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SAR EVALUATION REPORT

Applicant Name:
Samsung Electronics, Co. Ltd.
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Gyeonggi-do 443-742, Korea

Date of Testing:
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Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1405010890-R1.A3L

FCC ID: **A3LSMT805M**

APPLICANT: **SAMSUNG ELECTRONICS, CO. LTD.**

DUT Type: Portable Tablet
Application Type: Certification
FCC Rule Part(s): CFR §2.1093
Model(s): SM-T805M

Equipment Class	Band & Mode	Tx Frequency	SAR 1 gm Body (W/kg)
PCB	GSM/GPRS/EDGE 850	824.20 - 848.80 MHz	0.61
PCB	UMTS 850	826.40 - 846.60 MHz	0.73
PCB	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	0.91
PCB	UMTS 1900	1852.4 - 1907.6 MHz	1.03
PCB	LTE Band 17	706.5 - 713.5 MHz	0.36
PCB	LTE Band 5 (Cell)	824.7 - 848.3 MHz	0.49
PCB	LTE Band 4 (AWS)	1710.7 - 1754.3 MHz	1.09
PCB	LTE Band 2 (PCS)	1850.7 - 1909.3 MHz	1.07
DTS	2.4 GHz WLAN	2412 - 2462 MHz	1.01
DTS	5.8 GHz WLAN	5745 - 5825 MHz	N/A
NII	5.2 GHz WLAN	5180 - 5240 MHz	
NII	5.3 GHz WLAN	5260 - 5320 MHz	
NII	5.5 GHz WLAN	5500 - 5700 MHz	
DSS/DTS	Bluetooth	2402 - 2480 MHz	
Simultaneous SAR per KDB 690783 D01v01r02:			1.59

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.

Note: This revised Test Report (S/N: 0Y1405010890-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.

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
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
LTE Band 17	Data	706.5 - 713.5 MHz
LTE Band 5 (Cell)	Data	824.7 - 848.3 MHz
LTE Band 4 (AWS)	Data	1710.7 - 1754.3 MHz
LTE Band 2 (PCS)	Data	1850.7 - 1909.3 MHz
2.4 GHz WLAN	Data	2412 - 2462 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
ANT+	Data	2402 - 2480 MHz

1.2 Power Reduction for SAR

This device uses a sensor for SAR compliance. The sensor is activated when used in close proximity to the user's body. The sensor triggers power reduction for voice and data modes and is only applicable for tablet operations.

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.

Maximum Power:

Mode / Band		Voice (dBm)	Burst Average GMSK (dBm)				Burst Average 8-PSK (dBm)			
		1 TX Slot	1 TX Slots	2 TX Slots	3 TX Slots	4 TX Slots	1 TX Slots	2 TX Slots	3 TX Slots	4 TX Slots
GSM/GPRS/EDGE 850	Maximum	33.0	33.0	33.0	32.2	31.0	27.0	27.0	26.2	25.0
	Nominal	32.5	32.5	32.5	31.7	30.5	26.5	26.5	25.7	24.5
GSM/GPRS/EDGE 1900	Maximum	29.5	29.5	29.5	28.7	27.5	26.0	26.0	25.2	24.0
	Nominal	29.0	29.0	29.0	28.2	27.0	25.5	25.5	24.7	23.5

Mode / Band		Modulated Average (dBm)			
		3GPP RMC Rel 99	3GPP HSDPA Rel 5	3GPP HSUPA Rel 6	3GPP HSUPA Rel 8
UMTS Band 5 (850 MHz)	Maximum	23.0	23.0	23.0	23.0
	Nominal	22.5	22.5	22.5	22.5
UMTS Band 2 (1900 MHz)	Maximum	23.0	23.0	23.0	23.0
	Nominal	22.5	22.5	22.5	22.5

Mode / Band		Modulated Average (dBm)
LTE Band 17	Maximum	**23.0**
	Nominal	**22.5**
LTE Band 5 (Cell)	Maximum	**23.0**
	Nominal	**22.5**
LTE Band 4 (AWS)	Maximum	**23.0**
	Nominal	**22.5**
LTE Band 2 (PCS)	Maximum	**23.0**
	Nominal	**22.5**
Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	**12.5**
	Nominal	**12.0**
IEEE 802.11g (2.4 GHz)	Maximum	**12.5**
	Nominal	**12.0**
IEEE 802.11n (2.4 GHz)	Maximum	**12.5**
	Nominal	**12.0**
IEEE 802.11a (5 GHz)	Maximum	**7.5**
	Nominal	**7.0**
IEEE 802.11n (5 GHz)	Maximum	**7.5**
	Nominal	**7.0**
IEEE 802.11ac (5 GHz)	Maximum	**7.5**
	Nominal	**7.0**
Bluetooth	Maximum	**9.0**
	Nominal	**8.5**
Bluetooth LE	Maximum	**7.0**
	Nominal	**6.5**

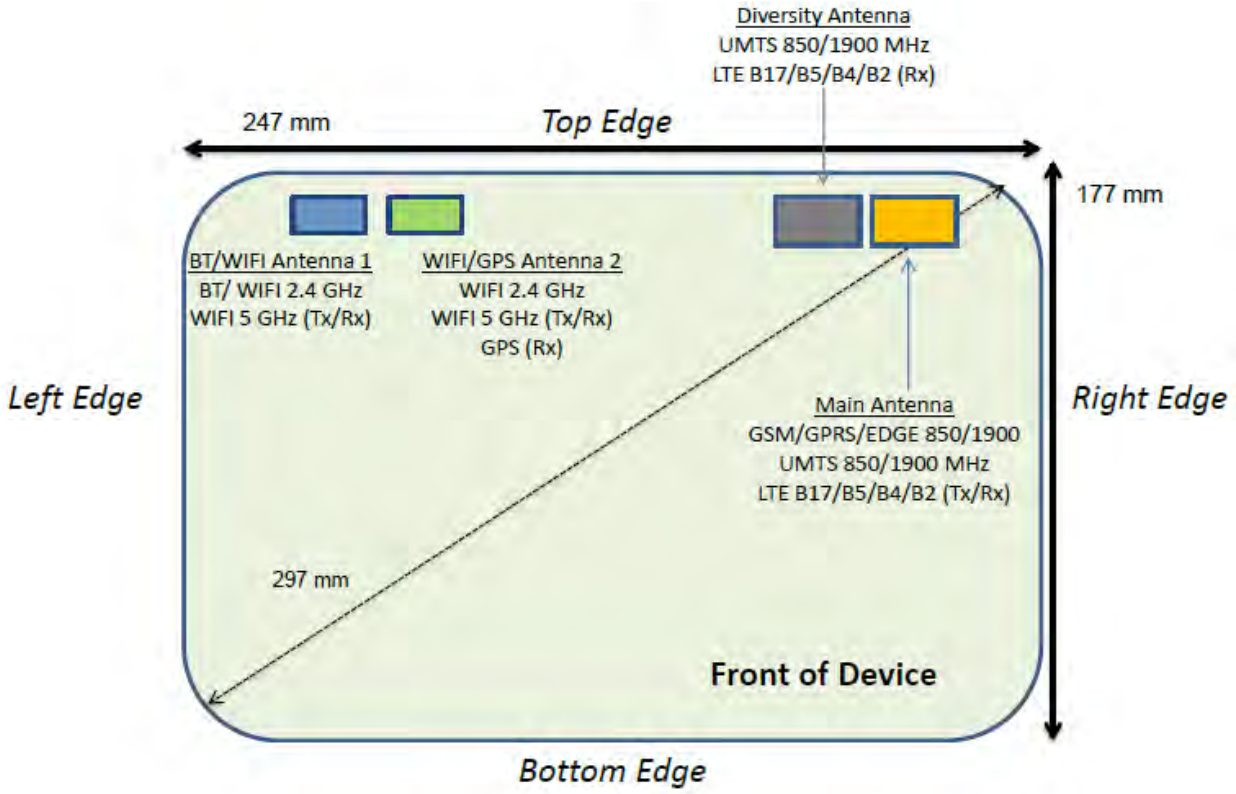
Reduced Power – Body at 0 mm:

Mode / Band		Voice (dBm)	Burst Average GMSK (dBm)				Burst Average 8-PSK (dBm)			
		1 TX Slot	*1 TX Slots*	*2 TX Slots*	*3 TX Slots*	*4 TX Slots*	*1 TX Slots*	*2 TX Slots*	*3 TX Slots*	*4 TX Slots*
GSM/GPRS/EDGE 850	Maximum	**25.0**	**25.0**	**24.0**	**23.0**	**21.5**	**23.0**	**22.0**	**21.0**	**19.5**
	Nominal	**24.5**	**24.5**	**23.5**	**22.5**	**21.0**	**22.5**	**21.5**	**20.5**	**19.0**
GSM/GPRS/EDGE 1900	Maximum	**22.0**	**22.0**	**19.0**	**17.0**	**16.0**	**18.0**	**17.0**	**16.0**	**15.0**
	Nominal	**21.5**	**21.5**	**18.5**	**16.5**	**15.5**	**17.5**	**16.5**	**15.5**	**14.5**

Mode / Band		Modulated Average (dBm)			
		3GPP RMC Rel 99	*3GPP HSDPA Rel 5*	*3GPP HSUPA Rel 6*	*3GPP HSUPA Rel 8*
UMTS Band 5 (850 MHz)	Maximum	**18.5**	**18.5**	**18.5**	**18.5**
	Nominal	**18.0**	**18.0**	**18.0**	**18.0**
UMTS Band 2 (1900 MHz)	Maximum	**13.5**	**13.5**	**13.5**	**13.5**
	Nominal	**13.0**	**13.0**	**13.0**	**13.0**

Mode / Band		Modulated Average (dBm)
LTE Band 17	Maximum	**16.5**
	Nominal	**16.0**
LTE Band 5 (Cell)	Maximum	**17.0**
	Nominal	**16.5**
LTE Band 4 (AWS)	Maximum	**14.5**
	Nominal	**14.0**
LTE Band 2 (PCS)	Maximum	**13.5**
	Nominal	**13.0**

1.4 DUT Antenna Locations



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

Figure 1-1
DUT Antenna Locations

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.

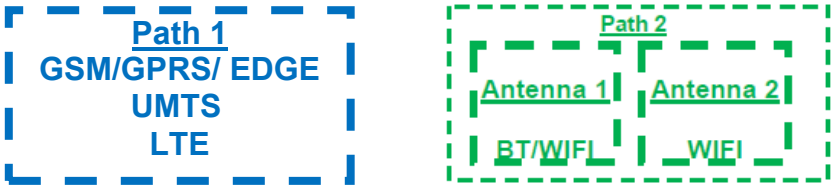


Figure 1-2
Simultaneous Transmission Paths

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 Configuration	Body
1	UMTS + 2.4 GHz WI-FI	Yes
2	UMTS + 5 GHz WI-FI	Yes
3	UMTS + 2.4 GHz Bluetooth	Yes
4	LTE + 2.4 GHz WI-FI	Yes
5	LTE + 5 GHz WI-FI	Yes
6	LTE + 2.4 GHz Bluetooth	Yes
7	GPRS/EDGE + 2.4 GHz WI-FI	Yes
8	GPRS/EDGE + 5 GHz WI-FI	Yes
9	GPRS/EDGE + 2.4 GHz Bluetooth	Yes

1. Bluetooth, 2.4 GHz, and 5 GHz share the same antenna path and cannot transmit simultaneously.
2. GSM/GPRS/EDGE, UMTS and LTE share the same antenna path and cannot transmit simultaneously.
3. This device supports 2x2 MIMO Tx for WLAN 802.11n/ac. Each WLAN antenna can transmit independently or together when operating with MIMO.

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 (rounded to the nearest mW) and the antenna to user separation distance, Bluetooth SAR was not required; [(8/5)* √2.441] = 2.5< 3.0. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.

Based on the maximum conducted power of 5GHz WLAN (rounded to the nearest mW) and the antenna to user separation distance, 5GHz WLAN SAR was not required; [(6/5)* √5.825] = 2.9< 3.0. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.

This device supports IEEE 802.11ac with the following features:
a) Up to 80 MHz Bandwidth only
b) No aggregate channel configurations
c) 2 Tx antenna output
d) 256 QAM is supported
e) No new 5 GHz channels

(B) Licensed Transmitter(s)

GSM/GPRS/EDGE DTM is not supported for US bands. Therefore, the GSM Voice modes in this report do not transmit simultaneously with GPRS/EDGE Data.

This device is only capable of QPSK HSUPA in the uplink. Therefore, no additional SAR tests are required beyond that described for devices with HSUPA in KDB 941225 D01v02.

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)
- April 2013 TCB Workshop Notes (IEEE 802.11ac)
- October 2013 TBC Workshop Notes (GPRS Considerations)

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.

Mode	Maximum Body Serial Number	Reduced Body Serial Number
GSM/GPRS/EDGE 850	805M-4	805M-7
UMTS 850	805M-4	805M-7
GSM/GPRS/EDGE 1900	805M-4	805M-97
UMTS 1900	805M-4	805M-7
LTE Band 17	805M-4	805M-7
LTE Band 5 (Cell)	805M-4	805M-7
LTE Band 4 (AWS)	805M-2	805M-7
LTE Band 2 (PCS)	805M-4	805M-7
2.4 GHz WLAN	805M-3	-

2 LTE INFORMATION

LTE Information			
FCC ID	**A3LSMT805M**		
Form Factor	Portable Tablet		
Frequency Range of each LTE transmission band	LTE Band 17 (706.5 - 713.5 MHz)		
	LTE Band 5 (Cell) (824.7 - 848.3 MHz)		
	LTE Band 4 (AWS) (1710.7 - 1754.3 MHz)		
	LTE Band 2 (PCS) (1850.7 - 1909.3 MHz)		
Channel Bandwidths	LTE Band 17: 5 MHz, 10 MHz		
	LTE Band 5 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz		
	LTE Band 4 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz		
	LTE Band 2 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz		
Channel Numbers and Frequencies (MHz)	Low	Mid	High
LTE Band 17: 5 MHz	706.5 (23755)	710 (23790)	713.5 (23825)
LTE Band 17: 10 MHz	709 (23780)	710 (23790)	711 (23800)
LTE Band 5 (Cell): 1.4 MHz	824.7 (20407)	836.5 (20525)	848.3 (20643)
LTE Band 5 (Cell): 3 MHz	825.5 (20415)	836.5 (20525)	847.5 (20635)
LTE Band 5 (Cell): 5 MHz	826.5 (20425)	836.5 (20525)	846.5 (20625)
LTE Band 5 (Cell): 10 MHz	829 (20450)	836.5 (20525)	844 (20600)
LTE Band 4 (AWS): 1.4 MHz	1710.7 (19957)	1732.5 (20175)	1754.3 (20393)
LTE Band 4 (AWS): 3 MHz	1711.5 (19965)	1732.5 (20175)	1753.5 (20385)
LTE Band 4 (AWS): 5 MHz	1712.5 (19975)	1732.5 (20175)	1752.5 (20375)
LTE Band 4 (AWS): 10 MHz	1715 (20000)	1732.5 (20175)	1750 (20350)
LTE Band 4 (AWS): 15 MHz	1717.5 (20025)	1732.5 (20175)	1747.5 (20325)
LTE Band 4 (AWS): 20 MHz	1720 (20050)	1732.5 (20175)	1745 (20300)
LTE Band 2 (PCS): 1.4 MHz	1850.7 (18607)	1880 (18900)	1909.3 (19193)
LTE Band 2 (PCS): 3 MHz	1851.5 (18615)	1880 (18900)	1908.5 (19185)
LTE Band 2 (PCS): 5 MHz	1852.5 (18625)	1880 (18900)	1907.5 (19175)
LTE Band 2 (PCS): 10 MHz	1855 (18650)	1880 (18900)	1905 (19150)
LTE Band 2 (PCS): 15 MHz	1857.5 (18675)	1880 (18900)	1902.5 (19125)
LTE Band 2 (PCS): 20 MHz	1860 (18700)	1880 (18900)	1900 (19100)
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)	YES		
A-MPR (Additional MPR) disabled for SAR Testing?	YES		

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 [22]. 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]

4 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01 and IEEE 1528-2013:

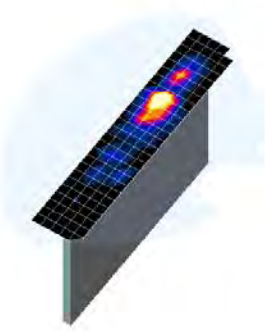


Figure 4-1
Sample SAR Area Scan

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) and IEEE 1528-2013.
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) and IEEE 1528-2013. 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. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 4-1. 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

*Also compliant to IEEE 1528-2013 Table 6

5 SAR TESTING PROCEDURES

5.1 SAR Testing for Tablet per FCC KDB Publication 616217 D04v01

Due to its size this device can be used in full sized tablet exposure conditions. 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.

5.2 Additional Test Positions due to Sensor Considerations

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

When the sensor detects a user is touching the device on or near to the antenna the device reduces the maximum allowed output power However, the sensor is not active when the device is moved beyond the sensor triggering distance and the 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 sensor activation distance for the back side of the device is 21 mm, a conservative distance of 20 mm was tested for SAR on the back side at maximum power. Since the sensor activation distance for the top edge of the device is 21 mm, a conservative distance of 20 mm was tested for SAR on the top edge at maximum power. Sensor triggering distance summary data is included in Appendix G. The sensor does not trigger power reduction from the front of the device.

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.

6 RF EXPOSURE LIMITS

6.1 Uncontrolled Environment

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

6.2 Controlled Environment

CONTROLLED ENVIRONMENTS are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. 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 6-1
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.

7 FCC MEASUREMENT PROCEDURES

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 UMTS

7.3.1 Output Power Verification

Maximum output power is measured on the High, Middle and Low channels for each applicable transmission band according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all "1s".

Maximum output power is verified on the High, Middle and Low channels according to the general descriptions in section 5.2 of 3GPP TS 34.121 (release 5), using the appropriate RMC with TPC (transmit power control) set to all "1s" or applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HS-DPCCH etc) are tabulated in this test report. All configurations that are not supported by the DUT or cannot be measured due to technical or equipment limitations are identified.

7.3.2 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all "1s".

7.3.3 Procedures Used to Establish RF Signal for SAR HSDPA Data Devices

The following procedures are applicable to HSDPA data devices operating under 3GPP Release 5. Body exposure conditions are typically applicable to these devices, including handsets and data modems operating in various electronic devices. HSDPA operates in conjunction with UMTS and requires an active DPCCH. The default test configuration is to measure SAR in UMTS without HSDPA, with an established radio link between the DUT and a communication test set with 12.2

kbps RMC mode configured in Test Loop Mode 1; and tested with HSDPA with FRC and a 12.2 kbps RMC using the highest SAR configuration in UMTS. SAR is selectively confirmed for other physical channel configurations according to output power, exposure conditions and device operating capabilities. Maximum output power is verified according to 3GPP TS 23.121 (Release 5) and SAR must be measured according to these maximum output conditions.

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

Note 1: Δ_{ACK}, Δ_{NACK} and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and $\Delta_{NACK} = 8$ ($A_{hs} = 30/15$) with $\beta_{hs} = 30/15 * \beta_c$, and $\Delta_{CQI} = 7$ ($A_{hs} = 24/15$) with $\beta_{hs} = 24/15 * \beta_c$.

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

Figure 7-1
Table C.10.1.4 of TS 234.121-1

7.3.4 SAR Measurement Conditions for HSUPA Data Devices

SAR for body exposure configurations are measured according to the 'Body SAR Measurements' procedures in the 'WCDMA Handsets' section of the KDB 941225 D01 FCC 3G document. In addition, Body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least ¼ dB higher of that measured without HSPA in 12.2 kbps RMC mode or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA. When VOIP is applicable for head exposure, SAR is not required when the maximum output of each RF channel with HSPA is less than ¼ dB higher than that measured using 12.2 kbps RMC; otherwise, the same HSPA configuration used for body measurements should be used to test for head exposure.

Due to inner loop power control requirements in HSPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and EDCH configurations for HSPA should be configured according to the β values indicated below as well as other applicable procedures described in the 'WCDMA Handset' and 'Release 5 HSDPA Data Devices' sections of the FCC 3G document.

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM (2) (dB)	MPR (dB)	AG (3) Index	E-TFCI
1	11/15 (3)	15/15 (3)	64	11/15 (3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}: 47/15 β_{ed2}: 47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (4)	15/15 (5)	64	15/15 (4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$.

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

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

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

Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.

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

7.3.5 SAR Measurement Conditions for DC-HSDPA

SAR test exclusion for DC-HSDPA devices is determined by power measurements according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to qualify for SAR test exclusion. DC-HSDPA uplink maximum output power measurements using the four Rel. 5 HSDPA subtests in Table C.10.1.4 of TS 234.121-1 is required.

When the maximum average output power of each RF channel with DC-HSDPA active is ≤ ¼ dB higher than that measured using 12.2 kbps RMC, or the maximum reported SAR for 12.2 kbps RMC is ≤ 75% of the SAR limit, SAR evaluation for DC-HSDPA is not required.

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. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

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 permanently implemented for this device by the manufacturer. 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
    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/ac 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 [24]

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 higher than 0.25 dB or more 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.

7.5.3 MIMO SAR Considerations

Per KDB 248227, SAR for MIMO was measured with both transmitting simultaneously and was evaluated independently of SISO operation. For 2.4 GHz MIMO, 802.11n was evaluated. 5 GHz WLAN were excluded per FCC KDB 447498 D01v05.

8 RF CONDUCTED POWERS

8.1 GSM Conducted Powers

Table 8-1
Maximum GSM/ GPRS/ EDGE Average RF Conducted Powers

		Maximum Burst-Averaged Output Power								
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
GSM 850	128	32.35	32.36	32.41	31.52	**30.40**	26.72	26.78	25.97	24.57
	190	32.46	32.46	32.44	31.63	**30.43**	26.61	26.69	25.81	24.48
	251	32.37	32.33	32.32	31.48	**30.34**	26.42	26.44	25.63	24.27
GSM 1900	512	29.15	29.14	29.18	28.15	**26.94**	25.93	25.98	25.11	23.90
	661	29.07	29.08	29.12	28.09	**26.89**	25.92	25.92	25.12	23.89
	810	29.27	29.27	29.32	28.27	**27.04**	26.00	25.99	25.20	23.98
		Calculated Maximum Frame-Averaged Output Power								
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
GSM 850	128	23.32	23.33	26.39	27.26	**27.39**	17.69	20.76	21.71	21.56
	190	23.43	23.43	26.42	27.37	**27.42**	17.58	20.67	21.55	21.47
	251	23.34	23.30	26.30	27.22	**27.33**	17.39	20.42	21.37	21.26
GSM 1900	512	20.12	20.11	23.16	23.89	**23.93**	16.90	19.96	20.85	20.89
	661	20.04	20.05	23.10	23.83	**23.88**	16.89	19.90	20.86	20.88
	810	20.24	20.24	23.30	24.01	**24.03**	16.97	19.97	20.94	20.97
GSM 850	**Frame Avg.Targets:**	23.47	23.47	26.48	27.44	**27.49**	17.47	20.48	21.44	21.49
GSM 1900		19.97	19.97	22.98	23.94	**23.99**	16.47	19.48	20.44	20.49

Table 8-2
Reduced GSM/ GPRS/ EDGE Average RF Conducted Powers

		Maximum Burst-Averaged Output Power								
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
GSM 850	128	24.98	25.00	23.98	**22.97**	21.50	23.00	22.00	21.00	19.50
	190	24.82	24.82	24.00	**23.00**	21.49	22.97	21.87	20.92	19.47
	251	24.83	24.77	23.96	**22.96**	21.48	22.75	21.67	20.72	19.22
GSM 1900	512	21.72	21.71	18.69	16.70	**15.70**	17.96	16.76	15.82	14.26
	661	21.58	21.55	18.58	16.54	**15.57**	17.94	16.77	15.88	14.42
	810	21.79	21.84	18.83	16.83	**15.77**	17.86	16.83	15.97	14.41
		Calculated Maximum Frame-Averaged Output Power								
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
GSM 850	128	15.95	15.97	17.96	**18.71**	18.49	13.97	15.98	16.74	16.49
	190	15.79	15.79	17.98	**18.74**	18.48	13.94	15.85	16.66	16.46
	251	15.80	15.74	17.94	**18.70**	18.47	13.72	15.65	16.46	16.21
GSM 1900	512	12.69	12.68	12.67	12.44	**12.69**	8.93	10.74	11.56	11.25
	661	12.55	12.52	12.56	12.28	**12.56**	8.91	10.75	11.62	11.41
	810	12.76	12.81	12.81	12.57	**12.76**	8.83	10.81	11.71	11.40
GSM 850	**Frame Avg.Targets:**	15.47	15.47	17.48	**18.24**	17.99	13.47	15.48	16.24	15.99
GSM 1900		12.47	12.47	12.48	12.24	**12.49**	8.47	10.48	11.24	11.49

Notes:

1. Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
2. October 2013 TBC Workshop Notes, the source-based frame-averaged output power was evaluated for all GPRS/EDGE slot configurations. The configuration with the highest target frame averaged output power was evaluated for body SAR. When the maximum frame-averaged powers are equivalent across two or more slots (within 0.25 dB), the configuration with the most number of time slots was tested.
3. GPRS/EDGE (GMSK) output powers were measured with coding scheme setting of 1 (CS1) on the base station simulator. CS1 was configured to measure GPRS output power measurements and SAR to ensure GMSK modulation in the signal. Our Investigation has shown that CS1 - CS4 settings do not have any impact on the output levels or modulation in the GPRS modes.
4. EDGE (8-PSK) output powers were measured with MCS7 on the base station simulator. MCS7 coding scheme was used to measure the output powers for EDGE since investigation has shown that choosing MCS7 coding scheme will ensure 8-PSK modulation. It has been shown that MCS levels that produce 8PSK modulation do not have an impact on output power.

GSM Class: B
GPRS Multislot class: 33 (Max 4 Tx uplink slots)
EDGE Multislot class: 33 (Max 4 Tx uplink slots)
DTM Multislot Class: N/A

Figure 8-1
Power Measurement Setup

8.2 UMTS Conducted Powers

Maximum Power:

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	22.22	22.26	22.31	22.97	22.84	22.86	-
99		12.2 kbps AMR	22.15	22.22	22.24	22.87	22.87	22.87	-
6	HSDPA	Subtest 1	22.18	22.17	22.20	22.49	22.42	22.59	0
6		Subtest 2	22.14	22.19	22.16	22.43	22.38	22.58	0
6		Subtest 3	22.14	22.17	22.18	22.47	22.41	22.49	0.5
6		Subtest 4	21.94	21.98	21.99	22.21	22.13	22.36	0.5
6	HSUPA	Subtest 1	21.52	21.09	21.43	21.04	21.00	21.02	0
6		Subtest 2	20.66	20.64	20.73	20.26	20.43	20.48	2
6		Subtest 3	21.26	21.35	21.31	21.46	21.03	21.16	1
6		Subtest 4	20.44	20.46	20.61	20.14	20.33	20.32	2
6		Subtest 5	21.02	21.28	21.20	21.15	21.11	21.27	0
8	DC-HSDPA	Subtest 1	22.42	22.46	22.38	22.48	22.32	22.49	0
8		Subtest 2	22.36	22.35	22.37	22.54	22.38	22.53	0
8		Subtest 3	22.38	22.43	22.46	22.49	22.33	22.48	0.5
8		Subtest 4	22.28	22.29	22.39	22.48	22.34	22.50	0.5

Reduced Power - Body at 0mm:

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	17.65	17.73	17.72	12.99	12.82	12.97	-
99		12.2 kbps AMR	17.73	17.82	17.75	12.96	12.84	12.92	-
6	HSDPA	Subtest 1	17.66	17.75	17.71	11.52	11.63	12.04	0
6		Subtest 2	17.55	17.72	17.61	11.54	11.66	12.02	0
6		Subtest 3	17.55	17.71	17.67	11.63	11.76	12.07	0.5
6		Subtest 4	17.68	17.61	17.72	11.67	11.79	12.10	0.5
6	HSUPA	Subtest 1	16.80	17.27	16.91	11.58	11.69	11.91	0
6		Subtest 2	17.15	16.92	16.89	11.23	12.07	12.34	2
6		Subtest 3	17.02	16.82	16.88	10.95	11.15	11.37	1
6		Subtest 4	17.11	16.99	16.84	11.18	12.01	12.22	2
6		Subtest 5	16.99	17.09	17.02	11.55	11.60	11.84	0
8	DC-HSDPA	Subtest 1	17.73	17.72	17.87	13.02	12.95	13.08	0
8		Subtest 2	17.75	17.72	17.90	13.00	12.99	13.10	0
8		Subtest 3	17.69	17.71	17.88	13.02	12.91	13.14	0.5
8		Subtest 4	17.72	17.73	17.85	13.01	12.93	13.16	0.5

UMTS SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v02. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.

DC-HSDPA considerations

- 3GPP Specification 34.121-1 Release 8 Ver 8.10.0 was used for DC-HSDPA guidance
- H-Set 12 (QPSK) was confirmed to be used during DC-HSDPA measurements
- Measured maximum output powers for DC-HSDPA were not greater than 1/4 dB higher than the WCDMA 12.2 kbps RMC maximum output, as a result, SAR is not required for DC-HSDPA
- The DUT supports UE category 24 for HSDPA.

It is expected by the manufacturer that MPR for some HSPA subtests may be up to 1 dB more than specified by 3GPP, but also as low as 0 dB according to the chipset implementation in this model.

Figure 8-2
Power Measurement Setup

8.3 LTE Conducted Powers

8.3.1 LTE Band 17 Maximum Power

Table 8-3
LTE Band 17 Conducted Powers – 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	710.0	23790	10	QPSK	1	0	**22.11**	0	0
	710.0	23790	10	QPSK	1	25	22.10	0	0
	710.0	23790	10	QPSK	1	49	22.00	0	0
	710.0	23790	10	QPSK	25	0	**21.19**	0-1	1
	710.0	23790	10	QPSK	25	12	21.17	0-1	1
	710.0	23790	10	QPSK	25	25	21.04	0-1	1
	710.0	23790	10	QPSK	50	0	21.18	0-1	1
	710.0	23790	10	16QAM	1	0	21.65	0-1	1
	710.0	23790	10	16QAM	1	25	21.72	0-1	1
	710.0	23790	10	16QAM	1	49	21.31	0-1	1
	710.0	23790	10	16QAM	25	0	20.17	0-2	2
	710.0	23790	10	16QAM	25	12	20.11	0-2	2
	710.0	23790	10	16QAM	25	25	20.00	0-2	2
	710.0	23790	10	16QAM	50	0	20.15	0-2	2

Table 8-4
LTE Band 17 Conducted Powers – 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	710.0	23790	5	QPSK	1	0	22.28	0	0
	710.0	23790	5	QPSK	1	12	22.20	0	0
	710.0	23790	5	QPSK	1	24	22.02	0	0
	710.0	23790	5	QPSK	12	0	21.27	0-1	1
	710.0	23790	5	QPSK	12	6	21.22	0-1	1
	710.0	23790	5	QPSK	12	13	21.12	0-1	1
	710.0	23790	5	QPSK	25	0	21.30	0-1	1
	710.0	23790	5	16-QAM	1	0	21.53	0-1	1
	710.0	23790	5	16-QAM	1	12	21.45	0-1	1
	710.0	23790	5	16-QAM	1	24	21.19	0-1	1
	710.0	23790	5	16-QAM	12	0	20.19	0-2	2
	710.0	23790	5	16-QAM	12	6	20.15	0-2	2
	710.0	23790	5	16-QAM	12	13	20.03	0-2	2
	710.0	23790	5	16-QAM	25	0	20.12	0-2	2

Note: LTE Band 17 at 5 and 10 MHz bandwidths do not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

8.3.2 LTE Band 17 Reduced Power - Body at 0mm

Table 8-5
LTE Band 17 Conducted Powers – 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	710.0	23790	10	QPSK	1	0	**15.98**	0	0
	710.0	23790	10	QPSK	1	25	15.96	0	0
	710.0	23790	10	QPSK	1	49	15.58	0	0
	710.0	23790	10	QPSK	25	0	**15.04**	0-1	1
	710.0	23790	10	QPSK	25	12	15.02	0-1	1
	710.0	23790	10	QPSK	25	25	14.86	0-1	1
	710.0	23790	10	QPSK	50	0	14.98	0-1	1
	710.0	23790	10	16QAM	1	0	15.36	0-1	1
	710.0	23790	10	16QAM	1	25	15.45	0-1	1
	710.0	23790	10	16QAM	1	49	15.09	0-1	1
	710.0	23790	10	16QAM	25	0	13.91	0-2	2
	710.0	23790	10	16QAM	25	12	13.85	0-2	2
	710.0	23790	10	16QAM	25	25	13.68	0-2	2
	710.0	23790	10	16QAM	50	0	13.92	0-2	2

Table 8-6
LTE Band 17 Conducted Powers – 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	710.0	23790	5	QPSK	1	0	16.01	0	0
	710.0	23790	5	QPSK	1	12	16.02	0	0
	710.0	23790	5	QPSK	1	24	15.89	0	0
	710.0	23790	5	QPSK	12	0	15.08	0-1	1
	710.0	23790	5	QPSK	12	6	15.07	0-1	1
	710.0	23790	5	QPSK	12	13	14.95	0-1	1
	710.0	23790	5	QPSK	25	0	15.08	0-1	1
	710.0	23790	5	16-QAM	1	0	15.27	0-1	1
	710.0	23790	5	16-QAM	1	12	15.20	0-1	1
	710.0	23790	5	16-QAM	1	24	14.94	0-1	1
	710.0	23790	5	16-QAM	12	0	13.96	0-2	2
	710.0	23790	5	16-QAM	12	6	13.87	0-2	2
	710.0	23790	5	16-QAM	12	13	13.77	0-2	2
	710.0	23790	5	16-QAM	25	0	13.85	0-2	2

Note: LTE Band 17 at 5 and 10 MHz bandwidths do not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

8.3.3 LTE Band 5 (Cell) Maximum Power

Table 8-7
LTE Band 5 Conducted Powers – 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	836.5	20525	10	QPSK	1	0	**22.46**	0	0
	836.5	20525	10	QPSK	1	25	22.44	0	0
	836.5	20525	10	QPSK	1	49	22.14	0	0
	836.5	20525	10	QPSK	25	0	**21.55**	0-1	1
	836.5	20525	10	QPSK	25	12	21.46	0-1	1
	836.5	20525	10	QPSK	25	25	21.38	0-1	1
	836.5	20525	10	QPSK	50	0	21.43	0-1	1
	836.5	20525	10	16QAM	1	0	21.50	0-1	1
	836.5	20525	10	16QAM	1	25	21.51	0-1	1
	836.5	20525	10	16QAM	1	49	21.20	0-1	1
	836.5	20525	10	16QAM	25	0	20.46	0-2	2
	836.5	20525	10	16QAM	25	12	20.47	0-2	2
	836.5	20525	10	16QAM	25	25	20.36	0-2	2
	836.5	20525	10	16QAM	50	0	20.31	0-2	2

Note: LTE Band 5 (Cell) at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Table 8-8
LTE Band 5 Conducted Powers – 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	826.5	20425	5	QPSK	1	0	22.51	0	0
	826.5	20425	5	QPSK	1	12	22.51	0	0
	826.5	20425	5	QPSK	1	24	22.42	0	0
	826.5	20425	5	QPSK	12	0	21.61	0-1	1
	826.5	20425	5	QPSK	12	6	21.52	0-1	1
	826.5	20425	5	QPSK	12	13	21.46	0-1	1
	826.5	20425	5	QPSK	25	0	21.50	0-1	1
	826.5	20425	5	16-QAM	1	0	21.55	0-1	1
	826.5	20425	5	16-QAM	1	12	21.47	0-1	1
	826.5	20425	5	16-QAM	1	24	21.48	0-1	1
	826.5	20425	5	16-QAM	12	0	20.49	0-2	2
	826.5	20425	5	16-QAM	12	6	20.46	0-2	2
	826.5	20425	5	16-QAM	12	13	20.40	0-2	2
	826.5	20425	5	16-QAM	25	0	20.45	0-2	2
Mid	836.5	20525	5	QPSK	1	0	22.48	0	0
	836.5	20525	5	QPSK	1	12	22.42	0	0
	836.5	20525	5	QPSK	1	24	22.32	0	0
	836.5	20525	5	QPSK	12	0	21.55	0-1	1
	836.5	20525	5	QPSK	12	6	21.51	0-1	1
	836.5	20525	5	QPSK	12	13	21.46	0-1	1
	836.5	20525	5	QPSK	25	0	21.60	0-1	1
	836.5	20525	5	16-QAM	1	0	21.55	0-1	1
	836.5	20525	5	16-QAM	1	12	21.53	0-1	1
	836.5	20525	5	16-QAM	1	24	21.37	0-1	1
	836.5	20525	5	16-QAM	12	0	20.41	0-2	2
	836.5	20525	5	16-QAM	12	6	20.42	0-2	2
	836.5	20525	5	16-QAM	12	13	20.39	0-2	2
	836.5	20525	5	16-QAM	25	0	20.40	0-2	2
High	846.5	20625	5	QPSK	1	0	22.12	0	0
	846.5	20625	5	QPSK	1	12	22.09	0	0
	846.5	20625	5	QPSK	1	24	22.02	0	0
	846.5	20625	5	QPSK	12	0	21.17	0-1	1
	846.5	20625	5	QPSK	12	6	21.15	0-1	1
	846.5	20625	5	QPSK	12	13	21.12	0-1	1
	846.5	20625	5	QPSK	25	0	21.14	0-1	1
	846.5	20625	5	16-QAM	1	0	21.24	0-1	1
	846.5	20625	5	16-QAM	1	12	21.22	0-1	1
	846.5	20625	5	16-QAM	1	24	21.08	0-1	1
	846.5	20625	5	16-QAM	12	0	20.13	0-2	2
	846.5	20625	5	16-QAM	12	6	20.09	0-2	2
	846.5	20625	5	16-QAM	12	13	20.07	0-2	2
	846.5	20625	5	16-QAM	25	0	20.10	0-2	2

Table 8-9
LTE Band 5 Conducted Powers – 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	825.5	20415	3	QPSK	1	0	22.51	0	0
	825.5	20415	3	QPSK	1	7	22.41	0	0
	825.5	20415	3	QPSK	1	14	22.52	0	0
	825.5	20415	3	QPSK	8	0	21.61	0-1	1
	825.5	20415	3	QPSK	8	4	21.52	0-1	1
	825.5	20415	3	QPSK	8	7	21.46	0-1	1
	825.5	20415	3	QPSK	15	0	21.60	0-1	1
	825.5	20415	3	16-QAM	1	0	21.55	0-1	1
	825.5	20415	3	16-QAM	1	7	21.37	0-1	1
	825.5	20415	3	16-QAM	1	14	21.58	0-1	1
	825.5	20415	3	16-QAM	8	0	20.39	0-2	2
	825.5	20415	3	16-QAM	8	4	20.36	0-2	2
	825.5	20415	3	16-QAM	8	7	20.50	0-2	2
	825.5	20415	3	16-QAM	15	0	20.45	0-2	2
Mid	836.5	20525	3	QPSK	1	0	22.58	0	0
	836.5	20525	3	QPSK	1	7	22.52	0	0
	836.5	20525	3	QPSK	1	14	22.42	0	0
	836.5	20525	3	QPSK	8	0	21.65	0-1	1
	836.5	20525	3	QPSK	8	4	21.41	0-1	1
	836.5	20525	3	QPSK	8	7	21.46	0-1	1
	836.5	20525	3	QPSK	15	0	21.60	0-1	1
	836.5	20525	3	16-QAM	1	0	21.65	0-1	1
	836.5	20525	3	16-QAM	1	7	21.63	0-1	1
	836.5	20525	3	16-QAM	1	14	21.47	0-1	1
	836.5	20525	3	16-QAM	8	0	20.51	0-2	2
	836.5	20525	3	16-QAM	8	4	20.52	0-2	2
	836.5	20525	3	16-QAM	8	7	20.29	0-2	2
	836.5	20525	3	16-QAM	15	0	20.30	0-2	2
High	847.5	20635	3	QPSK	1	0	22.01	0	0
	847.5	20635	3	QPSK	1	7	22.03	0	0
	847.5	20635	3	QPSK	1	14	22.02	0	0
	847.5	20635	3	QPSK	8	0	21.11	0-1	1
	847.5	20635	3	QPSK	8	4	21.08	0-1	1
	847.5	20635	3	QPSK	8	7	21.09	0-1	1
	847.5	20635	3	QPSK	15	0	21.11	0-1	1
	847.5	20635	3	16-QAM	1	0	21.07	0-1	1
	847.5	20635	3	16-QAM	1	7	21.08	0-1	1
	847.5	20635	3	16-QAM	1	14	21.11	0-1	1
	847.5	20635	3	16-QAM	8	0	20.18	0-2	2
	847.5	20635	3	16-QAM	8	4	20.11	0-2	2
	847.5	20635	3	16-QAM	8	7	20.10	0-2	2
	847.5	20635	3	16-QAM	15	0	20.02	0-2	2

Table 8-10
LTE Band 5 Conducted Powers – 1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	824.7	20407	1.4	QPSK	1	0	22.61	0	0
	824.7	20407	1.4	QPSK	1	2	22.51	0	0
	824.7	20407	1.4	QPSK	1	5	22.62	0	0
	824.7	20407	1.4	QPSK	3	0	22.60	0	0
	824.7	20407	1.4	QPSK	3	2	22.42	0	0
	824.7	20407	1.4	QPSK	3	3	22.46	0	0
	824.7	20407	1.4	QPSK	6	0	21.60	0-1	1
	824.7	20407	1.4	16-QAM	1	0	21.65	0-1	1
	824.7	20407	1.4	16-QAM	1	2	21.37	0-1	1
	824.7	20407	1.4	16-QAM	1	5	21.68	0-1	1
	824.7	20407	1.4	16-QAM	3	0	21.46	0-1	1
	824.7	20407	1.4	16-QAM	3	2	21.26	0-1	1
	824.7	20407	1.4	16-QAM	3	3	21.40	0-1	1
	824.7	20407	1.4	16-QAM	6	0	20.55	0-2	2
Mid	836.5	20525	1.4	QPSK	1	0	22.68	0	0
	836.5	20525	1.4	QPSK	1	2	22.62	0	0
	836.5	20525	1.4	QPSK	1	5	22.52	0	0
	836.5	20525	1.4	QPSK	3	0	22.65	0	0
	836.5	20525	1.4	QPSK	3	2	22.41	0	0
	836.5	20525	1.4	QPSK	3	3	22.56	0	0
	836.5	20525	1.4	QPSK	6	0	21.60	0-1	1
	836.5	20525	1.4	16-QAM	1	0	21.65	0-1	1
	836.5	20525	1.4	16-QAM	1	2	21.53	0-1	1
	836.5	20525	1.4	16-QAM	1	5	21.37	0-1	1
	836.5	20525	1.4	16-QAM	3	0	21.51	0-1	1
	836.5	20525	1.4	16-QAM	3	2	21.42	0-1	1
	836.5	20525	1.4	16-QAM	3	3	21.39	0-1	1
	836.5	20525	1.4	16-QAM	6	0	20.30	0-2	2
High	848.3	20643	1.4	QPSK	1	0	22.22	0	0
	848.3	20643	1.4	QPSK	1	2	22.19	0	0
	848.3	20643	1.4	QPSK	1	5	22.02	0	0
	848.3	20643	1.4	QPSK	3	0	22.07	0	0
	848.3	20643	1.4	QPSK	3	2	22.05	0	0
	848.3	20643	1.4	QPSK	3	3	22.12	0	0
	848.3	20643	1.4	QPSK	6	0	21.04	0-1	1
	848.3	20643	1.4	16-QAM	1	0	21.24	0-1	1
	848.3	20643	1.4	16-QAM	1	2	21.32	0-1	1
	848.3	20643	1.4	16-QAM	1	5	21.08	0-1	1
	848.3	20643	1.4	16-QAM	3	0	21.13	0-1	1
	848.3	20643	1.4	16-QAM	3	2	21.09	0-1	1
	848.3	20643	1.4	16-QAM	3	3	21.07	0-1	1
	848.3	20643	1.4	16-QAM	6	0	20.00	0-2	2

8.3.4 LTE Band 5 (Cell) Reduced Power - Body at 0mm

Table 8-11
LTE Band 5 Conducted Powers – 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	836.5	20525	10	QPSK	1	0	16.62	0	0
	836.5	20525	10	QPSK	1	25	**16.64**	0	0
	836.5	20525	10	QPSK	1	49	16.29	0	0
	836.5	20525	10	QPSK	25	0	**15.75**	0-1	1
	836.5	20525	10	QPSK	25	12	15.71	0-1	1
	836.5	20525	10	QPSK	25	25	15.60	0-1	1
	836.5	20525	10	QPSK	50	0	15.67	0-1	1
	836.5	20525	10	16QAM	1	0	15.95	0-1	1
	836.5	20525	10	16QAM	1	25	15.94	0-1	1
	836.5	20525	10	16QAM	1	49	15.65	0-1	1
	836.5	20525	10	16QAM	25	0	14.84	0-2	2
	836.5	20525	10	16QAM	25	12	14.82	0-2	2
	836.5	20525	10	16QAM	25	25	14.70	0-2	2
	836.5	20525	10	16QAM	50	0	14.72	0-2	2

Note: LTE Band 5 (Cell) at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Table 8-12
LTE Band 5 Conducted Powers – 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	826.5	20425	5	QPSK	1	0	16.53	0	0
	826.5	20425	5	QPSK	1	12	16.51	0	0
	826.5	20425	5	QPSK	1	24	16.33	0	0
	826.5	20425	5	QPSK	12	0	15.67	0-1	1
	826.5	20425	5	QPSK	12	6	15.64	0-1	1
	826.5	20425	5	QPSK	12	13	15.48	0-1	1
	826.5	20425	5	QPSK	25	0	15.63	0-1	1
	826.5	20425	5	16-QAM	1	0	15.55	0-1	1
	826.5	20425	5	16-QAM	1	12	15.72	0-1	1
	826.5	20425	5	16-QAM	1	24	15.52	0-1	1
	826.5	20425	5	16-QAM	12	0	14.51	0-2	2
	826.5	20425	5	16-QAM	12	6	14.55	0-2	2
	826.5	20425	5	16-QAM	12	13	14.42	0-2	2
	826.5	20425	5	16-QAM	25	0	14.55	0-2	2
Mid	836.5	20525	5	QPSK	1	0	16.59	0	0
	836.5	20525	5	QPSK	1	12	16.57	0	0
	836.5	20525	5	QPSK	1	24	16.41	0	0
	836.5	20525	5	QPSK	12	0	15.62	0-1	1
	836.5	20525	5	QPSK	12	6	15.60	0-1	1
	836.5	20525	5	QPSK	12	13	15.52	0-1	1
	836.5	20525	5	QPSK	25	0	15.56	0-1	1
	836.5	20525	5	16-QAM	1	0	15.64	0-1	1
	836.5	20525	5	16-QAM	1	12	15.67	0-1	1
	836.5	20525	5	16-QAM	1	24	15.49	0-1	1
	836.5	20525	5	16-QAM	12	0	14.51	0-2	2
	836.5	20525	5	16-QAM	12	6	14.48	0-2	2
	836.5	20525	5	16-QAM	12	13	14.40	0-2	2
	836.5	20525	5	16-QAM	25	0	14.49	0-2	2
High	846.5	20625	5	QPSK	1	0	16.50	0	0
	846.5	20625	5	QPSK	1	12	16.52	0	0
	846.5	20625	5	QPSK	1	24	16.40	0	0
	846.5	20625	5	QPSK	12	0	15.71	0-1	1
	846.5	20625	5	QPSK	12	6	15.66	0-1	1
	846.5	20625	5	QPSK	12	13	15.60	0-1	1
	846.5	20625	5	QPSK	25	0	15.46	0-1	1
	846.5	20625	5	16-QAM	1	0	15.68	0-1	1
	846.5	20625	5	16-QAM	1	12	15.68	0-1	1
	846.5	20625	5	16-QAM	1	24	15.39	0-1	1
	846.5	20625	5	16-QAM	12	0	14.42	0-2	2
	846.5	20625	5	16-QAM	12	6	14.47	0-2	2
	846.5	20625	5	16-QAM	12	13	14.41	0-2	2
	846.5	20625	5	16-QAM	25	0	14.52	0-2	2

Table 8-13
LTE Band 5 Conducted Powers – 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	825.5	20415	3	QPSK	1	0	16.55	0	0
	825.5	20415	3	QPSK	1	7	16.62	0	0
	825.5	20415	3	QPSK	1	14	16.33	0	0
	825.5	20415	3	QPSK	8	0	15.49	0-1	1
	825.5	20415	3	QPSK	8	4	15.58	0-1	1
	825.5	20415	3	QPSK	8	7	15.45	0-1	1
	825.5	20415	3	QPSK	15	0	15.52	0-1	1
	825.5	20415	3	16-QAM	1	0	15.49	0-1	1
	825.5	20415	3	16-QAM	1	7	15.63	0-1	1
	825.5	20415	3	16-QAM	1	14	15.42	0-1	1
	825.5	20415	3	16-QAM	8	0	14.50	0-2	2
	825.5	20415	3	16-QAM	8	4	14.55	0-2	2
	825.5	20415	3	16-QAM	8	7	14.50	0-2	2
	825.5	20415	3	16-QAM	15	0	14.41	0-2	2
Mid	836.5	20525	3	QPSK	1	0	16.55	0	0
	836.5	20525	3	QPSK	1	7	16.53	0	0
	836.5	20525	3	QPSK	1	14	16.43	0	0
	836.5	20525	3	QPSK	8	0	15.59	0-1	1
	836.5	20525	3	QPSK	8	4	15.56	0-1	1
	836.5	20525	3	QPSK	8	7	15.55	0-1	1
	836.5	20525	3	QPSK	15	0	15.57	0-1	1
	836.5	20525	3	16-QAM	1	0	15.58	0-1	1
	836.5	20525	3	16-QAM	1	7	15.59	0-1	1
	836.5	20525	3	16-QAM	1	14	15.50	0-1	1
	836.5	20525	3	16-QAM	8	0	14.52	0-2	2
	836.5	20525	3	16-QAM	8	4	14.48	0-2	2
	836.5	20525	3	16-QAM	8	7	14.46	0-2	2
	836.5	20525	3	16-QAM	15	0	14.49	0-2	2
High	847.5	20635	3	QPSK	1	0	16.45	0	0
	847.5	20635	3	QPSK	1	7	16.63	0	0
	847.5	20635	3	QPSK	1	14	16.41	0	0
	847.5	20635	3	QPSK	8	0	15.68	0-1	1
	847.5	20635	3	QPSK	8	4	15.51	0-1	1
	847.5	20635	3	QPSK	8	7	15.56	0-1	1
	847.5	20635	3	QPSK	15	0	15.65	0-1	1
	847.5	20635	3	16-QAM	1	0	15.64	0-1	1
	847.5	20635	3	16-QAM	1	7	15.67	0-1	1
	847.5	20635	3	16-QAM	1	14	15.45	0-1	1
	847.5	20635	3	16-QAM	8	0	14.55	0-2	2
	847.5	20635	3	16-QAM	8	4	14.51	0-2	2
	847.5	20635	3	16-QAM	8	7	14.56	0-2	2
	847.5	20635	3	16-QAM	15	0	14.57	0-2	2

Table 8-14
LTE Band 5 Conducted Powers – 1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	824.7	20407	1.4	QPSK	1	0	16.47	0	0
	824.7	20407	1.4	QPSK	1	2	16.62	0	0
	824.7	20407	1.4	QPSK	1	5	16.30	0	0
	824.7	20407	1.4	QPSK	3	0	16.50	0	0
	824.7	20407	1.4	QPSK	3	2	16.58	0	0
	824.7	20407	1.4	QPSK	3	3	16.55	0	0
	824.7	20407	1.4	QPSK	6	0	15.49	0-1	1
	824.7	20407	1.4	16-QAM	1	0	15.48	0-1	1
	824.7	20407	1.4	16-QAM	1	2	15.69	0-1	1
	824.7	20407	1.4	16-QAM	1	5	15.39	0-1	1
	824.7	20407	1.4	16-QAM	3	0	15.48	0-1	1
	824.7	20407	1.4	16-QAM	3	2	15.49	0-1	1
	824.7	20407	1.4	16-QAM	3	3	15.43	0-1	1
	824.7	20407	1.4	16-QAM	6	0	14.42	0-2	2
Mid	836.5	20525	1.4	QPSK	1	0	16.53	0	0
	836.5	20525	1.4	QPSK	1	2	16.62	0	0
	836.5	20525	1.4	QPSK	1	5	16.33	0	0
	836.5	20525	1.4	QPSK	3	0	16.49	0	0
	836.5	20525	1.4	QPSK	3	2	16.44	0	0
	836.5	20525	1.4	QPSK	3	3	16.59	0	0
	836.5	20525	1.4	QPSK	6	0	15.49	0-1	1
	836.5	20525	1.4	16-QAM	1	0	15.50	0-1	1
	836.5	20525	1.4	16-QAM	1	2	15.56	0-1	1
	836.5	20525	1.4	16-QAM	1	5	15.55	0-1	1
	836.5	20525	1.4	16-QAM	3	0	15.48	0-1	1
	836.5	20525	1.4	16-QAM	3	2	15.44	0-1	1
	836.5	20525	1.4	16-QAM	3	3	15.47	0-1	1
	836.5	20525	1.4	16-QAM	6	0	14.54	0-2	2
High	848.3	20643	1.4	QPSK	1	0	16.50	0	0
	848.3	20643	1.4	QPSK	1	2	16.72	0	0
	848.3	20643	1.4	QPSK	1	5	16.44	0	0
	848.3	20643	1.4	QPSK	3	0	16.62	0	0
	848.3	20643	1.4	QPSK	3	2	16.58	0	0
	848.3	20643	1.4	QPSK	3	3	16.52	0	0
	848.3	20643	1.4	QPSK	6	0	15.75	0-1	1
	848.3	20643	1.4	16-QAM	1	0	15.64	0-1	1
	848.3	20643	1.4	16-QAM	1	2	15.76	0-1	1
	848.3	20643	1.4	16-QAM	1	5	15.41	0-1	1
	848.3	20643	1.4	16-QAM	3	0	15.66	0-1	1
	848.3	20643	1.4	16-QAM	3	2	15.56	0-1	1
	848.3	20643	1.4	16-QAM	3	3	15.49	0-1	1
	848.3	20643	1.4	16-QAM	6	0	14.61	0-2	2

8.3.5 LTE Band 4 Maximum Power

Table 8-15
LTE Band 4 Conducted Powers – 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	1732.5	20175	20	QPSK	1	0	**22.54**	0	0
	1732.5	20175	20	QPSK	1	50	22.33	0	0
	1732.5	20175	20	QPSK	1	99	22.10	0	0
	1732.5	20175	20	QPSK	50	0	**21.71**	0-1	1
	1732.5	20175	20	QPSK	50	25	21.36	0-1	1
	1732.5	20175	20	QPSK	50	50	21.46	0-1	1
	1732.5	20175	20	QPSK	100	0	21.69	0-1	1
	1732.5	20175	20	16QAM	1	0	21.94	0-1	1
	1732.5	20175	20	16QAM	1	50	21.57	0-1	1
	1732.5	20175	20	16QAM	1	99	21.55	0-1	1
	1732.5	20175	20	16QAM	50	0	20.68	0-2	2
	1732.5	20175	20	16QAM	50	25	20.45	0-2	2
	1732.5	20175	20	16QAM	50	50	20.44	0-2	2
	1732.5	20175	20	16QAM	100	0	20.57	0-2	2

Note: LTE Band 4 (AWS) at 20 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Table 8-16
LTE Band 4 Conducted Powers – 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1717.5	20025	15	QPSK	1	0	22.50	0	0
	1717.5	20025	15	QPSK	1	36	22.34	0	0
	1717.5	20025	15	QPSK	1	74	22.25	0	0
	1717.5	20025	15	QPSK	36	0	21.51	0-1	1
	1717.5	20025	15	QPSK	36	18	21.45	0-1	1
	1717.5	20025	15	QPSK	36	37	21.33	0-1	1
	1717.5	20025	15	QPSK	75	0	21.37	0-1	1
	1717.5	20025	15	16QAM	1	0	21.43	0-1	1
	1717.5	20025	15	16QAM	1	36	21.18	0-1	1
	1717.5	20025	15	16QAM	1	74	21.09	0-1	1
	1717.5	20025	15	16QAM	36	0	20.41	0-2	2
	1717.5	20025	15	16QAM	36	18	20.42	0-2	2
	1717.5	20025	15	16QAM	36	37	20.28	0-2	2
	1717.5	20025	15	16QAM	75	0	20.26	0-2	2
Mid	1732.5	20175	15	QPSK	1	0	22.50	0	0
	1732.5	20175	15	QPSK	1	36	22.31	0	0
	1732.5	20175	15	QPSK	1	74	22.18	0	0
	1732.5	20175	15	QPSK	36	0	21.53	0-1	1
	1732.5	20175	15	QPSK	36	18	21.43	0-1	1
	1732.5	20175	15	QPSK	36	37	21.38	0-1	1
	1732.5	20175	15	QPSK	75	0	21.44	0-1	1
	1732.5	20175	15	16QAM	1	0	21.44	0-1	1
	1732.5	20175	15	16QAM	1	36	21.25	0-1	1
	1732.5	20175	15	16QAM	1	74	21.19	0-1	1
	1732.5	20175	15	16QAM	36	0	20.45	0-2	2
	1732.5	20175	15	16QAM	36	18	20.33	0-2	2
	1732.5	20175	15	16QAM	36	37	20.28	0-2	2
	1732.5	20175	15	16QAM	75	0	20.35	0-2	2
High	1747.5	20325	15	QPSK	1	0	22.58	0	0
	1747.5	20325	15	QPSK	1	36	22.38	0	0
	1747.5	20325	15	QPSK	1	74	22.27	0	0
	1747.5	20325	15	QPSK	36	0	21.57	0-1	1
	1747.5	20325	15	QPSK	36	18	21.52	0-1	1
	1747.5	20325	15	QPSK	36	37	21.39	0-1	1
	1747.5	20325	15	QPSK	75	0	21.49	0-1	1
	1747.5	20325	15	16QAM	1	0	21.54	0-1	1
	1747.5	20325	15	16QAM	1	36	21.32	0-1	1
	1747.5	20325	15	16QAM	1	74	21.28	0-1	1
	1747.5	20325	15	16QAM	36	0	20.48	0-2	2
	1747.5	20325	15	16QAM	36	18	20.28	0-2	2
	1747.5	20325	15	16QAM	36	37	20.37	0-2	2
	1747.5	20325	15	16QAM	75	0	20.44	0-2	2

Table 8-17
LTE Band 4 Conducted Powers – 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1715	20000	10	QPSK	1	0	22.32	0	0
	1715	20000	10	QPSK	1	25	22.13	0	0
	1715	20000	10	QPSK	1	49	22.13	0	0
	1715	20000	10	QPSK	25	0	21.35	0-1	1
	1715	20000	10	QPSK	25	12	21.27	0-1	1
	1715	20000	10	QPSK	25	25	21.20	0-1	1
	1715	20000	10	QPSK	50	0	21.33	0-1	1
	1715	20000	10	16QAM	1	0	21.44	0-1	1
	1715	20000	10	16QAM	1	25	21.22	0-1	1
	1715	20000	10	16QAM	1	49	21.23	0-1	1
	1715	20000	10	16QAM	25	0	20.31	0-2	2
	1715	20000	10	16QAM	25	12	20.21	0-2	2
	1715	20000	10	16QAM	25	25	20.24	0-2	2
	1715	20000	10	16QAM	50	0	20.19	0-2	2
Mid	1732.5	20175	10	QPSK	1	0	22.39	0	0
	1732.5	20175	10	QPSK	1	25	22.19	0	0
	1732.5	20175	10	QPSK	1	49	22.23	0	0
	1732.5	20175	10	QPSK	25	0	21.39	0-1	1
	1732.5	20175	10	QPSK	25	12	21.28	0-1	1
	1732.5	20175	10	QPSK	25	25	21.27	0-1	1
	1732.5	20175	10	QPSK	50	0	21.24	0-1	1
	1732.5	20175	10	16QAM	1	0	21.42	0-1	1
	1732.5	20175	10	16QAM	1	25	21.22	0-1	1
	1732.5	20175	10	16QAM	1	49	21.24	0-1	1
	1732.5	20175	10	16QAM	25	0	20.34	0-2	2
	1732.5	20175	10	16QAM	25	12	20.30	0-2	2
	1732.5	20175	10	16QAM	25	25	20.21	0-2	2
	1732.5	20175	10	16QAM	50	0	20.28	0-2	2
High	1750	20350	10	QPSK	1	0	22.36	0	0
	1750	20350	10	QPSK	1	25	22.15	0	0
	1750	20350	10	QPSK	1	49	22.32	0	0
	1750	20350	10	QPSK	25	0	21.37	0-1	1
	1750	20350	10	QPSK	25	12	21.19	0-1	1
	1750	20350	10	QPSK	25	25	21.34	0-1	1
	1750	20350	10	QPSK	50	0	21.30	0-1	1
	1750	20350	10	16QAM	1	0	21.36	0-1	1
	1750	20350	10	16QAM	1	25	21.24	0-1	1
	1750	20350	10	16QAM	1	49	21.25	0-1	1
	1750	20350	10	16QAM	25	0	20.24	0-2	2
	1750	20350	10	16QAM	25	12	20.25	0-2	2
	1750	20350	10	16QAM	25	25	20.17	0-2	2
	1750	20350	10	16QAM	50	0	20.22	0-2	2

Table 8-18
LTE Band 4 Conducted Powers – 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1712.5	19975	5	QPSK	1	0	22.43	0	0
	1712.5	19975	5	QPSK	1	12	22.33	0	0
	1712.5	19975	5	QPSK	1	24	22.31	0	0
	1712.5	19975	5	QPSK	12	0	21.49	0-1	1
	1712.5	19975	5	QPSK	12	6	21.46	0-1	1
	1712.5	19975	5	QPSK	12	13	21.45	0-1	1
	1712.5	19975	5	QPSK	25	0	21.28	0-1	1
	1712.5	19975	5	16-QAM	1	0	21.35	0-1	1
	1712.5	19975	5	16-QAM	1	12	21.20	0-1	1
	1712.5	19975	5	16-QAM	1	24	21.37	0-1	1
	1712.5	19975	5	16-QAM	12	0	20.31	0-2	2
	1712.5	19975	5	16-QAM	12	6	20.31	0-2	2
	1712.5	19975	5	16-QAM	12	13	20.34	0-2	2
	1712.5	19975	5	16-QAM	25	0	20.19	0-2	2
Mid	1732.5	20175	5	QPSK	1	0	22.33	0	0
	1732.5	20175	5	QPSK	1	12	22.26	0	0
	1732.5	20175	5	QPSK	1	24	22.24	0	0
	1732.5	20175	5	QPSK	12	0	21.43	0-1	1
	1732.5	20175	5	QPSK	12	6	21.39	0-1	1
	1732.5	20175	5	QPSK	12	13	21.35	0-1	1
	1732.5	20175	5	QPSK	25	0	21.36	0-1	1
	1732.5	20175	5	16-QAM	1	0	21.43	0-1	1
	1732.5	20175	5	16-QAM	1	12	21.28	0-1	1
	1732.5	20175	5	16-QAM	1	24	21.29	0-1	1
	1732.5	20175	5	16-QAM	12	0	20.32	0-2	2
	1732.5	20175	5	16-QAM	12	6	20.28	0-2	2
	1732.5	20175	5	16-QAM	12	13	20.28	0-2	2
	1732.5	20175	5	16-QAM	25	0	20.29	0-2	2
High	1752.5	20375	5	QPSK	1	0	22.28	0	0
	1752.5	20375	5	QPSK	1	12	22.29	0	0
	1752.5	20375	5	QPSK	1	24	22.17	0	0
	1752.5	20375	5	QPSK	12	0	21.46	0-1	1
	1752.5	20375	5	QPSK	12	6	21.47	0-1	1
	1752.5	20375	5	QPSK	12	13	21.43	0-1	1
	1752.5	20375	5	QPSK	25	0	21.45	0-1	1
	1752.5	20375	5	16-QAM	1	0	21.51	0-1	1
	1752.5	20375	5	16-QAM	1	12	21.26	0-1	1
	1752.5	20375	5	16-QAM	1	24	21.30	0-1	1
	1752.5	20375	5	16-QAM	12	0	20.35	0-2	2
	1752.5	20375	5	16-QAM	12	6	20.18	0-2	2
	1752.5	20375	5	16-QAM	12	13	20.36	0-2	2
	1752.5	20375	5	16-QAM	25	0	20.35	0-2	2

Table 8-19
LTE Band 4 Conducted Powers – 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1711.5	19965	3	QPSK	1	0	22.34	0	0
	1711.5	19965	3	QPSK	1	7	22.29	0	0
	1711.5	19965	3	QPSK	1	14	22.26	0	0
	1711.5	19965	3	QPSK	8	0	21.39	0-1	1
	1711.5	19965	3	QPSK	8	4	21.45	0-1	1
	1711.5	19965	3	QPSK	8	7	21.43	0-1	1
	1711.5	19965	3	QPSK	15	0	21.31	0-1	1
	1711.5	19965	3	16-QAM	1	0	21.42	0-1	1
	1711.5	19965	3	16-QAM	1	7	21.19	0-1	1
	1711.5	19965	3	16-QAM	1	14	21.35	0-1	1
	1711.5	19965	3	16-QAM	8	0	20.39	0-2	2
	1711.5	19965	3	16-QAM	8	4	20.36	0-2	2
	1711.5	19965	3	16-QAM	8	7	20.32	0-2	2
	1711.5	19965	3	16-QAM	15	0	20.28	0-2	2
Mid	1732.5	20175	3	QPSK	1	0	22.33	0	0
	1732.5	20175	3	QPSK	1	7	22.23	0	0
	1732.5	20175	3	QPSK	1	14	22.28	0	0
	1732.5	20175	3	QPSK	8	0	21.52	0-1	1
	1732.5	20175	3	QPSK	8	4	21.48	0-1	1
	1732.5	20175	3	QPSK	8	7	21.40	0-1	1
	1732.5	20175	3	QPSK	15	0	21.46	0-1	1
	1732.5	20175	3	16-QAM	1	0	21.35	0-1	1
	1732.5	20175	3	16-QAM	1	7	21.28	0-1	1
	1732.5	20175	3	16-QAM	1	14	21.25	0-1	1
	1732.5	20175	3	16-QAM	8	0	20.35	0-2	2
	1732.5	20175	3	16-QAM	8	4	20.37	0-2	2
	1732.5	20175	3	16-QAM	8	7	20.31	0-2	2
	1732.5	20175	3	16-QAM	15	0	20.24	0-2	2
High	1753.5	20385	3	QPSK	1	0	22.23	0	0
	1753.5	20385	3	QPSK	1	7	22.22	0	0
	1753.5	20385	3	QPSK	1	14	22.14	0	0
	1753.5	20385	3	QPSK	8	0	21.43	0-1	1
	1753.5	20385	3	QPSK	8	4	21.52	0-1	1
	1753.5	20385	3	QPSK	8	7	21.46	0-1	1
	1753.5	20385	3	QPSK	15	0	21.49	0-1	1
	1753.5	20385	3	16-QAM	1	0	21.47	0-1	1
	1753.5	20385	3	16-QAM	1	7	21.23	0-1	1
	1753.5	20385	3	16-QAM	1	14	21.20	0-1	1
	1753.5	20385	3	16-QAM	8	0	20.34	0-2	2
	1753.5	20385	3	16-QAM	8	4	20.16	0-2	2
	1753.5	20385	3	16-QAM	8	7	20.30	0-2	2
	1753.5	20385	3	16-QAM	15	0	20.31	0-2	2

Table 8-20
LTE Band 4 Conducted Powers – 1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1710.7	19957	1.4	QPSK	1	0	22.30	0	0
	1710.7	19957	1.4	QPSK	1	2	22.25	0	0
	1710.7	19957	1.4	QPSK	1	5	22.23	0	0
	1710.7	19957	1.4	QPSK	3	0	22.39	0	0
	1710.7	19957	1.4	QPSK	3	2	22.26	0	0
	1710.7	19957	1.4	QPSK	3	3	22.41	0	0
	1710.7	19957	1.4	QPSK	6	0	21.32	0-1	1
	1710.7	19957	1.4	16-QAM	1	0	21.44	0-1	1
	1710.7	19957	1.4	16-QAM	1	2	21.39	0-1	1
	1710.7	19957	1.4	16-QAM	1	5	21.27	0-1	1
	1710.7	19957	1.4	16-QAM	3	0	21.31	0-1	1
	1710.7	19957	1.4	16-QAM	3	2	21.37	0-1	1
	1710.7	19957	1.4	16-QAM	3	3	21.35	0-1	1
	1710.7	19957	1.4	16-QAM	6	0	20.20	0-2	2
Mid	1732.5	20175	1.4	QPSK	1	0	22.25	0	0
	1732.5	20175	1.4	QPSK	1	2	22.27	0	0
	1732.5	20175	1.4	QPSK	1	5	22.22	0	0
	1732.5	20175	1.4	QPSK	3	0	22.35	0	0
	1732.5	20175	1.4	QPSK	3	2	22.34	0	0
	1732.5	20175	1.4	QPSK	3	3	22.31	0	0
	1732.5	20175	1.4	QPSK	6	0	21.32	0-1	1
	1732.5	20175	1.4	16-QAM	1	0	21.35	0-1	1
	1732.5	20175	1.4	16-QAM	1	2	21.32	0-1	1
	1732.5	20175	1.4	16-QAM	1	5	21.29	0-1	1
	1732.5	20175	1.4	16-QAM	3	0	21.34	0-1	1
	1732.5	20175	1.4	16-QAM	3	2	21.36	0-1	1
	1732.5	20175	1.4	16-QAM	3	3	21.35	0-1	1
	1732.5	20175	1.4	16-QAM	6	0	20.29	0-2	2
High	1754.3	20393	1.4	QPSK	1	0	22.16	0	0
	1754.3	20393	1.4	QPSK	1	2	22.18	0	0
	1754.3	20393	1.4	QPSK	1	5	22.18	0	0
	1754.3	20393	1.4	QPSK	3	0	22.41	0	0
	1754.3	20393	1.4	QPSK	3	2	22.24	0	0
	1754.3	20393	1.4	QPSK	3	3	22.25	0	0
	1754.3	20393	1.4	QPSK	6	0	21.29	0-1	1
	1754.3	20393	1.4	16-QAM	1	0	21.26	0-1	1
	1754.3	20393	1.4	16-QAM	1	2	21.33	0-1	1
	1754.3	20393	1.4	16-QAM	1	5	21.25	0-1	1
	1754.3	20393	1.4	16-QAM	3	0	21.35	0-1	1
	1754.3	20393	1.4	16-QAM	3	2	21.40	0-1	1
	1754.3	20393	1.4	16-QAM	3	3	21.26	0-1	1
	1754.3	20393	1.4	16-QAM	6	0	20.27	0-2	2

8.3.6 LTE Band 4 (AWS) Reduced Power - Body at 0mm

Table 8-21
LTE Band 4 Conducted Powers – 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	1732.5	20175	20	QPSK	1	0	**13.98**	0	0
	1732.5	20175	20	QPSK	1	50	13.82	0	0
	1732.5	20175	20	QPSK	1	99	13.76	0	0
	1732.5	20175	20	QPSK	50	0	**13.14**	0-1	1
	1732.5	20175	20	QPSK	50	25	12.96	0-1	1
	1732.5	20175	20	QPSK	50	50	12.91	0-1	1
	1732.5	20175	20	QPSK	100	0	13.03	0-1	1
	1732.5	20175	20	16QAM	1	0	13.31	0-1	1
	1732.5	20175	20	16QAM	1	50	13.14	0-1	1
	1732.5	20175	20	16QAM	1	99	12.98	0-1	1
	1732.5	20175	20	16QAM	50	0	12.13	0-2	2
	1732.5	20175	20	16QAM	50	25	11.92	0-2	2
	1732.5	20175	20	16QAM	50	50	11.83	0-2	2
	1732.5	20175	20	16QAM	100	0	11.92	0-2	2

Note: LTE Band 4 (AWS) at 20 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Table 8-22
LTE Band 4 Conducted Powers – 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1717.5	20025	15	QPSK	1	0	14.00	0	0
	1717.5	20025	15	QPSK	1	36	13.95	0	0
	1717.5	20025	15	QPSK	1	74	13.71	0	0
	1717.5	20025	15	QPSK	36	0	13.09	0-1	1
	1717.5	20025	15	QPSK	36	18	13.04	0-1	1
	1717.5	20025	15	QPSK	36	37	12.97	0-1	1
	1717.5	20025	15	QPSK	75	0	12.99	0-1	1
	1717.5	20025	15	16QAM	1	0	13.05	0-1	1
	1717.5	20025	15	16QAM	1	36	12.97	0-1	1
	1717.5	20025	15	16QAM	1	74	12.78	0-1	1
	1717.5	20025	15	16QAM	36	0	12.00	0-2	2
	1717.5	20025	15	16QAM	36	18	11.90	0-2	2
	1717.5	20025	15	16QAM	36	37	11.79	0-2	2
	1717.5	20025	15	16QAM	75	0	11.86	0-2	2
Mid	1732.5	20175	15	QPSK	1	0	14.01	0	0
	1732.5	20175	15	QPSK	1	36	13.94	0	0
	1732.5	20175	15	QPSK	1	74	13.70	0	0
	1732.5	20175	15	QPSK	36	0	13.12	0-1	1
	1732.5	20175	15	QPSK	36	18	13.03	0-1	1
	1732.5	20175	15	QPSK	36	37	12.96	0-1	1
	1732.5	20175	15	QPSK	75	0	13.00	0-1	1
	1732.5	20175	15	16QAM	1	0	13.04	0-1	1
	1732.5	20175	15	16QAM	1	36	12.97	0-1	1
	1732.5	20175	15	16QAM	1	74	12.67	0-1	1
	1732.5	20175	15	16QAM	36	0	12.00	0-2	2
	1732.5	20175	15	16QAM	36	18	11.91	0-2	2
	1732.5	20175	15	16QAM	36	37	11.79	0-2	2
	1732.5	20175	15	16QAM	75	0	11.86	0-2	2
High	1747.5	20325	15	QPSK	1	0	14.02	0	0
	1747.5	20325	15	QPSK	1	36	13.93	0	0
	1747.5	20325	15	QPSK	1	74	13.70	0	0
	1747.5	20325	15	QPSK	36	0	13.13	0-1	1
	1747.5	20325	15	QPSK	36	18	13.02	0-1	1
	1747.5	20325	15	QPSK	36	37	12.96	0-1	1
	1747.5	20325	15	QPSK	75	0	13.00	0-1	1
	1747.5	20325	15	16QAM	1	0	13.03	0-1	1
	1747.5	20325	15	16QAM	1	36	12.97	0-1	1
	1747.5	20325	15	16QAM	1	74	12.67	0-1	1
	1747.5	20325	15	16QAM	36	0	12.00	0-2	2
	1747.5	20325	15	16QAM	36	18	11.91	0-2	2
	1747.5	20325	15	16QAM	36	37	11.78	0-2	2
	1747.5	20325	15	16QAM	75	0	11.86	0-2	2

Table 8-23
LTE Band 4 Conducted Powers – 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1715	20000	10	QPSK	1	0	13.80	0	0
	1715	20000	10	QPSK	1	25	13.76	0	0
	1715	20000	10	QPSK	1	49	13.75	0	0
	1715	20000	10	QPSK	25	0	12.94	0-1	1
	1715	20000	10	QPSK	25	12	13.02	0-1	1
	1715	20000	10	QPSK	25	25	12.95	0-1	1
	1715	20000	10	QPSK	50	0	13.01	0-1	1
	1715	20000	10	16QAM	1	0	12.87	0-1	1
	1715	20000	10	16QAM	1	25	12.83	0-1	1
	1715	20000	10	16QAM	1	49	12.69	0-1	1
	1715	20000	10	16QAM	25	0	11.96	0-2	2
	1715	20000	10	16QAM	25	12	11.75	0-2	2
	1715	20000	10	16QAM	25	25	11.77	0-2	2
	1715	20000	10	16QAM	50	0	11.80	0-2	2
Mid	1732.5	20175	10	QPSK	1	0	13.87	0	0
	1732.5	20175	10	QPSK	1	25	13.85	0	0
	1732.5	20175	10	QPSK	1	49	13.75	0	0
	1732.5	20175	10	QPSK	25	0	12.98	0-1	1
	1732.5	20175	10	QPSK	25	12	12.94	0-1	1
	1732.5	20175	10	QPSK	25	25	12.85	0-1	1
	1732.5	20175	10	QPSK	50	0	12.93	0-1	1
	1732.5	20175	10	16QAM	1	0	12.95	0-1	1
	1732.5	20175	10	16QAM	1	25	12.93	0-1	1
	1732.5	20175	10	16QAM	1	49	12.73	0-1	1
	1732.5	20175	10	16QAM	25	0	11.92	0-2	2
	1732.5	20175	10	16QAM	25	12	11.85	0-2	2
	1732.5	20175	10	16QAM	25	25	11.74	0-2	2
	1732.5	20175	10	16QAM	50	0	11.85	0-2	2
High	1750	20350	10	QPSK	1	0	13.77	0	0
	1750	20350	10	QPSK	1	25	13.83	0	0
	1750	20350	10	QPSK	1	49	13.84	0	0
	1750	20350	10	QPSK	25	0	12.93	0-1	1
	1750	20350	10	QPSK	25	12	12.93	0-1	1
	1750	20350	10	QPSK	25	25	12.86	0-1	1
	1750	20350	10	QPSK	50	0	12.97	0-1	1
	1750	20350	10	16QAM	1	0	12.92	0-1	1
	1750	20350	10	16QAM	1	25	12.94	0-1	1
	1750	20350	10	16QAM	1	49	12.74	0-1	1
	1750	20350	10	16QAM	25	0	11.94	0-2	2
	1750	20350	10	16QAM	25	12	11.81	0-2	2
	1750	20350	10	16QAM	25	25	11.76	0-2	2
	1750	20350	10	16QAM	50	0	11.92	0-2	2

Table 8-24
LTE Band 4 Conducted Powers – 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1712.5	19975	5	QPSK	1	0	13.89	0	0
	1712.5	19975	5	QPSK	1	12	13.85	0	0
	1712.5	19975	5	QPSK	1	24	13.77	0	0
	1712.5	19975	5	QPSK	12	0	12.98	0-1	1
	1712.5	19975	5	QPSK	12	6	12.84	0-1	1
	1712.5	19975	5	QPSK	12	13	13.01	0-1	1
	1712.5	19975	5	QPSK	25	0	12.88	0-1	1
	1712.5	19975	5	16-QAM	1	0	13.00	0-1	1
	1712.5	19975	5	16-QAM	1	12	13.05	0-1	1
	1712.5	19975	5	16-QAM	1	24	12.88	0-1	1
	1712.5	19975	5	16-QAM	12	0	11.88	0-2	2
	1712.5	19975	5	16-QAM	12	6	11.89	0-2	2
	1712.5	19975	5	16-QAM	12	13	11.79	0-2	2
	1712.5	19975	5	16-QAM	25	0	11.91	0-2	2
Mid	1732.5	20175	5	QPSK	1	0	13.93	0	0
	1732.5	20175	5	QPSK	1	12	13.90	0	0
	1732.5	20175	5	QPSK	1	24	13.82	0	0
	1732.5	20175	5	QPSK	12	0	13.01	0-1	1
	1732.5	20175	5	QPSK	12	6	12.93	0-1	1
	1732.5	20175	5	QPSK	12	13	12.91	0-1	1
	1732.5	20175	5	QPSK	25	0	12.96	0-1	1
	1732.5	20175	5	16-QAM	1	0	13.03	0-1	1
	1732.5	20175	5	16-QAM	1	12	12.96	0-1	1
	1732.5	20175	5	16-QAM	1	24	12.86	0-1	1
	1732.5	20175	5	16-QAM	12	0	11.89	0-2	2
	1732.5	20175	5	16-QAM	12	6	11.80	0-2	2
	1732.5	20175	5	16-QAM	12	13	11.77	0-2	2
	1732.5	20175	5	16-QAM	25	0	11.92	0-2	2
High	1752.5	20375	5	QPSK	1	0	13.96	0	0
	1752.5	20375	5	QPSK	1	12	13.97	0	0
	1752.5	20375	5	QPSK	1	24	13.87	0	0
	1752.5	20375	5	QPSK	12	0	13.10	0-1	1
	1752.5	20375	5	QPSK	12	6	12.87	0-1	1
	1752.5	20375	5	QPSK	12	13	12.93	0-1	1
	1752.5	20375	5	QPSK	25	0	12.94	0-1	1
	1752.5	20375	5	16-QAM	1	0	13.11	0-1	1
	1752.5	20375	5	16-QAM	1	12	12.93	0-1	1
	1752.5	20375	5	16-QAM	1	24	12.90	0-1	1
	1752.5	20375	5	16-QAM	12	0	11.96	0-2	2
	1752.5	20375	5	16-QAM	12	6	11.80	0-2	2
	1752.5	20375	5	16-QAM	12	13	11.76	0-2	2
	1752.5	20375	5	16-QAM	25	0	11.83	0-2	2

Table 8-25
LTE Band 4 Conducted Powers – 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1711.5	19965	3	QPSK	1	0	13.81	0	0
	1711.5	19965	3	QPSK	1	7	13.93	0	0
	1711.5	19965	3	QPSK	1	14	13.79	0	0
	1711.5	19965	3	QPSK	8	0	13.06	0-1	1
	1711.5	19965	3	QPSK	8	4	12.87	0-1	1
	1711.5	19965	3	QPSK	8	7	12.98	0-1	1
	1711.5	19965	3	QPSK	15	0	12.89	0-1	1
	1711.5	19965	3	16-QAM	1	0	12.96	0-1	1
	1711.5	19965	3	16-QAM	1	7	13.11	0-1	1
	1711.5	19965	3	16-QAM	1	14	12.98	0-1	1
	1711.5	19965	3	16-QAM	8	0	11.92	0-2	2
	1711.5	19965	3	16-QAM	8	4	11.80	0-2	2
	1711.5	19965	3	16-QAM	8	7	11.80	0-2	2
	1711.5	19965	3	16-QAM	15	0	12.01	0-2	2
Mid	1732.5	20175	3	QPSK	1	0	13.98	0	0
	1732.5	20175	3	QPSK	1	7	13.93	0	0
	1732.5	20175	3	QPSK	1	14	13.75	0	0
	1732.5	20175	3	QPSK	8	0	12.91	0-1	1
	1732.5	20175	3	QPSK	8	4	12.87	0-1	1
	1732.5	20175	3	QPSK	8	7	13.01	0-1	1
	1732.5	20175	3	QPSK	15	0	13.03	0-1	1
	1732.5	20175	3	16-QAM	1	0	12.97	0-1	1
	1732.5	20175	3	16-QAM	1	7	13.00	0-1	1
	1732.5	20175	3	16-QAM	1	14	12.79	0-1	1
	1732.5	20175	3	16-QAM	8	0	11.93	0-2	2
	1732.5	20175	3	16-QAM	8	4	11.88	0-2	2
	1732.5	20175	3	16-QAM	8	7	11.73	0-2	2
	1732.5	20175	3	16-QAM	15	0	11.83	0-2	2
High	1753.5	20385	3	QPSK	1	0	13.99	0	0
	1753.5	20385	3	QPSK	1	7	14.06	0	0
	1753.5	20385	3	QPSK	1	14	13.83	0	0
	1753.5	20385	3	QPSK	8	0	13.15	0-1	1
	1753.5	20385	3	QPSK	8	4	12.96	0-1	1
	1753.5	20385	3	QPSK	8	7	12.92	0-1	1
	1753.5	20385	3	QPSK	15	0	12.99	0-1	1
	1753.5	20385	3	16-QAM	1	0	13.02	0-1	1
	1753.5	20385	3	16-QAM	1	7	13.03	0-1	1
	1753.5	20385	3	16-QAM	1	14	12.85	0-1	1
	1753.5	20385	3	16-QAM	8	0	11.91	0-2	2
	1753.5	20385	3	16-QAM	8	4	11.72	0-2	2
	1753.5	20385	3	16-QAM	8	7	11.81	0-2	2
	1753.5	20385	3	16-QAM	15	0	11.92	0-2	2

Table 8-26
LTE Band 4 Conducted Powers – 1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1710.7	19957	1.4	QPSK	1	0	13.89	0	0
	1710.7	19957	1.4	QPSK	1	2	13.94	0	0
	1710.7	19957	1.4	QPSK	1	5	13.83	0	0
	1710.7	19957	1.4	QPSK	3	0	14.05	0	0
	1710.7	19957	1.4	QPSK	3	2	13.95	0	0
	1710.7	19957	1.4	QPSK	3	3	14.00	0	0
	1710.7	19957	1.4	QPSK	6	0	12.89	0-1	1
	1710.7	19957	1.4	16-QAM	1	0	13.12	0-1	1
	1710.7	19957	1.4	16-QAM	1	2	13.02	0-1	1
	1710.7	19957	1.4	16-QAM	1	5	12.98	0-1	1
	1710.7	19957	1.4	16-QAM	3	0	13.00	0-1	1
	1710.7	19957	1.4	16-QAM	3	2	13.02	0-1	1
	1710.7	19957	1.4	16-QAM	3	3	12.91	0-1	1
	1710.7	19957	1.4	16-QAM	6	0	11.79	0-2	2
Mid	1732.5	20175	1.4	QPSK	1	0	13.95	0	0
	1732.5	20175	1.4	QPSK	1	2	13.94	0	0
	1732.5	20175	1.4	QPSK	1	5	13.87	0	0
	1732.5	20175	1.4	QPSK	3	0	14.00	0	0
	1732.5	20175	1.4	QPSK	3	2	13.98	0	0
	1732.5	20175	1.4	QPSK	3	3	13.93	0	0
	1732.5	20175	1.4	QPSK	6	0	12.97	0-1	1
	1732.5	20175	1.4	16-QAM	1	0	13.04	0-1	1
	1732.5	20175	1.4	16-QAM	1	2	13.04	0-1	1
	1732.5	20175	1.4	16-QAM	1	5	12.92	0-1	1
	1732.5	20175	1.4	16-QAM	3	0	13.03	0-1	1
	1732.5	20175	1.4	16-QAM	3	2	13.01	0-1	1
	1732.5	20175	1.4	16-QAM	3	3	12.92	0-1	1
	1732.5	20175	1.4	16-QAM	6	0	11.87	0-2	2
High	1754.3	20393	1.4	QPSK	1	0	14.02	0	0
	1754.3	20393	1.4	QPSK	1	2	13.93	0	0
	1754.3	20393	1.4	QPSK	1	5	13.84	0	0
	1754.3	20393	1.4	QPSK	3	0	13.95	0	0
	1754.3	20393	1.4	QPSK	3	2	13.94	0	0
	1754.3	20393	1.4	QPSK	3	3	13.97	0	0
	1754.3	20393	1.4	QPSK	6	0	12.93	0-1	1
	1754.3	20393	1.4	16-QAM	1	0	13.04	0-1	1
	1754.3	20393	1.4	16-QAM	1	2	13.01	0-1	1
	1754.3	20393	1.4	16-QAM	1	5	12.96	0-1	1
	1754.3	20393	1.4	16-QAM	3	0	12.96	0-1	1
	1754.3	20393	1.4	16-QAM	3	2	13.08	0-1	1
	1754.3	20393	1.4	16-QAM	3	3	12.85	0-1	1
	1754.3	20393	1.4	16-QAM	6	0	11.86	0-2	2

8.3.7 LTE Band 2 (PCS) Maximum Power

Table 8-27
LTE Band 2 Conducted Powers – 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1860	18700	20	QPSK	1	0	22.67	0	0
	1860	18700	20	QPSK	1	50	22.19	0	0
	1860	18700	20	QPSK	1	99	22.05	0	0
	1860	18700	20	QPSK	50	0	21.61	0-1	1
	1860	18700	20	QPSK	50	25	21.26	0-1	1
	1860	18700	20	QPSK	50	50	21.21	0-1	1
	1860	18700	20	QPSK	100	0	21.38	0-1	1
	1860	18700	20	16QAM	1	0	21.70	0-1	1
	1860	18700	20	16QAM	1	50	21.16	0-1	1
	1860	18700	20	16QAM	1	99	21.05	0-1	1
	1860	18700	20	16QAM	50	0	20.45	0-2	2
	1860	18700	20	16QAM	50	25	20.14	0-2	2
	1860	18700	20	16QAM	50	50	20.11	0-2	2
	1860	18700	20	16QAM	100	0	20.21	0-2	2
Mid	1880.0	18900	20	QPSK	1	0	22.59	0	0
	1880.0	18900	20	QPSK	1	50	22.19	0	0
	1880.0	18900	20	QPSK	1	99	22.15	0	0
	1880.0	18900	20	QPSK	50	0	21.51	0-1	1
	1880.0	18900	20	QPSK	50	25	21.28	0-1	1
	1880.0	18900	20	QPSK	50	50	21.24	0-1	1
	1880.0	18900	20	QPSK	100	0	21.34	0-1	1
	1880.0	18900	20	16QAM	1	0	21.88	0-1	1
	1880.0	18900	20	16QAM	1	50	21.44	0-1	1
	1880.0	18900	20	16QAM	1	99	21.34	0-1	1
	1880.0	18900	20	16QAM	50	0	20.47	0-2	2
	1880.0	18900	20	16QAM	50	25	20.22	0-2	2
	1880.0	18900	20	16QAM	50	50	20.14	0-2	2
	1880.0	18900	20	16QAM	100	0	20.26	0-2	2
High	1900	19100	20	QPSK	1	0	**22.72**	0	0
	1900	19100	20	QPSK	1	50	22.25	0	0
	1900	19100	20	QPSK	1	99	22.02	0	0
	1900	19100	20	QPSK	50	0	**21.66**	0-1	1
	1900	19100	20	QPSK	50	25	21.41	0-1	1
	1900	19100	20	QPSK	50	50	21.32	0-1	1
	1900	19100	20	QPSK	100	0	21.43	0-1	1
	1900	19100	20	16QAM	1	0	21.76	0-1	1
	1900	19100	20	16QAM	1	50	21.49	0-1	1
	1900	19100	20	16QAM	1	99	21.08	0-1	1
	1900	19100	20	16QAM	50	0	20.52	0-2	2
	1900	19100	20	16QAM	50	25	20.31	0-2	2
	1900	19100	20	16QAM	50	50	20.15	0-2	2
	1900	19100	20	16QAM	100	0	20.31	0-2	2

Table 8-28
LTE Band 2 Conducted Powers – 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1857.5	18675	15	QPSK	1	0	22.63	0	0
	1857.5	18675	15	QPSK	1	36	22.32	0	0
	1857.5	18675	15	QPSK	1	74	22.12	0	0
	1857.5	18675	15	QPSK	36	0	21.64	0-1	1
	1857.5	18675	15	QPSK	36	18	21.43	0-1	1
	1857.5	18675	15	QPSK	36	37	21.38	0-1	1
	1857.5	18675	15	QPSK	75	0	21.44	0-1	1
	1857.5	18675	15	16QAM	1	0	21.63	0-1	1
	1857.5	18675	15	16QAM	1	36	21.33	0-1	1
	1857.5	18675	15	16QAM	1	74	21.13	0-1	1
	1857.5	18675	15	16QAM	36	0	20.49	0-2	2
	1857.5	18675	15	16QAM	36	18	20.30	0-2	2
	1857.5	18675	15	16QAM	36	37	20.16	0-2	2
	1857.5	18675	15	16QAM	75	0	20.37	0-2	2
Mid	1880.0	18900	15	QPSK	1	0	22.73	0	0
	1880.0	18900	15	QPSK	1	36	22.50	0	0
	1880.0	18900	15	QPSK	1	74	22.34	0	0
	1880.0	18900	15	QPSK	36	0	21.55	0-1	1
	1880.0	18900	15	QPSK	36	18	21.39	0-1	1
	1880.0	18900	15	QPSK	36	37	21.35	0-1	1
	1880.0	18900	15	QPSK	75	0	21.42	0-1	1
	1880.0	18900	15	16QAM	1	0	21.83	0-1	1
	1880.0	18900	15	16QAM	1	36	21.46	0-1	1
	1880.0	18900	15	16QAM	1	74	21.38	0-1	1
	1880.0	18900	15	16QAM	36	0	20.57	0-2	2
	1880.0	18900	15	16QAM	36	18	20.40	0-2	2
	1880.0	18900	15	16QAM	36	37	20.35	0-2	2
	1880.0	18900	15	16QAM	75	0	20.34	0-2	2
High	1902.5	19125	15	QPSK	1	0	22.72	0	0
	1902.5	19125	15	QPSK	1	36	22.42	0	0
	1902.5	19125	15	QPSK	1	74	22.16	0	0
	1902.5	19125	15	QPSK	36	0	21.81	0-1	1
	1902.5	19125	15	QPSK	36	18	21.63	0-1	1
	1902.5	19125	15	QPSK	36	37	21.57	0-1	1
	1902.5	19125	15	QPSK	75	0	21.64	0-1	1
	1902.5	19125	15	16QAM	1	0	21.89	0-1	1
	1902.5	19125	15	16QAM	1	36	21.82	0-1	1
	1902.5	19125	15	16QAM	1	74	21.65	0-1	1
	1902.5	19125	15	16QAM	36	0	20.79	0-2	2
	1902.5	19125	15	16QAM	36	18	20.60	0-2	2
	1902.5	19125	15	16QAM	36	37	20.53	0-2	2
	1902.5	19125	15	16QAM	75	0	20.57	0-2	2

Table 8-29
LTE Band 2 Conducted Powers – 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1855	18650	10	QPSK	1	0	22.50	0	0
	1855	18650	10	QPSK	1	25	22.20	0	0
	1855	18650	10	QPSK	1	49	22.13	0	0
	1855	18650	10	QPSK	25	0	21.45	0-1	1
	1855	18650	10	QPSK	25	12	21.32	0-1	1
	1855	18650	10	QPSK	25	25	21.26	0-1	1
	1855	18650	10	QPSK	50	0	21.36	0-1	1
	1855	18650	10	16QAM	1	0	21.94	0-1	1
	1855	18650	10	16QAM	1	25	21.63	0-1	1
	1855	18650	10	16QAM	1	49	21.59	0-1	1
	1855	18650	10	16QAM	25	0	20.39	0-2	2
	1855	18650	10	16QAM	25	12	20.27	0-2	2
	1855	18650	10	16QAM	25	25	20.24	0-2	2
	1855	18650	10	16QAM	50	0	20.34	0-2	2
Mid	1880.0	18900	10	QPSK	1	0	22.48	0	0
	1880.0	18900	10	QPSK	1	25	22.23	0	0
	1880.0	18900	10	QPSK	1	49	22.22	0	0
	1880.0	18900	10	QPSK	25	0	21.47	0-1	1
	1880.0	18900	10	QPSK	25	12	21.31	0-1	1
	1880.0	18900	10	QPSK	25	25	21.30	0-1	1
	1880.0	18900	10	QPSK	50	0	21.34	0-1	1
	1880.0	18900	10	16QAM	1	0	21.62	0-1	1
	1880.0	18900	10	16QAM	1	25	21.25	0-1	1
	1880.0	18900	10	16QAM	1	49	21.29	0-1	1
	1880.0	18900	10	16QAM	25	0	20.38	0-2	2
	1880.0	18900	10	16QAM	25	12	20.23	0-2	2
	1880.0	18900	10	16QAM	25	25	20.22	0-2	2
	1880.0	18900	10	16QAM	50	0	20.31	0-2	2
High	1905	19150	10	QPSK	1	0	22.73	0	0
	1905	19150	10	QPSK	1	25	22.42	0	0
	1905	19150	10	QPSK	1	49	22.39	0	0
	1905	19150	10	QPSK	25	0	21.60	0-1	1
	1905	19150	10	QPSK	25	12	21.64	0-1	1
	1905	19150	10	QPSK	25	25	21.56	0-1	1
	1905	19150	10	QPSK	50	0	21.66	0-1	1
	1905	19150	10	16QAM	1	0	21.88	0-1	1
	1905	19150	10	16QAM	1	25	21.58	0-1	1
	1905	19150	10	16QAM	1	49	21.45	0-1	1
	1905	19150	10	16QAM	25	0	20.65	0-2	2
	1905	19150	10	16QAM	25	12	20.46	0-2	2
	1905	19150	10	16QAM	25	25	20.39	0-2	2
	1905	19150	10	16QAM	50	0	20.51	0-2	2

Table 8-30
LTE Band 2 Conducted Powers – 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1852.5	18625	5	QPSK	1	0	22.58	0	0
	1852.5	18625	5	QPSK	1	12	22.29	0	0
	1852.5	18625	5	QPSK	1	24	22.44	0	0
	1852.5	18625	5	QPSK	12	0	21.47	0-1	1
	1852.5	18625	5	QPSK	12	6	21.41	0-1	1
	1852.5	18625	5	QPSK	12	13	21.40	0-1	1
	1852.5	18625	5	QPSK	25	0	21.44	0-1	1
	1852.5	18625	5	16-QAM	1	0	21.45	0-1	1
	1852.5	18625	5	16-QAM	1	12	21.43	0-1	1
	1852.5	18625	5	16-QAM	1	24	21.34	0-1	1
	1852.5	18625	5	16-QAM	12	0	20.42	0-2	2
	1852.5	18625	5	16-QAM	12	6	20.36	0-2	2
	1852.5	18625	5	16-QAM	12	13	20.34	0-2	2
	1852.5	18625	5	16-QAM	25	0	20.26	0-2	2
Mid	1880.0	18900	5	QPSK	1	0	22.47	0	0
	1880.0	18900	5	QPSK	1	12	22.43	0	0
	1880.0	18900	5	QPSK	1	24	22.41	0	0
	1880.0	18900	5	QPSK	12	0	21.44	0-1	1
	1880.0	18900	5	QPSK	12	6	21.38	0-1	1
	1880.0	18900	5	QPSK	12	13	21.36	0-1	1
	1880.0	18900	5	QPSK	25	0	21.41	0-1	1
	1880.0	18900	5	16-QAM	1	0	21.80	0-1	1
	1880.0	18900	5	16-QAM	1	12	21.72	0-1	1
	1880.0	18900	5	16-QAM	1	24	21.68	0-1	1
	1880.0	18900	5	16-QAM	12	0	20.31	0-2	2
	1880.0	18900	5	16-QAM	12	6	20.30	0-2	2
	1880.0	18900	5	16-QAM	12	13	20.27	0-2	2
	1880.0	18900	5	16-QAM	25	0	20.24	0-2	2
High	1907.5	19175	5	QPSK	1	0	22.73	0	0
	1907.5	19175	5	QPSK	1	12	22.61	0	0
	1907.5	19175	5	QPSK	1	24	22.48	0	0
	1907.5	19175	5	QPSK	12	0	21.71	0-1	1
	1907.5	19175	5	QPSK	12	6	21.64	0-1	1
	1907.5	19175	5	QPSK	12	13	21.54	0-1	1
	1907.5	19175	5	QPSK	25	0	21.70	0-1	1
	1907.5	19175	5	16-QAM	1	0	21.85	0-1	1
	1907.5	19175	5	16-QAM	1	12	21.77	0-1	1
	1907.5	19175	5	16-QAM	1	24	21.58	0-1	1
	1907.5	19175	5	16-QAM	12	0	20.68	0-2	2
	1907.5	19175	5	16-QAM	12	6	20.58	0-2	2
	1907.5	19175	5	16-QAM	12	13	20.49	0-2	2
	1907.5	19175	5	16-QAM	25	0	20.48	0-2	2

Table 8-31
LTE Band 2 Conducted Powers – 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1851.5	18615	3	QPSK	1	0	22.28	0	0
	1851.5	18615	3	QPSK	1	7	22.22	0	0
	1851.5	18615	3	QPSK	1	14	22.28	0	0
	1851.5	18615	3	QPSK	8	0	21.44	0-1	1
	1851.5	18615	3	QPSK	8	4	21.34	0-1	1
	1851.5	18615	3	QPSK	8	7	21.39	0-1	1
	1851.5	18615	3	QPSK	15	0	21.37	0-1	1
	1851.5	18615	3	16-QAM	1	0	21.41	0-1	1
	1851.5	18615	3	16-QAM	1	7	21.29	0-1	1
	1851.5	18615	3	16-QAM	1	14	21.22	0-1	1
	1851.5	18615	3	16-QAM	8	0	20.13	0-2	2
	1851.5	18615	3	16-QAM	8	4	20.08	0-2	2
	1851.5	18615	3	16-QAM	8	7	20.10	0-2	2
	1851.5	18615	3	16-QAM	15	0	20.23	0-2	2
Mid	1880.0	18900	3	QPSK	1	0	22.25	0	0
	1880.0	18900	3	QPSK	1	7	22.30	0	0
	1880.0	18900	3	QPSK	1	14	22.19	0	0
	1880.0	18900	3	QPSK	8	0	21.31	0-1	1
	1880.0	18900	3	QPSK	8	4	21.29	0-1	1
	1880.0	18900	3	QPSK	8	7	21.30	0-1	1
	1880.0	18900	3	QPSK	15	0	21.34	0-1	1
	1880.0	18900	3	16-QAM	1	0	21.42	0-1	1
	1880.0	18900	3	16-QAM	1	7	21.29	0-1	1
	1880.0	18900	3	16-QAM	1	14	21.28	0-1	1
	1880.0	18900	3	16-QAM	8	0	20.30	0-2	2
	1880.0	18900	3	16-QAM	8	4	20.22	0-2	2
	1880.0	18900	3	16-QAM	8	7	20.31	0-2	2
	1880.0	18900	3	16-QAM	15	0	20.22	0-2	2
High	1908.5	19185	3	QPSK	1	0	22.54	0	0
	1908.5	19185	3	QPSK	1	7	22.44	0	0
	1908.5	19185	3	QPSK	1	14	22.39	0	0
	1908.5	19185	3	QPSK	8	0	21.61	0-1	1
	1908.5	19185	3	QPSK	8	4	21.59	0-1	1
	1908.5	19185	3	QPSK	8	7	21.57	0-1	1
	1908.5	19185	3	QPSK	15	0	21.56	0-1	1
	1908.5	19185	3	16-QAM	1	0	21.51	0-1	1
	1908.5	19185	3	16-QAM	1	7	21.45	0-1	1
	1908.5	19185	3	16-QAM	1	14	21.30	0-1	1
	1908.5	19185	3	16-QAM	8	0	20.58	0-2	2
	1908.5	19185	3	16-QAM	8	4	20.49	0-2	2
	1908.5	19185	3	16-QAM	8	7	20.51	0-2	2
	1908.5	19185	3	16-QAM	15	0	20.60	0-2	2

Table 8-32
LTE Band 2 Conducted Powers – 1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1850.7	18607	1.4	QPSK	1	0	22.38	0	0
	1850.7	18607	1.4	QPSK	1	2	22.36	0	0
	1850.7	18607	1.4	QPSK	1	5	22.35	0	0
	1850.7	18607	1.4	QPSK	3	0	22.46	0	0
	1850.7	18607	1.4	QPSK	3	2	22.45	0	0
	1850.7	18607	1.4	QPSK	3	3	22.47	0	0
	1850.7	18607	1.4	QPSK	6	0	21.48	0-1	1
	1850.7	18607	1.4	16-QAM	1	0	21.42	0-1	1
	1850.7	18607	1.4	16-QAM	1	2	21.40	0-1	1
	1850.7	18607	1.4	16-QAM	1	5	21.39	0-1	1
	1850.7	18607	1.4	16-QAM	3	0	21.58	0-1	1
	1850.7	18607	1.4	16-QAM	3	2	21.55	0-1	1
	1850.7	18607	1.4	16-QAM	3	3	21.56	0-1	1
	1850.7	18607	1.4	16-QAM	6	0	20.32	0-2	2
Mid	1880.0	18900	1.4	QPSK	1	0	22.36	0	0
	1880.0	18900	1.4	QPSK	1	2	22.29	0	0
	1880.0	18900	1.4	QPSK	1	5	22.26	0	0
	1880.0	18900	1.4	QPSK	3	0	22.43	0	0
	1880.0	18900	1.4	QPSK	3	2	22.38	0	0
	1880.0	18900	1.4	QPSK	3	3	22.37	0	0
	1880.0	18900	1.4	QPSK	6	0	21.40	0-1	1
	1880.0	18900	1.4	16-QAM	1	0	21.49	0-1	1
	1880.0	18900	1.4	16-QAM	1	2	21.41	0-1	1
	1880.0	18900	1.4	16-QAM	1	5	21.43	0-1	1
	1880.0	18900	1.4	16-QAM	3	0	21.37	0-1	1
	1880.0	18900	1.4	16-QAM	3	2	21.32	0-1	1
	1880.0	18900	1.4	16-QAM	3	3	21.35	0-1	1
	1880.0	18900	1.4	16-QAM	6	0	20.24	0-2	2
High	1909.3	19193	1.4	QPSK	1	0	22.70	0	0
	1909.3	19193	1.4	QPSK	1	2	22.63	0	0
	1909.3	19193	1.4	QPSK	1	5	22.61	0	0
	1909.3	19193	1.4	QPSK	3	0	22.62	0	0
	1909.3	19193	1.4	QPSK	3	2	22.51	0	0
	1909.3	19193	1.4	QPSK	3	3	22.55	0	0
	1909.3	19193	1.4	QPSK	6	0	21.56	0-1	1
	1909.3	19193	1.4	16-QAM	1	0	21.42	0-1	1
	1909.3	19193	1.4	16-QAM	1	2	21.40	0-1	1
	1909.3	19193	1.4	16-QAM	1	5	21.36	0-1	1
	1909.3	19193	1.4	16-QAM	3	0	21.51	0-1	1
	1909.3	19193	1.4	16-QAM	3	2	21.46	0-1	1
	1909.3	19193	1.4	16-QAM	3	3	21.45	0-1	1
	1909.3	19193	1.4	16-QAM	6	0	20.59	0-2	2

8.3.8 LTE Band 2 (PCS) Reduced Power

Table 8-33
LTE Band 2 Conducted Powers – 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1860	18700	20	QPSK	1	0	13.15	0	0
	1860	18700	20	QPSK	1	50	12.92	0	0
	1860	18700	20	QPSK	1	99	12.50	0	0
	1860	18700	20	QPSK	50	0	12.33	0-1	1
	1860	18700	20	QPSK	50	25	12.07	0-1	1
	1860	18700	20	QPSK	50	50	11.91	0-1	1
	1860	18700	20	QPSK	100	0	12.12	0-1	1
	1860	18700	20	16QAM	1	0	12.42	0-1	1
	1860	18700	20	16QAM	1	50	12.07	0-1	1
	1860	18700	20	16QAM	1	99	11.68	0-1	1
	1860	18700	20	16QAM	50	0	11.23	0-2	2
	1860	18700	20	16QAM	50	25	10.93	0-2	2
	1860	18700	20	16QAM	50	50	10.85	0-2	2
	1860	18700	20	16QAM	100	0	11.03	0-2	2
Mid	1880.0	18900	20	QPSK	1	0	13.07	0	0
	1880.0	18900	20	QPSK	1	50	12.98	0	0
	1880.0	18900	20	QPSK	1	99	12.61	0	0
	1880.0	18900	20	QPSK	50	0	12.28	0-1	1
	1880.0	18900	20	QPSK	50	25	12.07	0-1	1
	1880.0	18900	20	QPSK	50	50	12.07	0-1	1
	1880.0	18900	20	QPSK	100	0	12.18	0-1	1
	1880.0	18900	20	16QAM	1	0	12.27	0-1	1
	1880.0	18900	20	16QAM	1	50	12.24	0-1	1
	1880.0	18900	20	16QAM	1	99	11.90	0-1	1
	1880.0	18900	20	16QAM	50	0	11.22	0-2	2
	1880.0	18900	20	16QAM	50	25	11.03	0-2	2
	1880.0	18900	20	16QAM	50	50	10.96	0-2	2
	1880.0	18900	20	16QAM	100	0	11.07	0-2	2
High	1900	19100	20	QPSK	1	0	**13.45**	0	0
	1900	19100	20	QPSK	1	50	13.11	0	0
	1900	19100	20	QPSK	1	99	12.79	0	0
	1900	19100	20	QPSK	50	0	**12.43**	0-1	1
	1900	19100	20	QPSK	50	25	12.30	0-1	1
	1900	19100	20	QPSK	50	50	12.29	0-1	1
	1900	19100	20	QPSK	100	0	12.42	0-1	1
	1900	19100	20	16QAM	1	0	12.50	0-1	1
	1900	19100	20	16QAM	1	50	12.22	0-1	1
	1900	19100	20	16QAM	1	99	11.90	0-1	1
	1900	19100	20	16QAM	50	0	11.29	0-2	2
	1900	19100	20	16QAM	50	25	11.14	0-2	2
	1900	19100	20	16QAM	50	50	11.13	0-2	2
	1900	19100	20	16QAM	100	0	11.19	0-2	2

Table 8-34
LTE Band 2 Conducted Powers – 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1857.5	18675	15	QPSK	1	0	13.48	0	0
	1857.5	18675	15	QPSK	1	36	13.32	0	0
	1857.5	18675	15	QPSK	1	74	12.96	0	0
	1857.5	18675	15	QPSK	36	0	12.49	0-1	1
	1857.5	18675	15	QPSK	36	18	12.42	0-1	1
	1857.5	18675	15	QPSK	36	37	12.30	0-1	1
	1857.5	18675	15	QPSK	75	0	12.43	0-1	1
	1857.5	18675	15	16QAM	1	0	12.43	0-1	1
	1857.5	18675	15	16QAM	1	36	12.40	0-1	1
	1857.5	18675	15	16QAM	1	74	12.01	0-1	1
	1857.5	18675	15	16QAM	36	0	11.47	0-2	2
	1857.5	18675	15	16QAM	36	18	11.30	0-2	2
	1857.5	18675	15	16QAM	36	37	11.16	0-2	2
	1857.5	18675	15	16QAM	75	0	11.29	0-2	2
Mid	1880.0	18900	15	QPSK	1	0	13.34	0	0
	1880.0	18900	15	QPSK	1	36	13.22	0	0
	1880.0	18900	15	QPSK	1	74	12.99	0	0
	1880.0	18900	15	QPSK	36	0	12.42	0-1	1
	1880.0	18900	15	QPSK	36	18	12.33	0-1	1
	1880.0	18900	15	QPSK	36	37	12.28	0-1	1
	1880.0	18900	15	QPSK	75	0	12.36	0-1	1
	1880.0	18900	15	16QAM	1	0	12.45	0-1	1
	1880.0	18900	15	16QAM	1	36	12.32	0-1	1
	1880.0	18900	15	16QAM	1	74	12.08	0-1	1
	1880.0	18900	15	16QAM	36	0	11.36	0-2	2
	1880.0	18900	15	16QAM	36	18	11.30	0-2	2
	1880.0	18900	15	16QAM	36	37	11.18	0-2	2
	1880.0	18900	15	16QAM	75	0	11.27	0-2	2
High	1902.5	19125	15	QPSK	1	0	13.49	0	0
	1902.5	19125	15	QPSK	1	36	13.45	0	0
	1902.5	19125	15	QPSK	1	74	13.17	0	0
	1902.5	19125	15	QPSK	36	0	12.50	0-1	1
	1902.5	19125	15	QPSK	36	18	12.44	0-1	1
	1902.5	19125	15	QPSK	36	37	12.40	0-1	1
	1902.5	19125	15	QPSK	75	0	12.45	0-1	1
	1902.5	19125	15	16QAM	1	0	12.43	0-1	1
	1902.5	19125	15	16QAM	1	36	12.40	0-1	1
	1902.5	19125	15	16QAM	1	74	12.18	0-1	1
	1902.5	19125	15	16QAM	36	0	11.40	0-2	2
	1902.5	19125	15	16QAM	36	18	11.39	0-2	2
	1902.5	19125	15	16QAM	36	37	11.33	0-2	2
	1902.5	19125	15	16QAM	75	0	11.42	0-2	2

Table 8-35
LTE Band 2 Conducted Powers – 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1855	18650	10	QPSK	1	0	13.48	0	0
	1855	18650	10	QPSK	1	25	13.22	0	0
	1855	18650	10	QPSK	1	49	12.86	0	0
	1855	18650	10	QPSK	25	0	12.49	0-1	1
	1855	18650	10	QPSK	25	12	12.32	0-1	1
	1855	18650	10	QPSK	25	25	12.20	0-1	1
	1855	18650	10	QPSK	50	0	12.33	0-1	1
	1855	18650	10	16QAM	1	0	12.33	0-1	1
	1855	18650	10	16QAM	1	25	12.40	0-1	1
	1855	18650	10	16QAM	1	49	11.91	0-1	1
	1855	18650	10	16QAM	25	0	11.47	0-2	2
	1855	18650	10	16QAM	25	12	11.20	0-2	2
	1855	18650	10	16QAM	25	25	11.16	0-2	2
	1855	18650	10	16QAM	50	0	11.19	0-2	2
Mid	1880.0	18900	10	QPSK	1	0	13.24	0	0
	1880.0	18900	10	QPSK	1	25	13.12	0	0
	1880.0	18900	10	QPSK	1	49	12.99	0	0
	1880.0	18900	10	QPSK	25	0	12.32	0-1	1
	1880.0	18900	10	QPSK	25	12	12.23	0-1	1
	1880.0	18900	10	QPSK	25	25	12.28	0-1	1
	1880.0	18900	10	QPSK	50	0	12.36	0-1	1
	1880.0	18900	10	16QAM	1	0	12.35	0-1	1
	1880.0	18900	10	16QAM	1	25	12.32	0-1	1
	1880.0	18900	10	16QAM	1	49	12.08	0-1	1
	1880.0	18900	10	16QAM	25	0	11.36	0-2	2
	1880.0	18900	10	16QAM	25	12	11.30	0-2	2
	1880.0	18900	10	16QAM	25	25	11.18	0-2	2
	1880.0	18900	10	16QAM	50	0	11.17	0-2	2
High	1905	19150	10	QPSK	1	0	13.49	0	0
	1905	19150	10	QPSK	1	25	13.35	0	0
	1905	19150	10	QPSK	1	49	13.17	0	0
	1905	19150	10	QPSK	25	0	12.40	0-1	1
	1905	19150	10	QPSK	25	12	12.44	0-1	1
	1905	19150	10	QPSK	25	25	12.40	0-1	1
	1905	19150	10	QPSK	50	0	12.35	0-1	1
	1905	19150	10	16QAM	1	0	12.43	0-1	1
	1905	19150	10	16QAM	1	25	12.30	0-1	1
	1905	19150	10	16QAM	1	49	12.08	0-1	1
	1905	19150	10	16QAM	25	0	11.30	0-2	2
	1905	19150	10	16QAM	25	12	11.39	0-2	2
	1905	19150	10	16QAM	25	25	11.33	0-2	2
	1905	19150	10	16QAM	50	0	11.32	0-2	2

Table 8-36
LTE Band 2 Conducted Powers – 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1852.5	18625	5	QPSK	1	0	13.38	0	0
	1852.5	18625	5	QPSK	1	12	13.22	0	0
	1852.5	18625	5	QPSK	1	24	12.86	0	0
	1852.5	18625	5	QPSK	12	0	12.49	0-1	1
	1852.5	18625	5	QPSK	12	6	12.32	0-1	1
	1852.5	18625	5	QPSK	12	13	12.20	0-1	1
	1852.5	18625	5	QPSK	25	0	12.23	0-1	1
	1852.5	18625	5	16-QAM	1	0	12.33	0-1	1
	1852.5	18625	5	16-QAM	1	12	12.50	0-1	1
	1852.5	18625	5	16-QAM	1	24	11.81	0-1	1
	1852.5	18625	5	16-QAM	12	0	11.47	0-2	2
	1852.5	18625	5	16-QAM	12	6	11.10	0-2	2
	1852.5	18625	5	16-QAM	12	13	11.06	0-2	2
	1852.5	18625	5	16-QAM	25	0	11.29	0-2	2
Mid	1880.0	18900	5	QPSK	1	0	13.14	0	0
	1880.0	18900	5	QPSK	1	12	13.12	0	0
	1880.0	18900	5	QPSK	1	24	12.99	0	0
	1880.0	18900	5	QPSK	12	0	12.42	0-1	1
	1880.0	18900	5	QPSK	12	6	12.23	0-1	1
	1880.0	18900	5	QPSK	12	13	12.28	0-1	1
	1880.0	18900	5	QPSK	25	0	12.46	0-1	1
	1880.0	18900	5	16-QAM	1	0	12.45	0-1	1
	1880.0	18900	5	16-QAM	1	12	12.42	0-1	1
	1880.0	18900	5	16-QAM	1	24	12.18	0-1	1
	1880.0	18900	5	16-QAM	12	0	11.26	0-2	2
	1880.0	18900	5	16-QAM	12	6	11.30	0-2	2
	1880.0	18900	5	16-QAM	12	13	11.18	0-2	2
	1880.0	18900	5	16-QAM	25	0	11.27	0-2	2
High	1907.5	19175	5	QPSK	1	0	13.49	0	0
	1907.5	19175	5	QPSK	1	12	13.35	0	0
	1907.5	19175	5	QPSK	1	24	13.17	0	0
	1907.5	19175	5	QPSK	12	0	12.30	0-1	1
	1907.5	19175	5	QPSK	12	6	12.44	0-1	1
	1907.5	19175	5	QPSK	12	13	12.50	0-1	1
	1907.5	19175	5	QPSK	25	0	12.45	0-1	1
	1907.5	19175	5	16-QAM	1	0	12.43	0-1	1
	1907.5	19175	5	16-QAM	1	12	12.40	0-1	1
	1907.5	19175	5	16-QAM	1	24	12.18	0-1	1
	1907.5	19175	5	16-QAM	12	0	11.20	0-2	2
	1907.5	19175	5	16-QAM	12	6	11.49	0-2	2
	1907.5	19175	5	16-QAM	12	13	11.23	0-2	2
	1907.5	19175	5	16-QAM	25	0	11.32	0-2	2

Table 8-37
LTE Band 2 Conducted Powers – 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1851.5	18615	3	QPSK	1	0	13.26	0	0
	1851.5	18615	3	QPSK	1	7	13.22	0	0
	1851.5	18615	3	QPSK	1	14	13.18	0	0
	1851.5	18615	3	QPSK	8	0	12.32	0-1	1
	1851.5	18615	3	QPSK	8	4	12.32	0-1	1
	1851.5	18615	3	QPSK	8	7	12.29	0-1	1
	1851.5	18615	3	QPSK	15	0	12.31	0-1	1
	1851.5	18615	3	16-QAM	1	0	12.34	0-1	1
	1851.5	18615	3	16-QAM	1	7	12.28	0-1	1
	1851.5	18615	3	16-QAM	1	14	12.22	0-1	1
	1851.5	18615	3	16-QAM	8	0	11.25	0-2	2
	1851.5	18615	3	16-QAM	8	4	11.23	0-2	2
	1851.5	18615	3	16-QAM	8	7	11.23	0-2	2
	1851.5	18615	3	16-QAM	15	0	11.28	0-2	2
Mid	1880.0	18900	3	QPSK	1	0	13.25	0	0
	1880.0	18900	3	QPSK	1	7	13.22	0	0
	1880.0	18900	3	QPSK	1	14	13.19	0	0
	1880.0	18900	3	QPSK	8	0	12.32	0-1	1
	1880.0	18900	3	QPSK	8	4	12.31	0-1	1
	1880.0	18900	3	QPSK	8	7	12.29	0-1	1
	1880.0	18900	3	QPSK	15	0	12.31	0-1	1
	1880.0	18900	3	16-QAM	1	0	12.33	0-1	1
	1880.0	18900	3	16-QAM	1	7	12.29	0-1	1
	1880.0	18900	3	16-QAM	1	14	12.23	0-1	1
	1880.0	18900	3	16-QAM	8	0	11.26	0-2	2
	1880.0	18900	3	16-QAM	8	4	11.22	0-2	2
	1880.0	18900	3	16-QAM	8	7	11.24	0-2	2
	1880.0	18900	3	16-QAM	15	0	11.27	0-2	2
High	1908.5	19185	3	QPSK	1	0	13.45	0	0
	1908.5	19185	3	QPSK	1	7	13.34	0	0
	1908.5	19185	3	QPSK	1	14	13.29	0	0
	1908.5	19185	3	QPSK	8	0	12.42	0-1	1
	1908.5	19185	3	QPSK	8	4	12.45	0-1	1
	1908.5	19185	3	QPSK	8	7	12.50	0-1	1
	1908.5	19185	3	QPSK	15	0	12.43	0-1	1
	1908.5	19185	3	16-QAM	1	0	12.45	0-1	1
	1908.5	19185	3	16-QAM	1	7	12.48	0-1	1
	1908.5	19185	3	16-QAM	1	14	12.37	0-1	1
	1908.5	19185	3	16-QAM	8	0	11.42	0-2	2
	1908.5	19185	3	16-QAM	8	4	11.36	0-2	2
	1908.5	19185	3	16-QAM	8	7	11.36	0-2	2
	1908.5	19185	3	16-QAM	15	0	11.40	0-2	2

Table 8-38
LTE Band 2 Conducted Powers – 1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1850.7	18607	1.4	QPSK	1	0	13.32	0	0
	1850.7	18607	1.4	QPSK	1	2	13.41	0	0
	1850.7	18607	1.4	QPSK	1	5	13.35	0	0
	1850.7	18607	1.4	QPSK	3	0	13.23	0	0
	1850.7	18607	1.4	QPSK	3	2	13.29	0	0
	1850.7	18607	1.4	QPSK	3	3	13.44	0	0
	1850.7	18607	1.4	QPSK	6	0	12.35	0-1	1
	1850.7	18607	1.4	16-QAM	1	0	12.31	0-1	1
	1850.7	18607	1.4	16-QAM	1	2	12.38	0-1	1
	1850.7	18607	1.4	16-QAM	1	5	12.34	0-1	1
	1850.7	18607	1.4	16-QAM	3	0	12.36	0-1	1
	1850.7	18607	1.4	16-QAM	3	2	12.45	0-1	1
	1850.7	18607	1.4	16-QAM	3	3	12.25	0-1	1
	1850.7	18607	1.4	16-QAM	6	0	11.29	0-2	2
Mid	1880.0	18900	1.4	QPSK	1	0	13.32	0	0
	1880.0	18900	1.4	QPSK	1	2	13.31	0	0
	1880.0	18900	1.4	QPSK	1	5	13.25	0	0
	1880.0	18900	1.4	QPSK	3	0	13.33	0	0
	1880.0	18900	1.4	QPSK	3	2	13.29	0	0
	1880.0	18900	1.4	QPSK	3	3	13.34	0	0
	1880.0	18900	1.4	QPSK	6	0	12.35	0-1	1
	1880.0	18900	1.4	16-QAM	1	0	12.41	0-1	1
	1880.0	18900	1.4	16-QAM	1	2	12.38	0-1	1
	1880.0	18900	1.4	16-QAM	1	5	12.34	0-1	1
	1880.0	18900	1.4	16-QAM	3	0	12.36	0-1	1
	1880.0	18900	1.4	16-QAM	3	2	12.35	0-1	1
	1880.0	18900	1.4	16-QAM	3	3	12.35	0-1	1
	1880.0	18900	1.4	16-QAM	6	0	11.29	0-2	2
High	1909.3	19193	1.4	QPSK	1	0	13.31	0	0
	1909.3	19193	1.4	QPSK	1	2	13.31	0	0
	1909.3	19193	1.4	QPSK	1	5	13.25	0	0
	1909.3	19193	1.4	QPSK	3	0	13.33	0	0
	1909.3	19193	1.4	QPSK	3	2	13.28	0	0
	1909.3	19193	1.4	QPSK	3	3	13.35	0	0
	1909.3	19193	1.4	QPSK	6	0	12.35	0-1	1
	1909.3	19193	1.4	16-QAM	1	0	12.42	0-1	1
	1909.3	19193	1.4	16-QAM	1	2	12.39	0-1	1
	1909.3	19193	1.4	16-QAM	1	5	12.33	0-1	1
	1909.3	19193	1.4	16-QAM	3	0	12.37	0-1	1
	1909.3	19193	1.4	16-QAM	3	2	12.35	0-1	1
	1909.3	19193	1.4	16-QAM	3	3	12.35	0-1	1
	1909.3	19193	1.4	16-QAM	6	0	11.30	0-2	2

8.4 Antenna 1 WLAN Conducted Powers

Table 8-39
IEEE 802.11b Average RF Power

Mode	Freq [MHz]	Channel	802.11b Conducted Power [dBm]			
			Data Rate [Mbps]			
			1	2	5.5	11
802.11b	2412	1*	11.62	11.82	11.71	11.41
802.11b	2437	6*	**12.28**	11.70	11.61	11.33
802.11b	2462	11*	12.11	11.65	11.59	11.28

Table 8-40
IEEE 802.11g Average RF Power

Mode	Freq [MHz]	Channel	802.11g Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11g	2412	1	12.21	12.22	12.32	12.27	11.88	11.75	11.83	11.61
802.11g	2437	6	12.17	12.09	12.31	12.27	11.86	11.69	11.77	11.58
802.11g	2462	11	12.01	12.05	12.11	12.05	11.65	11.58	11.57	11.47

Table 8-41
IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	802.11n (2.4GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	2412	1	12.15	12.10	12.12	11.78	11.61	11.61	11.57	11.78
802.11n	2437	6	12.24	12.26	12.14	11.88	11.66	11.61	11.70	11.82
802.11n	2462	11	11.91	11.86	11.85	11.61	11.31	11.40	11.38	11.62

Table 8-42
IEEE 802.11a Average RF Power

Mode	Freq [MHz]	Channel	802.11a Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11a	5180	36*	7.00	6.82	6.95	6.80	7.13	7.28	7.25	7.06
802.11a	5200	40	6.91	6.76	6.90	6.74	7.01	7.20	7.07	6.94
802.11a	5220	44	7.02	6.78	6.97	6.83	7.23	7.31	7.34	7.04
802.11a	5240	48*	7.10	6.90	7.07	6.93	7.22	7.24	7.32	7.23
802.11a	5260	52*	7.40	7.13	7.27	7.24	7.47	7.47	7.42	7.39
802.11a	5280	56	7.31	7.00	7.24	7.22	7.46	7.47	7.42	7.49
802.11a	5300	60	7.37	7.02	7.24	7.20	7.40	7.45	7.44	7.41
802.11a	5320	64*	7.17	6.94	6.97	6.96	7.20	7.30	7.37	7.26
802.11a	5500	100	7.39	7.46	6.60	7.31	6.59	6.59	6.85	6.61
802.11a	5520	104*	6.91	6.93	7.07	6.81	7.11	7.07	7.06	7.12
802.11a	5540	108	6.77	6.87	7.07	6.67	7.01	7.02	6.95	6.96
802.11a	5560	112	7.01	7.04	7.02	6.87	6.85	6.94	6.91	6.82
802.11a	5580	116*	7.01	7.10	7.18	6.88	6.91	7.01	6.91	6.88
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	7.02	7.03	6.95	6.96	7.07	6.97	7.05	6.97
802.11a	5680	136*	6.88	6.96	7.04	6.81	7.03	7.07	6.95	7.13
802.11a	5700	140	6.75	6.79	7.05	6.68	6.90	6.95	7.19	7.00
802.11a	5745	149*	7.48	7.41	7.44	7.34	7.42	6.69	6.67	6.91
802.11a	5765	153	6.51	6.57	6.63	7.39	6.67	6.73	6.68	6.90
802.11a	5785	157*	7.35	7.37	7.36	7.23	6.53	6.52	6.55	6.75
802.11a	5805	161	7.32	7.31	7.41	7.21	6.54	6.54	7.45	6.70
802.11a	5825	165*	7.38	7.39	7.46	7.20	6.57	6.52	6.52	6.83

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.

Table 8-43
IEEE 802.11n Average RF Power – 20 MHz Bandwidth

Mode	Freq [MHz]	Channel	20MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	5180	36	6.82	7.25	7.01	6.79	6.75	6.82	6.85	6.61
802.11n	5200	40	6.92	7.09	7.10	6.84	6.78	6.95	6.98	6.77
802.11n	5220	44	7.02	7.12	7.21	6.94	6.97	7.02	7.12	6.80
802.11n	5240	48	7.11	7.10	7.11	7.14	7.01	7.09	7.17	6.88
802.11n	5260	52	7.08	7.05	7.05	6.58	6.38	7.08	6.94	6.88
802.11n	5280	56	6.74	6.77	6.79	6.28	6.13	6.76	6.66	6.59
802.11n	5300	60	6.84	6.81	6.77	6.36	6.12	6.78	6.65	6.69
802.11n	5320	64	6.90	6.91	6.86	6.37	6.22	6.86	6.80	6.68
802.11n	5500	100	7.42	7.42	7.12	7.49	7.41	7.35	7.46	7.23
802.11n	5520	104	7.23	7.21	6.97	7.37	7.20	7.38	7.27	7.04
802.11n	5540	108	7.28	7.30	6.99	7.29	7.29	7.45	7.38	7.06
802.11n	5560	112	7.13	7.10	6.77	7.20	7.13	7.32	7.21	6.88
802.11n	5580	116	6.93	6.99	6.61	6.62	6.95	6.92	6.98	6.76
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	6.90	6.90	6.63	6.98	6.84	6.82	6.94	6.71
802.11n	5680	136	6.92	6.93	6.66	6.95	6.87	6.99	6.95	6.76
802.11n	5700	140	6.97	6.97	6.69	6.68	6.95	6.83	6.76	6.78
802.11n	5745	149	7.41	7.49	6.50	6.70	6.96	6.85	6.96	6.90
802.11n	5765	153	6.80	6.80	6.92	6.22	6.33	6.34	6.41	6.38
802.11n	5785	157	7.46	7.49	6.53	6.69	7.02	6.98	6.97	6.93
802.11n	5805	161	7.49	6.54	6.53	6.85	6.96	6.87	7.08	7.00
802.11n	5825	165	6.50	7.48	6.87	6.78	7.03	6.98	7.00	6.97

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 8-44
IEEE 802.11n Average RF Power – 40 MHz Bandwidth

Mode	Freq [MHz]	Channel	40MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			13.5	27	40.5	54	81	108	121.5	135
802.11n	5190	38	7.25	7.15	7.11	7.22	7.18	7.27	7.14	7.19
802.11n	5230	46	7.24	7.13	7.17	7.25	7.27	7.28	7.26	7.19
802.11n	5270	54	7.45	6.72	7.42	7.07	6.91	6.71	7.35	7.46
802.11n	5310	62	7.41	6.84	7.42	7.07	6.96	6.72	7.37	7.45
802.11n	5510	102	7.46	7.29	7.40	7.41	7.39	7.22	7.43	7.42
802.11n	5550	110	7.31	7.14	7.27	7.29	7.44	7.08	7.34	7.39
802.11n	5590	118	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5630	126	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5670	134	7.24	7.05	7.19	7.22	7.37	7.06	7.25	7.27
802.11n	5755	151	7.45	7.25	7.30	7.41	7.38	7.39	7.35	7.24
802.11n	5795	159	7.16	6.92	7.06	7.11	7.11	7.12	7.03	7.01

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 8-45
IEEE 802.11ac Average RF Power – 80 MHz Bandwidth

Mode	Freq [MHz]	Channel	80MHz BW 802.11ac (5GHz) Conducted Power [dBm]								
			Data Rate [Mbps]								
			29.3	58.5	87.8	117	175.5	234	263.3	292.5	351	390
802.11ac	5210	42	6.70	6.50	6.81	6.89	6.03	6.15	6.04	6.00	5.92	5.96
802.11ac	5290	58	7.01	7.12	7.15	7.18	7.19	7.22	7.21	7.11	7.24	7.25
802.11ac	5530	106	7.34	7.34	7.56	7.53	7.38	7.39	7.36	7.37	7.38	7.27
802.11ac	5775	155	7.28	6.71	6.58	6.92	6.79	6.74	6.68	6.68	6.77	6.56

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.
- 5 GHz WLAN were excluded per FCC KDB 447498 D01v05.
- 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.

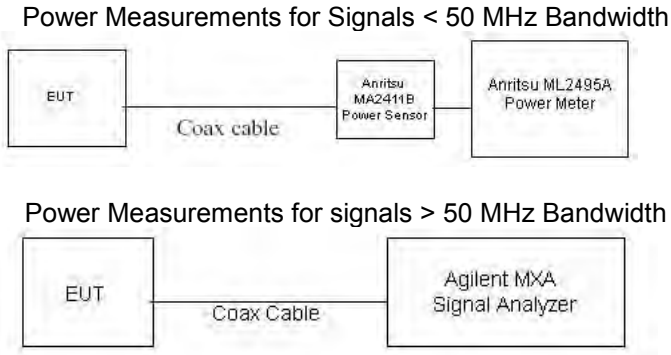


Figure 8-3
Power Measurement Setup

8.5 Antenna 2 WLAN Conducted Powers

Table 8-46
IEEE 802.11b Average RF Power

Mode	Freq [MHz]	Channel	802.11b Conducted Power [dBm]			
			Data Rate [Mbps]			
			1	2	5.5	11
802.11b	2412	1*	11.81	10.87	10.81	10.83
802.11b	2437	6*	**12.33**	12.38	12.32	12.34
802.11b	2462	11*	11.70	11.72	11.70	11.68

Table 8-47
IEEE 802.11g Average RF Power

Mode	Freq [MHz]	Channel	802.11g Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11g	2412	1	12.34	12.02	12.40	12.15	11.68	11.69	11.86	11.67
802.11g	2437	6	12.30	11.99	12.36	12.06	11.64	11.66	11.82	11.61
802.11g	2462	11	11.57	11.26	11.68	11.39	10.89	10.92	11.13	10.88

Table 8-48
IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	802.11n (2.4GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	2412	1	12.21	12.24	12.12	12.44	11.43	11.51	11.61	11.41
802.11n	2437	6	12.20	12.27	12.12	12.46	11.35	11.47	11.59	11.36
802.11n	2462	11	11.71	11.69	11.61	11.88	10.98	11.04	11.07	10.93

Table 8-49
IEEE 802.11a Average RF Power

Mode	Freq [MHz]	Channel	802.11a Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11a	5180	36*	7.45	7.31	7.46	7.24	6.65	6.63	6.55	6.65
802.11a	5200	40	7.35	7.47	6.61	7.38	6.72	6.71	6.77	6.76
802.11a	5220	44	7.36	7.42	6.77	7.40	6.85	6.81	6.71	6.85
802.11a	5240	48*	7.45	7.40	6.58	7.38	6.69	6.71	6.62	6.70
802.11a	5260	52*	7.46	7.47	6.52	7.27	6.80	6.62	6.71	6.60
802.11a	5280	56	7.41	7.39	6.77	7.41	6.42	6.75	6.47	6.69
802.11a	5300	60	7.35	7.35	6.57	7.44	6.74	6.73	6.64	6.66
802.11a	5320	64*	7.42	7.41	6.62	7.30	6.64	6.70	6.71	6.71
802.11a	5500	100	7.47	7.29	6.49	7.35	6.72	6.54	6.79	6.75
802.11a	5520	104*	7.49	7.26	6.50	7.37	6.73	6.60	6.87	6.69
802.11a	5540	108	7.39	7.42	6.60	7.33	6.85	6.65	6.92	6.94
802.11a	5560	112	7.29	7.09	6.32	7.24	6.48	6.34	6.58	6.52
802.11a	5580	116*	7.37	7.14	6.42	7.23	6.60	6.45	6.67	6.59
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	7.31	7.38	6.73	7.36	6.83	6.95	6.93	6.87
802.11a	5680	136*	7.29	7.49	6.66	7.34	6.83	6.64	6.75	6.95
802.11a	5700	140	7.42	7.40	6.71	7.35	6.92	6.65	6.87	6.91
802.11a	5745	149*	6.90	6.55	6.91	6.64	7.05	7.10	7.10	6.96
802.11a	5765	153	6.84	6.55	6.80	6.54	6.97	7.05	7.01	6.95
802.11a	5785	157*	6.54	7.18	6.52	7.28	6.71	6.67	6.71	6.56
802.11a	5805	161	6.54	7.16	6.61	7.23	6.68	6.66	6.62	6.63
802.11a	5825	165*	7.40	7.07	7.38	7.10	6.61	6.61	6.54	7.40

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.

Table 8-50
IEEE 802.11n Average RF Power – 20 MHz Bandwidth

Mode	Freq [MHz]	Channel	20MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	5180	36	7.49	6.64	7.48	6.73	6.77	6.70	6.82	6.71
802.11n	5200	40	6.59	6.74	6.59	6.82	6.85	6.79	6.92	6.84
802.11n	5220	44	6.58	6.80	6.55	6.79	6.91	6.70	6.95	6.77
802.11n	5240	48	6.77	6.92	6.82	6.81	6.70	6.78	6.67	6.78
802.11n	5260	52	6.48	6.52	6.68	6.76	6.61	6.73	6.71	6.64
802.11n	5280	56	6.76	6.73	6.94	6.71	6.91	6.86	6.87	6.95
802.11n	5300	60	6.56	6.60	6.71	6.80	6.67	6.82	6.81	6.75
802.11n	5320	64	6.66	6.75	6.89	6.95	6.81	6.90	6.84	6.80
802.11n	5500	100	7.24	7.02	7.12	7.40	7.38	7.34	7.29	7.23
802.11n	5520	104	7.20	6.99	7.14	7.32	7.35	7.32	7.24	7.22
802.11n	5540	108	7.29	7.05	7.21	7.44	7.46	7.42	7.34	7.30
802.11n	5560	112	6.86	6.68	6.70	7.07	6.94	7.01	6.88	6.78
802.11n	5580	116	6.88	6.68	6.69	7.05	6.94	7.00	6.93	6.83
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	7.34	7.06	7.21	6.50	7.48	7.44	7.39	7.30
802.11n	5680	136	7.23	6.92	7.05	7.38	7.35	7.35	7.27	7.19
802.11n	5700	140	7.21	6.92	7.07	7.32	7.35	7.31	7.29	7.15
802.11n	5745	149	6.60	6.81	6.65	6.85	6.82	6.92	7.03	6.89
802.11n	5765	153	6.63	6.64	6.66	6.59	6.58	6.57	6.69	6.60
802.11n	5785	157	6.58	6.56	6.64	6.61	6.59	6.51	6.56	6.51
802.11n	5805	161	6.57	6.51	6.60	6.50	6.50	6.56	6.54	6.49
802.11n	5825	165	7.23	7.47	7.32	6.53	7.47	6.57	6.53	6.57

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 8-51
IEEE 802.11n Average RF Power – 40 MHz Bandwidth

Mode	Freq [MHz]	Channel	40MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			13.5	27	40.5	54	81	108	121.5	135
802.11n	5190	38	7.14	7.16	7.34	7.32	7.29	7.27	7.12	7.31
802.11n	5230	46	7.29	7.32	7.29	7.26	7.28	7.27	7.33	7.25
802.11n	5270	54	7.00	6.98	7.01	6.92	6.93	6.99	6.98	6.92
802.11n	5310	62	6.99	6.99	6.96	6.88	6.95	6.98	6.93	6.84
802.11n	5510	102	6.99	7.24	7.19	7.24	6.09	6.23	6.19	6.35
802.11n	5550	110	6.98	7.22	7.13	7.20	6.13	6.15	6.23	6.37
802.11n	5590	118	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5630	126	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5670	134	6.28	6.45	6.51	6.55	6.42	5.57	5.53	5.65
802.11n	5755	151	7.28	7.28	7.31	6.67	7.43	7.45	7.46	6.63
802.11n	5795	159	7.21	7.17	7.21	6.56	7.37	7.34	7.38	6.53

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 8-52
IEEE 802.11ac Average RF Power – 80 MHz Bandwidth

Mode	Freq [MHz]	Channel	80MHz BW 802.11ac (5GHz) Conducted Power [dBm]								
			Data Rate [Mbps]								
			29.3	58.5	87.8	117	175.5	234	263.3	292.5	351	390
802.11ac	5210	42	6.68	6.68	6.62	6.54	6.78	6.78	6.64	6.81	6.54	6.62
802.11ac	5290	58	7.30	6.75	7.34	7.23	7.01	6.96	7.07	7.17	7.16	7.26
802.11ac	5530	106	6.81	6.67	6.47	6.52	6.34	6.41	6.31	6.36	6.58	6.61
802.11ac	5775	155	7.42	7.43	7.47	7.29	7.28	7.48	7.36	7.30	7.05	6.57

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.
- 5 GHz WLAN were excluded per FCC KDB 447498 D01v05.
- 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.

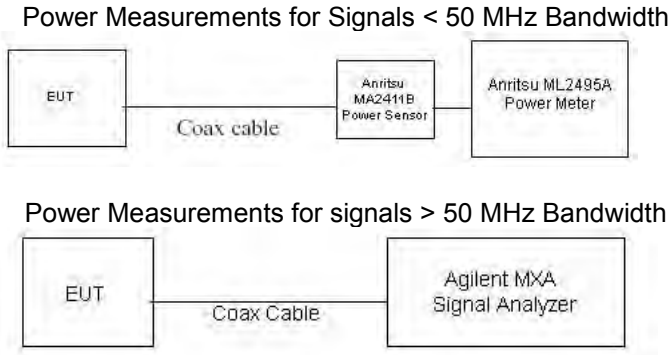


Figure 8-4
Power Measurement Setup

8.6 MIMO WLAN Conducted Powers

Table 8-53
IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	Data Rate [Mbps]
			13
802.11n	2412	1	**12.05**
802.11n	2437	6	11.66
802.11n	2462	11	11.33

Table 8-54
IEEE 802.11n Average RF Power – 20 MHz Bandwidth

Mode	Freq [MHz]	Channel	Data Rate [Mbps]
			13
802.11n	5180	36	7.33
802.11n	5200	40	7.23
802.11n	5220	44	7.49
802.11n	5240	48	7.50
802.11n	5260	52	7.39
802.11n	5280	56	7.39
802.11n	5300	60	7.47
802.11n	5320	64	7.38
802.11n	5500	100	7.30
802.11n	5520	104	7.26
802.11n	5540	108	6.96
802.11n	5560	112	7.00
802.11n	5580	116	7.09
802.11n	5600	120	N/A
802.11n	5620	124	N/A
802.11n	5640	128	N/A
802.11n	5660	132	7.07
802.11n	5680	136	7.02
802.11n	5700	140	7.46
802.11n	5745	149	7.09
802.11n	5765	153	7.33
802.11n	5785	157	7.21
802.11n	5805	161	7.31
802.11n	5825	165	7.05

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 8-55
IEEE 802.11n Average RF Power – 40 MHz Bandwidth

Mode	Freq [MHz]	Channel	Data Rate [Mbps]
			27
802.11n	5190	38	7.38
802.11n	5230	46	7.39
802.11n	5270	54	7.46
802.11n	5310	62	7.44
802.11n	5510	102	7.44
802.11n	5550	110	7.40
802.11n	5590	118	N/A
802.11n	5630	126	N/A
802.11n	5670	134	7.10
802.11n	5755	151	7.09
802.11n	5795	159	7.24

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 8-56
IEEE 802.11ac Average RF Power – 80 MHz Bandwidth

Mode	Freq [MHz]	Channel	Data Rate [Mbps]
			58.5
802.11ac	5210	42	7.28
802.11ac	5290	58	7.41
802.11ac	5530	106	7.05
802.11ac	5775	155	7.05

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 802.11n were selected for SAR evaluation.
- 5 GHz WLAN were excluded per FCC KDB 447498 D01v05.
- 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.
- Per KDB 662911 v02r01, the individual spectra for each 2x2 MIMO WIFI Antenna were summed mathematically in linear power units for the MIMO output power measurements

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
5/7/2014	750B	22.7	710	0.944	55.251	0.960	55.687	-1.67%	-0.78%
			725	0.960	55.045	0.961	55.629	-0.10%	-1.05%
			740	0.972	54.935	0.963	55.570	0.93%	-1.14%
			755	0.986	54.765	0.964	55.512	2.28%	-1.35%
5/5/2014	835B	22.6	820	0.996	53.867	0.969	55.258	2.79%	-2.52%
			835	1.011	53.677	0.970	55.200	4.23%	-2.76%
			850	1.025	53.516	0.988	55.154	3.74%	-2.97%
5/14/2014	1750B	23.1	1710	1.430	52.767	1.463	53.537	-2.26%	-1.44%
			1750	1.473	52.582	1.488	53.432	-1.01%	-1.59%
			1790	1.515	52.463	1.514	53.326	0.07%	-1.62%
5/5/2014	1900B	22.5	1850	1.496	53.215	1.520	53.300	-1.58%	-0.16%
			1880	1.531	53.126	1.520	53.300	0.72%	-0.33%
			1910	1.568	53.028	1.520	53.300	3.16%	-0.51%
5/21/2014	1900B	21.8	1850	1.490	52.830	1.520	53.300	-1.97%	-0.88%
			1880	1.527	52.703	1.520	53.300	0.46%	-1.12%
			1910	1.563	52.598	1.520	53.300	2.83%	-1.32%
5/1/2014	2450B	23.1	2401	1.969	51.471	1.903	52.765	3.47%	-2.45%
			2450	2.036	51.322	1.950	52.700	4.41%	-2.61%
			2499	2.101	51.156	2.019	52.638	4.06%	-2.82%

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 KDB 865664 and IEEE 1528-2013 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.

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)	$Deviation_{1g}$ (%)
K	750	BODY	05/07/2014	23.9	22.7	0.100	1003	3333	0.890	8.770	8.900	1.48%
D	835	BODY	05/05/2014	23.5	22.6	0.100	4d119	3022	0.988	9.340	9.880	5.78%
J	1750	BODY	05/14/2014	21.5	23.1	0.100	1051	3332	3.890	37.400	38.900	4.01%
E	1900	BODY	05/05/2014	23.5	22.5	0.100	5d149	3914	4.110	40.500	41.100	1.48%
J	1900	BODY	05/21/2014	22.4	21.8	0.100	5d149	3332	4.310	40.500	43.100	6.42%
G	2450	BODY	05/01/2014	24.5	23.1	0.040	797	3258	2.030	49.400	50.750	2.73%

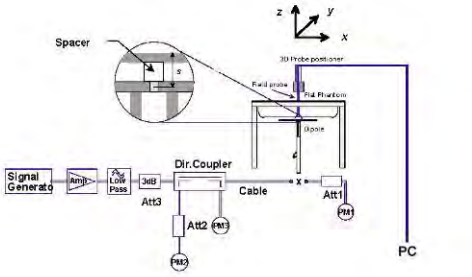


Figure 9-1
System Verification Setup Diagram

Figure 9-2
System Verification Setup Photo

10 SAR DATA SUMMARY

10.1 Standalone Body SAR Data

Table 10-1
GPRS/ UMTS Body SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of GPRS Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	190	GPRS 850	GPRS	23.0	23.00	0.12	0 mm	805M-7	3	1:2.76	back	0.612	1.000	0.612	A1
836.60	190	GPRS 850	GPRS	23.0	23.00	-0.17	0 mm	805M-7	3	1:2.76	top	0.328	1.000	0.328	
836.60	190	GPRS 850	GPRS	31.0	30.43	0.00	20 mm	805M-4	4	1:2.076	back	0.379	1.140	0.432	
836.60	190	GPRS 850	GPRS	31.0	30.43	-0.02	20 mm	805M-4	4	1:2.076	top	0.155	1.140	0.177	
836.60	190	GPRS 850	GPRS	31.0	30.43	0.04	0 mm	805M-4	4	1:2.076	right	0.458	1.140	0.522	
836.60	4183	UMTS 850	RMC	18.5	17.73	0.17	0 mm	805M-7	N/A	1:1	back	0.614	1.194	0.733	A2
836.60	4183	UMTS 850	RMC	18.5	17.73	-0.10	0 mm	805M-7	N/A	1:1	top	0.334	1.194	0.399	
836.60	4183	UMTS 850	RMC	23.0	22.26	-0.05	20 mm	805M-4	N/A	1:1	back	0.208	1.186	0.247	
836.60	4183	UMTS 850	RMC	23.0	22.26	-0.01	20 mm	805M-4	N/A	1:1	top	0.063	1.186	0.075	
836.60	4183	UMTS 850	RMC	23.0	22.26	0.01	0 mm	805M-4	N/A	1:1	right	0.178	1.186	0.211	
1880.00	661	GPRS 1900	GPRS	16.0	15.57	-0.02	0 mm	805M-97	4	1:2.076	back	0.678	1.104	0.749	
1880.00	661	GPRS 1900	GPRS	16.0	15.57	-0.13	0 mm	805M-97	4	1:2.076	top	0.380	1.104	0.420	
1850.20	512	GPRS 1900	GPRS	27.5	26.94	0.00	20 mm	805M-4	4	1:2.076	back	0.738	1.138	0.840	
1880.00	661	GPRS 1900	GPRS	27.5	26.89	0.01	20 mm	805M-4	4	1:2.076	back	0.760	1.151	0.875	
1909.80	810	GPRS 1900	GPRS	27.5	27.04	0.00	20 mm	805M-4	4	1:2.076	back	0.819	1.112	0.911	A3
1880.00	661	GPRS 1900	GPRS	27.5	26.89	-0.09	20 mm	805M-4	4	1:2.076	top	0.574	1.151	0.661	
1880.00	661	GPRS 1900	GPRS	27.5	26.89	0.01	0 mm	805M-4	4	1:2.076	right	0.202	1.151	0.233	
1852.40	9262	UMTS 1900	RMC	13.5	12.99	0.20	0 mm	805M-7	N/A	1:1	back	0.854	1.125	0.961	
1880.00	9400	UMTS 1900	RMC	13.5	12.82	0.19	0 mm	805M-7	N/A	1:1	back	0.824	1.169	0.963	
1907.60	9538	UMTS 1900	RMC	13.5	12.97	0.14	0 mm	805M-7	N/A	1:1	back	0.909	1.130	1.027	A4
1880.00	9400	UMTS 1900	RMC	13.5	12.82	-0.02	0 mm	805M-7	N/A	1:1	top	0.504	1.169	0.589	
1880.00	9400	UMTS 1900	RMC	23.0	22.84	-0.01	20 mm	805M-4	N/A	1:1	back	0.374	1.038	0.388	
1880.00	9400	UMTS 1900	RMC	23.0	22.84	-0.04	20 mm	805M-4	N/A	1:1	top	0.158	1.038	0.164	
1880.00	9400	UMTS 1900	RMC	23.0	22.84	-0.01	0 mm	805M-4	N/A	1:1	right	0.383	1.038	0.398	
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 10-2
LTE Band 17 Body SAR

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)	
710.00	23790	Mid	LTE Band 17	10	16.5	15.98	0.06	0	805M-7	QPSK	1	0	0 mm	back	1:1	0.317	1.127	0.357	A5
710.00	23790	Mid	LTE Band 17	10	15.5	15.04	0.07	1	805M-7	QPSK	25	0	0 mm	back	1:1	0.263	1.112	0.292	
710.00	23790	Mid	LTE Band 17	10	16.5	15.98	0.12	0	805M-7	QPSK	1	0	0 mm	top	1:1	0.145	1.127	0.163	
710.00	23790	Mid	LTE Band 17	10	15.5	15.04	0.16	1	805M-7	QPSK	25	0	0 mm	top	1:1	0.120	1.112	0.133	
710.00	23790	Mid	LTE Band 17	10	23.0	22.11	0.02	0	805M-4	QPSK	1	0	20 mm	back	1:1	0.108	1.227	0.133	
710.00	23790	Mid	LTE Band 17	10	22.0	21.19	0.02	1	805M-4	QPSK	25	0	20 mm	back	1:1	0.092	1.205	0.111	
710.00	23790	Mid	LTE Band 17	10	23.0	22.11	-0.10	0	805M-4	QPSK	1	0	20 mm	top	1:1	0.020	1.227	0.025	
710.00	23790	Mid	LTE Band 17	10	22.0	21.19	-0.02	1	805M-4	QPSK	25	0	20 mm	top	1:1	0.015	1.205	0.018	
710.00	23790	Mid	LTE Band 17	10	23.0	22.11	0.12	0	805M-4	QPSK	1	0	0 mm	right	1:1	0.129	1.227	0.158	
710.00	23790	Mid	LTE Band 17	10	22.0	21.19	0.06	1	805M-4	QPSK	25	0	0 mm	right	1:1	0.111	1.205	0.134	
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
LTE Band 5 (Cell) Body SAR

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)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	17.0	16.64	0.03	0	805M-7	QPSK	1	25	0 mm	back	1:1	0.453	1.086	0.492	A6
836.50	20525	Mid	LTE Band 5 (Cell)	10	16.0	15.75	0.04	1	805M-7	QPSK	25	0	0 mm	back	1:1	0.374	1.059	0.396	
836.50	20525	Mid	LTE Band 5 (Cell)	10	17.0	16.64	0.02	0	805M-7	QPSK	1	25	0 mm	top	1:1	0.240	1.086	0.261	
836.50	20525	Mid	LTE Band 5 (Cell)	10	16.0	15.75	0.00	1	805M-7	QPSK	25	0	0 mm	top	1:1	0.202	1.059	0.214	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.0	22.46	-0.03	0	805M-4	QPSK	1	0	20 mm	back	1:1	0.162	1.132	0.183	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.0	21.55	-0.02	1	805M-4	QPSK	25	0	20 mm	back	1:1	0.126	1.109	0.140	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.0	22.46	0.09	0	805M-4	QPSK	1	0	20 mm	top	1:1	0.053	1.132	0.060	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.0	21.55	-0.06	1	805M-4	QPSK	25	0	20 mm	top	1:1	0.046	1.109	0.051	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.0	22.46	0.00	0	805M-4	QPSK	1	0	0 mm	right	1:1	0.173	1.132	0.196	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.0	21.55	-0.01	1	805M-4	QPSK	25	0	0 mm	right	1:1	0.139	1.109	0.154	
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 10-4
LTE Band 4 (AWS) Body SAR

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)	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	14.5	13.98	-0.02	0	805M-7	QPSK	1	0	0 mm	back	1:1	0.966	1.127	**1.089**	A7
1732.50	20175	Mid	LTE Band 4 (AWS)	20	13.5	13.14	-0.04	1	805M-7	QPSK	50	0	0 mm	back	1:1	0.801	1.086	0.870	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	13.5	13.03	-0.10	1	805M-7	QPSK	100	0	0 mm	back	1:1	0.786	1.114	0.876	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	14.5	13.98	-0.02	0	805M-7	QPSK	1	0	0 mm	top	1:1	0.679	1.127	0.765	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	13.5	13.14	0.01	1	805M-7	QPSK	50	0	0 mm	top	1:1	0.581	1.086	0.631	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.0	22.54	0.00	0	805M-2	QPSK	1	0	20 mm	back	1:1	0.480	1.112	0.534	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.0	21.71	-0.03	1	805M-2	QPSK	50	0	20 mm	back	1:1	0.409	1.069	0.437	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.0	22.54	-0.01	0	805M-2	QPSK	1	0	20 mm	top	1:1	0.396	1.112	0.440	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.0	21.71	-0.02	1	805M-2	QPSK	50	0	20 mm	top	1:1	0.340	1.069	0.363	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.0	22.54	0.16	0	805M-2	QPSK	1	0	0 mm	right	1:1	0.103	1.112	0.115	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.0	21.71	0.07	1	805M-2	QPSK	50	0	0 mm	right	1:1	0.089	1.069	0.095	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	14.5	13.98	-0.08	0	805M-7	QPSK	1	0	0 mm	back	1:1	0.922	1.127	1.039	
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: Variability is highlighted in blue.

Table 10-5
LTE Band 2 (PCS) Body SAR

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)	
1860.00	18700	Low	LTE Band 2 (PCS)	20	13.5	13.15	0.01	0	805M-7	QPSK	1	0	0 mm	back	1:1	0.987	1.084	1.070	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	13.5	13.07	0.00	0	805M-7	QPSK	1	0	0 mm	back	1:1	0.925	1.104	1.021	
1900.00	19100	High	LTE Band 2 (PCS)	20	13.5	13.45	0.01	0	805M-7	QPSK	1	0	0 mm	back	1:1	1.010	1.012	1.022	A8
1860.00	18700	Low	LTE Band 2 (PCS)	20	12.5	12.33	-0.01	1	805M-7	QPSK	50	0	0 mm	back	1:1	0.793	1.040	0.825	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	12.5	12.28	0.00	1	805M-7	QPSK	50	0	0 mm	back	1:1	0.753	1.052	0.792	
1900.00	19100	High	LTE Band 2 (PCS)	20	12.5	12.43	0.00	1	805M-7	QPSK	50	0	0 mm	back	1:1	0.809	1.016	0.822	
1900.00	19100	High	LTE Band 2 (PCS)	20	12.5	12.42	0.02	1	805M-7	QPSK	100	0	0 mm	back	1:1	0.781	1.019	0.796	
1900.00	19100	High	LTE Band 2 (PCS)	20	13.5	13.45	0.10	0	805M-7	QPSK	1	0	0 mm	top	1:1	0.568	1.012	0.575	
1900.00	19100	High	LTE Band 2 (PCS)	20	12.5	12.43	-0.04	1	805M-7	QPSK	50	0	0 mm	top	1:1	0.461	1.016	0.468	
1900.00	19100	High	LTE Band 2 (PCS)	20	23.0	22.72	0.00	0	805M-4	QPSK	1	0	20 mm	back	1:1	0.527	1.067	0.562	
1900.00	19100	High	LTE Band 2 (PCS)	20	22.0	21.66	-0.05	1	805M-4	QPSK	50	0	20 mm	back	1:1	0.426	1.081	0.461	
1900.00	19100	High	LTE Band 2 (PCS)	20	23.0	22.72	0.07	0	805M-4	QPSK	1	0	20 mm	top	1:1	0.547	1.067	0.584	
1900.00	19100	High	LTE Band 2 (PCS)	20	22.0	21.66	-0.04	1	805M-4	QPSK	50	0	20 mm	top	1:1	0.419	1.081	0.453	
1900.00	19100	High	LTE Band 2 (PCS)	20	23.0	22.72	0.04	0	805M-4	QPSK	1	0	0 mm	right	1:1	0.219	1.067	0.234	
1900.00	19100	High	LTE Band 2 (PCS)	20	22.0	21.66	-0.02	1	805M-4	QPSK	50	0	0 mm	right	1:1	0.158	1.081	0.171	
1900.00	19100	High	LTE Band 2 (PCS)	20	13.5	13.45	0.02	0	805M-7	QPSK	1	0	0 mm	back	1:1	0.982	1.012	0.994	
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: Variability is highlighted in blue.

Table 10-6
WLAN Body SAR Antenna 1

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.														
2412	1	IEEE 802.11b	DSSS	12.5	11.62	-0.20	0 mm	805M-3	1	back	1:1	0.801	1.225	0.981	
2437	6	IEEE 802.11b	DSSS	12.5	12.28	-0.02	0 mm	805M-3	1	back	1:1	0.901	1.052	0.948	
2462	11	IEEE 802.11b	DSSS	12.5	12.11	-0.05	0 mm	805M-3	1	back	1:1	0.857	1.094	0.938	
2437	6	IEEE 802.11b	DSSS	12.5	12.28	-0.05	0 mm	805M-3	1	top	1:1	0.315	1.052	0.331	
2437	6	IEEE 802.11b	DSSS	12.5	12.28	0.02	0 mm	805M-3	1	left	1:1	0.039	1.052	0.041	
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 10-7
WLAN Body SAR Antenna 2

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.														
2412	1	IEEE 802.11b	DSSS	12.5	11.81	-0.05	0 mm	805M-3	1	back	1:1	0.774	1.172	0.907	
2437	6	IEEE 802.11b	DSSS	12.5	12.33	-0.07	0 mm	805M-3	1	back	1:1	0.974	1.040	**1.013**	A9
2462	11	IEEE 802.11b	DSSS	12.5	11.70	-0.07	0 mm	805M-3	1	back	1:1	0.724	1.202	0.870	
2437	6	IEEE 802.11b	DSSS	12.5	12.33	-0.02	0 mm	805M-3	1	top	1:1	0.573	1.040	0.596	
2437	6	IEEE 802.11b	DSSS	12.5	12.33	0.07	0 mm	805M-3	1	left	1:1	0.017	1.040	0.018	
2437	6	IEEE 802.11b	DSSS	12.5	12.33	-0.04	0 mm	805M-3	1	back	1:1	0.974	1.040	1.013	
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: Variability is highlighted in blue.

Table 10-8
WLAN Body SAR MIMO

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.														
2412	1	IEEE 802.11n	OFDM	12.5	12.05	0.18	0 mm	805M-3	13	back	1:1	0.499	1.109	0.553	
2437	6	IEEE 802.11n	OFDM	12.5	11.66	0.03	0 mm	805M-3	13	back	1:1	0.431	1.213	0.523	
2462	11	IEEE 802.11n	OFDM	12.5	11.33	0.10	0 mm	805M-3	13	back	1:1	0.424	1.309	0.555	
2412	1	IEEE 802.11n	OFDM	12.5	12.05	0.05	0 mm	805M-3	13	top	1:1	0.163	1.109	0.181	
2412	1	IEEE 802.11n	OFDM	12.5	12.05	0.08	0 mm	805M-3	13	left	1:1	0.022	1.109	0.024	
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 KDB 616217 D04v01r01, 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.
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 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. Top and Right Edge SAR tests were required for the main antenna. Top and Left Edge SAR tests were required for the WLAN antenna.

GPRS Test Notes:

1. Justification for reduced test configurations per KDB Publication 941225 D03v01 and October 2013 TCB Workshop Notes: The source-based frame-averaged output power was evaluated for all GPRS/EDGE slot configurations. The configuration with the highest target frame averaged output power was evaluated for Body SAR. When the maximum frame-averaged powers are equivalent across two or more slots (within 0.25 dB), the configuration with the most number of time slots was tested.
2. Per FCC KDB Publication 447498 D01v05, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel was used.

UMTS Notes:

1. UMTS mode in Body SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v02. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.
2. Per FCC KDB Publication 447498 D01v05, when the reported (scaled) SAR measured at the middle channel > 0.8 W/kg then testing at the other channels is required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be 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 permanently implemented for this device by the manufacturer. 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. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

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. For 5GHz WLAN, SAR was not required based on the maximum conducted power and the antenna to user separation distance. Please see section 1.6 for more information.
3. Per KDB 248227, SAR for MIMO was measured with both transmitting simultaneously and was evaluated in dependently of SISO operation. For 2.4 GHz MIMO, 802.11n was evaluated.
4. WIFI transmission was verified using an uncalibrated spectrum analyzer.
5. When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is >1.6 W/kg or the reported 1g averaged SAR is >0.8 W/kg, SAR testing on other default channels was required.
6. There is no sensor power reduction mechanism applied for WIFI/BT modes.

11 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

11.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v05 are applicable to data devices with built-in unlicensed transmitters such as 802.11a/b/g/n/ac 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 and IEEE 1528-2013 Section 6.3.4.1.2, 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. When standalone SAR is not required to be measured, per FCC KDB 447498 D01v05 4.3.2 2), the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

$$\text{Estimated SAR} = \frac{\sqrt{f(GHz)}}{7.5} * \frac{(\text{Max Power of channel, mW})}{\text{Min. Separation Distance, mm}}$$

Table 11-1
Estimated SAR

Mode	Configuration	Frequency	Maximum Allowed Power	Separation Distance (Body)	Estimated SAR (Body)
		[MHz]	[dBm]	[mm]	[W/kg]
5 GHz WLAN	Touching*, Back Side and Top Edge	5825	7.50	5	**0.386**
5 GHz WLAN	Back Side	5825	7.50	20	**0.097**
5 GHz WLAN	Top Edge	5825	7.50	20	**0.097**
5 GHz WLAN	Left Edge**	5825	7.50	21	**0.092**
Bluetooth	Touching*, Back Side and Top Edge	2441	9.00	5	**0.333**
Bluetooth	Back Side	2441	9.00	20	**0.083**
Bluetooth	Top Edge	2441	9.00	20	**0.083**
Bluetooth	Left Edge	2441	9.00	21	**0.079**

Note:
1. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.
2. (*) – Per FCC KDB Publication 447498, when the test separation distance is < 5 mm, a distance of 5 mm is applied to determine estimated SAR.
3. (**) – For 5 GHz WLAN, Left Edge a conservative distance of 21mm is applied for Antenna 1 and Antenna 2 to determine estimated SAR.
4. For configurations excluded per 447498 D01v05, an estimated SAR of 0.4 W/kg was used to determine simultaneous transmission SAR exclusion when the test separation distance was >50 mm.

11.3 Body SAR Simultaneous Transmission Analysis

Per FCC KDB Publication 941225 D06v01, the devices edges with antennas more than 2.5 cm from edge are not required to be evaluated for SAR ("-").

Table 11-2
Simultaneous Transmission Scenario with 2.4 GHz WLAN - Antenna 1 (Body at 0 mm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.612	0.981	1.593	N/A
	Top	0.328	0.331	0.659	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.522	0.400	0.922	N/A
	Left	0.400	0.041	0.441	N/A
Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.749	0.981	See Note 1	0.02
	Top	0.420	0.331	0.751	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.233	0.400	0.633	N/A
	Left	0.400	0.041	0.441	N/A
Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.357	0.981	1.338	N/A
	Top	0.163	0.331	0.494	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.158	0.400	0.558	N/A
	Left	0.400	0.041	0.441	N/A
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.089	0.981	See Note 1	0.02
	Top	0.765	0.331	1.096	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.115	0.400	0.515	N/A
	Left	0.400	0.041	0.441	N/A

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.733	0.981	See Note 1	0.02
	Top	0.399	0.331	0.730	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.211	0.400	0.611	N/A
	Left	0.400	0.041	0.441	N/A
Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.027	0.981	See Note 1	0.02
	Top	0.589	0.331	0.920	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.398	0.400	0.798	N/A
	Left	0.400	0.041	0.441	N/A
Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.492	0.981	1.473	N/A
	Top	0.261	0.331	0.592	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.196	0.400	0.596	N/A
	Left	0.400	0.041	0.441	N/A
Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.070	0.981	See Note 1	0.02
	Top	0.575	0.331	0.906	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.234	0.400	0.634	N/A
	Left	0.400	0.041	0.441	N/A

Table 11-3
Simultaneous Transmission Scenario with 2.4 GHz WLAN - Antenna 2 (Body at 0 mm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.612	1.013	See Note 1	0.02
	Top	0.328	0.596	0.924	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.522	0.400	0.922	N/A
	Left	0.400	0.018	0.418	N/A
Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.749	1.013	See Note 1	0.02
	Top	0.420	0.596	1.016	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.233	0.400	0.633	N/A
	Left	0.400	0.018	0.418	N/A
Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.357	1.013	1.370	N/A
	Top	0.163	0.596	0.759	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.158	0.400	0.558	N/A
	Left	0.400	0.018	0.418	N/A
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.089	1.013	See Note 1	0.03
	Top	0.765	0.596	1.361	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.115	0.400	0.515	N/A
	Left	0.400	0.018	0.418	N/A

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.733	1.013	See Note 1	0.02
	Top	0.399	0.596	0.995	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.211	0.400	0.611	N/A
	Left	0.400	0.018	0.418	N/A
Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.027	1.013	See Note 1	0.03
	Top	0.589	0.596	1.185	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.398	0.400	0.798	N/A
	Left	0.400	0.018	0.418	N/A
Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.492	1.013	1.505	N/A
	Top	0.261	0.596	0.857	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.196	0.400	0.596	N/A
	Left	0.400	0.018	0.418	N/A
Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.070	1.013	See Note 1	0.03
	Top	0.575	0.596	1.171	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.234	0.400	0.634	N/A
	Left	0.400	0.018	0.418	N/A

Table 11-4
Simultaneous Transmission Scenario with 2.4 GHz WLAN - MIMO (Body at 0 mm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.612	0.555	1.167	N/A
	Top	0.328	0.181	0.509	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.522	0.400	0.922	N/A
	Left	0.400	0.024	0.424	N/A

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.733	0.555	1.288	N/A
	Top	0.399	0.181	0.580	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.211	0.400	0.611	N/A
	Left	0.400	0.024	0.424	N/A

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.749	0.555	1.304	N/A
	Top	0.420	0.181	0.601	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.233	0.400	0.633	N/A
	Left	0.400	0.024	0.424	N/A

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.027	0.555	1.582	N/A
	Top	0.589	0.181	0.770	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.398	0.400	0.798	N/A
	Left	0.400	0.024	0.424	N/A

Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.357	0.555	0.912	N/A
	Top	0.163	0.181	0.344	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.158	0.400	0.558	N/A
	Left	0.400	0.024	0.424	N/A

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.492	0.555	1.047	N/A
	Top	0.261	0.181	0.442	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.196	0.400	0.596	N/A
	Left	0.400	0.024	0.424	N/A

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.089	0.555	See Note 1	0.02
	Top	0.765	0.181	0.946	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.115	0.400	0.515	N/A
	Left	0.400	0.024	0.424	N/A

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.070	0.555	See Note 1	0.01
	Top	0.575	0.181	0.756	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.234	0.400	0.634	N/A
	Left	0.400	0.024	0.424	N/A

Table 11-5
Simultaneous Transmission Scenario with 5 GHz WLAN - Antenna 1 (Body at 0 mm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.612	0.386	0.998	N/A
	Top	0.328	0.386	0.714	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.522	0.400	0.922	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.733	0.386	1.119	N/A
	Top	0.399	0.386	0.785	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.211	0.400	0.611	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.749	0.386	1.135	N/A
	Top	0.420	0.386	0.806	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.233	0.400	0.633	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.027	0.386	1.413	N/A
	Top	0.589	0.386	0.975	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.398	0.400	0.798	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.357	0.386	0.743	N/A
	Top	0.163	0.386	0.549	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.158	0.400	0.558	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.492	0.386	0.878	N/A
	Top	0.261	0.386	0.647	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.196	0.400	0.596	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.089	0.386	1.475	N/A
	Top	0.765	0.386	1.151	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.115	0.400	0.515	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.070	0.386	1.456	N/A
	Top	0.575	0.386	0.961	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.234	0.400	0.634	N/A
	Left	0.400	0.092	0.492	N/A

Table 11-6
Simultaneous Transmission Scenario with 5 GHz WLAN - Antenna 2 (Body at 0 mm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.612	0.386	0.998	N/A
	Top	0.328	0.386	0.714	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.522	0.400	0.922	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.733	0.386	1.119	N/A
	Top	0.399	0.386	0.785	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.211	0.400	0.611	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.749	0.386	1.135	N/A
	Top	0.420	0.386	0.806	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.233	0.400	0.633	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.027	0.386	1.413	N/A
	Top	0.589	0.386	0.975	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.398	0.400	0.798	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.357	0.386	0.743	N/A
	Top	0.163	0.386	0.549	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.158	0.400	0.558	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.492	0.386	0.878	N/A
	Top	0.261	0.386	0.647	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.196	0.400	0.596	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.089	0.386	1.475	N/A
	Top	0.765	0.386	1.151	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.115	0.400	0.515	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.070	0.386	1.456	N/A
	Top	0.575	0.386	0.961	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.234	0.400	0.634	N/A
	Left	0.400	0.092	0.492	N/A

Table 11-7
Simultaneous Transmission Scenario with 5 GHz WLAN - MIMO (Body at 0 mm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.612	0.386	0.998	N/A
	Top	0.328	0.386	0.714	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.522	0.400	0.922	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.733	0.386	1.119	N/A
	Top	0.399	0.386	0.785	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.211	0.400	0.611	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.749	0.386	1.135	N/A
	Top	0.420	0.386	0.806	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.233	0.400	0.633	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.027	0.386	1.413	N/A
	Top	0.589	0.386	0.975	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.398	0.400	0.798	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.357	0.386	0.743	N/A
	Top	0.163	0.386	0.549	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.158	0.400	0.558	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.492	0.386	0.878	N/A
	Top	0.261	0.386	0.647	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.196	0.400	0.596	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.089	0.386	1.475	N/A
	Top	0.765	0.386	1.151	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.115	0.400	0.515	N/A
	Left	0.400	0.092	0.492	N/A

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.070	0.386	1.456	N/A
	Top	0.575	0.386	0.961	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.234	0.400	0.634	N/A
	Left	0.400	0.092	0.492	N/A

Table 11-8
Simultaneous Transmission Scenario with Bluetooth (Body at 0 mm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.612	0.333	0.945	N/A
	Top	0.328	0.333	0.661	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.522	0.400	0.922	N/A
	Left	0.400	0.079	0.479	N/A

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.733	0.333	1.066	N/A
	Top	0.399	0.333	0.732	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.211	0.400	0.611	N/A
	Left	0.400	0.079	0.479	N/A

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.749	0.333	1.082	N/A
	Top	0.420	0.333	0.753	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.233	0.400	0.633	N/A
	Left	0.400	0.079	0.479	N/A

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.027	0.333	1.360	N/A
	Top	0.589	0.333	0.922	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.398	0.400	0.798	N/A
	Left	0.400	0.079	0.479	N/A

Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.357	0.333	0.690	N/A
	Top	0.163	0.333	0.496	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.158	0.400	0.558	N/A
	Left	0.400	0.079	0.479	N/A

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.492	0.333	0.825	N/A
	Top	0.261	0.333	0.594	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.196	0.400	0.596	N/A
	Left	0.400	0.079	0.479	N/A

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.089	0.333	1.422	N/A
	Top	0.765	0.333	1.098	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.115	0.400	0.515	N/A
	Left	0.400	0.079	0.479	N/A

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	1.070	0.333	1.403	N/A
	Top	0.575	0.333	0.908	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.234	0.400	0.634	N/A
	Left	0.400	0.079	0.479	N/A

Table 11-9
Simultaneous Transmission Scenario with 2.4 GHz WLAN - Antenna 1 (Back at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Back Side	GPRS 850	0.432	<0.981	<1.413	N/A
Back Side	UMTS 850	0.247	<0.981	<1.228	N/A
Back Side	GPRS 1900	0.911	<0.981	See Note 1	<0.02
Back Side	UMTS 1900	0.388	<0.981	<1.369	N/A
Back Side	LTE Band 17	0.133	<0.981	<1.114	N/A
Back Side	LTE Band 5 (Cell)	0.183	<0.981	<1.164	N/A
Back Side	LTE Band 4	0.534	<0.981	<1.515	N/A
Back Side	LTE Band 2	0.562	<0.981	<1.543	N/A

Table 11-10
Simultaneous Transmission Scenario with 2.4 GHz WLAN - Antenna 2 (Back at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Back Side	GPRS 850	0.432	<1.013	<1.445	N/A
Back Side	UMTS 850	0.247	<1.013	<1.26	N/A
Back Side	GPRS 1900	0.911	<1.013	See Note 1	<0.02
Back Side	UMTS 1900	0.388	<1.013	<1.401	N/A
Back Side	LTE Band 17	0.133	<1.013	<1.146	N/A
Back Side	LTE Band 5 (Cell)	0.183	<1.013	<1.196	N/A
Back Side	LTE Band 4	0.534	<1.013	<1.547	N/A
Back Side	LTE Band 2	0.562	<1.013	<1.575	N/A

Table 11-11
Simultaneous Transmission Scenario with 2.4 GHz WLAN - MIMO (Back at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Back Side	GPRS 850	0.432	<0.555	<0.987	N/A
Back Side	UMTS 850	0.247	<0.555	<0.802	N/A
Back Side	GPRS 1900	0.911	<0.555	<1.466	N/A
Back Side	UMTS 1900	0.388	<0.555	<0.943	N/A
Back Side	LTE Band 17	0.133	<0.555	<0.688	N/A
Back Side	LTE Band 5 (Cell)	0.183	<0.555	<0.738	N/A
Back Side	LTE Band 4	0.534	<0.555	<1.089	N/A
Back Side	LTE Band 2	0.562	<0.555	<1.117	N/A

Table 11-12
Simultaneous Transmission Scenario with 5 GHz WLAN - Antenna 1 (Back at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Back Side	GPRS 850	0.432	0.097	0.529	N/A
Back Side	UMTS 850	0.247	0.097	0.344	N/A
Back Side	GPRS 1900	0.911	0.097	1.008	N/A
Back Side	UMTS 1900	0.388	0.097	0.485	N/A
Back Side	LTE Band 17	0.133	0.097	0.230	N/A
Back Side	LTE Band 5 (Cell)	0.183	0.097	0.280	N/A
Back Side	LTE Band 4	0.534	0.097	0.631	N/A
Back Side	LTE Band 2	0.562	0.097	0.659	N/A

Table 11-13
Simultaneous Transmission Scenario with 5 GHz WLAN - Antenna 2 (Back at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Back Side	GPRS 850	0.432	0.097	0.529	N/A
Back Side	UMTS 850	0.247	0.097	0.344	N/A
Back Side	GPRS 1900	0.911	0.097	1.008	N/A
Back Side	UMTS 1900	0.388	0.097	0.485	N/A
Back Side	LTE Band 17	0.133	0.097	0.230	N/A
Back Side	LTE Band 5 (Cell)	0.183	0.097	0.280	N/A
Back Side	LTE Band 4	0.534	0.097	0.631	N/A
Back Side	LTE Band 2	0.562	0.097	0.659	N/A

Table 11-14
Simultaneous Transmission Scenario with 5 GHz WLAN - MIMO (Back at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Back Side	GPRS 850	0.432	0.097	0.529	N/A
Back Side	UMTS 850	0.247	0.097	0.344	N/A
Back Side	GPRS 1900	0.911	0.097	1.008	N/A
Back Side	UMTS 1900	0.388	0.097	0.485	N/A
Back Side	LTE Band 17	0.133	0.097	0.230	N/A
Back Side	LTE Band 5 (Cell)	0.183	0.097	0.280	N/A
Back Side	LTE Band 4	0.534	0.097	0.631	N/A
Back Side	LTE Band 2	0.562	0.097	0.659	N/A

Table 11-15
Simultaneous Transmission Scenario with Bluetooth (Back at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Back Side	GPRS 850	0.432	0.083	0.515	N/A
Back Side	UMTS 850	0.247	0.083	0.330	N/A
Back Side	GPRS 1900	0.911	0.083	0.994	N/A
Back Side	UMTS 1900	0.388	0.083	0.471	N/A
Back Side	LTE Band 17	0.133	0.083	0.216	N/A
Back Side	LTE Band 5 (Cell)	0.183	0.083	0.266	N/A
Back Side	LTE Band 4	0.534	0.083	0.617	N/A
Back Side	LTE Band 2	0.562	0.083	0.645	N/A

Table 11-16
Simultaneous Transmission Scenario with 2.4 GHz WLAN - Antenna 1 (Top at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Top Edge	GPRS 850	0.177	<0.331	<0.508	N/A
Top Edge	UMTS 850	0.075	<0.331	<0.406	N/A
Top Edge	GPRS 1900	0.661	<0.331	<0.992	N/A
Top Edge	UMTS 1900	0.164	<0.331	<0.495	N/A
Top Edge	LTE Band 17	0.025	<0.331	<0.356	N/A
Top Edge	LTE Band 5 (Cell)	0.060	<0.331	<0.391	N/A
Top Edge	LTE Band 4	0.440	<0.331	<0.771	N/A
Top Edge	LTE Band 2	0.584	<0.331	<0.915	N/A

Table 11-17
Simultaneous Transmission Scenario with 2.4 GHz WLAN - Antenna 2 (Top at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Top Edge	GPRS 850	0.177	<0.596	<0.773	N/A
Top Edge	UMTS 850	0.075	<0.596	<0.671	N/A
Top Edge	GPRS 1900	0.661	<0.596	<1.257	N/A
Top Edge	UMTS 1900	0.164	<0.596	<0.760	N/A
Top Edge	LTE Band 17	0.025	<0.596	<0.621	N/A
Top Edge	LTE Band 5 (Cell)	0.060	<0.596	<0.656	N/A
Top Edge	LTE Band 4	0.440	<0.596	<1.036	N/A
Top Edge	LTE Band 2	0.584	<0.596	<1.180	N/A

Table 11-18
Simultaneous Transmission Scenario with 2.4 GHz WLAN - MIMO (Top at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Top Edge	GPRS 850	0.177	<0.181	<0.358	N/A
Top Edge	UMTS 850	0.075	<0.181	<0.256	N/A
Top Edge	GPRS 1900	0.661	<0.181	<0.842	N/A
Top Edge	UMTS 1900	0.164	<0.181	<0.345	N/A
Top Edge	LTE Band 17	0.025	<0.181	<0.206	N/A
Top Edge	LTE Band 5 (Cell)	0.060	<0.181	<0.241	N/A
Top Edge	LTE Band 4	0.440	<0.181	<0.621	N/A
Top Edge	LTE Band 2	0.584	<0.181	<0.765	N/A

Table 11-19
Simultaneous Transmission Scenario with 5 GHz WLAN - Antenna 1 (Top at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Top Edge	GPRS 850	0.177	0.097	0.274	N/A
Top Edge	UMTS 850	0.075	0.097	0.172	N/A
Top Edge	GPRS 1900	0.661	0.097	0.758	N/A
Top Edge	UMTS 1900	0.164	0.097	0.261	N/A
Top Edge	LTE Band 17	0.025	0.097	0.122	N/A
Top Edge	LTE Band 5 (Cell)	0.060	0.097	0.157	N/A
Top Edge	LTE Band 4	0.440	0.097	0.537	N/A
Top Edge	LTE Band 2	0.584	0.097	0.681	N/A

Table 11-20
Simultaneous Transmission Scenario with 5 GHz WLAN - Antenna 2 (Top at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Top Edge	GPRS 850	0.177	0.097	0.274	N/A
Top Edge	UMTS 850	0.075	0.097	0.172	N/A
Top Edge	GPRS 1900	0.661	0.097	0.758	N/A
Top Edge	UMTS 1900	0.164	0.097	0.261	N/A
Top Edge	LTE Band 17	0.025	0.097	0.122	N/A
Top Edge	LTE Band 5 (Cell)	0.060	0.097	0.157	N/A
Top Edge	LTE Band 4	0.440	0.097	0.537	N/A
Top Edge	LTE Band 2	0.584	0.097	0.681	N/A

Table 11-21
Simultaneous Transmission Scenario with 5 GHz WLAN - MIMO (Top at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Top Edge	GPRS 850	0.177	0.097	0.274	N/A
Top Edge	UMTS 850	0.075	0.097	0.172	N/A
Top Edge	GPRS 1900	0.661	0.097	0.758	N/A
Top Edge	UMTS 1900	0.164	0.097	0.261	N/A
Top Edge	LTE Band 17	0.025	0.097	0.122	N/A
Top Edge	LTE Band 5 (Cell)	0.060	0.097	0.157	N/A
Top Edge	LTE Band 4	0.440	0.097	0.537	N/A
Top Edge	LTE Band 2	0.584	0.097	0.681	N/A

Table 11-22
Simultaneous Transmission Scenario with Bluetooth (Top at 20 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Top Edge	GPRS 850	0.177	0.083	0.260	N/A
Top Edge	UMTS 850	0.075	0.083	0.158	N/A
Top Edge	GPRS 1900	0.661	0.083	0.744	N/A
Top Edge	UMTS 1900	0.164	0.083	0.247	N/A
Top Edge	LTE Band 17	0.025	0.083	0.108	N/A
Top Edge	LTE Band 5 (Cell)	0.060	0.083	0.143	N/A
Top Edge	LTE Band 4	0.440	0.083	0.523	N/A
Top Edge	LTE Band 2	0.584	0.083	0.667	N/A

Note:
1. No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was not higher than 0.04 per FCC KDB 447498 D01v05. See Section 11.4 for detailed SPLS ratio analysis.
2. For SAR summations for body back at 20 mm, 2.4 GHz WLAN SAR values for 0.0 cm were used since the 0.0 cm test distance for 2.4 GHz WLAN was more conservative. "<" denotes that the 0.0 cm WLAN SAR values were used for summation purposes.
3. For SAR summations for body top edge at 20 mm, 2.4 GHz WLAN SAR values for 0.0 cm were used since the 0.0 cm test distance for 2.4 GHz WLAN was more conservative. "<" denotes that the 0.0 cm WLAN SAR values were used for summation purposes.
4. For SAR summation for body back side and top edge at 20 mm, estimated 5 GHz WLAN and Bluetooth SAR values for 20 mm were used.
5. For configurations excluded per 447498 D01v05, an estimated SAR of 0.4 W/kg was used to determine simultaneous transmission SAR exclusion when the test separation distance was >50 mm.
6. 5 GHz WLAN was excluded per FCC KDB 447498 D01v05 (Please see section 1.6 for more information). Therefore, estimated 5 GHz SAR values in table 11-1 were used for summation purposes.

11.4 SPLSR Evaluation and 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. The distance between the transmitters was calculated using the following formula.

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

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

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0 mm with UMTS 850 MHz antenna operating at limited output power with 2.4 GHz WIFI Antenna 1.

Table 11-23
Peak SAR Locations for Body Back Side at 0 mm UMTS 850 MHz and 2.4 GHz WLAN Antenna 1

Mode/Band	x (mm)	y (mm)
UMTS 850	-21.50	77.00
802.11b	-30.00	-72.00

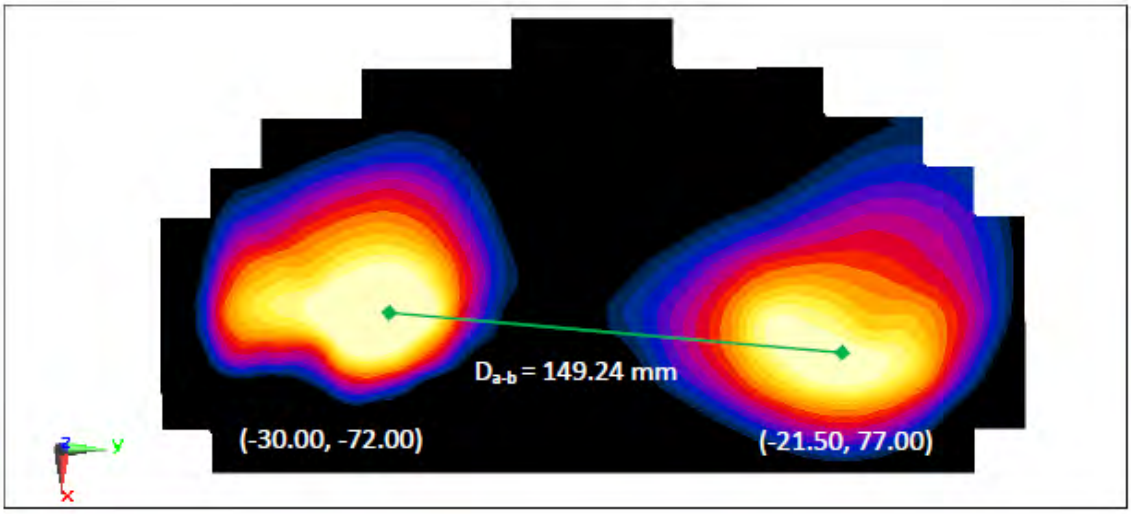


Figure 11-1
Peak SAR Locations for Body Back Side at 0 mm UMTS 850 MHz and 2.4 GHz WLAN Antenna 1

Table 11-24
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}	$(a+b)^{1.5}/D_{a-b}$
UMTS 850	802.11b	0.733	0.981	1.714	149.24	0.02

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0 mm with GPRS 1900 MHz antenna operating at limited output power with 2.4 GHz WIFI Antenna 1.

Table 11-25
Peak SAR Locations for Body Back Side at 0 mm GPRS 1900 MHz and 2.4 GHz WLAN Antenna 1

Mode/Band	x (mm)	y (mm)
GPRS 1900	-25.00	63.50
802.11b	-30.00	-72.00

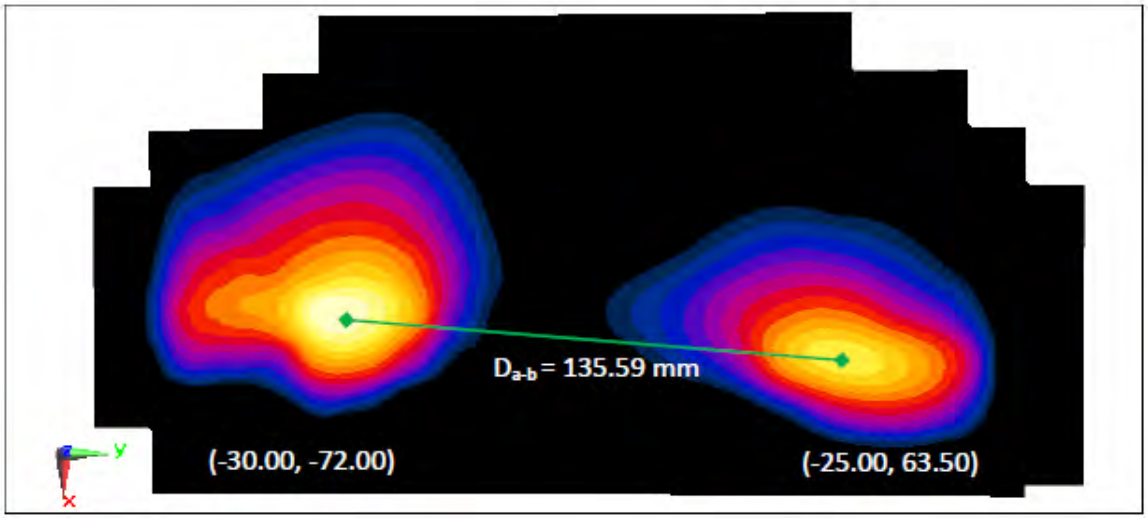


Figure 11-2
Peak SAR Locations for Body Back Side at 0 mm GPRS 1900 MHz and 2.4 GHz WLAN Antenna 1

Table 11-26
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}	$(a+b)^{1.5}/D_{a-b}$
GPRS 1900	802.11b	0.749	0.981	1.73	135.59	0.02

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0 mm with UMTS 1900 MHz antenna operating at limited output power with 2.4 GHz WIFI Antenna 1.

Table 11-27
Peak SAR Locations for Body Back Side at 0 mm UMTS 1900 MHz and 2.4 GHz WLAN Antenna 1

Mode/Band	x (mm)	y (mm)
UMTS 1900	-25.00	62.00
802.11b	-30.00	-72.00

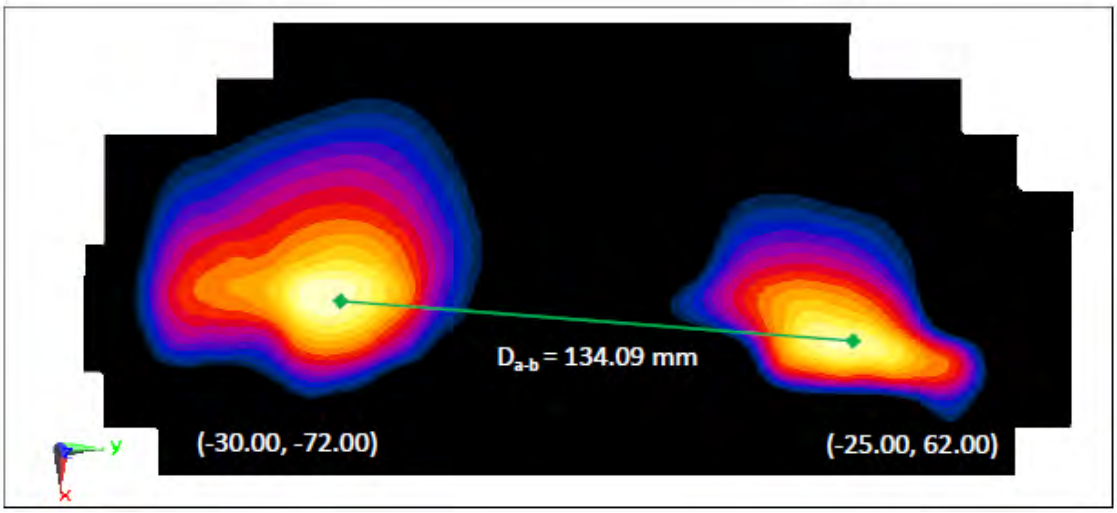


Figure 11-3
Peak SAR Locations for Body Back Side at 0 mm UMTS 1900 MHz and 2.4 GHz WLAN Antenna 1

Table 11-28
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}	$(a+b)^{1.5}/D_{a-b}$
UMTS 1900	802.11b	1.027	0.981	2.008	134.09	0.02

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0 mm with LTE Band 4 antenna operating at limited output power with 2.4 GHz WIFI Antenna 1.

Table 11-29
Peak SAR Locations for Body Back Side at 0 mm LTE Band 4 and 2.4 GHz WLAN Antenna 1

Mode/Band	x (mm)	y (mm)
LTE Band 4	-20.50	67.50
802.11b	-30.00	-72.00

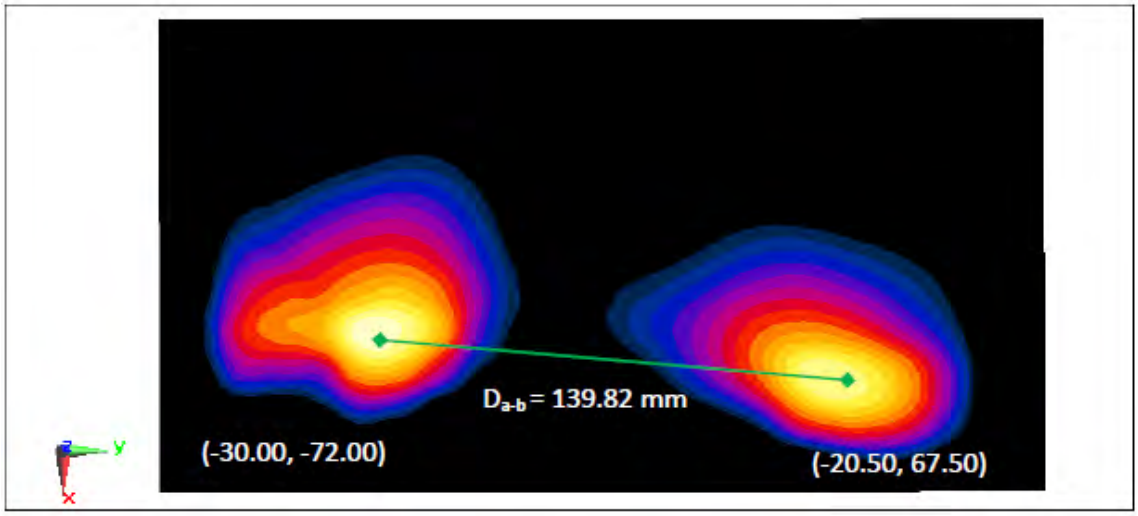


Figure 11-4
Peak SAR Locations for Body Back Side at 0 mm LTE Band 4 and 2.4 GHz WLAN Antenna 1

Table 11-30
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 4	802.11b	1.089	0.981	2.07	139.82	0.02

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0 mm with LTE Band 2 antenna operating at limited output power with 2.4 GHz WIFI Antenna 1.

Table 11-31
Peak SAR Locations for Body Back Side at 0 mm LTE Band 2 and 2.4 GHz WLAN Antenna 1

Mode/Band	x (mm)	y (mm)
LTE Band 2	-21.50	67.50
802.11b	-30.00	-72.00

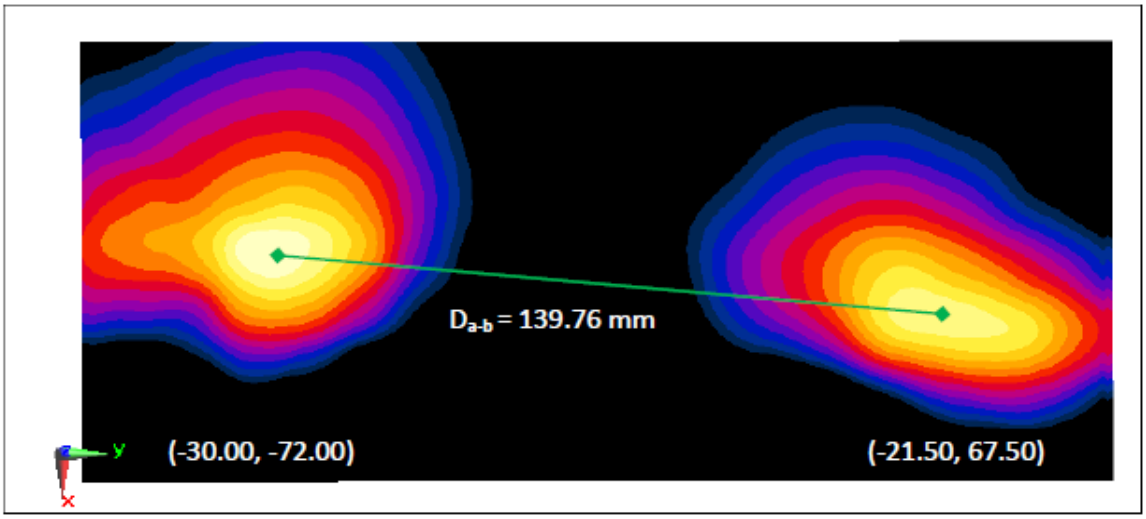


Figure 11-5
Peak SAR Locations for Body Back Side at 0 mm LTE Band 2 and 2.4 GHz WLAN Antenna 1

Table 11-32
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 2	802.11b	1.07	0.981	2.051	139.76	0.02

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0 mm with GPRS 850 MHz antenna operating at limited output power with 2.4 GHz WIFI Antenna 2.

Table 11-33
Peak SAR Locations for Body Back Side at 0 mm GPRS 850 MHz and 2.4 GHz WLAN Antenna 2

Mode/Band	x (mm)	y (mm)
GPRS 850	-17.00	73.50
802.11b	-30.00	-43.00

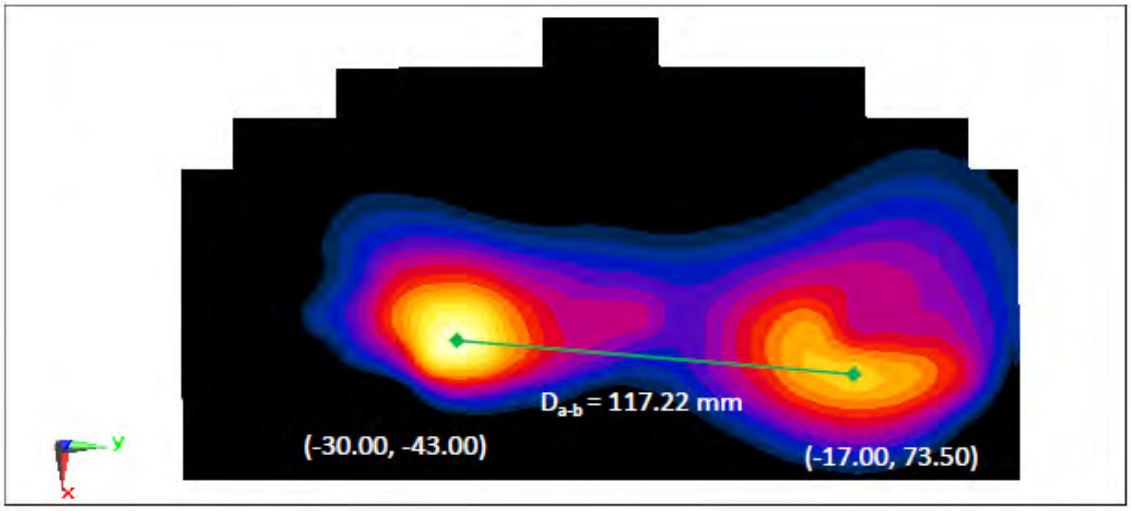


Figure 11-6
Peak SAR Locations for Body Back Side at 0 mm GPRS 850 MHz and 2.4 GHz WLAN Antenna 2

Table 11-34
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}	$(a+b)^{1.5}/D_{a-b}$
GPRS 850	802.11b	0.612	1.013	1.625	117.22	0.02

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0 mm with UMTS 850 MHz antenna operating at limited output power with 2.4 GHz WIFI Antenna 2.

Table 11-35
Peak SAR Locations for Body Back Side at 0 mm UMTS 850 MHz and 2.4 GHz WLAN Antenna 2

Mode/Band	x (mm)	y (mm)
UMTS 850	-21.50	77.00
802.11b	-30.00	-43.00

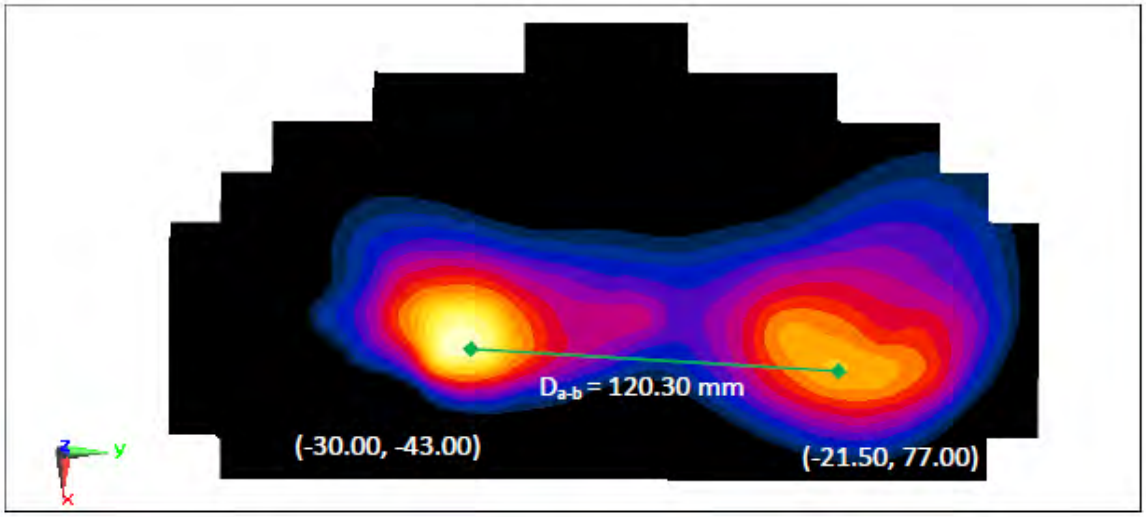


Figure 11-7
Peak SAR Locations for Body Back Side at 0 mm UMTS 850 MHz and 2.4 GHz WLAN Antenna 2

Table 11-36
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}	$(a+b)^{1.5}/D_{a-b}$
UMTS 850	802.11b	0.733	1.013	1.746	120.3	0.02

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0 mm with GPRS 1900 MHz antenna operating at limited output power with 2.4 GHz WIFI Antenna 2.

Table 11-37
Peak SAR Locations for Body Back Side at 0 mm GPRS 1900 MHz and 2.4 GHz WLAN Antenna 2

Mode/Band	x (mm)	y (mm)
GPRS 1900	-25.00	63.50
802.11b	-30.00	-43.00

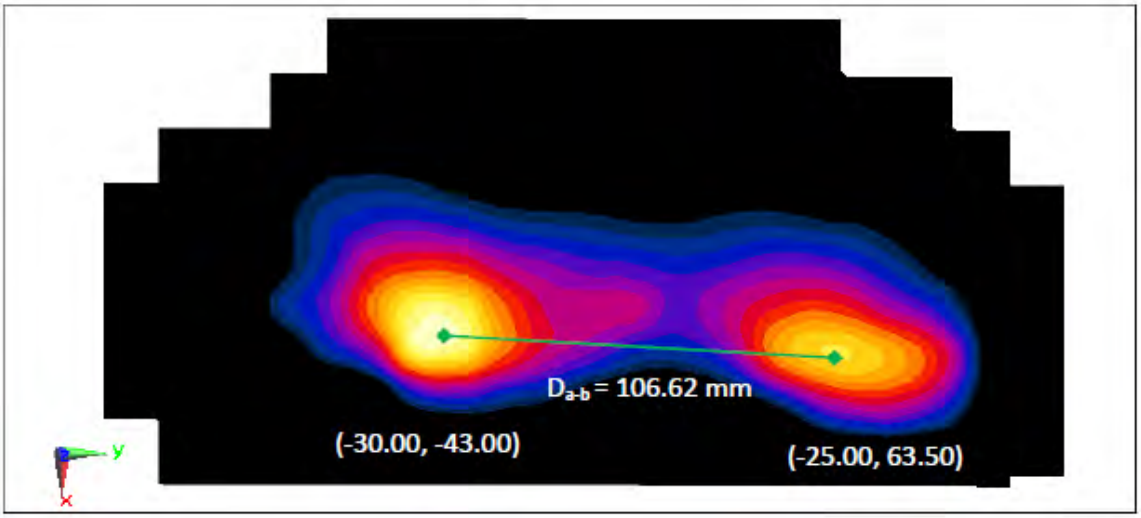


Figure 11-8
Peak SAR Locations for Body Back Side at 0 mm GPRS 1900 MHz and 2.4 GHz WLAN Antenna 2

Table 11-38
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}	$(a+b)^{1.5}/D_{a-b}$
GPRS 1900	802.11b	0.749	1.013	1.762	106.62	0.02

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0 mm with UMTS 1900 MHz antenna operating at limited output power with 2.4 GHz WIFI Antenna 2.

Table 11-39
Peak SAR Locations for Body Back Side at 0 mm UMTS 1900 MHz and 2.4 GHz WLAN Antenna 2

Mode/Band	x (mm)	y (mm)
UMTS 1900	-25.00	62.00
802.11b	-30.00	-43.00

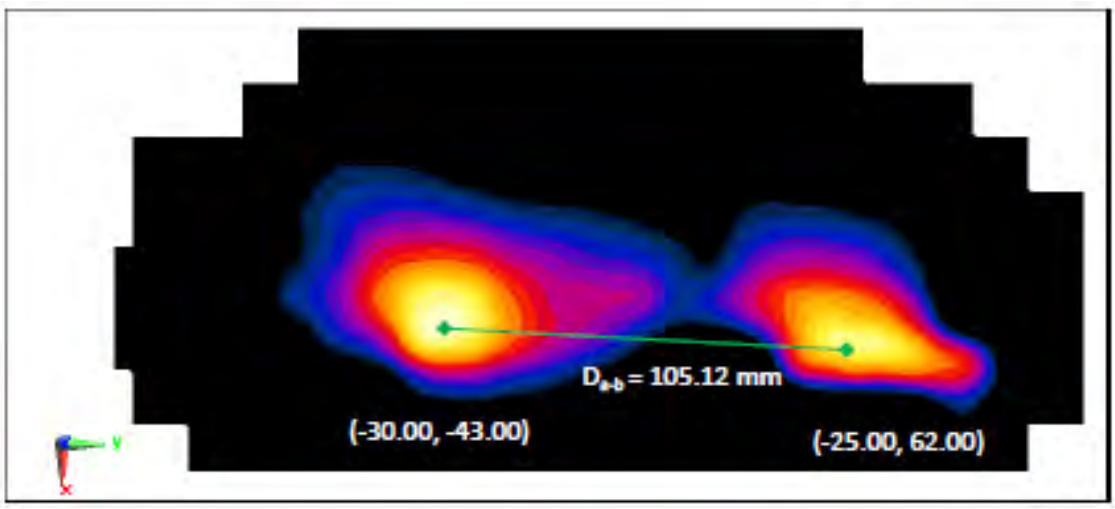


Figure 11-9
Peak SAR Locations for Body Back Side at 0 mm UMTS 1900 MHz and 2.4 GHz WLAN Antenna 2

Table 11-40
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}	$(a+b)^{1.5}/D_{a-b}$
UMTS 1900	802.11b	1.027	1.013	2.04	105.12	0.03

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0 mm with LTE Band 4 antenna operating at limited output power with 2.4 GHz WIFI Antenna 2.

Table 11-41
Peak SAR Locations for Body Back Side at 0 mm LTE Band 4 and 2.4 GHz WLAN Antenna 2

Mode/Band	x (mm)	y (mm)
LTE Band 4	-20.50	67.50
802.11b	-30.00	-43.00

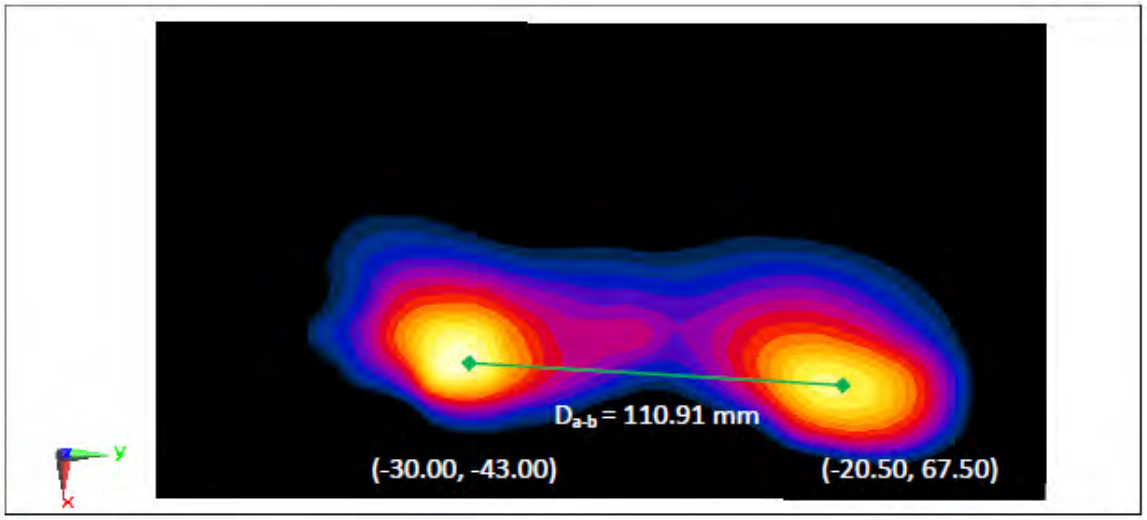


Figure 11-10
Peak SAR Locations for Body Back Side at 0 mm LTE Band 4 and 2.4 GHz WLAN Antenna 2

Table 11-42
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 4	802.11b	1.089	1.013	2.102	110.91	0.03

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0 mm with LTE Band 2 antenna operating at limited output power with 2.4 GHz WIFI Antenna 2.

Table 11-43
Peak SAR Locations for Body Back Side at 0 mm LTE Band 2 and 2.4 GHz WLAN Antenna 2

Mode/Band	x (mm)	y (mm)
LTE Band 2	-21.50	67.50
802.11b	-30.00	-43.00

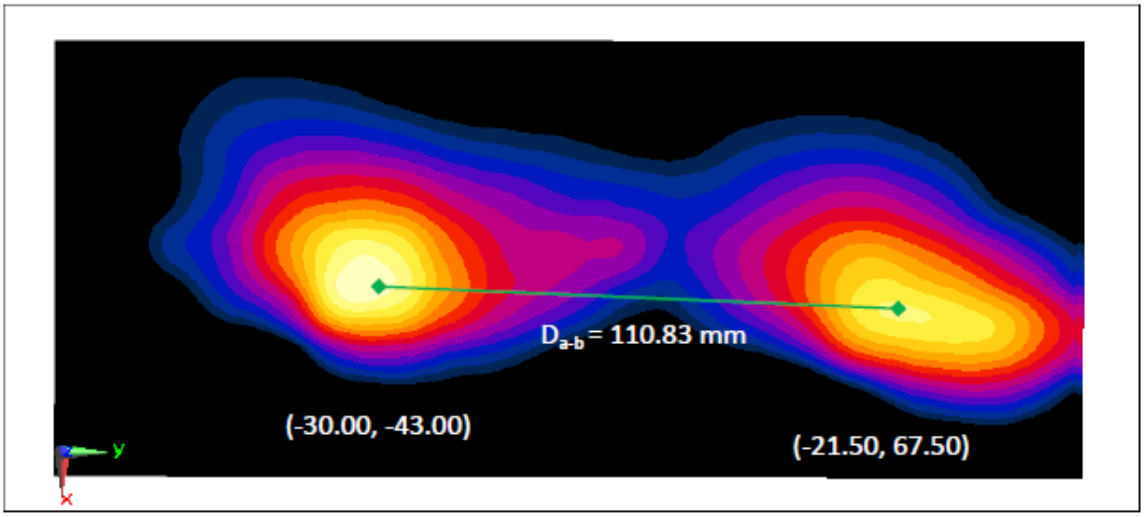


Figure 11-11
Peak SAR Locations for Body Back Side at 0 mm LTE Band 2 and 2.4 GHz WLAN Antenna 2

Table 11-44
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 2	802.11b	1.07	1.013	2.083	110.83	0.03

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0 mm with LTE Band 4 antenna operating at limited output power with 2.4 GHz WIFI MIMO.

Table 11-45
Peak SAR Locations for Body Back Side at 0 mm LTE Band 4 and 2.4 GHz WLAN MIMO

Mode/Band	x (mm)	y (mm)
LTE Band 4	-20.50	67.50
802.11n	-27.80	-72.00

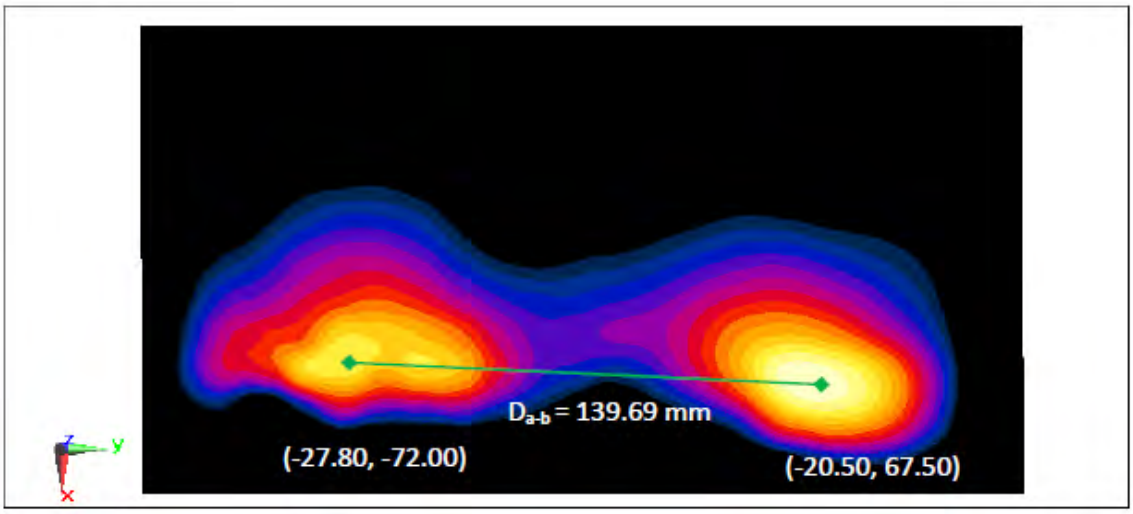


Figure 11-12
Peak SAR Locations for Body Back Side at 0 mm LTE Band 4 and 2.4 GHz WLAN MIMO

Table 11-46
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 4	802.11n	1.089	0.555	1.644	139.69	0.02

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0 mm with LTE Band 2 antenna operating at limited output power with 2.4 GHz WIFI MIMO.

Table 11-47
Peak SAR Locations for Body Back Side at 0 mm LTE Band 2 and 2.4 GHz WLAN MIMO

Mode/Band	x (mm)	y (mm)
LTE Band 2	-21.50	67.50
802.11n	-27.80	-72.00

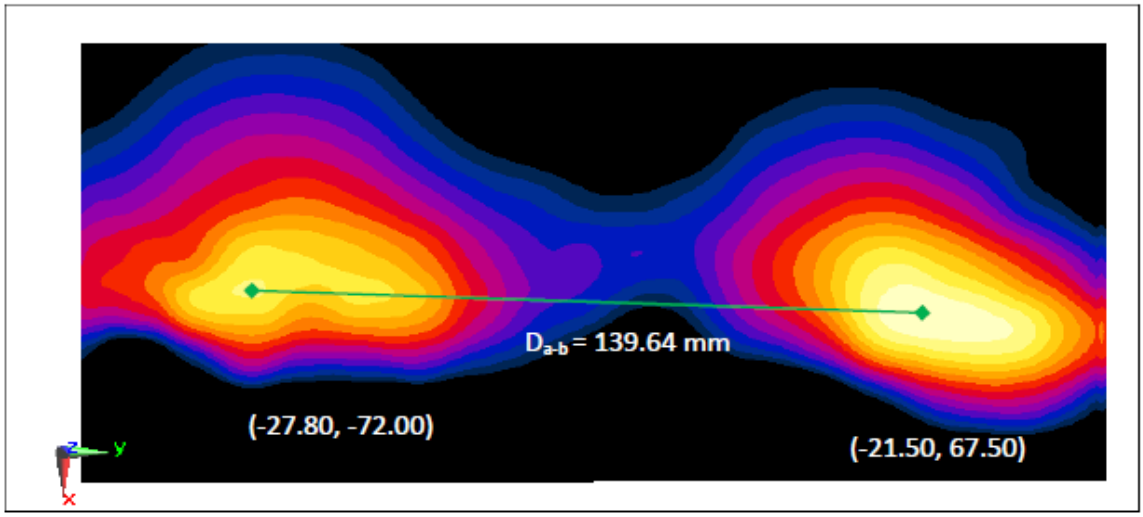


Figure 11-13
Peak SAR Locations for Body Back Side at 0 mm LTE Band 2 and 2.4 GHz WLAN MIMO

Table 11-48
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 2	802.11n	1.07	0.555	1.625	139.64	0.01

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 20 mm with GPRS 1900 MHz antenna operating at maximum output power with 2.4 GHz WIFI Antenna 1.

Table 11-49
Peak SAR Locations for Body Back Side at 20 mm GPRS 1900 MHz and 2.4 GHz WLAN Antenna 1

Mode/Band	x (mm)	y (mm)
GPRS 1900	-12.00	83.00
802.11b	-30.00	-72.00

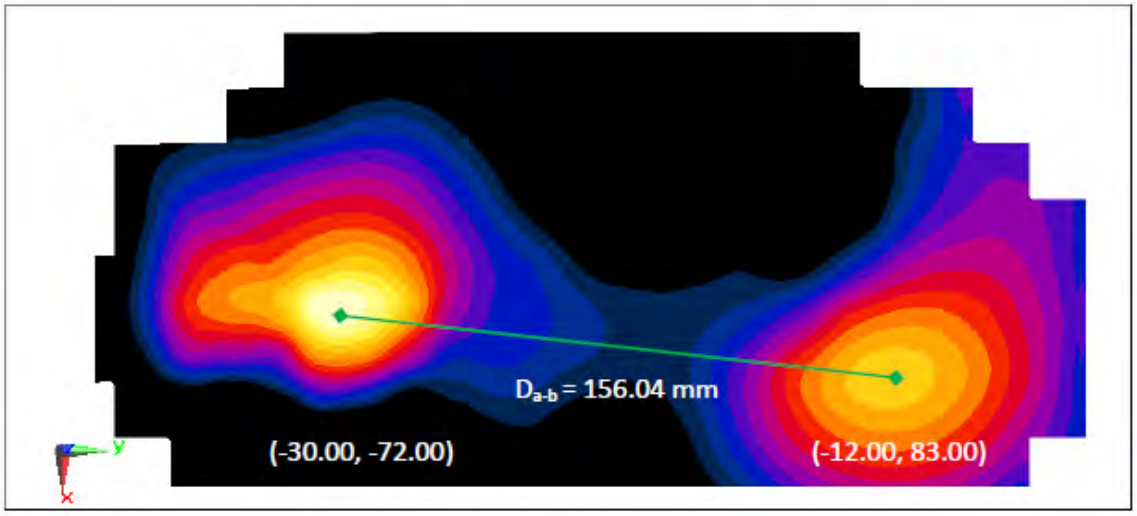


Figure 11-14
Peak SAR Locations for Body Back Side at 20 mm GPRS 1900 MHz and 2.4 GHz WLAN Antenna 1

Table 11-50
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}	$(a+b)^{1.5}/D_{a-b}$
GPRS 1900	802.11b	0.911	<0.981	<1.892	156.04	<0.02

The sum of the standalone SAR values was above 1.6 W/kg for the Body Back Side configuration at a separation distance of 20 mm with GPRS 1900 MHz antenna operating at maximum output power with 2.4 GHz WIFI Antenna 2.

Table 11-51
Peak SAR Locations for Body Back Side at 20 mm GPRS 1900 MHz and 2.4 GHz WLAN Antenna 2

Mode/Band	x (mm)	y (mm)
GPRS 1900	-12.00	83.00
802.11b	-30.00	-43.00

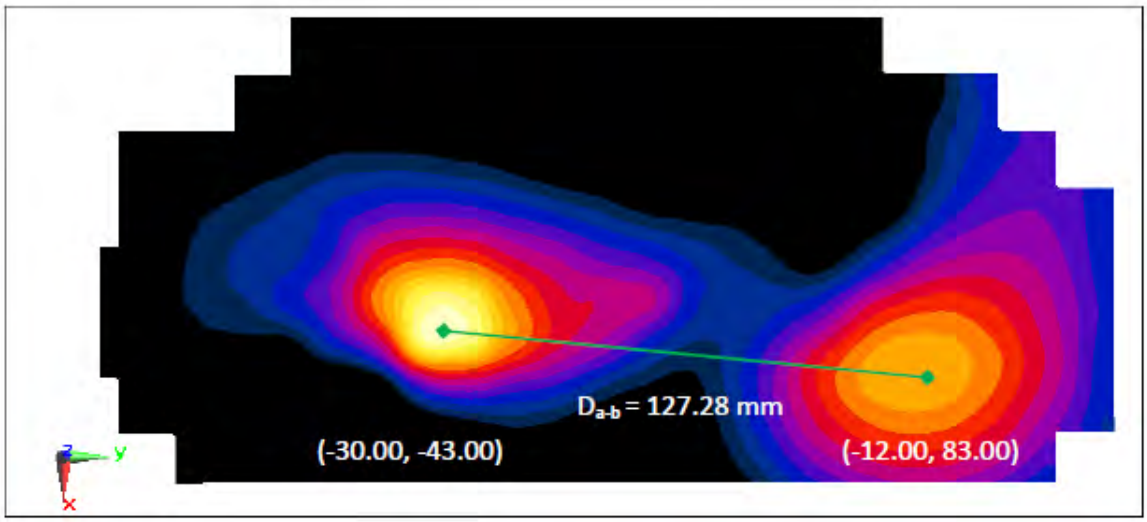


Figure 11-15
Peak SAR Locations for Body Back Side at 20 mm GPRS 1900 MHz and 2.4 GHz WLAN Antenna 2

Table 11-52
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}	$(a+b)^{1.5}/D_{a-b}$
GPRS 1900	802.11b	0.911	<1.013	<1.924	127.28	<0.02

11.5 Simultaneous Transmission Conclusion

The above numerical summed SAR and SPLSR analysis results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v05 and IEEE 1528-2013 Section 6.3.4.1.2.

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	Antenna	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)	
1750	1732.50	20175	LTE Band 4 (AWS)	QPSK, 1 RB, 0 RB Offset	N/A	N/A	back	0 mm	0.966	0.922	1.05	N/A	N/A	N/A	N/A
1900	1900.00	19100	LTE Band 2 (PCS)	QPSK, 1 RB, 0 RB Offset	N/A	N/A	back	0 mm	1.010	0.982	1.03	N/A	N/A	N/A	N/A
2450	2437.00	6	IEEE 802.11b	DSSS	2	1	back	0 mm	0.974	0.974	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.

13 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/30/2013	Annual	10/30/2014	1833460
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/15/2014	Annual	4/15/2015	MY45470194
Agilent	8753E	(30kHz-6GHz) Network Analyzer	7/23/2013	Annual	7/23/2014	US37390350
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	8648D	(9kHz-4GHz) Signal Generator	4/15/2014	Annual	4/15/2015	3629U00687
SPEAG	D1750V2	1750 MHz SAR Dipole	4/10/2014	Annual	4/10/2015	1051
SPEAG	D1900V2	1900 MHz SAR Dipole	7/22/2013	Annual	7/22/2014	5d149
SPEAG	D2450V2	2450 MHz SAR Dipole	1/21/2014	Annual	1/21/2015	797
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
SPEAG	D750V3	750 MHz Dipole	1/20/2014	Annual	1/20/2015	1003
SPEAG	D835V2	835 MHz SAR Dipole	4/7/2014	Annual	4/7/2015	4d119
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Rohde & Schwarz	CMU200	Base Station Simulator	9/23/2013	Annual	9/23/2014	109892
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/21/2013	Annual	8/21/2014	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/18/2013	Annual	11/18/2014	1407
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/19/2013	Annual	11/19/2014	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/19/2013	Annual	11/19/2014	1408
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/26/2014	Annual	2/26/2015	665
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAK-3.5	Dielectric Assessment Kit	11/13/2013	Annual	11/13/2014	1091
Mitutoyo	CD-6"CSX	Digital Caliper	5/8/2014	Biennial	5/8/2016	13264162
Fisher Scientific	15-077-960	Digital Thermometer	11/6/2012	Biennial	11/6/2014	122640025
Rohde & Schwarz	NRVD	Dual Channel Power Meter	10/12/2012	Biennial	10/12/2014	101695
Agilent	E4438C	ESG Vector Signal Generator	3/31/2014	Annual	3/31/2015	MY42082659
Control Company	4353	Long Stem Thermometer	9/25/2012	Biennial	9/25/2014	122541143
Control Company	4353	Long Stem Thermometer	9/25/2012	Biennial	9/25/2014	122541139
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Rohde & Schwarz	CMW500	Radio Communication Tester	10/4/2013	Annual	10/4/2014	108798
Rohde & Schwarz	CMW500	Radio Communication Tester	10/18/2013	Annual	10/18/2014	100976
Agilent	N9020A	MXA Signal Analyzer	10/29/2013	Annual	10/29/2014	US46470561
Agilent	N5182A	MXG Vector Signal Generator	4/15/2014	Annual	4/15/2015	MY47420800
Agilent	N5182A	MXG Vector Signal Generator	4/15/2014	Annual	4/15/2015	MY47420651
Rohde & Schwarz	NRV-Z32	Peak Power Sensor	10/12/2012	Biennial	10/12/2014	836019/013
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/18/2013	Annual	8/18/2014	1008
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/18/2013	Annual	8/18/2014	1009
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Anritsu	ML2495A	Power Meter	10/31/2013	Annual	10/31/2014	1039008
Anritsu	ML2469A	Power Meter	3/14/2014	Annual	3/14/2015	1306009
Anritsu	MA2481A	Power Sensor	10/30/2013	Annual	10/30/2014	5605
Anritsu	MA2411B	Pulse Power Sensor	11/14/2013	Annual	11/14/2014	1126066
Anritsu	MA2411B	Pulse Power Sensor	2/3/2014	Annual	2/3/2015	1339018
Anritsu	MT8820C	Radio Communication Analyzer	12/12/2013	Annual	12/12/2014	6200901190
Anritsu	MT8820C	Radio Communication Analyzer	12/12/2013	Annual	12/12/2014	6201300731
Tektronix	RSA6114A	Real Time Spectrum Analyzer	4/16/2014	Annual	4/16/2015	B010177
SPEAG	ES3DV2	SAR Probe	8/22/2013	Annual	8/22/2014	3022
SPEAG	EX3DV4	SAR Probe	10/23/2013	Annual	10/23/2014	3914
SPEAG	ES3DV3	SAR Probe	11/22/2013	Annual	11/22/2014	3333
SPEAG	ES3DV3	SAR Probe	11/25/2013	Annual	11/25/2014	3332
SPEAG	ES3DV3	SAR Probe	2/25/2014	Annual	2/25/2015	3258
Rohde & Schwarz	SME06	Signal Generator	10/30/2013	Annual	10/30/2014	832026
Rohde & Schwarz	NRVS	Single Channel Power Meter	10/31/2013	Annual	10/31/2014	835360/0079
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M1S5A00-009
Agilent	8753ES	S-Parameter Network Analyzer	10/29/2013	Annual	10/29/2014	US39170122
Agilent	85047A	S-Parameter Test Set	N/A	N/A	N/A	2904A00579
Seekonk	NC-100	Torque Wrench	3/18/2014	Biennial	3/18/2016	N/A
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/18/2014	Biennial	3/18/2016	N/A
Gigatronics	8651A	Universal Power Meter	10/30/2013	Annual	10/30/2014	8650319
Anritsu	MA24106A	USB Power Sensor	12/18/2013	Annual	12/18/2014	1344555
Anritsu	MA24106A	USB Power Sensor	12/18/2013	Annual	12/18/2014	1344556
VWR	36934-158	Wall-Mounted Thermometer	8/8/2013	Biennial	8/8/2015	130477877
VWR	36934-158	Wall-Mounted Thermometer	8/8/2013	Biennial	8/8/2015	130477866
VWR	36934-158	Wall-Mounted Thermometer	4/29/2014	Biennial	4/29/2016	111859323

Note:

1. 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.
2. Each equipment item was used solely within its respective calibration period.

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

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

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT805M; Type: Portable Tablet; Serial: 805M-7

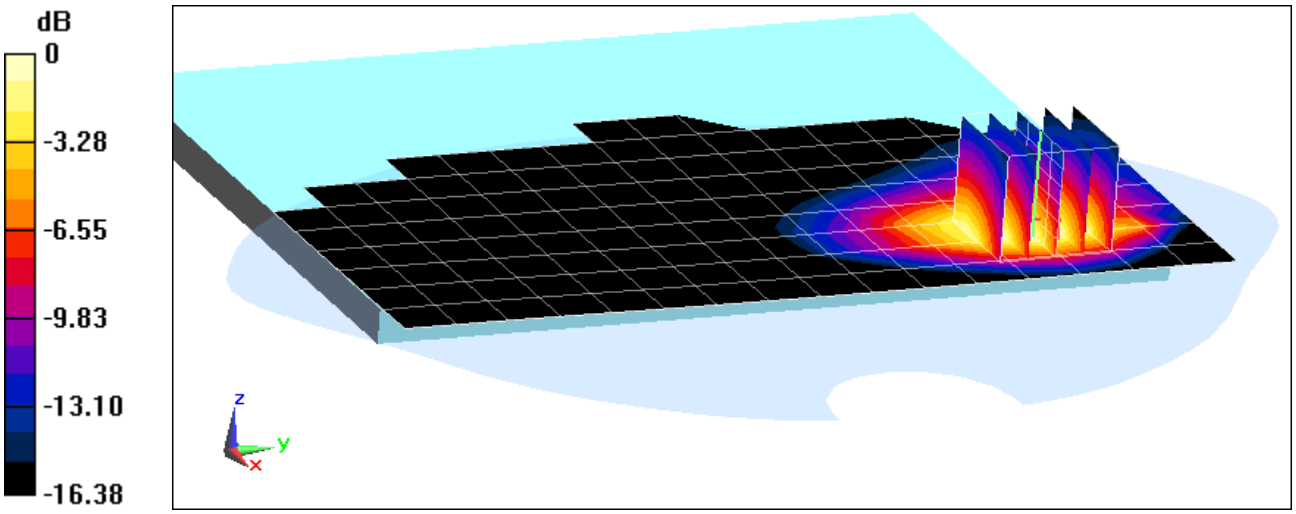
Communication System: UID 0, GSM GPRS; 3 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:2.76
Medium: 835 Body, Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.012 S/m; ε_r = 53.66; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 05-05-2014; Ambient Temp: 23.5°C; Tissue Temp: 22.6°C

Probe: ES3DV2 - SN3022; ConvF(5.91, 5.91, 5.91); Calibrated: 8/22/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: GPRS 850, Body SAR, Back side, Mid.ch, 3 Tx Slots

Area Scan (10x17x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.805 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 1.28 W/kg
SAR(1 g) = 0.612 W/kg



0 dB = 0.710 W/kg = -1.49 dBW/kg

DUT: A3LSMT805M; Type: Portable Tablet; Serial: 805M-7

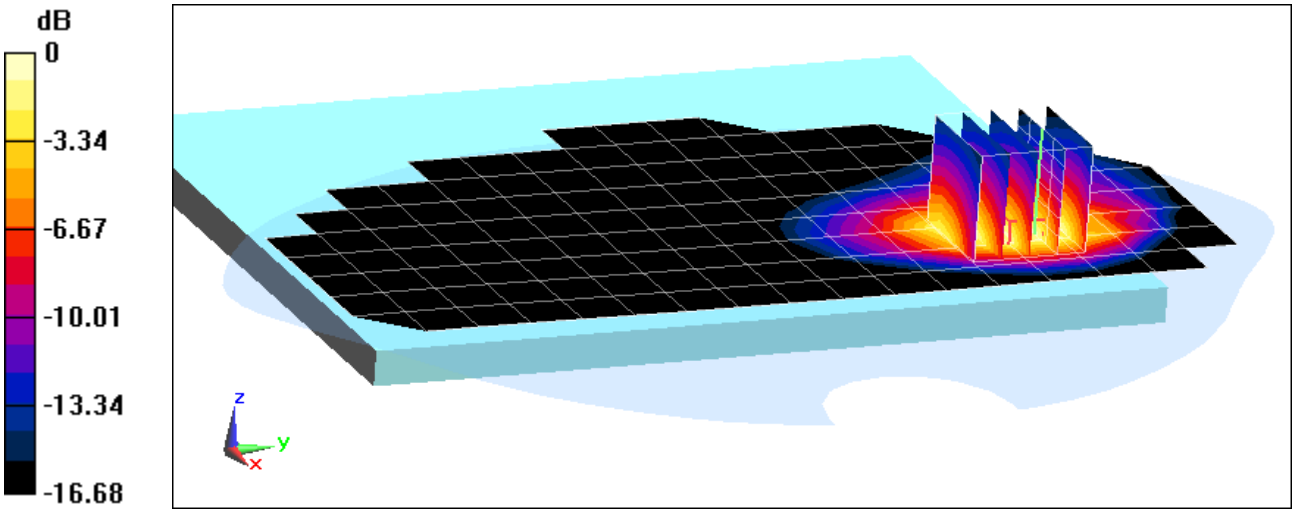
Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.012 S/m; ε_r = 53.66; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 05-05-2014; Ambient Temp: 23.5°C; Tissue Temp: 22.6°C

Probe: ES3DV2 - SN3022; ConvF(5.91, 5.91, 5.91); Calibrated: 8/22/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: UMTS 850, Body SAR, Back side, Mid.ch

Area Scan (10x18x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.954 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 1.29 W/kg
SAR(1 g) = 0.614 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT805M; Type: Portable Tablet; Serial: 805M-4

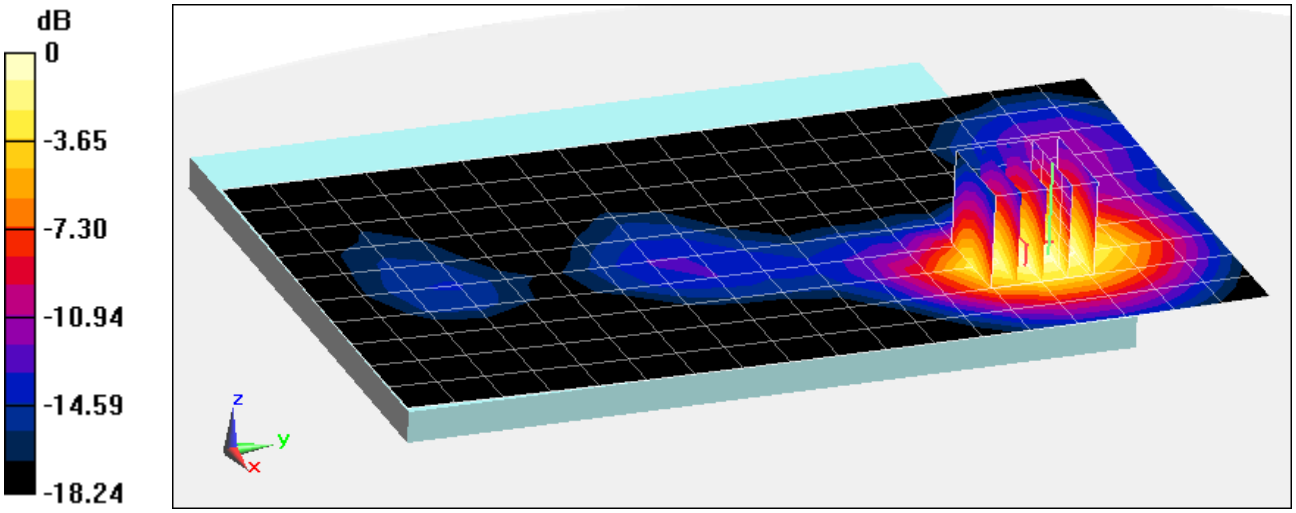
Communication System: UID 0, GSM GPRS; 4 Tx slots, Frequency: 1909.8 MHz; Duty Cycle: 1:2.076
Medium: 1900 Body, Medium parameters used:
f = 1910 MHz; σ = 1.563 S/m; ε_r = 52.598; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 2.0 cm

Test Date: 05-21-2014; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3332; ConvF(4.7, 4.7, 4.7); Calibrated: 11/25/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: GPRS 1900, Body SAR, Back side, High.ch, 4 Tx Slots

Area Scan (11x19x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.128 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 1.30 W/kg
SAR(1 g) = 0.819 W/kg



0 dB = 0.876 W/kg = -0.57 dBW/kg

DUT: A3LSMT805M; Type: Portable Tablet; Serial: 805M-7

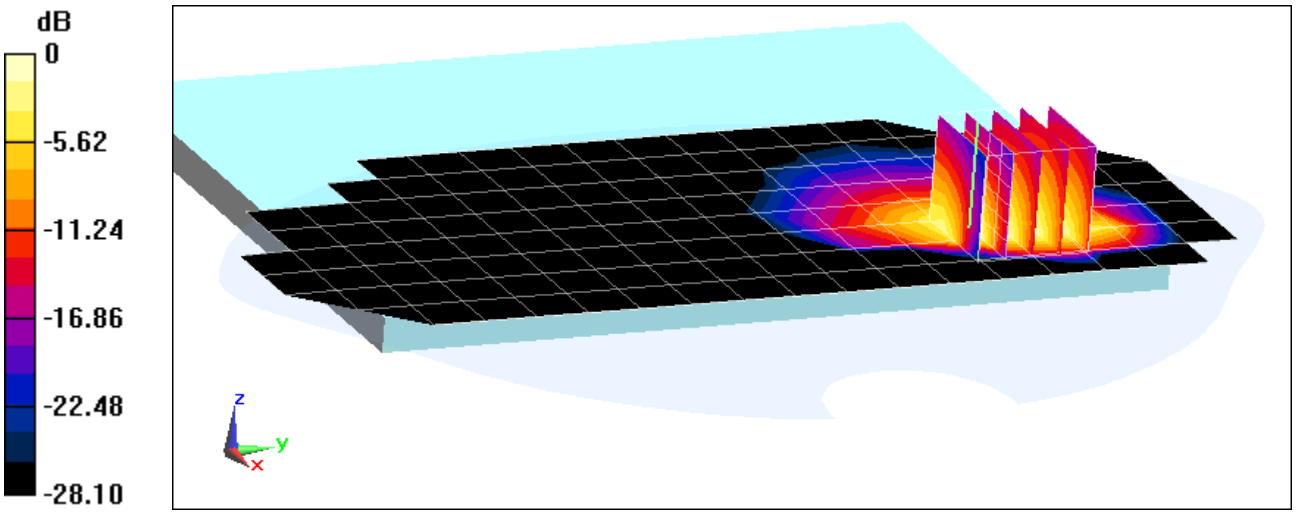
Communication System: UID 0, UMTS; Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used (interpolated):
f = 1907.6 MHz; σ = 1.565 S/m; ε_r = 53.036; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 05-05-2014; Ambient Temp: 23.5°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3914; ConvF(7.51, 7.51, 7.51); Calibrated: 10/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
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: UMTS 1900, Body SAR, Back side, High.ch

Area Scan (9x19x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.663 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 2.03 W/kg
SAR(1 g) = 0.909 W/kg



0 dB = 1.02 W/kg = 0.09 dBW/kg

DUT: A3LSMT805M; Type: Portable Tablet; Serial: 805M-7

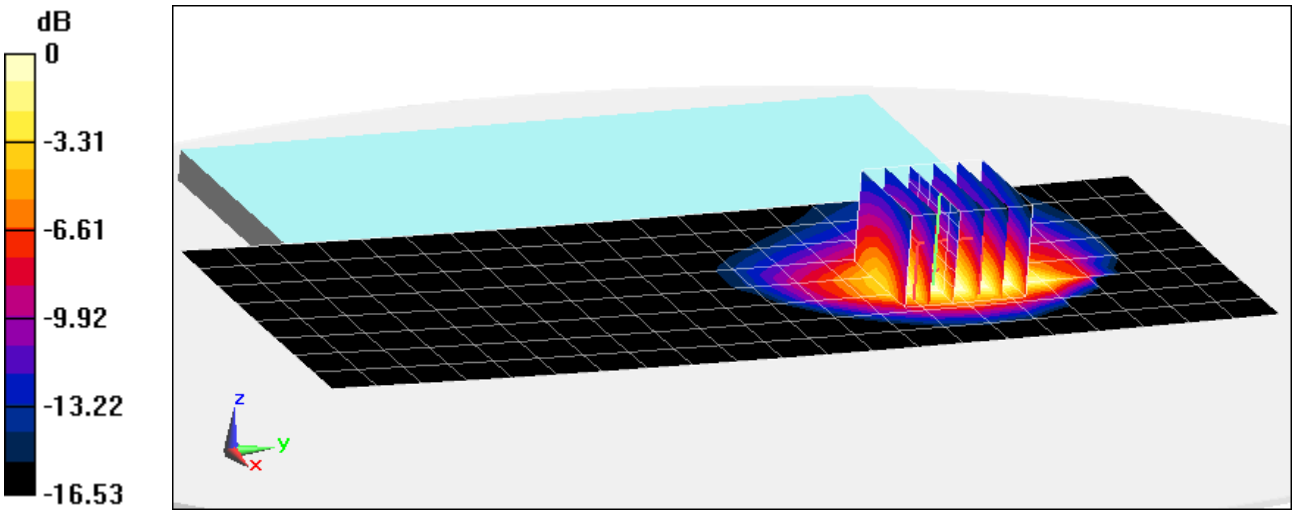
Communication System: UID 0, LTE Band 17; Frequency: 710 MHz; Duty Cycle: 1:1
Medium: 750 Body, Medium parameters used:
f = 710 MHz; σ = 0.944 S/m; ε_r = 55.251; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 05-07-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3333; ConvF(6.11, 6.11, 6.11); Calibrated: 11/22/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1229
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 17, Body SAR, Back Side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (9x22x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.400 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.646 W/kg
SAR(1 g) = 0.317 W/kg



0 dB = 0.345 W/kg = -4.62 dBW/kg

DUT: A3LSMT805M; Type: Portable Tablet; Serial: 805M-7

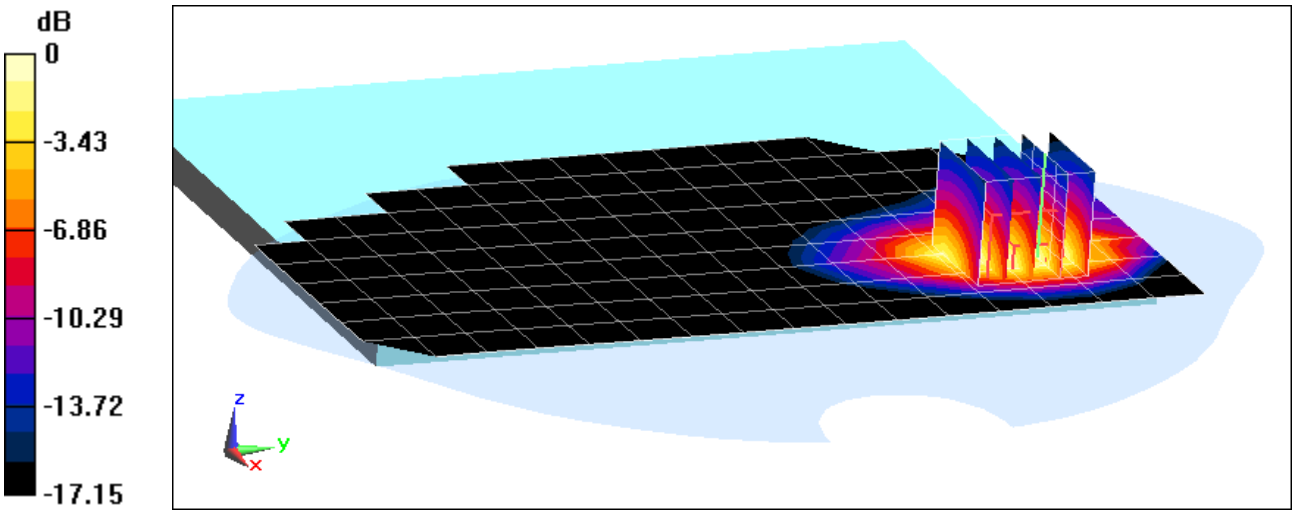
Communication System: UID 0, LTE Band 5; Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used (interpolated):
f = 836.5 MHz; σ = 1.012 S/m; ε_r = 53.661; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 05-05-2014; Ambient Temp: 23.5°C; Tissue Temp: 22.6°C

Probe: ES3DV2 - SN3022; ConvF(5.91, 5.91, 5.91); Calibrated: 8/22/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 5 (Cell.), Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset

Area Scan (11x17x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.551 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.955 W/kg
SAR(1 g) = 0.453 W/kg



0 dB = 0.545 W/kg = -2.64 dBW/kg

DUT: A3LSMT805M; Type: Portable Tablet; Serial: 805M-7

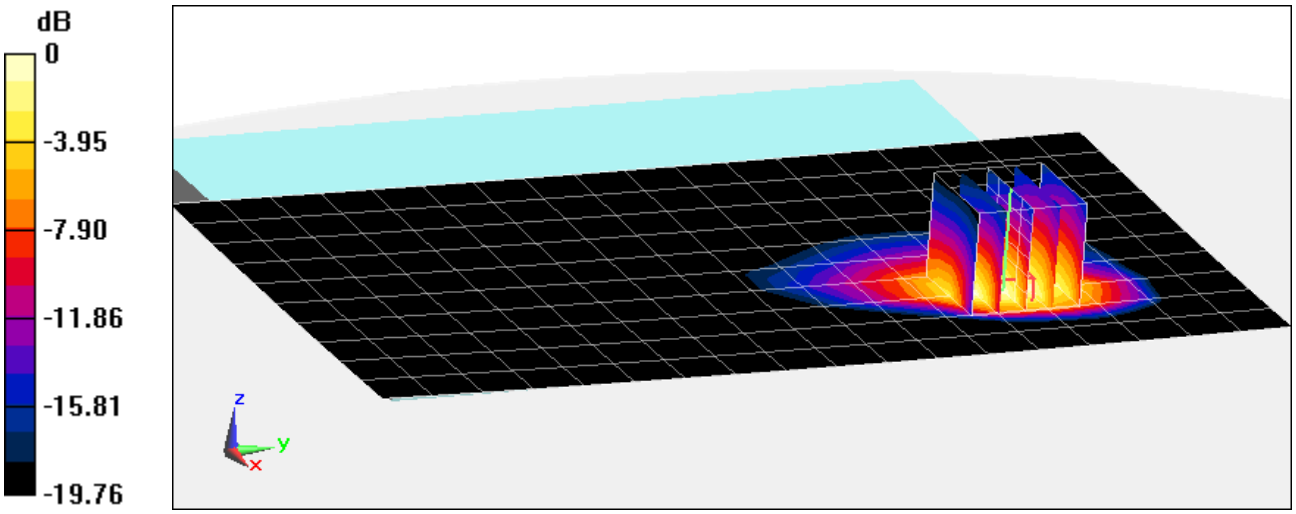
Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1
Medium: 1750 Body, Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.454 S/m; ε_r = 52.663; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 05-14-2014; Ambient Temp: 21.5°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3332; ConvF(4.93, 4.93, 4.93); Calibrated: 11/25/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 4 (AWS), Body SAR, Back side, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (11x19x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 28.294 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 2.00 W/kg
SAR(1 g) = 0.966 W/kg



0 dB = 1.13 W/kg = 0.53 dBW/kg

DUT: A3LSMT805M; Type: Portable Tablet; Serial: 805M-7

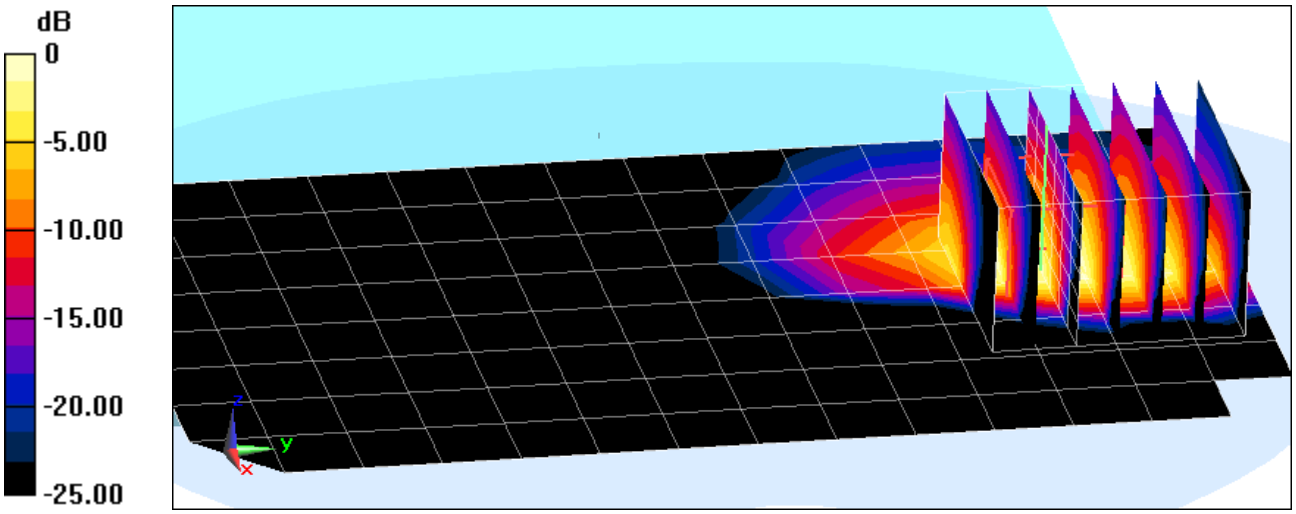
Communication System: UID 0, LTE Band 2 (PCS); Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.556 S/m; ε_r = 53.061; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 05-05-2014; Ambient Temp: 23.5°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3914; ConvF(7.51, 7.51, 7.51); Calibrated: 10/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
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: LTE Band 2 (PCS), Body SAR, Back side, High.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.343 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 2.26 W/kg
SAR(1 g) = 1.01 W/kg



0 dB = 1.16 W/kg = 0.64 dBW/kg

DUT: A3LSMT805M; Type: Portable Tablet; Serial: 805M-3

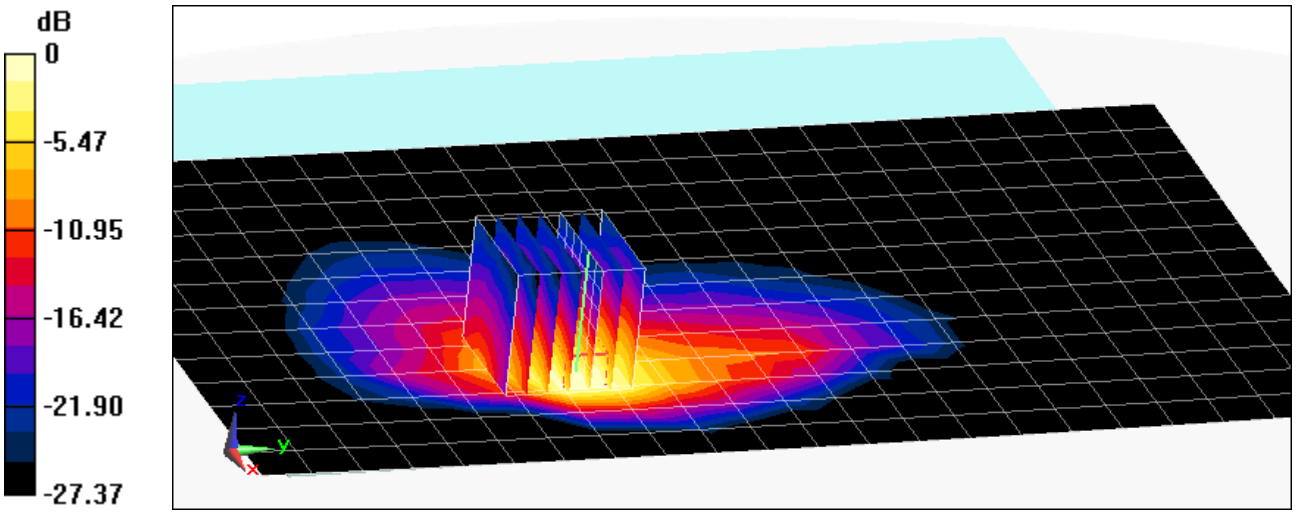
Communication System: UID 0, IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: 2450 Body, Medium parameters used (interpolated):
f = 2437 MHz; σ = 2.018 S/m; ε_r = 51.362; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 05-01-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3258; ConvF(4.14, 4.14, 4.14); Calibrated: 2/25/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11b, Body SAR, Ch 06, 1 Mbps, Back Side, Antenna 2

Area Scan (14x23x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.932 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 3.46 W/kg
SAR(1 g) = 0.974 W/kg



0 dB = 1.48 W/kg = 1.70 dBW/kg

APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1003

Communication System: UID 0, CW; Frequency: 750 MHz;Duty Cycle: 1:1
Medium: 750 Body Medium parameters used (interpolated):
f = 750 MHz; σ = 0.981 S/m; ε_r = 54.822; ρ = 1000 kg/m^3

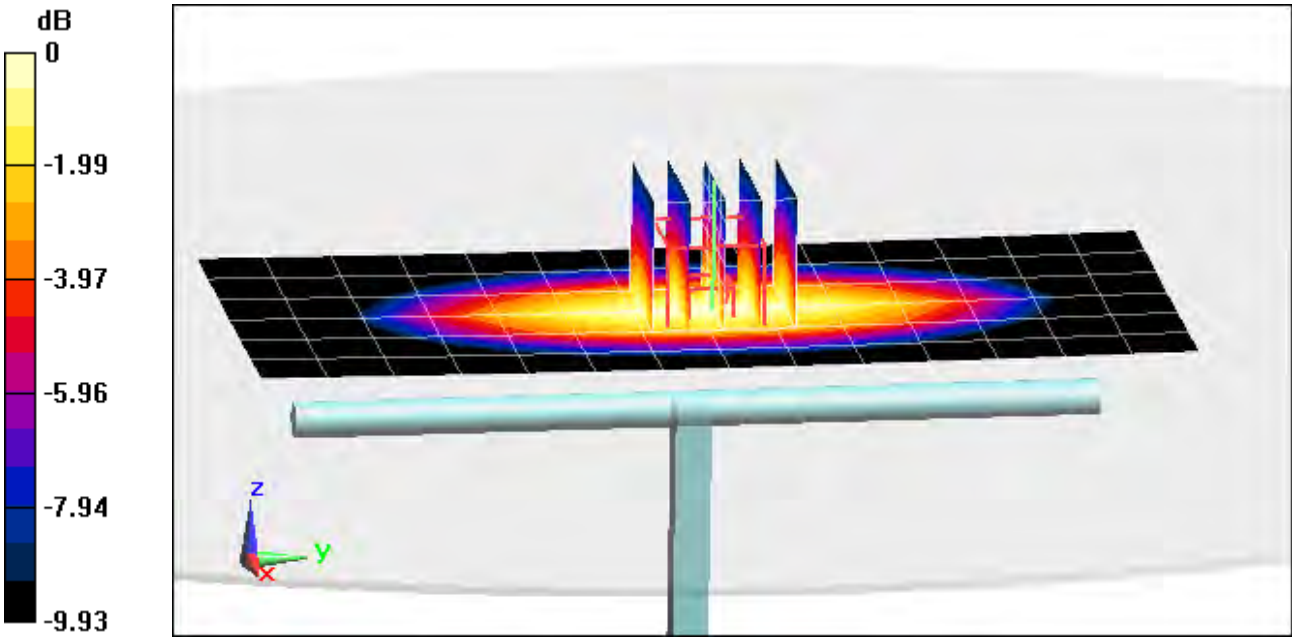
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 05-07-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3333; ConvF(6.11, 6.11, 6.11); Calibrated: 11/22/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1229
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

750 MHz System Verification

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20 dBm (100 mW)
Peak SAR (extrapolated) = 1.26 W/kg
SAR(1 g) = 0.890 W/kg
Deviation = 1.48%



0 dB = 0.961 W/kg = -0.17 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d119

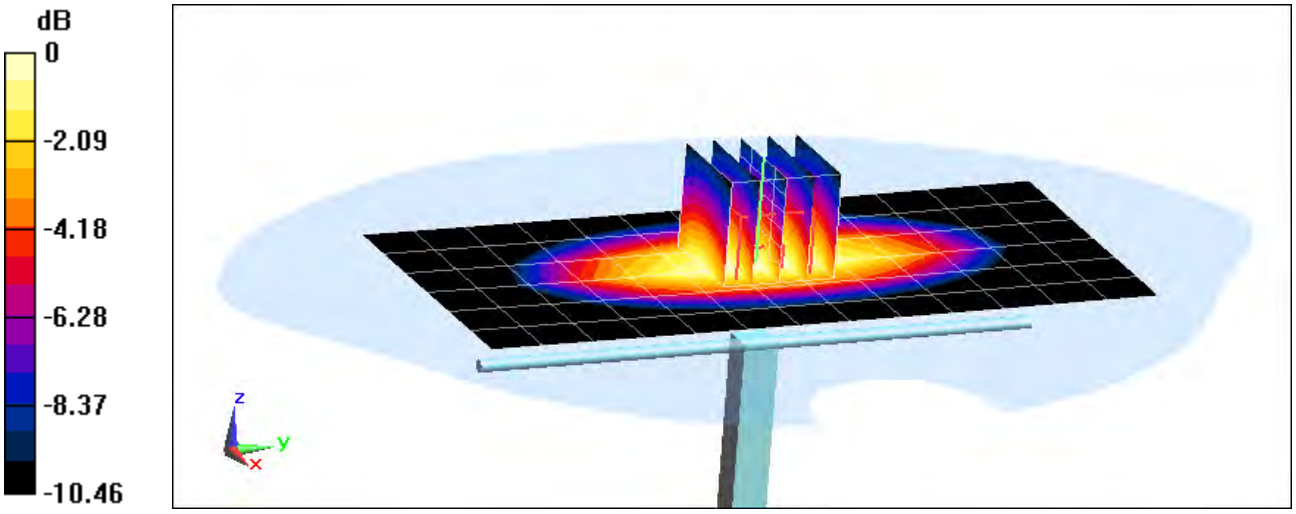
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used:
f = 835 MHz; σ = 1.011 S/m; ε_r = 53.677; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 05-05-2014; Ambient Temp: 23.5°C; Tissue Temp: 22.6°C

Probe: ES3DV2 - SN3022; ConvF(5.91, 5.91, 5.91); Calibrated: 8/22/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
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) = 1.43 W/kg
SAR(1 g) = 0.988 W/kg
Deviation = 5.78%



0 dB = 1.07 W/kg = 0.29 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1051

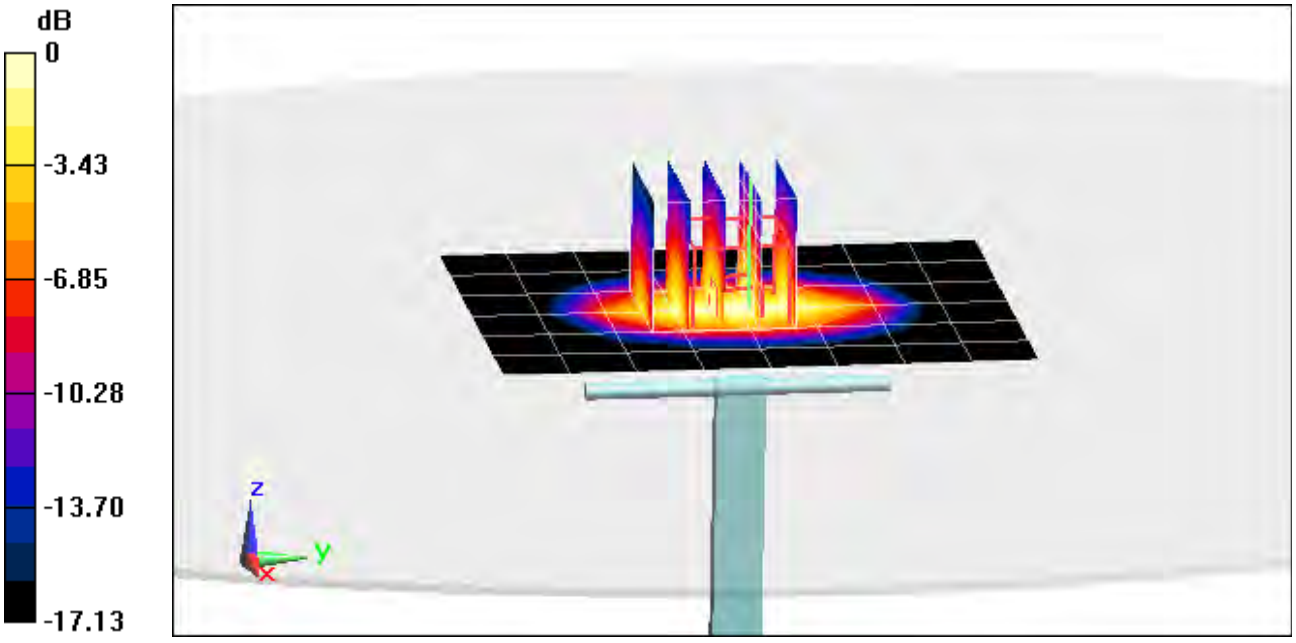
Communication System: UID 0, CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: 1750 Body Medium parameters used:
f = 1750 MHz; σ = 1.473 S/m; ε_r = 52.582; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-14-2014; Ambient Temp: 21.5°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3332; ConvF(4.93, 4.93, 4.93); Calibrated: 11/25/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

1750 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20 dBm (100 mW)
Peak SAR (extrapolated) = 6.82 W/kg
SAR(1 g) = 3.89 W/kg
Deviation = 4.01%



0 dB = 4.32 W/kg = 6.35 dBW/kg

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d149

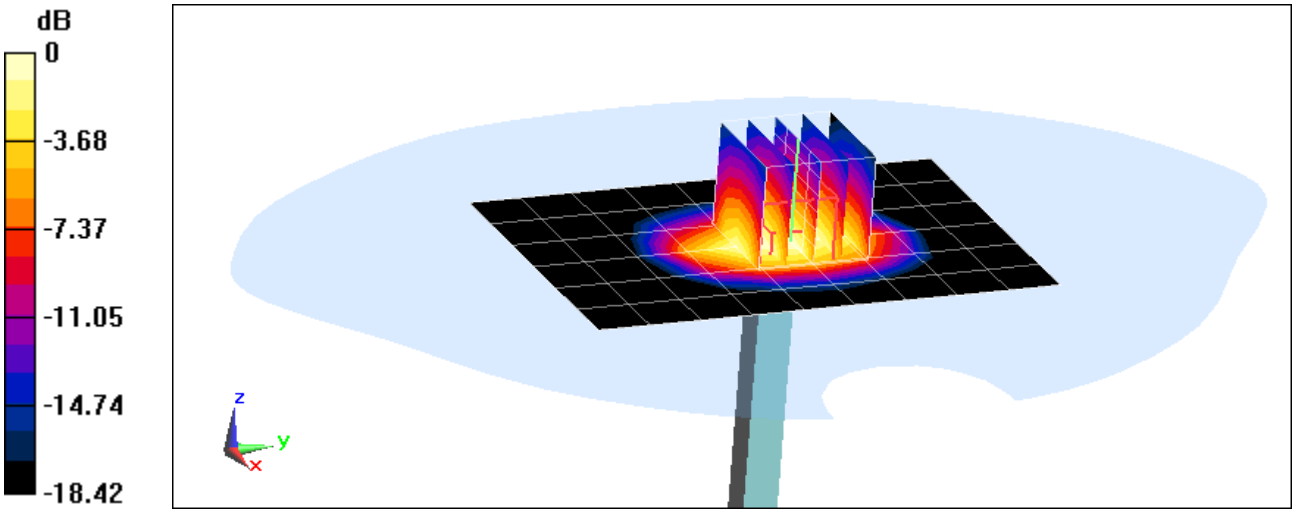
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.556 S/m; ε_r = 53.061; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-05-2014; Ambient Temp: 23.5°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3914; ConvF(7.51, 7.51, 7.51); Calibrated: 10/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

1900 MHz System Verification

Area Scan (7x10x1): 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) = 7.51 W/kg
SAR(1 g) = 4.11 W/kg
Deviation = 1.48%



0 dB = 4.45 W/kg = 6.48 dBW/kg

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d149

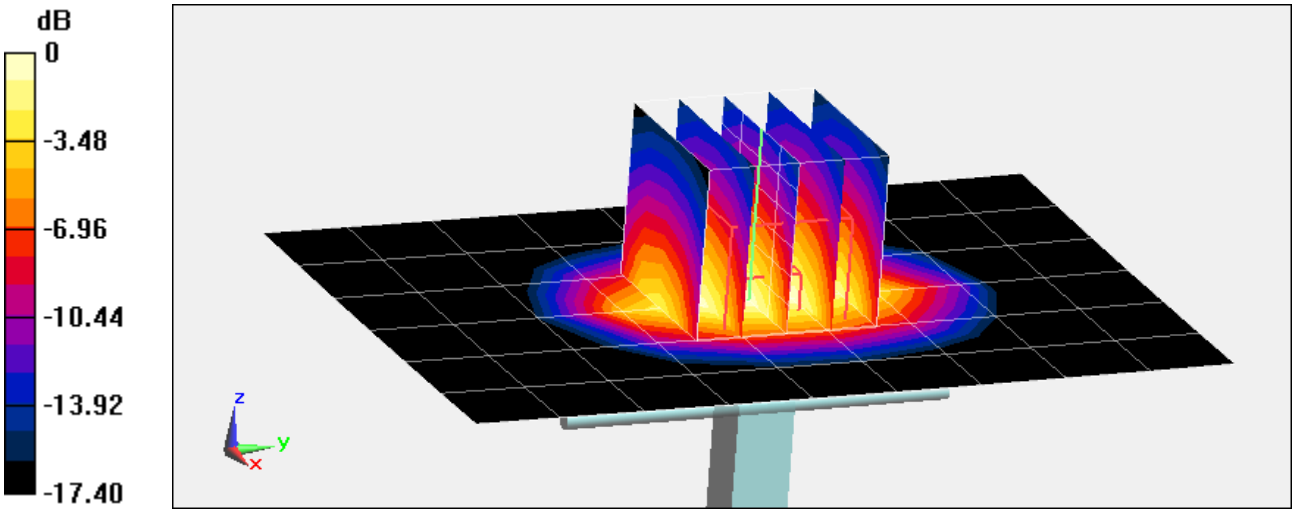
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.551 S/m; ε_r = 52.633; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-21-2014; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3332; ConvF(4.7, 4.7, 4.7); Calibrated: 11/25/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

1900 MHz System Verification

Area Scan (7x10x1): 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) = 7.77 W/kg
SAR(1 g) = 4.31 W/kg
Deviation = 6.42%



0 dB = 4.83 W/kg = 6.84 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

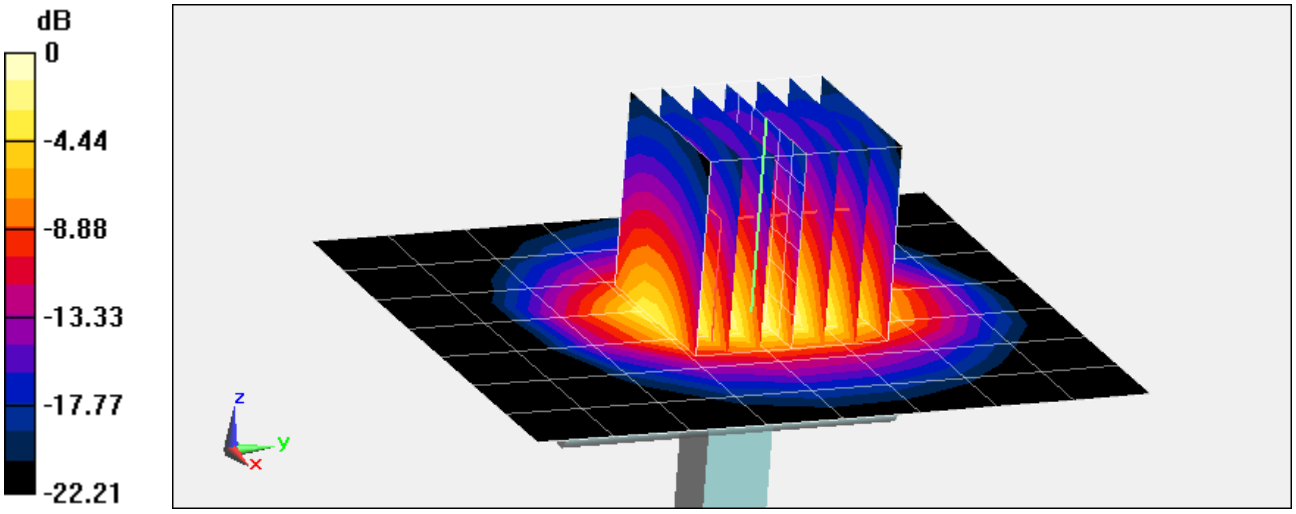
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Body, Medium parameters used:
f = 2450 MHz; σ = 2.036 S/m; ε_r = 51.322; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-01-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3258; ConvF(4.14, 4.14, 4.14); Calibrated: 2/25/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158
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 = 16.0 dBm (40 mW)
Peak SAR (extrapolated) = 4.40 W/kg
SAR(1 g) = 2.03 W/kg
Deviation = 2.73%



0 dB = 2.64 W/kg = 4.22 dBW/kg

APPENDIX C: PROBE CALIBRATION

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

Client PC Test **Certificate No: ES3-3333_Nov13**

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3333

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

Calibration date: November 22, 2013

1/7/14

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	4-Sep-13 (No. DAE4-660_Sep13)	Sep-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: November 25, 2013

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
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3333

Manufactured: January 24, 2012
Calibrated: November 22, 2013

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.08	0.90	0.88	± 10.1 %
DCP (mV)[B]	104.9	103.3	101.7	

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	140.9	±2.2 %
		Y	0.0	0.0	1.0		132.0	
		Z	0.0	0.0	1.0		170.3	

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.56	6.56	6.56	0.44	1.54	± 12.0 %
850	41.5	0.92	6.30	6.30	6.30	0.46	1.48	± 12.0 %
1750	40.1	1.37	5.23	5.23	5.23	0.77	1.17	± 12.0 %
1900	40.0	1.40	5.05	5.05	5.05	0.80	1.19	± 12.0 %
2450	39.2	1.80	4.42	4.42	4.42	0.74	1.31	± 12.0 %
2600	39.0	1.96	4.28	4.28	4.28	0.80	1.30	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333

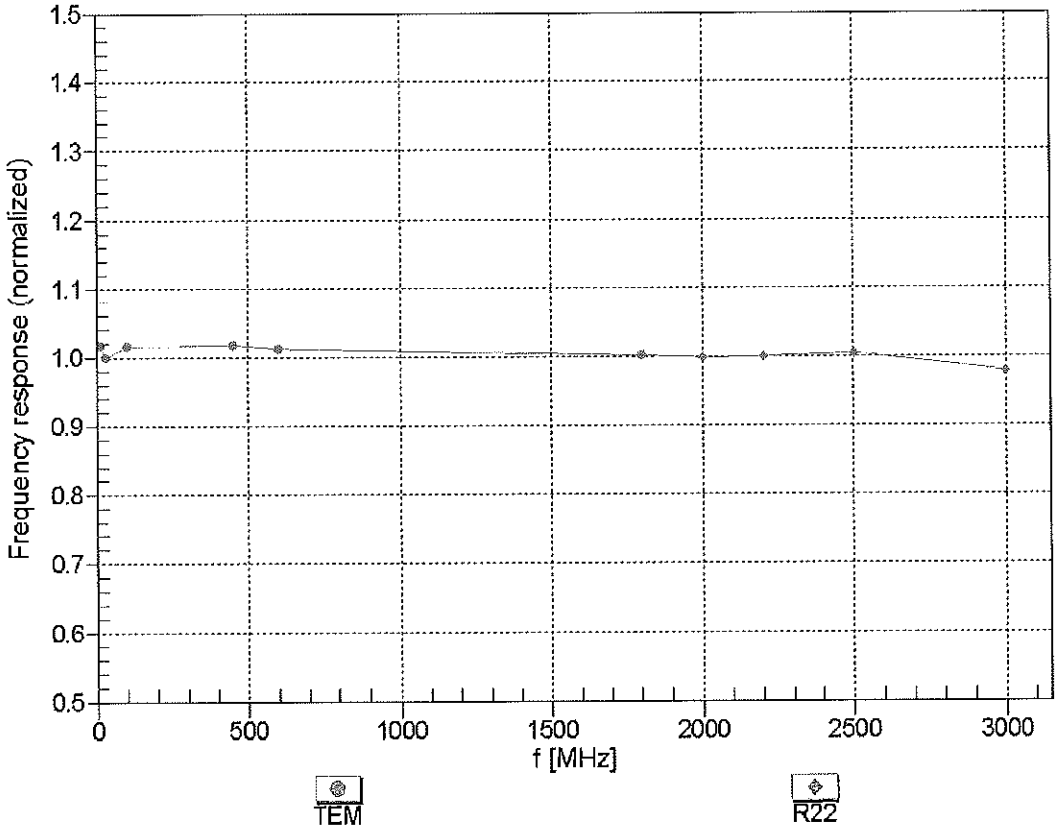
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.11	6.11	6.11	0.33	1.90	± 12.0 %
850	55.2	0.99	6.07	6.07	6.07	0.80	1.19	± 12.0 %
1750	53.4	1.49	4.95	4.95	4.95	0.80	1.26	± 12.0 %
1900	53.3	1.52	4.71	4.71	4.71	0.49	1.54	± 12.0 %
2450	52.7	1.95	4.22	4.22	4.22	0.80	0.95	± 12.0 %
2600	52.5	2.16	4.16	4.16	4.16	0.80	1.07	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

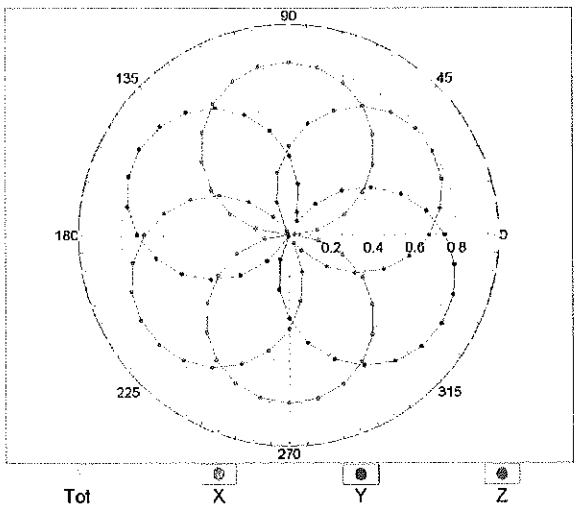
(TEM-Cell:ifi110 EXX, Waveguide: R22)



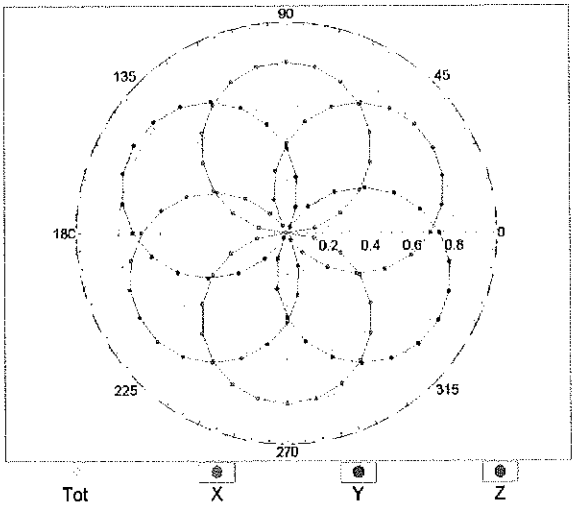
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

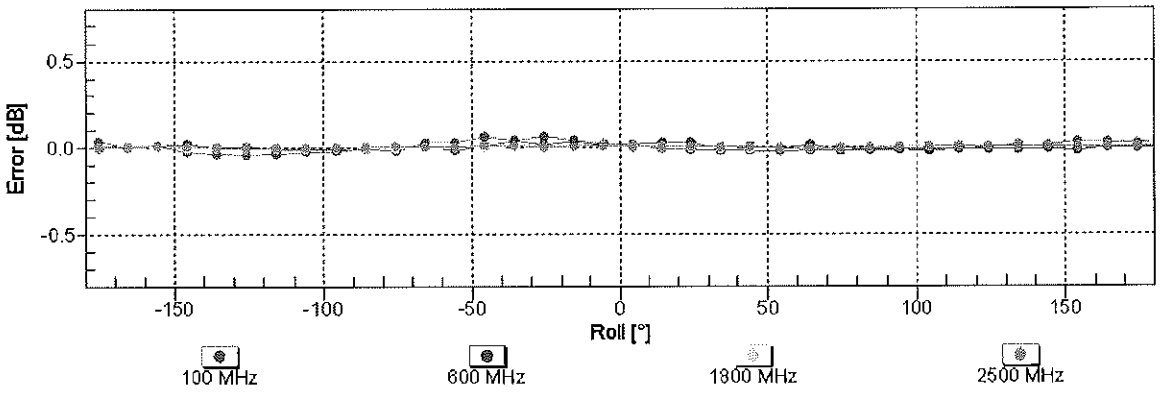
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



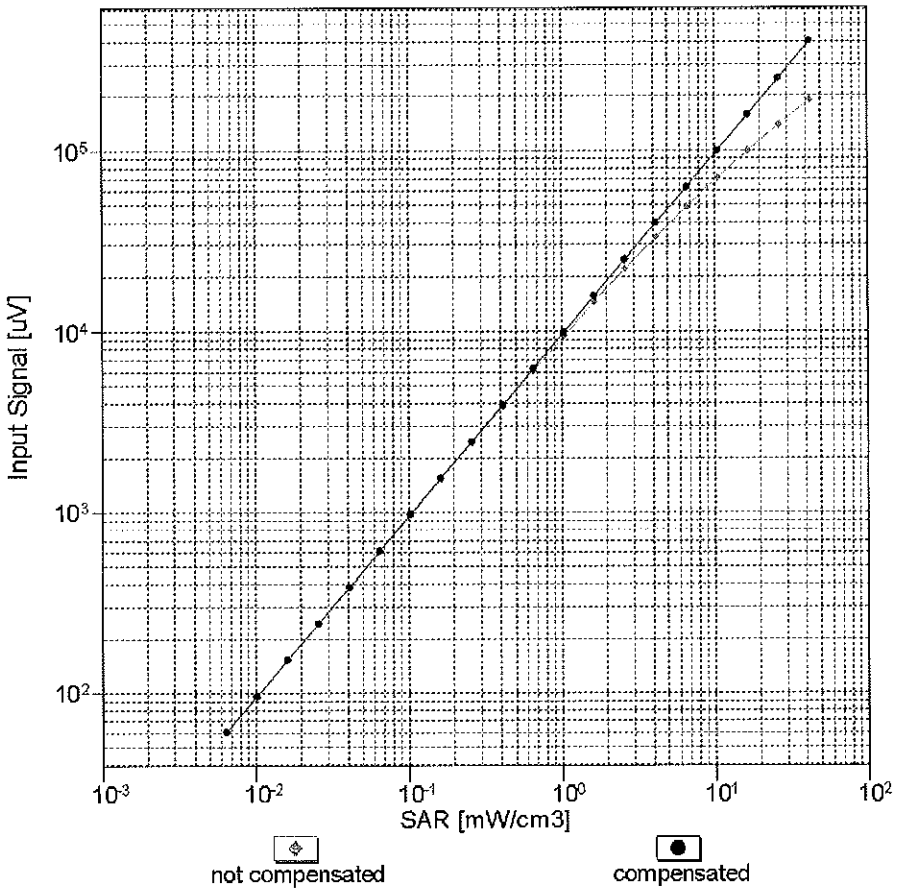
f=1800 MHz,R22

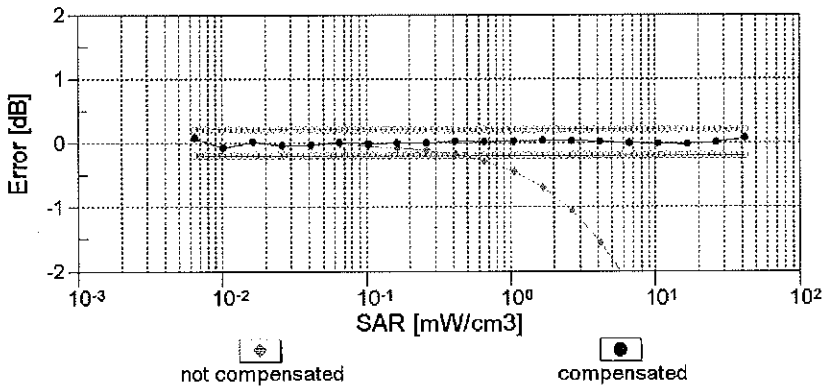




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

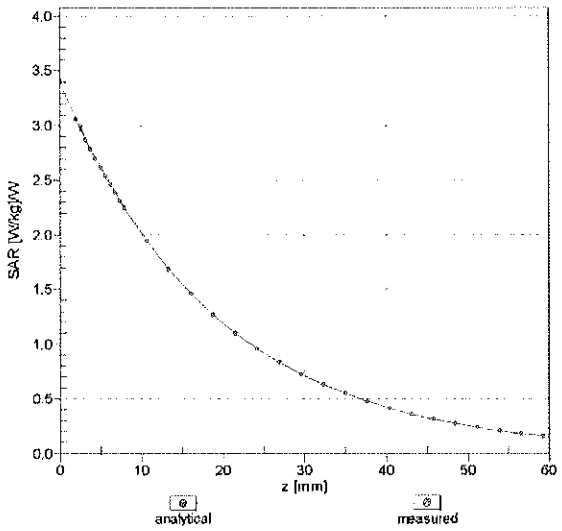




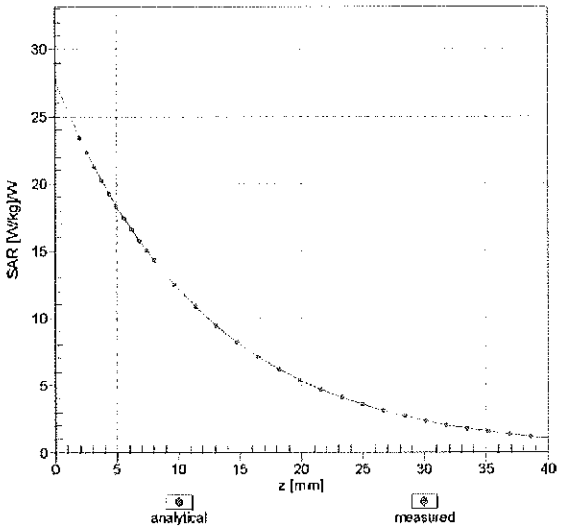
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 850 MHz,WGLS R9 (H_convF)

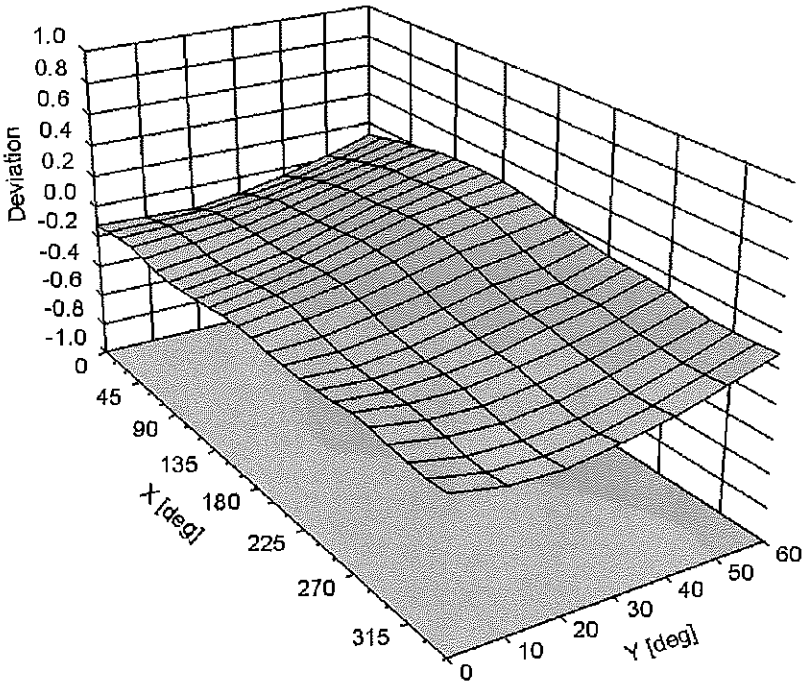


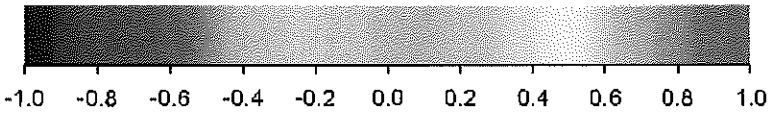
f = 1900 MHz,WGLS R22 (H_convF)



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:3333

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-35.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

Calibration Laboratory of
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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: ES3-3022_Aug13

CALIBRATION CERTIFICATE

Object: ES3DV2 - SN:3022

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

Calibration date: August 22, 2013

UCC
9/13/13

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 E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: August 23, 2013

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

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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 ES3DV2

SN:3022

Manufactured: April 15, 2003
Calibrated: August 22, 2013

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

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.00	1.04	0.99	± 10.1 %
DCP (mV)[B]	100.7	97.4	99.7	

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	178.6	±3.0 %
		Y	0.0	0.0	1.0		141.9	
		Z	0.0	0.0	1.0		134.7	

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: ES3DV2 - SN:3022

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	6.21	6.21	6.21	0.19	2.37	± 12.0 %
835	41.5	0.90	6.09	6.09	6.09	0.30	1.70	± 12.0 %
1750	40.1	1.37	5.19	5.19	5.19	0.65	1.23	± 12.0 %
1900	40.0	1.40	5.03	5.03	5.03	0.51	1.43	± 12.0 %
2450	39.2	1.80	4.36	4.36	4.36	0.51	1.51	± 12.0 %
2600	39.0	1.96	4.16	4.16	4.16	0.74	1.29	± 12.0 %

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

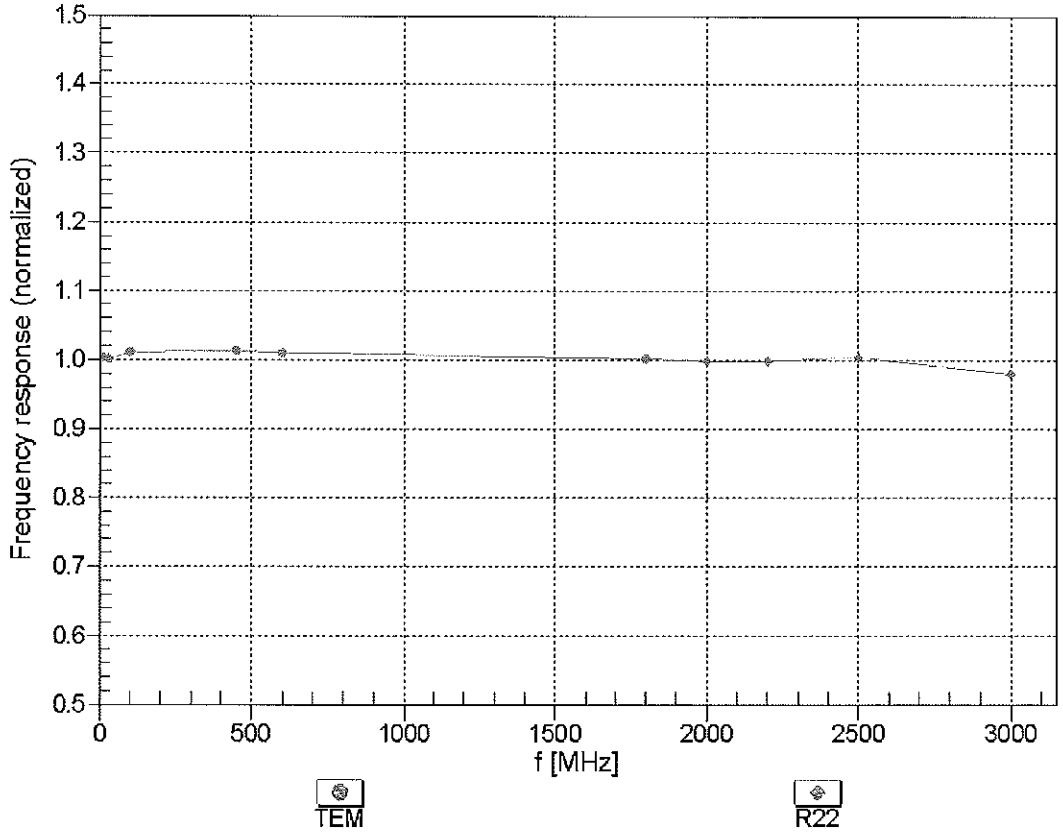
DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

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	5.92	5.92	5.92	0.24	1.99	± 12.0 %
835	55.2	0.97	5.91	5.91	5.91	0.29	1.85	± 12.0 %
1750	53.4	1.49	4.75	4.75	4.75	0.52	1.52	± 12.0 %
1900	53.3	1.52	4.49	4.49	4.49	0.49	1.56	± 12.0 %
2450	52.7	1.95	4.01	4.01	4.01	0.70	1.02	± 12.0 %
2600	52.5	2.16	3.85	3.85	3.85	0.58	0.90	± 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.

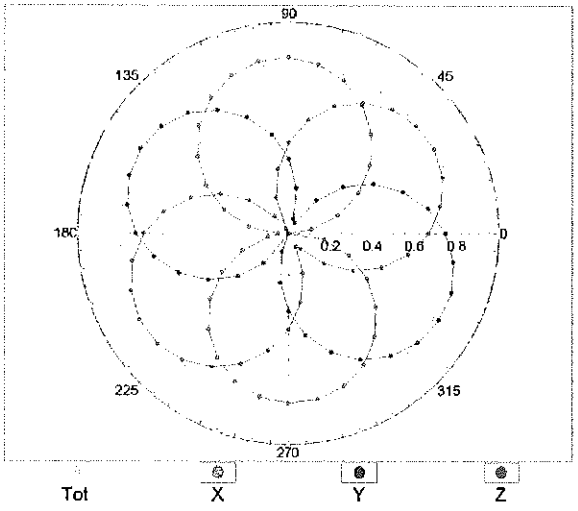
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



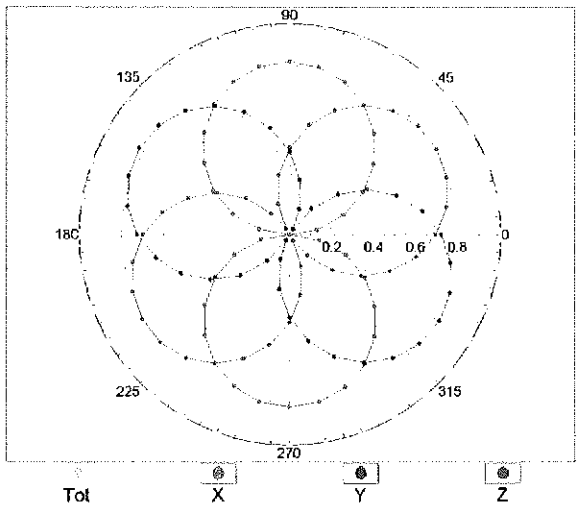
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

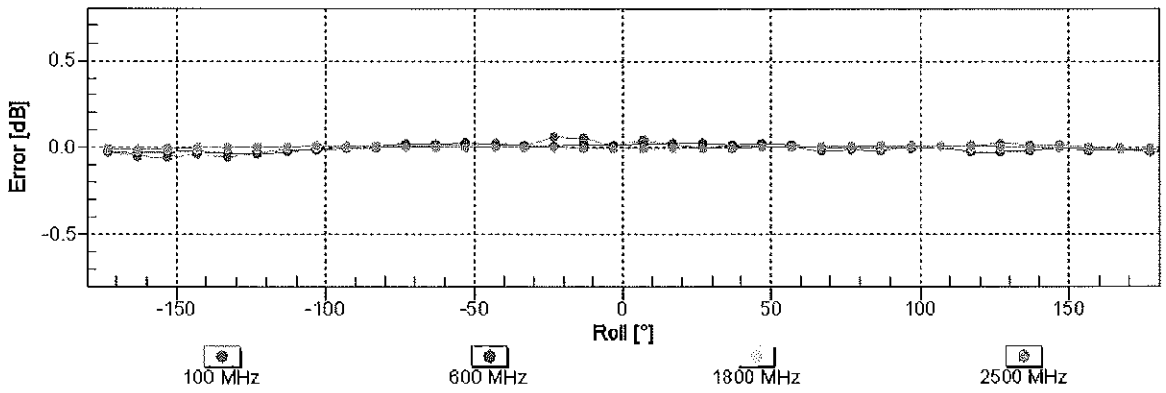
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



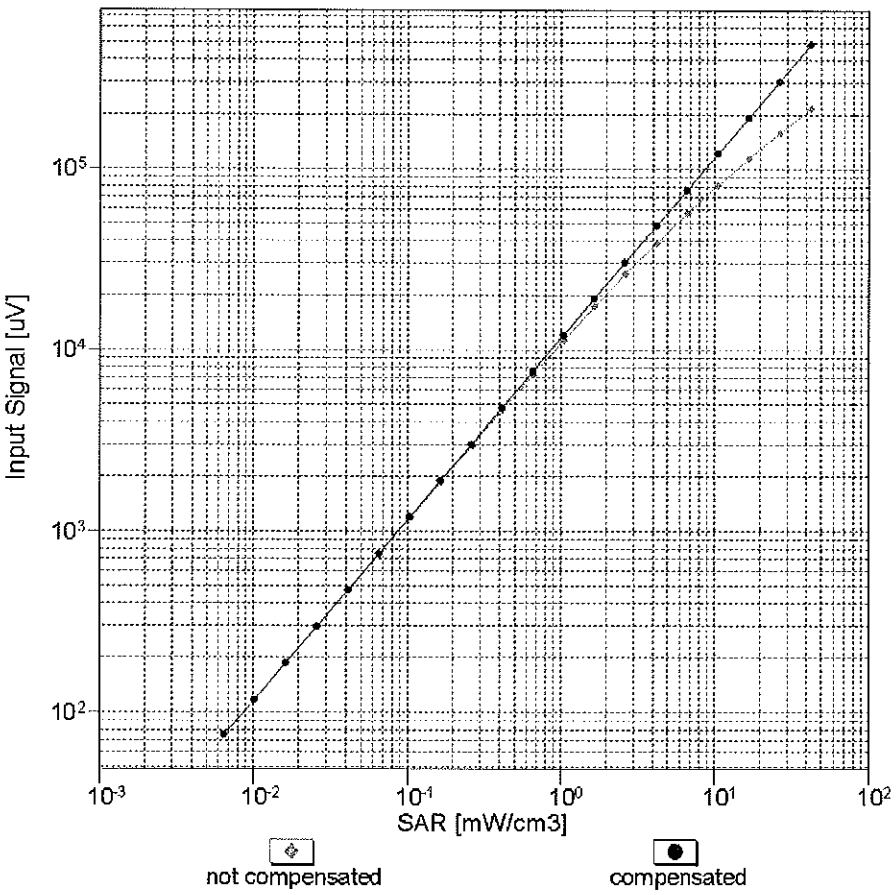
f=1800 MHz,R22

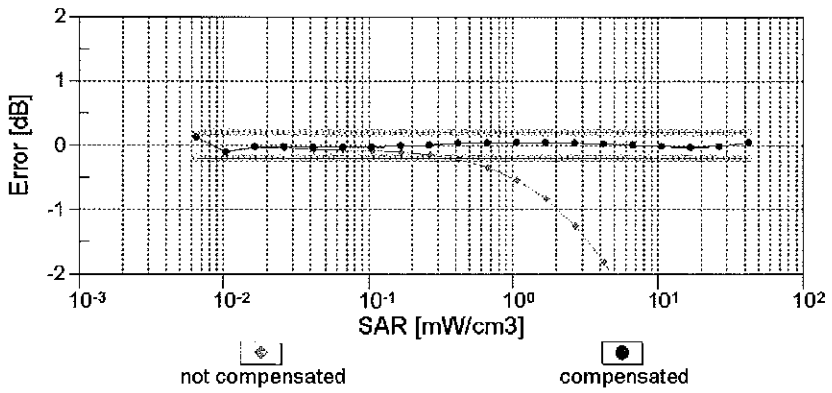




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

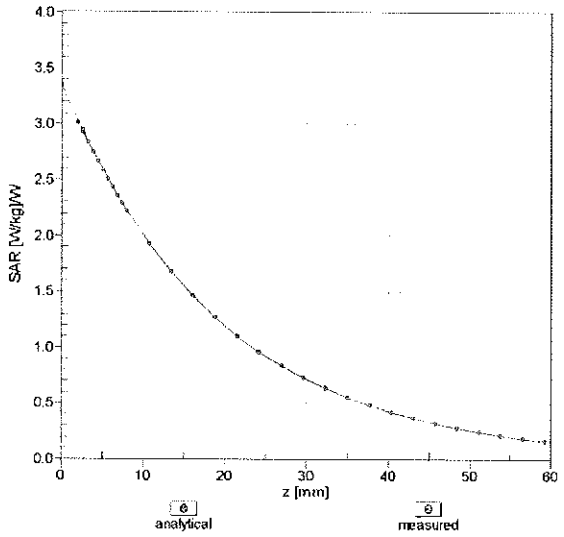




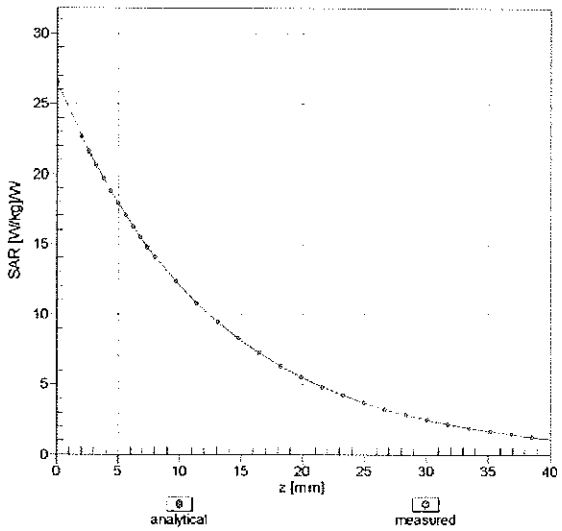
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

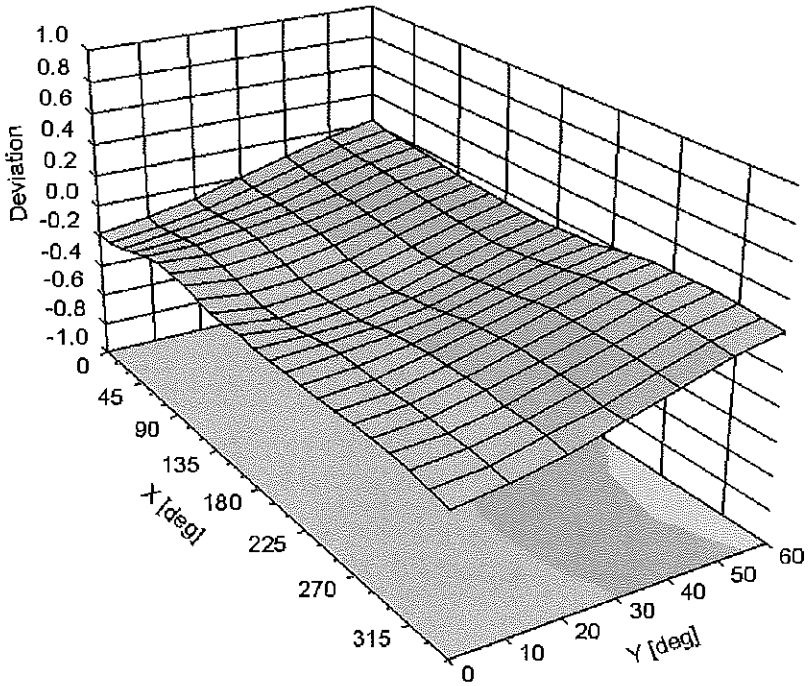


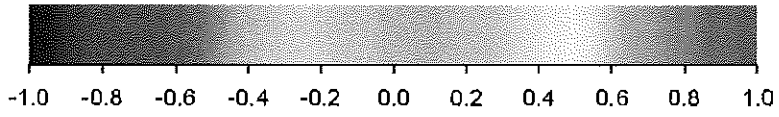
f = 1750 MHz,WGLS R22 (H_convF)



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: ES3DV2 - SN:3022

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-83.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Accreditation No.: SCS 108

Client PC Test

Certificate No: ES3-3332_Nov13

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3332

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

VCC 1/12/14

Calibration date: November 25, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	4-Sep-13 (No. DAE4-660_Sep13)	Sep-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: November 25, 2013

Calibration Laboratory of
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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
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3332

Manufactured: January 24, 2012
Calibrated: November 25, 2013

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3332

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.94	1.16	0.97	± 10.1 %
DCP (mV)[B]	103.5	101.0	111.0	

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	179.7	±2.5 %
		Y	0.0	0.0	1.0		147.3	
		Z	0.0	0.0	1.0		188.8	

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:3332

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.46	6.46	6.46	0.52	1.42	± 12.0 %
850	41.5	0.92	6.29	6.29	6.29	0.78	1.17	± 12.0 %
1750	40.1	1.37	5.27	5.27	5.27	0.80	1.10	± 12.0 %
1900	40.0	1.40	5.06	5.06	5.06	0.80	1.18	± 12.0 %
2450	39.2	1.80	4.50	4.50	4.50	0.80	1.19	± 12.0 %
2600	39.0	1.96	4.38	4.38	4.38	0.76	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.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

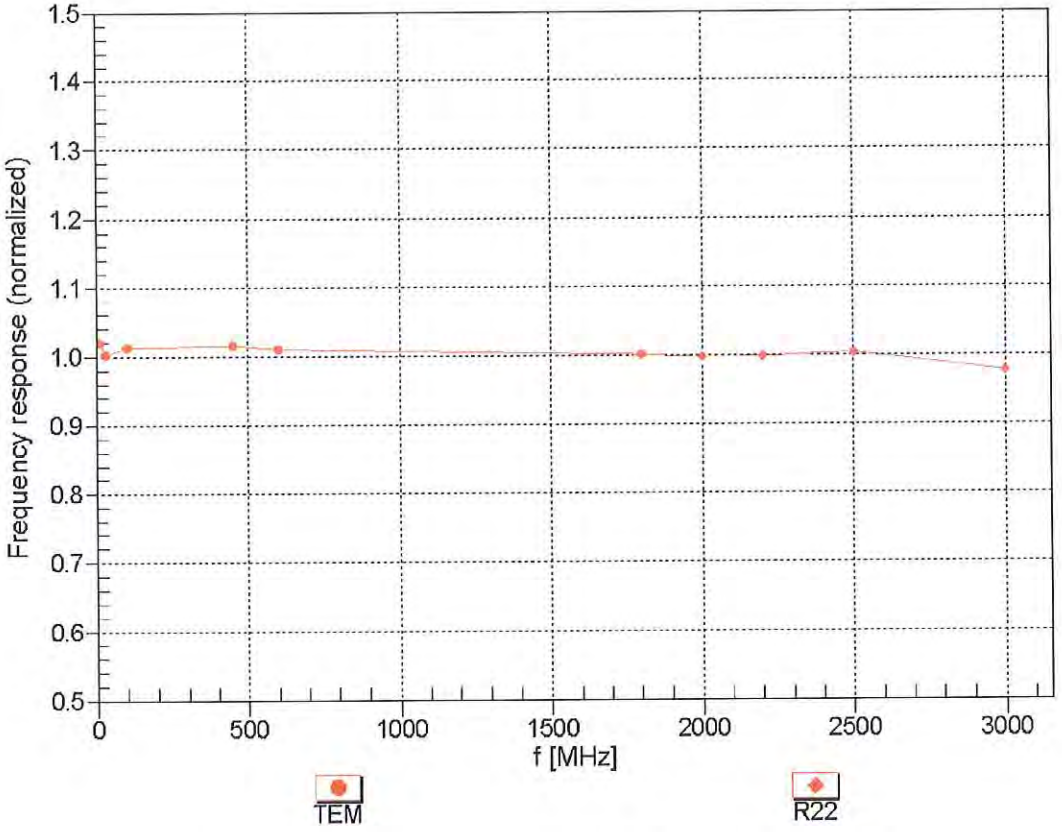
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3332

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.21	6.21	6.21	0.80	1.19	± 12.0 %
850	55.2	0.99	6.08	6.08	6.08	0.51	1.48	± 12.0 %
1750	53.4	1.49	4.93	4.93	4.93	0.42	1.72	± 12.0 %
1900	53.3	1.52	4.70	4.70	4.70	0.48	1.59	± 12.0 %
2450	52.7	1.95	4.24	4.24	4.24	0.80	1.01	± 12.0 %
2600	52.5	2.16	4.07	4.07	4.07	0.80	0.50	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

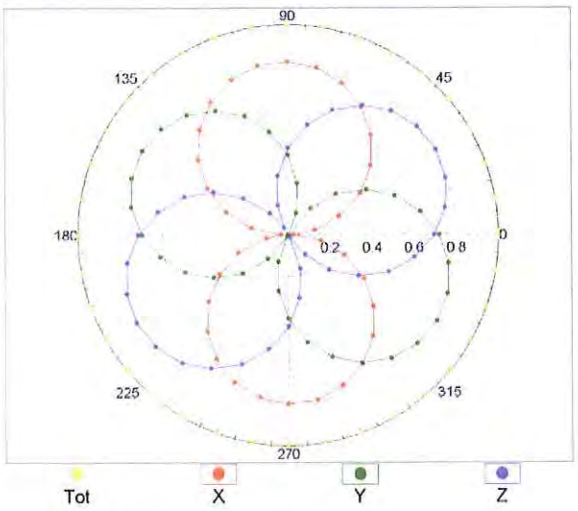
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



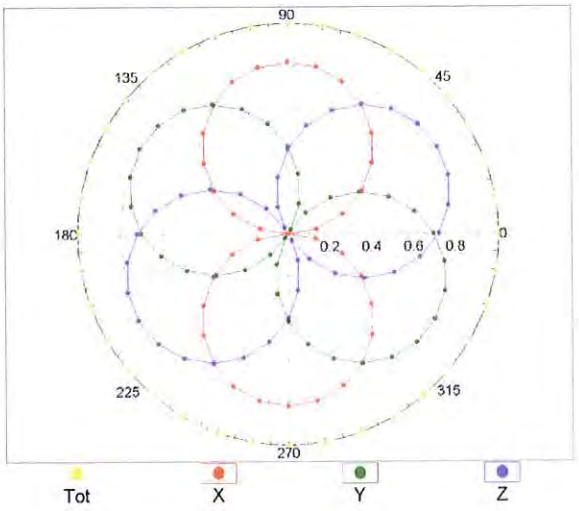
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

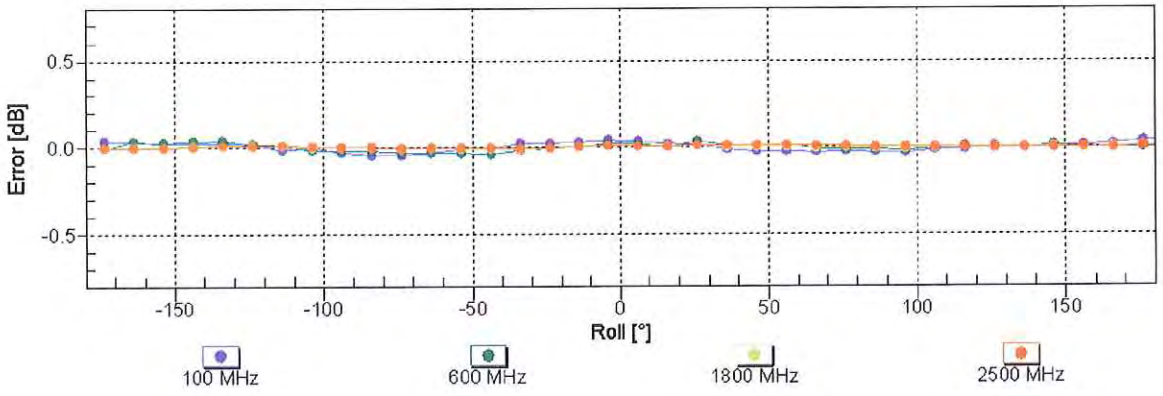
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



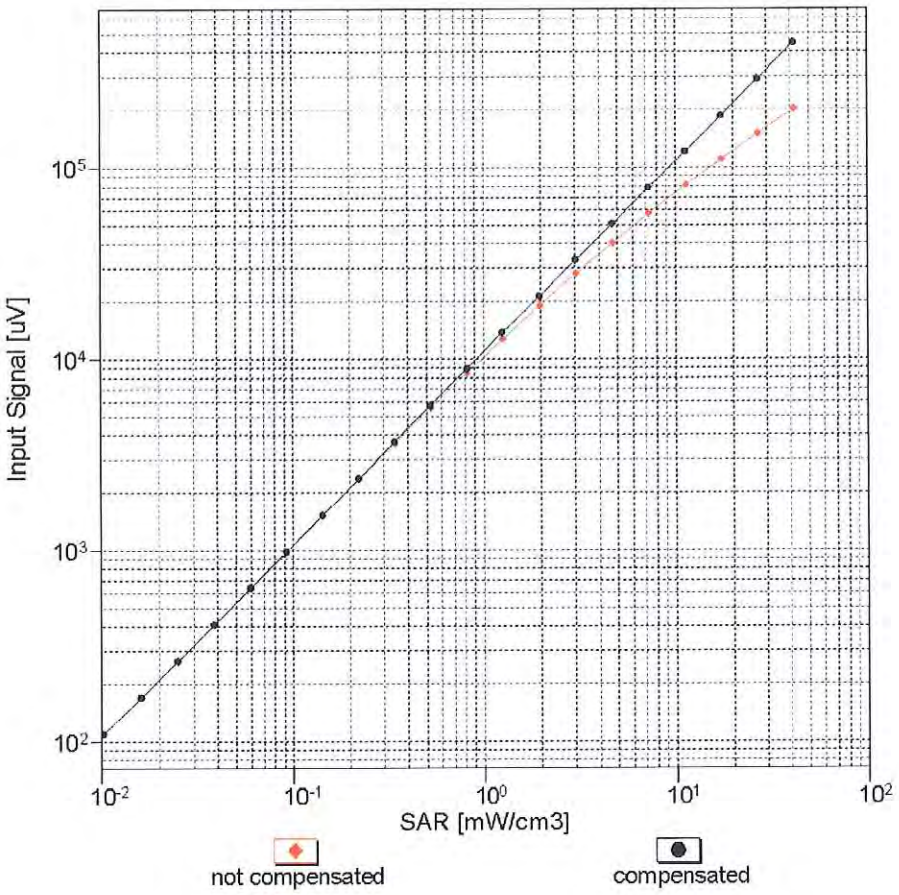
f=1800 MHz,R22

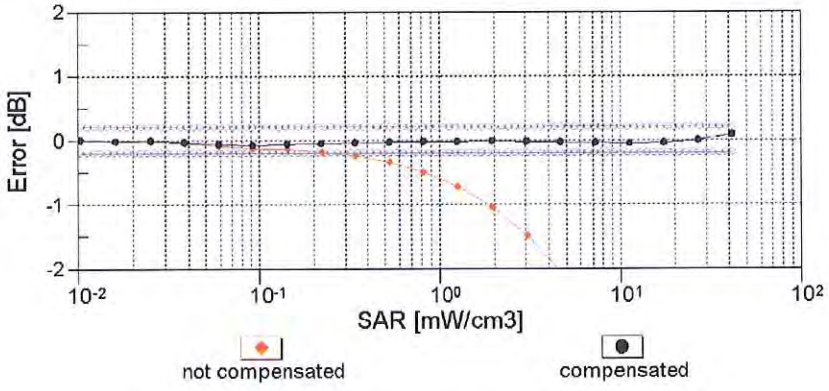




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

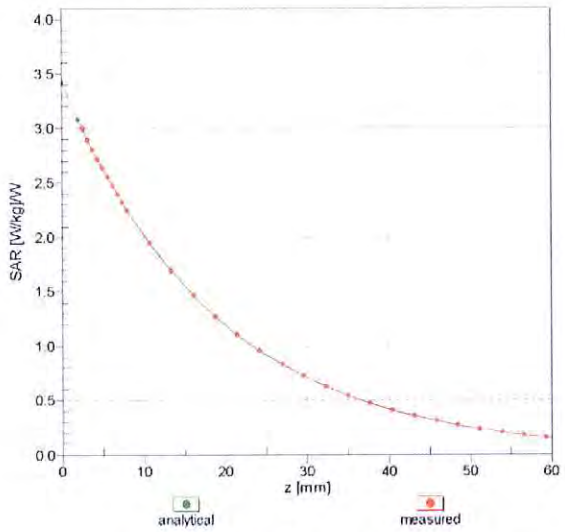




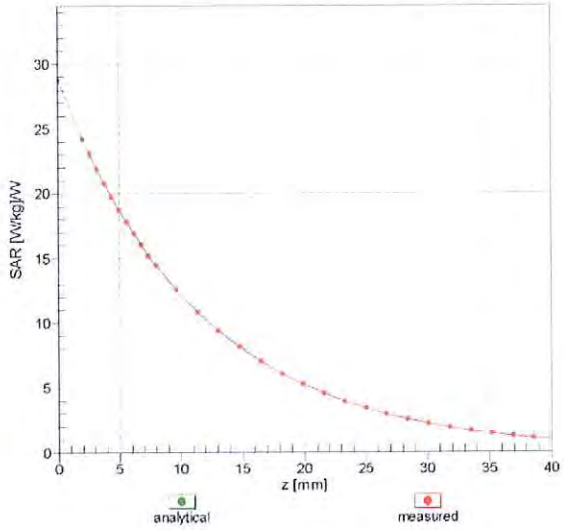
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 850 MHz,WGLS R9 (H_convF)

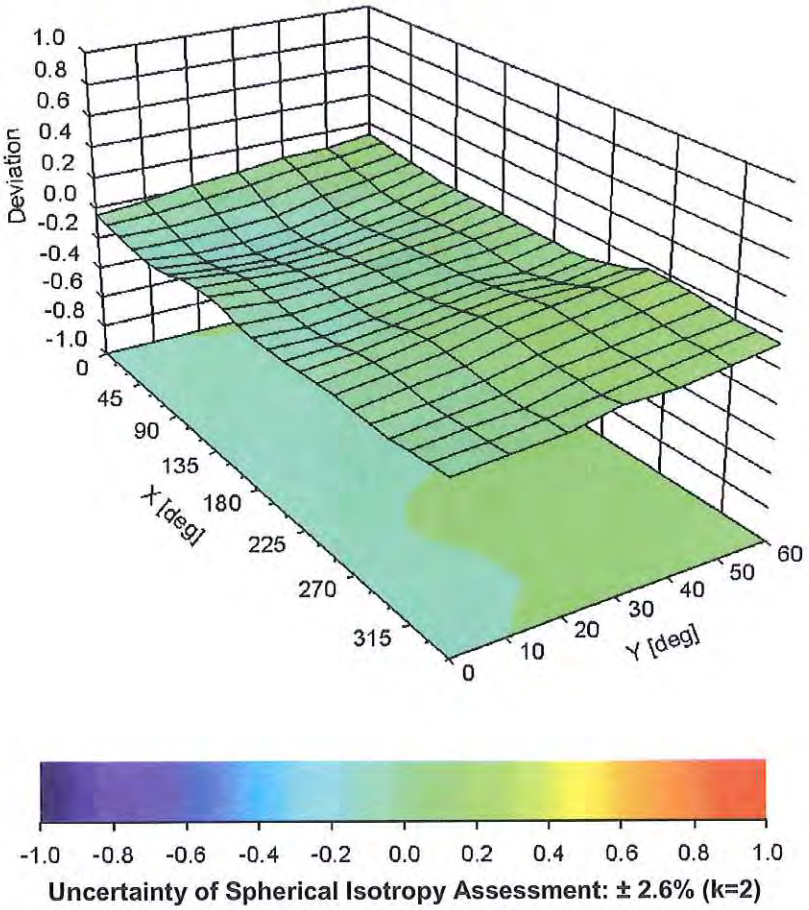


f = 1900 MHz,WGLS R22 (H_convF)



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:3332

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-3.9
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: EX3-3914_Oct13

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3914

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

Calibration date: October 23, 2013 VCL 11/26/2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	4-Sep-13 (No. DAE4-660_Sep13)	Sep-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: October 25, 2013

PCT # 81072

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:3914

Manufactured: December 18, 2012
Calibrated: October 23, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3914

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.47	0.49	0.51	± 10.1 %
DCP (mV)[B]	99.2	98.9	98.2	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	158.3	±3.0 %
		Y	0.0	0.0	1.0		154.6	
		Z	0.0	0.0	1.0		170.8	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	0.71	53.3	6.1	10.00	48.4	±2.5 %
		Y	2.43	67.0	13.8		39.9	
		Z	4.18	68.7	13.8		45.7	
10011-CAA	UMTS-FDD (WCDMA)	X	3.05	64.4	16.5	2.91	122.4	±0.5 %
		Y	3.31	66.5	18.2		123.5	
		Z	3.34	66.3	17.8		136.6	
10012-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.49	64.8	16.1	1.87	120.6	±0.5 %
		Y	2.94	68.6	18.7		123.6	
		Z	2.63	65.9	17.0		135.4	
10021-DAA	GSM-FDD (TDMA, GMSK)	X	1.52	61.5	10.9	9.39	83.6	±1.2 %
		Y	2.22	67.4	15.0		116.0	
		Z	2.47	66.8	14.7		95.9	
10023-DAA	GPRS-FDD (TDMA, GMSK, TN 0)	X	1.73	63.3	11.9	9.57	81.5	±1.7 %
		Y	2.11	66.2	14.2		111.8	
		Z	2.76	69.0	16.0		93.6	
10024-DAA	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	1.34	62.1	9.4	6.56	121.0	±1.2 %
		Y	4.24	78.6	17.9		130.0	
		Z	2.91	70.7	14.9		141.4	
10027-DAA	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	1.25	63.5	9.7	4.80	143.5	±1.4 %
		Y	1.59	66.9	12.2		149.7	
		Z	2.98	71.5	14.0		123.3	
10028-DAA	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	0.51	58.3	7.4	3.55	113.4	±1.2 %
		Y	25.43	100.0	22.6		121.3	
		Z	38.67	97.5	20.6		133.3	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	0.28	58.6	5.3	1.16	134.7	±0.9 %
		Y	65.75	99.6	18.6		141.3	
		Z	0.20	55.6	4.1		112.1	
10039-CAA	CDMA2000 (1xRTT, RC1)	X	4.33	64.6	17.4	4.57	113.8	±0.7 %
		Y	4.55	66.0	18.6		120.8	
		Z	4.85	66.2	18.4		135.9	
10062-CAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	9.83	67.6	20.7	8.68	109.0	±2.5 %
		Y	10.06	68.4	21.5		118.2	
		Z	10.66	69.2	21.7		134.0	

10081-CAA	CDMA2000 (1xRTT, RC3)	X	3.59	63.9	16.9	3.97	113.6	±0.7 %
		Y	3.84	65.6	18.2		119.6	
		Z	3.95	65.4	17.8		134.5	
10098-CAA	UMTS-FDD (HSUPA, Subtest 2)	X	4.41	65.2	17.3	3.98	126.0	±0.7 %
		Y	4.73	66.9	18.6		132.5	
		Z	4.51	65.5	17.7		105.6	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.26	66.2	18.6	5.67	130.5	±1.2 %
		Y	6.61	67.7	19.8		139.3	
		Z	6.21	66.0	18.7		107.7	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.13	65.8	18.6	5.80	126.3	±1.2 %
		Y	6.40	67.1	19.6		135.6	
		Z	6.10	65.5	18.5		107.4	
10110-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	5.78	65.3	18.3	5.75	123.1	±1.2 %
		Y	5.97	66.3	19.2		131.5	
		Z	5.86	65.3	18.4		104.9	
10114-CAA	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	9.92	67.7	20.3	8.10	115.7	±2.5 %
		Y	10.25	68.7	21.2		126.8	
		Z	10.71	69.4	21.3		146.0	
10117-CAA	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	9.95	67.8	20.3	8.07	116.6	±2.5 %
		Y	10.26	68.7	21.1		128.3	
		Z	10.70	69.4	21.3		146.9	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	7.19	67.3	21.5	9.28	145.0	±2.2 %
		Y	7.40	68.3	22.4		110.8	
		Z	7.79	68.4	22.0		128.0	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.79	65.3	18.3	5.75	124.2	±1.2 %
		Y	6.03	66.5	19.4		131.9	
		Z	6.29	66.9	19.3		149.7	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.23	65.9	18.6	5.82	128.3	±1.2 %
		Y	6.51	67.2	19.7		136.9	
		Z	6.24	65.7	18.6		107.3	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.83	66.0	18.9	5.73	147.5	±1.2 %
		Y	4.72	65.8	19.2		113.8	
		Z	5.03	66.1	19.1		129.7	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.83	69.2	22.8	9.21	149.9	±1.9 %
		Y	5.81	69.4	23.4		120.3	
		Z	6.38	70.0	23.2		137.2	
10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.86	66.1	18.9	5.72	149.8	±1.2 %
		Y	4.72	65.8	19.2		113.3	
		Z	5.09	66.4	19.1		126.0	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.83	66.0	18.9	5.72	146.3	±1.2 %
		Y	4.69	65.6	19.1		112.2	
		Z	5.02	66.1	19.0		125.1	
10193-CAA	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	9.51	67.4	20.2	8.09	108.6	±2.5 %
		Y	9.72	68.1	20.9		118.2	
		Z	10.30	68.9	21.1		135.0	

10196-CAA	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.52	67.4	20.2	8.10	111.6	±2.5 %
		Y	9.79	68.3	21.1		121.3	
		Z	10.30	68.9	21.2		139.2	
10219-CAA	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	9.47	67.4	20.2	8.03	111.8	±2.2 %
		Y	9.67	68.3	21.0		120.0	
		Z	10.20	68.9	21.1		138.0	
10222-CAA	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	9.96	67.9	20.4	8.06	118.4	±2.5 %
		Y	10.25	68.8	21.2		128.2	
		Z	10.65	69.3	21.3		144.5	
10225-CAA	UMTS-FDD (HSPA+)	X	6.96	66.7	18.9	5.97	140.0	±1.4 %
		Y	7.23	67.9	20.0		148.9	
		Z	7.03	66.4	18.9		115.6	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.51	67.5	21.8	9.21	114.2	±1.9 %
		Y	5.82	69.4	23.4		123.0	
		Z	6.49	70.6	23.6		140.2	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.83	67.1	21.4	9.24	136.6	±1.9 %
		Y	7.30	69.4	23.2		147.3	
		Z	7.36	68.1	22.0		117.5	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	7.26	67.5	21.6	9.30	142.7	±1.9 %
		Y	7.44	68.4	22.4		110.5	
		Z	7.84	68.7	22.2		122.6	
10274-CAA	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	5.86	66.2	18.2	4.87	135.4	±0.9 %
		Y	6.12	67.5	19.2		142.3	
		Z	5.91	65.9	18.2		107.6	
10275-CAA	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.17	64.8	17.3	3.96	115.6	±0.7 %
		Y	4.42	66.4	18.5		124.6	
		Z	4.47	66.0	18.0		132.6	
10291-AAA	CDMA2000, RC3, SO55, Full Rate	X	3.36	64.7	17.1	3.46	109.4	±0.5 %
		Y	3.55	66.2	18.3		118.2	
		Z	3.60	65.6	17.7		120.9	
10292-AAA	CDMA2000, RC3, SO32, Full Rate	X	3.34	64.9	17.2	3.39	110.1	±0.5 %
		Y	3.57	66.7	18.5		121.0	
		Z	3.54	65.6	17.7		123.9	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.14	65.8	18.6	5.81	125.1	±1.2 %
		Y	6.44	67.2	19.7		135.7	
		Z	6.52	67.0	19.3		142.2	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.76	66.6	19.1	6.06	131.8	±1.4 %
		Y	7.03	67.8	20.0		142.5	
		Z	7.15	67.7	19.7		148.6	
10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	2.42	64.6	16.1	1.71	116.8	±0.5 %
		Y	3.00	69.3	19.0		126.9	
		Z	2.61	66.3	17.2		128.2	
10317-AAA	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle)	X	9.71	67.6	20.5	8.36	111.7	±2.5 %
		Y	9.99	68.6	21.4		122.2	
		Z	10.38	68.9	21.3		129.5	

10400-AAA	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	9.83	67.8	20.6	8.37	112.9	±2.5 %
		Y	10.09	68.7	21.4		123.9	
		Z	10.48	68.9	21.3		130.5	
10402-AAA	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	X	10.61	68.3	20.7	8.53	121.1	±2.5 %
		Y	11.25	70.0	21.9		135.4	
		Z	11.15	69.4	21.4		137.4	
10403-AAA	CDMA2000 (1xEV-DO, Rev. 0)	X	4.51	67.4	17.8	3.76	119.2	±0.5 %
		Y	4.91	69.5	19.3		128.3	
		Z	4.84	67.5	18.1		135.4	
10404-AAA	CDMA2000 (1xEV-DO, Rev. A)	X	4.51	67.7	18.0	3.77	117.4	±0.5 %
		Y	4.92	69.8	19.5		125.4	
		Z	4.71	67.3	18.0		131.9	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 8 and 9).
[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:3914

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	9.70	9.70	9.70	0.34	1.01	± 12.0 %
835	41.5	0.90	9.34	9.34	9.34	0.67	0.67	± 12.0 %
1750	40.1	1.37	7.99	7.99	7.99	0.79	0.56	± 12.0 %
1900	40.0	1.40	7.69	7.69	7.69	0.80	0.58	± 12.0 %
2450	39.2	1.80	6.95	6.95	6.95	0.41	0.77	± 12.0 %
2600	39.0	1.96	6.79	6.79	6.79	0.40	0.82	± 12.0 %
5200	36.0	4.66	4.99	4.99	4.99	0.30	1.80	± 13.1 %
5300	35.9	4.76	4.82	4.82	4.82	0.30	1.80	± 13.1 %
5500	35.6	4.96	4.55	4.55	4.55	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.37	4.37	4.37	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.52	4.52	4.52	0.35	1.80	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3914

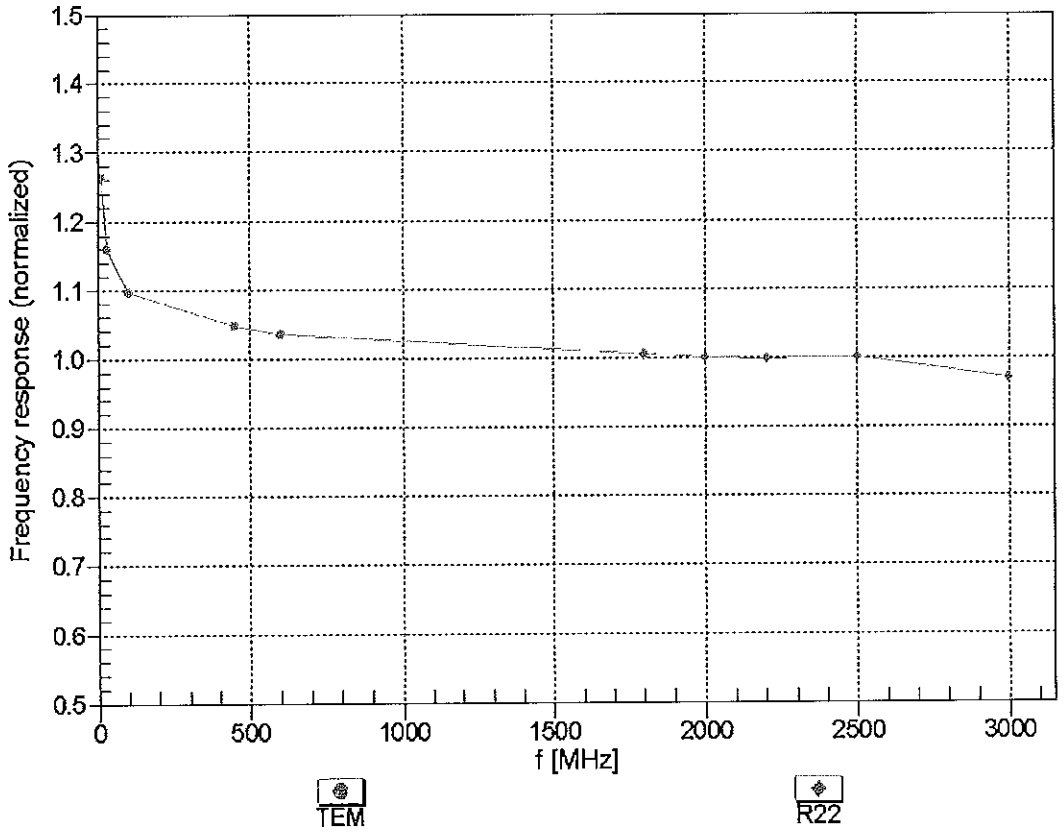
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	9.39	9.39	9.39	0.63	0.74	± 12.0 %
835	55.2	0.97	9.31	9.31	9.31	0.56	0.76	± 12.0 %
1750	53.4	1.49	7.89	7.89	7.89	0.32	1.03	± 12.0 %
1900	53.3	1.52	7.51	7.51	7.51	0.51	0.76	± 12.0 %
2450	52.7	1.95	7.02	7.02	7.02	0.80	0.50	± 12.0 %
2600	52.5	2.16	6.81	6.81	6.81	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.52	4.52	4.52	0.35	1.90	± 13.1 %
5300	48.9	5.42	4.32	4.32	4.32	0.35	1.90	± 13.1 %
5500	48.6	5.65	4.07	4.07	4.07	0.35	1.90	± 13.1 %
5600	48.5	5.77	3.97	3.97	3.97	0.35	1.90	± 13.1 %
5800	48.2	6.00	4.14	4.14	4.14	0.40	1.90	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

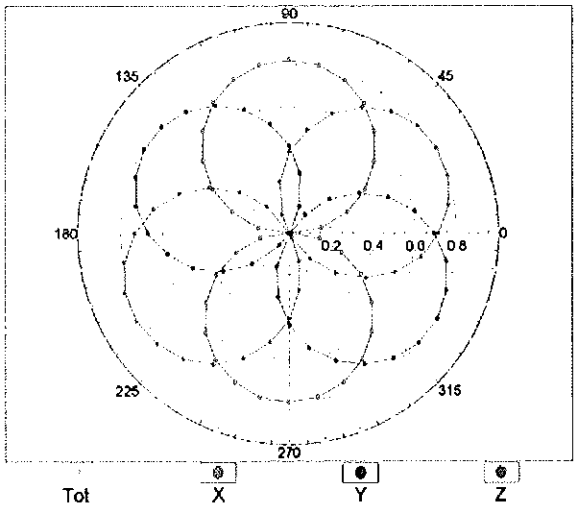
(TEM-Cell:ifi110 EXX, Waveguide: R22)



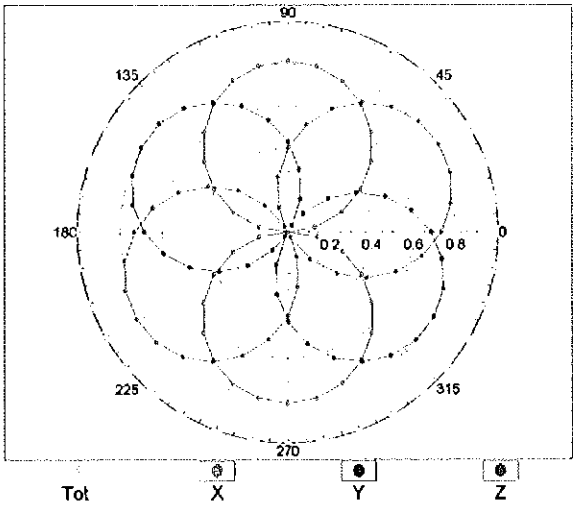
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

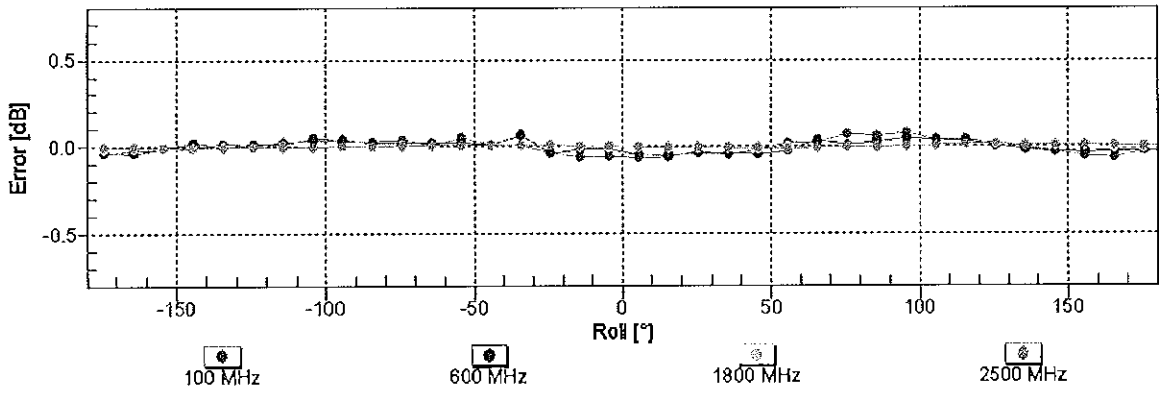
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



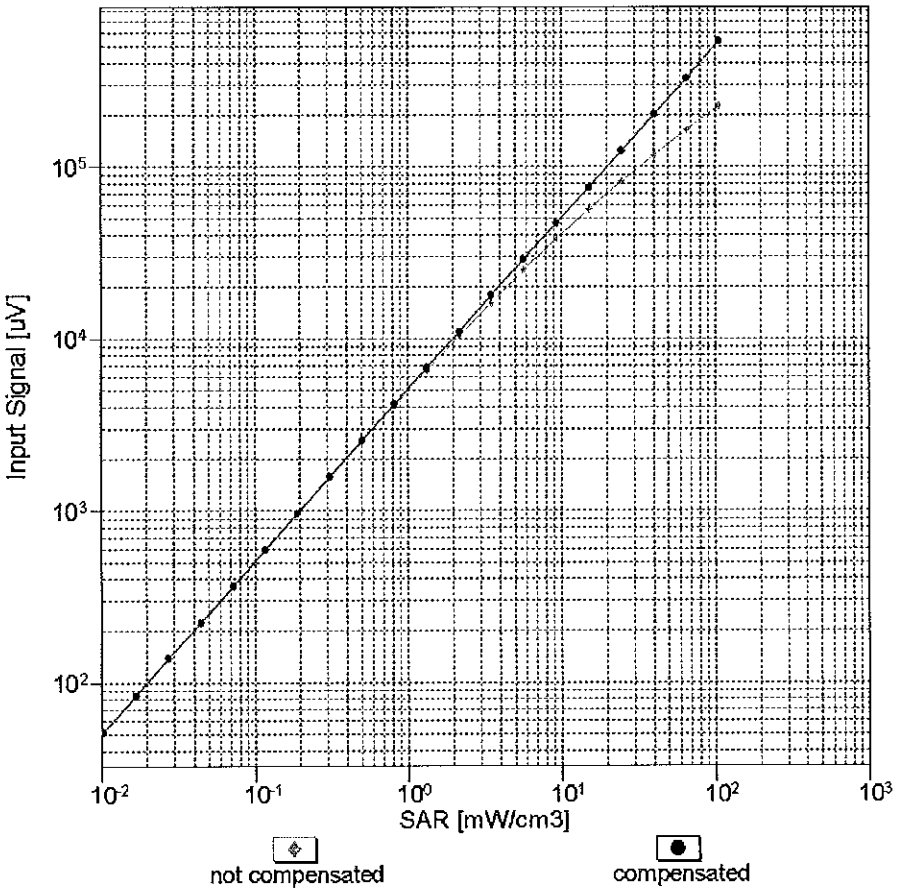
f=1800 MHz,R22

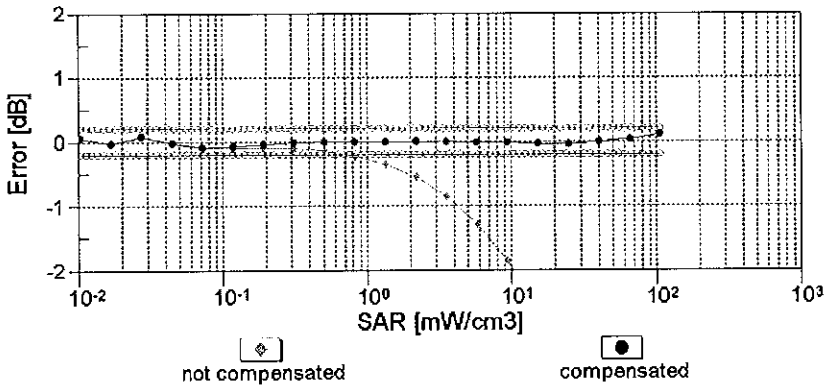




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

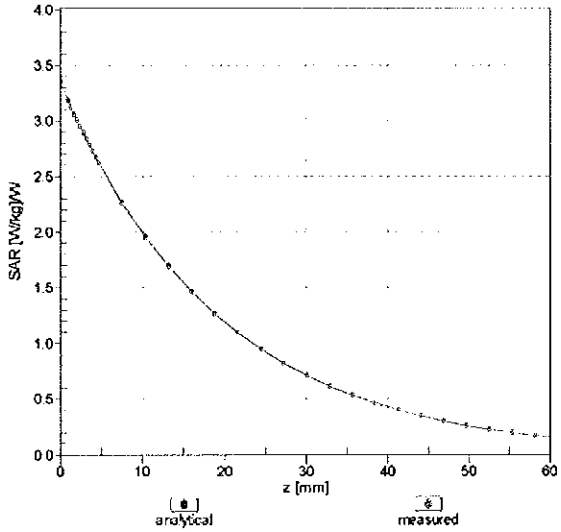




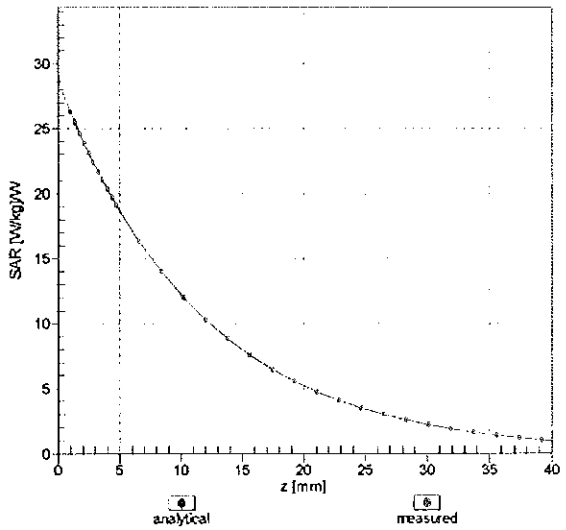
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

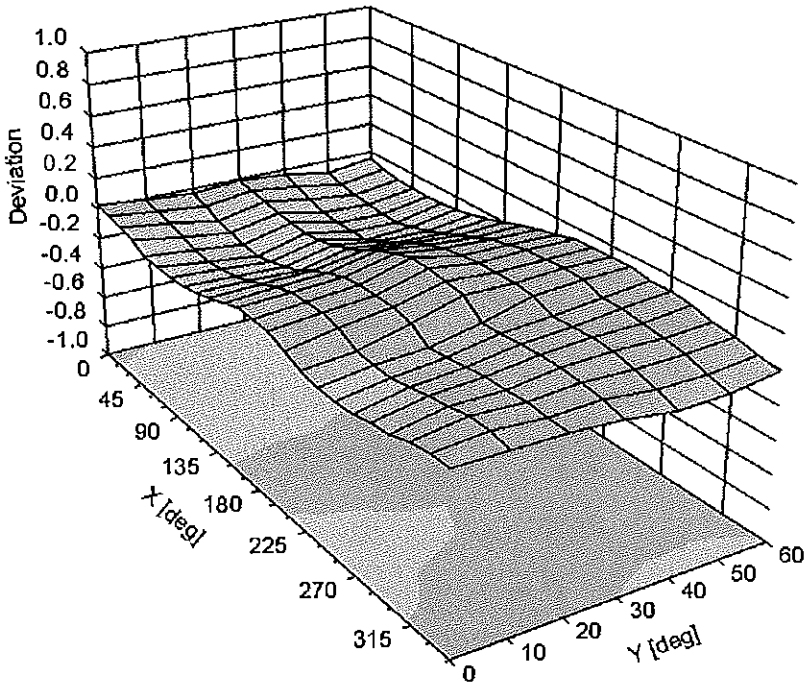


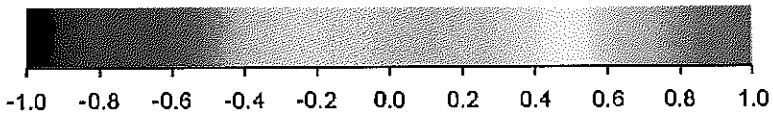
f = 1900 MHz,WGLS R22 (H_convF)



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:3914

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-24.3
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: ES3-3258_Feb14

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3258

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

CCV 3/6/14

Calibration date: February 25, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: February 27, 2014

PCT# 80615

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

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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
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3258

Manufactured: January 25, 2010
Calibrated: February 25, 2014

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3258

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.29	1.19	1.23	± 10.1 %
DCP (mV)[B]	104.5	107.0	103.0	

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	222.4	±3.8 %
		Y	0.0	0.0	1.0		202.2	
		Z	0.0	0.0	1.0		207.1	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	5.09	65.6	14.1	10.00	44.8	±1.9 %
		Y	1.68	57.4	9.3		40.7	
		Z	4.01	62.4	13.0		51.1	
10011-CAB	UMTS-FDD (WCDMA)	X	3.34	67.5	18.9	2.91	131.2	±0.5 %
		Y	3.43	67.9	18.7		137.1	
		Z	3.42	67.8	19.0		146.0	
10012-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.40	70.9	19.8	1.87	134.2	±0.7 %
		Y	3.19	70.2	19.2		137.9	
		Z	3.46	70.8	19.6		149.6	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	30.24	99.7	28.7	9.39	131.2	±1.4 %
		Y	12.91	88.5	23.9		147.5	
		Z	30.37	99.5	28.9		128.0	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	29.88	100.0	29.0	9.57	123.0	±1.9 %
		Y	16.02	92.5	25.4		140.7	
		Z	30.01	100.0	29.4		125.8	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	44.57	99.7	25.9	6.56	119.6	±1.7 %
		Y	28.97	95.3	23.2		127.6	
		Z	43.72	99.8	26.3		120.1	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	53.52	99.7	24.4	4.80	129.4	±2.2 %
		Y	54.55	99.9	22.9		143.3	
		Z	51.63	99.7	24.8		127.5	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	58.93	99.8	23.4	3.55	133.4	±2.2 %
		Y	77.54	99.7	21.3		125.3	
		Z	56.64	99.8	23.8		130.8	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	47.03	99.5	21.3	1.16	136.3	±1.7 %
		Y	95.86	95.2	17.1		138.2	
		Z	39.68	100.0	22.2		132.3	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.84	66.8	19.1	4.57	131.3	±0.9 %
		Y	4.75	67.0	18.9		135.2	
		Z	4.86	66.7	19.0		127.2	

10081-CAB	CDMA2000 (1xRTT, RC3)	X	4.06	66.8	19.0	3.97	148.4	±0.7 %
		Y	3.96	66.6	18.6		134.7	
		Z	4.13	66.9	19.1		143.4	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.63	66.8	18.7	3.98	137.3	±0.7 %
		Y	4.75	67.5	18.8		148.4	
		Z	4.65	66.7	18.7		133.2	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.66	68.5	20.3	5.67	144.0	±1.2 %
		Y	6.27	67.1	19.3		130.6	
		Z	6.62	68.2	20.1		140.5	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.53	68.0	20.2	5.80	142.6	±1.4 %
		Y	6.17	66.8	19.3		129.2	
		Z	6.52	67.8	20.1		139.0	
10110-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	6.19	67.3	19.9	5.75	137.9	±1.4 %
		Y	6.12	67.3	19.6		149.5	
		Z	6.19	67.1	19.8		136.1	
10114-CAA	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	10.49	69.5	21.7	8.10	132.4	±2.5 %
		Y	10.23	69.1	21.3		144.3	
		Z	10.45	69.3	21.6		129.5	
10117-CAA	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.46	69.5	21.7	8.07	133.9	±2.5 %
		Y	10.26	69.2	21.3		147.4	
		Z	10.47	69.4	21.7		130.5	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	11.61	77.4	26.8	9.28	118.8	±3.0 %
		Y	9.89	75.2	25.7		144.9	
		Z	12.01	77.8	26.9		119.6	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.20	67.3	19.9	5.75	139.2	±1.2 %
		Y	5.86	66.2	19.0		128.5	
		Z	6.22	67.3	19.9		136.3	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.63	67.8	20.1	5.82	144.1	±1.4 %
		Y	6.31	66.8	19.3		133.1	
		Z	6.66	67.7	20.0		140.9	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.25	67.5	20.2	5.73	143.6	±1.2 %
		Y	4.92	66.7	19.5		131.0	
		Z	5.29	67.4	20.2		140.7	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	13.49	87.5	31.6	9.21	139.0	±2.7 %
		Y	7.83	75.5	26.0		124.9	
		Z	13.47	86.5	31.1		137.8	
10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.22	67.4	20.1	5.72	144.3	±1.4 %
		Y	5.08	67.5	19.9		147.9	
		Z	5.26	67.2	20.0		139.6	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	5.24	67.5	20.1	5.72	144.5	±1.2 %
		Y	5.06	67.4	19.8		147.0	
		Z	5.29	67.3	20.1		139.2	

10193-CAA	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	10.12	69.1	21.6	8.09	128.8	±2.2 %
		Y	9.76	68.4	21.0		132.8	
		Z	10.08	68.9	21.5		123.4	
10196-CAA	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	10.15	69.2	21.7	8.10	130.2	±2.2 %
		Y	9.77	68.5	21.0		134.1	
		Z	10.10	69.0	21.5		124.0	
10219-CAA	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	10.02	69.0	21.5	8.03	128.7	±2.2 %
		Y	9.67	68.5	21.0		133.3	
		Z	10.02	68.9	21.5		123.9	
10222-CAA	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	10.46	69.6	21.7	8.06	134.0	±2.2 %
		Y	10.09	68.8	21.1		139.7	
		Z	10.40	69.3	21.6		128.7	
10225-CAB	UMTS-FDD (HSPA+)	X	7.09	67.1	19.6	5.97	131.2	±1.4 %
		Y	6.98	67.2	19.4		138.0	
		Z	7.06	66.8	19.4		127.2	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	13.63	87.8	31.7	9.21	141.6	±3.0 %
		Y	7.85	75.5	26.0		126.5	
		Z	13.99	87.7	31.6		141.4	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	12.86	81.4	28.9	9.24	142.1	±3.0 %
		Y	8.91	73.4	24.8		129.9	
		Z	13.15	81.4	28.8		142.0	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	11.63	77.5	26.8	9.30	118.7	±3.0 %
		Y	9.62	74.3	25.2		138.4	
		Z	11.96	77.7	26.9		119.3	
10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	6.14	67.4	19.3	4.87	149.9	±0.9 %
		Y	5.90	66.9	18.7		132.8	
		Z	6.20	67.5	19.3		146.6	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.45	66.9	18.9	3.96	130.1	±0.7 %
		Y	4.50	67.2	18.8		137.9	
		Z	4.64	67.6	19.3		149.2	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.79	67.5	19.2	3.46	145.3	±0.7 %
		Y	3.74	67.5	18.9		128.2	
		Z	3.78	67.3	19.1		139.1	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.77	67.8	19.3	3.39	147.0	±0.5 %
		Y	3.69	67.7	18.9		130.1	
		Z	3.73	67.3	19.0		141.3	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.52	67.9	20.1	5.81	141.4	±1.4 %
		Y	6.41	67.6	19.7		147.4	
		Z	6.51	67.7	20.1		135.4	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	7.17	68.7	20.7	6.06	147.7	±1.4 %
		Y	6.69	67.2	19.6		128.6	
		Z	7.12	68.4	20.5		142.0	

10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	3.04	70.0	19.6	1.71	129.8	±0.5 %
		Y	3.25	71.3	19.7		136.9	
		Z	3.09	69.9	19.5		148.7	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.73	67.3	18.6	3.76	135.7	±0.5 %
		Y	4.93	69.1	19.0		141.5	
		Z	4.73	67.1	18.4		132.7	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.67	67.5	18.6	3.77	134.0	±0.5 %
		Y	4.92	69.4	19.1		139.8	
		Z	4.65	67.1	18.5		130.7	

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 8 and 9).
[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:3258

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.53	6.53	6.53	0.40	1.60	± 12.0 %
835	41.5	0.90	6.27	6.27	6.27	0.80	1.17	± 12.0 %
1750	40.1	1.37	5.19	5.19	5.19	0.80	1.10	± 12.0 %
1900	40.0	1.40	5.04	5.04	5.04	0.68	1.27	± 12.0 %
2450	39.2	1.80	4.52	4.52	4.52	0.78	1.23	± 12.0 %
2600	39.0	1.96	4.34	4.34	4.34	0.76	1.33	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

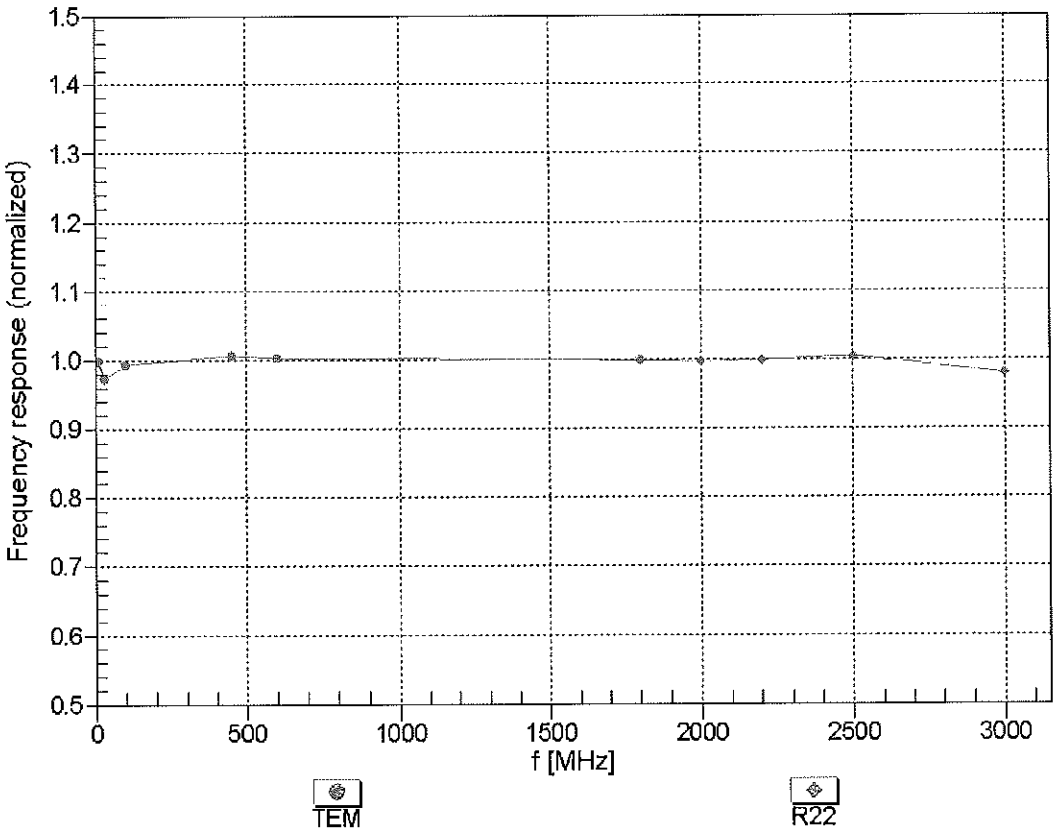
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3258

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.15	6.15	6.15	0.61	1.32	± 12.0 %
835	55.2	0.97	6.11	6.11	6.11	0.80	1.15	± 12.0 %
1750	53.4	1.49	4.83	4.83	4.83	0.47	1.74	± 12.0 %
1900	53.3	1.52	4.61	4.61	4.61	0.55	1.59	± 12.0 %
2450	52.7	1.95	4.14	4.14	4.14	0.80	1.11	± 12.0 %
2600	52.5	2.16	3.91	3.91	3.91	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.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

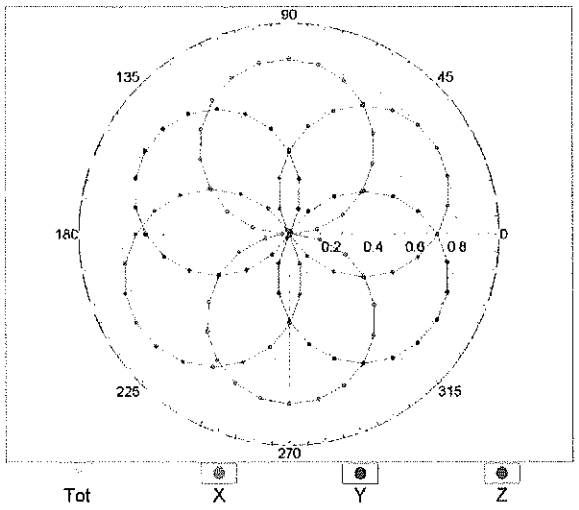
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



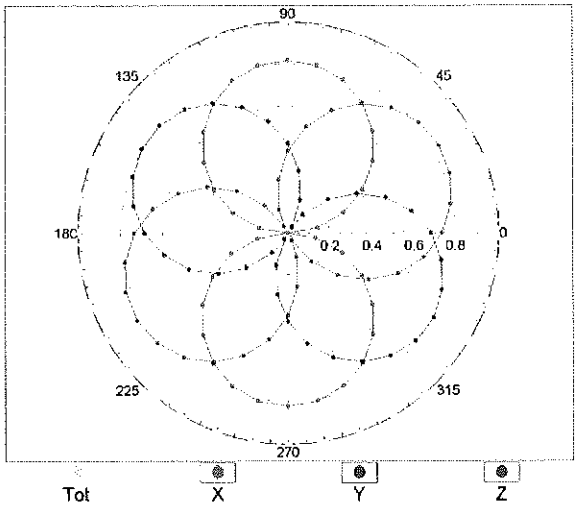
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

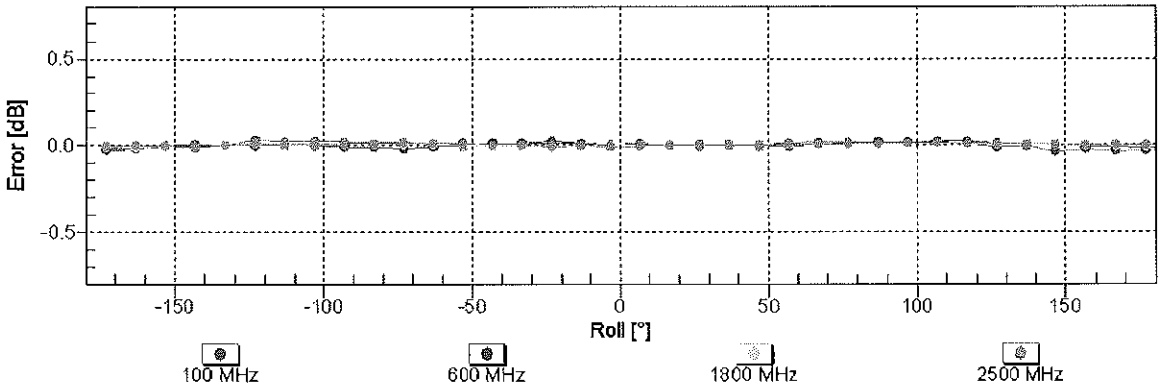
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



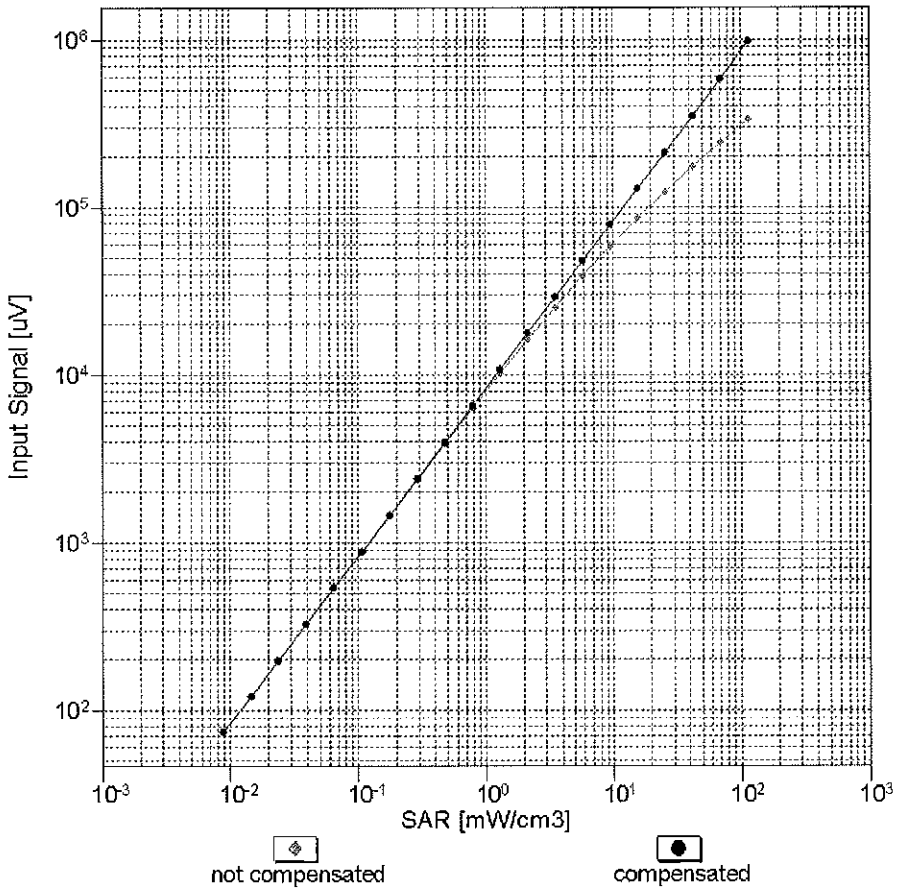
f=1800 MHz,R22

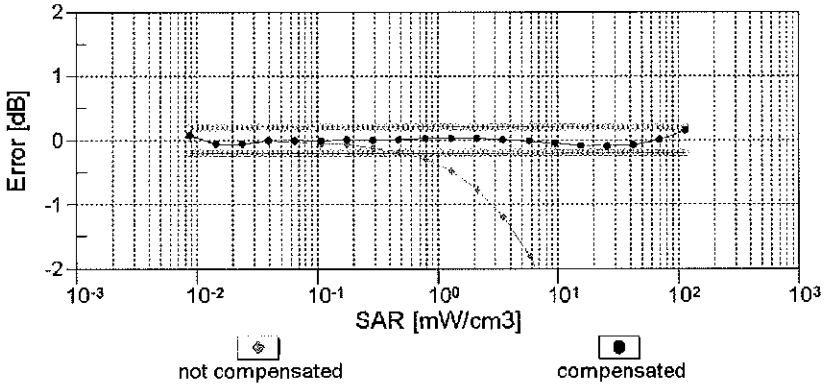




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)

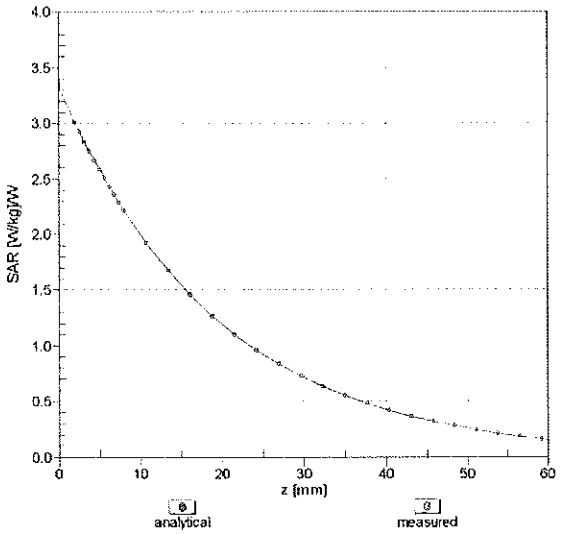




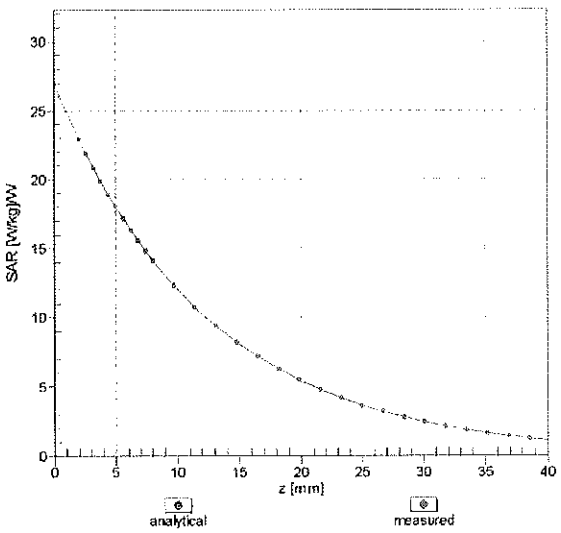
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

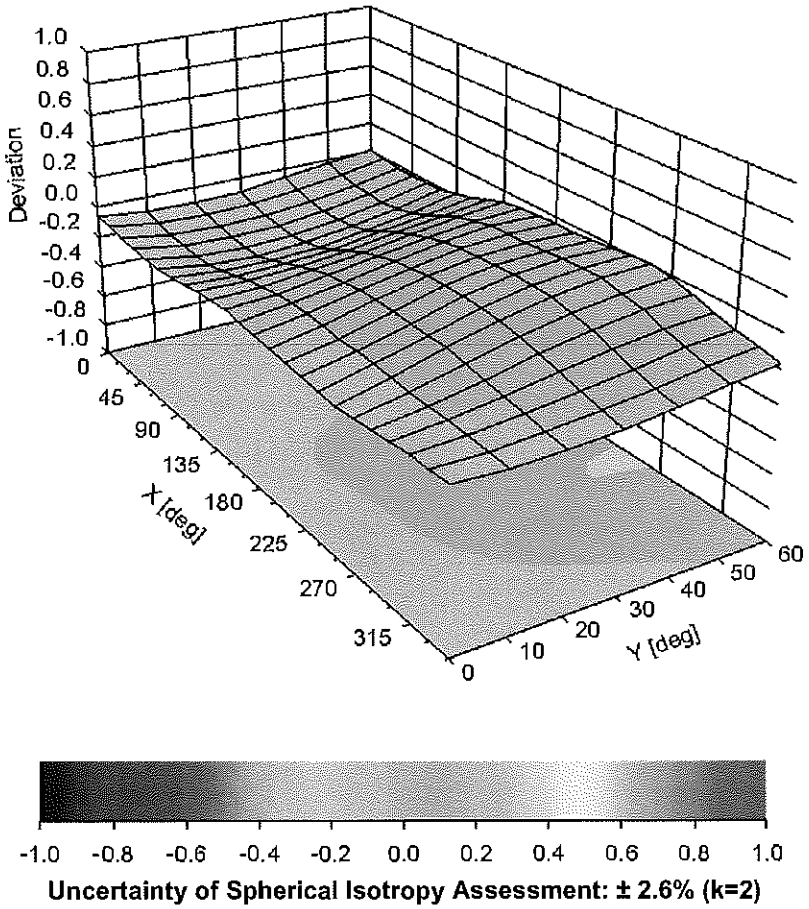


f = 1750 MHz,WGLS R22 (H_convF)



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:3258

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-123.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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: D750V3-1003_Jan14

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1003
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	January 20, 2014

CC √ 2/5/14

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: January 21, 2014

PCT# 80200

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.8 ± 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	2.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.37 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.46 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.0 ± 6 %	0.98 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	2.24 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.77 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.47 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.78 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.7 Ω - 0.2 jΩ
Return Loss	- 27.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.5 Ω - 2.6 jΩ
Return Loss	- 31.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.043 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 21, 2009

DASY5 Validation Report for Head TSL

Date: 20.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1003

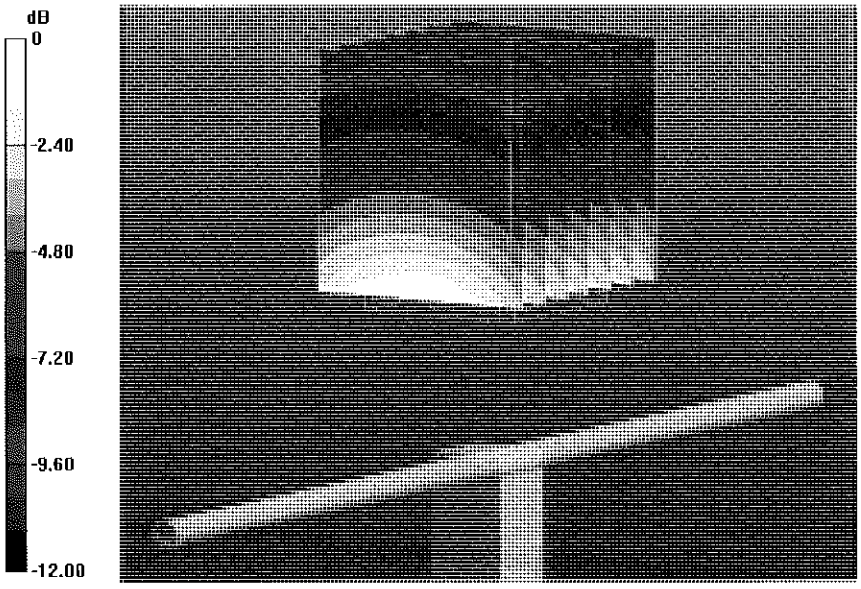
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; $\sigma = 0.92$ S/m; $\varepsilon_r = 40.8$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.37, 6.37, 6.37); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

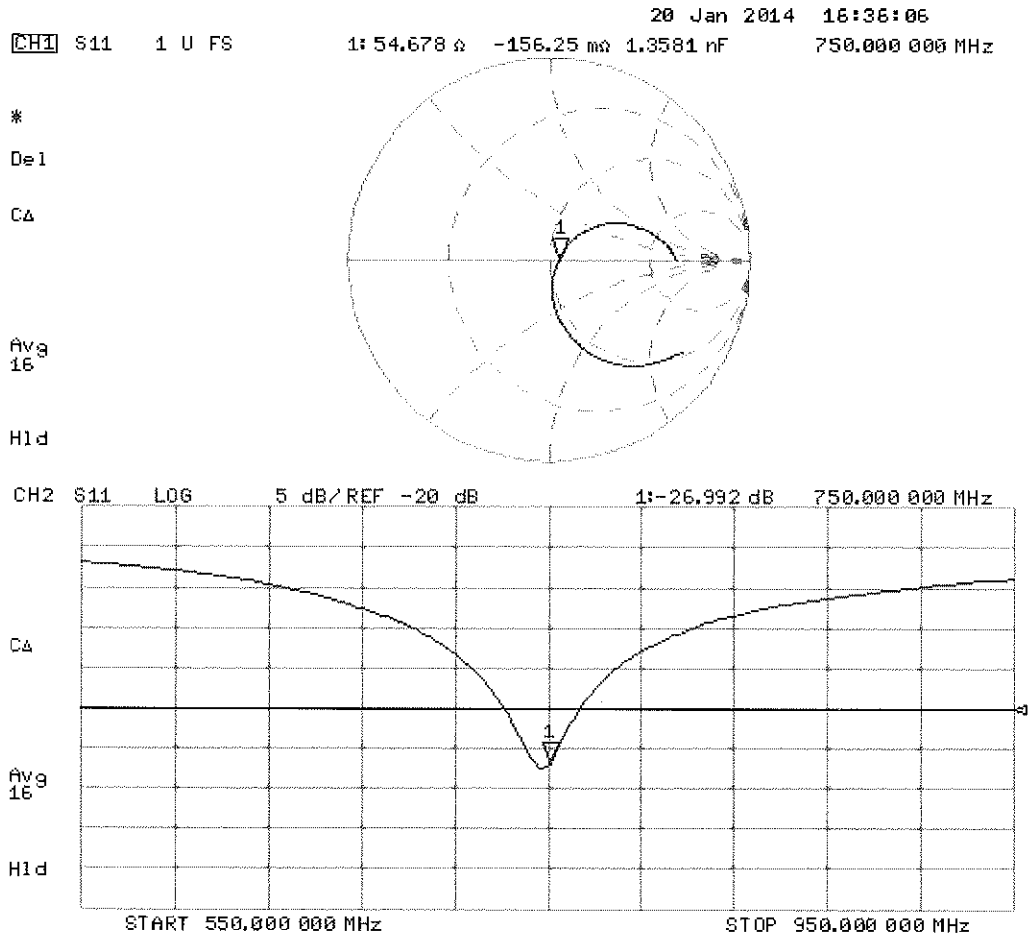
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.711 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.27 W/kg
SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.4 W/kg
Maximum value of SAR (measured) = 2.51 W/kg



0 dB = 2.51 W/kg = 4.00 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 20.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1003

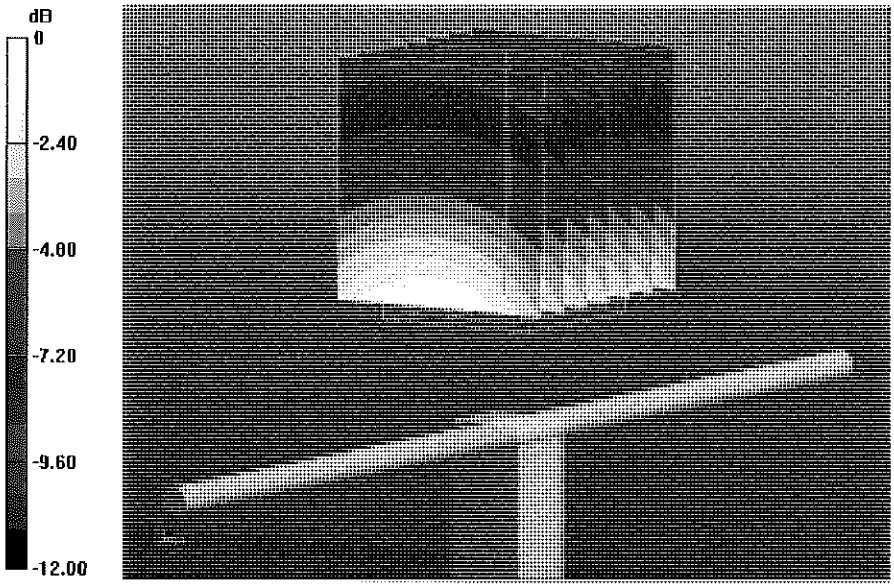
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.98 S/m; ε_r = 54; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.13, 6.13, 6.13); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

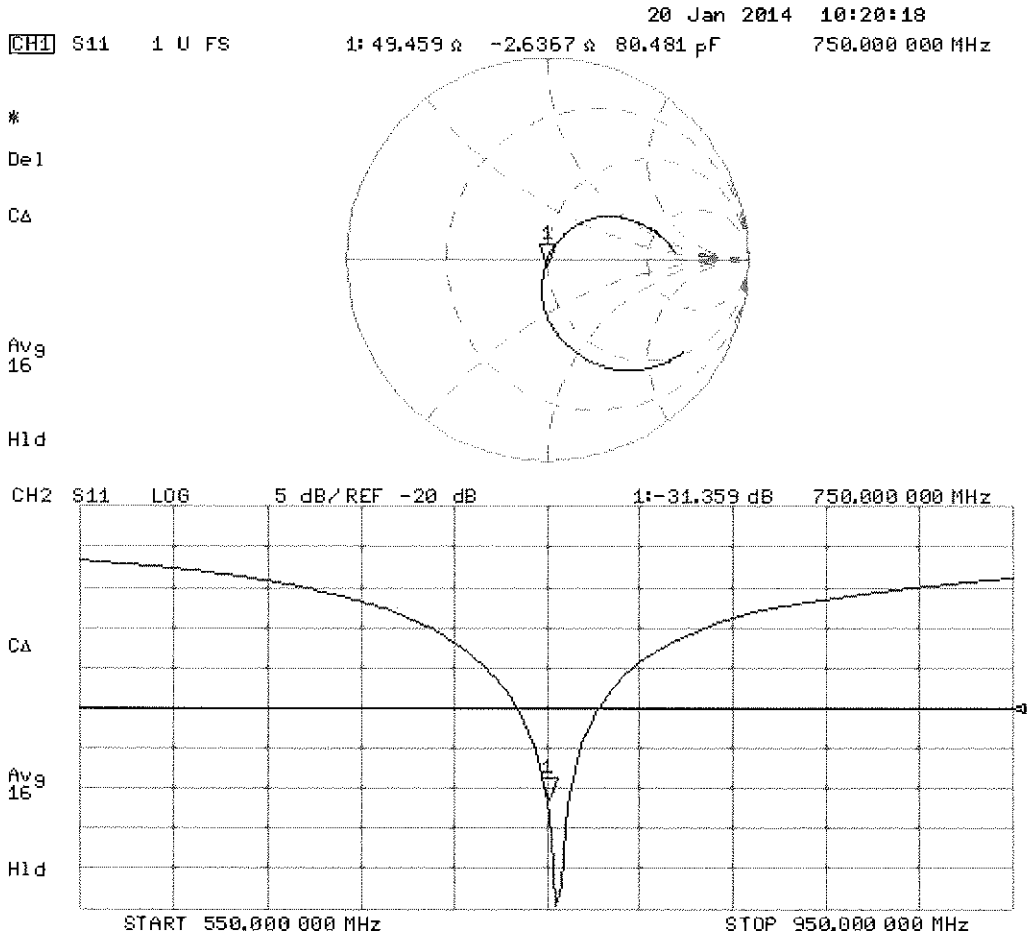
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.082 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 3.31 W/kg
SAR(1 g) = 2.24 W/kg; SAR(10 g) = 1.47 W/kg
Maximum value of SAR (measured) = 2.58 W/kg



0 dB = 2.58 W/kg = 4.12 dBW/kg

Impedance Measurement Plot for Body TSL



Calibration Laboratory of
Schmid & Partner
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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: D835V2-4d119_Apr14

CALIBRATION CERTIFICATE

Object: D835V2 - SN: 4d119

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

CC✓ 4/25/14

Calibration date: April 07, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: April 9, 2014

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.6 ± 6 %	0.94 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.22 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.97 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	53.6 ± 6 %	1.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.34 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.15 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.2 Ω - 1.6 jΩ
Return Loss	- 34.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.3 Ω - 4.5 jΩ
Return Loss	- 24.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.386 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 29, 2010

Date: 07.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d119

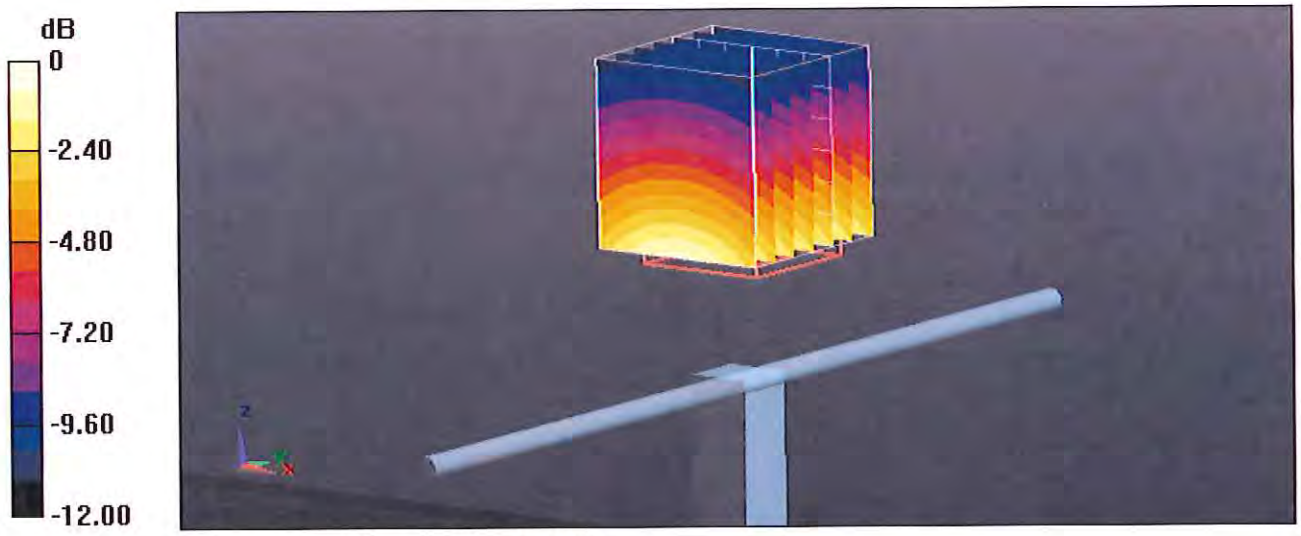
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.94 S/m; ε_r = 41.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.22, 6.22, 6.22); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

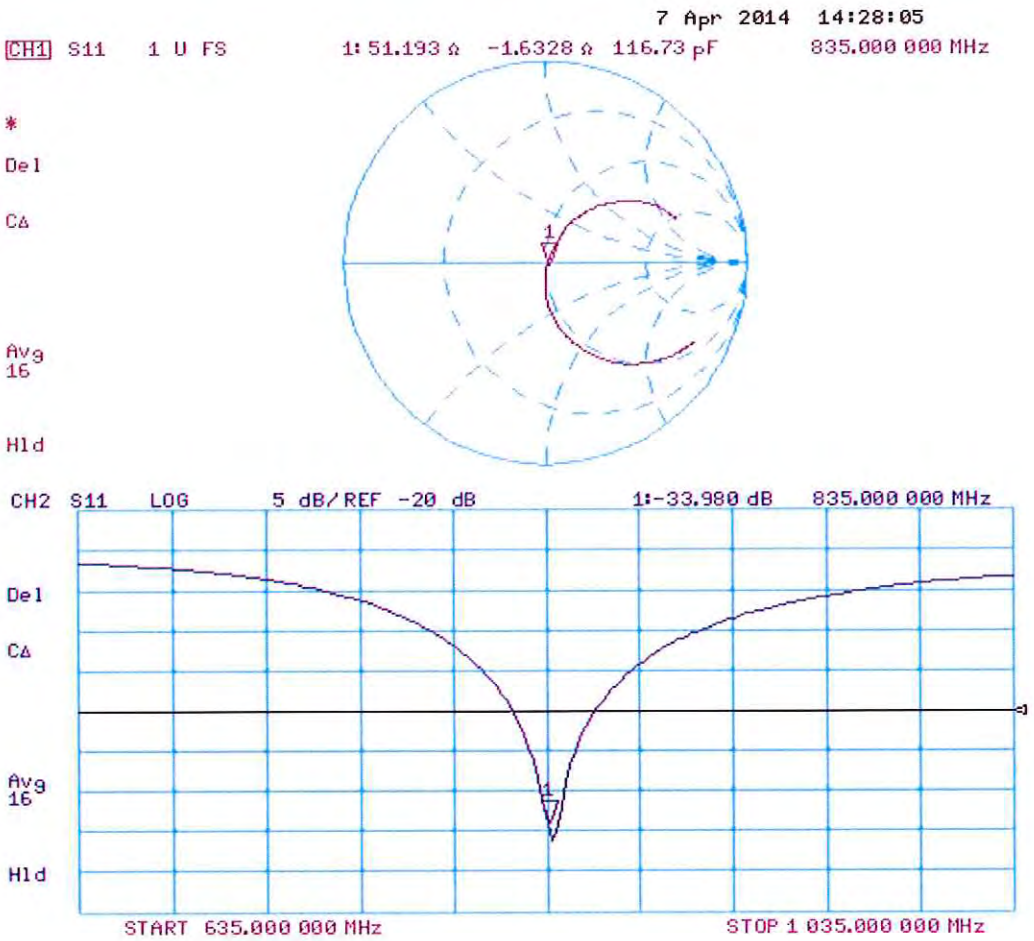
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.289 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.59 W/kg
SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.53 W/kg
Maximum value of SAR (measured) = 2.80 W/kg



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 07.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d119

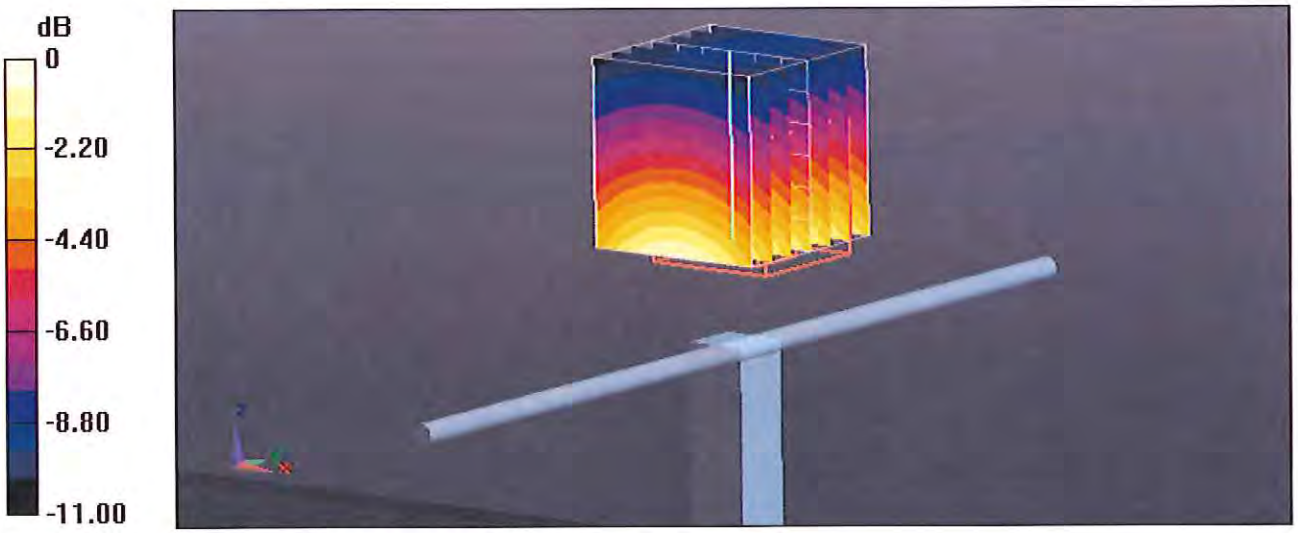
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.02 S/m; ε_r = 53.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.09, 6.09, 6.09); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

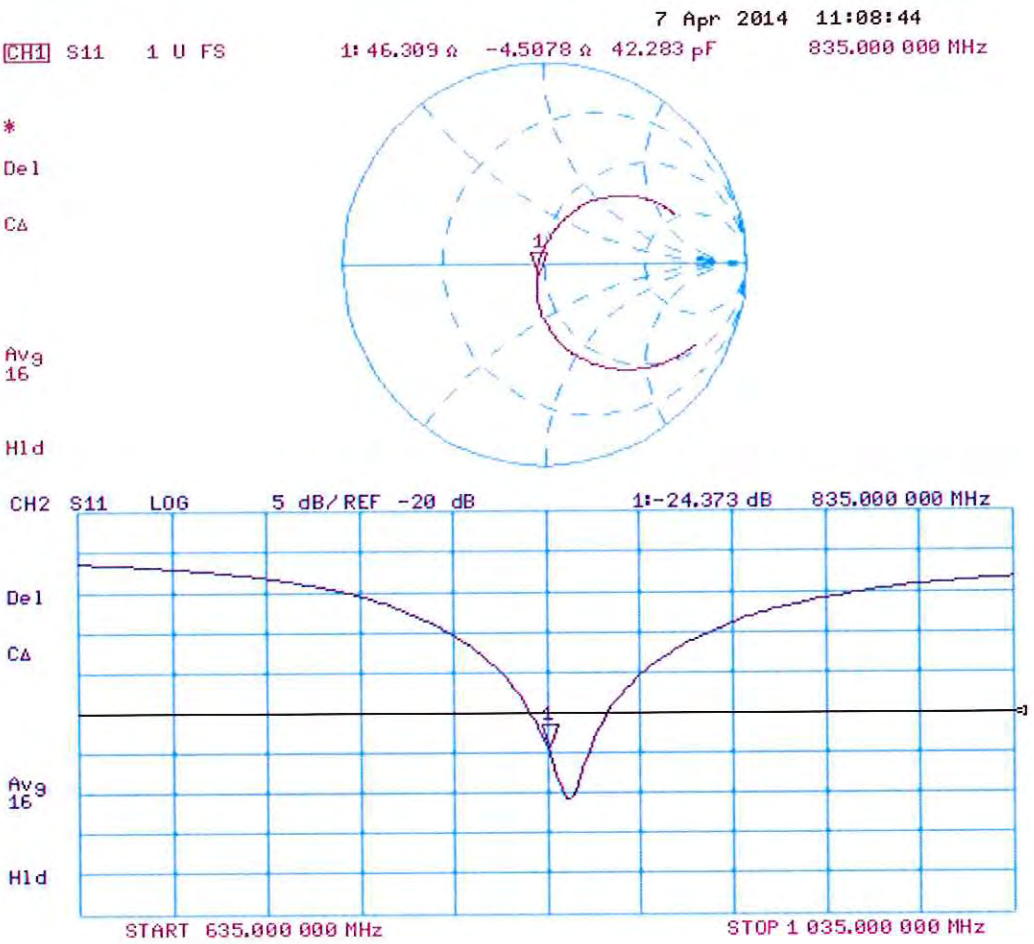
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.594 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.61 W/kg
SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.59 W/kg
Maximum value of SAR (measured) = 2.85 W/kg



0 dB = 2.85 W/kg = 4.55 dBW/kg

Impedance Measurement Plot for Body TSL



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Zeughausstrasse 43, 8004 Zurich, Switzerland

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

Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D1750V2-1051_Apr14

CALIBRATION CERTIFICATE

Object	D1750V2 - SN: 1051
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	April 10, 2014

OK 5/7/14

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: April 10, 2014

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.1 ± 6 %	1.35 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	9.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.2 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.0 ± 6 %	1.48 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.37 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**37.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.04 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.1 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.7 Ω + 0.4 jΩ
Return Loss	- 41.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.8 Ω + 0.8 jΩ
Return Loss	- 29.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.222 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	February 19, 2010

DASY5 Validation Report for Head TSL

Date: 10.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1051

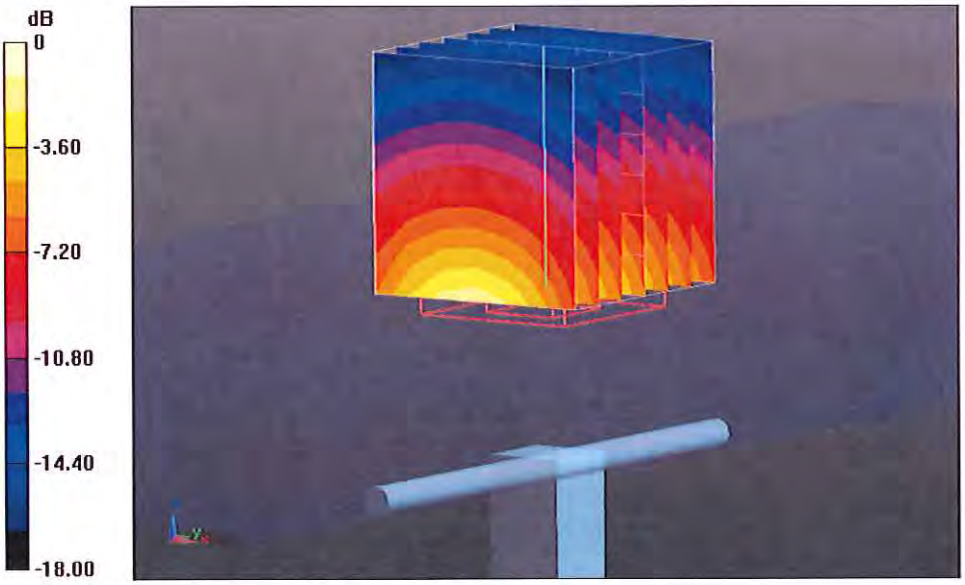
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.35 S/m; ε_r = 39.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.23, 5.23, 5.23); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

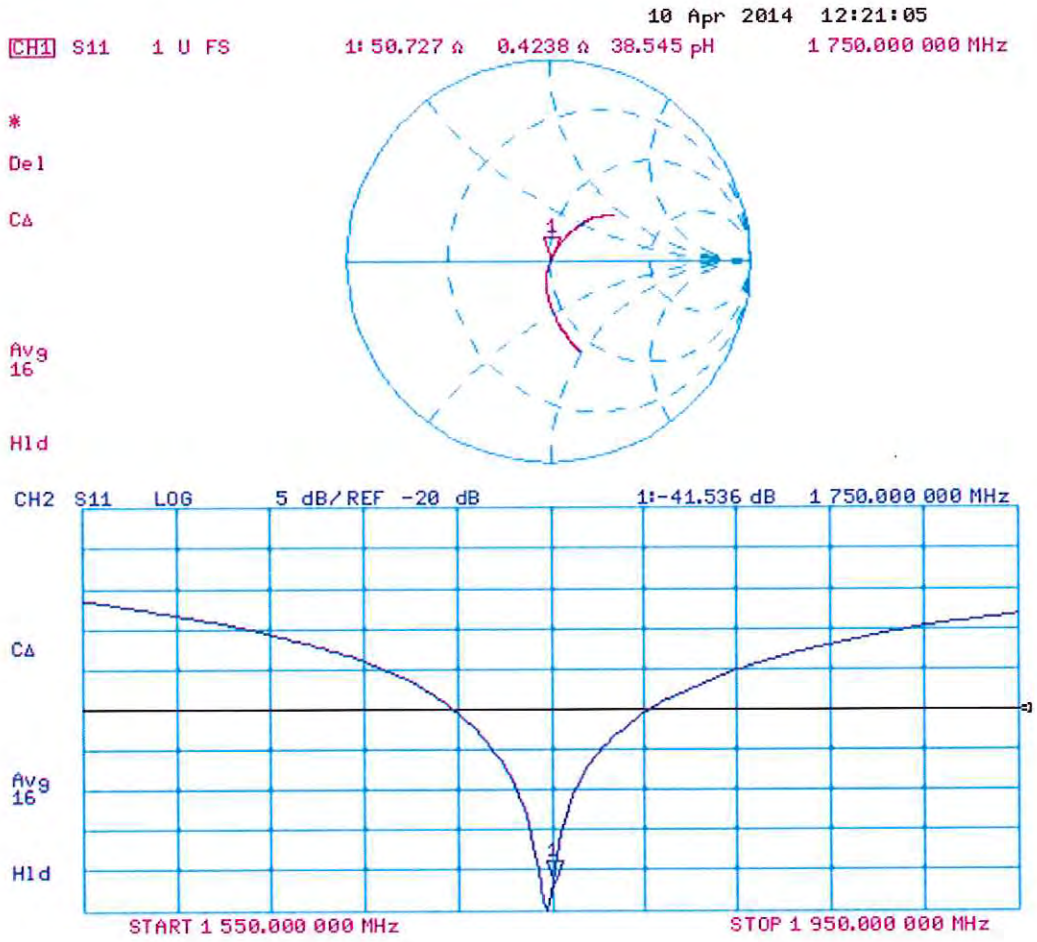
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.631 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 16.2 W/kg
SAR(1 g) = 9.02 W/kg; SAR(10 g) = 4.79 W/kg
Maximum value of SAR (measured) = 11.3 W/kg



0 dB = 11.3 W/kg = 10.53 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 10.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1051

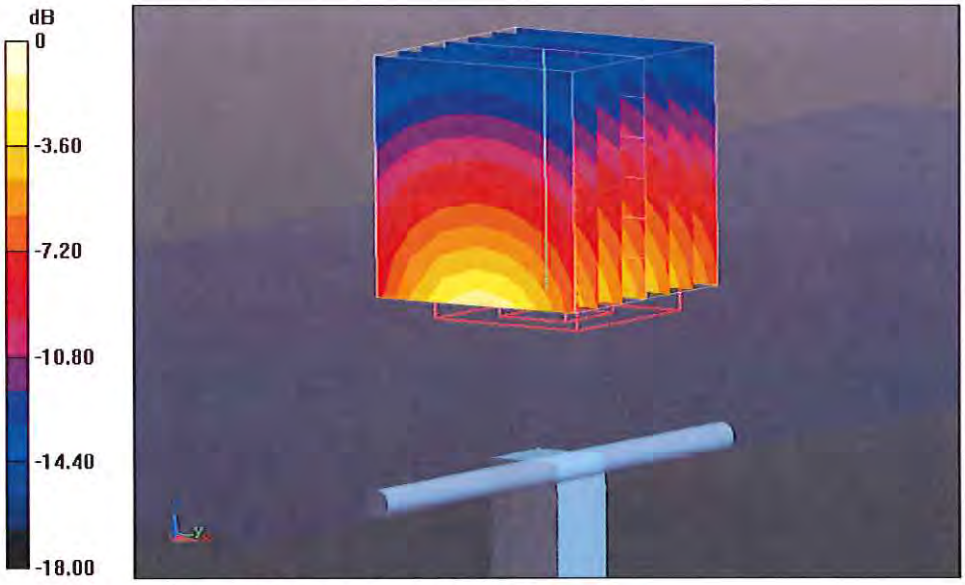
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.48 S/m; ε_r = 52; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.89, 4.89, 4.89); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

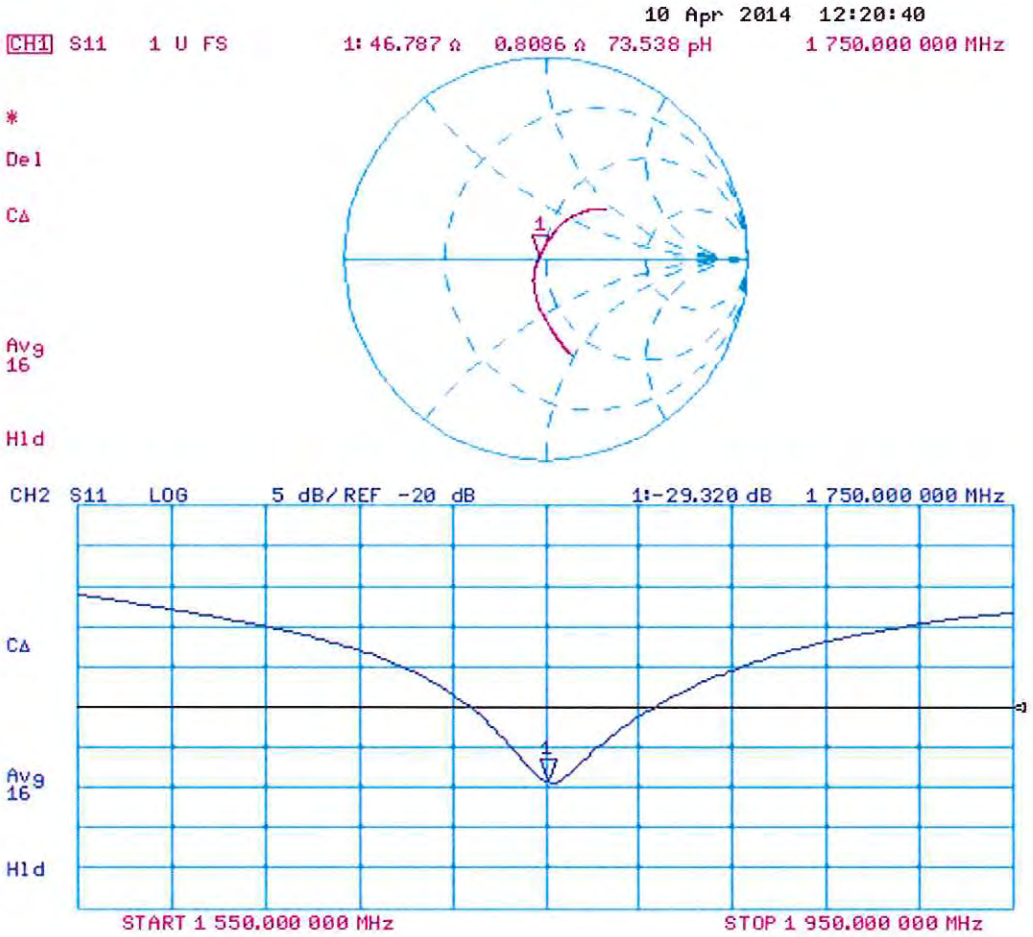
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.321 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 9.37 W/kg; SAR(10 g) = 5.04 W/kg
Maximum value of SAR (measured) = 11.8 W/kg



0 dB = 11.8 W/kg = 10.72 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client PC Test

Certificate No: D1900V2-5d149_Jul13

CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 5d149

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

Calibration date: July 22, 2013

✓ JCK 8/19/13

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)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: July 22, 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	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1.36 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	9.99 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.4 ± 6 %	1.49 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	10.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.36 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.9 Ω + 6.0 jΩ
Return Loss	- 23.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.5 Ω + 6.4 jΩ
Return Loss	- 23.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.196 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	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 22.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d149

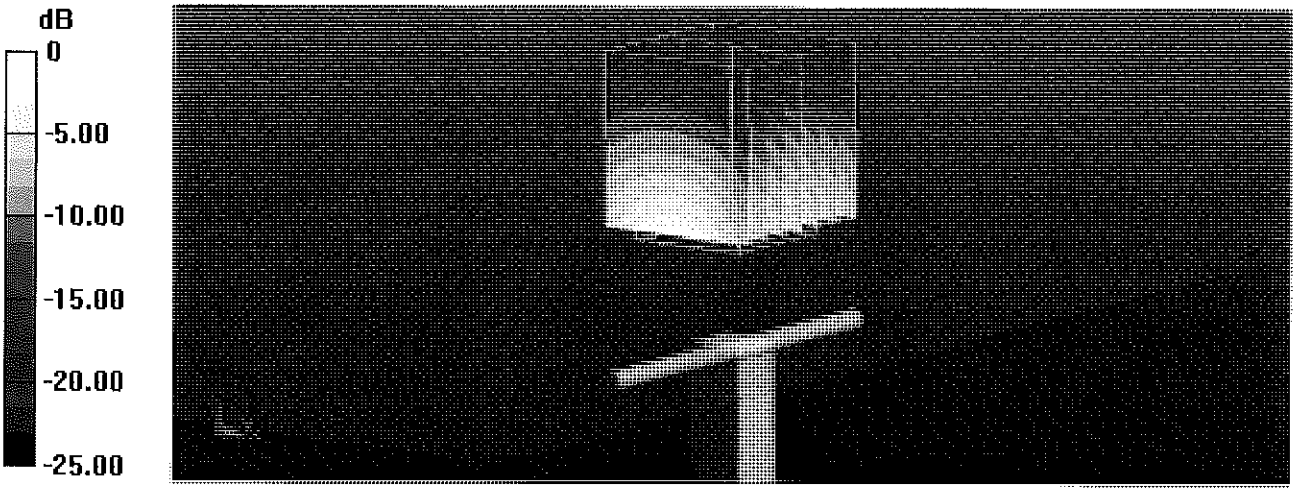
Communication System: UID 0 - CW ; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.36 S/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

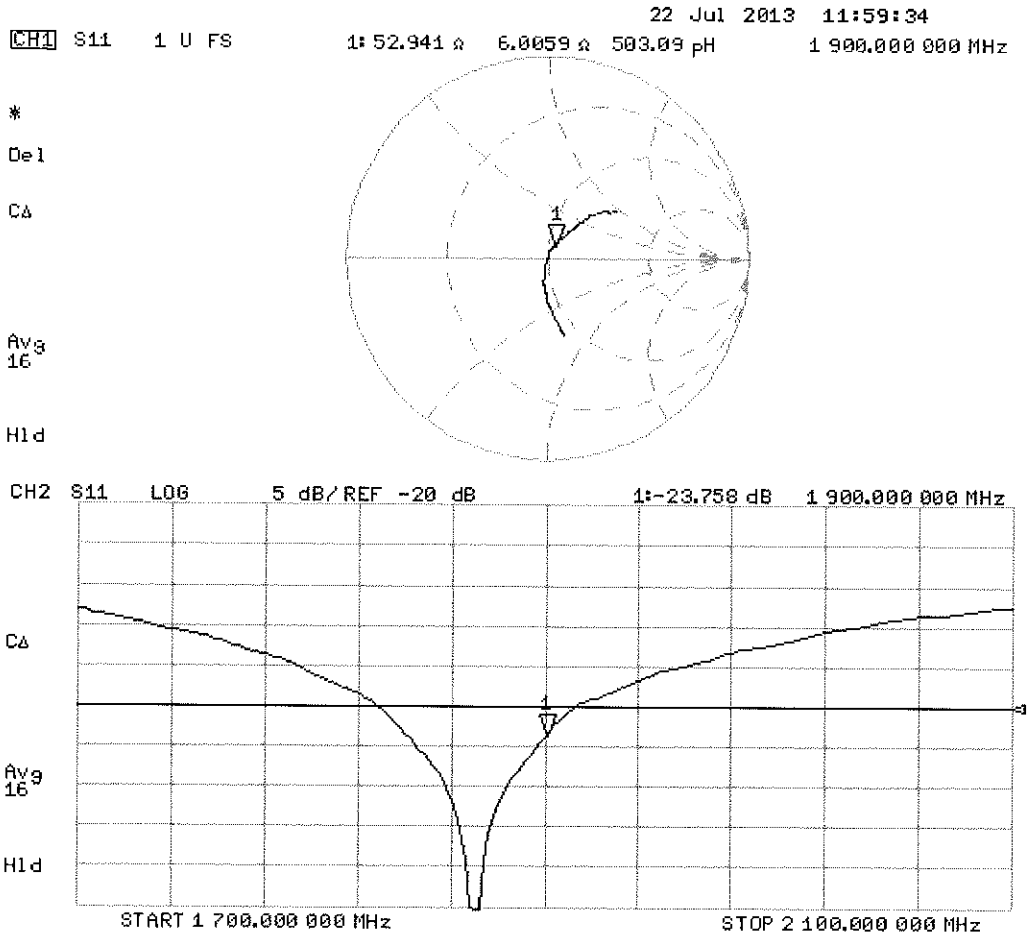
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.173 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 18.0 W/kg
SAR(1 g) = 9.99 W/kg; SAR(10 g) = 5.28 W/kg
Maximum value of SAR (measured) = 12.4 W/kg



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d149

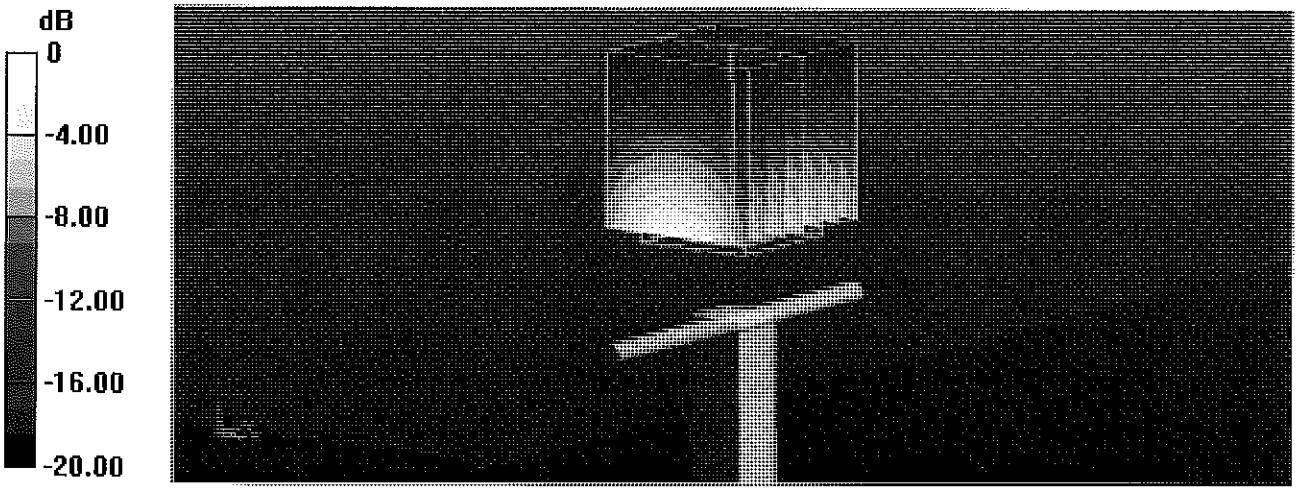
Communication System: UID 0 - CW ; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.49 S/m; ε_r = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

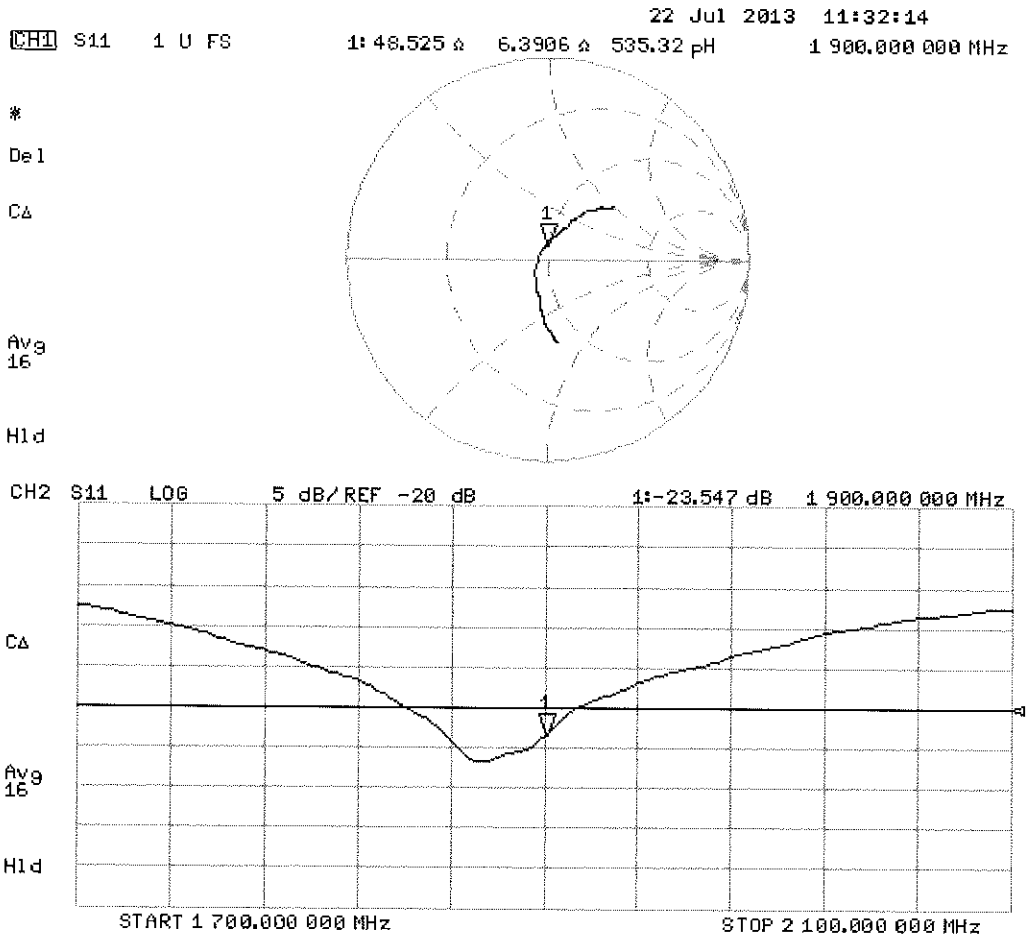
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.173 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 17.0 W/kg
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.36 W/kg
Maximum value of SAR (measured) = 12.6 W/kg



0 dB = 12.6 W/kg = 11.00 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D2450V2-797_Jan14

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 21, 2014

CC V
2/5/14

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: January 21, 2014

PCT# 751

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.7 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**51.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.3 ± 6 %	2.04 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	**49.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.86 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.1 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.5 Ω + 3.2 jΩ
Return Loss	- 26.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.0 Ω + 4.9 jΩ
Return Loss	- 26.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.151 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: 21.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

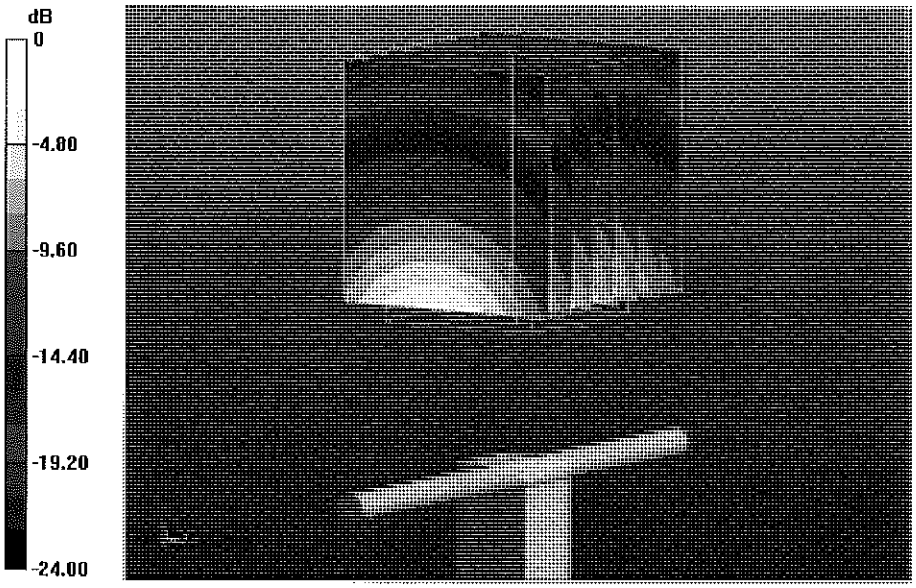
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 38.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

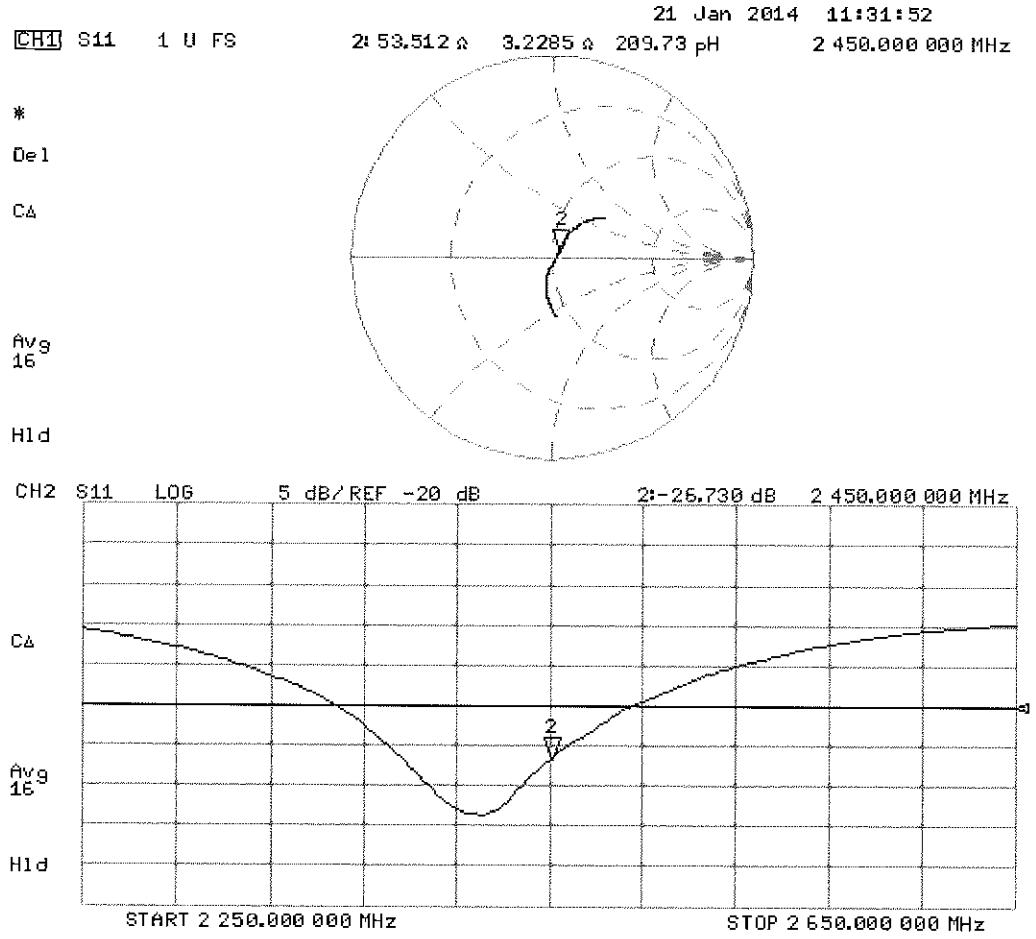
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.151 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 27.5 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.13 W/kg
Maximum value of SAR (measured) = 16.9 W/kg



0 dB = 16.9 W/kg = 12.28 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 21.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

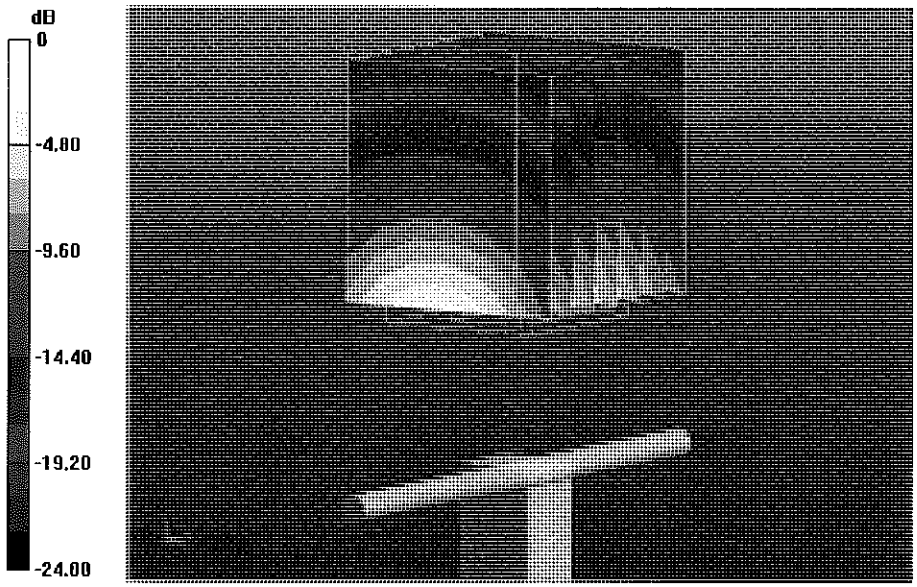
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.04 S/m; ε_r = 51.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

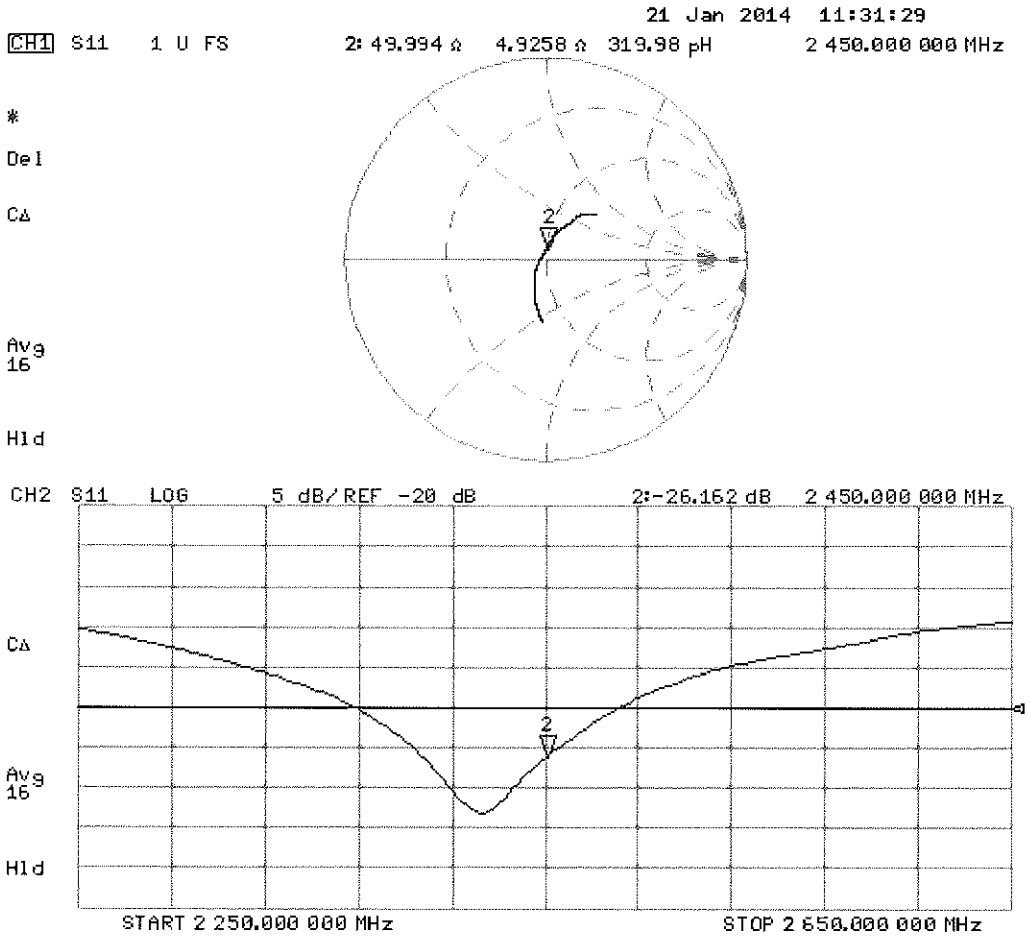
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.709 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.4 W/kg
SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.86 W/kg
Maximum value of SAR (measured) = 16.8 W/kg



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

Impedance Measurement Plot for Body TSL



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)	750	835	1750	1900	2450
Tissue	Body	Body	Body	Body	Body
Ingredients (% by weight)					
Bactericide	See Next Page	0.1			
DGBE			31	29.44	26.7
HEC		1			
NaCl		0.94	0.2	0.39	0.1
Sucrose		44.9			
Water		53.06	68.8	70.17	73.2

2 Composition / Information on ingredients

The Item is composed of the following ingredients:

H_2O	Water, 35 – 58%
Sucrose	Sugar, white, refined, 40 – 60%
NaCl	Sodium Chloride, 0 – 6%
Hydroxyethyl-cellulose	Medium Viscosity (CAS# 9004-62-0), <0.3%
Preventol-D7	Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyyl-3(2H)-isothiazolone, 0.1 – 0.7% Relevant for safety; Refer to the respective Safety Data Sheet*.

Figure D-1
Composition of 750 MHz Body Tissue Equivalent Matter

Note: 750MHz liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

Measurement Certificate / Material Test

Item Name	**Body Tissue Simulating Liquid (MSL750V2)**
Product No.	SL AAM 075 AA (Charge: 130313-1)
Manufacturer	SPEAG

Measurement Method
TSL dielectric parameters measured using calibrated OCP probe.

Setup Validation
Validation results were within ± 2.5% towards the target values of Methanol.

Target Parameters
Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

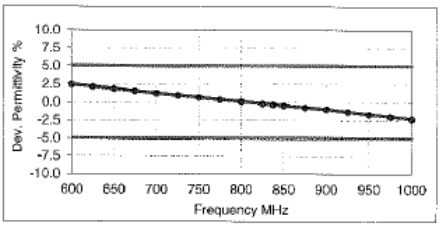
Test Condition

Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	13-Mar-13
Operator	IEN

Additional Information

TSL Density	1.212 g/cm^3
TSL Heat-capacity	3.006 kJ/(kg*K)

	Measured			Target		Diff.to Target [%]	
f [MHz]	HP-e'	HP-e''	sigma	eps	sigma	Δ-eps	Δ-sigma
600	57.5	24.64	0.82	56.1	0.95	2.5	-13.6
625	57.2	24.31	0.84	56.0	0.95	2.1	-11.4
650	57.0	23.99	0.87	55.9	0.96	1.8	-9.2
675	56.7	23.69	0.89	55.8	0.96	1.5	-7.1
700	56.4	23.39	0.91	55.7	0.96	1.2	-5.1
725	56.2	23.18	0.93	55.6	0.96	1.0	-2.8
750	55.9	22.97	0.96	55.5	0.96	0.7	-0.5
775	55.7	22.78	0.98	55.4	0.97	0.4	1.7
800	55.4	22.60	1.01	55.3	0.97	0.1	4.0
825	55.2	22.44	1.03	55.2	0.98	-0.2	5.3
838	55.0	22.36	1.04	55.2	0.98	-0.3	5.9
850	54.9	22.28	1.05	55.2	0.99	-0.4	6.6
875	54.7	22.16	1.08	55.1	1.02	-0.7	5.8
900	54.5	22.03	1.10	55.0	1.05	-1.0	5.1
925	54.2	21.93	1.13	55.0	1.06	-1.3	6.2
950	54.0	21.82	1.15	54.9	1.08	-1.7	7.2
975	53.8	21.74	1.18	54.9	1.09	-2.0	8.5
1000	53.6	21.66	1.21	54.8	1.10	-2.3	9.7



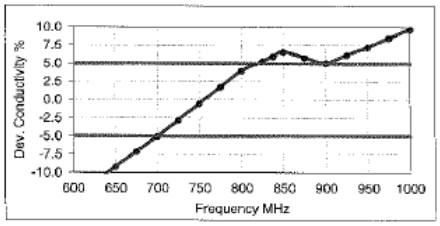


Figure D-2
750MHz Body Tissue Equivalent Matter

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 FCC KDB 865664 D01 v01 and IEEE 1528-2013. 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
K	750	12/21/2013	3333	ES3DV3	750	Body	0.975	55.77	PASS	PASS	PASS	N/A	N/A	N/A
D	835	10/8/2013	3022	ES3DV2	835	Body	1.012	53.65	PASS	PASS	PASS	GMSK	PASS	N/A
E	1900	12/18/2013	3914	EX3DV4	1900	Body	1.579	51.41	PASS	PASS	PASS	GMSK	PASS	N/A
G	2450	3/5/2014	3258	ES3DV3	2450	Body	2.044	51.30	PASS	PASS	PASS	OFDM	N/A	PASS
J	1750	1/14/2014	3332	ES3DV3	1750	Body	1.450	52.15	PASS	PASS	PASS	N/A	N/A	N/A
J	1900	1/14/2014	3332	ES3DV3	1900	Body	1.576	51.59	PASS	PASS	PASS	GMSK	PASS	N/A

NOTE: While the probes have been calibrated for both a CW and modulated signals, all measurements were performed using communication systems 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 for scenarios when CW probe calibrations are used with other signal types. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK and TDD, or with a high peak to average ratio (>5 dB), such as OFDM according to KDB 865664

APPENDIX G: SENSOR TRIGGERING DATA SUMMARY

A3LSMT805M 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 1 mm 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 SAR Tests are included in addition 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.

Back Side

Moving device toward the phantom:

KDB 616217 6.2.6 Measured Power [dBm]											
Distance[mm]	26	25	24	23	22	21	20	19	18	17	16
GSM 850	32.7	32.79	32.65	32.9	32.62	24.94	24.65	24.87	24.91	24.7	24.62
GSM 1900	29.18	29.24	29.45	29.23	29.28	21.64	21.6	21.79	21.73	21.93	21.83
GPRS 850 1Tx	32.69	32.89	32.94	32.86	32.62	24.8	24.78	24.93	24.82	24.64	24.65
GPRS 850 2Tx	32.72	32.88	32.65	32.94	32.76	23.66	23.81	23.74	23.93	23.76	23.86
GPRS 850 3Tx	31.95	31.95	32.03	31.9	31.98	22.87	22.82	22.91	22.74	22.89	22.74
GPRS 850 4Tx	30.69	30.77	30.7	30.64	30.89	21.33	21.37	21.12	21.38	21.4	21.18
GPRS 1900 1Tx	29.36	29.19	29.17	29.2	29.34	21.73	21.64	21.69	21.84	21.61	21.67
GPRS 1900 2Tx	29.1	29.24	29.43	29.39	29.19	18.61	18.61	18.91	18.8	18.68	18.61
GPRS 1900 3Tx	28.63	28.61	28.43	28.51	28.47	16.66	16.73	16.83	16.77	16.74	16.72
GPRS 1900 4Tx	27.13	27.32	27.32	27.21	27.27	15.93	15.67	15.78	15.7	15.73	15.68
EDGE850 1Tx	26.92	26.8	26.67	26.89	26.68	22.75	22.89	22.9	22.91	22.72	22.83
EDGE850 2Tx	26.79	26.9	26.86	26.68	26.75	21.88	21.67	21.91	21.94	21.64	21.86
EDGE850 3Tx	26.07	26.09	25.81	25.99	26.08	20.79	20.8	20.86	20.7	20.93	20.9
EDGE850 4Tx	24.92	24.82	24.61	24.73	24.62	19.19	19.31	19.23	19.39	19.14	19.3
EDGE1900 1Tx	25.65	25.6	25.71	25.72	25.61	17.84	17.94	17.78	17.82	17.62	17.84
EDGE1900 2Tx	25.94	25.95	25.93	25.76	25.87	16.82	16.77	16.62	16.87	16.64	16.91
EDGE1900 3Tx	25.03	25.06	24.84	24.83	24.87	15.87	15.88	15.62	15.62	15.9	15.66
EDGE1900 4Tx	23.92	23.67	23.67	23.72	23.78	14.87	14.89	14.7	14.92	14.63	14.81
WCDMA 850	22.79	22.87	22.83	22.8	22.79	18.36	18.11	18.34	18.28	18.22	18.3
WCDMA 1900	22.84	22.86	22.78	22.6	22.71	13.45	13.19	13.14	13.38	13.19	13.37
LTE B17	22.92	22.73	22.87	22.78	22.86	16.13	16.14	16.37	16.34	16.29	16.32
LTE B5	22.74	22.79	22.6	22.81	22.82	16.72	16.91	16.66	16.91	16.68	16.8
LTE B4	22.85	22.65	22.61	22.91	22.91	14.27	14.14	14.2	14.44	14.38	14.45
LTE B2	22.79	22.92	22.83	22.78	22.62	13.41	13.34	13.29	13.32	13.15	13.3

Moving device away from the phantom:

KDB 616217 6.2.8 Measured Power [dBm]											
Distance[mm]	26	25	24	23	22	21	20	19	18	17	16
GSM 850	32.66	32.6	32.75	32.84	32.93	24.73	24.88	24.8	24.81	24.83	24.92
GSM 1900	29.23	29.2	29.4	29.19	29.42	21.81	21.69	21.77	21.91	21.7	21.69
GPRS 850 1Tx	32.65	32.69	32.69	32.82	32.94	24.84	24.94	24.94	24.81	24.82	24.68
GPRS 850 2Tx	32.67	32.74	32.74	32.9	32.75	23.66	23.61	23.9	23.83	23.89	23.81
GPRS 850 3Tx	31.92	32.14	32	32.05	31.99	22.71	22.69	22.73	22.74	22.92	22.73
GPRS 850 4Tx	30.78	30.88	30.79	30.83	30.84	21.19	21.38	21.37	21.43	21.44	21.1
GPRS 1900 1Tx	29.25	29.13	29.38	29.41	29.35	21.9	21.65	21.79	21.84	21.65	21.64
GPRS 1900 2Tx	29.26	29.45	29.43	29.32	29.31	18.62	18.81	18.68	18.63	18.69	18.7
GPRS 1900 3Tx	28.64	28.49	28.36	28.46	28.49	16.83	16.72	16.89	16.7	16.85	16.9
GPRS 1900 4Tx	27.12	27.27	27.37	27.31	27.11	15.63	15.79	15.6	15.95	15.64	15.81
EDGE850 1Tx	26.89	26.73	26.91	26.85	26.62	22.76	22.75	22.72	22.79	22.84	22.84
EDGE850 2Tx	26.77	26.7	26.83	26.9	26.62	21.78	21.76	21.7	21.93	21.95	21.82
EDGE850 3Tx	26.05	25.83	25.81	26.15	25.87	20.86	20.63	20.91	20.92	20.76	20.72
EDGE850 4Tx	24.87	24.89	24.66	24.8	24.81	19.19	19.35	19.26	19.33	19.14	19.11
EDGE1900 1Tx	25.87	25.75	25.77	25.87	25.76	17.7	17.65	17.87	17.87	17.91	17.62
EDGE1900 2Tx	25.95	25.85	25.94	25.84	25.8	16.77	16.85	16.87	16.88	16.76	16.65
EDGE1900 3Tx	25.06	24.93	24.95	24.89	24.92	15.77	15.81	15.95	15.93	15.91	15.95
EDGE1900 4Tx	23.75	23.91	23.88	23.91	23.67	14.74	14.71	14.92	14.8	14.8	14.68
WCDMA 850	22.72	22.95	22.87	22.75	22.64	18.15	18.22	18.29	18.21	18.24	18.17
WCDMA 1900	22.71	22.79	22.94	22.8	22.8	13.22	13.16	13.28	13.33	13.32	13.44
LTE B17	22.75	22.6	22.93	22.65	22.67	16.24	16.24	16.45	16.43	16.31	16.36
LTE B5	22.78	22.77	22.93	22.86	22.6	16.87	16.67	16.69	16.66	16.66	16.87
LTE B4	22.95	22.92	22.85	22.79	22.6	14.4	14.42	14.27	14.25	14.17	14.22
LTE B2	22.65	22.95	22.63	22.91	22.8	13.4	13.38	13.27	13.4	13.12	13.2

Based on the most conservative measured triggering distance of 21 mm, additional SAR measurements were required at 20 mm from the back side.

Top Edge

Moving device toward the phantom:

KDB 616217 6.2.6 Measured Power [dBm]											
Distance[mm]	26	25	24	23	22	21	20	19	18	17	16
GSM 850	32.79	32.94	32.93	32.72	32.72	24.93	24.85	24.93	24.68	24.84	24.9
GSM 1900	29.22	29.43	29.37	29.14	29.35	21.81	21.68	21.82	21.71	21.93	21.68
GPRS 850 1Tx	32.89	32.67	32.6	32.86	32.88	24.9	24.87	24.69	24.93	24.63	24.61
GPRS 850 2Tx	32.6	32.72	32.64	32.93	32.9	23.78	23.88	23.63	23.8	23.67	23.8
GPRS 850 3Tx	31.8	31.86	31.88	31.81	32.02	22.68	22.63	22.74	22.87	22.63	22.65
GPRS 850 4Tx	30.69	30.77	30.78	30.6	30.7	21.16	21.37	21.27	21.2	21.26	21.27
GPRS 1900 1Tx	29.43	29.2	29.32	29.34	29.39	21.91	21.78	21.64	21.68	21.81	21.6
GPRS 1900 2Tx	29.38	29.24	29.28	29.32	29.24	18.91	18.89	18.86	18.7	18.63	18.61
GPRS 1900 3Tx	28.56	28.59	28.39	28.5	28.33	16.6	16.76	16.95	16.75	16.78	16.61
GPRS 1900 4Tx	27.17	27.31	27.37	27.22	27.37	15.67	15.93	15.65	15.95	15.77	15.7
EDGE850 1Tx	26.79	26.9	26.7	26.86	26.73	22.6	22.62	22.86	22.81	22.89	22.87
EDGE850 2Tx	26.75	26.72	26.67	26.6	26.64	21.72	21.9	21.62	21.72	21.81	21.83
EDGE850 3Tx	25.91	26.06	25.99	26.1	26.04	20.63	20.87	20.91	20.81	20.6	20.8
EDGE850 4Tx	24.79	24.86	24.87	24.7	24.8	19.24	19.39	19.11	19.33	19.13	19.17
EDGE1900 1Tx	25.73	25.76	25.91	25.63	25.91	17.88	17.69	17.9	17.76	17.71	17.91
EDGE1900 2Tx	25.71	25.79	25.7	25.72	25.86	16.8	16.84	16.74	16.69	16.85	16.83
EDGE1900 3Tx	25.06	25.07	24.83	24.99	25	15.74	15.76	15.78	15.87	15.63	15.79
EDGE1900 4Tx	23.65	23.89	23.8	23.71	23.63	14.81	14.67	14.82	14.82	14.9	14.9
WCDMA 850	22.79	22.78	22.76	22.81	22.91	18.26	18.38	18.1	18.35	18.34	18.43
WCDMA 1900	22.8	22.9	22.7	22.85	22.9	13.17	13.18	13.1	13.11	13.22	13.44
LTE B17	22.75	22.67	22.85	22.66	22.73	16.1	16.22	16.36	16.36	16.14	16.21
LTE B5	22.74	22.74	22.78	22.68	22.73	16.64	16.62	16.88	16.68	16.61	16.86
LTE B4	22.78	22.66	22.65	22.94	22.87	14.44	14.14	14.18	14.42	14.19	14.4
LTE B2	22.63	22.86	22.91	22.79	22.84	13.27	13.23	13.26	13.11	13.34	13.28

Moving device away from the phantom:

KDB 616217 6.2.8 Measured Power [dBm]											
Distance[mm]	26	25	24	23	22	21	20	19	18	17	16
GSM 850	32.89	32.9	32.81	32.93	32.86	24.68	24.89	24.75	24.85	24.63	24.85
GSM 1900	29.14	29.11	29.19	29.15	29.44	21.9	21.63	21.62	21.84	21.9	21.76
GPRS 850 1Tx	32.79	32.65	32.9	32.83	32.84	24.86	24.75	24.82	24.81	24.66	24.73
GPRS 850 2Tx	32.65	32.95	32.94	32.94	32.81	23.84	23.77	23.9	23.83	23.86	23.69
GPRS 850 3Tx	31.9	31.93	31.96	31.89	32.12	22.75	22.77	22.94	22.93	22.73	22.68
GPRS 850 4Tx	30.71	30.91	30.62	30.92	30.67	21.25	21.19	21.21	21.12	21.28	21.19
GPRS 1900 1Tx	29.33	29.34	29.3	29.26	29.31	21.94	21.63	21.79	21.75	21.86	21.66
GPRS 1900 2Tx	29.21	29.17	29.23	29.44	29.34	18.94	18.79	18.89	18.8	18.89	18.89
GPRS 1900 3Tx	28.35	28.41	28.61	28.51	28.37	16.93	16.93	16.94	16.68	16.6	16.63
GPRS 1900 4Tx	27.11	27.39	27.43	27.16	27.3	15.95	15.7	15.91	15.77	15.81	15.64
EDGE850 1Tx	26.81	26.93	26.63	26.84	26.84	22.68	22.66	22.72	22.69	22.62	22.63
EDGE850 2Tx	26.61	26.73	26.83	26.94	26.68	21.87	21.87	21.81	21.62	21.86	21.63
EDGE850 3Tx	26.12	25.96	26	25.97	25.93	20.71	20.8	20.82	20.87	20.78	20.64
EDGE850 4Tx	24.7	24.87	24.92	24.84	24.61	19.45	19.4	19.11	19.28	19.13	19.1
EDGE1900 1Tx	25.81	25.94	25.79	25.65	25.61	17.88	17.89	17.63	17.95	17.92	17.7
EDGE1900 2Tx	25.94	25.66	25.62	25.75	25.61	16.94	16.72	16.72	16.74	16.67	16.63
EDGE1900 3Tx	24.85	25.04	25.04	24.95	24.82	15.85	15.63	15.6	15.79	15.61	15.89
EDGE1900 4Tx	23.87	23.79	23.63	23.8	23.78	14.66	14.84	14.72	14.63	14.95	14.76
WCDMA 850	22.63	22.73	22.65	22.7	22.89	18.35	18.18	18.34	18.18	18.16	18.31
WCDMA 1900	22.86	22.92	22.63	22.8	22.82	13.26	13.24	13.15	13.29	13.23	13.4
LTE B17	22.69	22.82	22.64	22.85	22.83	16.36	16.15	16.42	16.41	16.39	16.3
LTE B5	22.63	22.6	22.9	22.66	22.95	16.72	16.74	16.94	16.6	16.64	16.85
LTE B4	22.66	22.92	22.77	22.65	22.79	14.26	14.35	14.31	14.43	14.1	14.16
LTE B2	22.78	22.88	22.7	22.71	22.8	13.36	13.23	13.21	13.32	13.18	13.39

Based on the most conservative measured triggering distance of 21 mm, additional SAR measurements were required at 20 mm from the top edge