



SAR EVALUATION REPORT

For

Motion Computing, Inc.

8601 Ranch Road 2222, Building 2,
Austin, TX, 78730, USA

FCC ID: Q3QHSWEM7355
IC: 4587A- SWEM7355

Report Type: Original Report	Product Type: Motion Tablet with WLAN+WWAN Module
Prepared By:	Jerry Tong
Report Number:	R1408134-SAR Rev A
Report Date:	2014-10-31
Reviewed By:	Bo Li
	RF Lead
	Bay Area Compliance Laboratories Corp. 1274 Anvilwood Avenue, Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732 9164

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Summary of Test Results			
Rule Part(s):	FCC §2.1093, IC RSS-102, Issue 4		
Test Procedure(s):	IEEE 1528:2013, KDB 248227, KDB 447498, KDB 865664, KDB 616217, KDB 941225		
Device Category: Exposure Category:	Portable Device General Population/Uncontrolled Exposure		
Device Type:	Portable Device		
Modulation Type:	GMSK, 8PSK, QPSK, 16QAM, 64QAM		
TX Frequency Range:	GSM 850: 824-849 MHz GSM 1900: 1850-1910 MHz LTE Band 2: 1850-1910 MHz LTE Band 4: 1710-1755 MHz LTE Band 5: 824-849 MHz LTE Band 13: 777-787 MHz LTE Band 17: 704-716 MHz LTE Band 25: 1850-1915 MHz UMTS Band 2: 1850-1910 MHz UMTS Band 4: 1710-1755 MHz UMTS Band 5: 824-849 MHz CDMA BC0: 824-849 MHz CDMA BC1: 1850-1910 MHz CDMA BC10: 816.0-823.975 MHz		
Maximum Rated Power (dBm) :	GSM 850: 27.72 GSM 1900: 26.55 LTE Band 2: 20.8 LTE Band 4: 22.67 LTE Band 5: 22.9 LTE Band 13: 23.7 LTE Band 17: 23.0 LTE Band 25: 22.7 UMTS Band 2: 21.89 UMTS Band 4: 22.16 CDMA BC0 : 23.51 UMTS Band 5: 22.34 CDMA BC10: 23.12 CDMA BC1: 23.71		
Antenna Type(s) Tested:	Internal Antennas		
Body-Worn Accessories:	None		
Face-Head Accessories:	None		
Battery Type (s) Tested:	Li-Ion: 2900 mAh		
Max. SAR Level (s) Measured:	Level (W/Kg)	Position	Operational Mode
	1.45	Back Side Touch	GSM 1900 Standalone
	Level (W/Kg)	Position	Operational Mode
	1.58	Top Side Touch	GSM 1900 Standalone
	Level (W/Kg)	Position	Operational Mode
	3.08 (SPLSR=0.031)	Edge Touch	Simultaneous

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1408134-SAR	Original Report	2014-10-24
1	R1408134-SAR Rev A	Revised Report	2014-10-31

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1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Motion Computing, Inc.*, and their product, Tablet PC, model: FWS-002. Motion Computing PC implemented 4 G WWAN module (FCC ID: Q3QHSWEM7355, IC: 4587A-SWEM7355) into the tablet PC. The tablet PC also contains a WLAN+BT Combo module (FCC ID: Q3QHI7260NG, IC: 4587A-HI7260NG).

1.2 Technical Specification

Item	Description
Modulation	GMSK, 8PSK, QPSK, 16QAM, 64QAM
Frequency Range	GSM 850: 824-849 MHz GSM 1900: 1850-1910 MHz LTE Band 2: 1850-1910 MHz LTE Band 4: 1710-1755 MHz LTE Band 5: 824-849 MHz LTE Band 13: 777-787 MHz LTE Band 17: 704-716 MHz LTE Band 25: 1850-1915 MHz UMTS Band 2: 1850-1910 MHz UMTS Band 4: 1710-1755 MHz UMTS Band 5: 824-849 MHz CDMA BC0: 824-849 MHz CDMA BC1: 1850-1910 MHz CDMA BC10: 816.0-823.975 MHz
Maximum Conducted Power Tested (dBm) :	GSM 850: 27.72 GSM 1900: 26.55 LTE Band 2: 20.8 LTE Band 4: 22.67 LTE Band 5: 22.9 LTE Band 13: 23.7 LTE Band 17: 23.0 LTE Band 25: 22.7 UMTS Band 2: 21.89 UMTS Band 4: 22.16 CDMA BC0 : 23.51 UMTS Band 5: 22.34 CDMA BC10: 23.12 CDMA BC1: 23.71
Dimensions (L*W*H)	Tablet: 276 (L) x 179 mm (W) x 15 mm (H)
Power Source	Li-Ion: 2900 mAh
Weight	879.5 g
Normal Operation	Body-supported

The test data gathered are from typical production sample, Sample ID: PVT-311 provided by the manufacturer.

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 Luminaires 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 Limit (1g Tissue)

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 (10g Tissue)

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

4.1 Equipment List & Calibration Info

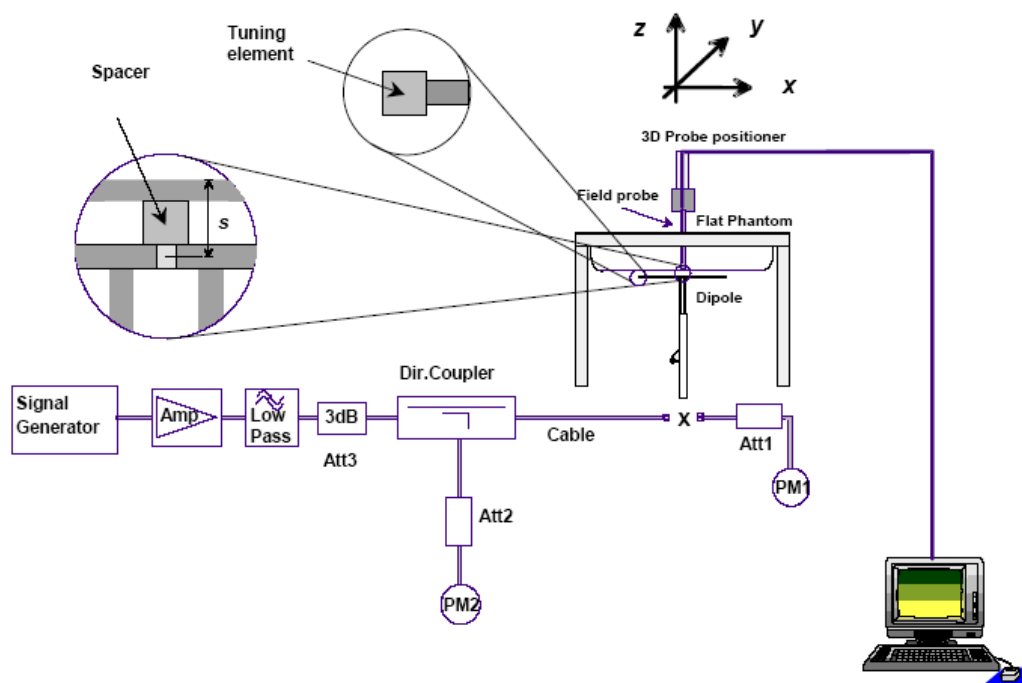
Type/Model	Cal. Due Date	S/N
DASY4 Professional Dosimetric System	N/A	N/A
Robot RX60L	N/A	CS7MBSP / 467
Robot Controller	N/A	F01/5J72A1/A/01
Dell Computer Dimension 3000	N/A	N/A
SPEAG EDC3	N/A	N/A
SPEAG DAE3	2015-08-13	456
DASY4 Measurement Server	N/A	1176
SPEAG Probe, SAR Sensor ET3DV6	2015-08-19	1604
Antenna, Dipole, D750V3	2014-11-05	1102
Antenna, Dipole, ALS-D-835-S-2	2014-10-27	180-00564
Antenna, Dipole, ALS-D-1750-S-2	2014-10-08	198-00304
Antenna, Dipole, ALS-D-1900-S-2	2014-10-27	210-00715
SPEAG Twin SAM Phantom	N/A	TP-1032
Muscle Equivalent Matter (750 MHz)	Each Time	N/A
Muscle Equivalent Matter (835 MHz)	Each Time	N/A
Muscle Equivalent Matter (1750 MHz)	Each Time	N/A
Muscle Equivalent Matter (1900 MHz)	Each Time	N/A
Agilent, Spectrum Analyzer E4440A	2014-11-07	MY44303352
Mini Circuits, AMPLIFIER ZHL-42	2014-09-28	QA1326001
Power Meter Agilent E4419B	2014-10-03	MY4121511
Power Sensor Agilent E4412A	2014-10-03	US38488542
Dielectric Probe Kit HP85070C	2015-03-07	US99360201
HP, Signal Generator, 83650B	2015-08-06	3614A00276
Mini Circuits, AMPLIFIER ZVE-8G+	2014-09-28	N605601404
HP, Analyzer, Network, 8753D	2014-10-22	3410A04346
Attenuator 3 dB	2014-11-20	00317
HP, Directional Coupler 779D	2014-11-23	00494
Antenna, Horn/3115	2014-10-17	9511-4627
R & S Communication Tester, CMW500	2015-08-26	120503
Agilent, Communications Analyzer, E5515C	2016-08-16	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. 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 ± 0.2 mm 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 15 mm (below 1 GHz) and 10 mm (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 [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
2014-08-28	Body	750	ϵ_r	22	55.5	54.3	-2.2	± 5
			σ	22	0.96	0.91	-5.2	± 5
			lg SAR	22	8.68	7.92	-8.8	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
2014-08-29	Body	835	ϵ_r	22	55.2	54.1	-2.0	± 5
			σ	22	0.97	0.94	-3.1	± 5
			lg SAR	22	9.59	10.52	9.6	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
2014-08-30	Body	1750	ϵ_r	22	53.5	51.6	-3.6	± 5
			σ	22	1.44	1.48	2.8	± 5
			lg SAR	22	36.65	34.6	-5.6	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
2014-09-01	Body	1900	ϵ_r	22	53.3	55.4	3.9	± 5
			σ	22	1.52	1.47	-3.3	± 5
			lg SAR	22	39.65	37	-6.7	± 10

ϵ_r = relative permittivity, σ = conductivity and $\rho=1000 \text{ kg/m}^3$

6 EUT Test Strategy and Methodology

6.1 Test positions for body-supported device and other configurations

A typical example of a body supported device is a wireless enabled laptop device that among other orientations may be supported on the thighs of a sitting user. To represent this orientation, the device shall be positioned with its base against the flat phantom.

Other orientations may be specified by the manufacturer in the user instructions. If the intended use is not specified, the device shall be tested directly against the flat phantom in all usable orientations.

The screen portion of the device shall be in an open position at a 90° angle, or at an operating angle specified for intended use by the manufacturer in the operating instructions. Where a body supported device has an integral screen required for normal operation, then the screen-side will not need to be tested if it ordinarily remains 200 mm from the body. Where a screen mounted antenna is present, this position shall be repeated with the screen against the flat phantom, if this is consistent with the intended use.

Other devices that fall into this category include tablet type portable computers and credit card transaction authorization terminals, point-of-sale and/or inventory terminals. Where these devices may be torso or limb-supported, the same principles for body-supported devices are applied.

The example in Figure 6) shows a tablet form factor portable computer for which SAR should be separately assessed with

- d) Each surface and
- e) The separation distances

Positioned against the flat phantom those correspond to the intended use as specified by the manufacturer. If the intended use is not specified in the user instructions, the device shall be tested directly against the flat phantom in all usable orientations.

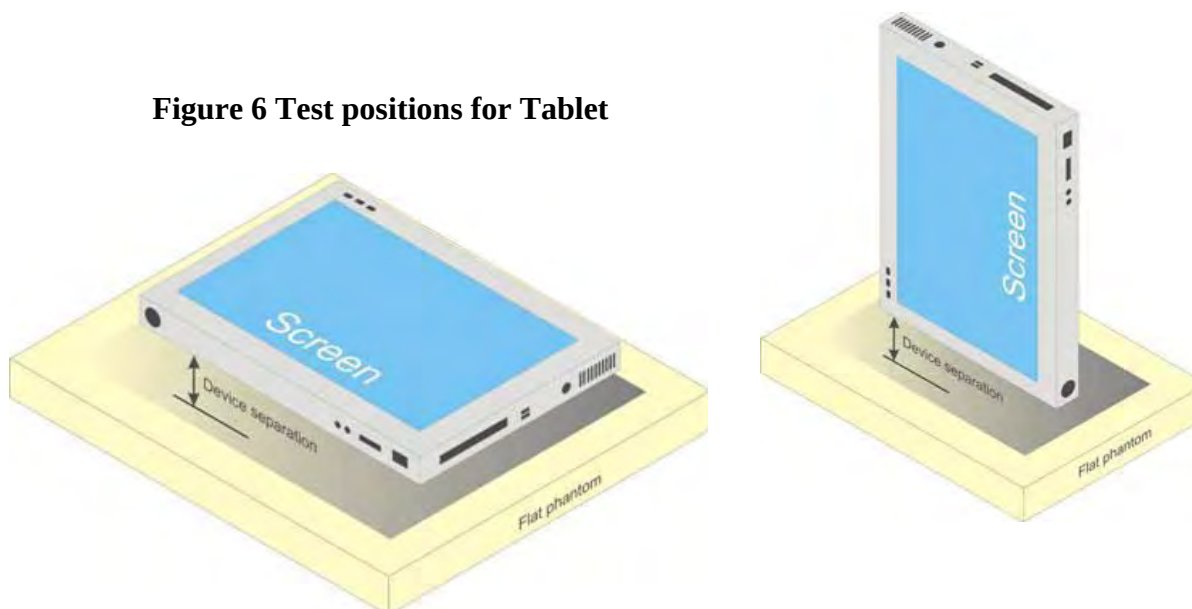


Figure 6 Test positions for Tablet

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 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 body was measured at a distance of 4 mm from the inner surface of the shell. The area covered the entire dimension of the body or EUT and the horizontal grid spacing was 50 mm x 110 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. 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 SAR Guidance)
- KDB 248227 D01 (SAR Consideration for 802.11 Devices)
- KDB 865664 D01 (SAR Measurements up to 6 GHz)
- KDB 616217 D04 (Tablet SAR Considerations) \
- KDB 941225 D01 (3G device)

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).

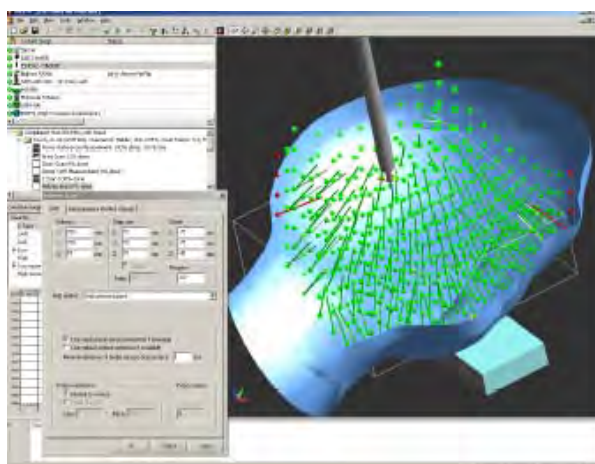
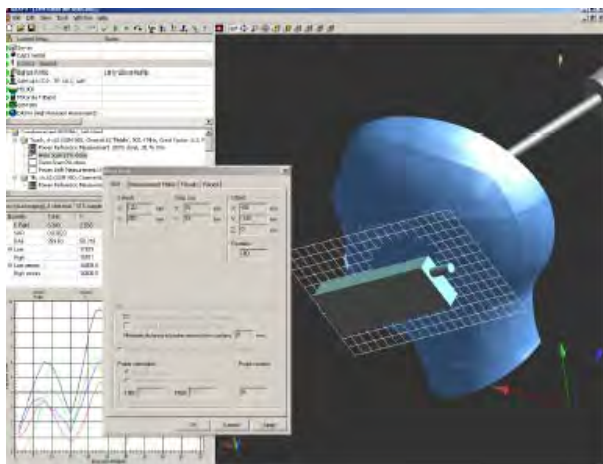
7.2 Area Scan

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

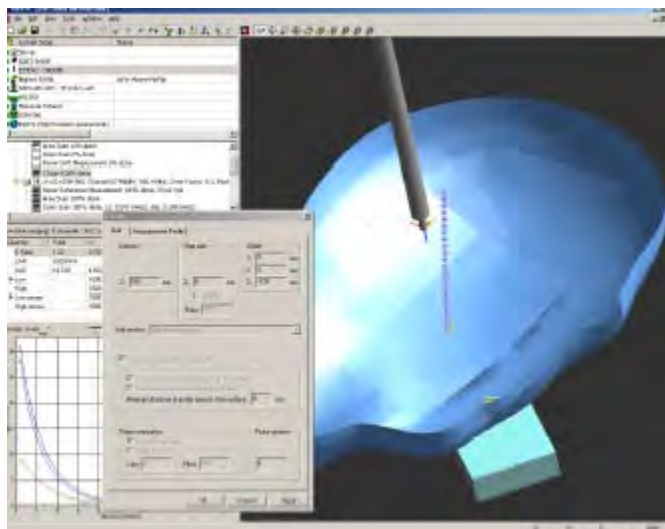
Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan measures 5 x 5 x 7 points within a cube whose base faces are centered around the maxima found in a preceding area scan job within the same procedure. 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:



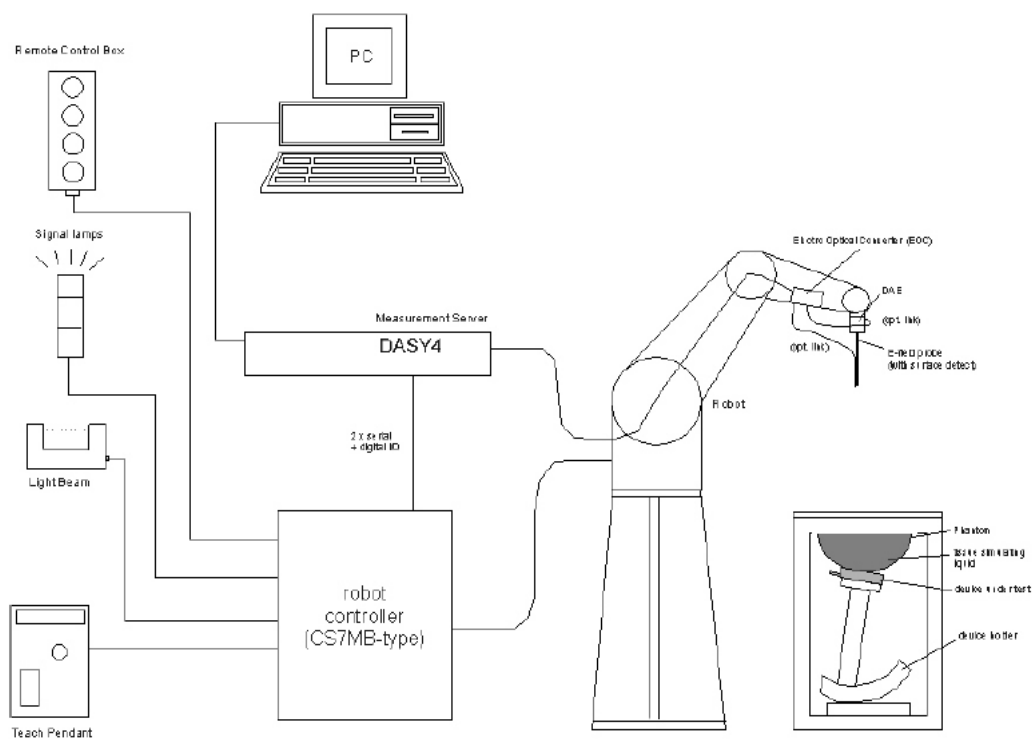
The system is based on a high precision robot (working range greater than 0.9m), which positions the probes with a positional repeatability of better than $\pm 0.02\text{mm}$. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are 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 $\pm 10\%$. The spherical isotropy was evaluated with the procedure and found to be better than $\pm 0.25\text{dB}$.

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

Frequency (MHz)	Head Tissue		Body Tissue	
	ϵ_r	σ (S/m)	ϵ_r	σ (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

8.1 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.

8.2 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 $\pm 8\%$)
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

Body diameter: 12 mm

Tip diameter: 6.8 mm

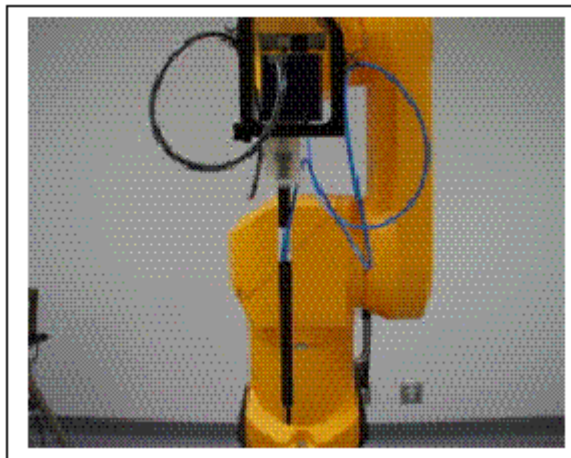
Distance from probe tip to dipole centers: 2.7 mm

Application General dosimetric up to 3 GHz

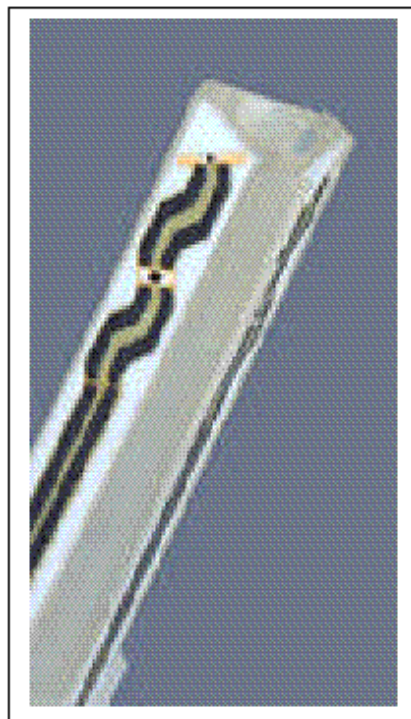
Compliance tests of mobile phones

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.



Photograph of the probe



**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 below 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	dcp _i
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 V_i = compensated signal of channel i (i=x, y, z)
 U_i = 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:

$$\text{E - fieldprobes : } E_i = \sqrt{\frac{V_i}{\text{Norm}_i \cdot \text{ConF}}}$$

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

With V_i = compensated signal of channel i (i=x, y, z)
 Norm_i = sensor sensitivity of channel i (i=x, y, z)
 $\mu\text{V}/(\text{V/m})^2$ for E-field probes
 ConF = sensitivity enhancement in solution
 a_{ij} = sensor sensitivity factors for H-field probes
 f = carrier frequency [GHz]
 E_i = 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.

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

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 accuracy. 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.



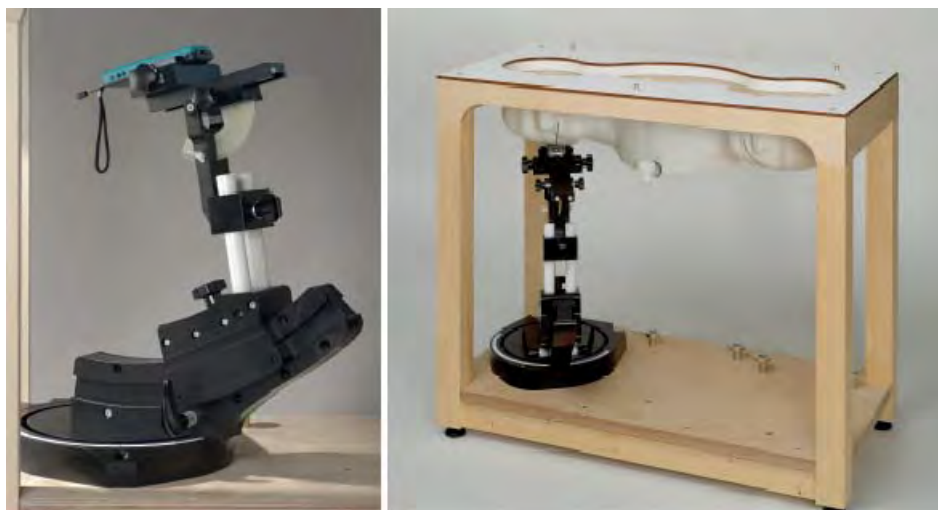
The phantom can be used with the following tissue simulating liquids:

- 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 $\pm 0.5\text{mm}$ would produce a SAR uncertainty of $\pm 20\%$. 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 $\epsilon_r=3$ and loss tangent $\tan \delta=0.02$. 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.



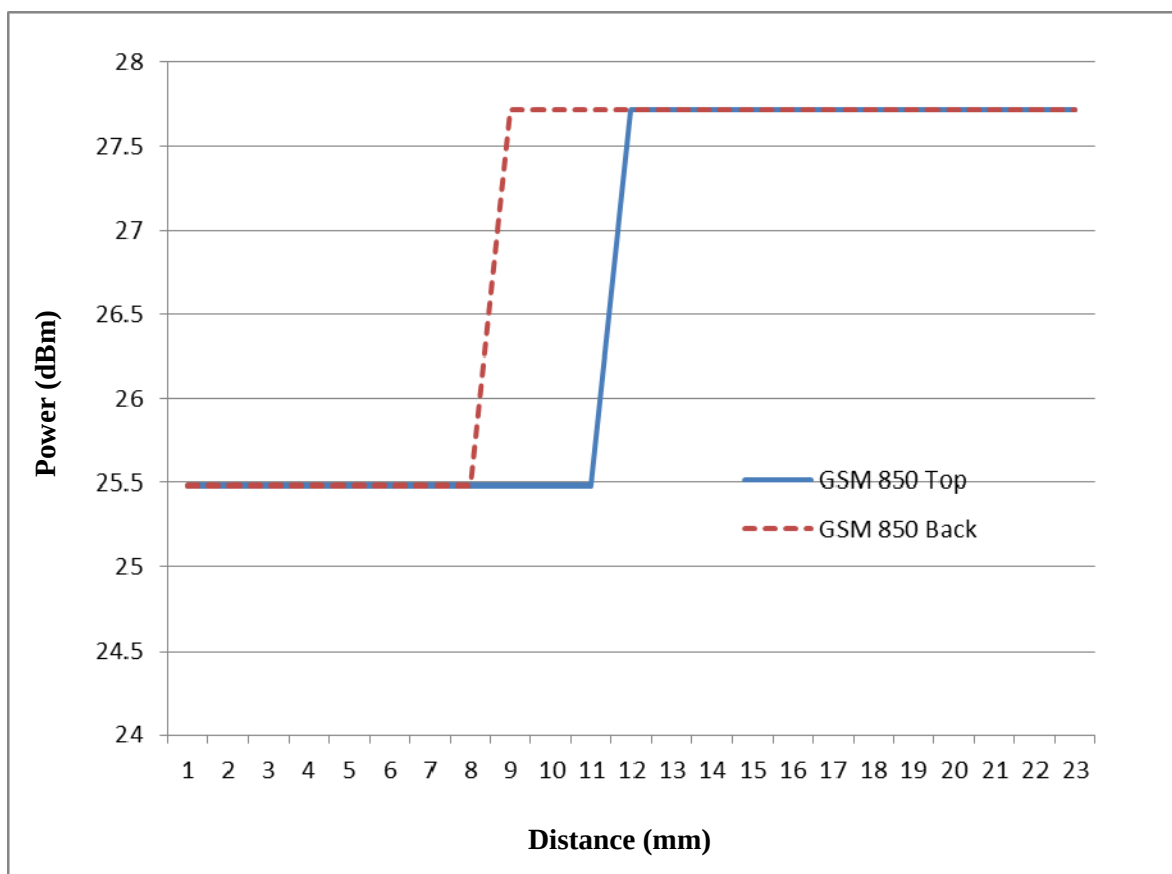
9 Sensor Triggering Data Summary

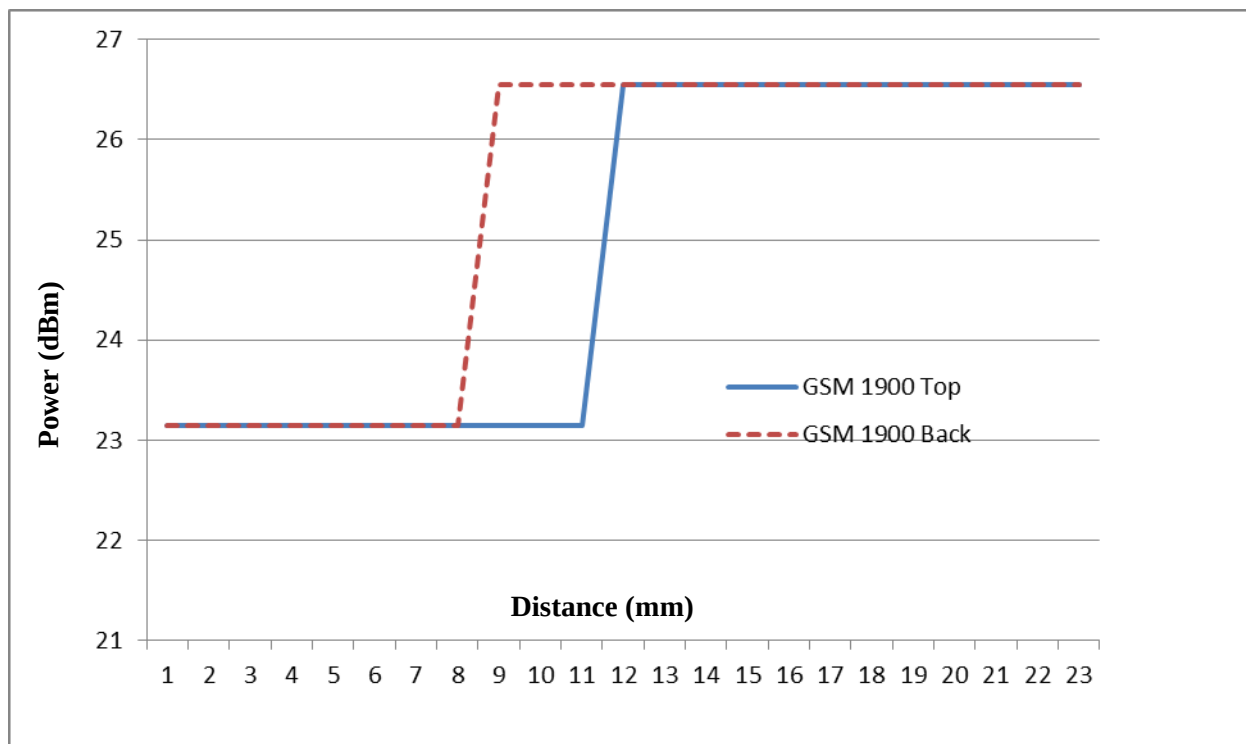
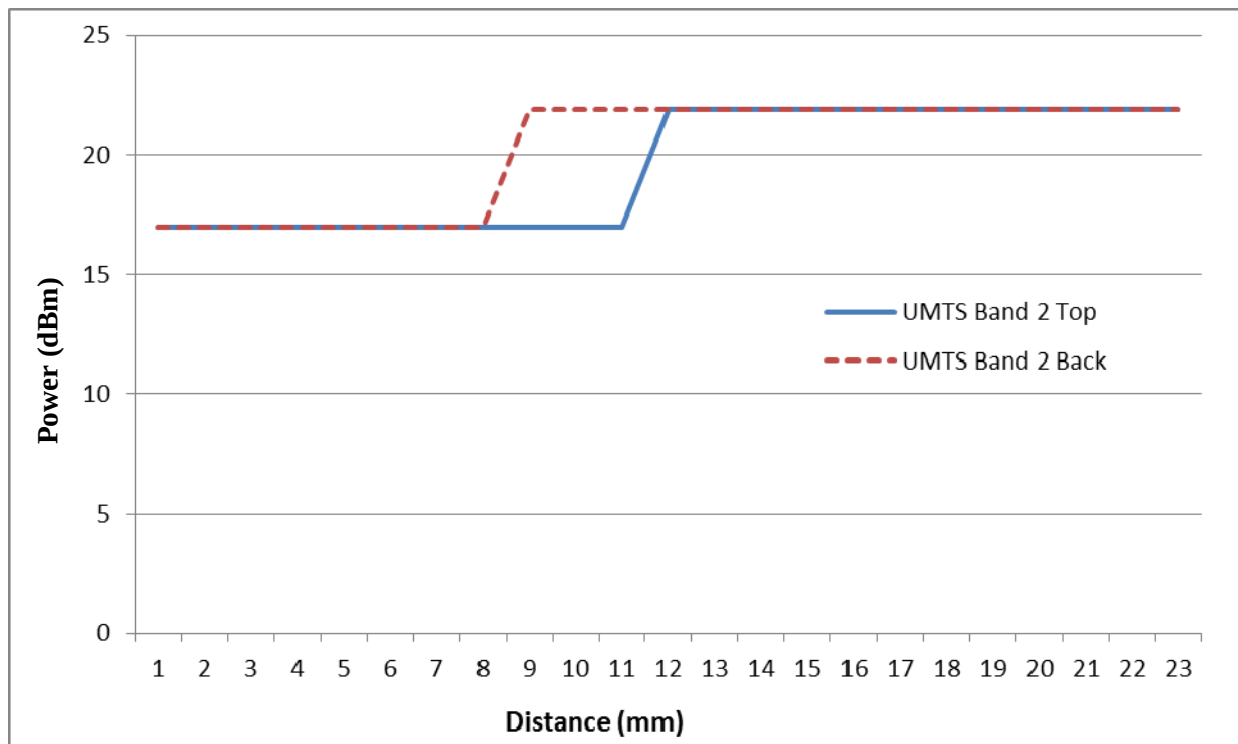
9.1 Sensor Triggering Testing Introduction

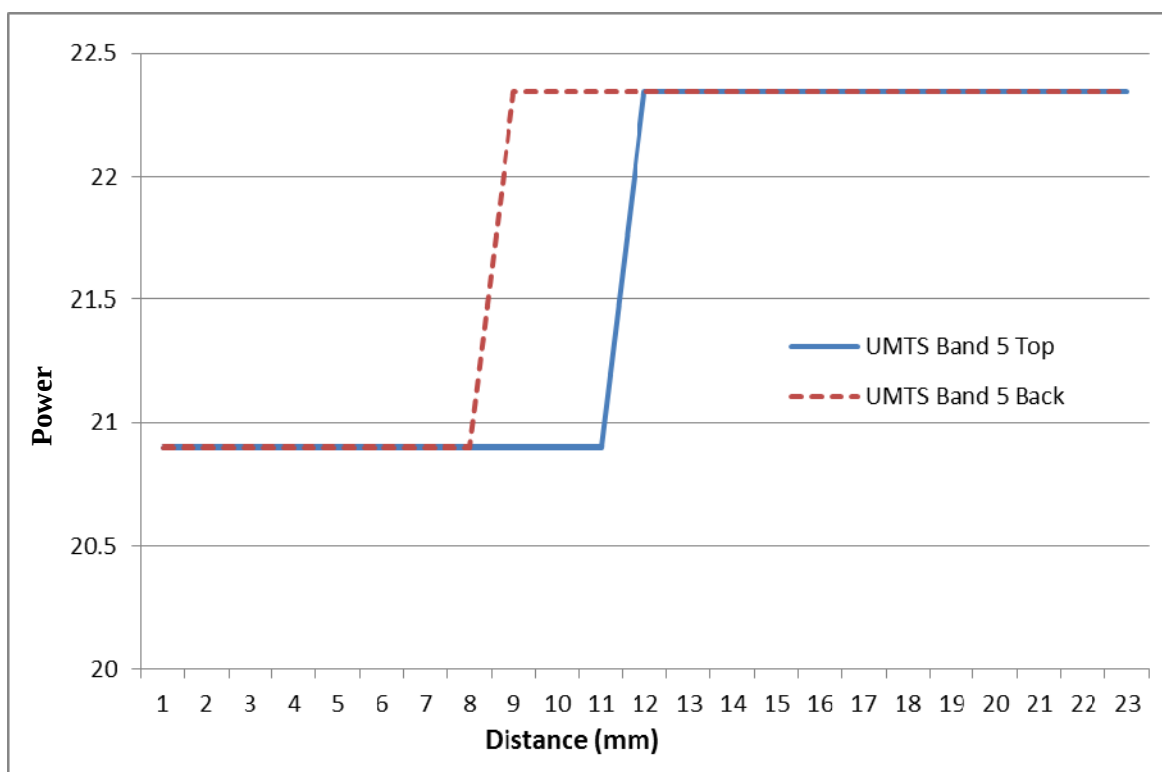
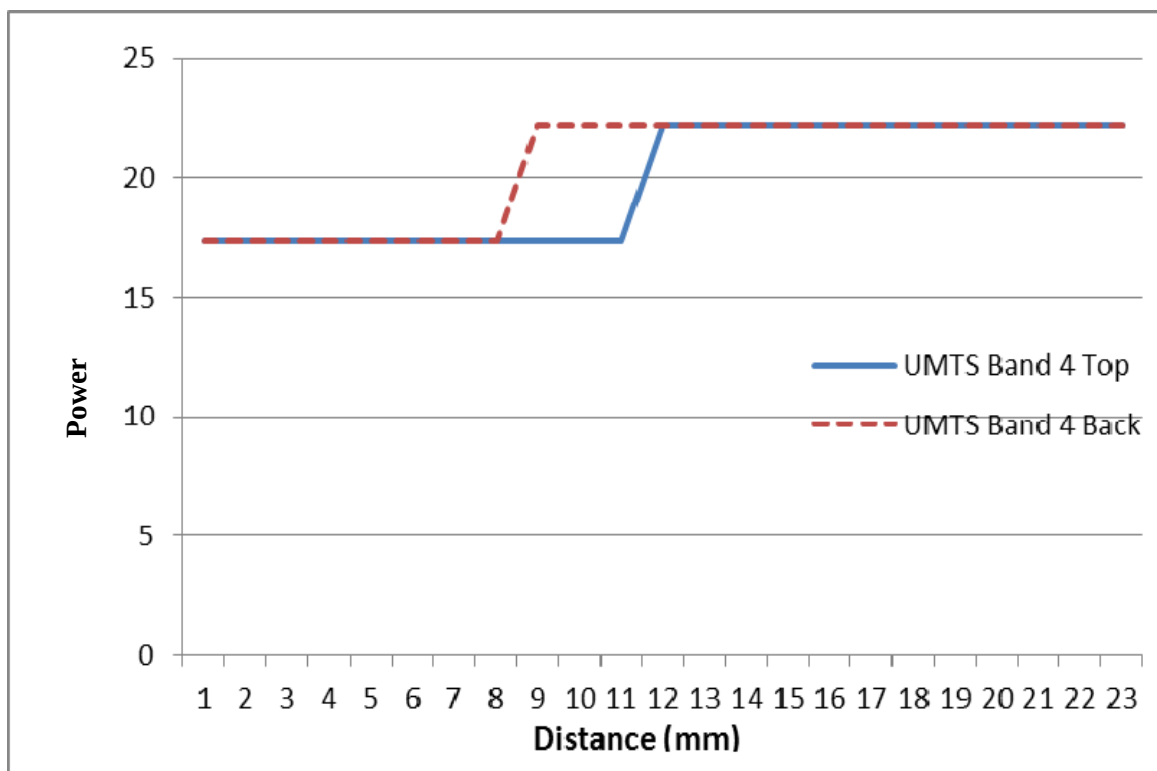
Per FCC KDB 616217 D04, this device was tested by the manufacturer to determine the proximity sensor triggering distances for the back side and top side edge of the device, the measured output power from 0 to 25 mm of the triggering points is included for back side and each applicable edge.

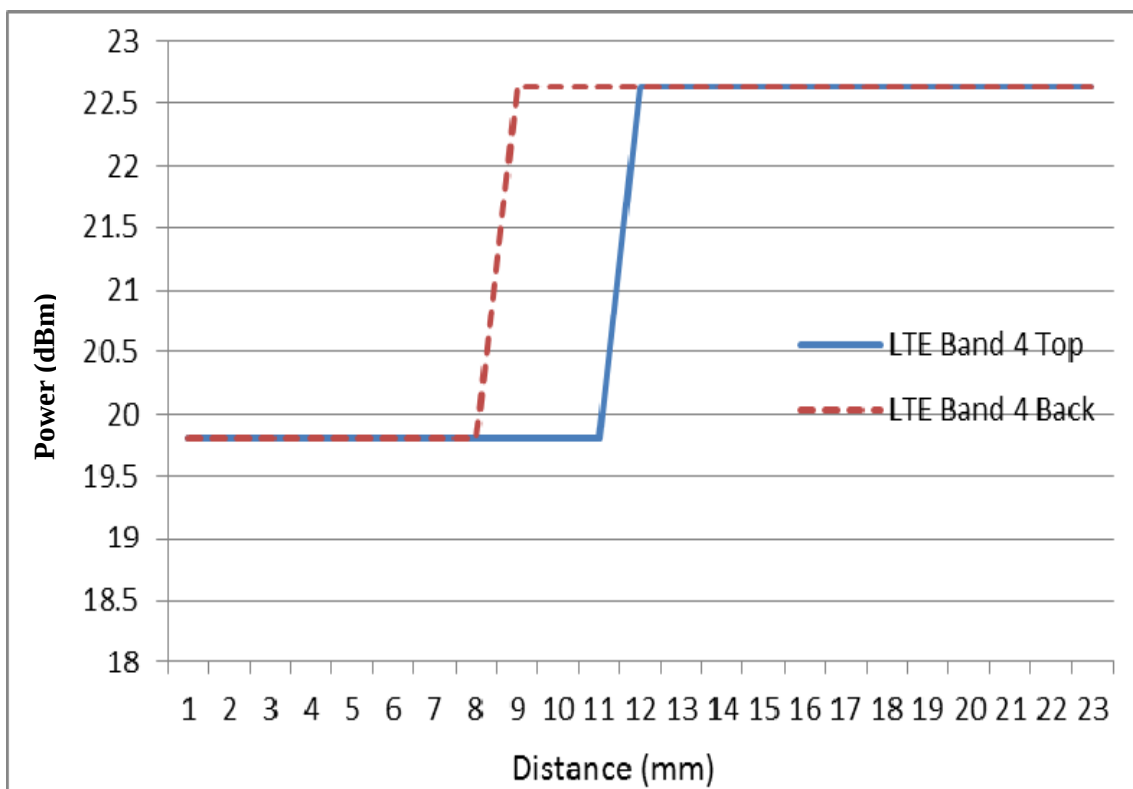
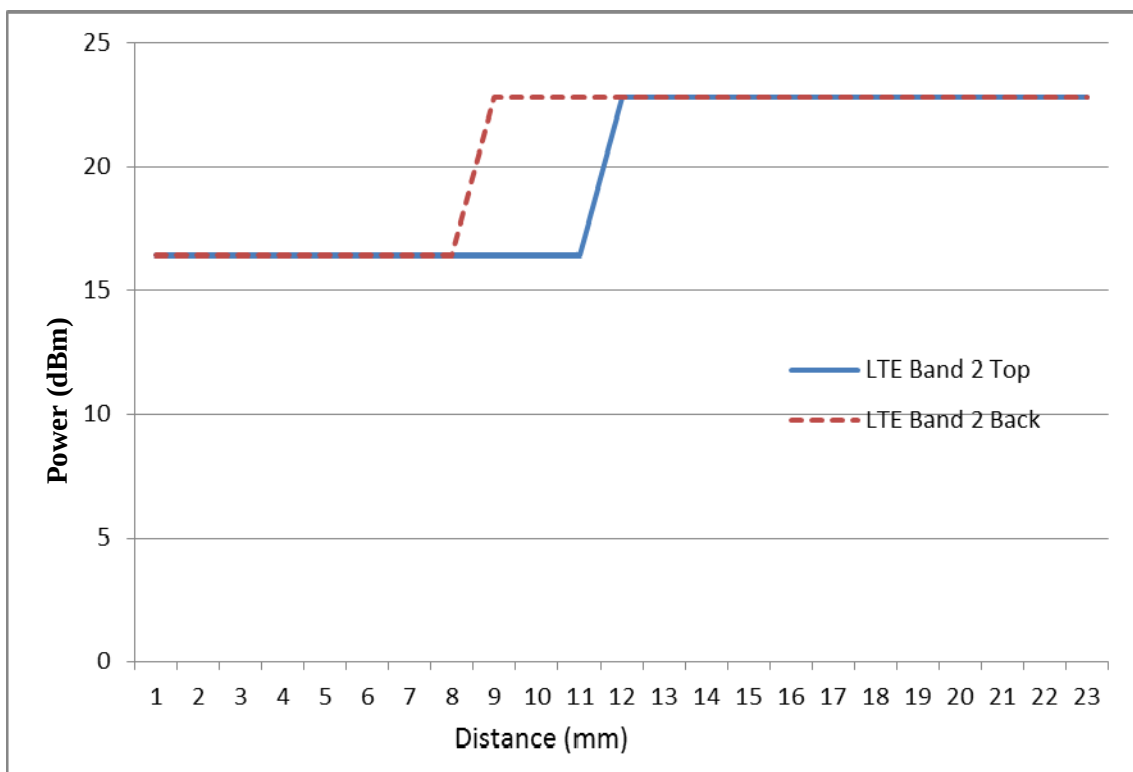
To ensure all production units are compliant it is necessary to test SAR at a distance 1 mm less than the smallest distance from the device and SAR phantom with the device at maximum output power without power reduction, these additional SAR tests are included additionally to the SAR tests for the device touching the SAR phantom with reduce power.

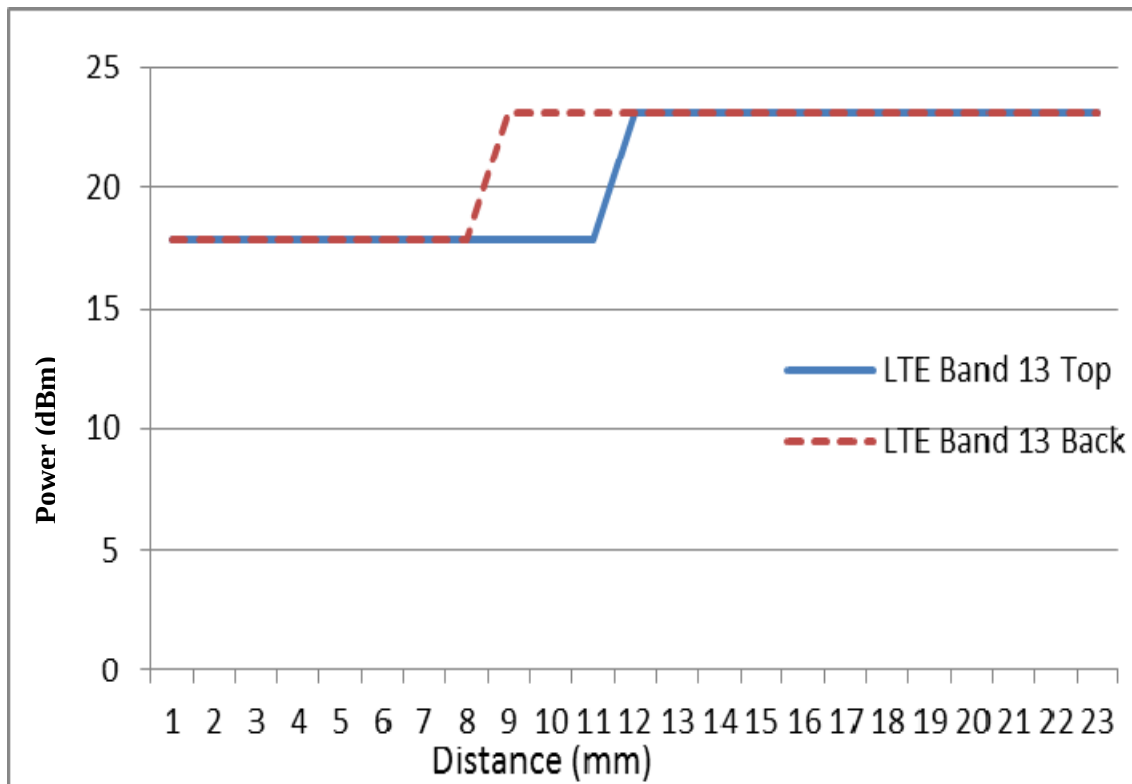
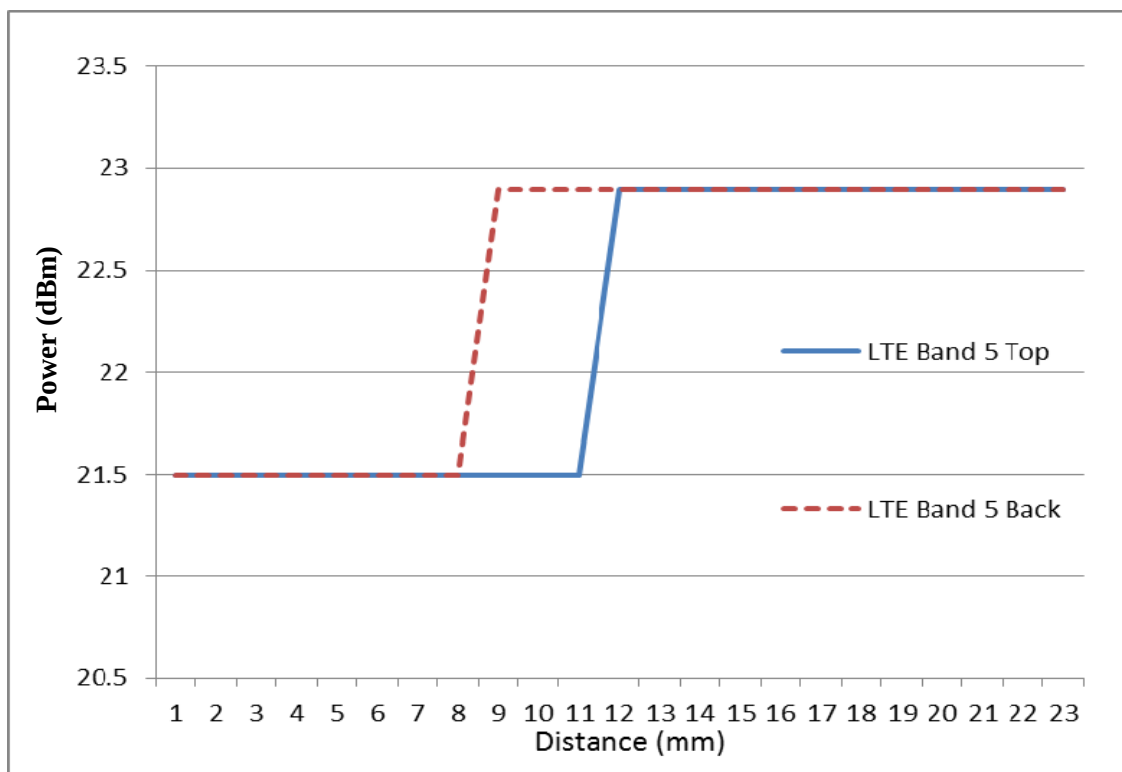
GSM:

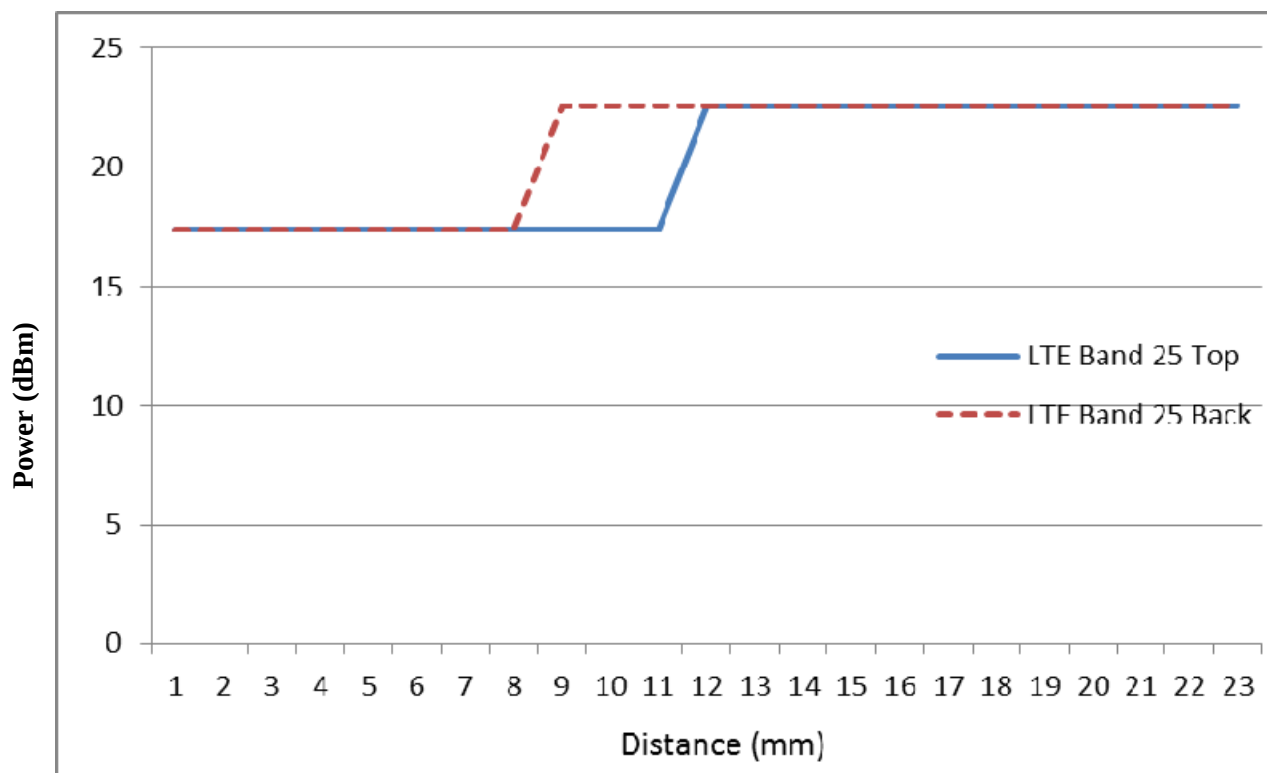
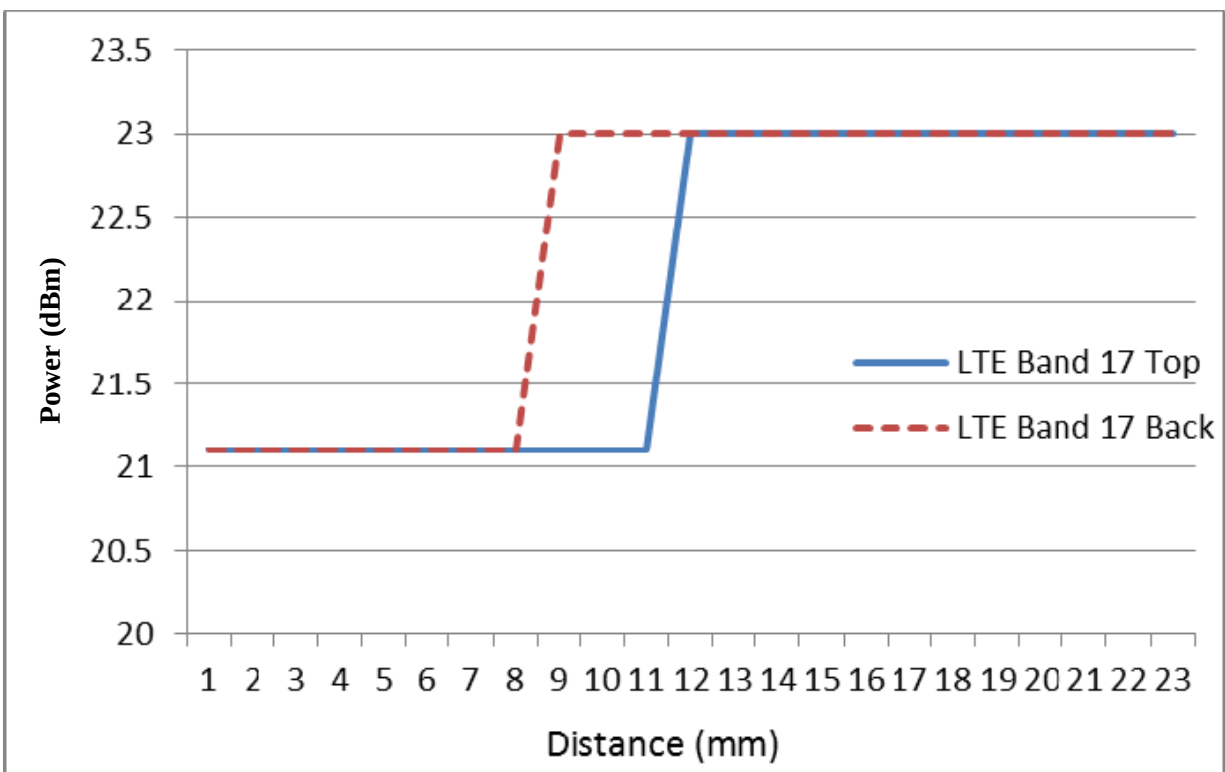


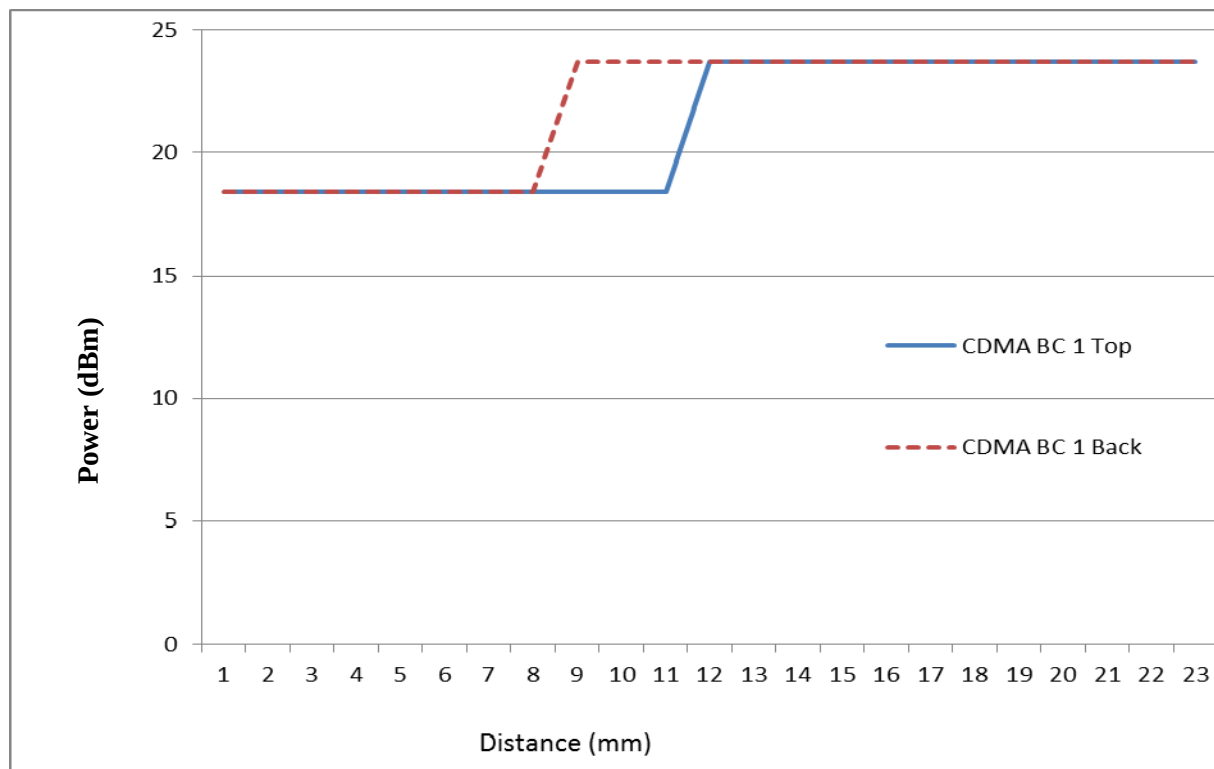
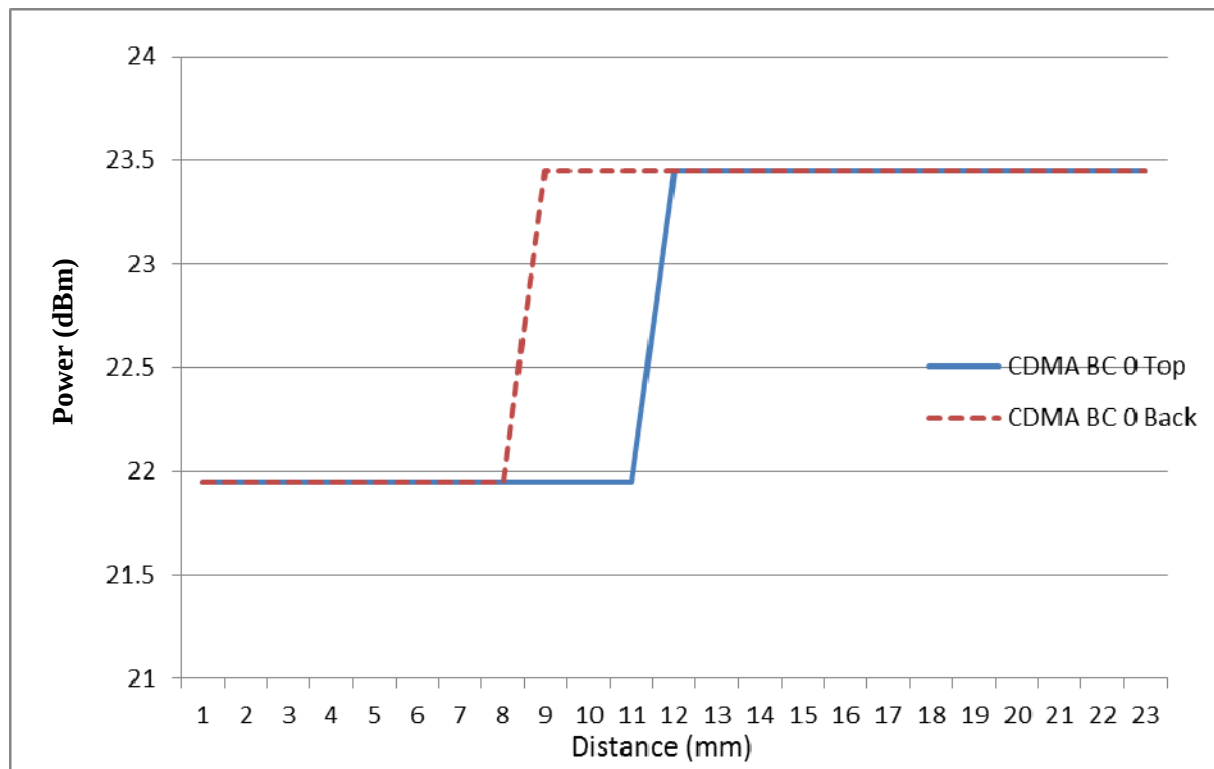
**WCDMA:**

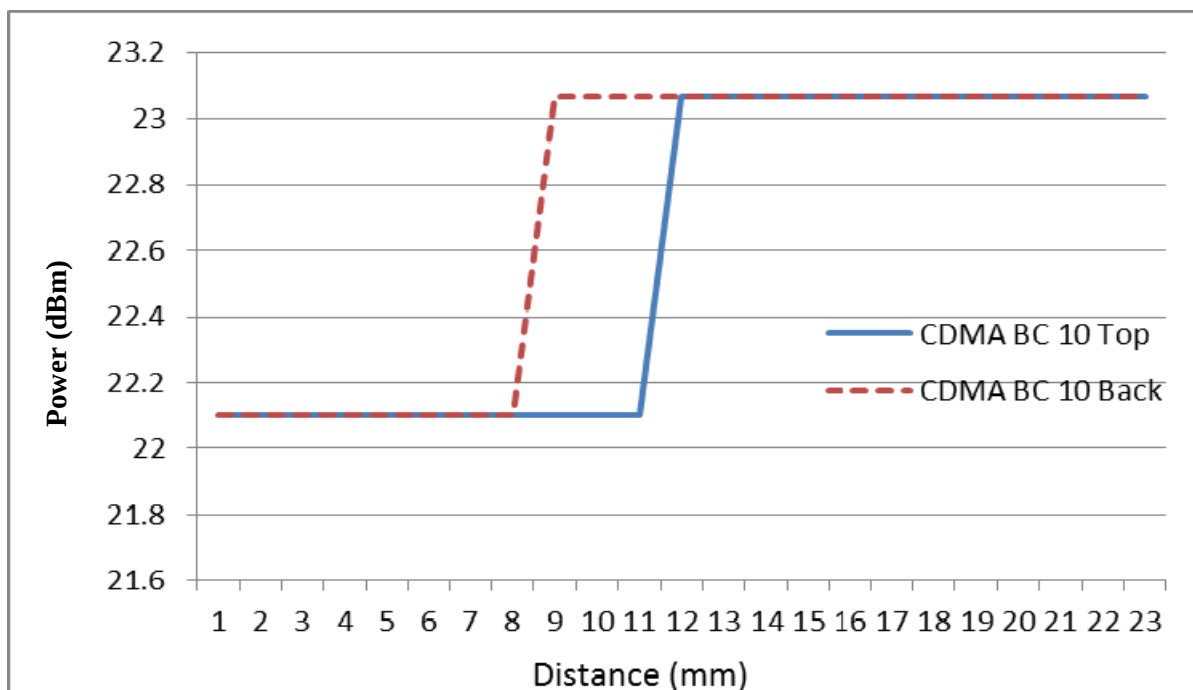


LTE:





CDMA:



Note 1: Based on the most conservative measured triggering distance of 11 mm for top side and 8 mm for back side, so additional SAR measurements were required at 10 mm for top side and 7 mm for back side.

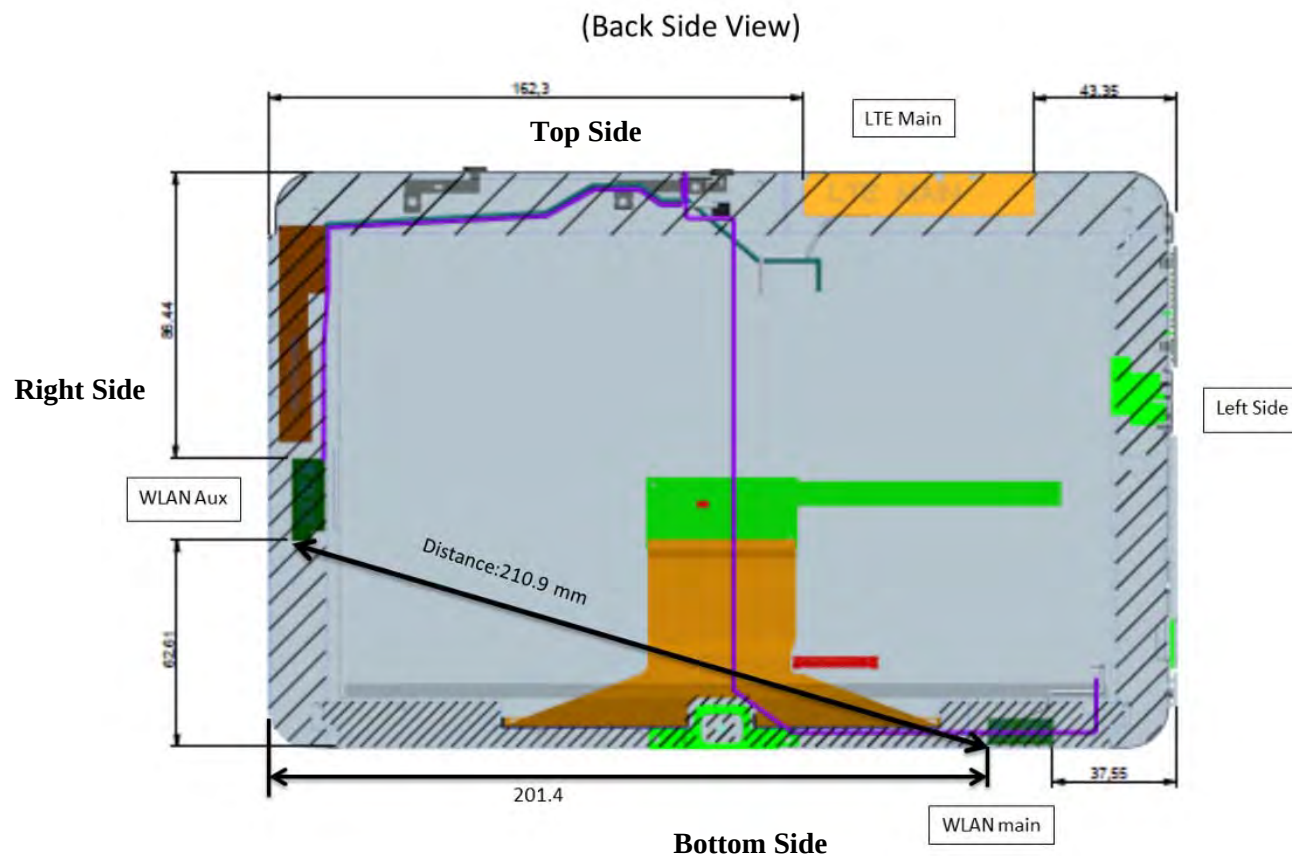
Note 2: Top standalone: Tablet top side faces to the phantom, output power stage I (full power).
Back standalone: Tablet back side faces to the phantom, output power stage I (full power)
Top simultaneous: Tablet Top side touch to the phantom, output power back off stage II
Back simultaneous: Tablet back side touch to the phantom, output power back off stage II

9.2 Sensor triggering distance

We test SAR sensor in two positions, back side and Top side. During testing the step is 1mm, we move the table towards phantom.

Back Side		Top Side	
Distance (mm)	Sensor Activated	Distance (mm)	Sensor Activated
20	N	20	N
19	N	19	N
18	N	18	N
17	N	17	N
16	N	16	N
15	N	15	N
14	N	14	N
13	N	13	N
12	N	12	N
11	N	11	Y
10	N	10	Y
9	N	9	Y
8	Y	8	Y
7	Y	7	Y
6	Y	6	Y
5	Y	5	Y
4	Y	4	Y
3	Y	3	Y
2	Y	2	Y
1	Y	1	Y

10 EUT Antennas Location & SAR Exclusion Consideration



Separation Distances (mm)	Top Side	Bottom Side	Right Side	Left Side	WLAN Main Ant	WLAN Aux Ant	WWAN Ant
WLAN Main Ant	174	0	201.4	38	-	211	170
WLAN Aux Ant	86	63	5	270	211	-	184
WWAN Ant	2.22	160.4	162.3	43.35	170	184	-

SAR test exclusion table distance is ≤ 50 mm

Exposure Position	Wireless Interface	GSM 850 2 Tx slots	GSM1900 2 Tx slots	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 13	LTE Band 17	LTE Band 25
	Tune-up Target power (dBm)	27.72	26.55	20.8	22.67	22.9	23.7	23.0	22.7
Back	Antenna to user (mm)	5	5	5	5	5	5	5	5
	SAR exclusion threshold (dBm)	12.1	10.4	10.4	10.6	12.1	12.5	12.5	10.4
	SAR Testing required?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Top	Antenna to user (mm)	5	5	5	5	5	5	5	5
	SAR exclusion threshold (dBm)	12.1	10.4	10.4	10.6	12.1	12.5	12.5	10.4
	SAR Testing required?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Left	Antenna to user (mm)	43	43	43	43	43	43	43	43
	SAR exclusion threshold (dBm)	21.9	19.7	19.7	19.9	21.9	21.6	21.8	19.7
	SAR Testing required?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Exposure Position	Wireless Interface	CDMA BC0	CDMA BC1	CDMA BC10	UMTS Band 2	UMTS Band 4	UMTS Band 5
	Tune-up Target power (dBm)	23.51	23.71	23.12	21.89	22.16	22.34
Back	Antenna to user (mm)	5	5	5	5	5	5
	SAR exclusion threshold (dBm)	12.1	10.4	12.1	10.4	10.6	12.1
	SAR Testing required?	Yes	Yes	Yes	Yes	Yes	Yes
Top	Antenna to user (mm)	5	5	5	5	5	5
	SAR exclusion threshold (dBm)	12.1	10.4	12.1	10.4	10.6	12.1
	SAR Testing required?	Yes	Yes	Yes	Yes	Yes	Yes
Left	Antenna to user (mm)	43	43	43	43	43	43
	SAR exclusion threshold (dBm)	21.9	19.7	21.9	19.9	19.7	21.9
	SAR Testing required?	No	No	No	No	No	No

SAR test exclusion table distance is > 50 mm

Exposure Position	Wireless Interface	GSM 850 2 Tx slots	GSM 1900 2 Tx slots	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 13	LTE Band 17	LTE Band 25
	Tune-up Target power (dBm)	27.72	26.55	20.8	22.67	22.9	23.7	23.0	22.7
Bottom	Antenna to user (mm)	174	174	174	174	174	174	174	174
	SAR exclusion threshold (dBm)	29.2	31.2	31.2	31.4	29.2	29.2	29.2	31.2
	SAR Testing required?	No	No	No	No	No	No	No	No
Right	Antenna to user (mm)	162	162	162	162	162	162	162	162
	SAR exclusion threshold (dBm)	29.2	31.2	31.2	31.4	29.2	29.2	29.2	31.2
	SAR Testing required?	No	No	No	No	No	No	No	No

Exposure Position	Wireless Interface	UMTS Band 2	UMTS Band 4	UMTS Band 5	CDMA BC 0	CDMA BC 1	CDMA BC 10
	Tune-up Target power (dBm)	21.89	22.16	22.34	23.51	23.71	23.12
Bottom	Antenna to user (mm)	174	174	174	174	174	174
	SAR exclusion threshold (dBm)	29.2	31.4	31.2	29.2	31.2	29.2
	SAR Testing required?	No	No	No	No	No	No
Right	Antenna to user (mm)	162	162	162	162	162	162
	SAR exclusion threshold (dBm)	29.2	31.4	31.2	29.2	31.2	29.2
	SAR Testing required?	No	No	No	No	No	No

Note:

- Maximum power is the source-based time-average power and represents the maximum RF output power among production units.
- Per KDB 447498 D01 v05r02, standalone SAR test exclusion threshold is applied; if the distance of the antenna to the user is < 5mm, 5mm is used to determine SAR exclusion threshold.
- Per KDB 447498 D01 v05r02, The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$(\text{Max. power of channel, including tune-up tolerance, mW}) / (\text{Min. test distance, mm}) \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$$
for 1-g SAR and ≤ 7.5 for 10-g extremity, where
 - * $f(\text{GHz})$ is the RF channel transmit frequency in GHz
 - * Power and distance are rounded to the nearest mW and mm before calculation
 - * The result is rounded to one decimal place for comparison
- Per KDB 447498 D01 v05r02, at 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following:
 - [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm) · ($f(\text{MHz})/150$)] mW, at 100 MHz to 1500 MHz
 - [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm) · 10] mW at > 1500 MHz and ≤ 6 GHz

5. According to the WWAN modular report, the max average output power of the GPRS mode is more than 2 dB higher than the EGPRS measured in the same frequency band, according to IEEE1528, the SAR of EGPRS mode is not required.
6. KDB 941225 D01-Body SAR is not required for HSDPA when the maximum average output of each RF channel with HSDPA active is less than $\frac{1}{4}$ dB higher than measured without HSDPA using 12.2kbps RMC or the maximum SAR for 12.2kbps RMC is $< 75\%$ of SAR limit.
7. KDB 941225 D01-Body SAR is not required for HSUPA when the maximum average output of each RF Channel with HSUPA active is less than $\frac{1}{4}$ dB higher than measured without HSUPA using 12.2kbps RMC and the maximum SAR for 12.2kbps RMC is $< 75\%$ of SAR limit.
8. According to KDB248227, SAR is not required for 802.11g/n channels when the maximum average output power is less than 0.25 dB higher than that measured on the corresponding 802.11a/b channels.

11 SAR Measurement Results

This page summarizes the results of the performed dosimetric 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.

11.1 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	43 %
ATM Pressure:	101.89 kPa

Testing was performed by Jerry Tong on 2014-08-27 to 2014-10-15 in SAR chamber.

GSM 850										
EUT Position	Frequency (MHz)	Uplink Slots	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	824.2	2	0	1.18	1.15	1.32	1.32	1.6		A
	836.6	2	0	1.15	1.15	1.29	1.29	1.6		A
	848.8	2	0	1.08	1.15	1.21	1.21	1.6		A
	824.2	2	7	0.986	1.15	1.10	1.10	1.6		B
	836.6	2	7	0.961	1.15	1.08	1.08	1.6		B
	848.8	2	7	1.06	1.15	1.19	1.19	1.6		B
Top Edge	824.2	2	0	1.2	1.15	1.34	1.34	1.6	1	A
	836.6	2	0	1.41	1.15	1.58	1.58	1.6	2	A
	848.8	2	0	1.37	1.15	1.53	1.53	1.6	3	A
	824.2	2	10	0.644	1.15	0.72	0.72	1.6		B
	836.6	2	10	0.848	1.15	0.95	0.95	1.6		B
	848.8	2	10	0.642	1.15	0.72	0.72	1.6		B
Left Touch	836.6	2	0	0.319	1.15	0.367	0.367	1.6		A

GSM 1900										
EUT Position	Frequency (MHz)	Uplink Slots	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	1850.2	2	0	1.42	1.03	1.463	1.463	1.6		A
	1880	2	0	1.45	1.11	1.610	1.610	1.6		A
	1909.8	2	0	1.37	1.05	1.44	1.44	1.6		A
	1880	2	7	0.652	1.12	0.730	0.730	1.6		B
Top Edge	1850.2	2	0	0.71	1.03	0.731	0.731	1.6		A
	1880	2	0	1.04	1.11	1.154	1.154	1.6		A
	1909.8	2	0	1.51	1.05	1.58	1.58	1.6	4	A
	1880	2	10	0.271	1.12	0.304	0.304	1.6		B
Left Touch	1880	2	0	0.135	1.11	0.15	0.15	1.6		A

LTE Band 2											
EUT Position	Frequency (MHz)	RB Size	RB Offset	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	1880	1	50	0	0.566	1.076	0.609	0.609	1.6		A
	1860	1	50	7	0.857	1.022	0.876	0.876	1.6	5	B
	1880	1	50	7	0.83	1.013	0.841	0.841	1.6	6	B
	1900	1	50	7	0.752	1.013	0.762	0.762	1.6	7	B
Top Edge	1880	1	50	0	0.146	1.076	0.157	0.157	1.6		A
	1880	1	50	10	0.224	1.013	0.227	0.227	1.6		B
Left Touch	1880	1	50	0	0.145	1.076	0.156	0.156	1.6		A

LTE Band 4											
EUT Position	Frequency (MHz)	RB Size	RB Offset	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	1732.5	1	50	0	0.796	1.013	0.807	0.807	1.6	8	A
	1732.5	1	50	7	0.558	1.020	0.569	0.569	1.6		B
Top Edge	1732.5	1	50	0	0.412	1.013	0.417	0.417	1.6		A
	1732.5	1	50	10	0.071	1.020	0.072	0.072	1.6		B
Left Touch	1732.5	1	50	0	0.109	1.013	0.11	0.11	1.6		A

LTE Band 5											
EUT Position	Frequency (MHz)	RB Size	RB Offset	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	829	1	25	0	1.24	1.010	1.252	1.252	1.6		A
	836.5	1	25	0	1.2	1.005	1.206	1.206	1.6		A
	844	1	25	0	1.14	1.020	1.163	1.163	1.6		A
	836.5	1	25	7	0.566	1.004	0.568	0.568	1.6		B
Top Edge	829	1	25	0	1.45	1.010	1.464	1.464	1.6	9	A
	836.5	1	25	0	1.44	1.005	1.447	1.447	1.6	10	A
	844	1	25	0	1.4	1.020	1.428	1.428	1.6	11	A
	836.5	1	25	10	0.466	1.004	0.468	0.468	1.6		B
Left Touch	836.5	1	25	0	0.19	1.005	0.191	0.191	1.6		A

LTE Band 13											
EUT Position	Frequency (MHz)	RB Size	RB Offset	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	782	1	25	0	0.596	1.145	0.683	0.683	1.6	12	A
	782	1	25	7	0.436	1.000	0.436	0.436	1.6		B
Top Edge	782	1	25	0	0.586	1.145	0.671	0.671	1.6		A
	782	1	25	10	0.389	1.000	0.389	0.389	1.6		B
Left Touch	782	1	25	0	0.237	1.145	0.271	0.271	1.6		A

LTE Band 17											
EUT Position	Frequency (MHz)	RB Size	RB Offset	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	709	1	25	0	1.04	1.019	1.060	1.060	1.6		A
	710	1	25	0	1.0	1.019	1.019	1.019	1.6		A
	711	1	25	0	1.05	1.019	1.070	1.070	1.6	13	A
	710	1	25	7	0.301	1.004	0.302	0.302	1.6		B
Top Edge	709	1	25	0	1.09	1.019	1.111	1.111	1.6	14	A
	710	1	25	0	1.02	1.019	1.039	1.039	1.6		A
	711	1	25	0	1.01	1.019	1.029	1.029	1.6		A
	710	1	25	10	0.181	1.004	0.182	0.182	1.6		B
Left Touch	710	1	25	0	0.166	1.019	0.169	0.169	1.6		A

LTE Band 25											
EUT Position	Frequency (MHz)	RB Size	RB Offset	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	1882.5	1	50	0	0.608	1.192	0.725	0.725	1.6		A
	1860	1	50	7	0.849	1.018	0.864	0.864	1.6	15	B
	1882.5	1	50	7	0.846	1.018	0.861	0.861	1.6	16	B
	1905	1	50	7	0.799	1.022	0.817	0.817	1.6	17	B
Top Edge	1882.5	1	50	0	0.396	1.192	0.472	0.472	1.6		A
	1882.5	1	50	10	0.071	1.018	0.072	0.072	1.6		B
Left Touch	1882.5	1	50	0	0.135	1.192	0.161	0.161	1.6		A

UMTS Band 2									
EUT Position	Frequency (MHz)	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	1880	0	0.62	1.00	0.65	0.65	1.6	18	A
	1880	7	0.561	1.05	0.59	0.59	1.6		B
Top Edge	1880	0	0.125	1.00	0.13	0.13	1.6		A
	1880	10	0.204	1.05	0.21	0.21	1.6		B
Left Touch	1880	0	0.126	1.00	0.126	0.126	1.6		A

UMTS Band 4									
EUT Position	Frequency (MHz)	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	1712.4	0	0.561	1.00	0.561	0.561	1.6		A
	1732.6	0	1.3	1.00	1.3	1.3	1.6	19	A
	1752.6	0	0.623	1.00	0.623	0.623	1.6		A
	1732.6	7	0.518	1.03	0.534	0.534	1.6		B
Top Edge	1732.6	0	0.296	1.00	0.296	0.296	1.6		A
	1732.6	10	0.0832	1.03	0.0857	0.0857	1.6		B
Left Touch	1732.6	0	0.0929	1.00	0.0929	0.0929	1.6		A

UMTS Band 5									
EUT Position	Frequency (MHz)	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	836.6	0	0.204	1.00	0.204	0.204	1.6		A
	836.6	7	0.676	1.03	0.696	0.696	1.6		B
Top Edge	826.4	0	0.882	1.00	0.882	0.882	1.6	20	A
	836.6	0	1.1	1.00	1.1	1.1	1.6	21	A
	846.6	0	0.876	1.00	0.876	0.876	1.6	22	A
	836.6	10	0.535	1.03	0.551	0.551	1.6		B
	836.6	0	0.208	1.00	0.208	0.208	1.6		A

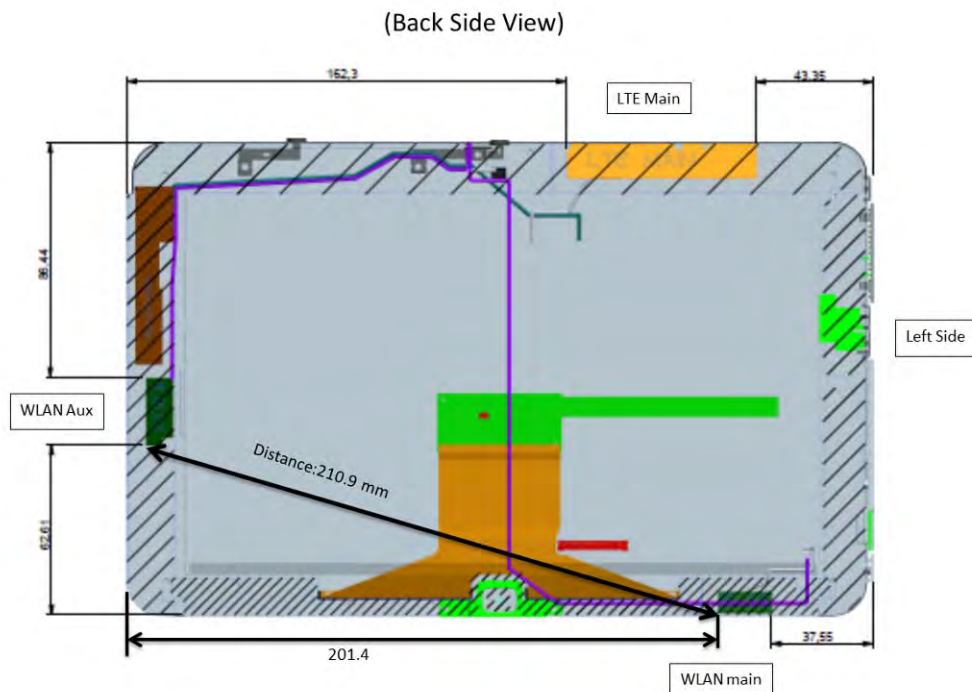
CDMA BC0										
EUT Position	Channel Number	Frequency (MHz)	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	1013	824.7	0	1.08	1.0350	1.118	1.118	1.6		A
	384	836.52	0	1.06	1.0421	1.105	1.105	1.6		A
	777	848.31	0	0.944	1.0369	0.979	0.979	1.6		A
	384	836.52	7	0.794	1.0235	0.813	0.813	1.6		B
Top Edge	1013	824.7	0	1.47	1.0350	1.521	1.521	1.6	23	A
	384	836.52	0	1.4	1.0421	1.459	1.459	1.6	24	A
	777	848.31	0	1.34	1.0369	1.389	1.389	1.6	25	A
	384	836.52	10	0.652	1.0235	0.667	0.667	1.6		B
Left Touch	384	836.52	0	0.237	1.0421	0.247	0.247	1.6		A

CDMA BC1										
EUT Position	Channel Number	Frequency (MHz)	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	25	1851.25	0	0.892	1.0690	0.954	0.954	1.6		A
	600	1880	0	0.888	1.0700	0.950	0.950	1.6		A
	1175	1908.75	0	0.859	1.0634	0.913	0.913	1.6		A
	25	1851.25	7	1.04	1.0213	1.062	1.062	1.6	26	B
	600	1880	7	1.05	1.0122	1.063	1.063	1.6	27	B
	1175	1908.75	7	0.999	1.0243	1.023	1.023	1.6	28	B
Top Edge	25	1851.25	0	0.685	1.0690	0.732	0.732	1.6		A
	600	1880	0	0.855	1.0700	0.915	0.915	1.6		A
	1175	1908.75	0	1.12	1.0634	1.191	1.191	1.6		A
	600	1880	10	0.375	1.0122	0.380	0.380	1.6		B
Left Touch	600	1880	0	0.161	1.0700	0.172	0.172	1.6		A

CDMA BC10										
EUT Position	Channel Number	Frequency (MHz)	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Correct SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	476	817.9	0	1.26	1.0412	1.312	1.312	1.6		A
	580	820.5	0	1.24	1.0407	1.290	1.290	1.6		A
	684	823.1	0	1.24	1.0384	1.288	1.288	1.6		A
	580	820.5	7	0.768	1.0403	0.799	0.799	1.6		B
Top Edge	476	817.9	0	1.45	1.0412	1.510	1.510	1.6	29	A
	580	820.5	0	1.44	1.0407	1.499	1.499	1.6	30	A
	684	823.1	0	1.5	1.0384	1.558	1.558	1.6	31	A
	580	820.5	10	0.595	1.0403	0.619	0.619	1.6		B
Left Touch	580	820.5	0	0.262	1.0407	0.273	0.273	1.6		A

Multi-TX and Antenna SAR Considerations

The Motion Tablet (Model: FWS-002) contains two radio modules inside, namely WLAN+BT Combo and WWAN radios, each internal radio has individual registration identifiers.



Note 1: According To KDB 447498, Bluetooth Power $\leq 10\text{mW}$, the standalone SAR is not required for Bluetooth. The maximum Bluetooth power is 6.0mW; therefore, standalone SAR is not required.

(Max. power of channel, including tune-up tolerance, mW)/(Min. test distance, mm)* $[\sqrt{f(\text{GHz})}/x]$ W/kg for test separation distances $\leq 50\text{mm}$;

Where $x=7.5$ for 1-g SAR, and $x=18.75$ for 10-g SAR.

(Max power= 10mW; min test separation distance= 5mm for body; $f=2.45\text{GHz}$)

BT estimated Body SAR = 0.417W/kg (1g)

Note 2: According To KDB 447498, SAR is not required for other channels when the SAR value of middle channel is less than 0.8 W/kg.

Note 3:

Condition A: Proximity sensor activated WWAN output power back of stage II.

Condition B Proximity sensor deactivated, WWAN radio works at Stage I (full output power).

Note 4: Simultaneous Transmission:

Bluetooth and 2.4 GHz WLAN radios, Bluetooth and 5 GHz WLAN, only occurs on antenna port 0. KDB447498 D01v05, $SPLSR = (SAR1 + SAR2) * \sqrt{1.5} / (\text{min. separation distance, mm}) \leq 0.04$, and the peak separation distance is computed by the square root of $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$, where $(x1, y1, z1)$ and $(x2, y2, z2)$ are the coordinates of the area scans or extrapolated peak SAR locations in the zoom scans.

If $SPLSR \leq 0.04$, simultaneously transmission SAR measurement is not necessary

WLAN SAR:

Radio Mode	EUT Position	Frequency (MHz)	Data Rate	Bandwidth (MHz)	Antenna	Measured 1g SAR (W/kg)	Corrected 1 g SAR (W/kg)	Limit (W/kg)
802.11n	Bottom Edge Touch (Low CH)	5745	HT4	20	Main	1.57	1.57	1.6
802.11a	Right Edge Touch (Low CH)	5785	6 Mbps	20	Aux	1.09	1.09	1.6
802.11n	Bottom Edge Touch (Mid CH)	2437	HT4	40	Main	1.54	1.54	1.6
802.11b	Back Side Touch (Low CH)	2412	1 Mbps	20	Aux	0.375	0.375	1.6

Simultaneous Transmission SAR Evaluation

Frequency (GHz)	WLAN Antenna	Highest SAR for WLAN	Highest SAR for WWAN Ant	Sum of SAR (W/Kg)	Peak SAR Distance (mm)	SPLSR	Threshold
5	Main	1.57	1.51	3.08	170	0.031	0.04
	Aux	1.09		2.6	184	0.023	0.04
2.4	Main	1.54	1.51	3.05	170	0.031	0.04
	Aux	0.375		1.885	184	0.014	0.04

Note 5: The simultaneous transmission occurs in WWAN antenna and WLAN Antenna. More specifically, it only occurs between WWAN and one WLAN modulation, either 5GHz or 2.4 GHz.

12 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

SASY4 Uncertainty Budget								
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	± 6.0 %	N	1	1	1	± 6.0 %	± 6.0 %	∞
Axial Isotropy	± 4.7 %	R	$\sqrt{3}$	0.7	0.7	± 1.9 %	± 1.9 %	∞
Hemispherical Isotropy	± 9.6 %	R	$\sqrt{3}$	0.7	0.7	± 3.9 %	± 3.9 %	∞
Boundary Effects	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∞
Linearity	± 4.7 %	R	$\sqrt{3}$	1	1	± 2.7 %	± 2.7 %	∞
System Detection Limits	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∞
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	± 3.0 %	R	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient Conditions	± 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 %	∞
Max. SAR Eval.	± 1.0 %	R	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∞
Test Sample Related								
Device Positioning	± 2.9 %	N	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	± 3.6 %	N	1	1	1	± 3.6 %	± 2.6 %	5
Power Drift	± 5.0 %	R		1	1	± 2.9 %	± 2.9 %	∞
Phantom and Setup								
Phantom Uncertainty	± 4.0 %	R	$\sqrt{3}$	1	1	± 2.3 %	± 2.3 %	∞
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 (Target)	± 2.5 %	N	1	0.6	0.49	± 1.5 %	± 1.0 %	∞
Combined Std. Uncertainty	-	-	-	-	-	± 10.7 %	± 10.4 %	330
Expanded STD Uncertainty	-	-	-	-	-	± 21.4 %	± 20.8 %	-

13 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
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 108**

Client **BACL**

Certificate No: **ET3-1604_Aug14**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1604**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-12.v9, QA CAL-23.v5, QA CAL-25.v6**
Calibration procedure for dosimetric E-field probes

Calibration date: **August 19, 2014**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: August 20, 2014

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

Certificate No: ET3-1604_Aug14

Page 1 of 11

**Calibration Laboratory of
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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**

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,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., $\theta = 0$ 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:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,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 $f \leq 800$ 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 NORM_{x,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 NORM_x (no uncertainty required).

ET3DV6- SN:1604

August 19, 2014

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1604**Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.89	1.80	1.82	± 10.1 %
DCP (mV) ^B	98.2	97.9	97.5	

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	262.1	±3.5 %
		Y	0.0	0.0	1.0		265.6	
		Z	0.0	0.0	1.0		252.9	

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

^A The uncertainties of NormX,Y,Z do not affect the E²-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.

ET3DV6- SN:1604

August 19, 2014

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1604

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^f	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha ^g	Depth ^g (mm)	Unct. (k=2)
450	43.5	0.87	7.42	7.42	7.42	0.24	2.71	± 13.3 %
600	42.7	0.88	7.16	7.16	7.16	0.19	2.18	± 13.3 %
835	41.5	0.90	6.55	6.55	6.55	0.29	2.74	± 12.0 %
900	41.5	0.97	6.40	6.40	6.40	0.27	2.91	± 12.0 %
1750	40.1	1.37	5.38	5.38	5.38	0.80	2.04	± 12.0 %
1900	40.0	1.40	5.13	5.13	5.13	0.80	1.96	± 12.0 %
2450	39.2	1.80	4.56	4.56	4.56	0.80	1.71	± 12.0 %

^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 $\pm 10\%$ 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 $\pm 5\%$. 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 $\pm 1\%$ for frequencies below 3 GHz and below $\pm 2\%$ for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

ET3DV6- SN:1604

August 19, 2014

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1604

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
450	56.7	0.94	7.73	7.73	7.73	0.16	1.96	± 13.3 %
600	56.1	0.95	7.20	7.20	7.20	0.07	1.20	± 13.3 %
835	55.2	0.97	6.27	6.27	6.27	0.29	3.00	± 12.0 %
900	55.0	1.05	6.18	6.18	6.18	0.63	1.82	± 12.0 %
1750	53.4	1.49	4.89	4.89	4.89	0.80	2.37	± 12.0 %
1900	53.3	1.52	4.68	4.68	4.68	0.80	2.45	± 12.0 %
2450	52.7	1.95	4.24	4.24	4.24	0.60	1.17	± 12.0 %

^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.

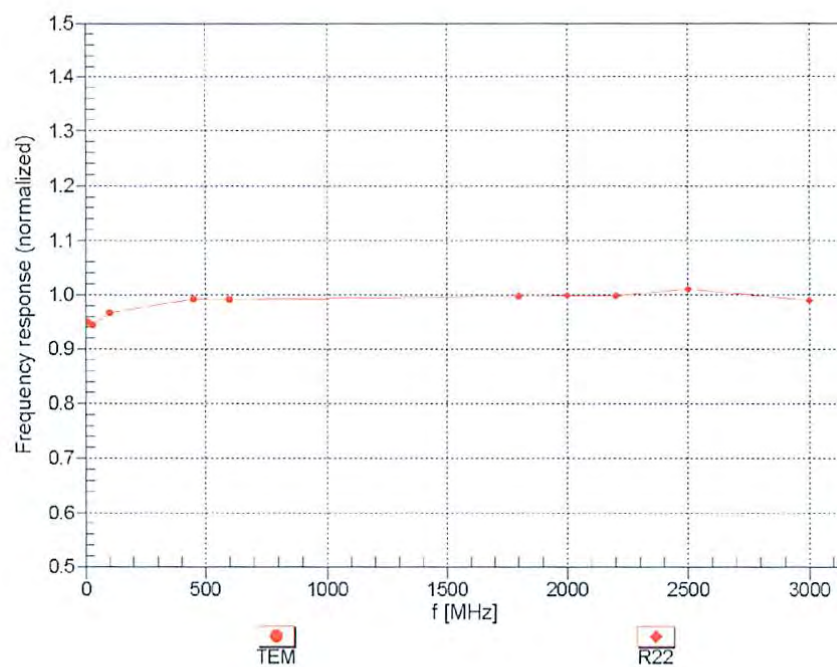
^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty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

ET3DV6- SN:1604

August 19, 2014

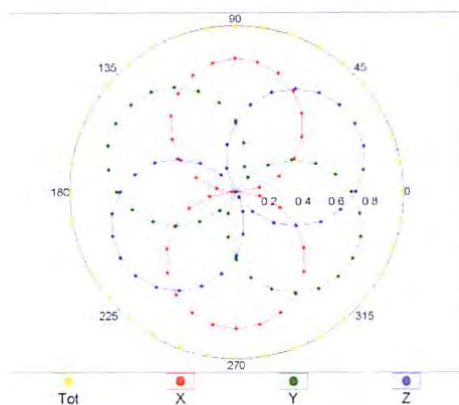
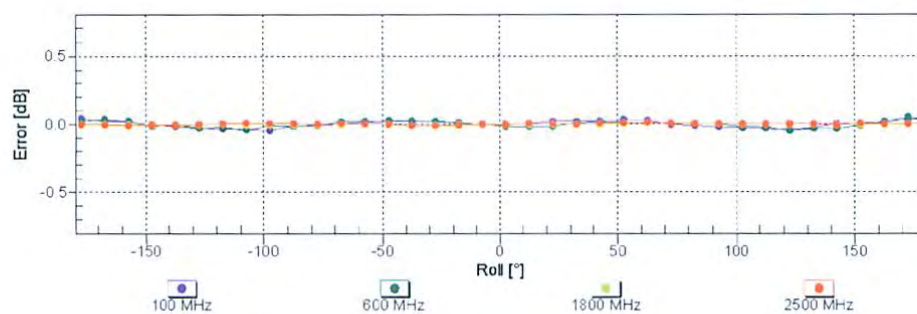
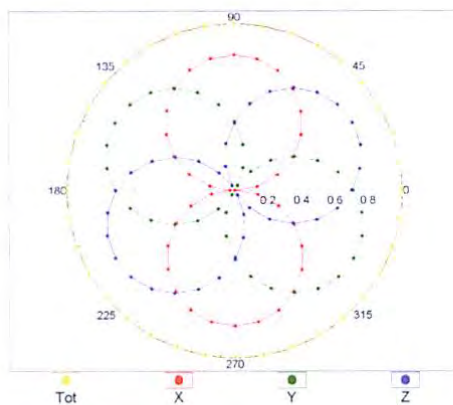
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

ET3DV6- SN:1604

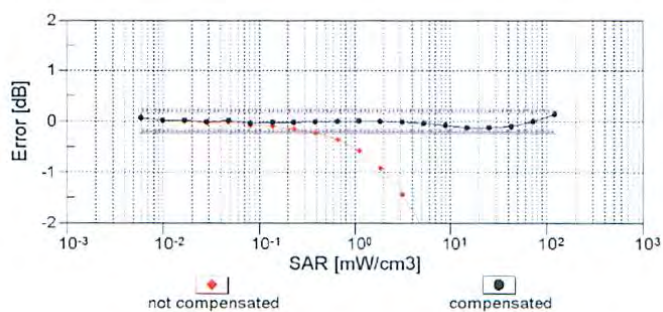
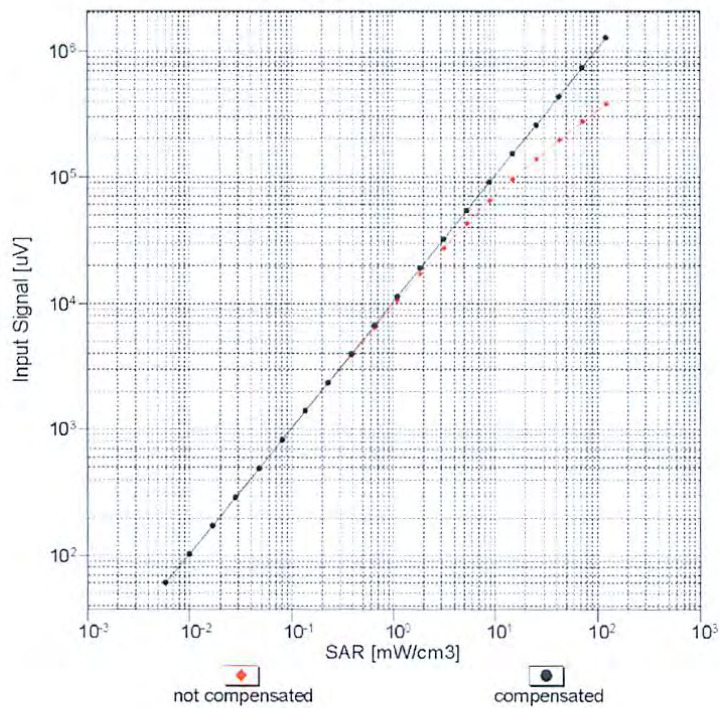
August 19, 2014

Receiving Pattern (ϕ), $\theta = 0^\circ$ **f=600 MHz,TEM****f=1800 MHz,R22****Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)**

ET3DV6- SN:1604

August 19, 2014

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

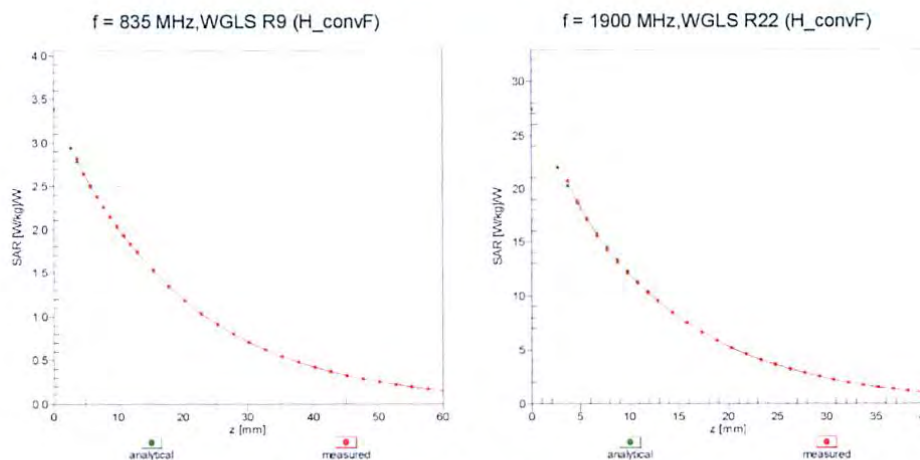


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

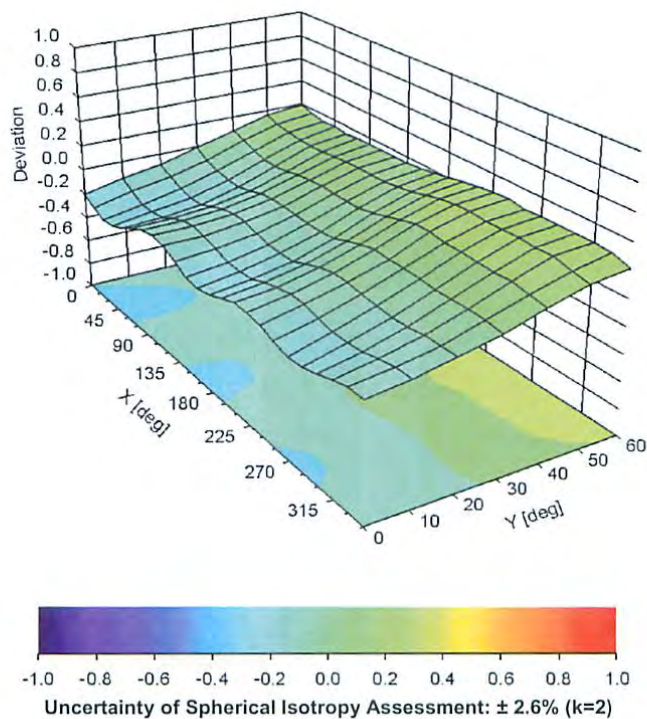
ET3DV6- SN:1604

August 19, 2014

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ , θ), f = 900 MHz

ET3DV6- SN:1604

August 19, 2014

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1604**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	-117.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

14 Appendix C – Dipole Calibration Certificates

Calibration Laboratory of
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Accreditation No.: **SCS 108**

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Client **BACL**

Certificate No: **D750V3-1102_Dec13**

CALIBRATION CERTIFICATE

Object **D750V3 - SN: 1102**

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

Calibration date: **December 06, 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 $(22 \pm 3)^{\circ}\text{C}$ 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

Calibrated by: Name **Claudio Leubler** Function **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** Technical Manager

Issued: December 6, 2013

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Certificate No: D750V3-1102_Dec13

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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:

- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.0 $\pm$ 6 %	0.92 mho/m $\pm$ 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	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.42 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.51 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	56.9 $\pm$ 6 %	0.99 mho/m $\pm$ 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	2.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.68 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.46 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.75 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.0 Ω - 3.8 j Ω
Return Loss	- 26.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.4 Ω - 5.4 j Ω
Return Loss	- 24.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.028 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 25, 2013

DASY5 Validation Report for Head TSL

Date: 04.12.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1102

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750$ MHz; $\sigma = 0.92$ S/m; $\epsilon_r = 41$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.28, 6.28, 6.28); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

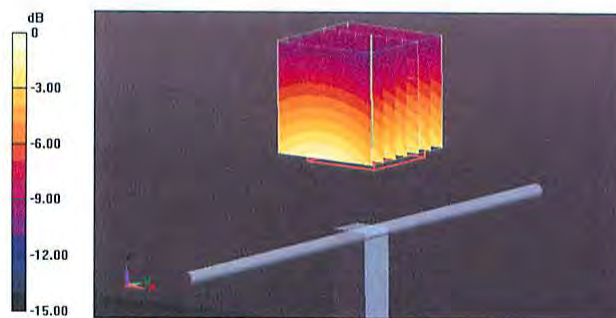
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 53.730 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 3.32 W/kg

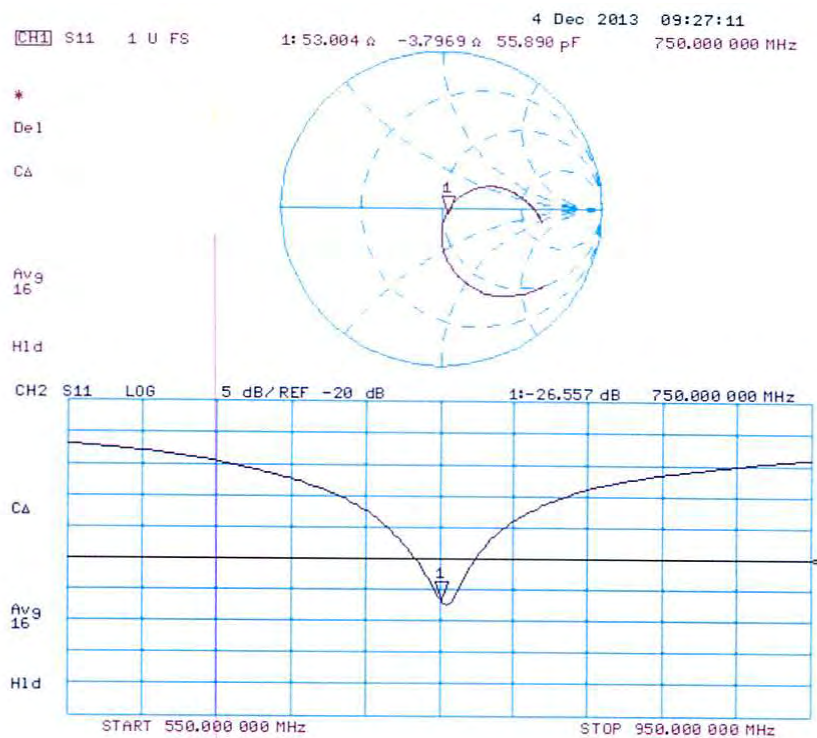
SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.41 W/kg

Maximum value of SAR (measured) = 2.54 W/kg



0 dB = 2.54 W/kg = 4.05 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 06.12.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1102

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: $f = 750$ MHz; $\sigma = 0.99$ S/m; $\epsilon_r = 56.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.11, 6.11, 6.11); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

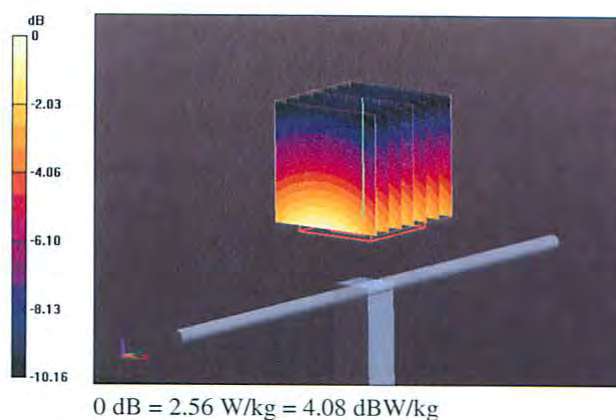
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 52.641 V/m; Power Drift = 0.02 dB

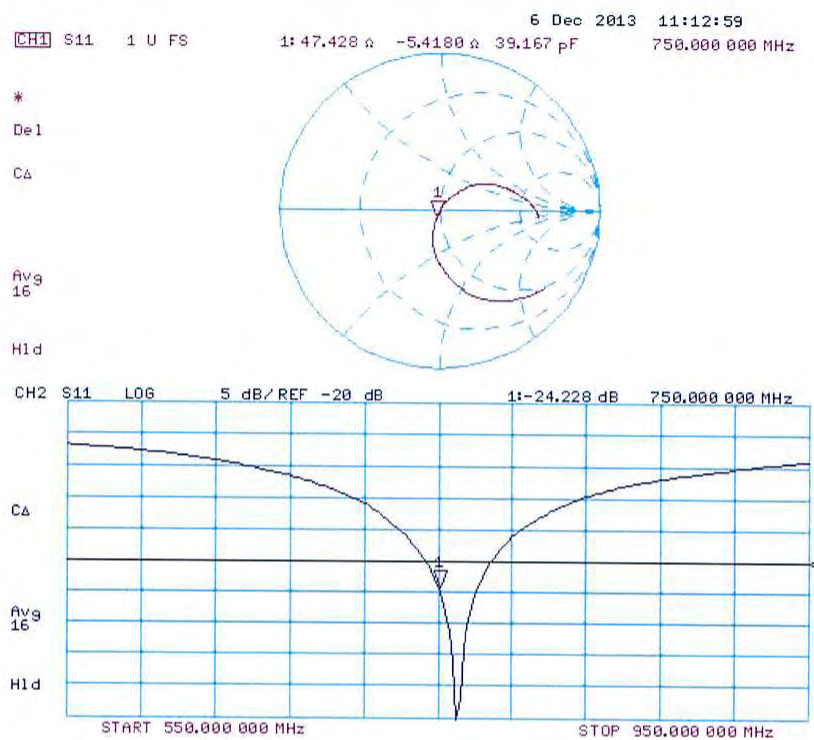
Peak SAR (extrapolated) = 3.28 W/kg

SAR(1 g) = 2.21 W/kg; SAR(10 g) = 1.46 W/kg

Maximum value of SAR (measured) = 2.56 W/kg



Impedance Measurement Plot for Body TSL



NCL CALIBRATION LABORATORIES

Calibration File No: DC-1384
Project Number: BAC-835-dipole-cal-5626

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

Calibrated: 24th October 2011
Released on: 27th October 2011

This Calibration Certificate is incomplete unless accompanied with the Calibration Results Summary

Released By: _____

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

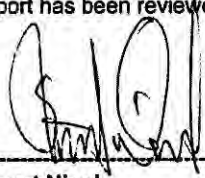
Division of APREL Inc.

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

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

**Stuart Nicol****G. Teodorian****Primary Measurement Standards**

Instrument	Serial Number	Cal due date
Power meter Anritsu MA2408A	90025437	Nov.4, 2011
Power Sensor Anritsu MA2481D	103555	Nov 4, 2011
Attenuator HP 8495A (70dB)	1944A10711	Sept. 14, 2012
Network Analyzer Agilent E5071C	1334746J	Aug. 8, 2012

Secondary Measurement Standards

Signal Generator Agilent E4438C -506	MY55182336	June 7, 2012
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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

Length: 161.0 mm

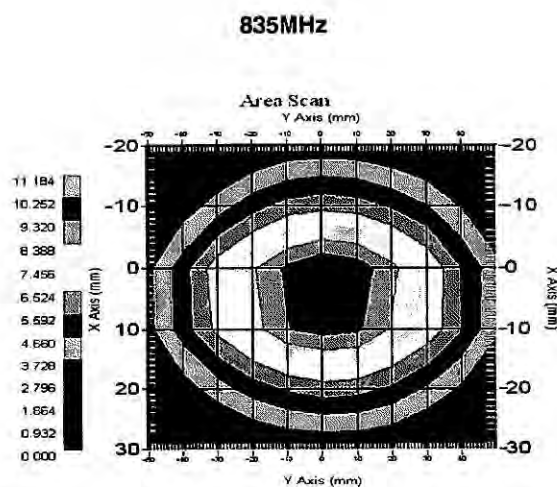
Height: 89.8 mm

Electrical Specification 835MHz

Tissue Type	Return Loss:	Impedance:	SWR:
Head	-32.132	48.897	1.0621U
Body	-24.800	53.311	1.1206U

System Validation Results

Tissue	Frequency	1 Gram	10 Gram	Peak
Head	835 MHz	9.590	6.003	15.013
Body	835 MHz	9.981	6.006	15.013



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

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-030 130 MHz to 26 GHz E-Field Probe Serial Number 215.

References

- o IEEE Standard 1528 (2003) including Amendment 1
IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- o EN 62209-1 (2006)
Human Exposure to RF Fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures-Part 1: Procedure to measure the Specific Absorption Rate (SAR) for hand-held mobile wireless devices
- o IEC 62209-2 Ed. 1.0 (2010-03)
Human exposure to RF fields from hand-held and body-mounted wireless devices - Human models, instrumentation, and procedures - Part 2: specific absorption rate (SAR) for wireless communication devices (30 MHz - 6 GHz)
- o TP-D01-032-E020-V2 E-Field probe calibration procedure
- o D22-012-Tissue dielectric tissue calibration procedure
- o D28-002-Dipole procedure for validation of SAR system using a dipole
- o IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

Conditions

Dipole 180-00564 was a recalibration.

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

Temperature of the Tissue: 20 °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)

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

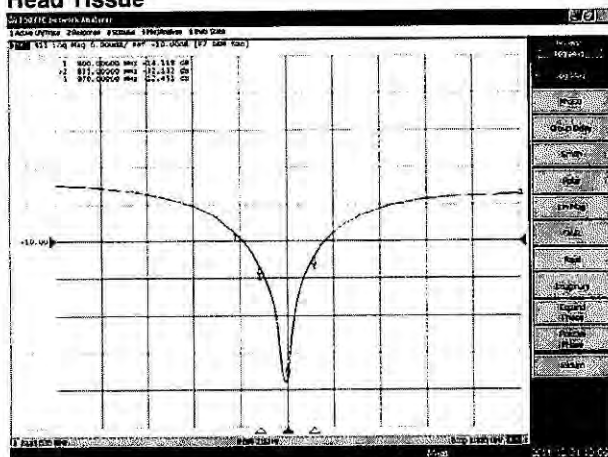
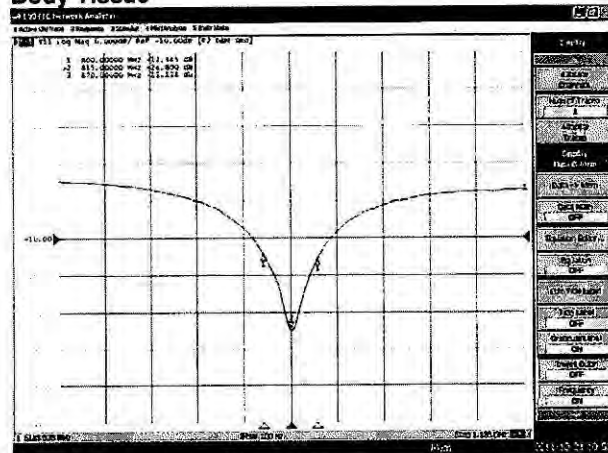
4

NCL Calibration Laboratories

Division of APREL Inc.

Electrical Calibration**Electrical Specification 835MHz**

Tissue Type	Measured Epsilon	Measured Sigma
Head	41.09	0.89
Body	53.15	0.95

Forward Reflection**Head Tissue****Body Tissue**

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

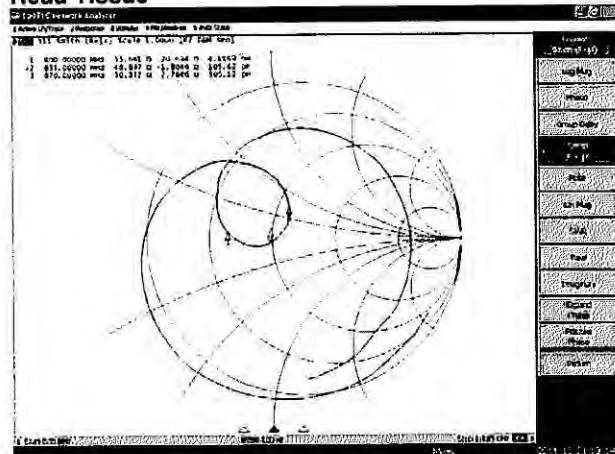
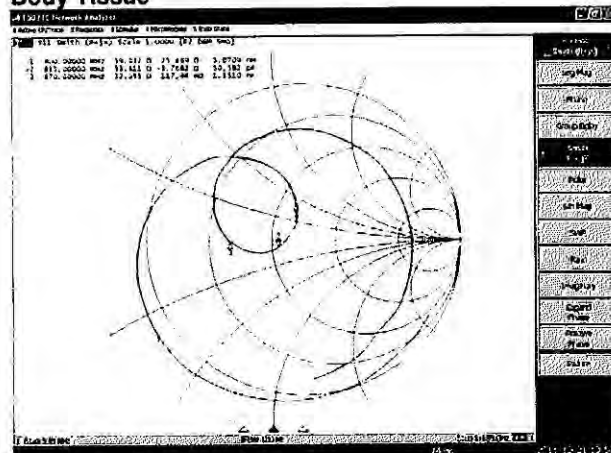
5

NCL Calibration Laboratories

Division of APREL Inc.

**Electrical Specification 835MHz
Impedance**

Tissue Type	Measured Epsilon	Measured Sigma
Head	41.09	0.89
Body	53.15	0.95

Head Tissue**Body Tissue**

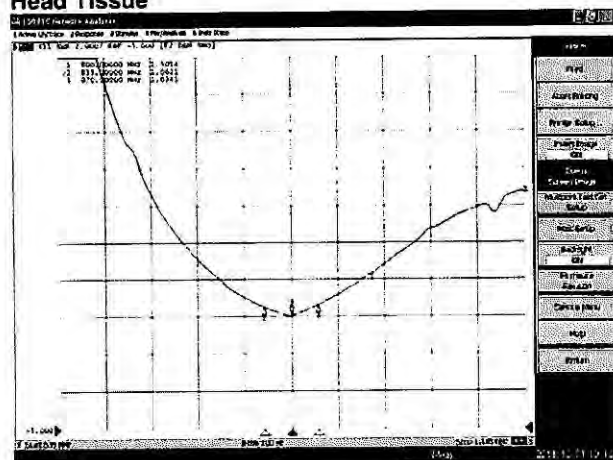
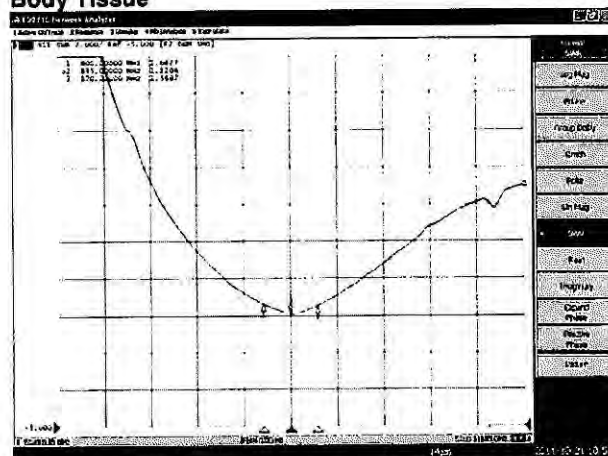
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories

Division of APREL Inc.

**Electrical Specification 835MHz
Standing Wave Ratio**

Tissue Type	Measured Epsilon	Measured Sigma
Head	41.09	0.89
Body	53.15	0.95

Head Tissue**Body Tissue**

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

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NCL Calibration Laboratories

Division of APREL Inc.

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2011.

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

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NCL CALIBRATION LABORATORIES

Calibration File No: DC-1531

Project Number: BACL-5745

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.

BACL Head & Body Validation Dipole

Manufacturer: APREL Laboratories

Part number: ALS-D-1750-S-2

Frequency: 1750 MHz

Serial No: 198-00304

Calibrated: 8th October, 2013

Released on: 8th October, 2013

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

Released By: _____



Art Brennan, Quality Manager

NCL CALIBRATION LABORATORIES

Suite 102, 303 Terry Fox Dr,
OTTAWA, ONTARIO
CANADA K2K 3J1

Division of APREL Lab
TEL: (613) 435-8300
FAX: (613) 435-8306

NCL Calibration Laboratories

Division of APREL Laboratories.

Conditions

Dipole 198-00304 was an original calibration.

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

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

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



Constantin Teodorian, Test Engineer

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

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NCL Calibration Laboratories

Division of APREL Laboratories.

Calibration Results Summary

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

Mechanical Dimensions

Length: 75 mm
Height: 42 mm

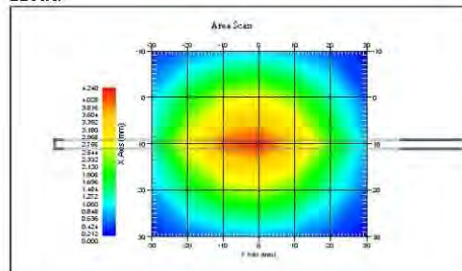
Electrical Calibration

Test	Result Head	Result Body
S11 R/L	-25.567	-20.548 dB
SWR	1.111U	1.207 U
Impedance	53.637 Ω	55.929 Ω

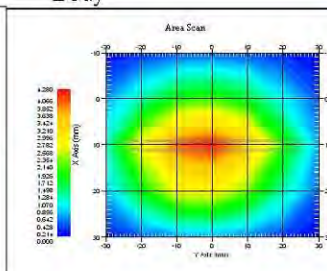
System Validation Results, 1750 MHz

Frequency 1750 MHz	1 Gram	10 Gram
Head	37.02	18.99
Body	36.65	18.85

Head



Body



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

NCL Calibration Laboratories

Division of APREL Laboratories.

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. 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-030 130 MHz to 26 GHz E-Field Probe Serial Number 215.

References

- SSI-TP-018-ALSAS Dipole Calibration Procedure
- SSI-TP-016 Tissue Calibration Procedure
- IEEE 1528 "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques"
- IEC-62209 "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 "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)"
- TP-D01-032-E020-V2 E-Field probe calibration procedure
- D22-012-Tissue dielectric tissue calibration procedure
- D28-002-Dipole procedure for validation of SAR system using a dipole
- IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

Conditions**Ambient Temperature of the Laboratory:** 22 °C +/- 0.5°C**Temperature of the Tissue:** 20 °C +/- 0.5°C

This was an original calibration taken from stock.

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NCL Calibration Laboratories

Division of APREL Laboratories.

Dipole Calibration Results**Mechanical Verification**

APREL Dimensions Length	APREL Dimensions Height	Measured Length	Measured Height
75 mm	42.86	75 mm	42 mm

Tissue Validation

Tissue 1750 MHz	Measured Head	Measured Body
Dielectric constant, ϵ_r	38.51	51.79
Conductivity, σ [S/m]	1.36	1.53

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)

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

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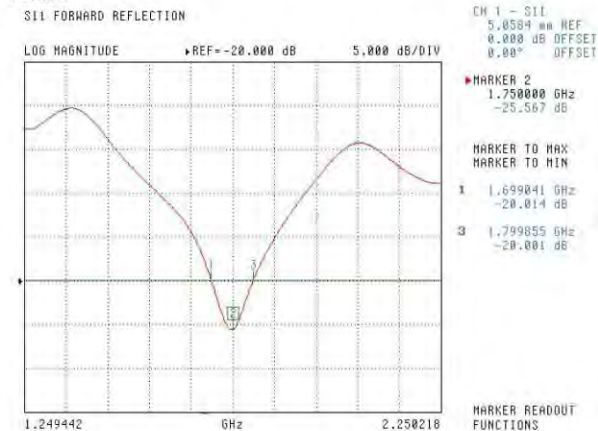
NCL Calibration Laboratories

Division of APREL Laboratories.

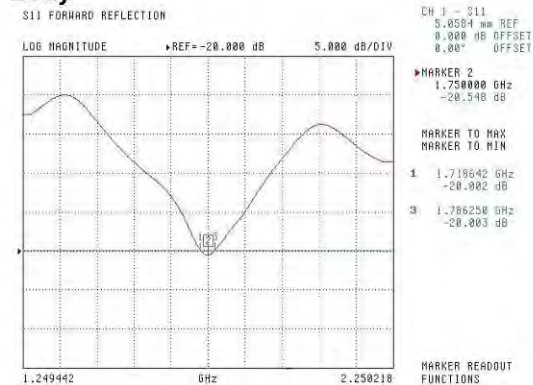
Electrical Calibration

Test	Result Head	Result Body
S11 R/L	-25.567	-20.548 dB
SWR	1.111U	1.207 U
Impedance	53.637 Ω	55.929 Ω

The Following Graphs are the results as displayed on the Vector Network Analyzer.

S11 Parameter Return Loss**Head**

Frequency range 1.699 GHz to 1.799 GHz

Body

Frequency range 1.718 GHz to 1.786 GHz

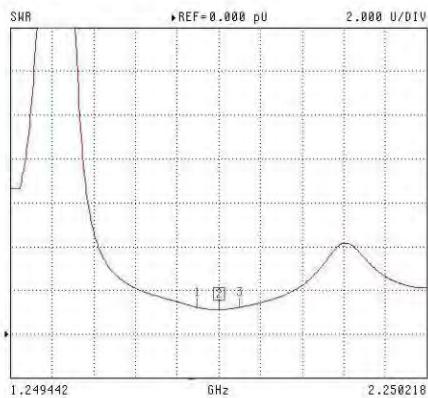
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories

Division of APREL Laboratories.

SWR**Head**

S11 FORWARD REFLECTION



CH 1 - S11
5.0584 uV REF
0.000 dB OFFSET
0.00° OFFSET

MARKER 2
1.750000 GHz
1.111 U

MARKER TO MAX

MARKER TO MIN

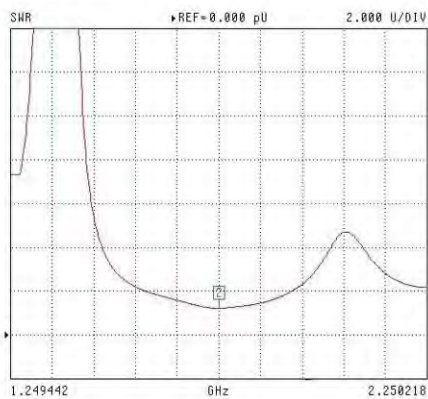
1 1.699041 GHz
1.225 U

3 1.799055 GHz
1.225 U

MARKER READOUT
FUNCTIONS

Body

S11 FORWARD REFLECTION



CH 1 - S11
5.0584 uV REF
0.000 dB OFFSET
0.00° OFFSET

MARKER 2
1.750000 GHz
1.207 U

MARKER TO MAX

MARKER TO MIN

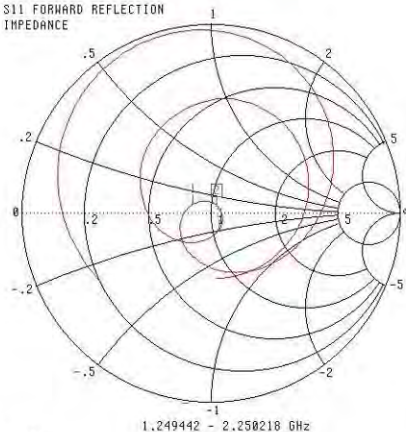
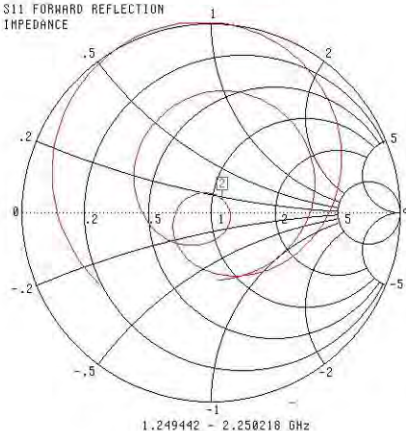
MARKER READOUT
FUNCTIONS

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NCL Calibration Laboratories

Division of APREL Laboratories.

Smith Chart Dipole Impedance**Head**S11 FORWARD REFLECTION
IMPEDANCECH 1 - S11
5.0584 dB REF
0.000 dB OFFSET
0.00° OFFSET▶ MARKER 2
1.750000 GHz
53.637 Ω
3.752 jΩMARKER TO MAX
MARKER TO MIN1 1.699041 GHz
41.539 Ω
3.495 jΩ
3 1.799053 GHz
54.266 Ω
-9.681 jΩMARKER READOUT
FUNCTIONS**Body**S11 FORWARD REFLECTION
IMPEDANCECH 1 - S11
5.0584 dB REF
0.000 dB OFFSET
0.00° OFFSET▶ MARKER 2
1.750000 GHz
55.929 Ω
7.816 jΩMARKER TO MAX
MARKER TO MINMARKER READOUT
FUNCTIONS

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

8

NCL Calibration Laboratories

Division of APREL Laboratories.

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2013

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

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NCL CALIBRATION LABORATORIES

Calibration File No: DC-1385
Project Number: BAC-1900-dipole-cal-5627

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
1900MHz Head & Body

Manufacturer: APREL Laboratories

Part number: ALS-D-1900-S-2

Frequency: 1900MHz

Serial No: 210-00715

Customer: Bay Area Compliance

Calibrated: 24th October 2011
Released on: 27th October 2011

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

Released By: _____

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

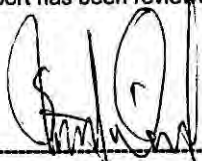
Division of APREL Inc.

Conditions

Dipole 210-00715 was a recalibration.

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

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

**Stuart Nicol****C. Teodorian****Primary Measurement Standards**

Instrument	Serial Number	Cal due date
Power meter Anritsu MA2408A	190025437	Nov.4, 2011
Power Sensor Anritsu MA2481D	103555	Nov 4, 2011
Attenuator HP 8495A (70dB)	1944A10711	Sept. 14, 2012
Network Analyzer Agilent E5071C	1334746J	Aug. 8, 2012

Secondary Measurement Standards

Signal Generator Agilent E4438C -506	MY55182336	June 7, 2012
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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

Length: 67.1 mm

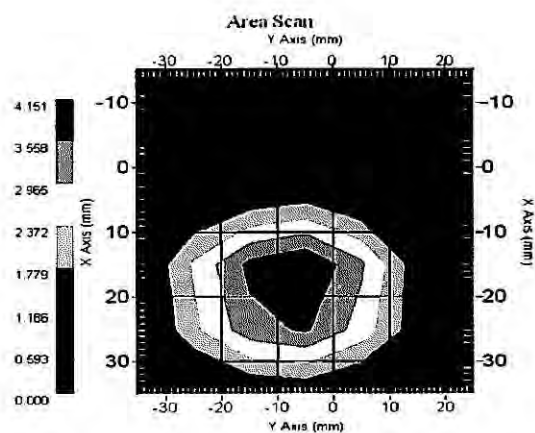
Height: 38.9 mm

Electrical Specification 1900MHz

Tissue Type	Return Loss:	Impedance:	SWR:
Head	-28.634	46.965	1.0813U
Body	-23.129	47.664	1.1520U

System Validation Results

Tissue	Frequency	1 Gram	10 Gram	Peak
Head	1900 MHz	39.378	19.668	77.268
Body	1900 MHz	39.654	19.668	77.268

1900MHz

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

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 210-00716. 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-030 130 MHz to 26 GHz E-Field Probe Serial Number 215.

References

- o IEEE Standard 1528 (2003) including Amendment 1
IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
- o EN 62209-1 (2006)
Human Exposure to RF Fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures-Part 1: Procedure to measure the Specific Absorption Rate (SAR) for hand-held mobile wireless devices
- o IEC 62209-2 Ed. 1.0 (2010-03)
Human exposure to RF fields from hand-held and body-mounted wireless devices - Human models, instrumentation, and procedures - Part 2: specific absorption rate (SAR) for wireless communication devices (30 MHz - 6 GHz)
- o TP-D01-032-E020-V2 E-Field probe calibration procedure
- o D22-012-Tissue dielectric tissue calibration procedure
- o D28-002-Dipole procedure for validation of SAR system using a dipole
- o IEEE 1309 Draft Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas, from 9kHz to 40GHz

Conditions

Dipole 210-00715 was a recalibration.

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

Temperature of the Tissue: 20 °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)

4

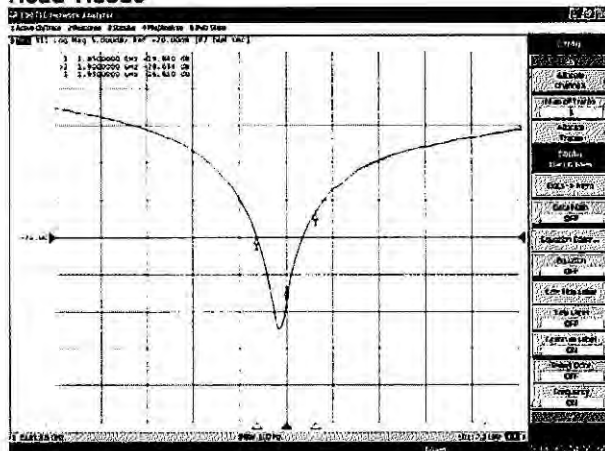
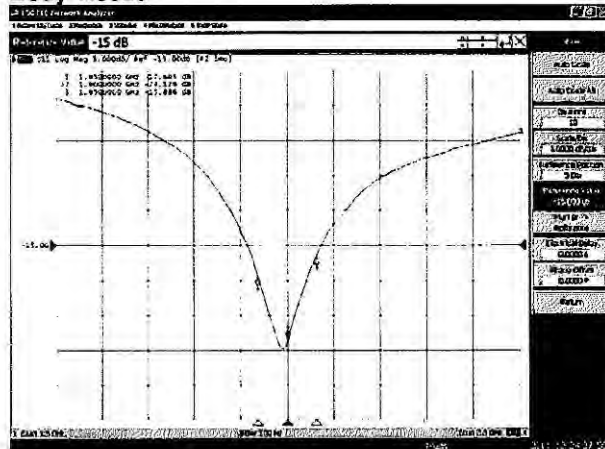
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories

Division of APREL Inc.

Electrical Calibration**Electrical Specification 1900MHz****Forward Reflection**

Tissue Type	Measured Epsilon	Measured Sigma
Head	38.12	1.41
Body	51.52	1.57

Head Tissue**Body Tissue**

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

Division of APREL Inc.

Electrical Specification 1900MHz Impedance

Tissue Type	Measured Epsilon	Measured Sigma
Head	38.12	1.41
Body	51.52	1.57

[illegible]

Figure 1: A computer-generated image of a body tissue cross-section. The image shows a circular cross-section with a central dark region and concentric rings of varying intensity. The outermost ring is labeled "Skin" and the innermost ring is labeled "Bone". The text "Figure 1: A computer-generated image of a body tissue cross-section" is visible at the top left of the image.

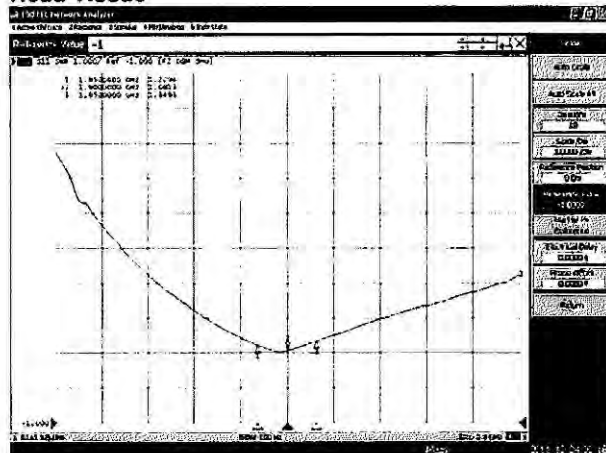
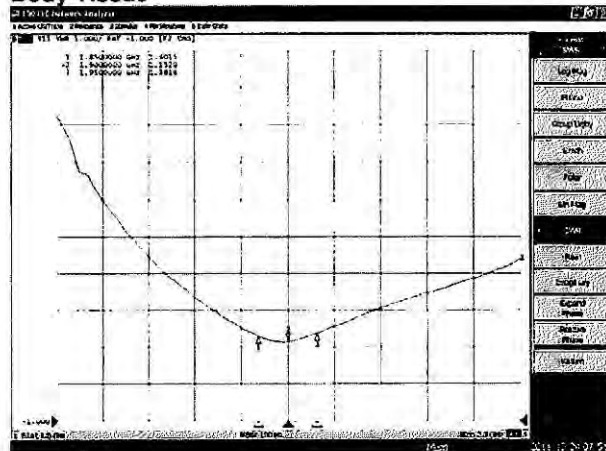
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories

Division of APREL Inc.

**Electrical Specification 1900MHz
Standing Wave Ratio**

Tissue Type	Measured Epsilon	Measured Sigma
Head	38.12	1.41
Body	51.52	1.57

Head Tissue**Body Tissue**

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

7

NCL Calibration Laboratories

Division of APREL Inc.

Test Equipment

The test equipment used during Probe Calibration, manufacturer, model number and, current calibration status are listed and located on the main APREL server R:\NCL\Calibration Equipment\Instrument List May 2011.

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

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15 Appendix D - Test System Verifications Scans

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

750 MHz body system validation

DUT: Dipole 750 MHz; Type: D750V3; S/N: 1102

Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 750 \text{ MHz}$; $\sigma = 0.96 \text{ mho/m}$; $\epsilon_r = 55.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 = 0.25 W/Area Scan (81x141x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 2.07 mW/g

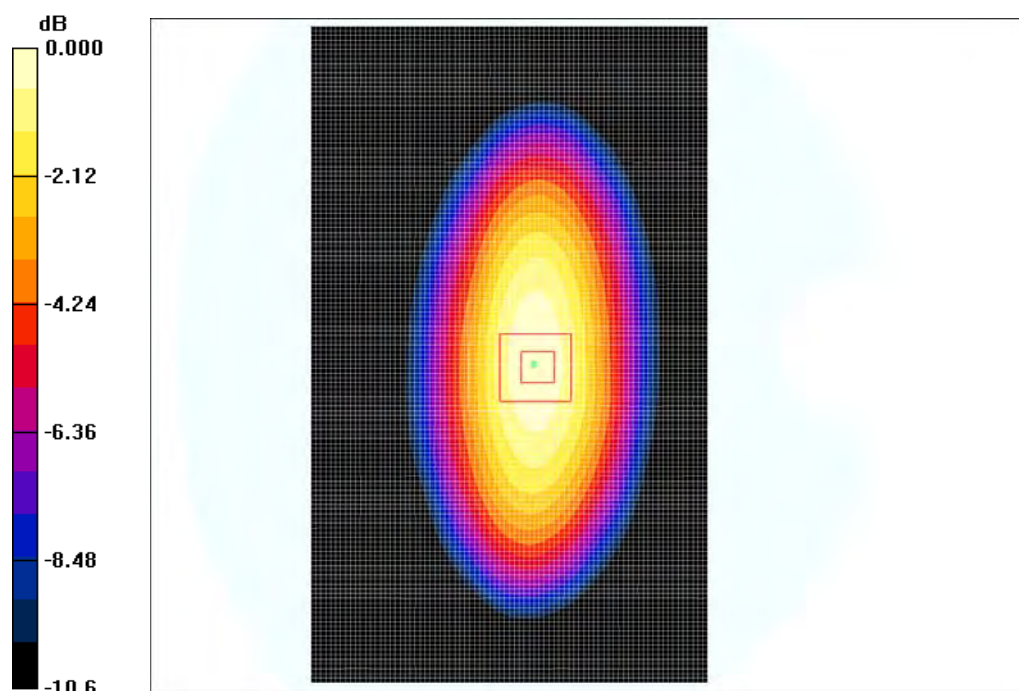
d = 15 mm, Pin = 0.25 W/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 48.1 V/m; Power Drift = 0.038 dB

Peak SAR (extrapolated) = 2.90 W/kg

SAR (1 g) = 1.98 mW/g; SAR (10 g) = 1.33 mW/g

Maximum value of SAR (measured) = 2.12 mW/g



0 dB = 2.12mW/g

750 MHz System Validation with Body Tissue

Test Laboratory: Bay Area Compliance Lab Corp.(BACL)**835 MHz body system validation****DUT: Dipole 835 MHz; Type: ALS-D-835-S-2; S/N: 180-00564**

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 835$ MHz; $\sigma = 0.95$ mho/m; $\epsilon_r = 55.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 = 0.25W/Area Scan (81x131x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 3.24 mW/g

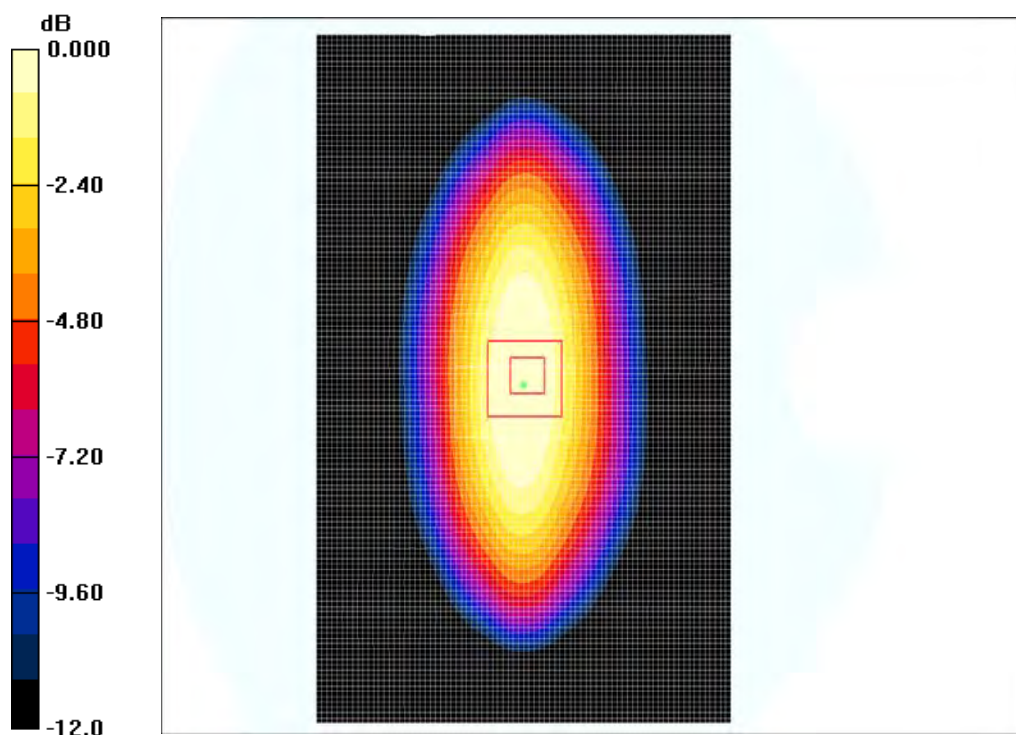
d =15 mm, Pin = 0.25W/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 59.5 V/m; Power Drift = -0.412 dB

Peak SAR (extrapolated) = 4.11 W/kg

SAR (1 g) = 2.63 mW/g; SAR (10 g) = 1.64 mW/g

Maximum value of SAR (measured) = 2.89 mW/g



0 dB = 2.89mW/g

835 MHz System Validation with Body Tissue

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**System Performance Test (1750 MHz, Body)****DUT: Dipole 1750 MHz; Type: ALS-D-1750-S-2; S/N: 198-00304**

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.48$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section, Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3019; ConvF(3.87, 3.87, 3.87); Calibrated: 8/26/2013
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 10/17/2013
- 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=0.5 W/Area Scan (51x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 21.5 mW/g

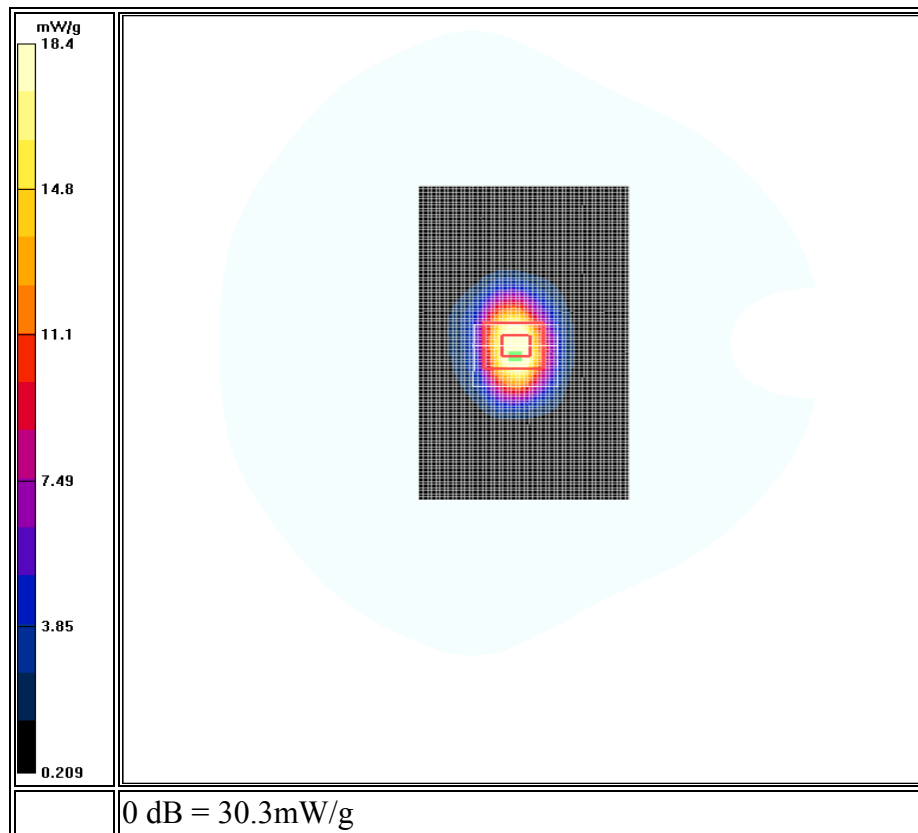
d=10mm, Pin=0.5 W/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 114.8 V/m; Power Drift = -0.024 dB

Peak SAR (extrapolated) = 31.5 W/kg

SAR (1 g) = 17.3 mW/g; SAR (10 g) = 9.3 mW/g

Maximum value of SAR (measured) = 18.4 mW/g

**1750 MHz System Validation with Body Tissue**

Test Laboratory: Bay Area Compliance Lab Corp.(BACL)**1900 MHz body system validation****DUT: Dipole 1900 MHz; Type: ALS-D-1900-S-2; S/N: 210-00715**

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.52$ mho/m; $\epsilon_r = 53.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.68, 4.68, 4.68); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 =10 mm, Pin = 0.25W/Area Scan (71x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 10.3 mW/g

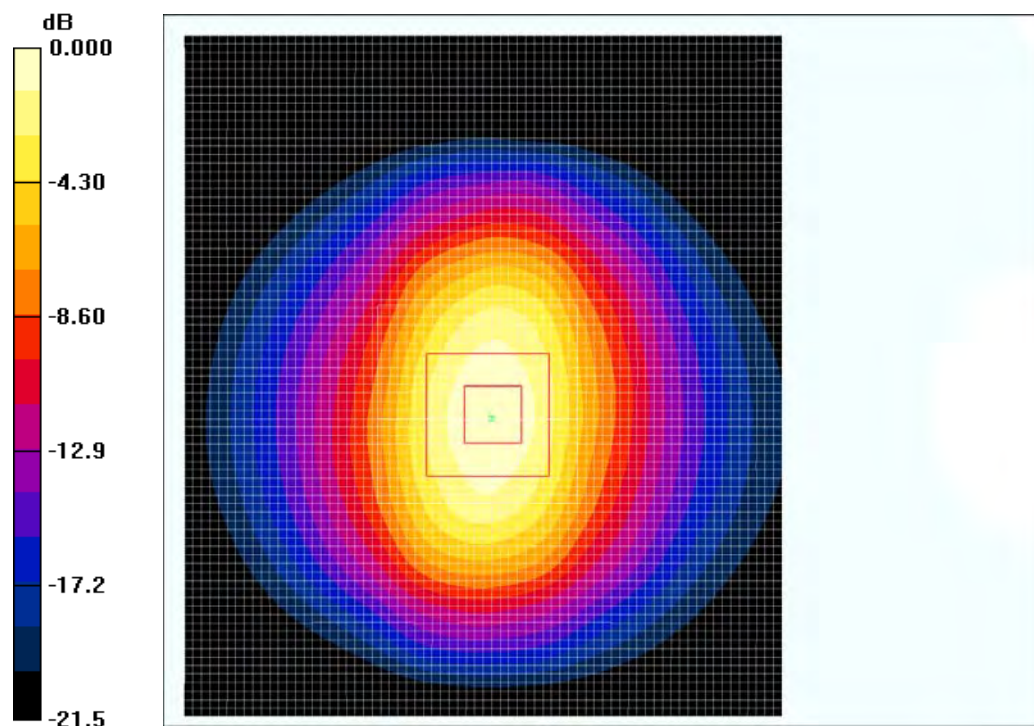
d =10 mm, Pin = 0.25W/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.5 V/m; Power Drift = 0.141 dB

Peak SAR (extrapolated) = 16.6 W/kg

SAR (1 g) = 9.25 mW/g; SAR(10 g) = 4.8 mW/g

Maximum value of SAR (measured) = 10.5 mW/g



0 dB = 10.5mW/g

1900 MHz System Validation with Body Tissue

16 Appendix E – EUT Scan Results

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

Top Touch GSM850_Sensor Enabled - (Low CH)

DUT: Motion; Type: Tablet; Serial: PVT-311

Communication System: GSM 850 2 Slot; Frequency: 824.2 MHz; Duty Cycle: 1:4.15

Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.95$ mho/m; $\epsilon_r = 56$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.29 mW/g

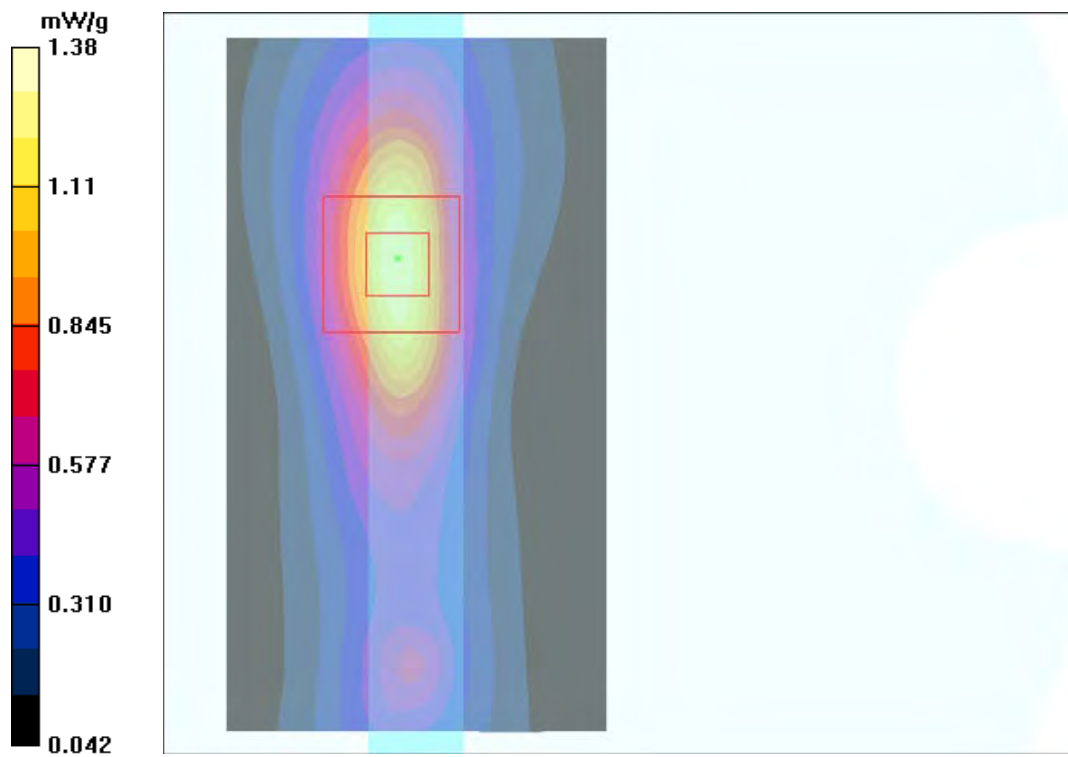
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 32.1 V/m; Power Drift = 0.0882 dB

Peak SAR (extrapolated) = 2.72 W/kg

SAR (1 g) = 1.2 mW/g; SAR (10 g) = 0.607 mW/g

Maximum value of SAR (measured) = 1.38 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch GSM850_ Sensor Enabled - (Mid CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: GSM 850 2 Slot; Frequency: 836.6 MHz; Duty Cycle: 1:4.15

Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.96$ mho/m; $\epsilon_r = 55.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.65 mW/g

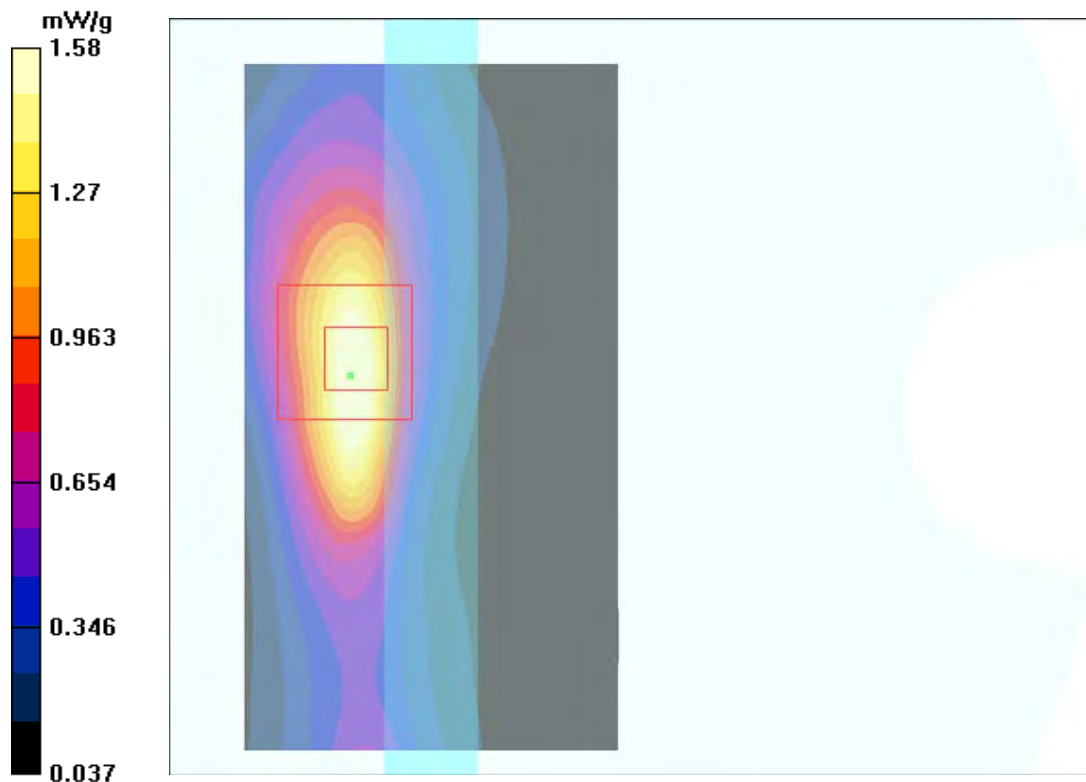
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 20.7 V/m; Power Drift = -0.0409 dB

Peak SAR (extrapolated) = 3.18 W/kg

SAR (1 g) = 1.41 mW/g; SAR (10 g) = 0.700 mW/g

Maximum value of SAR (measured) = 1.58 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch GSM850_ Sensor Enabled - (High CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: GSM 850 2 Slot; Frequency: 848.8 MHz; Duty Cycle: 1:4.15

Medium parameters used (interpolated): $f = 848.8$ MHz; $\sigma = 0.969$ mho/m; $\epsilon_r = 55.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DAS4 (High Precision Assessment)

DAS4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DAS4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.52 mW/g

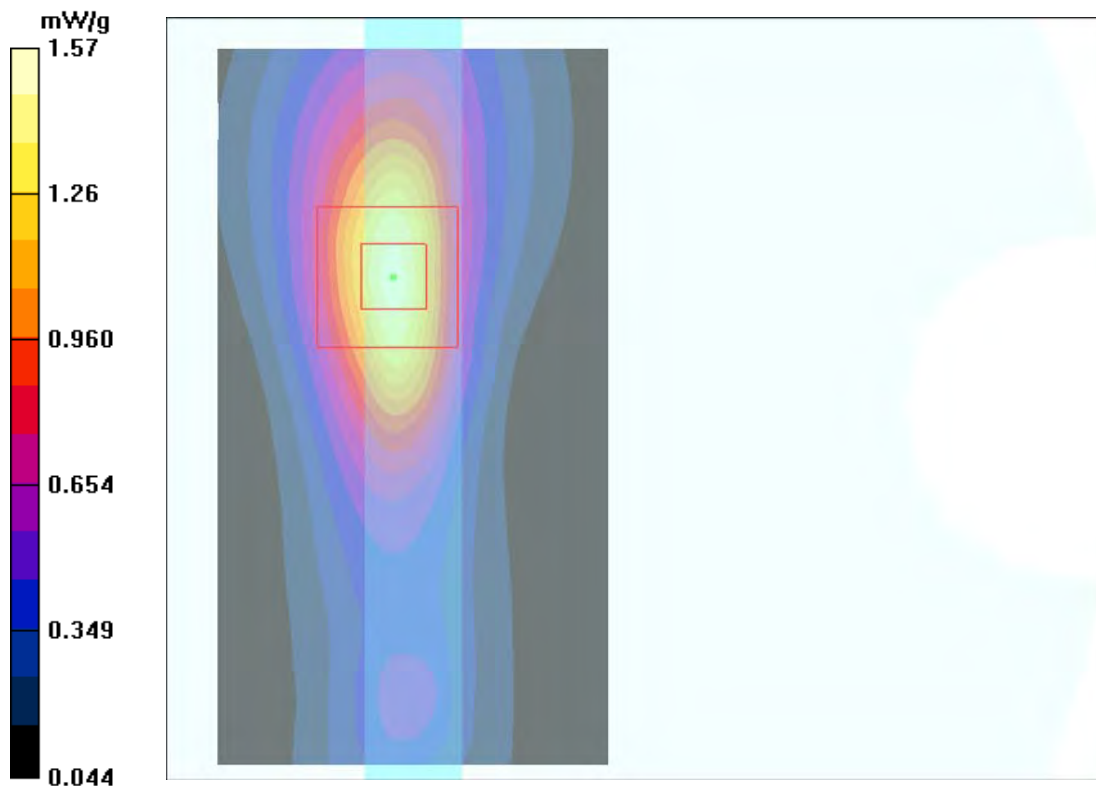
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 34.3 V/m; Power Drift = -0.185 dB

Peak SAR (extrapolated) = 3.00 W/kg

SAR (1 g) = 1.37 mW/g; SAR (10 g) = 0.704 mW/g

Maximum value of SAR (measured) = 1.57 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch GSM_1900_ Sensor Enabled - (High CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: GSM 1900; Frequency: 1909.8 MHz; Duty Cycle: 1:8.3
Medium parameters used: $f = 1909.8$ MHz; $\sigma = 1.6$ mho/m; $\epsilon_r = 51$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASy4 (High Precision Assessment)

DASy4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.68, 4.68, 4.68); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASy4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.74 mW/g

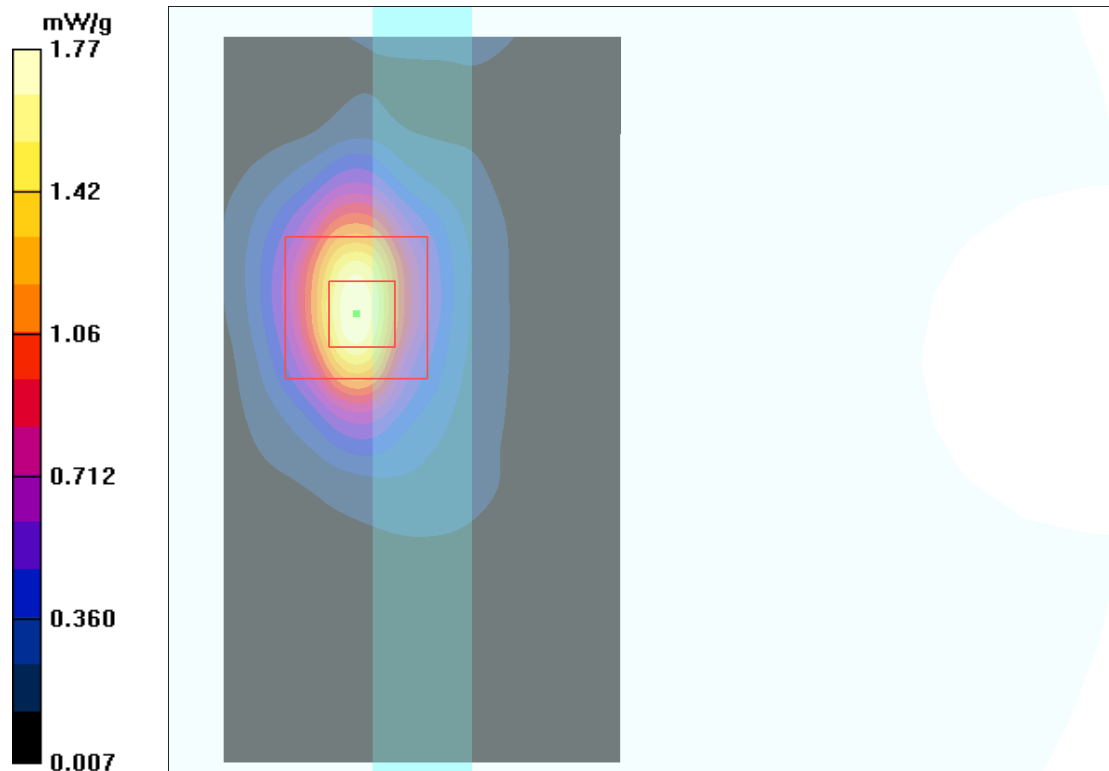
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 20.2 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 3.94 W/kg

SAR (1 g) = 1.51 mW/g; SAR (10 g) = 0.629 mW/g

Maximum value of SAR (measured) = 1.77 mW/g



#4

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**LTE_Band_2_back side 7mm to the Phantom - (Low Channel)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: LTE band 2; Frequency: 1860 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 1860$ MHz; $\sigma = 1.54$ mho/m; $\epsilon_r = 51.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.68, 4.68, 4.68); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 Side 7mm to the Phantom/Area Scan (81x121x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.937 mW/g

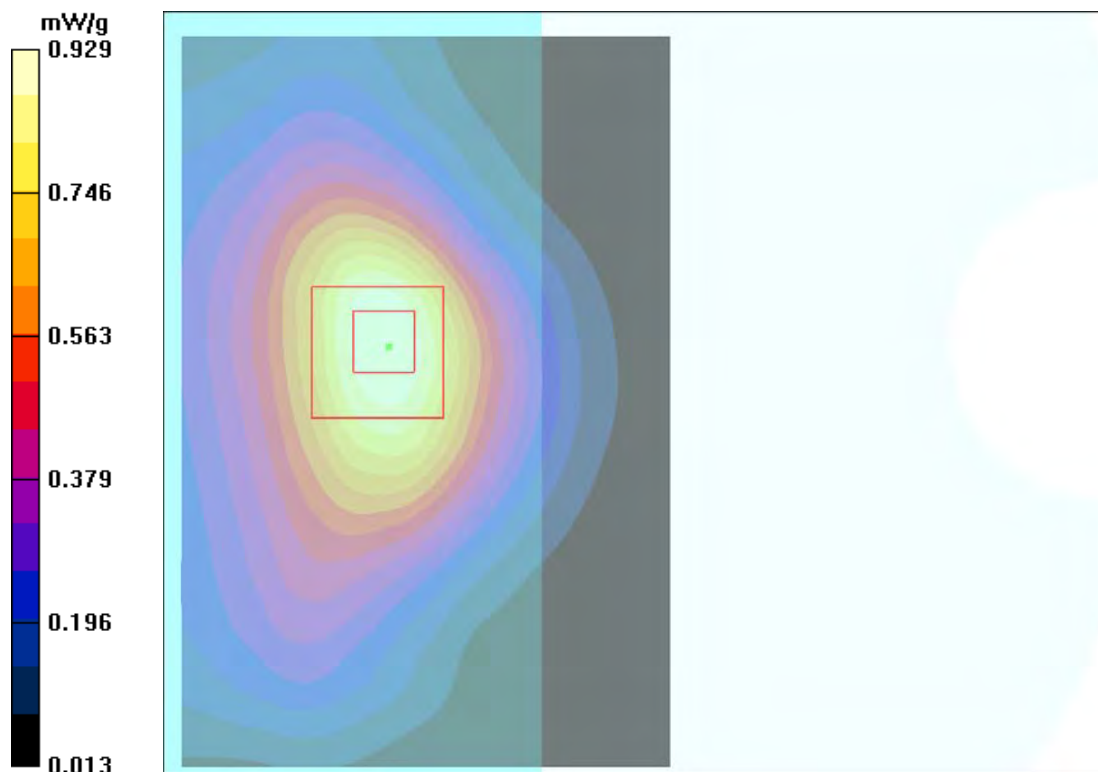
Back Side 7mm to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 20.1 V/m; Power Drift = 0.043 dB

Peak SAR (extrapolated) = 1.39 W/kg

SAR (1 g) = 0.857 mW/g; SAR (10 g) = 0.504 mW/g

Maximum value of SAR (measured) = 0.929 mW/g



#5

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**LTE_Band_2_back side 7mm to the Phantom - (Mid Channel)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: LTE band 2; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1880$ MHz; $\sigma = 1.57$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.68, 4.68, 4.68); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 Side 7mm to the Phantom/Area Scan (81x121x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.916 mW/g

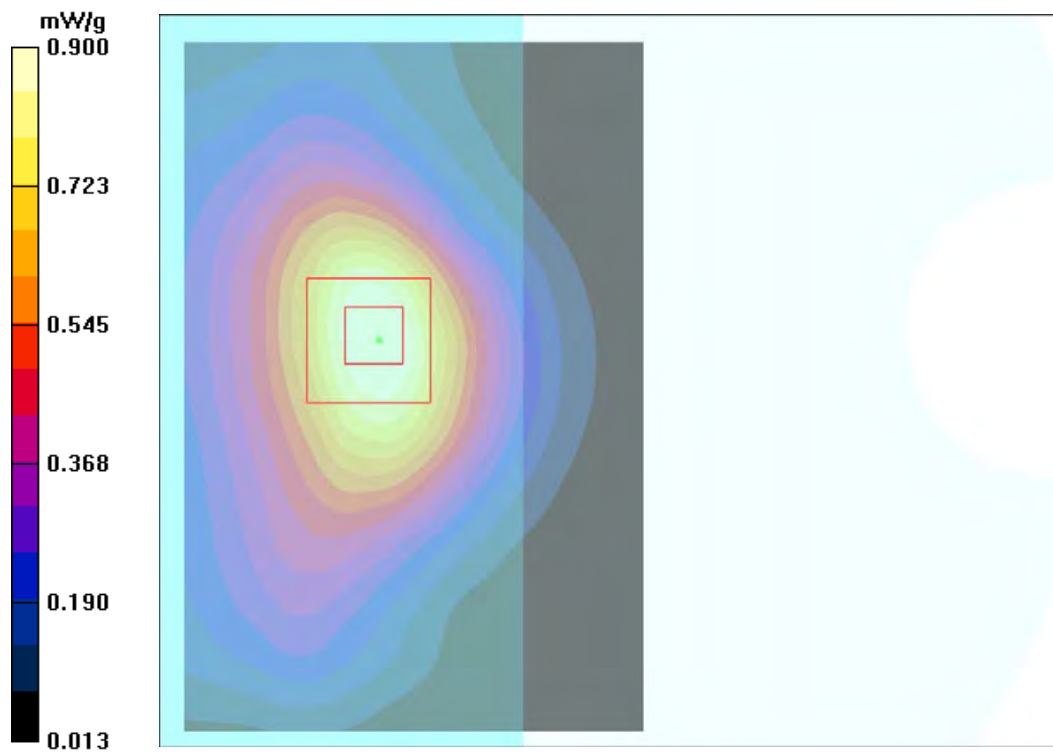
Back Side 7mm to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 19.7 V/m; Power Drift = -0.00474 dB

Peak SAR (extrapolated) = 1.38 W/kg

SAR (1 g) = 0.830 mW/g; SAR (10 g) = 0.486 mW/g

Maximum value of SAR (measured) = 0.900 mW/g



#6

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**LTE_Band_2_back side 7mm to the Phantom - (High Channel)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: LTE band 2; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.5$ mho/m; $\epsilon_r = 52.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.68, 4.68, 4.68); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 Side 7mm to the Phantom/Area Scan (81x121x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.820 mW/g

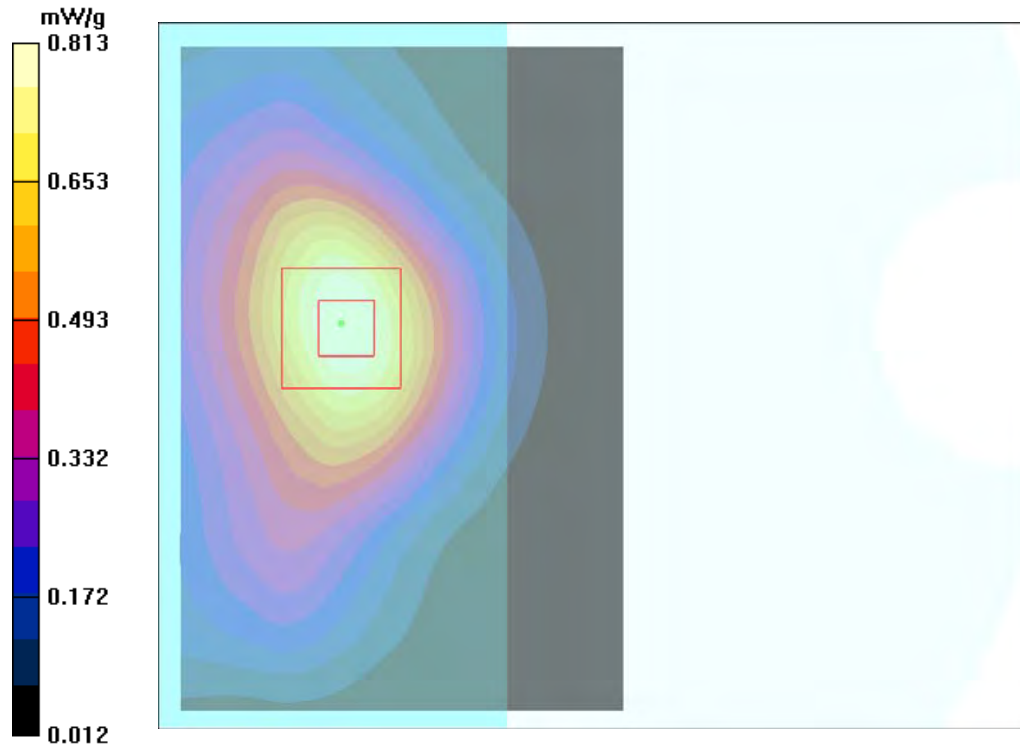
Back Side 7mm to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 16.9 V/m; Power Drift = 0.596 dB

Peak SAR (extrapolated) = 1.28 W/kg

SAR (1 g) = 0.752 mW/g; SAR (10 g) = 0.434 mW/g

Maximum value of SAR (measured) = 0.813 mW/g



#7

Test Laboratory: Bay Area Compliance Lab Corp.(BACL)**LTE Band_4 _Back Touch _ Sensor Enabled - (Mid CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: LTE-Band 4 @20MHz; Frequency: 1732.5 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 1732.5$ MHz; $\sigma = 1.4$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.89, 4.89, 4.89); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 Touch to the Phantom/Area Scan (71x121x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.70 mW/g

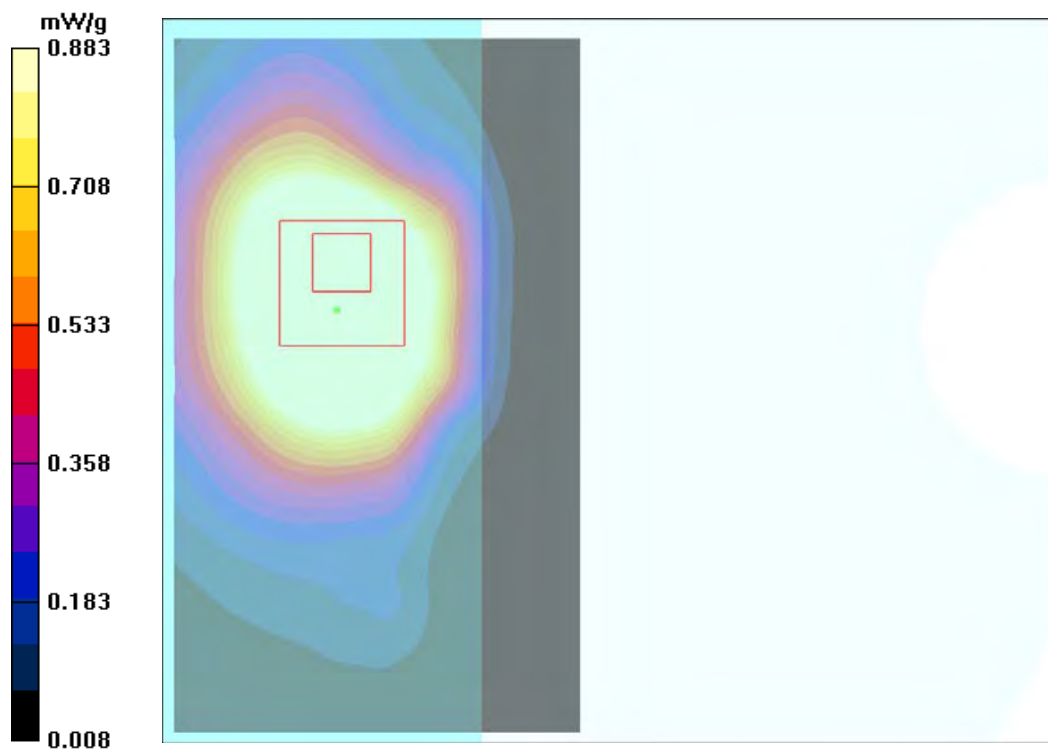
Back Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.0 V/m; Power Drift = 1.35 dB

Peak SAR (extrapolated) = 1.28 W/kg

SAR (1 g) = 0.796 mW/g; SAR (10 g) = 0.450 mW/g

Maximum value of SAR (measured) = 0.883 mW/g



#8

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch LTE Band_5_ Sensor Enabled - (Low CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: LTE-Band 5; Frequency: 829 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 829$ MHz; $\sigma = 0.945$ mho/m; $\epsilon_r = 55.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.54 mW/g

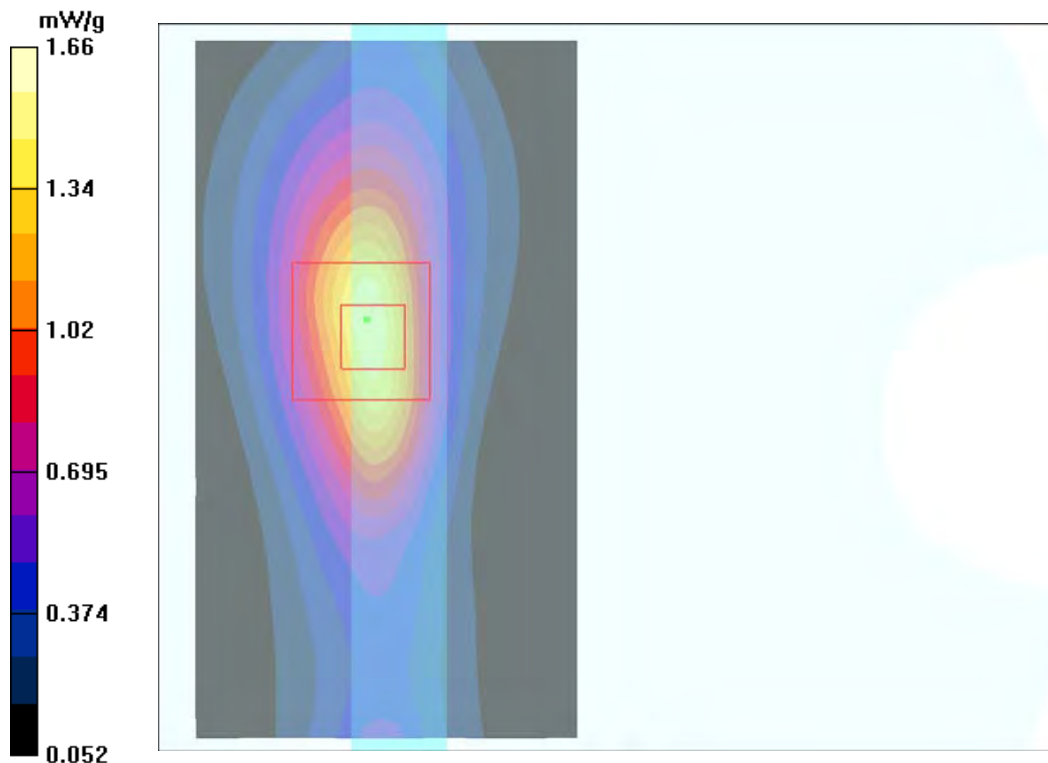
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 34.1 V/m; Power Drift = 0.066 dB

Peak SAR (extrapolated) = 3.17 W/kg

SAR (1 g) = 1.45 mW/g; SAR (10 g) = 0.747 mW/g

Maximum value of SAR (measured) = 1.66 mW/g



#9

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch LTE Band_5_ Sensor Enabled - (Mid CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: LTE-Band 5; Frequency: 836.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 836.5$ MHz; $\sigma = 0.954$ mho/m; $\epsilon_r = 55.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.54 mW/g

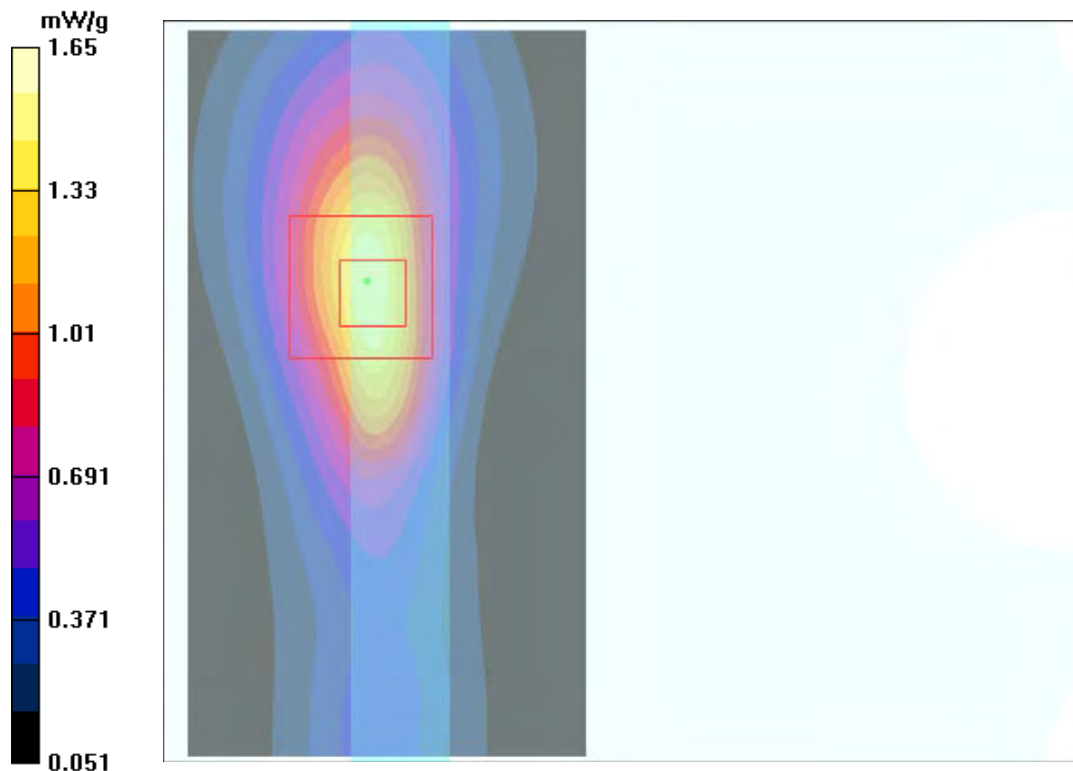
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 35.5 V/m; Power Drift = 0.283 dB

Peak SAR (extrapolated) = 3.13 W/kg

SAR (1 g) = 1.44 mW/g; SAR (10 g) = 0.745 mW/g

Maximum value of SAR (measured) = 1.65 mW/g



#10

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch LTE Band_5_ Sensor Enabled - (High CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: LTE-Band 5; Frequency: 844 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 844$ MHz; $\sigma = 0.966$ mho/m; $\epsilon_r = 55.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.48 mW/g

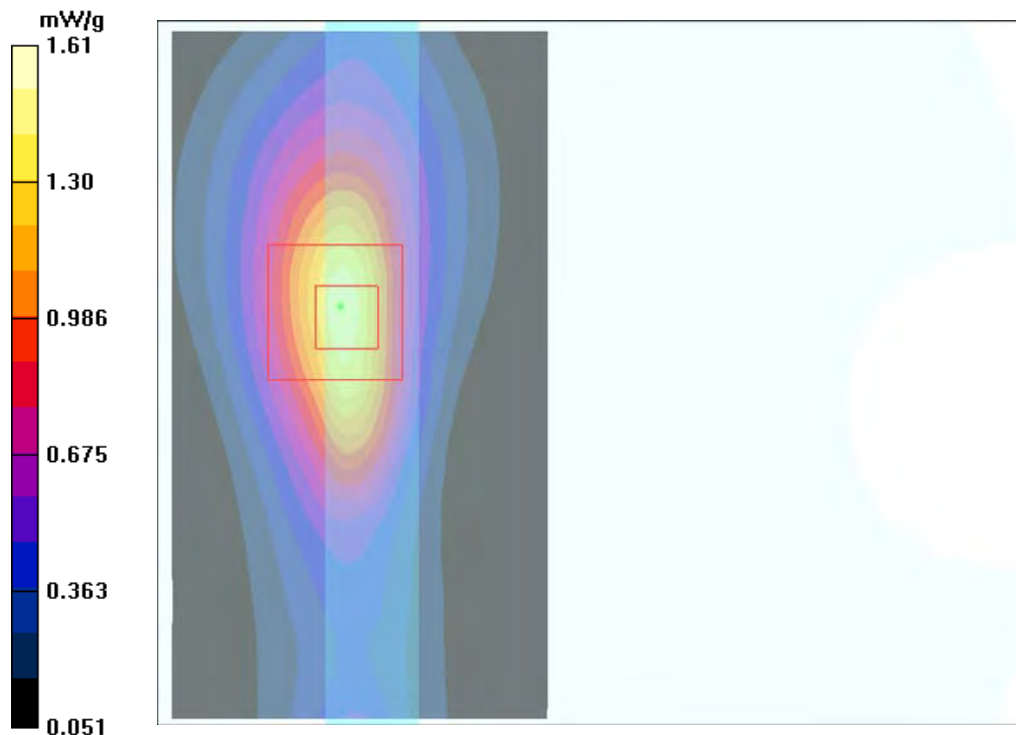
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 33.2 V/m; Power Drift = 0.167 dB

Peak SAR (extrapolated) = 3.05 W/kg

SAR (1 g) = 1.4 mW/g; SAR (10 g) = 0.729 mW/g

Maximum value of SAR (measured) = 1.61 mW/g



#11

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Back Touch LTE Band_13_ Sensor Enabled - (Mid CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: LTE Band13; Frequency: 782 MHz; Duty Cycle: 1:1

Medium parameters used (extrapolated): $f = 782 \text{ MHz}$; $\sigma = 0.96 \text{ mho/m}$; $\epsilon_r = 55.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DAS4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DAS4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back Touch to the Phantom/Area Scan (81x121x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of SAR (interpolated) = 0.644 mW/g

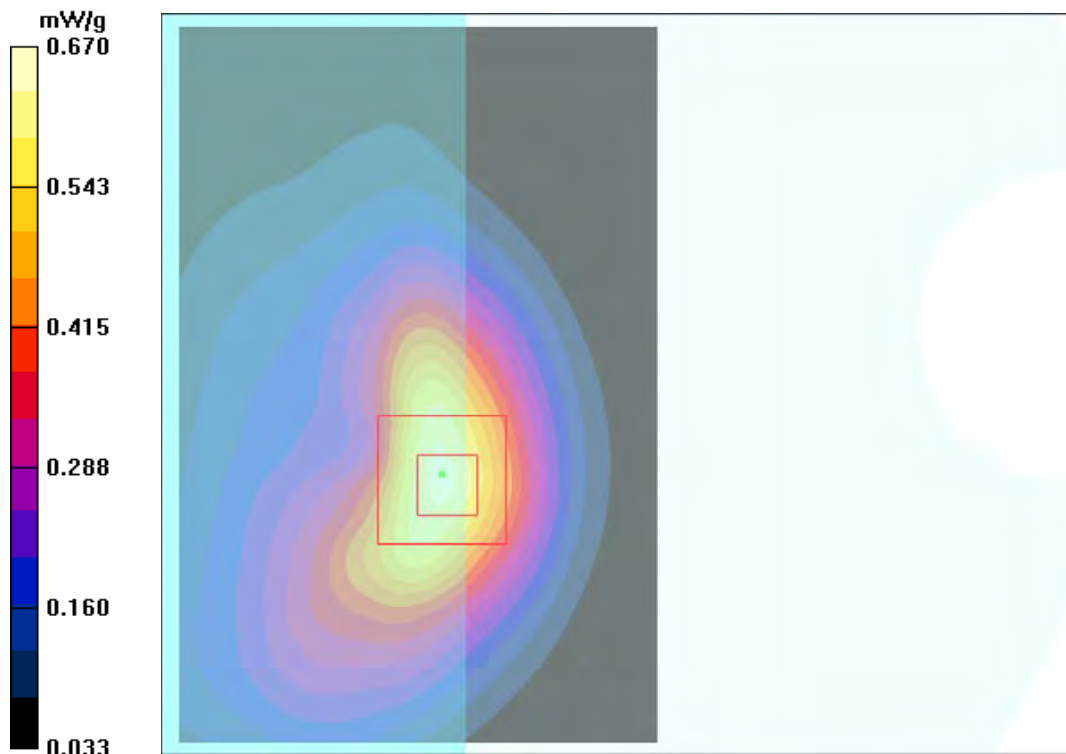
Back Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 19.8 V/m ; Power Drift = -0.0364 dB

Peak SAR (extrapolated) = 1.07 W/kg

SAR (1 g) = 0.596 mW/g ; SAR (10 g) = 0.343 mW/g

Maximum value of SAR (measured) = 0.670 mW/g



#12

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Back Touch LTE Band_17_ Sensor Enabled - (High CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: LTE-Band 17; Frequency: 711 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 711 \text{ MHz}$; $\sigma = 0.96 \text{ mho/m}$; $\epsilon_r = 55.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 Touch to the Phantom/Area Scan (81x121x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Maximum value of SAR (interpolated) = 1.19 mW/g

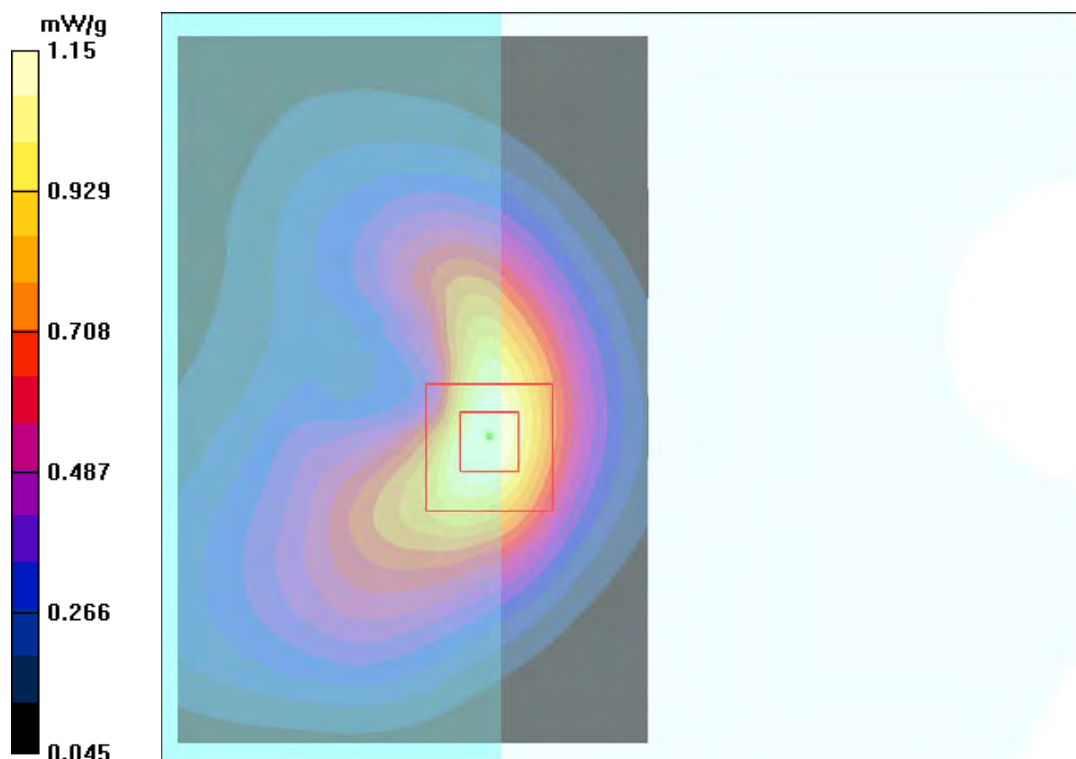
Back Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 31.2 V/m ; Power Drift = -0.0829 dB

Peak SAR (extrapolated) = 1.87 W/kg

SAR (1 g) = 1.05 mW/g ; SAR (10 g) = 0.592 mW/g

Maximum value of SAR (measured) = 1.15 mW/g



#13

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch LTE Band_17_ Sensor Enabled - (Low CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: LTE Band 17@10MHz; Frequency: 709 MHz;Duty Cycle: 1:1

Medium parameters used: $f = 709$ MHz; $\sigma = 0.96$ mho/m; $\epsilon_r = 55.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.18 mW/g

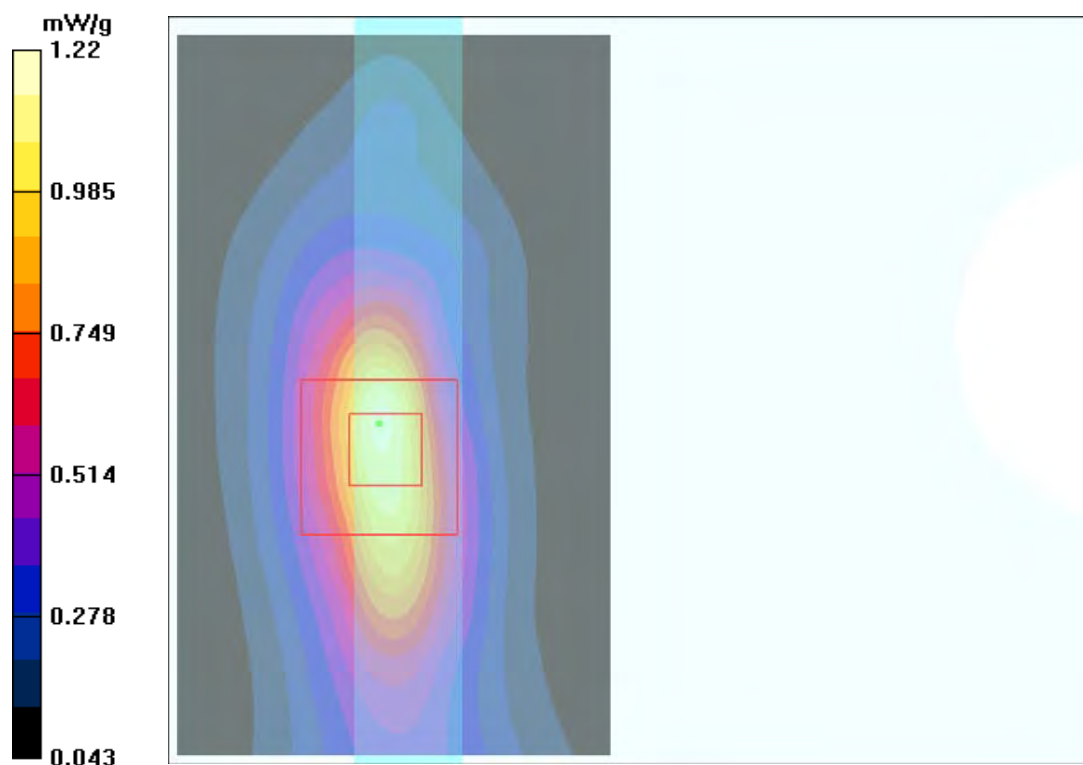
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 27.1 V/m; Power Drift = 0.336 dB

Peak SAR (extrapolated) = 2.58 W/kg

SAR (1 g) = 1.09 mW/g; SAR (10 g) = 0.534 mW/g

Maximum value of SAR (measured) = 1.22 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**LTE_Band_25_Back 7mm to the Phantom - (Low CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: LTE Band25; Frequency: 1860 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 1860$ MHz; $\sigma = 1.55$ mho/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.68, 4.68, 4.68); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 Side 7mm to the Phantom/Area Scan (81x121x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.926 mW/g

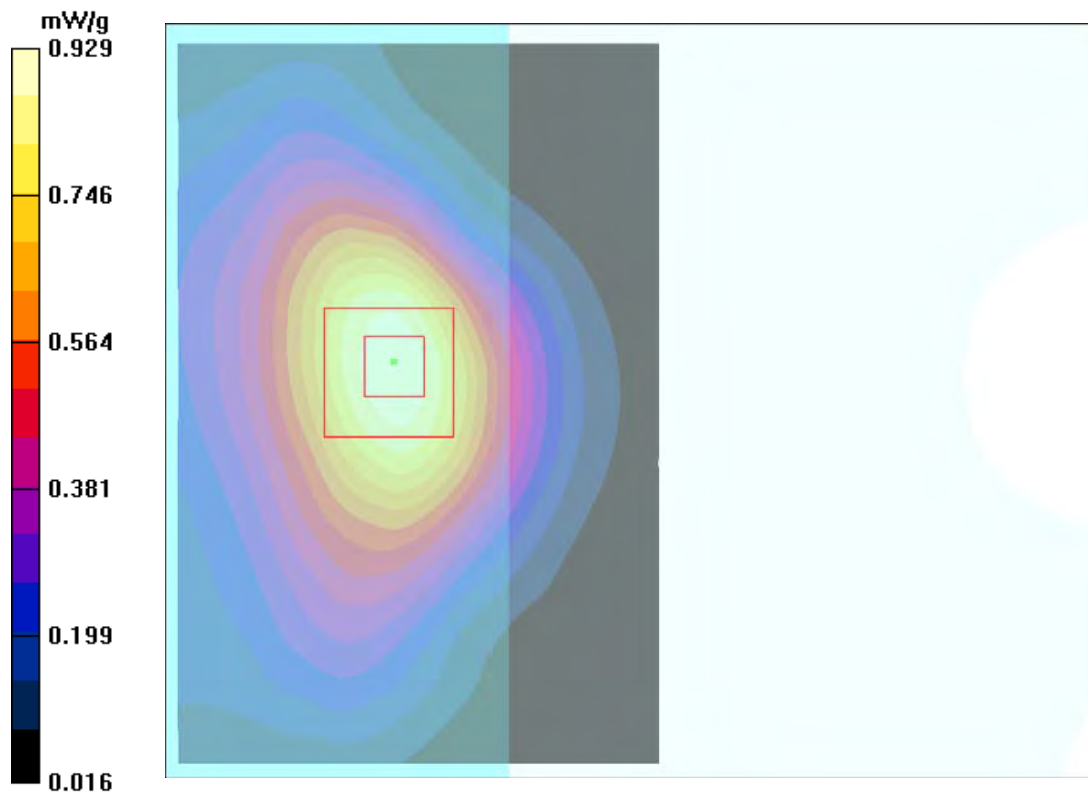
Back Side 7mm to the Phantom /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 18.4 V/m; Power Drift = 0.0896 dB

Peak SAR (extrapolated) = 1.43 W/kg

SAR (1 g) = 0.849 mW/g; SAR (10 g) = 0.498 mW/g

Maximum value of SAR (measured) = 0.929 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**LTE_Band_25_Back 7mm to the Phantom - (Mid CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: LTE Band25; Frequency: 1882.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 1882.5$ MHz; $\sigma = 1.59$ mho/m; $\epsilon_r = 53.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DAS4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.68, 4.68, 4.68); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 Side 7mm to the Phantom/Area Scan (81x121x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.922 mW/g

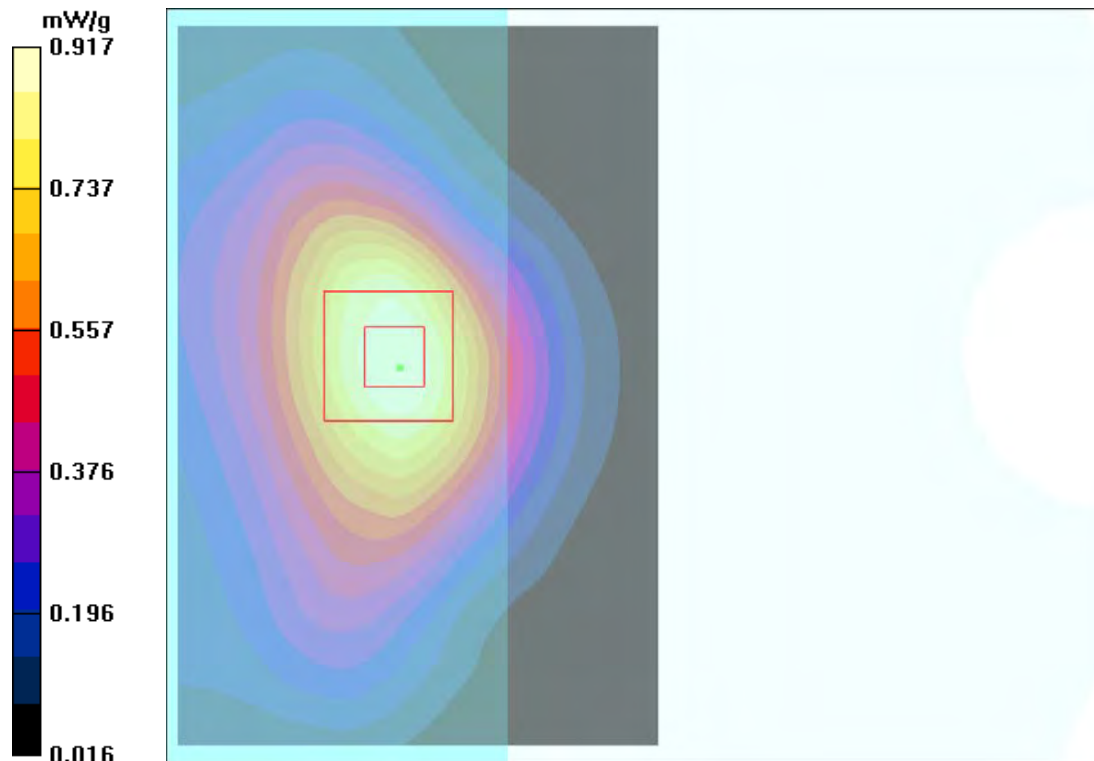
Back Side 7mm to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 18.1 V/m; Power Drift = 0.045 dB

Peak SAR (extrapolated) = 1.42 W/kg

SAR (1 g) = 0.846 mW/g; SAR (10 g) = 0.493 mW/g

Maximum value of SAR (measured) = 0.917 mW/g



#16

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**LTE_Band_25_Back 7mm to the Phantom - (High CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: LTE Band25; Frequency: 1905 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 1905$ MHz; $\sigma = 1.55$ mho/m; $\epsilon_r = 51.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.68, 4.68, 4.68); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 Side 7mm to the Phantom/Area Scan (81x121x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.873 mW/g

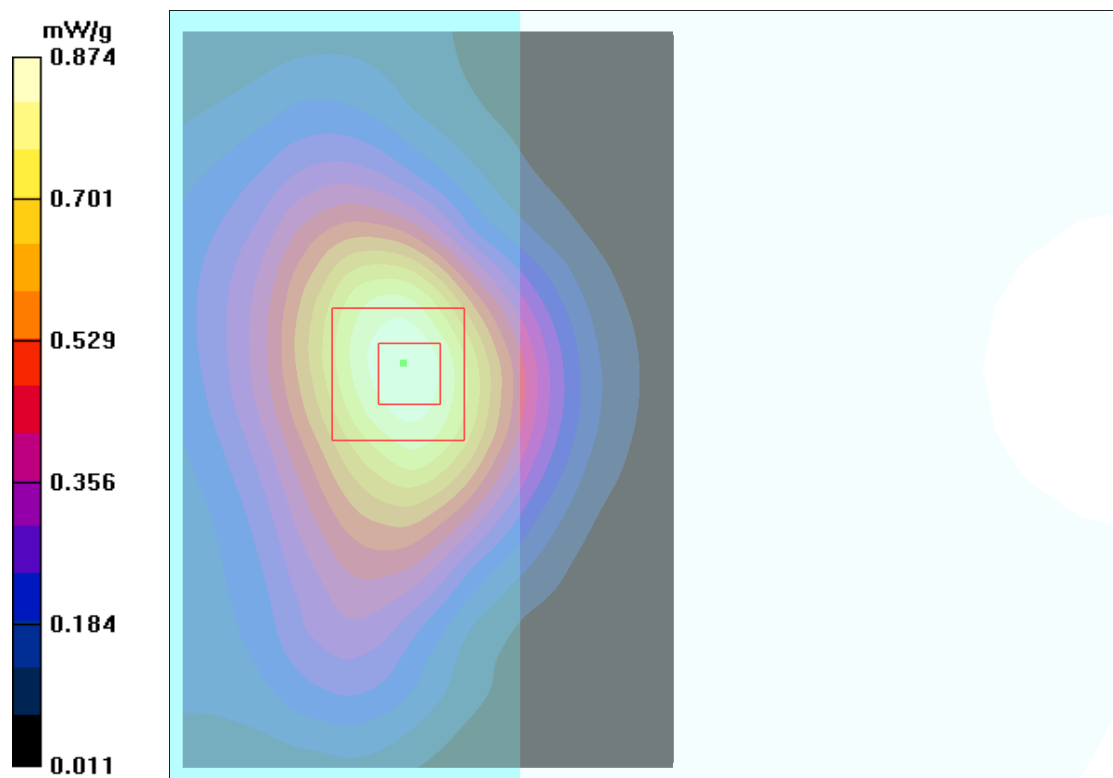
Back Side 7mm to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 18.2 V/m; Power Drift = 0.0105 dB

Peak SAR (extrapolated) = 1.38 W/kg

SAR (1 g) = 0.799 mW/g; SAR (10 g) = 0.458 mW/g

Maximum value of SAR (measured) = 0.874 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**WCDMA Band_2 _Back Touch _Sensor Enabled- (Mid CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: WCDMA1900 2 Slot; Frequency: 1880 MHz; Duty Cycle: 1:4.15

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.6$ mho/m; $\epsilon_r = 53.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DAS4 (High Precision Assessment)

DAS4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.68, 4.68, 4.68); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DAS4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back Touch to the Phantom/Area Scan (71x101x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.680 mW/g

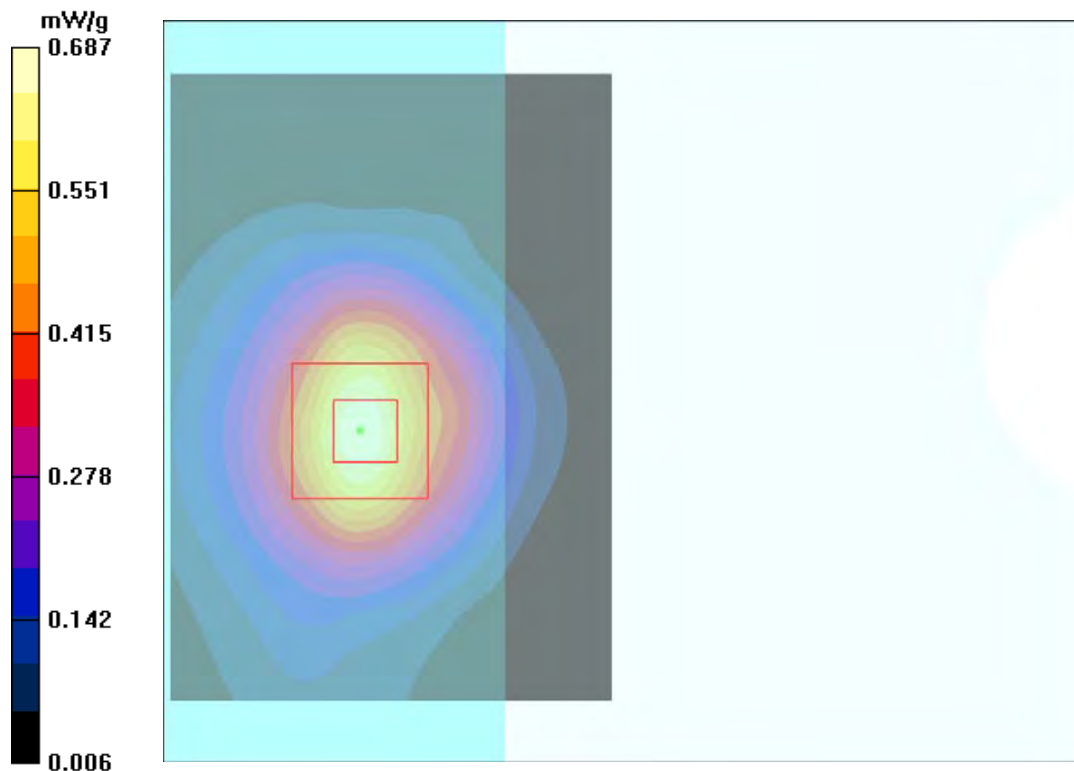
Back Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.86 V/m; Power Drift = 1.08 dB

Peak SAR (extrapolated) = 1.21 W/kg

SAR (1 g) = 0.620 mW/g; SAR (10 g) = 0.322 mW/g

Maximum value of SAR (measured) = 0.687 mW/g



#18

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Back Touch WCDMA Band_4_ Sensor Enabled - (Mid CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: WCDMA Band4; Frequency: 1732.6 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 1732.6$ MHz; $\sigma = 1.4$ mho/m; $\epsilon_r = 51.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.89, 4.89, 4.89); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 Touch to the Phantom/Area Scan (71x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.42 mW/g

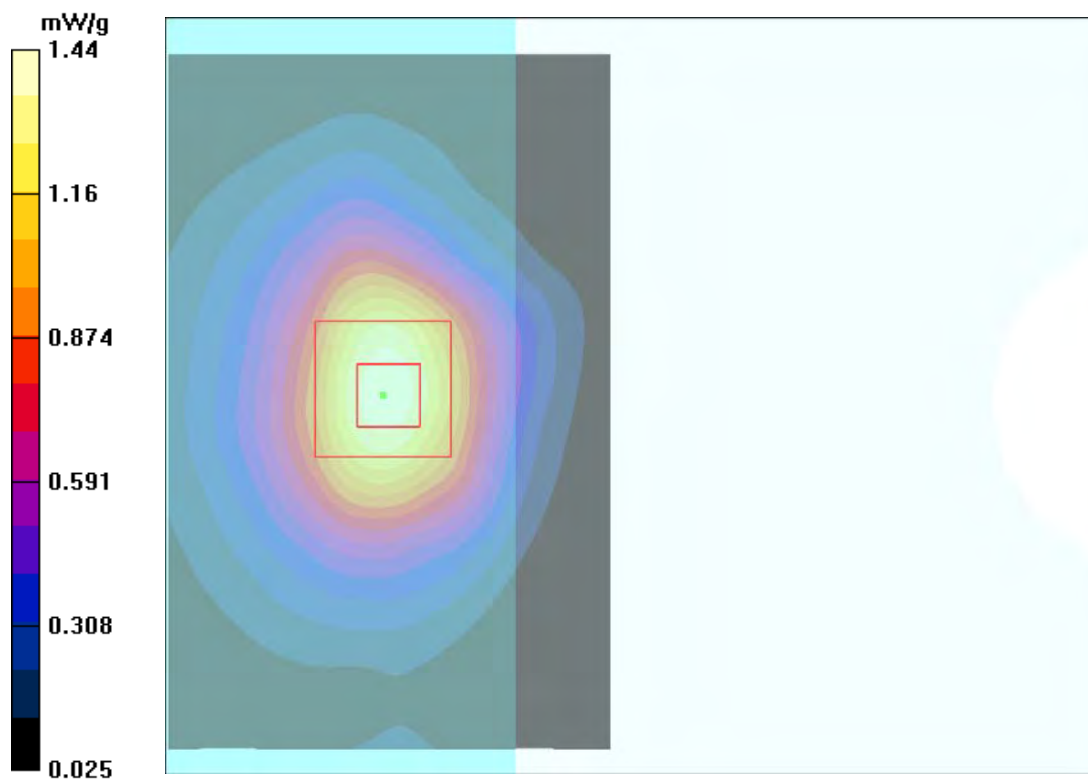
Back Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 18.8 V/m; Power Drift = 0.831 dB

Peak SAR (extrapolated) = 2.20 W/kg

SAR (1 g) = 1.3 mW/g; SAR (10 g) = 0.728 mW/g

Maximum value of SAR (measured) = 1.44 mW/g



#19

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch WCDMA Band_5_ Sensor Enabled - (Low CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: WCDMA Band_5; Frequency: 826.4 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 826.4$ MHz; $\sigma = 0.912$ mho/m; $\epsilon_r = 53.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.926 mW/g

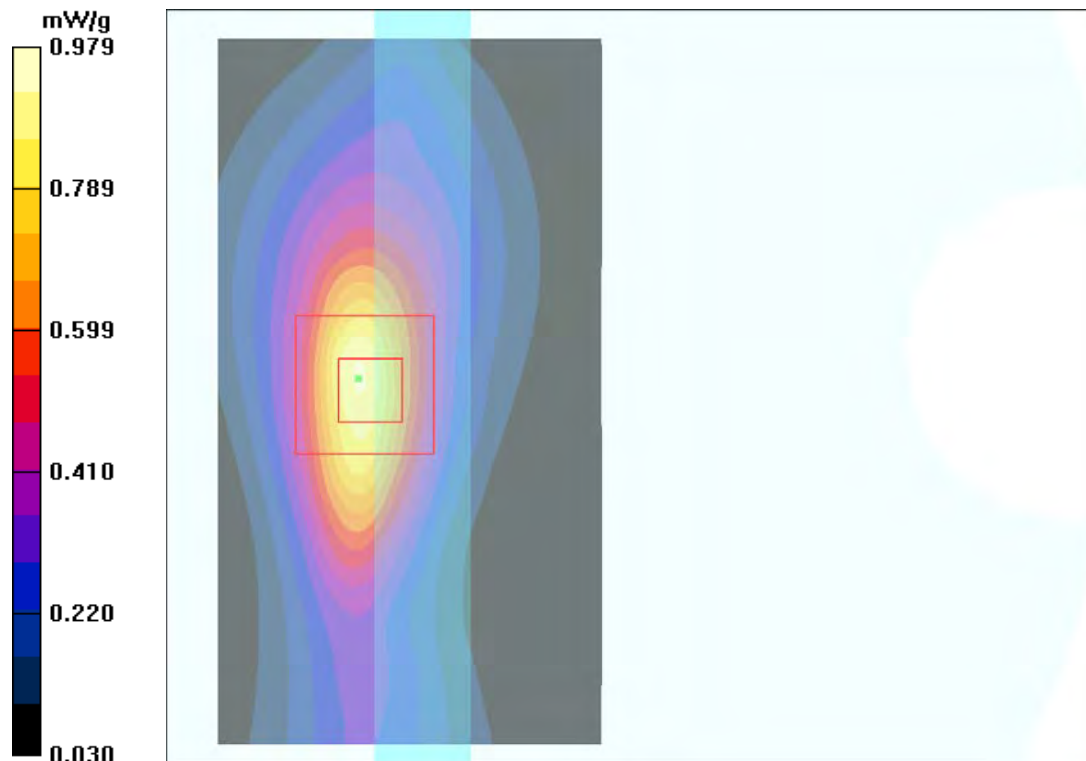
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 24.0 V/m; Power Drift = -0.0468 dB

Peak SAR (extrapolated) = 2.14 W/kg

SAR (1 g) = 0.882 mW/g; SAR (10 g) = 0.432 mW/g

Maximum value of SAR (measured) = 0.979 mW/g



#20

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch WCDMA Band_5_ Sensor Enabled - (Mid CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: WCDMA Band_5; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 836.87$ MHz; $\sigma = 0.927$ mho/m; $\epsilon_r = 52.6$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.827 mW/g

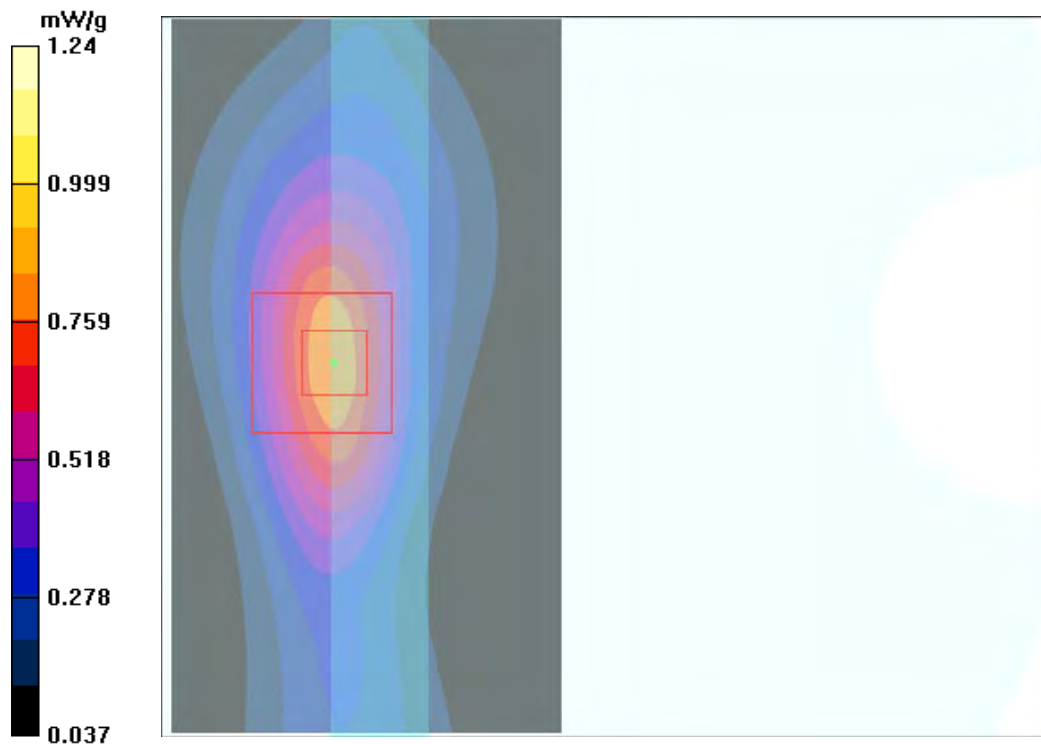
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 25.9 V/m; Power Drift = 1.08 dB

Peak SAR (extrapolated) = 2.30 W/kg

SAR (1 g) = 1.1 mW/g; SAR (10 g) = 0.578 mW/g

Maximum value of SAR (measured) = 1.24 mW/g



#21

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch WCDMA Band_5_ Sensor Enabled - (High CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: WCDMA Band_5; Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 846.6$ MHz; $\sigma = 0.938$ mho/m; $\epsilon_r = 51.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.908 mW/g

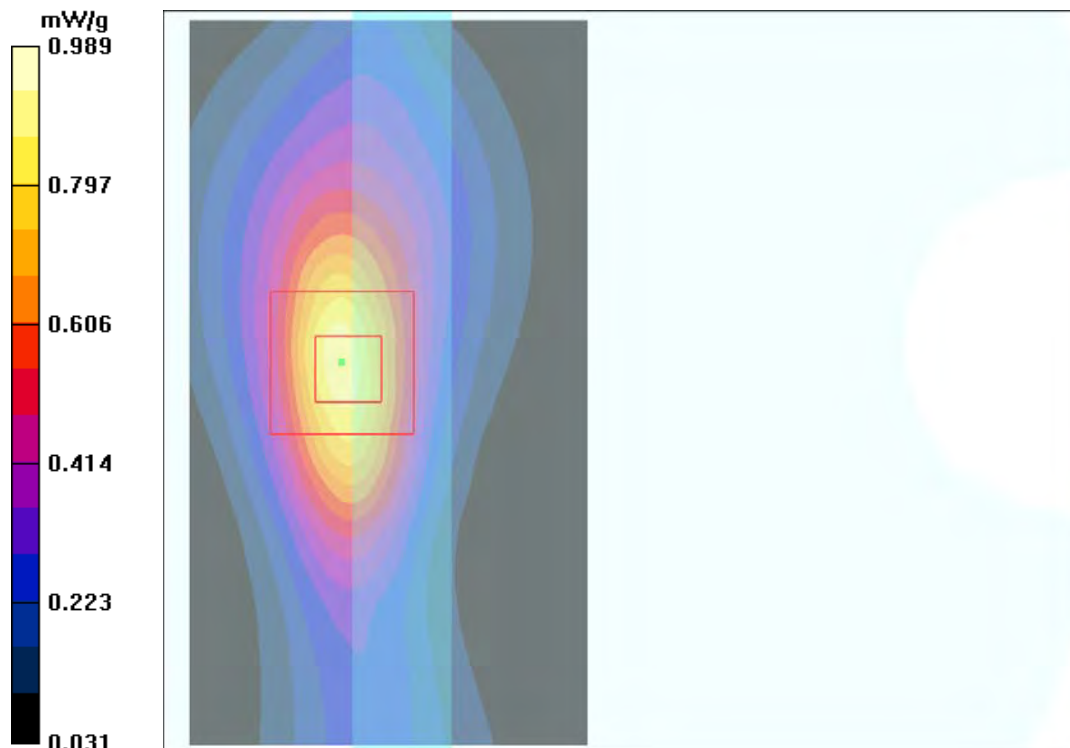
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 24.9 V/m; Power Drift = 0.144 dB

Peak SAR (extrapolated) = 1.97 W/kg

SAR (1 g) = 0.876 mW/g; SAR (10 g) = 0.449 mW/g

Maximum value of SAR (measured) = 0.989 mW/g



#22

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch CDMA_BC0_ Sensor Enabled - (Low CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: CDMA 835; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 824.7$ MHz; $\sigma = 0.951$ mho/m; $\epsilon_r = 56$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.43 mW/g

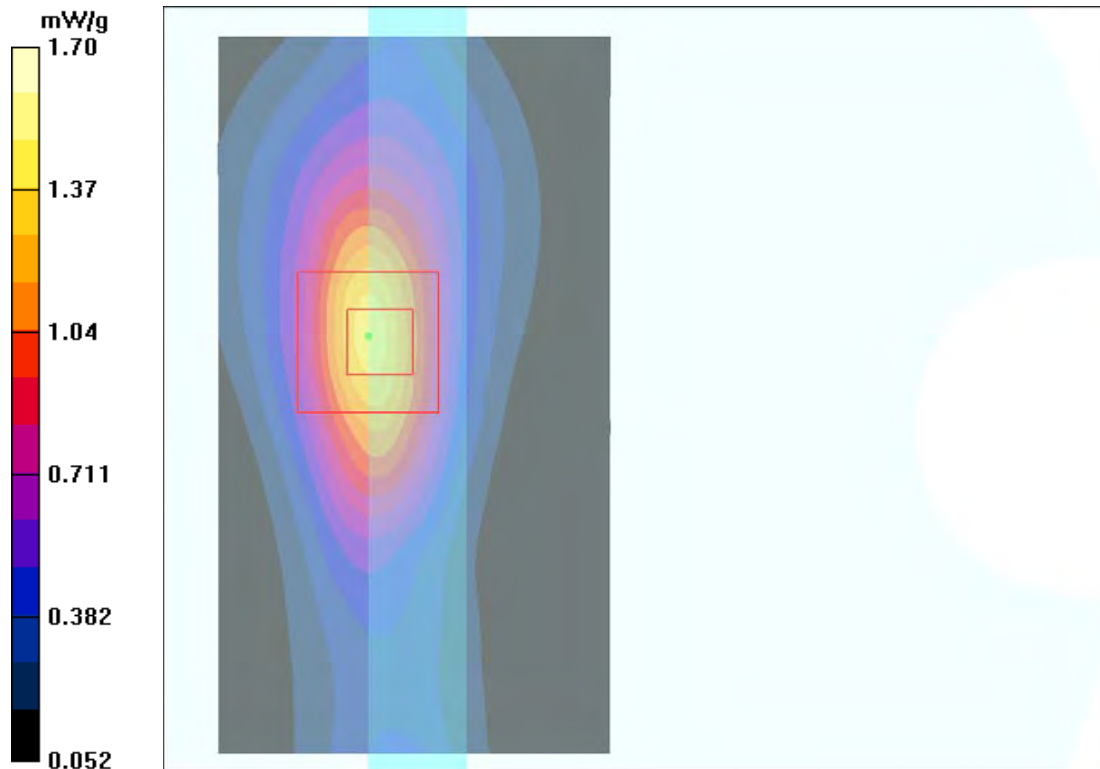
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 31.1 V/m; Power Drift = -0.0586 dB

Peak SAR (extrapolated) = 3.55 W/kg

SAR (1 g) = 1.47 mW/g; SAR (10 g) = 0.729 mW/g

Maximum value of SAR (measured) = 1.70 mW/g



#23

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch CDMA_BC0_ Sensor Enabled - (Mid CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: CDMA 835; Frequency: 836.52 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 836.52$ MHz; $\sigma = 0.96$ mho/m; $\epsilon_r = 55.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.47 mW/g

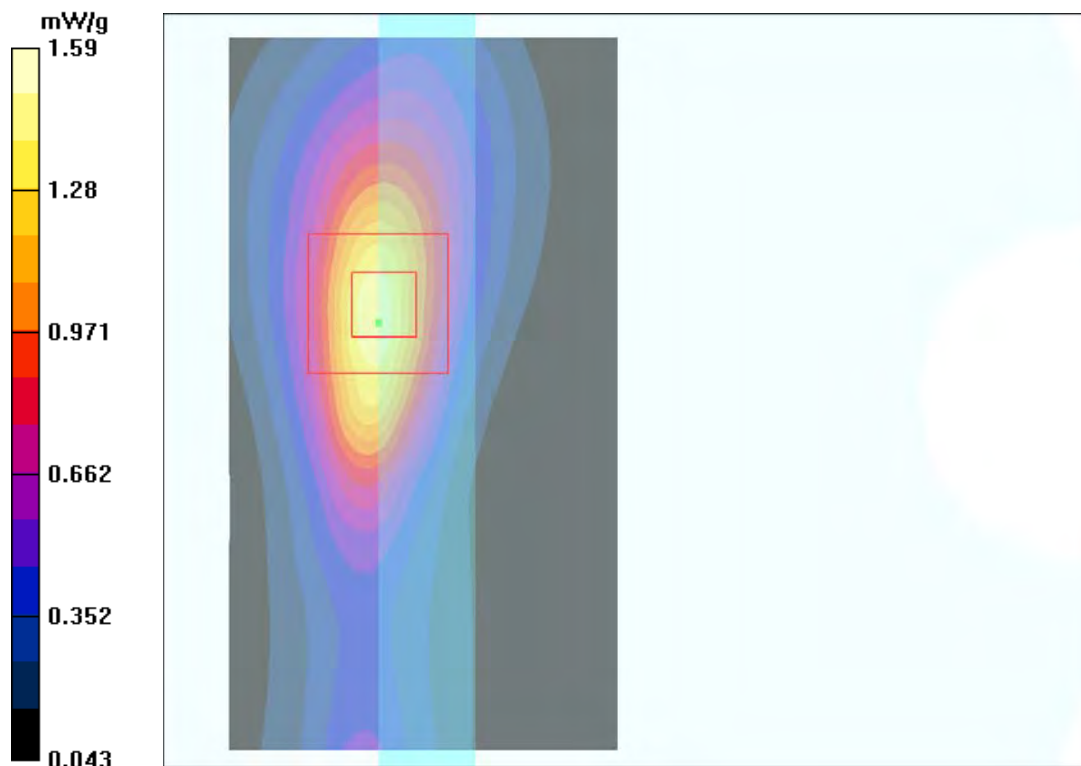
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 27.0 V/m; Power Drift = 0.278 dB

Peak SAR (extrapolated) = 3.18 W/kg

SAR (1 g) = 1.4 mW/g; SAR (10 g) = 0.712 mW/g

Maximum value of SAR (measured) = 1.59 mW/g



#24

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch CDMA_BC0_ Sensor Enabled - (High CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: CDMA 835; Frequency: 848.31 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 848.31$ MHz; $\sigma = 0.969$ mho/m; $\epsilon_r = 55.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.47 mW/g

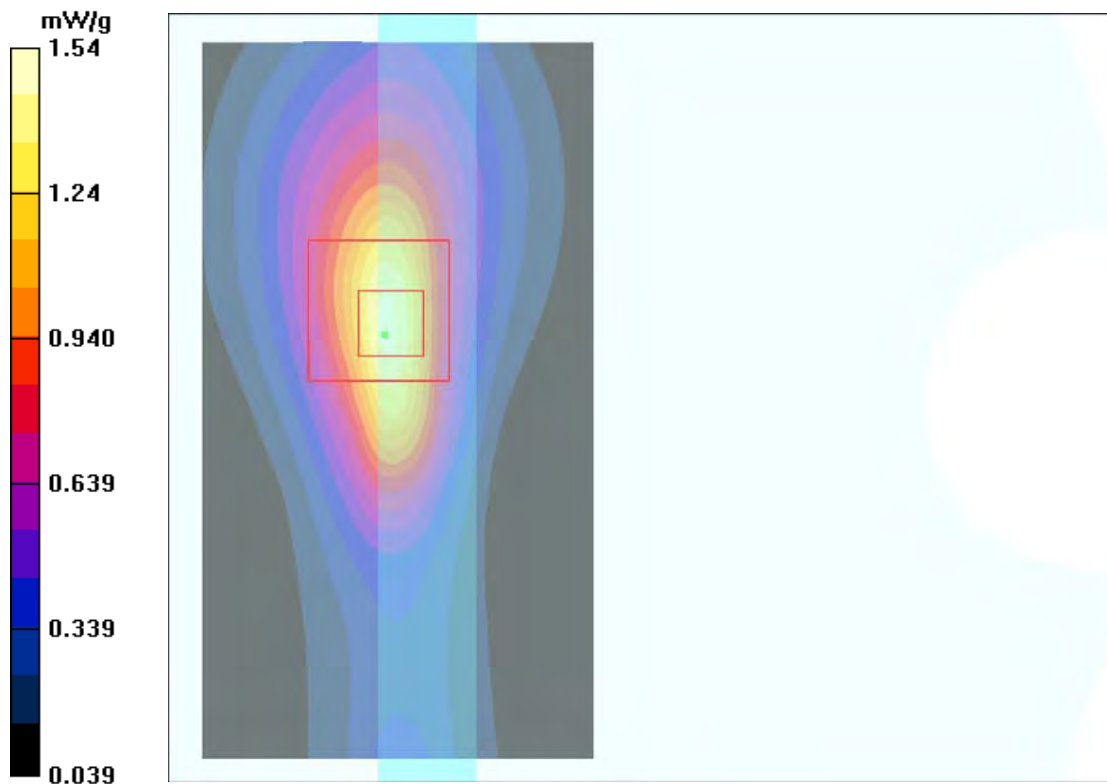
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 29.6 V/m; Power Drift = 0.112 dB

Peak SAR (extrapolated) = 3.08 W/kg

SAR (1 g) = 1.34 mW/g; SAR (10 g) = 0.682 mW/g

Maximum value of SAR (measured) = 1.54 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**CDMA_BC1_back side 7mm - (Low Channel)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: CDMA 1900; Frequency: 1851.25 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 1851.25$ MHz; $\sigma = 1.53$ mho/m; $\epsilon_r = 51.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DAS4 (High Precision Assessment)

DAS4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.68, 4.68, 4.68); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DAS4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back Side 7mm to the Phantom/Area Scan (81x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.13 mW/g

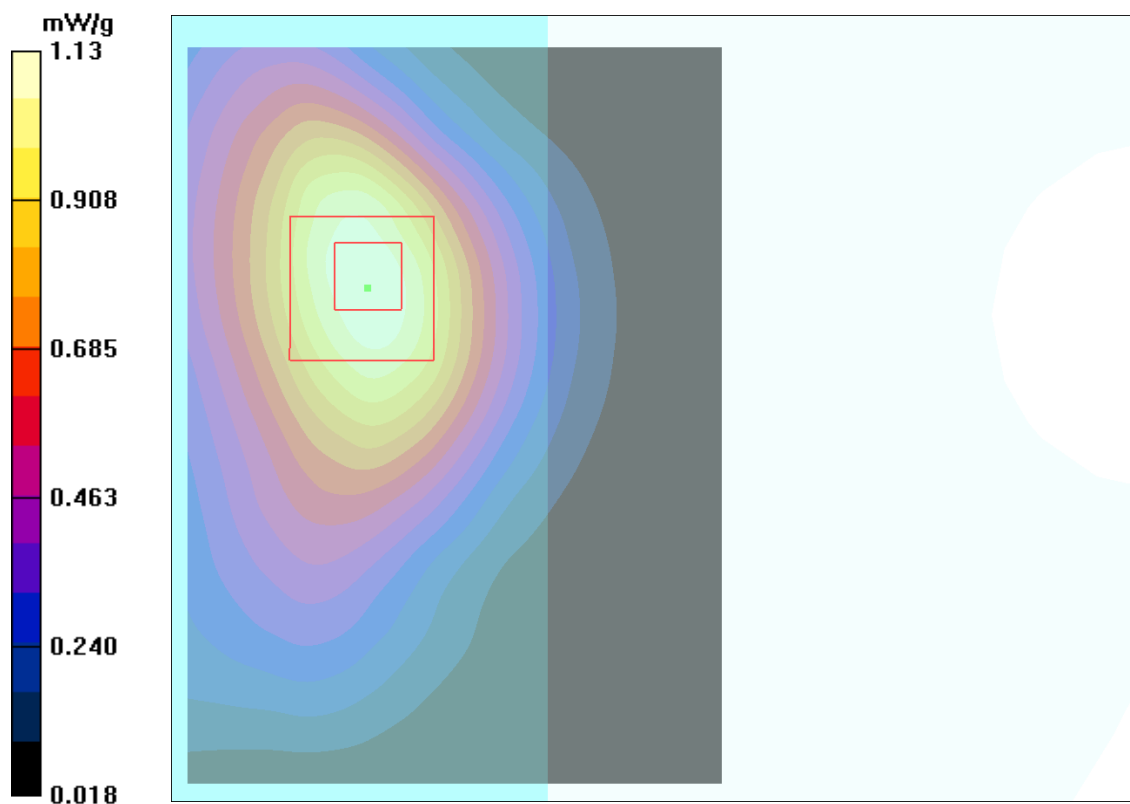
Back Side 7mm to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 21.3 V/m; Power Drift = 0.0894 dB

Peak SAR (extrapolated) = 1.70 W/kg

SAR (1 g) = 1.04 mW/g; SAR (10 g) = 0.611 mW/g

Maximum value of SAR (measured) = 1.13 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**CDMA_BC1_back side 7mm - (Mid Channel)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: CDMA 1900; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.57$ mho/m; $\epsilon_r = 51.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.68, 4.68, 4.68); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 Side 7mm to the Phantom/Area Scan (81x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.14 mW/g

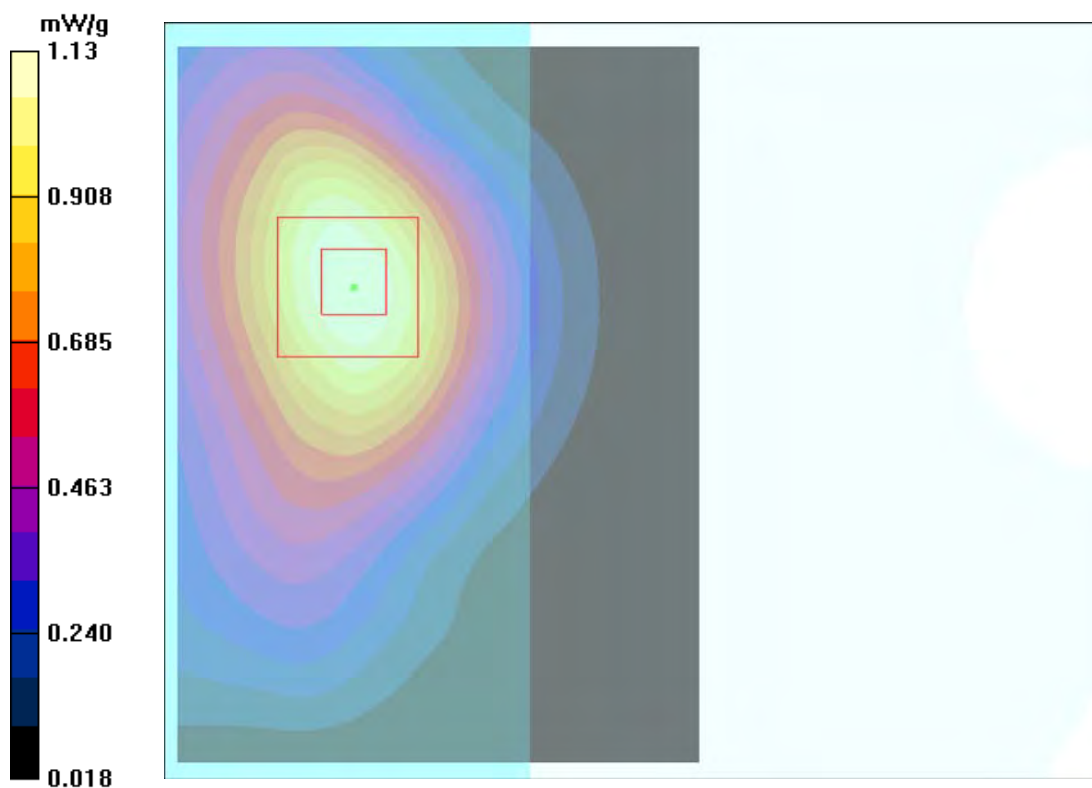
Back Side 7mm to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 21.4 V/m; Power Drift = 0.0195 dB

Peak SAR (extrapolated) = 1.74 W/kg

SAR (1 g) = 1.05 mW/g; SAR (10 g) = 0.612 mW/g

Maximum value of SAR (measured) = 1.13 mW/g



#27

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**CDMA_BC1_back side 7mm - (High Channel)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: CDMA 1900; Frequency: 1908.75 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 1908.75$ MHz; $\sigma = 1.59$ mho/m; $\epsilon_r = 51.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DAS4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(4.68, 4.68, 4.68); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- 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 Side 7mm to the Phantom/Area Scan (81x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.09 mW/g

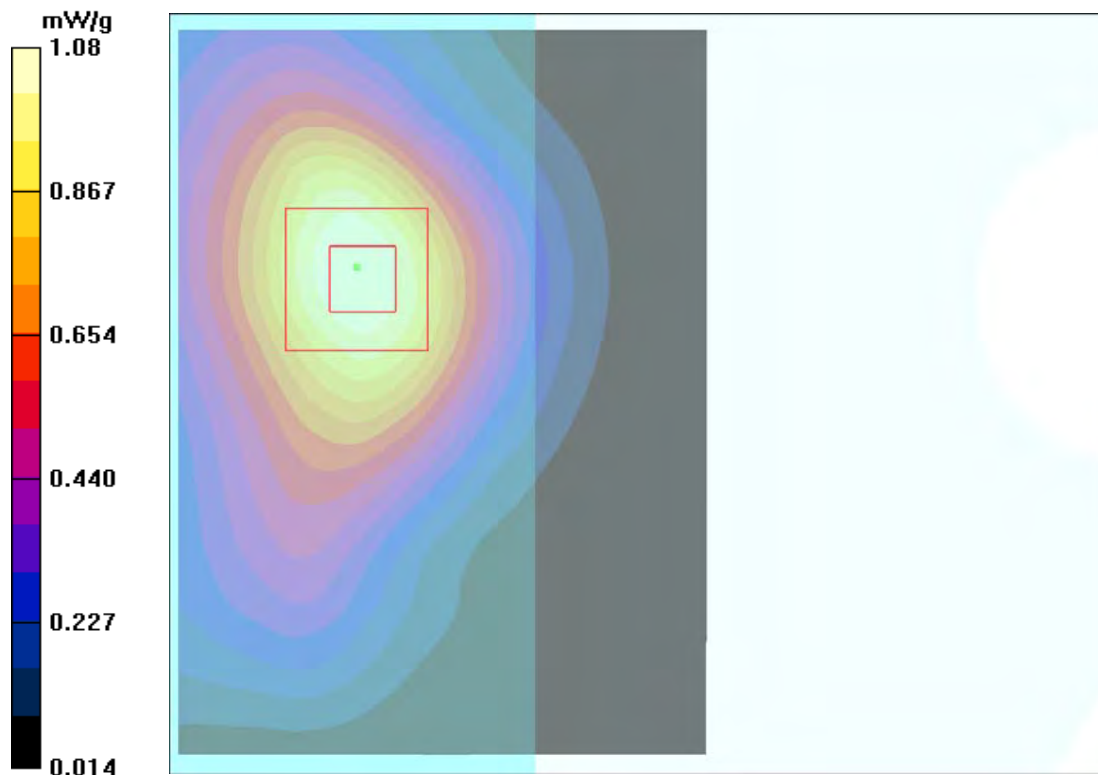
Back Side 7mm to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 20.8 V/m; Power Drift = 0.078 dB

Peak SAR (extrapolated) = 1.74 W/kg

SAR (1 g) = 0.999 mW/g; SAR (10 g) = 0.573 mW/g

Maximum value of SAR (measured) = 1.08 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch CDMA_BC10_ Sensor Enabled - (Low CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: CDMA BC10; Frequency: 817.9 MHz; Duty Cycle: 1:1

Medium parameters used (extrapolated): $f = 817.9$ MHz; $\sigma = 0.945$ mho/m; $\epsilon_r = 56$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (71x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.57 mW/g

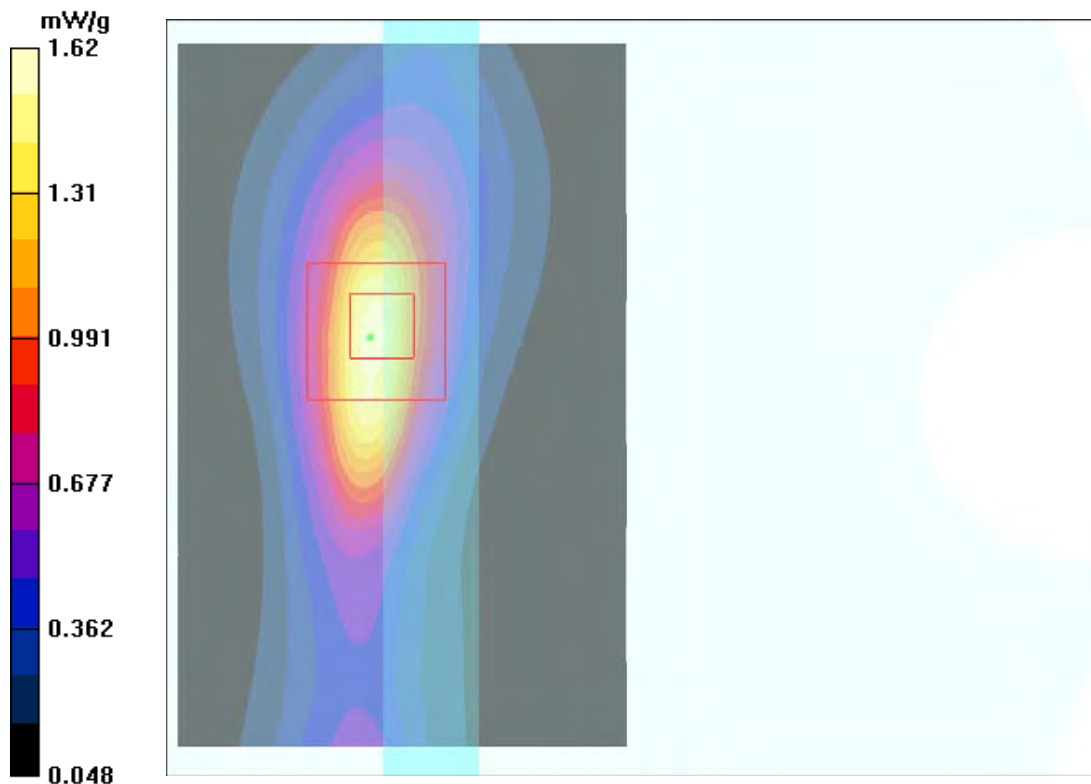
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 26.8 V/m; Power Drift = 0.123 dB

Peak SAR (extrapolated) = 3.51 W/kg

SAR (1 g) = 1.45 mW/g; SAR (10 g) = 0.713 mW/g

Maximum value of SAR (measured) = 1.62 mW/g



Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch CDMA_BC10_ Sensor Enabled - (Mid CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: CDMA BC10; Frequency: 820.5 MHz; Duty Cycle: 1:1

Medium parameters used (extrapolated): $f = 820.5$ MHz; $\sigma = 0.947$ mho/m; $\epsilon_r = 56$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (71x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.63 mW/g

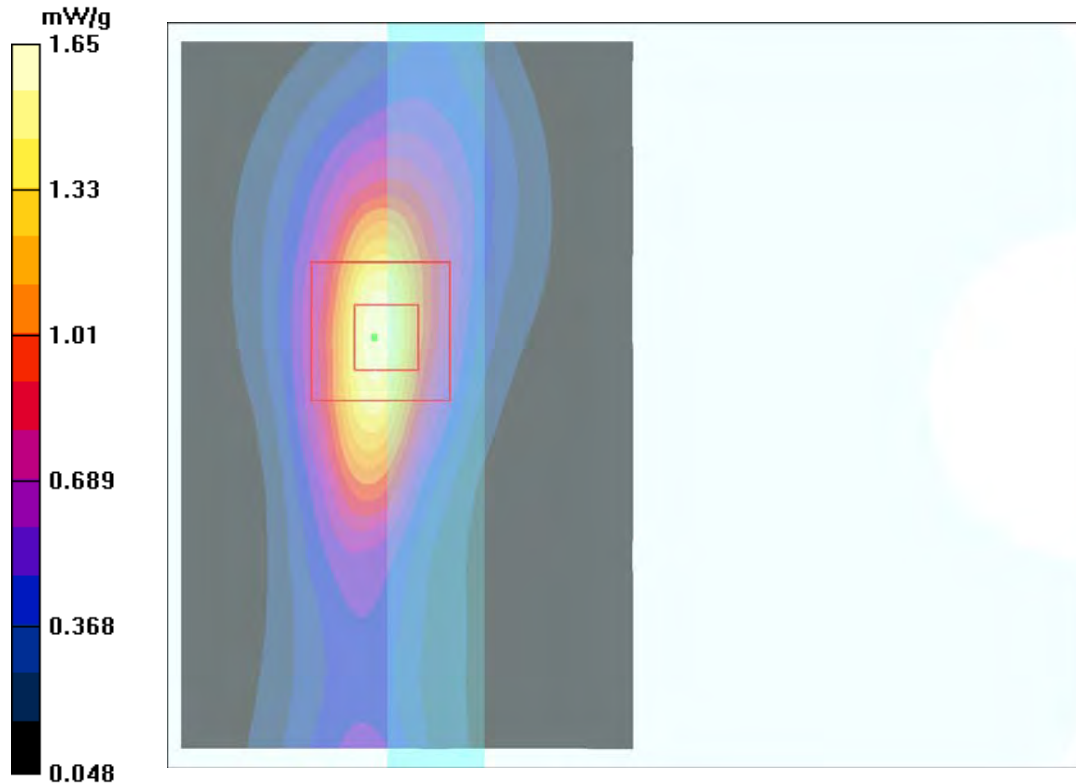
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 27.5 V/m; Power Drift = 0.927 dB

Peak SAR (extrapolated) = 3.44 W/kg

SAR (1 g) = 1.44 mW/g; SAR (10 g) = 0.712 mW/g

Maximum value of SAR (measured) = 1.65 mW/g



#30

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)**Top Touch CDMA_BC10_ Sensor Enabled - (High CH)****DUT: Motion; Type: Tablet; Serial: PVT-311**

Communication System: CDMA BC10; Frequency: 823.1 MHz; Duty Cycle: 1:1

Medium parameters used (extrapolated): $f = 823.1$ MHz; $\sigma = 0.949$ mho/m; $\epsilon_r = 56$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1604; ConvF(6.27, 6.27, 6.27); Calibrated: 8/19/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn456; Calibrated: 8/13/2014
- Phantom: SAM with CRP; Type: Twin SAM; Serial: TP-1032
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch to the Phantom/Area Scan (71x111x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.50 mW/g

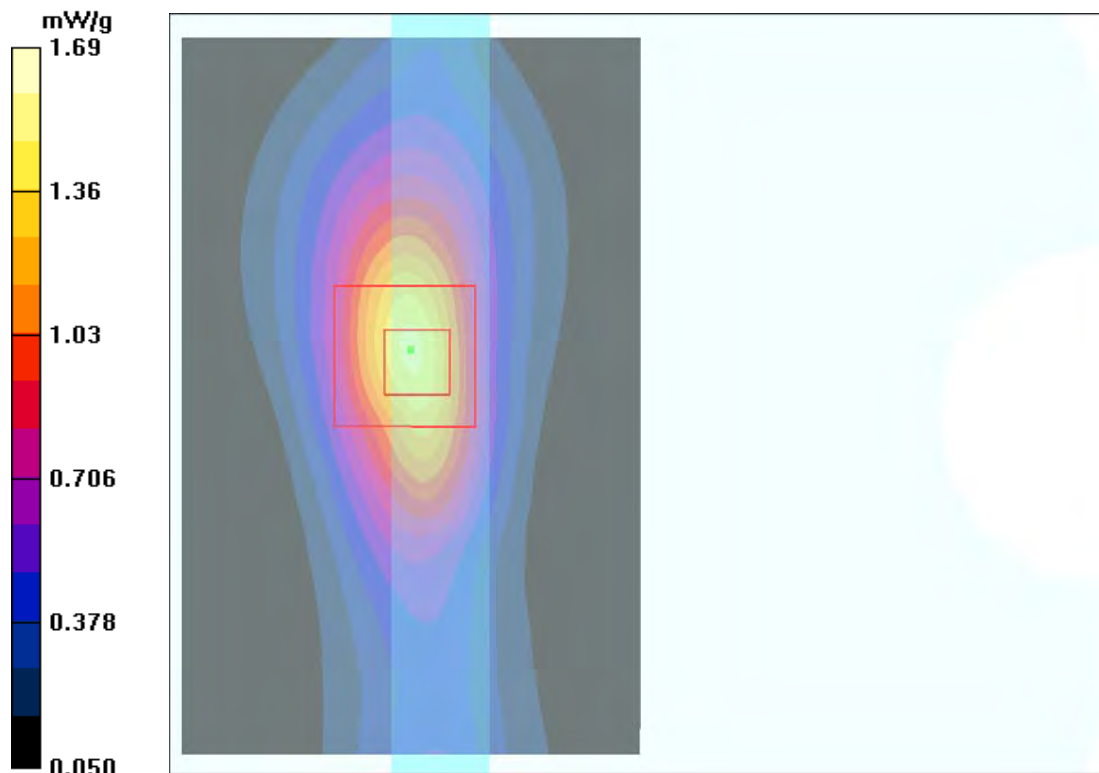
Top Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 37.3 V/m; Power Drift = 0.621 dB

Peak SAR (extrapolated) = 3.48 W/kg

SAR (1 g) = 1.5 mW/g; SAR (10 g) = 0.754 mW/g

Maximum value of SAR (measured) = 1.69 mW/g



#31

17 Appendix F– RF Output Power Measurement

RF Output Power Measurement Results

GSM (GMSK):

Radio	Frequency (MHz)	Output Average Power Conducted (dBm)							
		1 slot				2 slots			
		Measured Power	Target Power	Back off Power	Target Power	Measured Power	Target Power	Back off Power	Target Power
GSM 850	824.2	27.83	27	24.97	25	27.72	27	24.81	25
	836.6	27.15	27	24.5	25.5	26.97	27	25.48	25.5
	848.8	26.25	27	23.24	25	25.71	27	24.47	25
GSM 1900	1850.2	26.87	27	24.58	25	26.55	27	24.71	25
	1880	26.18	26	23.15	23	25.76	26	22.98	23
	1909.8	26.53	26	23.99	24	26.01	26	23.89	24

EDGE (8PSK):

Radio	Frequency (MHz)	Output Average Power Conducted (dBm)							
		1 slot				2 slots			
		Measured Power	Target Power	Back off Power	Target Power	Measured Power	Target Power	Back off Power	Target Power
GSM 850	824.2	26.53	27	23.97	24	26.45	27	24.12	24
	836.6	26.6	27	23.88	24	26.58	27	23.97	24
	848.8	26.63	27	24.12	24	26.54	27	23.84	24
GSM 1900	1850.2	25.27	25.5	22.94	23	25.22	25.5	22.95	23
	1880	25.12	25.5	22.81	23	25.07	25.5	22.91	23
	1909.8	25.38	25.5	22.88	23	25.03	25.5	22.88	23

Radio	Frequency (MHz)	Output Average Power Conducted (dBm)							
		3 slots				4 slots			
		Measured Power	Target Power	Back off Power	Target Power	Measured Power	Target Power	Back off Power	Target Power
GSM 850	824.2	25.87	26	22.87	23	25.31	26	23.03	23
	836.6	25.58	26	22.59	23	25.48	26	22.85	23
	848.8	25.69	26	22.47	23	25.62	26	22.97	23
GSM 1900	1850.2	24.32	24.5	21.48	22	24.15	24.5	21.84	22
	1880	24.01	24.5	21.56	22	24.02	24.5	21.68	22
	1909.8	24.12	24.5	21.84	22	24.1	24.5	21.69	22

WCDMA R99:

Radio	Frequency (MHz)	Output Average Power Conducted (dBm)			
		Measured Power	Target Power	Back off Power	Target Power
Band 2	1852.4	21.75	26	16.8	17
	1880	21.87	26	16.97	17
	1907.6	21.89	26	16.95	17
Band 4	1712.4	22.03	22	17.07	17.3
	1732.6	21.99	22	17.12	17.3
	1752.6	22.16	22	17.36	17.3
Band 5	826.4	22.3	22.5	20.9	21.1
	836.6	22.34	22.5	20.84	21.1
	846.6	22.11	22.5	20.77	21.1

R7 HSDPA:

Band	Mode	UL Ch No.	Frequency (MHz)	Average Power (dBm)	
				Full Power	Power Back-Off
Band 2	Subtest 1	9262	1852.4	21.21	16.21
		9400	1880	21.32	16.34
		9538	1907.6	21.35	16.38
	Subtest 2	9262	1852.4	20.89	15.89
		9400	1880	20.94	15.95
		9538	1907.6	20.93	15.97
	Subtest 3	9262	1852.4	20.85	15.87
		9400	1880	20.91	15.92
		9538	1907.6	20.9	15.95
	Subtest 4	9262	1852.4	20.8	15.74
		9400	1880	20.85	15.82
		9538	1907.6	20.87	15.91
Band 4	Subtest 1	1312	1712.4	21.56	16.67
		1413	1732.6	21.48	16.68
		1513	1752.6	21.61	16.82
	Subtest 2	1312	1712.4	21.12	16.31
		1413	1732.6	21.11	16.25
		1513	1752.6	21.19	16.46
	Subtest 3	1312	1712.4	21.08	16.3
		1413	1732.6	21.1	16.26
		1513	1752.6	21.15	16.45
	Subtest 4	1312	1712.4	21.07	16.29
		1413	1732.6	21.05	16.31
		1513	1752.6	21.12	16.37

Band	Mode	UL Ch No.	Frequency (MHz)	Average Power (dBm)	
				Full Power	Power Back-Off
Band 5	Subtest 1	4132	826.4	21.85	20.4
		4183	836.6	21.94	20.36
		4233	846.6	21.72	20.24
	Subtest 2	4132	826.4	21.53	20.16
		4183	836.6	21.58	20.08
		4233	846.6	21.32	20.01
	Subtest 3	4132	826.4	21.47	20.08
		4183	836.6	21.55	20.01
		4233	846.6	21.3	19.94
	Subtest 4	4132	826.4	21.45	19.95
		4183	836.6	21.49	19.97
		4233	846.6	21.25	19.86

R6 HSUPA:

Band	Mode	UL Ch No.	Frequency (MHz)	Average Power (dBm)	
				Full Power	Power Back-Off
Band 2	Subtest 1	9262	1852.4	20.88	15.88
		9400	1880	20.92	15.92
		9538	1907.6	20.91	15.96
	Subtest 2	9262	1852.4	20.84	15.84
		9400	1880	20.91	15.92
		9538	1907.6	20.95	15.96
	Subtest 3	9262	1852.4	21.2	16.2
		9400	1880	21.34	16.41
		9538	1907.6	21.31	16.37
	Subtest 4	9262	1852.4	21.15	16.22
		9400	1880	21.3	16.37
		9538	1907.6	21.29	16.39
	Subtest 5	9262	1852.4	21.29	16.18
		9400	1880	21.3	16.27
		9538	1907.6	21.27	16.29

Band	Mode	UL Ch No.	Frequency (MHz)	Average Power (dBm)	
				Full Power	Power Back-Off
Band 4	Subtest 1	1312	1712.4	21.1	16.35
		1413	1732.6	21.08	16.31
		1513	1752.6	21.15	16.35
	Subtest 2	1312	1712.4	21.15	16.25
		1413	1732.6	21.14	16.27
		1513	1752.6	21.13	16.44
	Subtest 3	1312	1712.4	21.54	16.69
		1413	1732.6	21.47	16.73
		1513	1752.6	21.6	16.88
	Subtest 4	1312	1712.4	21.59	16.63
		1413	1732.6	21.46	16.62
		1513	1752.6	21.6	16.85
	Subtest 5	1312	1712.4	21.55	16.64
		1413	1732.6	21.47	16.61
		1513	1752.6	21.69	16.84
Band 5	Subtest 1	4132	826.4	21.52	20.14
		4183	836.6	21.51	20.01
		4233	846.6	21.47	20.02
	Subtest 2	4132	826.4	21.43	20.09
		4183	836.6	21.51	19.86
		4233	846.6	21.39	19.99
	Subtest 3	4132	826.4	21.87	20.45
		4183	836.6	21.76	20.24
		4233	846.6	21.59	20.18
	Subtest 4	4132	826.4	21.81	20.42
		4183	836.6	21.86	20.39
		4233	846.6	21.77	20.21
	Subtest 5	4132	826.4	21.86	20.44
		4183	836.6	21.88	20.37
		4233	846.6	21.71	20.25

CDMA:

Radio	Frequency (MHz)	Output Average Power Conducted (dBm)			
		Measured Power	Target Power	Back off Power	Target Power
BC 0	824.7	23.5	23.5	22.1	22
	836.52	23.45	23.5	21.99	22
	848.31	23.51	23.5	22.08	22
BC 1	1851.25	23.5	23.5	18.21	18.2
	1880	23.71	23.5	18.37	18.2
	1908.75	23.43	23.5	18.05	18.2
BC 10	817.9	23.12	23.5	22.05	22.5
	820.5	23.07	23.5	22.12	22.5
	823.1	23.11	23.5	22.01	22.5

1xEVDO Rev 0:

Radio	Frequency (MHz)	Output Average Power Conducted (dBm)			
		Measured Power	Target Power	Back off Power	Target Power
BC 0	824.7	23.5	23.5	21.98	22
	836.52	23.4	23.5	21.91	22
	848.31	23.5	23.5	21.94	22
BC 1	1851.25	23.5	23.5	18.31	18.2
	1880	23.65	23.5	18.33	18.2
	1908.75	23.45	23.5	18.25	18.2
BC 10	817.9	23.21	23.5	22.17	22.5
	820.5	23.1	23.5	22.05	22.5
	823.1	23.1	23.5	22.03	22.5

1xEVDO Rev A:

Radio	Frequency (MHz)	Output Average Power Conducted (dBm)			
		Measured Power	Target Power	Back off Power	Target Power
BC 0	824.7	23.4	23.5	21.95	22
	836.52	23.4	23.5	21.9	22
	848.31	23.4	23.5	21.87	22
BC 1	1851.25	23.5	23.5	18.17	18.2
	1880	23.6	23.5	18.26	18.2
	1908.75	23.45	23.5	18.12	18.2
BC 10	817.9	23.2	23.5	22.3	22.5
	820.5	23.1	23.5	22	22.5
	823.1	23.1	23.5	22.11	22.5

LTE:

Radio	Bandwidth (MHz)	Frequency (MHz)	Modulation	RB Size	RB Offset	Measured Power (dBm)	Target Power (dBm)	Sensor Triggered Power (dBm)	Target Sensor Triggered Power (dBm)
LTE Band 2	20	1860	QPSK	1	0	22.5	23	15.6	17.0
				1	99	22.7	23	15.1	17.0
				50	50	21.5	23	15.7	17.0
				100	0	21.5	23	15.9	17.0
			16QAM	1	0	18.97	23	15.04	17.0
				1	99	19.07	23	16.3	17.0
				100	0	19.32	23	15.79	17.0
		1880	QPSK	1	0	22.7	23	15.8	17.0
				1	99	22.8	23	16.4	17.0
				50	50	21.5	23	17.3	17.0
				100	0	21.6	23	16.9	17.0
			16QAM	1	0	19.17	23	14.7	17.0
				1	99	18.12	23	15.2	17.0
				100	0	20.77	23	15.3	17.0
		1900	QPSK	1	0	22.7	23	15.7	17.0
				1	99	22.8	23	15.4	17.0
				50	50	21.5	23	15.0	17.0
				100	0	21.6	23	15.0	17.0
			16QAM	1	0	19.57	23	15.91	17.0
				1	99	20.02	23	15.02	17.0
				100	0	19.54	23	14.8	17.0

Radio	Bandwidth (MHz)	Frequency (MHz)	Modulation	RB Size	RB Offset	Measured Power (dBm)	Target Power (dBm)	Sensor Triggered Power (dBm)	Target Sensor Triggered Power (dBm)
LTE Band 4	20	1720	QPSK	1	0	22.2	23	19.5	20.5
				1	99	22.6	23	19.8	20.5
				50	50	21.5	23	18.6	20.5
				100	0	21.4	23	18.6	20.5
			16 QAM	1	0	22.3	23	20.9	20.5
				1	99	22.1	23	20.1	20.5
				100	0	20.8	23	19.06	20.5
		1732.5	QPSK	1	0	22.7	23	19.6	20.5
				1	99	22.5	23	19.8	20.5
				50	50	21.6	23	18.1	20.5
				100	0	21.5	23	18.7	20.5
			16 QAM	1	0	22.4	23	20.4	20.5
				1	99	22.1	23	20.3	20.5
				100	0	20.9	23	19.16	20.5
		1745	QPSK	1	0	22.6	23	19.8	20.5
				1	99	22.7	23	19.8	20.5
				50	50	21.4	23	19.0	20.5
				100	0	21.5	23	18.8	20.5
			16 QAM	1	0	22.6	23	20.5	20.5
				1	99	22.7	23	20.5	20.5
				100	0	20.8	23	19.1	20.5

Radio	Bandwidth (MHz)	Frequency (MHz)	Modulation	RB Size	RB Offset	Measured Power (dBm)	Target Power (dBm)	Sensor Triggered Power (dBm)	Target Sensor Triggered Power (dBm)
LTE Band 5	10	829	QPSK	1	0	22.5	23	20.3	21
				1	49	22.6	23	20.3	21
				25	25	21.7	23	19.3	21
				50	0	21.5	23	19.2	21
			16 QAM	1	0	21.37	23	19.7	21
				1	49	21.34	23	19.7	21
				50	0	20.12	23	18.8	21
		836.5	QPSK	1	0	22.9	23	20.4	21
				1	49	22.6	23	20.1	21
				25	25	21.5	23	19.1	21
				50	0	21.6	23	19.1	21
			16 QAM	1	0	22.08	23	20.6	21
				1	49	22.29	23	20.5	21
				50	0	20.24	23	18.9	21
		844	QPSK	1	0	22.5	23	20.1	21
				1	49	22.4	23	20.0	21
				25	25	21.5	23	19.1	21
				50	0	21.4	23	19.0	21
			16 QAM	1	0	22.09	23	19.7	21
				1	49	21.89	23	19.5	21
				50	0	20.07	23	18.7	21

Radio	Bandwidth (MHz)	Frequency (MHz)	Modulation	RB Size	RB Offset	Measured Power (dBm)	Target Power (dBm)	Sensor Triggered Power (dBm)	Target Sensor Triggered Power (dBm)
LTE Band 13	10	777	QPSK	1	0	22.6	23	17.6	20.5
				1	49	22.9	23	18.2	20.5
				25	25	21.4	23	17.9	20.5
				50	0	21.4	23	17.8	20.5
			16 QAM	1	0	22.5	23	20.0	20.5
				1	49	22.9	23	20.3	20.5
				50	0	20.94	23	19.3	20.5
				50	0	20.94	23	19.3	20.5
		782	QPSK	1	0	23.1	23	17.9	20.5
				1	49	22.3	23	17.9	20.5
				25	25	21.7	23	18.1	20.5
				50	0	21.5	23	18.0	20.5
			16 QAM	1	0	22.0	23	19.3	20.5
				1	49	22.0	23	19.3	20.5
				50	0	21.2	23	19.6	20.5
				50	0	21.2	23	19.6	20.5
		787	QPSK	1	0	22.7	23	18.1	20.5
				1	49	21.6	23	18.1	20.5
				25	25	23.7	23	20.5	20.5
				50	0	22.8	23	19.5	20.5
			16 QAM	1	0	22.2	23	19.6	20.5
				1	49	22.4	23	19.7	20.5
				50	0	22.3	23	20.3	20.5
				50	0	22.3	23	20.3	20.5

Radio	Bandwidth (MHz)	Frequency (MHz)	Modulation	RB Size	RB Offset	Measured Power (dBm)	Target Power (dBm)	Sensor Triggered Power (dBm)	Target Sensor Triggered Power (dBm)
LTE Band 17	10	709	QPSK	1	0	23.0	23	21.1	21.5
				1	49	22.8	23	21.0	21.5
				25	25	22.0	23	21.1	21.5
				50	0	21.9	23	21.0	21.5
			16 QAM	1	0	22.3	23	19.5	21.5
				1	49	22.2	23	19.6	21.5
				50	0	21.4	23	18.7	21.5
		710	QPSK	1	0	22.9	23	21.1	21.5
				1	49	23.0	23	21.0	21.5
				25	25	21.9	23	21.0	21.5
				50	0	21.9	23	20.9	21.5
			16 QAM	1	0	23.1	23	19.7	21.5
				1	49	22.4	23	20.4	21.5
				50	0	21.5	23	18.72	21.5
		711	QPSK	1	0	23.0	23	21.1	21.5
				1	49	22.8	23	21.1	21.5
				25	25	21.8	23	21.0	21.5
				50	0	22.0	23	21.0	21.5
			16 QAM	1	0	22.8	23	20.5	21.5
				1	49	22.2	23	19.6	21.5
				50	0	21.5	23	18.8	21.5

Radio	Bandwidth (MHz)	Frequency (MHz)	Modulation	RB Size	RB Offset	Measured Power (dBm)	Target Power (dBm)	Sensor Triggered Power (dBm)	Target Sensor Triggered Power (dBm)
LTE Band 25	20	1860	QPSK	1	0	22.6	23	17.8	18.0
				1	99	22.7	23	17.3	18.0
				50	50	21.6	23	16.5	18.0
				100	0	21.5	23	17.4	18.0
			16 QAM	1	0	22.0	23	16.1	18.0
				1	99	22.9	23	15.5	18.0
				100	0	20.92	23	15.6	18.0
		1882.5	QPSK	1	0	22.6	23	15.1	18.0
				1	99	22.5	23	15.7	18.0
				50	50	21.6	23	15.8	18.0
				100	0	21.4	23	15.5	18.0
			16 QAM	1	0	22.9	23	15.6	18.0
				1	99	22.3	23	16.6	18.0
				100	0	20.96	23	16.0	18.0
		1905	QPSK	1	0	22.5	23	15.6	18.0
				1	99	22.5	23	15.1	18.0
				50	50	21.9	23	16.1	18.0
				100	0	21.4	23	15.1	18.0
			16 QAM	1	0	22.2	23	16.0	18.0
				1	99	22.5	23	16.7	18.0
				100	0	21.0	23	15.7	18.0

18 Appendix G – Test Setup Photos

18.1 Tablet Back Side Touch to the Phantom Setup Photo



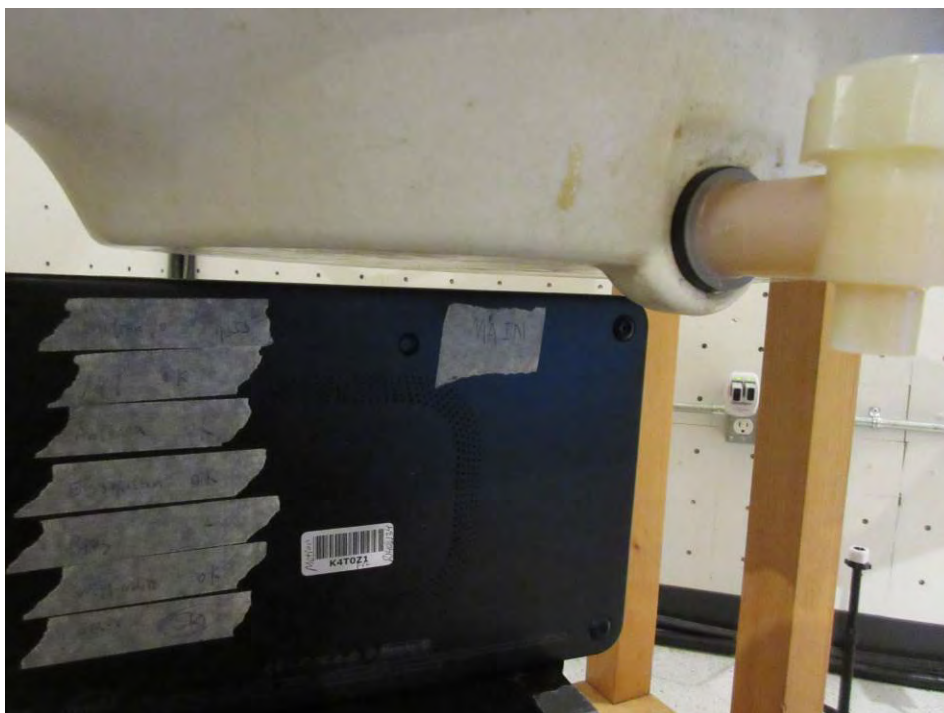
18.2 Tablet Top Side Touch to the Phantom Setup Photo



18.3 Tablet Back Side 7mm to the Phantom Setup Photo



18.4 Tablet Top Edge 10mm to the Phantom Setup Photo



18.5 Tablet Left Edge Touch to the Phantom Setup Photo



19 Appendix H – EUT Photos

19.1 Tablet – Front View



19.2 Tablet – Back View



19.3 Tablet – Top Edge View



19.4 Tablet – Bottom Edge View



19.5 Tablet – Right Side View



19.6 Tablet – Left Side View



19.7 Tablet – Open Case View



20 Appendix I - Informative References

- [1] Federal Communications Commission, "Report and order: Guidelines for evaluating the environmental effects of radiofrequency radiation", Tech. Rep. FCC 96-326, FCC, Washington, D.C. 20554, 1996.
- [2] David L. Means Kwok Chan, Robert F. Cleveland, "Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", Tech. Rep., Federal Communication Commission, Office of Engineering & Technology, Washington, DC, 1997.
- [3] Thomas Schmid, Oliver Egger, and Niels Kuster, "Automated E-field scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp. 105-113, Jan. 1996.
- [4] Niels Kuster, Ralph Kastle, and Thomas Schmid, "Dosimetric evaluation of mobile communications equipment with known precision", IEICE Transactions on Communications, vol. E80-B, no. 5, pp. 645-652, May 1997.
- [5] CENELEC, "Considerations for evaluating of human exposure to electromagnetic fields (EMFs) from mobile telecommunication equipment (MTE) in the frequency range 30MHz - 6GHz", Tech. Rep., CENELEC, European Committee for Electrotechnical Standardization, Brussels, 1997.
- [6] ANSI, ANSI/IEEE C95.1-1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.
- [7] Katja Pokovic, Thomas Schmid, and Niels Kuster, "Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies", in ICECOM '97, Dubrovnik, October 15-17, 1997, pp. 120-24.
- [8] Katja Pokovic, Thomas Schmid, and Niels Kuster, "E-field probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23-25 June, 1996, pp. 172-175.
- [9] Volker Hombach, Klaus Meier, Michael Burkhardt, Eberhard Kuhn, and Niels Kuster, "The dependence of EM energy absorption upon human head modeling at 900 MHz", IEEE Transactions on Microwave Theory and Techniques, vol. 44, no. 10, pp. 1865-1873, Oct. 1996.
- [10] Klaus Meier, Ralf Kastle, Volker Hombach, Roger Tay, and Niels Kuster, "The dependence of EM energy absorption upon human head modeling at 1800 MHz", IEEE Transactions on Microwave Theory and Techniques, Oct. 1997, in press.
- [11] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.
- [12] W. H. Press, S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second Edition, Cambridge University Press, 1992. Dosimetric Evaluation of Sample device, month 1998 9
- [13] NIS81 NAMAS, "The treatment of uncertainty in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddington, Middlesex, England, 1994.
- [14] Barry N. Taylor and Christ E. Kuyatt, "Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology, 1994. Dosimetric Evaluation of Sample device, month 1998 10.

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