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SAR EVALUATION REPORT

Applicant Name:
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Date of Testing:
09/10/14 - 09/11/14
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1411132118.A3L

FCC ID:	**A3LSWDSC01G**
APPLICANT:	**SAMSUNG ELECTRONICS, CO. LTD.**

DUT Type:	Portable Handset
Application Type:	Class II Permissive Change
FCC Rule Part(s):	CFR §2.1093
Model(s):	SC-01G
Sample Serial Number:	Pre-Production [S/N:624B1]
Permissive Change(s):	Adding LTE B41
Date of Original Certification:	09/19/2014

Equipment Class	Band & Mode	Tx Frequency	SAR		
			1 gm Head (W/kg)	1 gm Body-Worn (W/kg)	1 gm Hotspot (W/kg)
PCE	LTE Band 41	2498.5 - 2687.5 MHz	< 0.1	< 0.1	0.27

The table above shows Test Data evaluated for the current test report. Please refer to RF Exposure Technical Report S/N 0Y1408271784.A3L for compliance evaluation.

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

ACCREDITED
TESTING CERT#2041.01

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

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1 DEVICE UNDER TEST

1.1 Device Overview

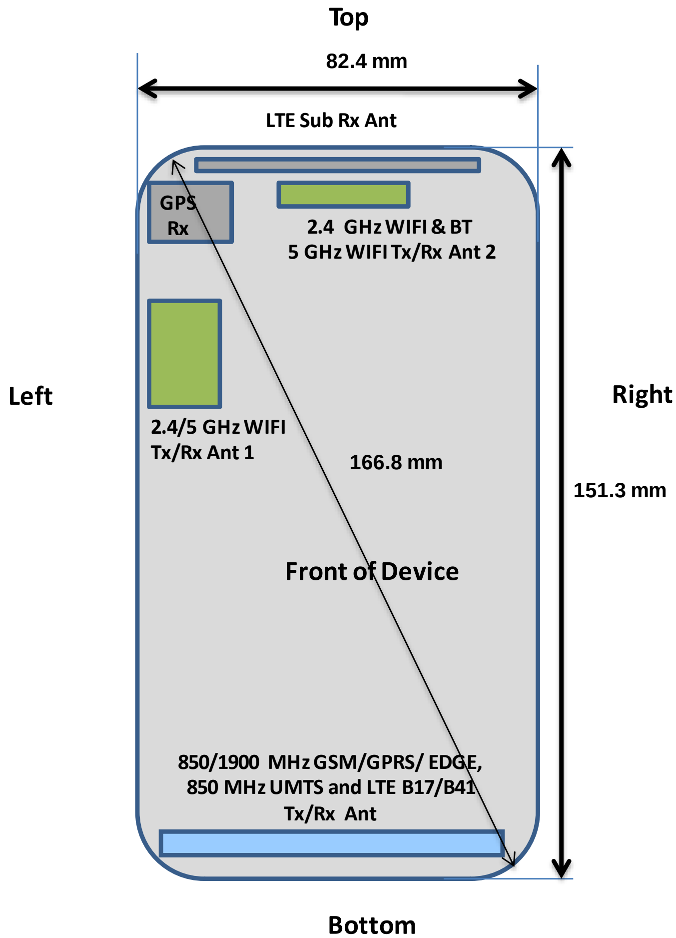
Band & Mode	Operating Modes	Tx Frequency
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
LTE Band 17	Data	706.5 - 713.5 MHz
LTE Band 41	Data	2498.5 - 2687.5 MHz
2.4 GHz WLAN	Data	2412 - 2462 MHz
5.8 GHz WLAN	Data	5745 - 5825 MHz
5.2 GHz WLAN	Data	5180 - 5240 MHz
5.3 GHz WLAN	Data	5260 - 5320 MHz
5.5 GHz WLAN	Data	5500 - 5700 MHz
Bluetooth	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz
ANT+	Data	2402 - 2480 MHz

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 (dBm)
LTE Band 41	Maximum	**23.0**
	Nominal	**22.5**

1.3 DUT Antenna Locations



Note: Exact antenna dimensions and separation distances are shown in the Technical Descriptions. Since the diagonal dimension of this device is > 160 mm and <200 mm, it is considered a "phablet.".

Figure 1-1
DUT Antenna Locations

Table 1-1
Sides for SAR Testing

Sides for SAR Testing						
Mode	Back	Front	Top	Bottom	Right	Left
LTE Band 41	Yes	Yes	No	Yes	Yes	Yes

Note: Particular DUT edges were not required to be evaluated for Wireless Router SAR or Extremity SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v01 guidance, page 2 and FCC KDB 648474 D04v01r01.

1.4 Near Field Communications (NFC) Antenna

This DUT has NFC operations. The NFC antenna is integrated into the specialized battery. The SAR tests were performed with the specialized battery (model: EB-BN915BBD).

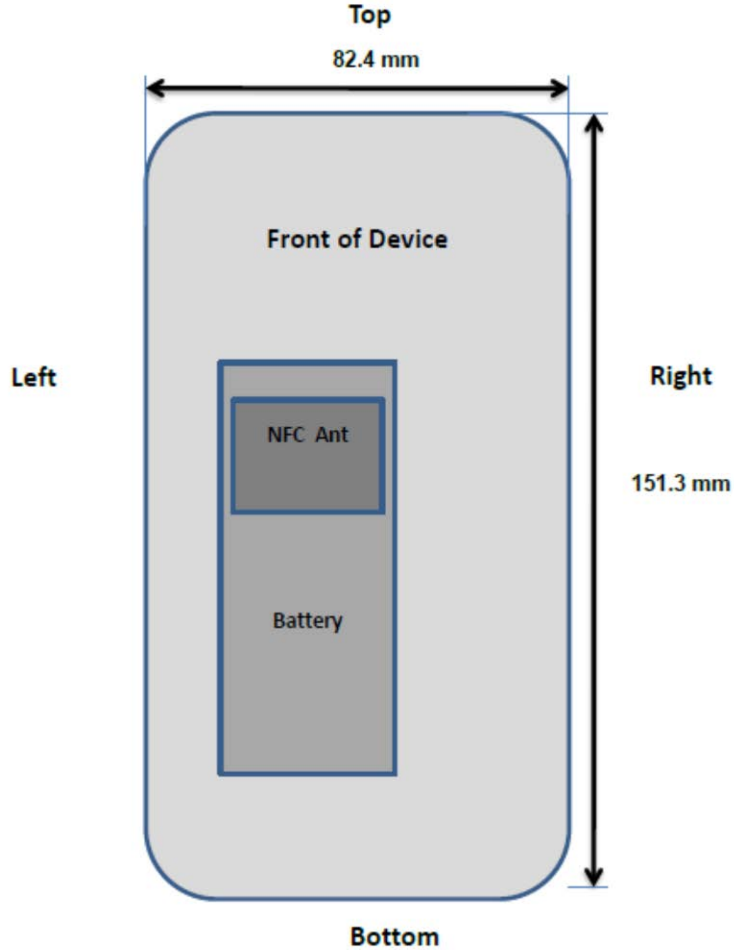


Figure 1-2
NFC Antenna Locations

1.5 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D05v01, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the DUT are shown in Figure 1-3 and are color-coded to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.

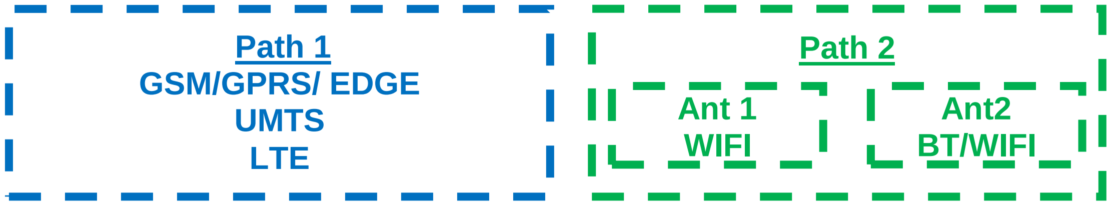


Figure 1-3
Simultaneous Transmission Paths

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

Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Head	Body-Worn Accessory	Wireless Router	Extremity	Notes
1	GSM voice + 2.4 GHz WI-FI	Yes	Yes	N/A	Yes	
2	GSM voice + 5 GHz WI-FI	Yes	Yes	N/A	Yes	
3	GSM voice + 2.4 GHz Bluetooth	N/A	Yes	N/A	Yes	
4	UMTS + 2.4 GHz WI-FI	Yes	Yes	Yes	Yes	
5	UMTS + 5 GHz WI-FI	Yes	Yes	N/A	Yes	
6	UMTS + 2.4 GHz Bluetooth	N/A	Yes	N/A	Yes	
7	LTE + 2.4 GHz WI-FI	Yes*	Yes*	Yes	Yes	*-Pre-installed VOIP applications are considered.
8	LTE + 2.4 GHz Bluetooth	N/A	Yes*	N/A	Yes	*-Pre-installed VOIP applications are considered.
9	GPRS/EDGE + 2.4 GHz WI-FI	N/A	N/A	Yes	Yes	
10	LTE + 5 GHz WI-FI	N/A	N/A	N/A	Yes	WIFI Direct Only
11	GPRS/EDGE + 5 GHz WI-FI	N/A	N/A	N/A	Yes	WIFI Direct Only

1. 2.4 GHz WLAN, 5 GHz WLAN, and 2.4 GHz Bluetooth share the same antenna path and cannot transmit simultaneously.
2. All licensed modes share the same antenna path and cannot transmit simultaneously.
3. When the user utilizes multiple services in UMTS 3G mode it uses multi-Radio Access Bearer or multi-RAB. The power control is based on a physical control channel (Dedicated Physical Control Channel [DPCCH]) and power control will be adjusted to meet the needs of both services. Therefore, the UMTS+WLAN scenario also represents the UMTS Voice/DATA + WLAN Hotspot scenario.
4. When wireless router mode is enabled, all 5GHz bands are disabled.
5. This device supports 2x2 MIMO Tx for WLAN 802.11n/ac. Each WLAN antenna can transmit independently or together when operating with MIMO.

1.6 SAR Test Exclusions Applied

This report evaluates SAR compliance for LTE Band 41. Please refer to RF Exposure Technical Report 0Y1408271784.A3L for original compliance report containing data for other main antenna and WLAN modes. No changes were made to any other mode or band.

(A) Licensed Transmitter(s)

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

Per FCC KDB Publication 648474 D04v01r01, this device is considered a "phablet" since the diagonal dimension is greater than 160mm and less than 200mm. Therefore, extremity SAR tests are required when wireless router mode does not apply or if wireless router 1g SAR > 1.2 W/kg. Extremity SAR was not evaluated for licensed technologies since wireless router 1g SAR was < 1.2 W/kg for these modes.

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 941225 D05, D06 (4G and Hotspot)
- FCC KDB Publication 447498 D01v05r02 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r03, D02v01r01 (SAR Measurements up to 6 GHz)
- FCC KDB Publication 648474 D03-D04 (Phablet Procedures)

2 LTE INFORMATION

LTE Information					
FCC ID	**A3LSWDSC01G**				
Form Factor	Portable Handset				
Frequency Range of each LTE transmission band	LTE Band 41 (2498.5 - 2687.5 MHz)				
Channel Bandwidths	LTE Band 41: 5 MHz, 10 MHz, 15 MHz, 20 MHz				
Channel Numbers and Frequencies (MHz)	Low	Low-Mid	Mid	High-Mid	High
LTE Band 41: 5 MHz	2498.5 (39675)	2545.8 (40148)	2593 (40620)	2640.3 (41093)	2687.5 (41565)
LTE Band 41: 10 MHz	2501 (39700)	2547 (40160)	2593 (40620)	2639 (41080)	2685 (41540)
LTE Band 41: 15 MHz	2503.5 (39725)	2548.3 (40173)	2593 (40620)	2637.8 (41068)	2682.5 (41515)
LTE Band 41: 20 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
UE Category	4				
Modulations Supported in UL	QPSK, 16QAM				
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES				
A-MPR (Additional MPR) disabled for SAR Testing?	YES				

3 INTRODUCTION

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

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [22]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

3.1 SAR Definition

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

Equation 3-1
SAR Mathematical Equation

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

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

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

where:

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

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

4 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

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

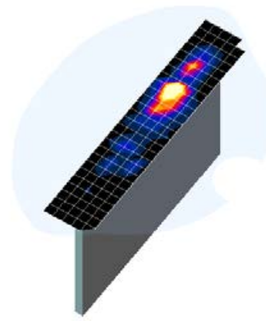


Figure 4-1
Sample SAR Area Scan

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01 (See Table 4-1) and IEEE 1528-2013.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01 (See Table 4-1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):

   a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 4-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).

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

   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

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

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

*Also compliant to IEEE 1528-2013 Table 6

5 DEFINITION OF REFERENCE POINTS

5.1 EAR REFERENCE POINT

Figure 5-2 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 5-1. 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 5-1). 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].

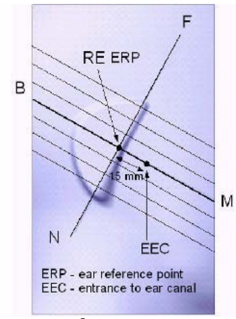


Figure 5-1
Close-Up Side view of ERP

5.2 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 5-3). The acoustic output was than 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 5-2
Front, back and side view of SAM Twin Phantom

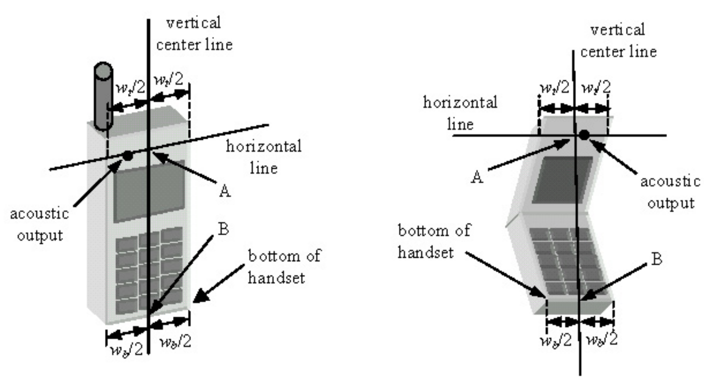


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

6 TEST CONFIGURATION POSITIONS FOR HANDSETS

6.1 Device Holder

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

6.2 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 6-1), 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.

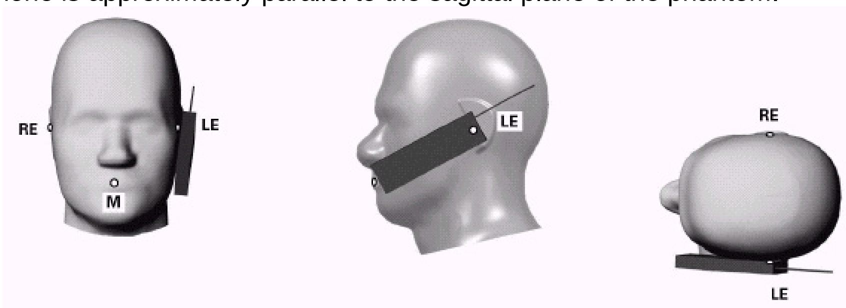


Figure 6-1 Front, Side and Top View of Cheek Position

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 was 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 6-2).

6.3 Positioning for Ear / 15º 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 15degrees.
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 6-2).

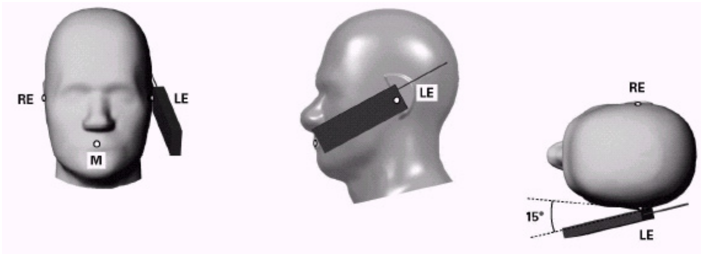


Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

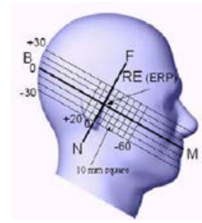


Figure 6-3
Side view w/ relevant markings

6.4 SAR Evaluations near the Mouth/Jaw Regions of the SAM Phantom

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jaw regions of the SAM head phantom. This typically applies to clam-shell style phones that are generally longer in the unfolded normal use positions or to certain older style long rectangular phones. Per IEEE 1528-2013, a rotated SAM phantom is necessary to allow probe access to such regions. Both SAM heads of the TwinSAM-Chin20 are rotated 20 degrees around the NF line. Each head can be removed from the table for emptying and cleaning.

Under these circumstances, the following procedures apply, adopted from the FCC guidance on SAR handsets document FCC KDB Publication 648474 D04_v01. The SAR required in these regions of SAM should be measured using a flat phantom. The phone should be positioned with a separation distance of 4 mm between the ear reference point (ERP) and the outer surface of the flat phantom shell. While maintaining this distance at the ERP location, the low (bottom) edge of the phone should be lowered from the phantom to establish the same separation distance between the peak SAR location identified by the truncated partial SAR distribution measured with the SAM phantom. The distance from the peak SAR location to the phone is determined by the straight line passing perpendicularly through the phantom surface. When it is not feasible to maintain 4 mm separation at the ERP while also establishing the required separation at the peak SAR location, the top edge of the phone will be allowed to touch the phantom with a separation < 4 mm at the ERP. The phone should not be tilted to the left or right while placed in this inclined position to the flat phantom.

6.5 Body-Worn Accessory Configurations

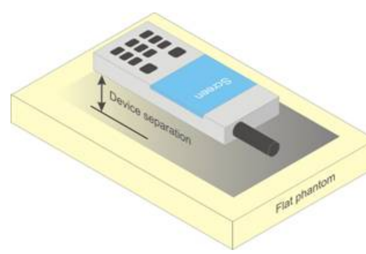


Figure 6-4
Sample Body-Worn Diagram

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 6-4). Per FCC KDB Publication 648474 D04v01, 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 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.

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.

6.6 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 44798 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 minitablets that support voice calls next to the ear, the phablets procedures outlined in KDB Publication 648474 D04 v01r01DR04 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. When hotspot mode applies, 10-g SAR is required only for the surfaces and edges with hotspot mode 1-g SAR > 1.2 W/kg.

6.7 Wireless Router Configurations

Some battery-operated handsets have the capability to transmit and receive user data through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 v01 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10 mm from the front, back and edges of the device containing transmitting antennas within 2.5 cm of their edges, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v05 publication procedures. The "Portable Hotspot" feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

7 RF EXPOSURE LIMITS

7.1 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.

7.2 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 7-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

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

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

8 FCC MEASUREMENT PROCEDURES

8.1 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.

8.2 Procedures Used to Establish RF Signal for SAR

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

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

8.3 SAR Measurement Conditions for LTE

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

8.3.1 Spectrum Plots for RB Configurations

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

8.3.2 MPR

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.

8.3.3 A-MPR

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

8.3.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r01:

a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
    i. The required channel and offset combination with the highest maximum output power is required for SAR.
    ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
    iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.
b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to ½ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is <1.45 W/kg.

8.3.5 TDD

LTE TDD testing procedures were performed using guidance from FCC KDB 941225 D05v02r05 and the SAR test guidance provided in April 2013 TCB workshop notes. TDD was tested at the highest duty factor using UL-DL configuration 0 with special subframe configuration 6 and applying the FDD LTE procedures in KDB 941225. SAR testing was performed using the extended cyclic prefix listed in 3GPP TS 36.211 Section 4.

9 RF CONDUCTED POWERS

9.1 LTE Conducted Powers

9.1.1 LTE Band 41

Table 9-1
LTE Band 41 Conducted Powers - 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2506	39750	20	QPSK	1	0	21.54	0	0
	2506	39750	20	QPSK	1	50	21.78	0	0
	2506	39750	20	QPSK	1	99	21.60	0	0
	2506	39750	20	QPSK	50	0	21.13	0-1	1
	2506	39750	20	QPSK	50	25	21.14	0-1	1
	2506	39750	20	QPSK	50	50	21.28	0-1	1
	2506	39750	20	QPSK	100	0	21.06	0-1	1
	2506	39750	20	16QAM	1	0	20.51	0-1	1
	2506	39750	20	16QAM	1	50	20.50	0-1	1
	2506	39750	20	16QAM	1	99	20.57	0-1	1
	2506	39750	20	16QAM	50	0	20.11	0-2	2
	2506	39750	20	16QAM	50	25	20.10	0-2	2
	2506	39750	20	16QAM	50	50	20.03	0-2	2
	2506	39750	20	16QAM	100	0	20.01	0-2	2
Low Mid	2549.5	40185	20	QPSK	1	0	22.60	0	0
	2549.5	40185	20	QPSK	1	50	**22.86**	0	0
	2549.5	40185	20	QPSK	1	99	22.58	0	0
	2549.5	40185	20	QPSK	50	0	21.82	0-1	1
	2549.5	40185	20	QPSK	50	25	21.98	0-1	1
	2549.5	40185	20	QPSK	50	50	**21.99**	0-1	1
	2549.5	40185	20	QPSK	100	0	21.79	0-1	1
	2549.5	40185	20	16-QAM	1	0	21.09	0-1	1
	2549.5	40185	20	16-QAM	1	50	21.26	0-1	1
	2549.5	40185	20	16-QAM	1	99	21.17	0-1	1
	2549.5	40185	20	16-QAM	50	0	20.84	0-2	2
	2549.5	40185	20	16-QAM	50	25	20.92	0-2	2
	2549.5	40185	20	16-QAM	50	50	20.97	0-2	2
	2549.5	40185	20	16-QAM	100	0	20.88	0-2	2
Mid	2593	40620	20	QPSK	1	0	22.68	0	0
	2593	40620	20	QPSK	1	50	22.85	0	0
	2593	40620	20	QPSK	1	99	22.78	0	0
	2593	40620	20	QPSK	50	0	21.98	0-1	1
	2593	40620	20	QPSK	50	25	21.68	0-1	1
	2593	40620	20	QPSK	50	50	21.66	0-1	1
	2593	40620	20	QPSK	100	0	21.64	0-1	1
	2593	40620	20	16-QAM	1	0	21.06	0-1	1
	2593	40620	20	16-QAM	1	50	21.09	0-1	1
	2593	40620	20	16-QAM	1	99	21.16	0-1	1
	2593	40620	20	16-QAM	50	0	20.99	0-2	2
	2593	40620	20	16-QAM	50	25	20.95	0-2	2
	2593	40620	20	16-QAM	50	50	20.93	0-2	2
	2593	40620	20	16-QAM	100	0	20.97	0-2	2
Mid High	2636.5	41055	20	QPSK	1	0	22.31	0	0
	2636.5	41055	20	QPSK	1	50	22.48	0	0
	2636.5	41055	20	QPSK	1	99	22.18	0	0
	2636.5	41055	20	QPSK	50	0	21.66	0-1	1
	2636.5	41055	20	QPSK	50	25	21.64	0-1	1
	2636.5	41055	20	QPSK	50	50	21.55	0-1	1
	2636.5	41055	20	QPSK	100	0	21.58	0-1	1
	2636.5	41055	20	16-QAM	1	0	21.24	0-1	1
	2636.5	41055	20	16-QAM	1	50	21.16	0-1	1
	2636.5	41055	20	16-QAM	1	99	21.14	0-1	1
	2636.5	41055	20	16-QAM	50	0	20.68	0-2	2
	2636.5	41055	20	16-QAM	50	25	20.65	0-2	2
	2636.5	41055	20	16-QAM	50	50	20.62	0-2	2
	2636.5	41055	20	16-QAM	100	0	20.60	0-2	2
High	2680	41490	20	QPSK	1	0	22.41	0	0
	2680	41490	20	QPSK	1	50	22.33	0	0
	2680	41490	20	QPSK	1	99	22.23	0	0
	2680	41490	20	QPSK	50	0	21.74	0-1	1
	2680	41490	20	QPSK	50	25	21.76	0-1	1
	2680	41490	20	QPSK	50	50	21.80	0-1	1
	2680	41490	20	QPSK	100	0	21.61	0-1	1
	2680	41490	20	16-QAM	1	0	21.43	0-1	1
	2680	41490	20	16-QAM	1	50	21.34	0-1	1
	2680	41490	20	16-QAM	1	99	21.28	0-1	1
	2680	41490	20	16-QAM	50	0	20.77	0-2	2
	2680	41490	20	16-QAM	50	25	20.62	0-2	2
	2680	41490	20	16-QAM	50	50	20.72	0-2	2
	2680	41490	20	16-QAM	100	0	20.70	0-2	2

Table 9-2
LTE Band 41 Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2503.5	39725	15	QPSK	1	0	21.88	0	0
	2503.5	39725	15	QPSK	1	36	21.79	0	0
	2503.5	39725	15	QPSK	1	74	21.67	0	0
	2503.5	39725	15	QPSK	36	0	21.15	0-1	1
	2503.5	39725	15	QPSK	36	18	21.14	0-1	1
	2503.5	39725	15	QPSK	36	37	21.25	0-1	1
	2503.5	39725	15	QPSK	75	0	21.07	0-1	1
	2503.5	39725	15	16QAM	1	0	20.75	0-1	1
	2503.5	39725	15	16QAM	1	36	20.70	0-1	1
	2503.5	39725	15	16QAM	1	74	20.72	0-1	1
	2503.5	39725	15	16QAM	36	0	20.03	0-2	2
	2503.5	39725	15	16QAM	36	18	20.19	0-2	2
	2503.5	39725	15	16QAM	36	37	20.08	0-2	2
	2503.5	39725	15	16QAM	75	0	20.02	0-2	2
Low Mid	2548.25	40173	15	QPSK	1	0	22.64	0	0
	2548.25	40173	15	QPSK	1	36	22.75	0	0
	2548.25	40173	15	QPSK	1	74	22.44	0	0
	2548.25	40173	15	QPSK	36	0	21.98	0-1	1
	2548.25	40173	15	QPSK	36	18	21.92	0-1	1
	2548.25	40173	15	QPSK	36	37	21.94	0-1	1
	2548.25	40173	15	QPSK	75	0	21.85	0-1	1
	2548.25	40173	15	16-QAM	1	0	21.02	0-1	1
	2548.25	40173	15	16-QAM	1	36	21.31	0-1	1
	2548.25	40173	15	16-QAM	1	74	21.26	0-1	1
	2548.25	40173	15	16-QAM	36	0	20.93	0-2	2
	2548.25	40173	15	16-QAM	36	18	20.75	0-2	2
	2548.25	40173	15	16-QAM	36	37	20.85	0-2	2
	2548.25	40173	15	16-QAM	75	0	20.74	0-2	2
Mid	2593	40620	15	QPSK	1	0	22.80	0	0
	2593	40620	15	QPSK	1	36	22.99	0	0
	2593	40620	15	QPSK	1	74	22.94	0	0
	2593	40620	15	QPSK	36	0	21.96	0-1	1
	2593	40620	15	QPSK	36	18	21.51	0-1	1
	2593	40620	15	QPSK	36	37	21.69	0-1	1
	2593	40620	15	QPSK	75	0	21.62	0-1	1
	2593	40620	15	16-QAM	1	0	21.04	0-1	1
	2593	40620	15	16-QAM	1	36	21.01	0-1	1
	2593	40620	15	16-QAM	1	74	21.30	0-1	1
	2593	40620	15	16-QAM	36	0	20.98	0-2	2
	2593	40620	15	16-QAM	36	18	20.81	0-2	2
	2593	40620	15	16-QAM	36	37	20.91	0-2	2
	2593	40620	15	16-QAM	75	0	20.87	0-2	2
Mid High	2637.75	41068	15	QPSK	1	0	22.42	0	0
	2637.75	41068	15	QPSK	1	36	22.53	0	0
	2637.75	41068	15	QPSK	1	74	22.17	0	0
	2637.75	41068	15	QPSK	36	0	21.70	0-1	1
	2637.75	41068	15	QPSK	36	18	21.60	0-1	1
	2637.75	41068	15	QPSK	36	37	21.56	0-1	1
	2637.75	41068	15	QPSK	75	0	21.74	0-1	1
	2637.75	41068	15	16-QAM	1	0	21.34	0-1	1
	2637.75	41068	15	16-QAM	1	36	21.06	0-1	1
	2637.75	41068	15	16-QAM	1	74	21.03	0-1	1
	2637.75	41068	15	16-QAM	36	0	20.53	0-2	2
	2637.75	41068	15	16-QAM	36	18	20.73	0-2	2
	2637.75	41068	15	16-QAM	36	37	20.45	0-2	2
	2637.75	41068	15	16-QAM	75	0	20.56	0-2	2
High	2682.5	41515	15	QPSK	1	0	22.45	0	0
	2682.5	41515	15	QPSK	1	36	22.15	0	0
	2682.5	41515	15	QPSK	1	74	22.34	0	0
	2682.5	41515	15	QPSK	36	0	21.85	0-1	1
	2682.5	41515	15	QPSK	36	18	21.79	0-1	1
	2682.5	41515	15	QPSK	36	37	21.71	0-1	1
	2682.5	41515	15	QPSK	75	0	21.72	0-1	1
	2682.5	41515	15	16-QAM	1	0	21.60	0-1	1
	2682.5	41515	15	16-QAM	1	36	21.36	0-1	1
	2682.5	41515	15	16-QAM	1	74	21.34	0-1	1
	2682.5	41515	15	16-QAM	36	0	20.73	0-2	2
	2682.5	41515	15	16-QAM	36	18	20.58	0-2	2
	2682.5	41515	15	16-QAM	36	37	20.81	0-2	2
	2682.5	41515	15	16-QAM	75	0	20.84	0-2	2

Table 9-3
LTE Band 41 Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2501	39700	10	QPSK	1	0	21.87	0	0
	2501	39700	10	QPSK	1	25	21.93	0	0
	2501	39700	10	QPSK	1	49	21.97	0	0
	2501	39700	10	QPSK	25	0	21.13	0-1	1
	2501	39700	10	QPSK	25	12	21.15	0-1	1
	2501	39700	10	QPSK	25	25	21.45	0-1	1
	2501	39700	10	QPSK	50	0	21.26	0-1	1
	2501	39700	10	16QAM	1	0	20.82	0-1	1
	2501	39700	10	16QAM	1	25	20.80	0-1	1
	2501	39700	10	16QAM	1	49	21.00	0-1	1
	2501	39700	10	16QAM	25	0	20.06	0-2	2
	2501	39700	10	16QAM	25	12	20.00	0-2	2
	2501	39700	10	16QAM	25	25	20.07	0-2	2
	2501	39700	10	16QAM	50	0	20.01	0-2	2
Low Mid	2547	40160	10	QPSK	1	0	22.63	0	0
	2547	40160	10	QPSK	1	25	22.63	0	0
	2547	40160	10	QPSK	1	49	22.64	0	0
	2547	40160	10	QPSK	25	0	21.88	0-1	1
	2547	40160	10	QPSK	25	12	21.98	0-1	1
	2547	40160	10	QPSK	25	25	21.95	0-1	1
	2547	40160	10	QPSK	50	0	21.87	0-1	1
	2547	40160	10	16-QAM	1	0	21.01	0-1	1
	2547	40160	10	16-QAM	1	25	21.11	0-1	1
	2547	40160	10	16-QAM	1	49	21.30	0-1	1
	2547	40160	10	16-QAM	25	0	20.97	0-2	2
	2547	40160	10	16-QAM	25	12	20.58	0-2	2
	2547	40160	10	16-QAM	25	25	20.66	0-2	2
	2547	40160	10	16-QAM	50	0	20.61	0-2	2
Mid	2593	40620	10	QPSK	1	0	22.95	0	0
	2593	40620	10	QPSK	1	25	22.94	0	0
	2593	40620	10	QPSK	1	49	22.90	0	0
	2593	40620	10	QPSK	25	0	21.88	0-1	1
	2593	40620	10	QPSK	25	12	21.37	0-1	1
	2593	40620	10	QPSK	25	25	21.58	0-1	1
	2593	40620	10	QPSK	50	0	21.70	0-1	1
	2593	40620	10	16-QAM	1	0	21.06	0-1	1
	2593	40620	10	16-QAM	1	25	21.00	0-1	1
	2593	40620	10	16-QAM	1	49	21.38	0-1	1
	2593	40620	10	16-QAM	25	0	20.98	0-2	2
	2593	40620	10	16-QAM	25	12	20.99	0-2	2
	2593	40620	10	16-QAM	25	25	20.95	0-2	2
	2593	40620	10	16-QAM	50	0	20.82	0-2	2
Mid High	2639	41080	10	QPSK	1	0	22.47	0	0
	2639	41080	10	QPSK	1	25	22.72	0	0
	2639	41080	10	QPSK	1	49	22.34	0	0
	2639	41080	10	QPSK	25	0	21.68	0-1	1
	2639	41080	10	QPSK	25	12	21.44	0-1	1
	2639	41080	10	QPSK	25	25	21.37	0-1	1
	2639	41080	10	QPSK	50	0	21.56	0-1	1
	2639	41080	10	16-QAM	1	0	21.50	0-1	1
	2639	41080	10	16-QAM	1	25	21.11	0-1	1
	2639	41080	10	16-QAM	1	49	21.23	0-1	1
	2639	41080	10	16-QAM	25	0	20.49	0-2	2
	2639	41080	10	16-QAM	25	12	20.79	0-2	2
	2639	41080	10	16-QAM	25	25	20.57	0-2	2
	2639	41080	10	16-QAM	50	0	20.49	0-2	2
High	2685	41540	10	QPSK	1	0	22.47	0	0
	2685	41540	10	QPSK	1	25	22.32	0	0
	2685	41540	10	QPSK	1	49	22.51	0	0
	2685	41540	10	QPSK	25	0	21.81	0-1	1
	2685	41540	10	QPSK	25	12	21.95	0-1	1
	2685	41540	10	QPSK	25	25	21.60	0-1	1
	2685	41540	10	QPSK	50	0	21.68	0-1	1
	2685	41540	10	16-QAM	1	0	21.53	0-1	1
	2685	41540	10	16-QAM	1	25	21.45	0-1	1
	2685	41540	10	16-QAM	1	49	21.32	0-1	1
	2685	41540	10	16-QAM	25	0	20.77	0-2	2
	2685	41540	10	16-QAM	25	12	20.75	0-2	2
	2685	41540	10	16-QAM	25	25	20.69	0-2	2
	2685	41540	10	16-QAM	50	0	20.78	0-2	2

Table 9-4
LTE Band 41 Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2498.5	39675	5	QPSK	1	0	22.04	0	0
	2498.5	39675	5	QPSK	1	12	22.18	0	0
	2498.5	39675	5	QPSK	1	24	22.17	0	0
	2498.5	39675	5	QPSK	12	0	21.03	0-1	1
	2498.5	39675	5	QPSK	12	6	21.13	0-1	1
	2498.5	39675	5	QPSK	12	13	21.31	0-1	1
	2498.5	39675	5	QPSK	25	0	21.05	0-1	1
	2498.5	39675	5	16-QAM	1	0	21.00	0-1	1
	2498.5	39675	5	16-QAM	1	12	21.15	0-1	1
	2498.5	39675	5	16-QAM	1	24	21.12	0-1	1
	2498.5	39675	5	16-QAM	12	0	20.04	0-2	2
	2498.5	39675	5	16-QAM	12	6	20.32	0-2	2
	2498.5	39675	5	16-QAM	12	13	20.21	0-2	2
	2498.5	39675	5	16-QAM	25	0	20.03	0-2	2
Low Mid	2545.75	40148	5	QPSK	1	0	22.54	0	0
	2545.75	40148	5	QPSK	1	12	22.86	0	0
	2545.75	40148	5	QPSK	1	24	22.63	0	0
	2545.75	40148	5	QPSK	12	0	21.96	0-1	1
	2545.75	40148	5	QPSK	12	6	21.95	0-1	1
	2545.75	40148	5	QPSK	12	13	21.92	0-1	1
	2545.75	40148	5	QPSK	25	0	21.80	0-1	1
	2545.75	40148	5	16-QAM	1	0	21.04	0-1	1
	2545.75	40148	5	16-QAM	1	12	21.20	0-1	1
	2545.75	40148	5	16-QAM	1	24	21.44	0-1	1
	2545.75	40148	5	16-QAM	12	0	20.99	0-2	2
	2545.75	40148	5	16-QAM	12	6	20.60	0-2	2
	2545.75	40148	5	16-QAM	12	13	20.91	0-2	2
	2545.75	40148	5	16-QAM	25	0	20.70	0-2	2
Mid	2593	40620	5	QPSK	1	0	22.81	0	0
	2593	40620	5	QPSK	1	12	22.81	0	0
	2593	40620	5	QPSK	1	24	22.81	0	0
	2593	40620	5	QPSK	12	0	21.88	0-1	1
	2593	40620	5	QPSK	12	6	21.36	0-1	1
	2593	40620	5	QPSK	12	13	21.62	0-1	1
	2593	40620	5	QPSK	25	0	21.47	0-1	1
	2593	40620	5	16-QAM	1	0	21.04	0-1	1
	2593	40620	5	16-QAM	1	12	21.03	0-1	1
	2593	40620	5	16-QAM	1	24	21.40	0-1	1
	2593	40620	5	16-QAM	12	0	20.99	0-2	2
	2593	40620	5	16-QAM	12	6	20.62	0-2	2
	2593	40620	5	16-QAM	12	13	20.91	0-2	2
	2593	40620	5	16-QAM	25	0	20.89	0-2	2
Mid High	2640.25	41093	5	QPSK	1	0	22.36	0	0
	2640.25	41093	5	QPSK	1	12	22.39	0	0
	2640.25	41093	5	QPSK	1	24	22.09	0	0
	2640.25	41093	5	QPSK	12	0	21.88	0-1	1
	2640.25	41093	5	QPSK	12	6	21.60	0-1	1
	2640.25	41093	5	QPSK	12	13	21.57	0-1	1
	2640.25	41093	5	QPSK	25	0	21.72	0-1	1
	2640.25	41093	5	16-QAM	1	0	21.20	0-1	1
	2640.25	41093	5	16-QAM	1	12	21.04	0-1	1
	2640.25	41093	5	16-QAM	1	24	21.02	0-1	1
	2640.25	41093	5	16-QAM	12	0	20.53	0-2	2
	2640.25	41093	5	16-QAM	12	6	20.56	0-2	2
	2640.25	41093	5	16-QAM	12	13	20.31	0-2	2
	2640.25	41093	5	16-QAM	25	0	20.45	0-2	2
High	2687.5	41565	5	QPSK	1	0	22.34	0	0
	2687.5	41565	5	QPSK	1	12	22.03	0	0
	2687.5	41565	5	QPSK	1	24	22.28	0	0
	2687.5	41565	5	QPSK	12	0	21.73	0-1	1
	2687.5	41565	5	QPSK	12	6	21.81	0-1	1
	2687.5	41565	5	QPSK	12	13	21.53	0-1	1
	2687.5	41565	5	QPSK	25	0	21.66	0-1	1
	2687.5	41565	5	16-QAM	1	0	21.66	0-1	1
	2687.5	41565	5	16-QAM	1	12	21.26	0-1	1
	2687.5	41565	5	16-QAM	1	24	21.33	0-1	1
	2687.5	41565	5	16-QAM	12	0	20.93	0-2	2
	2687.5	41565	5	16-QAM	12	6	20.52	0-2	2
	2687.5	41565	5	16-QAM	12	13	20.65	0-2	2
	2687.5	41565	5	16-QAM	25	0	20.90	0-2	2

10 SYSTEM VERIFICATION

10.1 Tissue Verification

Table 10-1
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
9/11/2014	**2600H**	22.1	2500	1.780	40.074	1.855	39.136	*-4.04%*	*2.40%*
			2550	1.838	39.872	1.909	39.073	*-3.72%*	*2.04%*
			2600	1.894	39.686	1.964	39.009	*-3.56%*	*1.74%*
			2650	1.945	39.484	2.018	38.945	*-3.62%*	*1.38%*
			2700	2.009	39.337	2.073	38.882	*-3.09%*	*1.17%*
9/10/2014	**2600B**	22.8	2500	2.029	50.582	2.021	52.636	*0.40%*	*-3.90%*
			2550	2.103	50.369	2.092	52.573	*0.53%*	*-4.19%*
			2600	2.173	50.192	2.163	52.509	*0.46%*	*-4.41%*
			2650	2.237	49.963	2.234	52.445	*0.13%*	*-4.73%*
			2700	2.316	49.795	2.305	52.382	*0.48%*	*-4.94%*

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.

10.2 Test System Verification

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

Table 10-2
System Verification Results (1g)

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	2600	HEAD	09/11/2014	22.8	22.6	0.100	1004	3258	5.520	57.300	55.200	-3.66%
G	2600	BODY	09/10/2014	23.4	22.4	0.100	1004	3258	5.630	56.700	56.300	-0.71%

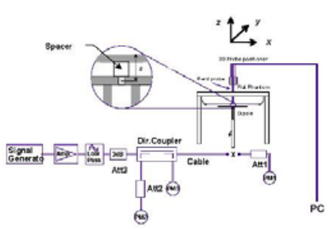


Figure 10-1
System Verification Setup Diagram

Figure 10-2
System Verification Setup Photo

11 SAR DATA SUMMARY

11.1 Standalone Head SAR Data

Table 11-1
LTE Band 41 Head SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
2549.50	40185	Low-Mid	LTE Band 41	20	23.0	22.86	0.14	0	Right	Cheek	QPSK	1	50	624B1	1:1.58	0.008	1.033	0.008	
2549.50	40185	Low-Mid	LTE Band 41	20	22.0	21.99	0.18	1	Right	Cheek	QPSK	50	50	624B1	1:1.58	0.005	1.002	0.005	
2549.50	40185	Low-Mid	LTE Band 41	20	23.0	22.86	0.12	0	Right	Tilt	QPSK	1	50	624B1	1:1.58	0.011	1.033	0.011	A1
2549.50	40185	Low-Mid	LTE Band 41	20	22.0	21.99	0.09	1	Right	Tilt	QPSK	50	50	624B1	1:1.58	0.010	1.002	0.010	
2549.50	40185	Low-Mid	LTE Band 41	20	23.0	22.86	0.17	0	Left	Cheek	QPSK	1	50	624B1	1:1.58	0.009	1.033	0.009	
2549.50	40185	Low-Mid	LTE Band 41	20	22.0	21.99	0.15	1	Left	Cheek	QPSK	50	50	624B1	1:1.58	0.009	1.002	0.009	
2549.50	40185	Low-Mid	LTE Band 41	20	23.0	22.86	0.12	0	Left	Tilt	QPSK	1	50	624B1	1:1.58	0.006	1.033	0.006	
2549.50	40185	Low-Mid	LTE Band 41	20	22.0	21.99	0.11	1	Left	Tilt	QPSK	50	50	624B1	1:1.58	0.006	1.002	0.006	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Head 1.6 W/kg (mW/g) averaged over 1 gram										

11.2 Standalone Body-Worn SAR Data

Table 11-2
LTE Body-Worn SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
2549.50	40185	Low-Mid	LTE Band 41	20	23.0	22.86	-0.01	0	624B1	QPSK	1	50	10 mm	back	1:1.58	0.087	1.033	0.090	A2
2549.50	40185	Low-Mid	LTE Band 41	20	22.0	21.99	0.12	1	624B1	QPSK	50	50	10 mm	back	1:1.58	0.078	1.002	0.078	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram										

11.3 Standalone Wireless Router SAR Data

Table 11-3
LTE Band 41 Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
2549.50	40185	Low-Mid	LTE Band 41	20	23.0	22.86	-0.01	0	624B1	QPSK	1	50	10 mm	back	1:1.58	0.087	1.033	0.090	
2549.50	40185	Low-Mid	LTE Band 41	20	22.0	21.99	0.12	1	624B1	QPSK	50	50	10 mm	back	1:1.58	0.078	1.002	0.078	
2549.50	40185	Low-Mid	LTE Band 41	20	23.0	22.86	0.01	0	624B1	QPSK	1	50	10 mm	front	1:1.58	0.105	1.033	0.108	
2549.50	40185	Low-Mid	LTE Band 41	20	22.0	21.99	0.12	1	624B1	QPSK	50	50	10 mm	front	1:1.58	0.095	1.002	0.095	
2549.50	40185	Low-Mid	LTE Band 41	20	23.0	22.86	-0.04	0	624B1	QPSK	1	50	10 mm	bottom	1:1.58	0.259	1.033	0.268	A3
2549.50	40185	Low-Mid	LTE Band 41	20	22.0	21.99	-0.01	1	624B1	QPSK	50	50	10 mm	bottom	1:1.58	0.234	1.002	0.234	
2549.50	40185	Low-Mid	LTE Band 41	20	23.0	22.86	0.02	0	624B1	QPSK	1	50	10 mm	right	1:1.58	0.014	1.033	0.014	
2549.50	40185	Low-Mid	LTE Band 41	20	22.0	21.99	0.08	1	624B1	QPSK	50	50	10 mm	right	1:1.58	0.012	1.002	0.012	
2549.50	40185	Low-Mid	LTE Band 41	20	23.0	22.86	0.05	0	624B1	QPSK	1	50	10 mm	left	1:1.58	0.011	1.033	0.011	
2549.50	40185	Low-Mid	LTE Band 41	20	22.0	21.99	0.06	1	624B1	QPSK	50	50	10 mm	left	1:1.58	0.011	1.002	0.011	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram										

11.4 SAR Test Notes

General Notes:

1. 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.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v05.
6. 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.
7. Per FCC KDB Publication 648474 D04v01, 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.
8. Per FCC KDB 865664 D01 v01, variability SAR tests were not performed since the measured SAR results for a frequency band were less than 0.8 W/kg for 1g SAR. Please see Section 13 for variability analysis.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.7 for more details).
10. Per FCC KDB Publication 648474 D04v01r01, this device is considered a "phablet" since the diagonal dimension is > 160 mm and < 200mm. Therefore, hand SAR tests are required when wireless router mode does not apply or if wireless router 1g SAR > 1.2 W/kg.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r01. The general test procedures used for testing can be found in Section 8.3.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).
4. Per FCC KDB Publication 447498 D01v05r01, when the reported (scaled) for LTE Band 41 SAR measured at the highest output power channel in a given a test configuration was > 0.6 W/kg, testing at the other channels was required for such test configurations.
5. TDD LTE was tested per FCC KDB 941225 D05 and using the guidance provided in April 2013 TCB workshop notes. Testing was performed using UL-DL configuration 0 with 6 UL subframes and 2 S subframes using extended cyclic prefix only and special subframe configuration 6. SAR tests were performed at maximum output power and worst-case transmission duty factor in extended cyclic prefix. Per 3GPP 36.211 Section 4, the duty factor for special subframe configuration 6 using extended cyclic prefix is 0.633.

12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

12.1 Introduction

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

12.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05 IV.C.1.iii and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤1.6 W/kg.

This report only contains the combinations applicable to this permissive change. Please see RF Exposure Technical Report 0Y1408271784.A3L for WLAN/Bluetooth SAR evaluations and for simultaneous SAR assessments for the other combinations not referred to in these tables.

Main antenna SAR testing was not required for extremity exposure conditions per FCC KDB 648474. Therefore, no further analysis was required to determine that possible simultaneous scenarios would not exceed the SAR limit.

12.3 Head SAR Simultaneous Transmission Analysis

Table 12-1
Simultaneous Transmission Scenario with 2.4 GHz WLAN Ant 1 (Held to Ear)

Simult Tx	Configuration	LTE Band 41 SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.008	0.044	**0.052**
	Right Tilt	0.011	0.016	0.027
	Left Cheek	0.009	0.023	0.032
	Left Tilt	0.006	0.017	0.023

Table 12-2
Simultaneous Transmission Scenario with 2.4 GHz WLAN Ant 2 (Held to Ear)

Simult Tx	Configuration	LTE Band 41 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.008	0.386	**0.394**
	Right Tilt	0.011	0.269	0.280
	Left Cheek	0.009	0.161	0.170
	Left Tilt	0.006	0.119	0.125

Table 12-3
Simultaneous Transmission Scenario with 2.4 GHz WLAN MIMO (Held to Ear)

Simult Tx	Configuration	LTE Band 41 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.008	0.229	**0.237**
	Right Tilt	0.011	0.176	0.187
	Left Cheek	0.009	0.110	0.119
	Left Tilt	0.006	0.074	0.080

12.4 Body-Worn Simultaneous Transmission Analysis

Table 12-4
Simultaneous Transmission Scenario with 2.4 GHz WLAN Ant 1(Body-Worn at 1.0 cm)

Configuration	Mode	4G SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Back Side	LTE Band 41	0.090	0.060	**0.150**

Table 12-5
Simultaneous Transmission Scenario with 2.4 GHz WLAN Ant 2 (Body-Worn at 1.0 cm)

Configuration	Mode	4G SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Back Side	LTE Band 41	0.090	0.053	**0.143**

Table 12-6
Simultaneous Transmission Scenario with 2.4 GHz WLAN MIMO (Body-Worn at 1.0 cm)

Configuration	Mode	4G SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Back Side	LTE Band 41	0.090	0.037	**0.127**

Table 12-7
Simultaneous Transmission Scenario with Bluetooth (Body-Worn at 1.0 cm)

Configuration	Mode	4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Back Side	LTE Band 41	0.090	0.126	**0.216**

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

12.5 Hotspot SAR Simultaneous Transmission Analysis

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

Table 12-8
Simultaneous Transmission Scenario (2.4 GHz WLAN Ant 1 Hotspot at 1.0 cm)

Simult Tx	Configuration	LTE Band 41 SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.090	0.060	0.150
	Front	0.108	0.003	0.111
	Top	-	0.000	0.000
	Bottom	0.268	-	**0.268**
	Right	0.014	-	0.014
	Left	0.011	0.015	0.026

Table 12-9
Simultaneous Transmission Scenario (2.4 GHz WLAN Ant 2 Hotspot at 1.0 cm)

Simult Tx	Configuration	LTE Band 41 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.090	0.053	0.143
	Front	0.108	0.047	0.155
	Top	-	0.021	0.021
	Bottom	0.268	-	**0.268**
	Right	0.014	-	0.014
	Left	0.011	-	0.011

Table 12-10
Simultaneous Transmission Scenario (2.4 GHz WLAN MIMO Hotspot at 1.0 cm)

Simult Tx	Configuration	LTE Band 41 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.090	0.037	0.127
	Front	0.108	0.012	0.120
	Top	-	0.006	0.006
	Bottom	0.268	-	**0.268**
	Right	0.014	-	0.014
	Left	0.011	0.006	0.017

12.6 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.

13 SAR MEASUREMENT VARIABILITY

13.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01, SAR measurement variability was not assessed since measured 1g SAR each frequency band was below 0.8 W/kg.

13.2 Measurement Uncertainty

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

14 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/15/2014	Annual	4/15/2015	MY45470194
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	8648D	(9kHz-4GHz) Signal Generator	4/15/2014	Annual	4/15/2015	3629U00687
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
SPEAG	D2600V2	2600 MHz SAR Dipole	4/8/2014	Annual	4/8/2015	1004
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433972
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/26/2014	Annual	2/26/2015	665
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
SPEAG	DAK-3.5	Dielectric Assessment Kit	11/13/2013	Annual	11/13/2014	1091
Mitutoyo	CD-6"CSX	Digital Caliper	5/8/2014	Biennial	5/8/2016	13264165
Fisher Scientific	15-077-960	Digital Thermometer	12/4/2013	Biennial	12/4/2015	130764558
Agilent	E4438C	ESG Vector Signal Generator	3/31/2014	Annual	3/31/2015	MY42082659
Fisher Scientific	15-078J	Long Stem Thermometer	1/7/2013	Biennial	1/7/2015	130018204
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
Agilent	N9020A	MXA Signal Analyzer	10/29/2013	Annual	10/29/2014	US46470561
Agilent	N5182A	MXG Vector Signal Generator	4/15/2014	Annual	4/15/2015	MY47420800
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Anritsu	ML2495A	Power Meter	10/31/2013	Annual	10/31/2014	1039008
Anritsu	ML2469A	Power Meter	3/14/2014	Annual	3/14/2015	1306009
Anritsu	MA2411B	Pulse Power Sensor	11/14/2013	Annual	11/14/2014	1126066
Anritsu	MT8820C	Radio Communication Analyzer	12/12/2013	Annual	12/12/2014	6200901190
Rohde & Schwarz	CMW500	Radio Communication Tester	2/20/2014	Annual	2/20/2015	128633
Tektronix	RSA6114A	Real Time Spectrum Analyzer	4/16/2014	Annual	4/16/2015	B010177
SPEAG	ES3DV3	SAR Probe	2/25/2014	Annual	2/25/2015	3258
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M1S5A00-009
Agilent	8753ES	S-Parameter Network Analyzer	5/22/2014	Annual	5/22/2015	US39170118
Fisher Scientific	S97611	Thermometer	4/12/2013	Biennial	4/12/2015	130219304
Seekonk	NC-100	Torque Wrench	3/18/2014	Biennial	3/18/2016	22313
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/18/2014	Biennial	3/18/2016	N/A
Anritsu	MA24106A	USB Power Sensor	12/18/2013	Annual	12/18/2014	1344555
Anritsu	MA24106A	USB Power Sensor	12/18/2013	Annual	12/18/2014	1344556
VWR	36934-158	Wall-Mounted Thermometer	8/8/2013	Biennial	8/8/2015	130477866

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.

15 MEASUREMENT UNCERTAINTIES

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

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

16 CONCLUSION

16.1 Measurement Conclusion

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

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

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APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSWDSC01G; Type: Portable Handset; Serial: 624B1

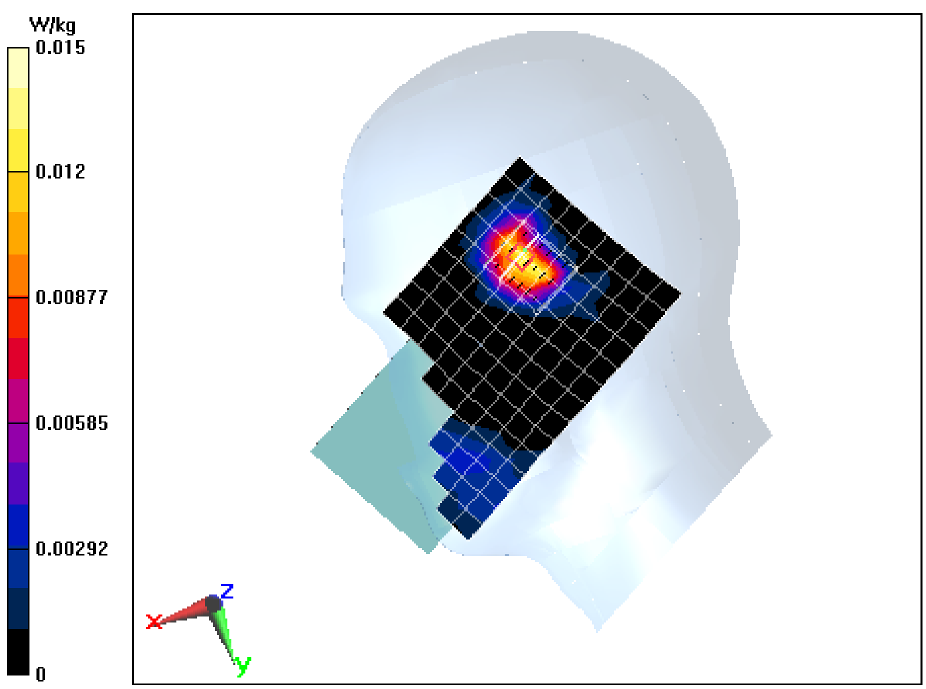
Communication System: UID 0, LTE Band 41; Frequency: 2549.5 MHz; Duty Cycle: 1:1.58
Medium: 2600 Head, Medium parameters used:
$f = 2550$ MHz; $\sigma = 1.838$ S/m; $\varepsilon_r = 39.872$; $\rho = 1000$ kg/m^3
Phantom section: Right Section

Test Date: 09-11-2014; Ambient Temp: 22.8°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3258; ConvF(4.34, 4.34, 4.34); Calibrated: 2/25/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 41, Right Head, Tilt, Low-Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset

Area Scan (10x17x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (8x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.684 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.0230 W/kg
SAR(1 g) = 0.011 W/kg



0 dB = 0.0146 W/kg = -18.36 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSWDSC01G; Type: Portable Handset; Serial: 624B1

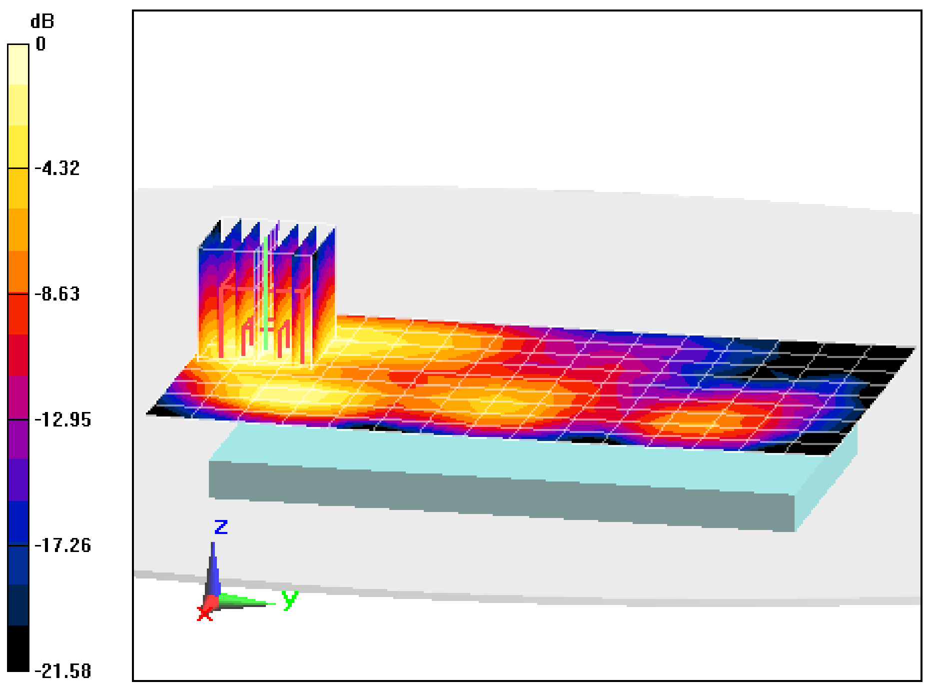
Communication System: UID 0, LTE Band 41; Frequency: 2549.5 MHz; Duty Cycle: 1:1.58
Medium: 2600 Body, Medium parameters used:
f = 2550 MHz; σ = 2.103 S/m; ε_r = 50.369; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-10-2014; Ambient Temp: 23.4°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3258; ConvF(3.91, 3.91, 3.91); Calibrated: 2/25/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 41, Body SAR, Back side, Low-Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset

Area Scan (10x16x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.829 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.172 W/kg
SAR(1 g) = 0.087 W/kg



0 dB = 0.110 W/kg = -9.59 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSWDSC01G; Type: Portable Handset; Serial: 624B1

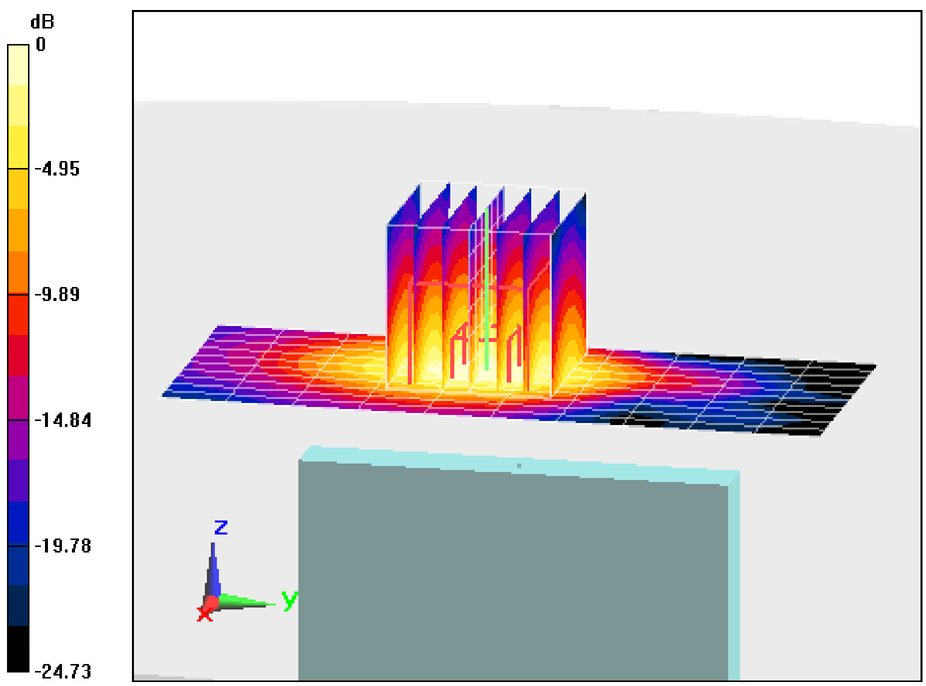
Communication System: UID 0, LTE Band 41; Frequency: 2549.5 MHz; Duty Cycle: 1:1.58
Medium: 2600 Body, Medium parameters used:
$f = 2550$ MHz; $\sigma = 2.103$ S/m; $\varepsilon_r = 50.369$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 09-10-2014; Ambient Temp: 23.4°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3258; ConvF(3.91, 3.91, 3.91); Calibrated: 2/25/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 41, Body SAR, Bottom Edge, Low-Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset

Area Scan (11x11x1): Measurement grid: dx=5mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.93 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.541 W/kg
SAR(1 g) = 0.259 W/kg



0 dB = 0.338 W/kg = -4.71 dBW/kg

APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1004

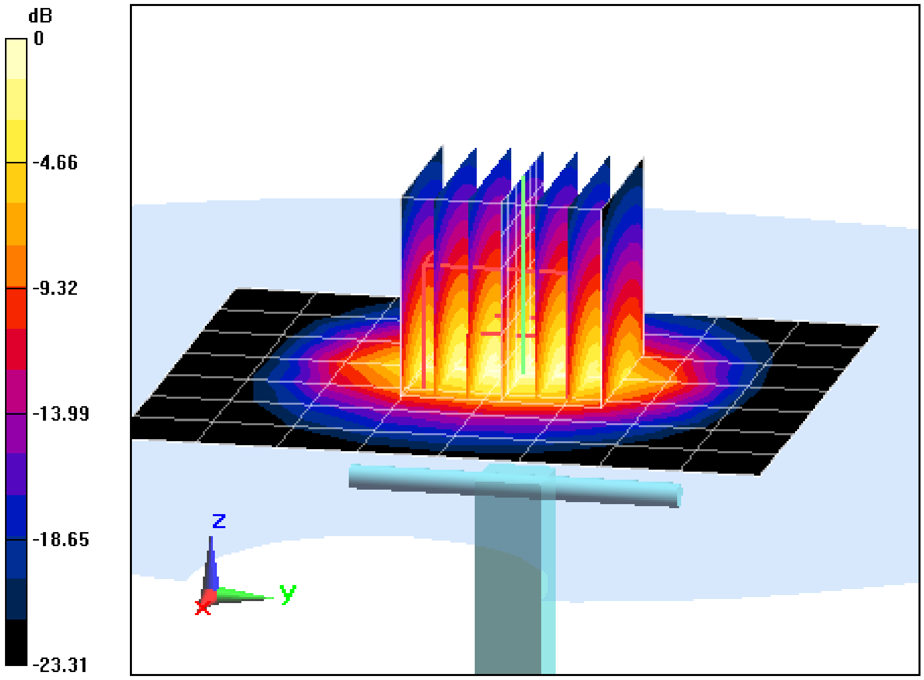
Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: 2600 Head, Medium parameters used:
f = 2600 MHz; σ = 1.894 S/m; ε_r = 39.686; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-11-2014; Ambient Temp: 22.8°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3258; ConvF(4.34, 4.34, 4.34); Calibrated: 2/25/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2600 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 11.6 W/kg
SAR(1 g) = 5.52 W/kg
Deviation = -3.66%



0 dB = 7.22 W/kg = 8.59 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1004

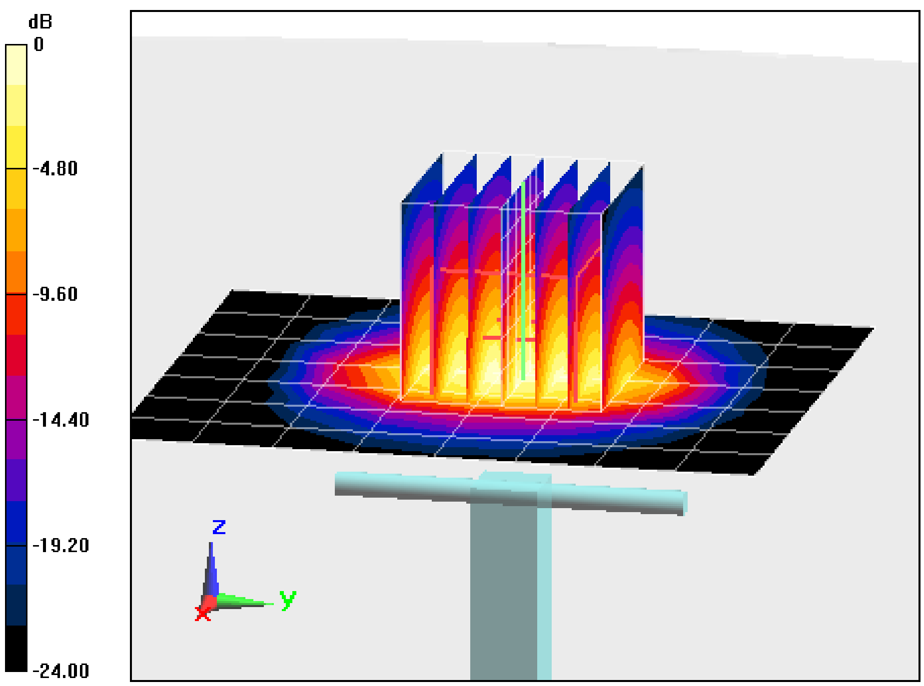
Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium: 2600 Body, Medium parameters used:
f = 2600 MHz; σ = 2.173 S/m; ε_r = 50.192; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-10-2014; Ambient Temp: 23.4°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3258; ConvF(3.91, 3.91, 3.91); Calibrated: 2/25/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2600 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 12.6 W/kg
SAR(1 g) = 5.63 W/kg
Deviation = -0.71%



0 dB = 7.34 W/kg = 8.66 dBW/kg

APPENDIX C: PROBE CALIBRATION

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

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

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

Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D2600V2-1004_Apr14

CALIBRATION CERTIFICATE

Object	D2600V2 - SN: 1004
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	April 08, 2014

√ KOK 5/7/14

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: April 9, 2014

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.7 ± 6 %	1.98 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**57.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.6 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.2 ± 6 %	2.19 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.4 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**56.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.38 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**25.2 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.4 Ω - 4.8 jΩ
Return Loss	- 26.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.4 Ω - 3.3 jΩ
Return Loss	- 25.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 23, 2006

DASY5 Validation Report for Head TSL

Date: 08.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1004

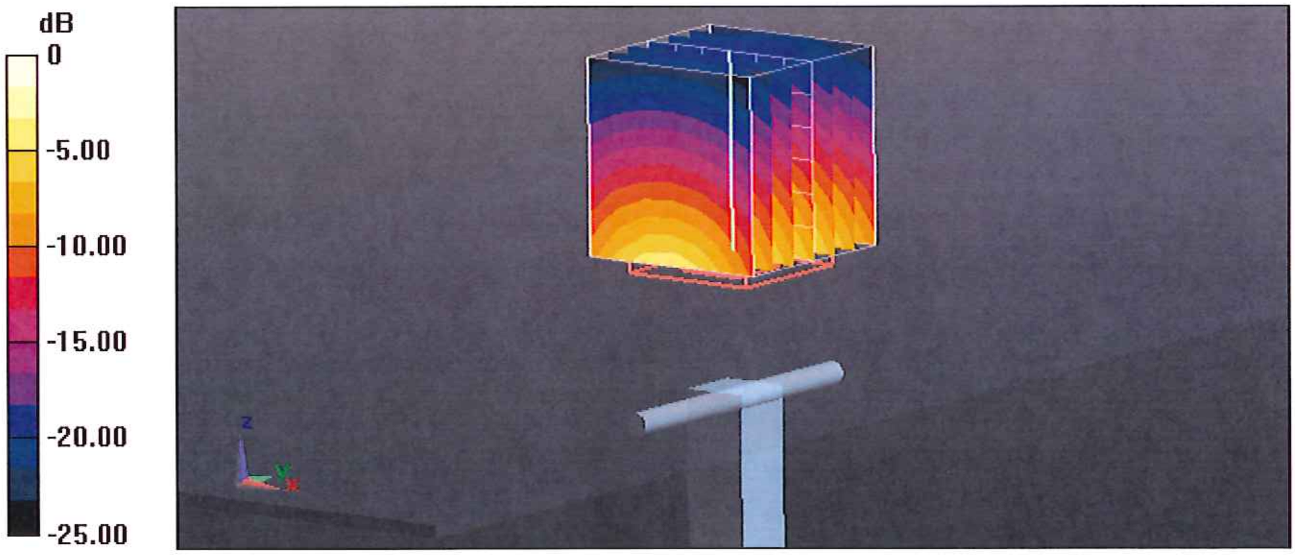
Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 1.98 S/m; ε_r = 37.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.46, 4.46, 4.46); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

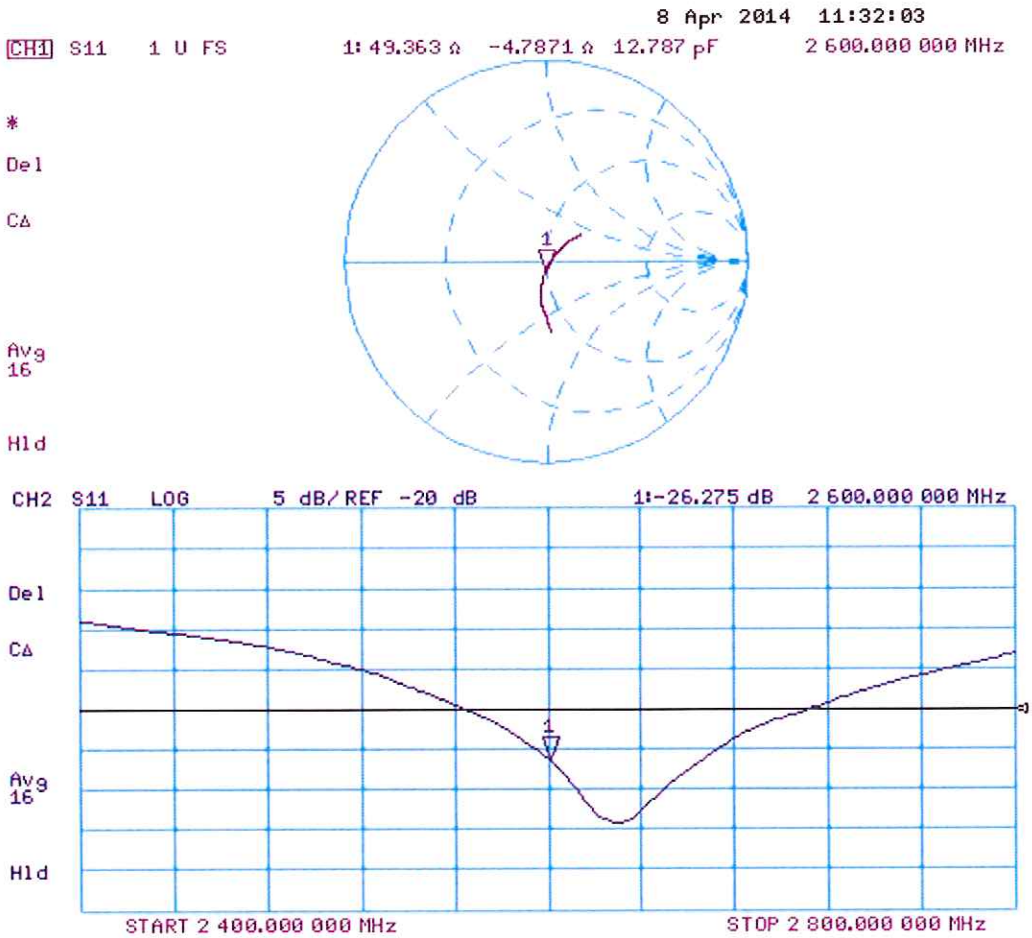
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 103.0 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 30.7 W/kg
SAR(1 g) = 14.5 W/kg; SAR(10 g) = 6.44 W/kg
Maximum value of SAR (measured) = 19.3 W/kg



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 08.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1004

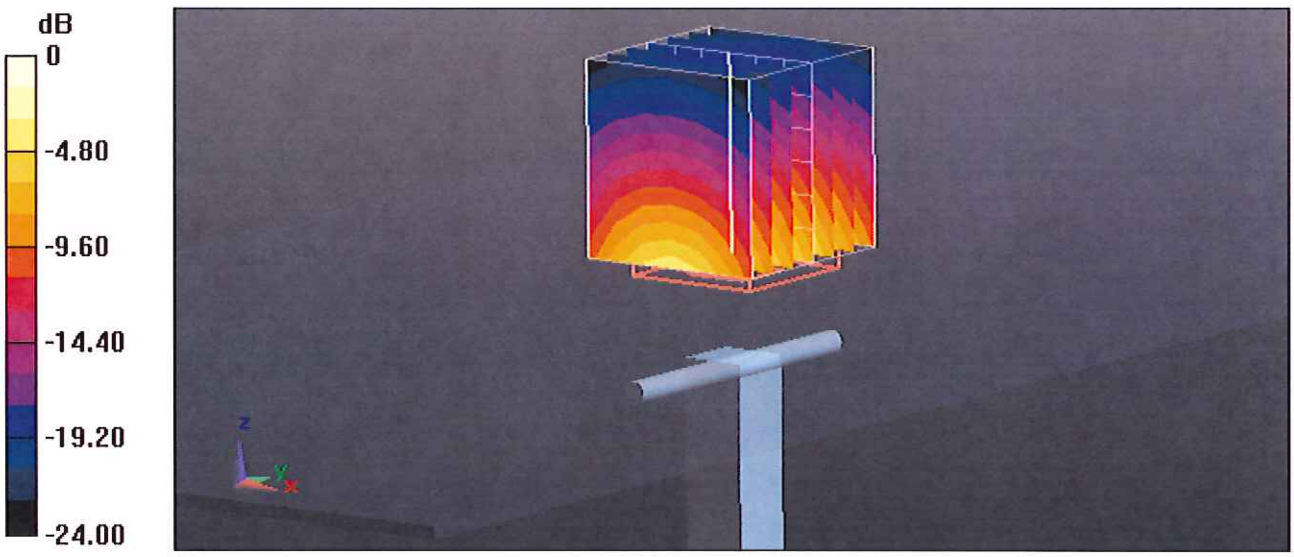
Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.19 S/m; ε_r = 50.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.24, 4.24, 4.24); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

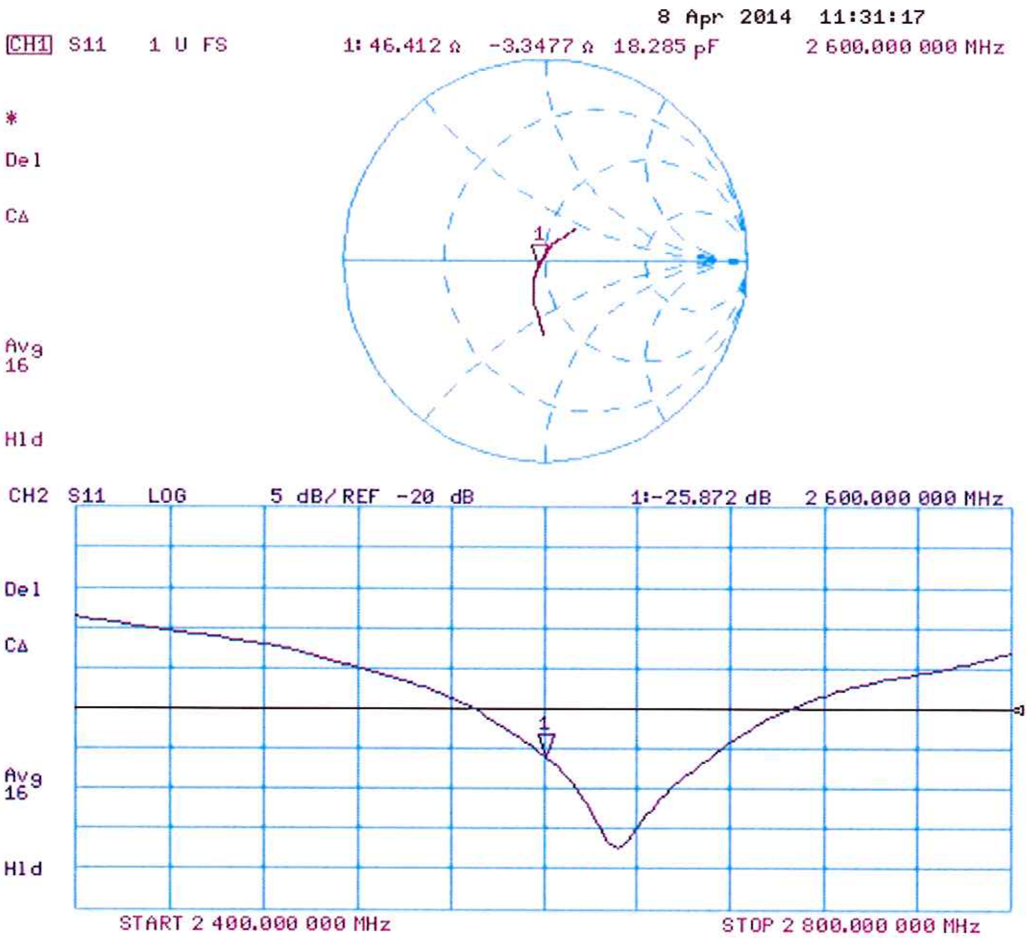
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.472 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 31.1 W/kg
SAR(1 g) = 14.4 W/kg; SAR(10 g) = 6.38 W/kg
Maximum value of SAR (measured) = 19.4 W/kg



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

Impedance Measurement Plot for Body TSL



Calibration Laboratory of
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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3258_Feb14**

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3258

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

CCV 3/6/14

Calibration date: February 25, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: February 27, 2014

PCT# 80615

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3258

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

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

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

Basic Calibration Parameters

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

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√µV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	222.4	±3.8 %
		Y	0.0	0.0	1.0		202.2	
		Z	0.0	0.0	1.0		207.1	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	5.09	65.6	14.1	10.00	44.8	±1.9 %
		Y	1.68	57.4	9.3		40.7	
		Z	4.01	62.4	13.0		51.1	
10011-CAB	UMTS-FDD (WCDMA)	X	3.34	67.5	18.9	2.91	131.2	±0.5 %
		Y	3.43	67.9	18.7		137.1	
		Z	3.42	67.8	19.0		146.0	
10012-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.40	70.9	19.8	1.87	134.2	±0.7 %
		Y	3.19	70.2	19.2		137.9	
		Z	3.46	70.8	19.6		149.6	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	30.24	99.7	28.7	9.39	131.2	±1.4 %
		Y	12.91	88.5	23.9		147.5	
		Z	30.37	99.5	28.9		128.0	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	29.88	100.0	29.0	9.57	123.0	±1.9 %
		Y	16.02	92.5	25.4		140.7	
		Z	30.01	100.0	29.4		125.8	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	44.57	99.7	25.9	6.56	119.6	±1.7 %
		Y	28.97	95.3	23.2		127.6	
		Z	43.72	99.8	26.3		120.1	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	53.52	99.7	24.4	4.80	129.4	±2.2 %
		Y	54.55	99.9	22.9		143.3	
		Z	51.63	99.7	24.8		127.5	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	58.93	99.8	23.4	3.55	133.4	±2.2 %
		Y	77.54	99.7	21.3		125.3	
		Z	56.64	99.8	23.8		130.8	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	47.03	99.5	21.3	1.16	136.3	±1.7 %
		Y	95.86	95.2	17.1		138.2	
		Z	39.68	100.0	22.2		132.3	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.84	66.8	19.1	4.57	131.3	±0.9 %
		Y	4.75	67.0	18.9		135.2	
		Z	4.86	66.7	19.0		127.2	

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

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

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

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 8 and 9).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

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

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

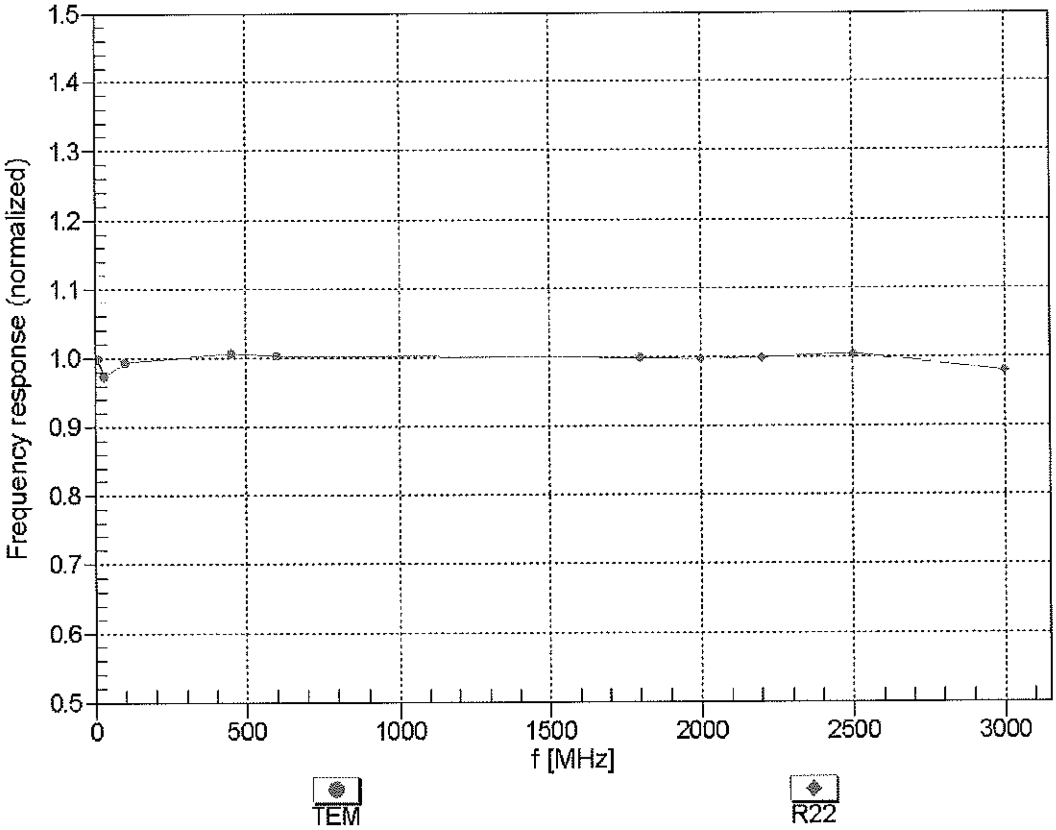
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3258

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.15	6.15	6.15	0.61	1.32	± 12.0 %
835	55.2	0.97	6.11	6.11	6.11	0.80	1.15	± 12.0 %
1750	53.4	1.49	4.83	4.83	4.83	0.47	1.74	± 12.0 %
1900	53.3	1.52	4.61	4.61	4.61	0.55	1.59	± 12.0 %
2450	52.7	1.95	4.14	4.14	4.14	0.80	1.11	± 12.0 %
2600	52.5	2.16	3.91	3.91	3.91	0.80	1.00	± 12.0 %

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

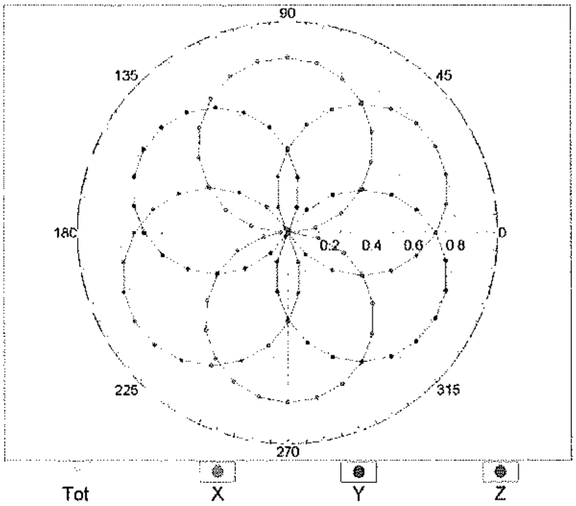
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



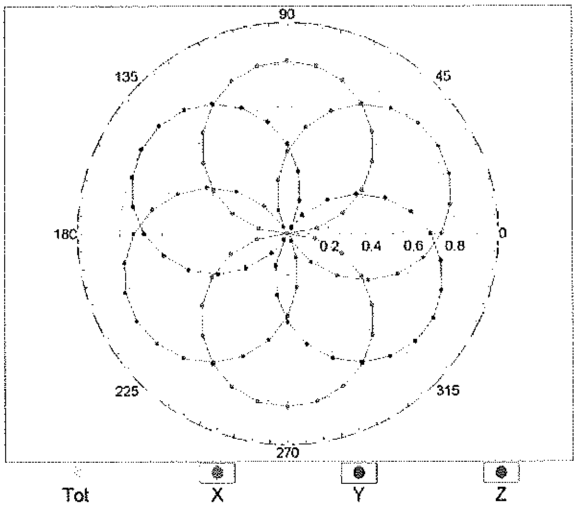
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

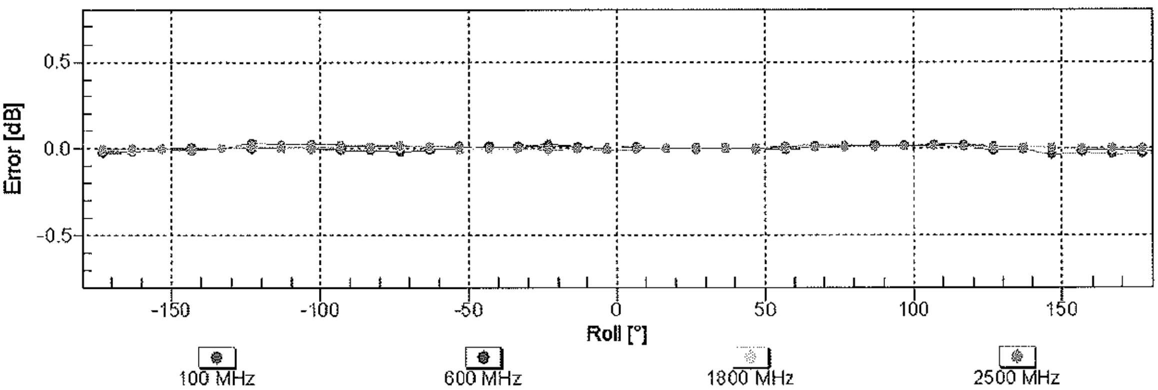
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



f=1800 MHz,R22

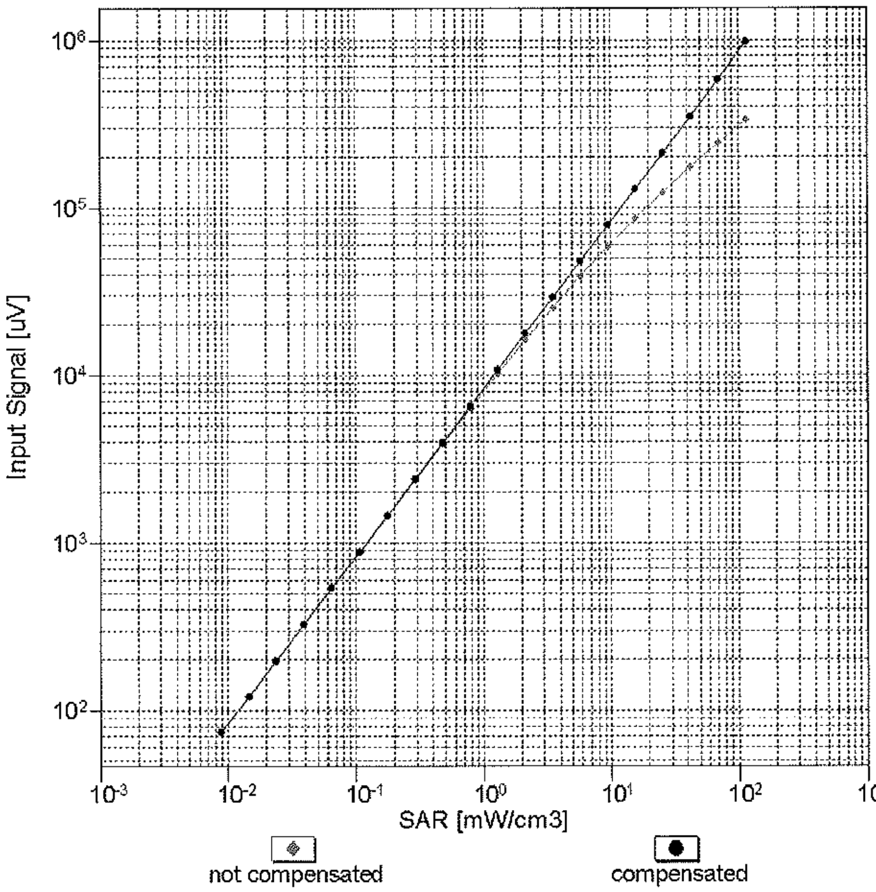


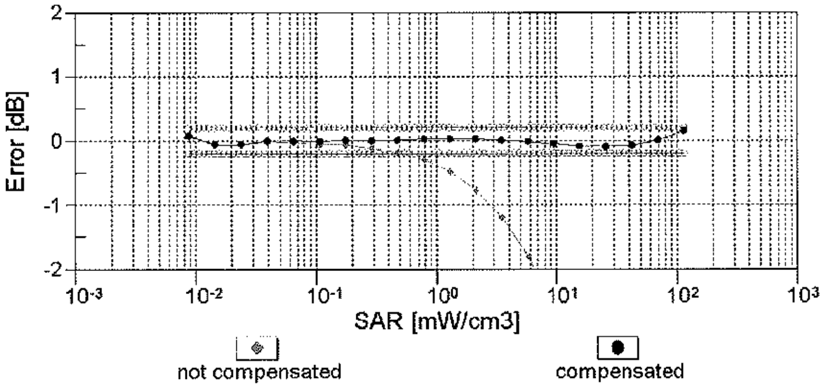


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

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

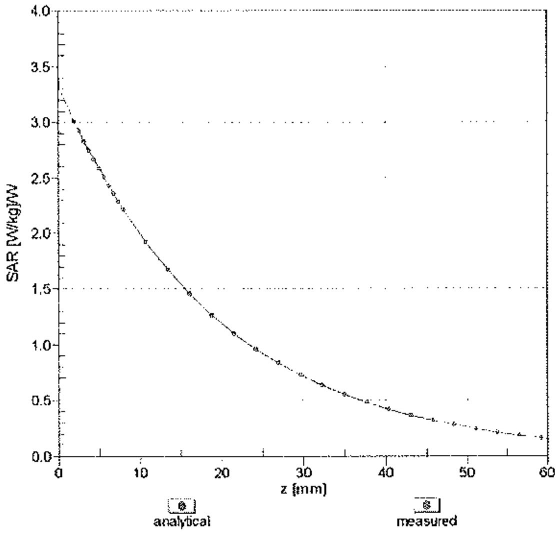




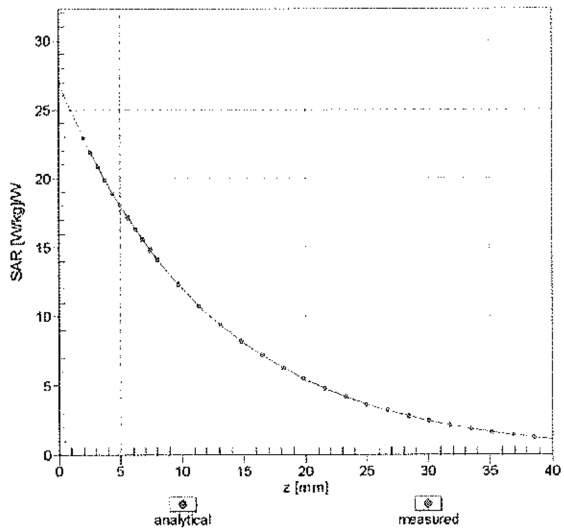
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

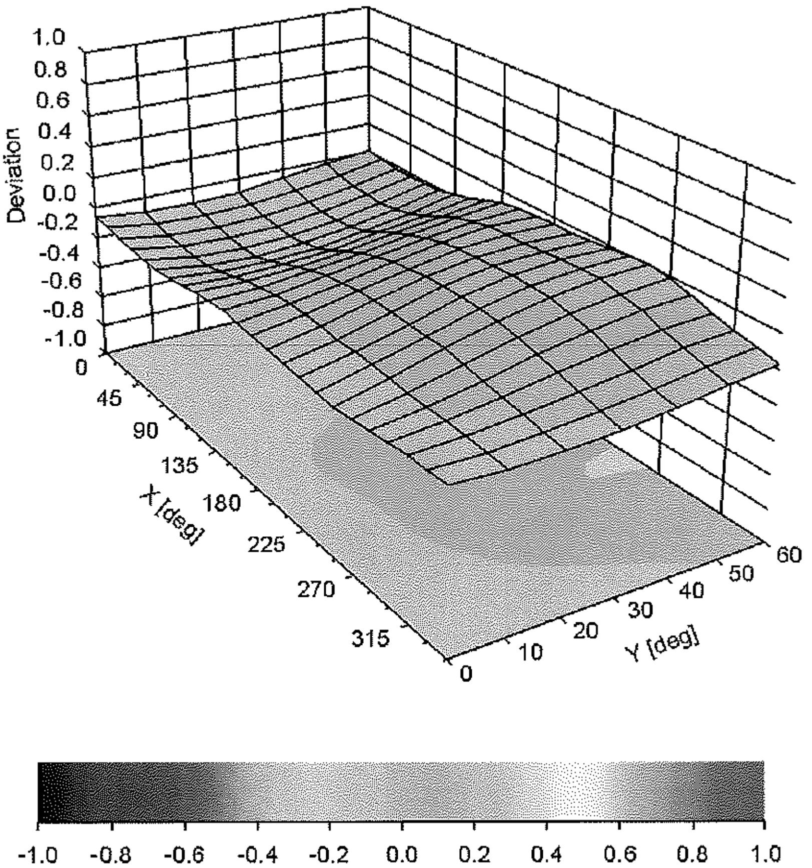


f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

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

APPENDIX D: SAR TISSUE SPECIFICATIONS

Measurement Procedure for Tissue Verification:

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

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

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

Table D-I
Composition of the Tissue Equivalent Matter

Frequency (MHz)	2600	2600
Tissue	Head	Body
Ingredients (% by weight)		
DGBE	See Page 2	26.7
NaCl		0.1
Water		73.2

2 Composition / Information on ingredients

The Item is composed of the following ingredients:

H_2O	Water, 52 – 75%
$C_8H_{18}O_3$	Diethylene glycol monobutyl ether (DGBE), 25 – 48% (CAS-No. 112-34-5, EC-No. 203-961-6, EC-index-No. 603-096-00-8) Relevant for safety; Refer to the respective Safety Data Sheet*.
NaCl	Sodium Chloride, <1.0%

Figure D-1
Composition of 2.6 GHz Head Tissue Equivalent Matter

Note: 2.6 GHz head liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

Measurement Certificate / Material Test

Item Name	**Head Tissue Simulating Liquid (HSL2450V2)**
Product No.	SL AAH 245 BA (Charge: 130212-2)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated OCP probe.

Setup Validation

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

Target Parameters

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

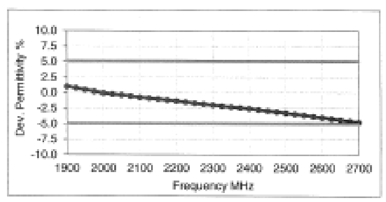
Test Condition

Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	23°C
Test Date	13-Feb-13
Operator	DI

Additional Information

TSL Density	0.988 g/cm³
TSL Heat-capacity	3.680 kJ/(kg*K)

	Measured			Target		Diff.to Target [%]	
f [MHz]	HP-e'	HP-e"	sigma	eps	sigma	Δ-eps	Δ-sigma
1900	40.4	11.94	1.26	40.0	1.40	1.0	-9.9
1925	40.3	12.02	1.29	40.0	1.40	0.7	-8.0
1950	40.2	12.11	1.31	40.0	1.40	0.5	-6.2
1975	40.1	12.20	1.34	40.0	1.40	0.2	-4.2
2000	40.0	12.29	1.37	40.0	1.40	-0.1	-2.3
2025	39.9	12.39	1.40	40.0	1.42	-0.2	-1.9
2050	39.8	12.49	1.42	39.9	1.44	-0.4	-1.4
2075	39.6	12.57	1.45	39.9	1.47	-0.6	-1.1
2100	39.5	12.65	1.48	39.8	1.49	-0.7	-0.7
2125	39.4	12.74	1.51	39.8	1.51	-0.9	-0.4
2150	39.3	12.82	1.53	39.7	1.53	-1.0	0.0
2175	39.2	12.89	1.56	39.7	1.56	-1.2	0.3
2200	39.1	12.97	1.59	39.6	1.58	-1.3	0.6
2225	39.0	13.04	1.61	39.6	1.60	-1.5	0.9
2250	38.9	13.11	1.64	39.6	1.62	-1.7	1.2
2275	38.8	13.20	1.67	39.5	1.64	-1.8	1.6
2300	**38.7**	**13.28**	**1.70**	**39.5**	**1.67**	**-2.0**	**2.0**
2325	38.6	13.35	1.73	39.4	1.69	-2.1	2.3
2350	38.5	13.42	1.75	39.4	1.71	-2.3	2.6
2375	38.4	13.50	1.78	39.3	1.73	-2.4	2.9
2400	38.3	13.58	1.81	39.3	1.76	-2.6	3.3
2425	38.2	13.65	1.84	39.2	1.78	-2.7	3.6
2450	**38.1**	**13.73**	**1.87**	**39.2**	**1.80**	**-2.9**	**4.0**
2475	38.0	13.79	1.90	39.2	1.83	-3.1	3.9
2500	37.9	13.85	1.93	39.1	1.85	-3.3	3.9
2525	37.8	13.94	1.96	39.1	1.88	-3.4	4.0
2550	37.7	14.02	1.99	39.1	1.91	-3.6	4.2
2575	37.6	14.09	2.02	39.0	1.94	-3.8	4.3
2600	**37.5**	**14.17**	**2.05**	**39.0**	**1.96**	**-4.0**	**4.4**
2625	37.4	14.23	2.08	39.0	1.99	-4.2	4.4
2650	37.3	14.29	2.11	38.9	2.02	-4.3	4.4
2675	37.1	14.36	2.14	38.9	2.05	-4.5	4.5
2700	37.0	14.43	2.17	38.9	2.07	-4.8	4.6



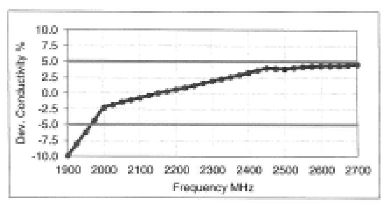


Figure D-2
2.6 GHz Head Tissue Equivalent Matter

APPENDIX E: SAR SYSTEM VALIDATION

Per FCC KDB 865664 D02v01, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in FCC KDB 865664 D01 v01 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

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

Table E-I
SAR System Validation Summary - 1g

SAR SYSTEM #	FREQ. [MHz]	DATE	PROBE SN	PROBE TYPE	PROBE CAL. POINT		COND.	PERM.	CW VALIDATION			MOD. VALIDATION		
							(σ)	(ε_r)	SENSI-TIVITY	PROBE LINEARITY	PROBE ISOTROPY	MOD. TYPE	DUTY FACTOR	PAR
G	2600	3/6/2014	3258	ES3DV3	2600	Head	1.893	37.87	PASS	PASS	PASS	TDD	PASS	N/A
G	2600	3/5/2014	3258	ES3DV3	2600	Body	2.253	50.73	PASS	PASS	PASS	TDD	PASS	N/A

NOTE: While the probes have been calibrated for both CW and modulated signals, all measurements were performed using communication systems calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01v01 for scenarios when CW probe calibrations are used with other signal types. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5 dB), such as OFDM according to KDB 865664.