FCC SAR Test Report

APPLICANT	**:**	**LG Electronics Inc.**
EQUIPMENT	**:**	**Tablet**
BRAND NAME	**:**	**LG Electronics Inc.**
MODEL NAME	**:**	**LG-V490**
FCC ID	**:**	**ZNFV490**
STANDARD	**:**	**FCC 47 CFR Part 2 (2.1093)** **ANSI/IEEE C95.1-1992** **IEEE 1528-2003**

We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and had been in compliance with the applicable technical standards.

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

Eric Huang

Reviewed by: Eric Huang / Deputy Manager

Jones Tsai

Approved by: Jones Tsai / Manager

ilac-MRA

TAF
Testing Laboratory
1190

SPORTON INTERNATIONAL INC.

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA451713	Rev. 01	Initial issue of report	Jul. 11, 2014
FA451713	Rev. 02	Corrected the GSM1900 SPLSR result on page41.	Jul. 18, 2014
FA451713	Rev. 03	1. Added verification of proximity sensor power reduction in appendix D. 2. Changed setup photo in appendix E.	Jul. 25, 2014

1. *Statement of Compliance*

The maximum results of Specific Absorption Rate (SAR) found during testing for **LG-V490**, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary	
		Body 1g SAR (W/kg)	Simultaneous Transmission 1g SAR (W/kg)
PCB	GSM850	1.18	1.53
	GSM1900	**1.20**	
	WCDMA Band V	0.80	
	WCDMA Band II	1.13	
	LTE Band 4	0.69	
	LTE Band 7	1.17	
DTS	WLAN 2.4GHz Band	0.67	1.46
	WLAN 5.8GHz Band	0.13	
NII	WLAN 5.2GHz Band	0.33	1.53
	WLAN 5.3GHz Band	0.34	
	WLAN 5.5GHz Band	0.17	
Date of Testing:		06/23/2014 ~ 07/01/2014	

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2003.

2. *Administration Data*

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978

Applicant	
Company Name	LG Electronics Inc.
Address	60-39, Kasan-dong, Keumchun-ku, Seoul Korea Zip code: 153-023

Manufacturer	
Company Name	LG ELECTRONICS MOBILECOMM U.S.A., INC
Address	100 SYLVAN AVENUE ENGEWOOD CLIFFS, NEW JERSEY, 07632, U.S.A.

3. Guidance Standard

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

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2003
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- FCC KDB 865664 D02 SAR Reporting v01r01
- FCC KDB 447498 D01 General RF Exposure Guidance v05r02
- FCC KDB 248227 D01 SAR meas for 802 11abg v01r02
- FCC KDB 616217 D04 SAR for laptop and tablets v01r01
- FCC KDB 941225 D01 SAR test for 3G devices v02
- FCC KDB 941225 D02 HSPA and 1x Advanced v02r02
- FCC KDB 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- FCC KDB 941225 D05 SAR for LTE Devices v02r03

4. Equipment Under Test (EUT)

4.1 General Information

Product Feature & Specification	
Equipment Name	Tablet
Brand Name	LG Electronics Inc.
Model Name	LG-V490
FCC ID	ZNFV490
IMEI Code	Sample for SAR testing: 004402346610060 Sample for conducted measurement: 004402346611233
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	• GPRS/EGPRS • RMC 12.2Kbps • HSDPA • HSUPA • DC-HSDPA • LTE: QPSK, 16QAM • 802.11a/b/g/n HT20/HT40 • Bluetooth v3.0 EDR，Bluetooth v4.0+LE
HW Version	Rev. A
SW Version	V107a-Op1-HQ
EUT Stage	Production Unit
Remark: 1. This device supports Hotspot and WiFi Direct capability, the detail operation channels and frequency bands which can be referred to "Operational Description"	

4.2 Maximum Tune-up Limit

Mode / Band	Burst Average Power (dBm)			
	GSM 850		GSM 1900	
Output Power Status	Full power mode	Reduced Power mode	Full power mode	Reduced Power mode
GPRS (GMSK, 1 Tx slot)	33.20	25.70	30.70	21.70
GPRS (GMSK, 2 Tx slots)	32.20	25.70	29.70	21.70
GPRS (GMSK, 3 Tx slots)	30.20	23.20	27.70	20.70
GPRS (GMSK, 4 Tx slots)	28.20	23.20	25.70	17.00
EDGE (8PSK, 1 Tx slot)	27.70	21.20	26.20	20.70
EDGE (8PSK, 2 Tx slots)	26.70	21.20	25.20	20.70
EDGE (8PSK, 3 Tx slot)	25.70	21.20	24.20	20.70
EDGE (8PSK, 4 Tx slots)	24.70	21.20	23.20	17.00

Mode / Band	Average Power (dBm)			
	WCDMA Band V		WCDMA Band II	
Output Power Status	Full power mode	Reduced Power mode	Full power mode	Reduced Power mode
RMC 12.2K	24.70	18.20	23.20	11.70
HSDPA Subtest-1	24.70	18.20	23.20	11.70
DC-HSDPA Subtest-1	24.70	18.20	23.20	11.70
HSUPA Subtest-5	24.70	18.20	23.20	11.70

Mode	Average power(dBm)	
	Full power mode	Reduced Power mode
LTE Band 4	23.70	10.90
LTE Band 7	23.70	10.90

Mode		Average Power (dBm)
2.4GHz	802.11b	13.00
	802.11g	10.00
	802.11n-HT20	8.00
5GGHz	802.11a	9.50
	802.11n-HT20	9.50
	802.11n-HT40	9.50
Bluetooth v3.0+EDR		7.00
Bluetooth v4.0+LE		3.00

4.3 General LTE SAR Test and Reporting Considerations

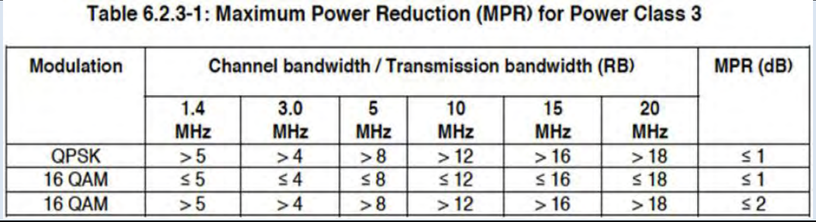
Summarized necessary items addressed in KDB 941225 D05 v02r03	
FCC ID	ZNFV490
Equipment Name	TABLET
Operating Frequency Range of each LTE transmission band	LTE Band 4: 1710.7 MHz ~ 1754.3 MHz LTE Band 7: 2502.5 MHz ~ 2567.5 MHz
Channel Bandwidth	LTE Band 4: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz. LTE Band 7: 5MHz, 10MHz, 15MHz, 20MHz
uplink modulations used	QPSK, and 16QAM
LTE Voice / Data requirements	Data only
LTE MPR permanently built-in by design	
LTE A-MPR	In the base station simulator configuration, Network Setting value is set to NS_01 to disable A-MPR during SAR testing and the LTE SAR tests was transmitting on all TTI frames (Maximum TTI)
Spectrum plots for RB configuration	A properly configured base station simulator was used for the SAR and power measurement; therefore, spectrum plots for each RB allocation and offset configuration are not included in the SAR report.
Power reduction applied to satisfy SAR compliance	Yes, proximity sensor.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth (RB)						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

Transmission (H, M, L) channel numbers and frequencies in each LTE band

LTE Band 4

	Bandwidth 1.4 MHz		Bandwidth 3 MHz		Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	19957	1710.7	19965	1711.5	19975	1712.5	20000	1715	20025	1717.5	20050	1720
M	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5	20175	1732.5
H	20393	1754.3	20385	1753.5	20375	1752.5	20350	1750	20325	1747.5	20300	1745

LTE Band 7

	Bandwidth 5 MHz		Bandwidth 10 MHz		Bandwidth 15 MHz		Bandwidth 20 MHz	
	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)	Ch. #	Freq. (MHz)
L	20775	2502.5	20800	2505	20825	2507.5	20850	2510
M	21100	2535	21100	2535	21100	2535	21100	2535
H	21425	2567.5	21400	2565	21375	2562.5	21350	2560

5. Proximity Sensor Triggering Test

This device uses the proximity sensor to trigger power reduction for SAR compliance, when the device is close to the human body.

According to FCC KDB 616217 D04 Section6, proximity sensor triggering distance and coverage should be verified to identify the proper SAR test separation distances, and the test data is included in the “Sensor Triggering Data Summary” and appendix D. For each exposure position at which proximity sensor triggers the power reduction, the triggering distance minus 1 mm is determined to be the SAR test separation for normal maximum output power mode.

SAR test separation for normal maximum output power mode:

- Bottom Face: 11 mm
- Edge 1: 12 mm
- Edge 2: 5 mm

6. RF Exposure Limits

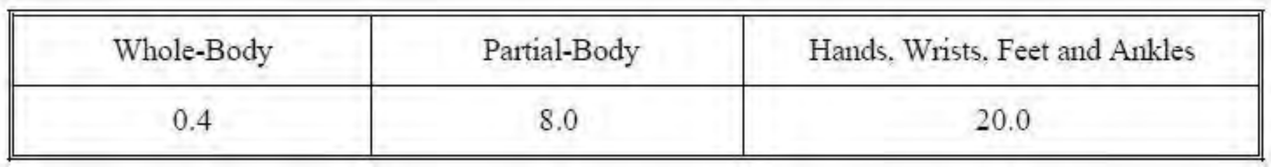
6.1 Uncontrolled Environment

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

6.2 Controlled Environment

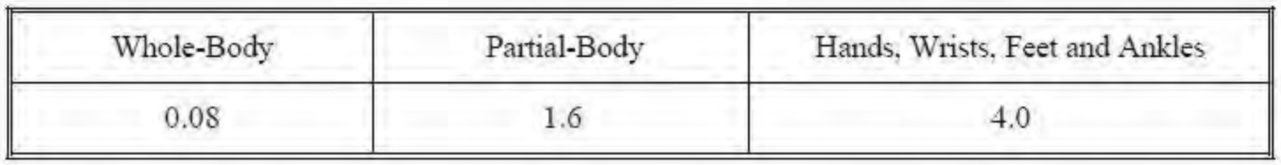
Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed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

Limits for Occupational/Controlled Exposure (W/kg)



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

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



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

1. Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

7. Specific Absorption Rate (SAR)

7.1 Introduction

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

7.2 SAR Definition

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

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

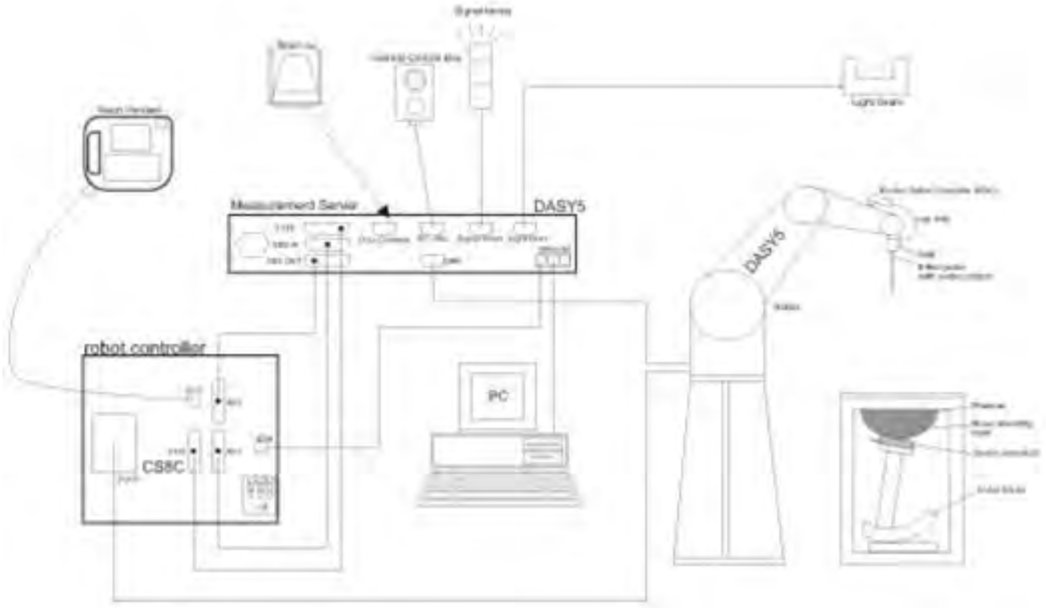
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

8. System Description and Setup

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



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

9. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

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

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
(b) Place the EUT in the positions as Appendix D demonstrates.
(c) Set scan area, grid size and other setting on the DASY software.
(d) Measure SAR results for the highest power channel on each testing position.
(e) Find out the largest SAR result on these testing positions of each band
(f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

9.1 Spatial Peak SAR Evaluation

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

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

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

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

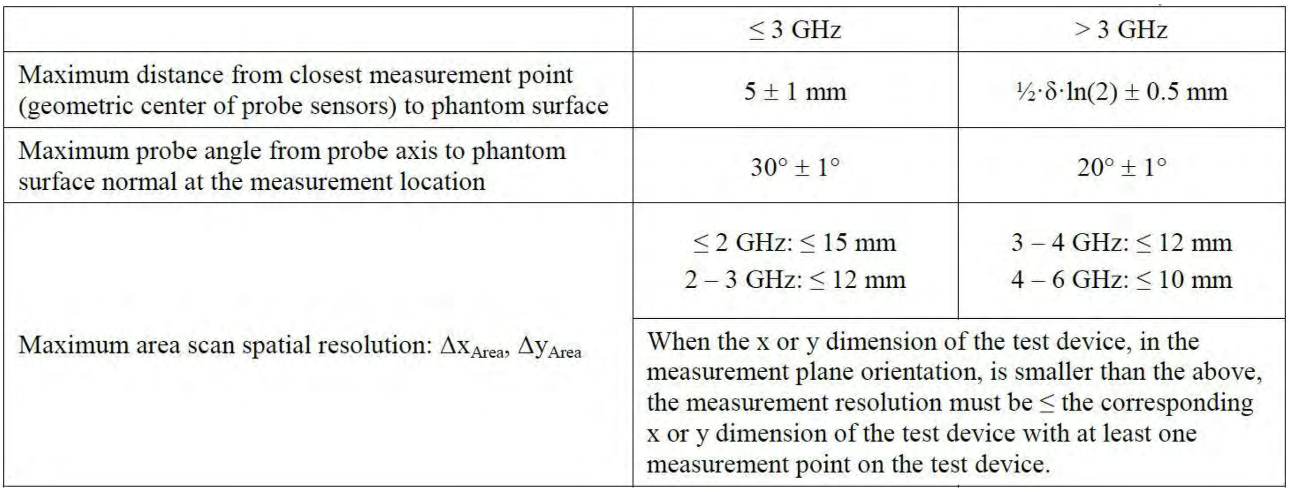
9.2 Power Reference Measurement

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

9.3 Area Scan

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

Area scan parameters extracted from FCC KDB 865664 D01v01r03 SAR measurement 100 MHz to 6 GHz.

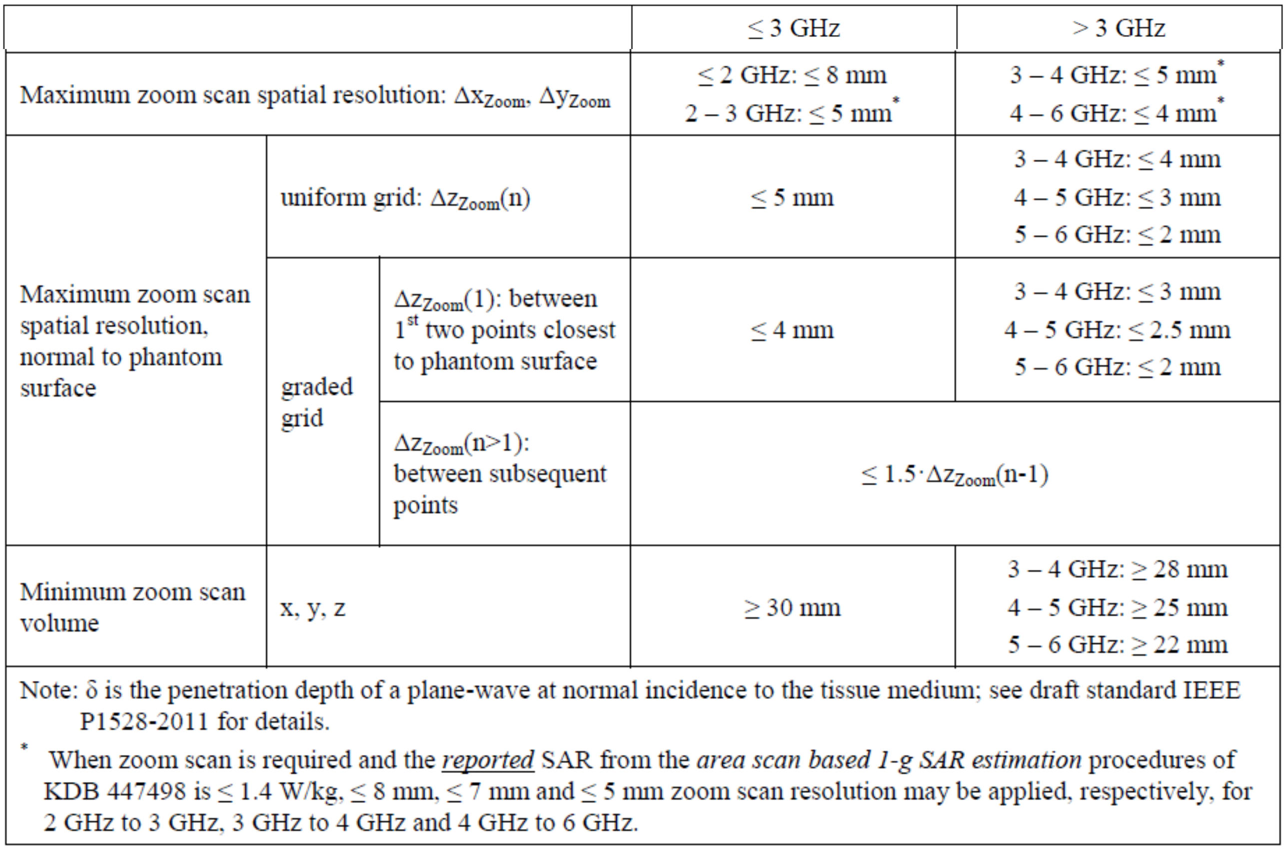


	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

9.4 Zoom Scan

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

Zoom scan parameters extracted from FCC KDB 865664 D01v01r03 SAR measurement 100 MHz to 6 GHz.



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

9.5 Volume Scan Procedures

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

9.6 Power Drift Monitoring

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

10. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	499	Mar. 24, 2014	Mar. 23, 2015
SPEAG	1750MHz System Validation Kit	D1750V2	1068	Nov. 27, 2013	Nov. 26, 2014
SPEAG	1900MHz System Validation Kit	D1900V2	5d041	Mar. 21, 2014	Mar. 20, 2015
SPEAG	2450MHz System Validation Kit	D2450V2	924	Nov. 13, 2013	Nov. 12, 2014
SPEAG	2600MHz System Validation Kit	D2600V2	1070	Nov. 13, 2013	Nov. 12, 2014
SPEAG	5GHz System Validation Kit	D5GHzV2	1128	Jul. 24, 2013	Jul. 23, 2014
SPEAG	Data Acquisition Electronics	DAE4	778	Aug. 21, 2013	Aug. 20, 2014
SPEAG	Data Acquisition Electronics	DAE3	495	May. 19, 2014	May. 18, 2015
SPEAG	Data Acquisition Electronics	DAE4	1399	Nov. 07, 2013	Nov. 06, 2014
SPEAG	Dosimetric E-Field Probe	ES3DV3	3270	Sep. 24, 2013	Sep. 23, 2014
SPEAG	Dosimetric E-Field Probe	EX3DV4	3925	May. 22, 2014	May. 21, 2015
SPEAG	Dosimetric E-Field Probe	EX3DV4	3955	Nov. 12, 2013	Nov. 11, 2014
Wisewind	Thermometer	ETP-101	TM560	Oct. 22, 2013	Oct. 21, 2014
Wisewind	Thermometer	ETP-101	TM685	Oct. 22, 2013	Oct. 21, 2014
Wisewind	Thermometer	HTC-1	TM642	Oct. 22, 2013	Oct. 21, 2014
Anritsu	Radio Communication Analyzer	MT8820C	6201074414	Feb. 11, 2014	Feb. 10, 2015
Anritsu	Radio Communication Analyzer	MT8820C	6201341950	Dec. 25, 2013	Dec. 24, 2014
Agilent	Wireless Communication Test Set	E5515C	MY50266977	May. 27, 2014	May. 26, 2015
SPEAG	Device Holder	N/A	N/A	NCR	NCR
Agilent	Signal Generator	E4438C	MY49070755	Oct. 08, 2013	Oct. 07, 2014
SPEAG	Dielectric Probe Kit	DAK-3.5	1138	Nov. 03, 2013	Nov. 02, 2014
Agilent	ENA Network Analyzer	E5071C	MY46316648	Feb. 07, 2014	Feb. 06, 2015
Anritsu	Power Meter	ML2495A	1349001	Dec. 04, 2013	Dec. 03, 2014
Anritsu	Power Sensor	MA2411B	1306099	Dec. 03, 2013	Dec. 02, 2014
R&S	Spectrum Analyzer	FSP30	101067	Nov. 20, 2013	Nov. 19, 2014
Agilent	Dual Directional Coupler	778D	50422	Note 1	
Woken	Attenuator	WK0602-XX	N/A	Note 1	
PE	Attenuator	PE7005-10	N/A	Note 1	
PE	Attenuator	PE7005- 3	N/A	Note 1	
AR	Power Amplifier	5S1G4M2	0328767	Note 1	
Mini-Circuits	Power Amplifier	ZVE-3W	162601250	Note 1	
Mini-Circuits	Power Amplifier	ZHL-42W+	13440021344	Note 1	

General Note:

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

11. System Verification

11.1 Tissue Verification

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

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
For Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Simulating Liquid for 5GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
835	Body	22.4	0.984	54.400	0.97	55.20	1.44	-1.45	±5	2014/6/23
1750	Body	22.4	1.455	54.501	1.49	53.40	-2.35	2.06	±5	2014/6/25
1900	Body	22.3	1.532	52.328	1.52	53.30	0.79	-1.82	±5	2014/6/24
1900	Body	22.5	1.546	52.216	1.52	53.30	1.71	-2.03	±5	2014/6/25
2450	Body	22.6	1.964	53.315	1.95	52.70	0.72	1.17	±5	2014/6/26
2600	Body	22.6	2.209	51.123	2.16	52.50	2.27	-2.62	±5	2014/6/26
5200	Body	22.5	5.143	47.437	5.30	49.00	-2.96	-3.19	±5	2014/7/1
5300	Body	22.5	5.274	47.199	5.42	48.88	-2.69	-3.44	±5	2014/7/1
5600	Body	22.5	5.654	46.749	5.77	48.47	-2.01	-3.55	±5	2014/7/1
5800	Body	22.5	5.988	46.473	6.00	48.20	-0.20	-3.58	±5	2014/7/1

11.2 System Performance Check Results

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

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured SAR (W/kg)	Targeted SAR (W/kg)	Normalized SAR (W/kg)	Deviation (%)
2014/6/23	835	Body	250	D835V2-499	3270	778	2.54	9.46	10.16	7.40
2014/6/25	1750	Body	250	D1750V2-1068	3270	778	8.86	37.50	35.44	-5.49
2014/6/24	1900	Body	250	D1900V2-5d041	3270	778	10.60	41.00	42.4	3.41
2014/6/25	1900	Body	250	D1900V2-5d041	3270	778	10.60	41.00	42.4	3.41
2014/6/26	2450	Body	250	D2450V2-924	3925	495	12.20	50.20	48.8	-2.79
2014/6/26	2600	Body	250	D2600V2-1070	3955	1399	14.80	55.70	59.2	6.28
2014/7/1	5200	Body	100	D5GHzV2-1128	3925	495	7.32	73.40	73.2	-0.27
2014/7/1	5300	Body	100	D5GHzV2-1128	3925	495	7.82	74.30	78.2	5.25
2014/7/1	5600	Body	100	D5GHzV2-1128	3925	495	8.19	77.80	81.9	5.27
2014/7/1	5800	Body	100	D5GHzV2-1128	3925	495	7.06	72.20	70.6	-2.22

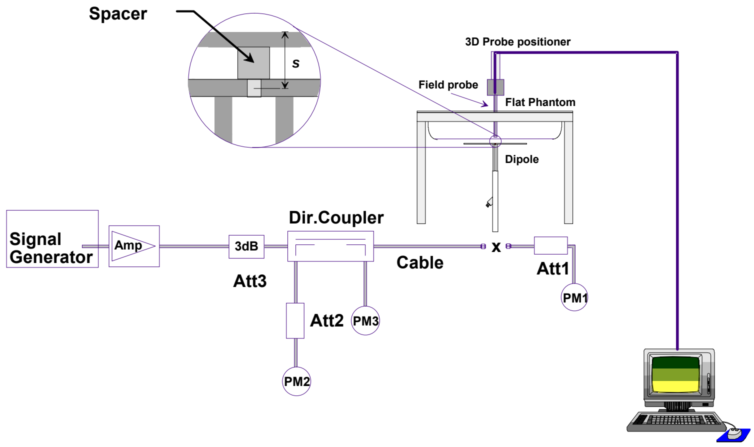


Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

12. RF Exposure Positions

12.1 SAR Testing for Tablet

This device can be used also in full sized tablet exposure conditions, due to its size. Per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR exclusion threshold in KDB 447498 D01v05r02 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

13. Conducted RF Output Power (Unit: dBm)

<GSM Conducted Power>

General Note:

1. Per KDB 447498 D01v05r02, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. For GSM850 Body SAR testing was following KDB 941225 D03v01, the GPRS 2Tx slots was selected when EUT operating without power back-off, the GPRS 4Tx slots was selected when EUT operating with power back-off, according to the highest source-based time-averaged output power.
3. For GSM1900 Body SAR testing was following KDB 941225 D03v01, the GPRS 2Tx slots was selected when EUT operating without power back-off, the GPRS 3Tx slots was selected when EUT operating with power back-off, according to the highest source-based time-averaged output power.

Full Power mode (Proximity Sensor Inactive)

Band GSM850	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	128	189	251		128	189	251	
Frequency (MHz)	824.2	836.4	848.8		824.2	836.4	848.8	
GPRS (GMSK, 1 Tx slot)	33.08	32.96	32.99	33.20	24.08	23.96	23.99	24.20
GPRS (GMSK, 2 Tx slots)	31.94	31.72	31.80	32.20	25.94	25.72	25.80	26.20
GPRS (GMSK, 3 Tx slots)	30.16	30.02	30.08	30.20	25.90	25.76	25.82	25.94
GPRS (GMSK, 4 Tx slots)	27.88	27.72	27.81	28.20	24.88	24.72	24.81	25.20
EDGE (8PSK, 1 Tx slot)	27.31	27.25	27.27	27.70	18.31	18.25	18.27	18.70
EDGE (8PSK, 2 Tx slots)	26.64	26.54	26.58	26.70	20.64	20.54	20.58	20.70
EDGE (8PSK, 3 Tx slots)	25.64	25.53	25.60	25.70	21.38	21.27	21.34	21.44
EDGE (8PSK, 4 Tx slots)	24.42	24.30	24.36	24.70	21.42	21.30	21.36	21.70

Band GSM1900	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GPRS (GMSK, 1 Tx slot)	30.38	30.45	30.48	30.70	21.38	21.45	21.48	21.70
GPRS (GMSK, 2 Tx slots)	29.43	29.52	29.61	29.70	23.43	23.52	23.61	23.70
GPRS (GMSK, 3 Tx slots)	27.44	27.47	27.52	27.70	23.18	23.21	23.26	23.44
GPRS (GMSK, 4 Tx slots)	25.48	25.51	25.54	25.70	22.48	22.51	22.54	22.70
EDGE (8PSK, 1 Tx slot)	26.07	26.08	26.10	26.20	17.07	17.08	17.10	17.20
EDGE (8PSK, 2 Tx slots)	25.07	25.08	25.09	25.20	19.07	19.08	19.09	19.20
EDGE (8PSK, 3 Tx slots)	24.14	24.17	24.20	24.20	19.88	19.91	19.94	19.94
EDGE (8PSK, 4 Tx slots)	23.04	23.05	23.07	23.20	20.04	20.05	20.07	20.20

Reduced Power Mode (Proximity Sensor active)

Band GSM850	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	128	189	251		128	189	251	
Frequency (MHz)	824.2	836.4	848.8		824.2	836.4	848.8	
GPRS (GMSK, 1 Tx slot)	25.62	25.27	25.41	25.70	16.62	16.27	16.41	16.70
GPRS (GMSK, 2 Tx slots)	25.58	25.25	25.28	25.70	19.58	19.25	19.28	19.70
GPRS (GMSK, 3 Tx slots)	23.19	23.16	23.17	23.20	18.93	18.90	18.91	18.94
GPRS (GMSK, 4 Tx slots)	23.13	23.08	23.12	23.20	20.13	20.08	20.12	20.20
EDGE (8PSK, 1 Tx slot)	20.93	20.76	20.86	21.20	11.93	11.76	11.86	12.20
EDGE (8PSK, 2 Tx slots)	20.95	20.83	20.84	21.20	14.95	14.83	14.84	15.20
EDGE (8PSK, 3 Tx slots)	20.78	20.72	20.75	21.20	16.52	16.46	16.49	16.94
EDGE (8PSK, 4 Tx slots)	20.79	20.71	20.75	21.20	17.79	17.71	17.75	18.20

Band GSM1900	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
TX Channel	512	661	810		512	661	810	
Frequency (MHz)	1850.2	1880	1909.8		1850.2	1880	1909.8	
GPRS (GMSK, 1 Tx slot)	21.42	21.45	21.49	21.70	12.42	12.45	12.49	12.70
GPRS (GMSK, 2 Tx slots)	21.40	21.42	21.47	21.70	15.40	15.42	15.47	15.70
GPRS (GMSK, 3 Tx slots)	20.62	20.67	20.69	20.70	16.36	16.41	16.43	16.44
GPRS (GMSK, 4 Tx slots)	16.54	16.57	16.59	17.00	13.54	13.57	13.59	14.00
EDGE (8PSK, 1 Tx slot)	20.62	20.63	20.68	20.70	11.62	11.63	11.68	11.70
EDGE (8PSK, 2 Tx slots)	20.58	20.66	20.67	20.70	14.58	14.66	14.67	14.70
EDGE (8PSK, 3 Tx slots)	20.24	20.30	20.37	20.70	15.98	16.04	16.11	16.44
EDGE (8PSK, 4 Tx slots)	16.91	16.97	16.99	17.00	13.91	13.97	13.99	14.00

<WCDMA Conducted Power>

1. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
2. The procedures in KDB 941225 D01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.
3. For DC-HSDPA, the device was configured according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1, with the primary and the secondary serving HS-DSCH Cell enabled during the power measurement.

A summary of these settings are illustrated below:

HSDPA Setup Configuration:

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

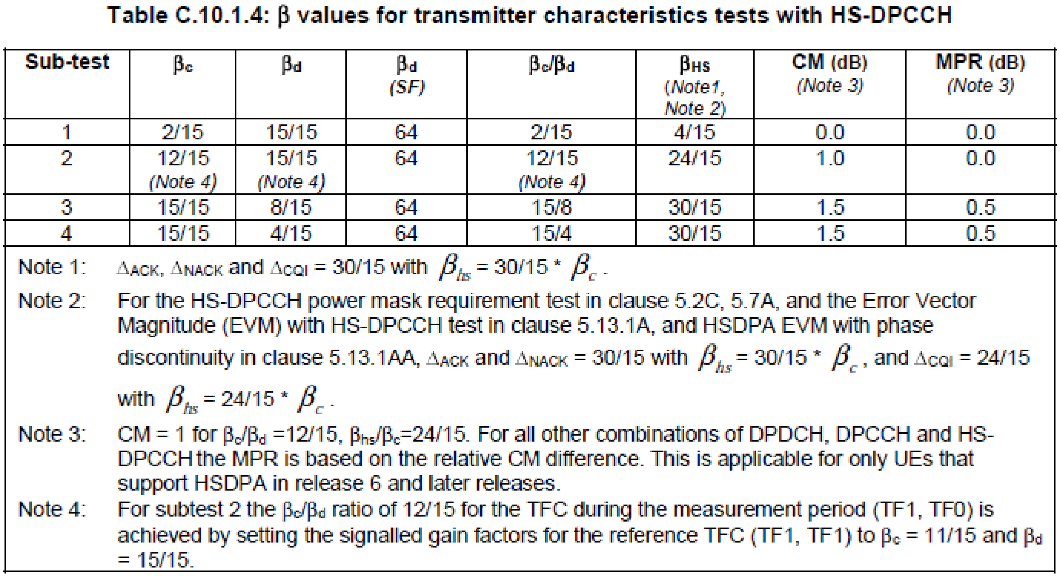


Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .

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

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

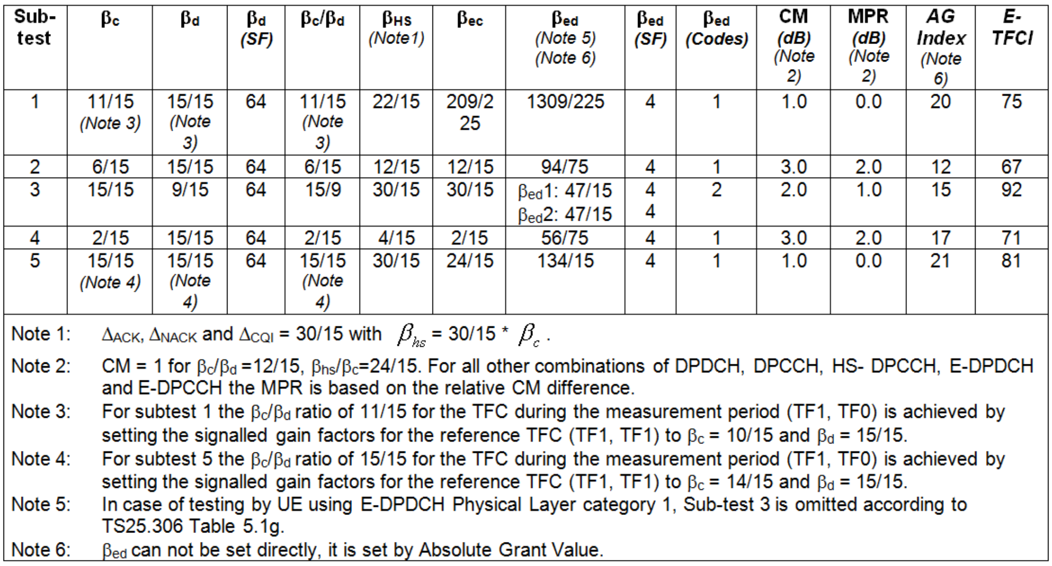
Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

Setup Configuration

HSUPA Setup Configuration:

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

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



Sub-test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1)*	β_{ec}	β_{ed} *(Note 5) (Note 6)*	β_{ed} *(SF)*	β_{ed} *(Codes)*	CM (dB) *(Note 2)*	MPR (dB) *(Note 2)*	*AG Index (Note 6)*	*E-TFCI*
1	11/15 *(Note 3)*	15/15 *(Note 3)*	64	11/15 *(Note 3)*	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed}1: 47/15 β_{ed}2: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 *(Note 4)*	15/15 *(Note 4)*	64	15/15 *(Note 4)*	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .

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

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

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

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

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

Setup Configuration

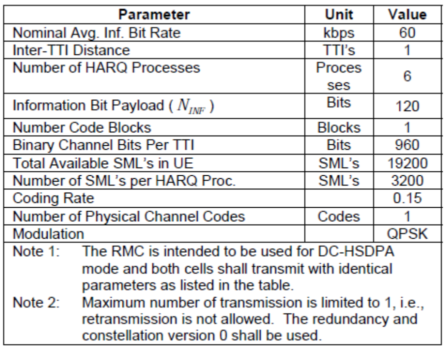
DC-HSDPA 3GPP release 8 Setup Configuration:

a. The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration below
b. The RF path losses were compensated into the measurements.
c. A call was established between EUT and Base Station with following setting:
  i. Set RMC 12.2Kbps + HSDPA mode.
  ii. Set Cell Power = -25 dBm
  iii. Set HS-DSCH Configuration Type to FRC (H-set 12, QPSK)
  iv. Select HSDPA Uplink Parameters
  v. Set Gain Factors (β_c and β_d) and parameters were set according to each Specific sub-test in the following table, C10.1.4, quoted from the TS 34.121
    a). Subtest 1: β_c/β_d=2/15
    b). Subtest 2: β_c/β_d=12/15
    c). Subtest 3: β_c/β_d=15/8
    d). Subtest 4: β_c/β_d=15/4
  vi. Set Delta ACK, Delta NACK and Delta CQI = 8
  vii. Set Ack-Nack Repetition Factor to 3
  viii. Set CQI Feedback Cycle (k) to 4 ms
  ix. Set CQI Repetition Factor to 2
  x. Power Ctrl Mode = All Up bits
d. The transmitted maximum output power was recorded.

The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
A summary of these settings are illustrated below:

C.8.1.12 Fixed Reference Channel Definition H-Set 12

Table C.8.1.12: Fixed Reference Channel H-Set 12



Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
Inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

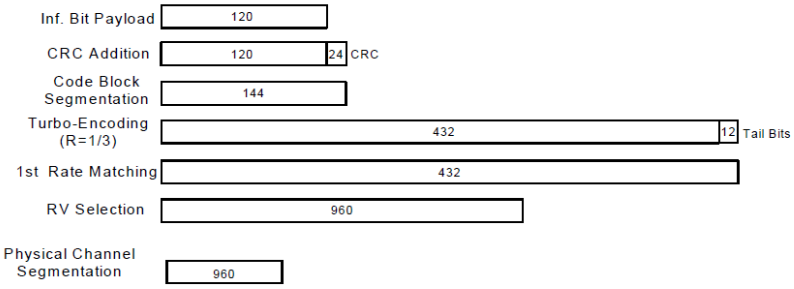


Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)

Setup Configuration

<WCDMA Conducted Power>

General Note:

1. Per KDB 941225 D02v02r02, RMC 12.2kbps setting is used to evaluate SAR. If HSDPA/HSUPA/DC-HSDPA output power is < 0.25dB higher than RMC, or reported SAR with RMC 12.2kbps setting is ≤ 1.2W/kg, HSDPA/HSUPA/DC-HSDPA SAR evaluation can be excluded..

Full Power mode (Proximity Sensor Inactive)

Band			WCDMA V			WCDMA II		
TX Channel			4132	4182	4233	9262	9400	9538
Frequency (MHz)			826.4	836.4	846.6	1852.4	1880	1907.6
MPR(dB)	3GPP Rel 99	RMC 12.2Kbps	24.27	24.36	24.24	22.68	22.53	22.70
0	3GPP Rel 6	HSDPA Subtest-1	24.25	24.32	24.20	22.53	22.50	22.61
0	3GPP Rel 6	HSDPA Subtest-2	24.24	24.26	24.23	22.52	22.46	22.58
0.5	3GPP Rel 6	HSDPA Subtest-3	23.83	23.97	23.74	22.04	21.99	22.09
0.5	3GPP Rel 6	HSDPA Subtest-4	23.79	23.81	23.76	22.01	21.97	22.07
0	3GPP Rel 8	DC-HSDPA Subtest-1	24.24	24.26	24.21	22.51	22.47	22.60
0	3GPP Rel 8	DC-HSDPA Subtest-2	24.23	24.28	24.21	22.50	22.44	22.57
0.5	3GPP Rel 8	DC-HSDPA Subtest-3	23.76	23.88	23.74	22.03	21.97	22.11
0.5	3GPP Rel 8	DC-HSDPA Subtest-4	23.74	23.77	23.72	22.00	21.95	22.09
0	3GPP Rel 6	HSUPA Subtest-1	24.25	24.30	24.22	22.02	21.86	22.23
2	3GPP Rel 6	HSUPA Subtest-2	22.53	22.64	22.50	20.65	20.63	20.69
1	3GPP Rel 6	HSUPA Subtest-3	23.28	23.36	23.21	21.59	21.51	21.64
2	3GPP Rel 6	HSUPA Subtest-4	22.62	22.70	22.58	20.61	20.58	20.70
0	3GPP Rel 6	HSUPA Subtest-5	24.26	24.27	24.25	22.60	22.51	22.64

Reduced Power Mode (Proximity Sensor active)

Band			WCDMA V			WCDMA II		
TX Channel			4132	4182	4233	9262	9400	9538
Frequency (MHz)			826.4	836.4	846.6	1852.4	1880	1907.6
MPR(dB)	3GPP Rel 99	RMC 12.2Kbps	17.84	17.87	17.80	11.53	11.36	11.31
0	3GPP Rel 6	HSDPA Subtest-1	17.78	17.81	17.76	11.48	11.29	11.25
0	3GPP Rel 6	HSDPA Subtest-2	17.74	17.75	17.71	11.43	11.28	11.22
0.5	3GPP Rel 6	HSDPA Subtest-3	17.21	17.30	17.20	10.85	10.76	10.64
0.5	3GPP Rel 6	HSDPA Subtest-4	17.23	17.26	17.21	10.82	10.74	10.66
0	3GPP Rel 8	DC-HSDPA Subtest-1	17.73	17.75	17.72	11.44	11.27	11.25
0	3GPP Rel 8	DC-HSDPA Subtest-2	17.74	17.75	17.71	11.40	11.25	11.16
0.5	3GPP Rel 8	DC-HSDPA Subtest-3	17.27	17.29	17.22	10.84	10.72	10.57
0.5	3GPP Rel 8	DC-HSDPA Subtest-4	17.24	17.26	17.21	10.82	10.69	10.64
0	3GPP Rel 6	HSUPA Subtest-1	17.76	17.77	17.73	11.37	10.95	10.88
2	3GPP Rel 6	HSUPA Subtest-2	16.07	16.11	15.99	9.67	9.48	9.37
1	3GPP Rel 6	HSUPA Subtest-3	16.74	16.78	16.71	10.26	10.01	9.86
2	3GPP Rel 6	HSUPA Subtest-4	15.92	15.96	15.86	9.58	9.47	9.23
0	3GPP Rel 6	HSUPA Subtest-5	17.72	17.75	17.71	11.41	11.22	10.78

<LTE Conducted Power>

General Note:

1. Anritsu MT8820C base station simulator was used to setup the connection with EUT; the frequency band, channel bandwidth, RB allocation configuration, modulation type are set in the base station simulator to configure EUT transmitting at maximum power and at different configurations which are requested to be reported to FCC, for conducted power measurement and SAR testing.
2. Per KDB 941225 D05v02r03, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
3. Per KDB 941225 D05v02r03, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
4. Per KDB 941225 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5. Per KDB 941225 D05v02r03, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
6. Per KDB 941225 D05v02r03, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, 16QAM SAR testing is not required.
7. Per KDB 941225 D05v02r03, Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05v02r03, smaller bandwidth SAR testing is not required.

Maximum Average RF Power (Proximity Sensor Inactive)

<LTE Band 4>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				20050	20175	20300		
Frequency (MHz)				1720	1732.5	1745		
20	QPSK	1	0	23.32	23.69	23.59	23.7	0
20	QPSK	1	49	23.27	23.68	23.60		
20	QPSK	1	99	23.26	23.67	23.54		
20	QPSK	50	0	22.25	22.63	22.66	22.7	1
20	QPSK	50	24	22.23	22.59	22.57		
20	QPSK	50	49	22.23	22.50	22.59		
20	QPSK	100	0	22.37	22.66	22.38		
20	16QAM	1	0	22.21	22.34	22.20	22.7	1
20	16QAM	1	49	22.34	22.47	22.47		
20	16QAM	1	99	22.27	22.52	22.40		
20	16QAM	50	0	21.32	21.68	21.45	21.7	2
20	16QAM	50	24	21.25	21.47	21.46		
20	16QAM	50	49	21.20	21.31	21.24		
20	16QAM	100	0	21.29	21.48	21.21		
Channel				20025	20175	20325	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1717.5	1732.5	1747.5		
15	QPSK	1	0	23.46	23.50	23.52	23.7	0
15	QPSK	1	37	23.43	23.48	23.43		
15	QPSK	1	74	23.41	23.46	23.48		
15	QPSK	36	0	22.31	22.48	22.55	22.7	1
15	QPSK	36	18	22.32	22.62	22.47		
15	QPSK	36	37	22.23	22.44	22.39		
15	QPSK	75	0	22.44	22.66	22.29		
15	16QAM	1	0	22.37	22.27	22.28	22.7	1
15	16QAM	1	37	22.31	22.32	22.47		
15	16QAM	1	74	22.28	22.39	22.30		
15	16QAM	36	0	21.39	21.58	21.25	21.7	2
15	16QAM	36	18	21.23	21.29	21.33		
15	16QAM	36	37	21.21	21.23	21.26		
15	16QAM	75	0	21.28	21.35	21.21		
Channel				20000	20175	20350	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1715	1732.5	1750		
10	QPSK	1	0	23.34	23.42	23.59	23.7	0
10	QPSK	1	24	23.36	23.50	23.49		
10	QPSK	1	49	23.32	23.56	23.37		
10	QPSK	25	0	22.43	22.60	22.63	22.7	1
10	QPSK	25	12	22.22	22.52	22.53		
10	QPSK	25	24	22.28	22.47	22.59		
10	QPSK	50	0	22.29	22.60	22.25		
10	16QAM	1	0	22.21	22.25	22.20	22.7	1
10	16QAM	1	24	22.31	22.30	22.46		
10	16QAM	1	49	22.24	22.39	22.29		
10	16QAM	25	0	21.32	21.57	21.37	21.7	2
10	16QAM	25	12	21.20	21.31	21.36		
10	16QAM	25	24	21.23	21.29	21.24		
10	16QAM	50	0	21.26	21.36	21.22		

Channel				19975	20175	20375	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1712.5	1732.5	1752.5		
5	QPSK	1	0	23.28	23.53	23.50	23.7	0
5	QPSK	1	12	23.34	23.47	23.46		
5	QPSK	1	24	23.26	23.47	23.34		
5	QPSK	12	0	22.23	22.52	22.46	22.7	1
5	QPSK	12	6	22.24	22.56	22.42		
5	QPSK	12	11	22.26	22.45	22.54		
5	QPSK	25	0	22.28	22.69	22.36		
5	16QAM	1	0	22.32	22.23	22.20	22.7	1
5	16QAM	1	12	22.24	22.27	22.42		
5	16QAM	1	24	22.21	22.38	22.44		
5	16QAM	12	0	21.54	21.65	21.58	21.7	2
5	16QAM	12	6	21.34	21.35	21.53		
5	16QAM	12	11	21.24	21.21	21.31		
5	16QAM	25	0	21.22	21.28	21.22		
Channel				19965	20175	20385	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1711.5	1732.5	1753.5		
3	QPSK	1	0	23.25	23.46	23.59	23.7	0
3	QPSK	1	7	23.34	23.50	23.40		
3	QPSK	1	14	23.28	23.52	23.44		
3	QPSK	8	0	22.26	22.43	22.50	22.7	1
3	QPSK	8	4	22.25	22.52	22.57		
3	QPSK	8	7	22.24	22.39	22.55		
3	QPSK	15	0	22.23	22.56	22.21		
3	16QAM	1	0	22.38	22.34	22.23	22.7	1
3	16QAM	1	7	22.26	22.28	22.44		
3	16QAM	1	14	22.37	22.37	22.39		
3	16QAM	8	0	21.29	21.48	21.46	21.7	2
3	16QAM	8	4	21.38	21.47	21.42		
3	16QAM	8	7	21.25	21.22	21.25		
3	16QAM	15	0	21.33	21.36	21.21		
Channel				19957	20175	20393	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1710.7	1732.5	1754.3		
1.4	QPSK	1	0	23.22	23.50	23.59	23.7	0
1.4	QPSK	1	2	23.21	23.42	23.41		
1.4	QPSK	1	5	23.25	23.46	23.47		
1.4	QPSK	3	0	22.56	22.92	22.95		
1.4	QPSK	3	1	22.62	22.96	22.97		
1.4	QPSK	3	2	22.58	22.95	22.90		
1.4	QPSK	6	0	22.28	22.68	22.33	22.7	1
1.4	16QAM	1	0	22.32	22.20	22.23	22.7	1
1.4	16QAM	1	2	22.31	22.45	22.27		
1.4	16QAM	1	5	22.25	22.52	22.21		
1.4	16QAM	3	0	21.82	22.06	21.97		
1.4	16QAM	3	1	21.80	21.92	21.97		
1.4	16QAM	3	2	21.77	21.91	21.92		
1.4	16QAM	6	0	21.26	21.34	21.21	21.7	2

<LTE Band 7>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				20850	21100	21350		
Frequency (MHz)				2510	2535	2560		
20	QPSK	1	0	23.41	23.63	23.39	23.7	0
20	QPSK	1	49	23.40	23.55	23.37		
20	QPSK	1	99	23.39	23.58	23.36		
20	QPSK	50	0	22.33	22.45	22.35	22.7	1
20	QPSK	50	24	22.36	22.66	22.45		
20	QPSK	50	49	22.45	22.70	22.54		
20	QPSK	100	0	22.45	22.52	22.51		
20	16QAM	1	0	22.28	22.32	22.20	22.7	1
20	16QAM	1	49	22.22	22.24	22.08		
20	16QAM	1	99	22.30	22.46	22.24		
20	16QAM	50	0	21.21	21.58	21.27	21.7	2
20	16QAM	50	24	21.25	21.53	21.20		
20	16QAM	50	49	21.30	21.33	21.05		
20	16QAM	100	0	21.26	21.57	21.23		
Channel				20825	21100	21375	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				2507.5	2535	2562.5		
15	QPSK	1	0	23.40	23.46	23.42	23.7	0
15	QPSK	1	37	23.20	23.41	23.34		
15	QPSK	1	74	23.41	23.43	23.36		
15	QPSK	36	0	22.30	22.27	22.01	22.7	1
15	QPSK	36	18	22.34	22.65	22.26		
15	QPSK	36	37	22.40	22.69	22.48		
15	QPSK	75	0	22.35	22.36	22.40		
15	16QAM	1	0	22.34	22.31	21.88	22.7	1
15	16QAM	1	37	22.24	22.20	21.76		
15	16QAM	1	74	22.27	22.38	21.98		
15	16QAM	36	0	21.20	21.38	21.11	21.7	2
15	16QAM	36	18	21.21	21.39	21.03		
15	16QAM	36	37	21.38	21.20	20.89		
15	16QAM	75	0	21.25	21.34	20.90		
Channel				20800	21100	21400	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				2505	2535	2565		
10	QPSK	1	0	23.37	23.56	23.34	23.7	0
10	QPSK	1	24	23.40	23.48	23.28		
10	QPSK	1	49	23.38	23.43	23.24		
10	QPSK	25	0	22.24	22.30	21.91	22.7	1
10	QPSK	25	12	22.25	22.55	22.23		
10	QPSK	25	24	22.35	22.69	22.38		
10	QPSK	50	0	22.27	22.39	22.30		
10	16QAM	1	0	22.25	22.30	21.88	22.7	1
10	16QAM	1	24	22.21	22.23	21.76		
10	16QAM	1	49	22.36	22.38	21.96		
10	16QAM	25	0	21.25	21.36	21.20	21.7	2
10	16QAM	25	12	21.21	21.31	20.82		
10	16QAM	25	24	21.23	21.26	20.79		
10	16QAM	50	0	21.20	21.33	20.90		

Channel				20775	21100	21425	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				2502.5	2535	2567.5		
5	QPSK	1	0	23.21	23.57	23.32	23.7	0
5	QPSK	1	12	23.26	23.44	23.22		
5	QPSK	1	24	23.41	23.56	23.27		
5	QPSK	12	0	22.21	22.31	21.91	22.7	1
5	QPSK	12	6	22.22	22.46	22.21		
5	QPSK	12	11	22.42	22.67	22.36		
5	QPSK	25	0	22.34	22.51	22.27		
5	16QAM	1	0	22.27	22.32	21.85	22.7	1
5	16QAM	1	12	22.20	22.20	21.74		
5	16QAM	1	24	22.24	22.34	21.97		
5	16QAM	12	0	21.22	21.39	20.89	21.7	2
5	16QAM	12	6	21.25	21.37	20.97		
5	16QAM	12	11	21.30	21.31	20.94		
5	16QAM	25	0	21.26	21.40	21.07		

Reduced Average RF Power (Proximity Sensor active)

<LTE Band 4>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				20050	20175	20300		
Frequency (MHz)				1720	1732.5	1745		
20	QPSK	1	0	10.62	10.79	10.68	10.9	0
20	QPSK	1	49	10.68	10.68	10.57		
20	QPSK	1	99	10.41	10.57	10.51		
20	QPSK	50	0	10.66	10.55	10.43	10.9	0
20	QPSK	50	24	10.53	10.66	10.60		
20	QPSK	50	49	10.48	10.44	10.61		
20	QPSK	100	0	10.65	10.44	10.51		
20	16QAM	1	0	10.46	10.42	10.47	10.9	0
20	16QAM	1	49	10.50	10.65	10.55		
20	16QAM	1	99	10.64	10.79	10.40		
20	16QAM	50	0	10.64	10.44	10.41	10.9	0
20	16QAM	50	24	10.71	10.42	10.45		
20	16QAM	50	49	10.65	10.48	10.52		
20	16QAM	100	0	10.68	10.49	10.47		
Channel				20025	20175	20325	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1717.5	1732.5	1747.5		
15	QPSK	1	0	10.50	10.48	10.85	10.9	0
15	QPSK	1	37	10.62	10.70	10.71		
15	QPSK	1	74	10.41	10.50	10.68		
15	QPSK	36	0	10.44	10.52	10.61	10.9	0
15	QPSK	36	18	10.53	10.44	10.43		
15	QPSK	36	37	10.86	10.43	10.56		
15	QPSK	75	0	10.52	10.46	10.49		
15	16QAM	1	0	10.56	10.59	10.61	10.9	0
15	16QAM	1	37	10.72	10.47	10.59		
15	16QAM	1	74	10.75	10.49	10.71		
15	16QAM	36	0	10.41	10.44	10.65	10.9	0
15	16QAM	36	18	10.54	10.42	10.45		
15	16QAM	36	37	10.52	10.48	10.57		
15	16QAM	75	0	10.54	10.43	10.43		
Channel				20000	20175	20350	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1715	1732.5	1750		
10	QPSK	1	0	10.48	10.41	10.70	10.9	0
10	QPSK	1	24	10.44	10.78	10.45		
10	QPSK	1	49	10.42	10.71	10.44		
10	QPSK	25	0	10.40	10.71	10.45	10.9	0
10	QPSK	25	12	10.41	10.71	10.56		
10	QPSK	25	24	10.46	10.52	10.53		
10	QPSK	50	0	10.41	10.63	10.50		
10	16QAM	1	0	10.46	10.59	10.41	10.9	0
10	16QAM	1	24	10.65	10.61	10.78		
10	16QAM	1	49	10.59	10.47	10.76		
10	16QAM	25	0	10.45	10.47	10.48	10.9	0
10	16QAM	25	12	10.41	10.57	10.56		
10	16QAM	25	24	10.49	10.51	10.62		
10	16QAM	50	0	10.48	10.49	10.51		

Channel				19975	20175	20375	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1712.5	1732.5	1752.5		
5	QPSK	1	0	10.52	10.66	10.69	10.9	0
5	QPSK	1	12	10.47	10.40	10.54		
5	QPSK	1	24	10.41	10.55	10.59		
5	QPSK	12	0	10.40	10.47	10.59	10.9	0
5	QPSK	12	6	10.43	10.59	10.58		
5	QPSK	12	11	10.49	10.53	10.63		
5	QPSK	25	0	10.44	10.47	10.60		
5	16QAM	1	0	10.49	10.62	10.64	10.9	0
5	16QAM	1	12	10.44	10.52	10.65		
5	16QAM	1	24	10.41	10.42	10.64		
5	16QAM	12	0	10.43	10.49	10.47	10.9	0
5	16QAM	12	6	10.42	10.47	10.49		
5	16QAM	12	11	10.46	10.41	10.43		
5	16QAM	25	0	10.45	10.44	10.47		
Channel				19965	20175	20385	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1711.5	1732.5	1753.5		
3	QPSK	1	0	10.59	10.63	10.69	10.9	0
3	QPSK	1	7	10.49	10.42	10.61		
3	QPSK	1	14	10.47	10.48	10.64		
3	QPSK	8	0	10.41	10.45	10.58	10.9	0
3	QPSK	8	4	10.44	10.56	10.62		
3	QPSK	8	7	10.41	10.53	10.62		
3	QPSK	15	0	10.46	10.57	10.57		
3	16QAM	1	0	10.54	10.49	10.57	10.9	0
3	16QAM	1	7	10.53	10.55	10.56		
3	16QAM	1	14	10.50	10.56	10.55		
3	16QAM	8	0	10.46	10.50	10.48	10.9	0
3	16QAM	8	4	10.45	10.57	10.49		
3	16QAM	8	7	10.43	10.48	10.50		
3	16QAM	15	0	10.42	10.41	10.42		
Channel				19957	20175	20393	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				1710.7	1732.5	1754.3		
1.4	QPSK	1	0	10.59	10.63	10.66	10.9	0
1.4	QPSK	1	2	10.49	10.59	10.64		
1.4	QPSK	1	5	10.48	10.50	10.40		
1.4	QPSK	3	0	10.43	10.45	10.59		
1.4	QPSK	3	1	10.40	10.40	10.65		
1.4	QPSK	3	2	10.42	10.42	10.55		
1.4	QPSK	6	0	10.46	10.44	10.62	10.9	0
1.4	16QAM	1	0	10.48	10.54	10.47	10.9	0
1.4	16QAM	1	2	10.46	10.48	10.48		
1.4	16QAM	1	5	10.44	10.46	10.47		
1.4	16QAM	3	0	10.40	10.44	10.44		
1.4	16QAM	3	1	10.42	10.42	10.44		
1.4	16QAM	3	2	10.43	10.40	10.45		
1.4	16QAM	6	0	10.41	10.45	10.42	10.9	0

<LTE Band 7>

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune up Limit (dBm)	MPR (dB)
Channel				20850	21100	21350		
Frequency (MHz)				2510	2535	2560		
20	QPSK	1	0	10.50	10.55	10.70	10.9	0
20	QPSK	1	49	10.61	10.84	10.80		
20	QPSK	1	99	10.43	10.45	10.40		
20	QPSK	50	0	10.49	10.65	10.60	10.9	0
20	QPSK	50	24	10.56	10.89	10.78		
20	QPSK	50	49	10.46	10.57	10.71		
20	QPSK	100	0	10.47	10.64	10.60		
20	16QAM	1	0	10.51	10.63	10.63	10.9	0
20	16QAM	1	49	10.88	10.85	10.82		
20	16QAM	1	99	10.43	10.51	10.70		
20	16QAM	50	0	10.49	10.66	10.60	10.9	0
20	16QAM	50	24	10.62	10.88	10.78		
20	16QAM	50	49	10.42	10.55	10.71		
20	16QAM	100	0	10.43	10.63	10.58		
Channel				20825	21100	21375	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				2507.5	2535	2562.5		
15	QPSK	1	0	10.58	10.61	10.72	10.9	0
15	QPSK	1	37	10.61	10.88	10.76		
15	QPSK	1	74	10.44	10.45	10.49		
15	QPSK	36	0	10.55	10.74	10.55	10.9	0
15	QPSK	36	18	10.48	10.85	10.79		
15	QPSK	36	37	10.49	10.64	10.76		
15	QPSK	75	0	10.51	10.74	10.52		
15	16QAM	1	0	10.46	10.54	10.68	10.9	0
15	16QAM	1	37	10.85	10.86	10.87		
15	16QAM	1	74	10.54	10.53	10.78		
15	16QAM	36	0	10.58	10.68	10.52	10.9	0
15	16QAM	36	18	10.54	10.87	10.77		
15	16QAM	36	37	10.44	10.55	10.77		
15	16QAM	75	0	10.45	10.65	10.58		
Channel				20800	21100	21400	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				2505	2535	2565		
10	QPSK	1	0	10.50	10.61	10.80	10.9	0
10	QPSK	1	24	10.60	10.88	10.83		
10	QPSK	1	49	10.48	10.43	10.46		
10	QPSK	25	0	10.53	10.77	10.59	10.9	0
10	QPSK	25	12	10.43	10.83	10.82		
10	QPSK	25	24	10.41	10.67	10.73		
10	QPSK	50	0	10.50	10.79	10.58		
10	16QAM	1	0	10.43	10.60	10.64	10.9	0
10	16QAM	1	24	10.83	10.90	10.84		
10	16QAM	1	49	10.58	10.57	10.76		
10	16QAM	25	0	10.59	10.64	10.42	10.9	0
10	16QAM	25	12	10.58	10.87	10.74		
10	16QAM	25	24	10.47	10.55	10.75		
10	16QAM	50	0	10.44	10.67	10.62		

Channel				20775	21100	21425	Tune up Limit (dBm)	MPR (dB)
Frequency (MHz)				2502.5	2535	2567.5		
5	QPSK	1	0	10.44	10.52	10.82	10.9	0
5	QPSK	1	12	10.54	10.90	10.78		
5	QPSK	1	24	10.47	10.52	10.41		
5	QPSK	12	0	10.53	10.83	10.63	10.9	0
5	QPSK	12	6	10.53	10.82	10.86		
5	QPSK	12	11	10.44	10.65	10.80		
5	QPSK	25	0	10.44	10.85	10.67		
5	16QAM	1	0	10.43	10.51	10.54	10.9	0
5	16QAM	1	12	10.83	10.81	10.80		
5	16QAM	1	24	10.53	10.58	10.67		
5	16QAM	12	0	10.54	10.65	10.46	10.9	0
5	16QAM	12	6	10.49	10.86	10.74		
5	16QAM	12	11	10.40	10.65	10.68		
5	16QAM	25	0	10.43	10.57	10.66		

<WLAN Conducted Power>

General Note:

1. For 2.4GHz WLAN SAR testing, highest average RF output power channel for the lowest data rate for 802.11b were selected for SAR evaluation. 802.11g/n HT20 were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher 802.11b mode.
2. For 5 GHz WLAN SAR testing, highest average RF output power channel for the lowest data rate for 802.11a were selected for SAR evaluation. 802.11n HT20/HT40 modes were not investigated since the tune-up average output powers over all channels and data rates are not more than 0.25 dB higher than 802.11a mode.

<2.4GHz WLAN >

WLAN 2.4GHz 802.11b Average Power (dBm)					
Power vs. Channel			Power vs. Data Rate		
Channel	Frequency (MHz)	Data Rate	2Mbps	5.5Mbps	11Mbps
		1Mbps			
CH 1	2412	12.36	12.39	12.39	12.34
CH 6	2437	12.41			
CH 11	2462	12.19			

WLAN 2.4GHz 802.11g Average Power (dBm)									
Power vs. Channel			Power vs. Data Rate						
Channel	Frequency (MHz)	Data Rate	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
		6Mbps							
CH 1	2412	8.43	8.61	8.68	8.68	8.66	8.70	8.63	8.58
CH 6	2437	8.61							
CH 11	2462	8.71							

WLAN 2.4GHz 802.11n-HT20 Average Power (dBm)									
Power vs. Channel			Power vs. MCS Index						
Channel	Frequency (MHz)	MCS Index	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
		MCS0							
CH 1	2412	6.44	6.60	6.54	6.59	6.60	6.55	6.57	6.53
CH 6	2437	6.69							
CH 11	2462	6.82							

<5GHz WLAN>

WLAN 5GHz 802.11a Average Power (dBm)									
Power vs. Channel			Power vs. Data Rate						
Channel	Frequency (MHz)	Data Rate	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
		6Mbps							
CH 36	5180	8.97	8.91	8.85	8.88	8.74	8.90	8.84	8.81
CH 40	5200	8.96							
CH 44	5220	8.98							
CH 48	5240	8.88							
CH 52	5260	8.95	8.89	8.88	8.90	8.81	8.86	8.74	8.82
CH 56	5280	8.86							
CH 60	5300	8.98							
CH 64	5320	8.97							
CH 100	5500	8.73	8.52	8.74	8.69	8.73	8.57	8.56	8.52
CH 104	5520	8.68							
CH 108	5540	8.52							
CH 112	5560	8.58							
CH 116	5580	8.71							
CH 120	5600	8.77							
CH 124	5620	8.83							
CH 128	5640	8.72							
CH 132	5660	8.86							
CH 136	5680	8.92							
CH 140	5700	8.99							
CH 149	5745	8.81	8.66	8.71	8.63	8.80	8.57	8.77	8.65
CH 153	5765	8.89							
CH 157	5785	8.99							
CH 161	5805	8.81							
CH 165	5825	8.75							

WLAN 5GHz 802.11n-HT20 Average Power (dBm)									
Power vs. Channel			Power vs. MCS Index						
Channel	Frequency (MHz)	MCS Index	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
		MCS0							
CH 36	5180	7.98	7.92	7.88	7.85	7.77	7.86	7.76	7.79
CH 40	5200	7.96							
CH 44	5220	7.92							
CH 48	5240	7.97							
CH 52	5260	7.92	7.91	7.93	7.81	7.80	7.88	7.72	7.75
CH 56	5280	7.86							
CH 60	5300	7.98							
CH 64	5320	7.97							
CH 100	5500	8.88	9.13	9.12	9.13	9.14	9.09	9.11	9.13
CH 104	5520	8.82							
CH 108	5540	8.78							
CH 112	5560	8.81							
CH 116	5580	8.84							
CH 120	5600	8.76							
CH 124	5620	8.79							
CH 128	5640	8.72							
CH 132	5660	8.83							
CH 136	5680	8.91							
CH 140	5700	9.31							
CH 149	5745	7.90	7.86	7.67	7.74	7.73	7.61	7.71	7.78
CH 153	5765	7.92							
CH 157	5785	7.99							
CH 161	5805	7.82							
CH 165	5825	7.73							

WLAN 5GHz 802.11n-HT40 Average Power (dBm)									
Power vs. Channel			Power vs. MCS Index						
Channel	Frequency (MHz)	MCS Index	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
		MCS0							
CH 38	5190	7.97	7.88	7.86	7.88	7.72	7.85	7.76	7.75
CH 46	5230	7.98							
CH 54	5270	7.96	8.77	8.74	8.77	8.70	8.75	8.63	8.66
CH 62	5310	8.85							
CH 102	5510	7.95	8.88	8.81	8.77	8.93	8.70	8.82	8.78
CH 110	5550	8.95							
CH 126	5630	8.63							
CH 134	5670	7.99							
CH 151	5755	9.24	9.07	9.08	9.15	8.81	8.85	9.12	9.11
CH 159	5795	9.23							

14. Bluetooth Exclusions Applied

Mode Band	Average power(dBm)	
	Bluetooth v3.0+EDR	Bluetooth v4.0+LE
2.4GHz Bluetooth	7.0	3.0

Note:

1. Per KDB 447498 D01v05r02, 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 separation distance, mm*)] ·[$\sqrt{f(GHz)}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

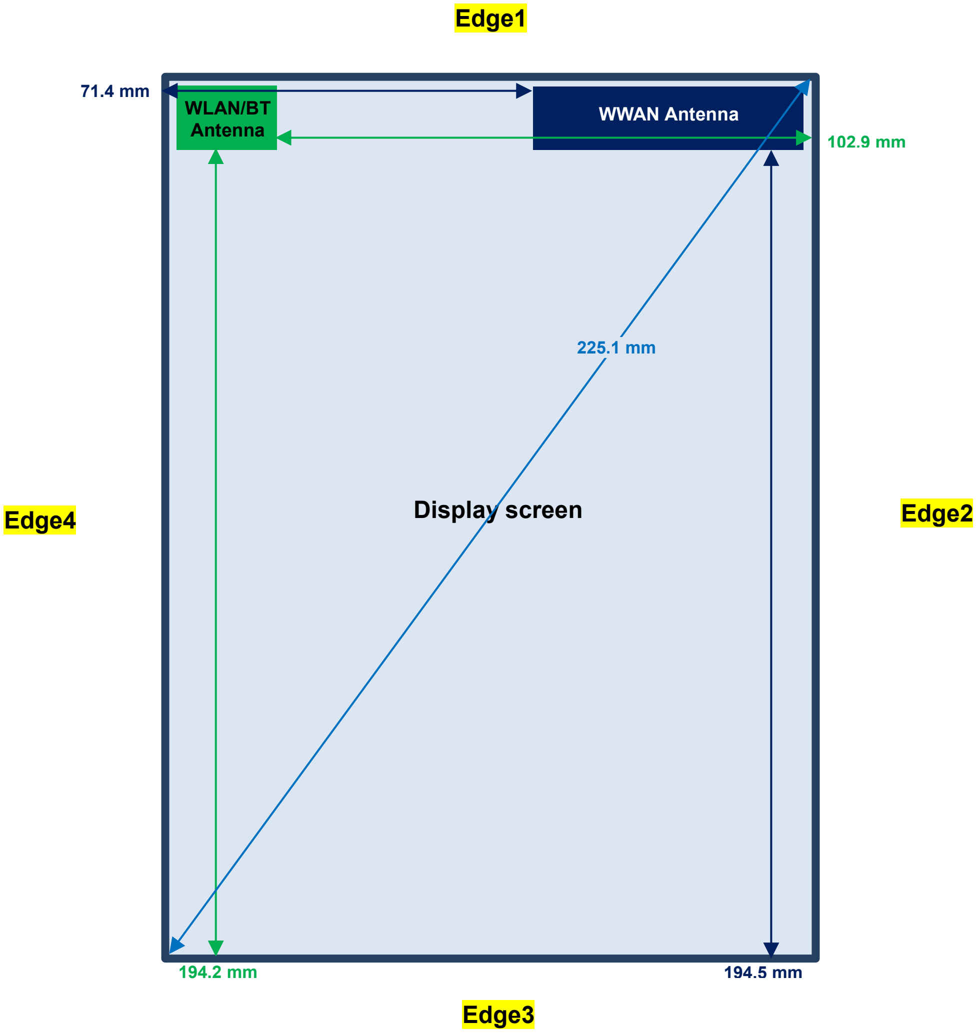
   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison

Bluetooth Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds
7.0	0	2.48	1.57

Note:

Per KDB 447498 D01v05r02, when the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion. The test exclusion threshold is 1.57 which is <= 3, SAR testing is not required.

15. Antenna Location



Front View

<SAR test exclusion table>

General Note:

1. The below table, when the distance is < 50 mm exclusion threshold is "Ratio", when the distance is > 50 mm exclusion threshold is "mW"
2. Maximum power is the source-based time-average power and represents the maximum RF output power among production units
3. Per KDB 447498 D01v05r02, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
4. Per KDB 447498 D01v05r02, standalone SAR test exclusion threshold is applied; If the test separation distance is < 5mm, 5mm is used to determine SAR exclusion threshold.
5. Per KDB 447498 D01v05r02, 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 separation distance, mm*)] ·[$\sqrt{f(GHz)}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison
6. Per KDB 447498 D01v05r02, 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) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz
   b) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

Exposure Position	Wireless Interface	GPRS 850 Class 10	GPRS 1900 Class 10	WCDMA Band V	WCDMA Band II	LTE Band4	LTE Band7	802.11b	802.11a
	Calculated Frequency	848MHz	1909MHz	846MHz	1907MHz	1754MHz	2570MHz	2462MHz	5825MHz
	Maximum power (dBm)	26.2	23.7	24.7	23.2	23.7	23.7	13	9.5
	Maximum rated power(mW)	417	234	295	209	234	234	20	9
Bottom Face	Separation distance(mm)	0.0						0.0	
	exclusion threshold	77	65	54	58	62	75	6	4
	Testing required?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Edge 1	Separation distance(mm)	0.0						0.0	
	exclusion threshold	77	65	54	58	62	75	6	4
	Testing required?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Edge 2	Separation distance(mm)	0.0						102.9	
	exclusion threshold	77	65	54	58	62	75	625	591
	Testing required?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**
Edge 3	Separation distance(mm)	194.0						194.2	
	exclusion threshold	980	1554	978	1554	1558	1539	1538	1504
	Testing required?	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Edge 4	Separation distance(mm)	71.4						0.0	
	exclusion threshold	284	323	284	323	327	308	6	4
	Testing required?	**Yes**	**No**	**Yes**	**No**	**No**	**No**	**Yes**	**Yes**

16. SAR Test Results

General Note:

1. Per KDB 447498 D01v05r02, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   d. For WLAN: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v05r02, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. For the exposure positions that proximity sensor power reduction is applied for SAR compliance, additional SAR testing with EUT transmitting full power in normal mode was performed; 1.1cm for bottom face, 1.2cm for edge1, 0.5cm for edge2.
4. Per KDB 616217 D04v01r01, the additional separation introduced by the contour against a flat phantom is < 5 mm on this device and reported SAR is < 1.2 W/kg, a curved or contoured back surface or edge SAR is not required, more detail information please refer to the “Sensor Triggering Data Summary”.
5. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

16.1 Body SAR

<GSM SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	GSM850	GPRS (2 Tx slots)	Bottom Face	1.1cm	OFF	128	824.2	31.94	32.20	1.062	0.18	0.629	0.668
	GSM850	GPRS (2 Tx slots)	Edge 1	1.2cm	OFF	128	824.2	31.94	32.20	1.062	-0.03	0.422	0.448
	GSM850	GPRS (2 Tx slots)	Edge 2	0.5cm	OFF	128	824.2	31.94	32.20	1.062	0	0.221	0.235
	GSM850	GPRS (2 Tx slots)	Edge 4	0cm	OFF	128	824.2	31.94	32.20	1.062	-0.02	0.101	0.107
01	GSM850	GPRS (4 Tx slots)	Bottom Face	0cm	ON	128	824.2	23.13	23.20	1.016	-0.1	1.160	**1.179**
	GSM850	GPRS (4 Tx slots)	Bottom Face	0cm	ON	189	836.4	23.08	23.20	1.028	-0.04	1.050	1.079
	GSM850	GPRS (4 Tx slots)	Bottom Face	0cm	ON	251	848.8	23.12	23.20	1.019	0.05	0.977	0.995
	GSM850	GPRS (4 Tx slots)	Edge 1	0cm	ON	128	824.2	23.13	23.20	1.016	-0.07	0.480	0.488
	GSM850	GPRS (4 Tx slots)	Edge 2	0cm	ON	128	824.2	23.13	23.20	1.016	0.01	0.120	0.122
	GSM1900	GPRS (2 Tx slots)	Bottom Face	1.1cm	OFF	810	1909.8	29.61	29.70	1.021	-0.03	1.170	1.194
	GSM1900	GPRS (2 Tx slots)	Bottom Face	1.1cm	OFF	512	1850.2	29.43	29.70	1.064	-0.05	1.030	1.096
	GSM1900	GPRS (2 Tx slots)	Bottom Face	1.1cm	OFF	661	1880	29.52	29.70	1.042	0.01	1.120	1.167
	GSM1900	GPRS (2 Tx slots)	Edge 1	1.2cm	OFF	810	1909.8	29.61	29.70	1.021	0.01	0.774	0.790
	GSM1900	GPRS (2 Tx slots)	Edge 2	0.5cm	OFF	810	1909.8	29.61	29.70	1.021	-0.08	0.435	0.444
	GSM1900	GPRS (3 Tx slots)	Bottom Face	0cm	ON	810	1909.8	20.69	20.70	1.002	-0.01	1.170	1.173
	GSM1900	GPRS (3 Tx slots)	Bottom Face	0cm	ON	512	1850.2	20.62	20.70	1.019	-0.02	1.170	1.192
02	GSM1900	GPRS (3 Tx slots)	Bottom Face	0cm	ON	661	1880	20.67	20.70	1.007	-0.04	1.190	**1.198**
	GSM1900	GPRS (3 Tx slots)	Edge 1	0cm	ON	810	1909.8	20.69	20.70	1.002	-0.07	1.050	1.052
	GSM1900	GPRS (3 Tx slots)	Edge 1	0cm	ON	512	1850.2	20.62	20.70	1.019	-0.14	1.000	1.019
	GSM1900	GPRS (3 Tx slots)	Edge 1	0cm	ON	661	1880	20.67	20.70	1.007	-0.11	1.040	1.047
	GSM1900	GPRS (3 Tx slots)	Edge 2	0cm	ON	810	1909.8	20.69	20.70	1.002	-0.02	0.124	0.124

<WCDMA SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WCDMA V	RMC 12.2Kbps	Bottom Face	1.1cm	OFF	4182	836.4	24.36	24.70	1.081	-0.02	0.672	0.727
	WCDMA V	RMC 12.2Kbps	Edge 1	1.2cm	OFF	4182	836.4	24.36	24.70	1.081	0.01	0.360	0.389
	WCDMA V	RMC 12.2Kbps	Edge 2	0.5cm	OFF	4182	836.4	24.36	24.70	1.081	0.08	0.194	0.210
	WCDMA V	RMC 12.2Kbps	Edge 4	0cm	OFF	4182	836.4	24.36	24.70	1.081	0	0.097	0.105
03	WCDMA V	RMC 12.2Kbps	Bottom Face	0cm	ON	4182	836.4	17.87	18.20	1.079	0.02	0.737	0.795
	WCDMA V	RMC 12.2Kbps	Edge 1	0cm	ON	4182	836.4	17.87	18.20	1.079	0.01	0.307	0.331
	WCDMA V	RMC 12.2Kbps	Edge 2	0cm	ON	4182	836.4	17.87	18.20	1.079	0.07	0.075	0.081
04	WCDMA II	RMC 12.2Kbps	Bottom Face	1.1cm	OFF	9538	1907.6	22.70	23.20	1.122	0.1	1.010	1.133
	WCDMA II	RMC 12.2Kbps	Bottom Face	1.1cm	OFF	9262	1852.4	22.68	23.20	1.127	-0.01	0.825	0.930
	WCDMA II	RMC 12.2Kbps	Bottom Face	1.1cm	OFF	9400	1880	22.53	23.20	1.167	0.11	0.930	1.085
	WCDMA II	RMC 12.2Kbps	Edge 1	1.2cm	OFF	9538	1907.6	22.70	23.20	1.122	-0.03	0.894	1.003
	WCDMA II	RMC 12.2Kbps	Edge 1	1.2cm	OFF	9262	1852.4	22.68	23.20	1.127	-0.03	0.646	0.728
	WCDMA II	RMC 12.2Kbps	Edge 1	1.2cm	OFF	9400	1880	22.53	23.20	1.167	0.01	0.739	0.862
	WCDMA II	RMC 12.2Kbps	Edge 2	0.5cm	OFF	9538	1907.6	22.70	23.20	1.122	-0.07	0.477	0.535
	WCDMA II	RMC 12.2Kbps	Bottom Face	0cm	ON	9262	1852.4	11.53	11.70	1.040	-0.02	0.479	0.498
	WCDMA II	RMC 12.2Kbps	Edge 1	0cm	ON	9262	1852.4	11.53	11.70	1.040	-0.16	0.389	0.405
	WCDMA II	RMC 12.2Kbps	Edge 2	0cm	ON	9262	1852.4	11.53	11.70	1.040	0.11	0.046	0.048

<LTE SAR>

Plot No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Test Position	Gap (cm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	LTE Band 4	20M	QPSK	1	0	Bottom Face	1.1cm	OFF	20175	1732.5	23.69	23.70	1.002	0.04	0.581	0.582
	LTE Band 4	20M	QPSK	50	0	Bottom Face	1.1cm	OFF	20300	1745	22.66	22.70	1.009	0.09	0.462	0.466
	LTE Band 4	20M	QPSK	1	0	Edge 1	1.2cm	OFF	20175	1732.5	23.69	23.70	1.002	0	0.411	0.412
	LTE Band 4	20M	QPSK	50	0	Edge 1	1.2cm	OFF	20300	1745	22.66	22.70	1.009	-0.01	0.344	0.347
05	LTE Band 4	20M	QPSK	1	0	Edge 2	0.5cm	OFF	20175	1732.5	23.69	23.70	1.002	0	0.688	0.690
	LTE Band 4	20M	QPSK	50	0	Edge 2	0.5cm	OFF	20300	1745	22.66	22.70	1.009	0.04	0.482	0.486
	LTE Band 4	20M	QPSK	1	0	Bottom Face	0cm	ON	20175	1732.5	10.79	10.90	1.026	0.09	0.285	0.292
	LTE Band 4	20M	QPSK	50	0	Bottom Face	0cm	ON	20050	1720	10.66	10.90	1.057	-0.01	0.281	0.297
	LTE Band 4	20M	QPSK	1	0	Edge 1	0cm	ON	20175	1732.5	10.79	10.90	1.026	-0.04	0.164	0.168
	LTE Band 4	20M	QPSK	50	0	Edge 1	0cm	ON	20050	1720	10.66	10.90	1.057	-0.13	0.169	0.179
	LTE Band 4	20M	QPSK	1	0	Edge 2	0cm	ON	20175	1732.5	10.79	10.90	1.026	-0.01	0.047	0.048
	LTE Band 4	20M	QPSK	50	0	Edge 2	0cm	ON	20050	1720	10.66	10.90	1.057	-0.06	0.053	0.056
	LTE Band 7	20M	QPSK	1	0	Bottom Face	1.1cm	OFF	21100	2535	23.63	23.70	1.016	-0.05	0.608	0.618
	LTE Band 7	20M	QPSK	50	49	Bottom Face	1.1cm	OFF	21100	2535	22.70	22.70	1.000	-0.04	0.527	0.527
	LTE Band 7	20M	QPSK	1	0	Edge 1	1.2cm	OFF	21100	2535	23.63	23.70	1.016	-0.13	0.511	0.519
	LTE Band 7	20M	QPSK	50	49	Edge 1	1.2cm	OFF	21100	2535	22.70	22.70	1.000	-0.06	0.424	0.424
	LTE Band 7	20M	QPSK	1	0	Edge 2	0.5cm	OFF	21100	2535	23.63	23.70	1.016	-0.04	1.050	1.067
06	LTE Band 7	20M	QPSK	1	0	Edge 2	0.5cm	OFF	20850	2510	23.41	23.70	1.069	-0.05	1.090	1.165
	LTE Band 7	20M	QPSK	1	0	Edge 2	0.5cm	OFF	21350	2560	23.39	23.70	1.074	0.06	1.010	1.085
	LTE Band 7	20M	QPSK	50	49	Edge 2	0.5cm	OFF	21100	2535	22.70	22.70	1.000	0.14	0.837	0.837
	LTE Band 7	20M	QPSK	50	49	Edge 2	0.5cm	OFF	20850	2510	22.45	22.70	1.059	-0.06	0.787	0.834
	LTE Band 7	20M	QPSK	50	49	Edge 2	0.5cm	OFF	21350	2560	22.54	22.70	1.038	0.1	0.770	0.799
	LTE Band 7	20M	QPSK	100	0	Edge 2	0.5cm	OFF	21100	2535	22.52	22.70	1.042	-0.06	0.876	0.913
	LTE Band 7	20M	QPSK	1	49	Bottom Face	0cm	ON	21100	2535	10.84	10.90	1.014	-0.14	0.296	0.300
	LTE Band 7	20M	QPSK	50	24	Bottom Face	0cm	ON	21100	2535	10.89	10.90	1.002	0.1	0.329	0.330
	LTE Band 7	20M	QPSK	1	49	Edge 1	0cm	ON	21100	2535	10.84	10.90	1.014	-0.15	0.072	0.073
	LTE Band 7	20M	QPSK	50	24	Edge 1	0cm	ON	21100	2535	10.89	10.90	1.002	-0.15	0.076	0.076
	LTE Band 7	20M	QPSK	1	49	Edge 2	0cm	ON	21100	2535	10.84	10.90	1.014	-0.16	0.160	0.162
	LTE Band 7	20M	QPSK	50	24	Edge 2	0cm	ON	21100	2535	10.89	10.90	1.002	-0.17	0.156	0.156

<DTS WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
07	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0cm	6	2437	12.41	13.00	1.146	99.09	1.009	0.07	0.575	**0.665**
	WLAN2.4GHz	802.11b 1Mbps	Edge 1	0cm	6	2437	12.41	13.00	1.146	99.09	1.009	0.12	0.107	0.124
	WLAN2.4GHz	802.11b 1Mbps	Edge 4	0cm	6	2437	12.41	13.00	1.146	99.09	1.009	-0.08	0.310	0.358
08	WLAN5GHz	802.11a 6Mbps	Bottom Face	0cm	157	5785	8.99	9.50	1.125	95.51	1.047	0.05	0.111	**0.131**
	WLAN5GHz	802.11a 6Mbps	Edge 1	0cm	157	5785	8.99	9.50	1.125	95.51	1.047	-0.12	0.094	0.111
	WLAN5GHz	802.11a 6Mbps	Edge 4	0cm	157	5785	8.99	9.50	1.125	95.51	1.047	-0.13	0.028	0.033

<NII WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
09	WLAN5GHz	802.11a 6Mbps	Bottom Face	0cm	44	5220	8.98	9.50	1.127	95.51	1.047	-0.08	0.277	**0.327**
	WLAN5GHz	802.11a 6Mbps	Edge 1	0cm	44	5220	8.98	9.50	1.127	95.51	1.047	-0.1	0.119	0.140
	WLAN5GHz	802.11a 6Mbps	Edge 4	0cm	44	5220	8.98	9.50	1.127	95.51	1.047	-0.1	0.035	0.041
10	WLAN5GHz	802.11a 6Mbps	Bottom Face	0cm	60	5300	8.98	9.50	1.127	95.51	1.047	-0.13	0.285	**0.336**
	WLAN5GHz	802.11a 6Mbps	Edge 1	0cm	60	5300	8.98	9.50	1.127	95.51	1.047	0.04	0.132	0.156
	WLAN5GHz	802.11a 6Mbps	Edge 4	0cm	60	5300	8.98	9.50	1.127	95.51	1.047	0.07	0.038	0.045
11	WLAN5GHz	802.11a 6Mbps	Bottom Face	0cm	140	5700	8.99	9.50	1.125	95.51	1.047	-0.02	0.143	**0.168**
	WLAN5GHz	802.11a 6Mbps	Edge 1	0cm	140	5700	8.99	9.50	1.125	95.51	1.047	-0.01	0.085	0.100
	WLAN5GHz	802.11a 6Mbps	Edge 4	0cm	140	5700	8.99	9.50	1.125	95.51	1.047	-0.11	0.021	0.025

16.2 Repeated SAR Measurement

No.	Band	BW (MHz)	Modulation	RB Size	RB offset	Mode	Test Position	Gap (cm)	Power Reduction	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	GSM850	-	-	-	-	GPRS (4 Tx slots)	Bottom Face	0cm	ON	128	824.2	23.13	23.20	1.016	-0.1	1.160	-	1.179
2nd	GSM850	-	-	-	-	GPRS (4 Tx slots)	Bottom Face	0cm	ON	128	824.2	23.13	23.20	1.016	-0.03	1.140	1.02	1.159
1st	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Bottom Face	0cm	ON	661	1880	20.67	20.70	1.007	-0.04	1.190	-	1.198
2nd	GSM1900	-	-	-	-	GPRS (3 Tx slots)	Bottom Face	0cm	ON	661	1880	20.67	20.70	1.007	-0.02	1.160	1.03	1.168
1st	LTE Band 7	20M	QPSK	1	0	-	Edge 2	0.5cm	OFF	20850	2510	23.41	23.70	1.069	-0.05	1.090	-	1.165
2nd	LTE Band 7	20M	QPSK	1	0	-	Edge 2	0.5cm	OFF	20850	2510	23.41	23.70	1.069	-0.06	1.070	1.02	1.144

General Note:

1. Per KDB 865664 D01v01r03, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg
2. Per KDB 865664 D01v01r03, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR <1.45W/kg, only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated *measured SAR*.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

17. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Portable Device
		Body
1.	GPRS/EDGE(Data) + WLAN2.4GHz(data)	Yes
2.	WCDMA(Data) + WLAN2.4GHz(data)	Yes
3.	LTE(Data) + WLAN2.4GHz(data)	Yes
4.	GPRS/EDGE(Data) + Bluetooth(data)	Yes
5.	WCDMA(Data) + Bluetooth(data)	Yes
6.	LTE(Data) + Bluetooth(data)	Yes
7.	GPRS/EDGE(data) + WLAN5GHz(data)	Yes
8.	WCDMA(data) + WLAN5GHz(data)	Yes
9.	LTE(data) + WLAN5GHz(data)	Yes

General Note:

1. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
2. EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment.
3. The worst case 2.4GHz / 5GHz WLAN reported SAR for each configuration was used for SAR summation, regardless of whether the WLAN channel has WiFi Direct and Hotspot capability. Therefore, the following summations represent the absolute worst cases for simultaneous transmission with WLAN.
4. For simultaneous transmission analysis for exposure position of Bottom Face 11mm, Edge1 12mm and Edge2 5mm, WLAN SAR tested at 0mm separation is worse and the test data is used for conservative SAR summation.
5. The Scaled SAR summation is calculated based on the same configuration and test position.
6. Per KDB 447498 D01v05r02, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = (SAR1 + SAR2)^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
   iii) If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.
   iv) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.
   v) The SPLSR calculated results please refer to section 17.2.
7. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01v05r02 based on the formula below.
   i) (*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)]·[$\sqrt{f(GHz)}/x$] W/kg for *test separation distances* ≤ 50 mm; where *x* = 7.5 for 1-g SAR, and *x* = 18.75 for 10-g SAR.
   ii) When the minimum separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.
   iii) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the *test separation distances* is > 50 mm.
   iv) Bluetooth estimated SAR is conservatively determined by 5mm separation, for all applicable exposure positions.

Bluetooth Max Power	Exposure Position	All Positions
7.0 dBm	Estimated SAR (W/kg)	0.210 W/kg

17.1 Body Exposure Conditions

WWAN Band		Exposure Position	1	2		**1+2 Summed SAR (W/kg)**	SPLSR	Case No
			WWAN	2.4GHz / 5.8GHz WLAN				
			SAR (W/kg)	Band	SAR (W/kg)			
GSM	GSM850	Bottom Face at 1.1 cm	0.668	2.4GHz WLAN	0.665	**1.33**		
		Edge1 at 1.2 cm	0.448	2.4GHz WLAN	0.124	**0.57**		
		Edge2 at 0.5cm	0.235			**0.24**		
		Edge4 at 0cm	0.107	2.4GHz WLAN	0.358	**0.47**		
		Bottom Face at 0cm	1.179	2.4GHz WLAN	0.665	**1.84**	0.03	Case 1
		Edge1 at 0cm	0.488	2.4GHz WLAN	0.124	**0.61**		
		Edge2 at 0cm	0.122			**0.12**		
	GSM1900	Bottom Face at 1.1 cm	1.194	2.4GHz WLAN	0.665	**1.86**	0.03	Case 2
		Edge1 at 1.2 cm	0.790	2.4GHz WLAN	0.124	**0.91**		
		Edge2 at 0.5cm	0.444			**0.44**		
		Edge4 at 0cm	0.143	2.4GHz WLAN	0.358	**0.50**		
		Bottom Face at 0cm	1.198	2.4GHz WLAN	0.665	**1.86**	0.03	Case 3
		Edge1 at 0cm	1.047	2.4GHz WLAN	0.124	**1.17**		
		Edge2 at 0cm	0.124			**0.12**		
WCMDA	Band V	Bottom Face at 1.1 cm	0.727	2.4GHz WLAN	0.665	**1.39**		
		Edge1 at 1.2 cm	0.389	2.4GHz WLAN	0.124	**0.51**		
		Edge2 at 0.5cm	0.210			**0.21**		
		Edge4 at 0cm	0.105	2.4GHz WLAN	0.358	**0.46**		
		Bottom Face at 0cm	0.795	2.4GHz WLAN	0.665	**1.46**		
		Edge1 at 0cm	0.331	2.4GHz WLAN	0.124	**0.46**		
		Edge2 at 0cm	0.081			**0.08**		
	Band II	Bottom Face at 1.1 cm	1.133	2.4GHz WLAN	0.665	**1.80**	0.03	Case 4
		Edge1 at 1.1 cm	1.003	2.4GHz WLAN	0.124	**1.13**		
		Edge2 at 0.5cm	0.535			**0.54**		
		Edge4 at 0cm	0.183	2.4GHz WLAN	0.358	**0.54**		
		Bottom Face at 0cm	0.498	2.4GHz WLAN	0.665	**1.16**		
		Edge1 at 0cm	0.405	2.4GHz WLAN	0.124	**0.53**		
		Edge2 at 0cm	0.048			**0.05**		
LTE	Band 4	Bottom Face at 1.1 cm	0.582	2.4GHz WLAN	0.665	**1.25**		
		Edge1 at 1.1 cm	0.412	2.4GHz WLAN	0.124	**0.54**		
		Edge2 at 0.5cm	0.690			**0.69**		
		Edge4 at 0cm	0.193	2.4GHz WLAN	0.358	**0.55**		
		Bottom Face at 0cm	0.297	2.4GHz WLAN	0.665	**0.96**		
		Edge1 at 0cm	0.179	2.4GHz WLAN	0.124	**0.30**		
		Edge2 at 0cm	0.056			**0.06**		
	Band 7	Bottom Face at 1.1 cm	0.618	2.4GHz WLAN	0.665	**1.28**		
		Edge1 at 1.1 cm	0.519	2.4GHz WLAN	0.124	**0.64**		
		Edge2 at 0.5cm	1.165			**1.17**		
		Edge4 at 0cm	0.298	2.4GHz WLAN	0.358	**0.66**		
		Bottom Face at 0cm	0.330	2.4GHz WLAN	0.665	**1.00**		
		Edge1 at 0cm	0.076	2.4GHz WLAN	0.124	**0.20**		
		Edge2 at 0cm	0.162			**0.16**		

WWAN Band		Exposure Position	1	2		**1+2 Summed SAR (W/kg)**	SPLSR	Case No
			WWAN	5.2GHz / 5.3GHz / 5.5GHz WLAN				
			SAR (W/kg)	Band	SAR (W/kg)			
GSM	GSM850	Bottom Face at 1.1 cm	0.668	5.3GHz WLAN	0.336	**1.00**		
		Edge1 at 1.2 cm	0.448	5.3GHz WLAN	0.156	**0.60**		
		Edge2 at 0.5cm	0.235			**0.24**		
		Edge4 at 0cm	0.107	5.3GHz WLAN	0.045	**0.15**		
		Bottom Face at 0cm	1.179	5.3GHz WLAN	0.336	**1.52**		
		Edge1 at 0cm	0.488	5.3GHz WLAN	0.156	**0.64**		
		Edge2 at 0cm	0.122			**0.12**		
	GSM1900	Bottom Face at 1.1 cm	1.194	5.3GHz WLAN	0.336	**1.53**		
		Edge1 at 1.2 cm	0.790	5.3GHz WLAN	0.156	**0.95**		
		Edge2 at 0.5cm	0.444			**0.44**		
		Edge4 at 0cm		5.3GHz WLAN	0.045	**0.05**		
		Bottom Face at 0cm	1.198	5.3GHz WLAN	0.336	**1.53**		
		Edge1 at 0cm	1.047	5.3GHz WLAN	0.156	**1.20**		
		Edge2 at 0cm	0.124			**0.12**		
WCMDA	Band V	Bottom Face at 1.1 cm	0.727	5.3GHz WLAN	0.336	**1.06**		
		Edge1 at 1.2 cm	0.389	5.3GHz WLAN	0.156	**0.55**		
		Edge2 at 0.5cm	0.210			**0.21**		
		Edge4 at 0cm	0.105	5.3GHz WLAN	0.045	**0.15**		
		Bottom Face at 0cm	0.795	5.3GHz WLAN	0.336	**1.13**		
		Edge1 at 0cm	0.331	5.3GHz WLAN	0.156	**0.49**		
		Edge2 at 0cm	0.081			**0.08**		
	Band II	Bottom Face at 1.1 cm	1.133	5.3GHz WLAN	0.336	**1.47**		
		Edge1 at 1.2 cm	1.003	5.3GHz WLAN	0.156	**1.16**		
		Edge2 at 0.5cm	0.535			**0.54**		
		Edge4 at 0cm		5.3GHz WLAN	0.045	**0.05**		
		Bottom Face at 0cm	0.498	5.3GHz WLAN	0.336	**0.83**		
		Edge1 at 0cm	0.405	5.3GHz WLAN	0.156	**0.56**		
		Edge2 at 0cm	0.048			**0.05**		
LTE	Band 4	Bottom Face at 1.1 cm	0.582	5.3GHz WLAN	0.336	**0.92**		
		Edge1 at 1.2 cm	0.412	5.3GHz WLAN	0.156	**0.57**		
		Edge2 at 0.5cm	0.690			**0.69**		
		Edge4 at 0cm		5.3GHz WLAN	0.045	**0.05**		
		Bottom Face at 0cm	0.297	5.3GHz WLAN	0.336	**0.63**		
		Edge1 at 0cm	0.179	5.3GHz WLAN	0.156	**0.34**		
		Edge2 at 0cm	0.056			**0.06**		
	Band 7	Bottom Face at 1.1 cm	0.618	5.3GHz WLAN	0.336	**0.95**		
		Edge1 at 1.2 cm	0.519	5.3GHz WLAN	0.156	**0.68**		
		Edge2 at 0.5cm	1.165			**1.17**		
		Edge4 at 0cm		5.3GHz WLAN	0.045	**0.05**		
		Bottom Face at 0cm	0.330	5.3GHz WLAN	0.336	**0.67**		
		Edge1 at 0cm	0.076	5.3GHz WLAN	0.156	**0.23**		
		Edge2 at 0cm	0.162			**0.16**		

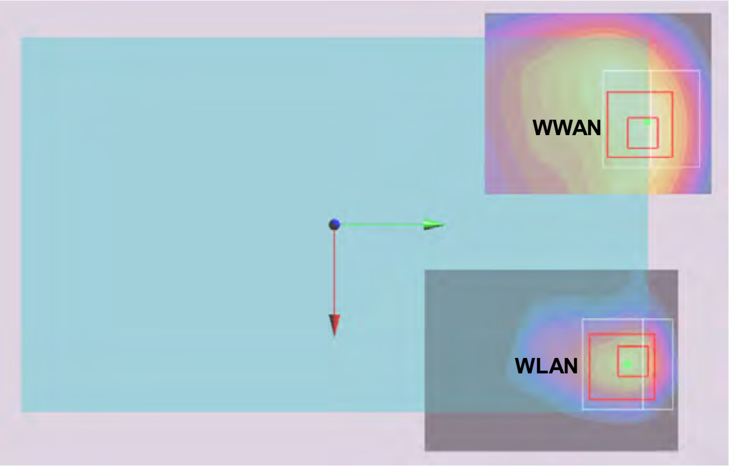
WWAN Band		Exposure Position	1 WWAN SAR (W/kg)	2 2.4GHz Bluetooth Estimated SAR (W/kg)	**1+2 Summed SAR (W/kg)**	SPLSR	Case No
GSM	GSM850	Bottom Face at 1.1 cm	0.668	0.210	**0.88**		
		Edge1 at 1.2 cm	0.448	0.210	**0.66**		
		Edge2 at 0.5cm	0.235	0.210	**0.45**		
		Edge4 at 0cm	0.107	0.210	**0.32**		
		Bottom Face at 0cm	1.179	0.210	**1.39**		
		Edge1 at 0cm	0.488	0.210	**0.70**		
		Edge2 at 0cm	0.122	0.210	**0.33**		
	GSM1900	Bottom Face at 1.1 cm	1.194	0.210	**1.40**		
		Edge1 at 1.2 cm	0.790	0.210	**1.00**		
		Edge2 at 0.5cm	0.444	0.210	**0.65**		
		Edge4 at 0cm	0.143	0.210	**0.35**		
		Bottom Face at 0cm	1.198	0.210	**1.41**		
		Edge1 at 0cm	1.047	0.210	**1.26**		
		Edge2 at 0cm	0.124	0.210	**0.33**		
WCMDA	Band V	Bottom Face at 1.1 cm	0.727	0.210	**0.94**		
		Edge1 at 1.2 cm	0.389	0.210	**0.60**		
		Edge2 at 0.5cm	0.210	0.210	**0.42**		
		Edge4 at 0cm	0.105	0.210	**0.32**		
		Bottom Face at 0cm	0.795	0.210	**1.01**		
		Edge1 at 0cm	0.331	0.210	**0.54**		
		Edge2 at 0cm	0.081	0.210	**0.29**		
	Band II	Bottom Face at 1.1 cm	1.133	0.210	**1.34**		
		Edge1 at 1.1 cm	1.003	0.210	**1.21**		
		Edge2 at 0.5cm	0.535	0.210	**0.75**		
		Edge4 at 0cm	0.183	0.210	**0.39**		
		Bottom Face at 0cm	0.498	0.210	**0.71**		
		Edge1 at 0cm	0.405	0.210	**0.62**		
		Edge2 at 0cm	0.048	0.210	**0.26**		
LTE	Band 4	Bottom Face at 1.1 cm	0.582	0.210	**0.79**		
		Edge1 at 1.1 cm	0.412	0.210	**0.62**		
		Edge2 at 0.5cm	0.690	0.210	**0.90**		
		Edge4 at 0cm	0.193	0.210	**0.40**		
		Bottom Face at 0cm	0.297	0.210	**0.51**		
		Edge1 at 0cm	0.179	0.210	**0.39**		
		Edge2 at 0cm	0.056	0.210	**0.27**		
	Band 7	Bottom Face at 1.1 cm	0.618	0.210	**0.83**		
		Edge1 at 1.1 cm	0.519	0.210	**0.73**		
		Edge2 at 0.5cm	1.165	0.210	**1.38**		
		Edge4 at 0cm	0.298	0.210	**0.51**		
		Bottom Face at 0cm	0.330	0.210	**0.54**		
		Edge1 at 0cm	0.076	0.210	**0.29**		
		Edge2 at 0cm	0.162	0.210	**0.37**		

17.2 SPLSR Evaluation and Analysis

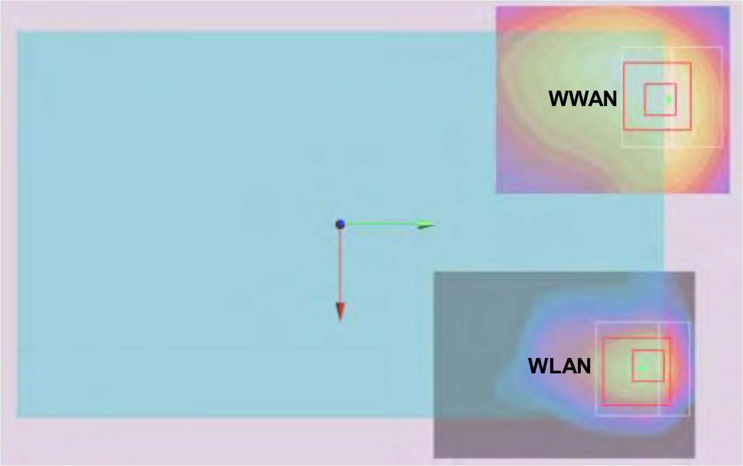
General Note:

1. SPLSR = $(SAR_1 + SAR_2)^{1.5}$ / (*min. separation distance, mm*). If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary

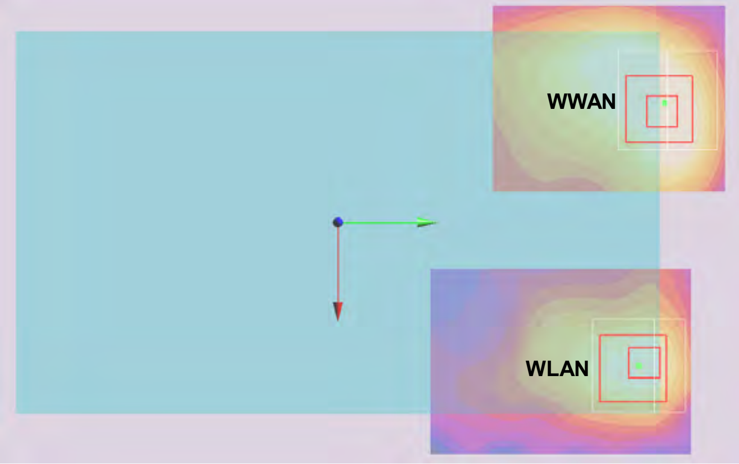
Case 1	Band	Position	SAR (W/kg)	Gap	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
				(cm)	X	Y	Z				
	GSM850	Bottom Face at 0cm	1.179	0	-0.027	0.105	-0.181	71.6	1.84	0.03	Not required
	2.4GHz WLAN		0.665	0	0.0438	0.095	-0.178				



Case 2	Band	Position	SAR (W/kg)	Gap	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
				(cm)	X	Y	Z				
	GSM1900	Bottom Face at 1.1 cm	1.194	1.1	-0.041	0.0985	-0.181	84.9	1.86	0.03	Not required
	2.4GHz WLAN		0.665	0	0.0438	0.095	-0.178				



Case 3	Band	Position	SAR (W/kg)	Gap	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
				(cm)	X	Y	Z				
	GSM1900	Bottom Face at 0cm	1.198	0	-0.0315	0.107	-0.18	76.3	1.86	0.03	Not required
	2.4GHz WLAN		0.665	0	0.0438	0.095	-0.178				



Case 4	Band	Position	SAR (W/kg)	Gap	SAR peak location (m)			3D distance (mm)	Summed SAR (W/kg)	SPLSR Results	Simultaneous SAR
				(cm)	X	Y	Z				
	Band II	Bottom Face at 1.1 cm	1.133	1.1	-0.0445	0.103	-0.181	88.7	1.80	0.03	Not required
	2.4GHz WLAN		0.665	0	0.0438	0.095	-0.178				

Test Engineer : Angelo Chang, Galen Zhang, Frank Wu, Ken Lee, Mood Huang, and Vic Yang

18. Uncertainty Assessment

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type An evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in table below.

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor$^{(a)}$	1/k$^{(b)}$	1/√3	1/√6	1/√2

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

(b) κ is the coverage factor

Table 18.1. Standard Uncertainty for Assumed Distribution

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

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

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)
Measurement System							
Probe Calibration	6.0	Normal	1	1	1	± 6.0 %	± 6.0 %
Axial Isotropy	4.7	Rectangular	√3	0.7	0.7	± 1.9 %	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	0.7	± 3.9 %	± 3.9 %
Boundary Effects	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Linearity	4.7	Rectangular	√3	1	1	± 2.7 %	± 2.7 %
System Detection Limits	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Readout Electronics	0.3	Normal	1	1	1	± 0.3 %	± 0.3 %
Response Time	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Probe Positioner	0.4	Rectangular	√3	1	1	± 0.2 %	± 0.2 %
Probe Positioning	2.9	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Max. SAR Eval.	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Test Sample Related							
Device Positioning	2.9	Normal	1	1	1	± 2.9 %	± 2.9 %
Device Holder	3.6	Normal	1	1	1	± 3.6 %	± 3.6 %
Power Drift	5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %
Phantom and Setup							
Phantom Uncertainty	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	0.43	± 1.6 %	± 1.1 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	0.49	± 1.7 %	± 1.4 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	0.49	± 1.5 %	± 1.2 %
Combined Standard Uncertainty						± 11.0 %	± 10.8 %
Coverage Factor for 95 %						K=2	
Expanded Uncertainty						**± 22.0 %**	**± 21.5 %**

Table 18.2. Uncertainty Budget for frequency range 300 MHz to 3 GHz

Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)
Measurement System							
Probe Calibration	6.55	Normal	1	1	1	± 6.55 %	± 6.55 %
Axial Isotropy	4.7	Rectangular	√3	0.7	0.7	± 1.9 %	± 1.9 %
Hemispherical Isotropy	9.6	Rectangular	√3	0.7	0.7	± 3.9 %	± 3.9 %
Boundary Effects	2.0	Rectangular	√3	1	1	± 1.2 %	± 1.2 %
Linearity	4.7	Rectangular	√3	1	1	± 2.7 %	± 2.7 %
System Detection Limits	1.0	Rectangular	√3	1	1	± 0.6 %	± 0.6 %
Readout Electronics	0.3	Normal	1	1	1	± 0.3 %	± 0.3 %
Response Time	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Integration Time	2.6	Rectangular	√3	1	1	± 1.5 %	± 1.5 %
RF Ambient Noise	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
RF Ambient Reflections	3.0	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
Probe Positioner	0.8	Rectangular	√3	1	1	± 0.5 %	± 0.5 %
Probe Positioning	9.9	Rectangular	√3	1	1	± 5.7 %	± 5.7 %
Max. SAR Eval.	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Test Sample Related							
Device Positioning	2.9	Normal	1	1	1	± 2.9 %	± 2.9 %
Device Holder	3.6	Normal	1	1	1	± 3.6 %	± 3.6 %
Power Drift	5.0	Rectangular	√3	1	1	± 2.9 %	± 2.9 %
Phantom and Setup							
Phantom Uncertainty	4.0	Rectangular	√3	1	1	± 2.3 %	± 2.3 %
Liquid Conductivity (Target)	5.0	Rectangular	√3	0.64	0.43	± 1.8 %	± 1.2 %
Liquid Conductivity (Meas.)	2.5	Normal	1	0.64	0.43	± 1.6 %	± 1.1 %
Liquid Permittivity (Target)	5.0	Rectangular	√3	0.6	0.49	± 1.7 %	± 1.4 %
Liquid Permittivity (Meas.)	2.5	Normal	1	0.6	0.49	± 1.5 %	± 1.2 %
Combined Standard Uncertainty						± 12.8 %	± 12.6 %
Coverage Factor for 95 %						K=2	
Expanded Uncertainty						**± 25.6 %**	**± 25.2 %**

Table 18.3. Uncertainty Budget for frequency range 3 GHz to 6 GHz

19. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] IEEE Std. 1528-2003, “Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, December 2003

[4] SPEAG DASY System Handbook

[5] FCC KDB 248227 D01 v01r02, “SAR Measurement Procedures for 802.11 a/b/g Transmitters”, May 2007

[6] FCC KDB 447498 D01 v05r02, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Feb 2014

[7] FCC KDB 941225 D01 v02, “SAR Measurement Procedures for 3G Devices – CDMA 2000 / Ev-Do / WCDMA / HSDPA / HSPA”, October 2007

[8] FCC KDB 941225 D02 v02r02, “SAR Guidance for HSPA, HSPA+, DC-HSDPA and 1x-Advanced”, May 2013.

[9] FCC KDB 941225 D03 v01, “Recommended SAR Test Reduction Procedures for GSM / GPRS / EDGE”, December 2008

[10] FCC KDB 941225 D05 v02r03, “SAR Evaluation Considerations for LTE Devices”, Dec 2013

[11] FCC KDB 616217 D04 v01r01, “SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers”, May 2013

[12] FCC KDB 865664 D01 v01r03, "SAR Measurement Requirements for 100 MHz to 6 GHz", Feb 2014.

[13] FCC KDB 865664 D02 v01r01, “RF Exposure Compliance Reporting and Documentation Considerations” May 2013.

Appendix A. Plots of System Performance Check

The plots are shown as follows.

System Check_Body_835MHz_140623

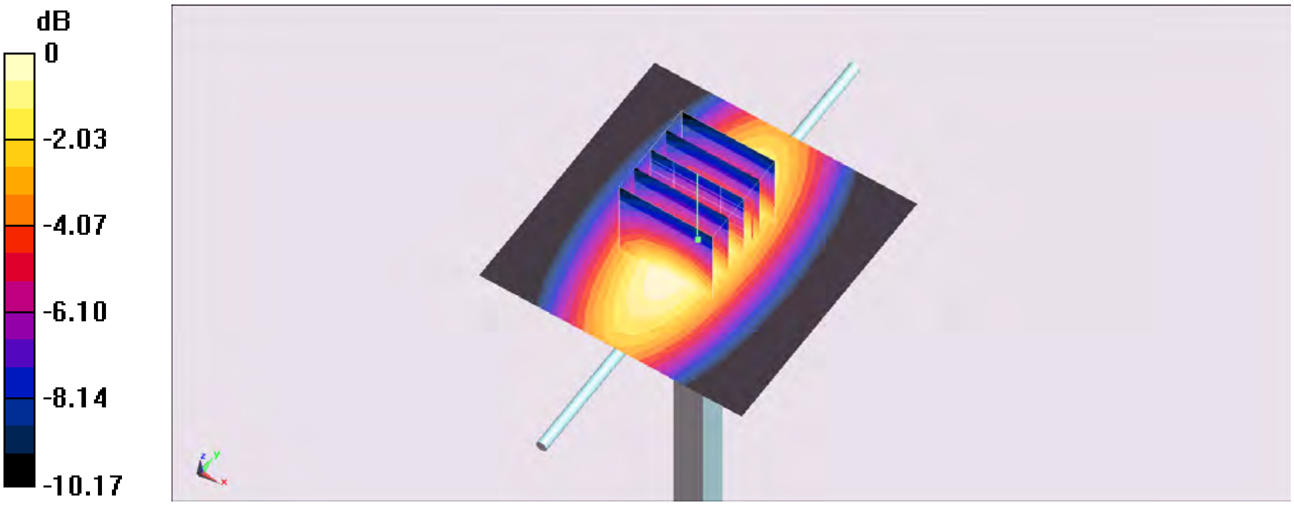
DUT: D835V2-499

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: MSL_850_140623 Medium parameters used: f = 835 MHz; $\sigma = 0.984$ S/m; $\varepsilon_r = 54.4$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.4 ℃； Liquid Temperature：22.4 ℃

DASY5 Configuration
- Probe: ES3DV3 - SN3270; ConvF(6.08, 6.08, 6.08); Calibrated: 2013/9/24;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2013/8/21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.96 W/kg

Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 55.857 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.54 W/kg
SAR(1 g) = 2.54 W/kg; SAR(10 g) = 1.71 W/kg
Maximum value of SAR (measured) = 2.87 W/kg



0 dB = 2.87 W/kg = 4.58 dBW/kg

System Check_Body_1750MHz_140625

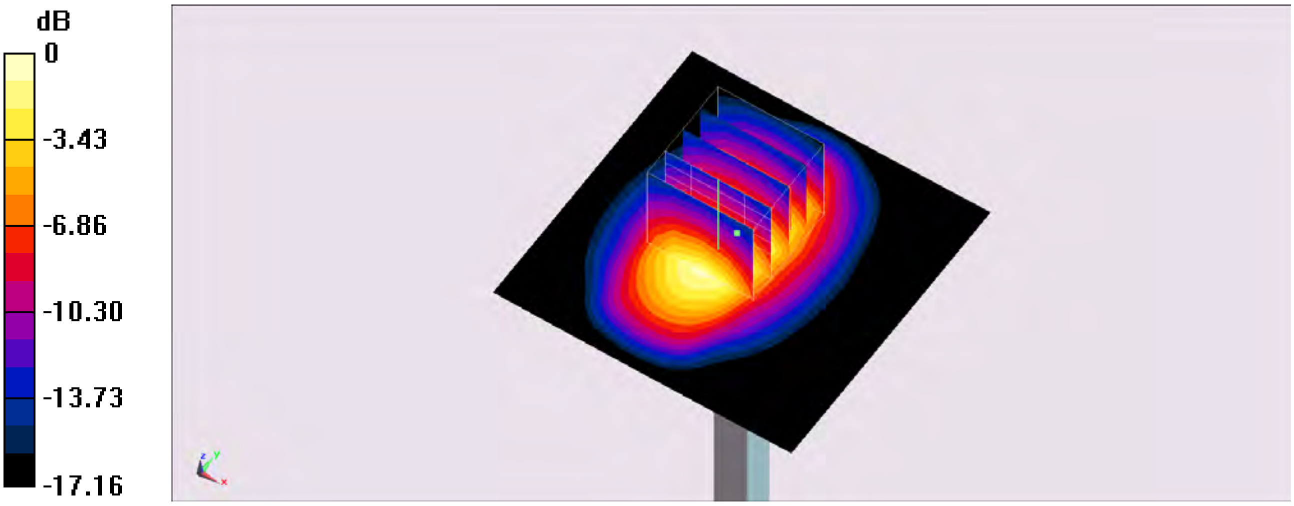
DUT: D1750V2-1068

Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: MSL_1750_140625 Medium parameters used: f = 1750 MHz; $\sigma = 1.455$ S/m; $\varepsilon_r = 54.501$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration
- Probe: ES3DV3 - SN3270; ConvF(4.91, 4.91, 4.91); Calibrated: 2013/9/24;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2013/8/21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 11.2 W/kg

Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 79.243 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 15.4 W/kg
SAR(1 g) = 8.86 W/kg; SAR(10 g) = 4.75 W/kg
Maximum value of SAR (measured) = 10.9 W/kg



0 dB = 10.9 W/kg = 10.37 dBW/kg

System Check_Body_1900MHz_140624

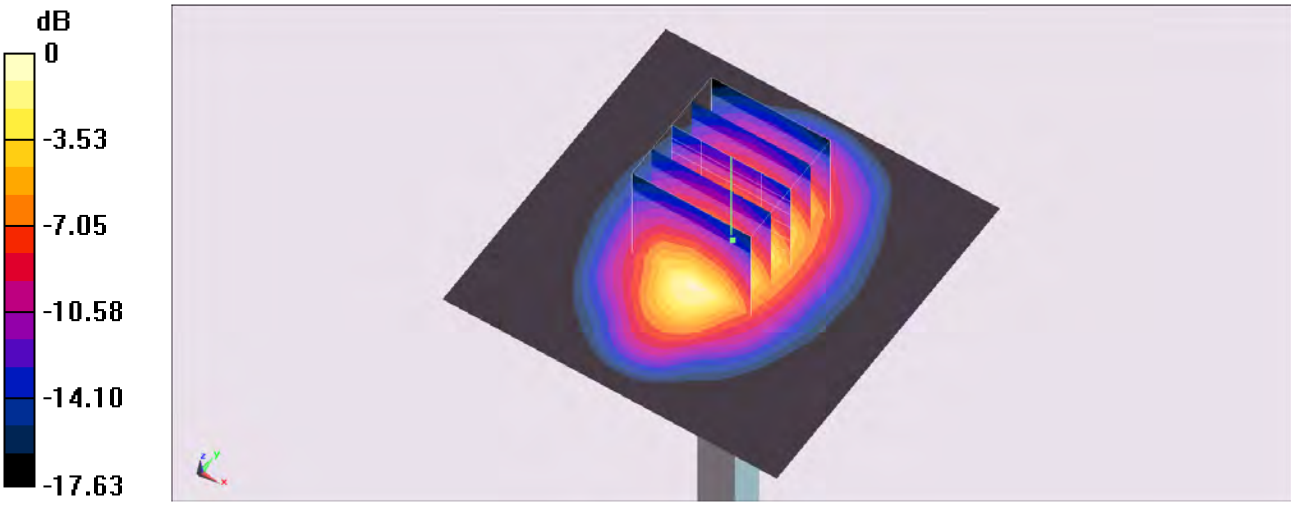
DUT: D1900V2-5d041

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: MSL_1900_140624 Medium parameters used: f = 1900 MHz; σ = 1.532 S/m; ε_r = 52.328; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY5 Configuration
- Probe: ES3DV3 - SN3270; ConvF(4.71, 4.71, 4.71); Calibrated: 2013/9/24;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2013/8/21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.4 W/kg

Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 95.776 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 17.3 W/kg
SAR(1 g) = 10.6 W/kg; SAR(10 g) = 5.59 W/kg
Maximum value of SAR (measured) = 12.8 W/kg



0 dB = 12.8 W/kg = 11.07 dBW/kg

System Check_Body_1900MHz_140625

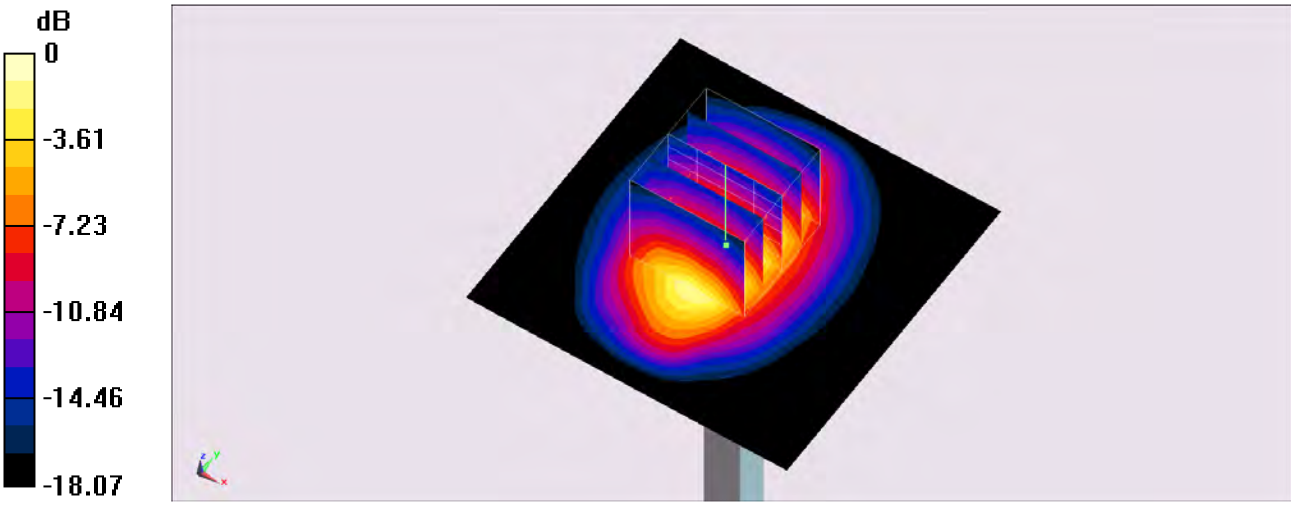
DUT: D1900V2-5d041

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: MSL_1900_140625 Medium parameters used: f = 1900 MHz; $\sigma = 1.546$ S/m; $\varepsilon_r = 52.216$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration
- Probe: ES3DV3 - SN3270; ConvF(4.71, 4.71, 4.71); Calibrated: 2013/9/24;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2013/8/21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.4 W/kg

Configuration/Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 93.608 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 19.0 W/kg
SAR(1 g) = 10.6 W/kg; SAR(10 g) = 5.45 W/kg
Maximum value of SAR (measured) = 13.3 W/kg



0 dB = 13.3 W/kg = 11.24 dBW/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2014/6/26

System Check_Body_2450MHz_140626

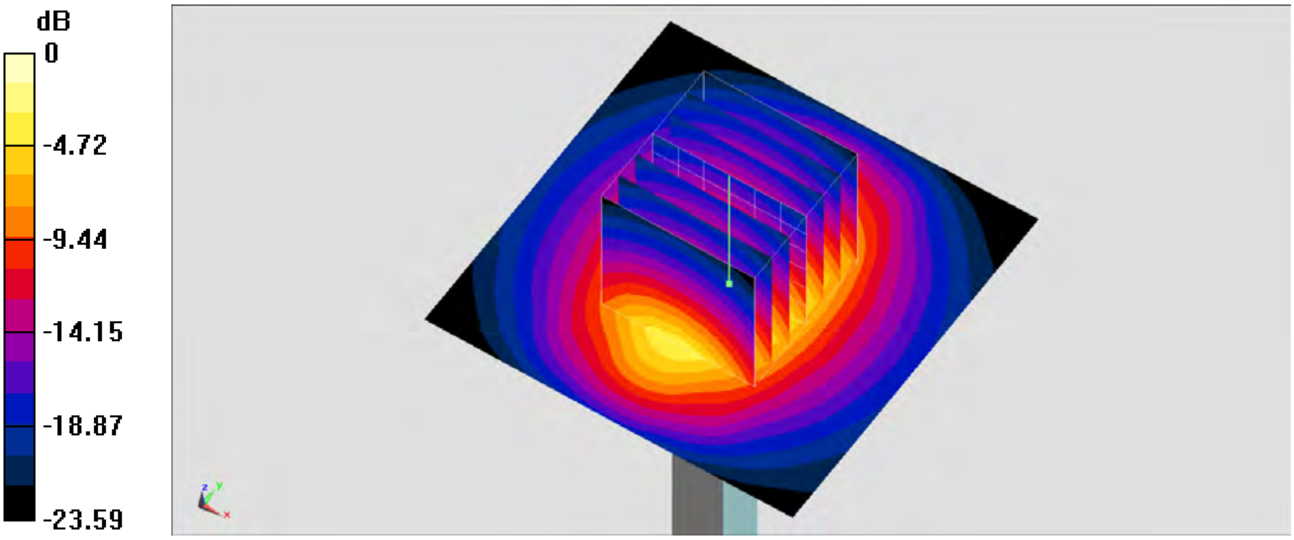
DUT: D2450V2-924

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: MSL_2450_140626 Medium parameters used: f = 2450 MHz; $\sigma = 1.964$ S/m; $\varepsilon_r = 53.315$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(7.36, 7.36, 7.36); Calibrated: 2014/5/22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1227
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 19.2 W/kg

Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.27 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 25.8 W/kg
SAR(1 g) = 12.2 W/kg; SAR(10 g) = 5.47 W/kg
Maximum value of SAR (measured) = 18.7 W/kg



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

System Check_Body_2600MHz_140626

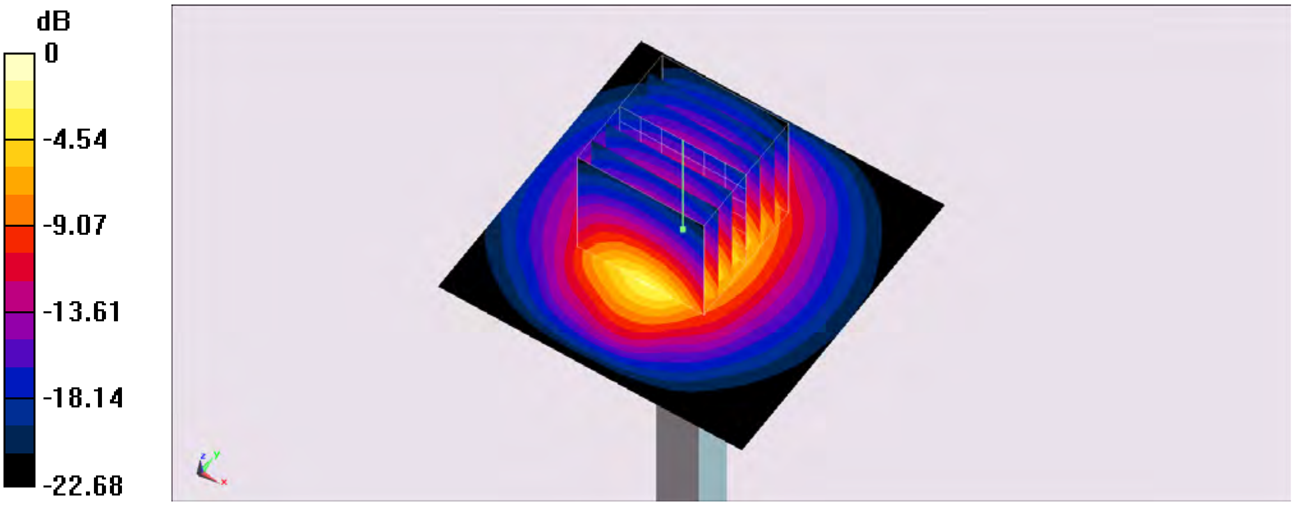
DUT: D2600V2-1070

Communication System: CW ; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: MSL_2600_140626 Medium parameters used: f = 2600 MHz; σ = 2.209 S/m; ε_r = 51.123; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3955; ConvF(7.58, 7.58, 7.58); Calibrated: 2013/12/23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1399; Calibrated: 2013/11/7
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Pin=250mW/Area Scan (61x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 23.3 W/kg

Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 100.3 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 32.0 W/kg
SAR(1 g) = 14.8 W/kg; SAR(10 g) = 6.62 W/kg
Maximum value of SAR (measured) = 22.9 W/kg



0 dB = 22.9 W/kg = 13.60 dBW/kg

System Check_Body_5200MHz_140701

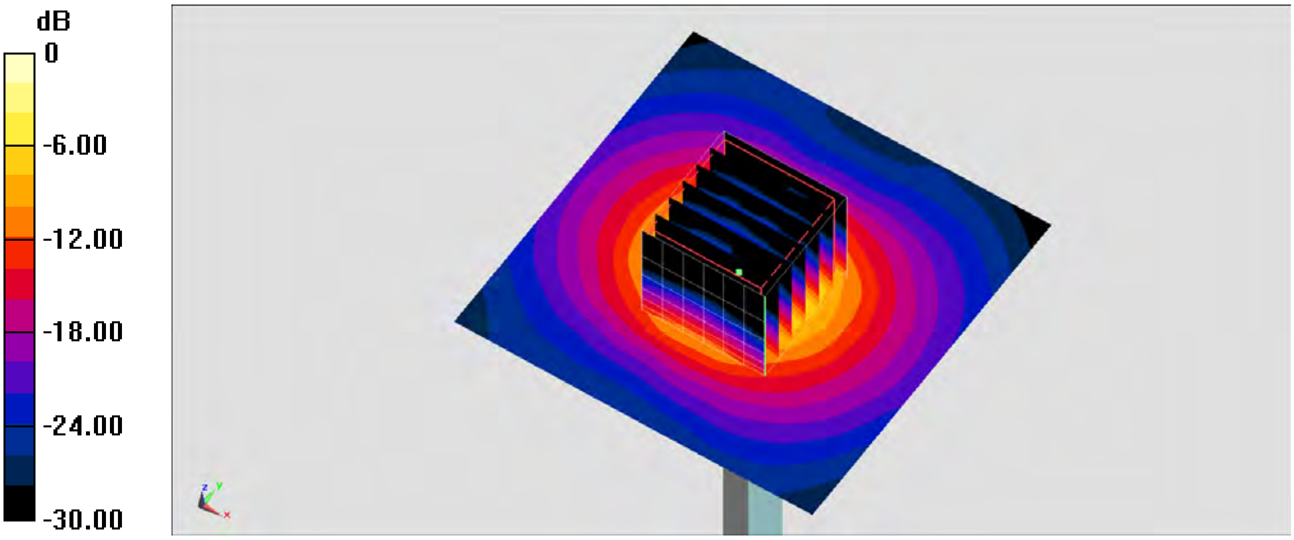
DUT: D5GHzV2-1128

Communication System: CW; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium: MSL_5G_140701 Medium parameters used: f = 5200 MHz; σ = 5.143 S/m; ε_r = 47.437; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(4.53, 4.53, 4.53); Calibrated: 2014/5/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1227
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/Pin=100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 17.8 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.49 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 32.7 W/kg
SAR(1 g) = 7.32 W/kg; SAR(10 g) = 2.01 W/kg
Maximum value of SAR (measured) = 17.8 W/kg



0 dB = 17.8 W/kg = 12.50 dBW/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2014/7/1

System Check_Body_5300MHz_140701

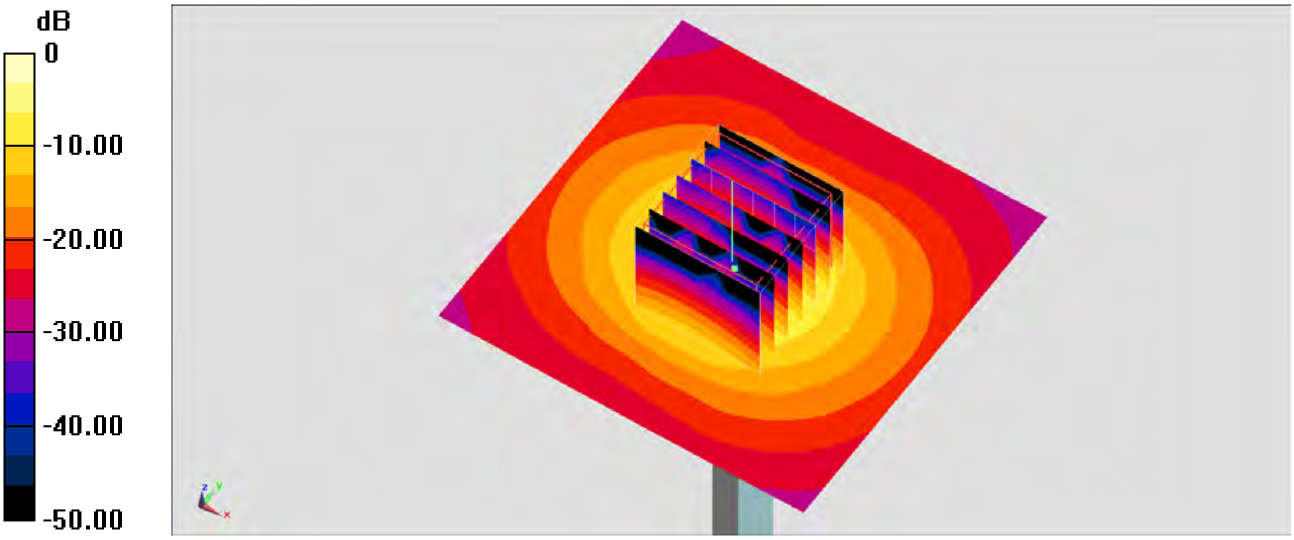
DUT: D5GHzV2-1128

Communication System: CW; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: MSL_5G_140701 Medium parameters used: f = 5300 MHz; σ = 5.274 S/m; ε_r = 47.199; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(4.36, 4.36, 4.36); Calibrated: 2014/5/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1227
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/Pin=100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.0 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 68.13 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 34.3 W/kg
SAR(1 g) = 7.82 W/kg; SAR(10 g) = 2.14 W/kg
Maximum value of SAR (measured) = 19.5 W/kg



0 dB = 19.5 W/kg = 12.90 dBW/kg

System Check_Body_5600MHz_140701

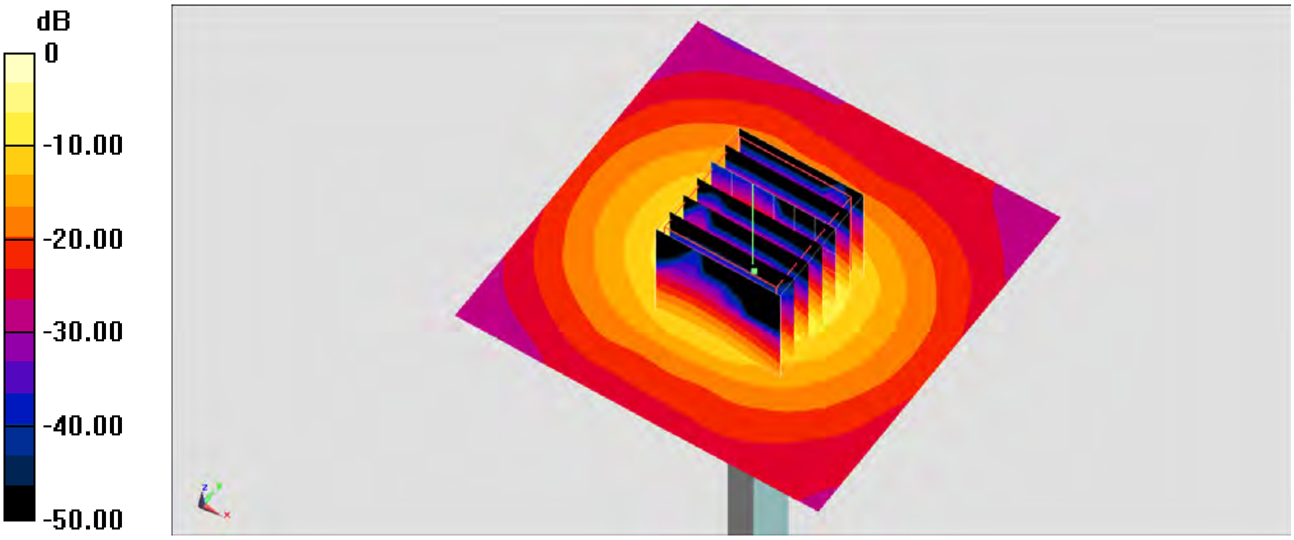
DUT: D5GHzV2-1128

Communication System: CW; Frequency: 5600 MHz;Duty Cycle: 1:1
Medium: MSL_5G_140701 Medium parameters used: f = 5600 MHz; σ = 5.654 S/m; ε_r = 46.749; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(4.12, 4.12, 4.12); Calibrated: 2014/5/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1227
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/Pin=100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 20.8 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 69.30 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 40.4 W/kg
SAR(1 g) = 8.19 W/kg; SAR(10 g) = 2.17 W/kg
Maximum value of SAR (measured) = 21.8 W/kg



0 dB = 21.8 W/kg = 13.38 dBW/kg

System Check_Body_5800MHz_140701

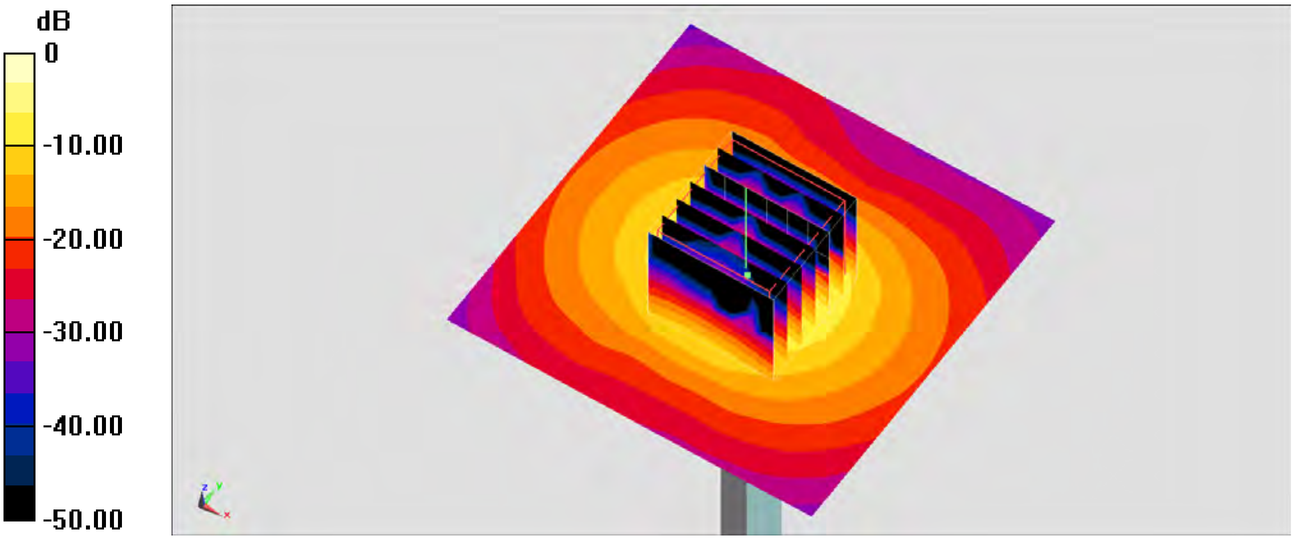
DUT: D5GHzV2-1128

Communication System: CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium: MSL_5G_140701 Medium parameters used: f = 5800 MHz; σ = 5.988 S/m; ε_r = 46.473; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(4.09, 4.09, 4.09); Calibrated: 2014/5/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1227
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/Pin=100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 17.8 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.77 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 35.0 W/kg
SAR(1 g) = 7.06 W/kg; SAR(10 g) = 1.89 W/kg
Maximum value of SAR (measured) = 18.7 W/kg



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

Appendix B. Plots of SAR Measurement

The plots are shown as follows.

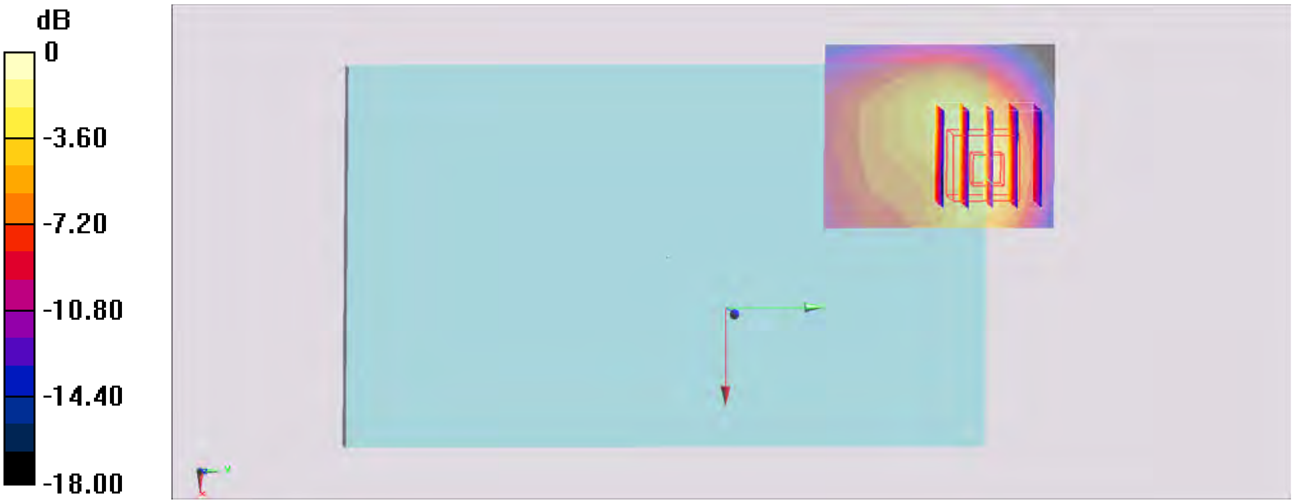
#01_GSM850_GPRS (4 Tx slots)_Bottom Face_0cm_Ch128

Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:2.08
Medium: MSL_850_140623 Medium parameters used : f = 824.2 MHz; σ = 0.972 S/m; ε_r = 54.534; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration
- Probe: ES3DV3 - SN3270; ConvF(6.08, 6.08, 6.08); Calibrated: 2013/9/24;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2013/8/21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Ch128/Area Scan (41x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.13 W/kg

Configuration/Ch128/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 43.212 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 2.54 W/kg
SAR(1 g) = 1.16 W/kg; SAR(10 g) = 0.600 W/kg
Maximum value of SAR (measured) = 1.74 W/kg



0 dB = 1.74 W/kg = 2.41 dBW/kg

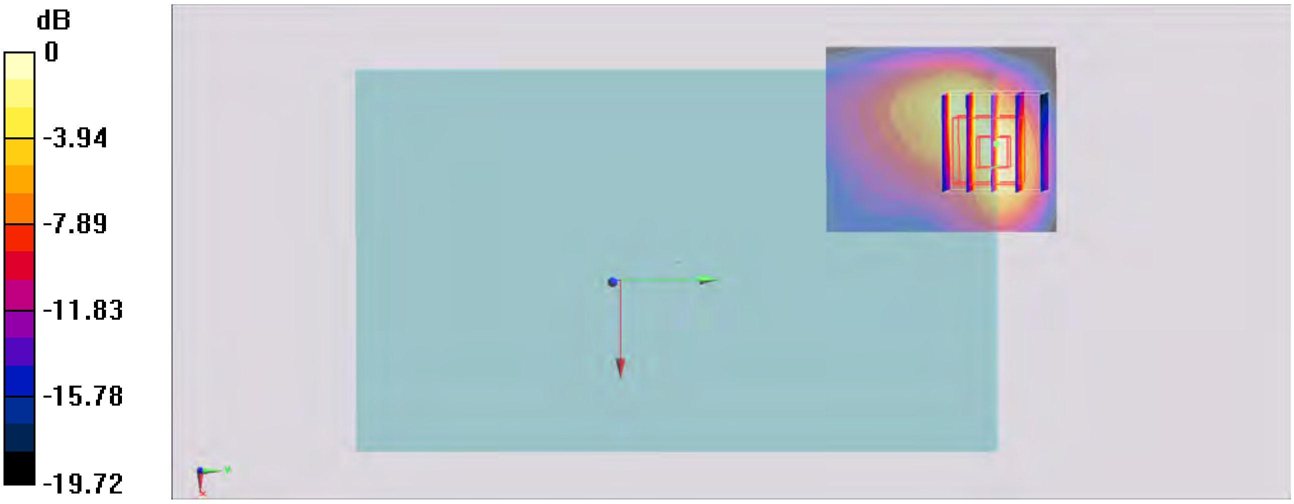
#02_GSM1900_GPRS (3 Tx slots)_Bottom Face_0cm_Ch661

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:2.77
Medium: MSL_1900_140624 Medium parameters used: f = 1880 MHz; σ = 1.515 S/m; ε_r = 52.419; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY5 Configuration
- Probe: ES3DV3 - SN3270; ConvF(4.71, 4.71, 4.71); Calibrated: 2013/9/24;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2013/8/21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Ch661/Area Scan (41x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.53 W/kg

Configuration/Ch661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34.602 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 2.63 W/kg
SAR(1 g) = 1.19 W/kg; SAR(10 g) = 0.600 W/kg
Maximum value of SAR (measured) = 1.67 W/kg



0 dB = 1.67 W/kg = 2.23 dBW/kg

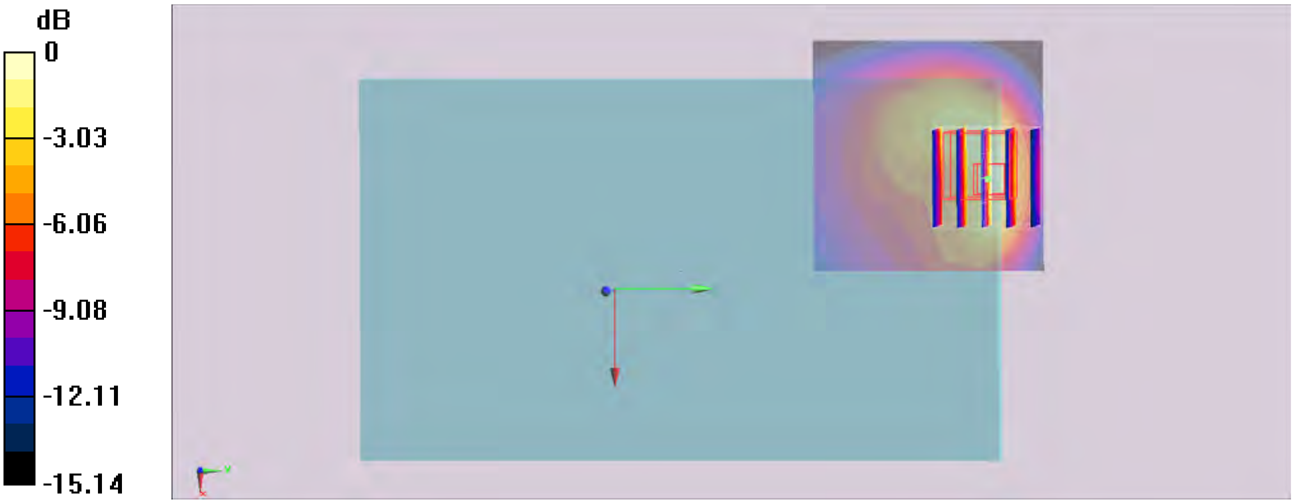
#03_WCDMA V_RMC 12.2Kbps_Bottom Face_0cm_Ch4182

Communication System: WCDMA; Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: MSL_850_140623 Medium parameters used : f = 836.4 MHz; σ = 0.985 S/m; ε_r = 54.382; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration
- Probe: ES3DV3 - SN3270; ConvF(6.08, 6.08, 6.08); Calibrated: 2013/9/24;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2013/8/21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Ch4182/Area Scan (51x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.972 W/kg

Configuration/Ch4182/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 34.034 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.56 W/kg
SAR(1 g) = 0.737 W/kg; SAR(10 g) = 0.377 W/kg
Maximum value of SAR (measured) = 1.05 W/kg



0 dB = 1.05 W/kg = 0.21 dBW/kg

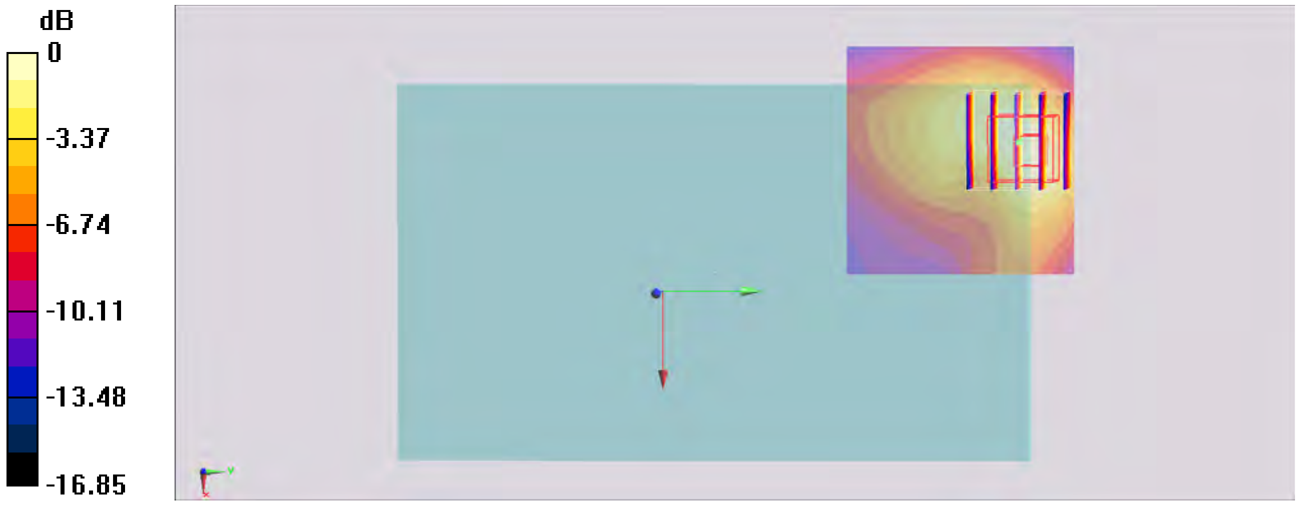
#04_WCDMA II_RMC 12.2Kbps_Bottom Face_1.1cm_Ch9538

Communication System: WCDMA; Frequency: 1907.6 MHz;Duty Cycle: 1:1
Medium: MSL_1900_140624 Medium parameters used: f = 1908 MHz; $\sigma = 1.539$ S/m; $\varepsilon_r = 52.297$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.3 ℃

DASY5 Configuration
- Probe: ES3DV3 - SN3270; ConvF(4.71, 4.71, 4.71); Calibrated: 2013/9/24;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2013/8/21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Ch9538/Area Scan (51x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.23 W/kg

Configuration/Ch9538/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 28.546 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 1.66 W/kg
SAR(1 g) = 1.01 W/kg; SAR(10 g) = 0.565 W/kg
Maximum value of SAR (measured) = 1.21 W/kg



0 dB = 1.21 W/kg = 0.83 dBW/kg

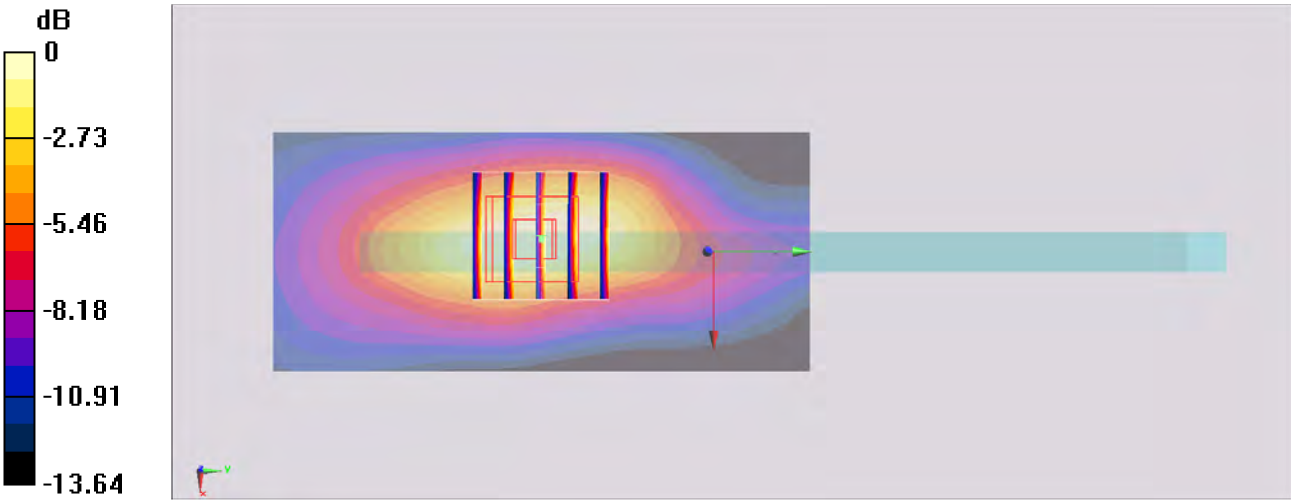
#05_LTE Band 4_20M_QPSK_1RB_0Offset_Edge 2_0.5cm_Ch20175

Communication System: LTE; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: MSL_1750_140625 Medium parameters used: f = 1732.5 MHz; $\sigma = 1.44$ S/m; $\varepsilon_r = 54.599$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration
- Probe: ES3DV3 - SN3270; ConvF(4.91, 4.91, 4.91); Calibrated: 2013/9/24;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn778; Calibrated: 2013/8/21
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Ch20175/Area Scan (41x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.860 W/kg

Configuration/Ch20175/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.078 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 1.12 W/kg
SAR(1 g) = 0.688 W/kg; SAR(10 g) = 0.401 W/kg
Maximum value of SAR (measured) = 0.833 W/kg



0 dB = 0.833 W/kg = -0.79 dBW/kg

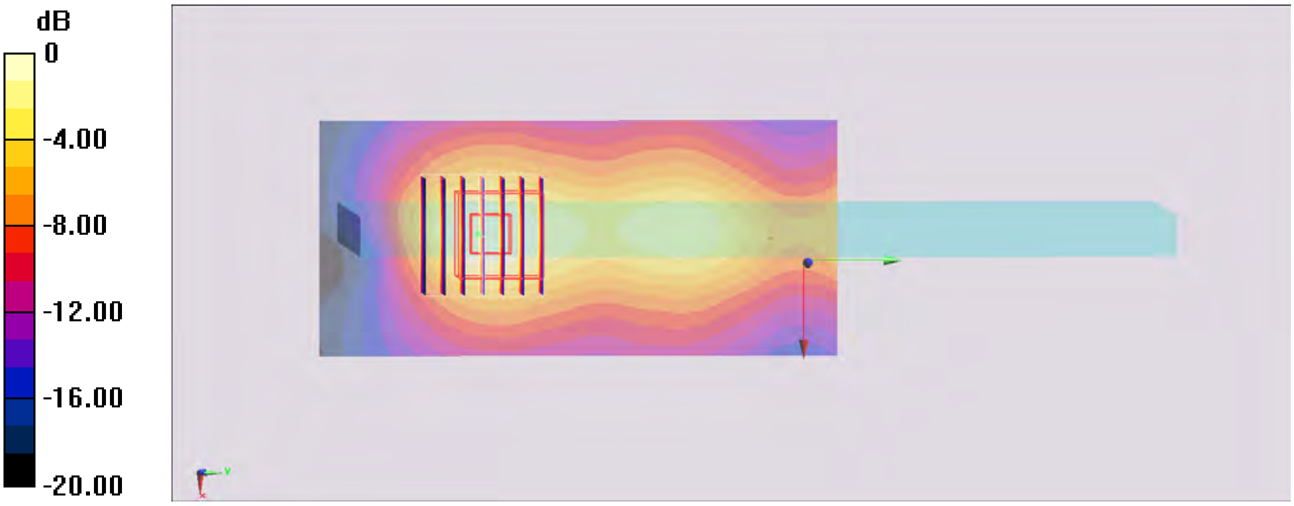
#06_LTE Band 7_20M_QPSK_1RB_0Offset_Edge 2_0.5cm_Ch20850

Communication System: LTE; Frequency: 2510 MHz;Duty Cycle: 1:1
Medium: MSL_2600_140626 Medium parameters used: f = 2510 MHz; σ = 2.113 S/m; ε_r = 51.294; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3955; ConvF(7.58, 7.58, 7.58); Calibrated: 2013/12/23;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1399; Calibrated: 2013/11/7
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: 1173
- Measurement SW: DASY52, Version 52.8 (6); SEMCAD X Version 14.6.9 (7117)

Configuration/Ch20850/Area Scan (51x111x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.70 W/kg

Configuration/Ch20850/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 27.841 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 2.05 W/kg
SAR(1 g) = 1.09 W/kg; SAR(10 g) = 0.553 W/kg
Maximum value of SAR (measured) = 1.56 W/kg



0 dB = 1.56 W/kg = 1.93 dBW/kg

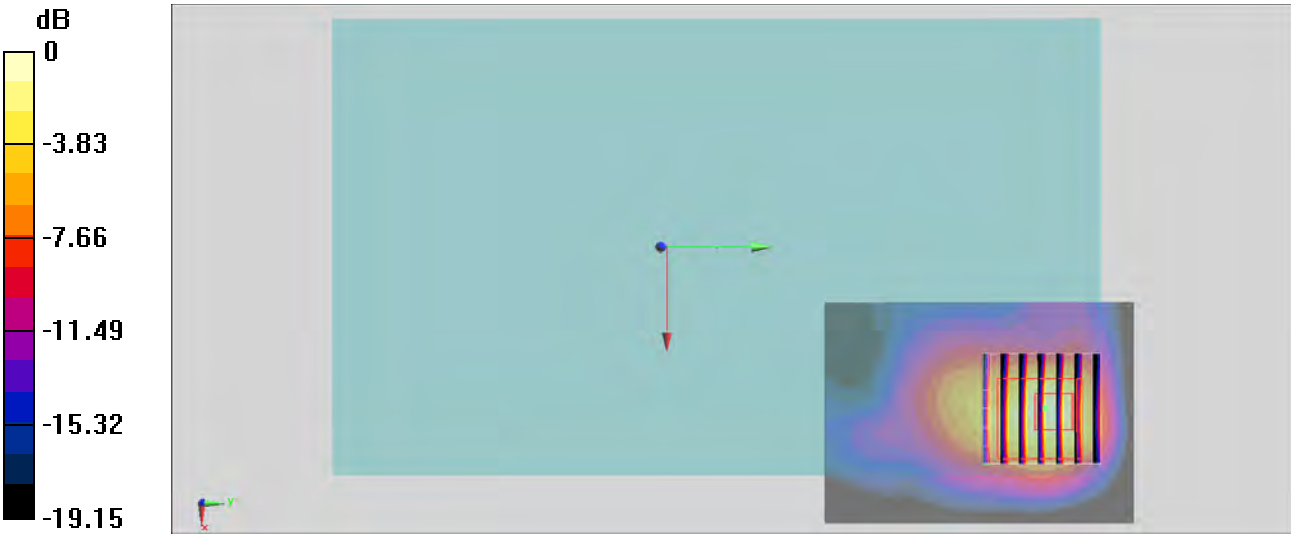
#07_WLAN2.4GHz_802.11b 1Mbps_Bottom Face_0cm_Ch6

Communication System: 802.11b ; Frequency: 2437 MHz;Duty Cycle: 1:1.009
Medium: MSL_2450_140626 Medium parameters used: f = 2437 MHz; σ = 1.952 S/m; ε_r = 53.373; ρ = 1000 kg/m^3
Ambient Temperature：23.6 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(7.36, 7.36, 7.36); Calibrated: 2014/5/22;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1227
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/Ch6/Area Scan (51x71x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.804 W/kg

Configuration/Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 21.14 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 1.39 W/kg
SAR(1 g) = 0.575 W/kg; SAR(10 g) = 0.246 W/kg
Maximum value of SAR (measured) = 0.941 W/kg



0 dB = 0.941 W/kg = -0.26 dBW/kg

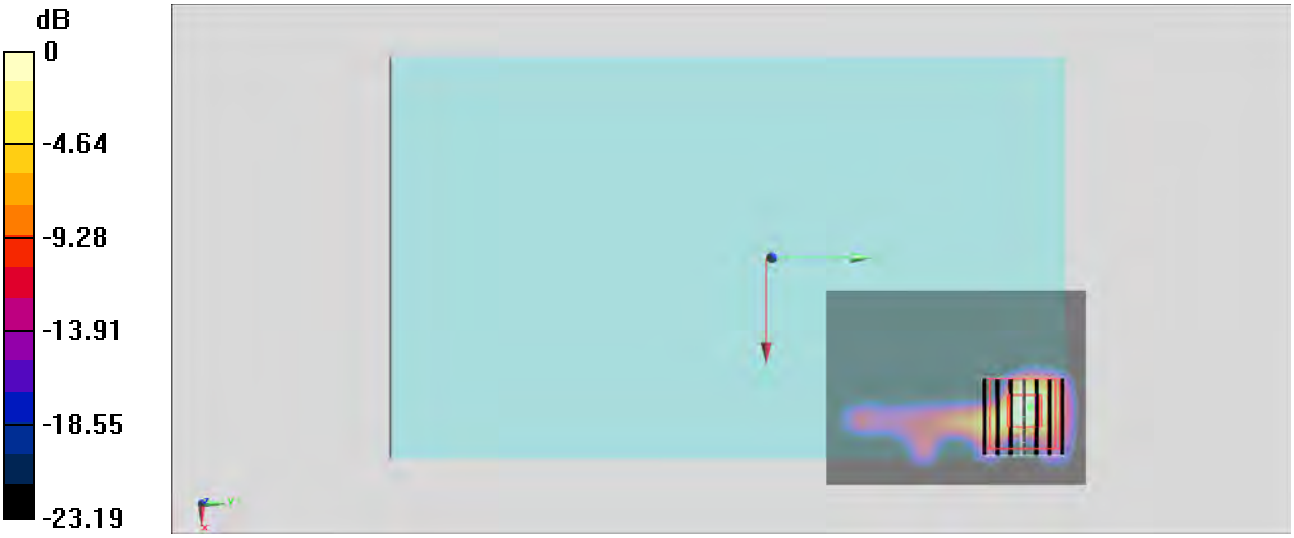
#08_WLAN5GHz_802.11a 6Mbps_Bottom Face_0cm_Ch157

Communication System: 802.11a; Frequency: 5785 MHz;Duty Cycle: 1:1.047
Medium: MSL_5G_140701 Medium parameters used: f = 5785 MHz; σ = 5.975 S/m; ε_r = 46.536; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(4.09, 4.09, 4.09); Calibrated: 2014/5/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1227
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/Ch157/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.585 W/kg

Configuration/Ch157/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 8.370 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.633 W/kg
SAR(1 g) = 0.111 W/kg; SAR(10 g) = 0.026 W/kg
Maximum value of SAR (measured) = 0.384 W/kg



0 dB = 0.384 W/kg = -4.16 dBW/kg

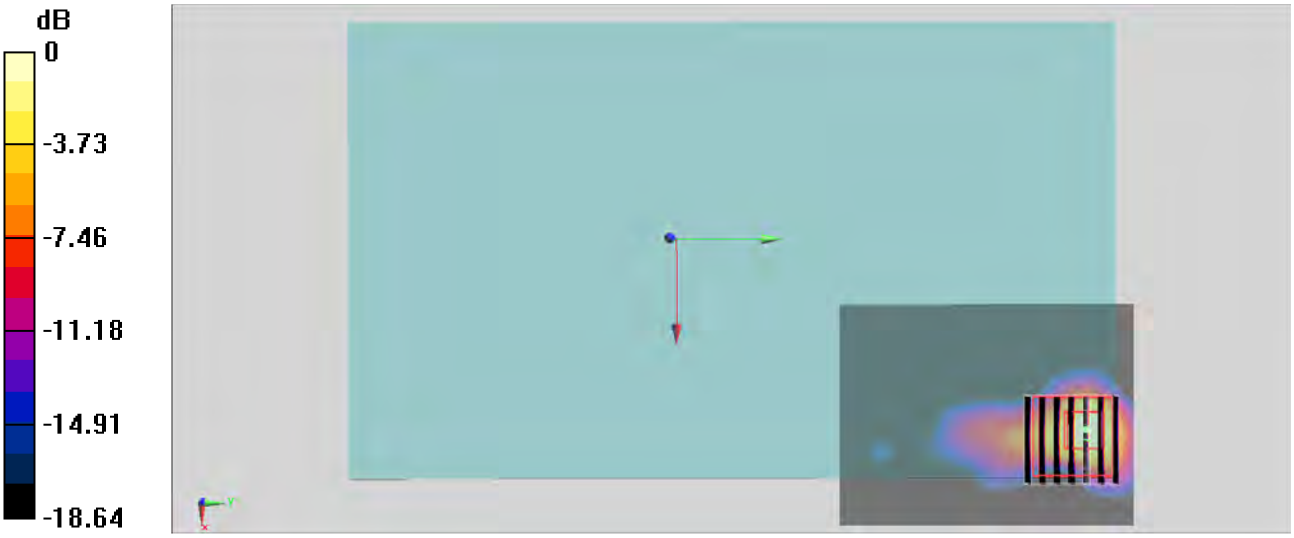
#09_WLAN5GHz_802.11a 6Mbps_Bottom Face_0cm_Ch44

Communication System: 802.11a ; Frequency: 5220 MHz;Duty Cycle: 1:1.047
Medium: MSL_5G_140701 Medium parameters used: f = 5220 MHz; σ = 5.156 S/m; εr = 47.381; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(4.53, 4.53, 4.53); Calibrated: 2014/5/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1227
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/Ch44/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.874 W/kg

Configuration/Ch44/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 13.72 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.42 W/kg
SAR(1 g) = 0.277 W/kg; SAR(10 g) = 0.066 W/kg
Maximum value of SAR (measured) = 0.747 W/kg



0 dB = 0.747 W/kg = -1.27 dBW/kg

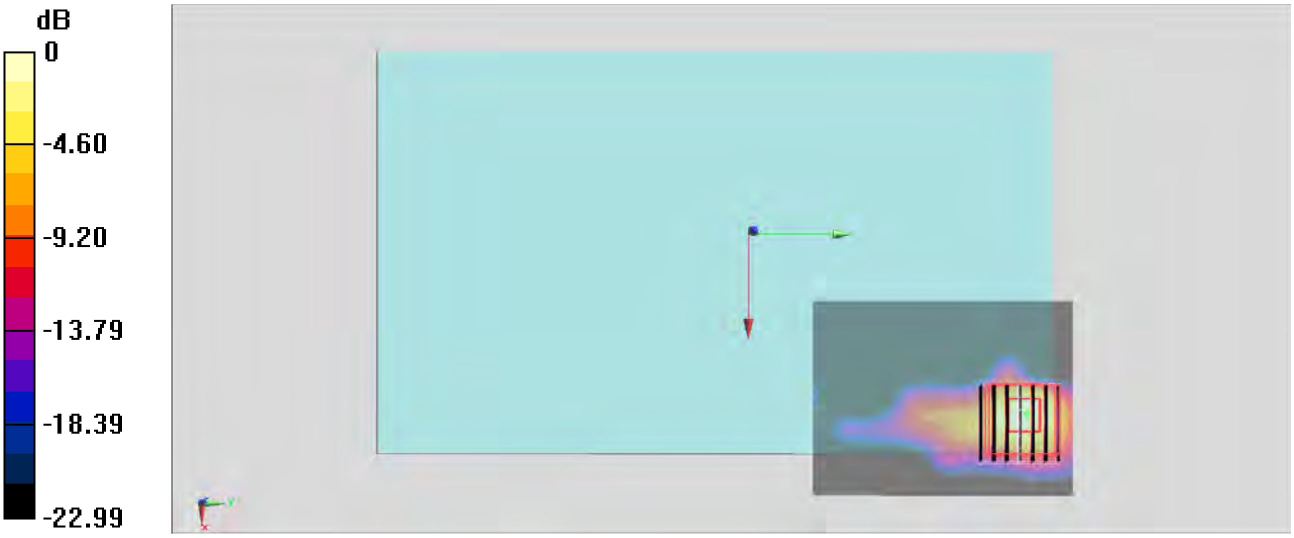
#10_WLAN5GHz_802.11a 6Mbps_Bottom Face_0cm_Ch60

Communication System: 802.11a; Frequency: 5300 MHz;Duty Cycle: 1:1.047
Medium: MSL_5G_140701 Medium parameters used: f = 5300 MHz; σ = 5.274 S/m; ε_r = 47.199; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(4.36, 4.36, 4.36); Calibrated: 2014/5/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1227
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/Ch60/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.945 W/kg

Configuration/Ch60/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 13.64 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 1.46 W/kg
SAR(1 g) = 0.285 W/kg; SAR(10 g) = 0.067 W/kg
Maximum value of SAR (measured) = 0.733 W/kg



0 dB = 0.733 W/kg = -1.35 dBW/kg

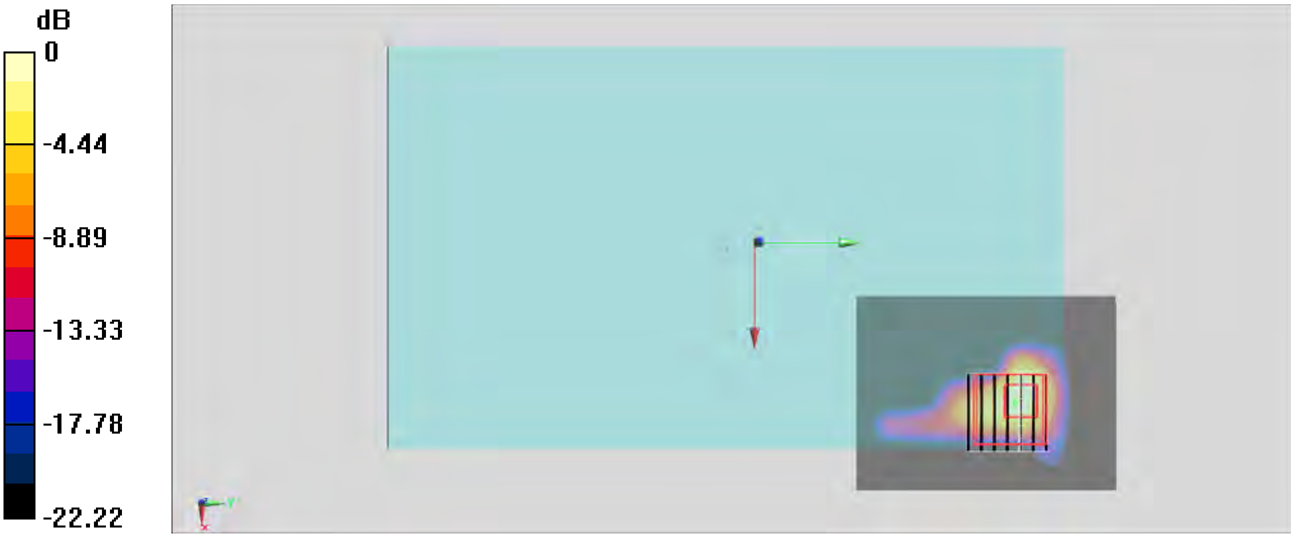
#11_WLAN5GHz_802.11a 6Mbps_Bottom Face_0cm_Ch140

Communication System: 802.11a; Frequency: 5700 MHz;Duty Cycle: 1:1.047
Medium: MSL_5G_140701 Medium parameters used: f = 5700 MHz; σ = 5.818 S/m; ε_r = 46.639; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration
- Probe: EX3DV4 - SN3925; ConvF(4.12, 4.12, 4.12); Calibrated: 2014/5/22;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn495; Calibrated: 2014/5/19
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:1227
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/Ch140/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.470 W/kg

Configuration/Ch140/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 10.12 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.759 W/kg
SAR(1 g) = 0.143 W/kg; SAR(10 g) = 0.032 W/kg
Maximum value of SAR (measured) = 0.460 W/kg



0 dB = 0.460 W/kg = -3.37 dBW/kg

Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

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 **Sporton-TW (Auden)**

Certificate No: D835V2-499_Mar14

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 499
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	March 24, 2014

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 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	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
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-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 24, 2014

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

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / 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	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.5 ± 6 %	0.94 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	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.13 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.94 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	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.0 ± 6 %	1.01 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	2.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.46 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.17 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.7 Ω - 2.8 jΩ
Return Loss	- 28.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.2 Ω - 5.6 jΩ
Return Loss	- 23.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.391 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 10, 2003

DASY5 Validation Report for Head TSL

Date: 24.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 499

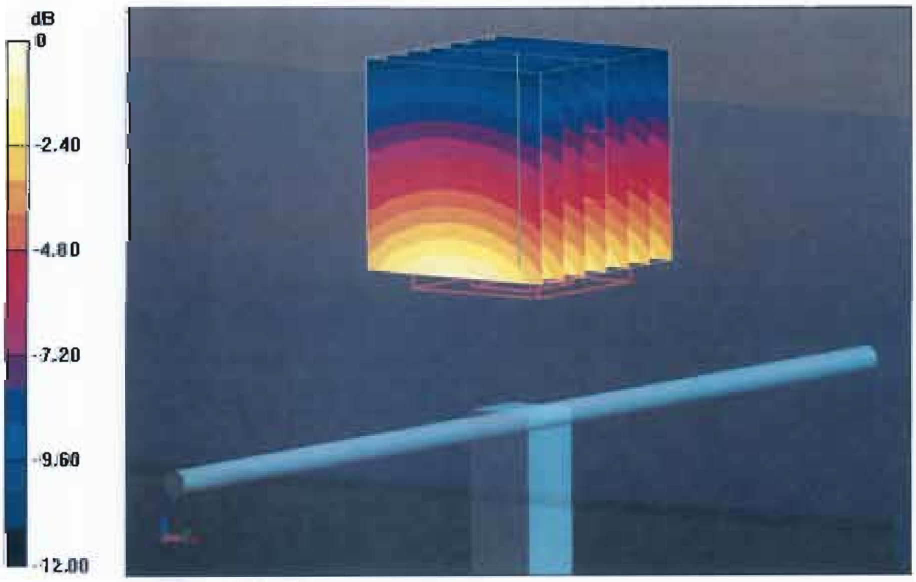
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 0.94$ S/m; $\varepsilon_r = 40.5$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.22, 6.22, 6.22); Calibrated: 30.12.2013;
- 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)

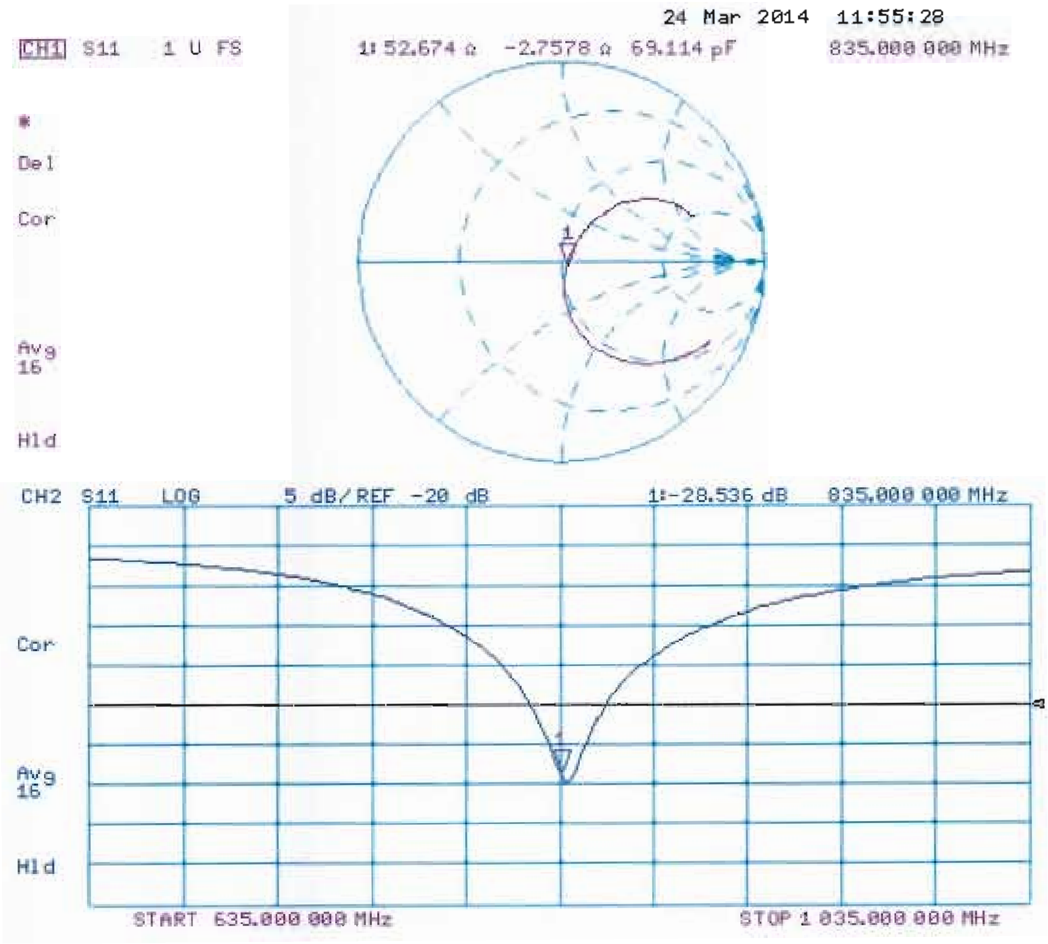
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.333 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.60 W/kg
SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.53 W/kg
Maximum value of SAR (measured) = 2.80 W/kg



0 dB = 2.80 W/kg = 4.47 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 24.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 499

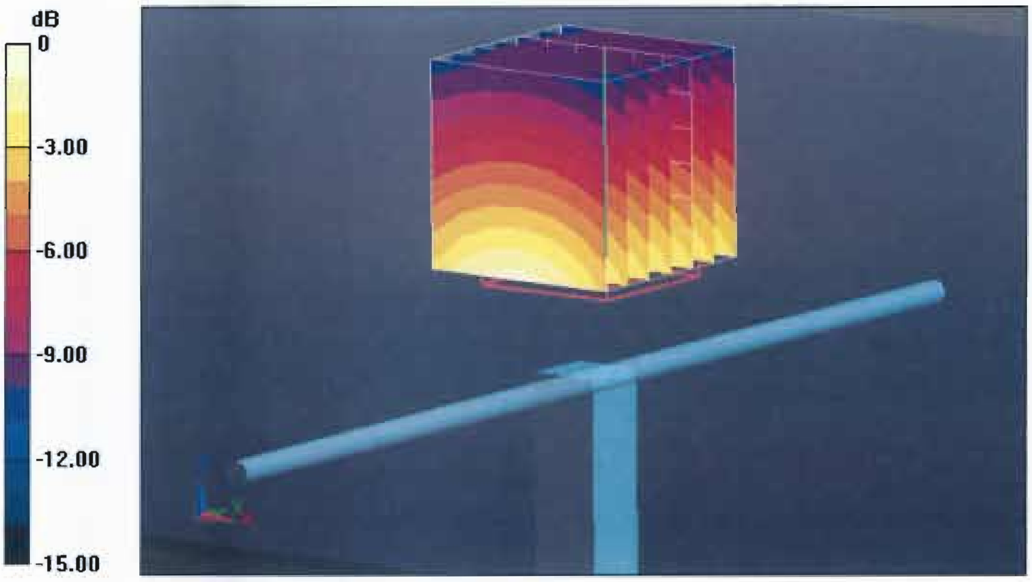
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 1.01$ S/m; $\varepsilon_r = 55$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.09, 6.09, 6.09); Calibrated: 30.12.2013;
- 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)

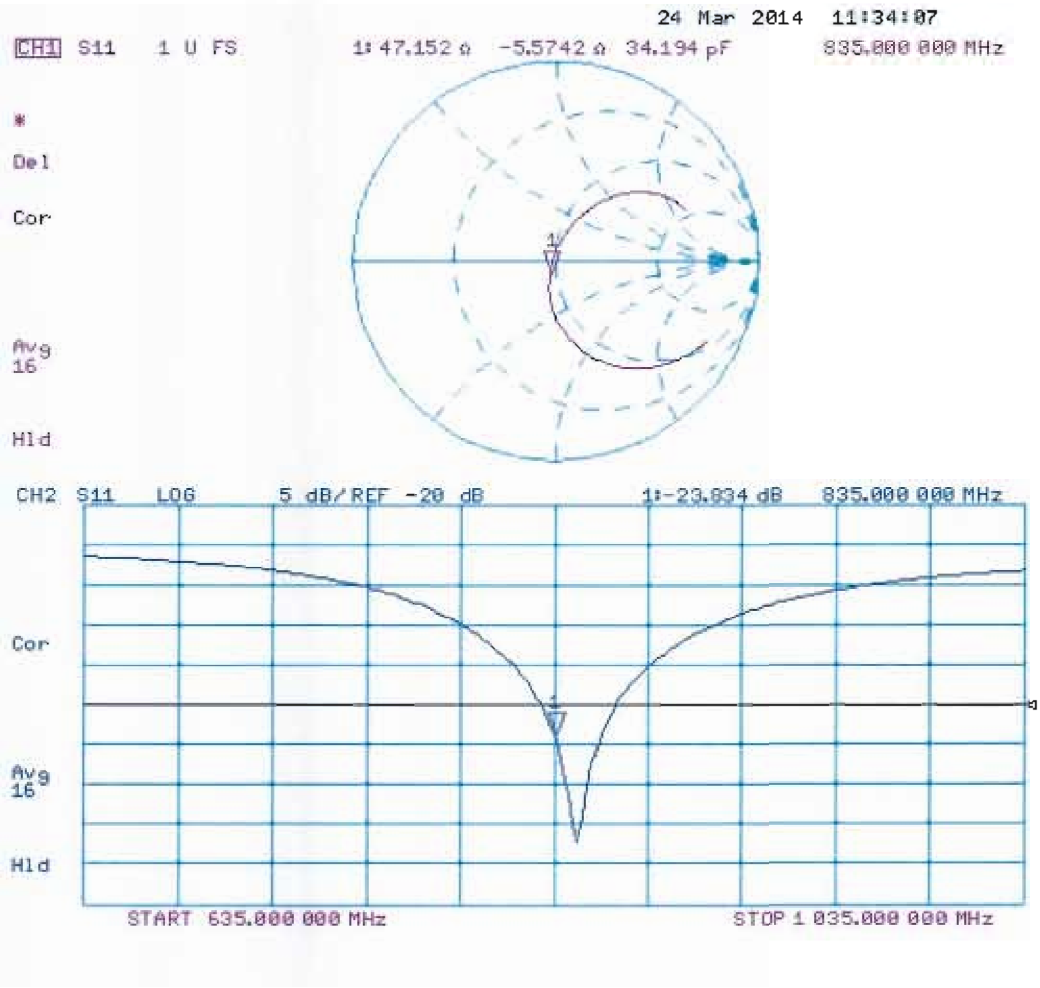
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.909 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.65 W/kg
SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.58 W/kg
Maximum value of SAR (measured) = 2.86 W/kg



0 dB = 2.86 W/kg = 4.56 dBW/kg

Impedance Measurement Plot for Body TSL



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

Client **Sporton-TW (Auden)**

Certificate No: D1750V2-1068_Nov13

CALIBRATION CERTIFICATE

Object	D1750V2 - SN: 1068
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	November 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 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:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 27, 2013

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.0 ± 6 %	1.37 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**37.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.8 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.0 ± 6 %	1.48 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.34 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**37.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.02 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.1 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.8 Ω - 0.2 jΩ
Return Loss	- 51.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.4 Ω - 0.3 jΩ
Return Loss	- 26.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.221 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	June 15, 2010

DASY5 Validation Report for Head TSL

Date: 27.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1068

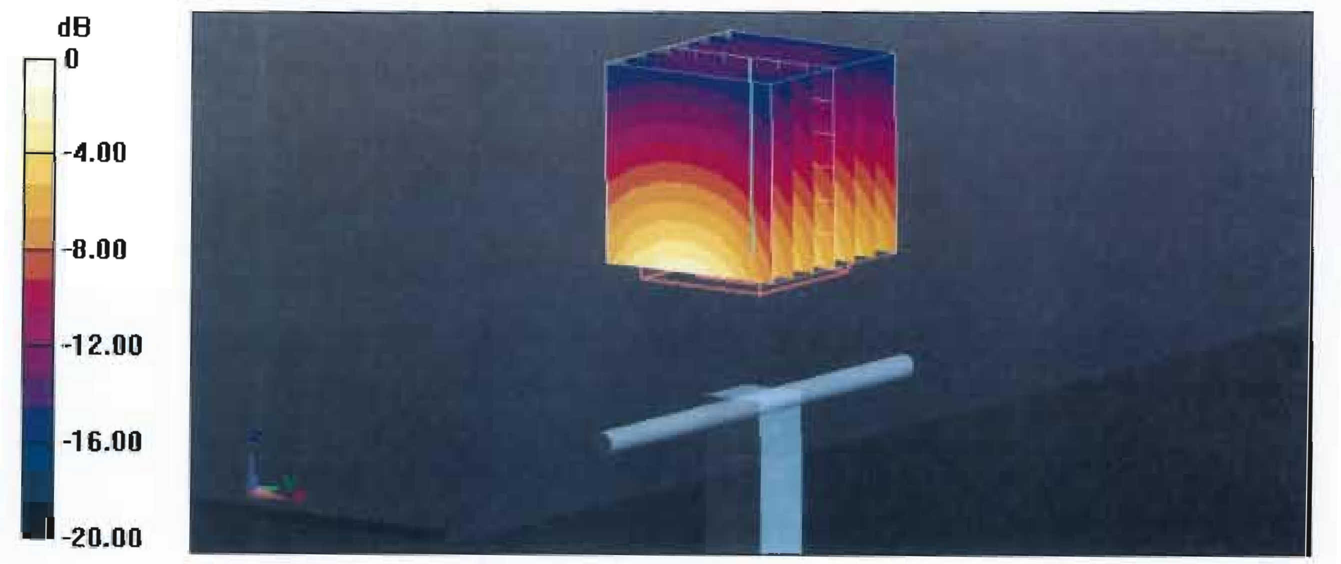
Communication System: UID 0 - CW ; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; $\sigma = 1.37$ S/m; $\varepsilon_r = 40$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.18, 5.18, 5.18); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

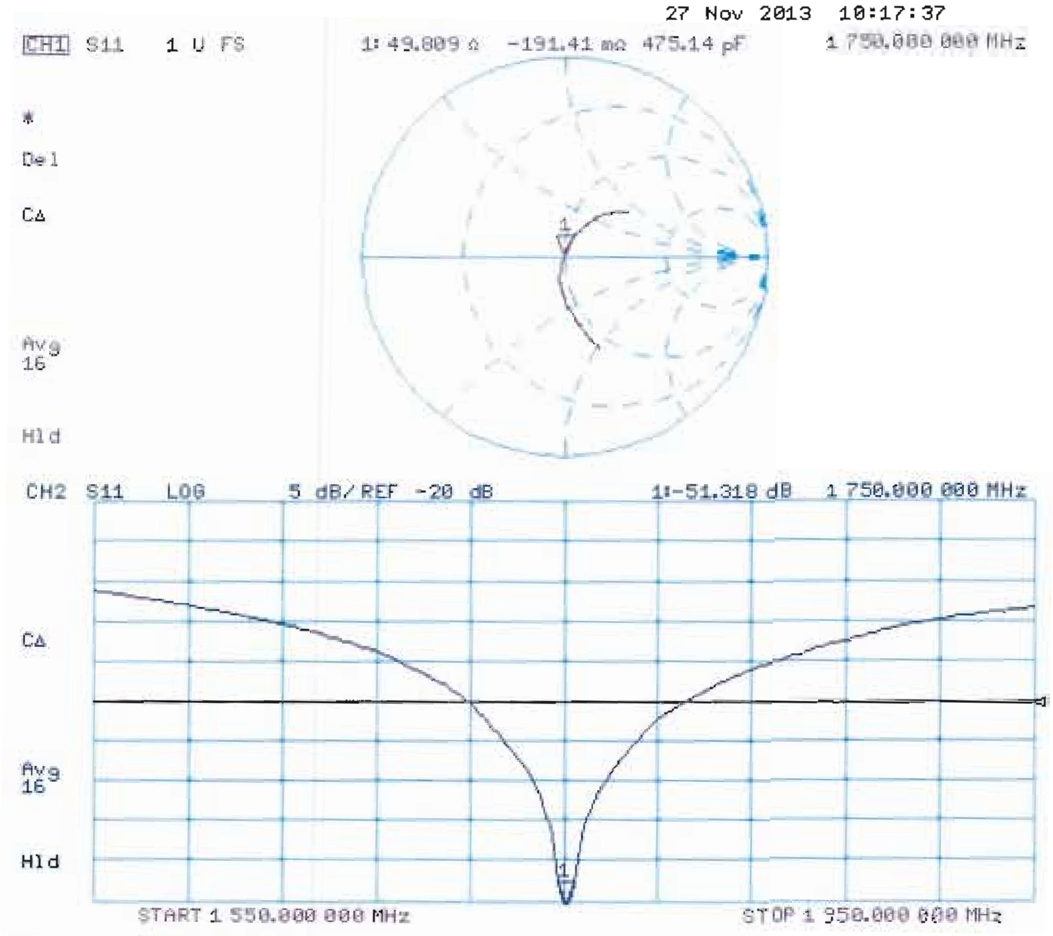
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.458 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 16.9 W/kg
SAR(1 g) = 9.33 W/kg; SAR(10 g) = 4.94 W/kg
Maximum value of SAR (measured) = 11.6 W/kg



0 dB = 11.6 W/kg = 10.64 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 25.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1068

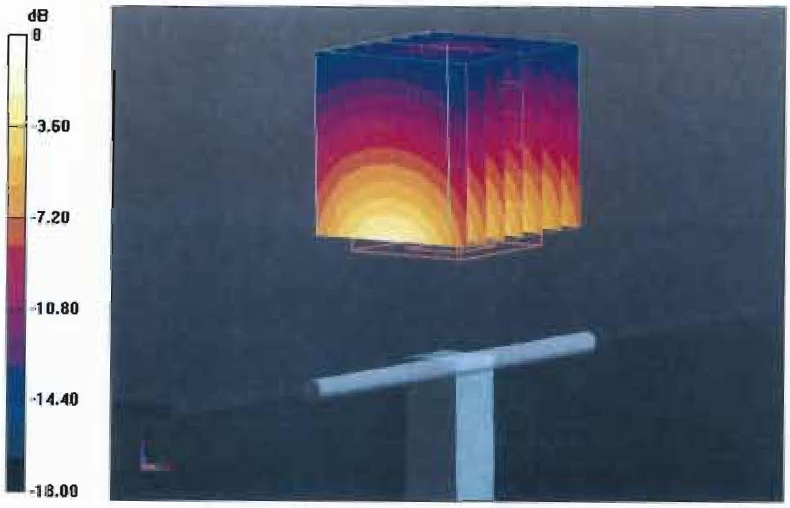
Communication System: UID 0 - CW ; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; $\sigma = 1.48$ S/m; $\varepsilon_r = 53$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.83, 4.83, 4.83); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

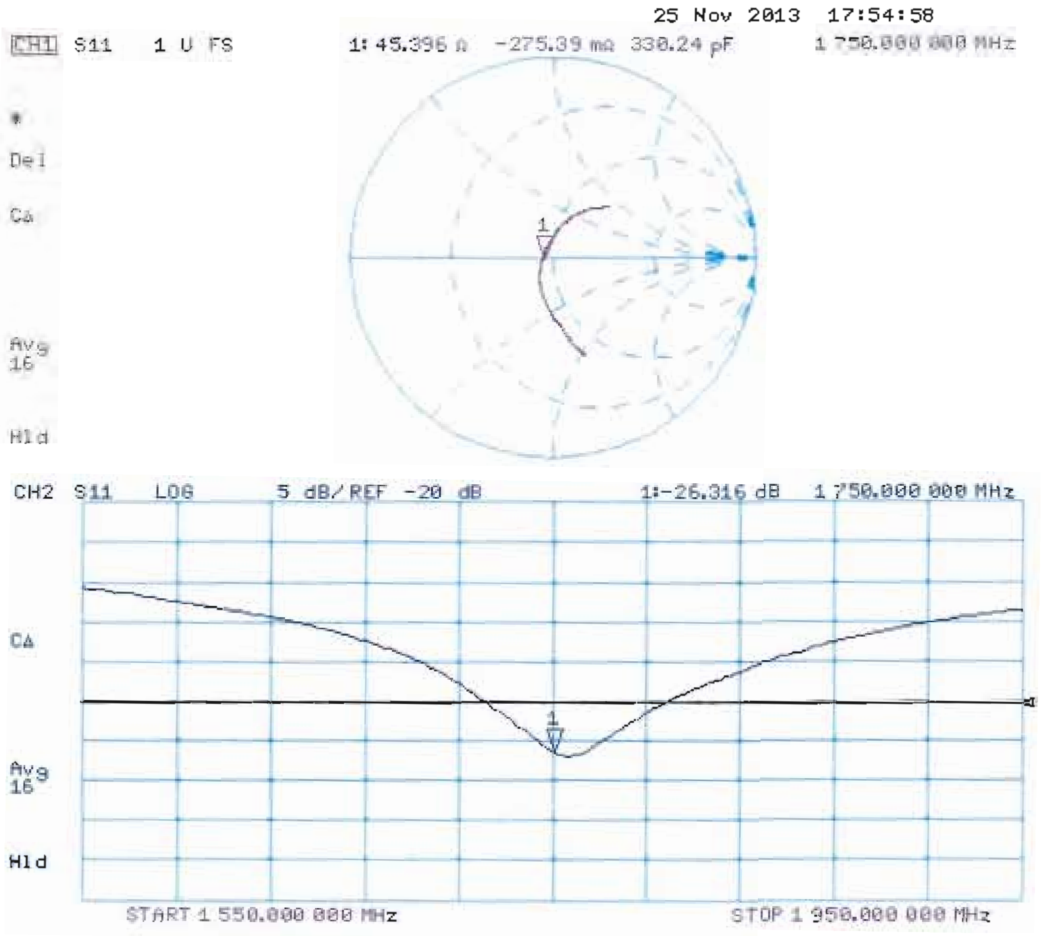
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.538 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 9.34 W/kg; SAR(10 g) = 5.02 W/kg
Maximum value of SAR (measured) = 11.7 W/kg



0 dB = 11.7 W/kg = 10.68 dBW/kg

Impedance Measurement Plot for Body TSL



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

S Schweizerischer Kalibrierdienst
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **Sporton (Auden)**

Certificate No: D1900V2-5d041_Mar14

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d041
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	March 21, 2014

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 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	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
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-16
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: March 21, 2014

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.8 ± 6 %	1.37 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	10.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**41.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.4 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.5 ± 6 %	1.50 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	10.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**41.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.7 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.9 Ω + 6.6 jΩ
Return Loss	- 22.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.2 Ω + 6.4 jΩ
Return Loss	- 23.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 04, 2003

DASY5 Validation Report for Head TSL

Date: 21.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d041

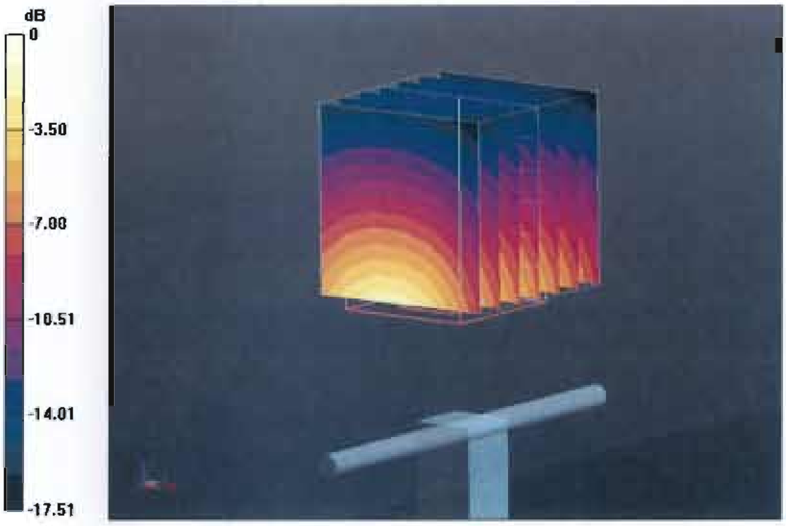
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.37 S/m; ε_r = 38.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.06, 5.06, 5.06); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

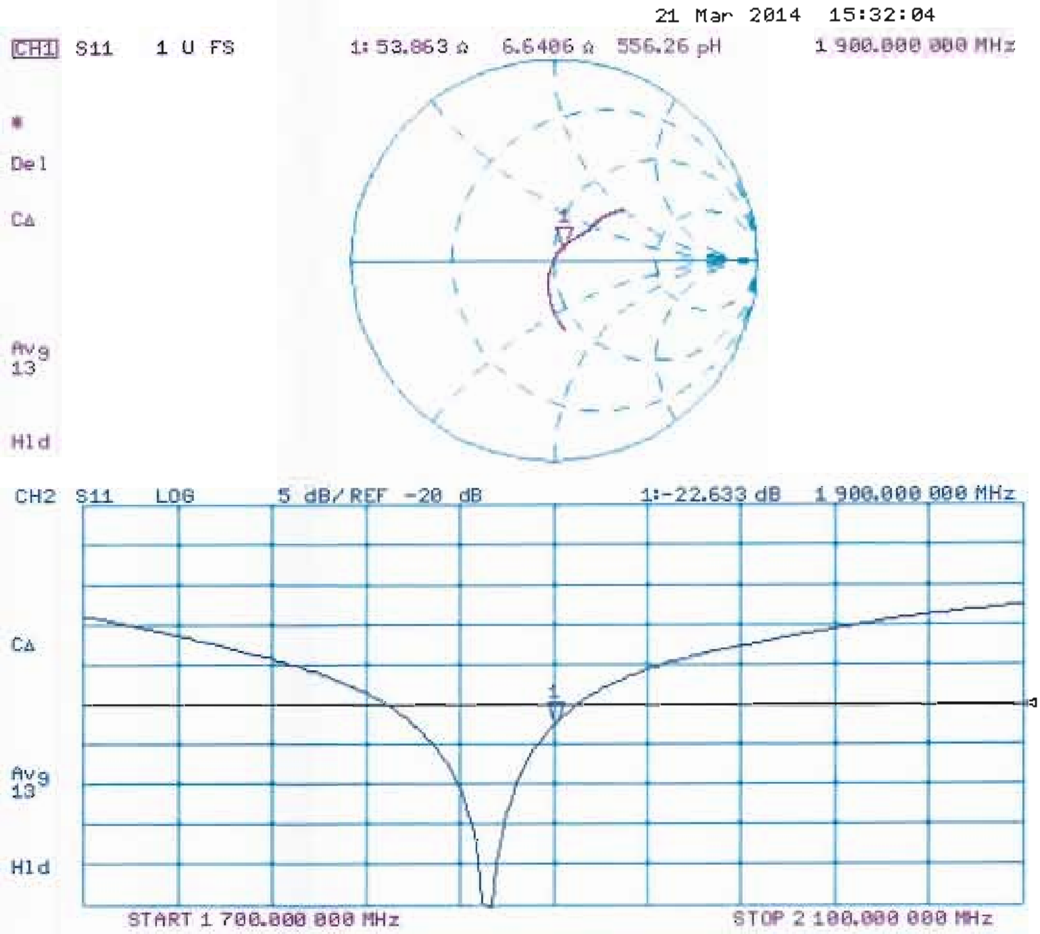
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.04 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 18.6 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.32 W/kg
Maximum value of SAR (measured) = 12.4 W/kg



0 dB = 12.4 W/kg = 10.93 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 21.03.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d041

Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma = 1.5$ S/m; $\varepsilon_r = 52.5$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

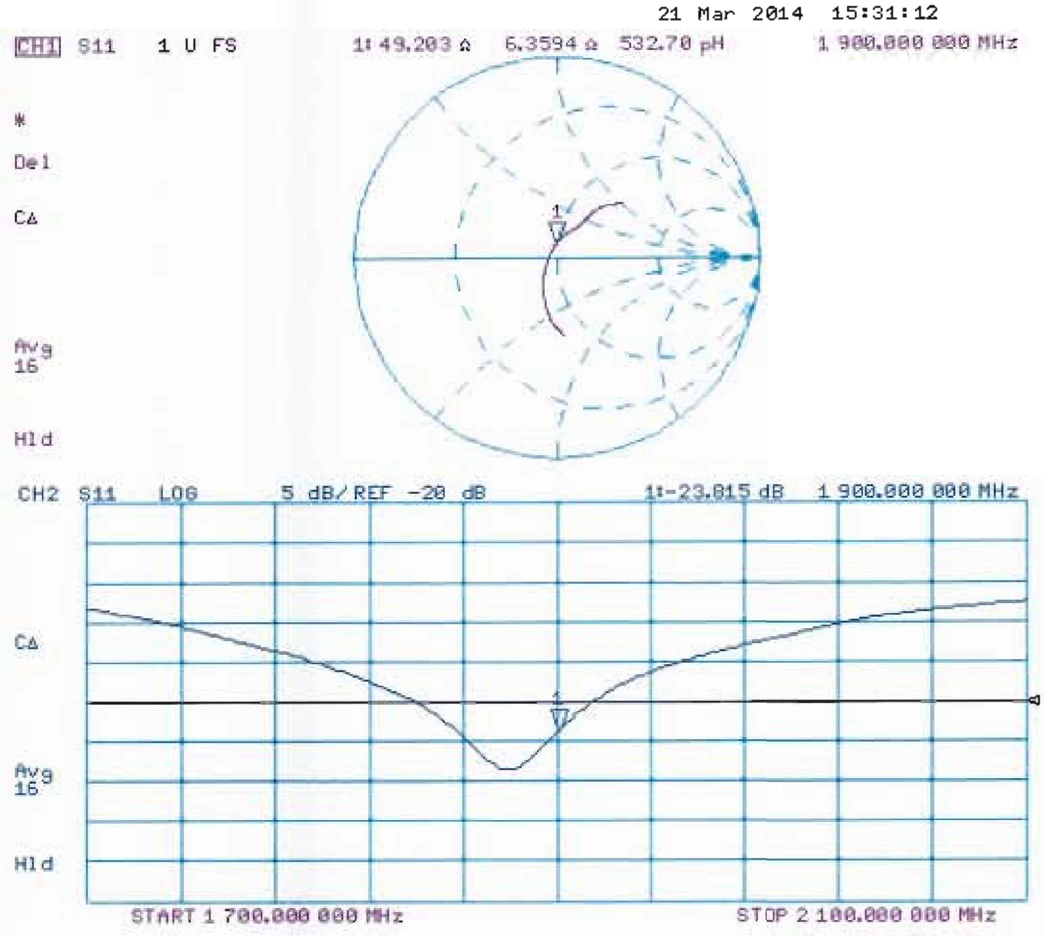
- Probe: ES3DV3 - SN3205; ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.439 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 17.7 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.4 W/kg
Maximum value of SAR (measured) = 12.9 W/kg

0 dB = 12.9 W/kg = 11.11 dBW/kg

Impedance Measurement Plot for Body TSL



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

S **Schweizerischer Kalibrierdienst**
C **Service suisse d'étalonnage**
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S **Swiss Calibration Service**

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

Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: D2450V2-924_Nov13

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 924

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

Calibration date: November 13, 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:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 13, 2013

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.7 ± 6 %	1.84 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	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.08 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.2 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.1 ± 6 %	2.02 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	12.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.92 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.4 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.1 Ω + 2.6 jΩ
Return Loss	- 28.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.6 Ω + 4.3 jΩ
Return Loss	- 27.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.154 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	September 26, 2013

DASY5 Validation Report for Head TSL

Date: 13.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 924

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma = 1.84$ S/m; $\varepsilon_r = 39.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

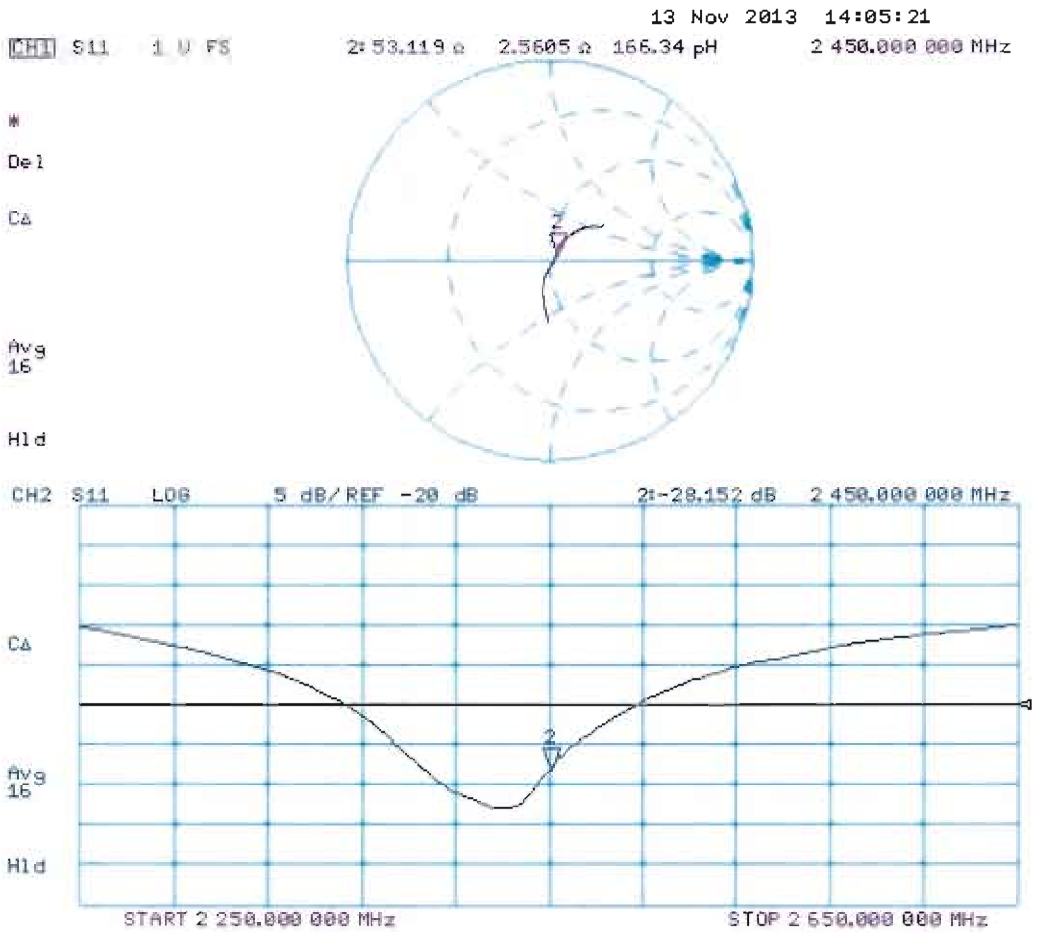
- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.75 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 27.5 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.08 W/kg
Maximum value of SAR (measured) = 16.7 W/kg

0 dB = 16.7 W/kg = 12.23 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 924

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma = 2.02$ S/m; $\varepsilon_r = 52.1$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

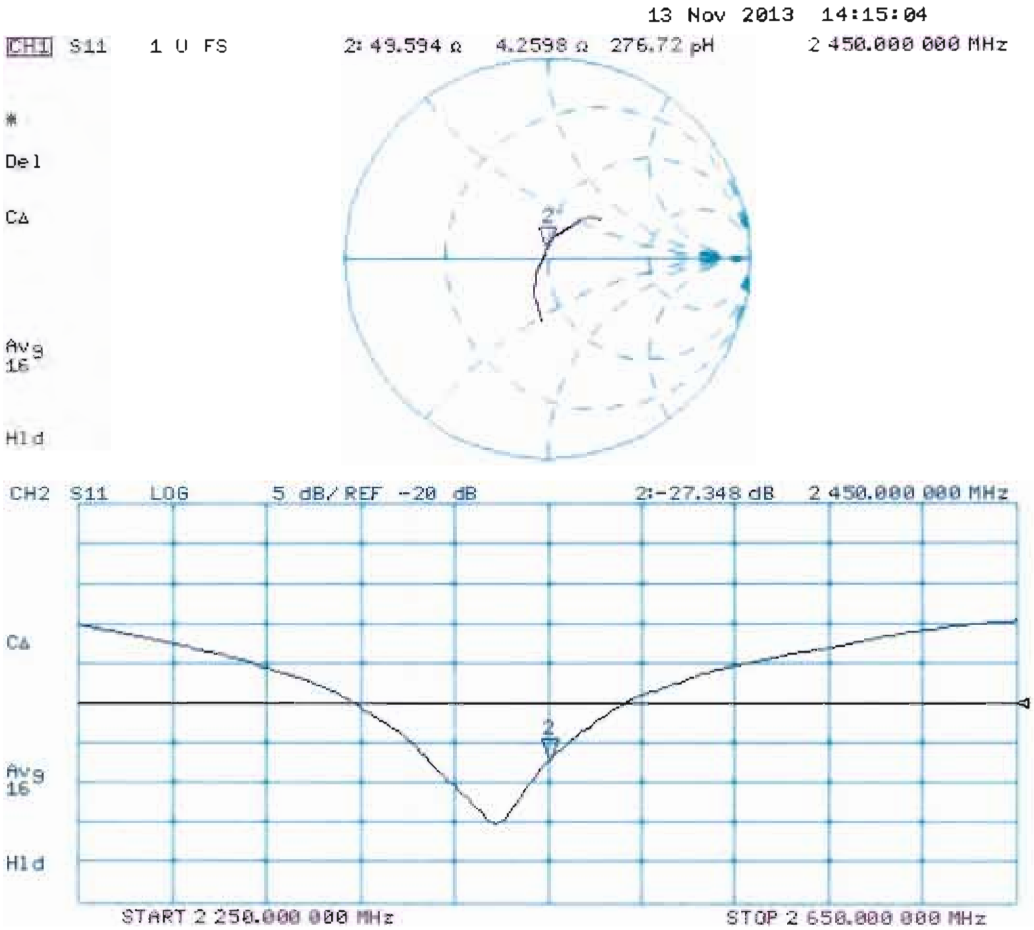
- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.726 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 26.8 W/kg
SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.92 W/kg
Maximum value of SAR (measured) = 16.8 W/kg

0 dB = 16.8 W/kg = 12.25 dBW/kg

Impedance Measurement Plot for Body TSL



Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland

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

Accreditation No.: SCS 108

Client **Sporton-TW (Auden)**

Certificate No: D2600V2-1070_Nov13

CALIBRATION CERTIFICATE

Object	D2600V2 - SN: 1070
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	November 13, 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:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 13, 2013

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**56.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.2 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

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

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**55.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.22 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.7 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.5 Ω - 4.0 jΩ
Return Loss	- 22.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.147 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 17, 2013

DASY5 Validation Report for Head TSL

Date: 13.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1070

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

DASY52 Configuration:

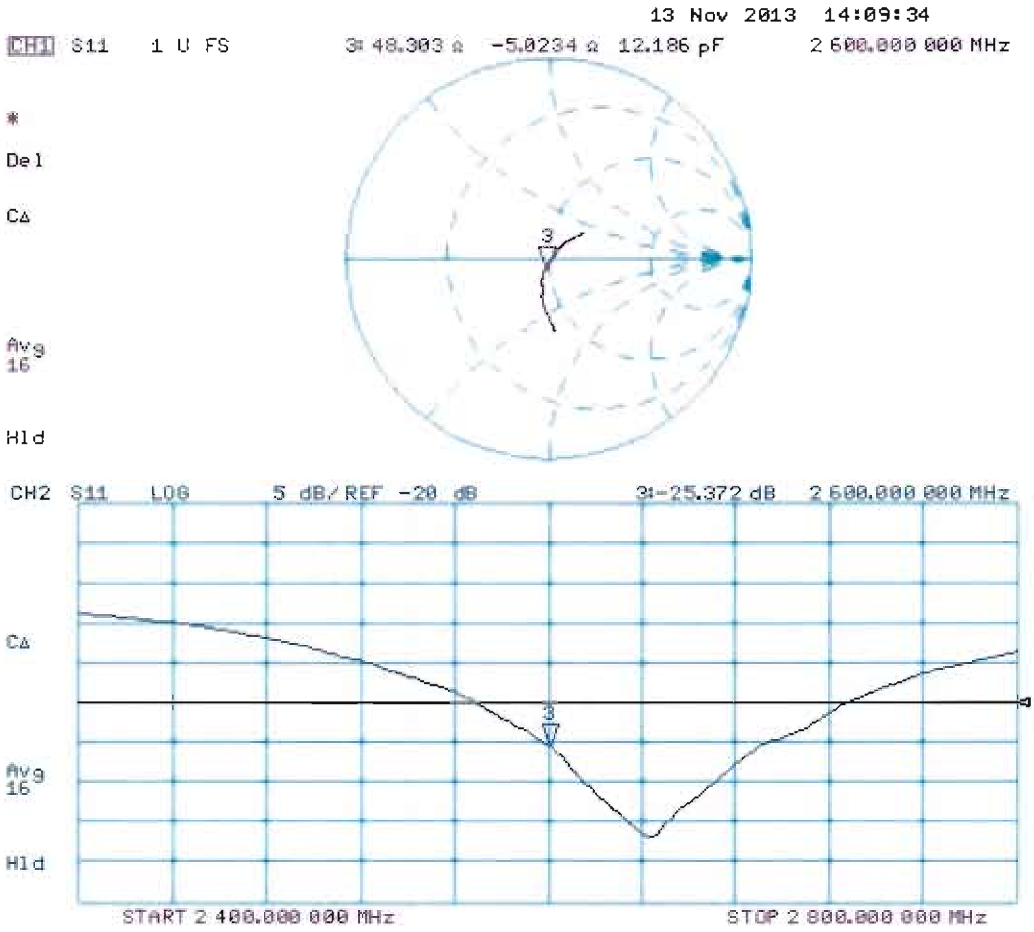
- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.401 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 31.0 W/kg
SAR(1 g) = 14.3 W/kg; SAR(10 g) = 6.33 W/kg
Maximum value of SAR (measured) = 18.4 W/kg

0 dB = 18.4 W/kg = 12.65 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1070

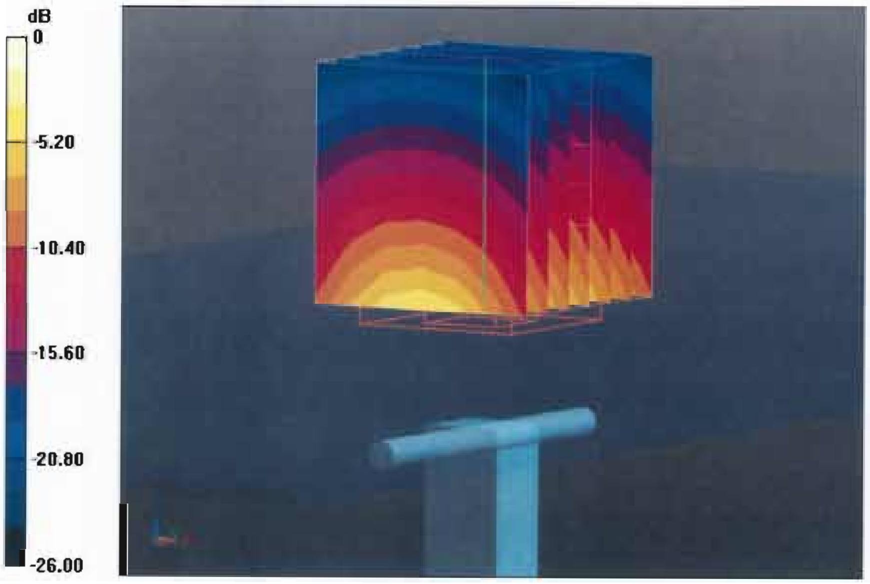
Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; $\sigma = 2.2$ S/m; $\varepsilon_r = 51.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

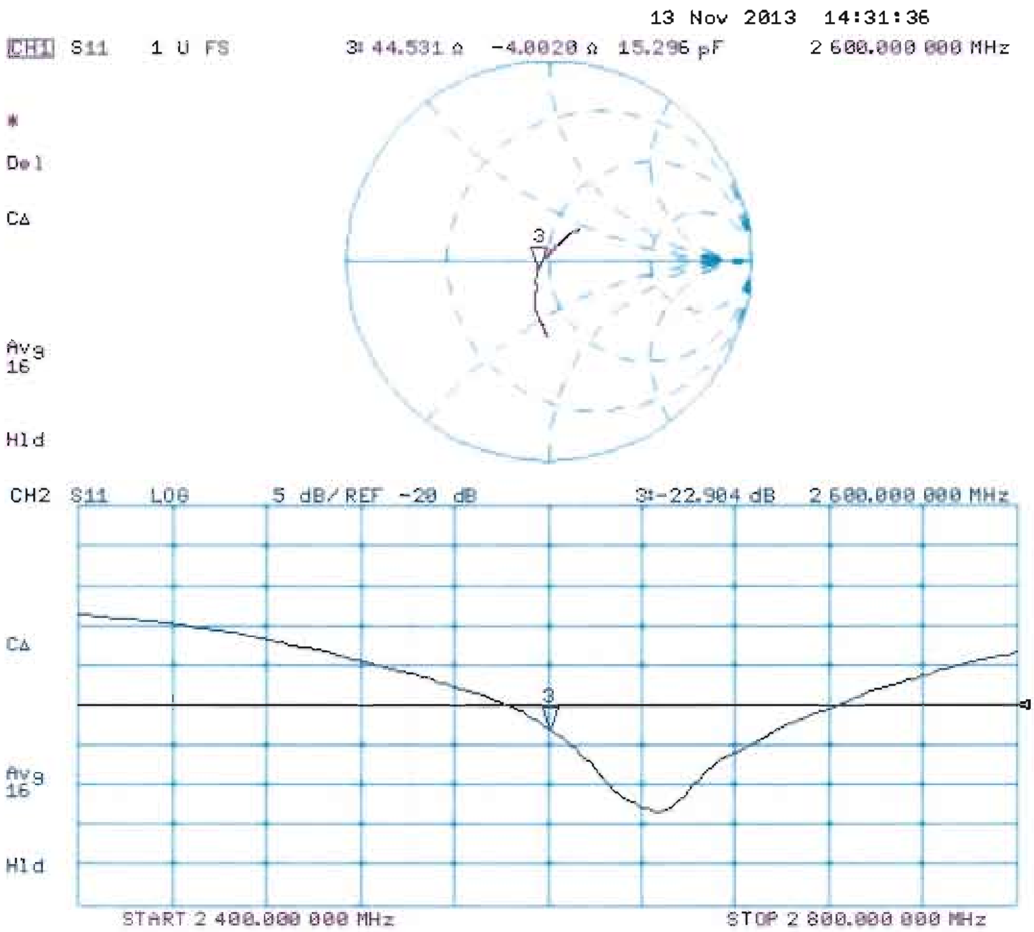
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.096 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 30.7 W/kg
SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.22 W/kg
Maximum value of SAR (measured) = 18.7 W/kg



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

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **Sporton-TW (Auden)**

Certificate No: D5GHzV2-1128_Jul13

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN: 1128

Calibration procedure(s): QA CAL-22.v2
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: July 24, 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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
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 EX3DV4	SN: 3503	28-Dec-12 (No. EX3-3503_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	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: July 24, 2013

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

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
b) 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:

c) 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 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 5300 MHz ± 1 MHz 5600 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	35.2 ± 6 %	4.46 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	7.86 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.5 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.1 ± 6 %	4.55 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.6 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.2 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.7 ± 6 %	4.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (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	34.4 ± 6 %	5.05 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	7.78 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.1 W/kg ± 19.5 % (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	48.9 ± 6 %	5.40 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	7.34 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**73.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.8 ± 6 %	5.55 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.49 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.9 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.2 ± 6 %	5.93 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.78 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.18 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.8 W/kg ± 19.5 % (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	47.9 ± 6 %	6.21 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	7.22 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**72.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.02 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.2 W/kg ± 19.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	52.6 Ω - 5.0 jΩ
Return Loss	- 25.2 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	50.7 Ω - 1.6 jΩ
Return Loss	- 35.2 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.2 Ω + 1.6 jΩ
Return Loss	- 24.4 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.5 Ω + 1.2 jΩ
Return Loss	- 25.4 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	52.3 Ω - 2.5 jΩ
Return Loss	- 29.6 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	50.7 Ω + 0.0 jΩ
Return Loss	- 42.7 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	56.4 Ω + 4.1 jΩ
Return Loss	- 22.9 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	55.3 Ω + 2.8 jΩ
Return Loss	- 24.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.209 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	September 08, 2011

DASY5 Validation Report for Head TSL

Date: 23.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1128

Communication System: UID 0 - CW ; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; $\sigma = 4.46$ S/m; $\varepsilon_r = 35.2$; $\rho = 1000$ kg/m^3 , Medium parameters used: f = 5300 MHz; $\sigma = 4.55$ S/m; $\varepsilon_r = 35.1$; $\rho = 1000$ kg/m^3 , Medium parameters used: f = 5600 MHz; $\sigma = 4.85$ S/m; $\varepsilon_r = 34.7$; $\rho = 1000$ kg/m^3 , Medium parameters used: f = 5800 MHz; $\sigma = 5.05$ S/m; $\varepsilon_r = 34.4$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

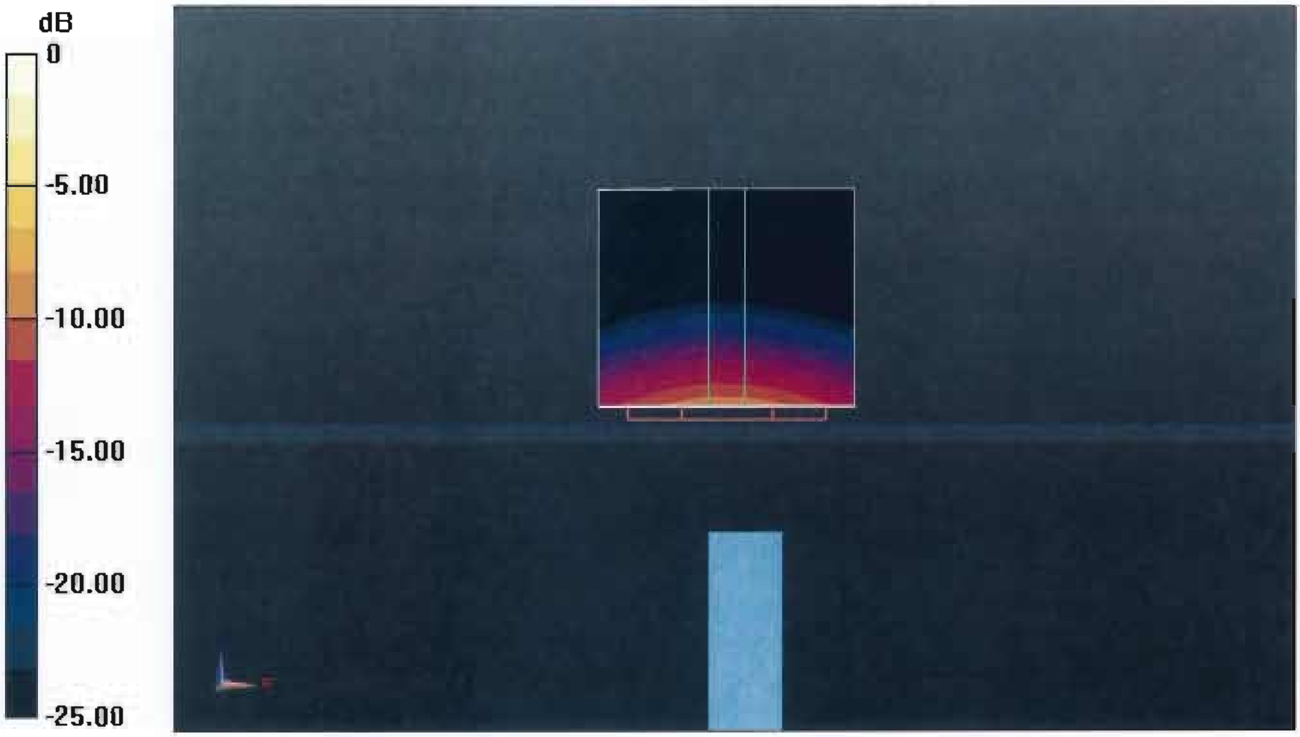
- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41); Calibrated: 28.12.2012, ConvF(5.1, 5.1, 5.1); Calibrated: 28.12.2012, ConvF(4.76, 4.76, 4.76); Calibrated: 28.12.2012, ConvF(4.81, 4.81, 4.81); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=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 = 63.593 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 28.2 W/kg
SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.27 W/kg
Maximum value of SAR (measured) = 17.6 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.984 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 29.9 W/kg
SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.34 W/kg
Maximum value of SAR (measured) = 18.2 W/kg

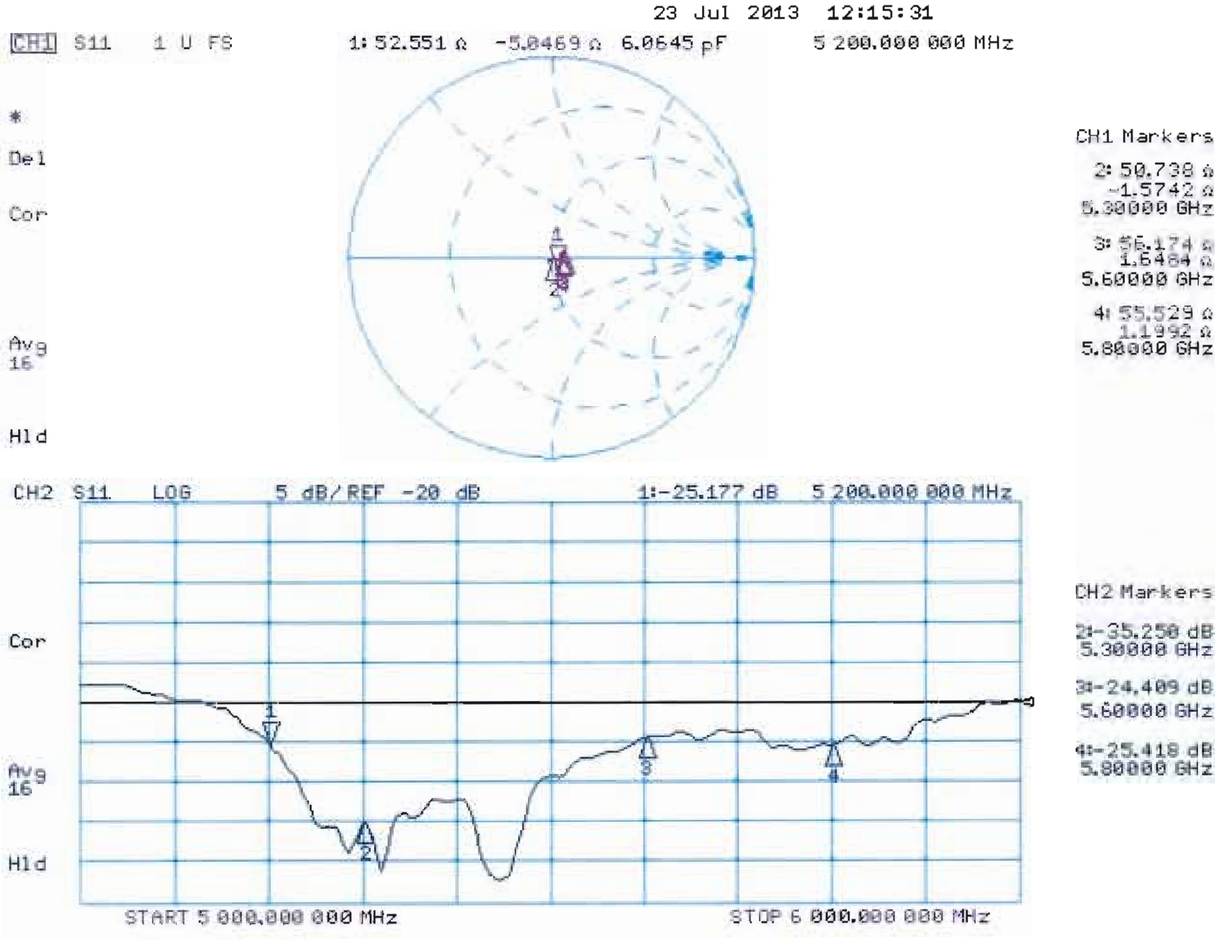
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 62.627 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 31.5 W/kg
SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.33 W/kg
Maximum value of SAR (measured) = 18.7 W/kg

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 = 60.557 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 31.6 W/kg
SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.23 W/kg
Maximum value of SAR (measured) = 18.3 W/kg



0 dB = 18.3 W/kg = 12.62 dBW/kg

Impedance Measurement Plot for Head TSL



```
23 Jul 2013  12:15:31
CH1  S11   1 U FS    1: 52.551 Ω  -5.0469 Ω  6.0645 pF    5 200.000 000 MHz

CH1 Markers
2: 50.738 Ω
  -1.5742 Ω
5.30000 GHz
3: 56.174 Ω
   1.6484 Ω
5.60000 GHz
4: 55.529 Ω
   1.1992 Ω
5.80000 GHz

CH2  S11   LOG    5 dB/REF -20 dB       1:-25.177 dB   5 200.000 000 MHz

CH2 Markers
2:-35.250 dB
 5.30000 GHz
3:-24.409 dB
 5.60000 GHz
4:-25.418 dB
 5.80000 GHz

START 5 000.000 000 MHz                        STOP 6 000.000 000 MHz
```

DASY5 Validation Report for Body TSL

Date: 24.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1128

Communication System: UID 0 - CW ; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.4 S/m; ε_r = 48.9; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 5.55 S/m; ε_r = 46.8; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.93 S/m; ε_r = 48.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.21 S/m; ε_r = 47.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

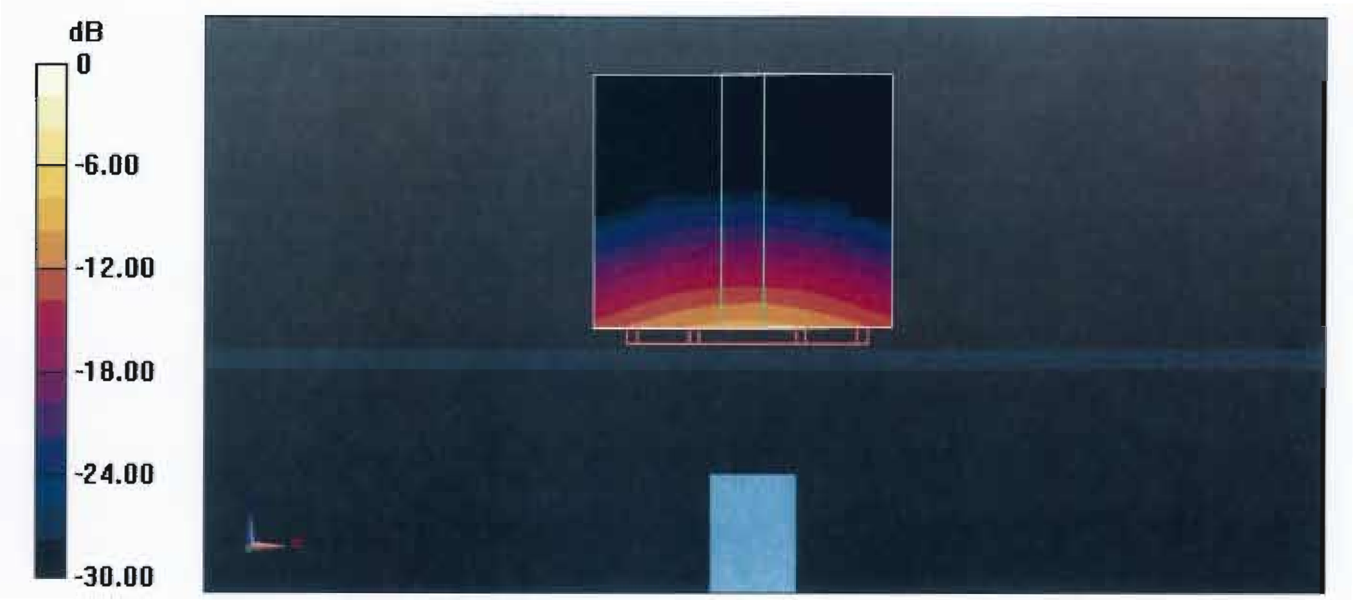
- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.67, 4.67, 4.67); Calibrated: 28.12.2012, ConvF(4.22, 4.22, 4.22); Calibrated: 28.12.2012, ConvF(4.38, 4.38, 4.38); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=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 = 57.643 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 28.4 W/kg
SAR(1 g) = 7.34 W/kg; SAR(10 g) = 2.07 W/kg
Maximum value of SAR (measured) = 16.6 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 57.535 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 29.9 W/kg
SAR(1 g) = 7.49 W/kg; SAR(10 g) = 2.11 W/kg
Maximum value of SAR (measured) = 17.2 W/kg

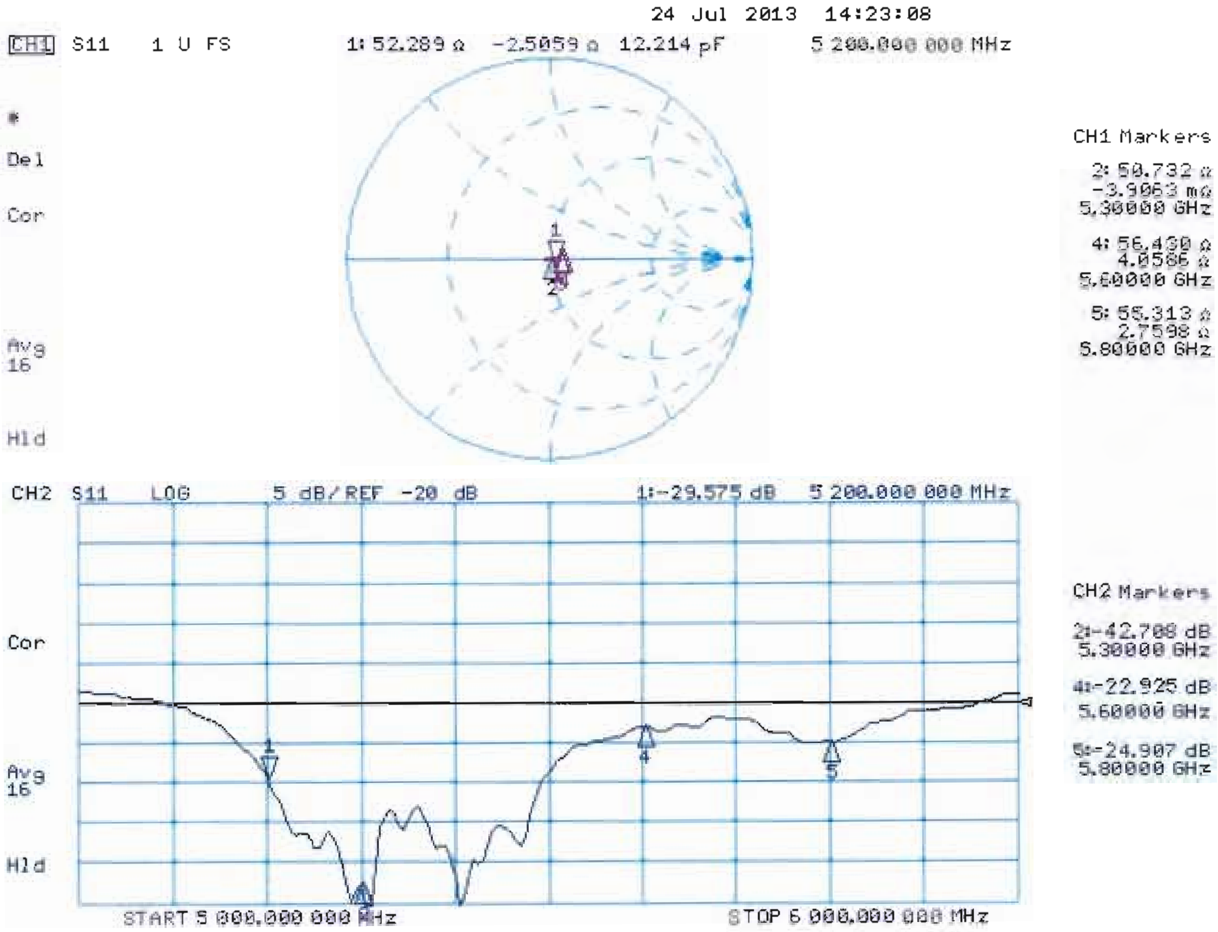
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 57.173 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 33.8 W/kg
SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.18 W/kg
Maximum value of SAR (measured) = 18.9 W/kg

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 = 54.111 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 32.9 W/kg
SAR(1 g) = 7.22 W/kg; SAR(10 g) = 2.02 W/kg
Maximum value of SAR (measured) = 17.8 W/kg



0 dB = 17.8 W/kg = 12.50 dBW/kg

Impedance Measurement Plot for Body TSL



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s p e a g

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IMPORTANT NOTICE

USAGE OF THE DAE 4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

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

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:
Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:
Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:
To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

Schmid & Partner Engineering

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 **Sporton-TW (Auden)**

Certificate No: **DAE4-778_Aug13**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 778
Calibration procedure(s)	QA CAL-06.v26 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	August 21, 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
Keithley Multimeter Type 2001	SN: 0810278	02-Oct-12 (No:12728)	Oct-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-13 (in house check)	In house check: Jan-14
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-13 (in house check)	In house check: Jan-14

	Name	Function	Signature
Calibrated by:	R.Mayoraz	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	i.V.

Issued: August 21, 2013

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

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
    - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
    - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
    - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
    - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
    - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
    - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
    - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
    - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
    - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	**X**	**Y**	**Z**
High Range	404.656 ± 0.02% (k=2)	403.459 ± 0.02% (k=2)	405.006 ± 0.02% (k=2)
Low Range	3.98558 ± 1.50% (k=2)	3.96461 ± 1.50% (k=2)	3.99935 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	283.0 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	199995.77	0.06	0.00
Channel X	+ Input	20002.53	2.55	0.01
Channel X	- Input	-19999.49	1.92	-0.01
Channel Y	+ Input	199997.44	1.64	0.00
Channel Y	+ Input	20001.15	1.28	0.01
Channel Y	- Input	-20001.01	0.48	-0.00
Channel Z	+ Input	199996.91	1.45	0.00
Channel Z	+ Input	19997.43	-2.47	-0.01
Channel Z	- Input	-20003.75	-2.20	0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.81	0.69	0.03
Channel X	+ Input	201.01	0.45	0.23
Channel X	- Input	-198.36	0.93	-0.46
Channel Y	+ Input	2000.40	0.37	0.02
Channel Y	+ Input	199.54	-0.90	-0.45
Channel Y	- Input	-200.61	-1.22	0.61
Channel Z	+ Input	2000.36	0.26	0.01
Channel Z	+ Input	199.66	-0.86	-0.43
Channel Z	- Input	-200.42	-1.13	0.56

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	-4.53	-5.58
	- 200	7.17	6.04
Channel Y	200	-1.81	-2.21
	- 200	-0.01	-0.08
Channel Z	200	-8.38	-9.43
	- 200	7.65	7.91

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	-1.57	-3.03
Channel Y	200	8.98	-	0.17
Channel Z	200	4.34	6.37	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16059	17241
Channel Y	16174	15934
Channel Z	16438	15805

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.80	-0.20	1.81	0.38
Channel Y	-0.87	-2.38	0.78	0.61
Channel Z	-0.59	-1.80	0.66	0.51

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	–0.01	-8	-9

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Accreditation No.: **SCS 108**

Client **Sporton - TW (Auden)**

Certificate No: **DAE3-495_May14**

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AD - SN: 495
Calibration procedure(s)	QA CAL-06.v26 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	May 19, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	01-Oct-13 (No:13976)	Oct-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-14 (in house check)	In house check: Jan-15
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-14 (in house check)	In house check: Jan-15

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: May 19, 2014

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

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range:	1LSB =	6.1μV ,	full range =	-100...+300 mV
Low Range:	1LSB =	61nV ,	full range =	-1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	**X**	**Y**	**Z**
High Range	404.385 ± 0.02% (k=2)	405.359 ± 0.02% (k=2)	405.713 ± 0.02% (k=2)
Low Range	3.95160 ± 1.50% (k=2)	3.99165 ± 1.50% (k=2)	3.96622 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	77.0 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	200034.33	-4.40	-0.00
Channel X	+ Input	20007.03	2.57	0.01
Channel X	- Input	-20001.24	3.51	-0.02
Channel Y	+ Input	200034.04	-0.65	-0.00
Channel Y	+ Input	20005.84	1.63	0.01
Channel Y	- Input	-20002.32	2.64	-0.01
Channel Z	+ Input	200038.21	3.22	0.00
Channel Z	+ Input	20008.03	3.75	0.02
Channel Z	- Input	-20002.39	2.50	-0.01

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2000.81	-0.32	-0.02
Channel X	+ Input	201.28	0.10	0.05
Channel X	- Input	-198.05	0.61	-0.31
Channel Y	+ Input	2000.54	-0.54	-0.03
Channel Y	+ Input	201.02	-0.05	-0.02
Channel Y	- Input	-199.81	-1.07	0.54
Channel Z	+ Input	2000.48	-0.52	-0.03
Channel Z	+ Input	199.62	-1.35	-0.67
Channel Z	- Input	-199.45	-0.67	0.34

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	4.33	2.52
	- 200	-1.22	-2.61
Channel Y	200	0.12	-0.32
	- 200	-0.79	-1.02
Channel Z	200	2.31	2.30
	- 200	-4.76	-4.84

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	-1.27	-2.19
Channel Y	200	8.58	-	-0.77
Channel Z	200	5.25	6.26	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	**Low Range (LSB)**
Channel X	15815	17196
Channel Y	15764	17349
Channel Z	15898	16472

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10MΩ

	Average (μV)	**min. Offset (μV)**	**max. Offset (μV)**	**Std. Deviation (μV)**
Channel X	-0.27	-1.43	0.67	0.49
Channel Y	-0.09	-1.79	1.08	0.58
Channel Z	-1.01	-2.74	0.55	0.60

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	**Measuring (MOhm)**
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	**Alarm Level (VDC)**
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	**Switched off (mA)**	**Stand by (mA)**	**Transmitting (mA)**
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

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Accreditation No.: SCS 108

Client **Sporton - TW (Auden)**

Certificate No: DAE4-1399_Nov13

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 1399
Calibration procedure(s)	QA CAL-06.v26 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	November 07, 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
Keithley Multimeter Type 2001	SN: 0810278	01-Oct-13 (No:13976)	Oct-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-13 (in house check)	In house check: Jan-14
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-13 (in house check)	In house check: Jan-14

	Name	Function	Signature
Calibrated by:	Eric Hainfeld	Technician	
Approved by:	Fin Bomholt	Deputy Technical Manager	i.V.

Issued: November 7, 2013

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Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
    - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
    - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
    - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
    - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
    - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
    - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
    - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
    - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
    - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range:	1LSB =	6.1μV ,	full range =	-100...+300 mV
Low Range:	1LSB =	61nV ,	full range =	-1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	**X**	**Y**	**Z**
High Range	403.576 ± 0.02% (k=2)	403.837 ± 0.02% (k=2)	403.694 ± 0.02% (k=2)
Low Range	3.99338 ± 1.50% (k=2)	3.98864 ± 1.50% (k=2)	3.95341 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	303.0 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	**+ Input**	199997.26	-0.61	-0.00
Channel X	**+ Input**	20001.91	1.03	0.01
Channel X	**- Input**	-19999.07	1.82	-0.01
Channel Y	**+ Input**	199998.80	1.10	0.00
Channel Y	**+ Input**	19999.34	-1.47	-0.01
Channel Y	**- Input**	-20001.19	-0.12	0.00
Channel Z	**+ Input**	199998.69	1.55	0.00
Channel Z	**+ Input**	19998.02	-2.80	-0.01
Channel Z	**- Input**	-20002.75	-1.69	0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	**+ Input**	2002.09	1.09	0.05
Channel X	**+ Input**	201.25	-0.05	-0.02
Channel X	**- Input**	-198.06	0.36	-0.18
Channel Y	**+ Input**	2001.83	0.90	0.04
Channel Y	**+ Input**	200.93	-0.36	-0.18
Channel Y	**- Input**	-198.96	-0.48	0.24
Channel Z	**+ Input**	2001.86	1.03	0.05
Channel Z	**+ Input**	200.25	-0.93	-0.46
Channel Z	**- Input**	-199.87	-1.30	0.65

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	-4.61	-6.77
	- 200	8.22	6.43
Channel Y	200	-5.41	-6.04
	- 200	5.24	4.85
Channel Z	200	-7.82	-7.62
	- 200	5.24	5.18

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	5.08	-1.79
Channel Y	200	9.74	-	6.74
Channel Z	200	8.83	7.35	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15808	15817
Channel Y	16090	15683
Channel Z	15894	15745

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.60	-0.24	1.27	0.29
Channel Y	-0.27	-1.00	0.44	0.33
Channel Z	-1.58	-2.64	-0.67	0.40

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	−0.01	-8	-9

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sporton-TW (Auden)**

Certificate No: **ES3-3270_Sep13**

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3270
Calibration procedure(s)	QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	September 24, 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	4-Sep-13 (No. DAE4-660_Sep13)	Apr-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:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 26, 2013

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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., $\vartheta = 0$ 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 $\vartheta = 0$ ($f \leq 900$ 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 $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *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 ES3DV3

SN:3270

Manufactured: February 25, 2010
Calibrated: September 24, 2013

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3270

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.11	1.20	1.22	± 10.1 %
DCP (mV)[B]	99.9	102.5	100.4	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	194.6	±2.7 %
		Y	0.0	0.0	1.0		153.1	
		Z	0.0	0.0	1.0		149.9	

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

[A] The uncertainties of NormX,Y,Z do not affect the 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: ES3DV3 - SN:3270

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)
835	41.5	0.90	6.18	6.18	6.18	0.40	1.59	± 12.0 %
900	41.5	0.97	6.06	6.06	6.06	0.80	1.10	± 12.0 %
1750	40.1	1.37	5.26	5.26	5.26	0.80	1.09	± 12.0 %
1900	40.0	1.40	5.08	5.08	5.08	0.58	1.37	± 12.0 %
2000	40.0	1.40	5.06	5.06	5.06	0.59	1.35	± 12.0 %
2450	39.2	1.80	4.53	4.53	4.53	0.80	1.26	± 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: ES3DV3 - SN:3270

Calibration Parameter Determined in Body Tissue Simulating Media

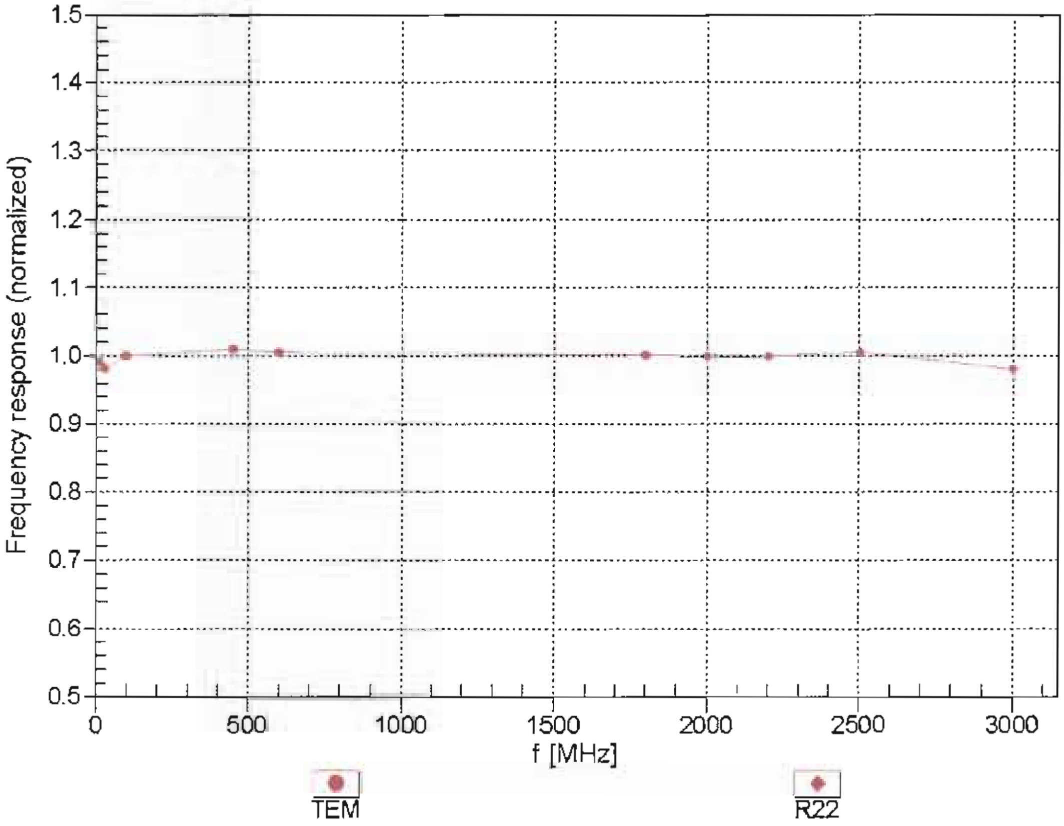
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	55.2	0.97	6.08	6.08	6.08	0.57	1.38	± 12.0 %
900	55.0	1.05	5.98	5.98	5.98	0.80	1.14	± 12.0 %
1750	53.4	1.49	4.91	4.91	4.91	0.55	1.50	± 12.0 %
1900	53.3	1.52	4.71	4.71	4.71	0.57	1.50	± 12.0 %
2000	53.3	1.52	4.78	4.78	4.78	0.60	1.46	± 12.0 %
2450	52.7	1.95	4.28	4.28	4.28	0.80	1.09	± 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

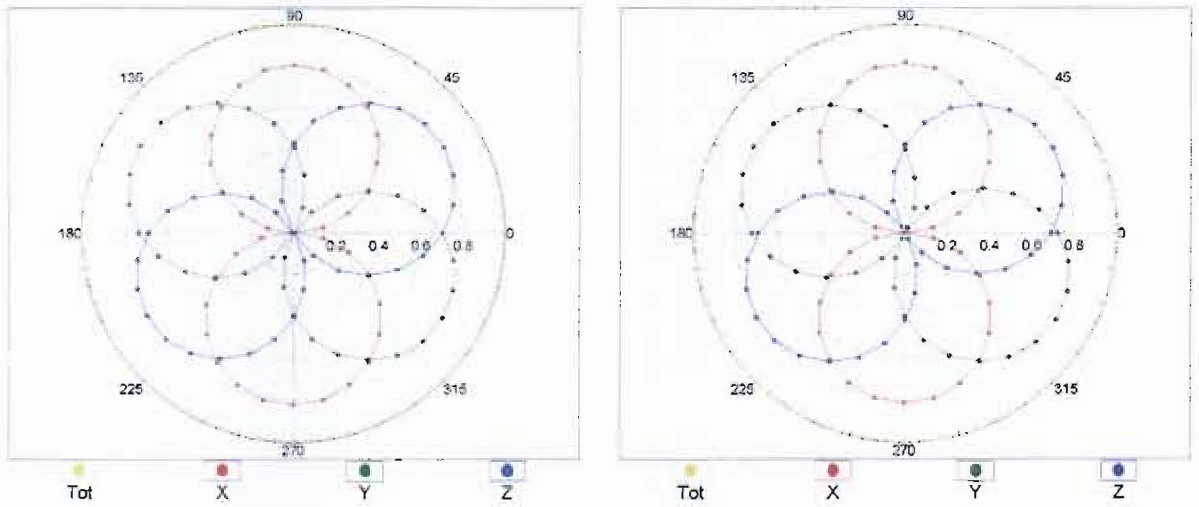
(TEM-Cell:ifi110 EXX, Waveguide: R22)

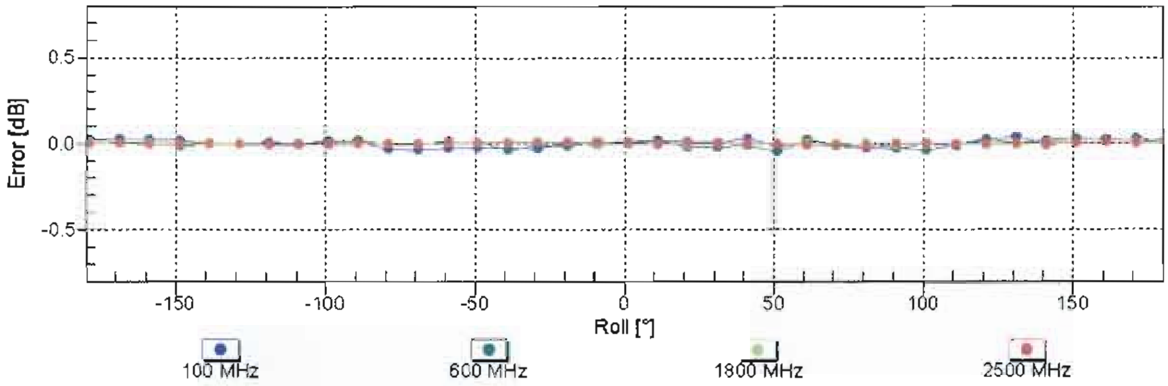


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

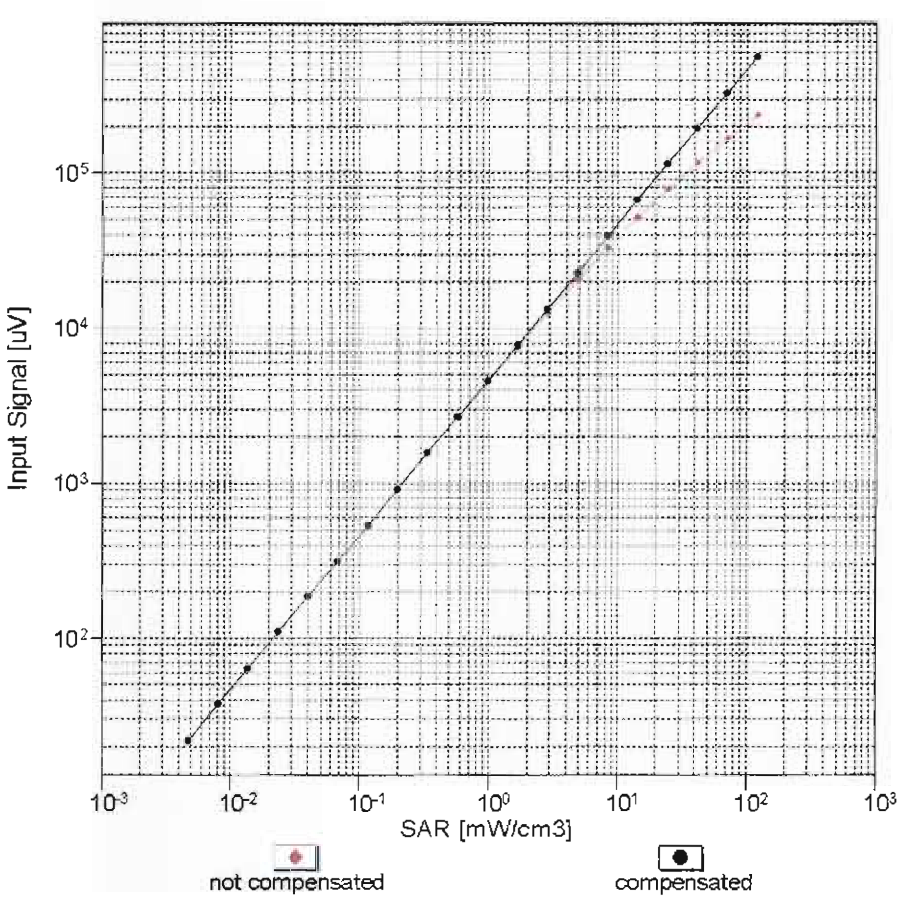
f=600 MHz,TEM f=1800 MHz,R22

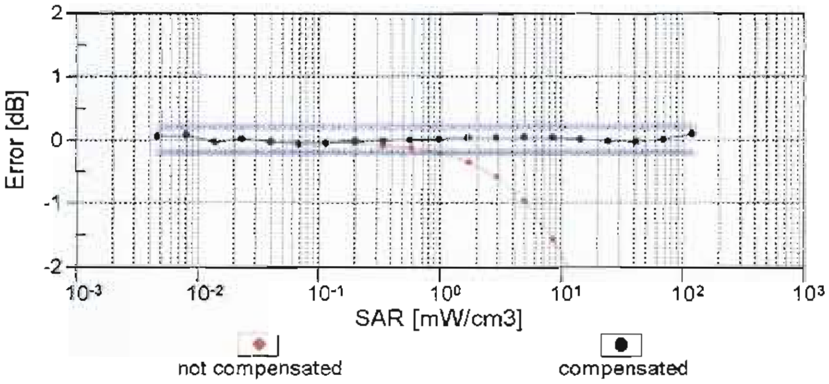




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

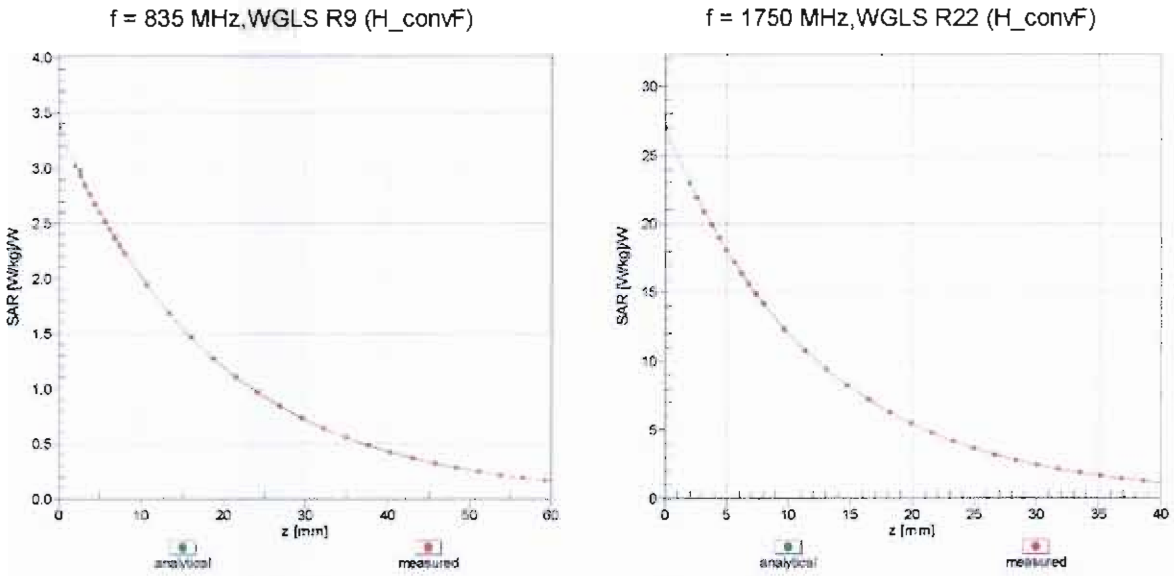
Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)





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

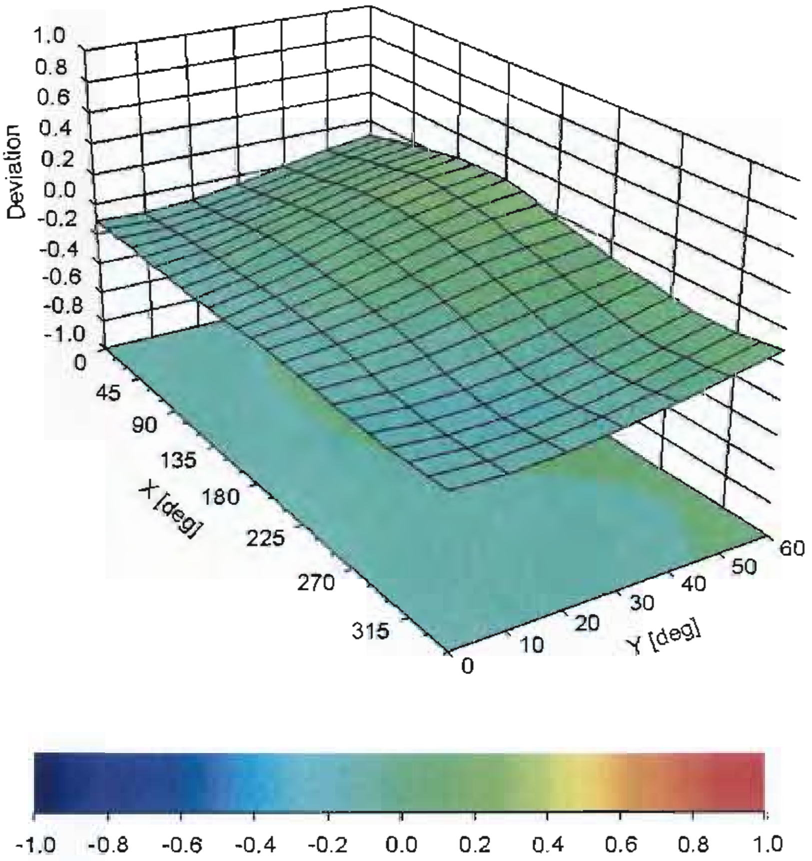
Conversion Factor Assessment


f = 835 MHz,WGLS R9 (H_convF)

f = 1750 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: ES3DV3 - SN:3270

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-18.9
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

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

Client **Sporton-TW (Auden)**

Certificate No: **EX3-3925_May14**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3925

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: May 22, 2014

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 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	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: May 23, 2014

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

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 EX3DV4

SN:3925

Manufactured: March 8, 2013
Calibrated: May 22, 2014

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3925

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.59	0.52	0.50	± 10.1 %
DCP (mV)[B]	97.0	96.5	102.4	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	132.7	±2.7 %
		Y	0.0	0.0	1.0		133.4	
		Z	0.0	0.0	1.0		148.4	

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

[A] The uncertainties of 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:3925

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	10.26	10.26	10.26	0.26	1.04	± 12.0 %
835	41.5	0.90	9.79	9.79	9.79	0.22	1.19	± 12.0 %
900	41.5	0.97	9.60	9.60	9.60	0.24	1.10	± 12.0 %
1750	40.1	1.37	8.54	8.54	8.54	0.43	0.79	± 12.0 %
1900	40.0	1.40	8.26	8.26	8.26	0.66	0.63	± 12.0 %
2000	40.0	1.40	8.18	8.18	8.18	0.59	0.66	± 12.0 %
2150	39.7	1.53	7.89	7.89	7.89	0.80	0.57	± 12.0 %
2450	39.2	1.80	7.26	7.26	7.26	0.47	0.71	± 12.0 %
2600	39.0	1.96	7.17	7.17	7.17	0.44	0.78	± 12.0 %
5200	36.0	4.66	5.31	5.31	5.31	0.30	1.80	± 13.1 %
5300	35.9	4.76	5.09	5.09	5.09	0.30	1.80	± 13.1 %
5500	35.6	4.96	4.83	4.83	4.83	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.69	4.69	4.69	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.63	4.63	4.63	0.40	1.80	± 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. Above 5 GHz frequency validity can be extended to ± 110 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: EX3DV4 - SN:3925

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	9.92	9.92	9.92	0.43	0.84	± 12.0 %
835	55.2	0.97	9.83	9.83	9.83	0.58	0.74	± 12.0 %
900	55.0	1.05	9.63	9.63	9.63	0.52	0.79	± 12.0 %
1750	53.4	1.49	8.30	8.30	8.30	0.51	0.78	± 12.0 %
1900	53.3	1.52	7.87	7.87	7.87	0.53	0.75	± 12.0 %
2000	53.3	1.52	7.98	7.98	7.98	0.48	0.80	± 12.0 %
2150	53.1	1.66	7.82	7.82	7.82	0.51	0.76	± 12.0 %
2450	52.7	1.95	7.36	7.36	7.36	0.76	0.59	± 12.0 %
2600	52.5	2.16	7.08	7.08	7.08	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.53	4.53	4.53	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.36	4.36	4.36	0.40	1.90	± 13.1 %
5500	48.6	5.65	4.21	4.21	4.21	0.40	1.90	± 13.1 %
5600	48.5	5.77	4.12	4.12	4.12	0.40	1.90	± 13.1 %
5800	48.2	6.00	4.09	4.09	4.09	0.50	1.90	± 13.1 %

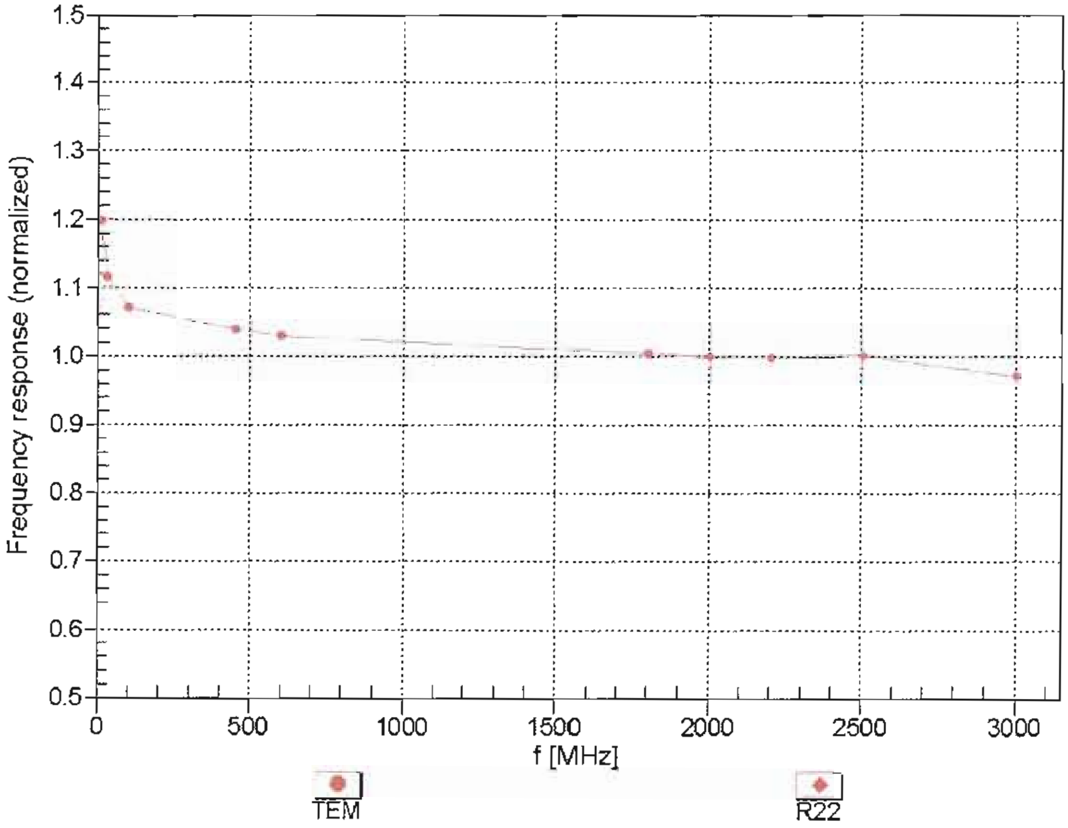
[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency 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.

Frequency Response of E-Field

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

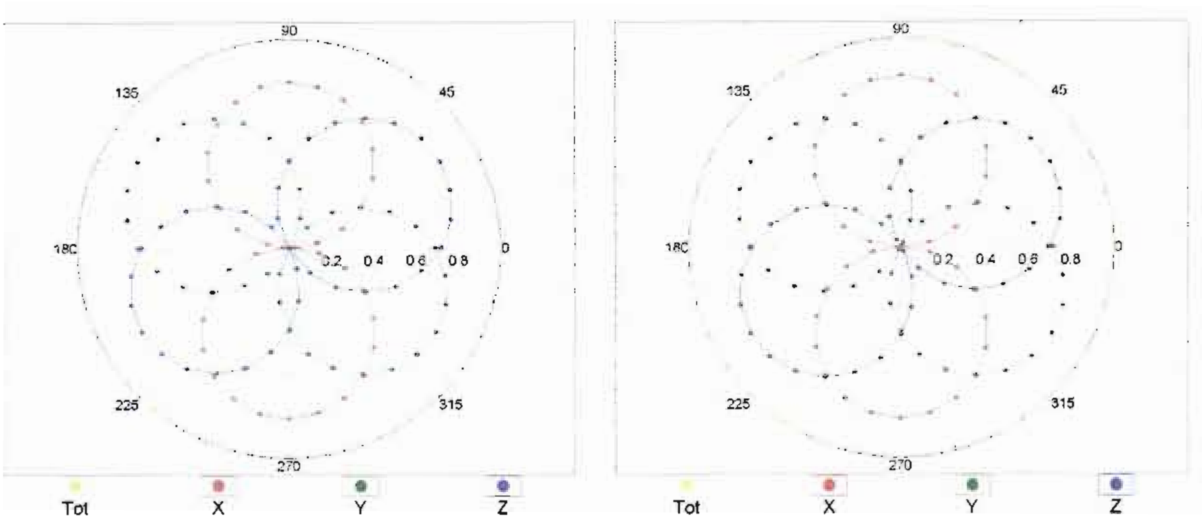


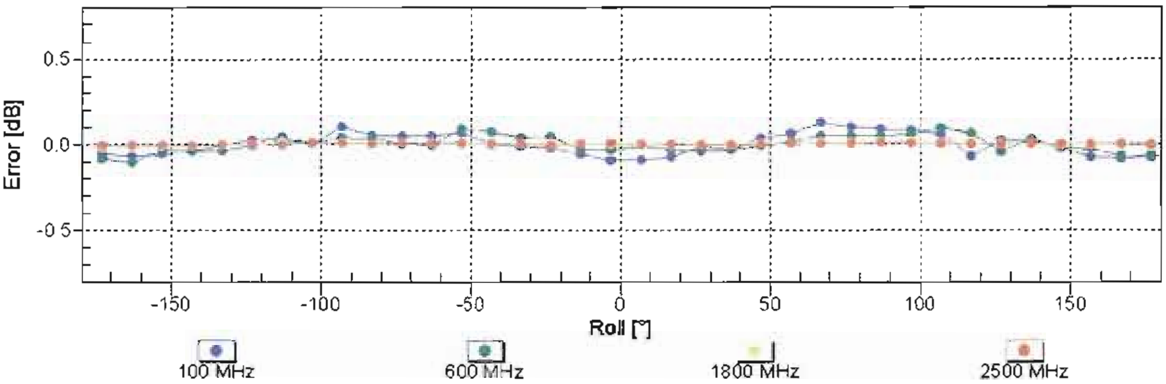
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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

f=600 MHz,TEM

f=1800 MHz,R22

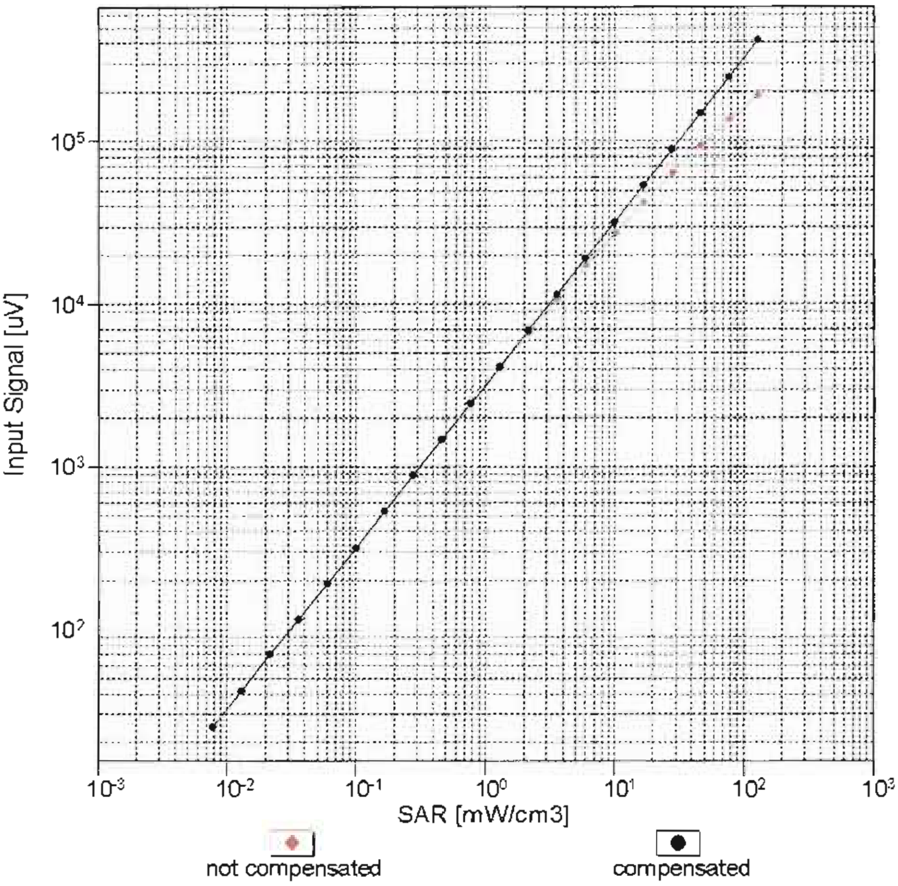


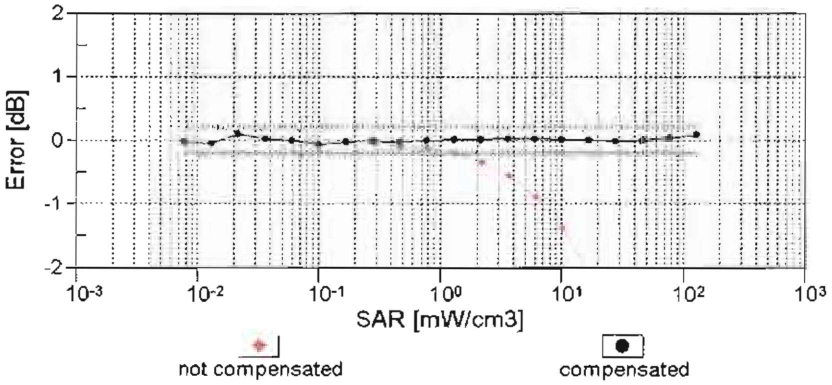


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR$_{head}$)

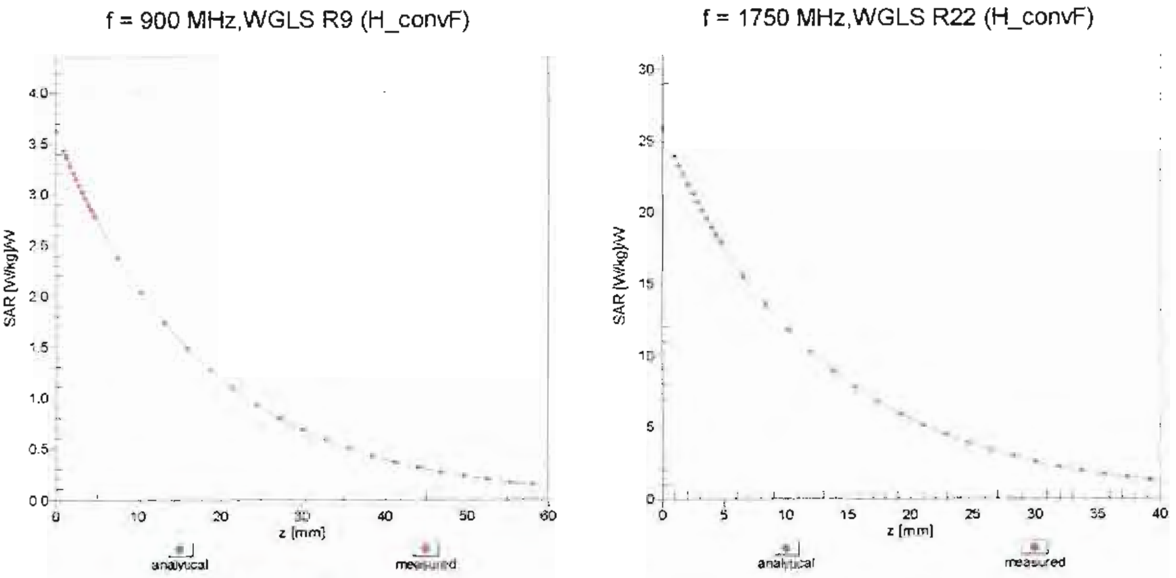
(TEM cell , f$_{eval}$= 1900 MHz)





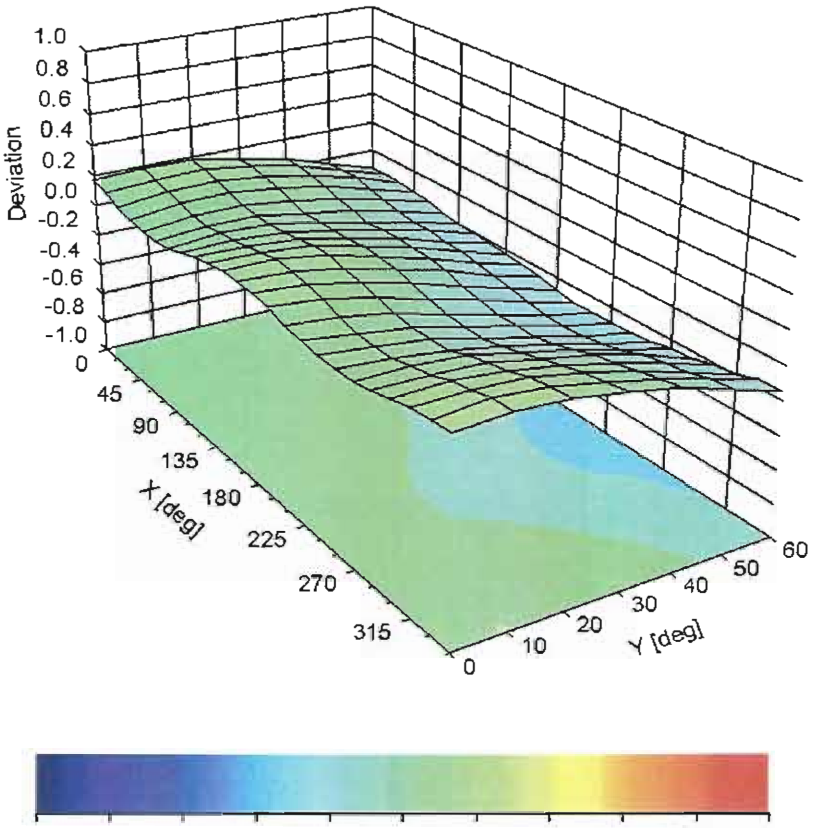
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3925

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-93.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

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

S **Schweizerischer Kalibrierdienst**
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S **Servizio svizzero di taratura**
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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 **Sporton-TW (Auden)**

Certificate No: EX3-3955_Nov13

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3955

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

Calibration date: November 12, 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	4-Sep-13 (No. DAE4-660_Sep13)	Sep-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: November 12, 2013

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

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., $\vartheta = 0$ 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 $\vartheta = 0$ ($f \leq 900$ 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 $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF.* A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe EX3DV4

SN:3955

Manufactured: August 6, 2013
Calibrated: November 12, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3955

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.35	0.41	0.32	± 10.1 %
DCP (mV)[B]	99.7	103.0	102.1	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B $dB\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	134.5	±2.7 %
		Y	0.0	0.0	1.0		144.1	
		Z	0.0	0.0	1.0		161.3	

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:3955

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	10.24	10.24	10.24	0.29	1.08	± 12.0 %
2450	39.2	1.80	7.29	7.29	7.29	0.34	0.81	± 12.0 %
5200	36.0	4.66	5.14	5.14	5.14	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.86	4.86	4.86	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.83	4.83	4.83	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.64	4.64	4.64	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.61	4.61	4.61	0.40	1.80	± 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.

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3955

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	9.89	9.89	9.89	0.37	0.93	± 12.0 %
2450	52.7	1.95	7.42	7.42	7.42	0.76	0.58	± 12.0 %
5200	49.0	5.30	4.64	4.64	4.64	0.40	1.90	± 13.1 %
5300	48.9	5.42	4.36	4.36	4.36	0.45	1.90	± 13.1 %
5500	48.6	5.65	4.32	4.32	4.32	0.40	1.90	± 13.1 %
5600	48.5	5.77	4.27	4.27	4.27	0.30	1.90	± 13.1 %
5800	48.2	6.00	4.25	4.25	4.25	0.45	1.90	± 13.1 %

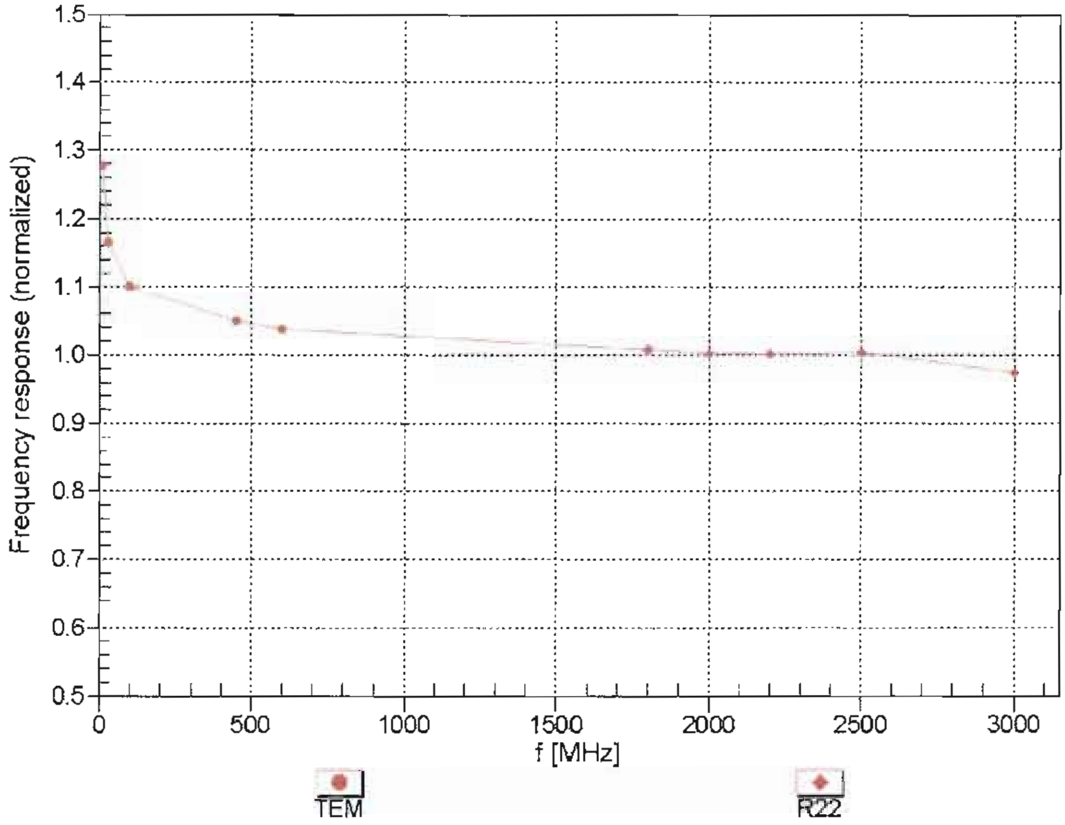
[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

[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.

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

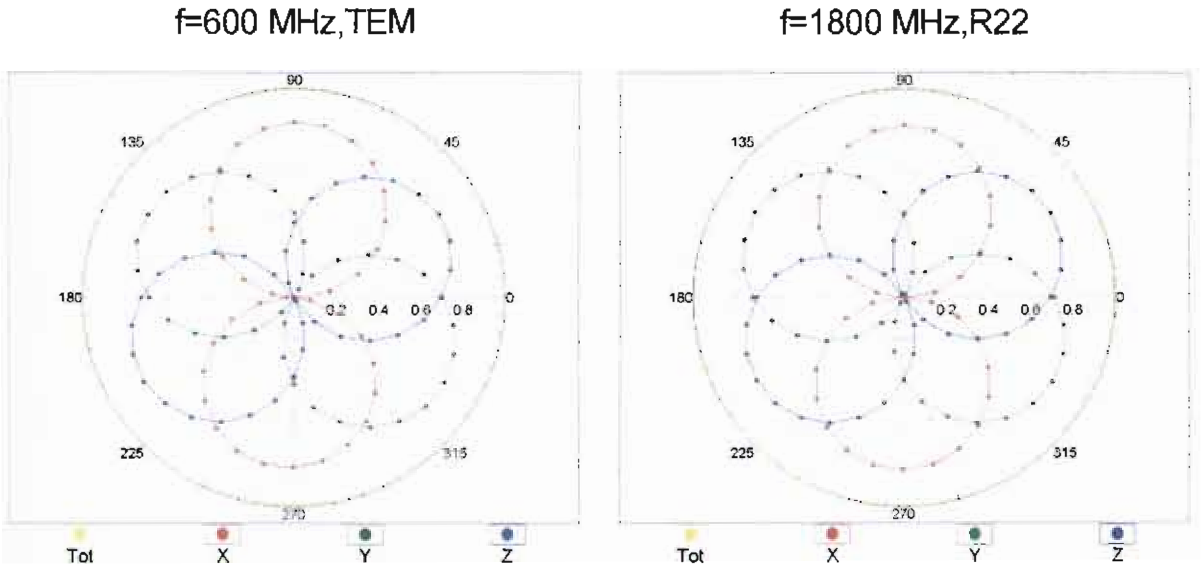
Frequency Response of E-Field

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

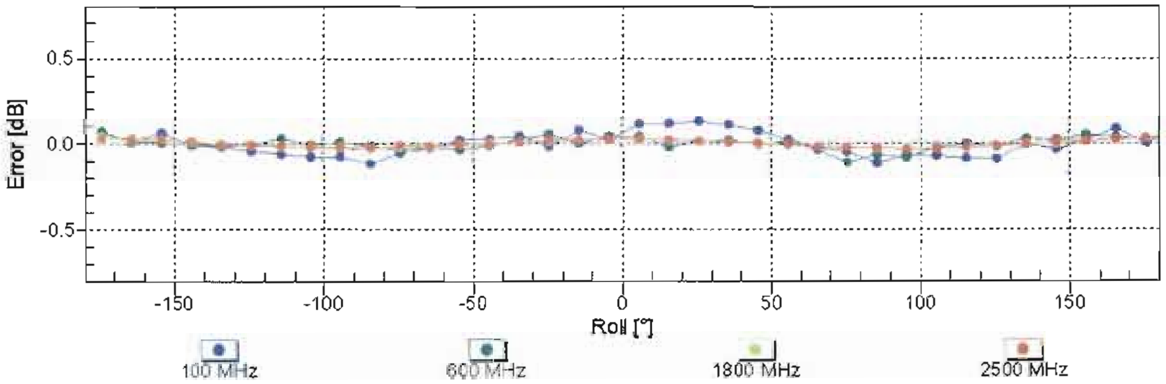


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°


f=600 MHz,TEM

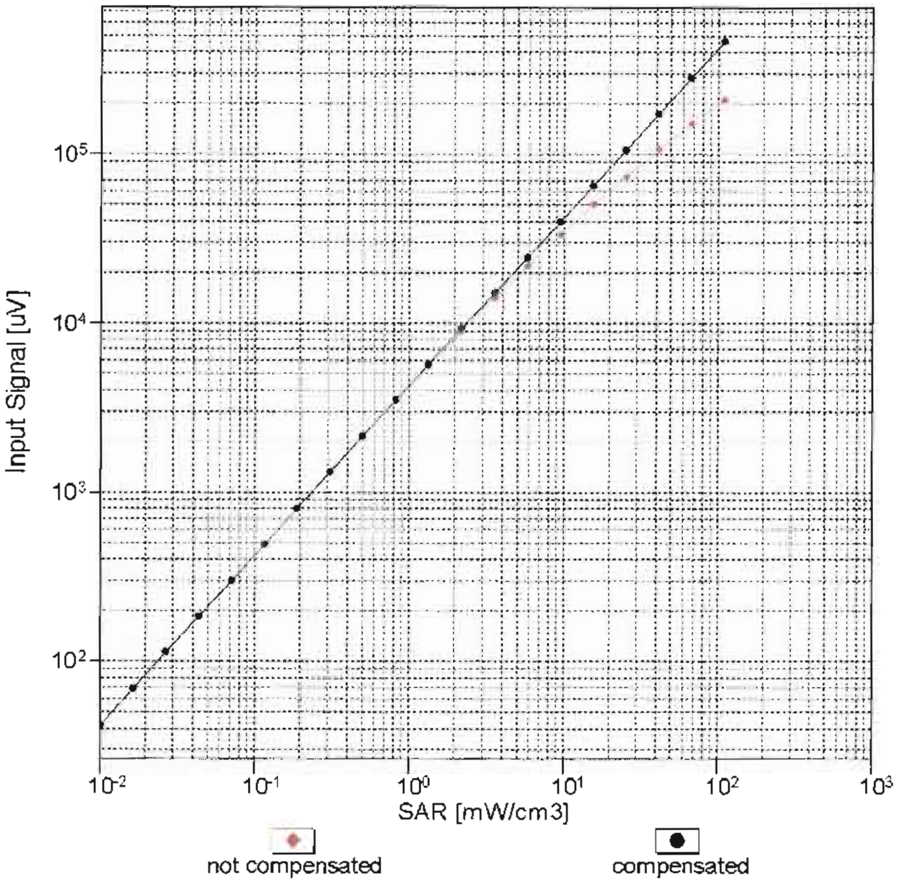
f=1800 MHz,R22

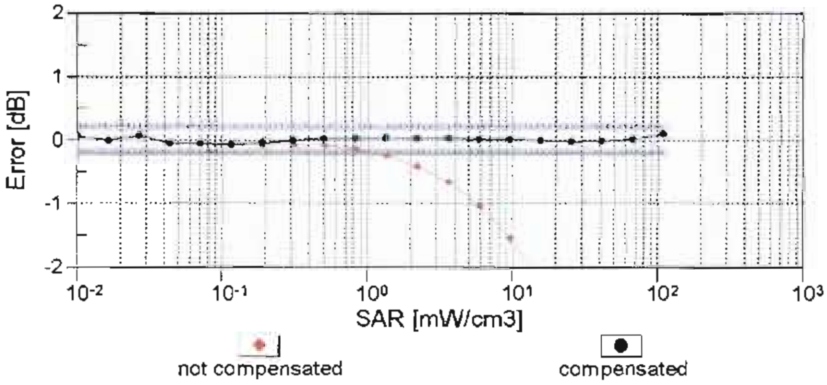


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

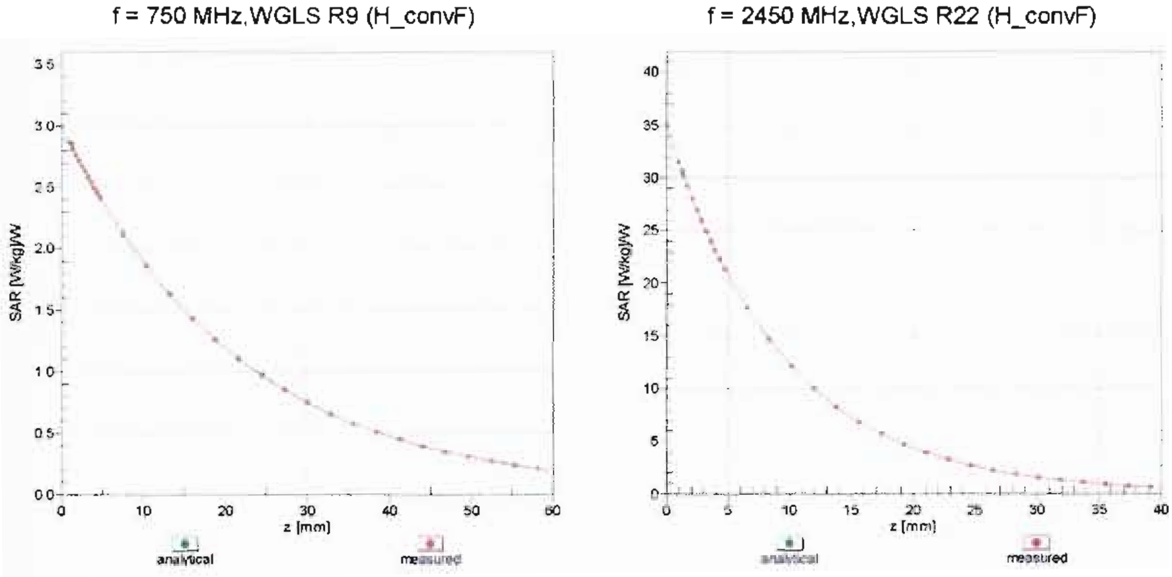
(TEM cell , f = 900 MHz)





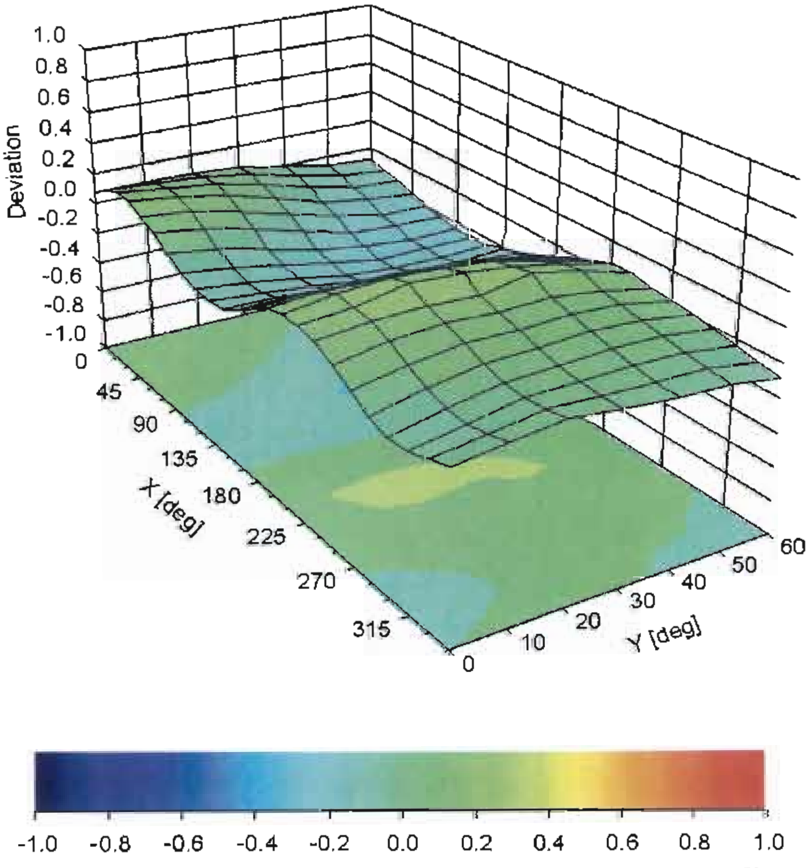
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3955

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-54.2
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

In Collaboration with
s p e a g
CALIBRATION LABORATORY

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E-mail: Info@emcite.com Http://www.emcite.com

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CNAS L0442

Client **Sporton-TW** **Certificate No: J13-2-3185**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3955
Calibration Procedure(s)	TMC-OS-E-02-195 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	December 23, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Power sensor NRP-Z91	101547	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Power sensor NRP-Z91	101548	01-Jul-13 (TMC, No.JW13-044)	Jun-14
Reference10dBAttenuator	BT0520	12-Dec-12(TMC,No.JZ12-867)	Dec-14
Reference20dBAttenuator	BT0267	12-Dec-12(TMC,No.JZ12-866)	Dec-14
Reference Probe EX3DV4	SN 3846	03-Sep-13(SPEAG,No.EX3-3846_Sep13)	Sep-14
DAE4	SN 777	22-Feb-13 (SPEAG, DAE4-777_Feb13)	Feb -14
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	01-Jul-13 (TMC, No.JW13-045)	Jun-14
Network Analyzer E5071C	MY46110673	15-Feb-13 (TMC, No.JZ13-781)	Feb-14

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

Issued: December 25, 2013

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

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 θ=0 is normal to probe axis

Calibration is Performed According to the Following Standards:

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

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect 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 (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;VRx,y,z:*A,B,C 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≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued 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±50MHz to±100MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe EX3DV4

SN: 3955

Calibrated: December 23, 2013

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

DASY – Parameters of Probe: EX3DV4 - SN: 3955

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)[A]	0.35	0.40	0.30	±10.8%
DCP(mV)[B]	110.8	104.5	101.4	

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	112.8	±4.8%
		Y	0.0	0.0	1.0		123.6	
		Z	0.0	0.0	1.0		100.5	

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

[A] The uncertainties of Norm X, Y, Z do not affect the E^2-field uncertainty inside TSL (see Page 5 and Page 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY – Parameters of Probe: EX3DV4 - SN: 3955

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)
850	41.5	0.92	9.86	9.86	9.86	0.12	1.53	±12%
900	41.5	0.97	9.98	9.98	9.98	0.13	1.53	±12%
1810	40.0	1.40	8.23	8.23	8.23	0.13	2.30	±12%
1900	40.0	1.40	8.31	8.31	8.31	0.15	1.81	±12%
2600	39.0	1.96	7.55	7.55	7.55	0.48	0.82	±12%

[C] Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

[F] At frequency 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 – Parameters of Probe: EX3DV4 - SN: 3955

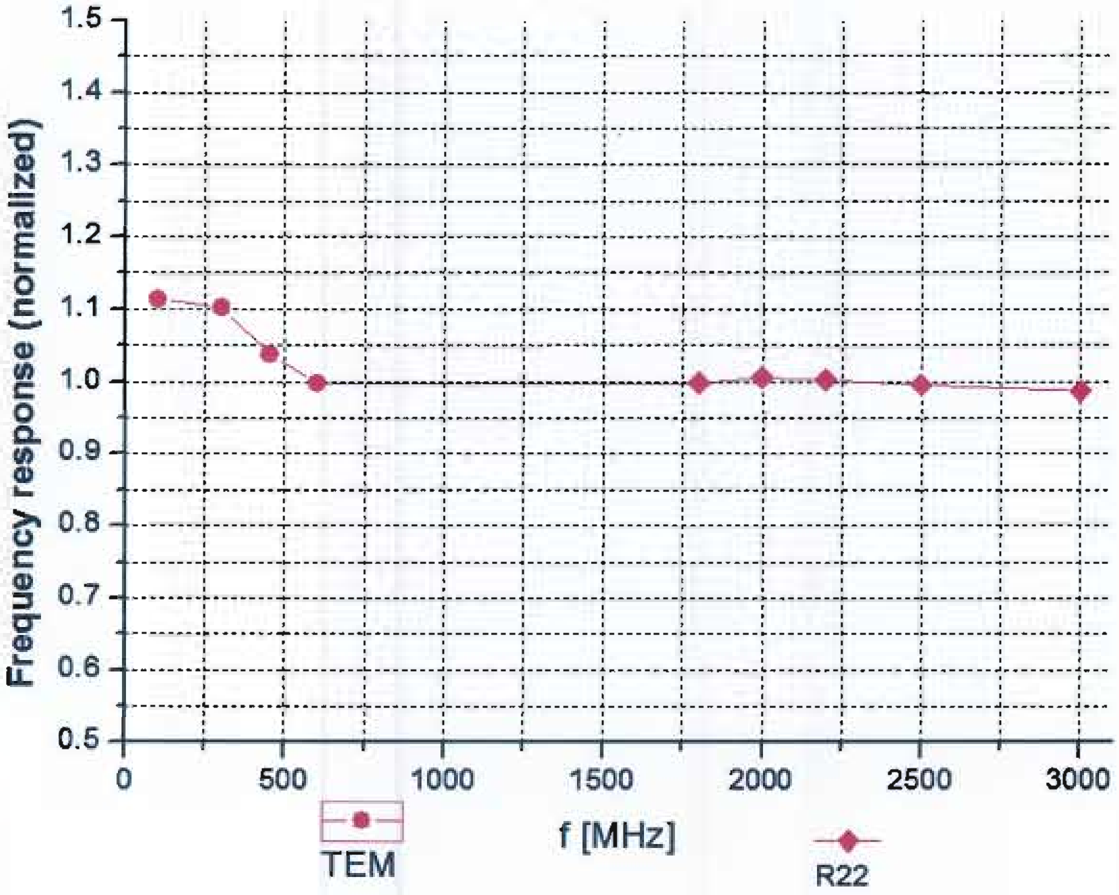
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz][C]	Relative Permittivity[F]	Conductivity (S/m)[F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
850	55.2	0.99	9.81	9.81	9.81	0.17	1.46	±12%
900	55.0	1.05	9.86	9.86	9.86	0.27	1.09	±12%
1810	53.3	1.52	8.17	8.17	8.17	0.14	2.85	±12%
1900	53.3	1.52	7.84	7.84	7.84	0.16	2.64	±12%
2600	52.5	2.16	7.58	7.58	7.58	0.50	0.85	±12%

[C] Frequency validity of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

[F] At frequency 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.

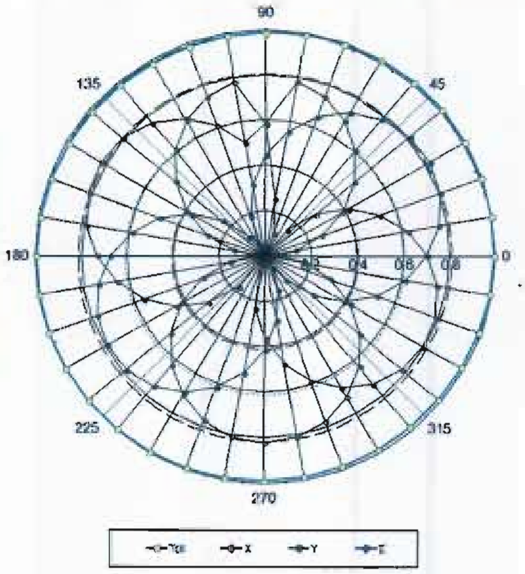
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



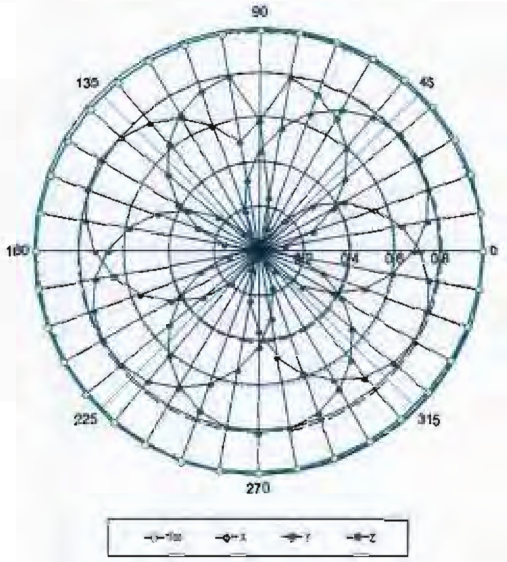
Uncertainty of Frequency Response of E-field: ±7.5% (k=2)

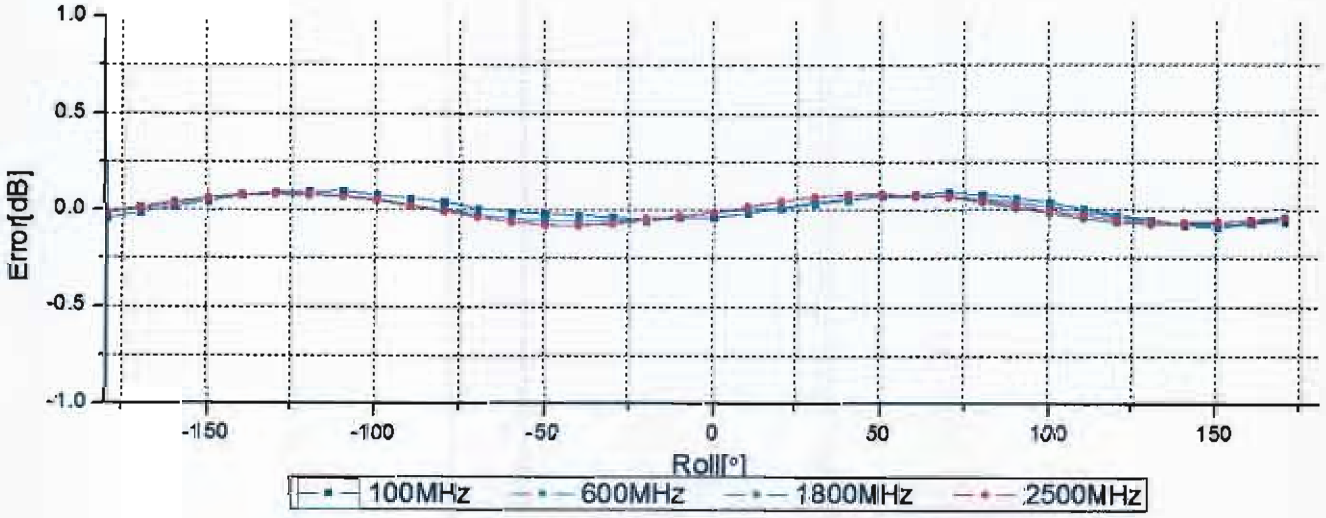
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



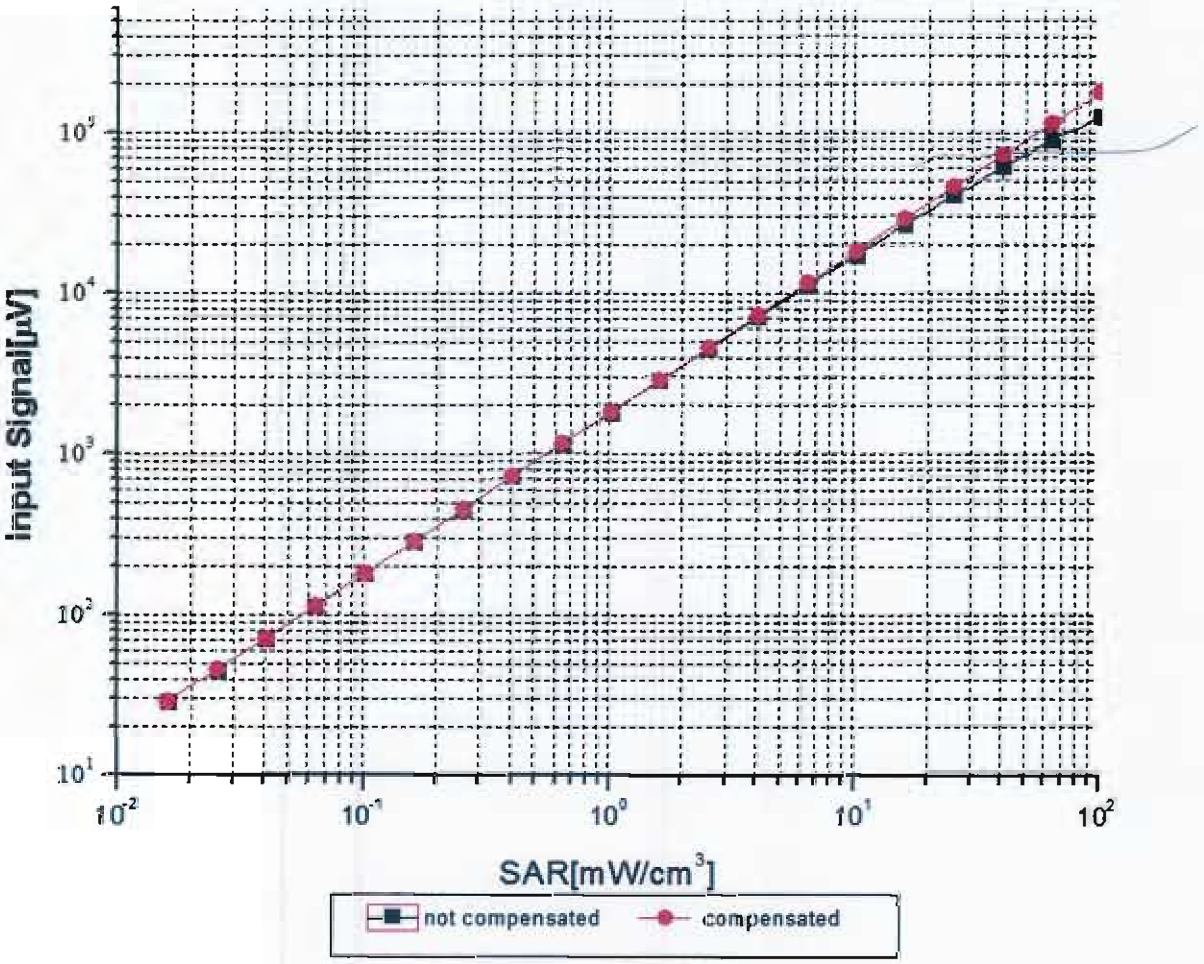
f=1800 MHz, R22

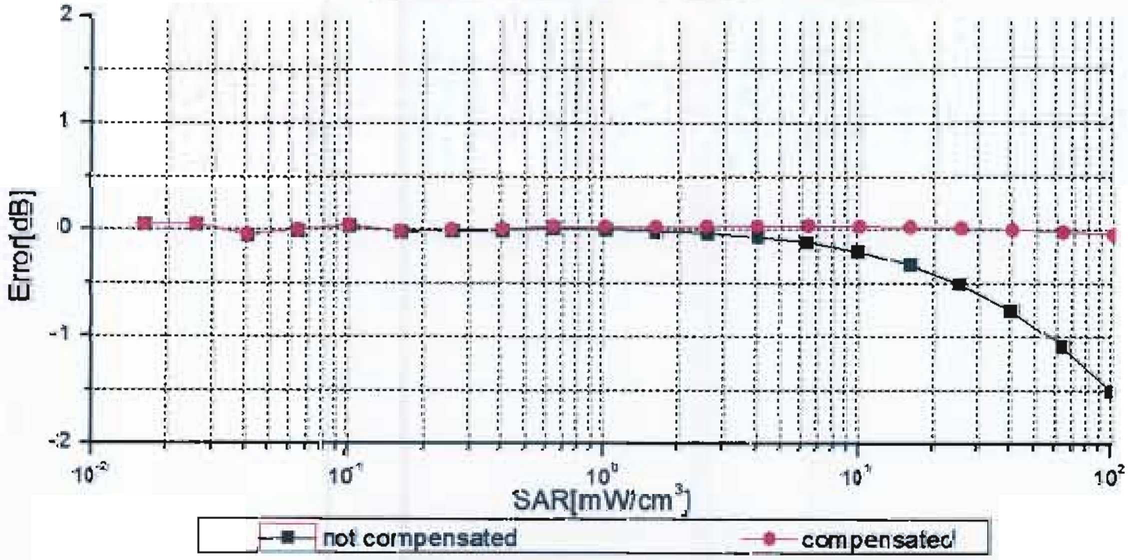




Uncertainty of Axial Isotropy Assessment: ±0.9% (k=2)

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

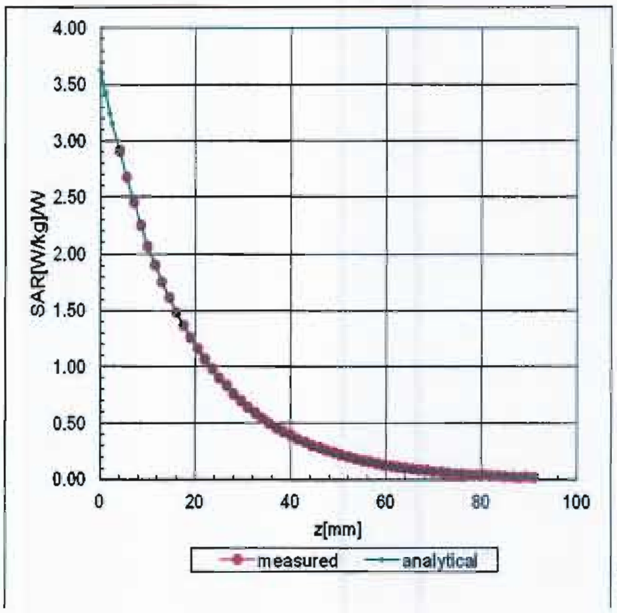




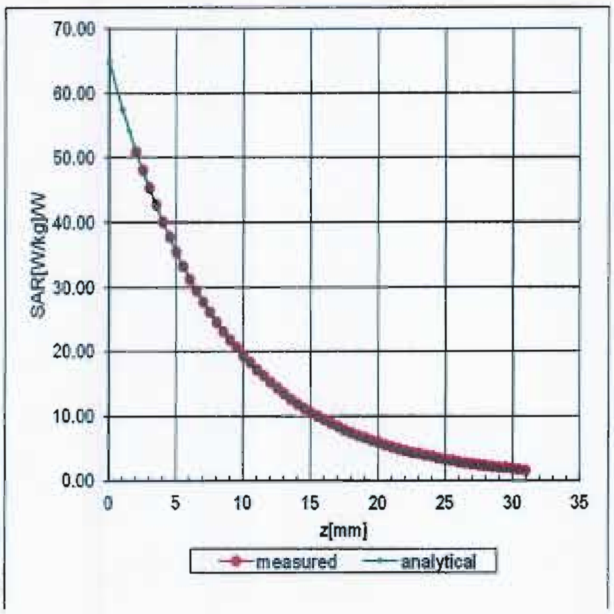
Uncertainty of Linearity Assessment: ±0.9% (k=2)

Conversion Factor Assessment

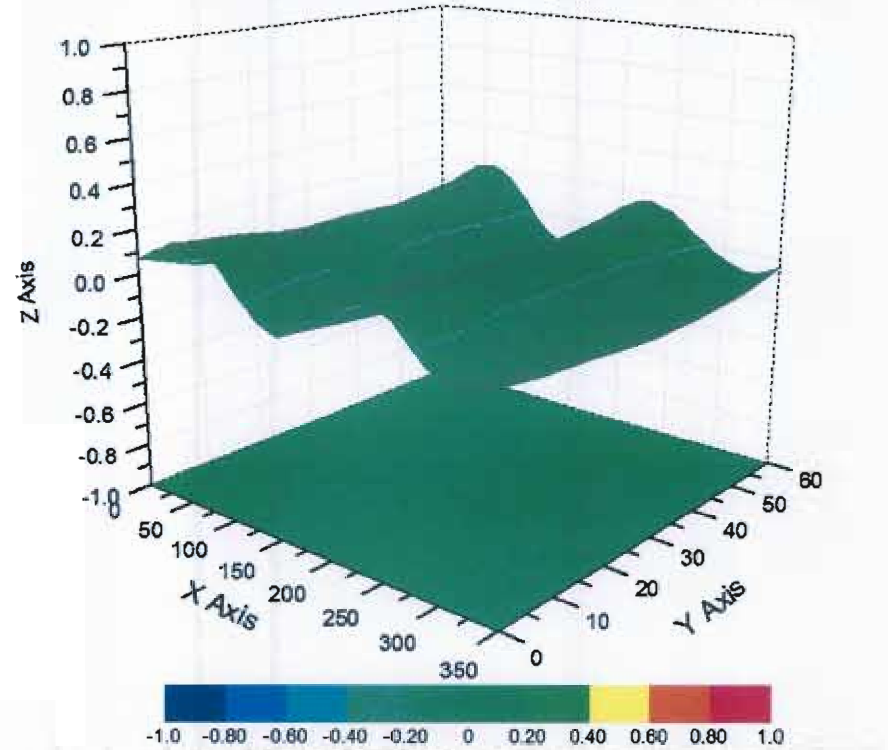
f=900 MHz, WGLS R9(H_convF)



f=2600 MHz, WGLS R26(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±2.8% (K=2)

DASY - Parameters of Probe: EX3DV4 - SN: 3955

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	128
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	2mm

OET

June 26, 2013

Acceptable Conditions for SAR Measurements Using Probes and Dipoles Calibrated under the SPEAG-TMC Dual-Logo Calibration Program to Support FCC Equipment Certification

The acceptable conditions for SAR measurements using probes, dipoles and DAEs calibrated by TMC (*Telecommunication Metrology Center of MITT in Beijing, China*), under the Dual-Logo Calibration Certificate program and quality assurance (QA) protocols established between SPEAG (*Schmid & Partner Engineering AG, Switzerland*) and TMC, to support FCC (*U.S. Federal Communications Commission*) equipment certification are defined and described in the following.

1) The agreement established between SPEAG and TMC is only applicable to calibration services performed by TMC where its clients (companies and divisions of such companies) are headquartered in the Greater China Region, including Taiwan and Hong Kong. This agreement is subject to renewal at the end of each calendar year between SPEAG and TMC. TMC shall inform the FCC of any changes or early termination to the agreement.
2) Only a subset of the calibration services specified in the SPEAG-TMC agreement, while it remains valid, are applicable to SAR measurements performed using such equipment for supporting FCC equipment certification. These are identified in the following.
    a) Calibration of dosimetric (SAR) probes EX3DVx, ET3DVx and ES3DVx.
        i) Free-space E-field and H-field probes, including those used for HAC (hearing aid compatibility) evaluation, temperature probes, other probes or equipment not identified in this document, when calibrated by TMC, are excluded and cannot be used for measurements to support FCC equipment certification.
        ii) Signal specific and bundled probe calibrations based on PMR (probe modulation response) characteristics are handled according to the requirements of KDB 865664; that is, "Until standardized procedures are available to make such determination, the applicability of a signal specific probe calibration for testing specific wireless modes and technologies is determined on a case-by-case basis through KDB inquiries, including SAR system verification requirements."
    b) Calibration of SAR system validation dipoles, excluding HAC dipoles.
    c) Calibration of data acquisition electronics DAE3Vx, DAE4Vx and DAEasyVx.
    d) For FCC equipment certification purposes, the frequency range of SAR probe and dipole calibrations is limited to 700 MHz - 6 GHz and provided it is supported by the equipment identified in the TMC QA protocol (a separate attachment to this document).
    e) The identical system and equipment setup, measurement configurations, hardware, evaluation algorithms, calibration and QA protocols, including the format of calibration certificates and reports used by SPEAG shall be applied by TMC.
    f) The calibrated items are only applicable to SPEAG DASY 4 and DASY 5 or higher version systems.

3) The SPEAG-TMC agreement includes specific protocols identified in the following to ensure the quality of calibration services provided by TMC under this SPEAG-TMC Dual-Logo calibration agreement are equivalent to the calibration services provided by SPEAG. TMC shall, upon request, provide copies of documentation to the FCC to substantiate program implementation.
   a) The Inter-laboratory Calibration Evaluation (ILCE) stated in the TMC QA protocol shall be performed between SPEAG and TMC at least once every 12 months. The ILCE acceptance criteria defined in the TMC QA protocol shall be satisfied for the TMC, SPEAG and FCC agreements to remain valid.
   b) Check of Calibration Certificate (CCC) shall be performed by SPEAG for all calibrations performed by TMC. Written confirmation from SPEAG is required for TMC to issue calibration certificates under the SPEAG-TMC Dual-Logo calibration program. Quarterly reports for all calibrations performed by TMC under the program are also issued by SPEAG.
   c) The calibration equipment and measurement system used by TMC shall be verified before each calibration service according to the specific reference SAR probes, dipoles, and DAE calibrated by SPEAG. The results shall be reproducible and within the defined acceptance criteria specified in the TMC QA protocol before each actual calibration can commence. TMC shall maintain records of the measurement and calibration system verification results for all calibrations.
   d) Quality Check of Calibration (QCC) certificates shall be performed by SPEAG at least once every 12 months. SPEAG shall visit TMC facilities to verify the laboratory, equipment, applied procedures and plausibility of randomly selected certificates.
4) A copy of this document, to be updated annually, shall be provided to TMC clients that accept calibration services according to the SPEAG-TMC Dual-Logo calibration program, which should be presented to a TCB (*Telecommunication Certification Body*), to facilitate FCC equipment approval.
5) TMC shall address any questions raised by its clients or TCBs relating to the SPEAG-TMC Dual-Logo calibration program and inform the FCC and SPEAG of any critical issues.

Change Note: Revised on June 26 to clarify the applicability of PMR and Bundled probe calibrations according to the requirements of KDB 865664.

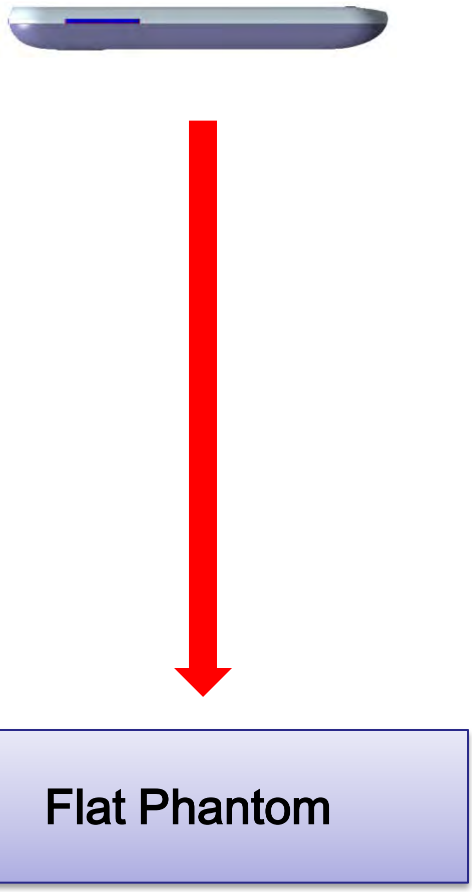
Appendix D. Proximity Sensor Power Reduction

As per the 616217 D04 SAR for laptop and tablets v01, section 6.2, procedure is used to determine the triggering distances.
The result of performing 616217 D04 6.2. 1) ~ 9) is tabulated below.
We tried 2 times using B4 and B13 tissue, and found the sensor triggering is not changed with different tissue.
And we confirmed this sensor design does not allow for additional variations of triggering distance tolerance.

Case1) Proximity sensor status table when DUT is moving towards the phantom

- back surface

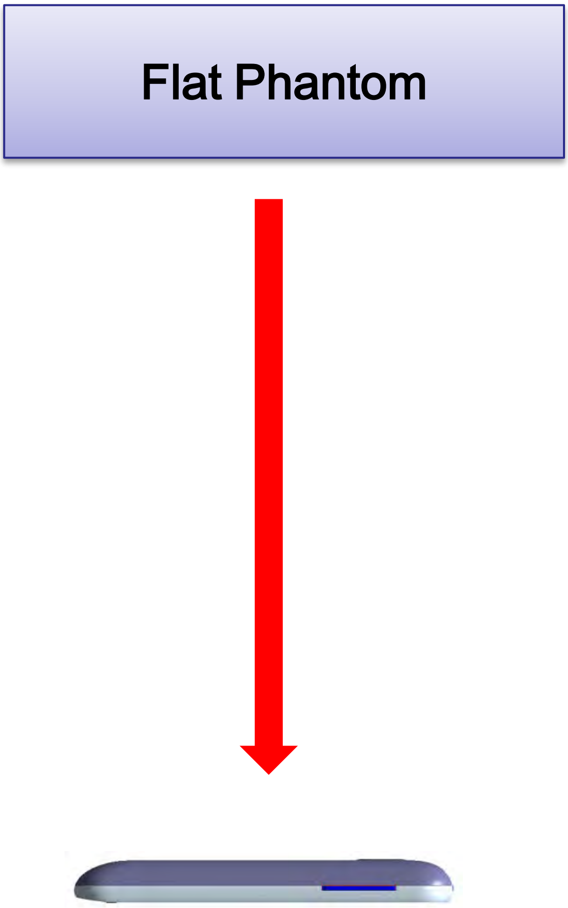
Distance to the DUT	Capacitive Sensor Status	Max Power(LTE) (dBm)		Max Power (WCDMA) (dBm)		Max Power (GSM) (dBm)	
(mm)	back surface	B4	B7	B2	B5	GSM 850	GSM 1900
33	OFF	23.7	23.7	23.2	24.7	33.2	30.7
30	OFF	23.7	23.7	23.2	24.7	33.2	30.7
27	OFF	23.7	23.7	23.2	24.7	33.2	30.7
24	OFF	23.7	23.7	23.2	24.7	33.2	30.7
21	OFF	23.7	23.7	23.2	24.7	33.2	30.7
18	OFF	23.7	23.7	23.2	24.7	33.2	30.7
17	OFF	23.7	23.7	23.2	24.7	33.2	30.7
16	OFF	23.7	23.7	23.2	24.7	33.2	30.7
15	OFF	23.7	23.7	23.2	24.7	33.2	30.7
14	OFF	23.7	23.7	23.2	24.7	33.2	30.7
13	OFF	23.7	23.7	23.2	24.7	33.2	30.7
12	ON	10.9	10.9	11.7	18.2	25.7	21.7
11	ON	10.9	10.9	11.7	18.2	25.7	21.7
10	ON	10.9	10.9	11.7	18.2	25.7	21.7
9	ON	10.9	10.9	11.7	18.2	25.7	21.7
8	ON	10.9	10.9	11.7	18.2	25.7	21.7
5	ON	10.9	10.9	11.7	18.2	25.7	21.7
2	ON	10.9	10.9	11.7	18.2	25.7	21.7
0	ON	10.9	10.9	11.7	18.2	25.7	21.7



<test set up drawing>

Case2) Proximity sensor status table when DUT is moving away the phantom
- back surface

Distance to the DUT	Capacitive Sensor Status	Max Power(LTE) (dBm)		Max Power (WCDMA) (dBm)		Max Power (GSM) (dBm)	
(mm)	back surface	B4	B7	B2	B5	GSM 850	GSM 1900
0	ON	10.9	10.9	11.7	18.2	25.7	21.7
3	ON	10.9	10.9	11.7	18.2	25.7	21.7
6	ON	10.9	10.9	11.7	18.2	25.7	21.7
7	ON	10.9	10.9	11.7	18.2	25.7	21.7
8	ON	10.9	10.9	11.7	18.2	25.7	21.7
9	ON	10.9	10.9	11.7	18.2	25.7	21.7
10	ON	10.9	10.9	11.7	18.2	25.7	21.7
11	ON	10.9	10.9	11.7	18.2	25.7	21.7
12	ON	10.9	10.9	11.7	18.2	25.7	21.7
13	OFF	23.7	23.7	23.2	24.7	33.2	30.7
14	OFF	23.7	23.7	23.2	24.7	33.2	30.7
15	OFF	23.7	23.7	23.2	24.7	33.2	30.7
16	OFF	23.7	23.7	23.2	24.7	33.2	30.7
17	OFF	23.7	23.7	23.2	24.7	33.2	30.7
18	OFF	23.7	23.7	23.2	24.7	33.2	30.7
21	OFF	23.7	23.7	23.2	24.7	33.2	30.7
24	OFF	23.7	23.7	23.2	24.7	33.2	30.7
27	OFF	23.7	23.7	23.2	24.7	33.2	30.7
30	OFF	23.7	23.7	23.2	24.7	33.2	30.7



<test set up drawing>

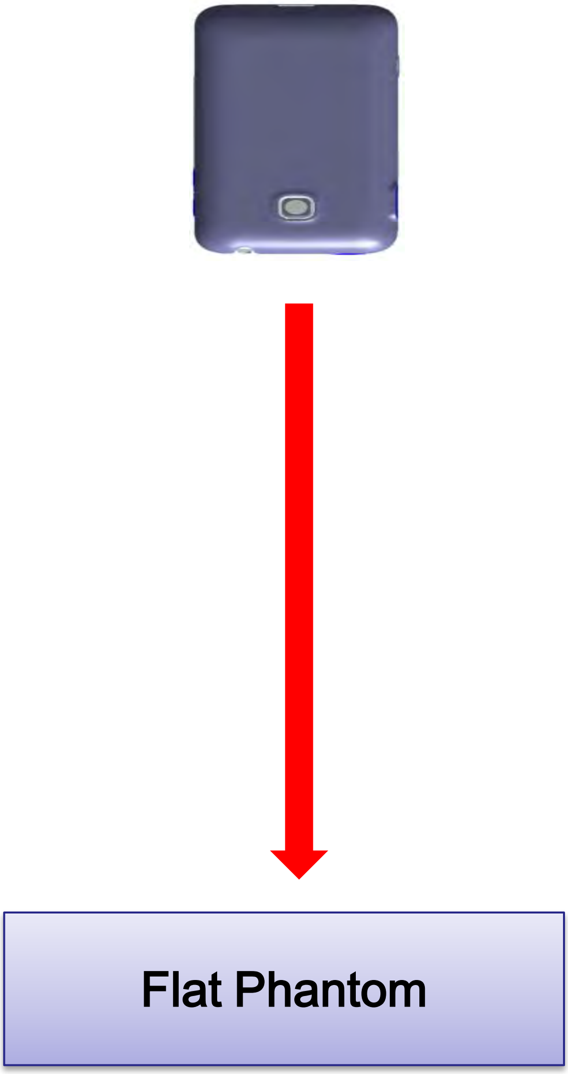
The distance at which the Cap sensor triggers is same for all LTE test frequencies.

We determined that the SAR measurement distance for back surface is 11mm.
: 12mm - 1mm = 11mm

Case3) Proximity sensor status table when DUT is moving towards the phantom

- top edge

Distance to the DUT	Capacitive Sensor Status	Max Power(LTE) (dBm)		Max Power (WCDMA) (dBm)		Max Power (GSM) (dBm)	
(mm)	back surface	B4	B7	B2	B5	GSM 850	GSM 1900
33	OFF	23.7	23.7	23.2	24.7	33.2	30.7
30	OFF	23.7	23.7	23.2	24.7	33.2	30.7
27	OFF	23.7	23.7	23.2	24.7	33.2	30.7
24	OFF	23.7	23.7	23.2	24.7	33.2	30.7
21	OFF	23.7	23.7	23.2	24.7	33.2	30.7
18	OFF	23.7	23.7	23.2	24.7	33.2	30.7
17	OFF	23.7	23.7	23.2	24.7	33.2	30.7
16	OFF	23.7	23.7	23.2	24.7	33.2	30.7
15	OFF	23.7	23.7	23.2	24.7	33.2	30.7
14	OFF	23.7	23.7	23.2	24.7	33.2	30.7
13	ON	10.9	10.9	11.7	18.2	25.7	21.7
12	ON	10.9	10.9	11.7	18.2	25.7	21.7
11	ON	10.9	10.9	11.7	18.2	25.7	21.7
10	ON	10.9	10.9	11.7	18.2	25.7	21.7
9	ON	10.9	10.9	11.7	18.2	25.7	21.7
8	ON	10.9	10.9	11.7	18.2	25.7	21.7
5	ON	10.9	10.9	11.7	18.2	25.7	21.7
2	ON	10.9	10.9	11.7	18.2	25.7	21.7
0	ON	10.9	10.9	11.7	18.2	25.7	21.7



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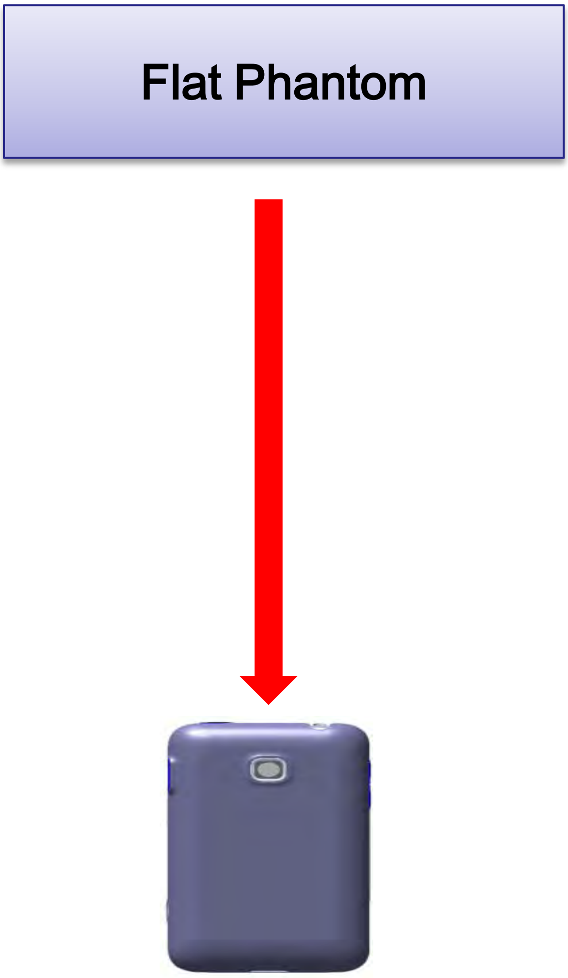
Case4) Proximity sensor status table when DUT is moving away the phantom
- top edge

Distance to the DUT	Capacitive Sensor Status	Max Power(LTE) (dBm)		Max Power (WCDMA) (dBm)		Max Power (GSM) (dBm)	
(mm)	back surface	B4	B7	B2	B5	GSM 850	GSM 1900
0	ON	10.9	10.9	11.7	18.2	25.7	21.7
3	ON	10.9	10.9	11.7	18.2	25.7	21.7
6	ON	10.9	10.9	11.7	18.2	25.7	21.7
7	ON	10.9	10.9	11.7	18.2	25.7	21.7
8	ON	10.9	10.9	11.7	18.2	25.7	21.7
9	ON	10.9	10.9	11.7	18.2	25.7	21.7
10	ON	10.9	10.9	11.7	18.2	25.7	21.7
11	ON	10.9	10.9	11.7	18.2	25.7	21.7
12	ON	10.9	10.9	11.7	18.2	25.7	21.7
13	ON	10.9	10.9	11.7	18.2	25.7	21.7
14	OFF	23.7	23.7	23.2	24.7	33.2	30.7
15	OFF	23.7	23.7	23.2	24.7	33.2	30.7
16	OFF	23.7	23.7	23.2	24.7	33.2	30.7
17	OFF	23.7	23.7	23.2	24.7	33.2	30.7
18	OFF	23.7	23.7	23.2	24.7	33.2	30.7
21	OFF	23.7	23.7	23.2	24.7	33.2	30.7
24	OFF	23.7	23.7	23.2	24.7	33.2	30.7
27	OFF	23.7	23.7	23.2	24.7	33.2	30.7
30	OFF	23.7	23.7	23.2	24.7	33.2	30.7



<test set up drawing>

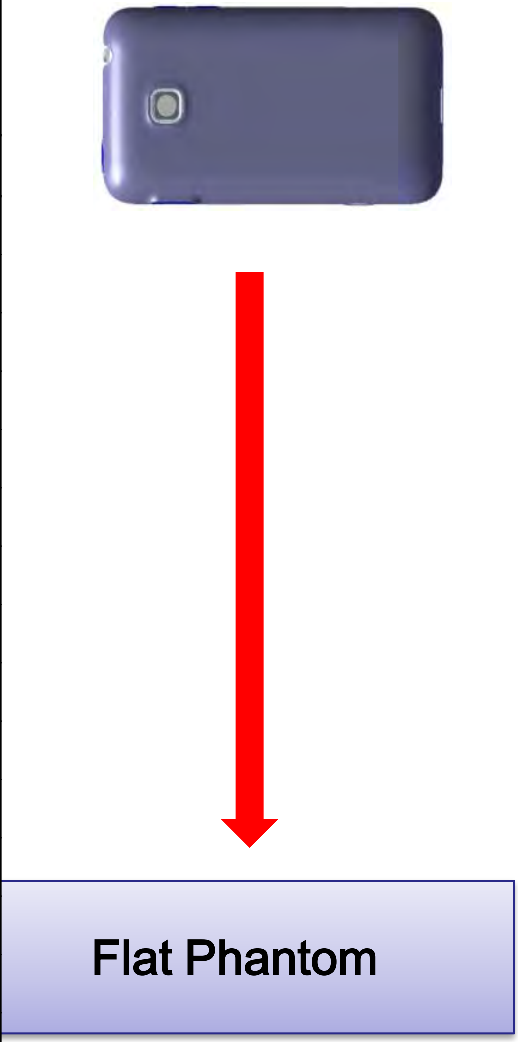
The distance at which the Cap sensor triggers is same for all LTE test frequencies.

We determined that the SAR measurement distance for top edge is 12mm.
: 13mm - 1mm = 12mm

Case5) Proximity sensor status table when DUT is moving towards the phantom

- Right edge

Distance to the DUT	Capacitive Sensor Status	Max Power(LTE) (dBm)		Max Power (WCDMA) (dBm)		Max Power (GSM) (dBm)	
(mm)	back surface	B4	B7	B2	B5	GSM 850	GSM 1900
33	OFF	23.7	23.7	23.2	24.7	33.2	30.7
30	OFF	23.7	23.7	23.2	24.7	33.2	30.7
27	OFF	23.7	23.7	23.2	24.7	33.2	30.7
24	OFF	23.7	23.7	23.2	24.7	33.2	30.7
21	OFF	23.7	23.7	23.2	24.7	33.2	30.7
18	OFF	23.7	23.7	23.2	24.7	33.2	30.7
17	OFF	23.7	23.7	23.2	24.7	33.2	30.7
16	OFF	23.7	23.7	23.2	24.7	33.2	30.7
14	OFF	23.7	23.7	23.2	24.7	33.2	30.7
11	OFF	23.7	23.7	23.2	24.7	33.2	30.7
10	OFF	23.7	23.7	23.2	24.7	33.2	30.7
9	OFF	23.7	23.7	23.2	24.7	33.2	30.7
8	OFF	23.7	23.7	23.2	24.7	33.2	30.7
7	OFF	23.7	23.7	23.2	24.7	33.2	30.7
6	ON	10.9	10.9	11.7	18.2	25.7	21.7
5	ON	10.9	10.9	11.7	18.2	25.7	21.7
4	ON	10.9	10.9	11.7	18.2	25.7	21.7
2	ON	10.9	10.9	11.7	18.2	25.7	21.7
0	ON	10.9	10.9	11.7	18.2	25.7	21.7



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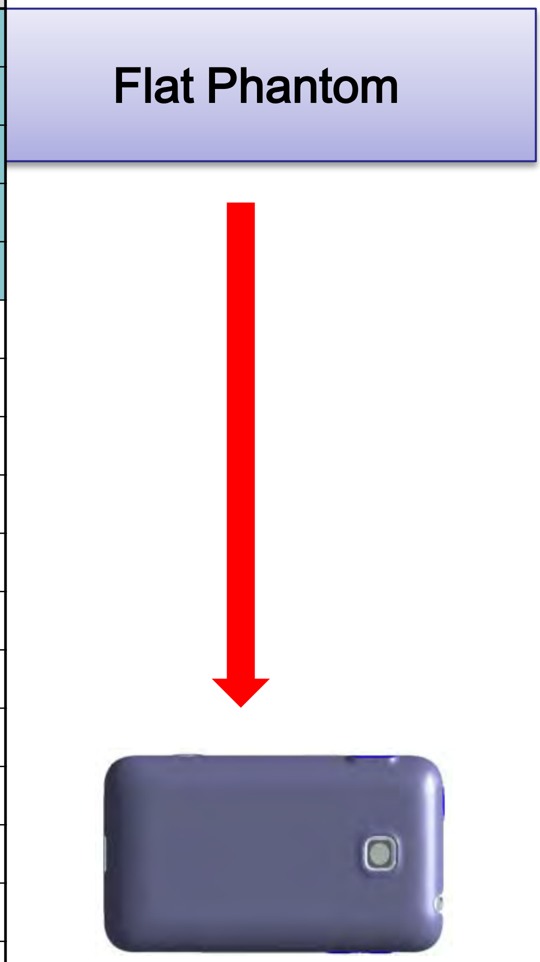
Case6) Proximity sensor status table when DUT is moving away the phantom

- Right edge

Distance to the DUT	Capacitive Sensor Status	Max Power(LTE) (dBm)		Max Power (WCDMA) (dBm)		Max Power (GSM) (dBm)	
(mm)	back surface	B4	B7	B2	B5	GSM 850	GSM 1900
0	ON	10.9	10.9	11.7	18.2	25.7	21.7
2	ON	10.9	10.9	11.7	18.2	25.7	21.7
4	ON	10.9	10.9	11.7	18.2	25.7	21.7
5	ON	10.9	10.9	11.7	18.2	25.7	21.7
6	ON	10.9	10.9	11.7	18.2	25.7	21.7
7	OFF	23.7	23.7	23.2	24.7	33.2	30.7
8	OFF	23.7	23.7	23.2	24.7	33.2	30.7
9	OFF	23.7	23.7	23.2	24.7	33.2	30.7
10	OFF	23.7	23.7	23.2	24.7	33.2	30.7
11	OFF	23.7	23.7	23.2	24.7	33.2	30.7
13	OFF	23.7	23.7	23.2	24.7	33.2	30.7
15	OFF	23.7	23.7	23.2	24.7	33.2	30.7
16	OFF	23.7	23.7	23.2	24.7	33.2	30.7
17	OFF	23.7	23.7	23.2	24.7	33.2	30.7
18	OFF	23.7	23.7	23.2	24.7	33.2	30.7
21	OFF	23.7	23.7	23.2	24.7	33.2	30.7
24	OFF	23.7	23.7	23.2	24.7	33.2	30.7
27	OFF	23.7	23.7	23.2	24.7	33.2	30.7
30	OFF	23.7	23.7	23.2	24.7	33.2	30.7



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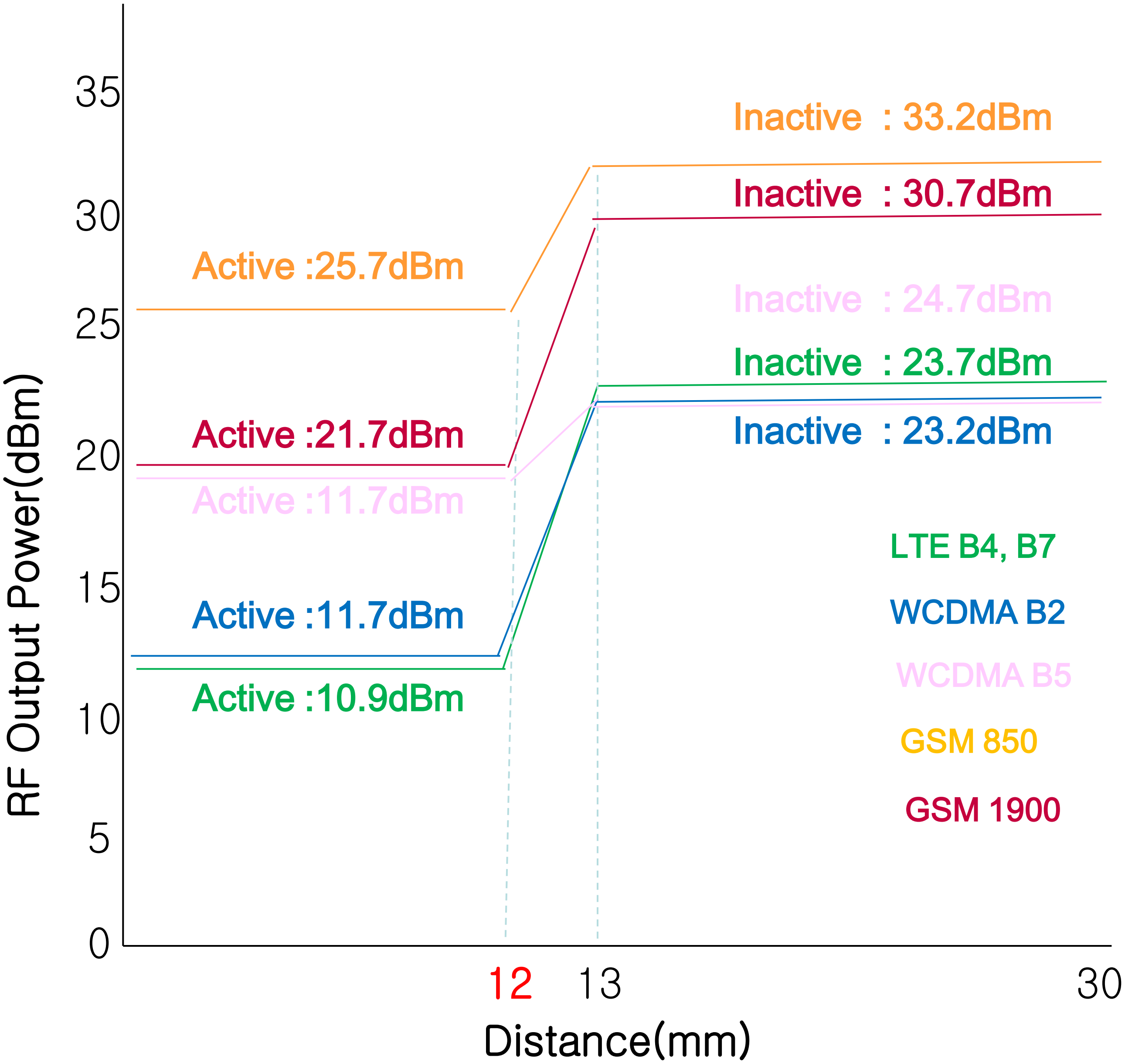
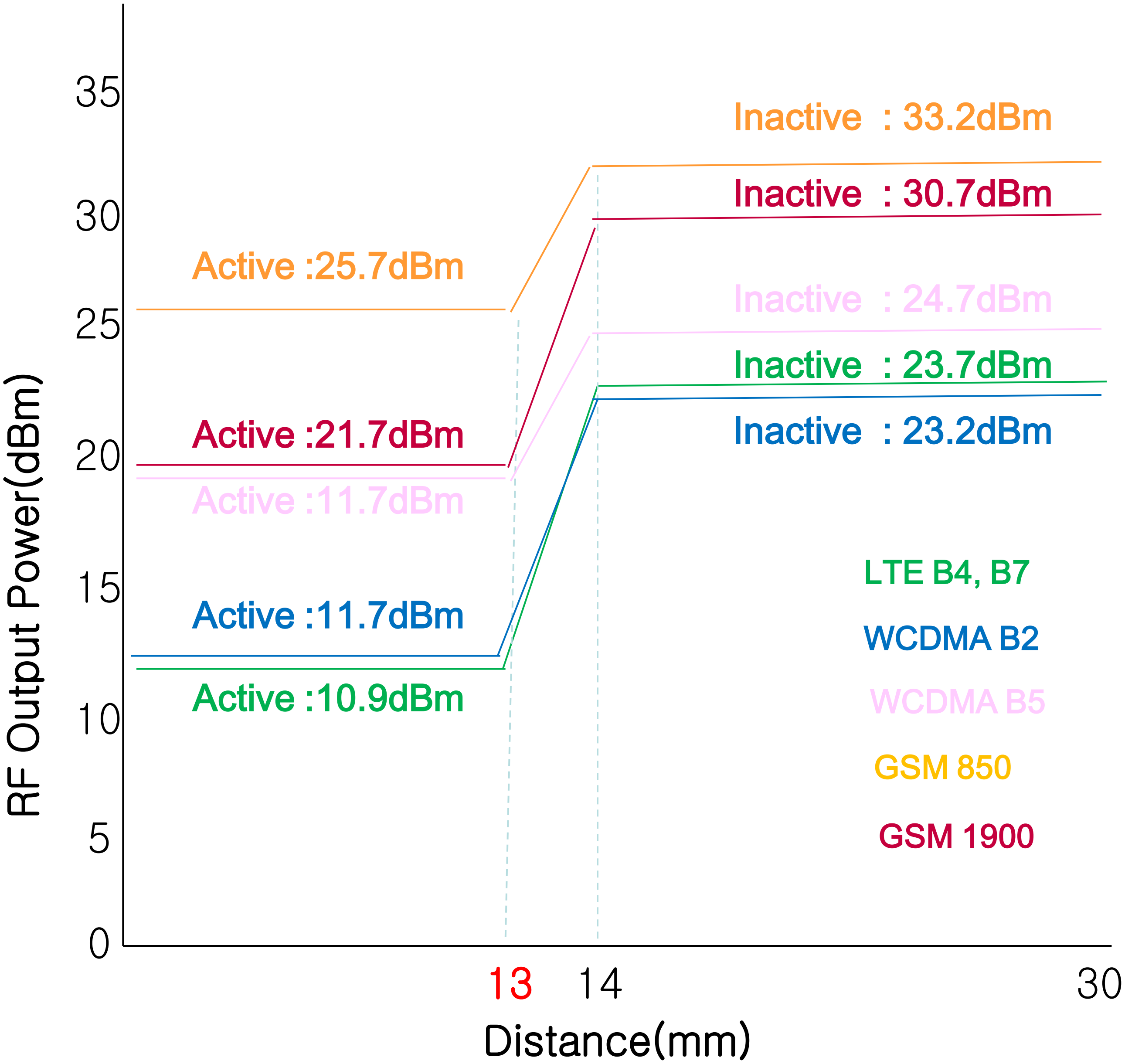
The distance at which the Cap sensor triggers is same for all LTE test frequencies.

We determined that the SAR measurement distance for top edge is 5mm.
: 6mm - 1mm = 5mm

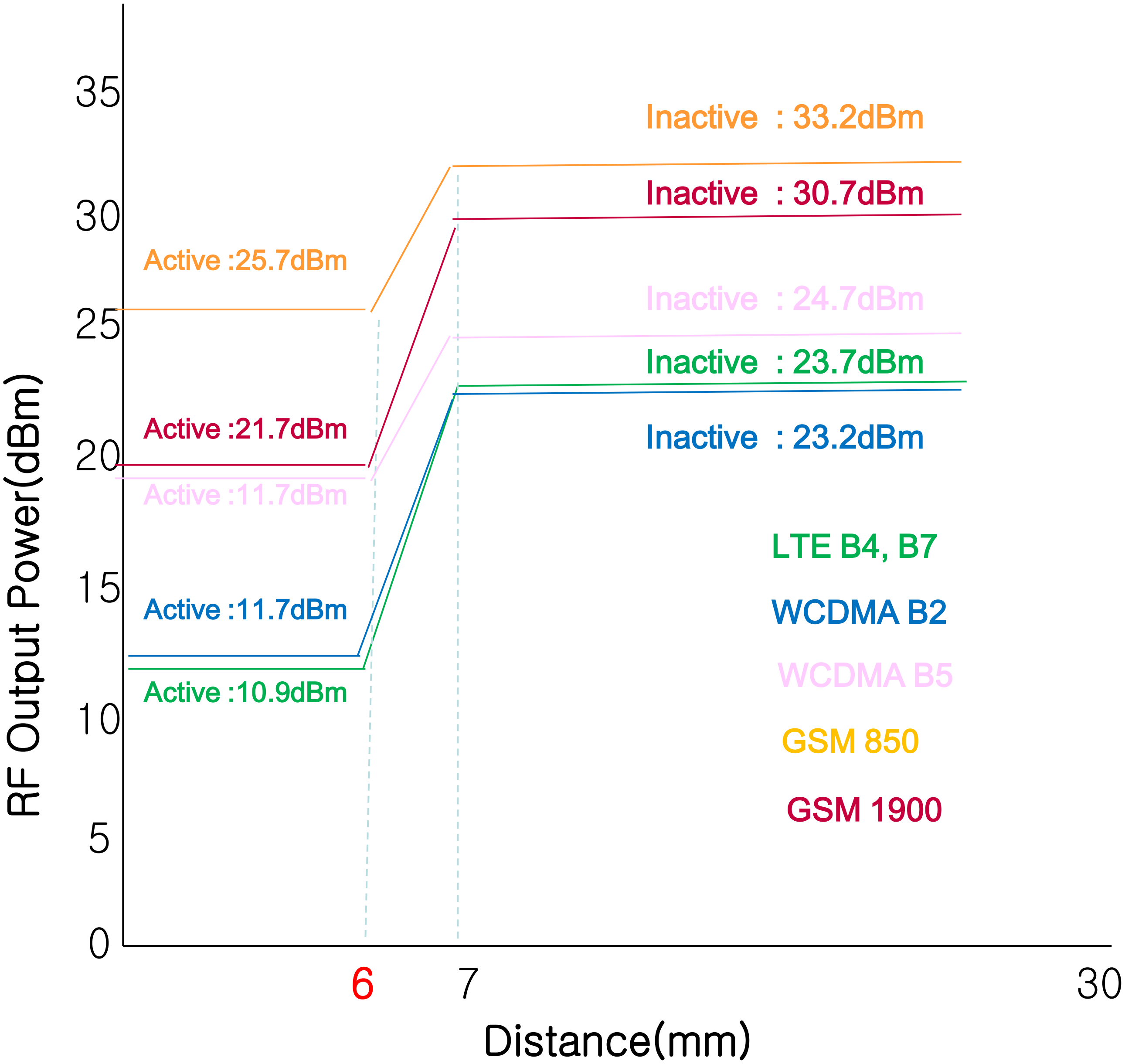
Distance from Back surface of DUT(mm)



Distance from Top-Edge surface of DUT(mm)



Distance from Right-Edge surface of DUT(mm)



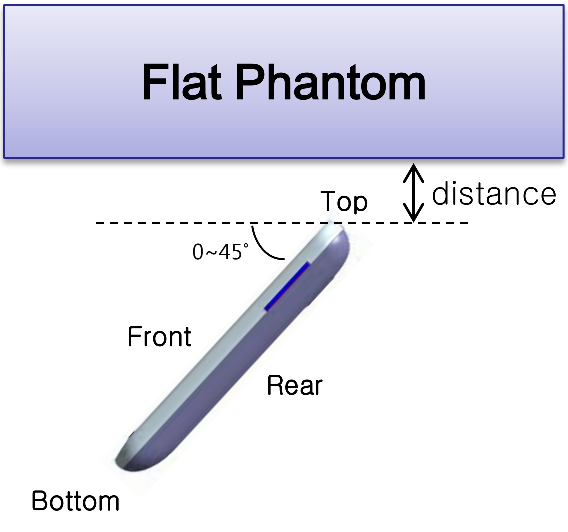
This procedures is not required because antenna and sensor are collocated and the peak SAR location is overlapping with the sensor.
- KDB616217 D04 6.3.

As per the 616217 D04 SAR for laptop and tablets v01, section 6.2, following procedure is used to determine the tilt angle influences to proximity sensor triggering distances.
The result of performing 616217 D04 6.4. 1) ~ 3) is tabulated below.
We tried 2 times using LTE B4,7/WCDMA B2,5/GSM 850,1900 tissue, and found sensor triggering is not changed with different tissue.
And we confirmed this sensor design does not allow for additional variations of triggering distance tolerance.

The degrees at which the Cap sensor triggers is same for all LTE test frequencies.

Case) Proximity sensor status table when DUT is tilt 0 ~ +-45˚ Top edge.

Distance / degrees to the DUT		Max Power(LTE) (dBm)		Max Power (WCDMA) (dBm)		Max Power (GSM) (dBm)	
(mm)	(degrees)	B4	B7	B2	B5	850	1900
13	0	10.9	10.9	11.7	18.2	25.7	21.7
13	5	10.9	10.9	11.7	18.2	25.7	21.7
13	10	10.9	10.9	11.7	18.2	25.7	21.7
13	15	10.9	10.9	11.7	18.2	25.7	21.7
13	20	10.9	10.9	11.7	18.2	25.7	21.7
13	25	10.9	10.9	11.7	18.2	25.7	21.7
13	30	10.9	10.9	11.7	18.2	25.7	21.7
13	35	10.9	10.9	11.7	18.2	25.7	21.7
13	40	10.9	10.9	11.7	18.2	25.7	21.7
13	45	10.9	10.9	11.7	18.2	25.7	21.7



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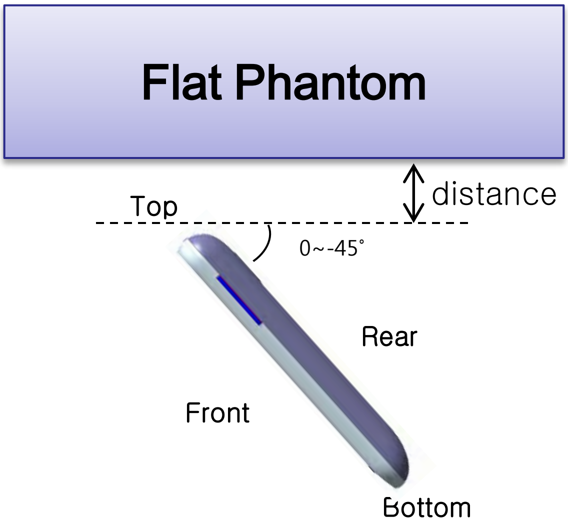
Distance / degrees to the DUT		Max Power(LTE) (dBm)		Max Power (WCDMA) (dBm)		Max Power (GSM) (dBm)	
(mm)	(degrees)	B4	B7	B2	B5	850	1900
13	0	10.9	10.9	11.7	18.2	25.7	21.7
13	-5	10.9	10.9	11.7	18.2	25.7	21.7
13	-10	10.9	10.9	11.7	18.2	25.7	21.7
13	-15	10.9	10.9	11.7	18.2	25.7	21.7
13	-20	10.9	10.9	11.7	18.2	25.7	21.7
13	-25	10.9	10.9	11.7	18.2	25.7	21.7
13	-30	10.9	10.9	11.7	18.2	25.7	21.7
13	-35	10.9	10.9	11.7	18.2	25.7	21.7
13	-40	10.9	10.9	11.7	18.2	25.7	21.7
13	-45	10.9	10.9	11.7	18.2	25.7	21.7



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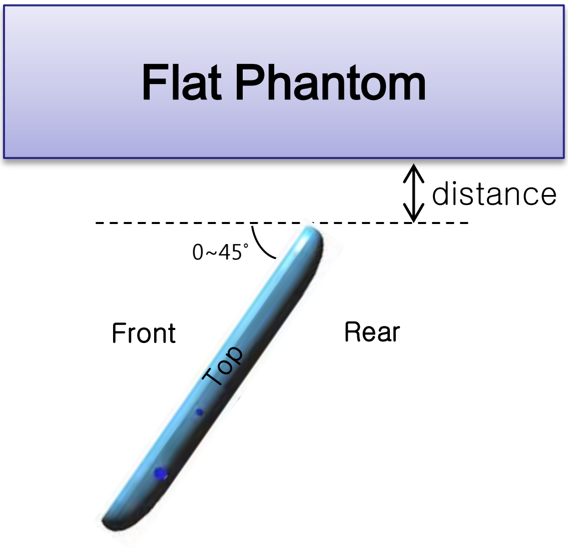
SAR evaluation for this Tilt position is not needed , because we measured Top-EDGE SAR testing with 12 mm.

As per the 616217 D04 SAR for laptop and tablets v01, section 6.2, following procedure is used to determine the tilt angle influences to proximity sensor triggering distances.
The result of performing 616217 D04 6.4. 1) ~ 3) is tabulated below.
We tried 2 times LTE B4,7/WCDMA B2,5/GSM 850,1900 tissue, and found sensor triggering is not changed with different tissue.
And we confirmed this sensor design does not allow for additional variations of triggering distance tolerance.

The degrees at which the Cap sensor triggers is same for all LTE test frequencies.

Case) Proximity sensor status table when DUT is tilt 0 ~ +-45˚ Right edge.

Distance / degrees to the DUT		Max Power(LTE) (dBm)		Max Power (WCDMA) (dBm)		Max Power (GSM) (dBm)	
(mm)	(degrees)	B4	B7	B2	B5	850	1900
6	0	10.9	10.9	11.7	18.2	25.7	21.7
6	5	10.9	10.9	11.7	18.2	25.7	21.7
6	10	10.9	10.9	11.7	18.2	25.7	21.7
6	15	10.9	10.9	11.7	18.2	25.7	21.7
6	20	10.9	10.9	11.7	18.2	25.7	21.7
6	25	10.9	10.9	11.7	18.2	25.7	21.7
6	30	10.9	10.9	11.7	18.2	25.7	21.7
6	35	10.9	10.9	11.7	18.2	25.7	21.7
6	40	10.9	10.9	11.7	18.2	25.7	21.7
6	45	10.9	10.9	11.7	18.2	25.7	21.7



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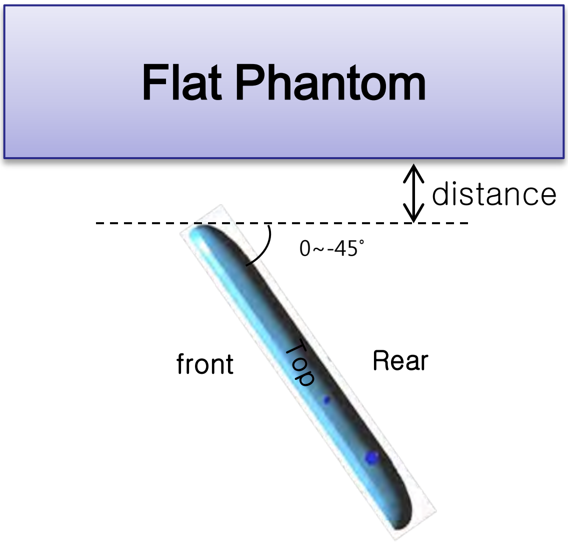
Distance / degrees to the DUT		Max Power(LTE) (dBm)		Max Power (WCDMA) (dBm)		Max Power (GSM) (dBm)	
(mm)	(degrees)	B4	B7	B2	B5	850	1900
6	0	10.9	10.9	11.7	18.2	25.7	21.7
6	-5	10.9	10.9	11.7	18.2	25.7	21.7
6	-10	10.9	10.9	11.7	18.2	25.7	21.7
6	-15	10.9	10.9	11.7	18.2	25.7	21.7
6	-20	10.9	10.9	11.7	18.2	25.7	21.7
6	-25	10.9	10.9	11.7	18.2	25.7	21.7
6	-30	10.9	10.9	11.7	18.2	25.7	21.7
6	-35	10.9	10.9	11.7	18.2	25.7	21.7
6	-40	10.9	10.9	11.7	18.2	25.7	21.7
6	-45	10.9	10.9	11.7	18.2	25.7	21.7



<test set up drawing>

SAR evaluation for this Tilt position is not needed , because we measured RIGHT-EDGE SAR testing with 5 mm.