SAR EVALUATION REPORT

For

NVIDIA Corporation

2701 San Tomas Expressway,

Santa Clara, CA 95050, USA

FCC ID: VOB-E1729

Report Type:	**Product Type:**
Class II Permissive Change	WWAN Modular within Tablet

Prepared By: Jerry Tong

Jerry Tong

Report Number: R1407019-SAR

Report Date: 2014-07-29

Reviewed By: Alvin Huang

Alvin Huang

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94089, USA
Tel: (408) 732-9162
Fax: (408) 732 9164

<table>
<tr><th colspan="4">Summary of Test Results</th></tr>
<tr><td>Rule Part(s):</td><td colspan="3">FCC §2.1093</td></tr>
<tr><td>Test Procedure(s):</td><td colspan="3">IEEE 1528: 2013, IEC 62209-2: 2010
FCC Published RF exposure KDB procedure</td></tr>
<tr><td>Device Category:
Exposure Category:</td><td colspan="3">Portable Device
General Population/Uncontrolled Exposure</td></tr>
<tr><td>Device Type:</td><td colspan="3">Portable Device</td></tr>
<tr><td>Modulation Type:</td><td colspan="3">GMSK, 8PSK, QPSK, 16QAM, 64QAM</td></tr>
<tr><td>Radio Bands:</td><td colspan="3">GSM/GPRS850: 824.2-848.8 MHz
GSM/GPRS1900: 1850.2-1909.8 MHz
WCDMA Band II: 1825.4-1907.6 MHz
WCDMA Band IV: 1712.4-1752.6 MHz
WCDMA Band V: 826.4-846.6 MHz
LTE Band 2: 1850-1910 MHz
LTE Band 4: 1710-1755 MHz
LTE Band 5: 824-849 MHz
LTE Band 7: 2500-2570 MHz
LTE Band 17: 704-716 MHz</td></tr>
<tr><td>Rated Power:</td><td colspan="3">GSM/GPRS850: 32 dBm
GSM/GPRS1900: 29 dBm
UMTS Band II, IV, V: 23 dBm
LTE Band II, IV, V, VII, XVII: 23 dBm</td></tr>
<tr><td>Antenna Type(s) Tested:</td><td colspan="3">Internal Antennas</td></tr>
<tr><td>Body-Worn Accessories:</td><td colspan="3">None</td></tr>
<tr><td>Face-Head Accessories:</td><td colspan="3">None</td></tr>
<tr><td>Operate Mode</td><td colspan="3">Data Only</td></tr>
<tr><td>Battery Type (s) Tested:</td><td colspan="3">Li-Ion: 3.8V/5200mAh</td></tr>
<tr><td>Date tested:</td><td colspan="3">06/23/2014-07/27/2014</td></tr>
<tr><td rowspan="4">Max. SAR Level (s) Measured:</td><td>Level (W/Kg)</td><td>Position</td><td>Operational Mode</td></tr>
<tr><td>1.467</td><td>Back Side Touch</td><td>Licensed</td></tr>
<tr><td>Level (W/Kg)</td><td>Position</td><td>Operational Mode</td></tr>
<tr><td>1.885
(SPLSR=0.039)</td><td>Back Side Touch</td><td>Simultaneous</td></tr>
</table>

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1 General Description

1.1 Introduction

This measurement report shows compliance of the Nvidia Corporation WWAN RF modular (Model: NB106-N, FCC ID: VOB-E1729) which installed in Nvidia Corporation product (Model: P1761W, FCC ID: VOB-P1761W) with FCC Part 2.1093 standard. The model number of Tablet with license WWAN module is P1761.

1.2 Test EUT Technical Specification

The following table indicates all the wireless technologies operating in the RF modular installed in Nvidia Corporation product.

For WWAN RF modular, please refer to FCC ID: VOB-E1729 granted on April 16, 2014.

<table>
<tr><th>Item</th><th colspan="4">Description</th></tr>
<tr><td>Radio</td><td colspan="4">GSM850/PCS1900 GPRS/EDGE
UMTS Band 2, Band 4, Band 5
LTE Band 2, Band 4, Band 5, Band 7 and Band 17</td></tr>
<tr><td rowspan="5">Rated Power</td><td>GPRS 850</td><td>32 dBm</td><td>GPRS 1900</td><td>29 dBm</td></tr>
<tr><td>UMTS Band 2</td><td>23 dBm</td><td>UMTS Band 4</td><td>23 dBm</td></tr>
<tr><td>UMTS Band 5</td><td>23 dBm</td><td>LTE Band 2</td><td>23 dBm</td></tr>
<tr><td>LTE Band 4</td><td>23 dBm</td><td>LTE Band 5</td><td>23 dBm</td></tr>
<tr><td>LTE Band 7</td><td>23 dBm</td><td>LTE Band 17</td><td>23 dBm</td></tr>
</table>

This WWAN module was installed into Nvidia certified Tablet (FCC ID: VOB-P1761W). To meet the simultaneous transmission condition, the WLAN output power at Antenna 1 was reduced by the manufacturer. The DFS bands (5.2 GHz and 5.6 GHz) were disabled. Please refer to the manufacturer declaration letter. Below is the detail technical specification of tablet to support the WWAN module.

<table>
<tr><th colspan="3">Host Product Feature (Tablet)</th></tr>
<tr><td>Host Name:</td><td colspan="2">Tablet</td></tr>
<tr><td>Company:</td><td colspan="2">Nvidia Corporation</td></tr>
<tr><td>Model Name:</td><td colspan="2">P1761</td></tr>
<tr><td>FCC ID:</td><td colspan="2">VOB-P1761W (WLAN)
VOB-E1729 (WWAN Module)</td></tr>
<tr><td>Dimensions (L*W*H)</td><td colspan="2">Tablet: 220 mm (L) x 125 mm (W) x 8 mm (H)</td></tr>
<tr><td>TX Frequency Range:</td><td colspan="2">802.11b/g/n: 2412-2472 MHz
802.11a/n: 5180-5240 MHz, 5745-5825 MHz
Bluetooth: 2402-2480 MHz</td></tr>
<tr><td rowspan="2">Rated Average Power:</td><td>Bluetooth: 10.0 dBm
802.11b: 12.0 dBm
802.11g: 11.0 dBm
802.11n: 11.0 dBm</td><td>2.4 GHz</td></tr>
<tr><td>802.11a/n 5180-5240: 7.5 dBm
802.11a/n 5745-5825: 10.0 dBm</td><td>5 GHz</td></tr>
</table>

2 Test Facility

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

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

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

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

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

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

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

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

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

3 Reference, Standards and Guidelines

FCC:

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

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

CE:

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

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

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

3.1 SAR Limits

FCC 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 1 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 Information

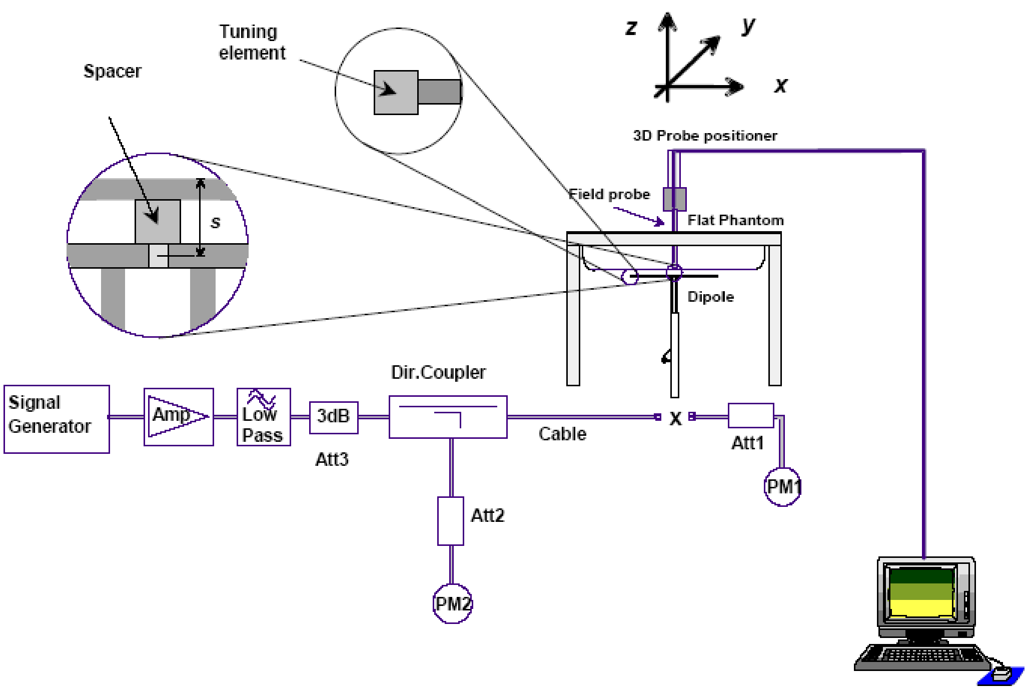
Type/Model	Cal. Due Date	S/N
DASY4 Professional Dosimetric System	N/A	N/A
Robot RX60L	N/A	CS7MBSP / 467
Robot Controller	N/A	F01/5J72A1/A/01
Dell Computer Dimension 3000	N/A	N/A
SPEAG EDC3	N/A	N/A
SPEAG DAE3	2014-10-17	456
DASY4 Measurement Server	N/A	1176
Schmid & Partner ES3DV2	2014-08-26	3019
SPEAG E-Field Probe EX3DV4	2014-08-27	3619
Antenna, Dipole, D-2450-S-1	2014-07-25	BCL-141
Antenna, Dipole, D5GHzV2	2014-08-23	1001
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 Flat Phantom	N/A	1004
Agilent, Spectrum Analyzer E4440A	2014-11-07	MY44303352
ZHL-42 Coaxial Amplifier	N/A	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	2014-07-13	3614A00276
Amplifier, ST181-20	N/A	E012-0101
HP, Analyzer, Network, 8753D	2014-10-22	3410A04346
Attenuator 3 dB	2014-11-20	00317
HP, Directional Coupler 779D	2014-11-23	00494

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±0.2mm filled with head or body liquid.

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

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

4) The dipole input power was 100 mW or 250 mW or 500 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 [%]
2014-06-23	Body	750	εr	22	55.55	55.5	-0.09	± 5
			σ	22	0.96	0.95	-1.04	± 5
			1g SAR	22	8.68	8.04	-7.37	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
2014-07-15	Body	835	εr	22	55.2	55.8	1.09	± 5
			σ	22	0.97	0.98	1.03	± 5
			1g SAR	22	9.59	9.62	0.31	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
2014-07-17	Body	1750	εr	22	53.44	51.6	-3.44	± 5
			σ	22	1.49	1.48	-0.67	± 5
			1g SAR	22	36.65	34.6	-5.59	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
2014-07-22	Body	1900	εr	22	53.3	52.1	-2.25	± 5
			σ	22	1.52	1.46	-3.95	± 5
			1g SAR	22	39.654	38	-4.17	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [°C]	Target Value	Measured Value	Deviation [%]	Limits [%]
2014-07-25	Body	2450	εr	22	52.7	50.7	-3.80	± 5
			σ	22	1.95	2.02	3.59	± 5
			1g SAR	22	53.115	51.4	-3.23	± 10

Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
2014-07-25	Body	5200	εr	22	49.0	49.9	1.84	± 5
			σ	22	5.3	5.53	4.34	± 5
			1g SAR	22	74.9	77.4	3.34	± 10

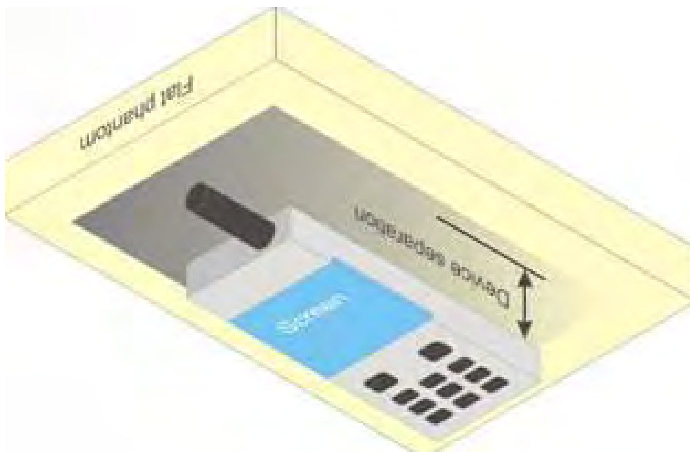
Date	Simulant	Freq. [MHz]	Parameters	Liquid Temp [ºC]	Target Value	Measured Value	Deviation [%]	Limits [%]
2014-07-25	Body	5800	εr	22	48.2	47.5	-1.45	± 5
			σ	22	6.0	5.8	-3.33	± 5
			1g SAR	22	74.2	69.9	-5.80	± 10

εr = relative permittivity, σ = conductivity and ρ=1000 kg/m3

6 EUT Test Strategy and Methodology

6.1 Test positions for body-worn and other configurations

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



6.2 SAR Evaluation Procedure

The evaluation was performed with the following procedure:

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

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

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

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

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

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

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

6.3 Test Methodology

- KDB 447498 D01 (General 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 D05 (SAR for LTE Devices)

7 DASY4 SAR Evaluation Procedure

7.1 Power Reference Measurement

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

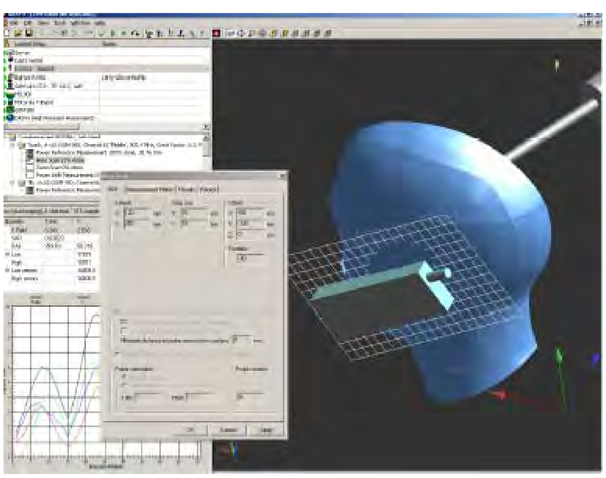
7.2 Area Scan

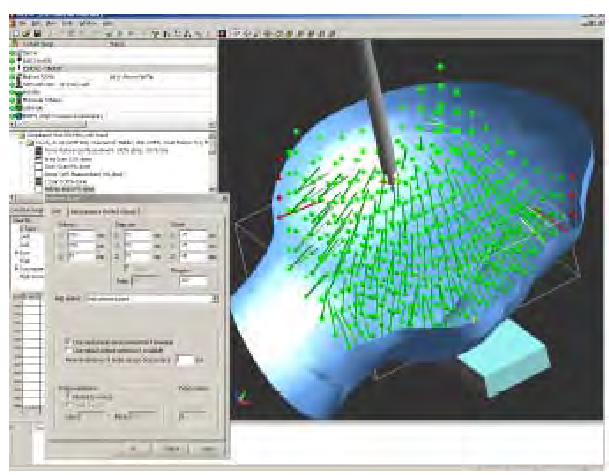
The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4 software can find the maximum locations even in relatively coarse grids.

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

When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE 1528-2003, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

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





7.3 Zoom Scan

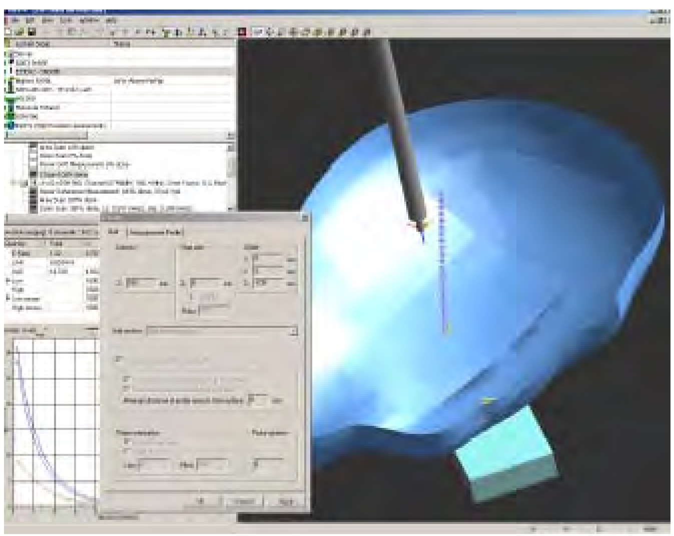
Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan measures 5 x 5 x 7 points within a cube whose base faces are centered around the maxima found in a preceding area scan job within the same procedure.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

7.4 Power drift measurement

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

7.5 Z-Scan

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



8 Description of Test System

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

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

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

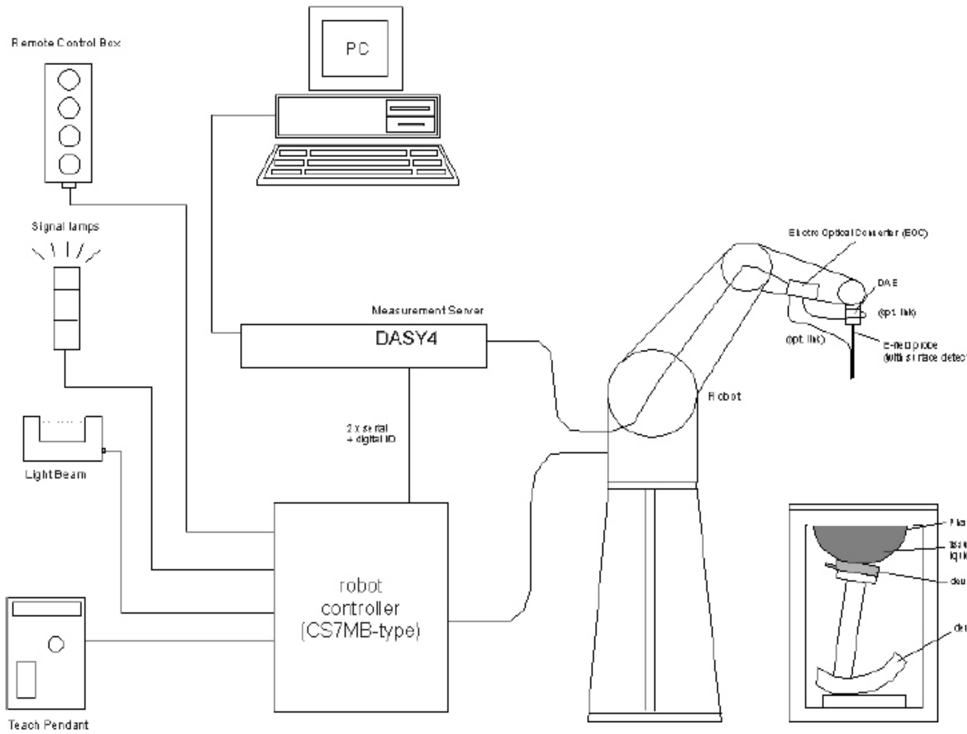
KDB 865664 Recommended Tissue Dielectric Parameters

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

DAY4 user's Manual Recommended Tissue Dielectric Parameters

Frequency (MHz)	Head Tissue		Body Tissue	
	εr	Ơ (S/m)	εr	Ơ (S/m)
5200	36.0	4.66	36.0	5.30
5300	35.9	4.76	48.9	5.42
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88

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.

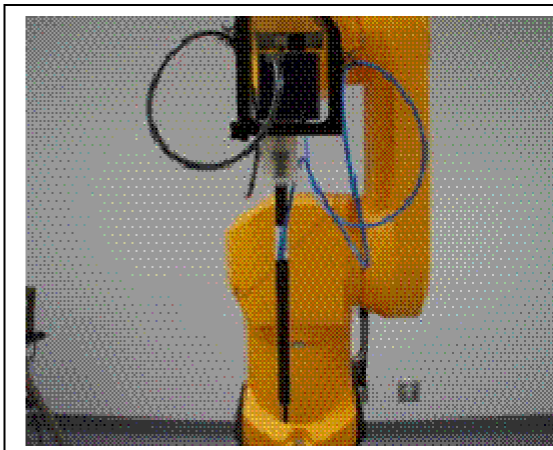
Dosimetric Probes: These probes are specially designed and calibrated for use in liquids with high permittivities. They should not be used in air, since the spherical isotropy in air is poor (±2 dB). The dosimetric probes have special calibrations in various liquids at different frequencies.

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

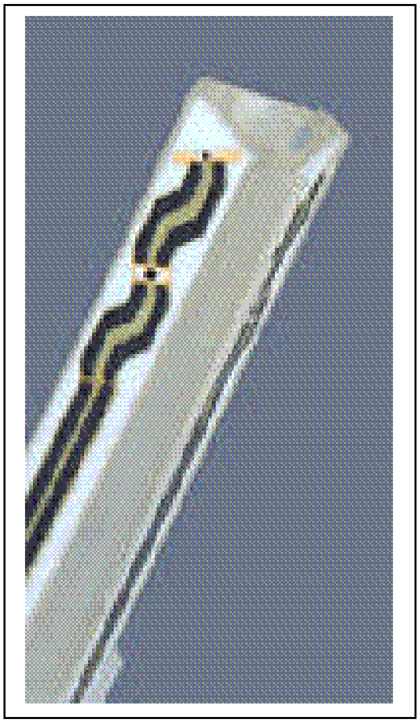
Construction Symmetrical design with triangular core
Built-in optical fiber for surface detection System
Built-in shielding against static charges
Calibration In air from 10 MHz to 2.5 GHz
In brain and muscle simulating tissue at
Frequencies of 450 MHz, 900 MHz and
1.8 GHz (accuracy ± 8%)
Frequency 10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



Photograph of the probe

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

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



Inside view of ET3DV6 E-field Probe

E-Field Probe Calibration Process

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

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

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

Data Evaluation

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Light Beam Unit

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

Medium

Parameters

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

Parameter measurements

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

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

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

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

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

SAM Twin Phantom

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

- Left hand
- Right hand
- Flat phantom

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

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

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

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

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

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 RF Output Power

GPRS:

Radio	Frequency (MHz)	Output Average Power Conducted (dBm)							
		1 Uplink slot		2 Uplink slot		3 Uplink slot		4 Uplink slot	
		Measured Power	Target Power	Measured Power	Target Power	Measured Power	Target Power	Measured Power	Target Power
GPRS 850	824.2	32.15	32	29.31	29	27.39	27.5	26.27	26
	836.6	32.24	32	29.31	29	27.46	27.5	26.35	26
	848.8	32.11	32	29.28	29	27.44	27.5	26.19	26
GPRS 1900	1850.2	28.42	29	25.76	26	24.02	24.5	22.75	23
	1880	28.46	29	25.81	26	24.03	24.5	22.71	23
	1909.8	28.44	29	25.64	26	24.01	24.5	22.64	23

UMTS:

Radio	Frequency (MHz)	Output Average Power Conducted (dBm)		Radio	Frequency (MHz)	Output Average Power Conducted (dBm)	
		Measured Power	Target Power			Measured Power	Target Power
Band 2	1852.4	22.86	23	Band 5	826.4	23.02	23
	1880	22.91	23		836.6	23.12	23
	1907.6	22.89	23		846.6	23.08	23
Band 4	1712.4	22.86	23	/	/	/	/
	1732.6	23.10	23		/	/	/
	1752.6	22.77	23		/	/	/

LTE:

Radio	Bandwidth (MHz)	Modulation	Frequency (MHz)	RB Size	RB Offset	Measured Power (dBm)	Target Power (dBm)
LTE Band 2	20	QPSK	1860	1	0	23.32	23
				1	99	22.98	23
				50	25	22.88	23
				100	0	22.76	23
			1880	1	0	23.31	23
				1	99	23.46	23
				50	25	23.02	23
				100	0	22.78	23
			1900	1	0	23.38	23
				1	99	22.96	23
				50	25	22.86	23
				100	0	22.91	23

Radio	Bandwidth (MHz)	Modulation	Frequency (MHz)	RB Size	RB Offset	Measured Power (dBm)	Target Power (dBm)
LTE Band 4	20	QPSK	1720	1	0	23.21	23
				1	99	23.05	23
				50	25	22.34	23
				100	0	22.15	23
			1732.5	1	0	23.11	23
				1	99	23.44	23
				50	25	23.13	23
				100	0	22.95	23
			1745	1	0	23.19	23
				1	99	23.00	23
				50	25	22.68	23
				100	0	22.76	23
Radio	Bandwidth (MHz)	Modulation	Frequency (MHz)	RB Size	RB Offset	Measured Power (dBm)	Target Power (dBm)
LTE Band 5	10	QPSK	829	1	0	23.55	23
				1	49	23.32	23
				25	12	22.89	23
				50	0	22.75	23
			836.5	1	0	23.47	23
				1	49	23.24	23
				25	12	23.01	23
				50	0	22.78	23
			844	1	0	23.33	23
				1	49	23.15	23
				25	12	23.05	23
				50	0	22.76	23
Radio	Bandwidth (MHz)	Modulation	Frequency (MHz)	RB Size	RB Offset	Measured Power (dBm)	Target Power (dBm)
LTE Band 7	20	QPSK	2510	1	0	23.05	23
				1	99	23.36	23
				50	25	22.56	23
				100	0	22.17	23
			2535	1	0	23.19	23
				1	99	23.45	23
				50	25	22.98	23
				100	0	22.86	23
			2560	1	0	23.22	23
				1	99	23.22	23
				50	25	22.86	23
				100	0	22.37	23

Radio	Bandwidth (MHz)	Modulation	Frequency (MHz)	RB Size	RB Offset	Measured Power (dBm)	Target Power (dBm)
LTE Band 17	10	QPSK	709	1	0	23.02	23
				1	49	23.15	23
				25	12	22.64	23
				50	0	22.57	23
			710	1	0	23.12	23
				1	49	23.32	23
				25	12	22.78	23
				50	0	22.39	23
			711	1	0	23.09	23
				1	49	23.32	23
				25	12	22.71	23
				50	0	22.66	23

Reduced Output power of Tablet at Antenna port 1:

Radio	Frequency (MHz)	Measured Power (dBm)	Target Power (dBm)	Radio	Frequency (MHz)	Measured Power (dBm)	Target Power (dBm)
2.4 GHz 802.11b	2412	11.0	12	2.4 GHz 802.11g	2412	10.89	11
	2437	11.68	12		2437	10.90	11
	2462	11.68	12		2462	10.02	11
2.4 GHz 802.11n20	2412	10.35	11	2.4 GHz 802.11n40	2422	9.46	10
	2437	10.12	11		2437	9.57	10
	2462	9.05	10		2452	5.97	7
5 GHz 802.11a	5180	7.00	7.5	5 GHz 802.11n20	5180	6.37	7.0
	5200	7.21	7.5		5200	6.36	7.0
	5240	6.34	7.5		5240	6.12	7.0
	5745	8.84	10		5745	9.54	10
	5785	9.40	10		5785	9.35	10
	5825	9.74	10		5825	9.24	10
5 GHz 802.11n40	5190	6.74	7	/	/	/	/
	5230	6.53	7	/	/	/	/
	5755	9.24	10	/	/	/	/
	5795	9.72	10	/	/	/	/

Note 1: LTE Band 2/Band 4 support 1.4/3/5/10/15/20 MHz bandwidth
LTE Band 5 support 1.4/3/5/10 MHz bandwidth
LTE Band 7 support 5/10/15/20 MHz bandwidth
LTE Band 17 support 5/10 MHz bandwidth
Note 2: According to KDB 941225 D05 required the largest channel bandwidth need to do SAR test.
Note 3: For WLAN radio, only antenna port 1 has been reduced and reported.in order to meet with simultaneous RF exposure requirements.

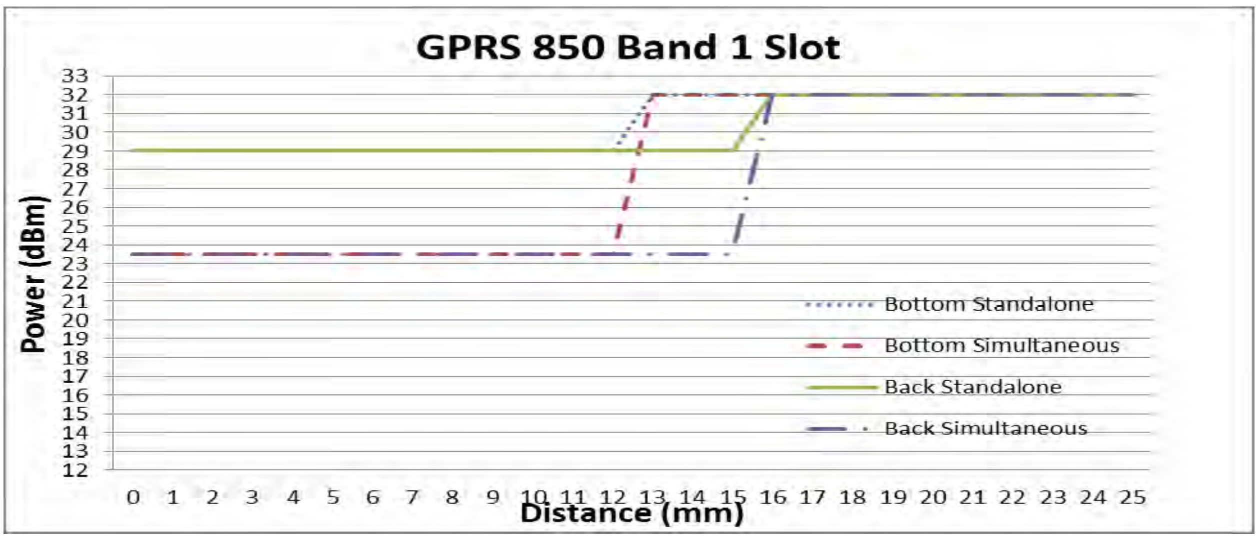
10 Sensor Triggering Data Summary

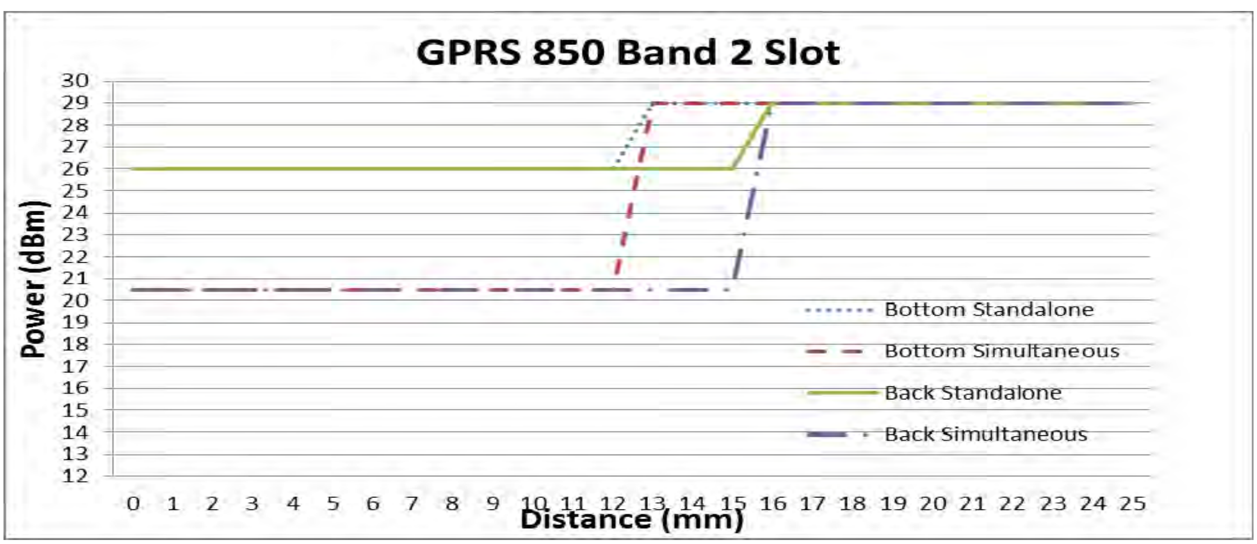
Per FCC KDB 616217 D04, this device was tested by the manufacturer to determine the proximity sensor triggering distances for the back side and bottom side edge of the device, the measured output power from 0 to 25 mm of the triggering points is included for back side and each applicable edge.

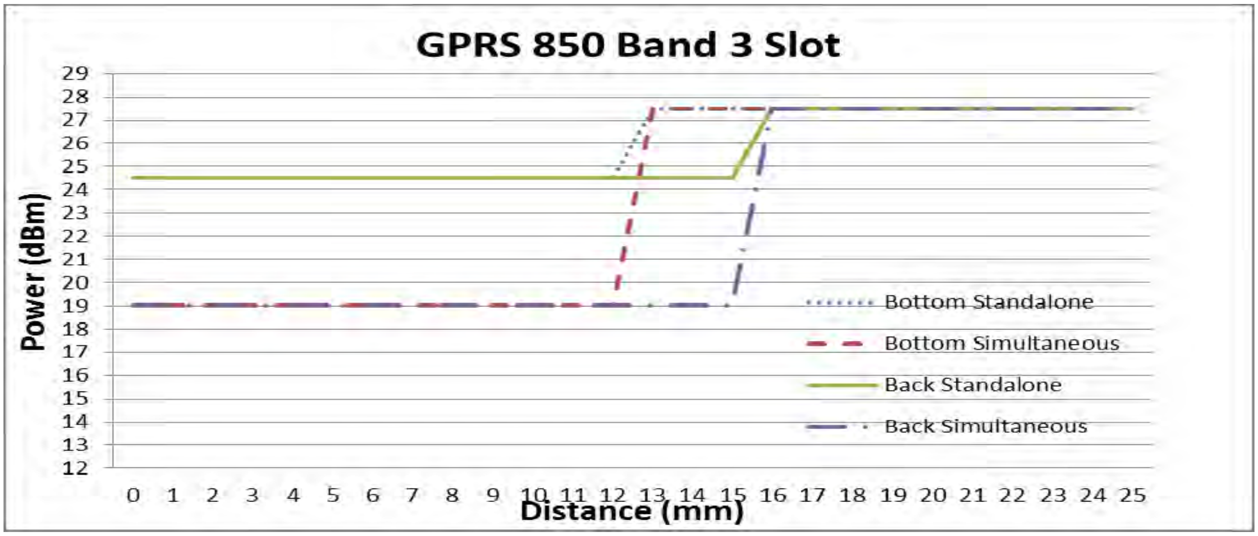
To ensure all production units are compliant it is necessary to test SAR at a distance 1 mm less than the smallest distance from the device and SAR phantom with the device at maximum output power without power reduction, these additional SAR tests are included additionally to the SAR tests for the device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

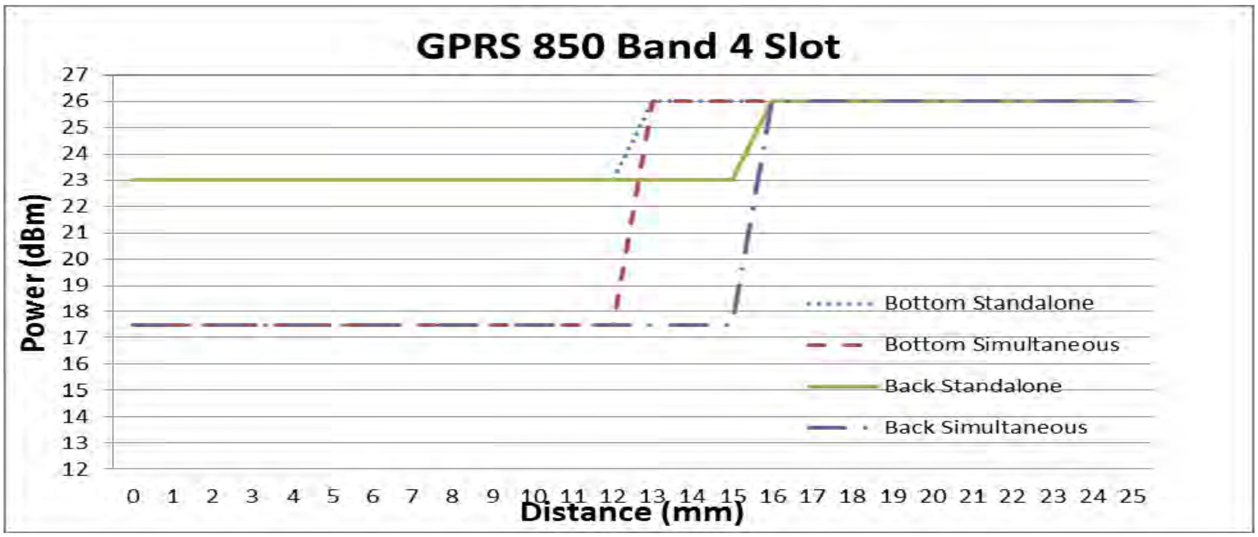
Moving device toward the phantom, according to KDB 616217 section 6.2.6 measured power in the graphs for clarity:

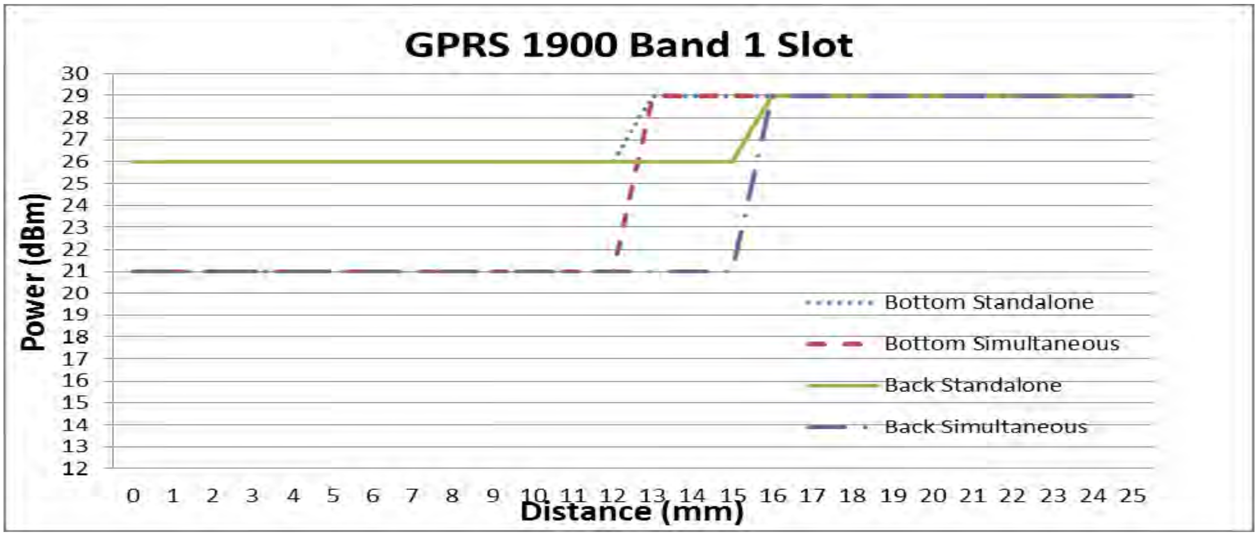
GSM Bands:

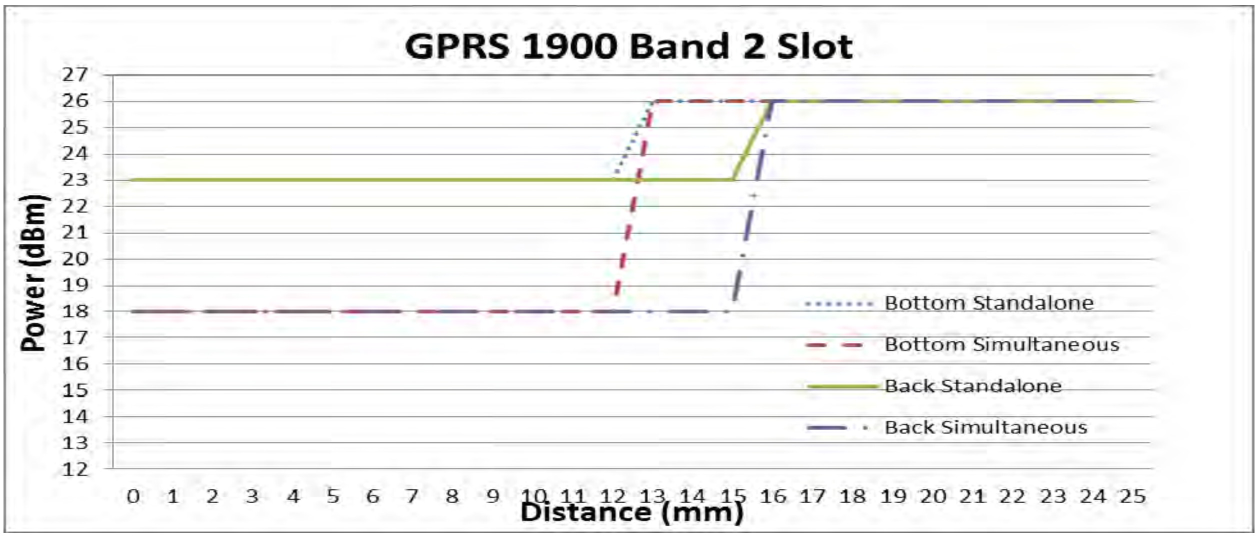


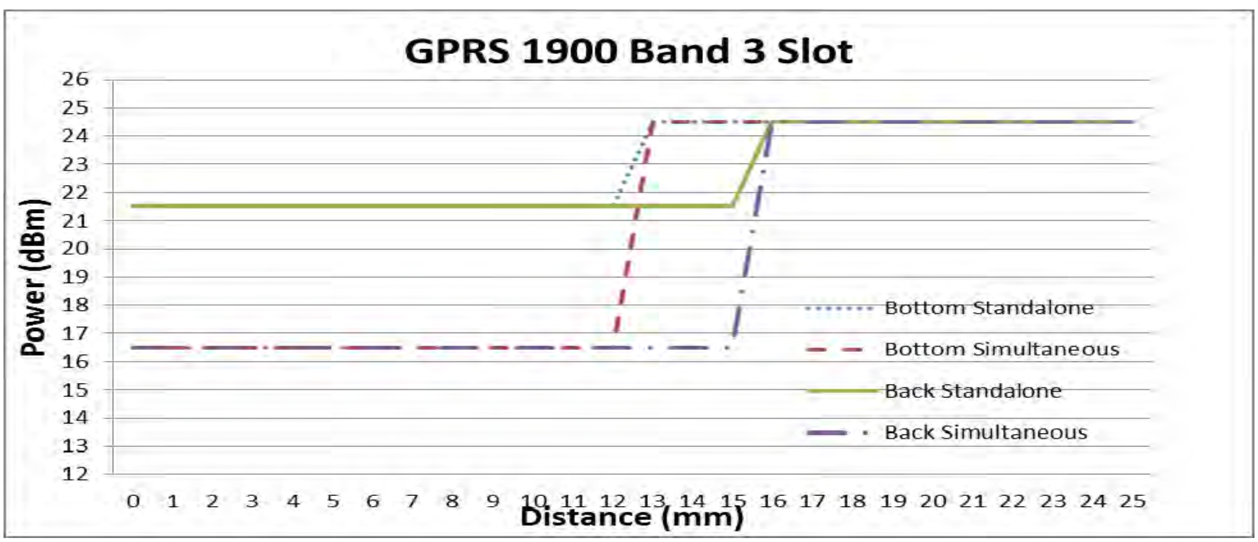


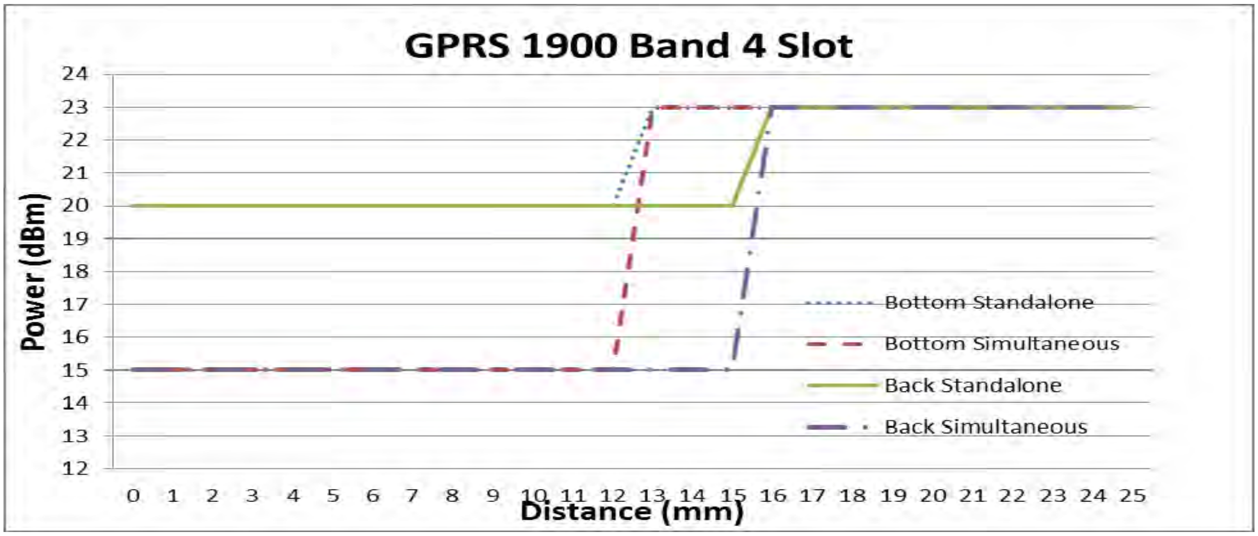

GPRS 850 Band 3 Slot
Power (dBm)
Distance (mm)
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous


GPRS 850 Band 4 Slot
Power (dBm)
Distance (mm)
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

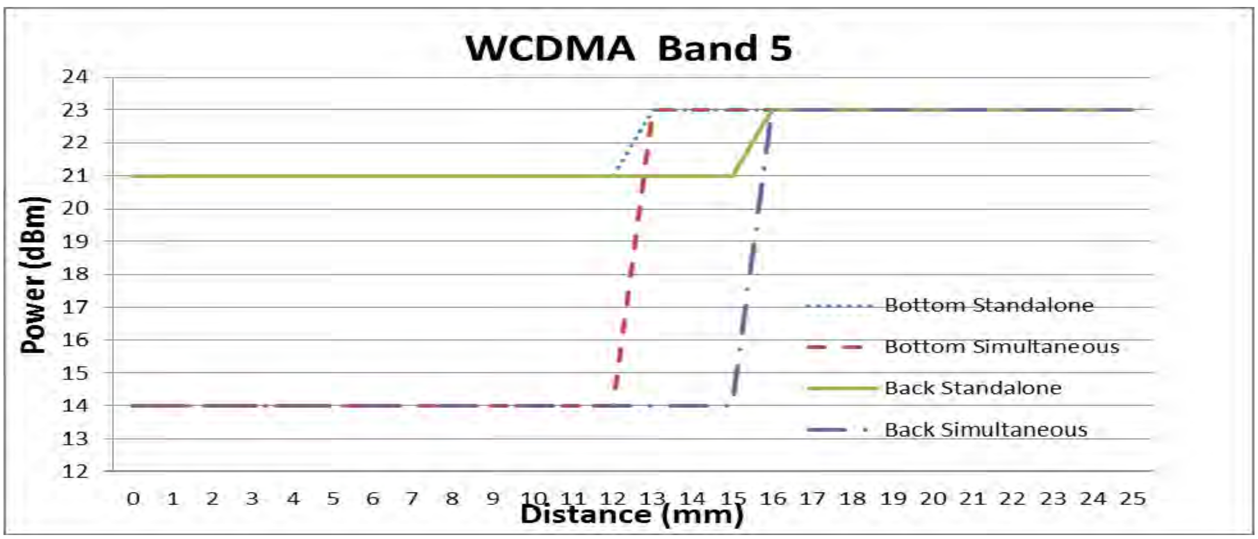

GPRS 1900 Band 1 Slot
Power (dBm)
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

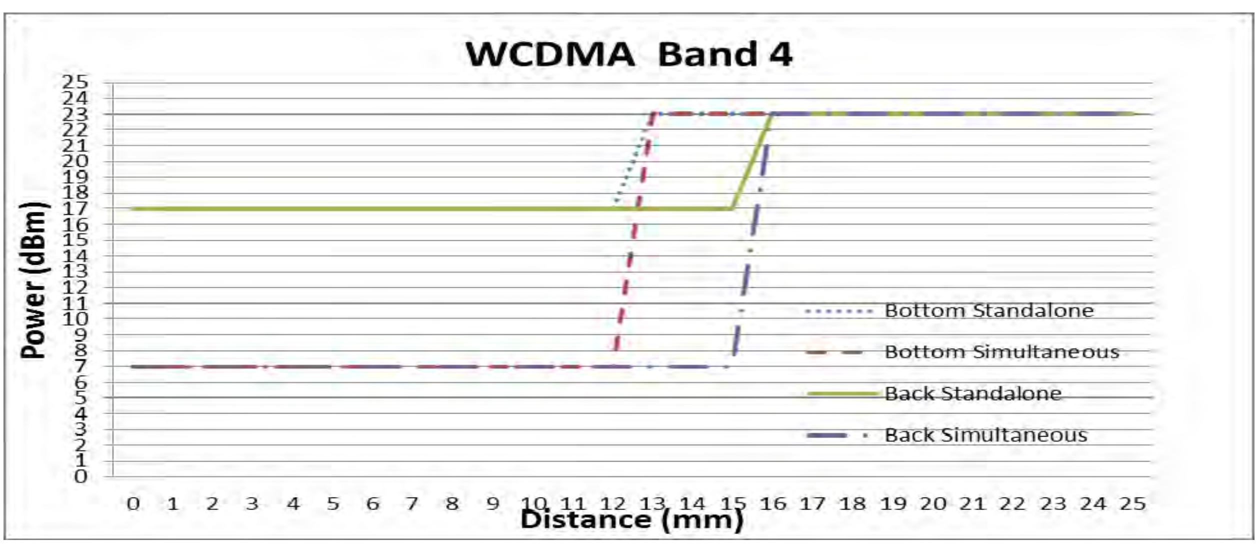

GPRS 1900 Band 2 Slot
Power (dBm)
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

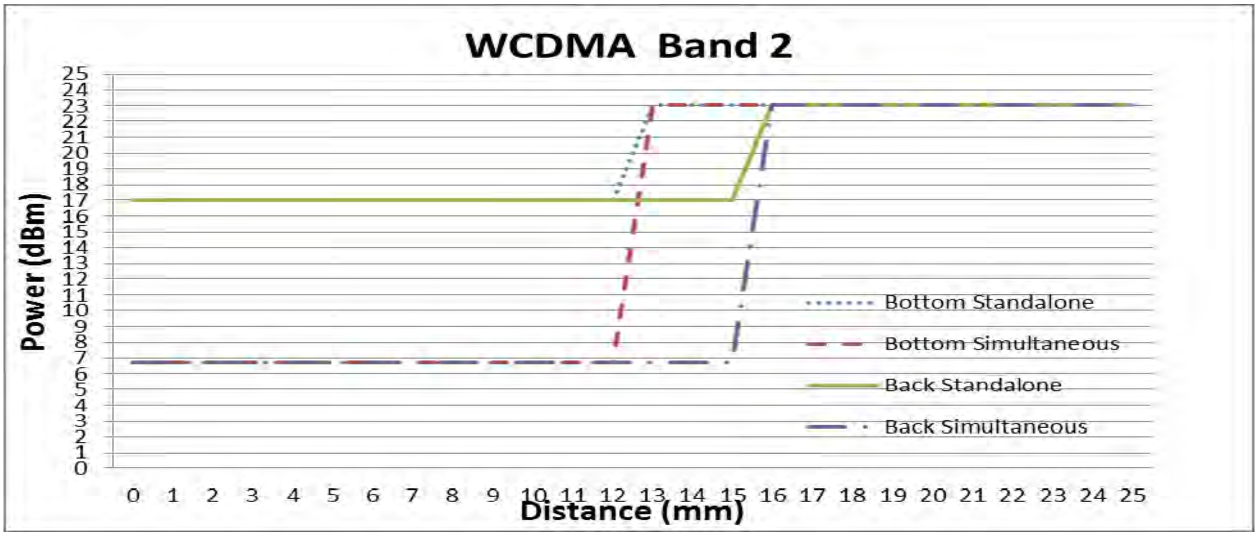

GPRS 1900 Band 3 Slot
Power (dBm)
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous


GPRS 1900 Band 4 Slot
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

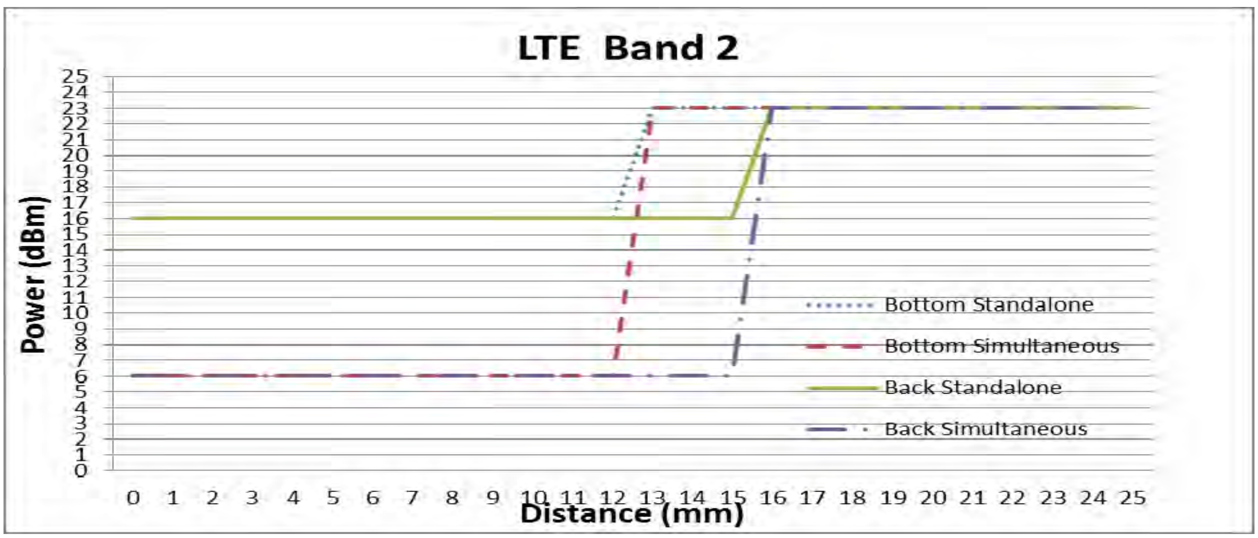
UMTS Bands:

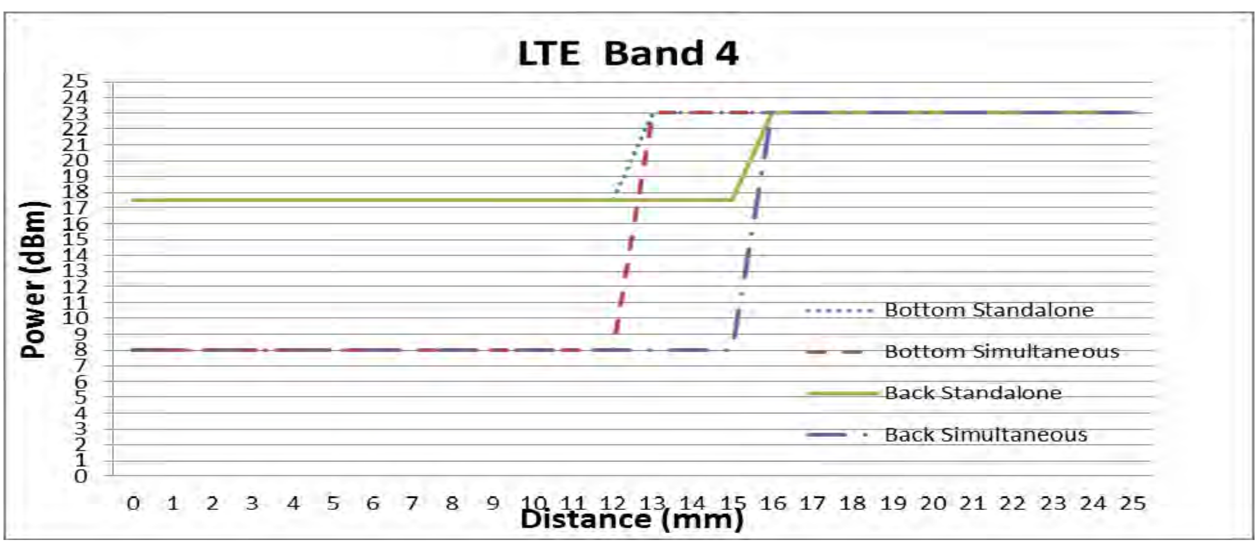

WCDMA Band 5
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

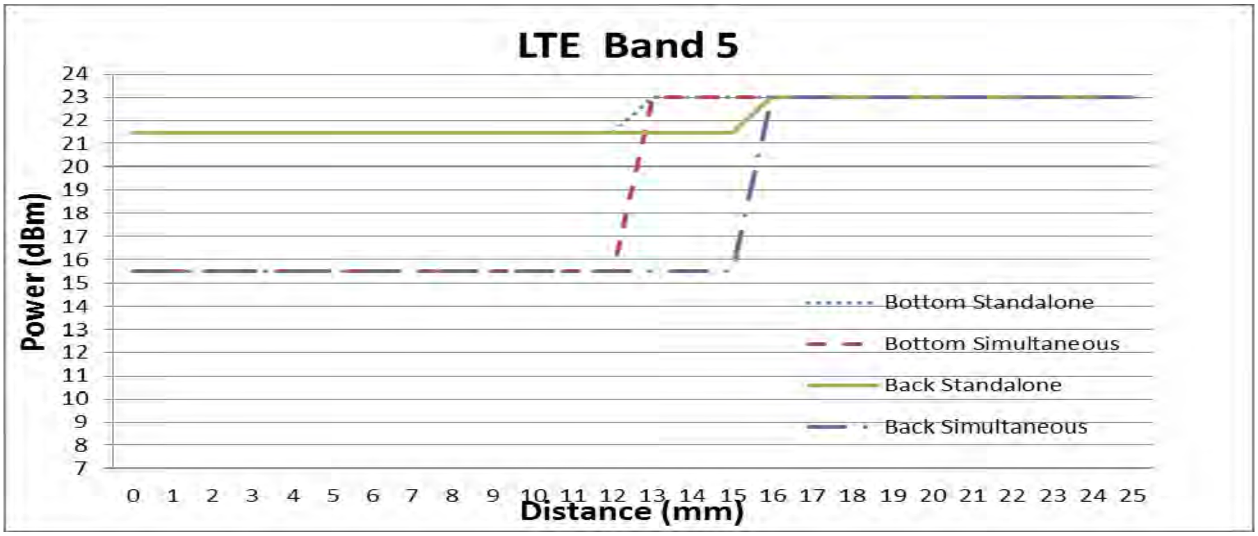

WCDMA Band 4
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

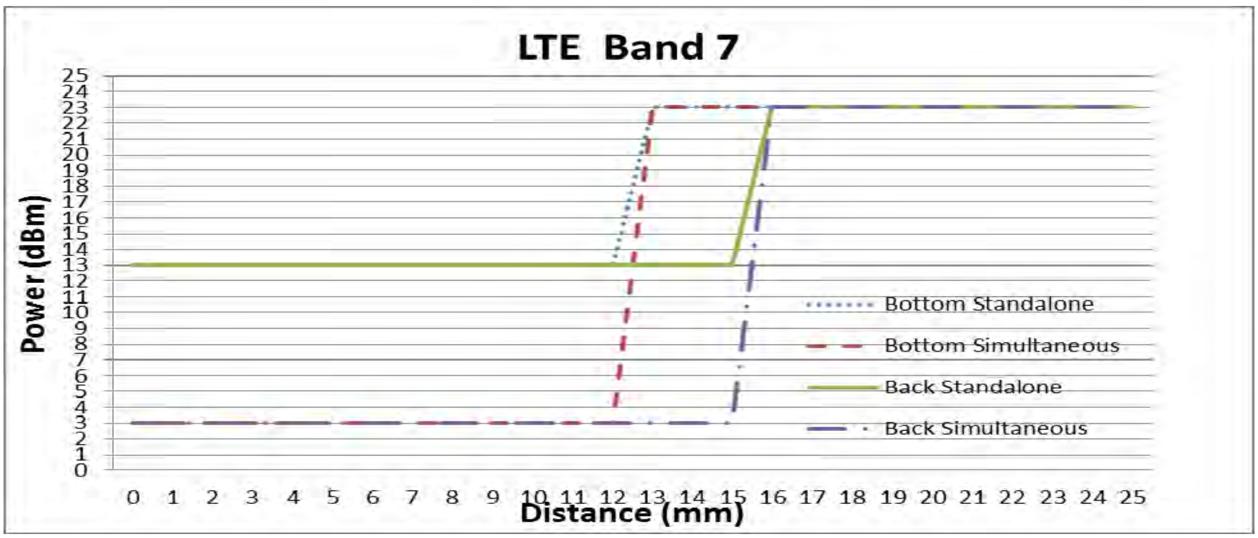

WCDMA Band 2
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

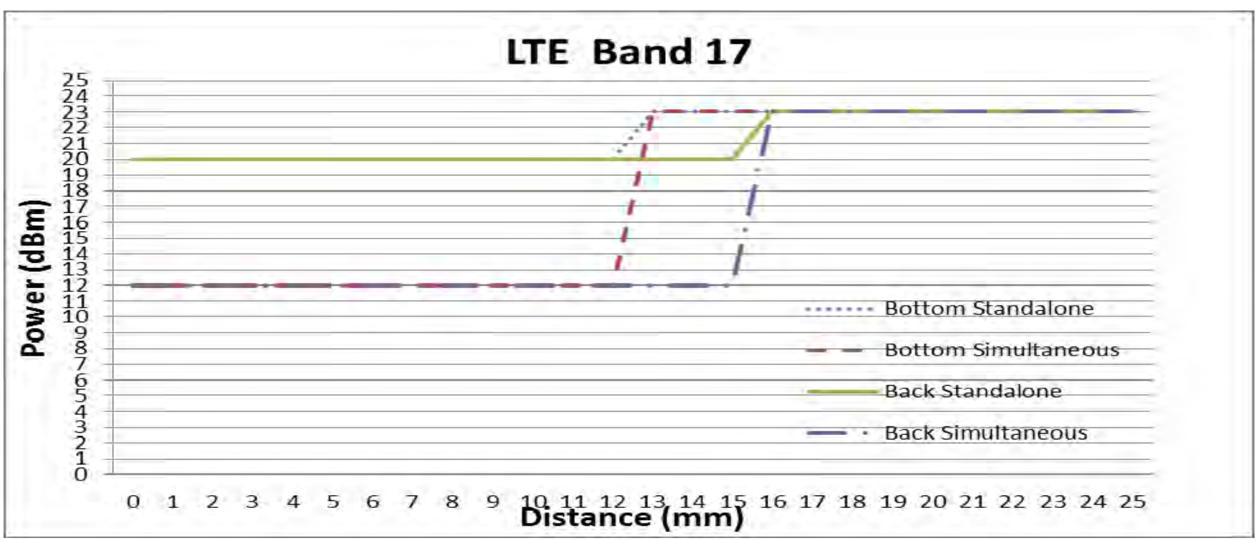
LTE Bands:


LTE Band 2
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous


LTE Band 4
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

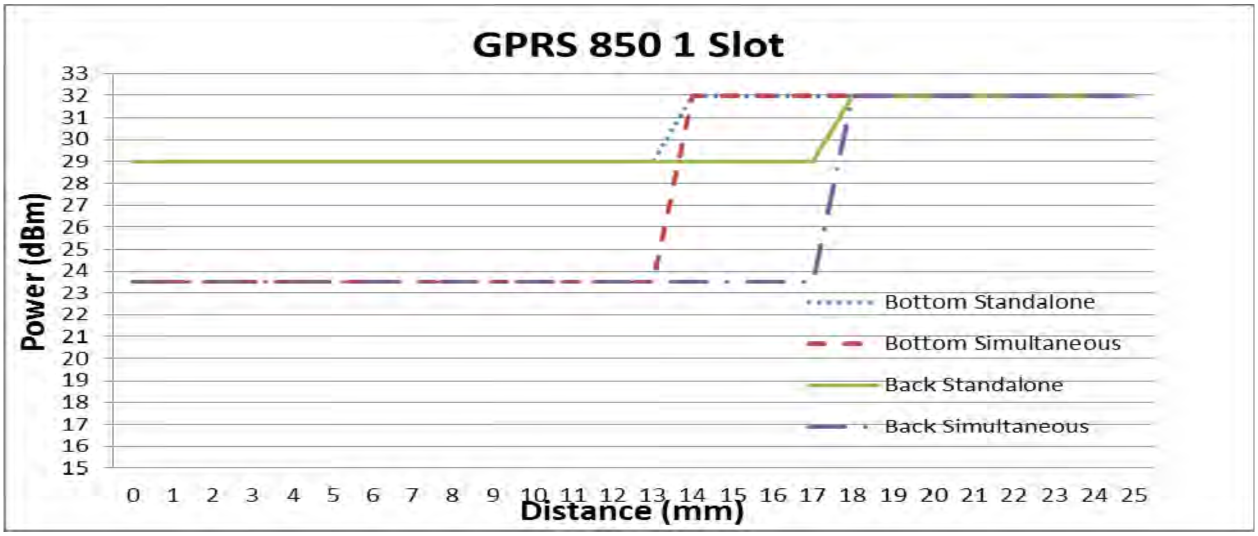

LTE Band 5
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

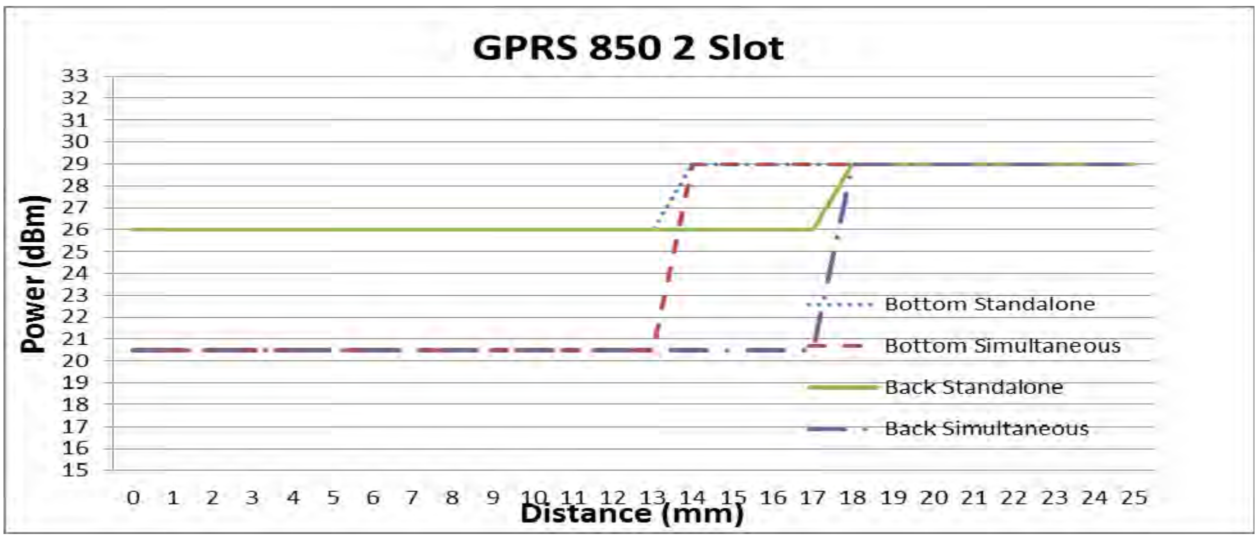

LTE Band 7
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

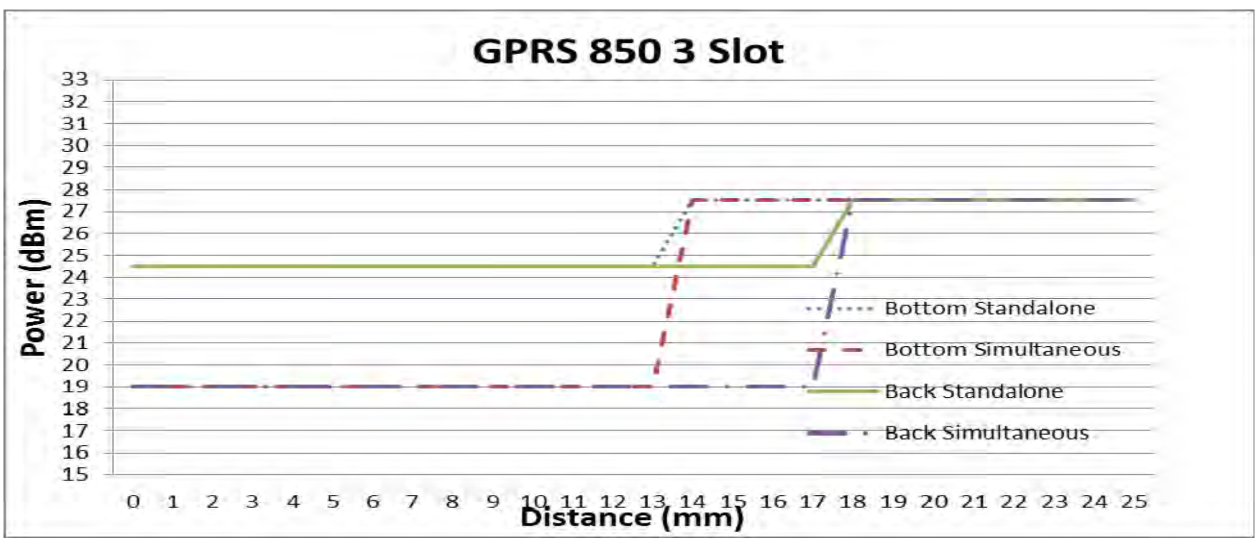

LTE Band 17
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

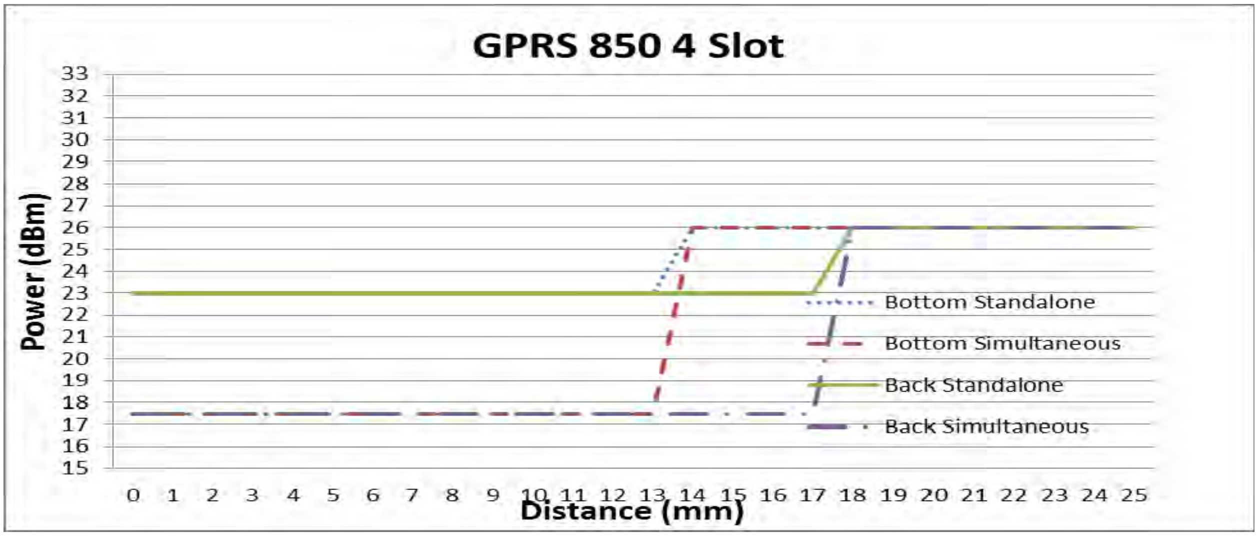
Moving device away from the phantom, according to KDB 616217 section 6.2.8 measured power in the graphs for clarity:

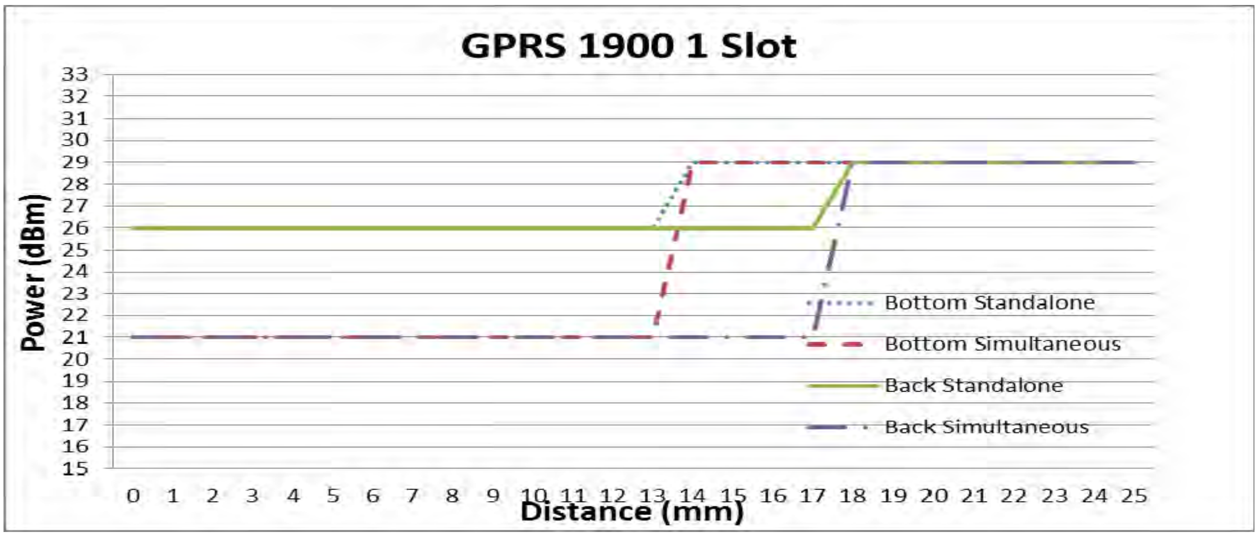
GSM Bands:

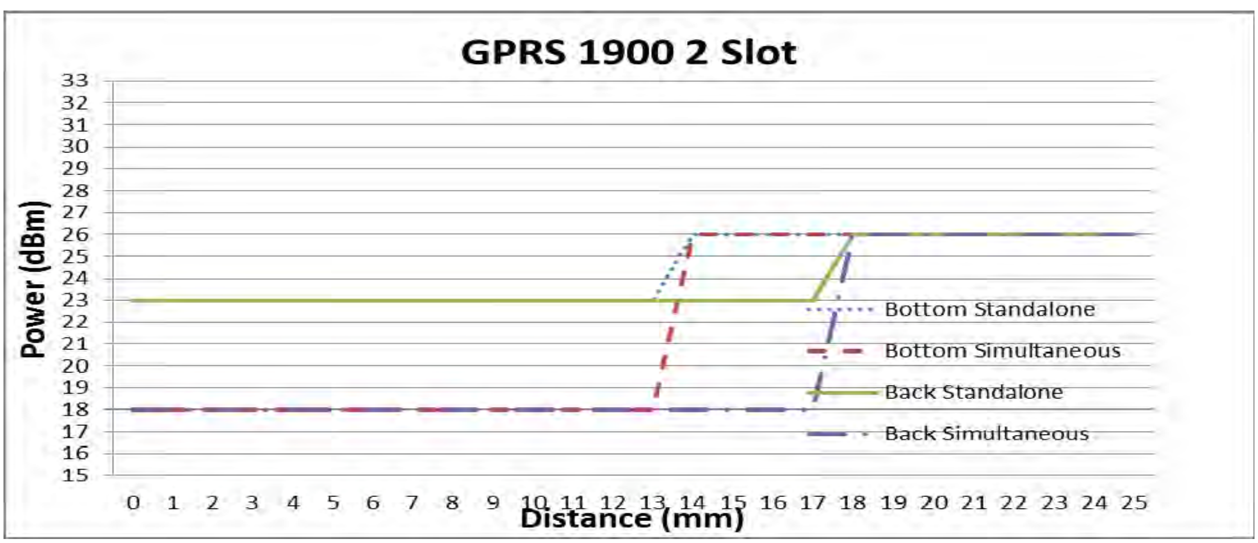


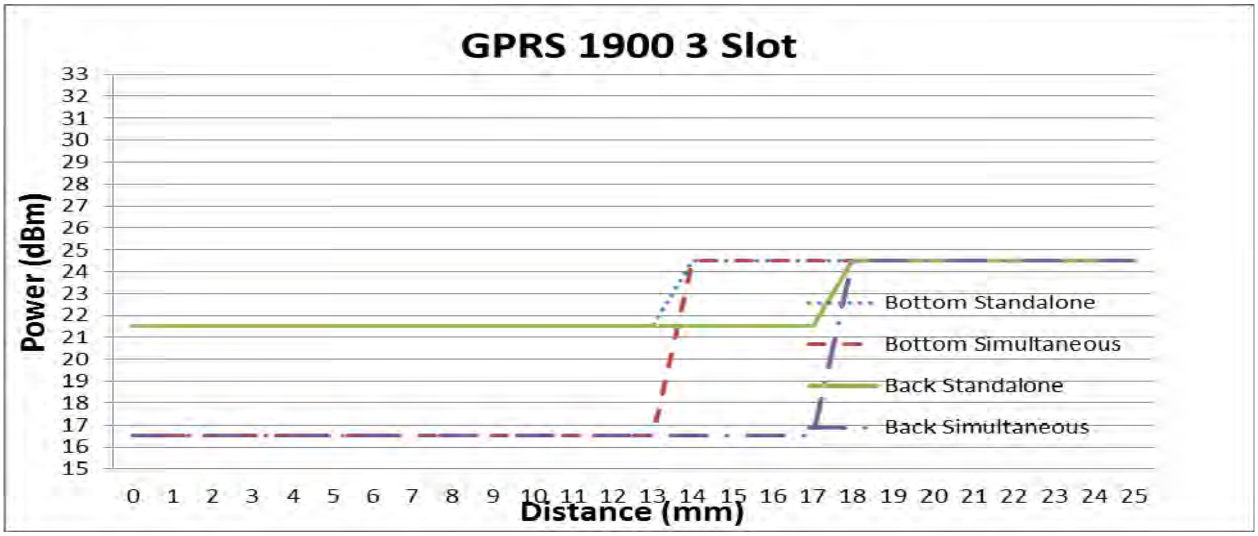


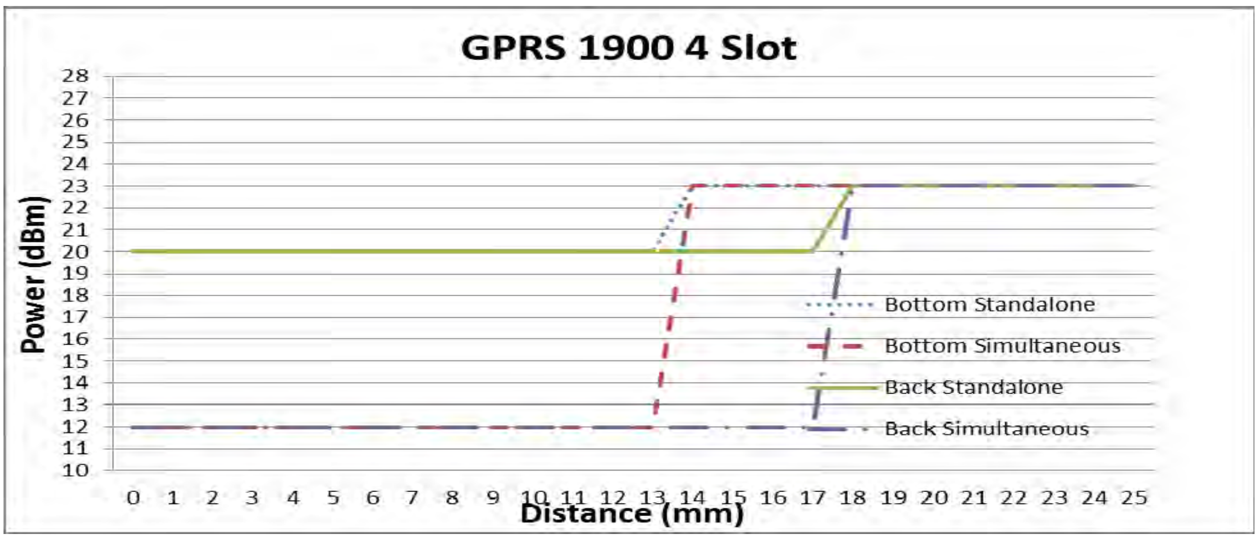



GPRS 850 4 Slot
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

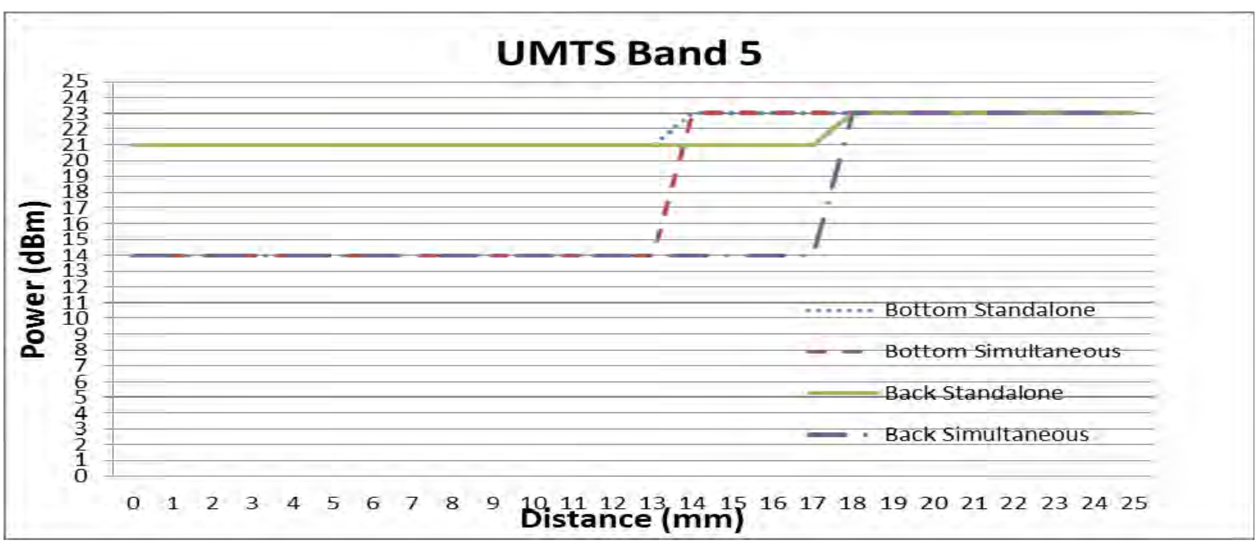

GPRS 1900 1 Slot
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

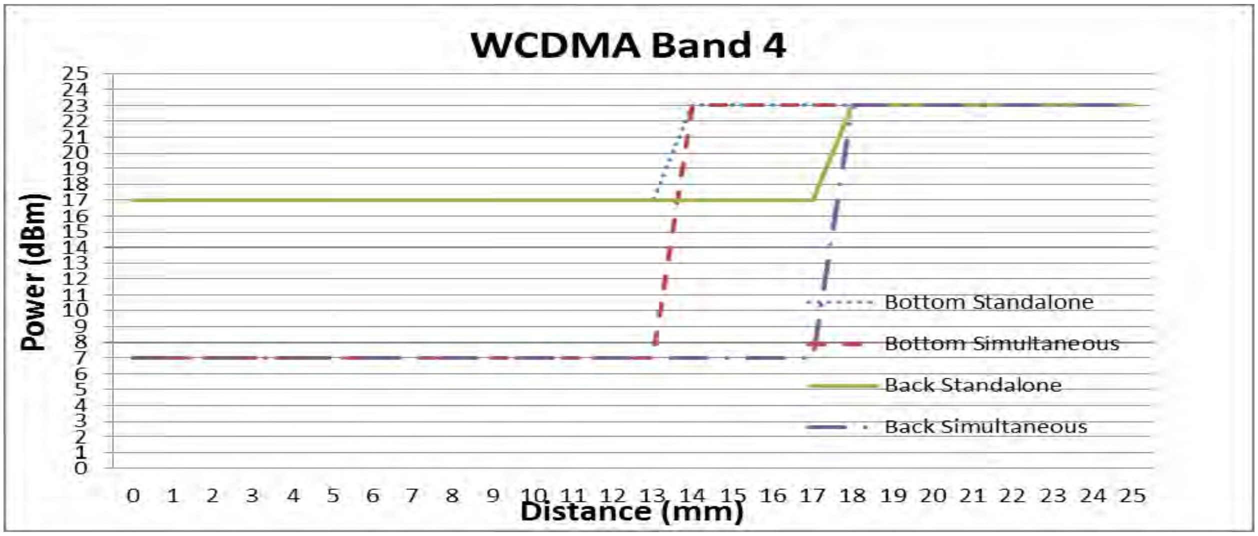

GPRS 1900 2 Slot
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

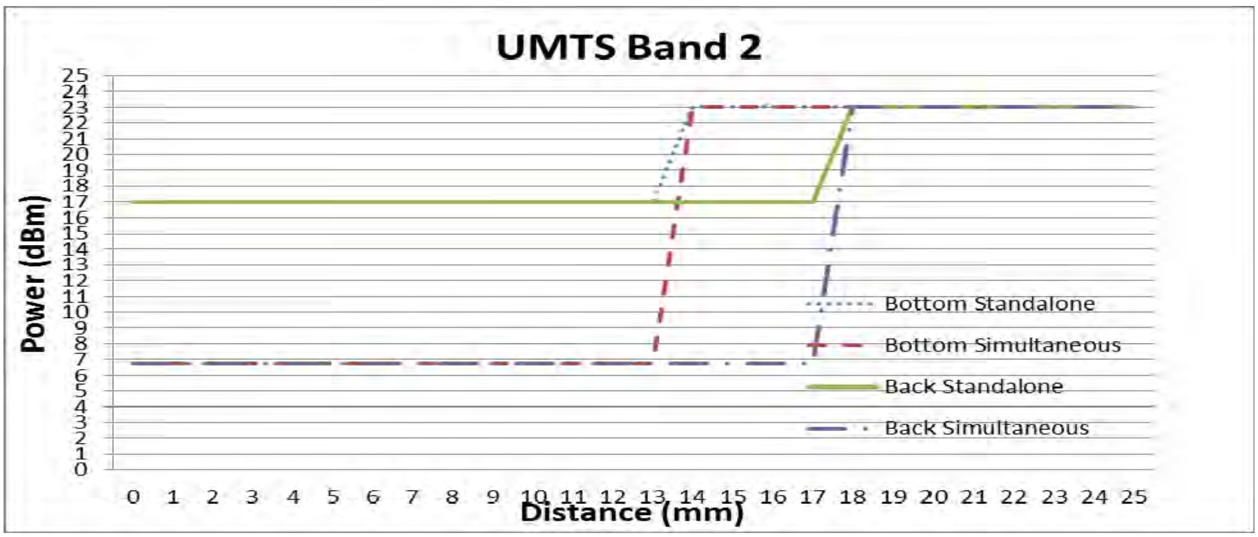

GPRS 1900 3 Slot
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous


GPRS 1900 4 Slot
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

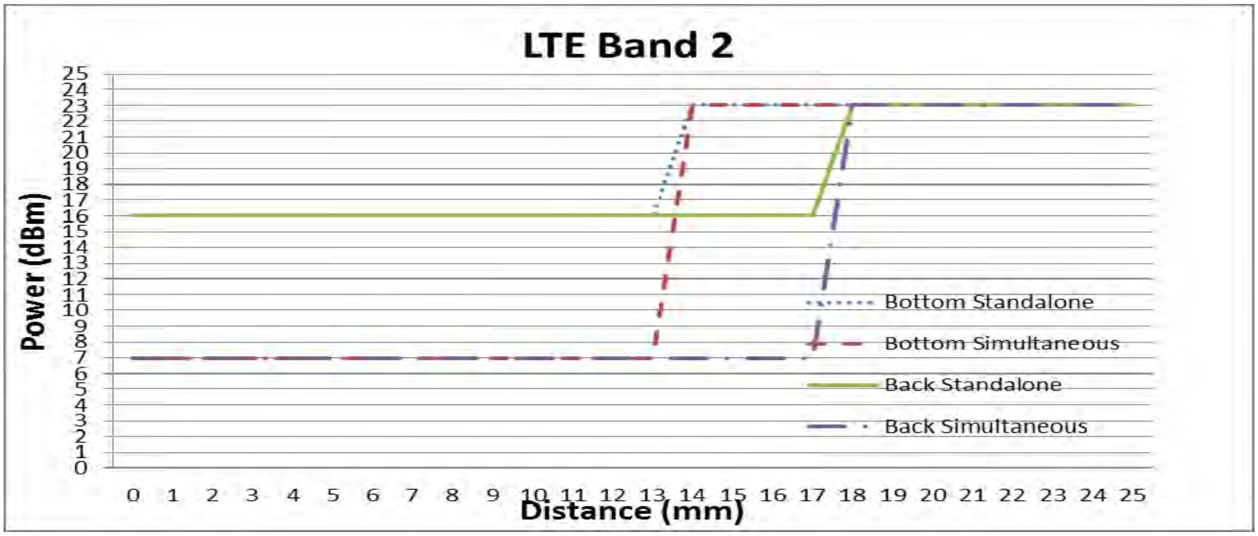
UMTS Bands:

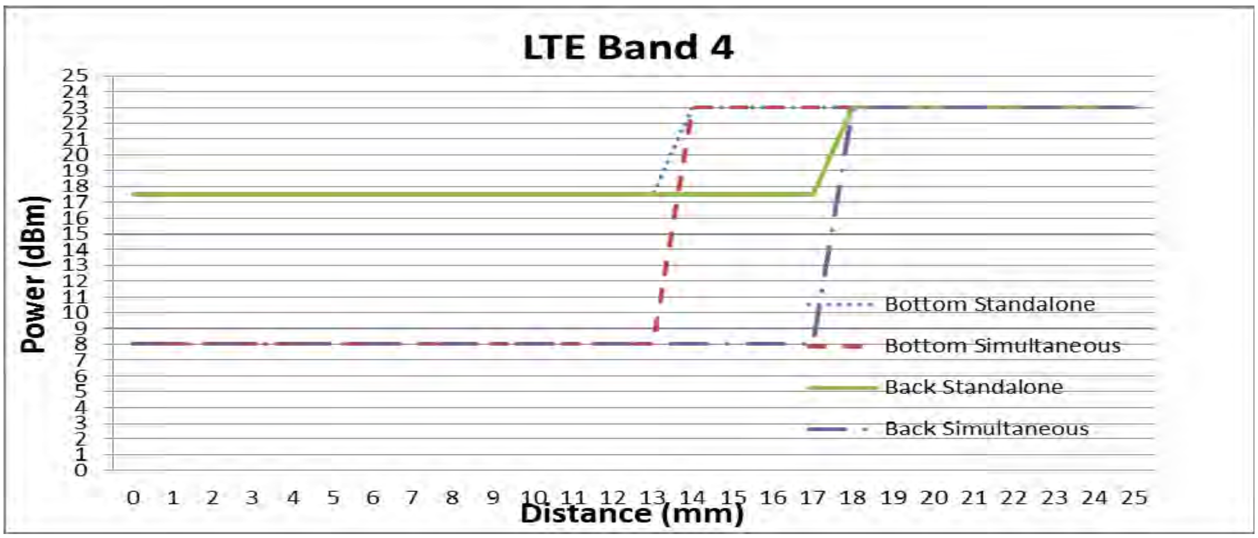

UMTS Band 5
Power (dBm)
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

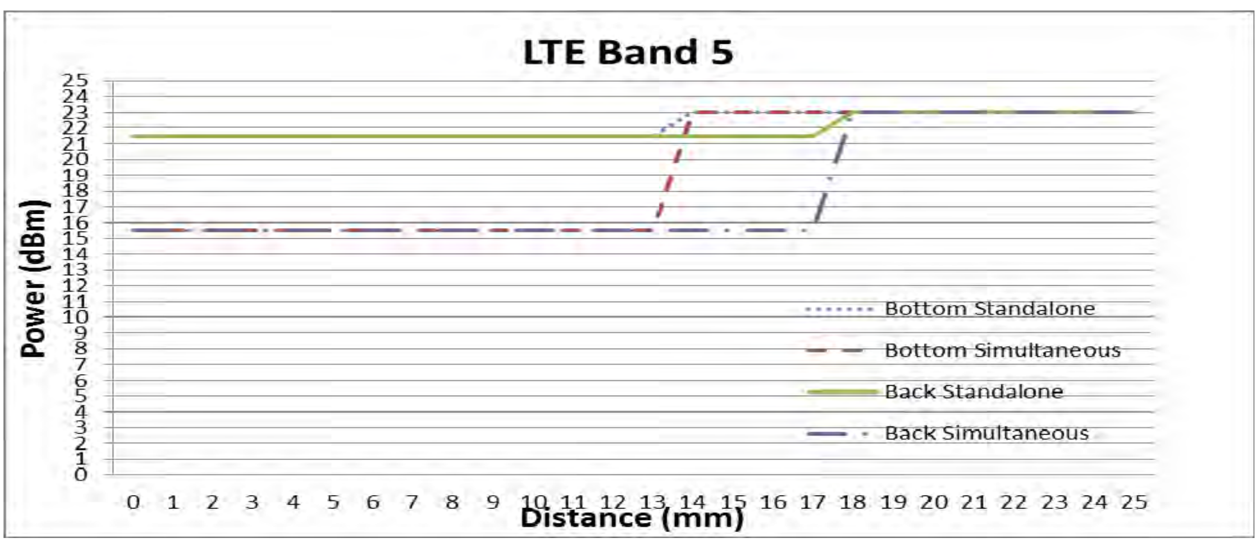

WCDMA Band 4
Power (dBm)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

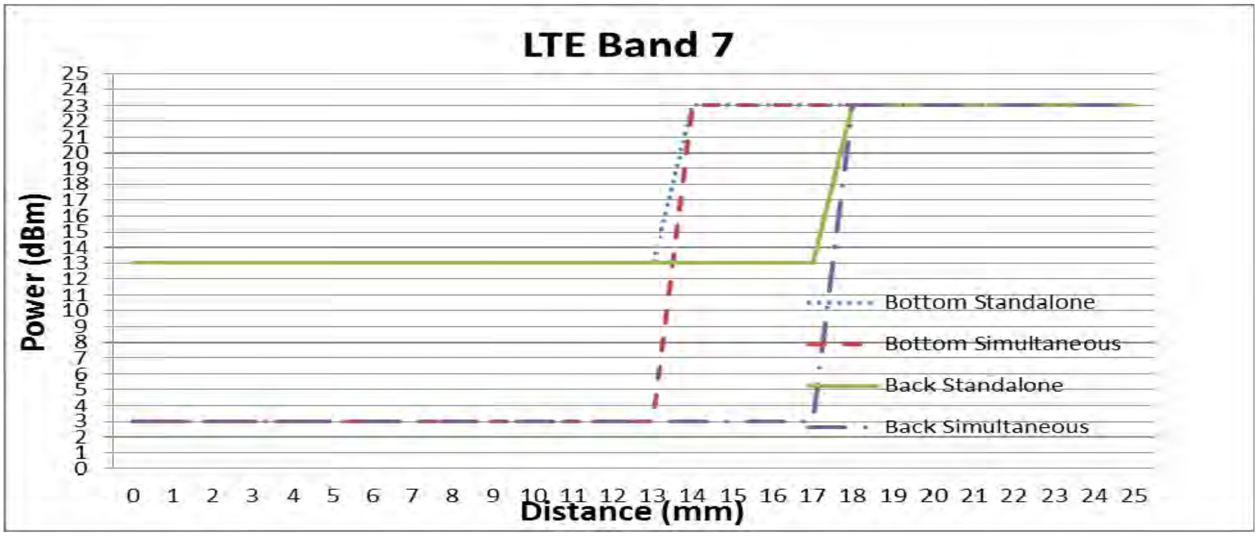

UMTS Band 2
Power (dBm)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous

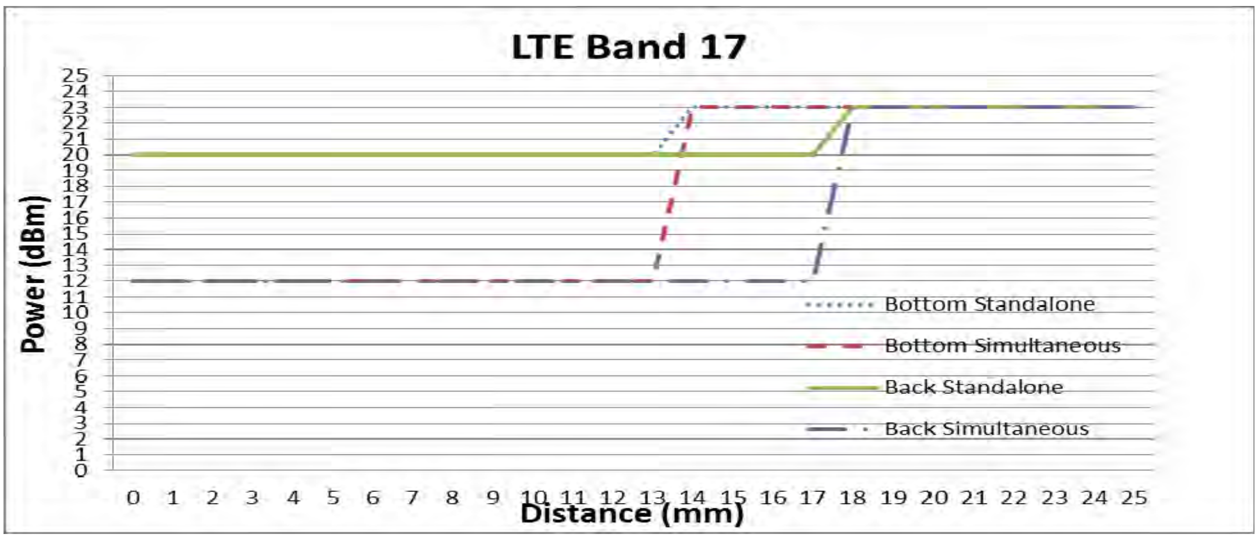
LTE Bands:


LTE Band 2
Power (dBm)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous


LTE Band 4
Power (dBm)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous


LTE Band 5
Power (dBm)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Distance (mm)
Bottom Standalone
Bottom Simultaneous
Back Standalone
Back Simultaneous



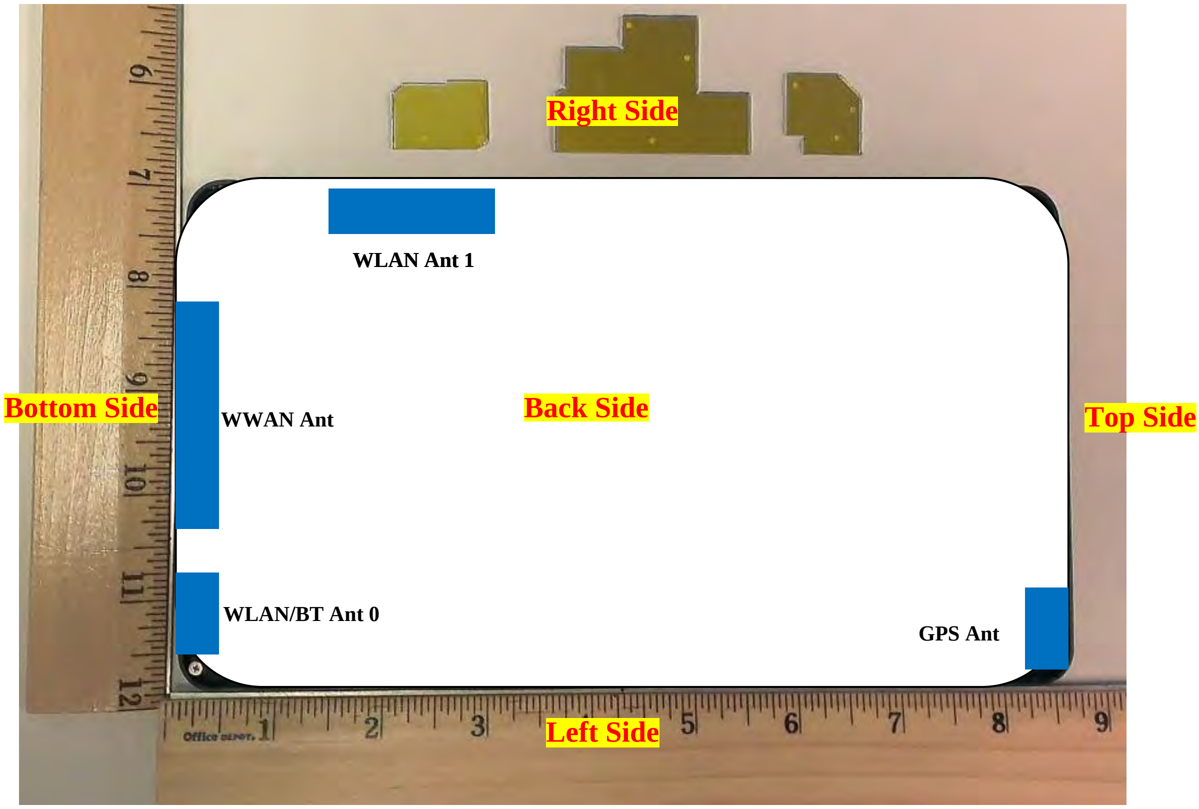


Note 1: Based on the most conservative measured triggering distance of 15 mm for back side and 12 mm for bottom side, so additional SAR measurements were required at 14 mm for back side and 11 mm for bottom side.

Note 2: Bottom standalone: Tablet bottom side faces to the phantom, output power back off stage I.
Back standalone: Tablet back side faces to the phantom, output power back off stage I
Bottom simultaneous: Tablet bottom side faces to the phantom, output power back off stage II
Back simultaneous: Tablet back side faces to the phantom, output power back off stage II

11 EUT Antennas Location & SAR Exclusion Consideration

(Back Side View)



Separation Distances (mm)	Top Side	Bottom Side	Right Side	Left Side	WWAN Ant	WLAN Ant 1	WLAN/BT Ant 0
WWAN Ant	210	0	22	37	-	36.5	17
WLAN Ant 1	158	35	0	120	36.5	-	96.8
WLAN/BT Ant 0	210	0	105	6	17	96.8	-

SAR test exclusion table distance is ≤ 50 mm

Exposure Position	Wireless Interface	GPRS 850 2 Tx slots	GPRS 1900 2 Tx slots	UMTS Band 5	UMTS Band 4	UMTS Band 2	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7	LTE Band 17
	Tune-up Target power (dBm)	23	20	23	23	23	23	23	23	23	23
Back	Antenna to user (mm)	5	5	5	5	5	5	5	5	5	5
	SAR exclusion threshold (dBm)	12.1	10.4	12.1	10.6	10.4	10.4	10.6	12.1	9.7	12.5
	SAR Testing required?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bottom	Antenna to user (mm)	5	5	5	5	5	5	5	5	5	5
	SAR exclusion threshold (dBm)	12.1	10.4	12.1	10.6	10.4	10.4	10.6	12.1	9.7	12.5
	SAR Testing required?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Right	Antenna to user (mm)	22	22	22	22	22	22	22	22	22	22
	SAR exclusion threshold (dBm)	18.6	16.8	18.6	17.0	16.8	16.8	17.0	18.6	16.2	18.9
	SAR Testing required?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Left	Antenna to user (mm)	37	37	37	37	37	37	37	37	37	37
	SAR exclusion threshold (dBm)	20.8	19.1	20.8	19.3	19.1	19.1	19.3	20.8	18.4	21.2
	SAR Testing required?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

SAR test exclusion table distance is > 50 mm

Exposure Position	Wireless Interface	GPRS 850 2 Tx slots	GPRS 1900 2 Tx slots	UMTS Band 5	UMTS Band 4	UMTS Band 2	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7	LTE Band 17
	Tune-up Target power (dBm)	23	20	23	23	23	23	23	23	23	23
Top	Antenna to user (mm)	210	210	210	210	210	210	210	210	210	210
	SAR exclusion threshold (dBm)	30.2	32.3	30.2	32.3	32.3	32.3	32.3	30.2	32.3	28.8
	SAR Testing required?	No	No	No	No	No	No	No	No	No	No

Note:

1. Maximum power is the source-based time-average power and represents the maximum RF output power among production units.
2. 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.
3. 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:
(Max. power of channel, including tune-up tolerance, mW)/(Min. test distance, mm)*[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity ,where
* f(GHz) is the RF channel transmit frequency in GHz
*Power and distance are rounded to the nearest mW and mm before calculation
*The result is rounded to one decimal place for comparison
4. 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:
a). [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz
b). [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 ¼ 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 ¼ 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.

12 SAR Evaluated Results

12.1 Test Environmental Conditions

Temperature:	21-22 °C
Relative Humidity:	43-46 %
ATM Pressure:	101.89 kPa

Testing was performed by Jerry.tong on 2014-06-25 - 2014-07-27 in SAR chamber.

12.2 Standalone Body SAR Data

GPRS 850 Band										
EUT Position	**Frequency (MHz)**	**Uplink Slots**	**Power Drift (dB)**	**Distance (mm)**	**Measured SAR Value (W/kg)**	**Scaling Factor**	**Scaled SAR Value (W/kg)**	**Limit (W/kg) 1g Tissue**	**Plot #**	**Condition (Note*)**
Back Side	824.2	2	0.04	0	1.240	1.00	1.240	1.6		A
	836.6	2	0.05	0	1.280	1.00	**1.280**	1.6	1	A
	848.8	2	0.14	0	1.260	1.00	1.260	1.6		A
	836.6	2	-0.03	0	0.396	1.00	0.396	1.6		B
	824.2	2	-0.05	14	0.471	1.00	0.471	1.6		C
Bottom Side	836.6	2	0.09	0	0.604	1.00	0.604	1.6		A
	836.6	2	-0.14	0	0.225	1.00	0.225	1.6		B
	836.6	2	-0.12	11	0.249	1.00	0.249	1.6		C
Right Side	836.6	2	-0.14	0	0.226	1.00	0.226	1.6		C
Left Side	836.6	2	-0.11	0	0.103	1.00	0.103	1.6		C

GPRS 1900 Band										
EUT Position	**Frequency (MHz)**	**Uplink Slots**	**Power Drift (dB)**	**Distance (mm)**	**Measured SAR Value (W/kg)**	**Scaling Factor**	**Scaled SAR Value (W/kg)**	**Limit (W/kg) 1g Tissue**	**Plot #**	**Condition (Note*)**
Back Side	1850.2	2	0.03	0	0.974	1.057	1.030	1.6		A
	1880	2	-0.15	0	1.090	1.045	1.139	1.6		A
	1909.8	2	-0.26	0	1.100	1.086	**1.195**	1.6	2	A
	1880	2	-0.17	0	0.359	1.045	0.375	1.6		B
	1880	2	-0.25	14	0.384	1.045	0.401	1.6		C
Bottom Side	1850.2	2	-0.05	0	0.792	1.057	0.837	1.6		A
	1880	2	0.24	0	0.957	1.045	1.000	1.6		A
	1909.8	2	-0.13	0	0.976	1.086	1.060	1.6		A
	1880	2	-0.27	0	0.306	1.045	0.320	1.6		B
	1880	2	-0.15	11	0.299	1.045	0.312	1.6		C
Right Side	1880	2	-0.31	0	0.039	1.045	0.041	1.6		C
Left Side	1880	2	-0.17	0	0.039	1.045	0.041	1.6		C

UMTS Band 5										
EUT Position	Frequency (MHz)	Service	Power Drift (dB)	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	826.4	RMC	-0.27	0	0.836	1.000	0.836	1.6		A
	836.6	RMC	-0.21	0	1.070	1.000	**1.070**	1.6	3	A
	846.6	RMC	-0.05	0	1.030	1.000	1.030	1.6		A
	836.6	RMC	-0.29	0	0.222	1.000	0.222	1.6		B
	836.6	RMC	-0.24	14	0.398	1.000	0.398	1.6		C
Bottom Side	836.6	RMC	-0.17	0	0.699	1.000	0.699	1.6		A
	836.6	RMC	-0.16	0	0.151	1.000	0.151	1.6		B
	836.6	RMC	-0.28	11	0.162	1.000	0.162	1.6		C
Right Side	836.6	RMC	-0.19	0	0.225	1.000	0.225	1.6		C
Left Side	836.6	RMC	-0.24	0	0.113	1.000	0.113	1.6		C

UMTS Band 4										
EUT Position	Frequency (MHz)	Service	Power Drift (dB)	Distance (mm)	Measured SAR Value (W/kg)	Scaling Factor	Scaled SAR Value (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	1712.4	RMC	0.18	0	1.060	1.033	**1.095**	1.6	4	A
	1732.6	RMC	-0.01	0	1.070	1.000	1.070	1.6		A
	1752.6	RMC	-0.16	0	1.010	1.054	1.065	1.6		A
	1732.6	RMC	-0.24	0	0.123	1.000	0.123	1.6		B
	1732.6	RMC	-0.31	14	0.437	1.000	0.437	1.6		C
Bottom Side	1732.6	RMC	-0.01	0	0.769	1.000	0.769	1.6		A
	1732.6	RMC	0.02	0	0.074	1.000	0.074	1.6		B
	1732.6	RMC	0.04	11	0.399	1.000	0.399	1.6		C
Right Side	1732.6	RMC	0.12	0	0.206	1.000	0.206	1.6		C
Left Side	1732.6	RMC	0.04	0	0.149	1.000	0.149	1.6		C

UMTS Band 2										
EUT Position	**Frequency (MHz)**	**Service**	**Power Drift (dB)**	**Distance (mm)**	**Measured SAR Value (W/kg)**	**Scaling Factor**	**Scaled SAR Value (W/kg)**	**Limit (W/kg) 1g Tissue**	**Plot #**	**Condition (Note*)**
Back Side	1852.4	RMC	-0.03	0	1.420	1.033	**1.467**	1.6	5	A
	1880	RMC	-0.05	0	1.430	1.021	1.460	1.6		A
	1907.6	RMC	0.16	0	1.340	1.026	1.375	1.6		A
	1880	RMC	0.21	0	0.122	1.021	0.125	1.6		B
	1880	RMC	0.16	14	0.490	1.021	0.500	1.6		C
Bottom Side	1852.4	RMC	0.01	0	1.080	1.033	1.116	1.6		A
	1880	RMC	-0.21	0	1.220	1.021	1.246	1.6		A
	1907.6	RMC	-0.02	0	1.260	1.026	1.293	1.6		A
	1880	RMC	-0.16	0	0.136	1.021	0.139	1.6		B
	1880	RMC	0.17	11	0.222	1.021	0.227	1.6		C
Right Side	1880	RMC	-0.16	0	0.084	1.021	0.086	1.6		C
Left Side	1880	RMC	-0.01	0	0.101	1.021	0.103	1.6		C

LTE Band 2											
EUT Position	**Frequency (MHz)**	**RB Size**	**RB Offset**	**Power Drift (dB)**	**Distance (mm)**	**Measured SAR (W/kg)**	**Scaling Factor**	**Scaled SAR (W/kg)**	**Limit (W/kg) 1g Tissue**	**Plot #**	**Condition (Note*)**
Back Side	1860	1	0	0.06	0	1.290	1.000	1.290	1.6		A
		50	25	-0.04	0	0.990	1.028	1.018	1.6		A
	1880	1	99	-0.06	0	1.270	1.000	1.270	1.6		A
		50	25	-0.14	0	0.838	1.000	0.838	1.6		A
		100	0	-0.15	0	0.875	1.052	0.920	1.6		A
	1900	1	0	-0.27	0	1.310	1.000	**1.310**	1.6	6	A
		50	25	-0.26	0	0.936	1.033	0.967	1.6		A
	1880	1	99	0.01	0	0.159	1.000	0.159	1.6		B
		50	25	-0.21	0	0.102	1.000	0.102	1.6		B
	1880	1	99	-0.14	14	0.772	1.000	0.772	1.6		C
		50	25	-0.26	14	0.782	1.000	0.782	1.6		C
Bottom Side	1860	1	0	-0.31	0	0.987	1.000	0.987	1.6		A
		50	25	-0.15	0	0.711	1.000	0.711	1.6		A
	1880	1	99	-0.17	0	1.120	1.000	1.120	1.6		A
		50	25	-0.12	0	0.865	1.000	0.865	1.6		A
		100	0	-0.01	0	0.868	1.052	0.913	1.6		A
	1900	1	0	-0.02	0	1.080	1.000	1.080	1.6		A
		50	25	-0.06	0	0.832	1.033	0.859	1.6		A
	1880	1	99	0.11	0	0.185	1.000	0.185	1.6		B
		50	25	0.13	0	0.057	1.000	0.057	1.6		B
		1	99	-0.16	11	0.708	1.000	0.708	1.6		C
		50	25	-0.19	11	0.659	1.000	0.659	1.6		C
Right Side	1880	1	99	0.18	0	0.090	1.000	0.090	1.6		C
		50	25	0.24	0	0.067	1.000	0.067	1.6		C
Left Side	1880	1	99	0.16	0	0.101	1.000	0.101	1.6		C
		50	25	0.00	0	0.081	1.000	0.081	1.6		C

LTE Band 4											
EUT Position	Frequency (MHz)	RB Size	RB Offset	Power Drift (dB)	Distance (mm)	Measured SAR (W/kg)	Scaling Factor	Scaled SAR (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	1720	1	0	0.03	0	1.300	1.000	**1.300**	1.6	7	A
		50	25	-0.60	0	0.938	1.164	1.092	1.6		A
	1732.5	1	99	0.12	0	1.200	1.000	1.200	1.6		A
		50	25	0.16	0	0.901	1.000	0.901	1.6		A
		100	0	-0.01	0	0.912	1.012	0.923	1.6		A
	1745	1	0	0.15	0	1.150	1.000	1.150	1.6		A
		50	25	-0.19	0	0.847	1.076	0.911	1.6		A
	1732.5	1	99	0.05	0	0.133	1.000	0.133	1.6		B
		50	25	-0.25	0	0.095	1.000	0.095	1.6		B
		1	99	-0.16	14	0.451	1.000	0.451	1.6		C
		50	25	-0.13	14	0.411	1.000	0.411	1.6		C
Bottom Side	1732.5	1	99	0.07	0	0.736	1.000	0.736	1.6		A
		50	25	0.24	0	0.559	1.000	0.559	1.6		A
	1732.5	1	99	-0.01	0	0.081	1.000	0.081	1.6		B
		50	25	-0.18	0	0.061	1.000	0.061	1.6		B
		1	99	-0.16	11	0.467	1.000	0.467	1.6		C
		50	25	0.18	11	0.309	1.000	0.309	1.6		C
Right Side	1732.5	1	99	0.12	0	0.207	1.000	0.207	1.6		C
		50	25	0.03	0	0.134	1.000	0.134	1.6		C
Left Side	1732.5	1	99	0.05	0	0.150	1.000	0.150	1.6		C
		50	25	-0.14	0	0.023	1.000	0.023	1.6		C

LTE Band 5											
EUT Position	Frequency (MHz)	RB Size	RB Offset	Power Drift (dB)	Distance (mm)	Measured SAR (W/kg)	Scaling Factor	Scaled SAR (W/kg)	Limit (W/kg) 1g Tissue	Plot #	Condition (Note*)
Back Side	829	1	0	-0.20	0	1.090	1.000	1.090	1.6		A
		25	12	-0.20	0	0.860	1.026	0.882	1.6		A
	836.5	1	0	-0.10	0	1.180	1.000	**1.180**	1.6	8	A
		25	12	-0.10	0	0.926	1.000	0.926	1.6		A
		50	0	0.15	0	0.943	1.052	0.992	1.6		A
	844	1	0	-0.27	0	1.100	1.000	1.100	1.6		A
		25	12	-0.18	0	0.909	1.000	0.909	1.6		A
	836.5	1	0	0.17	0	0.237	1.000	0.237	1.6		B
		25	12	0.12	0	0.259	1.000	0.259	1.6		B
		1	0	-0.13	14	0.357	1.000	0.357	1.6		C
		25	12	0.01	14	0.369	1.000	0.369	1.6		C
Bottom Side	836.5	1	0	-0.16	0	0.770	1.000	0.770	1.6		A
		25	12	-0.04	0	0.690	1.000	0.690	1.6		A
	836.5	1	0	0.04	0	0.186	1.000	0.186	1.6		B
		25	12	0.02	0	0.157	1.000	0.157	1.6		B
		1	0	0.21	11	0.268	1.000	0.268	1.6		C
		25	12	0.11	11	0.142	1.000	0.142	1.6		C
Right Side	836.5	1	0	-0.11	0	0.208	1.000	0.208	1.6		C
		25	12	-0.03	0	0.200	1.000	0.200	1.6		C
Left Side	836.5	1	0	0.02	0	0.115	1.000	0.115	1.6		C
		25	12	0.11	0	0.104	1.000	0.104	1.6		C

LTE Band 7											
EUT Position	**Frequency (MHz)**	**RB Size**	**RB Offset**	**Power Drift (dB)**	**Distance (mm)**	**Measured SAR (W/kg)**	**Scaling Factor**	**Scaled SAR (W/kg)**	**Limit (W/kg) 1g Tissue**	**Plot #**	**Condition (Note*)**
Back Side	2510	1	99	-0.01	0	1.290	1.000	**1.290**	1.6	9	A
		50	25	-0.12	0	1.100	1.052	1.157	1.6		A
	2535	1	99	0.10	0	1.180	1.000	1.180	1.6		A
		50	25	-0.06	0	0.917	1.005	0.922	1.6		A
		100	0	0.15	0	0.927	1.033	0.958	1.6		A
	2560	1	99	0.03	0	1.440	1.000	1.440	1.6		A
		50	25	0.00	0	1.020	1.033	1.045	1.6		A
	2535	1	99	0.16	0	0.125	1.000	0.125	1.6		B
		50	25	0.24	0	0.090	1.005	0.090	1.6		B
		1	99	0.15	14	0.476	1.000	0.476	1.6		C
		50	25	0.12	14	0.355	1.005	0.357	1.6		C
Bottom Side	2535	1	99	0.03	0	0.604	1.000	0.604	1.6		A
		50	25	0.04	0	0.459	1.005	0.461	1.6		A
	2535	1	99	0.02	0	0.045	1.000	0.045	1.6		B
		50	25	-0.25	0	0.032	1.005	0.032	1.6		B
	2535	1	99	-0.16	11	0.660	1.000	0.660	1.6		C
		50	25	-0.19	11	0.496	1.005	0.498	1.6		C
Right Side	2535	1	99	-0.24	0	0.372	1.000	0.372	1.6		C
		50	25	-0.17	0	0.236	1.005	0.237	1.6		C
Left Side	2535	1	99	-0.13	0	0.178	1.000	0.178	1.6		C
		50	25	-0.11	0	0.188	1.005	0.189	1.6		C

LTE Band 17											
EUT Position	**Frequency (MHz)**	**RB Size**	**RB Offset**	**Power Drift (dB)**	**Distance (mm)**	**Measured SAR (W/kg)**	**Scaling Factor**	**Scaled SAR (W/kg)**	**Limit (W/kg) 1g Tissue**	**Plot #**	**Condition (Note*)**
Back Side	709	1	49	0.10	0	1.080	1.000	1.080	1.6		A
		25	12	-0.17	0	0.858	1.086	0.932	1.6		A
	710	1	49	-0.05	0	1.210	1.000	**1.210**	1.6	10	A
		25	12	-0.18	0	0.953	1.052	1.003	1.6		A
		50	0	0.12	0	0.932	1.151	1.073	1.6		A
	711	1	49	-0.06	0	0.961	1.000	0.961	1.6		A
		25	12	0.07	0	0.808	1.000	0.808	1.6		A
	710	1	49	0.24	0	0.263	1.000	0.263	1.6		B
		25	12	0.16	0	0.169	1.052	0.178	1.6		B
		1	49	0.13	14	0.416	1.000	0.416	1.6		C
		25	12	0.21	14	0.208	1.052	0.219	1.6		C
Bottom Side	710	1	49	0.15	0	0.394	1.000	0.394	1.6		A
		25	12	-0.15	0	0.312	1.052	0.328	1.6		A
	710	1	49	-.028	0	0.081	1.000	0.081	1.6		B
		25	12	-0.05	0	0.057	1.052	0.060	1.6		B
		1	49	0.24	11	0.177	1.000	0.177	1.6		C
		25	12	0.16	11	0.133	1.052	0.140	1.6		C
Right Side	710	1	49	0.25	0	0.200	1.000	0.200	1.6		C
		25	12	-0.15	0	0.103	1.052	0.108	1.6		C
Left Side	710	1	49	0.02	0	0.189	1.000	0.189	1.6		C
		25	12	0.21	0	0.149	1.052	0.157	1.6		C

WLAN Radio										
EUT Position	**Radio**	**Frequency (MHz)**	**Power Drift (dB)**	**Distance (mm)**	**Measured SAR Value (W/kg)**	**Scaling Factor**	**Scaled SAR Value (W/kg)**	**Limit (W/kg) 1g Tissue**	**Plot #**	**Condition (Note*)**
Back Side	802.11b	2437	-0.15	0	0.738	1.076	0.794	1.6		D
	802.11a	5180	0.05	0	0.846	1.122	0.949	1.6		D
		5200	0.01	0	0.882	1.069	0.942	1.6		D
		5240	-0.16	0	0.943	1.306	1.231	1.6		D
		5745	0.11	0	0.847	1.306	1.106	1.6		D
		5785	0.08	0	1.130	1.148	1.297	1.6		D
		5825	-0.04	0	1.400	1.062	**1.489**	1.6	11	D
Right Side	802.11b	2437	0.01	0	0.547	1.076	0.589	1.6		D
	802.11a	5200	-0.19	0	0.352	1.069	0.376	1.6		D
		5785	-0.04	0	0.616	1.148	0.707	1.6		D

Note:

Condition A: Proximity sensor activated, WWAN output power back off stage I (WLAN does not work)
Condition B: Proximity sensor activated, WWAN output power back off stage II (Simultaneous TX with WLAN)
Condition C: Proximity sensor deactivated, WWAN radio works at full output power
Condition D: WLAN antenna port 1with reduced power

12.3 Simultaneous Transmission Analysis

The following procedures adopted from FCC KDB 447498 D01v05r02 are applicable to handsets with built-in unlicensed transmitters such as 802.11 a/b/g/n and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

Estimated SAR

Mode	Position	Frequency (MHz)	Maximum allowed Power (dBm)	Separation distance from body (mm)	Estimated SAR (W/kg)
Ant 0, Bluetooth	Back side	2441	10	5	0.400
	Back side	2441	10	14	0.149
	Bottom side	2441	10	5	0.400
	Bottom side	2441	10	11	0.189
	Top side	-	-	210	0.400
	Left side	2441	10	6	0.374
	Right side	-	-	105	0.400
Ant 0, 2.4 GHz WLAN	Bottom side	2437	12	11	0.300
	Back side	2437	12	14	0.236
	Top side	-	-	210	0.400
	Right side	-	-	105	0.400
Ant 1, 2.4 GHz WLAN	Back side	2437	12	14	0.236
	Bottom side	2437	12	35	0.119
	Bottom side	2437	12	46	0.072
	Top side	-	-	158	0.400
	Left side	-	-	120	0.400
Ant 0, 5 GHz WLAN	Bottom side	5825	11	11	0.368
	Back side	5825	11	14	0.289
	Top side	-	-	210	0.400
	Right side	-	-	105	0.400
Ant 1, 5 GHz WLAN	Back side	5825	10	14	0.230
	Bottom side	5825	10	35	0.092
	Bottom side	5825	10	46	0.070
	Left side	-	-	120	0.400
WWAN	Top side	-	-	158	0.400

Note:

1. 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:
(Max. power of channel, including tune-up tolerance, mW)/(Min. test distance, mm)*[$\sqrt{f(GHz)/x}$] W/kg where x=7.5 for 1-g,x=18.75 for 10-g SAR
2. 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm
3. The WWAN radio can simultaneously transmit with WLAN radio. GPRS, UMTS, LTE share the same antenna path and cannot transmit simultaneously.

Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body at 0 mm) Antenna 0

Position	SAR (W/kg)												Ri (mm)	SPLS Ratio
	GPRS 850	GPRS 1900	UMTS Band 5	UMTS Band 4	UMTS Band 2	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7	LTE Band 17	2.4GHz WLAN	Sum of SAR		
Back Touch (0mm)	0.396	-	-	-	-	-	-	-	-	-	0.212	**0.608**	-	-
	-	0.375	-	-	-	-	-	-	-	-	0.212	0.587	-	-
	-	-	0.222	-	-	-	-	-	-	-	0.212	0.434	-	-
	-	-	-	0.123	-	-	-	-	-	-	0.212	0.335	-	-
	-	-	-	-	0.125	-	-	-	-	-	0.212	0.337	-	-
	-	-	-	-	-	0.159	-	-	-	-	0.212	0.371	-	-
	-	-	-	-	-	-	0.133	-	-	-	0.212	0.345	-	-
	-	-	-	-	-	-	-	0.259	-	-	0.212	0.471	-	-
	-	-	-	-	-	-	-	-	0.125	-	0.212	0.337	-	-
	-	-	-	-	-	-	-	-	-	0.263	0.212	0.475	-	-
Bottom Touch (0mm)	0.225	-	-	-	-	-	-	-	-	-	0.060	0.285	-	-
	-	0.320	-	-	-	-	-	-	-	-	0.060	0.380	-	-
	-	-	0.151	-	-	-	-	-	-	-	0.060	0.211	-	-
	-	-	-	0.074	-	-	-	-	-	-	0.060	0.134	-	-
	-	-	-	-	0.139	-	-	-	-	-	0.060	0.199	-	-
	-	-	-	-	-	0.185	-	-	-	-	0.060	0.245	-	-
	-	-	-	-	-	-	0.081	-	-	-	0.060	0.141	-	-
	-	-	-	-	-	-	-	0.186	-	-	0.060	0.246	-	-
	-	-	-	-	-	-	-	-	0.045	-	0.060	0.105	-	-
	-	-	-	-	-	-	-	-	-	0.081	0.060	0.141	-	-
Left Touch (0mm)	0.103	-	-	-	-	-	-	-	-	-	0.142	0.245	-	-
	-	0.041	-	-	-	-	-	-	-	-	0.142	0.183	-	-
	-	-	0.113	-	-	-	-	-	-	-	0.142	0.255	-	-
	-	-	-	0.149	-	-	-	-	-	-	0.142	0.291	-	-
	-	-	-	-	0.103	-	-	-	-	-	0.142	0.245	-	-
	-	-	-	-	-	0.101	-	-	-	-	0.142	0.243	-	-
	-	-	-	-	-	-	0.023	-	-	-	0.142	0.165	-	-
	-	-	-	-	-	-	-	0.115	-	-	0.142	0.257	-	-
	-	-	-	-	-	-	-	-	0.189	-	0.142	0.331	-	-
	-	-	-	-	-	-	-	-	-	0.189	0.142	0.331	-	-
Right Touch (0mm)	0.226	-	-	-	-	-	-	-	-	-	0.400	0.626	-	-
	-	0.041	-	-	-	-	-	-	-	-	0.400	0.441	-	-
	-	-	0.225	-	-	-	-	-	-	-	0.400	0.625	-	-
	-	-	-	0.206	-	-	-	-	-	-	0.400	0.606	-	-
	-	-	-	-	0.086	-	-	-	-	-	0.400	0.486	-	-
	-	-	-	-	-	0.081	-	-	-	-	0.400	0.481	-	-
	-	-	-	-	-	-	0.150	-	-	-	0.400	0.55	-	-
	-	-	-	-	-	-	-	0.208	-	-	0.400	0.608	-	-
	-	-	-	-	-	-	-	-	0.178	-	0.400	0.578	-	-
	-	-	-	-	-	-	-	-	-	0.200	0.400	0.600	-	-

Simultaneous Transmission Scenario with 2.4GHz WLAN (Body at 0 mm) Antenna 1

Position	SAR (W/kg)												Ri (mm)	SPLS Ratio
	GPRS 850	GPRS 1900	UMTS Band 5	UMTS Band 4	UMTS Band 2	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7	LTE Band 17	2.4GHz WLAN	Sum of SAR		
Back Touch (0mm)	0.396	-	-	-	-	-	-	-	-	-	0.794	**1.190**	-	-
	-	0.375	-	-	-	-	-	-	-	-	0.794	1.169	-	-
	-	-	0.222	-	-	-	-	-	-	-	0.794	1.016	-	-
	-	-	-	0.123	-	-	-	-	-	-	0.794	0.917	-	-
	-	-	-	-	0.125	-	-	-	-	-	0.794	0.919	-	-
	-	-	-	-	-	0.159	-	-	-	-	0.794	0.953	-	-
	-	-	-	-	-	-	0.133	-	-	-	0.794	0.927	-	-
	-	-	-	-	-	-	-	0.259	-	-	0.794	1.053	-	-
	-	-	-	-	-	-	-	-	0.125	-	0.794	0.919	-	-
	-	-	-	-	-	-	-	-	-	0.263	0.794	1.057	-	-
Bottom Touch (0mm)	0.225	-	-	-	-	-	-	-	-	-	0.094	0.319	-	-
	-	0.320	-	-	-	-	-	-	-	-	0.094	0.414	-	-
	-	-	0.151	-	-	-	-	-	-	-	0.094	0.245	-	-
	-	-	-	0.074	-	-	-	-	-	-	0.094	0.168	-	-
	-	-	-	-	0.139	-	-	-	-	-	0.094	0.233	-	-
	-	-	-	-	-	0.185	-	-	-	-	0.094	0.279	-	-
	-	-	-	-	-	-	0.081	-	-	-	0.094	0.175	-	-
	-	-	-	-	-	-	-	0.186	-	-	0.094	0.280	-	-
	-	-	-	-	-	-	-	-	0.045	-	0.094	0.139	-	-
	-	-	-	-	-	-	-	-	-	0.081	0.094	0.175	-	-
Left Touch (0mm)	0.103	-	-	-	-	-	-	-	-	-	0.400	0.503	-	-
	-	0.041	-	-	-	-	-	-	-	-	0.400	0.441	-	-
	-	-	0.113	-	-	-	-	-	-	-	0.400	0.513	-	-
	-	-	-	0.149	-	-	-	-	-	-	0.400	0.549	-	-
	-	-	-	-	0.103	-	-	-	-	-	0.400	0.503	-	-
	-	-	-	-	-	0.101	-	-	-	-	0.400	0.501	-	-
	-	-	-	-	-	-	0.023	-	-	-	0.400	0.423	-	-
	-	-	-	-	-	-	-	0.115	-	-	0.400	0.515	-	-
	-	-	-	-	-	-	-	-	0.189	-	0.400	0.589	-	-
	-	-	-	-	-	-	-	-	-	0.189	0.400	0.589	-	-
Right Touch (0mm)	0.226	-	-	-	-	-	-	-	-	-	0.589	0.815	-	-
	-	0.041	-	-	-	-	-	-	-	-	0.589	0.630	-	-
	-	-	0.225	-	-	-	-	-	-	-	0.589	0.814	-	-
	-	-	-	0.206	-	-	-	-	-	-	0.589	0.795	-	-
	-	-	-	-	0.086	-	-	-	-	-	0.589	0.675	-	-
	-	-	-	-	-	0.081	-	-	-	-	0.589	0.67	-	-
	-	-	-	-	-	-	0.150	-	-	-	0.589	0.739	-	-
	-	-	-	-	-	-	-	0.208	-	-	0.589	0.797	-	-
	-	-	-	-	-	-	-	-	0.178	-	0.589	0.767	-	-
	-	-	-	-	-	-	-	-	-	0.200	0.589	0.789	-	-

Simultaneous Transmission Scenario with 5 GHz WLAN (Body at 0 mm) Antenna 0

Position	SAR (W/kg)												Ri (mm)	SPLS Ratio
	GPRS 850	GPRS 1900	UMTS Band 5	UMTS Band 4	UMTS Band 2	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7	LTE Band 17	5 GHz WLAN	Sum of SAR		
Back Touch (0mm)	0.396	-	-	-	-	-	-	-	-	-	0.502	**0.898**	-	-
	-	0.375	-	-	-	-	-	-	-	-	0.502	0.877	-	-
	-	-	0.222	-	-	-	-	-	-	-	0.502	0.724	-	-
	-	-	-	0.123	-	-	-	-	-	-	0.502	0.625	-	-
	-	-	-	-	0.125	-	-	-	-	-	0.502	0.627	-	-
	-	-	-	-	-	0.159	-	-	-	-	0.502	0.661	-	-
	-	-	-	-	-	-	0.133	-	-	-	0.502	0.635	-	-
	-	-	-	-	-	-	-	0.259	-	-	0.502	0.761	-	-
	-	-	-	-	-	-	-	-	0.125	-	0.502	0.627	-	-
	-	-	-	-	-	-	-	-	-	0.263	0.502	0.765	-	-
Bottom Touch (0mm)	0.225	-	-	-	-	-	-	-	-	-	0.631	0.856	-	-
	-	0.320	-	-	-	-	-	-	-	-	0.631	0.951	-	-
	-	-	0.151	-	-	-	-	-	-	-	0.631	0.782	-	-
	-	-	-	0.074	-	-	-	-	-	-	0.631	0.705	-	-
	-	-	-	-	0.139	-	-	-	-	-	0.631	0.770	-	-
	-	-	-	-	-	0.185	-	-	-	-	0.631	0.816	-	-
	-	-	-	-	-	-	0.081	-	-	-	0.631	0.712	-	-
	-	-	-	-	-	-	-	0.186	-	-	0.631	0.817	-	-
	-	-	-	-	-	-	-	-	0.045	-	0.631	0.676	-	-
	-	-	-	-	-	-	-	-	-	0.081	0.631	0.712	-	-
Left Touch (0mm)	0.103	-	-	-	-	-	-	-	-	-	0.074	0.177	-	-
	-	0.041	-	-	-	-	-	-	-	-	0.074	0.115	-	-
	-	-	0.113	-	-	-	-	-	-	-	0.074	0.187	-	-
	-	-	-	0.149	-	-	-	-	-	-	0.074	0.223	-	-
	-	-	-	-	0.103	-	-	-	-	-	0.074	0.177	-	-
	-	-	-	-	-	0.101	-	-	-	-	0.074	0.175	-	-
	-	-	-	-	-	-	0.023	-	-	-	0.074	0.097	-	-
	-	-	-	-	-	-	-	0.115	-	-	0.074	0.189	-	-
	-	-	-	-	-	-	-	-	0.189	-	0.074	0.263	-	-
	-	-	-	-	-	-	-	-	-	0.189	0.074	0.263	-	-
Right Touch (0mm)	0.226	-	-	-	-	-	-	-	-	-	0.400	0.626	-	-
	-	0.041	-	-	-	-	-	-	-	-	0.400	0.441	-	-
	-	-	0.225	-	-	-	-	-	-	-	0.400	0.625	-	-
	-	-	-	0.206	-	-	-	-	-	-	0.400	0.606	-	-
	-	-	-	-	0.086	-	-	-	-	-	0.400	0.486	-	-
	-	-	-	-	-	0.081	-	-	-	-	0.400	0.481	-	-
	-	-	-	-	-	-	0.150	-	-	-	0.400	0.550	-	-
	-	-	-	-	-	-	-	0.208	-	-	0.400	0.608	-	-
	-	-	-	-	-	-	-	-	0.178	-	0.400	0.578	-	-
	-	-	-	-	-	-	-	-	-	0.200	0.400	0.600	-	-

Simultaneous Transmission Scenario with 5 GHz WLAN (Body at 0 mm) Antenna 1

Position	SAR (W/kg)												Ri (mm)	SPLS Ratio
	GPRS 850	GPRS 1900	UMTS Band 5	UMTS Band 4	UMTS Band 2	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7	LTE Band 17	5 GHz WLAN	Sum of SAR		
Back Touch (0mm)	0.396	-	-	-	-	-	-	-	-	-	1.489	**1.885**	65.8	0.039
	-	0.375	-	-	-	-	-	-	-	-	1.489	1.864	75.9	0.033
	-	-	0.222	-	-	-	-	-	-	-	1.489	1.711	63.4	0.035
	-	-	-	0.123	-	-	-	-	-	-	1.489	1.612	52.6	0.039
	-	-	-	-	0.125	-	-	-	-	-	1.489	1.614	56.1	0.037
	-	-	-	-	-	0.159	-	-	-	-	1.489	1.648	57.3	0.037
	-	-	-	-	-	-	0.133	-	-	-	1.489	1.622	54.0	0.038
	-	-	-	-	-	-	-	0.259	-	-	1.489	1.748	65.9	0.035
	-	-	-	-	-	-	-	-	0.125	-	1.489	1.614	52.3	0.039
	-	-	-	-	-	-	-	-	-	0.263	1.489	1.752	62.9	0.039
Bottom Touch (0mm)	0.225	-	-	-	-	-	-	-	-	-	0.092	0.317	-	-
	-	0.320	-	-	-	-	-	-	-	-	0.092	0.412	-	-
	-	-	0.151	-	-	-	-	-	-	-	0.092	0.243	-	-
	-	-	-	0.074	-	-	-	-	-	-	0.092	0.166	-	-
	-	-	-	-	0.139	-	-	-	-	-	0.092	0.231	-	-
	-	-	-	-	-	0.185	-	-	-	-	0.092	0.277	-	-
	-	-	-	-	-	-	0.081	-	-	-	0.092	0.173	-	-
	-	-	-	-	-	-	-	0.186	-	-	0.092	0.278	-	-
	-	-	-	-	-	-	-	-	0.045	-	0.092	0.137	-	-
	-	-	-	-	-	-	-	-	-	0.081	0.092	0.173	-	-
Left Touch (0mm)	0.103	-	-	-	-	-	-	-	-	-	0.400	0.503	-	-
	-	0.041	-	-	-	-	-	-	-	-	0.400	0.441	-	-
	-	-	0.113	-	-	-	-	-	-	-	0.400	0.513	-	-
	-	-	-	0.149	-	-	-	-	-	-	0.400	0.549	-	-
	-	-	-	-	0.103	-	-	-	-	-	0.400	0.503	-	-
	-	-	-	-	-	0.101	-	-	-	-	0.400	0.501	-	-
	-	-	-	-	-	-	0.023	-	-	-	0.400	0.423	-	-
	-	-	-	-	-	-	-	0.115	-	-	0.400	0.515	-	-
	-	-	-	-	-	-	-	-	0.189	-	0.400	0.589	-	-
	-	-	-	-	-	-	-	-	-	0.189	0.400	0.589	-	-
Right Touch (0mm)	0.226	-	-	-	-	-	-	-	-	-	0.707	0.933	-	-
	-	0.041	-	-	-	-	-	-	-	-	0.707	0.748	-	-
	-	-	0.225	-	-	-	-	-	-	-	0.707	0.932	-	-
	-	-	-	0.206	-	-	-	-	-	-	0.707	0.913	-	-
	-	-	-	-	0.086	-	-	-	-	-	0.707	0.793	-	-
	-	-	-	-	-	0.081	-	-	-	-	0.707	0.788	-	-
	-	-	-	-	-	-	0.150	-	-	-	0.707	0.857	-	-
	-	-	-	-	-	-	-	0.208	-	-	0.707	0.915	-	-
	-	-	-	-	-	-	-	-	0.178	-	0.707	0.885	-	-
	-	-	-	-	-	-	-	-	-	0.200	0.707	0.907	-	-

Simultaneous Transmission Scenario with 2.4 GHz Bluetooth (Body at 0 mm) Antenna 0

Position	SAR (W/kg)												Ri (mm)	SPLS Ratio
	GPRS 850	GPRS 1900	UMTS Band 5	UMTS Band 4	UMTS Band 2	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7	LTE Band 17	2.4GHz BT	Sum of SAR		
Back Touch (0mm)	1.280	-	-	-	-	-	-	-	-	-	0.400	1.680	57.0	0.038
	-	1.195	-	-	-	-	-	-	-	-	0.400	1.595	-	-
	-	-	1.070	-	-	-	-	-	-	-	0.400	1.470	-	-
	-	-	-	1.095	-	-	-	-	-	-	0.400	1.495	-	-
	-	-	-	-	1.467	-	-	-	-	-	0.400	**1.867**	65.1	0.039
	-	-	-	-	-	1.310	-	-	-	-	0.400	1.710	65.1	0.034
	-	-	-	-	-	-	1.300	-	-	-	0.400	1.700	80.0	0.028
	-	-	-	-	-	-	-	1.180	-	-	0.400	1.580	-	-
	-	-	-	-	-	-	-	-	1.290	-	0.400	1.690	87.6	0.025
	-	-	-	-	-	-	-	-	-	1.210	0.400	1.610	61.7	0.033
Bottom Touch (0mm)	0.604	-	-	-	-	-	-	-	-	-	0.400	1.004	-	-
	-	0.106	-	-	-	-	-	-	-	-	0.400	0.506	-	-
	-	-	0.699	-	-	-	-	-	-	-	0.400	1.099	-	-
	-	-	-	0.769	-	-	-	-	-	-	0.400	1.169	-	-
	-	-	-	-	1.293	-	-	-	-	-	0.400	1.693	-	-
	-	-	-	-	-	1.120	-	-	-	-	0.400	1.520	-	-
	-	-	-	-	-	-	0.736	-	-	-	0.400	1.136	-	-
	-	-	-	-	-	-	-	0.770	-	-	0.400	1.170	-	-
	-	-	-	-	-	-	-	-	0.604	-	0.400	1.004	-	-
	-	-	-	-	-	-	-	-	-	0.394	0.400	0.794	-	-
Left Touch (0mm)	0.103	-	-	-	-	-	-	-	-	-	0.374	0.477	-	-
	-	0.041	-	-	-	-	-	-	-	-	0.374	0.415	-	-
	-	-	0.113	-	-	-	-	-	-	-	0.374	0.487	-	-
	-	-	-	0.149	-	-	-	-	-	-	0.374	0.523	-	-
	-	-	-	-	0.103	-	-	-	-	-	0.374	0.477	-	-
	-	-	-	-	-	0.101	-	-	-	-	0.374	0.475	-	-
	-	-	-	-	-	-	0.023	-	-	-	0.374	0.397	-	-
	-	-	-	-	-	-	-	0.115	-	-	0.374	0.489	-	-
	-	-	-	-	-	-	-	-	0.189	-	0.374	0.563	-	-
	-	-	-	-	-	-	-	-	-	0.189	0.374	0.563	-	-
Right Touch (0mm)	0.226	-	-	-	-	-	-	-	-	-	0.400	0.626	-	-
	-	0.041	-	-	-	-	-	-	-	-	0.400	0.441	-	-
	-	-	0.225	-	-	-	-	-	-	-	0.400	0.625	-	-
	-	-	-	0.206	-	-	-	-	-	-	0.400	0.606	-	-
	-	-	-	-	0.086	-	-	-	-	-	0.400	0.486	-	-
	-	-	-	-	-	0.081	-	-	-	-	0.400	0.481	-	-
	-	-	-	-	-	-	0.150	-	-	-	0.400	0.550	-	-
	-	-	-	-	-	-	-	0.208	-	-	0.400	0.608	-	-
	-	-	-	-	-	-	-	-	0.178	-	0.400	0.578	-	-
	-	-	-	-	-	-	-	-	-	0.200	0.400	0.600	-	-

Simultaneous Transmission Scenario with 2.4 GHz Bluetooth .Antenna 0, Full power

Position	SAR(W/kg)												Ri	SPLS Ratio
	GPRS 850	GPRS 1900	UMTS Band 5	UMTS Band 4	UMTS Band 2	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7	LTE Band 17	2.4GHz BT	Sum of SAR		
Back Touch (14mm)	0.471	-	-	-	-	-	-	-	-	-	0.149	0.620	-	-
	-	0.401	-	-	-	-	-	-	-	-	0.149	0.550	-	-
	-	-	0.398	-	-	-	-	-	-	-	0.149	0.547	-	-
	-	-	-	0.437	-	-	-	-	-	-	0.149	0.586	-	-
	-	-	-	-	0.500	-	-	-	-	-	0.149	0.649	-	-
	-	-	-	-	-	0.782	-	-	-	-	0.149	**0.931**	-	-
	-	-	-	-	-	-	0.451	-	-	-	0.149	0.600	-	-
	-	-	-	-	-	-	-	0.369	-	-	0.149	0.518	-	-
	-	-	-	-	-	-	-	-	0.476	-	0.149	0.625	-	-
	-	-	-	-	-	-	-	-	-	0.416	0.149	0.565	-	-
Bottom Touch (11mm)	0.249	-	-	-	-	-	-	-	-	-	0.189	0.438	-	-
	-	0.312	-	-	-	-	-	-	-	-	0.189	0.501	-	-
	-	-	0.162	-	-	-	-	-	-	-	0.189	0.351	-	-
	-	-	-	0.399	-	-	-	-	-	-	0.189	0.588	-	-
	-	-	-	-	0.227	-	-	-	-	-	0.189	0.416	-	-
	-	-	-	-	-	0.708	-	-	-	-	0.189	0.897	-	-
	-	-	-	-	-	-	0.467	-	-	-	0.189	0.656	-	-
	-	-	-	-	-	-	-	0.268	-	-	0.189	0.457	-	-
	-	-	-	-	-	-	-	-	0.660	-	0.189	0.849	-	-
	-	-	-	-	-	-	-	-	-	0.177	0.189	0.366	-	-

Simultaneous Transmission Scenario with 2.4 GHz WLAN .Antenna 0, Full power

Position	SAR (W/kg)												Ri	SPLS Ratio
	GPRS 850	GPRS 1900	UMTS Band 5	UMTS Band 4	UMTS Band 2	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7	LTE Band 17	2.4GHz WLAN	Sum of SAR		
Back Touch (14mm)	0.471	-	-	-	-	-	-	-	-	-	0.236	0.707	-	-
	-	0.401	-	-	-	-	-	-	-	-	0.236	0.637	-	-
	-	-	0.398	-	-	-	-	-	-	-	0.236	0.634	-	-
	-	-	-	0.437	-	-	-	-	-	-	0.236	0.673	-	-
	-	-	-	-	0.500	-	-	-	-	-	0.236	0.736	-	-
	-	-	-	-	-	0.782	-	-	-	-	0.236	**1.018**	-	-
	-	-	-	-	-	-	0.451	-	-	-	0.236	0.687	-	-
	-	-	-	-	-	-	-	0.369	-	-	0.236	0.605	-	-
	-	-	-	-	-	-	-	-	0.476	-	0.236	0.712	-	-
	-	-	-	-	-	-	-	-	-	0.416	0.236	0.652	-	-
Bottom Touch (11mm)	0.249	-	-	-	-	-	-	-	-	-	0.300	0.549	-	-
	-	0.312	-	-	-	-	-	-	-	-	0.300	0.612	-	-
	-	-	0.162	-	-	-	-	-	-	-	0.300	0.462	-	-
	-	-	-	0.399	-	-	-	-	-	-	0.300	0.699	-	-
	-	-	-	-	0.227	-	-	-	-	-	0.300	0.527	-	-
	-	-	-	-	-	0.708	-	-	-	-	0.300	1.008	-	-
	-	-	-	-	-	-	0.467	-	-	-	0.300	0.767	-	-
	-	-	-	-	-	-	-	0.268	-	-	0.300	0.568	-	-
	-	-	-	-	-	-	-	-	0.660	-	0.300	0.960	-	-
	-	-	-	-	-	-	-	-	-	0.177	0.300	0.477	-	-

Simultaneous Transmission Scenario with 2.4 GHz WLAN .Antenna 1, Full power

Position	SAR (W/kg)												Ri	SPLS Ratio
	GPRS 850	GPRS 1900	UMTS Band 5	UMTS Band 4	UMTS Band 2	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7	LTE Band 17	2.4GHz WLAN	Sum of SAR		
Back Touch (14mm)	0.471	-	-	-	-	-	-	-	-	-	0.236	0.707	-	-
	-	0.401	-	-	-	-	-	-	-	-	0.236	0.637	-	-
	-	-	0.398	-	-	-	-	-	-	-	0.236	0.634	-	-
	-	-	-	0.437	-	-	-	-	-	-	0.236	0.673	-	-
	-	-	-	-	0.500	-	-	-	-	-	0.236	0.736	-	-
	-	-	-	-	-	0.782	-	-	-	-	0.236	**1.018**	-	-
	-	-	-	-	-	-	0.451	-	-	-	0.236	0.687	-	-
	-	-	-	-	-	-	-	0.369	-	-	0.236	0.605	-	-
	-	-	-	-	-	-	-	-	0.476	-	0.236	0.712	-	-
	-	-	-	-	-	-	-	-	-	0.416	0.236	0.652	-	-
Bottom Touch (11mm)	0.249	-	-	-	-	-	-	-	-	-	0.072	0.321	-	-
	-	0.312	-	-	-	-	-	-	-	-	0.072	0.384	-	-
	-	-	0.162	-	-	-	-	-	-	-	0.072	0.234	-	-
	-	-	-	0.399	-	-	-	-	-	-	0.072	0.471	-	-
	-	-	-	-	0.227	-	-	-	-	-	0.072	0.299	-	-
	-	-	-	-	-	0.708	-	-	-	-	0.072	0.780	-	-
	-	-	-	-	-	-	0.467	-	-	-	0.072	0.539	-	-
	-	-	-	-	-	-	-	0.268	-	-	0.072	0.340	-	-
	-	-	-	-	-	-	-	-	0.660	-	0.072	0.732	-	-
	-	-	-	-	-	-	-	-	-	0.177	0.072	0.249	-	-

Simultaneous Transmission Scenario with 5 GHz WLAN .Antenna 0, Full power

Position	SAR (W/kg)												Ri	SPLS Ratio
	GPRS 850	GPRS 1900	UMTS Band 5	UMTS Band 4	UMTS Band 2	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7	LTE Band 17	5GHz WLAN	Sum of SAR		
Back Touch (14mm)	0.471	-	-	-	-	-	-	-	-	-	0.289	0.760	-	-
	-	0.401	-	-	-	-	-	-	-	-	0.289	0.690	-	-
	-	-	0.398	-	-	-	-	-	-	-	0.289	0.687	-	-
	-	-	-	0.437	-	-	-	-	-	-	0.289	0.726	-	-
	-	-	-	-	0.500	-	-	-	-	-	0.289	0.789	-	-
	-	-	-	-	-	0.782	-	-	-	-	0.289	1.071	-	-
	-	-	-	-	-	-	0.451	-	-	-	0.289	0.740	-	-
	-	-	-	-	-	-	-	0.369	-	-	0.289	0.658	-	-
	-	-	-	-	-	-	-	-	0.476	-	0.289	0.765	-	-
	-	-	-	-	-	-	-	-	-	0.416	0.289	0.705	-	-
Bottom Touch (11mm)	0.249	-	-	-	-	-	-	-	-	-	0.368	0.617	-	-
	-	0.312	-	-	-	-	-	-	-	-	0.368	0.680	-	-
	-	-	0.162	-	-	-	-	-	-	-	0.368	0.530	-	-
	-	-	-	0.399	-	-	-	-	-	-	0.368	0.767	-	-
	-	-	-	-	0.227	-	-	-	-	-	0.368	0.595	-	-
	-	-	-	-	-	0.708	-	-	-	-	0.368	**1.076**	-	-
	-	-	-	-	-	-	0.467	-	-	-	0.368	0.835	-	-
	-	-	-	-	-	-	-	0.268	-	-	0.368	0.636	-	-
	-	-	-	-	-	-	-	-	0.660	-	0.368	1.028	-	-
	-	-	-	-	-	-	-	-	-	0.177	0.368	0.545	-	-

Simultaneous Transmission Scenario with 5 GHz WLAN .Antenna 1, Full power

Position	SAR (W/kg)												Ri	SPLS Ratio
	GPRS 850	GPRS 1900	UMTS Band 5	UMTS Band 4	UMTS Band 2	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 7	LTE Band 17	5GHz WLAN	Sum of SAR		
Back Touch (14mm)	0.471	-	-	-	-	-	-	-	-	-	0.230	0.701	-	-
	-	0.401	-	-	-	-	-	-	-	-	0.230	0.631	-	-
	-	-	0.398	-	-	-	-	-	-	-	0.230	0.628	-	-
	-	-	-	0.437	-	-	-	-	-	-	0.230	0.667	-	-
	-	-	-	-	0.500	-	-	-	-	-	0.230	0.730	-	-
	-	-	-	-	-	0.782	-	-	-	-	0.230	**1.012**	-	-
	-	-	-	-	-	-	0.451	-	-	-	0.230	0.681	-	-
	-	-	-	-	-	-	-	0.369	-	-	0.230	0.599	-	-
	-	-	-	-	-	-	-	-	0.476	-	0.230	0.706	-	-
	-	-	-	-	-	-	-	-	-	0.416	0.230	0.646	-	-
Bottom Touch (11mm)	0.249	-	-	-	-	-	-	-	-	-	0.070	0.319	-	-
	-	0.312	-	-	-	-	-	-	-	-	0.070	0.382	-	-
	-	-	0.162	-	-	-	-	-	-	-	0.070	0.232	-	-
	-	-	-	0.399	-	-	-	-	-	-	0.070	0.469	-	-
	-	-	-	-	0.227	-	-	-	-	-	0.070	0.297	-	-
	-	-	-	-	-	0.708	-	-	-	-	0.070	0.778	-	-
	-	-	-	-	-	-	0.467	-	-	-	0.070	0.537	-	-
	-	-	-	-	-	-	-	0.268	-	-	0.070	0.338	-	-
	-	-	-	-	-	-	-	-	0.660	-	0.070	0.730	-	-
	-	-	-	-	-	-	-	-	-	0.177	0.070	0.247	-	-

Note 1: For top touch, the distance from all the antennas is more than 50 mm; the all sum of SAR is 0.8 W/Kg.

Note 2: According to KDB 447498 D01 v05r02, when the sum of the standalone transmitters is more than 1.6 W/kg, the SAR sum to peak locations can be analyzed to determine SAR distribution overlaps, when the SAR peak to location ratio for each pair of antennas is less than 0.04; simultaneous SAR evaluation is not required. The distance between the transmitters was

$$\text{Distance}_{Tx1-Tx2} = R_i = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

$$\text{SPLS Ratio} = \frac{(SAR_1 + SAR_2)^{1.5}}{R_i}$$

13 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 According to IEEE 1528								
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 (2450 MHz)	± 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 %	-

5 GHz to 6 GHz

SASY4 Uncertainty Budget According to IEEE 1528								
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 (5 GHz)	± 6.55 %	N	1	1	1	± 6.55 %	± 6.55 %	∝
Axial Isotropy	± 4.7 %	R	$\sqrt{3}$	1	1	± 2.7 %	± 2.7 %	∝
Hemispherical Isotropy	± 9.6 %	R	$\sqrt{3}$	0	0	0	0	∝
Boundary Effects	± 2.0 %	R	$\sqrt{3}$	1	1	± 1.2 %	± 1.2 %	∝
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	R	$\sqrt{3}$	1	1	0	0	∝
Integration Time	0	R	$\sqrt{3}$	1	1	0	0	∝
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	± 0.8 %	R	$\sqrt{3}$	1	1	± 0.5 %	± 0.5 %	∝
Probe Positioning	± 9.9 %	R	$\sqrt{3}$	1	1	± 5.7 %	± 5.7 %	∝
Max. SAR Eval.	± 4.0 %	R	$\sqrt{3}$	1	1	± 2.3 %	± 2.3 %	∝
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 %	± 1.2 %	∝
Combined Std. Uncertainty	-	-	-	-	-	± 12.2 %	± 12.1 %	330
Expanded STD Uncertainty	-	-	-	-	-	± 24.4 %	± 24.2 %	-

14 Appendix B – Probe Calibration Certificats

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

Client **BACL**

Certificate No: **ES3-3019_Aug13**

CALIBRATION CERTIFICATE

Object: ES3DV2 - SN:3019

Calibration procedure(s): QA CAL-01.v9, QA CAL-12.v8, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: August 26, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-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-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: August 28, 2013

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

Certificate No: ES3-3019_Aug13 Page 1 of 11

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV2

SN:3019

Manufactured: December 5, 2002
Calibrated: August 26, 2013

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

ES3DV2– SN:3019 August 26, 2013

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3019

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.04	1.15	0.96	± 10.1 %
DCP (mV)[B]	105.4	98.8	105.2	

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	193.2	±3.0 %
		Y	0.0	0.0	1.0		148.8	
		Z	0.0	0.0	1.0		187.1	

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

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

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3019

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	Depth (mm)	Unct. (k=2)
300	45.3	0.87	7.08	7.08	7.08	0.22	1.01	± 13.4 %
450	43.5	0.87	6.56	6.56	6.56	0.15	1.73	± 13.4 %
835	41.5	0.90	6.23	6.23	6.23	0.18	2.38	± 12.0 %
900	41.5	0.97	6.05	6.05	6.05	0.23	1.87	± 12.0 %
1810	40.0	1.40	4.89	4.89	4.89	0.37	1.51	± 12.0 %
1900	40.0	1.40	4.85	4.85	4.85	0.47	1.35	± 12.0 %
2450	39.2	1.80	4.19	4.19	4.19	0.63	1.27	± 12.0 %

[C] Frequency validity 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.
[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.

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3019

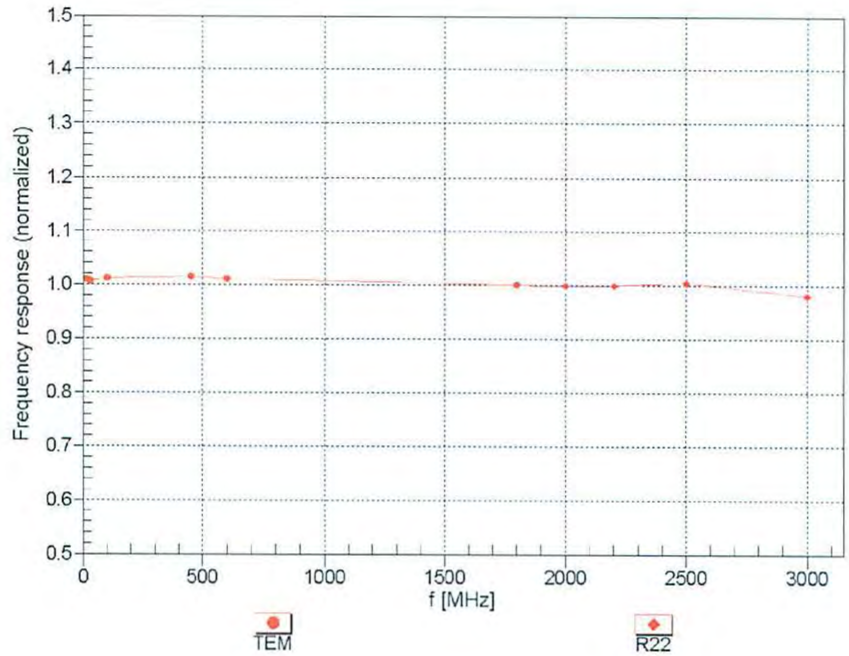
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
300	58.2	0.92	6.89	6.89	6.89	0.23	1.78	± 13.4 %
450	56.7	0.94	7.25	7.25	7.25	0.10	1.20	± 13.4 %
835	55.2	0.97	6.05	6.05	6.05	0.36	1.59	± 12.0 %
900	55.0	1.05	5.88	5.88	5.88	0.29	1.80	± 12.0 %
1810	53.3	1.52	4.55	4.55	4.55	0.31	2.02	± 12.0 %
1900	53.3	1.52	4.42	4.42	4.42	0.32	1.97	± 12.0 %
2450	52.7	1.95	3.87	3.87	3.87	0.80	1.13	± 12.0 %

[C] Frequency validity 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.
[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.

Frequency Response of E-Field

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

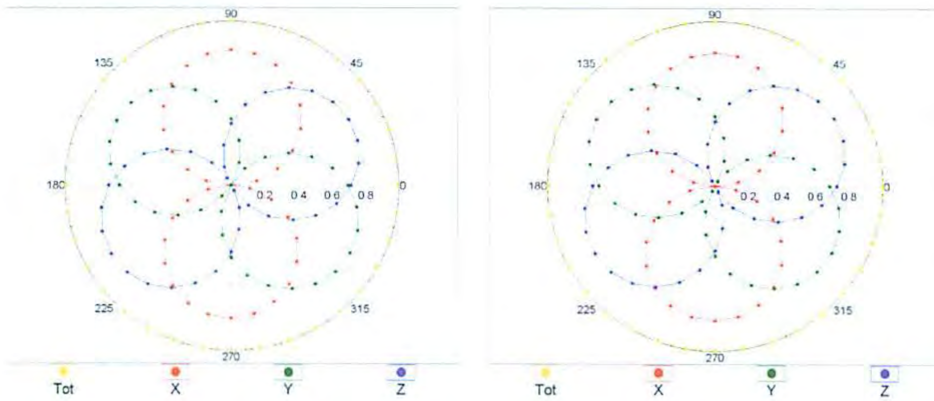


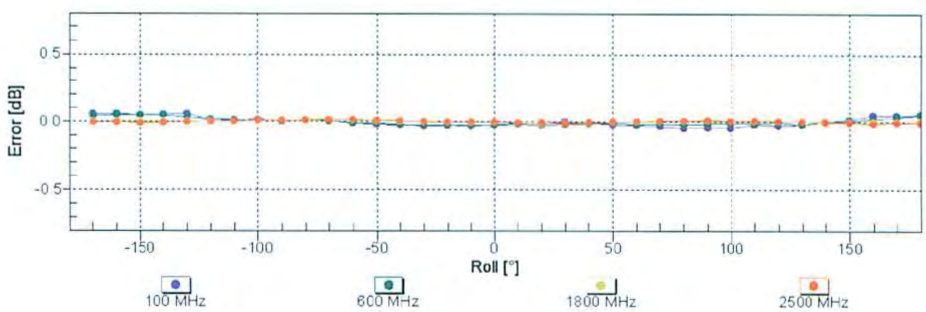
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

ES3DV2– SN:3019 August 26, 2013

Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM f=1800 MHz,R22

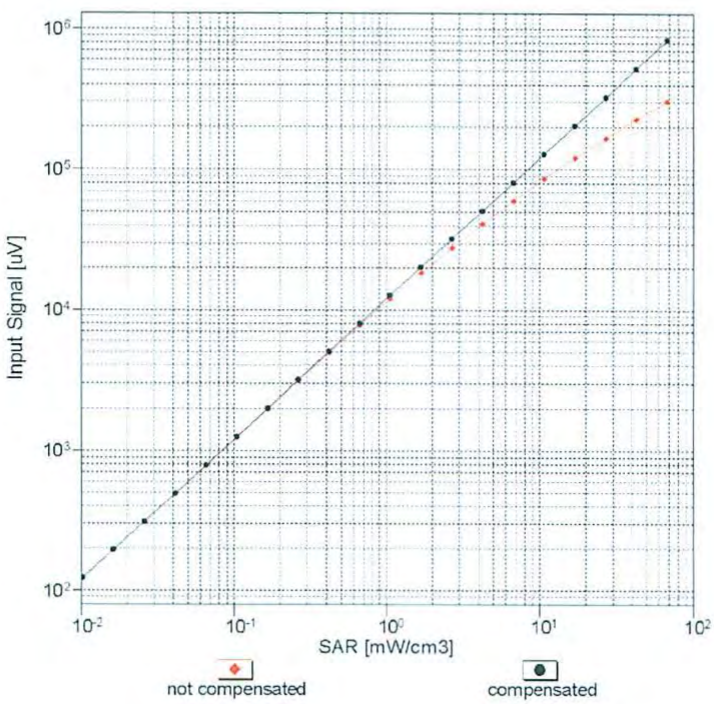


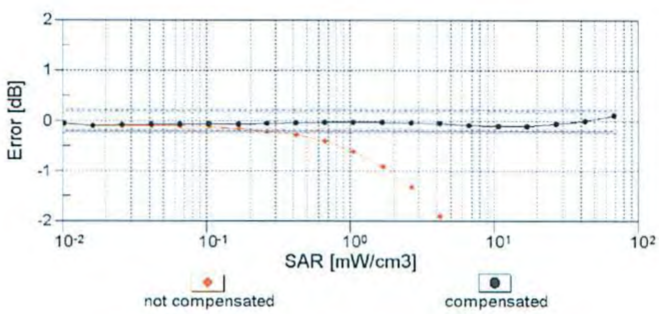


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

(TEM cell , f = 900 MHz)



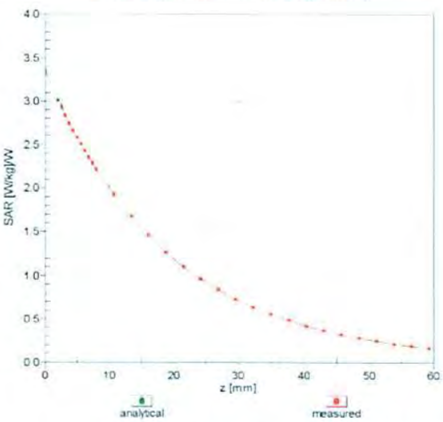


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

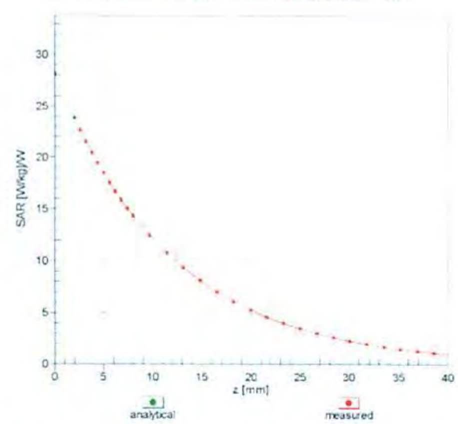
ES3DV2– SN:3019 August 26, 2013

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

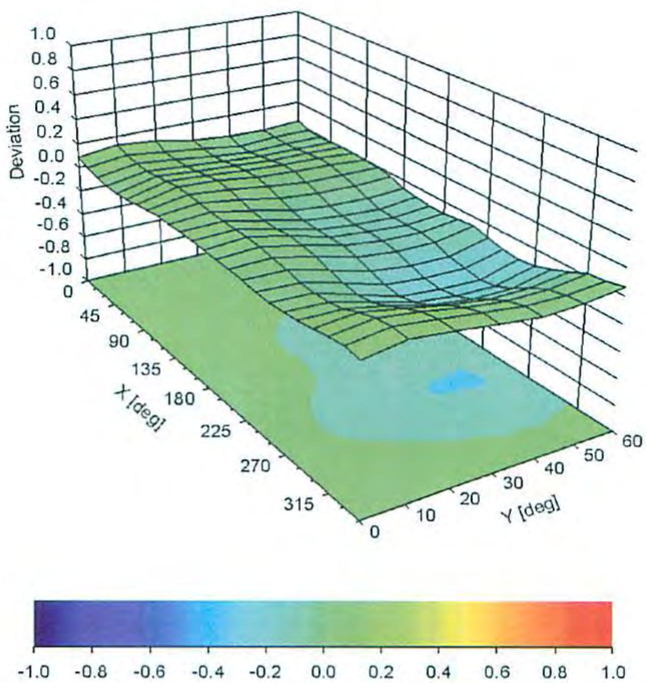


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3019

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-60.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Accreditation No.: **SCS 108**

Client **BACL**

Certificate No: **EX3-3619_Aug13**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3619
Calibration procedure(s)	QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	August 27, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-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-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: August 29, 2013

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Certificate No: EX3-3619_Aug13 Page 1 of 11

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Accreditation No.: **SCS 108**

Client **BACL**

Certificate No: **ES3-3019_Dec13**

CALIBRATION CERTIFICATE

Object: ES3DV2 - SN:3019

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

Calibration date: December 17, 2013 (Additional Conversion Factors)

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
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-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: December 17, 2013

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Certificate No: ES3-3019_Dec13 Page 1 of 8

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV2

SN:3019

Additional Conversion Factors

Manufactured: December 5, 2002
Calibrated: December 17, 2013

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

ES3DV2– SN:3019 December 17, 2013

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3019

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.04	1.15	0.96	± 10.1 %
DCP (mV)[B]	105.4	98.8	105.2	

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	193.2	±3.0 %
		Y	0.0	0.0	1.0		148.8	
		Z	0.0	0.0	1.0		187.1	

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

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

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3019

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.63	6.63	6.63	0.22	1.96	± 12.0 %
2600	39.0	1.96	3.89	3.89	3.89	0.62	1.44	± 12.0 %

[C] Frequency validity 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.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: ES3DV2- SN:3019

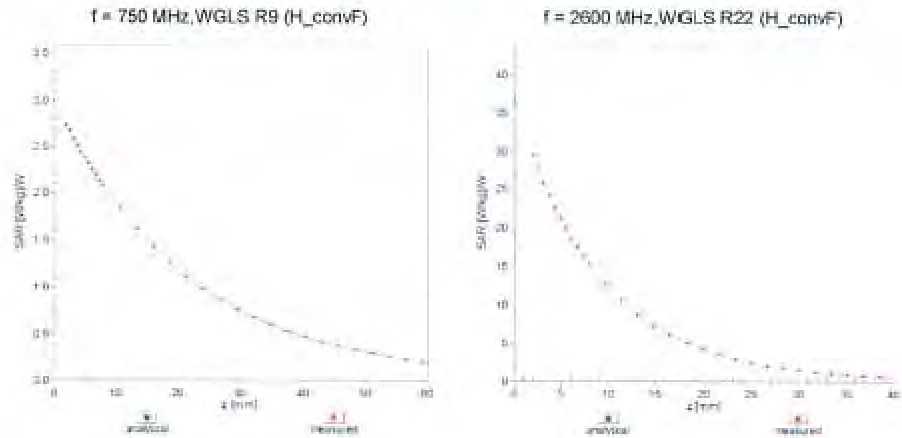
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.18	6.18	6.18	0.18	2.31	± 12.0 %
2600	52.5	2.16	3.76	3.76	3.76	0.61	0.95	± 12.0 %

[C] Frequency validity 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.
[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.

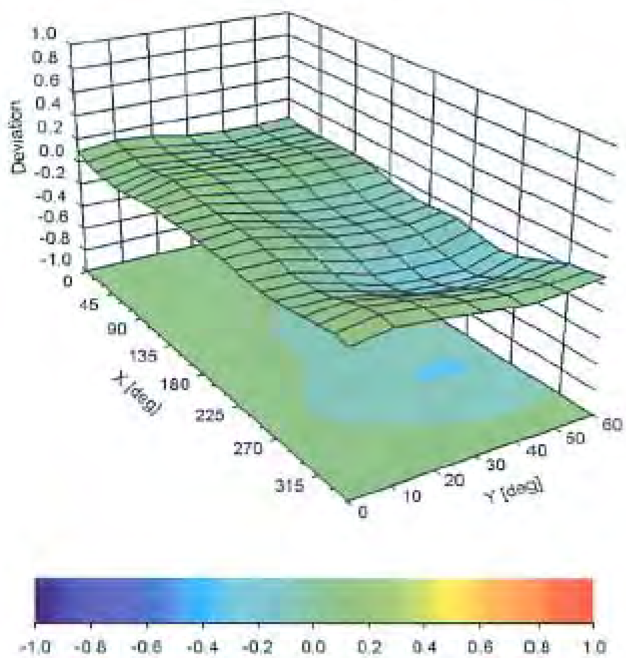
ES3DV2– SN:3019 December 17, 2013

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

Certificate No: ES3-3019_Dec13 Page 7 of 8

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3019

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-60.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Accreditation No.: **SCS 108**

Client **BACL**

Certificate No: **EX3-3619_Aug13**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3619

Calibration procedure(s): QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: August 27, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-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-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: August 29, 2013

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:3619

Manufactured: July 3, 2007
Calibrated: August 27, 2013

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.45	0.38	0.40	± 10.1 %
DCP (mV)[B]	98.2	94.5	99.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	141.2	±3.5 %
		Y	0.0	0.0	1.0		134.0	
		Z	0.0	0.0	1.0		175.7	

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

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

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
5200	36.0	4.66	4.63	4.63	4.63	0.48	1.30	± 13.1 %
5300	35.9	4.76	4.35	4.35	4.35	0.47	1.45	± 13.1 %
5600	35.5	5.07	4.00	4.00	4.00	0.47	1.58	± 13.1 %
5800	35.3	5.27	4.07	4.07	4.07	0.46	1.73	± 13.1 %

[C] Frequency validity 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.
[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.

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

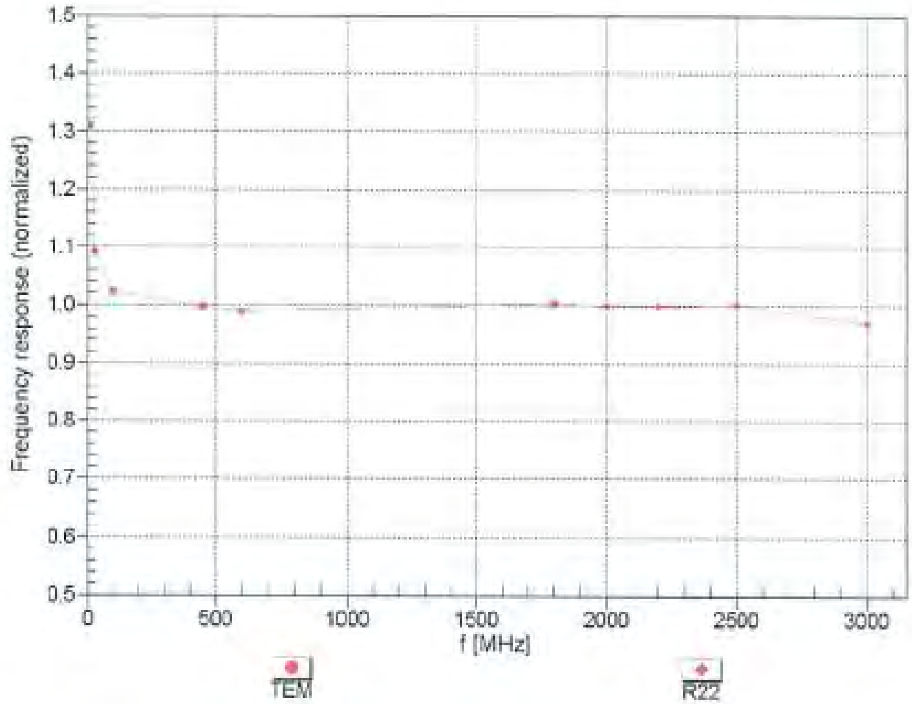
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
5200	49.0	5.30	4.05	4.05	4.05	0.40	1.90	± 13.1 %
5300	48.9	5.42	3.88	3.88	3.88	0.40	1.90	± 13.1 %
5600	48.5	5.77	3.38	3.38	3.38	0.50	1.90	± 13.1 %
5800	48.2	6.00	3.83	3.83	3.83	0.45	1.90	± 13.1 %

[C] Frequency validity 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.
[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.

Frequency Response of E-Field

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

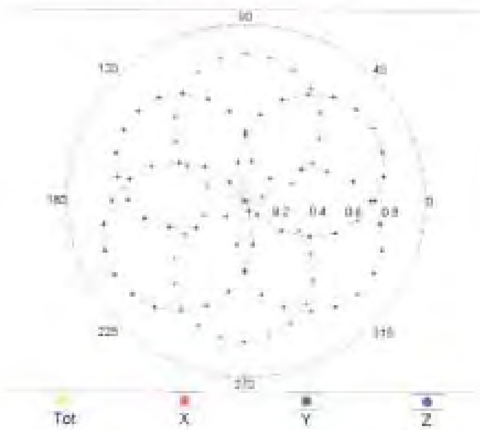


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

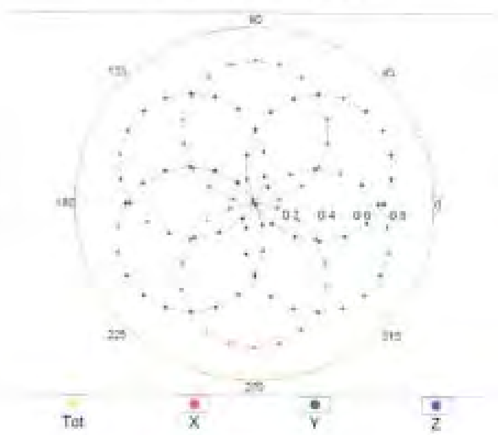
EX3DV4– SN:3619 August 27, 2013

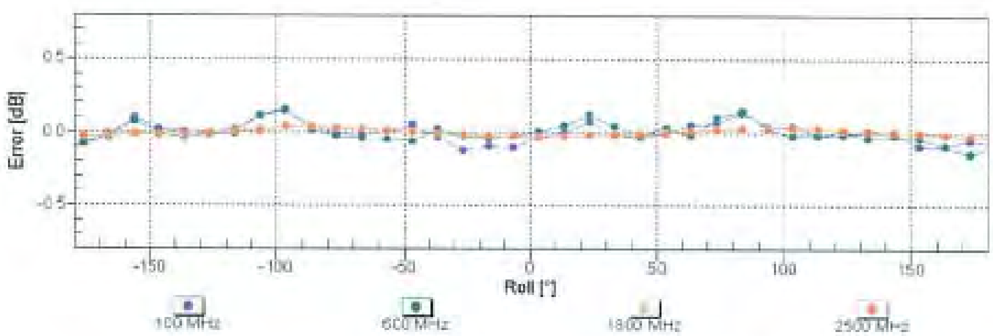
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM



f=1800 MHz,R22

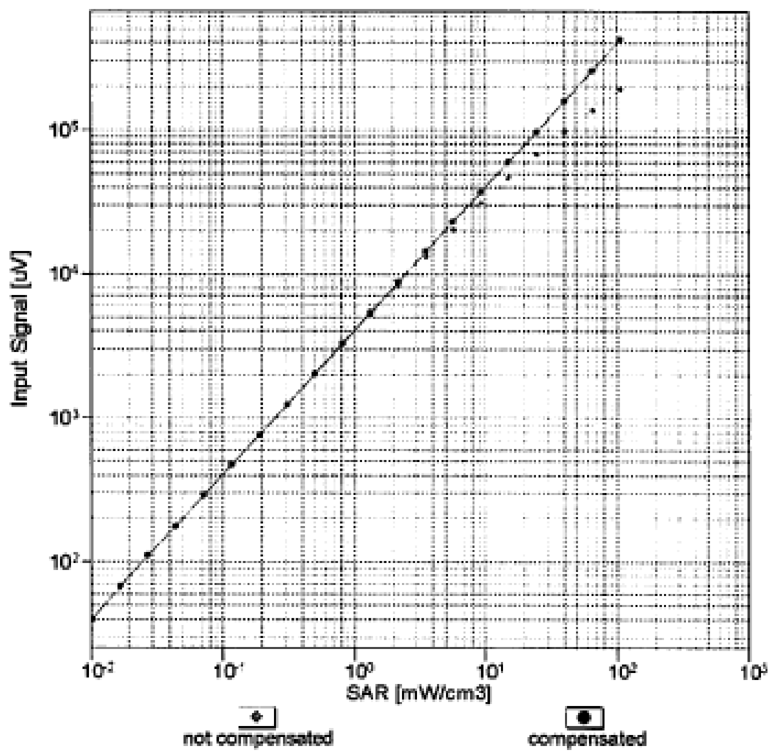


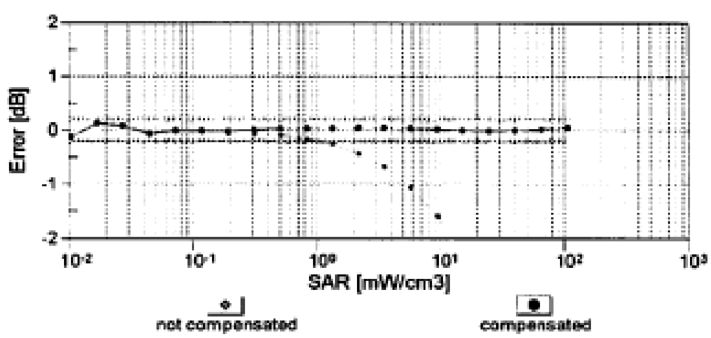


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

EX3DV4– SN:3619 August 27, 2013

Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)



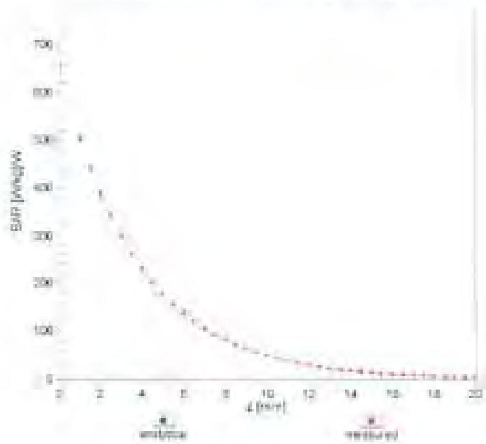


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

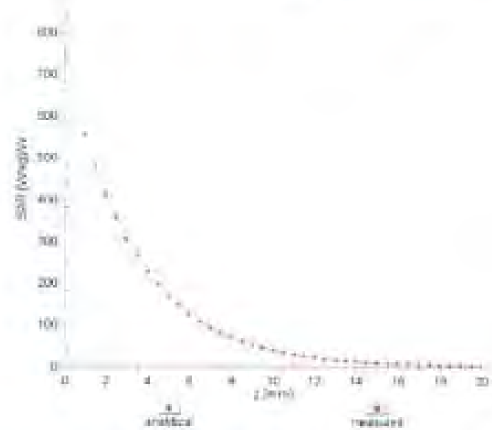
EX3DV4– SN:3619 August 27, 2013

Conversion Factor Assessment

f = 5200 MHz,WGLS R58 (H_convF)-SCS

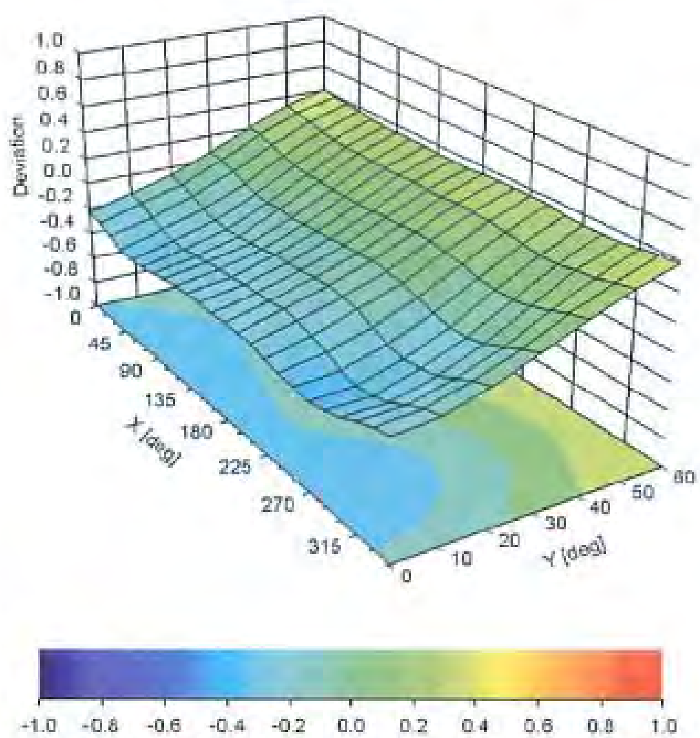


f = 5800 MHz,WGLS R58 (H_convF)-SCS



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

Certificate No: EX3-3619_Aug13 Page 10 of 11

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	23.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

15 Appendix C – Dipole Calibration Certificates

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Accreditation No.: **SCS 108**

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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

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

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: December 6, 2013

Certificate No: D750V3-1102_Dec13 Page 1 of 8

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**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 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 ± 0.2) °C	41.0 ± 6 %	0.92 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.42 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (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 ± 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 ± 0.2) °C	56.9 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.68 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (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 ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.4 Ω - 5.4 jΩ
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

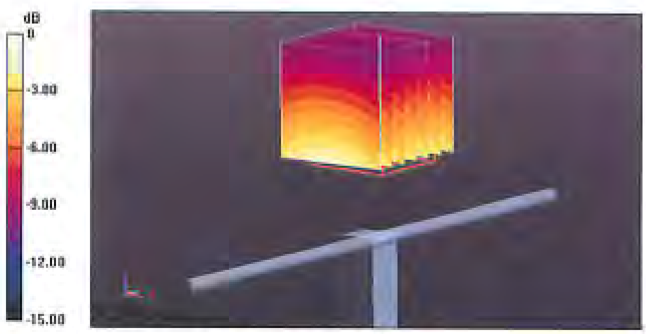
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1102

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.92 S/m; ε_r = 41; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

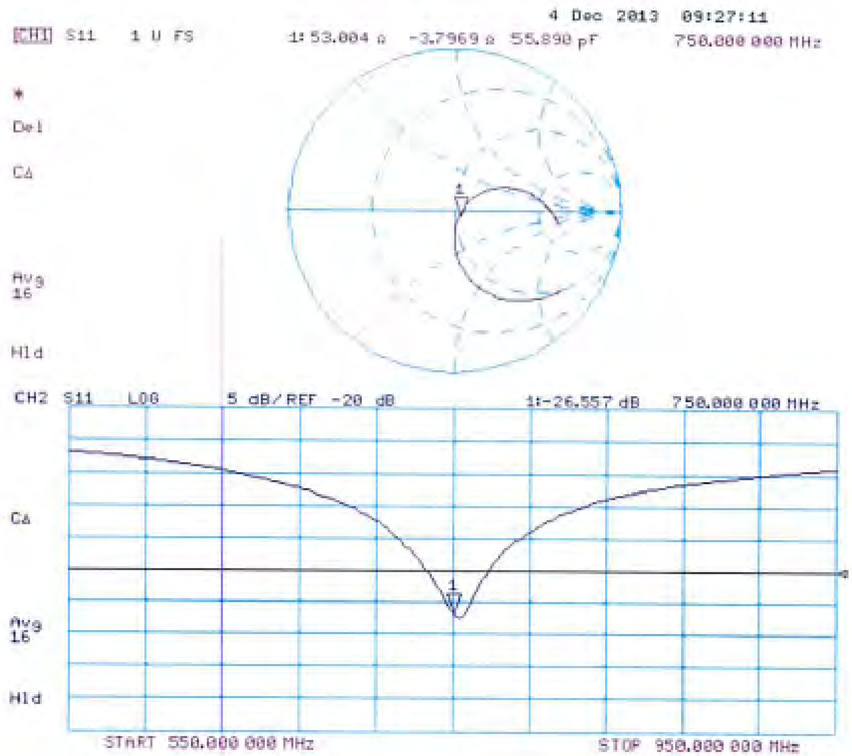
- Probe: ES3DV3 - SN3205; ConvF(6.28, 6.28, 6.28); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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



Certificate No: D750V3-1102_Dec13 Page 6 of 8

DASY5 Validation Report for Body TSL

Date: 06.12.2013

Test Laboratory: SPEAG, Zurich, Switzerland

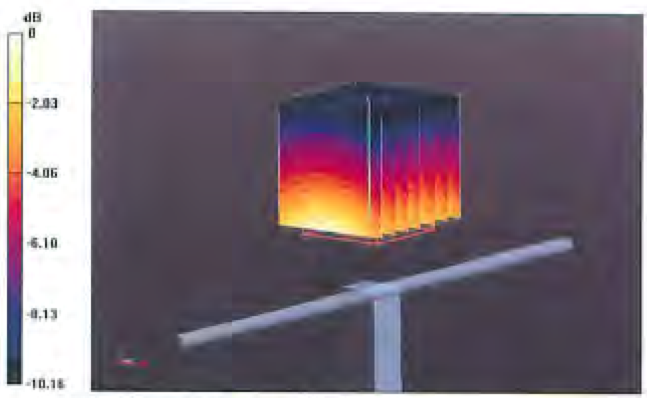
DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1102

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; $\sigma = 0.99$ S/m; $\varepsilon_r = 56.9$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

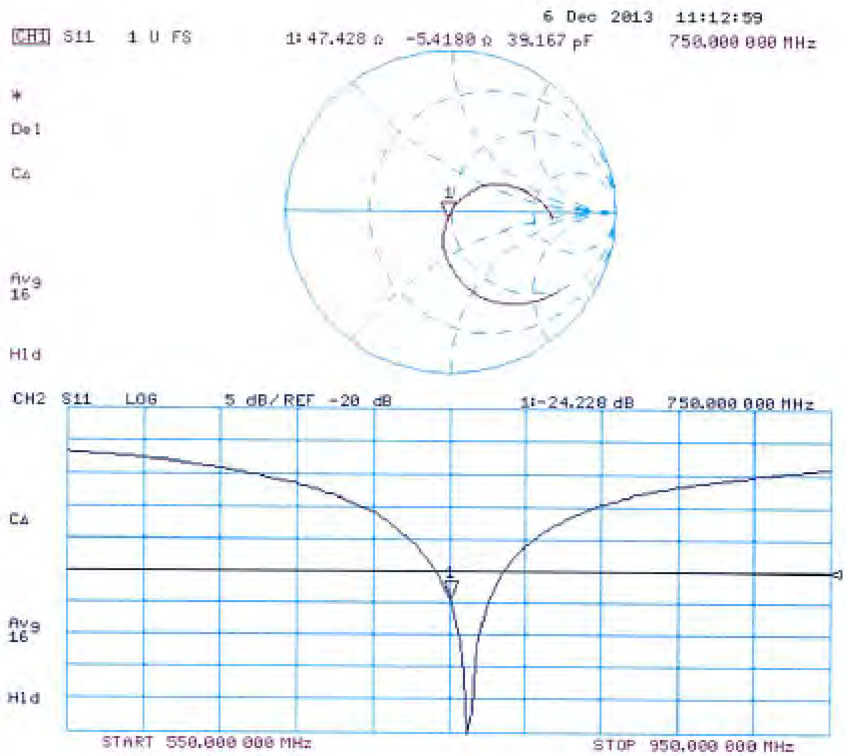
- Probe: ES3DV3 - SN3205; ConvF(6.11, 6.11, 6.11); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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



0 dB = 2.56 W/kg = 4.08 dBW/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

C. 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

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

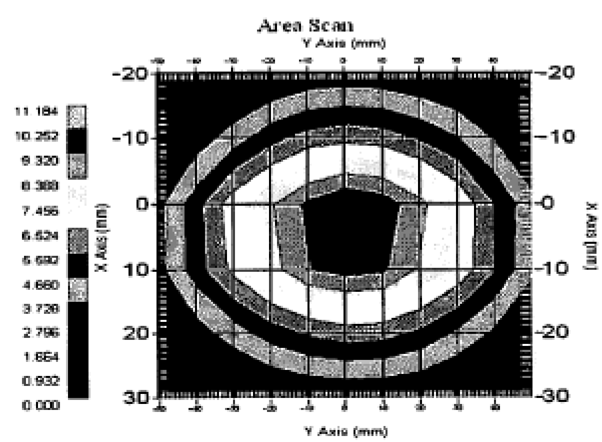
Electrical Specification 835MHz

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

835MHz



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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.

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

- 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
- 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
- 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)
- 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

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.

NCL Calibration Laboratories
Division of APREL Inc.

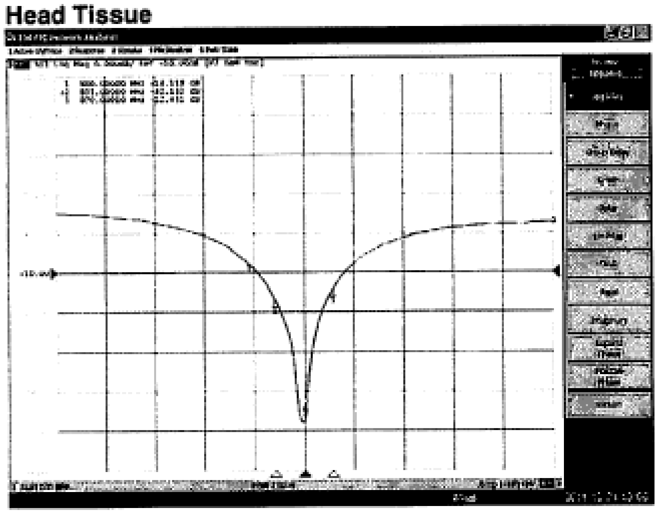
Electrical Calibration

Electrical Specification 835MHz

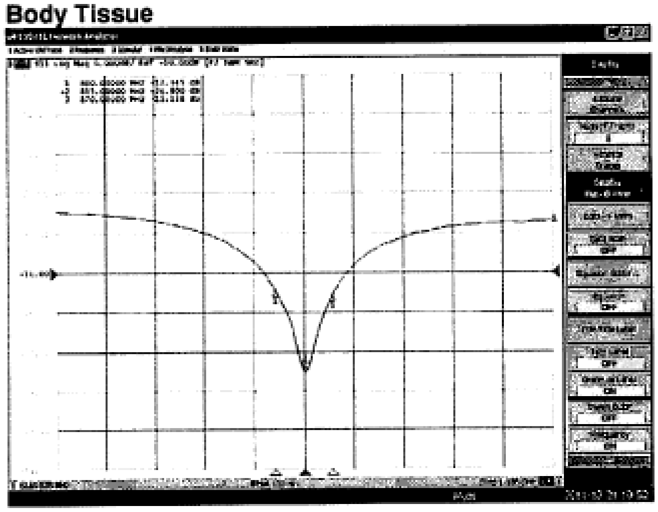
Tissue Type	Measured Epsilon	Measured Sigma
Head	41.09	0.89
Body	53.15	0.95

Forward Reflection

Head Tissue



Body Tissue



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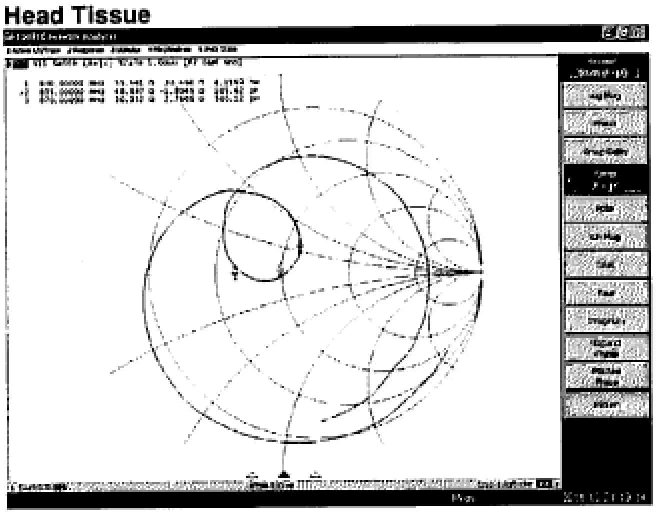
NCL Calibration Laboratories
Division of APREL Inc.

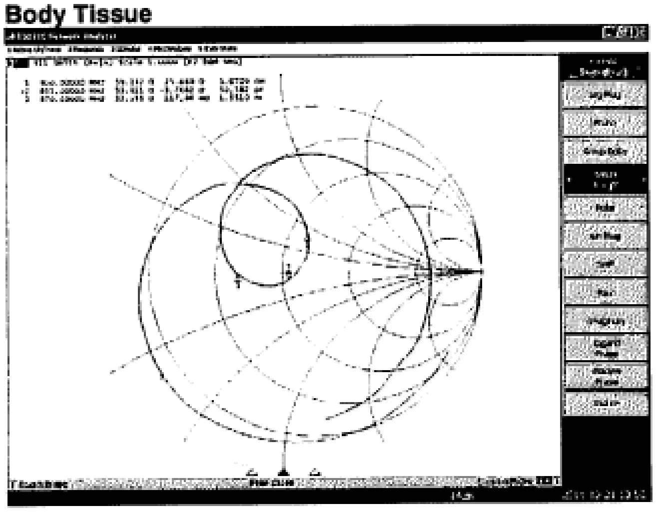
Electrical Specification 835MHz
Impedance

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

Head Tissue



Body Tissue



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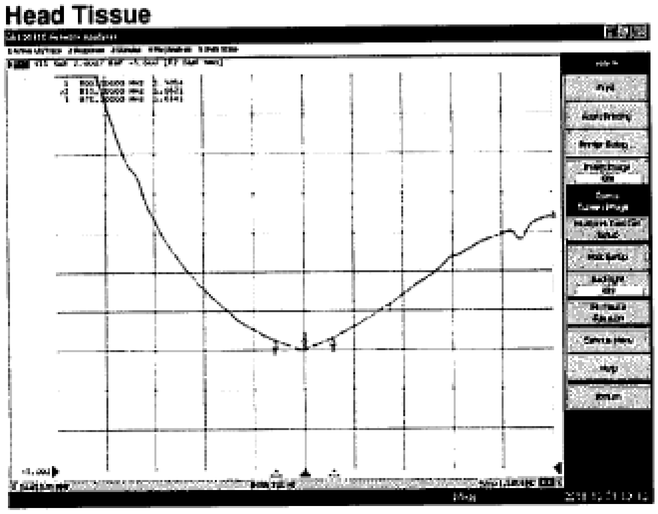
NCL Calibration Laboratories

Division of APREL Inc.

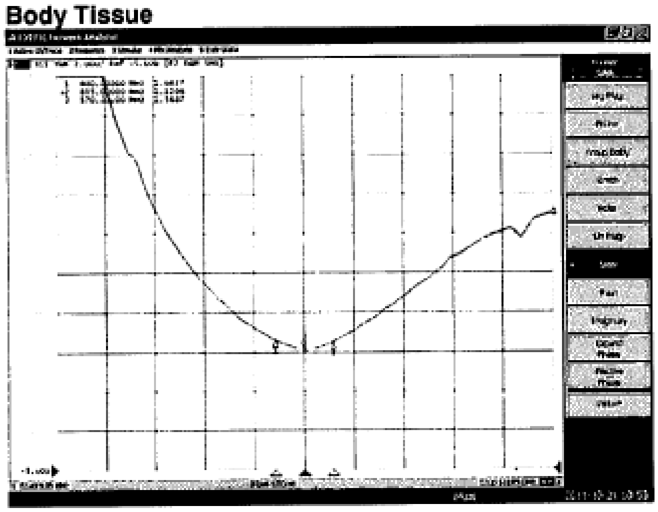
Electrical Specification 835MHz
Standing Wave Ratio

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

Head Tissue



Body Tissue



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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.

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

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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

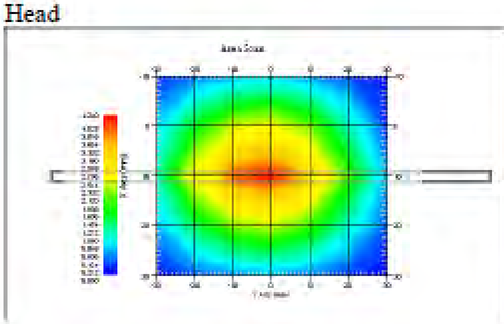
Electrical Calibration

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

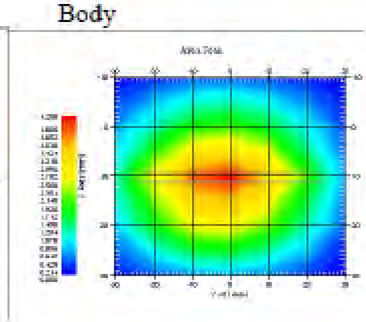
System Validation Results, 1750 MHz

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

Head



Body



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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.

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

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.

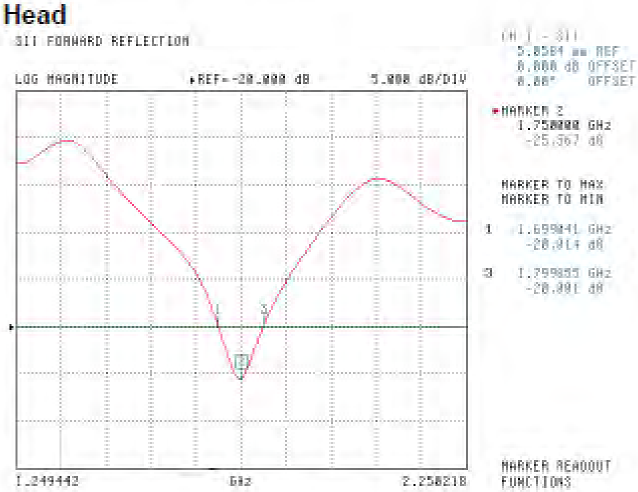
Electrical Calibration

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

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

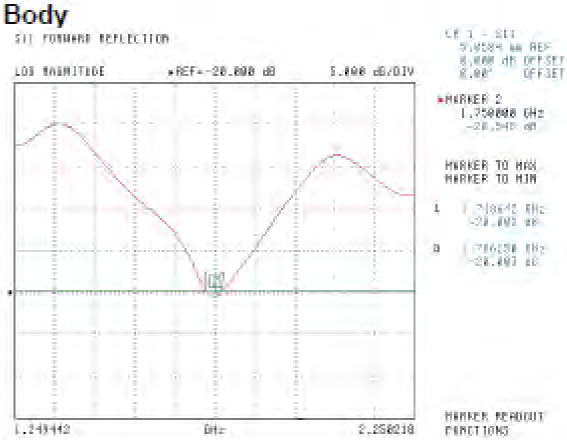
S11 Parameter Return Loss

Head



Frequency range 1.699 GHz to 1.799 GHz

Body



Frequency range 1.718 GHz to 1.786 GHz

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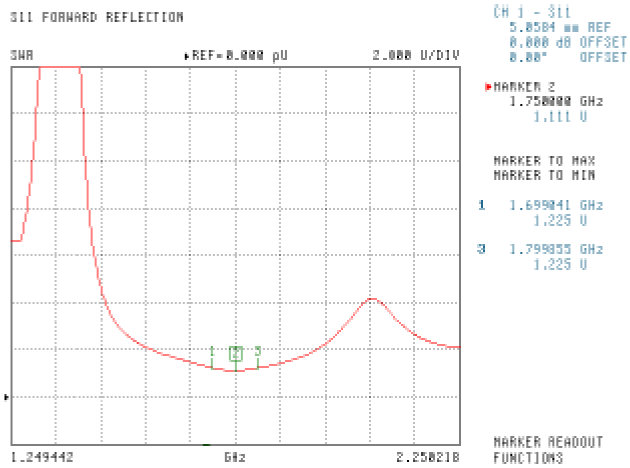
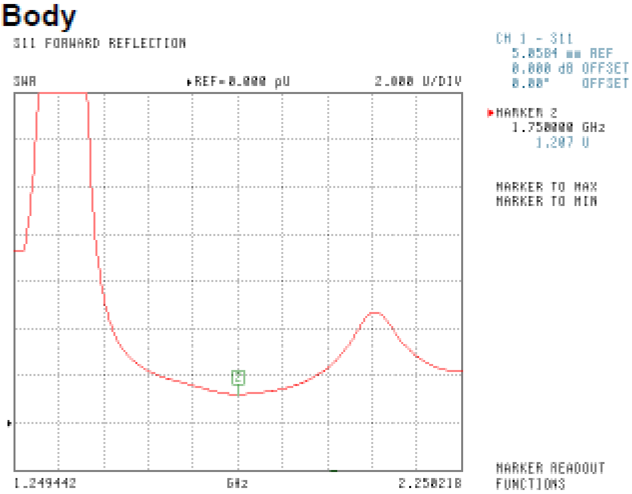
Division of APREL Laboratories.

SWR

Head



Body



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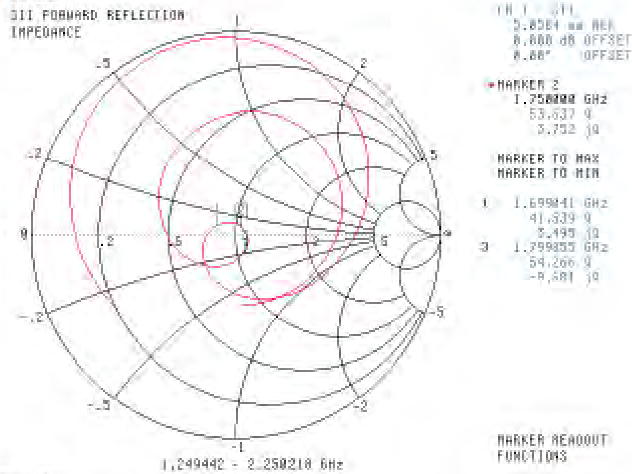
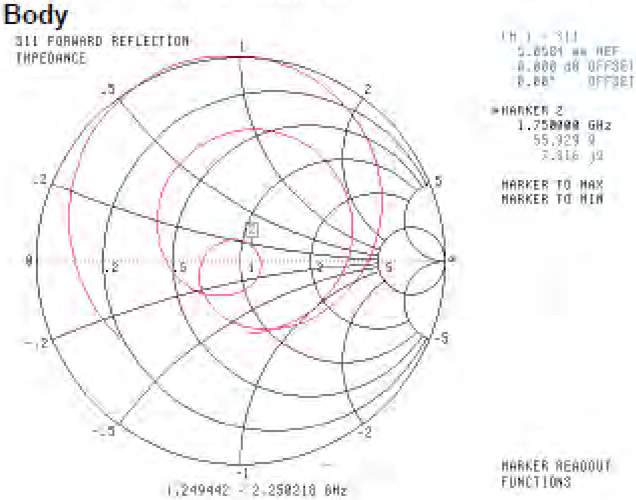
Division of APREL Laboratories.

Smith Chart Dipole Impedance

Head



Body



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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

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

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

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

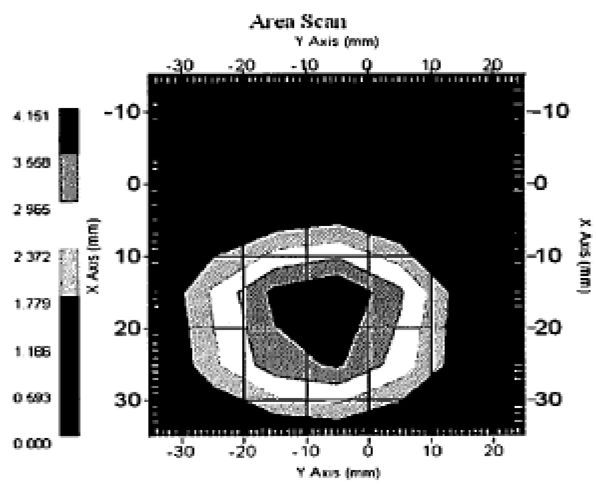
Electrical Specification 1900MHz

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



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

- 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
- 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
- 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)
- 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

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)**

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

NCL Calibration Laboratories
Division of APREL Inc.

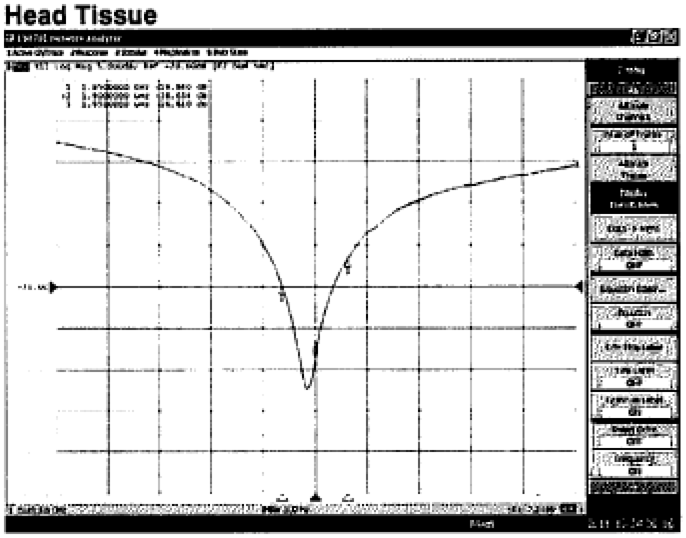
Electrical Calibration

Electrical Specification 1900MHz

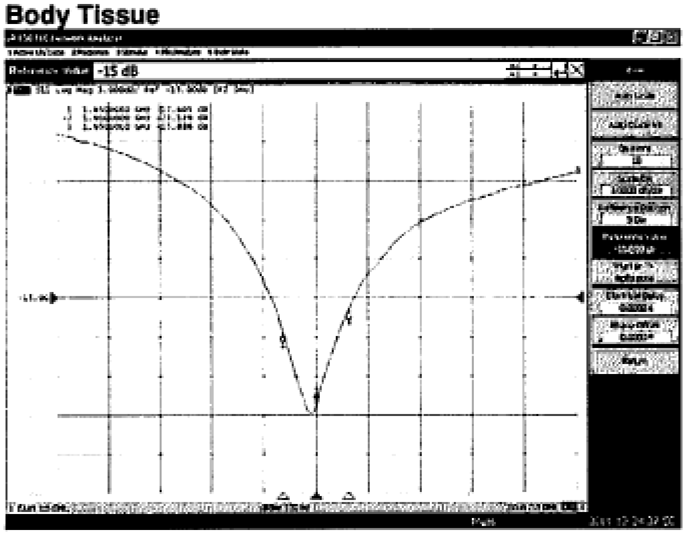
Forward Reflection

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

Head Tissue



Body Tissue



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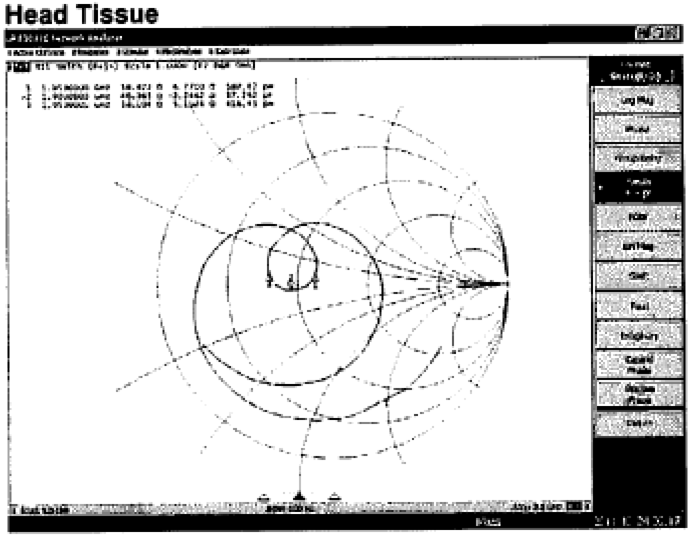
NCL Calibration Laboratories

Division of APREL Inc.

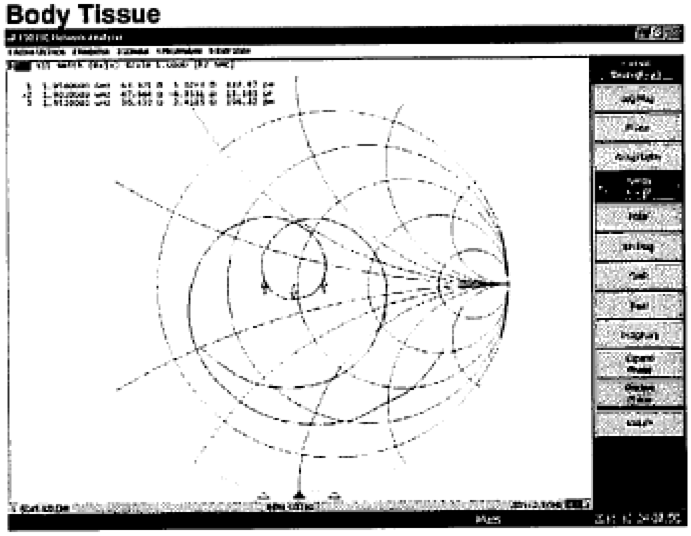
Electrical Specification 1900MHz
Impedance

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

Head Tissue



Body Tissue



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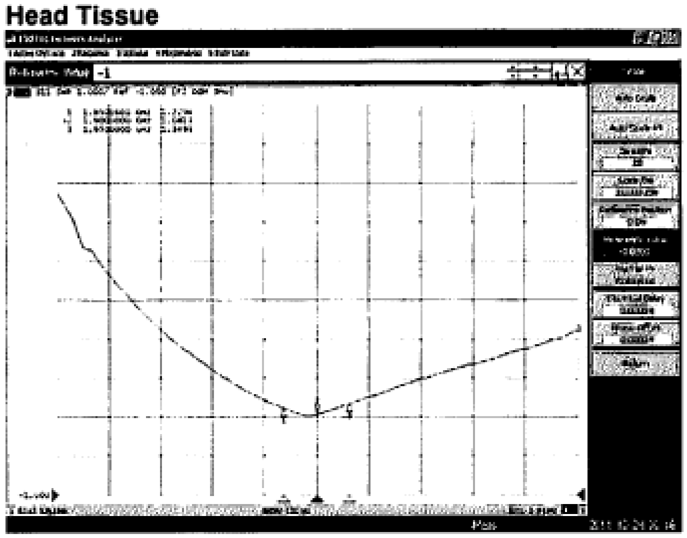
NCL Calibration Laboratories
Division of APREL Inc.

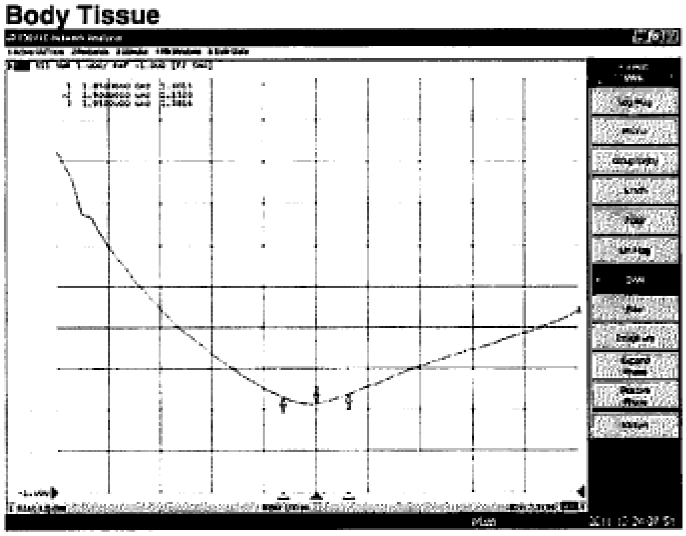
Electrical Specification 1900MHz
Standing Wave Ratio

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

Head Tissue



Body Tissue



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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.

NCL CALIBRATION LABORATORIES

Calibration File No: DC-1285
Project Number: BACL-dipole-cal-5612

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 Validation Dipole (Head & Body)

Manufacturer: APREL Laboratories
Part number: D-2450-S-1
Frequency: 2450 MHz
Serial No: BCL-141

Customer: Bay Area Compliance Laboratory

Calibrated: 25th July 2011
Released on: 27th July 2011

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

Released By: ______________________

NCL CALIBRATION LABORATORIES

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

Division of APREL Lab.
TEL: (613) 435-8300
FAX: (613) 432-8306

8.19.2011

NCL Calibration Laboratories
Division of APREL Laboratories.

Conditions

Dipole BCL-141 was received from customer in good condition for re-calibration, SMA connector required cleaning prior to 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 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	245025437	Nov.4, 2011
Power Sensor Anritsu MA2481D	103555	Nov 4, 2011
Attenuator HP 8495A (70dB) 1	944A10711	Sept. 14, 2011
Network Analyzer Anritsu MT8801C	MB11855	Feb. 8, 2012
Secondary Measurement Standards		
Signal Generator Agilent E4438C	-506 MY55182336	June 7, 2012

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

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

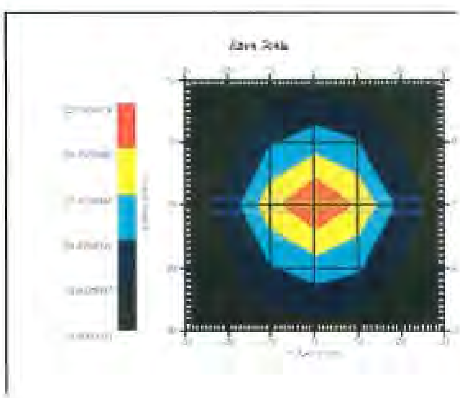
Length: 51.5 mm
Height: 30.4 mm

Electrical Specification 2450MHz

Tissue Type	Return Loss:	SWR:	Impedance:
Head	-29.565	1.076u	52.887
Body	-25.834	1.111u	55.110

System Validation Results

Tissue	Frequency	1 Gram	10 Gram	Peak
Head	2450MHz	54.075	24.19	113.98
Body	2450MHz	53.115	24.011	109.960



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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 BCL-141. The calibration routine consisted of a three-step process. Step 1 was a mechanical verification of the dipole to ensure that it meets the mechanical specifications. Step 2 was an Electrical Calibration for the Validation Dipole, where the SWR, Impedance, and the Return loss were assessed. Step 3 involved a System Validation using the ALSAS-10U, along with APREL E-020 130 MHz to 26 GHz E-Field Probe Serial Number 212.

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"

Conditions

Dipole BCL-141 was received from customer in good condition for re-calibration, SMA connector required cleaning prior to calibration.

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)**

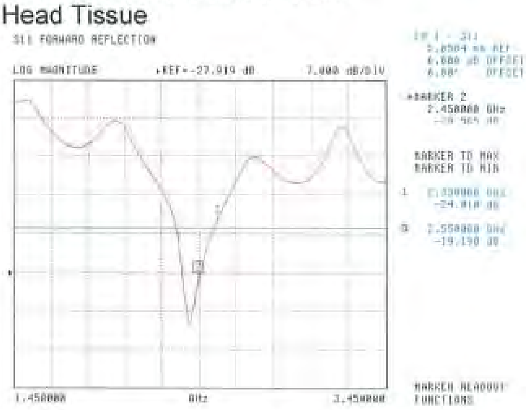
This page has been reviewed for content and attested to by signature within this document.

NCL Calibration Laboratories
Division of APREL Laboratories.

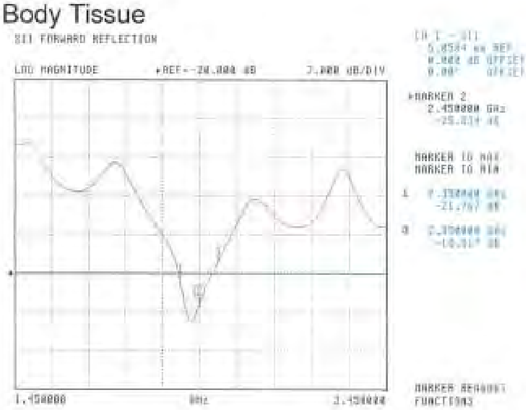
Tissue Type	Measured Epsilon	Measured Sigma
Head	38.06	1.86
Body	50.22	2.03

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

S11 Parameter Return Loss
Head Tissue



Body Tissue



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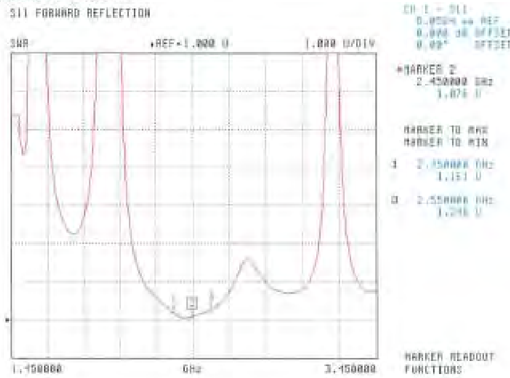
NCL Calibration Laboratories

Division of APREL Laboratories.

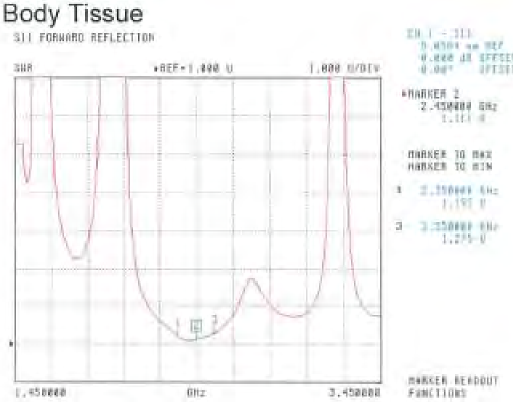
Tissue Type	Measured Epsilon	Measured Sigma
Head	38.06	1.86
Body	50.22	2.03

SWR

Head Tissue



Body Tissue



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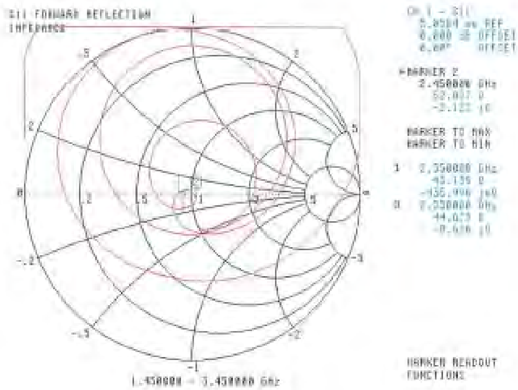
NCL Calibration Laboratories
Division of APREL Laboratories.

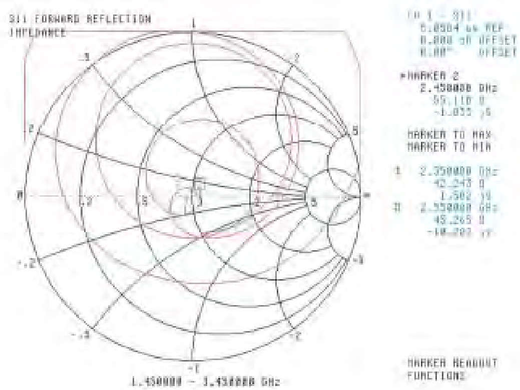
Tissue Type	Measured Epsilon	Measured Sigma
Head	38.06	1.86
Body	50.22	2.03

Smith Chart Dipole Impedance

Head Tissue



Body Tissue



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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

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

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

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

Accreditation No.: **SCS 108**

Client **BACL**

Certificate No: **D5GHz-1001_Aug11**

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN: 1001

Calibration procedure(s): QA CAL-22.v1
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: August 23, 2011

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe EX3DV4	SN: 3503	04-Mar-11 (No. EX3-3503_Mar11)	Mar-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 23, 2011

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

Certificate No: D5GHz-1001_Aug11 Page 1 of 13

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

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

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5500 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.7 ± 6 %	4.49 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.70 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**76.8 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.21 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**22.0 mW /g ± 16.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.3 ± 6 %	4.79 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.96 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**79.4 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.27 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**22.6 mW / g ± 16.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.8 ± 6 %	5.09 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.23 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**72.0 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.05 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**20.4 mW / g ± 16.5 % (k=2)**

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.8 ± 6 %	5.45 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.50 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**74.9 mW / g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.10 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**21.0 mW / g ± 17.6 % (k=2)**

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.3 ± 6 %	5.86 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.94 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**79.3 mW / g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.21 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**22.1 mW / g ± 17.6 % (k=2)**

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.7 ± 6 %	6.27 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.43 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**74.2 mW / g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.06 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**20.6 mW / g ± 17.6 % (k=2)**

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	51.4 Ω - 10.1 jΩ
Return Loss	- 20.0 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	51.3 Ω - 2.1 jΩ
Return Loss	- 32.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	56.7 Ω - 0.3 jΩ
Return Loss	- 24.1 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	49.5 Ω - 9.6 jΩ
Return Loss	- 20.4 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	49.3 Ω - 1.6 jΩ
Return Loss	- 35.2 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	54.8 Ω + 1.8 jΩ
Return Loss	- 26.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 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.
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	April 02, 2003

DASY5 Validation Report for Head TSL

Date: 22.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHz; Serial: D5GHzV2 - SN: 1001

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.49 mho/m; ε_r = 35.7; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5500 MHz; σ = 4.79 mho/m; ε_r = 35.3; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5800 MHz; σ = 5.09 mho/m; ε_r = 34.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

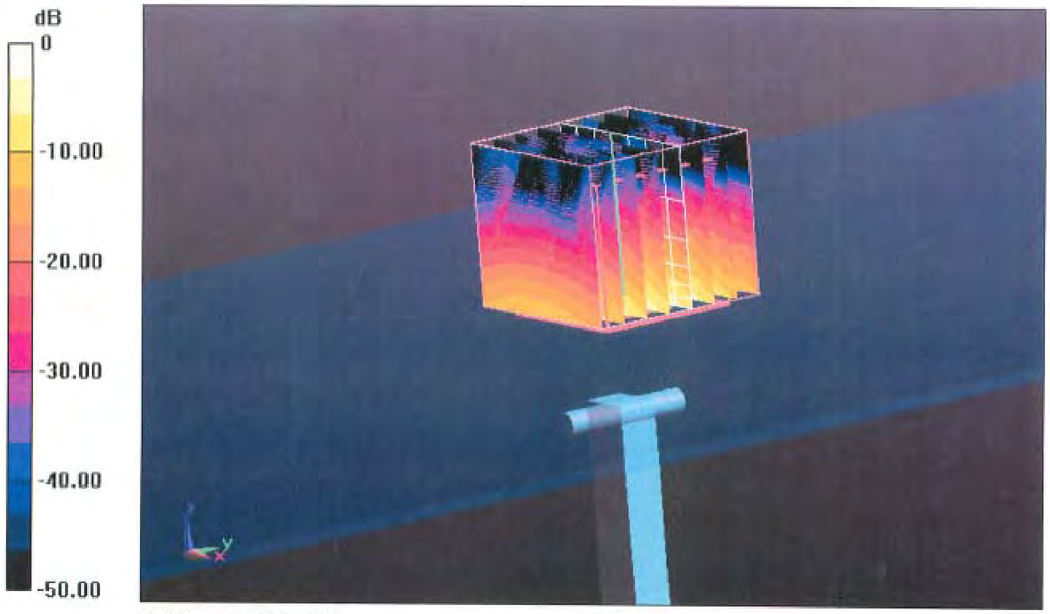
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41), ConvF(4.91, 4.91, 4.91), ConvF(4.81, 4.81, 4.81); Calibrated: 04.03.2011
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.587 V/m; Power Drift = -0.0082 dB
Peak SAR (extrapolated) = 28.409 W/kg
SAR(1 g) = 7.7 mW/g; SAR(10 g) = 2.21 mW/g
Maximum value of SAR (measured) = 17.676 mW/g

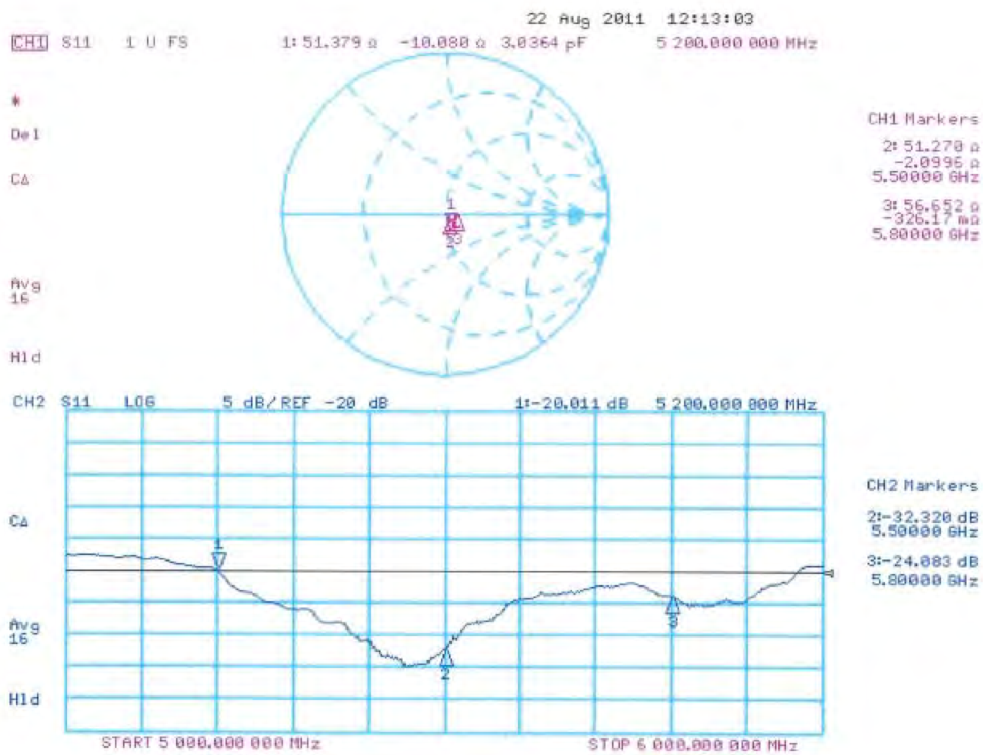
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 60.924 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 31.429 W/kg
SAR(1 g) = 7.96 mW/g; SAR(10 g) = 2.27 mW/g
Maximum value of SAR (measured) = 19.046 mW/g

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 57.308 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 30.086 W/kg
SAR(1 g) = 7.23 mW/g; SAR(10 g) = 2.05 mW/g
Maximum value of SAR (measured) = 17.772 mW/g



0 dB = 17.770mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.08.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHz; Serial: D5GHzV2 - SN: 1001

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.45 mho/m; ε_r = 48.8; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5500 MHz; σ = 5.86 mho/m; ε_r = 48.3; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5800 MHz; σ = 6.27 mho/m; ε_r = 47.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

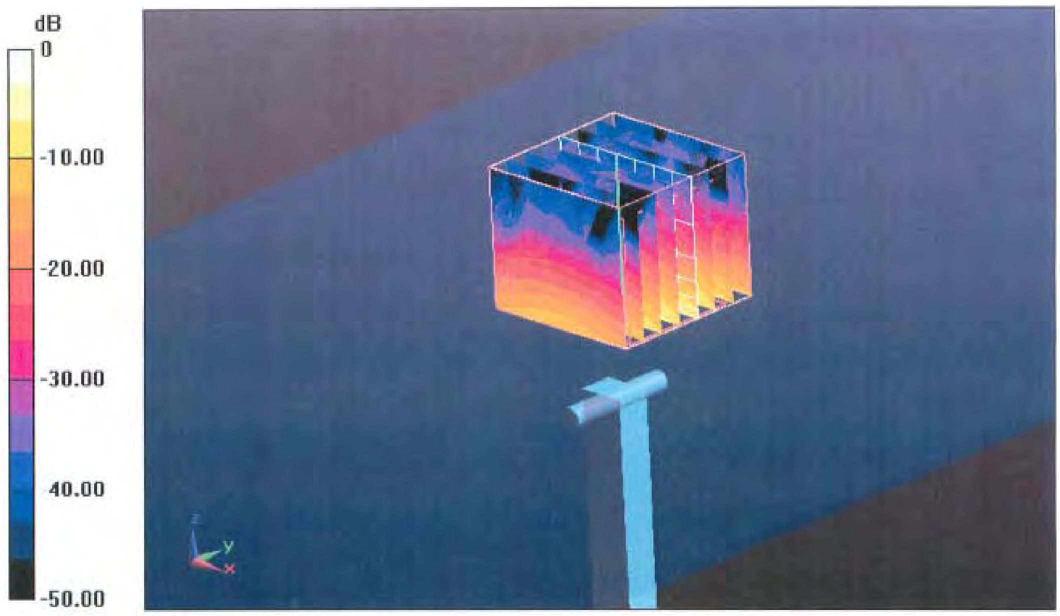
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91), ConvF(4.43, 4.43, 4.43), ConvF(4.38, 4.38, 4.38); Calibrated: 04.03.2011
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.015 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 29.052 W/kg
SAR(1 g) = 7.5 mW/g; SAR(10 g) = 2.1 mW/g
Maximum value of SAR (measured) = 17.252 mW/g

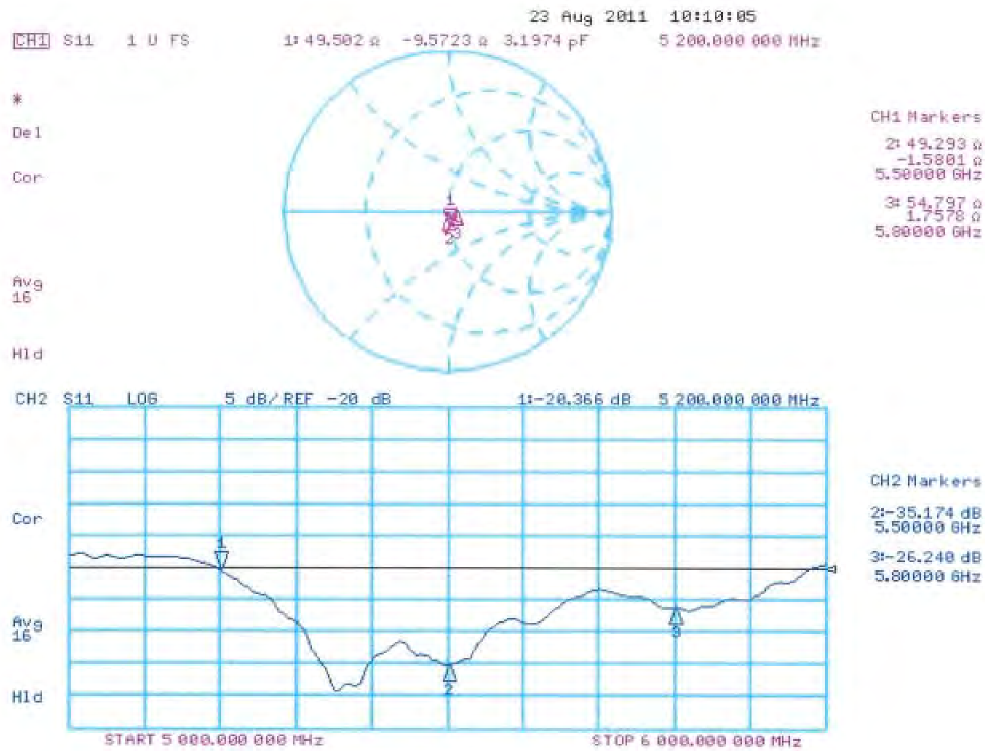
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 57.704 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 33.735 W/kg
SAR(1 g) = 7.94 mW/g; SAR(10 g) = 2.21 mW/g
Maximum value of SAR (measured) = 19.001 mW/g

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 54.075 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 34.299 W/kg
SAR(1 g) = 7.43 mW/g; SAR(10 g) = 2.06 mW/g
Maximum value of SAR (measured) = 18.305 mW/g



0 dB = 18.300mW/g

Impedance Measurement Plot for Body TSL



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16 Appendix D - Test System Verifications Scans

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

System Performance Test (750 MHz, Body)

DUT: Dipole 750 MHz; Type: D750v3; Serial: 1102

Communication System: CW; Frequency: 750 MHz;Duty Cycle: 1:1
Medium parameters used: f = 750 MHz; σ = 0.95 mho/m; ε_r = 55.5; ρ = 1000 kg/m^3
Phantom section: Flat Section , Measurement Standard: DASY4 (High Precision Assessment)

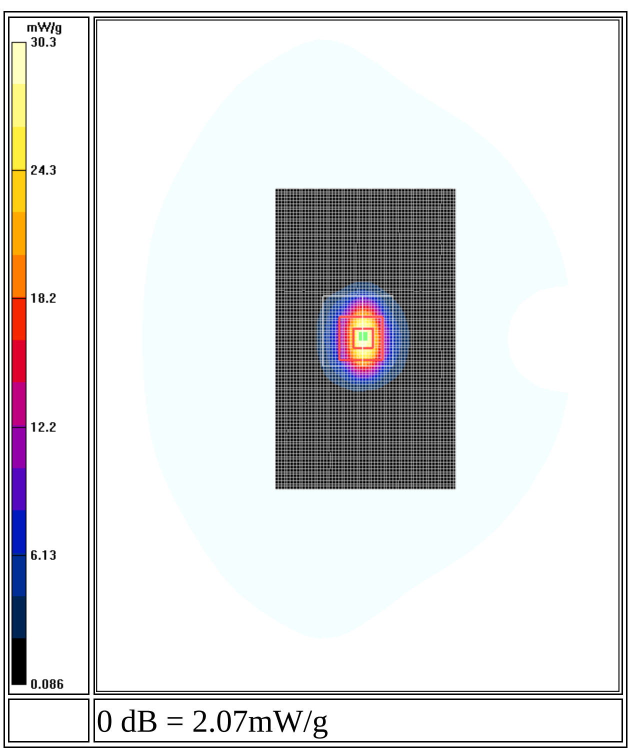
DASY4 Configuration:

- 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=250 mW/Area Scan (61x61x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 2.02 mW/g

d=10mm, Pin=250 mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 46.9 V/m; Power Drift = -0.086 dB
Peak SAR (extrapolated) = 2.76 W/kg

SAR (1 g) = 2.01 mW/g; SAR (10 g) = 1.41 mW/g
Maximum value of SAR (measured) = 2.07 mW/g



750 MHz System Validation with Body Tissue

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

System Performance Test (835 MHz, Body)

DUT: Dipole 835 MHz; Type: ALS-D-835-S-2; Serial: 210-00564

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.98 mho/m; ε_r = 55.8; ρ = 1000 kg/m^3
Phantom section: Flat Section , Measurement Standard: DASY4 (High Precision Assessment)

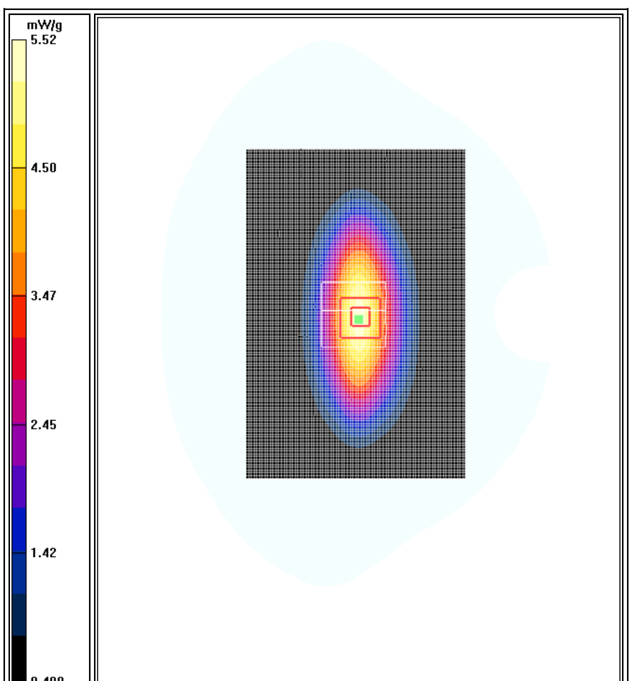
DASY4 Configuration:

- 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=0.5W/Area Scan (81x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 2.02 mW/g

d=10mm, Pin=0.5W/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 76.5 V/m; Power Drift = -0.031 dB
Peak SAR (extrapolated) = 7.42 W/kg

SAR (1 g) = 4.81 mW/g; SAR (10 g) = 3.12 mW/g
Maximum value of SAR (measured) = 5.52mW/g



0 dB = 5.52mW/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; Serial: 198-00304

Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1750 MHz; σ = 1.48 mho/m; ε_r = 51.6; ρ = 1000 kg/m^3
Phantom section: Flat Section , Measurement Standard: DASY4 (High Precision Assessment)

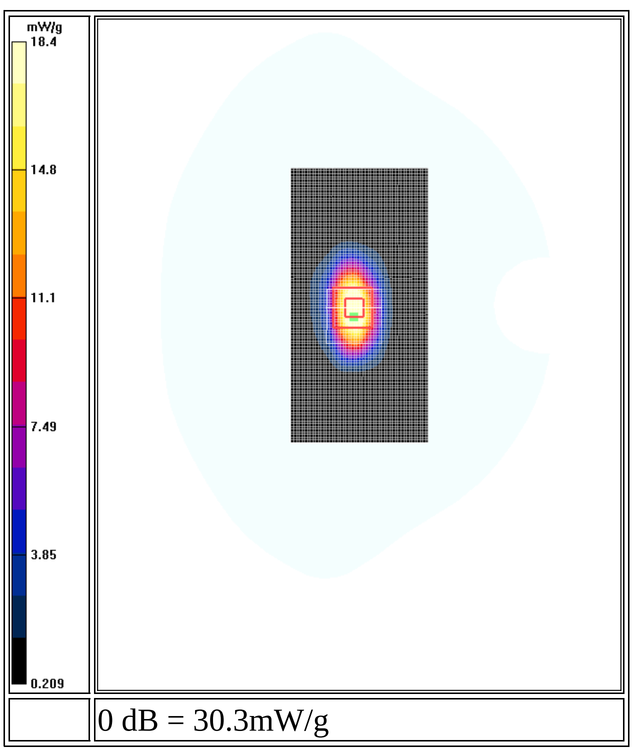
DASY4 Configuration:

- 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=0.5W/Area Scan (51x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 21.5 mW/g

d=10mm, Pin=0.5W/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)

System Performance Test (1900 MHz, Body)

DUT: Dipole 1900 MHz; Type: ALS-D-1900-S-2; Serial: 210-00715

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.46 mho/m; ε_r = 52.1; ρ = 1000 kg/m^3
Phantom section: Flat Section , Measurement Standard: DASY4 (High Precision Assessment)

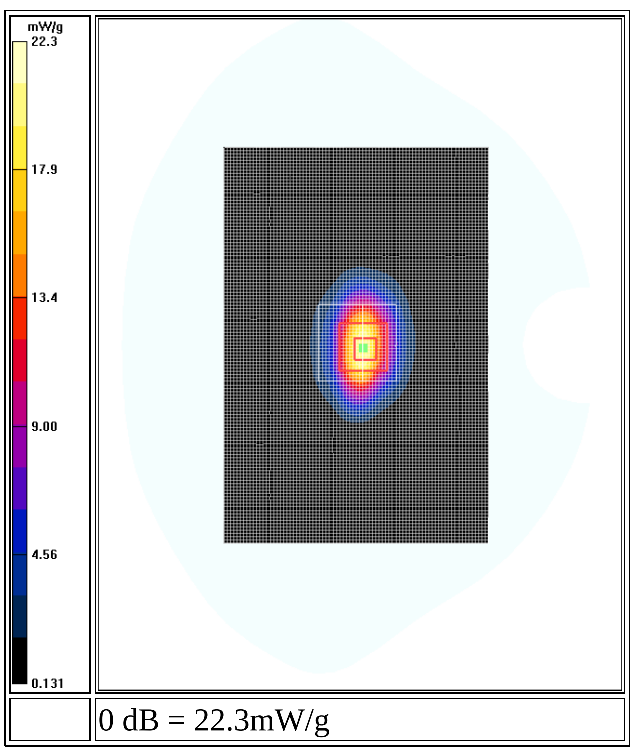
DASY4 Configuration:

- 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=0.5W/Area Scan (81x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 21.0 mW/g

d=10mm, Pin=0.5W/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 129.1 V/m; Power Drift = -0.031 dB
Peak SAR (extrapolated) = 34.3 W/kg

SAR (1 g) = 19.0 mW/g; SAR (10 g) = 8.6 mW/g
Maximum value of SAR (measured) = 22.3 mW/g



1900 MHz System Validation with Body Tissue

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

System Performance Test (2450 MHz, Body)

DUT: Dipole 2450 MHz; Type: D-2450-S-1; Serial: BCL-141

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 2.02 mho/m; ε_r = 50.7; ρ = 1000 kg/m^3
Phantom section: Flat Section , Measurement Standard: DASY4 (High Precision Assessment)

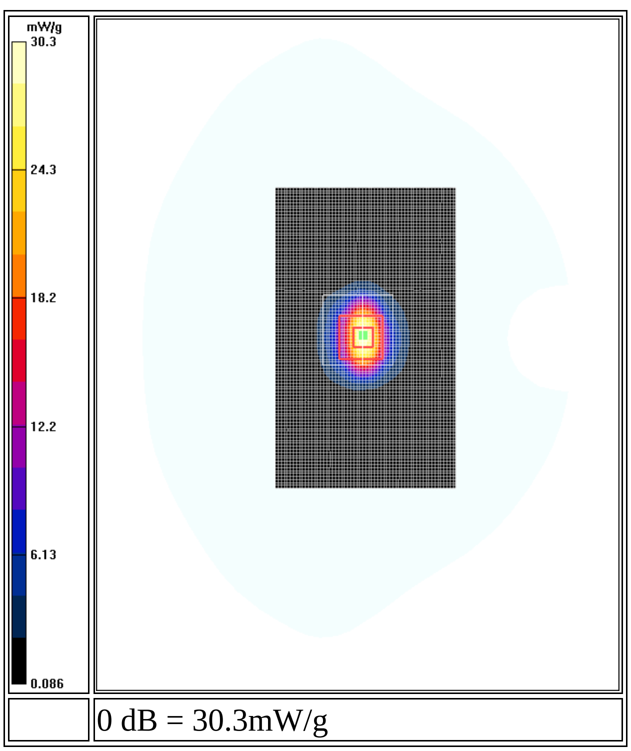
DASY4 Configuration:

- 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=0.5W/Area Scan (61x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 29.8 mW/g

d=10mm, Pin=0.5W/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 122.9 V/m; Power Drift = -0.058 dB
Peak SAR (extrapolated) = 74.4 W/kg

SAR (1 g) = 25.7 mW/g; SAR (10 g) = 11.6 mW/g
Maximum value of SAR (measured) = 30.3 mW/g



2450 MHz System Validation with Body Tissue

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

System Performance Test (5200 MHz, Body)

DUT: Dipole 5 GHz; Type: D5100V2; Serial: 1001

Communication System: CW; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5200 MHz; σ = 5.53 mho/m; ε_r = 49.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

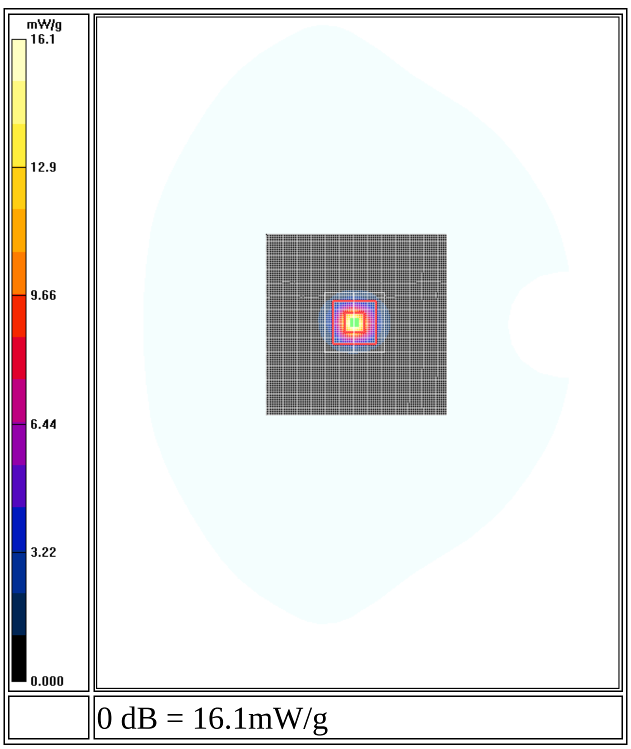
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(4.05, 4.05, 4.05); Calibrated: 8/27/2013
- Sensor-Surface: 2mm (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=100mW, f=5200 MHz/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 17.0 mW/g

d=10mm, Pin=100mW, f=5200 MHz/Zoom Scan (3x3x2mm, graded), dist=2mm (11x11x6)/Cube 0: Measurement grid: dx=3mm, dy=3mm, dz=2mm
Reference Value = 46.7 V/m; Power Drift = 0.048 dB
Peak SAR (extrapolated) = 35.2 W/kg

SAR (1 g) = 7.74 mW/g; SAR (10 g) = 2.17 mW/g
Maximum value of SAR (measured) = 16.1 mW/g



5200 MHz System Validation with Body Tissue

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)
System Performance Test (5800 MHz Body)

DUT: Dipole 5 GHz; Type: D5100V2; Serial: 1001

Communication System: CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 5.8 mho/m; ε_r = 47.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

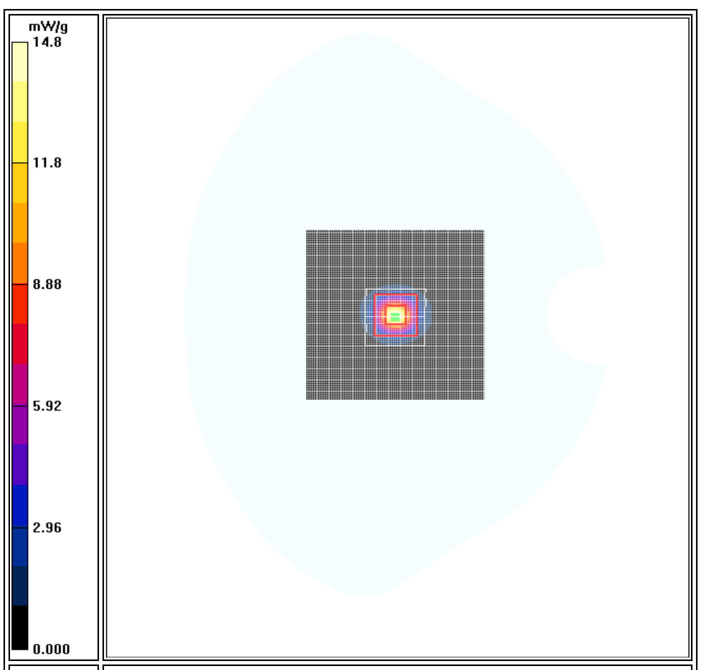
DASY4 Configuration:

- Probe: EX3DV4 - SN3619; ConvF(3.83, 3.83, 3.83); Calibrated: 8/27/2013
- Sensor-Surface: 2mm (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=100mW, f=5800 MHz/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 16.0 mW/g

d=10mm, Pin=100mW, f=5800 MHz/Zoom Scan (3x3x2mm, graded), dist=2mm (11x11x6)/Cube 0: Measurement grid: dx=3mm, dy=3mm, dz=2mm
Reference Value = 42.1 V/m; Power Drift = 0.001 dB
Peak SAR (extrapolated) = 32.0 W/kg

SAR (1 g) = 6.99 mW/g; SAR (10 g) = 1.91 mW/g
Maximum value of SAR (measured) = 14.8 mW/g



0 dB = 14.8mW/g

5800 MHz System Validation with Body Tissue

17 Appendix E – EUT Scan Results

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

Back Side Touch to the Phantom - (Middle Channel)

DUT: Nvidia; Type: Tablet; Serial: 0411414000083

Communication System: GPRS850; Frequency: 836.6 MHz; Duty Cycle: 1:4
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.95 mho/m; ε_r = 52.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

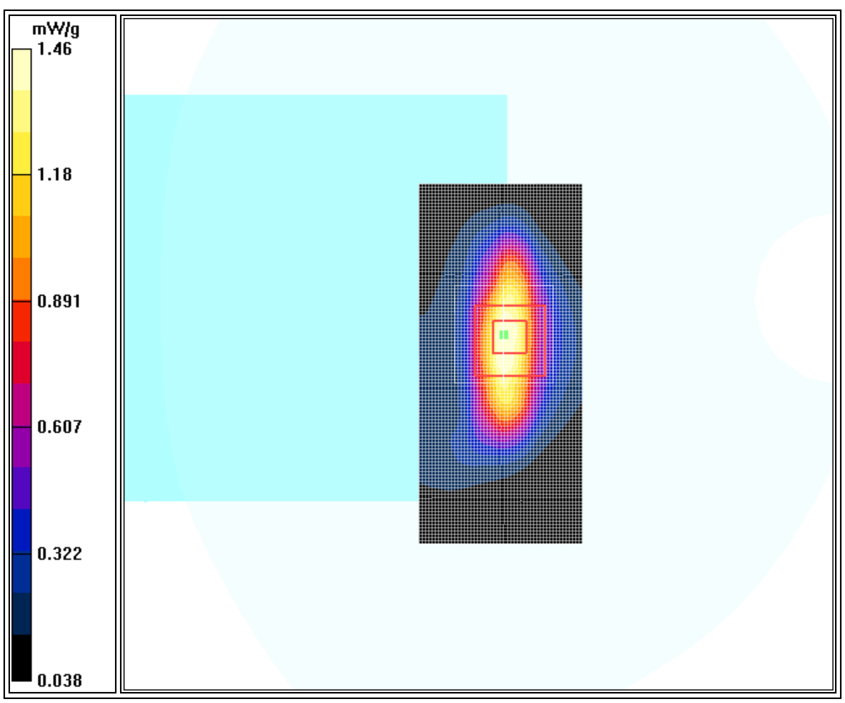
DASY4 Configuration:

- 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

Back Side Touch to the Phantom/Area Scan (51x111x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.50 mW/g

Back Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 36.4 V/m; Power Drift = 0.050 dB
Peak SAR (extrapolated) = 0.465 W/kg

SAR (1 g) = 1.28 mW/g; SAR (10 g) = 0.633 mW/g
Maximum value of SAR (measured) = 1.46 mW/g



#1

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

Back Side Touch to the Phantom - (High Channel)

DUT: Nvidia; Type: Tablet; Serial: 0411414000083

Communication System: GPRS 1900; Frequency: 1908.8 MHz; Duty Cycle: 1:4
Medium parameters used (interpolated): f = 1908.8 MHz; σ = 1.6 mho/m; ε_r = 51; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

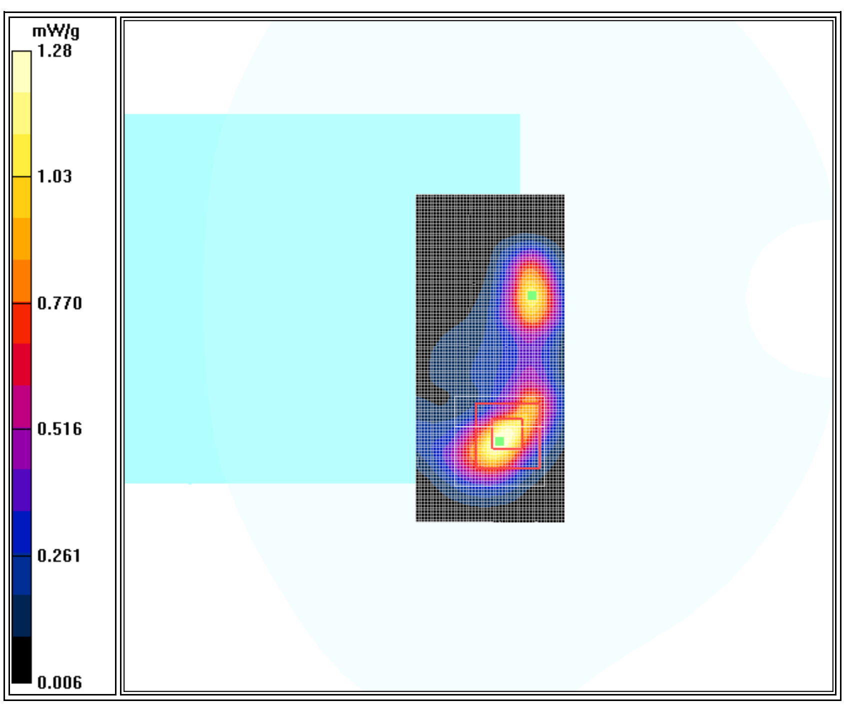
DASY4 Configuration:

- 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

Back Side Touch to the Phantom/Area Scan (51x111x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.30 mW/g

Back Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 26.9 V/m; Power Drift = -0.260 dB
Peak SAR (extrapolated) = 2.72 W/kg

SAR (1 g) = 1.10 mW/g; SAR (10 g) = 0.460 mW/g
Maximum value of SAR (measured) = 1.28 mW/g



#2

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

Back Side Touch to the Phantom - (Middle Channel)

DUT: Nvidia; Type: Tablet; Serial: 0411414000083

Communication System: UMTS Band 5; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.95 mho/m; ε_r = 52.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

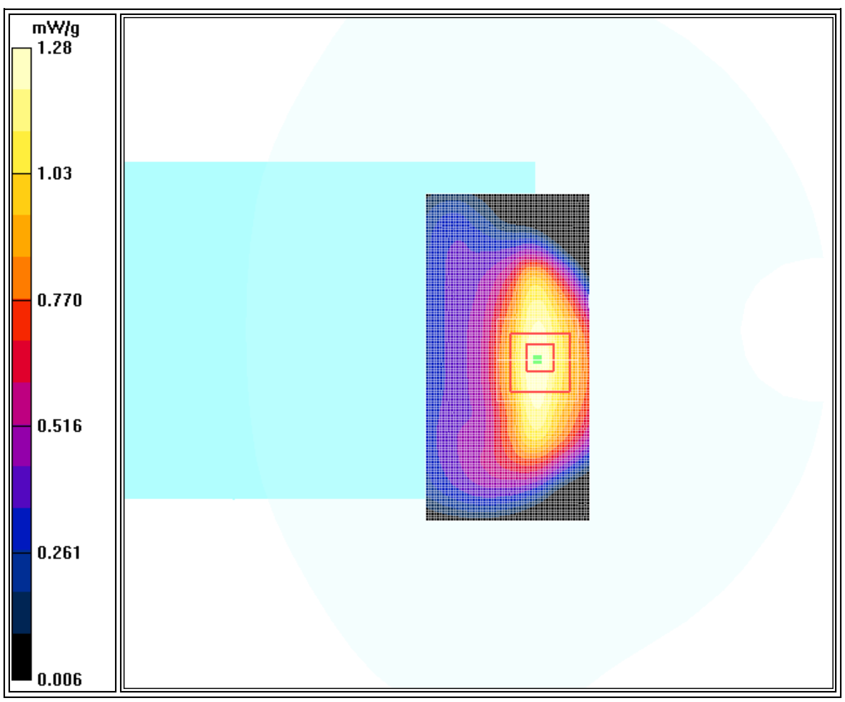
DASY4 Configuration:

- 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

Back Side Touch to the Phantom/Area Scan (61x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.23 mW/g

Back Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 33.9 V/m; Power Drift = -0.210 dB
Peak SAR (extrapolated) = 2.49 W/kg

SAR(1 g) = 1.07 mW/g; SAR(10 g) = 0.532 mW/g
Maximum value of SAR (measured) = 1.23 mW/g



#3

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

Back Side Touch to the Phantom - (Low Channel)

DUT: Nvidia; Type: Tablet; Serial: 0411414000083

Communication System: UMTS Band 4; Frequency: 1712.4 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1712.4 MHz; σ = 1.52 mho/m; ε_r = 50.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

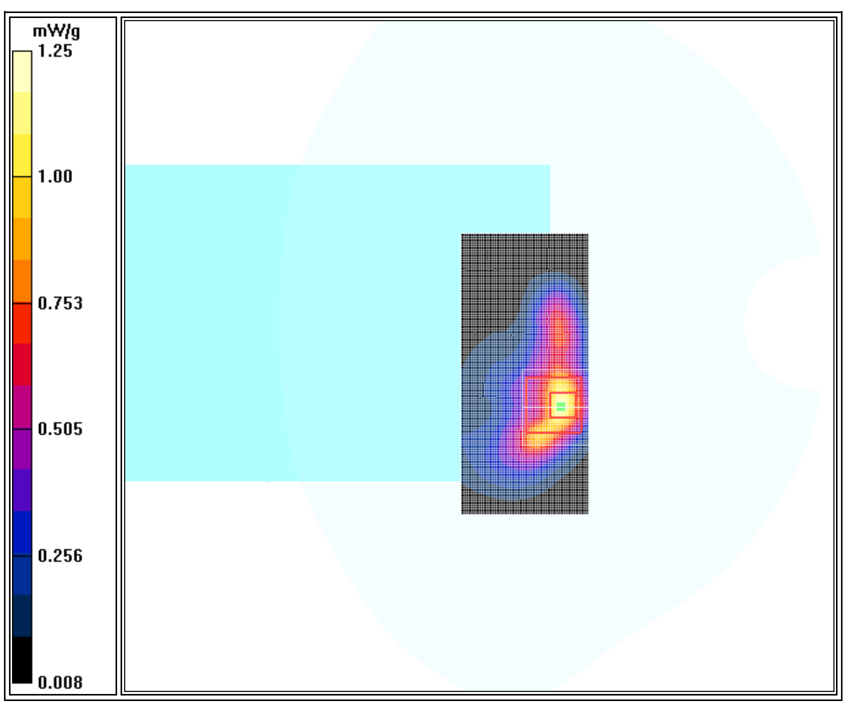
DASY4 Configuration:

- 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

Back Side Touch to the Phantom/Area Scan (51x111x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.21 mW/g

Back Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 22.0 V/m; Power Drift = 0.18dB
Peak SAR (extrapolated) = 2.92 W/kg

SAR (1 g) = 1.06 mW/g; SAR (10 g) = 0.473 mW/g
Maximum value of SAR (measured) = 1.25 mW/g



#4

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

Back Side Touch to the Phantom - (Low Channel)

DUT: Nvidia; Type: Tablet; Serial: 0411414000083

Communication System: UMTS Band 2; Frequency: 1852.4 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1852.4 MHz; σ = 1.54 mho/m; ε_r = 51.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

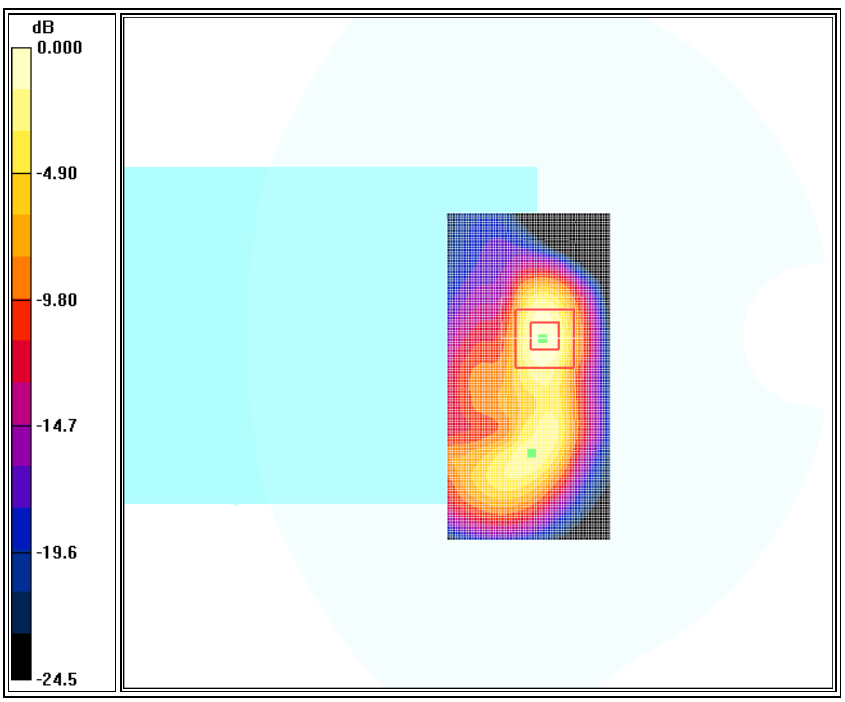
DASY4 Configuration:

- 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

Back Side Touch to the Phantom/Area Scan (61x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.80 mW/g

Back Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 33.3 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.66 W/kg

SAR (1 g) = 1.42 mW/g; SAR (10 g) = 0.565 mW/g
Maximum value of SAR (measured) = 1.72 mW/g



#5

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

Back Side Touch to the Phantom - (High Channel)

DUT: Nvidia; Type: Tablet; Serial: 0411414000083

Communication System: LTE Band 2; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1900 MHz; σ = 1.50 mho/m; ε_r = 52.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

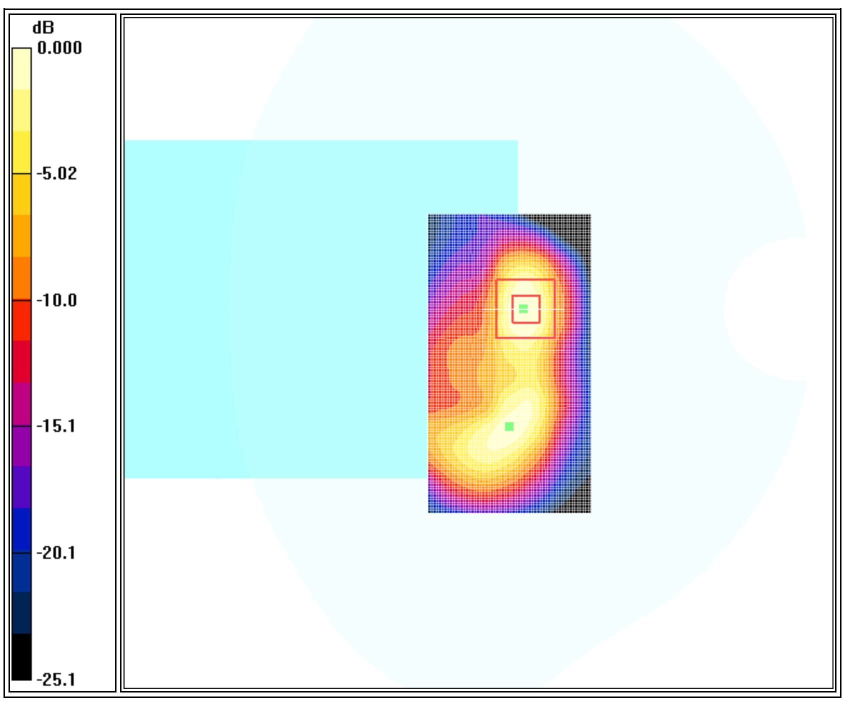
DASY4 Configuration:

- 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

Back Side Touch to the Phantom/Area Scan (61x111x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.83 mW/g

Back Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 32.9 V/m; Power Drift = -0.27 dB
Peak SAR (extrapolated) = 3.4 W/kg

SAR (1 g) = 1.31 mW/g; SAR (10 g) = 0.512 mW/g
Maximum value of SAR (measured) = 1.58 mW/g



#6

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

Back Side Touch to the Phantom - (Low Channel)

DUT: Nvidia; Type: Tablet; Serial: 0411414000083

Communication System: LTE Band 4; Frequency: 1720 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1720 MHz; σ = 1.47 mho/m; ε_r = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

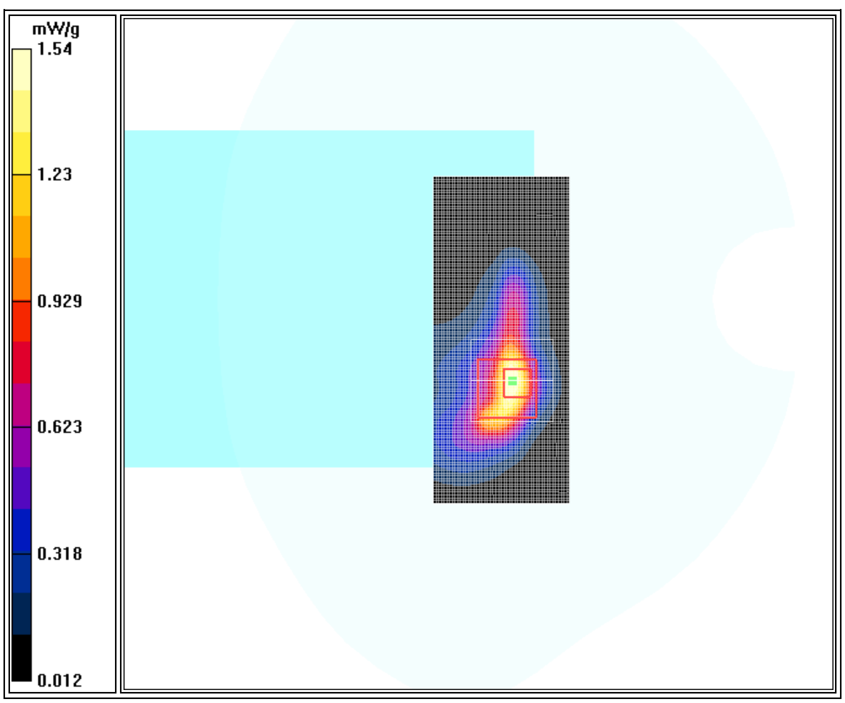
DASY4 Configuration:

- 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

Back Side Touch to the Phantom/Area Scan (51x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.58 mW/g

Back Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.9 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 3.66 W/kg

SAR (1 g) = 1.30 mW/g; SAR (10 g) = 0.559 mW/g
Maximum value of SAR (measured) = 1.54 mW/g



#7

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

Back Side Touch to the Phantom - (Middle Channel)

DUT: Nvidia; Type: Tablet; Serial: 0411414000083

Communication System: LTE Band 5; Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.5 MHz; σ = 0.95 mho/m; ε_r = 52.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

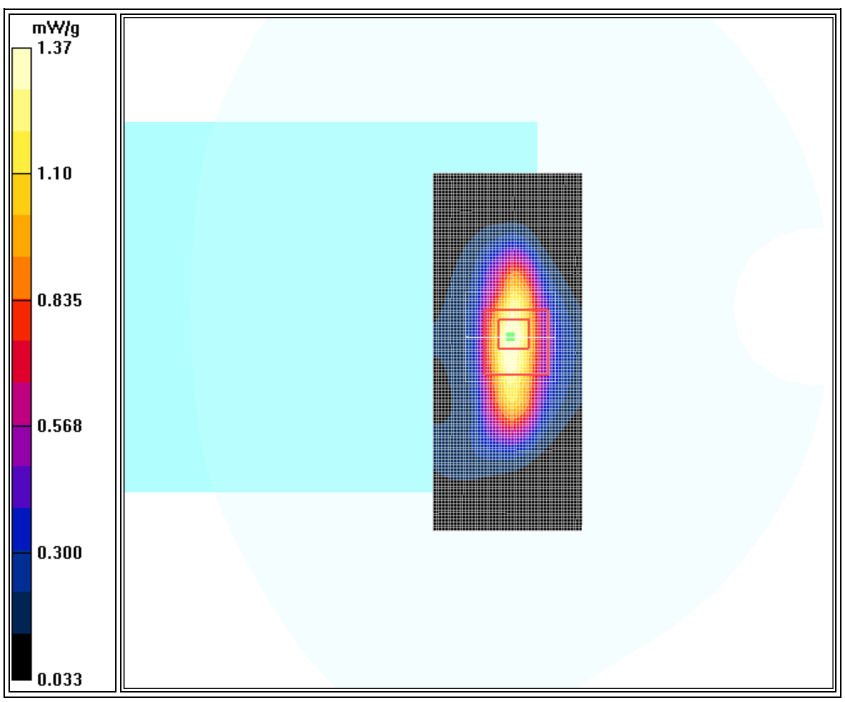
DASY4 Configuration:

- 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

Back Side Touch to the Phantom/Area Scan (51x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.40 mW/g

Back Side 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 = -0.10 dB
Peak SAR (extrapolated) = 2.89 W/kg

SAR (1 g) = 1.18 mW/g; SAR (10 g) = 0.584 mW/g
Maximum value of SAR (measured) = 1.37 mW/g



#8

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

Back Side Touch to the Phantom - (Low Channel)

DUT: Nvidia; Type: Tablet; Serial: 0411414000083

Communication System: LTE Band 7; Frequency: 2510 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2510 MHz; σ = 2.02 mho/m; ε_r = 50.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

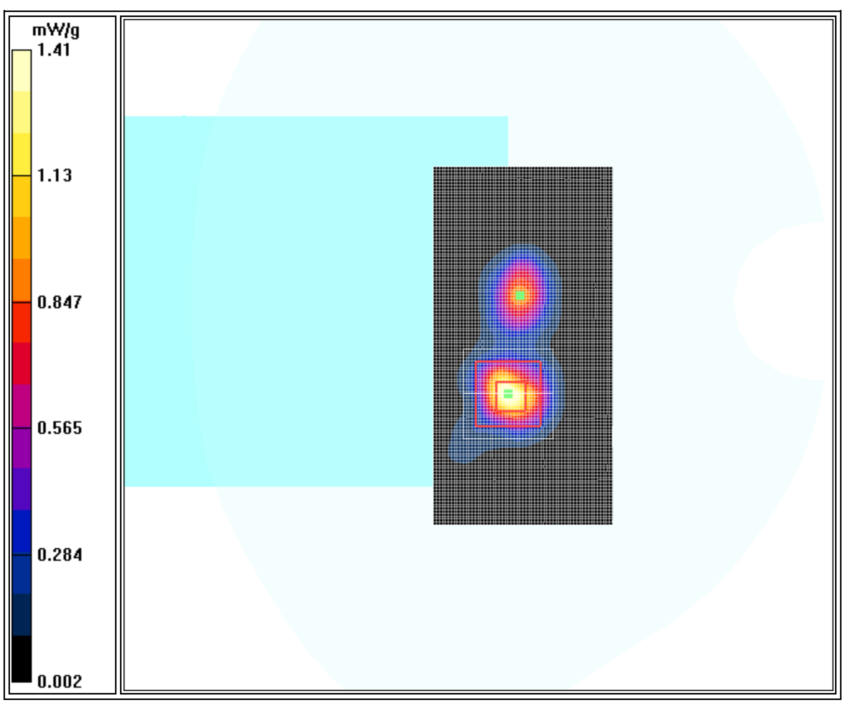
DASY4 Configuration:

- 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

Back Side Touch to the Phantom/Area Scan (61x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.51 mW/g

Back Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 21.3 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 4.35 W/kg

SAR (1 g) = 1.29 mW/g; SAR (10 g) = 0.460 mW/g
Maximum value of SAR (measured) = 1.41 mW/g



#9

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

Back Side Touch to the Phantom - (Middle Channel)

DUT: Nvidia; Type: Tablet; Serial: 0411414000083

Communication System: UMTS Band 17; Frequency: 710 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 710 MHz; σ = 0.96 mho/m; ε_r = 55.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

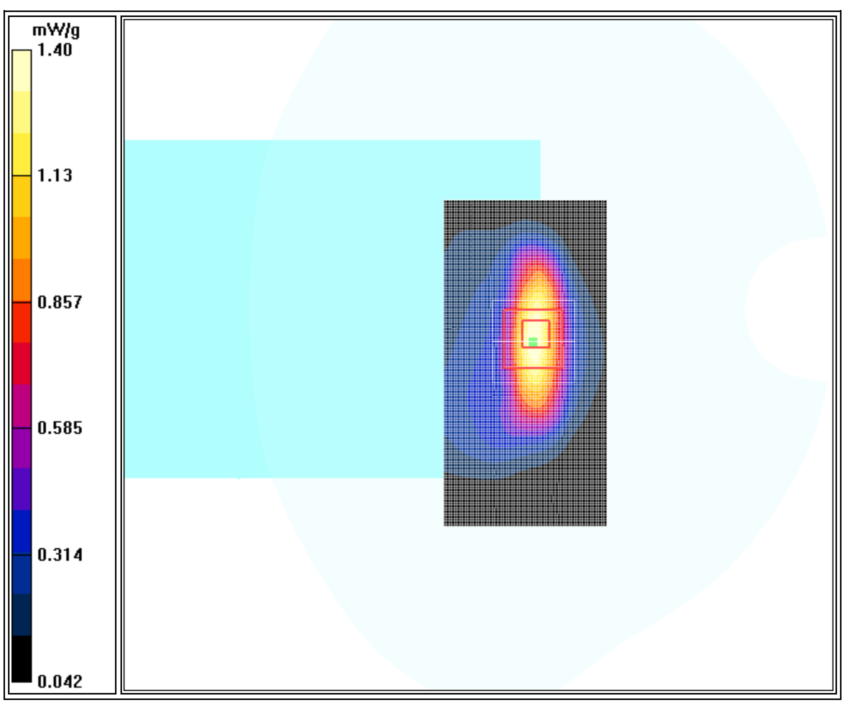
DASY4 Configuration:

- 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

Back Side Touch to the Phantom/Area Scan (61x121x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.80 mW/g

Back Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 38.0 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 3.17 W/kg

SAR (1 g) = 1.21 mW/g; SAR (10 g) = 0.588 mW/g
Maximum value of SAR (measured) = 1.40 mW/g



#10

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

Back Side Touch to the Phantom - (Middle Channel)

DUT: Nvidia; Type: Tablet; Serial: 0411414000083

Communication System: WiFi Band 5.8 GHz; Frequency: 5825 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5825 MHz; σ = 6.25 mho/m; ε_r = 48.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

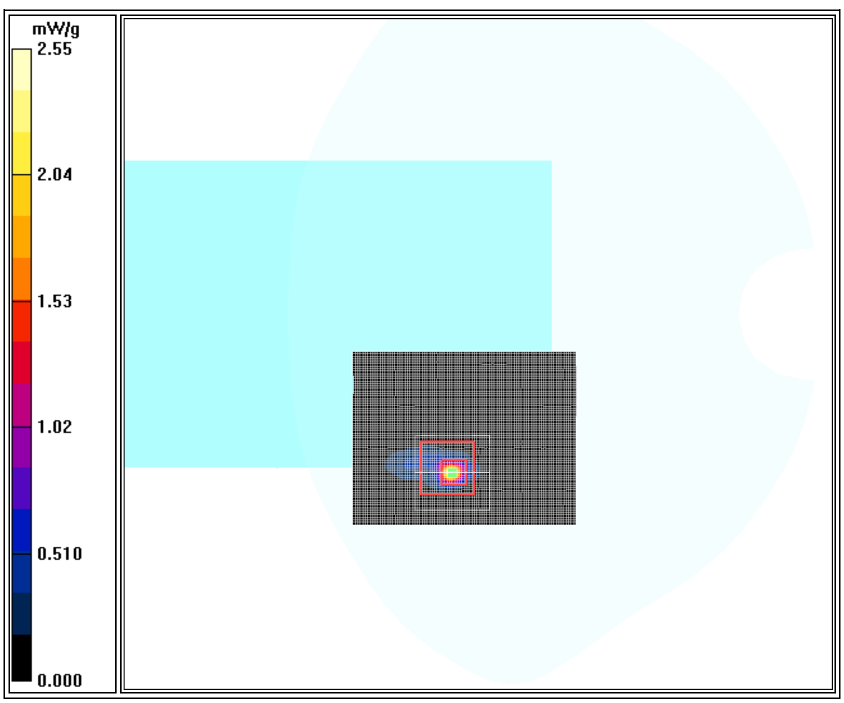
DASY4 Configuration:

- 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

Back Side Touch to the Phantom/Area Scan (91x71x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 2.43 mW/g

Back Side Touch to the Phantom/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 37.2 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.17 W/kg

SAR (1 g) = 1.4 mW/g; SAR (10 g) = 0.276 mW/g
Maximum value of SAR (measured) = 2.55 mW/g



#11

18 Appendix G – Test Setup Photos

18.1 Tablet Back Side Touch to the Flat Phantom Setup Photo

Confidentiality

18.2 Tablet Bottom Side Touch to the Flat Phantom Setup Photo

Confidentiality

18.3 Tablet Right Side Edge Touch to the Flat Phantom Setup Photo

Confidentiality

18.4 Tablet Left Side Edge Touch to the Flat Phantom Setup Photo

Confidentiality

18.5 Tablet Back Side to the Flat Phantom at 14 mm distance Setup Photo

Confidentiality

18.6 Tablet Bottom Side to the Flat Phantom at 11 mm distance Setup Photo

Confidentiality

19 Appendix H – EUT Photos

19.1 Tablet Front View Photo

Confidentiality

19.2 Tablet Rear View Photo

Confidentiality

19.3 Tablet Cover off View Photo

Confidentiality

20 Appendix I - Informative References

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