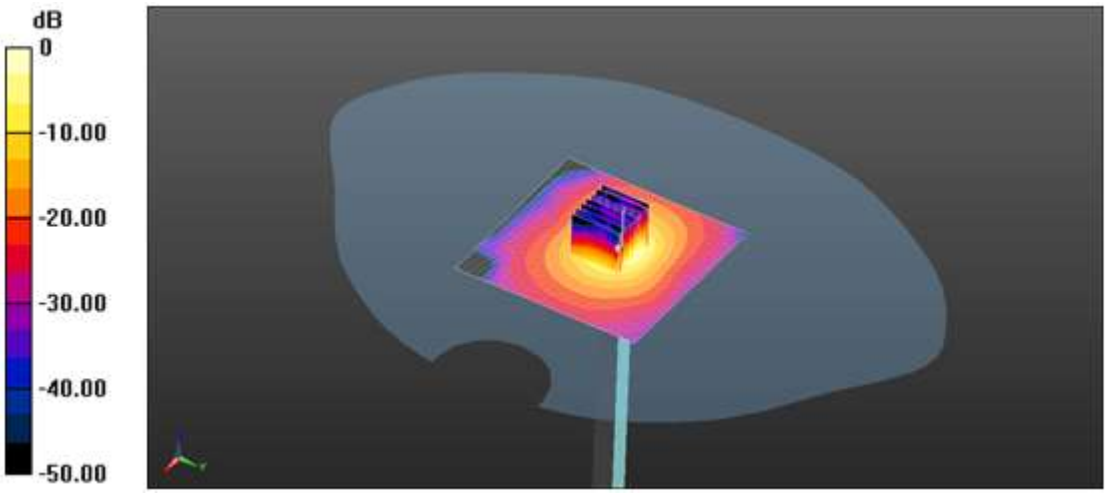
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 61.82 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 33.1 W/kg

SAR(1 g) = 7.37 W/kg; SAR(10 g) = 2.05 W/kg

Maximum value of SAR (measured) = 15.1 W/kg



System check for Body 5200 MHz(2015-06-25)

Procedure Name: d=10mm, Pin=100mW, f=5200MHz

Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5200 MHz; σ = 5.111 S/m; ε_r = 48.416; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.12, 4.12, 4.12); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/d=10mm, Pin=100mW, f=5200MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

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

Configuration/d=10mm, Pin=100mW, f=5200MHz/Zoom Scan (7x7x12)/Cube 0:

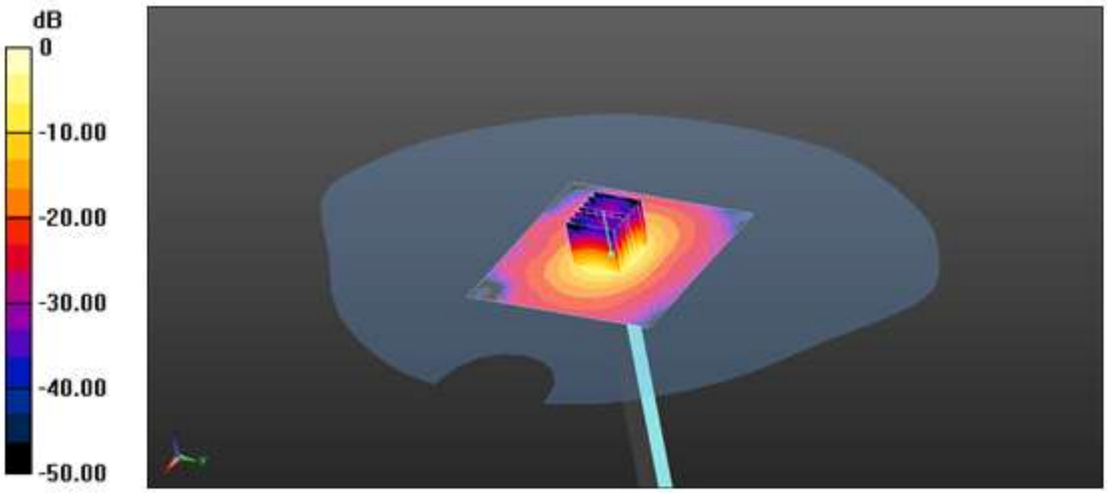
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 62.55 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 32.0 W/kg

SAR(1 g) = 7.67 W/kg; SAR(10 g) = 2.13 W/kg

Maximum value of SAR (measured) = 16.3 W/kg



System check for Head 5300 MHz(2015-06-20)

Procedure Name: d=10mm, Pin=100mW, f=5300MHz

Frequency: 5300 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5300 MHz; σ = 4.834 S/m; ε_r = 35.936; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.85, 4.85, 4.85); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/d=10mm, Pin=100mW, f=5300MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 18.0 W/kg

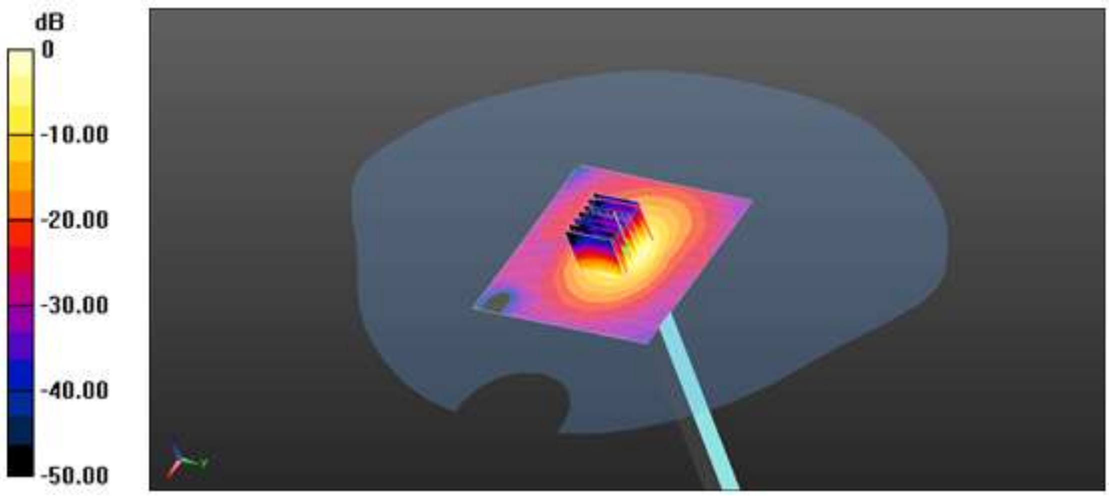
Configuration/d=10mm, Pin=100mW, f=5300MHz/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 64.40 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 39.2 W/kg

SAR(1 g) = 8.5 W/kg; SAR(10 g) = 2.35 W/kg

Maximum value of SAR (measured) = 17.3 W/kg



System check for Body 5300 MHz(2015-06-26)

Procedure Name: d=10mm, Pin=100mW, f=5300MHz

Frequency: 5300 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5300 MHz; σ = 5.252 S/m; ε_r = 48.742; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(3.93, 3.93, 3.93); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/d=10mm, Pin=100mW, f=5300MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 16.3 W/kg

Configuration/d=10mm, Pin=100mW, f=5300MHz/Zoom Scan (7x7x12)/Cube 0:

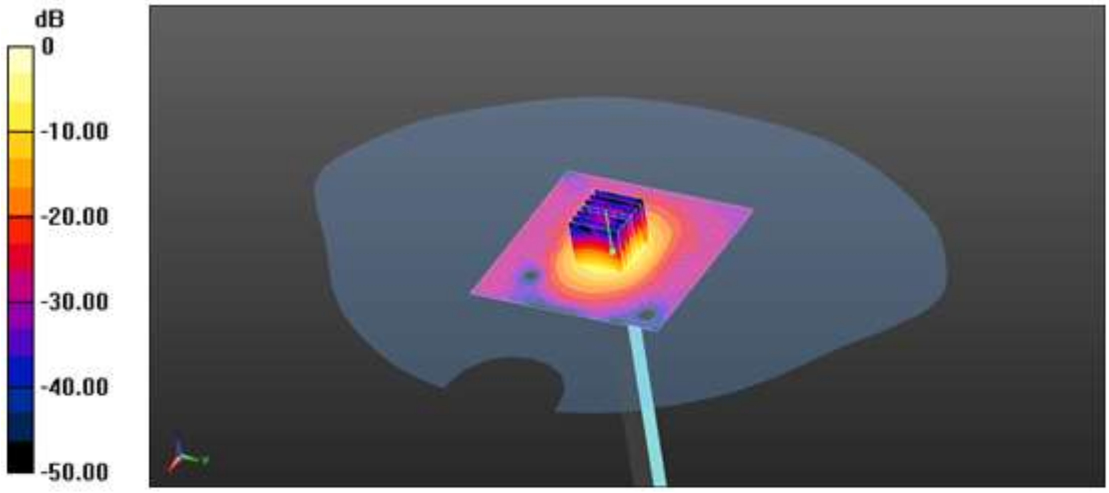
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 63.84 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 34.6 W/kg

SAR(1 g) = 8.19 W/kg; SAR(10 g) = 2.26 W/kg

Maximum value of SAR (measured) = 17.4 W/kg



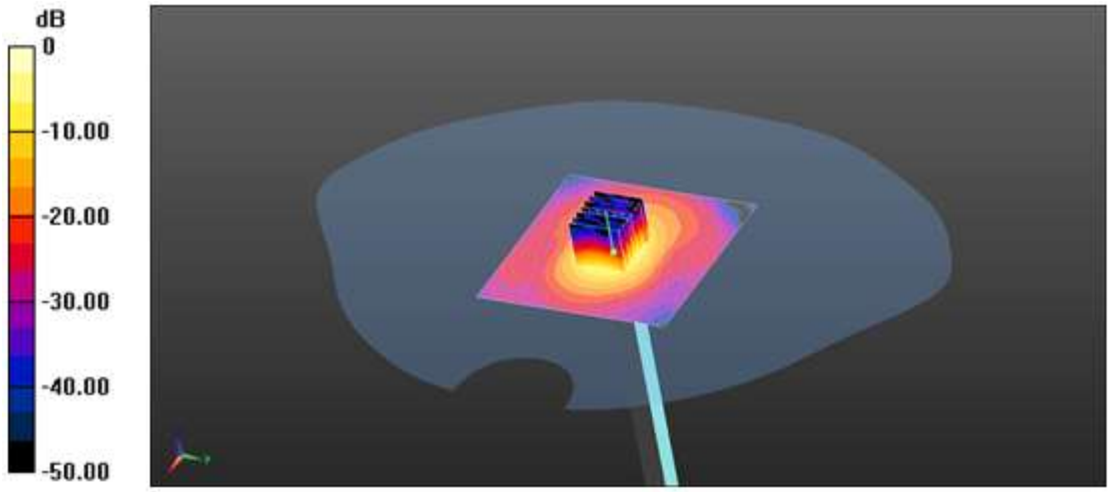
System check for Head 5600 MHz(2015-06-27)
Procedure Name: d=10mm, Pin=100mW, f=5600MHz

Frequency: 5600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.235 S/m; ε_r = 35.214; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.45, 4.45, 4.45); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/d=10mm, Pin=100mW, f=5600MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 17.9 W/kg

Configuration/d=10mm, Pin=100mW, f=5600MHz/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 64.29 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 40.0 W/kg
SAR(1 g) = 8.61 W/kg; SAR(10 g) = 2.4 W/kg
Maximum value of SAR (measured) = 18.6 W/kg



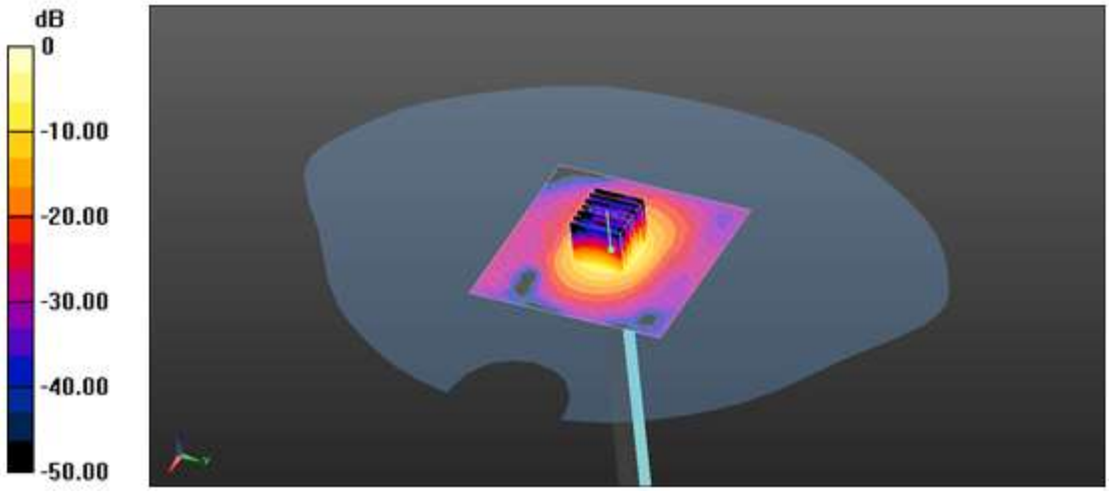
System check for Body 5600 MHz(2015-06-24)
Procedure Name: d=10mm, Pin=100mW, f=5600MHz

Frequency: 5600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.852 S/m; ε_r = 47.417; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(3.65, 3.65, 3.65); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/d=10mm, Pin=100mW, f=5600MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 16.4 W/kg

Configuration/d=10mm, Pin=100mW, f=5600MHz/Zoom Scan (7x7x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 63.25 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 36.9 W/kg
SAR(1 g) = 8.55 W/kg; SAR(10 g) = 2.36 W/kg
Maximum value of SAR (measured) = 18.2 W/kg



System check for Head 5800 MHz(2015-06-27)

Procedure Name: d=10mm, Pin=100mW, f=5800MHz

Frequency: 5800 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5800 MHz; σ = 5.488 S/m; ε_r = 34.679; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.58, 4.58, 4.58); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/d=10mm, Pin=100mW, f=5800MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 16.6 W/kg

Configuration/d=10mm, Pin=100mW, f=5800MHz/Zoom Scan (7x7x12)/Cube 0:

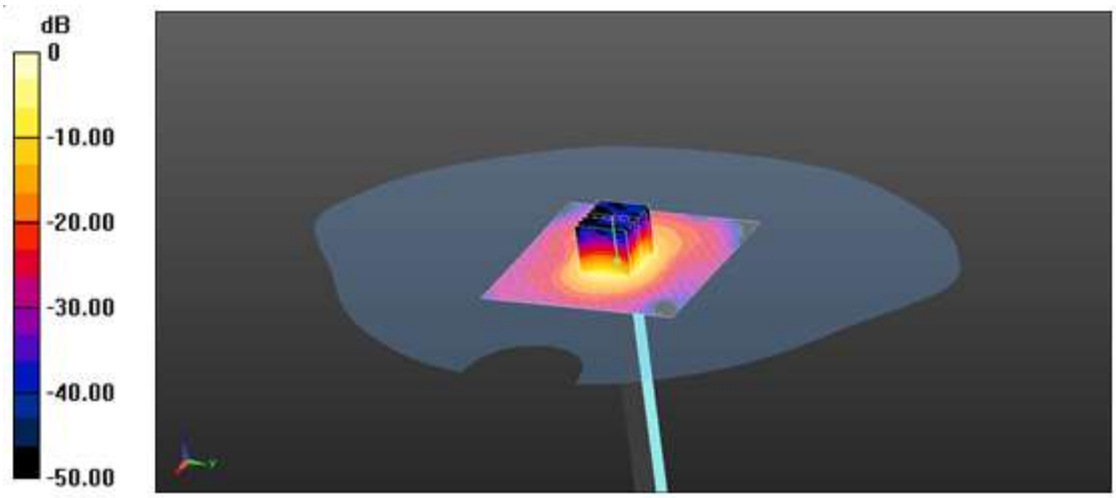
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 60.46 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 38.2 W/kg

SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.27 W/kg

Maximum value of SAR (measured) = 17.6 W/kg



System check for Body 5800 MHz(2015-06-26)

Procedure Name: d=10mm, Pin=100mW, f=5800MHz

Frequency: 5800 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5800 MHz; σ = 6.16 S/m; ε_r = 47.446; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(3.89, 3.89, 3.89); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/d=10mm, Pin=100mW, f=5800MHz/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 18.8 W/kg

Configuration/d=10mm, Pin=100mW, f=5800MHz/Zoom Scan (7x7x12)/Cube 0:

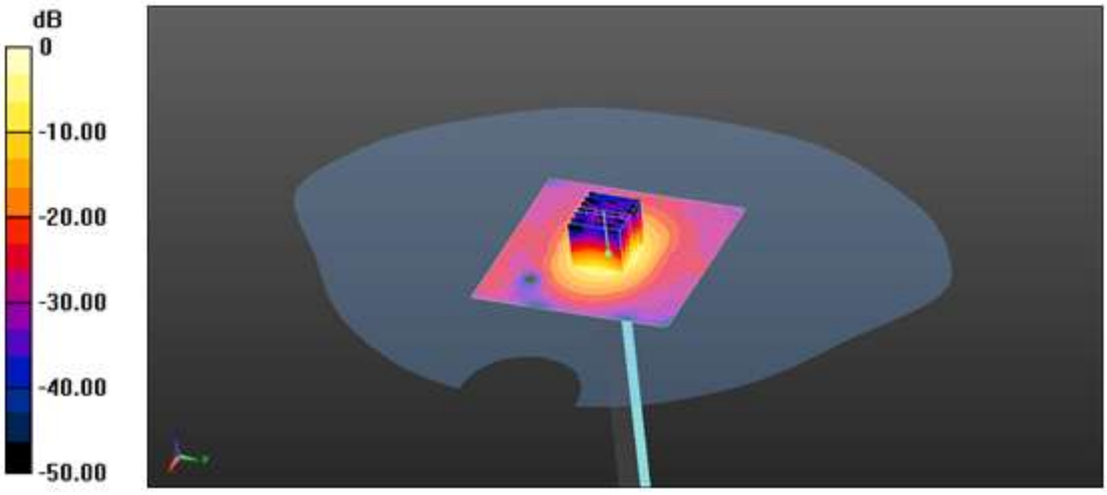
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 63.70 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 34.5 W/kg

SAR(1 g) = 8.06 W/kg; SAR(10 g) = 2.22 W/kg

Maximum value of SAR (measured) = 17.3 W/kg



17. Test Results

#1

Procedure Name: 802.11b_Ch6_f.2 437_Left Cheek

Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2437 MHz; σ = 1.847 S/m; ε_r = 39.455; ρ = 1000 kg/m^3

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(7.06, 7.06, 7.06); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11b_Ch6_f.2 437_Left Cheek/Area Scan (81x171x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.484 W/kg

Configuration/802.11b_Ch6_f.2 437_Left Cheek/Zoom Scan (7x7x7)/Cube 0:

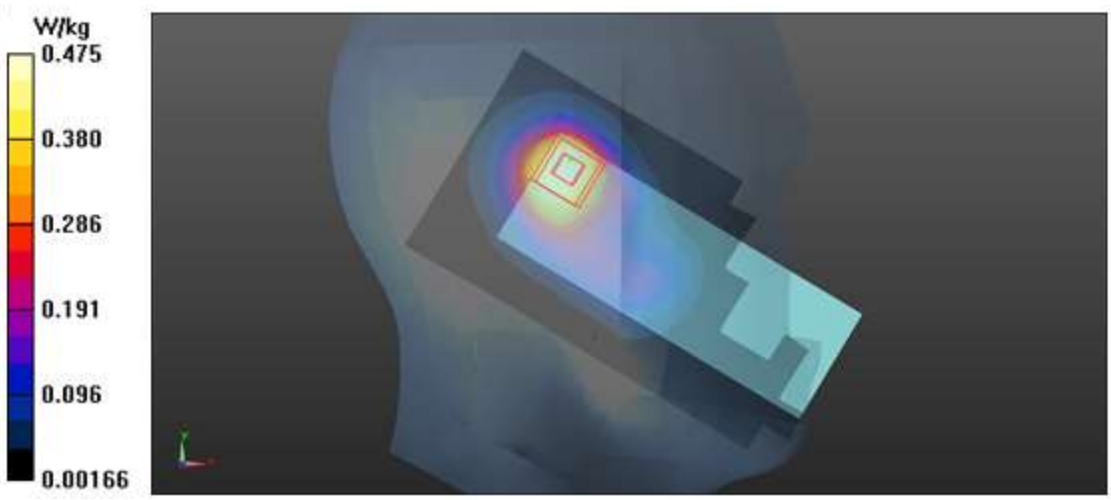
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 15.09 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.665 W/kg

SAR(1 g) = 0.324 W/kg; SAR(10 g) = 0.179 W/kg

Maximum value of SAR (measured) = 0.475 W/kg



#2

Procedure Name: 802.11b_Ch6_f.2 437_Body Back

Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2437 MHz; σ = 1.968 S/m; ε_r = 52.348; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(7.15, 7.15, 7.15); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11b_Ch6_f.2 437_Body Back/Area Scan (81x161x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.134 W/kg

Configuration/802.11b_Ch6_f.2 437_Body Back/Zoom Scan (7x7x7)/Cube 0:

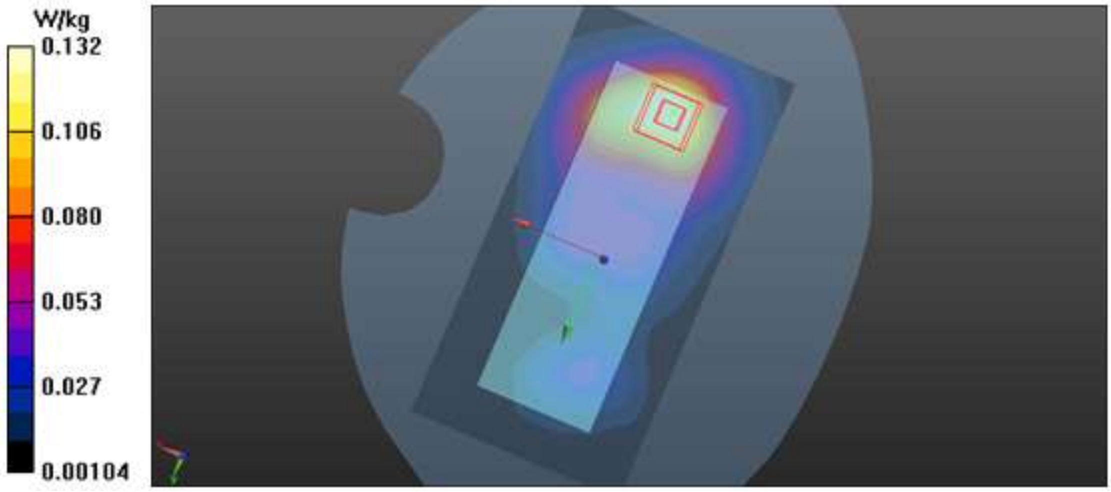
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.414 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.174 W/kg

SAR(1 g) = 0.096 W/kg; SAR(10 g) = 0.055 W/kg

Maximum value of SAR (measured) = 0.132 W/kg



#3

Procedure Name: 802.11a_Ch48_f.5 240_Right Cheek

Frequency: 5240 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5240 MHz; $\sigma = 4.767$ S/m; $\varepsilon_r = 36.025$; $\rho = 1000$ kg/m^3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(5.02, 5.02, 5.02); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11a_Ch48_f.5 240_Right Cheek/Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.18 W/kg

Configuration/802.11a_Ch48_f.5 240_Right Cheek/Zoom Scan (7x7x12)/Cube 0:

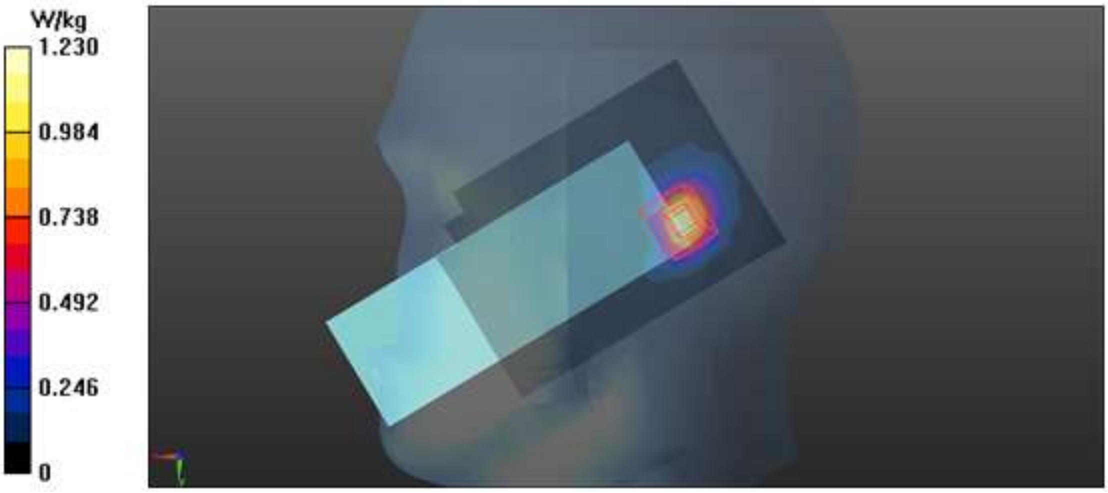
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 8.052 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 2.54 W/kg

SAR(1 g) = 0.662 W/kg; SAR(10 g) = 0.233 W/kg

Maximum value of SAR (measured) = 1.23 W/kg



#4

Procedure Name: 802.11a_Ch40_f.5 200_Body Back_Gap 15 mm

Frequency: 5200 MHz;   Duty Cycle: 1:1

Medium parameters used: f = 5200 MHz; σ = 5.111 S/m; ε_r = 48.416; ρ = 1000 kg/m^3

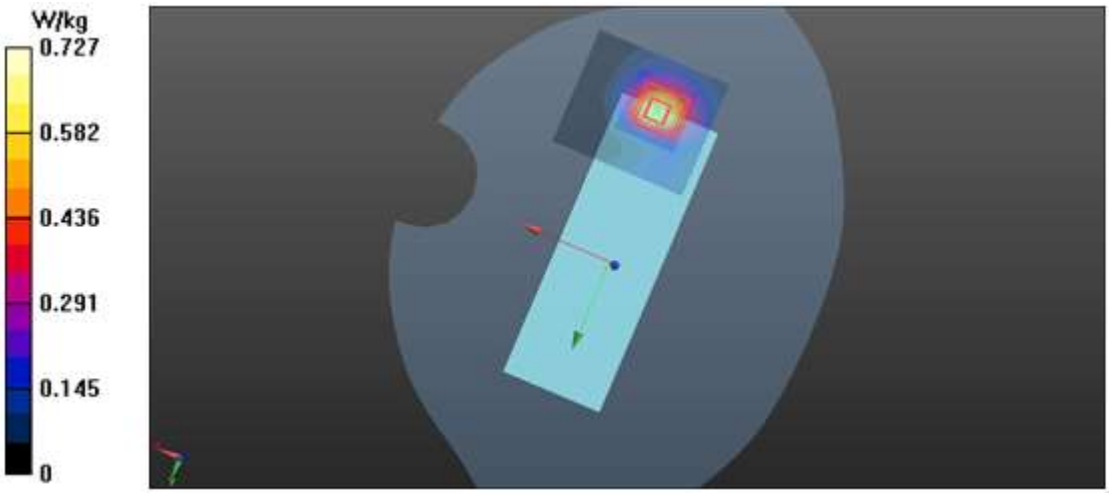
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.12, 4.12, 4.12); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11a_Ch40_f.5 200_Body Back_Gap 15 mm/Area Scan (71x61x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.746 W/kg

Configuration/802.11a_Ch40_f.5 200_Body Back_Gap 15 mm/Zoom Scan (9x9x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.836 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 1.39 W/kg
SAR(1 g) = 0.384 W/kg; SAR(10 g) = 0.141 W/kg
Maximum value of SAR (measured) = 0.727 W/kg



#5

Procedure Name: 802.11a_Ch64_f.5 320_Right Tilt

Frequency: 5320 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5320 MHz; $\sigma = 4.844$ S/m; $\varepsilon_r = 35.979$; $\rho = 1000$ kg/m^3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.85, 4.85, 4.85); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11a_Ch64_f.5 320_Right Tilt/Area Scan (101x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.54 W/kg

Configuration/802.11a_Ch64_f.5 320_Right Tilt/Zoom Scan (7x7x12)/Cube 0:

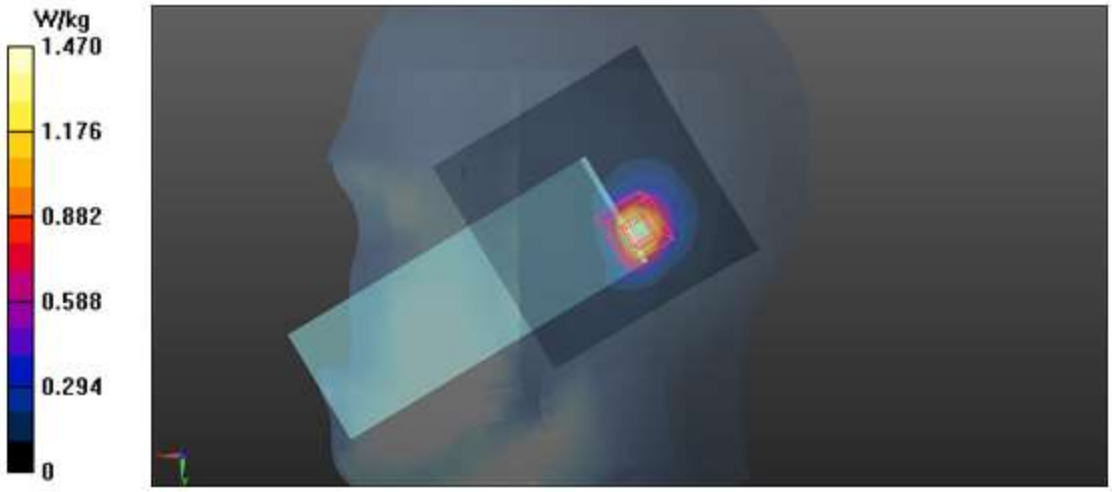
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 0 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 2.85 W/kg

SAR(1 g) = 0.794 W/kg; SAR(10 g) = 0.292 W/kg

Maximum value of SAR (measured) = 1.47 W/kg



#6

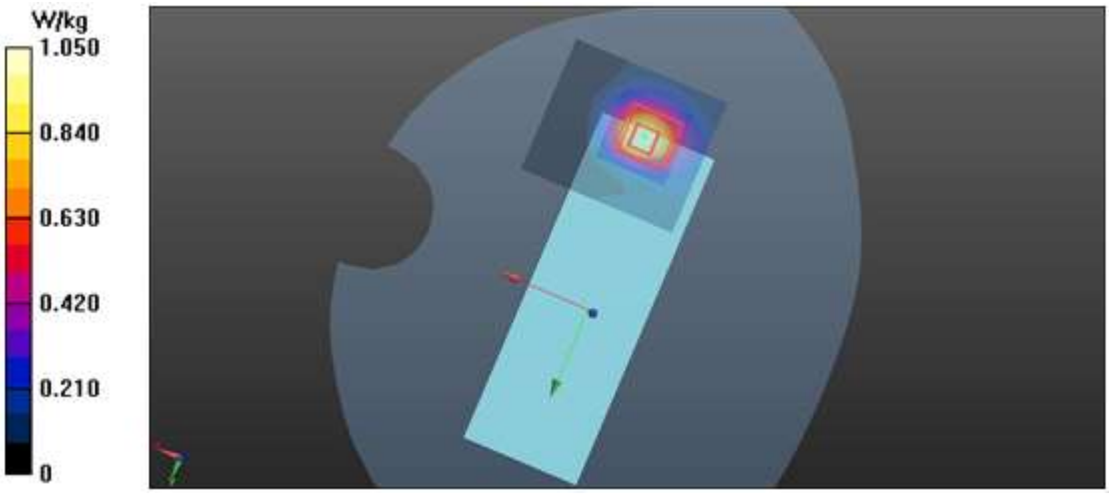
Procedure Name: 802.11a_Ch60_f.5 300_Body Back_Gap 15 mm

Frequency: 5300 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 5.252 S/m; ε_r = 48.742; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(3.93, 3.93, 3.93); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11a_Ch60_f.5 300_Body Back_Gap 15 mm/Area Scan (71x61x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.13 W/kg

Configuration/802.11a_Ch60_f.5 300_Body Back_Gap 15 mm/Zoom Scan (9x9x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 4.118 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 2.04 W/kg
SAR(1 g) = 0.566 W/kg; SAR(10 g) = 0.206 W/kg
Maximum value of SAR (measured) = 1.05 W/kg



#7

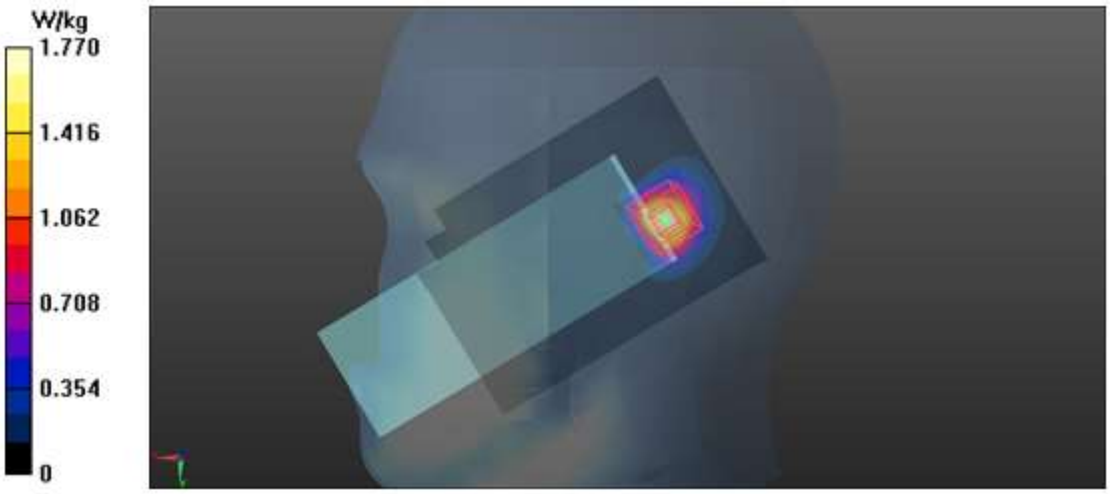
Procedure Name: 802.11a_Ch116_f.5 580_Right Tilt 2

Frequency: 5580 MHz;   Duty Cycle: 1:1
Medium parameters used: f = 5580 MHz; σ = 5.244 S/m; ε_r = 35.201; ρ = 1000 kg/m^3
Phantom section: Right Section
DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.45, 4.45, 4.45); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11a_Ch116_f.5 580_Right Tilt 2/Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.71 W/kg

Configuration/802.11a_Ch116_f.5 580_Right Tilt 2/Zoom Scan (9x9x12)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 11.74 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 3.47 W/kg
SAR(1 g) = 0.942 W/kg; SAR(10 g) = 0.363 W/kg
Maximum value of SAR (measured) = 1.77 W/kg



#8

Procedure Name: 802.11a_Ch116_f.5 580_Body Back_Gap 15 mm 2

Frequency: 5580 MHz;   Duty Cycle: 1:1

Medium parameters used: f = 5580 MHz; σ = 5.84 S/m; ε_r = 47.495; ρ = 1000 kg/m^3

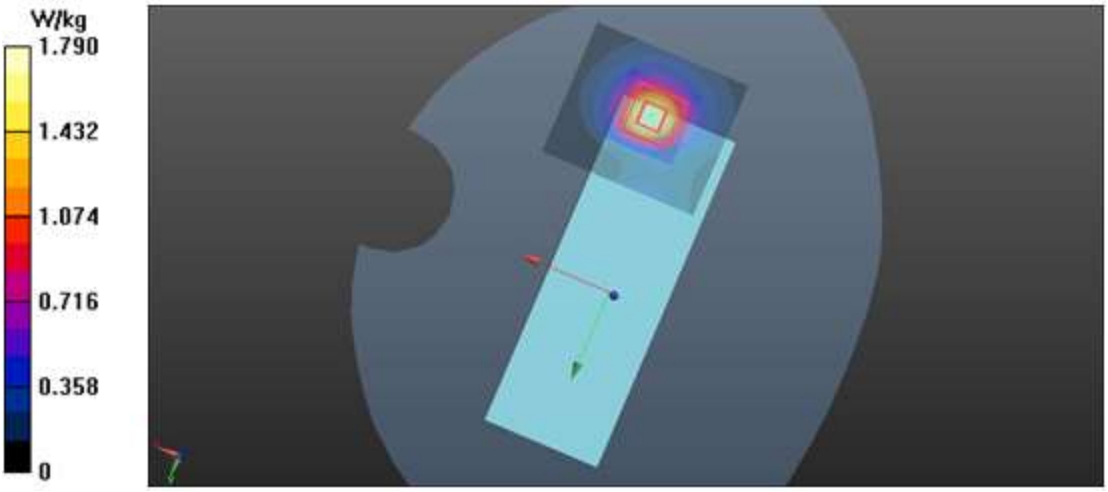
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(3.65, 3.65, 3.65); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11a_Ch116_f.5 580_Body Back_Gap 15 mm 2/Area Scan (71x61x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.88 W/kg

Configuration/802.11a_Ch116_f.5 580_Body Back_Gap 15 mm 2/Zoom Scan (9x9x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 9.861 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.91 W/kg
SAR(1 g) = 0.934 W/kg; SAR(10 g) = 0.339 W/kg
Maximum value of SAR (measured) = 1.79 W/kg



#9

Procedure Name: 802.11a_Ch165_f.5 825_Right Tilt

Frequency: 5825 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5825 MHz; $\sigma = 5.504$ S/m; $\varepsilon_r = 34.576$; $\rho = 1000$ kg/m^3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(4.58, 4.58, 4.58); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin 1728; Type: QD000P40CD; Serial: TP:1728
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11a_Ch165_f.5 825_Right Tilt/Area Scan (91x131x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.91 W/kg

Configuration/802.11a_Ch165_f.5 825_Right Tilt/Zoom Scan (9x10x12)/Cube 0:

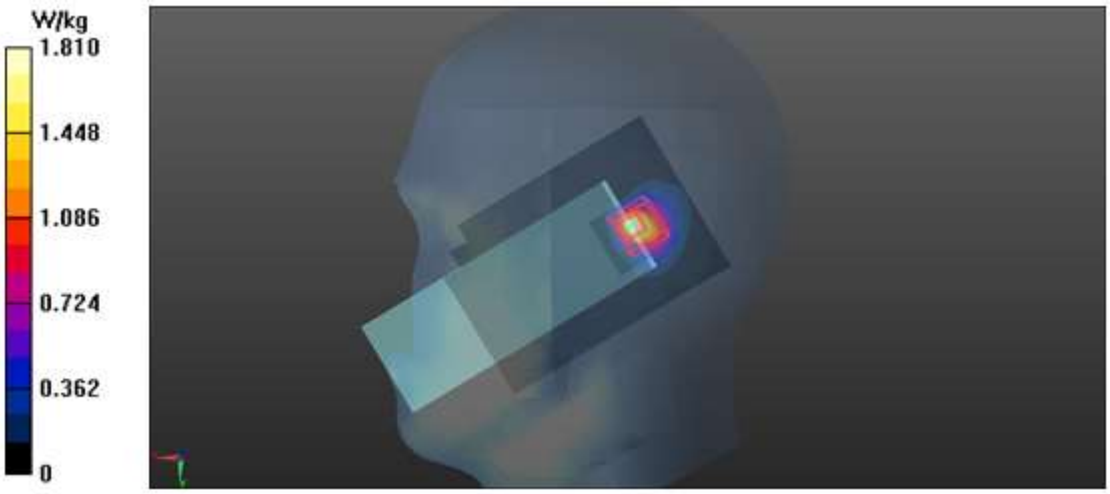
Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 15.59 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 3.92 W/kg

SAR(1 g) = 0.914 W/kg; SAR(10 g) = 0.305 W/kg

Maximum value of SAR (measured) = 1.81 W/kg



#10

Procedure Name: 802.11a_Ch165_f.5 825_Body Back_Gap 15 mm

Frequency: 5825 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5825 MHz; σ = 6.181 S/m; ε_r = 47.33; ρ = 1000 kg/m^3

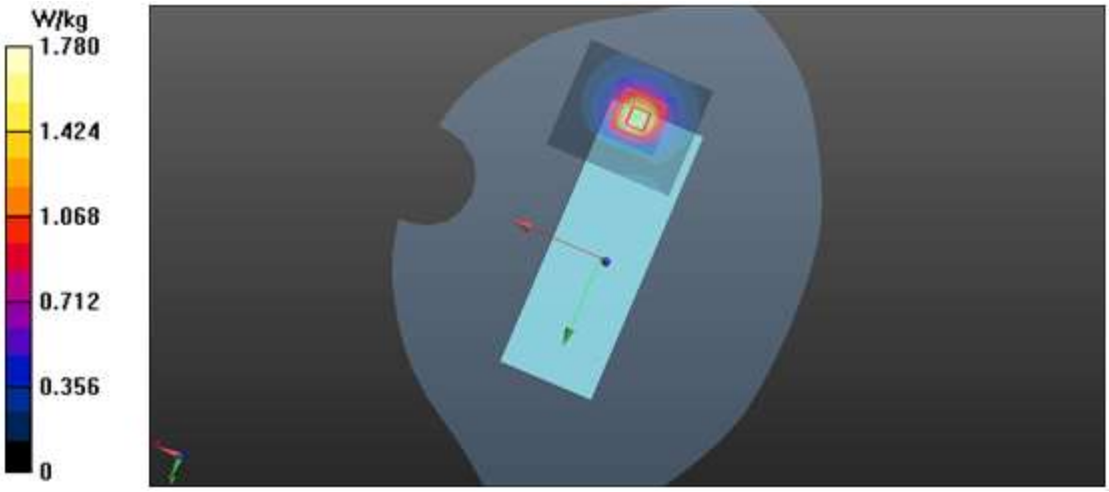
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3928; ConvF(3.89, 3.89, 3.89); Calibrated: 2015-01-28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1342; Calibrated: 2014-07-24
- Phantom: SAM twin SN1724; Type: QD000P40CD; Serial: TP:1724
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11a_Ch165_f.5 825_Body Back_Gap 15 mm/Area Scan (71x61x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.89 W/kg

Configuration/802.11a_Ch165_f.5 825_Body Back_Gap 15 mm/Zoom Scan (9x9x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.668 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 4.20 W/kg
SAR(1 g) = 0.930 W/kg; SAR(10 g) = 0.336 W/kg
Maximum value of SAR (measured) = 1.78 W/kg

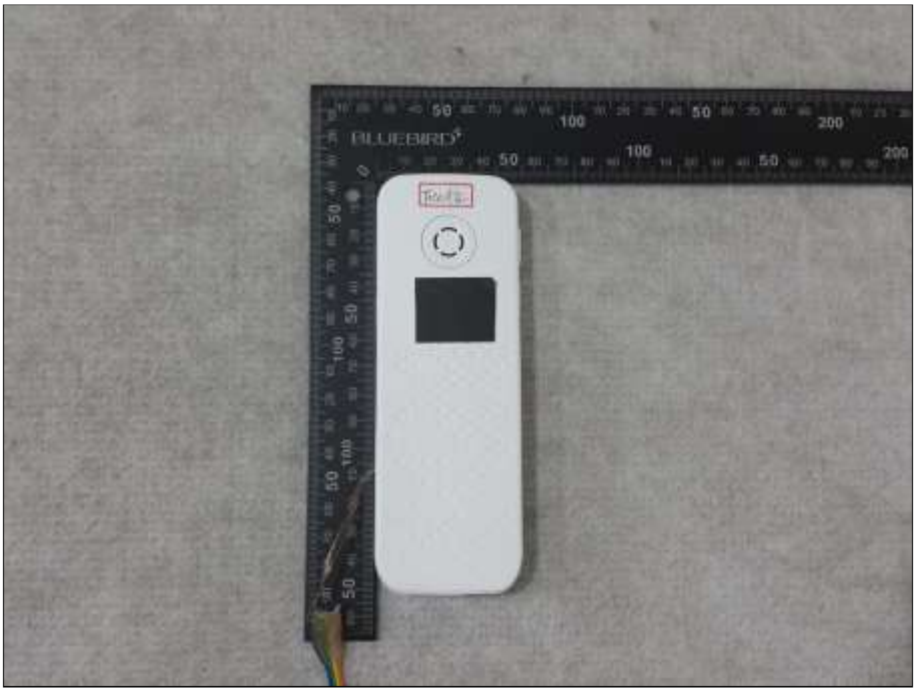


Annex A. Photographs

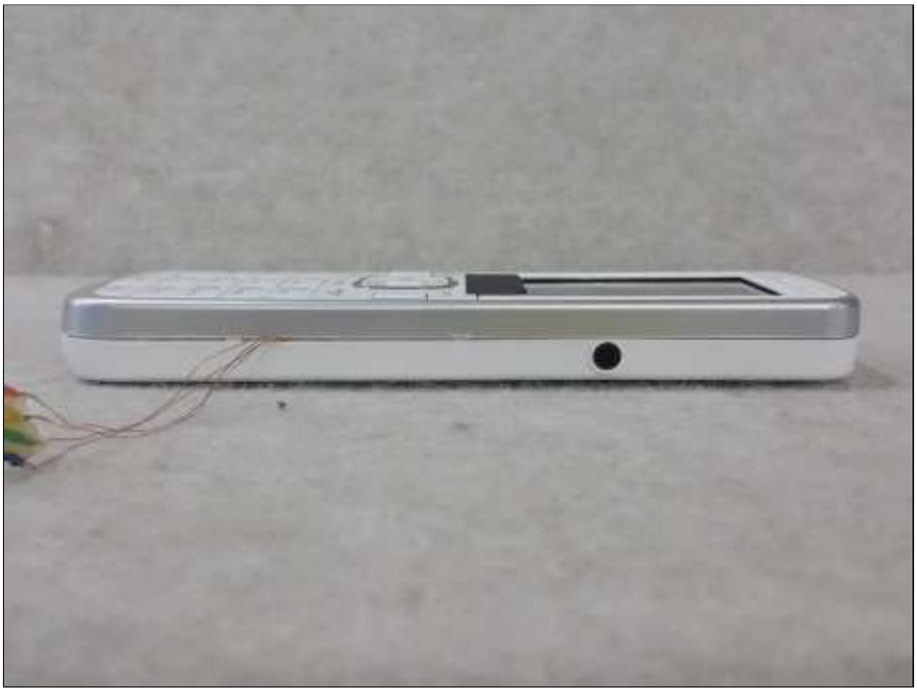
Annex A.1 EUT

Front View

Back View



Right side View



Left side View

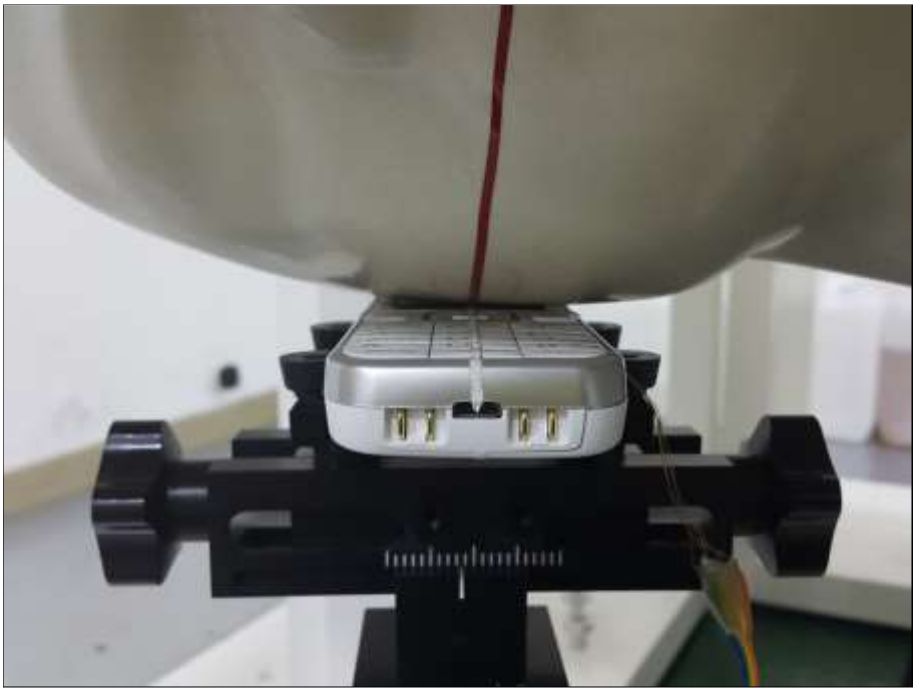
Top side View

Bottom side View

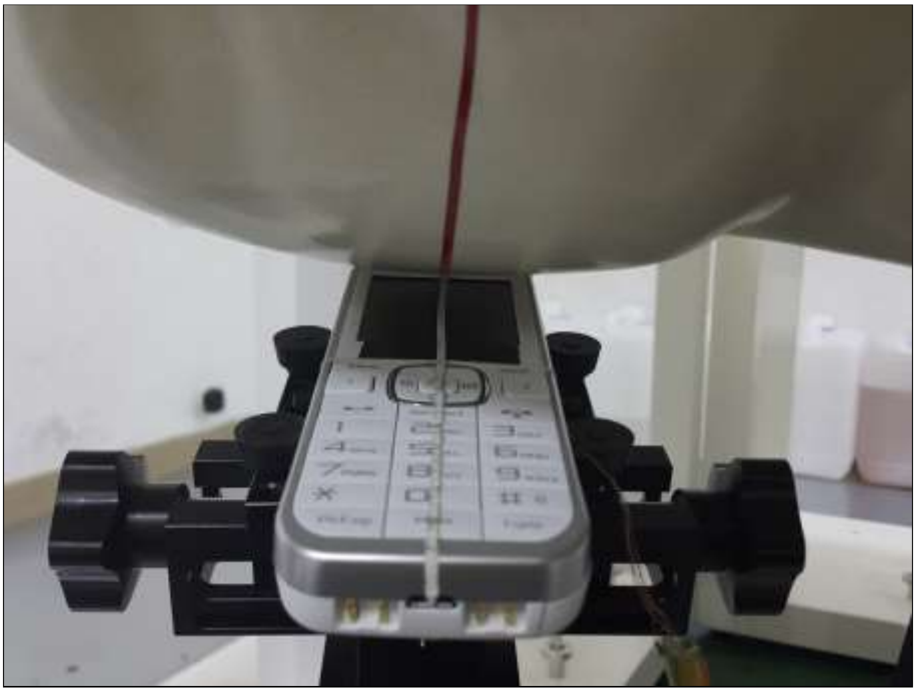
Annex A.2 Photographs of Test Setup

Photograph of the SAR measurement System

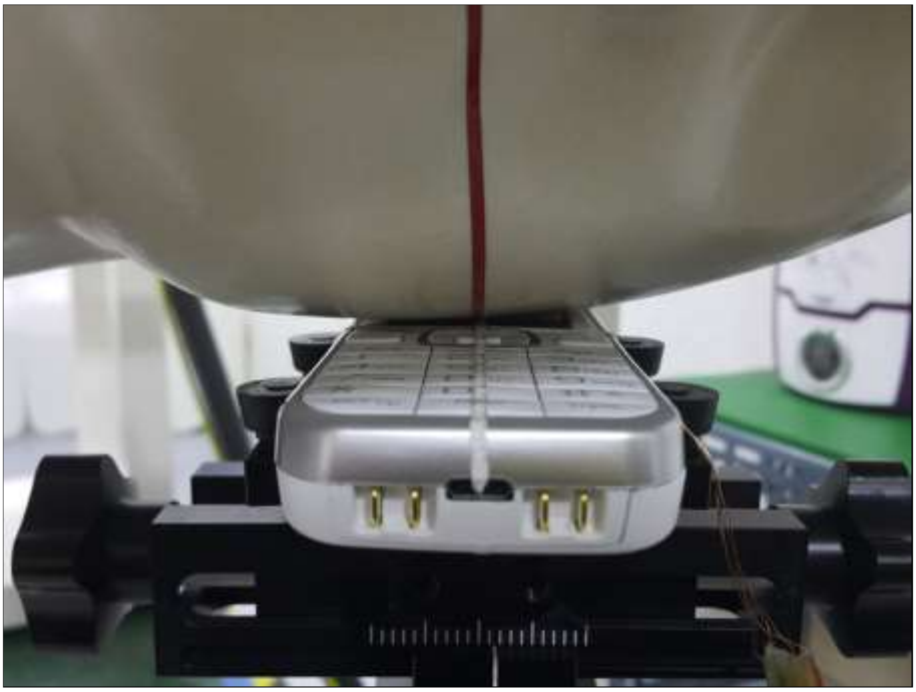
Annex A.3 Test Position



(a) Head_Right Cheek

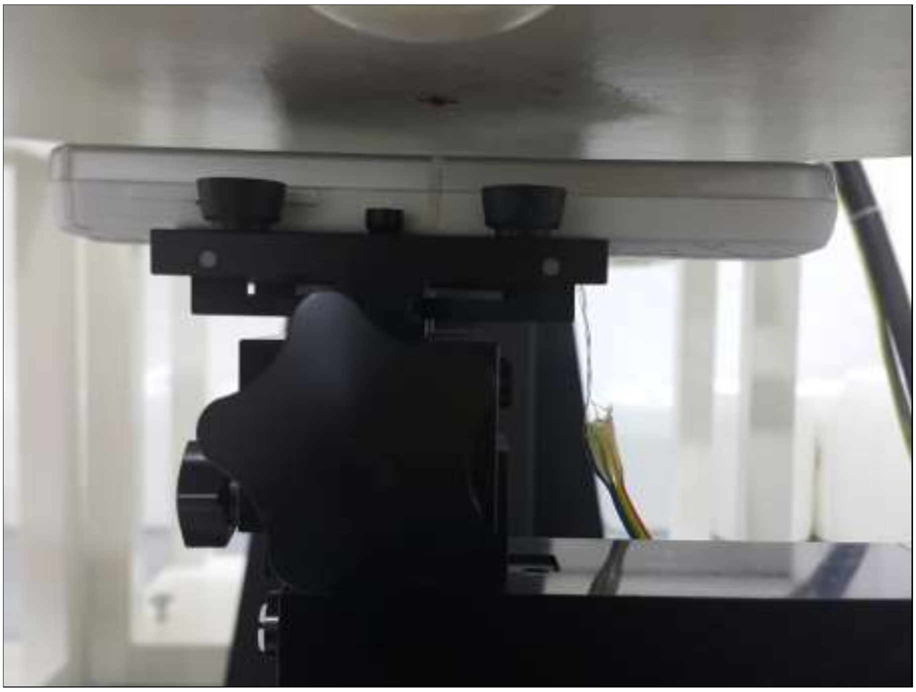


(b)Head_Right Tilt

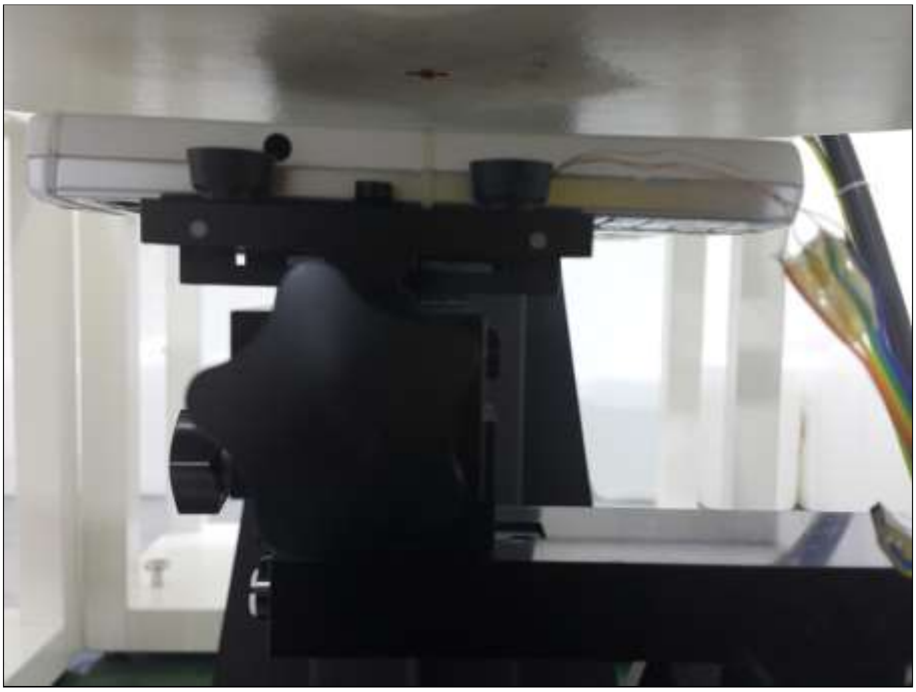


(c) Head_Left Cheek

(d) Head_Left Tilt



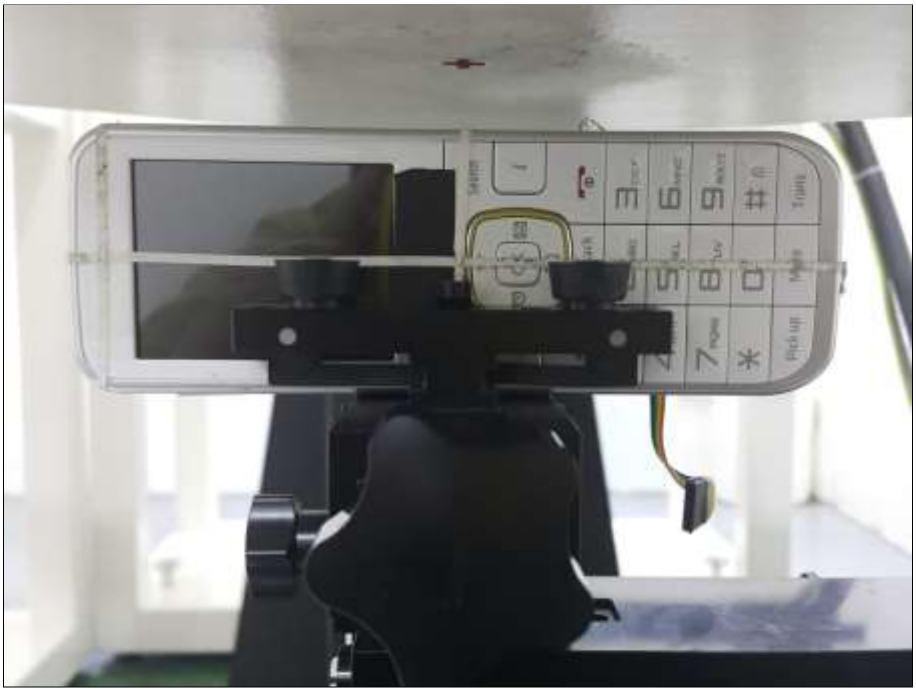
(e) Body_Front_15 mm



(f)Body_Back_15 mm

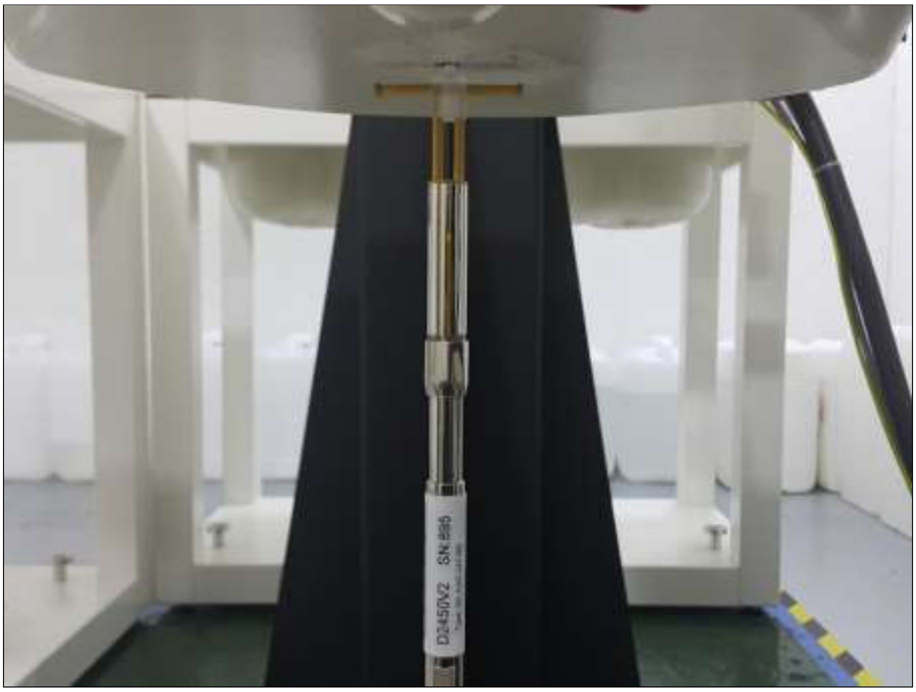
(g)Body_Top_15 mm

(h)Body_Left_15 mm



(i)Body_Right_15 mm

(j)Body_Bottom_15 mm

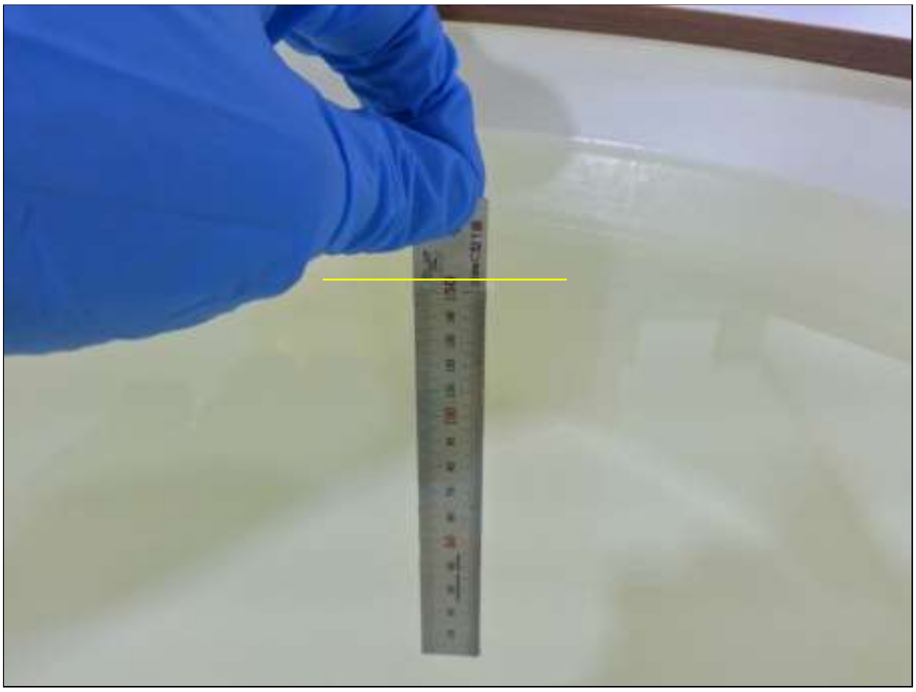


(k) System Check 2 450 MHz

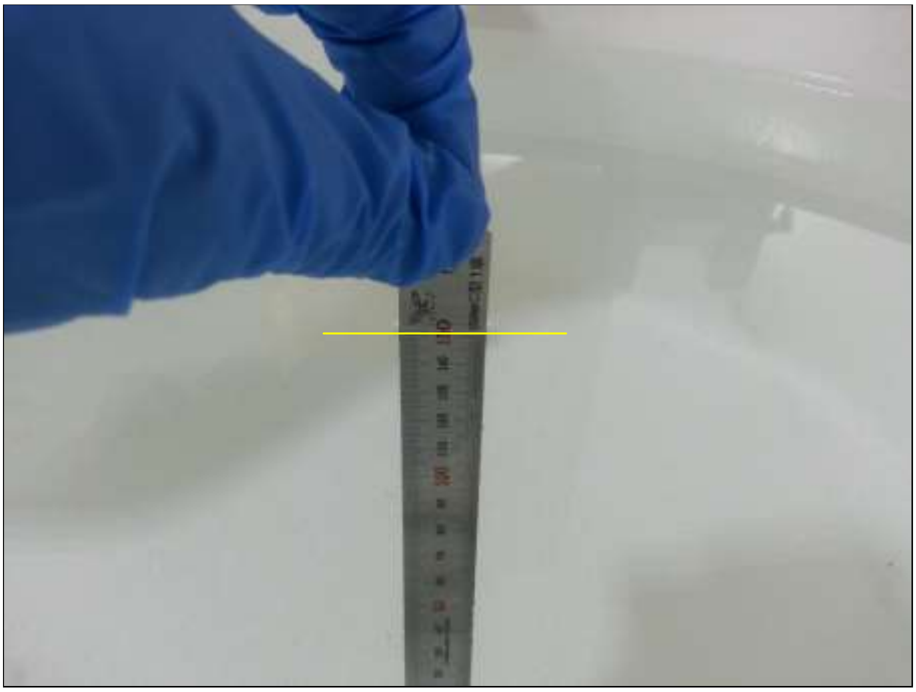
(l) System Check 5 000 MHz

Annex A.4 Liquid Depth

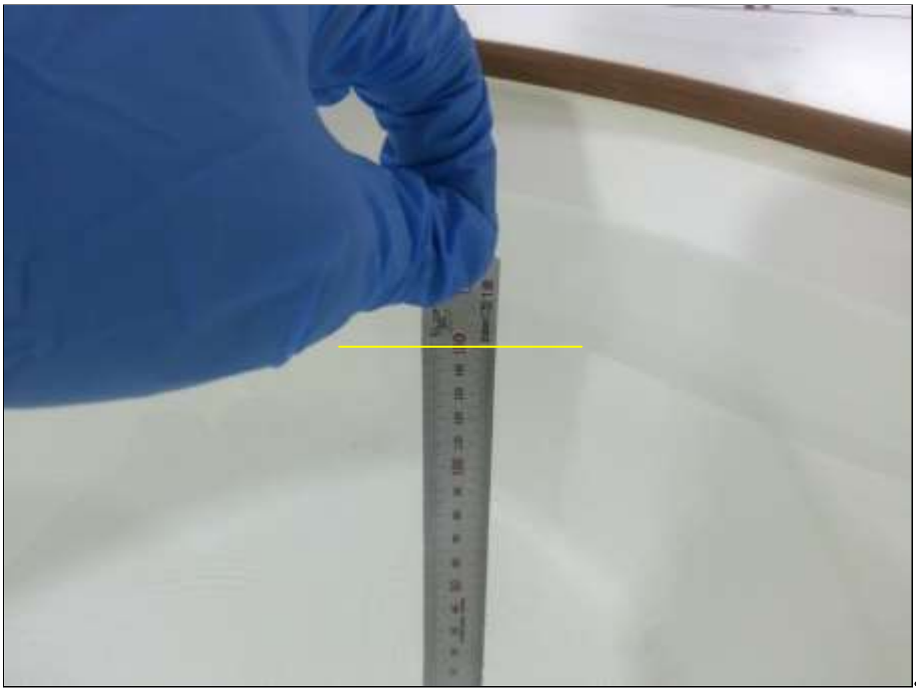
HSL2450



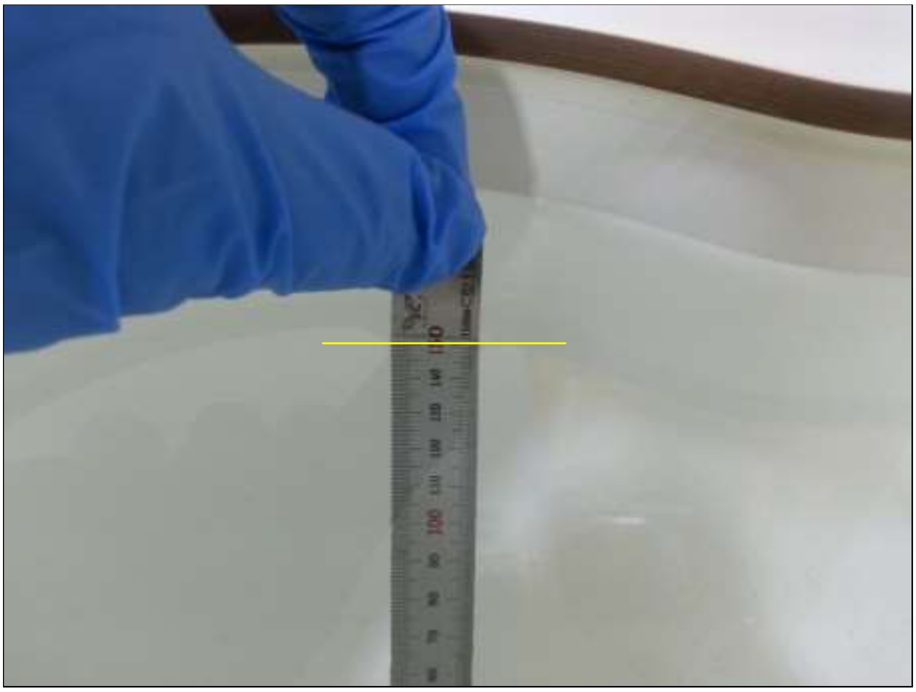
MSL2450



HSL5000



MSL5000



Annex B. Calibration certificate

Annex B.1 Probe Calibration certificate

EX3DV4_SN3928

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

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

Accreditation No.: SCS 0108

Client EMC Compliance (Dymstec)

Certificate No: EX3-3928_Jan15

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3928

Calibration procedure(s): QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: January 28, 2015

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 28, 2015

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

Certificate No: EX3-3928_Jan15 Page 1 of 11

결	작 성	검 토	승 인
재			

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

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

Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,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), i.e., ϑ = 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:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,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*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (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
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* 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 ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,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 ± 50 MHz to ± 100 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 *NORMx* (no uncertainty required).

Certificate No: EX3-3928_Jan15 Page 2 of 11

Probe EX3DV4

SN:3928

Manufactured: March 8, 2013
Calibrated: January 28, 2015

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3928

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.50	0.23	0.56	± 10.1 %
DCP (mV)[B]	101.5	88.2	99.5	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	139.7	±2.5 %
		Y	0.0	0.0	1.0		132.2	
		Z	0.0	0.0	1.0		144.6	

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 NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[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.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3928

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)
300	45.3	0.87	10.81	10.81	10.81	0.09	1.50	± 13.3 %
450	43.5	0.87	9.89	9.89	9.89	0.16	1.50	± 13.3 %
850	41.5	0.92	9.14	9.14	9.14	0.28	1.17	± 12.0 %
900	41.5	0.97	8.95	8.95	8.95	0.23	1.29	± 12.0 %
1750	40.1	1.37	7.93	7.93	7.93	0.62	0.66	± 12.0 %
1900	40.0	1.40	7.69	7.69	7.69	0.79	0.60	± 12.0 %
2300	39.5	1.67	7.25	7.25	7.25	0.40	0.74	± 12.0 %
2450	39.2	1.80	7.06	7.06	7.06	0.62	0.65	± 12.0 %
2600	39.0	1.96	6.79	6.79	6.79	0.45	0.81	± 12.0 %
5200	36.0	4.66	5.02	5.02	5.02	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.85	4.85	4.85	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.68	4.68	4.68	0.45	1.80	± 13.1 %
5600	35.5	5.07	4.45	4.45	4.45	0.45	1.80	± 13.1 %
5800	35.3	5.27	4.58	4.58	4.58	0.45	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the 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 frequencies 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 frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3928

Calibration Parameter Determined in Body 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)
300	58.2	0.92	10.68	10.68	10.68	0.06	1.20	± 13.3 %
450	56.7	0.94	10.90	10.90	10.90	0.07	1.20	± 13.3 %
850	55.2	0.99	9.11	9.11	9.11	0.36	0.95	± 12.0 %
900	55.0	1.05	8.83	8.83	8.83	0.30	1.06	± 12.0 %
1750	53.4	1.49	7.67	7.67	7.67	0.74	0.62	± 12.0 %
1900	53.3	1.52	7.45	7.45	7.45	0.61	0.67	± 12.0 %
2300	52.9	1.81	7.27	7.27	7.27	0.57	0.69	± 12.0 %
2450	52.7	1.95	7.15	7.15	7.15	0.55	0.71	± 12.0 %
2600	52.5	2.16	6.84	6.84	6.84	0.76	0.57	± 12.0 %
5200	49.0	5.30	4.12	4.12	4.12	0.55	1.90	± 13.1 %
5300	48.9	5.42	3.93	3.93	3.93	0.55	1.90	± 13.1 %
5500	48.6	5.65	3.72	3.72	3.72	0.55	1.90	± 13.1 %
5600	48.5	5.77	3.65	3.65	3.65	0.55	1.90	± 13.1 %
5800	48.2	6.00	3.89	3.89	3.89	0.55	1.90	± 13.1 %

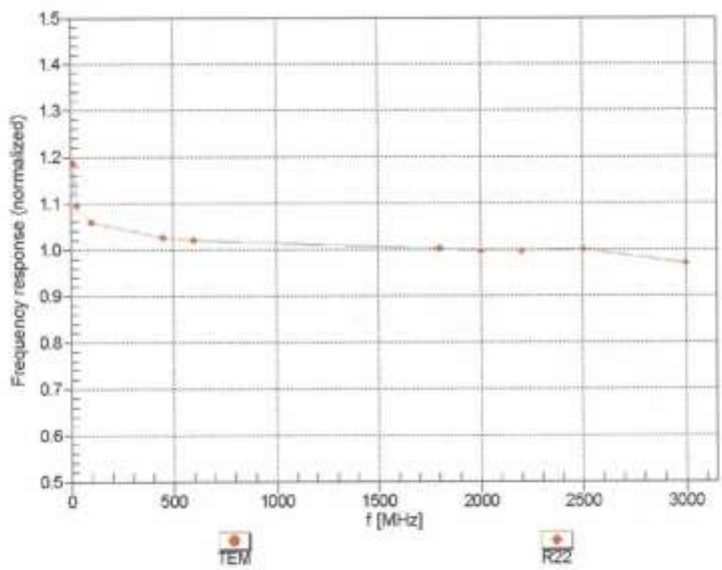
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz 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 frequencies 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 frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

EX3DV4– SN:3928

January 28, 2015

Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Certificate No: EX3-3928_Jan15

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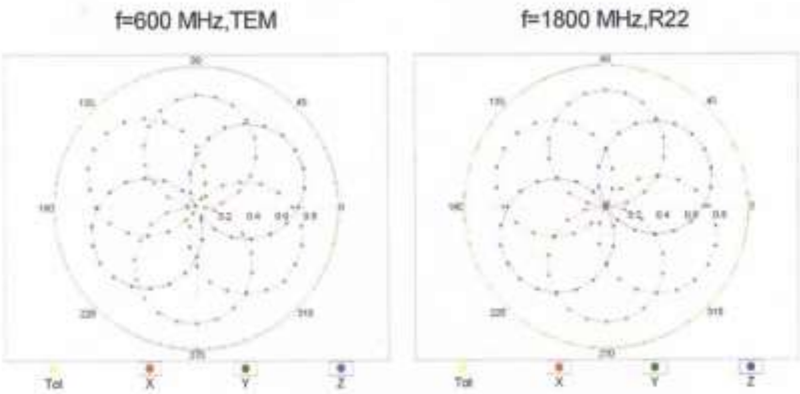
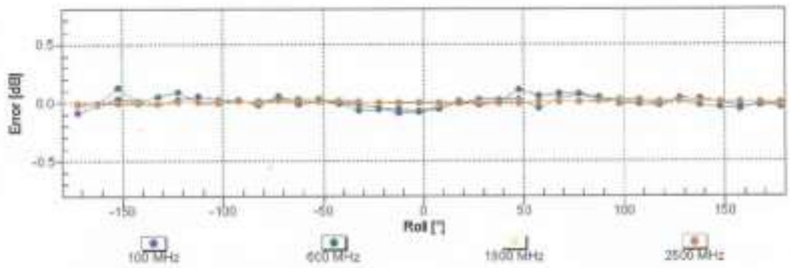
Receiving Pattern (ϕ), $\vartheta = 0°$

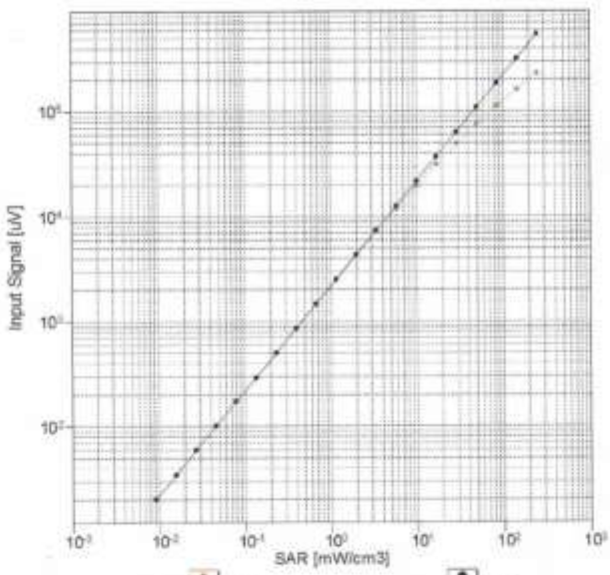


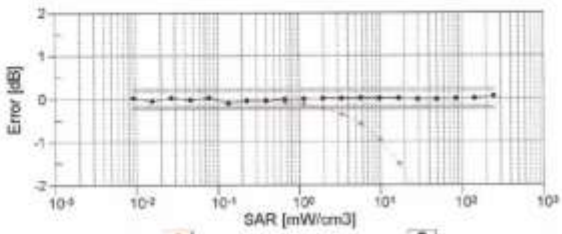


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

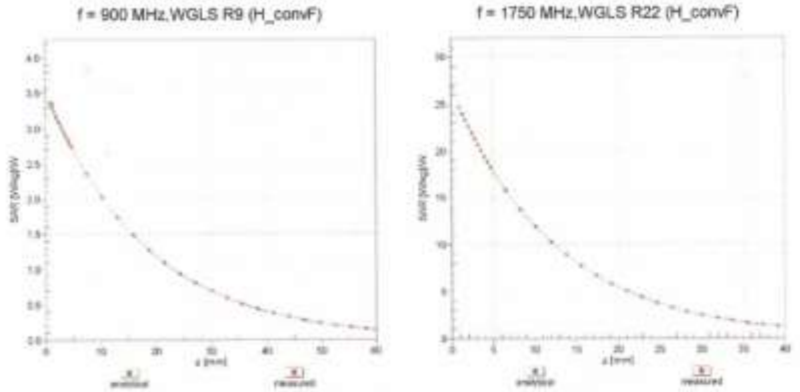
(TEM cell , f_{eval}= 1900 MHz)





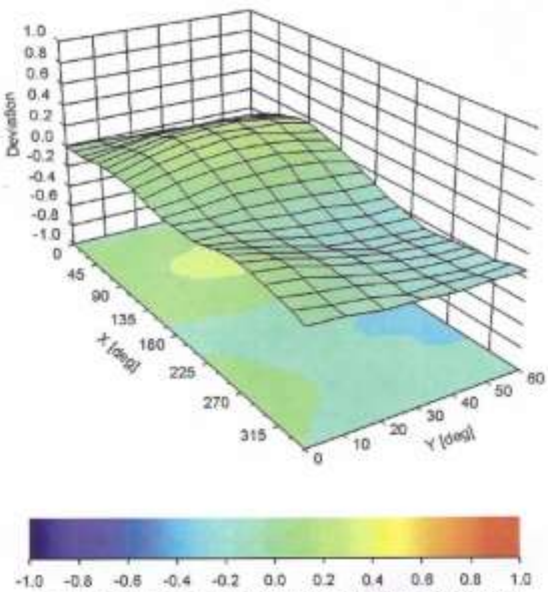
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3928

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-112.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Annex B.2 DAE Calibration certification

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

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Accreditation No.: SCS 108

Client EMC Compliance (Dymstec)

Certificate No: DAE4-1342_Jul14

CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BM - SN: 1342

Calibration procedure(s): QA CAL-06.v26
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: July 24, 2014

결재	작성	검토	승인
	X		

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	01-Oct-13 (No:13976)	Oct-14
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

	Name	Function	Signature
Calibrated by:	Eric Hainfeld	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	i.V.

Issued: July 24, 2014

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Certificate No: DAE4-1342_Jul14 Page 1 of 5

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.079 ± 0.02% (k=2)	404.229 ± 0.02% (k=2)	404.193 ± 0.02% (k=2)
Low Range	3.97194 ± 1.50% (k=2)	3.97818 ± 1.50% (k=2)	3.97832 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	36.5 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS108)

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	199994.48	-2.71	-0.00
Channel X	+ Input	20003.12	2.03	0.01
Channel X	- Input	-19998.22	2.56	-0.01
Channel Y	+ Input	199994.97	-2.37	-0.00
Channel Y	+ Input	20000.20	-0.94	-0.00
Channel Y	- Input	-20001.55	-0.79	0.00
Channel Z	+ Input	199993.69	-3.29	-0.00
Channel Z	+ Input	20000.13	-0.86	-0.00
Channel Z	- Input	-20001.35	-0.58	0.00

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2000.66	-0.29	-0.01
Channel X	+ Input	201.58	0.18	0.09
Channel X	- Input	-198.71	-0.04	0.02
Channel Y	+ Input	2001.16	0.25	0.01
Channel Y	+ Input	201.20	-0.03	-0.02
Channel Y	- Input	-199.87	-1.04	0.53
Channel Z	+ Input	2001.06	0.27	0.01
Channel Z	+ Input	200.54	-0.49	-0.24
Channel Z	- Input	-200.16	-1.24	0.62

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	11.07	9.27
	- 200	-8.96	-10.56
Channel Y	200	0.81	0.58
	- 200	-2.58	-2.76
Channel Z	200	1.15	0.69
	- 200	-2.73	-3.02

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	4.50	-2.81
Channel Y	200	9.68	-	6.17
Channel Z	200	10.07	7.09	-

Certificate No: DAE4-1342_Jul14 Page 4 of 5

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15949	15477
Channel Y	16473	14871
Channel Z	15667	14031

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (µV)	min. Offset (µV)	max. Offset (µV)	Std. Deviation (µV)
Channel X	0.59	-0.36	1.97	0.56
Channel Y	-0.70	-1.87	0.51	0.54
Channel Z	-0.60	-1.90	0.78	0.60

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

Annex B.3 Dipole Calibration certification

D2450V2

Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: **SCS 108**

Client **EMC Compliance (Dymstec)**

Certificate No: **D2450V2-895_Jul14**

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 895

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: July 24, 2014

결재	작성	검토	승인

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 24, 2014

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Certificate No: D2450V2-895_Jul14 Page 1 of 8

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) 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	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.8 ± 6 %	1.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.5 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.6 ± 6 %	2.03 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.01 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.6 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.0 Ω + 1.6 jΩ
Return Loss	- 29.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.6 Ω + 3.7 jΩ
Return Loss	- 28.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.157 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
Manufactured on	June 19, 2012

DASY5 Validation Report for Head TSL

Date: 24.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 895

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.85 S/m; ε_r = 37.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

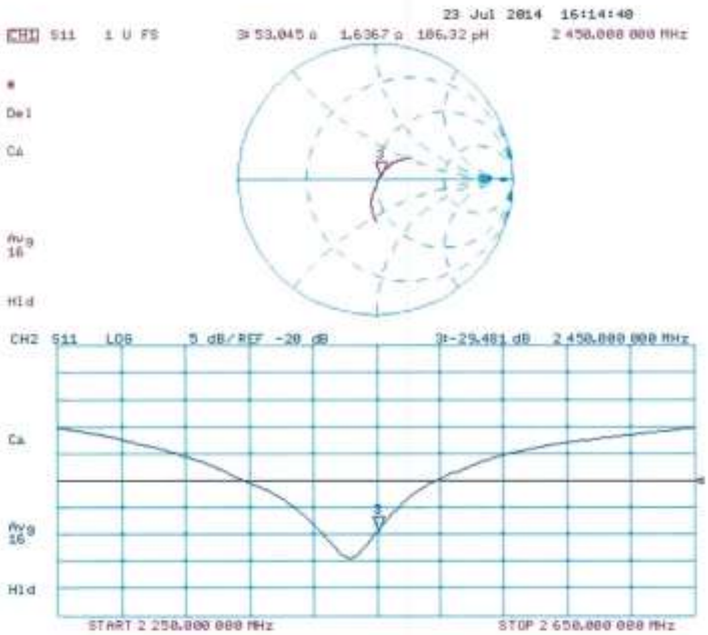
DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 102.2 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.2 W/kg
Maximum value of SAR (measured) = 17.9 W/kg

0 dB = 17.9 W/kg = 12.53 dBW/kg

Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-895_Jul14 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 16.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

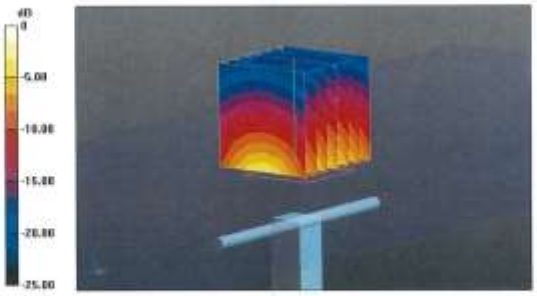
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 895

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 50.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

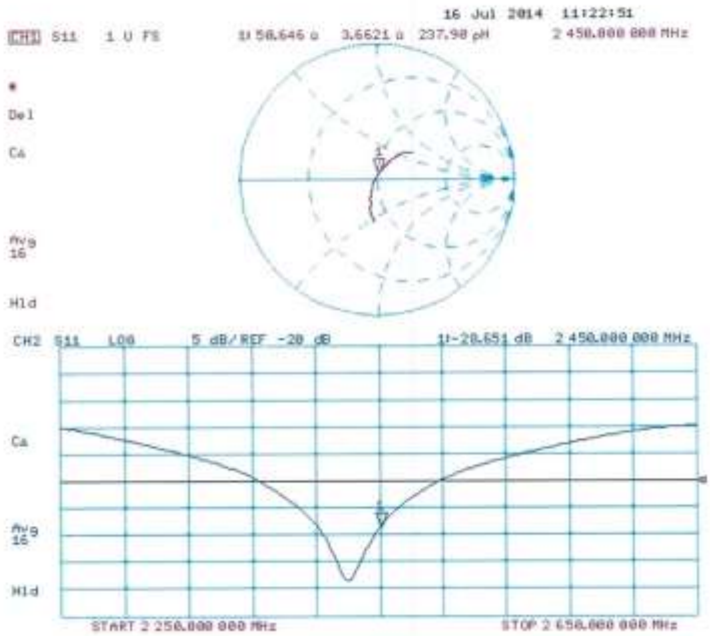
- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.39 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 27.6 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.01 W/kg
Maximum value of SAR (measured) = 17.3 W/kg



0 dB = 17.3 W/kg = 12.38 dBW/kg

Impedance Measurement Plot for Body TSL



D5GHzV2

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Accreditation No.: **SCS 0108**

Client **KCTL (Dymstec)**

Certificate No: **D5GHzV2-1134_May15**

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1134
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	May 22, 2015

결재	작성	검토	승인

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 3503	30-Dec-14 (No. EX3-3503_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 22, 2015

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Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010

b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

c) 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

Additional Documentation:

d) 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	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	4.45 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.77 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**76.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.3 ± 6 %	4.54 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.21 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.2 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.5 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.0 ± 6 %	4.73 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (k=2)**

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	33.9 ± 6 %	4.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °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	8.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.8 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.6 ± 6 %	5.03 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.87 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.25 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.2 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.3 ± 6 %	5.43 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.53 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.9 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.1 ± 6 %	5.56 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.60 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.0 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.8 ± 6 %	5.82 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.04 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**79.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.24 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.2 W/kg ± 19.5 % (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	46.6 ± 6 %	5.96 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.97 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**79.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.9 W/kg ± 19.5 % (k=2)**

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	46.3 ± 6 %	6.23 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	7.72 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**76.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.1 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	47.9 Ω - 9.4 jΩ
Return Loss	- 20.2 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	49.6 Ω - 7.0 jΩ
Return Loss	- 23.0 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	51.0 Ω - 3.3 jΩ
Return Loss	- 29.2 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.0 Ω - 3.9 jΩ
Return Loss	- 25.4 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.3 Ω - 5.0 jΩ
Return Loss	- 23.3 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	48.0 Ω - 7.7 jΩ
Return Loss	- 21.8 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	49.6 Ω - 6.3 jΩ
Return Loss	- 24.0 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	51.3 Ω - 1.8 jΩ
Return Loss	- 33.0 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	54.4 Ω - 2.3 jΩ
Return Loss	- 26.5 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	55.9 Ω - 3.6 jΩ
Return Loss	- 23.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.204 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
Manufactured on	May 07, 2012

DASY5 Validation Report for Head TSL

Date: 22.05.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1134

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.45 S/m; ε_r = 34.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.54 S/m; ε_r = 34.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 4.73 S/m; ε_r = 34; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.83 S/m; ε_r = 33.9; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.03 S/m; ε_r = 33.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.51, 5.51, 5.51); Calibrated: 30.12.2014, ConvF(5.21, 5.21, 5.21); Calibrated: 30.12.2014, ConvF(5.12, 5.12, 5.12); Calibrated: 30.12.2014, ConvF(4.92, 4.92, 4.92); Calibrated: 30.12.2014, ConvF(4.9, 4.9, 4.9); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 64.63 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.24 W/kg
Maximum value of SAR (measured) = 17.6 W/kg

Dipole Calibration for Head 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 = 65.59 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 30.4 W/kg
SAR(1 g) = 8.21 W/kg; SAR(10 g) = 2.38 W/kg
Maximum value of SAR (measured) = 18.7 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 = 64.27 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 31.4 W/kg
SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.34 W/kg
Maximum value of SAR (measured) = 19.0 W/kg

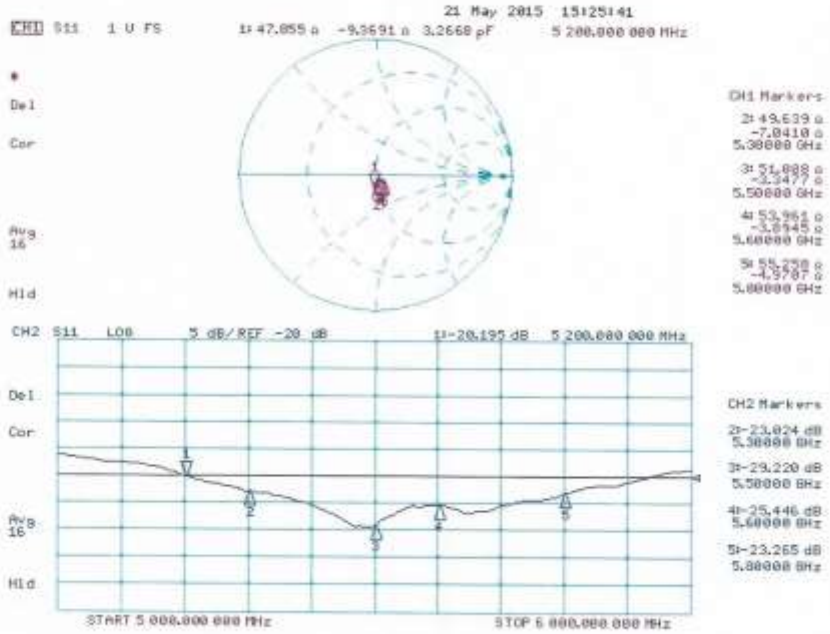
EMC compliance Ltd. 480-5, Sindong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea
TEL: 82 31 336 9919 FAX: 82 505 299 8311

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 = 63.94 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 30.9 W/kg
SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.31 W/kg
Maximum value of SAR (measured) = 18.8 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 = 61.63 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 32.1 W/kg
SAR(1 g) = 7.87 W/kg; SAR(10 g) = 2.25 W/kg

0 dB = 17.6 W/kg = 12.46 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 21.05.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1134

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.43 S/m; ε_r = 47.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 5.56 S/m; ε_r = 47.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 5.82 S/m; ε_r = 46.8; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.96 S/m; ε_r = 46.6; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.23 S/m; ε_r = 46.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.95, 4.95, 4.95); Calibrated: 30.12.2014, ConvF(4.78, 4.78, 4.78); Calibrated: 30.12.2014, ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2014, ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2014, ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

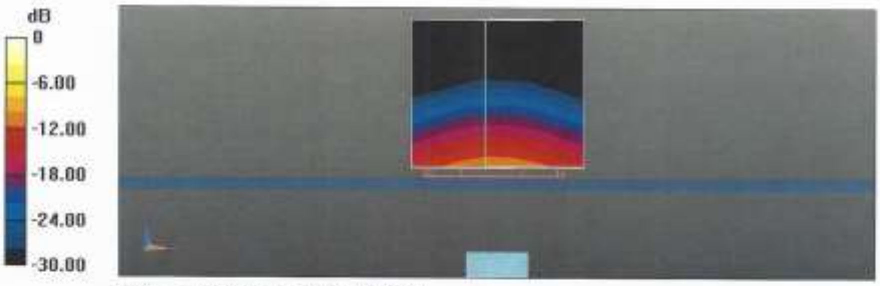
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.11 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 29.5 W/kg
SAR(1 g) = 7.53 W/kg; SAR(10 g) = 2.11 W/kg
Maximum value of SAR (measured) = 17.8 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 = 58.88 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 30.6 W/kg
SAR(1 g) = 7.6 W/kg; SAR(10 g) = 2.12 W/kg
Maximum value of SAR (measured) = 18.1 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 = 59.33 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 34.1 W/kg
SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.24 W/kg
Maximum value of SAR (measured) = 19.4 W/kg

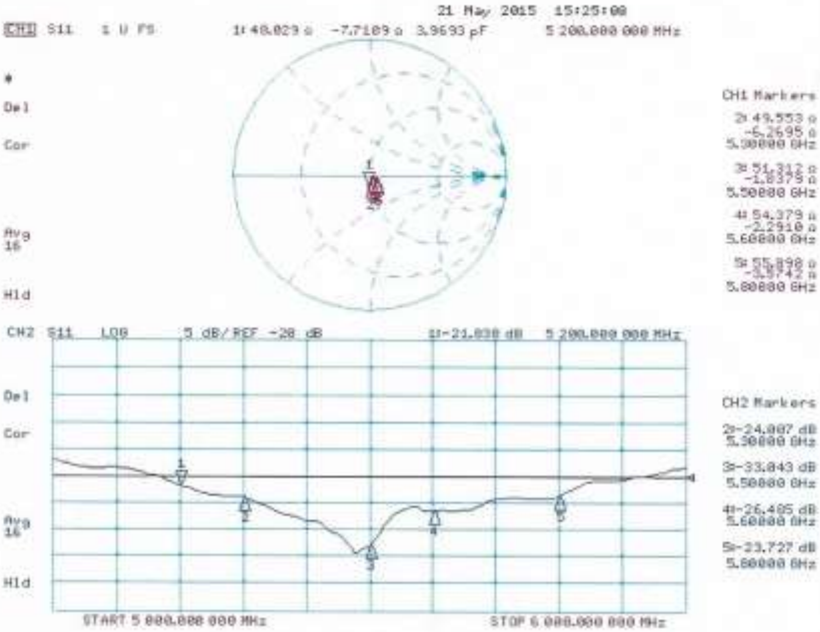
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.26 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 34.9 W/kg
SAR(1 g) = 7.97 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 19.6 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 = 55.96 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 35.6 W/kg
SAR(1 g) = 7.72 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 19.2 W/kg



0 dB = 17.8 W/kg = 12.50 dBW/kg

Impedance Measurement Plot for Body TSL



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-END OF REPORT -