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SAR EVALUATION REPORT

Applicant Name:
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Yeongtong-gu, Suwon-si
Gyeonggi-do 443-742, Korea

Date of Testing:
06/29/13 - 07/19/13
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1306281112-R1.A3L

FCC ID:	**A3LSMT217S**
APPLICANT:	**SAMSUNG ELECTRONICS, CO. LTD.**

DUT Type:	Portable Tablet
Application Type:	Certification
FCC Rule Part(s):	CFR §2.1093
Model(s):	SM-T217S

Equipment Class	Band & Mode	Tx Frequency	Measured Conducted Power [dBm]	SAR 1 gm Body (W/kg)
PCB	CDMA/EVDO BC10 (§90S)	817.90 - 823.10 MHz	24.96	0.80
PCB	CDMA/EVDO BC0 (§22H)	824.70 - 848.31 MHz	24.90	0.73
PCB	PCS CDMA/EVDO	1851.25 - 1908.75 MHz	24.94	1.06
PCB	LTE Band 25 (PCS)	1851.5 - 1913.5 MHz	23.71	1.01
DTS	2.4 GHz WLAN	2412 - 2462 MHz	14.07	1.06
DTS	Bluetooth LE	2402-2480 MHz	2.97	N/A
DTS	5.8 GHz WLAN	5745 - 5825 MHz	11.68	0.61
NII	5.2 GHz WLAN	5180 - 5240 MHz	11.75	0.21
NII	5.3 GHz WLAN	5260 - 5320 MHz	11.73	0.32
NII	5.5 GHz WLAN	5500 - 5700 MHz	11.77	0.50
DSS	Bluetooth	2402 - 2480 MHz	10.20	0.16
Simultaneous SAR per KDB 690783 D01v01r02:				1.50

Note: Powers in the above table represent output powers for the SAR test configurations and may not represent the highest output powers for all configurations for each mode.

Note: This revised Test Report (S/N: 0Y1306281112-R1.A3L) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in Section 1.7 of this report; for North American frequency bands only.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Test results reported herein relate only to the item(s) tested.

Randy Ortanez
President

ACCREDITED
TESTING LABORATORY
CERTIFICATE #2041.01

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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
CDMA/EVDO BC10 (§90S)	Data	817.90 - 823.10 MHz
CDMA/EVDO BC0 (§22H)	Data	824.70 - 848.31 MHz
PCS CDMA/EVDO	Data	1851.25 - 1908.75 MHz
LTE Band 25 (PCS)	Data	1851.5 - 1913.5 MHz
2.4 GHz WLAN	Data	2412 - 2462 MHz
Bluetooth LE	Data	2402-2480 MHz
5.8 GHz WLAN	Data	5745 - 5825 MHz
5.2 GHz WLAN	Data	5180 - 5240 MHz
5.3 GHz WLAN	Data	5260 - 5320 MHz
5.5 GHz WLAN	Data	5500 - 5700 MHz
Bluetooth	Data	2402 - 2480 MHz

1.2 Power Reduction for SAR

This device uses a proximity sensor for SAR compliance. The capacitive grip sensor is activated when used in close proximity to the user's body. There are no body worn accessories for this device.

Since the device is a full tablet size, the Body SAR was evaluated per FCC KDB Publication 616217 D04v01 for full sized tablets.

1.3 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v05.

Power backoff – capacitive sensor activated:

Mode / Band	Proximity Sensor State		Modulated Average (dBm)
CDMA/EVDO BC10 (§90S)	Active	Maximum	**18.5**
		Nominal	**18.0**
CDMA/EVDO BC0 (§22H)	Active	Maximum	**18.5**
		Nominal	**18.0**
PCS CDMA/EVDO BC1	Active	Maximum	**14.5**
		Nominal	**14.0**

Mode / Band	Proximity Sensor State		Modulated Average (dBm)
LTE Band 25 (PCS)	Active	Maximum	**13.5**
		Nominal	**13.0**

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Maximum power – capacitive sensor inactive for body SAR testing configurations:

Mode / Band	Proximity Sensor State		Modulated Average (dBm)
CDMA/EVDO BC10 (§90S)	Inactive	Maximum	**25.0**
		Nominal	**24.5**
CDMA/EVDO BC0 (§22H)	Inactive	Maximum	**25.0**
		Nominal	**24.5**
PCS CDMA/EVDO BC1	Inactive	Maximum	**25.0**
		Nominal	**24.5**

Mode / Band	Proximity Sensor State		Modulated Average (dBm)
LTE Band 25 (PCS)	Inactive	Maximum	**24.0**
		Nominal	**23.5**

Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	**14.5**
	Nominal	**14.0**
IEEE 802.11g (2.4 GHz)	Maximum	**12.0**
	Nominal	**11.5**
IEEE 802.11n (2.4 GHz)	Maximum	**10.0**
	Nominal	**9.5**
IEEE 802.11a (5 GHz)	Maximum	**12.0**
	Nominal	**11.5**
IEEE 802.11n (5 GHz) 20 MHz BW	Maximum	**12.0**
	Nominal	**11.5**
IEEE 802.11n (5 GHz) 40 MHz BW	Maximum	**10.0**
	Nominal	**9.5**
Bluetooth	Maximum	**10.5**
	Nominal	**10.0**
Bluetooth LE	Maximum	**3.0**
	Nominal	**2.5**

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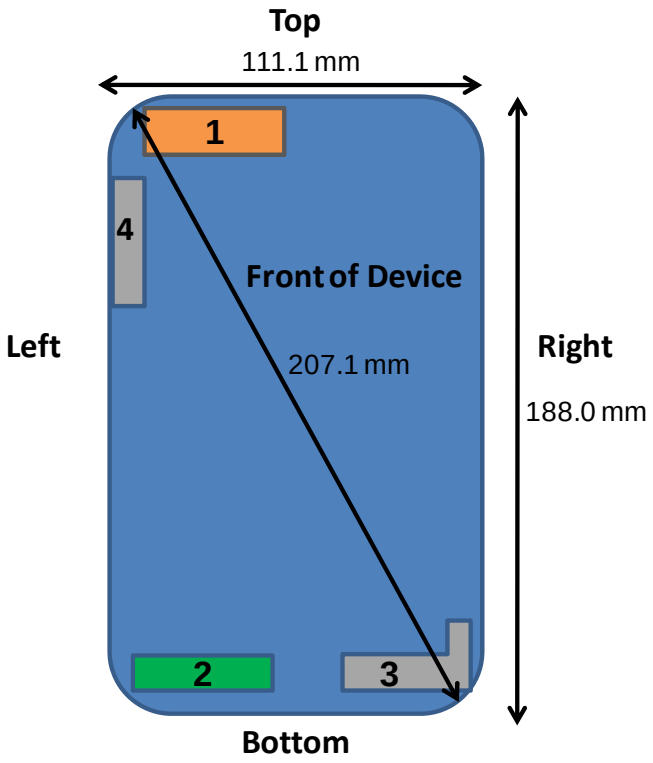
1.4 DUT Antenna Locations



1. Main Antenna (Tx/Rx)
- CDMA BC0/BC10/BC1
- LTE Band 25

2. BT/WIFI Antenna (Tx/Rx)
-2.4 GHz BT/WIFI
-5 GHz WIFI

3. Sub Antenna (Rx only)
- CDMA BC0/BC10/BC1
- LTE Band 25

4. GPS Antenna (Rx only)

Note: Exact antenna dimensions and separation distances are shown in the Technical Descriptions in the FCC Filing.

Figure 1-1
DUT Antenna Locations

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1.5 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D05v01, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the DUT are shown in Figure 1-2 and are color-coded to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.

Figure 1-2
Simultaneous Transmission Paths

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v05 3) procedures.

Table 1-1
Simultaneous Transmission Scenarios

No.	Capable Transmit Configurations	Body	Note
		FCC KDB 616217	
1	CDMA/EVDO BC0/10/1 Data + WIFI 2.4 GHz	Yes	2G/3G Hotspot or WIFI Direct
2	LTE B25 Data + WIFI 2.4 GHz	Yes	4G Hotspot or WIFI Direct
3	CDMA/EVDO BC0/10/1 Data + WIFI 5.8 GHz	Yes	2G/3G Hotspot (5.8 GHz) or WIFI Direct
4	LTE B25 Data + WIFI 5.8 GHz	Yes	4G Hotspot (5.8 GHz) or WIFI Direct
5	CDMA/EVDO BC0/10/1 Data + Bluetooth 2.4 GHz	Yes	
6	LTE B25 Data + Bluetooth 2.4 GHz	Yes	
7	CDMA/EVDO BC0/10/1 Data + WIFI 5.2, 5.3, 5.5~5.6 GHz	N/A	Blocked by Chipset F/W
8	LTE B25 + WIFI 5.2, 5.3, 5.5~5.6 GHz	N/A	Blocked by Chipset F/W

Notes:
1.CDMA/LTE use one modem and transciever IC.The signals can not be transmitted simultaneously.
2.This model cannot act as a master device in 5GHz WiFi, so this model is not capable of 5GHz WiFi hotspot except Ch. 149~165 with 5.8 GHz. This cannot be changed by any S/W modification by any party after it is manufactured.

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1.6 SAR Test Exclusions Applied

(A) WIFI/BT

Per FCC KDB 447498 D01v05, the SAR exclusion threshold for distances <50mm is defined by the following equation:

$$\frac{Max\ Power\ of\ Channel\ (mW)}{Test\ Separation\ Dist\ (mm)} * \sqrt{Frequency(GHz)} \leq 3.0$$

Based on the maximum conducted power of Bluetooth LE (rounded to the nearest mW) and the antenna to user separation distance, Bluetooth SAR was not required; [(2/5)* √2.440] = 0.6< 3.0. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.

This device supports 20 MHz and 40 MHz Bandwidths for IEEE 802.11n for 5 GHz WIFI only. IEEE 802.11n was not evaluated for SAR since the average output power of 20 MHz and 40 MHz bandwidths was not more than 0.25 dB higher than the average output power of IEEE 802.11a.

(B) Licensed Transmitter(s)

LTE SAR for the higher modulations and lower bandwidths were not tested since the maximum average output power of all required channels and configurations was not more than 0.5 dB higher than the highest bandwidth; and the reported LTE SAR for the highest bandwidth was less than 1.45 W/kg for all configurations according to FCC KDB 941225 D05v02.

1.7 Guidance Applied

- FCC KDB Publication 941225 D01-D06 (2G/3G/4G)
- FCC KDB Publication 248227 D01v01r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v05 (General SAR Guidance)
- FCC KDB Publication 865664 D01-D02 (SAR Measurements up to 6 GHz)
- FCC KDB Publication 616217 D04v01 (Tablet SAR Consideration)

1.8 Device Serial Numbers

Several samples were used with identical hardware to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.

	Body Maximum Power Serial Number	Body Reduced Power Serial Number
CDMA/EVDO BC10 (§90S)	037-1	037-2
CDMA/EVDO BC0 (§22H)	037-1	037-2
PCS CDMA/EVDO	037-3	037-4
LTE Band 25 (PCS)	037-5	037-6
2.4 GHz WLAN	276-1	-
5 GHz WLAN	276-1	-
Bluetooth	276-1	-

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2 LTE INFORMATION

LTE Information			
FCC ID	**A3LSMT217S**		
Form Factor	Portable Tablet		
Frequency Range of each LTE transmission band	LTE Band 25 (PCS) (1851.5 - 1913.5 MHz)		
Channel Bandwidths	LTE Band 25 (PCS): 3 MHz, 5 MHz, 10 MHz		
Channel Numbers and Frequencies (MHz)	Low	Mid	High
LTE Band 25 (PCS): 3 MHz	1851.5 (26055)	1882.5 (26365)	1913.5 (26675)
LTE Band 25 (PCS): 5 MHz	1852.5 (26065)	1882.5 (26365)	1912.5 (26665)
LTE Band 25 (PCS): 10 MHz	1855 (26090)	1882.5 (26365)	1910 (26640)
UE Category	3		
Modulations Supported in UL	QPSK, 16QAM		
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	See Sections 7.4 and 8.2		
A-MPR (Additional MPR) disabled for SAR Testing?	YES		

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3 INTRODUCTION

The FCC and Industry Canada have adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 and Health Canada Safety Code 6 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. [1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [24]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

3.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 3-1).

Equation 3-1
SAR Mathematical Equation

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

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

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

σ = conductivity of the tissue-simulating material (S/m)
ρ = mass density of the tissue-simulating material (kg/m^3)
E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

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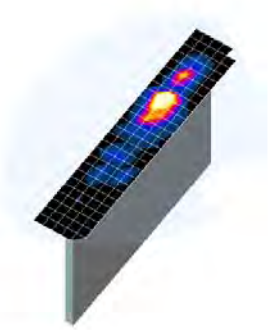
4 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

The evaluation was performed using the following procedure:



1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01 (See Table 4-1).

Figure 4-1
Sample SAR Area Scan

2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.

3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01 (See Table 4-1). On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):

   a. The data was extrapolated to the surface of the outer-shell of the phantom. The combined distance extrapolated was the combined distance from the center of the dipoles 2.7mm away from the tip of the probe housing plus the 1.2 mm distance between the surface and the lowest measuring point. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).

   b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.

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

4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

Table 4-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01

Frequency	Maximum Area Scan Resolution (mm) (Δx_{area}, Δy_{area})	Maximum Zoom Scan Resolution (mm) (Δx_{zoom}, Δy_{zoom})	Maximum Zoom Scan Spatial Resolution (mm)			Minimum Zoom Scan Volume (mm) (x,y,z)
			Uniform Grid	Graded Grid		
			$\Delta z_{zoom}(n)$	$\Delta z_{zoom}(1)$*	$\Delta z_{zoom}(n>1)$*	
≤ 2 GHz	≤ 15	≤ 8	≤ 5	≤ 4	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≤ 4	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≤ 3	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≤ 2.5	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 25
5-6 GHz	≤ 10	≤ 4	≤ 2	≤ 2	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 22

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5 RF EXPOSURE LIMITS

5.1 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.

5.2 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. This 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.

Table 5-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
Peak Spatial Average SAR Head	1.6	8.0
Whole Body SAR	0.08	0.4
Peak Spatial Average SAR Hands, Feet, Ankle, Wrists, etc.	4.0	20

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

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6 SAR TESTING PROCEDURES

6.1 SAR Testing for Tablet per KDB Publication 616217 D04v01

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 D01v05 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.

6.2 Additional Test Positions due to Proximity Sensor Considerations

This device uses a proximity sensor to reduce data powers in tablet-device use conditions.

While the device is touching the user on the antenna, the proximity sensor activates and thus reduces the maximum output power allowed. However, when the device is moved beyond the sensor triggering distance, the sensor de-activates and thus maximum output power is no longer limited. Therefore, an additional exposure condition is needed in the vicinity of the triggering distance to ensure SAR is compliant when the device is allowed to operate at a non-reduced output power level.

FCC KDB 616217 D04 Section 6 was used as a guideline for selecting SAR test distances for this device at these additional exposure conditions. Since the capacitive proximity sensor activation distance for the back side and top edge of the device is 16 mm, a conservative distance of 15 mm was tested for SAR on the back side and top edge at maximum power. Sensor triggering distance summary data is included in Appendix G.

The sensor is designed to support sufficient detection range and sensitivity to cover regions of the sensors in all applicable directions since the sensor entirely covers the antenna.

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7 FCC MEASUREMENT PROCEDURES

Power measurements were performed using a base station simulator under digital average power.

7.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v05, When SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* SAR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r02.

7.2 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01 "SAR Measurement Procedures for 3G Devices" v02, October 2007.

The device was placed into a simulated call using a base station simulator in a RF shielded chamber. Establishing connections in this manner ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. Devices under test were evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device was tested throughout the SAR test at maximum output power, the SAR measurement system measures a "point SAR" at an arbitrary reference point at the start and end of the 1 gram SAR evaluation, to assess for any power drifts during the evaluation. If the power drift deviated by more than 5%, the SAR test and drift measurements were repeated.

7.3 SAR Measurement Conditions for CDMA2000

The following procedures were performed according to FCC KDB Publication 941225 D01 "SAR Measurement Procedures for 3G Devices" v02, October 2007.

7.3.1 Output Power Verification

See 3GPP2 C.S0011/TIA-98-E as recommended by "SAR Measurement Procedures for 3G Devices" v02, October 2007. Maximum output power is verified on the High, Middle and Low channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E. SO55 tests were measured with power control bits in the "All Up" condition.

1. If the mobile station (MS) supports Reverse TCH RC 1 and Forward TCH RC 1, set up a call using Fundamental Channel Test Mode 1 (RC=1/1) with 9600 bps data rate only.
2. Under RC1, C.S0011 Table 4.4.5.2-1, Table 7-1 parameters were applied.
3. If the MS supports the RC 3 Reverse FCH, RC3 Reverse SCH_0 and demodulation of RC 3,4, or 5, set up a call using Supplemental Channel Test Mode 3 (RC 3/3) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
4. Under RC3, C.S0011 Table 4.4.5.2-2, Table 7-2 was applied.

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Table 7-1
Parameters for Max. Power for RC1

Parameter	Units	Value
I_{or}	dBm/1.23 MHz	-104
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

Table 7-2
Parameters for Max. Power for RC3

Parameter	Units	Value
I_{or}	dBm/1.23 MHz	-86
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

5. FCHs were configured at full rate for maximum SAR with "All Up" power control bits.

7.3.2 Body SAR Measurements for EVDO Data Devices

Body SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0 per KDB Publication 941225 D01 procedures for "1x Ev-Do data Devices". SAR for Subtype 2 Physical layer configurations is not required for Rev. A when the maximum average output of each RF channels is less than that measured in Subtype 0/1 Physical layer configurations. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for the RF channels in Rev. 0. The AT is tested with a Reverse Data Channel rate of 153.6 kbps in Subtype 0/1 Physical Layer configurations; and a Reverse Data Channel payload size of 4096 bits and Termination Target of 16 slots in Subtype 2 Physical Layer configurations.

SAR is not required for 1x RTT for Ev-Do devices that also support 1x RTT voice and/or data operations, when the maximum average output of each channel is less than 1/4 dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0.

7.4 SAR Measurement Conditions for LTE

LTE modes were tested according to FCC KDB 941225 D05v02 publication. Please see notes after the tabulated SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 was used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing.

7.4.1 Spectrum Plots for RB Configurations

A properly configured base station simulator was used for SAR tests and power measurements. Therefore, spectrum plots for RB configurations were not required to be included in this report.

7.4.2 MPR

MPR is implemented by the manufacturer for this device operating a maximum power with capacitive sensor inactive. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.

7.4.3 A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

7.4.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r01:

a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth

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i. The required channel and offset combination with the highest maximum output power is required for SAR.
ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.

b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to ½ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is <1.45 W/kg.

7.5 SAR Testing with 802.11 Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g/n transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227 D01v01r02 for more details.

7.5.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

7.5.2 Frequency Channel Configurations [27]

For 2.4 GHz, the highest average RF output power channel between the low, mid and high channel at the lowest data rate was selected for SAR evaluation in 802.11b mode. 802.11g/n modes and higher data rates for 802.11b were additionally evaluated for SAR if the output power of the respective mode was 0.25 dB or higher than the powers of the SAR configurations tested in the 802.11b mode.

For 5 GHz, the highest average RF output power channel across the default test channels at the lowest data rate was selected for SAR evaluation in 802.11a. When the adjacent channels are higher in power then the default channels, these “required channels” were considered instead of the default channels for SAR testing. 802.11n modes and higher data rates for 802.11a/n were evaluated only if the respective mode was 0.25 dB or higher than the 802.11a mode.

If the maximum extrapolated peak SAR of the zoom scan for the highest output channel was less than 1.6 W/kg and if the 1g averaged SAR was less than 0.8 W/kg, SAR testing was not required for the other test channels in the band.

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8 RF CONDUCTED POWERS

8.1 CDMA Conducted Powers

Table 8.1
Maximum CDMA Average RF Conducted Powers
Representing Capacitive Sensor Inactive

				Data			
Band	Channel	Rule Part	Frequency	TDSO SO32 [dBm]	TDSO SO32 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. A [dBm]
	F-RC		MHz	FCH+SCH	FCH	(RTAP)	(RETAP)
Cellular	564	90S	820.1	24.89	25.00	24.96	24.87
Cellular	1013	22H	824.7	24.84	24.87	24.83	24.80
	384	22H	836.52	24.84	24.97	24.90	24.73
	777	22H	848.31	24.75	24.78	24.92	24.88
PCS	25	24E	1851.25	24.81	24.90	24.98	24.90
	600	24E	1880	24.87	25.00	24.94	24.84
	1175	24E	1908.75	24.79	24.93	24.76	24.70

Table 8.2
Reduced CDMA Average RF Conducted Powers
Representing Capacitive Sensor Active

				Data			
Band	Channel	Rule Part	Frequency	TDSO SO32 [dBm]	TDSO SO32 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. A [dBm]
	F-RC		MHz	FCH+SCH	FCH	(RTAP)	(RETAP)
Cellular	564	90S	820.1	18.36	18.37	18.19	18.13
Cellular	1013	22H	824.7	18.40	18.48	18.49	18.36
	384	22H	836.52	18.30	18.40	18.43	18.35
	777	22H	848.31	18.31	18.33	18.17	18.14
PCS	25	24E	1851.25	13.96	14.00	13.93	13.82
	600	24E	1880	14.09	14.12	13.99	13.86
	1175	24E	1908.75	14.21	14.25	14.09	13.98

Note:

1. For FCC Rule Part 90S, Per FCC KDB Publication 447498 D01v05 4.1.6, only one channel is required since the device operates within the transmission range of 817.90 – 823.10 MHz
2. Per KDB Publication 941225 D01v02, Body SAR was measured using Subtype 0/1 Physical Layer configurations for Rev. 0. Since the average output power of Subtype 2 for Rev. A is less than the Rev. 0 power levels, Rev. A SAR is not required. SAR is not required for 1x RTT since the maximum average output of each channel is less than 1⁄4 dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0

Figure 8-1
Power Measurement Setup

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8.2 LTE Conducted Powers

8.2.1 LTE Band 25 (PCS)

Table 8-3
Maximum LTE Band 25 (PCS) Conducted Powers - 10 MHz Bandwidth
Representing Capacitive Sensor Inactive

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1855	26090	10	QPSK	1	0	23.58	0	0
	1855	26090	10	QPSK	1	25	23.69	0	0
	1855	26090	10	QPSK	1	49	**23.71**	0	0
	1855	26090	10	QPSK	25	0	22.72	1	0-1
	1855	26090	10	QPSK	25	12	**22.82**	1	0-1
	1855	26090	10	QPSK	25	25	22.73	1	0-1
	1855	26090	10	QPSK	50	0	22.75	1	0-1
	1855	26090	10	16QAM	1	0	22.63	1	0-1
	1855	26090	10	16QAM	1	25	22.71	1	0-1
	1855	26090	10	16QAM	1	49	22.72	1	0-1
	1855	26090	10	16QAM	25	0	21.75	2	0-2
	1855	26090	10	16QAM	25	12	21.86	2	0-2
	1855	26090	10	16QAM	25	25	21.82	2	0-2
	1855	26090	10	16QAM	50	0	21.83	2	0-2
Mid	1882.5	26365	10	QPSK	1	0	23.62	0	0
	1882.5	26365	10	QPSK	1	25	23.59	0	0
	1882.5	26365	10	QPSK	1	49	23.61	0	0
	1882.5	26365	10	QPSK	25	0	22.78	1	0-1
	1882.5	26365	10	QPSK	25	12	22.66	1	0-1
	1882.5	26365	10	QPSK	25	25	22.70	1	0-1
	1882.5	26365	10	QPSK	50	0	22.63	1	0-1
	1882.5	26365	10	16QAM	1	0	22.63	1	0-1
	1882.5	26365	10	16QAM	1	25	22.59	1	0-1
	1882.5	26365	10	16QAM	1	49	22.61	1	0-1
	1882.5	26365	10	16QAM	25	0	21.81	2	0-2
	1882.5	26365	10	16QAM	25	12	21.80	2	0-2
	1882.5	26365	10	16QAM	25	25	21.81	2	0-2
	1882.5	26365	10	16QAM	50	0	21.72	2	0-2
High	1910	26640	10	QPSK	1	0	23.70	0	0
	1910	26640	10	QPSK	1	25	23.57	0	0
	1910	26640	10	QPSK	1	49	23.45	0	0
	1910	26640	10	QPSK	25	0	22.76	1	0-1
	1910	26640	10	QPSK	25	12	22.70	1	0-1
	1910	26640	10	QPSK	25	25	22.67	1	0-1
	1910	26640	10	QPSK	50	0	22.72	1	0-1
	1910	26640	10	16QAM	1	0	22.68	1	0-1
	1910	26640	10	16QAM	1	25	22.47	1	0-1
	1910	26640	10	16QAM	1	49	22.29	1	0-1
	1910	26640	10	16QAM	25	0	21.81	2	0-2
	1910	26640	10	16QAM	25	12	21.65	2	0-2
	1910	26640	10	16QAM	25	25	21.63	2	0-2
	1910	26640	10	16QAM	50	0	21.69	2	0-2

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Table 8-4
Maximum LTE Band 25 (PCS) Conducted Powers - 5 MHz Bandwidth
Representing Capacitive Sensor Inactive

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1852.5	26065	5	QPSK	1	0	23.62	0	0
	1852.5	26065	5	QPSK	1	12	23.76	0	0
	1852.5	26065	5	QPSK	1	24	23.77	0	0
	1852.5	26065	5	QPSK	12	0	22.77	1	0-1
	1852.5	26065	5	QPSK	12	6	22.87	1	0-1
	1852.5	26065	5	QPSK	12	13	22.87	1	0-1
	1852.5	26065	5	QPSK	25	0	22.64	1	0-1
	1852.5	26065	5	16-QAM	1	0	22.77	1	0-1
	1852.5	26065	5	16-QAM	1	12	22.88	1	0-1
	1852.5	26065	5	16-QAM	1	24	22.85	1	0-1
	1852.5	26065	5	16-QAM	12	0	21.89	2	0-2
	1852.5	26065	5	16-QAM	12	6	22.00	2	0-2
	1852.5	26065	5	16-QAM	12	13	21.96	2	0-2
	1852.5	26065	5	16-QAM	25	0	21.68	2	0-2
Mid	1882.5	26365	5	QPSK	1	0	23.83	0	0
	1882.5	26365	5	QPSK	1	12	23.62	0	0
	1882.5	26365	5	QPSK	1	24	23.73	0	0
	1882.5	26365	5	QPSK	12	0	22.86	1	0-1
	1882.5	26365	5	QPSK	12	6	22.72	1	0-1
	1882.5	26365	5	QPSK	12	13	22.77	1	0-1
	1882.5	26365	5	QPSK	25	0	22.69	1	0-1
	1882.5	26365	5	16-QAM	1	0	22.80	1	0-1
	1882.5	26365	5	16-QAM	1	12	22.73	1	0-1
	1882.5	26365	5	16-QAM	1	24	22.75	1	0-1
	1882.5	26365	5	16-QAM	12	0	21.93	2	0-2
	1882.5	26365	5	16-QAM	12	6	21.87	2	0-2
	1882.5	26365	5	16-QAM	12	13	21.86	2	0-2
	1882.5	26365	5	16-QAM	25	0	21.67	2	0-2
High	1912.5	26665	5	QPSK	1	0	23.84	0	0
	1912.5	26665	5	QPSK	1	12	23.83	0	0
	1912.5	26665	5	QPSK	1	24	23.80	0	0
	1912.5	26665	5	QPSK	12	0	22.77	1	0-1
	1912.5	26665	5	QPSK	12	6	22.74	1	0-1
	1912.5	26665	5	QPSK	12	13	22.75	1	0-1
	1912.5	26665	5	QPSK	25	0	22.70	1	0-1
	1912.5	26665	5	16-QAM	1	0	22.86	1	0-1
	1912.5	26665	5	16-QAM	1	12	22.85	1	0-1
	1912.5	26665	5	16-QAM	1	24	22.80	1	0-1
	1912.5	26665	5	16-QAM	12	0	21.75	2	0-2
	1912.5	26665	5	16-QAM	12	6	21.72	2	0-2
	1912.5	26665	5	16-QAM	12	13	21.81	2	0-2
	1912.5	26665	5	16-QAM	25	0	21.60	2	0-2

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Table 8-5
Maximum LTE Band 25 (PCS) Conducted Powers - 3 MHz Bandwidth
Representing Capacitive Sensor Inactive

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1851.5	26055	3	QPSK	1	0	23.64	0	0
	1851.5	26055	3	QPSK	1	7	23.63	0	0
	1851.5	26055	3	QPSK	1	14	23.76	0	0
	1851.5	26055	3	QPSK	8	0	22.85	1	0-1
	1851.5	26055	3	QPSK	8	4	22.86	1	0-1
	1851.5	26055	3	QPSK	8	7	22.95	1	0-1
	1851.5	26055	3	QPSK	15	0	22.75	1	0-1
	1851.5	26055	3	16-QAM	1	0	22.55	1	0-1
	1851.5	26055	3	16-QAM	1	7	22.48	1	0-1
	1851.5	26055	3	16-QAM	1	14	22.64	1	0-1
	1851.5	26055	3	16-QAM	8	0	21.94	2	0-2
	1851.5	26055	3	16-QAM	8	4	21.94	2	0-2
	1851.5	26055	3	16-QAM	8	7	21.99	2	0-2
	1851.5	26055	3	16-QAM	15	0	21.80	2	0-2
Mid	1882.5	26365	3	QPSK	1	0	23.72	0	0
	1882.5	26365	3	QPSK	1	7	23.75	0	0
	1882.5	26365	3	QPSK	1	14	23.77	0	0
	1882.5	26365	3	QPSK	8	0	22.90	1	0-1
	1882.5	26365	3	QPSK	8	4	22.86	1	0-1
	1882.5	26365	3	QPSK	8	7	22.87	1	0-1
	1882.5	26365	3	QPSK	15	0	22.73	1	0-1
	1882.5	26365	3	16-QAM	1	0	22.64	1	0-1
	1882.5	26365	3	16-QAM	1	7	22.61	1	0-1
	1882.5	26365	3	16-QAM	1	14	22.63	1	0-1
	1882.5	26365	3	16-QAM	8	0	21.72	2	0-2
	1882.5	26365	3	16-QAM	8	4	21.68	2	0-2
	1882.5	26365	3	16-QAM	8	7	21.71	2	0-2
	1882.5	26365	3	16-QAM	15	0	21.84	2	0-2
High	1913.5	26675	3	QPSK	1	0	23.73	0	0
	1913.5	26675	3	QPSK	1	7	23.66	0	0
	1913.5	26675	3	QPSK	1	14	23.60	0	0
	1913.5	26675	3	QPSK	8	0	22.73	1	0-1
	1913.5	26675	3	QPSK	8	4	22.70	1	0-1
	1913.5	26675	3	QPSK	8	7	22.72	1	0-1
	1913.5	26675	3	QPSK	15	0	22.82	1	0-1
	1913.5	26675	3	16-QAM	1	0	22.62	1	0-1
	1913.5	26675	3	16-QAM	1	7	22.55	1	0-1
	1913.5	26675	3	16-QAM	1	14	22.54	1	0-1
	1913.5	26675	3	16-QAM	8	0	21.54	2	0-2
	1913.5	26675	3	16-QAM	8	4	21.56	2	0-2
	1913.5	26675	3	16-QAM	8	7	21.58	2	0-2
	1913.5	26675	3	16-QAM	15	0	21.83	2	0-2

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Table 8-6
Reduced LTE Band 25 (PCS) Conducted Powers - 10 MHz Bandwidth
Representing Capacitive Sensor Active

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1855	26090	10	QPSK	1	0	12.39	0	0
	1855	26090	10	QPSK	1	25	12.81	0	0
	1855	26090	10	QPSK	1	49	12.77	0	0
	1855	26090	10	QPSK	25	0	12.57	0	0-1
	1855	26090	10	QPSK	25	12	12.82	0	0-1
	1855	26090	10	QPSK	25	25	12.73	0	0-1
	1855	26090	10	QPSK	50	0	12.61	0	0-1
	1855	26090	10	16QAM	1	0	12.48	0	0-1
	1855	26090	10	16QAM	1	25	12.85	0	0-1
	1855	26090	10	16QAM	1	49	12.93	0	0-1
	1855	26090	10	16QAM	25	0	12.53	0	0-2
	1855	26090	10	16QAM	25	12	12.69	0	0-2
	1855	26090	10	16QAM	25	25	12.61	0	0-2
	1855	26090	10	16QAM	50	0	12.56	0	0-2
Mid	1882.5	26365	10	QPSK	1	0	12.68	0	0
	1882.5	26365	10	QPSK	1	25	12.80	0	0
	1882.5	26365	10	QPSK	1	49	12.81	0	0
	1882.5	26365	10	QPSK	25	0	12.63	0	0-1
	1882.5	26365	10	QPSK	25	12	12.77	0	0-1
	1882.5	26365	10	QPSK	25	25	12.69	0	0-1
	1882.5	26365	10	QPSK	50	0	12.68	0	0-1
	1882.5	26365	10	16QAM	1	0	12.66	0	0-1
	1882.5	26365	10	16QAM	1	25	12.97	0	0-1
	1882.5	26365	10	16QAM	1	49	12.91	0	0-1
	1882.5	26365	10	16QAM	25	0	12.53	0	0-2
	1882.5	26365	10	16QAM	25	12	12.68	0	0-2
	1882.5	26365	10	16QAM	25	25	12.55	0	0-2
	1882.5	26365	10	16QAM	50	0	12.63	0	0-2
High	1910	26640	10	QPSK	1	0	12.72	0	0
	1910	26640	10	QPSK	1	25	**13.02**	0	0
	1910	26640	10	QPSK	1	49	12.83	0	0
	1910	26640	10	QPSK	25	0	**13.05**	0	0-1
	1910	26640	10	QPSK	25	12	12.91	0	0-1
	1910	26640	10	QPSK	25	25	12.92	0	0-1
	1910	26640	10	QPSK	50	0	12.86	0	0-1
	1910	26640	10	16QAM	1	0	12.80	0	0-1
	1910	26640	10	16QAM	1	25	13.17	0	0-1
	1910	26640	10	16QAM	1	49	13.02	0	0-1
	1910	26640	10	16QAM	25	0	12.87	0	0-2
	1910	26640	10	16QAM	25	12	12.89	0	0-2
	1910	26640	10	16QAM	25	25	12.89	0	0-2
	1910	26640	10	16QAM	50	0	12.84	0	0-2

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Table 8-7
Reduced LTE Band 25 (PCS) Conducted Powers - 5 MHz Bandwidth
Representing Capacitive Sensor Active

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1852.5	26065	5	QPSK	1	0	12.43	0	0
	1852.5	26065	5	QPSK	1	12	12.79	0	0
	1852.5	26065	5	QPSK	1	24	12.66	0	0
	1852.5	26065	5	QPSK	12	0	12.63	0	0-1
	1852.5	26065	5	QPSK	12	6	12.74	0	0-1
	1852.5	26065	5	QPSK	12	13	12.67	0	0-1
	1852.5	26065	5	QPSK	25	0	12.66	0	0-1
	1852.5	26065	5	16-QAM	1	0	12.57	0	0-1
	1852.5	26065	5	16-QAM	1	12	12.92	0	0-1
	1852.5	26065	5	16-QAM	1	24	12.82	0	0-1
	1852.5	26065	5	16-QAM	12	0	12.54	0	0-2
	1852.5	26065	5	16-QAM	12	6	12.62	0	0-2
	1852.5	26065	5	16-QAM	12	13	12.68	0	0-2
	1852.5	26065	5	16-QAM	25	0	12.55	0	0-2
Mid	1882.5	26365	5	QPSK	1	0	12.60	0	0
	1882.5	26365	5	QPSK	1	12	12.86	0	0
	1882.5	26365	5	QPSK	1	24	12.74	0	0
	1882.5	26365	5	QPSK	12	0	12.73	0	0-1
	1882.5	26365	5	QPSK	12	6	12.76	0	0-1
	1882.5	26365	5	QPSK	12	13	12.76	0	0-1
	1882.5	26365	5	QPSK	25	0	12.72	0	0-1
	1882.5	26365	5	16-QAM	1	0	12.77	0	0-1
	1882.5	26365	5	16-QAM	1	12	13.02	0	0-1
	1882.5	26365	5	16-QAM	1	24	12.81	0	0-1
	1882.5	26365	5	16-QAM	12	0	12.67	0	0-2
	1882.5	26365	5	16-QAM	12	6	12.70	0	0-2
	1882.5	26365	5	16-QAM	12	13	12.74	0	0-2
	1882.5	26365	5	16-QAM	25	0	12.62	0	0-2
High	1912.5	26665	5	QPSK	1	0	12.78	0	0
	1912.5	26665	5	QPSK	1	12	12.89	0	0
	1912.5	26665	5	QPSK	1	24	12.73	0	0
	1912.5	26665	5	QPSK	12	0	12.81	0	0-1
	1912.5	26665	5	QPSK	12	6	12.84	0	0-1
	1912.5	26665	5	QPSK	12	13	12.78	0	0-1
	1912.5	26665	5	QPSK	25	0	12.90	0	0-1
	1912.5	26665	5	16-QAM	1	0	13.01	0	0-1
	1912.5	26665	5	16-QAM	1	12	13.09	0	0-1
	1912.5	26665	5	16-QAM	1	24	12.93	0	0-1
	1912.5	26665	5	16-QAM	12	0	12.78	0	0-2
	1912.5	26665	5	16-QAM	12	6	12.80	0	0-2
	1912.5	26665	5	16-QAM	12	13	12.79	0	0-2
	1912.5	26665	5	16-QAM	25	0	12.87	0	0-2

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Table 8-8
Reduced LTE Band 25 (PCS) Conducted Powers - 3 MHz Bandwidth
Representing Capacitive Sensor Active

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1851.5	26055	3	QPSK	1	0	12.42	0	0
	1851.5	26055	3	QPSK	1	7	12.55	0	0
	1851.5	26055	3	QPSK	1	14	12.47	0	0
	1851.5	26055	3	QPSK	8	0	12.46	0	0-1
	1851.5	26055	3	QPSK	8	4	12.57	0	0-1
	1851.5	26055	3	QPSK	8	7	12.62	0	0-1
	1851.5	26055	3	QPSK	15	0	12.49	0	0-1
	1851.5	26055	3	16-QAM	1	0	12.58	0	0-1
	1851.5	26055	3	16-QAM	1	7	12.63	0	0-1
	1851.5	26055	3	16-QAM	1	14	12.68	0	0-1
	1851.5	26055	3	16-QAM	8	0	12.35	0	0-2
	1851.5	26055	3	16-QAM	8	4	12.45	0	0-2
	1851.5	26055	3	16-QAM	8	7	12.49	0	0-2
	1851.5	26055	3	16-QAM	15	0	12.33	0	0-2
Mid	1882.5	26365	3	QPSK	1	0	12.65	0	0
	1882.5	26365	3	QPSK	1	7	12.83	0	0
	1882.5	26365	3	QPSK	1	14	12.66	0	0
	1882.5	26365	3	QPSK	8	0	12.65	0	0-1
	1882.5	26365	3	QPSK	8	4	12.72	0	0-1
	1882.5	26365	3	QPSK	8	7	12.74	0	0-1
	1882.5	26365	3	QPSK	15	0	12.76	0	0-1
	1882.5	26365	3	16-QAM	1	0	12.84	0	0-1
	1882.5	26365	3	16-QAM	1	7	13.03	0	0-1
	1882.5	26365	3	16-QAM	1	14	12.92	0	0-1
	1882.5	26365	3	16-QAM	8	0	12.61	0	0-2
	1882.5	26365	3	16-QAM	8	4	12.68	0	0-2
	1882.5	26365	3	16-QAM	8	7	12.70	0	0-2
	1882.5	26365	3	16-QAM	15	0	12.64	0	0-2
High	1913.5	26675	3	QPSK	1	0	12.79	0	0
	1913.5	26675	3	QPSK	1	7	12.83	0	0
	1913.5	26675	3	QPSK	1	14	12.76	0	0
	1913.5	26675	3	QPSK	8	0	12.79	0	0-1
	1913.5	26675	3	QPSK	8	4	12.73	0	0-1
	1913.5	26675	3	QPSK	8	7	12.78	0	0-1
	1913.5	26675	3	QPSK	15	0	12.76	0	0-1
	1913.5	26675	3	16-QAM	1	0	12.98	0	0-1
	1913.5	26675	3	16-QAM	1	7	13.06	0	0-1
	1913.5	26675	3	16-QAM	1	14	12.98	0	0-1
	1913.5	26675	3	16-QAM	8	0	12.79	0	0-2
	1913.5	26675	3	16-QAM	8	4	12.72	0	0-2
	1913.5	26675	3	16-QAM	8	7	12.80	0	0-2
	1913.5	26675	3	16-QAM	15	0	12.71	0	0-2

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8.3 WLAN/Bluetooth Conducted Powers

Table 8-9
IEEE 802.11b Average RF Power

Mode	Freq	Channel	802.11b (2.4 GHz) Conducted Power [dBm]			
			Data Rate [Mbps]			
	[MHz]		1	2	5.5	11
802.11b	2412	1*	**14.07**	14.05	13.98	14.04
802.11b	2437	6*	13.72	13.59	13.65	13.67
802.11b	2462	11*	13.47	13.34	13.37	13.48

Table 8-10
IEEE 802.11g Average RF Power

Mode	Freq	Channel	802.11g (2.4 GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		6	9	12	18	24	36	48	54
802.11g	2412	1	11.70	11.21	11.34	11.24	11.23	11.28	11.27	11.19
802.11g	2437	6	11.31	11.70	11.73	11.75	11.67	11.72	11.67	11.83
802.11g	2462	11	11.69	11.28	11.26	11.20	11.20	11.34	11.20	11.24

Table 8-11
IEEE 802.11n Average RF Power

Mode	Freq	Channel	802.11n (2.4 GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		6.50	13.00	19.50	26.00	39.00	52.00	58.00	65.00
802.11n	2412	1	9.80	9.39	9.31	9.36	9.38	9.32	9.37	9.39
802.11n	2437	6	9.37	9.37	9.75	9.72	9.85	9.85	9.85	9.80
802.11n	2462	11	9.12	9.36	9.23	9.42	9.39	9.37	9.34	9.44

Table 8-12
IEEE 802.11a Average RF Power

Mode	Freq	Channel	802.11a (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		6.00	9.00	12.00	18.00	24.00	36.00	48.00	54.00
802.11a	5180	36*	**11.75**	10.95	10.96	10.89	10.94	10.90	10.94	10.93
802.11a	5200	40	11.67	10.92	11.00	10.98	10.87	10.92	10.95	10.96
802.11a	5220	44	11.60	10.90	10.94	10.97	10.97	10.91	10.99	10.92
802.11a	5240	48*	11.70	10.84	10.89	10.84	10.99	10.82	10.86	10.92
802.11a	5260	52*	11.71	10.77	10.85	10.87	10.90	10.83	10.91	10.85
802.11a	5280	56	**11.73**	10.77	10.84	11.47	11.41	11.41	11.48	11.51
802.11a	5300	60	11.68	11.40	11.44	11.47	11.33	11.51	11.49	11.46
802.11a	5320	64*	11.72	11.75	11.70	11.70	11.71	11.70	11.74	11.82
802.11a	5500	100	11.67	11.39	11.43	11.41	11.38	11.44	11.44	11.41
802.11a	5520	104*	**11.77**	11.41	11.36	11.42	11.49	11.47	11.41	11.49
802.11a	5540	108	11.68	11.34	11.54	11.35	11.39	11.42	11.38	11.40
802.11a	5560	112	11.69	11.32	11.29	11.37	11.38	11.42	11.35	11.40
802.11a	5580	116*	11.65	11.37	11.43	11.46	11.39	11.35	11.40	11.46
802.11a	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5660	132	11.67	11.36	11.34	11.35	11.43	11.40	11.39	11.36
802.11a	5680	136*	11.67	11.31	11.33	11.40	11.33	11.41	11.30	11.30
802.11a	5700	140	11.69	11.24	11.29	11.22	11.23	11.34	11.25	11.33
802.11a	5745	149*	11.63	11.24	11.25	11.28	11.27	11.29	11.30	11.29
802.11a	5765	153	11.64	11.17	11.30	11.35	11.22	11.30	11.20	11.30
802.11a	5785	157*	11.63	11.24	11.25	11.27	11.21	11.18	11.22	11.26
802.11a	5805	161*	11.62	11.26	11.31	11.22	11.21	11.26	11.30	11.27
802.11a	5825	165	**11.68**	11.19	11.15	11.31	11.17	11.28	11.26	11.23

Per FCC KDB Publication 443999 and RSS-210 A9.2(3), transmission on channels which overlap the 5600-5650 MHz is prohibited as a client. This device does not transmit any beacons or initiate any transmissions in 5.3 and 5.5 GHz Band.

(*) – indicates default channels per KDB Publication 248227 D01v01r02. When the adjacent channels are higher in power then the default channels, these “required channels” are considered for SAR testing instead of the default channels.

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Table 8-13
IEEE 802.11n Average RF Power – 20 MHz Bandwidth

Mode	Freq	Channel	20MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		6.5	13	19.5	26	39	52	58.5	65
802.11n	5180	36	11.72	11.58	11.59	11.60	11.61	11.57	11.66	11.65
802.11n	5200	40	11.67	11.55	11.63	11.59	11.63	11.62	11.66	11.63
802.11n	5220	44	11.72	11.40	11.62	11.57	11.56	11.58	11.60	11.55
802.11n	5240	48	11.69	11.52	11.53	11.58	11.55	11.55	11.64	11.63
802.11n	5260	52	11.68	11.54	11.61	11.51	11.66	11.55	11.49	11.49
802.11n	5280	56	11.72	11.52	11.58	11.52	11.54	11.56	11.53	11.64
802.11n	5300	60	11.72	11.52	11.57	11.53	11.56	11.58	11.59	11.67
802.11n	5320	64	11.76	11.70	11.72	11.72	11.75	11.71	11.77	11.76
802.11n	5500	100	11.69	11.54	11.56	11.50	11.56	11.51	11.57	11.53
802.11n	5520	104	11.68	11.54	11.53	11.47	11.62	11.50	11.64	11.58
802.11n	5540	108	11.65	11.53	11.58	11.48	11.47	11.57	11.51	11.56
802.11n	5560	112	11.70	11.51	11.55	11.54	11.59	11.59	11.51	11.63
802.11n	5580	116	11.63	11.58	11.47	11.52	11.49	11.47	11.47	11.62
802.11n	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5660	132	11.68	11.56	11.50	11.46	11.57	11.50	11.66	11.51
802.11n	5680	136	11.69	11.50	11.53	11.51	11.56	11.59	11.53	11.58
802.11n	5700	140	11.70	11.52	11.56	11.60	11.53	11.54	11.59	11.52
802.11n	5745	149	11.65	11.54	11.51	11.46	11.48	11.59	11.58	11.50
802.11n	5765	153	11.64	11.57	11.53	11.53	11.53	11.52	11.55	11.52
802.11n	5785	157	11.67	11.59	11.55	11.50	11.53	11.55	11.53	11.55
802.11n	5805	161	11.66	11.44	11.48	11.53	11.59	11.47	11.65	11.52
802.11n	5825	165	11.65	11.56	11.53	11.52	11.52	11.59	11.55	11.55

Per FCC KDB Publication 443999 and RSS-210 A9.2(3), transmission on channels which overlap the 5600-5650 MHz is prohibited as a client. This device does not transmit any beacons or initiate any transmissions in 5.3 and 5.5 GHz Band.

Table 8-14
IEEE 802.11n Average RF Power – 40 MHz Bandwidth

Mode	Freq	Channel	40MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		13.5	27	40.5	54	81	108	121.5	135
802.11n	5190	38	9.41	9.33	9.30	9.27	9.20	9.15	9.29	9.23
802.11n	5230	46	9.55	9.30	9.30	9.26	9.30	9.28	9.26	9.27
802.11n	5270	54	9.60	9.45	9.45	9.49	9.40	9.46	9.47	9.40
802.11n	5310	62	9.61	9.46	9.50	9.49	9.56	9.44	9.44	9.42
802.11n	5510	102	9.63	9.73	9.65	9.64	9.60	9.61	9.62	9.55
802.11n	5550	110	9.66	9.87	9.81	9.91	9.84	9.82	9.83	9.86
802.11n	5670	134	9.38	9.26	9.23	9.27	9.20	9.26	9.18	9.20
802.11n	5755	151	9.84	9.30	9.26	9.19	9.19	9.24	9.25	9.29
802.11n	5795	159	9.87	9.67	9.71	9.66	9.81	9.80	9.80	9.70

Per FCC KDB Publication 443999 and RSS-210 A9.2(3), transmission on channels which overlap the 5600-5650 MHz is prohibited as a client. This device does not transmit any beacons or initiate any transmissions in 5.3 and 5.5 GHz Band.

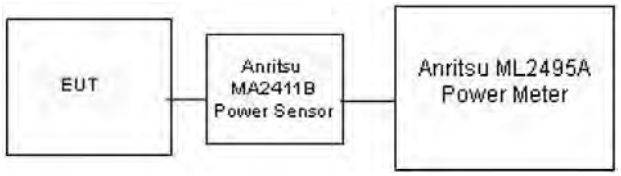

Figure 8-2
Power Measurement Setup

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Table 8-15
Bluetooth RF Conducted Powers

Frequency [MHz]	Data Rate [Mbps]	Channel No.	Peak Conducted Power		Avg Conducted Power	
			[dBm]	[mW]	[dBm]	[mW]
2402	1.0	0	10.66	11.644	10.13	10.302
2441	1.0	39	10.55	11.361	**10.20**	10.471
2480	1.0	78	10.24	10.571	9.92	9.813
2402	2.0	0	11.64	14.595	8.90	7.762
2441	2.0	39	11.45	13.948	8.89	7.751
2480	2.0	78	11.25	13.320	8.54	7.141
2402	3.0	0	11.90	15.481	9.02	7.981
2441	3.0	39	11.79	15.115	8.96	7.879
2480	3.0	78	11.51	14.164	8.61	7.269

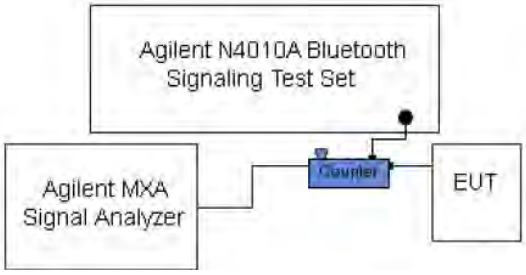

Figure 8-3
Power Measurement Setup

Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012/April 2013 FCC/TCB Meeting Notes:

- For 2.4 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11b were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
- For 5 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11a were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
- When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other channels is not required. Otherwise, the other default (or corresponding required) test channels were additionally tested using the lowest data rate.
- The bolded data rate and channel above were tested for SAR.

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9 SYSTEM VERIFICATION

9.1 Tissue Verification

Table 9-1
Measured Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (C°)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
07/08/2013	835B	23.5	820	0.996	55.968	0.969	55.258	2.79%	1.28%
			835	1.011	55.799	0.970	55.200	4.23%	1.09%
			850	1.027	55.659	0.988	55.154	3.95%	0.92%
07/08/2013	1900B	22.6	1850	1.482	54.208	1.520	53.300	-2.50%	1.70%
			1880	1.511	54.125	1.520	53.300	-0.59%	1.55%
			1910	1.553	54.032	1.520	53.300	2.17%	1.37%
07/11/2013	1900B	23.3	1850	1.496	53.312	1.520	53.300	-1.58%	0.02%
			1880	1.517	53.240	1.520	53.300	-0.20%	-0.11%
			1910	1.588	52.947	1.520	53.300	4.47%	-0.66%
06/29/2013	2450B	23.3	2401	1.949	51.688	1.903	52.765	2.42%	-2.04%
			2450	2.026	51.631	1.950	52.700	3.90%	-2.03%
			2499	2.092	51.393	2.019	52.638	3.62%	-2.37%
07/19/2013	2450B	23.8	2401	1.932	51.474	1.903	52.765	1.52%	-2.45%
			2450	1.998	51.321	1.950	52.700	2.46%	-2.62%
			2499	2.064	51.156	2.019	52.638	2.23%	-2.82%
07/01/2013	5200B-5800B	23.1	5180	5.291	46.969	5.276	49.041	0.28%	-4.23%
			5200	5.335	47.080	5.299	49.014	0.68%	-3.95%
			5240	5.378	46.920	5.346	48.933	0.60%	-4.11%
			5280	5.422	46.756	5.393	48.879	0.54%	-4.34%
			5300	5.438	46.810	5.416	48.851	0.41%	-4.18%
			5320	5.483	46.713	5.439	48.607	0.81%	-3.90%
			5500	5.732	46.335	5.650	48.580	1.45%	-4.62%
			5520	5.782	46.255	5.673	48.553	1.92%	-4.73%
			5560	5.851	46.193	5.720	48.499	2.29%	-4.75%
			5600	5.914	46.136	5.766	48.444	2.57%	-4.76%
			5700	6.091	46.026	5.880	48.275	3.59%	-4.66%
			5765	6.199	45.924	5.959	48.220	4.03%	-4.76%
			5785	6.207	45.987	5.982	48.242	3.76%	-4.67%
			5800	6.224	45.956	6.000	48.200	3.73%	-4.66%
			5825	6.284	45.887	6.029	48.132	4.23%	-4.66%

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per IEEE 1528 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

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9.2 Test System Verification

Prior to SAR assessment, the system is verified to ±10% of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in Appendix E.

Table 9-2
System Verification Results

System Verification TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR_{1g} (W/kg)	1 W Target SAR_{1g} (W/kg)	1 W Normalized SAR_{1g} (W/kg)	$Deviation_{1g}$ (%)
G	835	BODY	07/08/2013	24.5	23.5	0.100	4d132	3209	0.975	9.360	9.750	4.17%
B	1900	BODY	07/08/2013	23.2	22.8	0.100	5d080	3287	4.250	40.300	42.500	5.46%
B	1900	BODY	07/11/2013	23.1	22.9	0.100	5d080	3287	4.220	40.300	42.200	4.71%
B	2450	BODY	06/29/2013	23.5	23.3	0.100	719	3287	5.310	51.600	53.100	2.91%
E	2450	BODY	07/19/2013	24.4	23.9	0.100	797	3920	5.140	49.600	51.400	3.63%
A	5200	BODY	07/01/2013	24.3	23.1	0.100	1057	3589	7.510	75.500	75.100	-0.53%
A	5300	BODY	07/01/2013	24.3	23.1	0.100	1057	3589	7.980	75.300	79.800	5.98%
A	5500	BODY	07/01/2013	24.2	23.2	0.100	1057	3589	8.150	80.800	81.500	0.87%
A	5600	BODY	07/01/2013	24.2	23.2	0.100	1057	3589	8.440	80.300	84.400	5.11%
A	5800	BODY	07/01/2013	24.2	23.2	0.100	1057	3589	7.200	75.100	72.000	-4.13%

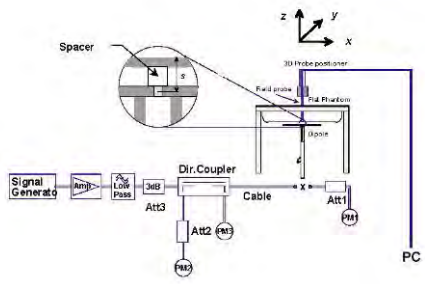

Figure 9-1
System Verification Setup Diagram

Figure 9-2
System Verification Setup Photo

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10 SAR DATA SUMMARY

10.1 Standalone Body SAR Data

Table 10-1
CDMA Body SAR Data

MEASUREMENT RESULTS														
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
820.10	564	CDMA BC10 (§90S)	EVDO Rev. 0	18.5	18.19	-0.02	0 mm	037-2	1:1	back	0.598	1.074	0.642	
820.10	564	CDMA BC10 (§90S)	EVDO Rev. 0	18.5	18.19	0.01	0 mm	037-2	1:1	top	0.222	1.074	0.238	
820.10	564	CDMA BC10 (§90S)	EVDO Rev. 0	25.0	24.96	-0.07	15 mm	037-1	1:1	back	0.702	1.009	0.708	
820.10	564	CDMA BC10 (§90S)	EVDO Rev. 0	25.0	24.96	-0.07	15 mm	037-1	1:1	top	0.344	1.009	0.347	
820.10	564	CDMA BC10 (§90S)	EVDO Rev. 0	25.0	24.96	-0.03	0 mm	037-1	1:1	left	0.794	1.009	0.801	A1
836.52	384	CDMA BC0 (§22H)	EVDO Rev. 0	18.5	18.43	-0.15	0 mm	037-2	1:1	back	0.457	1.016	0.464	
836.52	384	CDMA BC0 (§22H)	EVDO Rev. 0	18.5	18.43	0.02	0 mm	037-2	1:1	top	0.167	1.016	0.170	
836.52	384	CDMA BC0 (§22H)	EVDO Rev. 0	25.0	24.90	0.01	15 mm	037-1	1:1	back	0.469	1.023	0.480	
836.52	384	CDMA BC0 (§22H)	EVDO Rev. 0	25.0	24.90	-0.04	15 mm	037-1	1:1	top	0.255	1.023	0.261	
836.52	384	CDMA BC0 (§22H)	EVDO Rev. 0	25.0	24.90	-0.03	0 mm	037-1	1:1	left	0.715	1.023	0.731	A2
1851.25	25	PCS CDMA	EVDO Rev. 0	14.5	13.93	0.02	0 mm	037-4	1:1	back	0.868	1.140	0.990	
1880.00	600	PCS CDMA	EVDO Rev. 0	14.5	13.99	-0.03	0 mm	037-4	1:1	back	0.861	1.125	0.969	
1908.75	1175	PCS CDMA	EVDO Rev. 0	14.5	14.09	-0.05	0 mm	037-4	1:1	back	0.960	1.099	**1.055**	A3
1880.00	600	PCS CDMA	EVDO Rev. 0	14.5	13.99	-0.14	0 mm	037-4	1:1	top	0.635	1.125	0.714	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.0	24.94	0.10	15 mm	037-3	1:1	back	0.736	1.014	0.746	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.0	24.94	0.02	15 mm	037-3	1:1	top	0.725	1.014	0.735	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.0	24.94	0.14	0 mm	037-3	1:1	left	0.147	1.014	0.149	
1908.75	1175	PCS CDMA	EVDO Rev. 0	14.5	14.09	0.12	0 mm	037-4	1:1	back	0.869	1.099	0.955	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram							

Note: Blue entry represents variability measurement.

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Table 10-2
LTE Band 25 Body SAR Data

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
1855.00	26090	Low	LTE Band 25 (PCS)	10	13.5	12.81	-0.03	0	037-6	QPSK	1	25	0 mm	back	1:1	0.544	1.172	0.638	
1882.50	26365	Mid	LTE Band 25 (PCS)	10	13.5	12.81	0.04	0	037-6	QPSK	1	49	0 mm	back	1:1	0.711	1.172	0.833	
1910.00	26640	High	LTE Band 25 (PCS)	10	13.5	13.02	0.07	0	037-6	QPSK	1	25	0 mm	back	1:1	0.783	1.117	0.875	
1855.00	26090	Low	LTE Band 25 (PCS)	10	13.5	12.82	-0.03	0	037-6	QPSK	25	12	0 mm	back	1:1	0.584	1.169	0.683	
1882.50	26365	Mid	LTE Band 25 (PCS)	10	13.5	12.77	-0.04	0	037-6	QPSK	25	12	0 mm	back	1:1	0.840	1.183	0.994	
1910.00	26640	High	LTE Band 25 (PCS)	10	13.5	13.05	0.00	0	037-6	QPSK	25	0	0 mm	back	1:1	0.913	1.109	1.013	A4
1910.00	26640	High	LTE Band 25 (PCS)	10	13.5	12.86	0.05	0	037-6	QPSK	50	0	0 mm	back	1:1	0.868	1.159	1.006	
1910.00	26640	High	LTE Band 25 (PCS)	10	13.5	13.02	-0.08	0	037-6	QPSK	1	25	0 mm	top	1:1	0.574	1.117	0.641	
1910.00	26640	High	LTE Band 25 (PCS)	10	13.5	13.05	-0.01	0	037-6	QPSK	25	0	0 mm	top	1:1	0.576	1.109	0.639	
1855.00	26090	Low	LTE Band 25 (PCS)	10	24.0	23.71	-0.02	0	037-5	QPSK	1	49	15 mm	back	1:1	0.617	1.069	0.660	
1855.00	26090	Low	LTE Band 25 (PCS)	10	23.0	22.82	0.06	1	037-5	QPSK	25	12	15 mm	back	1:1	0.473	1.042	0.493	
1855.00	26090	Low	LTE Band 25 (PCS)	10	24.0	23.71	-0.02	0	037-5	QPSK	1	49	15 mm	top	1:1	0.580	1.069	0.620	
1855.00	26090	Low	LTE Band 25 (PCS)	10	23.0	22.82	-0.05	1	037-5	QPSK	25	12	15 mm	top	1:1	0.457	1.042	0.476	
1855.00	26090	Low	LTE Band 25 (PCS)	10	24.0	23.71	-0.02	0	037-5	QPSK	1	49	0 mm	left	1:1	0.718	1.069	0.768	
1855.00	26090	Low	LTE Band 25 (PCS)	10	23.0	22.82	-0.04	1	037-5	QPSK	25	12	0 mm	left	1:1	0.510	1.042	0.531	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram										

Table 10-3
DTS Body SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2412	1	IEEE 802.11b	DSSS	14.5	14.07	-0.16	0 mm	276-1	1	back	1:1	0.919	1.104	1.015	
2437	6	IEEE 802.11b	DSSS	14.5	13.72	-0.12	0 mm	276-1	1	back	1:1	0.762	1.197	0.912	
2462	11	IEEE 802.11b	DSSS	14.5	13.47	-0.09	0 mm	276-1	1	back	1:1	0.619	1.268	0.785	
2412	1	IEEE 802.11b	DSSS	14.5	14.07	0.03	0 mm	276-1	1	bottom	1:1	0.962	1.104	**1.062**	A5
2437	6	IEEE 802.11b	DSSS	14.5	13.72	0.00	0 mm	276-1	1	bottom	1:1	0.845	1.197	1.011	
2462	11	IEEE 802.11b	DSSS	14.5	13.47	0.00	0 mm	276-1	1	bottom	1:1	0.728	1.268	0.923	
2412	1	IEEE 802.11b	DSSS	14.5	14.07	-0.03	0 mm	276-1	1	left	1:1	0.090	1.104	0.099	
2412	1	IEEE 802.11b	DSSS	14.5	14.07	0.12	0 mm	276-1	1	bottom	1:1	0.958	1.104	**1.058**	
5825	165	IEEE 802.11a	OFDM	12.0	11.68	0.12	0 mm	276-1	6	back	1:1	0.157	1.076	0.169	
5765	153	IEEE 802.11a	OFDM	12.0	11.64	-0.18	0 mm	276-1	6	bottom	1:1	0.394	1.086	0.428	
5785	157	IEEE 802.11a	OFDM	12.0	11.63	-0.02	0 mm	276-1	6	bottom	1:1	0.542	1.089	0.590	
5825	165	IEEE 802.11a	OFDM	12.0	11.68	-0.02	0 mm	276-1	6	bottom	1:1	0.567	1.076	0.610	A7
5825	165	IEEE 802.11a	OFDM	12.0	11.68	0.11	0 mm	276-1	6	left	1:1	0.012	1.076	0.013	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram						

Note: Blue entry represents variability measurement.

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Table 10-4
NII Body SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.														
5180	36	IEEE 802.11a	OFDM	12.0	11.75	-0.03	0 mm	276-1	6	back	1:1	0.128	1.059	0.136	
5180	36	IEEE 802.11a	OFDM	12.0	11.75	-0.10	0 mm	276-1	6	bottom	1:1	0.121	1.059	0.128	
5240	48	IEEE 802.11a	OFDM	12.0	11.70	-0.11	0 mm	276-1	6	bottom	1:1	0.195	1.072	0.209	
5180	36	IEEE 802.11a	OFDM	12.0	11.75	0.05	0 mm	276-1	6	left	1:1	0.010	1.059	0.011	
5280	56	IEEE 802.11a	OFDM	12.0	11.73	0.13	0 mm	276-1	6	back	1:1	0.119	1.064	0.127	
5280	56	IEEE 802.11a	OFDM	12.0	11.73	-0.12	0 mm	276-1	6	bottom	1:1	0.260	1.064	0.277	
5320	64	IEEE 802.11a	OFDM	12.0	11.72	-0.12	0 mm	276-1	6	bottom	1:1	0.297	1.067	0.317	
5280	56	IEEE 802.11a	OFDM	12.0	11.73	0.03	0 mm	276-1	6	left	1:1	0.014	1.064	0.015	
5520	104	IEEE 802.11a	OFDM	12.0	11.77	-0.20	0 mm	276-1	6	back	1:1	0.117	1.054	0.123	
5520	104	IEEE 802.11a	OFDM	12.0	11.77	0.14	0 mm	276-1	6	bottom	1:1	0.436	1.054	0.460	
5560	112	IEEE 802.11a	OFDM	12.0	11.69	-0.02	0 mm	276-1	6	bottom	1:1	0.461	1.074	**0.495**	A6
5700	140	IEEE 802.11a	OFDM	12.0	11.69	-0.18	0 mm	276-1	6	bottom	1:1	0.420	1.074	0.451	
5520	104	IEEE 802.11a	OFDM	12.0	11.77	0.10	0 mm	276-1	6	left	1:1	0.009	1.054	0.009	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							**Body 1.6 W/kg (mW/g) averaged over 1 gram**								

Table 10-5
Bluetooth Body SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.														
2441	39	Bluetooth	FHSS	10.5	10.20	0.04	0 mm	276-1	1	back	1:1	0.119	1.072	0.128	
2441	39	Bluetooth	FHSS	10.5	10.20	0.02	0 mm	276-1	1	bottom	1:1	0.146	1.072	**0.157**	A8
2441	39	Bluetooth	FHSS	10.5	10.20	-0.13	0 mm	276-1	1	left	1:1	0.012	1.072	0.013	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							**Body 1.6 W/kg (mW/g) averaged over 1 gram**								

10.2 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in FCC KDB Publication 616217 D04v01 and FCC KDB Publication 447498 D01v05.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v05.

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6. Per FCC KDB 865664 D01 v01, variability SAR tests were performed when the measured SAR results for a frequency band were greater than 0.8 W/kg. Repeated SAR measurements are highlighted in blue in the tables above for clarity. Please see Section 12 for variability analysis.
7. Per FCC KDB 616217 D04 Section 4.3, SAR tests are required for the back surface and edges of the tablet with the tablet touching the phantom. The SAR Exclusion Threshold in FCC KDB 447498 D01v05 was applied to determine SAR test exclusion for adjacent edge configurations. SAR tests were required for top and left edge for the main antenna and bottom and left edge for the BT/WLAN antenna.

CDMA Notes:

1. CDMA Body SAR was measured using Subtype 0/1 Physical Layer configurations for Rev. 0 according to KDB 941225 D01 procedures for data devices. Since the average output power of Subtype 2 for Rev. A is less than the Rev. 0 power levels, EVDO Rev. A SAR was not required.. SAR was not required for 1x RTT for Ev-Do hotspot devices since the maximum average output of each channel is less than 1⁄4 dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0.
2. Per FCC KDB Publication 447498 D01v05, when the reported (scaled) SAR measured at the middle channel channel for a test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). Since the maximum output power variation across the required test channels is ≤½ dB, middle channel was the default channel used.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r01. The general test procedures used for testing can be found in Section 7.4.4.
2. MPR is implemented by the manufacturer for this device operating a maximum power with capacitive sensor inactive. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator.

WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11b. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
2. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes for 5 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11a. Other IEEE 802.11 modes (including 802.11n 20 MHz and 40 MHz bandwidths) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
3. WIFI transmission was verified using an uncalibrated spectrum analyzer.
4. When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other default channels was not required. Otherwise, the other default (or corresponding required) test channels were additionally tested using the lowest data rate.
5. There is no proximity sensor power reduction mechanism applied for WIFI/BT modes.

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11 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

11.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v05 are applicable to handsets with built-in unlicensed transmitters such as 802.11a/b/g/n and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

11.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05 IV.C.1.iii, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤1.6 W/kg.

Note: For configurations excluded per 447498 D01v05, an estimated SAR of 0.4 W/kg was used to determine simultaneous transmission SAR exclusion since the test separation distance was >50 mm.

11.3 Body SAR Simultaneous Transmission Analysis

Table 11-1
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body at 0 mm)

Simult Tx	Configuration	CDMA BC10 (§90S) EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR	Simult Tx	Configuration	CDMA BC0 (§22H) EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.642	1.015	See Note	0.01	Body SAR	Back	0.464	1.015	**1.479**	N/A
	Top	0.238	0.400	1.041	N/A		Top	0.170	0.400	0.570	N/A
	Bottom	0.400	1.062	**1.462**	N/A		Bottom	0.400	1.062	1.462	N/A
	Right	0.400	0.400	0.800	N/A		Right	0.400	0.400	0.800	N/A
	Left	0.801	0.099	0.867	N/A		Left	0.731	0.099	0.830	N/A
Simult Tx	Configuration	PCS EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR	Simult Tx	Configuration	LTE Band 25 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.055	1.015	See Note	0.02	Body SAR	Back	1.013	1.015	See Note	0.02
	Top	0.714	0.400	1.114	N/A		Top	0.641	0.400	1.041	N/A
	Bottom	0.400	1.062	**1.462**	N/A		Bottom	0.400	1.062	**1.462**	N/A
	Right	0.400	0.400	0.800	N/A		Right	0.400	0.400	0.800	N/A
	Left	0.149	0.099	0.248	N/A		Left	0.768	0.099	0.867	N/A

Note: No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was below 0.04 per FCC KDB 447498 D01v05. See Section 11.4 for detailed SPLS ratio analysis.

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Table 11-2
Simultaneous Transmission Scenario with 5 GHz WLAN (Body at 0 mm)

Simult Tx	Configuration	CDMA BC10 (§90S) EVDO SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	CDMA BC0 (§22H) EVDO SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.642	0.169	0.811	Body SAR	Back	0.464	0.169	0.633
	Top	0.238	0.400	0.638		Top	0.170	0.400	0.570
	Bottom	0.400	0.610	**1.010**		Bottom	0.400	0.610	**1.010**
	Right	0.400	0.400	0.800		Right	0.400	0.400	0.800
	Left	0.801	0.015	0.816		Left	0.731	0.015	0.746
Simult Tx	Configuration	PCS EVDO SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 25 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	1.055	0.169	**1.224**	Body SAR	Back	1.013	0.169	**1.182**
	Top	0.714	0.400	1.114		Top	0.641	0.400	1.041
	Bottom	0.400	0.610	1.010		Bottom	0.400	0.610	1.010
	Right	0.400	0.400	0.800		Right	0.400	0.400	0.800
	Left	0.149	0.015	0.164		Left	0.768	0.015	0.783

Table 11-3
Simultaneous Transmission Scenario with Bluetooth (Body at 0 mm)

Simult Tx	Configuration	CDMA BC10 (§90S) EVDO SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	CDMA BC0 (§22H) EVDO SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.642	0.128	0.770	Body SAR	Back	0.464	0.128	0.592
	Top	0.238	0.400	0.638		Top	0.170	0.400	0.570
	Bottom	0.400	0.157	0.557		Bottom	0.400	0.157	0.557
	Right	0.400	0.400	0.800		Right	0.400	0.400	**0.800**
	Left	0.801	0.013	**0.814**		Left	0.731	0.013	0.744
Simult Tx	Configuration	PCS EVDO SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 25 (PCS) SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	1.055	0.128	**1.183**	Body SAR	Back	1.013	0.128	**1.141**
	Top	0.714	0.400	1.114		Top	0.641	0.400	1.041
	Bottom	0.400	0.157	0.557		Bottom	0.400	0.157	0.557
	Right	0.400	0.400	0.800		Right	0.400	0.400	0.800
	Left	0.149	0.013	0.162		Left	0.768	0.013	0.781

Table 11-4
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Back Side at 15 mm)

Configuration	Mode	EVDO/LTE SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Back Side	CDMA BC10 (§90S) EVDO	0.708	<1.015	See Note	<0.01
Back Side	CDMA BC0 (§22H) EVDO	0.480	<1.015	**<1.495**	N/A
Back Side	PCS EVDO	0.746	<1.015	See Note	<0.01
Back Side	LTE Band 25 (PCS)	0.660	<1.015	See Note	<0.01

Note: No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was below 0.04 per FCC KDB 447498 D01v05. See Section 11.4 for detailed SPLS ratio analysis.

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Table 11-5
Simultaneous Transmission Scenario with 5 GHz WLAN (Back Side at 15 mm)

Configuration	Mode	EVDO/LTE SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	CDMA BC10 (§90S) EVDO	0.708	<0.169	<0.877
Back Side	CDMA BC0 (§22H) EVDO	0.480	<0.169	<0.649
Back Side	PCS EVDO	0.746	<0.169	**<0.915**
Back Side	LTE Band 25 (PCS)	0.660	<0.169	<0.829

Table 11-6
Simultaneous Transmission Scenario with Bluetooth (Back Side at 15 mm)

Configuration	Mode	EVDO/LTE SAR (W/kg)	Bluetooth WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	CDMA BC10 (§90S) EVDO	0.708	<0.128	<0.836
Back Side	CDMA BC0 (§22H) EVDO	0.480	<0.128	<0.608
Back Side	PCS EVDO	0.746	<0.128	**<0.874**
Back Side	LTE Band 25 (PCS)	0.660	<0.128	<0.788

Table 11-7
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Top Edge at 15 mm)

Configuration	Mode	EVDO/LTE SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Top Edge	CDMA BC10 (§90S)	0.347	0.400	0.747
Top Edge	CDMA BC0 (§22H)	0.261	0.400	0.661
Top Edge	PCS CDMA	0.735	0.400	1.135
Top Edge	LTE Band 25 (PCS)	0.620	0.400	1.020

Table 11-8
Simultaneous Transmission Scenario with 5 GHz WLAN (Top Edge at 15 mm)

Configuration	Mode	EVDO/LTE SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Top Edge	CDMA BC10 (§90S)	0.347	0.400	0.747
Top Edge	CDMA BC0 (§22H)	0.261	0.400	0.661
Top Edge	PCS CDMA	0.735	0.400	1.135
Top Edge	LTE Band 25 (PCS)	0.620	0.400	1.020

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Table 11-9
Simultaneous Transmission Scenario with Bluetooth (Top Edge at 15 mm)

Configuration	Mode	EVDO/LTE SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Top Edge	CDMA BC10 (§90S)	0.347	0.400	0.747
Top Edge	CDMA BC0 (§22H)	0.261	0.400	0.661
Top Edge	PCS CDMA	0.735	0.400	1.135
Top Edge	LTE Band 25 (PCS)	0.620	0.400	1.020

Note:

1. For configurations excluded per 447498 D01v05, an estimated SAR of 0.4 W/kg was used to determine simultaneous transmission SAR exclusion since the test separation distance was >50 mm.
2. For SAR summations for body at 15 mm, WLAN SAR values for 0.0 cm were used since the 0.0 cm test distance for WLAN was more conservative. "<" denotes that the 0.0 cm WLAN SAR values were used for summation purposes.
3. The worst case 5 GHz WLAN reported SAR for each configuration was used for SAR summation, regardless of whether the WLAN channel has Hotspot or WIFI Direct capability. Therefore, the summations above represent the absolute worst cases for simultaneous transmission with 5 GHz WLAN.

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11.4 SPLSR Evaluation Analysis

Per FCC KDB Publication 447498 D01v05, when the sum of the standalone transmitters is more than 1.6 W/kg, the SAR sum to peak locations can be analyzed to determine SAR distribution overlaps. When the SAR peak to location ratio (shown below) for each pair of antennas is ≤ 0.04, simultaneous SAR evaluation is not required. For a sum of more than two standalone transmitters, the simultaneous transmitting antennas in each operating mode and exposure condition combination must be considered one pair at a time to determine the SAR to peak location separation ratio to qualify for test exclusion, even if the sum of a pair is < 1.6 W/kg. The distance between the transmitting antenna pairs was calculated using the following formula.

$$\text{Distance}_{Tx1\text{-}Tx2} = R_i = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

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

The following is the SAR sum to peak location ratio analysis for Body Back Side configuration at a separation distance of 0 cm with CDMA BC10 (§90S) EVDO potentially operating with 2.4 GHz WIFI.

Figure 11-1
Peak SAR Location Plot of CDMA BC10 (§90S) EVDO and 2.4 GHz WLAN

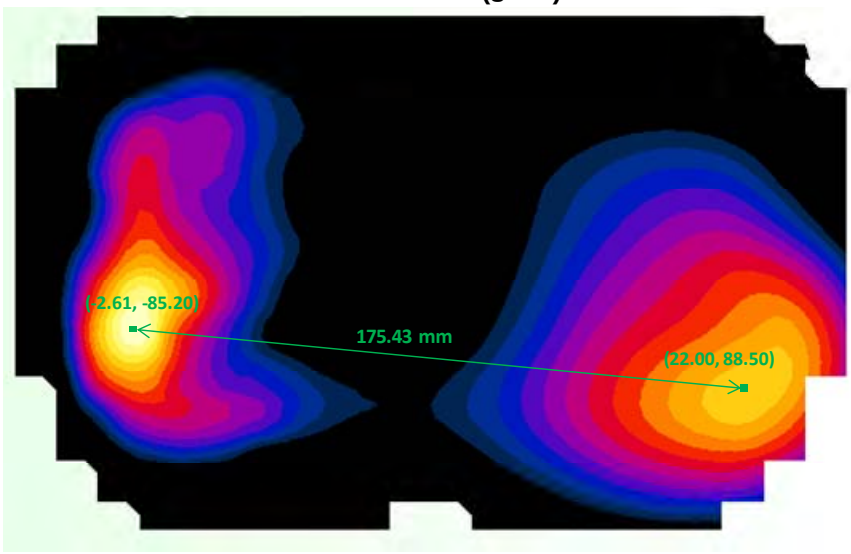

Table 11-11
Peak SAR Locations for Body Back CDMA BC10 (§90S) EVDO and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)
CDMA BC10 (§90S) EVDO	22.00	88.50
2.4 GHz WLAN	-2.61	-85.20

Table 11-12
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
CDMA BC10 (§90S) EVDO	2.4 GHz WLAN	0.642	1.015	1.657	175.43	0.01

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The following is the SAR sum to peak location ratio analysis for Body Back Side configuration at a separation distance of 0 cm with PCS EVDO potentially operating with 2.4 GHz WIFI.

Figure 11-2
Peak SAR Location Plot of PCS EVDO and 2.4 GHz WLAN

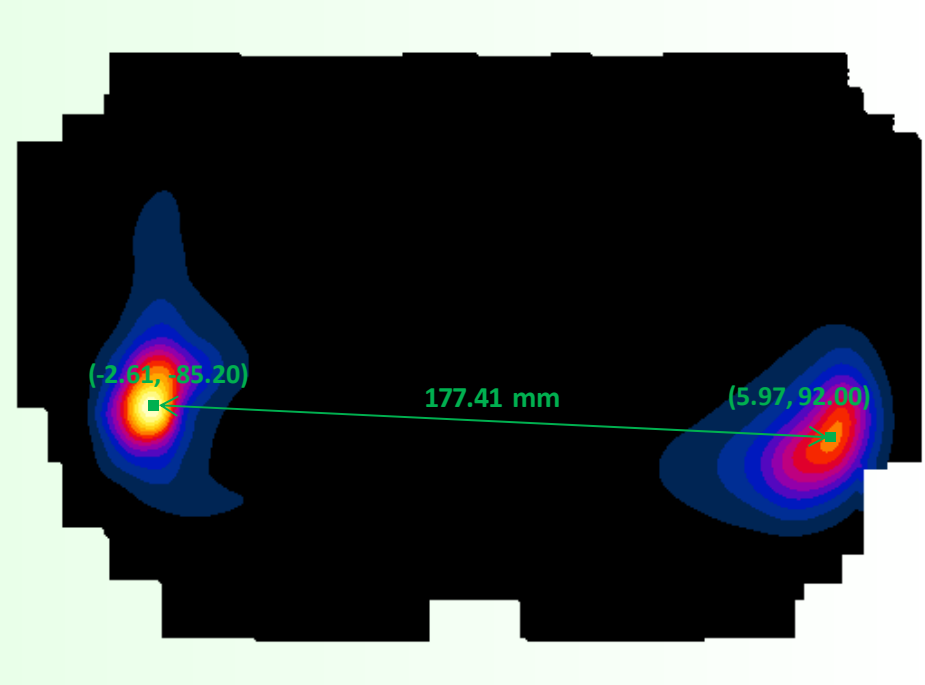

Table 11-13
Peak SAR Locations for Body Back PCS EVDO and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)
PCS EVDO	5.97	92.00
2. 4 GHz WLAN	-2.61	-85.20

Table 11-14
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
PCS EVDO	2. 4 GHz WLAN	1.055	1.015	2.07	177.41	0.02

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The following is the SAR sum to peak location ratio analysis for Body Back Side configuration at a separation distance of 0 cm with LTE Band 25 potentially operating with 2.4 GHz WIFI.

Figure 11-3
Peak SAR Location Plot of LTE Band 25 and 2.4 GHz WLAN

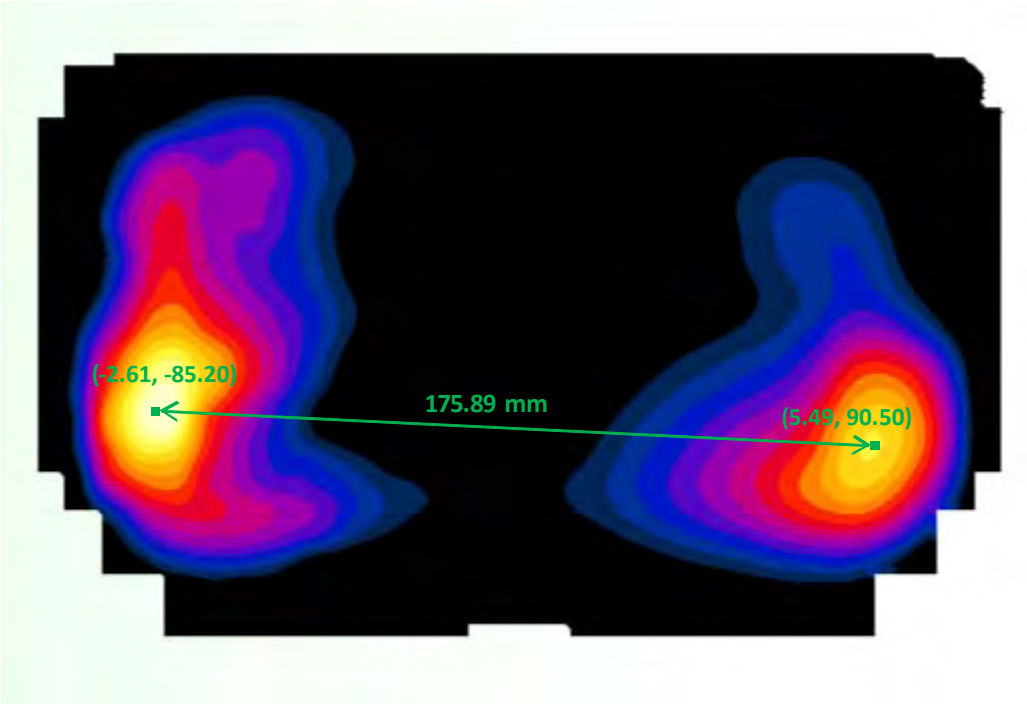

Table 11-15
Peak SAR Locations for Body Back Side LTE Band 25 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)
LTE Band 25	5.49	90.50
2.4 GHz WLAN	-2.61	-85.20

Table 11-16
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
LTE Band 25	2.4 GHz WLAN	1.013	1.015	2.028	175.89	0.02

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The following is the SAR sum to peak location ratio analysis for Body Back Side configuration at a separation distance of 1.5 cm with CDMA BC10 (§90S) EVDO potentially operating with 2.4 GHz WIFI.

Figure 11-4
Peak SAR Location Plot of CDMA BC10 (§90S) EVDO and 2.4 GHz WLAN

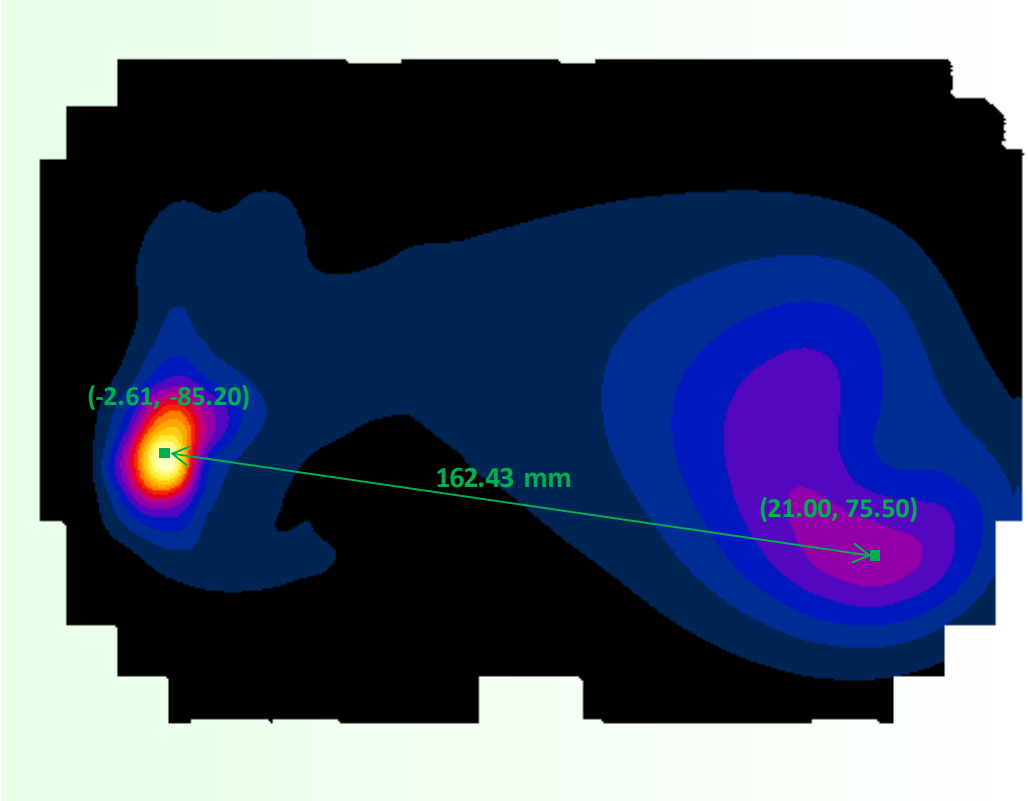

Table 11-17
Peak SAR Locations for Body Back Side CDMA BC10 (§90S) EVDO and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)
CDMA BC10 (§90S) EVDO	21.00	75.50
2.4 GHz WLAN	-2.61	-85.20

Table 11-18
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
CDMA BC10 (§90S) EVDO	2.4 GHz WLAN	0.708	< 1.015	< 1.723	162.43	< 0.01

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The following is the SAR sum to peak location ratio analysis for Body Back Side configuration at a separation distance of 1.5 cm with PCS EVDO potentially operating with 2.4 GHz WIFI.

Figure 11-5
Peak SAR Location Plot of PCS EVDO and 2.4 GHz WLAN

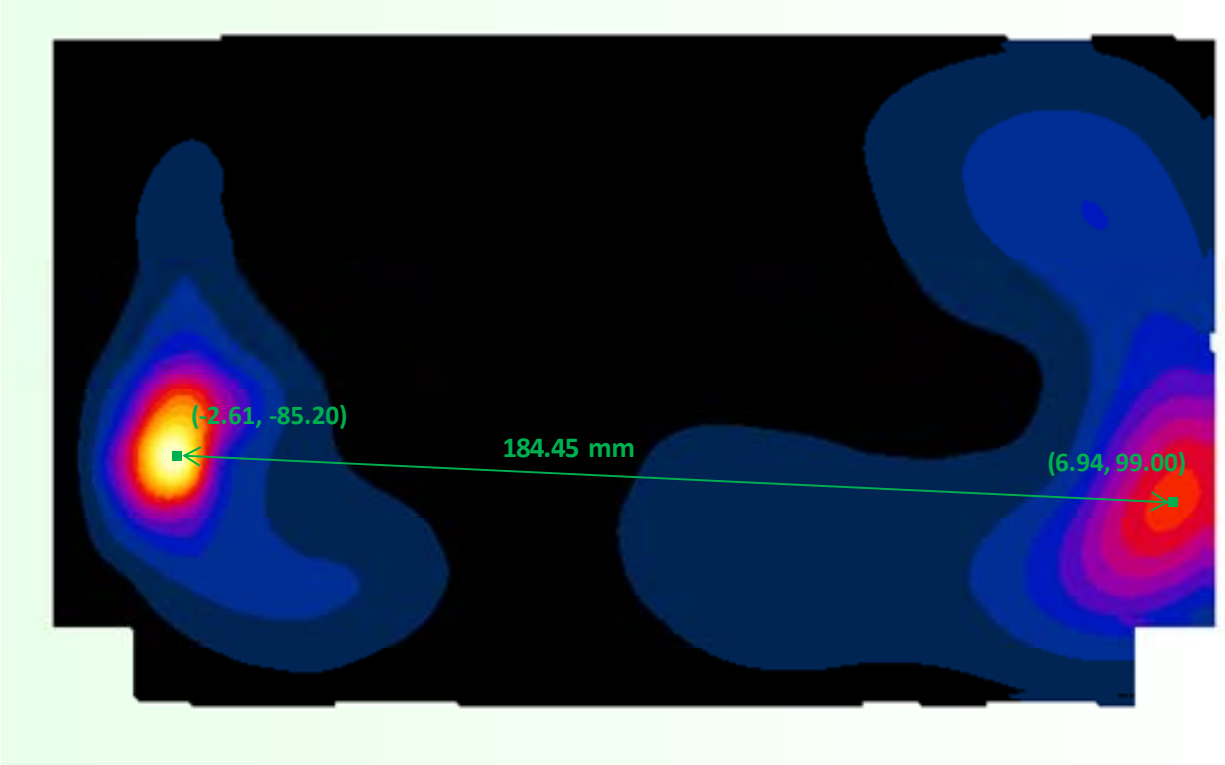

Table 11-19
Peak SAR Locations for Body Back Side PCS EVDO and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)
PCS EVDO	6.94	99.00
2.4 GHz WLAN	-2.61	-85.20

Table 11-20
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
PCS EVDO	2.4 GHz WLAN	0.746	< 1.015	< 1.761	184.45	< 0.01

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The following is the SAR sum to peak location ratio analysis for Body Back Side configuration at a separation distance of 1.5 cm with LTE Band 25 potentially operating with 2.4 GHz WIFI.

Figure 11-6
Peak SAR Location Plot of LTE Band 25 and 2.4 GHz WLAN

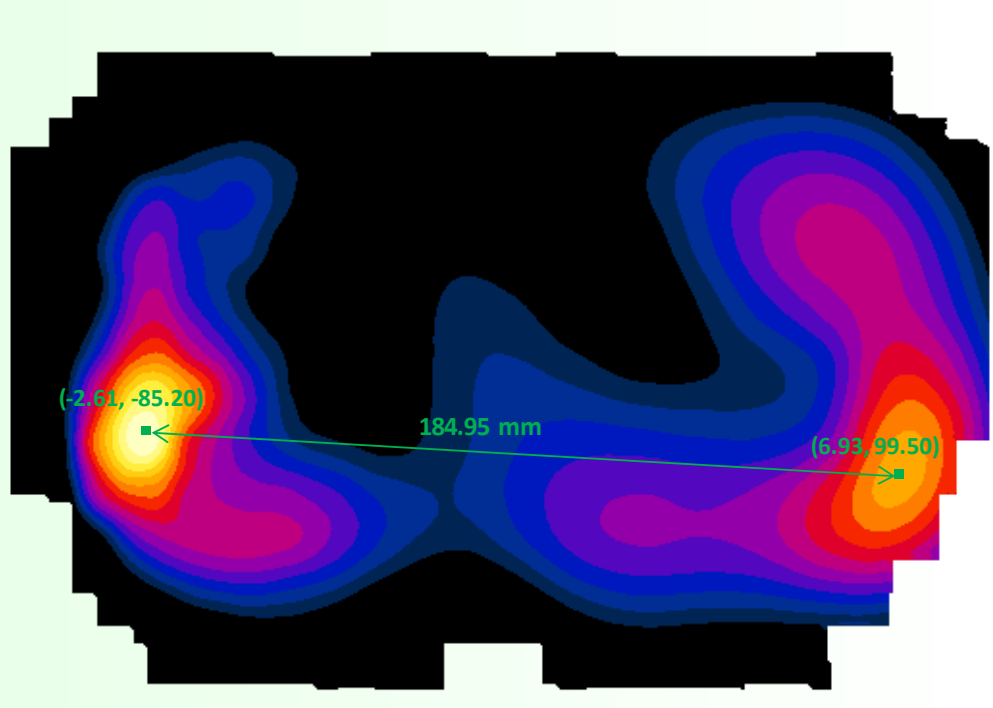

Table 11-21
Peak SAR Locations for Body Back Side LTE Band 25 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)
LTE Band 25	6.93	99.50
2.4 GHz WLAN	-2.61	-85.20

Table 11-22
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
LTE Band 25	2.4 GHz WLAN	0.660	< 1.015	< 1.675	184.95	< 0.01

11.5 Simultaneous Transmission Conclusion

Based on the simultaneous transmission analysis guidance described in KDB Publication 865664 D01 and the April 2012 TCB/ FCC Workshop, the above simultaneous transmission SAR analyses indicate that the device operating in any simultaneous transmission scenarios will not exceed SAR limit.

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12 SAR MEASUREMENT VARIABILITY

12.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

1) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
2) A second repeated measurement was preformed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
3) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

Table 12-1
Body SAR Measurement Variability Results

BODY VARIABILITY RESULTS														
Band	FREQUENCY		Mode	Service	Data Rate (Mbps)	Side	Spacing	Measured SAR (1g)	1st Repeated SAR (1g)	Ratio	2nd Repeated SAR (1g)	Ratio	3rd Repeated SAR (1g)	Ratio
	MHz	Ch.						(W/kg)	(W/kg)		(W/kg)		(W/kg)	
1900	1908.75	1175	PCS CDMA	EVDO Rev. 0	N/A	back	0 mm	0.960	0.869	1.10	N/A	N/A	N/A	N/A
2450	2412.00	1	IEEE 802.11b	DSSS	1	bottom	0 mm	0.962	0.958	1.00	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.2 Measurement Uncertainty

The measured SAR was <1.5 W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01, the extended measurement uncertainty analysis per IEEE 1528-2003 was not required.

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13 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E5515C	Wireless Communications Test Set	10/18/2012	Biennial	10/18/2014	GB43193563
Agilent	85047A	S-Parameter Test Set	N/A	N/A	N/A	2904A00579
Agilent	E5515C	Wireless Communications Test Set	5/9/2013	Biennial	5/9/2015	GB43304447
Agilent	N9020A	MXA Signal Analyzer	10/9/2012	Annual	10/9/2013	US46470561
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB46170464
Agilent	85070C	Dielectric Probe Kit	2/14/2013	Annual	2/14/2014	MY44300633
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/16/2013	Annual	4/16/2014	JP38020182
Agilent	8648D	(9kHz-4GHz) Signal Generator	4/17/2013	Annual	4/17/2014	3629U00687
Amplifier Research	5S1G4	5W, 800MHz-4.2GHz	CBT	N/A	CBT	21910
Anritsu	ML2495A	Power Meter	10/11/2012	Annual	10/11/2013	1039008
Anritsu	MA2481A	Power Sensor	2/14/2013	Annual	2/14/2014	5821
Anritsu	ML2438A	Power Meter	12/4/2012	Annual	12/4/2013	1070030
Anritsu	MA2481A	Power Sensor	2/14/2013	Annual	2/14/2014	2400
Anritsu	ML2438A	Power Meter	2/14/2013	Annual	2/14/2014	98150041
Anritsu	MA2411B	Pulse Power Sensor	12/4/2012	Annual	12/4/2013	1207364
Anritsu	MA2411B	Pulse Power Sensor	12/5/2012	Annual	12/5/2013	1126066
Anritsu	MA2481D	Universal Sensor	12/17/2012	Annual	12/17/2013	1204343
Anritsu	MT8820C	Radio Communication Tester	11/6/2012	Annual	11/6/2013	6200901190
Anritsu	MA24106A	USB Power Sensor	12/7/2012	Annual	12/7/2013	1244512
Anritsu	MA24106A	USB Power Sensor	12/7/2012	Annual	12/7/2013	1244524
Anritsu	MA24106A	USB Power Sensor	12/7/2012	Annual	12/7/2013	1244515
Anritsu	MA24106A	USB Power Sensor	12/6/2012	Annual	12/6/2013	1248508
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M1S5A00-009
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
Control Company	36934-158	Wall-Mounted Thermometer	1/4/2012	Biennial	1/4/2014	122014488
Control Company	36934-158	Wall-Mounted Thermometer	1/4/2012	Biennial	1/4/2014	122014497
Control Company	4353	Long Stem Thermometer	9/25/2012	Biennial	9/25/2014	122541139
Control Company	4353	Long Stem Thermometer	9/25/2012	Biennial	9/25/2014	122539615
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	10/7/2011	Biennial	10/7/2013	103962
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	9/26/2012	Annual	9/26/2013	108798
Rohde & Schwarz	NRVD	Dual Channel Power Meter	10/12/2012	Biennial	10/12/2014	101695
Seekonk	NC-100	Torque Wrench (8" lb)	3/5/2012	Triennial	3/5/2015	N/A
Seekonk	NC-100	Torque Wrench (8" lb)	3/5/2012	Triennial	3/5/2015	N/A
SPEAG	DAK-3.5	Dielectric Assessment Kit	12/11/2012	Annual	12/11/2013	1091
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/11/2013	Annual	1/11/2014	1057
SPEAG	D2450V2	2450 MHz SAR Dipole	1/8/2013	Annual	1/8/2014	797
SPEAG	D2450V2	2450 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	719
SPEAG	EX3DV4	SAR Probe	1/17/2013	Annual	1/17/2014	3589
SPEAG	EX3DV4	SAR Probe	2/27/2013	Annual	2/27/2014	3920
SPEAG	ES3DV3	SAR Probe	3/15/2013	Annual	3/15/2014	3209
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/14/2013	Annual	5/14/2014	1070
SPEAG	D1900V2	1900 MHz SAR Dipole	7/20/2012	Annual	7/20/2013	5d080
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/13/2012	Annual	11/13/2013	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/8/2013	Annual	3/8/2014	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/6/2013	Annual	2/6/2014	649
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/17/2013	Annual	1/17/2014	1272
SPEAG	D835V2	835 MHz SAR Dipole	1/7/2013	Annual	1/7/2014	4d132
SPEAG	ES3DV3	SAR Probe	11/15/2012	Annual	11/15/2013	3287
Tektronix	RSA6114A	Real Time Spectrum Analyzer	4/17/2013	Annual	4/17/2014	B010177
VWR	36934-158	Wall-Mounted Thermometer	9/30/2011	Biennial	9/30/2013	111859332
VWR	23226-658	Long Stem Thermometer	7/11/2012	Biennial	7/11/2014	122389334

Note: CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.

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14 MEASUREMENT UNCERTAINTIES

Applicable for frequencies less than 3000 MHz.

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	**IEEE 1528 Sec.**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i 1gm**	**c_i 10 gms**	**1gm u_i (± %)**	**10gms u_i (± %)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	6.0	N	1	1.0	1.0	6.0	6.0	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary Effect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout Electronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)			RSS				12.1	11.7	299
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.2	23.5	

The above measurement uncertainties are according to IEEE Std. 1528-2003

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Applicable for frequencies up to 6 GHz.

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	**IEEE 1528 Sec.**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i 1gm**	**c_i 10 gms**	**1gm u_i (± %)**	**10gms u_i (± %)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	6.55	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary Effect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout Electronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)			RSS				12.4	12.0	299
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.7	24.0	

The above measurement uncertainties are according to IEEE Std. 1528-2003

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15 CONCLUSION

15.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Industry Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

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APPENDIX A: SAR TEST DATA

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DUT: A3LSMT217S; Type: Portable Tablet; Serial: 037-1

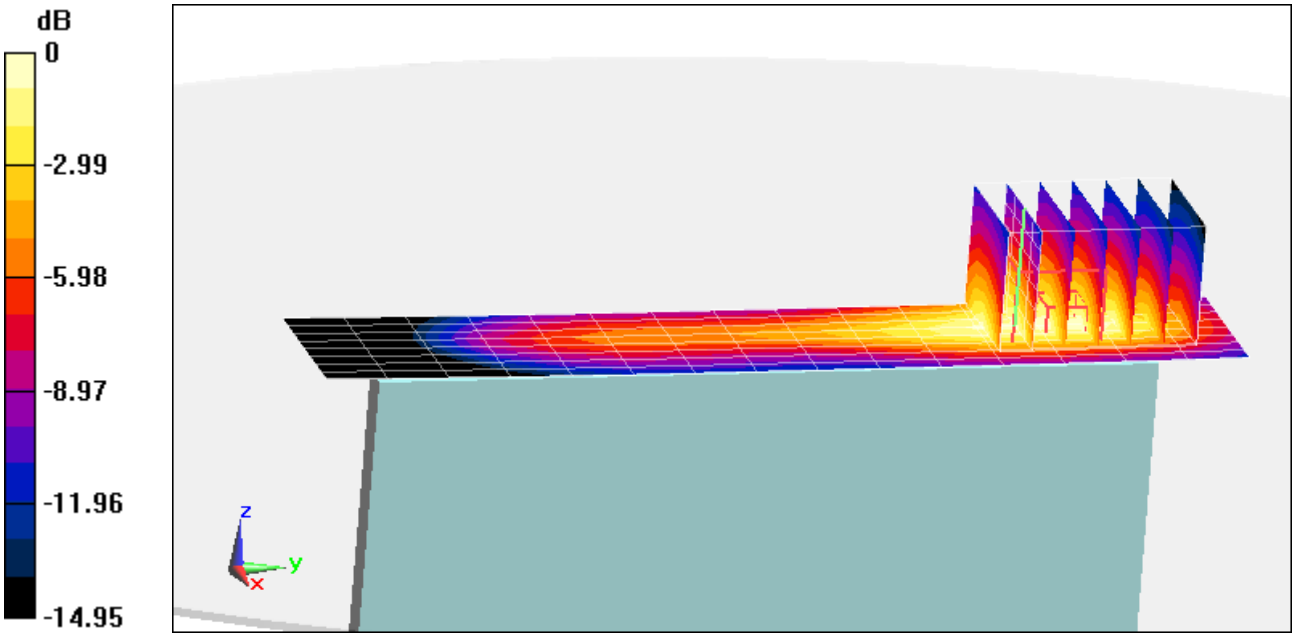
Communication System: CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 820.1 MHz; σ = 0.996 S/m; ε_r = 55.967; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-08-2013; Ambient Temp: 24.5°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3209; ConvF(6.28, 6.28, 6.28); Calibrated: 3/15/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/8/2013
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: BC10 Cell. EVDO, Body SAR, Left Edge, Mid.ch

Area Scan (9x16x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x7x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.491 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.39 W/kg
SAR(1 g) = 0.794 W/kg



0 dB = 0.889 W/kg = -0.51 dBW/kg

DUT: A3LSMT217S; Type: Portable Tablet; Serial: 037-1

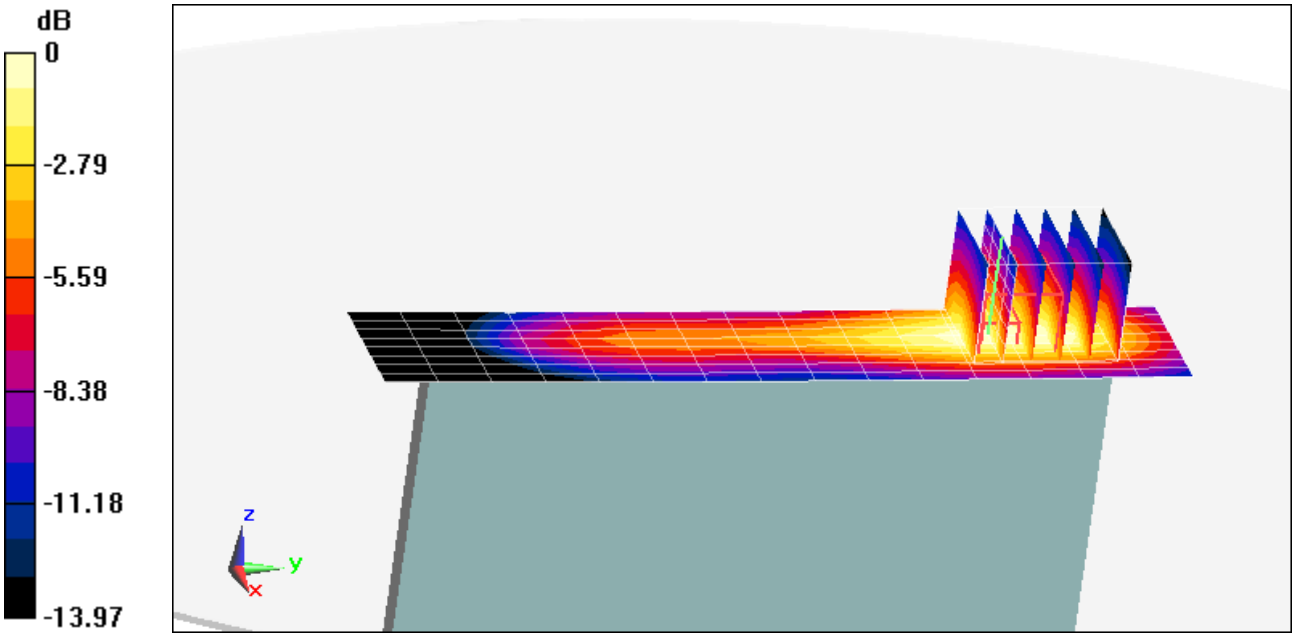
Communication System: CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.52 MHz; σ = 1.013 S/m; ε_r = 55.785; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-08-2013; Ambient Temp: 24.5°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3209; ConvF(6.28, 6.28, 6.28); Calibrated: 3/15/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/8/2013
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: BC0 Cell. EVDO, Body SAR, Left Edge, Mid.ch

Area Scan (9x16x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 28.525 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.24 W/kg
SAR(1 g) = 0.715 W/kg



0 dB = 0.808 W/kg = -0.93 dBW/kg

DUT: A3LSMT217S; Type: Portable Tablet; Serial: 037-4

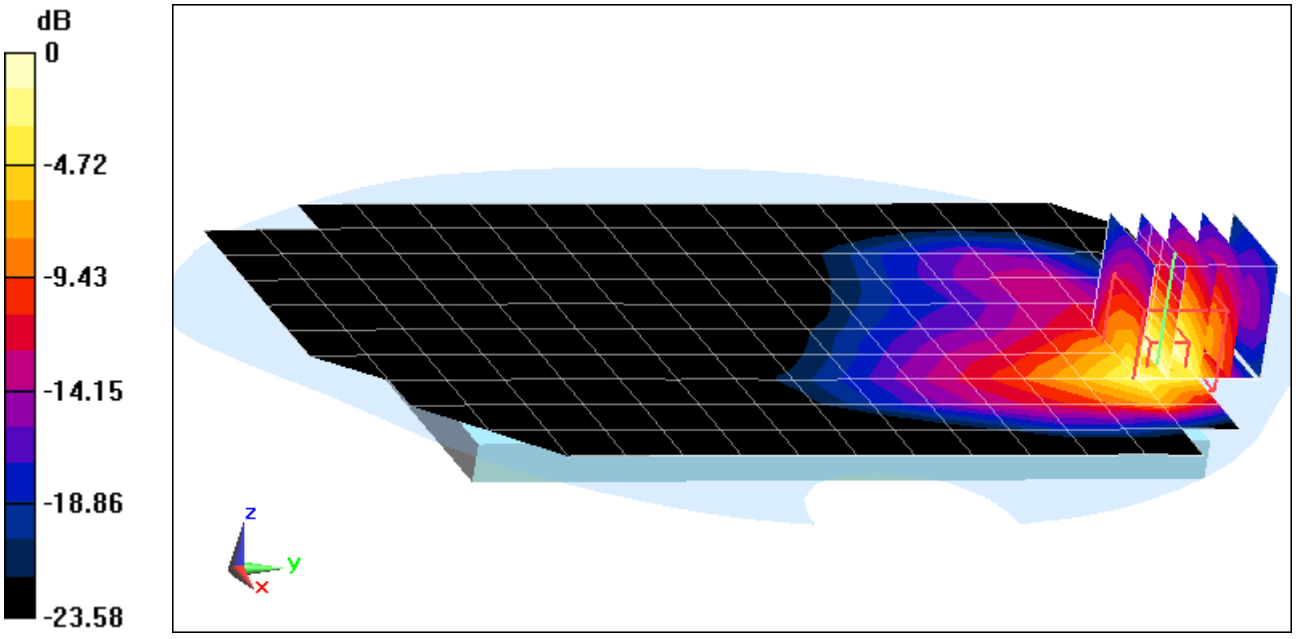
Communication System: PCS CDMA; Frequency: 1908.75 MHz; Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1908.75 MHz; σ = 1.551 S/m; ε_r = 54.036; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-08-2013; Ambient Temp: 23.2C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3287; ConvF(4.69, 4.69, 4.69); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

Mode: PCS EVDO, Body SAR, Back side, High.ch

Area Scan (11x17x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.048 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 2.04 W/kg
SAR(1 g) = 0.960 W/kg



0 dB = 1.03 W/kg = 0.13 dBW/kg

DUT: A3LSMT217S; Type: Portable Tablet; Serial: 037-6

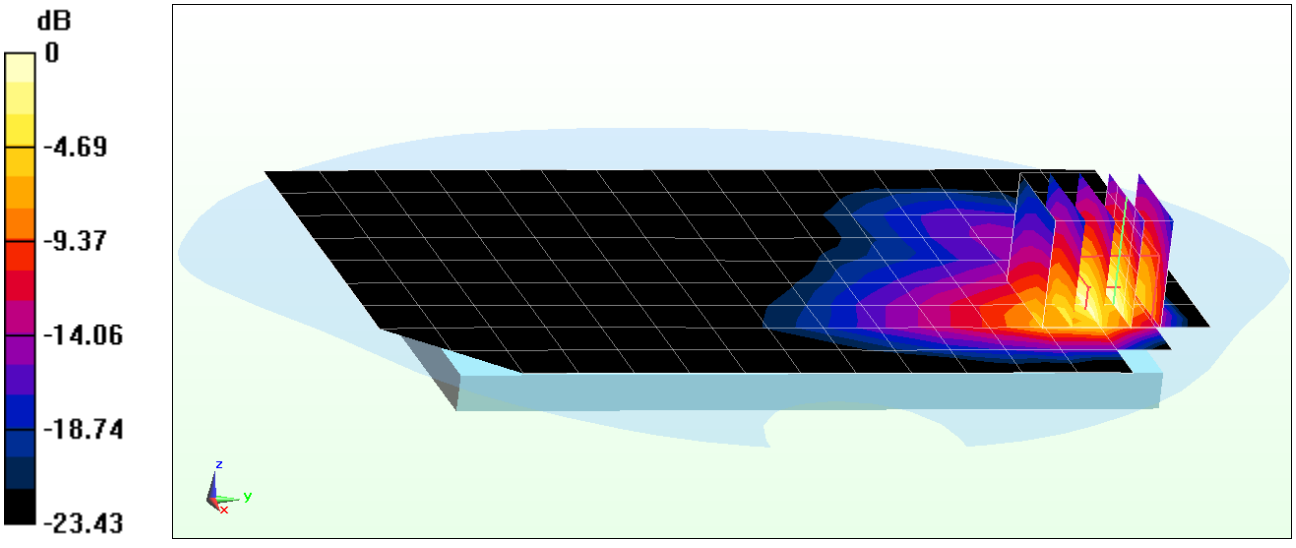
Communication System: LTE Band 25 (PCS); Frequency: 1910 MHz; Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1910 MHz; σ = 1.588 S/m; ε_r = 52.947; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-11-2013; Ambient Temp: 23.1°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3287; ConvF(4.69, 4.69, 4.69); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 25 (PCS), Body SAR, Back side, High.ch
10 MHz Bandwidth, QPSK, 25RB, 0 RB Offset

Area Scan (10x16x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.418 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 2.04 W/kg
SAR(1 g) = 0.913 W/kg



0 dB = 0.973 W/kg = -0.12 dBW/kg

DUT: A3LSMT217S; Type: Portable Tablet; Serial: 276-1

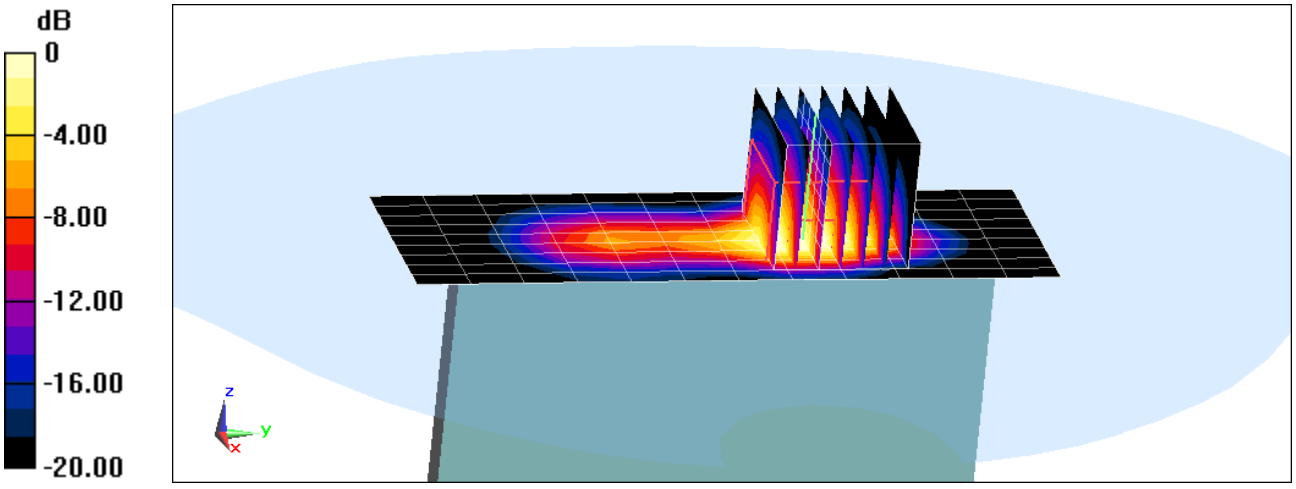
Communication System: IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2412 MHz; σ = 1.966 S/m; ε_r = 51.675; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-29-2013; Ambient Temp: 23.5°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3287; ConvF(4.29, 4.29, 4.29); Calibrated: 11/15/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11b, Body SAR, Ch 01, 1 Mbps, Bottom Edge

Area Scan (10x13x1): Measurement grid: dx=5mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 23.570 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 2.25 W/kg
SAR(1 g) = 0.962 W/kg



0 dB = 1.33 W/kg = 1.24 dBW/kg

DUT: A3LSMT217S; Type: Portable Tablet; Serial: 276-1

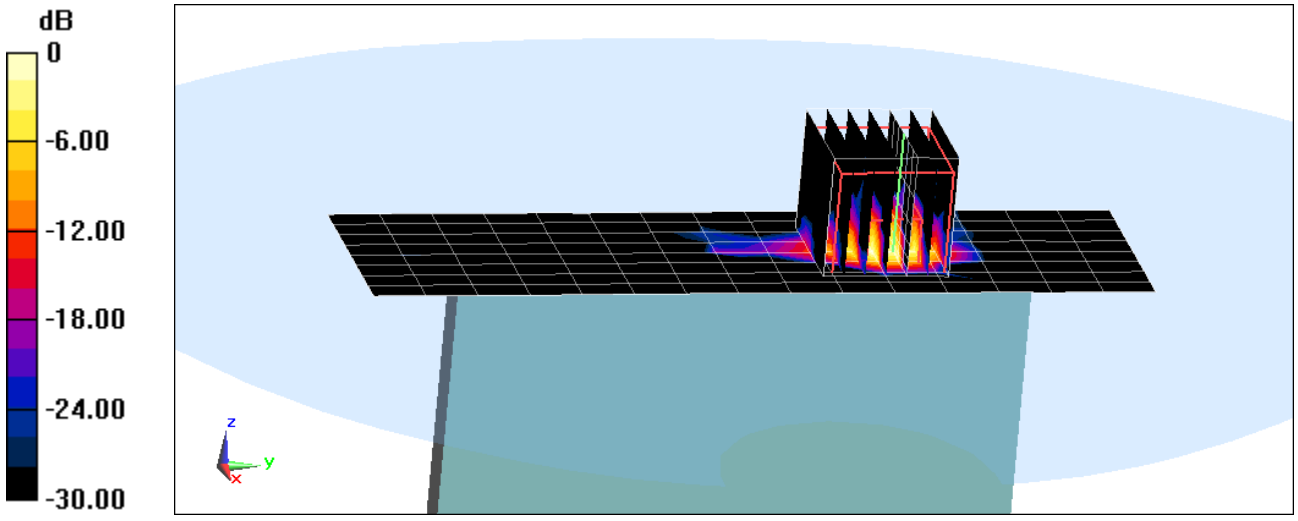
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5560 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5560 MHz; σ = 5.851 S/m; ε_r = 46.193; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-01-2013; Ambient Temp: 24.2°C; Tissue Temp: 23.2°C

Probe: EX3DV4 - SN3589; ConvF(3.32, 3.32, 3.32); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11a, 5.5 GHz, Body SAR, Ch 112, 6 Mbps, Bottom Side

Area Scan (9x16x1): Measurement grid: dx=5mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 10.723 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 6.12 W/kg
SAR(1 g) = 0.461 W/kg



0 dB = 1.52 W/kg = 1.82 dBW/kg

DUT: A3LSMT217S; Type: Portable Tablet; Serial: 276-1

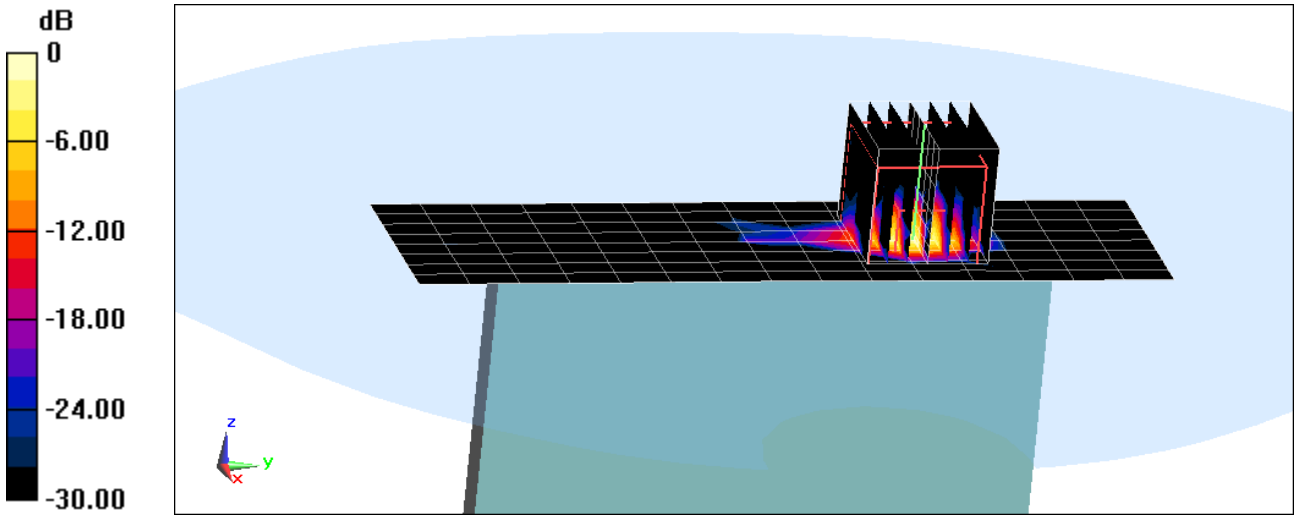
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5825 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5825 MHz; σ = 6.284 S/m; ε_r = 45.887; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-01-2013; Ambient Temp: 24.2°C; Tissue Temp: 23.2°C

Probe: EX3DV4 - SN3589; ConvF(3.66, 3.66, 3.66); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11a, 5.8 GHz, Body SAR, Ch 165, 6 Mbps, Bottom Side

Area Scan (9x16x1): Measurement grid: dx=5mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 10.125 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 8.47 W/kg
SAR(1 g) = 0.567 W/kg



0 dB = 1.98 W/kg = 2.97 dBW/kg

DUT: A3LSMT217S; Type: Portable Tablet; Serial: 276-1

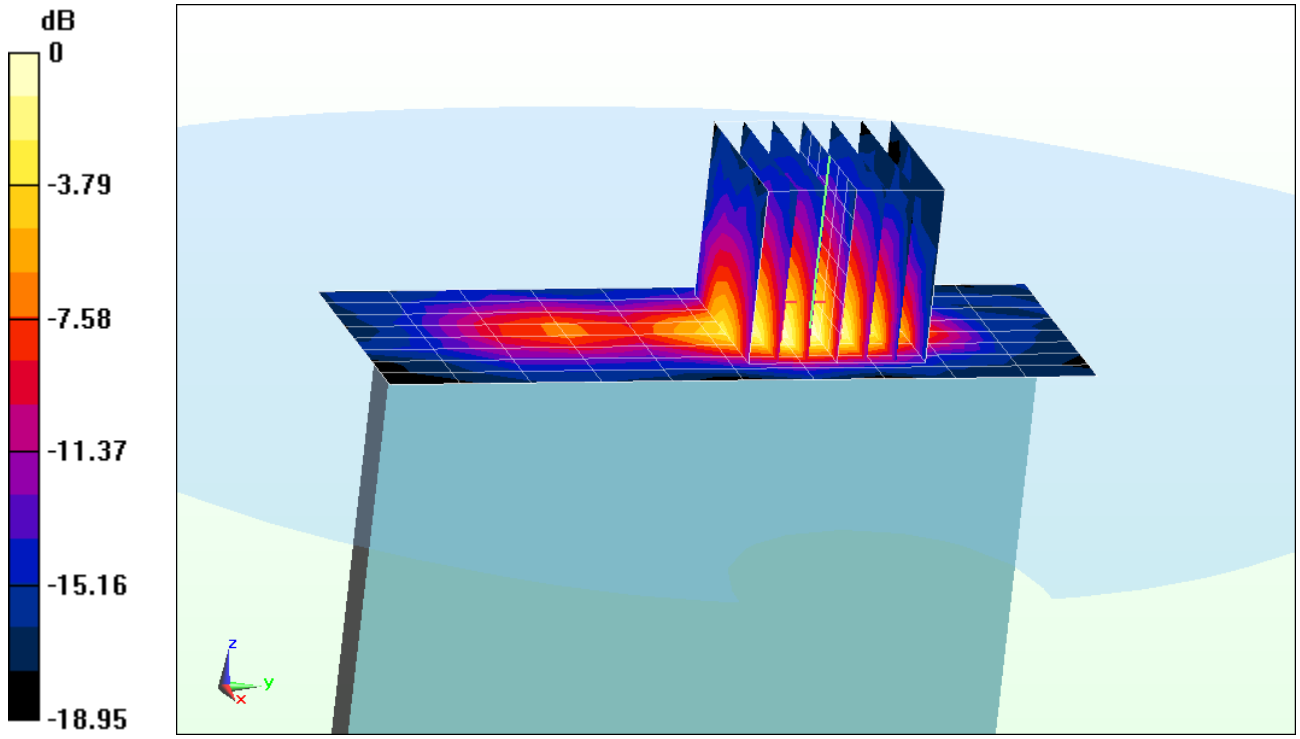
Communication System: Bluetooth; Frequency: 2441 MHz; Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2441 MHz; σ = 1.986 S/m; ε_r = 51.349; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 07-19-2013; Ambient Temp: 24.4°C; Tissue Temp: 23.9°C

Probe: EX3DV4 - SN3920; ConvF(7.07, 7.07, 7.07); Calibrated: 2/27/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/6/2013
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: Bluetooth, Body SAR, Ch 39, 1 Mbps, Bottom Edge

Area Scan (9x11x1): Measurement grid: dx=5mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.100 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.316 W/kg
SAR(1 g) = 0.146 W/kg



0 dB = 0.200 W/kg = -6.99 dBW/kg

APPENDIX B: SYSTEM VERIFICATION

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DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d132

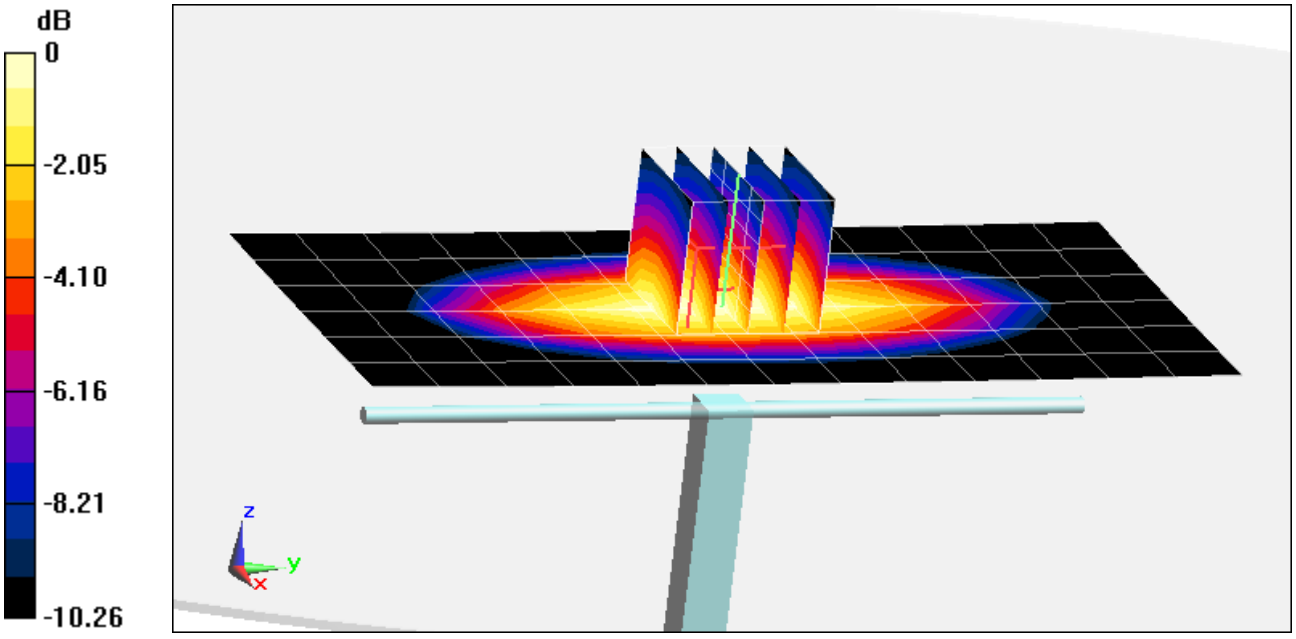
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used:
f = 835 MHz; σ = 1.011 S/m; ε_r = 55.799; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-08-2013; Ambient Temp: 24.5°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3209; ConvF(6.28, 6.28, 6.28); Calibrated: 3/15/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/8/2013
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.41 W/kg
SAR(1 g) = 0.975 W/kg
Deviation = 4.17%



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

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d080

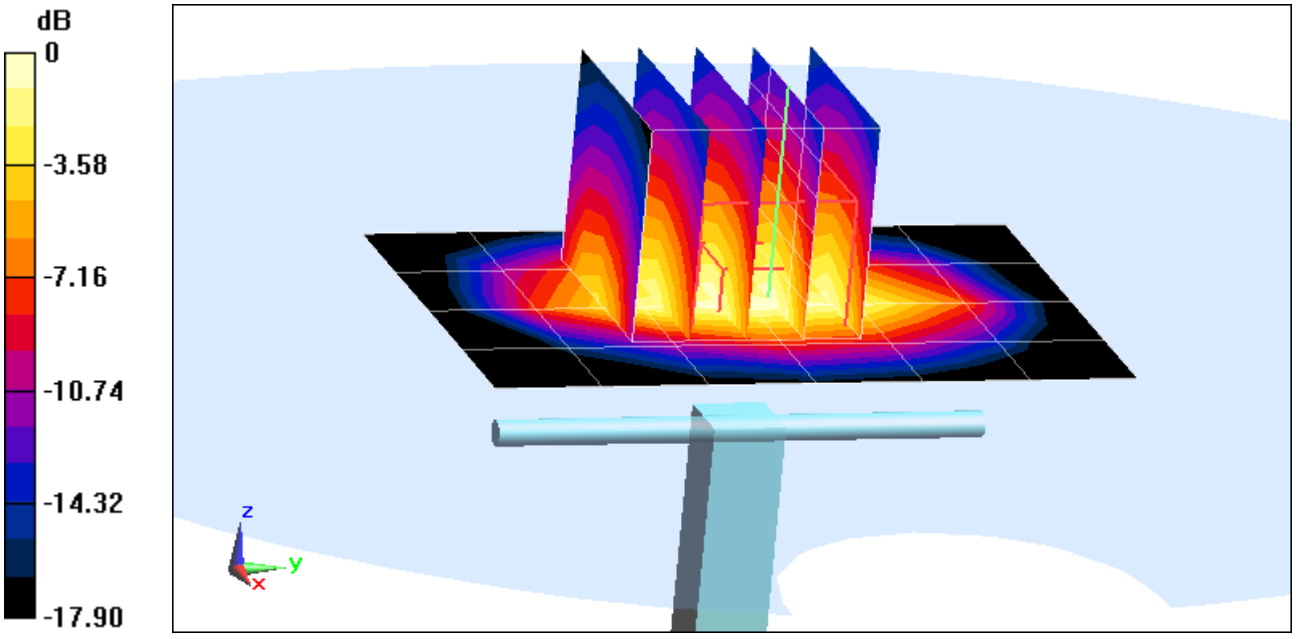
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.539 S/m; ε_r = 54.063; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2013; Ambient Temp: 23.2°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3287; ConvF(4.69, 4.69, 4.69); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

1900 MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 7.53 W/kg
SAR(1 g) = 4.25 W/kg
Deviation = 5.46%



0 dB = 4.66 W/kg = 6.68 dBW/kg

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DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 719

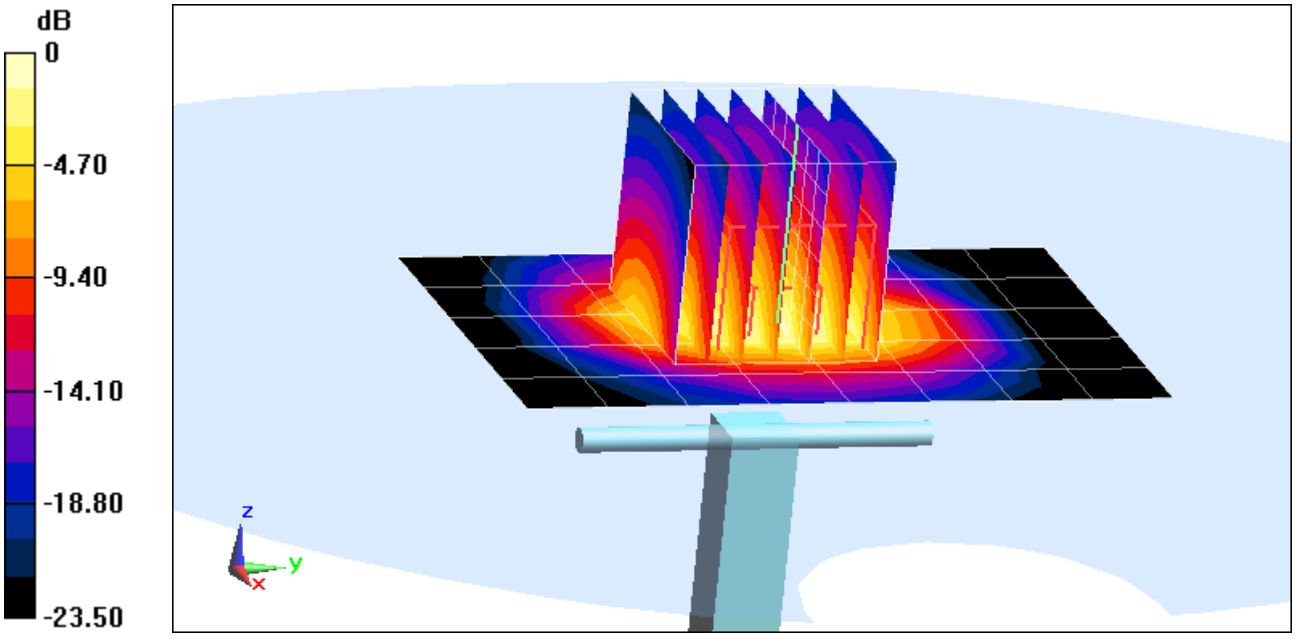
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used:
f = 2450 MHz; σ = 2.026 S/m; ε_r = 51.631; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-29-2013; Ambient Temp: 23.5°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3287; ConvF(4.29, 4.29, 4.29); Calibrated: 11/15/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

2450 MHz System Verification

Area Scan (6x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 11.3 W/kg
SAR(1 g) = 5.31 W/kg
Deviation = 2.91%



0 dB = 6.95 W/kg = 8.42 dBW/kg

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 797

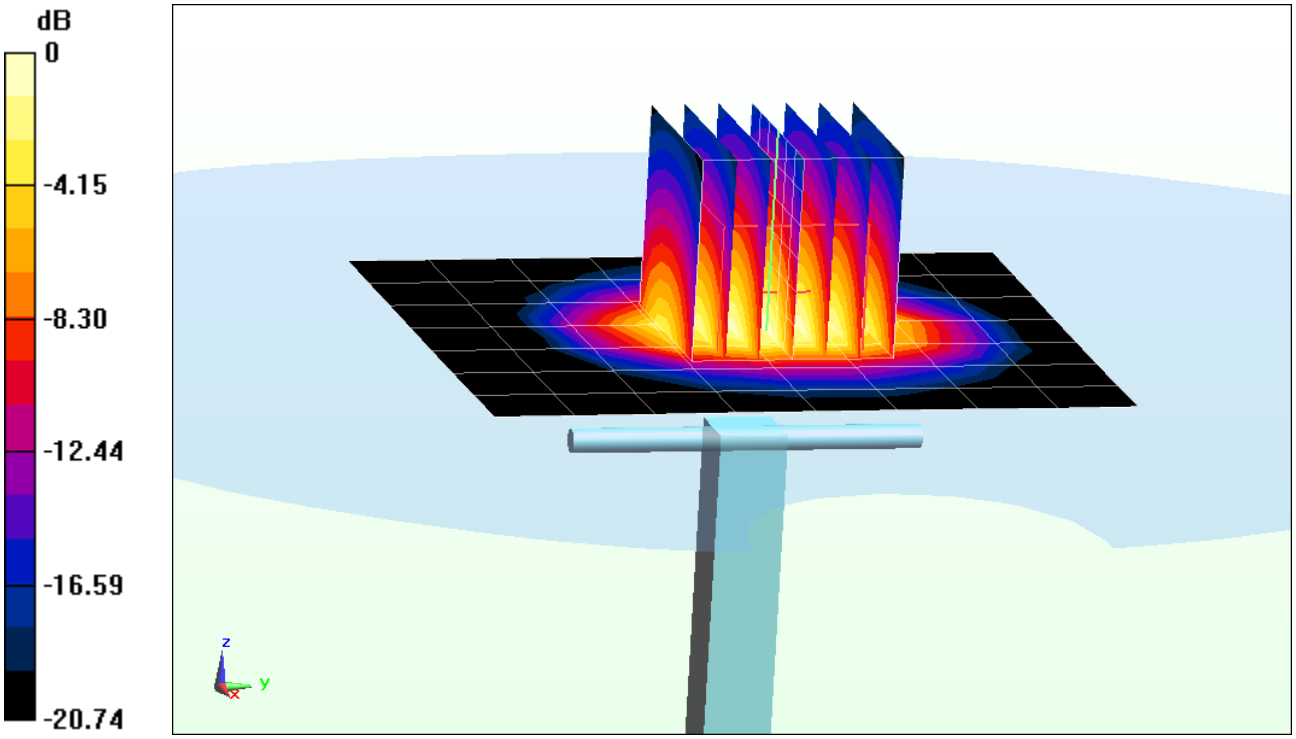
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used:
f = 2450 MHz; σ = 1.998 S/m; ε_r = 51.321; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-19-2013; Ambient Temp: 24.4°C; Tissue Temp: 23.9°C

Probe: EX3DV4 - SN3920; ConvF(7.07, 7.07, 7.07); Calibrated: 2/27/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/6/2013
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 10.3 W/kg
SAR(1 g) = 5.14 W/kg
Deviation = 3.63%



0 dB = 6.67 W/kg = 8.24 dBW/kg

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DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1057

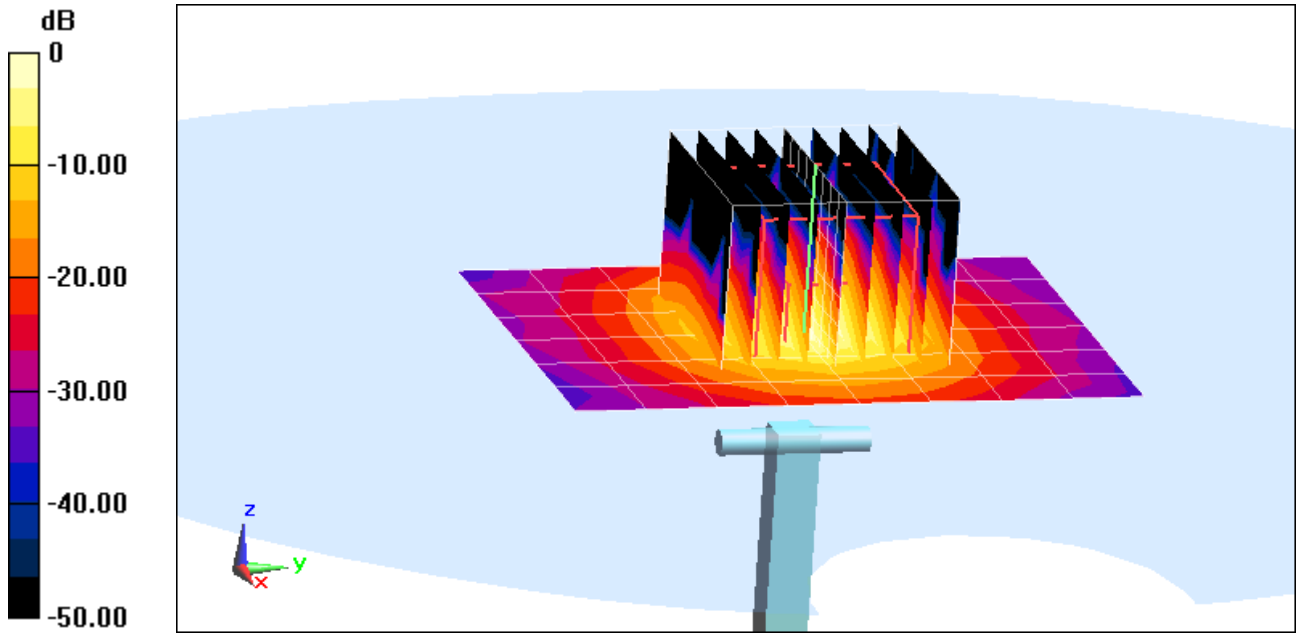
Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5200 MHz; σ = 5.335 S/m; ε_r = 47.08; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-01-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.1°C

Probe: EX3DV4 - SN3589; ConvF(3.99, 3.99, 3.99); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

5200 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 28.7 W/kg
SAR(1 g) = 7.51 W/kg
Deviation = -0.53%



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

DUT: Dipole 5300 MHz; Type: D5GHzV2; Serial: 1057

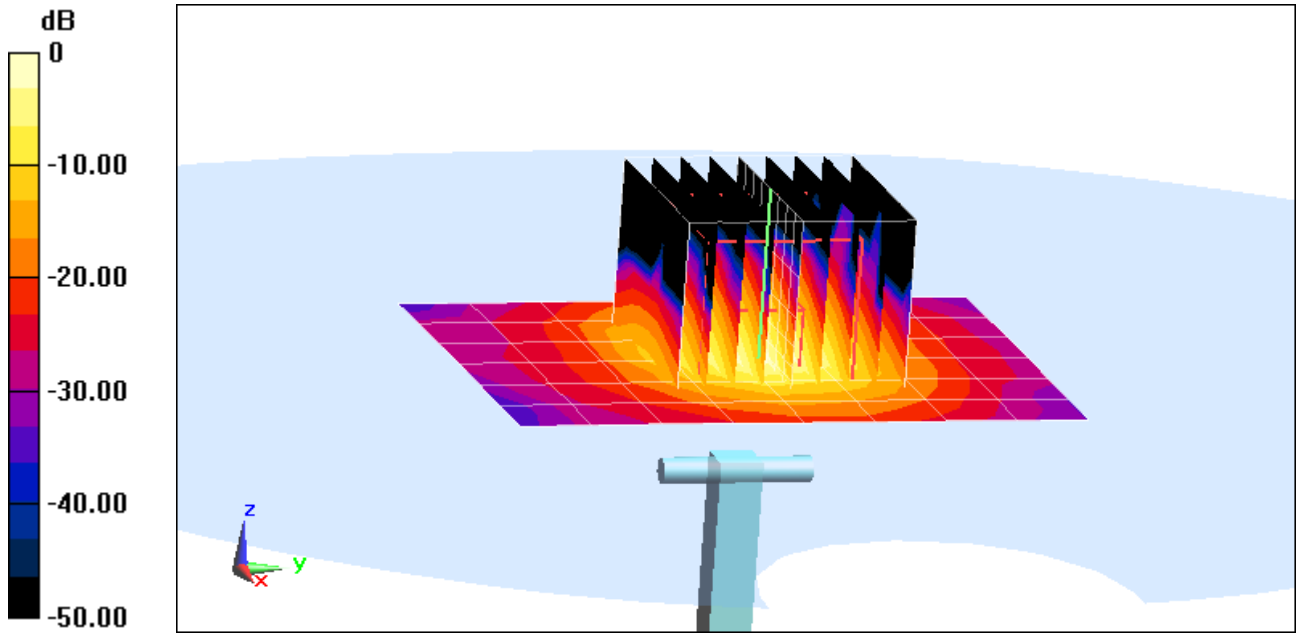
Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5300 MHz; σ = 5.438 S/m; ε_r = 46.81; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-01-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.1°C

Probe: EX3DV4 - SN3589; ConvF(3.81, 3.81, 3.81); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

5300 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 33.0 W/kg
SAR(1 g) = 7.98 W/kg
Deviation = 5.98%



0 dB = 19.1 W/kg = 12.81 dBW/kg

DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1057

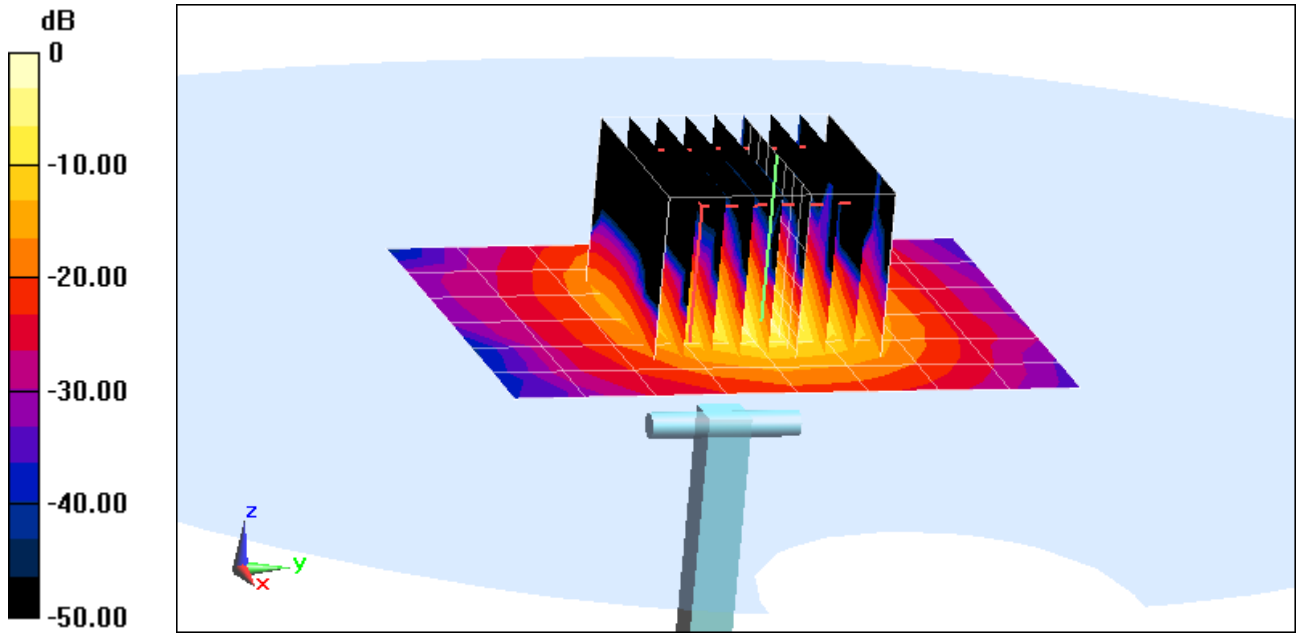
Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5500 MHz; σ = 5.732 S/m; ε_r = 46.335; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-01-2013; Ambient Temp: 24.2°C; Tissue Temp: 23.2°C

Probe: EX3DV4 - SN3589; ConvF(3.52, 3.52, 3.52); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

5500 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 39.7 W/kg
SAR(1 g) = 8.15 W/kg
Deviation = 0.87%



0 dB = 20.4 W/kg = 13.10 dBW/kg

DUT: Dipole 5600 MHz; Type: D5GHzV2; Serial: 1057

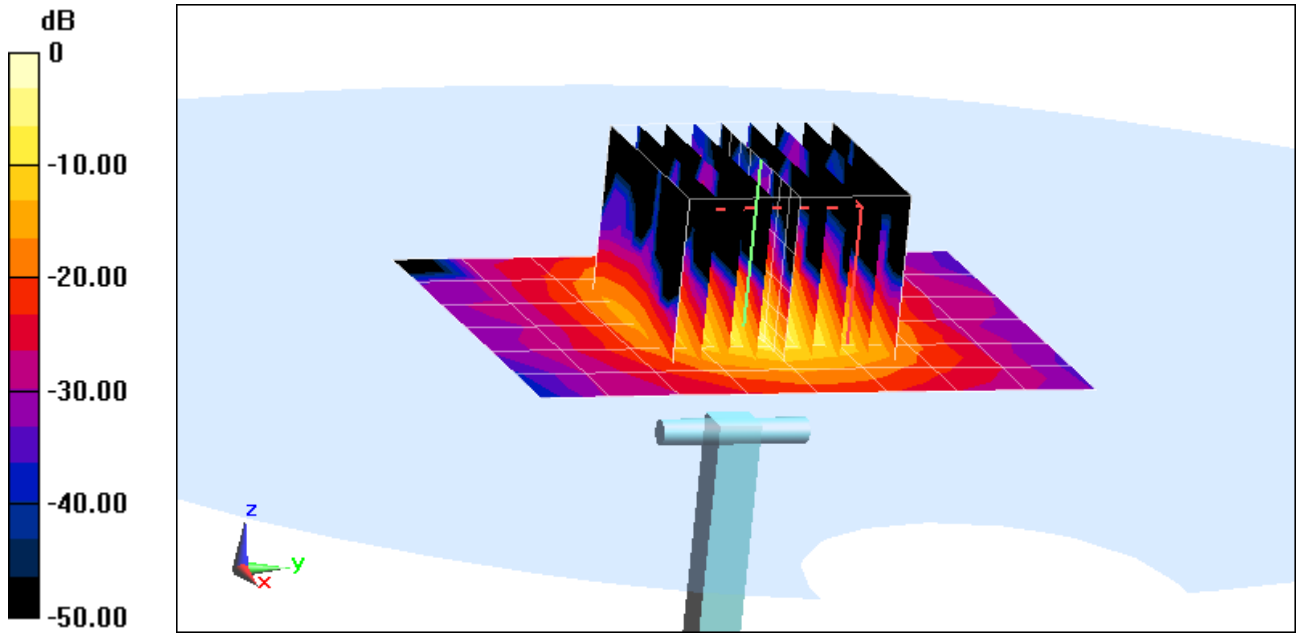
Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5600 MHz; σ = 5.914 S/m; ε_r = 46.136; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-01-2013; Ambient Temp: 24.2°C; Tissue Temp: 23.2°C

Probe: EX3DV4 - SN3589; ConvF(3.32, 3.32, 3.32); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

5600 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan 2 (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power = 20. 0 dBm (100 mW)
Peak SAR (extrapolated) = 40.9 W/kg
SAR(1 g) = 8.44 W/kg
Deviation = 5.11%



0 dB = 21.4 W/kg = 13.30 dBW/kg

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057

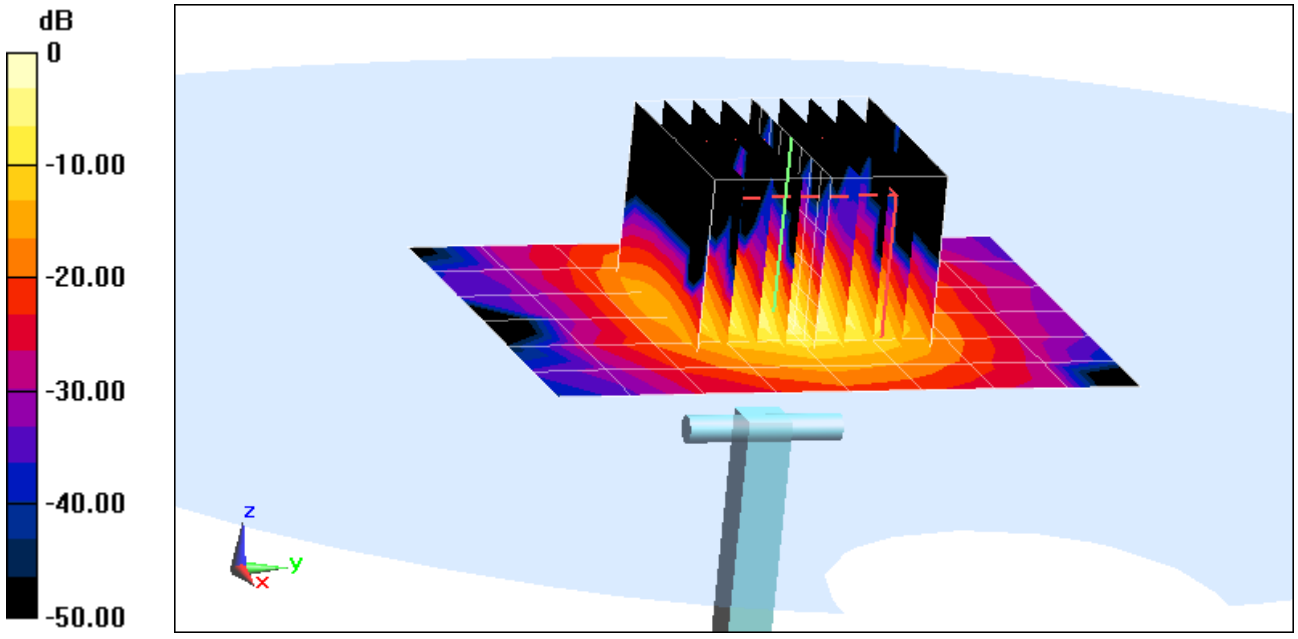
Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5800 MHz; σ = 6.224 S/m; ε_r = 45.956; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-01-2013; Ambient Temp: 24.2°C; Tissue Temp: 23.2°C

Probe: EX3DV4 - SN3589; ConvF(3.66, 3.66, 3.66); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

5800 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 32.2 W/kg
SAR(1 g) = 7.2 W/kg
Deviation = -4.13%



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

APPENDIX C: PROBE CALIBRATION

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

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

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

Accreditation No.: SCS 108

Client **PC Test**

Certificate No: ES3-3209_Mar13

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3209

Calibration procedure(s) QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: March 15, 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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
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	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 15, 2013

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

80244

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)
Accreditation No.: SCS 108

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3209

Manufactured: October 14, 2008
Calibrated: March 15, 2013

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.35	1.33	1.14	± 10.1 %
DCP (mV)[B]	99.2	97.8	98.3	

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	163.6	±3.5 %
		Y	0.0	0.0	1.0		170.3	
		Z	0.0	0.0	1.0		158.7	

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

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)
750	41.9	0.89	6.74	6.74	6.74	0.76	1.18	± 12.0 %
835	41.5	0.90	6.46	6.46	6.46	0.31	1.81	± 12.0 %
1750	40.1	1.37	5.39	5.39	5.39	0.80	1.21	± 12.0 %
1900	40.0	1.40	5.21	5.21	5.21	0.78	1.26	± 12.0 %
2450	39.2	1.80	4.57	4.57	4.57	0.65	1.43	± 12.0 %
2600	39.0	1.96	4.43	4.43	4.43	0.75	1.36	± 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:3209

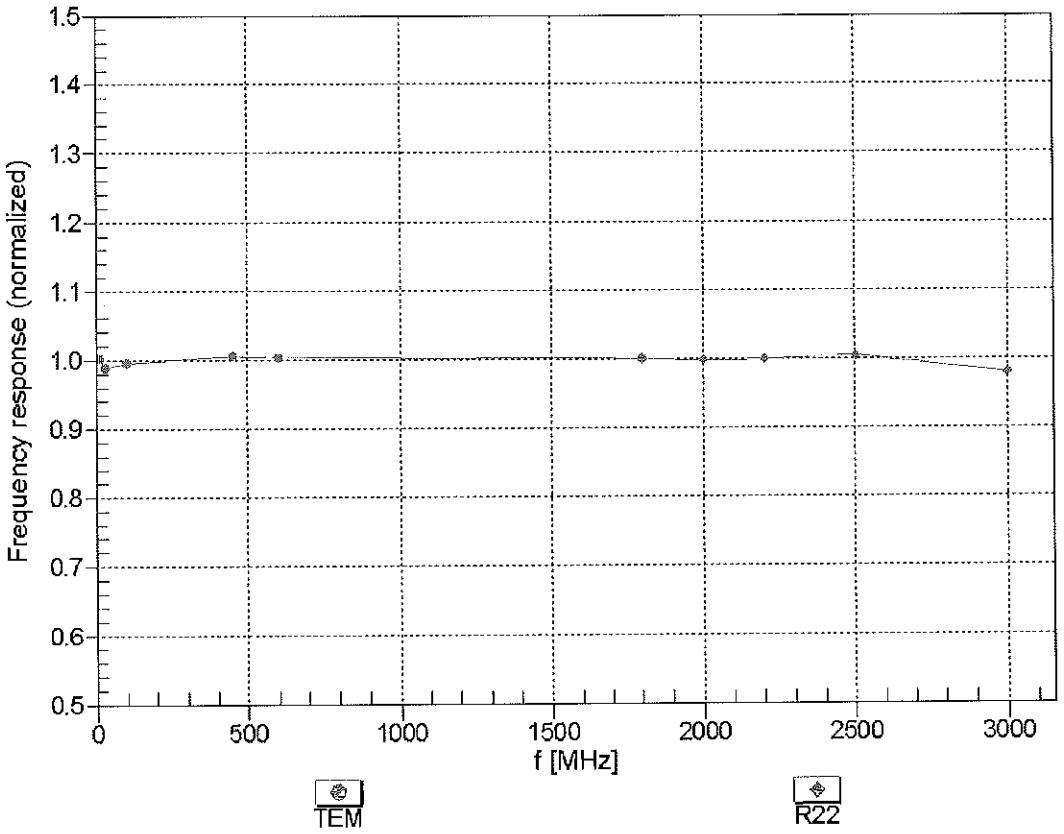
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.38	6.38	6.38	0.80	1.16	± 12.0 %
835	55.2	0.97	6.28	6.28	6.28	0.52	1.45	± 12.0 %
1750	53.4	1.49	5.03	5.03	5.03	0.58	1.45	± 12.0 %
1900	53.3	1.52	4.77	4.77	4.77	0.70	1.36	± 12.0 %
2450	52.7	1.95	4.34	4.34	4.34	0.80	1.15	± 12.0 %
2600	52.5	2.16	4.11	4.11	4.11	0.80	1.00	± 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

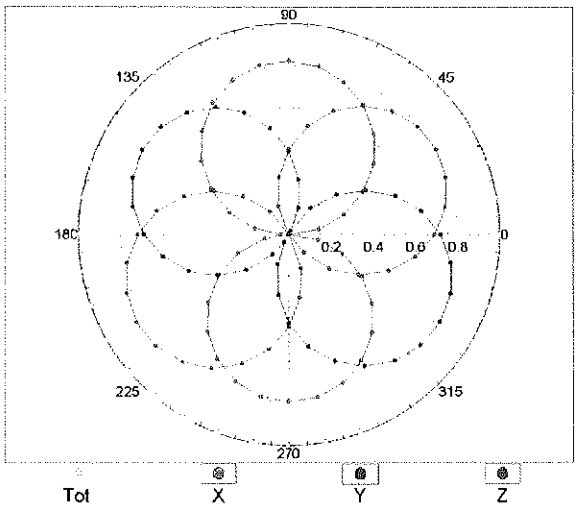
(TEM-Cell:ifi110 EXX, Waveguide: R22)



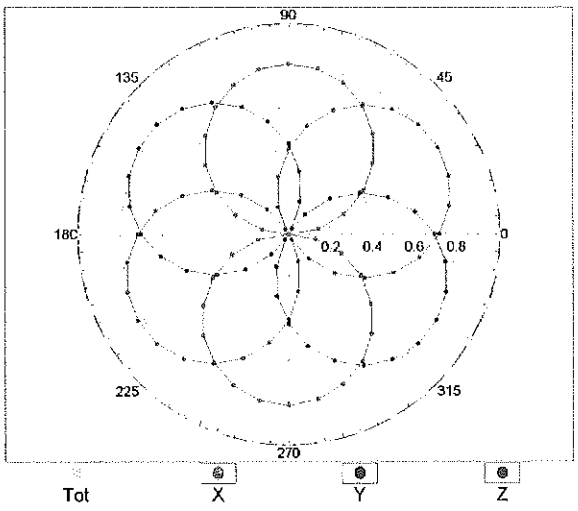
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

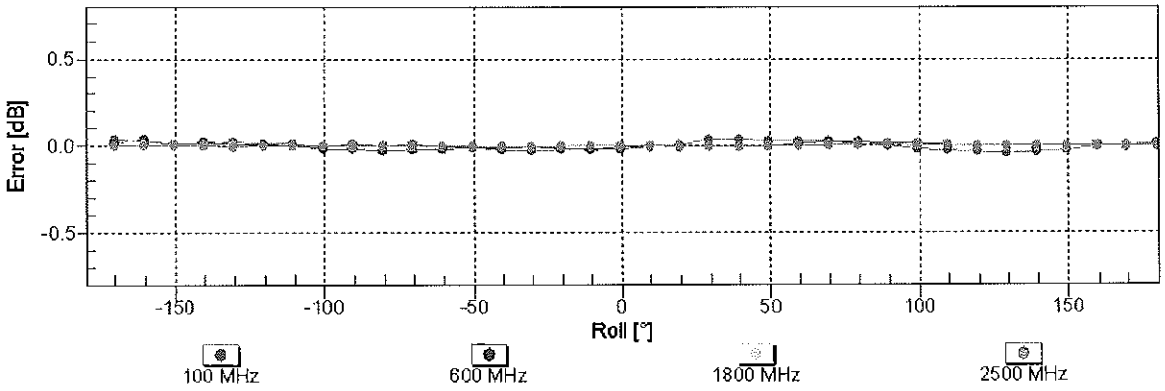
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



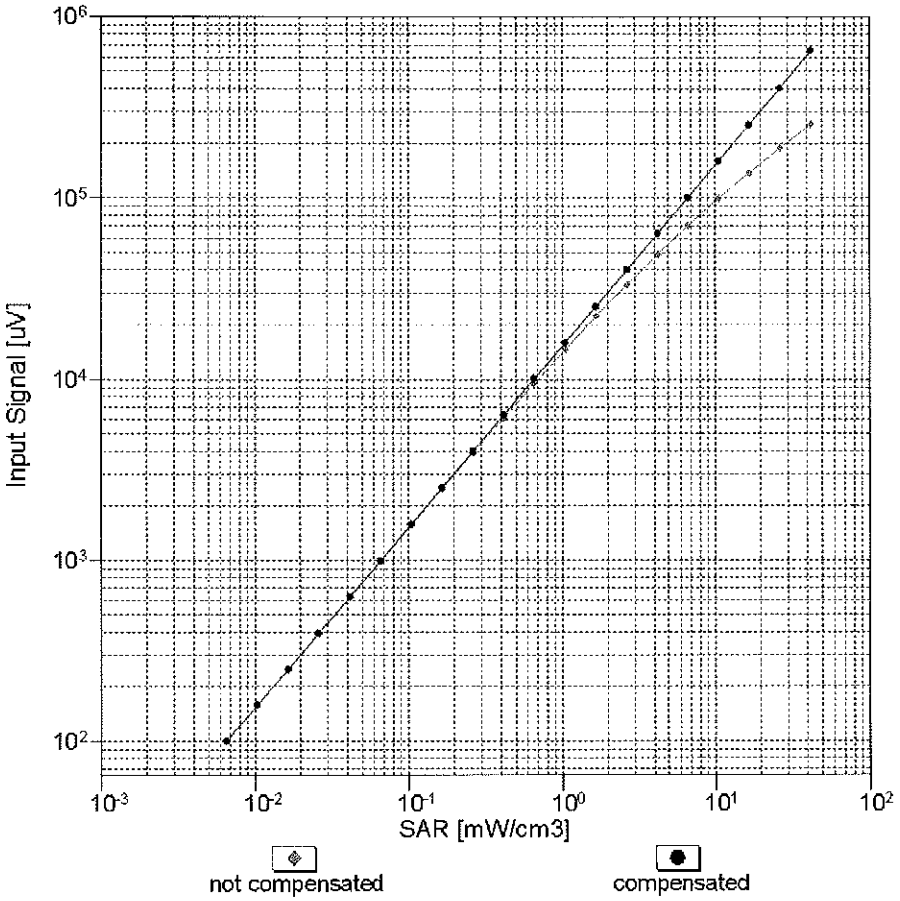
f=1800 MHz,R22

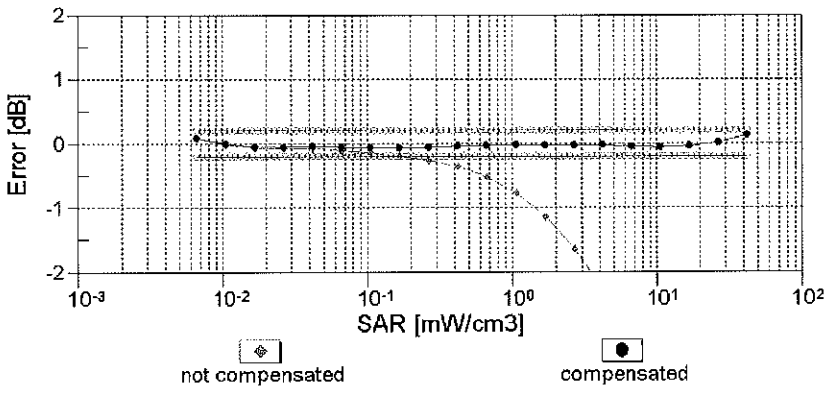




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

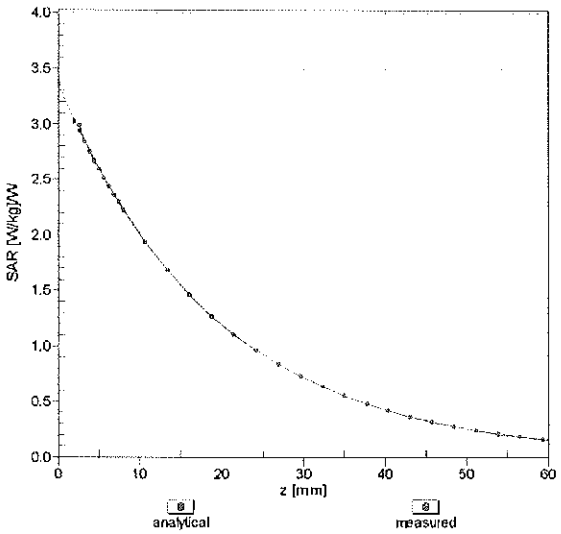




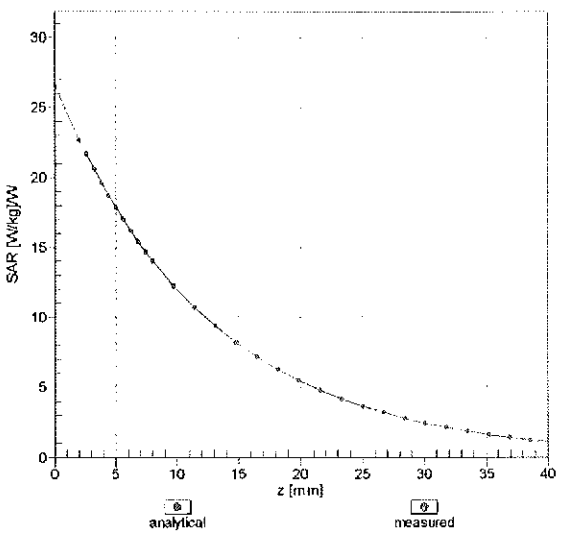
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

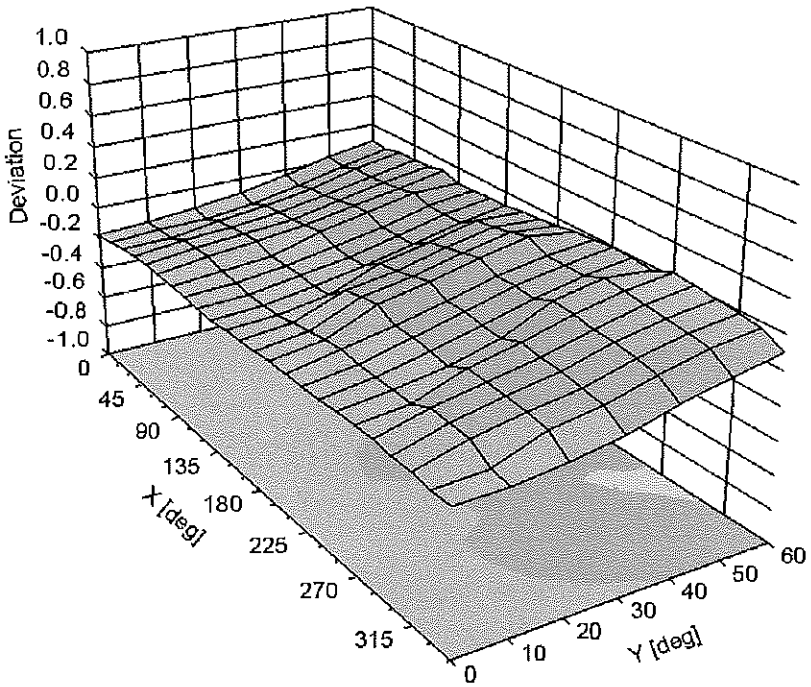


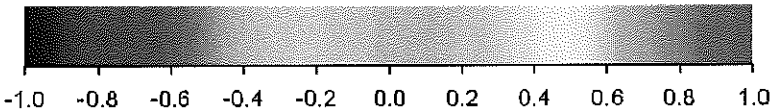
f = 1750 MHz,WGLS R22 (H_convF)



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:3209

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-40.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: ES3-3287_Nov12

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3287

Calibration procedure(s): QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: November 15, 2012

OK 11/20/12

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: November 16, 2012

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

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Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	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, 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 $f \leq 800$ 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:3287

Manufactured: June 7, 2010
Calibrated: November 15, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3287

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.31	1.25	1.25	± 10.1 %
DCP (mV)[B]	102.9	103.6	101.6	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.0	0.0	1.0	116.8	±3.5 %
			Y	0.0	0.0	1.0	118.5	
			Z	0.0	0.0	1.0	154.1	

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3287

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)
750	41.9	0.89	6.40	6.40	6.40	0.20	2.54	± 12.0 %
835	41.5	0.90	6.17	6.17	6.17	0.34	1.68	± 12.0 %
1750	40.1	1.37	5.16	5.16	5.16	0.63	1.30	± 12.0 %
1900	40.0	1.40	4.96	4.96	4.96	0.48	1.55	± 12.0 %
2450	39.2	1.80	4.30	4.30	4.30	0.79	1.31	± 12.0 %
2600	39.0	1.96	4.19	4.19	4.19	0.80	1.31	± 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.

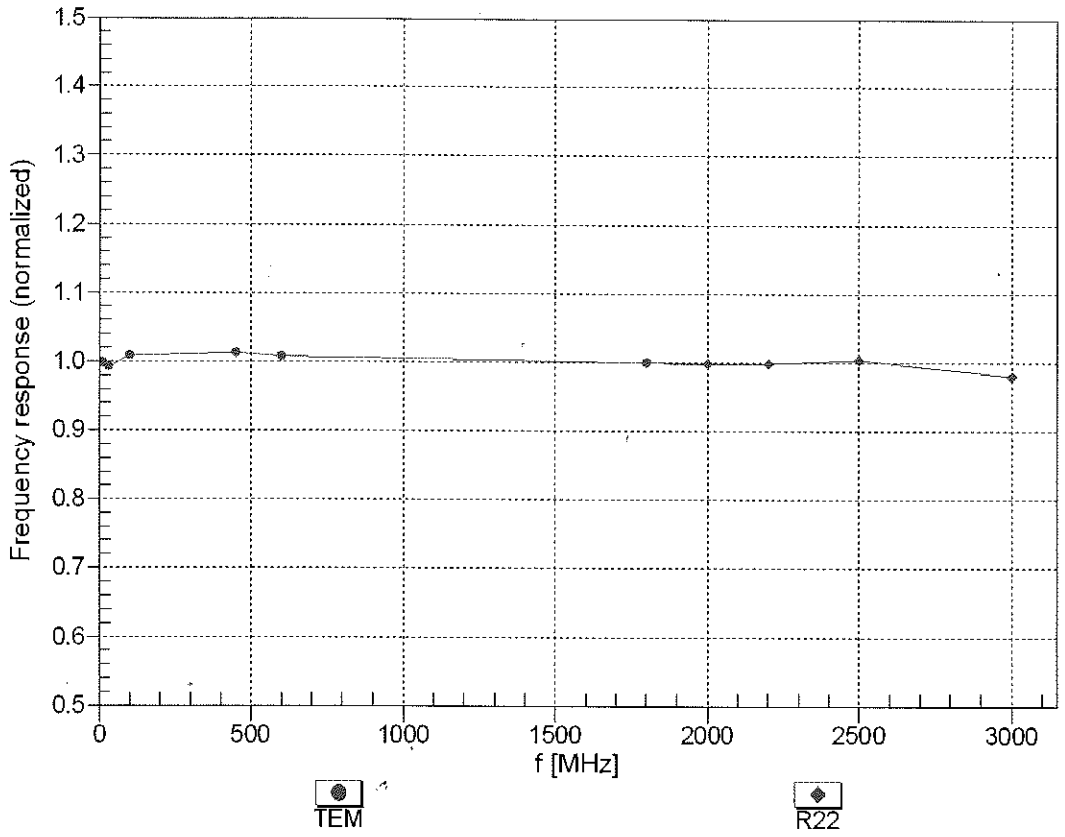
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3287

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)
750	55.5	0.96	6.14	6.14	6.14	0.28	2.06	± 12.0 %
835	55.2	0.97	6.06	6.06	6.06	0.42	1.63	± 12.0 %
1750	53.4	1.49	4.86	4.86	4.86	0.43	1.64	± 12.0 %
1900	53.3	1.52	4.69	4.69	4.69	0.56	1.54	± 12.0 %
2450	52.7	1.95	4.29	4.29	4.29	0.80	1.02	± 12.0 %
2600	52.5	2.16	4.12	4.12	4.12	0.64	0.92	± 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.

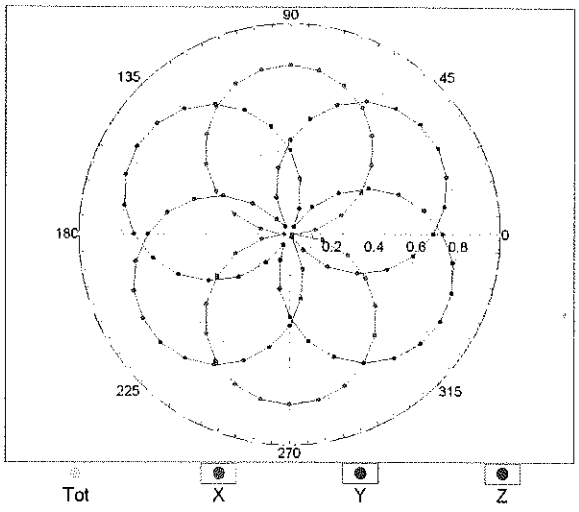
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



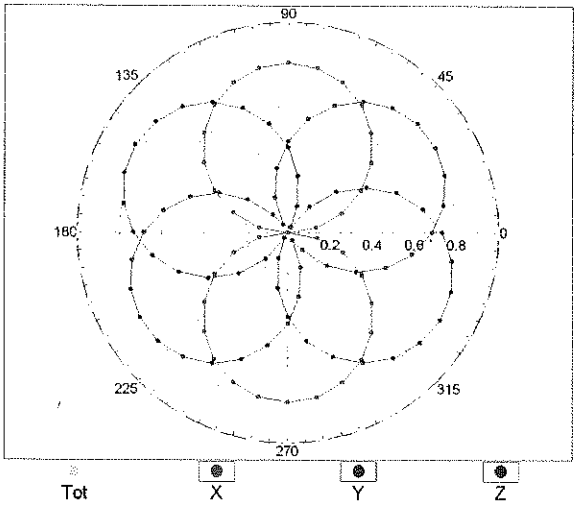
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

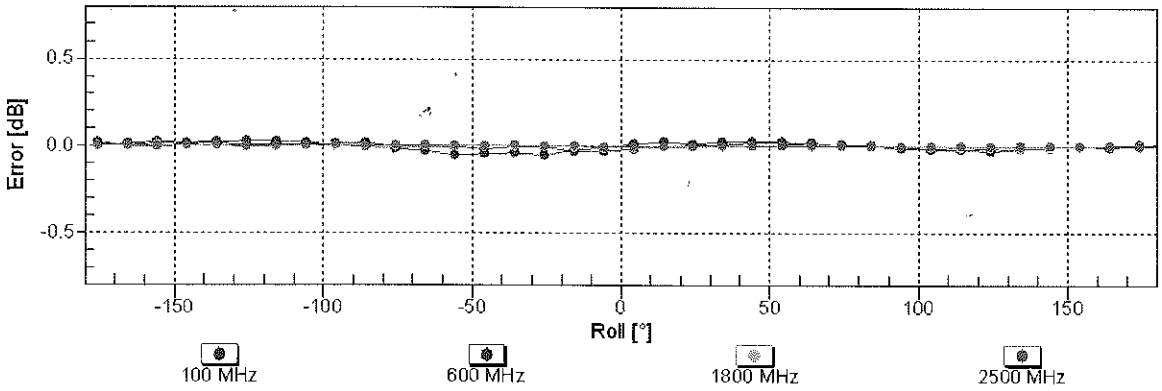
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



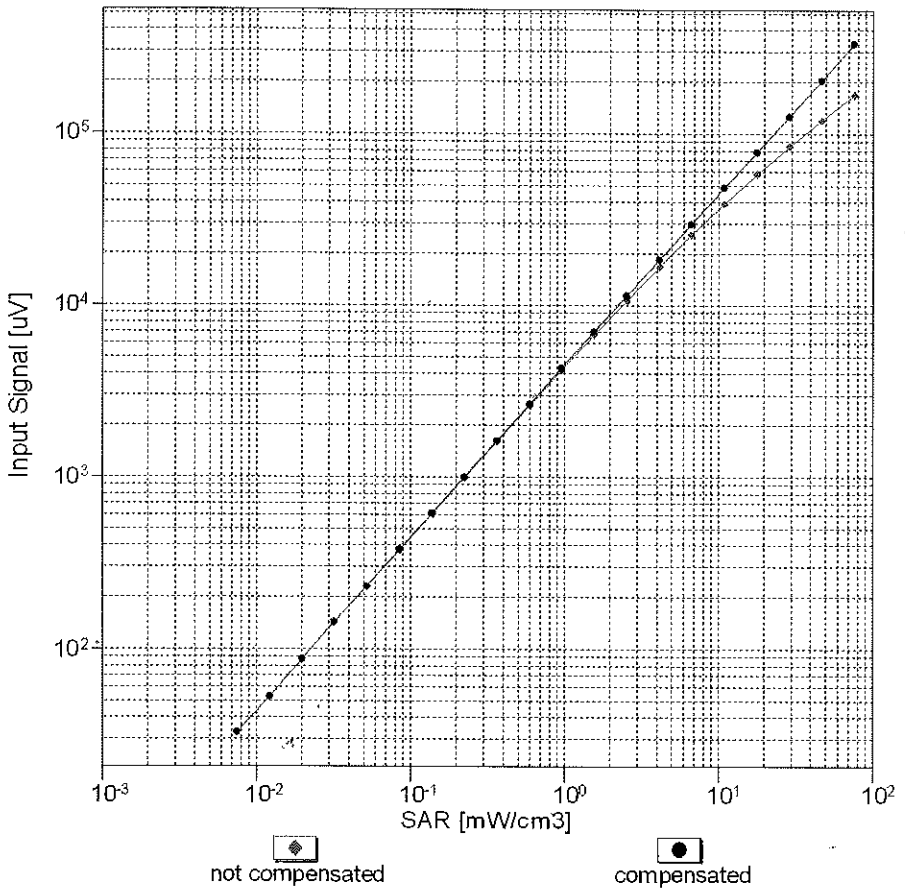
f=1800 MHz,R22

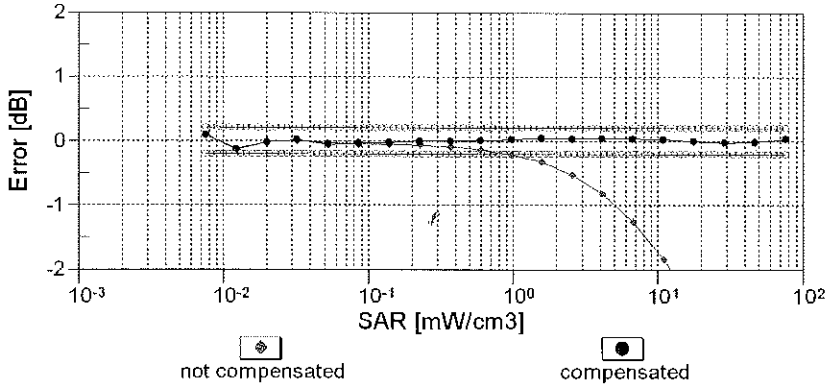




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

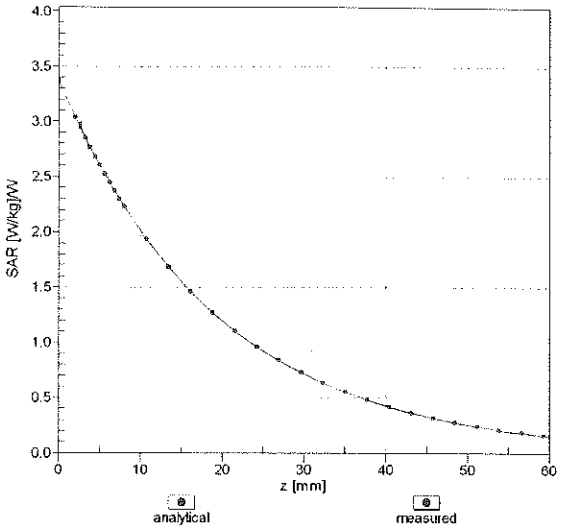




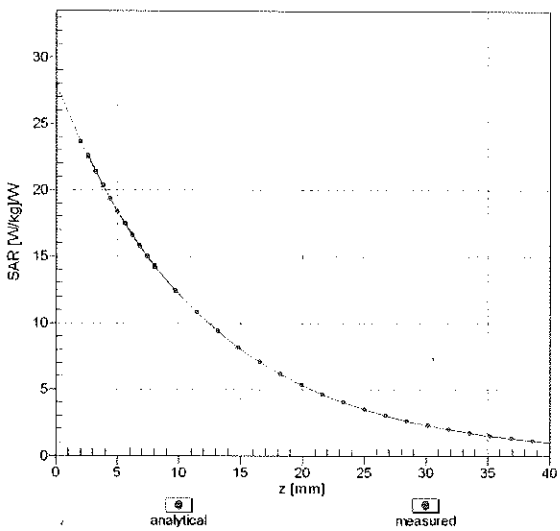
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

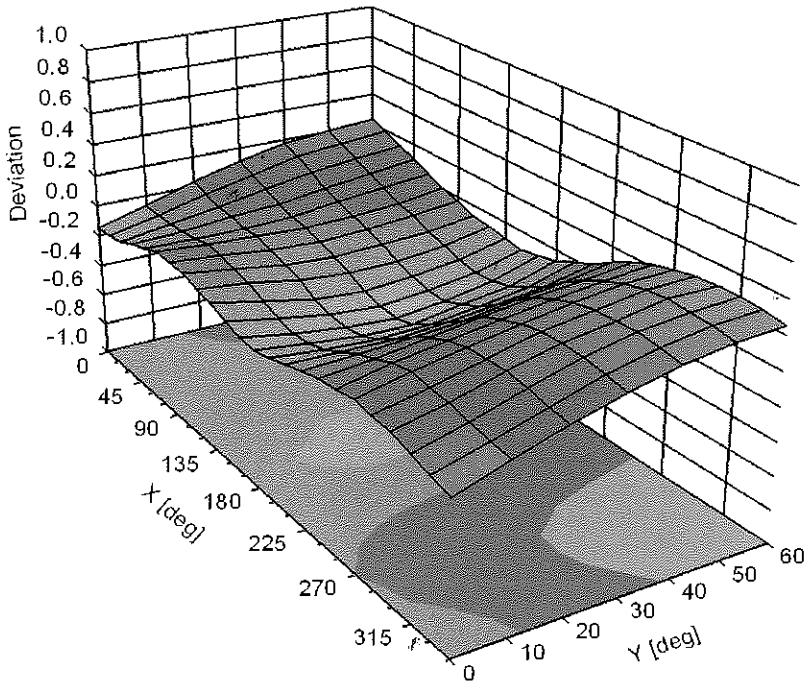


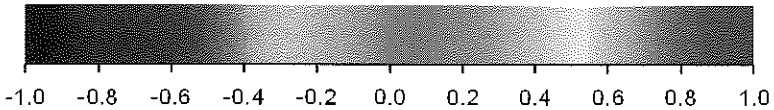
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3287

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-15.9
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

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Accreditation No.: SCS 108

Client PC Test

Certificate No: EX3-3920_Feb13/2

CALIBRATION CERTIFICATE (Replacement of No: EX3-3920_Feb13)

Object	EX3DV4 - SN:3920
Calibration procedure(s)	QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	February 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%.

✓ KK 3/22/13

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: March 5, 2013

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Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ 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 $\vartheta = 0$ ($f \le 900$ 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 $f \le 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe EX3DV4

SN:3920

Manufactured: December 18, 2012
Calibrated: February 27, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3920

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.34	0.50	0.50	± 10.1 %
DCP (mV)[B]	101.2	101.0	99.1	

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	134.3	±3.3 %
		Y	0.0	0.0	1.0		164.7	
		Z	0.0	0.0	1.0		161.4	

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:3920

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)
750	41.9	0.89	9.86	9.86	9.86	0.19	1.39	± 12.0 %
835	41.5	0.90	9.58	9.58	9.58	0.77	0.54	± 12.0 %
1750	40.1	1.37	7.97	7.97	7.97	0.57	0.69	± 12.0 %
1900	40.0	1.40	7.73	7.73	7.73	0.54	0.73	± 12.0 %
2450	39.2	1.80	7.04	7.04	7.04	0.40	0.82	± 12.0 %
2600	39.0	1.96	6.80	6.80	6.80	0.49	0.76	± 12.0 %
5200	36.0	4.66	4.87	4.87	4.87	0.35	1.80	± 13.1 %
5300	35.9	4.76	4.73	4.73	4.73	0.37	1.80	± 13.1 %
5500	35.6	4.96	4.52	4.52	4.52	0.39	1.80	± 13.1 %
5600	35.5	5.07	4.17	4.17	4.17	0.50	1.80	± 13.1 %
5800	35.3	5.27	4.02	4.02	4.02	0.45	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.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3920

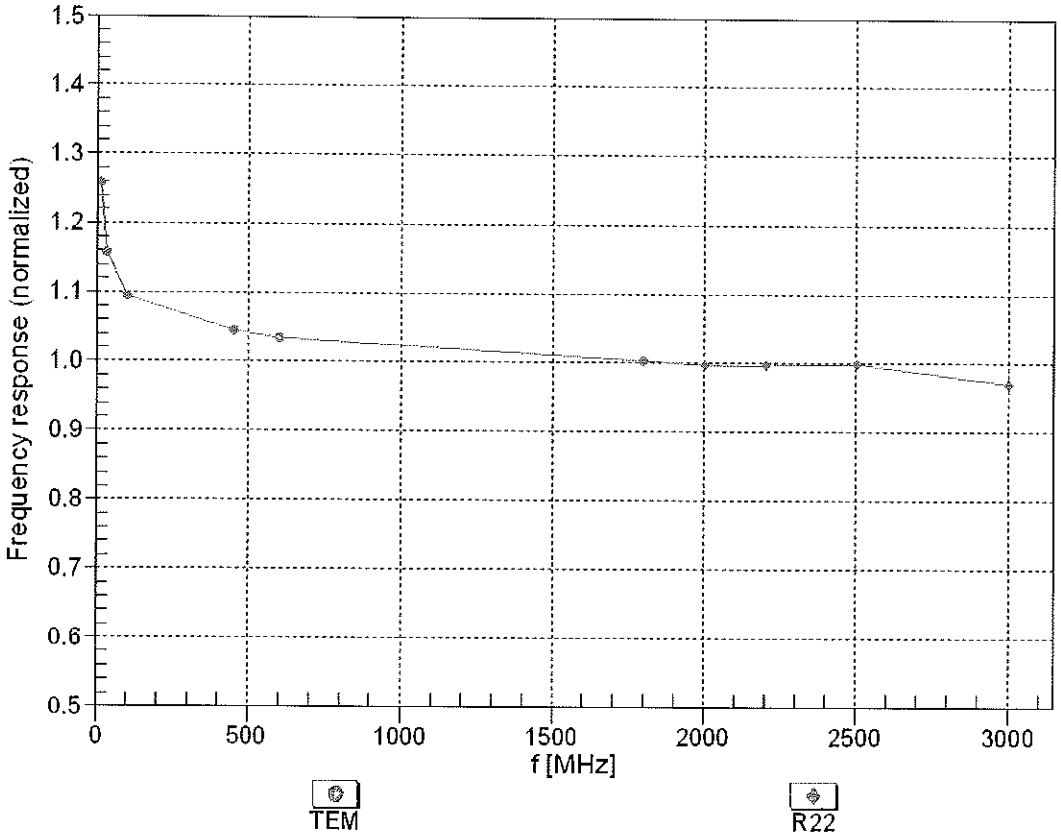
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	9.57	9.57	9.57	0.43	0.83	± 12.0 %
835	55.2	0.97	9.42	9.42	9.42	0.36	0.98	± 12.0 %
1750	53.4	1.49	7.59	7.59	7.59	0.43	0.78	± 12.0 %
1900	53.3	1.52	7.38	7.38	7.38	0.33	0.91	± 12.0 %
2450	52.7	1.95	7.07	7.07	7.07	0.80	0.55	± 12.0 %
2600	52.5	2.16	6.73	6.73	6.73	0.80	0.56	± 12.0 %
5200	49.0	5.30	4.23	4.23	4.23	0.51	1.90	± 13.1 %
5300	48.9	5.42	4.13	4.13	4.13	0.49	1.90	± 13.1 %
5500	48.6	5.65	3.63	3.63	3.63	0.52	1.90	± 13.1 %
5600	48.5	5.77	3.62	3.62	3.62	0.49	1.90	± 13.1 %
5800	48.2	6.00	3.91	3.91	3.91	0.54	1.90	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field

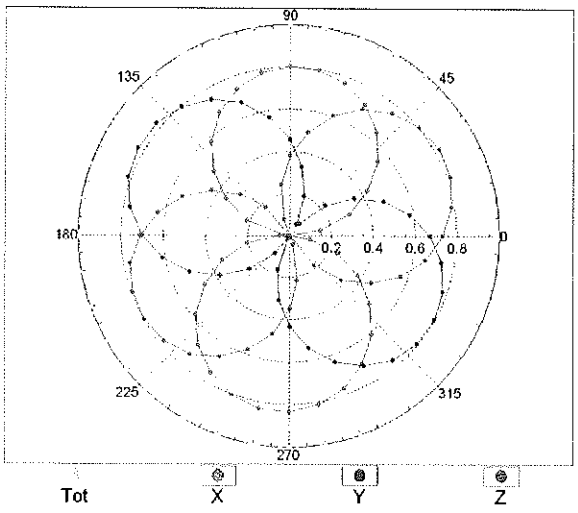
(TEM-Cell:ifi110 EXX, Waveguide: R22)



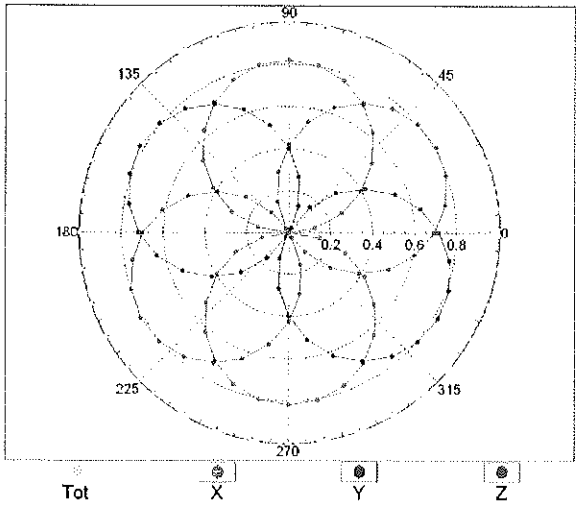
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

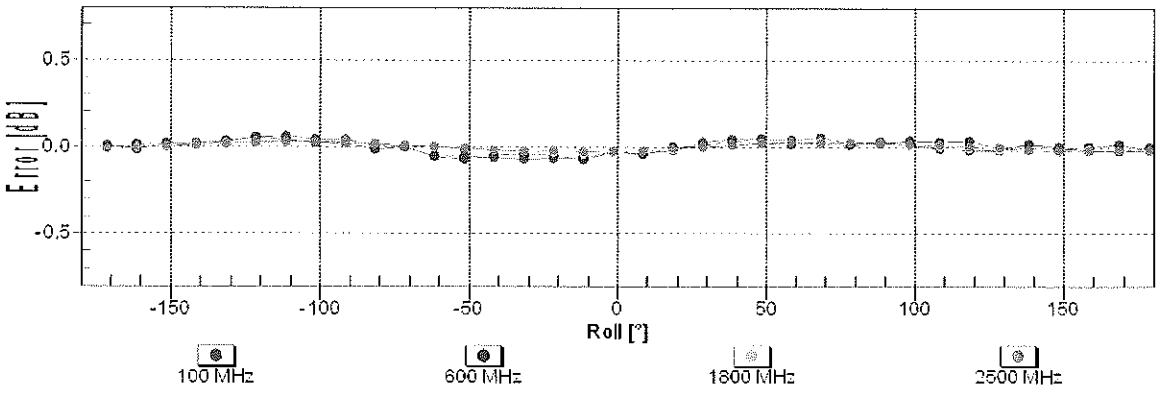
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



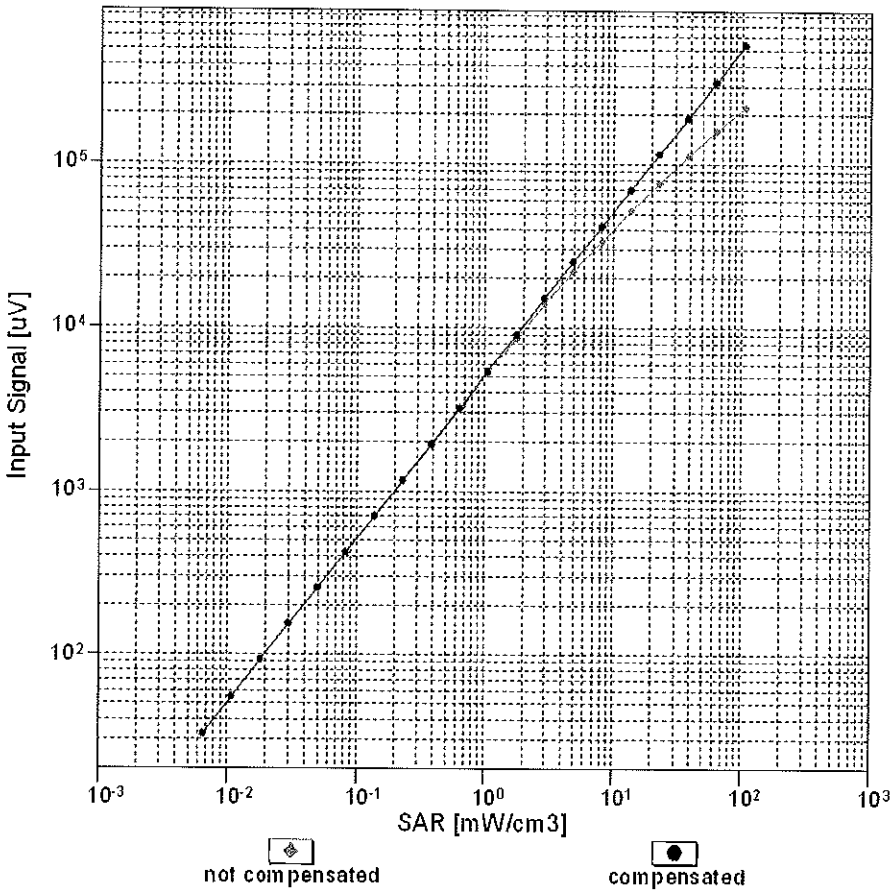
f=1800 MHz,R22

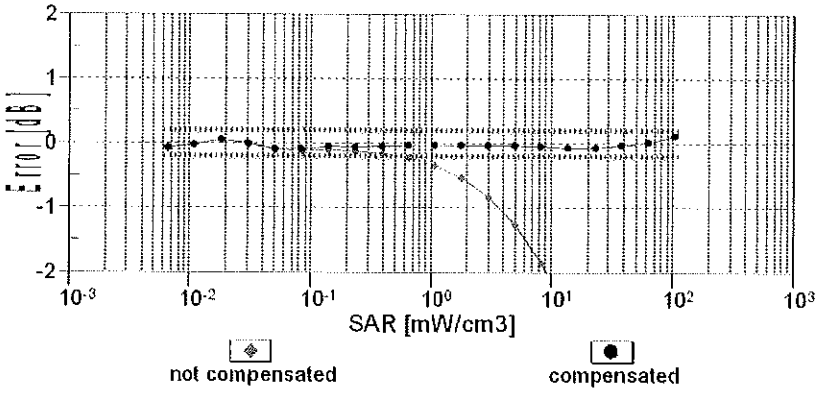




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

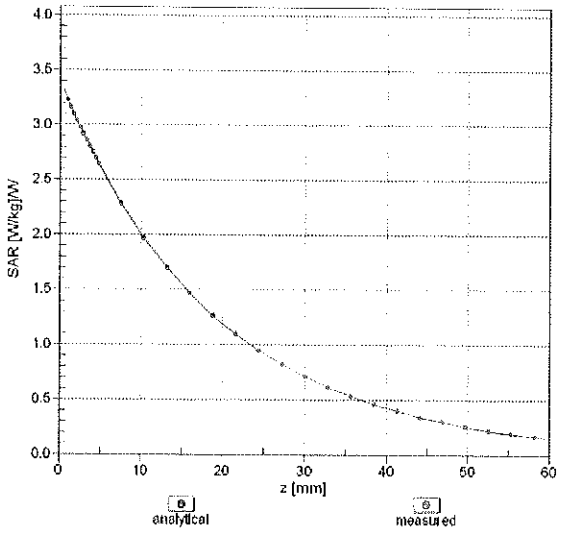




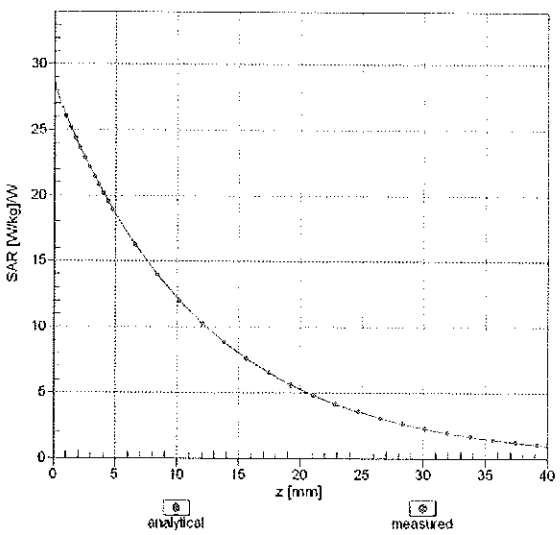
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

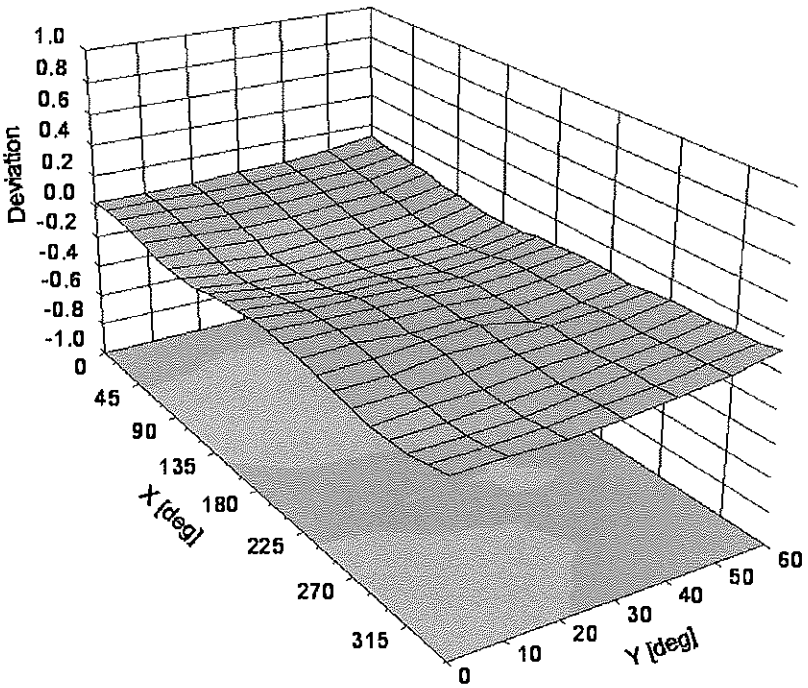


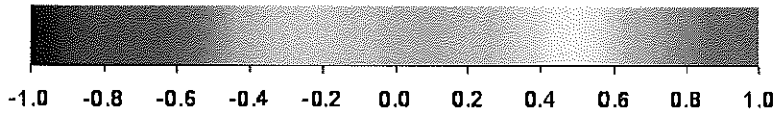
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3920

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-21.6
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
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 PC Test

Certificate No: EX3-3589_Jan13

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3589

Calibration procedure(s): QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: January 17, 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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: January 17, 2013

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

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) **Accreditation No.: SCS 108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

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 EX3DV4

SN:3589

Manufactured: March 30, 2006
Calibrated: January 17, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.46	0.40	0.40	± 10.1 %
DCP (mV)[B]	100.5	103.8	99.6	

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	165.8	±3.3 %
		Y	0.0	0.0	1.0		134.3	
		Z	0.0	0.0	1.0		140.5	

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 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:3589

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)
750	41.9	0.89	8.70	8.70	8.70	0.39	0.96	± 12.0 %
835	41.5	0.90	8.40	8.40	8.40	0.52	0.74	± 12.0 %
1750	40.1	1.37	7.34	7.34	7.34	0.45	0.93	± 12.0 %
1900	40.0	1.40	7.09	7.09	7.09	0.80	0.65	± 12.0 %
2450	39.2	1.80	6.37	6.37	6.37	0.39	0.97	± 12.0 %
2600	39.0	1.96	6.19	6.19	6.19	0.30	1.12	± 12.0 %
5200	36.0	4.66	4.48	4.48	4.48	0.45	1.80	± 13.1 %
5300	35.9	4.76	4.27	4.27	4.27	0.45	1.80	± 13.1 %
5500	35.6	4.96	4.14	4.14	4.14	0.50	1.80	± 13.1 %
5600	35.5	5.07	3.81	3.81	3.81	0.55	1.80	± 13.1 %
5800	35.3	5.27	3.85	3.85	3.85	0.55	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.

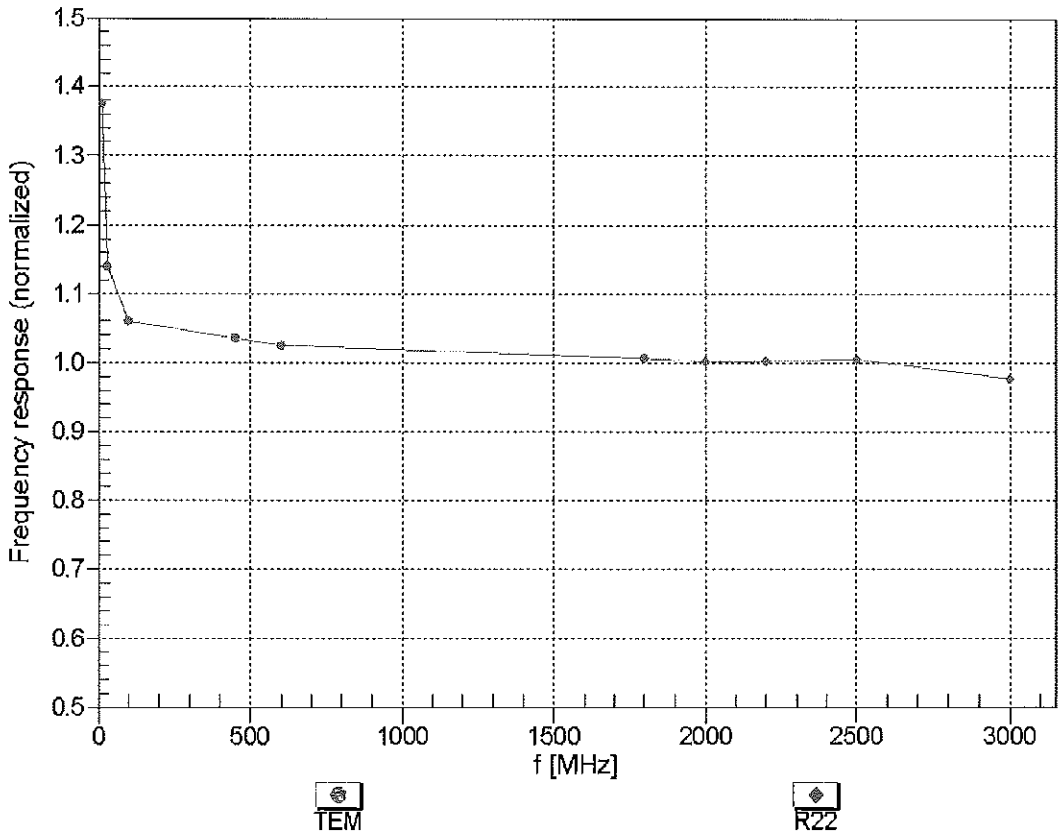
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589

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)
750	55.5	0.96	8.59	8.59	8.59	0.49	0.86	± 12.0 %
835	55.2	0.97	8.43	8.43	8.43	0.38	1.05	± 12.0 %
1750	53.4	1.49	7.87	7.87	7.87	0.44	0.89	± 12.0 %
1900	53.3	1.52	7.46	7.46	7.46	0.58	0.75	± 12.0 %
2450	52.7	1.95	7.07	7.07	7.07	0.80	0.50	± 12.0 %
2600	52.5	2.16	6.68	6.68	6.68	0.80	0.50	± 12.0 %
5200	49.0	5.30	3.99	3.99	3.99	0.50	1.90	± 13.1 %
5300	48.9	5.42	3.81	3.81	3.81	0.50	1.90	± 13.1 %
5500	48.6	5.65	3.52	3.52	3.52	0.55	1.90	± 13.1 %
5600	48.5	5.77	3.32	3.32	3.32	0.60	1.90	± 13.1 %
5800	48.2	6.00	3.66	3.66	3.66	0.60	1.90	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

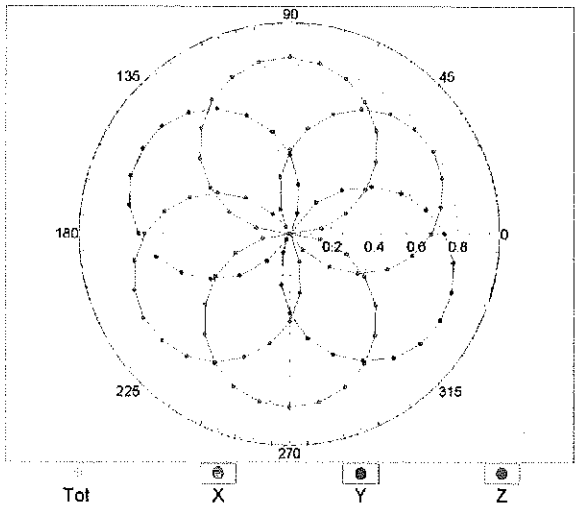
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



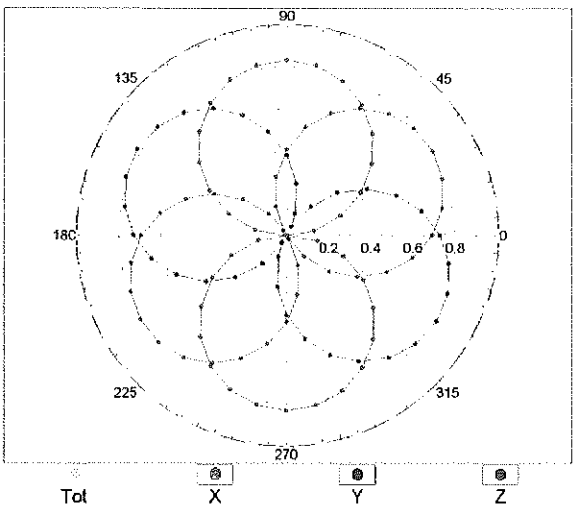
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

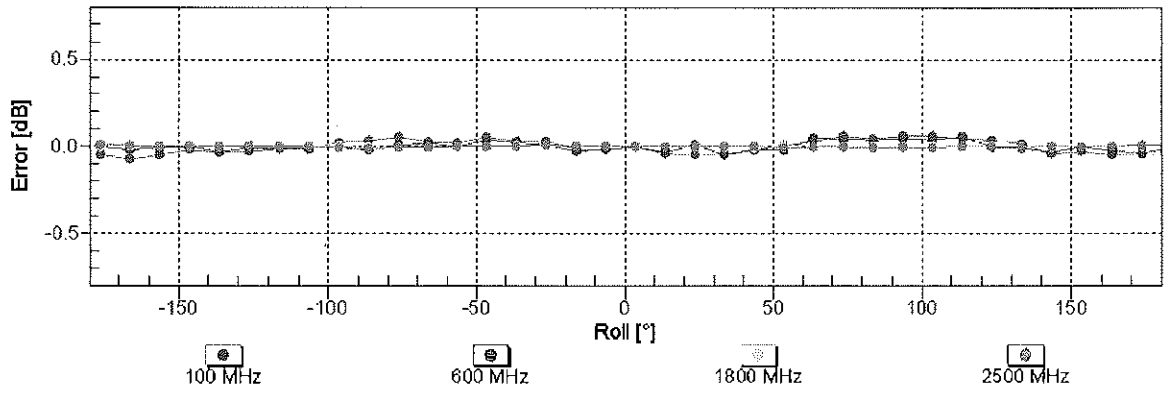
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



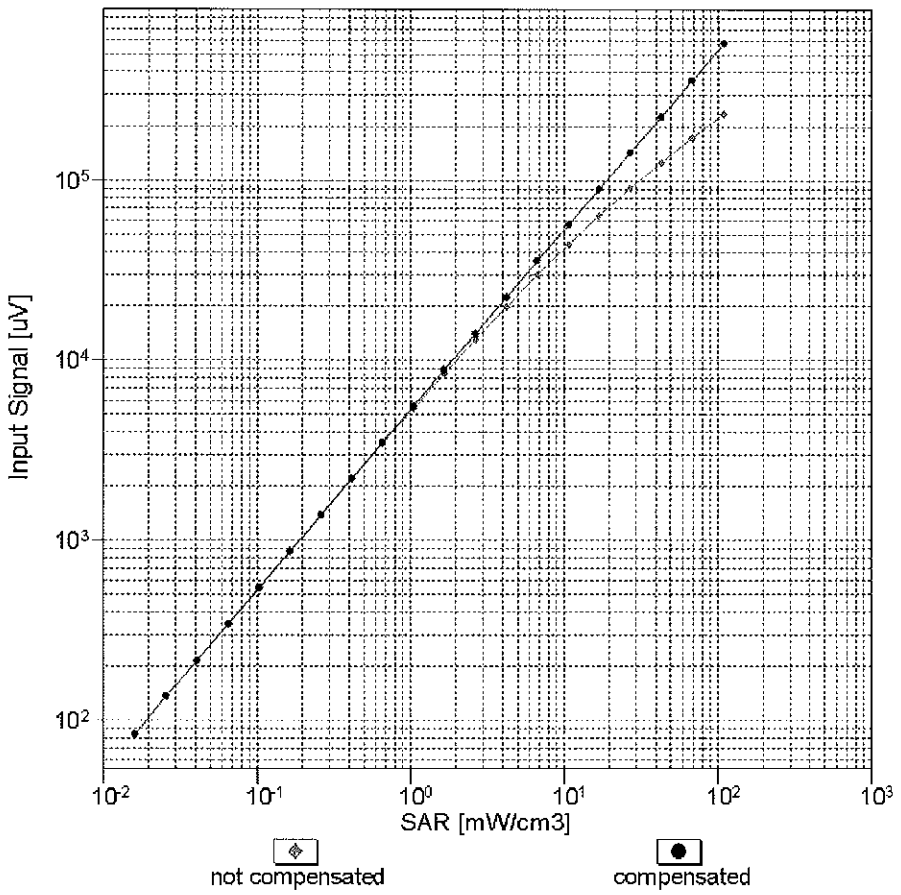
f=1800 MHz,R22

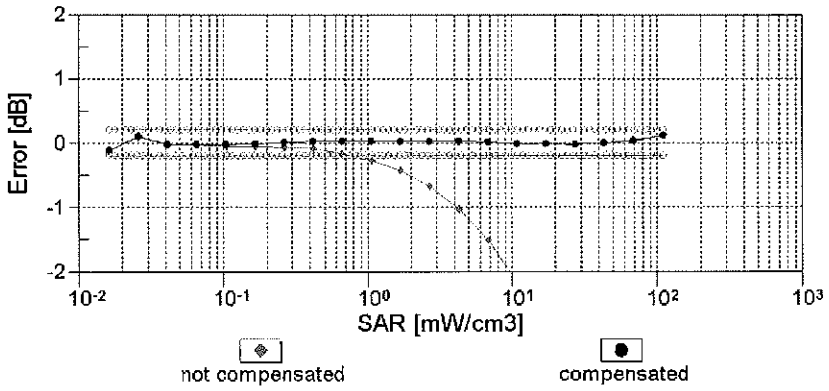




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

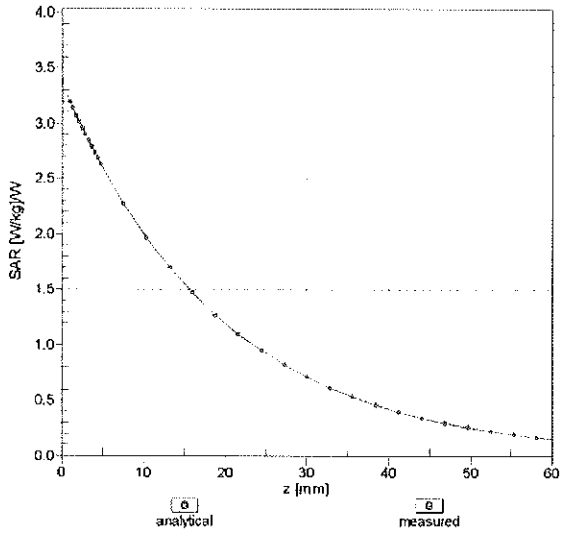




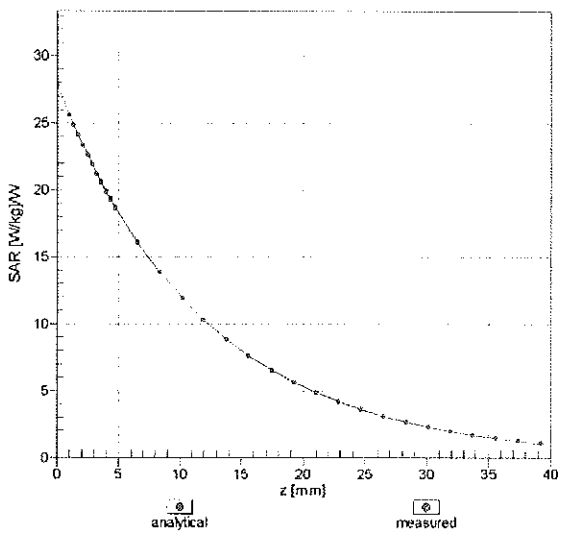
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

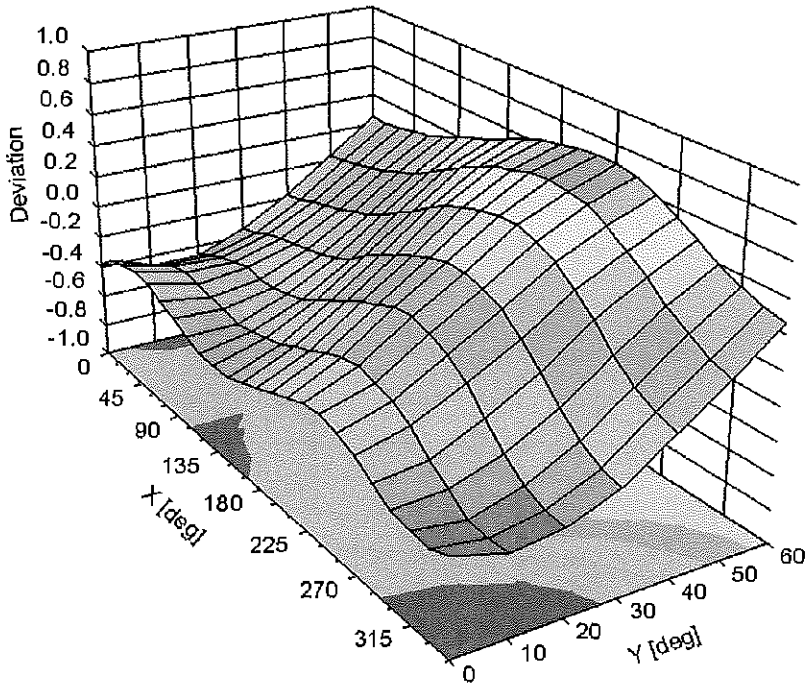


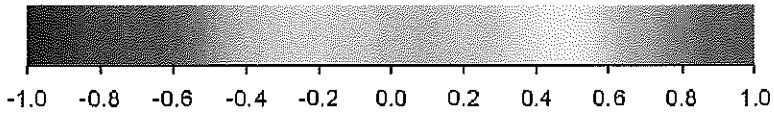
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-26.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

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Client **PC Test**

Certificate No: D835V2-4d132_Jan13

CALIBRATION CERTIFICATE

Object: D835V2 - SN: 4d132

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

Calibration date: January 07, 2013

KOK 1/24/13

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)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 8, 2013

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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	V52.8.4
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	42.0 ± 6 %	0.92 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.45 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.66 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.29 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	54.7 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.38 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.36 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.57 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.20 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.2 Ω + 1.3 jΩ
Return Loss	- 27.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.8 Ω - 1.3 jΩ
Return Loss	- 34.9 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 22, 2011

DASY5 Validation Report for Head TSL

Date: 07.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d132

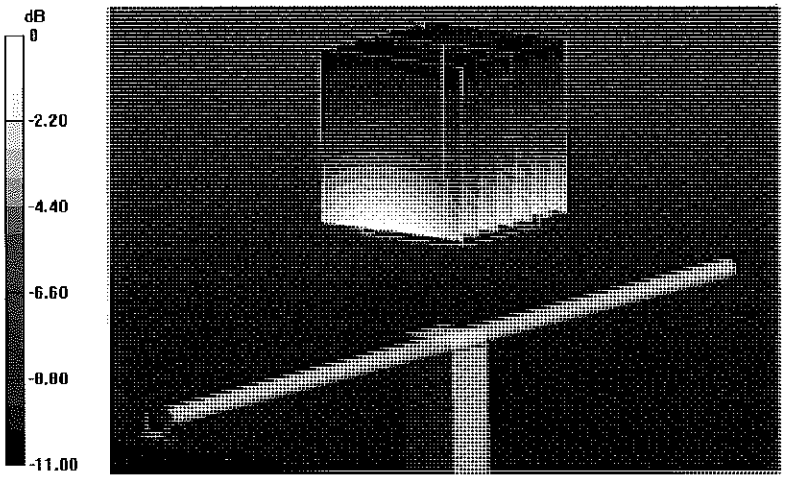
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.92 S/m; ε_r = 42; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.05, 6.05, 6.05); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

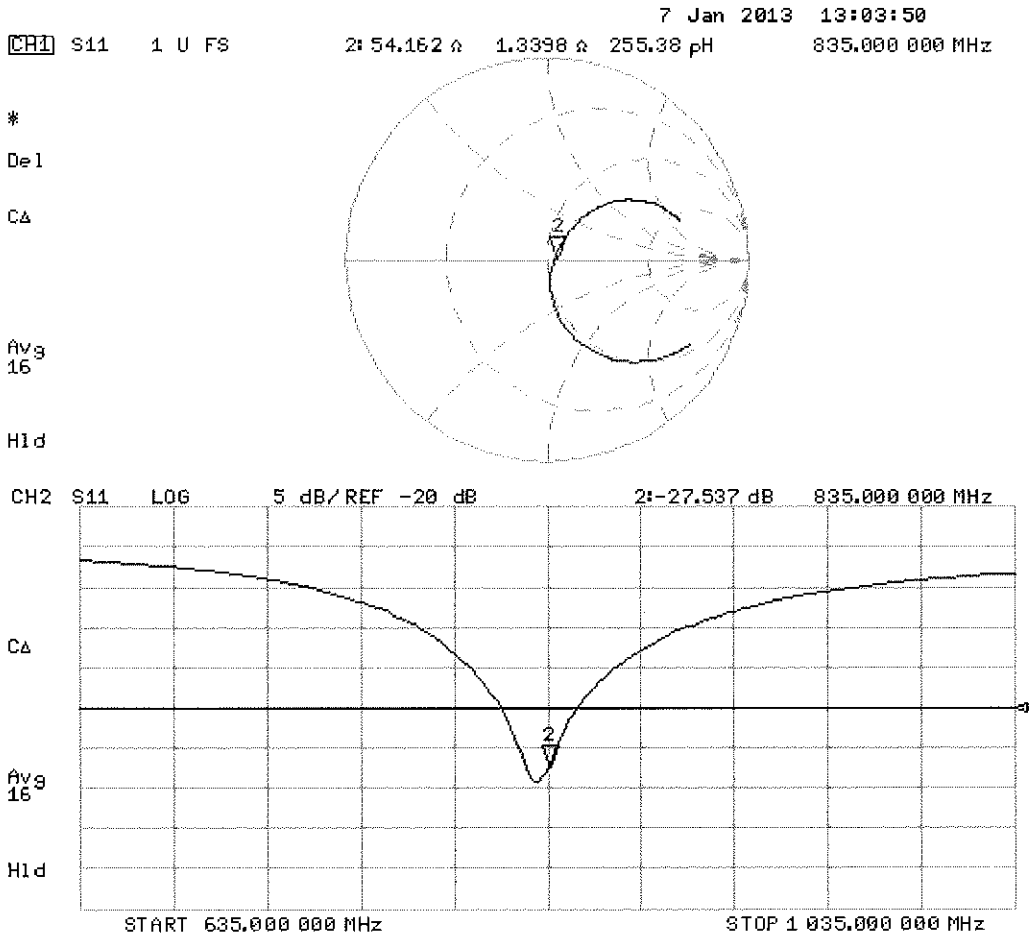
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.542 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 3.71 W/kg
SAR(1 g) = 2.45 W/kg; SAR(10 g) = 1.59 W/kg
Maximum value of SAR (measured) = 2.88 W/kg



0 dB = 2.88 W/kg = 4.59 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 07.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d132

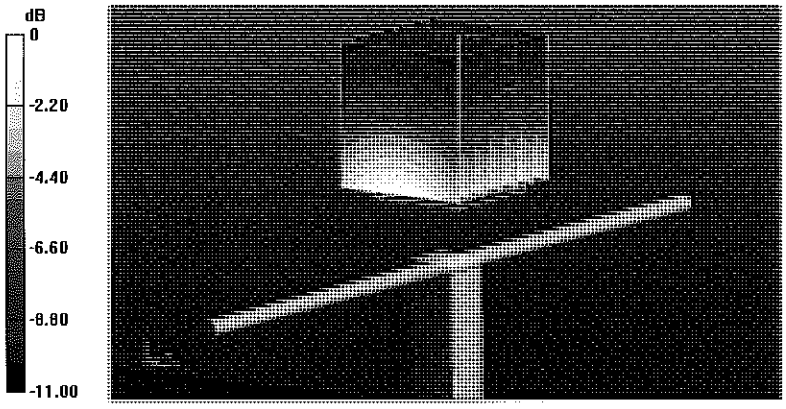
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.99 S/m; ε_r = 54.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.04, 6.04, 6.04); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

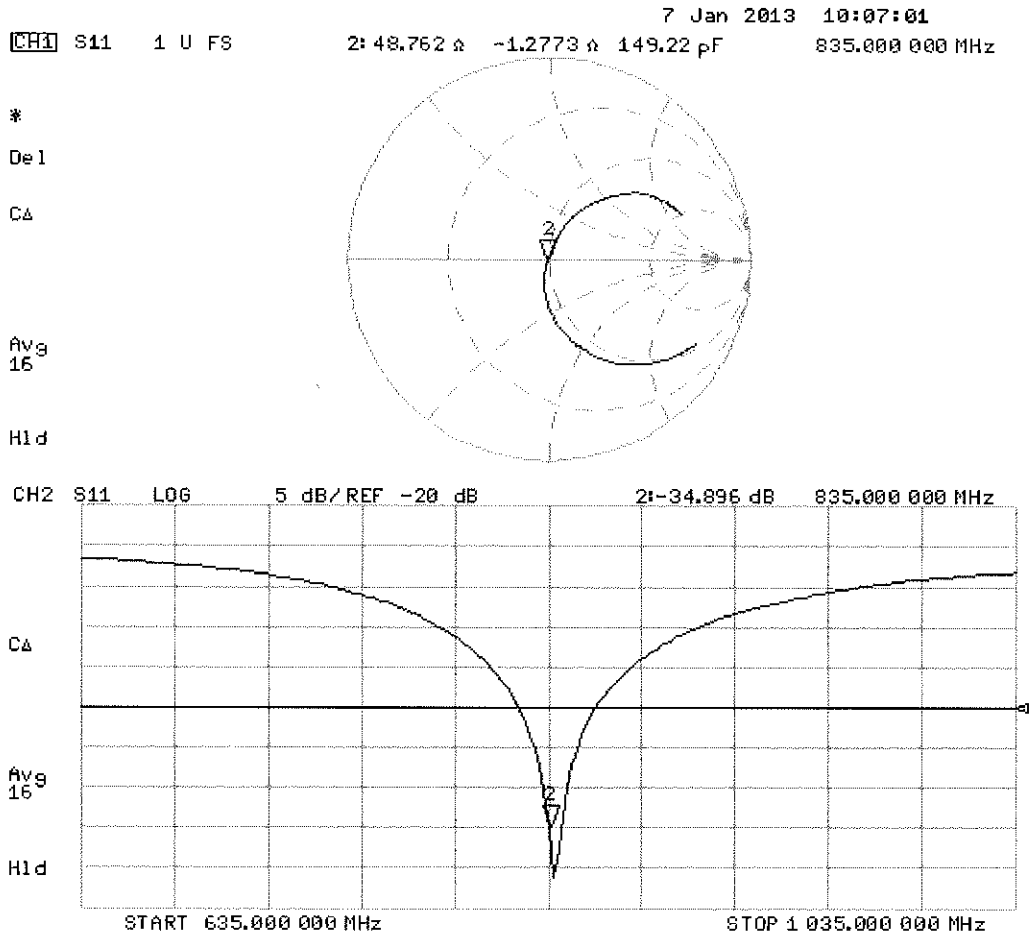
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.512 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 3.47 W/kg
SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.57 W/kg
Maximum value of SAR (measured) = 2.77 W/kg



0 dB = 2.77 W/kg = 4.42 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D1900V2-5d080_Jul12

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d080
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 20, 2012

✓ KOK 6/13/12

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	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 20, 2012

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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	V52.8.1
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	39.9 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.78 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**39.4 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.17 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**20.8 mW /g ± 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	52.6 ± 6 %	1.52 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	10.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**40.3 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.35 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**21.4 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.9 Ω + 5.7 jΩ
Return Loss	- 24.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.9 Ω + 6.0 jΩ
Return Loss	- 23.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.191 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 28, 2006

DASY5 Validation Report for Head TSL

Date: 20.07.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d080

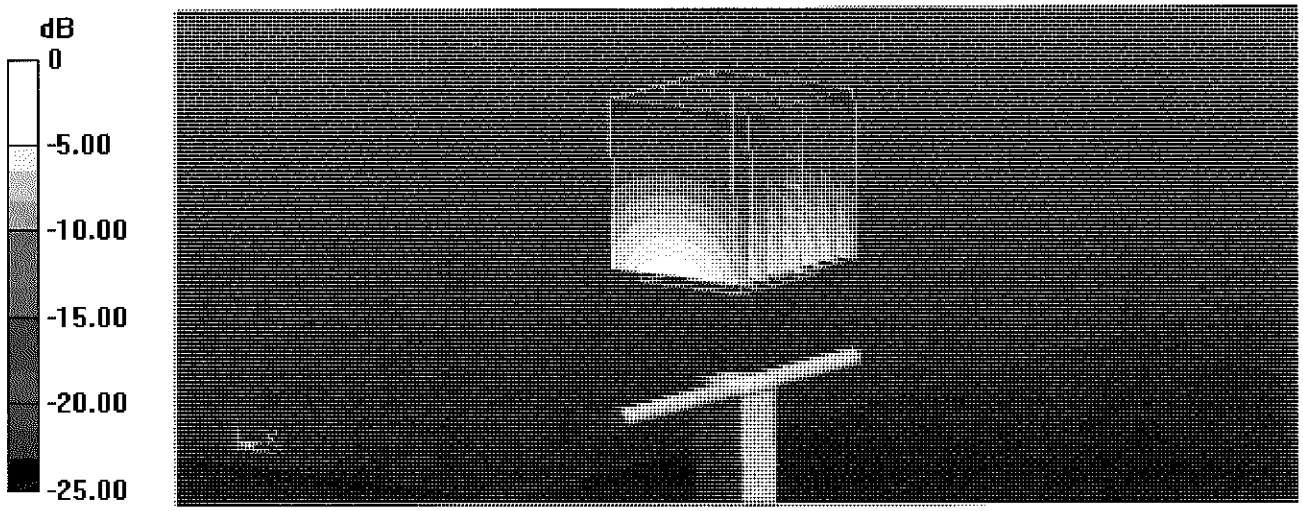
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

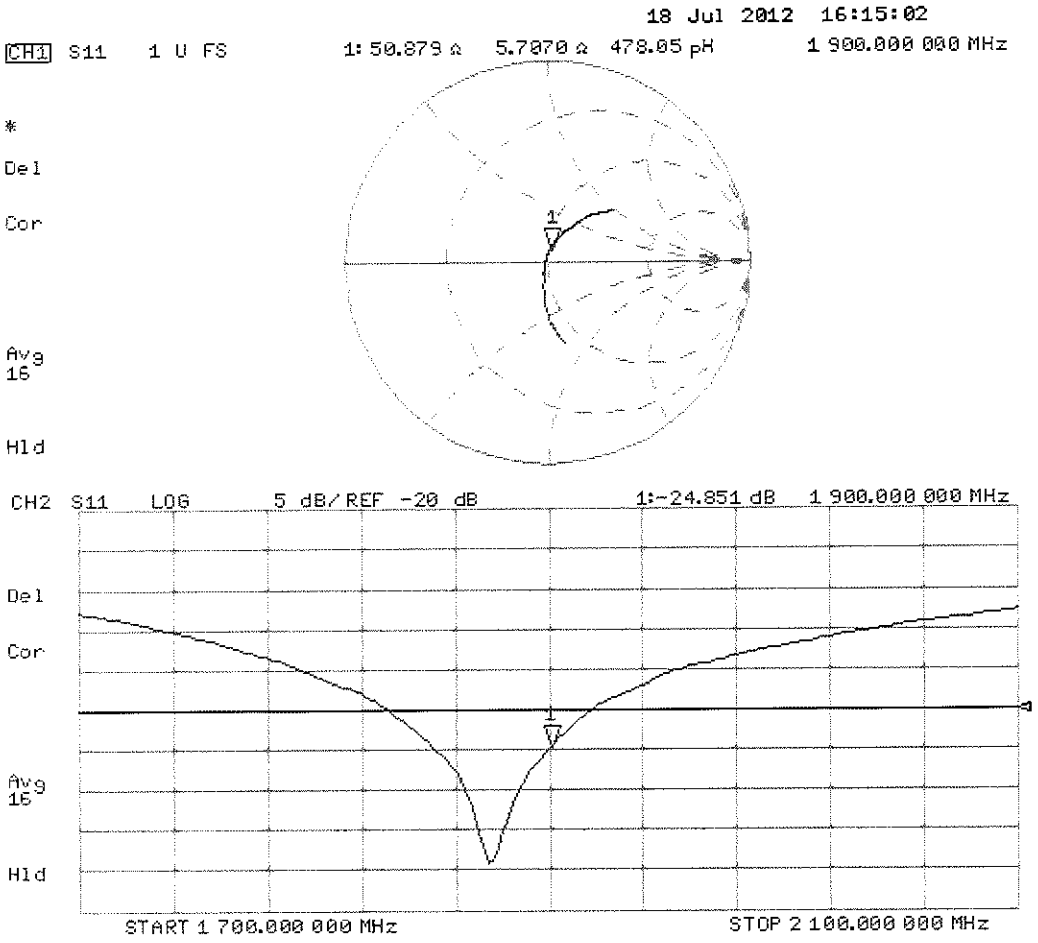
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.586 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 17.454 mW/g
SAR(1 g) = 9.78 mW/g; SAR(10 g) = 5.17 mW/g
Maximum value of SAR (measured) = 12.2 mW/g



0 dB = 12.2 mW/g = 21.73 dB mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 20.07.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d080

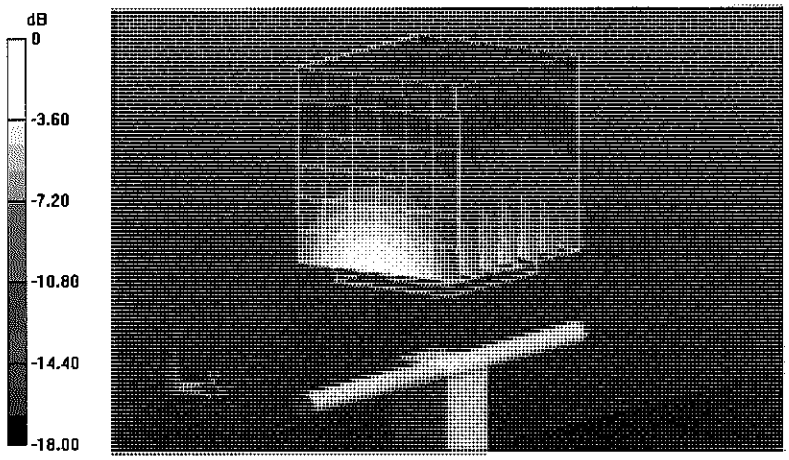
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.52 mho/m; ε_r = 52.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

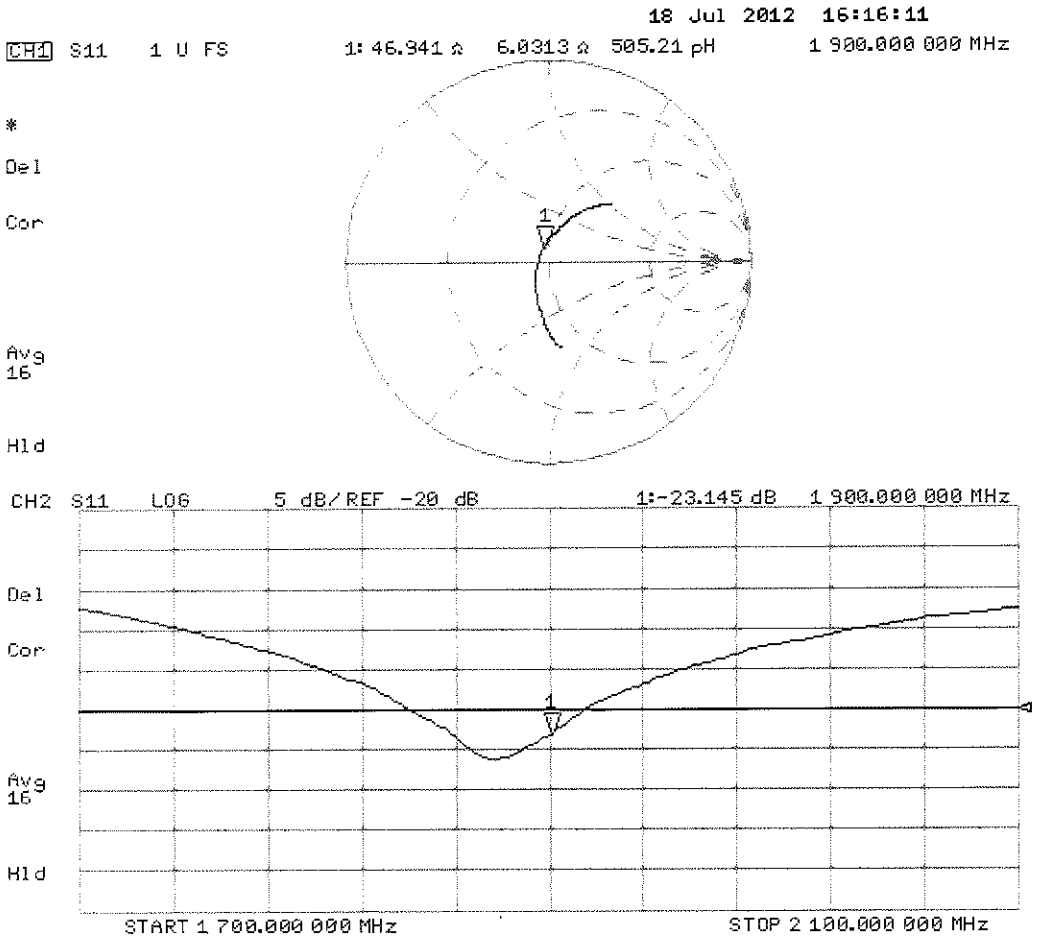
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.688 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 17.552 mW/g
SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.35 mW/g
Maximum value of SAR (measured) = 12.8 mW/g



0 dB = 12.8 mW/g = 22.14 dB mW/g

Impedance Measurement Plot for Body TSL



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Client **PC Test**

Certificate No: D2450V2-719_Aug12

CALIBRATION CERTIFICATE

Object D2450V2 - SN: 719

Calibration procedure(s) QA CAL-05.v8
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: August 23, 2012

✓ kot 9/17/12

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	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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-11)	In house check: Oct-12

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

Issued: August 23, 2012

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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	V52.8.2
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	39.2 ± 6 %	1.81 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 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**52.7 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.19 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**24.7 mW /g ± 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	51.3 ± 6 %	1.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**51.6 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.16 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**24.4 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.4 Ω + 3.8 jΩ
Return Loss	- 25.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.7 Ω + 5.9 jΩ
Return Loss	- 24.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.150 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 10, 2002

DASY5 Validation Report for Head TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

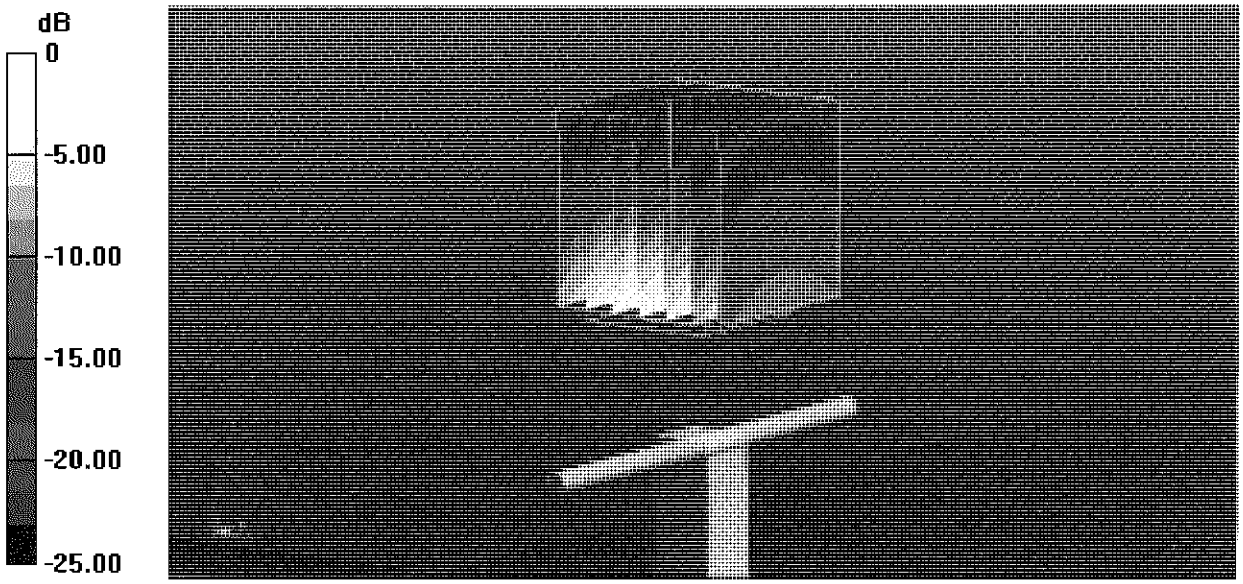
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.81 mho/m; ε_r = 39.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

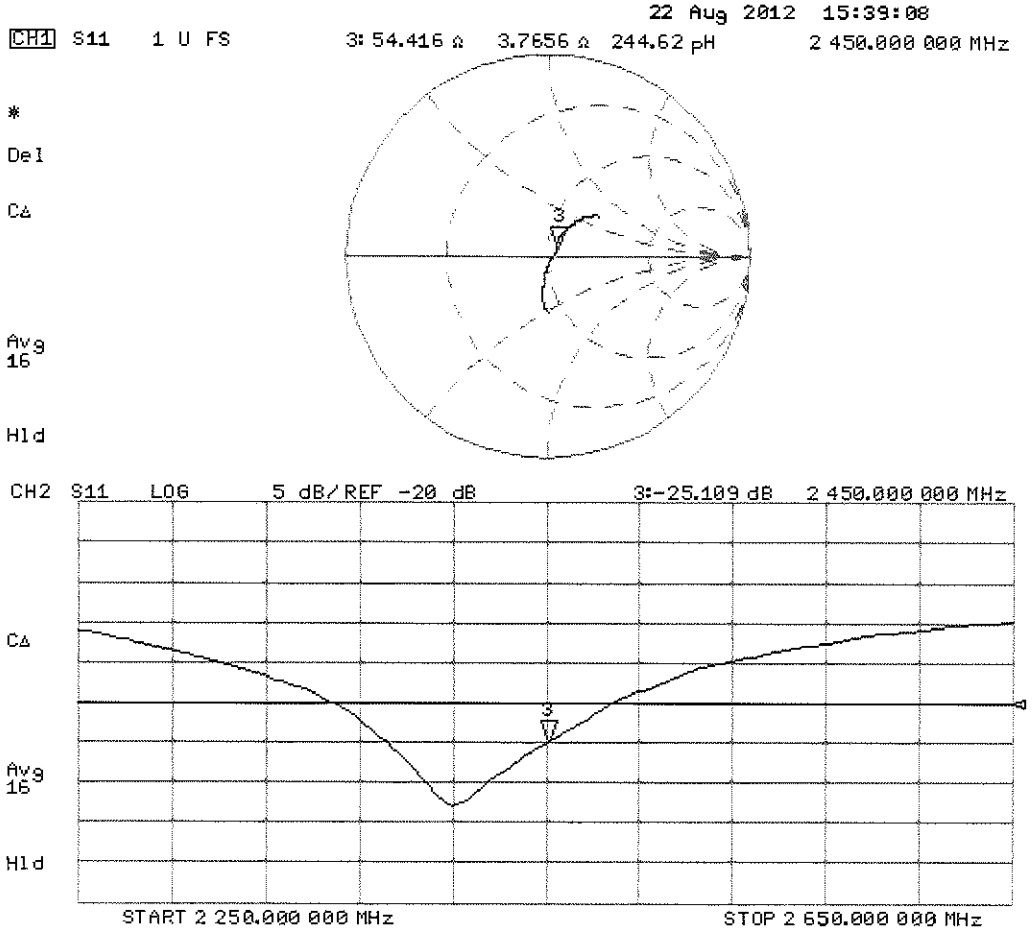
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.219 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 26.633 mW/g
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.19 mW/g
Maximum value of SAR (measured) = 16.5 W/kg



0 dB = 16.5 W/kg = 24.35 dB W/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

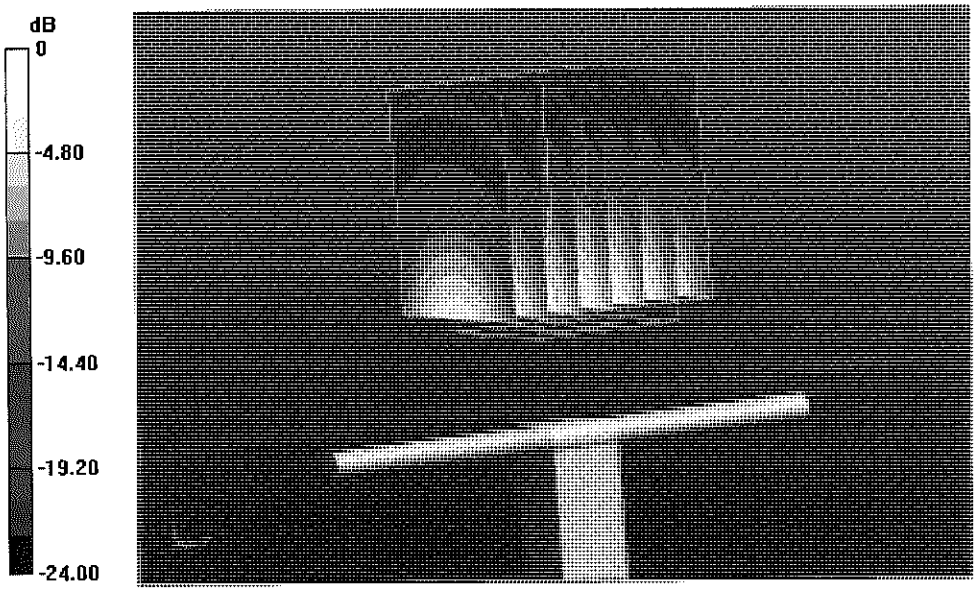
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.99 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

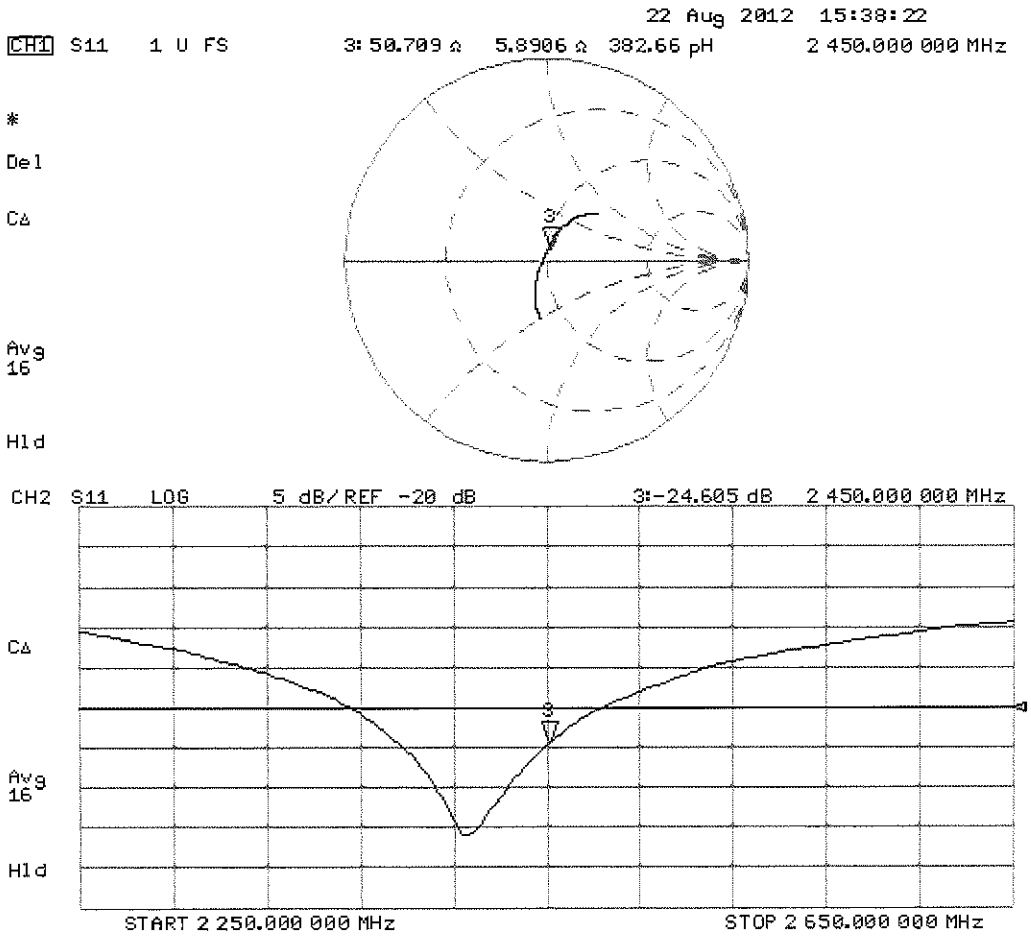
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.970 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 26.692 mW/g
SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.16 mW/g
Maximum value of SAR (measured) = 17.1 W/kg



0 dB = 17.1 W/kg = 24.66 dB W/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D2450V2-797_Jan13

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 797

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

Calibration date: January 08, 2013

✓ KOK 1/28/13

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)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 8, 2013

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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	V52.8.4
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	37.9 ± 6 %	1.85 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	13.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.5 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.5 ± 6 %	2.01 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	12.7 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**49.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.88 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.2 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.3 Ω + 3.1 jΩ
Return Loss	- 27.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.1 Ω + 4.9 jΩ
Return Loss	- 26.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.152 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	January 24, 2006

DASY5 Validation Report for Head TSL

Date: 08.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 797

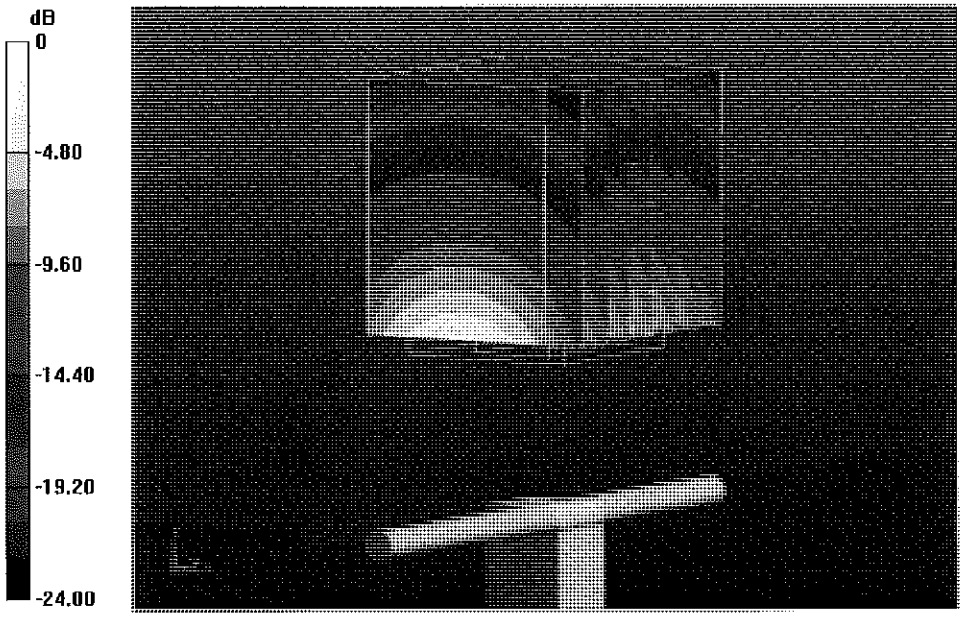
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.85 S/m; ε_r = 37.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

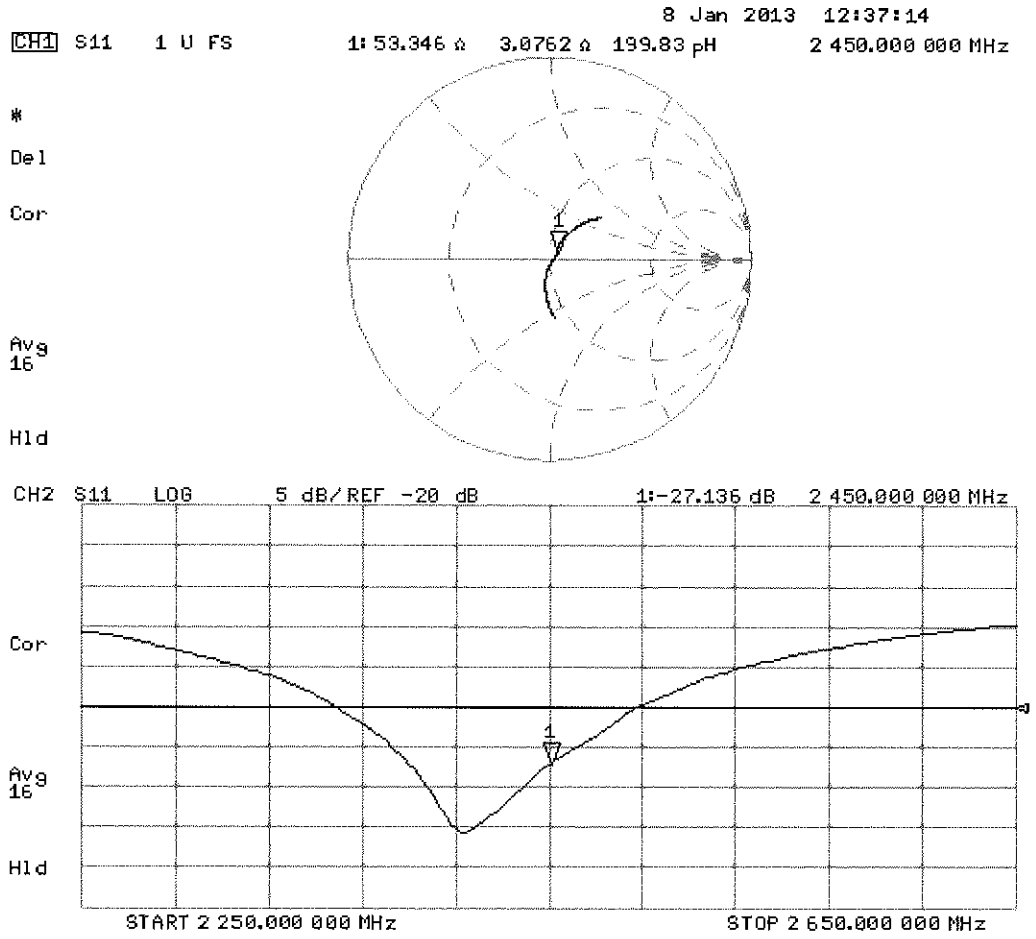
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.154 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 27.8 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.2 W/kg
Maximum value of SAR (measured) = 17.0 W/kg



0 dB = 17.0 W/kg = 12.30 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 08.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 797

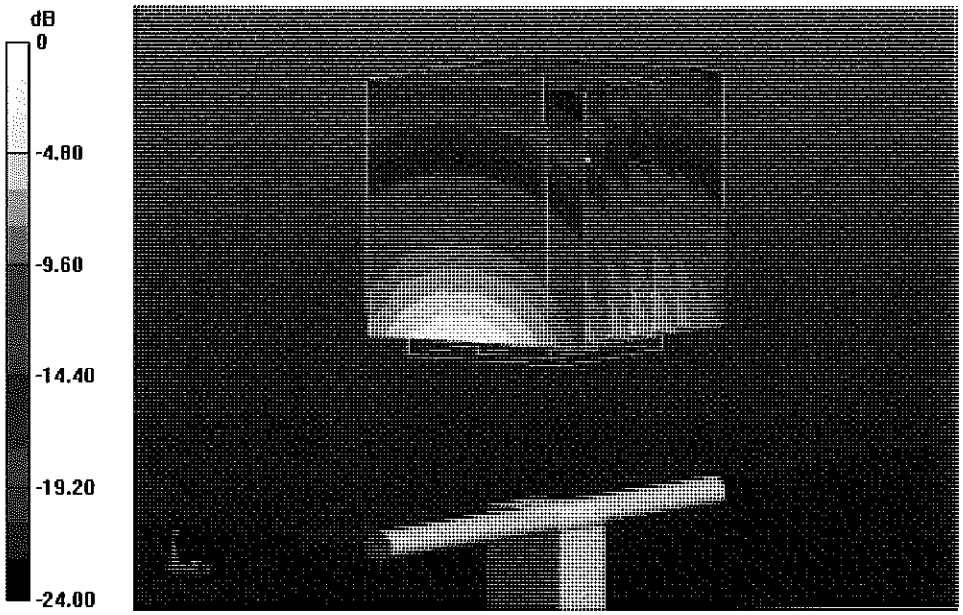
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.01 S/m; ε_r = 50.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

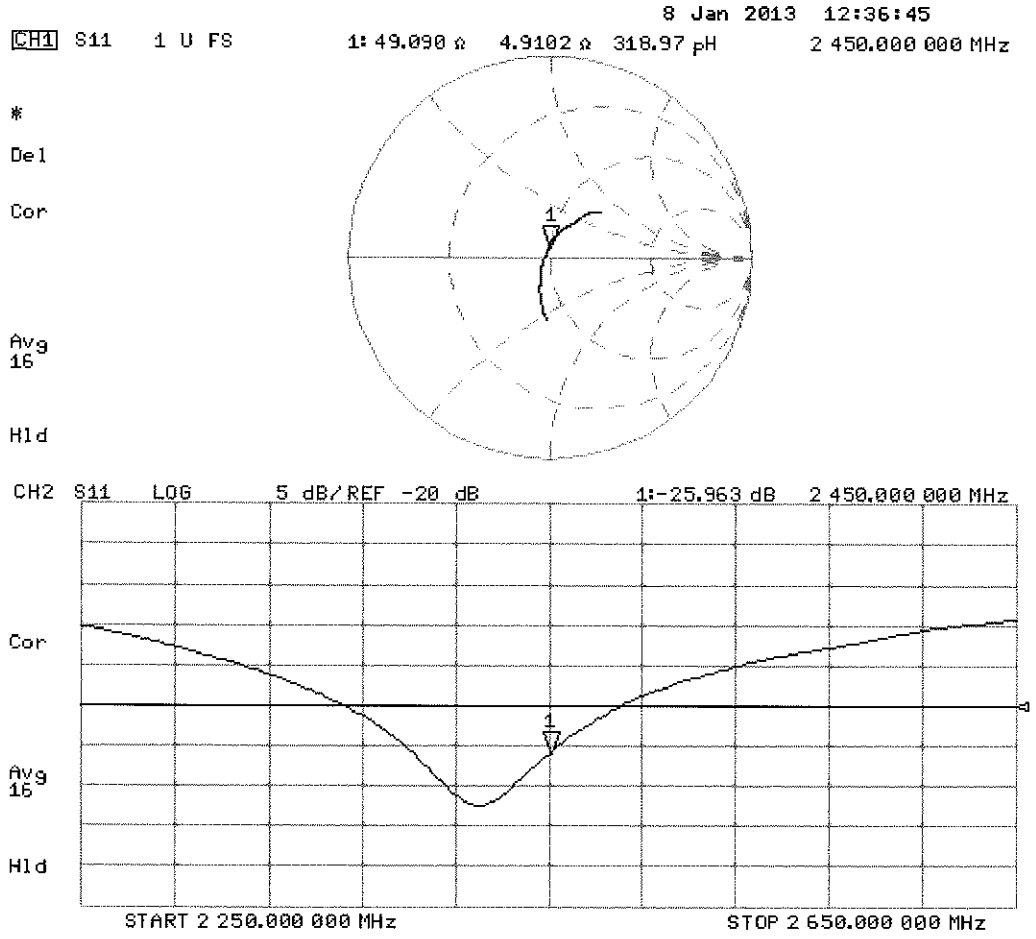
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.935 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.7 W/kg
SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.88 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 Body TSL



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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D5GHzV2-1057_Jan13

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1057
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	January 11, 2013

KOK 1/29/13

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)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe EX3DV4	SN: 3503	28-Dec-12 (No. EX3-3503_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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:	Israe El-Naouq	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 11, 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	V52.8.5
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 5500 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	34.6 ± 6 %	4.50 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	7.66 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**75.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.4 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	34.5 ± 6 %	4.60 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	7.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**76.9 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.9 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.2 ± 6 %	4.79 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.5 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	34.1 ± 6 %	4.88 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	8.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.7 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	33.8 ± 6 %	5.09 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	-----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.69 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**76.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.4 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	47.0 ± 6 %	5.42 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	7.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.1 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	7.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.1 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.5 ± 6 %	5.81 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**80.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.4 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	46.3 ± 6 %	5.94 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	8.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**80.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.3 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	46.0 ± 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	7.57 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 W/kg ± 19.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	50.5 Ω - 9.8 jΩ
Return Loss	- 20.3 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	48.5 Ω - 4.5 jΩ
Return Loss	- 26.4 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	50.6 Ω - 5.8 jΩ
Return Loss	- 24.8 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.9 Ω - 3.8 jΩ
Return Loss	- 25.6 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	52.5 Ω - 4.4 jΩ
Return Loss	- 26.1 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	49.3 Ω - 7.9 jΩ
Return Loss	- 22.0 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	48.7 Ω - 3.2 jΩ
Return Loss	- 29.2 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	51.2 Ω - 4.8 jΩ
Return Loss	- 26.2 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	53.6 Ω - 2.1 jΩ
Return Loss	- 27.9 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	53.3 Ω - 2.9 jΩ
Return Loss	- 27.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. 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	November 27, 2006

DASY5 Validation Report for Head TSL

Date: 11.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1057

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.5 S/m; ε_r = 34.6; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.6 S/m; ε_r = 34.5; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 4.79 S/m; ε_r = 34.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.88 S/m; ε_r = 34.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.09 S/m; ε_r = 33.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41); Calibrated: 28.12.2012, ConvF(5.1, 5.1, 5.1); Calibrated: 28.12.2012, ConvF(4.91, 4.91, 4.91); 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: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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 = 63.671 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 29.4 W/kg
SAR(1 g) = 7.66 W/kg; SAR(10 g) = 2.17 W/kg
Maximum value of SAR (measured) = 18.5 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

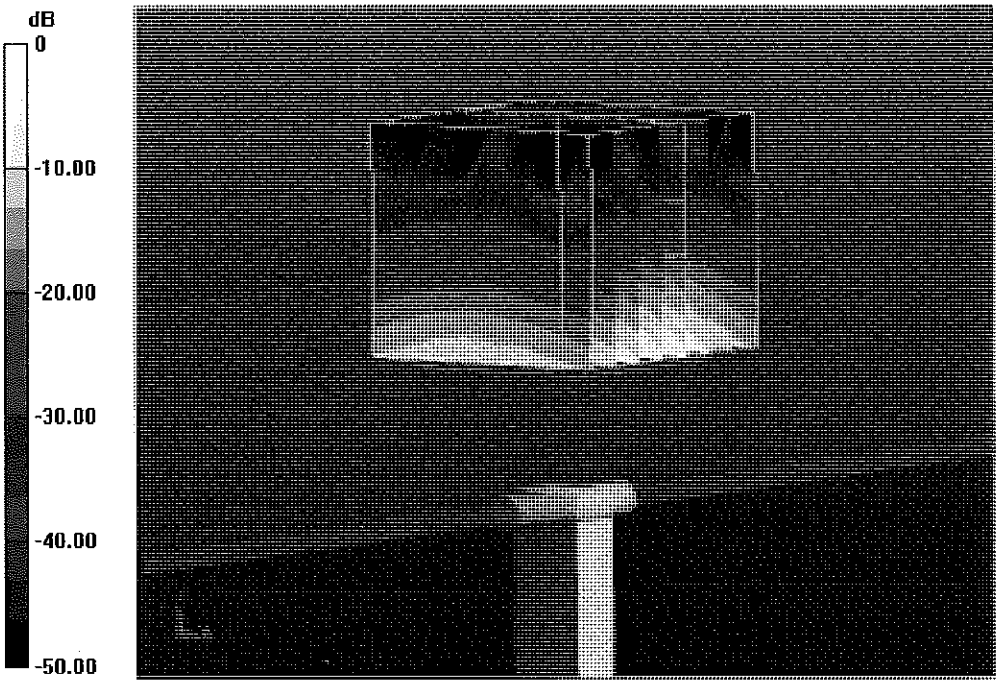
Reference Value = 63.473 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 30.3 W/kg
SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.22 W/kg
Maximum value of SAR (measured) = 18.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 63.735 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 33.2 W/kg
SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.28 W/kg
Maximum value of SAR (measured) = 20.1 W/kg

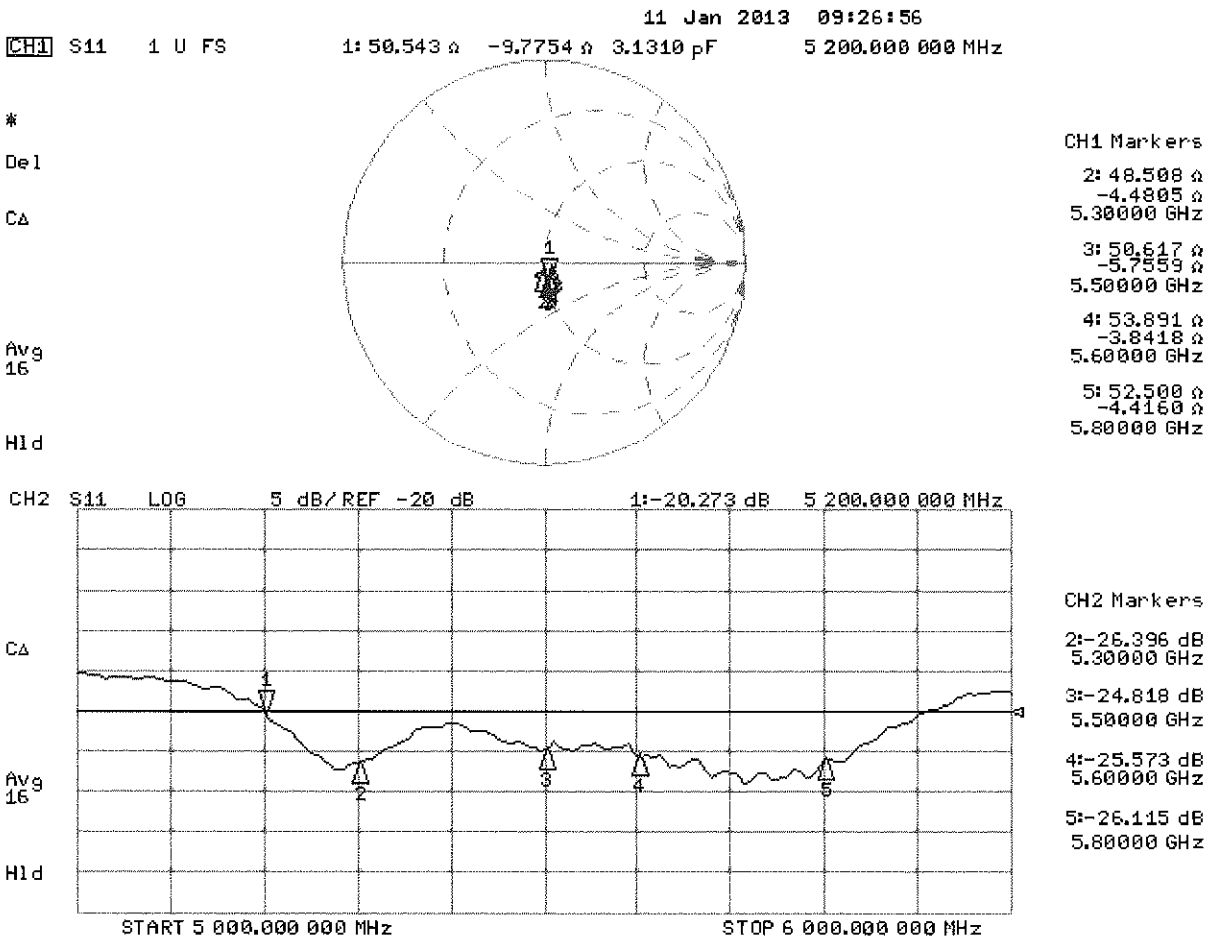
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.848 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 33.5 W/kg
SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.3 W/kg
Maximum value of SAR (measured) = 20.2 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 = 60.467 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 33.3 W/kg
SAR(1 g) = 7.69 W/kg; SAR(10 g) = 2.17 W/kg
Maximum value of SAR (measured) = 19.4 W/kg



0 dB = 19.4 W/kg = 12.88 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 10.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1057

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.42 S/m; ε_r = 47; 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 = 5500 MHz; σ = 5.81 S/m; ε_r = 46.5; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.94 S/m; ε_r = 46.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.21 S/m; ε_r = 46; 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(4.43, 4.43, 4.43); 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: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

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 = 59.074 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 30.4 W/kg
SAR(1 g) = 7.61 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 18.0 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

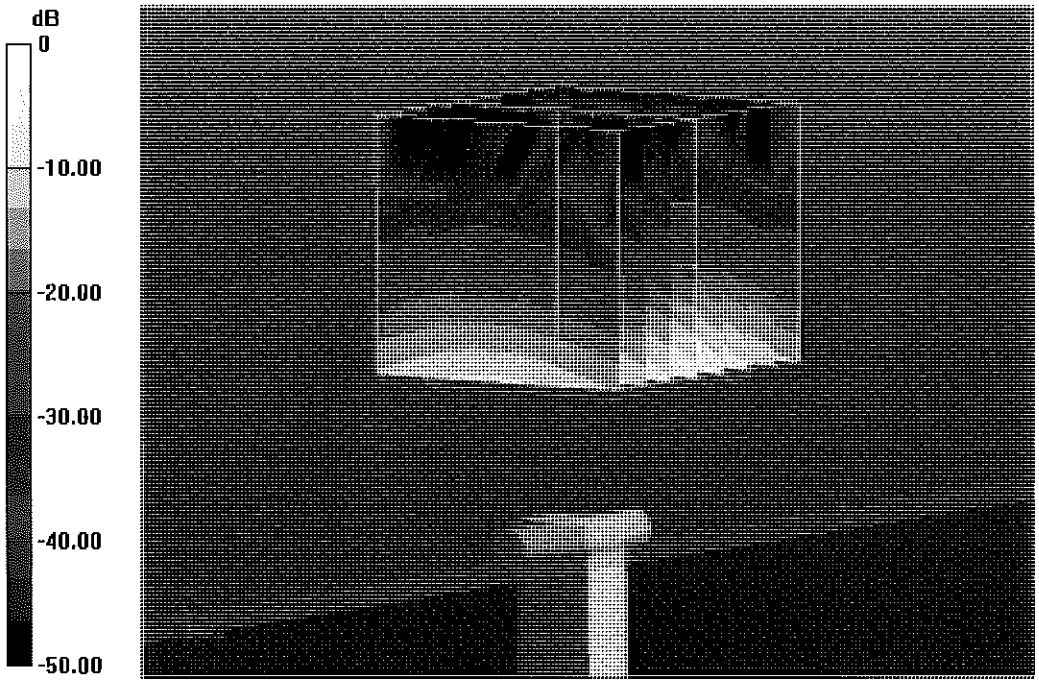
Reference Value = 58.924 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 30.9 W/kg
SAR(1 g) = 7.59 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 17.9 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 59.561 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 35.3 W/kg
SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.26 W/kg
Maximum value of SAR (measured) = 19.7 W/kg

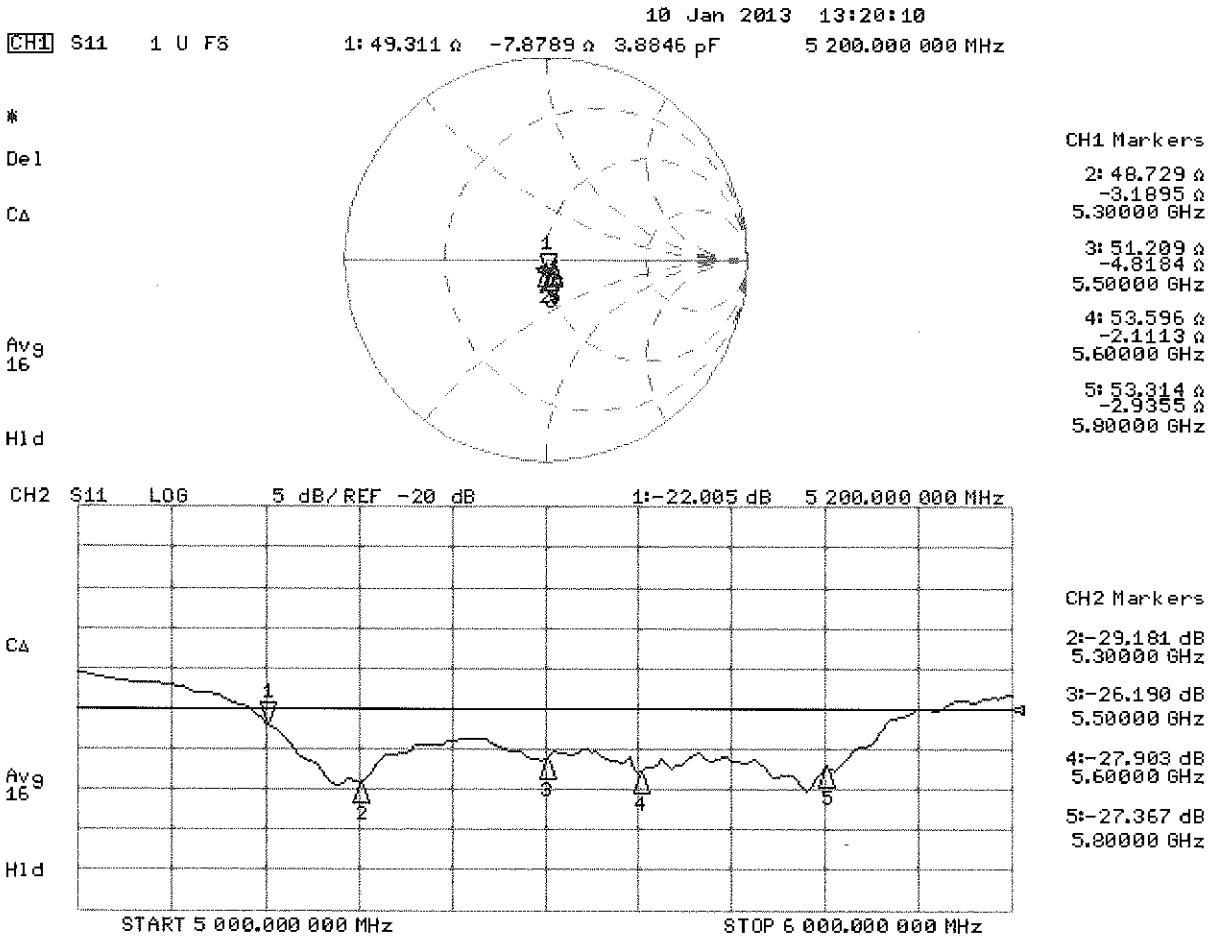
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.884 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 36.3 W/kg
SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.25 W/kg
Maximum value of SAR (measured) = 20.0 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 = 55.753 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 35.6 W/kg
SAR(1 g) = 7.57 W/kg; SAR(10 g) = 2.09 W/kg
Maximum value of SAR (measured) = 18.9 W/kg



0 dB = 18.9 W/kg = 12.76 dBW/kg

Impedance Measurement Plot for Body TSL



APPENDIX D: SAR TISSUE SPECIFICATIONS

Measurement Procedure for Tissue verification:

1) The network analyzer and probe system was configured and calibrated.
2) The probe was immersed in the tissue. The tissue was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
3) The complex admittance with respect to the probe aperture was measured
4) The complex relative permittivity ε' can be calculated from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\varepsilon_r\varepsilon_0}{\left[\ln(b/a)\right]^2}\int_a^b\int_a^b\int_0^\pi \cos\phi' \frac{\exp\left[-j\omega r(\mu_0\varepsilon_r'\varepsilon_0)^{1/2}\right]}{r} d\phi' d\rho' d\rho$$

where *Y* is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively, $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$, ω is the angular frequency, and $j = \sqrt{-1}$.

Table D-I
Composition of the Tissue Equivalent Matter

Frequency (MHz)	835	1900	2450	5200-5800
Tissue	Body	Body	Body	Body
Ingredients (% by weight)				
Bactericide	0.1			
DGBE		29.44	26.7	
HEC	1			
NaCl	0.94	0.39	0.1	
Sucrose	44.9			
Polysorbate (Tween) 80				20
Water	53.06	70.17	73.2	80

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APPENDIX E: SAR SYSTEM VALIDATION

Per FCC KDB 865664 D02v01, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in IEEE 1528-2003 and FCC KDB 865664 D01 v01. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

Table E-I
SAR System Validation Summary

SAR SYSTEM #	FREQ. [MHz]	DATE	PROBE SN	PROBE TYPE	PROBE CAL. POINT		COND.	PERM.	CW VALIDATION			MOD. VALIDATION		
							(σ)	(ε_r)	SENSI-TIVITY	PROBE LINEARITY	PROBE ISOTROPY	MOD. TYPE	DUTY FACTOR	PAR
G	835	3/26/2013	3209	ES3DV3	835	Body	1.006	54.42	PASS	PASS	PASS	GMSK	PASS	N/A
B	1900	1/29/2013	3287	ES3DV3	1900	Body	1.570	51.00	PASS	PASS	PASS	GMSK	PASS	N/A
B	2450	1/30/2013	3287	ES3DV3	2450	Body	1.985	51.49	PASS	PASS	PASS	OFDM	N/A	PASS
E	2450	3/18/2013	3920	EX3DV4	2450	Body	2.011	51.68	PASS	PASS	PASS	OFDM	N/A	PASS
A	5200	1/23/2013	3589	EX3DV4	5200	Body	5.292	47.85	PASS	PASS	PASS	OFDM	N/A	PASS
A	5300	1/23/2013	3589	EX3DV4	5300	Body	5.477	47.47	PASS	PASS	PASS	OFDM	N/A	PASS
A	5500	1/23/2013	3589	EX3DV4	5500	Body	5.729	47.03	PASS	PASS	PASS	OFDM	N/A	PASS
A	5600	1/23/2013	3589	EX3DV4	5600	Body	6.233	46.20	PASS	PASS	PASS	OFDM	N/A	PASS
A	5800	1/23/2013	3589	EX3DV4	5800	Body	6.233	46.20	PASS	PASS	PASS	OFDM	N/A	PASS

NOTE: All measurements were performed using probes calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01v01. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5 dB), such as OFDM according to KDB 865664.

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APPENDIX G:SENSOR TRIGGERING DATA SUMMARY

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A3LSMT217S Sensor Triggering Data Summary

Per FCC KDB Publication 616217 D04v01, this device was tested by the manufacturer to determine the proximity sensor triggering distances for the back and top edge of the device. The measured output power within ± 5 mm of the triggering points (or until touching the phantom) is included for back side and each applicable edge.

To ensure all production units are compliant, it is necessary to test SAR at a distance 1mm less than the smallest distance from the device and SAR phantom (determined from these triggering tests according to the KDB 616217 D04v01) with the device at maximum output power without power reduction. These additional SAR Tests are included additionally to the SAR tests for the device touching the SAR phantom, with reduced power.

The operational description contains information explaining how this device remains compliant in the event of a sensor malfunction.

The output power data included in the tables below was measured and provided by the applicant.

Back Side

Moving device toward the phantom:

Measured Power [dBm]											
Distance[mm]	21	20	19	18	17	16	15	14	13	12	11
CDMA BC0	24.83	24.81	24.78	24.81	24.83	18.15	18.14	18.12	18.09	18.21	18.15
CDMA BC1	24.89	24.84	24.81	24.75	24.79	14.21	14.15	14.17	14.12	14.09	14.14
CDMA BC10	24.8	24.76	24.88	24.77	24.72	18.25	18.23	18.22	18.19	18.22	18.24
LTE B25	23.79	23.74	23.81	23.83	23.78	13.16	13.13	13.11	13.14	13.12	13.25

Moving device away from the phantom:

Measured Power [dBm]											
Distance[mm]	22	21	20	19	18	17	16	15	14	13	12
CDMA BC0	24.84	24.81	24.86	24.79	24.81	18.05	18.09	18.13	18.15	18.18	18.07
CDMA BC1	24.91	24.93	24.89	24.88	24.9	14.13	14.09	14.07	14.01	14.02	14.03
CDMA BC10	24.75	24.73	24.71	24.78	24.76	18.23	18.15	18.19	18.12	18.07	17.99
LTE B25	23.79	23.71	23.62	23.72	23.73	13.14	13.12	13.11	13.05	13.11	13.09

Based on the most conservative measured triggering distance of 16 mm, additional SAR measurements were required at 15 mm from the back side.

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Top Edge

Moving device toward the phantom:

Measured Power [dBm]											
Distance[mm]	21	20	19	18	17	16	15	14	13	12	11
CDMA BC0	24.86	24.79	24.82	24.91	24.86	18.12	18.15	18.19	18.15	18.21	18.19
CDMA BC1	24.88	24.79	24.82	24.85	24.81	14.13	14.11	14.07	14.19	14.17	14.13
CDMA BC10	24.9	24.86	24.84	24.87	24.82	18.33	18.24	18.3	18.29	18.22	18.25
LTE B25	23.89	23.82	23.79	23.83	23.79	13.09	13.11	13.16	13.11	13.22	13.15

Moving device away from the phantom:

Measured Power [dBm]											
Distance[mm]	22	21	20	19	18	17	16	15	14	13	12
CDMA BC0	24.75	24.84	24.96	24.85	24.93	18.18	18.13	18.03	18.06	18.09	18.03
CDMA BC1	24.91	24.92	24.95	24.89	24.81	14.04	14.11	14.03	14.06	14.09	14.01
CDMA BC10	24.85	24.84	24.91	24.89	24.83	18.13	18.13	18.06	17.99	18.02	18.11
LTE B25	23.79	23.81	23.82	23.75	23.83	13.04	13.03	13.01	13.14	13.07	13.13

Based on the most conservative measured triggering distance of 16 mm, additional SAR measurements were required at 15 mm from the top edge.

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