FCC SAR Test Report

APPLICANT	:	**Qualcomm Atheros, Inc.**
EQUIPMENT	:	**802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card**
BRAND NAME	:	**Qualcomm Atheros**
MODEL NAME	:	**QCNFA364A**
FCC ID	:	**PPD-QCNFA364AH**
STANDARD	:	**FCC 47 CFR Part 2 (2.1093)** **ANSI/IEEE C95.1-1992** **IEEE 1528-2013**

The product was installed into Notebook Computer (Brand Name: Lenovo, Model Name: Lenovo Legion Y920-17IKB Laptop, 80YW) during test.

We, SPORTON International (ShenZhen) INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and had been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON International (ShenZhen) INC., the test report shall not be reproduced except in full.

Mark Qu

Prepared by: Mark Qu / Manager

Jones Tsai

Approved by: Jones Tsai / Manager

Testing Laboratory
2353

SPORTON International (ShenZhen) INC.
1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan District, Shenzhen City, Guangdong Province, China

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA721810	Rev. 01	Initial issue of report	Apr. 07, 2017

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Qualcomm Atheros, Inc., 802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card, QCNFA364A**, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary Body 1g SAR (W/kg) (0mm Gap)
DTS	WLAN 2.4GHz Band	0.32
NII	WLAN 5GHz Band	**0.37**
DSS	Bluetooth	<0.10
Date of Testing:		Mar. 10, 2017 ~ Mar. 30, 2017

Frequency Band		Highest SAR Summary Highest Simultaneous Transmission 1g SAR (W/kg)
Bluetooth Antenna 1	WLAN 2.4GHz Band Antenna 2	0.35
	WLAN 5GHz Band Antenna 2	0.32

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

2. Administration Data

Testing Laboratory	
Test Site	SPORTON International (ShenZhen) INC.
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan District, Shenzhen City, Guangdong Province, China TEL: +86-755-8637-9589 FAX: +86-755-8637-9595

Applicant	
Company Name	Qualcomm Atheros, Inc.
Address	1700 Technology Drive, San Jose, CA 95110

3. Guidance Applied

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 616217 D04 SAR for laptop and tablets v01r02

4. Equipment Under Test (EUT) Information

4.1 General Information

Product Feature & Specification	
Equipment Name	802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card
Brand Name	Qualcomm Atheros
Model Name	QCNFA364A
FCC ID	PPD-QCNFA364AH
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	• WLAN 2.4GHz 802.11b/g/n/ac HT20/HT40/VHT20/VHT40 • WLAN 5GHz 802.11a/n/ac HT20/HT40/VHT20/VHT40/VHT80 • Bluetooth v3.0+EDR, Bluetooth v4.0 LE, Bluetooth v4.1 LE
EUT Stage	Identical Prototype

Host Feature & Specification	
Equipment Name	Notebook Computer
Brand Name	Lenovo
Model Name	Lenovo Legion Y920-17IKB Laptop, 80YW
Applicant	**Lenovo (Shanghai) Electronics Technology Co., Ltd.** NO.68 BUILDING, 199 FENJU RD, China (Shanghai) Pilot Free Trade Zone, Shanghai, 200131 China
Manufacturer	**Lenovo PC HK Limited** 23/F, Lincoln House, Taikoo Place, 979 King's Road, Quarry Bay Hong Kong

5. RF Exposure Limits

5.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

5.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

6. Specific Absorption Rate (SAR)

6.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

6.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$\mathbf{SAR} = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\mathbf{dm}}\right) = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\boldsymbol{\rho}\mathbf{dv}}\right)$$

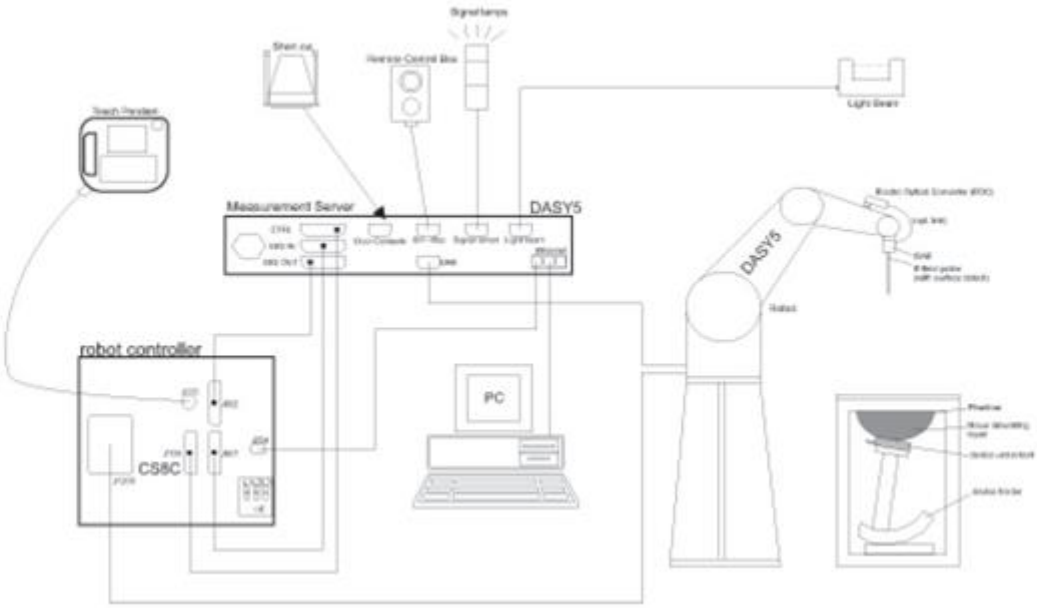
SAR is expressed in units of Watts per kilogram (W/kg)

$$\mathbf{SAR} = \frac{\boldsymbol{\sigma}|\mathbf{E}|^2}{\boldsymbol{\rho}}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

7. System Description and Setup

The DASY 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 WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

7.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

<EX3DV4 Probe>

Construction	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	10 MHz – >6 GHz Linearity: ±0.2 dB (30 MHz – 6 GHz)
Directivity	±0.3 dB in TSL (rotation around probe axis) ±0.5 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 µW/g – >100 mW/g Linearity: ±0.2 dB (noise: typically <1 µW/g)
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 2.5 mm (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

7.2 Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

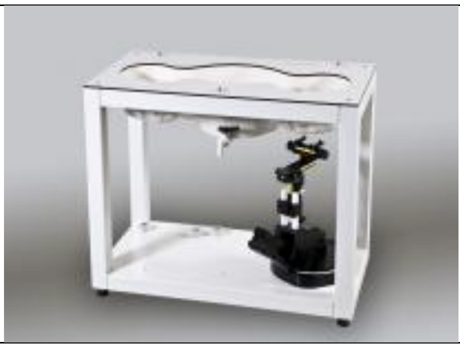
The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Fig 5.1 Photo of DAE

7.3 Phantom

<SAM Twin Phantom>

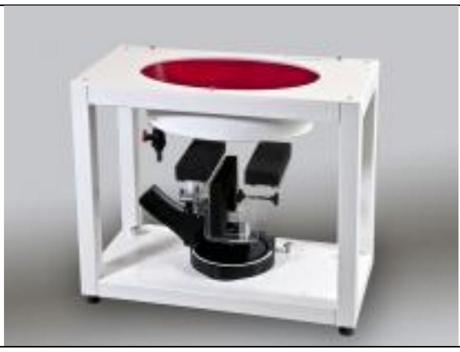
Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet
Measurement Areas	Left Hand, Right Hand, Flat Phantom



The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)
Filling Volume	Approx. 30 liters
Dimensions	Major ellipse axis: 600 mm Minor axis: 400 mm



The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

7.4 Device Holder

<Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.

Mounting Device for Hand-Held Transmitters

Mounting Device Adaptor for Wide-Phones

<Mounting Device for Laptops and other Body-Worn Transmitters>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.

Mounting Device for Laptops

8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band

(b) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

(a) Use base station simulator to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.

(b) Place the EUT in the positions as Appendix D demonstrates.

(c) Set scan area, grid size and other setting on the DASY software.

(d) Measure SAR results for the highest power channel on each testing position.

(e) Find out the largest SAR result on these testing positions of each band

(f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement

(b) Area scan

(c) Zoom scan

(d) Power drift measurement

8.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan

(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)

(c) Generation of a high-resolution mesh within the measured volume

(d) Interpolation of all measured values form the measurement grid to the high-resolution grid

(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface

(f) Calculation of the averaged SAR within masses of 1g and 10g

8.2 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. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

8.3 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 found in the scanned area, within a range of the global maximum. The range (in dB0 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 FCC KDB 865664 D01v01r04 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.	

8.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes 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 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

			$\leq$ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			$\leq$ 2 GHz: $\leq$ 8 mm 2 – 3 GHz: $\leq$ 5 mm*	3 – 4 GHz: $\leq$ 5 mm* 4 – 6 GHz: $\leq$ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		$\leq$ 5 mm	3 – 4 GHz: $\leq$ 4 mm 4 – 5 GHz: $\leq$ 3 mm 5 – 6 GHz: $\leq$ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	$\leq$ 4 mm	3 – 4 GHz: $\leq$ 3 mm 4 – 5 GHz: $\leq$ 2.5 mm 5 – 6 GHz: $\leq$ 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		$\geq$ 30 mm	3 – 4 GHz: $\geq$ 28 mm 4 – 5 GHz: $\geq$ 25 mm 5 – 6 GHz: $\geq$ 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 $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

8.5 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

8.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	2450MHz System Validation Kit	D2450V2	840	Nov. 25, 2016	Nov. 24, 2017
SPEAG	5000MHz System Validation Kit	D5GHzV2	1167	Jul. 27, 2016	Jul. 26, 2017
SPEAG	Data Acquisition Electronics	DAE4	1338	Nov. 22, 2016	Nov. 21, 2017
SPEAG	Data Acquisition Electronics	DAE4	1279	Apr. 04, 2016	Apr. 03, 2017
SPEAG	Dosimetric E-Field Probe	EX3DV4	3911	Sep. 29, 2016	Sep. 28, 2017
SPEAG	Dosimetric E-Field Probe	EX3DV4	3954	Nov. 28, 2016	Nov. 27, 2017
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
SPEAG	ELI4 Phantom	ELI5.0	1225	NCR	NCR
Anritsu	Radio communication analyzer	MT8820C	6201300653	Jul. 16, 2016	Jul. 15, 2017
Agilent	Wireless Communication Test Set	E5515C	MY50267224	Jul. 16, 2016	Jul. 15, 2017
Agilent	Network Analyzer	E5071C	MY46523671	Oct. 11, 2016	Oct. 10, 2017
Speag	Dielectric Assessment KIT	DAK-3.5	1071	Nov. 23, 2016	Nov. 22, 2017
Agilent	Signal Generator	N5181A	MY50145381	Jan. 03, 2017	Jan. 02, 2018
Anritsu	Power Senor	MA2411B	1306099	Jan. 03, 2017	Jan. 02, 2018
Anritsu	Power Meter	ML2495A	1349001	Jan. 03, 2017	Jan. 02, 2018
Anritsu	Power Sensor	MA2411B	1207253	Jan. 03, 2017	Jan. 02, 2018
Anritsu	Power Meter	ML2495A	1218010	Jan. 03, 2017	Jan. 02, 2018
R&S	Spectrum Analyzer	FSP7	101634	Jul. 16, 2016	Jul. 15, 2017
ARRA	Power Divider	A3200-2	NA	Note1	
Agilent	Dual Directional Coupler	778D	50422	Note1	
PASTERNACK	Dual Directional Coupler	PE2214-10	N/A	Note1	
AR	Amplifier	5S1G4	333096	Note1	
mini-circuits	Amplifier	ZVE-3W-83+	162601250	Note1	
MCL	Attenuation1	BW-S10W5+	N/A	Note1	
MCL	Attenuation2	BW-S10W5+	N/A	Note1	
MCL	Attenuation3	BW-S10W5+	N/A	Note1	

Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.

10. System Verification

10.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.1.

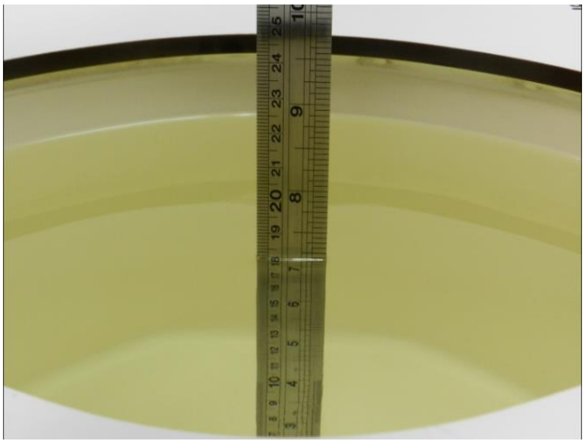


Fig 10.1 Photo of Liquid Height for Body SAR

10.2 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Body								
2450	68.6	0	0	0	0	31.4	1.95	52.7

Simulating Liquid for 5GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
2450	Body	22.7	2.001	52.089	1.95	52.70	2.62	-1.16	±5	Mar. 10, 2017
2450	Body	22.7	1.940	51.605	1.95	52.70	-0.51	-2.08	±5	Mar. 30, 2017
5250	Body	22.5	5.313	51.017	5.36	48.90	-0.88	4.33	±5	Mar. 11, 2017
5600	Body	22.6	5.909	50.389	5.77	48.50	2.41	3.89	±5	Mar. 11, 2017
5750	Body	22.7	6.139	50.029	5.94	48.30	3.35	3.58	±5	Mar. 11, 2017

10.3 System Performance Check Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured SAR (W/kg)	Targeted SAR (W/kg)	Normalized SAR (W/kg)	Deviation (%)
Mar. 10, 2017	2450	Body	250	840	3911	1338	13.70	50.90	54.8	7.66
Mar. 30, 2017	2450	Body	250	840	3954	1279	12.10	50.90	48.4	-4.91
Mar. 11, 2017	5250	Body	100	1167	3911	1338	7.81	75.80	78.1	3.03
Mar. 11, 2017	5600	Body	100	1167	3911	1338	8.04	78.40	80.4	2.55
Mar. 11, 2017	5750	Body	100	1167	3911	1338	7.29	75.90	72.9	-3.95

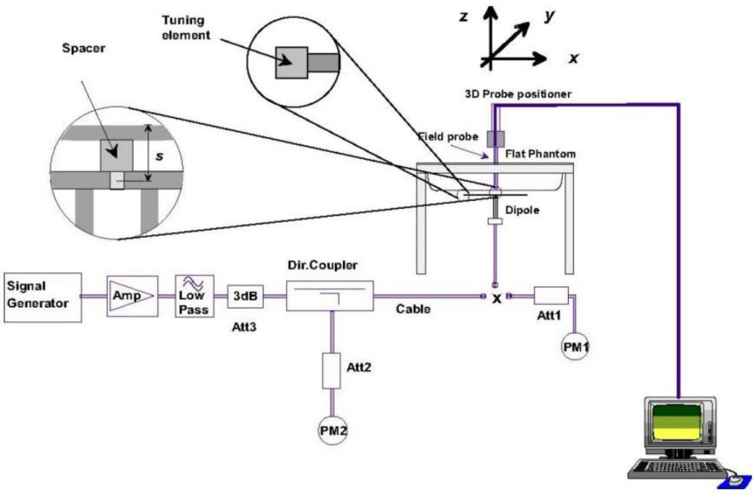


Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

11. RF Exposure Positions

This DUT was tested in one position. It is Bottom of Laptop with phantom 0 cm gap.

<EUT Setup Photos>

Please refer to Appendix D for the test setup photos.

12. Conducted RF Output Power (Unit: dBm)

<WLAN Conducted Power>

General Note:

1. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
2. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
3. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.
4. DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.18 The initial test position procedure is described in the following:
    a. When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
    b. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
    c. For all positions/configurations, 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.

<2.4GHz WLAN Ant.1>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN Ant.1	802.11b	CH 1	2412	1Mbps	17.69	18.50	100.00
		CH 6	2437		17.72	19.00	
		CH 11	2462		17.04	18.50	
	802.11g	CH 1	2412	6Mbps	14.45	15.50	94.70
		CH 6	2437		17.32	18.00	
		CH 11	2462		13.10	14.50	
	802.11n-HT20	CH 1	2412	MCS0	14.38	15.50	94.66
		CH 6	2437		17.09	18.00	
		CH 11	2462		13.22	14.50	
	802.11n-HT40	CH 03	2422	MCS0	10.58	11.50	89.04
		CH 06	2437		12.44	17.00	
		CH 09	2452		9.54	10.50	
	802.11ac-VHT20	CH 1	2412	MCS0	14.58	15.50	94.66
		CH 6	2437		17.47	18.00	
		CH 11	2462		13.26	14.50	
	802.11ac-VHT40	CH 03	2422	MCS0	10.63	11.50	89.73
		CH 06	2437		12.51	17.00	
		CH 09	2452		9.55	10.50	

<2.4GHz WLAN Ant.2>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN Ant.2	802.11b	CH 1	2412	1Mbps	17.83	18.50	100.00
		CH 6	2437		18.22	19.00	
		CH 11	2462		17.97	18.50	
	802.11g	CH 1	2412	6Mbps	14.86	15.50	94.67
		CH 6	2437		17.85	18.00	
		CH 11	2462		14.16	14.50	
	802.11n-HT20	CH 1	2412	MCS0	14.82	15.50	94.66
		CH 6	2437		17.80	18.00	
		CH 11	2462		14.38	14.50	
	802.11n-HT40	CH 03	2422	MCS0	11.06	11.50	89.12
		CH 06	2437		13.25	17.00	
		CH 09	2452		10.32	10.50	
	802.11ac-VHT20	CH 1	2412	MCS0	15.08	15.50	94.33
		CH 6	2437		17.89	18.00	
		CH 11	2462		14.50	14.50	
	802.11ac-VHT40	CH 03	2422	MCS0	11.09	11.50	89.12
		CH 06	2437		13.37	17.00	
		CH 09	2452		10.34	10.50	

<2.4GHz WLAN Ant.1+2>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN Ant.1+2	802.11b	CH 1	2412	1Mbps	20.99	21.50	100.00
		CH 6	2437		21.17	21.50	
		CH 11	2462		20.68	21.00	
	802.11g	CH 1	2412	6Mbps	17.91	18.00	94.68
		CH 6	2437		21.04	21.50	
		CH 11	2462		16.83	17.00	
	802.11n-HT20	CH 1	2412	MCS0	17.73	18.00	94.33
		CH 6	2437		20.83	21.50	
		CH 11	2462		16.97	17.50	
	802.11n-HT40	CH 03	2422	MCS0	13.88	14.50	89.73
		CH 06	2437		15.98	16.50	
		CH 09	2452		13.02	13.50	
	802.11ac-VHT20	CH 1	2412	MCS0	17.94	18.00	93.92
		CH 6	2437		20.93	21.50	
		CH 11	2462		17.05	17.50	
	802.11ac-VHT40	CH 03	2422	MCS0	13.93	14.50	89.67
		CH 06	2437		16.13	16.50	
		CH 09	2452		13.16	13.50	

<u><5GHz WLAN Ant.1></u>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN Ant.1	802.11a	CH 36	5180	6Mbps	11.38	13.00	94.67
		CH 40	5200		11.20	13.00	
		CH 44	5220		11.36	13.00	
		CH 48	5240		11.40	13.00	
	802.11n-HT20	CH 36	5180	MCS0	11.33	13.00	95.00
		CH 40	5200		11.17	13.00	
		CH 44	5220		10.89	13.00	
		CH 48	5240		11.25	13.00	
	802.11n-HT40	CH 38	5190	MCS0	11.09	13.00	89.73
		CH 46	5230		11.42	13.00	
	802.11ac-VHT20	CH 36	5180	MCS0	11.42	13.00	94.72
		CH 40	5200		11.22	13.00	
		CH 44	5220		11.06	13.00	
		CH 48	5240		11.33	13.00	
	802.11ac-VHT40	CH 38	5190	MCS0	11.30	13.00	90.35
		CH 46	5230		11.62	13.00	
	802.11ac-VHT80	CH 42	5210	MCS0	11.53	13.00	81.17

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.3GHz WLAN Ant.1	802.11a	CH 52	5260	6Mbps	15.08	17.00	94.67
		CH 56	5280		15.60	17.00	
		CH 60	5300		16.36	17.00	
		CH 64	5320		14.06	15.00	
	802.11n-HT20	CH 52	5260	MCS0	15.50	17.00	95.00
		CH 56	5280		15.46	17.00	
		CH 60	5300		16.58	17.00	
		CH 64	5320		13.83	15.00	
	802.11n-HT40	CH 54	5270	MCS0	15.31	17.00	89.73
		CH 62	5310		13.85	15.00	
	802.11ac-VHT20	CH 52	5260	MCS0	15.65	17.00	94.72
		CH 56	5280		15.56	17.00	
		CH 60	5300		16.76	17.00	
		CH 64	5320		13.99	15.00	
	802.11ac-VHT40	CH 54	5270	MCS0	15.40	17.00	90.35
		CH 62	5310		13.98	15.00	
	802.11ac-VHT80	CH 58	5290	MCS0	11.25	12.00	81.17

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.5GHz WLAN Ant.1	802.11a	CH 100	5500	6Mbps	13.38	15.00	94.67
		CH 104	5520		15.64	17.00	
		CH 108	5540		15.86	17.00	
		CH 112	5560		15.65	17.00	
		CH 116	5580		15.57	17.00	
		CH 120	5600		15.55	17.00	
		CH 124	5620		15.21	17.00	
		CH 128	5640		15.08	17.00	
		CH 132	5660		15.59	17.00	
		CH 136	5680		15.19	17.00	
		CH 140	5700		12.99	14.50	
		CH 144	5720		12.93	15.00	
	802.11n-HT20	CH 100	5500	MCS0	14.54	15.00	95.00
		CH 104	5520		14.40	17.00	
		CH 108	5540		14.10	17.00	
		CH 112	5560		13.94	17.00	
		CH 116	5580		13.89	17.00	
		CH 120	5600		15.33	17.00	
		CH 124	5620		14.08	17.00	
		CH 128	5640		13.90	17.00	
		CH 132	5660		13.88	17.00	
		CH 136	5680		14.03	17.00	
		CH 140	5700		12.75	14.00	
		CH 144	5720		12.66	15.00	
	802.11n-HT40	CH 102	5510	MCS0	14.38	15.00	89.73
		CH 110	5550		16.11	17.00	
		CH 126	5630		15.35	17.00	
		CH 134	5670		15.89	17.00	
		CH 142	5710		12.45	14.00	
	802.11ac-VHT20	CH 100	5500	MCS0	14.63	15.00	94.72
		CH 104	5520		14.90	17.00	
		CH 108	5540		14.65	17.00	
		CH 112	5560		14.45	17.00	
		CH 116	5580		14.39	17.00	
		CH 120	5600		15.46	17.00	

		CH 124	5620		14.62	17.00	
		CH 128	5640		14.36	17.00	
		CH 132	5660		14.48	17.00	
		CH 136	5680		14.59	17.00	
		CH 140	5700		13.35	14.00	
		CH 144	5720		12.76	15.00	
	802.11ac-VHT40	CH 102	5510	MCS0	14.53	15.00	90.35
		CH 110	5550		16.16	17.00	
		CH 126	5630		15.79	17.00	
		CH 134	5670		16.00	17.00	
		CH 142	5710		12.75	14.00	
	802.11ac-VHT80	CH 106	5530	MCS0	11.69	12.50	81.17
		CH 122	5610		14.93	16.00	
		CH 138	5690		10.42	16.00	

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN Ant.1	802.11a	CH 149	5745	MCS0	13.32	15.00	94.67
		CH 153	5765		16.05	17.00	
		CH 157	5785		16.26	17.00	
		CH 161	5805		16.47	17.00	
		CH 165	5825		16.49	17.00	
	802.11n-HT20	CH 149	5745	MCS0	13.15	15.00	95.00
		CH 153	5765		15.84	17.00	
		CH 157	5785		16.06	17.00	
		CH 161	5805		16.26	17.00	
		CH 165	5825		16.30	17.00	
	802.11n-HT40	CH 151	5755	MCS0	10.83	12.50	89.73
		CH 159	5795		16.25	17.00	
	802.11ac-VHT20	CH 149	5745	MCS0	13.25	15.00	94.72
		CH 153	5765		15.91	17.00	
		CH 157	5785		16.15	17.00	
		CH 161	5805		16.34	17.00	
		CH 165	5825		16.40	17.00	
	802.11ac-VHT40	CH 151	5755	MCS0	10.98	12.50	90.35
		CH 159	5795		16.33	17.00	
	802.11ac-VHT80	CH 155	5775	MCS0	10.50	12.00	81.17

<5GHz WLAN Ant.2>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN Ant.2	802.11a	CH 36	5180	6Mbps	12.42	13.00	94.84
		CH 40	5200		12.34	13.00	
		CH 44	5220		12.44	13.00	
		CH 48	5240		12.66	13.00	
	802.11n-HT20	CH 36	5180	MCS0	12.24	13.00	93.83
		CH 40	5200		12.69	13.00	
		CH 44	5220		12.15	13.00	
		CH 48	5240		12.45	13.00	
	802.11n-HT40	CH 38	5190	MCS0	12.13	13.00	89.47
		CH 46	5230		12.30	13.00	
	802.11ac-VHT20	CH 36	5180	MCS0	12.27	13.00	94.54
		CH 40	5200		12.73	13.00	
		CH 44	5220		12.18	13.00	
		CH 48	5240		12.49	13.00	
	802.11ac-VHT40	CH 38	5190	MCS0	12.69	13.00	89.47
		CH 46	5230		12.87	13.00	
	802.11ac-VHT80	CH 42	5210	MCS0	12.21	13.00	81.59

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.3GHz WLAN Ant.2	802.11a	CH 52	5260	6Mbps	16.00	17.00	94.84
		CH 56	5280		16.02	17.00	
		CH 60	5300		16.06	17.00	
		CH 64	5320		14.15	15.00	
	802.11n-HT20	CH 52	5260	MCS0	16.70	17.00	93.83
		CH 56	5280		15.88	17.00	
		CH 60	5300		16.48	17.00	
		CH 64	5320		13.92	15.00	
	802.11n-HT40	CH 54	5270	MCS0	15.58	17.00	89.47
		CH 62	5310		13.52	15.00	
	802.11ac-VHT20	CH 52	5260	MCS0	16.83	17.00	94.54
		CH 56	5280		16.22	17.00	
		CH 60	5300		16.91	17.00	
		CH 64	5320		14.00	15.00	
	802.11ac-VHT40	CH 54	5270	MCS0	15.92	17.00	89.47
		CH 62	5310		13.91	15.00	
	802.11ac-VHT80	CH 58	5290	MCS0	11.24	12.00	81.59

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.5GHz WLAN Ant.2	802.11a	CH 100	5500	6Mbps	13.74	15.00	94.84
		CH 104	5520		15.41	17.00	
		CH 108	5540		15.54	17.00	
		CH 112	5560		15.61	17.00	
		CH 116	5580		15.72	17.00	
		CH 120	5600		15.88	17.00	
		CH 124	5620		15.59	17.00	
		CH 128	5640		15.67	17.00	
		CH 132	5660		15.74	17.00	
		CH 136	5680		15.54	17.00	
		CH 140	5700		13.38	14.50	
		CH 144	5720		13.66	15.00	
	802.11n-HT20	CH 100	5500	MCS0	14.36	15.00	93.83
		CH 104	5520		15.24	17.00	
		CH 108	5540		15.45	17.00	
		CH 112	5560		15.55	17.00	
		CH 116	5580		15.50	17.00	
		CH 120	5600		15.80	17.00	
		CH 124	5620		15.55	17.00	
		CH 128	5640		15.61	17.00	
		CH 132	5660		15.54	17.00	
		CH 136	5680		15.31	17.00	
		CH 140	5700		13.27	14.50	
		CH 144	5720		13.40	15.00	
	802.11n-HT40	CH 102	5510	MCS0	14.16	15.00	89.47
		CH 110	5550		15.89	17.00	
		CH 126	5630		15.99	17.00	
		CH 134	5670		16.24	17.00	
		CH 142	5710		13.32	14.00	
	802.11ac-VHT20	CH 100	5500	MCS0	14.71	15.00	94.54
		CH 104	5520		15.77	17.00	
		CH 108	5540		15.89	17.00	
		CH 112	5560		15.88	17.00	
		CH 116	5580		15.85	17.00	
		CH 120	5600		16.11	17.00	

		CH 124	5620		15.90	17.00	
		CH 128	5640		15.98	17.00	
		CH 132	5660		16.00	17.00	
		CH 136	5680		15.74	17.00	
		CH 140	5700		13.70	14.00	
		CH 144	5720		13.47	15.00	
	802.11ac-VHT40	CH 102	5510	MCS0	14.59	15.00	89.47
		CH 110	5550		16.21	17.00	
		CH 126	5630		16.41	17.00	
		CH 134	5670		16.30	17.00	
		CH 142	5710		13.41	14.00	
	802.11ac-VHT80	CH 106	5530	MCS0	11.57	12.50	81.59
		CH 122	5610		15.33	16.00	
		CH 138	5690		11.29	16.00	

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN Ant.2	802.11a	CH 149	5745	MCS0	14.16	15.00	94.84
		CH 153	5765		16.57	17.00	
		CH 157	5785		16.39	17.00	
		CH 161	5805		16.65	17.00	
		CH 165	5825		16.54	17.00	
	802.11n-HT20	CH 149	5745	MCS0	14.52	15.00	93.83
		CH 153	5765		16.46	17.00	
		CH 157	5785		16.36	17.00	
		CH 161	5805		16.54	17.00	
		CH 165	5825		16.49	17.00	
	802.11n-HT40	CH 151	5755	MCS0	11.94	12.50	89.47
		CH 159	5795		16.41	17.00	
	802.11ac-VHT20	CH 149	5745	MCS0	14.59	15.00	94.54
		CH 153	5765		16.49	17.00	
		CH 157	5785		16.72	17.00	
		CH 161	5805		16.89	17.00	
		CH 165	5825		16.83	17.00	
	802.11ac-VHT40	CH 151	5755	MCS0	12.01	12.50	89.47
		CH 159	5795		16.50	17.00	
	802.11ac-VHT80	CH 155	5775	MCS0	11.40	12.00	81.59

<5GHz WLAN Ant.1+2>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN Ant.1+2	802.11a	CH 36	5180	6Mbps	15.37	16.00	95.32
		CH 40	5200		15.27	16.00	
		CH 44	5220		15.12	16.00	
		CH 48	5240		15.41	16.00	
	802.11n-HT20	CH 36	5180	MCS0	15.14	16.00	95.00
		CH 40	5200		15.15	16.00	
		CH 44	5220		14.95	16.00	
		CH 48	5240		15.28	16.00	
	802.11n-HT40	CH 38	5190	MCS0	15.05	16.00	89.73
		CH 46	5230		15.24	16.00	
	802.11ac-VHT20	CH 36	5180	MCS0	15.21	16.00	95.02
		CH 40	5200		15.22	16.00	
		CH 44	5220		15.04	16.00	
		CH 48	5240		15.30	16.00	
	802.11ac-VHT40	CH 38	5190	MCS0	15.12	16.00	90.41
		CH 46	5230		15.36	16.00	
	802.11ac-VHT80	CH 42	5210	MCS0	15.22	16.00	81.63

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.3GHz WLAN Ant.1+2	802.11a	CH 52	5260	6Mbps	18.94	19.50	95.32
		CH 56	5280		19.05	19.50	
		CH 60	5300		19.36	20.00	
		CH 64	5320		17.49	18.00	
	802.11n-HT20	CH 52	5260	MCS0	19.32	20.00	95.00
		CH 56	5280		18.86	19.50	
		CH 60	5300		19.83	20.00	
		CH 64	5320		17.12	18.00	
	802.11n-HT40	CH 54	5270	MCS0	18.67	19.50	89.73
		CH 62	5310		17.05	18.00	
	802.11ac-VHT20	CH 52	5260	MCS0	19.41	20.00	95.02
		CH 56	5280		18.99	19.50	
		CH 60	5300		19.98	20.50	
		CH 64	5320		17.29	18.00	
	802.11ac-VHT40	CH 54	5270	MCS0	18.74	19.50	90.41
		CH 62	5310		17.09	18.00	
	802.11ac-VHT80	CH 58	5290	MCS0	14.50	15.00	81.63

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.5GHz WLAN Ant.1+2	802.11a	CH 100	5500	6Mbps	16.86	17.00	95.32
		CH 104	5520		18.81	20.00	
		CH 108	5540		18.98	20.00	
		CH 112	5560		18.89	20.00	
		CH 116	5580		19.00	20.00	
		CH 120	5600		18.98	20.00	
		CH 124	5620		18.78	20.00	
		CH 128	5640		18.77	20.00	
		CH 132	5660		18.98	20.00	
		CH 136	5680		18.78	20.00	
		CH 140	5700		16.54	17.00	
		CH 144	5720		16.74	17.00	
	802.11n-HT20	CH 100	5500	MCS0	17.69	18.00	95.00
		CH 104	5520		18.08	19.50	
		CH 108	5540		18.14	19.50	
		CH 112	5560		17.90	18.50	
		CH 116	5580		17.87	18.50	
		CH 120	5600		18.86	20.00	
		CH 124	5620		18.11	18.50	
		CH 128	5640		18.10	18.50	
		CH 132	5660		18.15	18.50	
		CH 136	5680		18.07	18.50	
		CH 140	5700		16.47	17.00	
		CH 144	5720		16.49	17.00	
	802.11n-HT40	CH 102	5510	MCS0	17.60	18.00	89.73
		CH 110	5550		19.26	19.50	
		CH 126	5630		18.98	19.50	
		CH 134	5670		19.29	19.50	
		CH 142	5710		16.46	17.00	
	802.11ac-VHT20	CH 100	5500	MCS0	17.75	18.00	95.02
		CH 104	5520		18.59	19.50	
		CH 108	5540		18.58	19.50	
		CH 112	5560		18.46	18.50	
		CH 116	5580		18.36	18.50	
		CH 120	5600		19.02	20.00	

		CH 124	5620		18.64	18.50	
		CH 128	5640		18.60	18.50	
		CH 132	5660		18.56	18.50	
		CH 136	5680		18.42	18.50	
		CH 140	5700		16.74	17.00	
		CH 144	5720		16.58	17.00	
	802.11ac-VHT40	CH 102	5510	MCS0	17.66	18.00	90.41
		CH 110	5550		19.33	20.00	
		CH 126	5630		19.31	20.00	
		CH 134	5670		19.33	20.00	
		CH 142	5710		16.53	17.00	
	802.11ac-VHT80	CH 106	5530	MCS0	14.98	16.00	81.63
		CH 122	5610		18.36	18.50	
		CH 138	5690		14.14	14.50	

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN Ant.1+2	802.11a	CH 149	5745	MCS0	17.20	17.50	95.32
		CH 153	5765		19.53	20.00	
		CH 157	5785		19.59	20.00	
		CH 161	5805		19.79	20.00	
		CH 165	5825		19.81	20.00	
	802.11n-HT20	CH 149	5745	MCS0	17.07	17.50	95.00
		CH 153	5765		19.42	20.00	
		CH 157	5785		19.47	20.00	
		CH 161	5805		19.61	20.00	
		CH 165	5825		19.64	20.00	
	802.11n-HT40	CH 151	5755	MCS0	14.62	15.00	89.73
		CH 159	5795		19.55	20.00	
	802.11ac-VHT20	CH 149	5745	MCS0	17.12	17.50	95.02
		CH 153	5765		19.46	20.00	
		CH 157	5785		19.53	20.00	
		CH 161	5805		19.73	20.00	
		CH 165	5825		19.77	20.00	
	802.11ac-VHT40	CH 151	5755	MCS0	14.71	15.00	90.41
		CH 159	5795		19.63	20.00	
	802.11ac-VHT80	CH 155	5775	MCS0	14.20	14.50	81.63

<2.4GHz Bluetooth>

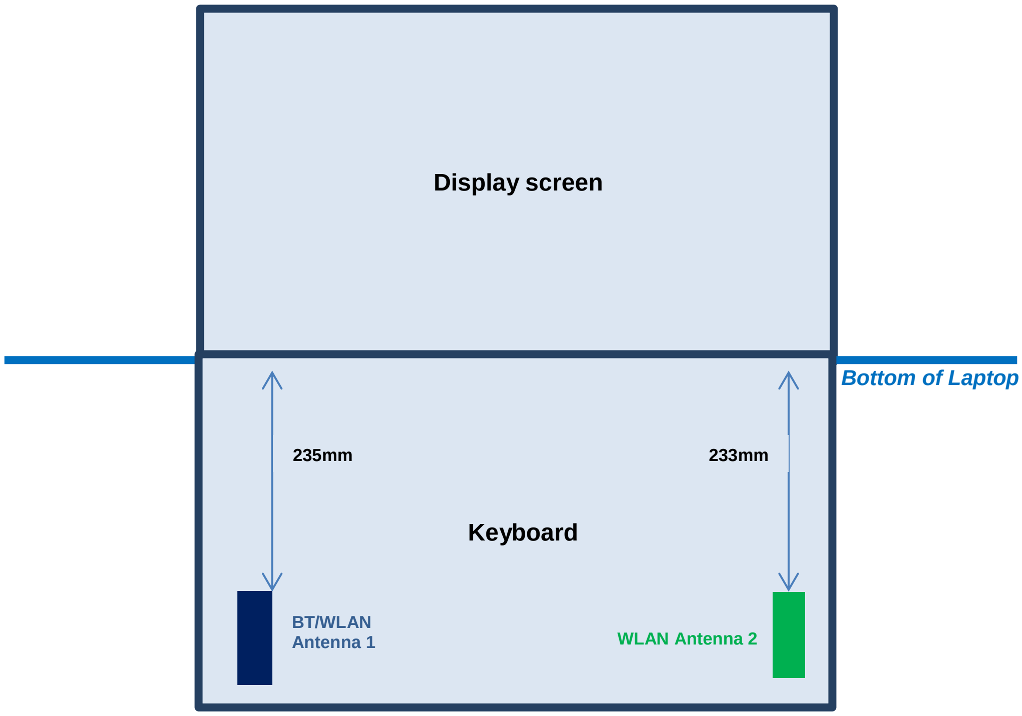
General Note:

1. For 2.4GHz Bluetooth SAR testing was selected 1Mbps, due to its highest average power.
2. The Bluetooth duty cycle is 76.79% as following figure, according to 2016 Oct. TCB workshop for Bluetooth SAR scaling need further consideration and the theoretical duty cycle is 83.3%, therefore the actual duty cycle will be scaled up to the theoretical value of Bluetooth reported SAR calculation

Mode	Channel	Frequency (MHz)	Average power (dBm)
			GFSK
Bluetooth 3.0+EDR	CH 00	2402	5.39
	CH 39	2441	5.70
	CH 78	2480	**5.83**
Tune-up Limit			7.00

Mode	Channel	Frequency (MHz)	Average power (dBm)
			GFSK
Bluetooth v4.0/4.1 with LE	CH 00	2402	-1.78
	CH 19	2440	-1.54
	CH 39	2480	**-1.33**
Tune-up Limit			4.50

13. Antenna Location



14. SAR Test Results

General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WLAN/BT: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v06, for each exposure position, 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
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is not required when the measured SAR is < 0.8W/kg.
4. Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required 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.
5. Per KDB 248227 D01v02r02, U-NII-1 SAR testing is not required when the U-NII-2A band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band.
6. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
7. For all positions / configurations, 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.
8. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

14.1 Body SAR

<DTS WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
01	WLAN 2.4GHz	802.11b 1Mbps	Bottom of Laptop	0	Ant 1	6	2437	17.72	19.00	1.343	100	1.000	0.03	0.180	**0.242**
	WLAN 2.4GHz	802.11b 1Mbps	Bottom of Laptop	0	Ant 1	1	2412	17.69	18.50	1.205	100	1.000	0.07	0.133	0.160
	WLAN 2.4GHz	802.11b 1Mbps	Bottom of Laptop	0	Ant 1	11	2462	17.04	18.50	1.400	100	1.000	0.02	0.145	0.203
02	WLAN 2.4GHz	802.11b 1Mbps	Bottom of Laptop	0	Ant 2	6	2437	18.22	19.00	1.197	100	1.000	0.08	0.267	**0.320**
	WLAN 2.4GHz	802.11b 1Mbps	Bottom of Laptop	0	Ant 2	1	2412	17.83	18.50	1.167	100	1.000	0.04	0.199	0.232
	WLAN 2.4GHz	802.11b 1Mbps	Bottom of Laptop	0	Ant 2	11	2462	17.97	18.50	1.130	100	1.000	-0.05	0.122	0.138
03	WLAN 2.4GHz	802.11b 1Mbps	Bottom of Laptop	0	Ant 1+2	6	2437	21.17	21.50	1.078	100	1.000	0.04	0.242	**0.261**
	WLAN 2.4GHz	802.11b 1Mbps	Bottom of Laptop	0	Ant 1+2	1	2412	20.99	21.50	1.125	100	1.000	-0.18	0.232	0.261
	WLAN 2.4GHz	802.11b 1Mbps	Bottom of Laptop	0	Ant 1+2	11	2462	20.68	21.00	1.077	100	1.000	0.08	0.154	0.166

<NII WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
04	WLAN 5.3GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 1	54	5270	15.31	17.00	1.475	89.73	1.114	-0.05	0.117	0.192
	WLAN 5.3GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 1	62	5310	13.85	15.00	1.303	89.73	1.114	0.11	0.070	0.102
05	WLAN 5.3GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 2	54	5270	15.58	17.00	1.386	89.47	1.118	-0.01	0.190	0.294
	WLAN 5.3GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 2	62	5310	13.52	15.00	1.405	89.47	1.118	-0.03	0.050	0.079
	WLAN 5.3GHz	802.11ac-VHT 20 MCS0	Bottom of Laptop	0	Ant 1+2	60	5300	19.98	20.50	1.127	95.02	1.052	-0.08	0.113	0.134
06	WLAN 5.3GHz	802.11ac-VHT 20 MCS0	Bottom of Laptop	0	Ant 1+2	52	5260	19.41	20.00	1.146	95.02	1.052	0.05	0.152	0.183
	WLAN 5.3GHz	802.11ac-VHT 20 MCS0	Bottom of Laptop	0	Ant 1+2	64	5320	17.29	18.00	1.178	95.02	1.052	0.04	0.049	0.061
	WLAN 5.5GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 1	110	5550	16.11	17.00	1.227	89.73	1.114	0.01	0.211	0.288
	WLAN 5.5GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 1	102	5510	14.38	15.00	1.153	89.73	1.114	0.07	0.070	0.090
	WLAN 5.5GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 1	126	5630	15.35	17.00	1.462	89.73	1.114	-0.04	0.092	0.150
07	WLAN 5.5GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 1	134	5670	15.89	17.00	1.291	89.73	1.114	-0.08	0.254	0.365
	WLAN 5.5GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 1	142	5710	12.45	14.00	1.429	89.73	1.114	0.06	0.030	0.048
08	WLAN 5.5GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 2	134	5670	16.24	17.00	1.191	89.47	1.118	0.09	0.189	0.252
	WLAN 5.5GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 2	102	5510	14.16	15.00	1.212	89.47	1.118	-0.1	0.065	0.088
	WLAN 5.5GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 2	110	5550	15.89	17.00	1.290	89.47	1.118	0.04	0.117	0.169
	WLAN 5.5GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 2	126	5630	15.99	17.00	1.261	89.47	1.118	0.09	0.053	0.075
	WLAN 5.5GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 2	142	5710	13.32	14.00	1.169	89.47	1.118	-0.01	0.035	0.046
	WLAN 5.5GHz	802.11ac-VHT 40 MCS0	Bottom of Laptop	0	Ant 1+2	110	5550	19.33	20.00	1.167	90.41	1.106	0.05	0.156	0.201
09	WLAN 5.5GHz	802.11ac-VHT 40 MCS0	Bottom of Laptop	0	Ant 1+2	134	5670	19.33	20.00	1.168	90.41	1.106	-0.04	0.168	0.217
	WLAN 5.5GHz	802.11ac-VHT 40 MCS0	Bottom of Laptop	0	Ant 1+2	142	5710	16.53	17.00	1.114	90.41	1.106	0.01	0.052	0.064
10	WLAN 5.8GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 1	159	5795	16.25	17.00	1.188	89.73	1.114	-0.08	0.121	0.160
	WLAN 5.8GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 1	151	5755	10.83	12.50	1.469	89.73	1.114	0.02	0.027	0.044
11	WLAN 5.8GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 2	159	5795	16.41	17.00	1.145	89.47	1.118	0.02	0.157	0.201
	WLAN 5.8GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 2	151	5755	11.94	12.50	1.137	89.47	1.118	0.03	0.047	0.060
12	WLAN 5.8GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 1+2	159	5795	19.55	20.00	1.109	89.73	1.114	0.06	0.178	0.220
	WLAN 5.8GHz	802.11n-HT40 MCS0	Bottom of Laptop	0	Ant 1+2	151	5755	14.62	15.00	1.091	89.73	1.114	0.03	0.051	0.062

<Bluetooth SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	Bluetooth	1Mbps	Bottom of Laptop	0	78	2480	5.83	7.00	1.309	76.79	1.085	0.1	0.011	0.016
	Bluetooth	1Mbps	Bottom of Laptop	0	0	2402	5.39	7.00	1.449	76.79	1.085	0.12	0.012	0.019
13	Bluetooth	1Mbps	Bottom of Laptop	0	39	2441	5.70	7.00	1.349	76.79	1.085	0.05	0.020	**0.029**

15. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Supported
1.	WLAN 2.4GHz Antenna 1 + WLAN 2.4GHz Antenna 2	Yes
2.	WLAN 5GHz Antenna 1 + WLAN 5GHz Antenna 2	Yes
3.	WLAN 2.4GHz Antenna 2 + Bluetooth	Yes
4.	WLAN 5GHz Antenna 2 + Bluetooth	Yes

General Note:

1. Bluetooth and WLAN share the same antenna 1, and cannot transmit simultaneously.
2. EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment.
3. WLAN 2.4GHz MIMO SAR and WLAN 5GHz MIMO SAR evaluated separately and complied, so no need add SAR test results of each antenna in SISO mode for co-located analysis.
4. The reported SAR summation is calculated based on the same configuration and test position.
5. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = (SAR1 + SAR2)^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
   iii) If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.
   iv) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.

15.1 Body Exposure Conditions

Exposure Position	Bluetooth	WLAN 2.4GHz Antenna 2	Summed 1g SAR (W/kg)
	1g SAR (W/kg)	SAR (W/kg)	
Bottom of Laptop at 0mm	0.029	0.320	**0.35**

Exposure Position	Bluetooth	WLAN 5GHz Antenna 2	Summed 1g SAR (W/kg)
	1g SAR (W/kg)	1g SAR (W/kg)	
Bottom of Laptop at 0mm	0.029	0.294	**0.32**

Test Engineer: Luke Lu

16. Uncertainty Assessment

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in table below.

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor[(a)]	1/k[(b)]	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) κ is the coverage factor

Table 16.1. Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.

Error Description	Uncertainty Value (±%)	Probability	Divisor	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g) (±%)	Standard Uncertainty (10g) (±%)
Measurement System							
Probe Calibration	6.0	N	1	1	1	6.0	6.0
Axial Isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9
Hemispherical Isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9
Boundary Effects	1.0	R	1.732	1	1	0.6	0.6
Linearity	4.7	R	1.732	1	1	2.7	2.7
System Detection Limits	1.0	R	1.732	1	1	0.6	0.6
Modulation Response	3.2	R	1.732	1	1	1.8	1.8
Readout Electronics	0.3	N	1	1	1	0.3	0.3
Response Time	0.0	R	1.732	1	1	0.0	0.0
Integration Time	2.6	R	1.732	1	1	1.5	1.5
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7
Probe Positioner	0.4	R	1.732	1	1	0.2	0.2
Probe Positioning	2.9	R	1.732	1	1	1.7	1.7
Max. SAR Eval.	2.0	R	1.732	1	1	1.2	1.2
Test Sample Related							
Device Positioning	3.0	N	1	1	1	3.0	3.0
Device Holder	3.6	N	1	1	1	3.6	3.6
Power Drift	5.0	R	1.732	1	1	2.9	2.9
Power Scaling	0.0	R	1.732	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty	6.1	R	1.732	1	1	3.5	3.5
SAR correction	0.0	R	1.732	1	0.84	0.0	0.0
Liquid Conductivity Repeatability	0.2	N	1	0.78	0.71	0.1	0.1
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0
Liquid Conductivity (mea.)	2.5	R	1.732	0.78	0.71	1.1	1.0
Temp. unc. - Conductivity	3.4	R	1.732	0.78	0.71	1.5	1.4
Liquid Permittivity Repeatability	0.15	N	1	0.23	0.26	0.0	0.0
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8
Liquid Permittivity (mea.)	2.5	R	1.732	0.23	0.26	0.3	0.4
Temp. unc. - Permittivity	0.83	R	1.732	0.23	0.26	0.1	0.1
Combined Std. Uncertainty						11.4%	11.4%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						22.9%	22.7%

Table 16.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

Error Description	Uncertainty Value (±%)	Probability	Divisor	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g) (±%)	Standard Uncertainty (10g) (±%)
Measurement System							
Probe Calibration	6.55	N	1	1	1	6.6	6.6
Axial Isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9
Hemispherical Isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9
Boundary Effects	2.0	R	1.732	1	1	1.2	1.2
Linearity	4.7	R	1.732	1	1	2.7	2.7
System Detection Limits	1.0	R	1.732	1	1	0.6	0.6
Modulation Response	3.2	R	1.732	1	1	1.8	1.8
Readout Electronics	0.3	N	1	1	1	0.3	0.3
Response Time	0.0	R	1.732	1	1	0.0	0.0
Integration Time	2.6	R	1.732	1	1	1.5	1.5
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7
Probe Positioner	0.4	R	1.732	1	1	0.2	0.2
Probe Positioning	6.7	R	1.732	1	1	3.9	3.9
Max. SAR Eval.	4.0	R	1.732	1	1	2.3	2.3
Test Sample Related							
Device Positioning	3.0	N	1	1	1	3.0	3.0
Device Holder	3.6	N	1	1	1	3.6	3.6
Power Drift	5.0	R	1.732	1	1	2.9	2.9
Power Scaling	0.0	R	1.732	1	1	0.0	0.0
Phantom and Setup							
Phantom Uncertainty	6.6	R	1.732	1	1	3.8	3.8
SAR correction	0.0	R	1.732	1	0.84	0.0	0.0
Liquid Conductivity Repeatability	0.2	N	1	0.78	0.71	0.1	0.1
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0
Liquid Conductivity (mea.)	2.5	R	1.732	0.78	0.71	1.1	1.0
Temp. unc. - Conductivity	3.4	R	1.732	0.78	0.71	1.5	1.4
Liquid Permittivity Repeatability	0.15	N	1	0.23	0.26	0.0	0.0
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8
Liquid Permittivity (mea.)	2.5	R	1.732	0.23	0.26	0.3	0.4
Temp. unc. - Permittivity	0.83	R	1.732	0.23	0.26	0.1	0.1
Combined Std. Uncertainty						12.5%	12.5%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						25.1%	25.0%

Table 16.3. Uncertainty Budget for frequency range 3 GHz to 6 GHz

17. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] 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”, Sep 2013

[4] SPEAG DASY System Handbook

[5] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015

[6] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015

[7] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015

[8] FCC KDB 248227 D01 v02r02, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Oct 2015.

[9] FCC KDB 616217 D04 v01r02, “SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers”, Oct 2015

Appendix A. Plots of System Performance Check

The plots are shown as follows.

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017.03.10

System Check_Body_2450MHz_170310

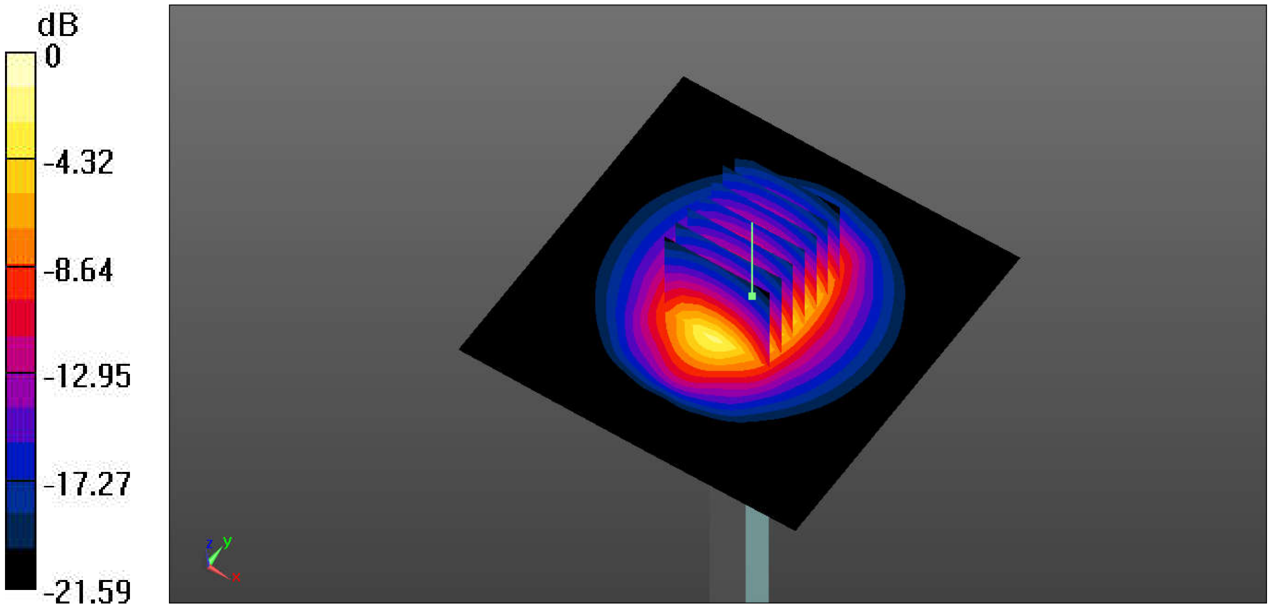
DUT: D2450V2 - SN: 840

Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL_2450_170310 Medium parameters used: f = 2450 MHz; σ = 2.001 S/m; ε_r = 52.089; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(7.66, 7.66, 7.66); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (81x81x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 21.1 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 87.82 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 28.1 W/kg
SAR(1 g) = 13.7 W/kg; SAR(10 g) = 6.36 W/kg
Maximum value of SAR (measured) = 21.0 W/kg



0 dB = 21.1 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017.3.30

System Check_Body_2450MHz_170330

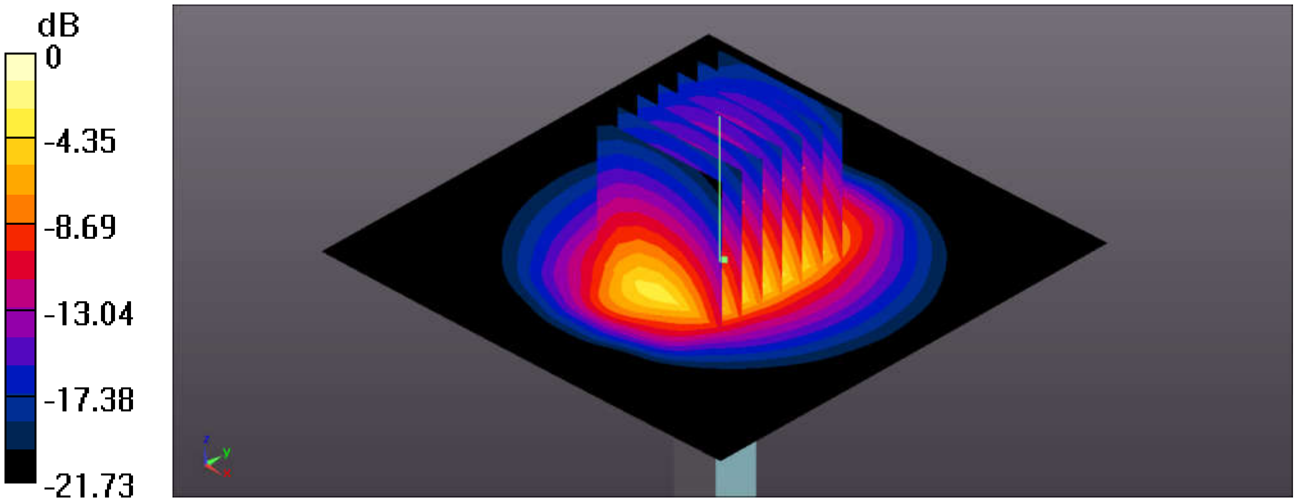
DUT: D2450V2 - SN:840

Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL_2450_170330 Medium parameters used: f = 2450 MHz; σ = 1.94 S/m; ε_r = 51.605; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3954; ConvF(7.55, 7.55, 7.55); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2016.4.4
- Phantom: SAM3; Type: SAM; Serial: TP-1127
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 17.6 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 84.64 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 24.5 W/kg
SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.64 W/kg
Maximum value of SAR (measured) = 18.1 W/kg



0 dB = 18.1 W/kg = 12.58 dBW/kg

System Check_Body_5250MHz_170311

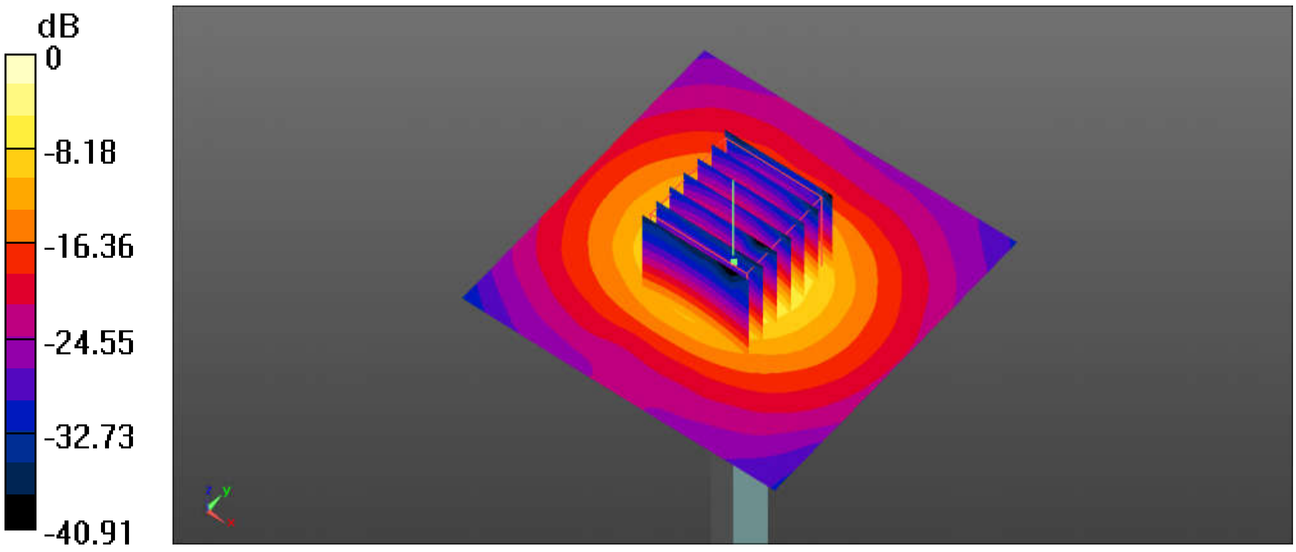
DUT: D5GHzV2 - SN: 1167

Communication System: UID 0, CW (0); Frequency: 5250 MHz;Duty Cycle: 1:1
Medium: MSL_5250_170311 Medium parameters used: f = 5250 MHz; σ = 5.313 S/m; ε_r = 51.017; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(4.62, 4.62, 4.62); Calibrated: 2016.09.29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=100mW/Area Scan (71x71x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 18.4 W/kg

Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 49.76 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 31.0 W/kg
SAR(1 g) = 7.81 W/kg; SAR(10 g) = 2.16 W/kg
Maximum value of SAR (measured) = 19.0 W/kg



0 dB = 18.4 W/kg

System Check_Body_5600MHz_170311

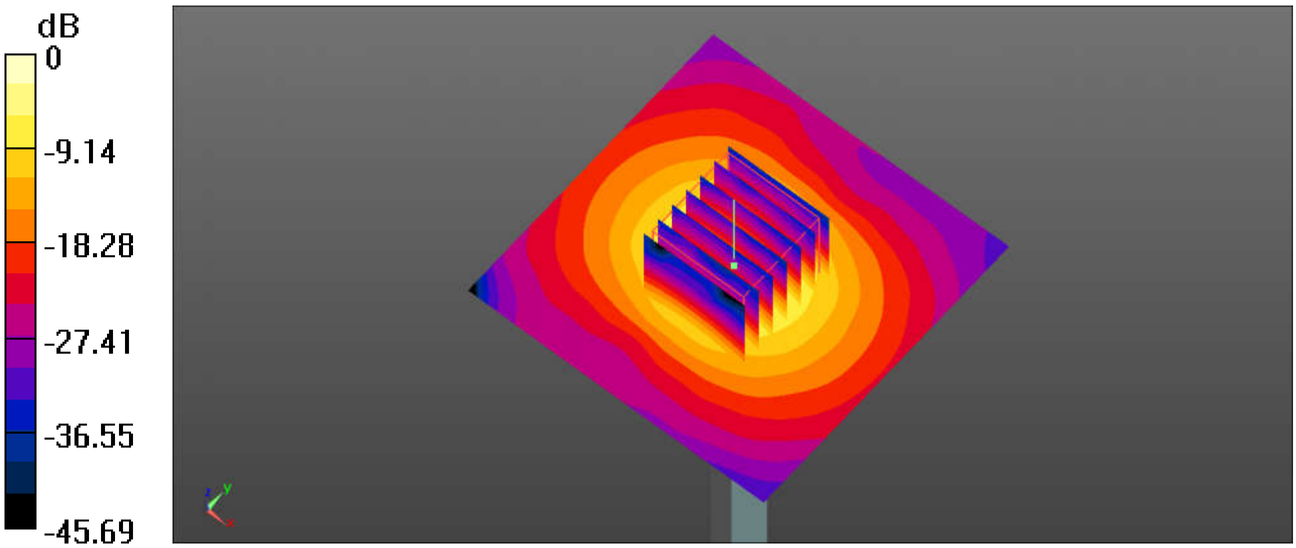
DUT: D5GHzV2 - SN: 1167

Communication System: UID 0, CW (0); Frequency: 5600 MHz;Duty Cycle: 1:1
Medium: MSL_5600_170311 Medium parameters used: f = 5600 MHz; σ = 5.909 S/m; ε_r = 50.389; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(3.78, 3.78, 3.78); Calibrated: 2016.09.29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=100mW/Area Scan (71x71x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 21.9 W/kg

Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 51.85 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 36.4 W/kg
SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.18 W/kg
Maximum value of SAR (measured) = 22.9 W/kg



0 dB = 21.9 W/kg

System Check_Body_5750MHz_170311

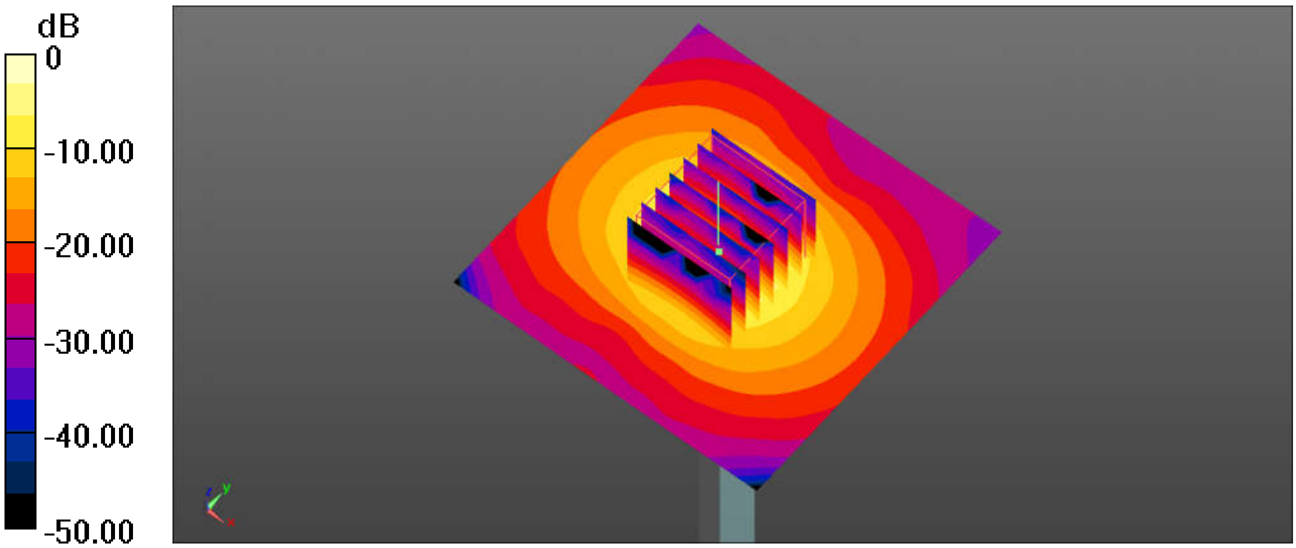
DUT: D5GHzV2 - SN: 1167

Communication System: UID 0, CW (0); Frequency: 5750 MHz;Duty Cycle: 1:1
Medium: MSL_5750_170311 Medium parameters used: f = 5750 MHz; σ = 6.139 S/m; ε_r = 50.029; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(4.13, 4.13, 4.13); Calibrated: 2016.09.29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=100mW/Area Scan (71x71x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 18.2 W/kg

Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 44.98 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 30.3 W/kg
SAR(1 g) = 7.29 W/kg; SAR(10 g) = 1.98 W/kg
Maximum value of SAR (measured) = 18.7 W/kg



0 dB = 18.2 W/kg

Appendix B. Plots of High SAR Measurement

The plots are shown as follows.

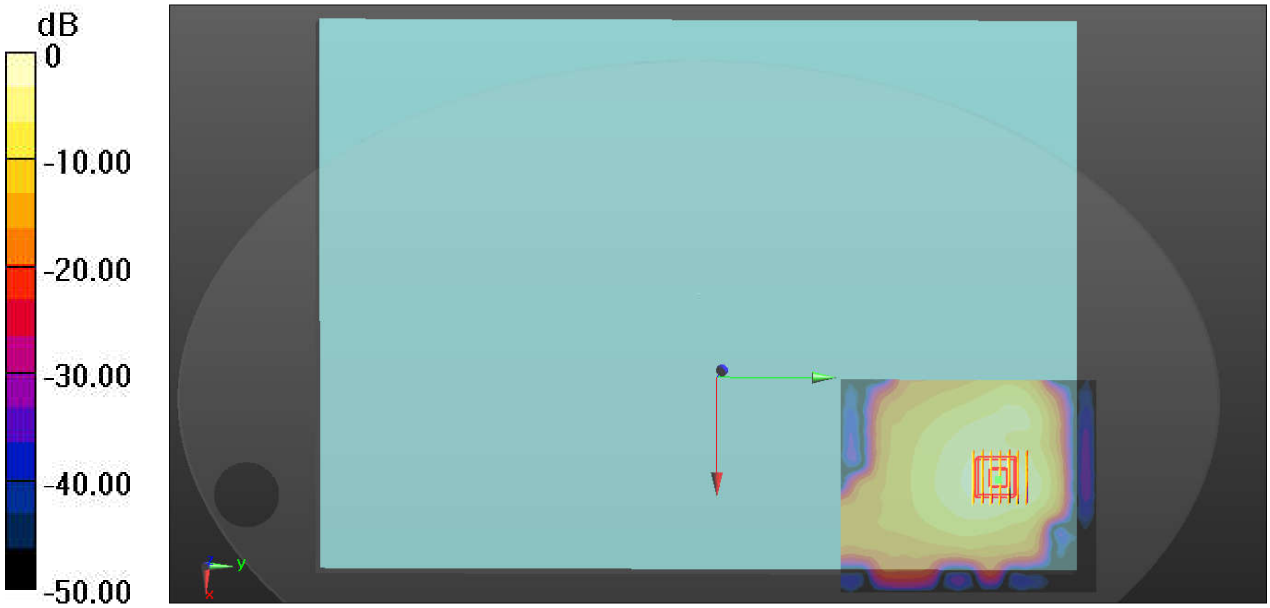
01_WLAN2.4GHz_802.11b 1Mbps_Bottom of Laptop_0mm_Ch6_Ant1

Communication System: UID 0, WIFI (0); Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_170310 Medium parameters used: f = 2437 MHz; $\sigma = 1.985$ S/m; $\varepsilon_r = 52.148$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(7.66, 7.66, 7.66); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch6/Area Scan (101x121x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.261 W/kg

Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.453 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.342 W/kg
SAR(1 g) = 0.180 W/kg; SAR(10 g) = 0.090 W/kg
Maximum value of SAR (measured) = 0.263 W/kg



0 dB = 0.261 W/kg

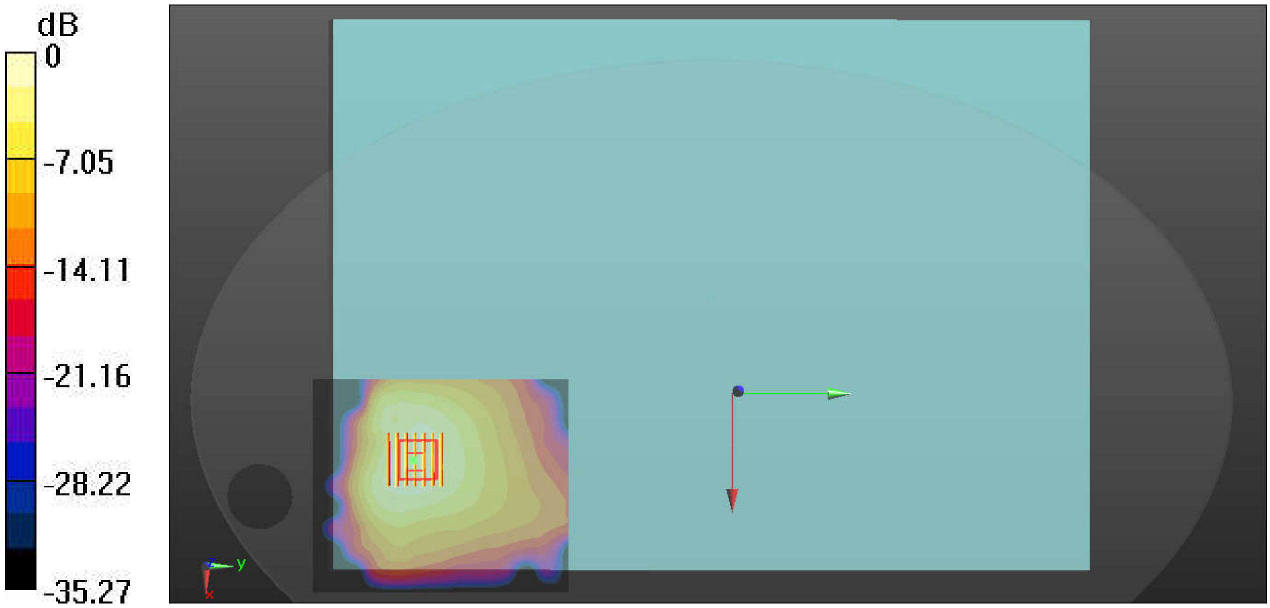
02_WLAN2.4GHz_802.11b 1Mbps_Bottom of Laptop_0mm_Ch6_Ant2

Communication System: UID 0, WIFI (0); Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_170310 Medium parameters used: f = 2437 MHz; $\sigma = 1.985$ S/m; $\varepsilon_r = 52.148$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(7.66, 7.66, 7.66); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch6/Area Scan (101x121x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.371 W/kg

Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.7980 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.486 W/kg
SAR(1 g) = 0.267 W/kg; SAR(10 g) = 0.150 W/kg
Maximum value of SAR (measured) = 0.373 W/kg



0 dB = 0.371 W/kg

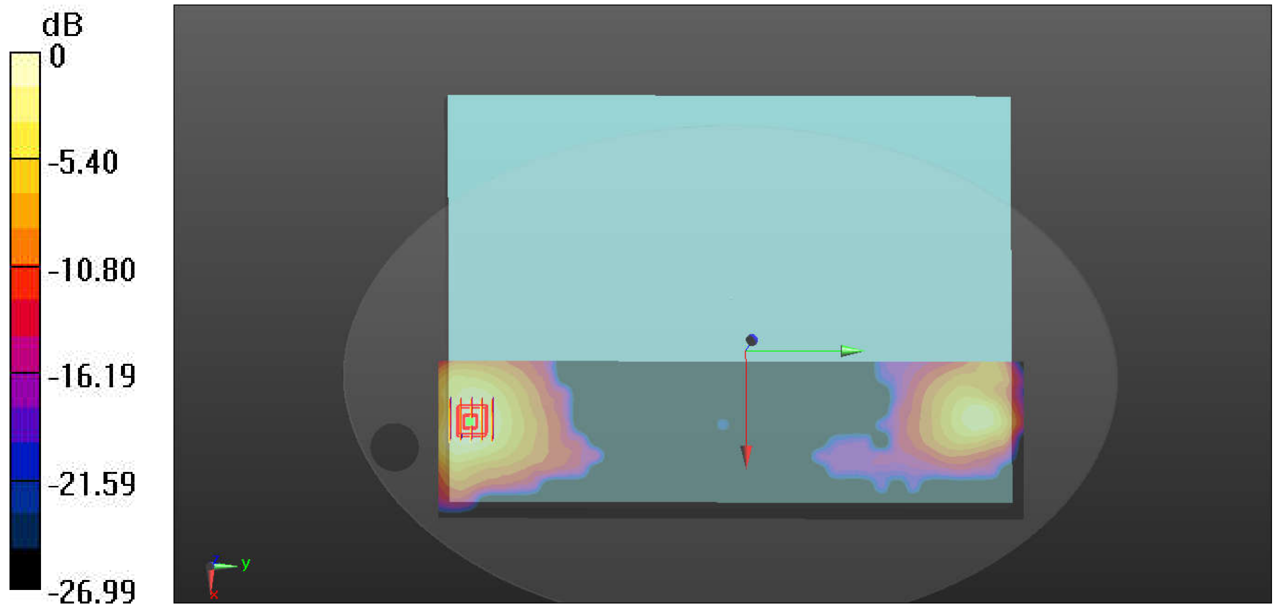
03_WLAN2.4GHz_802.11b 1Mbps_Bottom of Laptop_0mm_Ch6_Ant1+2

Communication System: UID 0, WIFI (0); Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: MSL_2450_170310 Medium parameters used: f = 2437 MHz; $\sigma = 1.985$ S/m; $\varepsilon_r = 52.148$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(7.66, 7.66, 7.66); Calibrated: 2016.09.29;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch6/Area Scan (101x371x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.334 W/kg

Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.209 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.435 W/kg
SAR(1 g) = 0.242 W/kg; SAR(10 g) = 0.135 W/kg
Maximum value of SAR (measured) = 0.336 W/kg



0 dB = 0.334 W/kg

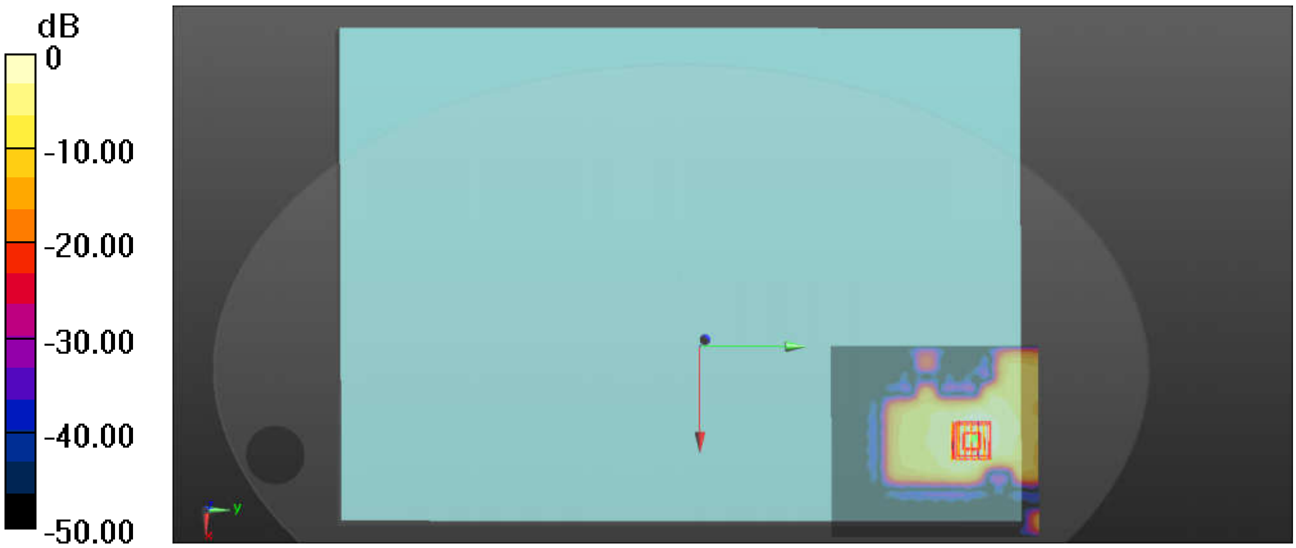
04_WLAN5.3GHz_802.11n-HT40 MCS0_Bottom of Laptop_0mm_Ch54_Ant1

Communication System: UID 0, WIFI (0); Frequency: 5270 MHz;Duty Cycle: 1:1.114
Medium: MSL_5250_170311 Medium parameters used: f = 5270 MHz; σ = 5.348 S/m; ε_r = 51.006; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(4.62, 4.62, 4.62); Calibrated: 2016.09.29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch54/Area Scan (121x131x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.289 W/kg

Ch54/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 1.840 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.427 W/kg
SAR(1 g) = 0.117 W/kg; SAR(10 g) = 0.041 W/kg
Maximum value of SAR (measured) = 0.285 W/kg



0 dB = 0.289 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2017.03.11

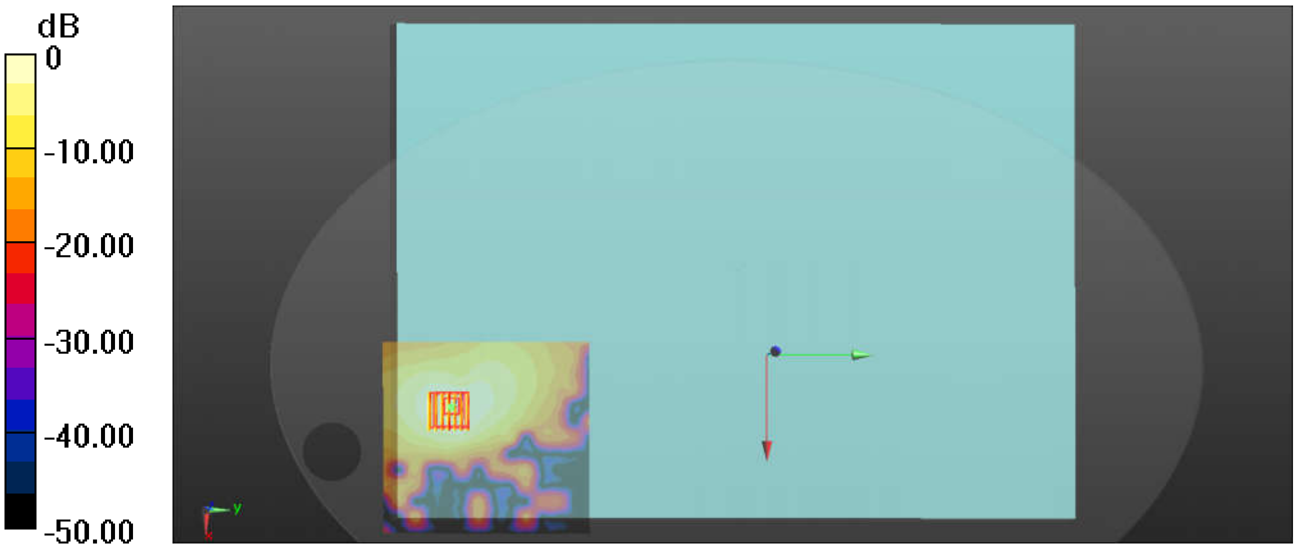
05_WLAN5.3GHz_802.11n-HT40 MCS0_Bottom of Laptop_0mm_Ch54_Ant2

Communication System: UID 0, WIFI (0); Frequency: 5270 MHz;Duty Cycle: 1:1.118
Medium: MSL_5250_170311 Medium parameters used: f = 5270 MHz; σ = 5.348 S/m; ε_r = 51.006; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(4.62, 4.62, 4.62); Calibrated: 2016.09.29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch54/Area Scan (121x131x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.395 W/kg

Ch54/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 0.9690 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.665 W/kg
SAR(1 g) = 0.190 W/kg; SAR(10 g) = 0.079 W/kg
Maximum value of SAR (measured) = 0.400 W/kg



0 dB = 0.395 W/kg

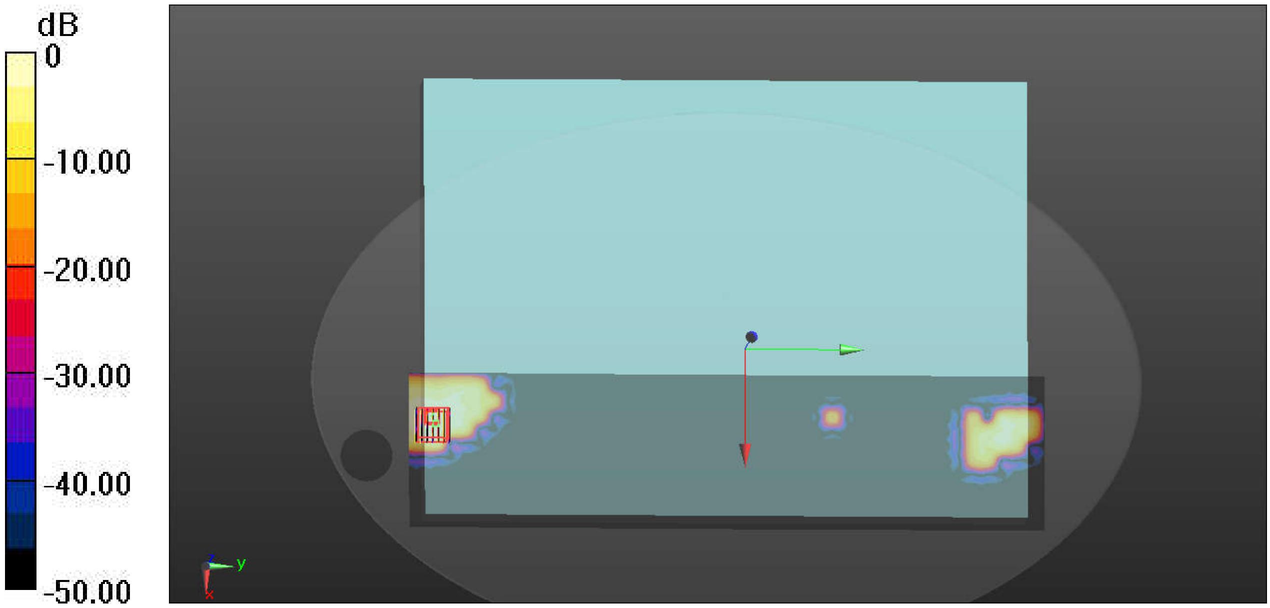
06_WLAN5.3GHz_802.11ac-VHT20 MCS0_Bottom of Laptop_0mm_Ch52_Ant1+2

Communication System: UID 0, WIFI (0); Frequency: 5260 MHz;Duty Cycle: 1:1.052
Medium: MSL_5250_170311 Medium parameters used: f = 5260 MHz; σ = 5.331 S/m; ε_r = 51.013; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(4.62, 4.62, 4.62); Calibrated: 2016.09.29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch52/Area Scan (111x451x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.367 W/kg

Ch52/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 1.268 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.557 W/kg
SAR(1 g) = 0.152 W/kg; SAR(10 g) = 0.050 W/kg
Maximum value of SAR (measured) = 0.353 W/kg



0 dB = 0.367 W/kg

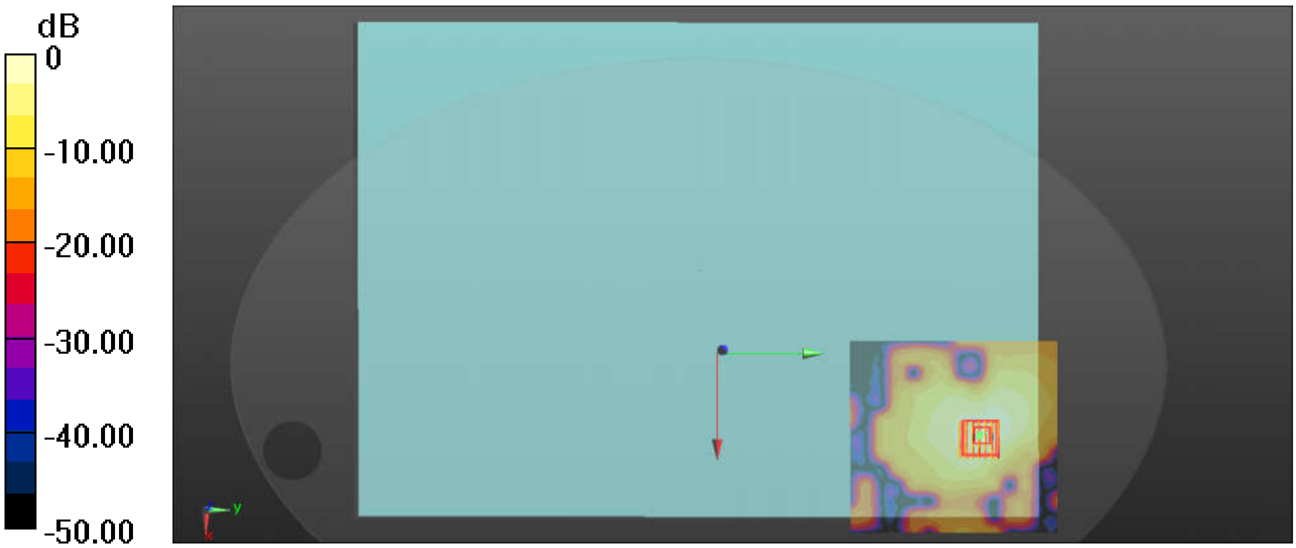
07_WLAN5.5GHz_802.11n-HT40 MCS0_Bottom of Laptop_0mm_Ch134_Ant1

Communication System: UID 0, WIFI (0); Frequency: 5670 MHz;Duty Cycle: 1:1.114
Medium: MSL_5600_170311 Medium parameters used: f = 5670 MHz; σ = 6.011 S/m; ε_r = 50.201; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(3.78, 3.78, 3.78); Calibrated: 2016.09.29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch134/Area Scan (121x131x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.554 W/kg

Ch134/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 1.845 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.52 W/kg
SAR(1 g) = 0.254 W/kg; SAR(10 g) = 0.092 W/kg
Maximum value of SAR (measured) = 0.712 W/kg



0 dB = 0.554 W/kg

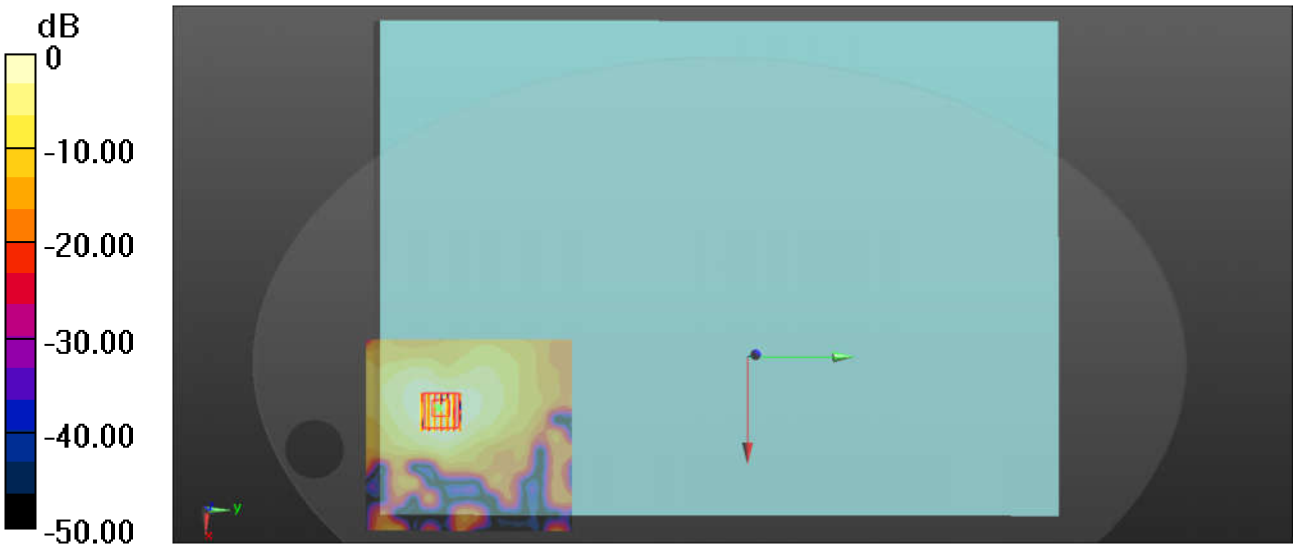
08_WLAN5.5GHz_802.11n-HT40 MCS0_Bottom of Laptop_0mm_Ch134_Ant2

Communication System: UID 0, WIFI (0); Frequency: 5670 MHz;Duty Cycle: 1:1.118
Medium: MSL_5600_170311 Medium parameters used: f = 5670 MHz; $\sigma = 6.011$ S/m; $\varepsilon_r = 50.201$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(3.78, 3.78, 3.78); Calibrated: 2016.09.29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch134/Area Scan (121x131x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.423 W/kg

Ch134/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 0.8330 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.657 W/kg
SAR(1 g) = 0.189 W/kg; SAR(10 g) = 0.082 W/kg
Maximum value of SAR (measured) = 0.407 W/kg



0 dB = 0.423 W/kg

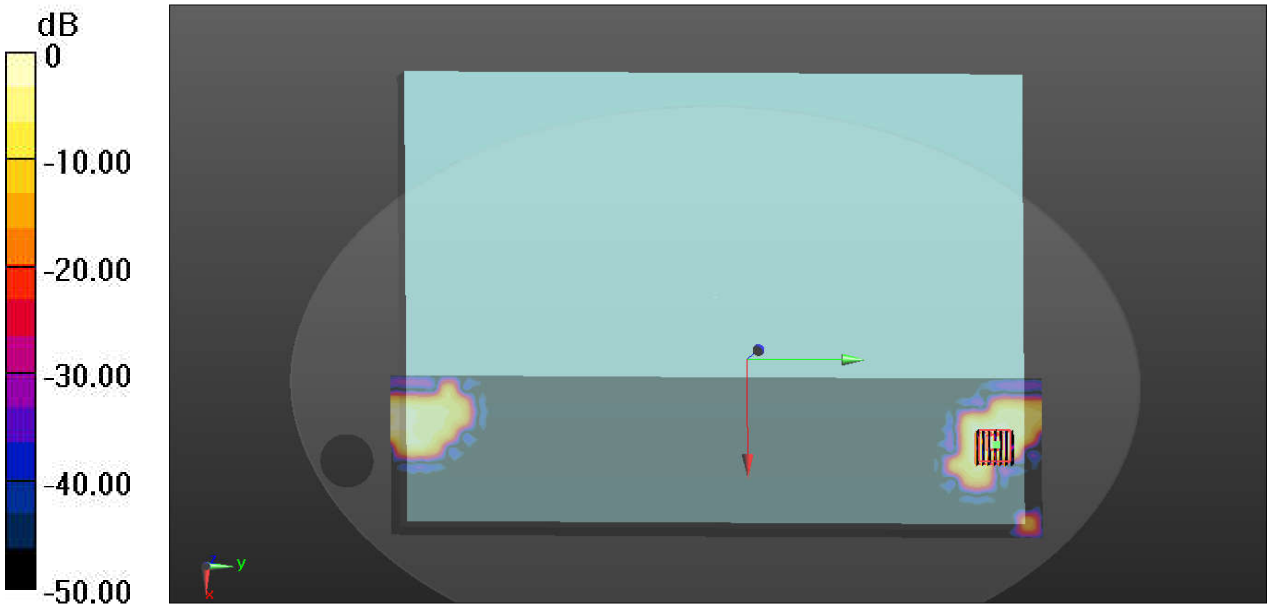
09_WLAN5.5GHz_802.11ac-VHT40 MCS0_Bottom of Laptop_0mm_Ch134_Ant1+2

Communication System: UID 0, WIFI (0); Frequency: 5670 MHz;Duty Cycle: 1:1.106
Medium: MSL_5600_170311 Medium parameters used: f = 5670 MHz; σ = 6.011 S/m; ε_r = 50.201; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(3.78, 3.78, 3.78); Calibrated: 2016.09.29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch134/Area Scan (111x451x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.588 W/kg

Ch134/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 0.9470 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.664 W/kg
SAR(1 g) = 0.168 W/kg; SAR(10 g) = 0.053 W/kg
Maximum value of SAR (measured) = 0.434 W/kg



0 dB = 0.588 W/kg

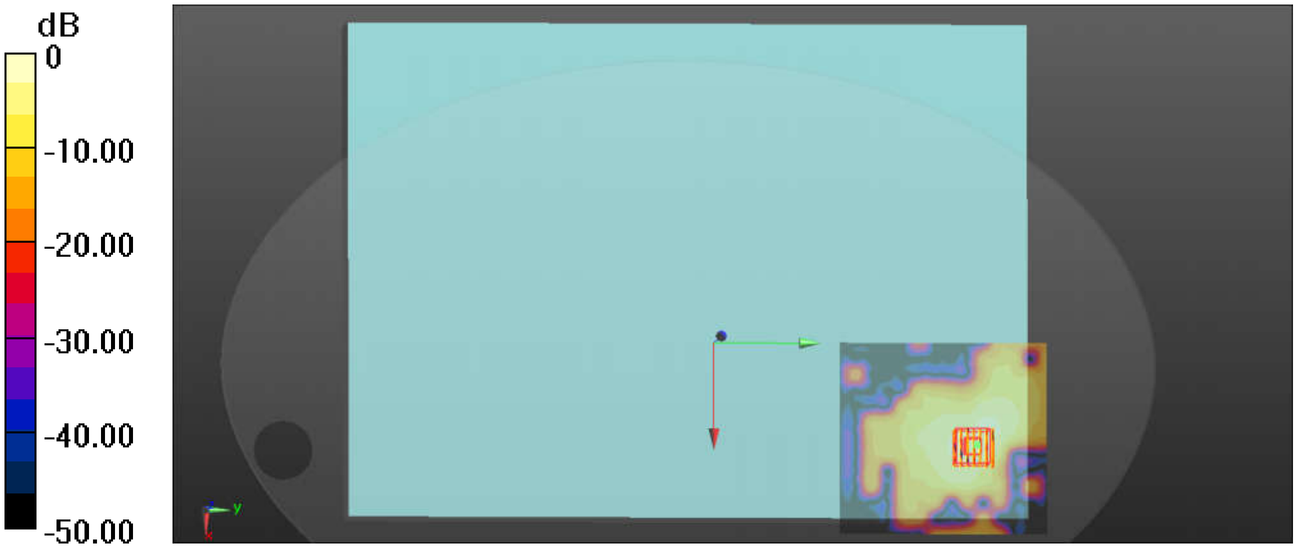
10_WLAN5.8GHz_802.11n-HT40 MCS0_Bottom of Laptop_0mm_Ch159_Ant1

Communication System: UID 0, WIFI (0); Frequency: 5795 MHz;Duty Cycle: 1:1.114
Medium: MSL_5750_170311 Medium parameters used: f = 5795 MHz; σ = 6.206 S/m; ε_r = 49.897; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(4.13, 4.13, 4.13); Calibrated: 2016.09.29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch159/Area Scan (121x131x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.347 W/kg

Ch159/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 1.681 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.121 W/kg; SAR(10 g) = 0.042 W/kg
Maximum value of SAR (measured) = 0.362 W/kg



0 dB = 0.347 W/kg

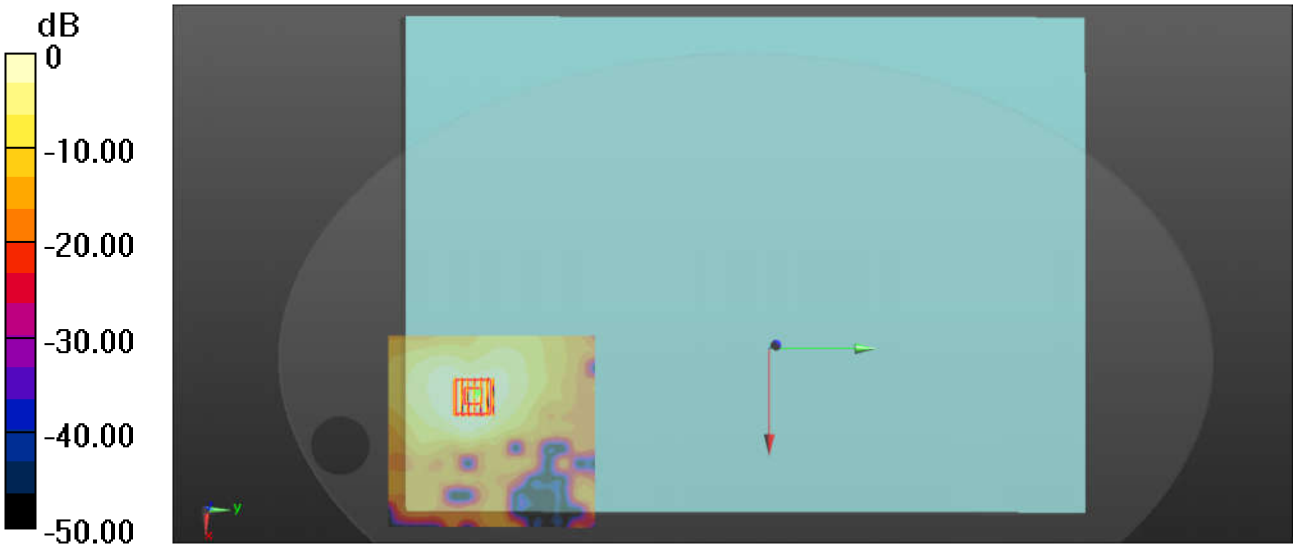
11_WLAN5.8GHz_802.11n-HT40 MCS0_Bottom of Laptop_0mm_Ch159_Ant2

Communication System: UID 0, WIFI (0); Frequency: 5795 MHz;Duty Cycle: 1:1.118
Medium: MSL_5750_170311 Medium parameters used: f = 5795 MHz; σ = 6.206 S/m; ε_r = 49.897; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(4.13, 4.13, 4.13); Calibrated: 2016.09.29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch159/Area Scan (121x131x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.345 W/kg

Ch159/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 1.003 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.609 W/kg
SAR(1 g) = 0.157 W/kg; SAR(10 g) = 0.069 W/kg
Maximum value of SAR (measured) = 0.346 W/kg



0 dB = 0.345 W/kg

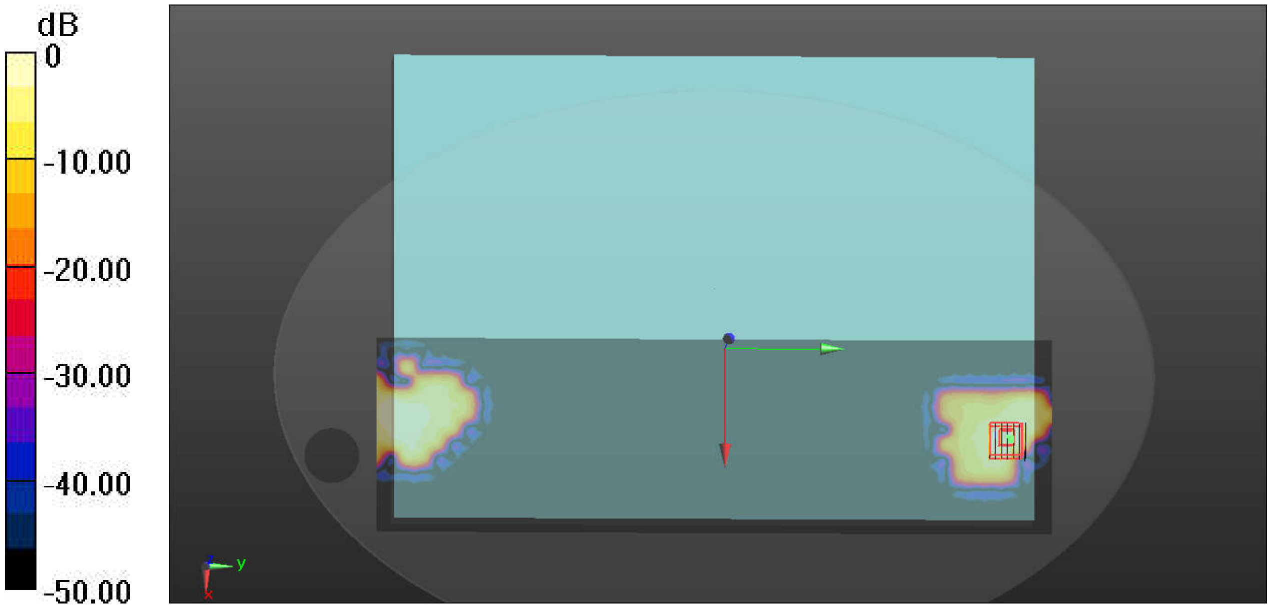
12_WLAN5.8GHz_802.11n-HT40 MCS0_Bottom of Laptop_0mm_Ch159_Ant1+2

Communication System: UID 0, WIFI (0); Frequency: 5795 MHz;Duty Cycle: 1:1.114
Medium: MSL_5750_170311 Medium parameters used: f = 5795 MHz; σ = 6.206 S/m; ε_r = 49.897; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3911; ConvF(3.95, 3.95, 3.95); Calibrated: 2016.09.29;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1338; Calibrated: 2016.11.22
- Phantom: ELI v5.0(Right); Type: QDOVA001BB; Serial: TP:1225
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch159/Area Scan (131x451x1): Interpolated grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.603 W/kg

Ch159/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 0 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 2.16 W/kg
SAR(1 g) = 0.178 W/kg; SAR(10 g) = 0.057 W/kg
Maximum value of SAR (measured) = 0.502 W/kg



0 dB = 0.603 W/kg

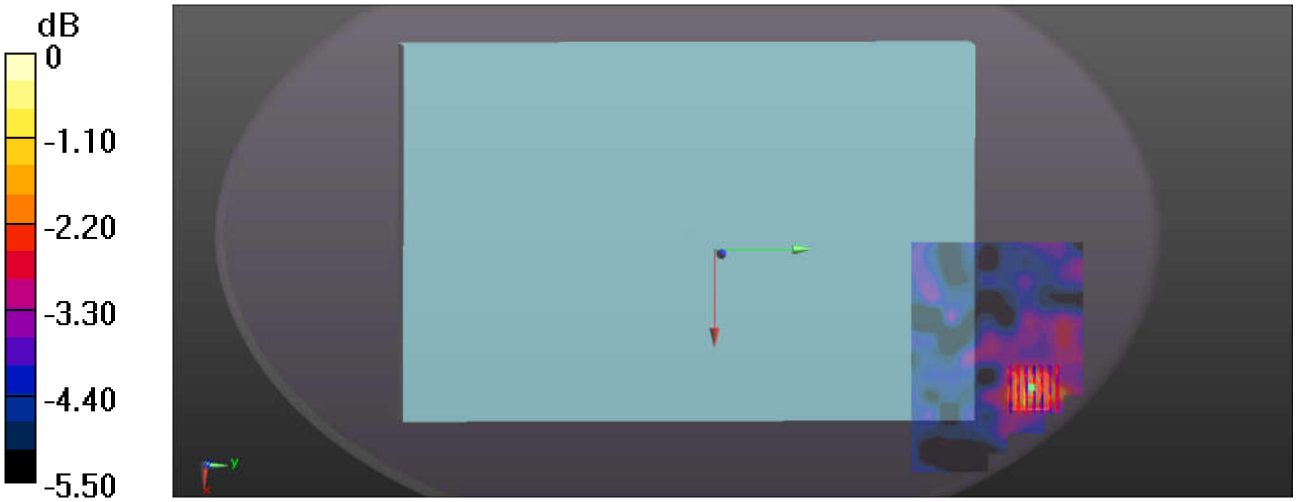
13_Bluetooth_1Mbps_Bottom_0mm_Ch39

Communication System: UID 0, Bluetooth (0); Frequency: 2441 MHz;Duty Cycle: 1:1.302
Medium: MSL_2450 Medium parameters used: f = 2441 MHz; σ = 1.929 S/m; ε_r = 51.64; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3954; ConvF(7.55, 7.55, 7.55); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1279; Calibrated: 2016.4.4
- Phantom: SAM3; Type: SAM; Serial: TP-1127
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch39/Area Scan (121x91x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0237 W/kg

Ch39/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.938 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.0280 W/kg
SAR(1 g) = 0.020 W/kg; SAR(10 g) = 0.015 W/kg
Maximum value of SAR (measured) = 0.0247 W/kg



0 dB = 0.0247 W/kg = -16.07 dBW/kg

Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

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国际互认
校准
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CNAS L0570

Client **Sporton-CN** **Certificate No: Z16-97231**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 840
Calibration Procedure(s)	FD-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	November 25, 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
Reference Probe EX3DV4	SN 7433	26-Sep-16(SPEAG,No.EX3-7433_Sep16)	Sep-17
DAE4	SN 771	02-Feb-16(CTTL-SPEAG,No.Z16-97011)	Feb-17
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-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: November 27, 2016

In Collaboration with
speag
CALIBRATION LABORATORY
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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,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 300MHz to 3GHz)", February 2005
c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
d) KDB865664, 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%.

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Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY52	52.8.8.1258
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	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	38.9 ± 6 %	1.79 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**54.0 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.33 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**25.3 mW /g ± 20.4 % (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	52.3 ± 6 %	1.97 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**50.9 mW /g ± 20.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.02 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**24.0 mW /g ± 20.4 % (k=2)**

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7Ω+ 5.54jΩ
Return Loss	- 24.9dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.8Ω+ 6.00jΩ
Return Loss	- 24.4dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.045 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

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DASY5 Validation Report for Head TSL Date: 11.25.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 840

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz; σ = 1.793 S/m; εr = 38.86; ρ = 1000 kg/m3

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.45, 7.45, 7.45); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

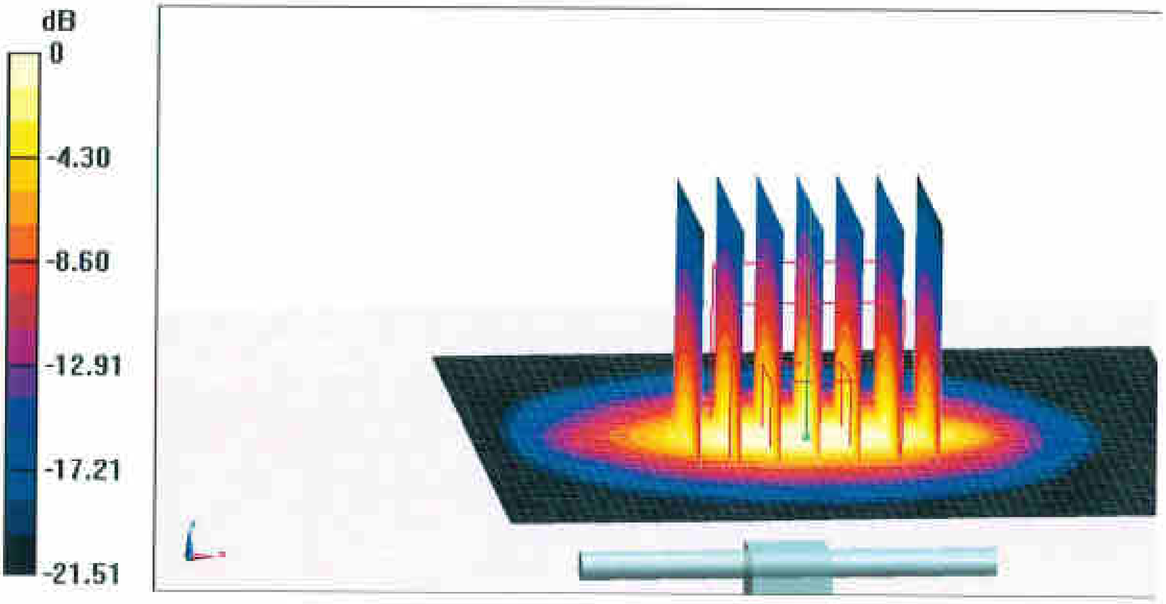
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 107.5 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 27.5 W/kg

SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.33 W/kg

Maximum value of SAR (measured) = 20.5 W/kg



0 dB = 20.5 W/kg = 13.12 dBW/kg

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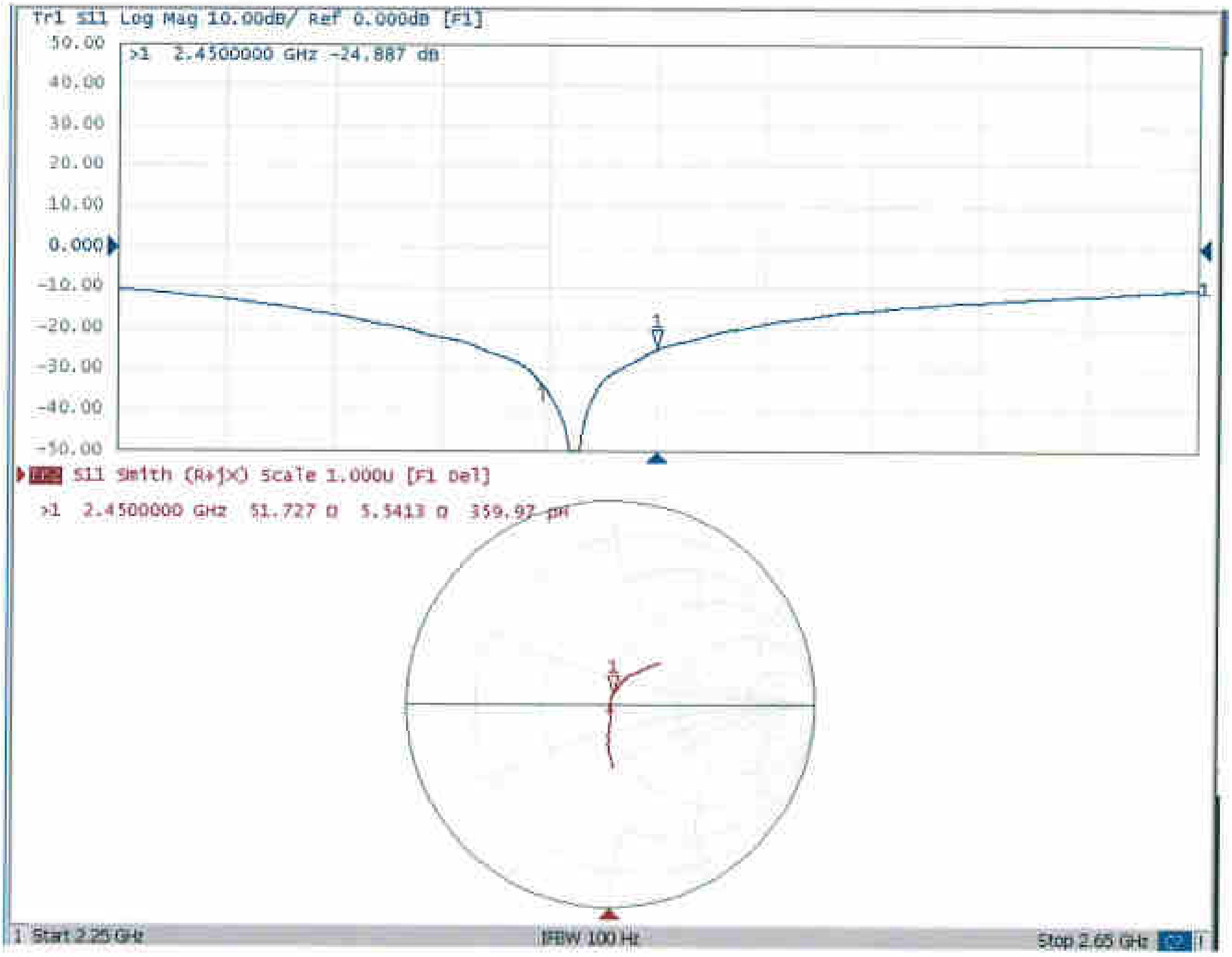
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 11.24.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 840

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz; σ = 1.966 S/m; ε_r = 52.29; ρ = 1000 kg/m^3

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.46, 7.46, 7.46); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

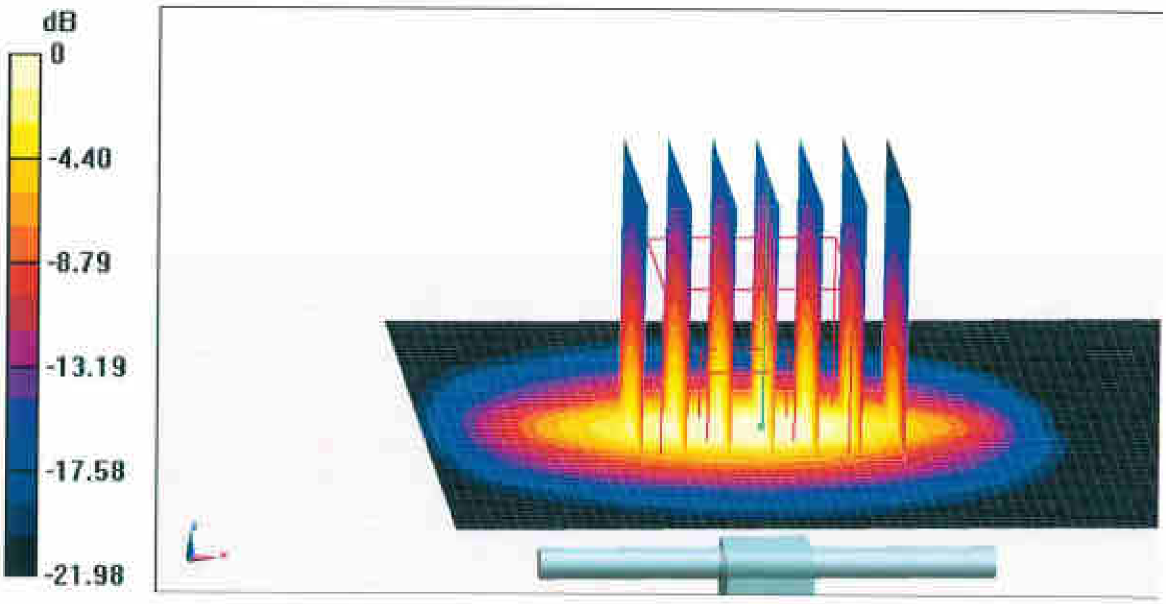
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.46 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 25.9 W/kg

SAR(1 g) = 12.8 W/kg; SAR(10 g) = 6.02 W/kg

Maximum value of SAR (measured) = 19.2 W/kg



0 dB = 19.2 W/kg = 12.83 dBW/kg

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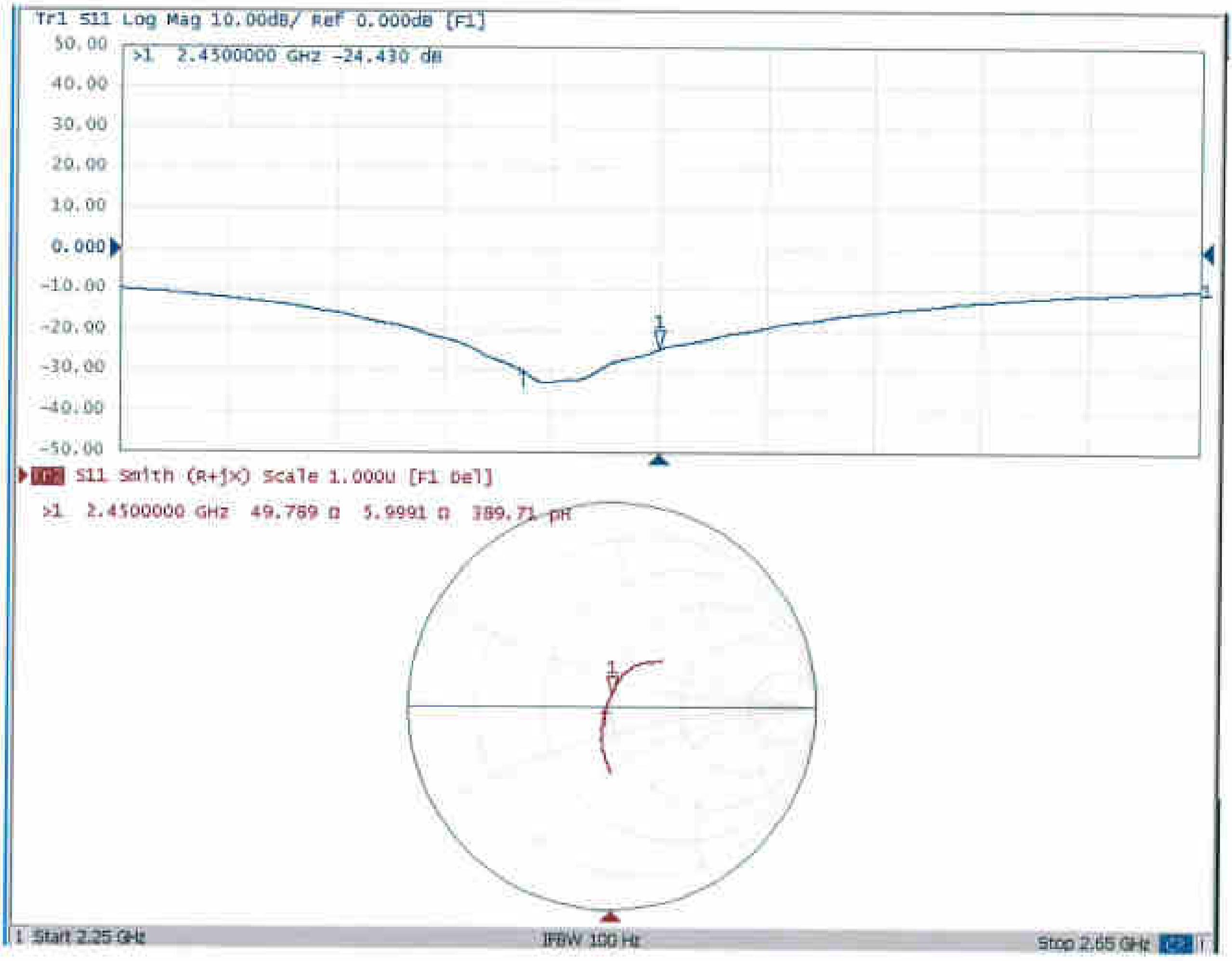
Impedance Measurement Plot for Body TSL



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

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

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

Accreditation No.: SCS 0108

Client **Sporton-SZ (Auden)**

Certificate No: D5GHzV2-1167_Jul16

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN:1167
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	July 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)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 3503	30-Jun-16 (No. EX3-3503_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

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

Issued: July 27, 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	34.4 ± 6 %	4.52 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	7.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.1 W/kg ± 19.9 % (k=2)**

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

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.9 ± 6 %	4.86 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	8.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.0 W / kg ± 19.9 % (k=2)**

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

Head TSL parameters at 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	33.7 ± 6 %	5.02 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	7.93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.4 W/kg ± 19.9 % (k=2)**

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

Body TSL parameters at 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	47.1 ± 6 %	5.42 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	7.64 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.1 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	46.5 ± 6 %	5.88 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	7.90 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**78.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.9 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	46.2 ± 6 %	6.11 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	7.65 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.1 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	46.9 Ω - 13.4 jΩ
Return Loss	- 17.0 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.9 Ω - 9.8 jΩ
Return Loss	- 19.9 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	53.9 Ω - 11.8 jΩ
Return Loss	- 18.5 dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	45.5 Ω - 11.0 jΩ
Return Loss	- 18.2 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	53.9 Ω - 8.9 jΩ
Return Loss	- 20.6 dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	52.7 Ω - 11.8 jΩ
Return Loss	- 18.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 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	October 30, 2013

DASY5 Validation Report for Head TSL

Date: 27.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1167

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 4.52 S/m; ε_r = 34.4; ρ = 1000 kg/m^3
Medium parameters used: f = 5600 MHz; σ = 4.86 S/m; ε_r = 33.9; ρ = 1000 kg/m^3
Medium parameters used: f = 5750 MHz; σ = 5.02 S/m; ε_r = 33.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.42, 5.42, 5.42); Calibrated: 30.06.2016, ConvF(4.89, 4.89, 4.89); Calibrated: 30.06.2016, ConvF(4.85, 4.85, 4.85); Calibrated: 30.06.2016;
- 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)

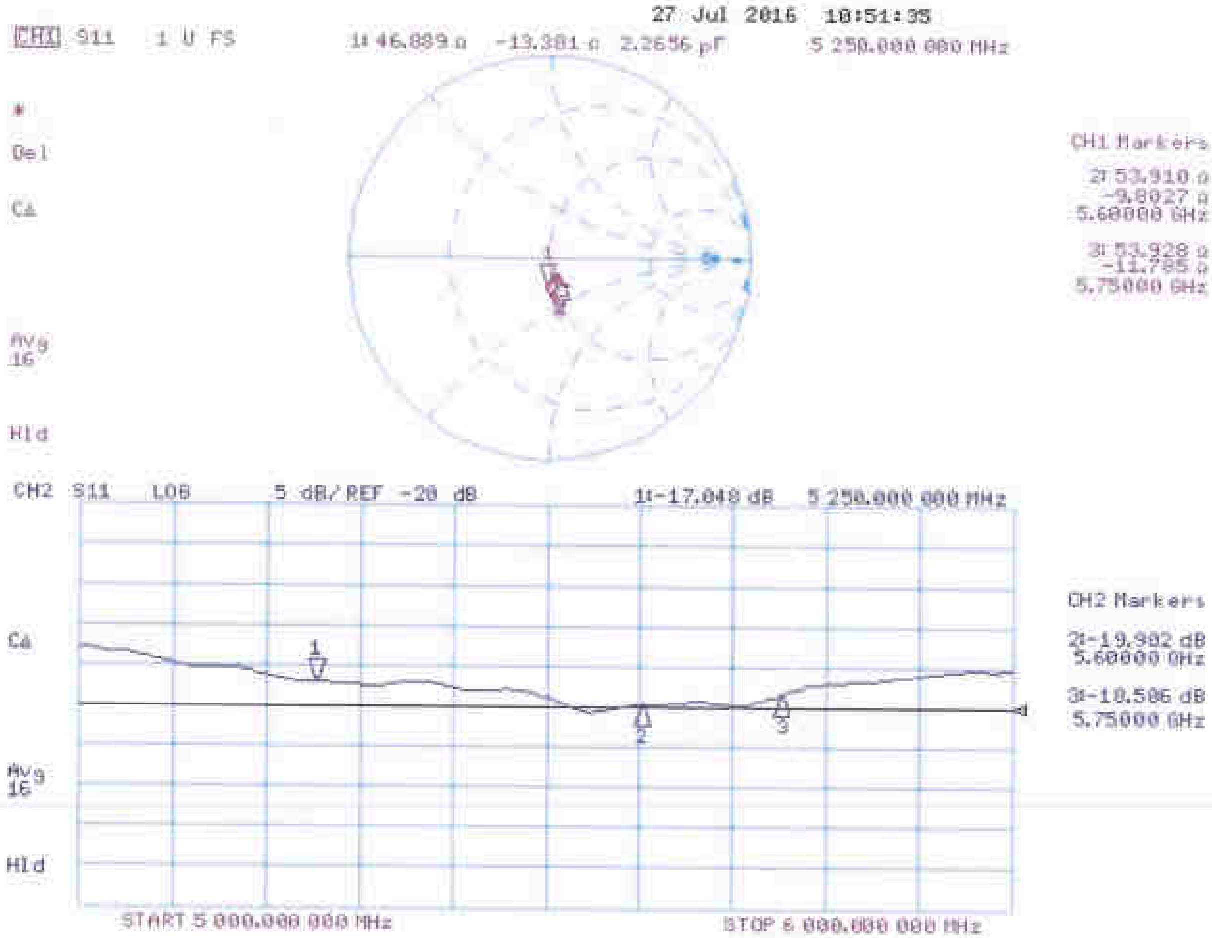
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 73.17 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 28.5 W/kg
SAR(1 g) = 7.79 W/kg; SAR(10 g) = 2.24 W/kg
Maximum value of SAR (measured) = 18.0 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 = 73.11 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 32.1 W/kg
SAR(1 g) = 8.19 W/kg; SAR(10 g) = 2.34 W/kg
Maximum value of SAR (measured) = 19.5 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 = 71.18 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 32.5 W/kg
SAR(1 g) = 7.93 W/kg; SAR(10 g) = 2.25 W/kg
Maximum value of SAR (measured) = 19.3 W/kg

0 dB = 19.3 W/kg = 12.86 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 26.07.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1167

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 5.42 S/m; ε_r = 47.1; ρ = 1000 kg/m^3
Medium parameters used: f = 5600 MHz; σ = 5.88 S/m; ε_r = 46.5; ρ = 1000 kg/m^3
Medium parameters used: f = 5750 MHz; σ = 6.11 S/m; ε_r = 46.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

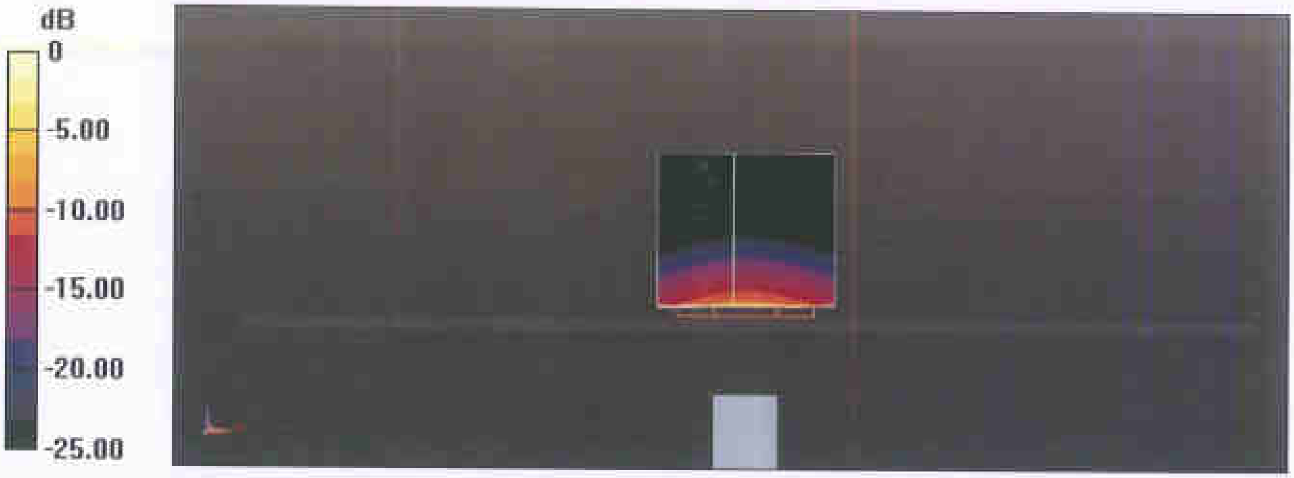
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.85, 4.85, 4.85); Calibrated: 30.06.2016, ConvF(4.35, 4.35, 4.35); Calibrated: 30.06.2016, ConvF(4.3, 4.3, 4.3); Calibrated: 30.06.2016;
- 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=5250MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 68.19 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 29.0 W/kg
SAR(1 g) = 7.64 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 17.7 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 = 68.01 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 32.7 W/kg
SAR(1 g) = 7.9 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 18.9 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 = 66.17 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 33.2 W/kg
SAR(1 g) = 7.65 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 18.6 W/kg



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

Impedance Measurement Plot for Body TSL