FCC SAR Test Report

APPLICANT	**: Lenovo(Shanghai) Electronics Technology Co., Ltd.**
EQUIPMENT	**: Portable Tablet Computer**
BRAND NAME	**: Lenovo**
MODEL NAME	**: Lenovo YT3-X90F**
FCC ID	**: O57YT3X90F**
STANDARD	**: FCC 47 CFR Part 2 (2.1093) ANSI/IEEE C95.1-1992 IEEE 1528-2013**

We, SPORTON INTERNATIONAL (KUNSHAN) 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 (KUNSHAN) INC., the test report shall not be reproduced except in full.

Reviewed by: Eric Huang / Deputy Manager

Approved by: Jones Tsai / Manager

Testing Laboratory
2627

SPORTON INTERNATIONAL (KUNSHAN) INC.
No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P. R. China

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA570804-01	Rev. 01	Initial issue of report	Sep. 02, 2015

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Lenovo(Shanghai) Electronics Technology Co., Ltd., Portable Tablet Computer, Lenovo YT3-X90F** are as follows.

Equipment Class	Frequency Band	Highest SAR Summary Body 1g SAR (W/kg) Gap(0cm)
DTS	WLAN 2.4GHz Band	1.29
NII	WLAN 5.2GHz Band	1.19
	WLAN 5.3GHz Band	1.17
	WLAN 5.5GHz Band	1.38
	WLAN 5.8GHz Band	**1.39**
DSS	Bluetooth	0.21
Date of Testing:		Aug. 12, 2015 ~ Aug. 15, 2015

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 (KUNSHAN) INC.
Test Site Location	No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P. R. China TEL: +86-0512-5790-0158 FAX: +86-0512-5790-0958

Applicant	
Company Name	Lenovo(Shanghai) Electronics Technology Co., Ltd.
Address	NO.68 BUILDING, 199 FENJU RD, China (Shanghai) Pilot Free Trade Zone, 200131, CHINA

Manufacturer	
Company Name	Lenovo PC HK Limited
Address	23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong

3. Guidance Standard

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 v01r01
- FCC KDB 447498 D01 General RF Exposure Guidance v05r02
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r01
- FCC KDB 616217 D04 SAR for laptop and tablets v01r01

4. Equipment Under Test (EUT)

4.1 General Information

Product Feature & Specification	
Equipment Name	Portable Tablet Computer
Brand Name	Lenovo
Model Name	Lenovo YT3-X90F
FCC ID	O57YT3X90F
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 ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	· 802.11b/g/n HT20 · 802.11a/n/ac HT20/HT40/VHT20/VHT40/VHT80 · Bluetooth v3.0+EDR，Bluetooth v4.1 LE
HW Version	LenovoPad YT3-X90F
SW Version	YT3-X90F_150714
EUT Stage	Identical Prototype

Remark:
1. This device has no voice function.
2. 802.11n-HT40 is not supported in 2.4GHz WLAN.
3. There are two types of EUT for this project. The differences between them are summary below, according to the differences, sample 1 full test and sample 2 verified the worse case SAR of sample 1.

4.2 Component List

Component	Sample 1	Sample 2
CPU	Intel_Z8500 Cherry Trail T4 Z8500,2.55 GHz Quad Core	Intel_ Z8500 Cherry Trail T4 Z8500,2.55 GHz Quad Core
BT/WIFI Module	Broadcom_BCM4356XKUBG BT/WIFI;BCM4356XKUBG;WLBGA192	Broadcom_ BCM4356XKUBG BT/WIFI;BCM4356XKUBG;WLBGA192
Flash	Samsung_K3QF1F1 0EM AGCE EMMC;KLMAG2WEPD-B031;16GB; FBGA153 LPDDR3;K3QF1F1 OEM-AGCE；1GB;1600Mbps	Toshiba & Micron_ ELPIDA FA164A2MA EMMC;THGBMFG7C2LBAIL;16GB;WFBGA153L PDDR3;EDF8164A3MA-GD-F-R;1GB;1600Mbps
LCM	AUO_B101QAN01 B101QAN01.0;10.1inch;IPS;2560x1600	Innolux_ P101SFA-AF0 P101SFA-AF0;10.1inch;IPS;2560x1600
TP	Ofilm_IST940E 152011 Yoga3 X10 _GFF TP MCF-101-2261	GIS_ S7813 5141 334 0037 ACFM727 YT3X10_GFF TC101GFL09V.B IST9400E
Front_camera	Sunny_F1521 CCM D5V13C 5M OV5693 COB 25PIN ZIF	Ofilm_ L5693F40 CCM L5693F40 5M OV5693 COB 25PIN ZIF
Back_camera	Sunny_F13M01D CCM F13M01D 13M AR1335 COB 30PIN BtoB	Ofilm_ L1335A00 CCM L1335A00 13M AR1335 COB 30PIN BtoB
Main Battery	SUNWODA_L15D2K32 L15D2K32	SCUD_ L15D2K32 L15D2K32
Ancillary Battery	SCUD_L15D1P31 L15D1P31	SUNWODA_ L15D1P31 L15D1P31

4.3 Maximum Tune-up Limit

Mode			Maximum Average Power (dBm)
2.4GHz	802.11b	Chain Port 1	16.20
		Chain Port 2	17.50
	802.11g	Chain Port 1	15.80
		Chain Port 2	17.00
	802.11n HT20	Chain Port 1	15.00
		Chain Port 2	15.50
		Chain Port 1+2	18.00
5.2GHz	802.11a	Chain Port 1	14.50
		Chain Port 2	15.20
	802.11n HT20	Chain Port 1	14.00
		Chain Port 2	14.50
		Chain Port 1+2	15.50
	802.11n HT40	Chain Port 1	13.00
		Chain Port 2	13.00
		Chain Port 1+2	15.00
	802.11ac-VHT20	Chain Port 1	13.00
		Chain Port 2	13.00
		Chain Port 1+2	15.50
	802.11ac-VHT40	Chain Port 1	13.00
		Chain Port 2	13.00
		Chain Port 1+2	15.50
	802.11ac-VHT80	Chain Port 1	13.00
		Chain Port 2	13.00
		Chain Port 1+2	15.50
5.3GHz	802.11a	Chain Port 1	14.00
		Chain Port 2	15.00
	802.11n HT20	Chain Port 1	14.00
		Chain Port 2	14.00
		Chain Port 1+2	15.50
	802.11n HT40	Chain Port 1	12.50
		Chain Port 2	13.00
		Chain Port 1+2	15.00
	802.11ac-VHT20	Chain Port 1	12.50
		Chain Port 2	12.50
		Chain Port 1+2	15.00
	802.11ac-VHT40	Chain Port 1	12.50
		Chain Port 2	13.00
		Chain Port 1+2	15.00
	802.11ac-VHT80	Chain Port 1	12.50
		Chain Port 2	12.50
		Chain Port 1+2	15.00

Mode			Maximum Average Power (dBm)
5.5GHz	802.11a	Chain Port 1	13.50
		Chain Port 2	13.00
	802.11n HT20	Chain Port 1	12.00
		Chain Port 2	12.50
		Chain Port 1+2	16.20
	802.11n HT40	Chain Port 1	12.00
		Chain Port 2	12.50
		Chain Port 1+2	15.50
	802.11ac-VHT20	Chain Port 1	11.50
		Chain Port 2	11.50
		Chain Port 1+2	15.00
	802.11ac-VHT40	Chain Port 1	11.50
		Chain Port 2	12.50
		Chain Port 1+2	15.00
	802.11ac-VHT80	Chain Port 1	10.50
		Chain Port 2	12.00
		Chain Port 1+2	15.00
5.8GHz	802.11a	Chain Port 1	11.30
		Chain Port 2	14.00
	802.11n HT20	Chain Port 1	10.00
		Chain Port 2	13.30
		Chain Port 1+2	14.50
	802.11n HT40	Chain Port 1	10.50
		Chain Port 2	12.00
		Chain Port 1+2	14.00
	802.11ac-VHT20	Chain Port 1	10.50
		Chain Port 2	12.00
		Chain Port 1+2	14.00
	802.11ac-VHT40	Chain Port 1	10.50
		Chain Port 2	12.00
		Chain Port 1+2	14.00
	802.11ac-VHT80	Chain Port 1	10.50
		Chain Port 2	12.00
		Chain Port 1+2	14.00
Bluetooth v3.0+EDR			10.00
Bluetooth v4.1 LE			7.50

5. Proximity Sensor Triggering Test

6. RF Exposure Limits

6.1 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.

6.2 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

1. 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.

7. Specific Absorption Rate (SAR)

7.1 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.

7.2 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:

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

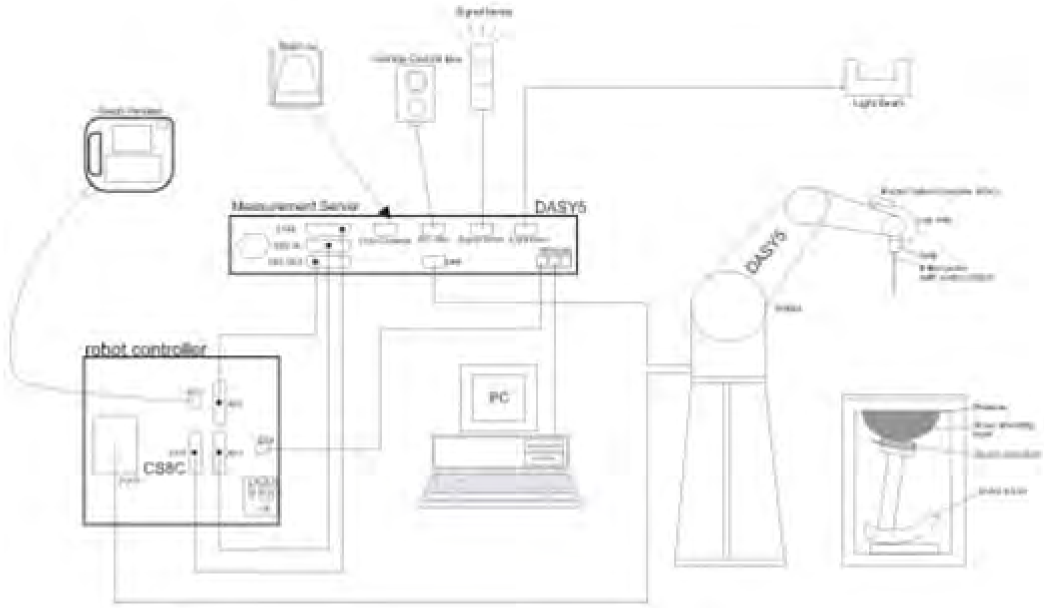
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

8. 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.

9. 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) Engineering software 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

9.1 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

9.2 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.

9.3 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.	

9.4 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.

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

9.5 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.

9.6 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.

10. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	2450MHz System Validation Kit	D2450V2	840	Nov. 19, 2014	Nov. 18, 2015
SPEAG	5000MHz System Validation Kit	D5GHzV2	1113	Nov. 24, 2014	Nov. 23, 2015
SPEAG	Data Acquisition Electronics	DAE4	1210	May 21, 2015	May 20, 2016
SPEAG	Dosimetric E-Field Probe	EX3DV4	3857	May 28, 2015	May 27, 2016
SPEAG	ELI4 Phantom	QD OVA 001 BB	TP-1079	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Agilent	ENA Series Network Analyzer	E5071C	MY46111157	May 04, 2015	May 03, 2016
Agilent	Dielectric Probe Kit	85070E	MY44300475	NCR	NCR
R&S	Signal Generator	SMBV100A	258305	Jan. 23, 2015	Jan. 22, 2016
Anritsu	Power Senor	MA2411B	0917070	Jan. 23, 2015	Jan. 22, 2016
Anritsu	Power Meter	ML2495A	1005002	Jan. 23, 2015	Jan. 22, 2016
Anritsu	Power Senor	MA2411B	1339163	Jan. 23, 2015	Jan. 22, 2016
Anritsu	Power Meter	ML2495A	1435004	Jan. 23, 2015	Jan. 22, 2016
ARRA	Power Divider	A3200-2	N/A	NA	NA
R&S	CBT BLUETOOTH TESTER	CBT	100783	Aug. 10, 2015	Aug. 09, 2016
R&S	Spectrum Analyzer	FSP40	100319	Oct. 28, 2014	Oct. 27, 2015
Agilent	Dual Directional Coupler	778D	50422	Note 1	
Woken	Attenuator	WK0602-XX	N/A	Note 1	
PE	Attenuator	PE7005-10	N/A	Note 1	
PE	Attenuator	PE7005- 3	N/A	Note 1	
AR	Power Amplifier	5S1G4M2	0328767	Note 1	
Mini-Circuits	Power Amplifier	ZVE-3W	162601250	Note 1	
Mini-Circuits	Power Amplifier	ZHL-42W+	13440021344	Note 1	

General 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.

11. System Verification

11.1 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	22.8	1.940	51.413	1.95	52.7	-0.51	-2.44	±5	Aug. 12, 2015
5200	Body	22.9	5.287	48.755	5.30	49	-0.25	-0.50	±5	Aug. 13, 2015
5300	Body	22.9	5.429	48.560	5.42	48.9	0.17	-0.70	±5	Aug. 13, 2015
5600	Body	22.7	5.860	47.892	5.77	48.5	1.56	-1.25	±5	Aug. 14, 2015
5800	Body	22.7	6.120	47.381	6.00	48.2	2.00	-1.70	±5	Aug. 15, 2015

11.2 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 (%)
Aug. 12, 2015	2450	Body	250	840	3857	1210	12	51	48	-5.88
Aug. 13, 2015	5200	Body	100	1113	3857	1210	7.42	74.9	74.2	-0.93
Aug. 13, 2015	5300	Body	100	1113	3857	1210	7.29	77.8	72.9	-6.30
Aug. 14, 2015	5600	Body	100	1113	3857	1210	7.68	81.5	76.8	-5.77
Aug. 15, 2015	5800	Body	100	1113	3857	1210	7.3	75.4	73	-3.18

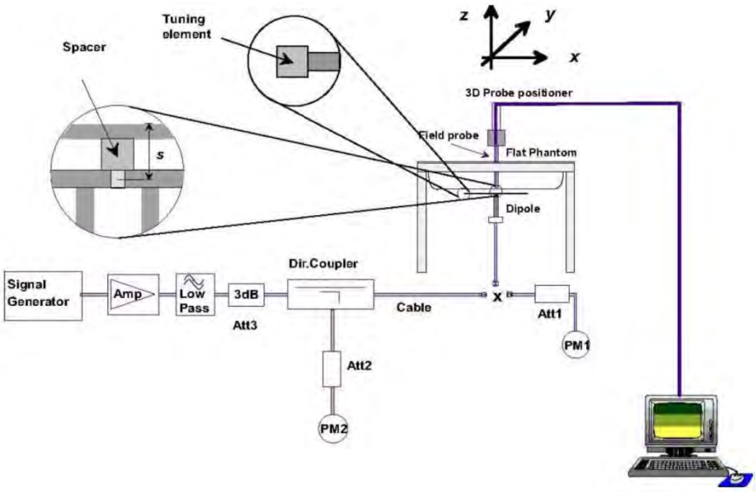


Fig 8.3.1 System Performance Check Setup

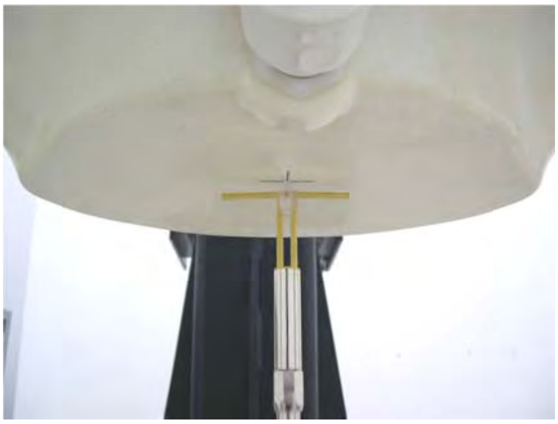


Fig 8.3.2 Setup Photo

12. RF Exposure Positions

12.1 SAR Testing for Tablet

This device can be used also in full sized tablet exposure conditions, due to its size. Per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR exclusion threshold in KDB 447498 D01v05r02 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

13. Conducted RF Output Power (Unit: dBm)

<WLAN Conducted Power>

General Note:

1. For WLAN SAR testing was performed on single antenna RF power in SISO mode is larger or equal to the single antenna RF power in MIMO mode, and for RF exposure assessment of MIMO mode simultaneous transmission exclusion analysis was performed with SAR test results of each antenna in SISO mode.
2. Per KDB 248227 D01v02r01, 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.
3. 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).
4. 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.
5. 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 Antenna 1>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN Antenna 1	802.11b	CH 1	2412	1Mbps	15.79	16.20	98.86
		CH 6	2437		15.73	16.20	
		CH 11	2462		15.94	16.20	
	802.11g	CH 1	2412	6Mbps	15.62	15.80	93.64
		CH 6	2437		15.48	15.80	
		CH 11	2462		15.55	15.80	
	802.11n-HT20	CH 1	2412	MCS0	14.13	15.00	95.28
		CH 6	2437		14.12	15.00	
		CH 11	2462		13.87	15.00	

<2.4GHz WLAN Antenna 2>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN Antenna 2	802.11b	CH 1	2412	1Mbps	17.03	17.50	98.86
		CH 6	2437		16.84	17.50	
		CH 11	2462		16.72	17.50	
	802.11g	CH 1	2412	6Mbps	16.81	17.00	93.64
		CH 6	2437		16.66	17.00	
		CH 11	2462		16.51	17.00	
	802.11n-HT20	CH 1	2412	MCS0	15.05	15.50	95.28
		CH 6	2437		14.84	15.50	
		CH 11	2462		14.43	15.50	

<2.4GHz WLAN Antenna 1+2>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN Antenna 1+2	802.11n-HT20	CH 1	2412	MCS0	17.65	18.00	91.38
		CH 6	2437		17.36	18.00	
		CH 11	2462		17.30	18.00	

<5.2GHz WLAN Antenna 1>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN Antenna 1	802.11a	CH 36	5180	6Mbps	14.33	14.50	92.86
		CH 40	5200		14.25	14.50	
		CH 44	5220		14.27	14.50	
		CH 48	5240		14.36	14.50	
	802.11n-HT20	CH 36	5180	MCS0	13.68	14.00	95.05
		CH 40	5200		13.65	14.00	
		CH 44	5220		13.74	14.00	
		CH 48	5240		13.90	14.00	
	802.11n-HT40	CH 38	5190	MCS0	12.49	13.00	90.38
		CH 46	5230		12.42	13.00	
	802.11ac-VHT20	CH 36	5180	MCS0	12.06	13.00	95.20
		CH 40	5200		11.82	13.00	
		CH 44	5220		11.93	13.00	
		CH 48	5240		11.86	13.00	
	802.11ac-VHT40	CH 38	5190	MCS0	12.50	13.00	87.22
		CH 46	5230		12.40	13.00	
	802.11ac-VHT80	CH 42	5210	MCS0	11.55	13.00	77.17

<5.2GHz WLAN Antenna 2>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN Antenna 2	802.11a	CH 36	5180	6Mbps	14.91	15.20	92.86
		CH 40	5200		14.92	15.20	
		CH 44	5220		14.93	15.20	
		CH 48	5240		14.97	15.20	
	802.11n-HT20	CH 36	5180	MCS0	13.56	14.50	95.05
		CH 40	5200		13.53	14.50	
		CH 44	5220		13.75	14.50	
		CH 48	5240		14.00	14.50	
	802.11n-HT40	CH 38	5190	MCS0	12.59	13.00	90.38
		CH 46	5230		12.58	13.00	
	802.11ac-VHT20	CH 36	5180	MCS0	12.28	13.00	95.20
		CH 40	5200		11.98	13.00	
		CH 44	5220		12.04	13.00	
		CH 48	5240		12.15	13.00	
	802.11ac-VHT40	CH 38	5190	MCS0	12.63	13.00	87.22
		CH 46	5230		12.44	13.00	
	802.11ac-VHT80	CH 42	5210	MCS0	12.01	13.00	77.17

<u><5.2GHz WLAN Antenna 1+2></u>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN Antenna 1+2	802.11n-HT20	CH 36	5180	MCS0	15.24	15.50	90.68
		CH 40	5200		15.10	15.50	
		CH 44	5220		15.14	15.50	
		CH 48	5240		15.12	15.50	
	802.11n-HT40	CH 38	5190	MCS0	14.78	15.00	82.78
		CH 46	5230		14.65	15.00	
	802.11ac-VHT20	CH 36	5180	MCS0	15.22	15.50	87.48
		CH 40	5200		15.02	15.50	
		CH 44	5220		15.04	15.50	
		CH 48	5240		14.88	15.50	
	802.11ac-VHT40	CH 38	5190	MCS0	15.13	15.50	87.31
		CH 46	5230		14.91	15.50	
	802.11ac-VHT80	CH 42	5210	MCS0	14.65	15.50	66.44

<5.3GHz WLAN Antenna 1>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.3GHz WLAN Antenna 1	802.11a	CH 52	5260	6Mbps	13.29	14.00	92.86
		CH 56	5280		13.18	14.00	
		CH 60	5300		12.99	14.00	
		CH 64	5320		13.06	14.00	
	802.11n-HT20	CH 52	5260	MCS0	13.57	14.00	95.05
		CH 56	5280		13.54	14.00	
		CH 60	5300		13.67	14.00	
		CH 64	5320		13.49	14.00	
	802.11n-HT40	CH 54	5270	MCS0	11.99	12.50	90.38
		CH 62	5310		11.87	12.50	
	802.11ac-VHT20	CH 52	5260	MCS0	11.75	12.50	95.20
		CH 56	5280		11.57	12.50	
		CH 60	5300		11.62	12.50	
		CH 64	5320		11.64	12.50	
	802.11ac-VHT40	CH 54	5270	MCS0	12.22	12.50	87.22
		CH 62	5310		12.04	12.50	
	802.11ac-VHT80	CH 58	5290	MCS0	11.04	12.50	77.17

<u><5.3GHz WLAN Antenna 2></u>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.3GHz WLAN Antenna 2	802.11a	CH 52	5260	6Mbps	14.81	15.00	92.86
		CH 56	5280		14.43	15.00	
		CH 60	5300		14.39	15.00	
		CH 64	5320		14.58	15.00	
	802.11n-HT20	CH 52	5260	MCS0	13.69	14.00	95.05
		CH 56	5280		13.61	14.00	
		CH 60	5300		13.71	14.00	
		CH 64	5320		13.45	14.00	
	802.11n-HT40	CH 54	5270	MCS0	12.51	13.00	90.38
		CH 62	5310		12.35	13.00	
	802.11ac-VHT20	CH 52	5260	MCS0	11.98	12.50	95.20
		CH 56	5280		11.51	12.50	
		CH 60	5300		11.56	12.50	
		CH 64	5320		11.75	12.50	
	802.11ac-VHT40	CH 54	5270	MCS0	12.48	13.00	87.22
		CH 62	5310		12.43	13.00	
	802.11ac-VHT80	CH 58	5290	MCS0	11.89	12.50	77.17

<5.3GHz WLAN Antenna 1+2>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.3GHz WLAN Antenna 1+2	802.11n-HT20	CH 52	5260	MCS0	14.93	15.50	90.68
		CH 56	5280		14.81	15.50	
		CH 60	5300		14.95	15.50	
		CH 64	5320		14.92	15.50	
	802.11n-HT40	CH 54	5270	MCS0	14.37	15.00	82.78
		CH 62	5310		14.31	15.00	
	802.11ac-VHT20	CH 52	5260	MCS0	14.72	15.00	87.48
		CH 56	5280		14.49	15.00	
		CH 60	5300		14.51	15.00	
		CH 64	5320		14.47	15.00	
	802.11ac-VHT40	CH 54	5270	MCS0	14.80	15.00	87.31
		CH 62	5310		14.67	15.00	
	802.11ac-VHT80	CH 58	5290	MCS0	14.43	15.00	66.44

<5.5GHz WLAN Antenna 1>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.5GHz WLAN Antenna 1	802.11a	CH 100	5500	6Mbps	12.99	13.50	92.86
		CH 116	5580		12.85	13.50	
		CH 124	5620		12.57	13.50	
		CH 132	5660		12.54	13.50	
		CH 140	5700		12.38	13.50	
	802.11n-HT20	CH 100	5500	MCS0	11.86	12.00	95.05
		CH 116	5580		11.09	12.00	
		CH 124	5620		11.28	12.00	
		CH 132	5660		11.30	12.00	
		CH 140	5700		11.47	12.00	
	802.11n-HT40	CH 102	5510	MCS0	11.50	12.00	90.38
		CH 110	5550		11.42	12.00	
		CH 126	5630		10.61	12.00	
		CH 134	5670		10.65	12.00	
	802.11ac-VHT20	CH 100	5500	MCS0	10.95	11.50	95.20
		CH 116	5580		10.19	11.50	
		CH 124	5620		10.21	11.50	
		CH 132	5660		10.20	11.50	
		CH 140	5700		10.42	11.50	
	802.11ac-VHT40	CH 102	5510	MCS0	11.28	11.50	87.22
		CH 110	5550		10.97	11.50	
		CH 126	5630		10.72	11.50	
		CH 134	5670		10.60	11.50	
	802.11ac-VHT80	CH 106	5530	MCS0	10.10	10.50	77.17
		CH 122	5610		9.83	10.50	

<5.5GHz WLAN Antenna 2>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.5GHz WLAN Antenna 2	802.11a	CH 100	5500	6Mbps	12.76	13.00	92.86
		CH 116	5580		12.58	13.00	
		CH 124	5620		12.52	13.00	
		CH 132	5660		12.47	13.00	
		CH 140	5700		12.40	13.00	
	802.11n-HT20	CH 100	5500	MCS0	12.20	12.50	95.05
		CH 116	5580		11.74	12.50	
		CH 124	5620		11.52	12.50	
		CH 132	5660		11.47	12.50	
		CH 140	5700		11.69	12.50	
	802.11n-HT40	CH 102	5510	MCS0	12.06	12.50	90.38
		CH 110	5550		11.98	12.50	
		CH 126	5630		11.56	12.50	
		CH 134	5670		11.42	12.50	
	802.11ac-VHT20	CH 100	5500	MCS0	11.30	11.50	95.20
		CH 116	5580		11.25	11.50	
		CH 124	5620		10.98	11.50	
		CH 132	5660		10.81	11.50	
		CH 140	5700		10.78	11.50	
	802.11ac-VHT40	CH 102	5510	MCS0	12.42	12.50	87.22
		CH 110	5550		12.37	12.50	
		CH 126	5630		12.29	12.50	
		CH 134	5670		12.35	12.50	
	802.11ac-VHT80	CH 106	5530	MCS0	11.49	12.00	77.17
		CH 122	5610		11.48	12.00	

<5.5GHz WLAN Antenna 1+2>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.5GHz WLAN Antenna 1+2	802.11n-HT20	CH 100	5500	MCS0	16.06	16.20	90.68
		CH 116	5580		15.67	16.20	
		CH 124	5620		15.47	16.20	
		CH 132	5660		15.56	16.20	
		CH 140	5700		15.61	16.20	
	802.11n-HT40	CH 102	5510	MCS0	15.00	15.50	82.78
		CH 110	5550		14.92	15.50	
		CH 126	5630		14.36	15.50	
		CH 134	5670		14.29	15.50	
	802.11ac-VHT20	CH 100	5500	MCS0	14.43	15.00	87.48
		CH 116	5580		14.17	15.00	
		CH 124	5620		13.98	15.00	
		CH 132	5660		13.85	15.00	
		CH 140	5700		13.98	15.00	
	802.11ac-VHT40	CH 102	5510	MCS0	14.54	15.00	87.31
		CH 110	5550		14.42	15.00	
		CH 126	5630		14.37	15.00	
		CH 134	5670		14.49	15.00	
	802.11ac-VHT80	CH 106	5530	MCS0	13.77	15.00	66.44
		CH 122	5610		13.62	15.00	

<5.8GHz WLAN Antenna 1>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN Antenna 1	802.11a	CH 149	5745	MCS0	11.15	11.30	92.86
		CH 157	5785		11.02	11.30	
		CH 165	5825		11.07	11.30	
	802.11n-HT20	CH 149	5745	MCS0	9.64	10.00	95.05
		CH 157	5785		9.61	10.00	
		CH 165	5825		9.45	10.00	
	802.11n-HT40	CH 151	5755	MCS0	10.35	10.50	90.38
		CH 159	5795		10.44	10.50	
	802.11ac-VHT20	CH 149	5745	MCS0	10.45	10.50	95.20
		CH 157	5785		10.33	10.50	
		CH 165	5825		10.44	10.50	
	802.11ac-VHT40	CH 151	5755	MCS0	10.48	10.50	87.22
		CH 159	5795		10.41	10.50	
	802.11ac-VHT80	CH 155	5775	MCS0	10.31	10.50	77.17

<5.8GHz WLAN Antenna 2>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN Antenna 2	802.11a	CH 149	5745	MCS0	13.69	14.00	92.86
		CH 157	5785		13.70	14.00	
		CH 165	5825		13.68	14.00	
	802.11n-HT20	CH 149	5745	MCS0	13.26	13.30	95.05
		CH 157	5785		13.20	13.30	
		CH 165	5825		12.89	13.30	
	802.11n-HT40	CH 151	5755	MCS0	11.72	12.00	90.38
		CH 159	5795		11.73	12.00	
	802.11ac-VHT20	CH 149	5745	MCS0	11.30	12.00	95.20
		CH 157	5785		11.27	12.00	
		CH 165	5825		10.37	12.00	
	802.11ac-VHT40	CH 151	5755	MCS0	11.89	12.00	87.22
		CH 159	5795		11.84	12.00	
	802.11ac-VHT80	CH 155	5775	MCS0	11.29	12.00	77.17

<u><5.8GHz WLAN Antenna 1+2></u>

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN Antenna 1+2	802.11n-HT20	CH 149	5745	MCS0	14.38	14.50	90.68
		CH 157	5785		13.99	14.50	
		CH 165	5825		13.95	14.50	
	802.11n-HT40	CH 151	5755	MCS0	13.51	14.00	82.78
		CH 159	5795		13.66	14.00	
	802.11ac-VHT20	CH 149	5745	MCS0	13.85	14.00	87.48
		CH 157	5785		13.98	14.00	
		CH 165	5825		13.90	14.00	
	802.11ac-VHT40	CH 151	5755	MCS0	13.95	14.00	87.31
		CH 159	5795		13.94	14.00	
	802.11ac-VHT80	CH 155	5775	MCS0	13.97	14.00	66.44

<2.4GHz Bluetooth>

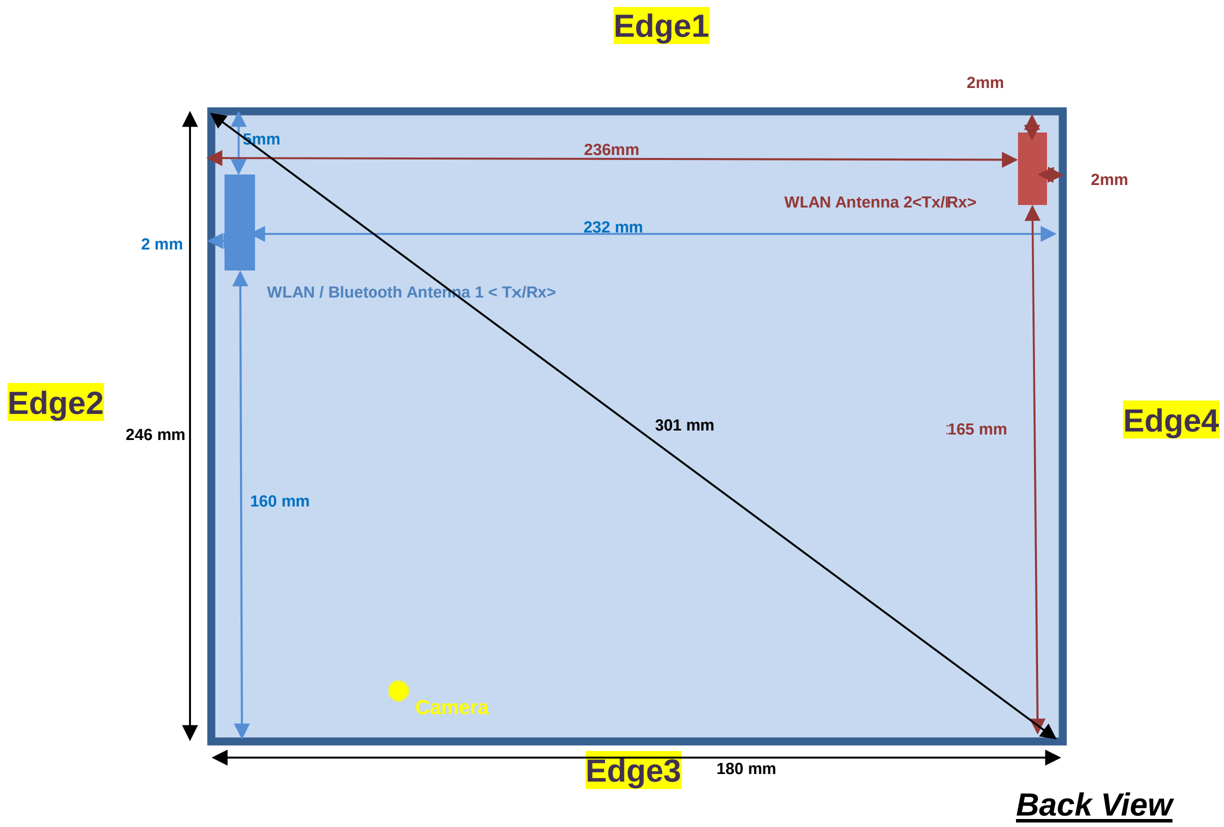
General Note:

1. For 2.4GHz Bluetooth SAR testing was selected 1Mbps, due to its highest average power.
2. The duty factor is selected theoretical 83.3% perform Bluetooth SAR testing.

Mode	Channel	Frequency (MHz)	Average power (dBm)		
			1Mbps	2Mbps	3Mbps
v3.0 with EDR	CH 00	2402	8.79	6.23	6.24
	CH 39	2441	**9.34**	6.99	6.99
	CH 78	2480	9.08	7.15	7.14

Mode	Channel	Frequency (MHz)	Average power (dBm)
			GFSK
v4.1 with LE	CH 00	2402	6.17
	CH 19	2440	7.00
	CH 39	2480	**7.17**

14. Antenna Location



<Transmission configuration>

Wireless Interface	SISO Mode		MIMO Mode
	Antenna 1 <Tx/Rx>	Antenna 2 <Tx/Rx>	Antenna 1+2 <Tx/Rx>
WLAN 2.4GHz 802.11b/g	yes	yes	
WLAN 2.4GHz 802.11n HT20	yes	yes	yes
WLAN 5GHz 802.11a	yes	yes	
WLAN 5GHz 802.11n HT20/ HT40	yes	yes	yes
Bluetooth	yes		

General Note:

1. The below table, when the distance is < 50 mm exclusion threshold is "Ratio", when the distance is > 50 mm exclusion threshold is "mW"
2. Maximum power is the source-based time-average power and represents the maximum RF output power among production units
3. Per KDB 447498 D01v05r02, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
4. Per KDB 447498 D01v05r02, standalone SAR test exclusion threshold is applied; If the test separation distance is < 5mm, 5mm is used to determine SAR exclusion threshold.
5. Per KDB 447498 D01v05r02, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:
   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison
6. Per KDB 447498 D01v05r02, at 100 MHz to 6 GHz and for *test separation distances* > 50 mm, the SAR test exclusion threshold is determined according to the following
   a) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz
   b) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

SAR test exclusion table distance is ≤ 50mm

Exposure Position	Wireless Interface	WLAN 2.4GHz 802.11b Ant.1	WLAN 5.2GHz 802.11a Ant.1	WLAN 5.3GHz 802.11a Ant.1	WLAN 5.5GHz 802.11a Ant.1	WLAN 5.8GHz 802.11a Ant.1	Bluetooth Tablet	WLAN 2.4GHz 802.11b Ant.2	WLAN 5.2GHz 802.11a Ant.2	WLAN 5.3GHz 802.11a Ant.2	WLAN 5.5GHz 802.11a Ant.2	WLAN 5.8GHz 802.11a Ant.2
	Calculated Frequency (MHz)	2462	5240	5320	5700	5825	2480	2462	5240	5320	5700	5825
	Tune-up Maximum power (dBm)	16.2	14.5	14.0	13.5	11.3	10.0	17.5	15.2	15.0	13.0	14.0
	Tune-up Maximum rated power (mW)	42	28	25	22	13	10	56	33	32	20	25
Bottom Face	Antenna to user (mm)	0						0				
	SAR exclusion threshold	13.2	12.8	11.5	10.5	6.3	3.2	17.6	15.9	15.5	9.7	12.1
	SAR testing required?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Edge 1	Antenna to user (mm)	5						2				
	SAR exclusion threshold	13.2	12.8	11.5	10.5	6.3	3.2	17.6	15.9	15.5	9.7	12.1
	SAR testing required?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Edge 2	Antenna to user (mm)	2										
	SAR exclusion threshold	13.2	12.8	11.5	10.5	6.3	3.2					
	SAR testing required?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**					
Edge 4	Antenna to user (mm)							2				
	SAR exclusion threshold							17.6	15.9	15.5	9.7	12.1
	SAR testing required?							**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

SAR test exclusion table distance is > 50mm

Exposure Position	Wireless Interface	WLAN 2.4GHz 802.11b Ant.1	WLAN 5.2GHz 802.11a Ant.1	WLAN 5.3GHz 802.11a Ant.1	WLAN 5.5GHz 802.11a Ant.1	WLAN 5.8GHz 802.11a Ant.1	Bluetooth Tablet	WLAN 2.4GHz 802.11b Ant.2	WLAN 5.2GHz 802.11a Ant.2	WLAN 5.3GHz 802.11a Ant.2	WLAN 5.5GHz 802.11a Ant.2	WLAN 5.8GHz 802.11a Ant.2
	Calculated Frequency (MHz)	2462	5240	5320	5700	5825	2480	2462	5240	5320	5700	5825
	Tune-up Maximum power (dBm)	16.2	14.5	14.0	13.5	11.3	10.0	17.5	15.2	15.0	13.0	14.0
	Tune-up Maximum rated power (mW)	42	28	25	22	13	10	56	33	32	20	25
Edge 1	Antenna to user (mm)											
	SAR exclusion threshold											
	SAR testing required?											
Edge 2	Antenna to user (mm)							236				
	SAR exclusion threshold							1956	1922	1922	1922	1922
	SAR testing required?							No	No	No	No	No
Edge 3	Antenna to user (mm)	160						165				
	SAR exclusion threshold	1196	1166	1165	1163	1162	1195	1246	1212	1212	1212	1212
	SAR testing required?	No	No	No	No	No	No	No	No	No	No	No
Edge 4	Antenna to user (mm)	232										
	SAR exclusion threshold	1916	1886	1885	1883	1882	1915					
	SAR testing required?	No	No	No	No	No	No					

15. SAR Test Results

General Note:

1. Per KDB 447498 D01v05r02, 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: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v05r02, 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. Curved region diagram of the device according to the test setup photo (exterior radius dimension), (For Antenna 1: X=1.74mm, Y=2.83mm, Z=1.64mm; For Antenna 2: X=1.64mm, Y=3.8mm Z=1.51mm), X>Z, Y>Z, Per KDB 616217 D04v01r01, curved SAR is necessary, more detail information which can be referred to setup photo.
4. For SAR testing of the curved region of the device, the device was placed directly against the phantom at the point where the distance between the antenna and device exterior is a minimum.

WLAN Note:

1. Per KDB 248227 D01v02r01, 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.
2. Per KDB 248227 D01v02r01, for U-NII-1 Body 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.
3. 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.
4. 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.
5. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

15.1 Body SAR

<Bluetooth SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ant.	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Sample	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	Bluetooth	1Mbps	Bottom Face	0	1	39	2441	9.34	10.00	1.164	#1	-0.1	0.146	0.170
	Bluetooth	1Mbps	Edge1	0	1	39	2441	9.34	10.00	1.164	#1	-0.02	0.128	0.149
	Bluetooth	1Mbps	Edge2	0	1	39	2441	9.34	10.00	1.164	#1	-0.05	0.154	0.179
	Bluetooth	1Mbps	Edge2	0	1	0	2402	8.79	10.00	1.321	#1	-0.04	0.137	0.181
	Bluetooth	1Mbps	Edge2	0	1	78	2480	9.08	10.00	1.236	#1	-0.06	0.159	0.197
#01	Bluetooth	1Mbps	Edge2	0	1	78	2480	9.08	10.00	1.236	#2	-0.05	0.167	**0.206**
	Bluetooth	1Mbps	Curved surface of Edge2	0	1	39	2441	9.34	10.00	1.164	#2	-0.09	0.163	0.190

<DTS WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ant.	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Sample	Power Drift (dB)	Area Scan Max SAR (W/kg)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN 2.4GHz	802.11b 1Mbps	Bottom Face	**0**	1	11	2462	15.94	16.20	1.062	98.86	1.012	#1	0.054		0.979	1.052
	WLAN 2.4GHz	802.11b 1Mbps	Edge1	0	1	11	2462	15.94	16.20	1.062	98.86	1.012	#1	-0.047		0.798	0.857
	WLAN 2.4GHz	802.11b 1Mbps	Edge2	0	1	11	2462	15.94	16.20	1.062	98.86	1.012	#1	0.01		0.974	1.047
	WLAN 2.4GHz	802.11b 1Mbps	Bottom Face	0	1	1	2412	15.79	16.20	1.099	98.86	1.012	#1	-0.085		0.818	0.910
	WLAN 2.4GHz	802.11b 1Mbps	Edge1	0	1	1	2412	15.79	16.20	1.099	98.86	1.012	#1	-0.031		0.735	0.817
	WLAN 2.4GHz	802.11b 1Mbps	Edge2	0	1	1	2412	15.79	16.20	1.099	98.86	1.012	#1	-0.022		0.919	1.022
	WLAN 2.4GHz	802.11b 1Mbps	Bottom Face	0	1	11	2462	15.94	16.20	1.062	98.86	1.012	#2	-0.056		0.851	0.914
	WLAN 2.4GHz	802.11b 1Mbps	Bottom Face	0	1	1	2412	15.79	16.20	1.099	98.86	1.012	#2	-0.10		0.706	0.785
#02	WLAN 2.4GHz	802.11b 1Mbps	Curved surface of Edge2	0	1	11	2462	15.94	16.20	1.062	98.86	1.012	#1	-0.04		1.200	**1.289**
	WLAN 2.4GHz	802.11b 1Mbps	Curved surface of Edge2	0	1	1	2412	15.79	16.20	1.099	98.86	1.012	#1	0.05		1.150	1.279
	WLAN 2.4GHz	802.11b 1Mbps	Curved surface of Edge2	0	1	6	2437	15.73	16.20	1.114	98.86	1.012	#1	0.02		1.140	1.286
	WLAN 2.4GHz	802.11b 1Mbps	Bottom Face	0	2	1	2412	17.03	17.50	1.114	98.86	1.012	#1	-0.02		0.755	0.851
	WLAN 2.4GHz	802.11b 1Mbps	Edge1	0	2	1	2412	17.03	17.50	1.114	98.86	1.012	#1	-0.13		1.110	1.252
	WLAN 2.4GHz	802.11b 1Mbps	Edge4	0	2	1	2412	17.03	17.50	1.114	98.86	1.012	#1	-0.054		0.268	0.302
	WLAN 2.4GHz	802.11b 1Mbps	Bottom Face	0	2	6	2437	16.84	17.50	1.164	98.86	1.012	#1	-0.024		0.719	0.847
	WLAN 2.4GHz	802.11b 1Mbps	Edge1	0	2	6	2437	16.84	17.50	1.164	98.86	1.012	#1	-0.048		1.050	1.237
	WLAN 2.4GHz	802.11b 1Mbps	Edge1	0	2	11	2462	16.72	17.50	1.197	98.86	1.012	#1	-0.13		0.893	1.082
	WLAN 2.4GHz	802.11b 1Mbps	Edge1	0	2	1	2412	17.03	17.50	1.114	98.86	1.012	#2	-0.022		0.862	0.972
	WLAN 2.4GHz	802.11b 1Mbps	Edge1	0	2	6	2437	16.84	17.50	1.164	98.86	1.012	#2	-0.11		0.847	0.998
	WLAN 2.4GHz	802.11b 1Mbps	Curved surface of Edge4	0	2	1	2412	17.03	17.50	1.114	98.86	1.012	#1	0.06		0.420	0.474
	WLAN 2.4GHz	802.11n-HT20 _MCS0	Bottom Face	0	1+2	1	2412	17.65	18.00	1.084	91.38	1.094	#1	-0.05	1.047	0.605	0.717
	WLAN 2.4GHz	802.11n-HT20 _MCS0	Edge1	0	1+2	1	2412	17.65	18.00	1.084	91.38	1.094	#1	-0.17	1.256	0.647	0.767
	WLAN 2.4GHz	802.11n-HT20 _MCS0	Edge2	0	1+2	1	2412	17.65	18.00	1.084	91.38	1.094	#1		0.912		
	WLAN 2.4GHz	802.11n-HT20 _MCS0	Edge4	0	1+2	1	2412	17.65	18.00	1.084	91.38	1.094	#1		0.322		
	WLAN 2.4GHz	802.11n-HT20 _MCS0	Edge1	0	1+2	1	2412	17.65	18.00	1.084	91.38	1.094	#2	0.03		0.481	0.570
	WLAN 2.4GHz	802.11n-HT20 _MCS0	Curved surface of Edge2	0	1+2	1	2412	17.65	18.00	1.084	91.38	1.094	#1	-0.02		0.816	0.968
	WLAN 2.4GHz	802.11n-HT20 _MCS0	Curved surface of Edge2	0	1+2	6	2437	17.36	18.00	1.158	91.38	1.094	#1	-0.14		0.573	0.726
	WLAN 2.4GHz	802.11n-HT20 _MCS0	Curved surface of Edge2	0	1+2	11	2462	17.30	18.00	1.175	91.38	1.094	#1	0.05		0.502	0.645
	WLAN 2.4GHz	802.11n-HT20 _MCS0	Curved surface of Edge4	0	1+2	1	2412	17.65	18.00	1.084	91.38	1.094	#1	0.08		0.326	0.387

<NII WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ant.	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Sample	Power Drift (dB)	Area Scan Max SAR (W/kg)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN 5.2GHz	802.11a 6Mbps	Bottom Face	0	1	48	5240	14.36	14.50	1.033	92.86	1.077	#1	-0.09	0.975	0.501	0.557
	WLAN 5.2GHz	802.11a 6Mbps	Edge1	0	1	48	5240	14.36	14.50	1.033	92.86	1.077	#1		0.877		
	WLAN 5.2GHz	802.11a 6Mbps	Edge2	0	1	48	5240	14.36	14.50	1.033	92.86	1.077	#1	0.08	3.021	0.908	1.010
	WLAN 5.2GHz	802.11a 6Mbps	Edge2	0	1	36	5180	14.33	14.50	1.040	92.86	1.077	#1	-0.09		0.608	0.681
	WLAN 5.2GHz	802.11a 6Mbps	Edge2	0	1	48	5240	14.36	14.50	1.033	92.86	1.077	#2	-0.15		0.619	0.689
	WLAN 5.2GHz	802.11a 6Mbps	Curved surface of Edge2	0	1	48	5240	14.36	14.50	1.033	92.86	1.077	#1	0.07		1.030	1.146
	WLAN 5.2GHz	802.11a 6Mbps	Curved surface of Edge2	0	1	36	5180	14.33	14.50	1.040	92.86	1.077	#1	-0.02		0.723	0.810
	WLAN 5.2GHz	802.11a 6Mbps	Curved surface of Edge2	0	1	44	5220	14.27	14.50	1.054	92.86	1.077	#1	0.05		0.856	0.972
	WLAN 5.2GHz	802.11a 6Mbps	Bottom Face	0	2	48	5240	14.97	15.20	1.054	92.86	1.077	#1	0.05		0.883	1.003
	WLAN 5.2GHz	802.11a 6Mbps	Edge1	0	2	48	5240	14.97	15.20	1.054	92.86	1.077	#1	-0.03		0.512	0.581
	WLAN 5.2GHz	802.11a 6Mbps	Edge4	0	2	48	5240	14.97	15.20	1.054	92.86	1.077	#1	0.11		0.608	0.690
	WLAN 5.2GHz	802.11a 6Mbps	Bottom Face	0	2	48	5240	14.97	15.20	1.054	92.86	1.077	#2	0.08		0.825	0.937
	WLAN 5.2GHz	802.11a 6Mbps	Bottom Face	0	2	44	5220	14.97	15.20	1.054	92.86	1.077	#2	0.04		0.702	0.797
#03	WLAN 5.2GHz	802.11a 6Mbps	Curved surface of Edge4	0	2	48	5240	14.97	15.20	1.054	92.86	1.077	#1	0.1		1.050	**1.192**
	WLAN 5.2GHz	802.11a 6Mbps	Curved surface of Edge4	0	2	44	5220	14.93	15.20	1.064	92.86	1.077	#1	0.08		0.956	1.096
	WLAN 5.2GHz	802.11a 6Mbps	Curved surface of Edge4	0	2	36	5180	14.91	15.20	1.069	92.86	1.077	#1	0.12		0.854	0.983
	WLAN 5.3GHz	802.11n-HT20_MCS0	Bottom Face	0	1+2	60	5300	14.95	15.50	1.135	90.68	1.103	#1	-0.07	1.209	0.513	0.642
	WLAN 5.3GHz	802.11n-HT20_MCS0	Edge1	0	1+2	60	5300	14.95	15.50	1.135	90.68	1.103	#1		0.861		
	WLAN 5.3GHz	802.11n-HT20_MCS0	Edge2	0	1+2	60	5300	14.95	15.50	1.135	90.68	1.103	#1	0.15	1.339	0.884	1.107
	WLAN 5.3GHz	802.11n-HT20_MCS0	Edge4	0	1+2	60	5300	14.95	15.50	1.135	90.68	1.103	#1		0.914		
	WLAN 5.3GHz	802.11n-HT20_MCS0	Edge2	0	1+2	52	5260	14.93	15.50	1.140	90.68	1.103	#1	-0.042		0.679	0.854
	WLAN 5.3GHz	802.11n-HT20_MCS0	Edge2	0	1+2	60	5300	14.95	15.50	1.135	90.68	1.103	#2	-0.05		0.622	0.779
#04	WLAN 5.3GHz	802.11n-HT20_MCS0	Curved surface of Edge2	0	1+2	60	5300	14.95	15.50	1.135	90.68	1.103	#1	-0.03		0.938	**1.174**
	WLAN 5.3GHz	802.11n-HT20_MCS0	Curved surface of Edge2	0	1+2	52	5260	14.93	15.50	1.140	90.68	1.103	#1	-0.042		0.702	0.883
	WLAN 5.3GHz	802.11n-HT20_MCS0	Curved surface of Edge2	0	1+2	64	5320	14.92	15.50	1.143	90.68	1.103	#1	-0.01		0.730	0.920
	WLAN 5.3GHz	802.11n-HT20_MCS0	Curved surface of Edge4	0	1+2	60	5300	14.95	15.50	1.135	90.68	1.103	#1	-0.05		0.628	0.786

Plot No.	Band	Mode	Test Position	Gap (cm)	Ant.	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Sample	Power Drift (dB)	Area Scan Max SAR (W/kg)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN 5.5GHz	802.11a 6Mbps	Bottom Face	0	1	100	5500	12.99	13.50	1.124	92.86	1.077	#1	-0.1	0.866	0.336	0.407
	WLAN 5.5GHz	802.11a 6Mbps	Edge1	0	1	100	5500	12.99	13.50	1.124	92.86	1.077	#1		0.745		
	WLAN 5.5GHz	802.11a 6Mbps	Edge2	0	1	100	5500	12.99	13.50	1.124	92.86	1.077	#1	0.05	1.009	0.589	0.713
	WLAN 5.5GHz	802.11a 6Mbps	Edge2	0	1	100	5500	12.99	13.50	1.124	92.86	1.077	#2	0.11		0.636	0.770
	WLAN 5.5GHz	802.11a 6Mbps	Curved surface of Edge2	0	1	100	5500	12.99	13.50	1.124	92.86	1.077	#1	-0.1		0.875	1.059
	WLAN 5.5GHz	802.11a 6Mbps	Curved surface of Edge2	0	1	116	5580	12.85	13.50	1.161	92.86	1.077	#1	-0.03		0.730	0.913
	WLAN 5.5GHz	802.11a 6Mbps	Curved surface of Edge2	0	1	140	5700	12.38	13.50	1.294	92.86	1.077	#1	-0.05		0.672	0.937
	WLAN 5.5GHz	802.11a 6Mbps	Bottom Face	0	2	100	5500	12.76	13.00	1.057	92.86	1.077	#1	-0.06		0.739	0.841
	WLAN 5.5GHz	802.11a 6Mbps	Edge1	0	2	100	5500	12.76	13.00	1.057	92.86	1.077	#1	-0.04		0.474	0.540
	WLAN 5.5GHz	802.11a 6Mbps	Edge4	0	2	100	5500	12.76	13.00	1.057	92.86	1.077	#1	0.19		0.853	0.971
	WLAN 5.5GHz	802.11a 6Mbps	Bottom Face	0	2	116	5580	12.58	13.00	1.102	92.86	1.077	#1	-0.1		0.679	0.806
	WLAN 5.5GHz	802.11a 6Mbps	Edge4	0	2	116	5580	12.58	13.00	1.102	92.86	1.077	#1	-0.09		0.786	0.932
	WLAN 5.5GHz	802.11a 6Mbps	Bottom Face	0	2	100	5500	12.76	13.00	1.057	92.86	1.077	#2	-0.07		0.955	1.087
	WLAN 5.5GHz	802.11a 6Mbps	Edge1	0	2	100	5500	12.76	13.00	1.057	92.86	1.077	#2	-0.03		0.416	0.473
	WLAN 5.5GHz	802.11a 6Mbps	Edge4	0	2	100	5500	12.76	13.00	1.057	92.86	1.077	#2	-0.03		1.120	1.275
	WLAN 5.5GHz	802.11a 6Mbps	Bottom Face	0	2	116	5580	12.58	13.00	1.102	92.86	1.077	#2	-0.01		0.792	0.940
	WLAN 5.5GHz	802.11a 6Mbps	Edge4	0	2	116	5580	12.58	13.00	1.102	92.86	1.077	#2	-0.002		1.040	1.234
	WLAN 5.5GHz	802.11a 6Mbps	Edge4	0	2	140	5700	12.40	13.00	1.148	92.86	1.077	#2	-0.077		0.818	1.012
	WLAN 5.5GHz	802.11a 6Mbps	Curved surface of Edge4	0	2	100	5500	12.76	13.00	1.057	92.86	1.077	#2	-0.12		1.160	1.320
	WLAN 5.5GHz	802.11a 6Mbps	Curved surface of Edge4	0	2	116	5580	12.58	13.00	1.102	92.86	1.077	#2	-0.03		1.010	1.198
	WLAN 5.5GHz	802.11a 6Mbps	Curved surface of Edge4	0	2	140	5700	12.40	13.00	1.148	92.86	1.077	#2	0.01		0.830	1.026

Plot No.	Band	Mode	Test Position	Gap (cm)	Ant.	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Sample	Power Drift (dB)	Area Scan Max SAR (W/kg)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN 5.5GHz	802.11n-HT20_MCS0	Bottom Face	0	1+2	100	5500	16.06	16.20	1.033	90.68	1.103	#1	-0.05	1.428	0.528	0.601
	WLAN 5.5GHz	802.11n-HT20_MCS0	Edge1	0	1+2	100	5500	16.06	16.20	1.033	90.68	1.103	#1		0.690		
	WLAN 5.5GHz	802.11n-HT20_MCS0	Edge2	0	1+2	100	5500	16.06	16.20	1.033	90.68	1.103	#1		1.003		
	WLAN 5.5GHz	802.11n-HT20_MCS0	Edge4	0	1+2	100	5500	16.06	16.20	1.033	90.68	1.103	#1	-0.03	1.639	0.633	0.721
	WLAN 5.5GHz	802.11n-HT20_MCS0	Bottom Face	0	1+2	100	5500	16.06	16.20	1.033	90.68	1.103	#2	-0.07		0.697	0.794
	WLAN 5.5GHz	802.11n-HT20_MCS0	Edge1	0	1+2	100	5500	16.06	16.20	1.033	90.68	1.103	#2		0.803		
	WLAN 5.5GHz	802.11n-HT20_MCS0	Edge2	0	1+2	100	5500	16.06	16.20	1.033	90.68	1.103	#2	-0.05	1.361	0.614	0.699
	WLAN 5.5GHz	802.11n-HT20_MCS0	Edge4	0	1+2	100	5500	16.06	16.20	1.033	90.68	1.103	#2	0.047	2.174	0.828	0.943
	WLAN 5.5GHz	802.11n-HT20_MCS0	Edge4	0	1+2	116	5580	15.67	16.20	1.130	90.68	1.103	#2	-0.02		0.783	0.976
	WLAN 5.5GHz	802.11n-HT20_MCS0	Curved surface of Edge2	0	1+2	100	5500	16.06	16.20	1.033	90.68	1.103	#2	-0.06		0.730	0.832
	WLAN 5.5GHz	802.11n-HT20_MCS0	Curved surface of Edge2	0	1+2	100	5500	16.06	16.20	1.033	90.68	1.103	#2	-0.02		0.650	0.740
#05	WLAN 5.5GHz	802.11n-HT20_MCS0	Curved surface of Edge4	0	1+2	100	5500	16.06	16.20	1.033	90.68	1.103	#2	-0.03		1.210	1.378
	WLAN 5.5GHz	802.11n-HT20_MCS0	Curved surface of Edge4	0	1+2	116	5580	15.67	16.20	1.130	90.68	1.103	#2	-0.02		0.783	0.976
	WLAN 5.5GHz	802.11n-HT20_MCS0	Curved surface of Edge4	0	1+2	140	5700	15.61	16.20	1.146	90.68	1.103	#2	-0.13		0.661	0.835

Plot No.	Band	Mode	Test Position	Gap (cm)	Ant.	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Sample	Power Drift (dB)	Area Scan Max SAR (W/kg)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN 5.8GHz	802.11a 6Mbps	Bottom Face	0	1	149	5745	11.15	11.30	1.035	92.86	1.077	#1	-0.06		0.758	0.845
	WLAN 5.8GHz	802.11a 6Mbps	Edge1	0	1	149	5745	11.15	11.30	1.035	92.86	1.077	#1	0.09		0.334	0.372
	WLAN 5.8GHz	802.11a 6Mbps	Edge2	0	1	149	5745	11.15	11.30	1.035	92.86	1.077	#1	-0.06		1.020	1.137
	WLAN 5.8GHz	802.11a 6Mbps	Bottom Face	0	1	165	5825	11.07	11.30	1.054	92.86	1.077	#1	-0.06		0.594	0.675
	WLAN 5.8GHz	802.11a 6Mbps	Edge2	0	1	157	5785	11.02	11.30	1.067	92.86	1.077	#1	-0.06		0.967	1.111
	WLAN 5.8GHz	802.11a 6Mbps	Edge2	0	1	149	5745	11.15	11.30	1.035	92.86	1.077	#2	-0.11		0.665	0.741
#06	WLAN 5.8GHz	802.11a 6Mbps	Curved surface of Edge2	0	1	149	5745	11.15	11.30	1.035	92.86	1.077	#1	-0.02		1.250	1.394
	WLAN 5.8GHz	802.11a 6Mbps	Curved surface of Edge2	0	1	157	5785	11.02	11.30	1.067	92.86	1.077	#1	-0.05		1.180	1.355
	WLAN 5.8GHz	802.11a 6Mbps	Curved surface of Edge2	0	1	165	5825	11.07	11.30	1.054	92.86	1.077	#1	0.01		1.120	1.272
	WLAN 5.8GHz	802.11a 6Mbps	Bottom Face	0	2	157	5785	13.70	14.00	1.072	92.86	1.077	#1	-0.1	1.600	0.683	0.788
	WLAN 5.8GHz	802.11a 6Mbps	Edge1	0	2	157	5785	13.70	14.00	1.072	92.86	1.077	#1		0.771		
	WLAN 5.8GHz	802.11a 6Mbps	Edge4	0	2	157	5785	13.70	14.00	1.072	92.86	1.077	#1	-0.09	2.494	1.000	1.154
	WLAN 5.8GHz	802.11a 6Mbps	Edge4	0	2	149	5745	13.69	14.00	1.074	92.86	1.077	#1	-0.04		0.884	1.023
	WLAN 5.8GHz	802.11a 6Mbps	Edge4	0	2	165	5825	13.68	14.00	1.076	92.86	1.077	#1	-0.1		1.070	1.241
	WLAN 5.8GHz	802.11a 6Mbps	Edge4	0	2	157	5785	13.70	14.00	1.072	92.86	1.077	#2	-0.08		0.927	1.070
	WLAN 5.8GHz	802.11a 6Mbps	Edge4	0	2	149	5745	13.69	14.00	1.074	92.86	1.077	#2	-0.06		0.892	1.032
	WLAN 5.8GHz	802.11a 6Mbps	Curved surface of Edge4	0	2	157	5785	13.70	14.00	1.072	92.86	1.077	#1	-0.03		0.930	1.073
	WLAN 5.8GHz	802.11a 6Mbps	Curved surface of Edge4	0	2	149	5745	13.69	14.00	1.074	92.86	1.077	#1	0.01		0.900	1.041
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Bottom Face	0	1+2	149	5745	14.38	14.50	1.028	90.68	1.103	#1	-0.01	1.660	0.711	0.806
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Edge1	0	1+2	149	5745	14.38	14.50	1.028	90.68	1.103	#1		0.669		
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Edge2	0	1+2	149	5745	14.38	14.50	1.028	90.68	1.103	#1	0.10	2.949	1.100	1.247
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Edge4	0	1+2	149	5745	14.38	14.50	1.028	90.68	1.103	#1	-0.02	1.261	0.544	0.617
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Bottom Face	0	1+2	157	5785	13.99	14.50	1.125	90.68	1.103	#1	0.046		0.758	0.940
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Edge2	0	1+2	157	5785	13.99	14.50	1.125	90.68	1.103	#1	-0.096		1.060	1.315
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Edge2	0	1+2	165	5825	13.95	14.50	1.135	90.68	1.103	#1	-0.06		1.060	1.327
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Edge2	0	1+2	165	5825	13.95	14.50	1.135	90.68	1.103	#2	-0.08		0.747	0.935
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Edge2	0	1+2	149	5745	14.38	14.50	1.028	90.68	1.103	#2	-0.15		0.940	1.066
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Curved surface of Edge2	0	1+2	149	5745	14.38	14.50	1.028	90.68	1.103	#1	0.08		1.090	1.236
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Curved surface of Edge2	0	1+2	157	5785	13.99	14.50	1.125	90.68	1.103	#1	-0.03		0.992	1.231
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Curved surface of Edge2	0	1+2	165	5825	13.95	14.50	1.135	90.68	1.103	#1	-0.05		0.982	1.229
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Curved surface of Edge4	0	1+2	149	5745	14.38	14.50	1.028	90.68	1.103	#1	-0.1		0.843	0.956
	WLAN 5.8GHz	802.11n-HT20 _MCS0	Curved surface of Edge4	0	1+2	157	5785	13.99	14.50	1.125	90.68	1.103	#1	-0.13		0.857	1.063

15.2 Repeated SAR Measurement

No.	Band	Mode	Test Position	Gap (cm)	Ant.	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Sample	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	WLAN 2.4GHz	802.11b 1Mbps	Curved surface of Edge2	0	1	11	2462	15.94	16.20	1.062	98.86	1.012	#1	-0.04	1.200	1	1.289
2nd	WLAN 2.4GHz	802.11b 1Mbps	Curved surface of Edge2	0	1	11	2462	15.94	16.20	1.062	98.86	1.012	#1	-0.08	1.190	1.008	1.279
1st	WLAN 5.2GHz	802.11a 6Mbps	Curved surface of Edge4	0	2	48	5240	14.97	15.20	1.054	92.86	1.077	#1	0.10	1.050	1	1.192
2nd	WLAN 5.2GHz	802.11a 6Mbps	Curved surface of Edge4	0	2	48	5240	14.97	15.20	1.054	92.86	1.077	#1	0.01	1.030	1.019	1.170
1st	WLAN 5.3GHz	802.11n-HT20 _MCS0	Curved surface of Edge2	0	1+2	60	5300	14.95	15.50	1.135	90.68	1.103	#1	-0.03	0.938	1	1.174
2nd	WLAN 5.3GHz	802.11n-HT20 _MCS0	Curved surface of Edge2	0	1+2	60	5300	14.95	15.50	1.135	90.68	1.103	#1	-0.02	0.928	1.011	1.162
1st	WLAN 5.5GHz	802.11n-HT20 _MCS0	Curved surface of Edge4	0	1+2	100	5500	16.06	16.20	1.033	90.68	1.103	#2	-0.03	1.210	1	1.378
2nd	WLAN 5.5GHz	802.11n-HT20 _MCS0	Curved surface of Edge4	0	1+2	100	5500	16.06	16.20	1.033	90.68	1.103	#2	0.15	1.150	1.052	1.310
1st	WLAN 5.8GHz	802.11a 6Mbps	Curved surface of Edge2	0	1	149	5745	11.15	11.30	1.035	92.86	1.077	#1	-0.02	1.250	1	1.394
2nd	WLAN 5.8GHz	802.11a 6Mbps	Curved surface of Edge2	0	1	149	5745	11.15	11.30	1.035	92.86	1.077	#1	0.02	1.220	1.025	1.360

General Note:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR <1.45W/kg, only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated *measured SAR*.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

16. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations
1.	None

General Note:

1. 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.
2. WLAN and Bluetooth share the same antenna 1 for tablet mode, so WLAN and Bluetooth cannot transmit simultaneously.
3. According to EUT character, Bluetooth with antenna 1 can not transmit simultaneously with WLAN antenna 2.

Test Engineer：Fulu Hu

17. 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 17.1. 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.

DASY Uncertainty Budget According to IEEE 1528-2013							
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	1.4	N	1	1	1	1.4	1.4
Device Holder	2.5	N	1	1	1	2.5	2.5
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						10.8%	10.7%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						21.6%	21.5%

Table 17.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

DASY Uncertainty Budget According to IEEE 1528-2013							
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	1.4	N	1	1	1	1.4	1.4
Device Holder	2.5	N	1	1	1	2.5	2.5
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						12.0%	11.9%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						23.9%	23.8%

Table 17.3. Uncertainty Budget for frequency range 3 GHz to 6 GHz

18. 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 248227 D01 v02r01, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Jun 2015.

[6] FCC KDB 447498 D01 v05r02, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Feb 2014

[7] FCC KDB 616217 D04 v01r01, “SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers”, May 2013

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

[9] FCC KDB 865664 D02 v01r01, “RF Exposure Compliance Reporting and Documentation Considerations” May 2013.

Appendix A. Plots of System Performance Check

The plots are shown as follows.

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2015.08.12

System Check_Body_2450MHz_150812

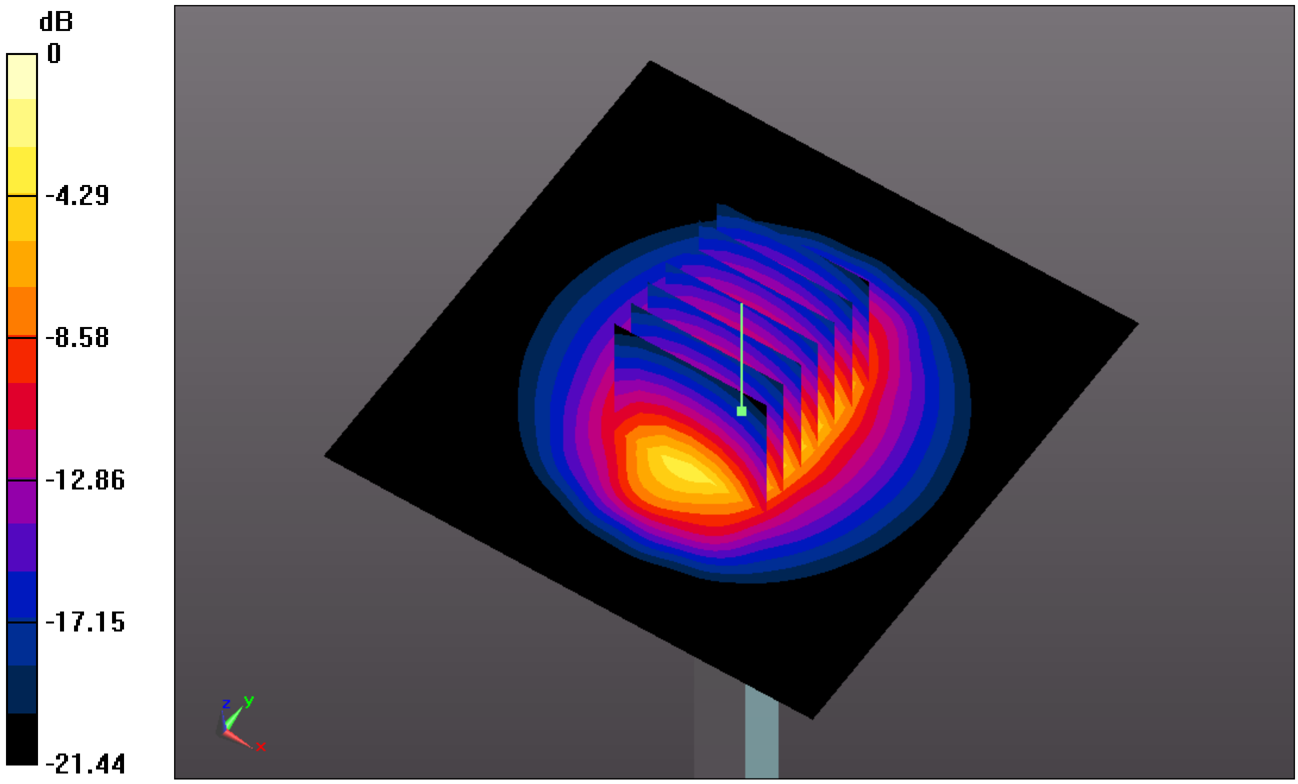
DUT: D2450V2 - SN:840

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL_2450_150812 Medium parameters used: f = 2450 MHz; σ = 1.94 mho/m; ε_r = 51.413; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(7.29, 7.29, 7.29); Calibrated: 2015.05.28
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM3; Type: SAM; Serial: TP-1079
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

Pin=250mW/Area Scan (81x81x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 17.945 mW/g

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 84.577 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 24.045 W/kg
SAR(1 g) = 12 mW/g; SAR(10 g) = 5.65 mW/g
Maximum value of SAR (measured) = 18.131 mW/g



0 dB = 18.130mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab　　　　Date: 2015.08.13

System Check_Body_5200MHz_150813

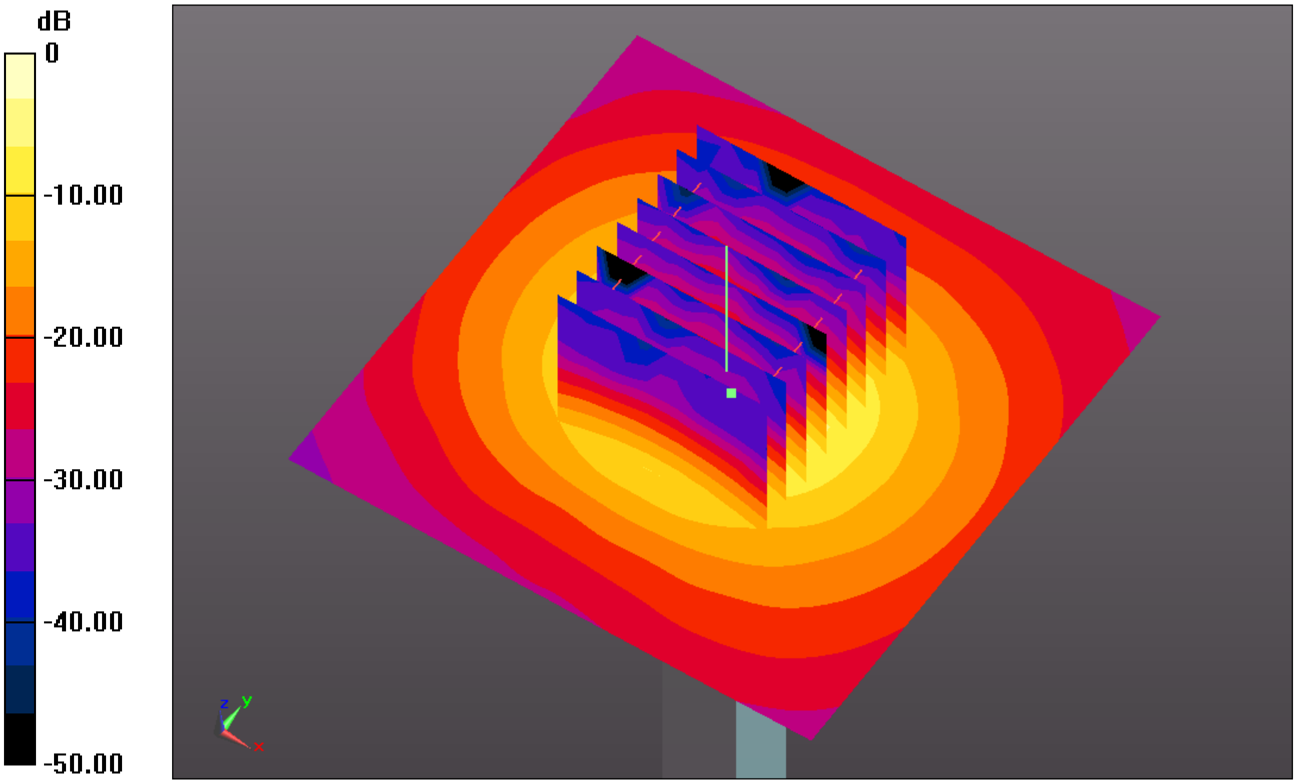
DUT: D5GHzV2-SN:1113

Communication System: CW; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium: MSL_5000_150813 Medium parameters used: f = 5200 MHz; σ = 5.287 mho/m; ε_r = 48.755; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.9 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(4.45, 4.45, 4.45); Calibrated: 2015.05.28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM3; Type: SAM; Serial: TP-1079
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

Pin=100mW/Area Scan (71x71x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 17.456 mW/g

Pin=100mW/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 41.288 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 29.472 W/kg
SAR(1 g) = 7.42 mW/g; SAR(10 g) = 2.09 mW/g
Maximum value of SAR (measured) = 17.584 mW/g



0 dB = 17.580mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2015.08.13

System Check_Body_5300MHz_150813

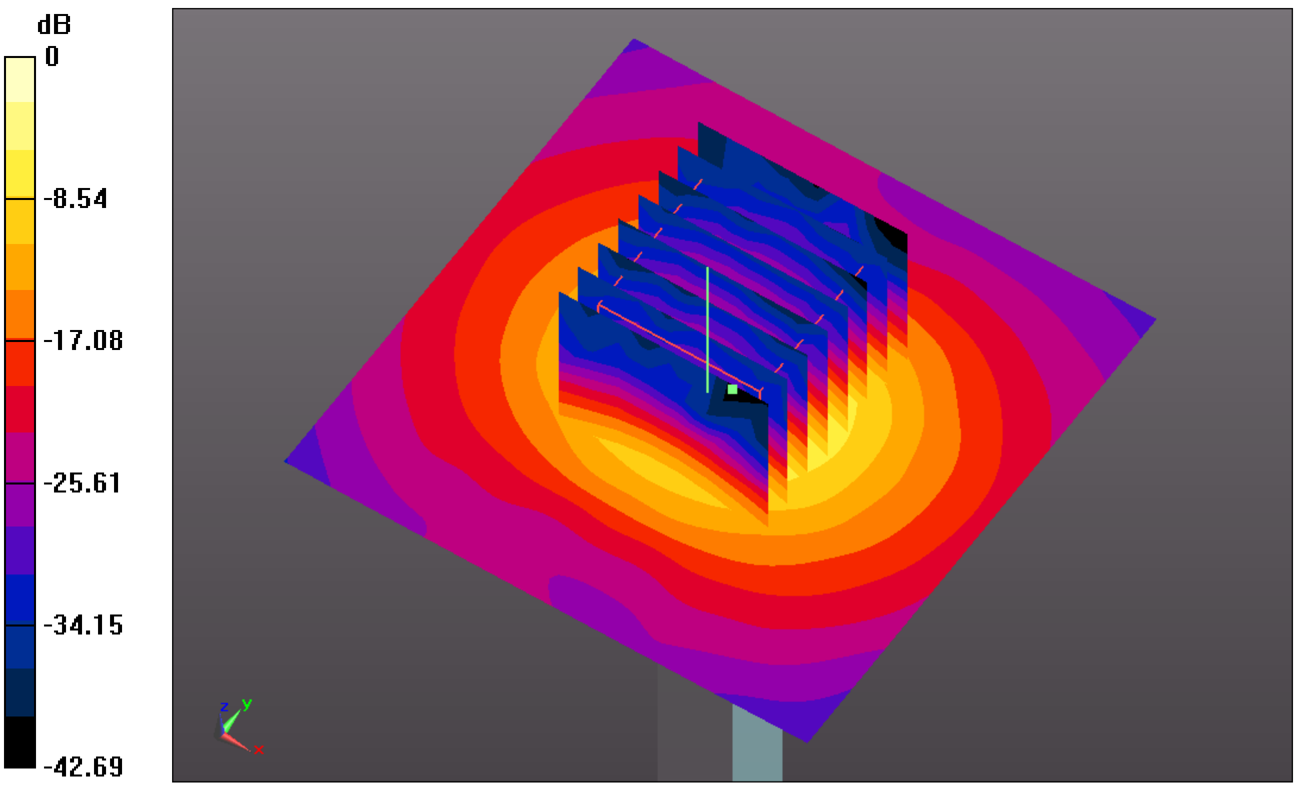
DUT: D5GHzV2-SN:1113

Communication System: CW; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: MSL_5000_150813 Medium parameters used: f = 5300 MHz; σ = 5.429 mho/m; ε_r = 48.56; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.9 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(4.25, 4.25, 4.25); Calibrated: 2015.05.28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM3; Type: SAM; Serial: TP-1079
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

Pin=100mW/Area Scan (71x71x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 17.824 mW/g

Pin=100mW/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 40.188 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 29.983 W/kg
SAR(1 g) = 7.29 mW/g; SAR(10 g) = 2.03 mW/g
Maximum value of SAR (measured) = 17.342 mW/g



0 dB = 17.340mW/g

System Check_Body_5600MHz_150813

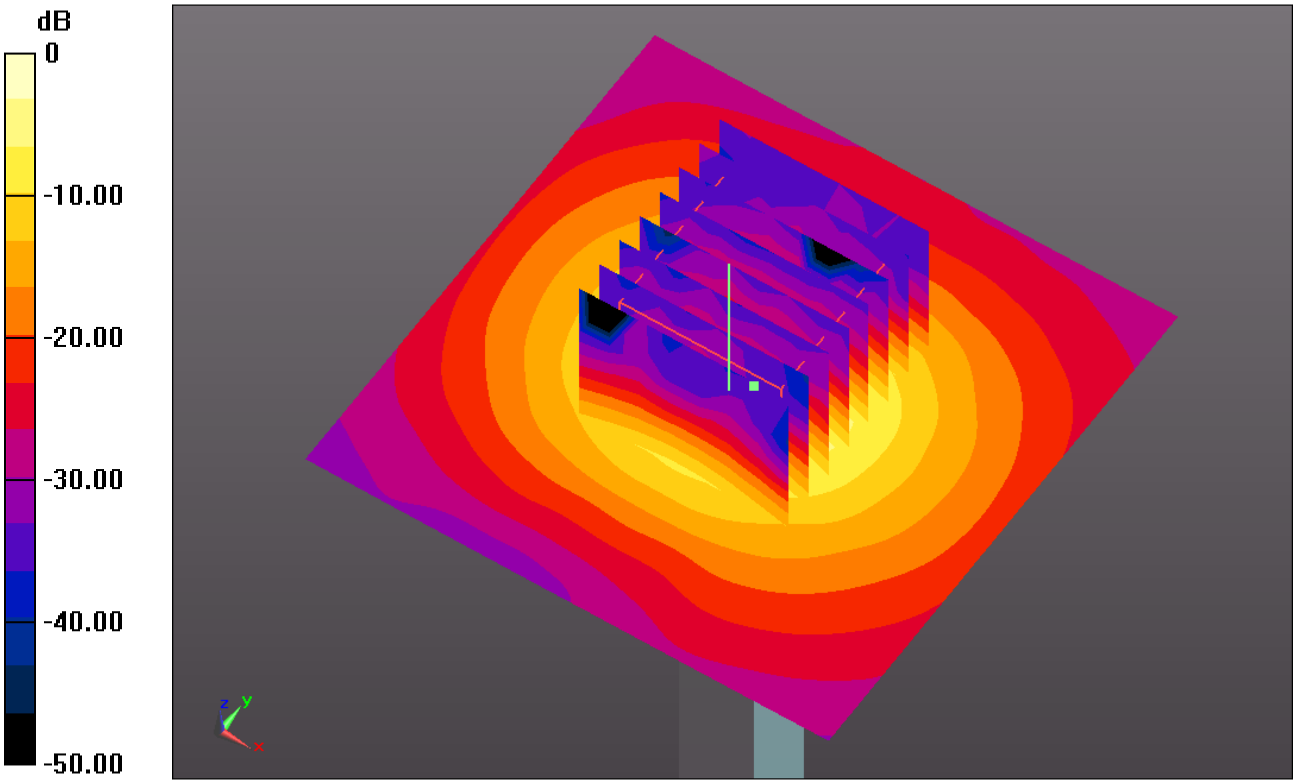
DUT: D5GHzV2-SN:1113

Communication System: CW; Frequency: 5600 MHz;Duty Cycle: 1:1
Medium: MSL_5000_150814 Medium parameters used: f = 5600 MHz; σ = 5.86 mho/m; ε_r = 47.892; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(3.8, 3.8, 3.8); Calibrated: 2015.05.28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM3; Type: SAM; Serial: TP-1079
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

Pin=100mW/Area Scan (71x71x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 17.953 mW/g

Pin=100mW/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 38.178 V/m; Power Drift = -0.14 dB
Peak SAR (extrapolated) = 31.396 W/kg
SAR(1 g) = 7.68 mW/g; SAR(10 g) = 2.32 mW/g
Maximum value of SAR (measured) = 17.584 mW/g



0 dB = 17.580mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2015.08.15

System Check_Body_5800MHz_150813

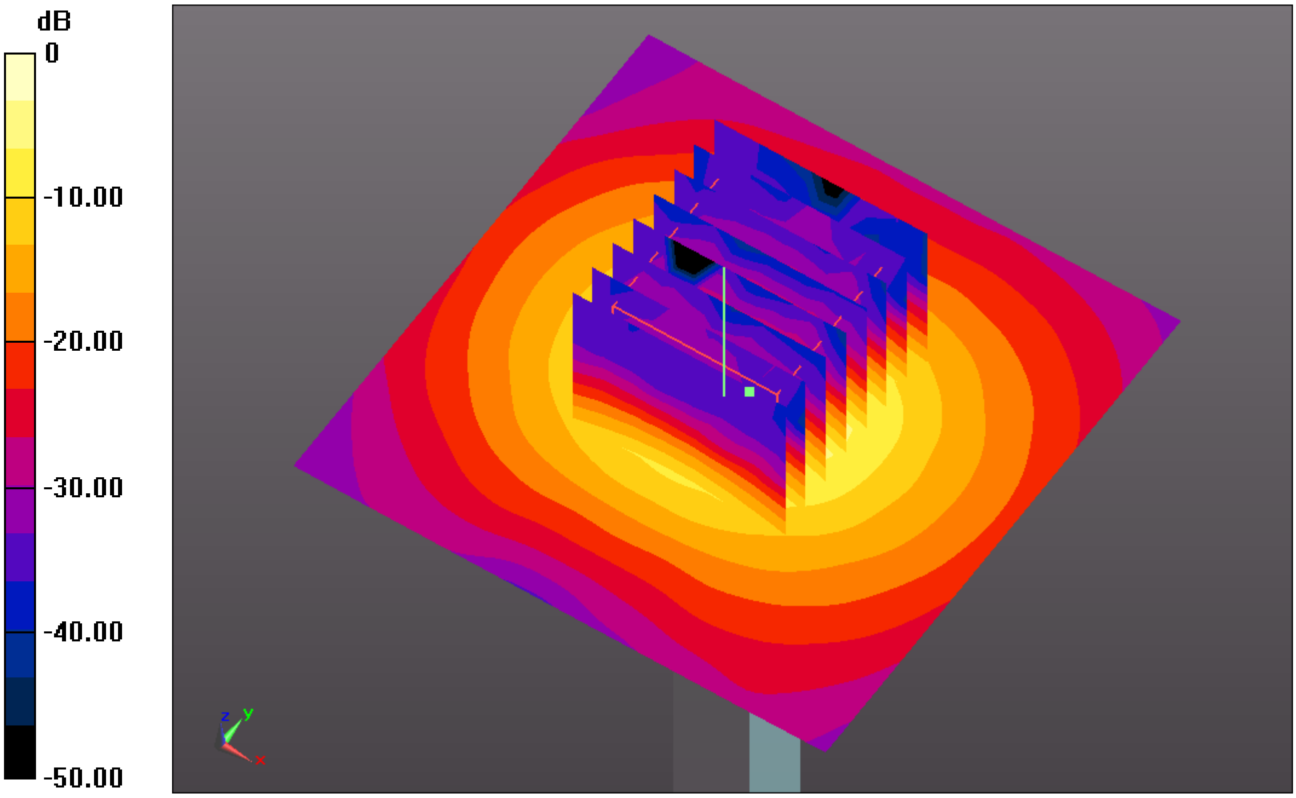
DUT: D5GHzV2-SN:1113

Communication System: CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium: MSL_5000_150815 Medium parameters used: f = 5800 MHz; σ = 6.12 mho/m; ε_r = 47.381; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(4.16, 4.16, 4.16); Calibrated: 2015.05.28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM3; Type: SAM; Serial: TP-1079
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

Pin=100mW/Area Scan (71x71x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 18.173 mW/g

Pin=100mW/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 37.121 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 33.080 W/kg
SAR(1 g) = 7.3 mW/g; SAR(10 g) = 2.04 mW/g
Maximum value of SAR (measured) = 17.922 mW/g



0 dB = 17.920mW/g

Appendix B. Plots of High SAR Measurement

The plots are shown as follows.

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2015.08.12

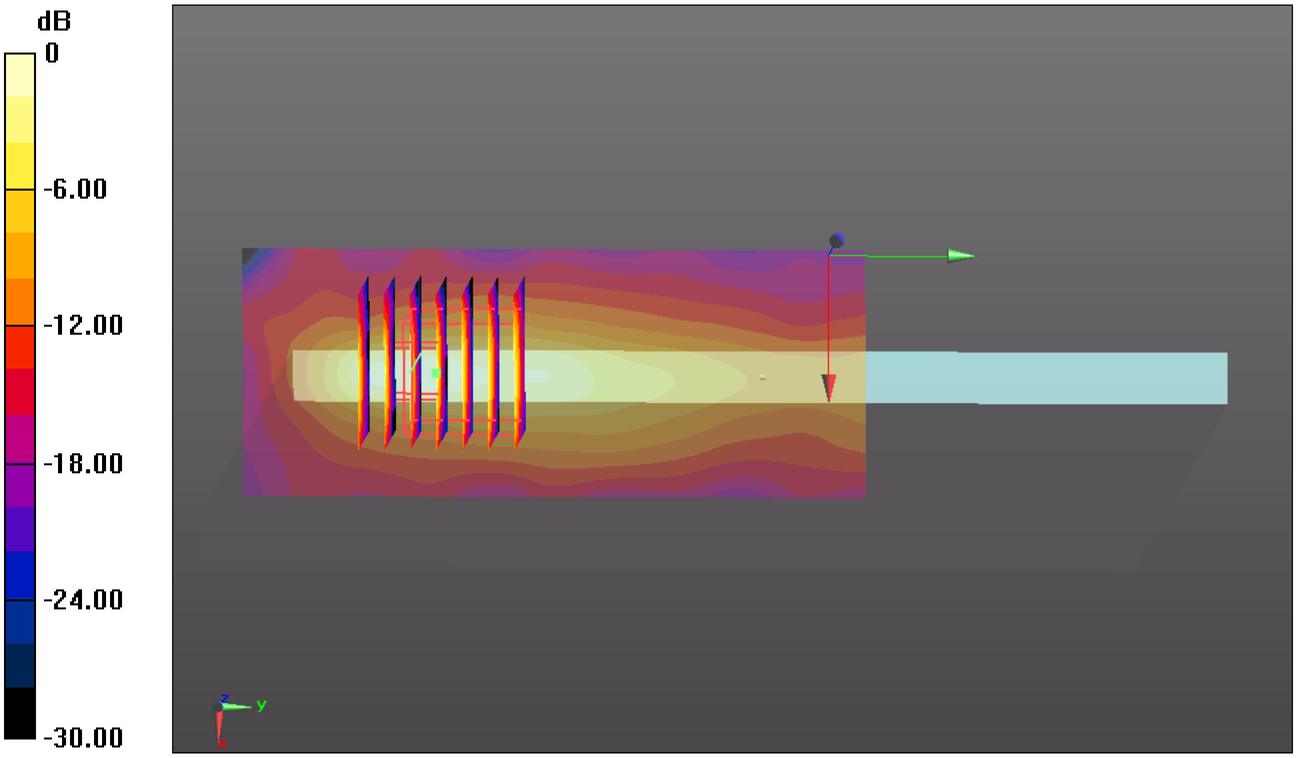
#01 Bluetooth_1Mbps_DH5_Edge2 0cm_Ch78_Ant.1_#2

Communication System: Bluetooth (0); Frequency: 2480 MHz;Duty Cycle: 1:1.2
Medium: MSL_2450_150812 Medium parameters used: f = 2480 MHz; σ = 1.981 mho/m; ε_r = 51.266; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(7.29, 7.29, 7.29); Calibrated: 2015.05.28
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM3; Type: SAM; Serial: TP-1079
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

Ch78/Area Scan (41x101x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.295 mW/g

Ch78/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.217 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.529 W/kg
SAR(1 g) = 0.167 mW/g; SAR(10 g) = 0.063 mW/g
Maximum value of SAR (measured) = 0.344 mW/g



0 dB = 0.340mW/g

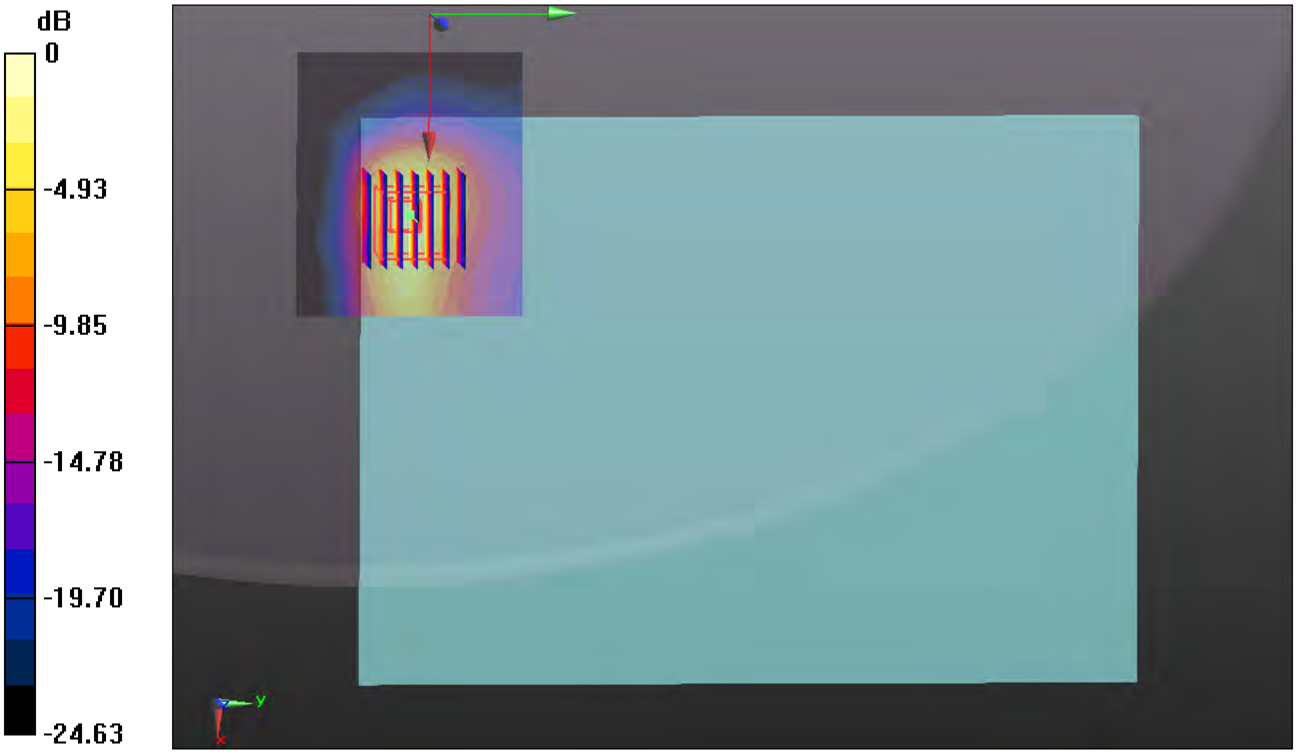
#02 WLAN2.4GHz_802.11b_1M_Curved surface of Edge2 0cm_Ch11_Ant.1_#1

Communication System: WIFI (0); Frequency: 2462 MHz;Duty Cycle: 1:1.012
Medium: MSL_2450_150812 Medium parameters used: f = 2462 MHz; σ = 1.956 mho/m; ε_r = 51.361; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(7.29, 7.29, 7.29); Calibrated: 2015.05.28
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM3; Type: SAM; Serial: TP-1079
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

Ch11/Area Scan (71x61x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 1.942 mW/g

Ch11/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.127 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.807 W/kg
SAR(1 g) = 1.200 mW/g; SAR(10 g) = 0.461 mW/g
Maximum value of SAR (measured) = 2.236 mW/g



0 dB = 2.240mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2015.08.13

#03 WLAN 5.2GHz_802.11a_6M_Curved surface of Edge4 0cm_Ch48_Ant.2_#1

Communication System: WIFI (0); Frequency: 5240 MHz;Duty Cycle: 1:1.077
Medium: MSL_5000_150813 Medium parameters used: f = 5240 MHz; σ = 5.35 mho/m; ε_r = 48.701; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.9 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(4.45, 4.45, 4.45); Calibrated: 2015.05.28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM3; Type: SAM; Serial: TP-1079
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

Ch48/Area Scan (101x71x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 2.703 mW/g

Ch48/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 0 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 5.415 W/kg
SAR(1 g) = 1.050 mW/g; SAR(10 g) = 0.255 mW/g
Maximum value of SAR (measured) = 2.958 mW/g

0 dB = 2.960mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2015.08.13

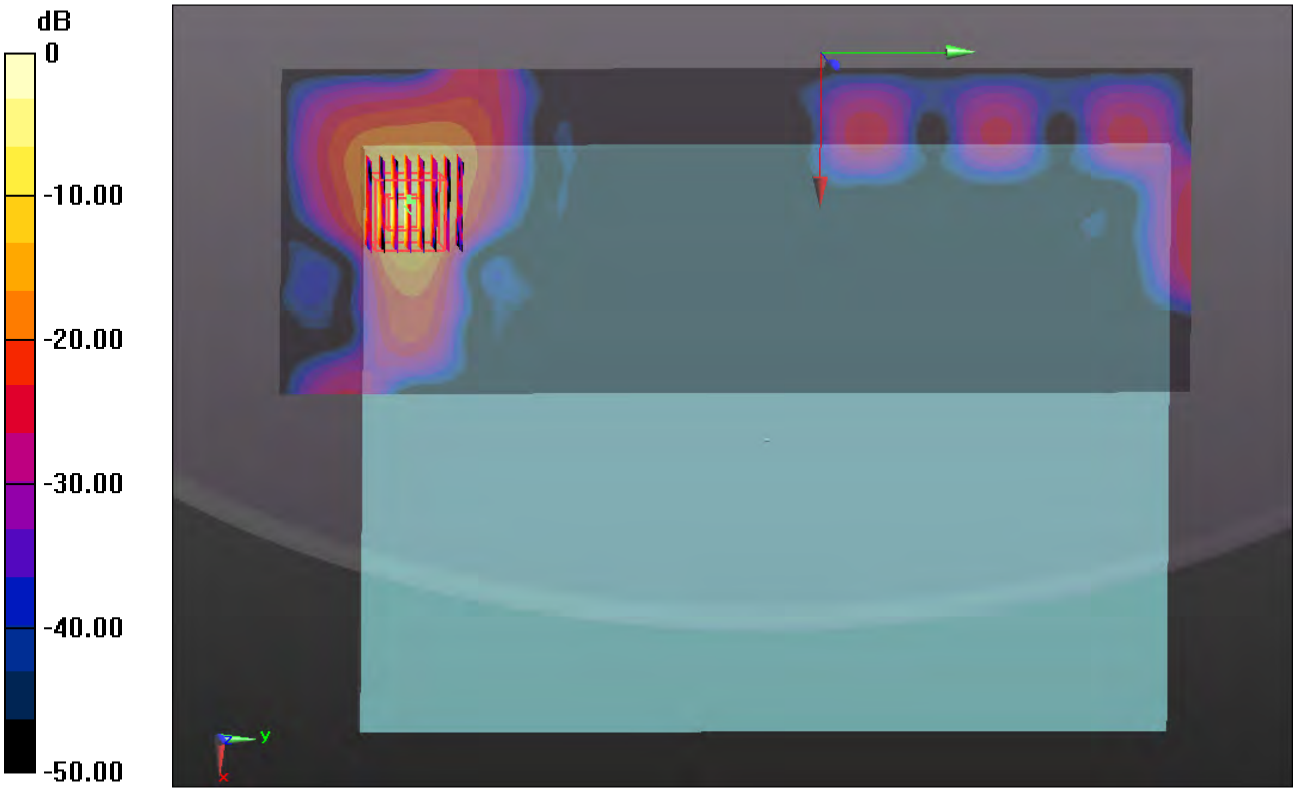
#04 WLAN 5.3GHz_Curved surface of Edge2 0cm_Ch60_Ant.1+2_#1

Communication System: WIFI (0); Frequency: 5300 MHz;Duty Cycle: 1:1.103
Medium: MSL_5000_150813 Medium parameters used: f = 5300 MHz; σ = 5.429 mho/m; ε_r = 48.56; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.9 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(4.25, 4.25, 4.25); Calibrated: 2015.05.28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM3; Type: SAM; Serial: TP-1079
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

Ch60/Area Scan (101x281x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.552 mW/g

Ch60/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 0.576 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 6.554 W/kg
SAR(1 g) = 0.938 mW/g; SAR(10 g) = 0.154 mW/g
Maximum value of SAR (measured) = 3.230 mW/g



0 dB = 3.230mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2015.08.14

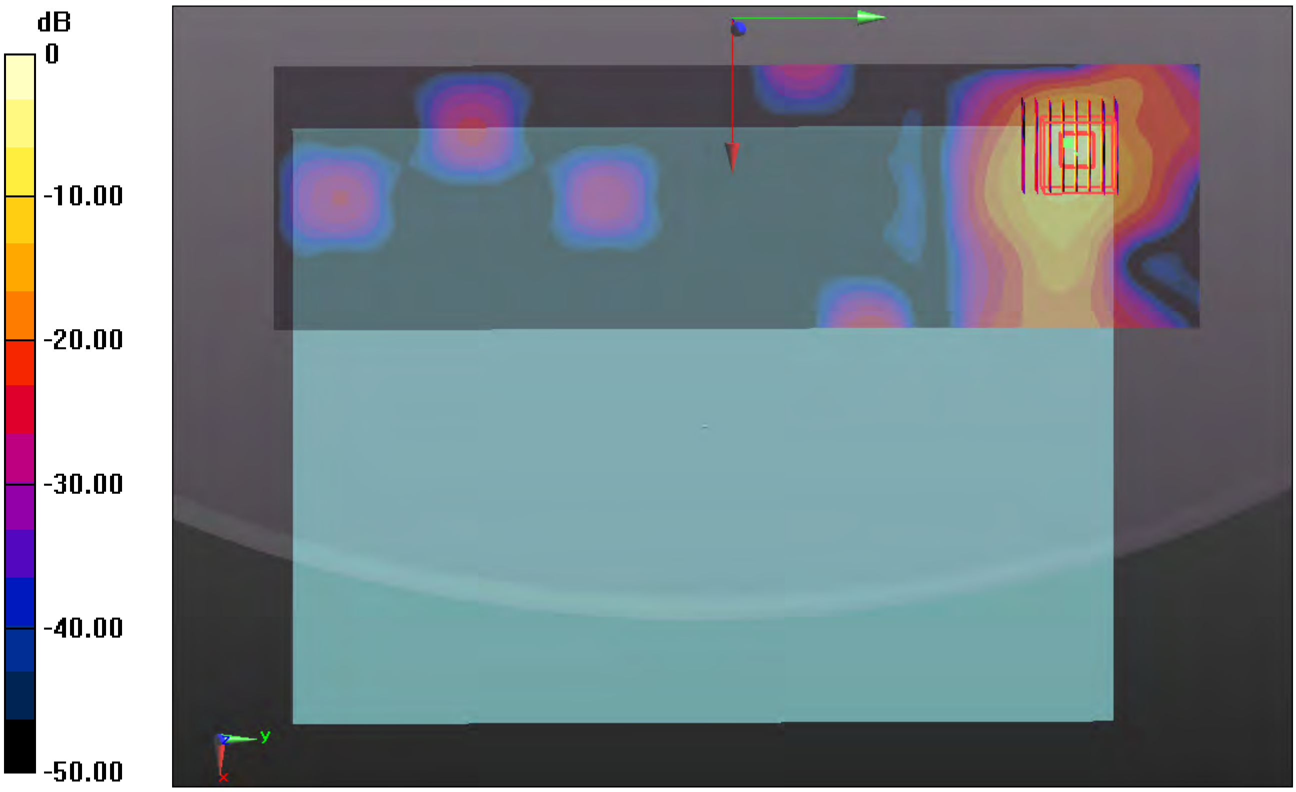
#05 WLAN 5.5GHz_802.11n-HT20_MCS0_Curved surface of Edge4 0cm_Ch100_Ant.1+2_#2

Communication System: WIFI (0); Frequency: 5500 MHz;Duty Cycle: 1:1.103
Medium: MSL_5000_150814 Medium parameters used: f = 5500 MHz; σ = 5.727 mho/m; ε_r = 48.178; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(3.8, 3.8, 3.8); Calibrated: 2015.05.28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM3; Type: SAM; Serial: TP-1079
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

Ch100/Area Scan (81x281x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.732 mW/g

Ch100/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 0.398 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 6.911 W/kg
SAR(1 g) = 1.210 mW/g; SAR(10 g) = 0.251 mW/g
Maximum value of SAR (measured) = 3.926 mW/g



0 dB = 3.930mW/g

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2015.08.15

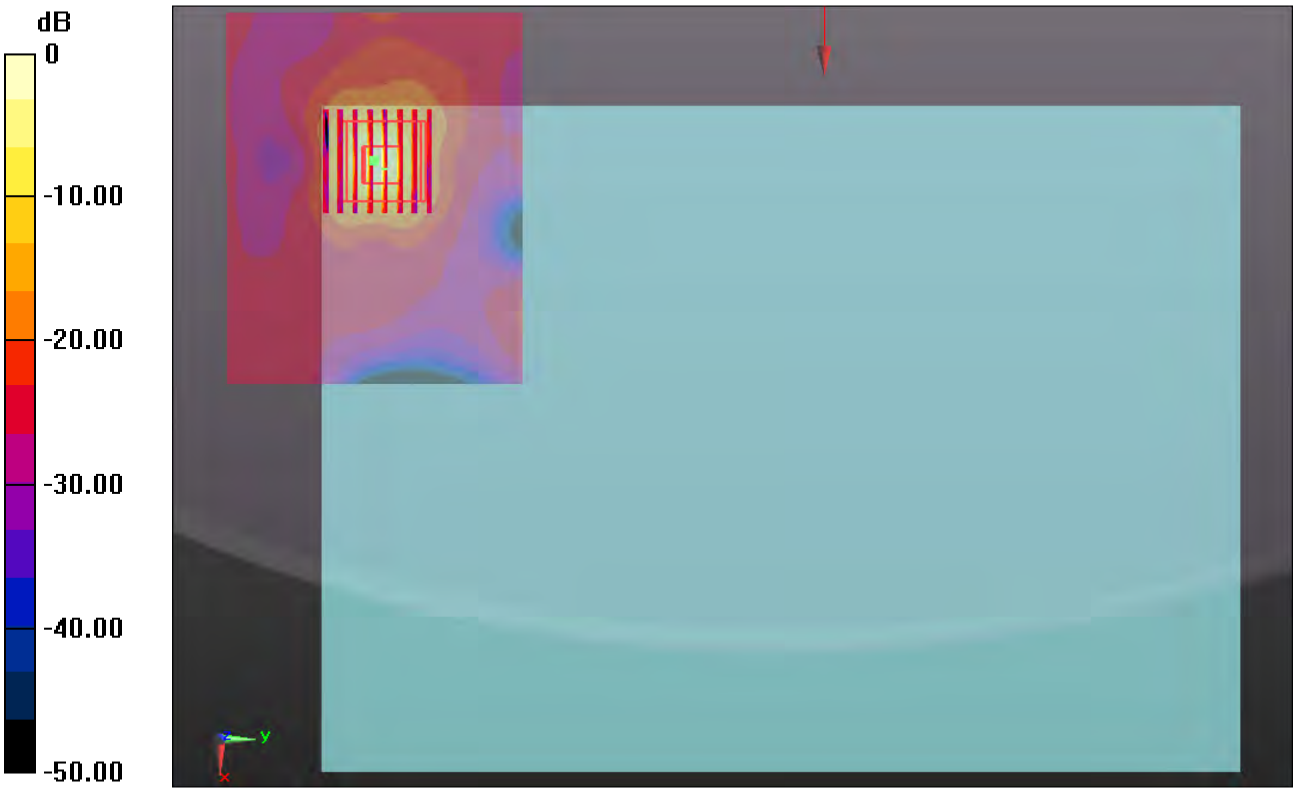
#06 WLAN 5.8GHz_802.11a_6M_Curved surface of Edge2 0cm_Ch149_Ant.1_#1

Communication System: WIFI (0); Frequency: 5745 MHz;Duty Cycle: 1:1.077
Medium: MSL_5000_150815 Medium parameters used: f = 5745 MHz; σ = 6.062 mho/m; ε_r = 47.59; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3857; ConvF(4.16, 4.16, 4.16); Calibrated: 2015.05.28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1210; Calibrated: 2015.05.21
- Phantom: SAM3; Type: SAM; Serial: TP-1079
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.4.5 (3634)

Ch149/Area Scan (101x81x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 4.194 mW/g

Ch149/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 1.648 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 9.547 W/kg
SAR(1 g) = 1.250 mW/g; SAR(10 g) = 0.201 mW/g
Maximum value of SAR (measured) = 4.673 mW/g



0 dB = 4.670mW/g

Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

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

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

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

Accreditation No.: SCS 108

Client Sporton-CN (Auden)

Certificate No: D2450V2-840_Nov14

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 840
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	November 19, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

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

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

Issued: November 20, 2014

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.0 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.21 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.6 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.9 ± 6 %	2.03 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.00 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.6 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.7 Ω + 2.8 jΩ
Return Loss	- 25.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.9 Ω + 4.4 jΩ
Return Loss	- 27.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.162 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	July 20, 2009

DASY5 Validation Report for Head TSL

Date: 19.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

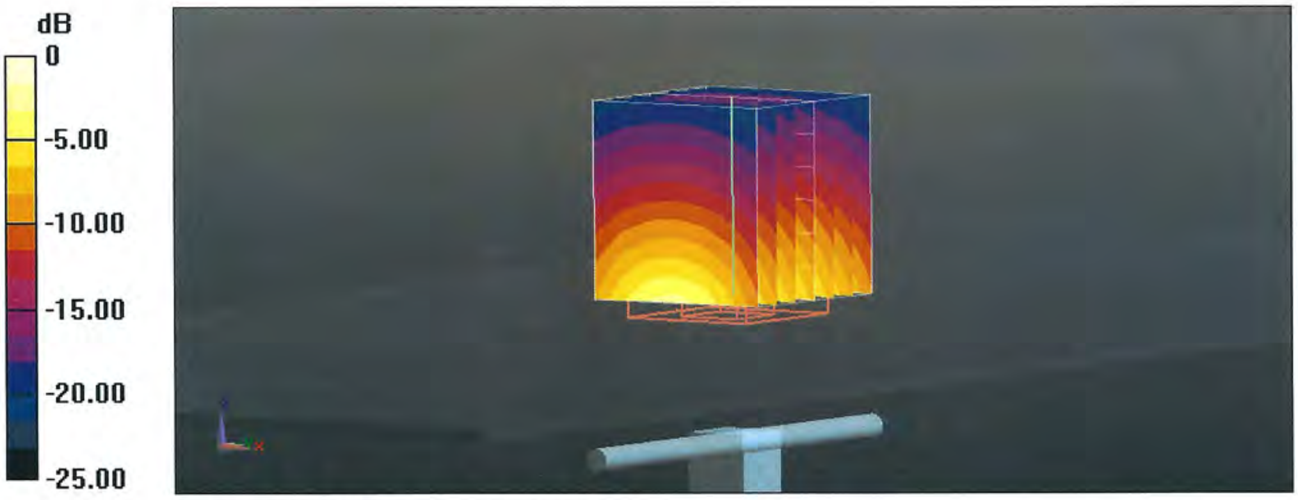
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 840

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 39; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

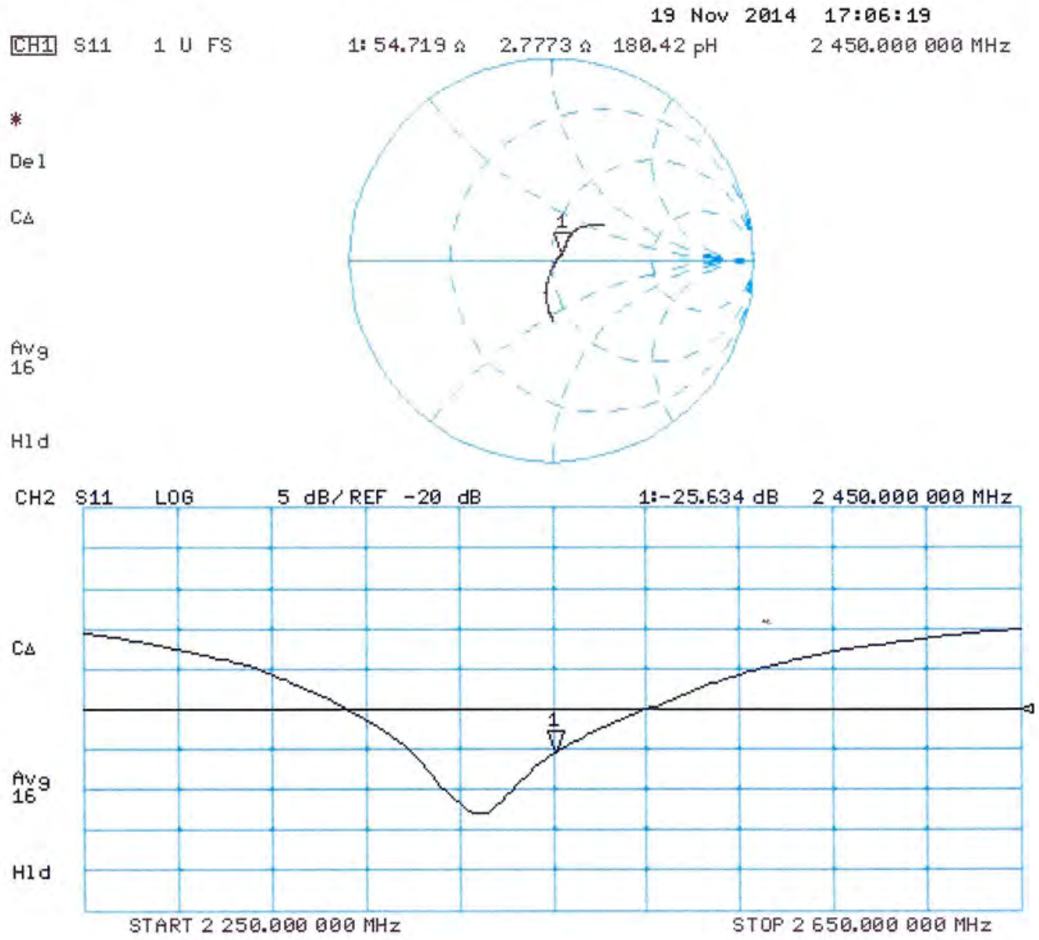
- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 100.9 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 27.3 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.21 W/kg
Maximum value of SAR (measured) = 17.5 W/kg



0 dB = 17.5 W/kg = 12.43 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 19.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

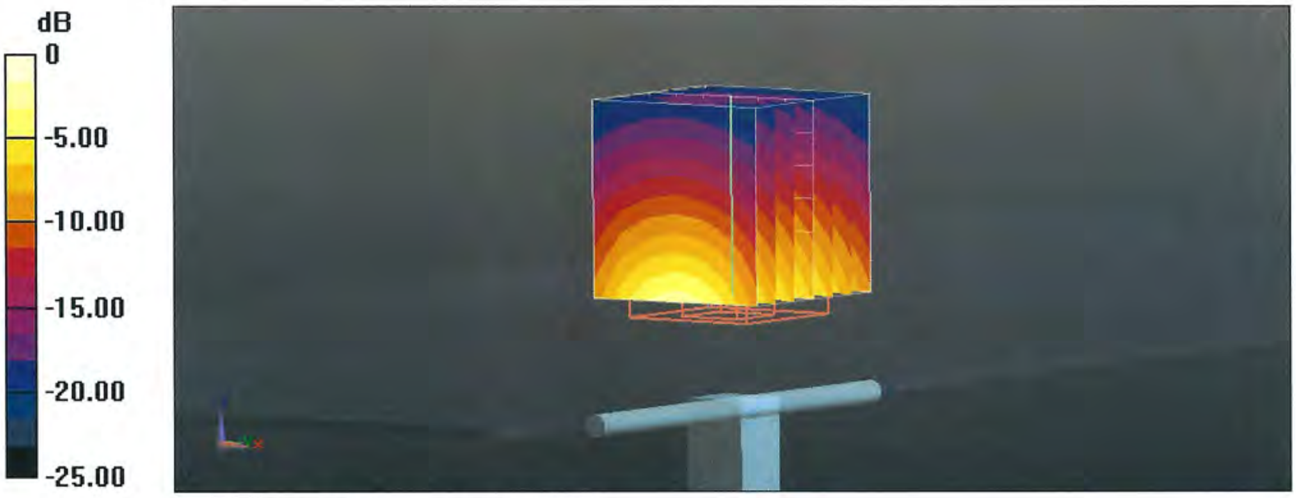
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 50.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

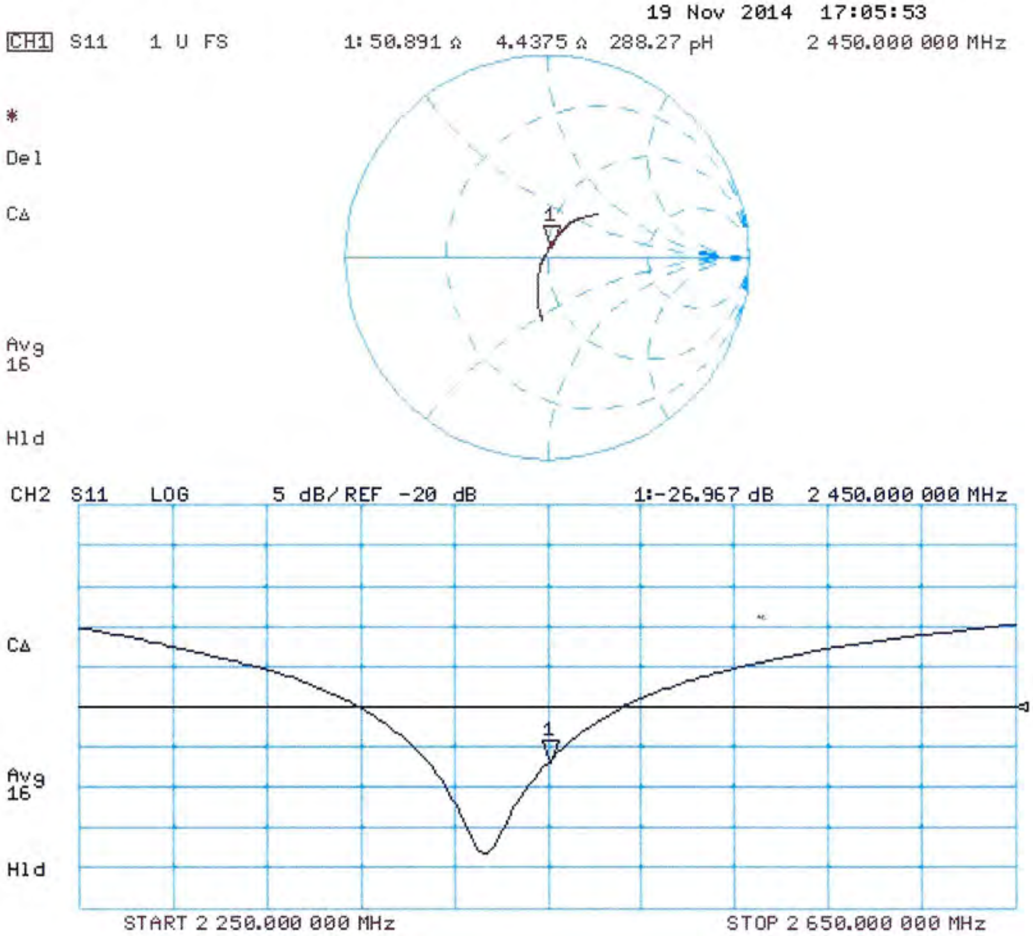
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.80 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 27.6 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6 W/kg
Maximum value of SAR (measured) = 17.3 W/kg



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

Impedance Measurement Plot for Body TSL



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 108

Client **Sporton-CN (Auden)**

Certificate No: D5GHzV2-1113_Nov14

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN:1113
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	November 24, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

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

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

Issued: November 24, 2014

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
c) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	4.59 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.8 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.7 ± 6 %	4.68 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.4 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.6 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.3 ± 6 %	4.98 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	8.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.5 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.0 ± 6 %	5.19 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.92 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.4 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.1 ± 6 %	5.45 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.55 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.9 W/kg ± 19.9 % (k=2)**

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

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	5.58 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.84 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.19 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.7 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	46.4 ± 6 %	5.98 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**81.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.24 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.2 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.0 ± 6 %	6.25 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.60 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.8 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	51.2 Ω - 8.5 jΩ
Return Loss	- 21.4 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	51.3 Ω - 4.0 jΩ
Return Loss	- 27.6 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	55.3 Ω - 2.2 jΩ
Return Loss	- 25.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.0 Ω - 0.4 jΩ
Return Loss	- 26.4 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	50.7 Ω - 7.9 jΩ
Return Loss	- 22.1 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	51.2 Ω - 2.9 jΩ
Return Loss	- 30.2 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	55.9 Ω - 1.8 jΩ
Return Loss	- 24.6 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	54.8 Ω + 0.5 jΩ
Return Loss	- 26.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 24.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1113

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.59 S/m; ε_r = 34.9; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.68 S/m; ε_r = 34.7; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.98 S/m; ε_r = 34.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.19 S/m; ε_r = 34; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

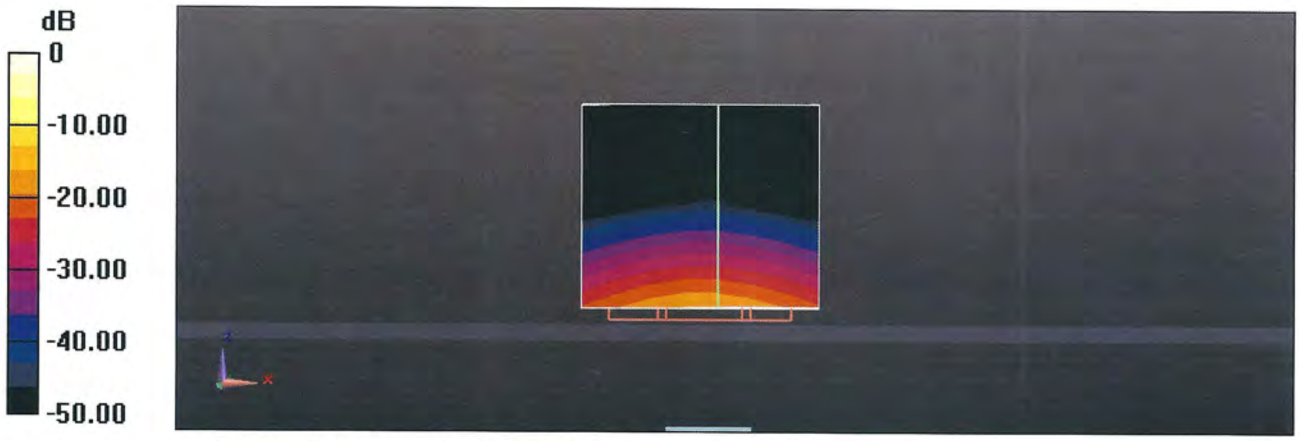
- Probe: EX3DV4 - SN3503; ConvF(5.52, 5.52, 5.52); Calibrated: 30.12.2013, ConvF(5.2, 5.2, 5.2); Calibrated: 30.12.2013, ConvF(4.86, 4.86, 4.86); Calibrated: 30.12.2013, ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.61 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 29.6 W/kg
SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.3 W/kg
Maximum value of SAR (measured) = 18.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.98 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 31.6 W/kg
SAR(1 g) = 8.3 W/kg; SAR(10 g) = 2.38 W/kg
Maximum value of SAR (measured) = 19.5 W/kg

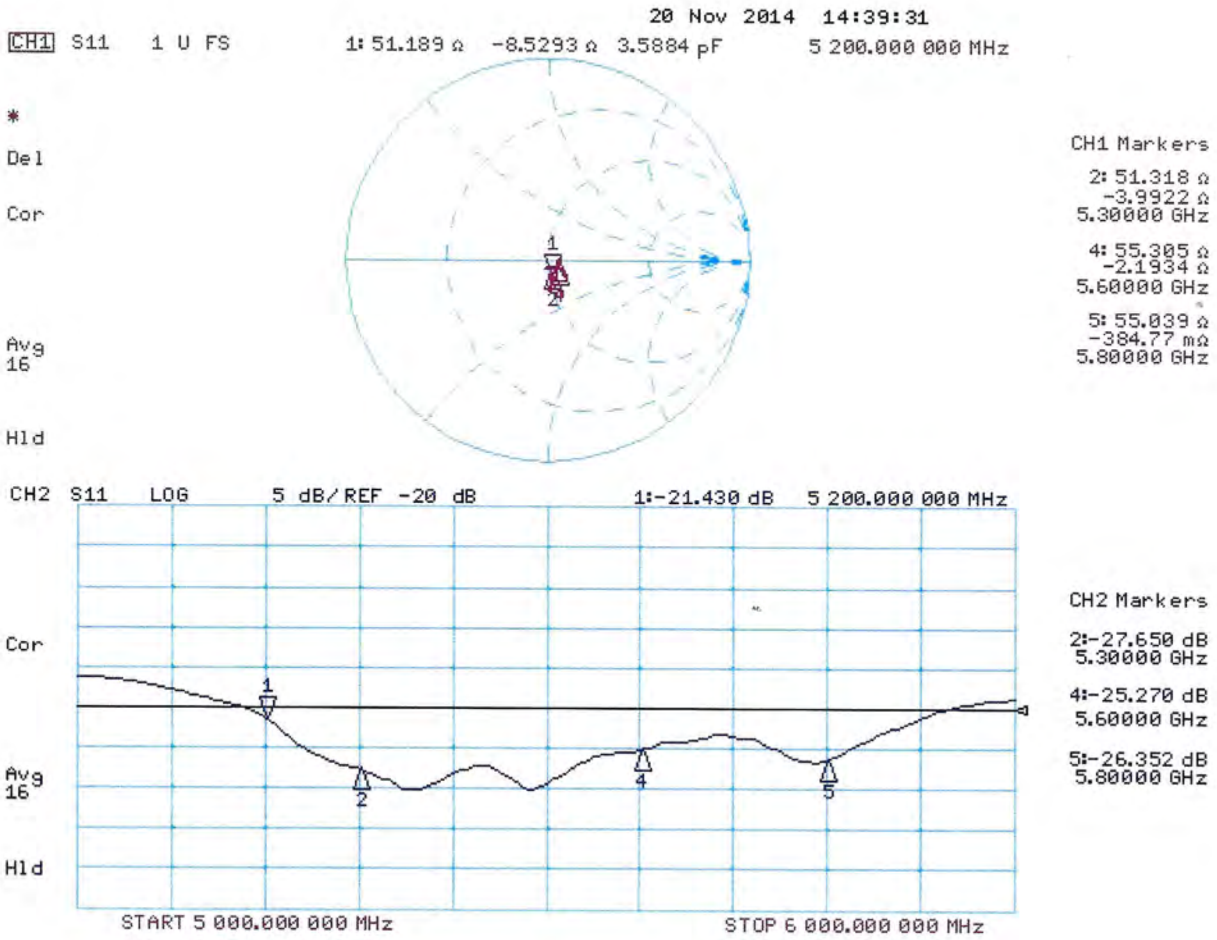
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.58 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 33.0 W/kg
SAR(1 g) = 8.31 W/kg; SAR(10 g) = 2.37 W/kg
Maximum value of SAR (measured) = 19.9 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 62.47 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 32.5 W/kg
SAR(1 g) = 7.92 W/kg; SAR(10 g) = 2.26 W/kg
Maximum value of SAR (measured) = 19.4 W/kg



0 dB = 18.8 W/kg = 12.74 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 20.11.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1113

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.45 S/m; ε_r = 47.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 5.58 S/m; ε_r = 46.9; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.98 S/m; ε_r = 46.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.25 S/m; ε_r = 46; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

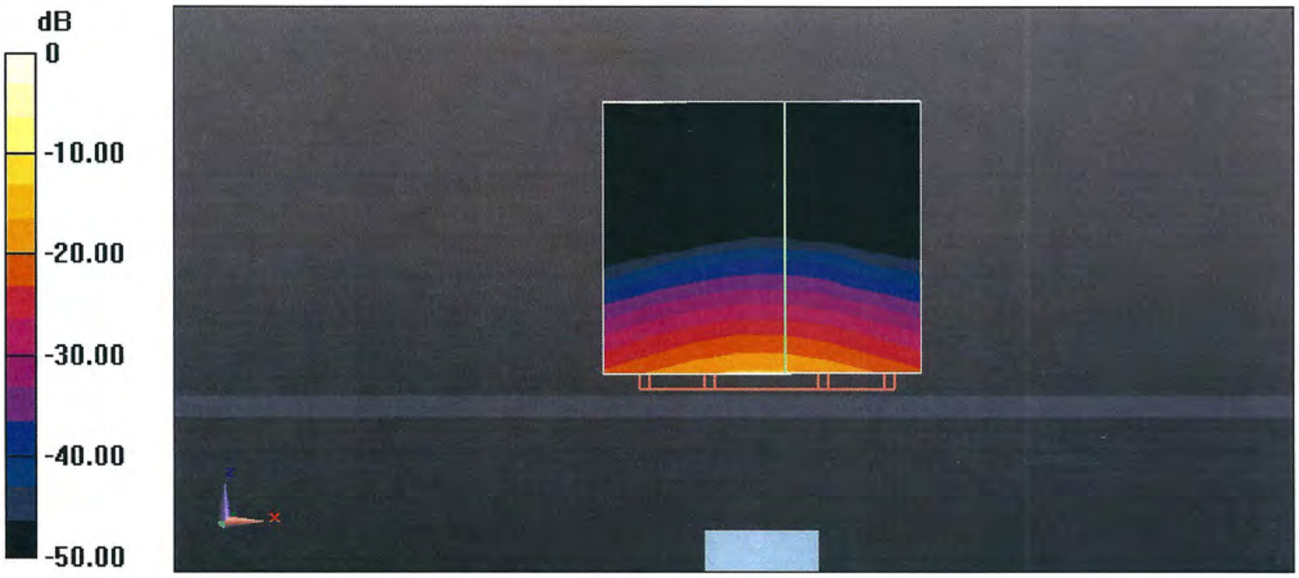
- Probe: EX3DV4 - SN3503; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2013, ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013, ConvF(4.3, 4.3, 4.3); Calibrated: 30.12.2013, ConvF(4.47, 4.47, 4.47); Calibrated: 30.12.2013;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.99 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 29.2 W/kg
SAR(1 g) = 7.55 W/kg; SAR(10 g) = 2.11 W/kg
Maximum value of SAR (measured) = 17.3 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.43 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 31.4 W/kg
SAR(1 g) = 7.84 W/kg; SAR(10 g) = 2.19 W/kg
Maximum value of SAR (measured) = 18.9 W/kg

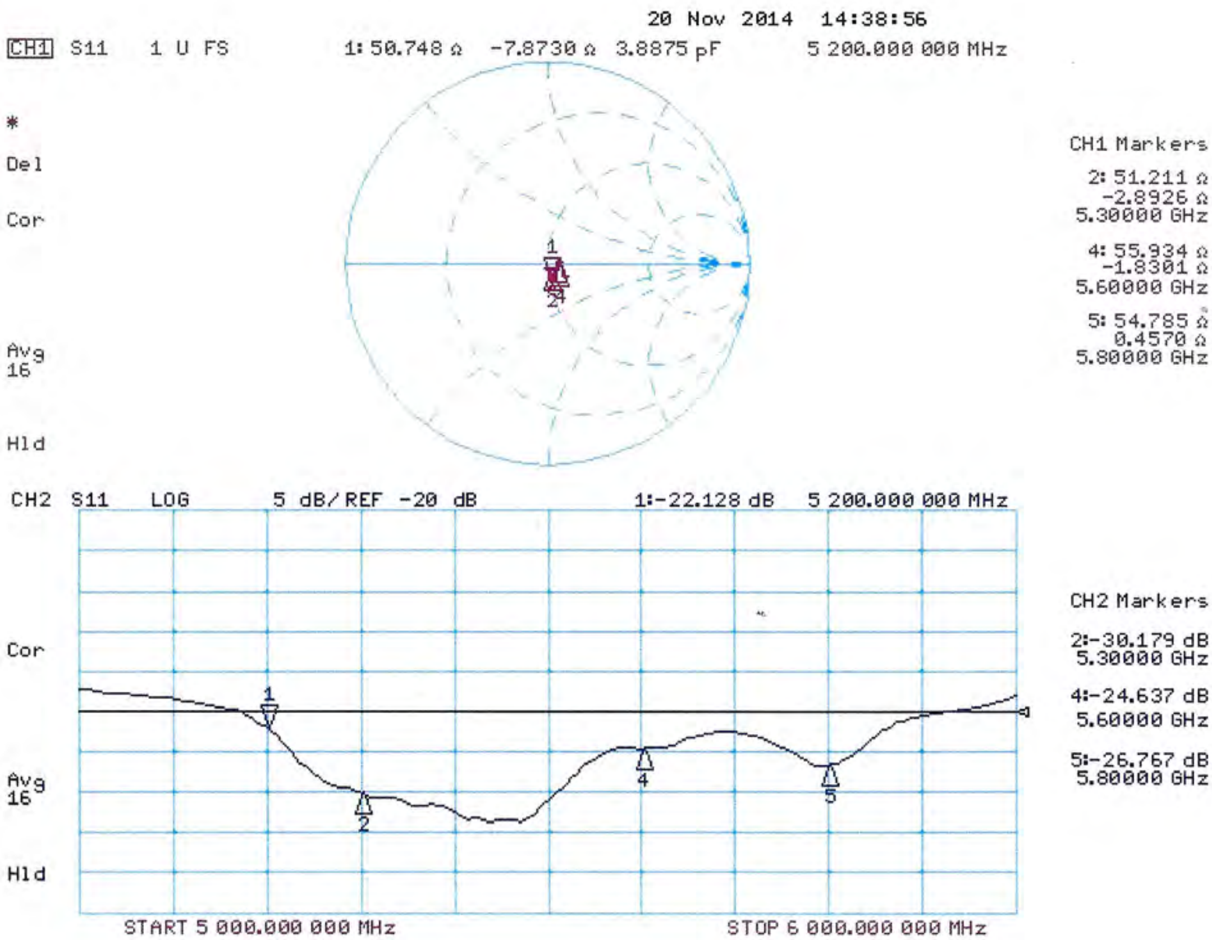
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.78 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 36.7 W/kg
SAR(1 g) = 8.21 W/kg; SAR(10 g) = 2.24 W/kg
Maximum value of SAR (measured) = 20.9 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 55.92 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 34.8 W/kg
SAR(1 g) = 7.6 W/kg; SAR(10 g) = 2.1 W/kg
Maximum value of SAR (measured) = 18.5 W/kg



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

Impedance Measurement Plot for Body TSL



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IMPORTANT NOTICE

USAGE OF THE DAE 4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:
Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:
Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:
To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

Schmid & Partner Engineering

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Accreditation No.: SCS 0108

Client **Sporton CN (Auden)**

Certificate No: DAE4-1210_May15

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 1210
Calibration procedure(s)	QA CAL-06.v29 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	May 21, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-14 (No:15573)	Oct-15
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	06-Jan-15 (in house check)	In house check: Jan-16
Calibrator Box V2.1	SE UMS 006 AA 1002	06-Jan-15 (in house check)	In house check: Jan-16

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

Issued: May 21, 2015

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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 0108

Glossary

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

Calibration Factors	X	Y	Z
High Range	404.137 ± 0.02% (k=2)	404.963 ± 0.02% (k=2)	405.072 ± 0.02% (k=2)
Low Range	3.99939 ± 1.50% (k=2)	3.98266 ± 1.50% (k=2)	3.99957 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	122.5 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199991.86	-2.70	-0.00
Channel X	+ Input	20001.56	0.90	0.00
Channel X	- Input	-19999.14	1.73	-0.01
Channel Y	+ Input	199988.37	-6.13	-0.00
Channel Y	+ Input	19999.78	-0.97	-0.00
Channel Y	- Input	-20000.29	0.53	-0.00
Channel Z	+ Input	199992.91	-1.80	-0.00
Channel Z	+ Input	19999.00	-1.82	-0.01
Channel Z	- Input	-20001.26	-0.34	0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.89	0.21	0.01
Channel X	+ Input	201.17	-0.00	-0.00
Channel X	- Input	-198.94	-0.16	0.08
Channel Y	+ Input	2001.04	0.23	0.01
Channel Y	+ Input	200.94	-0.35	-0.18
Channel Y	- Input	-198.65	0.00	-0.00
Channel Z	+ Input	2001.34	0.55	0.03
Channel Z	+ Input	200.34	-0.85	-0.42
Channel Z	- Input	-199.79	-1.03	0.52

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	-6.43	-7.81
	- 200	8.59	6.88
Channel Y	200	-9.24	-9.53
	- 200	8.64	8.82
Channel Z	200	12.32	11.91
	- 200	-14.23	-14.26

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	1.89	-4.39
Channel Y	200	8.48	-	2.69
Channel Z	200	9.38	6.78	-

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15958	16206
Channel Y	15960	16204
Channel Z	15870	16608

5. Input Offset Measurement

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

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.29	-1.11	0.62	0.33
Channel Y	0.75	-0.38	2.27	0.47
Channel Z	-1.15	-1.99	0.07	0.40

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

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

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Accreditation No.: SCS 0108

Client **Sporton-CN (Auden)**

Certificate No: EX3-3857_May15

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3857
Calibration procedure(s)	QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	May 28, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	i.V. [signature]
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: June 1, 2015

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe EX3DV4

SN:3857

Manufactured: January 23, 2012
Calibrated: May 28, 2015

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3857

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m)^2)[A]	0.18	0.44	0.46	± 10.1 %
DCP (mV)[B]	94.7	99.8	100.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√µV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	131.0	±2.7 %
		Y	0.0	0.0	1.0		144.7	
		Z	0.0	0.0	1.0		147.8	

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

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3857

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	9.75	9.75	9.75	0.44	0.80	± 12.0 %
835	41.5	0.90	9.26	9.26	9.26	0.25	1.28	± 12.0 %
900	41.5	0.97	9.09	9.09	9.09	0.40	0.92	± 12.0 %
1750	40.1	1.37	8.06	8.06	8.06	0.27	0.80	± 12.0 %
1900	40.0	1.40	7.81	7.81	7.81	0.33	0.80	± 12.0 %
2000	40.0	1.40	7.83	7.83	7.83	0.29	0.90	± 12.0 %
2300	39.5	1.67	7.44	7.44	7.44	0.30	0.80	± 12.0 %
2450	39.2	1.80	7.08	7.08	7.08	0.27	1.14	± 12.0 %
2600	39.0	1.96	7.05	7.05	7.05	0.35	1.20	± 12.0 %
3500	37.9	2.91	6.89	6.89	6.89	0.26	1.49	± 13.1 %
3700	37.7	3.12	6.48	6.48	6.48	0.21	2.12	± 13.1 %
5200	36.0	4.66	5.20	5.20	5.20	0.35	1.80	± 13.1 %
5300	35.9	4.76	4.97	4.97	4.97	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.63	4.63	4.63	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.76	4.76	4.76	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3857

Calibration Parameter Determined in Body Tissue Simulating Media

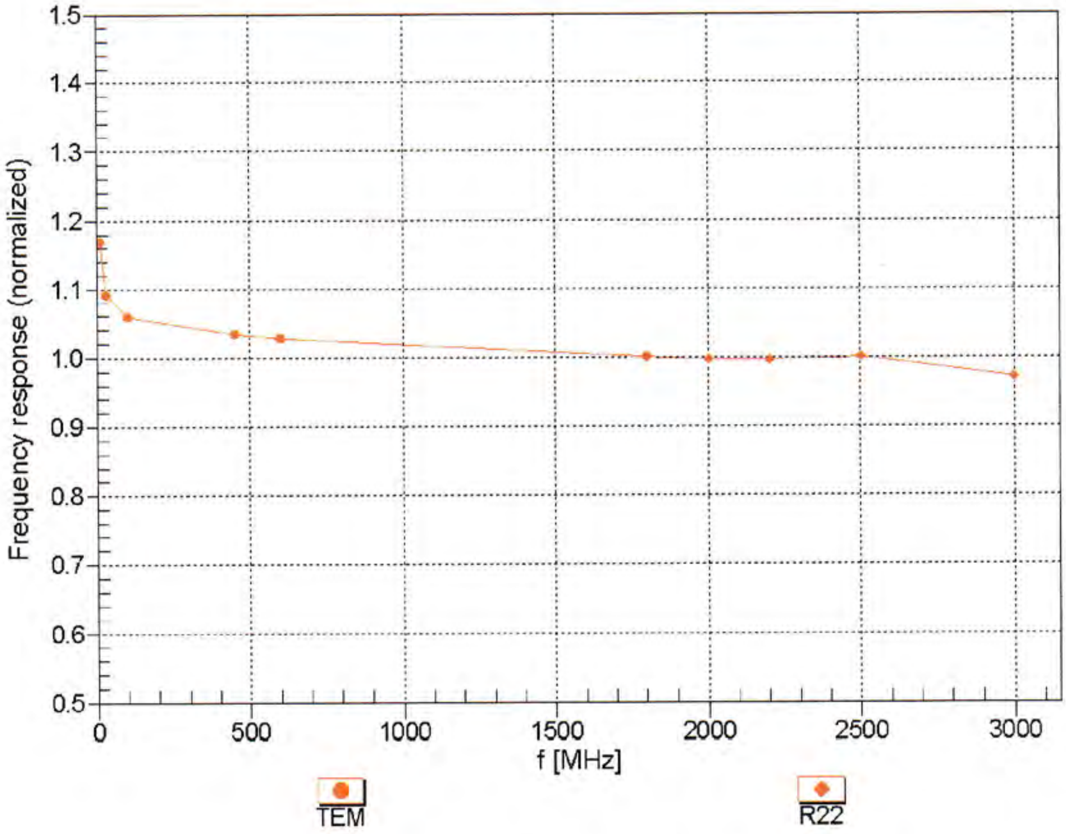
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	9.68	9.68	9.68	0.53	0.81	± 12.0 %
835	55.2	0.97	9.52	9.52	9.52	0.41	0.94	± 12.0 %
900	55.0	1.05	9.30	9.30	9.30	0.44	0.88	± 12.0 %
1750	53.4	1.49	7.77	7.77	7.77	0.35	0.80	± 12.0 %
1900	53.3	1.52	7.54	7.54	7.54	0.42	0.80	± 12.0 %
2000	53.3	1.52	7.74	7.74	7.74	0.37	0.86	± 12.0 %
2300	52.9	1.81	7.43	7.43	7.43	0.31	0.80	± 12.0 %
2450	52.7	1.95	7.29	7.29	7.29	0.39	0.80	± 12.0 %
2600	52.5	2.16	7.17	7.17	7.17	0.19	0.81	± 12.0 %
3700	51.0	3.55	6.49	6.49	6.49	0.31	1.31	± 13.1 %
5200	49.0	5.30	4.45	4.45	4.45	0.45	1.90	± 13.1 %
5300	48.9	5.42	4.25	4.25	4.25	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.80	3.80	3.80	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.16	4.16	4.16	0.50	1.90	± 13.1 %

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

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

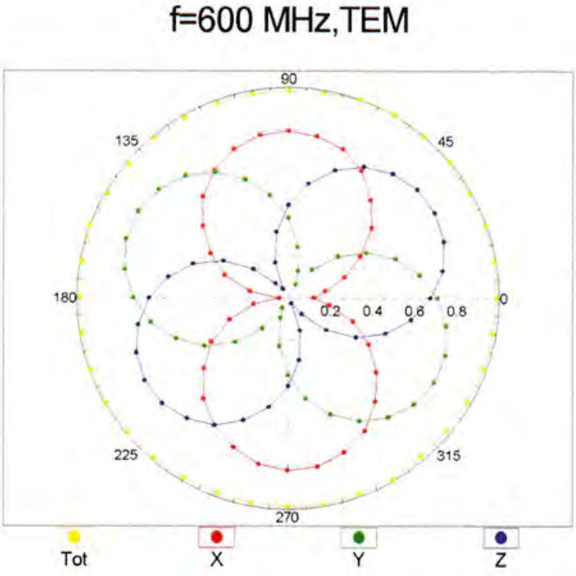
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from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

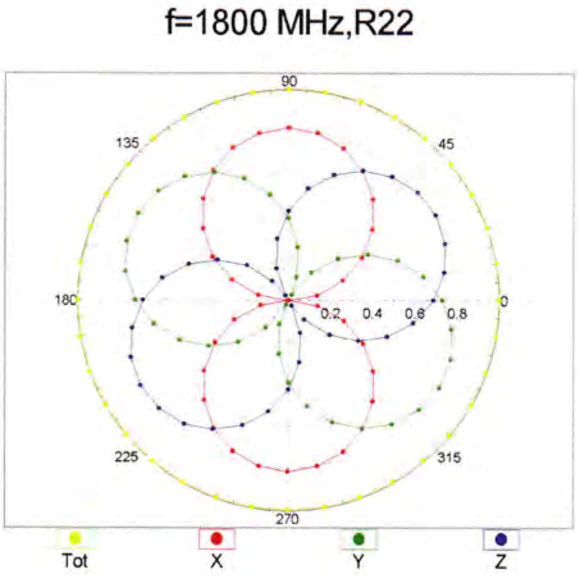
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)

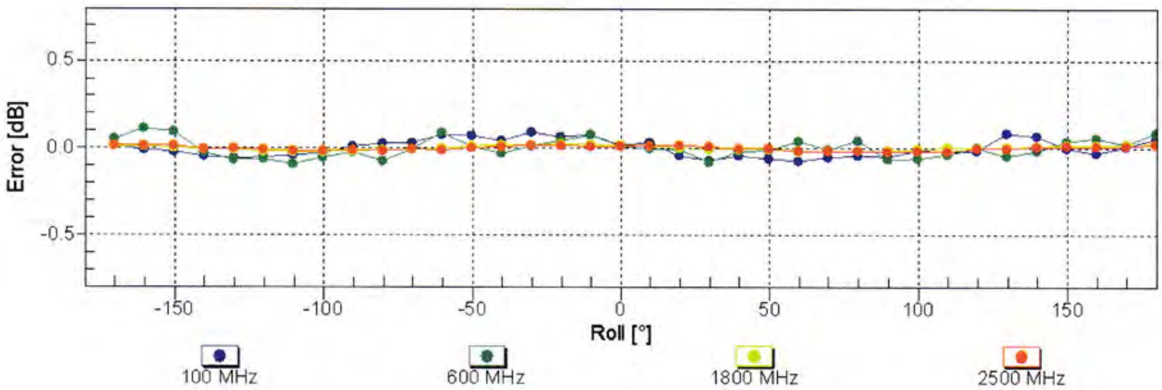


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

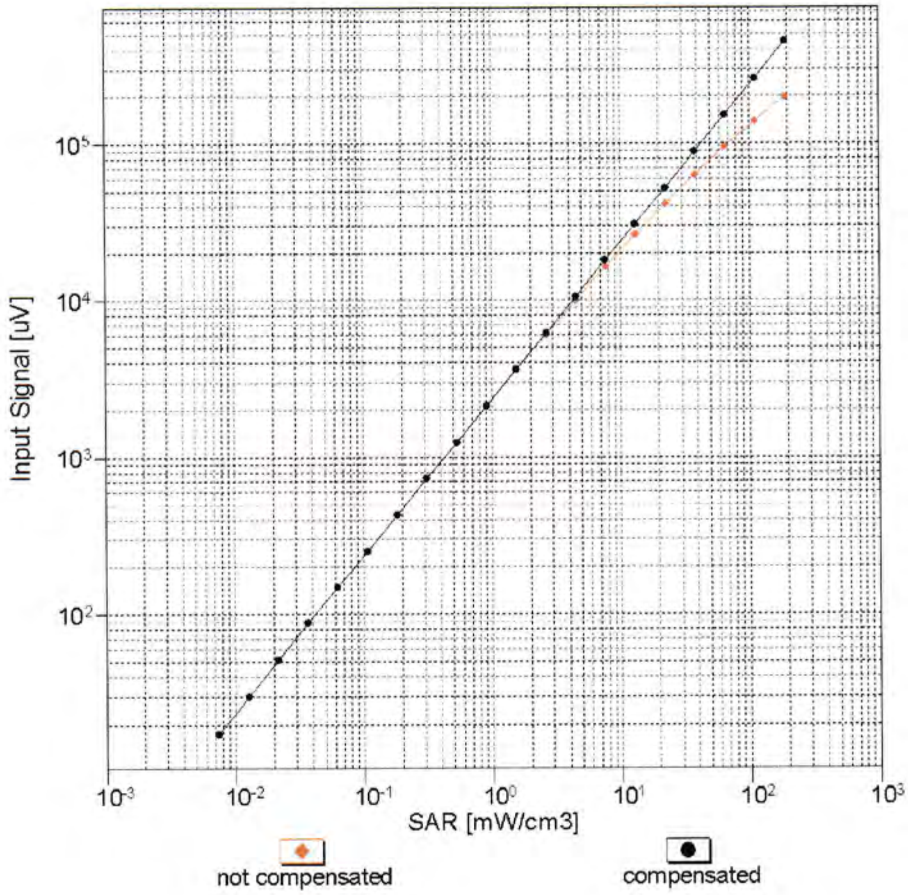


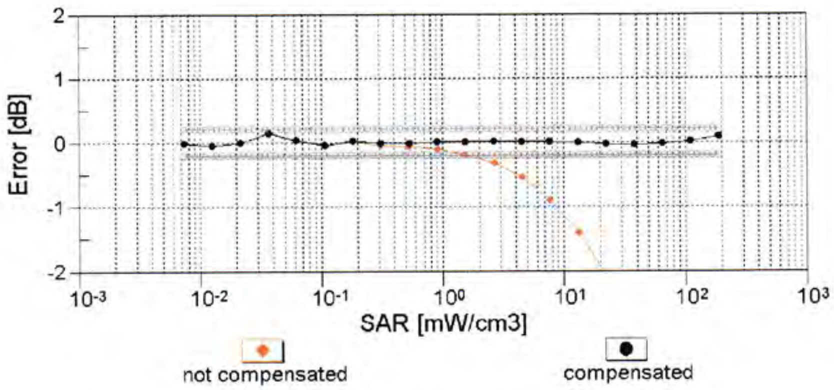




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

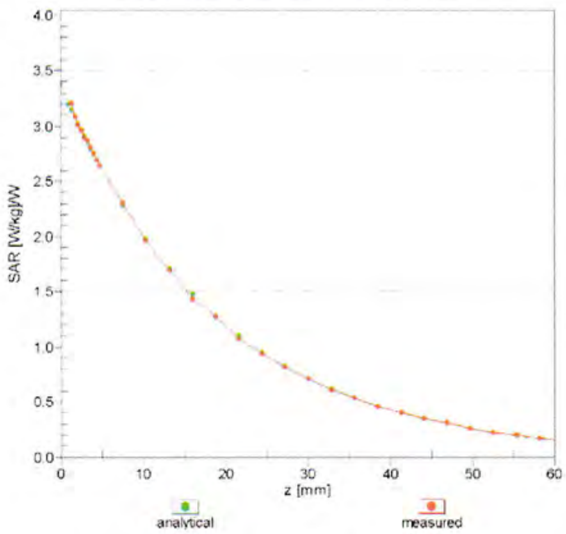
Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)

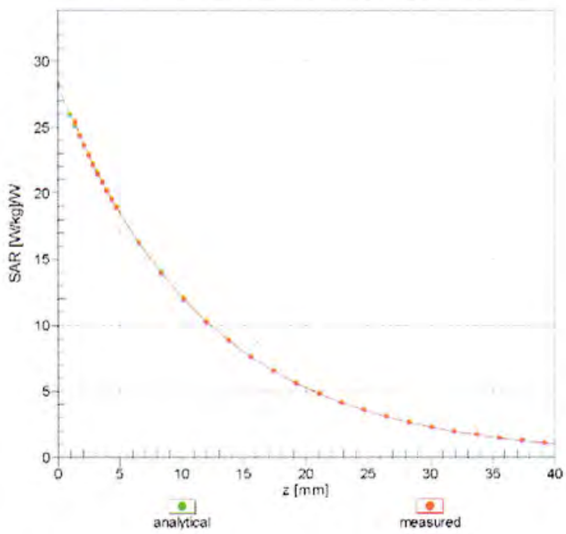




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

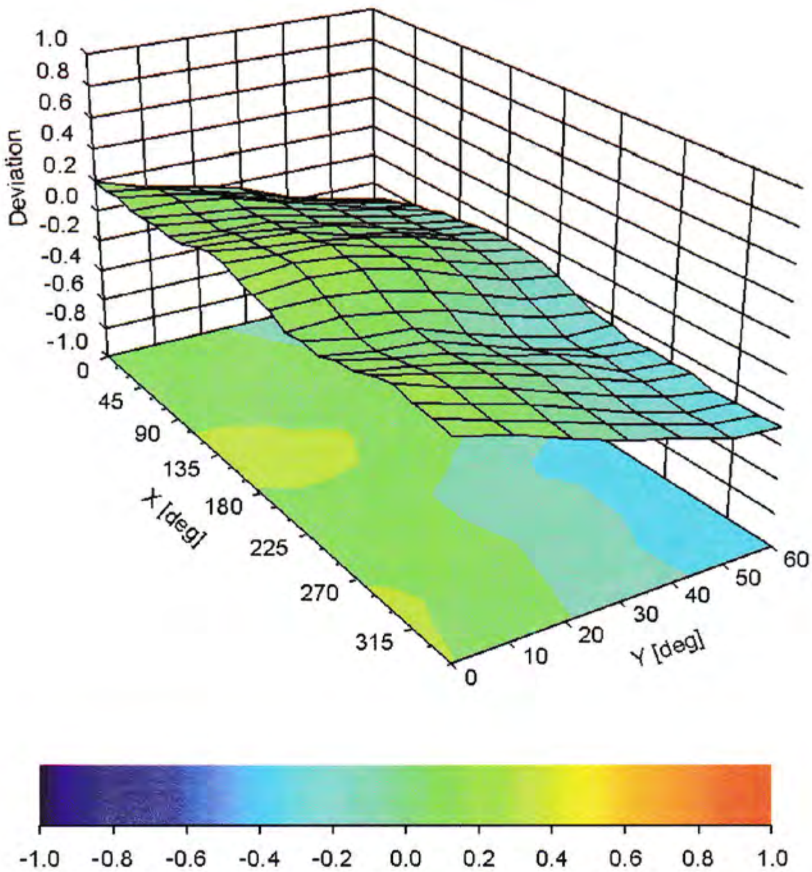
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3857

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	139.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm