

FCC SAR Test Report

APPLICANT : ZTE CORPORATION
EQUIPMENT : smart watch
BRAND NAME : ZTE
MODEL NAME : ZW10
FCC ID : SRQ-ZW10
STANDARD : FCC 47 CFR Part 2 (2.1093)
ANSI/IEEE C95.1-1992
IEEE 1528-2013

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



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1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **ZTE CORPORATION, smart watch, ZW10**, are as follows.

1g Next to Mouth SAR:

Equipment Class	Frequency Band		Highest SAR Summary	Highest Simultaneous Transmission 1g SAR (W/kg)
			Next to Mouth SAR (Separation 10mm) 1g SAR (W/kg)	
Licensed	GSM	GSM850	<0.10	1.01
		GSM1900	0.29	
	WCDMA	Band V	<0.10	
		Band IV	0.45	
		Band II	0.95	
DTS	WLAN	2.4GHz WLAN	<0.10	1.01
Date of Testing:			2017/1/10 ~ 2017/1/16	

10g Extremity SAR:

Equipment Class	Frequency Band		Highest SAR Summary	Highest Simultaneous Transmission 10g SAR (W/kg)
			Wrist-worn SAR (Separation 0mm) 10g SAR (W/kg)	
Licensed	GSM	GSM850	0.34	2.07
		GSM1900	0.63	
	WCDMA	Band V	0.58	
		Band IV	1.56	
		Band II	1.90	
DTS	WLAN	2.4GHz WLAN	0.17	2.07
Date of Testing:			2017/1/10 ~ 2017/1/16	

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled 1g SAR exposure limits (1.6 W/kg) and 10g Extremity SAR (4.0 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 Site	
Test Site	SPORTON INTERNATIONAL (XI'AN) INC.
Test Site Location	No. 39 Building A3, Entrepreneurship Avenue, New industrial park, High-tech district, Xi'an City, Shaanxi Province, P. R. China TEL: +86-029-8860-8767 FAX: +86-029-8860-8791

Applicant	
Company Name	ZTE CORPORATION
Address	ZTE Plaza, Keji Road South, Hi-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, 518057, P. R. China

Manufacturer	
Company Name	ZTE CORPORATION
Address	ZTE Plaza, Keji Road South, Hi-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, 518057, P. R. China

3. Guidance Applied

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

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 941225 D01 3G SAR Procedures v03r01

4. Equipment Under Test (EUT) Information

4.1 General Information

Product Feature & Specification	
Equipment Name	smart watch
Brand Name	ZTE
Model Name	ZW10
FCC ID	SRQ-ZW10
IMEI Code	863399030006870
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band IV: 1712.4 MHz ~ 1752.6 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	<ul style="list-style-type: none"> · GSM/GPRS/EGPRS · RMC/AMR 12.2Kbps · HSDPA · HSUPA · 802.11b/g/n HT20 · Bluetooth BR/EDR/LE
HW Version	ZW10HW1.0
SW Version	NFG08
GSM / (E)GPRS Transfer mode	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
EUT Stage	Identical Prototype
Remark: <ol style="list-style-type: none"> 1. 802.11n-HT40 is not supported in 2.4GHz WLAN. 2. This device supports GRPS/EGPRS mode up to multi-slot class 12. 3. This device does not support DTM operation. 4. This device supports voice function. 	

5. RF Exposure Limits

5.1 Uncontrolled Environment

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

5.2 Controlled Environment

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

Limits for Occupational/Controlled Exposure (W/kg)

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

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

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

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.

6. Specific Absorption Rate (SAR)

6.1 Introduction

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

6.2 SAR Definition

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

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

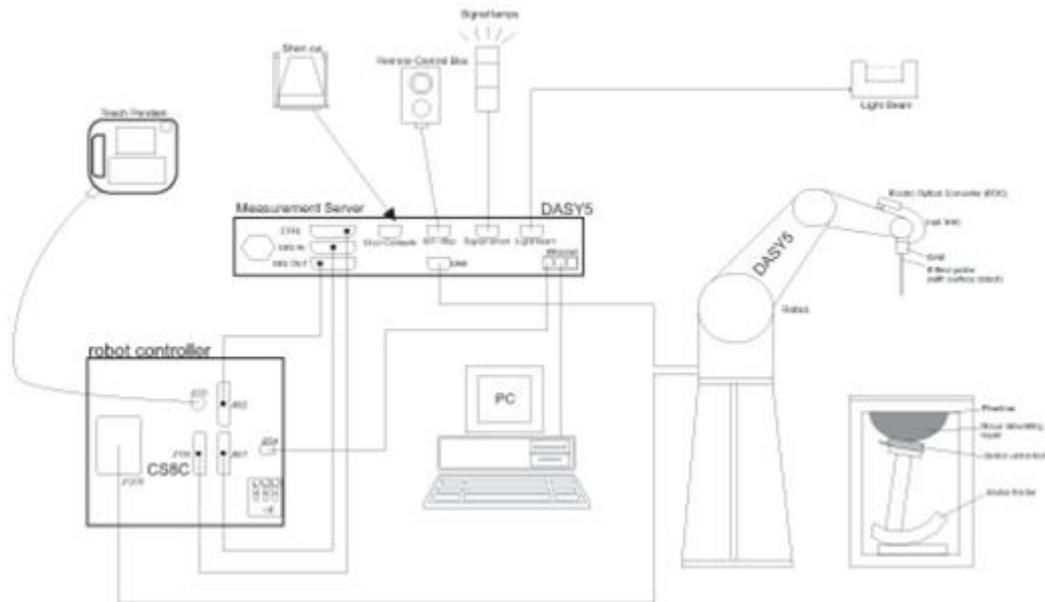
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

7. System Description and Setup

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



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

7.1 E-Field Probe

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

<EX3DV4 Probe>

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

7.2 Data Acquisition Electronics (DAE)

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

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



Fig 5.1 Photo of DAE

7.3 Phantom

<SAM Twin Phantom>

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



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

<ELI Phantom>

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



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

7.4 Device Holder

<Mounting Device for Hand-Held Transmitter>

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



Mounting Device for Hand-Held Transmitters



Mounting Device Adaptor for Wide-Phones

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

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



Mounting Device for Laptops

8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

- (a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- (b) Read the WWAN RF power level from the base station simulator.
- (c) 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
- (d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

- (a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and 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

8.1 Spatial Peak SAR Evaluation

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

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

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

- (a) Extraction of the measured data (grid and values) from the Zoom Scan
- (b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
- (c) Generation of a high-resolution mesh within the measured volume
- (d) Interpolation of all measured values from the measurement grid to the high-resolution grid
- (e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
- (f) Calculation of the averaged SAR within masses of 1g and 10g

8.2 Power Reference Measurement

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

8.3 Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

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

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

8.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

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

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

8.5 Volume Scan Procedures

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

8.6 Power Drift Monitoring

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



9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	4d151	2016/3/16	2017/3/15
SPEAG	1750MHz System Validation Kit	D1750V2	1090	2016/3/22	2017/3/21
SPEAG	1900MHz System Validation Kit	D1900V2	5d170	2016/3/21	2017/3/20
SPEAG	2450MHz System Validation Kit	D2450V2	908	2016/3/18	2017/3/17
SPEAG	Data Acquisition Electronics	DAE4	1358	2016/9/5	2017/9/4
SPEAG	Dosimetric E-Field Probe	EX3DV4	3935	2016/11/28	2017/11/27
SPEAG	SAM Twin Phantom	QD 000 P40 CD	TP-1753	NCR	NCR
SPEAG	SAM Twin Phantom	QD 000 P40 CD	TP-1754	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Agilent	Wireless Communication Test Set	E5515C	MY52102600	2016/12/5	2017/12/4
Agilent	ENA Series Network Analyzer	E5071C	MY46317418	2016/12/5	2017/12/4
Agilent	Dielectric Probe Kit	85070E	MY44300751	NCR	NCR
Anritsu	Power Sensor	MA2411B	0917070	2016/1/20	2017/1/19
Anritsu	Power Meter	ML2495A	1005002	2016/1/20	2017/1/19
Anritsu	Power Sensor	MA2411B	1339206	2016/1/20	2017/1/19
Anritsu	Power Meter	ML2495A	1438004	2016/1/20	2017/1/19
R&S	Signal Generator	N5181A	MY50145381	2017/1/3	2018/1/2
R&S	Spectrum Analyzer	FSV 7	101632	2016/12/5	2017/12/4
ARRA	Power Divider	A3200-2	NA	Note	
Agilent	Dual Directional Coupler	778D	50422	Note	
Woken	Attenuation1	WK0602-XX	N/A	Note	
PE	Attenuation2	PE7005-10	N/A	Note	
PE	Attenuation3	PE7005-3	N/A	Note	
AR	Amplifier	5S1G4	342137	Note	

Note:

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

10. System Verification

10.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.2.

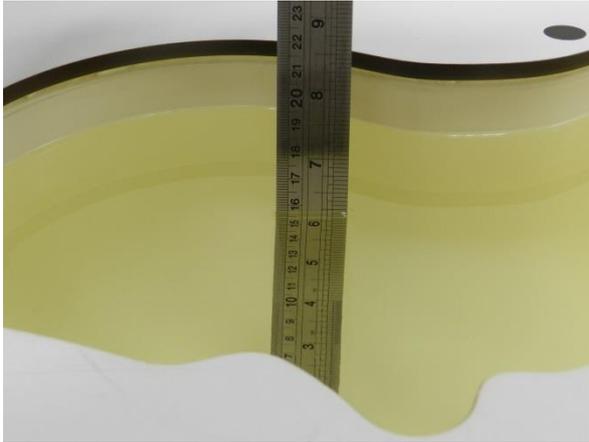


Fig 10.1 Photo of Liquid Height for Head SAR



Fig 10.2 Photo of Liquid Height for Body SAR

10.2 Tissue Verification

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

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (ϵ_r)
For Head								
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
For Body								
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Conductivity (σ)	Permittivity (ϵ_r)	Conductivity Target (σ)	Permittivity Target (ϵ_r)	Delta (σ) (%)	Delta (ϵ_r) (%)	Limit (%)	Date
835	Head	22.5	0.888	41.9	0.90	41.50	-1.33	0.96	±5	2017/1/11
1750	Head	22.7	1.376	41.981	1.37	40.10	0.44	4.69	±5	2017/1/10
1900	Head	22.6	1.458	39.709	1.40	40.00	4.14	-0.73	±5	2017/1/10
2450	Head	22.2	1.837	39.416	1.80	39.20	2.06	0.55	±5	2017/1/16
835	Body	22.5	0.962	56.105	0.97	55.2	-0.82	1.64	±5	2017/1/11
1750	Body	22.4	1.499	54.037	1.49	53.4	0.60	1.19	±5	2017/1/10
1900	Body	22.3	1.571	54.034	1.52	53.3	3.36	1.38	±5	2017/1/10
2450	Body	22.3	1.936	53.169	1.95	52.7	-0.72	0.89	±5	2017/1/16

10.3 System Performance Check Results

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

<1g SAR>

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2017/1/11	835	Head	250	4d151	3935	1358	2.27	9.26	9.08	-1.94
2017/1/10	1750	Head	250	1090	3935	1358	9.03	35.1	36.12	2.91
2017/1/10	1900	Head	250	5d170	3935	1358	10.2	38.1	40.8	7.09
2017/1/16	2450	Head	250	908	3935	1358	13	51.1	52	1.76

<10g SAR>

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2017/1/11	835	Body	250	4d151	3935	1358	1.56	6.28	6.24	-0.64
2017/1/10	1750	Body	250	1090	3935	1358	4.87	19.1	19.48	1.99
2017/1/10	1900	Body	250	5d170	3935	1358	5.41	20.6	21.64	5.05
2017/1/16	2450	Body	250	908	3935	1358	6.1	23.6	24.4	3.39

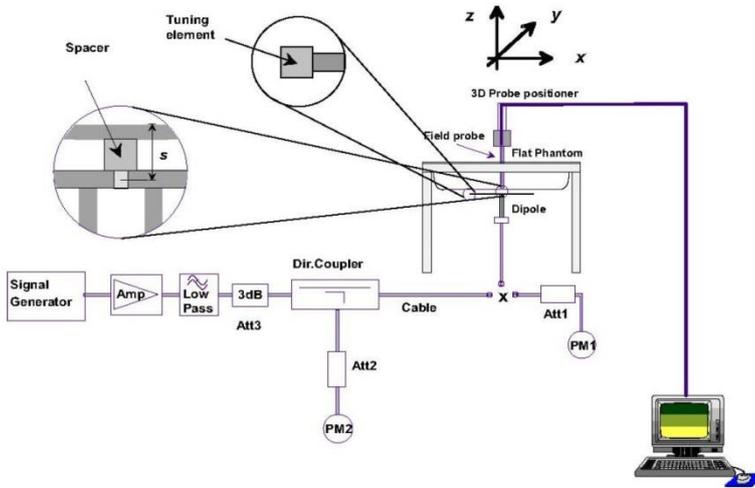


Fig 8.3.1 System Performance Check Setup



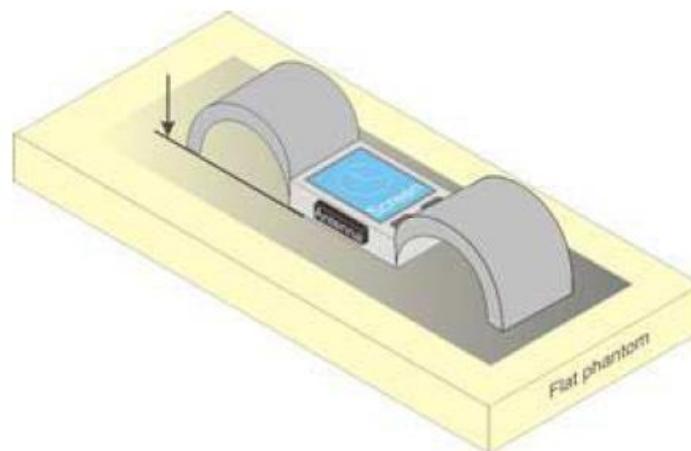
Fig 8.3.2 Setup Photo

11. RF Exposure Positions

11.1 Limb-Worn Accessory

A limb-worn device is a unit whose intended use includes being strapped to the arm of the user while transmitting. The strap shall be opened so that it is divided into two parts as following picture. The device shall be positioned directly against the phantom surface with the strap straightened as much as possible and the back of the device towards the phantom. If the strap cannot normally be opened to allow placing in direct contact with the phantom surface, it may be necessary to break the strap of the device but ensuring to not damage the antenna.

The device can use speak to Mouth mode, So this SAR test should be evaluated too. Adjust the distance between the device surface and the flat phantom to 10mm.



12. Conducted RF Output Power (Unit: dBm)

<GSM Conducted Power>

1. Per KDB 447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. Per KDB 941225 D01v03r01, for SAR test reduction for GSM / GPRS / EDGE modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. Therefore, the GSM and GPRS (1 Tx slots) for GSM850/GSM1900 is considered as the primary mode.
3. Other configurations of GSM / GPRS / EDGE are considered as secondary modes. The 3G SAR test reduction procedure is applied, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode, SAR measurement is not required for the secondary mode

GSM850 TX Channel	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
	128	189	251		128	189	251	
Frequency (MHz)	824.2	836.4	848.8		824.2	836.4	848.8	
GSM 1 Tx slot	32.67	32.77	32.93	34.00	23.67	23.77	23.93	25.00
GPRS 1 Tx slot	32.66	32.76	32.91	34.00	23.66	23.76	23.91	25.00
GPRS 2 Tx slots	28.64	28.71	28.83	30.50	22.64	22.71	22.83	24.50
GPRS 3 Tx slots	26.65	26.85	26.92	28.50	22.39	22.59	22.66	24.24
GPRS 4 Tx slots	25.06	25.22	25.44	26.50	22.06	22.22	22.44	23.50
EDGE 1 Tx slot	27.02	27.03	27.05	27.50	18.02	18.03	18.05	18.50
EDGE 2 Tx slots	25.31	25.29	25.27	26.50	19.31	19.29	19.27	20.50
EDGE 3 Tx slots	24.09	24.06	24.02	25.00	19.83	19.80	19.76	20.74
EDGE 4 Tx slots	22.82	22.77	22.75	23.50	19.82	19.77	19.75	20.50
GSM1900 TX Channel	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
512	661	810	512		661	810		
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GSM 1 Tx slot	31.32	31.05	30.50	32.00	22.32	22.05	21.50	23.00
GPRS 1 Tx slot	31.31	31.04	30.49	32.00	22.31	22.04	21.49	23.00
GPRS 2 Tx slots	26.27	26.25	26.08	27.50	20.27	20.25	20.08	21.50
GPRS 3 Tx slots	24.26	24.25	24.14	25.50	20.00	19.99	19.88	21.24
GPRS 4 Tx slots	22.77	22.75	22.52	24.00	19.77	19.75	19.52	21.00
EDGE 1 Tx slot	25.80	25.75	25.62	26.50	16.80	16.75	16.62	17.50
EDGE 2 Tx slots	24.01	23.92	23.99	24.50	18.01	17.92	17.99	18.50
EDGE 3 Tx slots	22.63	22.57	22.37	23.50	18.37	18.31	18.11	19.24
EDGE 4 Tx slots	21.81	21.77	21.66	22.50	18.81	18.77	18.66	19.50

<WCDMA Conducted Power>

1. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
2. The procedures in KDB 941225 D01v03r01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.

A summary of these settings are illustrated below:

HSDPA Setup Configuration:

- a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting:
 - i. Set Gain Factors (β_c and β_d) and parameters were set according to each
 - ii. Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
 - iii. Set RMC 12.2Kbps + HSDPA mode.
 - iv. Set Cell Power = -86 dBm
 - v. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
 - vi. Select HSDPA Uplink Parameters
 - vii. Set Delta ACK, Delta NACK and Delta CQI = 8
 - viii. Set Ack-Nack Repetition Factor to 3
 - ix. Set CQI Feedback Cycle (k) to 4 ms
 - x. Set CQI Repetition Factor to 2
 - xi. Power Ctrl Mode = All Up bits
- d. The transmitted maximum output power was recorded.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note 1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: $\Delta_{ACK}, \Delta_{NACK}$ and $\Delta_{CQI} = 30/15$ with $\beta_{HS} = 30/15 * \beta_c$.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and $\Delta_{NACK} = 30/15$ with $\beta_{HS} = 30/15 * \beta_c$, and $\Delta_{CQI} = 24/15$ with $\beta_{HS} = 24/15 * \beta_c$.

Note 3: CM = 1 for $\beta_c/\beta_d = 12/15, \beta_{HS}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$.

Setup Configuration

HSUPA Setup Configuration:

- a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
- b. The RF path losses were compensated into the measurements.
- c. A call was established between EUT and Base Station with following setting * :
 - i. Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
 - ii. Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
 - iii. Set Cell Power = -86 dBm
 - iv. Set Channel Type = 12.2k + HSPA
 - v. Set UE Target Power
 - vi. Power Ctrl Mode= Alternating bits
 - vii. Set and observe the E-TFCl
 - viii. Confirm that E-TFCl is equal to the target E-TFCl of 75 for sub-test 1, and other subtest's E-TFCl
- d. The transmitted maximum output power was recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note 1)	β_{ec}	β_{ed} (Note 5) (Note 6)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCl
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/25	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed1}: 47/15$ $\beta_{ed2}: 47/15$	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: $\Delta_{ACK}, \Delta_{NACK}$ and $\Delta_{CQI} = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Setup Configuration



<WCDMA Conducted Power>

General Note:

1. Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
2. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. If the maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA is $\leq \frac{1}{4}$ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA.

Band		WCDMA Band II			Tune-up Limit (dBm)	WCDMA Band IV			Tune-up Limit (dBm)	WCDMA Band V			Tune-up Limit (dBm)
TX Channel		9262	9400	9538		1312	1413	1513		4132	4182	4233	
Rx Channel		9662	9800	9938		1537	1638	1738		4357	4407	4458	
Frequency (MHz)		1852.4	1880	1907.6	1712.4	1732.6	1752.6	826.4	836.4	846.6			
3GPP Rel 99	AMR 12.2Kbps	23.49	23.68	23.75	25.00	23.77	23.72	23.76	25.00	23.80	23.75	23.78	25.00
3GPP Rel 99	RMC 12.2Kbps	23.50	23.70	23.76	25.00	23.78	23.73	23.77	25.00	23.81	23.76	23.80	25.00
3GPP Rel 6	HSDPA Subtest-1	22.80	22.86	22.89	23.00	22.81	22.80	22.79	23.00	23.00	23.02	23.01	23.50
3GPP Rel 6	HSDPA Subtest-2	22.79	22.89	22.88	23.00	22.78	22.75	22.70	23.00	23.01	22.98	23.00	23.50
3GPP Rel 6	HSDPA Subtest-3	22.30	22.40	22.42	22.50	22.30	22.28	22.29	22.50	22.52	22.51	22.50	23.00
3GPP Rel 6	HSDPA Subtest-4	22.28	22.38	22.40	22.50	22.36	22.30	22.31	22.50	22.51	22.50	22.46	23.00
3GPP Rel 6	HSUPA Subtest-1	18.74	18.35	18.15	19.50	18.37	18.76	18.55	19.50	18.16	18.37	18.19	19.50
3GPP Rel 6	HSUPA Subtest-2	18.08	18.80	18.69	19.50	18.89	18.17	19.00	19.50	18.82	18.78	18.39	19.50
3GPP Rel 6	HSUPA Subtest-3	18.48	18.28	18.29	19.50	18.09	18.77	18.55	19.50	19.13	18.39	18.84	19.50
3GPP Rel 6	HSUPA Subtest-4	18.78	18.54	18.44	19.50	18.91	18.95	18.72	19.50	18.90	18.58	19.09	19.50
3GPP Rel 6	HSUPA Subtest-5	21.63	21.47	21.65	22.00	21.67	21.65	21.82	22.00	21.45	21.39	21.46	22.00



<WLAN Conducted Power>

General Note:

1. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
2. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
3. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.
4. DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.18 The initial test position procedure is described in the following:
 - a. When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
 - b. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
 - c. For all positions/configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN	802.11b	CH 1	2412	1Mbps	19.97	20.00	97.59
		CH 6	2437		19.33	20.00	
		CH 11	2462		19.44	20.00	
	802.11g	CH 1	2412	6Mbps	16.24	17.50	87.50
		CH 6	2437		18.01	19.00	
		CH 11	2462		15.49	16.50	
	802.11n-HT20	CH 1	2412	MCS0	15.33	16.00	86.27
		CH 6	2437		17.15	18.00	
		CH 11	2462		14.65	16.00	

13. Bluetooth Exclusions Applied

Mode Band	Average power(dBm)	
	Bluetooth-BR/EDR	Bluetooth-LE
2.4GHz Bluetooth	11.5	2.5

Note:

- Per KDB 447498 D01v06, 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:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$$
 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

Bluetooth Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds
11.5	10	2.48	2.2

Note:

Per KDB 447498 D01v06, a distance of 10m is applied to determine SAR test exclusion. The test exclusion threshold is 2.2 which is ≤ 3, SAR testing is not required.

Bluetooth Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds
11.5	< 5	2.48	4.4

Note:

Per KDB 447498 D01v06, when the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion. The test exclusion threshold is 4.4 which is ≤ 7.5 SAR testing is not required.

14. SAR Test Results

General Note:

- Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
 - 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.
 - 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)"
 - For WWAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
 - For WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
- Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
 - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
 - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
 - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
- Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8W/kg.

GSM Note:

- Per KDB 941225 D01v03r01, for SAR test reduction for GSM / GPRS / EDGE modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. Therefore, the GSM and GPRS (1 Tx slots) for GSM850/GSM1900 is considered as the primary mode.
- Other configurations of GSM / GPRS / EDGE are considered as secondary modes. The 3G SAR test reduction procedure is applied, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode, SAR measurement is not required for the secondary mode.

UMTS Note:

- Per KDB 941225 D01v03r01, for SAR testing is measured using a 12.2 kbps RMC with TPC bits configured to all "1's".
- Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. If the maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA is ≤ ¼ dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA to RMC12.2Kbps and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for HSDPA / HSUPA.

WLAN Note:

- Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
- 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.
- 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.
- During SAR testing the WLAN transmission was verified using a spectrum analyzer.



14.1 Next to Mouth SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
#01	GSM850	GSM (1 Tx slot)	Next to Mouth	10mm	251	848.8	32.93	34	1.279	-0.01	0.057	0.073
#02	GSM1900	GSM (1 Tx slot)	Next to Mouth	10mm	512	1850.2	31.32	32	1.169	-0.08	0.247	0.289

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
#03	WCDMA Band V	RMC12.2Kbps	Next to Mouth	10mm	4132	826.4	23.81	25	1.315	0.05	0.061	0.080
#04	WCDMA Band IV	RMC12.2Kbps	Next to Mouth	10mm	1312	1712.4	23.78	25	1.324	0.05	0.340	0.450
#05	WCDMA Band II	RMC12.2Kbps	Next to Mouth	10mm	9538	1907.6	23.76	25	1.330	0.13	0.714	0.950
	WCDMA Band II	RMC12.2Kbps	Next to Mouth	10mm	9262	1852.4	23.5	25	1.413	0.04	0.565	0.798
	WCDMA Band II	RMC12.2Kbps	Next to Mouth	10mm	9400	1880	23.7	25	1.349	0.04	0.610	0.823

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
#06	WLAN 2.4GHz	802.11b 1Mbps	Next to Mouth	10mm	1	2412	19.97	20	1.007	97.59	1.025	-0.02	0.053	0.055



14.2 Wrist-Worn SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	GSM850	GSM (1 Tx slot)	Back	0mm	251	848.8	32.93	34	1.279	-0.01	0.253	0.324
#07	GSM850	GPRS (1 Tx slot)	Back	0mm	251	848.8	32.91	34	1.285	-0.1	0.261	0.335
#08	GSM1900	GSM (1 Tx slot)	Back	0mm	512	1850.2	31.32	32	1.169	-0.04	0.540	0.632
	GSM1900	GPRS (1 Tx slot)	Back	0mm	512	1850.2	31.31	32	1.172	-0.09	0.522	0.612

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
#09	WCDMA Band V	RMC 12.2Kbps	Back	0mm	4132	826.4	23.81	25	1.315	0.05	0.437	0.575
#10	WCDMA Band IV	RMC 12.2Kbps	Back	0mm	1312	1712.4	23.78	25	1.324	-0.01	1.180	1.563
#11	WCDMA Band II	RMC 12.2Kbps	Back	0mm	9538	1907.6	23.76	25	1.330	-0.07	1.430	1.903

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
#12	WLAN 2.4GHz	802.11b 1Mbps	Back	0mm	1	2412	19.97	20	1.007	97.59	1.025	0.05	0.163	0.168

15. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Next to Mouth	Wrist worn
1.	GSM Voice + WLAN2.4GHz	Yes	Yes
2.	GPRS/EDGE + WLAN2.4GHz	Yes	Yes
3.	WCDMA + WLAN2.4GHz	Yes	Yes
4.	GSM Voice + Bluetooth	Yes	Yes
5.	GPRS/EDGE + Bluetooth	Yes	Yes
6.	WCDMA+ Bluetooth	Yes	Yes

General Note:

1. This device supported VoIP in EGPRS, WCDMA, LTE (e.g. 3rd party VoIP).
2. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
3. EUT will choose each GSM and WCDMA according to the network signal condition; therefore, they will not operate simultaneously at any moment.
4. The Scaled SAR summation is calculated based on the same configuration and test position.
5. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
 - i) Scalar SAR summation < 1.6W/kg.
 - ii) $SPLSR = (SAR1 + SAR2)^{1.5} / (\text{min. separation distance, mm})$, and the peak separation distance is determined from the square root of $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$, where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
 - iii) If $SPLSR \leq 0.04$, simultaneously transmission SAR measurement is not necessary.
 - iv) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.
6. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v06 based on the formula below.
 - i) $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})} / x] \text{ W/kg}$ for test separation distances $\leq 50 \text{ mm}$; where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR.
 - ii) When the minimum separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.
 - iii) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.

Bluetooth Max Power	Exposure Position	Next to Mouth	Limbs-worn
	Test separation	10 mm	0 mm
11.50 dBm	Estimated SAR (W/kg)	0.294	0.235

15.1 Next to Mouth Exposure Conditions

WWAN Band		Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)
			WWAN	2.4GHz WLAN	Bluetooth		
			1g SAR (W/kg)	1g SAR (W/kg)	Estimated 1g SAR (W/kg)		
GSM	GSM850	Next to mouth at 10mm	0.073	0.055	0.294	0.13	0.37
	GSM1900	Next to mouth at 10mm	0.289	0.055	0.294	0.34	0.58
WCDMA	Band V	Next to mouth at 10mm	0.080	0.055	0.294	0.14	0.37
	Band IV	Next to mouth at 10mm	0.450	0.055	0.294	0.51	0.74
	Band II	Next to mouth at 10mm	0.950	0.055	0.294	1.01	1.24

15.2 Wrist-Worn Exposure Conditions

WWAN Band		Exposure Position	1	2	3	1+2 Summed 10g SAR (W/kg)	1+3 Summed 10g SAR (W/kg)
			WWAN	2.4GHz WLAN	Bluetooth		
			10g SAR (W/kg)	10g SAR (W/kg)	Estimated 10g SAR (W/kg)		
GSM	GSM850	Back at 0mm	0.335	0.168	0.235	0.50	0.57
	GSM1900	Back at 0mm	0.632	0.168	0.235	0.80	0.87
WCDMA	Band V	Back at 0mm	0.575	0.168	0.235	0.74	0.81
	Band IV	Back at 0mm	1.563	0.168	0.235	1.73	1.80
	Band II	Back at 0mm	1.903	0.168	0.235	2.07	2.14

Test Engineer: Kat Yin

16. Uncertainty Assessment

The component of uncertainty may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainty by the statistical analysis of a series of observations is termed a Type A 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/√3	1/√6	1/√2

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

(b) κ is the coverage factor

Table 16.1. Standard Uncertainty for Assumed Distribution

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

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

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

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



17. References

- [1] FCC 47 CFR Part 2 "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"
- [2] ANSI/IEEE Std. C95.1-1992, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz", September 1992
- [3] IEEE Std. 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", Sep 2013
- [4] SPEAG DASY System Handbook
- [5] FCC KDB 248227 D01 v02r02, "SAR Guidance for IEEE 802.11 (WiFi) Transmitters", Oct 2015.
- [6] FCC KDB 447498 D01 v06, "Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies", Oct 2015
- [7] FCC KDB 941225 D01 v03r01, "3G SAR MEAUREMENT PROCEDURES", Oct 2015
- [8] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.
- [9] FCC KDB 865664 D02 v01r02, "RF Exposure Compliance Reporting and Documentation Considerations" Oct 2015.



Appendix A. Plots of System Performance Check

The plots are shown as follows.

System Check_Head_835MHz_20170111

DUT:D835V2-SN:4d151

Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1

Medium: HSL_835_2017/01/11 Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.888 \text{ S/m}$; $\epsilon_r = 41.9$; $\rho = 1000 \text{ kg/m}^3$

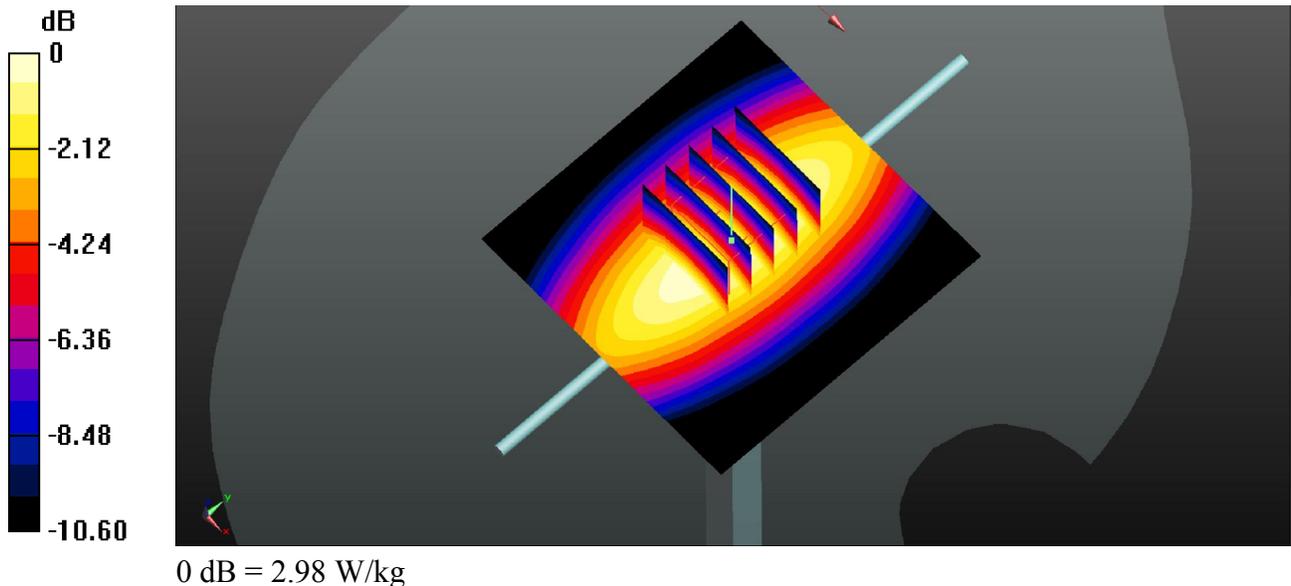
Ambient Temperature : $23.8 \text{ }^\circ\text{C}$; Liquid Temperature : $22.5 \text{ }^\circ\text{C}$

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(10.61, 10.61, 10.61); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: $dx=15\text{mm}$, $dy=15\text{mm}$
Maximum value of SAR (interpolated) = 3.01 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$
Reference Value = 54.45 V/m ; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 3.31 W/kg
SAR(1 g) = 2.27 W/kg ; SAR(10 g) = 1.5 W/kg
Maximum value of SAR (measured) = 2.98 W/kg



System Check_Head_1750MHz_20170110

DUT: D1750V2-SN:1090

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: HSL_1750_2017/01/10 Medium parameters used: $f = 1750$ MHz; $\sigma = 1.376$ S/m; $\epsilon_r = 41.981$; $\rho = 1000$ kg/m³

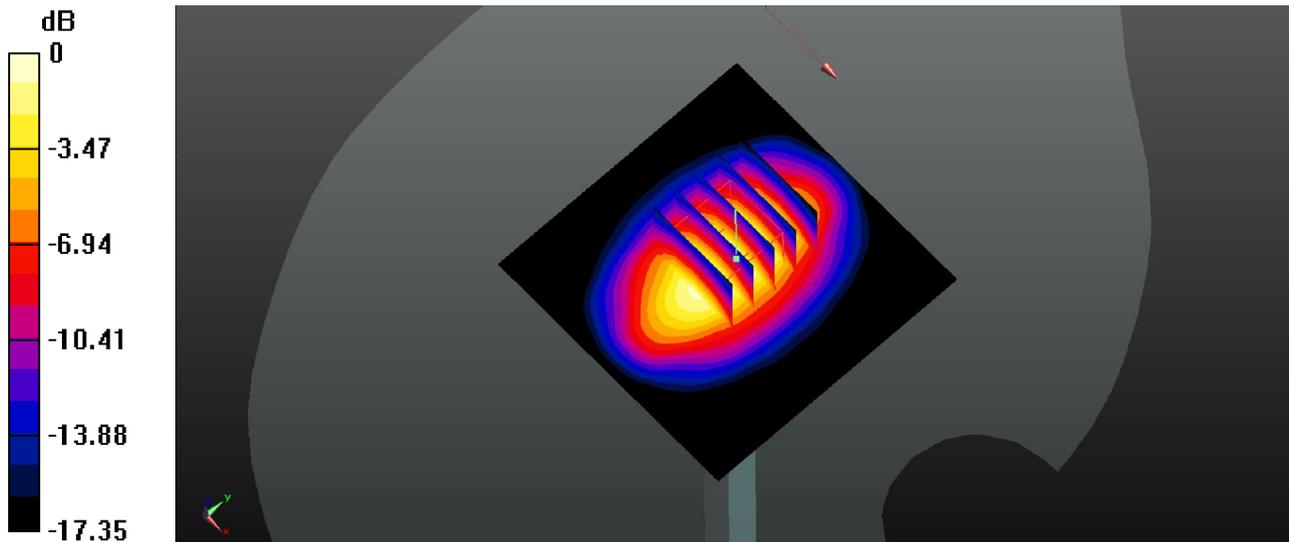
Ambient Temperature : 23.4 °C; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(9.03, 9.03, 9.03); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 13.8 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 94.97 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 16.7 W/kg
SAR(1 g) = 9.03 W/kg; SAR(10 g) = 4.8 W/kg
Maximum value of SAR (measured) = 13.8 W/kg



0 dB = 13.8 W/kg

System Check_Head_1900MHz_20170110

DUT: D1900V2-SN:5d170

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL_1900_2017/01/10 Medium parameters used: $f = 1900$ MHz; $\sigma = 1.458$ S/m; $\epsilon_r = 39.709$; $\rho = 1000$ kg/m³

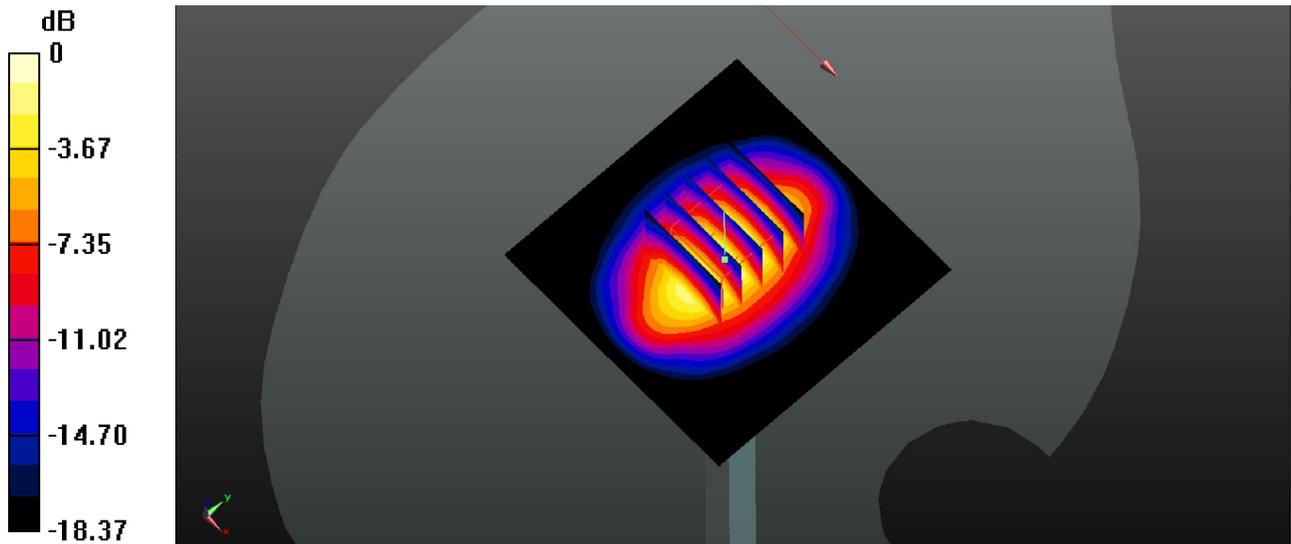
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(8.64, 8.64, 8.64); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 16.1 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 100.8 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 19.6 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.33 W/kg
Maximum value of SAR (measured) = 16.3 W/kg



0 dB = 16.3 W/kg

System Check_Head_2450MHz_20170116

DUT:D2450V2-SN:908

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

Medium: HSL_2450_2017/01/16 Medium parameters used: $f = 2450$ MHz; $\sigma = 1.837$ S/m; $\epsilon_r = 39.416$; $\rho = 1000$ kg/m³

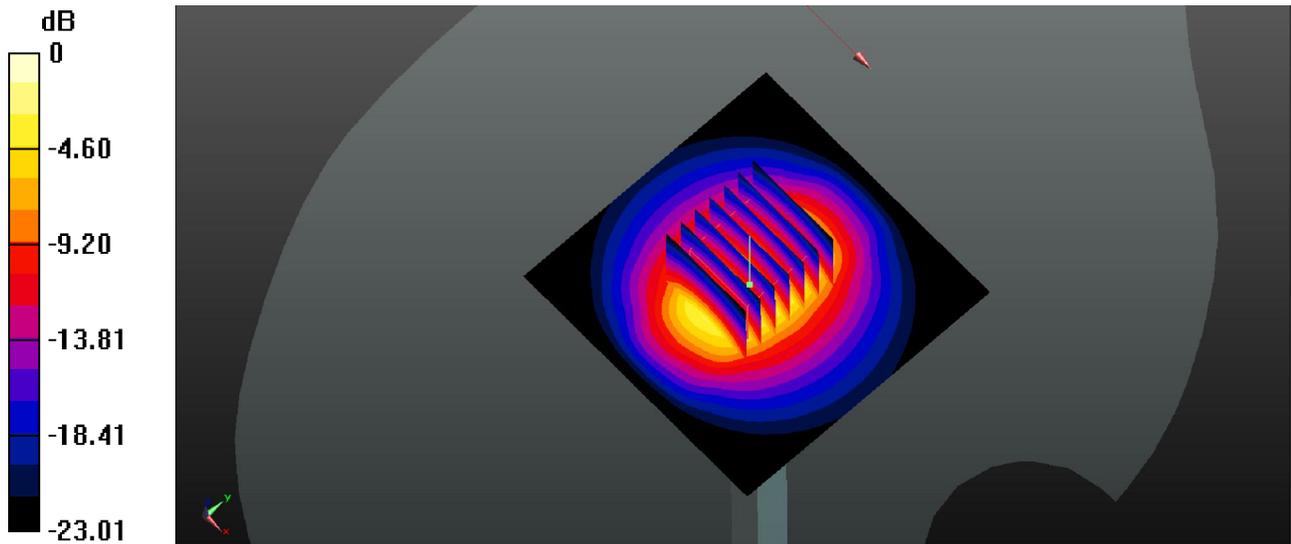
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.2 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(7.81, 7.81, 7.81); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (71x71x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 22.6 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.86 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 28.2 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 5.9 W/kg
Maximum value of SAR (measured) = 22.3 W/kg



0 dB = 22.3 W/kg

System Check_Body_835MHz_20170111

DUT: D835V2-SN:4d151

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: MSL_835_2017/01/11 Medium parameters used: $f = 835$ MHz; $\sigma = 0.962$ S/m; $\epsilon_r = 56.105$;
 $\rho = 1000$ kg/m³

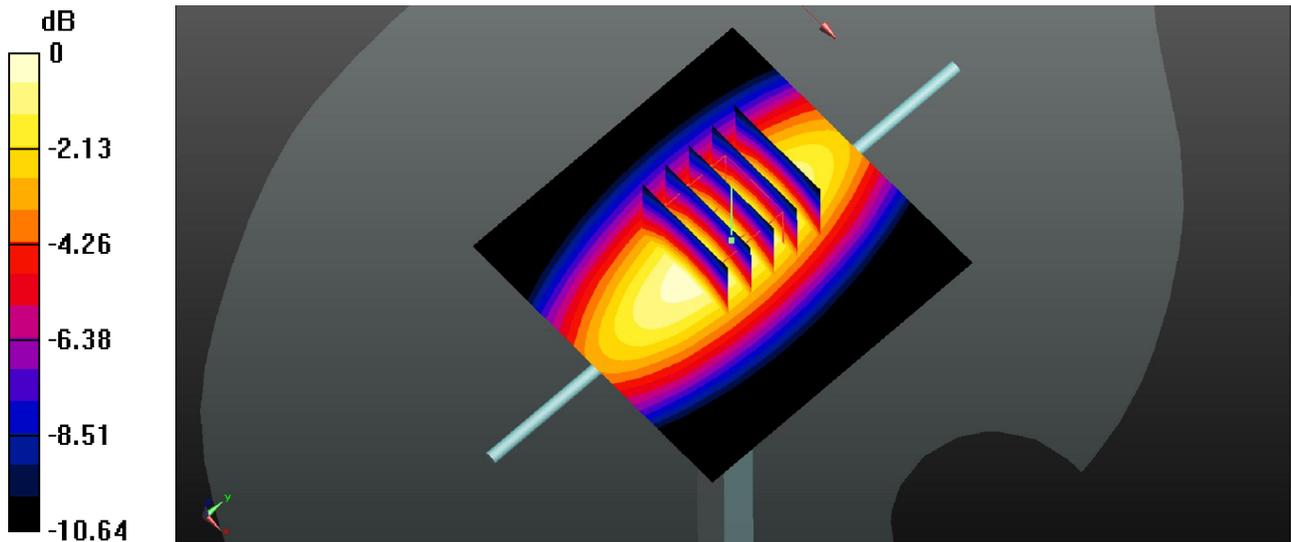
Ambient Temperature : 23.9 °C ; Liquid Temperature : 22.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(10.48, 10.48, 10.48); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.21 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 50.89 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.66 W/kg
SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.56 W/kg
Maximum value of SAR (measured) = 3.20 W/kg



0 dB = 3.20 W/kg

System Check_Body_1750MHz_20170110

DUT: D1750V2-SN:1090

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: MSL_1750_2017/01/10 Medium parameters used: $f = 1750$ MHz; $\sigma = 1.499$ S/m; $\epsilon_r = 54.037$; $\rho = 1000$ kg/m³

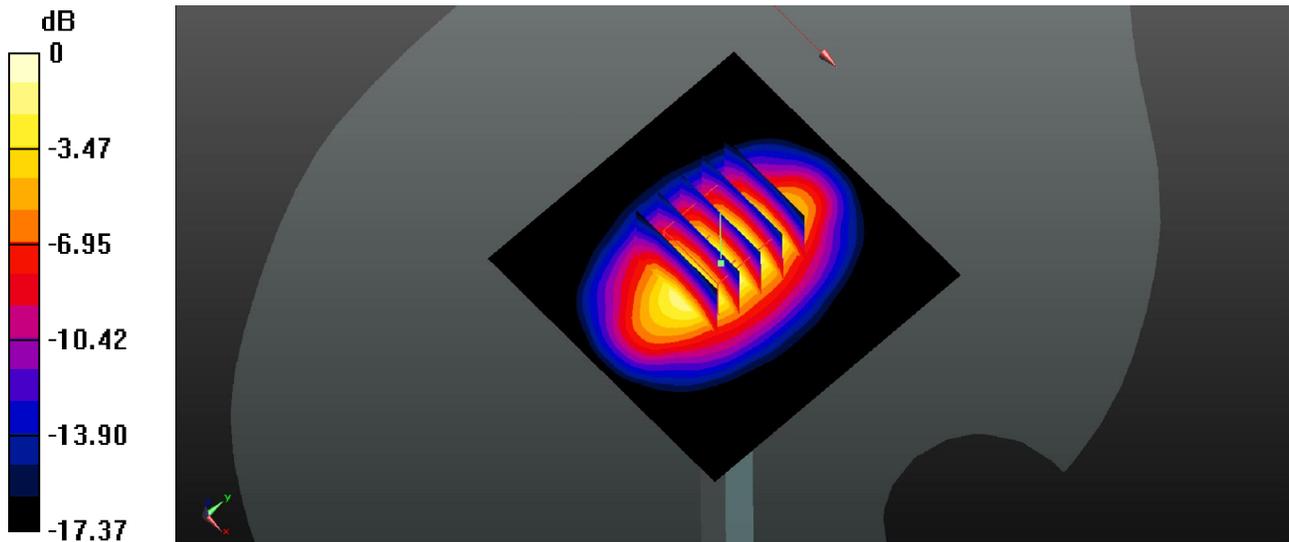
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(8.46, 8.46, 8.46); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 14.3 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 94.09 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 17.3 W/kg
SAR(1 g) = 9.28 W/kg; SAR(10 g) = 4.87 W/kg
Maximum value of SAR (measured) = 14.3 W/kg



0 dB = 14.3 W/kg

System Check_Body_1900MHz_20170110

DUT: D1900V2-SN:5d170

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: MSL_1900_2017/01/10 Medium parameters used: $f = 1900$ MHz; $\sigma = 1.571$ S/m; $\epsilon_r = 54.034$; $\rho = 1000$ kg/m³

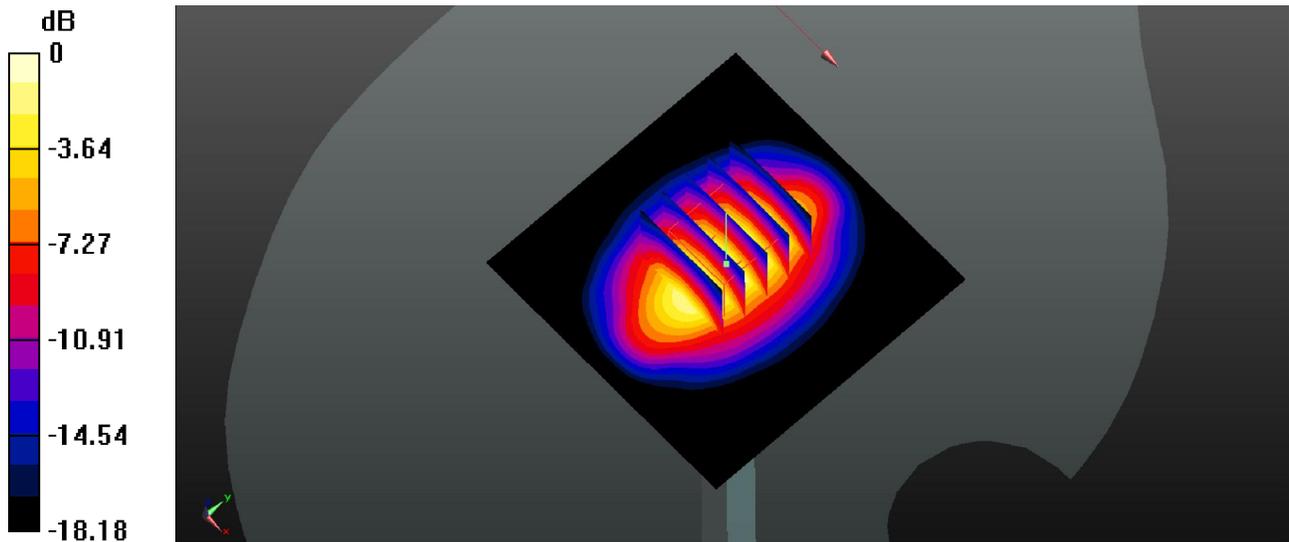
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(8.18, 8.18, 8.18); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 16.2 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 86.16 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 19.1 W/kg
SAR(1 g) = 10.5 W/kg; SAR(10 g) = 5.41 W/kg
Maximum value of SAR (measured) = 16.1 W/kg



0 dB = 16.1 W/kg

System Check_Body_2450MHz_20170116

DUT: D2450V2-SN:908

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

Medium: MSL_2450_2017/01/16 Medium parameters used: $f = 2450$ MHz; $\sigma = 1.936$ S/m; $\epsilon_r = 53.169$; $\rho = 1000$ kg/m³

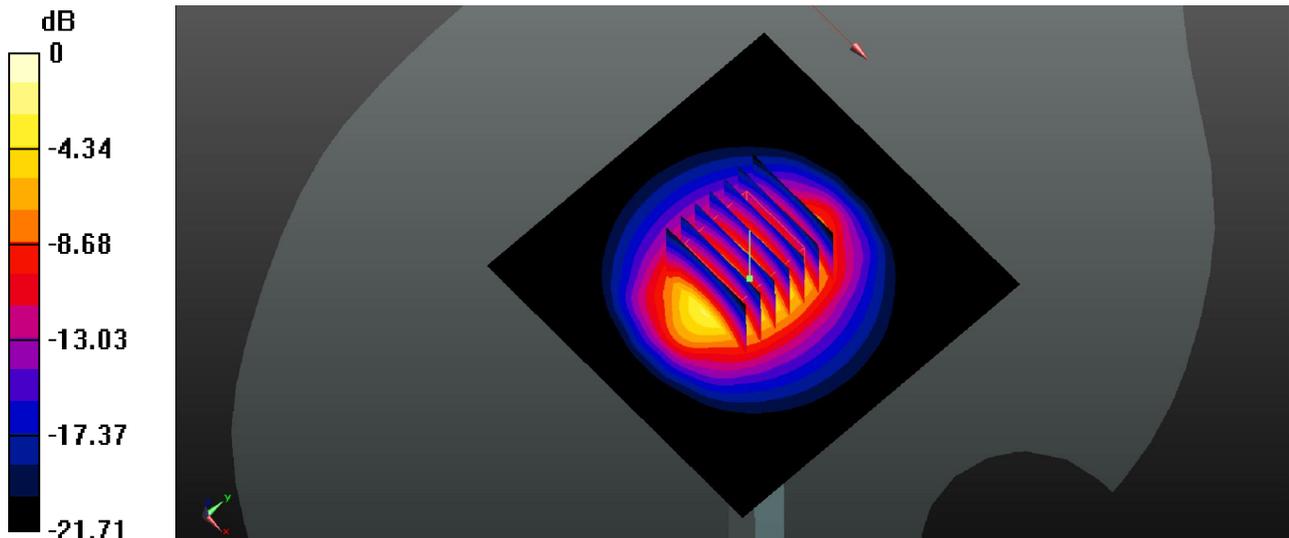
Ambient Temperature : 23.4 °C ; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(7.89, 7.89, 7.89); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (81x81x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 22.3 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.73 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 27.4 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.1 W/kg
Maximum value of SAR (measured) = 22.2 W/kg



0 dB = 22.2 W/kg



Appendix B. Plots of High SAR Measurement

The plots are shown as follows.

#01_GSM850_GSM(1 Tx slot)_Front_10mm_Ch251

Communication System: UID 0, GSM 1 Tx slot (0); Frequency: 848.8 MHz; Duty Cycle: 1:8.3

Medium: HSL_835_2017/01/11 Medium parameters used: $f = 848.8$ MHz; $\sigma = 0.9$ S/m; $\epsilon_r = 41.73$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.8 °C ; Liquid Temperature : 22.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(10.61, 10.61, 10.61); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch251/Area Scan (51x61x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.0707 W/kg

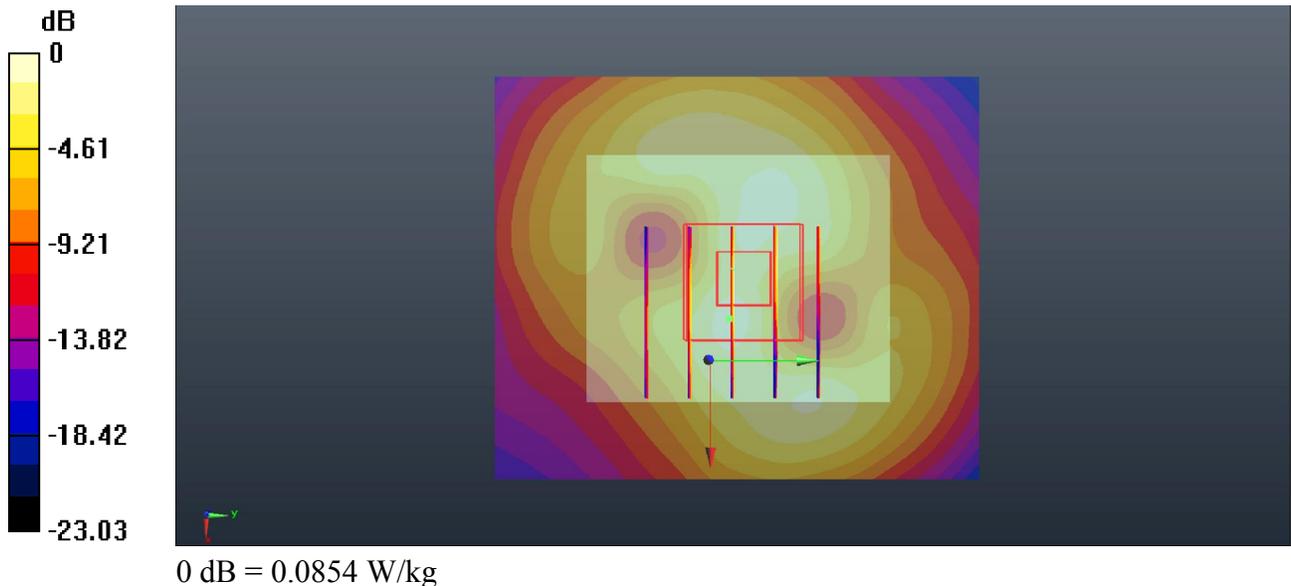
Ch251/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 8.857 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 0.118 W/kg

SAR(1 g) = 0.057 W/kg; SAR(10 g) = 0.026 W/kg

Maximum value of SAR (measured) = 0.0854 W/kg



#02_GSM1900_GSM(1 Tx slot)_Front_10mm_Ch512

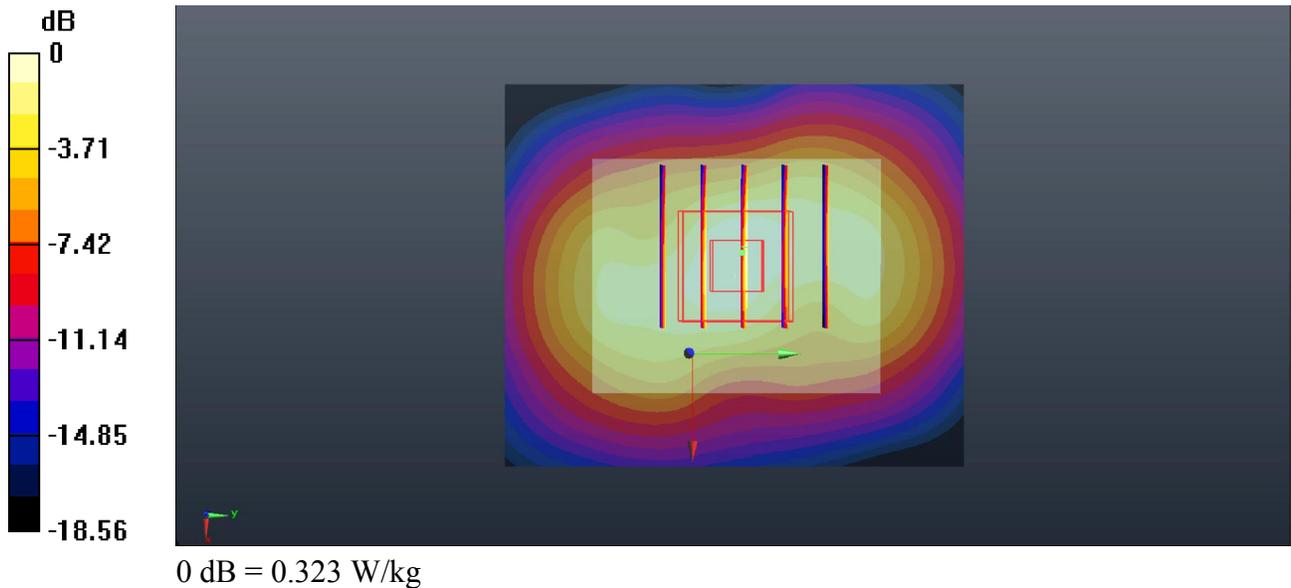
Communication System: UID 0, GSM 1 Tx slot (0); Frequency: 1850.2 MHz; Duty Cycle: 1:8.3
Medium: HSL_1900_2017/01/10 Medium parameters used: $f = 1850.2$ MHz; $\sigma = 1.41$ S/m; $\epsilon_r = 39.909$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(8.64, 8.64, 8.64); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch512/Area Scan (51x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.346 W/kg

Ch512/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.23 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.370 W/kg
SAR(1 g) = 0.247 W/kg; SAR(10 g) = 0.136 W/kg
Maximum value of SAR (measured) = 0.323 W/kg



#03_WCDMA V_RMC 12.2Kbps_Front_10mm_Ch4132

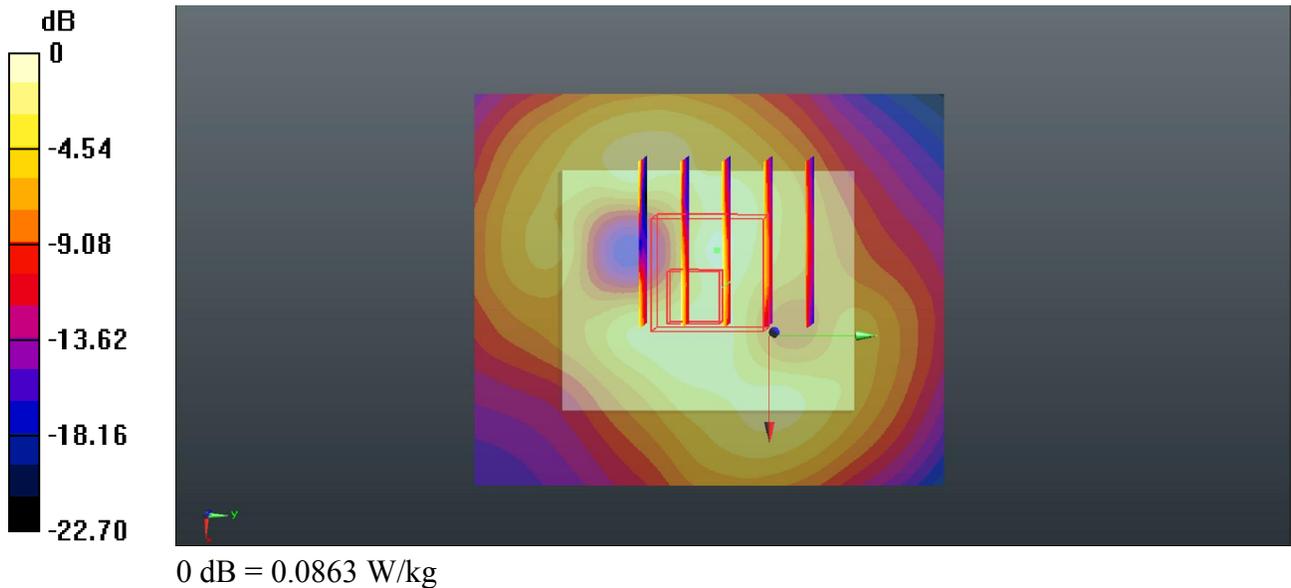
Communication System: UID 0, WCDMA (0); Frequency: 826.4 MHz; Duty Cycle: 1:1
Medium: HSL_835_2017/01/11 Medium parameters used: $f = 826.4$ MHz; $\sigma = 0.879$ S/m; $\epsilon_r = 42.007$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.8 °C ; Liquid Temperature : 22.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(10.61, 10.61, 10.61); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4132/Area Scan (51x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.0697 W/kg

Ch4132/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.823 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.128 W/kg
SAR(1 g) = 0.061 W/kg; SAR(10 g) = 0.026 W/kg
Maximum value of SAR (measured) = 0.0863 W/kg



#04_WCDMA IV_RMC 12.2Kbps_Front_10mm_Ch1312

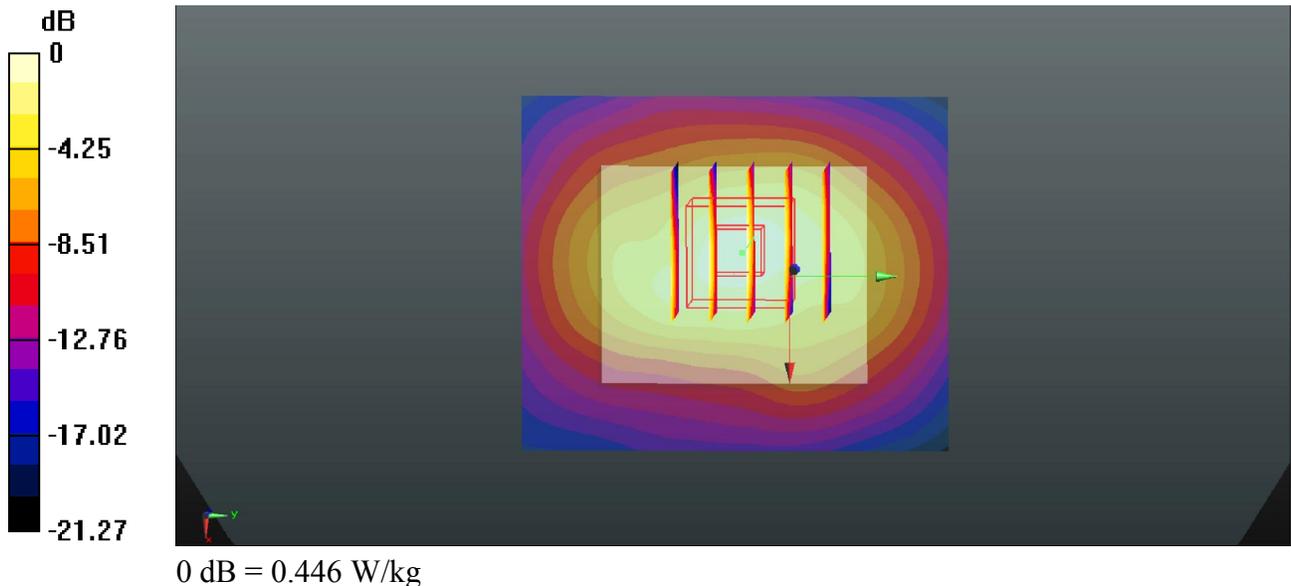
Communication System: UID 0, WCDMA (0); Frequency: 1712.4 MHz; Duty Cycle: 1:1
 Medium: HSL_1750_2017/01/10 Medium parameters used: $f = 1712.4$ MHz; $\sigma = 1.331$ S/m; $\epsilon_r = 42.025$; $\rho = 1000$ kg/m³
 Ambient Temperature : 23.4 °C ; Liquid Temperature : 22.7 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(9.03, 9.03, 9.03); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch1312/Area Scan (51x61x1): Interpolated grid: dx=15mm, dy=15mm
 Maximum value of SAR (interpolated) = 0.439 W/kg

Ch1312/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
 Reference Value = 16.10 V/m; Power Drift = 0.05 dB
 Peak SAR (extrapolated) = 0.502 W/kg
SAR(1 g) = 0.340 W/kg; SAR(10 g) = 0.190 W/kg
 Maximum value of SAR (measured) = 0.446 W/kg



#05_WCDMA II_RMC 12.2Kbps_Front_10mm_Ch9538

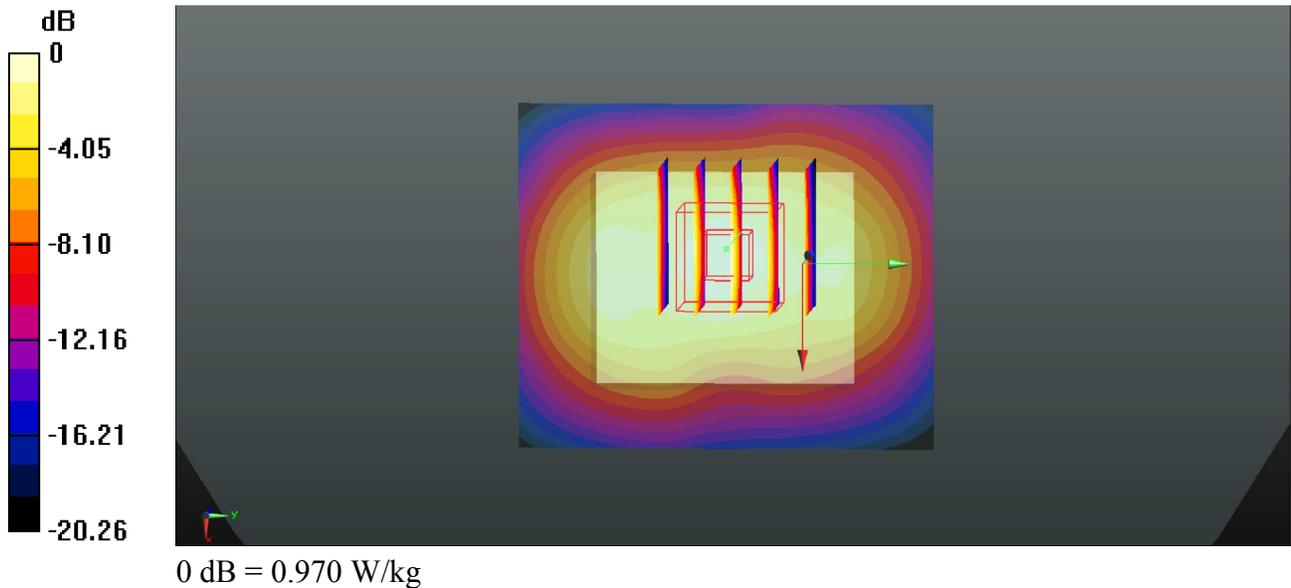
Communication System: UID 0, WCDMA (0); Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: HSL_1900_2017/01/10 Medium parameters used: $f = 1907.6$ MHz; $\sigma = 1.466$ S/m; $\epsilon_r = 39.676$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.7 °C ; Liquid Temperature : 22.6 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(8.64, 8.64, 8.64); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9538/Area Scan (51x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.00 W/kg

Ch9538/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.26 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 1.10 W/kg
SAR(1 g) = 0.714 W/kg; SAR(10 g) = 0.392 W/kg
Maximum value of SAR (measured) = 0.970 W/kg



#06_WLAN2.4GHz_802.11b 1Mbps_Front_10mm_Ch1

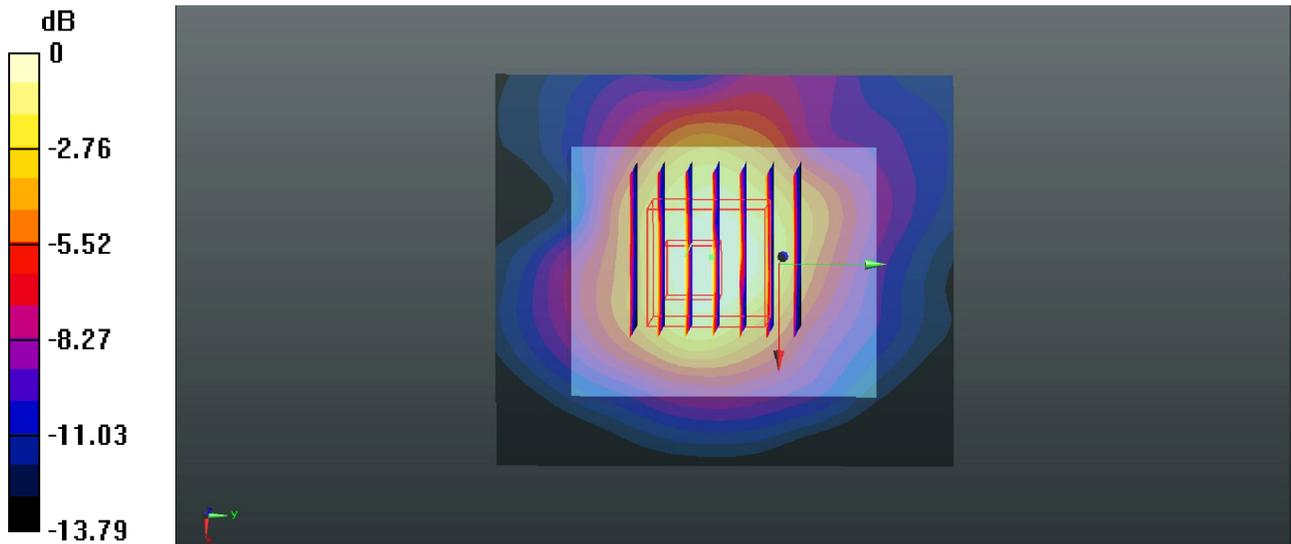
Communication System: UID 0, 802.11b (0); Frequency: 2412 MHz; Duty Cycle: 1:1.025
Medium: HSL_2450_2017/01/16 Medium parameters used: $f = 2412$ MHz; $\sigma = 1.794$ S/m; $\epsilon_r = 39.542$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.2 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(7.81, 7.81, 7.81); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch1/Area Scan (61x71x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.0830 W/kg

Ch1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.565 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.0950 W/kg
SAR(1 g) = 0.053 W/kg; SAR(10 g) = 0.027 W/kg
Maximum value of SAR (measured) = 0.0732 W/kg



0 dB = 0.0732 W/kg

#07_GSM850_GPRS(1 Tx slot)_Back_0mm_Ch251

Communication System: UID 0, GPRS (GMSK 1 Tx slot) (0); Frequency: 848.8 MHz; Duty Cycle: 1:8.3

Medium: MSL_835_2017/01/11 Medium parameters used: $f = 848.8$ MHz; $\sigma = 0.975$ S/m; $\epsilon_r = 56.009$; $\rho = 1000$ kg/m³

Ambient Temperature : 23.9 °C; Liquid Temperature : 22.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(10.48, 10.48, 10.48); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch251/Area Scan (51x61x1): Interpolated grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.876 W/kg

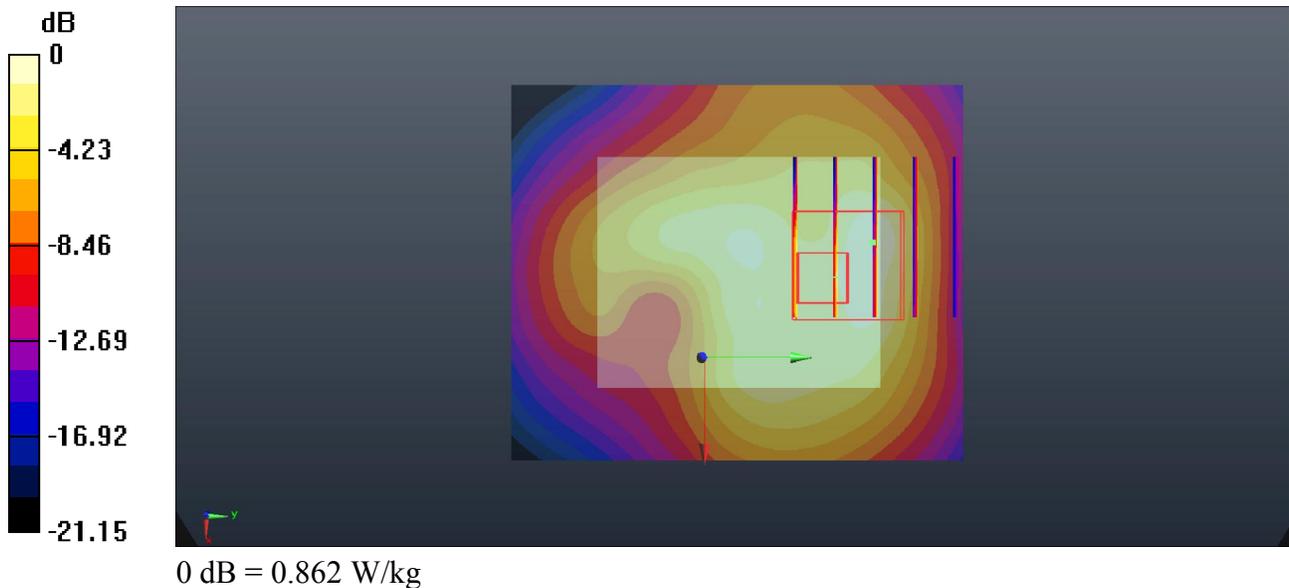
Ch251/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 23.92 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 1.10 W/kg

SAR(1 g) = 0.559 W/kg; SAR(10 g) = 0.261 W/kg

Maximum value of SAR (measured) = 0.862 W/kg



#08_GSM1900_GSM(1 Tx slot)_Back_0mm_Ch512

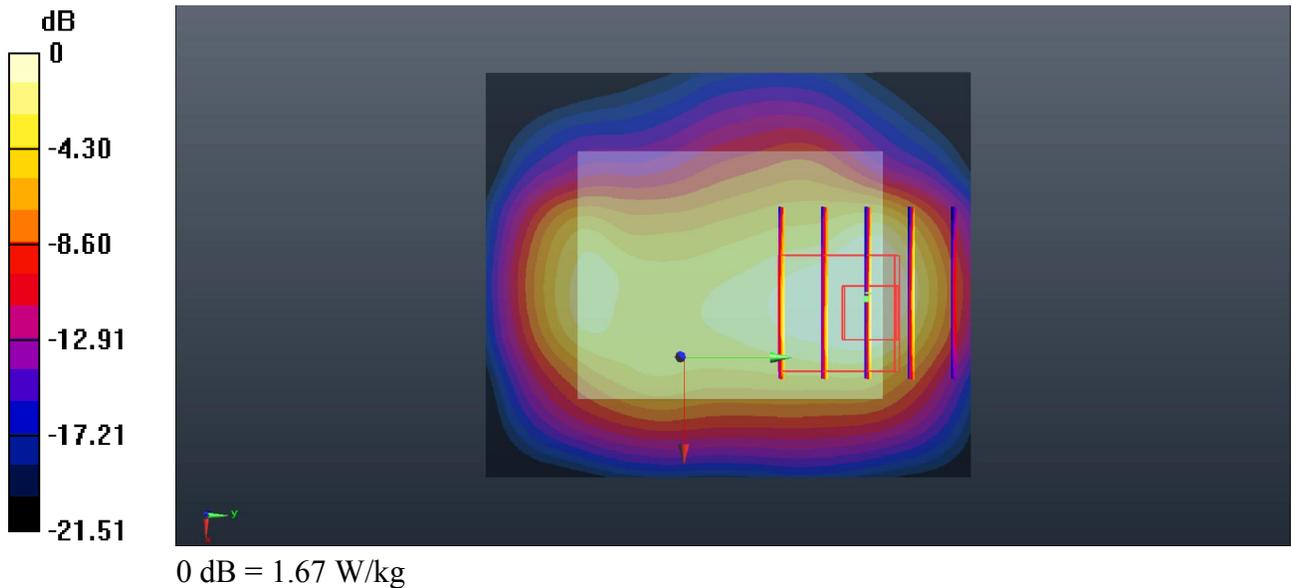
Communication System: UID 0, GSM 1 Tx slot (0); Frequency: 1850.2 MHz; Duty Cycle: 1:8.3
Medium: MSL_1900_2017/01/10 Medium parameters used: $f = 1850.2$ MHz; $\sigma = 1.521$ S/m; $\epsilon_r = 54.134$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(8.18, 8.18, 8.18); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch512/Area Scan (51x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.45 W/kg

Ch512/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.73 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 2.15 W/kg
SAR(1 g) = 1.03 W/kg; SAR(10 g) = 0.540 W/kg
Maximum value of SAR (measured) = 1.67 W/kg



#09_WCDMA V_RMC 12.2Kbps_Back_0mm_Ch4132

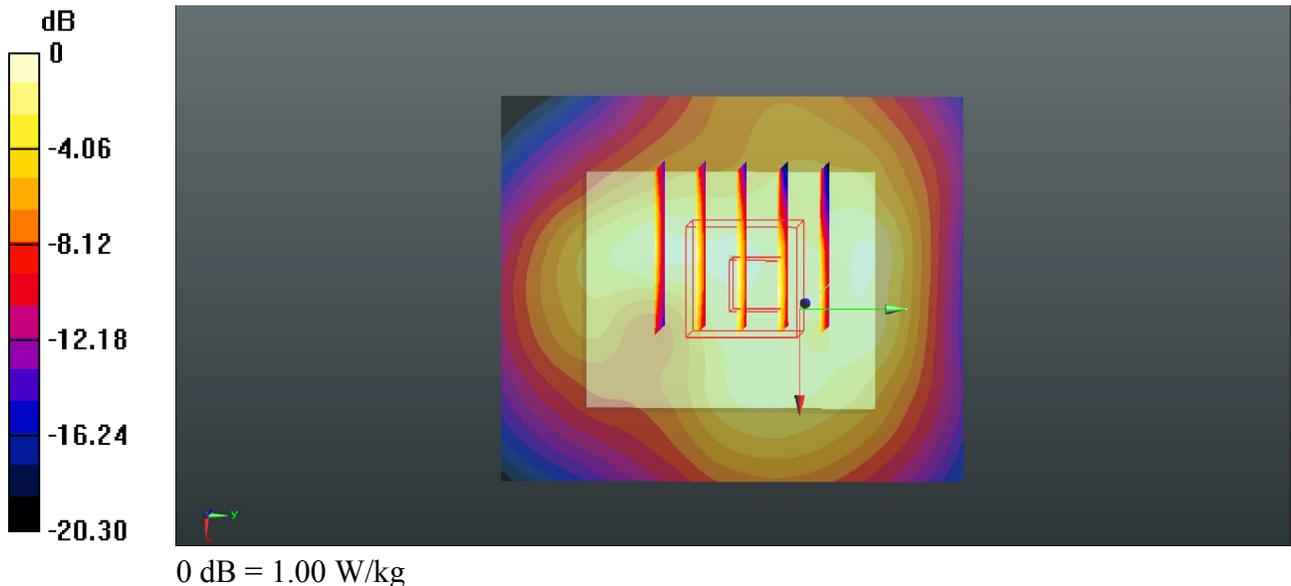
Communication System: UID 0, WCDMA (0); Frequency: 826.4 MHz; Duty Cycle: 1:1
 Medium: MSL_835_2017/01/11 Medium parameters used: $f = 826.4$ MHz; $\sigma = 0.954$ S/m; $\epsilon_r = 56.186$; $\rho = 1000$ kg/m³
 Ambient Temperature : 23.9 °C ; Liquid Temperature : 22.5 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(10.48, 10.48, 10.48); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4132/Area Scan (51x61x1): Interpolated grid: dx=15mm, dy=15mm
 Maximum value of SAR (interpolated) = 0.819 W/kg

Ch4132/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
 Reference Value = 27.56 V/m; Power Drift = 0.05 dB
 Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.709 W/kg; SAR(10 g) = 0.437 W/kg
 Maximum value of SAR (measured) = 1.00 W/kg



#10_WCDMA IV_RMC 12.2Kbps_Back_0mm_Ch1312

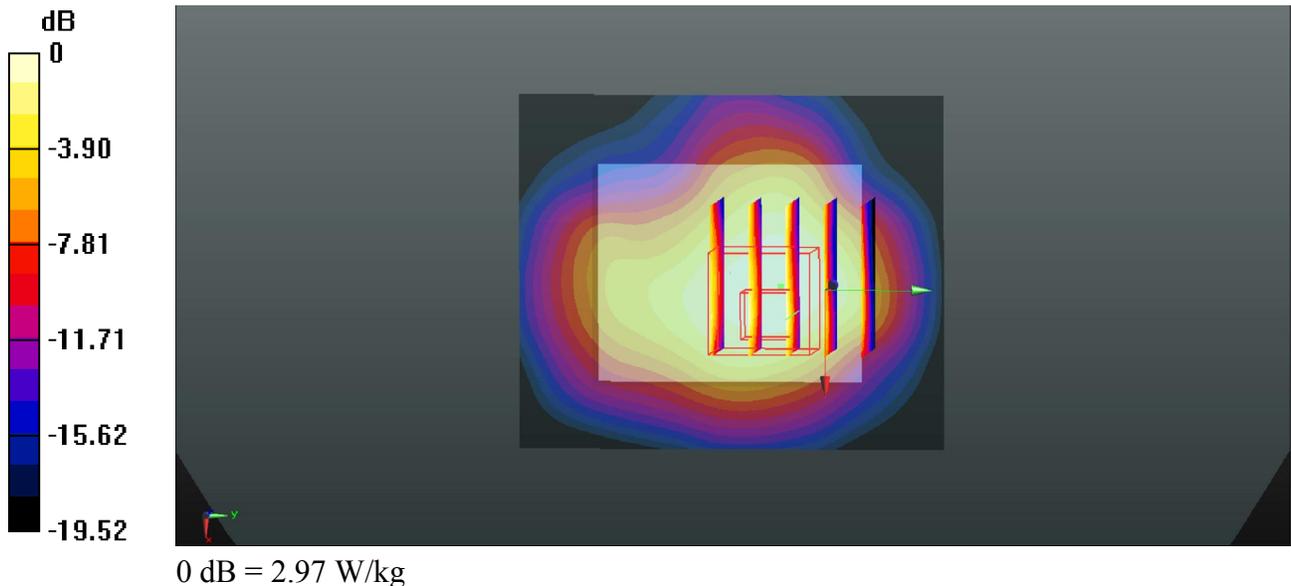
Communication System: UID 0, WCDMA (0); Frequency: 1712.4 MHz; Duty Cycle: 1:1
Medium: MSL_1750_2017/01/10 Medium parameters used: $f = 1712.4$ MHz; $\sigma = 1.466$ S/m; $\epsilon_r = 54.148$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.3 °C ; Liquid Temperature : 22.4 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(8.46, 8.46, 8.46); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch1312/Area Scan (51x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.36 W/kg

Ch1312/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.66 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.56 W/kg
SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.180 W/kg
Maximum value of SAR (measured) = 2.97 W/kg



#11_WCDMA II_RMC 12.2Kbps_Back_0mm_Ch9538

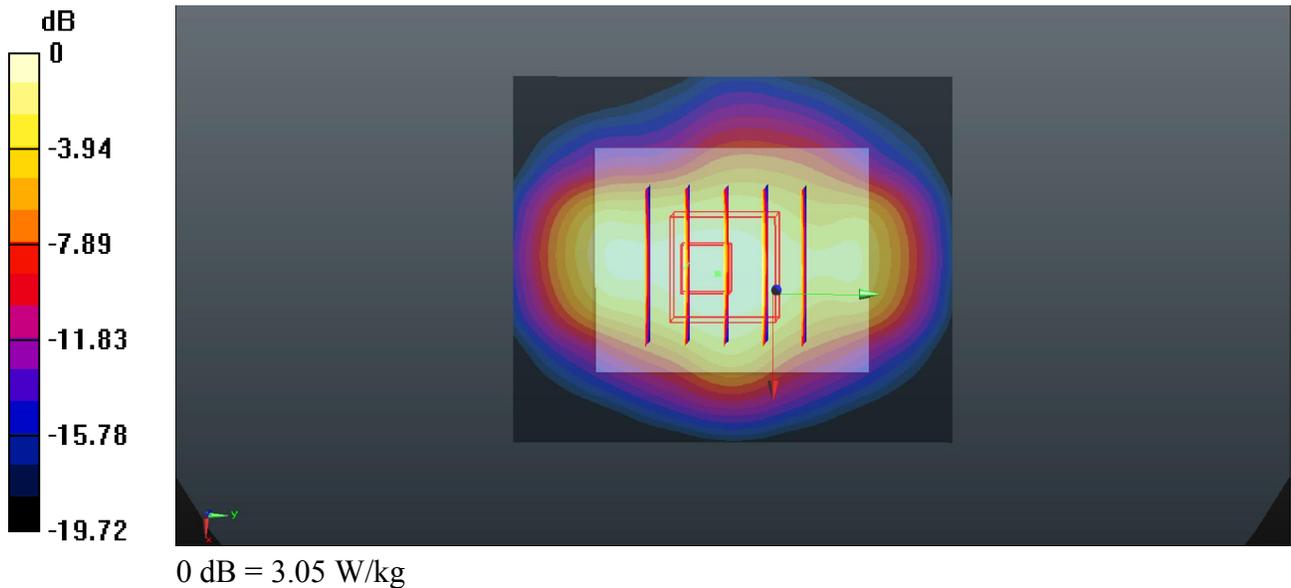
Communication System: UID 0, WCDMA (0); Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: MSL_1900_2017/01/10 Medium parameters used: $f = 1907.6$ MHz; $\sigma = 1.581$ S/m; $\epsilon_r = 53.976$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.5 °C ; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(8.18, 8.18, 8.18); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1754
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9538/Area Scan (51x61x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.27 W/kg

Ch9538/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 38.32 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 3.72 W/kg
SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.430 W/kg
Maximum value of SAR (measured) = 3.05 W/kg



#12_WLAN2.4GHz_802.11b 1Mbps_Back_0mm_Ch1

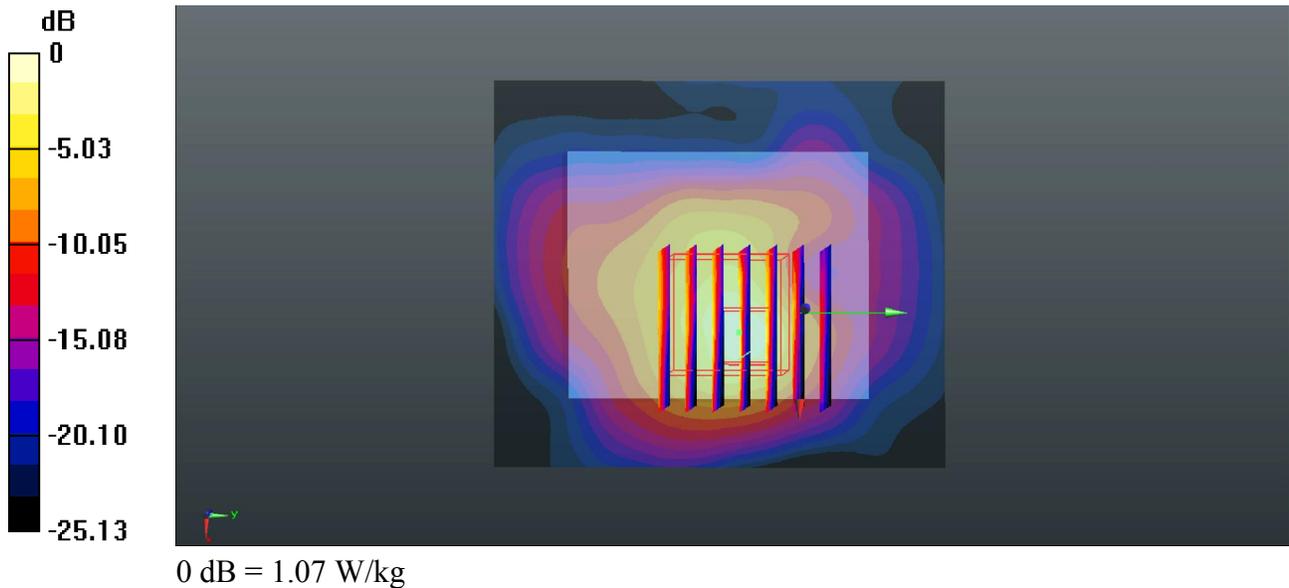
Communication System: UID 0, 802.11b (0); Frequency: 2412 MHz; Duty Cycle: 1:1.025
Medium: MSL_2450_2017/01/16 Medium parameters used: $f = 2412$ MHz; $\sigma = 1.882$ S/m; $\epsilon_r = 53.27$; $\rho = 1000$ kg/m³
Ambient Temperature : 23.4 °C ; Liquid Temperature : 22.3 °C

DASY5 Configuration:

- Probe: EX3DV4 - SN3935; ConvF(7.89, 7.89, 7.89); Calibrated: 2016/11/28;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1358; Calibrated: 2016/9/5
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1753
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch1/Area Scan (61x71x1): Interpolated grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 1.09 W/kg

Ch1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.41 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 1.74 W/kg
SAR(1 g) = 0.432 W/kg; SAR(10 g) = 0.163 W/kg
Maximum value of SAR (measured) = 1.07 W/kg





Appendix C. DASYS Calibration Certificate

The DASYS calibration certificates are shown as follows.



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

Accreditation No.: **SCS 0108**

Client **Sporton-CN (Auden)**

Certificate No: **D835V2-4d151_Mar16**

CALIBRATION CERTIFICATE

Object **D835V2 - SN:4d151**

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

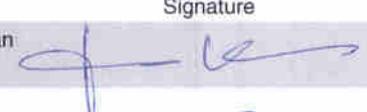
Calibration date: **March 16, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by: **Jeton Kastrati** (Name) / **Laboratory Technician** (Function) /  (Signature)

Approved by: **Katja Pokovic** (Name) / **Technical Manager** (Function) /  (Signature)

Issued: March 16, 2016

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