TEST REPORT

Report Reference No.................:	**TRE17060122** R/C……….: 12581
FCC ID.......................................:	**CNFSBDC1**
Applicant's name ....:	**GoPro, Inc.**
Address.....................................:	3000 Clearview Way, San Mateo, CA 94402, USA
Manufacturer...................................:	GoPro, Inc.
Address...:	San Zhong Quan Li Qu, Qingxi, Dongguan, Guangdong, China 523651
Test item description ....:	**Camera**
Trade Mark.................................:	GoPro
Model/Type reference ....:	SBDC1
Standard ....:	**IEEE Std 1528-2013** **IEEE Std C95.1 2005** **Relative FCC Published RF exposure KDB proceadures**

Date of receipt of test sample………..:	May 24, 2017
Date of testing…………………………:	May 25, 2017 to May 29, 2017
Date of issue…………………………...:	June 1, 2017
Result............ …………………...:	**PASS**

Reviewed By:	Approved By:
Shawn Wen Laboratory Leader	Stephen Guo Laboratory Manager

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Testing Laboratory Name ....:	**Shenzhen Huatongwei International Inspection Co., Ltd**
Address...................................... :	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

Note:

Shenzhen Huatongwei International Inspection Co., Ltd is UL accredited lab and UL accepts its test data.

Contents

1. Test standards and Report version

1.1. Test Standards

The tests were performed according to following standards:

IEEE Std C95.1-2005: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
IEEE Std 1528-2013: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

FCC Published RF exposure KDB proceadures:
KDB 248227 D01: 802.11Wi-Fi SAR v02r02
KDB 447498 D01: General RF Exposure Guidance v06
KDB 690783 D01: SAR Listings on Grants v01r03
KDB 865664 D01: SAR Measurement 100 MHz to 6 GHz v01r04
KDB 865664 D02: RF Exposure Reporting v01r02

1.2. Report version

Version No.	Date of issue	Description
1.0	June 1, 2017	\

2. Summary

2.1. Client Information

Applicant:	GoPro, Inc.
Address:	3000 Clearview Way, San Mateo, CA 94402, USA
FCC ID:	CNFSBDC1
Manufacturer:	Chicony Electronics (Dongguan) Co., Ltd.
Address:	San Zhong Quan Li Qu, Qingxi, Dongguan, Guangdong, China 523651

2.2. Product Description

Name of EUT:	Camera	
Trade Mark:	GoPro	
Model/Type reference:	SDBC1	
Power supply:	3.8Vdc	
Device Category:	Class B	
Product stage:	DVT	
RF Exposure Environment:	General Population/Uncontrolled Exposure (1g SAR limit: 1.6 W/kg)	
Hardware version:	Rev A	
Software version:	MF6.04.00.01.03	
Maximum SAR Value		
Separation Distance:	Head using scenario	Body using scenario
	5mm	0mm
Maximun SAR Value (1g):	Head using scenario	Body using scenario
	0.893	1.389

Remark:
The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power

3. Test Environment

3.1. Address of the test laboratory

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China
Phone: 86-755-26748019 Fax: 86-755-26748089

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 3902.01

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 317478

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 317478.

IC-Registration No.: 5377B

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered byCertification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377B.

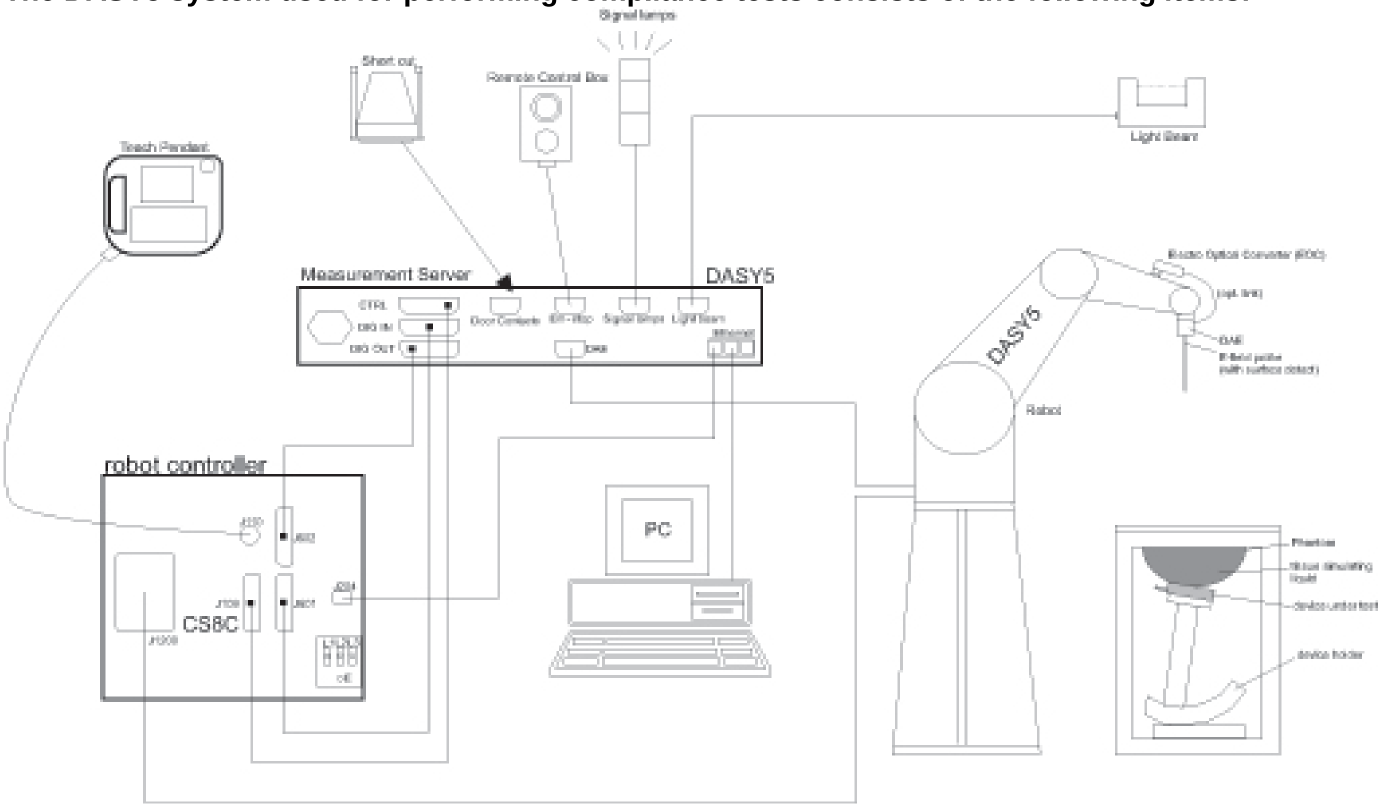
ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY5 system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A 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 with standard 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 digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC 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 of the 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 Win7 and the DASY52 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.

4.2. SAR Scan Procedures

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe 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 doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

	≤ 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 containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged 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 Measurement 100 MHz to 6 GHz

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

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 _reported_ SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 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.

Step 4: Power drift measurement

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

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z-direction.

4.3. Equipments Used during the Test

Test Equipment	Manufacturer	Type/Model	Serial Number	Calibration	
				Last Calibration	Calibration Interval (year)
Data Acquisition Electronics DAE3	SPEAG	DAE3	427	December 9, 2016	1
E-field Probe	SPEAG	EX3DV4	7383	December 27, 2016	1
System Validation Dipole D2450V2	SPEAG	D2450V2	977	January 14, 2016	3
System Validation Dipole D5GHzV2	SPEAG	D5GHzV2	1231	January 13, 2016	3
Dielectric Probe Kit	Agilent	85070E	US44020288	/	/
Power meter	Agilent	E4417A	GB41292254	October 22, 2016	1
Power sensor	Agilent	8481H	MY41095360	October 22, 2016	1
Power sensor	Agilent	E9327A	US40441621	October 22, 2016	1
Network analyzer	Agilent	8753E	US37390562	October 18, 2016	1

Note:

1) Per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.

a) There is no physical damage on the dipole;

b) System check with specific dipole is within 10% of calibrated value;

c) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.

d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

6. SAR Test Configuration

6.1. Head using scenario

The EUT supports to fix onto a helmet or a holder for using around the head, so the SAR evaluation for head using scenario is necessary, a conservative 5mm separation distance is selected for SAR evaluation.

6.2. Body using scenario

The EUT also supports to fix around body for using, so the SAR evaluation for body using scenario is necessary, and it maybe extreme close to the human body, a 0mm separation distance is selected for SAR evaluation.

7. Device Under Test (DUT) Information

7.1. DUT Description

The EUT is a camera with IEEE 802.11a/b/g/n/ac, and Bluetooth radio.	
Battery Options	Rechargeable Lithium-ion battery, Rating 3.8 Vdc, 2620mAh, 9.95Wh
Accessory	None

7.2. Wireless Technology

Wireless technology	Frequency band	Operating mode	Duty factor use for SAR testing
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n(20M) 802.11n(40M)	99%
Wi-Fi	5 GHz	802.11a 802.11n(20M) 802.11n(40M) 802.11ac(20M) 802.11ac(40M) 802.11ac(80M)	96.1%
BT	2.4 GHz	DH5 2DH5 3DH5 BLE	70%

7.3. Maximum Output Power from Tune-up Procedure

KDB 447498 sec.4.1.d) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit.

RF Air interface	Mode	Max. RF Output Power(dBm)
Wi-Fi 2.4 GHz	802.11b	11
	802.11g	13
	802.11n(20M)	13
	802.11n(40M)	13
Wi-Fi 5 GHz	802.11a	11
	802.11n(20M)	11
	802.11n(40M)	12
	802.11ac(20M)	11
	802.11ac(40M)	12
	802.11ac(80M)	11
BT	DH5	6
	2DH5	6
	3DH5	6
	BLE	6

8. Stand-alone SAR test exclusion

Per FCC KDB 447498D01: the 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for product specific 10-g SAR, where:

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Mode	Positon	Pmax (dBm)	Pmax (mW)	Seperation Distance(mm)	f(GHz)	Caculation result	Exclusion threshold	SAR test exclusion (Yes/No)
BT	Head	6.00	3.98	5	2.441	1.24	3.0	Yes
	Body	6.00	3.98	5	2.441	1.24	3.0	Yes

9. RF Exposure Conditions (Test Configurations)

Per FCC KDB 447498D01: the 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for product specific 10-g SAR, where:

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

For 2.4G Wi-Fi

Position	Frequency	Power (dBm)	Power (mW)	Separation Distance (mm)	Calculation Result	Threshold	SAR Test (Yes/No)
Front surface	2437	12.00	15.85	5.0	4.95	3.0	Yes
Back surface	2437	12.00	15.85	5.0	4.95	3.0	Yes
Left edge	2437	12.00	15.85	56.5	0.44	3.0	No
Right edge	2437	12.00	15.85	7.6	3.26	3.0	Yes
Top edge	2437	12.00	15.85	5.1	4.85	3.0	Yes
Bottom edge	2437	12.00	15.85	57.5	0.43	3.0	No

For 5G Wi-Fi U-NII-2A Band

Position	Frequency	Power (dBm)	Power (mW)	Separation Distance (mm)	Calculation Result	Threshold	SAR Test (Yes/No)
Front surface	5270	12.00	15.85	5.0	7.28	3.0	Yes
Back surface	5270	12.00	15.85	5.0	7.28	3.0	Yes
Left edge	5270	12.00	15.85	56.5	0.64	3.0	No
Right edge	5270	12.00	15.85	7.6	4.79	3.0	Yes
Top edge	5270	12.00	15.85	5.1	7.13	3.0	Yes
Bottom edge	5270	12.00	15.85	57.5	0.63	3.0	No

For 5G Wi-Fi U-NII-2C Band

Position	Frequency	Power (dBm)	Power (mW)	Separation Distance (mm)	Calculation Result	Threshold	SAR Test (Yes/No)
Front surface	5630	12.00	15.85	5.0	7.52	3.0	Yes
Back surface	5630	12.00	15.85	5.0	7.52	3.0	Yes
Left edge	5630	12.00	15.85	56.5	0.67	3.0	No
Right edge	5630	12.00	15.85	7.6	4.95	3.0	Yes
Top edge	5630	12.00	15.85	5.1	7.37	3.0	Yes
Bottom edge	5630	12.00	15.85	57.5	0.65	3.0	No

For 5G Wi-Fi U-NII-3 Band

Position	Frequency	Power (dBm)	Power (mW)	Separation Distance (mm)	Calculation Result	Threshold	SAR Test (Yes/No)
Front surface	5755	12.00	15.85	5.0	7.60	3.0	Yes
Back surface	5755	12.00	15.85	5.0	7.60	3.0	Yes
Left edge	5755	12.00	15.85	56.5	0.67	3.0	No
Right edge	5755	12.00	15.85	7.6	5.00	3.0	Yes
Top edge	5755	12.00	15.85	5.1	7.46	3.0	Yes
Bottom edge	5755	12.00	15.85	57.5	0.66	3.0	No

10. Dielectric Property Measurements & System Check

10.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

IEEE Std 1528-2013
Refer to Table 3 within the IEEE Std 1528-2013

Dielectric Property Measurements Results:

Liquid	Freq.	Liquid Parameters				Delta(%)		Limit (%)	Temp. (℃)	Test Date
		Measured		Target						
		ϵ_r	σ	ϵ_r	σ	ϵ_r	σ			
Head 2450	2360	40.00	1.69	39.36	1.72	1.63	-1.86	±5	22.5	May 25, 2017
	2450	39.90	1.80	39.20	1.80	1.79	-0.06	±5	22.5	
	2540	39.44	1.90	39.09	1.90	0.90	0.21	±5	22.5	
Body 2450	2360	51.76	1.85	52.82	1.86	-2.01	-0.81	±5	22.5	May 25, 2017
	2450	51.76	1.95	52.70	1.95	-1.78	0.15	±5	22.5	
	2540	51.34	2.07	52.59	2.08	-2.38	-0.58	±5	22.5	
Head 5250	5160	34.73	4.47	36.03	4.61	-3.61	-2.99	±5	22.7	May 28, 2017
	5250	34.63	4.56	35.93	4.71	-3.62	-3.18	±5	22.7	
	5340	34.50	4.64	35.83	4.80	-3.71	-3.25	±5	22.7	
Body 5250	5160	48.69	5.18	49.07	5.25	-0.77	-1.26	±5	22.3	May 26, 2017
	5250	48.56	5.28	48.95	5.36	-0.80	-1.51	±5	22.3	
	5340	48.38	5.39	48.96	5.46	-1.18	-1.30	±5	22.3	
Head 5600	5510	35.55	4.79	35.63	4.97	-0.22	-3.62	±5	22.7	May 27, 2017
	5600	35.34	4.89	35.53	5.07	-0.53	-3.49	±5	22.7	
	5690	35.27	4.99	35.43	5.16	-0.45	-3.39	±5	22.7	
Body 5600	5510	48.23	5.76	48.59	5.66	-0.74	1.71	±5	22.3	May 26, 2017
	5600	48.07	5.88	48.47	5.77	-0.83	1.96	±5	22.3	
	5690	47.89	6.00	48.35	5.87	-0.95	2.18	±5	22.3	
Head 5750	5660	35.40	4.94	35.46	5.13	-0.17	-3.72	±5	22.7	May 28, 2017
	5750	35.32	5.01	35.36	5.22	-0.11	-4.10	±5	22.7	
	5840	35.17	5.11	35.27	5.30	-0.28	-3.55	±5	22.7	
Body 5750	5660	47.16	5.89	48.39	5.84	-2.54	0.87	±5	22.3	May 26, 2017
	5750	47.11	6.00	48.27	5.94	-2.40	1.04	±5	22.3	
	5840	46.94	6.14	48.16	6.03	-2.53	1.87	±5	22.3	

10.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

System Performance Check Measurement Conditions:

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm (above 1GHZ) and 15mm (below 1GHz) from dipole center to the simulating liquid surface.
- For area scan, standard grid spacing for head measurements is 15 mm in x- and y-dimension(≤2GHz), 12 mm in x- and y-dimension(2-4 GHz) and 10mm in x- and y- dimension(4-6GHz).
- For zoom scan, Δx_{zoom}, Δy_{zoom}≤ 2GHz - ≤8mm, 2-4GHz - ≤5 mm and 4-6 GHz-≤4mm; Δz_{zoom} ≤3GHz - ≤5 mm, 3-4 GHz- ≤4mm and 4-6GHz-≤2mm.
- Distance between probe sensors and phantom surface was set to 3 mm except for 5 GHz band. For 5GHz band, Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was set to 100 mW or 250 mW depend on the certificate of the dipoles.
- The results are normalized to 1 W input power.

System Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target.

System Dipole Serial #	T.S. Liquid		Measured Results Zoom Scan (W/Kg)	Measured Results Normalize to 1W (W/Kg)	Target (Ref. value)	Delta (%)	Limit (%)	Temp. (℃)	Test Date
977	Head 2450	1-g	12.4	49.6	52.50	-5.52	±10	22.5	May 25, 2017
		10-g	5.92	23.68	24.50	-3.35	±10	22.5	
	Body 2450	1-g	13.2	52.8	51.70	2.13	±10	22.5	May 25, 2017
		10-g	6.29	25.16	24.30	3.54	±10	22.5	
1231	Head 5250	1-g	8.66	86.6	80.50	7.58	±10	22.7	May 28, 2017
		10-g	2.53	25.3	23.10	9.52	±10	22.7	
	Body 5250	1-g	7.15	71.5	76.10	-6.04	±10	22.3	May 26, 2017
		10-g	2.08	20.8	21.40	-2.80	±10	22.3	
	Head 5600	1-g	9.08	90.8	83.80	8.35	±10	22.7	May 27, 2017
		10-g	2.63	26.3	24.00	9.58	±10	22.7	
	Body 5600	1-g	7.87	78.7	80.40	-2.11	±10	22.3	May 26, 2017
		10-g	2.25	22.5	22.50	0.00	±10	22.3	
	Head 5750	1-g	8.38	83.8	81.70	2.57	±10	22.7	May 28, 2017
		10-g	2.4	24	23.10	3.90	±10	22.7	
	Body 5750	1-g	6.94	69.4	77.00	-9.87	±10	22.3	May 26, 2017
		10-g	1.98	19.8	21.50	-7.91	±10	22.3	

11. Power level setting

11.1. Wi-Fi 2.4GHz

Test Mode	Setting TX Power	Setting data rate (Mbps)	TX Pattern	TX Power Control
IEEE 802.11b	9	CCK_1Mbps	PN7_PATTERN	TXPowerForce_OLPC
	9	CCK_1Mbps	PN7_PATTERN	TXPowerForce_OLPC
	9	CCK_1Mbps	PN7_PATTERN	TXPowerForce_OLPC
IEEE 802.11g	12	NO HT_6Mbps	PN7_PATTERN	TXPowerForce_OLPC
	12	NO HT_6Mbps	PN7_PATTERN	TXPowerForce_OLPC
	12	NO HT_6Mbps	PN7_PATTERN	TXPowerForce_OLPC
IEEE 802.11n HT20	12	HT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
	12	HT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
	12	HT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
IEEE 802.11n HT40	12	HT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
	12	HT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
	12	HT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC

11.2. Wi-Fi 5GHz

UNII-1 / UNII-2A				
Test Software Version	QRCT (V3.0-00230) from QUALCOMM			
Test Mode	Setting TX Power	HT Mode	TX Pattern	TX Power Control
802.11a	11	NO HT_6Mbps	PN7_PATTERN	TXPowerForce_OLPC
	11	NO HT_6Mbps	PN7_PATTERN	TXPowerForce_OLPC
	11	NO HT_6Mbps	PN7_PATTERN	TXPowerForce_OLPC
802.11n HT20	11	HT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
	11	HT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
	11	HT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
802.11n HT40	12	HT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
	12	HT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
	12	HT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
802.11ac HT20	12	VHT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
	12	VHT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
	12	VHT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
802.11ac HT40	12	VHT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
	12	VHT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
	12	VHT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
802.11ac HT80	11	VHT80_1_MCS_0_80	PN7_PATTERN	TXPowerForce_OLPC
	11	VHT80_1_MCS_0_80	PN7_PATTERN	TXPowerForce_OLPC
	11	VHT80_1_MCS_0_80	PN7_PATTERN	TXPowerForce_OLPC

UNII-2C / UNII-3				
Test Software Version	QRCT (V3.0-00230) from QUALCOMM			
Test Mode	Setting TX Power	HT Mode	TX Pattern	TX Power Control
802.11a	12	NO HT_6Mbps	PN7_PATTERN	TXPowerForce_OLPC
	12	NO HT_6Mbps	PN7_PATTERN	TXPowerForce_OLPC
	12	NO HT_6Mbps	PN7_PATTERN	TXPowerForce_OLPC
802.11n HT20	12	HT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
	12	HT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
	12	HT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
802.11n HT40	13	HT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
	13	HT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
	13	HT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
802.11ac HT20	12	VHT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
	12	VHT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
	12	VHT20_MCS_0_20	PN7_PATTERN	TXPowerForce_OLPC
802.11ac HT40	13	VHT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
	13	VHT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
	13	VHT40+MCS_0_40	PN7_PATTERN	TXPowerForce_OLPC
802.11ac HT80	12	VHT80_1_MCS_0_80	PN7_PATTERN	TXPowerForce_OLPC
	12	VHT80_1_MCS_0_80	PN7_PATTERN	TXPowerForce_OLPC
	12	VHT80_1_MCS_0_80	PN7_PATTERN	TXPowerForce_OLPC

11.3. Bluetooth

BLE

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band	
Test Software Version	QRCT (V3.0-00230) from QUALCOMM
Modulation Type	Setting TX Power
GFSK	MAX

BT

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band		
Test Software Version	QRCT (V3.0-00230) from QUALCOMM	
Modulation Type	Setting TX Power	Packet Type
GFSK	8	DH5_339
8-DPSK	8	3DH5_1021

12. Conducted Output Power Measurement

12.1. Wi-Fi 2.4GHz (DTS Band)

Measured Results

Band	Mode	Date Rate	Ch.#	Freq.(MHz)	Avg. Pwr.(dBm)	SAR Test (Yes/No)
2.4G	802.11b	1Mbps	1	2412	10.35	Yes
			6	2437	10.45	
			11	2462	10.24	
	802.11g	6Mbps	1	2412	12.33	No
			6	2437	12.27	
			11	2462	12.12	
	802.11n (20M)	6.5Mbps	1	2412	12.15	No
			6	2437	12.23	
			11	2462	12.38	
	802.11n (40M)	13.5Mbps	3	2422	12.27	No
			6	2437	12.56	
			9	2452	12.35	

12.2. Wi-Fi 5GHz (U-NII Band)

Measured Results

Band	Mode	Date Rate	Ch.#	Freq.(MHz)	Avg. Pwr.(dBm)	SAR Test (Yes/No)
U-NII-1	802.11a	6Mbps	36	5180	10.78	No
			40	5200	10.74	
			44	5220	10.54	
			48	5240	9.98	
	802.11n (20M)	6.5Mbps	36	5180	10.63	No
			40	5200	10.53	
			44	5220	10.47	
			48	5240	9.95	
	802.11n (40M)	13.5Mbps	38	5190	11.96	No
			46	5230	11.05	
	802.11ac (20M)	6.5Mbps	36	5180	10.45	No
			40	5200	10.34	
			44	5220	10.24	
			48	5240	9.93	
	802.11ac (40M)	13.5Mbps	38	5190	11.91	No
			46	5230	11.25	
	802.11ac (80M)	29.3Mbps	42	5210	10.94	No

Measured Results

Band	Mode	Date Rate	Ch.#	Freq.(MHz)	Avg. Pwr.(dBm)	SAR Test (Yes/No)
U-NII-2A	802.11a	6Mbps	52	5260	10.71	No
			56	5280	10.91	
			60	5300	10.77	
			64	5320	10.75	
	802.11n (20M)	6.5Mbps	52	5260	10.35	No
			56	5280	10.66	
			60	5300	10.71	
			64	5320	10.55	
	802.11n (40M)	13.5Mbps	54	5270	11.72	Yes
			62	5310	11.47	
	802.11ac (20M)	6.5Mbps	52	5260	10.23	No
			56	5280	10.89	
			60	5300	10.76	
			64	5320	10.85	
	802.11ac (40M)	13.5Mbps	54	5270	11.45	No
			62	5310	11.84	
	802.11ac (80M)	29.3Mbps	58	5290	10.88	No

Measured Results

Band	Mode	Date Rate	Ch.#	Freq.(MHz)	Avg. Pwr.(dBm)	SAR Test (Yes/No)
U-NII-2C	802.11a	6Mbps	100	5500	10.68	No
			104	5520	10.61	
			108	5540	10.78	
			112	5560	10.65	
			116	5580	10.96	
			120	5600	10.31	
			124	5620	10.52	
			128	5640	10.43	
			182	5660	10.55	
			136	5680	10.65	
			140	5700	10.87	
			144	5720	10.81	
	802.11n (20M)	6.5Mbps	100	5500	10.63	No
			104	5520	10.55	
			108	5540	10.67	
			112	5560	10.81	
			116	5580	10.99	
			120	5600	10.76	
			124	5620	10.34	
			128	5640	10.57	
			182	5660	10.68	
			136	5680	10.71	
			140	5700	10.77	
			144	5720	10.68	
	802.11n (40M)	13.5Mbps	102	5510	11.59	Yes
			110	5550	11.67	
			118	5590	11.77	
			126	5630	11.95	
			134	5670	11.78	
			142	5710	11.87	
	802.11ac (20M)	6.5Mbps	100	5500	10.74	No
			104	5520	10.89	
			108	5540	10.58	
			112	5560	10.74	
			116	5580	10.91	
			120	5600	10.69	
			124	5620	10.53	
			128	5640	10.49	
			182	5660	10.61	
			136	5680	10.79	
			140	5700	10.93	
			144	5720	10.91	
	802.11ac (40M)	13.5Mbps	102	5510	11.64	Yes
			110	5550	11.93	
			118	5590	11.56	
			126	5630	11.67	
			134	5670	11.92	
			142	5710	11.88	
	802.11ac (80M)	29.3Mbps	106	5530	10.78	No
			122	5610	10.75	
			138	5690	10.66	

Measured Results

Band	Mode	Date Rate	Ch.#	Freq.(MHz)	Avg. Pwr.(dBm)	SAR Test (Yes/No)
U-NII-3	802.11a	6Mbps	149	5745	10.95	No
			153	5765	10.77	
			157	5785	10.69	
			161	5805	10.54	
			165	5825	10.93	
	802.11n (20M)	6.5Mbps	149	5745	10.93	No
			153	5765	10.67	
			157	5785	10.78	
			161	5805	10.65	
			165	5825	10.91	
	802.11n (40M)	13.5Mbps	151	5755	11.93	Yes
			159	5795	11.69	
	802.11ac (20M)	6.5Mbps	149	5745	10.77	No
			153	5765	10.68	
			157	5785	10.96	
			161	5805	10.59	
			165	5825	10.68	
	802.11ac (40M)	13.5Mbps	151	5755	11.98	No
			159	5795	11.69	
	802.11ac (80M)	29.3Mbps	155	5775	10.77	No

12.3. Bluetooth

Measured Results

BT 2450	Tune-up	Average Conducted Power (dBm)		
		0CH	39CH	78CH
DH5	6	4.13	4.41	4.28
2DH5	6	2.98	3.13	2.95
3DH5	6	2.79	3.21	3.04

BT 2450	Tune-up	Average Conducted Power (dBm)		
		0CH	39CH	78CH
BLE	6	2.89	2.98	2.78

13. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

A）Per KDB447498 D01v05r02, all SAR measurement results are scaled to the maximum tune-up tolerance limit to demonstrate SAR compliance.

B）Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz.
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz.

Per KDB865664 D01:

For each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤20%, and the measured SAR <1.45W/Kg, only one repeated measurement is required.

Per KDB 248227 D01:

For Wi-Fi SAR testing, a communication link is set up with the testing software for Wi-Fi mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. The RF signal utilized in SAR measurement has 100% duty cycle and its crest factor is 1. The test procedures in KDB 248227D01 are applied. (Refer to KDB 248227D01 for more details)

Initial Test Position Procedure

For exposure condition with multiple test position, such as handsets operating next to the ear, devices with hotspot mode or UMPC mini-tablet , procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all position in an exposure condition. The test position with the highest extrapolated(peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4W/kg, no additional testing for the remaining test position is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8W/kg or all test position are measured. For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions /configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

Initial Test Configuration Procedure

An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. For configurations with the same specified or measured maximum output power, additional transmission mode and test channel selection procedures are required (see section 5.3.2 of KDB 248227D01). SAR test reduction of subsequent highest output test channels is based on the reported SAR of the initial test configuration.

For next to the ear, hotspot mode and UMC mini-tablet exposure configurations where multiple test positions are required, the initial test position procedure is applied to minimize the number of test positions required for SAR measurement using the initial test configuration transmission mode. For fixed exposure conditions that do not have multiple SAR test positions, SAR is measured in the transmission mode determined by the initial test configuration.

When the reported SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for the subsequent next highest measured output power channel(s) in the initial test configuration until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

Sub Test Configuration Procedure
SAR measurement requirements for the remaining 802.11transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units.
When the highest reported SAR for the initial test configuration, according to the initial test position or
fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.

Wi-Fi 2.4G SAR Test Procedures
Separate SAR procedures are applied to DSSS and OFDM configurations in the 2.4 GHz band to simplify DSSS test requirements. For 802.11b DSSS SAR measurements, DSSS SAR procedure applies to fixed exposure test position and initial test position procedure applies to multiple exposure test positions.

A）802.11b DSSS SAR Test Requirements
SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

1）When the reported SAR of the highest measured maximum output power channel (section 3.1 of of KDB 248227D01) for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
2）When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

B）2.4GHz 802.11g/n OFDM SAR Test Exclusion Requirements
When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied (section 5.3 of of KDB 248227D01). SAR is not required for the following 2.4 GHz OFDM conditions.

1）When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
2）When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

C）SAR Test Requirements for OFDM configurations
When SAR measurement is required for 802.11g/n OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. In applying the initial test configuration and subsequent test configuration procedures, the 802.11transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

13.1. Wi-Fi 2.4GHz (DTS Band)

Test Positon (Body 5mm-Head using scenario)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value		Power Drift	Duty Factor (%)	Scaled (W/Kg)
			Tune-up	Meas.	1g (Area Scan)	1g (Zoom Scan)			
Front Surface	802.11b	6/2437	11.00	10.45	0.104	\	0.16	99.0	\
Back Surface	802.11b	6/2437	11.00	10.45	0.103	\	0.20	99.0	\
Top Edge	802.11b	6/2437	11.00	10.45	0.252	\	0.10	99.0	\
Right Edge	802.11b	6/2437	11.00	10.45	0.362	0.349	0.20	99.0	**0.400**
Test Positon (Body 0mm-Body using scenario)	**Test Mode**	**Channel/ Frequency**	**Power (dBm)**		**SAR Value**		**Power Drift**	**Duty Factor (%)**	**Scaled (W/Kg)**
			Tune-up	**Meas.**	**1g (Area Scan)**	**1g (Zoom Scan)**			
Front Surface	802.11b	6/2437	11.00	10.45	0.100	\	0.18	99.0	\
Back Surface	802.11b	6/2437	11.00	10.45	0.090	\	0.13	99.0	\
Top Edge	802.11b	6/2437	11.00	10.45	0.220	\	0.09	99.0	\
Right Edge	802.11b	6/2437	11.00	10.45	0.297	0.283	0.12	99.0	0.324

For head using scenario:

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR test (Yes/No)
802.11b	11	12.59	0.400	\	Yes
802.11g	13	19.95	\	0.634	No
802.11n	13	19.95	\	0.634	No

For body using scenario:

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR test (Yes/No)
802.11b	11	12.59	0.324	\	Yes
802.11g	13	19.95	\	0.514	No
802.11n	13	19.95	\	0.514	No

Note:
1) Per KDB248227D01, SAR is measured for 2.4 GHz 802.11b DSSS using the initial test position procedure.
2) The highest reported SAR for DSSS adjusted by the ratio of OFDM 802.11g/n to DSSS specified maximum output power and the adjusted SAR is < 1.2 W/kg, so SAR for 802.11g/n is not required.

13.2. Wi-Fi 5GHz (U-NII Band)

SAR test results of WiFi 5G U-NII-2A.

Test Positon (Body 5mm-Head using scenario)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value		Power Drift	Duty Factor (%)	Scaled (W/Kg)
			Tune -up	Meas.	1g (Area Scan)	1g (Zoom Scan)			
Front Surface	802.11n 40M	54/5270	12.00	11.72	0.157	\	0.13	96.1	\
Back Surface	802.11n 40M	54/5270	12.00	11.72	0.139	\	-0.01	96.1	\
Top Edge	802.11n 40M	54/5270	12.00	11.72	0.228	\	0.07	96.1	\
Right Edge	802.11n 40M	54/5270	12.00	11.72	0.342	0.353	0.09	96.1	**0.392**
Test Positon (Body 0mm-Body using scenario)	**Test Mode**	**Channel/ Frequency**	**Power (dBm)**		**SAR Value**		**Power Drift**	**Duty Factor (%)**	**Scaled (W/Kg)**
			Tune -up	**Meas.**	**1g (Area Scan)**	**1g (Zoom Scan)**			
Front Surface	802.11n 40M	54/5270	12.00	11.72	0.305	\	-0.05	96.1	\
Back Surface	802.11n 40M	54/5270	12.00	11.72	0.256	\	-0.02	96.1	\
Top Edge	802.11n 40M	54/5270	12.00	11.72	0.379	0.401	0.02	96.1	0.445
Right Edge	802.11n 40M	54/5270	12.00	11.72	0.452	0.516	0.01	96.1	**0.573**

For head using scenario:

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR test (Yes/No)
802.11n 40M	12	15.85	0.392	\	Yes
802.11a	11	12.59	\	0.311	No
802.11n 20M	11	12.59	\	0.311	No
802.11ac 20M	11	12.59	\	0.311	No
802.11ac 40M	12	15.85	\	0.392	No
802.11ac 80M	11	12.59	\	0.311	No

For body using scenario:

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR test (Yes/No)
802.11n 40M	12	15.85	0.573	\	Yes
802.11a	11	12.59	\	0.455	No
802.11n 20M	11	12.59	\	0.455	No
802.11ac 20M	11	12.59	\	0.455	No
802.11ac 40M	12	15.85	\	0.573	No
802.11ac 80M	11	12.59	\	0.455	No

Note:
1) Per KDB 248227D01, as the same maximum output power is specified for U-NII-1 and U-NII-2A bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements.
As the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration.
2) The 802.11n 40M mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. as the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR test for the other 802.11 modes are not required.

SAR test results of WiFi 5G U-NII-2C.

Test Positon (Body 5mm-Head using scenario)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value		Power Drift	Duty Factor (%)	Scaled (W/Kg)
			Tune-up	Meas.	1g (Area Scan)	1g (Zoom Scan)			
Front Surface	802.11n 40M	126/5630	12.00	11.95	0.250	\	0.13	96.1	\
Back Surface	802.11n 40M	126/5630	12.00	11.95	0.274	\	0.01	96.1	\
Top Edge	802.11n 40M	126/5630	12.00	11.95	0.407	0.403	0.04	96.1	0.424
Right Edge	802.11n 40M	126/5630	12.00	11.95	0.579	0.628	0.19	96.1	**0.661**
Test Positon (Body 0mm-Body using scenario)	**Test Mode**	**Channel/ Frequency**	**Power (dBm)**		**SAR Value**		**Power Drift**	**Duty Factor (%)**	**Scaled (W/Kg)**
			Tune-up	**Meas.**	**1g (Area Scan)**	**1g (Zoom Scan)**			
Front Surface	802.11n 40M	126/5630	12.00	11.95	0.502	\	0.13	96.1	\
Back Surface	802.11n 40M	126/5630	12.00	11.95	0.540	0.587	0.02	96.1	0.618
Top Edge	802.11n 40M	126/5630	12.00	11.95	0.788	0.924	0.14	96.1	0.973
Right Edge	802.11n 40M	126/5630	12.00	11.95	1.190	1.320	0.16	96.1	1.389
Right Edge	802.11n 40M	142/5710	12.00	11.87	0.959	1.090	0.17	96.1	1.169
Top Edge	802.11n 40M	142/5710	12.00	11.87	0.769	0.900	0.00	96.1	0.965
Right Edge-Repeated	802.11n 40M	126/5630	12.00	11.95	1.230	1.320	0.16	96.1	**1.389**
Subsequent test configuration									
Front Surface	802.11ac 40M	110/5550	12.00	11.93	0.404	\	0.19	96.1	\
Back Surface	802.11ac 40M	110/5550	12.00	11.93	0.447	0.458	0.13	96.1	0.484
Top Edge	802.11ac 40M	110/5550	12.00	11.93	0.687	0.767	-0.09	96.1	0.811
Right Edge	802.11ac 40M	110/5550	12.00	11.93	0.995	1.090	0.18	96.1	1.153
Top Edge	802.11ac 40M	134/5670	12.00	11.92	0.678	0.751	-0.04	96.1	0.796
Right Edge	802.11ac 40M	134/5670	12.00	11.92	0.946	1.070	0.04	96.1	1.134

Note：

1. For body using scenario, the ratio of the repeated SAR to original SAR is 1.320 / 1.320 = 100%，the deviation is within 20%，so only one repeated measurement is required.

For head using scenario:

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR test (Yes/No)
802.11n 40M	12	15.85	0.661	\	Yes
802.11a	11	12.59	\	0.525	No
802.11n 20M	11	12.59	\	0.525	No
802.11ac 20M	11	12.59	\	0.525	No
802.11ac 40M	12	15.85	\	0.661	No
802.11ac 80M	11	12.59	\	0.525	No

For body using scenario:

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR test (Yes/No)
802.11n 40M	12	15.85	1.389	\	Yes
802.11a	11	12.59	\	1.103	No
802.11n 20M	11	12.59	\	1.103	No
802.11ac 20M	11	12.59	\	1.103	No
802.11ac 40M	12	15.85	\	1.389	Yes
802.11ac 80M	11	12.59	\	1.103	No

Note:
The 802.11n 40M mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. as the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR of 802.11ac 40M is > 1.2 W/kg at body using scenario, SAR test for the 802.11ac 40M is required for body using scenario. SAR test for the other 802.11 modes are not required.

SAR test results of WiFi 5G U-NII-3.

Test Positon (Body 5mm-Head using scenario)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value		Power Drift	Duty Factor (%)	Scaled (W/Kg)
			Tune -up	Meas.	1g (Area Scan)	1g (Zoom Scan)			
Front Surface	802.11n 40M	151/5755	12.00	11.93	0.242	\	0.03	96.1	\
Back Surface	802.11n 40M	151/5755	12.00	11.93	0.419	\	0.12	96.1	\
Top Edge	802.11n 40M	151/5755	12.00	11.93	0.434	0.223	0.02	96.1	0.236
Right Edge	802.11n 40M	151/5755	12.00	11.93	0.718	0.844	0.11	96.1	**0.893**
Right Edge	802.11n 40M	159/5795	12.00	11.69	0.487	0.592	0.10	96.1	0.662
Right Edge-Repeated	802.11n 40M	151/5755	12.00	11.93	0.652	0.711	-0.15	96.1	0.752
Test Positon (Body 0mm-Body using scenario)	**Test Mode**	**Channel/ Frequency**	**Power (dBm)**		**SAR Value**		**Power Drift**	**Duty Factor (%)**	**Scaled (W/Kg)**
			Tune -up	**Meas.**	**1g (Area Scan)**	**1g (Zoom Scan)**			
Front Surface	802.11n 40M	151/5755	12.00	11.93	0.557	\	-0.11	96.1	\
Back Surface	802.11n 40M	151/5755	12.00	11.93	0.669	0.749	0.04	96.1	0.792
Top Edge	802.11n 40M	151/5755	12.00	11.93	0.766	0.873	0.17	96.1	0.923
Right Edge	802.11n 40M	151/5755	12.00	11.93	1.010	1.130	0.12	96.1	**1.195**
Right Edge	802.11n 40M	159/5795	12.00	11.69	0.804	0.907	0.18	96.1	1.014
Top Edge	802.11n 40M	159/5795	12.00	11.69	0.526	0.640	0.15	96.1	0.715
Right Edge-Repeated	802.11n 40M	151/5755	12.00	11.93	0.928	1.010	-0.05	96.1	1.068

Note：

1. For Head using scenario, the ratio of the repeated SAR to original SAR is 0.711 / 0.844 = 84.24%，the deviation is within 20%，so only one repeated measurement is required.
2. For body using scenario, the ratio of the repeated SAR to original SAR is 1.010 / 1.130 = 89.38%，the deviation is with 20%，so only one repeated measurement is required.

For head using scenario:

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR test (Yes/No)
802.11n 40M	12	15.85	0.893	\	Yes
802.11a	11	12.59	\	0.709	No
802.11n 20M	11	12.59	\	0.709	No
802.11ac 20M	11	12.59	\	0.709	No
802.11ac 40M	12	15.85	\	0.893	No
802.11ac 80M	11	12.59	\	0.709	No

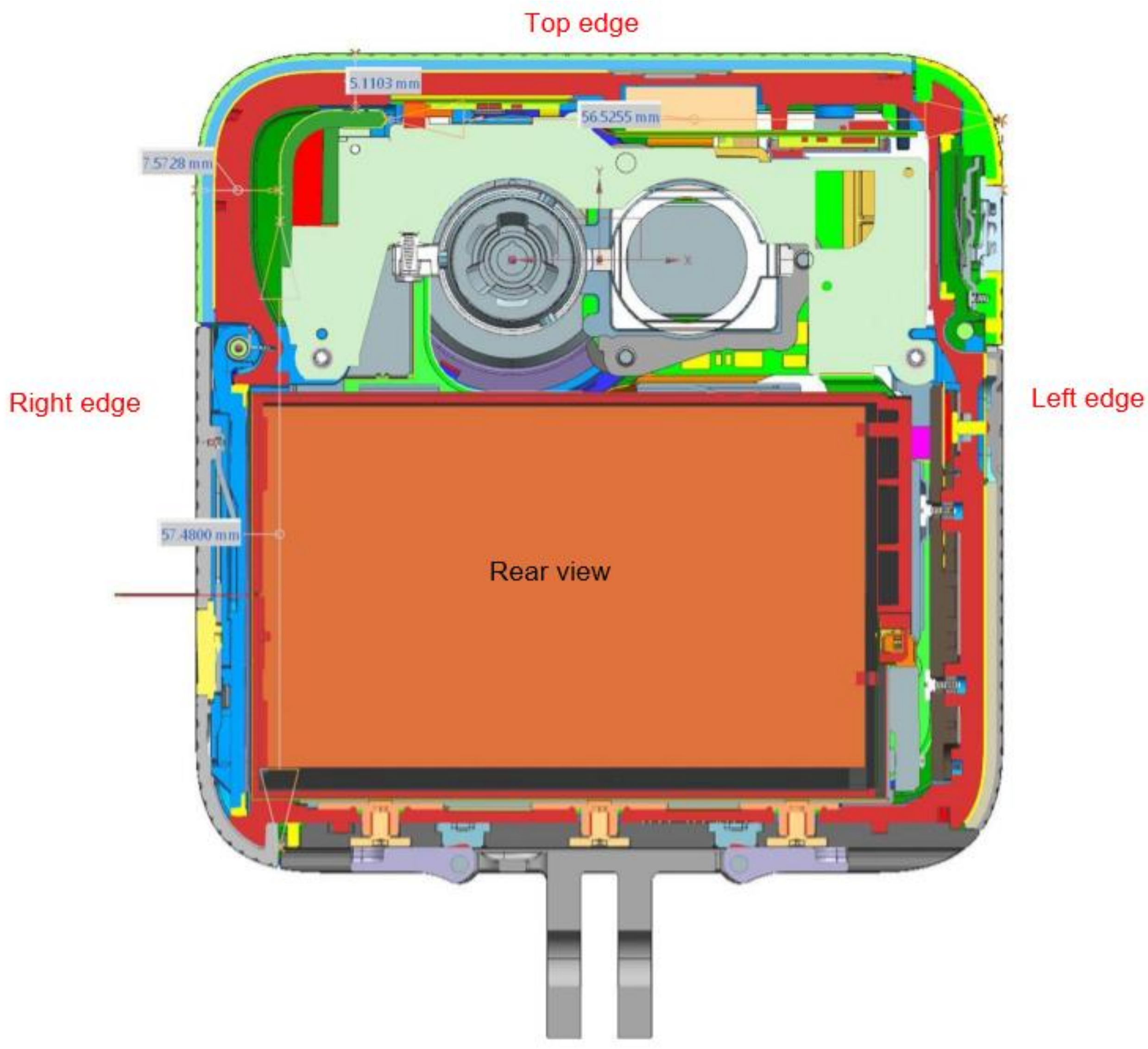
For body using scenario:

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR test (Yes/No)
802.11n 40M	12	15.85	1.195	\	Yes
802.11a	11	12.59	\	0.949	No
802.11n 20M	11	12.59	\	0.949	No
802.11ac 20M	11	12.59	\	0.949	No
802.11ac 40M	12	15.85	\	1.195	No
802.11ac 80M	11	12.59	\	0.949	No

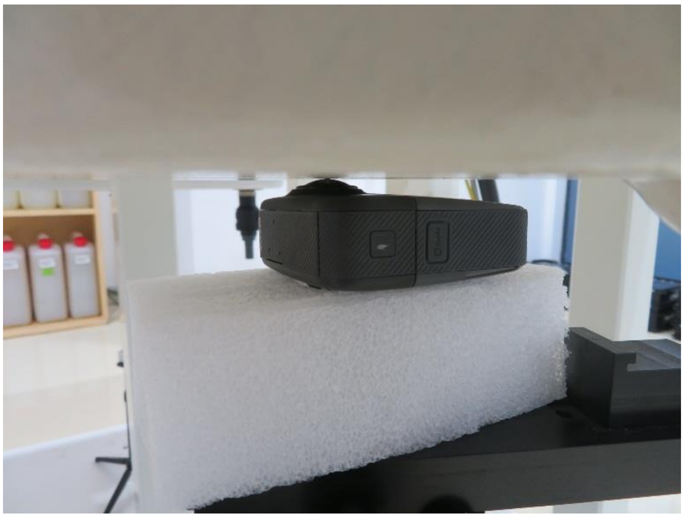
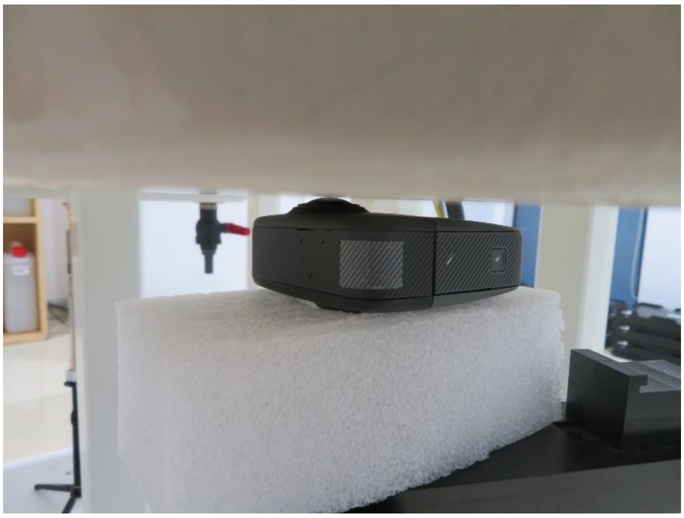
Note:
The 802.11n 40M mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. as the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR test for the other 802.11 modes are not required.

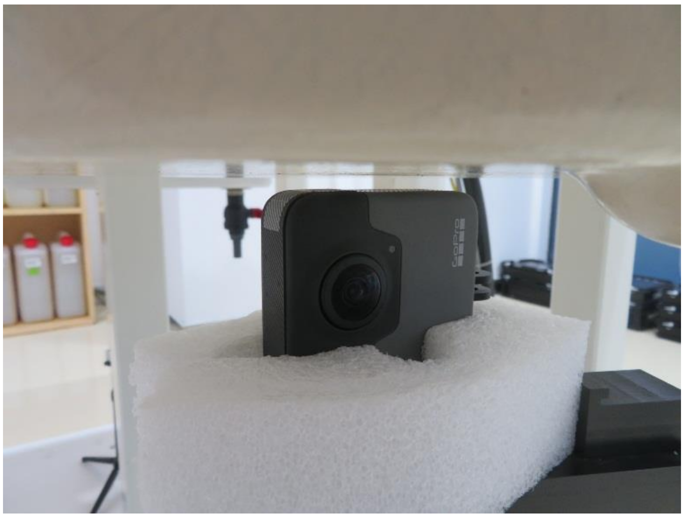
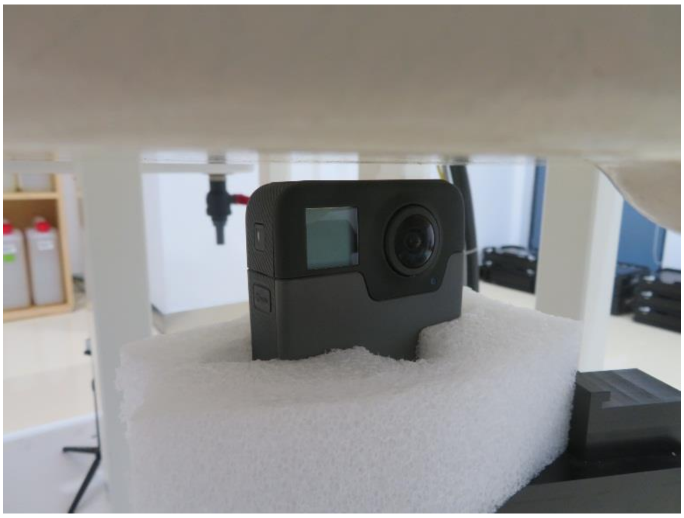
2. Simultaneous Transmission SAR Analysis

The antenna diagram inside the device is showed as below, because there is only one antenna, so simultaneous transmission is not exist.



Appendix A _ Photo

Test position	
Front surface(0mm)	Front surface(5mm)
	
Back surface(0mm)	Back surface(5mm)
	

Right edge(0mm)	Right edge(5mm)
	
Top edge(0mm)	Top edge(5mm)
	

Appendix B _ System Check Plots

System Performance Check-2450MHz-Head
System Performance Check-2450MHz-Body
System Performance Check-D5GHz-5250MHz-Head
System Performance Check-D5GHz-5250MHz-Body
System Performance Check-D5GHz-5600MHz-Head
System Performance Check-D5GHz-5600MHz-Body
System Performance Check-D5GHz-5750MHz-Head
System Performance Check-D5GHz-5750MHz-Body

Date: 2017/5/25

SystemPerformanceCheck-2450MHz-Head

Communication System: UID 0, CW (0); Frequency: 2450 MHz
Medium parameters used (interpolated): f = 2450 MHz; σ = 1.799 S/m; ε_r = 39.896; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

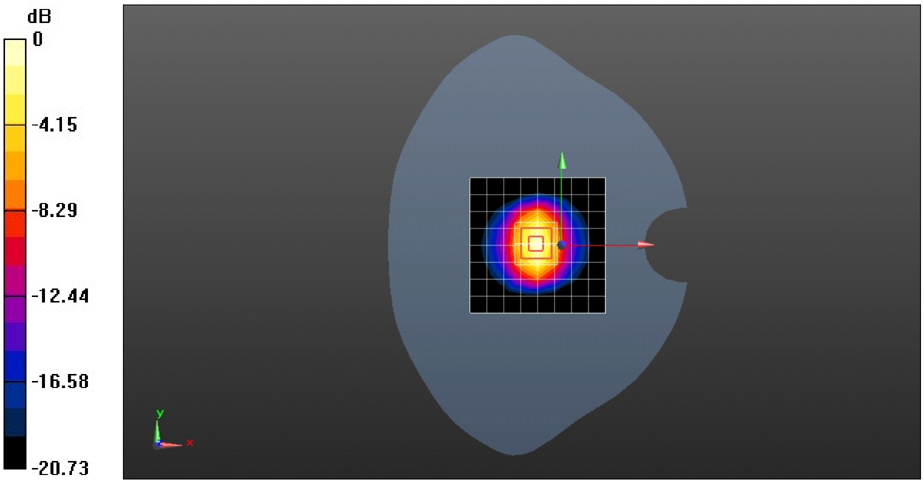
- Probe: EX3DV4 - SN7383; ConvF(7.45, 7.45, 7.45); Calibrated: 2016/12/27;
- Sensor-Surface: 3mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: SAM v5.0; Type: QD000P40CD; Serial: TP:1805
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

Configuration/D2450V2/Area Scan (9x9x1): Measurement grid: dx=12mm, dy=12mm

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

Configuration/D2450V2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.57 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 24.5 W/kg
SAR(1 g) = 12.4 W/kg; SAR(10 g) = 5.92 W/kg

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



0 dB = 16.4 W/kg = 12.15 dBW/kg

Date: 2017/5/25

SystemPerformanceCheck-2450MHz-Bdoy

Communication System: UID 0, CW (0); Frequency: 2450 MHz
Medium parameters used (interpolated): f = 2450 MHz; σ = 1.953 S/m; ε_r = 51.765; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

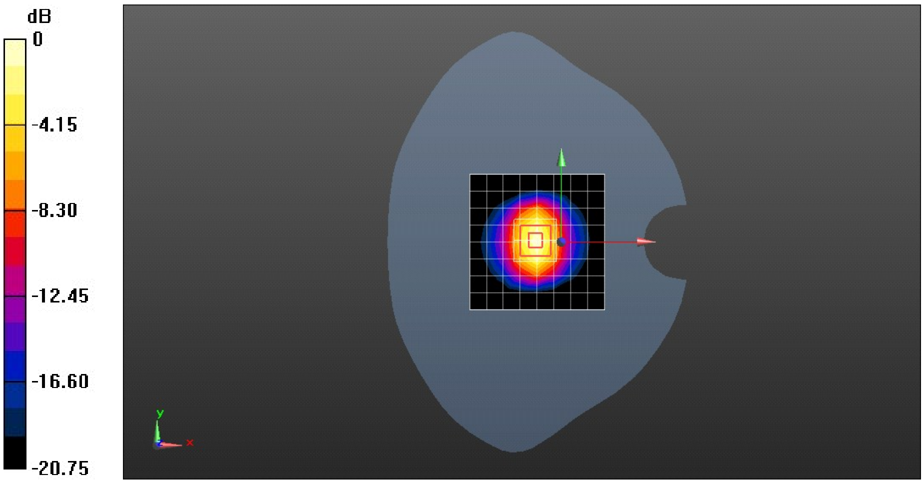
- Probe: EX3DV4 - SN7383; ConvF(7.63, 7.63, 7.63); Calibrated: 2016/12/27;
- Sensor-Surface: 3mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: SAM v5.0; Type: QD000P40CD; Serial: TP:1805
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

Configuration/D2450V2/Area Scan (9x9x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 17.2 W/kg

Configuration/D2450V2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.50 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 26.3 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.29 W/kg

Maximum value of SAR (measured) = 17.5 W/kg



0 dB = 17.5 W/kg = 12.42 dBW/kg

Date: 2017/5/28

SystemPerformanceCheck-D5GHz_5250MHz-Head

Communication System: UID 0, CW (0); Frequency: 5250 MHz
Medium parameters used (interpolated): f = 5250 MHz; σ = 4.56 S/m; ε_r = 34.632; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

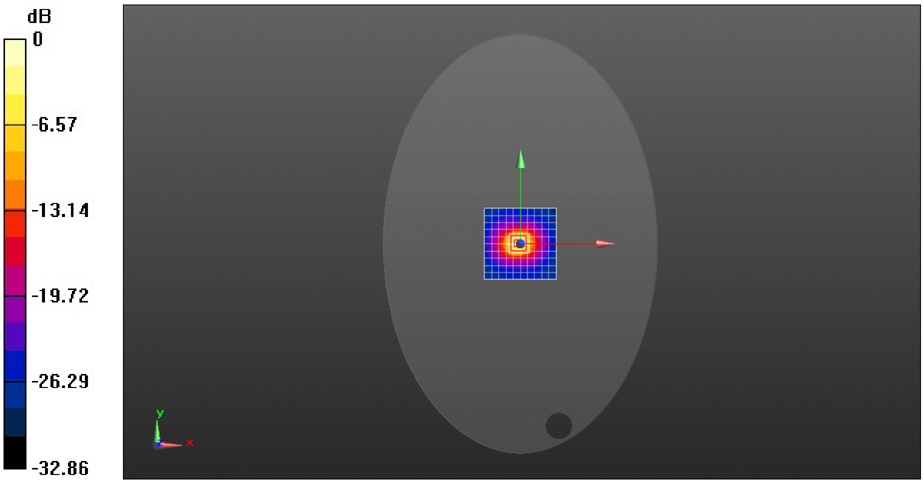
- Probe: EX3DV4 - SN7383; ConvF(5.2, 5.2, 5.2); Calibrated: 2016/12/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5600 MHz/Area Scan (11x11x1):
Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 19.8 W/kg

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5600 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 71.68 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 33.5 W/kg
SAR(1 g) = 8.66 W/kg; SAR(10 g) = 2.53 W/kg

Maximum value of SAR (measured) = 20.2 W/kg



0 dB = 20.2 W/kg = 13.06 dBW/kg

Date: 2017/5/26

SystemPerformanceCheck-D5GHz_5250MHz-Bdoy

Communication System: UID 0, CW (0); Frequency: 5250 MHz
Medium parameters used (interpolated): f = 5250 MHz; σ = 5.279 S/m; ε_r = 48.562; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

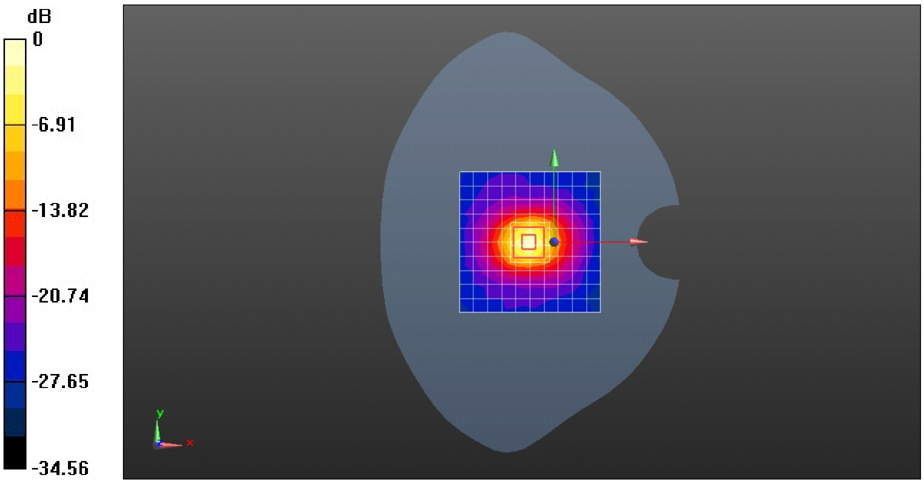
- Probe: EX3DV4 - SN7383; ConvF(4.63, 4.63, 4.63); Calibrated: 2016/12/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: SAM v5.0; Type: QD000P40CD; Serial: TP:1805
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5250 MHz/Area Scan (11x11x1): Measurement grid: dx=10mm, dy=10mm

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

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5250 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.03 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 26.3 W/kg
SAR(1 g) = 7.15 W/kg; SAR(10 g) = 2.08 W/kg

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



0 dB = 16.1 W/kg = 12.07 dBW/kg

Date: 2017/5/27

SystemPerformanceCheck-D5GHz_5600MHz-Head

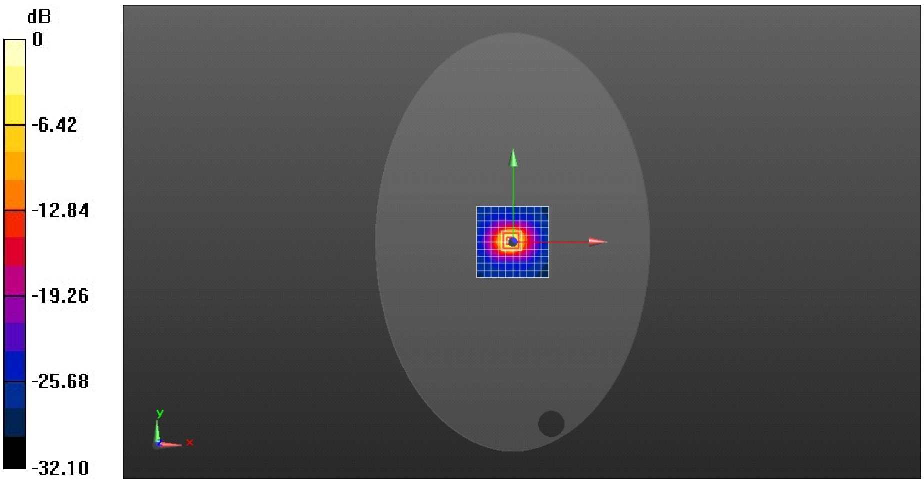
Communication System: UID 0, CW (0); Frequency: 5600 MHz
Medium parameters used: f = 5600 MHz; σ = 4.893 S/m; ε_r = 35.343; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7383; ConvF(4.69, 4.69, 4.69); Calibrated: 2016/12/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5600 MHz/Area Scan (11x11x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 20.2 W/kg

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5600 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 70.23 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 37.1 W/kg
SAR(1 g) = 9.08 W/kg; SAR(10 g) = 2.63 W/kg
Maximum value of SAR (measured) = 21.9 W/kg



0 dB = 21.9 W/kg = 13.40 dBW/kg

Date: 2017/5/26

SystemPerformanceCheck-D5GHz_5600MHz-Bdoy

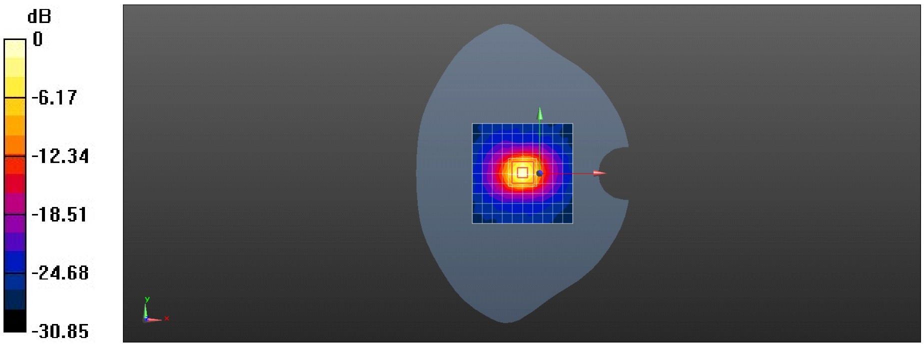
Communication System: UID 0, CW (0); Frequency: 5600 MHz
Medium parameters used: f = 5600 MHz; σ = 5.883 S/m; ε_r = 48.075; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7383; ConvF(3.99, 3.99, 3.99); Calibrated: 2016/12/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: SAM v5.0; Type: QD000P40CD; Serial: TP:1805
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5600 MHz/Area Scan (11x11x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 20.0 W/kg

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5600 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.31 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 31.1 W/kg
SAR(1 g) = 7.87 W/kg; SAR(10 g) = 2.25 W/kg
Maximum value of SAR (measured) = 18.4 W/kg



0 dB = 18.4 W/kg = 12.64 dBW/kg

Date: 2017/5/28

SystemPerformanceCheck-D5GHz_5750MHz-Head

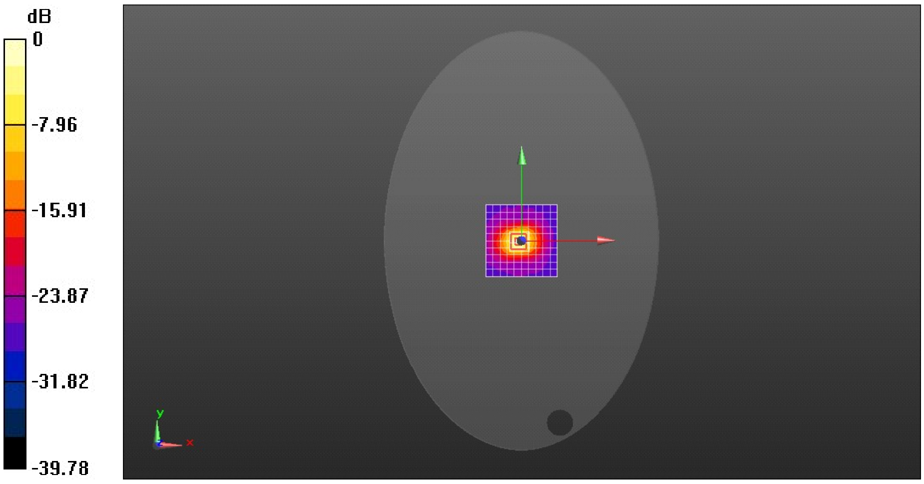
Communication System: UID 0, CW (0); Frequency: 5750 MHz
Medium parameters used: f = 5750 MHz; σ = 5.006 S/m; ε_r = 35.317; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7383; ConvF(4.9, 4.9, 4.9); Calibrated: 2016/12/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW/Area Scan (11x11x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 17.5 W/kg

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.03 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 35.9 W/kg
SAR(1 g) = 8.38 W/kg; SAR(10 g) = 2.4 W/kg
Maximum value of SAR (measured) = 20.2 W/kg



0 dB = 20.2 W/kg = 13.05 dBW/kg

Date: 2017/5/26

SystemPerformanceCheck-D5GHz_5750MHz-Bdoy

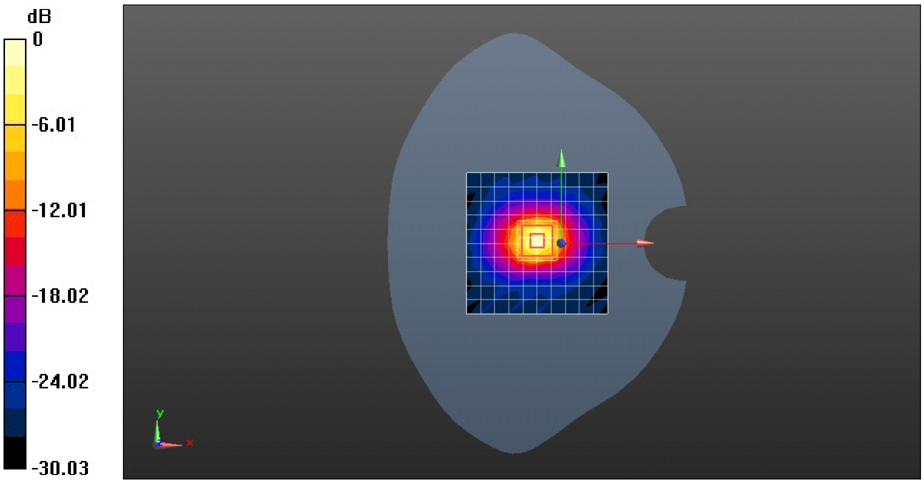
Communication System: UID 0, CW (0); Frequency: 5750 MHz
Medium parameters used: f = 5750 MHz; σ = 6.002 S/m; ε_r = 47.109; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7383; ConvF(4.33, 4.33, 4.33); Calibrated: 2016/12/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: SAM v5.0; Type: QD000P40CD; Serial: TP:1805
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5600 MHz/Area Scan (11x11x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 16.6 W/kg

System Performance Check with D5GHzV2 Dipole (graded grid)/d=10mm, Pin=100mW, f=5600 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 61.58 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 28.2 W/kg
SAR(1 g) = 6.94 W/kg; SAR(10 g) = 1.98 W/kg
Maximum value of SAR (measured) = 16.2 W/kg



0 dB = 16.2 W/kg = 12.10 dBW/kg

Appendix C _ Highest Test Plots

GoPro SBDC1 2.4G Wi-Fi 11CH right edge 5mm-Head using scenario
GoPro SBDC1 2.4G Wi-Fi 11CH right edge 0mm-Body using scenario
GoPro SBDC1 5G Wi-Fi 802.11n 40M 54CH right edge 5mm-Head using scenario
GoPro SBDC1 5G Wi-Fi 802.11n 40M 54CH right edge 0mm-Body using scenario
GoPro SBDC1 5G Wi-Fi 802.11n 40M 126CH right edge 5mm-Head using scenario
GoPro SBDC1 5G Wi-Fi 802.11n 40M 126CH right edge 0mm-Body using scenario-repeated
GoPro SBDC1 5G Wi-Fi 802.11n 40M 151CH right edge 5mm-Head using scenario
GoPro SBDC1 5G Wi-Fi 802.11n 40M 151CH right edge 0mm-Body using scenario
GoPro SBDC1 BT DH5 39CH right edge 5mm-Head using scenario
GoPro SBDC1 BT DH5 39CH right edge 0mm-Body using scenario

Date: 2017/5/25

GoPro SBDC1 2.4G WiFi 6CH right edge 0mm-Head scenario

Communication System: UID 0, WiFi (0); Frequency: 2437 MHz
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.791 S/m; ε_r = 39.915; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

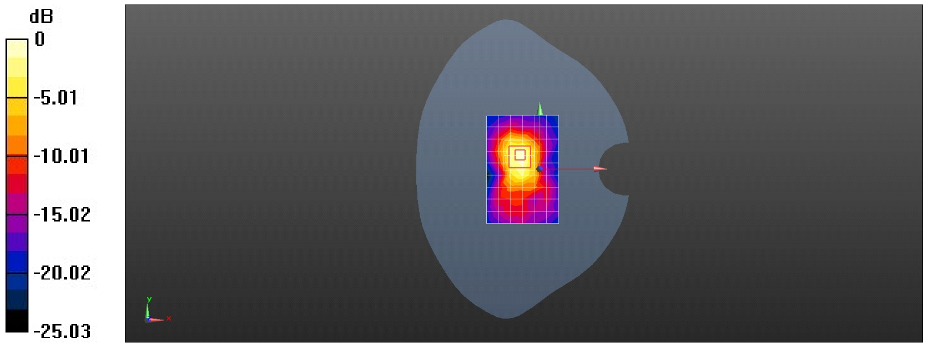
- Probe: EX3DV4 - SN7383; ConvF(7.45, 7.45, 7.45); Calibrated: 2016/12/27;
- Sensor-Surface: 3mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: SAM v5.0; Type: QD000P40CD; Serial: TP:1805
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

Configuration/Body/Area Scan (7x10x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.401 W/kg

Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.28 V/m; Power Drift = 0.20 dB
Peak SAR (extrapolated) = 0.684 W/kg
SAR(1 g) = 0.349 W/kg; SAR(10 g) = 0.165 W/kg

Maximum value of SAR (measured) = 0.448 W/kg



0 dB = 0.448 W/kg = -3.48 dBW/kg

Date: 2017/5/25

GoPro SBDC1 2.4G WiFi 6CH right edge 0mm-Body scenario

Communication System: UID 0, WiFi (0); Frequency: 2437 MHz
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.946 S/m; ε_r = 51.749; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

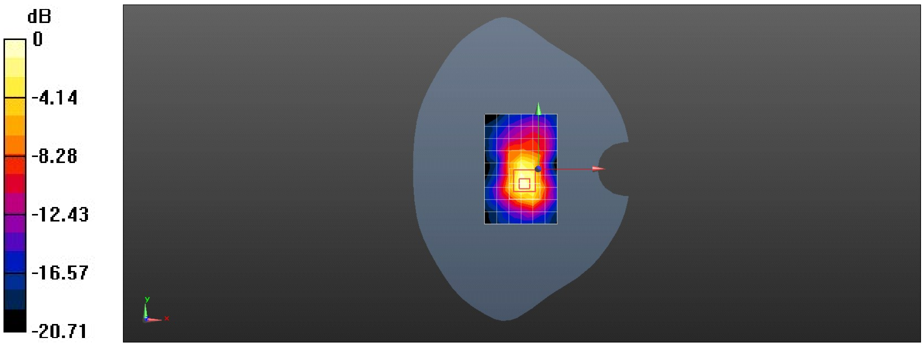
- Probe: EX3DV4 - SN7383; ConvF(7.63, 7.63, 7.63); Calibrated: 2016/12/27;
- Sensor-Surface: 3mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: SAM v5.0; Type: QD000P40CD; Serial: TP:1805
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

Configuration/Body/Area Scan (7x10x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.329 W/kg

Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.69 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.541 W/kg
SAR(1 g) = 0.283 W/kg; SAR(10 g) = 0.138 W/kg

Maximum value of SAR (measured) = 0.361 W/kg



0 dB = 0.361 W/kg = -4.42 dBW/kg

Date: 2017/5/28

GoPro SBDC1 5G WIFI 802.11n 40M 54CH right edge 5mm-Head scenario

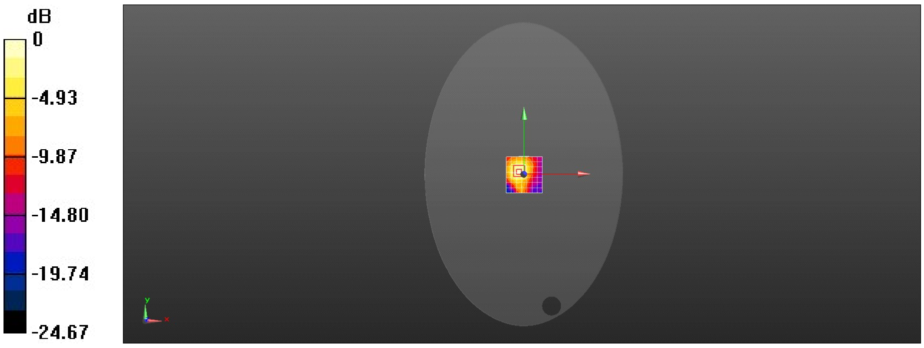
Communication System: UID 0, WiFi (0); Frequency: 5270 MHz
Medium parameters used: f = 5270 MHz; σ = 4.58 S/m; ε_r = 34.591; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7383; ConvF(5.2, 5.2, 5.2); Calibrated: 2016/12/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

Configuration/Body/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.718 W/kg

Configuration/Body/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 10.35 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 1.22 W/kg
SAR(1 g) = 0.353 W/kg; SAR(10 g) = 0.139 W/kg
Maximum value of SAR (measured) = 0.742 W/kg



0 dB = 0.742 W/kg = -1.30 dBW/kg

Date: 2017/5/26

GoPro SBDC1 5G WIFI 802.11n 40M 54CH right edge 0mm-Body scenario

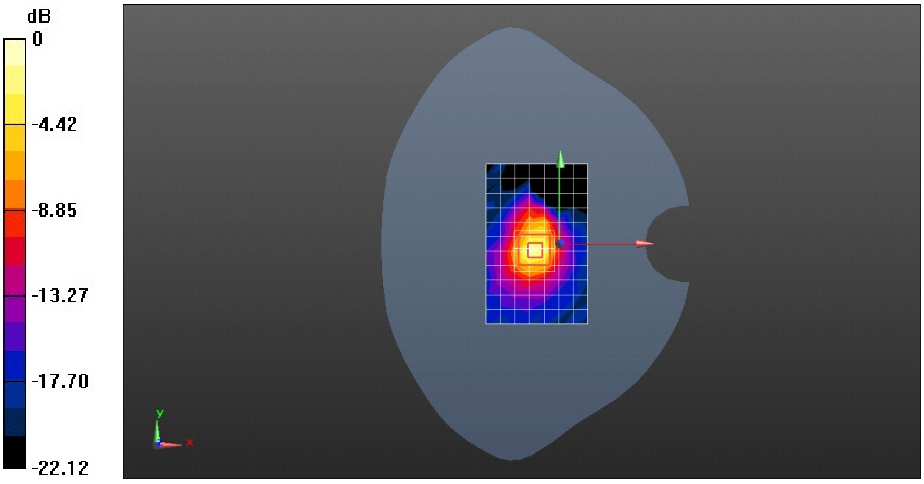
Communication System: UID 0, WiFi (0); Frequency: 5270 MHz
Medium parameters used: f = 5270 MHz; σ = 5.32 S/m; ε_r = 48.502; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7383; ConvF(4.63, 4.63, 4.63); Calibrated: 2016/12/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: SAM v5.0; Type: QD000P40CD; Serial: TP:1805
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

Configuration/Body/Area Scan (8x12x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.10 W/kg

Configuration/Body/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 15.26 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.97 W/kg
SAR(1 g) = 0.516 W/kg; SAR(10 g) = 0.157 W/kg
Maximum value of SAR (measured) = 1.22 W/kg



0 dB = 1.22 W/kg = 0.86 dBW/kg

Date: 2017/5/27

GoPro SBDC1 5G WIFI 802.11n 40M 126CH right edge 5mm-Head scenario

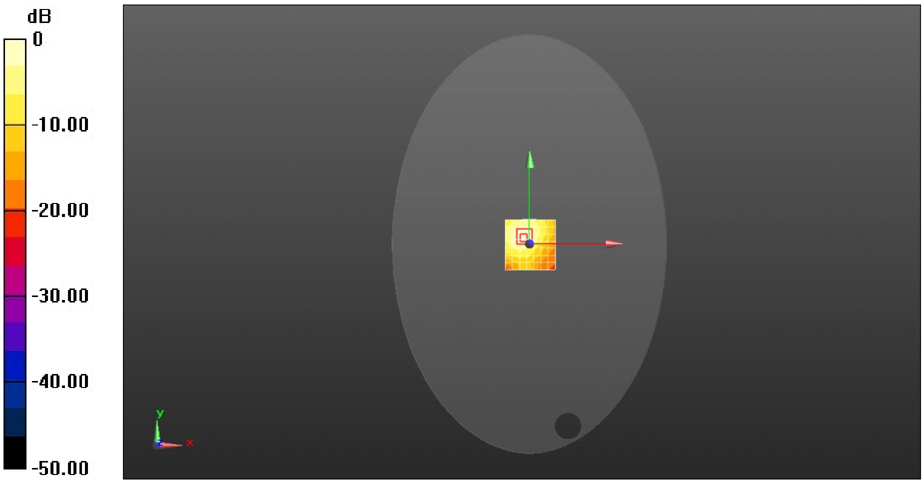
Communication System: UID 0, WiFi (0); Frequency: 5630 MHz
Medium parameters used: f = 5630 MHz; $\sigma = 4.925$ S/m; $\varepsilon_r = 35.391$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7383; ConvF(4.69, 4.69, 4.69); Calibrated: 2016/12/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

Configuration/Body/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.17 W/kg

Configuration/Body/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 11.52 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 2.84 W/kg
SAR(1 g) = 0.628 W/kg; SAR(10 g) = 0.249 W/kg
Maximum value of SAR (measured) = 1.36 W/kg



0 dB = 1.36 W/kg = 1.32 dBW/kg

Date: 2017/5/26

GoPro SBDC1 5G WIFI 802.11n 40M 126CH right edge 0mm-Body scenario-repeated

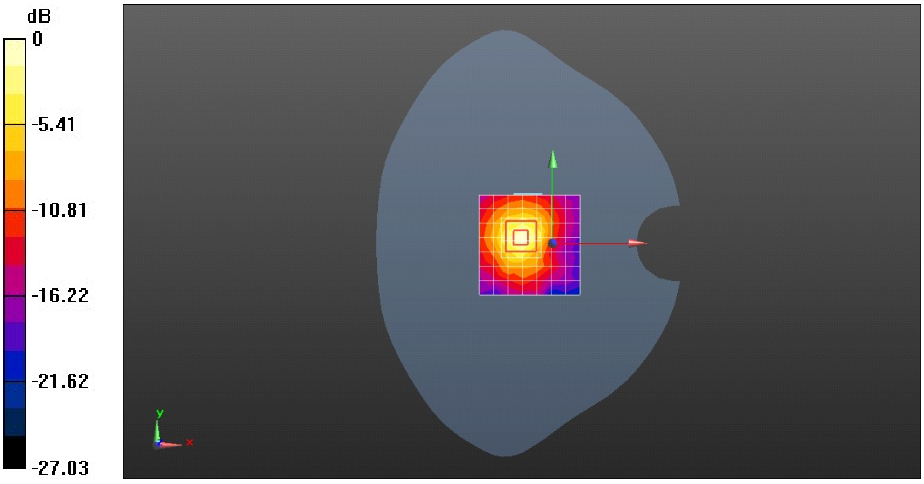
Communication System: UID 0, WiFi (0); Frequency: 5630 MHz
Medium parameters used: f = 5630 MHz; σ = 5.931 S/m; ε_r = 47.973; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7383; ConvF(3.99, 3.99, 3.99); Calibrated: 2016/12/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: SAM v5.0; Type: QD000P40CD; Serial: TP:1805
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

Configuration/Body/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 3.28 W/kg

Configuration/Body/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 21.92 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 4.95 W/kg
SAR(1 g) = 1.32 W/kg; SAR(10 g) = 0.432 W/kg
Maximum value of SAR (measured) = 2.97 W/kg



0 dB = 2.97 W/kg = 4.72 dBW/kg

Date: 2017/5/28

GoPro SBDC1 5G WIFI 802.11n 40M 151CH right edge 5mm-Head scenario

Communication System: UID 0, WiFi (0); Frequency: 5755 MHz
Medium parameters used (interpolated): f = 5755 MHz; σ = 5.015 S/m; ε_r = 35.32; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

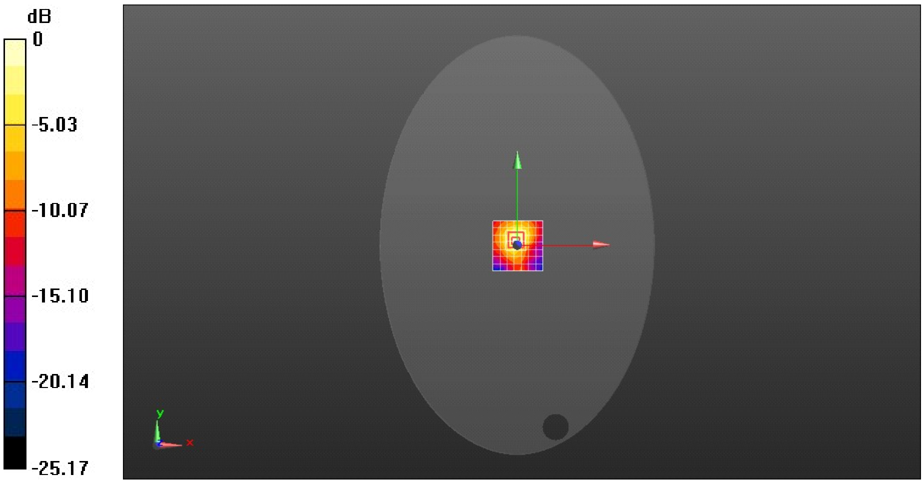
- Probe: EX3DV4 - SN7383; ConvF(4.9, 4.9, 4.9); Calibrated: 2016/12/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

Configuration/Body/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 1.63 W/kg

Configuration/Body/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 15.71 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 3.35 W/kg
SAR(1 g) = 0.844 W/kg; SAR(10 g) = 0.314 W/kg

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



0 dB = 1.91 W/kg = 2.80 dBW/kg

Date: 2017/5/26

GoPro SBDC1 5G WIFI 802.11n 40M 151CH right edge 0mm-Body scenario

Communication System: UID 0, WiFi (0); Frequency: 5755 MHz
Medium parameters used (interpolated): f = 5755 MHz; σ = 6.009 S/m; ε_r = 47.048; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY Configuration:

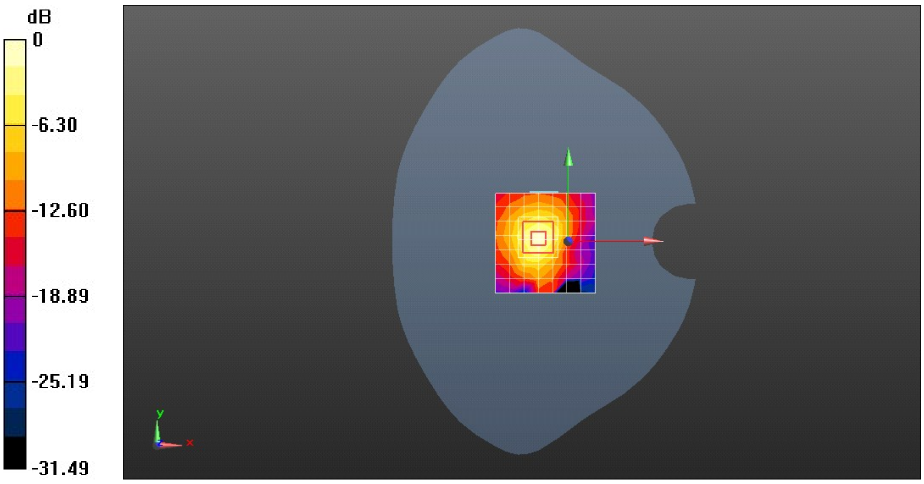
- Probe: EX3DV4 - SN7383; ConvF(4.33, 4.33, 4.33); Calibrated: 2016/12/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE3 Sn427; Calibrated: 2016/12/9
- Phantom: SAM v5.0; Type: QD000P40CD; Serial: TP:1805
- DASY52 52.10.0(1442); SEMCAD X 14.6.10(7413)

Configuration/Body/Area Scan (8x8x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 2.60 W/kg

Configuration/Body/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 22.10 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 4.37 W/kg
SAR(1 g) = 1.13 W/kg; SAR(10 g) = 0.369 W/kg

Maximum value of SAR (measured) = 2.58 W/kg



0 dB = 2.58 W/kg = 4.11 dBW/kg

Appendix D _ Calibration Certificates

DAE3-427
EX3DV4-7383
D2450V2-977
D5GHzV2-1231

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校准
CALIBRATION
CNAS L0570

Client : UL

Certificate No: Z16-97246

CALIBRATION CERTIFICATE

Object	DAE3 - SN: 427
Calibration Procedure(s)	FD-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	December 09, 2016

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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	27-June-16 (CTTL, No:J16X04778)	June-17

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: December 10, 2016

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E-mail: cttl@chinattl.com Http://www.chinattl.cn

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 report provide only calibration results for DAE, it does not contain other performance test results.

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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	404.093 ± 0.15% (k=2)	403.247 ± 0.15% (k=2)	404.055 ± 0.15% (k=2)
Low Range	3.95614 ± 0.7% (k=2)	3.99327 ± 0.7% (k=2)	4.00212 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	183° ± 1 °

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CNAS L0570

Client UL

Certificate No: Z16-97247

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:7383
Calibration Procedure(s)	FD-Z11-004-01 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	December 27, 2016

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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101548	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Reference10dBAttenuator	18N50W-10dB	13-Mar-16(CTTL,No.J16X01547)	Mar-18
Reference20dBAttenuator	18N50W-20dB	13-Mar-16(CTTL, No.J16X01548)	Mar-18
Reference Probe EX3DV4	SN 7433	26-Sep-16(SPEAG,No.EX3-7433_Sep16)	Sep-17
DAE4	SN 1331	21-Jan-16(SPEAG, No.DAE4-1331_Jan16)	Jan -17
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	27-Jun-16 (CTTL, No.J16X04776)	Jun-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan -17

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: December 31, 2016

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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 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 300MHz to 3GHz)", February 2005
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect 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 (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;VRx,y,z:*A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to 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±50MHz to±100MHz.
- *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).

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Probe EX3DV4

SN: 7383

Calibrated: December 27, 2016

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7383

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)[A]	0.39	0.48	0.51	±10.8%
DCP(mV)[B]	97.7	97.3	101.0	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	168.0	±2.5%
		Y	0.0	0.0	1.0		189.9	
		Z	0.0	0.0	1.0		196.8	

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

[A] The uncertainties of Norm X, Y, Z do not affect the E^2-field uncertainty inside TSL (see Page 5 and Page 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7383

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz][C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
750	41.9	0.89	10.08	10.08	10.08	0.30	0.70	±12%
835	41.5	0.90	9.69	9.69	9.69	0.13	1.45	±12%
900	41.5	0.97	9.81	9.81	9.81	0.13	1.41	±12%
1450	40.5	1.20	8.90	8.90	8.90	0.17	1.05	±12%
1810	40.0	1.40	8.17	8.17	8.17	0.25	1.02	±12%
1900	40.0	1.40	8.26	8.26	8.26	0.21	1.21	±12%
2100	39.8	1.49	8.34	8.34	8.34	0.16	1.36	±12%
2300	39.5	1.67	7.78	7.78	7.78	0.45	0.77	±12%
2450	39.2	1.80	7.45	7.45	7.45	0.28	1.27	±12%
2600	39.0	1.96	7.35	7.35	7.35	0.33	1.09	±12%
3500	37.9	2.91	6.92	6.92	6.92	0.32	1.64	±13%
3700	37.7	3.12	6.58	6.58	6.58	0.38	1.25	±13%
5250	35.9	4.71	5.20	5.20	5.20	0.35	1.50	±13%
5600	35.5	5.07	4.69	4.69	4.69	0.40	1.50	±13%
5750	35.4	5.22	4.90	4.90	4.90	0.40	1.50	±13%

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

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

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

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7383

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)
750	55.5	0.96	10.40	10.40	10.40	0.40	0.82	±12%
835	55.2	0.97	10.13	10.13	10.13	0.15	1.58	±12%
900	55.0	1.05	10.14	10.14	10.14	0.19	1.35	±12%
1450	54.0	1.30	8.71	8.71	8.71	0.12	1.49	±12%
1810	53.3	1.52	8.10	8.10	8.10	0.15	1.58	±12%
1900	53.3	1.52	8.01	8.01	8.01	0.17	1.41	±12%
2100	53.2	1.62	8.32	8.32	8.32	0.16	1.63	±12%
2300	52.9	1.81	7.83	7.83	7.83	0.33	1.21	±12%
2450	52.7	1.95	7.63	7.63	7.63	0.38	1.05	±12%
2600	52.5	2.16	7.55	7.55	7.55	0.38	1.03	±12%
3500	51.3	3.31	6.57	6.57	6.57	0.41	1.53	±13%
3700	51.0	3.55	6.58	6.58	6.58	0.40	1.85	±13%
5250	48.9	5.36	4.63	4.63	4.63	0.46	1.90	±13%
5600	48.5	5.77	3.99	3.99	3.99	0.50	1.95	±13%
5750	48.3	5.94	4.33	4.33	4.33	0.52	2.00	±13%

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

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

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

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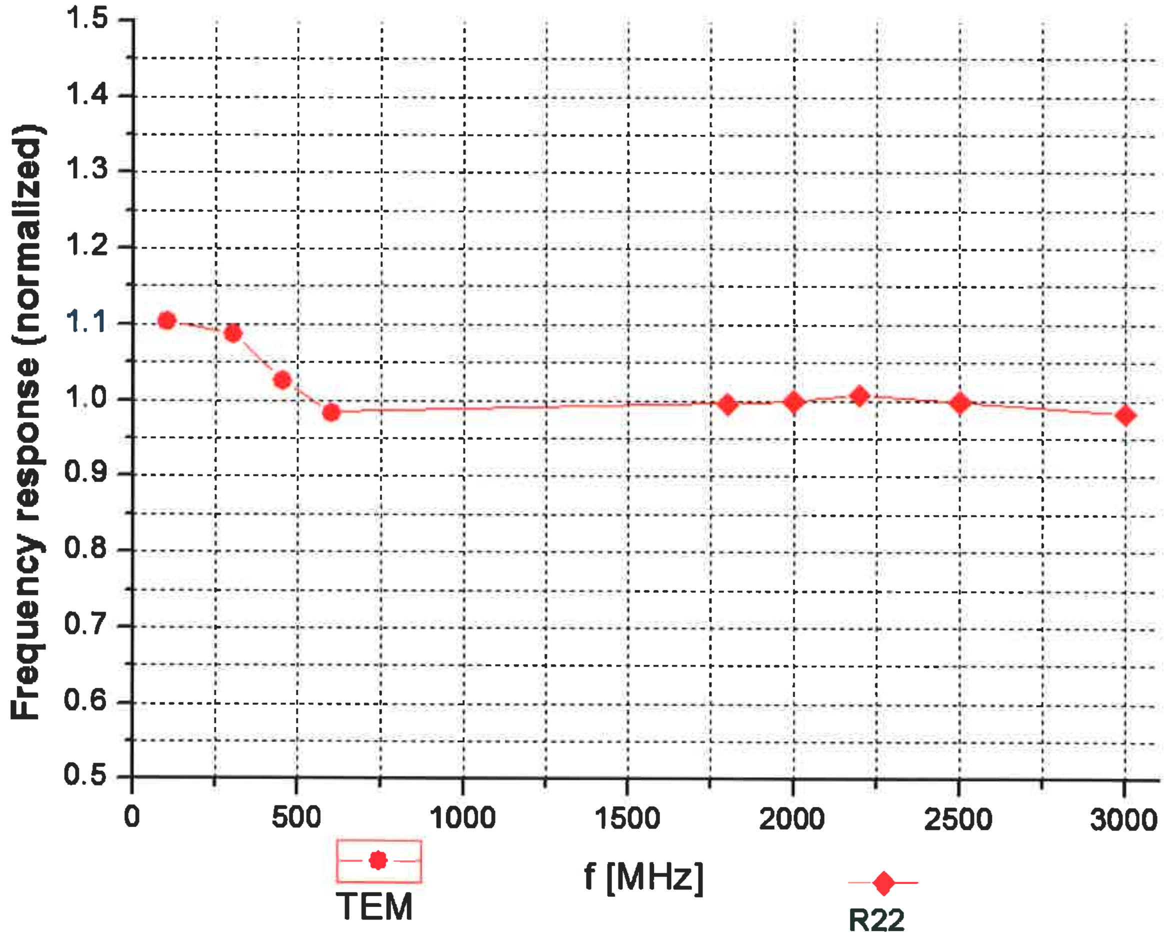
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ±7.5% (k=2)

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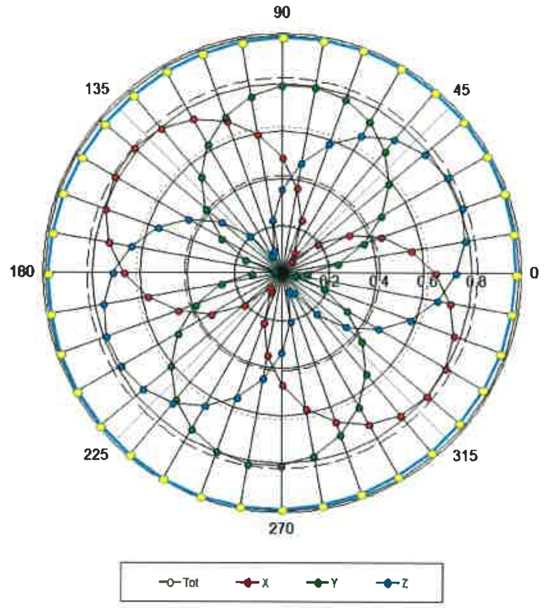
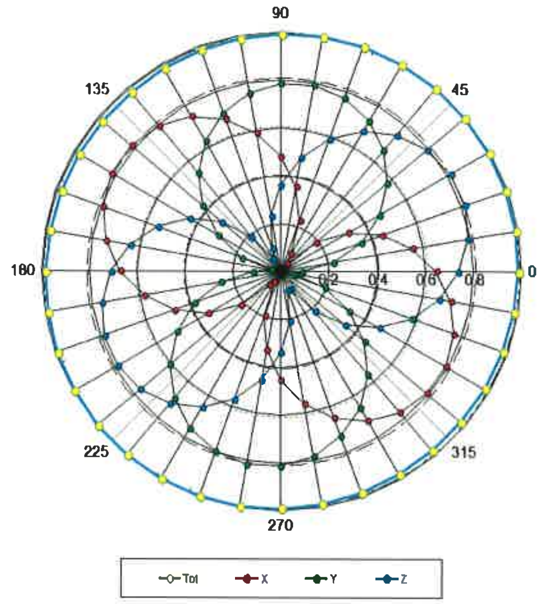
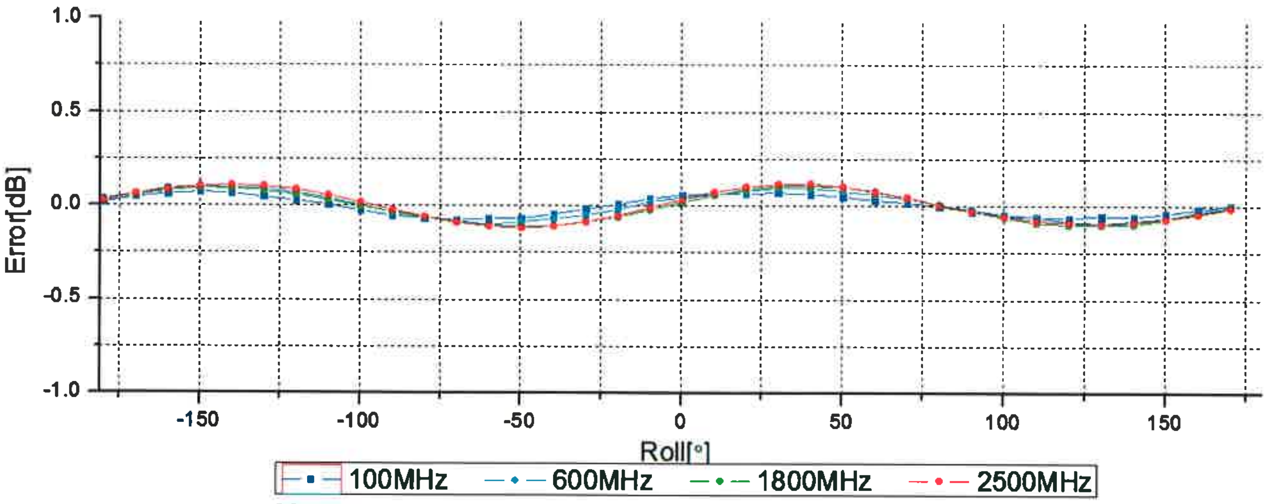
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





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

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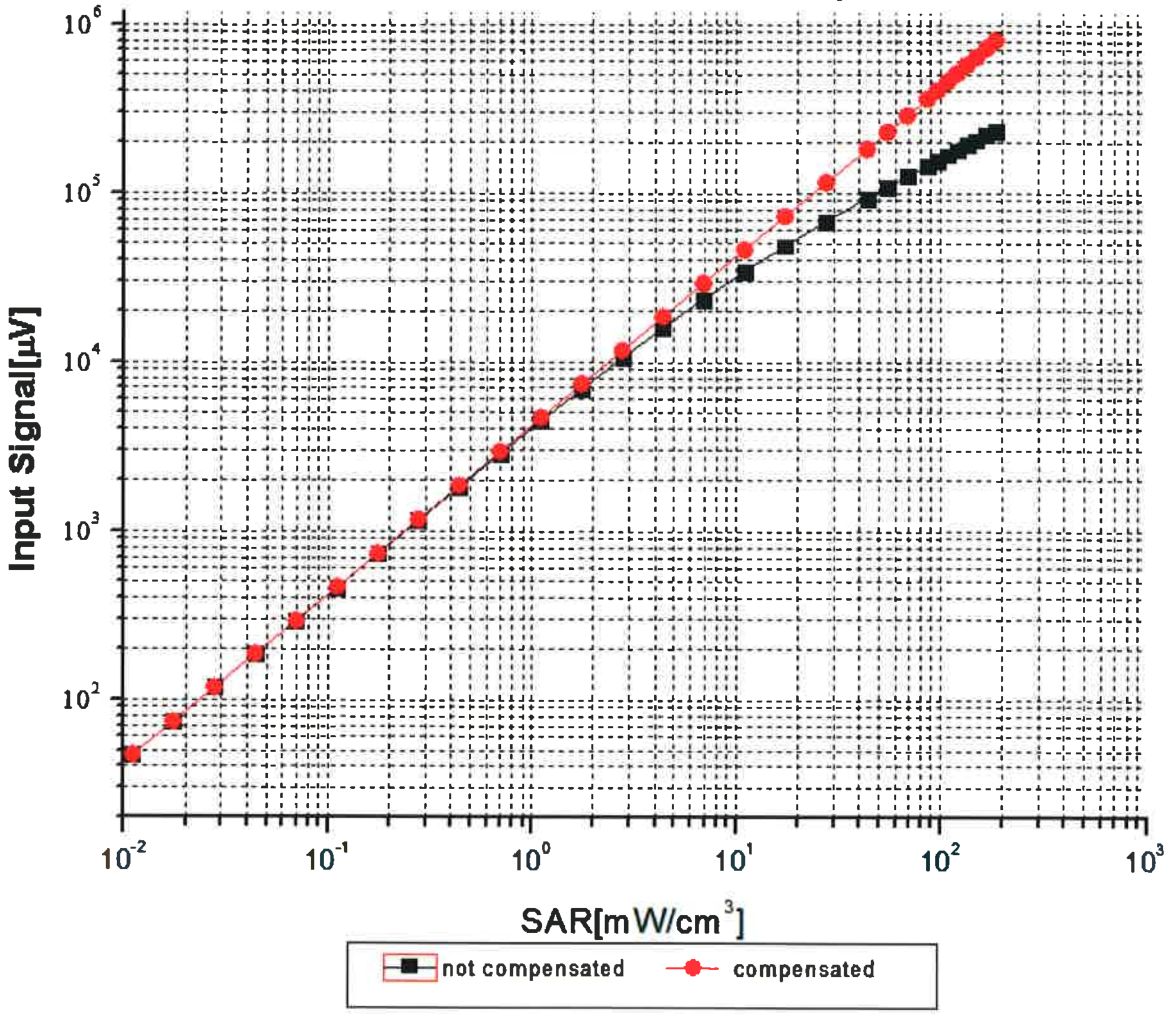
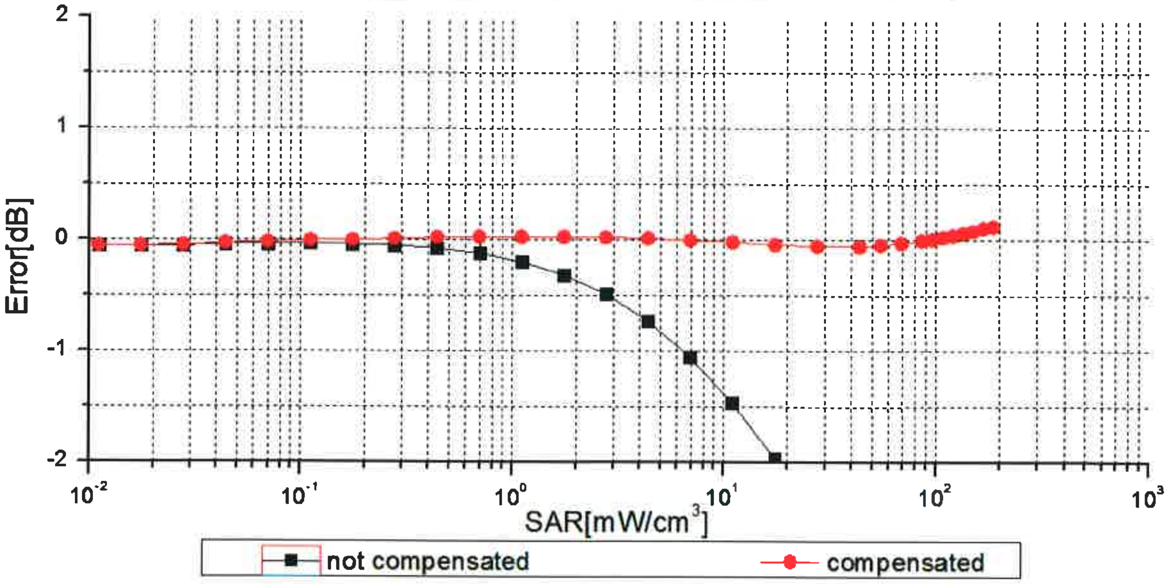
Dynamic Range f(SAR$_{head}$)
(TEM cell, f = 900 MHz)





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

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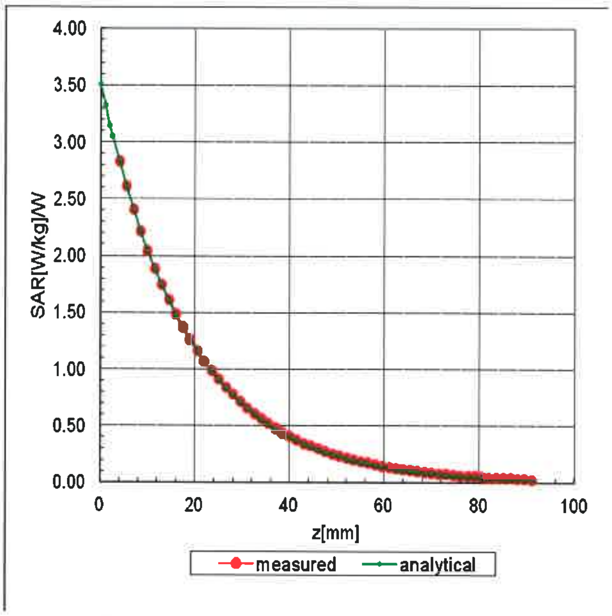
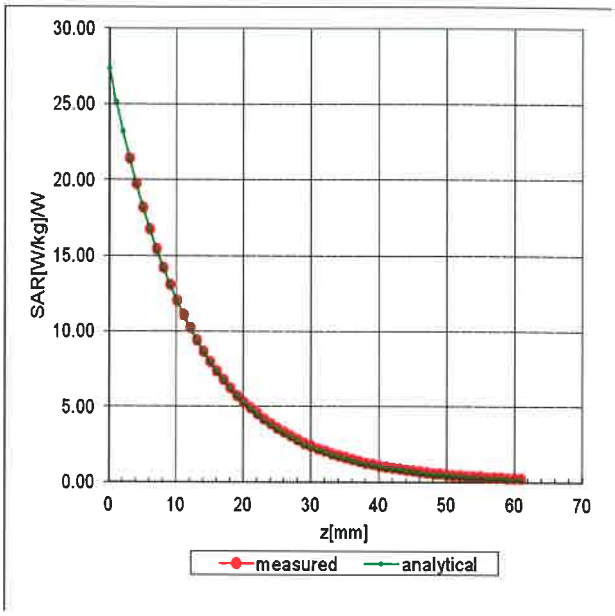
Conversion Factor Assessment

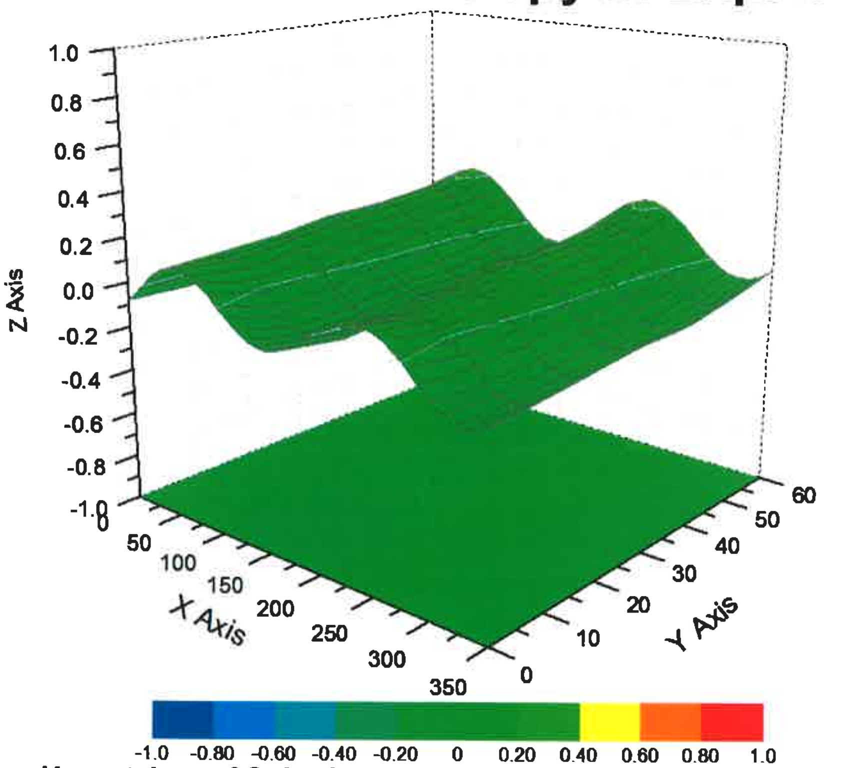
f=900 MHz, WGLS R9(H_convF)



f=1810 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±2.8% (K=2)

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7383

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	127.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

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Accreditation No.: SCS 0108

Client **UL (Song Shan Lake) Branch**

Certificate No: D2450V2-977_Jan16/2

CALIBRATION CERTIFICATE (Replacement of No:D2450V2-977_Jan16)

Object	D2450V2 - SN: 977
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	January 14, 2016

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-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
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: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

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

Issued: March 14, 2016

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

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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) 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) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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	37.9 ± 6 %	1.88 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	13.5 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	6.23 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	52.2 ± 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	13.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.3 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.3 Ω + 5.3 jΩ
Return Loss	- 23.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	52.1 Ω + 7.0 jΩ
Return Loss	- 22.9 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	December 30, 2014

DASY5 Validation Report for Head TSL

Date: 14.01.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz ; Type: D2450V2; Serial: D2450V2 - SN: 977

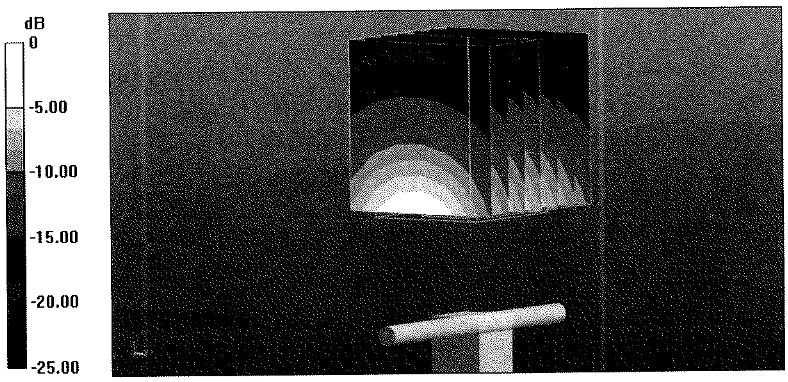
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.88 S/m; ε_r = 37.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.76, 7.76, 7.76); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

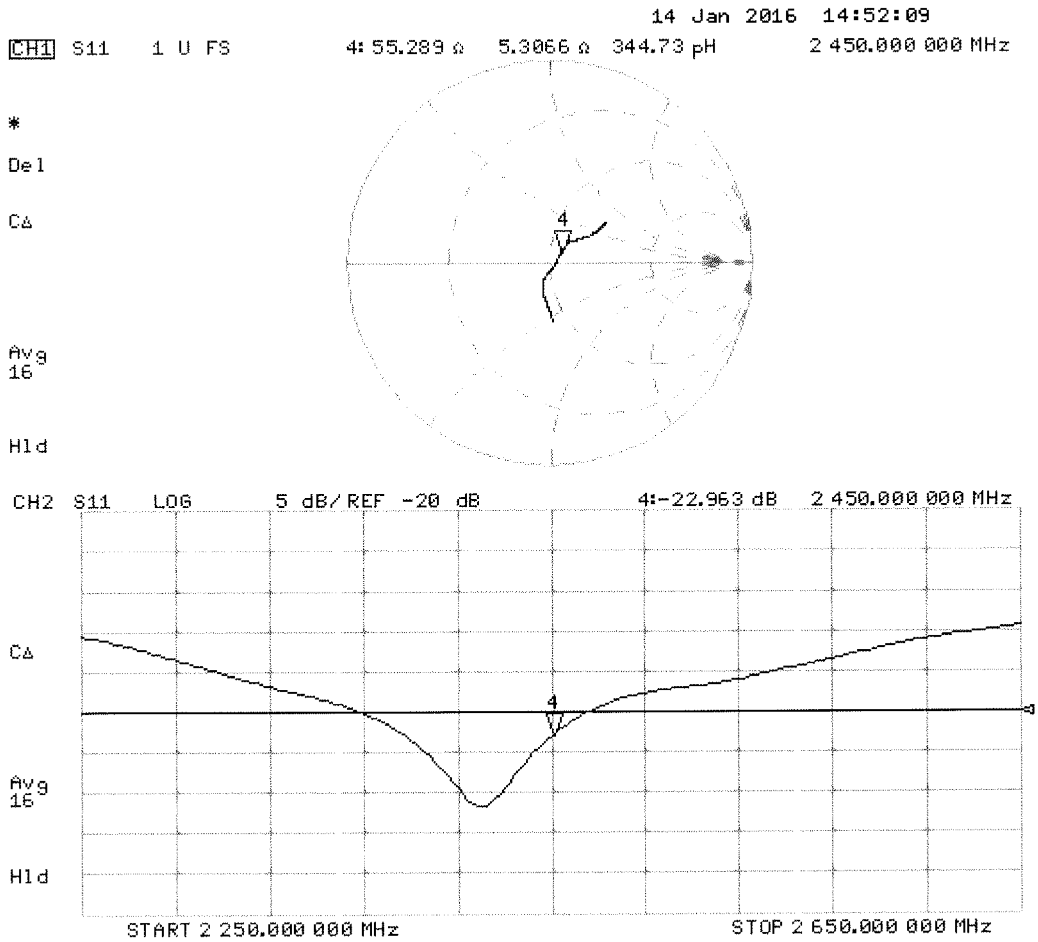
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 113.8 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 27.7 W/kg
SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.23 W/kg
Maximum value of SAR (measured) = 22.1 W/kg



0 dB = 22.1 W/kg = 13.44 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.01.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz ; Type: D2450V2; Serial: D2450V2 - SN: 977

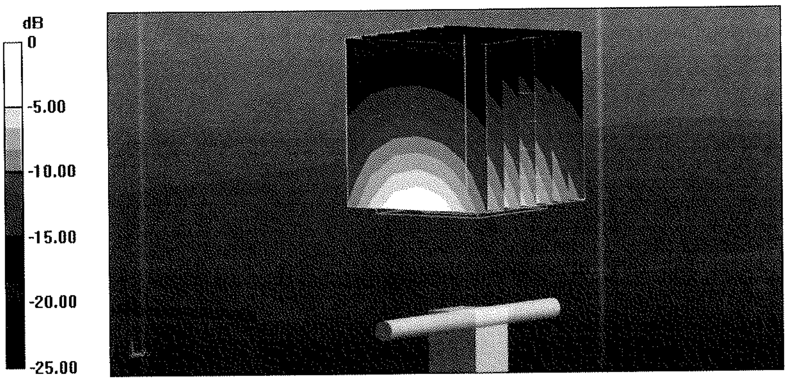
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.79, 7.79, 7.79); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

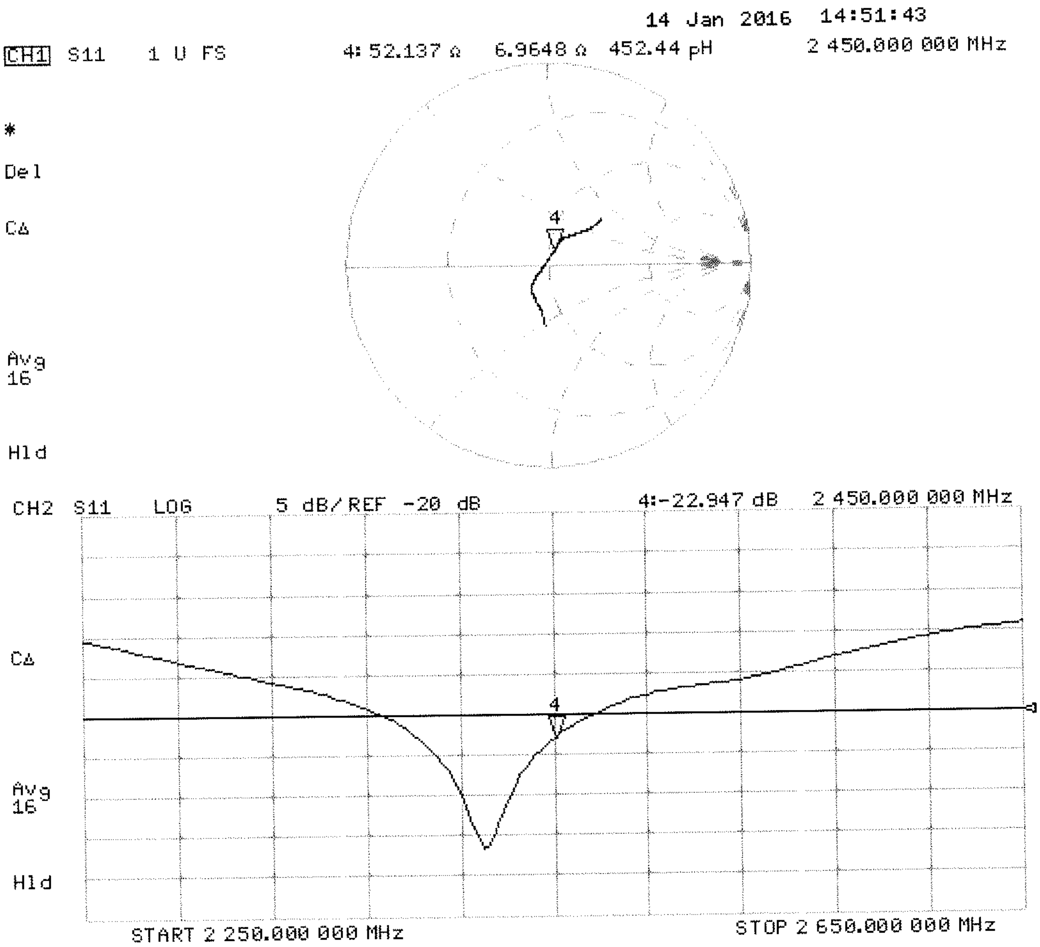
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 107.4 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 26.5 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.14 W/kg
Maximum value of SAR (measured) = 21.6 W/kg

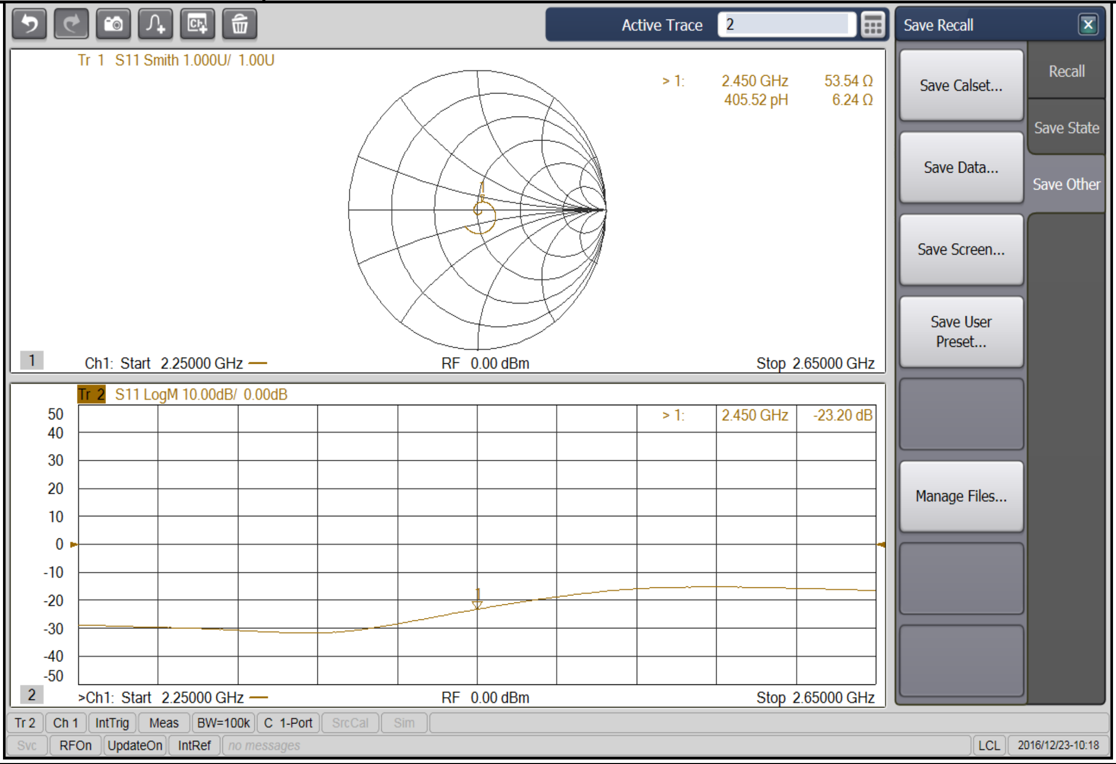


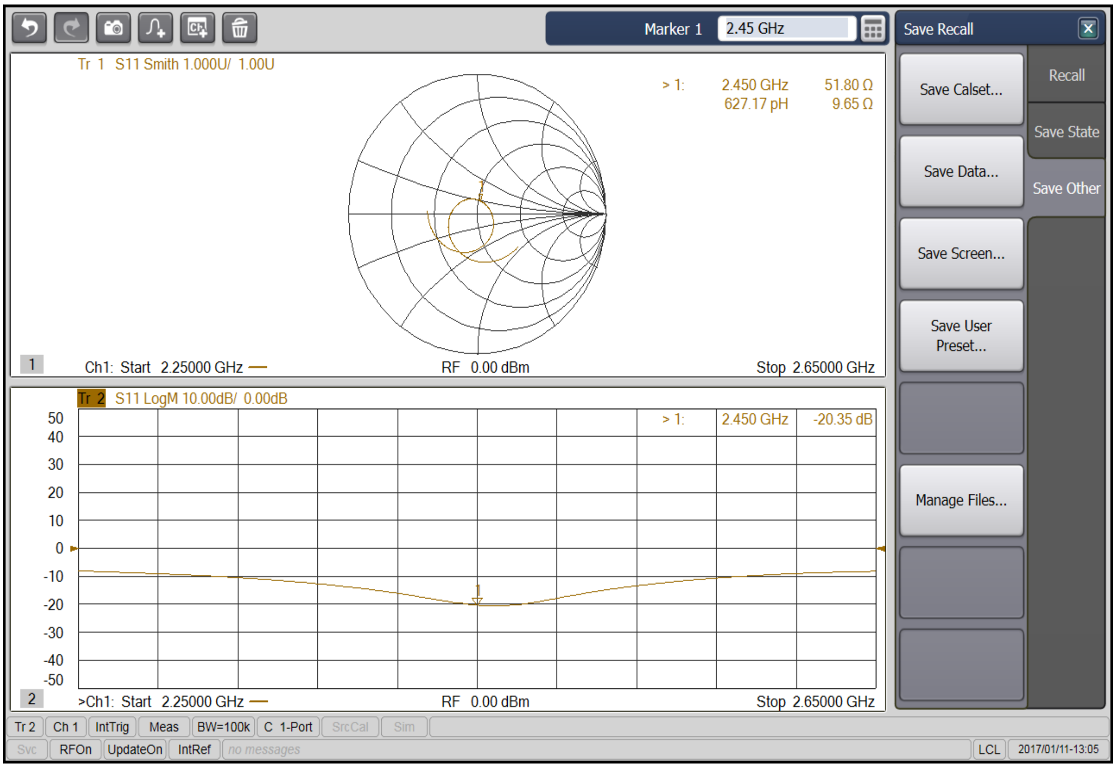
0 dB = 21.6 W/kg = 13.34 dBW/kg

Impedance Measurement Plot for Body TSL



Dipole2450 Head TSL	Target Value		Measure Value		Difference	
	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)
Impedance	55.3	5.3	53.5	6.2	-1.8	0.9
Return loss(dB)	-23.0		-23.2		0.9%	
Measure Date	23-Dec-16					
Dipole2450 Body TSL	Target Value		Measure Value		Difference	
	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)
Impedance	52.1	7.0	51.8	9.7	-0.3	2.7
Return loss(dB)	-22.9		-20.4		-11.1%	
Measure Date	11-Jan-17					





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Accreditation No.: SCS 0108

Client **UL (Song Shan Lake) Branch**

Certificate No: D5GHzV2-1231_Jan16/2

CALIBRATION CERTIFICATE (Replacement of No:D5GHzV2-1231_Jan16)

Object	D5GHzV2 - SN: 1231
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	January 13, 2016

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-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
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	31-Dec-15 (No. EX3-3503_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 14, 2016

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 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
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 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	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.3 ± 6 %	4.61 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.08 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	2.32 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	34.8 ± 6 %	4.97 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	8.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.8 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.0 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	5.13 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.21 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.2 ± 6 %	5.40 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.66 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**76.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.4 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 %	5.87 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**80.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.5 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.3 ± 6 %	6.09 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.76 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.5 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	49.3 Ω - 5.8 jΩ
Return Loss	- 24.6 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	50.5 Ω - 0.8 jΩ
Return Loss	- 40.8 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	56.6 Ω + 0.9 jΩ
Return Loss	- 24.1 dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	48.6 Ω - 4.0 jΩ
Return Loss	- 27.3 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	50.8 Ω + 1.4 jΩ
Return Loss	- 35.7 dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	56.9 Ω + 3.0 jΩ
Return Loss	- 23.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 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 04, 2015

DASY5 Validation Report for Head TSL

Date: 12.01.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1231

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 4.61 S/m; ε_r = 35.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.97 S/m; ε_r = 34.8; ρ = 1000 kg/m^3 , Medium parameters used: f = 5750 MHz; σ = 5.13 S/m; ε_r = 34.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

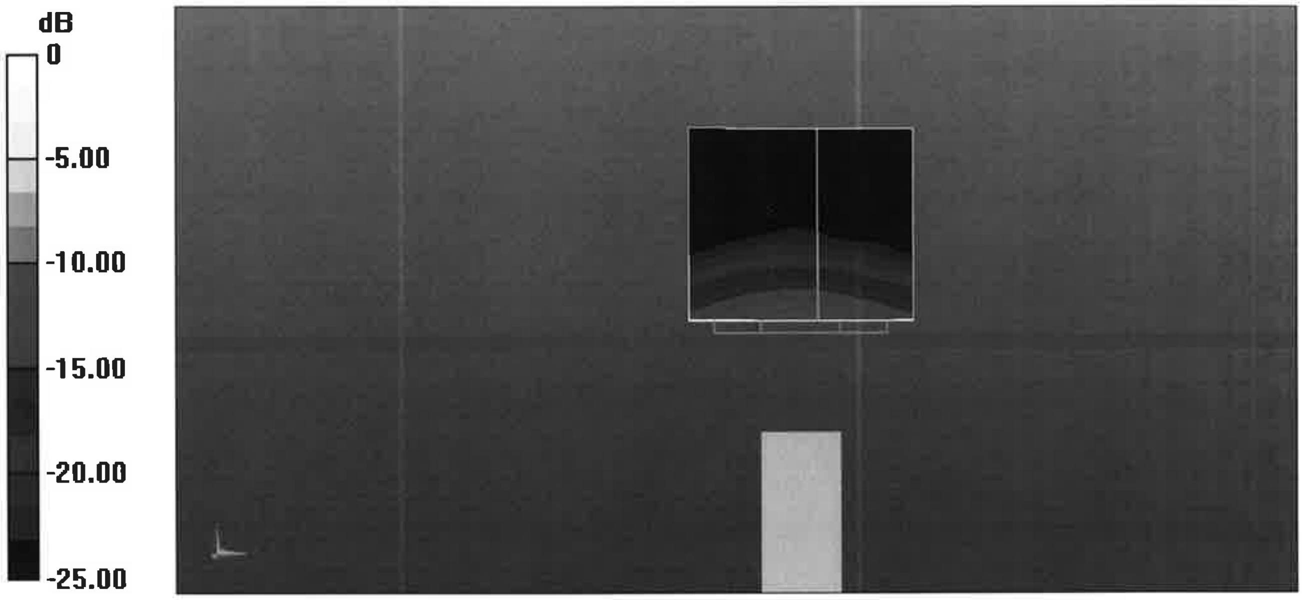
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.53, 5.53, 5.53); Calibrated: 31.12.2015, ConvF(4.99, 4.99, 4.99); Calibrated: 31.12.2015, ConvF(4.95, 4.95, 4.95); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 74.26 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 29.6 W/kg
SAR(1 g) = 8.08 W/kg; SAR(10 g) = 2.32 W/kg
Maximum value of SAR (measured) = 18.6 W/kg

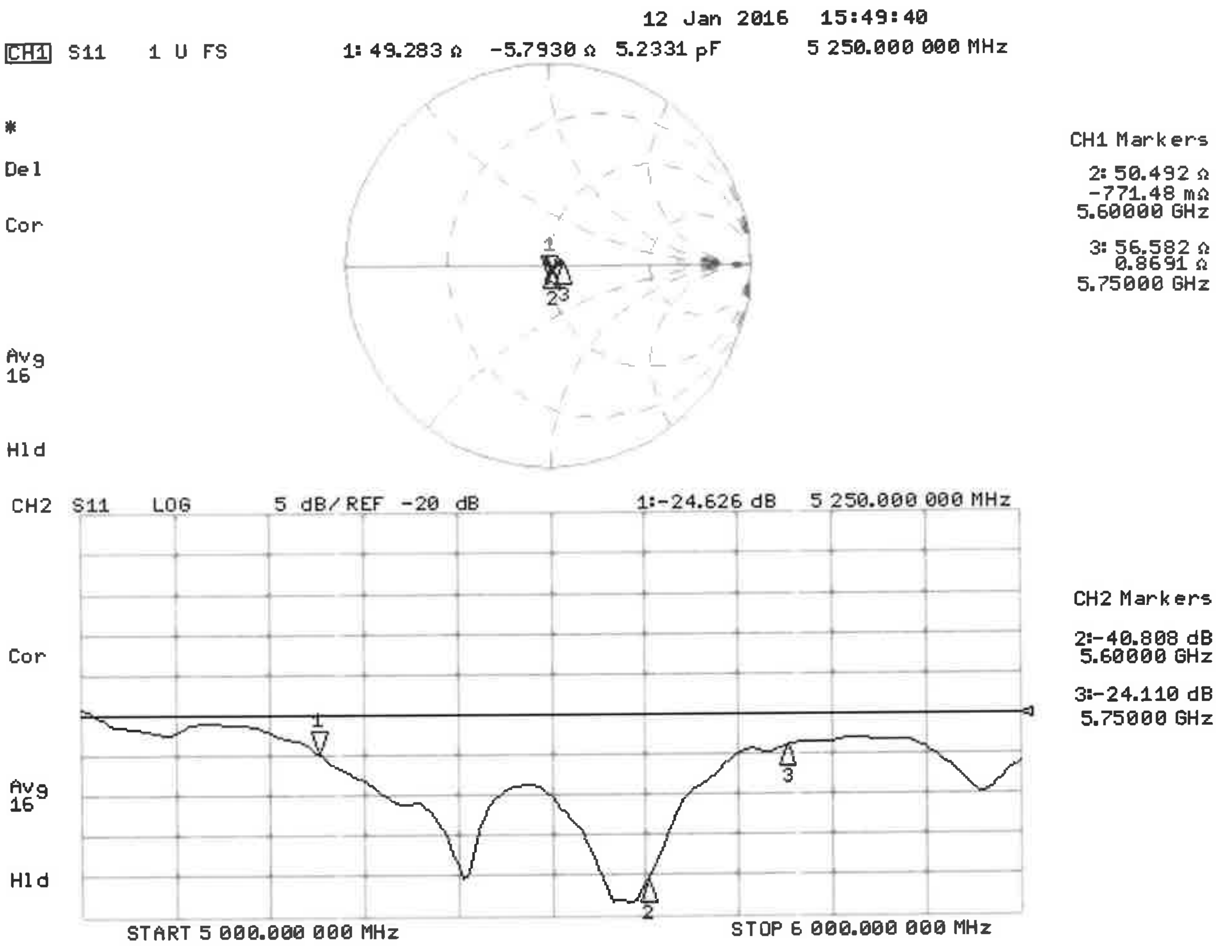
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 74.04 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 33.3 W/kg
SAR(1 g) = 8.42 W/kg; SAR(10 g) = 2.41 W/kg
Maximum value of SAR (measured) = 19.9 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 72.59 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 33.9 W/kg
SAR(1 g) = 8.21 W/kg; SAR(10 g) = 2.33 W/kg
Maximum value of SAR (measured) = 19.8 W/kg



0 dB = 18.6 W/kg = 12.70 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.01.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1231

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 5.4 S/m; ε_r = 47.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.87 S/m; ε_r = 46.6; ρ = 1000 kg/m^3 , Medium parameters used: f = 5750 MHz; σ = 6.09 S/m; ε_r = 46.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

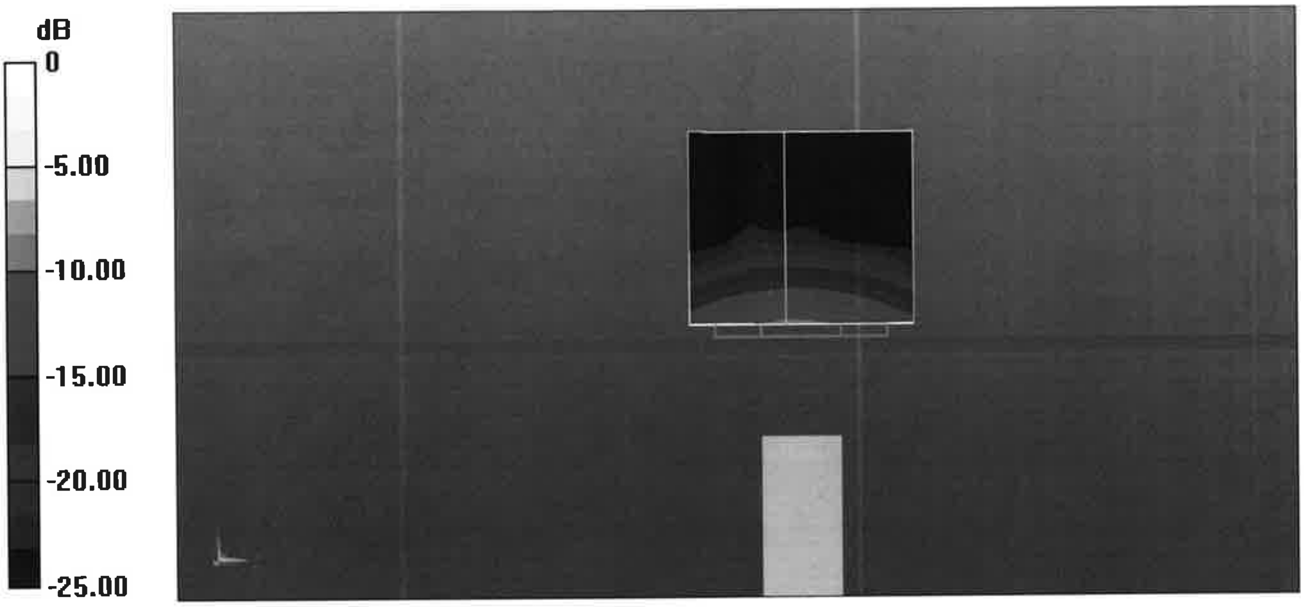
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.85, 4.85, 4.85); Calibrated: 31.12.2015, ConvF(4.35, 4.35, 4.35); Calibrated: 31.12.2015, ConvF(4.3, 4.3, 4.3); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.92 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 29.1 W/kg
SAR(1 g) = 7.66 W/kg; SAR(10 g) = 2.16 W/kg
Maximum value of SAR (measured) = 17.4 W/kg

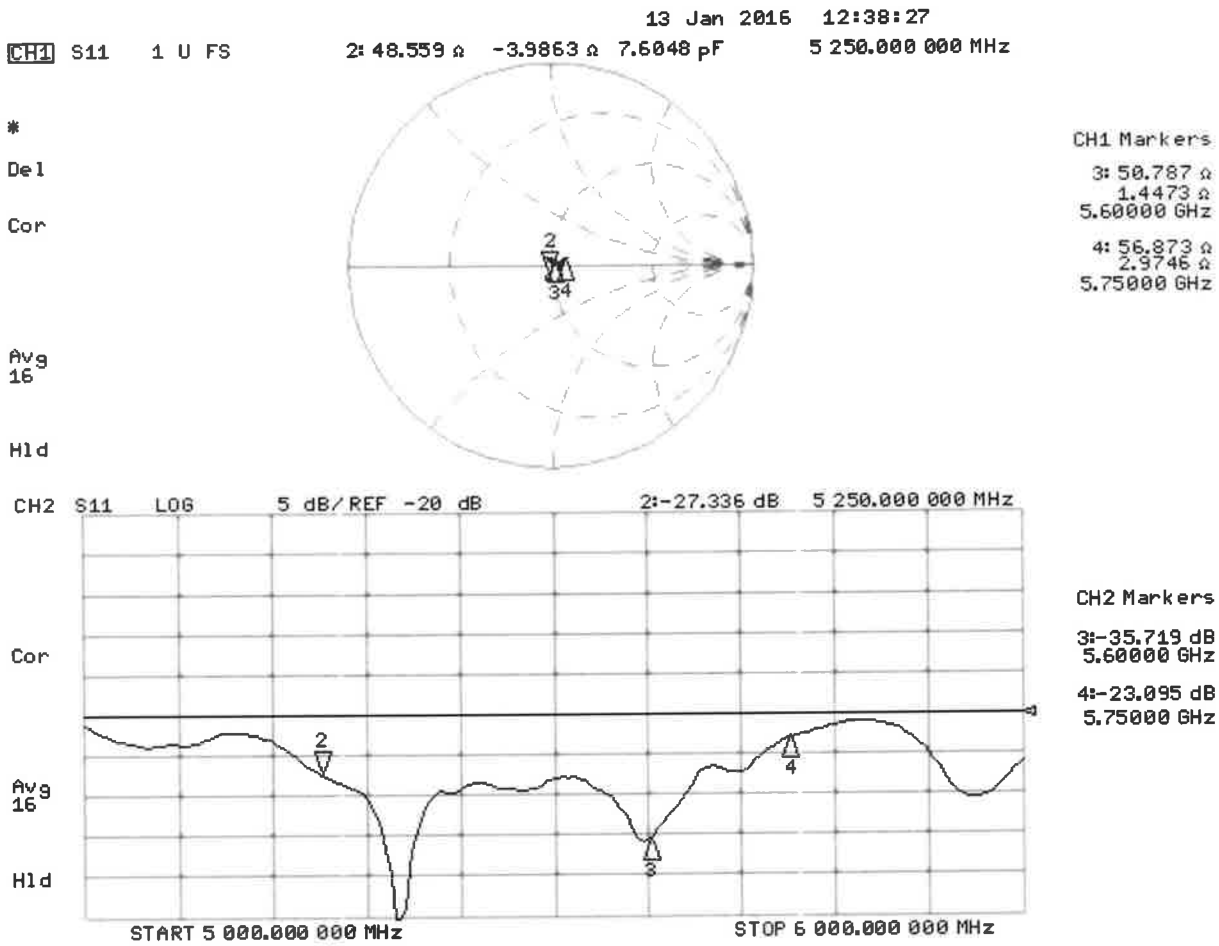
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 68.32 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 33.8 W/kg
SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.27 W/kg
Maximum value of SAR (measured) = 19.3 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.32 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 33.5 W/kg
SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.17 W/kg
Maximum value of SAR (measured) = 18.7 W/kg



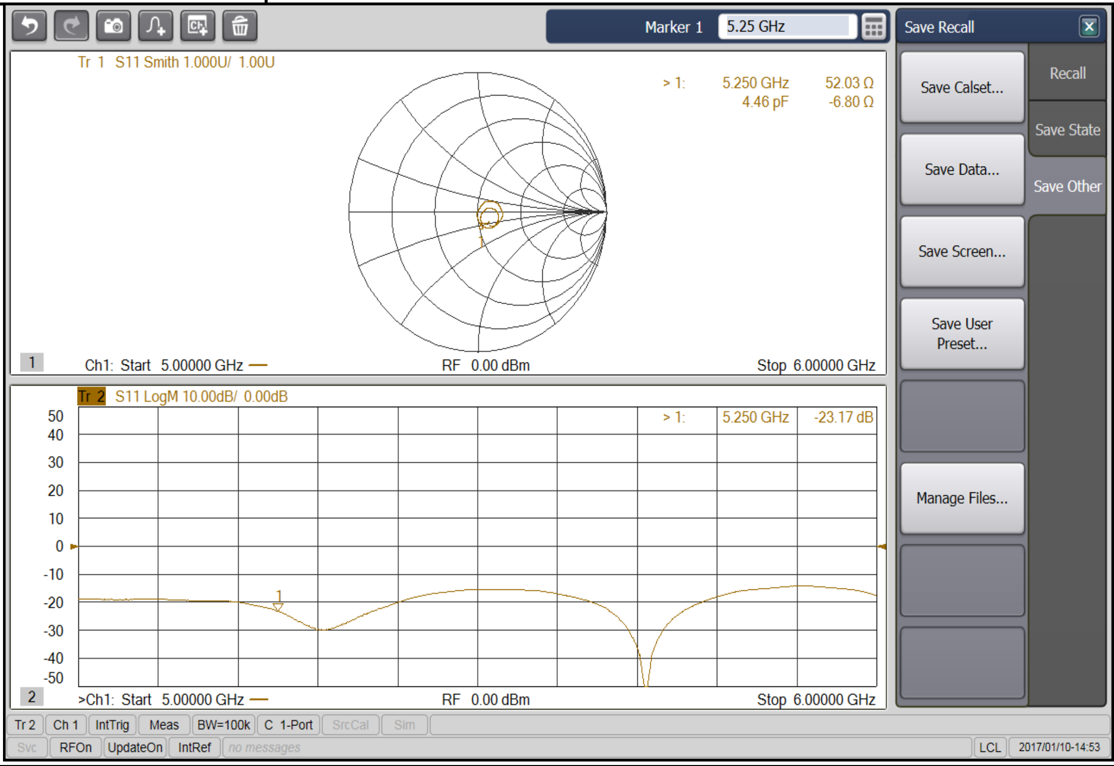
0 dB = 17.4 W/kg = 12.41 dBW/kg

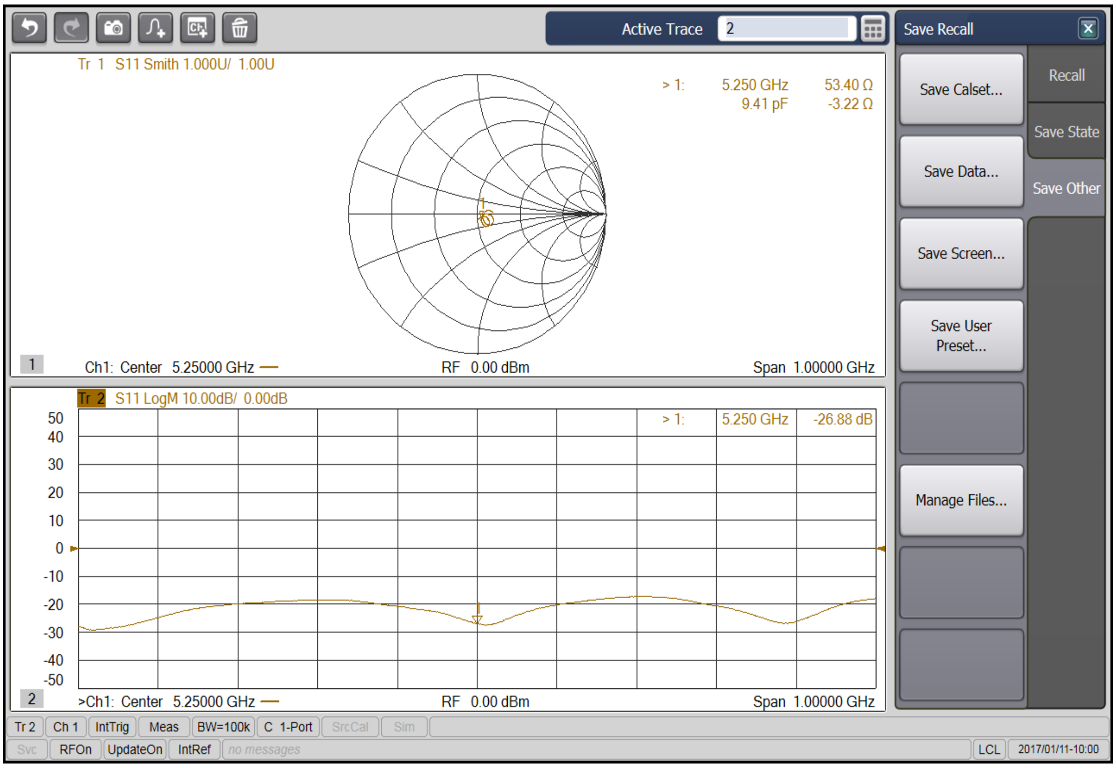
Impedance Measurement Plot for Body TSL



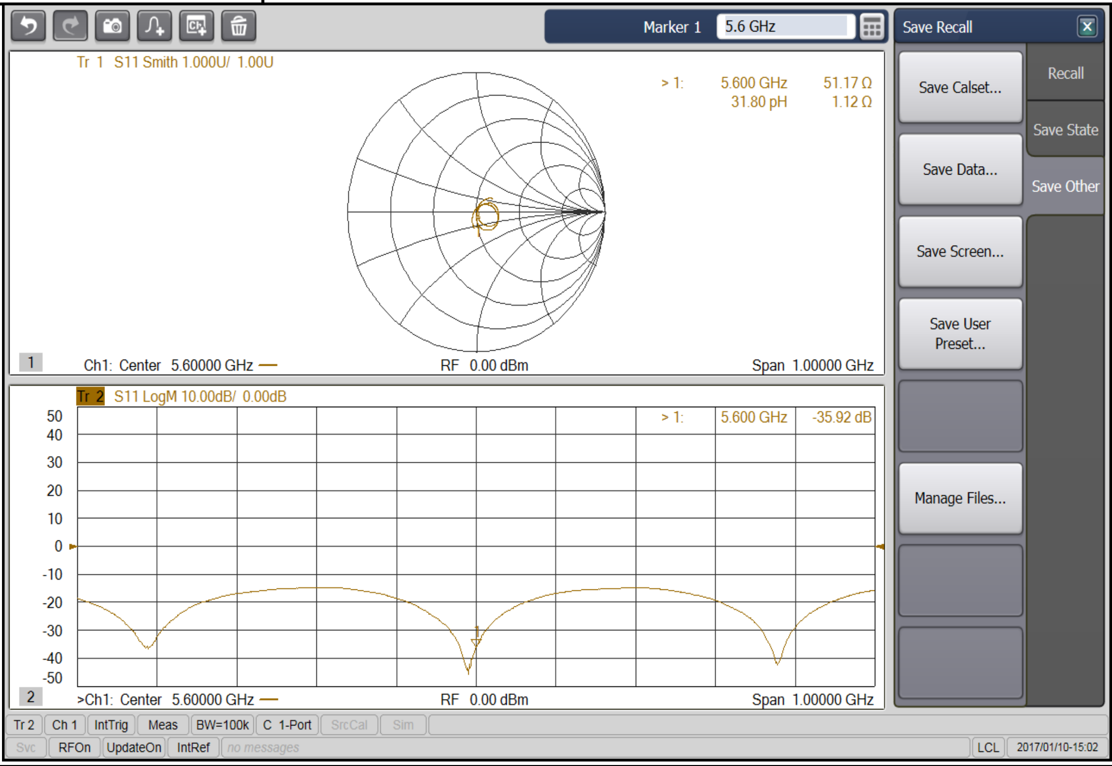
Dipole5250 Head TSL	Target Value		Measure Value		Difference	
	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)
Impedance	49.3	-5.8	52.0	-6.8	2.7	-1.0
Return loss(dB)	-24.6		-23.2		-5.8%	
Measure Date	10-Jan-17					

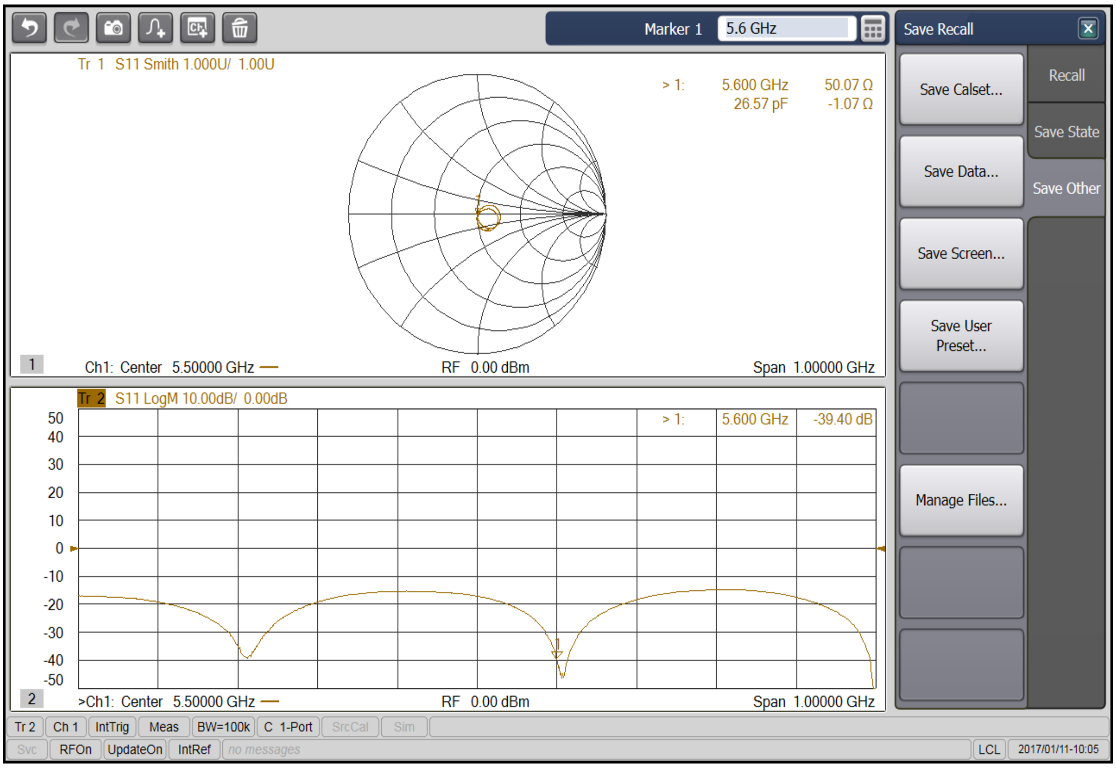
Dipole5250 Body TSL	Target Value		Measure Value		Difference	
	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)
Impedance	48.6	-4.0	53.4	-3.2	4.8	0.8
Return loss(dB)	-27.3		-26.9		-1.5%	
Measure Date	11-Jan-17					





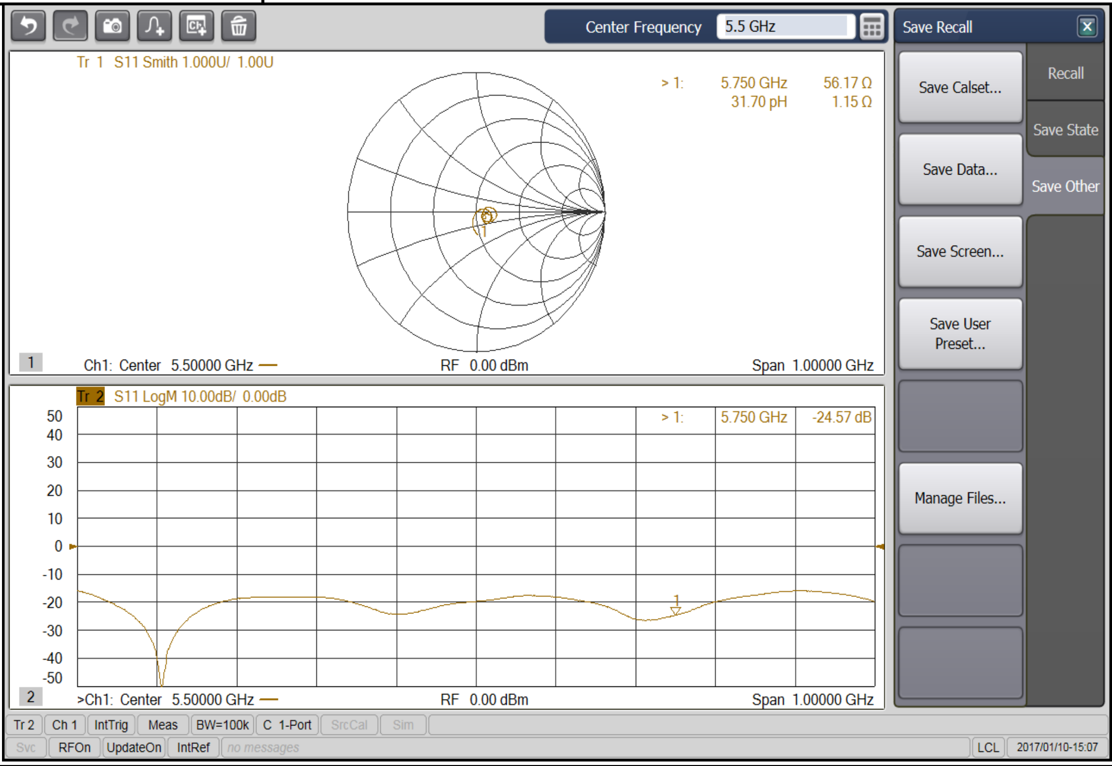
Dipole5600 Head TSL	Target Value		Measure Value		Difference	
	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)
Impedance	50.5	-0.8	51.2	1.1	0.7	1.9
Return loss(dB)	-40.8		-35.9		-12.0%	
Measure Date	10-Jan-17					
Dipole5600 Body TSL	**Target Value**		**Measure Value**		**Difference**	
	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)
Impedance	50.8	1.4	50.1	-1.1	-0.7	-2.5
Return loss(dB)	-35.7		-39.4		10.4%	
Measure Date	11-Jan-17					

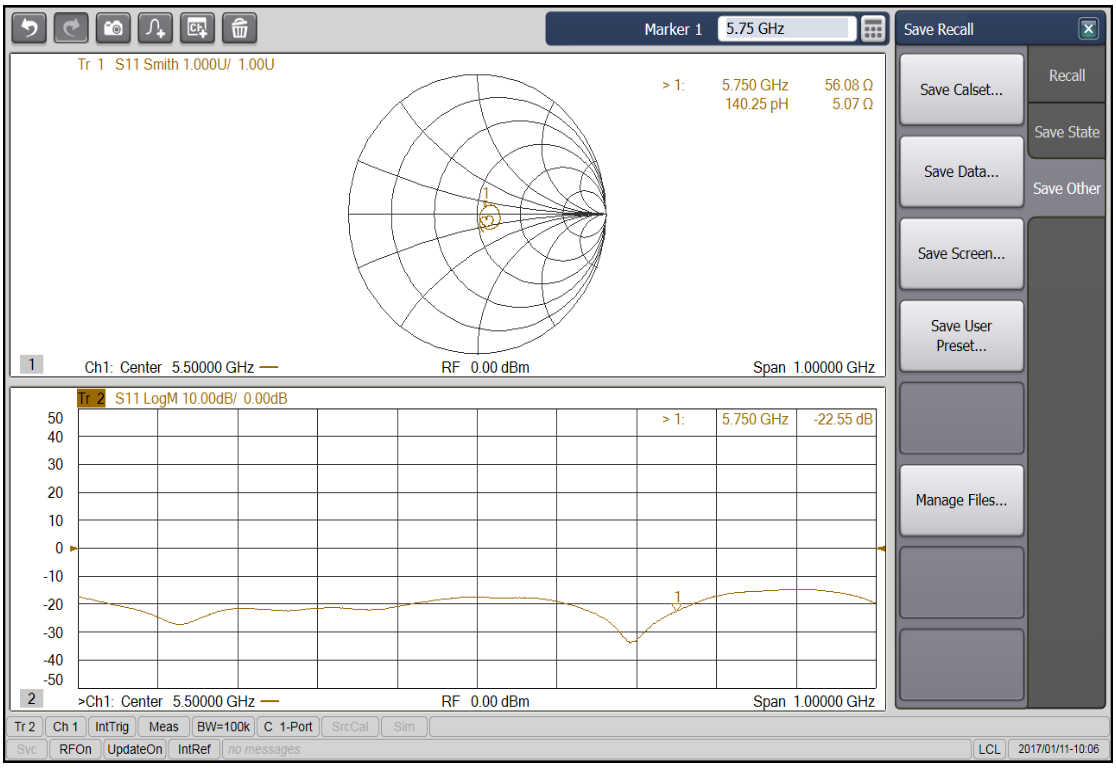




Dipole5750 Head TSL	Target Value		Measure Value		Difference	
	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)
Impedance	56.6	0.9	56.2	1.2	-0.4	0.3
Return loss(dB)	-24.1		-24.6		2.0%	
Measure Date	10-Jan-17					

Dipole5750 Body TSL	Target Value		Measure Value		Difference	
	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)	R(Ω)	X(jΩ)
Impedance	56.9	3.0	56.1	5.1	-0.8	2.1
Return loss(dB)	-23.1		-22.6		-2.4%	
Measure Date	11-Jan-17					





---------End of Report----------