



SAR EVALUATION REPORT

Applicant Name:

LG Electronics MobileComm U.S.A., Inc.
1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
United States

Date of Testing:

07/21/14 – 07/23/14

Test Site/Location:

PCTEST Lab, Columbia, MD, USA

Document Serial No.:

OY1407211417.ZNF

FCC ID:

ZNFUK410

APPLICANT:

LG ELECTRONICS MOBILECOMM U.S.A., INC.

DUT Type:

Portable Tablet

Application Type:

Certification

FCC Rule Part(s):

CFR §2.1093

Model(s):

LG-UK410, LGUK410, UK410

Equipment Class	Band & Mode	Tx Frequency	SAR
			1 gm Body (W/kg)
PCB	LTE Band 13	782 MHz	0.43
PCB	LTE Band 5 (Cell)	824.7 - 848.3 MHz	0.73
PCB	LTE Band 4 (AWS)	1712.5 - 1752.5 MHz	0.54
PCB	LTE Band 2 (PCS)	1852.5 - 1907.5 MHz	0.59
DTS	2.4 GHz WLAN	2412 - 2462 MHz	0.69
DTS	5.8 GHz WLAN	5745 - 5825 MHz	0.12
NII	5.2 GHz WLAN	5180 - 5240 MHz	0.47
NII	5.3 GHz WLAN	5260 - 5320 MHz	0.43
NII	5.5 GHz WLAN	5500 - 5700 MHz	0.17
DSS/DTS	Bluetooth	2402 - 2480 MHz	N/A
Simultaneous SAR per KDB 690783 D01v01r03:			1.42

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.

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet
		Page 1 of 61

T A B L E O F C O N T E N T S

1	DEVICE UNDER TEST	3
2	LTE INFORMATION	7
3	INTRODUCTION	8
4	DOSIMETRIC ASSESSMENT	9
5	SAR TESTING PROCEDURES	10
6	RF EXPOSURE LIMITS	11
7	FCC MEASUREMENT PROCEDURES.....	12
8	RF CONDUCTED POWERS.....	15
9	SYSTEM VERIFICATION.....	45
10	SAR DATA SUMMARY	47
11	FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS.....	50
12	SAR MEASUREMENT VARIABILITY	55
13	EQUIPMENT LIST	56
14	MEASUREMENT UNCERTAINTIES	57
15	CONCLUSION.....	59
16	REFERENCES	60
APPENDIX A: SAR TEST PLOTS		
APPENDIX B: SAR DIPOLE VERIFICATION PLOTS		
APPENDIX C: PROBE AND DIPOLE CALIBRATION CERTIFICATES		
APPENDIX D: SAR TISSUE SPECIFICATIONS		
APPENDIX E: SAR SYSTEM VALIDATION		
APPENDIX F: SAR TEST SETUP PHOTOGRAPHS		
APPENDIX G: SENSOR TRIGGERING DATA SUMMARY		

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 2 of 61	

1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
LTE Band 13	Data	782 MHz
LTE Band 5 (Cell)	Data	824.7 - 848.3 MHz
LTE Band 4 (AWS)	Data	1712.5 - 1752.5 MHz
LTE Band 2 (PCS)	Data	1852.5 - 1907.5 MHz
2.4 GHz WLAN	Data	2412 - 2462 MHz
5.8 GHz WLAN	Data	5745 - 5825 MHz
5.2 GHz WLAN	Data	5180 - 5240 MHz
5.3 GHz WLAN	Data	5260 - 5320 MHz
5.5 GHz WLAN	Data	5500 - 5700 MHz
Bluetooth	Data	2402 - 2480 MHz

1.2 Specifications Power Reduction for SAR

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

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

1.3 Nominal and Maximum Output Power Specifications

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

Maximum Power:

Mode / Band		Modulated Average (dBm)
LTE Band 13	Maximum	24.2
	Nominal	23.7
LTE Band 5 (Cell)	Maximum	24.2
	Nominal	23.7
LTE Band 4 (AWS)	Maximum	23.7
	Nominal	23.2
LTE Band 2 (PCS)	Maximum	23.7
	Nominal	23.2

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 3 of 61

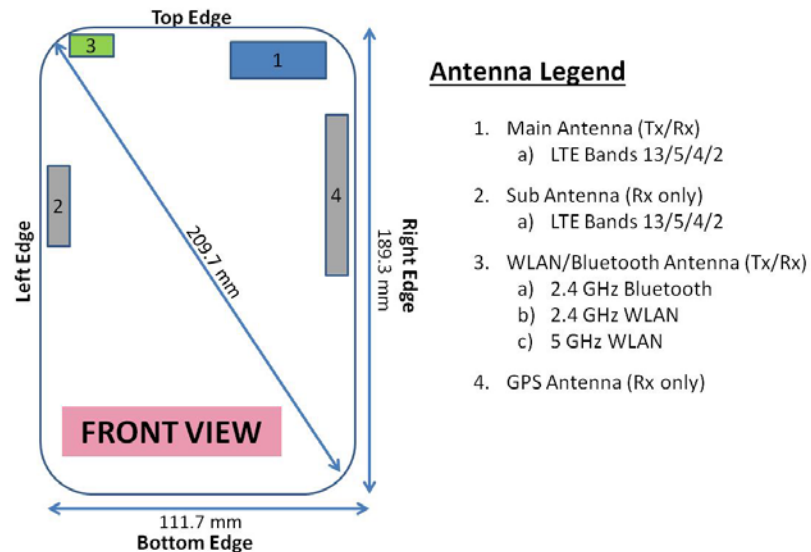
With Power Backoff (Body at 0mm):

Mode / Band		Modulated Average (dBm)
LTE Band 13	Maximum	18.2
	Nominal	17.7
LTE Band 5 (Cell)	Maximum	18.2
	Nominal	17.7
LTE Band 4 (AWS)	Maximum	13.7
	Nominal	13.2
LTE Band 2 (PCS)	Maximum	13.7
	Nominal	13.2

Bluetooth/WLAN Power Specifications:

Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	12.5
	Nominal	11.5
IEEE 802.11g (2.4 GHz)	Maximum	9.5
	Nominal	8.5
IEEE 802.11n (2.4 GHz)	Maximum	8.5
	Nominal	7.5
IEEE 802.11a (5 GHz)	Maximum	11.0
	Nominal	10.0
IEEE 802.11n (5 GHz)	Maximum	10.0
	Nominal	9.0
Bluetooth	Maximum	8.0
	Nominal	7.0
Bluetooth LE	Maximum	2.0
	Nominal	0.5

1.4 DUT Antenna Locations



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

Figure 1-1
DUT Antenna Locations

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 4 of 61

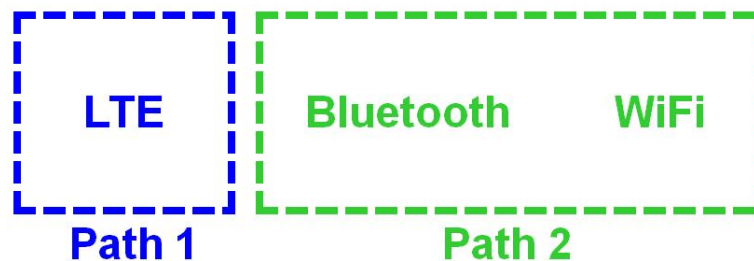
**Table 1-1
Body Sides for SAR Testing**

Sides for SAR Testing						
Mode	Back	Front	Top	Bottom	Right	Left
LTE Band 13	Yes	No	Yes	No	Yes	No
LTE Band 5 (Cell)	Yes	No	Yes	No	Yes	No
LTE Band 4 (AWS)	Yes	No	Yes	No	Yes	No
LTE Band 2 (PCS)	Yes	No	Yes	No	Yes	No
2.4 GHz WLAN	Yes	No	Yes	No	No	Yes
5 GHz WLAN	Yes	No	Yes	No	No	Yes

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.

1.5 Simultaneous Transmission Capabilities

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



**Figure 1-2
Simultaneous Transmission Paths**

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

**Table 1-2
Simultaneous Transmission Scenarios**

No.	Capable Transmit Configuration	Body
1	LTE + 2.4 GHz WI-FI	Yes
2	LTE + 2.4 GHz Bluetooth	Yes
3	LTE + 5 GHz WI-FI	Yes

Note: 2.4 GHz WLAN, 5 GHz WLAN, and 2.4 GHz Bluetooth share the same antenna path and cannot transmit simultaneously.

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet

1.6 SAR Test Exclusions Applied

(A) WIFI/BT

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

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

Based on the maximum conducted power of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, body Bluetooth SAR was not required; $[(6/5) * \sqrt{2.480}] = 1.9 < 3.0$. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.

This device supports 40 MHz Bandwidths for IEEE 802.11n for 5 GHz WIFI only.

(B) Licensed Transmitter(s)

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

1.7 Guidance Applied

- FCC KDB Publication 941225 D01v02, D03v01, D05v02r03, D06v01r01 (4G)
- FCC KDB Publication 248227 D01v01r02 (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 616217 D04v01 (Tablet SAR Consideration).

1.8 Device Serial Numbers

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

	Body Serial Number Max Power	Body Serial Number Reduced Power
LTE Band 13	628	610
LTE Band 5 (Cell)	628	610
LTE Band 4 (AWS)	628	610
LTE Band 2 (PCS)	628	610
2.4 GHz WLAN	529	-
5 GHz WLAN	529	-

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 6 of 61

2

LTE INFORMATION

LTE Information			
FCC ID	ZNFUK410		
Form Factor	Portable Tablet		
Frequency Range of each LTE transmission band	LTE Band 13 (782 MHz)		
	LTE Band 5 (Cell) (824.7 - 848.3 MHz)		
	LTE Band 4 (AWS) (1712.5 - 1752.5 MHz)		
	LTE Band 2 (PCS) (1852.5 - 1907.5 MHz)		
Channel Bandwidths	LTE Band 13: 10 MHz		
	LTE Band 5 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz		
	LTE Band 4 (AWS): 5 MHz, 10 MHz, 15 MHz, 20 MHz		
	LTE Band 2 (PCS): 5 MHz, 10 MHz, 15 MHz, 20 MHz		
Channel Numbers and Frequencies (MHz)	Low	Mid	High
LTE Band 13: 10 MHz	782 (23230)	782 (23230)	782 (23230)
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): 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): 5 MHz	1852.5 (18625)	1880 (18900)	1907.5 (19175)
LTE Band 2 (PCS): 10 MHz	1855 (18650)	1880 (18900)	1905 (19150)
LTE Band 2 (PCS): 15 MHz	1857.5 (18675)	1880 (18900)	1902.5 (19125)
LTE Band 2 (PCS): 20 MHz	1860 (18700)	1880 (18900)	1900 (19100)
UE Category	3		
Modulations Supported in UL	QPSK, 16QAM		
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES		
A-MPR (Additional MPR) disabled for SAR Testing?	YES		

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 7 of 61

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/m³)
- 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]

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 8 of 61

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:

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.

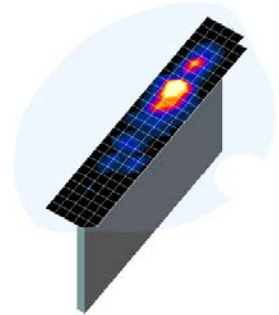


Figure 4-1
Sample SAR Area Scan

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		
				$\Delta z_{zoom}(n)$	$\Delta z_{zoom}(1)^*$	
≤ 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

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 9 of 61

5 SAR TESTING PROCEDURES

5.1 SAR Testing for Tablet per FCC 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.

5.2 Additional Test Positions due to Sensor Considerations

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

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 16 mm, a conservative distance of 15 mm was tested for SAR on the back side at maximum power. Since the capacitive proximity sensor activation distance for the top edge of the device is 17 mm, a conservative distance of 16 mm was tested for SAR on the top edge at maximum power. Since the capacitive proximity sensor activation distance for the right edge of the device is 6 mm, a conservative distance of 5 mm was tested for SAR on the right edge at maximum power. Sensor triggering distance summary data is included in Appendix G. The sensor does not trigger power reduction from the front of the device.

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

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 10 of 61

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 <i>General Population</i> (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT <i>Occupational</i> (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.

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 11 of 61

7 FCC MEASUREMENT PROCEDURES

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

7.1 Measured and Reported SAR

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

7.2 Procedures Used to Establish RF Signal for SAR

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

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

7.3 SAR Measurement Conditions for LTE

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

7.3.1 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.

7.3.2 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.

7.3.3 A-MPR

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

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet
		Page 12 of 61

7.3.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r01:

- a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
 - i. The required channel and offset combination with the highest maximum output power is required for SAR.
 - ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
 - iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.
- b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
- c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
- d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to $\frac{1}{2}$ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is < 1.45 W/kg.

7.4 SAR Testing with 802.11 Transmitters

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

7.4.1 General Device Setup

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

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 13 of 61

7.4.2 Frequency Channel Configurations [24]

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

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

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

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 14 of 61

8 RF CONDUCTED POWERS

8.1 Maximum Power LTE Conducted Powers

8.1.1 LTE Band 13

Table 8-1
LTE Band 13 Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	782.0	23230	10	QPSK	1	0	24.00	0	0
	782.0	23230	10	QPSK	1	25	24.14	0	0
	782.0	23230	10	QPSK	1	49	24.20	0	0
	782.0	23230	10	QPSK	25	0	23.01	0-1	1
	782.0	23230	10	QPSK	25	12	23.08	0-1	1
	782.0	23230	10	QPSK	25	25	23.16	0-1	1
	782.0	23230	10	QPSK	50	0	23.14	0-1	1
	782.0	23230	10	16QAM	1	0	23.20	0-1	1
	782.0	23230	10	16QAM	1	25	23.20	0-1	1
	782.0	23230	10	16QAM	1	49	23.19	0-1	1
	782.0	23230	10	16QAM	25	0	22.16	0-2	2
	782.0	23230	10	16QAM	25	12	22.13	0-2	2
	782.0	23230	10	16QAM	25	25	22.18	0-2	2
	782.0	23230	10	16QAM	50	0	22.15	0-2	2

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 15 of 61

8.1.2

LTE Band 5 (Cell)

Table 8-2

LTE Band 5 (Cell) Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	836.5	20525	10	QPSK	1	0	24.18	0	0
	836.5	20525	10	QPSK	1	25	24.08	0	0
	836.5	20525	10	QPSK	1	49	24.10	0	0
	836.5	20525	10	QPSK	25	0	23.13	0-1	1
	836.5	20525	10	QPSK	25	12	23.11	0-1	1
	836.5	20525	10	QPSK	25	25	23.18	0-1	1
	836.5	20525	10	QPSK	50	0	23.17	0-1	1
	836.5	20525	10	16QAM	1	0	23.18	0-1	1
	836.5	20525	10	16QAM	1	25	23.17	0-1	1
	836.5	20525	10	16QAM	1	49	23.13	0-1	1
	836.5	20525	10	16QAM	25	0	22.20	0-2	2
	836.5	20525	10	16QAM	25	12	22.15	0-2	2
	836.5	20525	10	16QAM	25	25	22.17	0-2	2
	836.5	20525	10	16QAM	50	0	22.19	0-2	2

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

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 16 of 61

Table 8-3
LTE Band 5 (Cell) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	826.5	20425	5	QPSK	1	0	24.19	0	0
	826.5	20425	5	QPSK	1	12	24.20	0	0
	826.5	20425	5	QPSK	1	24	24.18	0	0
	826.5	20425	5	QPSK	12	0	23.06	0-1	1
	826.5	20425	5	QPSK	12	6	23.15	0-1	1
	826.5	20425	5	QPSK	12	13	23.17	0-1	1
	826.5	20425	5	QPSK	25	0	23.19	0-1	1
	826.5	20425	5	16-QAM	1	0	23.20	0-1	1
	826.5	20425	5	16-QAM	1	12	23.16	0-1	1
	826.5	20425	5	16-QAM	1	24	23.16	0-1	1
	826.5	20425	5	16-QAM	12	0	22.16	0-2	2
	826.5	20425	5	16-QAM	12	6	22.05	0-2	2
	826.5	20425	5	16-QAM	12	13	22.11	0-2	2
	826.5	20425	5	16-QAM	25	0	22.16	0-2	2
Mid	836.5	20525	5	QPSK	1	0	24.19	0	0
	836.5	20525	5	QPSK	1	12	23.95	0	0
	836.5	20525	5	QPSK	1	24	24.13	0	0
	836.5	20525	5	QPSK	12	0	23.13	0-1	1
	836.5	20525	5	QPSK	12	6	23.10	0-1	1
	836.5	20525	5	QPSK	12	13	23.03	0-1	1
	836.5	20525	5	QPSK	25	0	23.19	0-1	1
	836.5	20525	5	16-QAM	1	0	23.12	0-1	1
	836.5	20525	5	16-QAM	1	12	23.19	0-1	1
	836.5	20525	5	16-QAM	1	24	23.11	0-1	1
	836.5	20525	5	16-QAM	12	0	22.09	0-2	2
	836.5	20525	5	16-QAM	12	6	22.15	0-2	2
	836.5	20525	5	16-QAM	12	13	22.18	0-2	2
	836.5	20525	5	16-QAM	25	0	22.12	0-2	2
High	846.5	20625	5	QPSK	1	0	23.80	0	0
	846.5	20625	5	QPSK	1	12	23.70	0	0
	846.5	20625	5	QPSK	1	24	23.81	0	0
	846.5	20625	5	QPSK	12	0	23.03	0-1	1
	846.5	20625	5	QPSK	12	6	23.13	0-1	1
	846.5	20625	5	QPSK	12	13	23.15	0-1	1
	846.5	20625	5	QPSK	25	0	23.19	0-1	1
	846.5	20625	5	16-QAM	1	0	23.09	0-1	1
	846.5	20625	5	16-QAM	1	12	22.95	0-1	1
	846.5	20625	5	16-QAM	1	24	22.90	0-1	1
	846.5	20625	5	16-QAM	12	0	22.04	0-2	2
	846.5	20625	5	16-QAM	12	6	22.01	0-2	2
	846.5	20625	5	16-QAM	12	13	22.16	0-2	2
	846.5	20625	5	16-QAM	25	0	22.12	0-2	2

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 17 of 61	

Table 8-4
LTE Band 5 (Cell) Conducted Powers - 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	825.5	20415	3	QPSK	1	0	24.03	0	0
	825.5	20415	3	QPSK	1	7	24.07	0	0
	825.5	20415	3	QPSK	1	14	24.00	0	0
	825.5	20415	3	QPSK	8	0	23.11	0-1	1
	825.5	20415	3	QPSK	8	4	23.09	0-1	1
	825.5	20415	3	QPSK	8	7	23.11	0-1	1
	825.5	20415	3	QPSK	15	0	23.02	0-1	1
	825.5	20415	3	16-QAM	1	0	23.12	0-1	1
	825.5	20415	3	16-QAM	1	7	22.94	0-1	1
	825.5	20415	3	16-QAM	1	14	23.14	0-1	1
	825.5	20415	3	16-QAM	8	0	22.05	0-2	2
	825.5	20415	3	16-QAM	8	4	21.98	0-2	2
	825.5	20415	3	16-QAM	8	7	22.07	0-2	2
	825.5	20415	3	16-QAM	15	0	22.20	0-2	2
Mid	836.5	20525	3	QPSK	1	0	24.02	0	0
	836.5	20525	3	QPSK	1	7	24.13	0	0
	836.5	20525	3	QPSK	1	14	24.10	0	0
	836.5	20525	3	QPSK	8	0	23.11	0-1	1
	836.5	20525	3	QPSK	8	4	23.09	0-1	1
	836.5	20525	3	QPSK	8	7	23.13	0-1	1
	836.5	20525	3	QPSK	15	0	23.18	0-1	1
	836.5	20525	3	16-QAM	1	0	23.20	0-1	1
	836.5	20525	3	16-QAM	1	7	23.13	0-1	1
	836.5	20525	3	16-QAM	1	14	23.19	0-1	1
	836.5	20525	3	16-QAM	8	0	22.04	0-2	2
	836.5	20525	3	16-QAM	8	4	22.04	0-2	2
	836.5	20525	3	16-QAM	8	7	22.15	0-2	2
	836.5	20525	3	16-QAM	15	0	22.19	0-2	2
High	847.5	20635	3	QPSK	1	0	24.08	0	0
	847.5	20635	3	QPSK	1	7	24.07	0	0
	847.5	20635	3	QPSK	1	14	24.04	0	0
	847.5	20635	3	QPSK	8	0	23.11	0-1	1
	847.5	20635	3	QPSK	8	4	23.08	0-1	1
	847.5	20635	3	QPSK	8	7	23.04	0-1	1
	847.5	20635	3	QPSK	15	0	23.02	0-1	1
	847.5	20635	3	16-QAM	1	0	23.02	0-1	1
	847.5	20635	3	16-QAM	1	7	23.00	0-1	1
	847.5	20635	3	16-QAM	1	14	22.96	0-1	1
	847.5	20635	3	16-QAM	8	0	22.07	0-2	2
	847.5	20635	3	16-QAM	8	4	22.02	0-2	2
	847.5	20635	3	16-QAM	8	7	22.05	0-2	2
	847.5	20635	3	16-QAM	15	0	22.16	0-2	2

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 18 of 61	

Table 8-5
LTE Band 5 (Cell) Conducted Powers -1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	824.7	20407	1.4	QPSK	1	0	24.19	0	0
	824.7	20407	1.4	QPSK	1	2	24.12	0	0
	824.7	20407	1.4	QPSK	1	5	24.17	0	0
	824.7	20407	1.4	QPSK	3	0	24.17	0	0
	824.7	20407	1.4	QPSK	3	2	24.18	0	0
	824.7	20407	1.4	QPSK	3	3	24.20	0	0
	824.7	20407	1.4	QPSK	6	0	23.18	0-1	1
	824.7	20407	1.4	16-QAM	1	0	22.89	0-1	1
	824.7	20407	1.4	16-QAM	1	2	22.87	0-1	1
	824.7	20407	1.4	16-QAM	1	5	22.94	0-1	1
	824.7	20407	1.4	16-QAM	3	0	23.04	0-1	1
	824.7	20407	1.4	16-QAM	3	2	23.07	0-1	1
	824.7	20407	1.4	16-QAM	3	3	23.17	0-1	1
	824.7	20407	1.4	16-QAM	6	0	22.19	0-2	2
Mid	836.5	20525	1.4	QPSK	1	0	24.15	0	0
	836.5	20525	1.4	QPSK	1	2	24.13	0	0
	836.5	20525	1.4	QPSK	1	5	24.17	0	0
	836.5	20525	1.4	QPSK	3	0	24.19	0	0
	836.5	20525	1.4	QPSK	3	2	24.06	0	0
	836.5	20525	1.4	QPSK	3	3	24.03	0	0
	836.5	20525	1.4	QPSK	6	0	23.13	0-1	1
	836.5	20525	1.4	16-QAM	1	0	23.11	0-1	1
	836.5	20525	1.4	16-QAM	1	2	23.19	0-1	1
	836.5	20525	1.4	16-QAM	1	5	23.03	0-1	1
	836.5	20525	1.4	16-QAM	3	0	23.03	0-1	1
	836.5	20525	1.4	16-QAM	3	2	23.09	0-1	1
	836.5	20525	1.4	16-QAM	3	3	23.04	0-1	1
	836.5	20525	1.4	16-QAM	6	0	22.18	0-2	2
High	848.3	20643	1.4	QPSK	1	0	24.16	0	0
	848.3	20643	1.4	QPSK	1	2	24.00	0	0
	848.3	20643	1.4	QPSK	1	5	24.15	0	0
	848.3	20643	1.4	QPSK	3	0	24.07	0	0
	848.3	20643	1.4	QPSK	3	2	24.10	0	0
	848.3	20643	1.4	QPSK	3	3	24.05	0	0
	848.3	20643	1.4	QPSK	6	0	23.01	0-1	1
	848.3	20643	1.4	16-QAM	1	0	23.13	0-1	1
	848.3	20643	1.4	16-QAM	1	2	23.16	0-1	1
	848.3	20643	1.4	16-QAM	1	5	23.20	0-1	1
	848.3	20643	1.4	16-QAM	3	0	23.19	0-1	1
	848.3	20643	1.4	16-QAM	3	2	22.87	0-1	1
	848.3	20643	1.4	16-QAM	3	3	23.08	0-1	1
	848.3	20643	1.4	16-QAM	6	0	22.05	0-2	2

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet
Page 19 of 61		

8.1.3

LTE Band 4 (AWS)

Table 8-6
LTE Band 4 (AWS) Conducted Powers - 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	1732.5	20175	20	QPSK	1	0	23.69	0	0
	1732.5	20175	20	QPSK	1	50	23.64	0	0
	1732.5	20175	20	QPSK	1	99	23.54	0	0
	1732.5	20175	20	QPSK	50	0	22.59	0-1	1
	1732.5	20175	20	QPSK	50	25	22.57	0-1	1
	1732.5	20175	20	QPSK	50	50	22.61	0-1	1
	1732.5	20175	20	QPSK	100	0	22.56	0-1	1
	1732.5	20175	20	16QAM	1	0	22.48	0-1	1
	1732.5	20175	20	16QAM	1	50	22.50	0-1	1
	1732.5	20175	20	16QAM	1	99	22.60	0-1	1
	1732.5	20175	20	16QAM	50	0	21.54	0-2	2
	1732.5	20175	20	16QAM	50	25	21.64	0-2	2
	1732.5	20175	20	16QAM	50	50	21.61	0-2	2
	1732.5	20175	20	16QAM	100	0	21.55	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.

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 20 of 61

Table 8-7
LTE Band 4 (AWS) Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1717.5	20025	15	QPSK	1	0	23.69	0	0
	1717.5	20025	15	QPSK	1	36	23.61	0	0
	1717.5	20025	15	QPSK	1	74	23.60	0	0
	1717.5	20025	15	QPSK	36	0	22.70	0-1	1
	1717.5	20025	15	QPSK	36	18	22.70	0-1	1
	1717.5	20025	15	QPSK	36	37	22.64	0-1	1
	1717.5	20025	15	QPSK	75	0	22.67	0-1	1
	1717.5	20025	15	16QAM	1	0	22.64	0-1	1
	1717.5	20025	15	16QAM	1	36	22.62	0-1	1
	1717.5	20025	15	16QAM	1	74	22.70	0-1	1
	1717.5	20025	15	16QAM	36	0	21.65	0-2	2
	1717.5	20025	15	16QAM	36	18	21.62	0-2	2
	1717.5	20025	15	16QAM	36	37	21.57	0-2	2
Mid	1732.5	20175	15	QPSK	1	0	23.40	0	0
	1732.5	20175	15	QPSK	1	36	23.58	0	0
	1732.5	20175	15	QPSK	1	74	23.63	0	0
	1732.5	20175	15	QPSK	36	0	22.55	0-1	1
	1732.5	20175	15	QPSK	36	18	22.54	0-1	1
	1732.5	20175	15	QPSK	36	37	22.59	0-1	1
	1732.5	20175	15	QPSK	75	0	22.57	0-1	1
	1732.5	20175	15	16QAM	1	0	22.70	0-1	1
	1732.5	20175	15	16QAM	1	36	22.34	0-1	1
	1732.5	20175	15	16QAM	1	74	22.39	0-1	1
	1732.5	20175	15	16QAM	36	0	21.45	0-2	2
	1732.5	20175	15	16QAM	36	18	21.51	0-2	2
	1732.5	20175	15	16QAM	36	37	21.62	0-2	2
	1732.5	20175	15	16QAM	75	0	21.59	0-2	2
High	1747.5	20325	15	QPSK	1	0	23.69	0	0
	1747.5	20325	15	QPSK	1	36	23.68	0	0
	1747.5	20325	15	QPSK	1	74	23.61	0	0
	1747.5	20325	15	QPSK	36	0	22.70	0-1	1
	1747.5	20325	15	QPSK	36	18	22.66	0-1	1
	1747.5	20325	15	QPSK	36	37	22.65	0-1	1
	1747.5	20325	15	QPSK	75	0	22.66	0-1	1
	1747.5	20325	15	16QAM	1	0	22.61	0-1	1
	1747.5	20325	15	16QAM	1	36	22.56	0-1	1
	1747.5	20325	15	16QAM	1	74	22.46	0-1	1
	1747.5	20325	15	16QAM	36	0	21.64	0-2	2
	1747.5	20325	15	16QAM	36	18	21.70	0-2	2
	1747.5	20325	15	16QAM	36	37	21.65	0-2	2
	1747.5	20325	15	16QAM	75	0	21.60	0-2	2

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet
Page 21 of 61		

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1715	20000	10	QPSK	1	0	23.67	0	0
	1715	20000	10	QPSK	1	25	23.64	0	0
	1715	20000	10	QPSK	1	49	23.59	0	0
	1715	20000	10	QPSK	25	0	22.69	0-1	1
	1715	20000	10	QPSK	25	12	22.64	0-1	1
	1715	20000	10	QPSK	25	25	22.65	0-1	1
	1715	20000	10	QPSK	50	0	22.65	0-1	1
	1715	20000	10	16QAM	1	0	22.70	0-1	1
	1715	20000	10	16QAM	1	25	22.69	0-1	1
	1715	20000	10	16QAM	1	49	22.68	0-1	1
	1715	20000	10	16QAM	25	0	21.70	0-2	2
	1715	20000	10	16QAM	25	12	21.69	0-2	2
	1715	20000	10	16QAM	25	25	21.59	0-2	2
Mid	1732.5	20175	10	QPSK	1	0	23.65	0	0
	1732.5	20175	10	QPSK	1	25	23.60	0	0
	1732.5	20175	10	QPSK	1	49	23.58	0	0
	1732.5	20175	10	QPSK	25	0	22.55	0-1	1
	1732.5	20175	10	QPSK	25	12	22.55	0-1	1
	1732.5	20175	10	QPSK	25	25	22.63	0-1	1
	1732.5	20175	10	QPSK	50	0	22.60	0-1	1
	1732.5	20175	10	16QAM	1	0	22.55	0-1	1
	1732.5	20175	10	16QAM	1	25	22.62	0-1	1
	1732.5	20175	10	16QAM	1	49	22.64	0-1	1
	1732.5	20175	10	16QAM	25	0	21.58	0-2	2
	1732.5	20175	10	16QAM	25	12	21.61	0-2	2
	1732.5	20175	10	16QAM	25	25	21.69	0-2	2
	1732.5	20175	10	16QAM	50	0	21.53	0-2	2
High	1750	20350	10	QPSK	1	0	23.67	0	0
	1750	20350	10	QPSK	1	25	23.63	0	0
	1750	20350	10	QPSK	1	49	23.56	0	0
	1750	20350	10	QPSK	25	0	22.60	0-1	1
	1750	20350	10	QPSK	25	12	22.58	0-1	1
	1750	20350	10	QPSK	25	25	22.66	0-1	1
	1750	20350	10	QPSK	50	0	22.63	0-1	1
	1750	20350	10	16QAM	1	0	22.58	0-1	1
	1750	20350	10	16QAM	1	25	22.53	0-1	1
	1750	20350	10	16QAM	1	49	22.41	0-1	1
	1750	20350	10	16QAM	25	0	21.54	0-2	2
	1750	20350	10	16QAM	25	12	21.52	0-2	2
	1750	20350	10	16QAM	25	25	21.53	0-2	2
	1750	20350	10	16QAM	50	0	21.60	0-2	2

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet

Table 8-9
LTE Band 4 (AWS) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1712.5	19975	5	QPSK	1	0	23.70	0	0
	1712.5	19975	5	QPSK	1	12	23.64	0	0
	1712.5	19975	5	QPSK	1	24	23.61	0	0
	1712.5	19975	5	QPSK	12	0	22.70	0-1	1
	1712.5	19975	5	QPSK	12	6	22.66	0-1	1
	1712.5	19975	5	QPSK	12	13	22.62	0-1	1
	1712.5	19975	5	QPSK	25	0	22.69	0-1	1
	1712.5	19975	5	16-QAM	1	0	22.67	0-1	1
	1712.5	19975	5	16-QAM	1	12	22.65	0-1	1
	1712.5	19975	5	16-QAM	1	24	22.62	0-1	1
	1712.5	19975	5	16-QAM	12	0	21.68	0-2	2
	1712.5	19975	5	16-QAM	12	6	21.64	0-2	2
	1712.5	19975	5	16-QAM	12	13	21.69	0-2	2
Mid	1732.5	20175	5	QPSK	1	0	23.60	0	0
	1732.5	20175	5	QPSK	1	12	23.53	0	0
	1732.5	20175	5	QPSK	1	24	23.38	0	0
	1732.5	20175	5	QPSK	12	0	22.53	0-1	1
	1732.5	20175	5	QPSK	12	6	22.57	0-1	1
	1732.5	20175	5	QPSK	12	13	22.51	0-1	1
	1732.5	20175	5	QPSK	25	0	22.61	0-1	1
	1732.5	20175	5	16-QAM	1	0	22.65	0-1	1
	1732.5	20175	5	16-QAM	1	12	22.58	0-1	1
	1732.5	20175	5	16-QAM	1	24	22.63	0-1	1
	1732.5	20175	5	16-QAM	12	0	21.51	0-2	2
	1732.5	20175	5	16-QAM	12	6	21.63	0-2	2
	1732.5	20175	5	16-QAM	12	13	21.48	0-2	2
	1732.5	20175	5	16-QAM	25	0	21.55	0-2	2
High	1752.5	20375	5	QPSK	1	0	23.43	0	0
	1752.5	20375	5	QPSK	1	12	23.39	0	0
	1752.5	20375	5	QPSK	1	24	23.57	0	0
	1752.5	20375	5	QPSK	12	0	22.56	0-1	1
	1752.5	20375	5	QPSK	12	6	22.59	0-1	1
	1752.5	20375	5	QPSK	12	13	22.53	0-1	1
	1752.5	20375	5	QPSK	25	0	22.58	0-1	1
	1752.5	20375	5	16-QAM	1	0	22.52	0-1	1
	1752.5	20375	5	16-QAM	1	12	22.46	0-1	1
	1752.5	20375	5	16-QAM	1	24	22.57	0-1	1
	1752.5	20375	5	16-QAM	12	0	21.52	0-2	2
	1752.5	20375	5	16-QAM	12	6	21.48	0-2	2
	1752.5	20375	5	16-QAM	12	13	21.43	0-2	2
	1752.5	20375	5	16-QAM	25	0	21.53	0-2	2

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet

8.1.4

LTE Band 2 (PCS)

Table 8-10
LTE Band 2 (PCS) Conducted Powers - 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1860	18700	20	QPSK	1	0	23.26	0	0
	1860	18700	20	QPSK	1	50	23.46	0	0
	1860	18700	20	QPSK	1	99	23.52	0	0
	1860	18700	20	QPSK	50	0	22.68	0-1	1
	1860	18700	20	QPSK	50	25	22.69	0-1	1
	1860	18700	20	QPSK	50	50	22.57	0-1	1
	1860	18700	20	QPSK	100	0	22.57	0-1	1
	1860	18700	20	16QAM	1	0	22.65	0-1	1
	1860	18700	20	16QAM	1	50	22.34	0-1	1
	1860	18700	20	16QAM	1	99	22.42	0-1	1
	1860	18700	20	16QAM	50	0	21.70	0-2	2
	1860	18700	20	16QAM	50	25	21.67	0-2	2
	1860	18700	20	16QAM	50	50	21.67	0-2	2
	1860	18700	20	16QAM	100	0	21.62	0-2	2
Mid	1880.0	18900	20	QPSK	1	0	23.40	0	0
	1880.0	18900	20	QPSK	1	50	23.70	0	0
	1880.0	18900	20	QPSK	1	99	23.65	0	0
	1880.0	18900	20	QPSK	50	0	22.70	0-1	1
	1880.0	18900	20	QPSK	50	25	22.64	0-1	1
	1880.0	18900	20	QPSK	50	50	22.57	0-1	1
	1880.0	18900	20	QPSK	100	0	22.64	0-1	1
	1880.0	18900	20	16QAM	1	0	22.70	0-1	1
	1880.0	18900	20	16QAM	1	50	22.65	0-1	1
	1880.0	18900	20	16QAM	1	99	22.66	0-1	1
	1880.0	18900	20	16QAM	50	0	21.54	0-2	2
	1880.0	18900	20	16QAM	50	25	21.55	0-2	2
	1880.0	18900	20	16QAM	50	50	21.56	0-2	2
	1880.0	18900	20	16QAM	100	0	21.65	0-2	2
High	1900	19100	20	QPSK	1	0	23.29	0	0
	1900	19100	20	QPSK	1	50	23.58	0	0
	1900	19100	20	QPSK	1	99	23.48	0	0
	1900	19100	20	QPSK	50	0	22.69	0-1	1
	1900	19100	20	QPSK	50	25	22.50	0-1	1
	1900	19100	20	QPSK	50	50	22.49	0-1	1
	1900	19100	20	QPSK	100	0	22.49	0-1	1
	1900	19100	20	16QAM	1	0	22.68	0-1	1
	1900	19100	20	16QAM	1	50	22.68	0-1	1
	1900	19100	20	16QAM	1	99	22.69	0-1	1
	1900	19100	20	16QAM	50	0	21.44	0-2	2
	1900	19100	20	16QAM	50	25	21.43	0-2	2
	1900	19100	20	16QAM	50	50	21.42	0-2	2
	1900	19100	20	16QAM	100	0	21.48	0-2	2

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 24 of 61	

Table 8-11
LTE Band 2 (PCS) Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1857.5	18675	15	QPSK	1	0	23.45	0	0
	1857.5	18675	15	QPSK	1	36	23.59	0	0
	1857.5	18675	15	QPSK	1	74	23.70	0	0
	1857.5	18675	15	QPSK	36	0	22.67	0-1	1
	1857.5	18675	15	QPSK	36	18	22.65	0-1	1
	1857.5	18675	15	QPSK	36	37	22.68	0-1	1
	1857.5	18675	15	QPSK	75	0	22.65	0-1	1
	1857.5	18675	15	16QAM	1	0	22.61	0-1	1
	1857.5	18675	15	16QAM	1	36	22.70	0-1	1
	1857.5	18675	15	16QAM	1	74	22.68	0-1	1
	1857.5	18675	15	16QAM	36	0	21.61	0-2	2
	1857.5	18675	15	16QAM	36	18	21.64	0-2	2
Mid	1857.5	18675	15	16QAM	36	37	21.68	0-2	2
	1857.5	18675	15	16QAM	75	0	21.69	0-2	2
	1880.0	18900	15	QPSK	1	0	23.27	0	0
	1880.0	18900	15	QPSK	1	36	23.53	0	0
	1880.0	18900	15	QPSK	1	74	23.66	0	0
	1880.0	18900	15	QPSK	36	0	22.51	0-1	1
	1880.0	18900	15	QPSK	36	18	22.53	0-1	1
	1880.0	18900	15	QPSK	36	37	22.58	0-1	1
	1880.0	18900	15	QPSK	75	0	22.65	0-1	1
	1880.0	18900	15	16QAM	1	0	22.69	0-1	1
	1880.0	18900	15	16QAM	1	36	22.55	0-1	1
	1880.0	18900	15	16QAM	1	74	22.66	0-1	1
High	1880.0	18900	15	16QAM	36	0	21.70	0-2	2
	1880.0	18900	15	16QAM	36	18	21.50	0-2	2
	1880.0	18900	15	16QAM	36	37	21.50	0-2	2
	1880.0	18900	15	16QAM	75	0	21.58	0-2	2
	1902.5	19125	15	QPSK	1	0	23.44	0	0
	1902.5	19125	15	QPSK	1	36	23.57	0	0
	1902.5	19125	15	QPSK	1	74	23.59	0	0
	1902.5	19125	15	QPSK	36	0	22.47	0-1	1
	1902.5	19125	15	QPSK	36	18	22.52	0-1	1
	1902.5	19125	15	QPSK	36	37	22.56	0-1	1
	1902.5	19125	15	QPSK	75	0	22.65	0-1	1
	1902.5	19125	15	16QAM	1	0	22.66	0-1	1
	1902.5	19125	15	16QAM	1	36	22.70	0-1	1
	1902.5	19125	15	16QAM	1	74	22.65	0-1	1
	1902.5	19125	15	16QAM	36	0	21.47	0-2	2
	1902.5	19125	15	16QAM	36	18	21.45	0-2	2
	1902.5	19125	15	16QAM	36	37	21.60	0-2	2
	1902.5	19125	15	16QAM	75	0	21.61	0-2	2

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet
Page 25 of 61		

Table 8-12
LTE Band 2 (PCS) Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1855	18650	10	QPSK	1	0	23.56	0	0
	1855	18650	10	QPSK	1	25	23.70	0	0
	1855	18650	10	QPSK	1	49	23.70	0	0
	1855	18650	10	QPSK	25	0	22.64	0-1	1
	1855	18650	10	QPSK	25	12	22.63	0-1	1
	1855	18650	10	QPSK	25	25	22.66	0-1	1
	1855	18650	10	QPSK	50	0	22.66	0-1	1
	1855	18650	10	16QAM	1	0	22.53	0-1	1
	1855	18650	10	16QAM	1	25	22.68	0-1	1
	1855	18650	10	16QAM	1	49	22.70	0-1	1
	1855	18650	10	16QAM	25	0	21.62	0-2	2
	1855	18650	10	16QAM	25	12	21.64	0-2	2
Mid	1855	18650	10	16QAM	25	25	21.62	0-2	2
	1855	18650	10	16QAM	50	0	21.66	0-2	2
	1880.0	18900	10	QPSK	1	0	23.53	0	0
	1880.0	18900	10	QPSK	1	25	23.54	0	0
	1880.0	18900	10	QPSK	1	49	23.58	0	0
	1880.0	18900	10	QPSK	25	0	22.53	0-1	1
	1880.0	18900	10	QPSK	25	12	22.54	0-1	1
	1880.0	18900	10	QPSK	25	25	22.57	0-1	1
	1880.0	18900	10	QPSK	50	0	22.62	0-1	1
	1880.0	18900	10	16QAM	1	0	22.70	0-1	1
	1880.0	18900	10	16QAM	1	25	22.61	0-1	1
	1880.0	18900	10	16QAM	1	49	22.64	0-1	1
High	1880.0	18900	10	16QAM	25	0	21.61	0-2	2
	1880.0	18900	10	16QAM	25	12	21.56	0-2	2
	1880.0	18900	10	16QAM	25	25	21.55	0-2	2
	1880.0	18900	10	16QAM	50	0	21.60	0-2	2
	1905	19150	10	QPSK	1	0	23.51	0	0
	1905	19150	10	QPSK	1	25	23.56	0	0
	1905	19150	10	QPSK	1	49	23.52	0	0
	1905	19150	10	QPSK	25	0	22.62	0-1	1
	1905	19150	10	QPSK	25	12	22.58	0-1	1
	1905	19150	10	QPSK	25	25	22.58	0-1	1
	1905	19150	10	QPSK	50	0	22.54	0-1	1
	1905	19150	10	16QAM	1	0	22.70	0-1	1
	1905	19150	10	16QAM	1	25	22.69	0-1	1
	1905	19150	10	16QAM	1	49	22.70	0-1	1
	1905	19150	10	16QAM	25	0	21.63	0-2	2
	1905	19150	10	16QAM	25	12	21.67	0-2	2
	1905	19150	10	16QAM	25	25	21.66	0-2	2
	1905	19150	10	16QAM	50	0	21.55	0-2	2

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 26 of 61	

Table 8-13
LTE Band 2 (PCS) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1852.5	18625	5	QPSK	1	0	23.30	0	0
	1852.5	18625	5	QPSK	1	12	23.49	0	0
	1852.5	18625	5	QPSK	1	24	23.53	0	0
	1852.5	18625	5	QPSK	12	0	22.62	0-1	1
	1852.5	18625	5	QPSK	12	6	22.54	0-1	1
	1852.5	18625	5	QPSK	12	13	22.62	0-1	1
	1852.5	18625	5	QPSK	25	0	22.60	0-1	1
	1852.5	18625	5	16-QAM	1	0	22.62	0-1	1
	1852.5	18625	5	16-QAM	1	12	22.70	0-1	1
	1852.5	18625	5	16-QAM	1	24	22.68	0-1	1
	1852.5	18625	5	16-QAM	12	0	21.59	0-2	2
	1852.5	18625	5	16-QAM	12	6	21.51	0-2	2
Mid	1852.5	18625	5	16-QAM	12	13	21.56	0-2	2
	1852.5	18625	5	16-QAM	25	0	21.53	0-2	2
	1880.0	18900	5	QPSK	1	0	23.58	0	0
	1880.0	18900	5	QPSK	1	12	23.58	0	0
	1880.0	18900	5	QPSK	1	24	23.60	0	0
	1880.0	18900	5	QPSK	12	0	22.59	0-1	1
	1880.0	18900	5	QPSK	12	6	22.50	0-1	1
	1880.0	18900	5	QPSK	12	13	22.54	0-1	1
	1880.0	18900	5	QPSK	25	0	22.59	0-1	1
	1880.0	18900	5	16-QAM	1	0	22.61	0-1	1
	1880.0	18900	5	16-QAM	1	12	22.55	0-1	1
	1880.0	18900	5	16-QAM	1	24	22.63	0-1	1
High	1880.0	18900	5	16-QAM	12	0	21.70	0-2	2
	1880.0	18900	5	16-QAM	12	6	21.50	0-2	2
	1880.0	18900	5	16-QAM	12	13	21.56	0-2	2
	1880.0	18900	5	16-QAM	25	0	21.55	0-2	2
	1907.5	19175	5	QPSK	1	0	23.32	0	0
	1907.5	19175	5	QPSK	1	12	23.36	0	0
	1907.5	19175	5	QPSK	1	24	23.21	0	0
	1907.5	19175	5	QPSK	12	0	22.60	0-1	1
	1907.5	19175	5	QPSK	12	6	22.55	0-1	1
	1907.5	19175	5	QPSK	12	13	22.53	0-1	1
	1907.5	19175	5	QPSK	25	0	22.56	0-1	1
	1907.5	19175	5	16-QAM	1	0	22.46	0-1	1
	1907.5	19175	5	16-QAM	1	12	22.50	0-1	1
	1907.5	19175	5	16-QAM	1	24	22.38	0-1	1
	1907.5	19175	5	16-QAM	12	0	21.53	0-2	2
	1907.5	19175	5	16-QAM	12	6	21.52	0-2	2
	1907.5	19175	5	16-QAM	12	13	21.48	0-2	2
	1907.5	19175	5	16-QAM	25	0	21.52	0-2	2

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet
Page 27 of 61		

8.2 Reduced Power LTE Conducted Powers

8.2.1 LTE Band 13

Table 8-14
LTE Band 13 Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	782.0	23230	10	QPSK	1	0	18.20	0	0
	782.0	23230	10	QPSK	1	25	18.00	0	0
	782.0	23230	10	QPSK	1	49	18.18	0	0
	782.0	23230	10	QPSK	25	0	18.07	0-1	0
	782.0	23230	10	QPSK	25	12	18.02	0-1	0
	782.0	23230	10	QPSK	25	25	18.10	0-1	0
	782.0	23230	10	QPSK	50	0	18.00	0-1	0
	782.0	23230	10	16QAM	1	0	18.20	0-1	0
	782.0	23230	10	16QAM	1	25	18.20	0-1	0
	782.0	23230	10	16QAM	1	49	18.19	0-1	0
	782.0	23230	10	16QAM	25	0	18.03	0-2	0
	782.0	23230	10	16QAM	25	12	18.02	0-2	0
	782.0	23230	10	16QAM	25	25	18.02	0-2	0
	782.0	23230	10	16QAM	50	0	18.06	0-2	0

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 28 of 61

8.2.2

LTE Band 5 (Cell)

Table 8-15

LTE Band 5 (Cell) Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	836.5	20525	10	QPSK	1	0	18.01	0	0
	836.5	20525	10	QPSK	1	25	17.96	0	0
	836.5	20525	10	QPSK	1	49	18.06	0	0
	836.5	20525	10	QPSK	25	0	18.04	0-1	0
	836.5	20525	10	QPSK	25	12	18.07	0-1	0
	836.5	20525	10	QPSK	25	25	18.03	0-1	0
	836.5	20525	10	QPSK	50	0	18.05	0-1	0
	836.5	20525	10	16QAM	1	0	18.04	0-1	0
	836.5	20525	10	16QAM	1	25	18.18	0-1	0
	836.5	20525	10	16QAM	1	49	18.19	0-1	0
	836.5	20525	10	16QAM	25	0	18.10	0-2	0
	836.5	20525	10	16QAM	25	12	18.08	0-2	0
	836.5	20525	10	16QAM	25	25	18.00	0-2	0
	836.5	20525	10	16QAM	50	0	18.03	0-2	0

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

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 29 of 61

Table 8-16
LTE Band 5 (Cell) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	826.5	20425	5	QPSK	1	0	18.01	0	0
	826.5	20425	5	QPSK	1	12	17.92	0	0
	826.5	20425	5	QPSK	1	24	17.99	0	0
	826.5	20425	5	QPSK	12	0	17.93	0-1	0
	826.5	20425	5	QPSK	12	6	17.98	0-1	0
	826.5	20425	5	QPSK	12	13	17.94	0-1	0
	826.5	20425	5	QPSK	25	0	17.95	0-1	0
	826.5	20425	5	16-QAM	1	0	17.92	0-1	0
	826.5	20425	5	16-QAM	1	12	17.93	0-1	0
	826.5	20425	5	16-QAM	1	24	18.07	0-1	0
	826.5	20425	5	16-QAM	12	0	17.98	0-2	0
	826.5	20425	5	16-QAM	12	6	17.96	0-2	0
	826.5	20425	5	16-QAM	12	13	17.93	0-2	0
	826.5	20425	5	16-QAM	25	0	18.00	0-2	0
Mid	836.5	20525	5	QPSK	1	0	17.81	0	0
	836.5	20525	5	QPSK	1	12	17.80	0	0
	836.5	20525	5	QPSK	1	24	17.86	0	0
	836.5	20525	5	QPSK	12	0	18.03	0-1	0
	836.5	20525	5	QPSK	12	6	18.04	0-1	0
	836.5	20525	5	QPSK	12	13	17.97	0-1	0
	836.5	20525	5	QPSK	25	0	18.05	0-1	0
	836.5	20525	5	16-QAM	1	0	18.03	0-1	0
	836.5	20525	5	16-QAM	1	12	18.05	0-1	0
	836.5	20525	5	16-QAM	1	24	18.11	0-1	0
	836.5	20525	5	16-QAM	12	0	18.00	0-2	0
	836.5	20525	5	16-QAM	12	6	17.97	0-2	0
	836.5	20525	5	16-QAM	12	13	17.89	0-2	0
	836.5	20525	5	16-QAM	25	0	18.04	0-2	0
High	846.5	20625	5	QPSK	1	0	18.04	0	0
	846.5	20625	5	QPSK	1	12	18.06	0	0
	846.5	20625	5	QPSK	1	24	18.01	0	0
	846.5	20625	5	QPSK	12	0	18.02	0-1	0
	846.5	20625	5	QPSK	12	6	18.01	0-1	0
	846.5	20625	5	QPSK	12	13	18.06	0-1	0
	846.5	20625	5	QPSK	25	0	17.93	0-1	0
	846.5	20625	5	16-QAM	1	0	18.15	0-1	0
	846.5	20625	5	16-QAM	1	12	18.05	0-1	0
	846.5	20625	5	16-QAM	1	24	17.93	0-1	0
	846.5	20625	5	16-QAM	12	0	18.10	0-2	0
	846.5	20625	5	16-QAM	12	6	17.95	0-2	0
	846.5	20625	5	16-QAM	12	13	18.04	0-2	0
	846.5	20625	5	16-QAM	25	0	18.06	0-2	0

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 30 of 61	

Table 8-17
LTE Band 5 (Cell) Conducted Powers - 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	825.5	20415	3	QPSK	1	0	18.04	0	0
	825.5	20415	3	QPSK	1	7	18.13	0	0
	825.5	20415	3	QPSK	1	14	18.05	0	0
	825.5	20415	3	QPSK	8	0	18.05	0-1	0
	825.5	20415	3	QPSK	8	4	18.07	0-1	0
	825.5	20415	3	QPSK	8	7	18.02	0-1	0
	825.5	20415	3	QPSK	15	0	18.04	0-1	0
	825.5	20415	3	16-QAM	1	0	18.01	0-1	0
	825.5	20415	3	16-QAM	1	7	18.12	0-1	0
	825.5	20415	3	16-QAM	1	14	18.20	0-1	0
	825.5	20415	3	16-QAM	8	0	18.08	0-2	0
	825.5	20415	3	16-QAM	8	4	18.01	0-2	0
	825.5	20415	3	16-QAM	8	7	18.02	0-2	0
	825.5	20415	3	16-QAM	15	0	18.00	0-2	0
Mid	836.5	20525	3	QPSK	1	0	18.12	0	0
	836.5	20525	3	QPSK	1	7	18.10	0	0
	836.5	20525	3	QPSK	1	14	18.12	0	0
	836.5	20525	3	QPSK	8	0	18.11	0-1	0
	836.5	20525	3	QPSK	8	4	18.00	0-1	0
	836.5	20525	3	QPSK	8	7	17.96	0-1	0
	836.5	20525	3	QPSK	15	0	17.94	0-1	0
	836.5	20525	3	16-QAM	1	0	18.19	0-1	0
	836.5	20525	3	16-QAM	1	7	17.99	0-1	0
	836.5	20525	3	16-QAM	1	14	18.20	0-1	0
	836.5	20525	3	16-QAM	8	0	18.18	0-2	0
	836.5	20525	3	16-QAM	8	4	18.11	0-2	0
	836.5	20525	3	16-QAM	8	7	18.09	0-2	0
	836.5	20525	3	16-QAM	15	0	18.10	0-2	0
High	847.5	20635	3	QPSK	1	0	18.09	0	0
	847.5	20635	3	QPSK	1	7	18.02	0	0
	847.5	20635	3	QPSK	1	14	18.02	0	0
	847.5	20635	3	QPSK	8	0	17.95	0-1	0
	847.5	20635	3	QPSK	8	4	18.10	0-1	0
	847.5	20635	3	QPSK	8	7	18.06	0-1	0
	847.5	20635	3	QPSK	15	0	17.94	0-1	0
	847.5	20635	3	16-QAM	1	0	18.06	0-1	0
	847.5	20635	3	16-QAM	1	7	18.01	0-1	0
	847.5	20635	3	16-QAM	1	14	18.13	0-1	0
	847.5	20635	3	16-QAM	8	0	17.91	0-2	0
	847.5	20635	3	16-QAM	8	4	18.04	0-2	0
	847.5	20635	3	16-QAM	8	7	17.99	0-2	0
	847.5	20635	3	16-QAM	15	0	18.03	0-2	0

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 31 of 61	

Table 8-18
LTE Band 5 (Cell) Conducted Powers -1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	824.7	20407	1.4	QPSK	1	0	18.17	0	0
	824.7	20407	1.4	QPSK	1	2	18.16	0	0
	824.7	20407	1.4	QPSK	1	5	18.15	0	0
	824.7	20407	1.4	QPSK	3	0	18.04	0	0
	824.7	20407	1.4	QPSK	3	2	18.06	0	0
	824.7	20407	1.4	QPSK	3	3	18.05	0	0
	824.7	20407	1.4	QPSK	6	0	18.09	0-1	0
	824.7	20407	1.4	16-QAM	1	0	18.13	0-1	0
	824.7	20407	1.4	16-QAM	1	2	18.08	0-1	0
	824.7	20407	1.4	16-QAM	1	5	18.02	0-1	0
	824.7	20407	1.4	16-QAM	3	0	18.01	0-1	0
	824.7	20407	1.4	16-QAM	3	2	18.03	0-1	0
	824.7	20407	1.4	16-QAM	3	3	18.00	0-1	0
Mid	824.7	20407	1.4	16-QAM	6	0	18.19	0-2	0
	836.5	20525	1.4	QPSK	1	0	18.20	0	0
	836.5	20525	1.4	QPSK	1	2	18.17	0	0
	836.5	20525	1.4	QPSK	1	5	18.07	0	0
	836.5	20525	1.4	QPSK	3	0	18.01	0	0
	836.5	20525	1.4	QPSK	3	2	18.08	0	0
	836.5	20525	1.4	QPSK	3	3	17.99	0	0
	836.5	20525	1.4	QPSK	6	0	18.03	0-1	0
	836.5	20525	1.4	16-QAM	1	0	18.17	0-1	0
	836.5	20525	1.4	16-QAM	1	2	18.20	0-1	0
	836.5	20525	1.4	16-QAM	1	5	18.12	0-1	0
	836.5	20525	1.4	16-QAM	3	0	18.12	0-1	0
	836.5	20525	1.4	16-QAM	3	2	18.06	0-1	0
	836.5	20525	1.4	16-QAM	3	3	17.97	0-1	0
High	836.5	20525	1.4	16-QAM	6	0	18.14	0-2	0
	848.3	20643	1.4	QPSK	1	0	18.15	0	0
	848.3	20643	1.4	QPSK	1	2	18.08	0	0
	848.3	20643	1.4	QPSK	1	5	18.01	0	0
	848.3	20643	1.4	QPSK	3	0	18.06	0	0
	848.3	20643	1.4	QPSK	3	2	18.05	0	0
	848.3	20643	1.4	QPSK	3	3	17.96	0	0
	848.3	20643	1.4	QPSK	6	0	17.99	0-1	0
	848.3	20643	1.4	16-QAM	1	0	18.00	0-1	0
	848.3	20643	1.4	16-QAM	1	2	17.93	0-1	0
	848.3	20643	1.4	16-QAM	1	5	17.96	0-1	0
	848.3	20643	1.4	16-QAM	3	0	18.00	0-1	0
	848.3	20643	1.4	16-QAM	3	2	17.93	0-1	0
	848.3	20643	1.4	16-QAM	3	3	17.97	0-1	0
	848.3	20643	1.4	16-QAM	6	0	18.05	0-2	0

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 32 of 61	

8.2.3

LTE Band 4 (AWS)

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	1732.5	20175	20	QPSK	1	0	13.39	0	0
	1732.5	20175	20	QPSK	1	50	13.41	0	0
	1732.5	20175	20	QPSK	1	99	13.37	0	0
	1732.5	20175	20	QPSK	50	0	13.31	0-1	0
	1732.5	20175	20	QPSK	50	25	13.36	0-1	0
	1732.5	20175	20	QPSK	50	50	13.32	0-1	0
	1732.5	20175	20	QPSK	100	0	13.35	0-1	0
	1732.5	20175	20	16QAM	1	0	13.41	0-1	0
	1732.5	20175	20	16QAM	1	50	13.42	0-1	0
	1732.5	20175	20	16QAM	1	99	13.31	0-1	0
	1732.5	20175	20	16QAM	50	0	13.28	0-2	0
	1732.5	20175	20	16QAM	50	25	13.29	0-2	0
	1732.5	20175	20	16QAM	50	50	13.26	0-2	0
	1732.5	20175	20	16QAM	100	0	13.35	0-2	0

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.

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 33 of 61

Table 8-20
LTE Band 4 (AWS) Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1717.5	20025	15	QPSK	1	0	13.40	0	0
	1717.5	20025	15	QPSK	1	36	13.49	0	0
	1717.5	20025	15	QPSK	1	74	13.49	0	0
	1717.5	20025	15	QPSK	36	0	13.40	0-1	0
	1717.5	20025	15	QPSK	36	18	13.39	0-1	0
	1717.5	20025	15	QPSK	36	37	13.41	0-1	0
	1717.5	20025	15	QPSK	75	0	13.42	0-1	0
	1717.5	20025	15	16QAM	1	0	13.44	0-1	0
	1717.5	20025	15	16QAM	1	36	13.52	0-1	0
	1717.5	20025	15	16QAM	1	74	13.53	0-1	0
	1717.5	20025	15	16QAM	36	0	13.47	0-2	0
	1717.5	20025	15	16QAM	36	18	13.42	0-2	0
Mid	1717.5	20025	15	16QAM	36	37	13.41	0-2	0
	1717.5	20025	15	16QAM	75	0	13.40	0-2	0
	1732.5	20175	15	QPSK	1	0	13.29	0	0
	1732.5	20175	15	QPSK	1	36	13.25	0	0
	1732.5	20175	15	QPSK	1	74	13.22	0	0
	1732.5	20175	15	QPSK	36	0	13.32	0-1	0
	1732.5	20175	15	QPSK	36	18	13.29	0-1	0
	1732.5	20175	15	QPSK	36	37	13.34	0-1	0
	1732.5	20175	15	QPSK	75	0	13.39	0-1	0
	1732.5	20175	15	16QAM	1	0	13.46	0-1	0
	1732.5	20175	15	16QAM	1	36	13.45	0-1	0
	1732.5	20175	15	16QAM	1	74	13.34	0-1	0
High	1732.5	20175	15	16QAM	36	0	13.28	0-2	0
	1732.5	20175	15	16QAM	36	18	13.24	0-2	0
	1732.5	20175	15	16QAM	36	37	13.30	0-2	0
	1732.5	20175	15	16QAM	75	0	13.44	0-2	0
	1747.5	20325	15	QPSK	1	0	13.22	0	0
	1747.5	20325	15	QPSK	1	36	13.22	0	0
	1747.5	20325	15	QPSK	1	74	13.18	0	0
	1747.5	20325	15	QPSK	36	0	13.22	0-1	0
	1747.5	20325	15	QPSK	36	18	13.25	0-1	0
	1747.5	20325	15	QPSK	36	37	13.21	0-1	0
	1747.5	20325	15	QPSK	75	0	13.24	0-1	0
	1747.5	20325	15	16QAM	1	0	13.37	0-1	0
	1747.5	20325	15	16QAM	1	36	13.56	0-1	0
	1747.5	20325	15	16QAM	1	74	13.51	0-1	0
	1747.5	20325	15	16QAM	36	0	13.28	0-2	0
	1747.5	20325	15	16QAM	36	18	13.25	0-2	0
	1747.5	20325	15	16QAM	36	37	13.23	0-2	0
	1747.5	20325	15	16QAM	75	0	13.34	0-2	0

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 34 of 61	

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1715	20000	10	QPSK	1	0	13.43	0	0
	1715	20000	10	QPSK	1	25	13.44	0	0
	1715	20000	10	QPSK	1	49	13.36	0	0
	1715	20000	10	QPSK	25	0	13.42	0-1	0
	1715	20000	10	QPSK	25	12	13.43	0-1	0
	1715	20000	10	QPSK	25	25	13.42	0-1	0
	1715	20000	10	QPSK	50	0	13.44	0-1	0
	1715	20000	10	16QAM	1	0	13.48	0-1	0
	1715	20000	10	16QAM	1	25	13.48	0-1	0
	1715	20000	10	16QAM	1	49	13.38	0-1	0
	1715	20000	10	16QAM	25	0	13.47	0-2	0
	1715	20000	10	16QAM	25	12	13.49	0-2	0
Mid	1715	20000	10	16QAM	25	25	13.47	0-2	0
	1715	20000	10	16QAM	50	0	13.45	0-2	0
	1732.5	20175	10	QPSK	1	0	13.34	0	0
	1732.5	20175	10	QPSK	1	25	13.40	0	0
	1732.5	20175	10	QPSK	1	49	13.34	0	0
	1732.5	20175	10	QPSK	25	0	13.38	0-1	0
	1732.5	20175	10	QPSK	25	12	13.39	0-1	0
	1732.5	20175	10	QPSK	25	25	13.40	0-1	0
	1732.5	20175	10	QPSK	50	0	13.38	0-1	0
	1732.5	20175	10	16QAM	1	0	13.43	0-1	0
	1732.5	20175	10	16QAM	1	25	13.43	0-1	0
	1732.5	20175	10	16QAM	1	49	13.45	0-1	0
High	1732.5	20175	10	16QAM	25	0	13.41	0-2	0
	1732.5	20175	10	16QAM	25	12	13.29	0-2	0
	1732.5	20175	10	16QAM	25	25	13.38	0-2	0
	1732.5	20175	10	16QAM	50	0	13.41	0-2	0
	1750	20350	10	QPSK	1	0	13.20	0	0
	1750	20350	10	QPSK	1	25	13.22	0	0
	1750	20350	10	QPSK	1	49	13.21	0	0
	1750	20350	10	QPSK	25	0	13.30	0-1	0
	1750	20350	10	QPSK	25	12	13.25	0-1	0
	1750	20350	10	QPSK	25	25	13.24	0-1	0
	1750	20350	10	QPSK	50	0	13.26	0-1	0
	1750	20350	10	16QAM	1	0	13.35	0-1	0
	1750	20350	10	16QAM	1	25	13.61	0-1	0
	1750	20350	10	16QAM	1	49	13.57	0-1	0
	1750	20350	10	16QAM	25	0	13.30	0-2	0
	1750	20350	10	16QAM	25	12	13.25	0-2	0
	1750	20350	10	16QAM	25	25	13.33	0-2	0
	1750	20350	10	16QAM	50	0	13.29	0-2	0

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet
Page 35 of 61		

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1712.5	19975	5	QPSK	1	0	13.48	0	0
	1712.5	19975	5	QPSK	1	12	13.40	0	0
	1712.5	19975	5	QPSK	1	24	13.41	0	0
	1712.5	19975	5	QPSK	12	0	13.48	0-1	0
	1712.5	19975	5	QPSK	12	6	13.47	0-1	0
	1712.5	19975	5	QPSK	12	13	13.45	0-1	0
	1712.5	19975	5	QPSK	25	0	13.41	0-1	0
	1712.5	19975	5	16-QAM	1	0	13.47	0-1	0
	1712.5	19975	5	16-QAM	1	12	13.47	0-1	0
	1712.5	19975	5	16-QAM	1	24	13.52	0-1	0
	1712.5	19975	5	16-QAM	12	0	13.48	0-2	0
	1712.5	19975	5	16-QAM	12	6	13.42	0-2	0
	1712.5	19975	5	16-QAM	12	13	13.46	0-2	0
Mid	1732.5	20175	5	QPSK	1	0	13.20	0	0
	1732.5	20175	5	QPSK	1	12	13.20	0	0
	1732.5	20175	5	QPSK	1	24	13.21	0	0
	1732.5	20175	5	QPSK	12	0	13.28	0-1	0
	1732.5	20175	5	QPSK	12	6	13.34	0-1	0
	1732.5	20175	5	QPSK	12	13	13.34	0-1	0
	1732.5	20175	5	QPSK	25	0	13.33	0-1	0
	1732.5	20175	5	16-QAM	1	0	13.33	0-1	0
	1732.5	20175	5	16-QAM	1	12	13.33	0-1	0
	1732.5	20175	5	16-QAM	1	24	13.23	0-1	0
	1732.5	20175	5	16-QAM	12	0	13.23	0-2	0
	1732.5	20175	5	16-QAM	12	6	13.28	0-2	0
	1732.5	20175	5	16-QAM	12	13	13.29	0-2	0
	1732.5	20175	5	16-QAM	25	0	13.33	0-2	0
High	1752.5	20375	5	QPSK	1	0	13.28	0	0
	1752.5	20375	5	QPSK	1	12	13.21	0	0
	1752.5	20375	5	QPSK	1	24	13.24	0	0
	1752.5	20375	5	QPSK	12	0	13.22	0-1	0
	1752.5	20375	5	QPSK	12	6	13.20	0-1	0
	1752.5	20375	5	QPSK	12	13	13.21	0-1	0
	1752.5	20375	5	QPSK	25	0	13.22	0-1	0
	1752.5	20375	5	16-QAM	1	0	13.41	0-1	0
	1752.5	20375	5	16-QAM	1	12	13.37	0-1	0
	1752.5	20375	5	16-QAM	1	24	13.39	0-1	0
	1752.5	20375	5	16-QAM	12	0	13.20	0-2	0
	1752.5	20375	5	16-QAM	12	6	13.21	0-2	0
	1752.5	20375	5	16-QAM	12	13	13.22	0-2	0
	1752.5	20375	5	16-QAM	25	0	13.23	0-2	0

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 36 of 61	

8.2.4

LTE Band 2 (PCS)

Table 8-23
LTE Band 2 (PCS) Conducted Powers - 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1860	18700	20	QPSK	1	0	13.62	0	0
	1860	18700	20	QPSK	1	50	13.70	0	0
	1860	18700	20	QPSK	1	99	13.65	0	0
	1860	18700	20	QPSK	50	0	13.70	0-1	0
	1860	18700	20	QPSK	50	25	13.69	0-1	0
	1860	18700	20	QPSK	50	50	13.65	0-1	0
	1860	18700	20	QPSK	100	0	13.66	0-1	0
	1860	18700	20	16QAM	1	0	13.65	0-1	0
	1860	18700	20	16QAM	1	50	13.70	0-1	0
	1860	18700	20	16QAM	1	99	13.69	0-1	0
	1860	18700	20	16QAM	50	0	13.63	0-2	0
	1860	18700	20	16QAM	50	25	13.67	0-2	0
	1860	18700	20	16QAM	50	50	13.68	0-2	0
	1860	18700	20	16QAM	100	0	13.62	0-2	0
Mid	1880.0	18900	20	QPSK	1	0	13.62	0	0
	1880.0	18900	20	QPSK	1	50	13.64	0	0
	1880.0	18900	20	QPSK	1	99	13.59	0	0
	1880.0	18900	20	QPSK	50	0	13.69	0-1	0
	1880.0	18900	20	QPSK	50	25	13.67	0-1	0
	1880.0	18900	20	QPSK	50	50	13.65	0-1	0
	1880.0	18900	20	QPSK	100	0	13.69	0-1	0
	1880.0	18900	20	16QAM	1	0	13.66	0-1	0
	1880.0	18900	20	16QAM	1	50	13.54	0-1	0
	1880.0	18900	20	16QAM	1	99	13.70	0-1	0
	1880.0	18900	20	16QAM	50	0	13.03	0-2	0
	1880.0	18900	20	16QAM	50	25	13.14	0-2	0
	1880.0	18900	20	16QAM	50	50	13.00	0-2	0
	1880.0	18900	20	16QAM	100	0	13.01	0-2	0
High	1900	19100	20	QPSK	1	0	13.69	0	0
	1900	19100	20	QPSK	1	50	13.59	0	0
	1900	19100	20	QPSK	1	99	12.70	0	0
	1900	19100	20	QPSK	50	0	13.26	0-1	0
	1900	19100	20	QPSK	50	25	13.39	0-1	0
	1900	19100	20	QPSK	50	50	13.44	0-1	0
	1900	19100	20	QPSK	100	0	13.41	0-1	0
	1900	19100	20	16QAM	1	0	12.87	0-1	0
	1900	19100	20	16QAM	1	50	13.41	0-1	0
	1900	19100	20	16QAM	1	99	12.86	0-1	0
	1900	19100	20	16QAM	50	0	13.23	0-2	0
	1900	19100	20	16QAM	50	25	13.13	0-2	0
	1900	19100	20	16QAM	50	50	13.03	0-2	0
	1900	19100	20	16QAM	100	0	13.02	0-2	0

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 37 of 61

Table 8-24
LTE Band 2 (PCS) Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1857.5	18675	15	QPSK	1	0	13.67	0	0
	1857.5	18675	15	QPSK	1	36	13.70	0	0
	1857.5	18675	15	QPSK	1	74	13.69	0	0
	1857.5	18675	15	QPSK	36	0	13.67	0-1	0
	1857.5	18675	15	QPSK	36	18	13.65	0-1	0
	1857.5	18675	15	QPSK	36	37	13.64	0-1	0
	1857.5	18675	15	QPSK	75	0	13.70	0-1	0
	1857.5	18675	15	16QAM	1	0	13.62	0-1	0
	1857.5	18675	15	16QAM	1	36	13.70	0-1	0
	1857.5	18675	15	16QAM	1	74	13.70	0-1	0
	1857.5	18675	15	16QAM	36	0	13.69	0-2	0
	1857.5	18675	15	16QAM	36	18	13.69	0-2	0
	1857.5	18675	15	16QAM	36	37	13.68	0-2	0
Mid	1857.5	18675	15	16QAM	75	0	13.65	0-2	0
	1880.0	18900	15	QPSK	1	0	13.66	0	0
	1880.0	18900	15	QPSK	1	36	13.67	0	0
	1880.0	18900	15	QPSK	1	74	13.70	0	0
	1880.0	18900	15	QPSK	36	0	13.69	0-1	0
	1880.0	18900	15	QPSK	36	18	13.67	0-1	0
	1880.0	18900	15	QPSK	36	37	13.69	0-1	0
	1880.0	18900	15	QPSK	75	0	13.70	0-1	0
	1880.0	18900	15	16QAM	1	0	13.65	0-1	0
	1880.0	18900	15	16QAM	1	36	13.68	0-1	0
	1880.0	18900	15	16QAM	1	74	13.66	0-1	0
	1880.0	18900	15	16QAM	36	0	13.70	0-2	0
	1880.0	18900	15	16QAM	36	18	13.68	0-2	0
	1880.0	18900	15	16QAM	36	37	13.69	0-2	0
High	1880.0	18900	15	16QAM	75	0	13.70	0-2	0
	1902.5	19125	15	QPSK	1	0	13.69	0	0
	1902.5	19125	15	QPSK	1	36	13.69	0	0
	1902.5	19125	15	QPSK	1	74	13.65	0	0
	1902.5	19125	15	QPSK	36	0	13.63	0-1	0
	1902.5	19125	15	QPSK	36	18	13.66	0-1	0
	1902.5	19125	15	QPSK	36	37	13.70	0-1	0
	1902.5	19125	15	QPSK	75	0	13.65	0-1	0
	1902.5	19125	15	16QAM	1	0	13.50	0-1	0
	1902.5	19125	15	16QAM	1	36	13.51	0-1	0
	1902.5	19125	15	16QAM	1	74	13.53	0-1	0
	1902.5	19125	15	16QAM	36	0	13.24	0-2	0
	1902.5	19125	15	16QAM	36	18	13.27	0-2	0
	1902.5	19125	15	16QAM	36	37	13.33	0-2	0
	1902.5	19125	15	16QAM	75	0	13.23	0-2	0

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 38 of 61	

Table 8-25
LTE Band 2 (PCS) Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1855	18650	10	QPSK	1	0	13.47	0	0
	1855	18650	10	QPSK	1	25	13.52	0	0
	1855	18650	10	QPSK	1	49	13.54	0	0
	1855	18650	10	QPSK	25	0	13.68	0-1	0
	1855	18650	10	QPSK	25	12	13.61	0-1	0
	1855	18650	10	QPSK	25	25	13.65	0-1	0
	1855	18650	10	QPSK	50	0	13.64	0-1	0
	1855	18650	10	16QAM	1	0	13.67	0-1	0
	1855	18650	10	16QAM	1	25	13.64	0-1	0
	1855	18650	10	16QAM	1	49	13.70	0-1	0
	1855	18650	10	16QAM	25	0	13.67	0-2	0
	1855	18650	10	16QAM	25	12	13.69	0-2	0
Mid	1855	18650	10	16QAM	25	25	13.65	0-2	0
	1855	18650	10	16QAM	50	0	13.70	0-2	0
	1880.0	18900	10	QPSK	1	0	13.56	0	0
	1880.0	18900	10	QPSK	1	25	13.60	0	0
	1880.0	18900	10	QPSK	1	49	13.62	0	0
	1880.0	18900	10	QPSK	25	0	13.70	0-1	0
	1880.0	18900	10	QPSK	25	12	13.64	0-1	0
	1880.0	18900	10	QPSK	25	25	13.70	0-1	0
	1880.0	18900	10	QPSK	50	0	13.68	0-1	0
	1880.0	18900	10	16QAM	1	0	13.65	0-1	0
	1880.0	18900	10	16QAM	1	25	13.67	0-1	0
	1880.0	18900	10	16QAM	1	49	13.70	0-1	0
High	1880.0	18900	10	16QAM	25	0	13.66	0-2	0
	1880.0	18900	10	16QAM	25	12	13.66	0-2	0
	1880.0	18900	10	16QAM	25	25	13.69	0-2	0
	1880.0	18900	10	16QAM	50	0	13.68	0-2	0
	1905	19150	10	QPSK	1	0	13.65	0	0
	1905	19150	10	QPSK	1	25	13.57	0	0
	1905	19150	10	QPSK	1	49	13.34	0	0
	1905	19150	10	QPSK	25	0	13.52	0-1	0
	1905	19150	10	QPSK	25	12	13.57	0-1	0
	1905	19150	10	QPSK	25	25	13.56	0-1	0
	1905	19150	10	QPSK	50	0	13.58	0-1	0
	1905	19150	10	16QAM	1	0	13.25	0-1	0
	1905	19150	10	16QAM	1	25	13.48	0-1	0
	1905	19150	10	16QAM	1	49	13.39	0-1	0
	1905	19150	10	16QAM	25	0	13.20	0-2	0
	1905	19150	10	16QAM	25	12	13.24	0-2	0
	1905	19150	10	16QAM	25	25	13.21	0-2	0
	1905	19150	10	16QAM	50	0	13.23	0-2	0

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 39 of 61	

Table 8-26
LTE Band 2 (PCS) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1852.5	18625	5	QPSK	1	0	13.52	0	0
	1852.5	18625	5	QPSK	1	12	13.70	0	0
	1852.5	18625	5	QPSK	1	24	13.65	0	0
	1852.5	18625	5	QPSK	12	0	13.57	0-1	0
	1852.5	18625	5	QPSK	12	6	13.67	0-1	0
	1852.5	18625	5	QPSK	12	13	13.70	0-1	0
	1852.5	18625	5	QPSK	25	0	13.69	0-1	0
	1852.5	18625	5	16-QAM	1	0	13.59	0-1	0
	1852.5	18625	5	16-QAM	1	12	13.66	0-1	0
	1852.5	18625	5	16-QAM	1	24	13.70	0-1	0
	1852.5	18625	5	16-QAM	12	0	13.68	0-2	0
	1852.5	18625	5	16-QAM	12	6	13.70	0-2	0
Mid	1852.5	18625	5	16-QAM	12	13	13.70	0-2	0
	1852.5	18625	5	16-QAM	25	0	13.64	0-2	0
	1880.0	18900	5	QPSK	1	0	13.50	0	0
	1880.0	18900	5	QPSK	1	12	13.44	0	0
	1880.0	18900	5	QPSK	1	24	13.46	0	0
	1880.0	18900	5	QPSK	12	0	13.67	0-1	0
	1880.0	18900	5	QPSK	12	6	13.70	0-1	0
	1880.0	18900	5	QPSK	12	13	13.68	0-1	0
	1880.0	18900	5	QPSK	25	0	13.70	0-1	0
	1880.0	18900	5	16-QAM	1	0	13.67	0-1	0
	1880.0	18900	5	16-QAM	1	12	13.60	0-1	0
	1880.0	18900	5	16-QAM	1	24	13.67	0-1	0
High	1880.0	18900	5	16-QAM	12	0	13.66	0-2	0
	1880.0	18900	5	16-QAM	12	6	13.63	0-2	0
	1880.0	18900	5	16-QAM	12	13	13.67	0-2	0
	1880.0	18900	5	16-QAM	25	0	13.65	0-2	0
	1907.5	19175	5	QPSK	1	0	13.67	0	0
	1907.5	19175	5	QPSK	1	12	13.69	0	0
	1907.5	19175	5	QPSK	1	24	13.70	0	0
	1907.5	19175	5	QPSK	12	0	13.68	0-1	0
	1907.5	19175	5	QPSK	12	6	13.69	0-1	0
	1907.5	19175	5	QPSK	12	13	13.68	0-1	0
	1907.5	19175	5	QPSK	25	0	13.69	0-1	0
	1907.5	19175	5	16-QAM	1	0	13.63	0-1	0
	1907.5	19175	5	16-QAM	1	12	13.68	0-1	0
	1907.5	19175	5	16-QAM	1	24	13.65	0-1	0
	1907.5	19175	5	16-QAM	12	0	13.30	0-2	0
	1907.5	19175	5	16-QAM	12	6	13.30	0-2	0
	1907.5	19175	5	16-QAM	12	13	13.29	0-2	0
	1907.5	19175	5	16-QAM	25	0	13.24	0-2	0
	1907.5	19175	5	16-QAM	25	0	13.24	0-2	0

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 40 of 61	

8.3 WLAN Conducted Powers

Table 8-27
IEEE 802.11b Average RF Power

802.11b	Mode	Freq [MHz]	Channel	802.11b Conducted Power [dBm]			
				Data Rate [Mbps]			
				1	2	5.5	11
	802.11b	2412	1*	11.52	11.74	11.75	11.79
	802.11b	2437	6*	11.69	11.69	11.66	11.72
	802.11b	2462	11*	11.42	11.43	11.43	11.46

Table 8-28
IEEE 802.11g Average RF Power

802.11g	Mode	Freq [MHz]	Channel	802.11g Conducted Power [dBm]							
				Data Rate [Mbps]							
				6	9	12	18	24	36	48	54
	802.11g	2412	1	8.99	9.01	9.06	9.06	8.99	9.04	9.06	9.03
	802.11g	2437	6	8.99	8.98	9.00	9.03	8.96	8.93	9.05	9.00
	802.11g	2462	11	8.85	8.86	8.88	8.88	8.88	8.94	8.86	8.89

Table 8-29
IEEE 802.11n Average RF Power

802.11n (2.4GHz)	Mode	Freq [MHz]	Channel	802.11n (2.4GHz) Conducted Power [dBm]							
				Data Rate [Mbps]							
				6.5	13	19.5	26	39	52	58.5	65
	802.11n	2412	1	8.06	8.02	8.08	8.04	8.03	8.07	8.12	8.13
	802.11n	2437	6	8.01	8.07	8.00	8.01	8.02	8.00	8.07	8.00
	802.11n	2462	11	7.93	7.96	7.94	7.86	7.98	7.99	7.93	7.94

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 41 of 61

Table 8-30
IEEE 802.11a Average RF Power

802.11a	Mode	Freq [MHz]	Channel	802.11a Conducted Power [dBm]							
				Data Rate [Mbps]							
				6	9	12	18	24	36	48	54
	802.11a	5180	36*	10.37	10.28	10.32	10.20	10.22	10.26	10.12	10.13
	802.11a	5200	40	10.26	10.27	10.23	10.28	10.19	10.25	10.12	10.12
	802.11a	5220	44	10.37	10.34	10.49	10.32	10.33	10.22	10.24	10.23
	802.11a	5240	48*	10.45	10.41	10.25	10.29	10.21	10.17	10.24	10.16
	802.11a	5260	52*	10.52	10.35	10.43	10.41	10.40	10.30	10.29	10.29
	802.11a	5280	56	10.39	10.22	10.34	10.27	10.23	10.36	10.18	10.26
	802.11a	5300	60	10.49	10.53	10.42	10.42	10.26	10.41	10.27	10.35
	802.11a	5320	64*	10.52	10.62	10.42	10.50	10.44	10.32	10.31	10.25
	802.11a	5500	100	10.22	10.12	10.14	10.12	10.14	10.12	10.09	10.17
	802.11a	5520	104*	10.35	10.21	10.14	10.22	10.21	10.23	9.90	10.13
	802.11a	5540	108	10.04	9.98	10.05	10.08	10.08	10.11	10.12	9.99
	802.11a	5560	112	10.13	10.14	10.21	10.14	10.11	10.11	10.14	9.92
	802.11a	5580	116*	10.19	10.18	10.17	10.15	10.07	10.06	10.05	10.06
	802.11a	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	802.11a	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	802.11a	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	802.11a	5660	132	10.19	10.04	10.08	10.14	10.24	10.03	10.03	10.07
	802.11a	5680	136*	10.11	10.10	10.13	10.11	10.07	10.00	10.03	9.98
	802.11a	5700	140	10.17	10.23	10.20	10.12	10.08	10.11	10.04	10.05
	802.11a	5745	149*	10.42	10.30	10.33	10.31	10.17	10.36	10.17	10.24
	802.11a	5765	153	10.57	10.46	10.46	10.46	10.29	10.33	10.29	10.24
	802.11a	5785	157*	10.49	10.47	10.41	10.38	10.47	10.47	10.23	10.35
	802.11a	5805	161	10.21	10.16	10.02	10.06	10.09	10.02	9.92	9.86
	802.11a	5825	165*	10.12	10.01	10.01	10.16	10.07	10.06	10.01	10.02

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

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

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 42 of 61	

Table 8-31
IEEE 802.11n Average RF Power – 20 MHz Bandwidth

20MHz 802.11n (5GHz)	Mode	Freq [MHz]	Channel	20MHz BW 802.11n (5GHz) Conducted Power [dBm]							
				Data Rate [Mbps]							
				6.5	13	19.5	26	39	52	58.5	65
	802.11n	5180	36	9.40	9.59	9.48	9.54	9.47	9.29	9.22	9.36
	802.11n	5200	40	9.51	9.47	9.53	9.45	9.46	9.37	9.25	9.28
	802.11n	5220	44	9.56	9.63	9.63	9.47	9.47	9.29	9.27	9.32
	802.11n	5240	48	9.41	9.51	9.36	9.29	9.36	9.26	9.28	9.21
	802.11n	5260	52	9.41	9.44	9.38	9.32	9.12	9.28	9.09	9.09
	802.11n	5280	56	9.40	9.50	9.34	9.40	9.25	9.23	9.23	9.13
	802.11n	5300	60	9.25	9.27	9.27	9.25	9.05	9.18	9.07	9.14
	802.11n	5320	64	9.27	9.47	9.30	9.26	9.26	9.11	9.20	9.03
	802.11n	5500	100	9.13	9.06	9.04	8.96	8.90	8.93	8.89	8.96
	802.11n	5520	104	9.21	9.14	9.20	9.13	9.04	8.94	8.92	8.90
	802.11n	5540	108	9.15	9.07	9.14	8.91	8.94	8.95	8.93	8.83
	802.11n	5560	112	9.07	8.99	8.99	8.91	8.89	8.84	8.86	8.77
	802.11n	5580	116	9.07	9.08	9.03	9.01	9.00	8.87	8.81	8.78
	802.11n	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	802.11n	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	802.11n	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	802.11n	5660	132	9.26	9.24	9.22	9.18	9.06	8.98	8.97	8.94
	802.11n	5680	136	9.10	8.98	8.99	8.94	8.85	8.81	8.77	8.89
	802.11n	5700	140	9.11	9.07	9.00	8.97	8.92	9.01	8.93	8.81
	802.11n	5745	149	9.40	9.32	9.29	9.21	9.13	9.12	9.07	9.04
	802.11n	5765	153	9.35	9.31	9.28	9.26	9.21	9.14	9.15	9.10
	802.11n	5785	157	9.36	9.37	9.35	9.28	9.22	9.20	9.19	9.11
	802.11n	5805	161	8.99	9.09	9.00	8.92	8.90	8.81	8.82	8.82
	802.11n	5825	165	9.04	9.02	8.98	8.96	8.95	8.82	8.83	8.76

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 43 of 61	

Table 8-32
IEEE 802.11n Average RF Power – 40 MHz Bandwidth

40MHz 802.11n (5GHz)	Mode	Freq [MHz]	Channel	40MHz BW 802.11n (5GHz) Conducted Power [dBm]							
				Data Rate [Mbps]							
				13.5	27	40.5	54	81	108	121.5	135
	802.11n	5190	38	8.32	8.22	8.20	8.34	8.09	7.85	8.06	7.93
	802.11n	5230	46	8.18	8.28	8.10	8.27	8.14	7.94	8.09	7.88
	802.11n	5270	54	8.11	8.09	8.16	8.14	7.87	7.94	7.82	7.96
	802.11n	5310	62	8.23	8.36	8.15	8.30	8.26	7.98	8.12	8.00
	802.11n	5510	102	8.81	8.70	8.72	8.77	8.56	8.55	8.44	8.55
	802.11n	5550	110	8.66	8.59	8.64	8.56	8.75	8.37	8.31	8.44
	802.11n	5590	118	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	802.11n	5630	126	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	802.11n	5670	134	8.53	8.56	8.59	8.45	8.21	8.26	8.31	8.34
	802.11n	5755	151	8.94	8.87	8.69	8.87	8.92	8.72	8.70	8.52
	802.11n	5795	159	9.06	9.09	9.00	8.88	8.85	8.75	8.72	8.88

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

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

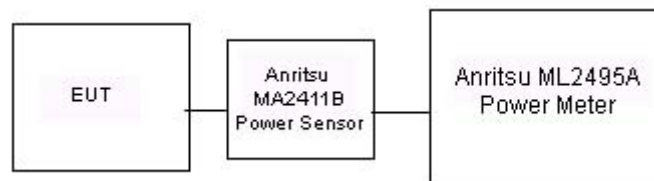


Figure 8-1
Power Measurement Setup

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 44 of 61	

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
7/23/2014	740B	23.4	740	0.948	54.146	0.963	55.570	-1.56%	-2.56%
			755	0.961	54.046	0.964	55.512	-0.31%	-2.64%
			770	0.975	53.897	0.965	55.453	1.04%	-2.81%
			785	0.991	53.724	0.966	55.395	2.59%	-3.02%
7/21/2014	835B	22.9	820	0.995	54.599	0.969	55.258	2.68%	-1.19%
			835	1.010	54.452	0.970	55.200	4.12%	-1.36%
			850	1.024	54.282	0.988	55.154	3.64%	-1.58%
7/21/2014	1750B	21.0	1710	1.496	52.641	1.463	53.537	2.26%	-1.67%
			1750	1.539	52.495	1.488	53.432	3.43%	-1.75%
			1790	1.584	52.349	1.514	53.326	4.62%	-1.83%
7/21/2014	1900B	23.7	1850	1.469	52.184	1.520	53.300	-3.36%	-2.09%
			1880	1.500	52.073	1.520	53.300	-1.32%	-2.30%
			1910	1.535	51.978	1.520	53.300	0.99%	-2.48%
7/21/2014	2450B	24.0	2401	1.884	51.107	1.903	52.765	-1.00%	-3.14%
			2450	1.952	50.957	1.950	52.700	0.10%	-3.31%
			2499	2.016	50.789	2.019	52.638	-0.15%	-3.51%
07/21/2014	5200B-5800B	23.0	5180	5.432	47.189	5.276	49.041	2.96%	-3.78%
			5200	5.444	47.184	5.299	49.014	2.74%	-3.73%
			5240	5.489	47.163	5.346	48.960	2.67%	-3.67%
			5260	5.517	47.200	5.369	48.933	2.76%	-3.54%
			5300	5.573	47.108	5.416	48.879	2.90%	-3.62%
			5320	5.598	47.180	5.439	48.851	2.92%	-3.42%
			5500	5.806	47.163	5.650	48.607	2.76%	-2.97%
			5520	5.839	47.142	5.673	48.580	2.93%	-2.96%
			5765	6.092	46.588	5.959	48.248	2.23%	-3.44%
			5800	6.134	46.486	6.000	48.200	2.23%	-3.56%

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.

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 45 of 61	

9.2 Test System Verification

Prior to SAR assessment, the system is verified to $\pm 10\%$ 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} (%)
B	750	BODY	07/23/2014	22.4	22.0	0.100	1046	3288	0.870	8.540	8.700	1.87%
J	835	BODY	07/21/2014	22.6	22.9	0.100	4d119	3332	0.962	9.340	9.620	3.00%
C	1750	BODY	07/21/2014	23.3	21.0	0.100	1051	3213	3.670	37.400	36.700	-1.87%
B	1900	BODY	07/21/2014	23.8	23.7	0.100	5d148	3288	4.170	39.300	41.700	6.11%
H	2450	BODY	07/21/2014	24.5	24.0	0.100	797	3319	5.180	49.400	51.800	4.86%
A	5200	BODY	07/21/2014	24.5	23.3	0.100	1007	3920	7.650	72.600	76.500	5.37%
A	5300	BODY	07/21/2014	24.6	23.3	0.100	1007	3920	7.880	74.700	78.800	5.49%
A	5500	BODY	07/21/2014	24.6	24.4	0.100	1007	3920	8.140	75.900	81.400	7.25%
A	5800	BODY	07/21/2014	24.5	23.4	0.100	1007	3920	7.480	72.900	74.800	2.61%

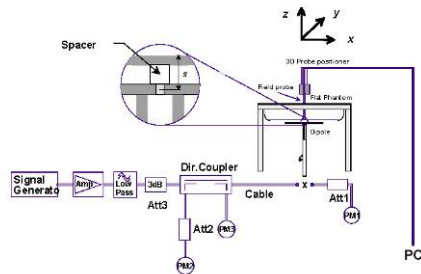


Figure 9-1
System Verification Setup Diagram



Figure 9-2
System Verification Setup Photo

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 46 of 61

10 SAR DATA SUMMARY

10.1 Standalone Body SAR Data

Table 10-1
LTE Band 13 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)		
782.00	23230	Mid	LTE Band 13	10	24.2	24.20	0.04	0	628	QPSK	1	49	15 mm	back	1.1	0.303	1.000	0.303	A1
782.00	23230	Mid	LTE Band 13	10	23.2	23.16	0.02	1	628	QPSK	25	25	15 mm	back	1.1	0.217	1.009	0.219	
782.00	23230	Mid	LTE Band 13	10	24.2	24.20	0.18	0	628	QPSK	1	49	16 mm	top	1.1	0.118	1.000	0.118	
782.00	23230	Mid	LTE Band 13	10	23.2	23.16	0.03	1	628	QPSK	25	25	16 mm	top	1.1	0.083	1.009	0.084	
782.00	23230	Mid	LTE Band 13	10	24.2	24.20	-0.05	0	628	QPSK	1	49	5 mm	right	1.1	0.232	1.000	0.232	
782.00	23230	Mid	LTE Band 13	10	23.2	23.16	0.10	1	628	QPSK	25	25	5 mm	right	1.1	0.170	1.009	0.172	
782.00	23230	Mid	LTE Band 13	10	18.2	18.20	-0.05	0	610	QPSK	1	0	0 mm	back	1.1	0.428	1.000	0.428	
782.00	23230	Mid	LTE Band 13	10	18.2	18.10	-0.03	0	610	QPSK	25	25	0 mm	back	1.1	0.410	1.023	0.419	
782.00	23230	Mid	LTE Band 13	10	18.2	18.20	0.01	0	610	QPSK	1	0	0 mm	top	1.1	0.201	1.000	0.201	
782.00	23230	Mid	LTE Band 13	10	18.2	18.10	-0.03	0	610	QPSK	25	25	0 mm	top	1.1	0.212	1.023	0.217	
782.00	23230	Mid	LTE Band 13	10	18.2	18.20	0.04	0	610	QPSK	1	0	0 mm	right	1.1	0.135	1.000	0.135	
782.00	23230	Mid	LTE Band 13	10	18.2	18.10	0.06	0	610	QPSK	25	25	0 mm	right	1.1	0.119	1.023	0.122	
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 10-2
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	24.2	24.18	-0.03	0	628	QPSK	1	0	15 mm	back	1:1	0.356	1.005	0.358	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.2	23.18	-0.03	1	628	QPSK	25	25	15 mm	back	1:1	0.286	1.005	0.287	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.2	24.18	-0.10	0	628	QPSK	1	0	16 mm	top	1:1	0.225	1.005	0.226	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.2	23.18	0.01	1	628	QPSK	25	25	16 mm	top	1:1	0.176	1.005	0.177	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.2	24.18	0.04	0	628	QPSK	1	0	5 mm	right	1:1	0.331	1.005	0.333	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.2	23.18	0.00	1	628	QPSK	25	25	5 mm	right	1:1	0.267	1.005	0.268	
836.50	20525	Mid	LTE Band 5 (Cell)	10	18.2	18.06	0.04	0	610	QPSK	1	49	0 mm	back	1:1	0.711	1.033	0.734	
836.50	20525	Mid	LTE Band 5 (Cell)	10	18.2	18.07	0.01	0	610	QPSK	25	12	0 mm	back	1:1	0.707	1.030	0.728	
836.50	20525	Mid	LTE Band 5 (Cell)	10	18.2	18.06	-0.09	0	610	QPSK	1	49	0 mm	top	1:1	0.339	1.033	0.350	
836.50	20525	Mid	LTE Band 5 (Cell)	10	18.2	18.07	-0.10	0	610	QPSK	25	12	0 mm	top	1:1	0.342	1.030	0.352	
836.50	20525	Mid	LTE Band 5 (Cell)	10	18.2	18.06	0.01	0	610	QPSK	1	49	0 mm	right	1:1	0.202	1.033	0.209	
836.50	20525	Mid	LTE Band 5 (Cell)	10	18.2	18.07	0.02	0	610	QPSK	25	12	0 mm	right	1:1	0.206	1.030	0.212	
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 10-3
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) [W/kg]	Scaling Factor	Scaled SAR (1g) [W/kg]	Plot #	
MHz	Ch.																		
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.69	0.04	0	628	QPSK	1	0	15 mm	back	1:1	0.432	1.002	0.433	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.7	22.61	0.00	1	628	QPSK	50	50	15 mm	back	1:1	0.362	1.021	0.370	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.69	0.01	0	628	QPSK	1	0	16 mm	top	1:1	0.297	1.002	0.298	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.7	22.61	0.06	1	628	QPSK	50	50	16 mm	top	1:1	0.248	1.021	0.253	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.69	0.05	0	628	QPSK	1	0	5 mm	right	1:1	0.491	1.002	0.492	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.7	22.61	-0.01	1	628	QPSK	50	50	5 mm	right	1:1	0.392	1.021	0.400	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	13.7	13.41	-0.15	0	610	QPSK	1	50	0 mm	back	1:1	0.484	1.069	0.517	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	13.7	13.36	-0.15	0	610	QPSK	50	25	0 mm	back	1:1	0.495	1.081	0.535	A3
1732.50	20175	Mid	LTE Band 4 (AWS)	20	13.7	13.41	-0.04	0	610	QPSK	1	50	0 mm	top	1:1	0.159	1.069	0.170	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	13.7	13.36	0.07	0	610	QPSK	50	25	0 mm	top	1:1	0.164	1.081	0.177	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	13.7	13.41	-0.04	0	610	QPSK	1	50	0 mm	right	1:1	0.102	1.069	0.109	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	13.7	13.36	0.02	0	610	QPSK	50	25	0 mm	right	1:1	0.104	1.081	0.112	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body											
Spatial Peak								1.6 W/kg (mW/g)											
Uncontrolled Exposure/General Population								averaged over 1 gram											

FCC ID: ZNFUK410			SAR EVALUATION REPORT			Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014		DUT Type: Portable Tablet		Page 47 of 61	

Table 10-4
LTE Band 2 (PCS) Body SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.7	23.70	0.10	0	628	QPSK	1	50	15 mm	back	1:1	0.433	1.000	0.433	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	22.7	22.70	0.01	1	628	QPSK	50	0	15 mm	back	1:1	0.354	1.000	0.354	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.7	23.70	0.03	0	628	QPSK	1	50	16 mm	top	1:1	0.307	1.000	0.307	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	22.7	22.70	0.03	1	628	QPSK	50	0	16 mm	top	1:1	0.241	1.000	0.241	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.7	23.70	0.07	0	628	QPSK	1	50	5 mm	right	1:1	0.284	1.000	0.284	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	22.7	22.70	0.02	1	628	QPSK	50	0	5 mm	right	1:1	0.220	1.000	0.220	
1860.00	18700	Low	LTE Band 2 (PCS)	20	13.7	13.70	-0.06	0	610	QPSK	1	50	0 mm	back	1:1	0.587	1.000	0.587	
1860.00	18700	Low	LTE Band 2 (PCS)	20	13.7	13.70	0.00	0	610	QPSK	50	0	0 mm	back	1:1	0.547	1.000	0.547	
1860.00	18700	Low	LTE Band 2 (PCS)	20	13.7	13.70	-0.03	0	610	QPSK	1	50	0 mm	top	1:1	0.244	1.000	0.244	
1860.00	18700	Low	LTE Band 2 (PCS)	20	13.7	13.70	-0.06	0	610	QPSK	50	0	0 mm	top	1:1	0.222	1.000	0.222	
1860.00	18700	Low	LTE Band 2 (PCS)	20	13.7	13.70	-0.01	0	610	QPSK	1	50	0 mm	right	1:1	0.107	1.000	0.107	
1860.00	18700	Low	LTE Band 2 (PCS)	20	13.7	13.70	0.06	0	610	QPSK	50	0	0 mm	right	1:1	0.093	1.000	0.093	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram											

Table 10-5
DTS WLAN 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) (W/kg)	Plot #
MHz	Ch.											(W/kg)			
2437	6	IEEE 802.11b	DSSS	12.5	11.69	0.01	0 mm	529	1	back	1:1	0.571	1.205	0.688	A5
2437	6	IEEE 802.11b	DSSS	12.5	11.69	0.18	0 mm	529	1	top	1:1	0.150	1.205	0.181	
2437	6	IEEE 802.11b	DSSS	12.5	11.69	0.13	0 mm	529	1	left	1:1	0.245	1.205	0.295	
5765	153	IEEE 802.11a	OFDM	11.0	10.57	0.14	0 mm	529	6	back	1:1	0.092	1.104	0.102	
5765	153	IEEE 802.11a	OFDM	11.0	10.57	0.12	0 mm	529	6	top	1:1	0.020	1.104	0.022	
5765	153	IEEE 802.11a	OFDM	11.0	10.57	0.13	0 mm	529	6	left	1:1	0.107	1.104	0.118	A6
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 10-6
NII WLAN 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) (W/kg)	Plot #
MHz	Ch.											(W/kg)			
5180	36	IEEE 802.11a	OFDM	11.0	10.37	0.06	0 mm	529	6	back	1:1	0.407	1.156	0.470	A7
5240	48	IEEE 802.11a	OFDM	11.0	10.45	0.10	0 mm	529	6	back	1:1	0.403	1.135	0.457	
5240	48	IEEE 802.11a	OFDM	11.0	10.45	-0.16	0 mm	529	6	top	1:1	0.115	1.135	0.131	
5240	48	IEEE 802.11a	OFDM	11.0	10.45	0.19	0 mm	529	6	left	1:1	0.186	1.135	0.211	
5260	52	IEEE 802.11a	OFDM	11.0	10.52	0.03	0 mm	529	6	back	1:1	0.386	1.117	0.431	
5320	64	IEEE 802.11a	OFDM	11.0	10.52	0.10	0 mm	529	6	back	1:1	0.355	1.117	0.397	
5320	64	IEEE 802.11a	OFDM	11.0	10.52	0.17	0 mm	529	6	top	1:1	0.076	1.117	0.085	
5320	64	IEEE 802.11a	OFDM	11.0	10.52	0.19	0 mm	529	6	left	1:1	0.231	1.117	0.258	
5520	104	IEEE 802.11a	OFDM	11.0	10.35	0.21	0 mm	529	6	back	1:1	0.121	1.161	0.140	
5520	104	IEEE 802.11a	OFDM	11.0	10.35	0.11	0 mm	529	6	top	1:1	0.020	1.161	0.023	
5520	104	IEEE 802.11a	OFDM	11.0	10.35	0.15	0 mm	529	6	left	1:1	0.150	1.161	0.174	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram							

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 48 of 61	

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 Publications 447498 D01v05 and 616217 D04v01.
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, if the measured SAR results for a frequency band were greater than 0.8 W/kg then variability tests were performed. Please see Section 12 for variability analysis.
7. Per FCC KDB 616217 D04 Section 4.3, SAR tests are required for the back surface and edges of the tablet with the tablet touching the phantom. The SAR Exclusion Threshold in FCC KDB 447498 D01v05 was applied to determine SAR test exclusion for adjacent edge configurations. Top and right edges SAR tests were required for the main antenna. Top and left edges SAR tests were required for the WLAN/BT antennas

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r01. The general test procedures used for testing can be found in Section 7.3.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

WLAN Notes:

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

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 49 of 61	

11 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

11.1 Introduction

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

11.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05 IV.C.1.iii and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤ 1.6 W/kg. When standalone SAR is not required to be measured, per FCC KDB 447498 D01v05 4.3.2 2), the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

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

Table 11-1
Estimated SAR

Mode	Frequency	Maximum Allowed Power	Estimated SAR	Separation Distance (Body)	Estimated SAR (Body)
	[MHz]	[dBm]	[W/kg]	[mm]	[W/kg]
Bluetooth	2480	8.00	Back Side Touching(*)	5	0.252
Bluetooth	2480	8.00	Top Edge Touching(*)	5	0.252
Bluetooth	2480	8.00	Left Edge Touching(*)	5	0.252
Bluetooth	2480	8.00	Back Side	15	0.084
Bluetooth	2480	8.00	Top Edge	16	0.079

Note:

1. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.
2. When test separation distance was > 50 mm, an estimated SAR of 0.4 W/kg was used to determine simultaneous transmission SAR exclusion, for configurations excluded per FCC KDB Publication 447498 D01v05. When the test separation distance was > 50 mm, an estimated SAR was determined per FCC KDB Publication 447498 D01v05.
3. (*) – Per FCC KDB 447498, when the test separation distance is <5 mm, a distance of 5mm is applied to determine estimated SAR.

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 50 of 61

11.3 Body Simultaneous Transmission Analysis

Table 11-2
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body at 0.0 mm)

Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.428	0.688	1.116	Body SAR	Back	0.734	0.688	1.422
	Top	0.217	0.181	0.398		Top	0.352	0.181	0.533
	Bottom	0.400	0.400	0.800		Bottom	0.400	0.400	0.800
	Right	0.135	0.400	0.535		Right	0.212	0.400	0.612
	Left	0.400	0.295	0.695		Left	0.400	0.295	0.695
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.535	0.688	1.223	Body SAR	Back	0.587	0.688	1.275
	Top	0.177	0.181	0.358		Top	0.244	0.181	0.425
	Bottom	0.400	0.400	0.800		Bottom	0.400	0.400	0.800
	Right	0.112	0.400	0.512		Right	0.107	0.400	0.507
	Left	0.400	0.295	0.695		Left	0.400	0.295	0.695

Table 11-3
Simultaneous Transmission Scenario with 5 GHz WLAN (Body at 0.0 mm)

Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.428	0.470	0.898	Body SAR	Back	0.734	0.470	1.204
	Top	0.217	0.131	0.348		Top	0.352	0.131	0.483
	Bottom	0.400	0.400	0.800		Bottom	0.400	0.400	0.800
	Right	0.135	0.400	0.535		Right	0.212	0.400	0.612
	Left	0.400	0.258	0.658		Left	0.400	0.258	0.658
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.535	0.470	1.005	Body SAR	Back	0.587	0.470	1.057
	Top	0.177	0.131	0.308		Top	0.244	0.131	0.375
	Bottom	0.400	0.400	0.800		Bottom	0.400	0.400	0.800
	Right	0.112	0.400	0.512		Right	0.107	0.400	0.507
	Left	0.400	0.258	0.658		Left	0.400	0.258	0.658

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 51 of 61	

Table 11-4
Simultaneous Transmission Scenario with Bluetooth (Body at 0.0 mm)

Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.428	0.252	0.680	Body SAR	Back	0.734	0.252	0.986
	Top	0.217	0.252	0.469		Top	0.352	0.252	0.604
	Bottom	0.400	0.400	0.800		Bottom	0.400	0.400	0.800
	Right	0.135	0.400	0.535		Right	0.212	0.400	0.612
	Left	0.400	0.252	0.652		Left	0.400	0.252	0.652
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.535	0.252	0.787	Body SAR	Back	0.587	0.252	0.839
	Top	0.177	0.252	0.429		Top	0.244	0.252	0.496
	Bottom	0.400	0.400	0.800		Bottom	0.400	0.400	0.800
	Right	0.112	0.400	0.512		Right	0.107	0.400	0.507
	Left	0.400	0.252	0.652		Left	0.400	0.252	0.652

Note: Bluetooth SAR was not required to be measured per FCC KDB 447498. Estimated SAR results were used in the above table to determine simultaneous transmission SAR test exclusion.

Table 11-5
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body Back Side at 15 mm)

Configuration	Mode	LTE SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	LTE Band 13	0.303	<0.688	<0.991
Back Side	LTE Band 5 (Cell)	0.358	<0.688	<1.046
Back Side	LTE Band 4 (AWS)	0.433	<0.688	<1.121
Back Side	LTE Band 2 (PCS)	0.433	<0.688	<1.121

Table 11-6
Simultaneous Transmission Scenario with 5 GHz WLAN (Body Back Side at 15 mm)

Configuration	Mode	LTE SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	LTE Band 13	0.303	<0.470	<0.773
Back Side	LTE Band 5 (Cell)	0.358	<0.470	<0.828
Back Side	LTE Band 4 (AWS)	0.433	<0.470	<0.903
Back Side	LTE Band 2 (PCS)	0.433	<0.470	<0.903

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 52 of 61	

Table 11-7
Simultaneous Transmission Scenario with Bluetooth (Body Back Side at 15 mm)

Configuration	Mode	LTE SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Back Side	LTE Band 13	0.303	0.084	0.387
Back Side	LTE Band 5 (Cell)	0.358	0.084	0.442
Back Side	LTE Band 4 (AWS)	0.433	0.084	0.517
Back Side	LTE Band 2 (PCS)	0.433	0.084	0.517

Note: Bluetooth SAR was not required to be measured per FCC KDB 447498. Estimated SAR results were used in the above table to determine simultaneous transmission SAR test exclusion.

Table 11-8
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body Top Edge at 16 mm)

Configuration	Mode	LTE SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Top Edge	LTE Band 13	0.118	<0.181	<0.299
Top Edge	LTE Band 5 (Cell)	0.226	<0.181	<0.407
Top Edge	LTE Band 4 (AWS)	0.298	<0.181	<0.479
Top Edge	LTE Band 2 (PCS)	0.307	<0.181	<0.488

Table 11-9
Simultaneous Transmission Scenario with 5 GHz WLAN (Body Top Edge at 16 mm)

Configuration	Mode	LTE SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Top Edge	LTE Band 13	0.118	<0.131	<0.249
Top Edge	LTE Band 5 (Cell)	0.226	<0.131	<0.357
Top Edge	LTE Band 4 (AWS)	0.298	<0.131	<0.429
Top Edge	LTE Band 2 (PCS)	0.307	<0.131	<0.438

Table 11-10
Simultaneous Transmission Scenario with Bluetooth (Body Top Edge at 16 mm)

Configuration	Mode	LTE SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Top Edge	LTE Band 13	0.118	0.079	0.197
Top Edge	LTE Band 5 (Cell)	0.226	0.079	0.305
Top Edge	LTE Band 4 (AWS)	0.298	0.079	0.377
Top Edge	LTE Band 2 (PCS)	0.307	0.079	0.386

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 53 of 61	

Table 11-11
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body Right Edge at 5 mm)

Configuration	Mode	LTE SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Right Edge	LTE Band 13	0.232	0.400	0.632
Right Edge	LTE Band 5 (Cell)	0.333	0.400	0.733
Right Edge	LTE Band 4 (AWS)	0.492	0.400	0.892
Right Edge	LTE Band 2 (PCS)	0.284	0.400	0.684

Table 11-12
Simultaneous Transmission Scenario with 5 GHz WLAN (Body Right Edge at 5 mm)

Configuration	Mode	LTE SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Right Edge	LTE Band 13	0.232	0.400	0.632
Right Edge	LTE Band 5 (Cell)	0.333	0.400	0.733
Right Edge	LTE Band 4 (AWS)	0.492	0.400	0.892
Right Edge	LTE Band 2 (PCS)	0.284	0.400	0.684

Table 11-13
Simultaneous Transmission Scenario with Bluetooth (Body Right Edge at 5 mm)

Configuration	Mode	LTE SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Right Edge	LTE Band 13	0.232	0.400	0.632
Right Edge	LTE Band 5 (Cell)	0.333	0.400	0.733
Right Edge	LTE Band 4 (AWS)	0.492	0.400	0.892
Right Edge	LTE Band 2 (PCS)	0.284	0.400	0.684

Note:

- For SAR summations for body back side at 15 mm, 2.4 GHz and 5 GHz WLAN SAR values for 0.0 cm were used since the 0.0 cm test distance for WLAN was more conservative. "<" Denotes that the 0.0 cm WLAN SAR values were used for summation purposes.
- For SAR summations for body top edge at 16 mm, 2.4 GHz and 5 GHz WLAN SAR values for 0.0 cm were used since the 0.0 cm test distance for WLAN was more conservative. "<" Denotes that the 0.0 cm WLAN SAR values were used for summation purposes.

11.4 Simultaneous Transmission Conclusion

The above numerical summed SAR 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.

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 54 of 61	

12 SAR MEASUREMENT VARIABILITY

12.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01, SAR measurement variability is assessed when the highest measured SAR is ≥ 0.80 W/kg. Since all measured SAR values are < 0.80 W/kg for this device, SAR measurement variability was not assessed.

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.

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 55 of 61

13 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
SPEAG	DAE4	Dasy Data Acquisition Electronics	12/12/2013	Annual	12/12/2014	649
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/17/2013	Annual	9/17/2014	1323
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/17/2014	Annual	3/17/2015	1364
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/11/2014	Annual	4/11/2015	1368
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/18/2013	Annual	11/18/2014	1407
SPEAG	D1750V2	1750 MHz SAR Dipole	4/10/2014	Annual	4/10/2015	1051
SPEAG	D1900V2	1900 MHz SAR Dipole	2/27/2014	Annual	2/27/2015	5d148
SPEAG	D2450V2	2450 MHz SAR Dipole	1/21/2014	Annual	1/21/2015	797
SPEAG	D5GHzV2	5 GHz SAR Dipole	9/23/2013	Annual	9/23/2014	1007
SPEAG	D750V3	750 MHz Dipole	2/27/2014	Annual	2/27/2015	1046
SPEAG	D835V2	835 MHz SAR Dipole	4/7/2014	Annual	4/7/2015	4d119
SPEAG	ES3DV3	SAR Probe	4/11/2014	Annual	4/11/2015	3213
SPEAG	ES3DV3	SAR Probe	9/23/2013	Annual	9/23/2014	3288
SPEAG	ES3DV3	SAR Probe	4/17/2014	Annual	4/17/2015	3319
SPEAG	ES3DV3	SAR Probe	11/25/2013	Annual	11/25/2014	3332
SPEAG	EX3DV4	SAR Probe	12/18/2013	Annual	12/18/2014	3920
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/15/2014	Annual	4/15/2015	MY45470194
Agilent	8648D	(9kHz-4GHz) Signal Generator	4/15/2014	Annual	4/15/2015	3629U00687
Agilent	E4438C	ESG Vector Signal Generator	4/15/2014	Annual	4/15/2015	MY45091346
Agilent	N9020A	MXA Signal Analyzer	10/29/2013	Annual	10/29/2014	US46470561
Agilent	8753ES	S-Parameter Network Analyzer	5/22/2014	Annual	5/22/2015	US39170118
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433978
Anritsu	ML2495A	Power Meter	10/31/2013	Annual	10/31/2014	1039008
Anritsu	MA2481A	Power Sensor	10/30/2013	Annual	10/30/2014	5605
Anritsu	MA2411B	Pulse Power Sensor	3/25/2014	Annual	3/25/2015	1207470
Anritsu	MA2411B	Pulse Power Sensor	2/3/2014	Annual	2/3/2015	1339018
Anritsu	MA24106A	USB Power Sensor	5/15/2014	Annual	5/15/2015	1244512
Anritsu	MA24106A	USB Power Sensor	5/15/2014	Annual	5/15/2015	1244524
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M155A00-009
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
Control Company	61220-416	Long-Stem Thermometer	4/29/2014	Biennial	4/29/2016	111331323
Control Company	36934-158	Wall-Mounted Thermometer	4/29/2014	Biennial	4/29/2016	122014488
Fisher Scientific	15-077-960	Digital Thermometer	11/6/2012	Biennial	11/6/2014	122640025
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/30/2013	Annual	10/30/2014	1833460
Gigatronics	8651A	Universal Power Meter	10/30/2013	Annual	10/30/2014	8650319
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
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	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	N/A	N/A	N/A	N/A
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	CMU200	Base Station Simulator	6/6/2014	Annual	6/6/2015	109892
Rohde & Schwarz	NRVD	Dual Channel Power Meter	10/12/2012	Biennial	10/12/2014	101695
Rohde & Schwarz	NRV-Z32	Peak Power Sensor	10/12/2012	Biennial	10/12/2014	836019/013
Rohde & Schwarz	CMW500	Radio Communication Tester	10/4/2013	Biennial	10/4/2015	103962
Rohde & Schwarz	CMW500	Radio Communication Tester	7/9/2014	Annual	7/9/2015	106578
Rohde & Schwarz	SME06	Signal Generator	10/30/2013	Annual	10/30/2014	832026
Rohde & Schwarz	NRVS	Single Channel Power Meter	10/31/2013	Annual	10/31/2014	835360/0079
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/18/2014	Biennial	3/18/2016	N/A
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/6/2014	Annual	5/6/2015	1070
SPEAG	DAK-3.5	Dielectric Assessment Kit	11/13/2013	Annual	11/13/2014	1091
Tektronix	RSA6114A	Real Time Spectrum Analyzer	4/16/2014	Annual	4/16/2015	B010177
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.

FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 56 of 61

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
Expanded Uncertainty							k=2	24.2	23.5
(95% CONFIDENCE LEVEL)									

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

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 57 of 61

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
Expanded Uncertainty (95% CONFIDENCE LEVEL)							k=2	24.7	24.0

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

FCC ID: ZNFUK410	 SAR EVALUATION REPORT 		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 58 of 61

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]

FCC ID: ZNFUK410	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT	 LG	Reviewed by: Quality Manager
Document S/N: 0Y1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 59 of 61	

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FCC ID: ZNFUK410	 SAR EVALUATION REPORT 		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet	Page 60 of 61

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FCC ID: ZNFUK410		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1407211417.ZNF	Test Dates: 07/21/14 – 07/23/2014	DUT Type: Portable Tablet		Page 61 of 61

APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFUK410; Type: Portable Tablet; Serial: 610

Communication System: UID 0, LTE RF; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 740 Body Medium parameters used (interpolated):

$f = 782 \text{ MHz}$; $\sigma = 0.988 \text{ S/m}$; $\epsilon_r = 53.759$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 0.0 cm

Test Date: 07-23-2014; Ambient Temp: 22.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3288; ConvF(6.25, 6.25, 6.25); Calibrated: 9/23/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2013

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 13, Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset**

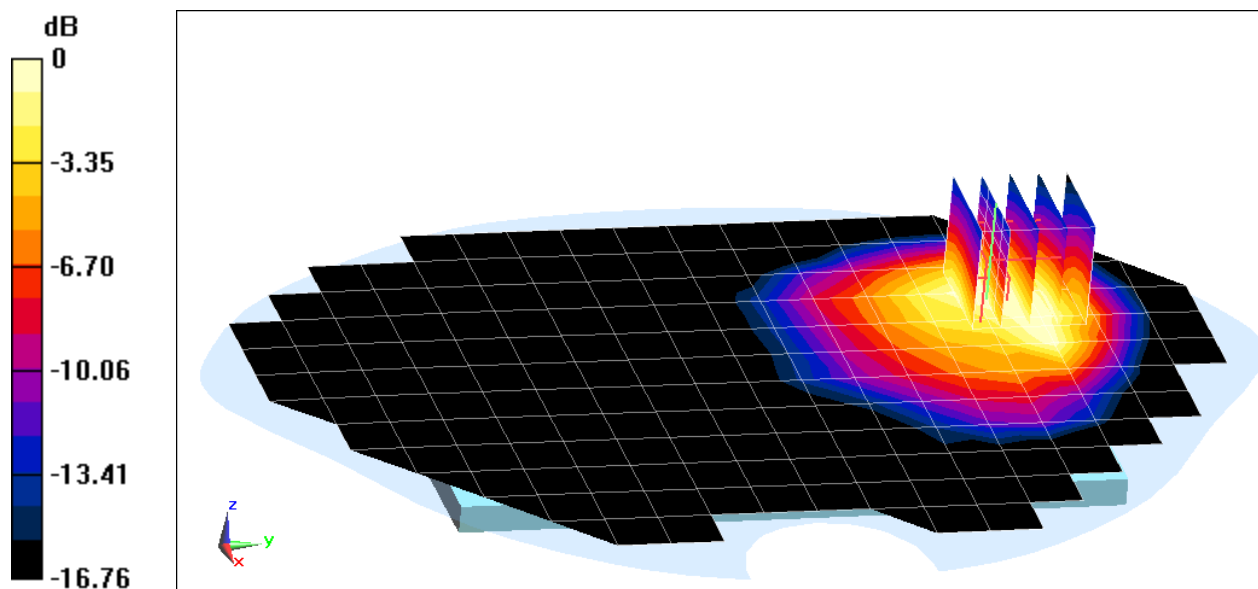
Area Scan (13x21x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 22.12 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.879 W/kg

SAR(1 g) = 0.428 W/kg



0 dB = 0.522 W/kg = -2.82 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFUK410; Type: Portable Tablet; Serial: 610

Communication System: UID 0, LTE Band 5; Frequency: 836.5 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.5 \text{ MHz}$; $\sigma = 1.011 \text{ S/m}$; $\epsilon_r = 54.435$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 0.0 cm

Test Date: 07-21-2014; Ambient Temp: 22.6°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3332; ConvF(6.08, 6.08, 6.08); Calibrated: 11/25/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 11/18/2013

Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**LTE Band 5 (Cell.), Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset**

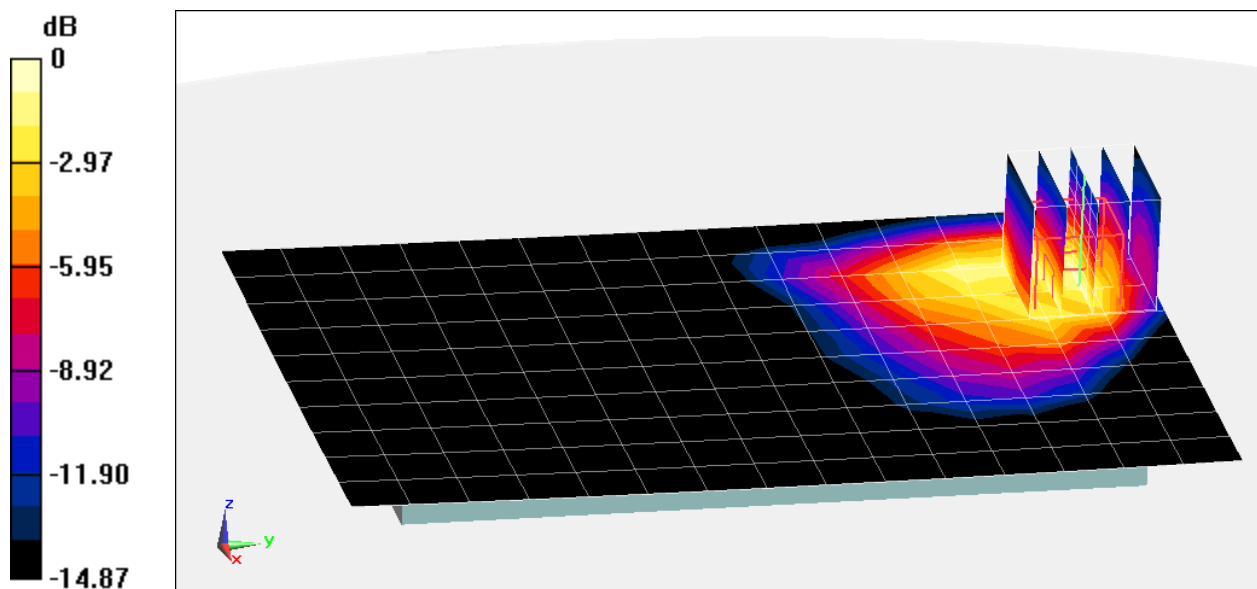
Area Scan (11x16x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 28.00 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 1.37 W/kg

SAR(1 g) = 0.711 W/kg



0 dB = 0.861 W/kg = -0.65 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFUK410; Type: Portable Tablet; Serial: 610

Communication System: UID 0, LTE RF; Frequency: 1732.5 MHz; Duty Cycle: 1:1
Medium: 1750 Body Medium parameters used (interpolated):
 $f = 1732.5 \text{ MHz}$; $\sigma = 1.52 \text{ S/m}$; $\epsilon_r = 52.559$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section ; Space: 0.0 cm

Test Date: 07-21-2014; Ambient Temp: 23.3°C; Tissue Temp: 21.0°C

Probe: ES3DV3 - SN3213; ConvF(4.89, 4.89, 4.89); Calibrated: 4/11/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 3/17/2014
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 4 (AWS), Body SAR, Back side, Mid.ch,
20 MHz Bandwidth, QPSK, 50 RB, 25 RB Offset**

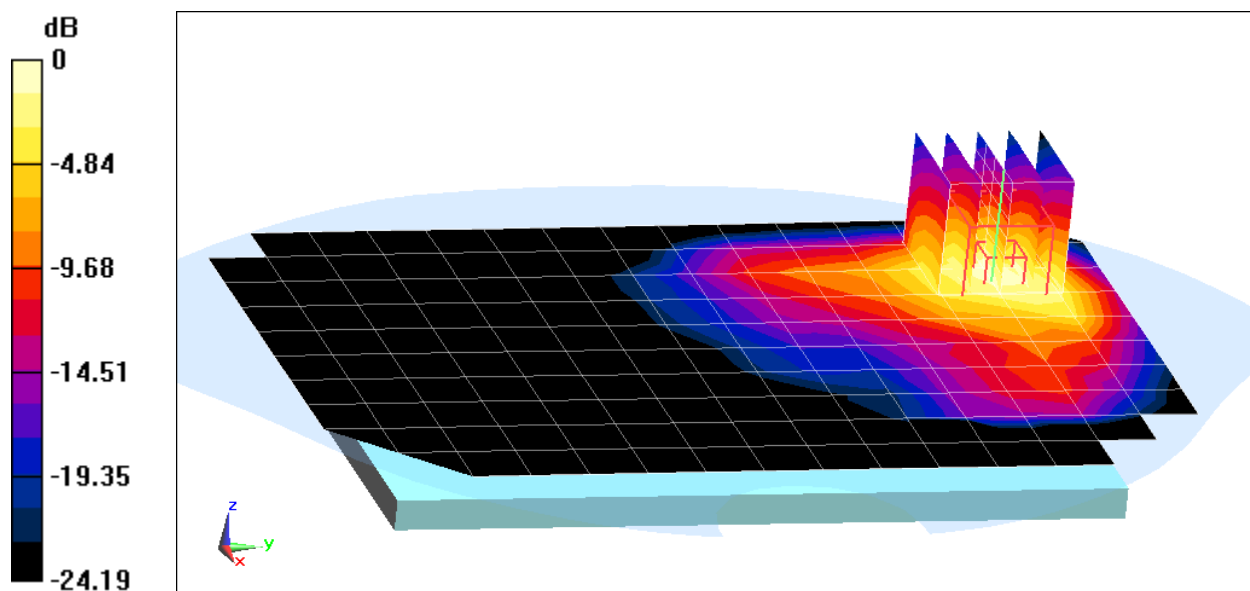
Area Scan (11x16x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 18.72 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 1.03 W/kg

SAR(1 g) = 0.495 W/kg



0 dB = 0.571 W/kg = -2.43 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFUK410; Type: Portable Tablet; Serial: 610

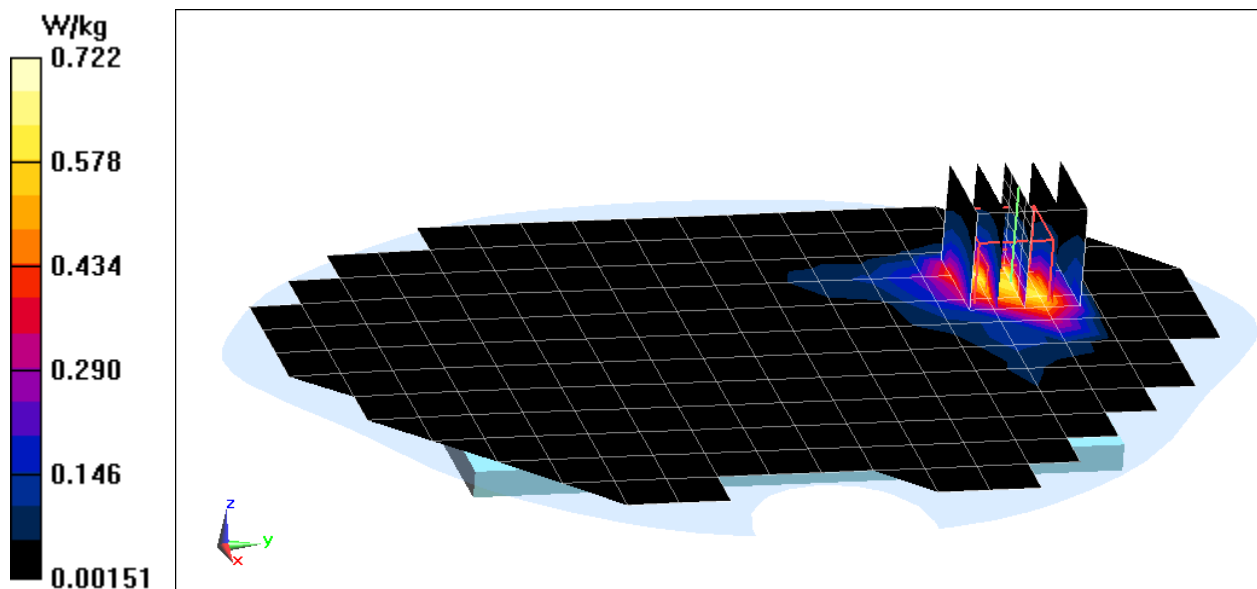
Communication System: UID 0, LTE PCS20 Mhz; Frequency: 1860 MHz; Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
 $f = 1860 \text{ MHz}$; $\sigma = 1.479 \text{ S/m}$; $\epsilon_r = 52.147$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section ; Space: 0.0 cm

Test Date: 07-21-2014; Ambient Temp: 23.8°C; Tissue Temp: 23.7°C

Probe: ES3DV3 - SN3288; ConvF(4.82, 4.82, 4.82); Calibrated: 9/23/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2013
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 2 (PCS), Body SAR, Back side, Low.ch,
20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset**

Area Scan (13x21x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$
Reference Value = 19.26 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 1.24 W/kg
SAR(1 g) = 0.587 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFUK410; Type: Portable Tablet; Serial: 529

Communication System: UID 0, IEEE 802.11b (0); Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$; $\sigma = 1.934 \text{ S/m}$; $\epsilon_r = 50.997$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 0.0 cm

Test Date: 07-21-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.0°C

Probe: ES3DV3 - SN3319; ConvF(4.24, 4.24, 4.24); Calibrated: 4/17/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1368; Calibrated: 4/11/2014

Phantom: SAM; Type: QD000P40CD; Serial: TP:1758

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11b, Body SAR, Ch 6, 1 Mbps, Back Side

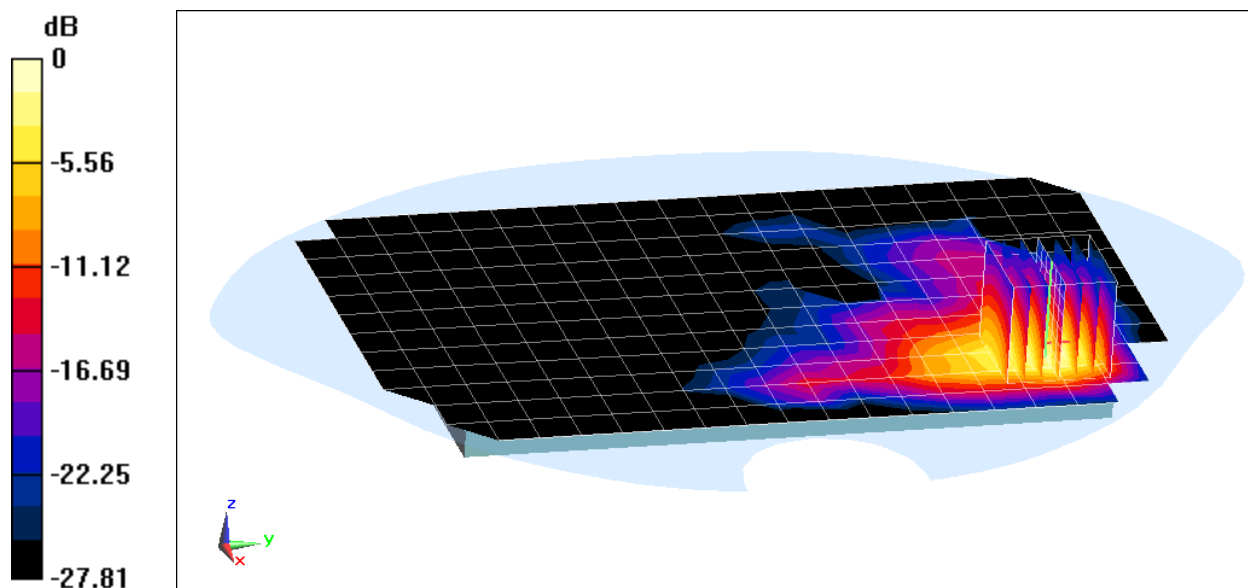
Area Scan (13x20x1): Measurement grid: dx=12mm, dy=12mm

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 17.09 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 1.46 W/kg

SAR(1 g) = 0.571 W/kg



0 dB = 0.808 W/kg = -0.92 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFUK410; Type: Portable Tablet; Serial: 529

Communication System: UID 0, IEEE 802.11a (0); Frequency: 5765 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used:

$f = 5765 \text{ MHz}$; $\sigma = 6.092 \text{ S/m}$; $\epsilon_r = 46.588$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 0.0 cm

Test Date: 07-21-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.4°C

Probe: EX3DV4 - SN3920; ConvF(4, 4, 4); Calibrated: 12/18/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 12/12/2013

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11a, 5.8 GHz, Body SAR, Ch 153, 6 Mbps, Left Edge

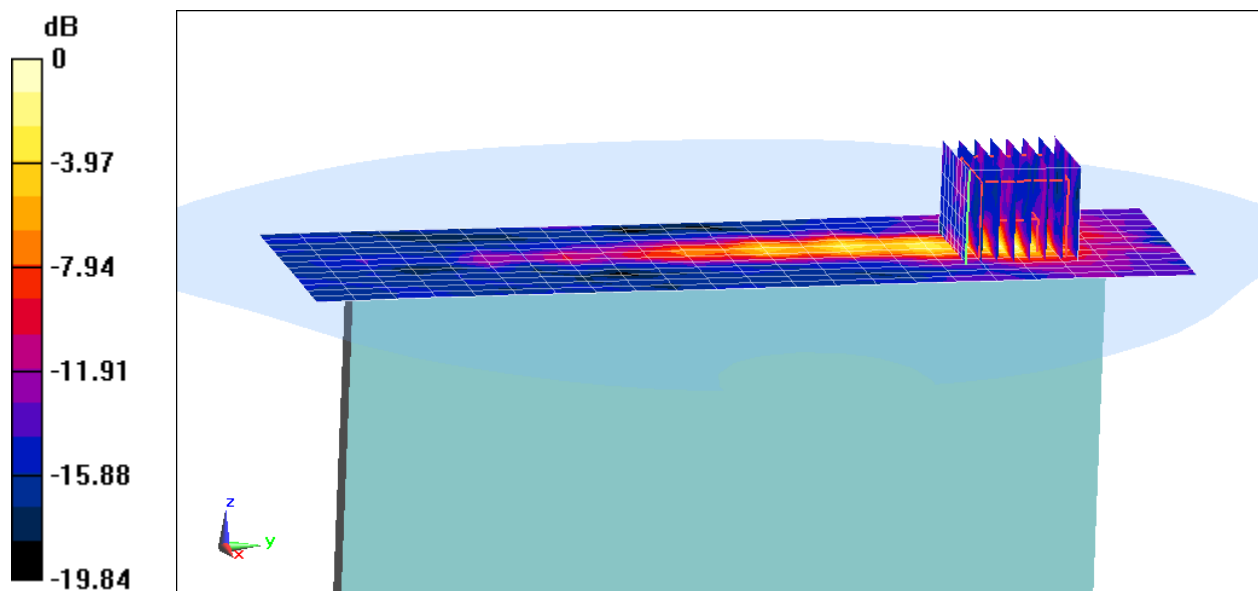
Area Scan (13x23x1): Measurement grid: dx=5mm, dy=10mm

Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4

Reference Value = 4.281 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.767 W/kg

SAR(1 g) = 0.107 W/kg



0 dB = 0.357 W/kg = -4.47 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFUK410; Type: Portable Tablet; Serial: 529

Communication System: UID 0, IEEE 802.11a (0); Frequency: 5180 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
 $f = 5180 \text{ MHz}$; $\sigma = 5.432 \text{ S/m}$; $\epsilon_r = 47.189$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section ; Space: 0.0 cm

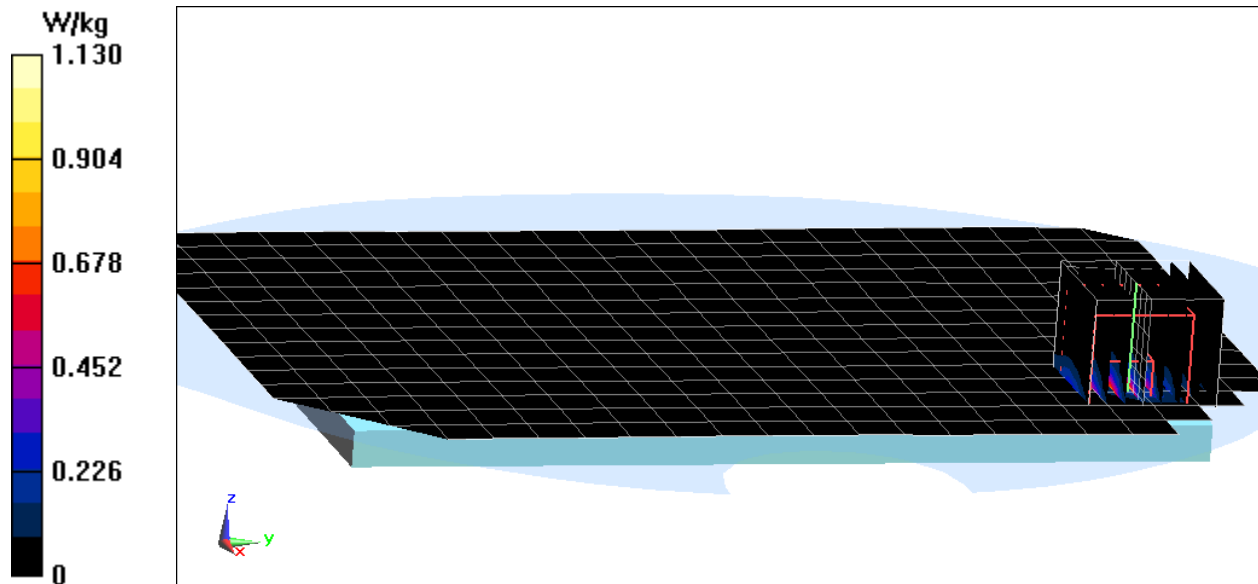
Test Date: 07-21-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.3°C

Probe: EX3DV4 - SN3920; ConvF(4.23, 4.23, 4.23); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11a, 5.2 GHz, Body SAR, Ch 36, 6 Mbps, Back Side

Area Scan (16x23x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4
Reference Value = 9.290 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 2.70 W/kg
SAR(1 g) = 0.407 W/kg



APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium: 740 Body Medium parameters used (interpolated):

$f = 750 \text{ MHz}$; $\sigma = 0.957 \text{ S/m}$; $\epsilon_r = 54.079$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.5 cm

Test Date: 07-23-2014; Ambient Temp: 22.4°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3288; ConvF(6.25, 6.25, 6.25); Calibrated: 9/23/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2013

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

750MHz System Verification

Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

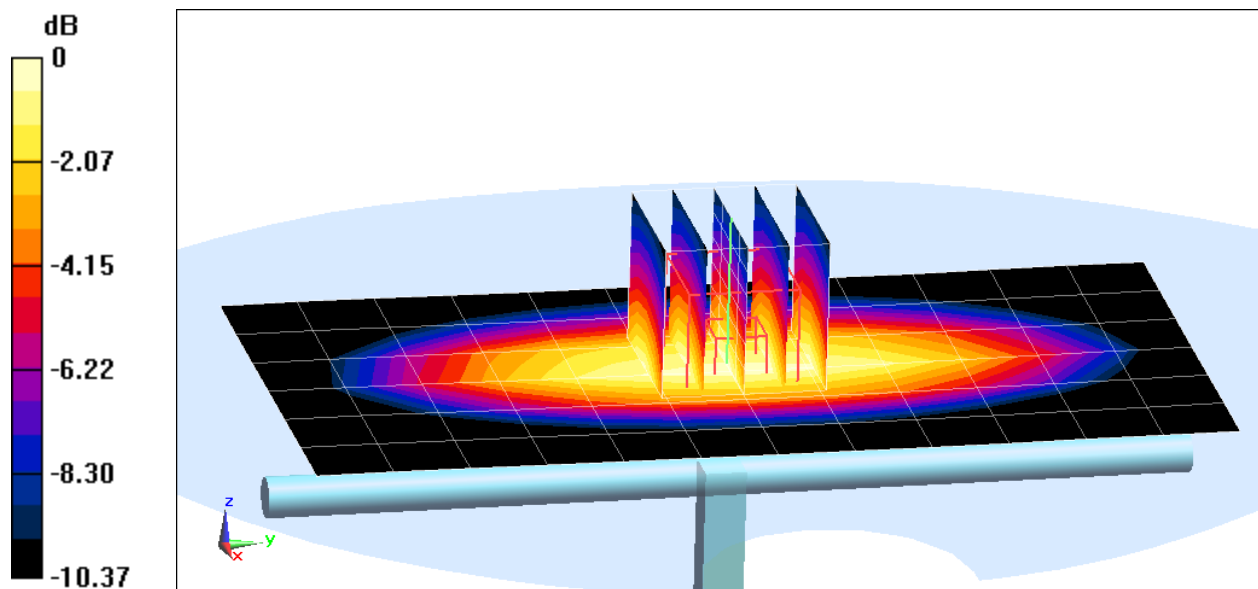
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 1.28 W/kg

SAR(1 g) = 0.870 W/kg

Deviation = 1.87 %



0 dB = 1.01 W/kg = 0.06 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 1.01 \text{ S/m}$; $\epsilon_r = 54.452$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.5 cm

Test Date: 07-21-2014; Ambient Temp: 22.6°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3332; ConvF(6.08, 6.08, 6.08); Calibrated: 11/25/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1407; Calibrated: 11/18/2013

Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

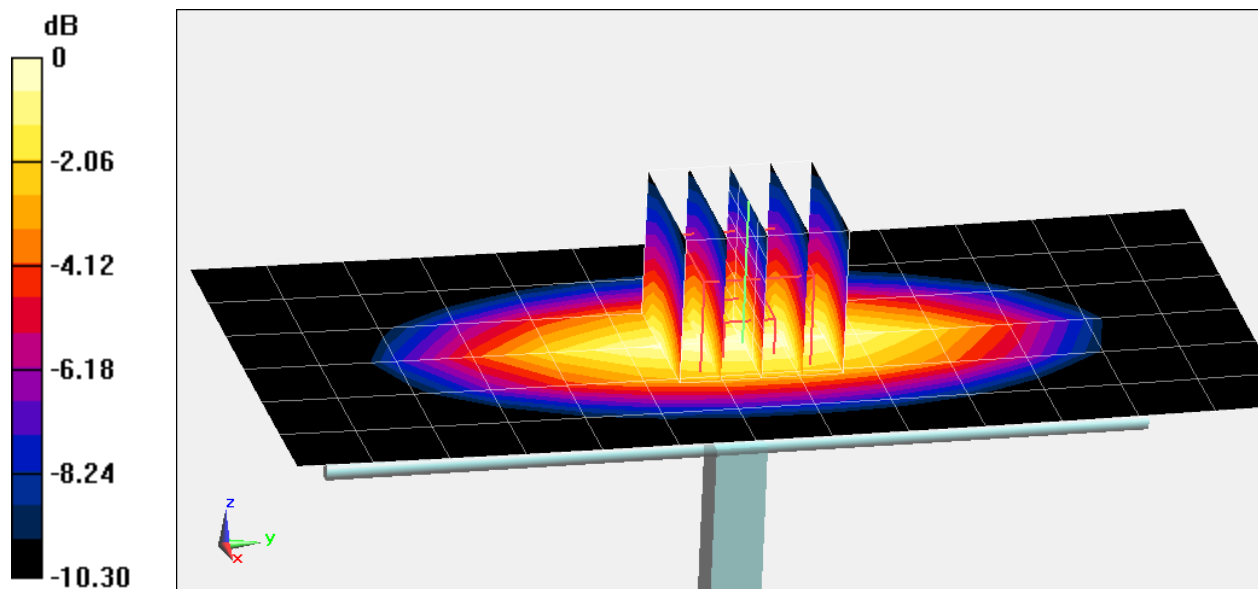
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 1.40 W/kg

SAR(1 g) = 0.962 W/kg

Deviation = 3.00 %



0 dB = 1.12 W/kg = 0.50 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: 1750 Body Medium parameters used:

$f = 1750 \text{ MHz}$; $\sigma = 1.539 \text{ S/m}$; $\epsilon_r = 52.495$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-21-2014; Ambient Temp: 23.3°C; Tissue Temp: 21.0°C

Probe: ES3DV3 - SN3213; ConvF(4.89, 4.89, 4.89); Calibrated: 4/11/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 3/17/2014

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

1750 MHz System Verification

Area Scan (6x8x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

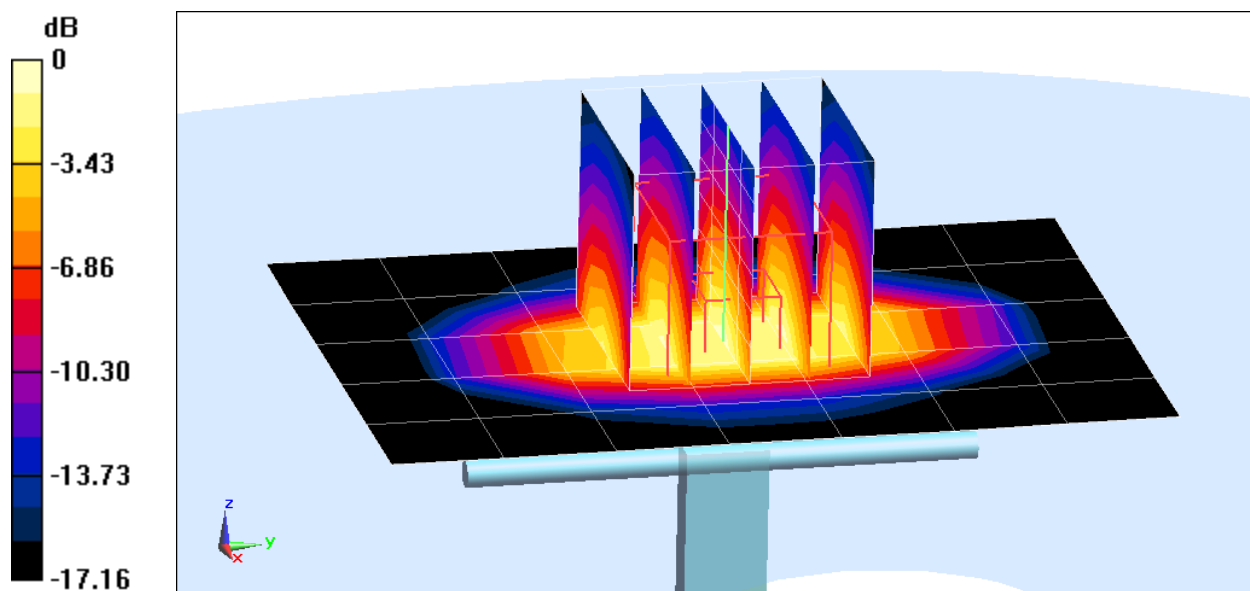
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 6.57 W/kg

SAR(1 g) = 3.67 W/kg

Deviation = -1.87 %



0 dB = 4.59 W/kg = 6.62 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):

$f = 1900 \text{ MHz}$; $\sigma = 1.523 \text{ S/m}$; $\epsilon_r = 52.01$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-21-2014; Ambient Temp: 23.8°C; Tissue Temp: 23.7°C

Probe: ES3DV3 - SN3288; ConvF(4.82, 4.82, 4.82); Calibrated: 9/23/2013;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2013

Phantom: SAM with CRP; Type: SAM; Serial: TP1375

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

1900MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm

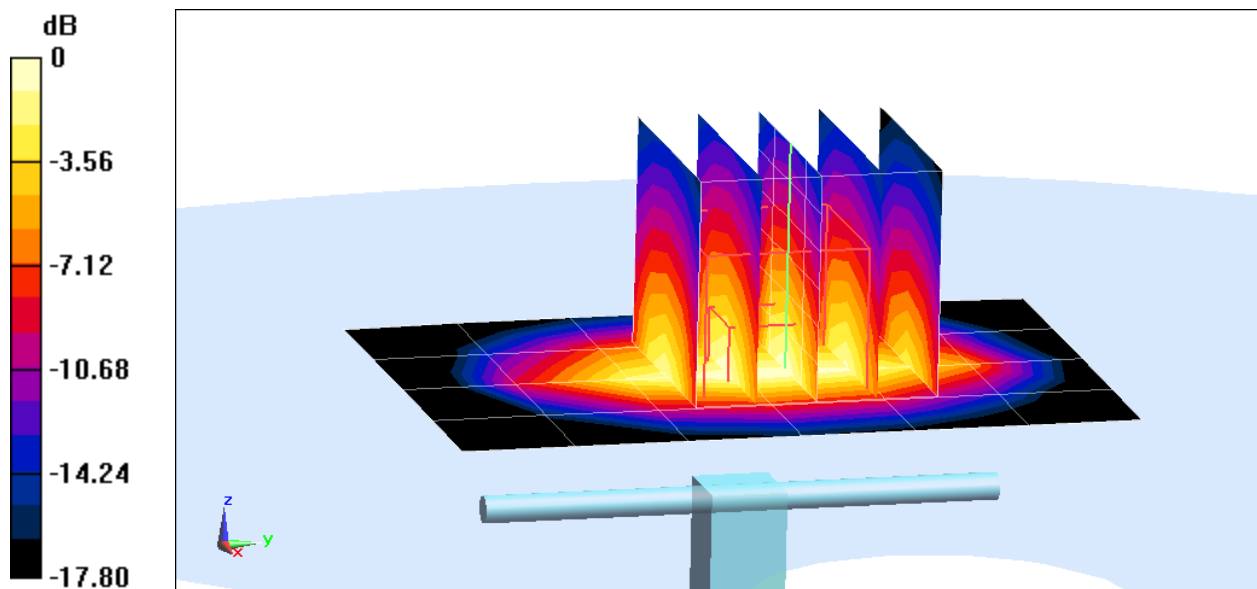
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 7.25 W/kg

SAR(1 g) = 4.17 W/kg

Deviation = 6.11 %



0 dB = 5.14 W/kg = 7.11 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$; $\sigma = 1.952 \text{ S/m}$; $\epsilon_r = 50.957$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-21-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.0°C

Probe: ES3DV3 - SN3319; ConvF(4.24, 4.24, 4.24); Calibrated: 4/17/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1368; Calibrated: 4/11/2014

Phantom: SAM; Type: QD000P40CD; Serial: TP:1758

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

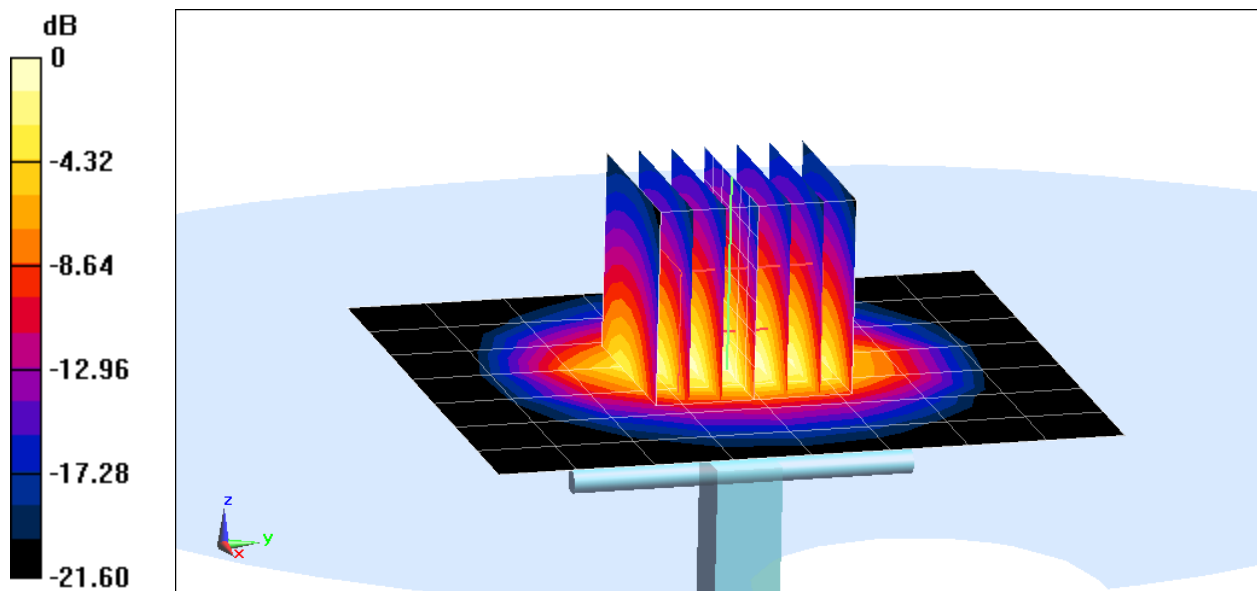
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 10.8 W/kg

SAR(1 g) = 5.18 W/kg

Deviation = 4.86 %



0 dB = 6.60 W/kg = 8.20 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1007

Communication System: UID 0, CW; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
 $f = 5200 \text{ MHz}$; $\sigma = 5.444 \text{ S/m}$; $\epsilon_r = 47.184$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-21-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.3°C

Probe: EX3DV4 - SN3920; ConvF(4.23, 4.23, 4.23); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

5200MHz System Verification

Area Scan (7x9x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

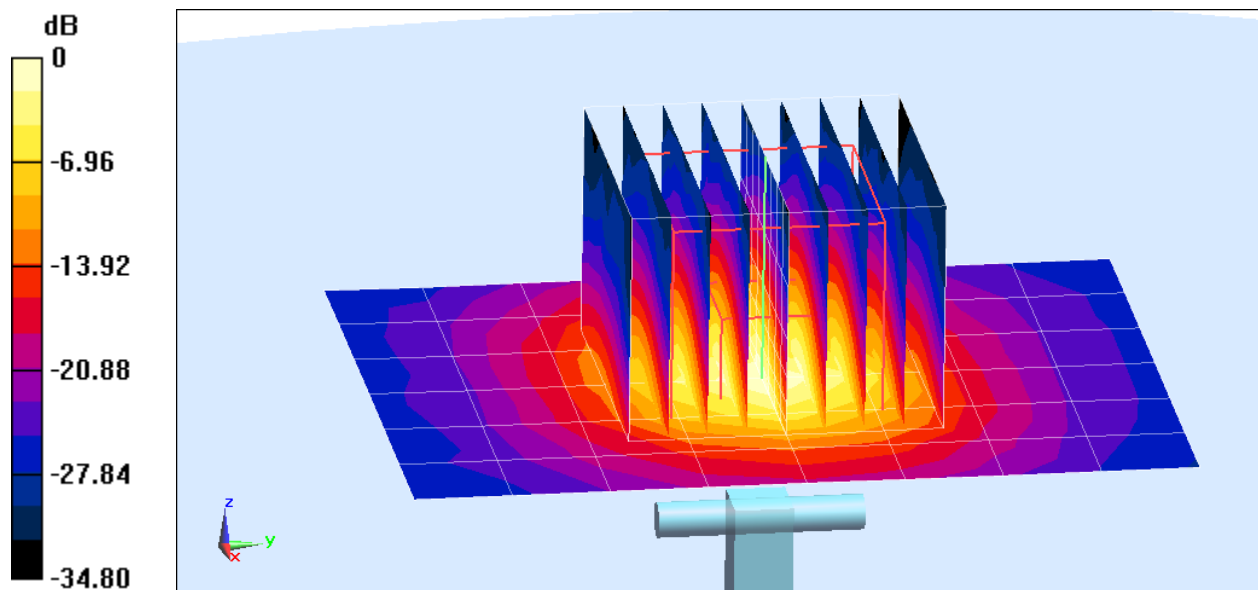
Zoom Scan (9x9x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 29.3 W/kg

SAR(1 g) = 7.65 W/kg

Deviation = 5.37 %



0 dB = 19.0 W/kg = 12.79 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5300 MHz; Type: D5GHzV2; Serial: 1007

Communication System: UID 0, CW; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used:

$f = 5300 \text{ MHz}$; $\sigma = 5.573 \text{ S/m}$; $\epsilon_r = 47.108$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-21-2014; Ambient Temp: 24.6°C; Tissue Temp: 23.3°C

Probe: EX3DV4 - SN3920; ConvF(4.11, 4.11, 4.11); Calibrated: 12/18/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 12/12/2013

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

5300MHz System Verification

Area Scan (7x9x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

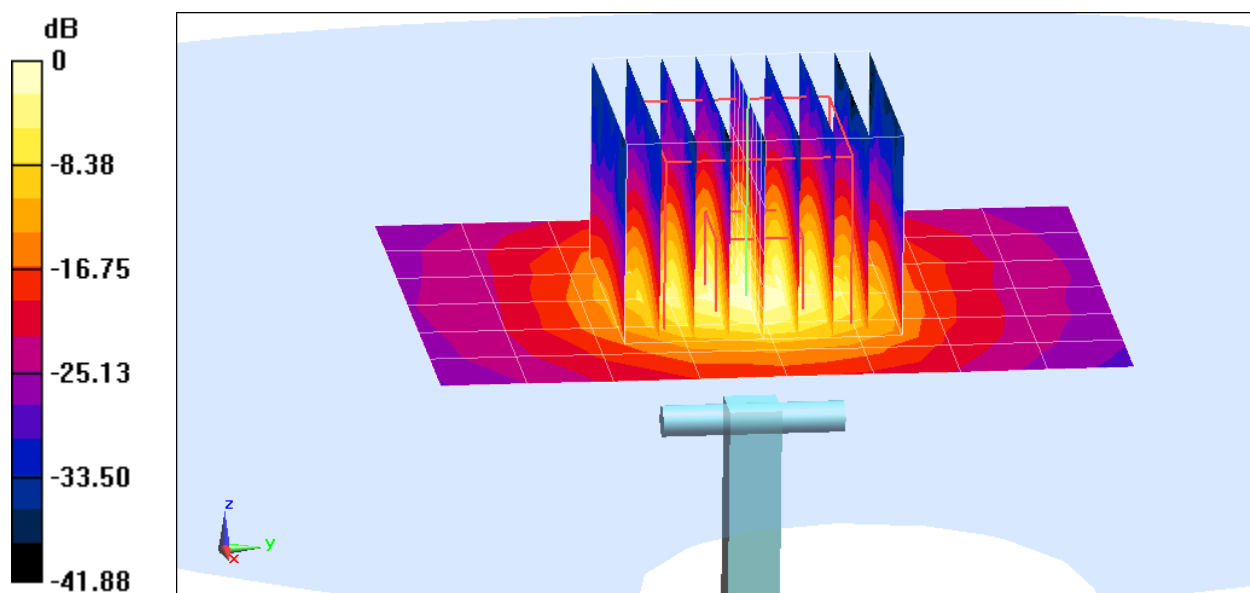
Zoom Scan (9x9x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 31.2 W/kg

SAR(1 g) = 7.88 W/kg

Deviation = 5.49 %



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1007

Communication System: UID 0, CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used:

$f = 5500 \text{ MHz}$; $\sigma = 5.806 \text{ S/m}$; $\epsilon_r = 47.163$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-21-2014; Ambient Temp: 24.6°C; Tissue Temp: 24.4°C

Probe: EX3DV4 - SN3920; ConvF(3.8, 3.8, 3.8); Calibrated: 12/18/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 12/12/2013

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

5500MHz System Verification

Area Scan (7x9x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

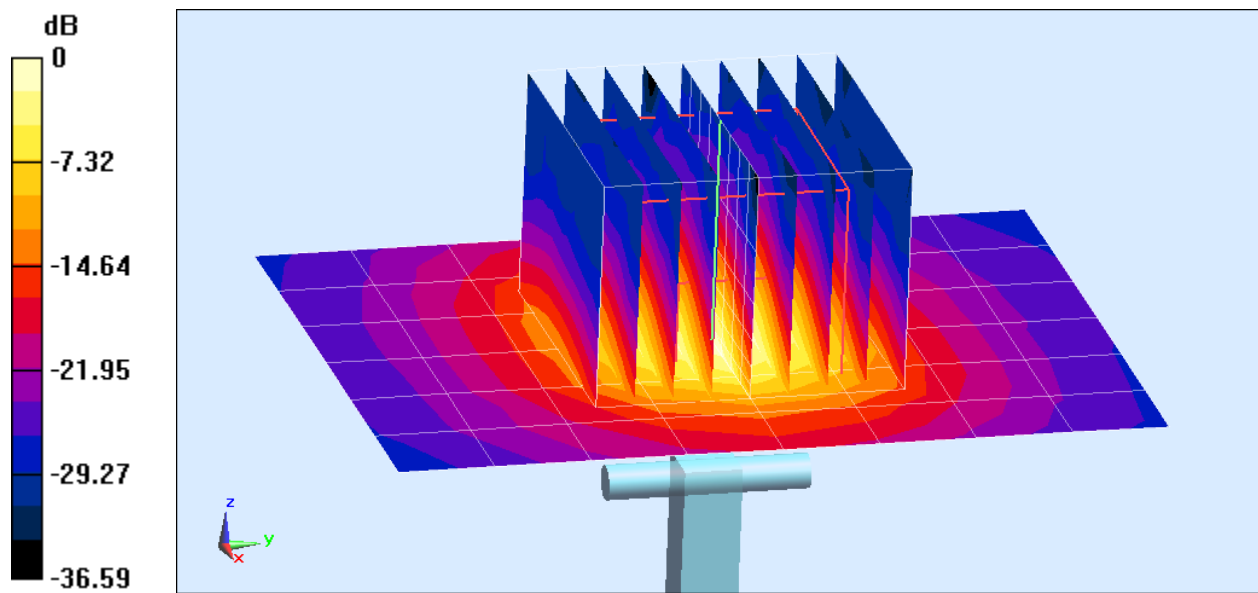
Zoom Scan (9x9x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power - 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 34.1 W/kg

SAR(1 g) = 8.14 W/kg

Deviation = 7.25 %



0 dB = 20.8 W/kg = 13.18 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1007

Communication System: UID 0, CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used:

$f = 5800 \text{ MHz}$; $\sigma = 6.134 \text{ S/m}$; $\epsilon_r = 46.486$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-21-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.4°C

Probe: EX3DV4 - SN3920; ConvF(4, 4, 4); Calibrated: 12/18/2013;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 12/12/2013

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

5800MHz System Verification

Area Scan (7x9x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

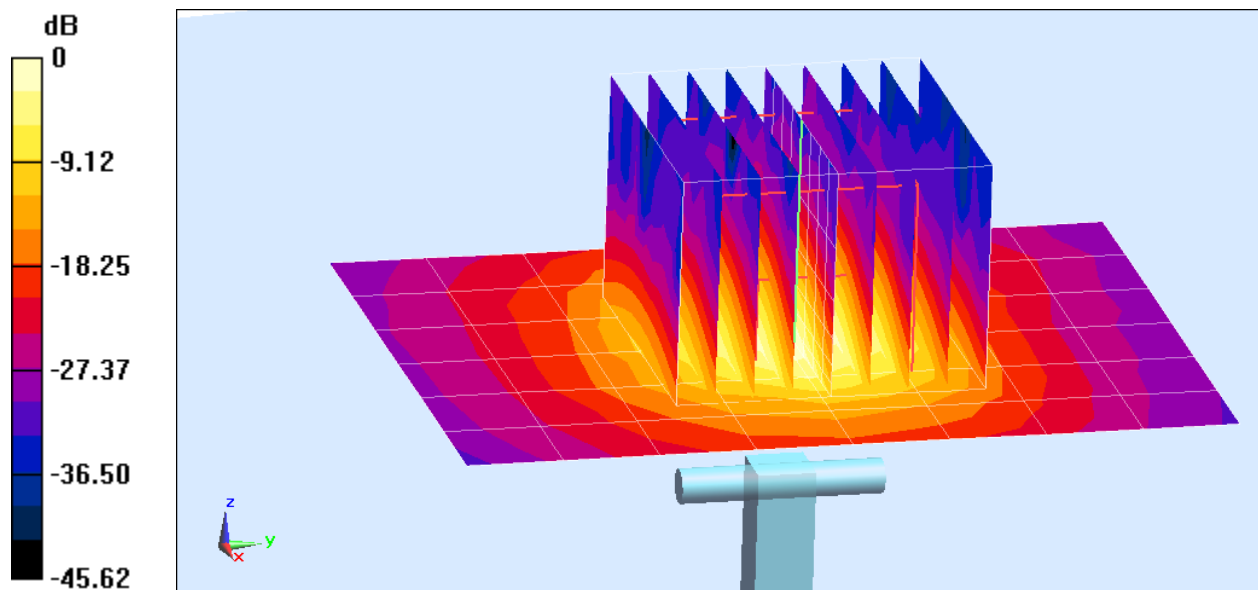
Zoom Scan (9x9x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 34.1 W/kg

SAR(1 g) = 7.48 W/kg

Deviation = 2.61 %



0 dB = 20.0 W/kg = 13.01 dBW/kg

APPENDIX C: PROBE CALIBRATION



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA
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Client **PC Test**

Certificate No: **ES3-3332_Nov13**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3332**

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

Calibration date: **November 25, 2013**

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

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

Calibration Equipment used (M&TE critical for calibration)

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

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
Issued: November 25, 2013			
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Accreditation No.: **SCS 108**

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

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,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:

- 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
- 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:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below *ConvF*).
- NORM(f)_{x,y,z}** = NORM_{x,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*.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,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 NORM_{x,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 NORM_x (no uncertainty required).

Probe ES3DV3

SN:3332

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

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

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

Basic Calibration Parameters

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

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	179.7	±2.5 %
		Y	0.0	0.0	1.0		147.3	
		Z	0.0	0.0	1.0		188.8	

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

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

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

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	41.9	0.89	6.46	6.46	6.46	0.52	1.42	± 12.0 %
850	41.5	0.92	6.29	6.29	6.29	0.78	1.17	± 12.0 %
1750	40.1	1.37	5.27	5.27	5.27	0.80	1.10	± 12.0 %
1900	40.0	1.40	5.06	5.06	5.06	0.80	1.18	± 12.0 %
2450	39.2	1.80	4.50	4.50	4.50	0.80	1.19	± 12.0 %
2600	39.0	1.96	4.38	4.38	4.38	0.76	1.31	± 12.0 %

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

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

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

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

Calibration Parameter Determined in Body Tissue Simulating Media

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

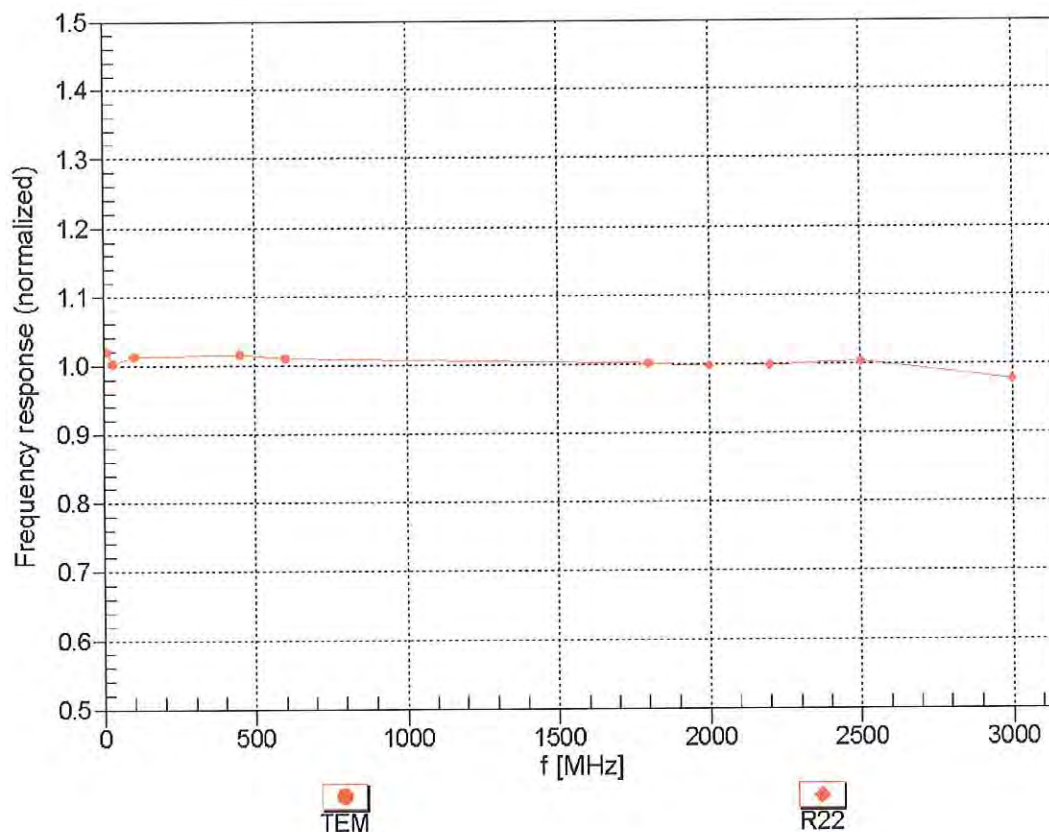
^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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

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

Frequency Response of E-Field

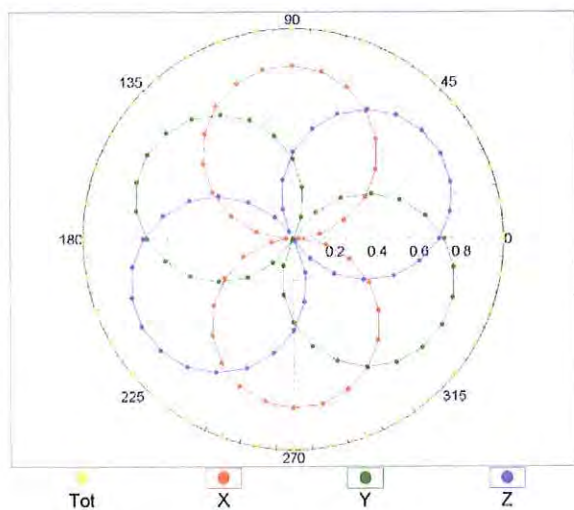
(TEM-Cell:ifi110 EXX, Waveguide: R22)



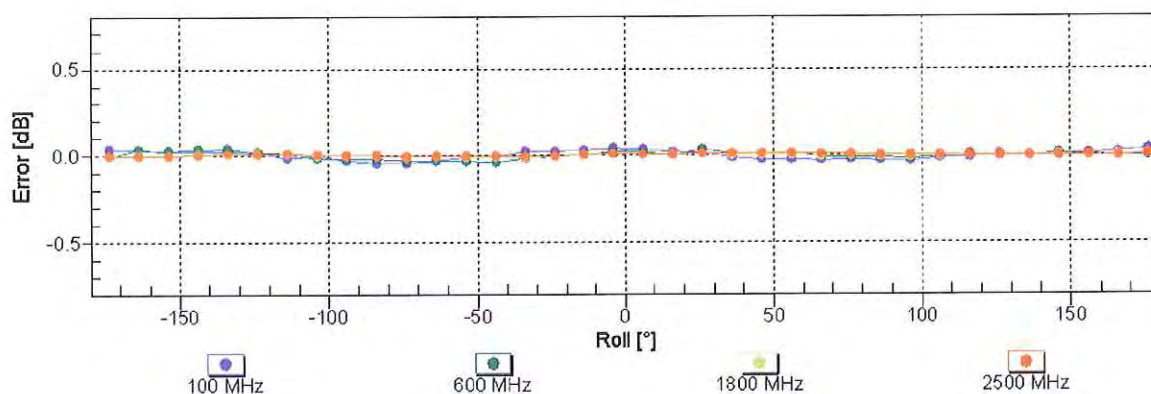
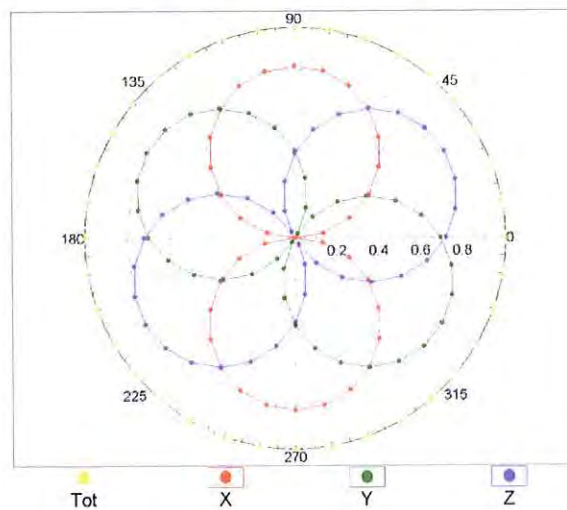
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\vartheta = 0^\circ$

f=600 MHz,TEM

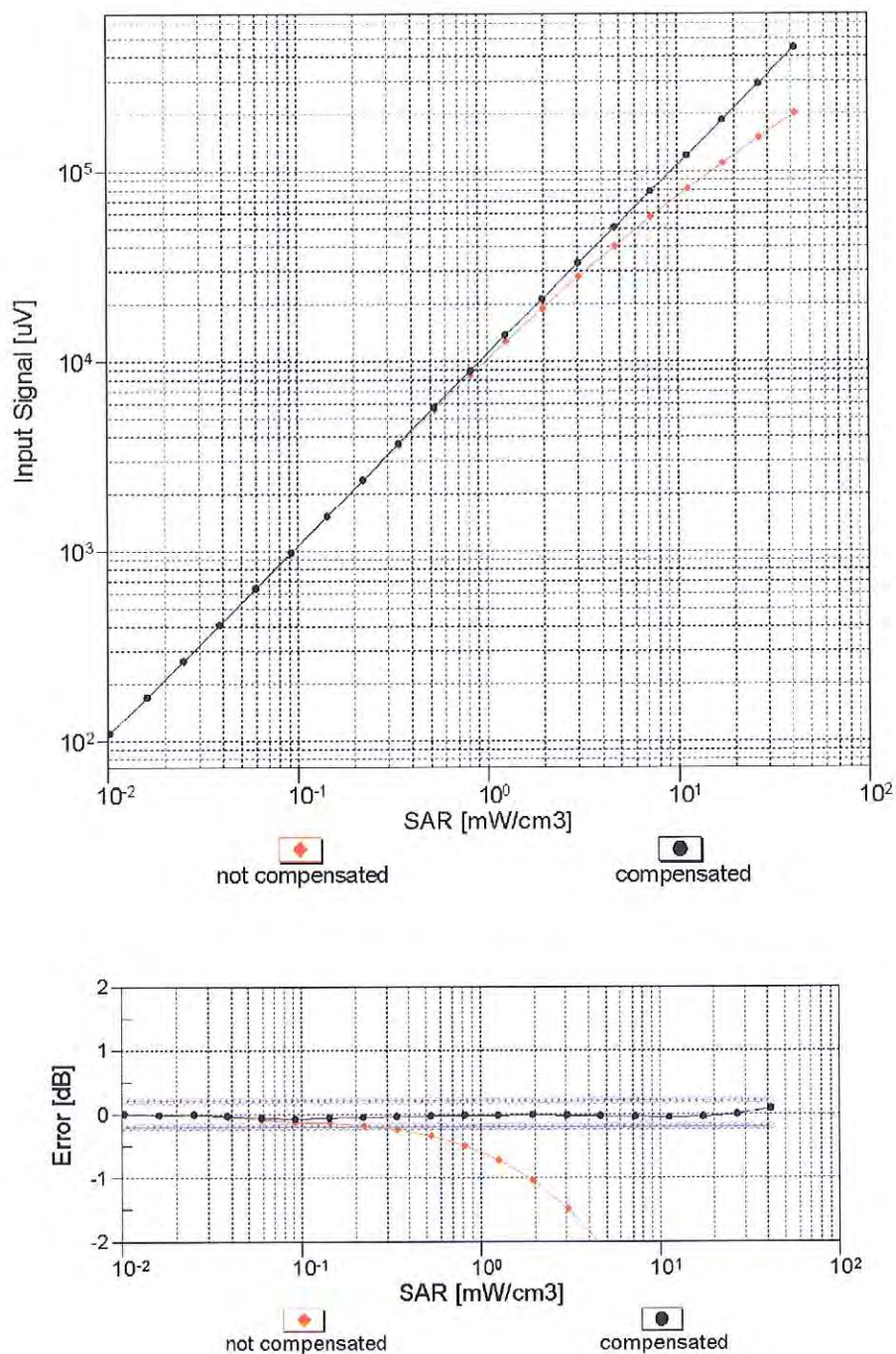


f=1800 MHz,R22



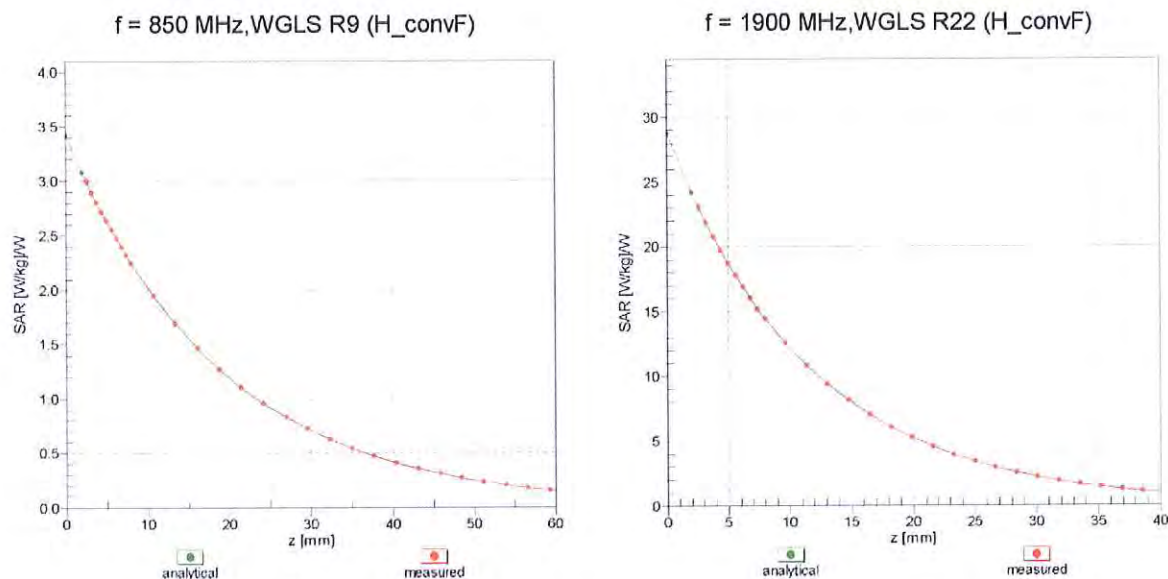
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f = 900 \text{ MHz}$)



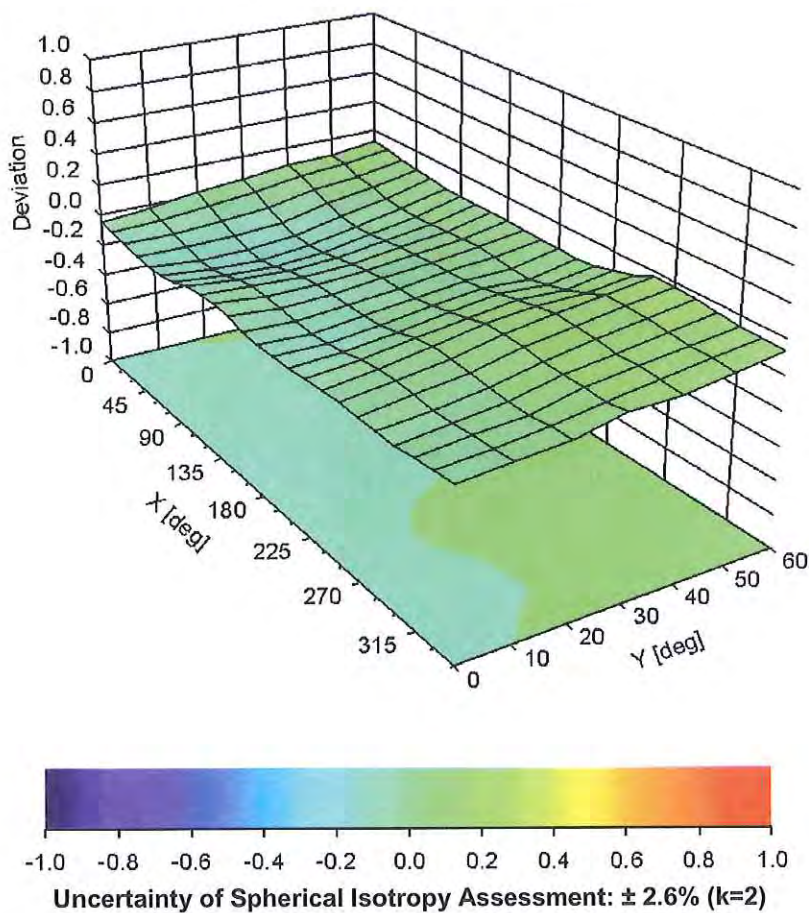
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-3.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1750V2-1051_Apr14**

CALIBRATION CERTIFICATE

Object **D1750V2 - SN: 1051**

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

Calibration date: **April 10, 2014**

✓
KOK
5/7/14

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by: **Israe El-Naouq** Name: **Israe El-Naouq** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Name: **Katja Pokovic** Function: **Technical Manager**

Signature

Israe El-Naouq
Katja Pokovic

Issued: April 10, 2014

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Accreditation No.: **SCS 108**

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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	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz $\pm$ 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 $\pm$ 0.2) °C	39.1 $\pm$ 6 %	1.35 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.2 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.2 W/kg $\pm$ 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 $\pm$ 0.2) °C	52.0 $\pm$ 6 %	1.48 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

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

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

Appendix

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

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

General Antenna Parameters and Design

Electrical Delay (one direction)	1.222 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	February 19, 2010

DASY5 Validation Report for Head TSL

Date: 10.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.35$ S/m; $\epsilon_r = 39.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

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

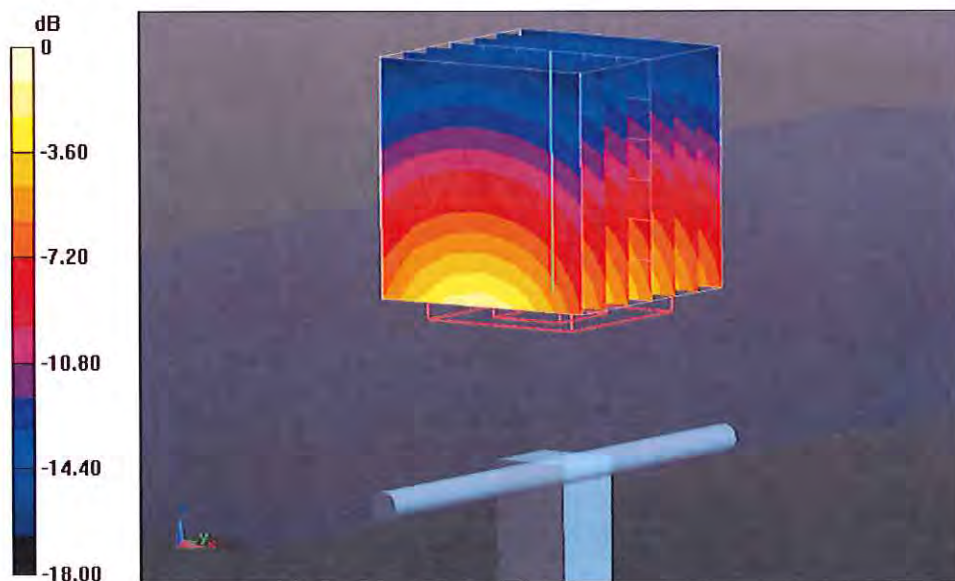
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.631 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 16.2 W/kg

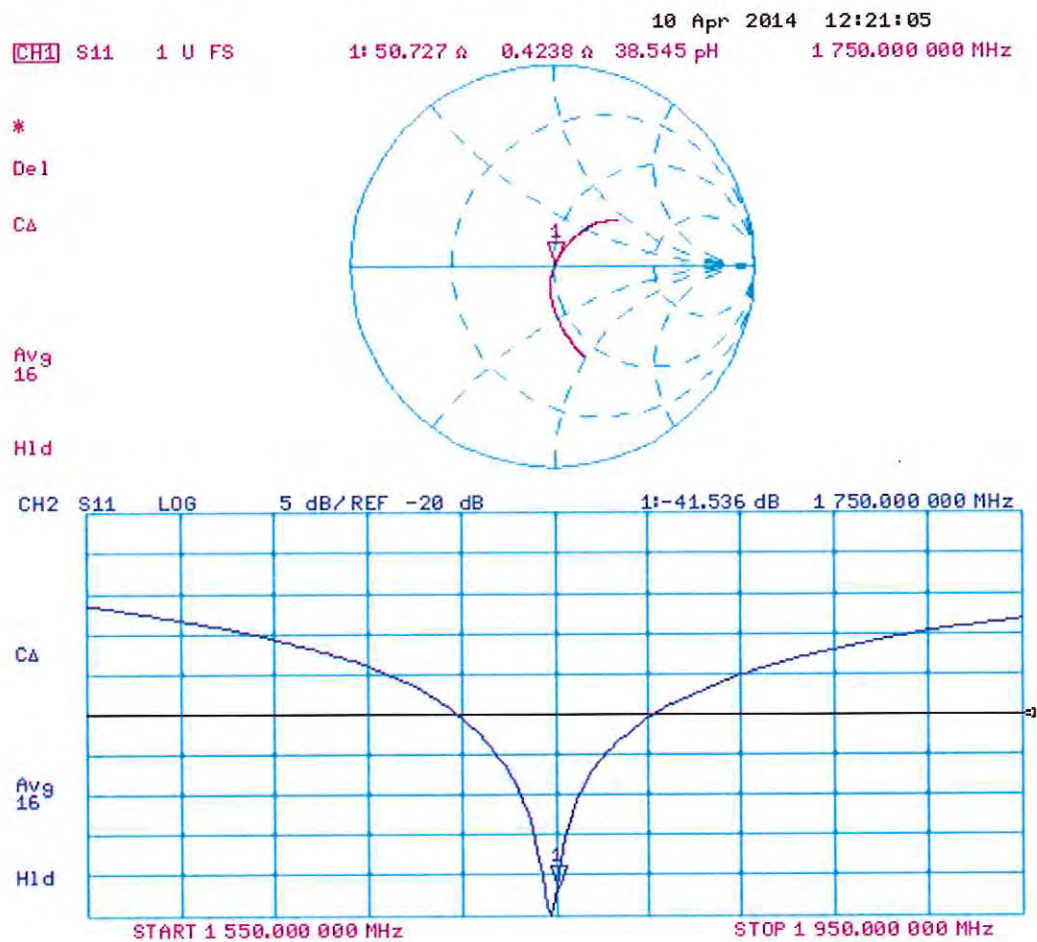
SAR(1 g) = 9.02 W/kg; SAR(10 g) = 4.79 W/kg

Maximum value of SAR (measured) = 11.3 W/kg



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 10.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.48$ S/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

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

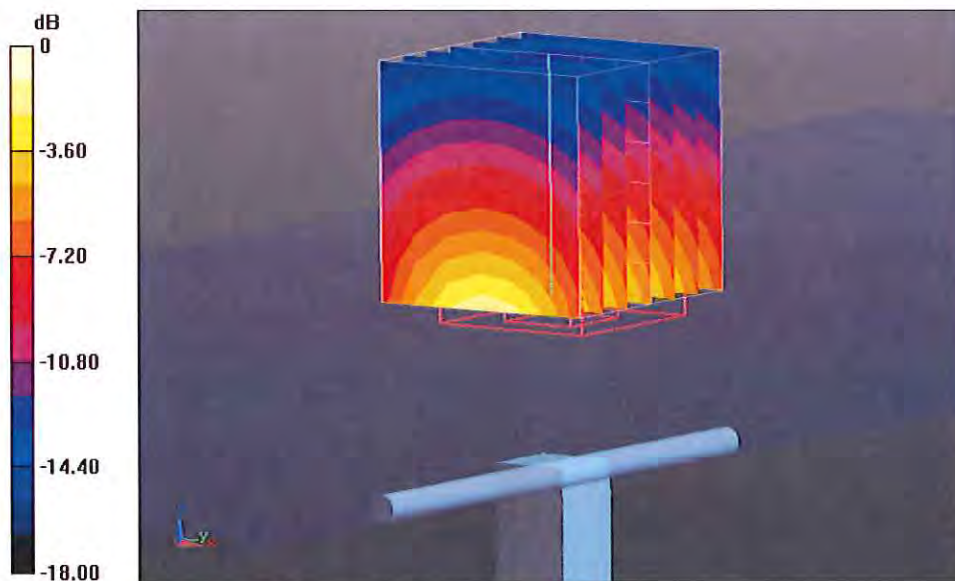
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.321 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 16.1 W/kg

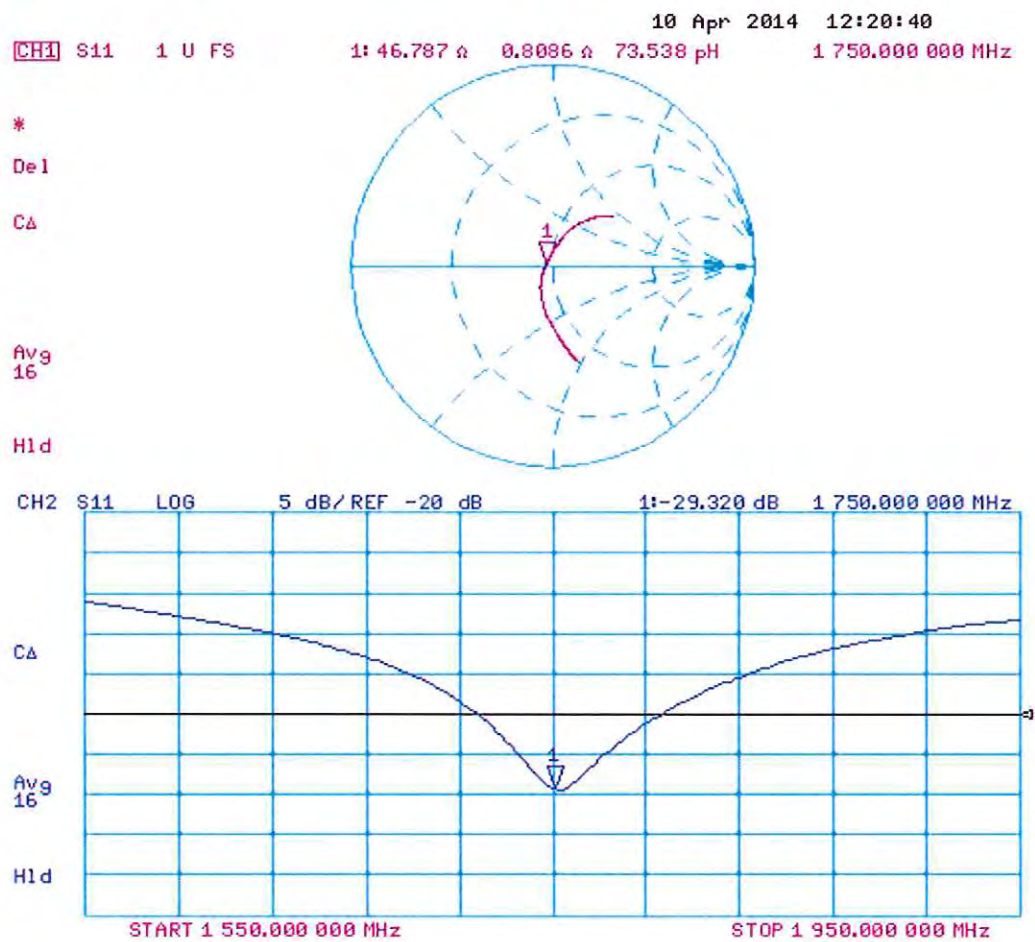
SAR(1 g) = 9.37 W/kg; SAR(10 g) = 5.04 W/kg

Maximum value of SAR (measured) = 11.8 W/kg



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

Impedance Measurement Plot for Body TSL





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Client **PC Test**

Certificate No: **D1900V2-5d148_Feb14**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d148**

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

Calibration date: **February 27, 2014**

CCV
3/1/2014

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by: **Jeton Kastrati** Name **Laboratory Technician** Function **Signature**

Approved by: **Katja Pokovic** Technical Manager

Issued: February 27, 2014

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

Calibration is Performed According to the Following Standards:

- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 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 $\pm$ 0.2) °C	38.9 $\pm$ 6 %	1.39 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.7 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.2 W/kg $\pm$ 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 $\pm$ 0.2) °C	52.8 $\pm$ 6 %	1.49 mho/m $\pm$ 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	9.73 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	39.3 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.15 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.7 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$52.5 \Omega + 5.5 j\Omega$
Return Loss	- 24.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.0 \Omega + 6.7 j\Omega$
Return Loss	- 23.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 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: 27.02.2014

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; $\sigma = 1.39$ S/m; $\epsilon_r = 38.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

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

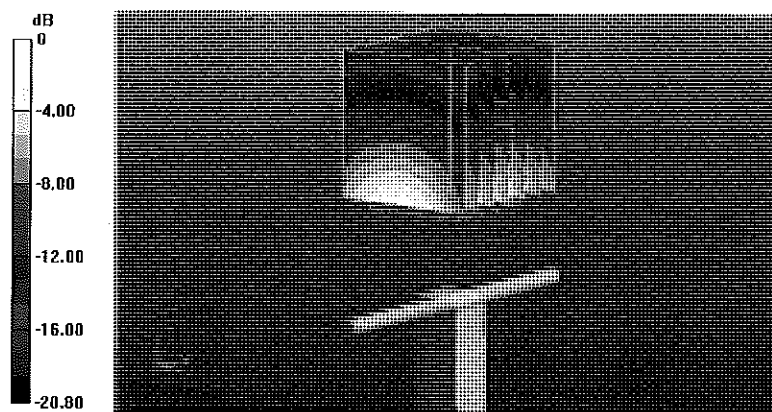
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.796 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 18.9 W/kg

SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.31 W/kg

Maximum value of SAR (measured) = 12.8 W/kg

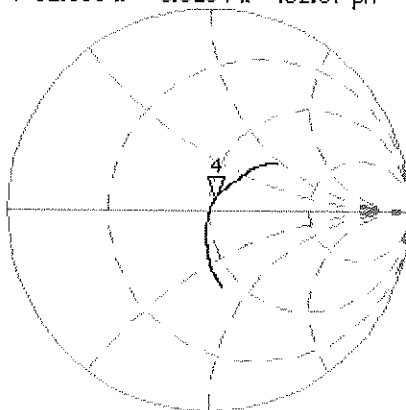


0 dB = 12.8 W/kg = 11.07 dBW/kg

Impedance Measurement Plot for Head TSL

27 Feb 2014 09:42:31
 [CH1] S11 1 U FS 4: 52.533 Δ 5.5234 Δ 462.67 pH 1 900.000 000 MHz

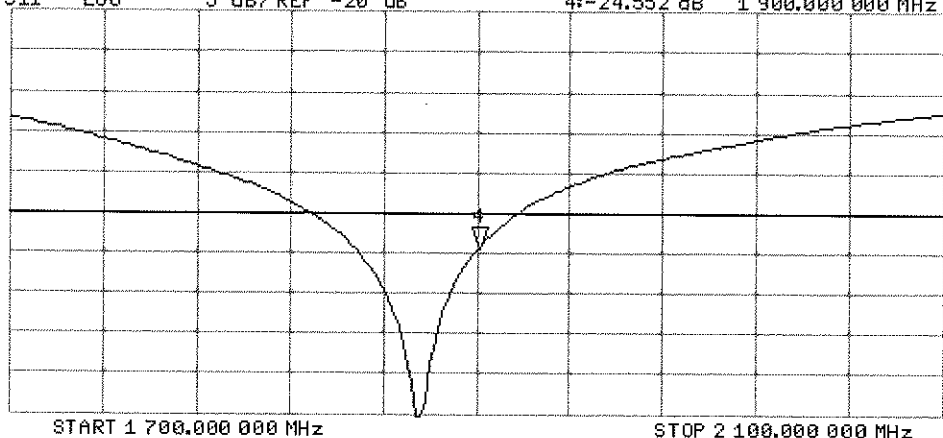
*
 De1
 CA



AVG
 16
 H1d

CH2 S11 LOG 5 dB/REF -20 dB 4:-24.552 dB 1 900.000 000 MHz

CA
 AVG
 16
 H1d



DASY5 Validation Report for Body TSL

Date: 27.02.2014

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; $\sigma = 1.49$ S/m; $\epsilon_r = 52.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

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

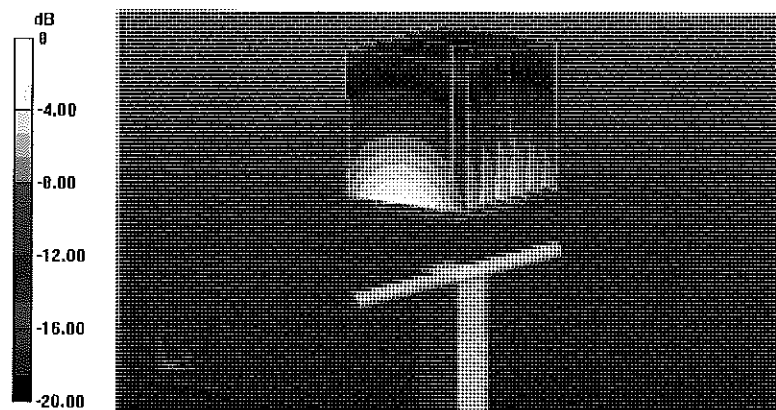
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.520 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 17.0 W/kg

SAR(1 g) = 9.73 W/kg; SAR(10 g) = 5.15 W/kg

Maximum value of SAR (measured) = 12.2 W/kg

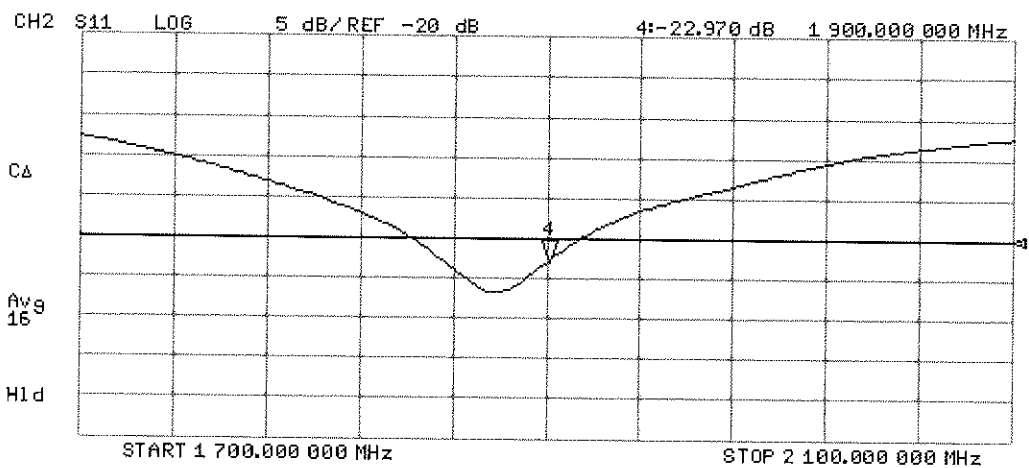
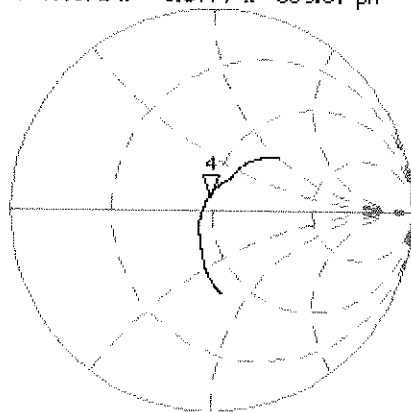


0 dB = 12.2 W/kg = 10.86 dBW/kg

Impedance Measurement Plot for Body TSL

CH1 S11 1 U FS 4: 47.971 Ω 6.6777 Ω 559.37 pF 1 900.000 000 MHz 27 Feb 2014 09:42:04

*
De1
CA
Avg
16
H1d





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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D2450V2-797_Jan14**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 797**

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

Calibration date: **January 21, 2014**

CC ✓
2/5/14

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: January 21, 2014

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Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

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:

- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 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 $\pm$ 0.2) °C	38.7 $\pm$ 6 %	1.86 mho/m $\pm$ 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	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	51.8 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.3 W/kg $\pm$ 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 $\pm$ 0.2) °C	51.3 $\pm$ 6 %	2.04 mho/m $\pm$ 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	12.7 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	49.4 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.86 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.1 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$53.5 \Omega + 3.2 j\Omega$
Return Loss	- 26.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$50.0 \Omega + 4.9 j\Omega$
Return Loss	- 26.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.151 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 24, 2006

DASY5 Validation Report for Head TSL

Date: 21.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.86$ S/m; $\epsilon_r = 38.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

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

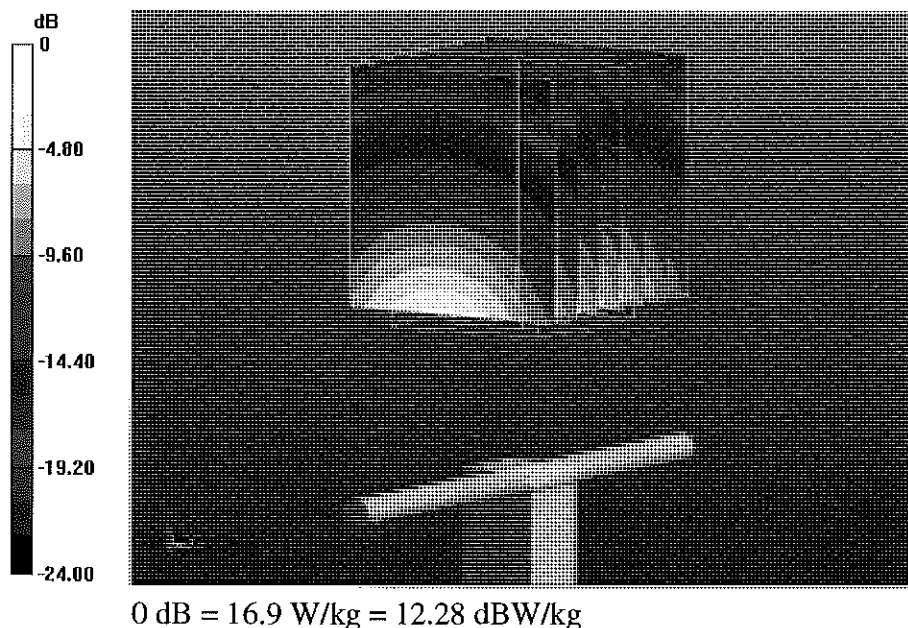
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.151 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 27.5 W/kg

SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.13 W/kg

Maximum value of SAR (measured) = 16.9 W/kg



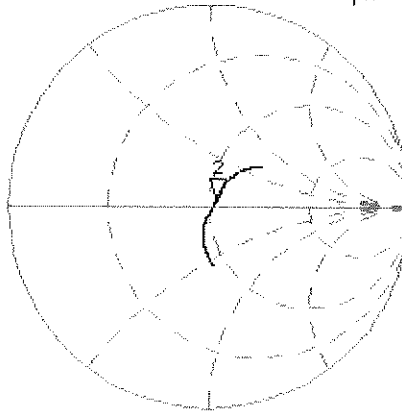
Impedance Measurement Plot for Head TSL

21 Jan 2014 11:31:52
 [CH1] S11 1 U FS 2: 53.512 $\angle$ 3.2285 $\angle$ 209.73 pH 2 450.000 000 MHz

*
 Del
 CA

Avg
 16

H1d

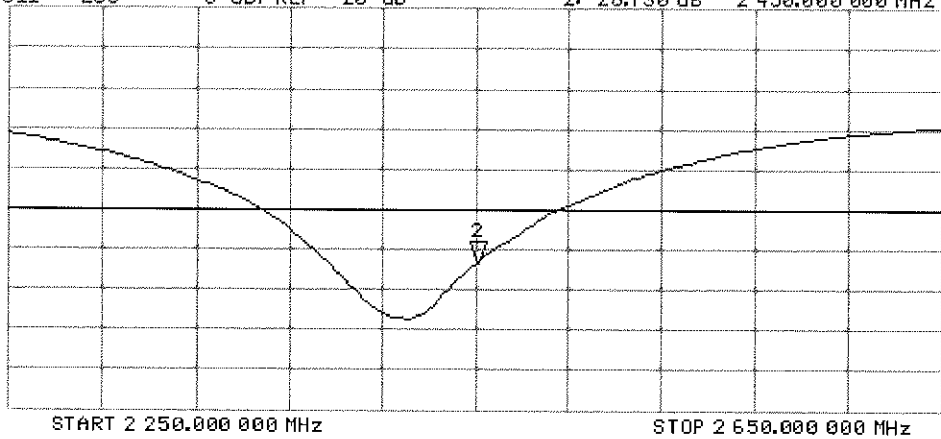


CH2 S11 LOG 5 dB/REF -20 dB 2:-26.730 dB 2 450.000 000 MHz

CA

Avg
 16

H1d



DASY5 Validation Report for Body TSL

Date: 21.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.04$ S/m; $\epsilon_r = 51.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

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

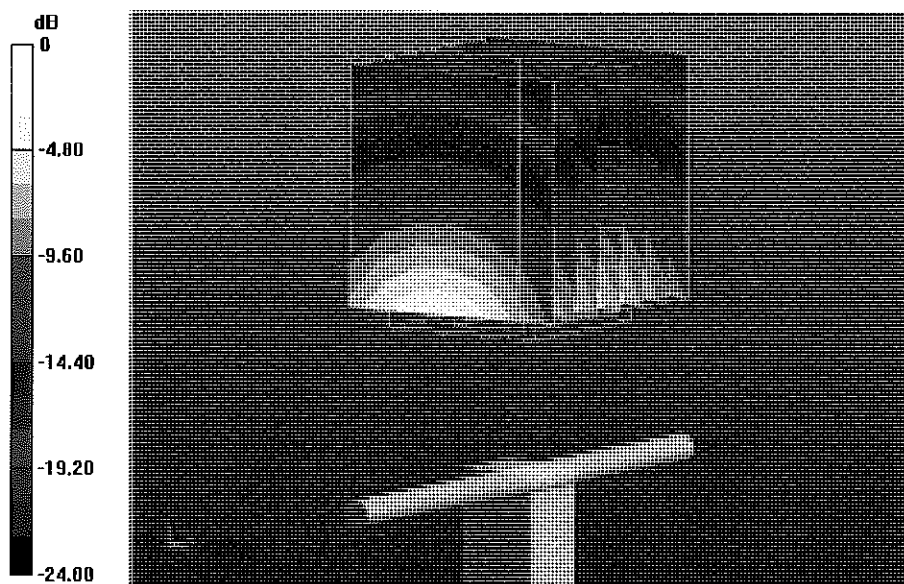
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.709 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 26.4 W/kg

SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.86 W/kg

Maximum value of SAR (measured) = 16.8 W/kg



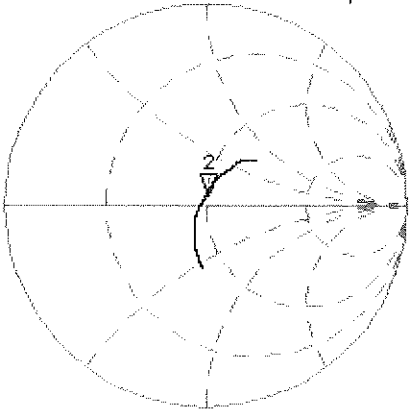
0 dB = 16.8 W/kg = 12.25 dBW/kg

Impedance Measurement Plot for Body TSL

21 Jan 2014 11:31:29

CH1 S11 1 U FS 2: 49.994 Ω 4.9258 Ω 319.98 μ H 2 450.000 000 MHz

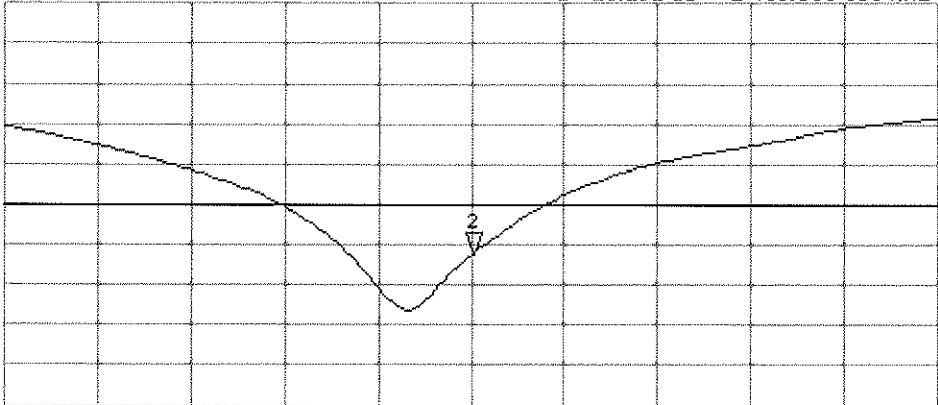
*
Del
CA



Avg
16
H1d

CH2 S11 LOG 5 dB/REF -20 dB 2:-26.162 dB 2 450.000 000 MHz

CA
Avg
16
H1d



START 2 250.000 000 MHz

STOP 2 450.000 000 MHz



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Accreditation No.: **SCS 108**

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Client **PC Test**

Certificate No: **D5GHzV2-1007_Sep13/2**

CALIBRATION CERTIFICATE (Replacement of No: D5GHzV2-1007_Sep13)

Object **D5GHzV2 - SN: 1007**

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

CC✓
 10/15/13

Calibration date: **September 23, 2013**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe EX3DV4	SN: 3503	28-Dec-12 (No. EX3-3503_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by: **Leif Klysner** Function: **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** Technical Manager

Issued: October 4, 2013

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



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Accreditation No.: **SCS 108**

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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:

- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
- 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:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz $\pm$ 1 MHz 5300 MHz $\pm$ 1 MHz 5500 MHz $\pm$ 1 MHz 5600 MHz $\pm$ 1 MHz 5800 MHz $\pm$ 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 $\pm$ 0.2) °C	35.8 $\pm$ 6 %	4.48 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.77 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	77.5 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.2 W/kg $\pm$ 19.5 % (k=2)

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.6 ± 6 %	4.62 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.2 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.9 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	4.76 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 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	35.2 ± 6 %	4.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.03 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.0 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.7 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	35.0 ± 6 %	5.07 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.78 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	77.5 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.9 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	48.3 ± 6 %	5.36 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.28 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	72.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.03 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.2 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	48.1 ± 6 %	5.56 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.49 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	74.7 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.8 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	47.8 ± 6 %	5.75 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.0 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	47.6 ± 6 %	5.88 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm³ (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	77.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.16 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	47.3 ± 6 %	6.17 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.31 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	72.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.02 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.1 W/kg ± 19.5 % (k=2)

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	52.4 Ω - 11.0 j Ω
Return Loss	- 19.2 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	56.8 Ω - 4.4 j Ω
Return Loss	- 22.3 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	48.8 Ω - 5.4 j Ω
Return Loss	- 25.1 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	57.3 Ω - 8.7 j Ω
Return Loss	- 19.5 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	56.9 Ω + 1.6 j Ω
Return Loss	- 23.5 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	53.1 Ω - 10.3 j Ω
Return Loss	- 19.7 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	54.3 Ω - 1.5 j Ω
Return Loss	- 27.2 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	49.7 Ω - 3.6 j Ω
Return Loss	- 28.7 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	58.2 Ω - 5.2 j Ω
Return Loss	- 20.9 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	58.7 Ω + 3.9 j Ω
Return Loss	- 21.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 ns
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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	August 28, 2003

DASY5 Validation Report for Head TSL

Date: 23.09.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1007

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; $\sigma = 4.48$ S/m; $\epsilon_r = 35.8$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 4.62$ S/m; $\epsilon_r = 35.6$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 4.76$ S/m; $\epsilon_r = 35.4$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 4.86$ S/m; $\epsilon_r = 35.2$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 5.07$ S/m; $\epsilon_r = 35$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41); Calibrated: 28.12.2012, ConvF(5.1, 5.1, 5.1); Calibrated: 28.12.2012, ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.76, 4.76, 4.76); Calibrated: 28.12.2012, ConvF(4.81, 4.81, 4.81); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 63.505 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 28.1 W/kg

SAR(1 g) = 7.77 W/kg; SAR(10 g) = 2.23 W/kg

Maximum value of SAR (measured) = 18.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 63.817 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 29.7 W/kg

SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.3 W/kg

Maximum value of SAR (measured) = 18.7 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 = 64.029 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 32.0 W/kg

SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.32 W/kg

Maximum value of SAR (measured) = 19.7 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 63.403 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 31.3 W/kg

SAR(1 g) = 8.03 W/kg; SAR(10 g) = 2.28 W/kg

Maximum value of SAR (measured) = 19.3 W/kg

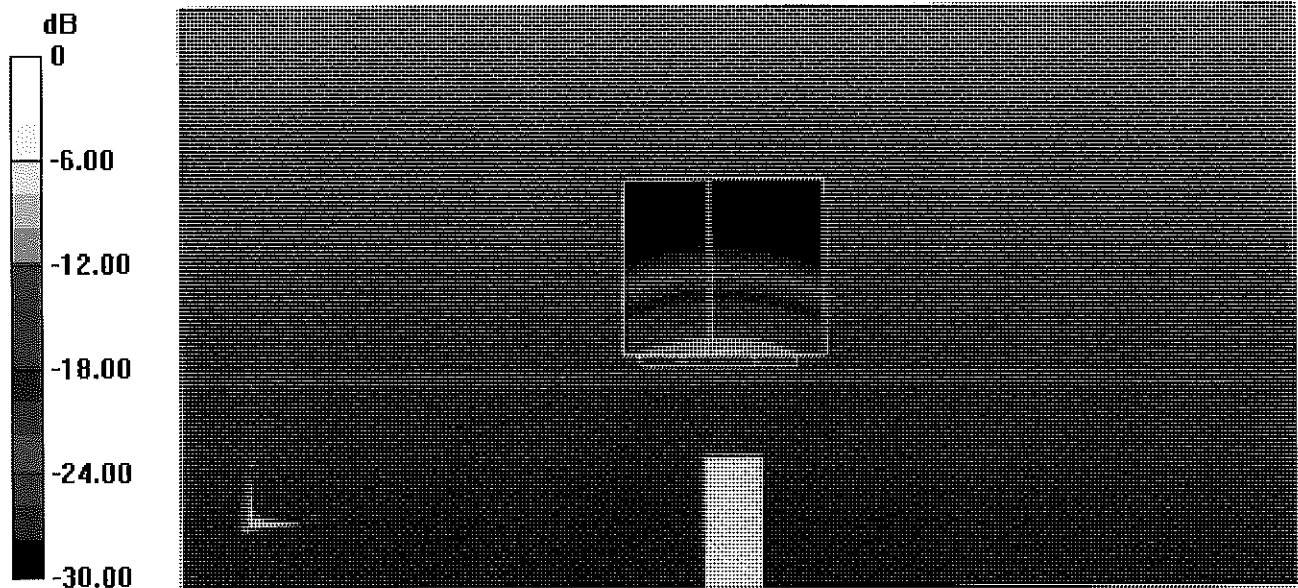
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 60.987 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 31.9 W/kg

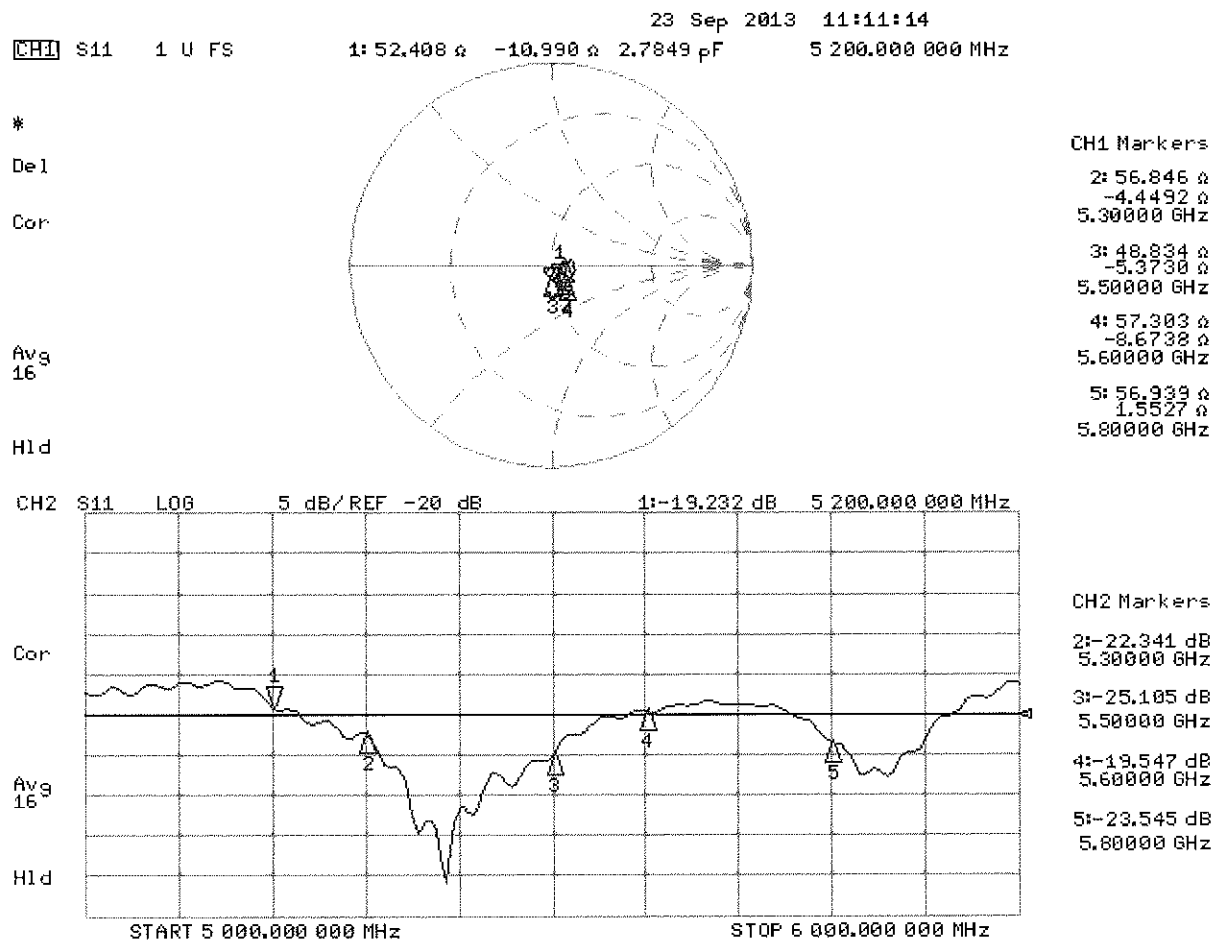
SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.2 W/kg

Maximum value of SAR (measured) = 19.0 W/kg



0 dB = 19.0 W/kg = 12.79 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 20.09.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1007

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; $\sigma = 5.36$ S/m; $\epsilon_r = 48.3$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 5.56$ S/m; $\epsilon_r = 48.1$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 5.75$ S/m; $\epsilon_r = 47.8$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 5.88$ S/m; $\epsilon_r = 47.6$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 6.17$ S/m; $\epsilon_r = 47.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.67, 4.67, 4.67); Calibrated: 28.12.2012, ConvF(4.43, 4.43, 4.43); Calibrated: 28.12.2012, ConvF(4.22, 4.22, 4.22); Calibrated: 28.12.2012, ConvF(4.38, 4.38, 4.38); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.606 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 28.6 W/kg

SAR(1 g) = 7.28 W/kg; SAR(10 g) = 2.03 W/kg

Maximum value of SAR (measured) = 17.2 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 = 58.305 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 30.3 W/kg

SAR(1 g) = 7.49 W/kg; SAR(10 g) = 2.09 W/kg

Maximum value of SAR (measured) = 17.8 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 = 58.471 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 32.4 W/kg

SAR(1 g) = 7.61 W/kg; SAR(10 g) = 2.11 W/kg

Maximum value of SAR (measured) = 18.5 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.333 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 33.8 W/kg

SAR(1 g) = 7.75 W/kg; SAR(10 g) = 2.16 W/kg

Maximum value of SAR (measured) = 19.1 W/kg

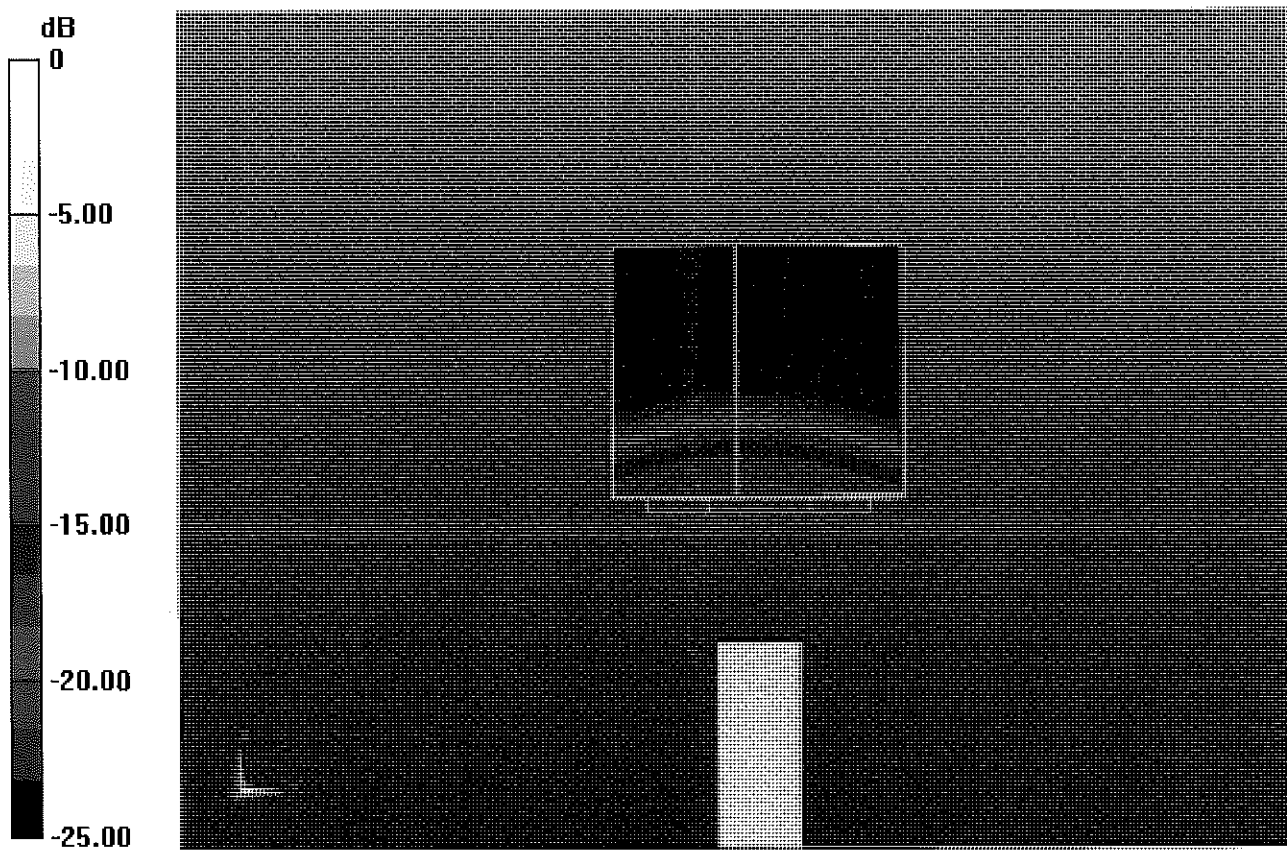
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 55.389 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 34.1 W/kg

SAR(1 g) = 7.31 W/kg; SAR(10 g) = 2.02 W/kg

Maximum value of SAR (measured) = 18.3 W/kg



Impedance Measurement Plot for Body TSL

