SAR Test Report

APPLICANT	**:**	**Panasales Clearance centre Pty. Ltd.**
		TA Cellsafe Pty Ltd.
EQUIPMENT	**:**	**Cellsafe UNIVERAL RADI-CHIP**
BRAND NAME	**:**	**CELLSAFE**
MODEL NAME	**:**	**UNIVERSAL RADI-CHIP**
TEST DATES	**:**	**2017/5/10 ~ 2017/5/26**

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

zheng xu

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Table of Contents

Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA753113	Rev. 01	Initial issue of report	Jun. 05, 2017

1. *Statement of Compliance*

The maximum results of Specific Absorption Rate (SAR) found during testing for **Panasales Clearance centre Pty. Ltd. TA Cellsafe Pty Ltd., Cellsafe UNIVERAL RADI-CHIP, UNIVERSAL RADI-CHIP** are as follows.

Frequency Band		Highest Head SAR Summary			
		With Cellsafe Chip		Without Cellsafe Chip	
		1g SAR (W/kg)	10g SAR (W/kg)	1g SAR (W/kg)	10g SAR (W/kg)
HUAWEI P9	WCDMA Band V	0.206	0.141	0.335	0.229
	WCDMA Band II	0.118	0.067	0.671	0.378
OPPO R9S	WCDMA Band V	0.005	0.003	0.179	0.122
	WCDMA Band II	0.177	0.103	0.315	0.186
S7	WCDMA Band V	0.022	0.015	0.154	0.106
	WCDMA Band II	0.056	0.033	0.087	0.052
S7 EDGE	WCDMA Band V	0.094	0.065	0.183	0.125
	WCDMA Band II	0.008	0.005	0.071	0.042
S8	WCDMA Band V	0.078	0.055	0.326	0.224
	WCDMA Band II	0.094	0.054	0.287	0.164
S8 Plus	WCDMA Band V	0.102	0.071	0.203	0.141
	WCDMA Band II	0.042	0.025	0.152	0.089
Date of Testing:		2017/5/10 ~ 2017/5/26			

2. *Administration Data*

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

Applicant	
Company Name	Panasales Clearance Centre Pty. Ltd. TA Cellsafe Pty. Ltd
Address	14/1866 Princes Highway, Clayton VIC 3168 Australia
Contact Name:	Nicole Bennett sales@cellsafe.com.au

3. *Equipment Under Test (EUT) Information*

3.1 *General Information*

Product Feature & Specification	
Equipment Name	Cellsafe UNIVERAL RADI-CHIP
Brand Name	CELLSAFE
Model Name	UNIVERSAL RADI-CHIP
Wireless Technology and Frequency Range	WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz

4. *RF Exposure Limits*

4.1 *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.

4.2 *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.

5. *Specific Absorption Rate (SAR)*

5.1 *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.

5.2 *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:

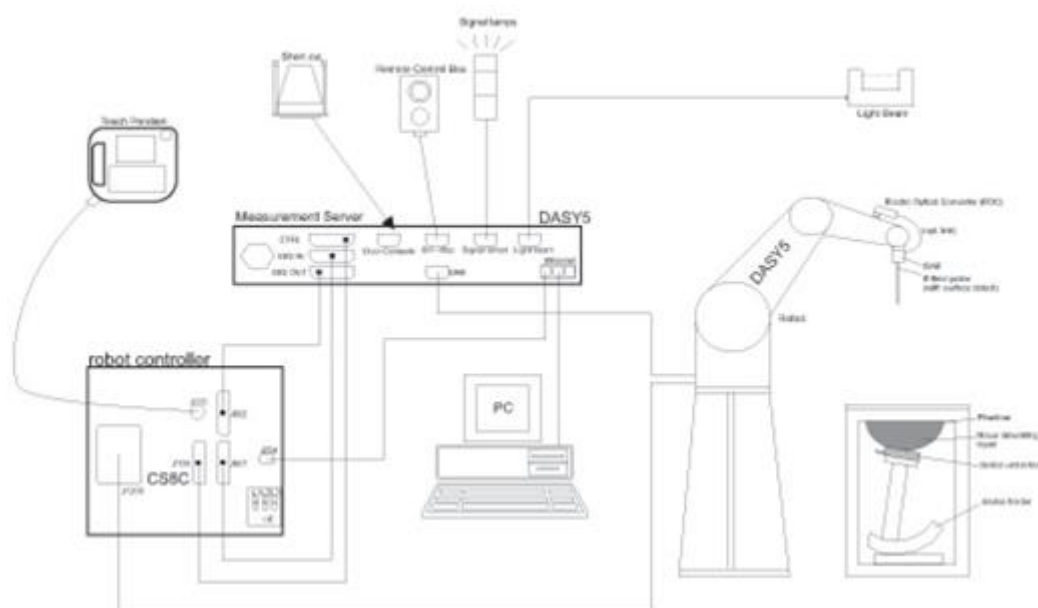$$SAR = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dv}\right)$$

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.

6. *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.

6.1 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	

6.2 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 6.1   Photo of DAE

6.3 *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
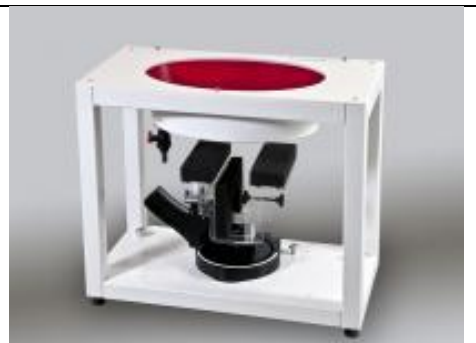
The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

6.4 *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

7. *Measurement Procedures*

The measurement procedures are as follows:

<u>SAR measurement></u>
(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, 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

7.1 *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

7.2 *Area Scan*

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum 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	$30° \pm 1°$	$20° \pm 1°$
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 $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

8. *Test Equipment List*

| Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	4d162	Nov. 22, 2016	Nov. 21, 2017
SPEAG	1900MHz System Validation Kit	D1900V2	5d182	Nov. 24, 2016	Nov. 23, 2017
SPEAG	Data Acquisition Electronics	DAE4	1303	Nov. 22, 2016	Nov. 21, 2017
SPEAG	Dosimetric E-Field Probe	EX3DV4	3819	Nov. 28, 2016	Nov. 27, 2017
SPEAG	SAM Twin Phantom	QD 000 P40 CD	TP-1671	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Agilent	Wireless Communication Test Set	E5515C	MY50267224	Jul. 16, 2016	Jul. 15, 2017
Agilent	Network Analyzer	E5071C	MY46523671	Oct. 11, 2016	Oct. 10, 2017
Speag	Dielectric Assessment KIT	DAK-3.5	1071	Nov. 23, 2016	Nov. 22, 2017
Agilent	Signal Generator	N5181A	MY50145381	Jan. 03, 2017	Jan. 02, 2018
Anritsu	Power Senor	MA2411B	1306099	Jan. 03, 2017	Jan. 02, 2018
Anritsu	Power Meter	ML2495A	1349001	Jan. 03, 2017	Jan. 02, 2018
Anritsu	Power Sensor	MA2411B	1207253	Jan. 03, 2017	Jan. 02, 2018
Anritsu	Power Meter	ML2495A	1218010	Jan. 03, 2017	Jan. 02, 2018
R&S	Spectrum Analyzer	FSP7	101634	Jul. 16, 2016	Jul. 15, 2017
ARRA	Power Divider	A3200-2	N/A	Note	
PASTERNACK	Dual Directional Coupler	PE2214-10	N/A	Note	
Agilent	Dual Directional Coupler	778D	50422	Note	
MCL	Attenuation1	BW-S10W5	N/A	Note	
Weinschel	Attenuation2	3M-20	N/A	Note	
Zhongjilianhe	Attenuation3	MVE2214-03	N/A	Note	
AR	Amplifier	5S1G4	333096	Note	
mini-circuits	Amplifier	ZVE-3W-83+	162601250	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.

9. *System Verification*

9.1 *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. 9.1.
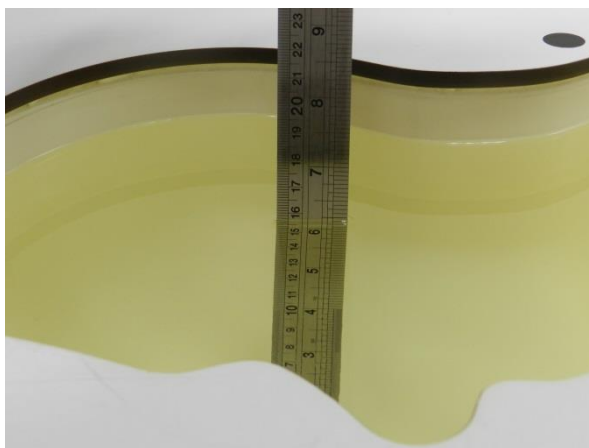
Fig 9.1 Photo of Liquid Height for Head SAR

9.2 *Tissue Verification*

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

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For 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

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (εr)	Conductivity Target (σ)	Permittivity Target (εr)	Delta (σ) (%)	Delta (εr) (%)	Limit (%)	Date
835	Head	22.7	0.914	41.826	0.90	41.50	1.56	0.79	±5	2017/5/24
1900	Head	22.8	1.460	39.248	1.40	40.00	4.29	-1.88	±5	2017/5/24
835	Head	22.5	0.919	41.524	0.90	41.50	2.11	0.06	±5	2017/5/22
1900	Head	22.7	1.440	40.038	1.40	40.00	2.86	0.09	±5	2017/5/22
835	Head	22.6	0.927	42.674	0.90	41.50	3.00	2.83	±5	2017/5/26
1900	Head	22.7	1.427	41.191	1.40	40.00	1.93	2.98	±5	2017/5/26
835	Head	22.5	0.910	42.910	0.90	41.50	1.11	3.40	±5	2017/5/10
1900	Head	22.6	1.417	40.994	1.40	40.00	1.21	2.49	±5	2017/5/10
835	Head	22.5	0.913	40.859	0.90	41.50	1.44	-1.54	±5	2017/5/12
1900	Head	22.6	1.455	40.068	1.40	40.00	3.93	0.17	±5	2017/5/12

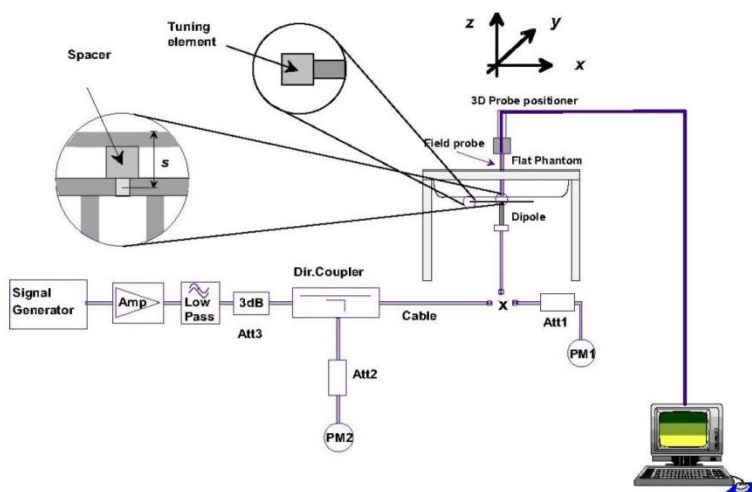### 9.3 System Performance Check Results

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 (%)
2017/5/24	835	Head	250	4d162	3819	1303	2.27	9.31	9.08	-2.47
2017/5/24	1900	Head	250	5d182	3819	1303	9.95	40.00	39.8	-0.50
2017/5/22	835	Head	250	4d162	3819	1303	2.28	9.31	9.12	-2.04
2017/5/22	1900	Head	250	5d182	3819	1303	9.82	40.00	39.28	-1.80
2017/5/26	835	Head	250	4d162	3819	1303	2.30	9.31	9.2	-1.18
2017/5/26	1900	Head	250	5d182	3819	1303	9.73	40.00	38.92	-2.70
2017/5/10	835	Head	250	4d162	3819	1303	2.26	9.31	9.04	-2.90
2017/5/10	1900	Head	250	5d182	3819	1303	9.66	40.00	38.64	-3.40
2017/5/12	835	Head	250	4d162	3819	1303	2.26	9.31	9.04	-2.90
2017/5/12	1900	Head	250	5d182	3819	1303	9.92	40.00	39.68	-0.80

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 (%)
2017/5/24	835	Head	250	4d162	3819	1303	1.48	6.13	5.92	-3.43
2017/5/24	1900	Head	250	5d182	3819	1303	5.19	20.80	20.76	-0.19
2017/5/22	835	Head	250	4d162	3819	1303	1.49	6.13	5.96	-2.77
2017/5/22	1900	Head	250	5d182	3819	1303	5.12	20.80	20.48	-1.54
2017/5/26	835	Head	250	4d162	3819	1303	1.50	6.13	6	-2.12
2017/5/26	1900	Head	250	5d182	3819	1303	5.08	20.80	20.32	-2.31
2017/5/10	835	Head	250	4d162	3819	1303	1.48	6.13	5.92	-3.43
2017/5/10	1900	Head	250	5d182	3819	1303	5.04	20.80	20.16	-3.08
2017/5/12	835	Head	250	4d162	3819	1303	1.48	6.13	5.92	-3.43
2017/5/12	1900	Head	250	5d182	3819	1303	5.17	20.80	20.68	-0.58

**Fig 9.3.1 System Performance Check Setup**   **Fig 9.3.2 Setup Photo**

10. <u>RF Exposure Positions</u>

## 10.1 <u>Ear and handset reference point</u>

Figure 10.1.1 shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled "M," the left ear reference point (ERP) is marked "LE," and the right ERP is marked "RE." Each ERP is 15 mm along the B-M (back-mouth) line behind the entrance-to-ear-canal (EEC) point, as shown in Figure 10.1.2 The Reference Plane is defined as passing through the two ear reference points and point M. The line N-F (neck-front), also called the reference pivoting line, is normal to the Reference Plane and perpendicular to both a line passing through RE and LE and the B-M line (see Figure 10.1.3). Both N-F and B-M lines should be marked on the exterior of the phantom shell to facilitate handset positioning. Posterior to the N-F line the ear shape is a flat surface with 6 mm thickness at each ERP, and forward of the N-F line the ear is truncated, as illustrated in Figure 10.1.2. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.
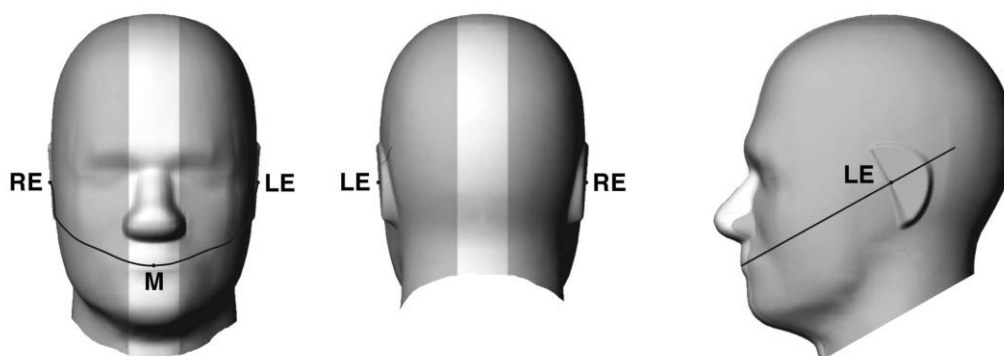
Fig 10.1.1 Front, back, and side views of SAM twin phantom
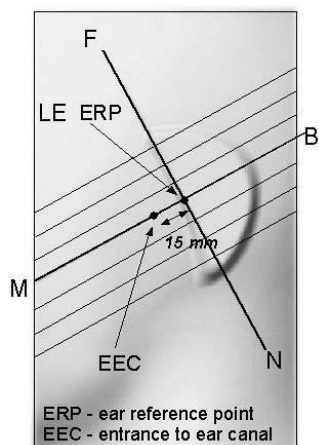
Fig 10.1.2 Close-up side view of phantom showing the ear region.
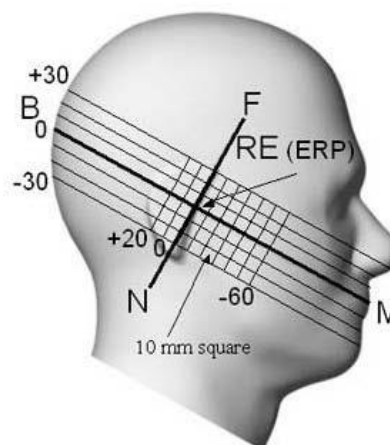
Fig 10.1.3 Side view of the phantom showing relevant markings and seven cross-sectional plane locations

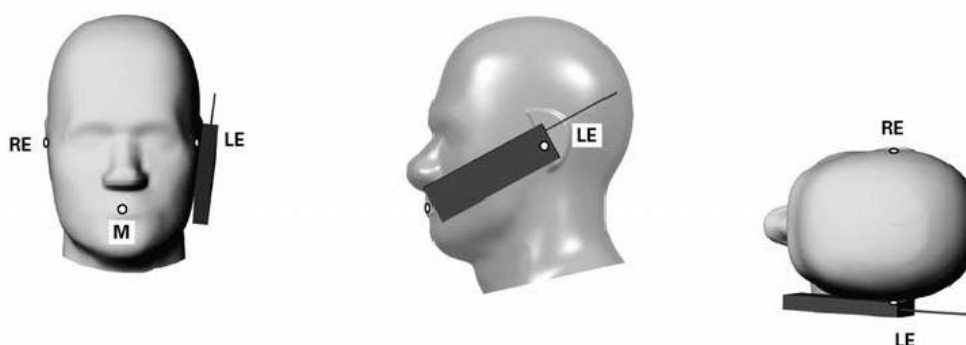## 10.2 *Definition of the cheek position*

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.

2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset—the midpoint of the width wt of the handset at the level of the acoustic output (point A in Figure 10.2.1 and Figure 10.2.2), and the midpoint of the width wb of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 10.2.1). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 10.2.2), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.

3. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 10.2.3), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.

4. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.

5. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.

6. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.

7. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Figure 10.2.3. The actual rotation angles should be documented in the test report.
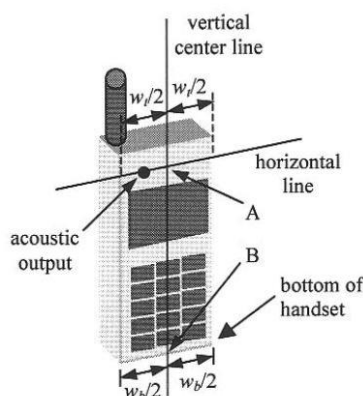
**Fig 10.2.1 Handset vertical and horizontal reference lines—"fixed case**
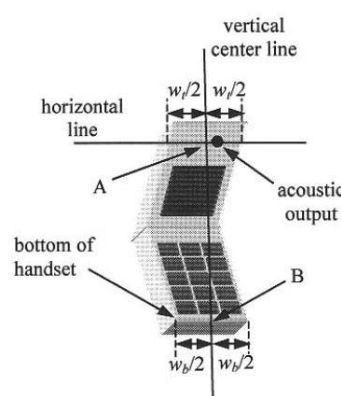
Fig 10.2.2 Handset vertical and horizontal reference lines—"clam-shell case"

Fig 10.2.3 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

10.3 *Definition of the tilt position*

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.

2. While maintaining the orientation of the handset, move the handset away from the pinna along the line passing through RE and LE far enough to allow a rotation of the handset away from the cheek by 15°.

3. Rotate the handset around the horizontal line by 15°.

4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Figure 10.3.1. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point on the handset is in contact with the pinna and a second point
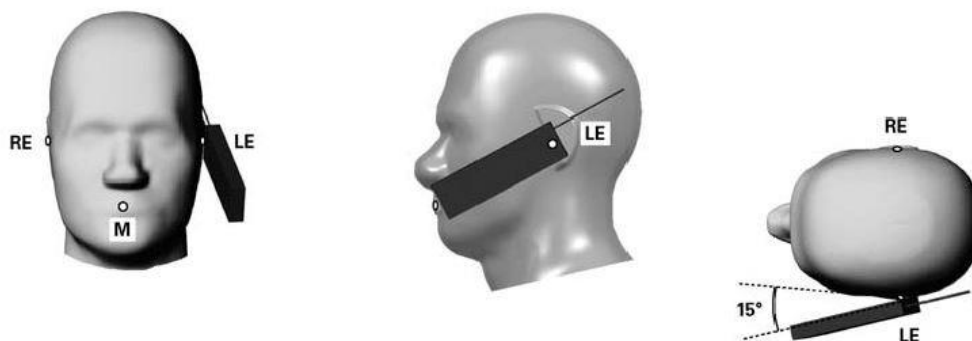
Fig 10.3.1 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

11. *SAR Test Results*

11.1 *Head SAR*

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Sample	Cellsafe Chip	Measured 1g SAR (W/kg)	Measured 10g SAR (W/kg)
#01	WCDMA Band V	RMC 12.2Kbps	Right Cheek	4182	836.4	HUAWEI P9	With	0.206	0.141
#02	WCDMA Band II	RMC 12.2Kbps	Right Cheek	9400	1880	HUAWEI P9	With	0.118	0.067
#03	WCDMA Band V	RMC 12.2Kbps	Right Cheek	4182	836.4	HUAWEI P9	Without	0.335	0.229
#04	WCDMA Band II	RMC 12.2Kbps	Right Cheek	9400	1880	HUAWEI P9	Without	0.671	0.378
#05	WCDMA Band V	RMC 12.2Kbps	Right Cheek	4182	836.4	OPPO R9S	With	0.005	0.003
#06	WCDMA Band II	RMC 12.2Kbps	Right Cheek	9400	1880	OPPO R9S	With	0.177	0.103
#07	WCDMA Band V	RMC 12.2Kbps	Right Cheek	4182	836.4	OPPO R9S	Without	0.179	0.122
#08	WCDMA Band II	RMC 12.2Kbps	Right Cheek	9400	1880	OPPO R9S	Without	0.315	0.186
#09	WCDMA Band V	RMC 12.2Kbps	Right Cheek	4182	836.4	S7	With	0.022	0.015
#10	WCDMA Band II	RMC 12.2Kbps	Right Cheek	9400	1880	S7	With	0.056	0.033
#11	WCDMA Band V	RMC 12.2Kbps	Right Cheek	4182	836.4	S7	Without	0.154	0.106
#12	WCDMA Band II	RMC 12.2Kbps	Right Cheek	9400	1880	S7	Without	0.087	0.052
#13	WCDMA Band V	RMC 12.2Kbps	Right Cheek	4182	836.4	S7 EDGE	With	0.094	0.065
#14	WCDMA Band II	RMC 12.2Kbps	Right Cheek	9400	1880	S7 EDGE	With	0.008	0.005
#15	WCDMA Band V	RMC 12.2Kbps	Right Cheek	4182	836.4	S7 EDGE	Without	0.183	0.125
#16	WCDMA Band II	RMC 12.2Kbps	Right Cheek	9400	1880	S7 EDGE	Without	0.071	0.042
#17	WCDMA Band V	RMC 12.2Kbps	Right Cheek	4182	836.4	S8	With	0.078	0.055
#18	WCDMA Band V	RMC 12.2Kbps	Left Cheek	4182	836.4	S8	With	0.070	0.049
#19	WCDMA Band II	RMC 12.2Kbps	Right Cheek	9400	1880	S8	With	0.073	0.043
#20	WCDMA Band II	RMC 12.2Kbps	Left Cheek	9400	1880	S8	With	0.094	0.054
#21	WCDMA Band V	RMC 12.2Kbps	Right Cheek	4182	836.4	S8	Without	0.326	0.224
#22	WCDMA Band V	RMC 12.2Kbps	Left Cheek	4182	836.4	S8	Without	0.234	0.164
#23	WCDMA Band II	RMC 12.2Kbps	Right Cheek	9400	1880	S8	Without	0.215	0.125
#24	WCDMA Band II	RMC 12.2Kbps	Left Cheek	9400	1880	S8	Without	0.287	0.164
#25	WCDMA Band V	RMC 12.2Kbps	Right Cheek	4182	836.4	S8 Plus	With	0.102	0.071
#26	WCDMA Band V	RMC 12.2Kbps	Left Cheek	4182	836.4	S8 Plus	With	0.072	0.050
#27	WCDMA Band II	RMC 12.2Kbps	Right Cheek	9400	1880	S8 Plus	With	0.028	0.017
#28	WCDMA Band II	RMC 12.2Kbps	Left Cheek	9400	1880	S8 Plus	With	0.042	0.025
#29	WCDMA Band V	RMC 12.2Kbps	Right Cheek	4182	836.4	S8 Plus	Without	0.203	0.141
#30	WCDMA Band V	RMC 12.2Kbps	Left Cheek	4182	836.4	S8 Plus	Without	0.142	0.099
#31	WCDMA Band II	RMC 12.2Kbps	Right Cheek	9400	1880	S8 Plus	Without	0.112	0.066
#32	WCDMA Band II	RMC 12.2Kbps	Left Cheek	9400	1880	S8 Plus	Without	0.152	0.089

11.2 *Test Sample and Test Setup Photographs*

Test Sample

UNIVERSAL RADI-CHIP with HUAWEI P9

UNIVERSAL RADI-CHIP with OPPO R9S

UNIVERSAL RADI-CHIP with S7

UNIVERSAL RADI-CHIP with S7 EDGE

UNIVERSAL RADI-CHIP with S8
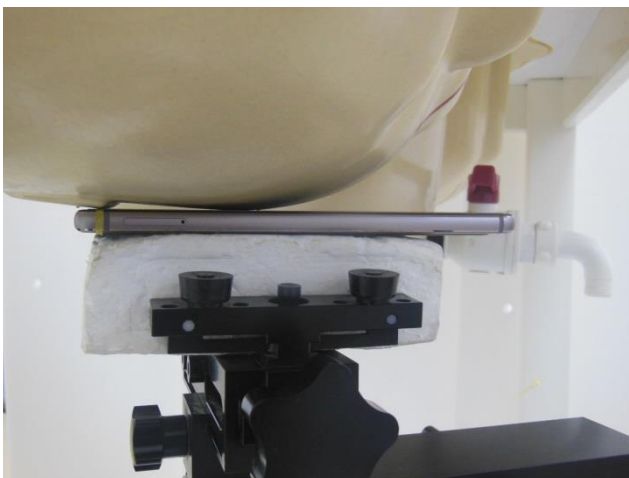
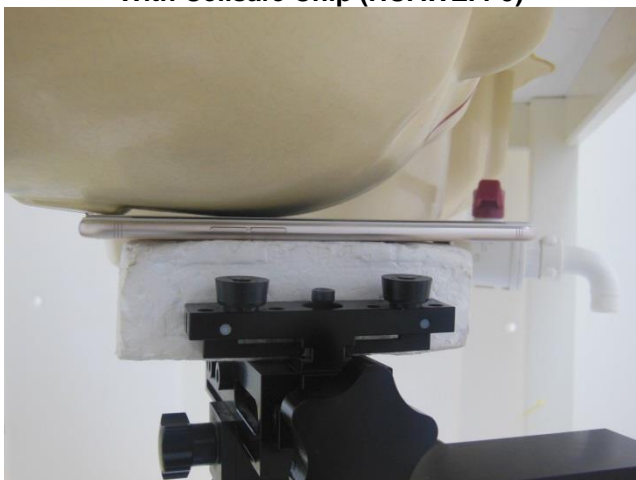UNIVERSAL RADI-CHIP with S8 Plus
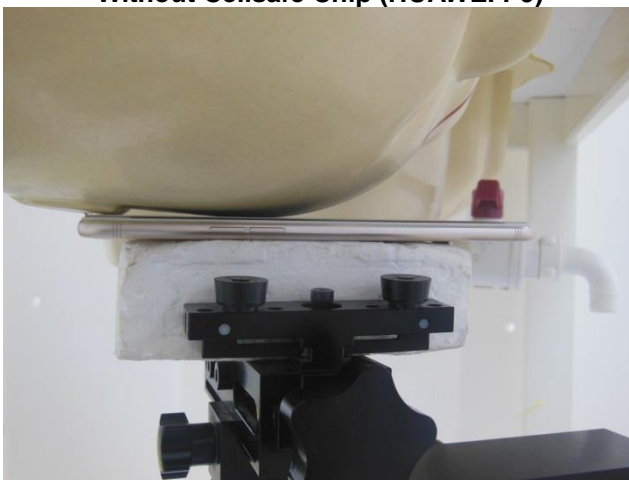
Test Setup Photographs

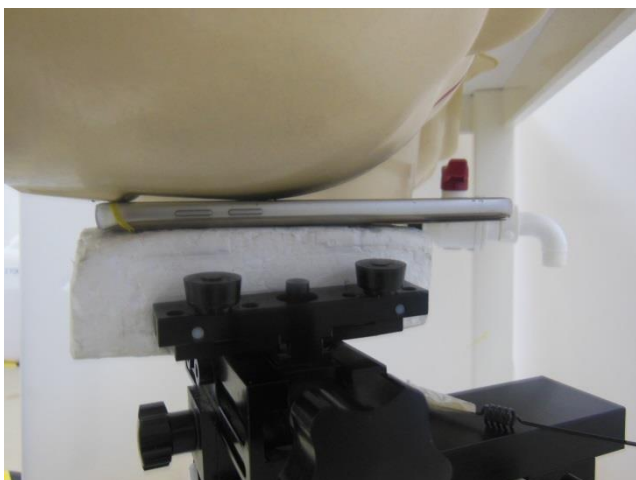**Right Cheek**
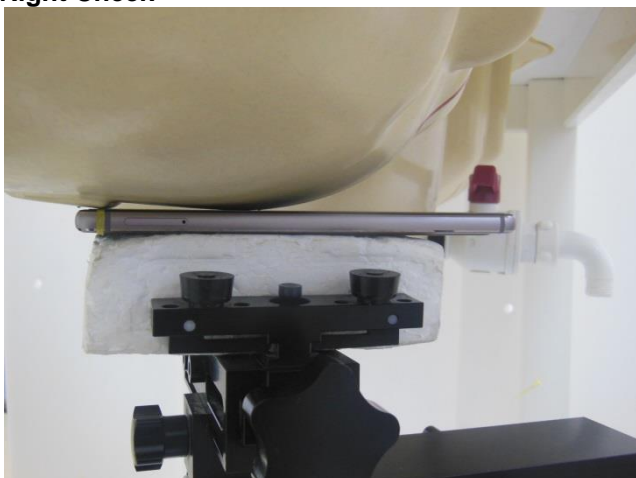
With Cellsafe Chip (HUAWEI P9)

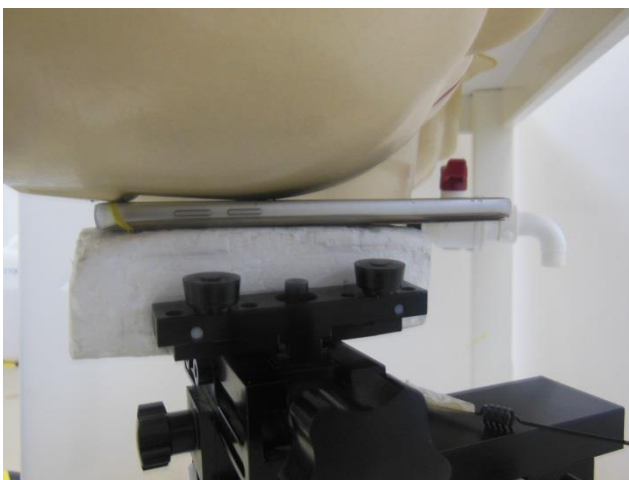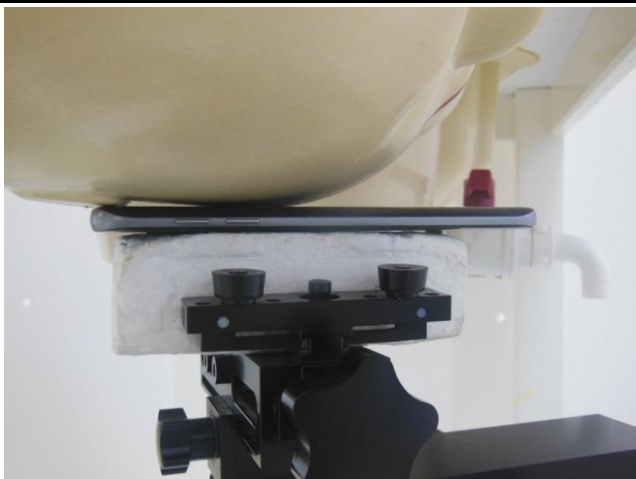**Without Cellsafe Chip (HUAWEI P9)**

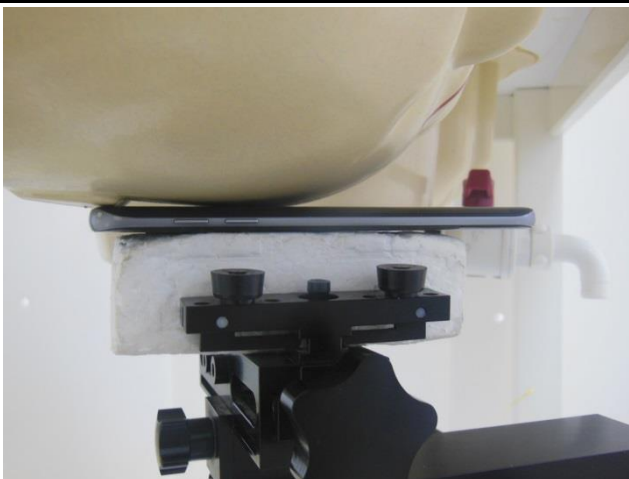**With Cellsafe Chip (OPPO R9S)**

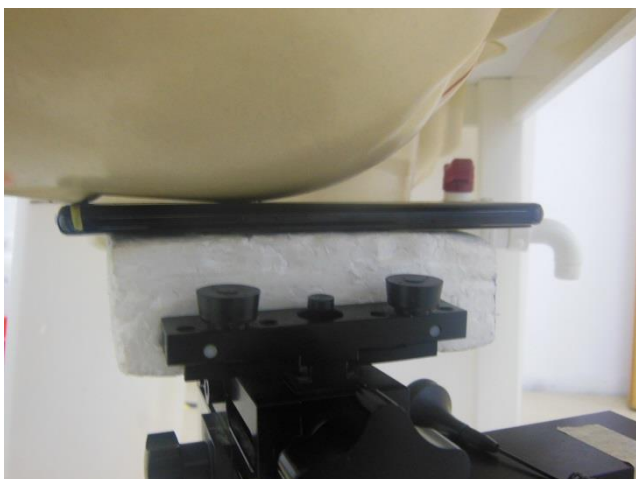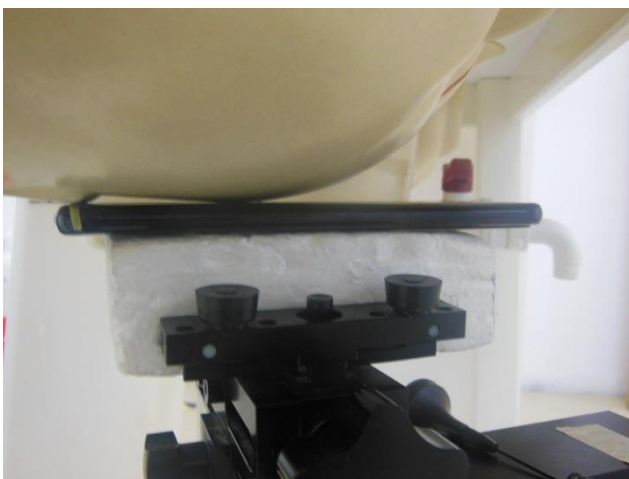**Without Cellsafe Chip (OPPO R9S)**

With Cellsafe Chip (S7)

Without Cellsafe Chip (S7)

With Cellsafe Chip (S7 EDGE)

Without Cellsafe Chip (S7 EDGE)

With Cellsafe Chip (S8)

Without Cellsafe Chip (S8)

With Cellsafe Chip (S8 Plus)

Without Cellsafe Chip (S8 Plus)

Left Cheek
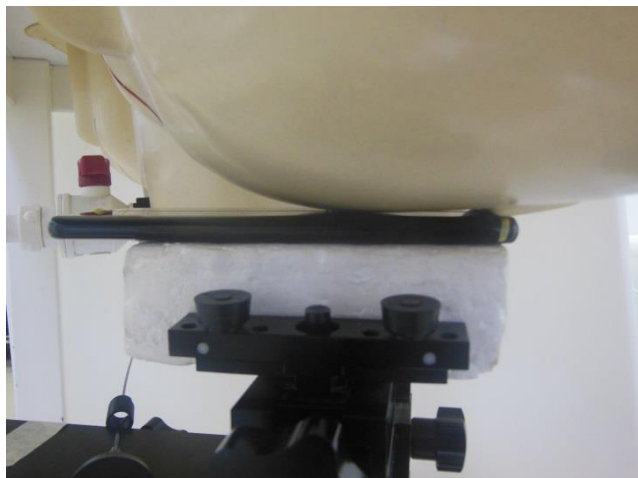
With Cellsafe Chip (S8)   **Without Cellsafe Chip (S8)**
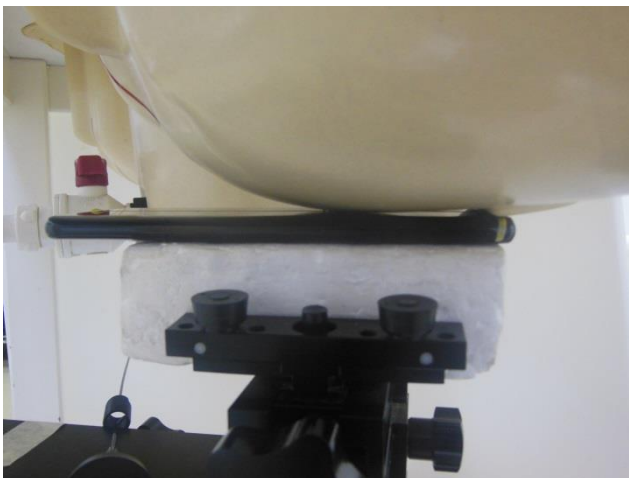
With Cellsafe Chip (S8 Plus)   **Without Cellsafe Chip (S8 Plus)**

12. *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 12.1. 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 12.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

Appendix A.   Plots of System Performance Check

The plots are shown as follows.

System Check_Head_835MHz_170524

DUT: D835V2 - SN: 4d162

Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL_835_170524 Medium parameters used: f = 835 MHz; σ = 0.914 S/m; ε_r = 41.826; ρ =

1000 kg/m^3
Ambient Temperature：23.5 ℃；Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- 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) = 2.87 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 56.55 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.40 W/kg
SAR(1 g) = 2.27 W/kg; SAR(10 g) = 1.48 W/kg
Maximum value of SAR (measured) = 2.87 W/kg

0 dB = 2.87 W/kg
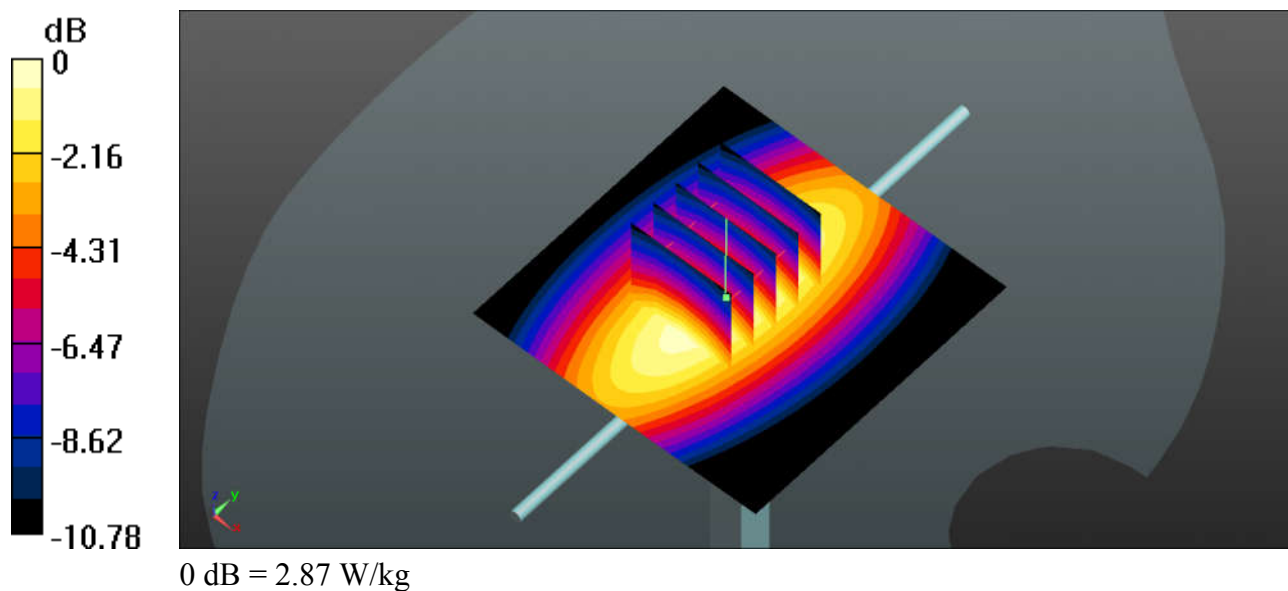
System Check_Head_1900MHz_170524

DUT: D1900V2 - SN: 5d182

Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170524 Medium parameters used: f = 1900 MHz; σ = 1.46 S/m; ε_r = 39.248; ρ

= 1000 kg/m^3
Ambient Temperature：23.5 ℃；Liquid Temperature：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- 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 = 98.11 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 18.1 W/kg
SAR(1 g) = 9.95 W/kg; SAR(10 g) = 5.19 W/kg
Maximum value of SAR (measured) = 14.1 W/kg

0 dB = 14.3 W/kg
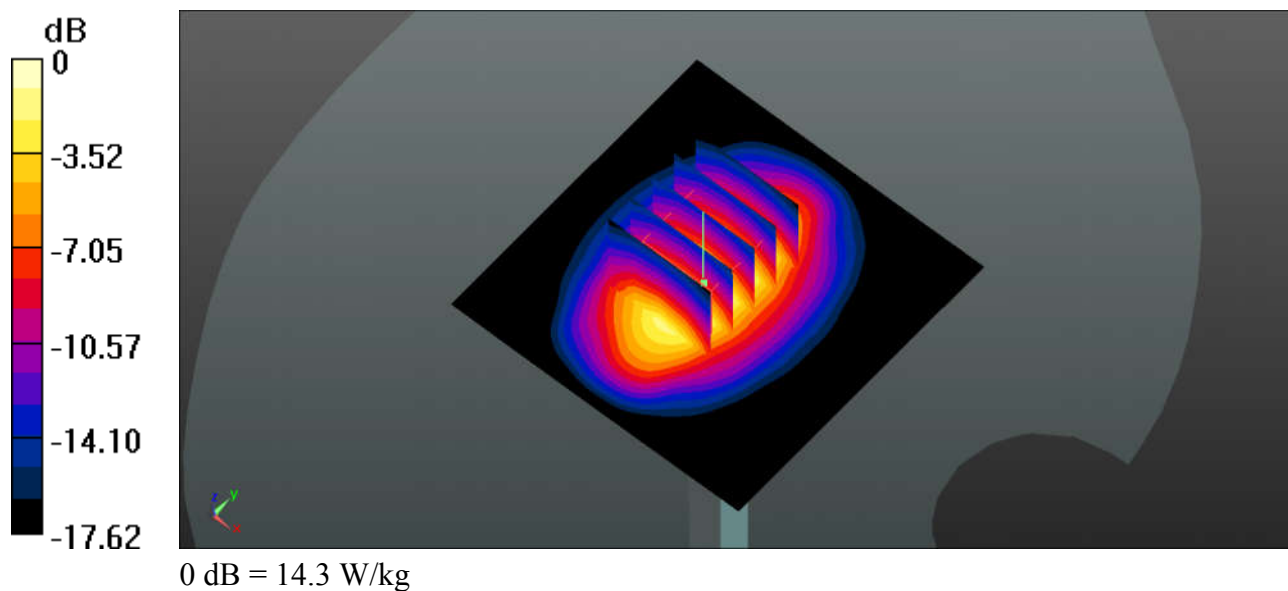
System Check_Head_835MHz_170522

DUT: D835V2 - SN: 4d162

Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL_835_170522 Medium parameters used: f = 835 MHz; σ = 0.919 S/m; ε_r = 41.524; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- 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) = 2.89 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 56.55 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.42 W/kg
SAR(1 g) = 2.28 W/kg; SAR(10 g) = 1.49 W/kg
Maximum value of SAR (measured) = 2.89 W/kg

0 dB = 2.89 W/kg
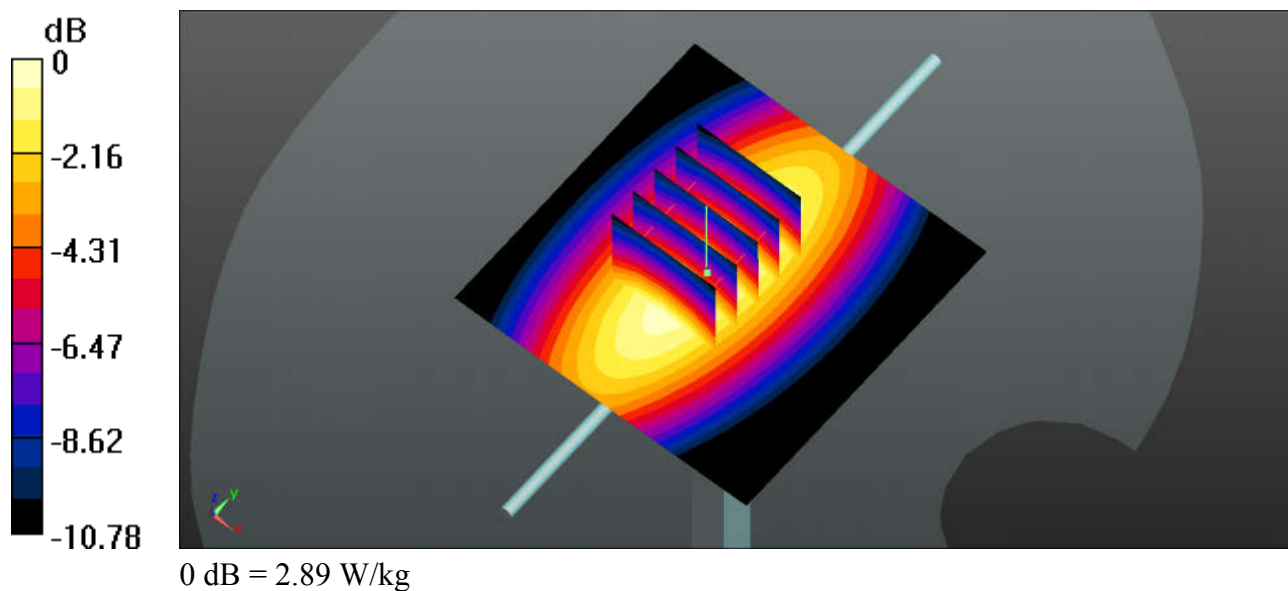
System Check_Head_1900MHz_170522

DUT: D1900V2 - SN: 5d182

Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170522 Medium parameters used: f = 1900 MHz; σ = 1.44 S/m; ε_r = 40.038; ρ

= 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- 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) = 14.1 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 98.11 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 17.8 W/kg
SAR(1 g) = 9.82 W/kg; SAR(10 g) = 5.12 W/kg
Maximum value of SAR (measured) = 13.9 W/kg

0 dB = 14.1 W/kg
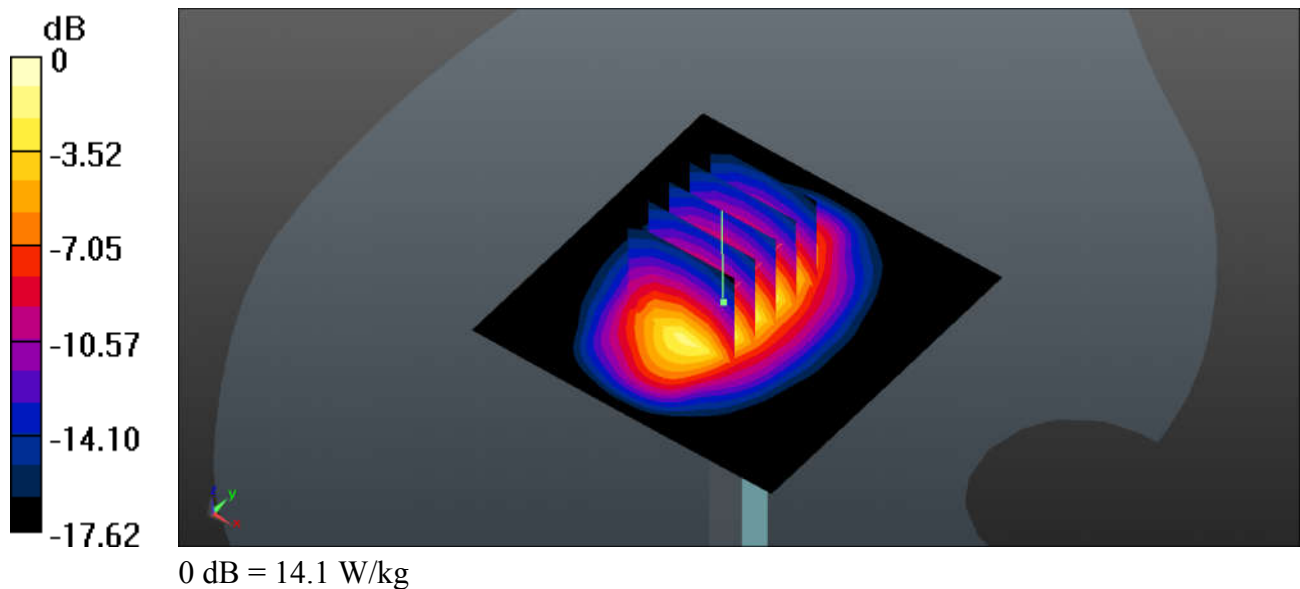
System Check_Head_835MHz_170526

DUT: D835V2 - SN: 4d162

Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL_835_170526 Medium parameters used: f = 835 MHz; σ = 0.927 S/m; ε_r = 42.674; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- 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) = 2.91 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 56.55 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.45 W/kg
SAR(1 g) = 2.3 W/kg; SAR(10 g) = 1.5 W/kg
Maximum value of SAR (measured) = 2.91 W/kg

0 dB = 2.91 W/kg
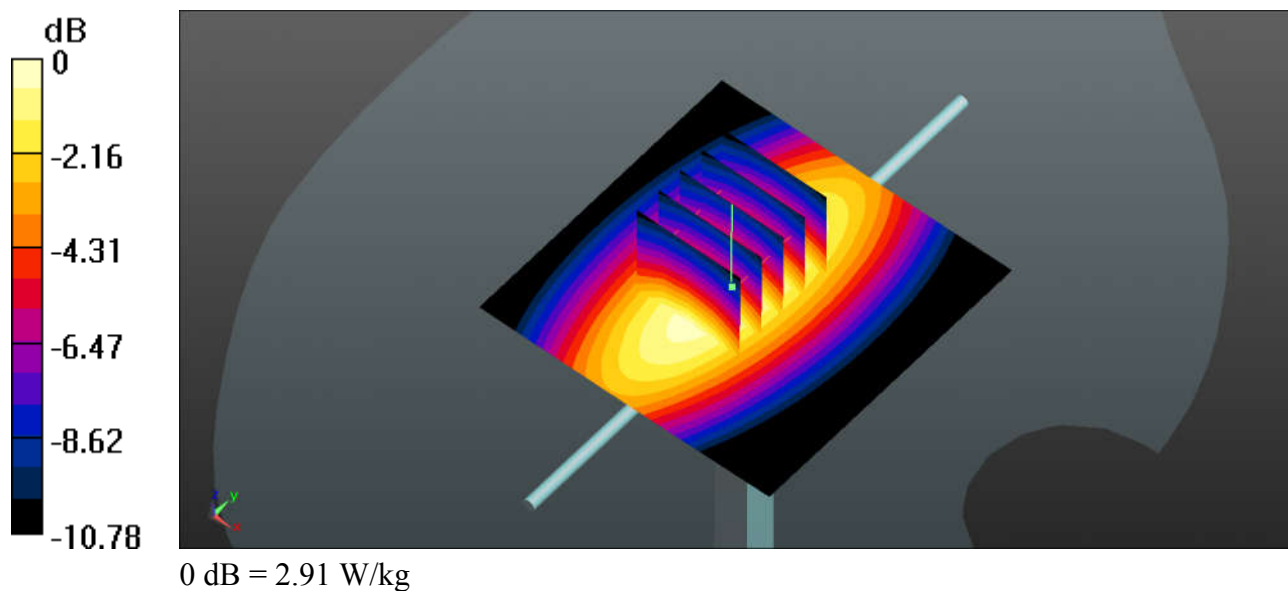
System Check_Head_1900MHz_170526

DUT: D1900V2 - SN: 5d182

Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170526 Medium parameters used: f = 1900 MHz; σ = 1.427 S/m; ε_r = 41.191; ρ

= 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- 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) = 14.0 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 98.11 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 17.7 W/kg
SAR(1 g) = 9.73 W/kg; SAR(10 g) = 5.08 W/kg
Maximum value of SAR (measured) = 13.8 W/kg

0 dB = 13.8 W/kg
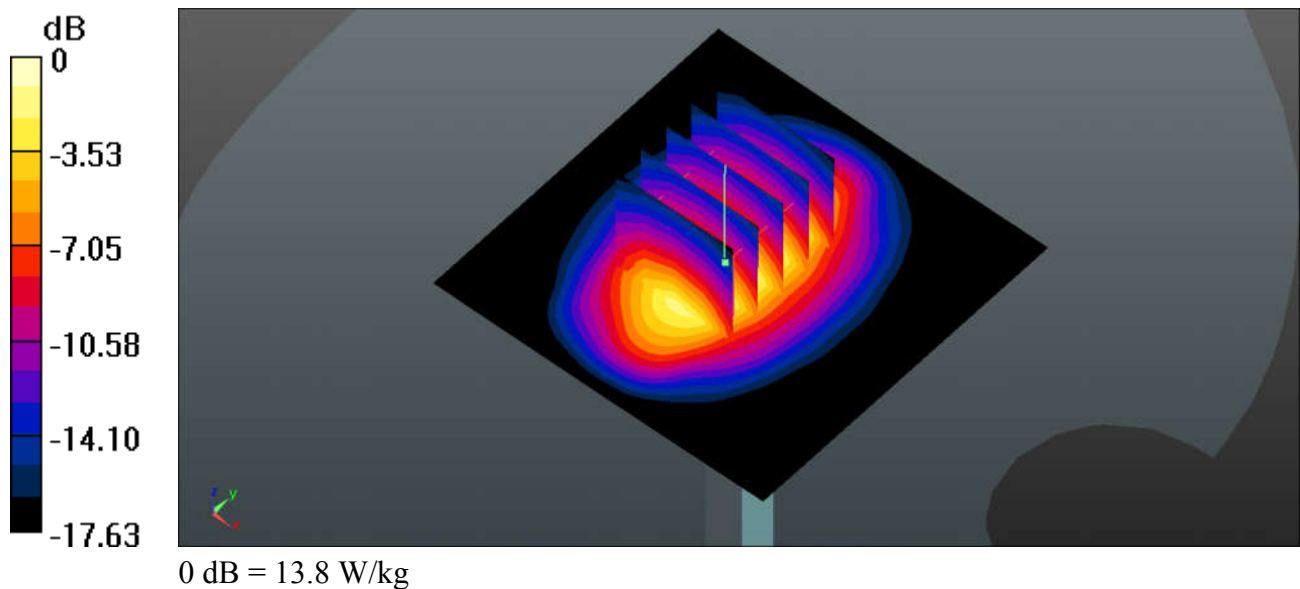
System Check_Head_835MHz_170510

DUT: D835V2 - SN: 4d162

Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL_835_170510 Medium parameters used: f = 835 MHz; σ = 0.91 S/m; ε_r = 42.91; ρ =

1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- 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) = 2.86 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 56.55 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.39 W/kg
SAR(1 g) = 2.26 W/kg; SAR(10 g) = 1.48 W/kg
Maximum value of SAR (measured) = 2.86 W/kg

0 dB = 2.86 W/kg
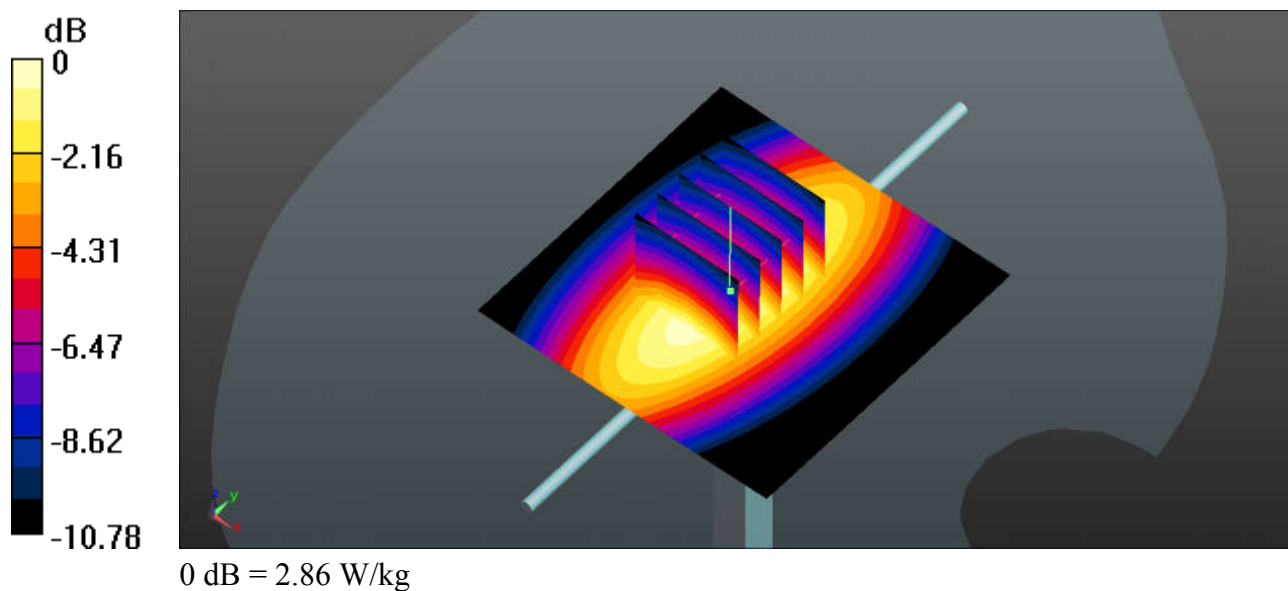
System Check_Head_1900MHz_170510

DUT: D1900V2 - SN: 5d182

Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170510 Medium parameters used: f = 1900 MHz; σ = 1.417 S/m; ε_r = 40.994; ρ

= 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- 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
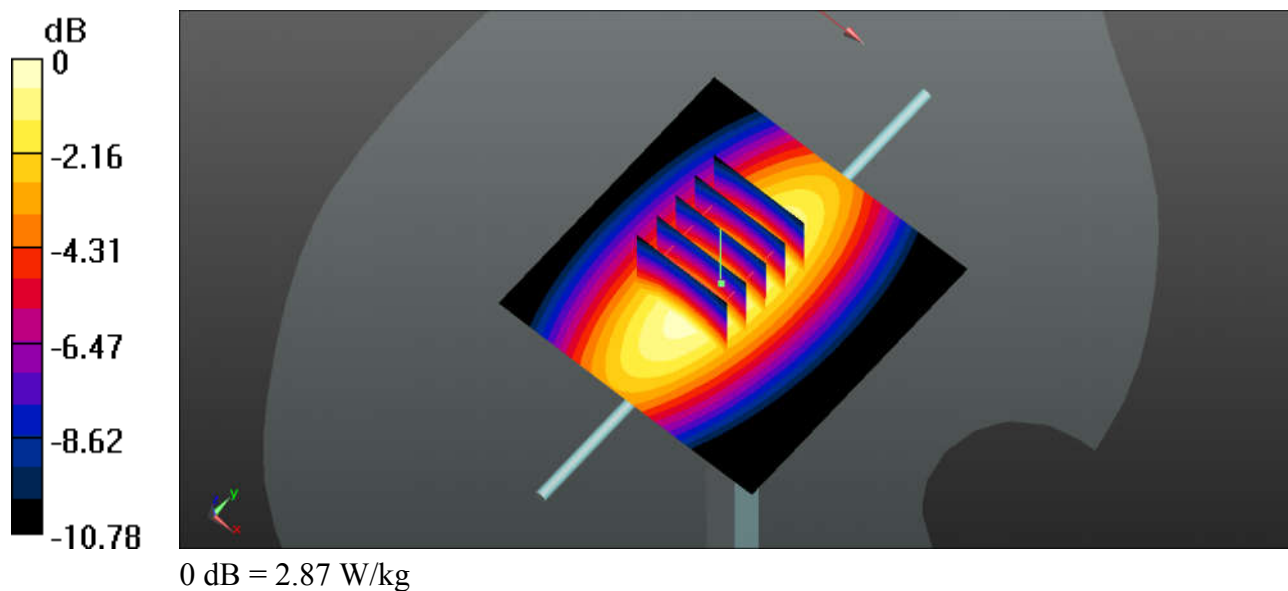Maximum value of SAR (interpolated) = 13.9 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 98.11 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 17.6 W/kg
SAR(1 g) = 9.66 W/kg; SAR(10 g) = 5.04 W/kg
Maximum value of SAR (measured) = 13.7 W/kg

0 dB = 13.9 W/kg
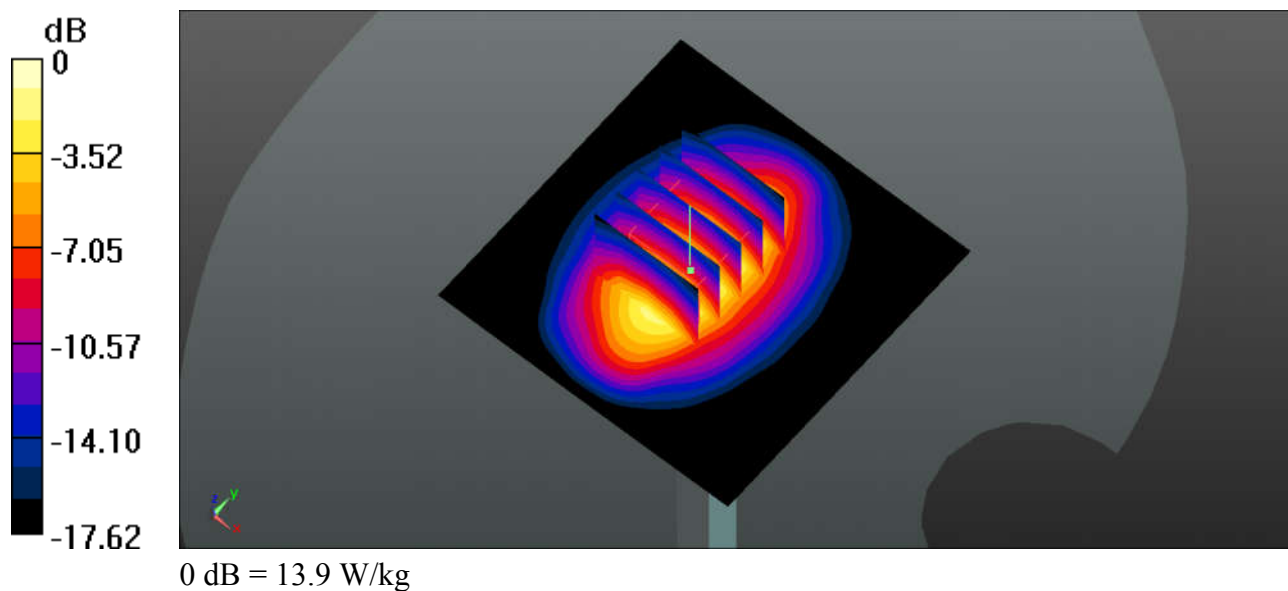
System Check_Head_835MHz_170512

DUT: D835V2 - SN: 4d162

Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL_835_170512 Medium parameters used: f = 835 MHz; σ = 0.913 S/m; ε_r = 40.859; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- 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) = 2.87 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 56.55 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.40 W/kg
SAR(1 g) = 2.26 W/kg; SAR(10 g) = 1.48 W/kg
Maximum value of SAR (measured) = 2.87 W/kg

0 dB = 2.87 W/kg

System Check_Head_1900MHz_170512

DUT: D1900V2 - SN: 5d182

Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170512 Medium parameters used: f = 1900 MHz; σ = 1.455 S/m; ε_r = 40.068; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- 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) = 14.2 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 98.11 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 18.0 W/kg
SAR(1 g) = 9.92 W/kg; SAR(10 g) = 5.17 W/kg
Maximum value of SAR (measured) = 14.1 W/kg

0 dB = 14.2 W/kg
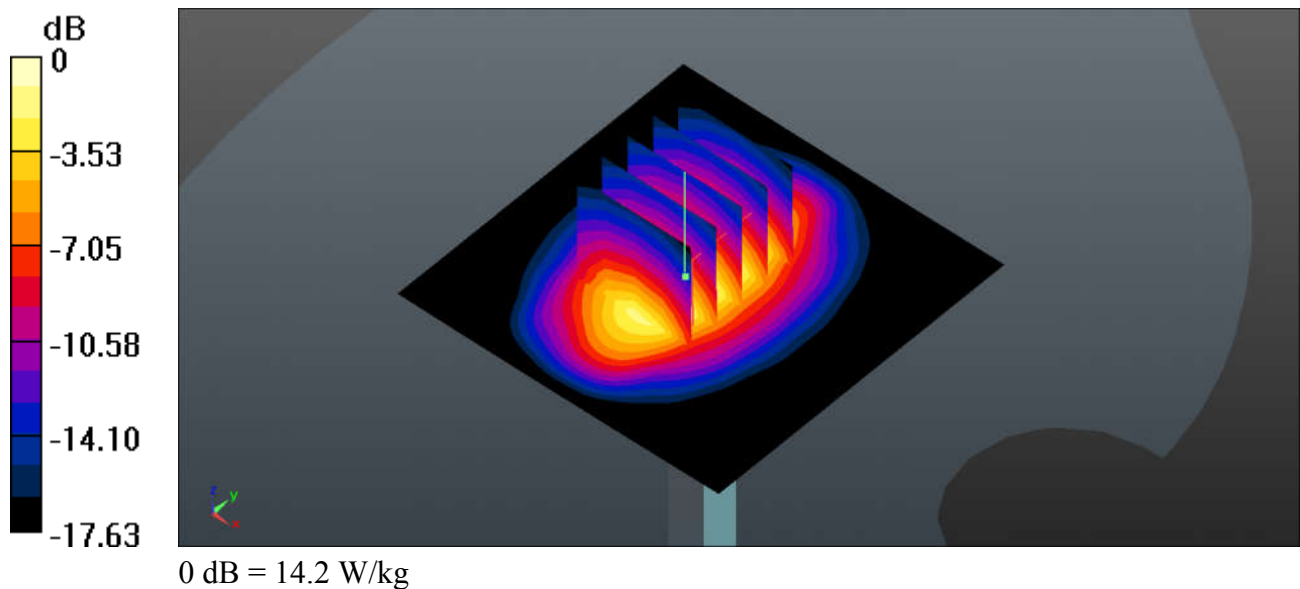
Appendix B.   Plots of SAR Measurement

The plots are shown as follows.

#01_WCDMA Band V_RMC 12.2Kbps_Right Cheek_Ch4182_HUAWEI P9_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_170524 Medium parameters used: f = 836.4 MHz; σ = 0.915 S/m; ε_r = 41.816; ρ
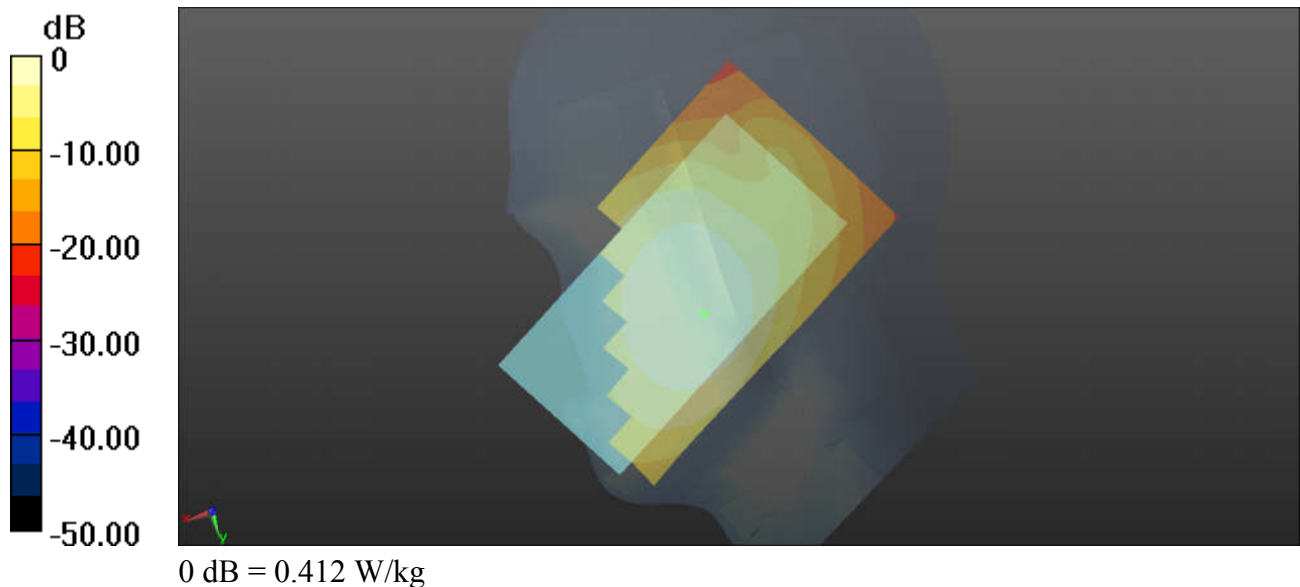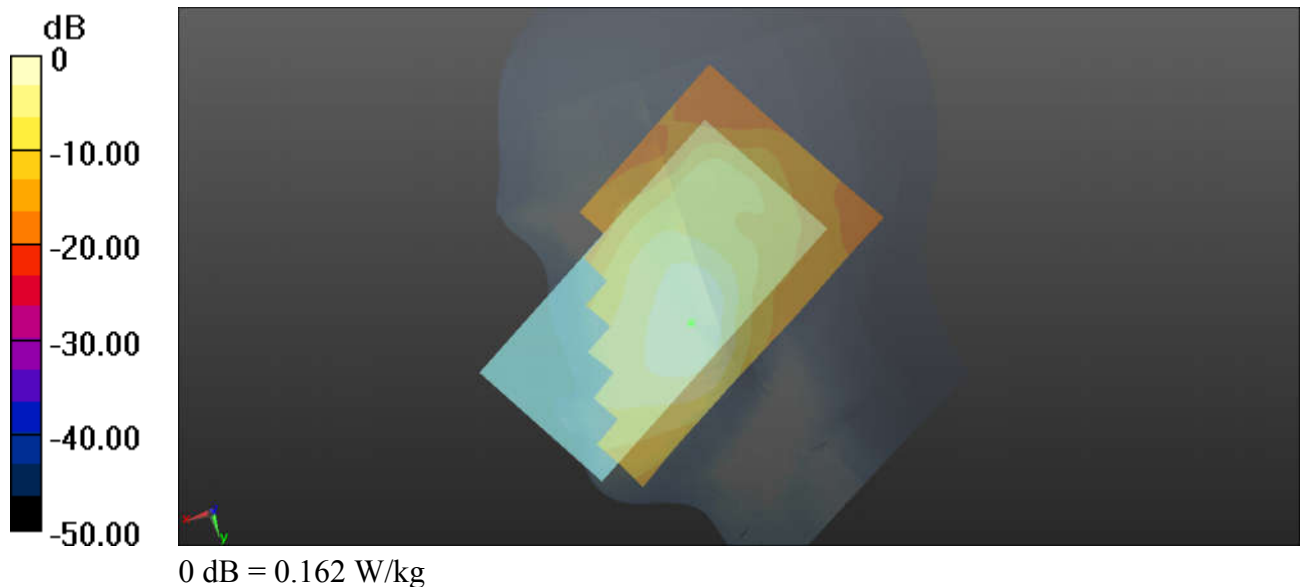
=1000 kg/m^3
Ambient Temperature：23.5 ℃；Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.412 W/kg

0 dB = 0.412 W/kg

#02_WCDMA Band II_RMC 12.2Kbps_Right Cheek_Ch9400_HUAWEI P9_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170524 Medium parameters used: f = 1880 MHz; σ = 1.439 S/m; ε_r = 39.346;

ρ= 1000 kg/m^3
Ambient Temperature：23.5 ℃；Liquid Temperature：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.162 W/kg

0 dB = 0.162 W/kg

#03_WCDMA Band V_RMC 12.2Kbps_Right Cheek_Ch4182_HUAWEI P9_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_170524 Medium parameters used: f = 836.4 MHz; σ = 0.915 S/m; ε_r = 41.816; ρ

= 1000 kg/m^3
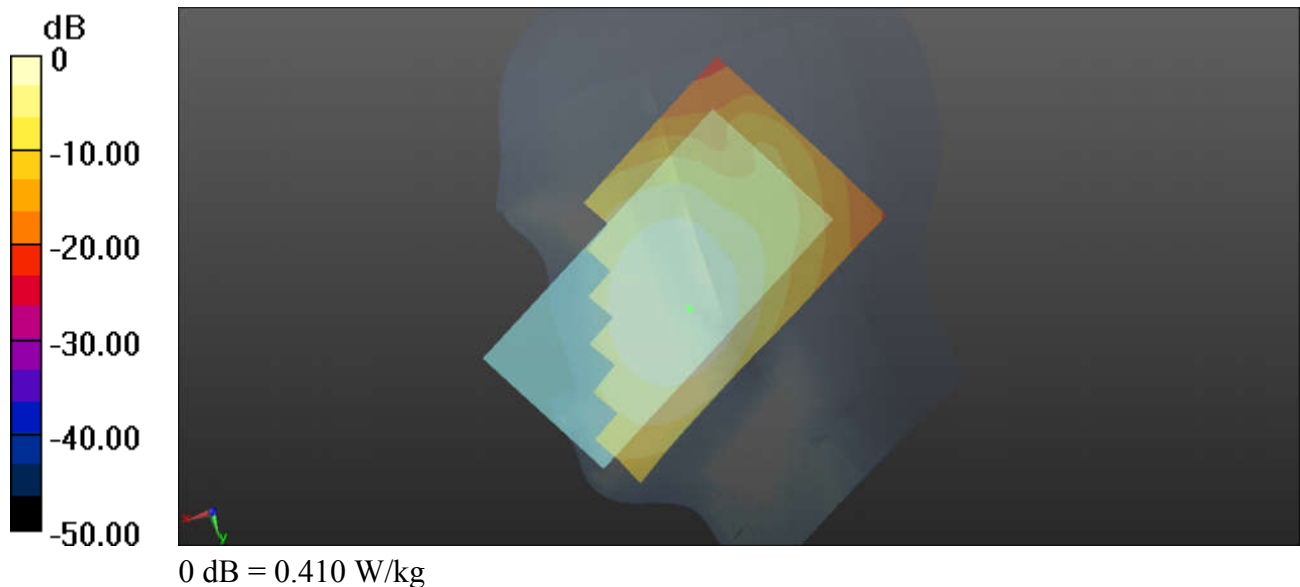Ambient Temperature：23.5 ℃；Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
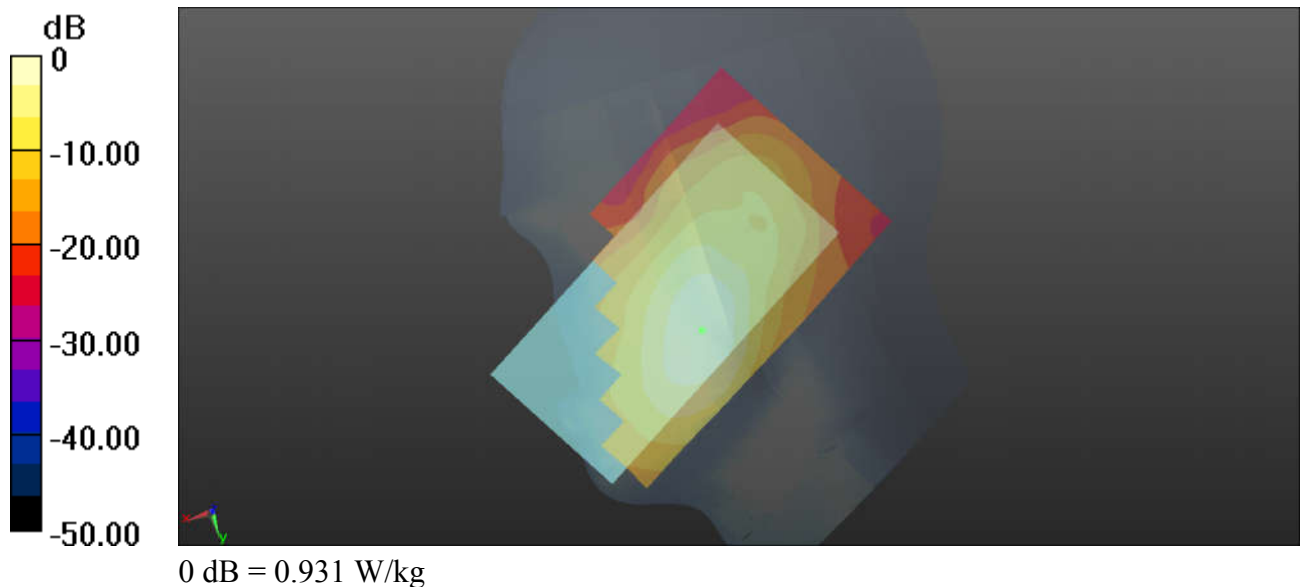Maximum value of SAR (interpolated) = 0.410 W/kg

0 dB = 0.410 W/kg

#04_WCDMA Band II_RMC 12.2Kbps_Right Cheek_Ch9400_HUAWEI P9_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170524 Medium parameters used: f = 1880 MHz; σ = 1.439 S/m; $ε_r$ = 39.346; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃；Liquid Temperature：22.8 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.931 W/kg

0 dB = 0.931 W/kg

#05_WCDMA Band V_RMC 12.2Kbps_Right Cheek_Ch4182_OPPO R9S_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
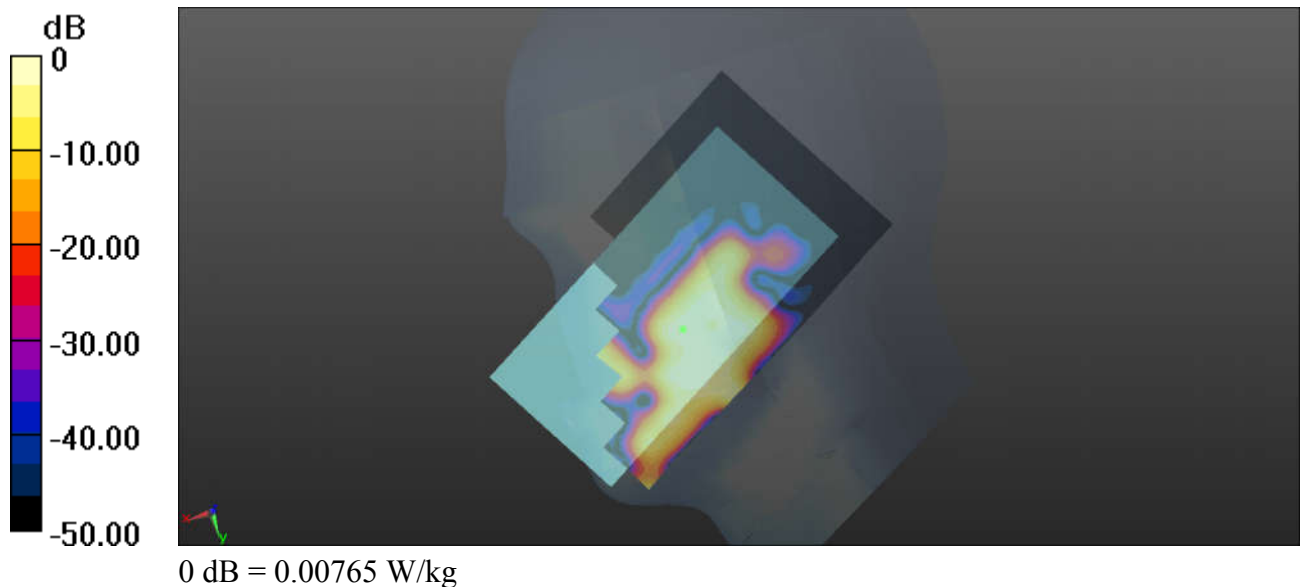Medium: HSL_835_170522 Medium parameters used: f = 836.4 MHz; σ = 0.92 S/m; ε_r = 41.511; ρ =

1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.00765 W/kg

0 dB = 0.00765 W/kg

#06_WCDMA Band II_RMC 12.2Kbps_Right Cheek_Ch9400_OPPO R9S_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170522 Medium parameters used: f = 1880 MHz; σ = 1.42 S/m; ε_r = 40.129; ρ
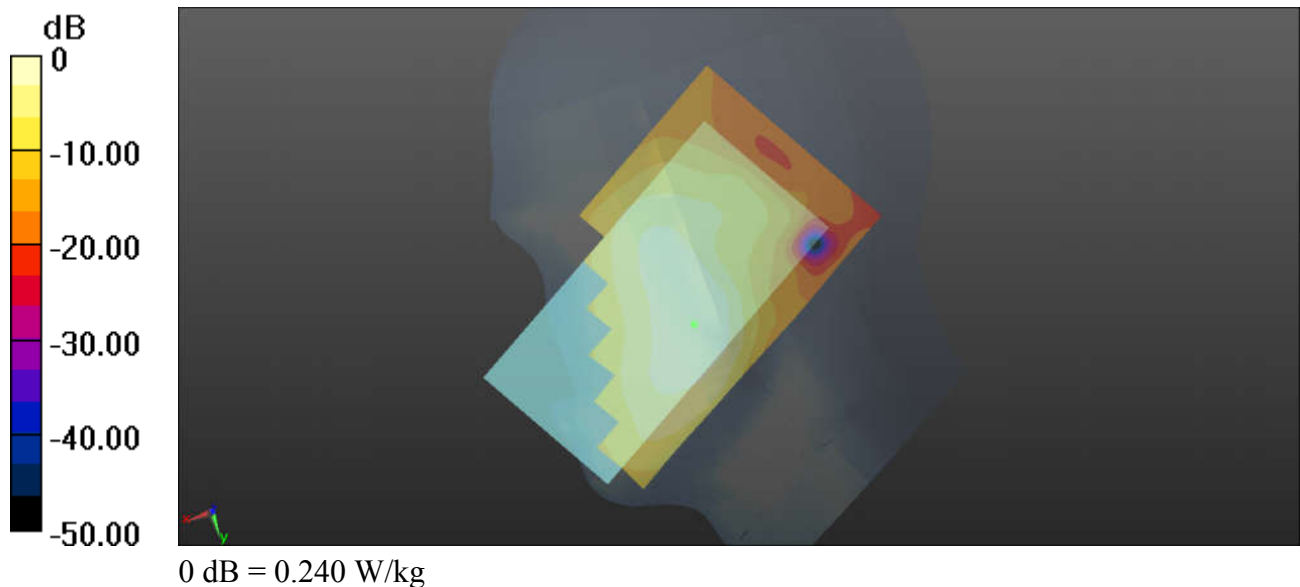
= 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.240 W/kg

0 dB = 0.240 W/kg

#07_WCDMA Band V_RMC 12.2Kbps_Right Cheek_Ch4182_OPPO R9S_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
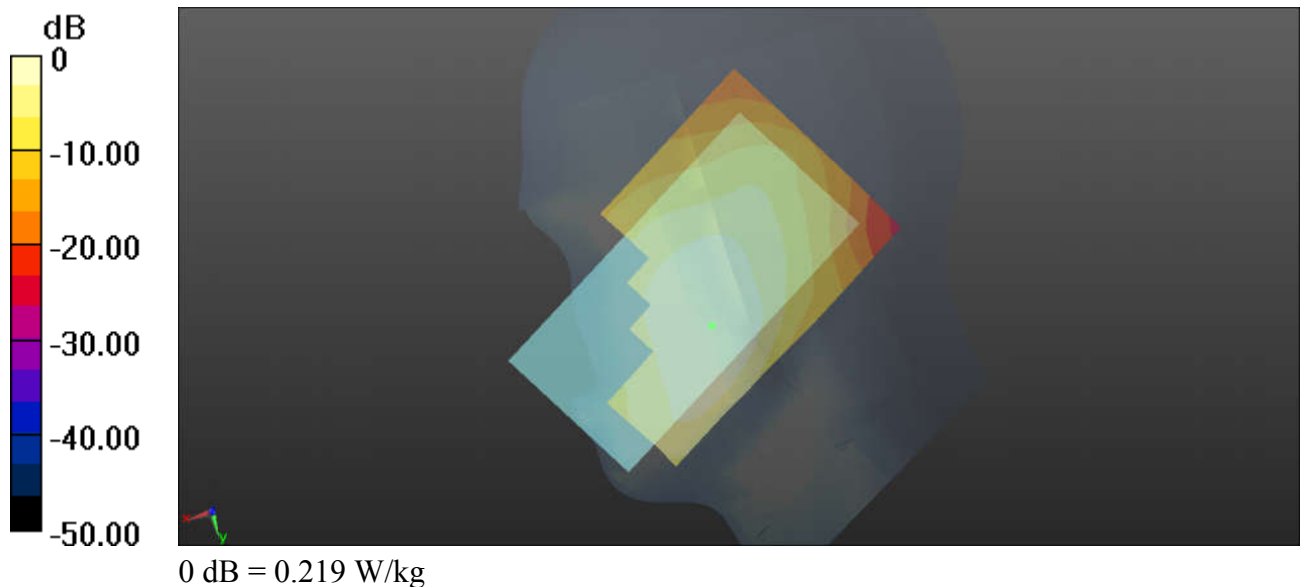Medium: HSL_835_170522 Medium parameters used: f = 836.4 MHz; σ = 0.92 S/m; ε_r = 41.511; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.219 W/kg

0 dB = 0.219 W/kg

#08_WCDMA Band II_RMC 12.2Kbps_Right Cheek_Ch9400_OPPO R9S_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170522 Medium parameters used: f = 1880 MHz; σ = 1.42 S/m; ε_r = 40.129; ρ
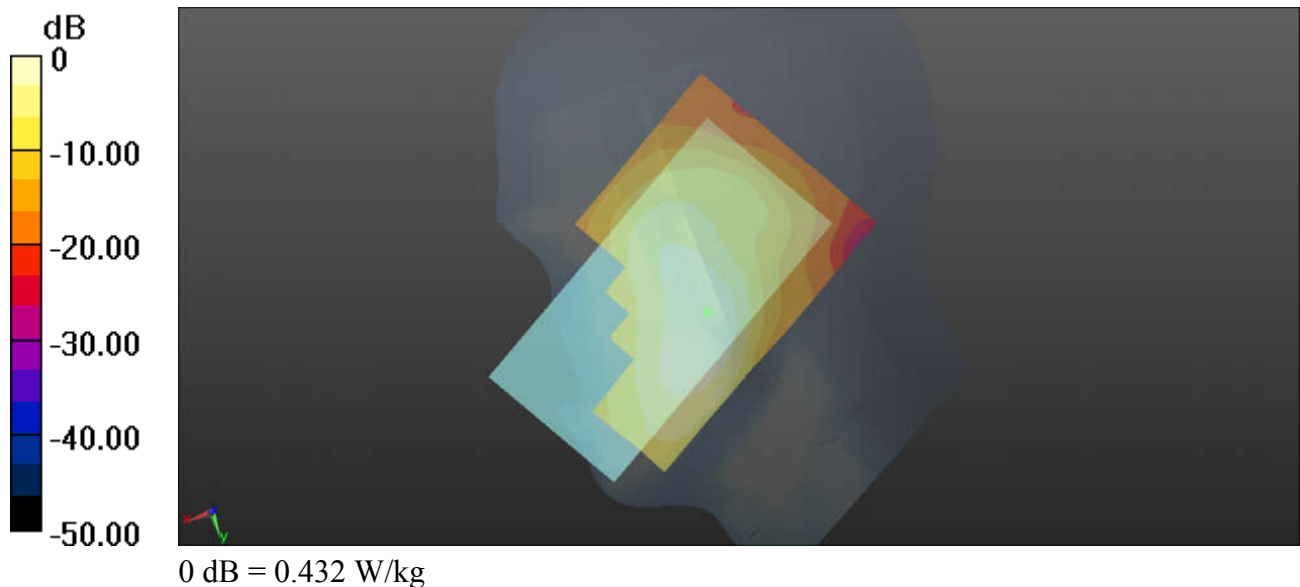
= 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.432 W/kg

0 dB = 0.432 W/kg

#09_WCDMA Band V_RMC 12.2Kbps_Right Cheek_Ch4182_S7_WithCellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_170526 Medium parameters used: f = 836.4 MHz; σ = 0.928 S/m; ε_r = 42.659; ρ
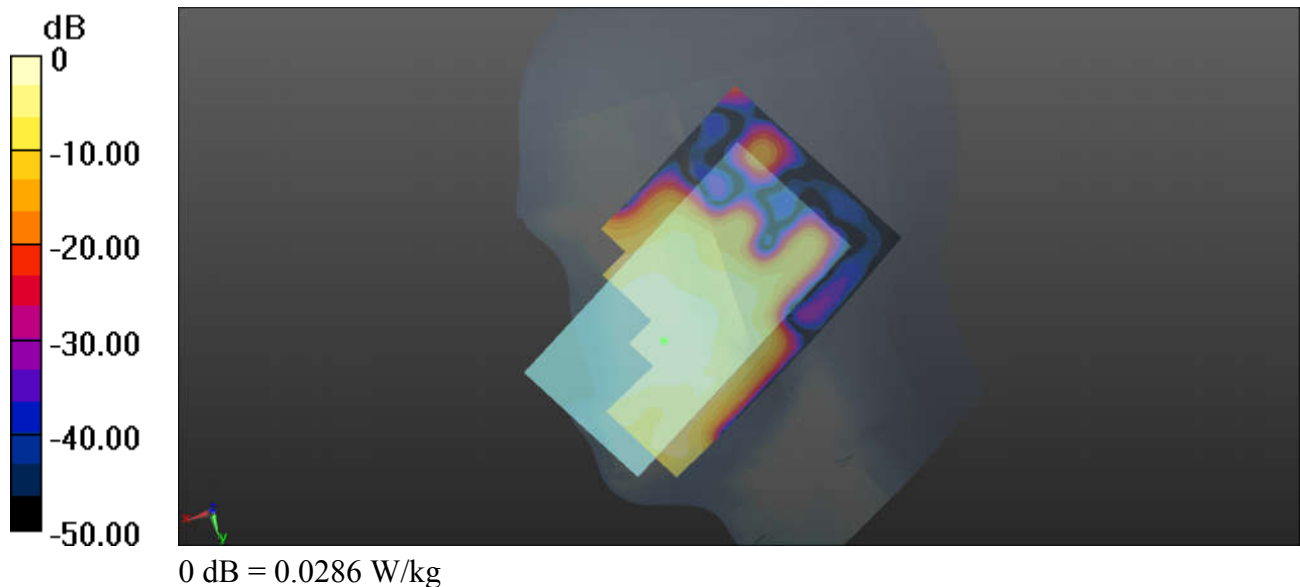
= 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.0286 W/kg

0 dB = 0.0286 W/kg

#10_WCDMA Band II_RMC 12.2Kbps_Right Cheek_Ch9400_S7_WithCellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
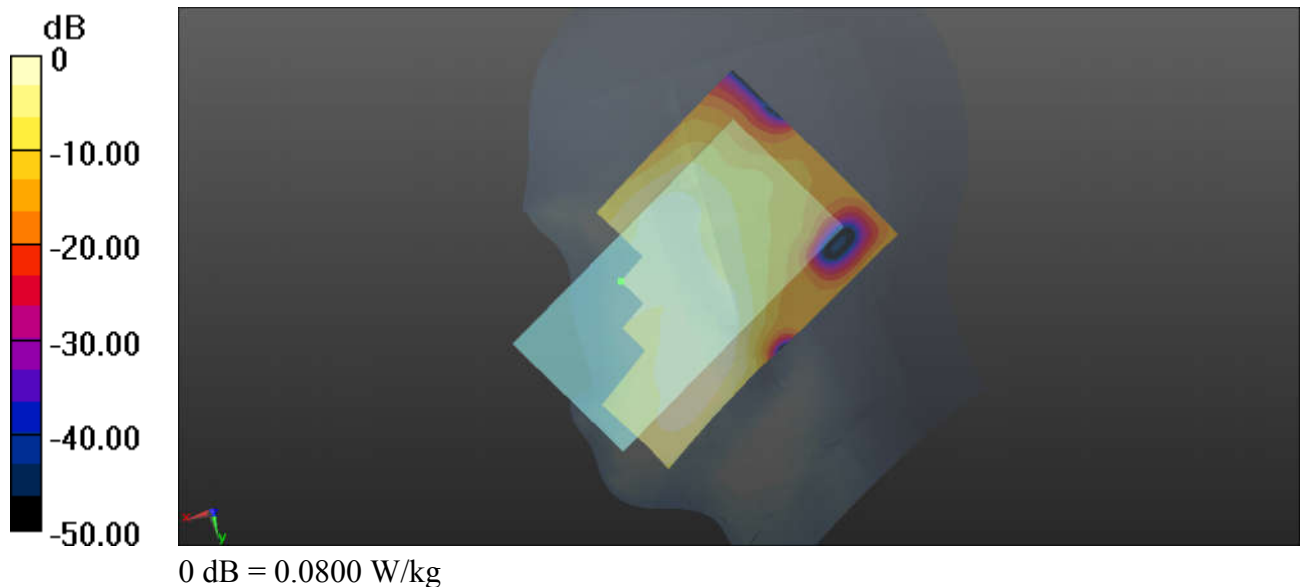Medium: HSL_1900_170526 Medium parameters used: f = 1880 MHz; σ = 1.402 S/m; ε_r = 41.184; ρ
= 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.0800 W/kg

0 dB = 0.0800 W/kg

#11_WCDMA Band V_RMC 12.2Kbps_Right Cheek_Ch4182_S7_WithoutCellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_170526 Medium parameters used: f = 836.4 MHz; σ = 0.928 S/m; ε_r = 42.659; ρ
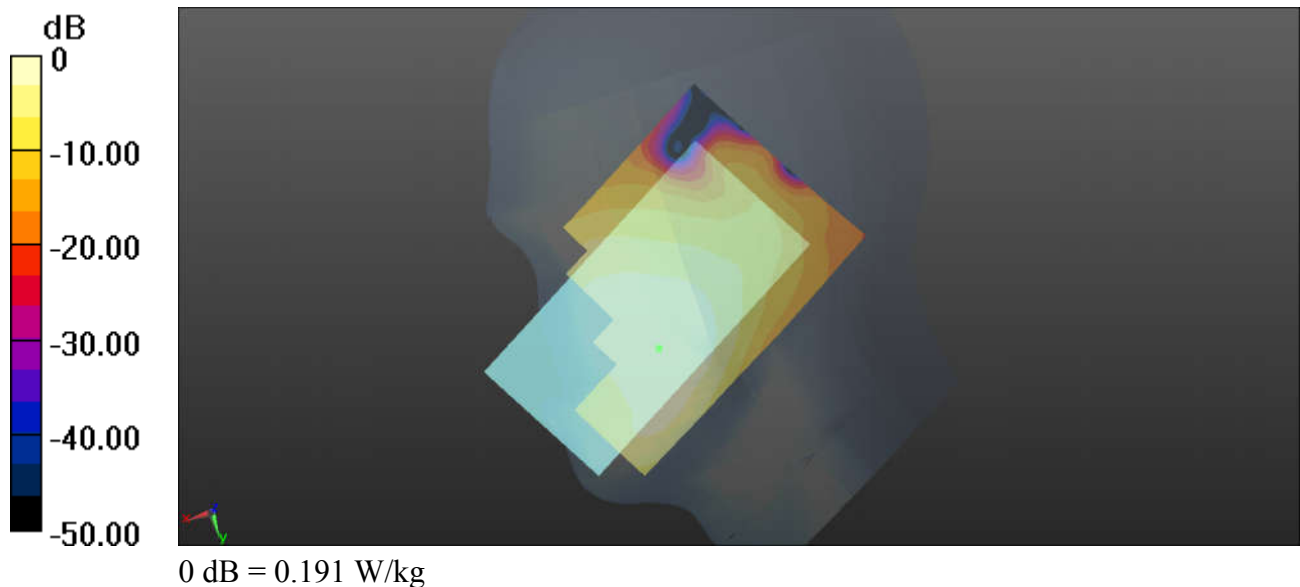
= 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.191 W/kg

0 dB = 0.191 W/kg

#12_WCDMA Band II_RMC 12.2Kbps_Right Cheek_Ch9400_S7_WithoutCellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170526 Medium parameters used: f = 1880 MHz; σ = 1.402 S/m; ε_r = 41.184; ρ
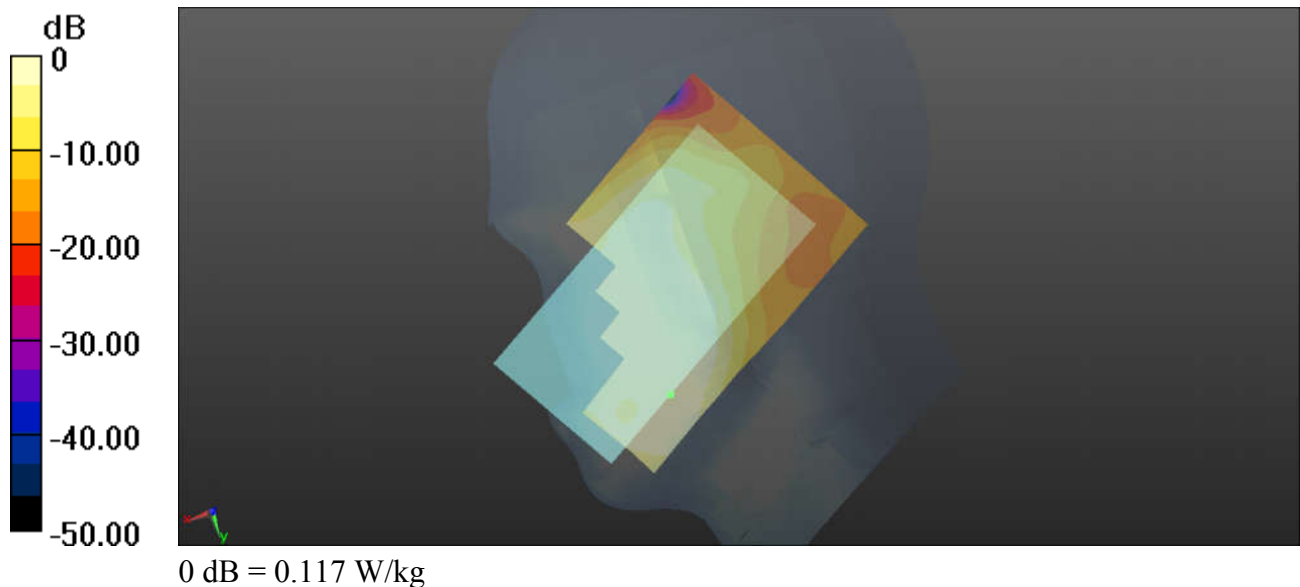
= 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.117 W/kg

0 dB = 0.117 W/kg

#13_WCDMA Band V_RMC 12.2Kbps_Right Cheek_Ch4182_S7 EDGE_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_170522 Medium parameters used: f = 836.4 MHz; σ = 0.92 S/m; ε_r = 41.511; ρ =

1000 kg/m^3
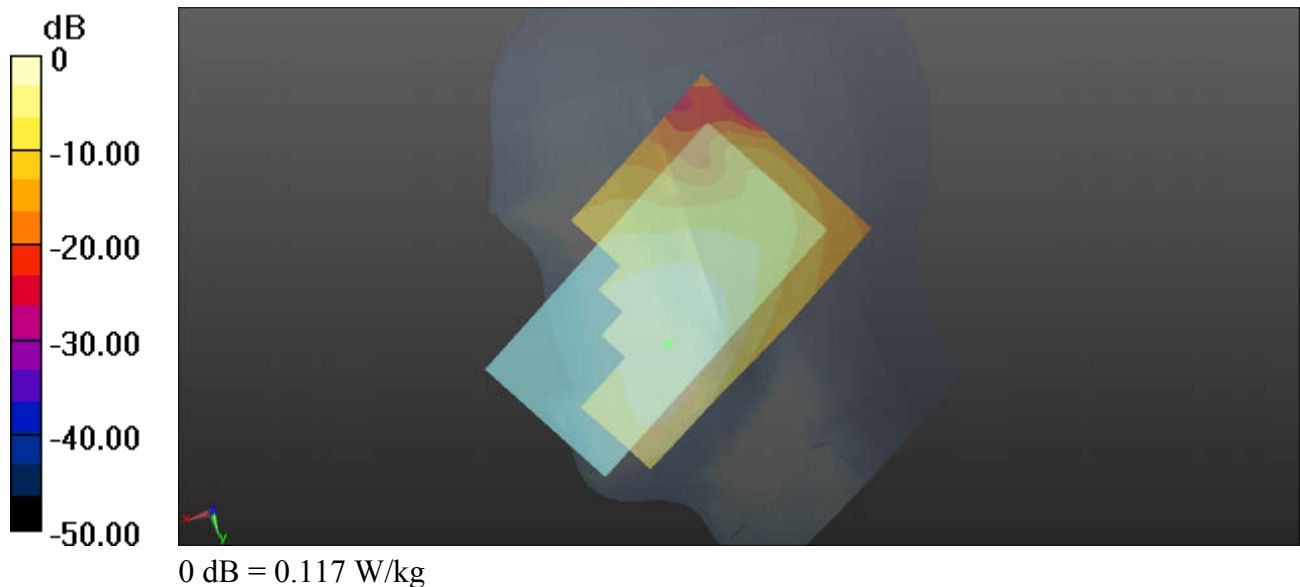Ambient Temperature：23.4 ℃；Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.117 W/kg

0 dB = 0.117 W/kg

#14_WCDMA Band II_RMC 12.2Kbps_Right Cheek_Ch9400_S7 EDGE_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170522 Medium parameters used: f = 1880 MHz; σ = 1.42 S/m; ε_r = 40.129; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.0222 W/kg

0 dB = 0.0222 W/kg

#15_WCDMA Band V_RMC 12.2Kbps_Right Cheek_Ch4182_S7 EDGE_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_170522 Medium parameters used: f = 836.4 MHz; σ = 0.92 S/m; ε_r = 41.511; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.226 W/kg

0 dB = 0.226 W/kg

#16_WCDMA Band II_RMC 12.2Kbps_Right Cheek_Ch9400_S7 EDGE_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170522 Medium parameters used: f = 1880 MHz; σ = 1.42 S/m; ε_r = 40.129; ρ
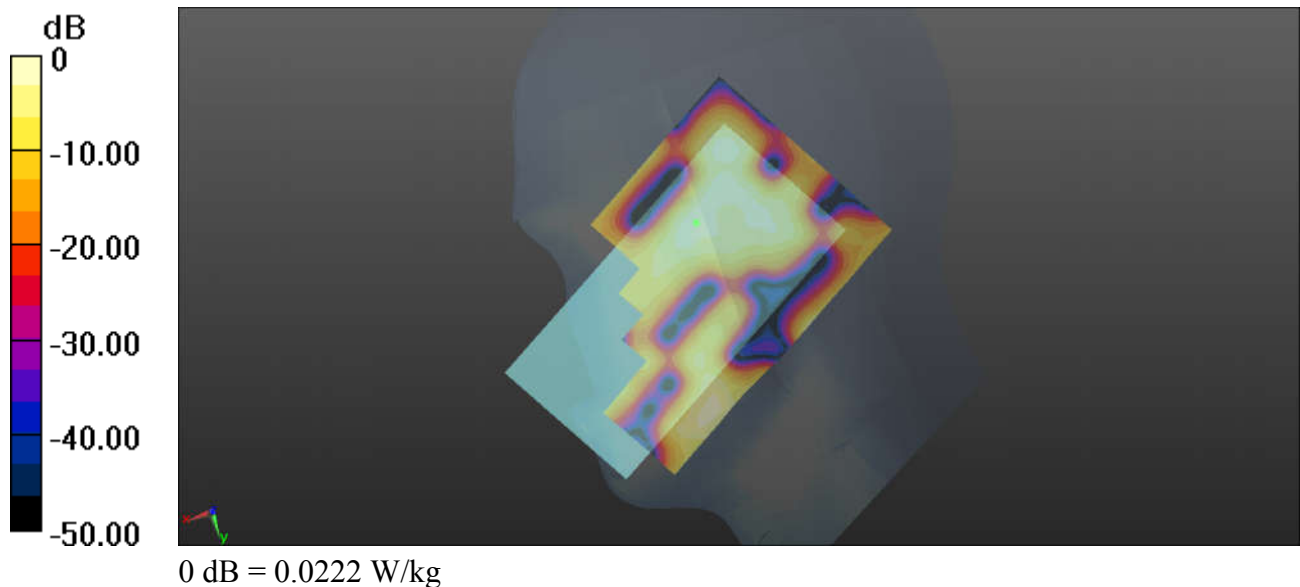
= 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.0959 W/kg

0 dB = 0.0959 W/kg

#17_WCDMA Band V_RMC 12.2Kbps_Right Cheek_Ch4182_S8_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
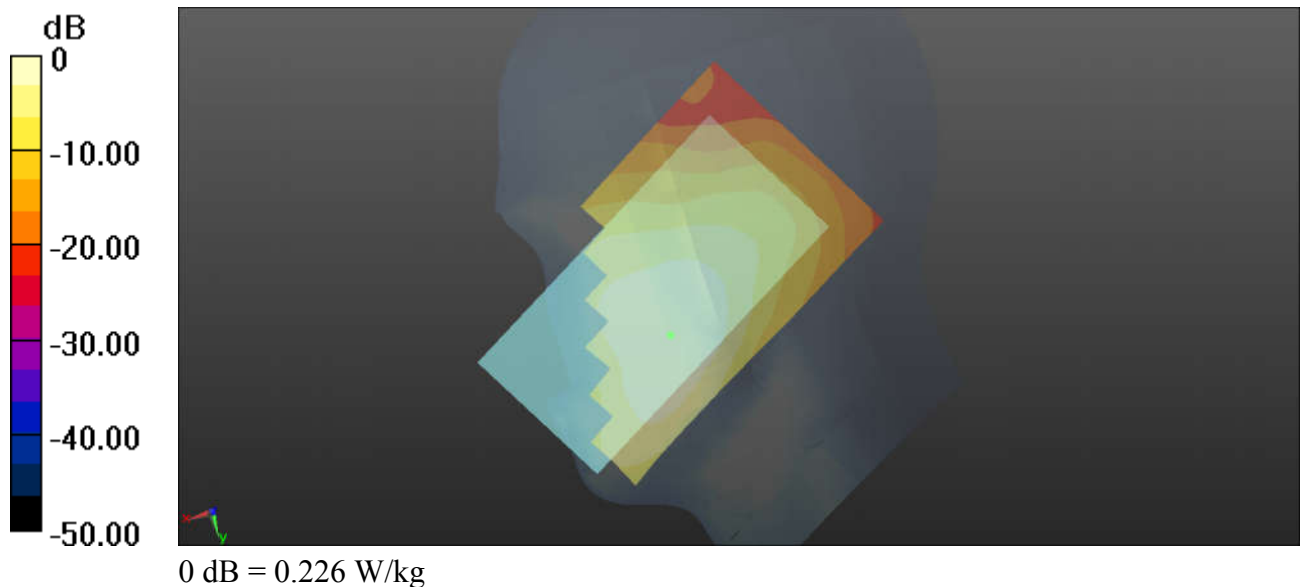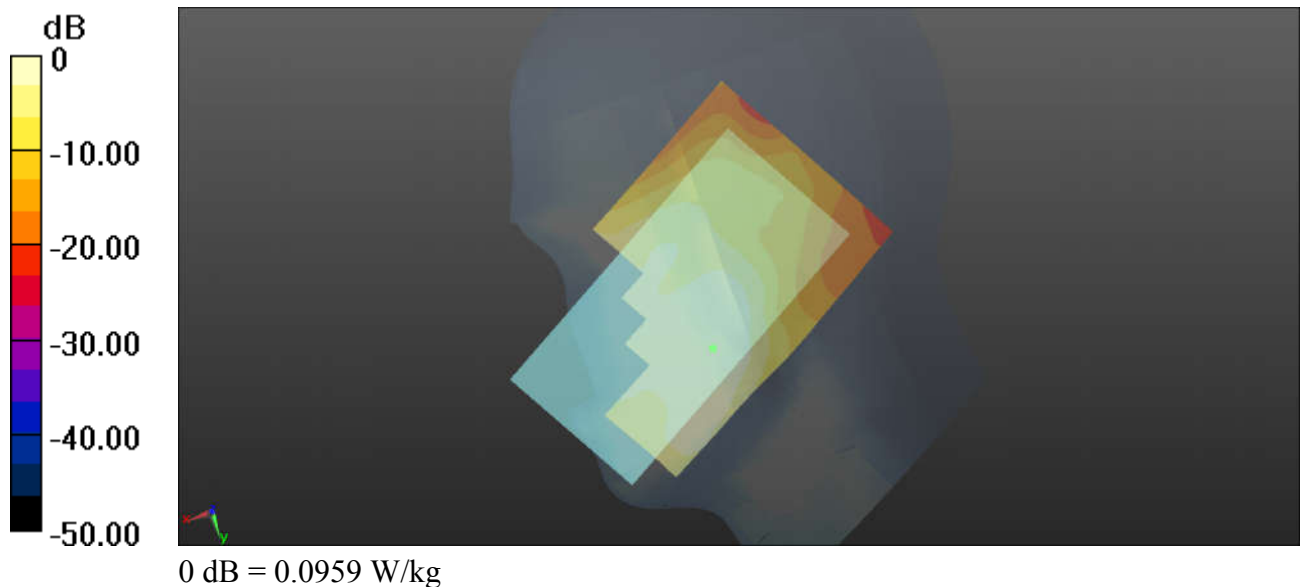Medium: HSL_835_170510 Medium parameters used: f = 836.4 MHz; σ = 0.912 S/m; ε_r = 42.893; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.0944 W/kg

0 dB = 0.0944 W/kg

#18_WCDMA Band V_RMC 12.2Kbps_Left Cheek_Ch4182_S8_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_170510 Medium parameters used: f = 836.4 MHz; σ = 0.912 S/m; ε_r = 42.893; ρ
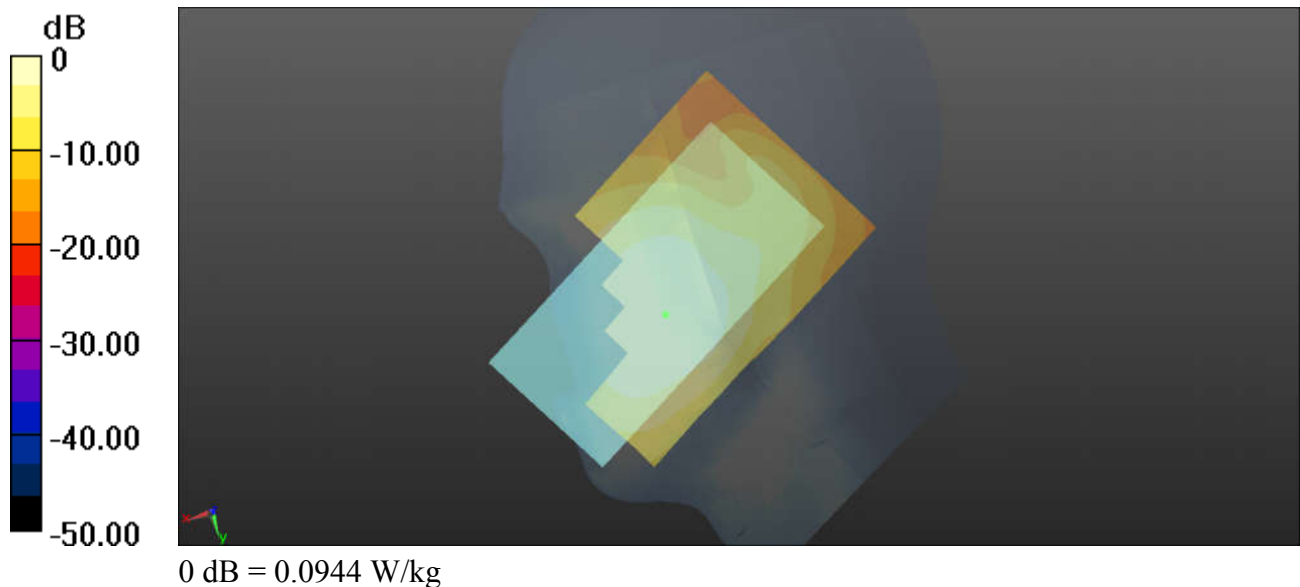
= 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.0855 W/kg

0 dB = 0.0855 W/kg

#19_WCDMA Band II_RMC 12.2Kbps_Right Cheek_Ch9400_S8_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170510 Medium parameters used: f = 1880 MHz; σ = 1.392 S/m; ε_r = 41.101; ρ
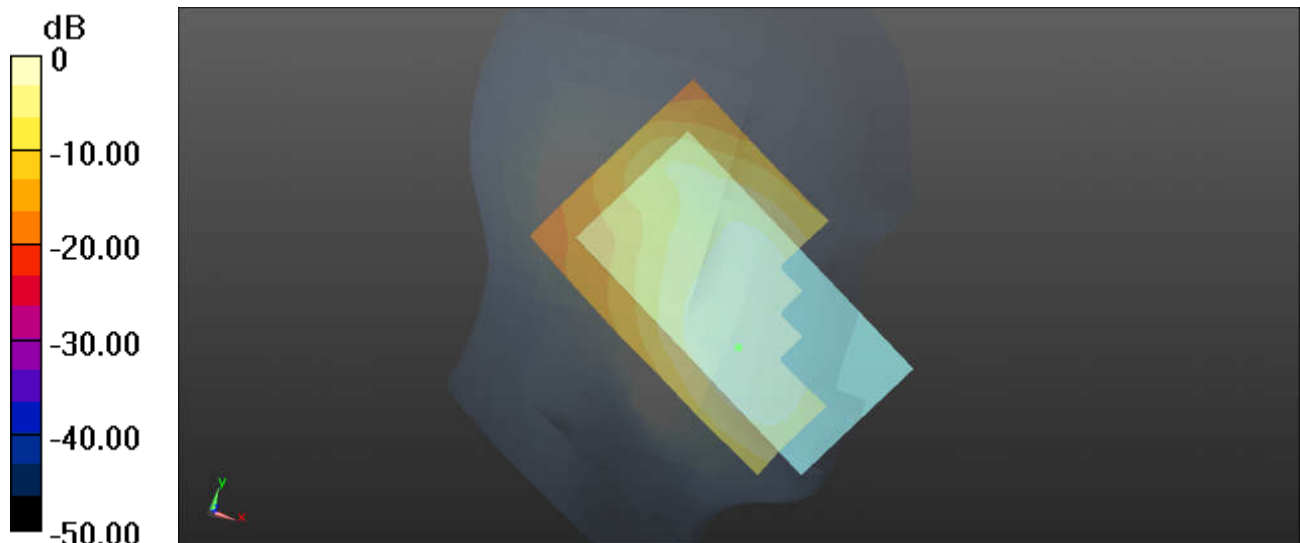
= 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.0985 W/kg

0 dB = 0.0985 W/kg

#20_WCDMA Band II_RMC 12.2Kbps_Left Cheek_Ch9400_S8_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170510 Medium parameters used: f = 1880 MHz; σ = 1.392 S/m; $ε_r$ = 41.101; ρ

= 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
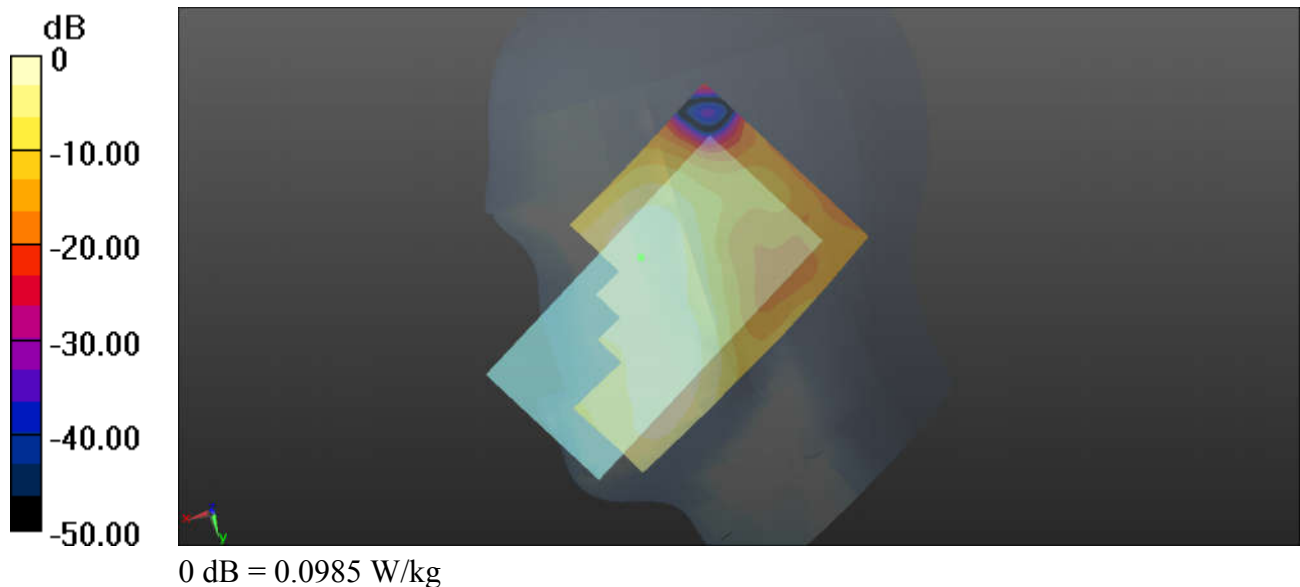Maximum value of SAR (interpolated) = 0.129 W/kg

0 dB = 0.129 W/kg

#21_WCDMA Band V_RMC 12.2Kbps_Right Cheek_Ch4182_S8_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_170510 Medium parameters used: f = 836.4 MHz; σ = 0.912 S/m; ε_r = 42.893; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.401 W/kg

0 dB = 0.401 W/kg

#22_WCDMA Band V_RMC 12.2Kbps_Left Cheek_Ch4182_S8_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_170510 Medium parameters used: f = 836.4 MHz; σ = 0.912 S/m; ε_r = 42.893; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.287 W/kg

0 dB = 0.287 W/kg

#23_WCDMA Band II_RMC 12.2Kbps_Right Cheek_Ch9400_S8_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170510 Medium parameters used: f = 1880 MHz; σ = 1.392 S/m; ε_r = 41.101; ρ
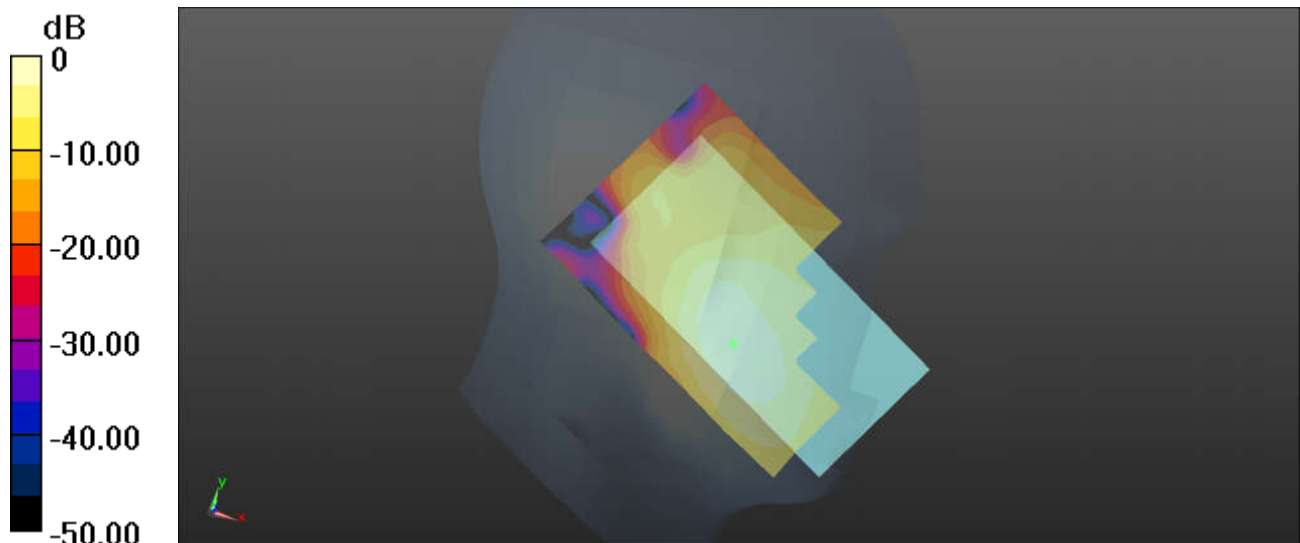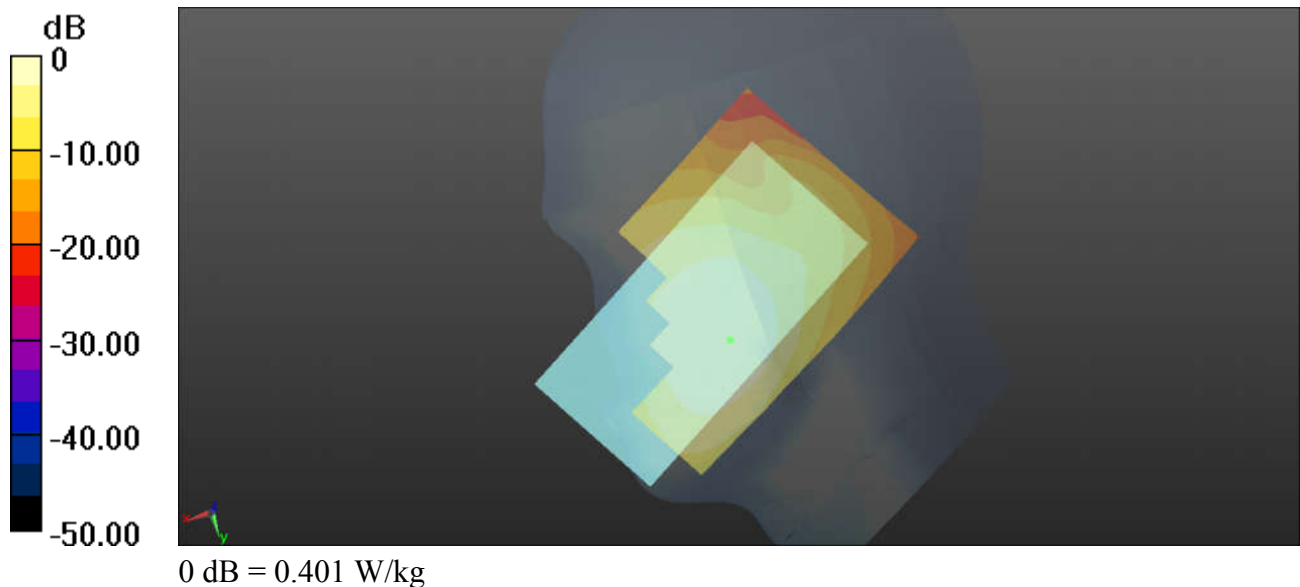
= 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.292 W/kg

0 dB = 0.292 W/kg

#24_WCDMA Band II_RMC 12.2Kbps_Left Cheek_Ch9400_S8_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
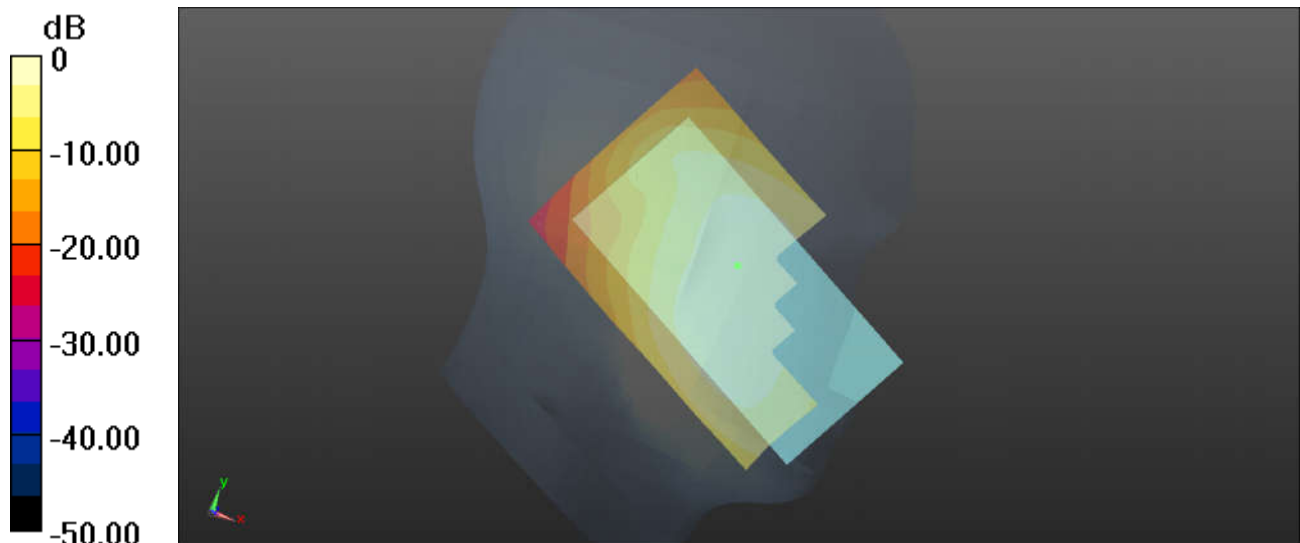Medium: HSL_1900_170510 Medium parameters used: f = 1880 MHz; σ = 1.392 S/m; ε_r = 41.101; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃；Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x121x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.392 W/kg

0 dB = 0.392 W/kg

#25_WCDMA Band V_RMC 12.2Kbps_Right Cheek_Ch4182_S8 Plus_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_170512 Medium parameters used: f = 836.4 MHz; σ = 0.914 S/m; ε_r = 40.842; ρ
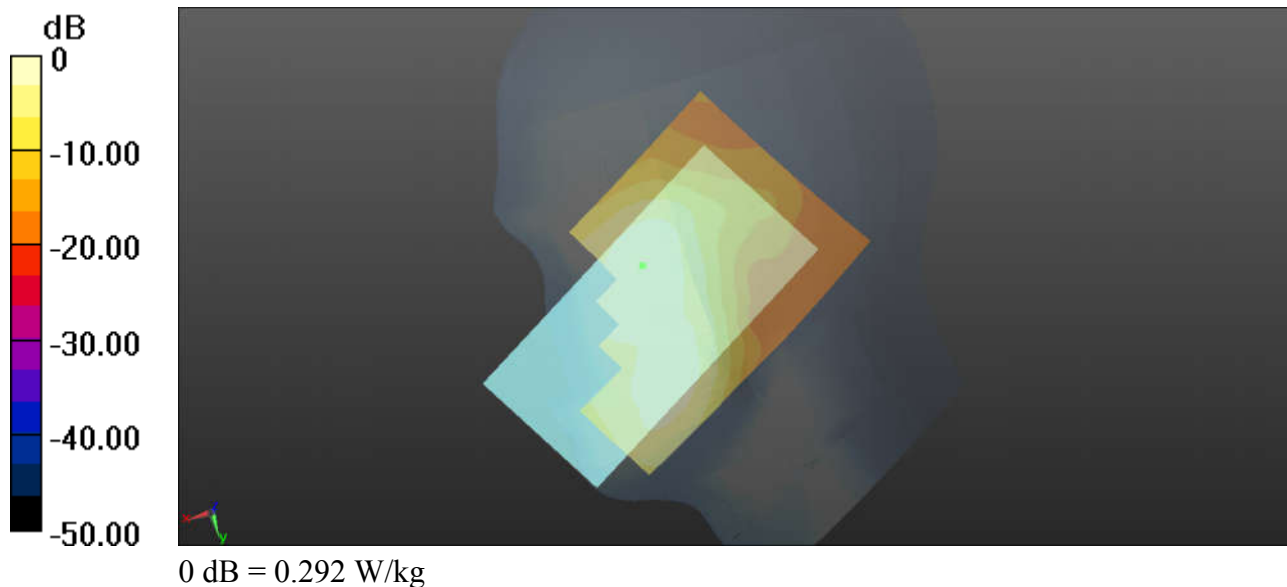
= 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.125 W/kg

0 dB = 0.125 W/kg

#26_WCDMA Band V_RMC 12.2Kbps_Left Cheek_Ch4182_S8 Plus_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_170512 Medium parameters used: f = 836.4 MHz; σ = 0.914 S/m; ε_r = 40.842; ρ

= 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.0873 W/kg

0 dB = 0.0873 W/kg

#27_WCDMA Band II_RMC 12.2Kbps_Right Cheek_Ch9400_S8 Plus_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
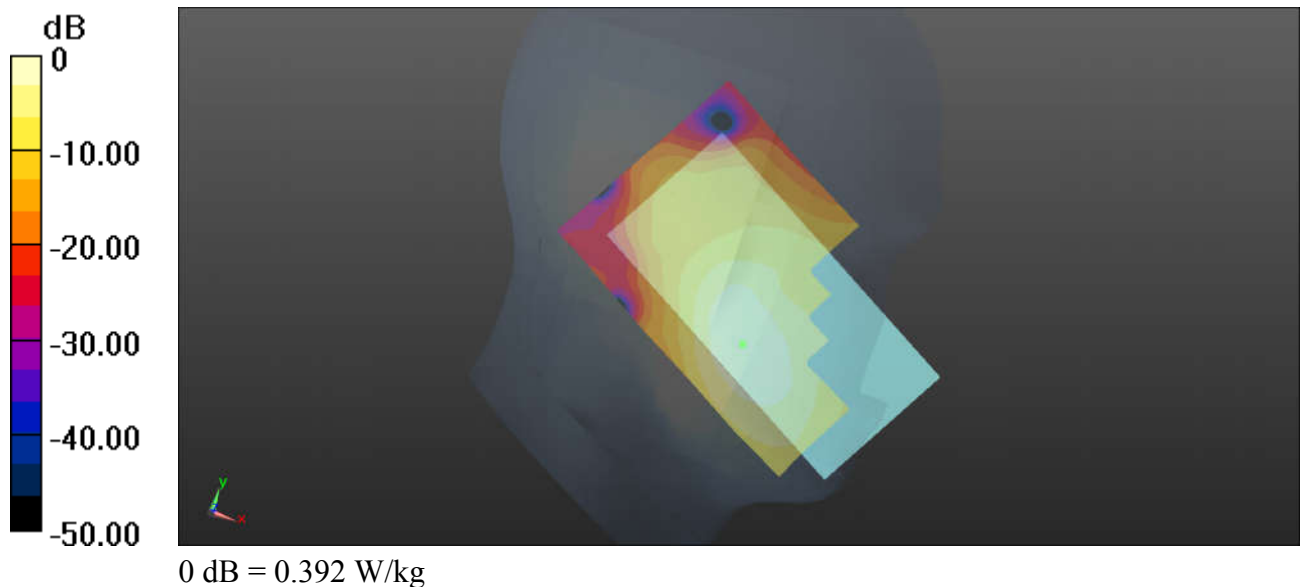Medium: HSL_1900_170512 Medium parameters used: f = 1880 MHz; σ = 1.435 S/m; $ε_r$ = 40.161; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.0387 W/kg

0 dB = 0.0387 W/kg

#28_WCDMA Band II_RMC 12.2Kbps_Left Cheek_Ch9400_S8 Plus_With Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
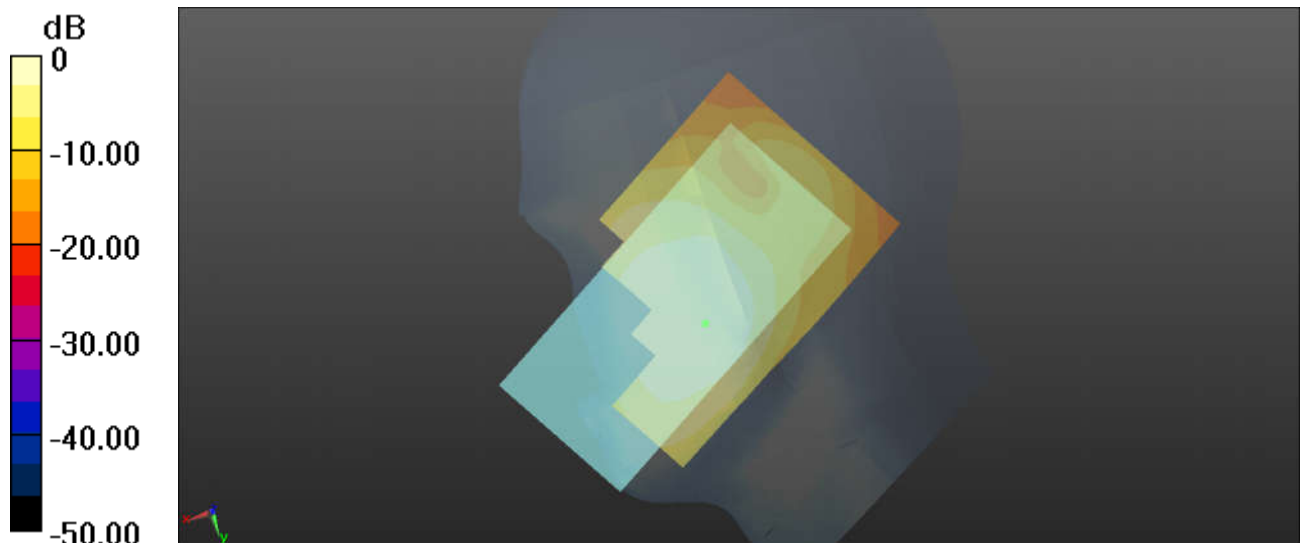Medium: HSL_1900_170512 Medium parameters used: f = 1880 MHz; σ = 1.435 S/m; $ε_r$ = 40.161; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.0574 W/kg

0 dB = 0.0574 W/kg

#29_WCDMA Band V_RMC 12.2Kbps_Right Cheek_Ch4182_S8 Plus_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_170512 Medium parameters used: f = 836.4 MHz; σ = 0.914 S/m; ε_r = 40.842; ρ
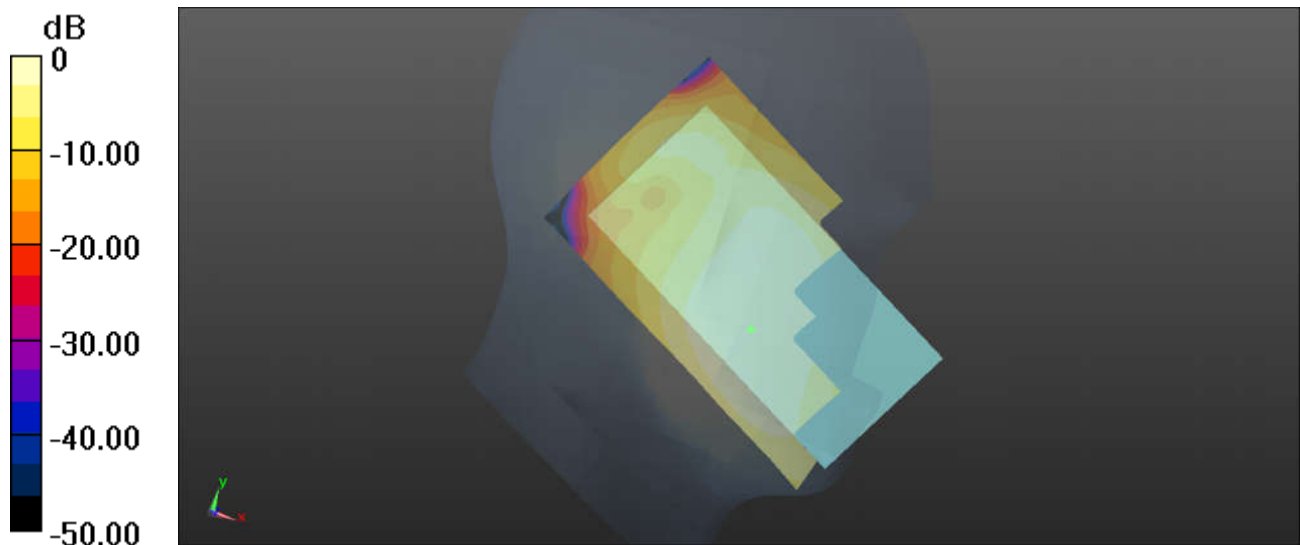
= 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.252 W/kg

0 dB = 0.252 W/kg

#30_WCDMA Band V_RMC 12.2Kbps_Left Cheek_Ch4182_S8 Plus_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: HSL_835_170512 Medium parameters used: f = 836.4 MHz; σ = 0.914 S/m; ε_r = 40.842; ρ
= 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(9.76, 9.76, 9.76); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch4182/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.173 W/kg

0 dB = 0.173 W/kg

#31_WCDMA Band II_RMC 12.2Kbps_Right Cheek_Ch9400_S8 Plus_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170512 Medium parameters used: f = 1880 MHz; σ = 1.435 S/m; ε_r = 40.161; ρ
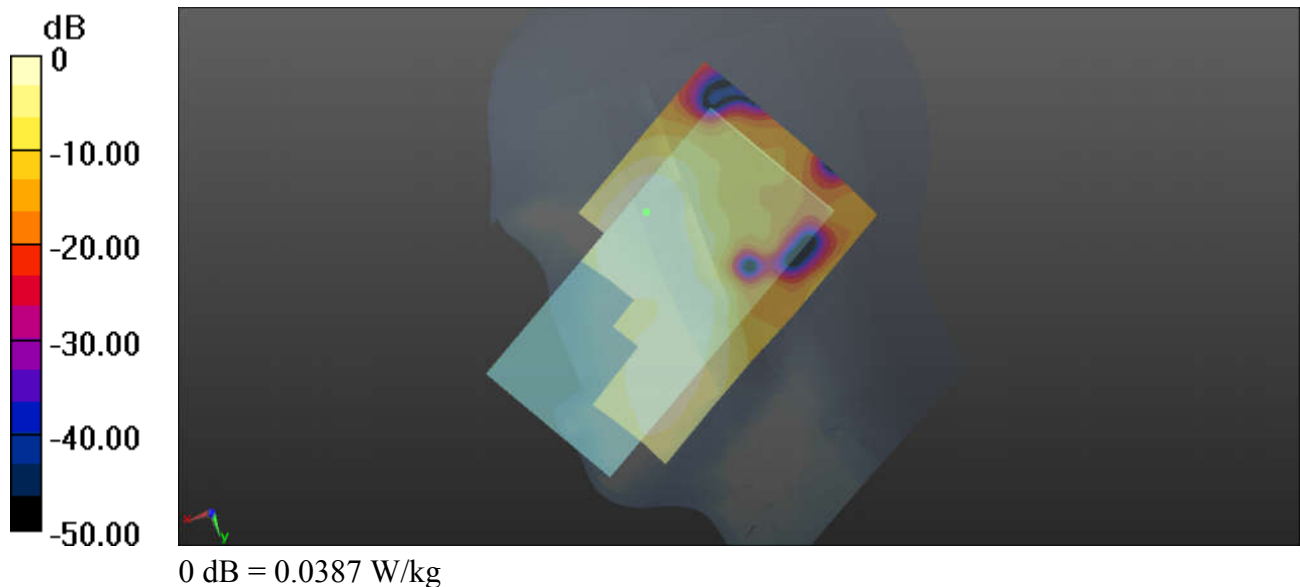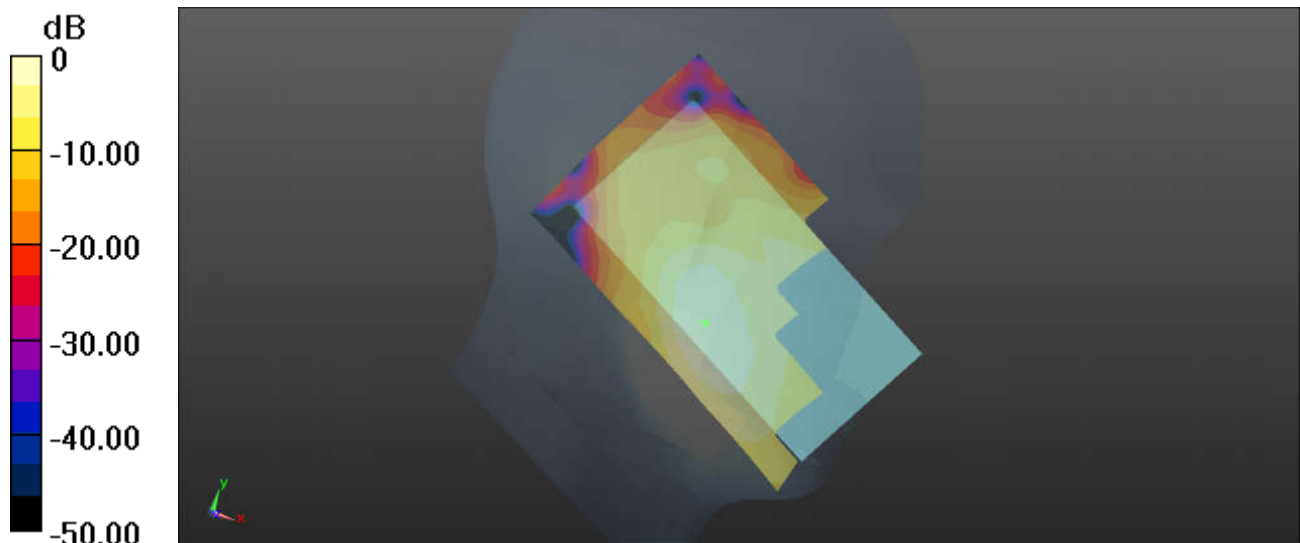
= 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.156 W/kg

0 dB = 0.156 W/kg

#32_WCDMA Band II_RMC 12.2Kbps_Left Cheek_Ch9400_S8 Plus_Without Cellsafe Chip

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: HSL_1900_170512 Medium parameters used: f = 1880 MHz; σ = 1.435 S/m; ε_r = 40.161; ρ
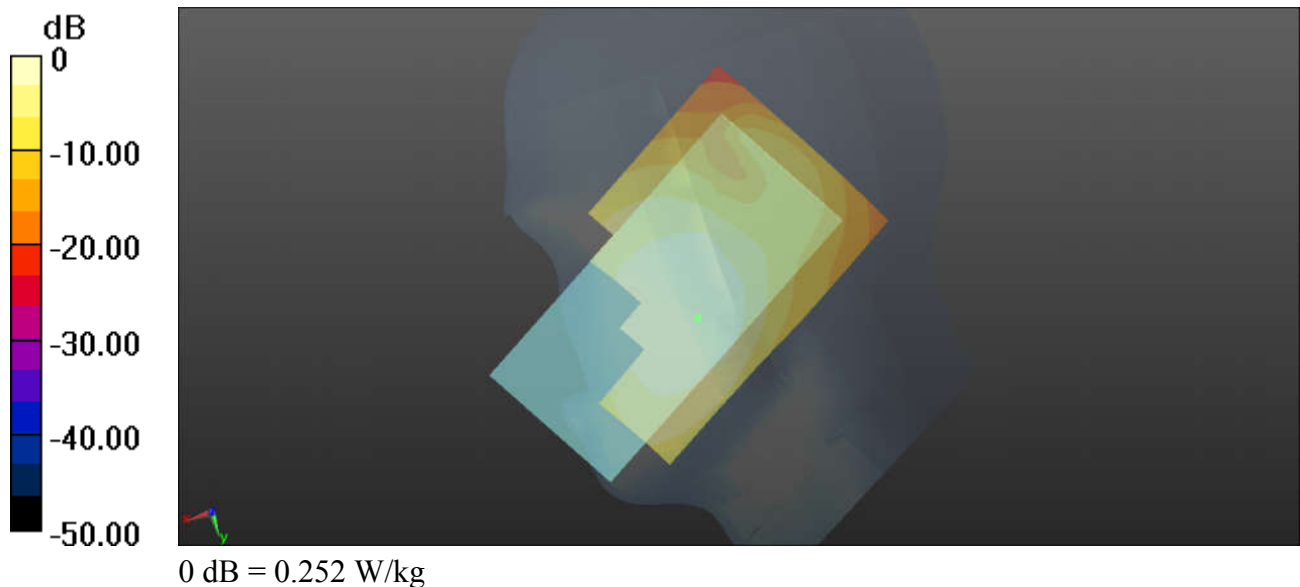
= 1000 kg/m^3
Ambient Temperature：23.3 ℃；Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3819; ConvF(8.17, 8.17, 8.17); Calibrated: 2016.11.28;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1303; Calibrated: 2016.11.22
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1671
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch9400/Area Scan (71x131x1): Interpolated grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.205 W/kg

0 dB = 0.205 W/kg

Appendix C.   DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

In Collaboration with
s p e a g
CALIBRATION LABORATORY

TTL

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079   Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com   Http://www.chinattl.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client	**Sporton-CN**	**Certificate No:**	**Z16-97224**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d162
Calibration Procedure(s)	FD-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	November 22, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Reference Probe EX3DV4	SN 7433	26-Sep-16(SPEAG,No.EX3-7433_Sep16)	Sep-17
DAE4	SN 771	02-Feb-16(CTTL-SPEAG,No.Z16-97011)	Feb-17

Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

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

Issued: November 26, 2016

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

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005

c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010

d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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CALIBRATION LABORATORY

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

Measurement Conditions

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

DASY Version	DASY52	52.8.8.1258
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.4 ± 6 %	0.92 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.36 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.31 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.55 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.13 mW /g ± 20.4 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.2 ± 6 %	0.95 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.39 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.64 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.59 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.41 mW /g ± 20.4 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.0Ω- 2.13jΩ
Return Loss	- 32.6dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.0Ω- 3.53jΩ
Return Loss	- 27.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.326 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

DASY5 Validation Report for Head TSL   Date: 11.22.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d162

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

Medium parameters used: f = 835 MHz; σ = 0.916 S/m; ε_r = 41.41; ρ = 1000 kg/m^3

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(9.82, 9.82, 9.82); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

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

Reference Value = 58.15V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 3.53 W/kg

SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.55 W/kg

Maximum value of SAR (measured) = 3.00 W/kg

0 dB = 3.00 W/kg = 4.77 dBW/kg

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Impedance Measurement Plot for Head TSL

Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB [F1]

>1 835.00000 MHz -32.626 dB

S11 Smith (R+jX) Scale 1.000U [F1 Del]

>1 835.00000 MHz 51.030 Ω -2.1257 Ω 89.669 pF

1 Start 635 MHz   IFBW 100 Hz   Stop 1.035 GHz

DASY5 Validation Report for Body TSL   Date: 11.22.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d162

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

Medium parameters used: f = 835 MHz; σ = 0.954 S/m; ε_r = 54.22; ρ = 1000 kg/m^3

Phantom section: Left Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(9.5,9.5, 9.5); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)
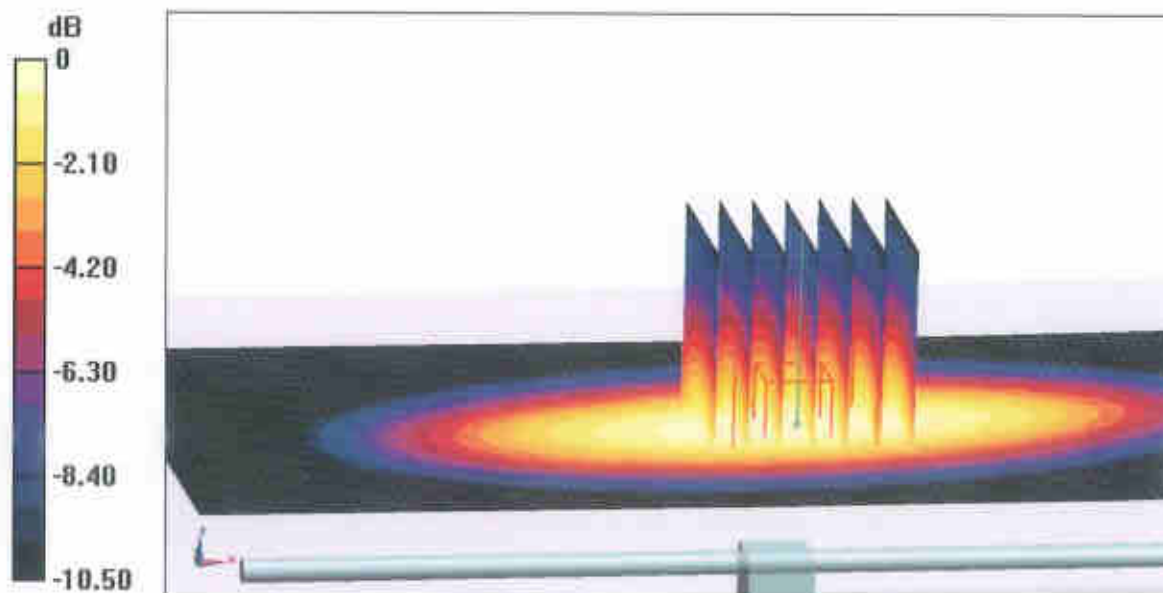
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.01 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 3.48 W/kg

SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.59 W/kg

Maximum value of SAR (measured) = 2.99 W/kg
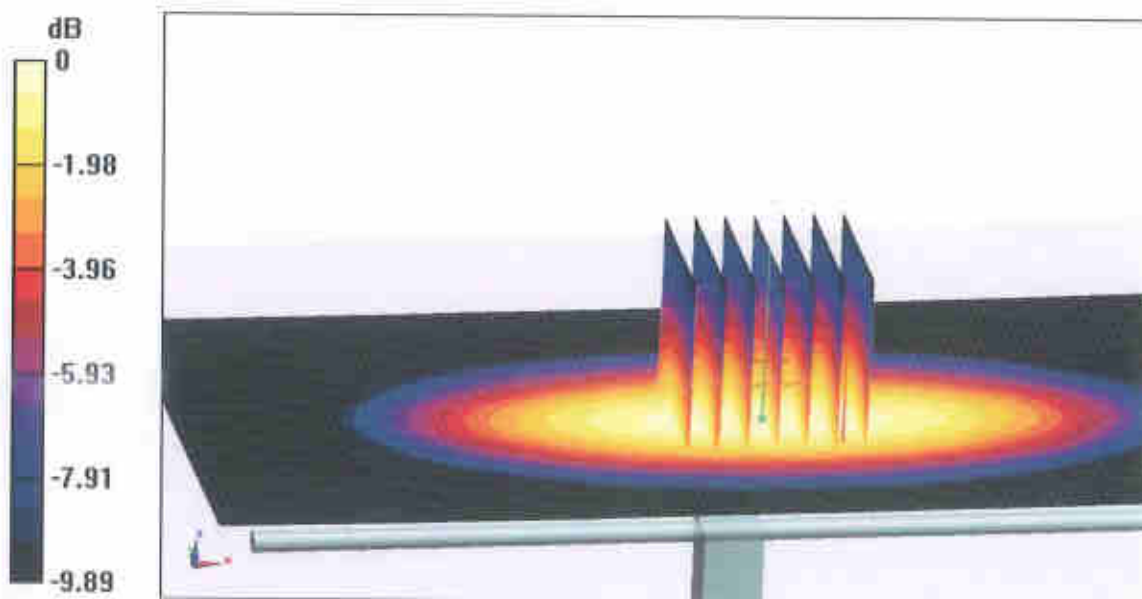
0 dB = 2.99 W/kg = 4.76 dBW/kg

Impedance Measurement Plot for Body TSL
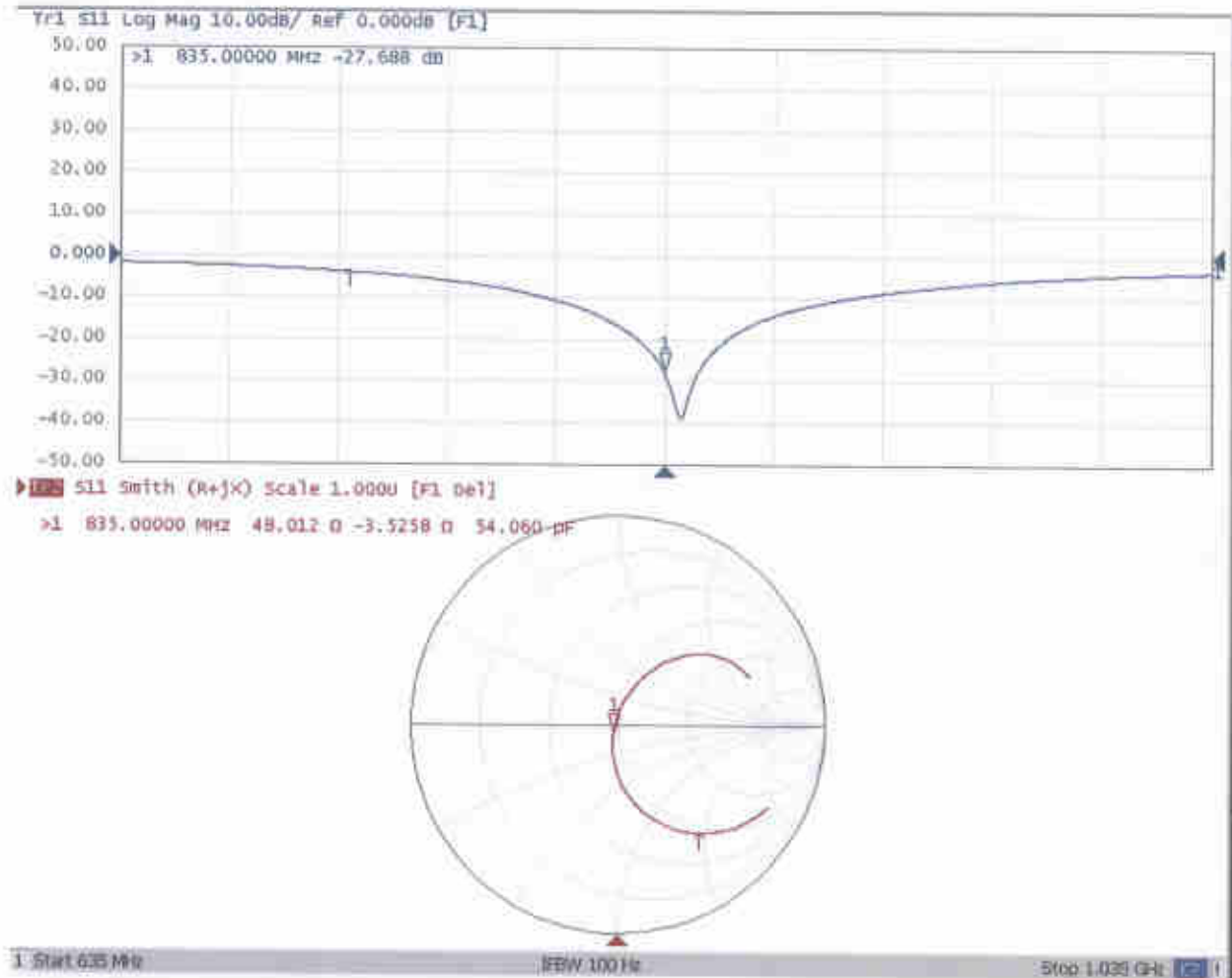
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Client	**Sporton-CN**	**Certificate No:**	**Z16-97230**

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d182
Calibration Procedure(s)	FD-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	November 24, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Power sensor NRP-Z91	101547	27-Jun-16 (CTTL, No.J16X04777)	Jun-17
Reference Probe EX3DV4	SN 7433	26-Sep-16(SPEAG,No.EX3-7433_Sep16)	Sep-17
DAE4	SN 771	02-Feb-16(CTTL-SPEAG,No.Z16-97011)	Feb-17

Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-16 (CTTL, No.J16X00893)	Jan-17
Network Analyzer E5071C	MY46110673	26-Jan-16 (CTTL, No.J16X00894)	Jan-17

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

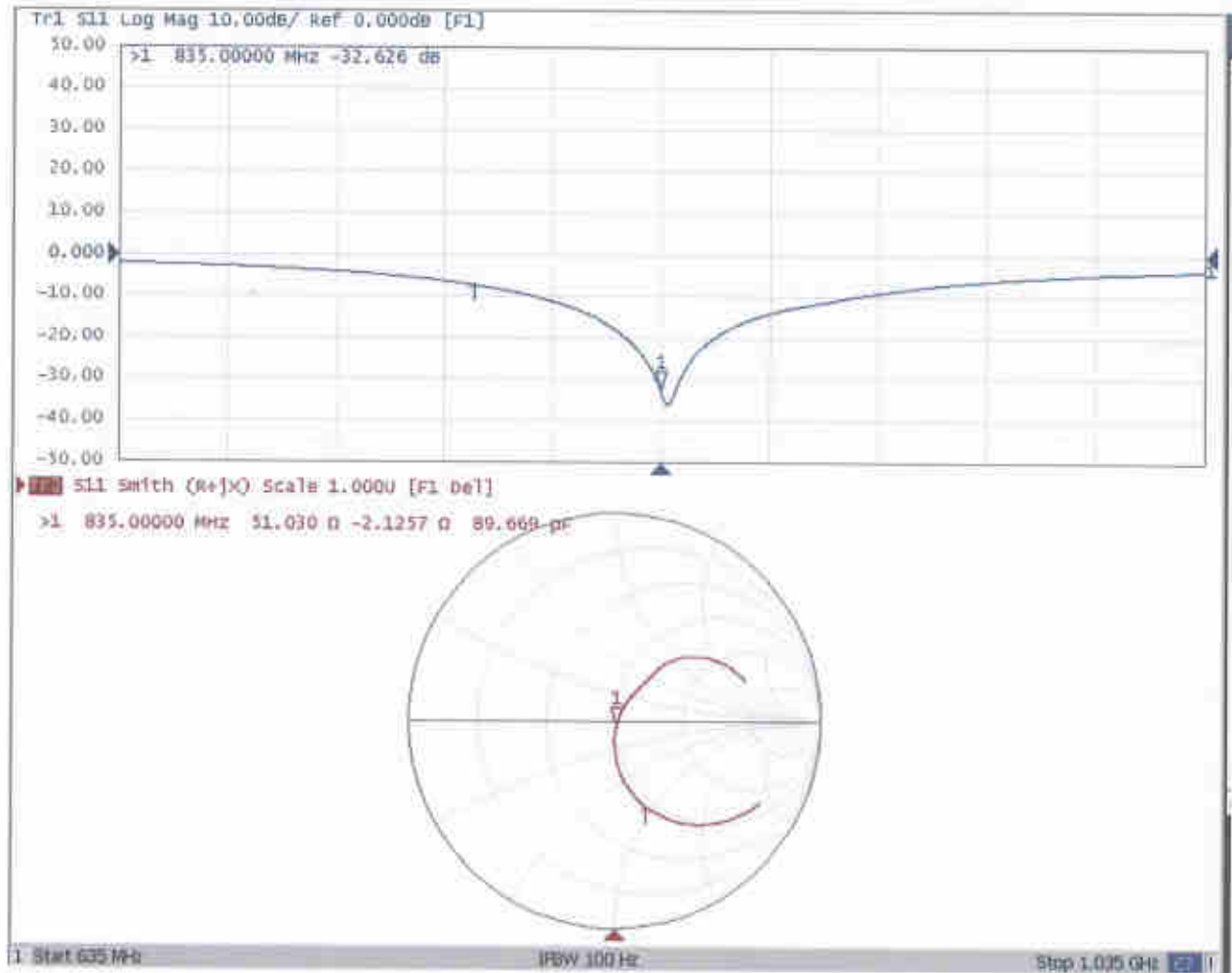Issued: November 27, 2016

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## Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005

c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010

d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY52	52.8.8.1258
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.4 ± 6 %	1.43 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	40.0 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.23 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.8 mW /g ± 20.4 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.6 ± 6 %	1.53 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	---	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	40.8 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.32 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.3 mW /g ± 20.4 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$52.6\Omega + 5.15j\Omega$
Return Loss	- 25.0dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.2\Omega + 6.18j\Omega$
Return Loss	- 23.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.086 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

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DASY5 Validation Report for Head TSL   Date: 11.24.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d182

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

Medium parameters used: f = 1900 MHz; σ = 1.426 S/m; εr = 40.35; ρ = 1000 kg/m3

Phantom section: Center Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.98, 7.98, 7.98); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.8 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 18.7 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.23 W/kg

Maximum value of SAR (measured) = 14.5 W/kg
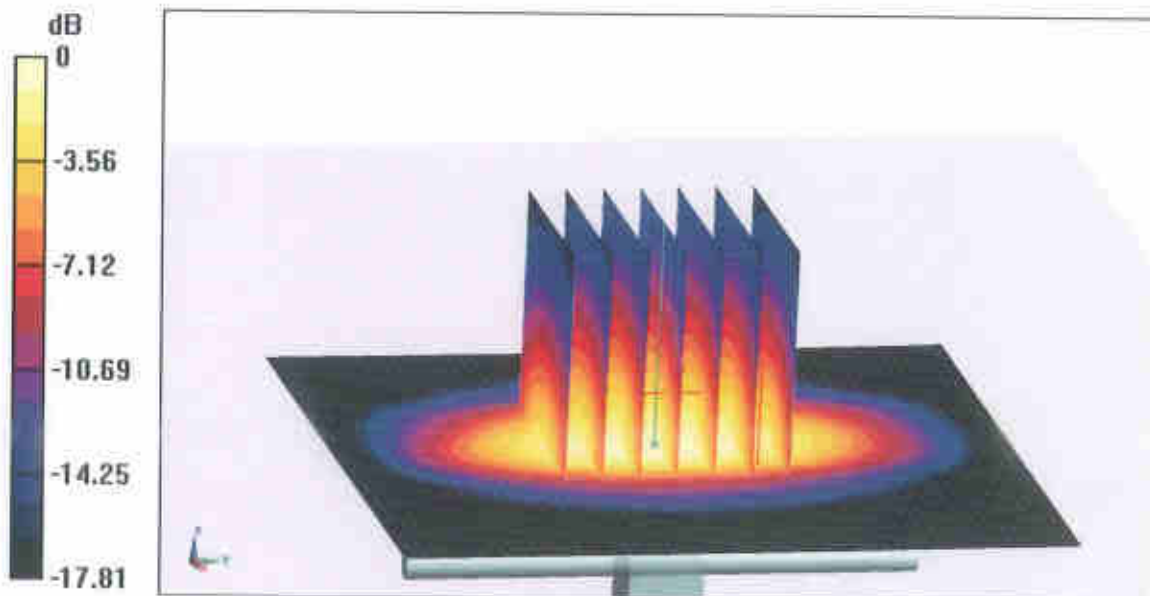
0 dB = 14.5 W/kg = 11.61 dBW/kg

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Impedance Measurement Plot for Head TSL

Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB [F1]

>1 1.9000000 GHz -25.016 dB

50.00	
40.00	
30.00	
20.00	
10.00	
0.000	
-10.00	
-20.00	
-30.00	
-40.00	
-50.00	

S11 Smith (R+jX) Scale 1.000U [F1 Del]

>1 1.9000000 GHz 52.583 Ω 5.1547 Ω 431.78 pH

1 Start 1.7 GHz   IFBW 100 Hz   Stop 2.1 GHz

DASY5 Validation Report for Body TSL   Date: 11.23.2016

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d182

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

Medium parameters used: f = 1900 MHz; σ = 1.531 S/m; ε_r = 54.57; ρ = 1000 kg/m^3

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7433; ConvF(7.7, 7.7, 7.7); Calibrated: 9/26/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2/2/2016
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.33 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 18.6 W/kg

SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.32 W/kg

Maximum value of SAR (measured) = 14.6 W/kg
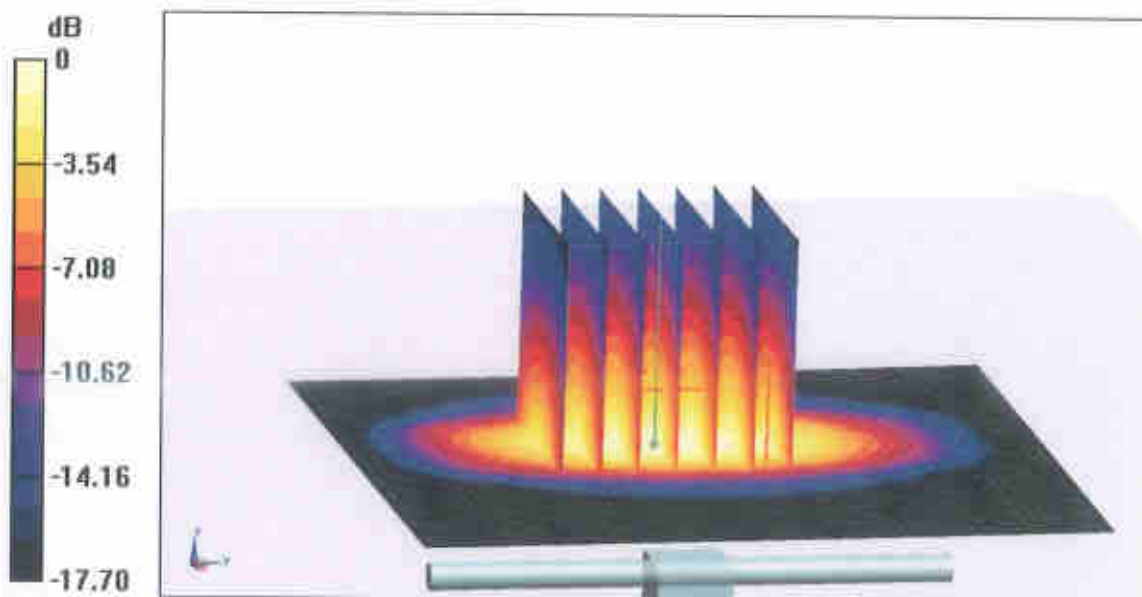
0 dB = 14.6 W/kg = 11.64 dBW/kg

Impedance Measurement Plot for Body TSL

Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB [F1]
>1 1.9000000 GHz -23.711 dB

S11 Smith (R+jX) Scale 1.000U [F1 Del]
>1 1.9000000 GHz 48.248 Ω 6.1777 Ω 517.48 pH

1 Start 1.7 GHz   IFBW 100 Hz   Stop 2.1 GHz
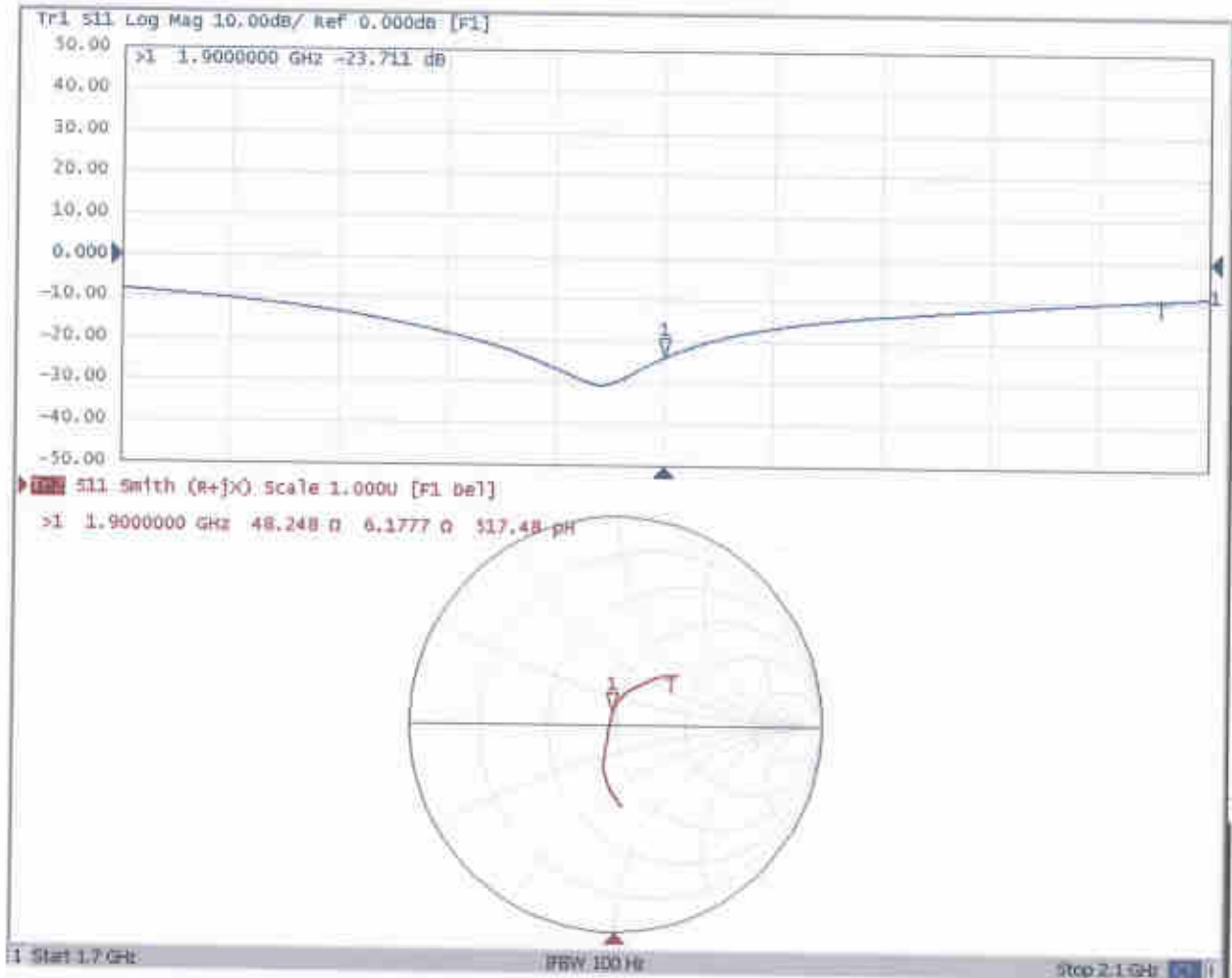
IMPORTANT NOTICE

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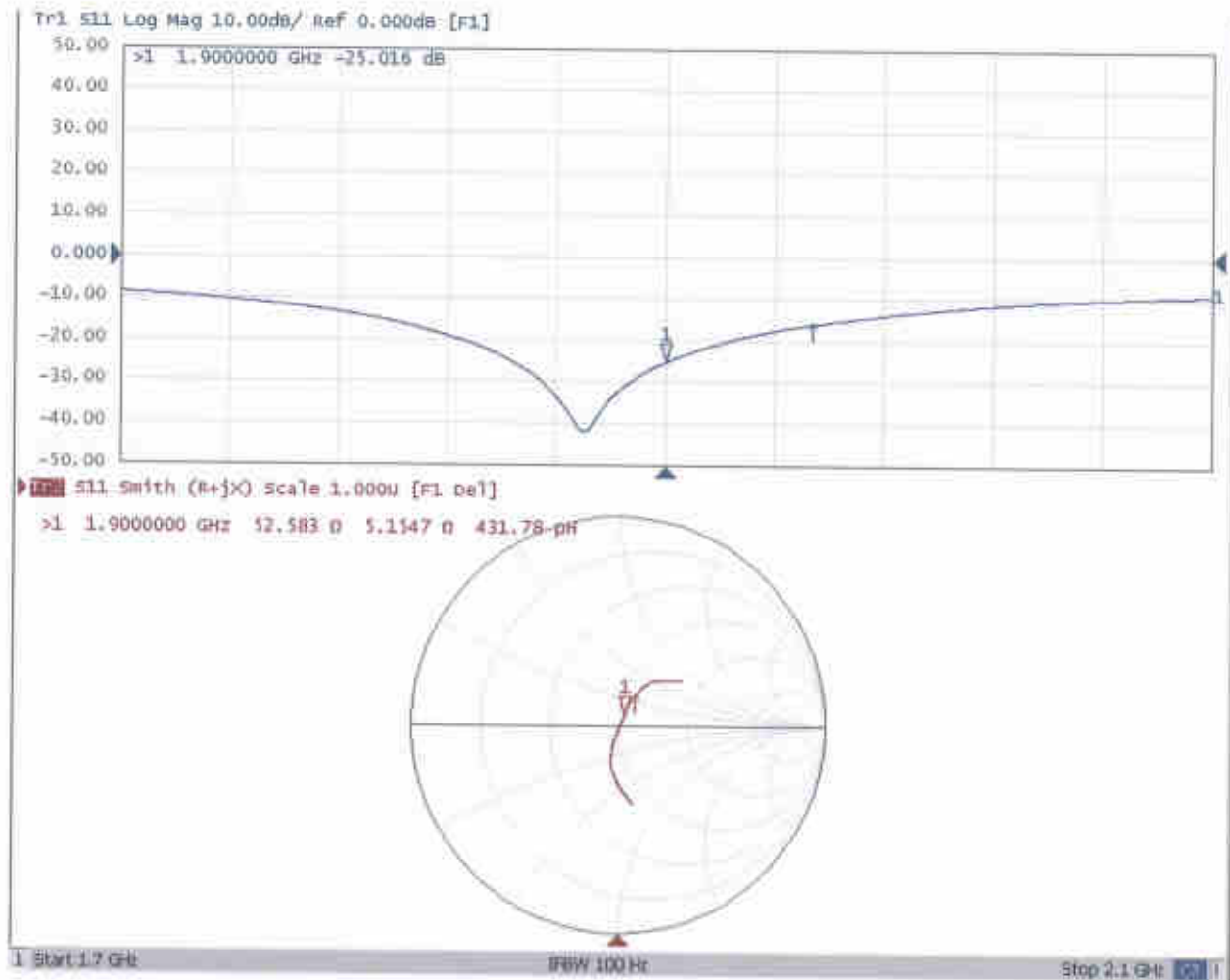
Battery Exchange: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

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.**

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

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

Accreditation No.: **SCS 0108**

Client	**Sporton - SZ (Auden)**	Certificate No:	**DAE4-1303_Nov16**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 1303
Calibration procedure(s)	QA CAL-06.v29 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	November 22, 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
Keithley Multimeter Type 2001	SN: 0810278	09-Sep-16 (No:19065)	Sep-17

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	05-Jan-16 (in house check)	In house check: Jan-17
Calibrator Box V2.1	SE UMS 006 AA 1002	05-Jan-16 (in house check)	In house check: Jan-17

	Name	Function	Signature
Calibrated by:	Adrian Gehring	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: November 22, 2016

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

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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	405.606 ± 0.02% (k=2)	403.476 ± 0.02% (k=2)	404.919 ± 0.02% (k=2)
Low Range	3.96607 ± 1.50% (k=2)	3.99309 ± 1.50% (k=2)	4.01584 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	35.5 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	200033.27	-3.37	-0.00
Channel X	+ Input	20005.30	-0.07	-0.00
Channel X	- Input	-20004.41	0.82	-0.00
Channel Y	+ Input	200032.45	-3.99	-0.00
Channel Y	+ Input	20004.24	-0.94	-0.00
Channel Y	- Input	-20006.06	-0.71	0.00
Channel Z	+ Input	200036.33	-0.22	-0.00
Channel Z	+ Input	20003.18	-2.03	-0.01
Channel Z	- Input	-20006.39	-1.04	0.01

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2001.51	-0.05	-0.00
Channel X	+ Input	201.95	0.53	0.26
Channel X	- Input	-197.81	0.55	-0.28
Channel Y	+ Input	2000.90	-0.50	-0.03
Channel Y	+ Input	200.67	-0.72	-0.36
Channel Y	- Input	-199.08	-0.50	0.25
Channel Z	+ Input	2002.13	0.75	0.04
Channel Z	+ Input	201.06	-0.23	-0.11
Channel Z	- Input	-200.21	-1.59	0.80

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	17.00	15.49
	- 200	-3.45	-5.04
Channel Y	200	6.40	5.76
	- 200	-7.38	-7.65
Channel Z	200	-2.14	-1.80
	- 200	-2.12	-1.86

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	-	1.16	-4.78
Channel Y	200	7.83	-	1.39
Channel Z	200	9.43	5.25	-

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	15919	16679
Channel Y	15630	16907
Channel Z	16103	14029

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	0.32	-0.90	1.62	0.50
Channel Y	-0.88	-2.56	0.01	0.41
Channel Z	-1.07	-2.44	0.01	0.50

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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Multilateral Agreement for the recognition of calibration certificates

Client   **Sporton-SZ (Auden)**   Certificate No: **EX3-3819_Nov16**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3819
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:	November 28, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: S5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-16)	In house check: Oct-17

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 28, 2016

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

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

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z*: Assessed for E-field polarization ϑ = 0 (f ≤ 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:3819

Manufactured:	September 2, 2011
Calibrated:	November 28, 2016

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3819

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm $(\mu V/(V/m)^2)^A$	0.46	0.40	0.45	± 10.1 %
DCP $(mV)^B$	96.6	98.3	104.7	

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	130.8	±3.5 %
		Y	0.0	0.0	1.0		142.8	
		Z	0.0	0.0	1.0		133.4	

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

^{A} The uncertainties of Norm X,Y,Z do not affect the E^2-field uncertainty inside TSL (see 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:3819

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)	Unc (k=2)
750	41.9	0.89	10.11	10.11	10.11	0.30	1.13	± 12.0 %
835	41.5	0.90	9.76	9.76	9.76	0.41	0.90	± 12.0 %
900	41.5	0.97	9.65	9.65	9.65	0.38	0.92	± 12.0 %
1450	40.5	1.20	8.71	8.71	8.71	0.32	0.80	± 12.0 %
1750	40.1	1.37	8.56	8.56	8.56	0.36	0.84	± 12.0 %
1900	40.0	1.40	8.17	8.17	8.17	0.37	0.80	± 12.0 %
2000	40.0	1.40	8.10	8.10	8.10	0.18	1.15	± 12.0 %
2300	39.5	1.67	7.57	7.57	7.57	0.29	0.90	± 12.0 %
2450	39.2	1.80	7.24	7.24	7.24	0.31	0.90	± 12.0 %
2600	39.0	1.96	7.03	7.03	7.03	0.44	0.80	± 12.0 %
3500	37.9	2.91	6.98	6.98	6.98	0.27	1.25	± 13.1 %
5250	35.9	4.71	5.17	5.17	5.17	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.55	4.55	4.55	0.45	1.80	± 13.1 %
5750	35.4	5.22	4.70	4.70	4.70	0.45	1.80	± 13.1 %

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

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

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3819

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)	Unc (k=2)
750	55.5	0.96	9.86	9.86	9.86	0.36	0.92	± 12.0 %
835	55.2	0.97	9.53	9.53	9.53	0.36	1.00	± 12.0 %
1750	53.4	1.49	8.08	8.08	8.08	0.41	0.80	± 12.0 %
1900	53.3	1.52	7.77	7.77	7.77	0.28	0.99	± 12.0 %
2300	52.9	1.81	7.54	7.54	7.54	0.43	0.80	± 12.0 %
2450	52.7	1.95	7.34	7.34	7.34	0.36	0.80	± 12.0 %
2600	52.5	2.16	7.11	7.11	7.11	0.38	0.80	± 12.0 %
3500	51.3	3.31	6.69	6.69	6.69	0.30	1.25	± 13.1 %
5250	48.9	5.36	4.50	4.50	4.50	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.95	3.95	3.95	0.50	1.90	± 13.1 %
5750	48.3	5.94	4.13	4.13	4.13	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
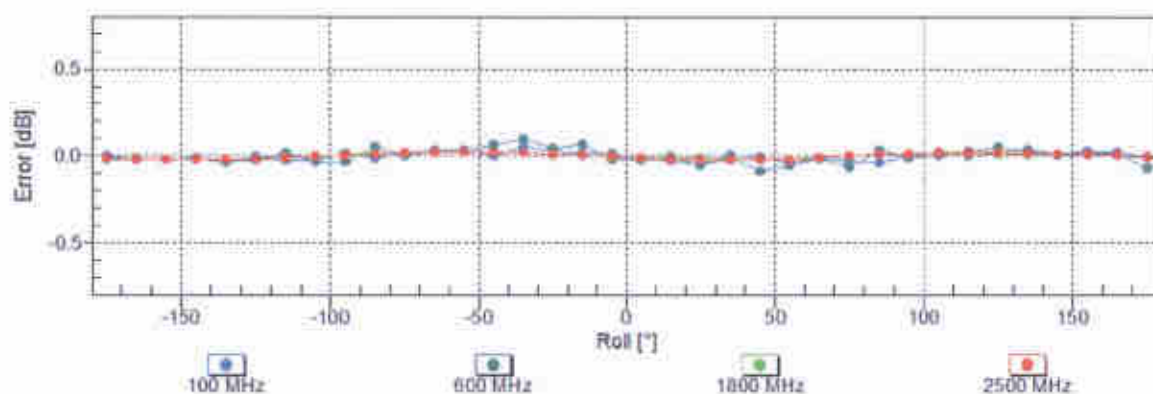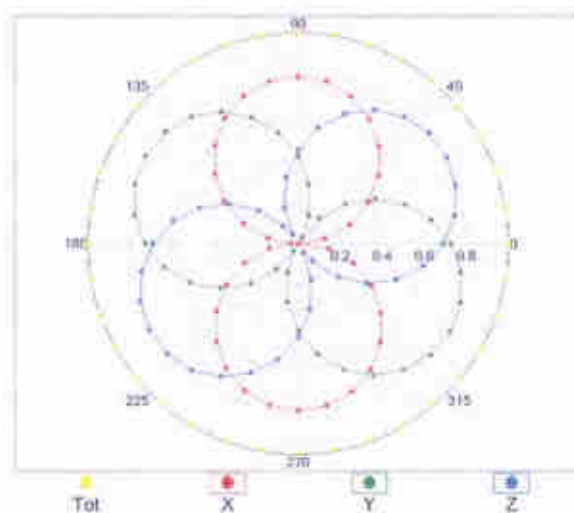## (TEM-Cell:ifi110 EXX, Waveguide: R22)
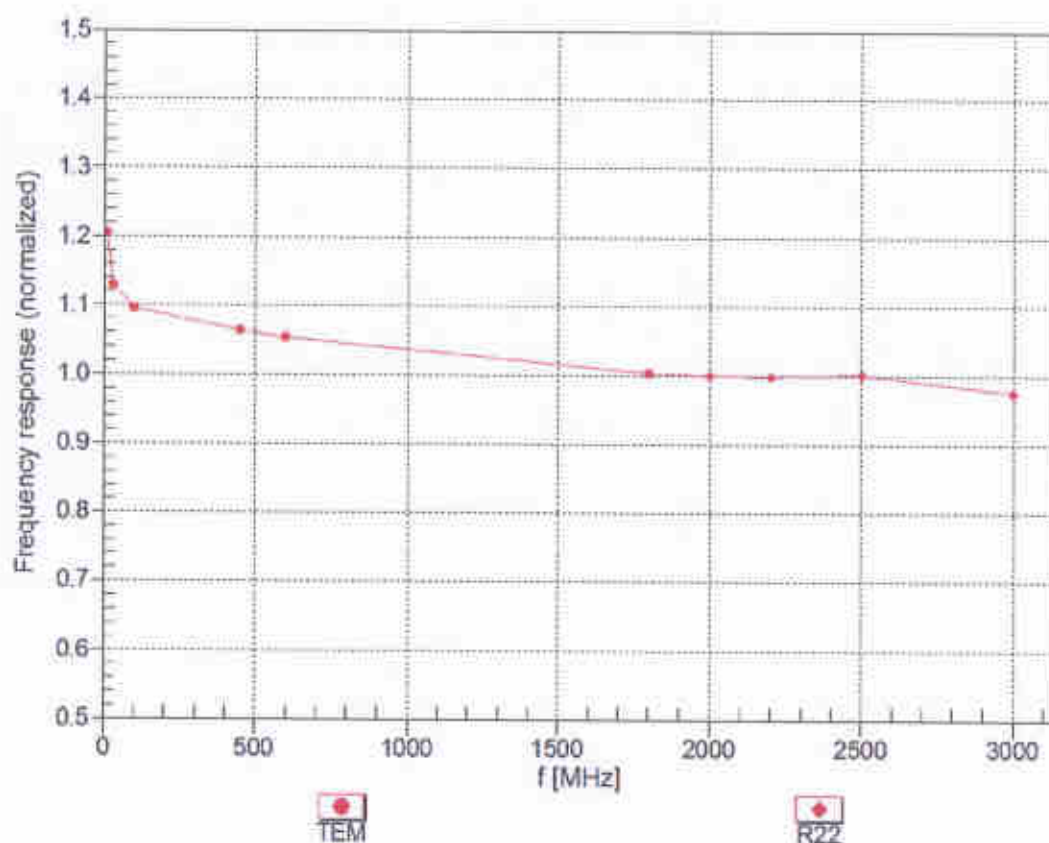
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (φ), ϑ = 0°

f=600 MHz,TEM

| Tot | X | Y | Z |

f=1800 MHz,R22

| Tot | X | Y | Z |

| 100 MHz | 600 MHz | 1800 MHz | 2500 MHz |

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

Dynamic Range f(SAR$_{head}$)
(TEM cell , f$_{eval}$= 1900 MHz)

not compensated   compensated

not compensated   compensated
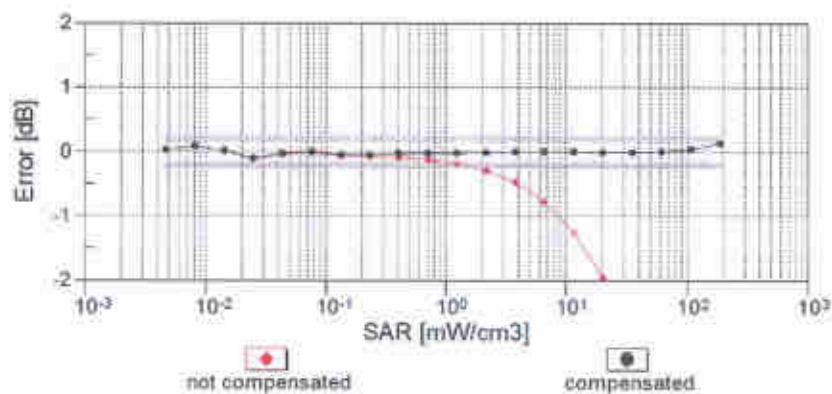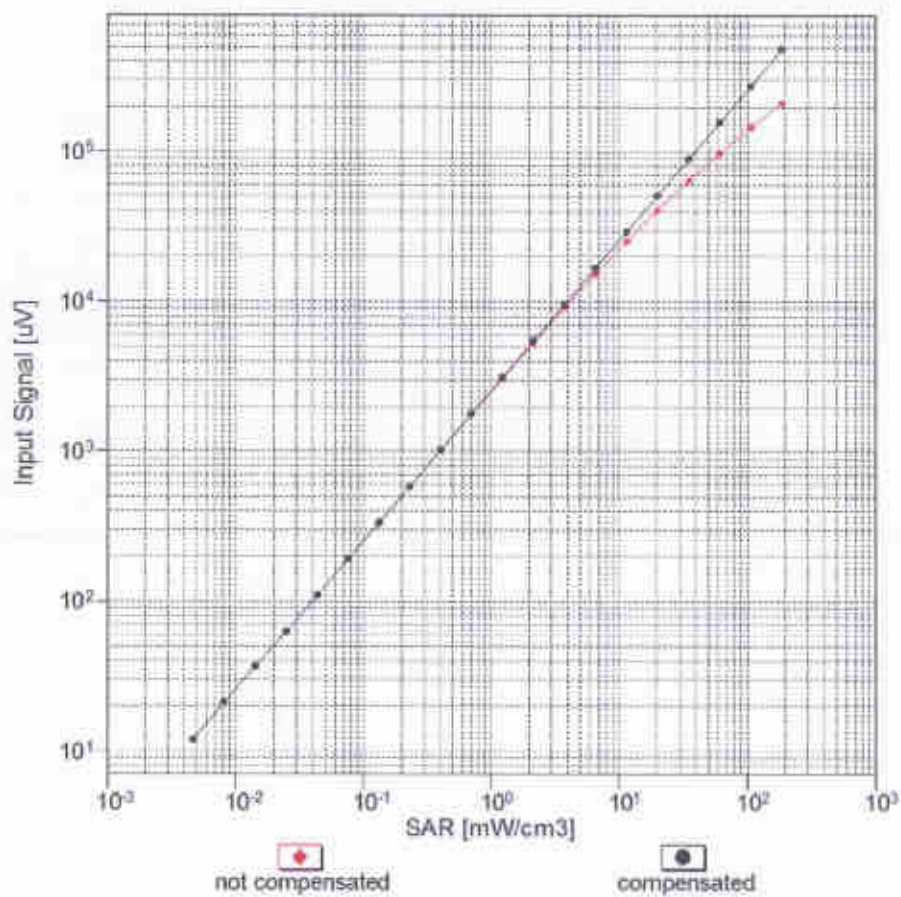
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)   f = 1900 MHz,WGLS R22 (H_convF)
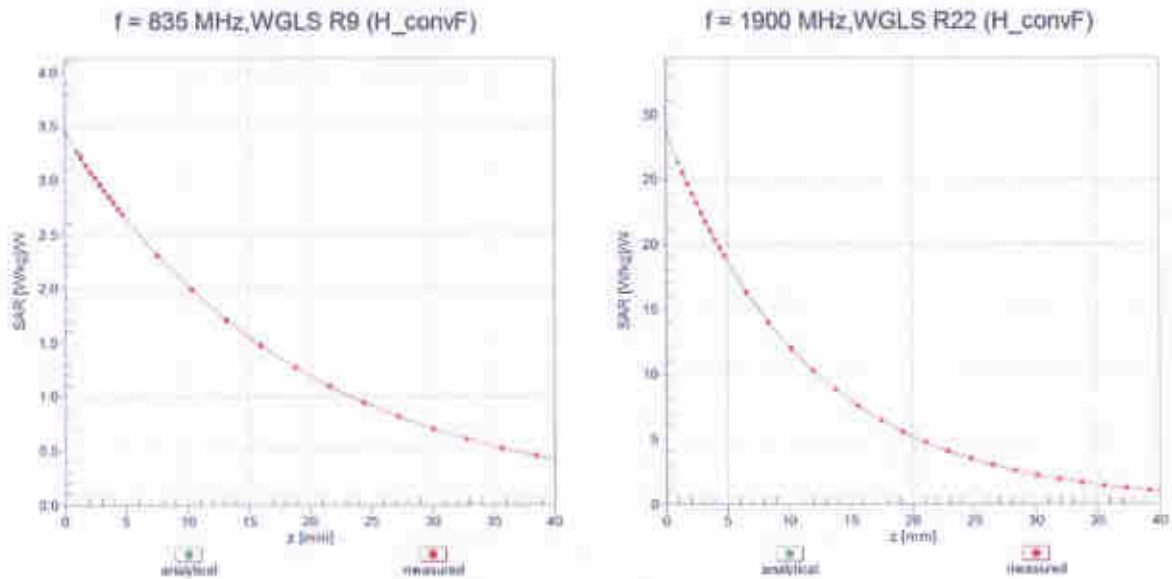
Deviation from Isotropy in Liquid
Error (ϕ, ϑ), f = 900 MHz
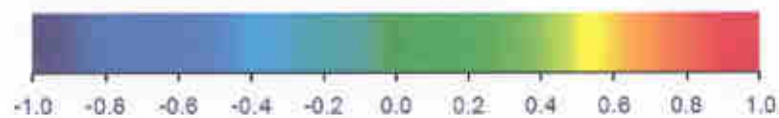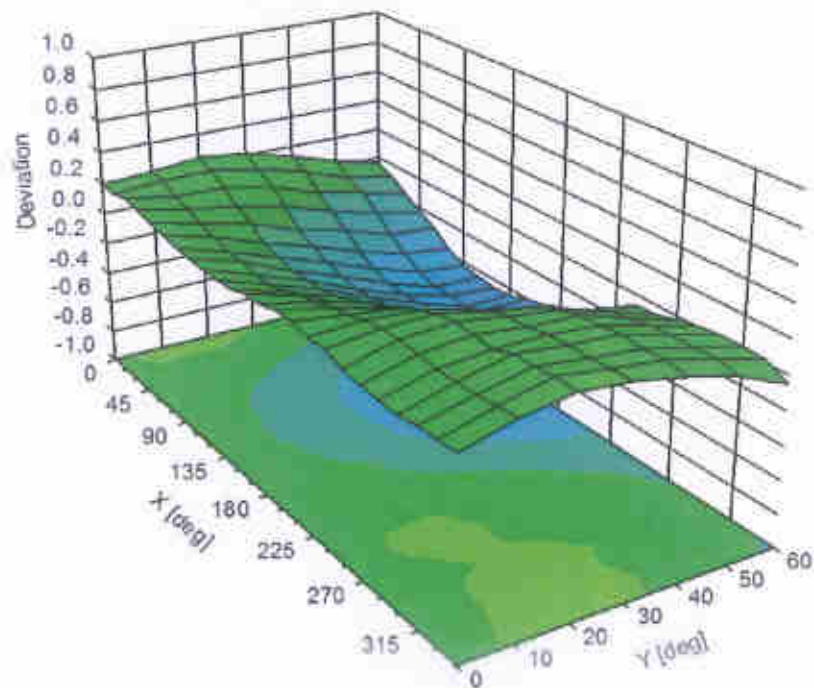
Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3819

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	115.1
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