ACCREDITED
TESTING LABORATORY
CERTIFICATE NUMBER: 3297.02

Bay Area Compliance Labs Corp.

SAR EVALUATION REPORT

For

Logic Instrument SA

43, Avenue de l'Europe P.O. Box BP 60012,

DOMONT, 95330, France

FCC ID: XGIFBF1

Report Type:	**Product Type:**
Original Report	Mobile Phone

Prepared By:	Jin Yang Test Engineer
Report Number:	R16102513-SAR
Report Date:	2016-11-10
Reviewed By:	Simon Ma RF Lead
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Summary of Test Results			
Rule Part(s):	FCC §2.1093		
Test Procedure(s):	IEEE 1528: 2013, IEC 62209-2:2010 KDB 447498 D01 General RF Exposure Guidance v06 KDB 648474 D04 Handset SAR v01r03 KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04 KDB 865664 D02 RF Exposure Reporting v01r02 KDB 941225 D01 3G SAR Procedures v03r01 KDB 941225 D05 SAR for LTE Devices v02r05 KDB 941225 D06 Hotspot Mode v02r01,		
Device Category: Exposure Category:	Portable Device General Population/Uncontrolled Exposure		
Operation Mode:	GSM Voice, GPRS/EDGE Data, WCDMA (R99, HSUPA, HSDPA, DC-HSDPA, HSPA+), FDD-LTE, WLAN 2.4G, WLAN 5G, Bluetooth		
TX Frequency Range:	GSM850/WCDMA Band 5: 824-849 MHz (TX); 869-894 MHz (RX) PCS1900/WCDMA Band 2: 1850-1910 MHz (TX); 1930-1990 MHz (RX) LTE Band 19: 830-845 MHz (TX); 875-890 MHz (RX) LTE Band 7: 2500-2570 MHz (TX); 2620-2690 MHz (RX) LTE Band 41: 2496-2690 MHz (TX); 2496-2690 MHz (RX) WLAN 2.4G: 2412-2462 MHz; Bluetooth/BLE: 2402-2480 MHz WLAN 5G: 5150-5250 MHz; 5725-5850 MHz		
Maximum Average Conducted Power:	GSM850: 32.37 dBm; PCS1900: 31.18 dBm WCDMA Band 5: 22.08 dBm; WCDMA Band 2: 22.69 dBm LTE: 22.63 dBm (Band 19), 22.89 dBm (Band 7), 22.81 dBm (Band 41) WLAN 2.4G: 9.39 dBm; WLAN 5G: 6.89 dBm Bluetooth: -0.48 dBm; BLE: -5.54 dBm		
Antenna Type(s) Tested:	Internal Antennas		
Body-Worn Accessories:	Headset		
Battery Type (s) Tested:	3.7 VDC Rechargeable Battery		
Max. SAR Level (s) Measured:	**Level (W/Kg)**	**Position**	**Operational Mode**
	0.537	Body	GSM850
	0.130	Head	
	0.426	Body	PCS1900
	0.012	Head	
	0.430	Body	WCDMA Band 5
	0.099	Head	
	0.552	Body	WCDMA Band 2
	0.025	Head	
	0.833	Body	LTE Band 19
	0.098	Head	
	1.370	Body	LTE Band 7
	0.090	Head	
	0.461	Body	LTE Band 41
	0.036	Head	
	1.557	Body	Simultaneous
	0.503	Head	
	1.557	Body	Hotspot

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R16102513-SAR	Original Report	2016-11-10

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This report has been prepared on behalf of *Logic Instrument SA* and their product *Mobile Phone*, Model: *Fieldbook F1*, FCC ID: XGIFBF1 or the EUT (Equipment under Test) as referred to in the rest of this report.

1.2 EUT Technical Specification

Item	Description
Operation Mode:	GSM Voice, GPRS/EDGE Data, WCDMA (R99, HSUPA, HSDPA, DC-HSDPA, HSPA+), FDD-LTE, WLAN 2.4G, WLAN 5G, Bluetooth, BLE
Frequency Range	GSM850: 824-849 MHz (TX); 869-894 MHz (RX) PCS1900: 1850-1910 MHz (TX); 1930-1990 MHz (RX) WCDMA Band 5: 824-849 MHz (TX); 869-894 MHz (RX) WCDMA Band 2: 1850-1910 MHz (TX); 1930-1990 MHz (RX) LTE Band 19: 830-845 MHz (TX); 875-890 MHz (RX) LTE Band 7: 2500-2570 MHz (TX); 2620-2690 MHz (RX) LTE Band 41: 2496-2690 MHz (TX); 2496-2690 MHz (RX) WLAN 2.4G: 2412-2462 MHz WLAN 5G: 5150-5250 MHz; 5725-5850 MHz Bluetooth/BLE: 2402-2480 MHz
Maximum Conducted Power Tested:	GSM850 : 32.37 dBm PCS1900: 31.18 dBm WCDMA Band 5: 22.08 dBm WCDMA Band 2: 22.69 dBm LTE Band 19: 22.63 dBm LTE Band 7: 22.89 dBm LTE Band 41: 22.81 dBm WLAN 2.4G: 9.39 dBm WLAN 5G: 6.89 dBm Bluetooth: -0.48 dBm BLE: -5.54 dBm
Dimensions (L*W*H):	17.7 cm (L) × 8.9 cm (W) × 1.1 cm (H)
Power Source	3.7 VDC Rechargeable Battery
Normal Operation	Head and Body-worn

2 Test Facility

Bay area compliance Laboratories Corp. (BACL) is:
1- An independent Commercial Test Laboratory accredited to **ISO 17025:2005** by **A2LA**, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminares and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC(Industry Canada), Korea (Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4- A Product Certification Body accredited to **ISO Guide 65:1996** by **A2LA** to certify:
1- Unlicensed, Licensed radio frequency devices and Telephone Terminal Equipment for the FCC. Scope A1, A2, A3, A4, B1, B2, B3, B4 & C.
2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.
3. Radio Communication Equipment for Singapore.
4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.
5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).
6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (Including GU24s),Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2009, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

3 Reference, Standards and Guidelines

FCC:

The Report and Order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g as recommended by the ANSI/IEEE standard C95.1-1992 [6] for an uncontrolled environment (Paragraph 65). According to the Supplement C of OET Bulletin 65 “Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under “worst-case” conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits. SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in North America is 1.6 mW/g average over 1 gram of tissue mass.

CE:

The CE requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 2 mW/g as recommended by the EN50360 for an uncontrolled environment. According to the Standard, the device should be evaluated at maximum output power (radiated from the antenna) under “worst-case” conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to determine if there is RF radiation and if radiation is found, what is the extent of radiation with respect to safety limits? SAR (Specific Absorption Rate) is the measure of RF exposure determined by the amount of RF energy absorbed by human body (or its parts) – to determine how the RF energy couples to the body or head which is a primary health concern for body worn devices. The limit below which the exposure to RF is considered safe by regulatory bodies in Europe is 2 mW/g average over 10 gram of tissue mass.

The test configurations were laid out on a specially designed test fixture to ensure the reproducibility of measurements. Each configuration was scanned for SAR. Analysis of each scan was carried out to characterize the above effects in the device.

3.1 SAR Limits

FCC/IC Limit

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1 g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

CE Limit

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 10 g of tissue)	2.0	10
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.0	20.0

Population/Uncontrolled Environments are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.

Occupational/Controlled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).

General Population/Uncontrolled environments Spatial Peak limit 1.6 W/kg (FCC) & 2 W/kg (CE) applied to the EUT.

4 Equipment List and Calibration

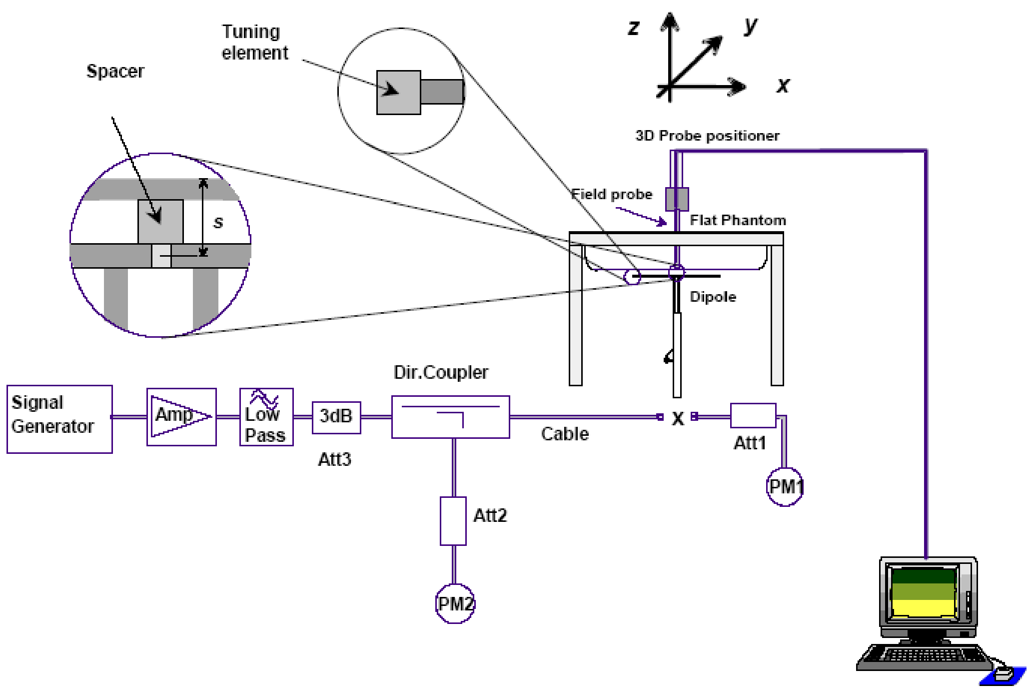
Type/Model	Cal. Due Date	S/N
DASY4 Professional Dosimetric System	N/A	N/A
Robot RX60L	N/A	CS7MBSP/467
Robot Controller	N/A	F01/5J72A1/A/01
Dell Computer Dimension 3000	N/A	N/A
SPEAG EDC3	N/A	N/A
SPEAG DAE4	2017-09-21	530
DASY4 Measurement Server	N/A	1176
SPEAG E-Field Probe EX3DV4	2017-09-23	3619
Antenna, Dipole, ALS-D-835-S-2	2017-10-27	180-00564
Antenna, Dipole, D1900V2	2018-10-19	5d003
Antenna, Dipole, D2600V2	2016-12-09	1073
SPEAG Twin SAM Phantom	N/A	TP-1032
Muscle Equivalent Matter (835 MHz)	Each Time	N/A
Head Equivalent Matter (835 MHz)	Each Time	N/A
Muscle Equivalent Matter (1900 MHz)	Each Time	N/A
Head Equivalent Matter (1900 MHz)	Each Time	N/A
Muscle Equivalent Matter (2600 MHz)	Each Time	N/A
Head Equivalent Matter (2600 MHz)	Each Time	N/A
Agilent, Spectrum Analyzer E4440A	2017-01-19	US45303156
Power Sensor Agilent E9304A	2017-08-31	MY54280008
Power Sensor Agilent E9304A	2017-08-31	MY54280006
Dielectric Probe Kit HP85070A	N/A	US99360201
HP, Signal Generator, 83650B	2017-09-09	3614A00276
Mini Circuits, AMPLIFIER ZVA-183-S	2017-10-05	570400946
Wideband Radio Communication Tester	2017-10-22	120503
Analyzer, Communications	2017-09-16	GB44051221

5 SAR Measurement System Verification

5.1 System Accuracy Verification

SAR system verification is required to confirm measurement accuracy. The system verification must be performed for each frequency band. A system verification must be performed before each series of SAR measurements.

5.2 SAR System Verification Setup and procedure



Procedure:

1) The SAR system verification measurements were performed in the flat section of TWIN SAM or flat phantom with shell thickness of 2±0.2mm filled with head or body liquid.

2) The depth of liquid in phantom must be ≥15 cm for SAR measurement less than 3 GHz and ≥10 cm for SAR measurement above 3 GHz.

3) The dipole was mounted below the center of flat phantom, and oriented parallel to the Y-Axis. The standard measurement distance is 15mm (below 1 GHz) and 10mm (above 1 GHz) from dipole center to the liquid surface.

4) The dipole input power was 250 mW or 100 mW.

5) The SAR results are normalized to 1 Watt input power.

6) Compared the normalized the SAR results to the dipole calibration results.

5.3 Liquid and System Validation

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
11/01/2016	Body	835	ερ	22	55.2	53.96	-2.25	± 5
			σ	22	0.97	0.98	1.03	± 5
			1g SAR	22	9.76	10.3	5.53	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
11/02/2016	Head	835	ερ	22	41.5	42.05	1.33	± 5
			σ	22	0.9	0.92	2.22	± 5
			1g SAR	22	9.78	9.11	-6.85	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
11/07/2016	Body	1900	ερ	22	53.3	52.81	-0.92	± 5
			σ	22	1.52	1.54	1.32	± 5
			1g SAR	22	39.1	40.6	3.84	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
11/08/2016	Head	1900	ερ	22	40	38.88	-2.80	± 5
			σ	22	1.4	1.42	1.43	± 5
			1g SAR	22	38.8	37.4	-3.61	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
10/27/2016	Body	2600	ερ	22	52.51	51.34	-2.23	± 5
			σ	22	2.16	2.19	1.39	± 5
			1g SAR	22	55.4	56.3	1.62	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
10/28/2016	Body	2600	ερ	22	52.51	52.2	-0.59	± 5
			σ	22	2.16	2.18	0.93	± 5
			1g SAR	22	55.4	54.7	-1.26	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
10/29/2016	Head	2600	ερ	22	39.01	38.37	-1.64	± 5
			σ	22	1.96	1.98	1.02	± 5
			1g SAR	22	57.4	59.9	4.36	± 10

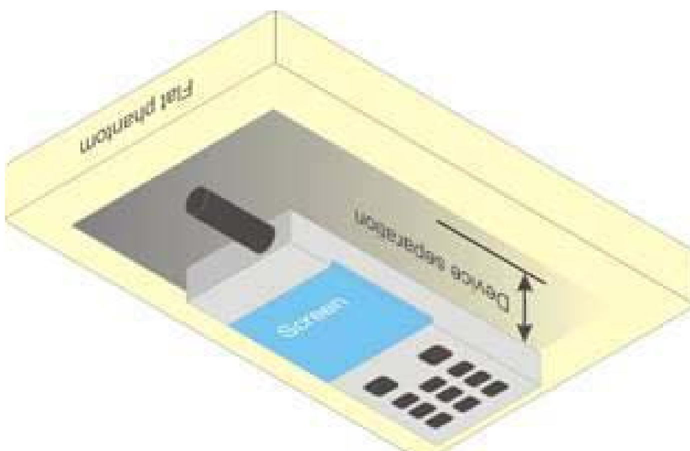
εr = relative permittivity, σ = conductivity and ρ=1000 kg/m^3

6 EUT Test Strategy and Methodology

6.1 Test positions for body-worn and other configurations

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations. Devices with a headset output should be tested with a headset connected to the device. When multiple accessories that do not contain metallic components are supplied with the device, the device may be tested with only the accessory that dictates the closest spacing to the body. When multiple accessories that contain metallic components are supplied with the device, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component (e.g., the same metallic belt-clip used with different holsters with no other metallic components), only the accessory that dictates the closest spacing to the body must be tested.

Body-worn accessories may not always be supplied or available as options for some devices that are intended to be authorized for body-worn use. A separation distance of 1.5 cm between the back of the device and a flat phantom is recommended for testing body-worn SAR compliance under such circumstances. Other separation distances may be used, but they should not exceed 2.5 cm. In these cases, the device may use body-worn accessories that provide a separation distance greater than that tested for the device provided however that the accessory contains no metallic components.



6.2 SAR Evaluation Procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the SAR value at a fixed location above the ear point or central position was used as a reference value for assessing the power drop. The SAR at this point is measured at the start of the test and then again at the end of the testing.

Step 2: The SAR distribution at the exposed side of the head was measured at a distance of 4 mm from the inner surface of the shell. The area covered the entire dimension of the head or EUT and the horizontal grid spacing was 15 mm x 15 mm. Based on these data, the area of the maximum absorption was determined by line interpolation. The first Area Scan covers the entire dimension of the EUT to ensure that the hotspot was correctly identified.

Step 3: Around this point, a volume of 30 mm x 30 mm x 21 mm was assessed by measuring 5 x 5 x 7 points. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

1. The data at the surface were extrapolated, since the center of the dipoles is 1.2 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.

2. The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one dimensional splines with the “Not a knot"-condition (in x, y and z-directions). The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the averages.

3. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the SAR value at the same location as in Step 1. If the value changed by more than 5%, the evaluation was repeated.

6.3 Test Methodology

KDB 447498 D01 General RF Exposure Guidance v06
KDB 648474 D04 Handset SAR v01r03
KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
KDB 865664 D02 RF Exposure Reporting v01r02
KDB 941225 D01 3G SAR Procedures v03r01
KDB 941225 D05 SAR for LTE Devices v02r05
KDB 941225 D06 Hotspot Mode v02r01

7 DASY4 SAR Evaluation Procedure

7.1 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurement jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. By default, the Minimum distance of probe sensors to surface is 4mm. This distance can be modified by the user, but cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties (for example, 2.7mm for an ET3DV6 probe type).

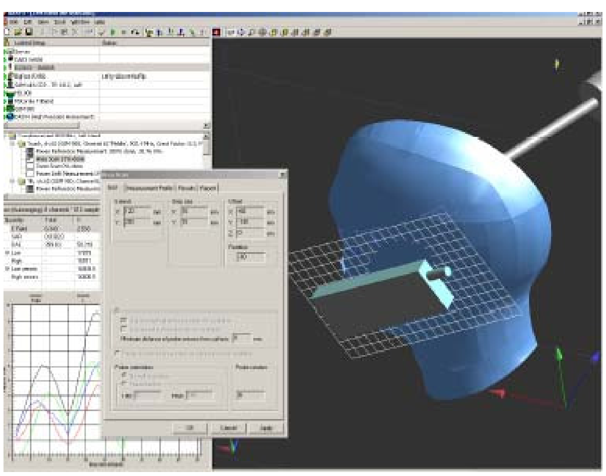
7.2 Area Scan

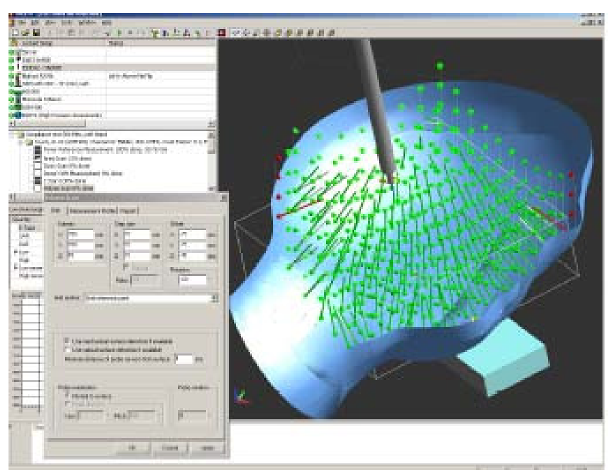
The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4 software can find the maximum locations even in relatively coarse grids.

The scanning area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the Area Scan's property sheet is brought-up, grid settings can be edited by a user.

When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE 1528-2003, EN 50361 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.

After measurement is completed, all maxima and their coordinates are listed in the Results property page. The maximum selected in the list is highlighted in the 3-D view. For the secondary maxima returned from an Area Scan, the user can specify a lower limit (peak SAR value), in addition to the Find secondary maxima within x dB condition. Only the primary maximum and any secondary maxima within x dB from the primary maximum and above this limit will be measured.





7.3 Zoom Scan

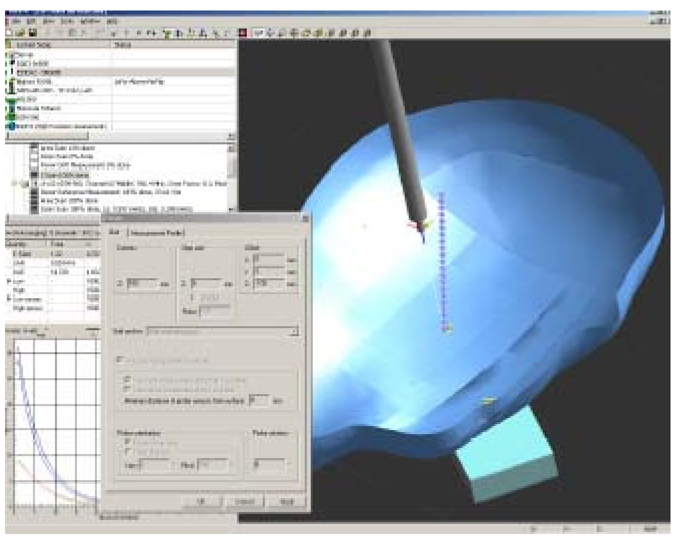
Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan measures 5 x 5 x 7 points within a cube whose base faces are centered around the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

7.4 Power drift measurement

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

7.5 Z-Scan

The Z Scan job measures points along a vertical straight line. The line runs along the Z axis of a one-dimensional grid. A user can anchor the grid to the section reference point, to any defined user point or to the current probe location. As with any other grids, the local Z axis of the anchor location establishes the Z axis of the grid.



8 Description of Test System

These measurements were performed with the automated near-field scanning system DASY4 from Schmid & Partner Engineering AG (SPEAG) which is the fourth generation of the system shown in the figure hereinafter:

The system is based on a high precision robot (working range greater than 0.9m), which positions the probes with a positional repeatability of better than ±0.02mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit.

The SAR measurements were conducted with the dosimetric probe ET3DV6 SN: 1604 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure and found to be better than ±0.25dB.

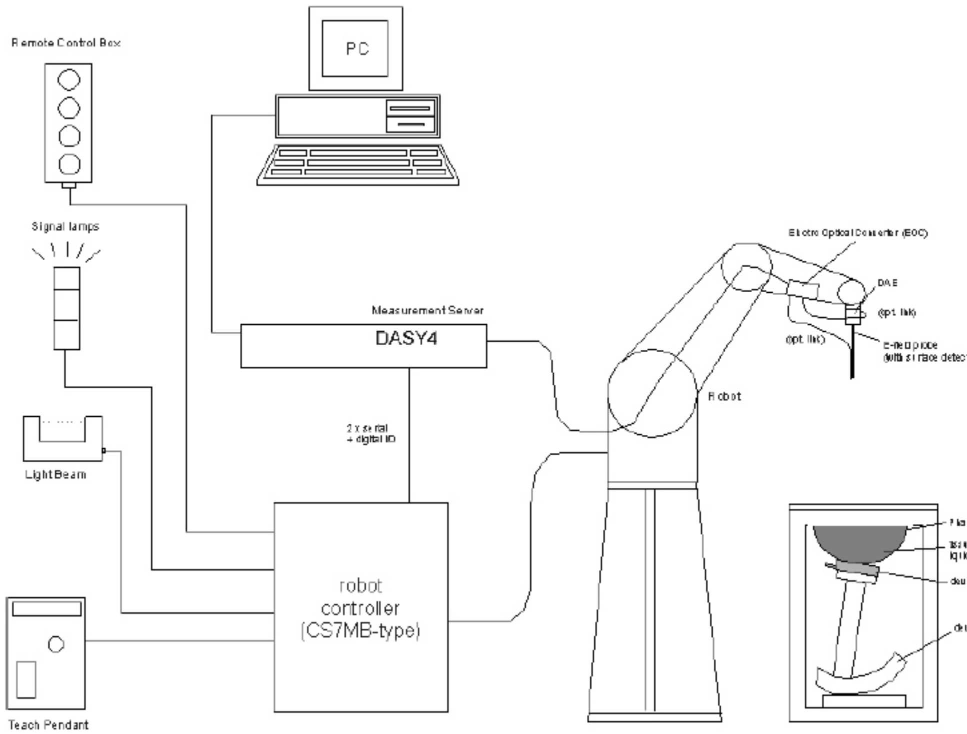
8.1 IEEE SCC-34/SC-2 P1528 Recommended Tissue Dielectric Parameters

Frequency (MHz)	Head Tissue		Body Tissue	
	εr	Ơ (S/m)	εr	Ơ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

8.2 DASY4 user's Manual Recommended Tissue Dielectric Parameters

Frequency (MHz)	Head Tissue		Body Tissue	
	εr	Ơ (S/m)	εr	Ơ (S/m)
2450	39.2	1.8	52.7	1.95
5200	36.0	4.66	49.0	5.30
5500	35.6	4.96	48.6	5.65
5800	35.3	5.27	48.2	6.00

8.3 Measurement System Diagram



The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).

- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

- 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 between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected 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.

- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.

- A computer operating Windows 2000 or Windows XP.

• DASY4 software.

• Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.

• The SAM twin phantom enabling testing left-hand and right-hand usage.

• The device holder for handheld mobile phones.

• Tissue simulating liquid mixed according to the given recipes.

• Validation dipole kits allowing system validation.

8.4 System Components

• DASY4 Measurement Server
• Data Acquisition Electronics
• Probes
• Light Beam Unit
• Medium
• SAM Twin Phantom
• Device Holder for SAM Twin Phantom
• System Validation Kits
• Robot

DASY4 Measurement Server

The DASY4 measurement server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chip disk and 64MB RAM. The necessary circuits for communication with either the DAE4 (or DAE3) electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pin out and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server.

Data Acquisition Electronics

The data acquisition electronics DAE3 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.

Probes

The DASY system can support many different probe types.

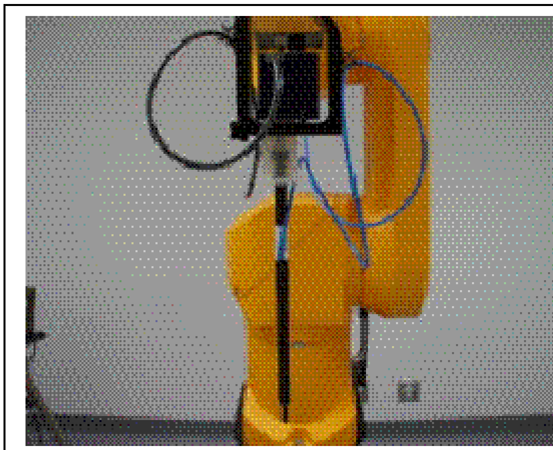
Dosimetric Probes: These probes are specially designed and calibrated for use in liquids with high permittivities. They should not be used in air, since the spherical isotropy in air is poor (±2 dB). The dosimetric probes have special calibrations in various liquids at different frequencies.

Free Space Probes: These are electric and magnetic field probes specially designed for measurements in free space. The z-sensor is aligned to the probe axis and the rotation angle of the x-sensor is specified. This allows the DASY system to automatically align the probe to the measurement grid for field component measurement. The free space probes are generally not calibrated in liquid. (The H-field probes can be used in liquids without any change of parameters.)

Temperature Probes: Small and sensitive temperature probes for general use. They use a completely different parameter set and different evaluation procedures. Temperature rise features allow direct SAR evaluations with these probes.

ET3DV6 Probe Specification

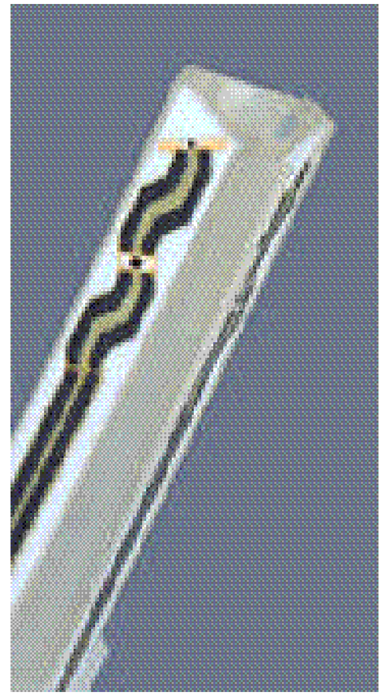
Construction Symmetrical design with triangular core
Built-in optical fiber for surface detection System
Built-in shielding against static charges
Calibration In air from 10 MHz to 2.5 GHz
In brain and muscle simulating tissue at
Frequencies of 450 MHz, 900 MHz and
1.8 GHz (accuracy ± 8%)
Frequency 10 MHz to > 6 GHz; Linearity: ± 0.2 dB
(30 MHz to 3 GHz)
Directivity ± 0.2 dB in brain tissue (rotation around
probe axis)
± 0.4 dB in brain tissue (rotation normal probe axis)
Dynamic 5 mW/g to > 100 mW/g;
Range Linearity: ± 0.2 dB
Surface ± 0.2 mm repeatability in air and clear liquids
Detection over diffuse reflecting surfaces.
Dimensions Overall length: 330 mm
Tip length: 16 mm



Photograph of the probe

Body diameter: 12 mm
Tip diameter: 6.8 mm
Distance from probe tip to dipole centers: 2.7 mm
Application General dosimetric up to 3 GHz
Compliance tests of mobile phones
Fast automatic scanning in arbitrary phantoms

The SAR measurements were conducted with the dosimetric probe ET3DV6 designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multi-fiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY3 software reads the reflection during a software approach and looks for the maximum using a 2nd order fitting. The approach is stopped when reaching the maximum.



Inside view of ET3DV6 E-field Probe

E-Field Probe Calibration Process

Each probe is calibrated according to a dosimetric assessment procedure described in [6] with accuracy better than +/- 10%. The spherical isotropy was evaluated with the procedure described in [7] and found to be better than +/-0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a waveguide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

Data Evaluation

The DASY4 post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	Normi, ai0, ai1, ai2
	- Conversion factor	ConvFi
	- Diode compression point	dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.
The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

With Vi = compensated signal of channel i (i =x, y, z)
Ui = input signal of channel i (i =x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcp_i = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\text{E} - \text{fieldprobes :} \qquad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$\text{H} - \text{fieldprobes :} \qquad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

With Vi = compensated signal of channel i (i =x, y, z)
$Norm_i$ = sensor sensitivity of channel i (i =x, y, z)
$\mu V/(V/m)^2$ for E-field probes
ConF = sensitivity enhancement in solution
a_{ij} = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = electric field strenggy of channel i in V/m
H_i = diode compression point (DASY parameter)

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

With SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/meter] or [Siemens/meter]
ρ = equivalent tissue density in g/cm^3

Note that the density is normally set to 1, to account for actual brain density rather than the density of the simulation liquid.

Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, so that the robot coordinates are valid for the probe tip. The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

Medium

Parameters

The parameters of the tissue simulating liquid strongly influence the SAR in the liquid. The parameters for the different frequencies are defined in the corresponding compliance standards (e.g., EN 50361, IEEE 1528-2003).

Parameter measurements

Several measurement systems are available for measuring the dielectric parameters of liquids:

- The open coax test method (e.g., HP85070 dielectric probe kit) is easy to use, but has only moderate acuracy. It is calibrated with open, short, and deionized water and the calibrations a critical process.

- The transmission line method (e.g., model 1500T from DAMASKOS, INC.) measures the transmission and reflection in a liquid filled high precision line. It needs standard two port calibration and is probably more accurate than the open coax method.

- The reflection line method measures the reflection in a liquid filled shorted precision lined.The method is not suitable for these liquids because of its low sensitivity.

• The slotted line method scans the field magnitude and phase along a liquid filled line. The evaluation is straight forward and only needs a simple response calibration. The method is very accurate, but can only be used in high loss liquids and at frequencies above 100 to 200MHz. Cleaning the line can be tedious.

SAM Twin Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas:

• Left hand
• Right hand
• Flat phantom

The phantom table comes in two sizes: A 100 x 50 x 85 cm (L x W x H) table for use with free standing robots (DASY4 professional system option) or as a second phantom and a 100 x 75 x 85 cm(L x W x H) table with reinforcements for table mounted robots (DASY4 compact system option) .
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. Only one device holder is necessary if two phantoms are used (e.g., for different liquids) A white cover is provided to tap the phantom during o_-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on the cover are possible. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

The phantom can be used with the following tissue simulating liquids:

• Water-sugar based liquids can be left permanently in the phantom. Always cover the liquid if the system is not used, otherwise the parameters will change due to water evaporation.

• Glycol based liquids should be used with care. As glycol is a softener for most plastics, the liquid should be taken out of the phantom and the phantom should be dried when the system is not used (desirable at least once a week).

• Do not use other organic solvents without previously testing the phantom's compatibility.

Device Holder for SAM Twin Phantom

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source in 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. An accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions, in which the devices must be measured, are defined by the standards.

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point ERP). Thus the device needs no repositioning when changing the angles.

The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity "=3 and loss tangent _=0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

System Validation Kits

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. For that purpose a well defined SAR distribution in the flat section of the SAM twin phantom is produced.

System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder. Dipoles are available for the variety of frequencies between 300MHz and 6 GHz (dipoles for other frequencies or media and other calibration conditions are available upon request).

The dipoles are highly symmetric and matched at the center frequency for the specified liquid and distance to the flat phantom (or flat section of the SAM-twin phantom). The accurate distance between the liquid surface and the dipole center is achieved with a distance holder that snaps on the dipole.

Robot

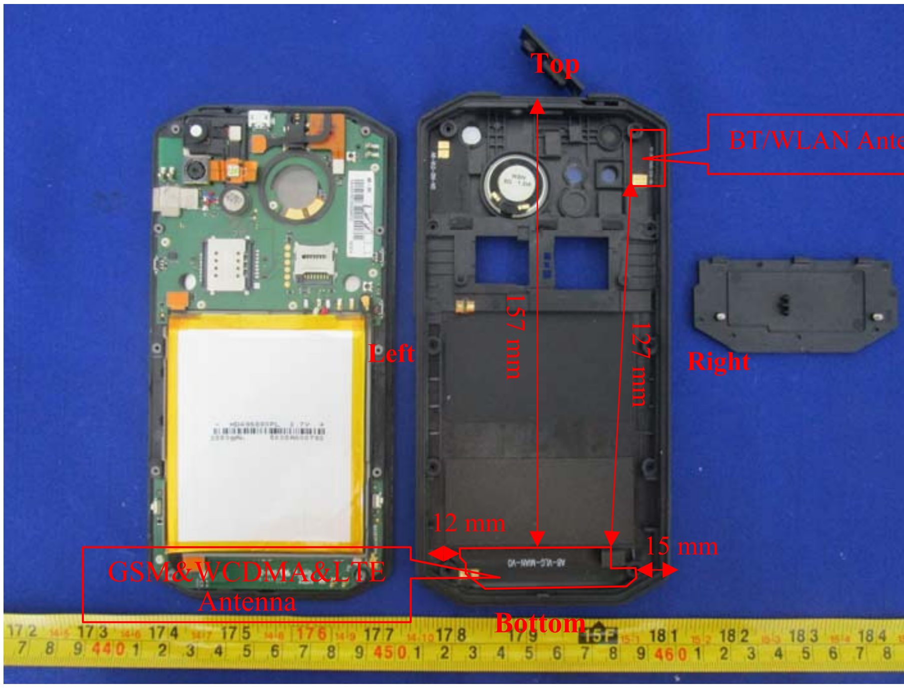
The DASY4 system uses the high precision industrial robots RX60L, RX90 and RX90L, as well as the RX60BL and RX90BL types out of the newer series from Stäubli SA (France). The RX robot series offers many features that are important for our application:

• High precision (repeatability 0.02mm)
• High reliability (industrial design)
• Low maintenance costs (virtually maintenance-free due to direct drive gears; no belt drives)
• Jerk-free straight movements (brushless synchronous motors; no stepper motors)
• Low ELF interference (the closed metallic construction shields against motor control fields)

For the newly delivered DASY4 systems as well as for the older DASY3 systems delivered since 1999, the CS7MB robot controller version from Stäubli is used. Previously delivered systems have either a CS7 or CS7M controller; the differences to the CS7MB are mainly in the hardware, but some procedures in the robot software from Stäubli are also not completely the same. The following descriptions about robot hard- and software correspond to CS7MB controller with software version 13.1 (edit S5). The actual commands, procedures and configurations, also including details in hardware, might differ if an older robot controller is in use. In this case please also refer to the Stäubli manuals for further information.

9 SAR Measurement Consideration and Reduction

9.1 Antenna Location



9.2 2G/3G/4G SAR Consideration

Antenna Distance To Edge

Antenna Distance To Edge(mm)					
Antenna	**Left**	**Right**	**Top**	**Back**	**Bottom**
GSM/WCDMA/LTE	12	15	157	< 5	< 5

SAR test exclusion for the EUT edge considerations Result

SAR test exclusion for the EUT edge considerations					
Antenna	**Left**	**Right**	**Top**	**Back**	**Bottom**
GSM/WCDMA/LTE	Required	Required	Exclusion	Required	Required

Note Required: The distance is less than 2.5 cm, SAR test is required for Hotspot mode.
Exclusion: The distance is more than 2.5 cm to the edge; SAR test is not required for Hotspot mode.

Note: According to KDB 447498 D01 Section 4.1.1, Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:38
a) ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
b) ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
c) ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

Please refer to Appendix F RF output power:

GSM/GPRS/EGPRS: According to KDB941225 D01-SAR for EGPRS mode are not required when the source-based time-averaged output power for data mode is lower than that in the normal GPRS mode.

WCDMA: KDB 941225 D01-Body SAR is not required for HSDPA/HSUPA/HSPA+/DC-HSDPA when the maximum average output of each RF channel is less than ¼ dB higher than measured 12.2kbps RMC or the maximum SAR for 12.2kbps RMC is < 75% of SAR limit.

LTE: KDB941225 D05- SAR for higher order modulation is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg

9.3 BT&WLAN SAR Consideration

According to 447498 Section 4.3.1 (a), for 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by [(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR. Calculation details are shown in the tables below.

Mode	Frequency (MHz)	Target Power (dBm)	Target Power (mW)	Distance (mm)	Calculated value	Threshold (1-g)	SAR Test Exclusion
WLAN 2.4G	2462	9.5	8.91	0	2.8	3	YES
WLAN 5G	5825	7	5.01	0	2.4	3	YES
Bluetooth	2480	-0.4	0.91	0	0.3	3	YES

10 SAR Measurement Results

This page summarizes the results of the performed SAR evaluation. The plots with the corresponding SAR distributions, which reveal information about the location of the maximum SAR with respect to the device, could be found in Appendix E.

10.1 Test Environmental Conditions

Temperature:	22-24 ºC
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

Testing was performed by Jin Yang in SAR chamber from 10-27-2016 to 11-08-2016.

10.2 Standalone SAR Results

Please refer to the following tables.

GSM 850:

EUT Position	Frequency (MHz)	Test Mode	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
					Scaled Factor	Meas. SAR	Scaled SAR	Plot
Head-Flat	824.2	GSM	/	/	/	/	/	/
	836.6	GSM	32.35	32.5	1.035	0.126	0.130	**1#**
	848.8	GSM	/	/	/	/	/	/
Body-Worn-Headset (10mm)	824.2	GSM	/	/	/	/	/	/
	836.6	GSM	32.35	32.5	1.035	0.519	0.537	/
	848.8	GSM	/	/	/	/	/	/
Body-Back Hotspot (10mm)	824.2	GPRS	28.93	29	1.016	0.689	0.700	/
	836.6	GPRS	28.8	29	1.047	0.783	0.820	/
	848.8	GPRS	28.71	29	1.069	**0.963**	**1.029**	**2#**
Body-Left Hotspot (10mm)	824.2	GPRS	/	/	/	/	/	/
	836.6	GPRS	28.8	29	1.047	0.117	0.123	/
	848.8	GPRS	/	/	/	/	/	/
Body-Right Hotspot (10mm)	824.2	GPRS	/	/	/	/	/	/
	836.6	GPRS	28.8	29	1.047	0.297	0.311	/
	848.8	GPRS	/	/	/	/	/	/
Body-Bottom Hotspot (10mm)	824.2	GPRS	/	/	/	/	/	/
	836.6	GPRS	28.8	29	1.047	0.298	0.312	/
	848.8	GPRS	/	/	/	/	/	/

Note[1]: the Multi-slot Classes of EUT is Class 12 which has maximum 4 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 1DL+4UL is the worst case.

PCS 1900:

EUT Position	Frequency (MHz)	Test Mode	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
					Scaled Factor	Meas. SAR	Scaled SAR	Plot
Head-Flat	1850.2	GSM	/	/	/	/	/	/
	1880	GSM	31.18	31.3	1.028	0.012	0.012	**3#**
	1909.8	GSM	/	/	/	/	/	/
Body-Worn-Headset (10mm)	1850.2	GSM	/	/	/	/	/	/
	1880	GSM	31.18	31.3	1.028	0.414	0.426	/
	1909.8	GSM	/	/	/	/	/	/
Body-Back Hotspot (10mm)	1850.2	GPRS	/	/	/	/	/	/
	1880.0	GPRS	30.24	30.4	1.038	0.321	0.333	/
	1909.8	GPRS	/	/	/	/	/	/
Body-Left Hotspot (10mm)	1850.2	GPRS	/	/	/	/	/	/
	1880.0	GPRS	30.24	30.4	1.038	0.159	0.165	/
	1909.8	GPRS	/	/	/	/	/	/
Body-Right Hotspot (10mm)	1850.2	GPRS	/	/	/	/	/	/
	1880.0	GPRS	30.24	30.4	1.038	0.0541	0.056	/
	1909.8	GPRS	/	/	/	/	/	/
Body-Bottom Hotspot (10mm)	1850.2	GPRS	/	/	/	/	/	/
	1880.0	GPRS	30.24	30.4	1.038	**0.432**	**0.448**	**4#**
	1909.8	GPRS	/	/	/	/	/	/

Note[1]: The Multi-slot Classes of EUT is Class 12 which has maximum 4 Downlink slots and 4 Uplink slots, the maximum active slots is 5, when perform the multiple slots scan, 3DL+2UL is the worst case.

WCDMA Band 5:

EUT Position	Frequency (MHz)	Test Mode	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
					Scaled Factor	Meas. SAR	Scaled SAR	Plot
Head-Flat	826.4	RMC	/	/	/	/	/	/
	836.6	RMC	22.08	22.2	1.028	0.0967	0.099	**5#**
	846.6	RMC	/	/	/	/	/	/
Body-Back Hotspot (10mm)	826.4	RMC	/	/	/	/	/	/
	836.6	RMC	22.08	22.2	1.028	**0.418**	**0.430**	**6#**
	846.6	RMC	/	/	/	/	/	/
Body-Left Hotspot (10mm)	826.4	RMC	/	/	/	/	/	/
	836.6	RMC	22.08	22.2	1.028	0.0602	0.062	/
	846.6	RMC	/	/	/	/	/	/
Body-Right Hotspot (10mm)	826.4	RMC	/	/	/	/	/	/
	836.6	RMC	22.08	22.2	1.028	0.156	0.160	/
	846.6	RMC	/	/	/	/	/	/
Body-Bottom Hotspot (10mm)	826.4	RMC	/	/	/	/	/	/
	836.6	RMC	22.08	22.2	1.028	0.133	0.137	/
	846.6	RMC	/	/	/	/	/	/

WCDMA Band 2:

EUT Position	Frequency (MHz)	Test Mode	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
					Scaled Factor	Meas. SAR	Scaled SAR	Plot
Head-Flat	1852.4	RMC	/	/	/	/	/	/
	1880	RMC	22.43	22.8	1.089	0.0226	0.025	**7#**
	1907.6	RMC	/	/	/	/	/	/
Body-Back Hotspot (10mm)	1852.4	RMC	/	/	/	/	/	/
	1880	RMC	22.43	22.8	1.089	**0.507**	**0.552**	**8#**
	1907.6	RMC	/	/	/	/	/	/
Body-Left Hotspot (10mm)	1852.4	RMC	/	/	/	/	/	/
	1880	RMC	22.43	22.8	1.089	0.141	0.154	/
	1907.6	RMC	/	/	/	/	/	/
Body-Right Hotspot (10mm)	1852.4	RMC	/	/	/	/	/	/
	1880	RMC	22.43	22.8	1.089	0.0447	0.049	/
	1907.6	RMC	/	/	/	/	/	/
Body-Bottom Hotspot (10mm)	1852.4	RMC	/	/	/	/	/	/
	1880	RMC	22.43	22.8	1.089	0.402	0.438	/
	1907.6	RMC	/	/	/	/	/	/

LTE Band 19:

EUT Position	Frequency (MHz)	Bandwidth （MHz）	Test Mode	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Head-Flat	839.5	15	1RB	/	/	/	/	/	/
	840.5	15	1RB	22.34	22.7	1.086	0.0902	0.098	**9#**
	841.5	15	1RB	/	/	/	/	/	/
	840.5	15	50%RB	22.47	22.7	1.054	0.0729	0.077	/
Body-Back Hotspot (10mm)	839.5	15	1RB	22.31	22.7	1.094	0.558	0.610	/
	840.5	15	1RB	22.34	22.7	1.086	**0.767**	**0.833**	**10#**
	841.5	15	1RB	22.24	22.7	1.112	0.566	0.629	/
	840.5	15	50%RB	22.47	22.7	1.054	0.438	0.462	/
	840.5	15	100%RB	21.35	22.7	1.365	0.343	0.468	/
Body-Left Hotspot (10mm)	839.5	15	1RB	/	/	/	/	/	/
	840.5	15	1RB	22.34	22.7	1.086	0.0661	0.072	/
	841.5	15	1RB	/	/	/	/	/	/
	840.5	15	50%RB	22.47	22.7	1.054	0.0566	0.060	/
Body-Right Hotspot (10mm)	839.5	15	1RB	/	/	/	/	/	/
	840.5	15	1RB	22.34	22.7	1.086	0.172	0.187	/
	841.5	15	1RB	/	/	/	/	/	/
	840.5	15	50%RB	22.47	22.7	1.054	0.138	0.146	/
Body-Bottom Hotspot (10mm)	839.5	15	1RB	/	/	/	/	/	/
	840.5	15	1RB	22.34	22.7	1.086	0.163	0.177	/
	841.5	15	1RB	/	/	/	/	/	/
	840.5	15	50%RB	22.47	22.7	1.054	0.133	0.140	/

LTE Band 7:

EUT Position	Frequency (MHz)	Bandwidth （MHz）	Test Mode	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Head-Flat	2510	20	1RB	/	/	/	/	/	/
	2535	20	1RB	22.46	23	1.132	0.0794	0.090	**11#**
	2560	20	1RB	/	/	/	/	/	/
	2535	20	50%RB	22.43	23	1.140	0.0586	0.067	/
Body-Back Hotspot (10mm)	2510	20	1RB	22.8	23	1.047	1.06	1.110	/
	2535	20	1RB	22.46	23	1.132	**1.21**	**1.370**	**12#**
	2560	20	1RB	22.36	23	1.159	1.15	1.333	/
	2535	20	50%RB	22.58	23	1.102	0.856	0.943	/
	2510	20	50%RB	22.48	23	1.127	0.884	0.996	/
	2560	20	50%RB	22.24	23	1.191	0.932	1.110	/
	2535	20	100%RB	21.47	23	1.422	0.786	1.118	/
Body-Left Hotspot (10mm)	2510	20	1RB	/	/	/	/	/	/
	2535	20	1RB	22.46	23	1.132	0.124	0.140	/
	2560	20	1RB	/	/	/	/	/	/
	2535	20	50%RB	22.58	23	1.102	0.0921	0.101	/
Body-Right Hotspot (10mm)	2510	20	1RB	/	/	/	/	/	/
	2535	20	1RB	22.46	23	1.132	0.053	0.060	/
	2560	20	1RB	/	/	/	/	/	/
	2535	20	50%RB	22.58	23	1.102	0.0537	0.059	/
Body-Bottom Hotspot (10mm)	2510	20	1RB	22.8	23	1.047	0.817	0.856	/
	2535	20	1RB	22.46	23	1.132	1.00	1.132	/
	2560	20	1RB	22.36	23	1.159	0.808	0.936	/
	2535	20	50%RB	22.58	23	1.102	0.69	0.760	/
	2535	20	100%RB	21.47	23	1.422	0.706	1.004	/

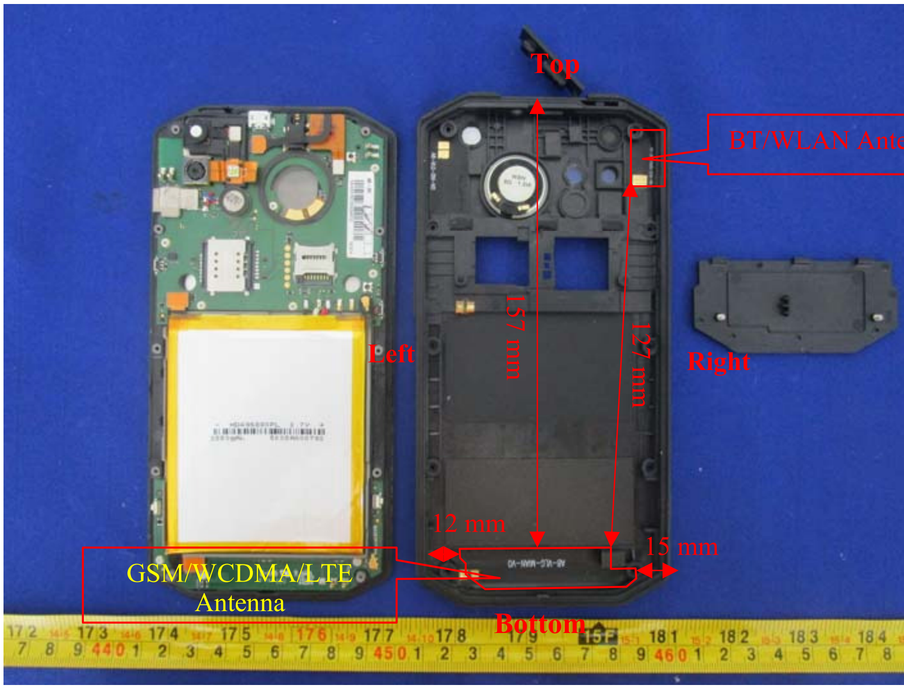
LTE Band 41:

EUT Position	Frequency (MHz)	Bandwidth（MHz）	Test Mode	Max. Meas. Power (dBm)	Max. Rated Power (dBm)	1g SAR (W/Kg)			
						Scaled Factor	Meas. SAR	Scaled SAR	Plot
Head-Flat	2506	20	1RB	/	/	/	/	/	/
	2593	20	1RB	22.66	22.9	1.057	0.0337	0.036	**13#**
	2683	20	1RB	/	/	/	/	/	/
	2593	20	50%RB	22.63	22.9	1.064	0.0243	0.026	/
Body-Back Hotspot (10mm)	2506	20	1RB	/	/	/	/	/	/
	2593	20	1RB	22.66	22.9	1.057	0.421	0.445	/
	2683	20	1RB	/	/	/	/	/	/
	2593	20	50%RB	22.63	22.9	1.064	0.337	0.359	/
Body-Left Hotspot (10mm)	2506	20	1RB	/	/	/	/	/	/
	2593	20	1RB	22.66	22.9	1.057	0.0383	0.040	/
	2683	20	1RB	/	/	/	/	/	/
	2593	20	50%RB	22.63	22.9	1.064	0.0282	0.030	/
Body-Right Hotspot (10mm)	2506	20	1RB	/	/	/	/	/	/
	2593	20	1RB	22.66	22.9	1.057	0.0722	0.076	/
	2683	20	1RB	/	/	/	/	/	/
	2593	20	50%RB	22.63	22.9	1.064	0.0546	0.058	/
Body-Bottom Hotspot (10mm)	2506	20	1RB	/	/	/	/	/	/
	2593	20	1RB	22.66	22.9	1.057	**0.436**	**0.461**	**14#**
	2683	20	1RB	/	/	/	/	/	/
	2593	20	50%RB	22.63	22.9	1.064	0.338	0.360	/

Note: KDB941225D05- For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation in 5.2.1 and 5.2.2 are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

10.3 Multi-TX and Antenna SAR Considerations

BT/WLAN and GSM/WCDMA/LTE Antenna Location



10.3.1 Estimated SAR

Mode	Frequency (MHz)	Target Power (dBm)	Target Power (mW)	Distance (mm)	Estimated 1-g (W/kg)
WLAN 2.4G Head	2462	9.5	8.91	0	0.373
WLAN 2.4G Body	2462	9.5	8.91	10	0.187
WLAN 5G Head	5825	7	5.01	0	0.322
WLAN 5G Body	5825	7	5.01	10	0.161
BT Head	2480	-0.4	0.91	0	0.043
BT Body	2480	-0.4	0.91	10	0.022

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
[(max. power of channel, including tune-up tolerance , mW)/(min. test separation distance,mm)] · [$\sqrt{f(GHz)}/x$]
W/kg for test separation distances ≤50 mm;
where x = 7.5 for 1-g SAR.
When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion

Simultaneous Transmission:

Description of Simultaneous Transmit Capabilities			Antennas Distance (mm)
Transmitter Combination	Simultaneous?	Hotspot?	
GSM + WCDMA	×	×	0
GSM+LTE	×	×	0
GSM + Bluetooth	√	×	127
GSM + WLAN	√	√	127
WCDMA+LTE	×	×	0
WCDMA + Bluetooth	√	×	127
WCDMA + WLAN	√	√	127
LTE + Bluetooth	√	×	127
LTE + WLAN	√	√	127

Simultaneous and Hotspot SAR test exclusion considerations:

Mode(SAR1+SAR2)	Position	Reported SAR (W/kg)		Σ SAR (W/kg)
		SAR1	SAR2	
GSM 850+Bluetooth	Head-Flat	0.130	0.043	0.173
	Body-Back-Headset	0.537	0.022	0.559
	Body-Back	1.029	0.022	1.051
	Body- Left	0.123	0.022	0.145
	Body- Right	0.311	0.022	0.333
	Body- Bottom	0.312	0.022	0.334
PCS1900 +Bluetooth	Head-Flat	0.012	0.043	0.055
	Body-Back-Headset	0.426	0.022	0.448
	Body-Back	0.333	0.022	0.355
	Body- Left	0.165	0.022	0.187
	Body- Right	0.056	0.022	0.078
	Body- Bottom	0.448	0.022	0.47
WCDMA Band 5+Bluetooth	Head-Flat	0.099	0.043	0.142
	Body-Back	0.430	0.022	0.452
	Body- Left	0.062	0.022	0.084
	Body- Right	0.160	0.022	0.182
	Body- Bottom	0.137	0.022	0.159
WCDMA Band 2+Bluetooth	Head-Flat	0.025	0.043	0.068
	Body-Back	0.552	0.022	0.574
	Body- Left	0.154	0.022	0.176
	Body- Right	0.049	0.022	0.071
	Body- Bottom	0.438	0.022	0.46
LTE Band 19+Bluetooth	Head-Flat	0.098	0.043	0.141
	Body-Back	0.833	0.022	0.855
	Body- Left	0.072	0.022	0.094
	Body- Right	0.187	0.022	0.209
	Body- Bottom	0.177	0.022	0.199
LTE Band 7+Bluetooth	Head-Flat	0.090	0.043	0.133
	Body-Back	1.370	0.022	1.392
	Body- Left	0.140	0.022	0.162
	Body- Right	0.060	0.022	0.082
	Body- Bottom	1.132	0.022	1.154
LTE Band 41+Bluetooth	Head-Flat	0.036	0.043	0.079
	Body-Back	0.445	0.022	0.467
	Body- Left	0.040	0.022	0.062
	Body- Right	0.076	0.022	0.098
	Body- Bottom	0.461	0.022	0.483

Mode(SAR1+SAR2)	Position	Reported SAR (W/kg)		Σ SAR (W/kg)
		SAR 1	SAR 2	
GSM 850+ WLAN 2.4G	Head-Flat	**0.130**	0.373	**0.503**
	Body-Back-Headset	0.537	0.187	0.724
GPRS 850 + WLAN 2.4G (Hotspot)	Body-Back	1.029	0.187	1.216
	Body- Left	0.123	0.187	0.31
	Body- Right	0.311	0.187	0.498
	Body- Bottom	0.312	0.187	0.499
PCS1900 + WLAN 2.4G	Head-Flat	0.012	0.373	0.385
	Body-Back-Headset	0.426	0.187	0.613
GPRS 1900 + WLAN 2.4G (Hotspot)	Body-Back	0.333	0.187	0.52
	Body- Left	0.165	0.187	0.352
	Body- Right	0.056	0.187	0.243
	Body- Bottom	0.448	0.187	0.635
WCDMA Band 5+ WLAN 2.4G	Head-Flat	0.099	0.373	0.472
WCDMA Band 5+ WLAN 2.4G (Hotspot)	Body-Back	0.430	0.187	0.617
	Body- Left	0.062	0.187	0.249
	Body- Right	0.160	0.187	0.347
	Body- Bottom	0.137	0.187	0.324
WCDMA Band 2+ WLAN 2.4G	Head-Flat	0.025	0.373	0.398
WCDMA Band 2+ WLAN 2.4G (Hotspot)	Body-Back	0.552	0.187	0.739
	Body- Left	0.154	0.187	0.341
	Body- Right	0.049	0.187	0.236
	Body- Bottom	0.438	0.187	0.625
LTE Band 19+ WLAN 2.4G	Head-Flat	0.098	0.373	0.471
LTE Band 19+ WLAN 2.4G (Hotspot)	Body-Back	0.833	0.187	1.02
	Body- Left	0.072	0.187	0.259
	Body- Right	0.187	0.187	0.374
	Body- Bottom	0.177	0.187	0.364
LTE Band 7+ WLAN 2.4G	Head-Flat	0.090	0.373	0.463
LTE Band 7+ WLAN 2.4G (Hotspot)	Body-Back	**1.370**	0.187	**1.557**
	Body- Left	0.140	0.187	0.327
	Body- Right	0.060	0.187	0.247
	Body- Bottom	1.132	0.187	1.319
LTE Band 41+ WLAN 2.4G	Head-Flat	0.036	0.373	0.409
LTE Band 41+ WLAN 2.4G (Hotspot)	Body-Back	0.445	0.187	0.632
	Body- Left	0.040	0.187	0.227
	Body- Right	0.076	0.187	0.263
	Body- Bottom	0.461	0.187	0.648

Mode(SAR1+SAR2)	Position	Reported SAR (W/kg)		Σ SAR (W/kg)
		SAR 1	SAR 2	
GSM 850+ WLAN 5G	Head-Flat	0.130	0.322	0.452
	Body-Back-Headset	0.537	0.161	0.698
GPRS 850 + WLAN 5G (Hotspot)	Body-Back	1.029	0.161	1.19
	Body- Left	0.123	0.161	0.284
	Body- Right	0.311	0.161	0.472
	Body- Bottom	0.312	0.161	0.473
PCS1900 + WLAN 5G	Head-Flat	0.012	0.322	0.334
	Body-Back-Headset	0.426	0.161	0.587
GPRS 1900 + WLAN 5G (Hotspot)	Body-Back	0.333	0.161	0.494
	Body- Left	0.165	0.161	0.326
	Body- Right	0.056	0.161	0.217
	Body- Bottom	0.448	0.161	0.609
WCDMA Band 5+ WLAN 5G	Head-Flat	0.099	0.322	0.421
WCDMA Band 5+ WLAN 5G (Hotspot)	Body-Back	0.430	0.161	0.591
	Body- Left	0.062	0.161	0.223
	Body- Right	0.160	0.161	0.321
	Body- Bottom	0.137	0.161	0.298
WCDMA Band 2+ WLAN 5G	Head-Flat	0.025	0.322	0.347
WCDMA Band 2+ WLAN 5G (Hotspot)	Body-Back	0.552	0.161	0.713
	Body- Left	0.154	0.161	0.315
	Body- Right	0.049	0.161	0.21
	Body- Bottom	0.438	0.161	0.599
LTE Band 19+ WLAN 5G	Head-Flat	0.098	0.322	0.42
LTE Band 19+ WLAN 5G (Hotspot)	Body-Back	0.833	0.161	0.994
	Body- Left	0.072	0.161	0.233
	Body- Right	0.187	0.161	0.348
	Body- Bottom	0.177	0.161	0.338
LTE Band 7+ WLAN 5G	Head-Flat	0.090	0.322	0.412
LTE Band 7+ WLAN 5G (Hotspot)	Body-Back	1.370	0.161	1.531
	Body- Left	0.140	0.161	0.301
	Body- Right	0.060	0.161	0.221
	Body- Bottom	1.132	0.161	1.293
LTE Band 41+ WLAN 5G	Head-Flat	0.036	0.322	0.358
LTE Band 41+ WLAN 5G (Hotspot)	Body-Back	0.445	0.161	0.606
	Body- Left	0.040	0.161	0.201
	Body- Right	0.076	0.161	0.237
	Body- Bottom	0.461	0.161	0.622

Note:
1. Hotspot mode SAR is only required for the edges within 25mm from the transmitting antenna located.
2. Hotspot Mode is not feasible during voice calls.

Conclusion:
Sum of SAR: **Σ SAR < 1.6 W/kg** therefore simultaneous transmission SAR with Volume Scans is **not required**.

11 Appendix A – Measurement Uncertainty

The uncertainty budget has been determined for the DASY4 measurement system and is given in the following Table.

Below 3 GHz

DASY4 Uncertainty Budget According to IEC 62209-2								
Error Description	Uncertainty Value	Prob. Dist.	Div.	(c i) 1g	(c i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v i) veff
Measurement System								
Probe Calibration	± 6.00 %	N	1	1	1	± 6.00 %	± 6.00 %	∝
Isotropy	± 0.94 %	R	$\sqrt{3}$	1	1	± 0.54 %	± 0.54 %	∝
Linearity	± 0.3 %	R	$\sqrt{3}$	1	1	± 0.17 %	± 0.17 %	∝
Modulation Response	± 1.65 %	R	$\sqrt{3}$	1	1	± 0.95 %	± 0.95 %	∝
System Detection Limits	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∝
Boundary Effects	± 0.5 %	R	$\sqrt{3}$	1	1	± 0.29 %	± 0.29 %	∝
Readout Electronics	± 0.3 %	N	1	1	1	± 0.3 %	± 0.3 %	∝
Response Time	± 0.8 %	R	$\sqrt{3}$	1	1	± 0.5 %	± 0.5 %	∝
Integration Time	± 2.6 %	R	$\sqrt{3}$	1	1	± 1.5 %	± 1.5 %	∝
RF Ambient Noise	± 0.0 %	R	$\sqrt{3}$	1	1	± 0.0 %	± 0.0 %	∝
RF Ambient Reflections	± 3.0 %	R	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∝
Probe Positioner	± 0.4 %	R	$\sqrt{3}$	1	1	± 0.2 %	± 0.2 %	∝
Probe Positioning	± 2.9 %	R	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∝
Post-processing	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∝
Test Sample Related								
Device Holder	± 3.6 %	N	1	1	1	± 3.6 %	± 2.6 %	5
Device Positioning	± 2.9 %	N	1	1	1	± 2.9 %	± 2.9 %	145
SAR Scaling	± 0.0 %	R	$\sqrt{3}$	1	1	± 0.0 %	± 0.0 %	∝
Power Drift	± 5.0 %	R	$\sqrt{3}$	1	1	± 2.9 %	± 2.9 %	∝
Phantom and Setup								
Phantom Uncertainty	± 4.0 %	R	$\sqrt{3}$	1	1	± 2.3 %	± 2.3 %	∝
SAR Correction	± 0.0 %	N	1	1	1	± 0.0 %	± 0.0 %	∝
Liquid Conductivity (Target)	± 5.0 %	R	$\sqrt{3}$	0.64	0.43	± 1.8 %	± 1.2 %	∝
Liquid Conductivity (meas.)	± 2.5 %	N	1	0.64	0.43	± 1.6 %	± 1.1 %	∝
Liquid Permittivity (Target)	± 5.0 %	R	$\sqrt{3}$	0.6	0.49	± 1.7 %	± 1.4 %	∝
Liquid Permittivity (meas.)	± 2.5 %	N	1	0.6	0.49	± 1.5 %	± 1.2 %	∝
Combined Std. Uncertainty	-	RSS	-	-	-	± 9.32 %	± 9.23 %	330
Expanded STD Uncertainty	-	2	-	-	-	± 18.6 %	± 18.5 %	-

Below 3 GHz

DASY4 Uncertainty Budget According to IEC 62209-2								
Error Description	Uncertainty Value	Prob. Dist.	Div.	(c i) 1g	(c i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v i) veff
Measurement System								
Probe Calibration	± 6.00 %	N	1	1	1	± 6.00 %	± 6.00 %	∝
Isotropy	± 0.94 %	R	$\sqrt{3}$	1	1	± 0.54 %	± 0.54 %	∝
Linearity	± 0.3 %	R	$\sqrt{3}$	1	1	± 0.17 %	± 0.17 %	∝
Modulation Response	± 1.65 %	R	$\sqrt{3}$	1	1	± 0.95 %	± 0.95 %	∝
System Detection Limits	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∝
Boundary Effects	± 0.5 %	R	$\sqrt{3}$	1	1	± 0.29 %	± 0.29 %	∝
Readout Electronics	± 0.3 %	N	1	1	1	± 0.3 %	± 0.3 %	∝
Response Time	± 0.8 %	R	$\sqrt{3}$	1	1	± 0.5 %	± 0.5 %	∝
Integration Time	± 2.6 %	R	$\sqrt{3}$	1	1	± 1.5 %	± 1.5 %	∝
RF Ambient Noise	± 0.0 %	R	$\sqrt{3}$	1	1	± 0.0 %	± 0.0 %	∝
RF Ambient Reflections	± 3.0 %	R	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∝
Probe Positioner	± 0.4 %	R	$\sqrt{3}$	1	1	± 0.2 %	± 0.2 %	∝
Probe Positioning	± 2.9 %	R	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∝
Post-processing	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∝
Test Sample Related								
Device Holder	± 3.6 %	N	1	1	1	± 3.6 %	± 2.6 %	5
Device Positioning	± 2.9 %	N	1	1	1	± 2.9 %	± 2.9 %	145
SAR Scaling	± 0.0 %	R	$\sqrt{3}$	1	1	± 0.0 %	± 0.0 %	∝
Power Drift	± 5.0 %	R	$\sqrt{3}$	1	1	± 2.9 %	± 2.9 %	∝
Phantom and Setup								
Phantom Uncertainty	± 4.0 %	R	$\sqrt{3}$	1	1	± 2.3 %	± 2.3 %	∝
SAR Correction	± 0.0 %	N	1	1	1	± 0.0 %	± 0.0 %	∝
Liquid Conductivity (Target)	± 5.0 %	R	$\sqrt{3}$	0.64	0.43	± 1.8 %	± 1.2 %	∝
Liquid Conductivity (meas.)	± 2.5 %	N	1	0.64	0.43	± 1.6 %	± 1.1 %	∝
Liquid Permittivity (Target)	± 5.0 %	R	$\sqrt{3}$	0.6	0.49	± 1.7 %	± 1.4 %	∝
Liquid Permittivity (meas.)	± 2.5 %	N	1	0.6	0.49	± 1.5 %	± 1.2 %	∝
Combined Std. Uncertainty	-	RSS	-	-	-	± 9.32 %	± 9.23 %	330
Expanded STD Uncertainty	-	2	-	-	-	± 18.6 %	± 18.5 %	-

12 Appendix B - Probe Calibration Certificates

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

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

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

Accreditation No.: **SCS 0108**

Client **BACL**

Certificate No: **EX3-3619_Sep16**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3619
Calibration procedure(s)	QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	September 23, 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-15)	In house check: Oct-16

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

Issued: September 28, 2016

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

Certificate No: EX3-3619_Sep16 Page 1 of 11

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

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

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

Accreditation No.: SCS 0108

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).

Certificate No: EX3-3619_Sep16 Page 2 of 11

Probe EX3DV4

SN:3619

Manufactured: July 3, 2007
Calibrated: September 23, 2016

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3619

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m)^2)[A]	0.44	0.36	0.39	± 10.1 %
DCP (mV)[B]	101.0	98.1	99.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√µV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	176.2	±3.3 %
		Y	0.0	0.0	1.0		178.2	
		Z	0.0	0.0	1.0		177.1	

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:3619

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)
450	43.5	0.87	9.60	9.60	9.60	0.17	1.15	± 13.3 %
600	42.7	0.88	8.83	8.83	8.83	0.14	1.15	± 13.3 %
750	41.9	0.89	9.88	9.88	9.88	0.64	0.80	± 12.0 %
835	41.5	0.90	9.28	9.28	9.28	0.54	0.80	± 12.0 %
1750	40.1	1.37	7.56	7.56	7.56	0.30	0.80	± 12.0 %
1900	40.0	1.40	7.21	7.21	7.21	0.34	0.87	± 12.0 %
2450	39.2	1.80	6.64	6.64	6.64	0.34	0.85	± 12.0 %
2600	39.0	1.96	6.59	6.59	6.59	0.32	0.97	± 12.0 %
5250	35.9	4.71	4.52	4.52	4.52	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.00	4.00	4.00	0.50	1.80	± 13.1 %
5800	35.3	5.27	4.05	4.05	4.05	0.50	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:3619

Calibration Parameter Determined in Body Tissue Simulating Media

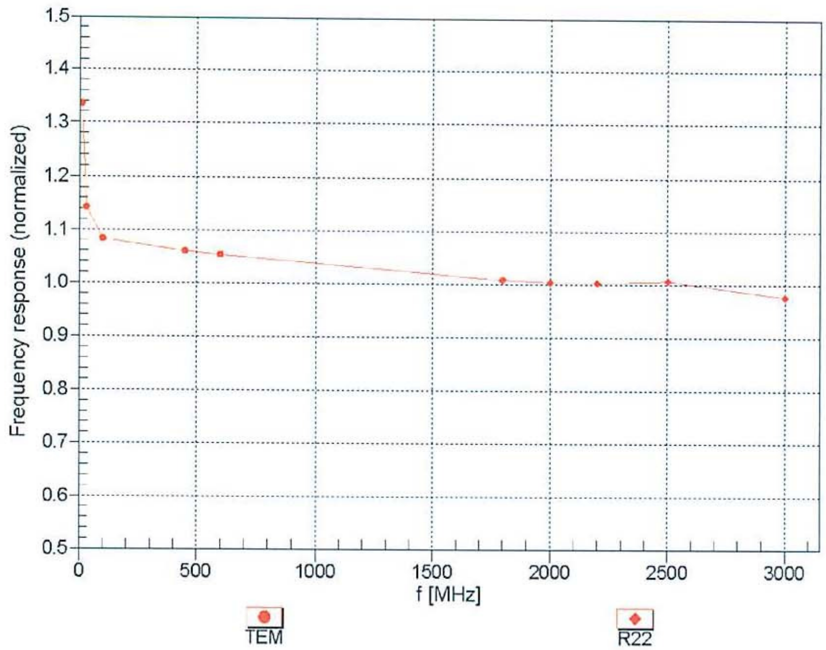
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
450	56.7	0.94	10.05	10.05	10.05	0.08	1.15	± 13.3 %
600	56.1	0.95	9.19	9.19	9.19	0.12	1.15	± 13.3 %
750	55.5	0.96	8.36	8.36	8.36	0.45	0.80	± 12.0 %
835	55.2	0.97	8.20	8.20	8.20	0.44	0.80	± 12.0 %
1750	53.4	1.49	7.26	7.26	7.26	0.27	1.05	± 12.0 %
1900	53.3	1.52	7.00	7.00	7.00	0.39	0.84	± 12.0 %
2450	52.7	1.95	6.69	6.69	6.69	0.35	0.85	± 12.0 %
2600	52.5	2.16	6.54	6.54	6.54	0.26	0.95	± 12.0 %
5250	48.9	5.36	4.05	4.05	4.05	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.39	3.39	3.39	0.60	1.90	± 13.1 %
5800	48.2	6.00	3.68	3.68	3.68	0.60	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.

EX3DV4– SN:3619 September 23, 2016

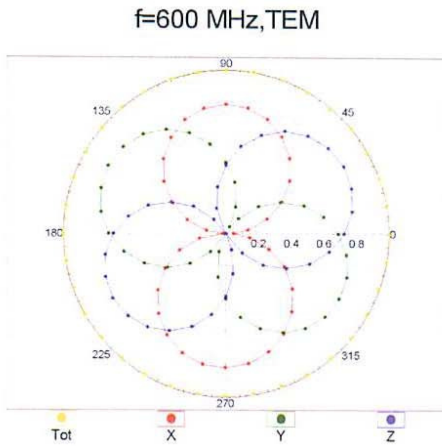
Frequency Response of E-Field

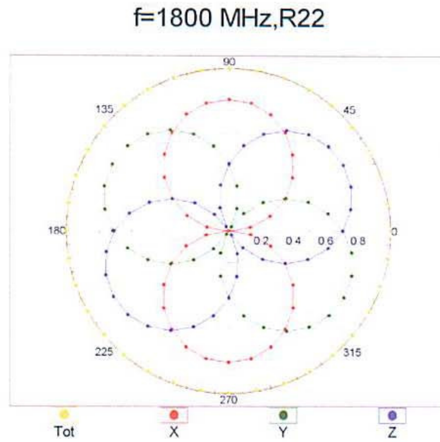
(TEM-Cell:ifi110 EXX, Waveguide: R22)

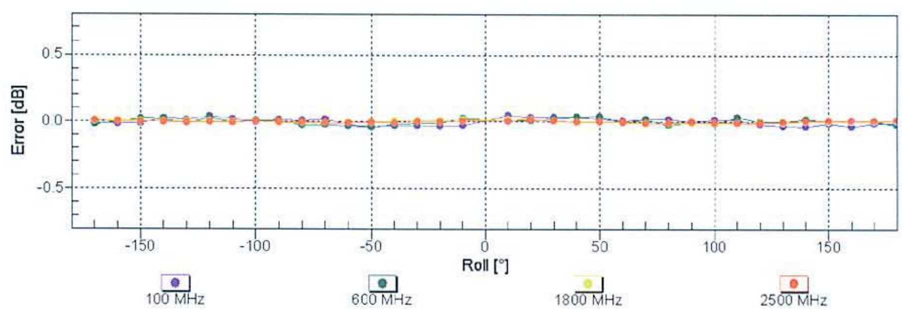


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), $\vartheta = 0°$



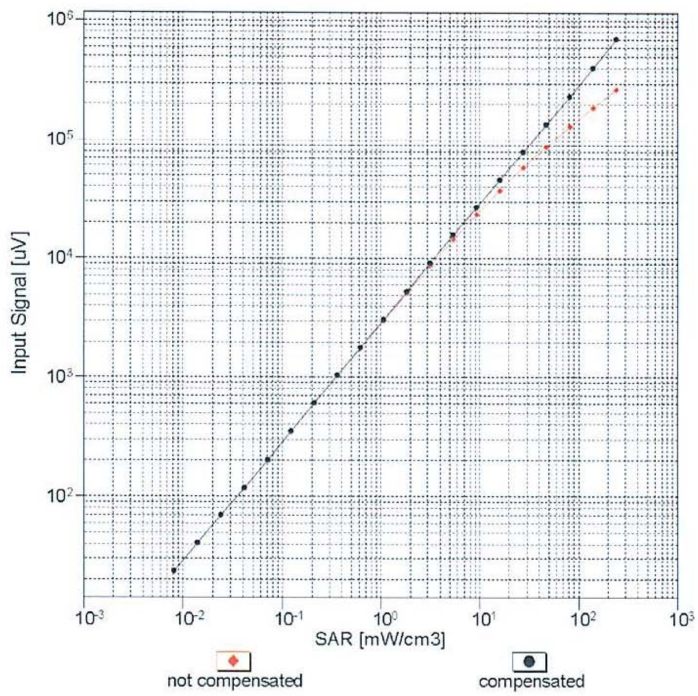


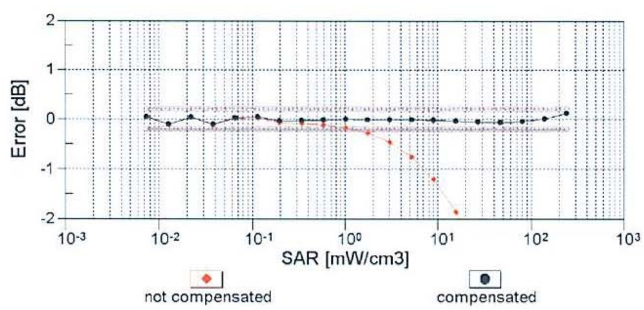


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

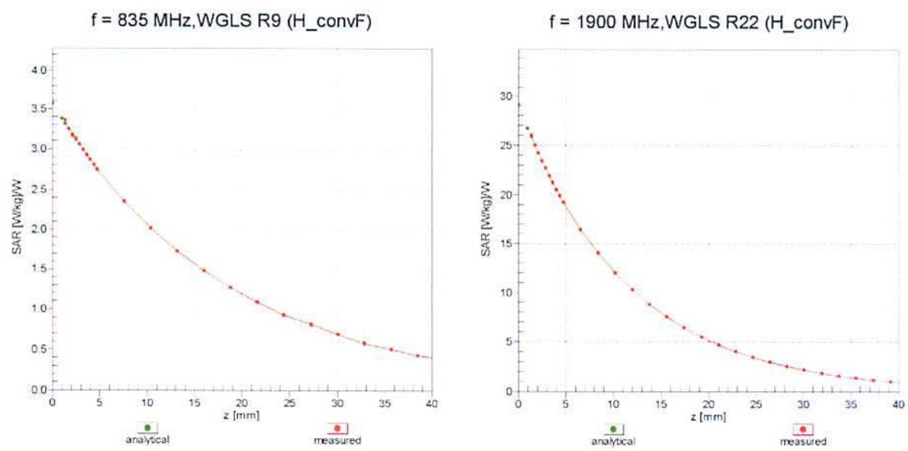
(TEM cell , f_{eval}= 1900 MHz)





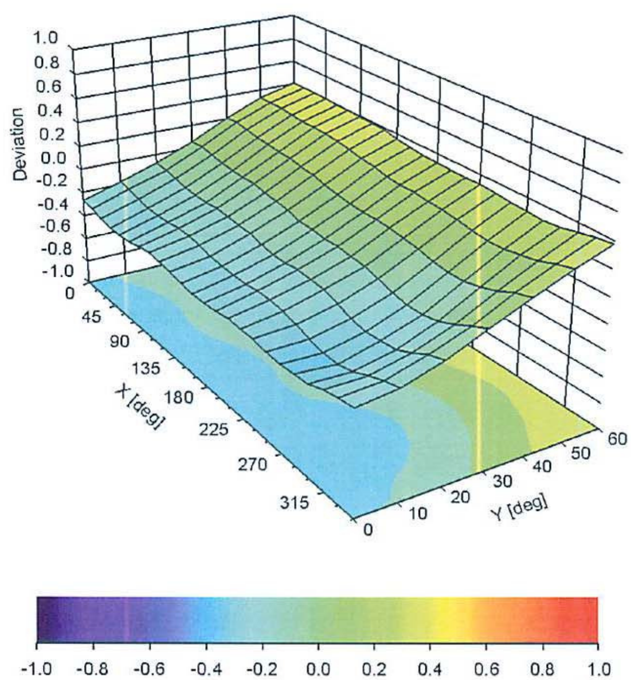
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3619

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	30
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

13 Appendix C – Dipole Calibration Certificates

NCL CALIBRATION LABORATORIES

Calibration File No: DC-1604
Project Number: BACL-dipole cal-5780

CERTIFICATE OF CALIBRATION

It is certified that the equipment identified below has been calibrated in the **NCL CALIBRATION LABORATORIES** by qualified personnel following recognized procedures and using transfer standards traceable to NRC/NIST.

Validation Dipole
835MHz Head & Body

Manufacturer: APREL Laboratories
Part number: ALS-D-835-S-2
Frequency: 835MHz
Serial No: 180-00564

Customer: Bay Area Compliance (USA)

Calibrated: 27th October 2014
Released on: 30th October 2014

This Calibration Certificate is Incomplete Unless Accompanied with the Calibration Results Summary

Released By: ______________________

Art Brennan, Quality Manager

NCL CALIBRATION LABORATORIES
303 Terry Fox Drive, Suite 102
Kanata, Ontario
CANADA K2K 3J1
Division of APREL
TEL: (613) 435-8300
FAX: (613) 435-8306

NCL Calibration Laboratories
Division of APREL Inc.

Conditions

Dipole 180-00565 was a recalibration.

Ambient Temperature of the Laboratory: 22 °C +/- 0.5°C
Temperature of the Tissue: 21 °C +/- 0.5°C

Attestation

The below named signatories have conducted the calibration and review of the data which is presented in this calibration report.

We the undersigned attest that to the best of our knowledge the calibration of this subject has been accurately conducted and that all information contained within the results pages have been reviewed for accuracy.

Art Brennan, Quality Manager

Maryna Nesterova Calibration Engineer

Primary Measurement Standards

Instrument	Serial Number	Cal due date
Tektronix USB Power Meter	11C940	May 14, 2015
Network Analyzer Anritsu 37347C	002106	Feb. 20, 2015

This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Inc.

Calibration Results Summary

The following results relate the Calibrated Dipole and should be used as a quick reference for the user.

Mechanical Dimensions and Mechanical Verification

APREL Length	APREL Height	Measured Length	Measured Height
161.0 mm	89.8 mm	161.0 mm	89.8 mm

Electrical Specification 835MHz

Tissue Type	Return Loss:	Impedance:	SWR:
Head	-28.171 dB	53.551 Ω	1.084 U
Body	-22.838 dB	57.573 Ω	1.1206 U

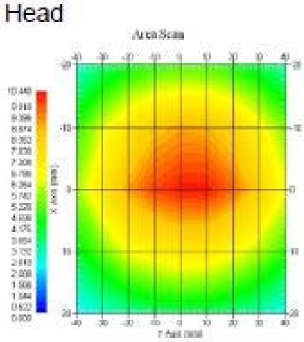
System Validation Results

Tissue	Frequency	1 Gram	10 Gram
Head	835 MHz	9.78	6.21
Body	835 MHz	9.76	6.27

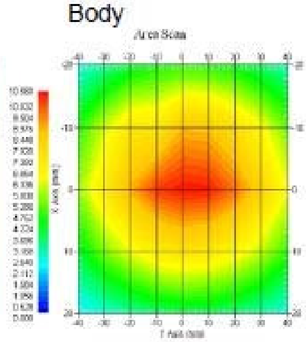
Tissue Type	Measured Epsilon (permittivity)	Measured Sigma (conductivity)
Head	43.35	0.94
Body	55.46	1.00

835MHz

Head



Body



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NCL Calibration Laboratories
Division of APREL Inc.

Introduction

This Calibration Report has been produced in line with the SSI Dipole Calibration Procedure SSI-TP-018-ALSAS. The results contained within this report are for Validation Dipole 180-00565. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 30 MHz to 6 GHz E-Field Probe Serial Number 225.

References

- SSI-TP-018-ALSAS Dipole Calibration Procedure
- SSI-TP-016 Tissue Calibration Procedure
- IEEE 1528:2013 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques"
- IEC-62209-1:2006 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"
Part 1: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 300 MHz to 3 GHz)"
- IEC-62209-2:2010 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures"
Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for hand-held devices used in close proximity of the ear (frequency range of 30 MHz to 6 GHz)"
- D28-002 Procedure for validation of SAR system using a dipole

Conditions

Ambient Temperature of the Laboratory:	22 °C +/- 0.5°C
Temperature of the Tissue:	21 °C +/- 0.5°C

Dipole Calibration uncertainty

The calibration uncertainty for the dipole is made up of various parameters presented below.

Mechanical	1%
Positioning Error	1.22%
Electrical	1.7%
Tissue	2.2%
Dipole Validation	2.2%
TOTAL	**8.32% (16.64% K=2)**

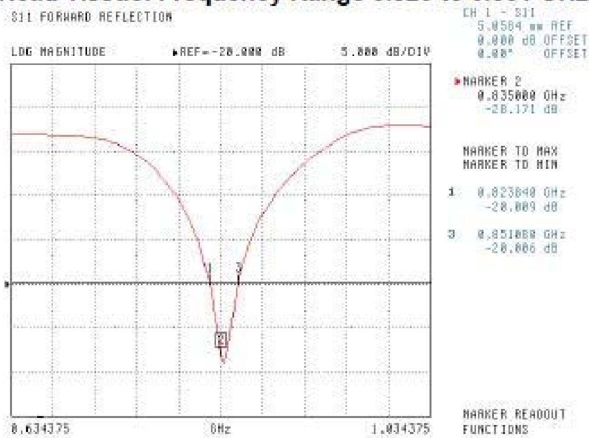
NCL Calibration Laboratories
Division of APREL Inc.

Electrical Calibration

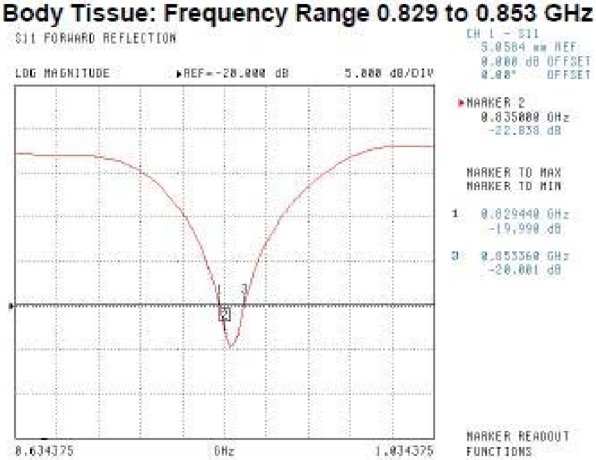
Electrical Specification 835MHz

Forward Reflection

Head Tissue: Frequency Range 0.823 to 0.851 GHz



Body Tissue: Frequency Range 0.829 to 0.853 GHz



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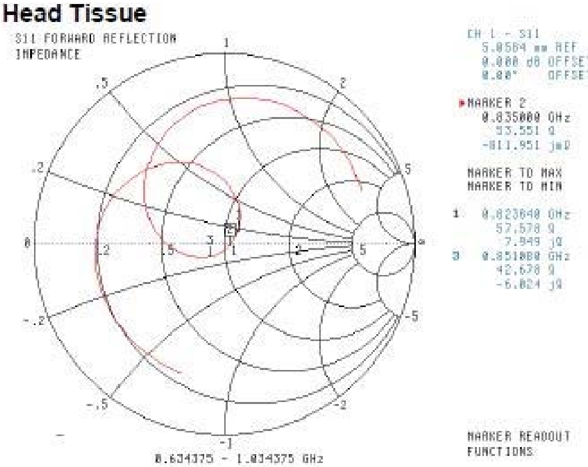
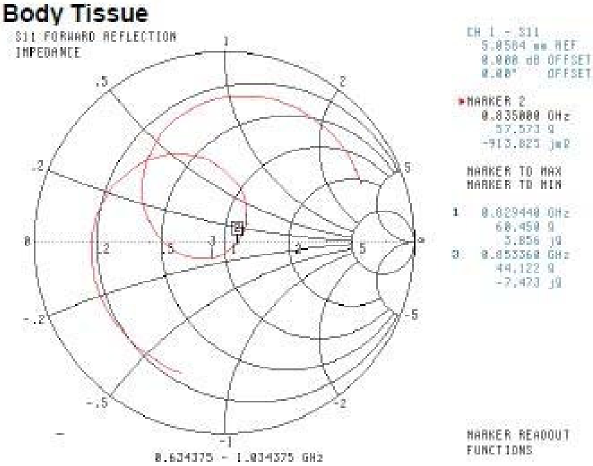
NCL Calibration Laboratories
Division of APREL Inc.

Electrical Specification 835MHz
Impedance

Head Tissue



Body Tissue



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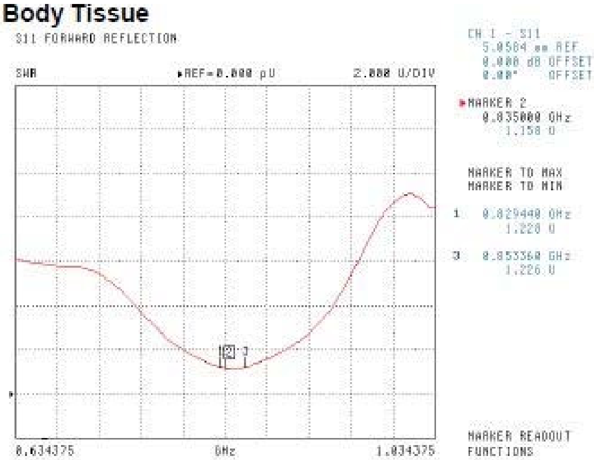
NCL Calibration Laboratories
Division of APREL Inc.

Electrical Specification 835MHz
Standing Wave Ratio

Head Tissue

Body Tissue



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Asset # 00788

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

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

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

Accreditation No.: SCS 0108

Client **BACL**

Certificate No: D1900V2-5d003_Oct15

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d003
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	October 19, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 7349	30-Dec-14 (No. EX3-7349_Dec14)	Dec-15
DAE4	SN: 601	17-Aug-15 (No. DAE4-601_Aug15)	Aug-16

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

	Name	Function	Signature
Calibrated by:	Israe Elnaouq	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: October 19, 2015

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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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**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	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	38.9 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.68 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**38.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.3 ± 6 %	1.51 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.79 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**39.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.9 Ω + 4.7 jΩ
Return Loss	- 24.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.3 Ω + 5.0 jΩ
Return Loss	- 25.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.188 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	February 14, 2002

DASY5 Validation Report for Head TSL

Date: 19.10.2015

Test Laboratory: SPEAG, Zurich, Switzerland

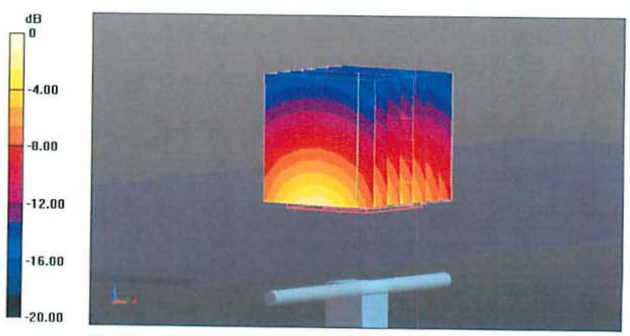
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d003

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 S/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.14, 8.14, 8.14); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

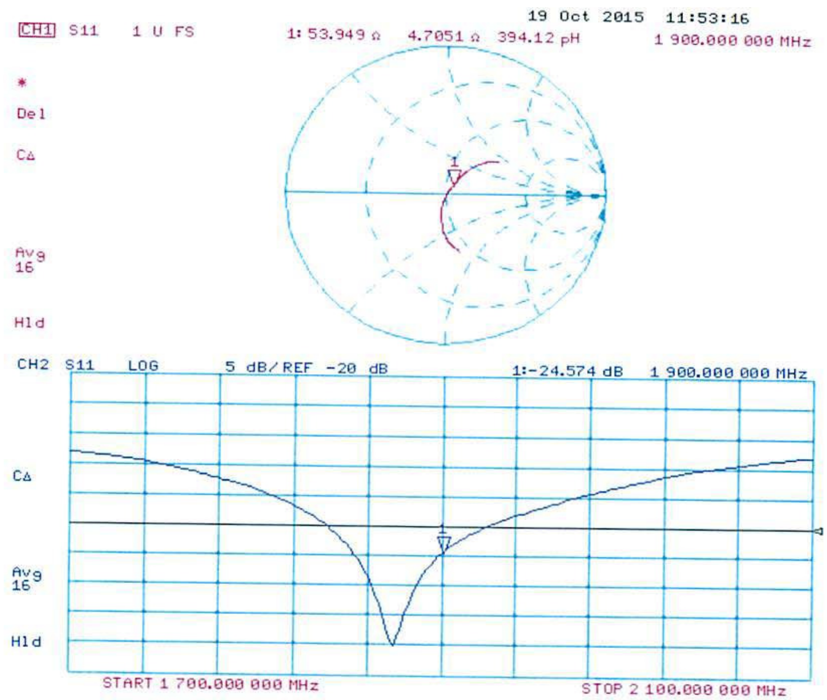
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 107.6 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 18.1 W/kg
SAR(1 g) = 9.68 W/kg; SAR(10 g) = 5.07 W/kg
Maximum value of SAR (measured) = 14.9 W/kg



0 dB = 14.9 W/kg = 11.73 dBW/kg

Certificate No: D1900V2-5d003_Oct15 Page 5 of 8

Impedance Measurement Plot for Head TSL



Certificate No: D1900V2-5d003_Oct15 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 19.10.2015

Test Laboratory: SPEAG, Zurich, Switzerland

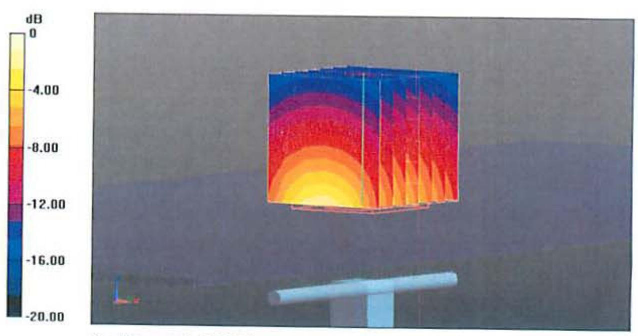
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d003

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.51 S/m; ε_r = 52.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.9, 7.9, 7.9); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

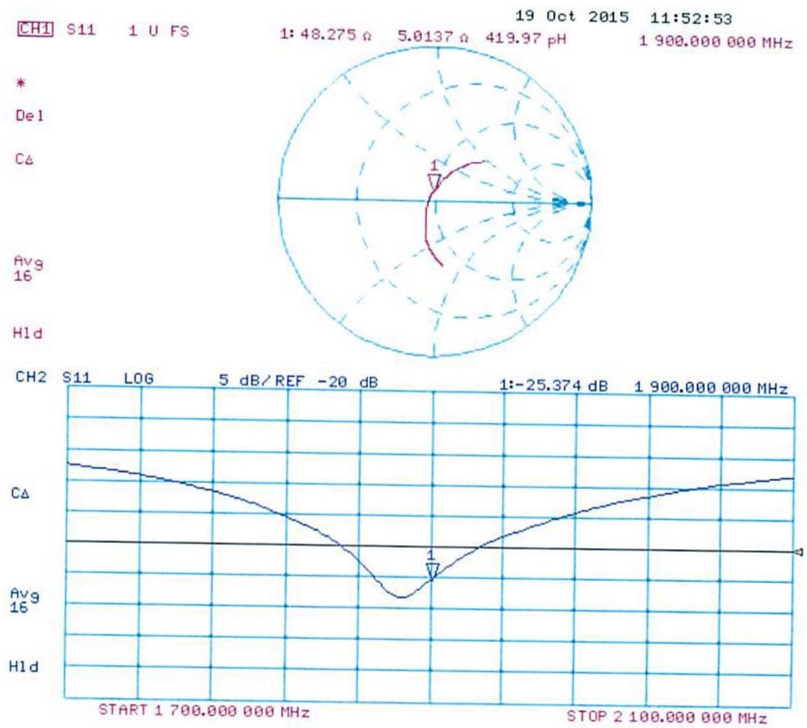
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 103.5 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 17.4 W/kg
SAR(1 g) = 9.79 W/kg; SAR(10 g) = 5.17 W/kg
Maximum value of SAR (measured) = 14.9 W/kg



0 dB = 14.9 W/kg = 11.73 dBW/kg

Certificate No: D1900V2-5d003_Oct15 Page 7 of 8

Impedance Measurement Plot for Body TSL



Certificate No: D1900V2-5d003_Oct15 Page 8 of 8

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

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The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **BACL**

Certificate No: **D2600V2-1073_Dec13**

CALIBRATION CERTIFICATE

Object	D2600V2 - SN: 1073
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	December 09, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-15
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: December 9, 2013

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

Certificate No: D2600V2-1073_Dec13 Page 1 of 8

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

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

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The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.1 ± 6 %	2.01 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**57.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.5 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.7 ± 6 %	2.20 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**55.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.18 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.6 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.3 Ω - 5.4 jΩ
Return Loss	- 25.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.7 Ω - 4.3 jΩ
Return Loss	- 23.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.148 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 17, 2013

DASY5 Validation Report for Head TSL

Date: 09.12.2013

Test Laboratory: SPEAG, Zurich, Switzerland

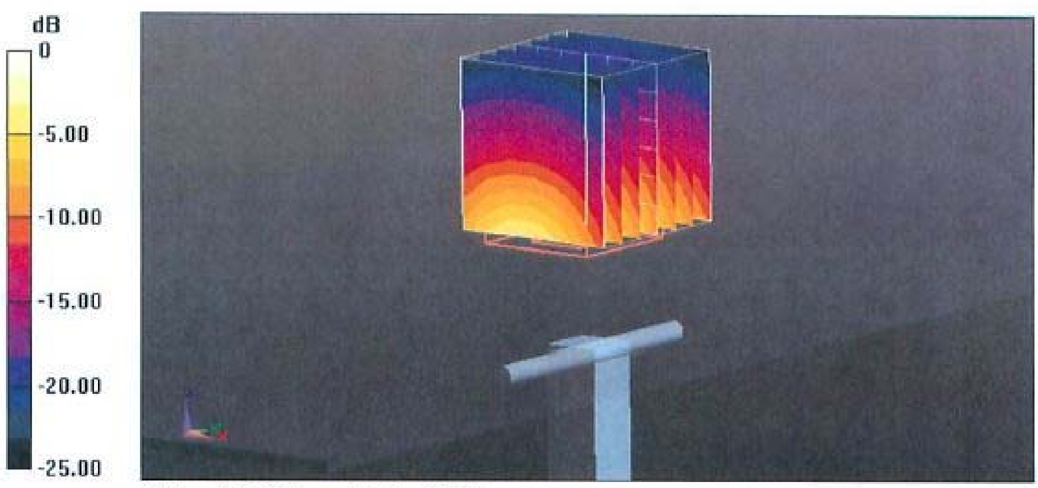
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1073

Communication System: UID 0 - CW ; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.01 S/m; ε_r = 39.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

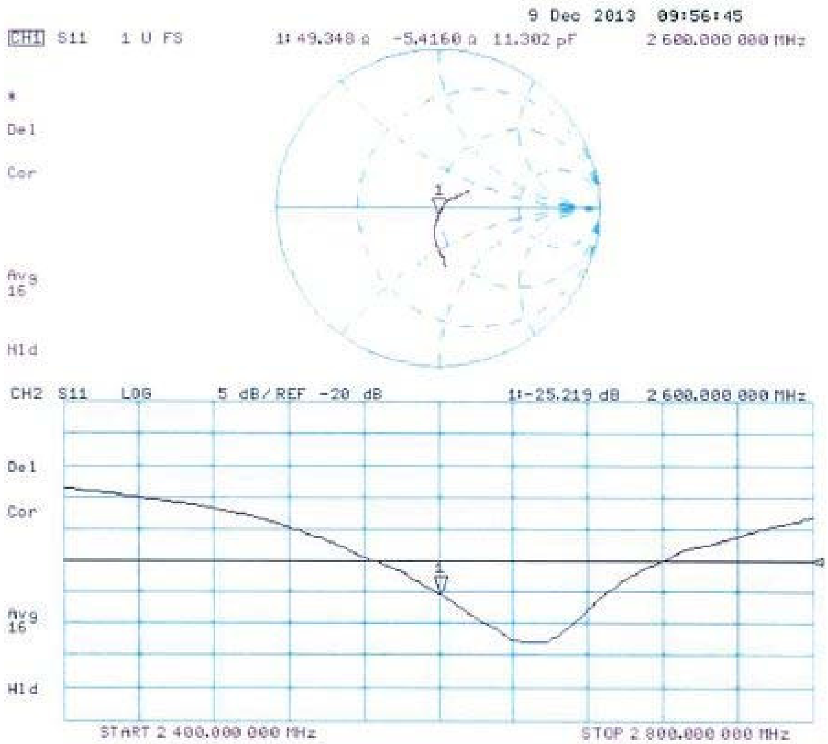
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.889 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 31.5 W/kg
SAR(1 g) = 14.5 W/kg; SAR(10 g) = 6.4 W/kg
Maximum value of SAR (measured) = 18.6 W/kg



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

Certificate No: D2600V2-1073_Dec13 Page 5 of 8

Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1073_Dec13 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 09.12.2013

Test Laboratory: SPEAG, Zurich, Switzerland

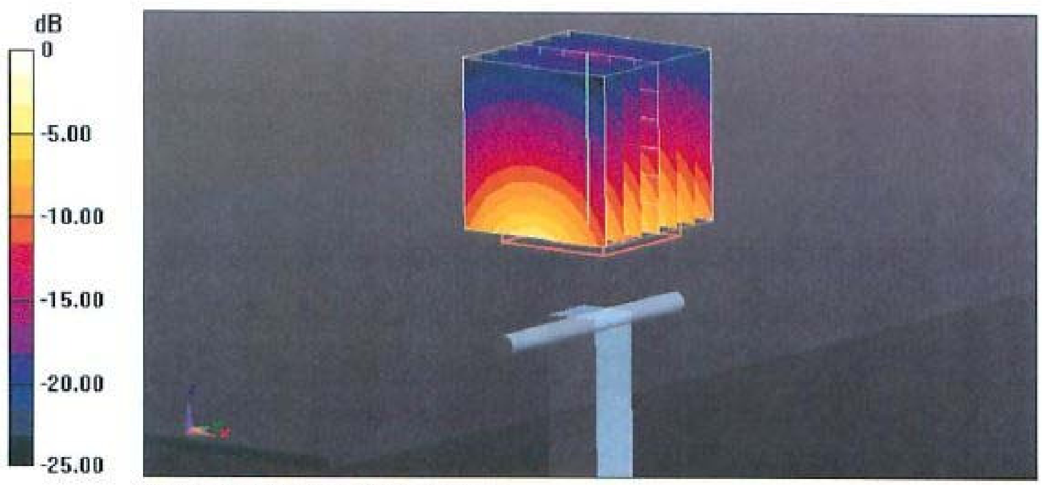
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1073

Communication System: UID 0 - CW ; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.2 S/m; ε_r = 51.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

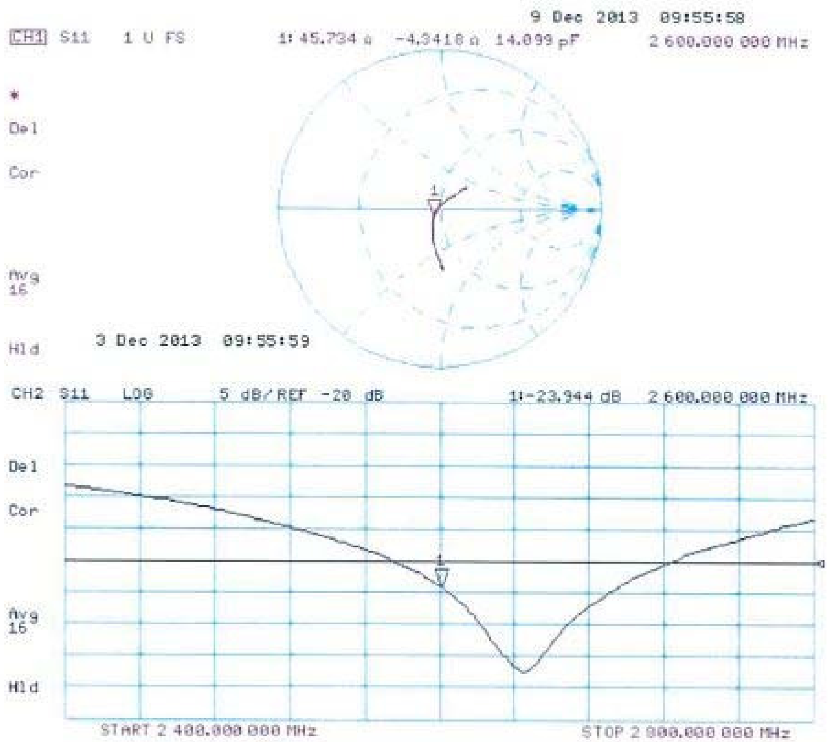
- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.902 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 30.9 W/kg
SAR(1 g) = 14 W/kg; SAR(10 g) = 6.18 W/kg
Maximum value of SAR (measured) = 18.7 W/kg



0 dB = 18.7 W/kg = 12.72 dBW/kg

Impedance Measurement Plot for Body TSL



Certificate No: D2600V2-1073_Dec13 Page 8 of 8

14 Appendix D - Test System Verifications Scans

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

835 MHz body validation

DUT: Dipole 835 MHz; Type: ALS-D-835-S-2; Serial: 180-00564

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.98 mho/m; ε_r = 54; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

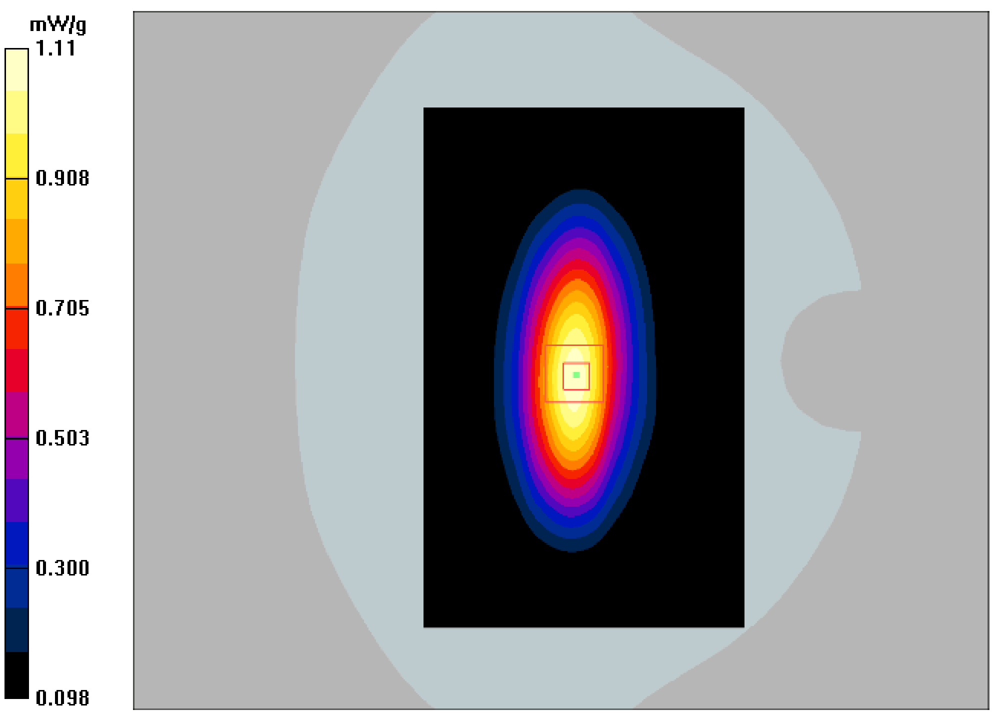
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(8.2, 8.2, 8.2); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d =15 mm, Pin = 100 mW/Area Scan (81x131x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.09 mW/g

d =15 mm, Pin = 100 mW/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 33.4 V/m; Power Drift = 0.260 dB
Peak SAR (extrapolated) = 1.55 W/kg

SAR(1 g) = 1.03 mW/g; SAR(10 g) = 0.681 mW/g
Maximum value of SAR (measured) = 1.11 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

835 MHz Head validation

DUT: Dipole 835 MHz; Type: ALS-D-835-S-2; Serial: 180-00564

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.92 mho/m; ε_r = 42.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

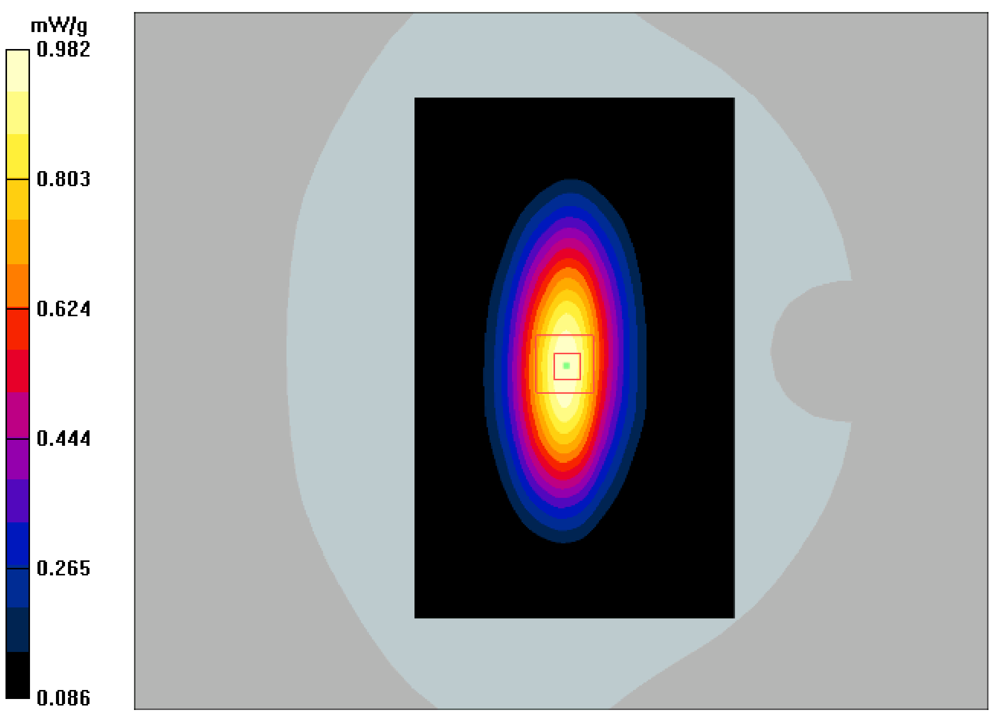
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(9.28, 9.28, 9.28); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d =15 mm, Pin = 100 mW/Area Scan (81x131x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.980 mW/g

d =15 mm, Pin = 100 mW/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 32.5 V/m; Power Drift = 0.049 dB
Peak SAR (extrapolated) = 1.37 W/kg

SAR(1 g) = 0.911 mW/g; SAR(10 g) = 0.605 mW/g
Maximum value of SAR (measured) = 0.982 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

1900 MHz Body System Validation

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d003

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.54 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

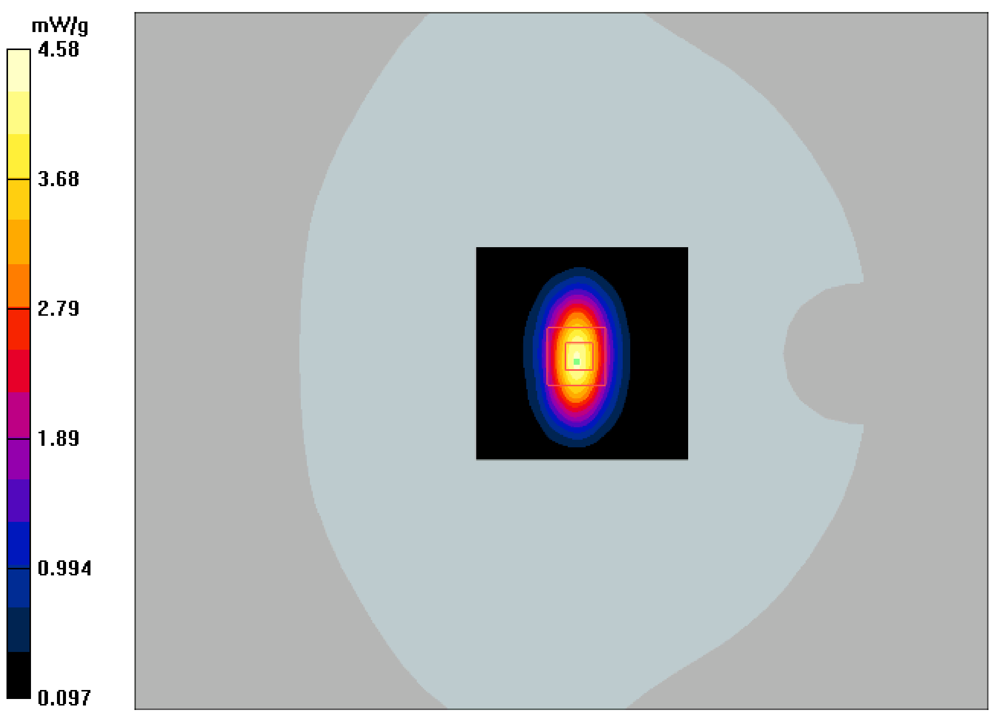
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(7, 7, 7); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d = 10mm, Pin = 0.1W/Area Scan (81x81x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 4.35 mW/g

d = 10mm, Pin = 0.1W/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 50.1 V/m; Power Drift = 0.868 dB
Peak SAR (extrapolated) = 7.70 W/kg

SAR(1 g) = 4.06 mW/g; SAR(10 g) = 2.12 mW/g
Maximum value of SAR (measured) = 4.58 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

1900 MHz Head System Validation

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d003

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.42 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

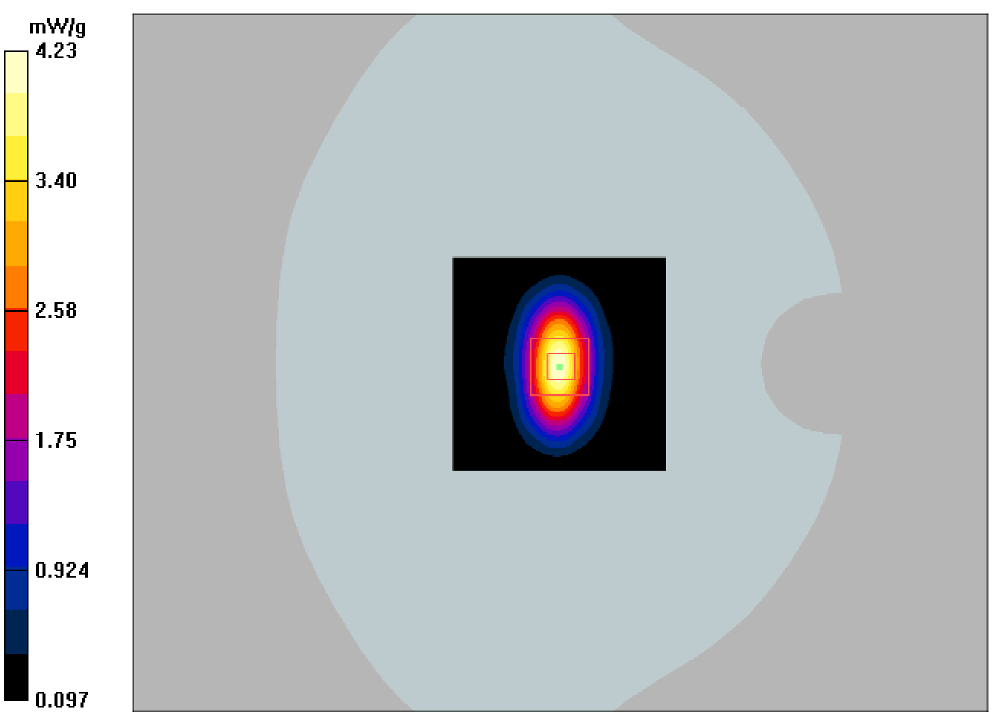
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(7.21, 7.21, 7.21); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d = 10mm, Pin = 0.1W/Area Scan (81x81x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 4.16 mW/g

d = 10mm, Pin = 0.1W/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.0 V/m; Power Drift = 0.194 dB
Peak SAR (extrapolated) = 6.96 W/kg

SAR(1 g) = 3.74 mW/g; SAR(10 g) = 1.96 mW/g
Maximum value of SAR (measured) = 4.23 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

2600 MHz Body System Validation

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1073

Communication System: CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2600 MHz; σ = 2.19 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

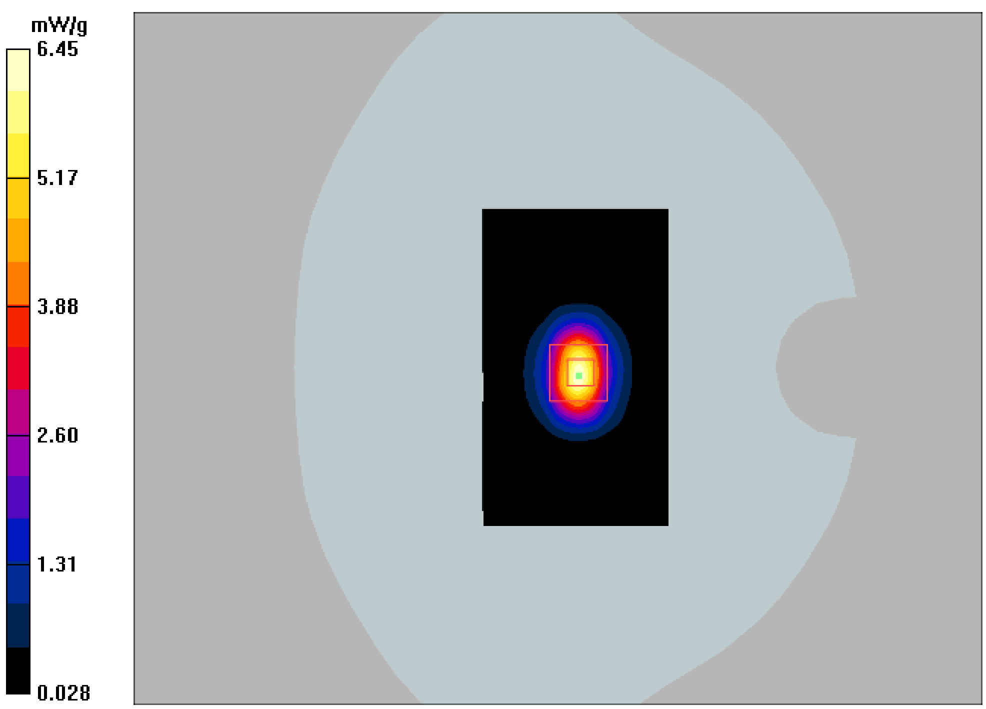
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(6.54, 6.54, 6.54); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d = 10mm, Pin = 100mW/Area Scan (71x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 6.34 mW/g

d = 10mm, Pin = 100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.9 V/m; Power Drift = 0.056 dB
Peak SAR (extrapolated) = 12.7 W/kg

SAR(1 g) = 5.63 mW/g; SAR(10 g) = 2.47 mW/g
Maximum value of SAR (measured) = 6.45 mW/g



Test Laboratory: Bay Area Compliance Lab Corp.(BACL)

2600 MHz Body System Validation

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1073

Communication System: CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2600 MHz; σ = 2.18 mho/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

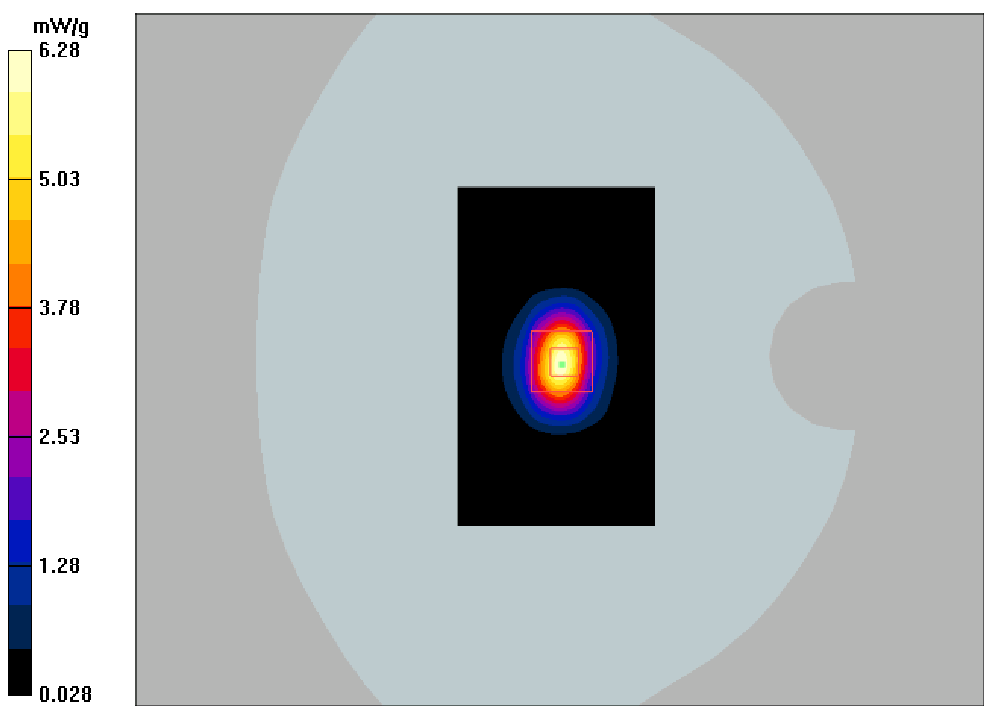
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(6.54, 6.54, 6.54); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d = 10mm, Pin = 100mW/Area Scan (71x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 6.20 mW/g

d = 10mm, Pin = 100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.8 V/m; Power Drift = -0.178 dB
Peak SAR (extrapolated) = 12.3 W/kg

SAR(1 g) = 5.47 mW/g; SAR(10 g) = 2.41 mW/g
Maximum value of SAR (measured) = 6.28 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

2600 MHz Head System Validation

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1073

Communication System: CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2600 MHz; σ = 1.98 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

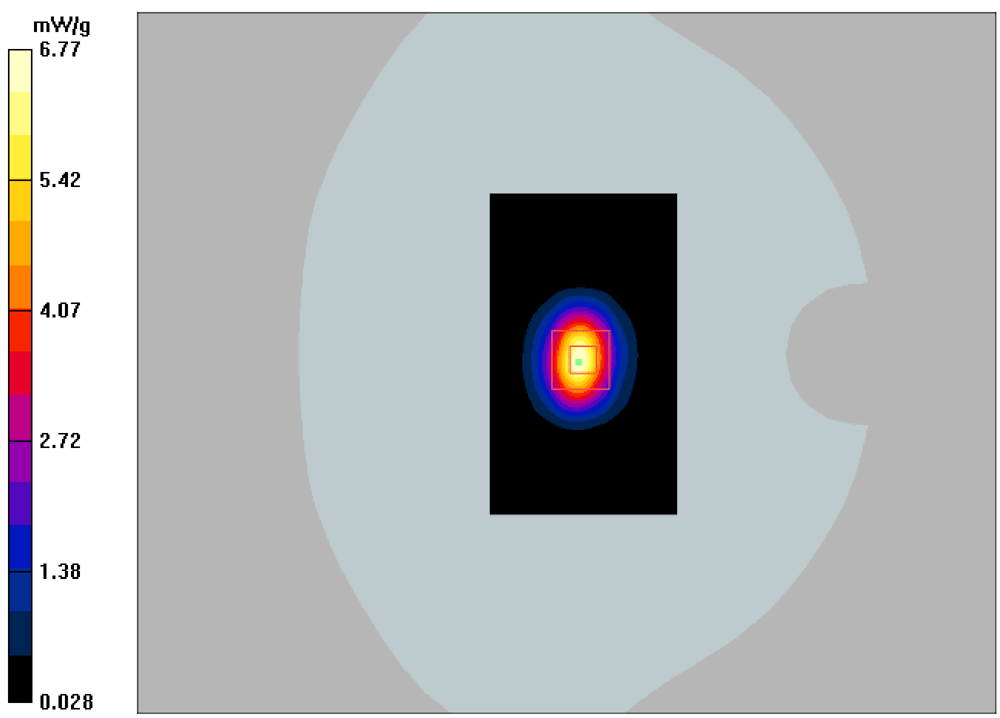
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(6.59, 6.59, 6.59); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d = 10mm, Pin = 100mW/Area Scan (71x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 6.70 mW/g

d = 10mm, Pin = 100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 60.1 V/m; Power Drift = 0.030 dB
Peak SAR (extrapolated) = 13.9 W/kg

SAR(1 g) = 5.99 mW/g; SAR(10 g) = 2.63 mW/g
Maximum value of SAR (measured) = 6.77 mW/g



15 Appendix E - EUT Scan Results

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

GSM Head Flat Mid (836.6 MHz)

DUT: Logic; Type: Mobile Phone; Serial: R16102513-1

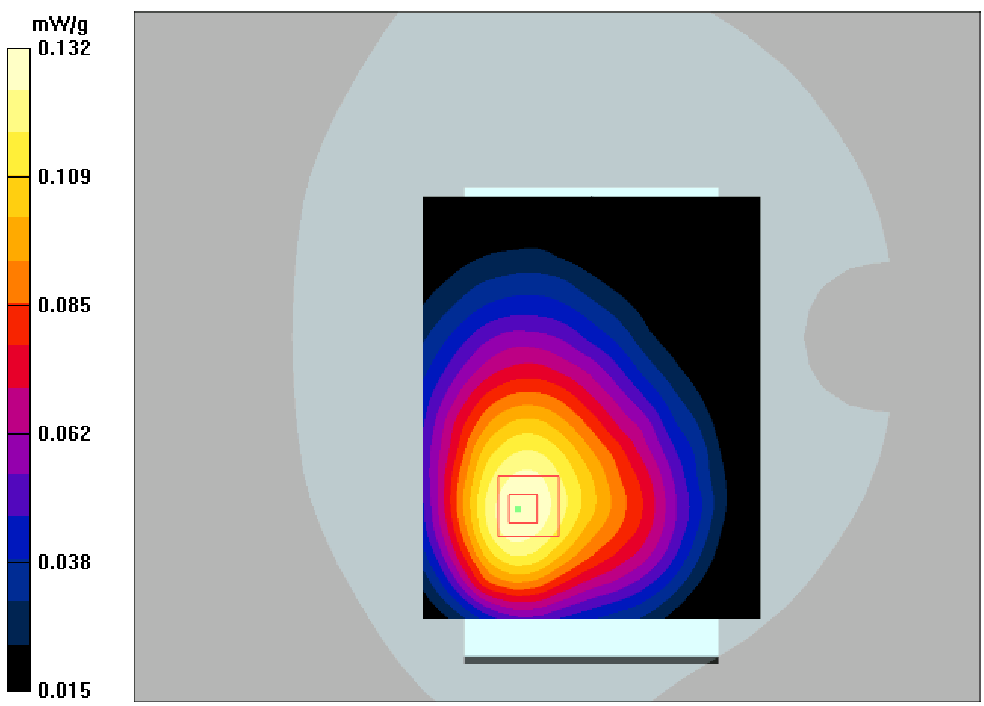
Communication System: GSM 835; Frequency: 836.6 MHz; Duty Cycle: 1:8
Medium parameters used: f = 836.6 MHz; σ = 0.92 mho/m; ε_r = 42.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(8.2, 8.2, 8.2); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Head Front to Phantom(Mid)/Area Scan (121x151x1): Measurement grid: dx=10mm, dy=10mm.
Maximum value of SAR (interpolated) = 0.132 mW/g

Head Front to Phantom(Mid)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.14 V/m; Power Drift = -0.267 dB
Peak SAR (extrapolated) = 0.164 W/kg
SAR(1 g) = 0.126 mW/g; SAR(10 g) = 0.094 mW/g
Maximum value of SAR (measured) = 0.132 mW/g



#1

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

GPRS Back 10mm High Channel (848.8 MHz)

DUT: Logic; Type: Mobile Phone; Serial: R16102513-1

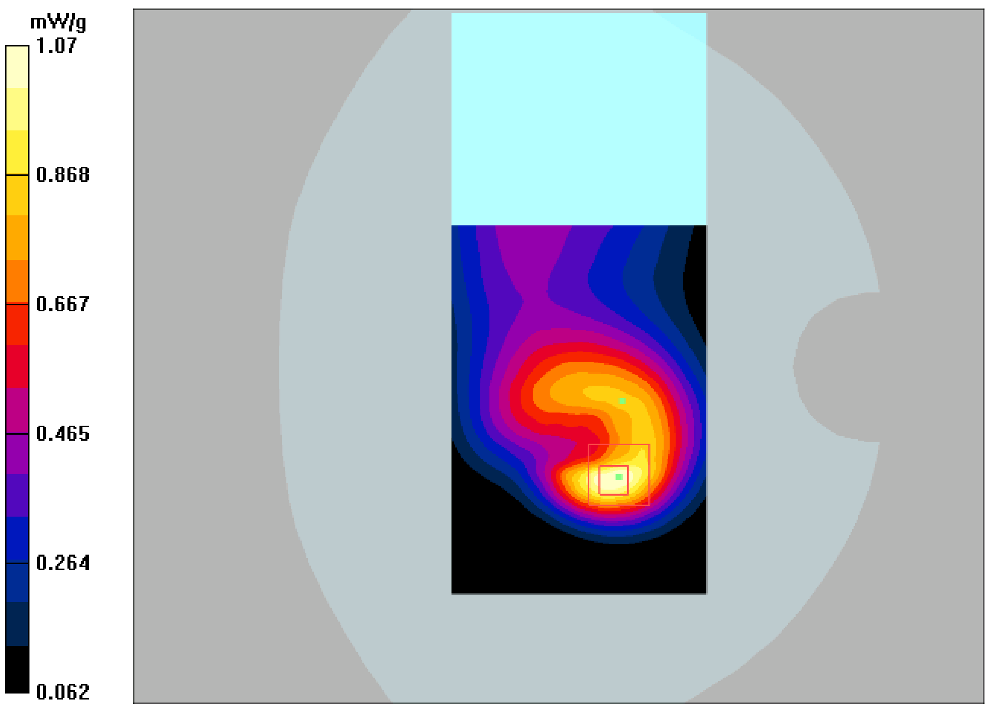
Communication System: GSM 850 4 Slot; Frequency: 848.8 MHz; Duty Cycle: 1:2
Medium parameters used: f = 848.8 MHz; σ = 0.98 mho/m; ε_r = 54.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(8.2, 8.2, 8.2); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back 10mm to the Phantom (High Channel)/Area Scan (91x131x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.07 mW/g

Back 10mm to the Phantom (High Channel)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 27.0 V/m; Power Drift = -0.003 dB
Peak SAR (extrapolated) = 1.59 W/kg
SAR(1 g) = 0.963 mW/g; SAR(10 g) = 0.574 mW/g
Maximum value of SAR (measured) = 1.07 mW/g



#2

Test Laboratory: Bay Area Compliance Lab Corp.(BACL)

GSM PCS Band Head Flat Mid (1880 MHz)

DUT: Logic; Type: Mobile Phone; Serial: R16102513-1

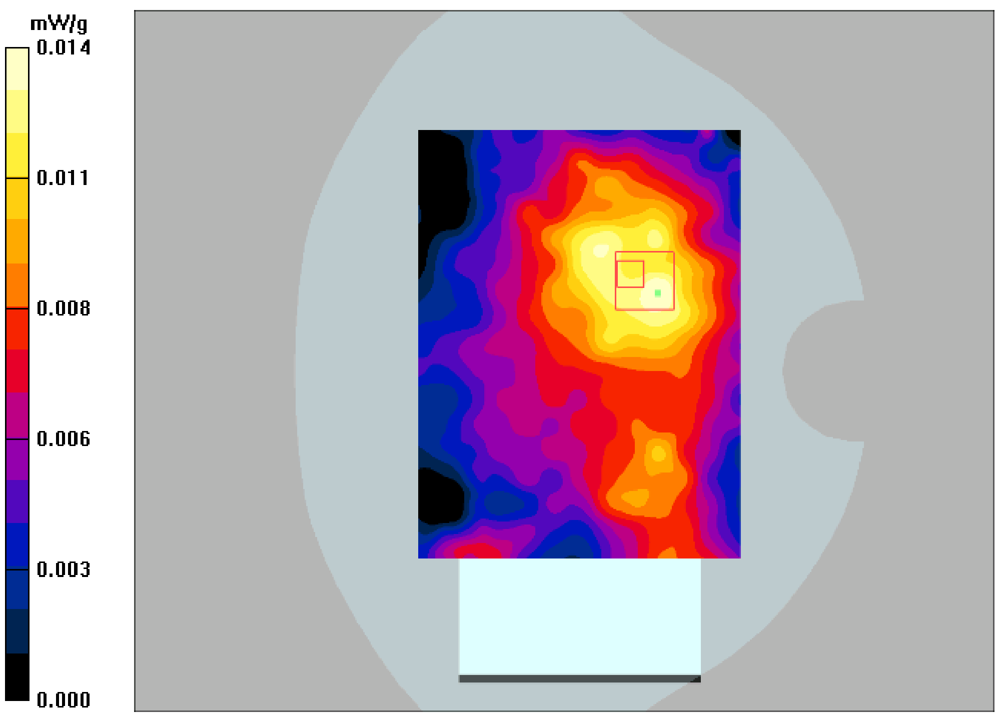
Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8
Medium parameters used: f = 1880 MHz; σ = 1.41 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(7, 7, 7); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Head Front to Phantom(Mid)/Area Scan (121x161x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.015 mW/g

Head Front to Phantom(Mid)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.28 V/m; Power Drift = -0.550 dB
Peak SAR (extrapolated) = 0.018 W/kg
SAR(1 g) = 0.012 mW/g; SAR(10 g) = 0.00648 mW/g
Maximum value of SAR (measured) = 0.014 mW/g



#3

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

GPRS PCS Band Bottom 10mm Mid Channel (1880 MHz) 2 Slots

DUT: Logic; Type: Mobile Phone; Serial: R16102513-1

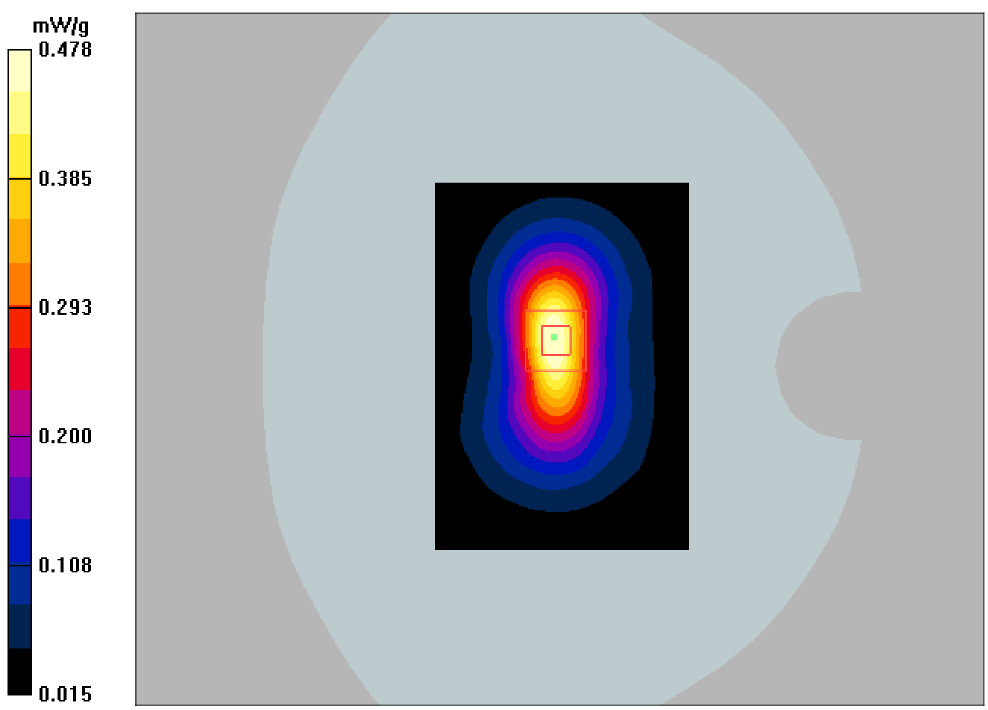
Communication System: PCS 1900 2 Slot; Frequency: 1880 MHz;Duty Cycle: 1:4
Medium parameters used: f = 1880 MHz; σ = 1.53 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(7, 7, 7); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Bottom 10mm to the Phantom (Middle Channel)/Area Scan (91x131x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.487 mW/g

Bottom 10mm to the Phantom (Middle Channel)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.5 V/m; Power Drift = 0.001 dB
Peak SAR (extrapolated) = 0.731 W/kg
SAR(1 g) = 0.432 mW/g; SAR(10 g) = 0.249 mW/g
Maximum value of SAR (measured) = 0.478 mW/g



#4

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

WCDMA Band 5 Head Flat Mid (836.6 MHz)

DUT: Logic; Type: MobilePhone; Serial: R16102513-1

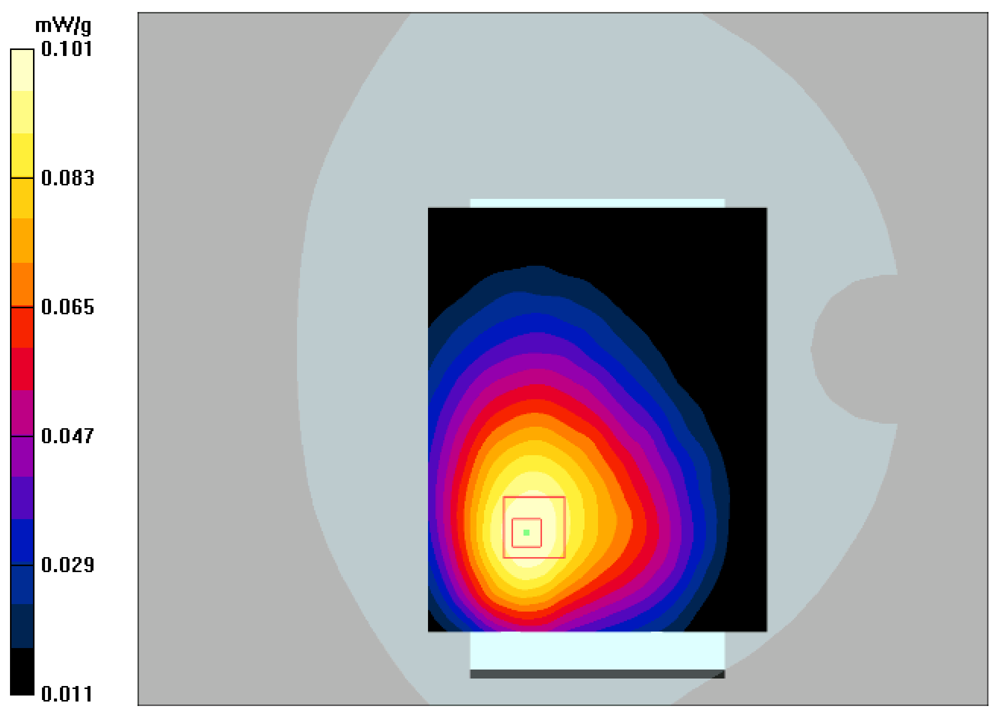
Communication System: WCDMA-850MHz; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used: f = 836.6 MHz; σ = 0.92 mho/m; ε_r = 42.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(8.2, 8.2, 8.2); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Head Front to Phantom(Mid)/Area Scan (121x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.102 mW/g

Head Front to Phantom(Mid)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.87 V/m; Power Drift = -0.152 dB
Peak SAR (extrapolated) = 0.126 W/kg
SAR(1 g) = 0.097 mW/g; SAR(10 g) = 0.073 mW/g
Maximum value of SAR (measured) = 0.101 mW/g



#5

Test Laboratory: Bay Area Compliance Lab Corp.(BA CL)

WCDMA Band 5 Back 10mm Mid Channel (836.6 MHz)

DUT: Logic; Type: Mobile Phone; Serial: R16102513-1

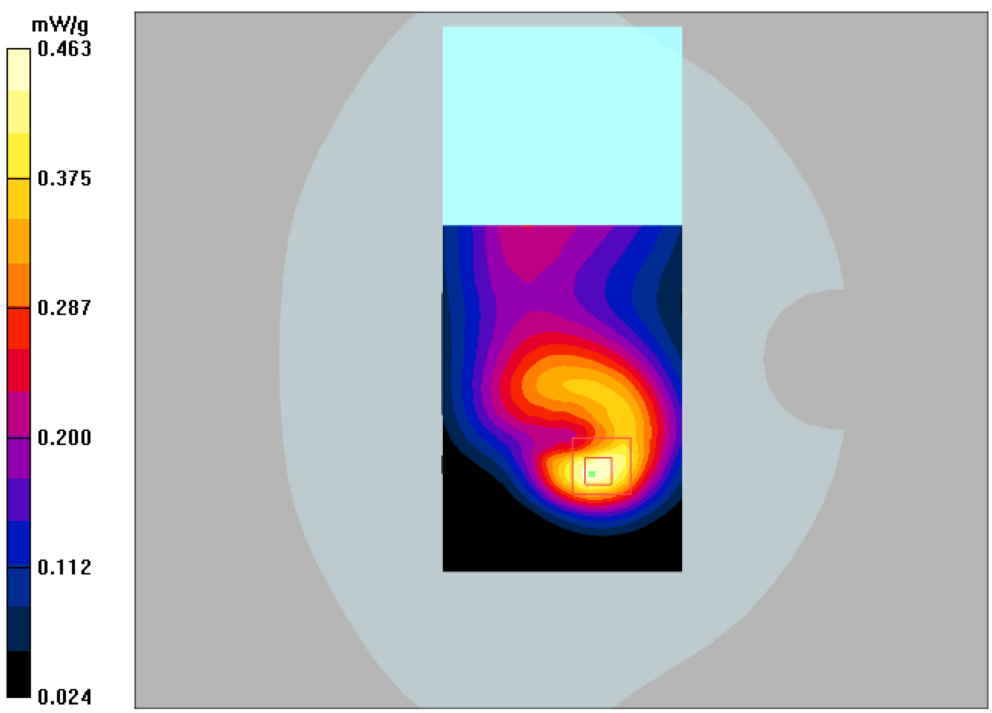
Communication System: WCDMA-850MHz; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used: f = 836.6 MHz; σ = 0.98 mho/m; ε_r = 54.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(8.2, 8.2, 8.2); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back 10mm to the Phantom (Middle Channel)/Area Scan (91x131x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.454 mW/g

Back 10mm to the Phantom (Middle Channel)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.7 V/m; Power Drift = -0.054 dB
Peak SAR (extrapolated) = 0.681 W/kg
SAR(1 g) = 0.418 mW/g; SAR(10 g) = 0.252 mW/g
Maximum value of SAR (measured) = 0.463 mW/g



#6

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

WCDMA Band 2 Head Flat Mid (1880 MHz)

DUT: Logic; Type: Mobile Phone; Serial: R16102513-1

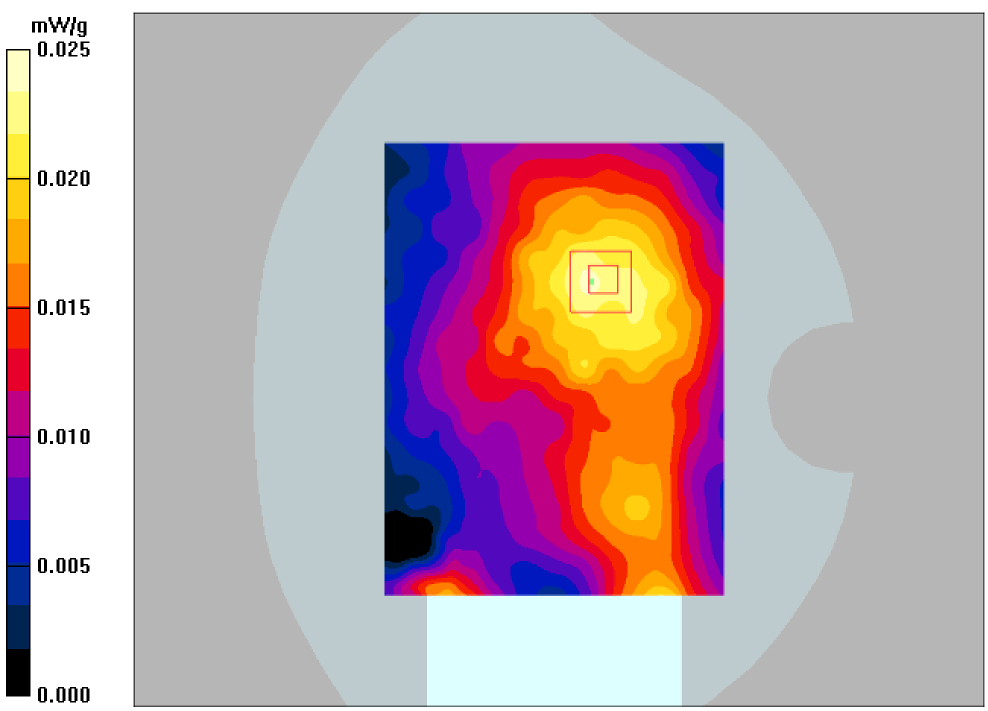
Communication System: WCDMA 1900; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.41 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(7, 7, 7); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Head Front to Phantom(Mid)/Area Scan (121x161x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.024 mW/g

Head Front to Phantom(Mid)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.99 V/m; Power Drift = 0.263 dB
Peak SAR (extrapolated) = 0.041 W/kg
SAR(1 g) = 0.023 mW/g; SAR(10 g) = 0.014 mW/g
Maximum value of SAR (measured) = 0.025 mW/g



#7

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

WCDMA Band 2 Back 10mm Mid Channel (1880 MHz)

DUT: Logic; Type: Mobile Phone; Serial: R16102513-1

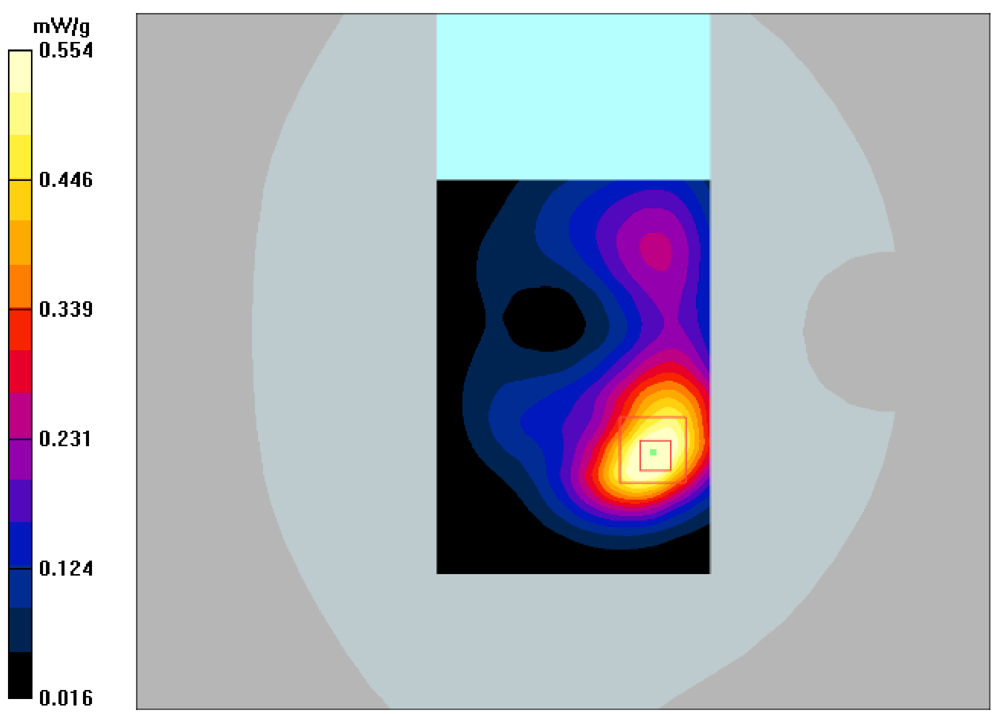
Communication System: WCDMA-1900MHz; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1880 MHz; σ = 1.53 mho/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(7, 7, 7); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back 10mm to the Phantom (Middle Channel)/Area Scan (91x131x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.592 mW/g

Back 10mm to the Phantom (Middle Channel)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.69 V/m; Power Drift = -0.123 dB
Peak SAR (extrapolated) = 0.848 W/kg
SAR(1 g) = 0.507 mW/g; SAR(10 g) = 0.297 mW/g
Maximum value of SAR (measured) = 0.554 mW/g



#8

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

LTE Band 19 Head Flat Mid (840.5 MHz) 1RB 15BW

DUT: Logic; Type: Mobile Phone; Serial: R16102513-1

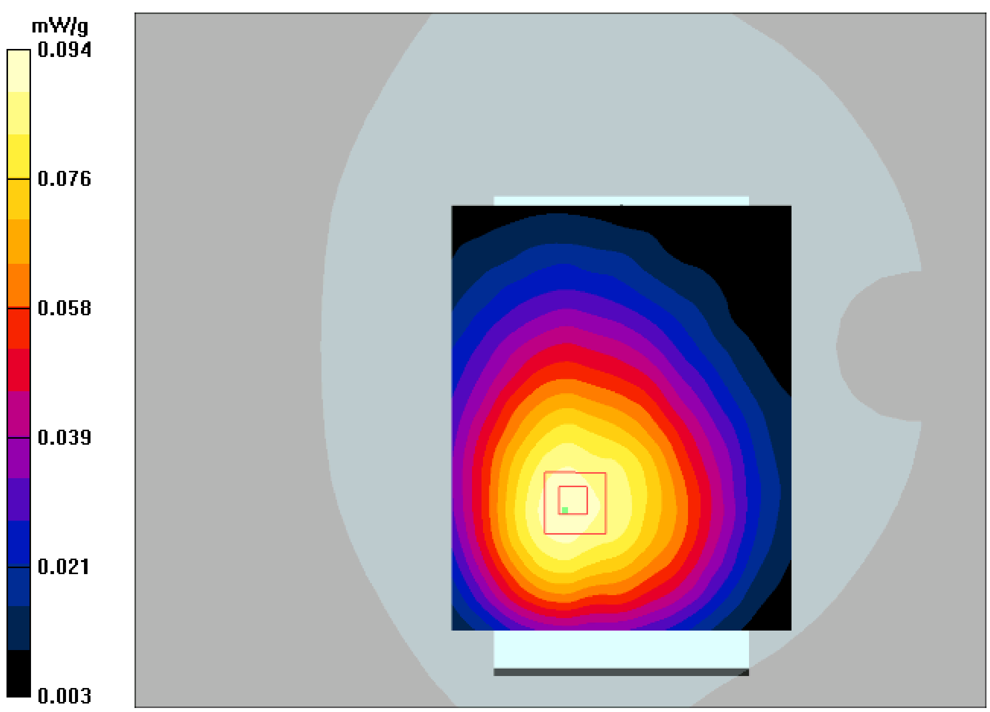
Communication System: LTE Band19; Frequency: 840.5 MHz;Duty Cycle: 1:1
Medium parameters used: f = 840.5 MHz; σ = 0.93 mho/m; ε_r = 42; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(8.2, 8.2, 8.2); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Head Front to Phantom(Mid)/Area Scan (121x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.094 mW/g

Head Front to Phantom(Mid)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.24 V/m; Power Drift = -0.724 dB
Peak SAR (extrapolated) = 0.117 W/kg
SAR(1 g) = 0.090 mW/g; SAR(10 g) = 0.068 mW/g
Maximum value of SAR (measured) = 0.094 mW/g



#9

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

LTE Band 19 Body Back 10mm Mid (840.5 MHz) 1RB 15BW

DUT: Logic; Type: Mobile Phone; Serial: R16102513-1

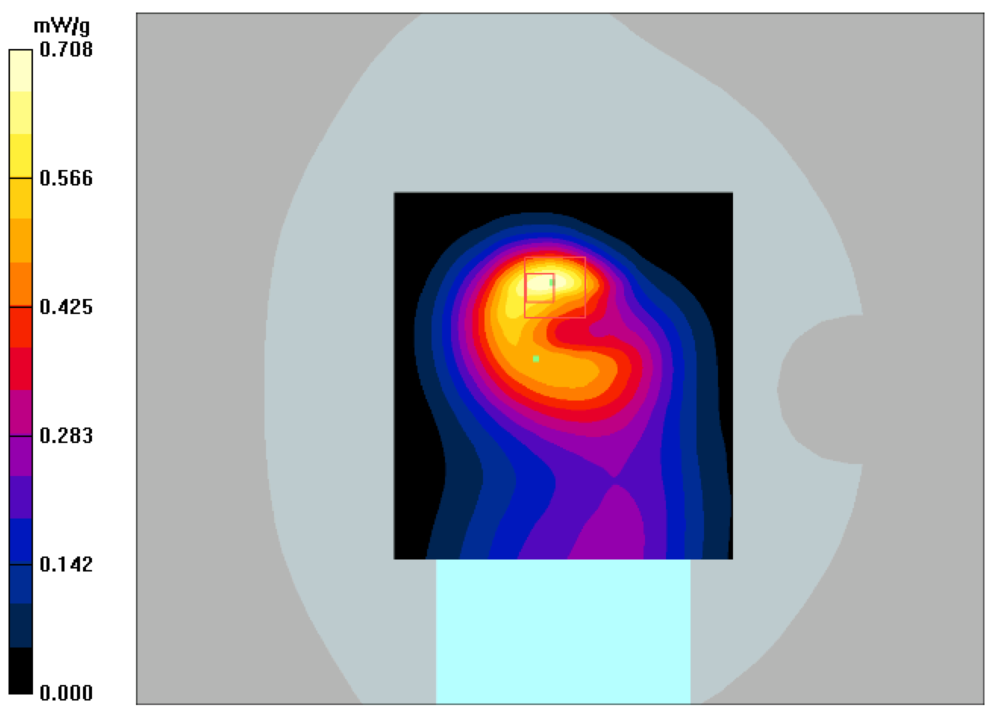
Communication System: LTE Band19; Frequency: 840.5 MHz;Duty Cycle: 1:1
Medium parameters used: f = 840.5 MHz; $\sigma = 0.99$ mho/m; $\varepsilon_r = 54.1$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(8.2, 8.2, 8.2); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back 10mm to Phantom(Mid)/Area Scan (121x131x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.700 mW/g

Back 10mm to Phantom(Mid)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 22.0 V/m; Power Drift = -0.136 dB
Peak SAR (extrapolated) = 2.05 W/kg
SAR(1 g) = 0.767 mW/g; SAR(10 g) = 0.397 mW/g
Maximum value of SAR (measured) = 0.708 mW/g



#10

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

LTE Band 7 Head Flat Mid (2535MHz) 1RB 20BW

DUT: Logic; Type: Mobile Phone; Serial: R16102513-1

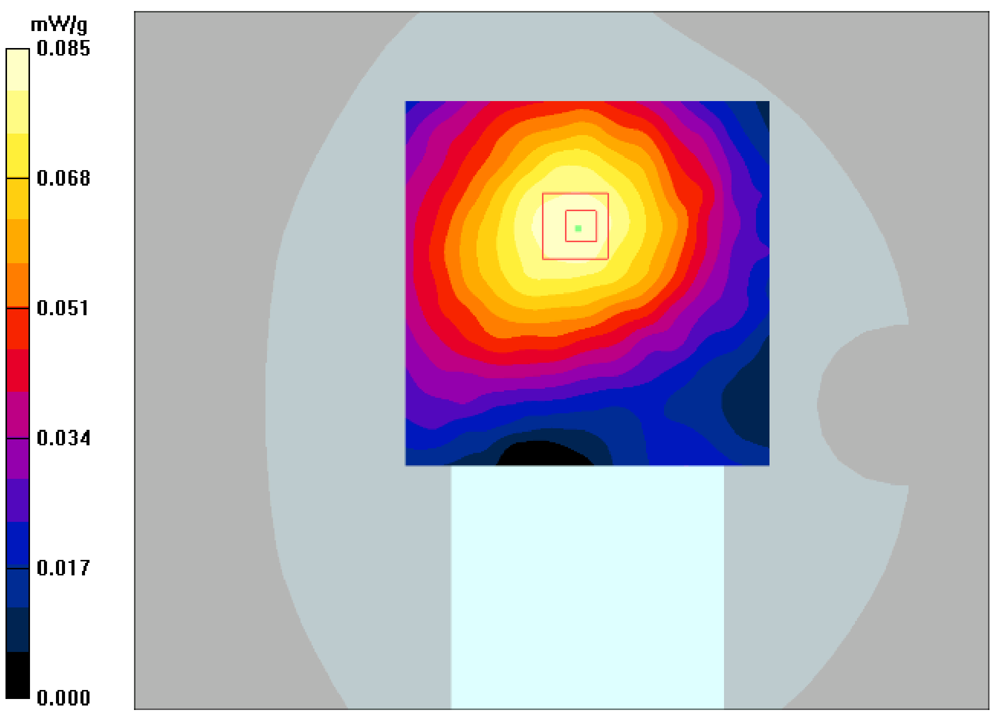
Communication System: LTE Band 7@20MHz; Frequency: 2535 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2535 MHz; σ = 1.91 mho/m; ε_r = 38.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(6.59, 6.59, 6.59); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Head Front to Phantom(Mid)/Area Scan (121x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.086 mW/g

Head Front to Phantom(Mid)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.10 V/m; Power Drift = 0.794 dB
Peak SAR (extrapolated) = 0.145 W/kg
SAR(1 g) = 0.079 mW/g; SAR(10 g) = 0.047 mW/g
Maximum value of SAR (measured) = 0.085 mW/g



#11

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

LTE Band 7 Body Back 10mm Mid (2535 MHz) 1RB 20BW

DUT: Logic; Type: Mobile Phone; Serial: R16102513-1

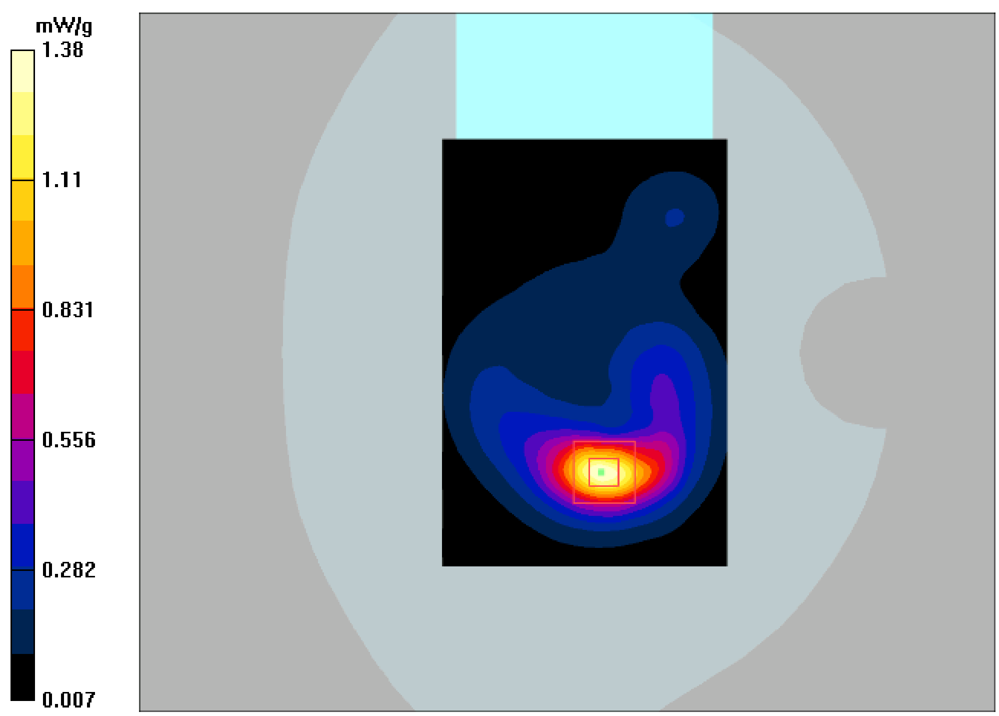
Communication System: LTE Band 7@20MHz; Frequency: 2535 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2535 MHz; σ = 2.09 mho/m; ε_r = 51.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(6.54, 6.54, 6.54); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back 10mm to Phantom(Mid)/Area Scan (101x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.37 mW/g

Back 10mm to Phantom(Mid)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.91 V/m; Power Drift = 0.067 dB
Peak SAR (extrapolated) = 2.31 W/kg
SAR(1 g) = 1.21 mW/g; SAR(10 g) = 0.580 mW/g
Maximum value of SAR (measured) = 1.38 mW/g



#12

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

LTE Band 41 Head Flat Mid (2593 MHz) 1RB 20BW

DUT: Logic; Type: Mobile Phone; Serial: R16102513-1

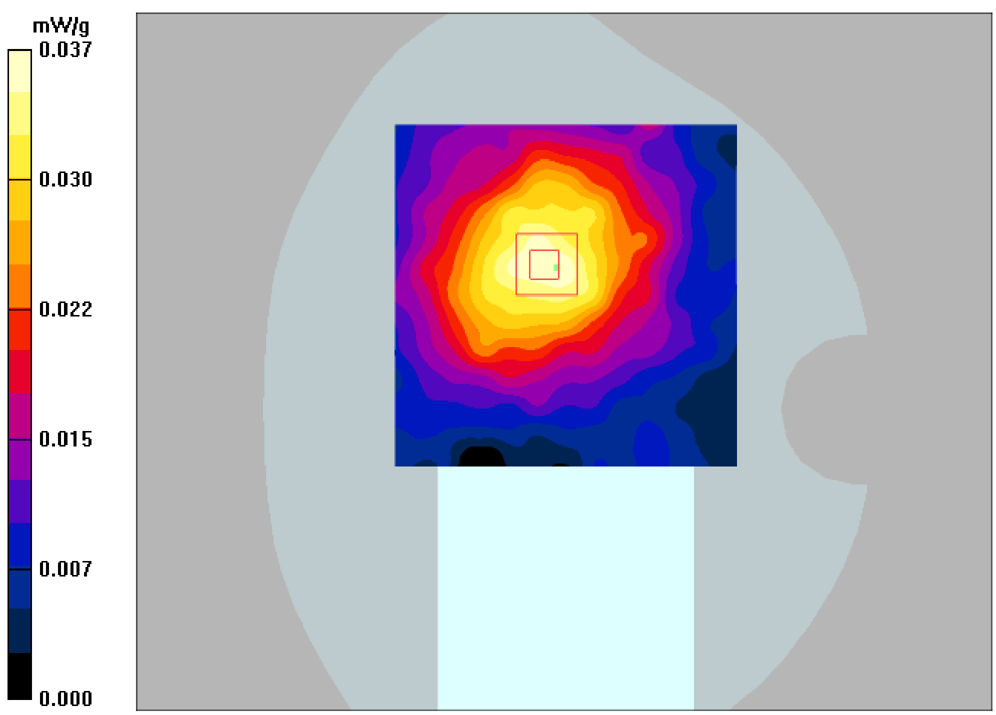
Communication System: LTE Band 41 @ 20 MHz; Frequency: 2593 MHz;Duty Cycle: 1:1.58
Medium parameters used: f = 2593 MHz; σ = 1.98 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(6.59, 6.59, 6.59); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Head Front to Phantom(Mid)/Area Scan (121x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.036 mW/g

Head Front to Phantom(Mid)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.28 V/m; Power Drift = 0.655 dB
Peak SAR (extrapolated) = 0.070 W/kg
SAR(1 g) = 0.034 mW/g; SAR(10 g) = 0.019 mW/g
Maximum value of SAR (measured) = 0.037 mW/g



#13

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

LTE Band 41 Body Bottom 10mm Mid (2593 MHz) 1RB 20BW

DUT: Logic; Type: Mobile Phone; Serial: R16102513-1

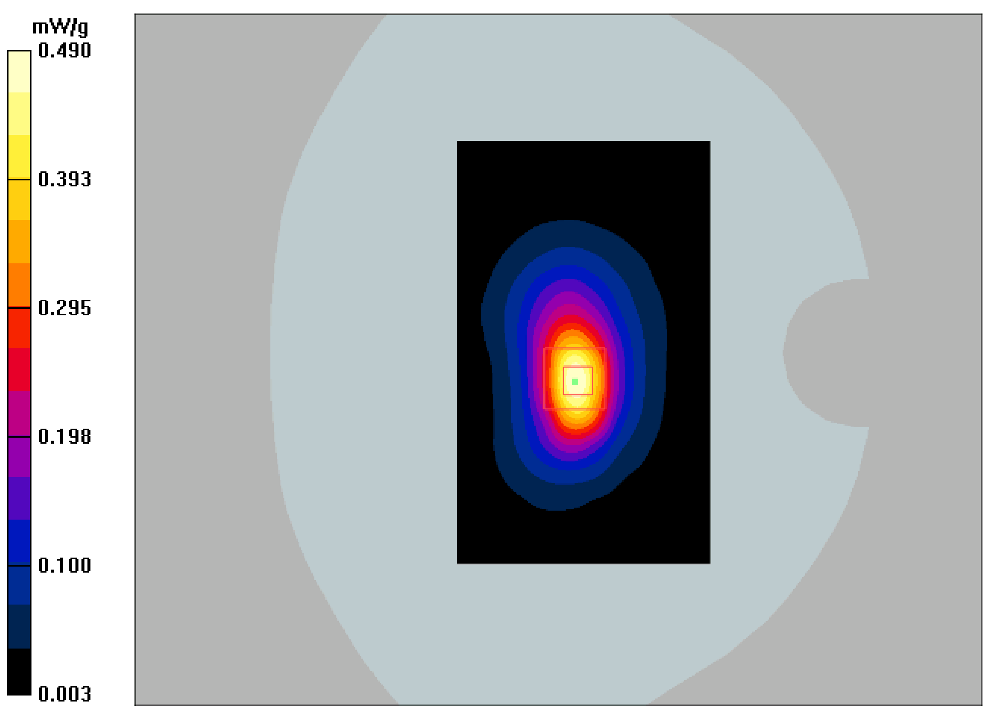
Communication System: LTE Band 41 @ 20 MHz; Frequency: 2593 MHz;Duty Cycle: 1:1.58
Medium parameters used: f = 2593 MHz; σ = 2.18 mho/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(6.54, 6.54, 6.54); Calibrated: 9/23/2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn530; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Bottom 10mm to Phantom(Mid)/Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.493 mW/g

Bottom 10mm to Phantom(Mid)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.6 V/m; Power Drift = 0.027 dB
Peak SAR (extrapolated) = 0.860 W/kg
SAR(1 g) = 0.436 mW/g; SAR(10 g) = 0.217 mW/g
Maximum value of SAR (measured) = 0.490 mW/g



#14

16 Appendix F- RF Output Power Measurement

Maximum target power include the tune-up

Max Target Power (dBm)			
Mode/Band	Channel		
	Low	Middle	High
GSM 850	32.5	32.5	32.5
GPRS 1 TX Slot	32.4	32.4	32.4
GPRS 2 TX Slot	31.6	31.6	31.6
GPRS 3 TX Slot	29.9	29.9	29.9
GPRS 4 TX Slot	29	29	29
EDGE 1 TX Slot	26.8	26.8	26.8
EDGE 2 TX Slot	26	26	26
EDGE 3 TX Slot	24	24	24
EDGE 4 TX Slot	23.3	23.3	23.3
PCS 1900	31.3	31.3	31.3
GPRS 1 TX Slot	31.2	31.2	31.2
GPRS 2 TX Slot	30.4	30.4	30.4
GPRS 3 TX Slot	28.5	28.5	28.5
GPRS 4 TX Slot	27.2	27.2	27.2
EDGE 1 TX Slot	26.7	26.7	26.7
EDGE 2 TX Slot	25.7	25.7	25.7
EDGE 3 TX Slot	23.5	23.5	23.5
EDGE 4 TX Slot	22.4	22.4	22.4
WCDMA Band 5	22.2	22.2	22.2
HSDPA	21.2	21.2	21.2
HSUPA	21.2	21.2	21.2
DC-HSDPA	21.1	21.1	21.1
HSPA+	21	21	21
WCDMA Band 2	22.8	22.8	22.8
HSDPA	21.6	21.6	21.6
HSUPA	21.9	21.9	21.9
DC-HSDPA	21.9	21.9	21.9
HSPA+	21.8	21.8	21.8
LTE Band 19	22.7	22.7	22.7
LTE Band 7	23	23	23
LTE Band 41	22.9	22.9	22.9

Max Target Power (dBm)			
Mode/Band	Channel		
	Low	Middle	High
WLAN 2.4G (802.11b)	9.5	9.5	9.5
WLAN 2.4G (802.11g)	6.4	6.4	6.4
WLAN 2.4G (802.11n20)	9.2	9.2	9.2
WLAN 2.4G (802.11n40)	6.4	6.4	6.4
WLAN 5.2G (802.11a)	7	7	7
WLAN 5.2G (802.11n20)	7	7	7
WLAN 5.2G (802.11n40)	7	7	7
WLAN 5.2G (802.11ac80)	7	7	7
WLAN 5.8G (802.11a)	7	7	7
WLAN 5.8G (802.11n20)	7	7	7
WLAN 5.8G (802.11n40)	7	7	7
WLAN 5.8G (802.11ac80)	7	7	7
Bluetooth BDR/EDR	-0.4	-0.4	-0.4
Bluetooth LE	-5.4	-5.4	-5.4

RF Output Power Measurement Results

GSM:

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)
GSM 850	128	824.2	**32.37**
	190	836.6	32.35
	251	848.8	32.22
PCS 1900	512	1850.2	30.91
	661	1880	**31.18**
	810	1909.8	31.11

GPRS:

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot(s)	2 slots(s)	3 slot(s)	4 slot(s)
GSM 850	128	824.2	32.29	31.52	29.82	28.93
	190	836.6	32.2	31.33	29.52	28.8
	251	848.8	32.28	31.39	29.49	28.71
PCS 1900	512	1850.2	30.8	29.93	27.68	26.38
	661	1880	31.08	30.24	28.35	27
	810	1909.8	31.09	30.25	28.42	27.1

EGPRS:

Band	Channel No.	Frequency (MHz)	RF Output Power (dBm)			
			1 slot(s)	2 slots(s)	3 slot(s)	4 slot(s)
GSM 850	128	824.2	26.71	25.89	23.93	23.18
	190	836.6	26.31	25.34	23.69	22.65
	251	848.8	26.05	24.95	23.3	22.24
PCS 1900	512	1850.2	25.45	24.21	22.13	21.09
	661	1880	26.27	25.27	23.13	21.85
	810	1909.8	26.63	25.58	23.41	22.3

For SAR, the time based average power is relevant, the difference in between depends on the duty cycle of the TDMA signal.

Number of Time slot	1	2	3	4
Duty Cycle	1:8	1:4	1:2.66	1:2
Time based Ave. power compared to slotted Ave. power	-9 dB	-6 dB	-4.25 dB	-3 dB
Crest Factor	8	4	2.66	2

The time based average power for GPRS

Band	Channel No.	Frequency (MHz)	Time based average Power (dBm)			
			1 slot(s)	2 slot(s)	3 slot(s)	4 slot(s)
GSM 850	128	824.2	23.29	25.52	25.57	**25.93**
	190	836.6	23.2	25.33	25.27	25.8
	251	848.8	23.28	25.39	25.24	25.71
PCS 1900	512	1850.2	21.8	23.93	23.43	23.38
	661	1880	22.08	24.24	24.1	24
	810	1909.8	22.09	**24.25**	24.17	24.1

The time based average power for EGPRS

Band	Channel No.	Frequency (MHz)	Time based average Power (dBm)			
			1 slot(s)	2 slot(s)	3 slot(s)	4 slot(s)
GSM 850	128	824.2	17.71	19.89	19.68	20.18
	190	836.6	17.31	19.34	19.44	19.65
	251	848.8	17.05	18.95	19.05	19.24
PCS 1900	512	1850.2	16.45	18.21	17.88	18.09
	661	1880	17.27	19.27	18.88	18.85
	810	1909.8	17.63	19.58	19.16	19.3

WCDMA:

Results (12.2 kbps RMC)

Band	Frequency (MHz)	RF Output Power (dBm)
WCDMA Band 5	826.4	22.02
	836.6	**22.08**
	846.6	21.94
WCDMA Band 2	1852.4	22.11
	1880	22.43
	1907.6	**22.69**

Results (HSDPA)

Band	Frequency (MHz)	RF Output Power (dBm)			
		Subset 1	Subset 2	Subset 3	Subset 4
WCDMA Band 5	826.4	20.91	21.02	20.87	20.71
	836.6	20.83	20.9	20.96	20.89
	846.6	21.1	21.04	20.94	20.93
WCDMA Band 2	1852.4	20.94	21.03	20.78	20.93
	1880	21.45	21.34	21.51	21.39
	1907.6	21.54	21.37	21.48	21.35

Results (HSUPA)

Band	Frequency (MHz)	RF Output Power (dBm)				
		Subset 1	Subset 2	Subset 3	Subset 4	Subset 5
WCDMA Band 5	826.4	20.93	21.05	20.86	20.88	20.91
	836.6	20.82	20.82	20.79	20.81	20.94
	846.6	21.11	21.04	20.93	20.82	20.82
WCDMA Band 2	1852.4	20.74	20.88	21.06	20.89	21.07
	1880	21.52	21.42	21.57	21.44	21.43
	1907.6	21.69	21.57	21.46	21.48	21.76

Results (DC-HSDPA)

Band	Frequency (MHz)	RF Output Power (dBm)			
		Subset 1	Subset 2	Subset 3	Subset 4
WCDMA Band 5	826.4	20.79	20.85	20.76	20.89
	836.6	20.68	21.02	21.04	20.93
	846.6	20.66	20.67	20.67	20.7
WCDMA Band 2	1852.4	21.07	21.13	21.11	20.97
	1880	21.46	21.22	21.31	21.5
	1907.6	21.57	21.78	21.47	21.59

Results (HSPA+)

Band	Frequency (MHz)	RF Output Power (dBm)
WCDMA Band 5	826.4	20.75
	836.6	20.92
	846.6	20.82
WCDMA Band 2	1852.4	20.88
	1880	21.4
	1907.6	21.73

LTE Band 19:

Test Bandwidth	Test Modulation	Resource Block & RB offset	Target MPR	Meas MPR	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
5 MHz	QPSK	1#0	0	0	22.46	22.06	22.13
		1#12	0	0	22.36	22.2	22.39
		1#24	0	0	22.26	22.09	22.31
		12#0	1	1	22.17	22.13	21.96
		12#6	1	1	22.35	22.28	22.26
		12#11	1	1	22.22	21.89	22.12
		25#0	1	1	21.12	21.07	21.19
	16-QAM	1#0	1	1	21.61	21.38	21.65
		1#12	1	1	21.65	21.16	21.62
		1#24	1	1	21.75	21.32	21.62
		12#0	2	2	21.71	21.29	21.44
		12#6	2	2	21.62	21.28	21.54
		12#11	2	2	21.99	21.42	21.64
		25#0	2	2	20.14	20.25	20.22
10 MHz	QPSK	1#0	0	0	22.25	22.07	22.31
		1#24	0	0	22.16	21.95	22.02
		1#49	0	0	22.03	22.03	22.18
		25#0	1	1	22.05	22.08	22.24
		25#12	1	1	22.46	22.22	22.23
		25#24	1	1	22.47	22.22	22.36
		50#0	1	1	21.14	21.35	21.39
	16-QAM	1#0	1	1	21.38	21.86	21.37
		1#24	1	1	21.66	22.1	21.53
		1#49	1	1	21.69	22.09	21.41
		25#0	2	2	21.57	22.19	21.47
		25#12	2	2	21.55	22.02	21.31
		25#24	2	2	21.19	21.81	21.01
		50#0	2	2	20.33	20.38	20.62
15 MHz	QPSK	1#0	0	0	22.31	22.34	22.24
		1#37	0	0	22.29	21.97	22.02
		1#74	0	0	22.31	22.26	22.45
		36#0	1	1	22.63	22.47	22.41
		36#17	1	1	22.54	22.31	22.45
		36#35	1	1	22.48	22.24	22.37
		75#0	1	1	21.37	21.35	21.52
	16-QAM	1#0	1	1	21.97	22.18	21.51
		1#37	1	1	21.78	22.07	21.74
		1#74	1	1	21.89	21.87	21.43
		36#0	2	2	21.88	22	21.42
		36#17	2	2	22	22.14	21.68
		36#35	2	2	22.08	22.11	21.91
		75#0	2	2	20.43	20.35	20.33

LTE Band 7:

Test Bandwidth	Test Modulation	Resource Block & RB offset	Target MPR	Meas MPR	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
5 MHz	QPSK	1#0	0	0	22.54	22.61	22.05
		1#12	0	0	22.68	22.45	22.02
		1#24	0	0	22.41	22.31	21.71
		12#0	1	1	22.77	22.77	22.12
		12#6	1	1	22.3	22.3	21.71
		12#11	1	1	22.89	22.52	22.04
		25#0	1	1	21.47	21.51	20.95
	16-QAM	1#0	1	1	21.72	21.38	20.97
		1#12	1	1	21.79	21.45	21.29
		1#24	1	1	21.6	21.27	21.03
		12#0	2	2	21.6	21.5	20.94
		12#6	2	2	21.71	21.57	21.05
		12#11	2	2	21.97	21.66	210.25
		25#0	2	2	20.31	20.49	19.7
10 MHz	QPSK	1#0	0	0	22.49	22.48	22.23
		1#24	0	0	22.45	22.28	22.07
		1#49	0	0	22.42	22.43	21.9
		25#0	1	1	22.33	22.4	22.06
		25#12	1	1	22.66	22.63	22.18
		25#24	1	1	22.82	22.69	22.32
		50#0	1	1	21.35	21.36	21.01
	16-QAM	1#0	1	1	21.62	21.76	20.99
		1#24	1	1	21.45	21.83	20.97
		1#49	1	1	21.62	21.95	20.98
		25#0	2	2	21.52	21.77	20.98
		25#12	2	2	21.43	21.77	20.97
		25#24	2	2	21.48	21.61	20.76
		50#0	2	2	20.44	20.58	20.79
15 MHz	QPSK	1#0	0	0	22.34	22.45	22.32
		1#37	0	0	22.4	22.6	22.28
		1#74	0	0	22.65	22.62	22.35
		36#0	1	1	22.37	22.55	22.14
		36#17	1	1	22.54	22.45	22.32
		36#35	1	1	22.68	22.58	22.36
		75#0	1	1	21.49	21.43	21.13
	16-QAM	1#0	1	1	21.71	21.8	21.6
		1#37	1	1	21.42	21.58	21.43
		1#74	1	1	21.39	21.92	21.31
		36#0	2	2	21.57	21.88	21.55
		36#17	2	2	21.57	21.82	21.63
		36#35	2	2	21.47	21.73	21.48
		75#0	2	2	20.51	20.48	19.99

20 MHz	QPSK	1#0	0	0	22.8	22.46	22.36
		1#49	0	0	22.4	22.41	22.35
		1#99	0	0	22.39	22.36	22.14
		50#0	1	1	22.29	22.43	22.07
		50#24	1	1	22.48	22.58	22.24
		50#49	1	1	22.51	22.52	22.45
		100#0	1	1	21.58	21.47	20.99
	16-QAM	1#0	1	1	21.49	21.66	21.84
		1#49	1	1	21.66	21.76	21.94
		1#99	1	1	21.48	21.58	21.58
		50#0	2	2	21.45	21.57	21.78
		50#24	2	2	21.74	21.8	21.97
		50#49	2	2	21.66	21.85	22.01
		100#0	2	2	20.41	20.47	20.19

LTE Band 41:

Test Bandwidth	Test Modulation	Resource Block & RB offset	Target MPR	Meas MPR	Low Channel (dBm)	Middle Channel (dBm)	High Channel (dBm)
5 MHz	QPSK	1#0	0	0	22.55	22.34	21.99
		1#12	0	0	22.78	22.58	22.21
		1#24	0	0	22.42	22.2	21.9
		12#0	1	1	22.81	22.8	22.15
		12#6	1	1	22.54	22.28	21.83
		12#11	1	1	22.73	22.64	22.1
		25#0	1	1	21.33	21.28	21.03
	16-QAM	1#0	1	1	21.64	21.52	21.13
		1#12	1	1	21.92	21.63	21.3
		1#24	1	1	21.67	21.41	20.93
		12#0	2	2	21.64	21.35	21
		12#6	2	2	21.78	21.6	21.2
		12#11	2	2	21.81	21.54	21.25
		25#0	2	2	20.49	20.5	19.82
10 MHz	QPSK	1#0	0	0	22.51	22.42	22.05
		1#24	0	0	22.25	22.08	22.04
		1#49	0	0	22.41	22.33	22.16
		25#0	1	1	22.38	22.36	22.14
		25#12	1	1	22.6	22.62	22.33
		25#24	1	1	22.52	22.69	22.39
		50#0	1	1	21.4	21.52	21.02
	16-QAM	1#0	1	1	21.67	21.91	21.23
		1#24	1	1	21.38	21.92	20.91
		1#49	1	1	21.47	22	20.99
		25#0	2	2	21.48	21.79	20.89
		25#12	2	2	21.56	21.73	20.87
		25#24	2	2	21.54	21.73	20.71
		50#0	2	2	20.37	20.46	20.84
15 MHz	QPSK	1#0	0	0	22.61	22.56	22.34
		1#37	0	0	22.58	22.65	22.18
		1#74	0	0	22.62	22.67	22.52
		36#0	1	1	22.42	22.41	22.24
		36#17	1	1	22.36	22.37	22.24
		36#35	1	1	22.51	22.38	22.27
		75#0	1	1	21.45	21.41	21.16
	16-QAM	1#0	1	1	21.54	22.06	21.62
		1#37	1	1	21.25	21.8	21.31
		1#74	1	1	21.37	21.7	21.33
		36#0	2	2	21.7	21.96	21.67
		36#17	2	2	21.46	21.96	21.62
		36#35	2	2	21.53	21.93	21.57
		75#0	2	2	20.5	20.52	20.09

20 MHz	QPSK	1#0	0	0	22.38	22.61	22.29
		1#49	0	0	22.56	22.66	22.12
		1#99	0	0	22.49	22.58	22.24
		50#0	1	1	22.26	22.21	22.2
		50#24	1	1	22.56	22.63	22.32
		50#49	1	1	22.49	22.58	22.29
		100#0	1	1	21.58	21.48	21.02
	16-QAM	1#0	1	1	21.55	21.68	22.03
		1#49	1	1	21.73	21.71	22.09
		1#99	1	1	21.38	21.56	21.77
		50#0	2	2	21.63	21.81	21.69
		50#24	2	2	21.69	21.91	22.04
		50#49	2	2	21.67	21.94	21.9
		100#0	2	2	20.46	20.6	20.21

Bluetooth:

Mode	Channel frequency (MHz)	RF Output Power (dBm)
BDR (GFSK)	2402	-0.67
	2441	**-0.48**
	2480	-1.4
EDR (4-DQPSK)	2402	-1.43
	2441	-1.17
	2480	-2.06
EDR (8-DPSK)	2402	-1.41
	2441	-1.11
	2480	-2
Bluetooth LE	2402	-6.69
	2440	-5.54
	2480	-7.02

WLAN 2.4G:

Mode	Channel frequency (MHz)	RF Output Power (dBm)
802.11 b	2412	8.93
	2437	**9.39**
	2462	8.99
802.11 g	2412	6.06
	2437	6.29
	2462	6.18
802.11 n20	2412	6.25
	2437	9.12
	2462	6.45
802.11 n40	2422	5.92
	2437	6.32
	2452	6.13

WLAN 5G (5150~5250 MHz):

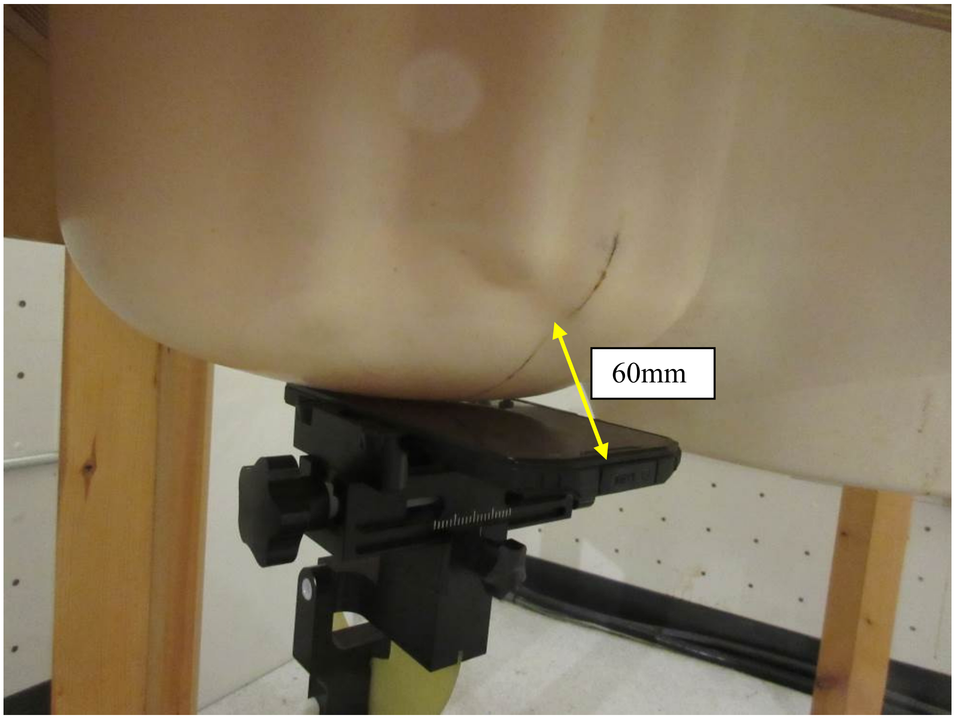
Mode	Channel frequency (MHz)	RF Output Power (dBm)
802.11a	5180	6.12
	5200	6.57
	5240	6.43
802.11n20	5180	6.01
	5200	6.53
	5240	6.40
802.11n40	5190	6.36
	5230	6.26
802.11ac80	5210	6.72

WLAN 5G (5725~5850 MHz):

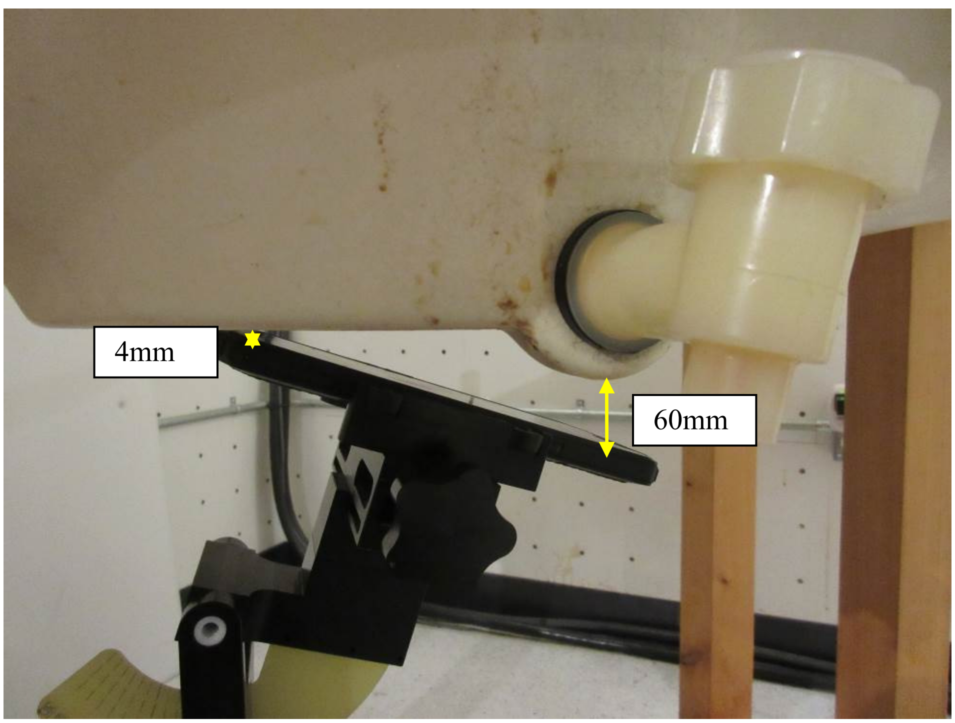
Mode	Channel frequency (MHz)	RF Output Power (dBm)
802.11a	5745	6.71
	5785	6.05
	5825	6.54
802.11n20	5745	6.60
	5785	6.50
	5825	6.38
802.1140	5755	**6.98**
	5795	6.40
802.11ac80	5775	6.58

17 Appendix G - Test Setup Photos

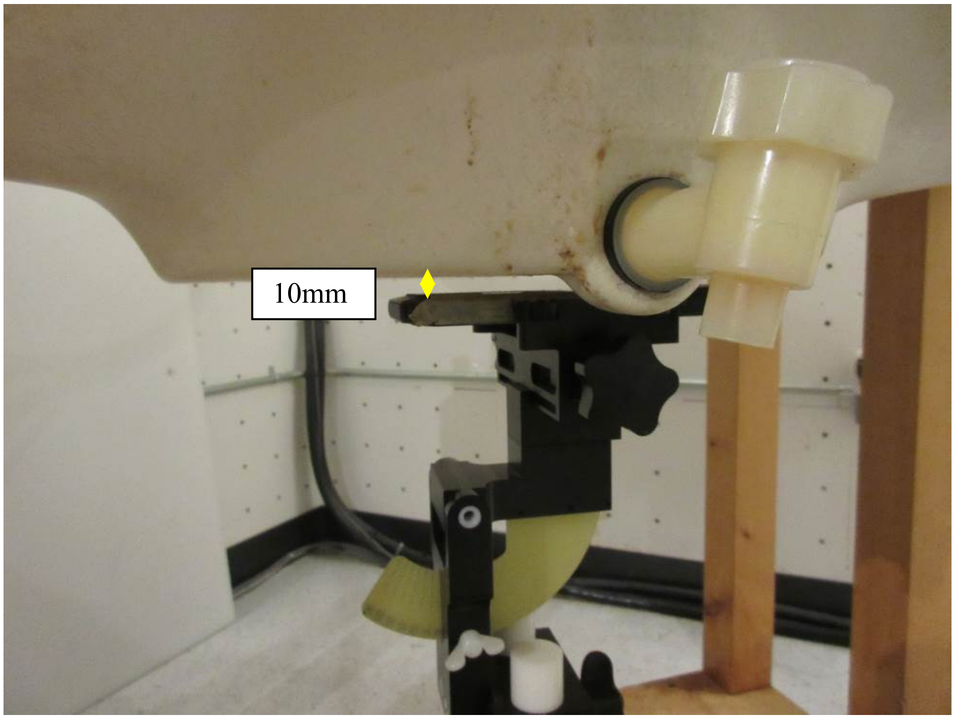
17.1 EUT Head Mode Setup Photo



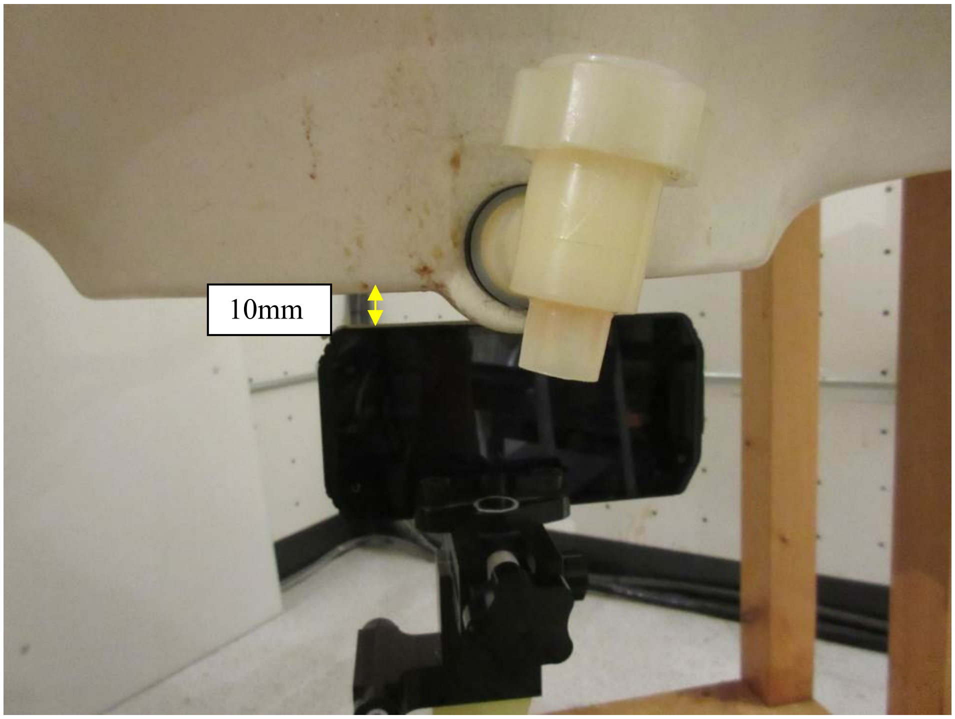
17.2 EUT Head Flat Setup Photo



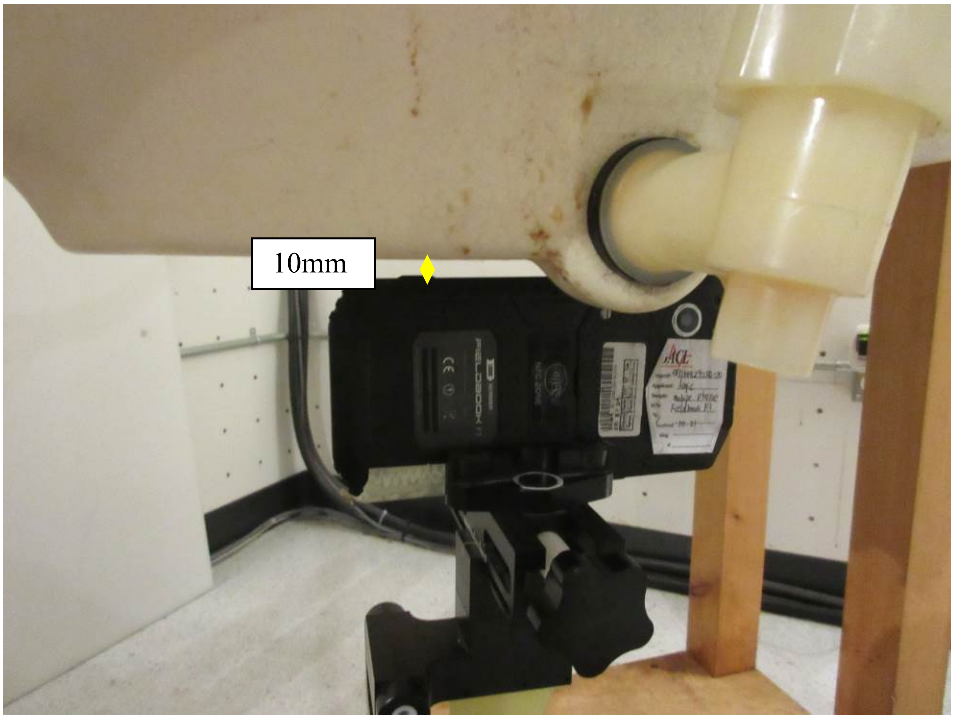
17.3 EUT Back Side 10mm Setup Photo



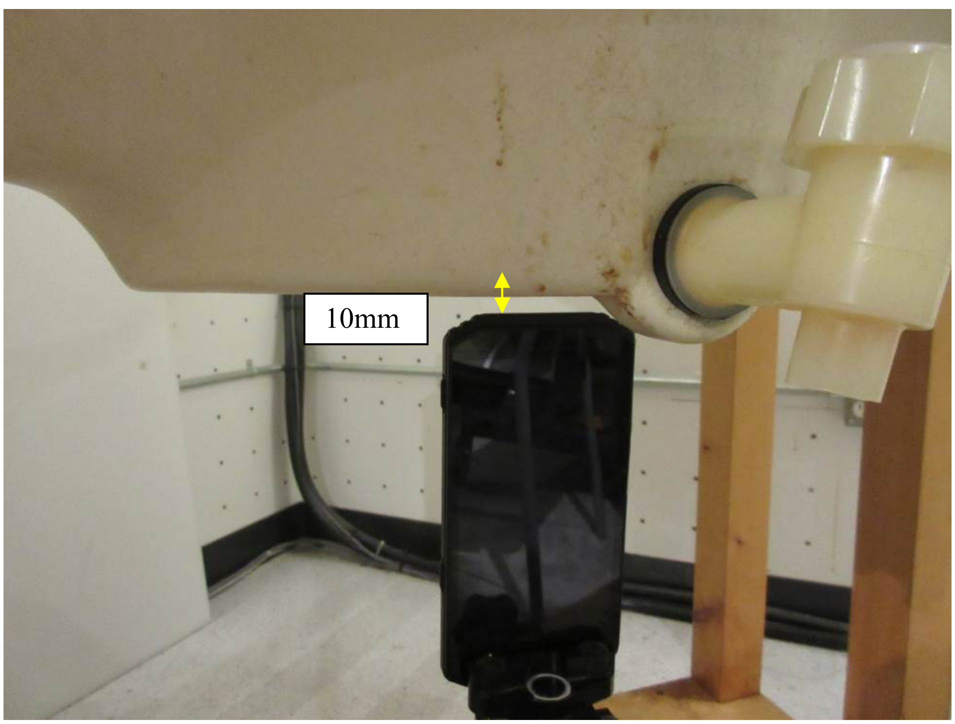
17.4 EUT Left Side 10mm Setup Photo



17.5 EUT Right Side 10mm Setup Photo



17.6 EUT Bottom Side 10mm Setup Photo



18 Appendix H - EUT Photos

18.1 EUT Front View

18.2 EUT Rear View

18.3 EUT Top View

18.4 EUT Bottom View

19 Appendix I - Informative References

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