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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:
06/03/15 - 06/30/15
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1506151178.A3L

FCC ID: **A3LSMT357W**

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

DUT Type: Portable Tablet
Application Type: Certification
FCC Rule Part(s): CFR §2.1093
Model(s): SM-T357W

Equipment Class	Band & Mode	Tx Frequency	SAR 1 gm Body (W/kg)
PCB	UMTS 850	826.40 - 846.60 MHz	0.57
PCB	UMTS 1750	1712.4 - 1752.5 MHz	0.59
PCB	UMTS 1900	1852.4 - 1907.6 MHz	0.60
PCB	LTE Band 12	701.5 - 713.5 MHz	0.96
PCB	LTE Band 17	706.5 - 713.5 MHz	1.09
PCB	LTE Band 5 (Cell)	824.7 - 848.3 MHz	1.04
PCB	LTE Band 4 (AWS)	1710.7 - 1754.3 MHz	0.85
PCB	LTE Band 2 (PCS)	1850.7 - 1909.3 MHz	0.69
DTS	2.4 GHz WLAN	2412 - 2462 MHz	0.59
NII	U-NII-1	5180 - 5240 MHz	
NII	U-NII-2A	5260 - 5320 MHz	0.63
NII	U-NII-2C	5500 - 5700 MHz	0.61
NII	U-NII-3	5745 - 5825 MHz	0.54
DSS/DTS	Bluetooth	2402 - 2480 MHz	0.13
Simultaneous SAR per KDB 690783 D01v01r03:			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.

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

The SAR Tick is an initiative of the Mobile Manufacturers Forum (MMF). While a product may be considered eligible, use of the SAR Tick logo requires an agreement with the MMF. Further details can be obtained by emailing: sartick@mmfai.info.

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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
UMTS 850	Data	826.40 - 846.60 MHz
UMTS 1750	Data	1712.4 - 1752.5 MHz
UMTS 1900	Data	1852.4 - 1907.6 MHz
LTE Band 12	Data	701.5 - 713.5 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
U-NII-1	Data	5180 - 5240 MHz
U-NII-2A	Data	5260 - 5320 MHz
U-NII-2C	Data	5500 - 5700 MHz
U-NII-3	Data	5745 - 5825 MHz
Bluetooth	Data	2402 - 2480 MHz
ANT+	Data	2402 - 2480 MHz

1.2 Power Reduction for SAR

This device uses independent power reduction mechanisms for WLAN and PCB SAR compliance. The power reduction mechanisms are activated when the device is used in close proximity to the user's body.

Since the device is a full sized tablet, the Body SAR was evaluated per FCC KDB Publication 616217 D04 for full sized tablets.

The reduced powers for the power reduction mechanisms were confirmed via conducted power measurements at the RF port (see Section 9). Detailed descriptions of the mechanisms are included in the operational description.

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.

Main Antenna Maximum Power

Mode / Band		Modulated Average (dBm)			
		3GPP Rel 99	*3GPP Rel 5*	*3GPP Rel 6*	*3GPP Rel 8*
		WCDMA	*HSDPA*	*HSUPA*	*DC-HSDPA*
UMTS Band 5 (850 MHz)	Maximum	**23.5**	**23.5**	**23.5**	**23.5**
	Nominal	**23.0**	**23.0**	**23.0**	**23.0**
UMTS Band 4 (1750 MHz)	Maximum	**23.5**	**23.5**	**23.5**	**23.5**
	Nominal	**23.0**	**23.0**	**23.0**	**23.0**
UMTS Band 2 (1900 MHz)	Maximum	**23.5**	**23.5**	**23.5**	**23.5**
	Nominal	**23.0**	**23.0**	**23.0**	**23.0**

Mode / Band		Modulated Average (dBm)
LTE Band 12	Maximum	**24.0**
	Nominal	**23.5**
LTE Band 17	Maximum	**23.5**
	Nominal	**23.0**
LTE Band 5 (Cell)	Maximum	**23.5**
	Nominal	**23.0**
LTE Band 4 (AWS)	Maximum	**24.0**
	Nominal	**23.5**
LTE Band 2 (PCS)	Maximum	**24.0**
	Nominal	**23.5**

Main Antenna Reduced Power – Body at 0.0 cm

Mode / Band		Modulated Average (dBm)			
		3GPP Rel 99	*3GPP Rel 5*	*3GPP Rel 6*	*3GPP Rel 8*
		WCDMA	*HSDPA*	*HSUPA*	*DC-HSDPA*
UMTS Band 5 (850 MHz)	Maximum	**18.1**	**18.1**	**18.1**	**18.1**
	Nominal	**17.6**	**17.6**	**17.6**	**17.6**
UMTS Band 4 (1750 MHz)	Maximum	**13.5**	**13.5**	**13.5**	**13.5**
	Nominal	**13.0**	**13.0**	**13.0**	**13.0**
UMTS Band 2 (1900 MHz)	Maximum	**12.0**	**12.0**	**12.0**	**12.0**
	Nominal	**11.5**	**11.5**	**11.5**	**11.5**

Mode / Band		Modulated Average (dBm)
LTE Band 12	Maximum	**20.0**
	Nominal	**19.5**
LTE Band 17	Maximum	**20.9**
	Nominal	**20.4**
LTE Band 5 (Cell)	Maximum	**19.8**
	Nominal	**19.3**
LTE Band 4 (AWS)	Maximum	**13.7**
	Nominal	**13.2**
LTE Band 2 (PCS)	Maximum	**12.3**
	Nominal	**11.8**

WLAN/BT Antenna Maximum Power

Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	**16.5**
	Nominal	**16.0**
IEEE 802.11g (2.4 GHz)	Maximum	**12.5**
	Nominal	**12.0**
IEEE 802.11n (2.4 GHz)	Maximum	**10.5**
	Nominal	**10.0**
Bluetooth	Maximum	**9.5**
	Nominal	**9.0**
Bluetooth LE	Maximum	**0.0**
	Nominal	**-0.5**

Mode / Band		Modulated Average (dBm)	
		20 MHz Bandwidth	40 MHz Bandwidth
IEEE 802.11a (5 GHz)	Maximum	**11.5**	
	Nominal	**11.0**	
IEEE 802.11n (5 GHz)	Maximum	**10.5**	**10.5**
	Nominal	**10.0**	**10.0**

WLAN Antenna Reduced Power – Body at 0.0 cm

Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	**11.5**
	Nominal	**11.0**
IEEE 802.11g (2.4 GHz)	Maximum	**10.5**
	Nominal	**10.0**
IEEE 802.11n (2.4 GHz)	Maximum	**9.5**
	Nominal	**9.0**

Mode / Band		Modulated Average (dBm)	
		20 MHz Bandwidth	40 MHz Bandwidth
IEEE 802.11a (5 GHz)	Maximum	**6.5**	
	Nominal	**6.0**	
IEEE 802.11n (5 GHz)	Maximum	**5.5**	**7.5**
	Nominal	**5.0**	**7.0**

1.4 DUT Antenna Locations

The overall diagonal dimension of the device is > 200 mm. A diagram showing the locations of the device antennas can be found in Appendix F. Exact antenna dimensions and separation distances are shown in the Technical Descriptions in the FCC filing.

Table 1-1
Sides for SAR Testing

Mode	Back	Top	Bottom	Right	Left
UMTS 850	Yes	Yes	Yes	Yes	Yes
UMTS 1750	Yes	No	Yes	Yes	No
UMTS 1900	Yes	No	Yes	Yes	No
LTE Band 12	Yes	Yes	Yes	Yes	Yes
LTE Band 17	Yes	Yes	Yes	Yes	Yes
LTE Band 5 (Cell)	Yes	Yes	Yes	Yes	Yes
LTE Band 4 (AWS)	Yes	No	Yes	Yes	No
LTE Band 2 (PCS)	Yes	No	Yes	Yes	No
2.4 GHz WLAN	Yes	Yes	No	Yes	No
5 GHz WLAN	Yes	Yes	No	Yes	No
Bluetooth	Yes	Yes	No	Yes	No

Note: Per FCC KDB 616217 D04v01r01, particular DUT edges were not required to be evaluated for SAR based on the SAR exclusion threshold in KDB 447498 D01v05r01. Some edges for UMTS 850 and LTE Bands 12/17/5 were not required to be evaluated for SAR, but were tested per the manufacturer's request.

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 1-1 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 1-1
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 1-2
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

1. 2.4 GHz WLAN, 5 GHz WLAN, and 2.4 GHz Bluetooth share the same antenna path and cannot transmit simultaneously.
2. All licensed modes share the same antenna path and cannot transmit simultaneously.

1.6 Miscellaneous SAR Test Considerations

(A) WIFI/BT

Per FCC KDB 447498 D01v05, the 1g SAR exclusion threshold for distances <50mm is defined by the following equation:

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

Based on the maximum conducted power of Bluetooth LE (rounded to the nearest mW) and the antenna to user separation distance, Bluetooth LE SAR was not required; [(1/5)* √2.480] = 0.3 < 3.0. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.

Since U-NII-1 and U-NII-2A bands have the same maximum output power and the highest reported SAR for U-NII-2A is less than 1.2 W/kg, SAR is not required for U-NII-1 band according to FCC KDB 248227 D01v02.

(B) Licensed Transmitter(s)

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 D01v03.

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 D05v02r03.

1.7 Guidance Applied

- FCC KDB Publication 941225 D01v03, D05v02r03 (3G/4G)
- FCC KDB Publication 248227 D01v02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v05r02 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r03, D02v01r01 (SAR Measurements up to 6 GHz)
- FCC KDB Publication 616217 D04v01r01 (Tablet SAR Considerations)

1.8 Device Serial Numbers

Several samples with identical hardware were used 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.

	Maximum Serial Number	Reduced Serial Number
UMTS 850	11524	01806
UMTS 1750	11524	01798
UMTS 1900	11524	01780
LTE Band 12	11524	01806
LTE Band 17	01991	01884
LTE Band 5 (Cell)	01991	01884
LTE Band 4 (AWS)	11524	01780
LTE Band 2 (PCS)	11490	01806
2.4 GHz WLAN	11490	11490
5 GHz WLAN	11516	11516
Bluetooth	11490	-

2 LTE INFORMATION

LTE Information			
FCC ID	**A3LSMT357W**		
Form Factor	Portable Tablet		
Frequency Range of each LTE transmission band	LTE Band 12 (701.5 - 713.5 MHz)		
	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 12: 5 MHz, 10 MHz		
	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 12: 5 MHz	701.5 (23035)	707.5 (23095)	713.5 (23155)
LTE Band 12: 10 MHz	704 (23060)	707.5 (23095)	711 (23130)
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	4		
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		
LTE Release 10 Additional Information	This device does not support full LTE Release 10 operations in the US. The following LTE Release 10 features are not supported: Carrier Aggregation, Relay, HetNet, Enhanced MIMO, eICI, WIFI Offloading, MDH, eMBMA, Cross-Carrier Scheduling, Enhanced SC-FDMA.		

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:

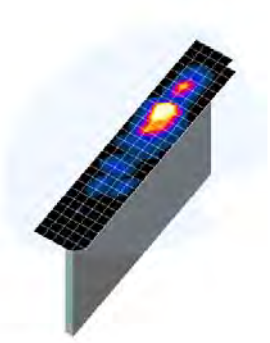


Figure 4-1
Sample SAR Area Scan

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 Device Holder

The device is positioned for test using a SPEAG laptop holder, which is designed for testing larger devices such as laptops, cameras, etc. It is constructed out of low-loss POM, PET-G acrylic glass, and foam.

5.2 SAR Testing for Tablet per KDB Publication 616217 D04v01

This device can be used also in full sized tablet exposure conditions, due to its size. Per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR Exclusion Threshold in KDB 447498 D01v05 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

5.3 Proximity Sensor Considerations

This device uses independent power reduction mechanisms to reduce powers in certain use conditions for both PCB and WLAN operations when the device is used close the user's body. There are no dependencies on either mechanism (i.e. the state of one mechanism does not affect the other).

While the device's antenna is within a certain distance of the user, the sensor activates and reduces the maximum output power allowed. 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 22 mm, a conservative distance of 21 mm was tested for SAR on the back side at maximum power for UMTS and LTE. Since the sensor activation distance for the top edge of the device is 19 mm, a conservative distance of 18 mm was tested for SAR on the back side at maximum power for UMTS and LTE. Since the sensor activation distance for the right edge of the device is 7 mm, a conservative distance of 6 mm was tested for SAR on the back side at maximum power for UMTS and LTE. Since the sensor activation distance for the back side of the device is 13 mm, a conservative distance of 12 mm was tested for SAR on the back side at maximum power for WLAN. Since the sensor activation distance for the top edge of the device is 6 mm, a conservative distance of 5 mm was tested for SAR on the top edge at maximum power for WLAN. Sensor triggering distance summary data is included in Appendix G.

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

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

Power measurements for licensed transmitters are performed using a base station simulator under digital average power.

7.1 Measured and Reported SAR

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

7.2 3G SAR Test Reduction Procedure

In FCC KDB Publication 941225 D01v03, certain transmission modes within a frequency band and wireless mode evaluated for SAR are defined as primary modes. The equivalent modes considered for SAR test reduction are denoted as secondary modes. When the maximum output power including tune-up tolerance specified for production units in a secondary mode is $\leq$ 0.25 dB higher than the primary mode or when the highest reported SAR of the primary mode, scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode, is $\leq$ 1.2 W/kg, SAR measurements are not required for the secondary mode. These criteria are referred to as the 3G SAR test reduction procedure. When the 3G SAR test reduction procedure is not satisfied, SAR measurements are additionally required for the secondary mode.

7.3 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01v03 “3G SAR Measurement Procedures.”

The device is 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 are 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 is 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 deviates by more than 5%, the SAR test and drift measurements are repeated.

7.4 SAR Measurement Conditions for UMTS

7.4.1 Output Power Verification

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, 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.

7.4.2 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all "1s". The 3G SAR test reduction procedure is applied to other spreading codes and multiple $DPDCH_n$ configurations supported by the handset with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreading code or $DPDCH_n$, for the highest reported SAR configuration in 12.2 kbps RMC.

7.4.3 SAR Measurements with Rel 5 HSDPA

The 3G SAR test reduction procedure is applied to HSDPA body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, for the highest reported SAR configuration in 12.2 kbps RMC without HSDPA. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

7.4.4 SAR Measurements with Rel 6 HSUPA

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, 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 and power control algorithm 2, according to the highest reported body SAR configuration in 12.2 kbps RMC without HSPA.

When VOIP applies to head exposure, the 3G SAR test reduction procedure is applied with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body SAR measurements are applied to head exposure testing.

7.4.5 SAR Measurement Conditions for DC-HSDPA

SAR is required for Rel. 8 DC-HSDPA when SAR is required for Rel. 5 HSDPA; otherwise, the 3G SAR test reduction procedure is applied to DC-HSDPA with 12.2 kbps RMC as the primary mode. Power is measured for DC-HSDPA according to the H-Set 12, FRC configuration in Table C.8.1.12 of 3GPP TS 34.121-1 to determine SAR test reduction. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to be acceptable.

7.5 SAR Measurement Conditions for LTE

LTE modes are tested according to FCC KDB 941225 D05v02r03 publication. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 or Anritsu MT8820C simulators are 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).

7.5.1 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.

7.5.2 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.

7.5.3 A-MPR

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

7.5.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r03:

a. Per Section 4.2.1, 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 4.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 4.2.1.
c. Per Section 4.2.3, 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 4.2.4 and 4.3, 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 4.2.1 through 4.2.3 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.

7.6 SAR Testing with 802.11 Transmitters

The normal network operating configurations of 802.11 transmitters are not suitable for SAR measurements. 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 D01 DR02-41929 for more details.

7.6.1 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.

A periodic duty factor is required for current generation SAR systems to measure SAR. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. The reported SAR is scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

7.6.2 U-NII-1 and U-NII-2A

For devices that operate in both U-NII-1 and U-NII-2A bands, when the same maximum output power is specified for both bands, SAR measurement using OFDM SAR test procedures is not required for U-NII-1 unless the highest reported SAR for U-NII-2A is > 1.2 W/kg. When different maximum output powers are specified for the bands, SAR measurement for the U-NII band with the lower maximum output power is not required unless the highest reported SAR for the U-NII band with the higher maximum output power, adjusted by the ratio of lower to higher specified maximum output power for the two bands, is > 1.2 W/kg.

7.6.3 U-NII-2C and U-NII-3

The frequency range covered by U-NII-2C and U-NII-3 is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. When Terminal Doppler Weather Radar (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification.

Unless band gap channels are permanently disabled, SAR must be considered for these channels.

7.6.4 2.4 GHz SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either the fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

2) When the reported SAR is > 0.8 W/kg, SAR is required for that position using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

2.4 GHz 802.11 g/n OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is › 1.2 W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed.

7.6.5 OFDM Transmission Mode and SAR Test Channel Selection

For the 2.4 GHz and 5 GHz bands, when the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation, lowest data rate, and lowest order of 802.11a/g/n/ac mode. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11a, 802.11n and 802.11ac or 802.11g and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 802.11a, then 802.11n and 802.11ac or 802.11g then 802.11n, is used for SAR measurement. When the maximum output power are the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

7.6.6 Initial Test Configuration Procedure

For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output power is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, lowest data rate, and lowest order 802.11a/g/n/ac mode. The channel of the transmission mode with the highest average RF output conducted power will be the initial test configuration.

When the reported SAR is ≤ 0.8 W/kg, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤ 1.2 W/kg or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurements (See Section 7.6.5).

7.6.7 Subsequent Test Configuration Procedures

For OFDM configurations in each frequency band and aggregated band, SAR is evaluated for initial test configuration using the fixed test position or the initial test position procedure. When the highest reported SAR (for the initial test configuration), adjusted by the ratio of the specified maximum output power of the subsequent test configuration to initial test configuration, is ≤ 1.2 W/kg, no additional SAR tests for the subsequent test configurations are required.

8 RF CONDUCTED POWERS

8.1 UMTS Conducted Powers

Table 8-1
Maximum Average RF Output Powers

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			AWS Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	1312	1412	1862	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	22.86	22.91	22.94	22.88	22.93	22.87	22.68	22.79	22.84	-
6	HSDPA	Subtest 1	22.49	22.50	22.56	22.91	22.92	22.89	22.11	22.21	22.29	0
6		Subtest 2	22.44	22.49	22.56	22.89	22.88	22.93	22.14	22.27	22.33	0
6		Subtest 3	21.40	21.45	21.49	22.45	22.35	22.40	21.18	21.21	21.32	0.5
6		Subtest 4	21.34	21.40	21.50	22.41	22.38	22.42	21.08	21.23	21.29	0.5
6	HSUPA	Subtest 1	21.54	21.56	21.68	21.63	21.89	21.91	21.54	21.56	21.62	0
6		Subtest 2	20.53	20.47	20.63	21.08	21.12	21.05	20.49	20.30	20.46	2
6		Subtest 3	20.76	20.95	20.97	21.77	21.62	21.68	20.89	21.06	21.29	1
6		Subtest 4	21.41	21.57	21.59	22.08	21.92	22.06	21.33	21.42	21.48	2
6		Subtest 5	22.31	22.46	22.50	22.91	22.89	22.97	22.18	22.23	22.26	0
8	DC-HSDPA	Subtest 1	22.45	22.52	22.52	23.15	23.12	23.35	22.57	22.68	22.82	0
8		Subtest 2	22.42	22.48	22.51	23.13	23.17	23.26	22.58	22.75	22.76	0
8		Subtest 3	21.39	21.43	21.54	22.77	22.81	22.91	21.56	21.67	21.82	0.5
8		Subtest 4	21.43	21.52	21.52	22.76	22.80	22.97	21.47	21.66	21.78	0.5

Table 8-2
Reduced Average RF Output Powers – Body at 0.0 cm

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			AWS Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	1312	1412	1862	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	17.34	17.34	17.30	13.31	13.06	13.29	11.60	11.75	11.20	-
6	HSDPA	Subtest 1	16.97	16.87	16.86	13.50	13.18	13.48	11.12	11.12	10.80	0
6		Subtest 2	16.88	16.96	16.88	13.49	13.18	13.44	11.11	11.12	10.78	0
6		Subtest 3	15.97	15.98	15.89	13.10	12.67	12.94	10.15	10.16	9.70	0.5
6		Subtest 4	15.97	15.87	15.88	13.19	12.65	12.91	10.15	10.16	9.66	0.5
6	HSUPA	Subtest 1	16.28	16.10	16.29	12.80	12.20	12.63	11.01	11.10	10.13	0
6		Subtest 2	14.97	15.10	15.04	12.00	11.53	11.80	8.89	9.00	8.67	2
6		Subtest 3	14.88	14.65	14.70	12.88	12.33	12.58	8.51	8.56	8.50	1
6		Subtest 4	15.61	15.62	15.66	12.66	12.08	12.41	9.60	9.75	9.36	2
6		Subtest 5	16.70	16.73	16.71	13.50	13.28	13.40	11.19	11.18	10.82	0
8	DC-HSDPA	Subtest 1	16.72	16.71	16.68	13.50	12.93	13.35	11.50	11.28	11.27	0
8		Subtest 2	16.76	16.74	16.65	13.47	12.89	13.33	11.36	11.20	11.00	0
8		Subtest 3	15.93	16.01	15.72	12.99	12.40	12.81	10.44	10.25	9.80	0.5
8		Subtest 4	15.90	16.00	15.92	12.99	12.39	12.82	10.41	10.24	9.78	0.5

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
- The DUT supports UE category 24 for HSDPA

It is expected by the manufacturer that MPR for some HSPA subtests may be up to 2 dB more than specified by 3GPP, but also as low as 0 dB according to the chipset implementation in this model.

Figure 8-1
Power Measurement Setup

8.2 LTE Conducted Powers

8.2.1 LTE Band 12

Table 8-3
LTE Band 12 Conducted Powers - 10 MHz Bandwidth
Maximum Power

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	707.5	23095	10	QPSK	1	0	**23.68**	0	0
	707.5	23095	10	QPSK	1	25	23.66	0	0
	707.5	23095	10	QPSK	1	49	23.50	0	0
	707.5	23095	10	QPSK	25	0	**22.51**	0-1	1
	707.5	23095	10	QPSK	25	12	22.37	0-1	1
	707.5	23095	10	QPSK	25	25	22.39	0-1	1
	707.5	23095	10	QPSK	50	0	22.46	0-1	1
	707.5	23095	10	16QAM	1	0	22.64	0-1	1
	707.5	23095	10	16QAM	1	25	22.58	0-1	1
	707.5	23095	10	16QAM	1	49	22.56	0-1	1
	707.5	23095	10	16QAM	25	0	21.43	0-2	2
	707.5	23095	10	16QAM	25	12	21.38	0-2	2
	707.5	23095	10	16QAM	25	25	21.27	0-2	2
	707.5	23095	10	16QAM	50	0	21.39	0-2	2

Note: LTE Band 12 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 8-4
LTE Band 12 Conducted Powers - 5 MHz Bandwidth
Maximum Power

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	701.5	23035	5	QPSK	1	0	23.66	0	0
	701.5	23035	5	QPSK	1	12	23.72	0	0
	701.5	23035	5	QPSK	1	24	23.80	0	0
	701.5	23035	5	QPSK	12	0	22.46	0-1	1
	701.5	23035	5	QPSK	12	6	22.44	0-1	1
	701.5	23035	5	QPSK	12	13	22.52	0-1	1
	701.5	23035	5	QPSK	25	0	22.41	0-1	1
	701.5	23035	5	16-QAM	1	0	22.78	0-1	1
	701.5	23035	5	16-QAM	1	12	22.81	0-1	1
	701.5	23035	5	16-QAM	1	24	22.84	0-1	1
	701.5	23035	5	16-QAM	12	0	21.40	0-2	2
	701.5	23035	5	16-QAM	12	6	21.39	0-2	2
	701.5	23035	5	16-QAM	12	13	21.42	0-2	2
	701.5	23035	5	16-QAM	25	0	21.43	0-2	2
Mid	707.5	23095	5	QPSK	1	0	23.67	0	0
	707.5	23095	5	QPSK	1	12	23.54	0	0
	707.5	23095	5	QPSK	1	24	23.32	0	0
	707.5	23095	5	QPSK	12	0	22.45	0-1	1
	707.5	23095	5	QPSK	12	6	22.41	0-1	1
	707.5	23095	5	QPSK	12	13	22.47	0-1	1
	707.5	23095	5	QPSK	25	0	22.41	0-1	1
	707.5	23095	5	16-QAM	1	0	22.53	0-1	1
	707.5	23095	5	16-QAM	1	12	22.52	0-1	1
	707.5	23095	5	16-QAM	1	24	22.46	0-1	1
	707.5	23095	5	16-QAM	12	0	21.37	0-2	2
	707.5	23095	5	16-QAM	12	6	21.32	0-2	2
	707.5	23095	5	16-QAM	12	13	21.31	0-2	2
	707.5	23095	5	16-QAM	25	0	21.34	0-2	2
High	713.5	23155	5	QPSK	1	0	23.55	0	0
	713.5	23155	5	QPSK	1	12	23.38	0	0
	713.5	23155	5	QPSK	1	24	23.71	0	0
	713.5	23155	5	QPSK	12	0	22.44	0-1	1
	713.5	23155	5	QPSK	12	6	22.51	0-1	1
	713.5	23155	5	QPSK	12	13	22.50	0-1	1
	713.5	23155	5	QPSK	25	0	22.53	0-1	1
	713.5	23155	5	16-QAM	1	0	22.52	0-1	1
	713.5	23155	5	16-QAM	1	12	22.66	0-1	1
	713.5	23155	5	16-QAM	1	24	22.63	0-1	1
	713.5	23155	5	16-QAM	12	0	21.43	0-2	2
	713.5	23155	5	16-QAM	12	6	21.41	0-2	2
	713.5	23155	5	16-QAM	12	13	21.38	0-2	2
	713.5	23155	5	16-QAM	25	0	21.42	0-2	2

Table 8-5
LTE Band 12 Conducted Powers - 10 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	707.5	23095	10	QPSK	1	0	19.72	0	0
	707.5	23095	10	QPSK	1	25	**19.86**	0	0
	707.5	23095	10	QPSK	1	49	19.68	0	0
	707.5	23095	10	QPSK	25	0	**18.67**	0-1	1
	707.5	23095	10	QPSK	25	12	18.63	0-1	1
	707.5	23095	10	QPSK	25	25	18.53	0-1	1
	707.5	23095	10	QPSK	50	0	18.63	0-1	1
	707.5	23095	10	16QAM	1	0	18.53	0-1	1
	707.5	23095	10	16QAM	1	25	18.90	0-1	1
	707.5	23095	10	16QAM	1	49	18.50	0-1	1
	707.5	23095	10	16QAM	25	0	17.77	0-2	2
	707.5	23095	10	16QAM	25	12	17.82	0-2	2
	707.5	23095	10	16QAM	25	25	17.64	0-2	2
	707.5	23095	10	16QAM	50	0	17.77	0-2	2

Note: LTE Band 12 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 8-6
LTE Band 12 Conducted Powers - 5 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	701.5	23035	5	QPSK	1	0	19.80	0	0
	701.5	23035	5	QPSK	1	12	20.00	0	0
	701.5	23035	5	QPSK	1	24	19.83	0	0
	701.5	23035	5	QPSK	12	0	18.66	0-1	1
	701.5	23035	5	QPSK	12	6	18.60	0-1	1
	701.5	23035	5	QPSK	12	13	18.72	0-1	1
	701.5	23035	5	QPSK	25	0	18.64	0-1	1
	701.5	23035	5	16-QAM	1	0	18.79	0-1	1
	701.5	23035	5	16-QAM	1	12	18.91	0-1	1
	701.5	23035	5	16-QAM	1	24	18.75	0-1	1
	701.5	23035	5	16-QAM	12	0	17.56	0-2	2
	701.5	23035	5	16-QAM	12	6	17.58	0-2	2
	701.5	23035	5	16-QAM	12	13	17.58	0-2	2
	701.5	23035	5	16-QAM	25	0	17.68	0-2	2
Mid	707.5	23095	5	QPSK	1	0	19.77	0	0
	707.5	23095	5	QPSK	1	12	19.41	0	0
	707.5	23095	5	QPSK	1	24	19.65	0	0
	707.5	23095	5	QPSK	12	0	18.83	0-1	1
	707.5	23095	5	QPSK	12	6	18.55	0-1	1
	707.5	23095	5	QPSK	12	13	18.61	0-1	1
	707.5	23095	5	QPSK	25	0	18.63	0-1	1
	707.5	23095	5	16-QAM	1	0	18.30	0-1	1
	707.5	23095	5	16-QAM	1	12	18.27	0-1	1
	707.5	23095	5	16-QAM	1	24	18.31	0-1	1
	707.5	23095	5	16-QAM	12	0	17.64	0-2	2
	707.5	23095	5	16-QAM	12	6	17.49	0-2	2
	707.5	23095	5	16-QAM	12	13	17.45	0-2	2
	707.5	23095	5	16-QAM	25	0	17.92	0-2	2
High	713.5	23155	5	QPSK	1	0	19.57	0	0
	713.5	23155	5	QPSK	1	12	19.84	0	0
	713.5	23155	5	QPSK	1	24	19.73	0	0
	713.5	23155	5	QPSK	12	0	18.68	0-1	1
	713.5	23155	5	QPSK	12	6	18.73	0-1	1
	713.5	23155	5	QPSK	12	13	18.72	0-1	1
	713.5	23155	5	QPSK	25	0	18.73	0-1	1
	713.5	23155	5	16-QAM	1	0	18.43	0-1	1
	713.5	23155	5	16-QAM	1	12	19.00	0-1	1
	713.5	23155	5	16-QAM	1	24	18.41	0-1	1
	713.5	23155	5	16-QAM	12	0	17.68	0-2	2
	713.5	23155	5	16-QAM	12	6	17.55	0-2	2
	713.5	23155	5	16-QAM	12	13	17.73	0-2	2
	713.5	23155	5	16-QAM	25	0	17.80	0-2	2

8.2.1 LTE Band 17

Table 8-7
LTE Band 17 Conducted Powers - 10 MHz Bandwidth
Maximum Power

	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	**23.40**	0	0
	710.0	23790	10	QPSK	1	25	23.26	0	0
	710.0	23790	10	QPSK	1	49	23.38	0	0
	710.0	23790	10	QPSK	25	0	**22.06**	0-1	1
	710.0	23790	10	QPSK	25	12	22.02	0-1	1
	710.0	23790	10	QPSK	25	25	22.01	0-1	1
	710.0	23790	10	QPSK	50	0	22.04	0-1	1
	710.0	23790	10	16QAM	1	0	22.22	0-1	1
	710.0	23790	10	16QAM	1	25	22.00	0-1	1
	710.0	23790	10	16QAM	1	49	22.20	0-1	1
	710.0	23790	10	16QAM	25	0	21.00	0-2	2
	710.0	23790	10	16QAM	25	12	21.00	0-2	2
	710.0	23790	10	16QAM	25	25	21.06	0-2	2
	710.0	23790	10	16QAM	50	0	21.02	0-2	2

Note: LTE Band 17 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 17 Conducted Powers - 5 MHz Bandwidth
Maximum Power

	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	22.96	0	0
	710.0	23790	5	QPSK	1	12	22.98	0	0
	710.0	23790	5	QPSK	1	24	22.88	0	0
	710.0	23790	5	QPSK	12	0	22.17	0-1	1
	710.0	23790	5	QPSK	12	6	22.24	0-1	1
	710.0	23790	5	QPSK	12	13	22.13	0-1	1
	710.0	23790	5	QPSK	25	0	22.13	0-1	1
	710.0	23790	5	16-QAM	1	0	21.92	0-1	1
	710.0	23790	5	16-QAM	1	12	22.24	0-1	1
	710.0	23790	5	16-QAM	1	24	21.86	0-1	1
	710.0	23790	5	16-QAM	12	0	20.97	0-2	2
	710.0	23790	5	16-QAM	12	6	21.06	0-2	2
	710.0	23790	5	16-QAM	12	13	20.95	0-2	2
	710.0	23790	5	16-QAM	25	0	20.84	0-2	2

Note: LTE Band 17 at 5 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 8-9
LTE Band 17 Conducted Powers - 10 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	20.32	0	0
	710.0	23790	10	QPSK	1	25	19.94	0	0
	710.0	23790	10	QPSK	1	49	**20.44**	0	0
	710.0	23790	10	QPSK	25	0	18.93	0-1	1
	710.0	23790	10	QPSK	25	12	18.98	0-1	1
	710.0	23790	10	QPSK	25	25	**19.01**	0-1	1
	710.0	23790	10	QPSK	50	0	18.95	0-1	1
	710.0	23790	10	16QAM	1	0	19.31	0-1	1
	710.0	23790	10	16QAM	1	25	18.93	0-1	1
	710.0	23790	10	16QAM	1	49	19.55	0-1	1
	710.0	23790	10	16QAM	25	0	18.04	0-2	2
	710.0	23790	10	16QAM	25	12	17.91	0-2	2
	710.0	23790	10	16QAM	25	25	18.08	0-2	2
	710.0	23790	10	16QAM	50	0	17.98	0-2	2

Note: LTE Band 17 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 8-10
LTE Band 17 Conducted Powers - 5 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
	710.0	23790	5	QPSK	1	0	19.99	0	0
	710.0	23790	5	QPSK	1	12	20.10	0	0
	710.0	23790	5	QPSK	1	24	19.94	0	0
	710.0	23790	5	QPSK	12	0	18.95	0-1	1
	710.0	23790	5	QPSK	12	6	18.94	0-1	1
	710.0	23790	5	QPSK	12	13	18.98	0-1	1
	710.0	23790	5	QPSK	25	0	18.95	0-1	1
	710.0	23790	5	16-QAM	1	0	18.95	0-1	1
	710.0	23790	5	16-QAM	1	12	18.98	0-1	1
	710.0	23790	5	16-QAM	1	24	18.90	0-1	1
	710.0	23790	5	16-QAM	12	0	17.95	0-2	2
	710.0	23790	5	16-QAM	12	6	18.02	0-2	2
	710.0	23790	5	16-QAM	12	13	18.09	0-2	2
	710.0	23790	5	16-QAM	25	0	18.08	0-2	2

Note: LTE Band 17 at 5 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.

8.2.1 LTE Band 5

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

	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	**23.44**	0	0
	836.5	20525	10	QPSK	1	25	23.01	0	0
	836.5	20525	10	QPSK	1	49	23.02	0	0
	836.5	20525	10	QPSK	25	0	**22.25**	0-1	1
	836.5	20525	10	QPSK	25	12	22.18	0-1	1
	836.5	20525	10	QPSK	25	25	22.21	0-1	1
	836.5	20525	10	QPSK	50	0	22.17	0-1	1
	836.5	20525	10	16QAM	1	0	22.12	0-1	1
	836.5	20525	10	16QAM	1	25	22.00	0-1	1
	836.5	20525	10	16QAM	1	49	22.08	0-1	1
	836.5	20525	10	16QAM	25	0	21.30	0-2	2
	836.5	20525	10	16QAM	25	12	21.01	0-2	2
	836.5	20525	10	16QAM	25	25	21.00	0-2	2
	836.5	20525	10	16QAM	50	0	21.20	0-2	2

Note: LTE Band 5 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
Maximum Power

	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	22.72	0	0
	826.5	20425	5	QPSK	1	12	23.01	0	0
	826.5	20425	5	QPSK	1	24	22.91	0	0
	826.5	20425	5	QPSK	12	0	21.99	0-1	1
	826.5	20425	5	QPSK	12	6	21.84	0-1	1
	826.5	20425	5	QPSK	12	13	21.86	0-1	1
	826.5	20425	5	QPSK	25	0	21.96	0-1	1
	826.5	20425	5	16-QAM	1	0	21.59	0-1	1
	826.5	20425	5	16-QAM	1	12	21.76	0-1	1
	826.5	20425	5	16-QAM	1	24	21.65	0-1	1
	826.5	20425	5	16-QAM	12	0	20.77	0-2	2
	826.5	20425	5	16-QAM	12	6	20.86	0-2	2
	826.5	20425	5	16-QAM	12	13	20.94	0-2	2
	826.5	20425	5	16-QAM	25	0	20.99	0-2	2
Mid	836.5	20525	5	QPSK	1	0	22.62	0	0
	836.5	20525	5	QPSK	1	12	22.63	0	0
	836.5	20525	5	QPSK	1	24	22.87	0	0
	836.5	20525	5	QPSK	12	0	21.77	0-1	1
	836.5	20525	5	QPSK	12	6	21.72	0-1	1
	836.5	20525	5	QPSK	12	13	21.98	0-1	1
	836.5	20525	5	QPSK	25	0	21.93	0-1	1
	836.5	20525	5	16-QAM	1	0	21.58	0-1	1
	836.5	20525	5	16-QAM	1	12	22.19	0-1	1
	836.5	20525	5	16-QAM	1	24	22.19	0-1	1
	836.5	20525	5	16-QAM	12	0	20.84	0-2	2
	836.5	20525	5	16-QAM	12	6	20.87	0-2	2
	836.5	20525	5	16-QAM	12	13	21.14	0-2	2
	836.5	20525	5	16-QAM	25	0	20.90	0-2	2
High	846.5	20625	5	QPSK	1	0	23.18	0	0
	846.5	20625	5	QPSK	1	12	23.24	0	0
	846.5	20625	5	QPSK	1	24	23.03	0	0
	846.5	20625	5	QPSK	12	0	21.94	0-1	1
	846.5	20625	5	QPSK	12	6	21.85	0-1	1
	846.5	20625	5	QPSK	12	13	21.91	0-1	1
	846.5	20625	5	QPSK	25	0	21.98	0-1	1
	846.5	20625	5	16-QAM	1	0	22.37	0-1	1
	846.5	20625	5	16-QAM	1	12	21.96	0-1	1
	846.5	20625	5	16-QAM	1	24	22.50	0-1	1
	846.5	20625	5	16-QAM	12	0	21.33	0-2	2
	846.5	20625	5	16-QAM	12	6	20.88	0-2	2
	846.5	20625	5	16-QAM	12	13	21.05	0-2	2
	846.5	20625	5	16-QAM	25	0	20.96	0-2	2

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

	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	22.62	0	0
	825.5	20415	3	QPSK	1	7	22.71	0	0
	825.5	20415	3	QPSK	1	14	22.65	0	0
	825.5	20415	3	QPSK	8	0	21.63	0-1	1
	825.5	20415	3	QPSK	8	4	21.51	0-1	1
	825.5	20415	3	QPSK	8	7	21.59	0-1	1
	825.5	20415	3	QPSK	15	0	21.61	0-1	1
	825.5	20415	3	16-QAM	1	0	21.71	0-1	1
	825.5	20415	3	16-QAM	1	7	21.78	0-1	1
	825.5	20415	3	16-QAM	1	14	22.01	0-1	1
	825.5	20415	3	16-QAM	8	0	20.54	0-2	2
	825.5	20415	3	16-QAM	8	4	20.51	0-2	2
	825.5	20415	3	16-QAM	8	7	20.52	0-2	2
	825.5	20415	3	16-QAM	15	0	20.58	0-2	2
Mid	836.5	20525	3	QPSK	1	0	22.90	0	0
	836.5	20525	3	QPSK	1	7	22.67	0	0
	836.5	20525	3	QPSK	1	14	22.80	0	0
	836.5	20525	3	QPSK	8	0	21.60	0-1	1
	836.5	20525	3	QPSK	8	4	21.55	0-1	1
	836.5	20525	3	QPSK	8	7	21.53	0-1	1
	836.5	20525	3	QPSK	15	0	21.62	0-1	1
	836.5	20525	3	16-QAM	1	0	22.01	0-1	1
	836.5	20525	3	16-QAM	1	7	21.86	0-1	1
	836.5	20525	3	16-QAM	1	14	22.07	0-1	1
	836.5	20525	3	16-QAM	8	0	20.54	0-2	2
	836.5	20525	3	16-QAM	8	4	20.59	0-2	2
	836.5	20525	3	16-QAM	8	7	20.56	0-2	2
	836.5	20525	3	16-QAM	15	0	20.84	0-2	2
High	847.5	20635	3	QPSK	1	0	22.76	0	0
	847.5	20635	3	QPSK	1	7	22.74	0	0
	847.5	20635	3	QPSK	1	14	22.81	0	0
	847.5	20635	3	QPSK	8	0	21.57	0-1	1
	847.5	20635	3	QPSK	8	4	21.58	0-1	1
	847.5	20635	3	QPSK	8	7	21.61	0-1	1
	847.5	20635	3	QPSK	15	0	21.61	0-1	1
	847.5	20635	3	16-QAM	1	0	22.11	0-1	1
	847.5	20635	3	16-QAM	1	7	21.81	0-1	1
	847.5	20635	3	16-QAM	1	14	21.81	0-1	1
	847.5	20635	3	16-QAM	8	0	20.52	0-2	2
	847.5	20635	3	16-QAM	8	4	20.53	0-2	2
	847.5	20635	3	16-QAM	8	7	20.56	0-2	2
	847.5	20635	3	16-QAM	15	0	20.57	0-2	2

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

	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	22.51	0	0
	824.7	20407	1.4	QPSK	1	2	22.55	0	0
	824.7	20407	1.4	QPSK	1	5	22.64	0	0
	824.7	20407	1.4	QPSK	3	0	22.57	0	0
	824.7	20407	1.4	QPSK	3	2	22.59	0	0
	824.7	20407	1.4	QPSK	3	3	22.54	0	0
	824.7	20407	1.4	QPSK	6	0	21.53	0-1	1
	824.7	20407	1.4	16-QAM	1	0	21.78	0-1	1
	824.7	20407	1.4	16-QAM	1	2	21.72	0-1	1
	824.7	20407	1.4	16-QAM	1	5	21.59	0-1	1
	824.7	20407	1.4	16-QAM	3	0	21.66	0-1	1
	824.7	20407	1.4	16-QAM	3	2	21.67	0-1	1
	824.7	20407	1.4	16-QAM	3	3	21.61	0-1	1
	824.7	20407	1.4	16-QAM	6	0	20.61	0-2	2
Mid	836.5	20525	1.4	QPSK	1	0	22.61	0	0
	836.5	20525	1.4	QPSK	1	2	22.77	0	0
	836.5	20525	1.4	QPSK	1	5	22.59	0	0
	836.5	20525	1.4	QPSK	3	0	22.53	0	0
	836.5	20525	1.4	QPSK	3	2	22.58	0	0
	836.5	20525	1.4	QPSK	3	3	22.56	0	0
	836.5	20525	1.4	QPSK	6	0	21.64	0-1	1
	836.5	20525	1.4	16-QAM	1	0	21.86	0-1	1
	836.5	20525	1.4	16-QAM	1	2	22.04	0-1	1
	836.5	20525	1.4	16-QAM	1	5	21.85	0-1	1
	836.5	20525	1.4	16-QAM	3	0	21.63	0-1	1
	836.5	20525	1.4	16-QAM	3	2	21.68	0-1	1
	836.5	20525	1.4	16-QAM	3	3	21.66	0-1	1
	836.5	20525	1.4	16-QAM	6	0	20.58	0-2	2
High	848.3	20643	1.4	QPSK	1	0	22.59	0	0
	848.3	20643	1.4	QPSK	1	2	22.63	0	0
	848.3	20643	1.4	QPSK	1	5	22.71	0	0
	848.3	20643	1.4	QPSK	3	0	22.56	0	0
	848.3	20643	1.4	QPSK	3	2	22.50	0	0
	848.3	20643	1.4	QPSK	3	3	22.54	0	0
	848.3	20643	1.4	QPSK	6	0	21.51	0-1	1
	848.3	20643	1.4	16-QAM	1	0	21.80	0-1	1
	848.3	20643	1.4	16-QAM	1	2	22.01	0-1	1
	848.3	20643	1.4	16-QAM	1	5	21.75	0-1	1
	848.3	20643	1.4	16-QAM	3	0	21.58	0-1	1
	848.3	20643	1.4	16-QAM	3	2	21.66	0-1	1
	848.3	20643	1.4	16-QAM	3	3	21.58	0-1	1
	848.3	20643	1.4	16-QAM	6	0	20.63	0-2	2

Table 8-15
LTE Band 5 Conducted Powers - 10 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	**19.50**	0	0
	836.5	20525	10	QPSK	1	25	19.19	0	0
	836.5	20525	10	QPSK	1	49	19.42	0	0
	836.5	20525	10	QPSK	25	0	**18.02**	0-1	1
	836.5	20525	10	QPSK	25	12	17.93	0-1	1
	836.5	20525	10	QPSK	25	25	17.93	0-1	1
	836.5	20525	10	QPSK	50	0	17.94	0-1	1
	836.5	20525	10	16QAM	1	0	18.40	0-1	1
	836.5	20525	10	16QAM	1	25	17.88	0-1	1
	836.5	20525	10	16QAM	1	49	18.54	0-1	1
	836.5	20525	10	16QAM	25	0	17.16	0-2	2
	836.5	20525	10	16QAM	25	12	16.93	0-2	2
	836.5	20525	10	16QAM	25	25	16.88	0-2	2
	836.5	20525	10	16QAM	50	0	17.00	0-2	2

Note: LTE Band 5 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 8-16
LTE Band 5 Conducted Powers - 5 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	18.80	0	0
	826.5	20425	5	QPSK	1	12	19.11	0	0
	826.5	20425	5	QPSK	1	24	19.05	0	0
	826.5	20425	5	QPSK	12	0	17.87	0-1	1
	826.5	20425	5	QPSK	12	6	17.84	0-1	1
	826.5	20425	5	QPSK	12	13	17.84	0-1	1
	826.5	20425	5	QPSK	25	0	17.85	0-1	1
	826.5	20425	5	16-QAM	1	0	18.26	0-1	1
	826.5	20425	5	16-QAM	1	12	18.05	0-1	1
	826.5	20425	5	16-QAM	1	24	18.31	0-1	1
	826.5	20425	5	16-QAM	12	0	16.82	0-2	2
	826.5	20425	5	16-QAM	12	6	16.83	0-2	2
	826.5	20425	5	16-QAM	12	13	16.86	0-2	2
	826.5	20425	5	16-QAM	25	0	17.00	0-2	2
Mid	836.5	20525	5	QPSK	1	0	18.92	0	0
	836.5	20525	5	QPSK	1	12	19.00	0	0
	836.5	20525	5	QPSK	1	24	19.12	0	0
	836.5	20525	5	QPSK	12	0	17.80	0-1	1
	836.5	20525	5	QPSK	12	6	17.81	0-1	1
	836.5	20525	5	QPSK	12	13	17.82	0-1	1
	836.5	20525	5	QPSK	25	0	17.80	0-1	1
	836.5	20525	5	16-QAM	1	0	18.25	0-1	1
	836.5	20525	5	16-QAM	1	12	18.00	0-1	1
	836.5	20525	5	16-QAM	1	24	18.12	0-1	1
	836.5	20525	5	16-QAM	12	0	16.82	0-2	2
	836.5	20525	5	16-QAM	12	6	16.83	0-2	2
	836.5	20525	5	16-QAM	12	13	16.82	0-2	2
	836.5	20525	5	16-QAM	25	0	16.81	0-2	2
High	846.5	20625	5	QPSK	1	0	19.09	0	0
	846.5	20625	5	QPSK	1	12	19.30	0	0
	846.5	20625	5	QPSK	1	24	18.99	0	0
	846.5	20625	5	QPSK	12	0	17.84	0-1	1
	846.5	20625	5	QPSK	12	6	17.84	0-1	1
	846.5	20625	5	QPSK	12	13	17.88	0-1	1
	846.5	20625	5	QPSK	25	0	17.93	0-1	1
	846.5	20625	5	16-QAM	1	0	18.32	0-1	1
	846.5	20625	5	16-QAM	1	12	18.35	0-1	1
	846.5	20625	5	16-QAM	1	24	18.31	0-1	1
	846.5	20625	5	16-QAM	12	0	16.90	0-2	2
	846.5	20625	5	16-QAM	12	6	16.84	0-2	2
	846.5	20625	5	16-QAM	12	13	16.88	0-2	2
	846.5	20625	5	16-QAM	25	0	17.00	0-2	2

Table 8-17
LTE Band 5 Conducted Powers - 3 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	19.00	0	0
	825.5	20415	3	QPSK	1	7	19.11	0	0
	825.5	20415	3	QPSK	1	14	19.06	0	0
	825.5	20415	3	QPSK	8	0	17.80	0-1	1
	825.5	20415	3	QPSK	8	4	17.85	0-1	1
	825.5	20415	3	QPSK	8	7	17.88	0-1	1
	825.5	20415	3	QPSK	15	0	17.88	0-1	1
	825.5	20415	3	16-QAM	1	0	18.00	0-1	1
	825.5	20415	3	16-QAM	1	7	18.15	0-1	1
	825.5	20415	3	16-QAM	1	14	18.20	0-1	1
	825.5	20415	3	16-QAM	8	0	17.00	0-2	2
	825.5	20415	3	16-QAM	8	4	16.93	0-2	2
	825.5	20415	3	16-QAM	8	7	17.11	0-2	2
	825.5	20415	3	16-QAM	15	0	17.11	0-2	2
Mid	836.5	20525	3	QPSK	1	0	19.09	0	0
	836.5	20525	3	QPSK	1	7	19.12	0	0
	836.5	20525	3	QPSK	1	14	19.07	0	0
	836.5	20525	3	QPSK	8	0	17.84	0-1	1
	836.5	20525	3	QPSK	8	4	17.92	0-1	1
	836.5	20525	3	QPSK	8	7	17.90	0-1	1
	836.5	20525	3	QPSK	15	0	17.82	0-1	1
	836.5	20525	3	16-QAM	1	0	18.02	0-1	1
	836.5	20525	3	16-QAM	1	7	18.12	0-1	1
	836.5	20525	3	16-QAM	1	14	18.11	0-1	1
	836.5	20525	3	16-QAM	8	0	16.92	0-2	2
	836.5	20525	3	16-QAM	8	4	17.00	0-2	2
	836.5	20525	3	16-QAM	8	7	16.90	0-2	2
	836.5	20525	3	16-QAM	15	0	17.04	0-2	2
High	847.5	20635	3	QPSK	1	0	19.10	0	0
	847.5	20635	3	QPSK	1	7	19.05	0	0
	847.5	20635	3	QPSK	1	14	18.94	0	0
	847.5	20635	3	QPSK	8	0	17.92	0-1	1
	847.5	20635	3	QPSK	8	4	17.91	0-1	1
	847.5	20635	3	QPSK	8	7	17.81	0-1	1
	847.5	20635	3	QPSK	15	0	17.83	0-1	1
	847.5	20635	3	16-QAM	1	0	18.10	0-1	1
	847.5	20635	3	16-QAM	1	7	17.97	0-1	1
	847.5	20635	3	16-QAM	1	14	17.94	0-1	1
	847.5	20635	3	16-QAM	8	0	17.13	0-2	2
	847.5	20635	3	16-QAM	8	4	17.03	0-2	2
	847.5	20635	3	16-QAM	8	7	17.11	0-2	2
	847.5	20635	3	16-QAM	15	0	17.00	0-2	2

Table 8-18
LTE Band 5 Conducted Powers – 1.4 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	19.08	0	0
	824.7	20407	1.4	QPSK	1	2	19.34	0	0
	824.7	20407	1.4	QPSK	1	5	19.06	0	0
	824.7	20407	1.4	QPSK	3	0	18.91	0	0
	824.7	20407	1.4	QPSK	3	2	18.82	0	0
	824.7	20407	1.4	QPSK	3	3	18.95	0	0
	824.7	20407	1.4	QPSK	6	0	17.91	0-1	1
	824.7	20407	1.4	16-QAM	1	0	18.04	0-1	1
	824.7	20407	1.4	16-QAM	1	2	18.00	0-1	1
	824.7	20407	1.4	16-QAM	1	5	17.93	0-1	1
	824.7	20407	1.4	16-QAM	3	0	17.97	0-1	1
	824.7	20407	1.4	16-QAM	3	2	18.01	0-1	1
	824.7	20407	1.4	16-QAM	3	3	17.92	0-1	1
	824.7	20407	1.4	16-QAM	6	0	16.80	0-2	2
Mid	836.5	20525	1.4	QPSK	1	0	18.95	0	0
	836.5	20525	1.4	QPSK	1	2	19.39	0	0
	836.5	20525	1.4	QPSK	1	5	19.03	0	0
	836.5	20525	1.4	QPSK	3	0	18.90	0	0
	836.5	20525	1.4	QPSK	3	2	18.91	0	0
	836.5	20525	1.4	QPSK	3	3	18.87	0	0
	836.5	20525	1.4	QPSK	6	0	17.81	0-1	1
	836.5	20525	1.4	16-QAM	1	0	18.35	0-1	1
	836.5	20525	1.4	16-QAM	1	2	18.35	0-1	1
	836.5	20525	1.4	16-QAM	1	5	18.37	0-1	1
	836.5	20525	1.4	16-QAM	3	0	18.02	0-1	1
	836.5	20525	1.4	16-QAM	3	2	18.00	0-1	1
	836.5	20525	1.4	16-QAM	3	3	18.04	0-1	1
	836.5	20525	1.4	16-QAM	6	0	17.09	0-2	2
High	848.3	20643	1.4	QPSK	1	0	19.02	0	0
	848.3	20643	1.4	QPSK	1	2	19.09	0	0
	848.3	20643	1.4	QPSK	1	5	18.94	0	0
	848.3	20643	1.4	QPSK	3	0	18.95	0	0
	848.3	20643	1.4	QPSK	3	2	18.81	0	0
	848.3	20643	1.4	QPSK	3	3	18.84	0	0
	848.3	20643	1.4	QPSK	6	0	17.83	0-1	1
	848.3	20643	1.4	16-QAM	1	0	18.51	0-1	1
	848.3	20643	1.4	16-QAM	1	2	18.38	0-1	1
	848.3	20643	1.4	16-QAM	1	5	18.27	0-1	1
	848.3	20643	1.4	16-QAM	3	0	18.02	0-1	1
	848.3	20643	1.4	16-QAM	3	2	17.99	0-1	1
	848.3	20643	1.4	16-QAM	3	3	18.00	0-1	1
	848.3	20643	1.4	16-QAM	6	0	17.02	0-2	2

8.2.2 LTE Band 4 (AWS)

Table 8-19
LTE Band 4 (AWS) Conducted Powers - 20 MHz Bandwidth
Maximum Power

	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	**23.71**	0	0
	1732.5	20175	20	QPSK	1	50	23.52	0	0
	1732.5	20175	20	QPSK	1	99	23.50	0	0
	1732.5	20175	20	QPSK	50	0	**22.75**	0-1	1
	1732.5	20175	20	QPSK	50	25	22.66	0-1	1
	1732.5	20175	20	QPSK	50	50	22.48	0-1	1
	1732.5	20175	20	QPSK	100	0	22.53	0-1	1
	1732.5	20175	20	16QAM	1	0	22.68	0-1	1
	1732.5	20175	20	16QAM	1	50	22.32	0-1	1
	1732.5	20175	20	16QAM	1	99	22.25	0-1	1
	1732.5	20175	20	16QAM	50	0	21.81	0-2	2
	1732.5	20175	20	16QAM	50	25	21.48	0-2	2
	1732.5	20175	20	16QAM	50	50	21.41	0-2	2
	1732.5	20175	20	16QAM	100	0	21.65	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 8-20
LTE Band 4 (AWS) Conducted Powers - 15 MHz Bandwidth
Maximum Power

	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	24.00	0	0
	1717.5	20025	15	QPSK	1	36	23.79	0	0
	1717.5	20025	15	QPSK	1	74	23.78	0	0
	1717.5	20025	15	QPSK	36	0	22.70	0-1	1
	1717.5	20025	15	QPSK	36	18	22.68	0-1	1
	1717.5	20025	15	QPSK	36	37	22.76	0-1	1
	1717.5	20025	15	QPSK	75	0	22.75	0-1	1
	1717.5	20025	15	16QAM	1	0	23.00	0-1	1
	1717.5	20025	15	16QAM	1	36	22.34	0-1	1
	1717.5	20025	15	16QAM	1	74	22.53	0-1	1
	1717.5	20025	15	16QAM	36	0	21.65	0-2	2
	1717.5	20025	15	16QAM	36	18	21.64	0-2	2
	1717.5	20025	15	16QAM	36	37	21.65	0-2	2
	1717.5	20025	15	16QAM	75	0	21.72	0-2	2
Mid	1732.5	20175	15	QPSK	1	0	23.82	0	0
	1732.5	20175	15	QPSK	1	36	23.89	0	0
	1732.5	20175	15	QPSK	1	74	23.90	0	0
	1732.5	20175	15	QPSK	36	0	22.78	0-1	1
	1732.5	20175	15	QPSK	36	18	22.67	0-1	1
	1732.5	20175	15	QPSK	36	37	22.63	0-1	1
	1732.5	20175	15	QPSK	75	0	22.73	0-1	1
	1732.5	20175	15	16QAM	1	0	22.75	0-1	1
	1732.5	20175	15	16QAM	1	36	22.20	0-1	1
	1732.5	20175	15	16QAM	1	74	22.75	0-1	1
	1732.5	20175	15	16QAM	36	0	21.73	0-2	2
	1732.5	20175	15	16QAM	36	18	21.63	0-2	2
	1732.5	20175	15	16QAM	36	37	21.70	0-2	2
	1732.5	20175	15	16QAM	75	0	21.73	0-2	2
High	1747.5	20325	15	QPSK	1	0	23.83	0	0
	1747.5	20325	15	QPSK	1	36	23.85	0	0
	1747.5	20325	15	QPSK	1	74	23.89	0	0
	1747.5	20325	15	QPSK	36	0	22.74	0-1	1
	1747.5	20325	15	QPSK	36	18	22.78	0-1	1
	1747.5	20325	15	QPSK	36	37	22.84	0-1	1
	1747.5	20325	15	QPSK	75	0	22.74	0-1	1
	1747.5	20325	15	16QAM	1	0	22.99	0-1	1
	1747.5	20325	15	16QAM	1	36	22.88	0-1	1
	1747.5	20325	15	16QAM	1	74	22.91	0-1	1
	1747.5	20325	15	16QAM	36	0	21.75	0-2	2
	1747.5	20325	15	16QAM	36	18	21.65	0-2	2
	1747.5	20325	15	16QAM	36	37	21.72	0-2	2
	1747.5	20325	15	16QAM	75	0	21.75	0-2	2

Table 8-21
LTE Band 4 (AWS) Conducted Powers - 10 MHz Bandwidth
Maximum Power

	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	24.00	0	0
	1715	20000	10	QPSK	1	25	23.81	0	0
	1715	20000	10	QPSK	1	49	23.92	0	0
	1715	20000	10	QPSK	25	0	22.76	0-1	1
	1715	20000	10	QPSK	25	12	22.75	0-1	1
	1715	20000	10	QPSK	25	25	22.76	0-1	1
	1715	20000	10	QPSK	50	0	22.67	0-1	1
	1715	20000	10	16QAM	1	0	23.00	0-1	1
	1715	20000	10	16QAM	1	25	22.15	0-1	1
	1715	20000	10	16QAM	1	49	22.48	0-1	1
	1715	20000	10	16QAM	25	0	21.84	0-2	2
	1715	20000	10	16QAM	25	12	21.83	0-2	2
	1715	20000	10	16QAM	25	25	21.61	0-2	2
	1715	20000	10	16QAM	50	0	21.65	0-2	2
Mid	1732.5	20175	10	QPSK	1	0	23.93	0	0
	1732.5	20175	10	QPSK	1	25	23.88	0	0
	1732.5	20175	10	QPSK	1	49	24.00	0	0
	1732.5	20175	10	QPSK	25	0	22.85	0-1	1
	1732.5	20175	10	QPSK	25	12	22.78	0-1	1
	1732.5	20175	10	QPSK	25	25	22.68	0-1	1
	1732.5	20175	10	QPSK	50	0	22.78	0-1	1
	1732.5	20175	10	16QAM	1	0	22.88	0-1	1
	1732.5	20175	10	16QAM	1	25	22.86	0-1	1
	1732.5	20175	10	16QAM	1	49	22.82	0-1	1
	1732.5	20175	10	16QAM	25	0	21.75	0-2	2
	1732.5	20175	10	16QAM	25	12	21.82	0-2	2
	1732.5	20175	10	16QAM	25	25	21.67	0-2	2
	1732.5	20175	10	16QAM	50	0	21.70	0-2	2
High	1750	20350	10	QPSK	1	0	23.97	0	0
	1750	20350	10	QPSK	1	25	23.84	0	0
	1750	20350	10	QPSK	1	49	23.89	0	0
	1750	20350	10	QPSK	25	0	22.82	0-1	1
	1750	20350	10	QPSK	25	12	22.79	0-1	1
	1750	20350	10	QPSK	25	25	22.74	0-1	1
	1750	20350	10	QPSK	50	0	22.83	0-1	1
	1750	20350	10	16QAM	1	0	22.98	0-1	1
	1750	20350	10	16QAM	1	25	23.00	0-1	1
	1750	20350	10	16QAM	1	49	22.95	0-1	1
	1750	20350	10	16QAM	25	0	21.75	0-2	2
	1750	20350	10	16QAM	25	12	21.79	0-2	2
	1750	20350	10	16QAM	25	25	21.75	0-2	2
	1750	20350	10	16QAM	50	0	21.84	0-2	2

Table 8-22
LTE Band 4 (AWS) Conducted Powers - 5 MHz Bandwidth
Maximum Power

	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	23.91	0	0
	1712.5	19975	5	QPSK	1	12	23.67	0	0
	1712.5	19975	5	QPSK	1	24	23.59	0	0
	1712.5	19975	5	QPSK	12	0	22.66	0-1	1
	1712.5	19975	5	QPSK	12	6	22.72	0-1	1
	1712.5	19975	5	QPSK	12	13	22.64	0-1	1
	1712.5	19975	5	QPSK	25	0	22.70	0-1	1
	1712.5	19975	5	16-QAM	1	0	22.83	0-1	1
	1712.5	19975	5	16-QAM	1	12	23.00	0-1	1
	1712.5	19975	5	16-QAM	1	24	22.85	0-1	1
	1712.5	19975	5	16-QAM	12	0	21.40	0-2	2
	1712.5	19975	5	16-QAM	12	6	21.43	0-2	2
	1712.5	19975	5	16-QAM	12	13	21.56	0-2	2
	1712.5	19975	5	16-QAM	25	0	21.52	0-2	2
Mid	1732.5	20175	5	QPSK	1	0	23.39	0	0
	1732.5	20175	5	QPSK	1	12	23.81	0	0
	1732.5	20175	5	QPSK	1	24	23.64	0	0
	1732.5	20175	5	QPSK	12	0	22.74	0-1	1
	1732.5	20175	5	QPSK	12	6	22.73	0-1	1
	1732.5	20175	5	QPSK	12	13	22.63	0-1	1
	1732.5	20175	5	QPSK	25	0	22.78	0-1	1
	1732.5	20175	5	16-QAM	1	0	22.70	0-1	1
	1732.5	20175	5	16-QAM	1	12	22.34	0-1	1
	1732.5	20175	5	16-QAM	1	24	22.54	0-1	1
	1732.5	20175	5	16-QAM	12	0	21.94	0-2	2
	1732.5	20175	5	16-QAM	12	6	21.92	0-2	2
	1732.5	20175	5	16-QAM	12	13	21.83	0-2	2
	1732.5	20175	5	16-QAM	25	0	21.78	0-2	2
High	1752.5	20375	5	QPSK	1	0	23.71	0	0
	1752.5	20375	5	QPSK	1	12	24.00	0	0
	1752.5	20375	5	QPSK	1	24	23.81	0	0
	1752.5	20375	5	QPSK	12	0	22.89	0-1	1
	1752.5	20375	5	QPSK	12	6	22.72	0-1	1
	1752.5	20375	5	QPSK	12	13	22.80	0-1	1
	1752.5	20375	5	QPSK	25	0	22.76	0-1	1
	1752.5	20375	5	16-QAM	1	0	22.95	0-1	1
	1752.5	20375	5	16-QAM	1	12	22.93	0-1	1
	1752.5	20375	5	16-QAM	1	24	22.70	0-1	1
	1752.5	20375	5	16-QAM	12	0	21.75	0-2	2
	1752.5	20375	5	16-QAM	12	6	21.69	0-2	2
	1752.5	20375	5	16-QAM	12	13	21.63	0-2	2
	1752.5	20375	5	16-QAM	25	0	21.70	0-2	2

Table 8-23
LTE Band 4 (AWS) Conducted Powers - 3 MHz Bandwidth
Maximum Power

	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	23.81	0	0
	1711.5	19965	3	QPSK	1	7	23.74	0	0
	1711.5	19965	3	QPSK	1	14	23.69	0	0
	1711.5	19965	3	QPSK	8	0	22.73	0-1	1
	1711.5	19965	3	QPSK	8	4	22.68	0-1	1
	1711.5	19965	3	QPSK	8	7	22.66	0-1	1
	1711.5	19965	3	QPSK	15	0	22.61	0-1	1
	1711.5	19965	3	16-QAM	1	0	22.45	0-1	1
	1711.5	19965	3	16-QAM	1	7	22.50	0-1	1
	1711.5	19965	3	16-QAM	1	14	22.40	0-1	1
	1711.5	19965	3	16-QAM	8	0	21.75	0-2	2
	1711.5	19965	3	16-QAM	8	4	21.81	0-2	2
	1711.5	19965	3	16-QAM	8	7	21.69	0-2	2
	1711.5	19965	3	16-QAM	15	0	21.64	0-2	2
Mid	1732.5	20175	3	QPSK	1	0	23.88	0	0
	1732.5	20175	3	QPSK	1	7	23.84	0	0
	1732.5	20175	3	QPSK	1	14	23.77	0	0
	1732.5	20175	3	QPSK	8	0	22.75	0-1	1
	1732.5	20175	3	QPSK	8	4	22.77	0-1	1
	1732.5	20175	3	QPSK	8	7	22.68	0-1	1
	1732.5	20175	3	QPSK	15	0	22.76	0-1	1
	1732.5	20175	3	16-QAM	1	0	22.71	0-1	1
	1732.5	20175	3	16-QAM	1	7	22.63	0-1	1
	1732.5	20175	3	16-QAM	1	14	22.64	0-1	1
	1732.5	20175	3	16-QAM	8	0	21.58	0-2	2
	1732.5	20175	3	16-QAM	8	4	21.73	0-2	2
	1732.5	20175	3	16-QAM	8	7	21.64	0-2	2
	1732.5	20175	3	16-QAM	15	0	21.69	0-2	2
High	1753.5	20385	3	QPSK	1	0	23.93	0	0
	1753.5	20385	3	QPSK	1	7	23.91	0	0
	1753.5	20385	3	QPSK	1	14	23.88	0	0
	1753.5	20385	3	QPSK	8	0	22.77	0-1	1
	1753.5	20385	3	QPSK	8	4	22.78	0-1	1
	1753.5	20385	3	QPSK	8	7	22.71	0-1	1
	1753.5	20385	3	QPSK	15	0	22.82	0-1	1
	1753.5	20385	3	16-QAM	1	0	22.98	0-1	1
	1753.5	20385	3	16-QAM	1	7	23.00	0-1	1
	1753.5	20385	3	16-QAM	1	14	22.96	0-1	1
	1753.5	20385	3	16-QAM	8	0	21.87	0-2	2
	1753.5	20385	3	16-QAM	8	4	21.77	0-2	2
	1753.5	20385	3	16-QAM	8	7	21.72	0-2	2
	1753.5	20385	3	16-QAM	15	0	21.36	0-2	2

Table 8-24
LTE Band 4 (AWS) Conducted Powers - 1.4 MHz Bandwidth
Maximum Power

	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	23.99	0	0
	1710.7	19957	1.4	QPSK	1	2	24.00	0	0
	1710.7	19957	1.4	QPSK	1	5	23.96	0	0
	1710.7	19957	1.4	QPSK	3	0	23.87	0	0
	1710.7	19957	1.4	QPSK	3	2	23.74	0	0
	1710.7	19957	1.4	QPSK	3	3	23.81	0	0
	1710.7	19957	1.4	QPSK	6	0	22.72	0-1	1
	1710.7	19957	1.4	16-QAM	1	0	22.11	0-1	1
	1710.7	19957	1.4	16-QAM	1	2	22.23	0-1	1
	1710.7	19957	1.4	16-QAM	1	5	22.10	0-1	1
	1710.7	19957	1.4	16-QAM	3	0	22.37	0-1	1
	1710.7	19957	1.4	16-QAM	3	2	22.48	0-1	1
	1710.7	19957	1.4	16-QAM	3	3	22.56	0-1	1
	1710.7	19957	1.4	16-QAM	6	0	21.60	0-2	2
Mid	1732.5	20175	1.4	QPSK	1	0	24.00	0	0
	1732.5	20175	1.4	QPSK	1	2	23.96	0	0
	1732.5	20175	1.4	QPSK	1	5	23.99	0	0
	1732.5	20175	1.4	QPSK	3	0	23.68	0	0
	1732.5	20175	1.4	QPSK	3	2	23.84	0	0
	1732.5	20175	1.4	QPSK	3	3	23.67	0	0
	1732.5	20175	1.4	QPSK	6	0	22.73	0-1	1
	1732.5	20175	1.4	16-QAM	1	0	22.90	0-1	1
	1732.5	20175	1.4	16-QAM	1	2	22.92	0-1	1
	1732.5	20175	1.4	16-QAM	1	5	22.73	0-1	1
	1732.5	20175	1.4	16-QAM	3	0	22.85	0-1	1
	1732.5	20175	1.4	16-QAM	3	2	22.79	0-1	1
	1732.5	20175	1.4	16-QAM	3	3	22.63	0-1	1
	1732.5	20175	1.4	16-QAM	6	0	21.97	0-2	2
High	1754.3	20393	1.4	QPSK	1	0	23.85	0	0
	1754.3	20393	1.4	QPSK	1	2	23.91	0	0
	1754.3	20393	1.4	QPSK	1	5	23.99	0	0
	1754.3	20393	1.4	QPSK	3	0	23.76	0	0
	1754.3	20393	1.4	QPSK	3	2	23.75	0	0
	1754.3	20393	1.4	QPSK	3	3	23.80	0	0
	1754.3	20393	1.4	QPSK	6	0	22.78	0-1	1
	1754.3	20393	1.4	16-QAM	1	0	22.90	0-1	1
	1754.3	20393	1.4	16-QAM	1	2	23.00	0-1	1
	1754.3	20393	1.4	16-QAM	1	5	22.95	0-1	1
	1754.3	20393	1.4	16-QAM	3	0	22.96	0-1	1
	1754.3	20393	1.4	16-QAM	3	2	22.84	0-1	1
	1754.3	20393	1.4	16-QAM	3	3	22.85	0-1	1
	1754.3	20393	1.4	16-QAM	6	0	22.00	0-2	2

Table 8-25
LTE Band 4 (AWS) Conducted Powers - 20 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	**13.60**	0	0
	1732.5	20175	20	QPSK	1	50	13.15	0	0
	1732.5	20175	20	QPSK	1	99	13.32	0	0
	1732.5	20175	20	QPSK	50	0	**12.03**	0-1	1
	1732.5	20175	20	QPSK	50	25	11.87	0-1	1
	1732.5	20175	20	QPSK	50	50	11.80	0-1	1
	1732.5	20175	20	QPSK	100	0	11.87	0-1	1
	1732.5	20175	20	16QAM	1	0	12.60	0-1	1
	1732.5	20175	20	16QAM	1	50	12.41	0-1	1
	1732.5	20175	20	16QAM	1	99	12.64	0-1	1
	1732.5	20175	20	16QAM	50	0	11.34	0-2	2
	1732.5	20175	20	16QAM	50	25	11.04	0-2	2
	1732.5	20175	20	16QAM	50	50	11.05	0-2	2
	1732.5	20175	20	16QAM	100	0	10.96	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 8-26
LTE Band 4 (AWS) Conducted Powers - 15 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	13.50	0	0
	1717.5	20025	15	QPSK	1	36	12.79	0	0
	1717.5	20025	15	QPSK	1	74	13.20	0	0
	1717.5	20025	15	QPSK	36	0	11.77	0-1	1
	1717.5	20025	15	QPSK	36	18	11.79	0-1	1
	1717.5	20025	15	QPSK	36	37	11.74	0-1	1
	1717.5	20025	15	QPSK	75	0	11.76	0-1	1
	1717.5	20025	15	16QAM	1	0	12.49	0-1	1
	1717.5	20025	15	16QAM	1	36	11.70	0-1	1
	1717.5	20025	15	16QAM	1	74	12.25	0-1	1
	1717.5	20025	15	16QAM	36	0	10.82	0-2	2
	1717.5	20025	15	16QAM	36	18	10.79	0-2	2
	1717.5	20025	15	16QAM	36	37	10.76	0-2	2
	1717.5	20025	15	16QAM	75	0	10.80	0-2	2
Mid	1732.5	20175	15	QPSK	1	0	13.32	0	0
	1732.5	20175	15	QPSK	1	36	13.24	0	0
	1732.5	20175	15	QPSK	1	74	13.04	0	0
	1732.5	20175	15	QPSK	36	0	11.90	0-1	1
	1732.5	20175	15	QPSK	36	18	11.93	0-1	1
	1732.5	20175	15	QPSK	36	37	11.82	0-1	1
	1732.5	20175	15	QPSK	75	0	11.85	0-1	1
	1732.5	20175	15	16QAM	1	0	12.29	0-1	1
	1732.5	20175	15	16QAM	1	36	12.08	0-1	1
	1732.5	20175	15	16QAM	1	74	11.88	0-1	1
	1732.5	20175	15	16QAM	36	0	10.87	0-2	2
	1732.5	20175	15	16QAM	36	18	10.94	0-2	2
	1732.5	20175	15	16QAM	36	37	10.82	0-2	2
	1732.5	20175	15	16QAM	75	0	10.83	0-2	2
High	1747.5	20325	15	QPSK	1	0	13.50	0	0
	1747.5	20325	15	QPSK	1	36	12.73	0	0
	1747.5	20325	15	QPSK	1	74	13.35	0	0
	1747.5	20325	15	QPSK	36	0	11.90	0-1	1
	1747.5	20325	15	QPSK	36	18	11.74	0-1	1
	1747.5	20325	15	QPSK	36	37	11.89	0-1	1
	1747.5	20325	15	QPSK	75	0	11.90	0-1	1
	1747.5	20325	15	16QAM	1	0	12.47	0-1	1
	1747.5	20325	15	16QAM	1	36	11.77	0-1	1
	1747.5	20325	15	16QAM	1	74	12.37	0-1	1
	1747.5	20325	15	16QAM	36	0	10.86	0-2	2
	1747.5	20325	15	16QAM	36	18	10.78	0-2	2
	1747.5	20325	15	16QAM	36	37	10.99	0-2	2
	1747.5	20325	15	16QAM	75	0	10.74	0-2	2

Table 8-27
LTE Band 4 (AWS) Conducted Powers - 10 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	13.29	0	0
	1715	20000	10	QPSK	1	25	12.74	0	0
	1715	20000	10	QPSK	1	49	13.18	0	0
	1715	20000	10	QPSK	25	0	11.80	0-1	1
	1715	20000	10	QPSK	25	12	11.72	0-1	1
	1715	20000	10	QPSK	25	25	11.74	0-1	1
	1715	20000	10	QPSK	50	0	11.72	0-1	1
	1715	20000	10	16QAM	1	0	12.39	0-1	1
	1715	20000	10	16QAM	1	25	11.77	0-1	1
	1715	20000	10	16QAM	1	49	12.31	0-1	1
	1715	20000	10	16QAM	25	0	10.82	0-2	2
	1715	20000	10	16QAM	25	12	10.79	0-2	2
	1715	20000	10	16QAM	25	25	10.80	0-2	2
	1715	20000	10	16QAM	50	0	10.76	0-2	2
Mid	1732.5	20175	10	QPSK	1	0	13.00	0	0
	1732.5	20175	10	QPSK	1	25	13.00	0	0
	1732.5	20175	10	QPSK	1	49	12.81	0	0
	1732.5	20175	10	QPSK	25	0	11.83	0-1	1
	1732.5	20175	10	QPSK	25	12	11.90	0-1	1
	1732.5	20175	10	QPSK	25	25	11.91	0-1	1
	1732.5	20175	10	QPSK	50	0	11.77	0-1	1
	1732.5	20175	10	16QAM	1	0	12.24	0-1	1
	1732.5	20175	10	16QAM	1	25	12.26	0-1	1
	1732.5	20175	10	16QAM	1	49	11.89	0-1	1
	1732.5	20175	10	16QAM	25	0	10.85	0-2	2
	1732.5	20175	10	16QAM	25	12	10.92	0-2	2
	1732.5	20175	10	16QAM	25	25	10.88	0-2	2
	1732.5	20175	10	16QAM	50	0	10.83	0-2	2
High	1750	20350	10	QPSK	1	0	13.16	0	0
	1750	20350	10	QPSK	1	25	12.70	0	0
	1750	20350	10	QPSK	1	49	12.96	0	0
	1750	20350	10	QPSK	25	0	11.79	0-1	1
	1750	20350	10	QPSK	25	12	11.86	0-1	1
	1750	20350	10	QPSK	25	25	12.03	0-1	1
	1750	20350	10	QPSK	50	0	11.76	0-1	1
	1750	20350	10	16QAM	1	0	12.38	0-1	1
	1750	20350	10	16QAM	1	25	11.72	0-1	1
	1750	20350	10	16QAM	1	49	12.27	0-1	1
	1750	20350	10	16QAM	25	0	10.76	0-2	2
	1750	20350	10	16QAM	25	12	10.83	0-2	2
	1750	20350	10	16QAM	25	25	11.06	0-2	2
	1750	20350	10	16QAM	50	0	10.72	0-2	2

Table 8-28
LTE Band 4 (AWS) Conducted Powers - 5 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	12.91	0	0
	1712.5	19975	5	QPSK	1	12	12.70	0	0
	1712.5	19975	5	QPSK	1	24	12.84	0	0
	1712.5	19975	5	QPSK	12	0	11.79	0-1	1
	1712.5	19975	5	QPSK	12	6	11.72	0-1	1
	1712.5	19975	5	QPSK	12	13	11.70	0-1	1
	1712.5	19975	5	QPSK	25	0	11.74	0-1	1
	1712.5	19975	5	16-QAM	1	0	12.27	0-1	1
	1712.5	19975	5	16-QAM	1	12	11.73	0-1	1
	1712.5	19975	5	16-QAM	1	24	12.16	0-1	1
	1712.5	19975	5	16-QAM	12	0	10.83	0-2	2
	1712.5	19975	5	16-QAM	12	6	10.74	0-2	2
	1712.5	19975	5	16-QAM	12	13	10.72	0-2	2
	1712.5	19975	5	16-QAM	25	0	10.72	0-2	2
Mid	1732.5	20175	5	QPSK	1	0	13.00	0	0
	1732.5	20175	5	QPSK	1	12	13.08	0	0
	1732.5	20175	5	QPSK	1	24	12.99	0	0
	1732.5	20175	5	QPSK	12	0	11.73	0-1	1
	1732.5	20175	5	QPSK	12	6	11.83	0-1	1
	1732.5	20175	5	QPSK	12	13	11.90	0-1	1
	1732.5	20175	5	QPSK	25	0	11.81	0-1	1
	1732.5	20175	5	16-QAM	1	0	12.01	0-1	1
	1732.5	20175	5	16-QAM	1	12	12.32	0-1	1
	1732.5	20175	5	16-QAM	1	24	12.02	0-1	1
	1732.5	20175	5	16-QAM	12	0	10.79	0-2	2
	1732.5	20175	5	16-QAM	12	6	10.92	0-2	2
	1732.5	20175	5	16-QAM	12	13	11.01	0-2	2
	1732.5	20175	5	16-QAM	25	0	10.90	0-2	2
High	1752.5	20375	5	QPSK	1	0	13.07	0	0
	1752.5	20375	5	QPSK	1	12	12.73	0	0
	1752.5	20375	5	QPSK	1	24	13.23	0	0
	1752.5	20375	5	QPSK	12	0	11.73	0-1	1
	1752.5	20375	5	QPSK	12	6	11.93	0-1	1
	1752.5	20375	5	QPSK	12	13	11.80	0-1	1
	1752.5	20375	5	QPSK	25	0	11.82	0-1	1
	1752.5	20375	5	16-QAM	1	0	11.84	0-1	1
	1752.5	20375	5	16-QAM	1	12	12.38	0-1	1
	1752.5	20375	5	16-QAM	1	24	12.11	0-1	1
	1752.5	20375	5	16-QAM	12	0	10.74	0-2	2
	1752.5	20375	5	16-QAM	12	6	10.98	0-2	2
	1752.5	20375	5	16-QAM	12	13	10.78	0-2	2
	1752.5	20375	5	16-QAM	25	0	10.84	0-2	2

Table 8-29
LTE Band 4 (AWS) Conducted Powers - 3 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	12.92	0	0
	1711.5	19965	3	QPSK	1	7	12.86	0	0
	1711.5	19965	3	QPSK	1	14	12.89	0	0
	1711.5	19965	3	QPSK	8	0	11.83	0-1	1
	1711.5	19965	3	QPSK	8	4	11.80	0-1	1
	1711.5	19965	3	QPSK	8	7	11.79	0-1	1
	1711.5	19965	3	QPSK	15	0	11.80	0-1	1
	1711.5	19965	3	16-QAM	1	0	12.17	0-1	1
	1711.5	19965	3	16-QAM	1	7	12.24	0-1	1
	1711.5	19965	3	16-QAM	1	14	11.92	0-1	1
	1711.5	19965	3	16-QAM	8	0	10.87	0-2	2
	1711.5	19965	3	16-QAM	8	4	10.87	0-2	2
	1711.5	19965	3	16-QAM	8	7	10.83	0-2	2
	1711.5	19965	3	16-QAM	15	0	10.84	0-2	2
Mid	1732.5	20175	3	QPSK	1	0	12.84	0	0
	1732.5	20175	3	QPSK	1	7	12.93	0	0
	1732.5	20175	3	QPSK	1	14	13.09	0	0
	1732.5	20175	3	QPSK	8	0	11.90	0-1	1
	1732.5	20175	3	QPSK	8	4	11.88	0-1	1
	1732.5	20175	3	QPSK	8	7	11.88	0-1	1
	1732.5	20175	3	QPSK	15	0	11.84	0-1	1
	1732.5	20175	3	16-QAM	1	0	12.09	0-1	1
	1732.5	20175	3	16-QAM	1	7	12.29	0-1	1
	1732.5	20175	3	16-QAM	1	14	12.23	0-1	1
	1732.5	20175	3	16-QAM	8	0	10.90	0-2	2
	1732.5	20175	3	16-QAM	8	4	10.89	0-2	2
	1732.5	20175	3	16-QAM	8	7	10.89	0-2	2
	1732.5	20175	3	16-QAM	15	0	10.90	0-2	2
High	1753.5	20385	3	QPSK	1	0	13.00	0	0
	1753.5	20385	3	QPSK	1	7	12.90	0	0
	1753.5	20385	3	QPSK	1	14	13.04	0	0
	1753.5	20385	3	QPSK	8	0	11.94	0-1	1
	1753.5	20385	3	QPSK	8	4	11.85	0-1	1
	1753.5	20385	3	QPSK	8	7	11.83	0-1	1
	1753.5	20385	3	QPSK	15	0	11.82	0-1	1
	1753.5	20385	3	16-QAM	1	0	12.24	0-1	1
	1753.5	20385	3	16-QAM	1	7	12.29	0-1	1
	1753.5	20385	3	16-QAM	1	14	12.15	0-1	1
	1753.5	20385	3	16-QAM	8	0	10.94	0-2	2
	1753.5	20385	3	16-QAM	8	4	10.84	0-2	2
	1753.5	20385	3	16-QAM	8	7	10.82	0-2	2
	1753.5	20385	3	16-QAM	15	0	10.84	0-2	2

Table 8-30
LTE Band 4 (AWS) Conducted Powers – 1.4 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	13.12	0	0
	1710.7	19957	1.4	QPSK	1	2	13.33	0	0
	1710.7	19957	1.4	QPSK	1	5	12.94	0	0
	1710.7	19957	1.4	QPSK	3	0	12.85	0	0
	1710.7	19957	1.4	QPSK	3	2	12.88	0	0
	1710.7	19957	1.4	QPSK	3	3	12.84	0	0
	1710.7	19957	1.4	QPSK	6	0	11.89	0-1	1
	1710.7	19957	1.4	16-QAM	1	0	12.07	0-1	1
	1710.7	19957	1.4	16-QAM	1	2	12.29	0-1	1
	1710.7	19957	1.4	16-QAM	1	5	12.02	0-1	1
	1710.7	19957	1.4	16-QAM	3	0	11.94	0-1	1
	1710.7	19957	1.4	16-QAM	3	2	11.92	0-1	1
	1710.7	19957	1.4	16-QAM	3	3	11.84	0-1	1
	1710.7	19957	1.4	16-QAM	6	0	10.93	0-2	2
Mid	1732.5	20175	1.4	QPSK	1	0	13.02	0	0
	1732.5	20175	1.4	QPSK	1	2	13.28	0	0
	1732.5	20175	1.4	QPSK	1	5	13.09	0	0
	1732.5	20175	1.4	QPSK	3	0	12.83	0	0
	1732.5	20175	1.4	QPSK	3	2	12.86	0	0
	1732.5	20175	1.4	QPSK	3	3	12.90	0	0
	1732.5	20175	1.4	QPSK	6	0	11.81	0-1	1
	1732.5	20175	1.4	16-QAM	1	0	12.08	0-1	1
	1732.5	20175	1.4	16-QAM	1	2	12.24	0-1	1
	1732.5	20175	1.4	16-QAM	1	5	12.04	0-1	1
	1732.5	20175	1.4	16-QAM	3	0	11.89	0-1	1
	1732.5	20175	1.4	16-QAM	3	2	11.92	0-1	1
	1732.5	20175	1.4	16-QAM	3	3	11.89	0-1	1
	1732.5	20175	1.4	16-QAM	6	0	10.92	0-2	2
High	1754.3	20393	1.4	QPSK	1	0	12.91	0	0
	1754.3	20393	1.4	QPSK	1	2	12.92	0	0
	1754.3	20393	1.4	QPSK	1	5	12.91	0	0
	1754.3	20393	1.4	QPSK	3	0	12.78	0	0
	1754.3	20393	1.4	QPSK	3	2	12.86	0	0
	1754.3	20393	1.4	QPSK	3	3	12.82	0	0
	1754.3	20393	1.4	QPSK	6	0	11.82	0-1	1
	1754.3	20393	1.4	16-QAM	1	0	12.05	0-1	1
	1754.3	20393	1.4	16-QAM	1	2	12.17	0-1	1
	1754.3	20393	1.4	16-QAM	1	5	12.00	0-1	1
	1754.3	20393	1.4	16-QAM	3	0	11.90	0-1	1
	1754.3	20393	1.4	16-QAM	3	2	11.91	0-1	1
	1754.3	20393	1.4	16-QAM	3	3	11.82	0-1	1
	1754.3	20393	1.4	16-QAM	6	0	10.82	0-2	2

8.2.3 LTE Band 2 (PCS)

Table 8-31
LTE Band 2 (PCS) Conducted Powers - 20 MHz Bandwidth
Maximum Power

	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	23.05	0	0
	1860	18700	20	QPSK	1	50	23.00	0	0
	1860	18700	20	QPSK	1	99	23.11	0	0
	1860	18700	20	QPSK	50	0	22.13	0-1	1
	1860	18700	20	QPSK	50	25	22.00	0-1	1
	1860	18700	20	QPSK	50	50	22.01	0-1	1
	1860	18700	20	QPSK	100	0	22.04	0-1	1
	1860	18700	20	16QAM	1	0	22.37	0-1	1
	1860	18700	20	16QAM	1	50	22.02	0-1	1
	1860	18700	20	16QAM	1	99	22.50	0-1	1
	1860	18700	20	16QAM	50	0	21.15	0-2	2
	1860	18700	20	16QAM	50	25	21.00	0-2	2
	1860	18700	20	16QAM	50	50	21.04	0-2	2
	1860	18700	20	16QAM	100	0	21.00	0-2	2
Mid	1880.0	18900	20	QPSK	1	0	**23.62**	0	0
	1880.0	18900	20	QPSK	1	50	23.25	0	0
	1880.0	18900	20	QPSK	1	99	23.25	0	0
	1880.0	18900	20	QPSK	50	0	22.24	0-1	1
	1880.0	18900	20	QPSK	50	25	22.17	0-1	1
	1880.0	18900	20	QPSK	50	50	22.16	0-1	1
	1880.0	18900	20	QPSK	100	0	22.19	0-1	1
	1880.0	18900	20	16QAM	1	0	22.48	0-1	1
	1880.0	18900	20	16QAM	1	50	22.25	0-1	1
	1880.0	18900	20	16QAM	1	99	22.26	0-1	1
	1880.0	18900	20	16QAM	50	0	21.38	0-2	2
	1880.0	18900	20	16QAM	50	25	21.31	0-2	2
	1880.0	18900	20	16QAM	50	50	21.29	0-2	2
	1880.0	18900	20	16QAM	100	0	21.27	0-2	2
High	1900	19100	20	QPSK	1	0	23.24	0	0
	1900	19100	20	QPSK	1	50	23.61	0	0
	1900	19100	20	QPSK	1	99	23.30	0	0
	1900	19100	20	QPSK	50	0	22.28	0-1	1
	1900	19100	20	QPSK	50	25	**22.31**	0-1	1
	1900	19100	20	QPSK	50	50	22.28	0-1	1
	1900	19100	20	QPSK	100	0	22.30	0-1	1
	1900	19100	20	16QAM	1	0	22.29	0-1	1
	1900	19100	20	16QAM	1	50	22.30	0-1	1
	1900	19100	20	16QAM	1	99	22.54	0-1	1
	1900	19100	20	16QAM	50	0	21.35	0-2	2
	1900	19100	20	16QAM	50	25	21.34	0-2	2
	1900	19100	20	16QAM	50	50	21.36	0-2	2
	1900	19100	20	16QAM	100	0	21.34	0-2	2

Table 8-32
LTE Band 2 (PCS) Conducted Powers - 15 MHz Bandwidth
Maximum Power

	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	23.70	0	0
	1857.5	18675	15	QPSK	1	36	23.13	0	0
	1857.5	18675	15	QPSK	1	74	23.26	0	0
	1857.5	18675	15	QPSK	36	0	22.43	0-1	1
	1857.5	18675	15	QPSK	36	18	22.15	0-1	1
	1857.5	18675	15	QPSK	36	37	22.03	0-1	1
	1857.5	18675	15	QPSK	75	0	22.08	0-1	1
	1857.5	18675	15	16QAM	1	0	22.76	0-1	1
	1857.5	18675	15	16QAM	1	36	22.60	0-1	1
	1857.5	18675	15	16QAM	1	74	22.49	0-1	1
	1857.5	18675	15	16QAM	36	0	21.24	0-2	2
	1857.5	18675	15	16QAM	36	18	21.04	0-2	2
	1857.5	18675	15	16QAM	36	37	21.09	0-2	2
	1857.5	18675	15	16QAM	75	0	21.15	0-2	2
Mid	1880.0	18900	15	QPSK	1	0	23.86	0	0
	1880.0	18900	15	QPSK	1	36	23.24	0	0
	1880.0	18900	15	QPSK	1	74	23.56	0	0
	1880.0	18900	15	QPSK	36	0	22.37	0-1	1
	1880.0	18900	15	QPSK	36	18	22.31	0-1	1
	1880.0	18900	15	QPSK	36	37	22.36	0-1	1
	1880.0	18900	15	QPSK	75	0	22.25	0-1	1
	1880.0	18900	15	16QAM	1	0	22.66	0-1	1
	1880.0	18900	15	16QAM	1	36	22.10	0-1	1
	1880.0	18900	15	16QAM	1	74	22.37	0-1	1
	1880.0	18900	15	16QAM	36	0	21.45	0-2	2
	1880.0	18900	15	16QAM	36	18	21.20	0-2	2
	1880.0	18900	15	16QAM	36	37	21.35	0-2	2
	1880.0	18900	15	16QAM	75	0	21.33	0-2	2
High	1902.5	19125	15	QPSK	1	0	23.41	0	0
	1902.5	19125	15	QPSK	1	36	23.26	0	0
	1902.5	19125	15	QPSK	1	74	23.50	0	0
	1902.5	19125	15	QPSK	36	0	22.37	0-1	1
	1902.5	19125	15	QPSK	36	18	22.35	0-1	1
	1902.5	19125	15	QPSK	36	37	22.43	0-1	1
	1902.5	19125	15	QPSK	75	0	22.44	0-1	1
	1902.5	19125	15	16QAM	1	0	22.73	0-1	1
	1902.5	19125	15	16QAM	1	36	22.70	0-1	1
	1902.5	19125	15	16QAM	1	74	22.68	0-1	1
	1902.5	19125	15	16QAM	36	0	21.39	0-2	2
	1902.5	19125	15	16QAM	36	18	21.37	0-2	2
	1902.5	19125	15	16QAM	36	37	21.55	0-2	2
	1902.5	19125	15	16QAM	75	0	21.46	0-2	2

Table 8-33
LTE Band 2 (PCS) Conducted Powers - 10 MHz Bandwidth
Maximum Power

	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	23.52	0	0
	1855	18650	10	QPSK	1	25	23.48	0	0
	1855	18650	10	QPSK	1	49	23.18	0	0
	1855	18650	10	QPSK	25	0	22.23	0-1	1
	1855	18650	10	QPSK	25	12	22.14	0-1	1
	1855	18650	10	QPSK	25	25	22.00	0-1	1
	1855	18650	10	QPSK	50	0	22.10	0-1	1
	1855	18650	10	16QAM	1	0	22.52	0-1	1
	1855	18650	10	16QAM	1	25	22.30	0-1	1
	1855	18650	10	16QAM	1	49	22.23	0-1	1
	1855	18650	10	16QAM	25	0	21.30	0-2	2
	1855	18650	10	16QAM	25	12	21.24	0-2	2
	1855	18650	10	16QAM	25	25	21.06	0-2	2
	1855	18650	10	16QAM	50	0	21.06	0-2	2
Mid	1880.0	18900	10	QPSK	1	0	23.78	0	0
	1880.0	18900	10	QPSK	1	25	23.16	0	0
	1880.0	18900	10	QPSK	1	49	23.66	0	0
	1880.0	18900	10	QPSK	25	0	22.32	0-1	1
	1880.0	18900	10	QPSK	25	12	22.13	0-1	1
	1880.0	18900	10	QPSK	25	25	22.21	0-1	1
	1880.0	18900	10	QPSK	50	0	22.17	0-1	1
	1880.0	18900	10	16QAM	1	0	22.52	0-1	1
	1880.0	18900	10	16QAM	1	25	22.42	0-1	1
	1880.0	18900	10	16QAM	1	49	22.36	0-1	1
	1880.0	18900	10	16QAM	25	0	21.23	0-2	2
	1880.0	18900	10	16QAM	25	12	21.18	0-2	2
	1880.0	18900	10	16QAM	25	25	21.27	0-2	2
	1880.0	18900	10	16QAM	50	0	21.27	0-2	2
High	1905	19150	10	QPSK	1	0	23.62	0	0
	1905	19150	10	QPSK	1	25	23.50	0	0
	1905	19150	10	QPSK	1	49	23.67	0	0
	1905	19150	10	QPSK	25	0	22.28	0-1	1
	1905	19150	10	QPSK	25	12	22.27	0-1	1
	1905	19150	10	QPSK	25	25	22.19	0-1	1
	1905	19150	10	QPSK	50	0	22.28	0-1	1
	1905	19150	10	16QAM	1	0	22.23	0-1	1
	1905	19150	10	16QAM	1	25	21.92	0-1	1
	1905	19150	10	16QAM	1	49	22.14	0-1	1
	1905	19150	10	16QAM	25	0	21.46	0-2	2
	1905	19150	10	16QAM	25	12	21.56	0-2	2
	1905	19150	10	16QAM	25	25	21.39	0-2	2
	1905	19150	10	16QAM	50	0	21.30	0-2	2

Table 8-34
LTE Band 2 (PCS) Conducted Powers - 5 MHz Bandwidth
Maximum Power

	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	23.43	0	0
	1852.5	18625	5	QPSK	1	12	22.91	0	0
	1852.5	18625	5	QPSK	1	24	23.26	0	0
	1852.5	18625	5	QPSK	12	0	22.18	0-1	1
	1852.5	18625	5	QPSK	12	6	22.17	0-1	1
	1852.5	18625	5	QPSK	12	13	21.99	0-1	1
	1852.5	18625	5	QPSK	25	0	22.09	0-1	1
	1852.5	18625	5	16-QAM	1	0	22.09	0-1	1
	1852.5	18625	5	16-QAM	1	12	22.29	0-1	1
	1852.5	18625	5	16-QAM	1	24	21.99	0-1	1
	1852.5	18625	5	16-QAM	12	0	21.15	0-2	2
	1852.5	18625	5	16-QAM	12	6	21.02	0-2	2
	1852.5	18625	5	16-QAM	12	13	20.96	0-2	2
	1852.5	18625	5	16-QAM	25	0	21.21	0-2	2
Mid	1880.0	18900	5	QPSK	1	0	23.28	0	0
	1880.0	18900	5	QPSK	1	12	23.35	0	0
	1880.0	18900	5	QPSK	1	24	23.39	0	0
	1880.0	18900	5	QPSK	12	0	22.15	0-1	1
	1880.0	18900	5	QPSK	12	6	22.18	0-1	1
	1880.0	18900	5	QPSK	12	13	22.14	0-1	1
	1880.0	18900	5	QPSK	25	0	22.14	0-1	1
	1880.0	18900	5	16-QAM	1	0	22.32	0-1	1
	1880.0	18900	5	16-QAM	1	12	22.06	0-1	1
	1880.0	18900	5	16-QAM	1	24	22.19	0-1	1
	1880.0	18900	5	16-QAM	12	0	21.14	0-2	2
	1880.0	18900	5	16-QAM	12	6	21.10	0-2	2
	1880.0	18900	5	16-QAM	12	13	21.11	0-2	2
	1880.0	18900	5	16-QAM	25	0	21.15	0-2	2
High	1907.5	19175	5	QPSK	1	0	23.38	0	0
	1907.5	19175	5	QPSK	1	12	23.42	0	0
	1907.5	19175	5	QPSK	1	24	23.48	0	0
	1907.5	19175	5	QPSK	12	0	22.25	0-1	1
	1907.5	19175	5	QPSK	12	6	22.34	0-1	1
	1907.5	19175	5	QPSK	12	13	22.31	0-1	1
	1907.5	19175	5	QPSK	25	0	22.27	0-1	1
	1907.5	19175	5	16-QAM	1	0	21.97	0-1	1
	1907.5	19175	5	16-QAM	1	12	22.51	0-1	1
	1907.5	19175	5	16-QAM	1	24	22.04	0-1	1
	1907.5	19175	5	16-QAM	12	0	21.24	0-2	2
	1907.5	19175	5	16-QAM	12	6	21.28	0-2	2
	1907.5	19175	5	16-QAM	12	13	21.08	0-2	2
	1907.5	19175	5	16-QAM	25	0	21.28	0-2	2

Table 8-35
LTE Band 2 (PCS) Conducted Powers - 3 MHz Bandwidth
Maximum Power

	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	23.30	0	0
	1851.5	18615	3	QPSK	1	7	23.37	0	0
	1851.5	18615	3	QPSK	1	14	23.12	0	0
	1851.5	18615	3	QPSK	8	0	22.21	0-1	1
	1851.5	18615	3	QPSK	8	4	22.10	0-1	1
	1851.5	18615	3	QPSK	8	7	22.11	0-1	1
	1851.5	18615	3	QPSK	15	0	22.13	0-1	1
	1851.5	18615	3	16-QAM	1	0	22.40	0-1	1
	1851.5	18615	3	16-QAM	1	7	22.33	0-1	1
	1851.5	18615	3	16-QAM	1	14	22.41	0-1	1
	1851.5	18615	3	16-QAM	8	0	21.05	0-2	2
	1851.5	18615	3	16-QAM	8	4	20.95	0-2	2
	1851.5	18615	3	16-QAM	8	7	21.37	0-2	2
	1851.5	18615	3	16-QAM	15	0	21.30	0-2	2
Mid	1880.0	18900	3	QPSK	1	0	23.31	0	0
	1880.0	18900	3	QPSK	1	7	23.47	0	0
	1880.0	18900	3	QPSK	1	14	23.30	0	0
	1880.0	18900	3	QPSK	8	0	22.22	0-1	1
	1880.0	18900	3	QPSK	8	4	22.19	0-1	1
	1880.0	18900	3	QPSK	8	7	22.20	0-1	1
	1880.0	18900	3	QPSK	15	0	22.21	0-1	1
	1880.0	18900	3	16-QAM	1	0	22.46	0-1	1
	1880.0	18900	3	16-QAM	1	7	22.53	0-1	1
	1880.0	18900	3	16-QAM	1	14	22.36	0-1	1
	1880.0	18900	3	16-QAM	8	0	21.27	0-2	2
	1880.0	18900	3	16-QAM	8	4	21.31	0-2	2
	1880.0	18900	3	16-QAM	8	7	21.31	0-2	2
	1880.0	18900	3	16-QAM	15	0	21.01	0-2	2
High	1908.5	19185	3	QPSK	1	0	23.63	0	0
	1908.5	19185	3	QPSK	1	7	23.64	0	0
	1908.5	19185	3	QPSK	1	14	23.56	0	0
	1908.5	19185	3	QPSK	8	0	22.29	0-1	1
	1908.5	19185	3	QPSK	8	4	22.25	0-1	1
	1908.5	19185	3	QPSK	8	7	22.29	0-1	1
	1908.5	19185	3	QPSK	15	0	22.23	0-1	1
	1908.5	19185	3	16-QAM	1	0	22.02	0-1	1
	1908.5	19185	3	16-QAM	1	7	22.57	0-1	1
	1908.5	19185	3	16-QAM	1	14	22.40	0-1	1
	1908.5	19185	3	16-QAM	8	0	21.43	0-2	2
	1908.5	19185	3	16-QAM	8	4	21.28	0-2	2
	1908.5	19185	3	16-QAM	8	7	21.29	0-2	2
	1908.5	19185	3	16-QAM	15	0	21.17	0-2	2

Table 8-36
LTE Band 2 (PCS) Conducted Powers -1.4 MHz Bandwidth
Maximum Power

	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	23.30	0	0
	1850.7	18607	1.4	QPSK	1	2	23.22	0	0
	1850.7	18607	1.4	QPSK	1	5	23.43	0	0
	1850.7	18607	1.4	QPSK	3	0	23.26	0	0
	1850.7	18607	1.4	QPSK	3	2	23.31	0	0
	1850.7	18607	1.4	QPSK	3	3	23.22	0	0
	1850.7	18607	1.4	QPSK	6	0	22.49	0-1	1
	1850.7	18607	1.4	16-QAM	1	0	22.41	0-1	1
	1850.7	18607	1.4	16-QAM	1	2	22.46	0-1	1
	1850.7	18607	1.4	16-QAM	1	5	22.31	0-1	1
	1850.7	18607	1.4	16-QAM	3	0	22.41	0-1	1
	1850.7	18607	1.4	16-QAM	3	2	22.39	0-1	1
	1850.7	18607	1.4	16-QAM	3	3	22.35	0-1	1
	1850.7	18607	1.4	16-QAM	6	0	21.50	0-2	2
Mid	1880.0	18900	1.4	QPSK	1	0	23.26	0	0
	1880.0	18900	1.4	QPSK	1	2	23.31	0	0
	1880.0	18900	1.4	QPSK	1	5	23.37	0	0
	1880.0	18900	1.4	QPSK	3	0	23.22	0	0
	1880.0	18900	1.4	QPSK	3	2	23.09	0	0
	1880.0	18900	1.4	QPSK	3	3	23.20	0	0
	1880.0	18900	1.4	QPSK	6	0	22.17	0-1	1
	1880.0	18900	1.4	16-QAM	1	0	22.19	0-1	1
	1880.0	18900	1.4	16-QAM	1	2	22.35	0-1	1
	1880.0	18900	1.4	16-QAM	1	5	22.21	0-1	1
	1880.0	18900	1.4	16-QAM	3	0	22.16	0-1	1
	1880.0	18900	1.4	16-QAM	3	2	22.20	0-1	1
	1880.0	18900	1.4	16-QAM	3	3	22.19	0-1	1
	1880.0	18900	1.4	16-QAM	6	0	21.24	0-2	2
High	1909.3	19193	1.4	QPSK	1	0	23.35	0	0
	1909.3	19193	1.4	QPSK	1	2	23.55	0	0
	1909.3	19193	1.4	QPSK	1	5	23.40	0	0
	1909.3	19193	1.4	QPSK	3	0	23.36	0	0
	1909.3	19193	1.4	QPSK	3	2	23.30	0	0
	1909.3	19193	1.4	QPSK	3	3	23.35	0	0
	1909.3	19193	1.4	QPSK	6	0	22.40	0-1	1
	1909.3	19193	1.4	16-QAM	1	0	22.36	0-1	1
	1909.3	19193	1.4	16-QAM	1	2	22.53	0-1	1
	1909.3	19193	1.4	16-QAM	1	5	22.56	0-1	1
	1909.3	19193	1.4	16-QAM	3	0	22.26	0-1	1
	1909.3	19193	1.4	16-QAM	3	2	22.18	0-1	1
	1909.3	19193	1.4	16-QAM	3	3	22.16	0-1	1
	1909.3	19193	1.4	16-QAM	6	0	21.48	0-2	2

Table 8-37
LTE Band 2 (PCS) Conducted Powers - 20 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	12.03	0	0
	1860	18700	20	QPSK	1	50	11.38	0	0
	1860	18700	20	QPSK	1	99	12.22	0	0
	1860	18700	20	QPSK	50	0	10.55	0-1	1
	1860	18700	20	QPSK	50	25	10.62	0-1	1
	1860	18700	20	QPSK	50	50	10.70	0-1	1
	1860	18700	20	QPSK	100	0	10.63	0-1	1
	1860	18700	20	16QAM	1	0	11.27	0-1	1
	1860	18700	20	16QAM	1	50	10.76	0-1	1
	1860	18700	20	16QAM	1	99	11.30	0-1	1
	1860	18700	20	16QAM	50	0	9.76	0-2	2
	1860	18700	20	16QAM	50	25	9.63	0-2	2
	1860	18700	20	16QAM	50	50	9.71	0-2	2
	1860	18700	20	16QAM	100	0	10.25	0-2	2
Mid	1880.0	18900	20	QPSK	1	0	**12.30**	0	0
	1880.0	18900	20	QPSK	1	50	11.83	0	0
	1880.0	18900	20	QPSK	1	99	12.28	0	0
	1880.0	18900	20	QPSK	50	0	10.63	0-1	1
	1880.0	18900	20	QPSK	50	25	10.75	0-1	1
	1880.0	18900	20	QPSK	50	50	10.79	0-1	1
	1880.0	18900	20	QPSK	100	0	10.65	0-1	1
	1880.0	18900	20	16QAM	1	0	11.29	0-1	1
	1880.0	18900	20	16QAM	1	50	11.04	0-1	1
	1880.0	18900	20	16QAM	1	99	11.30	0-1	1
	1880.0	18900	20	16QAM	50	0	9.84	0-2	2
	1880.0	18900	20	16QAM	50	25	9.93	0-2	2
	1880.0	18900	20	16QAM	50	50	9.96	0-2	2
	1880.0	18900	20	16QAM	100	0	9.87	0-2	2
High	1900	19100	20	QPSK	1	0	11.92	0	0
	1900	19100	20	QPSK	1	50	11.35	0	0
	1900	19100	20	QPSK	1	99	11.96	0	0
	1900	19100	20	QPSK	50	0	**10.81**	0-1	1
	1900	19100	20	QPSK	50	25	10.68	0-1	1
	1900	19100	20	QPSK	50	50	10.45	0-1	1
	1900	19100	20	QPSK	100	0	10.55	0-1	1
	1900	19100	20	16QAM	1	0	11.11	0-1	1
	1900	19100	20	16QAM	1	50	10.50	0-1	1
	1900	19100	20	16QAM	1	99	11.11	0-1	1
	1900	19100	20	16QAM	50	0	9.94	0-2	2
	1900	19100	20	16QAM	50	25	9.67	0-2	2
	1900	19100	20	16QAM	50	50	9.45	0-2	2
	1900	19100	20	16QAM	100	0	9.56	0-2	2

Table 8-38
LTE Band 2 (PCS) Conducted Powers - 15 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	11.73	0	0
	1857.5	18675	15	QPSK	1	36	11.52	0	0
	1857.5	18675	15	QPSK	1	74	12.00	0	0
	1857.5	18675	15	QPSK	36	0	10.44	0-1	1
	1857.5	18675	15	QPSK	36	18	10.40	0-1	1
	1857.5	18675	15	QPSK	36	37	10.48	0-1	1
	1857.5	18675	15	QPSK	75	0	10.56	0-1	1
	1857.5	18675	15	16QAM	1	0	10.89	0-1	1
	1857.5	18675	15	16QAM	1	36	10.66	0-1	1
	1857.5	18675	15	16QAM	1	74	11.30	0-1	1
	1857.5	18675	15	16QAM	36	0	9.41	0-2	2
	1857.5	18675	15	16QAM	36	18	9.41	0-2	2
	1857.5	18675	15	16QAM	36	37	9.46	0-2	2
	1857.5	18675	15	16QAM	75	0	9.53	0-2	2
Mid	1880.0	18900	15	QPSK	1	0	11.96	0	0
	1880.0	18900	15	QPSK	1	36	11.67	0	0
	1880.0	18900	15	QPSK	1	74	12.30	0	0
	1880.0	18900	15	QPSK	36	0	10.76	0-1	1
	1880.0	18900	15	QPSK	36	18	10.66	0-1	1
	1880.0	18900	15	QPSK	36	37	10.96	0-1	1
	1880.0	18900	15	QPSK	75	0	10.72	0-1	1
	1880.0	18900	15	16QAM	1	0	10.82	0-1	1
	1880.0	18900	15	16QAM	1	36	10.70	0-1	1
	1880.0	18900	15	16QAM	1	74	11.29	0-1	1
	1880.0	18900	15	16QAM	36	0	9.71	0-2	2
	1880.0	18900	15	16QAM	36	18	9.69	0-2	2
	1880.0	18900	15	16QAM	36	37	9.90	0-2	2
	1880.0	18900	15	16QAM	75	0	9.79	0-2	2
High	1902.5	19125	15	QPSK	1	0	11.98	0	0
	1902.5	19125	15	QPSK	1	36	11.57	0	0
	1902.5	19125	15	QPSK	1	74	12.26	0	0
	1902.5	19125	15	QPSK	36	0	10.73	0-1	1
	1902.5	19125	15	QPSK	36	18	10.71	0-1	1
	1902.5	19125	15	QPSK	36	37	10.85	0-1	1
	1902.5	19125	15	QPSK	75	0	10.79	0-1	1
	1902.5	19125	15	16QAM	1	0	10.90	0-1	1
	1902.5	19125	15	16QAM	1	36	10.69	0-1	1
	1902.5	19125	15	16QAM	1	74	11.21	0-1	1
	1902.5	19125	15	16QAM	36	0	9.76	0-2	2
	1902.5	19125	15	16QAM	36	18	9.77	0-2	2
	1902.5	19125	15	16QAM	36	37	9.79	0-2	2
	1902.5	19125	15	16QAM	75	0	9.80	0-2	2

Table 8-39
LTE Band 2 (PCS) Conducted Powers - 10 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	11.80	0	0
	1855	18650	10	QPSK	1	25	11.32	0	0
	1855	18650	10	QPSK	1	49	11.76	0	0
	1855	18650	10	QPSK	25	0	10.57	0-1	1
	1855	18650	10	QPSK	25	12	10.49	0-1	1
	1855	18650	10	QPSK	25	25	10.57	0-1	1
	1855	18650	10	QPSK	50	0	10.48	0-1	1
	1855	18650	10	16QAM	1	0	11.00	0-1	1
	1855	18650	10	16QAM	1	25	10.44	0-1	1
	1855	18650	10	16QAM	1	49	11.15	0-1	1
	1855	18650	10	16QAM	25	0	9.31	0-2	2
	1855	18650	10	16QAM	25	12	9.58	0-2	2
	1855	18650	10	16QAM	25	25	9.59	0-2	2
	1855	18650	10	16QAM	50	0	9.50	0-2	2
Mid	1880.0	18900	10	QPSK	1	0	11.78	0	0
	1880.0	18900	10	QPSK	1	25	11.52	0	0
	1880.0	18900	10	QPSK	1	49	12.25	0	0
	1880.0	18900	10	QPSK	25	0	10.51	0-1	1
	1880.0	18900	10	QPSK	25	12	10.54	0-1	1
	1880.0	18900	10	QPSK	25	25	10.89	0-1	1
	1880.0	18900	10	QPSK	50	0	10.52	0-1	1
	1880.0	18900	10	16QAM	1	0	11.28	0-1	1
	1880.0	18900	10	16QAM	1	25	10.95	0-1	1
	1880.0	18900	10	16QAM	1	49	11.23	0-1	1
	1880.0	18900	10	16QAM	25	0	9.57	0-2	2
	1880.0	18900	10	16QAM	25	12	9.52	0-2	2
	1880.0	18900	10	16QAM	25	25	9.74	0-2	2
	1880.0	18900	10	16QAM	50	0	9.61	0-2	2
High	1905	19150	10	QPSK	1	0	11.89	0	0
	1905	19150	10	QPSK	1	25	11.30	0	0
	1905	19150	10	QPSK	1	49	12.06	0	0
	1905	19150	10	QPSK	25	0	10.55	0-1	1
	1905	19150	10	QPSK	25	12	10.57	0-1	1
	1905	19150	10	QPSK	25	25	10.51	0-1	1
	1905	19150	10	QPSK	50	0	10.56	0-1	1
	1905	19150	10	16QAM	1	0	11.04	0-1	1
	1905	19150	10	16QAM	1	25	10.41	0-1	1
	1905	19150	10	16QAM	1	49	11.29	0-1	1
	1905	19150	10	16QAM	25	0	9.63	0-2	2
	1905	19150	10	16QAM	25	12	9.66	0-2	2
	1905	19150	10	16QAM	25	25	9.55	0-2	2
	1905	19150	10	16QAM	50	0	9.65	0-2	2

Table 8-40
LTE Band 2 (PCS) Conducted Powers - 5 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	11.73	0	0
	1852.5	18625	5	QPSK	1	12	11.49	0	0
	1852.5	18625	5	QPSK	1	24	11.70	0	0
	1852.5	18625	5	QPSK	12	0	10.40	0-1	1
	1852.5	18625	5	QPSK	12	6	10.34	0-1	1
	1852.5	18625	5	QPSK	12	13	10.42	0-1	1
	1852.5	18625	5	QPSK	25	0	10.37	0-1	1
	1852.5	18625	5	16-QAM	1	0	11.22	0-1	1
	1852.5	18625	5	16-QAM	1	12	10.62	0-1	1
	1852.5	18625	5	16-QAM	1	24	11.16	0-1	1
	1852.5	18625	5	16-QAM	12	0	9.63	0-2	2
	1852.5	18625	5	16-QAM	12	6	9.59	0-2	2
	1852.5	18625	5	16-QAM	12	13	9.55	0-2	2
	1852.5	18625	5	16-QAM	25	0	9.51	0-2	2
Mid	1880.0	18900	5	QPSK	1	0	11.93	0	0
	1880.0	18900	5	QPSK	1	12	11.47	0	0
	1880.0	18900	5	QPSK	1	24	12.06	0	0
	1880.0	18900	5	QPSK	12	0	10.58	0-1	1
	1880.0	18900	5	QPSK	12	6	10.64	0-1	1
	1880.0	18900	5	QPSK	12	13	10.67	0-1	1
	1880.0	18900	5	QPSK	25	0	10.73	0-1	1
	1880.0	18900	5	16-QAM	1	0	10.98	0-1	1
	1880.0	18900	5	16-QAM	1	12	10.68	0-1	1
	1880.0	18900	5	16-QAM	1	24	11.21	0-1	1
	1880.0	18900	5	16-QAM	12	0	9.73	0-2	2
	1880.0	18900	5	16-QAM	12	6	9.77	0-2	2
	1880.0	18900	5	16-QAM	12	13	9.68	0-2	2
	1880.0	18900	5	16-QAM	25	0	9.77	0-2	2
High	1907.5	19175	5	QPSK	1	0	11.64	0	0
	1907.5	19175	5	QPSK	1	12	11.30	0	0
	1907.5	19175	5	QPSK	1	24	11.63	0	0
	1907.5	19175	5	QPSK	12	0	10.45	0-1	1
	1907.5	19175	5	QPSK	12	6	10.46	0-1	1
	1907.5	19175	5	QPSK	12	13	10.50	0-1	1
	1907.5	19175	5	QPSK	25	0	10.46	0-1	1
	1907.5	19175	5	16-QAM	1	0	10.90	0-1	1
	1907.5	19175	5	16-QAM	1	12	10.68	0-1	1
	1907.5	19175	5	16-QAM	1	24	11.09	0-1	1
	1907.5	19175	5	16-QAM	12	0	9.51	0-2	2
	1907.5	19175	5	16-QAM	12	6	9.50	0-2	2
	1907.5	19175	5	16-QAM	12	13	9.52	0-2	2
	1907.5	19175	5	16-QAM	25	0	9.52	0-2	2

Table 8-41
LTE Band 2 (PCS) Conducted Powers - 3 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	11.69	0	0
	1851.5	18615	3	QPSK	1	7	11.34	0	0
	1851.5	18615	3	QPSK	1	14	11.57	0	0
	1851.5	18615	3	QPSK	8	0	10.38	0-1	1
	1851.5	18615	3	QPSK	8	4	10.45	0-1	1
	1851.5	18615	3	QPSK	8	7	10.44	0-1	1
	1851.5	18615	3	QPSK	15	0	10.48	0-1	1
	1851.5	18615	3	16-QAM	1	0	11.28	0-1	1
	1851.5	18615	3	16-QAM	1	7	10.98	0-1	1
	1851.5	18615	3	16-QAM	1	14	11.21	0-1	1
	1851.5	18615	3	16-QAM	8	0	9.58	0-2	2
	1851.5	18615	3	16-QAM	8	4	9.54	0-2	2
	1851.5	18615	3	16-QAM	8	7	9.55	0-2	2
	1851.5	18615	3	16-QAM	15	0	9.55	0-2	2
Mid	1880.0	18900	3	QPSK	1	0	11.76	0	0
	1880.0	18900	3	QPSK	1	7	11.65	0	0
	1880.0	18900	3	QPSK	1	14	12.09	0	0
	1880.0	18900	3	QPSK	8	0	10.63	0-1	1
	1880.0	18900	3	QPSK	8	4	10.70	0-1	1
	1880.0	18900	3	QPSK	8	7	10.72	0-1	1
	1880.0	18900	3	QPSK	15	0	10.74	0-1	1
	1880.0	18900	3	16-QAM	1	0	11.06	0-1	1
	1880.0	18900	3	16-QAM	1	7	10.87	0-1	1
	1880.0	18900	3	16-QAM	1	14	11.18	0-1	1
	1880.0	18900	3	16-QAM	8	0	9.80	0-2	2
	1880.0	18900	3	16-QAM	8	4	9.74	0-2	2
	1880.0	18900	3	16-QAM	8	7	9.86	0-2	2
	1880.0	18900	3	16-QAM	15	0	9.84	0-2	2
High	1908.5	19185	3	QPSK	1	0	12.01	0	0
	1908.5	19185	3	QPSK	1	7	11.72	0	0
	1908.5	19185	3	QPSK	1	14	11.81	0	0
	1908.5	19185	3	QPSK	8	0	10.76	0-1	1
	1908.5	19185	3	QPSK	8	4	10.80	0-1	1
	1908.5	19185	3	QPSK	8	7	10.87	0-1	1
	1908.5	19185	3	QPSK	15	0	10.85	0-1	1
	1908.5	19185	3	16-QAM	1	0	11.01	0-1	1
	1908.5	19185	3	16-QAM	1	7	10.73	0-1	1
	1908.5	19185	3	16-QAM	1	14	10.83	0-1	1
	1908.5	19185	3	16-QAM	8	0	9.65	0-2	2
	1908.5	19185	3	16-QAM	8	4	9.62	0-2	2
	1908.5	19185	3	16-QAM	8	7	9.88	0-2	2
	1908.5	19185	3	16-QAM	15	0	9.97	0-2	2

Table 8-42
LTE Band 2 (PCS) Conducted Powers – 1.4 MHz Bandwidth
Reduced Power – Body at 0.0 cm

	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	11.41	0	0
	1850.7	18607	1.4	QPSK	1	2	11.63	0	0
	1850.7	18607	1.4	QPSK	1	5	11.38	0	0
	1850.7	18607	1.4	QPSK	3	0	11.36	0	0
	1850.7	18607	1.4	QPSK	3	2	11.41	0	0
	1850.7	18607	1.4	QPSK	3	3	11.40	0	0
	1850.7	18607	1.4	QPSK	6	0	10.36	0-1	1
	1850.7	18607	1.4	16-QAM	1	0	10.74	0-1	1
	1850.7	18607	1.4	16-QAM	1	2	10.82	0-1	1
	1850.7	18607	1.4	16-QAM	1	5	10.63	0-1	1
	1850.7	18607	1.4	16-QAM	3	0	10.39	0-1	1
	1850.7	18607	1.4	16-QAM	3	2	10.44	0-1	1
	1850.7	18607	1.4	16-QAM	3	3	10.36	0-1	1
	1850.7	18607	1.4	16-QAM	6	0	9.31	0-2	2
Mid	1880.0	18900	1.4	QPSK	1	0	11.65	0	0
	1880.0	18900	1.4	QPSK	1	2	11.88	0	0
	1880.0	18900	1.4	QPSK	1	5	11.65	0	0
	1880.0	18900	1.4	QPSK	3	0	11.40	0	0
	1880.0	18900	1.4	QPSK	3	2	11.46	0	0
	1880.0	18900	1.4	QPSK	3	3	11.44	0	0
	1880.0	18900	1.4	QPSK	6	0	10.49	0-1	1
	1880.0	18900	1.4	16-QAM	1	0	10.98	0-1	1
	1880.0	18900	1.4	16-QAM	1	2	11.14	0-1	1
	1880.0	18900	1.4	16-QAM	1	5	10.97	0-1	1
	1880.0	18900	1.4	16-QAM	3	0	10.72	0-1	1
	1880.0	18900	1.4	16-QAM	3	2	10.77	0-1	1
	1880.0	18900	1.4	16-QAM	3	3	10.72	0-1	1
	1880.0	18900	1.4	16-QAM	6	0	9.59	0-2	2
High	1909.3	19193	1.4	QPSK	1	0	11.85	0	0
	1909.3	19193	1.4	QPSK	1	2	11.93	0	0
	1909.3	19193	1.4	QPSK	1	5	11.72	0	0
	1909.3	19193	1.4	QPSK	3	0	11.58	0	0
	1909.3	19193	1.4	QPSK	3	2	11.63	0	0
	1909.3	19193	1.4	QPSK	3	3	11.62	0	0
	1909.3	19193	1.4	QPSK	6	0	10.60	0-1	1
	1909.3	19193	1.4	16-QAM	1	0	10.67	0-1	1
	1909.3	19193	1.4	16-QAM	1	2	10.82	0-1	1
	1909.3	19193	1.4	16-QAM	1	5	10.67	0-1	1
	1909.3	19193	1.4	16-QAM	3	0	10.42	0-1	1
	1909.3	19193	1.4	16-QAM	3	2	10.50	0-1	1
	1909.3	19193	1.4	16-QAM	3	3	10.43	0-1	1
	1909.3	19193	1.4	16-QAM	6	0	9.42	0-2	2

8.3 WLAN Conducted Powers

Table 8-43
2.4 GHz Average RF Power
Maximum Power

Freq [MHz]	Channel	2.4GHz Conducted Power [dBm]	
		IEEE Transmission Mode	
		802.11b	802.11g
2412	1	16.01	11.87
2437	6	16.12	11.93
2462	11	**16.23**	12.27

Table 8-44
2.4 GHz Average RF Power
Reduced Power – Body at 0.0 cm

Freq [MHz]	Channel	2.4GHz Conducted Power [dBm]	
		IEEE Transmission Mode	
		802.11b	802.11g
2412	1	**11.49**	10.34
2437	6	11.13	10.40
2462	11	11.08	9.79

Table 8-45
5 GHz (20 MHz Bandwidth) Average RF Power
Maximum Power

Freq [MHz]	Channel	5GHz (20MHz) Conducted Power [dBm]
		IEEE Transmission Mode
		802.11a
5180	36	11.39
5200	40	11.37
5220	44	11.48
5240	48	11.38
5260	52	11.41
5280	56	11.46
5300	60	**11.48**
5320	64	11.47
5500	100	**11.44**
5580	116	11.06
5660	132	11.17
5720	144	11.38
5745	149	**11.40**
5785	157	11.28
5825	165	11.29

Table 8-46
5 GHz (40 MHz Bandwidth) Average RF Power
Reduced Power – Body at 0.0 cm

Freq [MHz]	Channel	5GHz (40MHz) Conducted Power
		IEEE Transmission Mode
		802.11n
5190	38	6.76
5230	46	6.75
5270	54	**6.78**
5310	62	6.70
5510	102	6.60
5550	110	7.24
5670	134	**7.44**
5710	142	7.31
5755	151	**6.63**
5795	159	6.56

Justification for test configurations for WLAN per KDB Publication 248227 D01v02:

- Power measurements were performed for the transmission mode configuration with the highest maximum output power specified for production units.
- For transmission modes with the same maximum output power specification, powers were measured for the largest channel bandwidth, lowest order modulation and lowest data rate.
- For transmission modes with identical maximum specified output power, channel bandwidth, modulation and data rates, power measurements were required for all identical configurations.
- For each transmission mode configuration, powers were measured for the highest and lowest channels; and at the mid-band channel(s) when there were at least 3 channels supported. For configurations with multiple mid-band channels, due to an even number of channels, both channels were measured.
- The bolded data rate and channel above were tested for SAR.

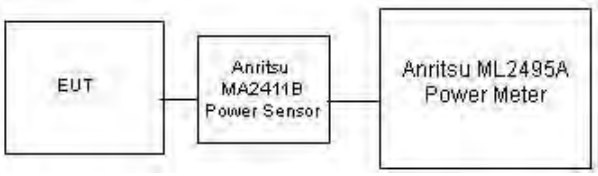


Figure 8-2
Power Measurement Setup

8.4 Bluetooth Conducted Powers

Table 8-47
Bluetooth Conducted Output Power Measurements

Frequency [MHz]	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
			[dBm]	[mW]
2402	1.0	0	8.38	6.884
2441	1.0	39	**9.47**	8.860
2480	1.0	78	7.26	5.326
2402	2.0	0	5.89	3.881
2441	2.0	39	6.94	4.948
2480	2.0	78	4.73	2.971
2402	3.0	0	5.94	3.924
2441	3.0	39	7.04	5.056
2480	3.0	78	4.81	3.029

The bolded data rate and channel above was tested for SAR.

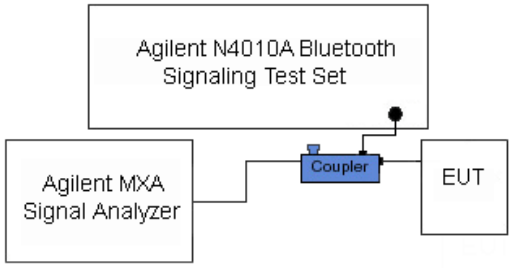


Figure 8-3
Test Instrument & Measurement Setup

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
6/23/2015	750B	22.0	710	0.928	55.146	0.960	55.687	-3.33%	-0.97%
			740	0.959	54.746	0.963	55.570	-0.42%	-1.48%
			755	0.968	54.582	0.964	55.512	0.41%	-1.68%
6/30/2015	750B	22.5	700	0.924	55.978	0.959	55.726	-3.65%	0.45%
			710	0.935	55.892	0.960	55.687	-2.60%	0.37%
			740	0.963	55.433	0.963	55.570	0.00%	-0.25%
			755	0.975	55.414	0.964	55.512	1.14%	-0.18%
6/4/2015	835B	20.2	820	1.003	55.144	0.969	55.258	3.51%	-0.21%
			835	1.018	55.002	0.970	55.200	4.95%	-0.36%
			850	1.033	54.851	0.988	55.154	4.55%	-0.55%
6/16/2015	835B	22.3	820	0.993	53.706	0.969	55.258	2.48%	-2.81%
			835	1.004	53.507	0.970	55.200	3.51%	-3.07%
			850	1.019	53.342	0.988	55.154	3.14%	-3.29%
6/4/2015	1750B	22.0	1710	1.441	51.885	1.463	53.537	-1.50%	-3.09%
			1750	1.485	51.684	1.488	53.432	-0.20%	-3.27%
			1790	1.531	51.535	1.514	53.326	1.12%	-3.36%
6/4/2015	1900B	21.7	1850	1.491	51.966	1.520	53.300	-1.91%	-2.50%
			1880	1.528	51.803	1.520	53.300	0.53%	-2.81%
			1910	1.558	51.757	1.520	53.300	2.50%	-2.89%
6/3/2015	2450B	22.0	2401	1.942	50.647	1.903	52.765	2.05%	-4.01%
			2450	2.008	50.462	1.950	52.700	2.97%	-4.25%
			2499	2.068	50.278	2.019	52.638	2.43%	-4.48%
6/3/2015	5200B-5800B	21.4	5260	5.203	48.135	5.369	48.933	-3.09%	-1.63%
			5280	5.228	48.110	5.393	48.906	-3.06%	-1.63%
			5300	5.248	48.083	5.416	48.879	-3.10%	-1.63%
			5500	5.495	47.779	5.650	48.607	-2.74%	-1.70%
			5600	5.621	47.640	5.766	48.471	-2.51%	-1.71%
			5660	5.718	47.511	5.837	48.390	-2.04%	-1.82%
			5680	5.749	47.507	5.860	48.363	-1.89%	-1.77%
			5745	5.822	47.405	5.936	48.275	-1.92%	-1.80%
			5765	5.854	47.386	5.959	48.248	-1.76%	-1.79%
			5800	5.914	47.336	6.000	48.200	-1.43%	-1.79%

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 Publication 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)	$Deviation_{1g}$ (%)
A	750	BODY	06/23/2015	23.8	22.0	0.200	1046	3331	1.770	8.290	8.850	6.76%
A	750	BODY	06/30/2015	24.3	22.3	0.200	1046	3331	1.760	8.290	8.800	6.15%
I	835	BODY	06/04/2015	22.7	22.0	0.100	4d133	3213	0.883	9.350	8.830	-5.56%
A	835	BODY	06/16/2015	24.0	22.9	0.200	4d119	3331	1.980	9.200	9.900	7.61%
H	1750	BODY	06/04/2015	21.5	22.0	0.100	1051	3263	3.820	37.100	38.200	2.96%
B	1900	BODY	06/04/2015	22.0	21.7	0.100	5d148	3334	4.040	40.200	40.400	0.50%
D	2450	BODY	06/03/2015	21.1	21.0	0.100	719	3209	5.400	51.800	54.000	4.25%
E	5300	BODY	06/03/2015	22.1	21.2	0.050	1057	3589	3.910	74.200	78.200	5.39%
E	5500	BODY	06/03/2015	22.2	21.3	0.050	1057	3589	3.680	79.200	73.600	-7.07%
E	5600	BODY	06/03/2015	22.1	21.3	0.050	1057	3589	3.960	77.700	79.200	1.93%
E	5800	BODY	06/03/2015	22.1	21.2	0.050	1057	3589	3.410	75.100	68.200	-9.19%

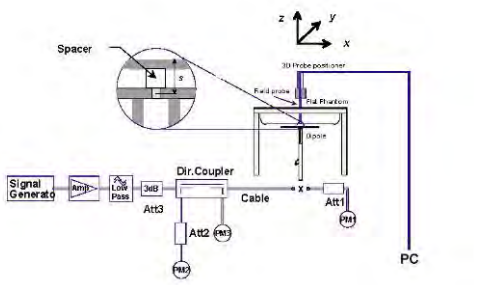


Figure 9-1
System Verification Setup Diagram

Figure 9-2
System Verification Setup Photo

10 SAR DATA SUMMARY

10.1 Standalone Body SAR Data

Table 10-1
UMTS Body SAR Data

MEASUREMENT RESULTS														
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	23.5	22.91	0.05	21 mm	11524	1:1	back	0.292	1.146	0.335	
836.60	4183	UMTS 850	RMC	23.5	22.91	-0.13	0 mm	11524	1:1	top	0.030	1.146	0.034	
836.60	4183	UMTS 850	RMC	23.5	22.91	-0.05	18 mm	11524	1:1	bottom	0.020	1.146	0.023	
836.60	4183	UMTS 850	RMC	23.5	22.91	0.11	6 mm	11524	1:1	right	0.137	1.146	0.157	
836.60	4183	UMTS 850	RMC	23.5	22.91	-0.17	0 mm	11524	1:1	left	0.102	1.146	0.117	
836.60	4183	UMTS 850	RMC	18.1	17.34	-0.01	0 mm	01806	1:1	back	0.478	1.191	0.569	A1
836.60	4183	UMTS 850	RMC	18.1	17.34	0.08	0 mm	01806	1:1	bottom	0.159	1.191	0.189	
836.60	4183	UMTS 850	RMC	18.1	17.34	0.03	0 mm	01806	1:1	right	0.133	1.191	0.158	
1732.40	1412	UMTS 1750	RMC	23.5	22.93	0.12	21 mm	11524	1:1	back	0.443	1.140	0.505	
1732.40	1412	UMTS 1750	RMC	23.5	22.93	-0.01	18 mm	11524	1:1	bottom	0.325	1.140	0.371	
1732.40	1412	UMTS 1750	RMC	23.5	22.93	0.00	6 mm	11524	1:1	right	0.415	1.140	0.473	
1732.40	1412	UMTS 1750	RMC	13.5	13.06	-0.02	0 mm	01798	1:1	back	0.535	1.107	0.592	A2
1732.40	1412	UMTS 1750	RMC	13.5	13.06	-0.01	0 mm	01798	1:1	bottom	0.181	1.107	0.200	
1732.40	1412	UMTS 1750	RMC	13.5	13.06	0.02	0 mm	01798	1:1	right	0.075	1.107	0.083	
1880.00	9400	UMTS 1900	RMC	23.5	22.79	-0.02	21 mm	11524	1:1	back	0.413	1.178	0.487	
1880.00	9400	UMTS 1900	RMC	23.5	22.79	0.08	18 mm	11524	1:1	bottom	0.461	1.178	0.543	
1880.00	9400	UMTS 1900	RMC	23.5	22.79	0.02	6 mm	11524	1:1	right	0.449	1.178	0.529	
1880.00	9400	UMTS 1900	RMC	12.0	11.75	0.11	0 mm	01780	1:1	back	0.570	1.059	0.604	A3
1880.00	9400	UMTS 1900	RMC	12.0	11.75	0.14	0 mm	01780	1:1	bottom	0.253	1.059	0.268	
1880.00	9400	UMTS 1900	RMC	12.0	11.75	0.06	0 mm	01780	1:1	right	0.078	1.059	0.083	
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 12 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)	
707.50	23095	Mid	LTE Band 12	10	24.0	23.68	0.15	0	11524	QPSK	1	0	21 mm	back	1:1	0.259	1.076	0.279	
707.50	23095	Mid	LTE Band 12	10	23.0	22.51	-0.05	1	11524	QPSK	25	0	21 mm	back	1:1	0.202	1.119	0.226	
707.50	23095	Mid	LTE Band 12	10	24.0	23.68	0.13	0	11524	QPSK	1	0	0 mm	top	1:1	0.063	1.076	0.068	
707.50	23095	Mid	LTE Band 12	10	23.0	22.51	0.00	1	11524	QPSK	25	0	0 mm	top	1:1	0.047	1.119	0.053	
707.50	23095	Mid	LTE Band 12	10	24.0	23.68	-0.05	0	11524	QPSK	1	0	18 mm	bottom	1:1	0.100	1.076	0.108	
707.50	23095	Mid	LTE Band 12	10	23.0	22.51	-0.03	1	11524	QPSK	25	0	18 mm	bottom	1:1	0.083	1.119	0.093	
707.50	23095	Mid	LTE Band 12	10	24.0	23.68	-0.14	0	11524	QPSK	1	0	6 mm	right	1:1	0.178	1.076	0.192	
707.50	23095	Mid	LTE Band 12	10	23.0	22.51	0.10	1	11524	QPSK	25	0	6 mm	right	1:1	0.130	1.119	0.145	
707.50	23095	Mid	LTE Band 12	10	24.0	23.68	0.14	0	11524	QPSK	1	0	0 mm	left	1:1	0.085	1.076	0.091	
707.50	23095	Mid	LTE Band 12	10	23.0	22.51	-0.02	1	11524	QPSK	25	0	0 mm	left	1:1	0.064	1.119	0.072	
707.50	23095	Mid	LTE Band 12	10	20.0	19.86	0.13	0	01806	QPSK	1	25	0 mm	back	1:1	0.933	1.033	0.964	A4
707.50	23095	Mid	LTE Band 12	10	19.0	18.67	-0.09	1	01806	QPSK	25	0	0 mm	back	1:1	0.754	1.079	0.814	
707.50	23095	Mid	LTE Band 12	10	19.0	18.63	-0.03	1	01806	QPSK	50	0	0 mm	back	1:1	0.741	1.089	0.807	
707.50	23095	Mid	LTE Band 12	10	20.0	19.86	-0.19	0	01806	QPSK	1	25	0 mm	bottom	1:1	0.219	1.033	0.226	
707.50	23095	Mid	LTE Band 12	10	19.0	18.67	0.03	1	01806	QPSK	25	0	0 mm	bottom	1:1	0.179	1.079	0.193	
707.50	23095	Mid	LTE Band 12	10	20.0	19.86	0.02	0	01806	QPSK	1	25	0 mm	right	1:1	0.154	1.033	0.159	
707.50	23095	Mid	LTE Band 12	10	19.0	18.67	-0.01	1	01806	QPSK	25	0	0 mm	right	1:1	0.136	1.079	0.147	
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 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	23.5	23.40	-0.13	0	01991	QPSK	1	0	21 mm	back	1:1	0.160	1.023	0.164	
710.00	23790	Mid	LTE Band 17	10	22.5	22.06	-0.13	1	01991	QPSK	25	0	21 mm	back	1:1	0.115	1.107	0.127	
710.00	23790	Mid	LTE Band 17	10	23.5	23.40	-0.13	0	01991	QPSK	1	0	0 mm	top	1:1	0.056	1.023	0.057	
710.00	23790	Mid	LTE Band 17	10	22.5	22.06	-0.01	1	01991	QPSK	25	0	0 mm	top	1:1	0.040	1.107	0.044	
710.00	23790	Mid	LTE Band 17	10	23.5	23.40	-0.11	0	01991	QPSK	1	0	18 mm	bottom	1:1	0.072	1.023	0.074	
710.00	23790	Mid	LTE Band 17	10	22.5	22.06	0.03	1	01991	QPSK	25	0	18 mm	bottom	1:1	0.055	1.107	0.061	
710.00	23790	Mid	LTE Band 17	10	23.5	23.40	-0.02	0	01991	QPSK	1	0	6 mm	right	1:1	0.137	1.023	0.140	
710.00	23790	Mid	LTE Band 17	10	22.5	22.06	-0.03	1	01991	QPSK	25	0	6 mm	right	1:1	0.112	1.107	0.124	
710.00	23790	Mid	LTE Band 17	10	23.5	23.40	-0.01	0	01991	QPSK	1	0	0 mm	left	1:1	0.077	1.023	0.079	
710.00	23790	Mid	LTE Band 17	10	22.5	22.06	-0.05	1	01991	QPSK	25	0	0 mm	left	1:1	0.052	1.107	0.058	
710.00	23790	Mid	LTE Band 17	10	20.9	20.44	0.00	0	01884	QPSK	1	49	0 mm	back	1:1	0.981	1.112	**1.091**	A5
710.00	23790	Mid	LTE Band 17	10	19.9	19.01	-0.12	1	01884	QPSK	25	25	0 mm	back	1:1	0.700	1.227	0.859	
710.00	23790	Mid	LTE Band 17	10	19.9	18.95	0.02	1	01884	QPSK	50	0	0 mm	back	1:1	0.689	1.245	0.858	
710.00	23790	Mid	LTE Band 17	10	20.9	20.44	-0.01	0	01884	QPSK	1	49	0 mm	bottom	1:1	0.265	1.112	0.295	
710.00	23790	Mid	LTE Band 17	10	19.9	19.01	-0.08	1	01884	QPSK	25	25	0 mm	bottom	1:1	0.183	1.227	0.225	
710.00	23790	Mid	LTE Band 17	10	20.9	20.44	-0.08	0	01884	QPSK	1	49	0 mm	right	1:1	0.205	1.112	0.228	
710.00	23790	Mid	LTE Band 17	10	19.9	19.01	-0.03	1	01884	QPSK	25	25	0 mm	right	1:1	0.140	1.227	0.172	
710.00	23790	Mid	LTE Band 17	10	20.9	20.44	0.01	0	01884	QPSK	1	49	0 mm	back	1:1	0.922	1.112	1.025	
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 data is highlighted blue in the table above.

Table 10-4
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	23.5	23.44	-0.08	0	01991	QPSK	1	0	21 mm	back	1:1	0.181	1.014	0.184	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	22.25	-0.06	1	01991	QPSK	25	0	21 mm	back	1:1	0.125	1.059	0.132	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	23.44	0.09	0	01991	QPSK	1	0	0 mm	top	1:1	0.053	1.014	0.054	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	22.25	0.06	1	01991	QPSK	25	0	0 mm	top	1:1	0.036	1.059	0.038	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	23.44	-0.04	0	01991	QPSK	1	0	18 mm	bottom	1:1	0.120	1.014	0.122	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	22.25	0.05	1	01991	QPSK	25	0	18 mm	bottom	1:1	0.081	1.059	0.086	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	23.44	-0.11	0	01991	QPSK	1	0	6 mm	right	1:1	0.236	1.014	0.239	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	22.25	-0.10	1	01991	QPSK	25	0	6 mm	right	1:1	0.175	1.059	0.185	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.5	23.44	-0.11	0	01991	QPSK	1	0	0 mm	left	1:1	0.096	1.014	0.097	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.5	22.25	0.03	1	01991	QPSK	25	0	0 mm	left	1:1	0.075	1.059	0.079	
836.50	20525	Mid	LTE Band 5 (Cell)	10	19.8	19.50	-0.08	0	01884	QPSK	1	0	0 mm	back	1:1	0.974	1.072	1.044	A6
836.50	20525	Mid	LTE Band 5 (Cell)	10	18.8	18.02	-0.01	1	01884	QPSK	25	0	0 mm	back	1:1	0.690	1.197	0.826	
836.50	20525	Mid	LTE Band 5 (Cell)	10	18.8	17.94	-0.04	1	01884	QPSK	50	0	0 mm	back	1:1	0.704	1.219	0.858	
836.50	20525	Mid	LTE Band 5 (Cell)	10	19.8	19.50	-0.03	0	01884	QPSK	1	0	0 mm	bottom	1:1	0.296	1.072	0.317	
836.50	20525	Mid	LTE Band 5 (Cell)	10	18.8	18.02	-0.02	1	01884	QPSK	25	0	0 mm	bottom	1:1	0.204	1.197	0.244	
836.50	20525	Mid	LTE Band 5 (Cell)	10	19.8	19.50	-0.03	0	01884	QPSK	1	0	0 mm	right	1:1	0.269	1.072	0.288	
836.50	20525	Mid	LTE Band 5 (Cell)	10	18.8	18.02	0.02	1	01884	QPSK	25	0	0 mm	right	1:1	0.183	1.197	0.219	
836.50	20525	Mid	LTE Band 5 (Cell)	10	19.8	19.50	0.09	0	01884	QPSK	1	0	0 mm	back	1:1	0.909	1.072	0.974	

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 data is highlighted blue in the table above.

Table 10-5
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	24.0	23.71	-0.02	0	11524	QPSK	1	0	21 mm	back	1:1	0.400	1.069	0.428	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.0	22.75	0.02	1	11524	QPSK	50	0	21 mm	back	1:1	0.322	1.059	0.341	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.0	23.71	0.00	0	11524	QPSK	1	0	18 mm	bottom	1:1	0.322	1.069	0.344	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.0	22.75	0.04	1	11524	QPSK	50	0	18 mm	bottom	1:1	0.239	1.059	0.253	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.0	23.71	0.10	0	11524	QPSK	1	0	6 mm	right	1:1	0.461	1.069	0.493	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.0	22.75	0.05	1	11524	QPSK	50	0	6 mm	right	1:1	0.340	1.059	0.360	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	13.7	13.60	-0.11	0	01780	QPSK	1	0	0 mm	back	1:1	0.831	1.023	0.850	A7
1732.50	20175	Mid	LTE Band 4 (AWS)	20	12.7	12.03	0.02	1	01780	QPSK	50	0	0 mm	back	1:1	0.577	1.167	0.673	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	12.7	11.87	-0.08	1	01780	QPSK	100	0	0 mm	back	1:1	0.581	1.211	0.704	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	13.7	13.60	-0.16	0	01780	QPSK	1	0	0 mm	bottom	1:1	0.224	1.023	0.229	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	12.7	12.03	0.06	1	01780	QPSK	50	0	0 mm	bottom	1:1	0.163	1.167	0.190	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	13.7	13.60	0.17	0	01780	QPSK	1	0	0 mm	right	1:1	0.129	1.023	0.132	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	12.7	12.03	0.04	1	01780	QPSK	50	0	0 mm	right	1:1	0.090	1.167	0.105	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	13.7	13.60	0.01	0	01780	QPSK	1	0	0 mm	back	1:1	0.817	1.023	0.836	

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 data is highlighted blue in the table above.

Table 10-6
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) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.																		
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.0	23.62	-0.01	0	11490	QPSK	1	0	21 mm	back	1:1	0.437	1.091	0.477	
1900.00	19100	High	LTE Band 2 (PCS)	20	23.0	22.31	0.03	1	11490	QPSK	50	25	21 mm	back	1:1	0.350	1.172	0.410	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.0	23.62	-0.03	0	11490	QPSK	1	0	18 mm	bottom	1:1	0.513	1.091	0.560	
1900.00	19100	High	LTE Band 2 (PCS)	20	23.0	22.31	-0.01	1	11490	QPSK	50	25	18 mm	bottom	1:1	0.407	1.172	0.477	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.0	23.62	-0.12	0	11490	QPSK	1	0	6 mm	right	1:1	0.469	1.091	0.512	
1900.00	19100	High	LTE Band 2 (PCS)	20	23.0	22.31	0.09	1	11490	QPSK	50	25	6 mm	right	1:1	0.401	1.172	0.470	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	12.3	12.30	0.08	0	01806	QPSK	1	0	0 mm	back	1:1	0.678	1.000	0.678	
1900.00	19100	High	LTE Band 2 (PCS)	20	11.3	10.81	0.01	1	01806	QPSK	50	0	0 mm	back	1:1	0.467	1.119	0.523	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	12.3	12.30	0.02	0	01806	QPSK	1	0	0 mm	bottom	1:1	0.688	1.000	0.688	A8
1900.00	19100	High	LTE Band 2 (PCS)	20	11.3	10.81	0.01	1	01806	QPSK	50	0	0 mm	bottom	1:1	0.254	1.119	0.284	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	12.3	12.30	0.01	0	01806	QPSK	1	0	0 mm	right	1:1	0.119	1.000	0.119	
1900.00	19100	High	LTE Band 2 (PCS)	20	11.3	10.81	-0.12	1	01806	QPSK	50	0	0 mm	right	1:1	0.078	1.119	0.087	

ANSI / IEEE C95.1 1992 - SAFETY LIMIT	Body
Spatial Peak	1.6 W/kg (mW/g)
Uncontrolled Exposure/General Population	averaged over 1 gram

Table 10-7
WLAN Body SAR

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Service	Bandwidth [MHz]	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 (Power)	Scaling Factor (Duty Cycle)	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.																
2462	11	802.11b	DSSS	22	16.5	16.23	0.00	12 mm	11490	1	back	99.6	0.219	1.064	1.004	0.234	
2462	11	802.11b	DSSS	22	16.5	16.23	0.02	5 mm	11490	1	top	99.6	0.141	1.064	1.004	0.151	
2462	11	802.11b	DSSS	22	16.5	16.23	0.14	0 mm	11490	1	right	99.6	0.318	1.064	1.004	0.339	
2412	1	802.11b	DSSS	22	11.5	11.49	0.06	0 mm	11490	1	back	99.6	0.591	1.002	1.004	**0.594**	A9
2412	1	802.11b	DSSS	22	11.5	11.49	0.10	0 mm	11490	1	top	99.6	0.057	1.002	1.004	0.057	
5300	60	802.11a	OFDM	20	11.5	11.48	-0.05	12 mm	11516	6	back	98.5	0.104	1.005	1.015	0.107	
5300	60	802.11a	OFDM	20	11.5	11.48	-0.10	5 mm	11516	6	top	98.5	0.306	1.005	1.015	0.313	
5300	60	802.11a	OFDM	20	11.5	11.48	0.05	0 mm	11516	6	right	98.5	0.044	1.005	1.015	0.045	
5270	54	802.11n	OFDM	40	7.5	6.78	-0.02	0 mm	11516	13.5	back	98.2	0.523	1.180	1.018	**0.628**	
5270	54	802.11n	OFDM	40	7.5	6.78	-0.09	0 mm	11516	13.5	top	98.2	0.210	1.180	1.018	0.252	
5500	100	802.11a	OFDM	20	11.5	11.44	-0.14	12 mm	11516	6	back	98.5	0.106	1.014	1.015	0.109	
5500	100	802.11a	OFDM	20	11.5	11.44	0.08	5 mm	11516	6	top	98.5	0.370	1.014	1.015	0.381	
5500	100	802.11a	OFDM	20	11.5	11.44	0.17	0 mm	11516	6	right	98.5	0.079	1.014	1.015	0.081	
5670	134	802.11n	OFDM	40	7.5	7.44	-0.16	0 mm	11516	13.5	back	98.2	0.590	1.014	1.018	0.609	A11
5670	134	802.11n	OFDM	40	7.5	7.44	0.14	0 mm	11516	13.5	top	98.2	0.275	1.014	1.018	0.284	
5745	149	802.11a	OFDM	20	11.5	11.40	0.05	12 mm	11516	6	back	98.5	0.089	1.023	1.015	0.092	
5745	149	802.11a	OFDM	20	11.5	11.40	0.07	5 mm	11516	6	top	98.5	0.349	1.023	1.015	0.362	
5745	149	802.11a	OFDM	20	11.5	11.40	-0.17	0 mm	11516	6	right	98.5	0.133	1.023	1.015	0.138	
5755	151	802.11n	OFDM	40	7.5	6.63	-0.14	0 mm	11516	13.5	back	98.2	0.436	1.222	1.018	0.543	
5755	151	802.11n	OFDM	40	7.5	6.63	0.20	0 mm	11516	13.5	top	98.2	0.201	1.222	1.018	0.250	

ANSI / IEEE C95.1 1992 - SAFETY LIMIT	Body
Spatial Peak	1.6 W/kg (mW/g)
Uncontrolled Exposure/General Population	averaged over 1 gram

Table 10-8
Bluetooth Body SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2441	39	Bluetooth	FHSS	9.5	9.47	0.04	0 mm	11490	1	back	1:1	0.133	1.007	0.134	A10
2441	39	Bluetooth	FHSS	9.5	9.47	0.13	0 mm	11490	1	top	1:1	0.016	1.007	0.016	
2441	39	Bluetooth	FHSS	9.5	9.47	-0.01	0 mm	11490	1	right	1:1	0.019	1.007	0.019	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

10.2 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in FCC KDB Publication 616217 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. SAR tests were required for bottom and right edges for the main antenna, and were required for top and right edges for the WLAN/BT antenna. For UMTS 850, LTE B12/17/5, SAR was additionally evaluated for top and left edges per manufacturer request.

UMTS Notes:

1. UMTS mode was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v03. HSPA SAR was not required per 3G Test Reduction Procedures.
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.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r03. The general test procedures used for testing can be found in Section 7.5.4.
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 test configurations for WLAN per KDB Publication 248227 D01v02 for 2.4 GHz WIFI operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 7.6.4 for more information.
2. Justification for test configurations for WLAN per KDB Publication 248227 D01v02 for 5 GHz WIFI operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2 W/kg. See Section 7.6.5 for more information.
3. When the maximum reported 1g averaged SAR is ≤0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg or all test channels were measured.
4. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. Procedures used to measure the duty factor are identical to that in the associated EMC test reports.

11 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

11.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v05r02 are applicable to devices with built-in unlicensed transmitters such as 802.11 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. The different test positions in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1-g or 10-g SAR.

Notes: When the antenna separation distance was > 50 mm, an estimated SAR of 0.4 W/kg was used to determine the simultaneous transmission SAR exclusion, for configurations excluded per FCC KDB Publication 447498 D01v05.

11.3 Body SAR Simultaneous Transmission Analysis

Table 11-1
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body at 0.0 cm)

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.569	0.594	**1.163**	N/A
	Top	0.034	0.057	0.091	N/A
	Bottom	0.189	0.400	0.589	N/A
	Right	0.158	0.339	0.497	N/A
	Left	0.117	0.400	0.517	N/A

Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.592	0.594	**1.186**	N/A
	Top	0.400	0.057	0.457	N/A
	Bottom	0.200	0.400	0.600	N/A
	Right	0.083	0.339	0.422	N/A
	Left	0.400	0.400	0.800	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	0.604	0.594	**1.198**	N/A
	Top	0.400	0.057	0.457	N/A
	Bottom	0.268	0.400	0.668	N/A
	Right	0.083	0.339	0.422	N/A
	Left	0.400	0.400	0.800	N/A

Simult Tx	Configuration	LTE Band 12 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.964	0.594	**1.558**	N/A
	Top	0.068	0.057	0.125	N/A
	Bottom	0.226	0.400	0.626	N/A
	Right	0.159	0.339	0.498	N/A
	Left	0.091	0.400	0.491	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	1.091	0.594	See Note 1	0.01
	Top	0.057	0.057	0.114	N/A
	Bottom	0.295	0.400	**0.695**	N/A
	Right	0.228	0.339	0.567	N/A
	Left	0.079	0.400	0.479	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	1.044	0.594	See Note 1	0.01
	Top	0.054	0.057	0.111	N/A
	Bottom	0.317	0.400	**0.717**	N/A
	Right	0.288	0.339	0.627	N/A
	Left	0.097	0.400	0.497	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	0.850	0.594	**1.444**	N/A
	Top	0.400	0.057	0.457	N/A
	Bottom	0.229	0.400	0.629	N/A
	Right	0.132	0.339	0.471	N/A
	Left	0.400	0.400	0.800	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	0.678	0.594	**1.272**	N/A
	Top	0.400	0.057	0.457	N/A
	Bottom	0.688	0.400	1.088	N/A
	Right	0.119	0.339	0.458	N/A
	Left	0.400	0.400	0.800	N/A

Table 11-2
Simultaneous Transmission Scenario with 5 GHz WLAN (Body at 0.0 cm)

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.569	0.628	**1.197**	N/A
	Top	0.034	0.284	0.318	N/A
	Bottom	0.189	0.400	0.589	N/A
	Right	0.158	0.138	0.296	N/A
	Left	0.117	0.400	0.517	N/A

Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.592	0.628	**1.220**	N/A
	Top	0.400	0.284	0.684	N/A
	Bottom	0.200	0.400	0.600	N/A
	Right	0.083	0.138	0.221	N/A
	Left	0.400	0.400	0.800	N/A

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.604	0.628	**1.232**	N/A
	Top	0.400	0.284	0.684	N/A
	Bottom	0.268	0.400	0.668	N/A
	Right	0.083	0.138	0.221	N/A
	Left	0.400	0.400	0.800	N/A

Simult Tx	Configuration	LTE Band 12 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.964	0.628	**1.592**	N/A
	Top	0.068	0.284	0.352	N/A
	Bottom	0.226	0.400	0.626	N/A
	Right	0.159	0.138	0.297	N/A
	Left	0.091	0.400	0.491	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	1.091	0.628	See Note 1	0.01
	Top	0.057	0.284	0.341	N/A
	Bottom	0.295	0.400	**0.695**	N/A
	Right	0.228	0.138	0.366	N/A
	Left	0.079	0.400	0.479	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	1.044	0.628	See Note 1	0.01
	Top	0.054	0.284	0.338	N/A
	Bottom	0.317	0.400	**0.717**	N/A
	Right	0.288	0.138	0.426	N/A
	Left	0.097	0.400	0.497	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	0.850	0.628	**1.478**	N/A
	Top	0.400	0.284	0.684	N/A
	Bottom	0.229	0.400	0.629	N/A
	Right	0.132	0.138	0.270	N/A
	Left	0.400	0.400	0.800	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	0.678	0.628	**1.306**	N/A
	Top	0.400	0.284	0.684	N/A
	Bottom	0.688	0.400	1.088	N/A
	Right	0.119	0.138	0.257	N/A
	Left	0.400	0.400	0.800	N/A

Table 11-3
Simultaneous Transmission Scenario with Bluetooth (Body at 0.0 cm)

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.569	0.134	**0.703**
	Top	0.034	0.016	0.050
	Bottom	0.189	0.400	0.589
	Right	0.158	0.019	0.177
	Left	0.117	0.400	0.517

Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.592	0.134	0.726
	Top	0.400	0.016	0.416
	Bottom	0.200	0.400	0.600
	Right	0.083	0.019	0.102
	Left	0.400	0.400	**0.800**

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.604	0.134	0.738
	Top	0.400	0.016	0.416
	Bottom	0.268	0.400	0.668
	Right	0.083	0.019	0.102
	Left	0.400	0.400	**0.800**

Simult Tx	Configuration	LTE Band 12 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.964	0.134	**1.098**
	Top	0.068	0.016	0.084
	Bottom	0.226	0.400	0.626
	Right	0.159	0.019	0.178
	Left	0.091	0.400	0.491

Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	1.091	0.134	**1.225**
	Top	0.057	0.016	0.073
	Bottom	0.295	0.400	0.695
	Right	0.228	0.019	0.247
	Left	0.079	0.400	0.479

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	1.044	0.134	**1.178**
	Top	0.054	0.016	0.070
	Bottom	0.317	0.400	0.717
	Right	0.288	0.019	0.307
	Left	0.097	0.400	0.497

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.850	0.134	**0.984**
	Top	0.400	0.016	0.416
	Bottom	0.229	0.400	0.629
	Right	0.132	0.019	0.151
	Left	0.400	0.400	0.800

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.678	0.134	0.812
	Top	0.400	0.016	0.416
	Bottom	0.688	0.400	**1.088**
	Right	0.119	0.019	0.138
	Left	0.400	0.400	0.800

Table 11-4
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body at 2.1 cm)

Configuration	Mode	3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	UMTS 850	0.335	< 0.234	< 0.569
Back Side	UMTS 1750	0.505	< 0.234	< 0.739
Back Side	UMTS 1900	0.487	< 0.234	< 0.721
Back Side	LTE Band 12	0.279	< 0.234	< 0.513
Back Side	LTE Band 17	0.164	< 0.234	< 0.398
Back Side	LTE Band 5	0.184	< 0.234	< 0.418
Back Side	LTE Band 4 (AWS)	0.428	< 0.234	< 0.662
Back Side	LTE Band 2 (PCS)	0.477	< 0.234	< 0.711

Table 11-5
Simultaneous Transmission Scenario with 5 GHz WLAN (Body at 2.1 cm)

Configuration	Mode	3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	UMTS 850	0.335	< 0.109	< 0.444
Back Side	UMTS 1750	0.505	< 0.109	< 0.614
Back Side	UMTS 1900	0.487	< 0.109	< 0.596
Back Side	LTE Band 12	0.279	< 0.109	< 0.388
Back Side	LTE Band 17	0.164	< 0.109	< 0.273
Back Side	LTE Band 5	0.184	< 0.109	< 0.293
Back Side	LTE Band 4 (AWS)	0.428	< 0.109	< 0.537
Back Side	LTE Band 2 (PCS)	0.477	< 0.109	< 0.586

Table 11-6
Simultaneous Transmission Scenario with Bluetooth (Body at 2.1 cm)

Configuration	Mode	3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Back Side	UMTS 850	0.335	< 0.134	< 0.469
Back Side	UMTS 1750	0.505	< 0.134	< 0.639
Back Side	UMTS 1900	0.487	< 0.134	< 0.621
Back Side	LTE Band 12	0.279	< 0.134	< 0.413
Back Side	LTE Band 17	0.164	< 0.134	< 0.298
Back Side	LTE Band 5	0.184	< 0.134	< 0.318
Back Side	LTE Band 4 (AWS)	0.428	< 0.134	< 0.562
Back Side	LTE Band 2 (PCS)	0.477	< 0.134	< 0.611

Table 11-7
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body at 1.8 cm)

Configuration	Mode	3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Bottom Edge	UMTS 850	0.023	0.400	0.423
Bottom Edge	UMTS 1750	0.371	0.400	0.771
Bottom Edge	UMTS 1900	0.543	0.400	0.943
Bottom Edge	LTE Band 12	0.108	0.400	0.508
Bottom Edge	LTE Band 17	0.074	0.400	0.474
Bottom Edge	LTE Band 5	0.122	0.400	0.522
Bottom Edge	LTE Band 4 (AWS)	0.344	0.400	0.744
Bottom Edge	LTE Band 2 (PCS)	0.560	0.400	0.960

Table 11-8
Simultaneous Transmission Scenario with 5 GHz WLAN (Body at 1.8 cm)

Configuration	Mode	3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Bottom Edge	UMTS 850	0.023	0.400	0.423
Bottom Edge	UMTS 1750	0.371	0.400	0.771
Bottom Edge	UMTS 1900	0.543	0.400	0.943
Bottom Edge	LTE Band 12	0.108	0.400	0.508
Bottom Edge	LTE Band 17	0.074	0.400	0.474
Bottom Edge	LTE Band 5	0.122	0.400	0.522
Bottom Edge	LTE Band 4 (AWS)	0.344	0.400	0.744
Bottom Edge	LTE Band 2 (PCS)	0.560	0.400	0.960

Table 11-9
Simultaneous Transmission Scenario with Bluetooth (Body at 1.8 cm)

Configuration	Mode	3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Bottom Edge	UMTS 850	0.023	0.400	0.423
Bottom Edge	UMTS 1750	0.371	0.400	0.771
Bottom Edge	UMTS 1900	0.543	0.400	0.943
Bottom Edge	LTE Band 12	0.108	0.400	0.508
Bottom Edge	LTE Band 17	0.074	0.400	0.474
Bottom Edge	LTE Band 5	0.122	0.400	0.522
Bottom Edge	LTE Band 4 (AWS)	0.344	0.400	0.744
Bottom Edge	LTE Band 2 (PCS)	0.560	0.400	0.960

Table 11-10
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body at 0.6 cm)

Configuration	Mode	3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Right Edge	UMTS 850	0.157	< 0.339	< 0.496
Right Edge	UMTS 1750	0.473	< 0.339	< 0.812
Right Edge	UMTS 1900	0.529	< 0.339	< 0.868
Right Edge	LTE Band 12	0.192	< 0.339	< 0.531
Right Edge	LTE Band 17	0.140	< 0.339	< 0.479
Right Edge	LTE Band 5	0.239	< 0.339	< 0.578
Right Edge	LTE Band 4 (AWS)	0.493	< 0.339	< 0.832
Right Edge	LTE Band 2 (PCS)	0.512	< 0.339	< 0.851

Table 11-11
Simultaneous Transmission Scenario with 5 GHz WLAN (Body at 0.6 cm)

Configuration	Mode	3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Right Edge	UMTS 850	0.157	< 0.138	< 0.295
Right Edge	UMTS 1750	0.473	< 0.138	< 0.611
Right Edge	UMTS 1900	0.529	< 0.138	< 0.667
Right Edge	LTE Band 12	0.192	< 0.138	< 0.330
Right Edge	LTE Band 17	0.140	< 0.138	< 0.278
Right Edge	LTE Band 5	0.239	< 0.138	< 0.377
Right Edge	LTE Band 4 (AWS)	0.493	< 0.138	< 0.631
Right Edge	LTE Band 2 (PCS)	0.512	< 0.138	< 0.650

Table 11-12
Simultaneous Transmission Scenario with Bluetooth (Body at 0.6 cm)

Configuration	Mode	3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Right Edge	UMTS 850	0.157	< 0.019	< 0.176
Right Edge	UMTS 1750	0.473	< 0.019	< 0.492
Right Edge	UMTS 1900	0.529	< 0.019	< 0.548
Right Edge	LTE Band 12	0.192	< 0.019	< 0.211
Right Edge	LTE Band 17	0.140	< 0.019	< 0.159
Right Edge	LTE Band 5	0.239	< 0.019	< 0.258
Right Edge	LTE Band 4 (AWS)	0.493	< 0.019	< 0.512
Right Edge	LTE Band 2 (PCS)	0.512	< 0.019	< 0.531

Table 11-13
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body at 1.2 cm)

Configuration	Mode	3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	UMTS 850	< 0.569	0.234	< 0.803
Back Side	UMTS 1750	< 0.592	0.234	< 0.826
Back Side	UMTS 1900	< 0.604	0.234	< 0.838
Back Side	LTE Band 12	< 0.964	0.234	< 1.198
Back Side	LTE Band 17	< 1.091	0.234	< 1.325
Back Side	LTE Band 5	< 1.044	0.234	< 1.084
Back Side	LTE Band 4 (AWS)	< 0.850	0.234	< 1.084
Back Side	LTE Band 2 (PCS)	< 0.678	0.234	< 0.912

Table 11-14
Simultaneous Transmission Scenario with 5 GHz WLAN (Body at 1.2 cm)

Configuration	Mode	3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	UMTS 850	< 0.569	0.109	< 0.678
Back Side	UMTS 1750	< 0.592	0.109	< 0.701
Back Side	UMTS 1900	< 0.604	0.109	< 0.713
Back Side	LTE Band 12	< 0.964	0.109	< 1.073
Back Side	LTE Band 17	< 1.091	0.109	< 1.200
Back Side	LTE Band 5	< 1.044	0.109	< 0.959
Back Side	LTE Band 4 (AWS)	< 0.850	0.109	< 0.959
Back Side	LTE Band 2 (PCS)	< 0.678	0.109	< 0.787

Table 11-15
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body at 0.5 cm)

Configuration	Mode	3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Top Edge	UMTS 850	0.400	0.151	0.551
Top Edge	UMTS 1750	0.400	0.151	0.551
Top Edge	UMTS 1900	0.400	0.151	0.551
Top Edge	LTE Band 12	0.400	0.151	0.551
Top Edge	LTE Band 17	0.400	0.151	0.551
Top Edge	LTE Band 5	0.400	0.151	0.551
Top Edge	LTE Band 4 (AWS)	0.400	0.151	0.551
Top Edge	LTE Band 2 (PCS)	0.400	0.151	0.551

Table 11-16
Simultaneous Transmission Scenario with 5 GHz WLAN (Body at 0.5 cm)

Configuration	Mode	3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Top Edge	UMTS 850	0.400	0.381	0.781
Top Edge	UMTS 1750	0.400	0.381	0.781
Top Edge	UMTS 1900	0.400	0.381	0.781
Top Edge	LTE Band 12	0.400	0.381	0.781
Top Edge	LTE Band 17	0.400	0.381	0.781
Top Edge	LTE Band 5	0.400	0.381	0.781
Top Edge	LTE Band 4 (AWS)	0.400	0.381	0.781
Top Edge	LTE Band 2 (PCS)	0.400	0.381	0.781

Notes:

1. No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was ≤ 0.04 per FCC KDB 447498 D01v05. See Section 11.4 for detailed SPLS ratio analysis.
2. For SAR summation for body (back side at 21 mm), WLAN SAR values for 12 mm were used since the 12 mm test distance for WLAN SAR was more conservative. "<" denotes that the 12 mm WLAN SAR values were used for summation purposes.
3. For SAR summation for body (back side at 21 mm), BT SAR values for 0 mm were used since the 0 mm test distance for BT SAR was more conservative. "<" denotes that the 0 mm BT SAR values were used for summation purposes.
4. For SAR summation for body (right edge at 6 mm), WLAN/BT SAR values for 0 mm were used since the 0 mm test distance for WLAN/BT SAR was more conservative. "<" denotes that the 0 mm WLAN/BT SAR values were used for summation purposes.
5. For SAR summation for body (back side at 12 mm), UMTS/LTE SAR values for 0 mm were used since the 0 mm test distance for UMTS/LTE SAR was more conservative. "<" denotes that the 0 mm UMTS/LTE SAR values 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.

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

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

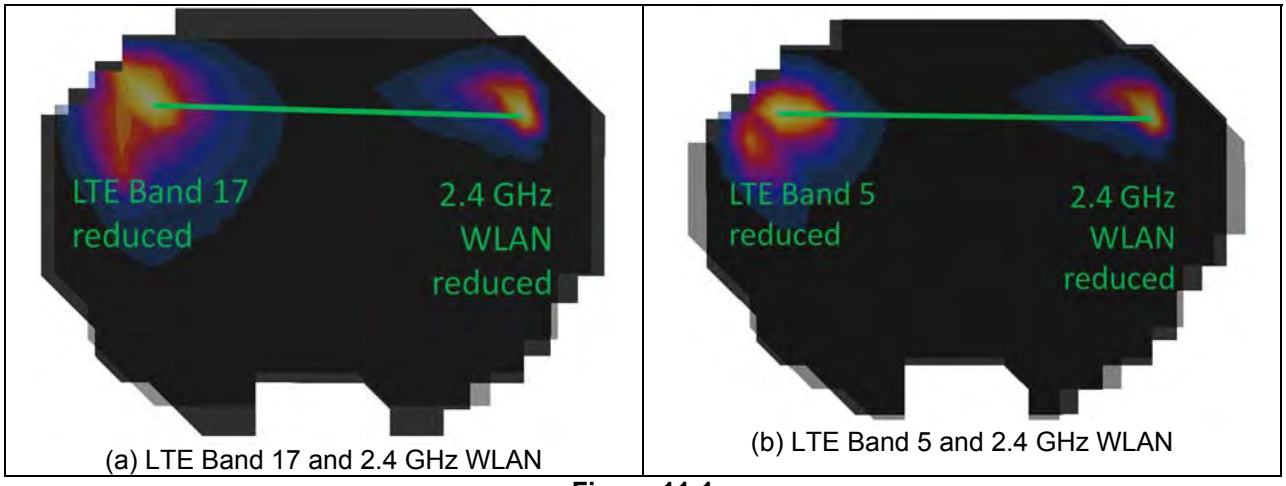
The sums of the standalone SAR values were above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0.0 cm for 2.4 GHz WLAN operating with LTE Band 17 and LTE Band 5 (Cell.) operating at limited power.

Table 11-17
Peak SAR Locations for Body Back Side at 0.0 cm

Mode/Band	x (mm)	y (mm)
2.4 GHz WLAN	-67.40	87.60
LTE Band 17	-56.00	-93.50
LTE Band 5	-68.50	-98.50

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

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 17	2.4 GHz WLAN	1.091	0.594	1.685	181.46	0.01
LTE Band 5	2.4 GHz WLAN	1.044	0.594	1.638	186.10	0.01



(a) LTE Band 17 and 2.4 GHz WLAN

(b) LTE Band 5 and 2.4 GHz WLAN

Figure 11-1
Peak SAR Locations for Body Back Side at 0.0 cm

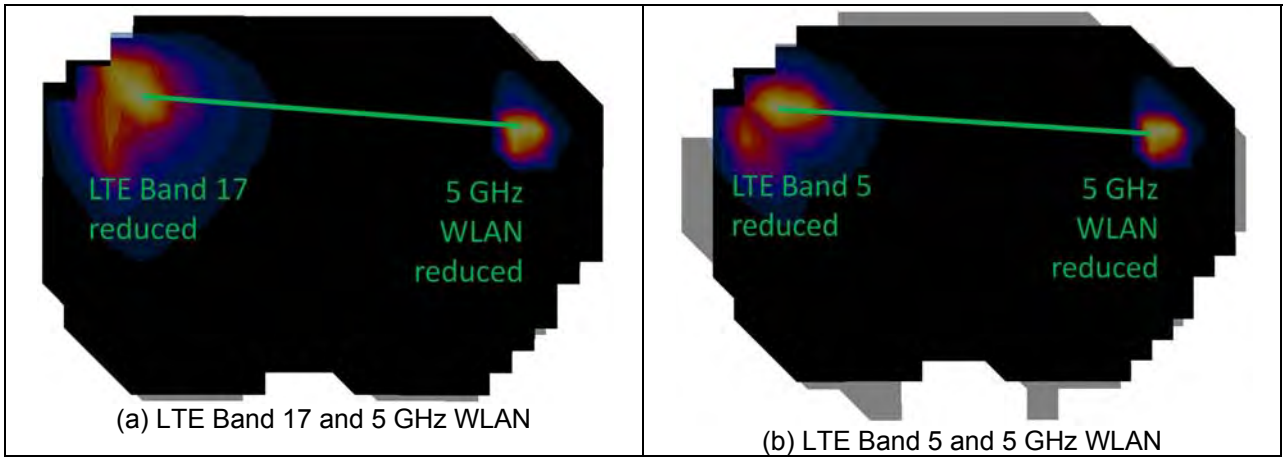
The sums of the standalone SAR values were above 1.6 W/kg for the Body Back Side configuration at a separation distance of 0.0 cm for 5 GHz WLAN operating with LTE Band 17 and LTE Band 5 (Cell.) operating at limited power.

Table 11-19
Peak SAR Locations for Body Back Side at 0.0 cm

Mode/Band	x (mm)	y (mm)
5 GHz WLAN	-53.00	94.00
LTE Band 17	-56.00	-93.50
LTE Band 5	-68.50	-98.50

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

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 17	5 GHz WLAN	1.091	0.628	1.719	187.52	0.01
LTE Band 5	5 GHz WLAN	1.044	0.628	1.672	193.12	0.01



(a) LTE Band 17 and 5 GHz WLAN

(b) LTE Band 5 and 5 GHz WLAN

Figure 11-2
Peak SAR Locations for Body Back Side at 0.0 cm

11.5 Simultaneous Transmission Conclusion

The above numerical summed SAR and SPLSR 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	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)	
750	710.00	23790	LTE Band 17	QPSK, 1 RB, 49 RB Offset	back	0 mm	0.981	0.922	1.06	N/A	N/A	N/A	N/A
835	836.50	20525	LTE Band 5 (Cell)	QPSK, 1 RB, 0 RB Offset	back	0 mm	0.974	0.909	1.07	N/A	N/A	N/A	N/A
1750	1732.50	20175	LTE Band 4 (AWS)	QPSK, 1 RB, 0 RB Offset	back	0 mm	0.831	0.817	1.02	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
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/12/2014	Annual	8/12/2015	1041
SPEAG	DAK-3.5	Dielectric Assessment Kit	10/21/2014	Annual	10/21/2015	1091
SPEAG	D750V3	750 MHz Dipole	2/19/2015	Annual	2/19/2016	1046
SPEAG	D835V2	835 MHz SAR Dipole	7/24/2014	Annual	7/24/2015	4d133
SPEAG	D835V2	835 MHz SAR Dipole	4/13/2015	Annual	4/13/2016	4d119
SPEAG	D1750V2	1750 MHz SAR Dipole	4/15/2015	Annual	4/15/2016	1051
SPEAG	D1900V2	1900 MHz SAR Dipole	2/18/2015	Annual	2/18/2016	5d148
SPEAG	D2450V2	2450 MHz SAR Dipole	8/11/2014	Annual	8/11/2015	719
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/21/2015	Annual	1/21/2016	1057
SPEAG	ES3DV3	SAR Probe	8/20/2014	Annual	8/20/2015	3331
SPEAG	ES3DV3	SAR Probe	1/20/2015	Annual	1/20/2016	3213
SPEAG	ES3DV3	SAR Probe	5/20/2015	Annual	5/20/2016	3263
SPEAG	ES3DV3	SAR Probe	12/16/2014	Annual	12/16/2015	3334
SPEAG	ES3DV3	SAR Probe	3/19/2015	Annual	3/19/2016	3209
SPEAG	EX3DV4	SAR Probe	1/22/2015	Annual	1/22/2016	3589
SPEAG	DAE4	Dasy Data Acquisition Electronics	10/31/2014	Annual	10/31/2015	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/20/2015	Annual	4/20/2016	1407
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/22/2015	Annual	5/22/2016	859
SPEAG	DAE4	Dasy Data Acquisition Electronics	12/12/2014	Annual	12/12/2015	1415
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/13/2015	Annual	3/13/2016	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/17/2014	Annual	9/17/2015	1323
Agilent	8753ES	S-Parameter Network Analyzer	1/20/2015	Annual	1/20/2016	US39170122
Agilent	N5182A	MXG Vector Signal Generator	3/16/2015	Annual	3/16/2016	MY47420651
Agilent	E4438C	ESG Vector Signal Generator	4/1/2014	Biennial	4/1/2016	MY47270002
Agilent	8753ES	Network Analyzer	3/20/2015	Annual	3/20/2016	MY40001472
Agilent	8753ES	S-Parameter Network Analyzer	3/12/2015	Annual	3/12/2016	MY40000670
Agilent	E4438C	ESG Vector Signal Generator	3/12/2015	Annual	3/12/2016	MY45090700
Agilent	E4438C	ESG Vector Signal Generator	3/15/2015	Annual	3/15/2016	MY45091346
Agilent	8753E	(30kHz-6GHz) Network Analyzer	12/30/2014	Annual	12/30/2015	JP38020182
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	E8257D	(250kHz-20GHz) Signal Generator	3/15/2015	Annual	3/15/2016	MY45470194
Agilent	N9020A	MXA Signal Analyzer	10/27/2014	Annual	10/27/2015	US46470561
Agilent	N4010A	Wireless Connectivity Test Set	CBT	N/A	CBT	GB46170464
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433975
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433974
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433977
Anritsu	ML2438A	Power Meter	3/13/2015	Annual	3/13/2016	1190013
Anritsu	MA2411B	Pulse Power Sensor	11/17/2014	Annual	11/17/2015	1207364
Anritsu	MA2411B	Pulse Power Sensor	11/17/2014	Annual	11/17/2015	1126066
Anritsu	MA24106A	USB Power Sensor	3/11/2015	Annual	3/11/2016	1349514
Anritsu	MA24106A	USB Power Sensor	3/11/2015	Annual	3/11/2016	1344557
Anritsu	MA24106A	USB Power Sensor	3/11/2015	Annual	3/11/2016	1349509
Anritsu	MA24106A	USB Power Sensor	3/2/2015	Annual	3/2/2016	1349503
Anritsu	MA2481A	Power Sensor	3/11/2015	Annual	3/11/2016	5318
Anritsu	ML2496A	Power Meter	3/13/2015	Annual	3/13/2016	1306009
Anritsu	ML2496A	Power Meter	3/13/2015	Annual	3/13/2016	1351001
Anritsu	MA2481A	Power Sensor	3/10/2015	Annual	3/10/2016	2400
Anritsu	MT8820C	Radio Communication Analyzer	11/18/2014	Annual	11/18/2015	6201300731
Anritsu	MA2481A	Power Sensor	3/10/2015	Annual	3/10/2016	5821
Anritsu	MA2481A	Power Sensor	3/10/2015	Annual	3/10/2016	5605
Anritsu	ML2438A	Power Meter	3/13/2015	Annual	3/13/2016	1070030
Anritsu	ML2495A	Power Meter	10/31/2013	Biennial	10/31/2015	1039008
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M1S5A00-009
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
Control Company	4353	Long Stem Thermometer	1/22/2015	Biennial	1/22/2017	150053029
Control Company	4040	Digital Thermometer	3/15/2015	Biennial	3/15/2017	150194898
Control Company	4040	Digital Thermometer	3/18/2015	Biennial	3/18/2017	150194895
Control Company	4353	Long Stem Thermometer	1/22/2015	Biennial	1/22/2017	150053042
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mitutoyo	CD-6"CSX	Digital Caliper	5/8/2014	Biennial	5/8/2016	13264165
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	CMW500	Radio Communication Tester	4/8/2015	Annual	4/8/2016	140148
Rohde & Schwarz	CMW500	Radio Communication Tester	5/28/2015	Annual	5/28/2016	102060
Rohde & Schwarz	CMU200	Base Station Simulator	6/3/2015	Annual	6/3/2016	109892
Rohde & Schwarz	CMW500	Radio Communication tester	5/5/2015	Annual	5/5/2016	140144
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
SPEAG	MDA4LAP	Laptop Holder	N/A	N/A	N/A	001 CD
VWR	36934-158	Wall-Mounted Thermometer	4/29/2014	Biennial	4/29/2016	111859323
VWR	36934-158	Wall-Mounted Thermometer	4/29/2014	Biennial	4/29/2016	111859332

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

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

Applicable for frequencies up to 6 GHz.

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

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

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]

16 REFERENCES

[1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Aug. 1996.

[2] ANSI/IEEE C95.1-2005, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, 2006.

[3] ANSI/IEEE C95.1-1992, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, Sept. 1992.

[4] ANSI/IEEE C95.3-2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, New York: IEEE, December 2002.

[5] IEEE Standards Coordinating Committee 39 –Standards Coordinating Committee 34 – IEEE Std. 1528-2003, Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Measurement Techniques.

[6] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for RadioFrequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.

[7] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.

[8] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. 1 - 124.

[9] K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.

[10] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.

[11] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.

[12] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.

[13] G. Hartsgrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36.

[14] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.

[15] W. Gander, Computermathematick, Birkhaeuser, Basel, 1992.

[16] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.

[17] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.

[18] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.

[19] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hoschschule Zürich, Dosimetric Evaluation of the Cellular Phone.

[20] IEC 62209-1, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz), Feb. 2005.

[21] Industry Canada RSS-102 Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 4, March 2010.

[22] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2009

[23] FCC SAR Test Procedures for 2G-3G Devices, Mobile Hotspot and UMPC Devices KDB Publications 941225, D01-D07

[24] SAR Measurement Guidance for IEEE 802.11 Transmitters, KDB Publication 248227 D01 DR02-41929

[25] FCC SAR Considerations for Handsets with Multiple Transmitters and Antennas, KDB Publications 648474 D03-D04

[26] FCC SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers, FCC KDB Publication 616217 D04

[27] FCC SAR Measurement and Reporting Requirements for 100MHz – 6 GHz, KDB Publications 865664 D01-D02

[28] FCC General RF Exposure Guidance and SAR Procedures for Dongles, KDB Publication 447498, D01-D02

[29] Anexo à Resolução No. 533, de 10 de Septembro de 2009.

[30] IEC 62209-2, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz), Mar. 2010.

APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT357W; Type: Portable Tablet; Serial: 01806

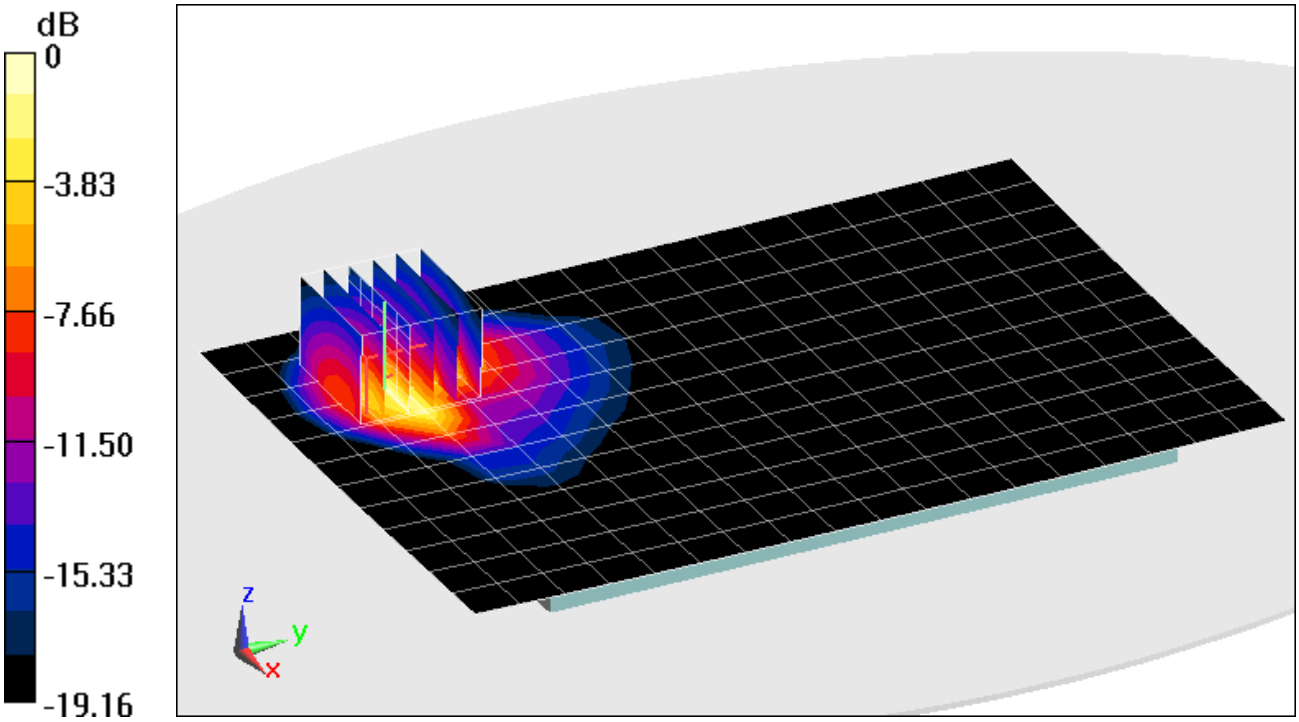
Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.02 S/m; ε_r = 54.986; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-04-2015; Ambient Temp: 22.7°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3213; ConvF(6.07, 6.07, 6.07); Calibrated: 1/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/20/2015
Phantom: ELI Left v6.0; Type: QDOVA003AA; Serial: TP:1202
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Area Scan (13x19x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.56 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.18 W/kg
SAR(1 g) = 0.478 W/kg



0 dB = 0.722 W/kg = -1.41 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT357W; Type: Portable Tablet; Serial: 01798

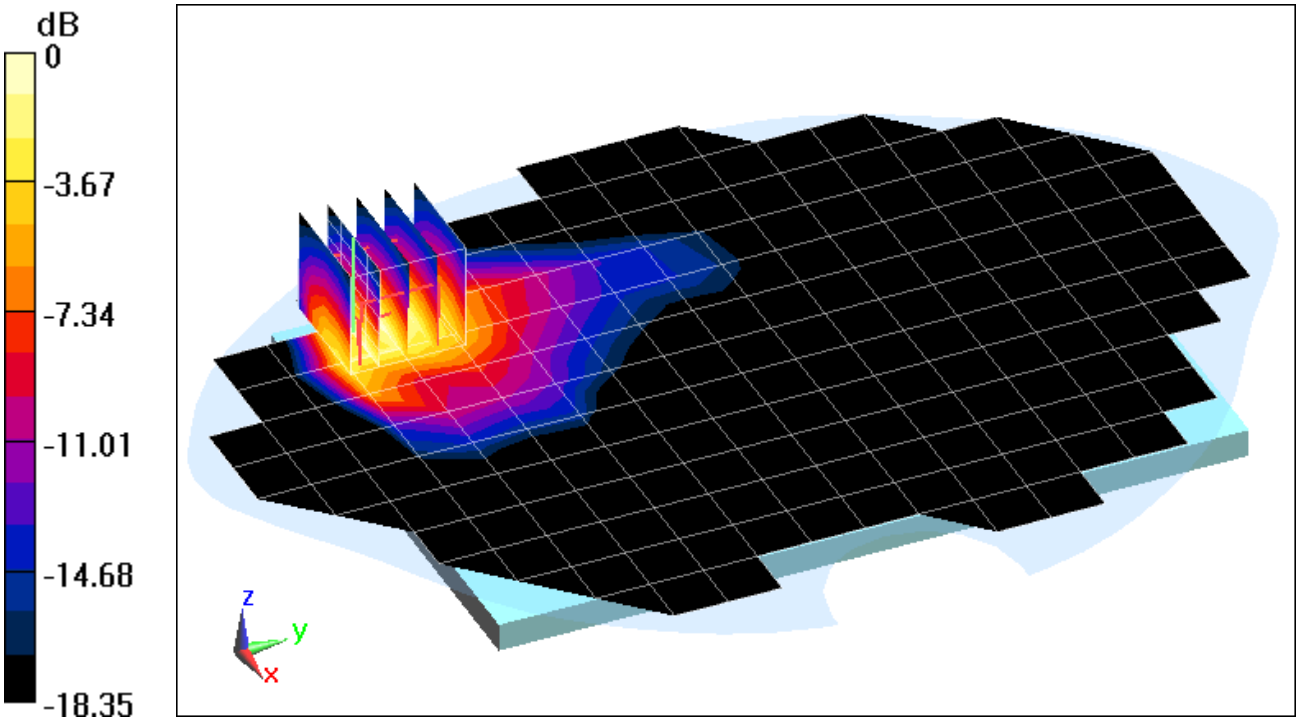
Communication System: UID 0, UMTS; Frequency: 1732.4 MHz; Duty Cycle: 1:1
Medium: 1750 Body, Medium parameters used (interpolated):
f = 1732.4 MHz; σ = 1.466 S/m; ε_r = 51.772; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-04-2015; Ambient Temp: 21.5°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3263; ConvF(4.88, 4.88, 4.88); Calibrated: 5/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/22/2015
Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: UMTS 1750, Body SAR, Back side, Mid.ch

Area Scan (15x19x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.60 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.14 W/kg
SAR(1 g) = 0.535 W/kg



0 dB = 0.644 W/kg = -1.91 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT357W; Type: Portable Tablet; Serial: 01780

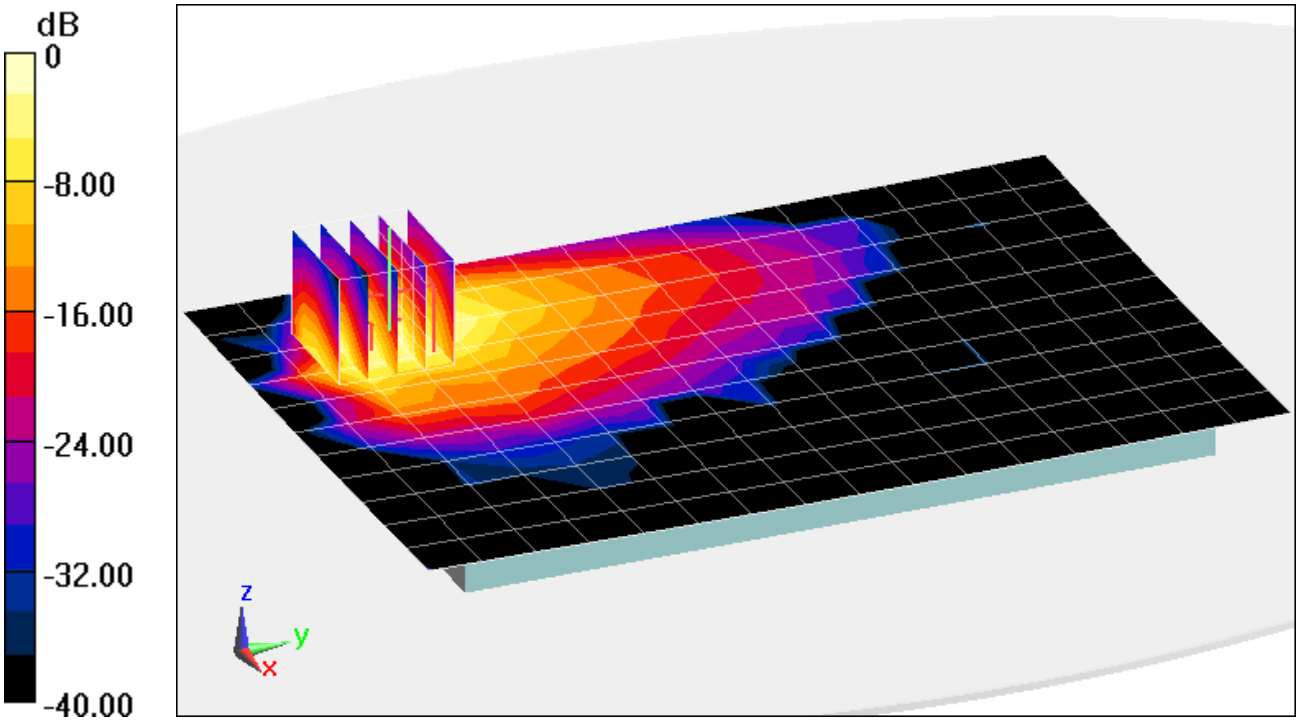
Communication System: UID 0, UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used:
f = 1880 MHz; σ = 1.528 S/m; ε_r = 51.803; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-04-2015; Ambient Temp: 22.0°C; Tissue Temp: 21.7°C

Probe: ES3DV3 - SN3334; ConvF(4.73, 4.73, 4.73); Calibrated: 12/16/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1415; Calibrated: 12/12/2014
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1158
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: UMTS 1900, Body SAR, Back side, Mid.ch

Area Scan (12x17x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.11 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 1.12 W/kg
SAR(1 g) = 0.570 W/kg



0 dB = 0.735 W/kg = -1.34 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT357W; Type: Portable Tablet; Serial: 01806

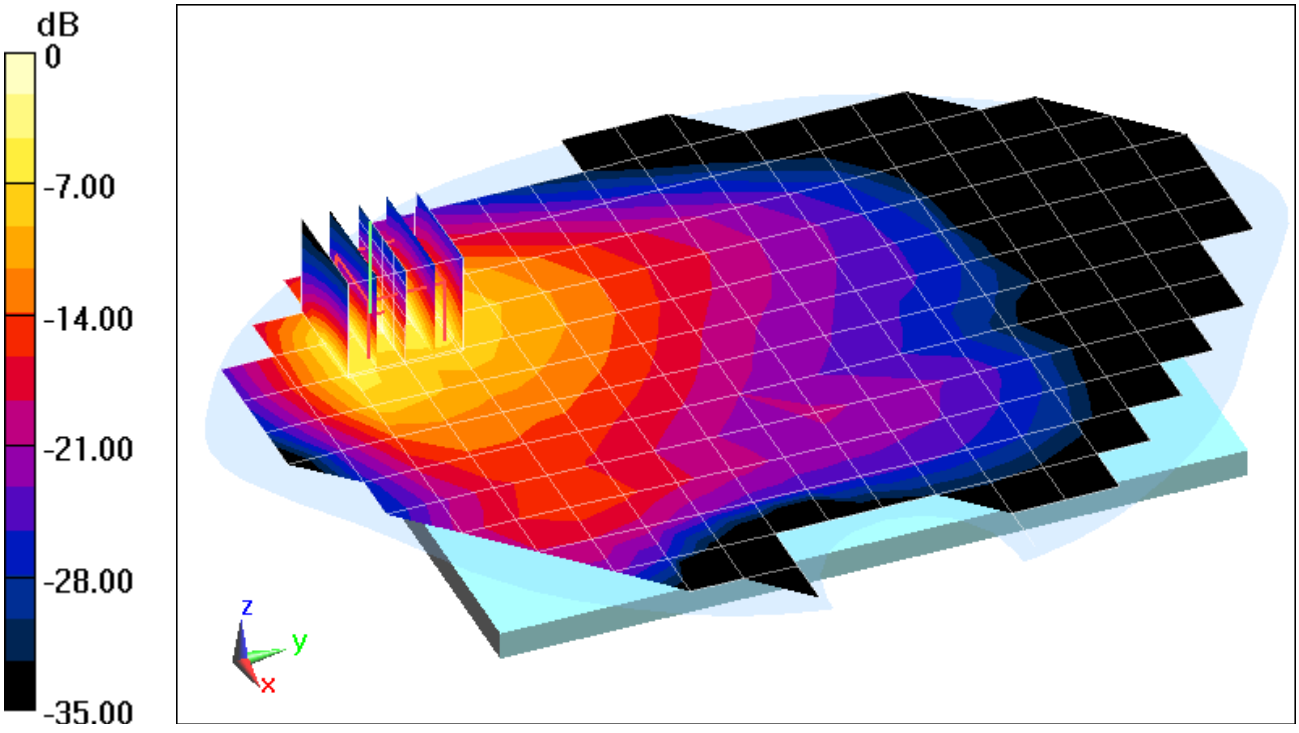
Communication System: UID 0, LTE Band 12; Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: 750 Body, Medium parameters used (interpolated):
f = 707.5 MHz; σ = 0.932 S/m; ε_r = 55.913; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-30-2015; Ambient Temp: 24.3°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3331; ConvF(6.12, 6.12, 6.12); Calibrated: 8/20/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 10/31/2014
Phantom: SAM Main ; Type: QD000P40CC; Serial: TP 1114
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 12, Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset

Area Scan (15x21x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.94 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 2.27 W/kg
SAR(1 g) = 0.933 W/kg



0 dB = 1.09 W/kg = 0.37 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT357W; Type: Portable Tablet; Serial: 01884

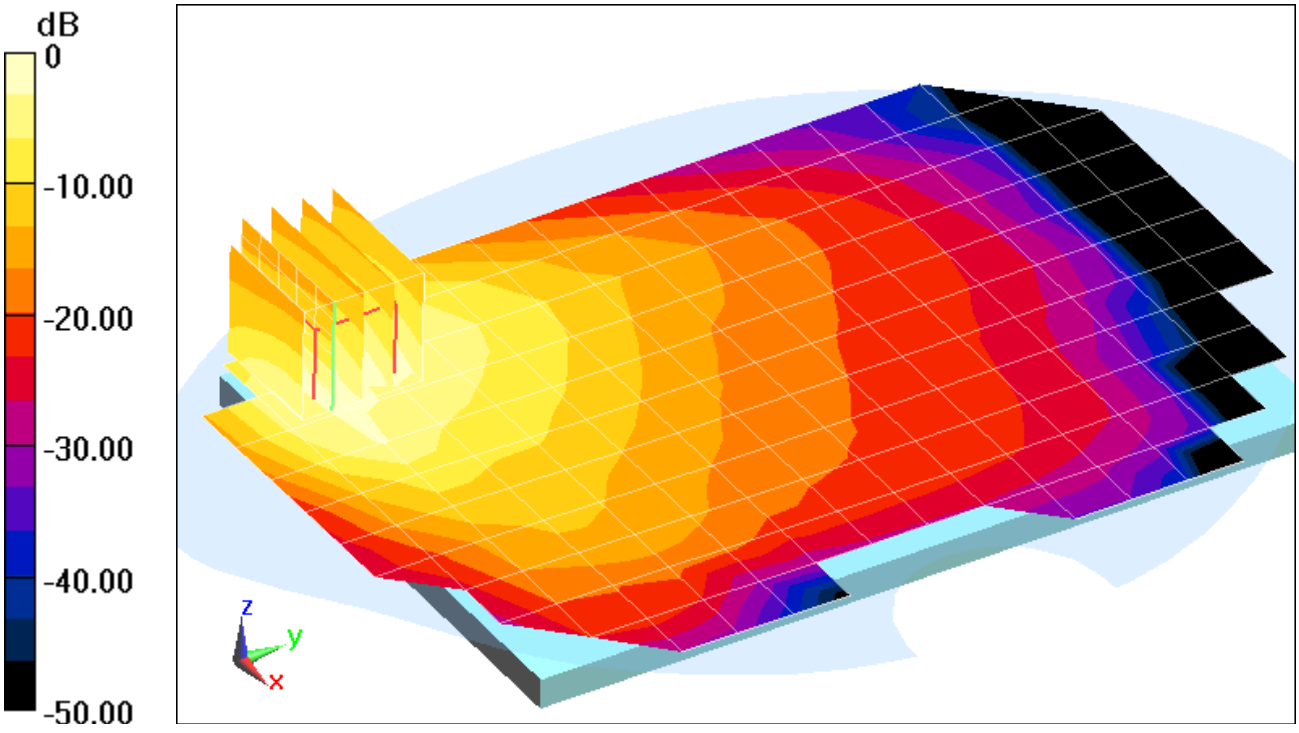
Communication System: UID 0, LTE Band 17; Frequency: 710 MHz; Duty Cycle: 1:1
Medium: 750 Body, Medium parameters used:
f = 710 MHz; σ = 0.928 S/m; ε_r = 55.146; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-23-2015; Ambient Temp: 23.8°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3331; ConvF(6.12, 6.12, 6.12); Calibrated: 8/20/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 10/31/2014
Phantom: SAM Main ; Type: QD000P40CC; Serial: TP 1114
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 17, Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset

Area Scan (12x17x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.34 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 2.71 W/kg
SAR(1 g) = 0.981 W/kg



0 dB = 1.20 W/kg = 0.79 dBW/kg

DUT: A3LSMT357W; Type: Portable Tablet; Serial: 01884

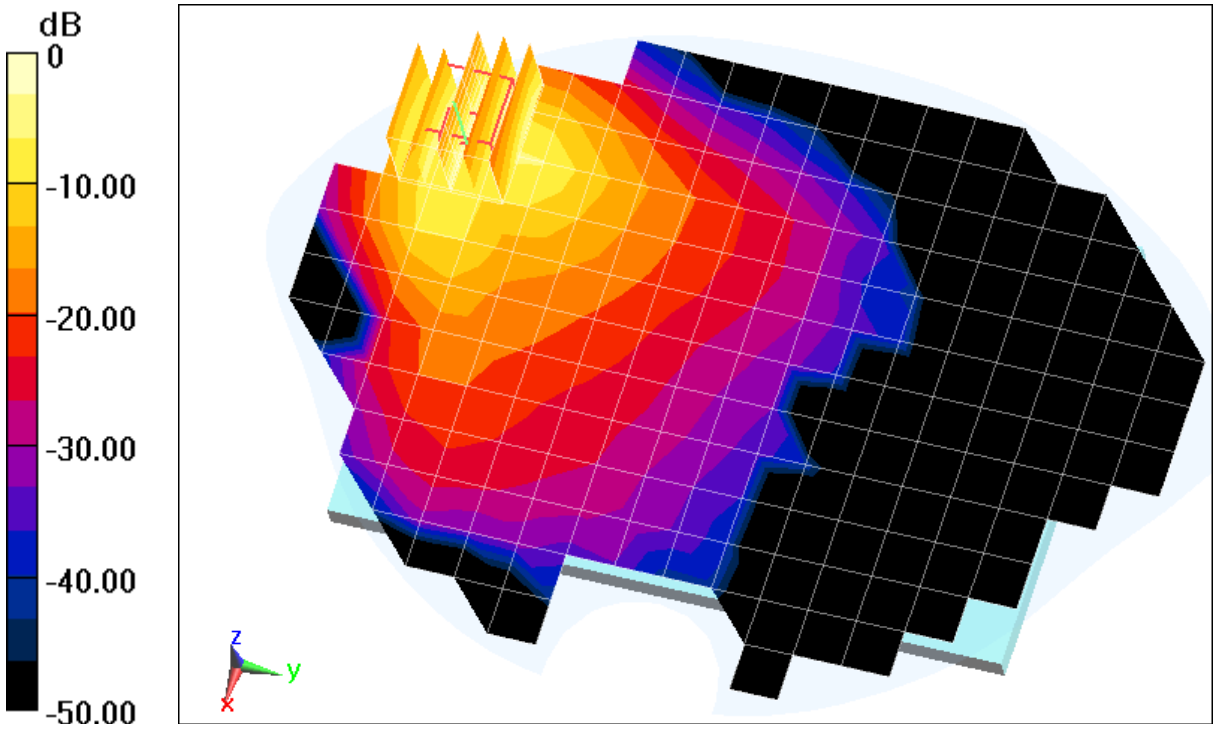
Communication System: UID 0, LTE Band 5; Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used (interpolated):
f = 836.5 MHz; σ = 1.006 S/m; ε_r = 53.49; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-16-2015; Ambient Temp: 24.0°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3331; ConvF(6.14, 6.14, 6.14); Calibrated: 8/20/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 10/31/2014
Phantom: SAM Main ; Type: QD000P40CC; Serial: TP 1114
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 5 (Cell.), Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (14x19x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.15 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 2.92 W/kg
SAR(1 g) = 0.974 W/kg



0 dB = 1.39 W/kg = 1.43 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT357W; Type: Portable Tablet; Serial: 01780

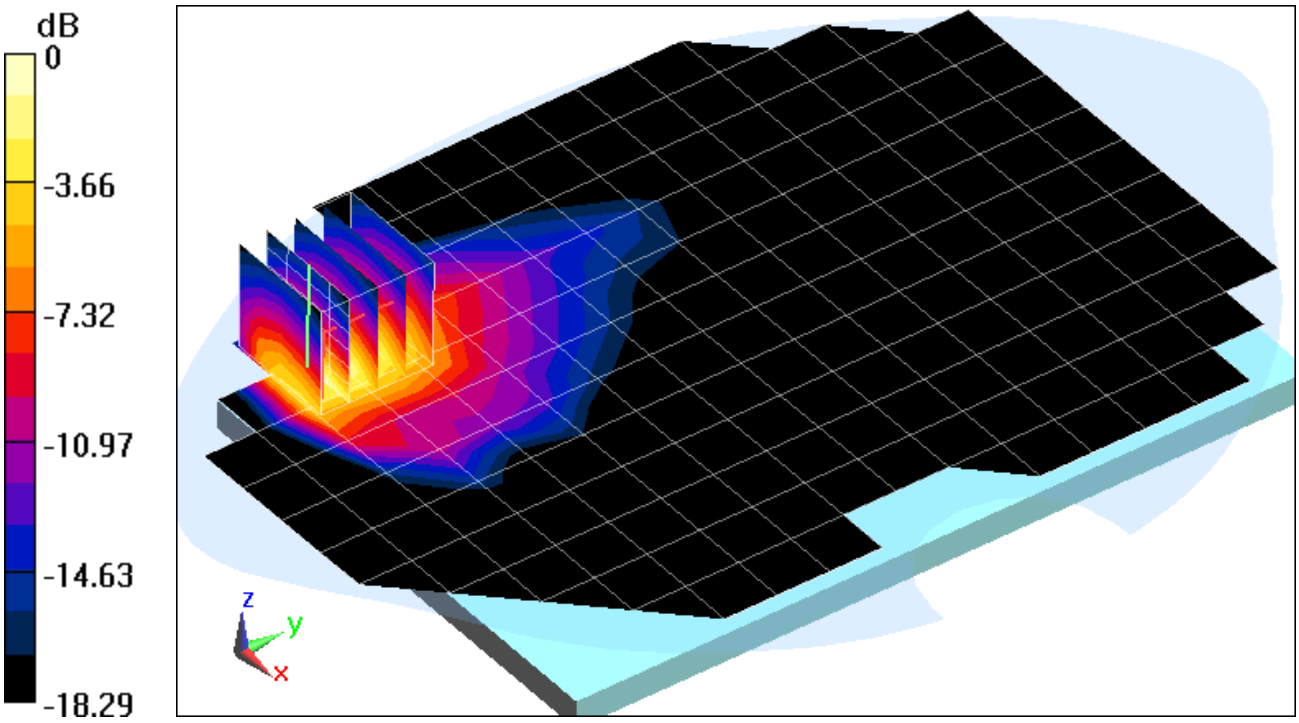
Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1
Medium: 1750 Body, Medium parameters used (interpolated):
$f = 1732.5$ MHz; $\sigma = 1.466$ S/m; $\varepsilon_r = 51.772$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-04-2015; Ambient Temp: 21.5°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3263; ConvF(4.88, 4.88, 4.88); Calibrated: 5/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/22/2015
Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Area Scan (13x17x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.39 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 1.79 W/kg
SAR(1 g) = 0.831 W/kg



0 dB = 0.982 W/kg = -0.08 dBW/kg

DUT: A3LSMT357W; Type: Portable Tablet; Serial: 01806

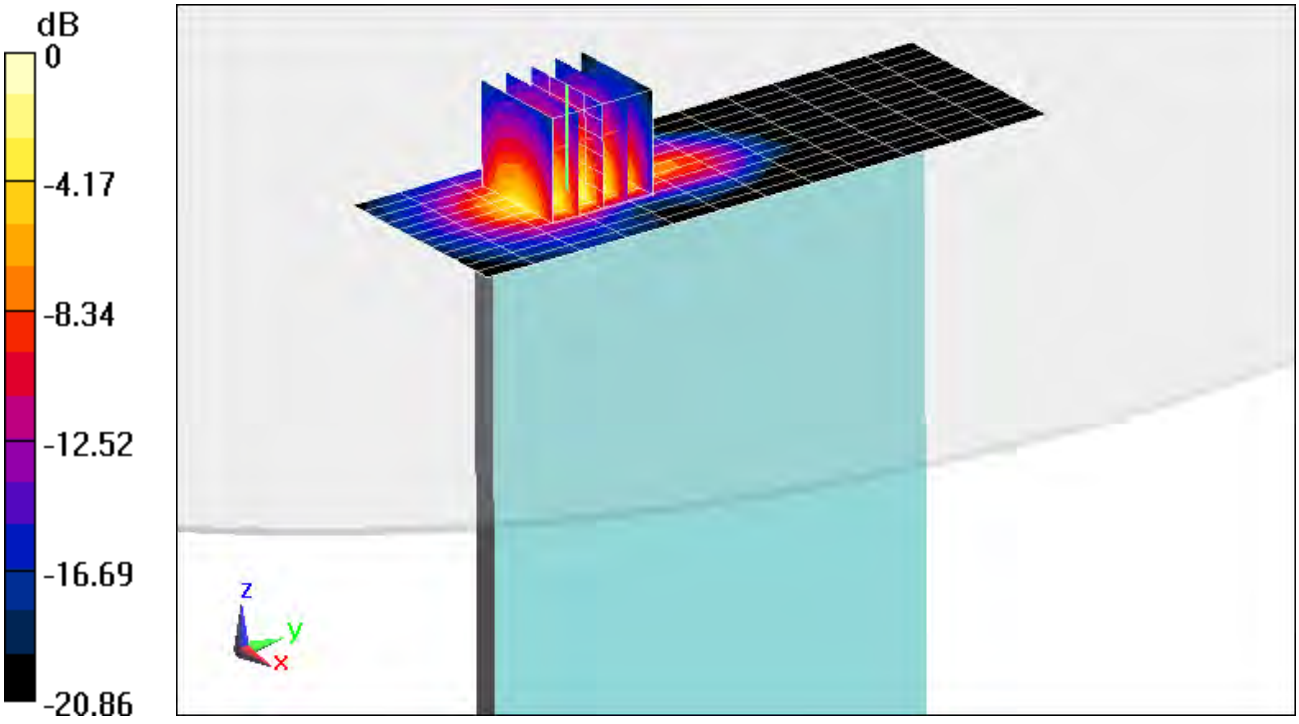
Communication System: UID 0, LTE Band 2 (PCS); Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used:
f = 1880 MHz; σ = 1.528 S/m; ε_r = 51.803; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-04-2015; Ambient Temp: 22.0°C; Tissue Temp: 21.7°C

Probe: ES3DV3 - SN3334; ConvF(4.73, 4.73, 4.73); Calibrated: 12/16/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1415; Calibrated: 12/12/2014
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1158
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 2 (PCS), Body SAR, Bottom Edge, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (13x13x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.73 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.31 W/kg
SAR(1 g) = 0.688 W/kg



0 dB = 0.921 W/kg = -0.36 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT357W; Type: Portable Tablet; Serial: 11490

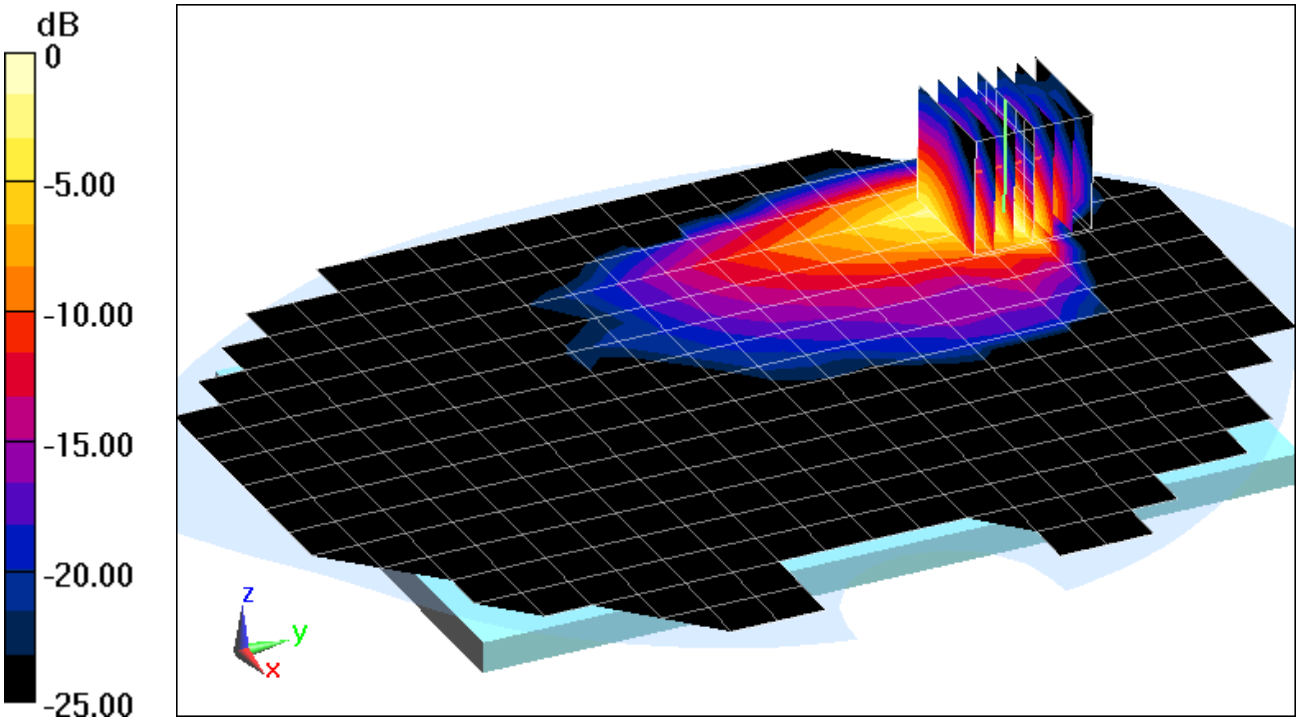
Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: 2450 Body, Medium parameters used (interpolated):
f = 2412 MHz; σ = 1.957 S/m; ε_r = 50.605; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-03-2015; Ambient Temp: 21.1°C; Tissue Temp: 21.0°C

Probe: ES3DV3 - SN3209; ConvF(4.12, 4.12, 4.12); Calibrated: 3/19/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/13/2015
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Area Scan (17x22x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.47 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 1.59 W/kg
SAR(1 g) = 0.591 W/kg



0 dB = 0.720 W/kg = -1.43 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMT357W; Type: Portable Tablet; Serial: 11490

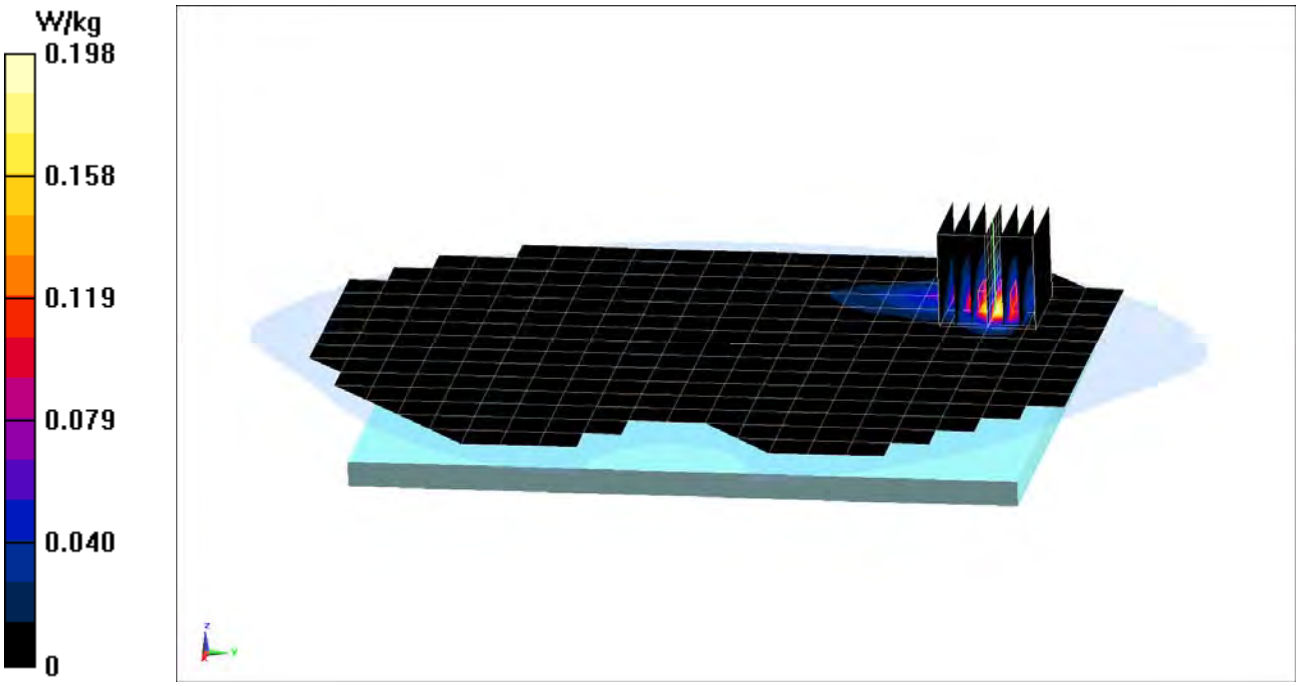
Communication System: UID 0, Bluetooth; Frequency: 2441 MHz; Duty Cycle: 1:1
Medium: 2450 Body, Medium parameters used (interpolated):
f = 2441 MHz; σ = 1.996 S/m; ε_r = 50.496; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-03-2015; Ambient Temp: 21.1°C; Tissue Temp: 21.0°C

Probe: ES3DV3 - SN3209; ConvF(4.12, 4.12, 4.12); Calibrated: 3/19/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/13/2015
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: Bluetooth, Body SAR, Ch 39, 1 Mbps, Back Side

Area Scan (16x21x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.047 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.371 W/kg
SAR(1 g) = 0.133 W/kg



DUT: A3LSMT357W; Type: Portable Tablet; Serial: 11516

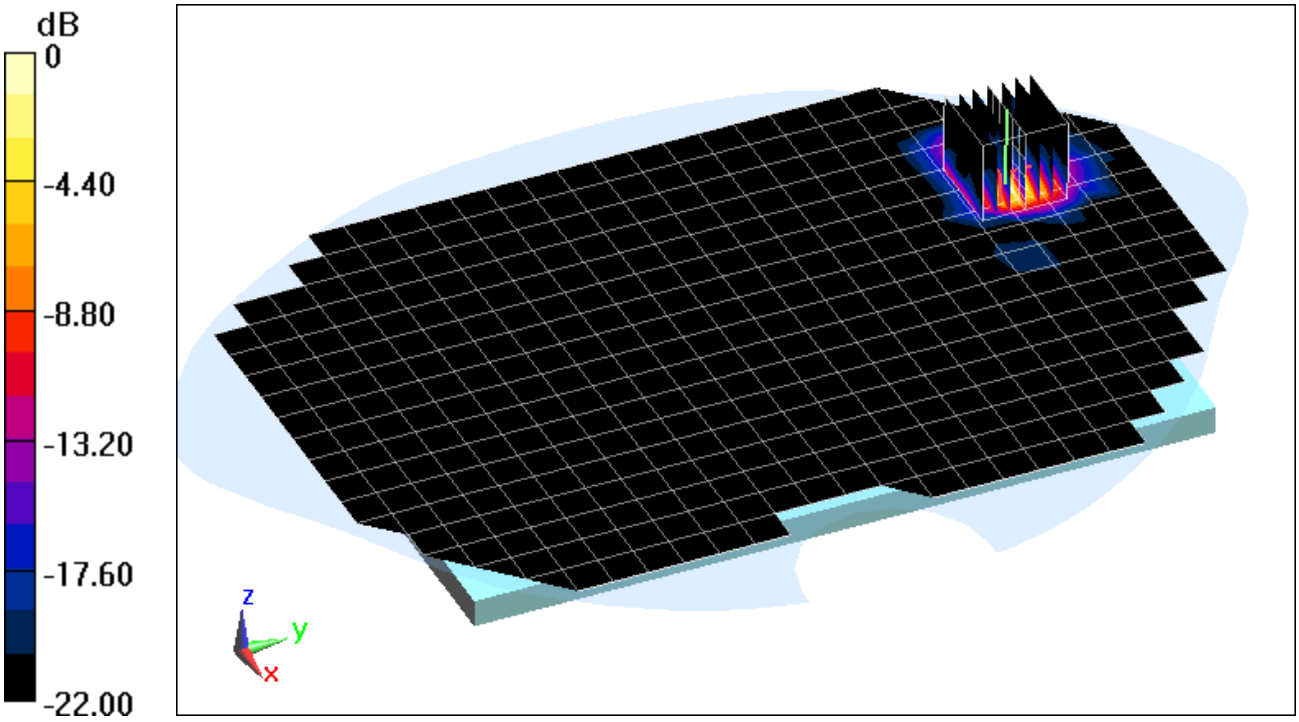
Communication System: UID 0, IEEE 802.11n; Frequency: 5670 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used (interpolated):
f = 5670 MHz; σ = 5.733 S/m; ε_r = 47.509; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-03-2015; Ambient Temp: 22.1°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3589; ConvF(3.42, 3.42, 3.42); Calibrated: 1/22/2015;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2014
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11n, U-NII-2C, 40 MHz Bandwidth,
Body SAR, Ch 134, 13.5 Mbps, Back Side

Area Scan (11x11x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 9.291 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 3.24 W/kg
SAR(1 g) = 0.590 W/kg



0 dB = 1.72 W/kg = 2.36 dBW/kg

APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 750 MHz; Type: D750V3; Serial: 1046

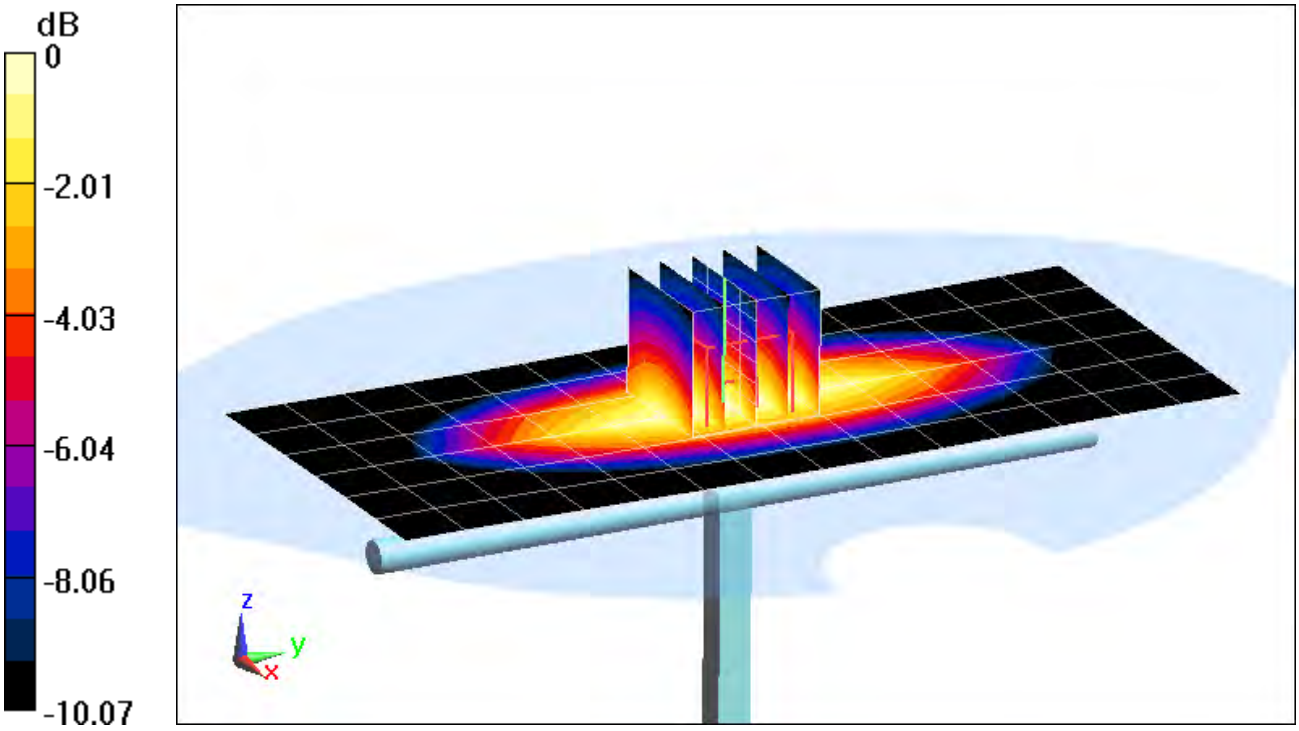
Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: 750 Body, Medium parameters used (interpolated):
f = 750 MHz; σ = 0.965 S/m; ε_r = 54.637; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 06-23-2015; Ambient Temp: 23.8°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3331; ConvF(6.12, 6.12, 6.12); Calibrated: 8/20/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 10/31/2014
Phantom: SAM Main ; Type: QD000P40CC; Serial: TP 1114
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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: 23.0 dBm (200 mW)
Peak SAR (extrapolated) = 2.60 W/kg
SAR(1 g) = 1.77 W/kg
Deviation(1 g): 6.76%



0 dB = 2.07 W/kg = 3.16 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 835 MHz; Type: D835V2; Serial: 4d133

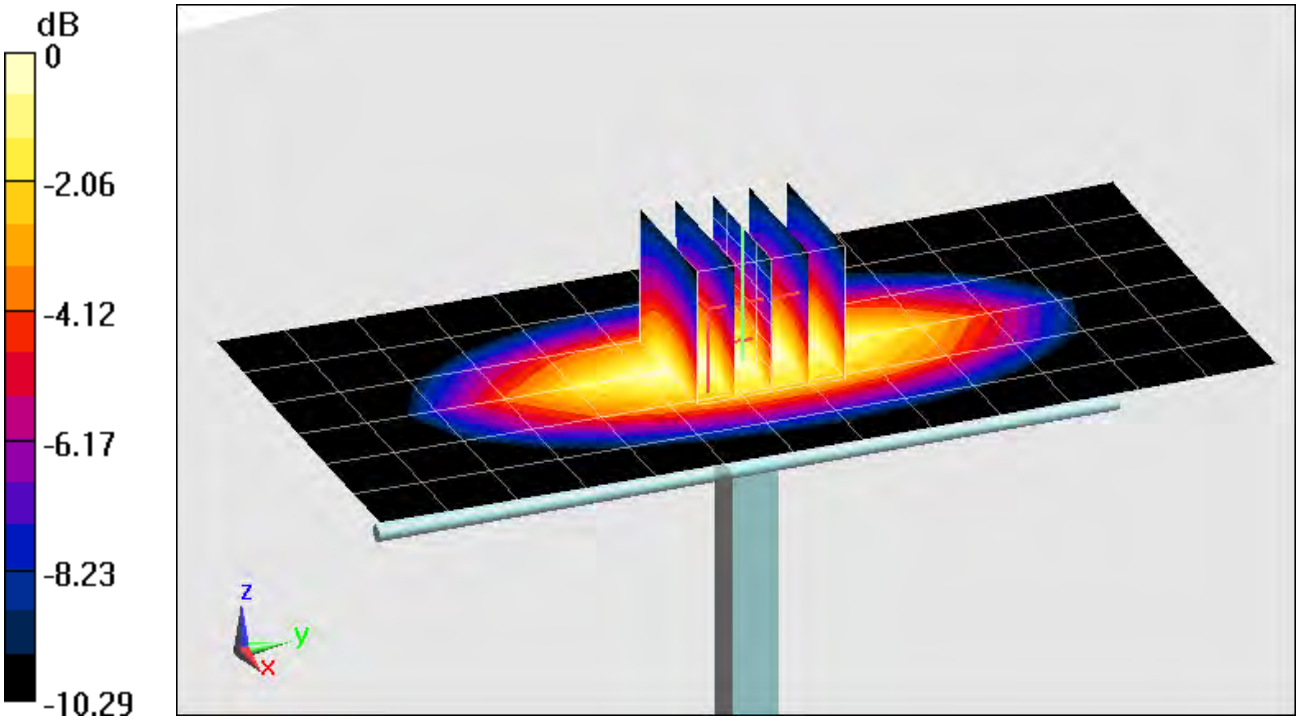
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used:
f = 835 MHz; σ = 1.018 S/m; ε_r = 55.002; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 06-04-2015; Ambient Temp: 22.7°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3213; ConvF(6.07, 6.07, 6.07); Calibrated: 1/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/20/2015
Phantom: ELI Left v6.0; Type: QDOVA003AA; Serial: TP:1202
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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) = 1.28 W/kg
SAR(1 g) = 0.883 W/kg
Deviation(1 g): -5.56%



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

PCTEST ENGINEERING LABORATORY, INC.

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

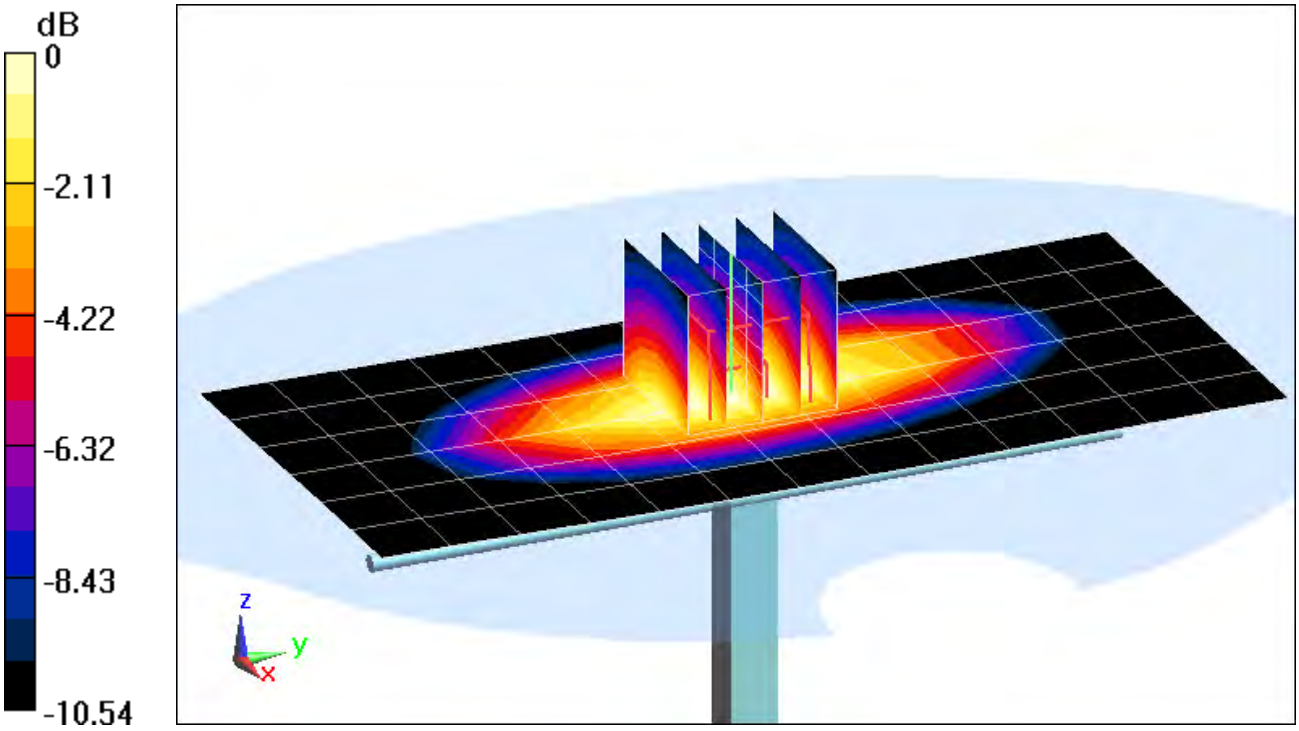
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used:
f = 835 MHz; σ = 1.004 S/m; ε_r = 53.507; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 06-16-2015; Ambient Temp: 24.0°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3331; ConvF(6.14, 6.14, 6.14); Calibrated: 8/20/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 10/31/2014
Phantom: SAM Main ; Type: QD000P40CC; Serial: TP 1114
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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: 23.0 dBm (200 mW)
Peak SAR (extrapolated) = 2.96 W/kg
SAR(1 g) = 1.98 W/kg
Deviation(1 g): 7.61%



0 dB = 2.31 W/kg = 3.64 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

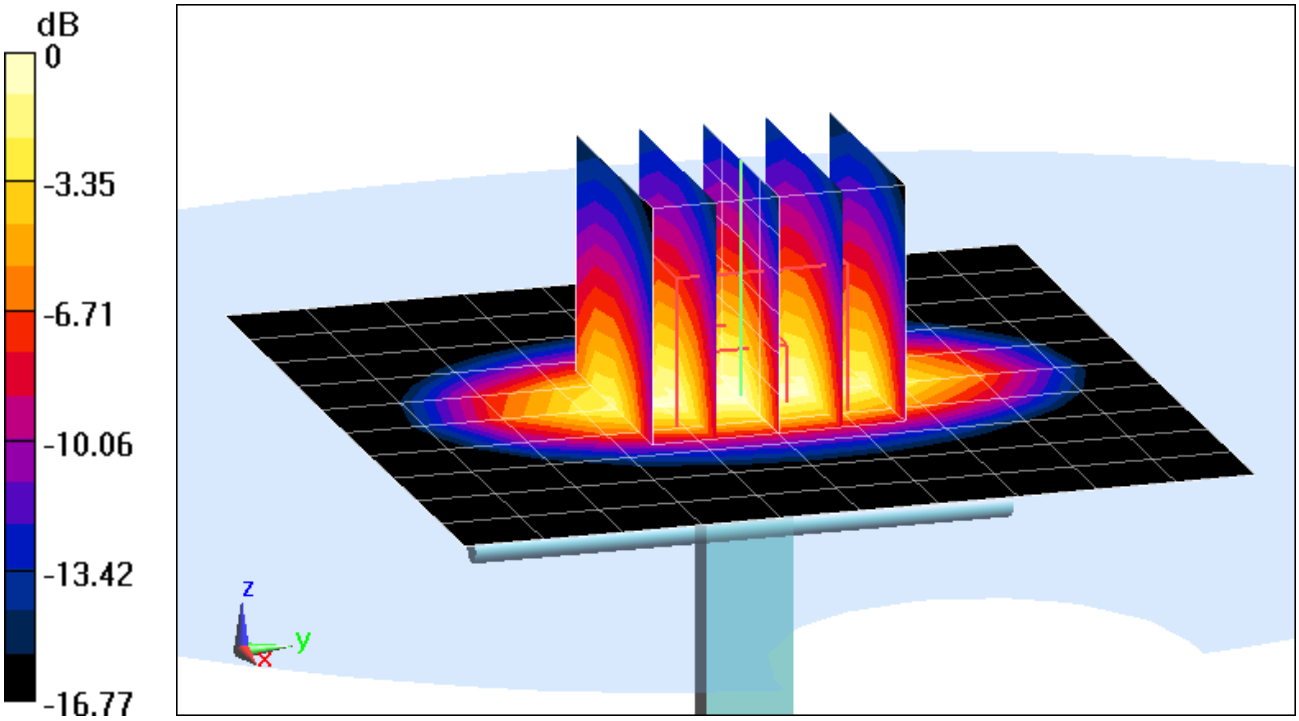
Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: 1750 Body, Medium parameters used:
f = 1750 MHz; σ = 1.485 S/m; ε_r = 51.684; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-04-2015; Ambient Temp: 21.5°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3263; ConvF(4.88, 4.88, 4.88); Calibrated: 5/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/22/2015
Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

1750 MHz System Verification

Area Scan (11x11x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 6.70 W/kg
SAR(1 g) = 3.82 W/kg
Deviation(1 g): 2.96%



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d148

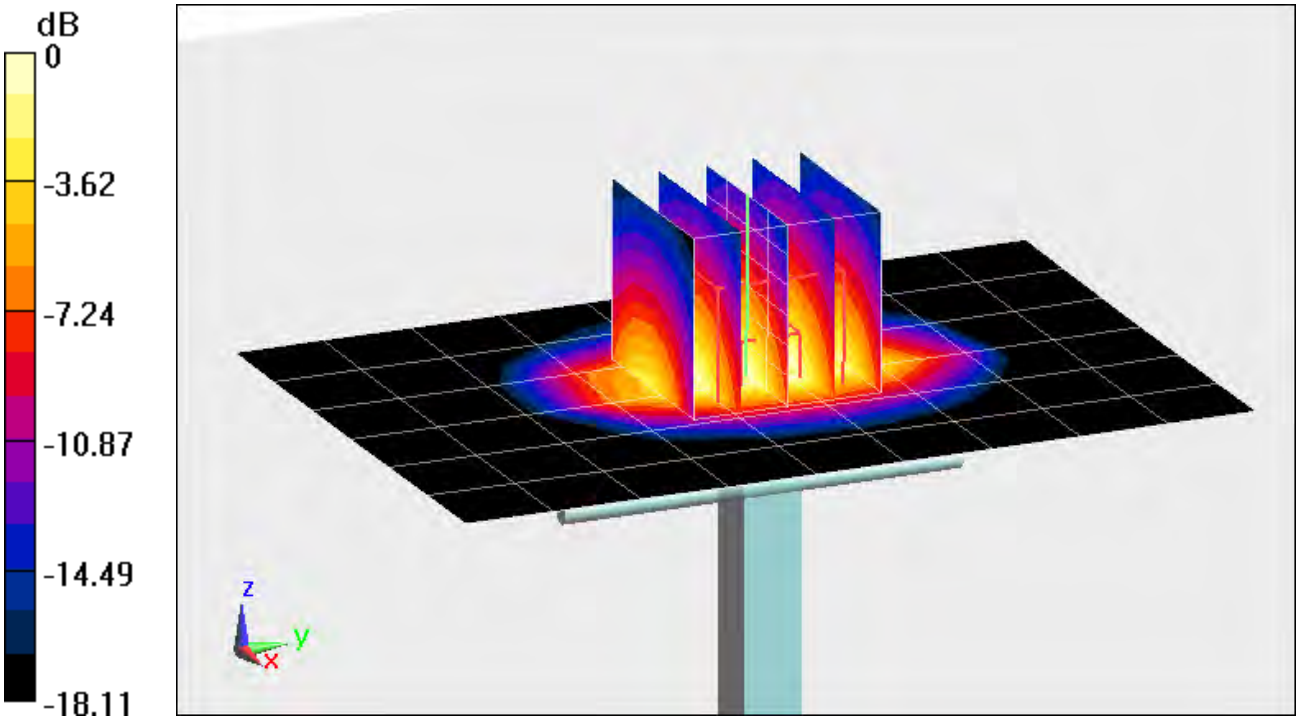
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.548 S/m; ε_r = 51.772; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-04-2015; Ambient Temp: 22.0°C; Tissue Temp: 21.7°C

Probe: ES3DV3 - SN3334; ConvF(4.73, 4.73, 4.73); Calibrated: 12/16/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1415; Calibrated: 12/12/2014
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1158
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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) = 7.24 W/kg
SAR(1 g) = 4.04 W/kg
Deviation(1 g): 0.50%



0 dB = 4.91 W/kg = 6.91 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

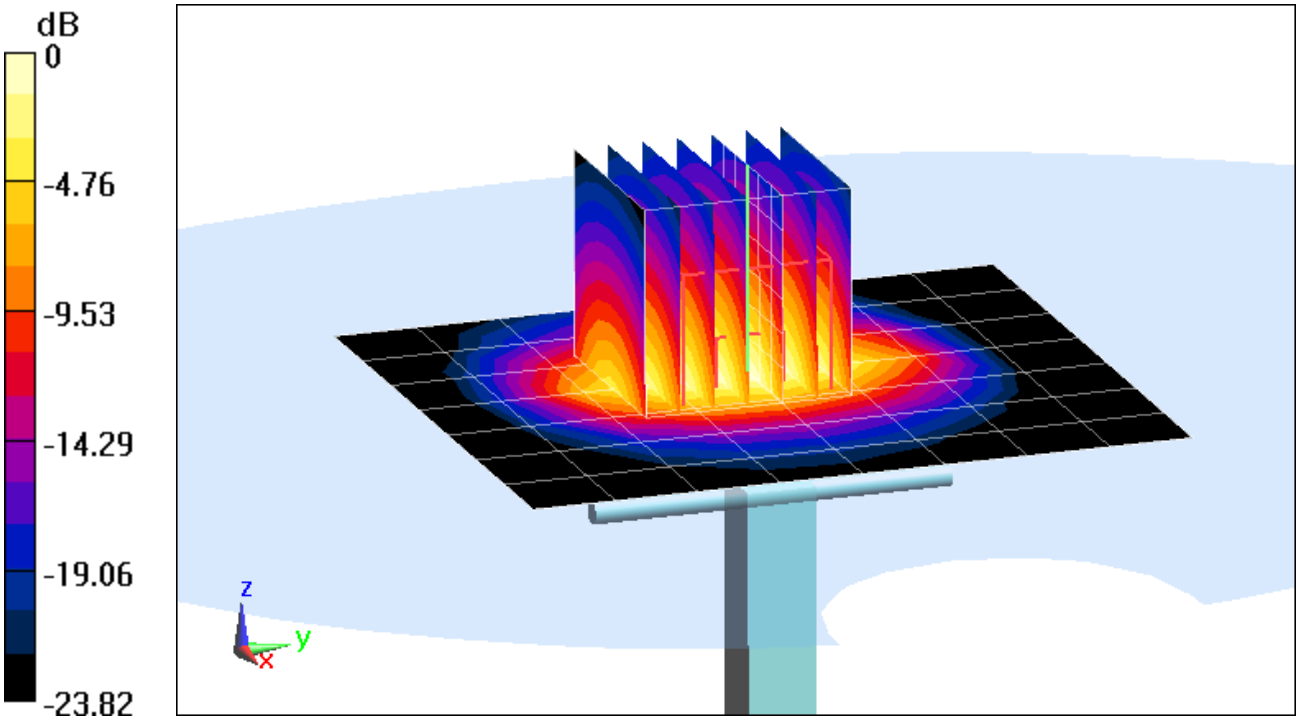
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Body, Medium parameters used:
f = 2450 MHz; σ = 2.008 S/m; ε_r = 50.462; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-03-2015; Ambient Temp: 21.1°C; Tissue Temp: 21.0°C

Probe: ES3DV3 - SN3209; ConvF(4.12, 4.12, 4.12); Calibrated: 3/19/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/13/2015
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power: 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 11.8 W/kg
SAR(1 g) = 5.4 W/kg
Deviation(1 g): 4.25%



0 dB = 7.15 W/kg = 8.54 dBW/kg

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

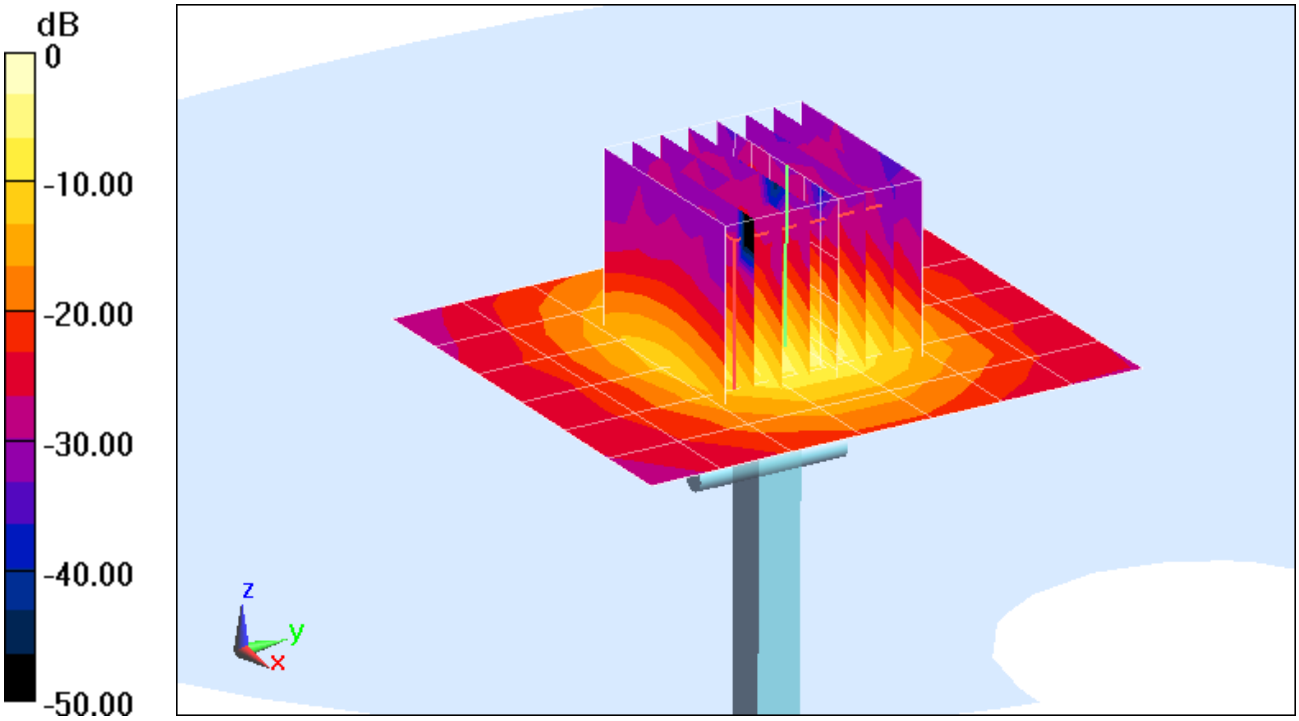
Communication System: UID 0, CW; Frequency: 5300 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5300 MHz; σ = 5.248 S/m; ε_r = 48.083; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-03-2015; Ambient Temp: 22.1°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN3589; ConvF(3.79, 3.79, 3.79); Calibrated: 1/22/2015;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2014
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5300 MHz System Verification

Area Scan (7x8x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 17.0 dBm (50 mW)
Peak SAR (extrapolated) = 16.2 W/kg
SAR(1 g) = 3.91 W/kg
Deviation(1 g): 5.39%



0 dB = 9.31 W/kg = 9.69 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

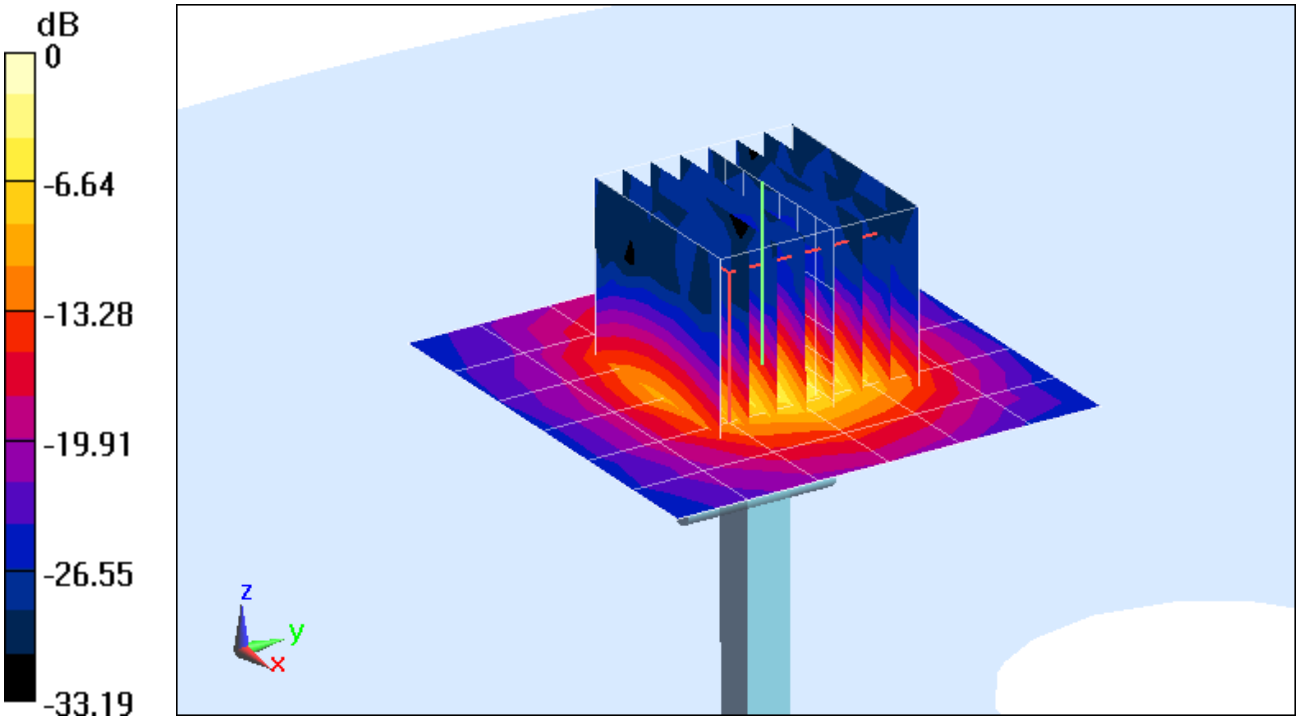
Communication System: UID 0, CW; Frequency: 5500 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5500 MHz; σ = 5.495 S/m; ε_r = 47.779; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-03-2015; Ambient Temp: 22.2°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3589; ConvF(3.65, 3.65, 3.65); Calibrated: 1/22/2015;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2014
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5500 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 17.0 dBm (50 mW)
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 3.68 W/kg
Deviation(1 g): -7.07%



0 dB = 8.74 W/kg = 9.42 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

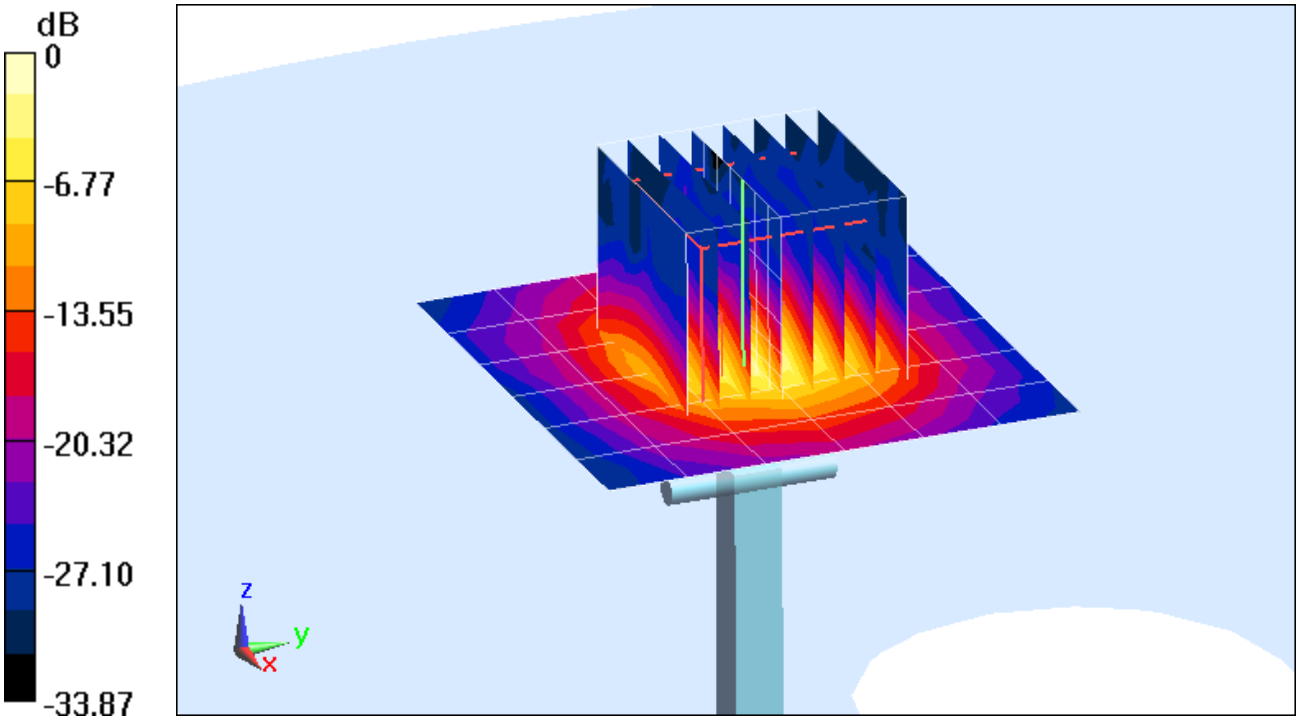
Communication System: UID 0, CW; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5600 MHz; σ = 5.621 S/m; ε_r = 47.64; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-03-2015; Ambient Temp: 22.1°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3589; ConvF(3.42, 3.42, 3.42); Calibrated: 1/22/2015;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2014
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5600 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 17.0 dBm (50 mW)
Peak SAR (extrapolated) = 17.1 W/kg
SAR(1 g) = 3.96 W/kg
Deviation(1 g): 1.93%



0 dB = 9.56 W/kg = 9.80 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

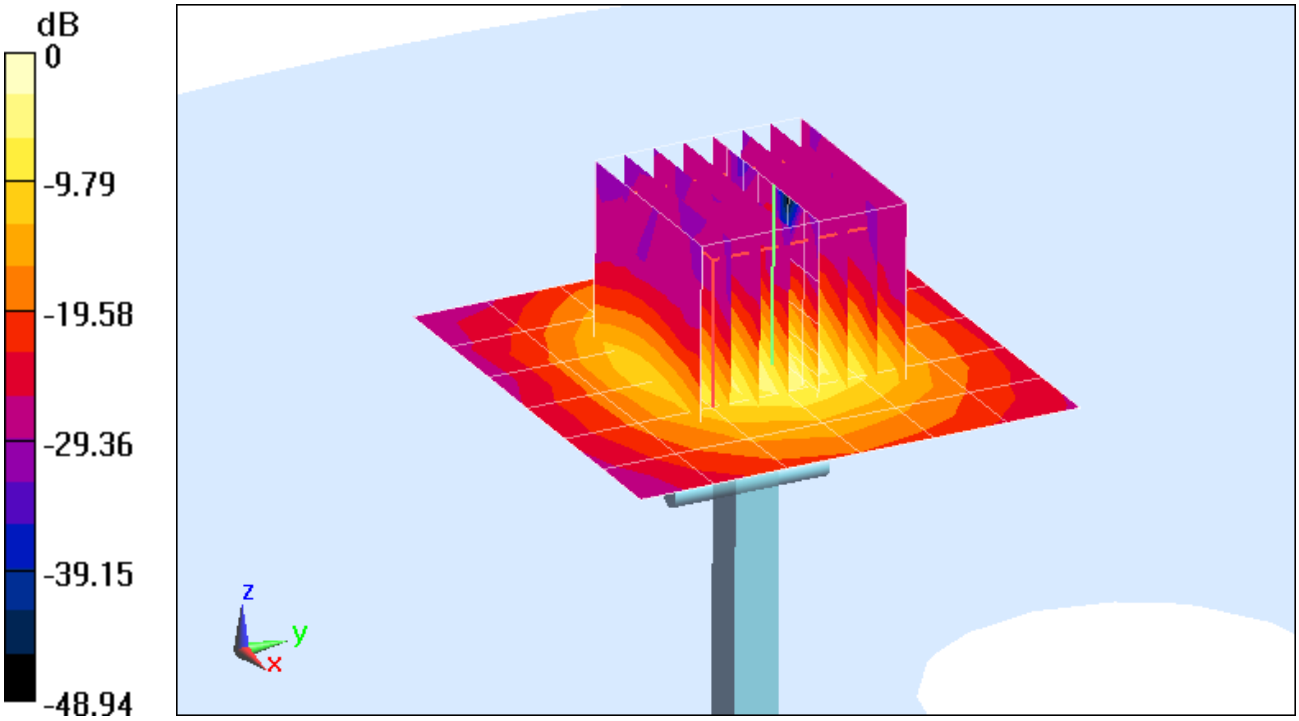
Communication System: UID 0, CW; Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5800 MHz; σ = 5.914 S/m; ε_r = 47.336; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-03-2015; Ambient Temp: 22.1°C; Tissue Temp: 21.2°C

Probe: EX3DV4 - SN3589; ConvF(3.79, 3.79, 3.79); Calibrated: 1/22/2015;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2014
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5800 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 17.0 dBm (50 mW)
Peak SAR (extrapolated) = 15.5 W/kg
SAR(1 g) = 3.41 W/kg
Deviation(1 g): -9.19%



0 dB = 8.24 W/kg = 9.16 dBW/kg

APPENDIX C: PROBE CALIBRATION

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

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

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

Accreditation No.: SCS 0108

Client **PC Test** **Certificate No: D750V3-1046_Feb15**

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1046
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	February 19, 2015

BN ✓ 3/6/2015

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	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
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-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

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-14)	In house check: Oct-15

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

Issued: February 19, 2015

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	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.6 ± 6 %	0.90 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	2.03 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.04 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.28 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	53.9 ± 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	2.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.29 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.39 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.47 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.8 Ω + 1.5 jΩ
Return Loss	- 24.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.4 Ω - 1.3 jΩ
Return Loss	- 34.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.038 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 02, 2011

DASY5 Validation Report for Head TSL

Date: 18.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1046

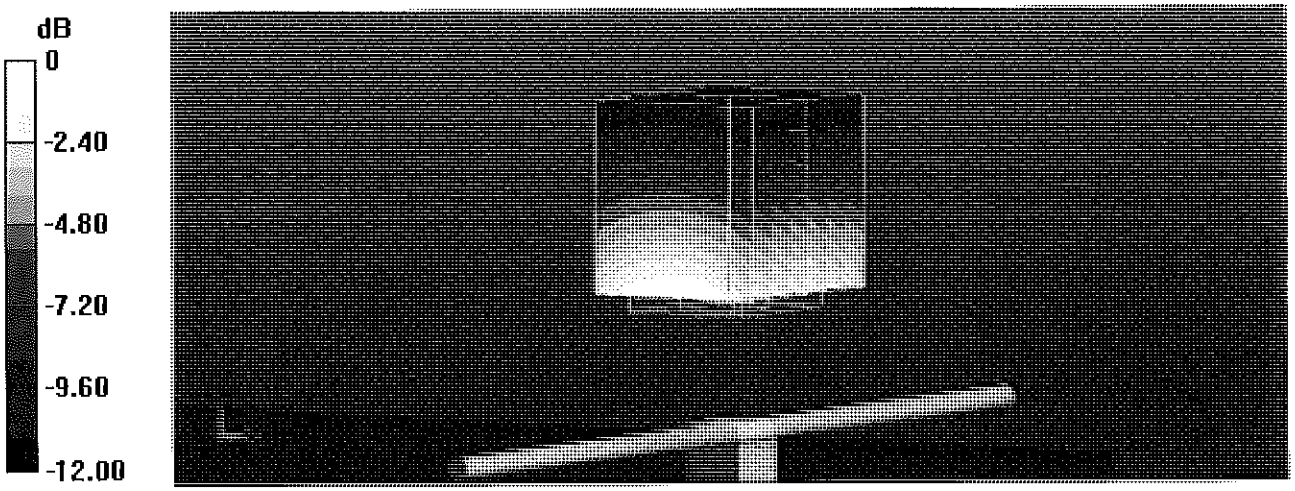
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.9 S/m; ε_r = 41.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.44, 6.44, 6.44); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

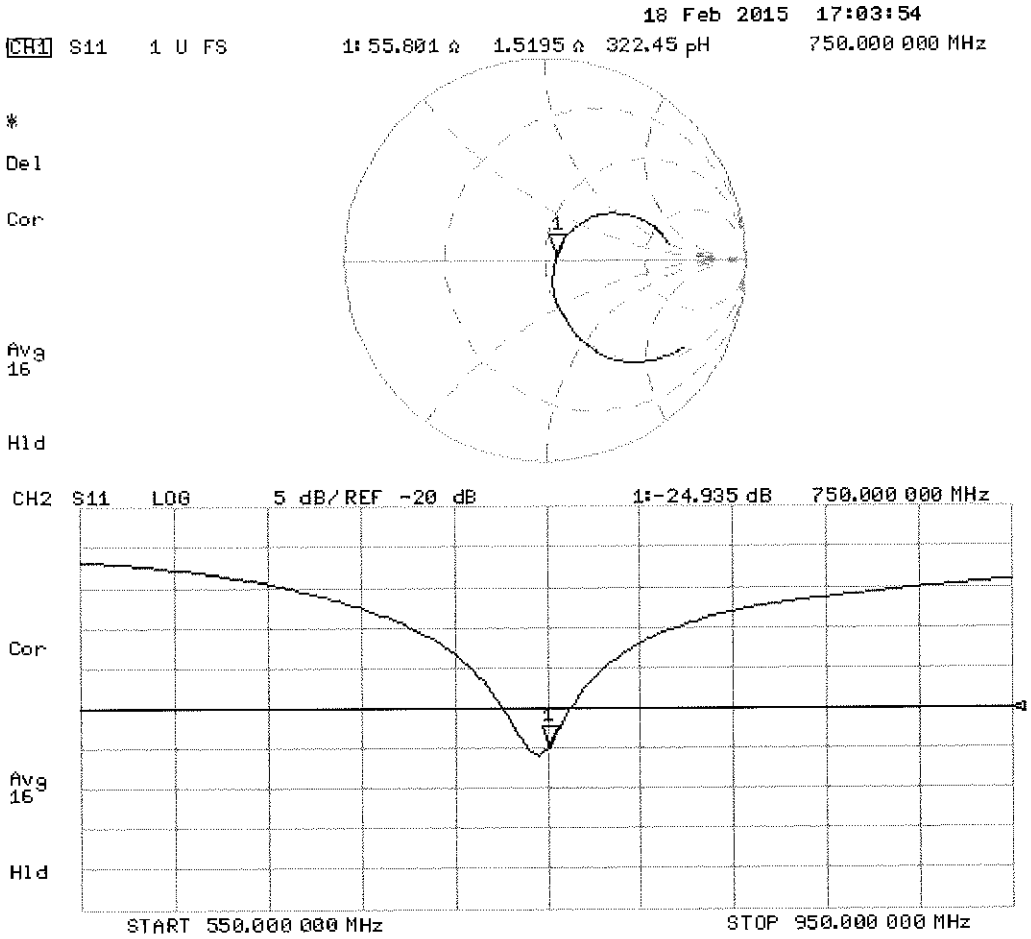
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.99 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.02 W/kg
SAR(1 g) = 2.03 W/kg; SAR(10 g) = 1.33 W/kg
Maximum value of SAR (measured) = 2.37 W/kg



0 dB = 2.37 W/kg = 3.75 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 19.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1046

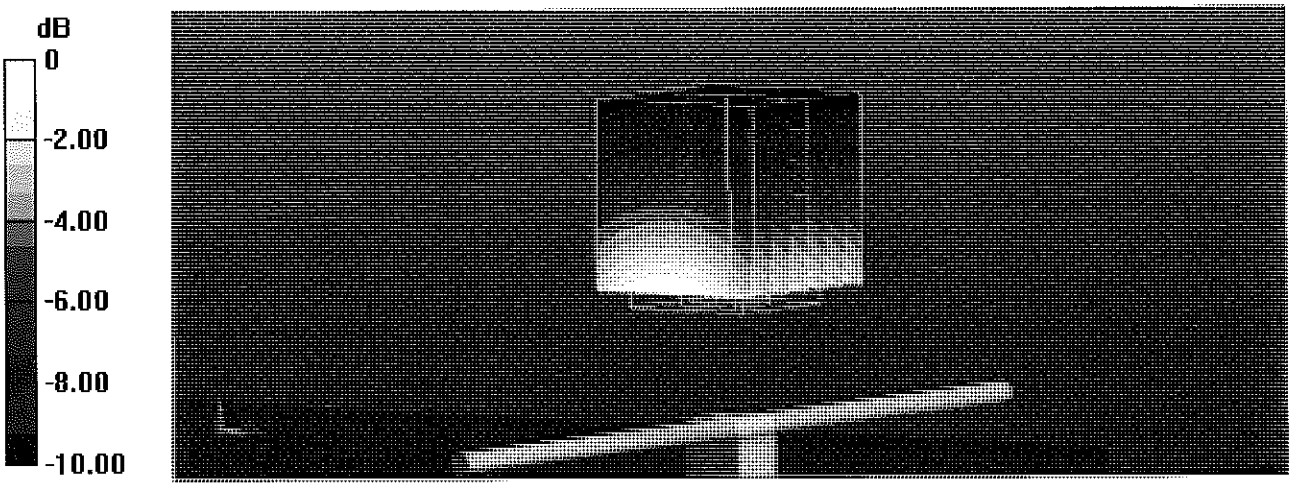
Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.98 S/m; ε_r = 53.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.21, 6.21, 6.21); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

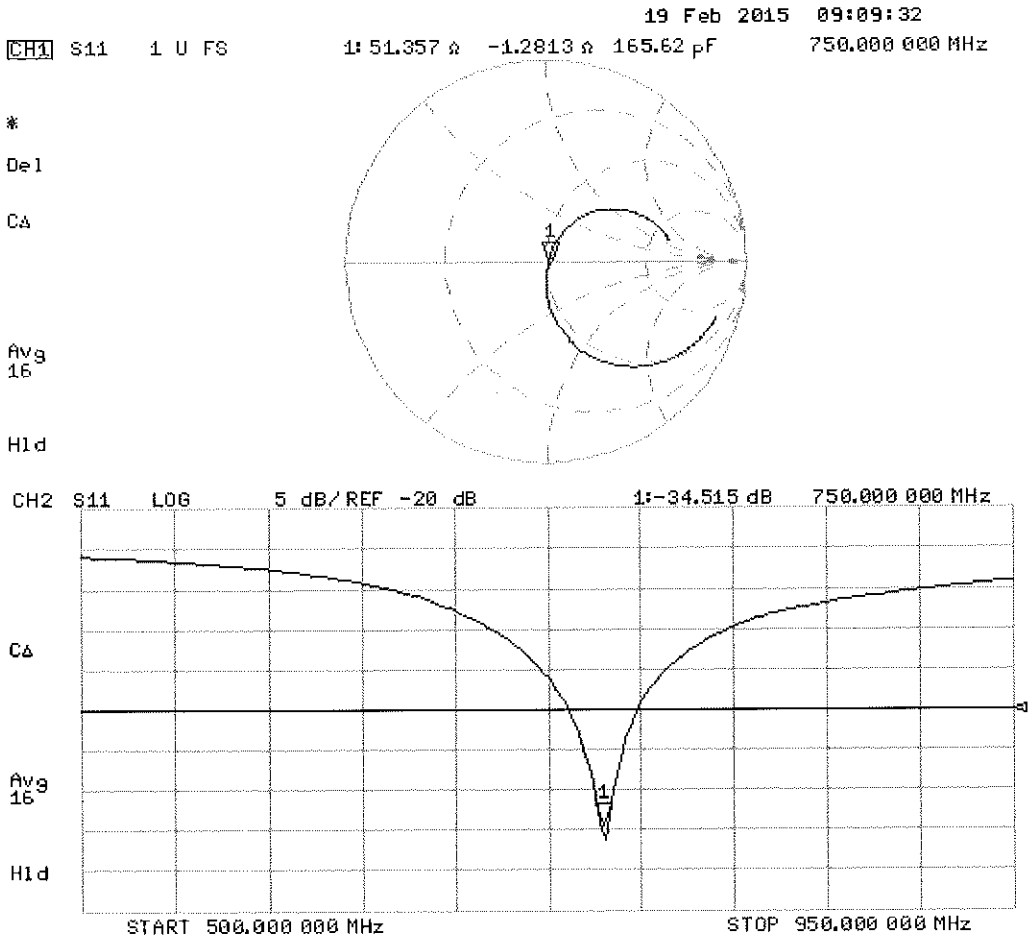
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.00 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.10 W/kg
SAR(1 g) = 2.12 W/kg; SAR(10 g) = 1.39 W/kg
Maximum value of SAR (measured) = 2.46 W/kg



0 dB = 2.46 W/kg = 3.91 dBW/kg

Impedance Measurement Plot for Body TSL



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

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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D835V2-4d133_Jul14**

CALIBRATION CERTIFICATE

Object D835V2 - SN: 4d133

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

CC 8/6/14

Calibration date: July 24, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	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	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15

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:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 24, 2014

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

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S Swiss Calibration Service

Accreditation No.: **SCS 108**

Accredited by the Swiss Accreditation Service (SAS)
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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	V52.8.8
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	41.1 ± 6 %	0.94 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.20 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (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	**5.96 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	53.8 ± 6 %	1.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.35 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (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 (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.6 Ω - 1.0 jΩ
Return Loss	- 34.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.8 Ω - 3.3 jΩ
Return Loss	- 27.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.395 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 22, 2011

DASY5 Validation Report for Head TSL

Date: 24.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d133

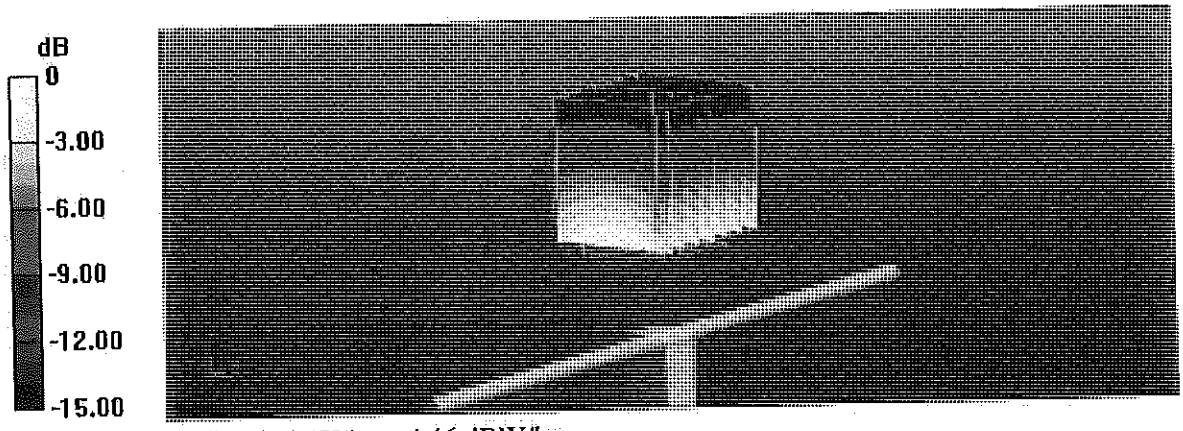
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.94 S/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

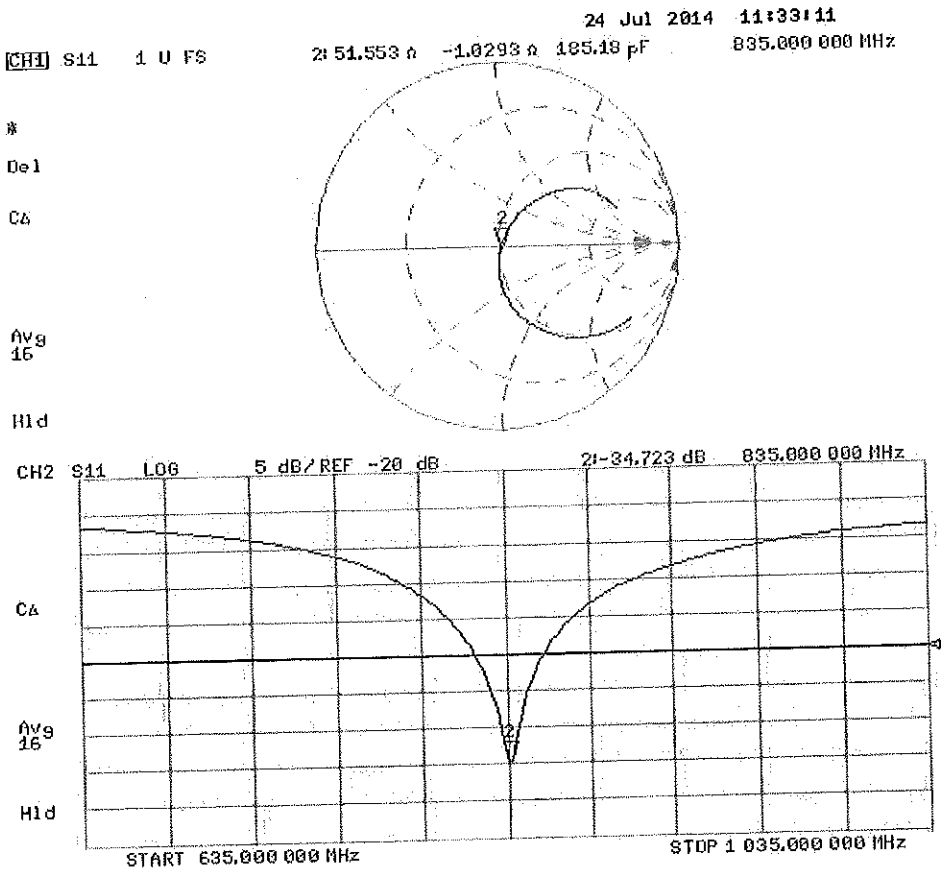
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.07 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 3.58 W/kg
SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.53 W/kg
Maximum value of SAR (measured) = 2.79 W/kg



0 dB = 2.79 W/kg = 4.46 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d133

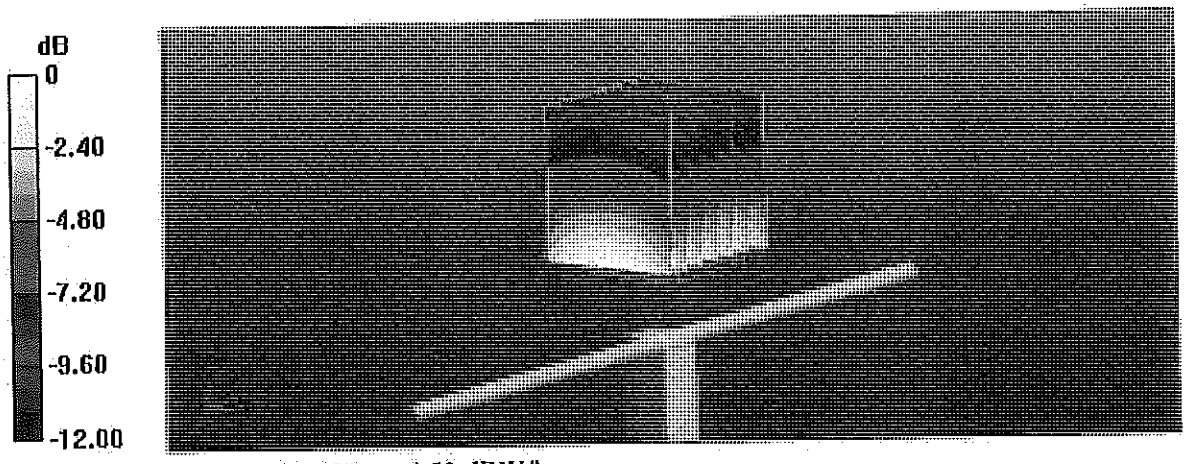
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.02 S/m; ε_r = 53.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

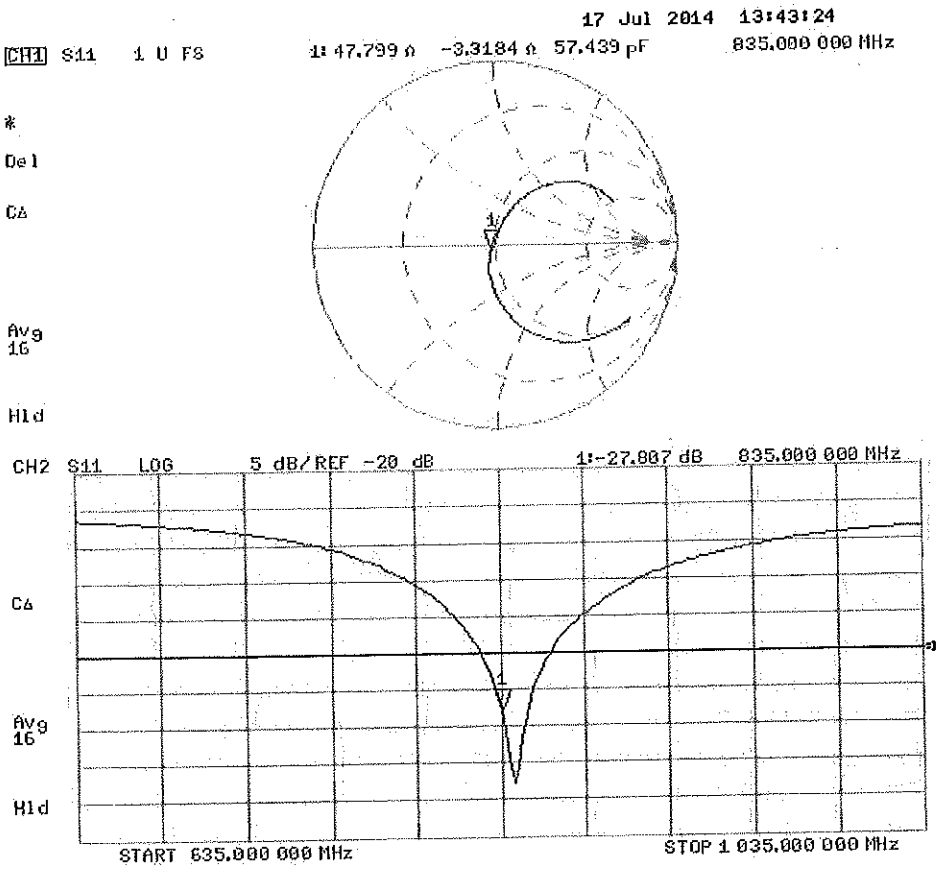
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.61 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.59 W/kg
SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.59 W/kg
Maximum value of SAR (measured) = 2.84 W/kg



0 dB = 2.84 W/kg = 4.53 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 0108

Client **PC Test**

Certificate No: D835V2-4d119_Apr15

CALIBRATION CERTIFICATE

Object: D835V2 - SN:4d119

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

RN ✓ 4/29/15

Calibration date: April 13, 2015

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	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

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-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Israe Elnaouq	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 13, 2015

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Accreditation No.: SCS 0108

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	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.9 ± 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	2.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.38 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.57 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.11 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.4 ± 6 %	1.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.37 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.20 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.55 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.06 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.2 Ω - 2.2 jΩ
Return Loss	- 33.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.7 Ω - 4.9 jΩ
Return Loss	- 25.1 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: 13.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

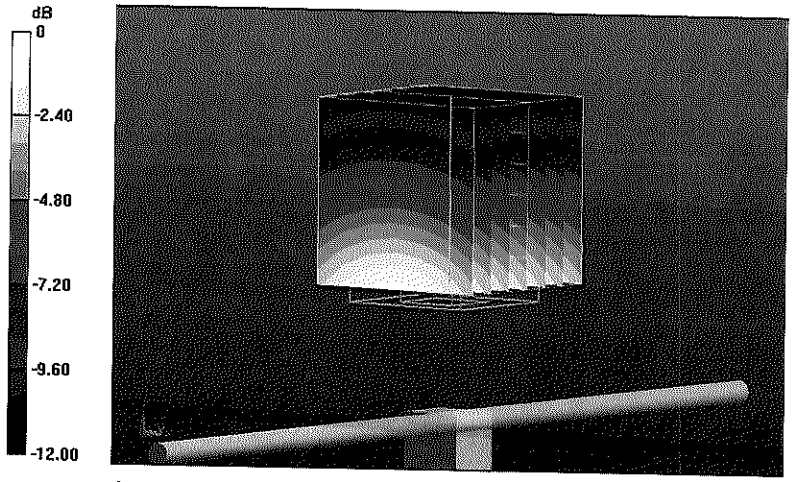
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.94 S/m; ε_r = 40.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.2, 6.2, 6.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

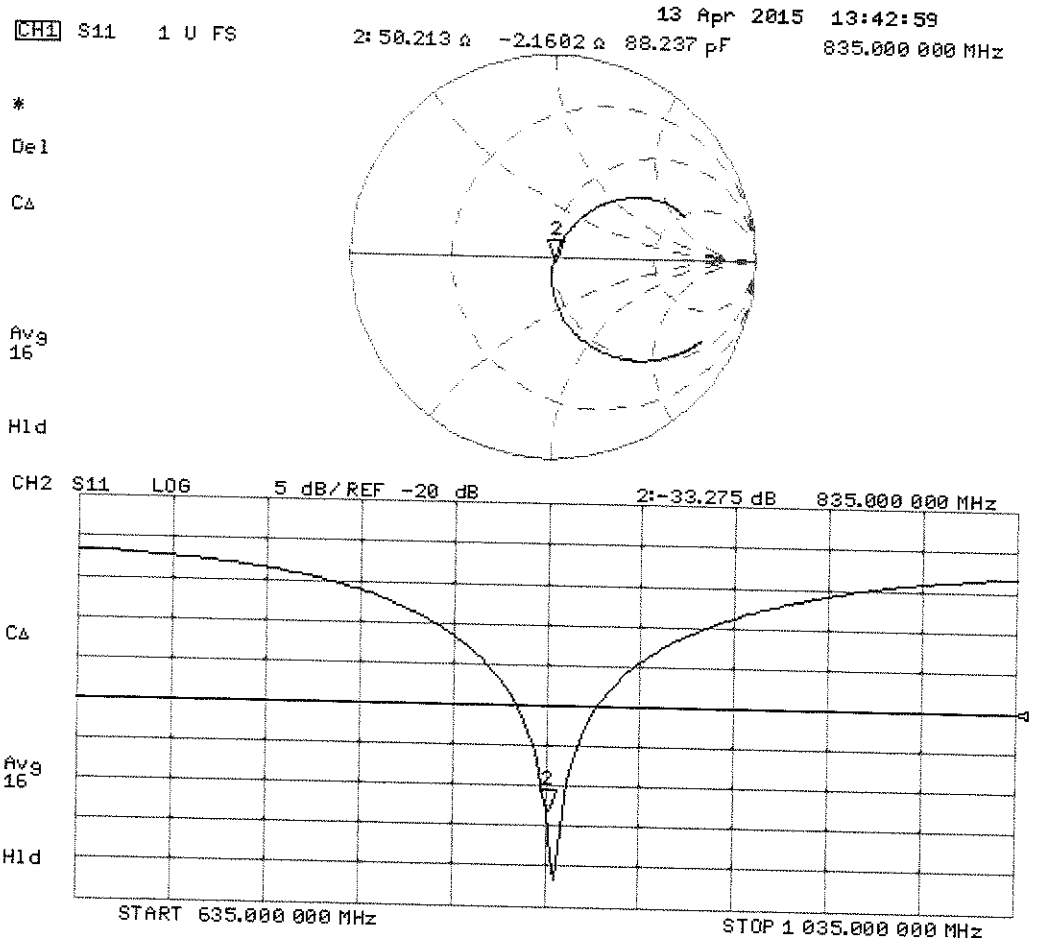
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.77 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.64 W/kg
SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.57 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 Head TSL



DASY5 Validation Report for Body TSL

Date: 13.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

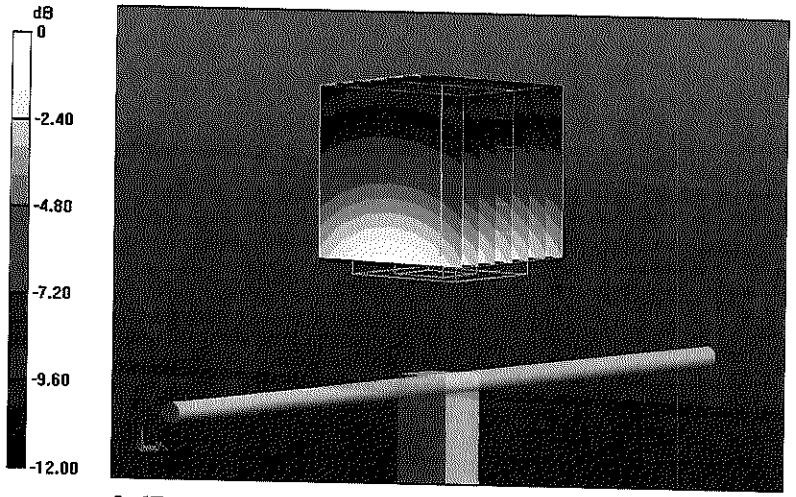
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.01 S/m; ε_r = 55.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.17, 6.17, 6.17); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

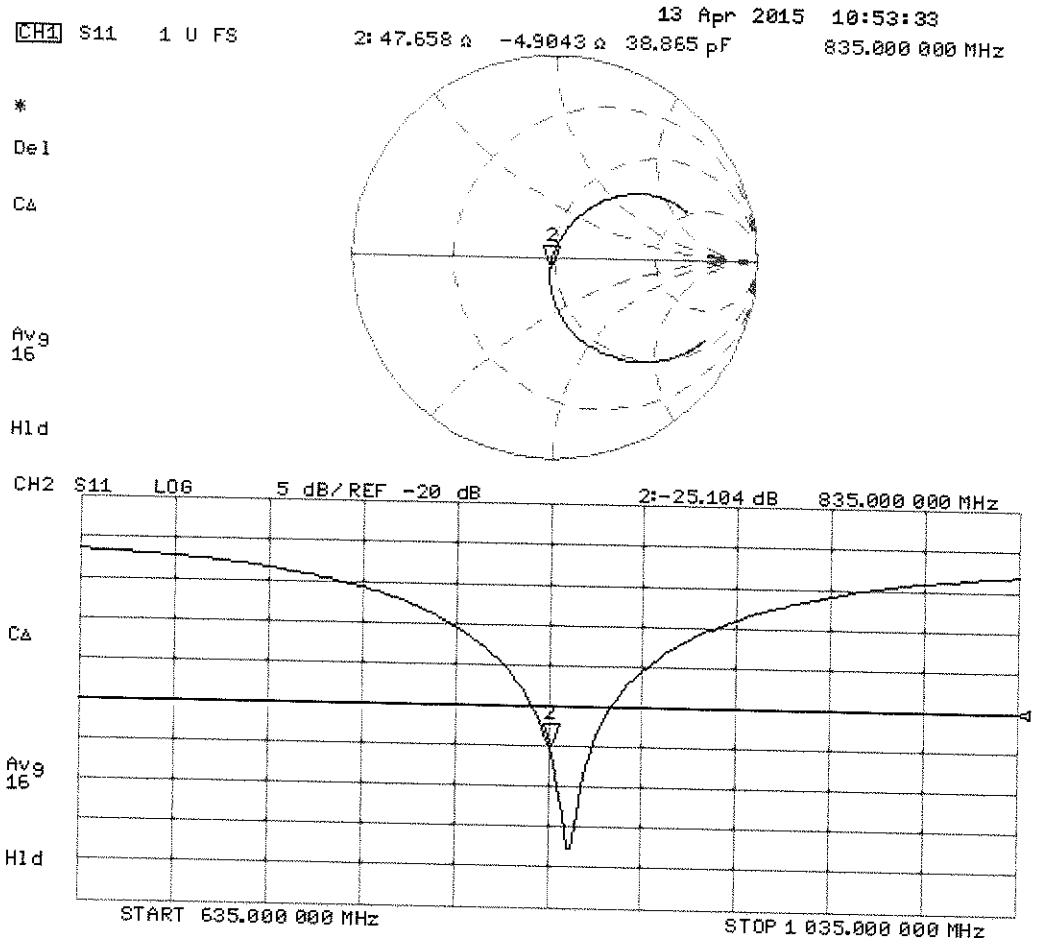
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.44 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 3.52 W/kg
SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.55 W/kg
Maximum value of SAR (measured) = 2.77 W/kg



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

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 0108

Client **PC Test**

Certificate No: D1750V2-1051_Apr15

CALIBRATION CERTIFICATE

Object D1750V2 - SN:1051

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

PM ✓ 4/29/15

Calibration date: April 15, 2015

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	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

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-14)	In house check: Oct-15

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

Issued: April 15, 2015

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Accreditation No.: SCS 0108

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	V52.8.8
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	38.9 ± 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	9.04 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	4.80 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	51.5 ± 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	9.32 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**37.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.01 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.0 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.3 Ω - 0.2 jΩ
Return Loss	- 37.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.9 Ω + 0.3 jΩ
Return Loss	- 29.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.221 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	February 19, 2010

DASY5 Validation Report for Head TSL

Date: 15.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

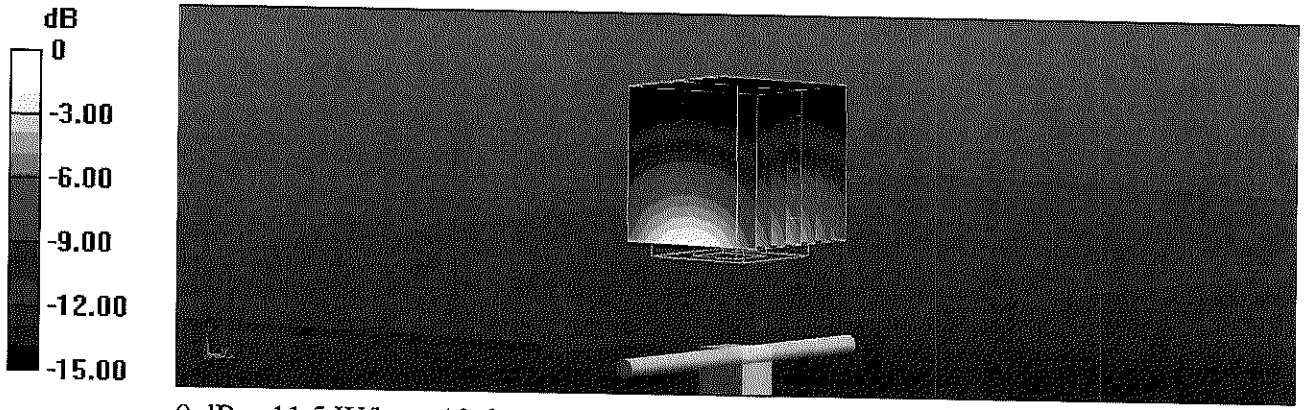
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.35 S/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.2, 5.2, 5.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

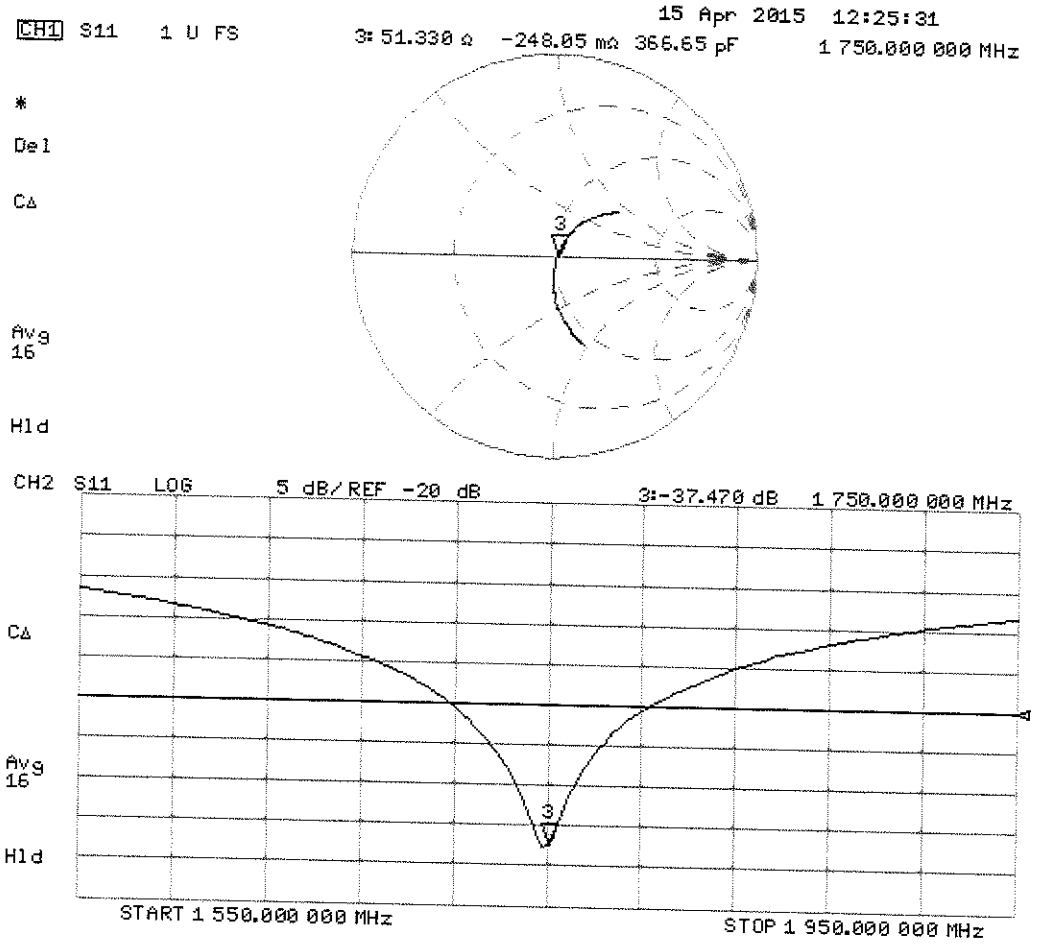
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.99 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 16.3 W/kg
SAR(1 g) = 9.04 W/kg; SAR(10 g) = 4.8 W/kg
Maximum value of SAR (measured) = 11.5 W/kg



0 dB = 11.5 W/kg = 10.61 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 15.04.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

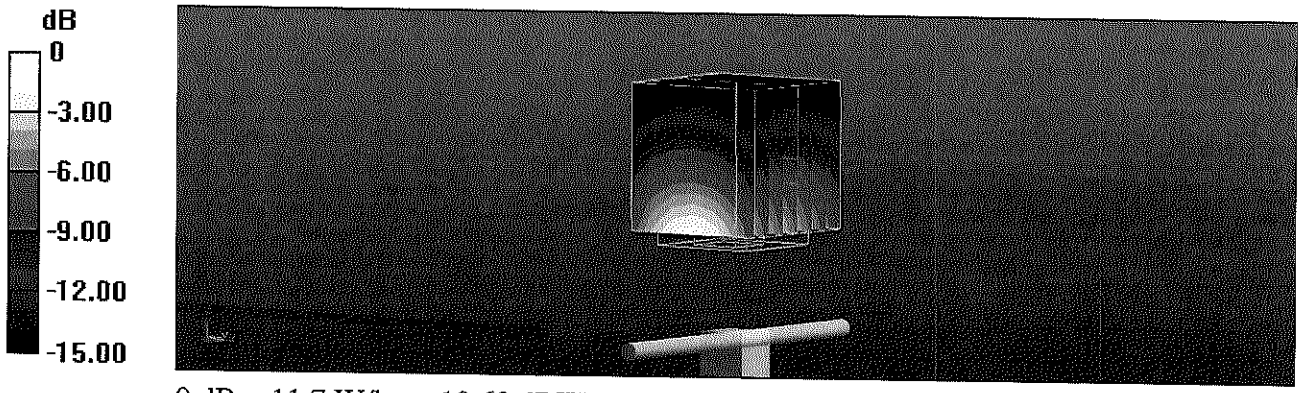
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.48 S/m; ε_r = 51.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.88, 4.88, 4.88); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

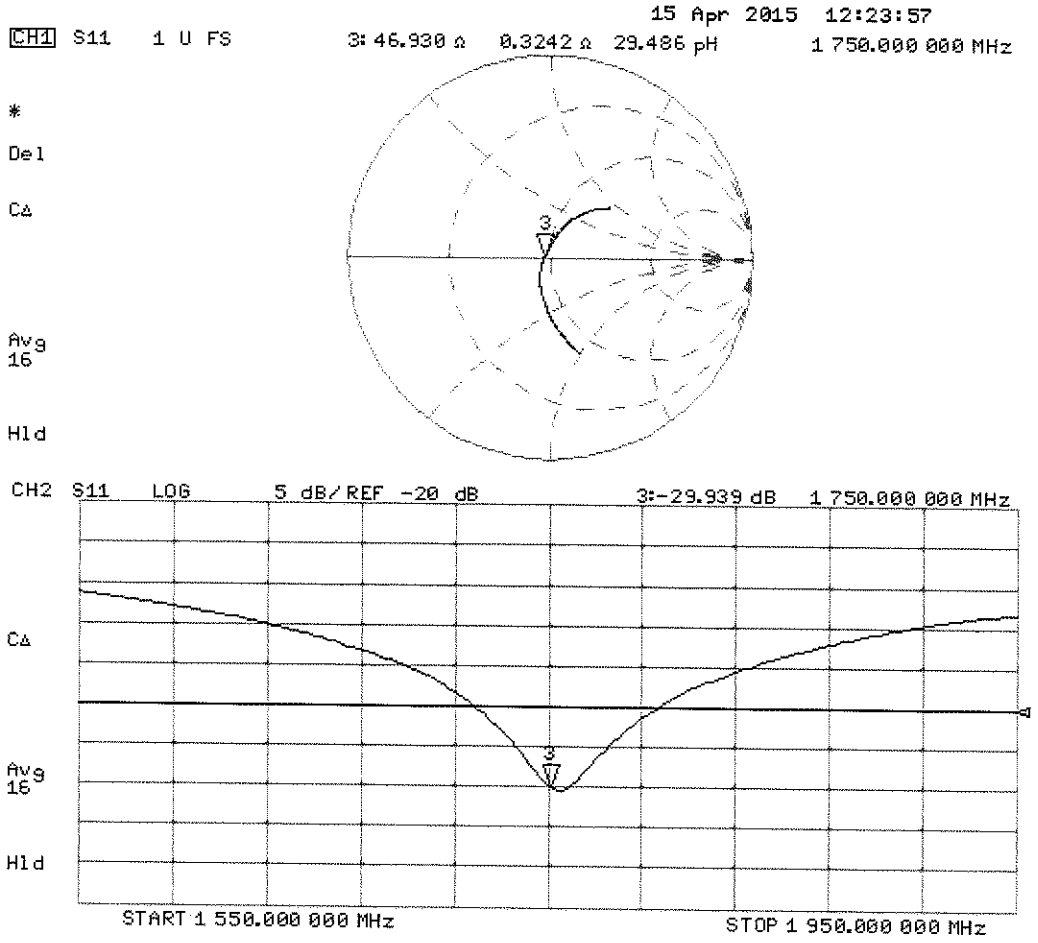
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.87 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 16.0 W/kg
SAR(1 g) = 9.32 W/kg; SAR(10 g) = 5.01 W/kg
Maximum value of SAR (measured) = 11.7 W/kg



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

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 0108

Client **PC Test**

Certificate No: D1900V2-5d148_Feb15

CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 5d148

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

CC ✓ 3/6/15

Calibration date: February 18, 2015

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	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
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-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

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-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 18, 2015

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Accreditation No.: SCS 0108

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	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.1 ± 6 %	1.42 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.37 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	53.1 ± 6 %	1.53 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.5 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4 Ω + 6.2 jΩ
Return Loss	- 23.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.2 Ω + 6.6 jΩ
Return Loss	- 23.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.198 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: 18.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d148

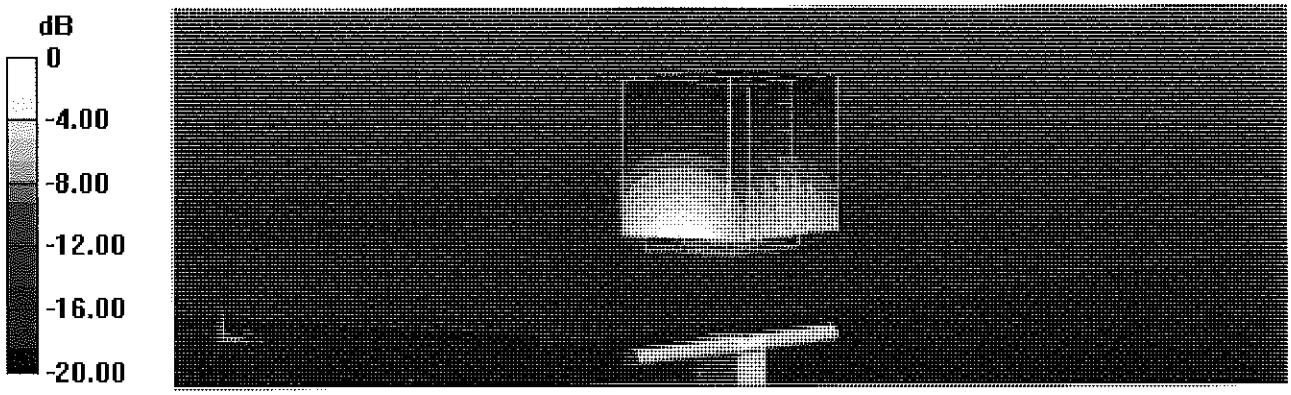
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.42 S/m; ε_r = 39.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5, 5, 5); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

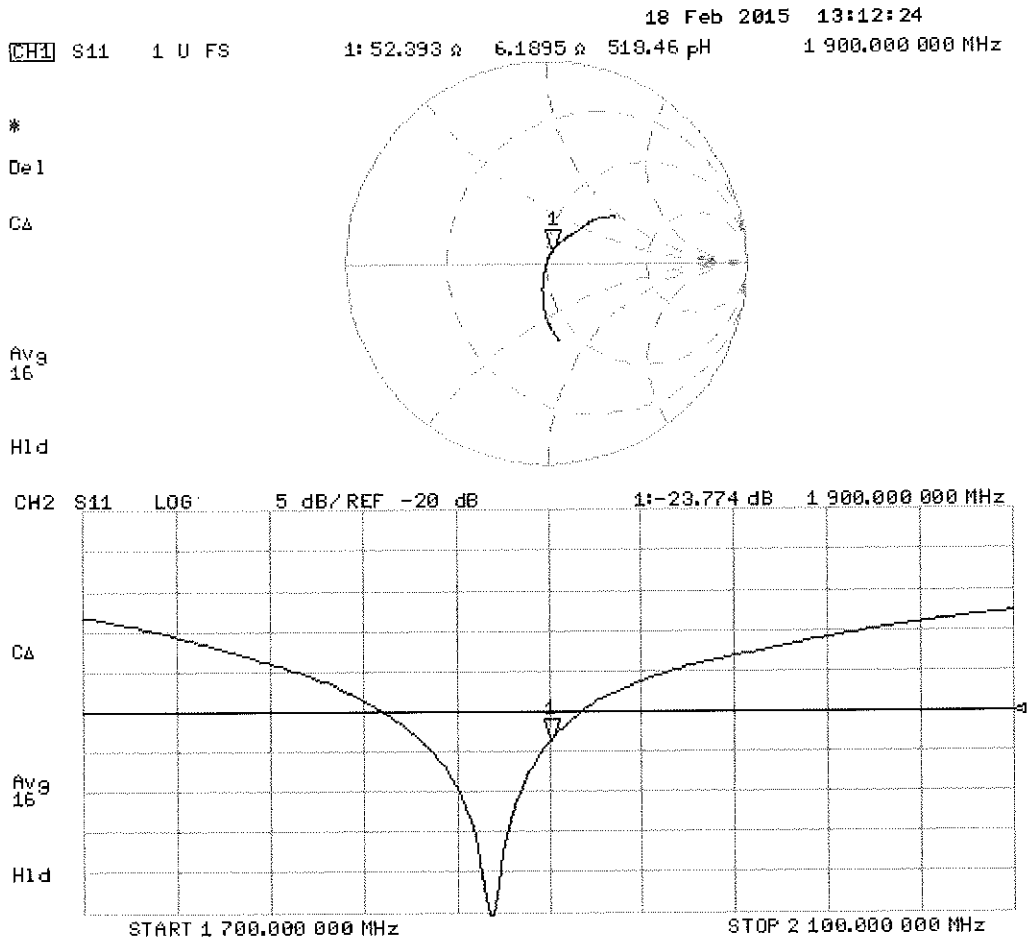
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.30 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 18.8 W/kg
SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.37 W/kg
Maximum value of SAR (measured) = 13.0 W/kg

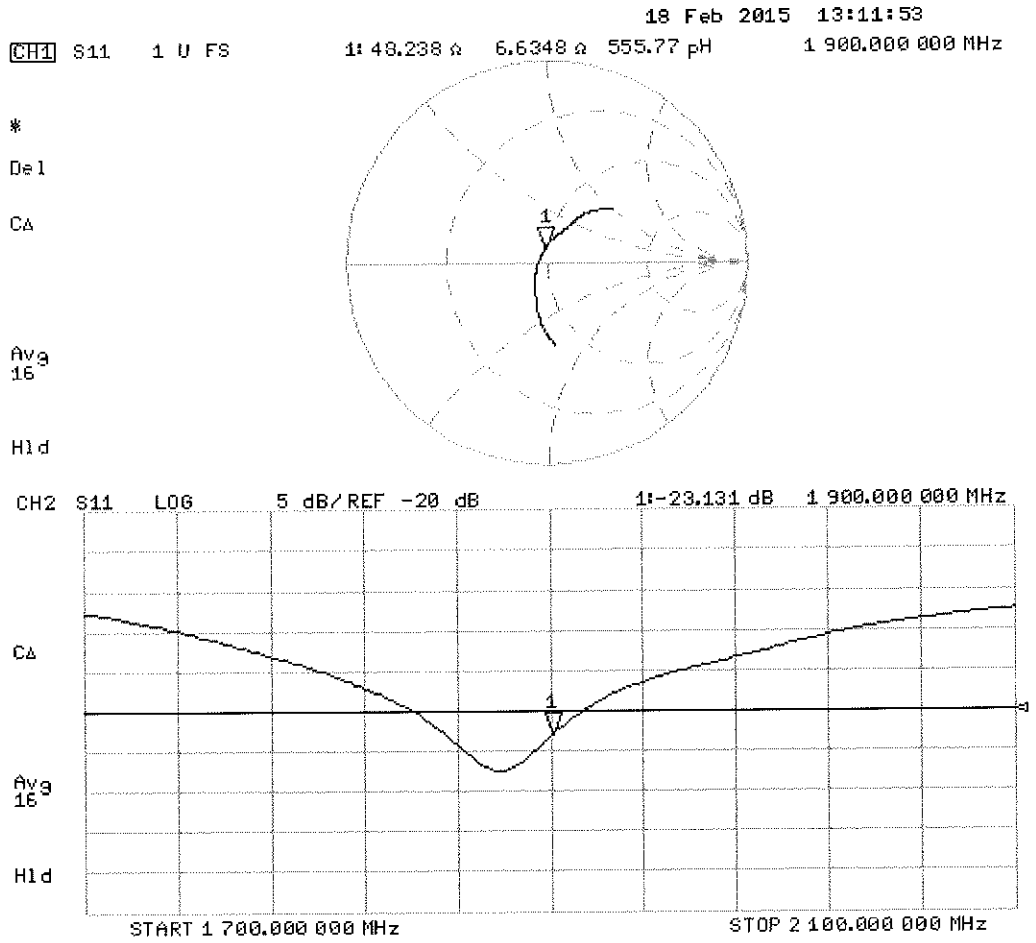


0 dB = 13.0 W/kg = 11.14 dBW/kg

Impedance Measurement Plot for Head TSL



Impedance Measurement Plot for Body TSL



DASY5 Validation Report for Body TSL

Date: 18.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d148

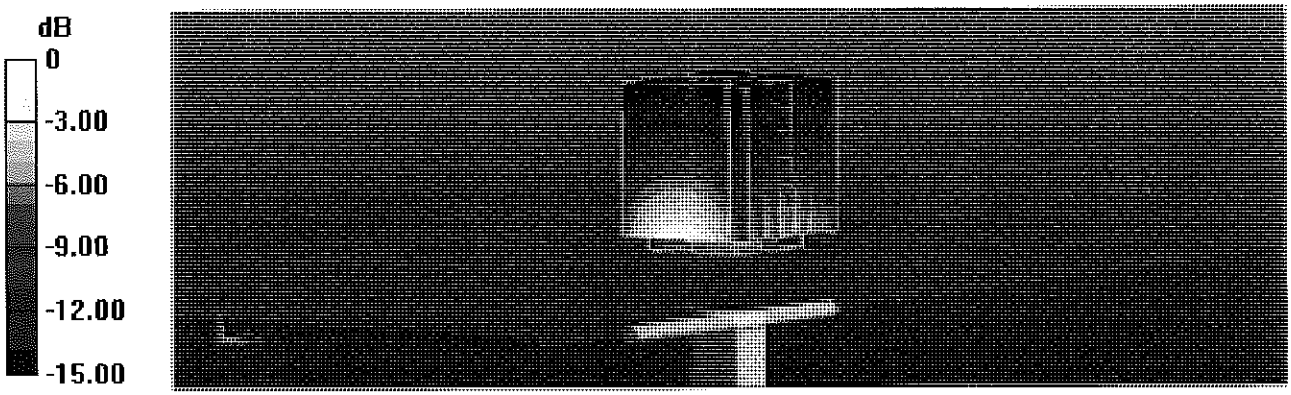
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.53 S/m; ε_r = 53.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.65, 4.65, 4.65); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.79 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 17.2 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.4 W/kg
Maximum value of SAR (measured) = 12.7 W/kg



0 dB = 12.7 W/kg = 11.04 dBW/kg

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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D2450V2-719_Aug14

CALIBRATION CERTIFICATE

Object D2450V2 - SN: 719

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

Calibration date: August 11, 2014

✓ KOK 9/8/14

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	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15

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:	Michael Weber	Laboratory Technician	M. Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 12, 2014

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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 1528-2013, "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	V52.8.8
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	38.0 ± 6 %	1.82 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.2 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.5 ± 6 %	2.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.0 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.9 Ω + 3.0 jΩ
Return Loss	- 25.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.9 Ω + 5.8 jΩ
Return Loss	- 24.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 10, 2002

DASY5 Validation Report for Head TSL

Date: 11.08.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

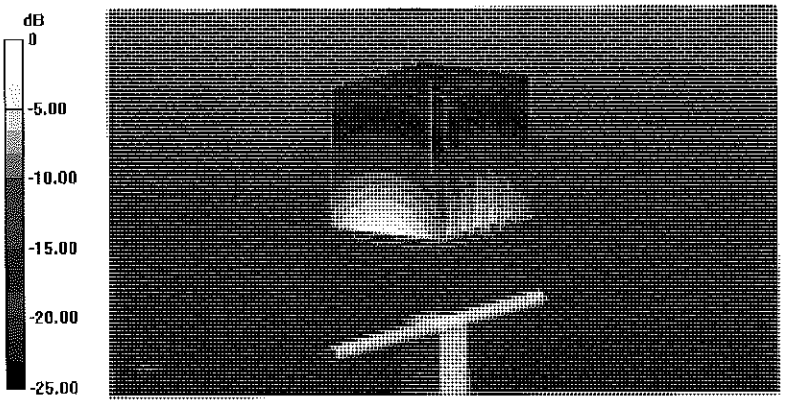
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.82 S/m; ε_r = 38; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

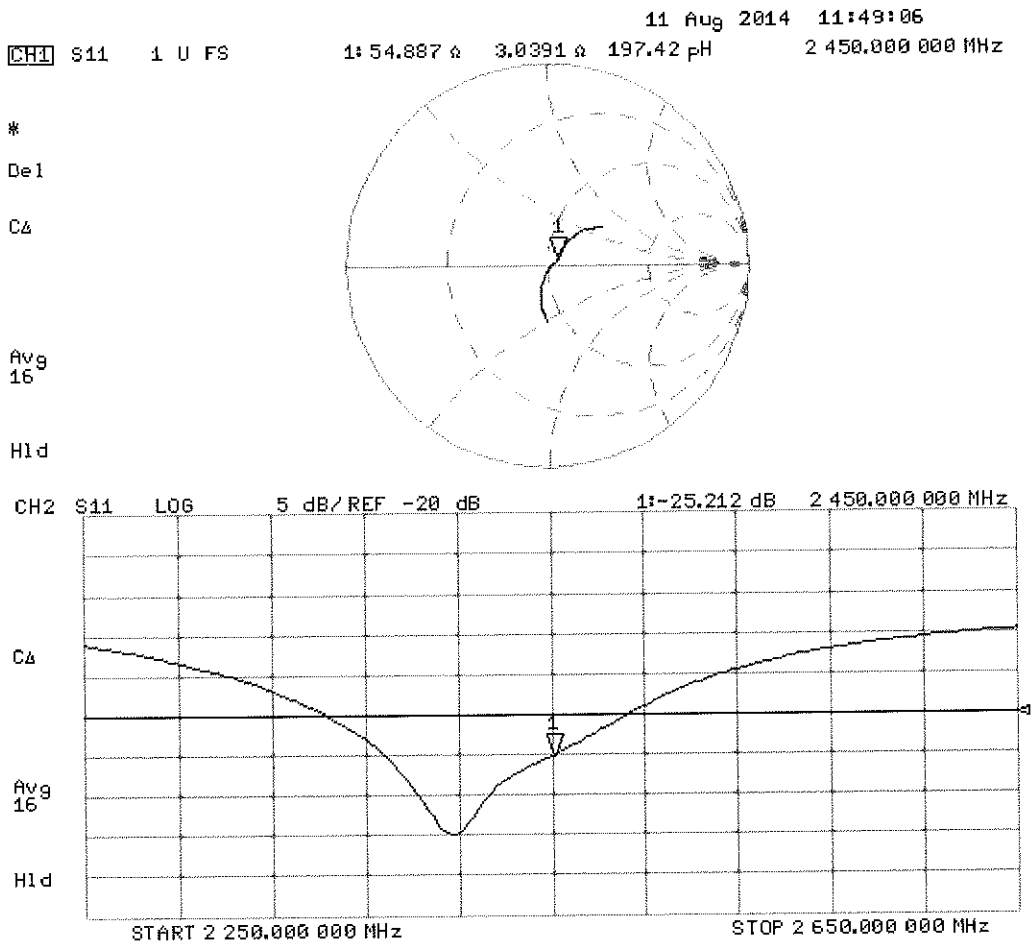
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 101.6 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 27.5 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.09 W/kg
Maximum value of SAR (measured) = 17.4 W/kg



0 dB = 17.4 W/kg = 12.41 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 11.08.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

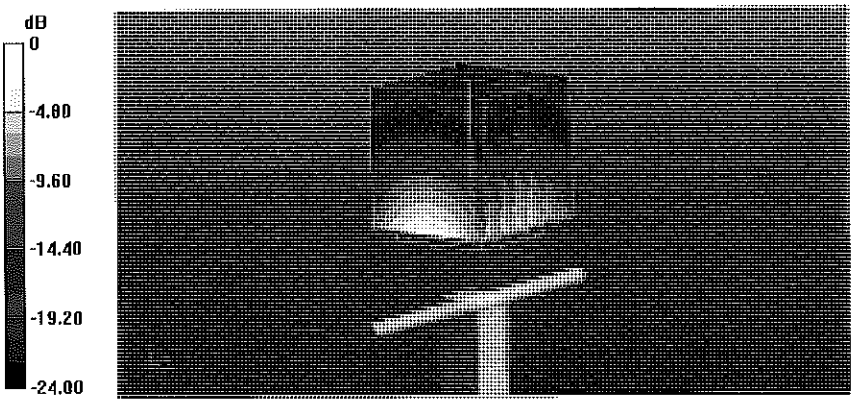
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 S/m; ε_r = 50.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

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: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

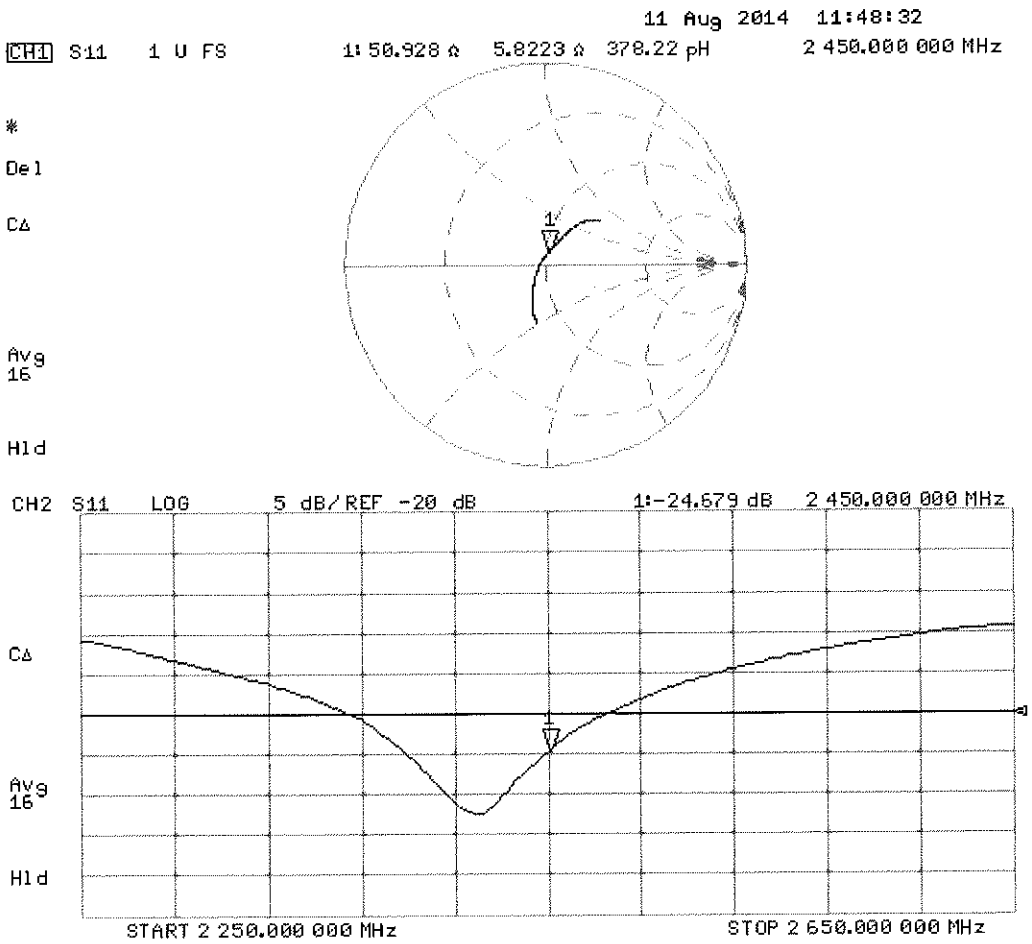
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.08 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.1 W/kg
Maximum value of SAR (measured) = 17.6 W/kg



0 dB = 17.6 W/kg = 12.46 dBW/kg

Impedance Measurement Plot for Body TSL



Calibration Laboratory of
Schmid & Partner
Engineering AG
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 0108

Client **PC Test**

Certificate No: D5GHzV2-1057_Jan15

CALIBRATION CERTIFICATE

Object D5GHzV2 - SN:1057

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

CC 2/3/15

Calibration date: January 21, 2015

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	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
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 EX3DV4	SN: 3503	30-Dec-14 (No. EX3-3503_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

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-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 22, 2015

Calibration Laboratory of
Schmid & Partner
Engineering AG
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 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
c) 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

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	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.3 ± 6 %	4.56 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.14 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.1 ± 6 %	4.66 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.47 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**84.7 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.9 ± 6 %	4.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**84.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.8 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.6 ± 6 %	4.97 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.7 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	5.18 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.9 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	49.4 ± 6 %	5.42 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.37 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**73.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.05 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.6 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	49.2 ± 6 %	5.55 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.9 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.9 ± 6 %	5.82 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.90 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**79.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.19 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.0 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.7 ± 6 %	5.96 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.75 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**77.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.5 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.4 ± 6 %	6.25 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.49 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.06 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.6 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	49.0 Ω - 9.4 jΩ
Return Loss	- 20.4 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	48.3 Ω - 4.2 jΩ
Return Loss	- 26.8 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	49.2 Ω - 5.0 jΩ
Return Loss	- 25.9 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.4 Ω - 4.8 jΩ
Return Loss	- 24.1 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	51.8 Ω - 2.6 jΩ
Return Loss	- 30.1 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	48.2 Ω - 8.4 jΩ
Return Loss	- 21.2 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	48.6 Ω - 3.6 jΩ
Return Loss	- 28.2 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	49.4 Ω - 4.1 jΩ
Return Loss	- 27.6 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	55.1 Ω - 4.0 jΩ
Return Loss	- 24.2 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	51.6 Ω - 1.6 jΩ
Return Loss	- 33.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 27, 2006

DASY5 Validation Report for Head TSL

Date: 21.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.56 S/m; ε_r = 36.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.66 S/m; ε_r = 36.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 4.86 S/m; ε_r = 35.9; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.97 S/m; ε_r = 35.6; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.18 S/m; ε_r = 35.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.51, 5.51, 5.51); Calibrated: 30.12.2014, ConvF(5.21, 5.21, 5.21); Calibrated: 30.12.2014, ConvF(5.12, 5.12, 5.12); Calibrated: 30.12.2014, ConvF(4.92, 4.92, 4.92); Calibrated: 30.12.2014, ConvF(4.9, 4.9, 4.9); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

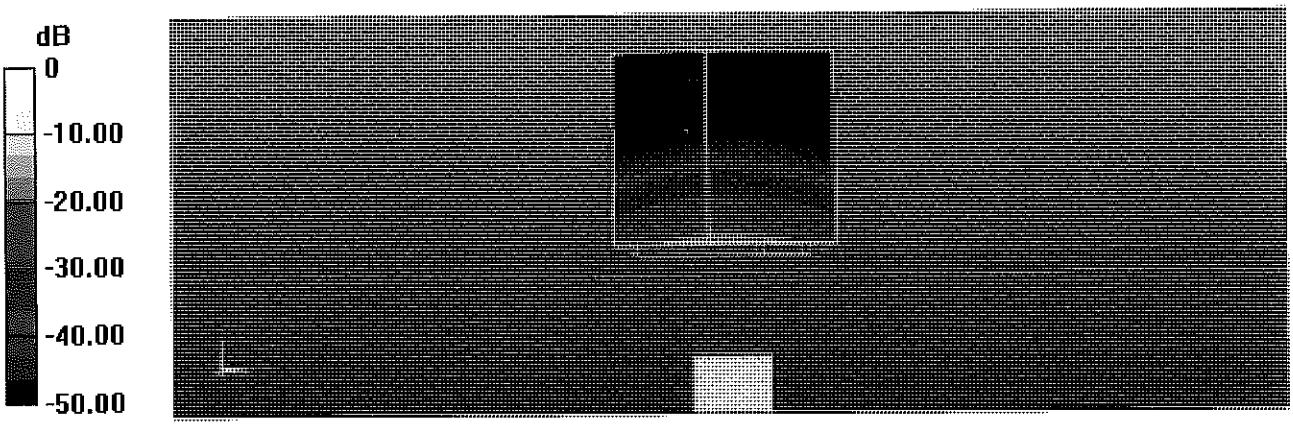
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.51 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 29.8 W/kg
SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.31 W/kg
Maximum value of SAR (measured) = 19.3 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.30 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 32.1 W/kg
SAR(1 g) = 8.47 W/kg; SAR(10 g) = 2.41 W/kg
Maximum value of SAR (measured) = 20.4 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.33 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 33.5 W/kg
SAR(1 g) = 8.43 W/kg; SAR(10 g) = 2.38 W/kg
Maximum value of SAR (measured) = 20.6 W/kg

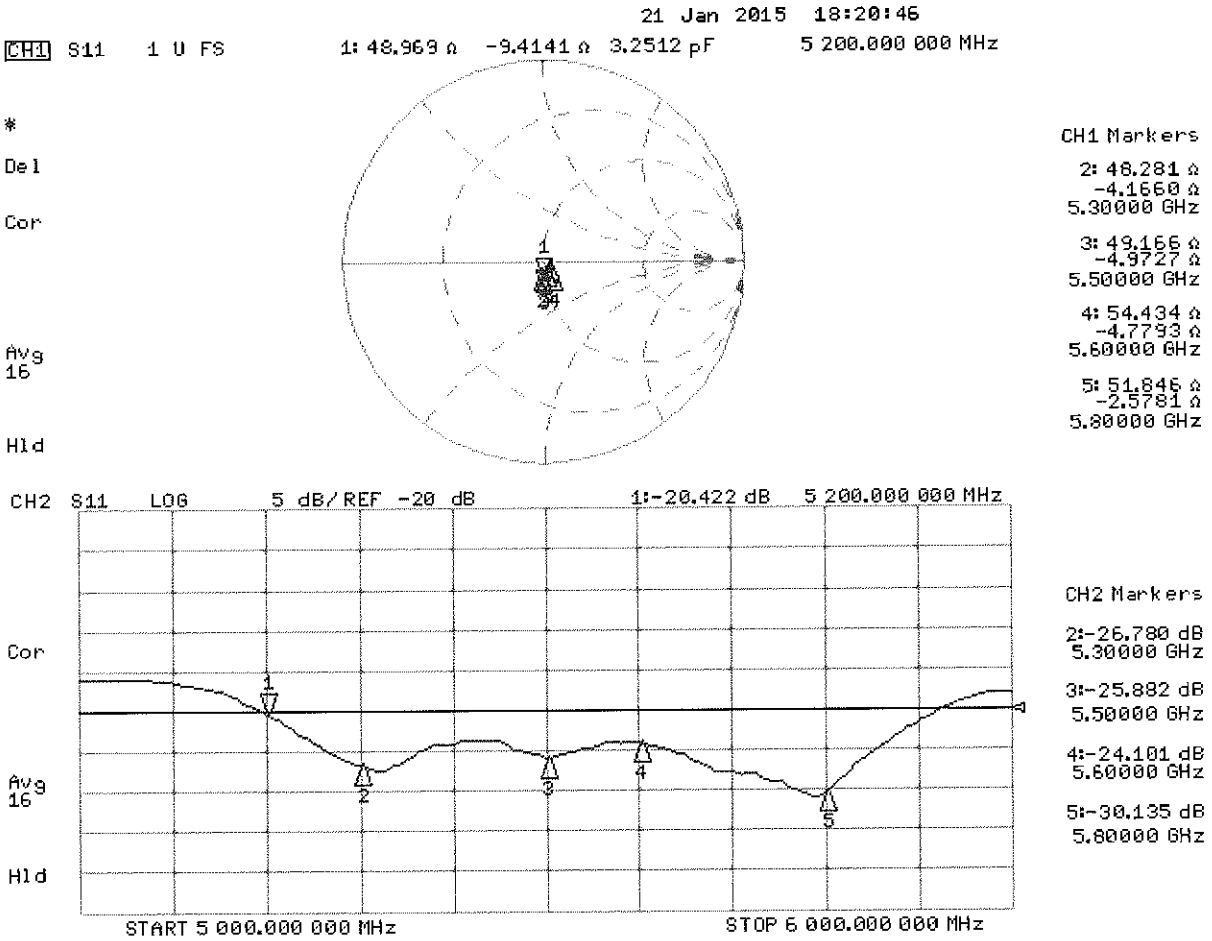
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.47 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 33.5 W/kg
SAR(1 g) = 8.38 W/kg; SAR(10 g) = 2.37 W/kg
Maximum value of SAR (measured) = 20.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 62.34 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 33.8 W/kg
SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.29 W/kg
Maximum value of SAR (measured) = 19.8 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 20.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.42 S/m; ε_r = 49.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 5.55 S/m; ε_r = 49.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 5.82 S/m; ε_r = 48.9; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.96 S/m; ε_r = 48.7; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.25 S/m; ε_r = 48.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.95, 4.95, 4.95); Calibrated: 30.12.2014, ConvF(4.78, 4.78, 4.78); Calibrated: 30.12.2014, ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2014, ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2014, ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

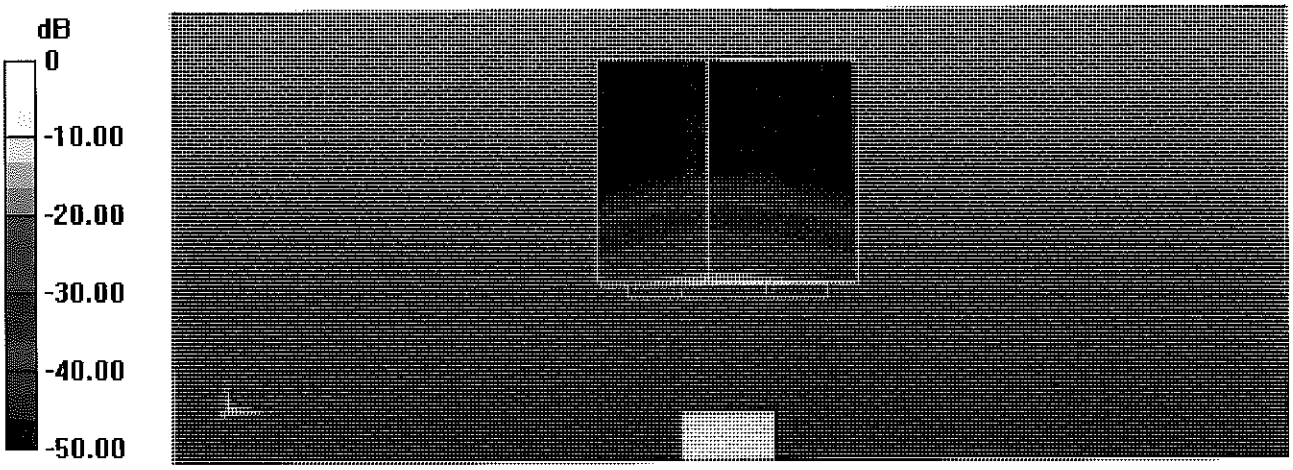
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.76 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 28.9 W/kg
SAR(1 g) = 7.37 W/kg; SAR(10 g) = 2.05 W/kg
Maximum value of SAR (measured) = 17.4 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.35 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 29.8 W/kg
SAR(1 g) = 7.41 W/kg; SAR(10 g) = 2.08 W/kg
Maximum value of SAR (measured) = 17.6 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.04 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 33.7 W/kg
SAR(1 g) = 7.9 W/kg; SAR(10 g) = 2.19 W/kg
Maximum value of SAR (measured) = 19.2 W/kg

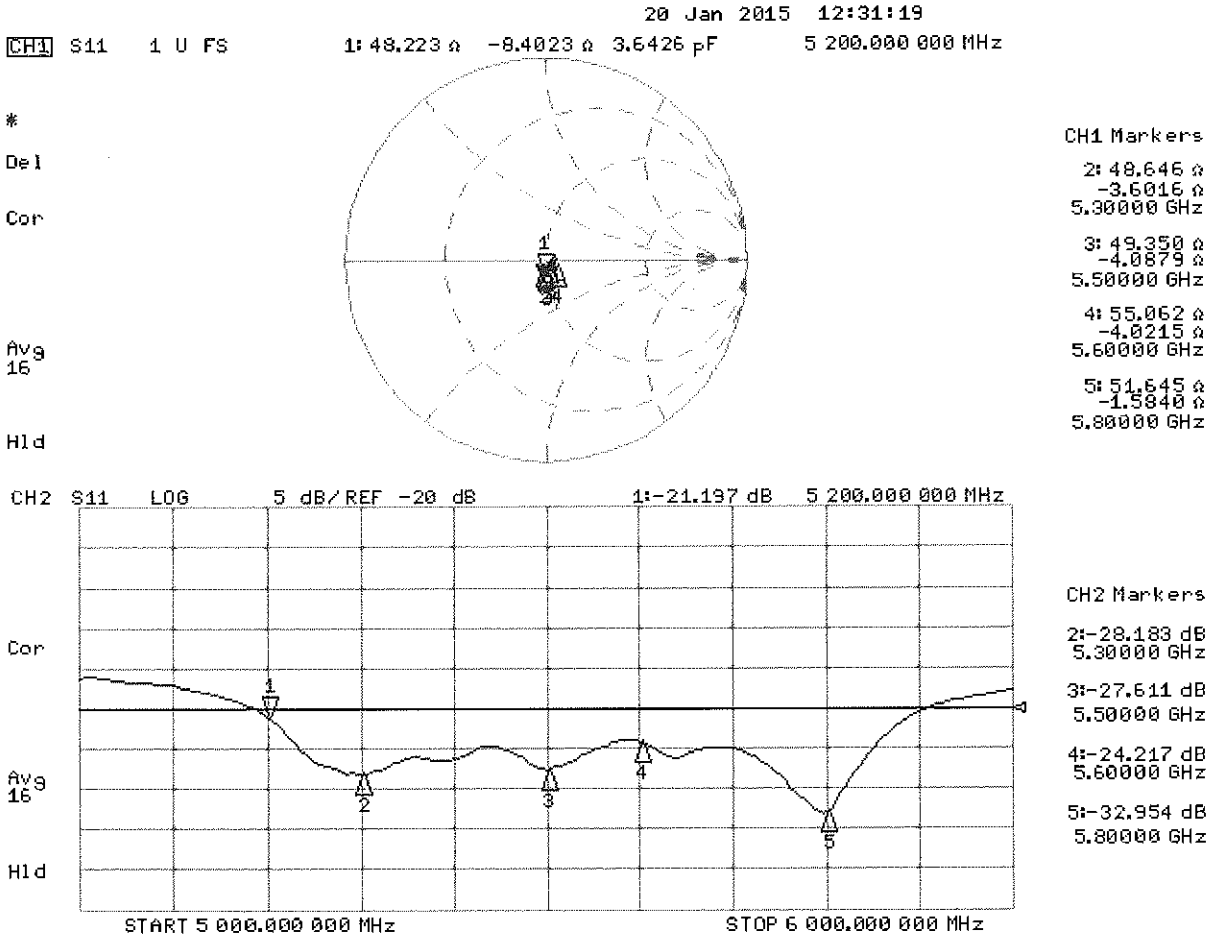
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 57.74 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 34.1 W/kg
SAR(1 g) = 7.75 W/kg; SAR(10 g) = 2.14 W/kg
Maximum value of SAR (measured) = 19.1 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 55.86 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 34.7 W/kg
SAR(1 g) = 7.49 W/kg; SAR(10 g) = 2.06 W/kg
Maximum value of SAR (measured) = 18.6 W/kg



0 dB = 17.4 W/kg = 12.41 dBW/kg

Impedance Measurement Plot for Body TSL



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S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3331_Aug14/2**

CALIBRATION CERTIFICATE (Replacement of No: ES3-3331_Aug14)

Object	ES3DV3 - SN:3331
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 20, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: November 3, 2014

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:3331

Manufactured: January 24, 2012
Calibrated: August 20, 2014

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3331

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.16	1.22	0.65	± 10.1 %
DCP (mV)[B]	97.2	104.5	101.6	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	196.9	±2.7 %
		Y	0.0	0.0	1.0		202.0	
		Z	0.0	0.0	1.0		182.4	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	3.20	62.4	12.3	10.00	41.8	±1.7 %
		Y	3.15	62.4	12.1		43.7	
		Z	36.65	88.0	19.5		35.8	
10011-CAB	UMTS-FDD (WCDMA)	X	3.03	63.8	15.9	2.91	133.8	±0.9 %
		Y	3.28	67.2	18.6		140.9	
		Z	3.32	66.8	18.3		146.0	
10012-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.51	63.6	15.0	1.87	134.4	±0.9 %
		Y	3.11	69.9	19.3		144.5	
		Z	2.92	68.3	18.4		145.1	
10013-CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	11.32	70.3	22.8	9.46	135.4	±3.5 %
		Y	11.79	72.2	24.2		146.6	
		Z	11.30	70.4	22.8		145.6	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	11.03	85.1	23.4	9.39	127.4	±2.2 %
		Y	25.94	99.5	28.1		119.9	
		Z	11.02	88.4	24.4		123.1	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	12.84	87.5	24.3	9.57	138.6	±2.5 %
		Y	26.90	99.8	28.2		146.7	
		Z	10.27	87.7	24.4		113.6	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	14.52	85.4	20.8	6.56	149.8	±2.2 %
		Y	38.05	99.6	25.4		119.6	
		Z	31.13	99.9	25.4		147.0	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	6.94	75.0	16.0	4.80	136.5	±1.7 %
		Y	55.93	99.7	23.3		134.0	
		Z	38.81	99.8	23.8		145.4	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	4.68	71.0	13.6	3.55	149.6	±1.7 %
		Y	58.60	99.9	22.7		140.1	
		Z	41.15	99.6	22.7		129.1	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	1.18	62.6	8.4	1.16	134.1	±1.7 %
		Y	81.15	99.6	19.6		149.1	
		Z	50.90	99.9	20.1		142.0	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.57	64.6	17.2	4.57	130.2	±1.4 %
		Y	4.83	67.2	19.3		145.2	
		Z	4.79	66.5	18.8		141.3	

10081-CAB	CDMA2000 (1xRTT, RC3)	X	3.91	64.7	17.0	3.97	148.6	±1.4 %
		Y	3.94	66.4	18.7		139.3	
		Z	3.93	65.9	18.3		136.4	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.42	64.7	16.9	3.98	138.2	±1.2 %
		Y	4.53	66.5	18.6		128.9	
		Z	4.60	66.3	18.3		127.5	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.39	66.6	18.8	5.67	143.8	±1.9 %
		Y	6.42	67.7	19.9		134.4	
		Z	6.37	66.9	19.2		132.5	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.27	66.1	18.6	5.80	140.5	±1.9 %
		Y	6.27	67.1	19.7		132.3	
		Z	6.27	66.5	19.1		131.1	
10110-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	5.98	65.6	18.4	5.75	137.0	±1.9 %
		Y	5.98	66.8	19.6		129.1	
		Z	5.98	66.2	19.1		128.1	
10114-CAA	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	10.08	68.1	20.6	8.10	131.5	±3.3 %
		Y	10.54	69.9	22.0		148.4	
		Z	10.46	69.1	21.2		149.0	
10117-CAA	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.12	68.2	20.6	8.07	132.9	±2.7 %
		Y	10.54	69.9	21.9		149.5	
		Z	10.04	68.1	20.6		123.5	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	10.07	74.1	24.8	9.28	135.5	±3.8 %
		Y	10.33	76.0	26.3		123.9	
		Z	9.05	71.9	23.9		145.1	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.96	65.6	18.4	5.75	137.0	±1.9 %
		Y	5.93	66.5	19.4		128.7	
		Z	6.00	66.2	19.1		129.9	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.41	66.2	18.7	5.82	141.3	±1.9 %
		Y	6.42	67.3	19.8		133.3	
		Z	6.45	66.8	19.3		133.9	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.01	65.6	18.5	5.73	139.9	±1.7 %
		Y	5.00	66.9	19.8		133.5	
		Z	4.88	66.1	19.2		132.6	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	9.20	77.8	26.8	9.21	149.1	±3.8 %
		Y	11.00	84.2	30.5		140.6	
		Z	7.06	72.2	24.3		129.4	
10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.93	65.2	18.3	5.72	131.8	±1.7 %
		Y	5.03	67.0	19.9		133.9	
		Z	4.97	66.5	19.4		148.0	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.97	65.4	18.3	5.72	137.6	±1.9 %
		Y	5.01	66.9	19.8		133.3	
		Z	4.96	66.5	19.4		146.6	
10193-CAA	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	9.74	67.7	20.4	8.09	123.4	±3.0 %
		Y	10.16	69.5	21.8		142.8	
		Z	10.03	68.5	21.0		136.4	

10196-CAA	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.71	67.7	20.4	8.10	124.5	±3.0 %
		Y	10.16	69.5	21.9		144.1	
		Z	10.17	68.9	21.2		146.1	
10219-CAA	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	9.59	67.5	20.3	8.03	123.8	±3.0 %
		Y	10.07	69.5	21.8		143.7	
		Z	10.08	68.9	21.2		145.5	
10222-CAA	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	10.01	68.0	20.5	8.06	129.1	±2.7 %
		Y	10.16	69.0	21.4		123.7	
		Z	10.02	68.1	20.7		123.3	
10225-CAB	UMTS-FDD (HSPA+)	X	6.84	65.7	18.3	5.97	128.3	±1.7 %
		Y	7.10	67.5	19.8		145.9	
		Z	7.17	67.2	19.4		146.7	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	9.23	77.8	26.8	9.21	149.7	±4.1 %
		Y	11.46	85.4	31.1		143.6	
		Z	7.17	72.6	24.5		132.3	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	9.84	74.4	25.0	9.24	143.3	±4.1 %
		Y	11.53	80.3	28.7		147.8	
		Z	8.43	71.1	23.5		136.1	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	9.60	72.7	24.1	9.30	124.1	±3.6 %
		Y	10.50	76.3	26.6		125.1	
		Z	9.07	72.0	23.9		144.3	
10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	5.95	66.0	18.0	4.87	147.1	±1.7 %
		Y	6.00	67.2	19.2		139.8	
		Z	6.11	67.0	18.9		140.5	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.17	64.3	16.7	3.96	129.0	±1.2 %
		Y	4.50	67.3	19.1		144.7	
		Z	4.48	66.6	18.5		141.5	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.50	64.4	16.6	3.46	142.1	±1.2 %
		Y	3.69	67.2	19.0		134.8	
		Z	3.67	66.6	18.5		130.8	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.45	64.5	16.5	3.39	145.2	±1.2 %
		Y	3.64	67.3	19.0		135.9	
		Z	3.66	67.0	18.7		133.8	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.28	66.1	18.6	5.81	139.0	±1.9 %
		Y	6.28	67.2	19.8		130.1	
		Z	6.29	66.6	19.2		128.4	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.86	66.8	19.1	6.06	144.5	±1.9 %
		Y	6.89	67.9	20.2		135.9	
		Z	6.88	67.3	19.6		135.0	
10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	2.32	63.0	14.7	1.71	128.7	±0.7 %
		Y	3.14	71.0	20.1		142.2	
		Z	2.95	69.2	18.9		142.4	
10316-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc duty cycle)	X	9.99	68.0	20.8	8.36	125.5	±3.3 %
		Y	10.41	69.8	22.2		141.5	
		Z	10.36	69.1	21.4		143.6	

10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.41	65.2	16.6	3.76	135.0	±0.9 %
		Y	4.81	68.3	19.0		149.0	
		Z	4.82	68.1	18.7		150.0	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.31	65.1	16.6	3.77	131.6	±0.9 %
		Y	4.71	68.2	19.0		146.2	
		Z	4.86	68.7	19.0		147.0	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.13	62.1	14.2	1.54	128.1	±0.7 %
		Y	2.65	68.6	19.0		142.6	
		Z	2.74	68.5	18.7		143.2	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.84	67.8	20.6	8.23	125.2	±3.0 %
		Y	10.22	69.5	21.9		142.0	
		Z	10.23	68.9	21.3		144.4	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 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:3331

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	6.47	6.47	6.47	0.48	1.48	± 12.0 %
835	41.5	0.90	6.24	6.24	6.24	0.30	1.98	± 12.0 %
1750	40.1	1.37	5.28	5.28	5.28	0.75	1.19	± 12.0 %
1900	40.0	1.40	5.09	5.09	5.09	0.80	1.16	± 12.0 %
2450	39.2	1.80	4.48	4.48	4.48	0.70	1.32	± 12.0 %
2600	39.0	1.96	4.38	4.38	4.38	0.80	1.29	± 12.0 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3331

Calibration Parameter Determined in Body Tissue Simulating Media

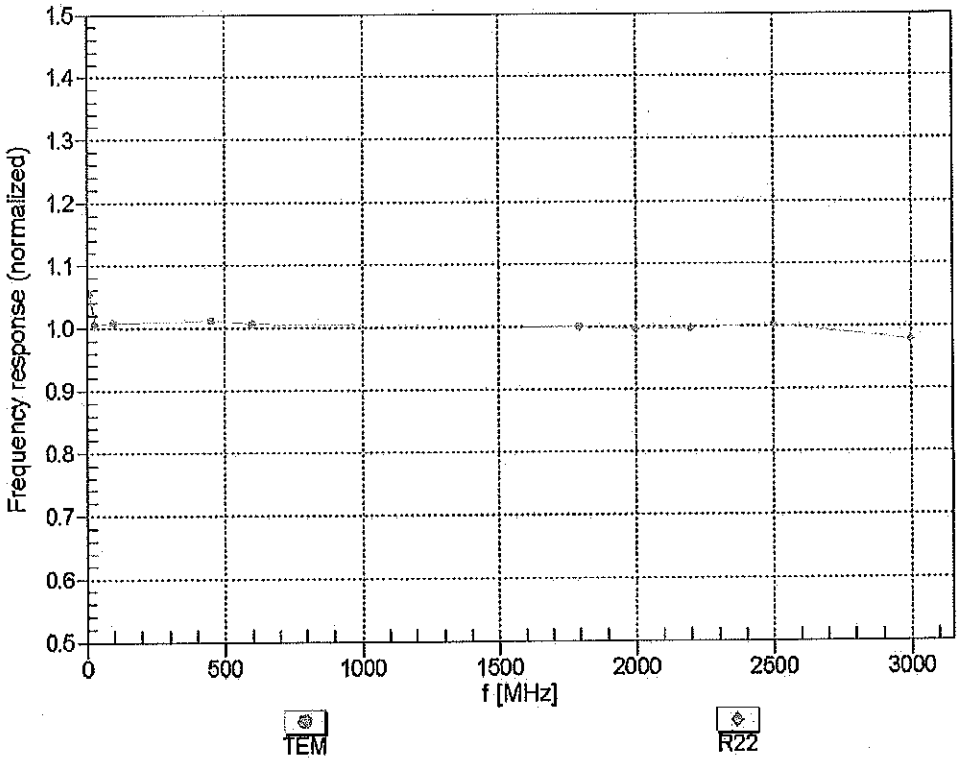
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.12	6.12	6.12	0.64	1.30	± 12.0 %
835	55.2	0.97	6.14	6.14	6.14	0.80	1.14	± 12.0 %
1750	53.4	1.49	4.93	4.93	4.93	0.46	1.67	± 12.0 %
1900	53.3	1.52	4.73	4.73	4.73	0.44	1.72	± 12.0 %
2450	52.7	1.95	4.29	4.29	4.29	0.71	0.98	± 12.0 %
2600	52.5	2.16	4.23	4.23	4.23	0.68	1.00	± 12.0 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

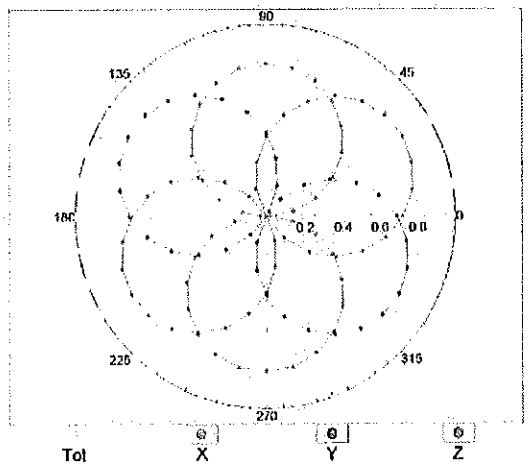
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



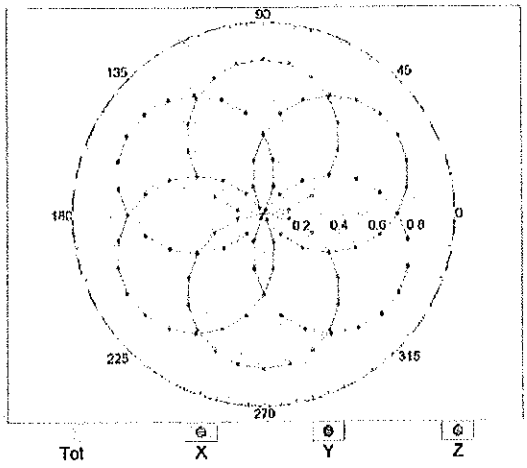
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

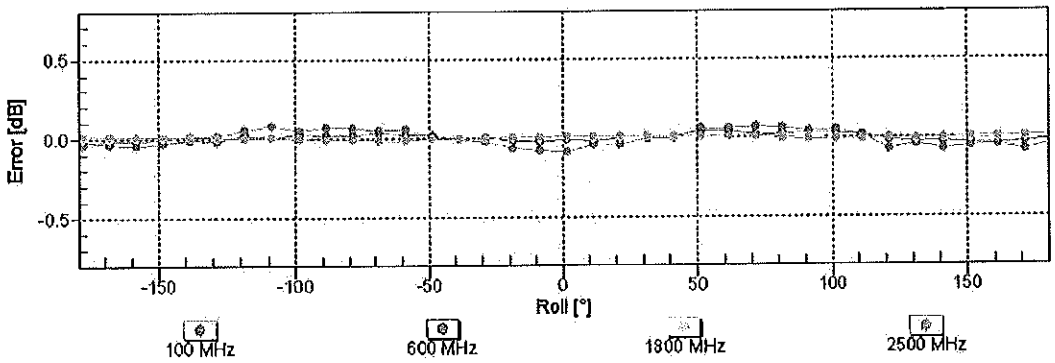
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM



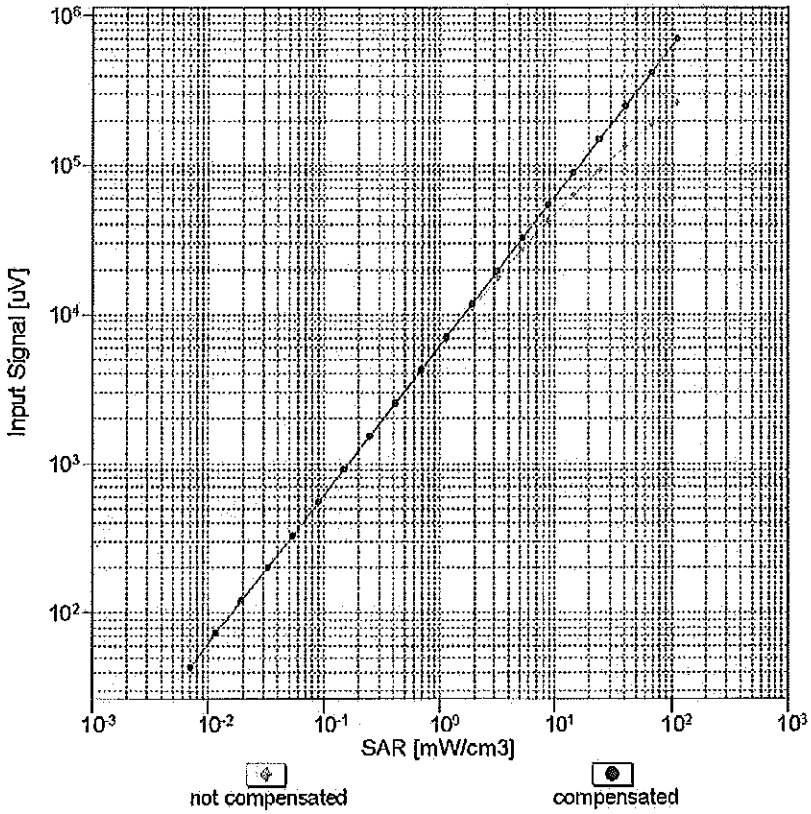
f=1800 MHz,R22

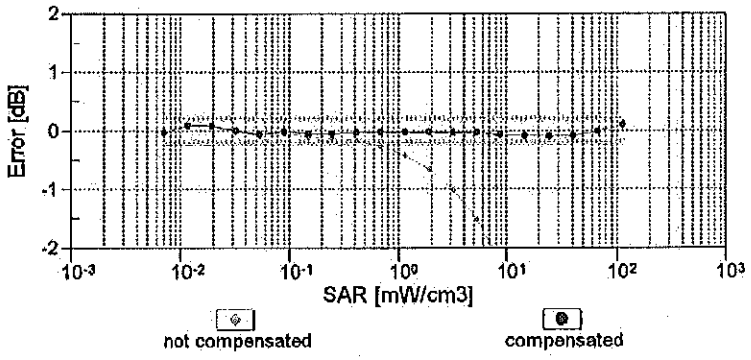




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

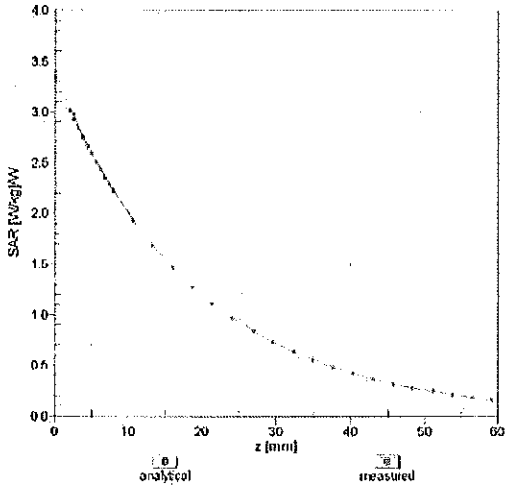




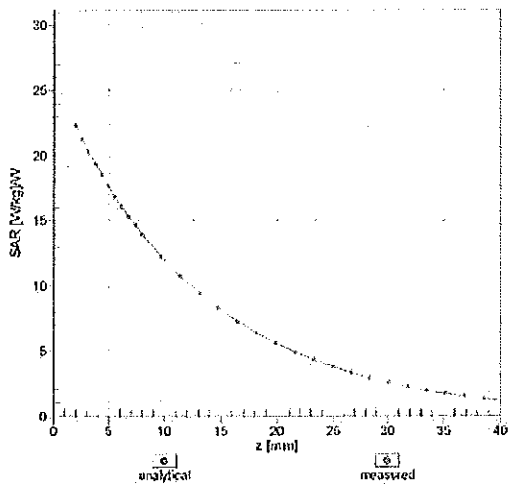
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

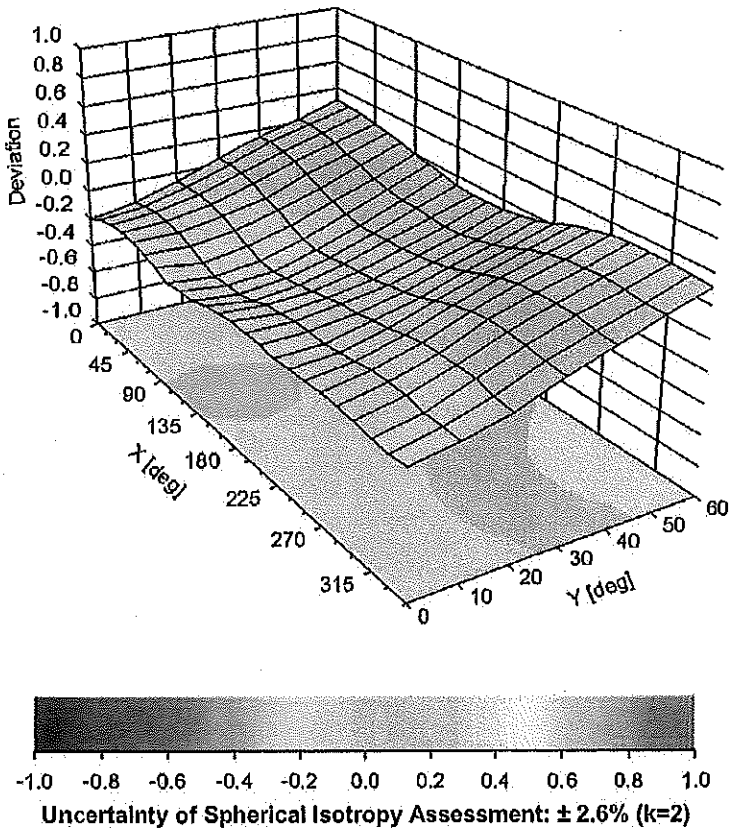


f = 1750 MHz,WGLS R22 (H_convF)



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:3331

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-108.5
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
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 0108

Client PC Test

Certificate No: ES3-3213_Jan15

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3213

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

CC 1/30/15

Calibration date: January 20, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
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-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Israe Elnaouq	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 22, 2015

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

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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 0108

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:3213

Manufactured: October 14, 2008
Calibrated: January 20, 2015

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.49	1.37	1.34	± 10.1 %
DCP (mV)[B]	99.9	101.8	101.4	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	169.8	±3.8 %
		Y	0.0	0.0	1.0		215.4	
		Z	0.0	0.0	1.0		214.5	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	1.84	57.8	10.2	10.00	47.4	±1.9 %
		Y	1.82	58.6	10.3		44.3	
		Z	1.65	57.3	9.2		44.2	
10011-CAB	UMTS-FDD (WCDMA)	X	3.32	66.8	18.5	2.91	135.8	±0.5 %
		Y	3.18	66.4	18.2		127.9	
		Z	3.21	66.5	18.2		128.1	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.90	68.1	18.4	1.87	137.2	±0.7 %
		Y	2.97	69.2	19.0		130.1	
		Z	2.80	68.0	18.4		129.9	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	11.40	71.2	23.7	9.46	135.1	±3.8 %
		Y	11.25	71.3	23.9		124.2	
		Z	10.96	70.3	23.2		124.8	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	18.25	96.6	27.2	9.39	140.4	±1.7 %
		Y	21.48	99.9	28.2		133.3	
		Z	11.76	89.4	24.5		127.3	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	13.12	91.7	26.0	9.57	126.4	±1.9 %
		Y	17.05	95.2	26.6		127.3	
		Z	8.91	85.2	23.3		118.8	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	34.78	100.0	25.2	6.56	116.4	±1.7 %
		Y	33.37	99.5	24.8		111.7	
		Z	34.11	99.5	24.6		110.5	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	37.18	99.7	24.0	4.80	131.2	±1.7 %
		Y	44.91	99.8	23.3		127.4	
		Z	41.51	99.7	23.2		125.0	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	48.95	99.5	22.4	3.55	140.9	±1.7 %
		Y	67.41	99.8	21.5		137.8	
		Z	56.45	100.0	21.9		135.0	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	20.23	99.3	22.1	1.16	111.3	±1.2 %
		Y	32.72	99.5	20.6		109.6	
		Z	48.57	100.0	20.0		108.8	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.60	67.9	20.0	5.67	144.6	±1.2 %
		Y	6.55	68.2	20.2		142.7	
		Z	6.50	67.8	19.9		141.5	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	10.34	75.7	26.2	9.29	133.2	±2.5 %
		Y	10.31	76.5	26.9		128.2	
		Z	9.74	74.5	25.6		127.1	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.50	67.6	20.0	5.80	142.8	±1.2 %
		Y	6.41	67.7	20.1		140.3	
		Z	6.41	67.6	19.9		140.2	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.36	69.2	21.6	8.07	132.8	±2.7 %
		Y	10.42	69.7	21.9		131.4	
		Z	10.22	69.1	21.4		130.0	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.65	74.6	25.8	9.28	127.9	±2.5 %
		Y	9.66	75.6	26.7		123.7	
		Z	9.14	73.6	25.3		122.7	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.14	66.9	19.6	5.75	139.3	±1.4 %
		Y	6.08	67.2	19.9		138.5	
		Z	6.05	66.9	19.6		137.3	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.58	67.5	19.9	5.82	144.3	±1.4 %
		Y	6.54	67.8	20.1		143.7	
		Z	6.50	67.5	19.8		142.1	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.93	66.1	19.3	5.73	120.6	±0.9 %
		Y	4.93	66.7	19.8		120.9	
		Z	4.85	66.3	19.5		118.9	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	8.93	79.5	28.6	9.21	140.8	±2.5 %
		Y	9.60	82.9	30.6		139.9	
		Z	8.30	78.2	27.9		136.6	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.90	66.0	19.3	5.72	118.8	±0.9 %
		Y	4.93	66.8	19.8		120.2	
		Z	4.81	66.1	19.3		116.6	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.92	66.1	19.3	5.72	119.0	±0.9 %
		Y	4.92	66.6	19.8		120.5	
		Z	4.77	65.8	19.2		115.8	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.93	68.7	21.4	8.10	125.0	±2.5 %
		Y	10.06	69.4	21.9		128.3	
		Z	9.78	68.5	21.2		120.5	
10225-CAB	UMTS-FDD (HSPA+)	X	6.66	65.7	18.8	5.97	106.5	±0.9 %
		Y	6.81	66.6	19.3		112.3	
		Z	6.64	66.0	18.9		108.0	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	8.91	79.4	28.5	9.21	141.4	±2.2 %
		Y	9.39	82.3	30.4		146.7	
		Z	8.40	78.5	28.2		141.2	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	8.84	73.3	25.2	9.24	119.1	±2.7 %
		Y	8.94	74.6	26.3		118.6	
		Z	8.39	72.4	24.7		114.0	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	9.62	74.6	25.8	9.30	126.2	±2.7 %
		Y	9.77	76.0	26.9		126.1	
		Z	9.10	73.4	25.2		121.4	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.43	66.4	18.5	3.96	132.5	±0.7 %
		Y	4.37	66.6	18.6		134.1	
		Z	4.40	66.7	18.6		130.5	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.63	66.4	18.4	3.46	122.5	±0.5 %
		Y	3.54	66.5	18.5		124.9	
		Z	3.55	66.3	18.3		121.4	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.49	65.9	18.1	3.39	125.1	±0.5 %
		Y	3.52	66.7	18.6		126.1	
		Z	3.51	66.5	18.4		123.8	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.49	67.6	19.9	5.81	143.1	±1.4 %
		Y	6.49	68.0	20.3		142.3	
		Z	6.42	67.6	19.9		144.3	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	7.06	68.1	20.2	6.06	147.6	±1.7 %
		Y	7.09	68.7	20.7		148.2	
		Z	7.03	68.3	20.4		149.8	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.66	67.4	18.4	3.76	135.3	±0.5 %
		Y	4.69	68.1	18.7		134.9	
		Z	4.72	68.2	18.7		136.5	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.58	67.4	18.3	3.77	133.4	±0.5 %
		Y	4.68	68.4	18.9		132.8	
		Z	4.58	67.9	18.5		135.4	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.41	65.7	17.2	1.54	131.4	±0.7 %
		Y	2.42	66.4	17.7		131.3	
		Z	2.59	67.7	18.2		134.1	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	10.06	68.9	21.5	8.23	127.6	±2.7 %
		Y	10.12	69.5	22.0		126.3	
		Z	10.04	69.1	21.7		129.7	

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 7 and 8).
[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:3213

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	6.45	6.45	6.45	0.57	1.37	± 12.0 %
835	41.5	0.90	6.26	6.26	6.26	0.65	1.26	± 12.0 %
1750	40.1	1.37	5.22	5.22	5.22	0.47	1.47	± 12.0 %
1900	40.0	1.40	5.06	5.06	5.06	0.80	1.14	± 12.0 %
2450	39.2	1.80	4.54	4.54	4.54	0.78	1.22	± 12.0 %
2600	39.0	1.96	4.33	4.33	4.33	0.80	1.28	± 12.0 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

Calibration Parameter Determined in Body Tissue Simulating Media

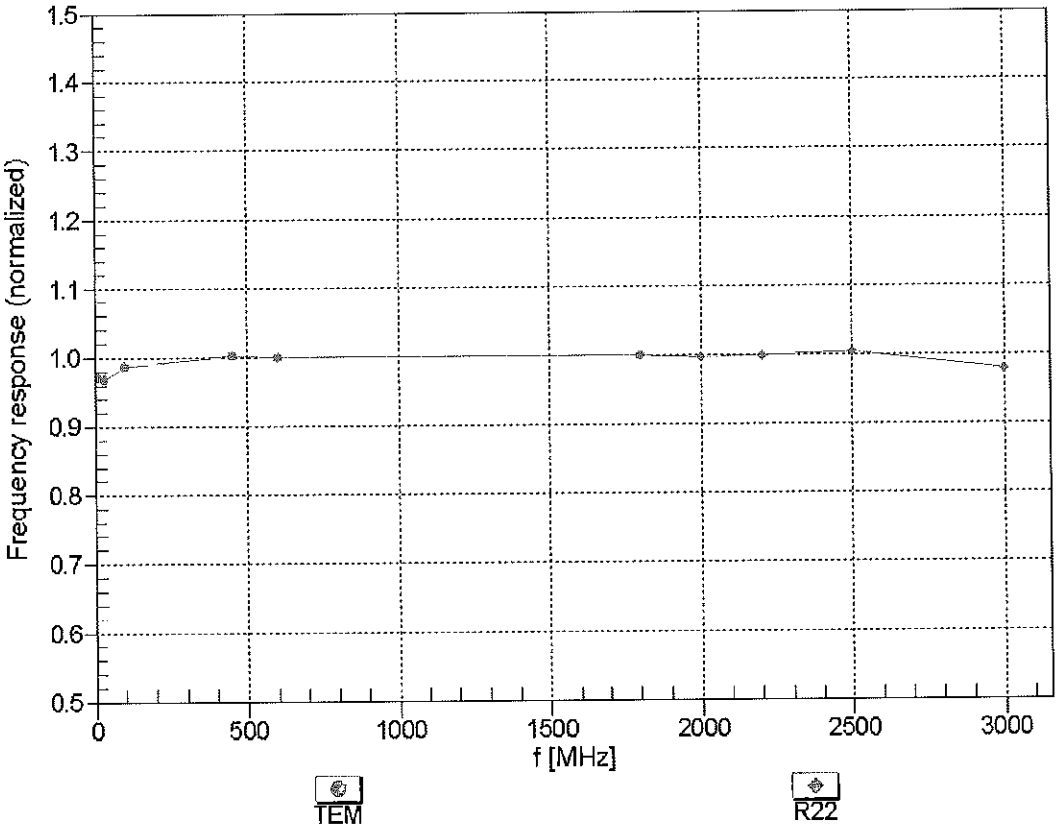
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.11	6.11	6.11	0.71	1.24	± 12.0 %
835	55.2	0.97	6.07	6.07	6.07	0.35	1.86	± 12.0 %
1750	53.4	1.49	4.93	4.93	4.93	0.51	1.47	± 12.0 %
1900	53.3	1.52	4.72	4.72	4.72	0.80	1.20	± 12.0 %
2450	52.7	1.95	4.37	4.37	4.37	0.71	1.12	± 12.0 %
2600	52.5	2.16	4.20	4.20	4.20	0.66	0.95	± 12.0 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

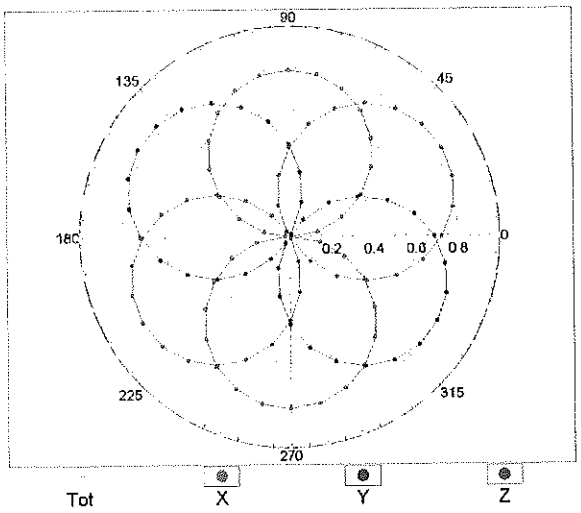
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



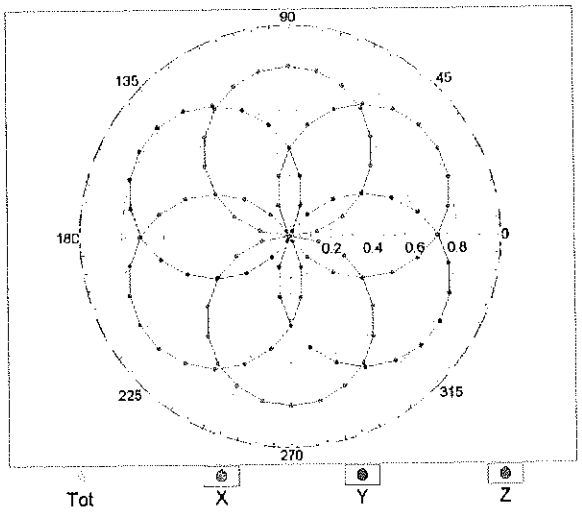
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

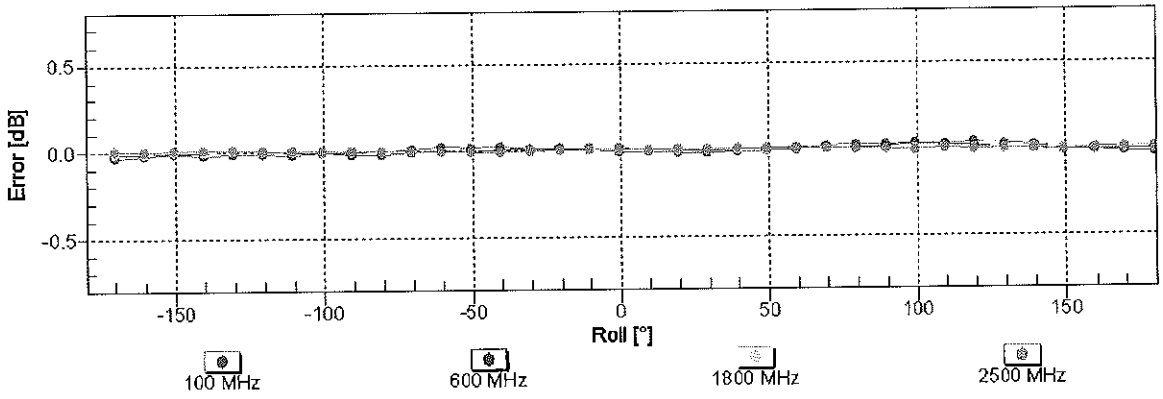
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



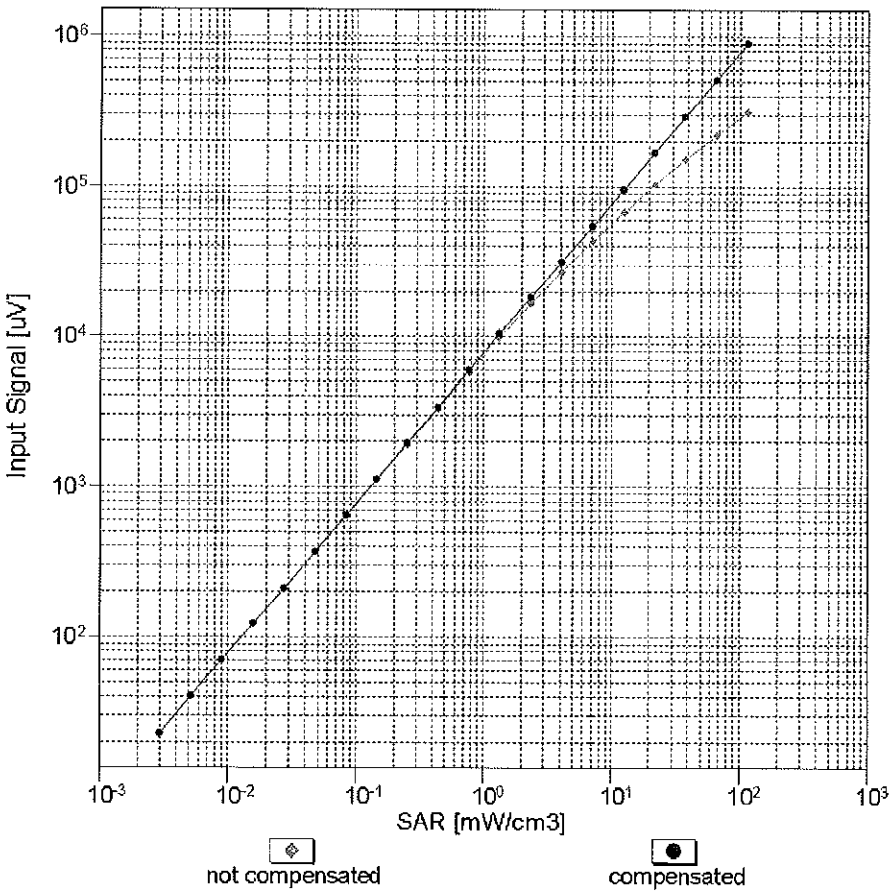
f=1800 MHz,R22

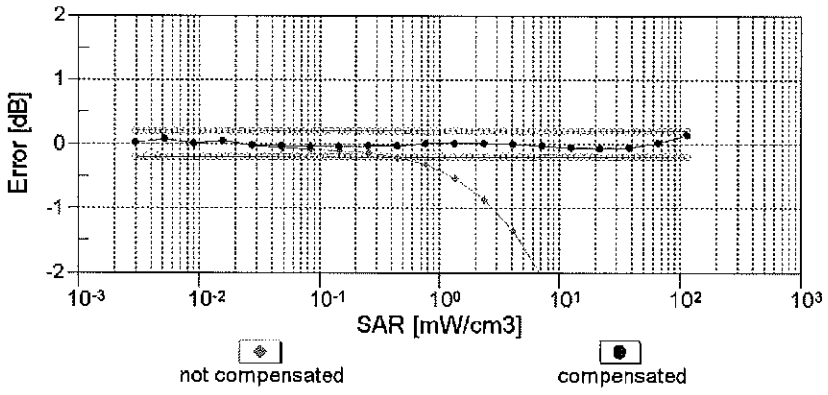




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

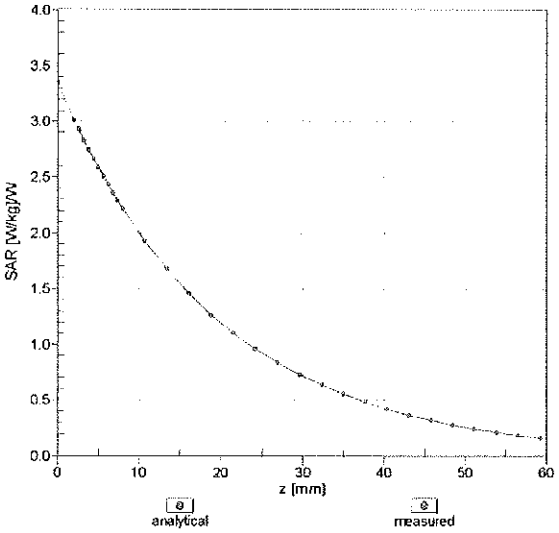




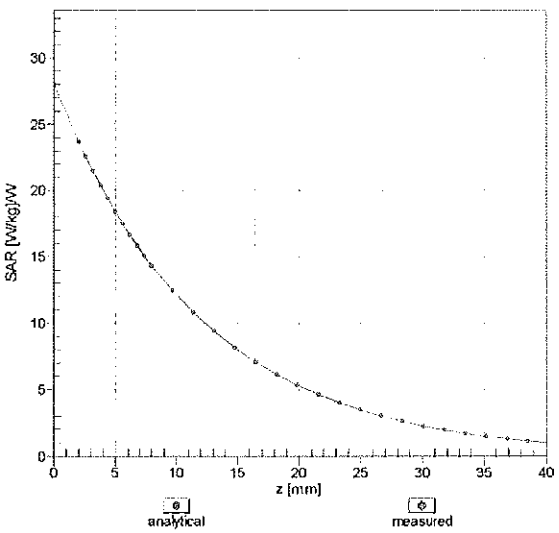
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

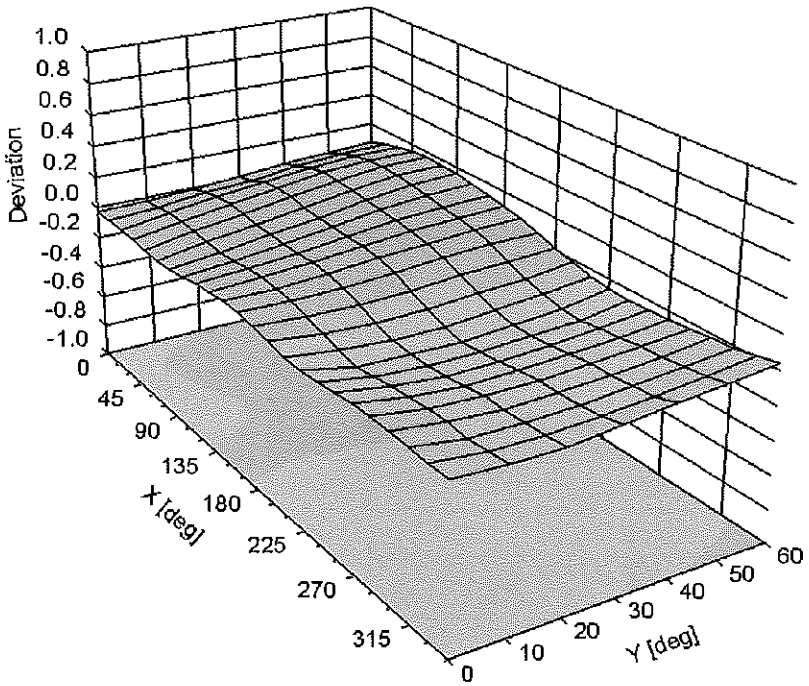


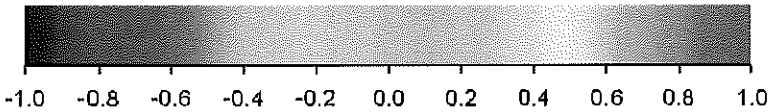
f = 1900 MHz,WGLS R22 (H_convF)



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:3213

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-70.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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 0108

Client PC Test

Certificate No: ES3-3263_May15

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3263

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

BN ✓ 5/28/15

Calibration date: May 20, 2015

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	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
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-14)	In house check: Oct-15

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

Issued: May 19, 2015

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

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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 0108

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:3263

Manufactured: January 25, 2010
Calibrated: May 20, 2015

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3263

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.21	1.25	1.13	± 10.1 %
DCP (mV)[B]	106.1	103.6	108.3	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	205.3	±3.3 %
		Y	0.0	0.0	1.0		207.3	
		Z	0.0	0.0	1.0		199.5	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	1.83	58.4	9.4	10.00	41.2	±1.4 %
		Y	3.88	63.3	12.9		47.5	
		Z	1.42	56.8	8.7		39.5	
10011-CAB	UMTS-FDD (WCDMA)	X	3.27	67.4	18.6	2.91	140.1	±0.7 %
		Y	3.39	67.5	18.7		142.7	
		Z	3.32	67.6	18.6		136.9	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.85	68.8	18.8	1.87	142.2	±0.7 %
		Y	3.38	70.7	19.5		144.8	
		Z	3.07	70.0	19.1		138.1	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	10.99	70.8	23.4	9.46	135.9	±2.5 %
		Y	11.36	70.3	22.8		124.7	
		Z	10.57	70.0	22.9		129.4	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	9.38	84.7	22.1	9.39	139.8	±1.9 %
		Y	27.79	100.0	28.7		129.4	
		Z	9.29	86.8	23.8		134.5	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	9.63	84.9	22.1	9.57	134.1	±2.5 %
		Y	25.29	98.2	28.2		124.0	
		Z	9.65	87.7	24.3		128.2	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	16.20	88.9	21.0	6.56	145.2	±1.4 %
		Y	41.82	99.7	25.6		128.5	
		Z	24.57	96.8	24.1		142.0	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	55.77	99.6	22.1	4.80	138.5	±2.2 %
		Y	53.39	99.7	23.9		140.5	
		Z	40.28	99.6	23.2		134.3	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	81.43	99.8	20.7	3.55	148.6	±1.7 %
		Y	60.49	99.7	22.9		146.0	
		Z	62.69	99.6	21.2		145.0	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	96.06	93.7	16.0	1.16	140.3	±1.9 %
		Y	77.08	99.9	20.1		149.0	
		Z	99.64	99.9	18.6		138.0	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.24	67.2	19.6	5.67	131.7	±1.4 %
		Y	6.39	67.3	19.5		133.8	
		Z	6.19	67.2	19.6		126.8	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	10.13	76.3	26.6	9.29	142.6	±2.7 %
		Y	12.07	77.9	26.6		138.9	
		Z	9.41	74.3	25.6		134.1	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.13	66.9	19.5	5.80	129.6	±1.4 %
		Y	6.35	67.1	19.5		133.7	
		Z	6.39	68.0	20.1		150.0	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.34	69.6	21.7	8.07	147.0	±1.9 %
		Y	10.05	68.3	20.9		123.4	
		Z	10.08	69.1	21.3		138.2	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.44	75.3	26.3	9.28	137.0	±3.5 %
		Y	11.36	76.9	26.3		134.5	
		Z	8.85	73.5	25.3		130.3	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.79	66.2	19.2	5.75	126.9	±1.2 %
		Y	6.05	66.5	19.3		130.9	
		Z	5.92	66.9	19.5		145.5	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.25	66.9	19.5	5.82	131.8	±1.4 %
		Y	6.47	67.0	19.5		135.4	
		Z	6.09	66.5	19.3		127.5	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.78	66.7	19.7	5.73	130.0	±1.2 %
		Y	5.14	66.7	19.5		135.0	
		Z	4.83	67.1	19.9		147.9	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	8.63	80.4	29.1	9.21	147.7	±2.7 %
		Y	9.72	78.5	27.2		123.9	
		Z	7.63	76.7	27.2		142.5	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.75	66.6	19.6	5.72	128.2	±1.2 %
		Y	5.12	66.6	19.5		134.3	
		Z	4.87	67.1	19.9		148.0	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.76	66.6	19.6	5.72	127.9	±1.2 %
		Y	5.12	66.6	19.5		134.5	
		Z	4.87	67.3	20.0		147.0	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.87	69.1	21.6	8.10	135.8	±2.2 %
		Y	10.19	69.1	21.4		145.3	
		Z	9.65	68.8	21.3		130.5	
10225-CAB	UMTS-FDD (HSPA+)	X	6.90	67.2	19.5	5.97	139.2	±1.7 %
		Y	7.22	67.3	19.6		148.0	
		Z	6.75	67.0	19.4		134.1	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	8.68	80.6	29.2	9.21	148.0	±3.0 %
		Y	9.82	78.8	27.3		125.0	
		Z	7.85	77.6	27.7		143.5	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	8.56	73.7	25.6	9.24	126.6	±3.5 %
		Y	10.58	76.0	25.9		126.3	
		Z	8.84	74.8	26.1		146.7	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	9.24	74.6	25.9	9.30	133.6	±3.3 %
		Y	11.38	76.9	26.2		134.3	
		Z	8.79	73.2	25.1		128.6	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.39	67.0	18.9	3.96	143.8	±0.9 %
		Y	4.55	67.1	18.8		147.3	
		Z	4.42	67.4	19.0		139.9	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.59	67.2	18.9	3.46	132.2	±0.5 %
		Y	3.68	66.7	18.5		136.0	
		Z	3.57	67.1	18.6		128.5	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.50	67.0	18.7	3.39	134.0	±0.7 %
		Y	3.62	66.6	18.4		138.6	
		Z	3.50	67.2	18.7		129.8	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.11	66.8	19.4	5.81	127.7	±1.4 %
		Y	6.33	67.0	19.5		132.1	
		Z	6.28	67.6	19.9		146.6	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.71	67.5	19.9	6.06	134.2	±1.7 %
		Y	6.93	67.7	19.9		138.0	
		Z	6.57	67.2	19.6		128.0	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.17	69.5	21.9	8.37	138.5	±2.5 %
		Y	10.55	69.5	21.8		148.0	
		Z	9.92	69.0	21.6		132.5	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.79	69.2	19.1	3.76	144.1	±0.7 %
		Y	4.71	67.0	18.2		129.2	
		Z	4.72	69.3	19.2		139.3	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.69	69.2	19.2	3.77	142.1	±0.7 %
		Y	4.71	67.5	18.5		126.7	
		Z	4.51	68.6	18.8		137.3	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.55	68.0	18.5	1.54	141.7	±0.7 %
		Y	2.67	68.4	18.6		144.0	
		Z	2.98	70.8	19.5		138.0	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	10.01	69.3	21.8	8.23	137.3	±2.5 %
		Y	10.31	69.3	21.6		146.0	
		Z	9.69	68.8	21.4		129.9	

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 7 and 8).
[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:3263

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	6.27	6.27	6.27	0.29	1.87	± 12.0 %
835	41.5	0.90	6.18	6.18	6.18	0.49	1.42	± 12.0 %
1750	40.1	1.37	5.27	5.27	5.27	0.49	1.46	± 12.0 %
1900	40.0	1.40	4.96	4.96	4.96	0.66	1.28	± 12.0 %
2300	39.5	1.67	4.63	4.63	4.63	0.58	1.41	± 12.0 %
2450	39.2	1.80	4.40	4.40	4.40	0.71	1.34	± 12.0 %
2600	39.0	1.96	4.25	4.25	4.25	0.80	1.25	± 12.0 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3263

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	6.07	6.07	6.07	0.53	1.42	± 12.0 %
835	55.2	0.97	6.08	6.08	6.08	0.57	1.36	± 12.0 %
1750	53.4	1.49	4.88	4.88	4.88	0.54	1.50	± 12.0 %
1900	53.3	1.52	4.66	4.66	4.66	0.56	1.51	± 12.0 %
2300	52.9	1.81	4.42	4.42	4.42	0.69	1.33	± 12.0 %
2450	52.7	1.95	4.28	4.28	4.28	0.80	1.08	± 12.0 %
2600	52.5	2.16	4.11	4.11	4.11	0.80	1.09	± 12.0 %

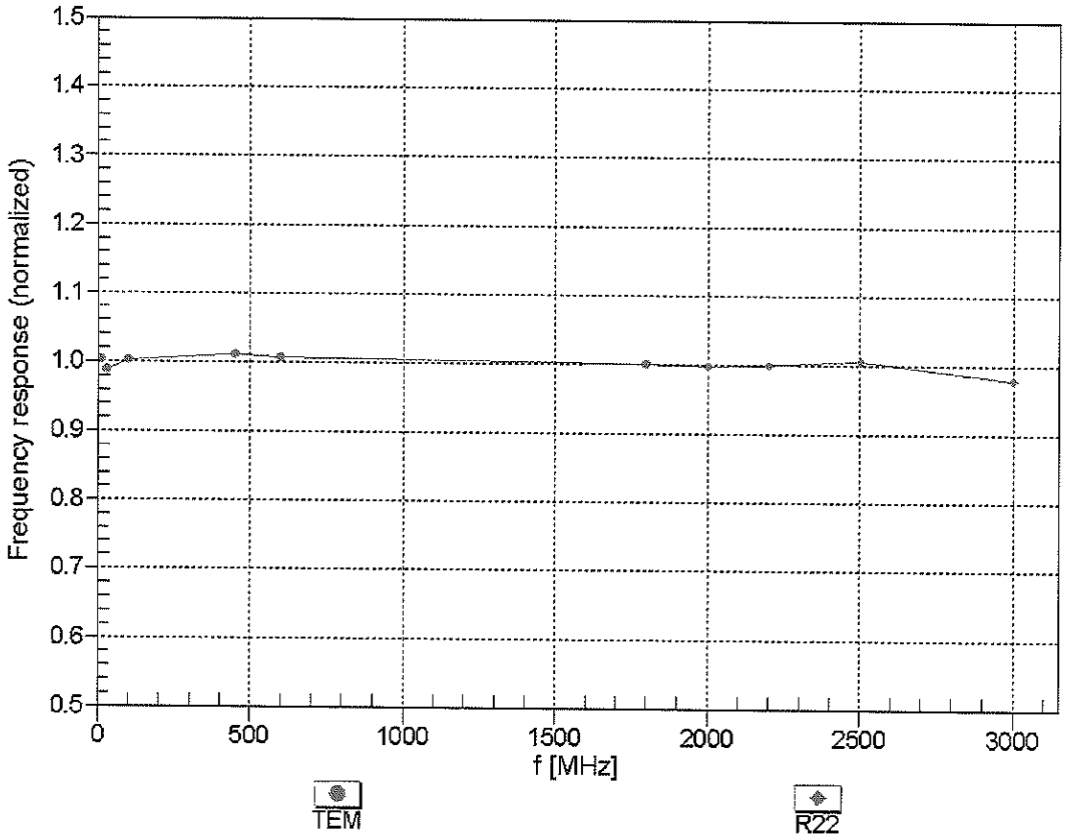
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

Frequency Response of E-Field

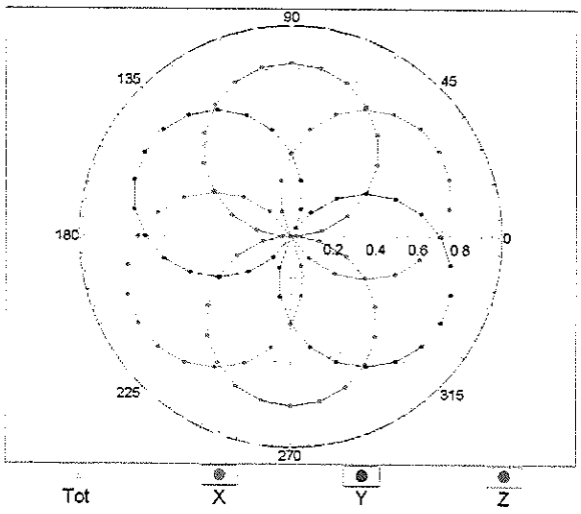
(TEM-Cell:ifi110 EXX, Waveguide: R22)



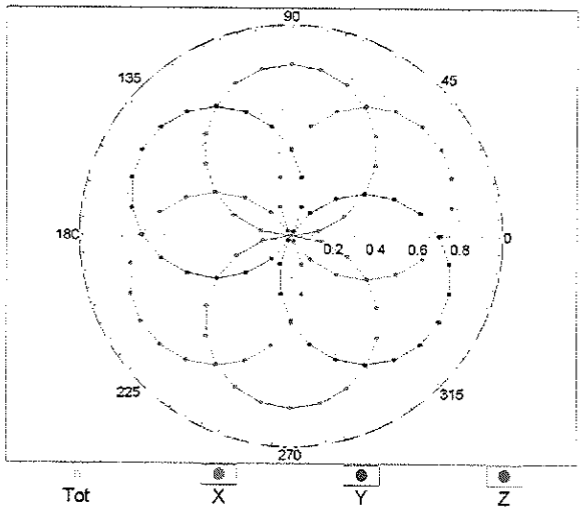
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

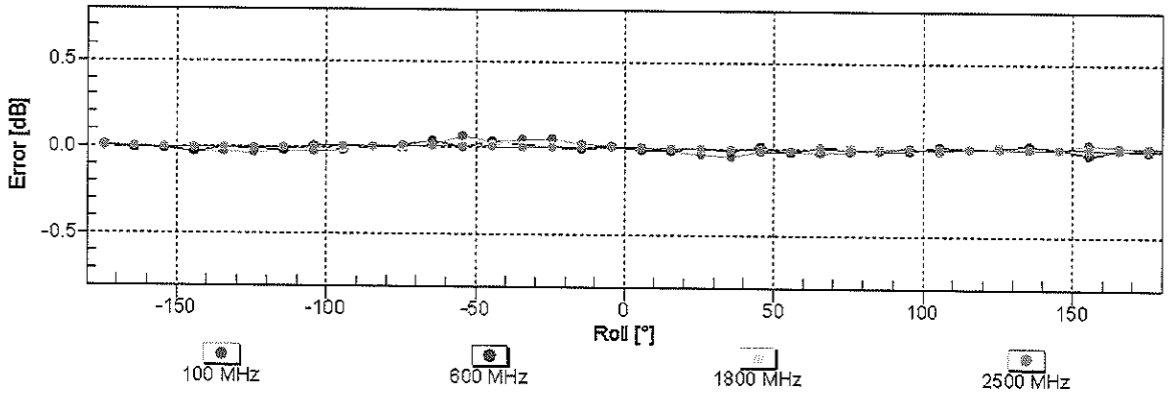
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

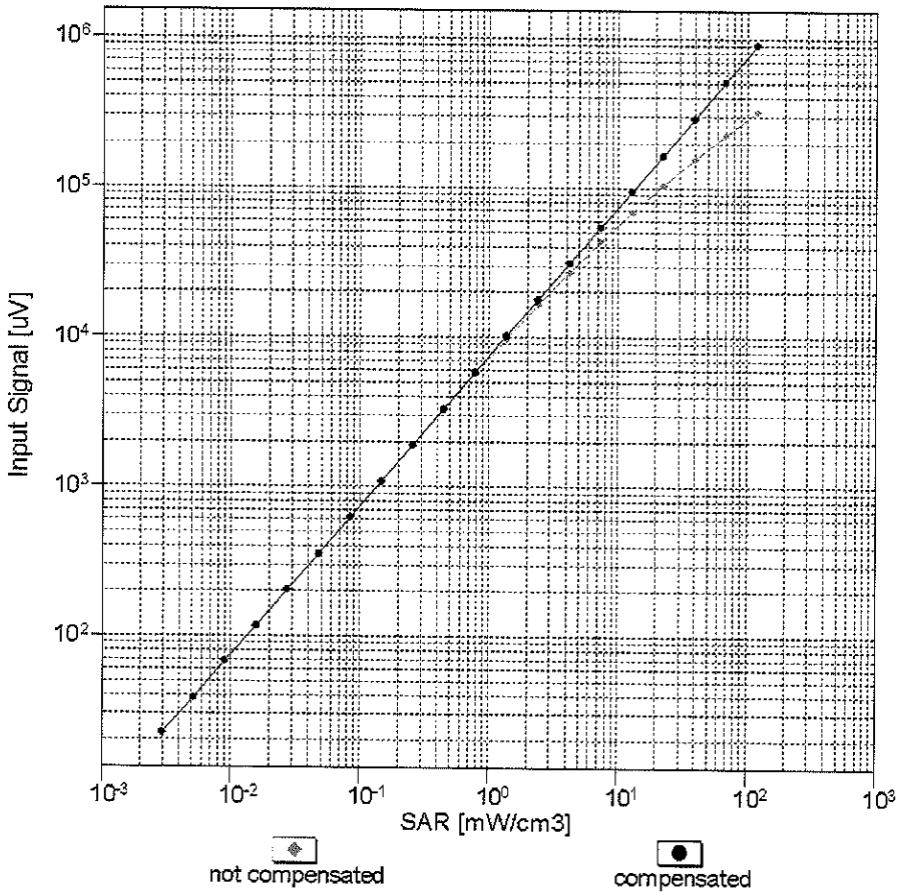


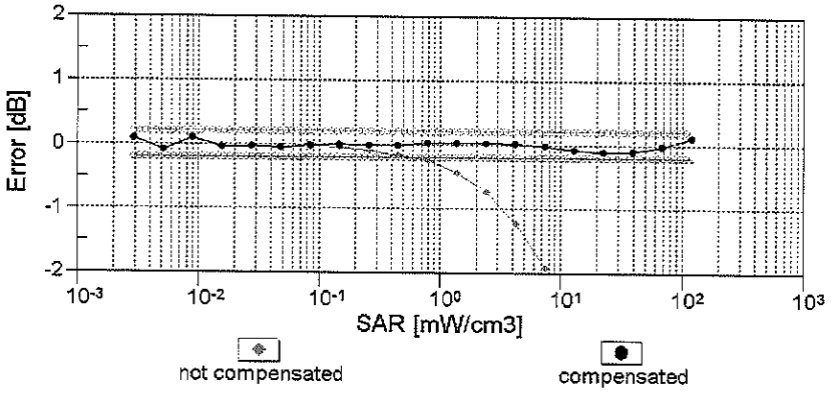


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

(TEM cell , f_{eval}= 1900 MHz)

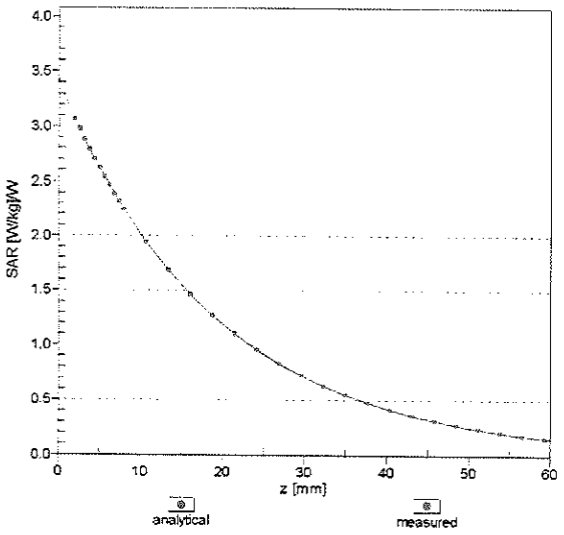




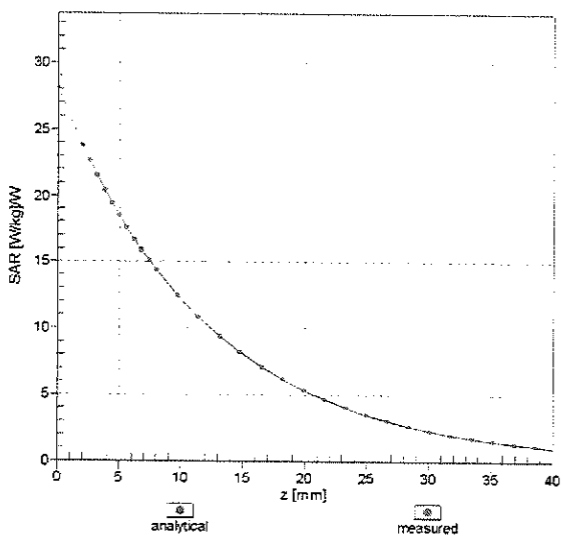
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

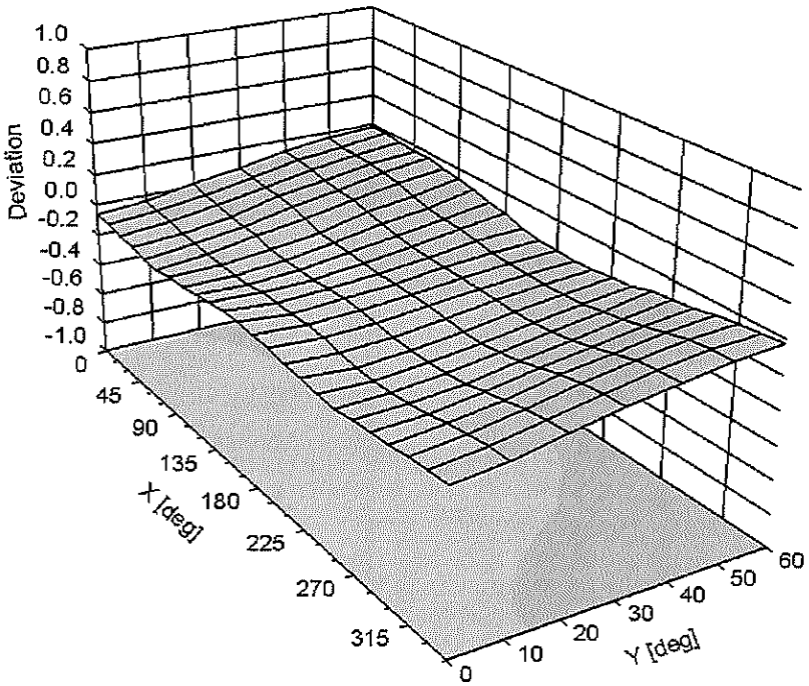


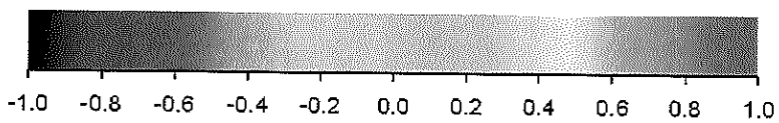
f = 1900 MHz,WGLS R22 (H_convF)



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:3263

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	65.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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 signetories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3334_Dec14**

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3334

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

CC 12/31/14

Calibration date: December 16, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 789	30-Apr-14 (No. DAE4-789_Apr14)	Apr-15
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-14)	In house check: Oct-15

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

Issued: December 16, 2014

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**

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:3334

Manufactured:	January 24, 2012
Repaired:	December 9, 2014
Calibrated:	December 16, 2014

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3334

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.04	1.05	1.01	± 10.1 %
DCP (mV)[B]	106.5	105.0	105.6	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	188.0	±3.0 %
		Y	0.0	0.0	1.0		183.2	
		Z	0.0	0.0	1.0		181.8	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	4.61	67.2	13.7	10.00	38.4	±1.4 %
		Y	20.36	82.7	18.7		38.0	
		Z	17.55	80.3	17.6		37.0	
10011-CAB	UMTS-FDD (WCDMA)	X	3.56	68.4	19.1	2.91	148.4	±0.7 %
		Y	3.44	68.1	19.2		146.9	
		Z	3.52	68.3	19.1		144.7	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.54	71.9	20.0	1.87	148.0	±0.7 %
		Y	3.51	72.2	20.5		148.9	
		Z	3.80	73.3	20.6		144.6	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	11.39	71.1	23.3	9.46	149.8	±3.8 %
		Y	11.54	71.8	24.0		149.5	
		Z	11.11	70.5	23.0		141.6	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	15.29	91.3	25.0	9.39	131.9	±1.7 %
		Y	24.16	100.0	28.4		142.8	
		Z	13.05	89.2	24.5		126.5	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	16.07	91.7	25.1	9.57	144.0	±2.2 %
		Y	19.00	95.3	26.8		136.4	
		Z	13.93	89.8	24.6		141.0	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	19.98	91.0	22.4	6.56	134.2	±1.9 %
		Y	34.78	99.7	25.5		145.0	
		Z	29.89	96.8	24.1		129.8	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	56.30	99.7	22.8	4.80	125.2	±1.9 %
		Y	41.16	99.6	23.9		131.2	
		Z	50.78	99.8	23.1		147.6	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	49.35	99.7	22.5	3.55	133.2	±2.2 %
		Y	46.49	99.6	22.9		139.2	
		Z	58.21	99.7	22.0		129.4	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	56.54	100.0	20.2	1.16	128.0	±1.7 %
		Y	20.03	99.3	22.4		130.3	
		Z	84.01	100.0	19.4		141.0	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.44	67.6	19.6	5.67	138.5	±1.4 %
		Y	6.50	67.9	20.0		142.1	
		Z	6.31	67.2	19.4		129.4	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	9.77	73.6	24.6	9.29	129.6	±3.3 %
		Y	10.52	76.0	26.3		132.1	
		Z	10.21	75.0	25.4		147.7	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.36	67.2	19.6	5.80	136.8	±1.4 %
		Y	6.31	67.3	19.8		137.2	
		Z	6.20	66.7	19.3		128.8	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	9.96	68.3	20.8	8.07	126.5	±2.5 %
		Y	10.12	68.8	21.3		126.6	
		Z	10.22	69.0	21.2		143.7	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.29	73.0	24.4	9.28	125.3	±3.3 %
		Y	9.65	74.5	25.6		124.4	
		Z	9.65	74.3	25.2		141.1	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.03	66.7	19.3	5.75	132.7	±1.4 %
		Y	5.97	66.7	19.5		132.7	
		Z	6.17	67.3	19.7		148.3	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.47	67.2	19.5	5.82	138.1	±1.4 %
		Y	6.44	67.3	19.8		138.2	
		Z	6.27	66.6	19.2		126.8	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.03	66.9	19.6	5.73	137.2	±1.2 %
		Y	4.97	67.0	19.9		135.7	
		Z	4.91	66.5	19.5		127.1	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	8.53	77.4	26.9	9.21	142.4	±2.7 %
		Y	9.59	81.3	29.3		142.3	
		Z	7.78	75.0	25.7		126.7	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.02	67.0	19.7	5.72	131.8	±1.2 %
		Y	4.98	67.0	19.9		136.1	
		Z	4.95	66.8	19.6		128.1	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.99	66.8	19.6	5.72	131.2	±1.2 %
		Y	4.99	67.1	20.0		136.2	
		Z	4.92	66.6	19.5		127.9	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.98	68.8	21.2	8.10	141.7	±2.5 %
		Y	10.14	69.5	21.8		147.2	
		Z	9.85	68.6	21.1		137.5	
10225-CAB	UMTS-FDD (HSPA+)	X	7.17	67.5	19.6	5.97	146.0	±1.4 %
		Y	7.13	67.7	19.9		149.9	
		Z	7.12	67.5	19.6		142.9	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	8.29	76.6	26.5	9.21	136.1	±2.7 %
		Y	9.60	81.4	29.3		142.3	
		Z	7.98	75.8	26.1		132.9	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	9.27	74.1	25.1	9.24	139.1	±3.3 %
		Y	10.25	77.5	27.4		146.3	
		Z	9.07	73.7	25.0		135.8	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	9.95	74.9	25.4	9.30	147.0	±3.3 %
		Y	9.80	75.0	25.9		125.9	
		Z	9.74	74.6	25.4		143.8	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.63	67.6	19.0	3.96	147.5	±0.7 %
		Y	4.41	66.9	18.9		129.5	
		Z	4.61	67.6	19.1		148.1	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.83	67.7	19.0	3.46	133.7	±0.7 %
		Y	3.71	67.4	19.0		139.0	
		Z	3.86	68.1	19.2		133.7	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.85	68.2	19.2	3.39	136.7	±0.5 %
		Y	3.67	67.5	19.1		141.3	
		Z	3.75	67.8	19.0		136.2	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.31	67.1	19.5	5.81	130.6	±1.4 %
		Y	6.32	67.3	19.8		135.1	
		Z	6.24	66.9	19.4		129.2	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.85	67.5	19.8	6.06	135.1	±1.4 %
		Y	6.90	67.9	20.2		141.5	
		Z	6.82	67.5	19.8		135.1	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	5.04	69.1	19.1	3.76	126.0	±0.5 %
		Y	4.90	69.0	19.3		129.6	
		Z	5.11	69.7	19.4		125.8	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	5.05	69.6	19.4	3.77	147.1	±0.7 %
		Y	4.84	69.2	19.5		127.8	
		Z	5.15	70.1	19.6		143.3	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	3.13	71.2	19.9	1.54	144.5	±0.5 %
		Y	2.93	70.4	19.9		149.8	
		Z	3.18	71.6	20.1		141.4	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	10.11	69.0	21.4	8.23	144.3	±2.5 %
		Y	10.21	69.6	21.9		148.3	
		Z	9.99	68.9	21.3		141.1	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 7 and 8).
[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:3334

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	6.51	6.51	6.51	0.80	1.17	± 12.0 %
835	41.5	0.90	6.25	6.25	6.25	0.38	1.58	± 12.0 %
1750	40.1	1.37	5.21	5.21	5.21	0.43	1.63	± 12.0 %
1900	40.0	1.40	5.03	5.03	5.03	0.53	1.45	± 12.0 %
2450	39.2	1.80	4.51	4.51	4.51	0.80	1.26	± 12.0 %
2600	39.0	1.96	4.31	4.31	4.31	0.79	1.27	± 12.0 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3334

Calibration Parameter Determined in Body Tissue Simulating Media

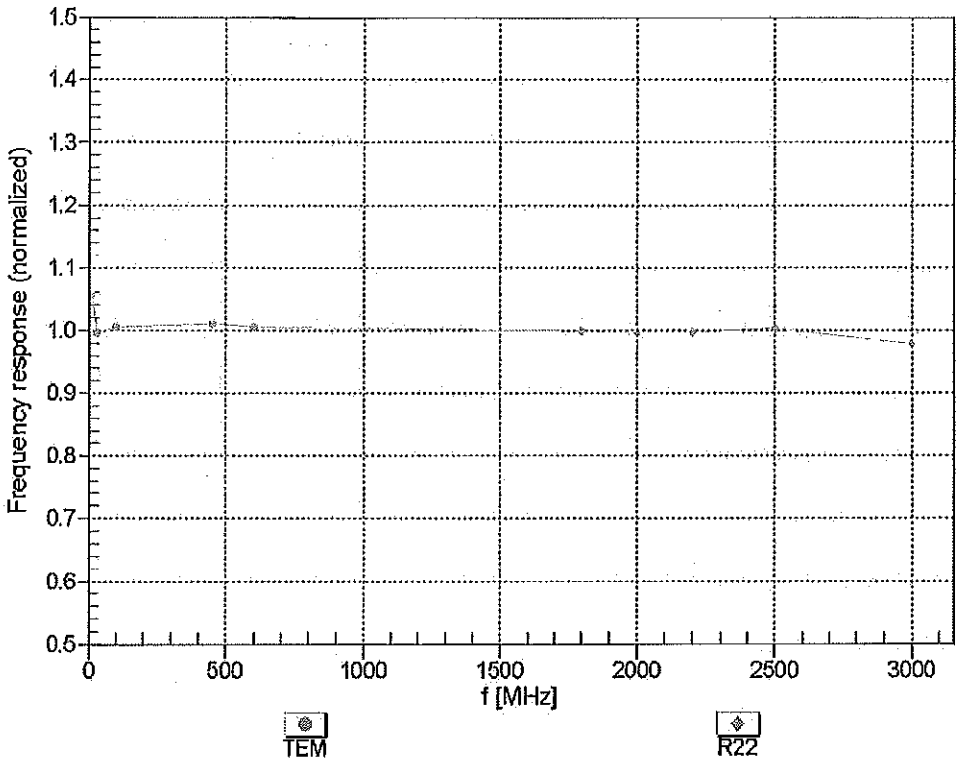
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.09	6.09	6.09	0.49	1.47	± 12.0 %
835	55.2	0.97	6.14	6.14	6.14	0.69	1.27	± 12.0 %
1750	53.4	1.49	4.94	4.94	4.94	0.80	1.24	± 12.0 %
1900	53.3	1.52	4.73	4.73	4.73	0.62	1.44	± 12.0 %
2450	52.7	1.95	4.28	4.28	4.28	0.80	1.13	± 12.0 %
2600	52.5	2.16	4.16	4.16	4.16	0.75	1.25	± 12.0 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

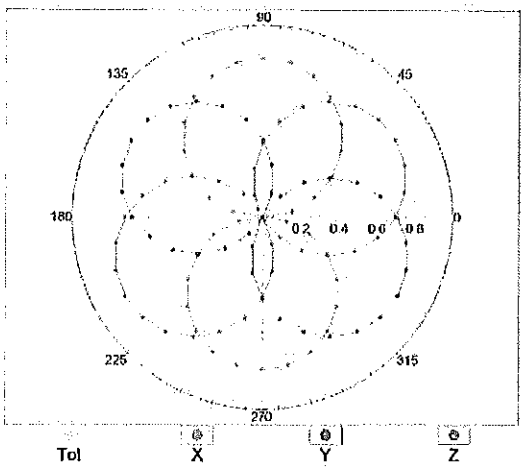
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



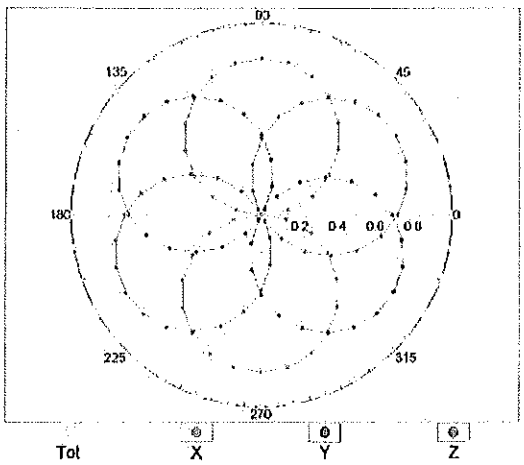
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

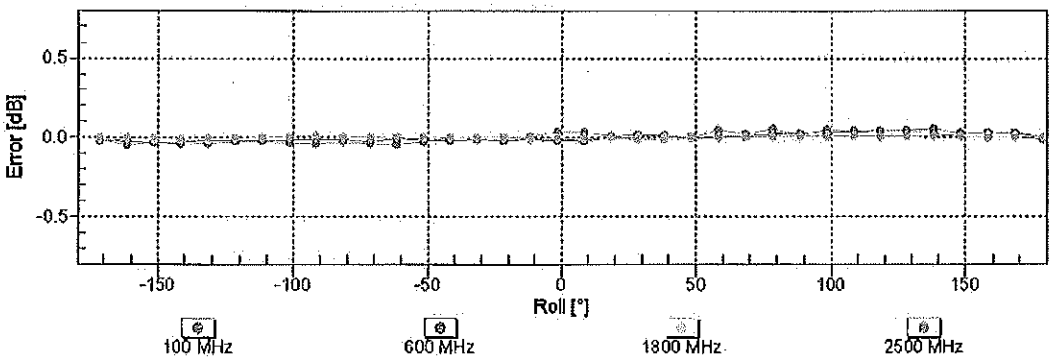
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



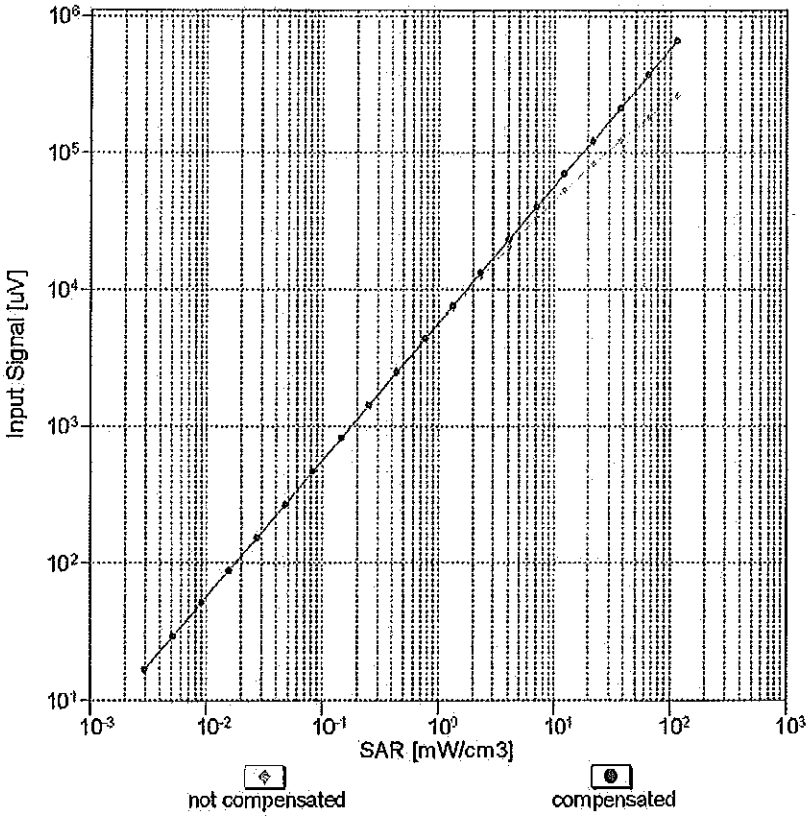
f=1800 MHz,R22

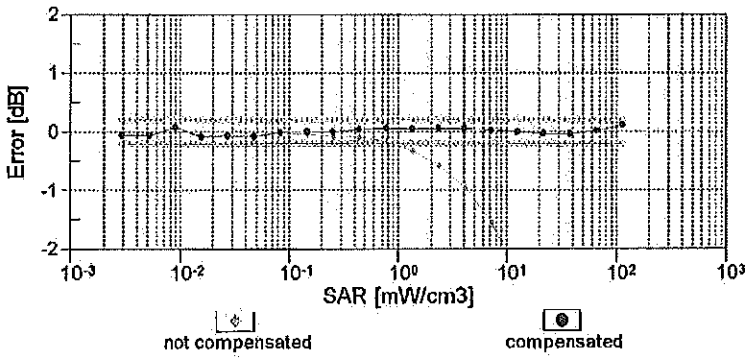




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

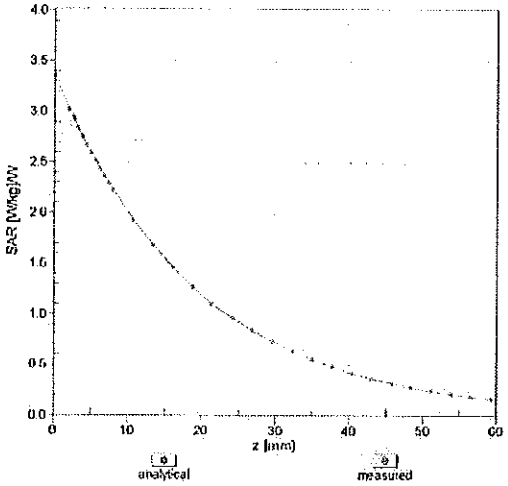




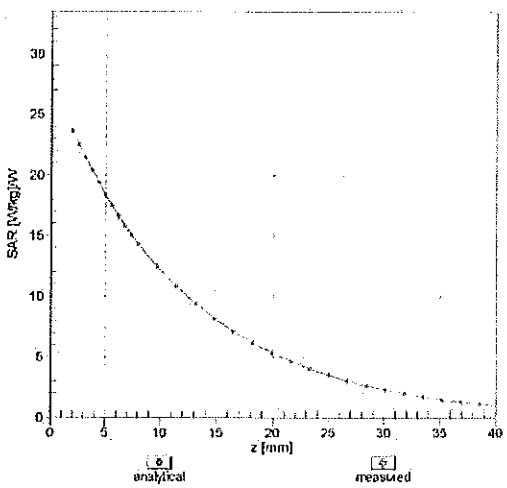
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

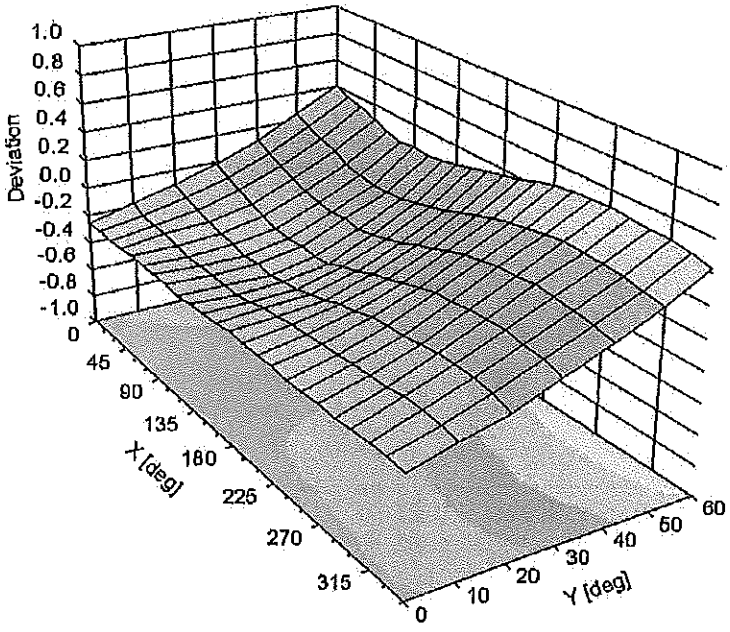


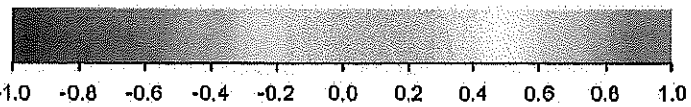
f = 1900 MHz,WGLS R22 (H_convF)



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:3334

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	18.5
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 0108

Client PC Test

Certificate No: ES3-3209_Mar15

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3209

BAD ✓ 3/26

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

Calibration date: March 19, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
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-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Israe Elnaouq	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 19, 2015

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 0108

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

Probe ES3DV3

SN:3209

Manufactured: October 14, 2008
Calibrated: March 19, 2015

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.35	1.33	1.14	± 10.1 %
DCP (mV)[B]	102.0	100.9	103.3	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	214.5	±3.5 %
		Y	0.0	0.0	1.0		192.6	
		Z	0.0	0.0	1.0		199.1	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	2.61	65.1	12.2	10.00	42.3	±1.7 %
		Y	1.39	57.8	8.9		42.7	
		Z	4.57	70.3	14.0		38.3	
10011-CAB	UMTS-FDD (WCDMA)	X	3.12	66.3	18.1	2.91	130.3	±0.7 %
		Y	3.08	65.6	17.5		132.2	
		Z	3.32	67.7	19.0		137.6	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.54	66.8	17.8	1.87	131.1	±0.7 %
		Y	2.67	67.1	17.7		131.6	
		Z	2.85	69.2	19.1		138.0	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	10.78	70.5	23.4	9.46	146.9	±2.7 %
		Y	10.39	69.2	22.5		123.5	
		Z	10.50	69.9	23.1		128.4	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	3.65	74.2	17.7	9.39	130.0	±1.9 %
		Y	6.62	83.5	22.0		149.4	
		Z	4.25	76.8	19.2		136.2	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	3.95	75.3	18.4	9.57	138.8	±2.5 %
		Y	4.99	78.2	19.8		143.3	
		Z	4.11	75.8	18.9		129.3	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	6.44	80.3	17.7	6.56	135.0	±1.7 %
		Y	3.76	73.7	16.0		144.2	
		Z	11.61	88.5	20.7		148.0	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	43.77	99.9	21.8	4.80	131.8	±1.7 %
		Y	13.95	87.5	19.0		142.7	
		Z	39.96	99.9	22.1		145.6	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	62.88	99.8	20.4	3.55	144.5	±2.2 %
		Y	2.45	70.4	12.9		130.3	
		Z	80.83	99.9	19.9		135.1	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	0.32	58.4	4.3	1.16	144.1	±1.9 %
		Y	16.25	79.9	12.1		129.5	
		Z	95.90	91.1	14.4		134.6	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.32	67.4	19.8	5.67	138.3	±1.4 %
		Y	6.35	67.3	19.5		144.4	
		Z	6.20	67.1	19.6		127.7	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	8.72	73.1	25.3	9.29	138.6	±2.7 %
		Y	8.88	72.9	24.9		147.9	
		Z	8.48	72.3	24.9		127.4	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.14	66.9	19.6	5.80	136.2	±1.7 %
		Y	6.20	66.8	19.4		142.8	
		Z	6.10	66.8	19.6		126.2	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.05	68.9	21.4	8.07	126.8	±2.2 %
		Y	9.98	68.5	21.1		132.4	
		Z	10.23	69.4	21.7		140.4	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	8.16	72.2	25.0	9.28	133.6	±2.7 %
		Y	8.33	72.0	24.5		142.6	
		Z	8.40	73.1	25.6		147.5	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.83	66.5	19.4	5.75	133.1	±1.4 %
		Y	5.89	66.3	19.2		139.3	
		Z	6.00	67.2	19.9		146.5	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.26	66.9	19.6	5.82	138.8	±1.7 %
		Y	6.34	67.0	19.5		145.1	
		Z	6.22	66.9	19.7		128.8	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.77	66.7	19.8	5.73	135.9	±1.4 %
		Y	4.89	66.6	19.5		141.8	
		Z	4.85	66.8	19.9		128.3	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	6.77	75.0	26.9	9.21	144.2	±2.5 %
		Y	6.56	72.6	25.2		131.1	
		Z	6.68	74.0	26.4		137.1	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.80	66.9	19.9	5.72	135.2	±1.4 %
		Y	4.87	66.5	19.5		140.6	
		Z	5.03	67.7	20.4		149.4	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.77	66.7	19.8	5.72	134.7	±1.2 %
		Y	4.88	66.5	19.5		140.6	
		Z	4.84	66.8	19.9		127.8	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.97	69.5	21.9	8.10	145.2	±2.2 %
		Y	9.60	68.2	21.0		125.1	
		Z	9.80	69.1	21.7		133.9	
10225-CAB	UMTS-FDD (HSPA+)	X	6.95	67.5	19.8	5.97	147.3	±1.4 %
		Y	6.73	66.4	19.1		128.7	
		Z	6.89	67.4	19.8		137.2	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	6.85	75.4	27.2	9.21	146.0	±2.5 %
		Y	6.54	72.5	25.1		131.6	
		Z	6.76	74.4	26.6		138.2	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	7.58	71.3	24.6	9.24	126.6	±2.5 %
		Y	7.73	71.1	24.2		133.3	
		Z	7.82	72.4	25.3		139.0	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	8.18	72.2	25.1	9.30	133.6	±2.7 %
		Y	8.35	72.0	24.6		141.1	
		Z	8.42	73.2	25.6		147.0	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.22	66.1	18.4	3.96	128.8	±0.9 %
		Y	4.24	65.9	18.1		133.8	
		Z	4.39	67.1	19.0		141.7	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.51	66.7	18.6	3.46	140.9	±0.7 %
		Y	3.52	66.2	18.1		143.4	
		Z	3.58	67.2	19.0		131.7	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.45	66.7	18.5	3.39	142.0	±0.7 %
		Y	3.50	66.4	18.2		146.9	
		Z	3.61	67.8	19.3		132.2	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.15	66.9	19.6	5.81	136.3	±1.4 %
		Y	6.20	66.8	19.4		140.3	
		Z	6.11	66.8	19.6		126.6	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.80	67.8	20.1	6.06	143.2	±1.7 %
		Y	6.80	67.5	19.9		147.4	
		Z	6.71	67.6	20.1		131.9	
10400-AAB	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.31	70.0	22.4	8.37	147.9	±3.0 %
		Y	9.88	68.5	21.3		127.2	
		Z	10.13	69.5	22.1		135.8	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.60	68.6	18.9	3.76	128.2	±0.5 %
		Y	4.58	67.9	18.4		134.2	
		Z	4.86	69.6	19.5		142.6	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.57	68.9	19.1	3.77	149.7	±0.5 %
		Y	4.51	68.0	18.5		132.3	
		Z	4.78	69.6	19.5		140.3	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.47	67.0	17.9	1.54	128.1	±0.7 %
		Y	2.46	66.4	17.4		132.5	
		Z	2.72	69.1	19.2		140.6	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	10.12	69.7	22.1	8.23	146.8	±2.7 %
		Y	9.66	68.2	21.1		125.0	
		Z	9.91	69.2	21.8		134.3	

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 7 and 8).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.34	6.34	6.34	0.29	2.02	± 12.0 %
835	41.5	0.90	6.04	6.04	6.04	0.23	2.57	± 12.0 %
1750	40.1	1.37	5.23	5.23	5.23	0.80	1.08	± 12.0 %
1900	40.0	1.40	5.05	5.05	5.05	0.10	2.40	± 12.0 %
2300	39.5	1.67	4.76	4.76	4.76	0.70	1.27	± 12.0 %
2450	39.2	1.80	4.53	4.53	4.53	0.80	1.22	± 12.0 %
2600	39.0	1.96	4.36	4.36	4.36	0.75	1.31	± 12.0 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

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

Calibration Parameter Determined in Body Tissue Simulating Media

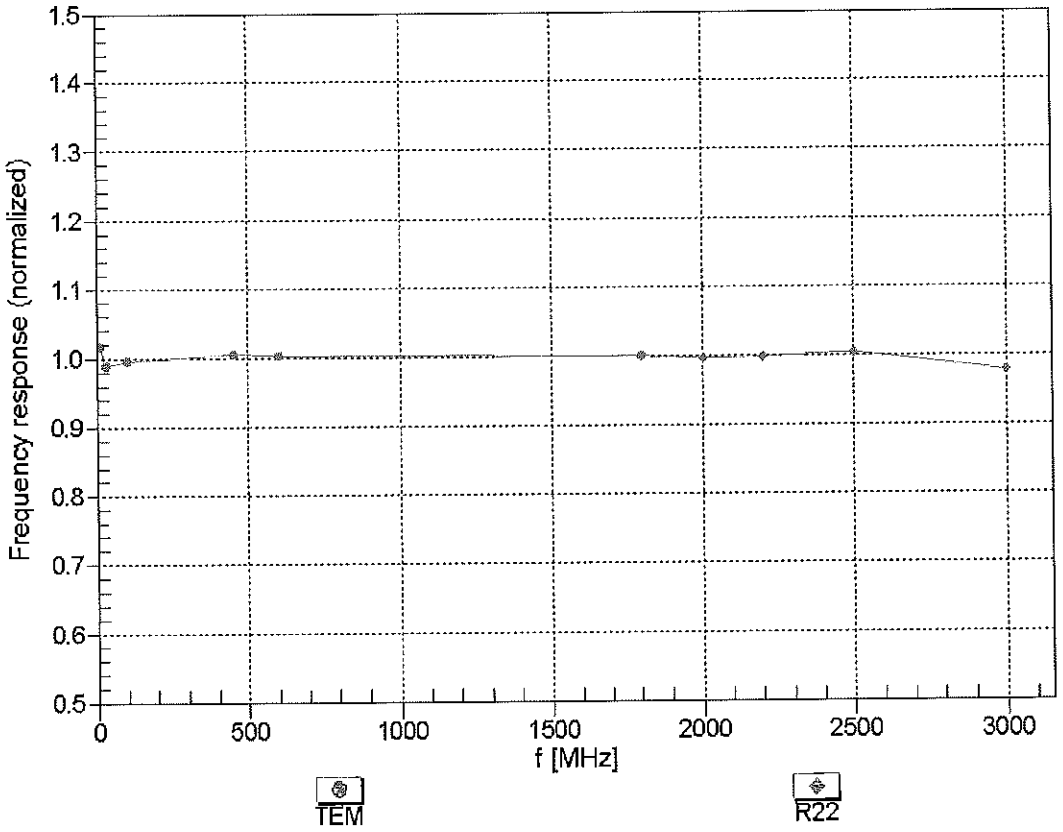
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.12	6.12	6.12	0.34	1.81	± 12.0 %
835	55.2	0.97	6.07	6.07	6.07	0.37	1.79	± 12.0 %
1750	53.4	1.49	4.86	4.86	4.86	0.67	1.43	± 12.0 %
1900	53.3	1.52	4.57	4.57	4.57	0.57	1.53	± 12.0 %
2300	52.9	1.81	4.28	4.28	4.28	0.80	1.19	± 12.0 %
2450	52.7	1.95	4.12	4.12	4.12	0.72	1.15	± 12.0 %
2600	52.5	2.16	3.92	3.92	3.92	0.80	1.10	± 12.0 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

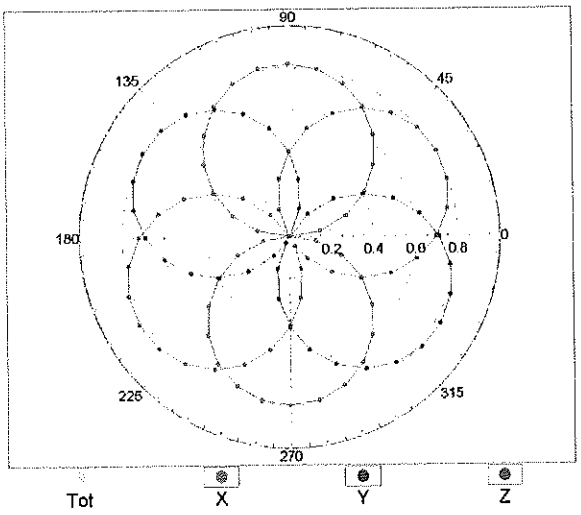
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



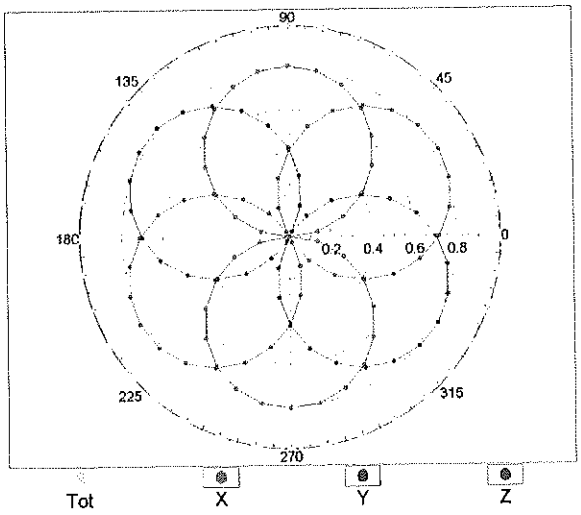
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

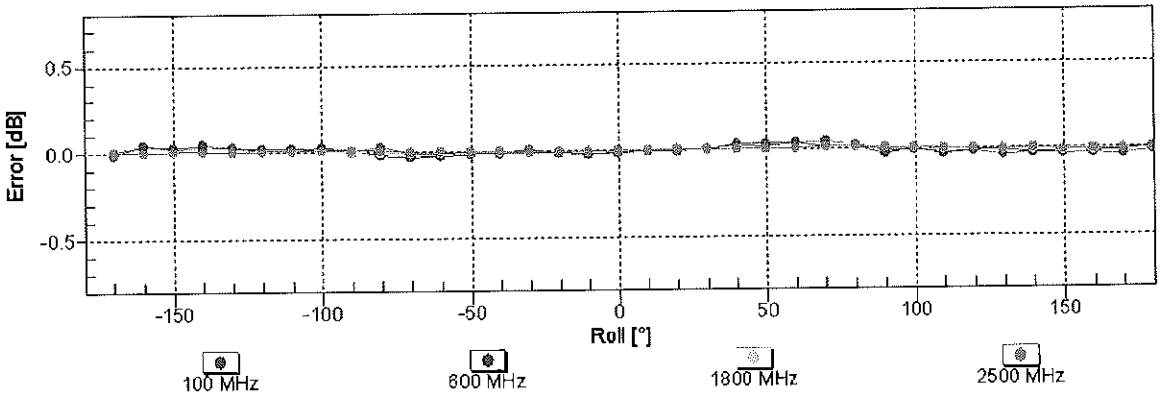
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



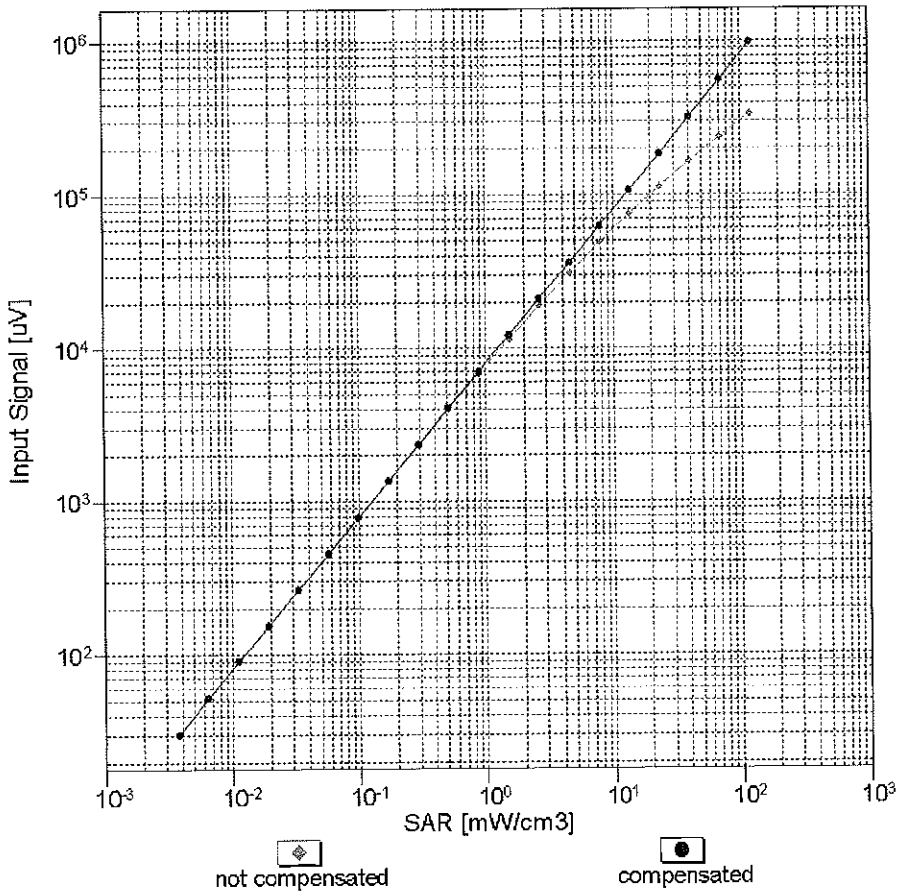
f=1800 MHz,R22

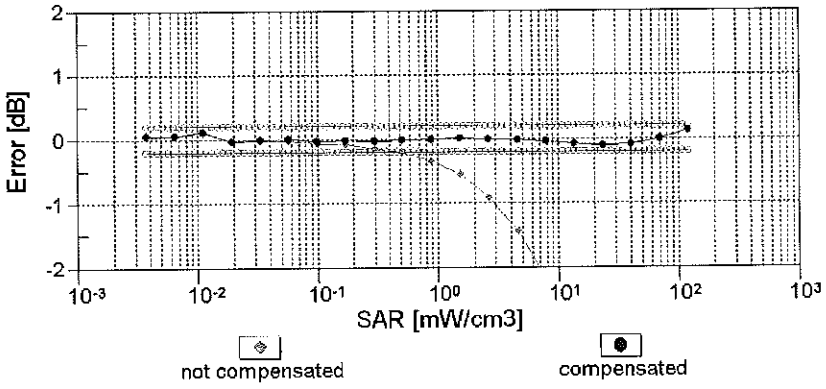




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

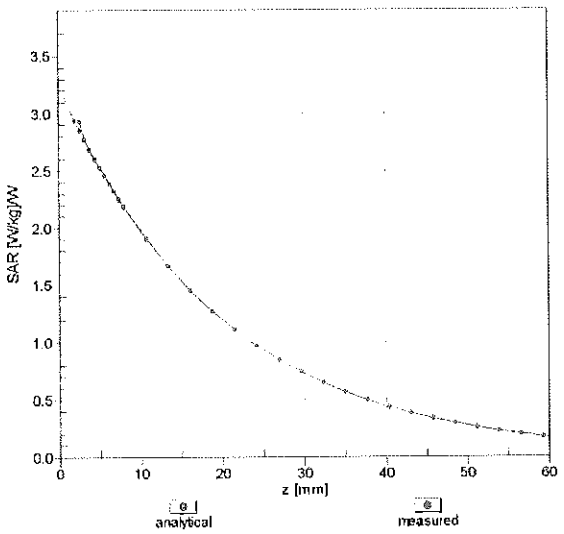




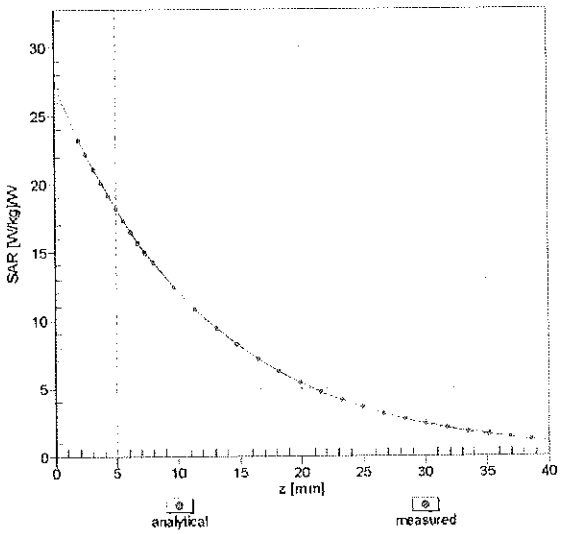
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

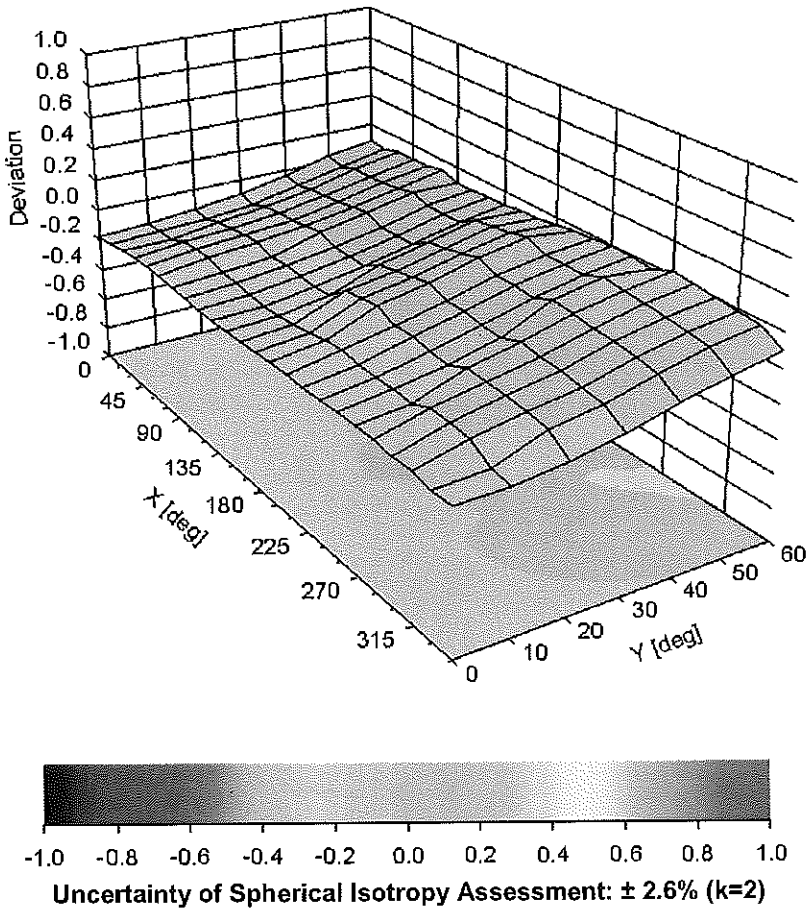


f = 1900 MHz,WGLS R22 (H_convF)



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:3209

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-40.3
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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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 0108

Client PC Test

Certificate No: EX3-3589_Jan15

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3589

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

CC 1/30/15

Calibration date: January 22, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
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-14)	In house check: Oct-15

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

Issued: January 26, 2015

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 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:3589

Manufactured: March 30, 2006
Calibrated: January 22, 2015

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.46	0.41	0.39	± 10.1 %
DCP (mV)[B]	103.1	102.4	104.4	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	146.6	±3.3 %
		Y	0.0	0.0	1.0		143.1	
		Z	0.0	0.0	1.0		170.4	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	16.82	80.0	16.9	10.00	39.1	±0.7 %
		Y	7.79	73.4	15.1		39.0	
		Z	2.50	64.1	12.2		43.2	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.02	68.9	18.6	1.87	115.1	±0.7 %
		Y	3.08	69.3	18.8		114.1	
		Z	3.07	70.1	19.4		134.9	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	10.36	68.2	21.5	9.46	104.8	±2.5 %
		Y	10.20	68.2	21.6		104.2	
		Z	10.36	68.6	21.7		122.2	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	79.80	100.0	18.7	1.16	134.5	±0.9 %
		Y	98.53	99.4	18.2		133.2	
		Z	0.27	57.7	4.8		113.6	
10062-CAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	9.91	67.7	20.7	8.68	104.8	±2.2 %
		Y	9.83	67.7	20.9		105.4	
		Z	10.08	68.3	21.1		126.6	
10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	7.73	67.7	21.4	9.29	106.3	±1.9 %
		Y	8.16	69.5	22.6		106.5	
		Z	7.50	67.6	21.5		121.6	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	9.91	67.7	20.3	8.07	112.1	±1.9 %
		Y	9.90	67.8	20.5		111.8	
		Z	10.04	68.2	20.6		134.2	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	7.99	69.5	22.6	9.28	146.2	±2.2 %
		Y	8.43	71.4	23.8		148.8	
		Z	7.09	66.7	21.0		116.8	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	6.34	69.7	22.8	9.21	118.1	±1.7 %
		Y	6.41	70.8	23.7		115.8	
		Z	6.10	69.1	22.6		132.9	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.49	67.3	20.2	8.10	101.7	±1.9 %
		Y	9.44	67.3	20.3		106.1	
		Z	9.71	68.1	20.6		127.1	
10317-AAB	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle)	X	9.70	67.5	20.5	8.36	102.8	±2.2 %
		Y	9.68	67.7	20.7		108.0	
		Z	9.97	68.5	21.0		127.5	

10400-AAB	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	9.73	67.5	20.4	8.37	102.2	±1.9 %
		Y	9.78	67.8	20.7		109.0	
		Z	10.00	68.4	20.9		129.9	
10401-AAB	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc duty cycle)	X	10.39	67.9	20.7	8.60	108.7	±2.2 %
		Y	10.63	68.6	21.2		117.4	
		Z	10.71	68.9	21.2		138.2	
10402-AAB	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	X	10.38	67.8	20.5	8.53	107.9	±2.2 %
		Y	10.82	69.0	21.2		119.6	
		Z	10.65	68.6	20.9		137.1	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	3.06	70.1	19.2	1.54	108.9	±0.7 %
		Y	3.37	71.8	19.9		116.8	
		Z	2.93	69.8	19.1		135.5	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	10.23	69.0	21.2	8.23	149.0	±2.2 %
		Y	9.64	67.7	20.7		109.5	
		Z	9.67	67.8	20.5		125.2	
10417-AAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc duty cycle)	X	9.56	67.3	20.3	8.23	101.7	±1.9 %
		Y	9.64	67.8	20.7		109.6	
		Z	9.79	68.1	20.7		128.3	

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 6 and 7).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
2450	39.2	1.80	6.48	6.48	6.48	0.39	0.82	± 12.0 %
2600	39.0	1.96	6.30	6.30	6.30	0.38	0.89	± 12.0 %
5200	36.0	4.66	4.66	4.66	4.66	0.35	1.80	± 13.1 %
5300	35.9	4.76	4.43	4.43	4.43	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.23	4.23	4.23	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.03	4.03	4.03	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.19	4.19	4.19	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

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

Calibration Parameter Determined in Body Tissue Simulating Media

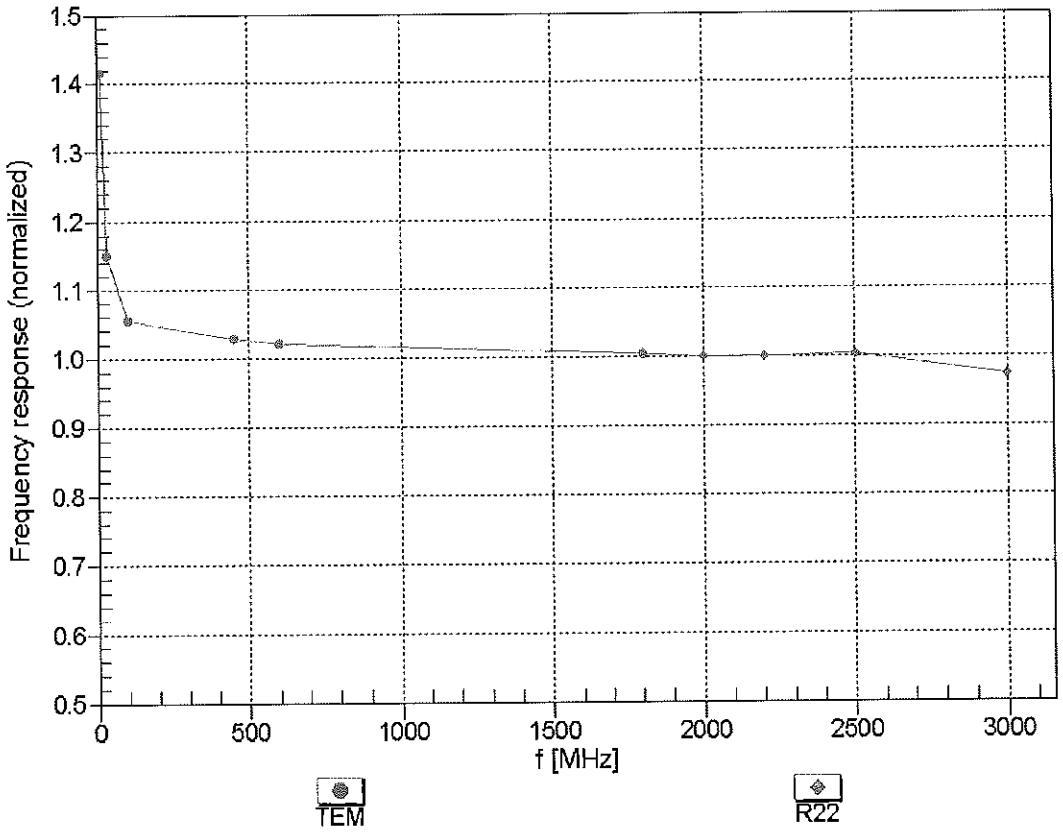
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
2450	52.7	1.95	6.60	6.60	6.60	0.80	0.57	± 12.0 %
2600	52.5	2.16	6.36	6.36	6.36	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.01	4.01	4.01	0.45	1.90	± 13.1 %
5300	48.9	5.42	3.79	3.79	3.79	0.45	1.90	± 13.1 %
5500	48.6	5.65	3.65	3.65	3.65	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.42	3.42	3.42	0.50	1.90	± 13.1 %
5800	48.2	6.00	3.79	3.79	3.79	0.50	1.90	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

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

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

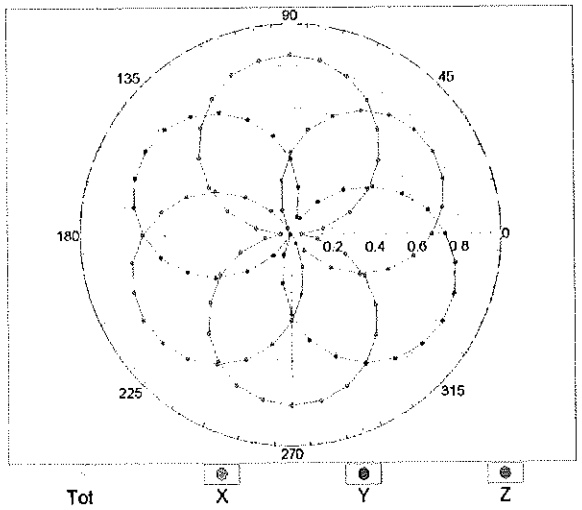
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



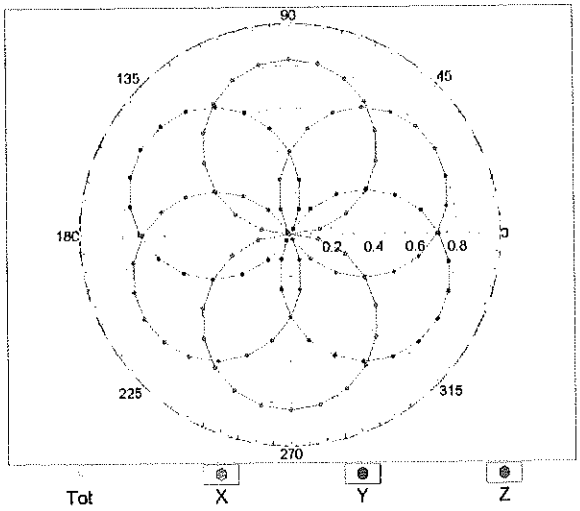
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

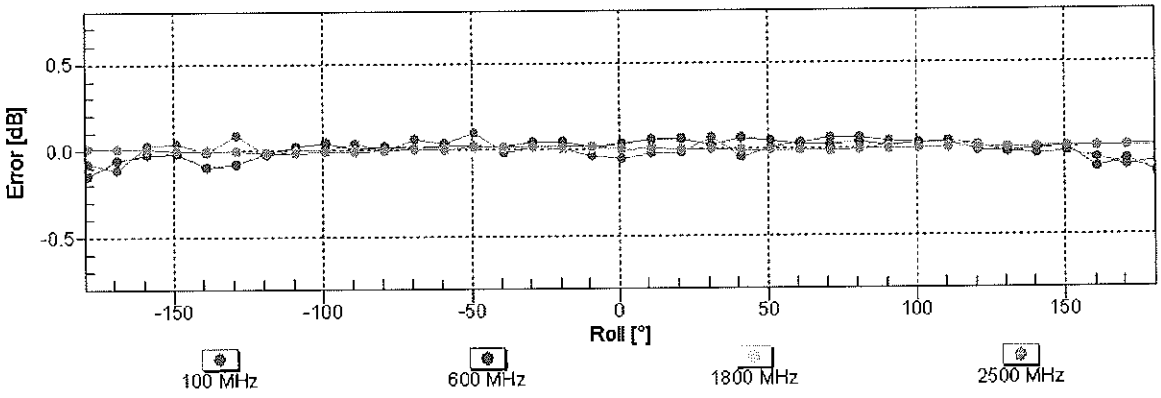
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



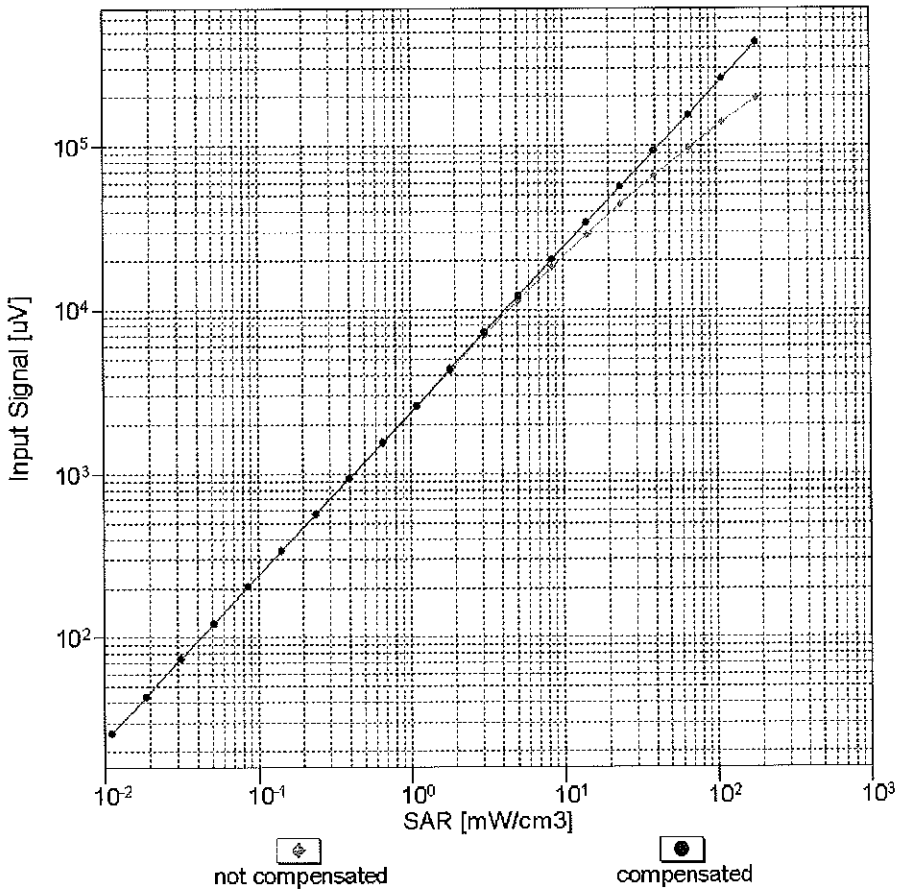
f=1800 MHz,R22

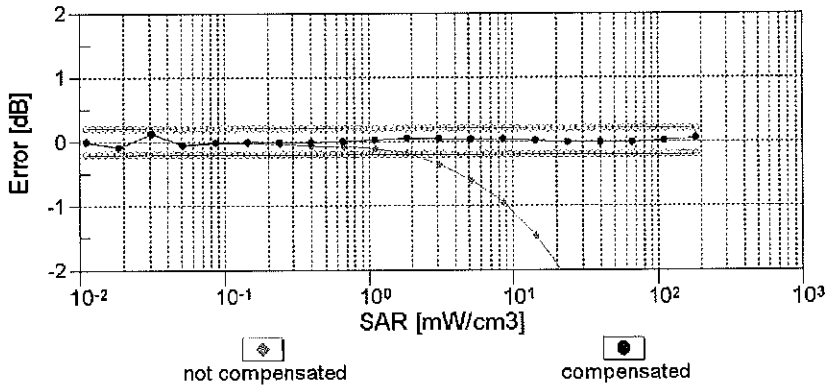




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

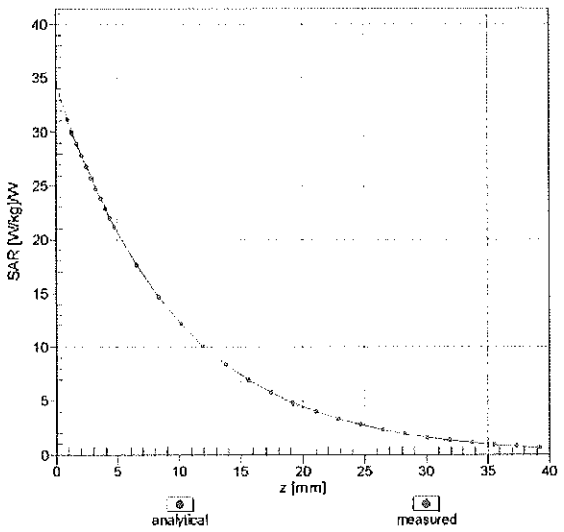




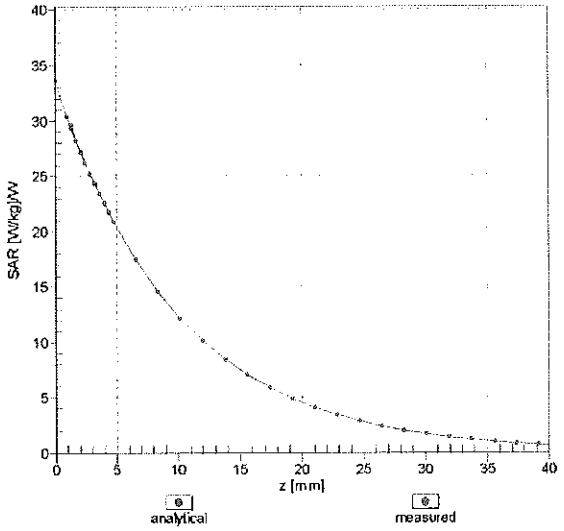
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 2450 MHz,WGLS R22 (H_convF)

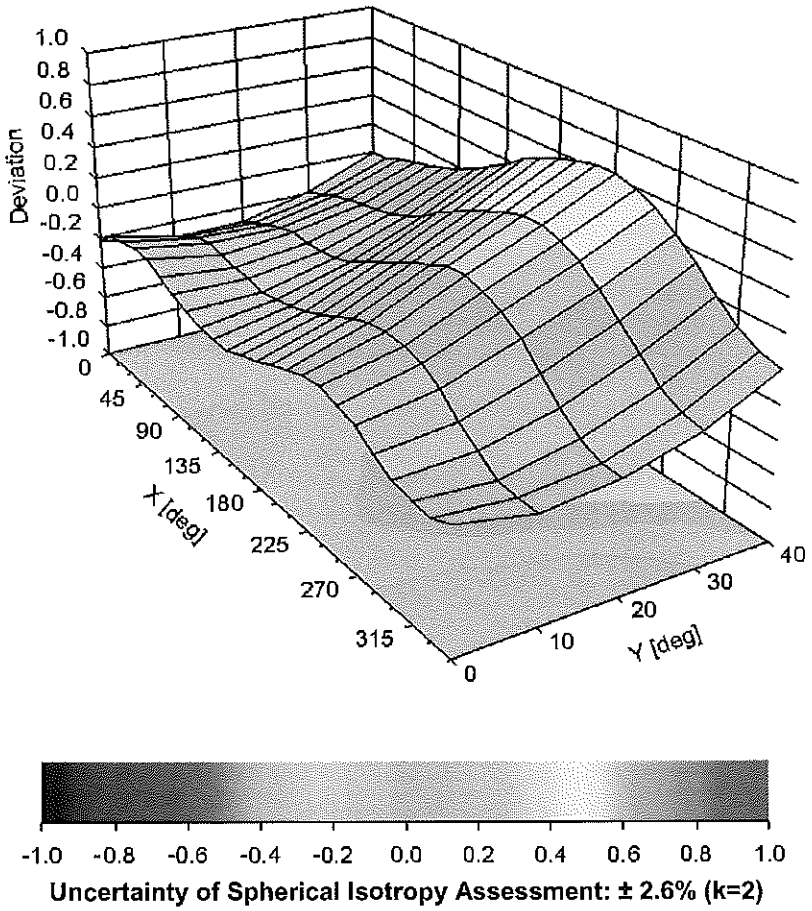


f = 2450 MHz,WGLS R22 (M_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-39.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

APPENDIX D: SAR TISSUE SPECIFICATIONS

Measurement Procedure for Tissue verification:

3) The network analyzer and probe system was configured and calibrated.
4) 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.
5) The complex admittance with respect to the probe aperture was measured
6) 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	5200 - 5800
Tissue	Body	Body	Body	Body	Body	Body
Ingredients (% by weight)						
Bactericide	See page 2	0.1				
DGBE			31	29.44	26.7	
HEC		1				
NaCl		0.94	0.2	0.39	0.1	
Sucrose		44.9				
Polysorbate (Tween) 80						20
Water		53.06	68.8	70.17	73.2	80

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: 130828-1)
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.

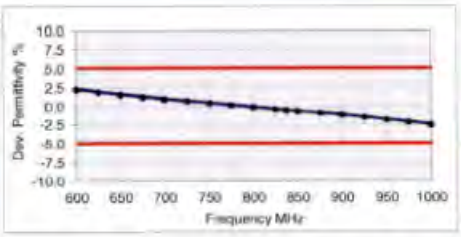
Test Condition

Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	28-Aug-13
Operator	IEN

Additional Information

TSL Density	1.212 g/cm³
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	57.4	24.76	0.83	56.1	0.95	2.3	-13.2
625	57.1	24.42	0.85	56.0	0.95	2.0	-11.0
650	56.8	24.09	0.87	55.9	0.96	1.6	-8.9
675	56.6	23.80	0.89	55.8	0.96	1.3	-6.7
700	56.3	23.52	0.92	55.7	0.96	1.0	-4.5
725	56.1	23.27	0.94	55.6	0.96	0.8	-2.4
750	**55.8**	**23.03**	**0.96**	**55.5**	**0.96**	**0.5**	**-0.3**
775	55.6	22.87	0.99	55.4	0.97	0.2	2.1
800	55.3	22.71	1.01	55.3	0.97	-0.1	4.5
825	55.1	22.54	1.03	55.2	0.98	-0.3	5.8
838	54.9	22.45	1.05	55.2	0.98	-0.5	6.4
850	54.8	22.37	1.06	55.2	0.99	-0.6	7.0
875	54.6	22.25	1.08	55.1	1.02	-0.9	6.2
900	54.4	22.13	1.11	55.0	1.05	-1.1	5.5
925	54.2	22.02	1.13	55.0	1.06	-1.5	6.6
950	53.9	21.91	1.16	54.9	1.08	-1.8	7.7
975	53.7	21.84	1.18	54.9	1.09	-2.2	9.0
1000	53.5	21.77	1.21	54.8	1.10	-2.5	10.3



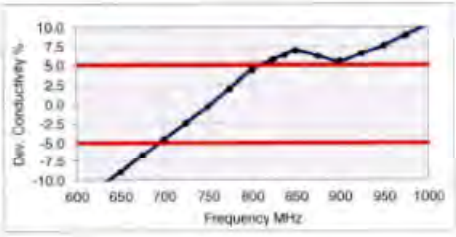


Figure D-2
750MHz Body Tissue Equivalent Matter

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. (σ)	PERM. (εr)	CW VALIDATION			MOD. VALIDATION		
									SENSITIVITY	PROBE LINEARITY	PROBE ISOTROPY	MOD. TYPE	DUTY FACTOR	PAR
A	750	1/12/2015	3331	ES3DV3	750	Body	0.975	56.382	PASS	PASS	PASS	N/A	N/A	N/A
I	835	5/30/2015	3213	ES3DV3	835	Body	0.987	53.378	PASS	PASS	PASS	GMSK	PASS	N/A
A	835	1/12/2015	3331	ES3DV3	835	Body	0.952	53.660	PASS	PASS	PASS	GMSK	PASS	N/A
H	1750	6/2/2015	3263	ES3DV3	1750	Body	1.471	51.851	PASS	PASS	PASS	N/A	N/A	N/A
B	1900	1/6/2015	3334	ES3DV3	1900	Body	1.582	53.070	PASS	PASS	PASS	GMSK	PASS	N/A
D	2450	4/24/2015	3209	ES3DV3	2450	Body	1.947	51.280	PASS	PASS	PASS	OFDM	N/A	PASS
E	5300	4/20/2015	3589	EX3DV4	5300	Body	5.460	48.600	PASS	PASS	PASS	OFDM	N/A	PASS
E	5500	4/20/2015	3589	EX3DV4	5500	Body	5.724	48.270	PASS	PASS	PASS	OFDM	N/A	PASS
E	5600	4/20/2015	3589	EX3DV4	5600	Body	5.871	48.130	PASS	PASS	PASS	OFDM	N/A	PASS
E	5800	4/20/2015	3589	EX3DV4	5800	Body	6.150	47.800	PASS	PASS	PASS	OFDM	N/A	PASS

NOTE: While the probes have been calibrated for both 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, or with a high peak to average ratio (>5 dB), such as OFDM according to KDB 865664.

APPENDIX G: SENSOR TRIGGERING DATA SUMMARY

A3LSMT357W 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, top, bottom, and right 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 (Main Antenna)

Moving device toward the phantom:

KDB 616217 6.2.6 Measured Power [dBm]											
Distance[mm]	27	26	25	24	23	22	21	20	19	18	17
WCDMA 850	23.19	23.32	23.16	23.15	23.19	17.92	17.88	17.85	18.04	17.70	17.91
WCDMA 1750	23.32	23.25	23.21	23.43	23.15	13.14	13.11	13.26	13.44	13.16	13.27
WCDMA 1900	23.14	23.19	23.18	23.41	23.44	11.82	11.86	11.68	11.71	11.69	11.69
LTE B17	23.31	23.36	23.13	23.26	23.33	20.52	20.50	20.57	20.82	20.80	20.67
LTE B12	23.69	23.76	23.65	23.67	23.63	19.84	19.82	19.92	19.86	19.91	19.95
LTE B5	23.45	23.37	23.16	23.12	23.20	19.66	19.41	19.42	19.68	19.46	19.45
LTE B4	23.63	23.76	23.72	23.77	23.92	13.47	13.53	13.61	13.48	13.58	13.41
LTE B2	23.86	23.92	23.87	23.68	23.92	12.13	11.93	12.08	12.21	11.93	12.16

Moving device away from the phantom:

KDB 616217 6.2.8 Measured Power [dBm]											
Distance[mm]	27	26	25	24	23	22	21	20	19	18	17
WCDMA 850	23.25	23.42	23.45	23.38	23.18	17.78	17.84	17.96	17.93	17.84	17.72
WCDMA 1750	23.12	23.45	23.22	23.43	23.17	13.40	13.10	13.17	13.20	13.31	13.26
WCDMA 1900	23.39	23.15	23.20	23.37	23.38	11.90	11.89	11.65	11.76	11.69	11.82
LTE B17	23.39	23.29	23.13	23.29	23.27	20.61	20.74	20.85	20.50	20.51	20.76
LTE B12	23.70	23.75	23.68	23.86	23.89	19.78	19.61	19.80	19.75	19.75	19.67
LTE B5	23.19	23.41	23.43	23.30	23.19	19.40	19.70	19.66	19.57	19.72	19.56
LTE B4	23.91	23.76	23.91	23.86	23.84	13.64	13.60	13.37	13.64	13.47	13.32
LTE B2	23.78	23.67	23.79	23.74	23.84	12.07	12.16	12.07	11.96	11.93	12.04

Based on the most conservative measured triggering distance of 22 mm, additional SAR measurements were required at 21 mm from the back side for the above modes/bands.

Back Side (WLAN Antenna)

Moving device toward the phantom:

KDB 616217 6.2.6 Measured Power [dBm]											
Distance[mm]	18	17	16	15	14	13	12	11	10	9	8
IEEE 802.11b	16.37	16.28	16.23	16.42	16.44	11.27	11.34	11.15	11.14	11.17	11.35
IEEE 802.11g	12.42	12.33	12.32	12.11	12.11	10.36	10.34	10.18	10.43	10.25	10.40
IEEE 802.11n (2.4GHz)	10.13	10.13	10.34	10.42	10.19	9.45	9.42	9.22	9.28	9.39	9.17
IEEE 802.11a	11.43	11.29	11.32	11.41	11.24	6.22	6.12	6.34	6.43	6.25	6.40
IEEE 802.11n (5GHz, 20MHz BW)	10.43	10.24	10.30	10.12	10.34	5.42	5.15	5.39	5.38	5.12	5.44
IEEE 802.11n (5GHz, 40MHz BW)	10.37	10.19	10.44	10.29	10.43	7.10	7.17	7.14	7.45	7.26	7.33

Moving device away from the phantom:

KDB 616217 6.2.8 Measured Power [dBm]											
Distance[mm]	18	17	16	15	14	13	12	11	10	9	8
IEEE 802.11b	16.43	16.42	16.19	16.34	16.13	11.40	11.20	11.22	11.39	11.38	11.18
IEEE 802.11g	12.18	12.41	12.20	12.32	12.27	10.35	10.41	10.38	10.36	10.38	10.25
IEEE 802.11n (2.4GHz)	10.24	10.18	10.10	10.22	10.27	9.18	9.32	9.16	9.12	9.11	9.35
IEEE 802.11a	11.15	11.32	11.31	11.43	11.29	6.34	6.25	6.38	6.18	6.29	6.15
IEEE 802.11n (5GHz, 20MHz BW)	10.25	10.26	10.15	10.45	10.13	5.12	5.17	5.43	5.15	5.29	5.31
IEEE 802.11n (5GHz, 40MHz BW)	10.31	10.11	10.42	10.23	10.35	7.33	7.28	7.24	7.27	7.43	7.28

Based on the most conservative measured triggering distance of 13 mm, additional SAR measurements were required at 12 mm from the back side for the above modes/bands.

Top Edge (WLAN Antenna)

Moving device toward the phantom:

KDB 616217 6.2.6 Measured Power [dBm]											
Distance[mm]	11	10	9	8	7	6	5	4	3	2	1
IEEE 802.11b	16.28	16.17	16.28	16.40	16.25	11.13	11.17	11.29	11.27	11.11	11.24
IEEE 802.11g	12.32	12.35	12.11	12.33	12.43	10.29	10.30	10.27	10.44	10.16	10.44
IEEE 802.11n (2.4GHz)	10.35	10.44	10.24	10.22	10.14	9.36	9.44	9.23	9.11	9.10	9.12
IEEE 802.11a	11.30	11.42	11.42	11.24	11.32	6.34	6.45	6.37	6.29	6.24	6.37
IEEE 802.11n (5GHz, 20MHz BW)	10.43	10.25	10.30	10.29	10.25	5.23	5.25	5.39	5.35	5.44	5.43
IEEE 802.11n (5GHz, 40MHz BW)	10.23	10.40	10.21	10.23	10.26	7.17	7.21	7.38	7.24	7.29	7.37

Moving device away from the phantom:

KDB 616217 6.2.8 Measured Power [dBm]											
Distance[mm]	11	10	9	8	7	6	5	4	3	2	1
IEEE 802.11b	16.22	16.22	16.33	16.15	16.41	11.30	11.13	11.27	11.16	11.19	11.36
IEEE 802.11g	12.19	12.17	12.31	12.34	12.24	10.14	10.45	10.21	10.16	10.41	10.16
IEEE 802.11n (2.4GHz)	10.34	10.31	10.42	10.19	10.29	9.36	9.31	9.40	9.10	9.25	9.27
IEEE 802.11a	11.15	11.24	11.43	11.26	11.25	6.27	6.26	6.41	6.39	6.42	6.25
IEEE 802.11n (5GHz, 20MHz BW)	10.39	10.20	10.41	10.32	10.44	5.44	5.17	5.30	5.29	5.13	5.29
IEEE 802.11n (5GHz, 40MHz BW)	10.23	10.15	10.11	10.31	10.41	7.41	7.27	7.45	7.15	7.12	7.28

Based on the most conservative measured triggering distance of 6 mm, additional SAR measurements were required at 5 mm from the top edge for the above modes/bands.

Bottom Edge (Main Antenna)

Moving device toward the phantom:

KDB 616217 6.2.6 Measured Power [dBm]											
Distance[mm]	24	23	22	21	20	19	18	17	16	15	14
WCDMA 850	23.12	23.11	23.18	23.14	23.36	17.89	17.99	17.75	17.74	17.94	17.96
WCDMA 1750	23.39	23.15	23.16	23.31	23.31	13.44	13.21	13.23	13.34	13.34	13.20
WCDMA 1900	23.29	23.24	23.10	23.19	23.28	11.75	11.88	11.90	11.81	11.71	11.70
LTE B17	23.35	23.27	23.16	23.36	23.22	20.75	20.68	20.50	20.82	20.67	20.83
LTE B12	23.60	23.78	23.84	23.95	23.70	19.64	19.95	19.83	19.77	19.79	19.66
LTE B5	23.15	23.10	23.38	23.20	23.18	19.44	19.51	19.66	19.70	19.72	19.41
LTE B4	23.70	23.95	23.86	23.82	23.92	13.52	13.39	13.46	13.46	13.57	13.65
LTE B2	23.82	23.88	23.77	23.68	23.65	11.90	11.90	11.95	12.10	12.25	12.16

Moving device away from the phantom:

KDB 616217 6.2.8 Measured Power [dBm]											
Distance[mm]	24	23	22	21	20	19	18	17	16	15	14
WCDMA 850	23.15	23.34	23.23	23.32	23.35	17.72	17.91	17.82	17.97	17.70	18.02
WCDMA 1750	23.31	23.16	23.24	23.23	23.19	13.33	13.11	13.41	13.11	13.27	13.41
WCDMA 1900	23.41	23.11	23.27	23.24	23.22	11.89	11.64	11.75	11.74	11.74	11.90
LTE B17	23.23	23.31	23.24	23.17	23.14	20.85	20.72	20.78	20.77	20.66	20.66
LTE B12	23.92	23.94	23.83	23.73	23.64	19.66	19.66	19.88	19.70	19.86	19.95
LTE B5	23.27	23.40	23.34	23.10	23.40	19.68	19.73	19.48	19.40	19.73	19.42
LTE B4	23.84	23.68	23.93	23.65	23.71	13.49	13.47	13.35	13.50	13.55	13.57
LTE B2	23.91	23.86	23.63	23.60	23.84	12.25	12.21	12.12	12.08	11.93	12.19

Based on the most conservative measured triggering distance of 19 mm, additional SAR measurements were required at 18 mm from the bottom edge for the above modes/bands.

Right Edge (Main Antenna)

Moving device toward the phantom:

KDB 616217 6.2.6 Measured Power [dBm]											
Distance[mm]	12	11	10	9	8	7	6	5	4	3	2
WCDMA 850	23.24	23.33	23.10	23.14	23.38	17.79	17.98	17.96	18.04	17.89	17.80
WCDMA 1750	23.28	23.27	23.20	23.18	23.26	13.35	13.13	13.23	13.23	13.14	13.30
WCDMA 1900	23.18	23.39	23.14	23.35	23.11	11.60	11.82	11.79	11.71	11.78	11.83
LTE B17	23.34	23.23	23.43	23.40	23.43	20.71	20.65	20.64	20.58	20.65	20.69
LTE B12	23.73	23.84	23.87	23.73	23.77	19.63	19.61	19.82	19.65	19.83	19.83
LTE B5	23.36	23.17	23.32	23.39	23.32	19.40	19.48	19.63	19.43	19.68	19.57
LTE B4	23.87	23.95	23.64	23.69	23.69	13.38	13.40	13.44	13.61	13.38	13.58
LTE B2	23.92	23.79	23.68	23.72	23.86	11.95	11.96	11.92	12.01	11.90	12.20

Moving device away from the phantom:

KDB 616217 6.2.8 Measured Power [dBm]											
Distance[mm]	12	11	10	9	8	7	6	5	4	3	2
WCDMA 850	23.34	23.34	23.38	23.41	23.42	17.91	17.93	18.05	18.05	17.79	17.78
WCDMA 1750	23.10	23.33	23.14	23.11	23.43	13.34	13.15	13.21	13.22	13.22	13.25
WCDMA 1900	23.14	23.33	23.24	23.40	23.40	11.91	11.61	11.72	11.75	11.95	11.67
LTE B17	23.15	23.23	23.32	23.45	23.21	20.65	20.76	20.75	20.81	20.54	20.60
LTE B12	23.68	23.81	23.69	23.89	23.87	19.61	19.66	19.85	19.93	19.71	19.63
LTE B5	23.25	23.16	23.10	23.14	23.13	19.74	19.51	19.57	19.61	19.52	19.72
LTE B4	23.67	23.82	23.81	23.74	23.62	13.49	13.50	13.54	13.41	13.59	13.50
LTE B2	23.74	23.79	23.64	23.85	23.82	12.03	11.91	12.21	12.13	12.21	12.05

Based on the most conservative measured triggering distance of 7 mm, additional SAR measurements were required at 6 mm from the right edge for the above modes/bands.