



SAR EVALUATION REPORT

Applicant Name:

Samsung Electronics, Co. Ltd.
129, Samsung-ro, Maetan dong,
Yeongtong-gu, Suwon-si
Gyeonggi-do 443-742, Korea

Date of Testing:

06/03/15 - 06/22/15

Test Site/Location:

PCTEST Lab, Columbia, MD, USA

Document Serial No.:

OY1506191287.A3L

FCC ID:

A3LSMN920X

APPLICANT:

SAMSUNG ELECTRONICS, CO. LTD.

DUT Type:

Portable Handset

Application Type:

Certification

FCC Rule Part(s):

CFR §2.1093

Model(s):

SM-N920X

Equipment Class	Band & Mode	Tx Frequency	SAR		
			1 gm Head (W/kg)	1 gm Body-Worn (W/kg)	10 gm Extremity (W/kg)
DTS	2.4 GHz WLAN	2412-2472 MHz	0.65	< 0.1	0.49
NII	U-NII-1	5180 - 5240 MHz			
NII	U-NII-2A	5260 - 5320 MHz	0.72	0.12	0.28
NII	U-NII-2C	5500 - 5720 MHz	0.70	< 0.1	0.34
NII	U-NII-3	5745 - 5825 MHz	0.54	< 0.1	0.28
DSS/DTS	Bluetooth	2402 - 2480 MHz	N/A		
Simultaneous SAR per KDB 690783 D01v01r03:			1.37	0.22	0.98

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 1.8 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



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FCC ID: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset	Page 1 of 35	

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

1	DEVICE UNDER TEST	3
2	INTRODUCTION	7
3	DOSIMETRIC ASSESSMENT	8
4	DEFINITION OF REFERENCE POINTS	9
5	TEST CONFIGURATION POSITIONS FOR HANDSETS	10
6	RF EXPOSURE LIMITS	13
7	FCC MEASUREMENT PROCEDURES.....	14
8	RF CONDUCTED POWERS.....	17
9	SYSTEM VERIFICATION.....	19
10	SAR DATA SUMMARY	21
11	FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS.....	25
12	SAR MEASUREMENT VARIABILITY	29
13	EQUIPMENT LIST	30
14	MEASUREMENT UNCERTAINTIES	31
15	CONCLUSION.....	33
16	REFERENCES	34
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: DUT ANTENNA DIAGRAM & SAR TEST SETUP PHOTOGRAPHS		

FCC ID: A3LSMN920X	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset	Page 2 of 35	

1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
2.4 GHz WLAN	Data	2412 - 2472 MHz
U-NII-1	Data	5180 - 5240 MHz
U-NII-2A	Data	5260 - 5320 MHz
U-NII-2C	Data	5500 - 5720 MHz
U-NII-3	Data	5745 - 5825 MHz
Bluetooth	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz
ANT+	Data	2402 - 2480 MHz
MST	Data	1 - 8.3 kHz

1.2 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.

Mode / Band		Modulated Average Ant 1 & Ant 2 (dBm)	Modulated Average Ant 1 (dBm)	Modulated Average Ant 2 (dBm)
		Channel 1-11	Channel 12-13	Channel 12-13
IEEE 802.11b (2.4 GHz)	Maximum	17.5	6.5	4.5
	Nominal	17.0	6.0	4.0
IEEE 802.11g (2.4 GHz)	Maximum	14.5	3.5	4.5
	Nominal	14.0	3.0	4.0
IEEE 802.11n (2.4 GHz)	Maximum	13.5	3.0	4.5
	Nominal	13.0	2.5	4.0

Mode / Band		Modulated Average - MIMO (dBm)	
		Channel 1-11	Channel 12-13
IEEE 802.11n (2.4 GHz)	Maximum	16.5	7.0
	Nominal	16.0	6.5

Mode / Band		Modulated Average (dBm)
Bluetooth	Maximum	11.0
	Nominal	10.5
Bluetooth LE	Maximum	6.0
	Nominal	5.5

FCC ID: A3LSMN920X	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset	Page 3 of 35	

Mode / Band		Modulated Average - Single Tx Chain (dBm)		
		20 MHz Bandwidth	40 MHz Bandwidth	80 MHz Bandwidth
IEEE 802.11a (5 GHz)	Maximum	12.5		
	Nominal	12.0		
IEEE 802.11n (5 GHz)	Maximum	12.5	12.5	
	Nominal	12.0	12.0	
IEEE 802.11ac (5 GHz)	Maximum	12.5	12.5	11.5
	Nominal	12.0	12.0	11.0

Mode / Band		Modulated Average - MIMO (dBm)		
		20 MHz Bandwidth	40 MHz Bandwidth	80 MHz Bandwidth
IEEE 802.11n (5 GHz)	Maximum	15.5	15.5	
	Nominal	15.0	15.0	
IEEE 802.11ac (5 GHz)	Maximum	15.5	15.5	14.5
	Nominal	15.0	15.0	14.0

1.3 DUT Antenna Locations

The overall dimensions of this device are $\geq 9 \times 5$ cm. A diagram showing the location of the device antennas can be found in Appendix F. Since the diagonal dimension of this device is > 160 mm and < 200 mm, it is considered a "phablet".

Table 1-1
Device Edges/Sides for SAR Testing

Mode	Configuration	Back	Front	Top	Bottom	Right	Left
2.4 GHz WLAN	Extremity	Yes	Yes	Yes	No	No	Yes
U-NII-2A, U-NII-2C & U-NII-3	Extremity	Yes	Yes	Yes	No	No	Yes

Note: Particular DUT edges were not required to be evaluated for Extremity SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB 648474 D04v01r02.

1.4 Near Field Communications (NFC) Antenna

This DUT has NFC Operations. The NFC antenna is integrated into the device for this model. Therefore, all SAR tests were performed with the device which already incorporates the NFC antenna. A diagram showing the location of the NFC antenna can be found in Appendix F.

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.

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.

FCC ID: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 4 of 35

Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Head	Body-Worn Accessory	Extremity	Notes
1	2.4 GHz WIFI Ant 1 + 2.4 GHz WIFI Ant 2	Yes*	Yes*	Yes	*-Pre-installed VOIP applications are considered.
2	2.4 GHz WIFI Ant 1 + 5 GHz WIFI Ant 2	Yes*	Yes*	Yes	*-Pre-installed VOIP applications are considered.
3	5 GHz WIFI Ant 1 + 5 GHz WIFI Ant 2	Yes*	Yes*	Yes	*-Pre-installed VOIP applications are considered.
4	5 GHz WIFI Ant 1 + 2.4 GHz WIFI Ant 2	Yes*	Yes*	Yes	*-Pre-installed VOIP applications are considered.
5	2.4 GHz WIFI Ant 1 + 5 GHz WIFI Ant 1	N/A	N/A	N/A	Not Supported by HW
6	2.4 GHz WIFI Ant 2 + 5 GHz WIFI Ant 2	N/A	N/A	N/A	Not Supported by HW

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

1.6 Miscellaneous SAR Test Considerations

(A) WIFI/BT

This device does not support network-based voice services but does support VOIP operations. Therefore, this device was evaluated per the procedures outlined in KDB 648474 D04 for handsets.

This device supports IEEE 802.11ac with the following features:

- a) Up to 80 MHz Bandwidth only
- b) No aggregate channel configurations
- c) 2 Tx antenna output
- d) 256 QAM is supported
- e) Band gap and TDWR channels are supported

Per FCC KDB Publication 648474 D04v01r02, this device is considered a "phablet" since the diagonal dimension is greater than 160mm and less than 200mm. Extremity SAR tests are required when wireless router mode does not apply or if wireless router 1g SAR > 1.2 W/kg.

Since U-NII-1 and U-NII-2A bands have the same maximum output power and the highest reported SAR for U-NII-2A is less than 1.2 W/kg for 1g SAR and less than 3.0 W/kg for 10g SAR, SAR is not required for U-NII-1 band according to FCC KDB 248227 D01v02r01.

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-worn Bluetooth SAR was not required; $[(13/10) * \sqrt{2.480}] = 2.0 < 3.0$. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.

FCC ID: A3LSMN920X	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset	Page 5 of 35	

Per FCC KDB 447498 D01v05, the 10g SAR exclusion threshold for distances <50mm is defined by the following equation:

$$\frac{\text{Max Power of Channel (mW)}}{\text{Test Separation Dist (mm)}} * \sqrt{\text{Frequency (GHz)}} \leq 7.5$$

Based on the maximum conducted power of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, extremity Bluetooth SAR was not required; $[(13/5) * \sqrt{2.480}] = 4.1 < 7.5$. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.

This device supports channel 1-13 for 2.4 GHz WLAN. However, due to the reduced output power for channels 12 and 13, channels 1, 6, and 11 were considered for SAR testing per KDB 248227 D01v02r01.

1.7 Power Reduction for SAR

There is no power reduction used for any band/mode implemented in this device for SAR purposes.

1.8 Guidance Applied

- IEEE 1528-2003
- FCC KDB Publication 248227 D01v02r01 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v05r02 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r03, D02v01r01 (SAR Measurements up to 6 GHz)
- FCC KDB Publication 648474 D04v01r02 (Phablet Procedures)

1.9 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.

	Head Serial Number	Body-Worn Serial Number	Extremity Serial Number
2.4 GHz WLAN	7CEE8	7CEE8	7C924
5 GHz U-NII 2A, U-NII 2C & U-NII 3 WLAN	7C924	7CEE8	7C924

FCC ID: A3LSMN920X	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 6 of 35

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.

2.1 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 2-1).

Equation 2-1
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: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 7 of 35

3 DOSIMETRIC ASSESSMENT

3.1 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 3-1) 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 3-1) 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 3-1. 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.

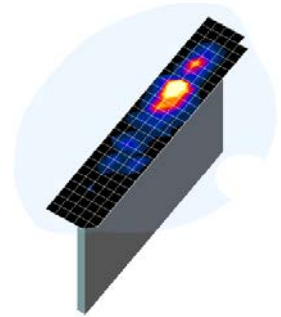


Figure 3-1
Sample SAR Area
Scan

Table 3-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01*

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

*Also compliant to IEEE 1528-2013 Table 6

FCC ID: A3LSMN920X		SAR EVALUATION REPORT			Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset			Page 8 of 35

4

DEFINITION OF REFERENCE POINTS

4.1 EAR REFERENCE POINT

Figure 4-2 shows the front, back and side views of the SAM Twin Phantom. The point “M” is the reference point for the center of the mouth, “LE” is the left ear reference point (ERP), and “RE” is the right ERP. The ERP is 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 4-1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front), also called the Reference Pivoting Line, is not perpendicular to the reference plane (see Figure 4-1). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].

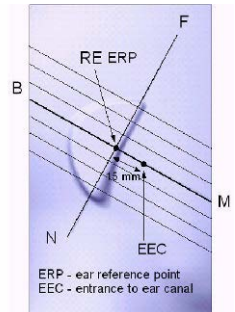


Figure 4-1
Close-Up Side view
of ERP

4.2 HANDSET REFERENCE POINTS

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the acoustic output located along the “vertical centerline” on the front of the device aligned to the “ear reference point” (See Figure 4-3). The acoustic output was then located at the same level as the center of the ear reference point. The test device was positioned so that the “vertical centerline” was bisecting the front surface of the handset at its top and bottom edges, positioning the “ear reference point” on the outer surface of the both the left and right head phantoms on the ear reference point.



Figure 4-2
Front, back and side view of SAM Twin Phantom

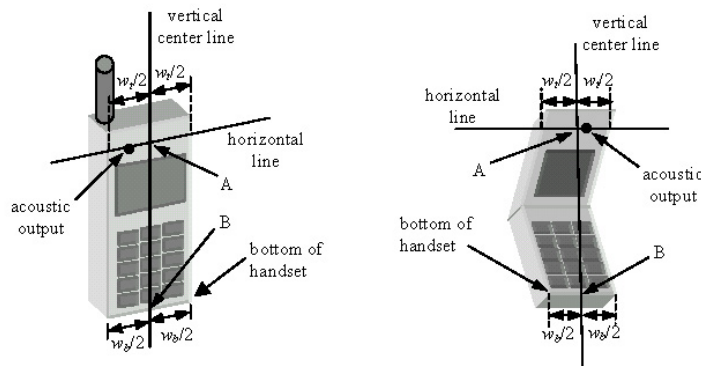


Figure 4-3
Handset Vertical Center & Horizontal Line Reference Points

FCC ID: A3LSMN920X	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 9 of 35

5

TEST CONFIGURATION POSITIONS FOR HANDSETS

5.1 Device Holder

The device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon = 3$ and loss tangent $\delta = 0.02$.

5.2 Positioning for Cheek

1. The test device was positioned with the device close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 5-1), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

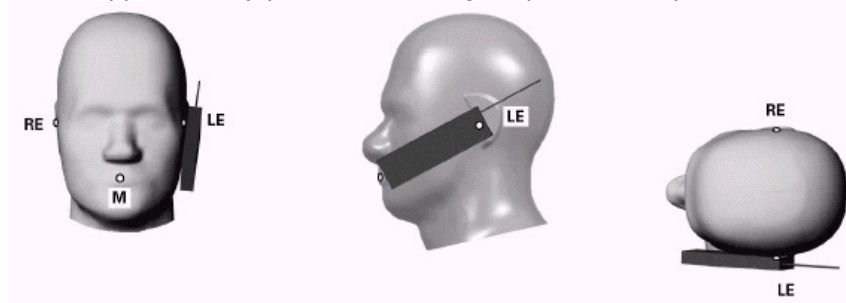


Figure 5-1 Front, Side and Top View of Cheek Position

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the pinna.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the reference plane.
4. The phone was then rotated around the vertical centerline until the phone (horizontal line) was symmetrical with respect to the line NF.
5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the device contact with the ear, the device was rotated about the NF line until any point on the handset made contact with a phantom point below the ear (cheek) (See Figure 5-2).

5.3 Positioning for Ear / 15° Tilt

With the test device aligned in the “Cheek Position”:

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15 degrees.
2. The phone was then rotated around the horizontal line by 15 degrees.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the handset touched the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. In this situation, the tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 5-2).

FCC ID: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 10 of 35

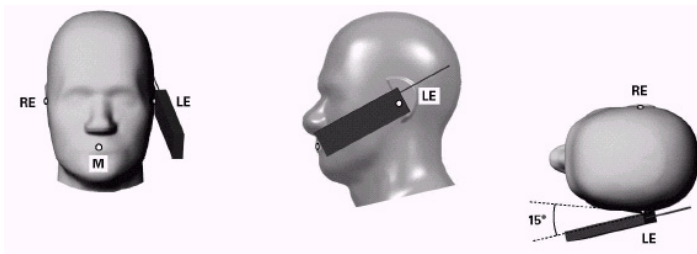


Figure 5-2 Front, Side and Top View of Ear/15° Tilt Position

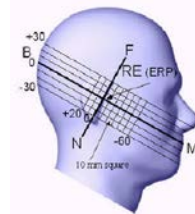


Figure 5-3 Side view w/ relevant markings

5.4 Body-Worn Accessory Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 5-4). Per FCC KDB Publication 648474 D04v01r02, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01v05 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is $> 1.2 \text{ W/kg}$, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

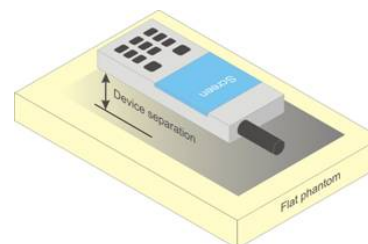


Figure 5-4 Sample Body-Worn Diagram

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented. Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

FCC ID: A3LSMN920X	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 11 of 35

5.5 Extremity Exposure Configurations

Devices that are designed or intended for use on extremities or mainly operated in extremity only exposure conditions; i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. The 1-g body and 10-g extremity SAR Exclusion Thresholds found in KDB Publication 447498 D01v05 should be applied to determine SAR test requirements.

For smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets that support voice calls next to the ear, the phablets procedures outlined in KDB Publication 648474 D04 v01r02 should be applied to evaluate SAR compliance. A device marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance. In addition to the normally required head and body-worn accessory SAR test procedures required for handsets, the UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna ≤ 25 mm from that surface or edge, in direct contact with the phantom, for 10-g SAR. The UMPC mini-tablet 1-g SAR at 5 mm is not required. Extremity SAR evaluation is required when wireless router mode does not apply

FCC ID: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 12 of 35

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: A3LSMN920X	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 13 of 35

7 FCC MEASUREMENT PROCEDURES

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

7.1 Measured and Reported SAR

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

7.2 SAR Testing with 802.11 Transmitters

The normal network operating configurations of 802.11 transmitters are not suitable for SAR measurements. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227 D01v02r01 for more details.

7.2.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters.

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

7.2.2 U-NII-1 and U-NII-2A

For devices that operate in both U-NII-1 and U-NII-2A bands, when the same maximum output power is specified for both bands, SAR measurement using OFDM SAR test procedures is not required for U-NII-1 unless the highest reported SAR for U-NII-2A is > 1.2 W/kg for 1g SAR or > 3.0 W/kg for 10g SAR. When different maximum output powers are specified for the bands, SAR measurement for the U-NII band with the lower maximum output power is not required unless the highest reported SAR for the U-NII band with the higher maximum output power, adjusted by the ratio of lower to higher specified maximum output power for the two bands, is > 1.2 W/kg for 1g SAR or > 3.0 W/kg for 10g SAR.

FCC ID: A3LSMN920X	 SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset

7.2.3 U-NII-2C and U-NII-3

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

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

7.2.4 Initial Test Position Procedure

For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all positions in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg for 1g SAR and ≤ 1.0 W/kg for 10g SAR, no additional testing for the remaining test positions is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg for 1g SAR and ≤ 2.0 W/kg for 10g SAR or all test positions are measured.

7.2.5 2.4 GHz SAR Test Requirements

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

- 1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg for 1g SAR and ≤ 2.0 W/kg for 10g SAR, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- 2) When the reported SAR is > 0.8 W/kg for 1g SAR or > 2.0 W/kg for 10g SAR, SAR is required for that position using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg for 1g SAR or > 3.0 W/kg for 10g SAR, SAR is required for the third channel; i.e., all channels require testing.

2.4 GHz 802.11 g/n OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is > 1.2 W/kg for 1g SAR or > 3.0 W/kg for 10g SAR. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed.

7.2.6 OFDM Transmission Mode and SAR Test Channel Selection

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

FCC ID: A3LSMN920X	 SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: OY1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset
		Page 15 of 35

7.2.7 Initial Test Configuration Procedure

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

When the reported SAR is ≤ 0.8 W/kg for 1g SAR and ≤ 2.0 W/kg for 10g SAR, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤ 1.2 W/kg for 1g SAR and ≤ 3.0 W/kg for 10g SAR or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurements (See Section 7.2.6).

7.2.8 Subsequent Test Configuration Procedures

For OFDM configurations in each frequency band and aggregated band, SAR is evaluated for initial test configuration using the fixed test position or the initial test position procedure. When the highest reported SAR (for the initial test configuration), adjusted by the ratio of the specified maximum output power of the subsequent test configuration to initial test configuration, is ≤ 1.2 W/kg for 1g SAR and ≤ 3.0 W/kg for 10g SAR, no additional SAR tests for the subsequent test configurations are required.

7.2.9 MIMO SAR considerations

Per KDB 248227 D01v02r01, the simultaneous SAR provisions in KDB Publication 447498 should be applied to determine simultaneous transmission SAR test exclusion for WIFI MIMO. If the sum of 1g single transmission chain SAR measurements is < 1.6 W/kg for 1g SAR and < 4 W/kg for 10g SAR, no additional SAR measurements for MIMO are required. Alternatively, SAR for MIMO can be measured with all antennas transmitting simultaneously at the specified maximum output power of MIMO operation.

FCC ID: A3LSMN920X	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset	Page 16 of 35	

8 RF CONDUCTED POWERS

8.1 WLAN Conducted Powers

Table 8-1
2.4 GHz WLAN Average RF Power – Ant 1

Freq [MHz]	Channel	2.4GHz Conducted Power [dBm]	
		IEEE Transmission Mode	
		802.11b	802.11g
2412	1	17.49	13.77
2437	6	17.39	13.83
2462	11	17.24	13.60

Table 8-2
2.4 GHz WLAN Average RF Power – Ant 2

Freq [MHz]	Channel	2.4GHz Conducted Power [dBm]	
		IEEE Transmission Mode	
		802.11b	802.11g
2412	1	16.81	13.70
2437	6	16.70	13.50
2462	11	17.43	14.00

Table 8-3
5 GHz WLAN (40MHz) Average RF Power – Ant 1

Freq [MHz]	Channel	5GHz (40MHz) Conducted Power [dBm]	
		IEEE Transmission Mode	
		802.11n	802.11ac
5190	38	11.50	11.50
5230	46	11.30	11.33
5270	54	12.16	12.30
5310	62	12.25	12.42
5510	102	12.39	12.44
5590	118	12.27	12.24
5630	126	12.18	12.15
5710	142	12.00	12.03
5755	151	12.40	12.37
5795	159	12.27	12.28

FCC ID: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 17 of 35

Table 8-4
5 GHz WLAN (40MHz) Average RF Power – Ant 2

Freq [MHz]	Channel	5GHz (40MHz) Conducted Power [dBm]	
		IEEE Transmission Mode	
		802.11n	802.11ac
5190	38	11.70	11.65
5230	46	11.62	11.60
5270	54	11.54	11.56
5310	62	12.28	11.50
5510	102	11.60	11.60
5590	118	11.40	11.50
5630	126	11.40	12.42
5710	142	12.40	12.37
5755	151	12.35	12.28
5795	159	12.28	12.26

Justification for test configurations for WLAN per KDB Publication 248227 D01v02r01:

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

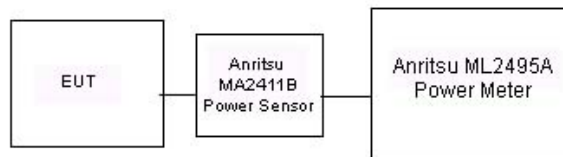


Figure 8-1
Power Measurement Setup

FCC ID: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 18 of 35

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
06/05/2015	2400H	22.6	2400	1.830	39.103	1.756	39.289	4.21%	-0.47%
			2450	1.887	38.883	1.800	39.200	4.83%	-0.81%
			2500	1.947	38.656	1.855	39.136	4.96%	-1.23%
06/08/2015	5200H-5800H	20.1	5300	4.607	35.501	4.758	35.871	-3.17%	-1.03%
			5320	4.645	35.449	4.778	35.849	-2.78%	-1.12%
			5500	4.860	35.279	4.963	35.643	-2.08%	-1.02%
			5520	4.855	35.308	4.983	35.620	-2.57%	-0.88%
			5700	5.063	34.827	5.168	35.414	-4.43%	-0.43%
			5745	5.154	34.887	5.214	35.363	-1.15%	-1.35%
			5765	5.175	34.885	5.234	35.340	-1.13%	-1.29%
			5800	5.164	34.752	5.270	35.300	-2.01%	-1.55%
06/03/2015	2450B	22.0	2401	1.942	50.647	1.903	52.765	2.05%	-4.01%
			2450	2.008	50.462	1.950	52.700	2.97%	-4.25%
			2499	2.068	50.278	2.019	52.638	2.43%	-4.48%
06/22/2015	2400B	22.5	2400	1.898	51.664	1.902	52.767	-0.21%	-2.09%
			2450	1.964	51.479	1.950	52.700	0.72%	-2.32%
			2500	2.029	51.276	2.021	52.636	0.40%	-2.58%
06/03/2015	5200B-5800B	21.4	5300	5.248	48.083	5.416	48.879	-3.10%	-1.63%
			5320	5.270	48.063	5.439	48.851	-3.11%	-1.61%
			5500	5.495	47.779	5.650	48.607	-2.74%	-1.70%
			5520	5.534	47.739	5.673	48.580	-2.45%	-1.73%
			5700	5.772	47.478	5.883	48.336	-1.89%	-1.78%
			5745	5.822	47.405	5.936	48.275	-1.92%	-1.80%
			5765	5.854	47.386	5.959	48.248	-1.76%	-1.79%
			5800	5.914	47.336	6.000	48.200	-1.43%	-1.79%
06/11/2015	5200B-5800B	21.3	5300	5.450	48.362	5.416	48.879	0.63%	-1.06%
			5320	5.483	48.346	5.439	48.851	0.81%	-1.03%
			5500	5.706	48.053	5.650	48.607	0.99%	-1.14%
			5520	5.727	48.016	5.673	48.580	0.95%	-1.16%
			5700	6.004	47.668	5.883	48.336	2.06%	-1.38%
			5745	6.073	47.632	5.936	48.275	2.31%	-1.33%
			5765	6.092	47.622	5.959	48.248	2.31%	-1.33%
			5800	6.139	47.566	6.000	48.200	2.32%	-1.32%

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: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset	Page 19 of 35	

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 – 1 g

System Verification TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR _{1g} (W/kg)	1 W Target SAR _{1g} (W/kg)	1 W Normalized SAR _{1g} (W/kg)	Deviation _{1g} (%)
G	2450	HEAD	06/05/2015	22.9	22.2	0.100	719	3318	5.120	52.100	51.200	-1.73%
D	5300	HEAD	06/08/2015	21.9	20.1	0.050	1057	7357	4.020	84.700	80.400	-5.08%
D	5500	HEAD	06/08/2015	22.5	20.1	0.050	1057	7357	4.400	84.300	88.000	4.39%
D	5800	HEAD	06/08/2015	22.9	20.1	0.050	1057	7357	4.060	81.100	81.200	0.12%
D	2450	BODY	06/03/2015	21.1	21.0	0.100	719	3209	5.400	51.800	54.000	4.25%
E	5300	BODY	06/03/2015	22.1	21.2	0.050	1057	3589	3.910	74.200	78.200	5.39%
E	5500	BODY	06/03/2015	22.2	21.4	0.050	1057	3589	3.680	79.200	73.600	-7.07%
E	5800	BODY	06/03/2015	22.1	21.2	0.050	1057	3589	3.410	75.100	68.200	-9.19%

Table 9-3
System Verification Results – 10 g

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 _{10g} (W/kg)	1 W Target SAR _{10g} (W/kg)	1 W Normalized SAR _{10g} (W/kg)	Deviation _{10g} (%)
E	2450	BODY	06/22/2015	22.4	21.9	0.100	719	3332	2.380	24.000	23.800	-0.83%
E	5300	BODY	06/11/2015	22.7	21.3	0.050	1057	3589	1.090	20.900	21.800	4.31%
E	5500	BODY	06/11/2015	22.7	21.3	0.050	1057	3589	1.080	22.000	21.600	-1.82%
E	5800	BODY	06/11/2015	22.6	21.3	0.050	1057	3589	0.962	20.600	19.240	-6.60%

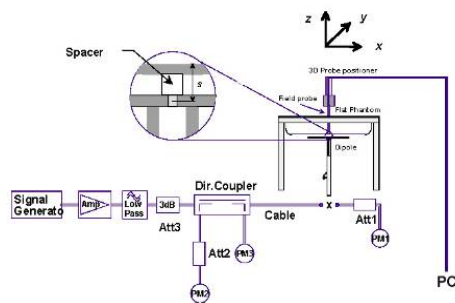


Figure 9-1
System Verification Setup Diagram



Figure 9-2
System Verification Setup Photo

FCC ID: A3LSMN920X	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 20 of 35

10 SAR DATA SUMMARY

10.1 Standalone Head SAR Data

**Table 10-1
DTS Head SAR**

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Scaled SAR (1g)	Plot #
MHz	Ch.													W/kg	(W/kg)			(W/kg)	
2412	1	802.11b	DSSS	22	17.5	17.49	0.05	Right	Cheek	1	7CEE8	1	99.5	0.806	0.644	1.002	1.005	0.648	A1
2412	1	802.11b	DSSS	22	17.5	17.49	-0.02	Right	Tilt	1	7CEE8	1	99.5	0.699	0.601	1.002	1.005	0.605	
2412	1	802.11b	DSSS	22	17.5	17.49	-	Left	Cheek	1	7CEE8	1	99.5	0.223	-	1.002	1.005	-	
2412	1	802.11b	DSSS	22	17.5	17.49	-	Left	Tilt	1	7CEE8	1	99.5	0.221	-	1.002	1.005	-	
2462	11	802.11b	DSSS	22	17.5	17.43	0.18	Right	Cheek	2	7CEE8	1	99.2	0.266	0.211	1.016	1.008	0.216	
2462	11	802.11b	DSSS	22	17.5	17.43	-	Right	Tilt	2	7CEE8	1	99.2	0.118	-	1.016	1.008	-	
2462	11	802.11b	DSSS	22	17.5	17.43	-	Left	Cheek	2	7CEE8	1	99.2	0.081	-	1.016	1.008	-	
2462	11	802.11b	DSSS	22	17.5	17.43	-	Left	Tilt	2	7CEE8	1	99.2	0.097	-	1.016	1.008	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram											

**Table 10-2
NII Head SAR**

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Scaled SAR (1g)	Plot #
MHz	Ch.													W/kg	(W/kg)		(W/kg)		
5310	62	802.11n	OFDM	40	12.5	12.25	0.06	Right	Cheek	1	7C924	13.5	98.8	0.269	0.102	1.059	1.012	0.109	
5310	62	802.11n	OFDM	40	12.5	12.25	-	Right	Tilt	1	7C924	13.5	98.8	0.210	-	1.059	1.012	-	
5310	62	802.11n	OFDM	40	12.5	12.25	-	Left	Cheek	1	7C924	13.5	98.8	0.079	-	1.059	1.012	-	
5310	62	802.11n	OFDM	40	12.5	12.25	-	Left	Tilt	1	7C924	13.5	98.8	0.079	-	1.059	1.012	-	
5310	62	802.11n	OFDM	40	12.5	12.28	-0.07	Right	Cheek	2	7C924	13.5	99.1	1.882	0.676	1.052	1.009	0.717	
5310	62	802.11n	OFDM	40	12.5	12.28	0.07	Right	Tilt	2	7C924	13.5	99.1	0.700	0.513	1.052	1.009	0.545	
5310	62	802.11n	OFDM	40	12.5	12.28	-	Left	Cheek	2	7C924	13.5	99.1	0.554	-	1.052	1.009	-	
5310	62	802.11n	OFDM	40	12.5	12.28	-	Left	Tilt	2	7C924	13.5	99.1	0.270	-	1.052	1.009	-	
5510	102	802.11n	OFDM	40	12.5	12.39	0.05	Right	Cheek	1	7C924	13.5	98.8	0.029	0.005	1.026	1.012	0.005	
5510	102	802.11n	OFDM	40	12.5	12.39	-	Right	Tilt	1	7C924	13.5	98.8	0.025	-	1.026	1.012	-	
5510	102	802.11n	OFDM	40	12.5	12.39	-	Left	Cheek	1	7C924	13.5	98.8	0.008	-	1.026	1.012	-	
5510	102	802.11n	OFDM	40	12.5	12.39	-	Left	Tilt	1	7C924	13.5	98.8	0.010	-	1.026	1.012	-	
5710	142	802.11n	OFDM	40	12.5	12.40	0.02	Right	Cheek	2	7C924	13.5	99.1	1.665	0.677	1.023	1.009	0.699	A2
5710	142	802.11n	OFDM	40	12.5	12.40	0.13	Right	Tilt	2	7C924	13.5	99.1	1.269	0.544	1.023	1.009	0.562	
5710	142	802.11n	OFDM	40	12.5	12.40	-	Left	Cheek	2	7C924	13.5	99.1	0.661	-	1.023	1.009	-	
5710	142	802.11n	OFDM	40	12.5	12.40	-	Left	Tilt	2	7C924	13.5	99.1	0.633	-	1.023	1.009	-	
5755	151	802.11n	OFDM	40	12.5	12.40	0.10	Right	Cheek	1	7C924	13.5	98.8	0.018	0.007	1.023	1.012	0.007	
5755	151	802.11n	OFDM	40	12.5	12.40	-	Right	Tilt	1	7C924	13.5	98.8	0.014	-	1.023	1.012	-	
5755	151	802.11n	OFDM	40	12.5	12.40	-	Left	Cheek	1	7C924	13.5	98.8	0.013	-	1.023	1.012	-	
5755	151	802.11n	OFDM	40	12.5	12.40	-	Left	Tilt	1	7C924	13.5	98.8	0.014	-	1.023	1.012	-	
5755	151	802.11n	OFDM	40	12.5	12.35	0.02	Right	Cheek	2	7C924	13.5	99.1	1.245	0.518	1.035	1.009	0.541	
5755	151	802.11n	OFDM	40	12.5	12.35	0.03	Right	Tilt	2	7C924	13.5	99.1	0.919	0.405	1.035	1.009	0.423	
5755	151	802.11n	OFDM	40	12.5	12.35	-	Left	Cheek	2	7C924	13.5	99.1	0.507	-	1.035	1.009	-	
5755	151	802.11n	OFDM	40	12.5	12.35	-	Left	Tilt	2	7C924	13.5	99.1	0.396	-	1.035	1.009	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Head											
Spatial Peak								1.6 W/kg (mW/g)											
Uncontrolled Exposure/General Population								averaged over 1 gram											

FCC ID: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 21 of 35

10.2 Standalone Body-Worn SAR Data

Table 10-3
DTS Body-Worn SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Scaled SAR (1g)	Plot #
MHz	Ch.													W/kg	(W/kg)				
2412	1	802.11b	DSSS	22	17.5	17.49	0.01	10 mm	1	7CEE8	1	back	99.5	0.080	0.058	1.002	1.005	0.058	A3
2462	11	802.11b	DSSS	22	17.5	17.43	0.13	10 mm	2	7CEE8	1	back	99.2	0.071	0.042	1.016	1.008	0.043	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram											

Table 10-4
NII Body-Worn SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR(1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.													W/kg	(W/kg)				
5310	62	802.11n	OFDM	40	12.5	12.25	0.03	10 mm	1	7CEE8	13.5	back	98.8	0.197	0.099	1.059	1.012	0.106	
5310	62	802.11n	OFDM	40	12.5	12.28	0.04	10 mm	2	7CEE8	13.5	back	99.1	0.271	0.108	1.052	1.009	0.115	A4
5510	102	802.11n	OFDM	40	12.5	12.39	0.07	10 mm	1	7CEE8	13.5	back	98.8	0.055	0.022	1.026	1.012	0.023	
5710	142	802.11n	OFDM	40	12.5	12.40	0.09	10 mm	2	7CEE8	13.5	back	99.1	0.087	0.084	1.023	1.009	0.087	
5755	151	802.11n	OFDM	40	12.5	12.40	-0.10	10 mm	1	7CEE8	13.5	back	98.8	0.043	0.017	1.023	1.012	0.017	
5755	151	802.11n	OFDM	40	12.5	12.35	0.20	10 mm	2	7CEE8	13.5	back	99.1	0.049	0.023	1.035	1.009	0.024	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body											
Spatial Peak								1.6 W/kg (mW/g)											
Uncontrolled Exposure/General Population								averaged over 1 gram											

10.3 Standalone Extremity SAR Data

Table 10-5
DTS Extremity SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (10g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Scaled SAR (10g)	Plot #
MHz	Ch.													W/kg	(W/kg)				
2412	1	802.11b	DSSS	22	17.5	17.49	-	0 mm	1	7C924	1	back	99.5	1.432	-	1.002	1.005	-	A5
2412	1	802.11b	DSSS	22	17.5	17.49	0.00	0 mm	1	7C924	1	front	99.5	1.564	0.486	1.002	1.005	0.489	
2412	1	802.11b	DSSS	22	17.5	17.49	-	0 mm	1	7C924	1	top	99.5	1.108	-	1.002	1.005	-	
2412	1	802.11b	DSSS	22	17.5	17.49	-	0 mm	1	7C924	1	left	99.5	0.535	-	1.002	1.005	-	
2462	11	802.11b	DSSS	22	17.5	17.43	-0.19	0 mm	2	7C924	1	back	99.2	1.411	0.482	1.016	1.008	0.494	
2462	11	802.11b	DSSS	22	17.5	17.43	-	0 mm	2	7C924	1	front	99.2	0.612	-	1.016	1.008	-	
2462	11	802.11b	DSSS	22	17.5	17.43	-	0 mm	2	7C924	1	top	99.2	0.606	-	1.016	1.008	-	
2462	11	802.11b	DSSS	22	17.5	17.43	-	0 mm	2	7C924	1	left	99.2	0.085	-	1.016	1.008	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT																			
Spatial Peak								Extremity											
Uncontrolled Exposure/General Population								4.0 W/kg (mW/g) averaged over 10 grams											

FCC ID: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset	Page 22 of 35	

Table 10-6
NII Extremity SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (10g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Scaled SAR (10g)	Plot #
MHz	Ch.													W/kg	(W/kg)			(W/kg)	
5310	62	802.11n	OFDM	40	12.5	12.25	0.08	0 mm	1	7C924	13.5	back	98.8	2.222	0.233	1.059	1.012	0.250	
5310	62	802.11n	OFDM	40	12.5	12.25	-	0 mm	1	7C924	13.5	front	98.8	0.562	-	1.059	1.012	-	
5310	62	802.11n	OFDM	40	12.5	12.25	-	0 mm	1	7C924	13.5	top	98.8	0.587	-	1.059	1.012	-	
5310	62	802.11n	OFDM	40	12.5	12.25	-	0 mm	1	7C924	13.5	left	98.8	0.308	-	1.059	1.012	-	
5310	62	802.11n	OFDM	40	12.5	12.28	-	0 mm	2	7C924	13.5	back	99.1	2.016	-	1.052	1.009	-	
5310	62	802.11n	OFDM	40	12.5	12.28	0.20	0 mm	2	7C924	13.5	front	99.1	3.025	0.263	1.052	1.009	0.279	
5310	62	802.11n	OFDM	40	12.5	12.28	-	0 mm	2	7C924	13.5	top	99.1	2.067	-	1.052	1.009	-	
5310	62	802.11n	OFDM	40	12.5	12.28	-	0 mm	2	7C924	13.5	left	99.1	0.225	-	1.052	1.009	-	
5510	102	802.11n	OFDM	40	12.5	12.39	0.05	0 mm	1	7C924	13.5	back	98.8	0.959	0.097	1.026	1.012	0.101	
5510	102	802.11n	OFDM	40	12.5	12.39	-	0 mm	1	7C924	13.5	front	98.8	0.042	-	1.026	1.012	-	
5510	102	802.11n	OFDM	40	12.5	12.39	-	0 mm	1	7C924	13.5	top	98.8	0.110	-	1.026	1.012	-	
5510	102	802.11n	OFDM	40	12.5	12.39	-	0 mm	1	7C924	13.5	left	98.8	0.044	-	1.026	1.012	-	
5710	142	802.11n	OFDM	40	12.5	12.40	-	0 mm	2	7C924	13.5	back	99.1	1.433	-	1.023	1.009	-	
5710	142	802.11n	OFDM	40	12.5	12.40	-0.03	0 mm	2	7C924	13.5	front	99.1	3.827	0.330	1.023	1.009	0.341	A6
5710	142	802.11n	OFDM	40	12.5	12.40	-	0 mm	2	7C924	13.5	top	99.1	1.882	-	1.023	1.009	-	
5710	142	802.11n	OFDM	40	12.5	12.40	-	0 mm	2	7C924	13.5	left	99.1	0.147	-	1.023	1.009	-	
5755	151	802.11n	OFDM	40	12.5	12.40	0.07	0 mm	1	7C924	13.5	back	98.8	0.788	0.062	1.023	1.012	0.064	
5755	151	802.11n	OFDM	40	12.5	12.40	-	0 mm	1	7C924	13.5	front	98.8	0.027	-	1.023	1.012	-	
5755	151	802.11n	OFDM	40	12.5	12.40	-	0 mm	1	7C924	13.5	top	98.8	0.150	-	1.023	1.012	-	
5755	151	802.11n	OFDM	40	12.5	12.40	-	0 mm	1	7C924	13.5	left	98.8	0.040	-	1.023	1.012	-	
5755	151	802.11n	OFDM	40	12.5	12.35	-	0 mm	2	7C924	13.5	back	99.1	2.112	-	1.035	1.009	-	
5755	151	802.11n	OFDM	40	12.5	12.35	0.05	0 mm	2	7C924	13.5	front	99.1	2.167	0.264	1.035	1.009	0.275	
5755	151	802.11n	OFDM	40	12.5	12.35	-	0 mm	2	7C924	13.5	top	99.1	1.175	-	1.035	1.009	-	
5755	151	802.11n	OFDM	40	12.5	12.35	-	0 mm	2	7C924	13.5	left	99.1	0.151	-	1.035	1.009	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Extremity											
Spatial Peak								4.0 W/kg (mW/g)											
Uncontrolled Exposure/General Population								averaged over 10 grams											

10.4 SAR Test Notes

General Notes:

- The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, and FCC KDB Publication 447498 D01v05.
- Batteries are fully charged at the beginning of the SAR measurements.
- Liquid tissue depth was at least 15.0 cm for all frequencies.
- 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.
- SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v05.
- Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
- Per FCC KDB Publication 648474 D04v01r02, body-worn SAR was evaluated without a headset connected to the device. Since the standalone reported body-worn SAR was ≤ 1.2 W/kg, no additional body-worn SAR evaluations using a headset cable were required.
- Per FCC KDB 865664 D01 v01, variability SAR tests were not performed because the measured SAR results for a frequency band were less than 0.8 W/kg for 1g SAR and 2.0 W/kg for 10g SAR. Please see Section 12 for more information.
- Per FCC KDB Publication 648474 D04v01r02, this device is considered a "phablet" since the diagonal dimension is > 160 mm and < 200 mm. Therefore, hand SAR was evaluated.

FCC ID: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 23 of 35

WLAN Notes:

1. For held-to-ear and extremity SAR, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg for 1g SAR and ≤ 1.0 W/kg for 10g SAR, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg for 1g SAR and ≤ 2.0 W/kg for 10g SAR or all test positions are measured.
2. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r01 for 2.4 GHz WIFI single transmission chain operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 7.2.5 for more information.
3. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r01 for 5 GHz WIFI single transmission chain operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2 W/kg for 1g SAR and less than 3.0 W/kg for 10g SAR. See Section 7.2.6 for more information.
4. Per KDB Publication 248227 D01v02r01, SAR for MIMO was evaluated by following the simultaneous SAR provisions from KDB Publication 447498. Please see Section 11 for complete analysis.
5. When the maximum reported averaged SAR is ≤ 0.8 W/kg for 1g SAR and ≤ 2.0 W/kg for 10g SAR, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg for 1g SAR and ≤ 3.0 W/kg for 10g SAR or all test channels were measured.
6. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. Procedures used to measure the duty factor are identical to that in the associated EMC test reports.

FCC ID: A3LSMN920X	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT	 SAMSUNG	Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 24 of 35

11 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

11.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v05r02 are applicable to devices with built-in unlicensed transmitter such as 802.11 and Bluetooth devices which may simultaneously transmit with the other unlicensed 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 physical test configuration is ≤ 1.6 W/kg and the sum of 10-g SAR for all the simultaneous transmitting antennas in a specific physical test configuration is ≤ 4 W/kg. The different test positions in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1-g or 10-g SAR.

11.3 Head SAR Simultaneous Transmission Analysis

Table 11-1
Simultaneous Transmission Scenario for MIMO 2.4 GHz WLAN (Held to Ear)

Exposure Condition	2.4 GHz WLAN Ant 1 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
	1	2	1+2
Head SAR	0.648	0.216	0.864

Table 11-2
Simultaneous Transmission Scenario for MIMO 5 GHz WLAN (Held to Ear)

Exposure Condition	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
	1	2	1+2
Head SAR	0.109	0.717	0.826

FCC ID: A3LSMN920X	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 25 of 35

Table 11-3
Simultaneous Transmission Scenario for 2.4 GHz Ant 1 and 5 GHz Ant 2 WLAN (Held to Ear)

Exposure Condition	2.4 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
	1	2	1+2
Head SAR	0.648	0.717	1.365

Table 11-4
Simultaneous Transmission Scenario for 2.4 GHz Ant 2 and 5 GHz Ant 1 WLAN (Held to Ear)

Exposure Condition	2.4 GHz WLAN Ant 2 SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
	1	2	1+2
Head SAR	0.216	0.109	0.325

11.4 Body-Worn Simultaneous Transmission Analysis

Table 11-5
Simultaneous Transmission Scenario for MIMO 2.4 GHz WLAN (Body-Worn at 1.0 cm)

Exposure Condition	2.4 GHz WLAN Ant 1 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
	1	2	1+2
Body-Worn	0.058	0.043	0.101

Table 11-6
Simultaneous Transmission Scenario for MIMO 5 GHz WLAN (Body-Worn at 1.0 cm)

Exposure Condition	5 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
	1	2	1+2
Body-Worn	0.106	0.115	0.221

FCC ID: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset	Page 26 of 35	

Table 11-7
Simultaneous Transmission Scenario for 2.4 GHz Ant 1 and 5 GHz Ant 2 WLAN
(Body-Worn at 1.0 cm)

Exposure Condition	2.4 GHz WLAN Ant 1 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
	1	2	1+2
Body-Worn	0.058	0.115	0.173

Table 11-8
Simultaneous Transmission Scenario for 2.4 GHz Ant 2 and 5 GHz Ant 1 WLAN
(Body-Worn at 1.0 cm)

Exposure Condition	2.4 GHz WLAN Ant 2 SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
	1	2	1+2
Body-Worn	0.043	0.106	0.149

11.5 Extremity SAR Simultaneous Transmission Analysis

Table 11-9
Simultaneous Transmission Scenario for MIMO 2.4 GHz WLAN
(Extremity at 0.0 cm)

Exposure Condition	2.4 GHz Ant 1 SAR (W/kg)	2.4 GHz Ant 2 SAR (W/kg)	Σ SAR (W/kg)
	1	2	1+2
Extremity	0.489	0.494	0.983

Table 11-10
Simultaneous Transmission Scenario for MIMO 5 GHz WLAN
(Extremity at 0.0 cm)

Exposure Condition	5 GHz Ant 1 SAR (W/kg)	5 GHz Ant 2 SAR (W/kg)	Σ SAR (W/kg)
	1	2	1+2
Extremity	0.250	0.341	0.591

FCC ID: A3LSMN920X		SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset	Page 27 of 35

Table 11-11
Simultaneous Transmission Scenario for 2.4 GHz Ant 1 and 5 GHz Ant 2 WLAN
(Extremity at 0.0 cm)

Exposure Condition	2.4 GHz Ant 1 SAR (W/kg)	5 GHz Ant 2 SAR (W/kg)	Σ SAR (W/kg)
	1	2	1+2
Extremity	0.489	0.341	0.830

Table 11-12
Simultaneous Transmission Scenario for 2.4 GHz Ant 2 and 5 GHz Ant 1 WLAN
(Extremity at 0.0 cm)

Exposure Condition	2.4 GHz Ant 2 SAR (W/kg)	5 GHz Ant 1 SAR (W/kg)	Σ SAR (W/kg)
	1	2	1+2
Extremity	0.494	0.250	0.744

11.6 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: A3LSMN920X		SAR EVALUATION REPORT 	Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset	Page 28 of 35

12 SAR MEASUREMENT VARIABILITY

12.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01, SAR measurement variability was not assessed for each frequency band since all measured SAR values are < 0.80 W/kg for 1g SAR and < 2.00 W/kg for 10g SAR.

12.2 Measurement Uncertainty

The measured 1g SAR was < 1.5 W/kg and the measured 10g SAR was < 3.75 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: A3LSMN920X	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 29 of 35

13 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E8257D	(250kHz-20GHz) Signal Generator	3/15/2015	Annual	3/15/2016	MY45470194
Agilent	8753E	(30kHz-6GHz) Network Analyzer	12/30/2014	Annual	12/30/2015	JP38020182
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	8648D	(9kHz-4GHz) Signal Generator	3/15/2015	Annual	3/15/2016	3629U00687
Agilent	N9020A	MXA Signal Analyzer	10/27/2014	Annual	10/27/2015	US46470561
Agilent	8753ES	S-Parameter Network Analyzer	1/20/2015	Annual	1/20/2016	US39170122
Anritsu	ML2438A	Power Meter	3/13/2015	Annual	3/13/2016	1190013
Anritsu	ML2495A	Power Meter	10/31/2013	Biennial	10/31/2015	941001
Anritsu	MA2481A	Power Sensor	3/10/2015	Annual	3/10/2016	5821
Anritsu	MA2481A	Power Sensor	3/10/2015	Annual	3/10/2016	5605
Anritsu	MA2411B	Pulse Power Sensor	11/17/2014	Annual	11/17/2015	1207364
Anritsu	MA2411B	Pulse Power Sensor	11/17/2014	Annual	11/17/2015	1126066
Anritsu	MT8820C	Radio Communication Analyzer	8/28/2014	Annual	8/28/2015	6201240328
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
COMTECH	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M1S5A00-009
Control Company	4052	Long Stem Thermometer	9/27/2013	Biennial	9/27/2015	130567447
Control Company	36934-158	Wall-Mounted Thermometer	4/29/2014	Biennial	4/29/2016	122014488
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/30/2014	Annual	10/30/2015	1833460
Gigatronics	8651A	Universal Power Meter	10/30/2014	Annual	10/30/2015	8650319
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	VLF-6000+	Low Pass Filter	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
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/18/2014	Biennial	3/18/2016	N/A
SPEAG	D2450V2	2450 MHz SAR Dipole	8/11/2014	Annual	8/11/2015	719
SPEAG	D5GHZV2	5 GHz SAR Dipole	1/21/2015	Annual	1/21/2016	1057
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/14/2015	Annual	1/14/2016	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/13/2015	Annual	3/13/2016	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/17/2014	Annual	9/17/2015	1323
SPEAG	DAK-3.5	Dielectric Assessment Kit	10/21/2014	Annual	10/21/2015	1091
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	7/15/2014	Annual	7/15/2015	1039
SPEAG	ES3DV3	SAR Probe	9/18/2014	Annual	9/18/2015	3332
SPEAG	EX3DV4	SAR Probe	1/22/2015	Annual	1/22/2016	3589
SPEAG	ES3DV3	SAR Probe	1/23/2015	Annual	1/23/2016	3318
SPEAG	ES3DV3	SAR Probe	3/19/2015	Annual	3/19/2016	3209
SPEAG	EX3DV4	SAR Probe	4/23/2015	Annual	4/23/2016	7357
VWR	36934-158	Wall-Mounted Thermometer	8/8/2013	Biennial	8/8/2015	130477877

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: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 30 of 35

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 (95% CONFIDENCE LEVEL)							k=2	24.2	23.5

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

FCC ID: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: OY1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset	Page 31 of 35	

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: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset	Page 32 of 35	

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: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset	Page 33 of 35	

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FCC ID: A3LSMN920X		SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 34 of 35

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FCC ID: A3LSMN920X	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Document S/N: 0Y1506191287.A3L	Test Dates: 06/03/15 - 06/22/15	DUT Type: Portable Handset		Page 35 of 35

APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN920X; Type: Portable Handset; Serial: 7CEE8

Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2412 \text{ MHz}$; $\sigma = 1.844 \text{ S/m}$; $\epsilon_r = 39.050$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 06-05-2015; Ambient Temp: 22.9°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3318; ConvF(4.5, 4.5, 4.5); Calibrated: 1/23/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/14/2015

Phantom: SAM Front; Type: SAM; Serial: 1686

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

Mode: IEEE 802.11b, Ant. 1, 22 MHz Bandwidth, Right Head, Cheek, Ch 1, 1 Mbps

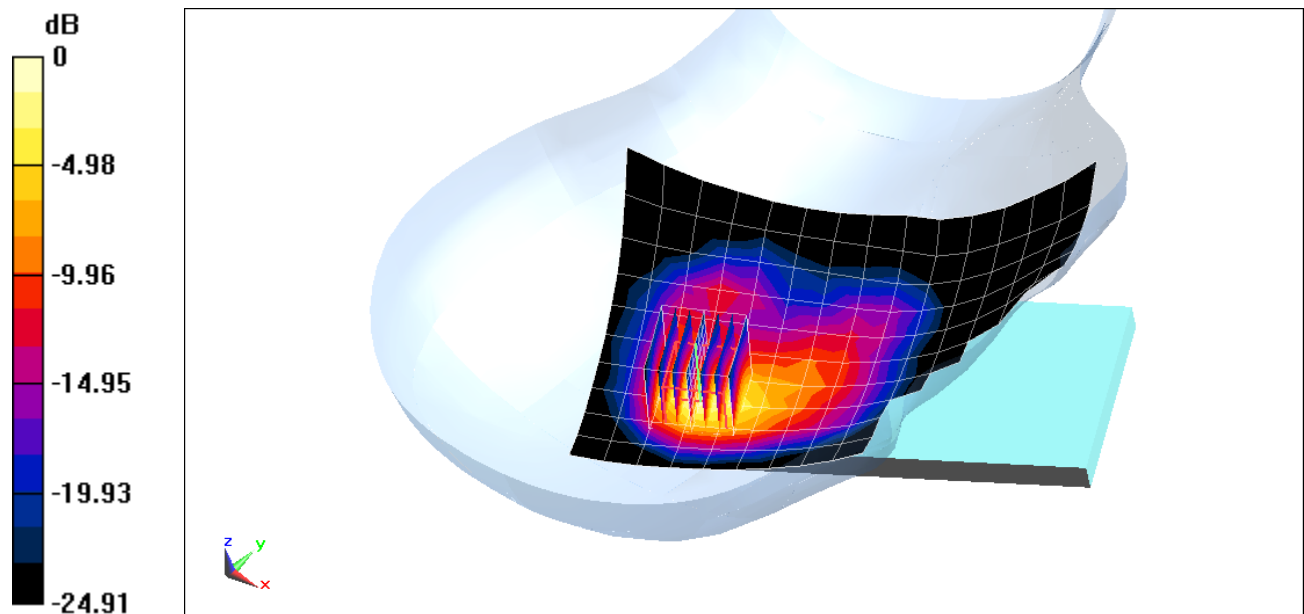
Area Scan (11x18x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

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

Reference Value = 20.81 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.61 W/kg

SAR(1 g) = 0.644 W/kg



0 dB = 0.909 W/kg = -0.41 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN920X; Type: Portable Handset; Serial: 7C924

Communication System: UID 0, IEEE 802.11n; Frequency: 5710 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used (interpolated):

$f = 5710 \text{ MHz}$; $\sigma = 5.083 \text{ S/m}$; $\epsilon_r = 34.84$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 06-08-2015; Ambient Temp: 22.9°C; Tissue Temp: 20.1°C

Probe: EX3DV4 - SN7357; ConvF(4.41, 4.41, 4.41); Calibrated: 4/23/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/13/2015

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

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

**Mode: IEEE 802.11n, Ant. 2, U-NII-2C, 40 MHz Bandwidth, Right Head, Cheek,
Ch 142, 13.5 Mbps**

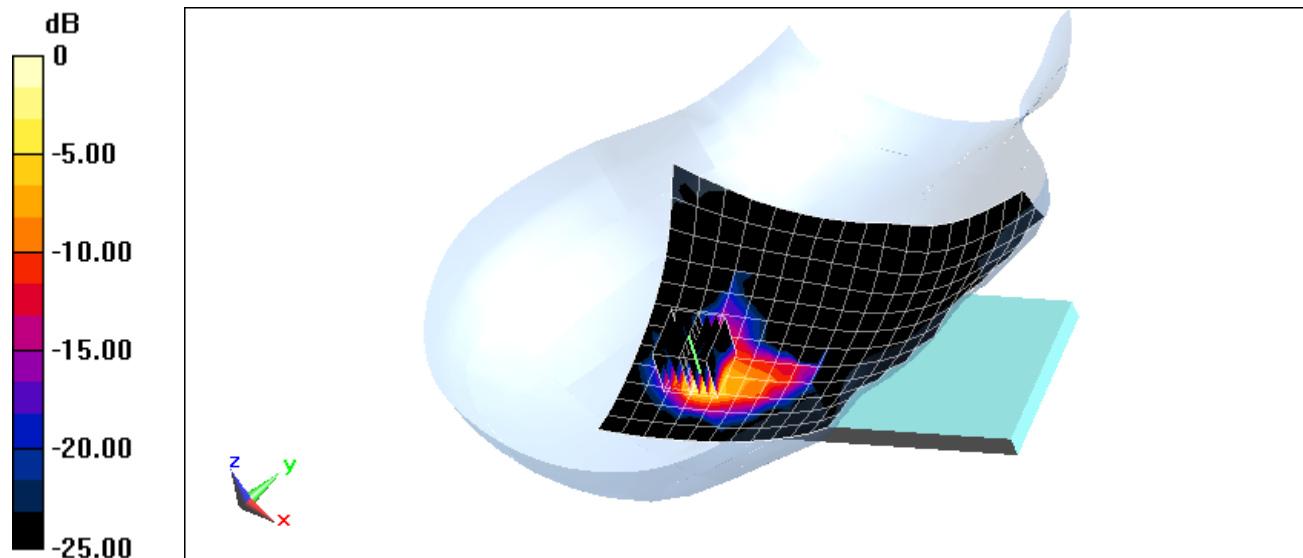
Area Scan (11x9x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Reference Value = 12.41 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 2.99 W/kg

SAR(1 g) = 0.677 W/kg



0 dB = 1.71 W/kg = 2.33 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN920X; Type: Portable Handset; Serial: 7CEE8

Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2412 \text{ MHz}$; $\sigma = 1.957 \text{ S/m}$; $\epsilon_r = 50.605$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

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

Probe: ES3DV3 - SN3209; ConvF(4.12, 4.12, 4.12); Calibrated: 3/19/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/13/2015

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

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

Mode: IEEE 802.11b, Ant. 1, 22 MHz Bandwidth, Body SAR, Back Side, Ch 01, 1 Mbps

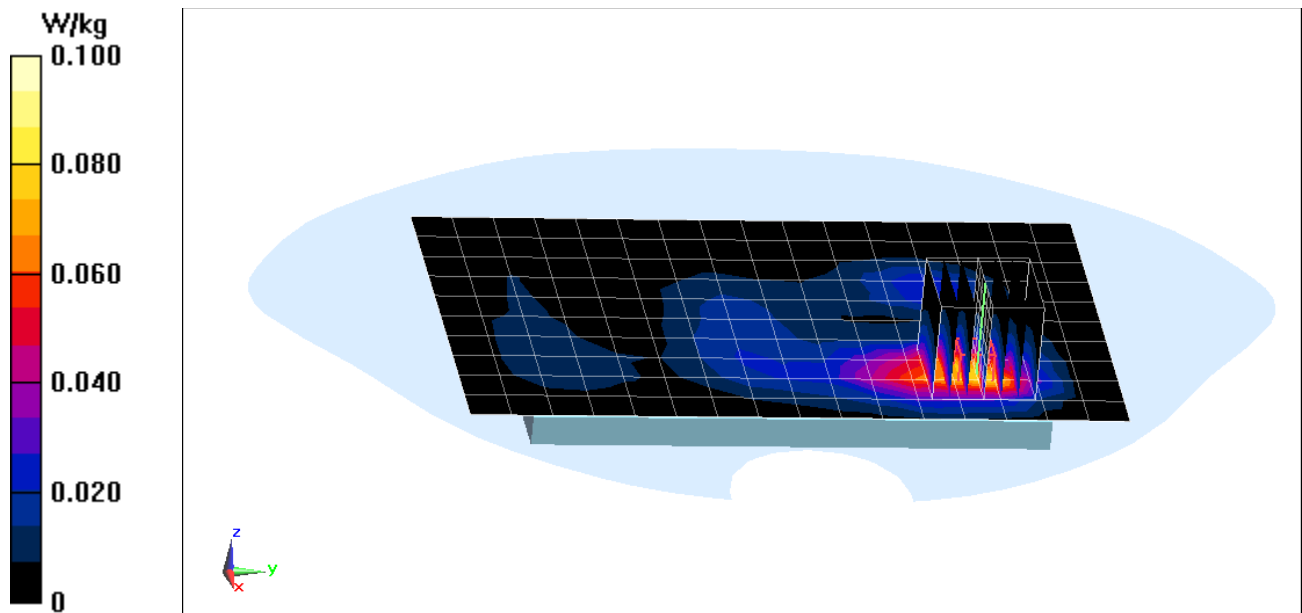
Area Scan (11x17x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

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

Reference Value = 5.527 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 0.107 W/kg

SAR(1 g) = 0.0575 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN920X; Type: Portable Handset; Serial: 7CEE8

Communication System: UID 0, IEEE 802.11n; Frequency: 5310 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used (interpolated):
 $f = 5310 \text{ MHz}$; $\sigma = 5.259 \text{ S/m}$; $\epsilon_r = 48.073$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section; Space: 1.0 cm

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

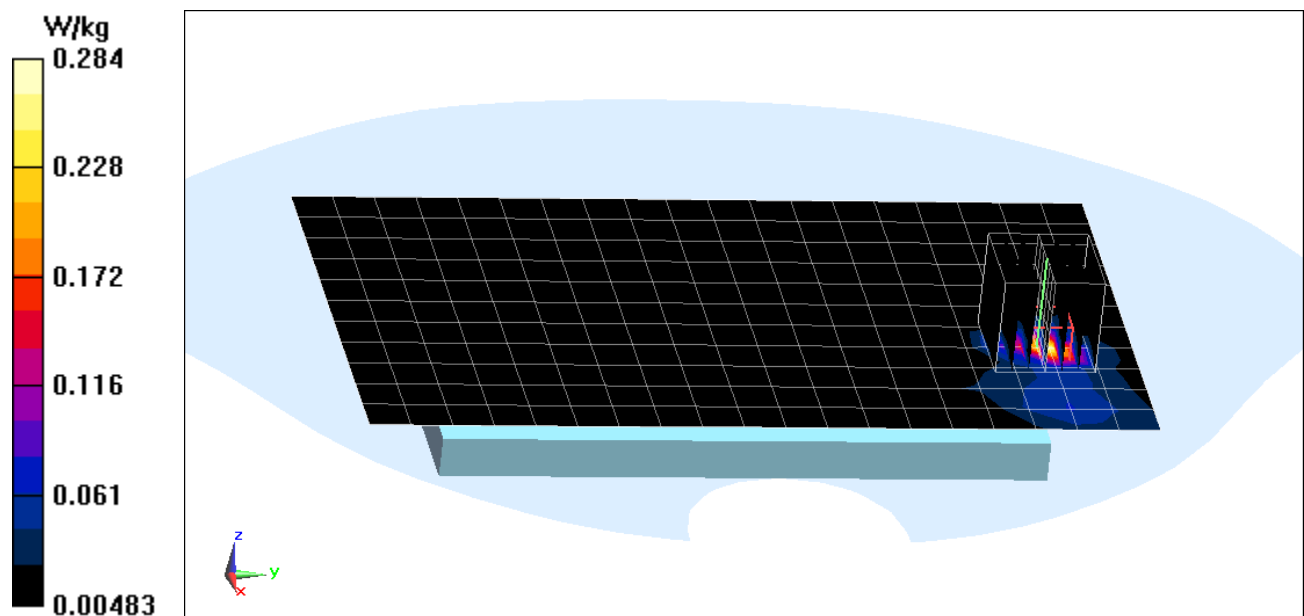
Probe: EX3DV4 - SN3589; ConvF(3.79, 3.79, 3.79); Calibrated: 1/22/2015;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Mode: IEEE 802.11n, Ant. 2, U-NII-2A, 40 MHz Bandwidth, Body SAR
Back Side, Ch 62, 13.5 Mbps**

Area Scan (12x20x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4
Reference Value = 4.942 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.108 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN920X; Type: Portable Handset; Serial: 7C924

Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: 2400 Body Medium parameters used (interpolated):

$f = 2412 \text{ MHz}$; $\sigma = 1.914 \text{ S/m}$; $\epsilon_r = 51.620$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 06-22-2015; Ambient Temp: 22.4°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3332; ConvF(4.31, 4.31, 4.31); Calibrated: 9/18/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

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

**Mode: IEEE 802.11b, Ant 1, 22 MHz Bandwidth, Extremity SAR
Front Side, Ch 01, 1 Mbps**

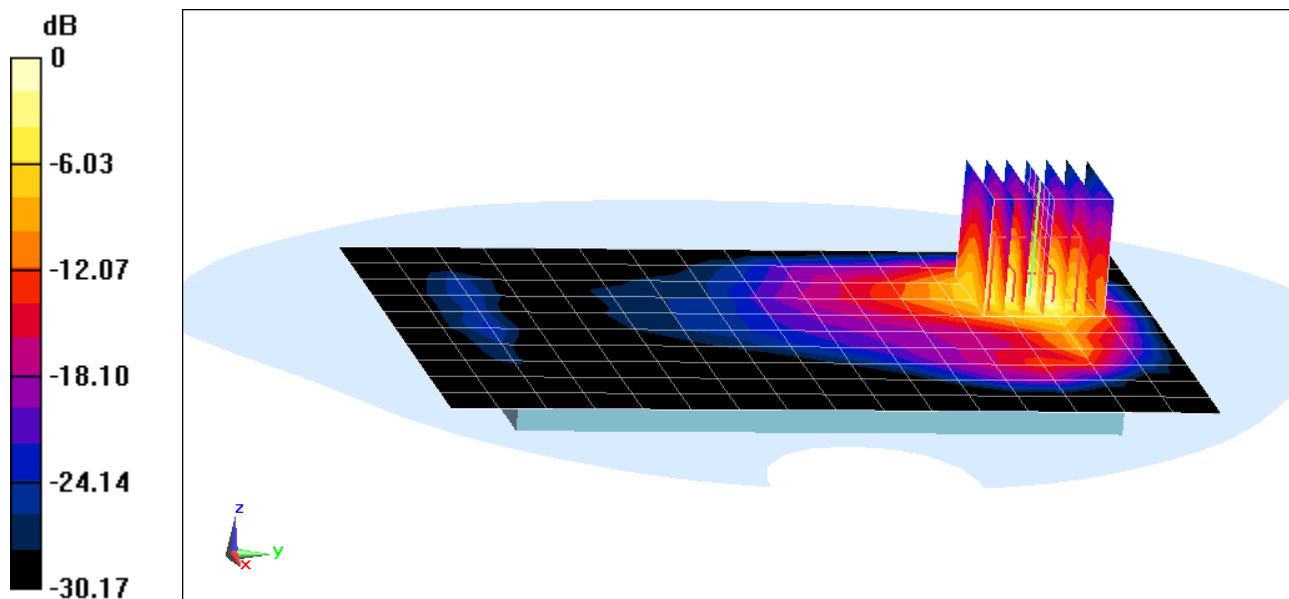
Area Scan (11x17x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

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

Reference Value = 6.739 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 4.09 W/kg

SAR(10 g) = 0.486 W/kg



0 dB = 2.02 W/kg = 3.05 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN920X; Type: Portable Handset; Serial: 7C924

Communication System: UID 0, IEEE 802.11n; Frequency: 5710 MHz; Duty Cycle: 1:1

Medium: 5 GHz Body Medium parameters used (interpolated):

$f = 5710 \text{ MHz}$; $\sigma = 6.019 \text{ S/m}$; $\epsilon_r = 47.66$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 0.0 cm

Test Date: 06-11-2015; Ambient Temp: 22.6°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3589; ConvF(3.79, 3.79, 3.79); Calibrated: 1/22/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

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

Mode: IEEE 802.11n, Ant. 2, U-NII-2C, 40 MHz Bandwidth, Extremity SAR
Front Side, Ch 142, 13.5 Mbps

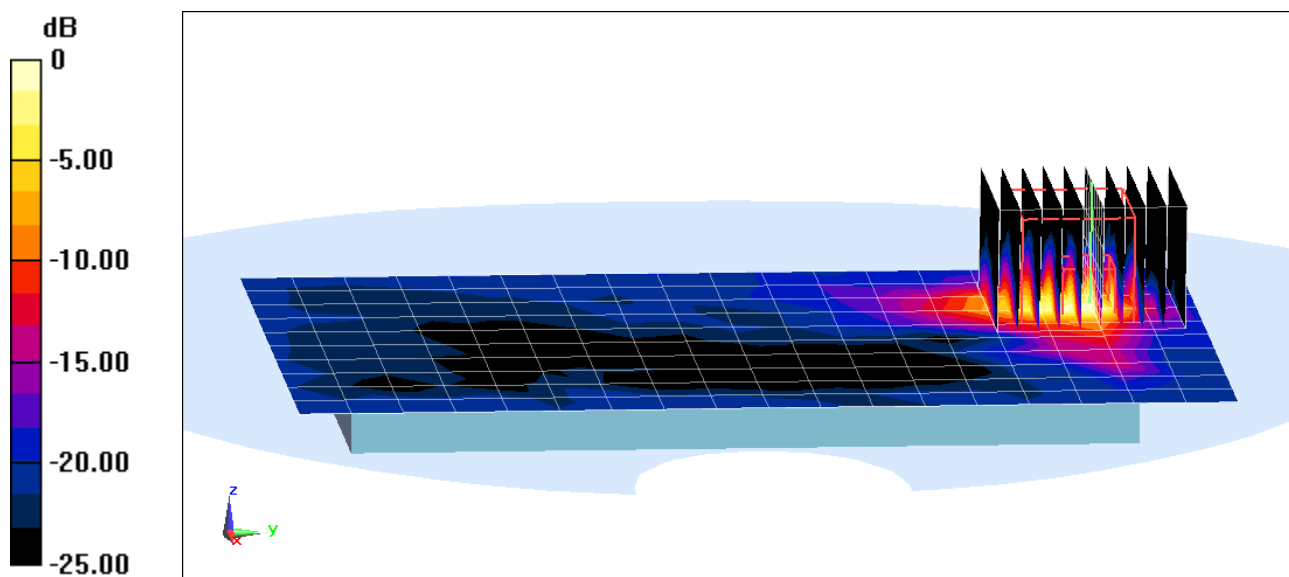
Area Scan (11x19x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Zoom Scan (9x10x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Reference Value = 16.65 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 7.02 W/kg

SAR(10 g) = 0.330 W/kg



0 dB = 3.58 W/kg = 5.54 dBW/kg

APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 2450 Head Medium parameters used:

$f = 2450 \text{ MHz}$; $\sigma = 1.887 \text{ S/m}$; $\epsilon_r = 38.883$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-05-2015; Ambient Temp: 22.9°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3318; ConvF(4.5, 4.5, 4.5); Calibrated: 1/23/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/14/2015

Phantom: SAM Front; Type: SAM; Serial: 1686

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

2450 MHz System Verification

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

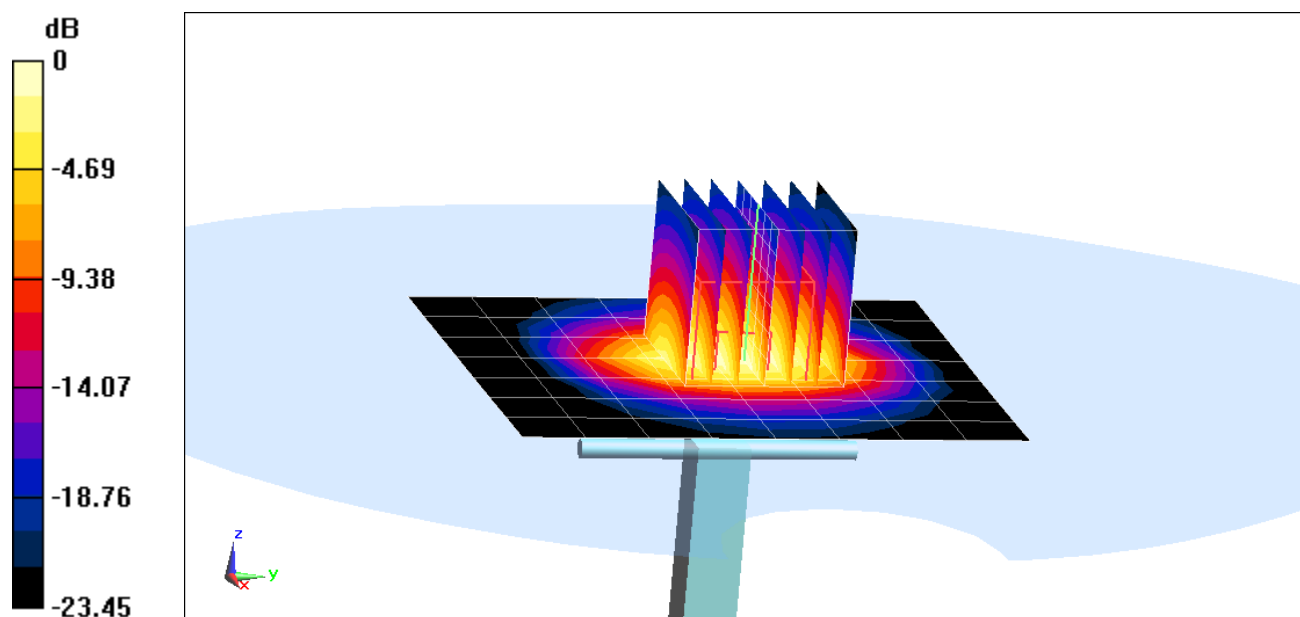
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 10.9 W/kg

SAR(1 g) = 5.12 W/kg

Deviation = -1.73%



0 dB = 6.78 W/kg = 8.31 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 5 GHz Head Medium parameters used:

$f = 5300 \text{ MHz}$; $\sigma = 4.607 \text{ S/m}$; $\epsilon_r = 35.501$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-08-2015; Ambient Temp: 21.9°C; Tissue Temp: 20.1°C

Probe: EX3DV4 - SN7357; ConvF(4.93, 4.93, 4.93); Calibrated: 4/23/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/13/2015

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

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

5300 MHz System Verification

Area Scan (7x8x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

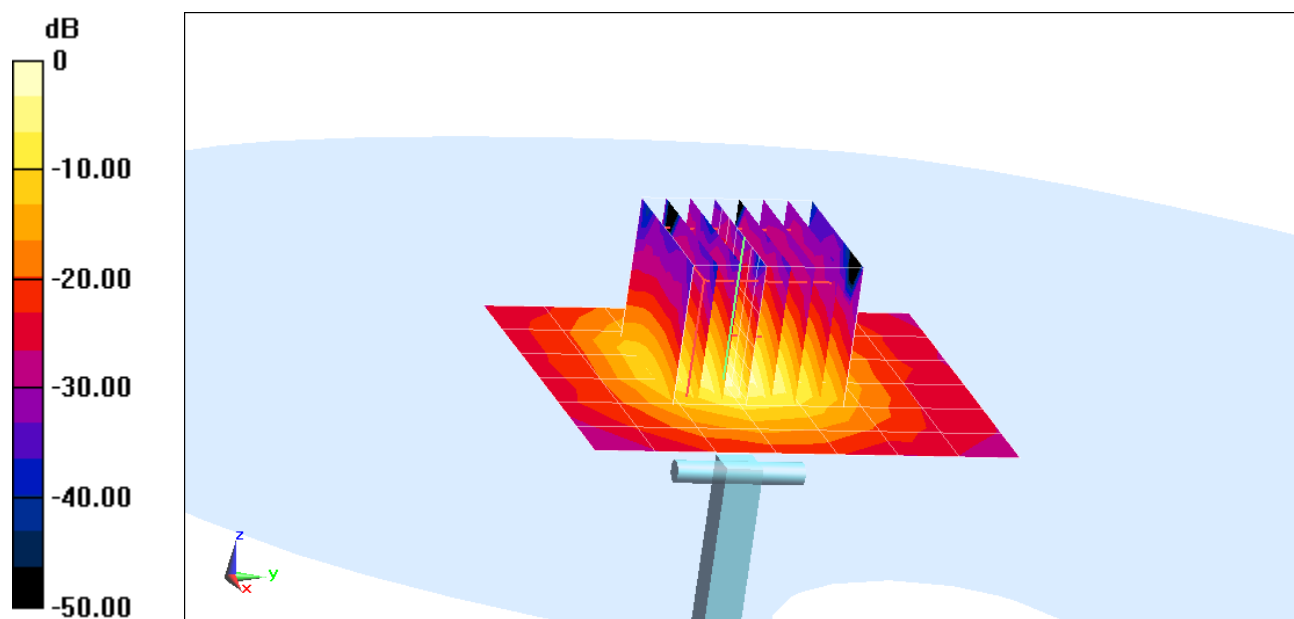
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17 dBm (50 mW)

Peak SAR (extrapolated) = 16.5 W/kg

SAR(1 g) = 4.02 W/kg

Deviation = -5.08%



0 dB = 9.47 W/kg = 9.76 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 5 GHz Head Medium parameters used:

$f = 5500 \text{ MHz}$; $\sigma = 4.86 \text{ S/m}$; $\epsilon_r = 35.279$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-08-2015; Ambient Temp: 22.5°C; Tissue Temp: 20.1°C

Probe: EX3DV4 - SN7357; ConvF(4.7, 4.7, 4.7); Calibrated: 4/23/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/13/2015

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

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

5500 MHz System Verification

Area Scan (7x7x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

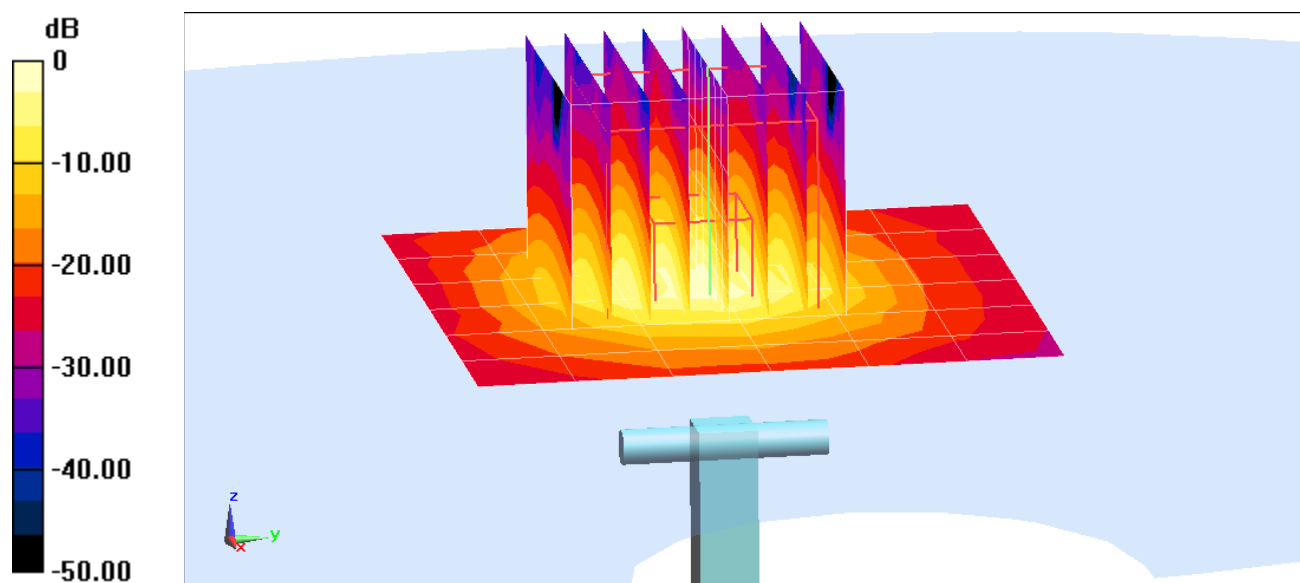
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17 dBm (50 mW)

Peak SAR (extrapolated) = 18.8 W/kg

SAR(1 g) = 4.4 W/kg

Deviation = 4.39%



0 dB = 10.5 W/kg = 10.21 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 5 GHz Head Medium parameters used:

$f = 5800 \text{ MHz}$; $\sigma = 5.164 \text{ S/m}$; $\epsilon_r = 34.752$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-08-2015; Ambient Temp: 22.9°C; Tissue Temp: 20.1°C

Probe: EX3DV4 - SN7357; ConvF(4.41, 4.41, 4.41); Calibrated: 4/23/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/13/2015

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

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

5800 MHz System Verification

Area Scan (7x7x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

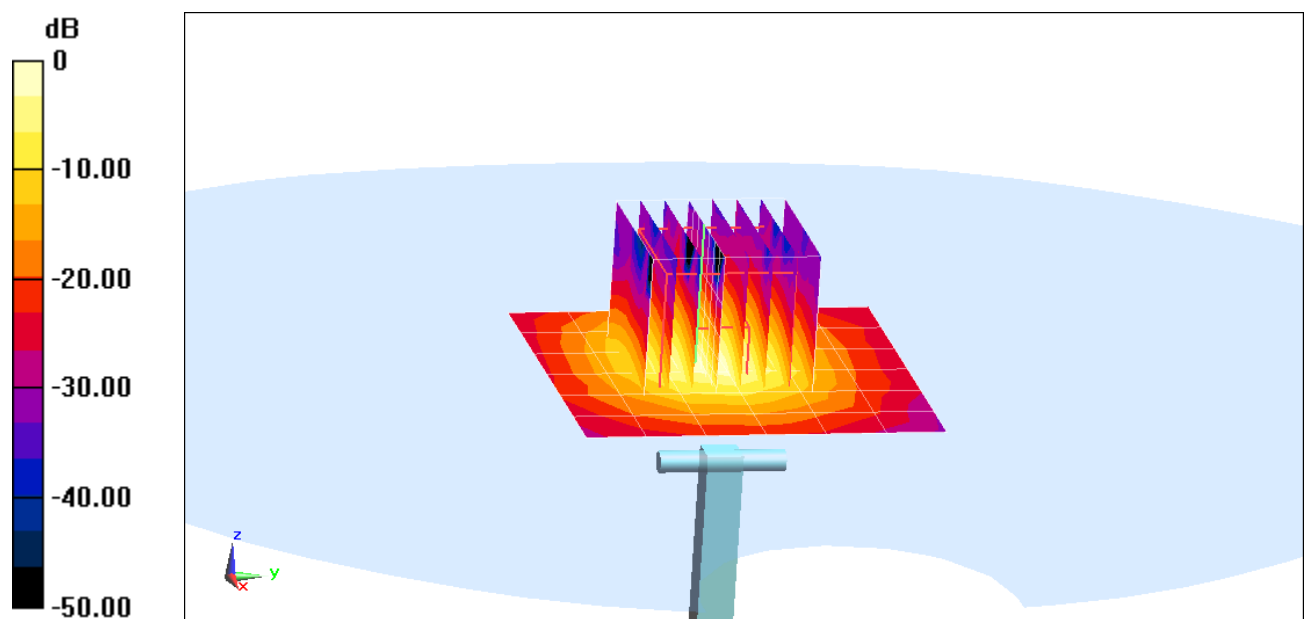
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17 dBm (50 mW)

Peak SAR (extrapolated) = 18.0 W/kg

SAR(1 g) = 4.06 W/kg

Deviation = 0.12%



0 dB = 9.82 W/kg = 9.92 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$; $\sigma = 2.008 \text{ S/m}$; $\epsilon_r = 50.462$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

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

Probe: ES3DV3 - SN3209; ConvF(4.12, 4.12, 4.12); Calibrated: 3/19/2015;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/13/2015

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

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

2450 MHz System Verification

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

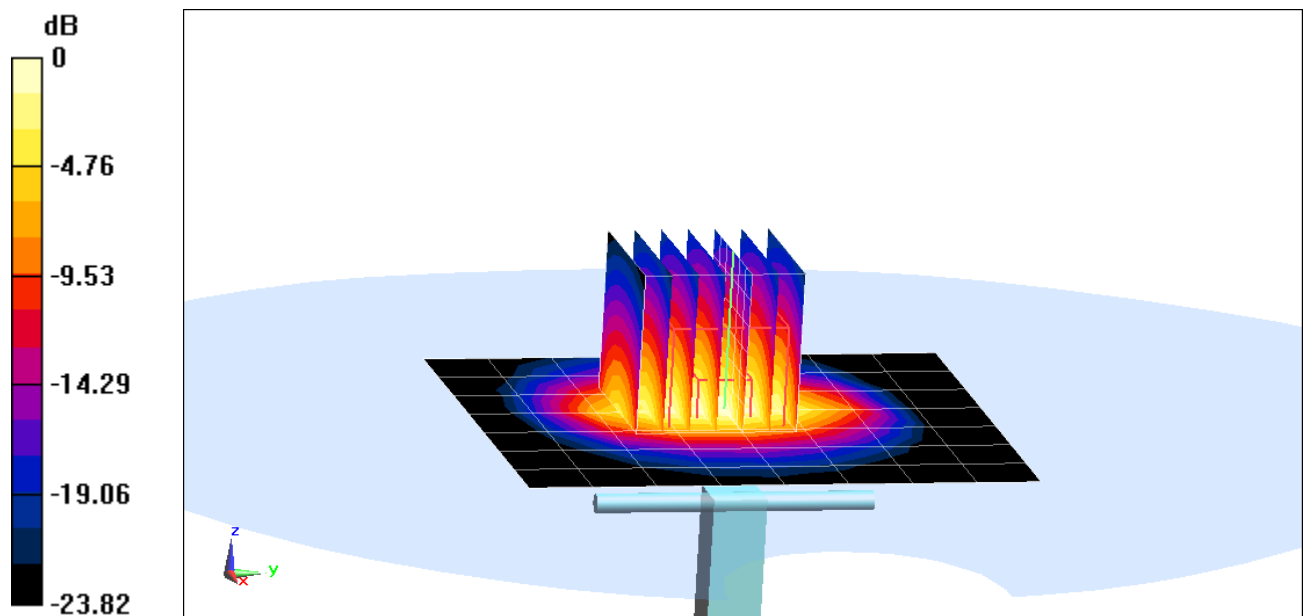
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 11.8 W/kg

SAR(1 g) = 5.40 W/kg

Deviation = 4.25%



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

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 5 GHz Body Medium parameters used:

$f = 5300 \text{ MHz}$; $\sigma = 5.248 \text{ S/m}$; $\epsilon_r = 48.083$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

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

Probe: EX3DV4 - SN3589; ConvF(3.79, 3.79, 3.79); Calibrated: 1/22/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

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

5300 MHz System Verification

Area Scan (7x8x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

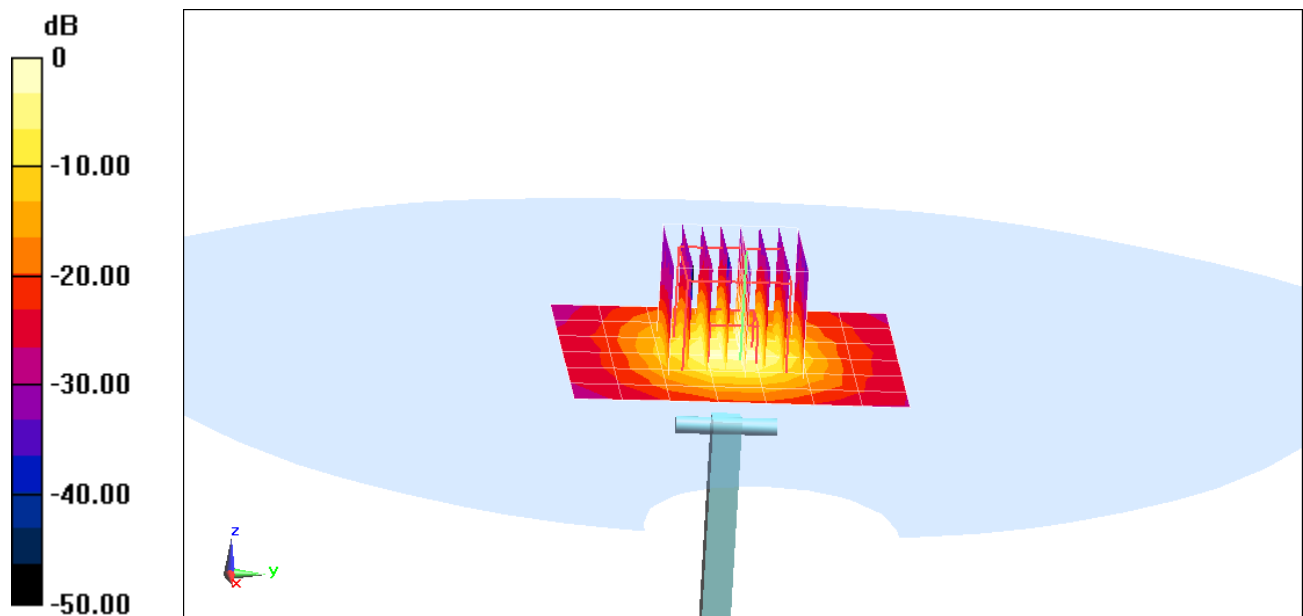
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17 dBm (50 mW)

Peak SAR (extrapolated) = 16.2 W/kg

SAR(1 g) = 3.91 W/kg

Deviation = 5.39%



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

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 5 GHz Body Medium parameters used:

$f = 5500 \text{ MHz}$; $\sigma = 5.495 \text{ S/m}$; $\epsilon_r = 47.779$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-03-2015; Ambient Temp: 22.2°C; Tissue Temp: 21.4°C

Probe: EX3DV4 - SN3589; ConvF(3.65, 3.65, 3.65); Calibrated: 1/22/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

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

5500 MHz System Verification

Area Scan (7x7x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

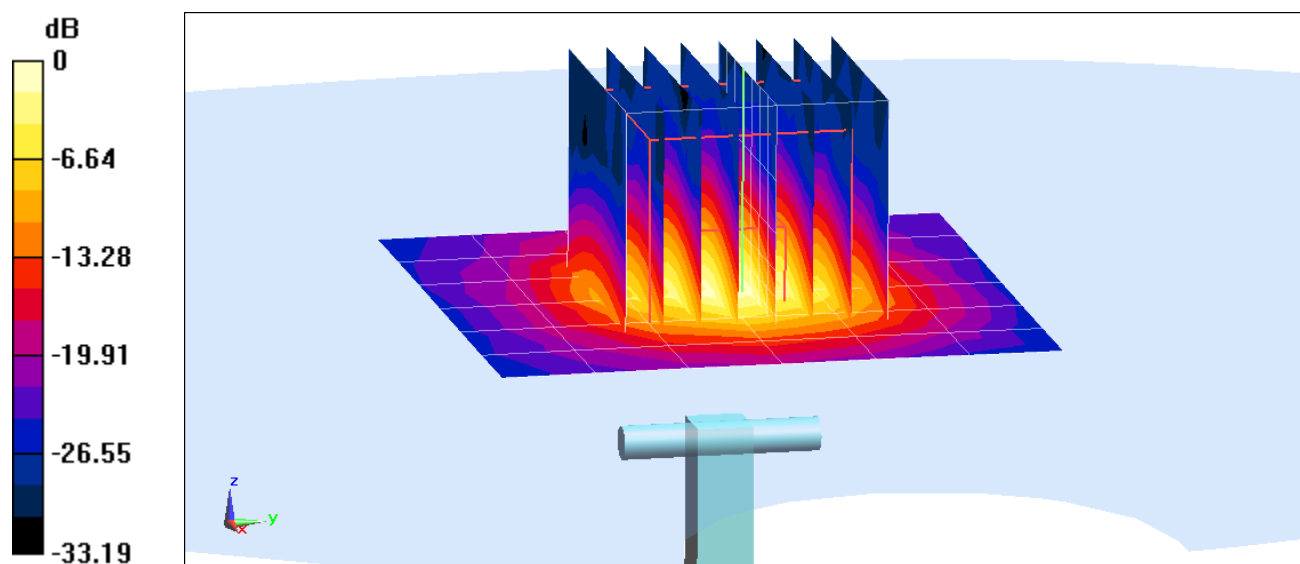
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power: 17 dBm (50 mW)

Peak SAR (extrapolated) = 16.1 W/kg

SAR(1 g) = 3.68 W/kg

Deviation = -7.07%



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

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 5 GHz Body Medium parameters used:

$f = 5800 \text{ MHz}$; $\sigma = 5.914 \text{ S/m}$; $\epsilon_r = 47.336$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

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

Probe: EX3DV4 - SN3589; ConvF(3.79, 3.79, 3.79); Calibrated: 1/22/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

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

5800 MHz System Verification

Area Scan (7x7x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

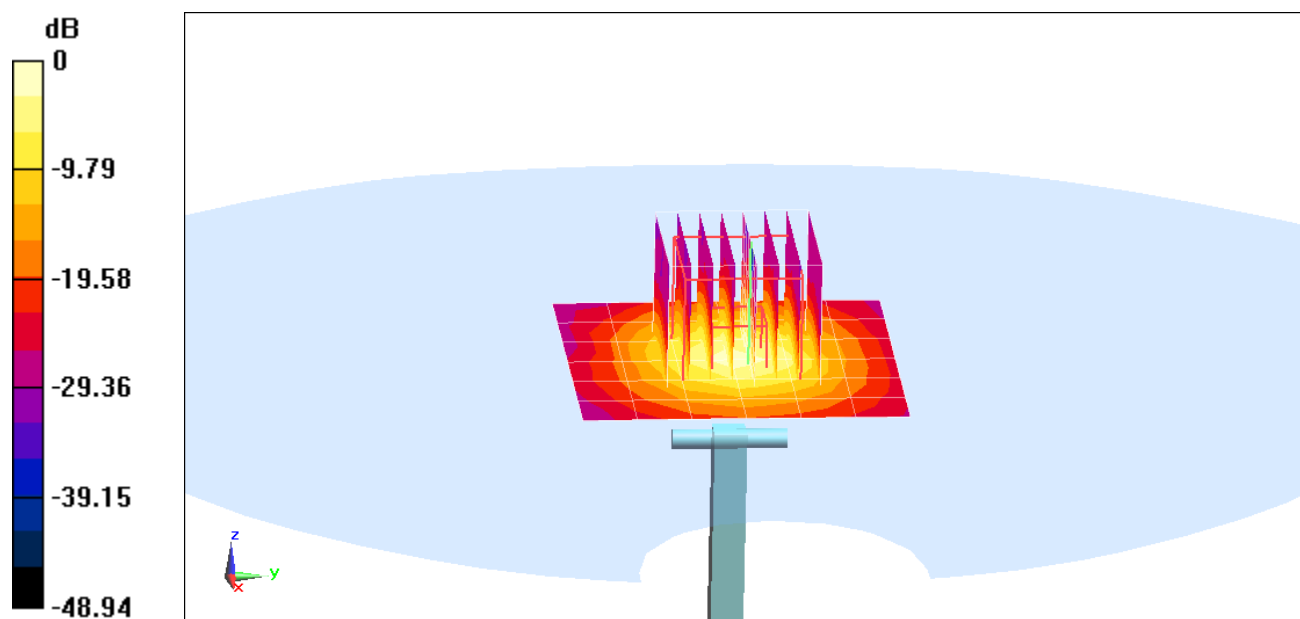
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17 dBm (50 mW)

Peak SAR (extrapolated) = 15.5 W/kg

SAR(1 g) = 3.41 W/kg

Deviation = -9.19%



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

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 2400 Body Medium parameters used:

$f = 2450 \text{ MHz}$; $\sigma = 1.964 \text{ S/m}$; $\epsilon_r = 51.479$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-22-2015; Ambient Temp: 22.4°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3332; ConvF(4.31, 4.31, 4.31); Calibrated: 9/18/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

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

2450 MHz System Verification

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

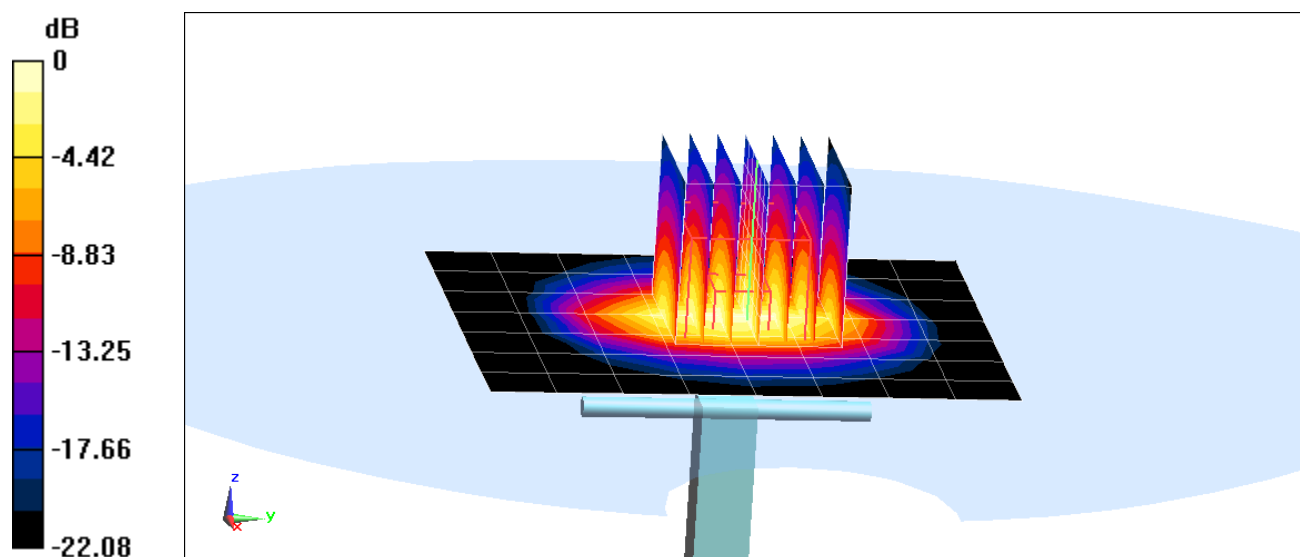
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 10.7 W/kg

SAR(10 g) = 2.38 W/kg

Deviation = -0.83 %



0 dB = 6.76 W/kg = 8.30 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 5 GHz Body Medium parameters used:

$f = 5300 \text{ MHz}$; $\sigma = 5.450 \text{ S/m}$; $\epsilon_r = 48.362$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-11-2015; Ambient Temp: 22.7°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3589; ConvF(3.79, 3.79, 3.79); Calibrated: 1/22/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

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

5300 MHz System Verification

Area Scan (7x8x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

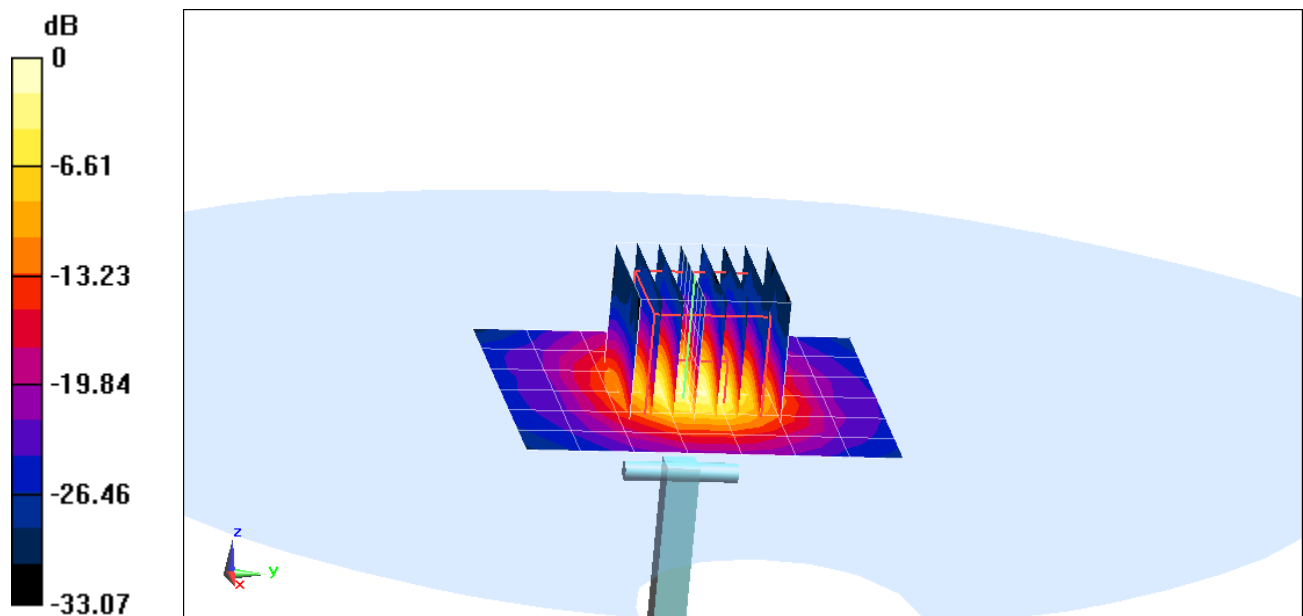
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17 dBm (50 mW)

Peak SAR (extrapolated) = 16.2 W/kg

SAR(10 g) = 1.09 W/kg

Deviation = 4.31%



0 dB = 9.22 W/kg = 9.65 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 5 GHz Body Medium parameters used:

$f = 5500 \text{ MHz}$; $\sigma = 5.706 \text{ S/m}$; $\epsilon_r = 48.053$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-11-2015; Ambient Temp: 22.7°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3589; ConvF(3.65, 3.65, 3.65); Calibrated: 1/22/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

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

5500 MHz System Verification

Area Scan (7x7x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

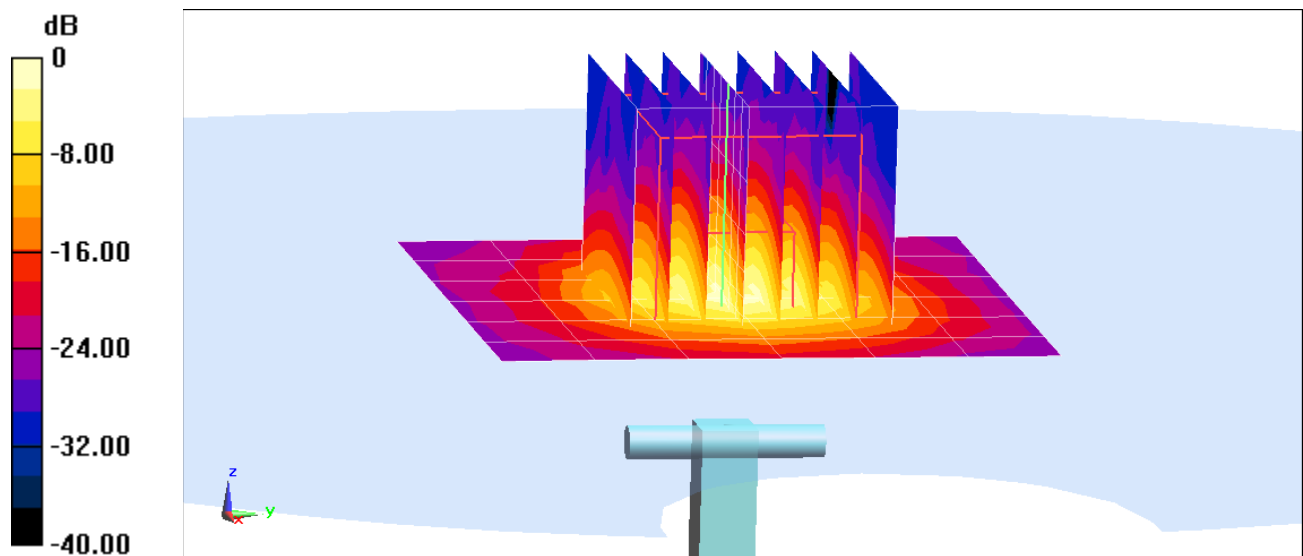
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17 dBm (50 mW)

Peak SAR (extrapolated) = 17.2 W/kg

SAR(10 g) = 1.08 W/kg

Deviation = -1.82%



0 dB = 9.47 W/kg = 9.76 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

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

Medium: 5 GHz Body Medium parameters used:

$f = 5800 \text{ MHz}$; $\sigma = 6.139 \text{ S/m}$; $\epsilon_r = 47.566$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-11-2015; Ambient Temp: 22.6°C; Tissue Temp: 21.3°C

Probe: EX3DV4 - SN3589; ConvF(3.79, 3.79, 3.79); Calibrated: 1/22/2015;

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/17/2014

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

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

5800 MHz System Verification

Area Scan (7x7x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

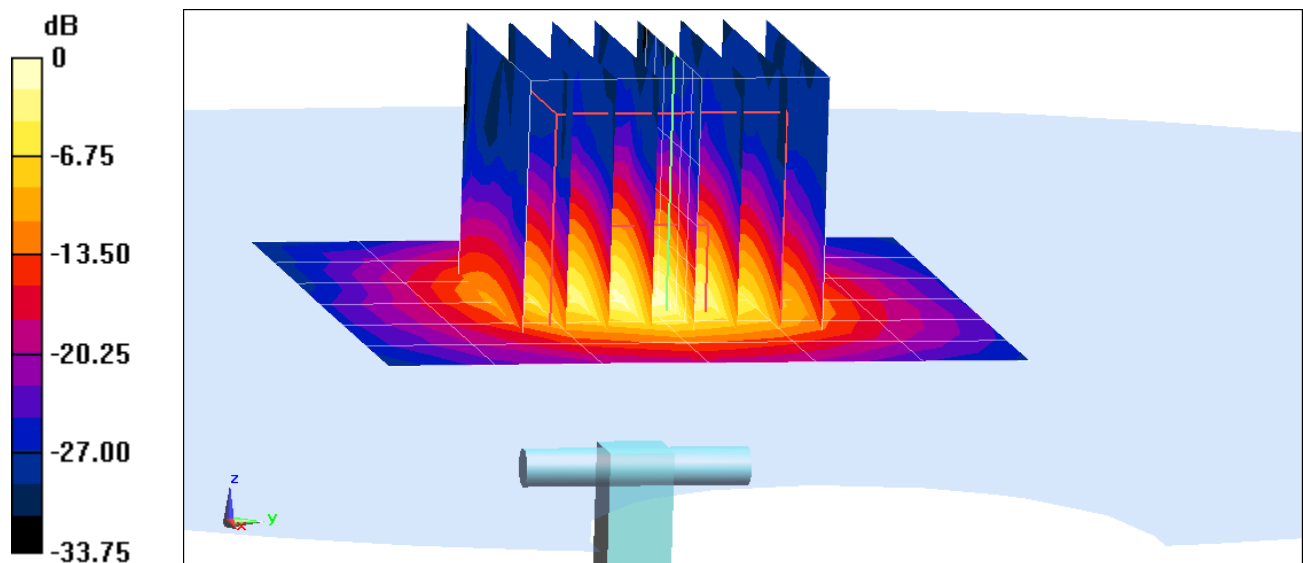
Zoom Scan (8x8x7)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$; Graded Ratio: 1.4

Input Power = 17 dBm (50 mW)

Peak SAR (extrapolated) = 15.3 W/kg

SAR(10 g) = 0.962 W/kg

Deviation = -6.60%



0 dB = 8.29 W/kg = 9.19 dBW/kg