PCTEST
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. +1.410.290.6652 / Fax +1.410.290.6654
http://www.pctest.com

SAR EVALUATION REPORT

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

Date of Testing:
01/21/20 – 2/10/2020
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
1M2001200008-01-R1.ZNF

FCC ID: **ZNFK300AM**

APPLICANT: **LG ELECTRONICS U.S.A., INC.**

DUT Type:	Portable Handset
Application Type:	Certification
FCC Rule Part(s):	CFR §2.1093
Model:	LM-K300AM
Additional Models:	LM-K300CMR, LMK300AM, LMK300CMR, K300AM, K300CMR

Equipment Class	Band & Mode	Tx Frequency	SAR		
			1g Head (W/kg)	1g Body-Worn (W/kg)	1g Hotspot (W/kg)
PCE	GSM/GPRS/EDGE 850	824.20 - 848.80 MHz	0.43	0.59	0.59
PCE	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	0.15	0.33	0.43
PCE	UMTS 850	826.40 - 846.60 MHz	0.25	0.30	0.30
PCE	UMTS 1750	1712.4 - 1752.6 MHz	0.26	0.76	0.76
PCE	UMTS 1900	1852.4 - 1907.6 MHz	0.24	0.59	0.71
PCE	LTE Band 12	699.7 - 715.3 MHz	0.38	0.55	0.57
PCE	LTE Band 14	790.5 - 795.5 MHz	0.30	0.48	0.55
PCE	LTE Band 5 (Cell)	824.7 - 848.3 MHz	0.36	0.47	0.47
PCE	LTE Band 4 (AWS)	1710.7 - 1754.3 MHz	0.25	0.73	0.76
PCE	LTE Band 2 (PCS)	1850.7 - 1909.3 MHz	0.22	0.51	0.67
PCE	LTE Band 30	2307.5 - 2312.5 MHz	0.23	0.60	0.82
DTS	2.4 GHz WLAN	2412 - 2462 MHz	0.63	0.33	0.33
DSS/DTS	Bluetooth	2402 - 2480 MHz	< 0.1	N/A	N/A
Simultaneous SAR per KDB 690783 D01v01r03:			1.06	1.08	1.15

Note: This revised Test Report (S/N: 1M2001200008-01-R1.ZNF) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly

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 0 of this report; for North American frequency bands only.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Test results reported herein relate only to the item(s) tested.

Randy Ortanez
President

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

TABLE OF CONTENTS

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
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1750	Voice/Data	1712.4 - 1752.6 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
LTE Band 12	Voice/Data	699.7 - 715.3 MHz
LTE Band 14	Voice/Data	790.5 - 795.5 MHz
LTE Band 5 (Cell)	Voice/Data	824.7 - 848.3 MHz
LTE Band 4 (AWS)	Voice/Data	1710.7 - 1754.3 MHz
LTE Band 2 (PCS)	Voice/Data	1850.7 - 1909.3 MHz
LTE Band 30	Voice/Data	2307.5 - 2312.5 MHz
2.4 GHz WLAN	Voice/Data	2412 - 2462 MHz
Bluetooth	Data	2402 - 2480 MHz

1.2 Power Reduction for SAR

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

1.3 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v06.

1.3.1 Maximum Output Power

Mode / Band		Voice (dBm)	Burst Average GMSK (dBm)		Burst Average 8-PSK (dBm)	
		1 TX Slot	*1 TX Slots*	*2 TX Slots*	*1 TX Slots*	*2 TX Slots*
GSM/GPRS/EDGE 850	Maximum	**32.7**	**32.7**	**31.7**	**27.7**	**25.7**
	Nominal	**32.2**	**32.2**	**31.2**	**27.2**	**25.2**
GSM/GPRS/EDGE 1900	Maximum	**30.7**	**30.7**	**28.7**	**26.7**	**24.7**
	Nominal	**30.2**	**30.2**	**28.2**	**26.2**	**24.2**

Mode / Band		Modulated Average (dBm)		
		3GPP WCDMA	*3GPP HSDPA*	*3GPP HSUPA*
UMTS Band 5 (850 MHz)	Maximum	**25.2**	**25.2**	**25.2**
	Nominal	**24.7**	**24.7**	**24.7**
UMTS Band 4 (1750 MHz)	Maximum	**24.7**	**24.7**	**24.7**
	Nominal	**24.2**	**24.2**	**24.2**
UMTS Band 2 (1900 MHz)	Maximum	**24.7**	**24.7**	**24.7**
	Nominal	**24.2**	**24.2**	**24.2**

Mode / Band		Modulated Average (dBm)
LTE Band 12	Maximum	**25.2**
	Nominal	**24.7**
LTE Band 14	Maximum	**25.2**
	Nominal	**24.7**
LTE Band 5 (Cell)	Maximum	**25.2**
	Nominal	**24.7**
LTE Band 4 (AWS)	Maximum	**24.7**
	Nominal	**24.2**
LTE Band 2 (PCS)	Maximum	**24.7**
	Nominal	**24.2**
LTE Band 30	Maximum	**24.2**
	Nominal	**23.7**

Mode / Band		Modulated Average - Single Tx Chain (dBm)		
Channels		1	2 - 10	11
IEEE 802.11b (2.4 GHz)	Maximum	**19.0**		
	Nominal	**18.0**		
IEEE 802.11g (2.4 GHz)	Maximum	**16.0**	**18.0**	**15.0**
	Nominal	**15.0**	**17.0**	**14.0**
IEEE 802.11n (2.4 GHz)	Maximum	**15.5**	**17.5**	**14.5**
	Nominal	**14.5**	**16.5**	**13.5**

Mode / Band		Modulated Average - Single Tx Chain (dBm)
Bluetooth	Maximum	**10.0**
	Nominal	**9.0**
Bluetooth LE	Maximum	**6.5**
	Nominal	**5.5**

1.4 DUT Antenna Locations

The overall dimensions of this device are > 9 x 5 cm. The overall diagonal dimension of the device is ≤160 mm and the diagonal display is ≤150 mm. A diagram showing the location of the device antennas can be found in Appendix E.

Table 1-1
Device Edges/Sides for SAR Testing

Mode	Back	Front	Top	Bottom	Right	Left
GPRS 850	Yes	Yes	No	Yes	No	Yes
GPRS 1900	Yes	Yes	No	Yes	Yes	No
UMTS 850	Yes	Yes	No	Yes	No	Yes
UMTS 1750	Yes	Yes	No	Yes	Yes	No
UMTS 1900	Yes	Yes	No	Yes	Yes	No
LTE Band 12	Yes	Yes	No	Yes	No	Yes
LTE Band 14	Yes	Yes	No	Yes	No	Yes
LTE Band 5 (Cell)	Yes	Yes	No	Yes	No	Yes
LTE Band 4 (AWS)	Yes	Yes	No	Yes	Yes	No
LTE Band 2 (PCS)	Yes	Yes	No	Yes	Yes	No
LTE Band 30	Yes	Yes	No	Yes	Yes	No
2.4 GHz WLAN	Yes	Yes	Yes	No	No	Yes

Note: Particular DUT edges were not required to be evaluated for wireless router SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v02r01 Section III. The distances between the transmit antennas and the edges of the device are included in the filing.

1.5 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01v06, transmitters are considered to be operating simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds.

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v06 4.3.2 procedures.

Table 1-2
Simultaneous Transmission Scenarios

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

1. 2.4 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. Per the manufacturer, WIFI Direct is expected to be used in conjunction with a held-to-ear or body-worn accessory voice call. Therefore, there are no simultaneous transmission scenarios involving WIFI direct beyond that listed in the above table.
5. This device supports VOLTE.
6. This device supports VOWIFI.
7. This device supports Bluetooth Tethering.

1.6 Miscellaneous SAR Test Considerations

(A) WIFI/BT

Per FCC KDB 447498 D01v06, the 1g SAR exclusion threshold for distances <50mm is defined by the following equation:

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

Based on the maximum conducted power of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, body-worn and hotspot Bluetooth SAR was not required; [(10/10)* √2.480] = 1.6< 3.0. Per KDB Publication 447498 D01v06, the maximum power of the channel was rounded to the nearest mW before calculation.

(B) Licensed Transmitter(s)

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

This device is only capable of QPSK HSUPA in the uplink. Therefore, no additional SAR tests are required beyond that described for devices with HSUPA in KDB 941225 D01v03r01.

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 D05v02r04.

This device supports LTE Carrier Aggregation (CA) in the downlink. All uplink communications are identical to Release 8 specifications. Per FCC KDB Publication 941225 D05A v01r02, SAR for LTE CA operations was not needed since the maximum average output power in LTE CA mode was not >0.25 dB higher than the maximum output power when downlink carrier aggregation was inactive. The ownlink carrier aggregation exclusion analysis can be found in Appendix F

1.7 Guidance Applied

- IEEE 1528-2013
- FCC KDB Publication 941225 D01v03r01, D05v02r04, D06v02r01 (2G/3G/4G and Hotspot)
- FCC KDB Publication 248227 D01v02r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v06 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r04, D02v01r02 (SAR Measurements up to 6 GHz)
- October 2013 TCB Workshop Notes (GPRS Testing Considerations)

1.8 Device Serial Numbers

Several samples with identical hardware were used to support SAR testing. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units. The serial numbers used for each test are indicated alongside the results in Section 11.

2 LTE INFORMATION

LTE Information			
Form Factor	Portable Handset		
Frequency Range of each LTE transmission band	LTE Band 12 (699.7 - 715.3 MHz)		
	LTE Band 14 (790.5 - 795.5 MHz)		
	LTE Band 5 (Cell) (824.7 - 848.3 MHz)		
	LTE Band 4 (AWS) (1710.7 - 1754.3 MHz)		
	LTE Band 2 (PCS) (1850.7 - 1909.3 MHz)		
	LTE Band 30 (2307.5 - 2312.5 MHz)		
Channel Bandwidths	LTE Band 12: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz		
	LTE Band 14: 5 MHz, 10 MHz		
	LTE Band 5 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz		
	LTE Band 4 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz		
	LTE Band 2 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz		
	LTE Band 30: 5 MHz, 10 MHz		
Channel Numbers and Frequencies (MHz)	Low	Mid	High
LTE Band 12: 1.4 MHz	699.7 (23017)	707.5 (23095)	715.3 (23173)
LTE Band 12: 3 MHz	700.5 (23025)	707.5 (23095)	714.5 (23165)
LTE Band 12: 5 MHz	701.5 (23035)	707.5 (23095)	713.5 (23155)
LTE Band 12: 10 MHz	704 (23060)	707.5 (23095)	711 (23130)
LTE Band 14: 5 MHz	790.5 (23305)	793 (23330)	795.5 (23355)
LTE Band 14: 10 MHz	N/A	793 (23330)	N/A
LTE Band 5 (Cell): 1.4 MHz	824.7 (20407)	836.5 (20525)	848.3 (20643)
LTE Band 5 (Cell): 3 MHz	825.5 (20415)	836.5 (20525)	847.5 (20635)
LTE Band 5 (Cell): 5 MHz	826.5 (20425)	836.5 (20525)	846.5 (20625)
LTE Band 5 (Cell): 10 MHz	829 (20450)	836.5 (20525)	844 (20600)
LTE Band 4 (AWS): 1.4 MHz	1710.7 (19957)	1732.5 (20175)	1754.3 (20393)
LTE Band 4 (AWS): 3 MHz	1711.5 (19965)	1732.5 (20175)	1753.5 (20385)
LTE Band 4 (AWS): 5 MHz	1712.5 (19975)	1732.5 (20175)	1752.5 (20375)
LTE Band 4 (AWS): 10 MHz	1715 (20000)	1732.5 (20175)	1750 (20350)
LTE Band 4 (AWS): 15 MHz	1717.5 (20025)	1732.5 (20175)	1747.5 (20325)
LTE Band 4 (AWS): 20 MHz	1720 (20050)	1732.5 (20175)	1745 (20300)
LTE Band 2 (PCS): 1.4 MHz	1850.7 (18607)	1880 (18900)	1909.3 (19193)
LTE Band 2 (PCS): 3 MHz	1851.5 (18615)	1880 (18900)	1908.5 (19185)
LTE Band 2 (PCS): 5 MHz	1852.5 (18625)	1880 (18900)	1907.5 (19175)
LTE Band 2 (PCS): 10 MHz	1855 (18650)	1880 (18900)	1905 (19150)
LTE Band 2 (PCS): 15 MHz	1857.5 (18675)	1880 (18900)	1902.5 (19125)
LTE Band 2 (PCS): 20 MHz	1860 (18700)	1880 (18900)	1900 (19100)
LTE Band 30: 5 MHz	2307.5 (27685)	2310 (27710)	2312.5 (27735)
LTE Band 30: 10 MHz	N/A	2310 (27710)	N/A
UE Category	6		
Modulations Supported in UL	QPSK, 16QAM		
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES		
A-MPR (Additional MPR) disabled for SAR Testing?	YES		
LTE Carrier Aggregation Possible Combinations	The technical description includes all the possible carrier aggregation combinations		
LTE Additional Information	This device does not support full CA features on 3GPP Release 11. All uplink communications are identical to the Release 8 Specifications. The following LTE Release 11 Features are not supported: Relay, HetNet, Enhanced MIMO, eICIC, WIFI Offloading, eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA.		

3 INTRODUCTION

The FCC and Innovation, Science, and Economic Development 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 D01v01r04 and IEEE 1528-2013:

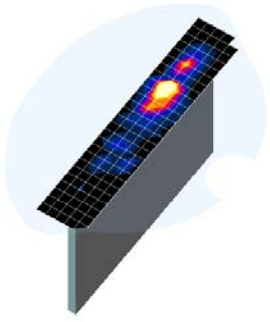


Figure 4-1
Sample SAR Area Scan

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 D01v01r04 (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 D01v01r04 (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 D01v01r04*

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].

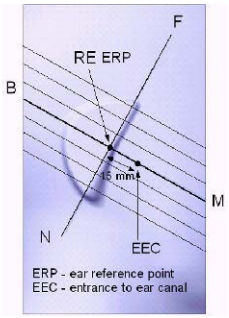


Figure 5-1
Close-Up Side view of ERP

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.

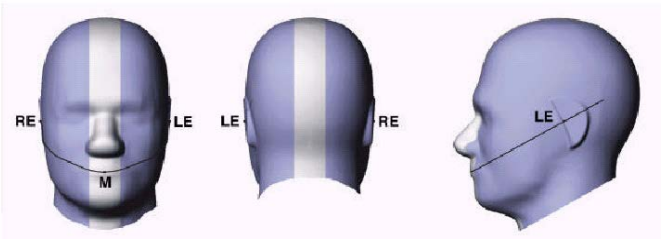


Figure 5-2
Front, back and side view of SAM Twin Phantom

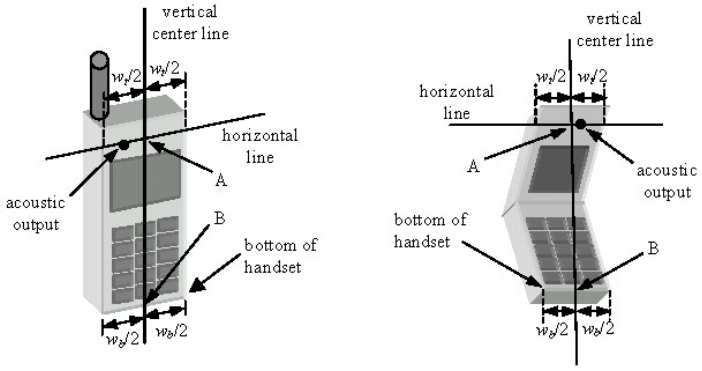


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

6 TEST CONFIGURATION POSITIONS

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).

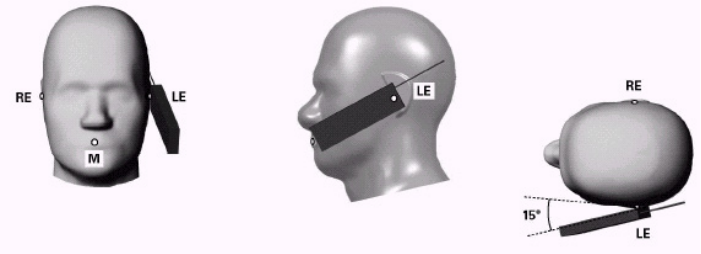


Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

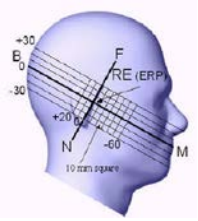


Figure 6-3
Side view w/ relevant markings

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 D04v01r03. 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

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 D04v01r03, 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 D01v06 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.

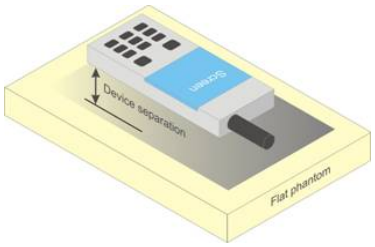


Figure 6-4
Sample Body-Worn Diagram

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not

contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

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

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 1g body and 10g extremity SAR Exclusion Thresholds found in KDB Publication 447498 D01v06 should be applied to determine SAR test requirements.

Per KDB Publication 447498 D01v06, Cell phones (handsets) are not normally designed to be used on extremities or operated in extremity only exposure conditions. The maximum output power levels of handsets generally do not require extremity SAR testing to show compliance. Therefore, extremity SAR was not evaluated for this device.

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 D06v02r01 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 D01v06 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

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

8.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v06, 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 D01v01r03.

8.2 3G SAR Test Reduction Procedure

In FCC KDB Publication 941225 D01v03r01, certain transmission modes within a frequency band and wireless mode evaluated for SAR are defined as primary modes. The equivalent modes considered for SAR test reduction are denoted as secondary modes. When the maximum output power including tune-up tolerance specified for production units in a secondary mode is ≤ 0.25 dB higher than the primary mode or when the highest reported SAR of the primary mode, scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode, is ≤ 1.2 W/kg, SAR measurements are not required for the secondary mode. These criteria are referred to as the 3G SAR test reduction procedure. When the 3G SAR test reduction procedure is not satisfied, SAR measurements are additionally required for the secondary mode.

8.3 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01v03r01 “3G SAR Measurement Procedures.”

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

8.4 SAR Measurement Conditions for UMTS

8.4.1 Output Power Verification

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

8.4.2 Head SAR Measurements

SAR for next to the ear head exposure is measured using a 12.2 kbps RMC with TPC bits configured to all "1's". The 3G SAR test reduction procedure is applied to AMR configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for 12.2 kbps AMR in 3.4 kbps SRB (signaling radio bearer) using the highest reported SAR configuration in 12.2 kbps RMC for head exposure.

8.4.3 Body SAR Measurements

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

8.4.4 SAR Measurements with Rel 5 HSDPA

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

8.4.5 SAR Measurements with Rel 6 HSUPA

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 and power control algorithm 2, according to the highest reported body SAR configuration in 12.2 kbps RMC without HSPA.

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

8.5 SAR Measurement Conditions for LTE

LTE modes are tested according to FCC KDB 941225 D05v02r04 publication. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 or Anritsu MT8820C simulators are used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

8.5.1 Spectrum Plots for RB Configurations

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

8.5.2 MPR

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

8.5.3 A-MPR

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

8.5.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r04:

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.

8.5.5 Downlink Only Carrier Aggregation

Conducted power measurements with LTE Carrier Aggregation (CA) (downlink only) active are made in accordance to KDB Publication 941225 D05Av01r02. The RRC connection is only handled by one cell, the primary component carrier (PCC) for downlink and uplink communications. After making a data connection to the PCC, the UE device adds secondary component carrier(s) (SCC) on the downlink only. All uplink communications and acknowledgements remain identical to specifications when downlink carrier aggregation is inactive on the PCC. Additional conducted output powers are measured with the downlink carrier aggregation active for the configuration with highest measured maximum conducted power with downlink carrier aggregation inactive measured among the channel bandwidth, modulation, and RB combinations in each frequency band. Per FCC KDB Publication 941225 D05Av01r02, no SAR measurements are required for downlink only carrier aggregation configurations when the average output power with downlink only carrier aggregation active is not more than 0.25 dB higher than the average output power with downlink only carrier aggregation inactive

8.6 SAR Testing with 802.11 Transmitters

The normal network operating configurations of 802.11 transmitters are not suitable for SAR measurements. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227 D01v02r02 for more details.

8.6.1 General Device Setup

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

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

8.6.2 Initial Test Position Procedure

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

8.6.3 2.4 GHz SAR Test Requirements

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

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

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

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

8.6.4 OFDM Transmission Mode and SAR Test Channel Selection

When the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11g and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 802.11g then 802.11n, is used for

SAR measurement. When the maximum output power are the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

8.6.5 Initial Test Configuration Procedure

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

When the reported SAR is ≤ 0.8 W/kg, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤ 1.2 W/kg or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurements (See Section 8.6.4).

8.6.6 Subsequent Test Configuration Procedures

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

9 RF CONDUCTED POWERS

9.1 GSM Conducted Powers

Table 9-1
Maximum Conducted Power

Maximum Burst-Averaged Output Power						
		Voice	*GPRS/EDGE Data (GMSK)*		*EDGE Data (8-PSK)*	
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**
GSM 850	128	32.66	32.66	**31.31**	26.85	24.51
	190	32.70	32.70	**31.36**	26.90	24.60
	251	32.65	32.69	**31.35**	27.02	24.69
GSM 1900	512	30.54	30.40	**28.43**	26.70	24.67
	661	30.55	30.59	**28.35**	26.69	24.55
	810	30.46	30.56	**28.46**	26.65	24.57

Calculated Maximum Frame-Averaged Output Power						
		Voice	*GPRS/EDGE Data (GMSK)*		*EDGE Data (8-PSK)*	
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**
GSM 850	128	23.63	23.63	**25.29**	17.82	18.49
	190	23.67	23.67	**25.34**	17.87	18.58
	251	23.62	23.66	**25.33**	17.99	18.67
GSM 1900	512	21.51	21.37	**22.41**	17.67	18.65
	661	21.52	21.56	**22.33**	17.66	18.53
	810	21.43	21.53	**22.44**	17.62	18.55

GSM 850	**Frame Avg.Targets:**	23.17	23.17	**25.18**	18.17	19.18
GSM 1900		21.17	21.17	**22.18**	17.17	18.18

Note:

1. Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
2. GPRS/EDGE (GMSK) output powers were measured with coding scheme setting of 1 (CS1) on the base station simulator. CS1 was configured to measure GPRS output power measurements and SAR to ensure GMSK modulation in the signal. Our Investigation has shown that CS1 - CS4 settings do not have any impact on the output levels or modulation in the GPRS modes.
3. EDGE (8-PSK) output powers were measured with MCS7 on the base station simulator. MCS7 coding scheme was used to measure the output powers for EDGE since investigation has shown that choosing MCS7 coding scheme will ensure 8-PSK modulation. It has been shown that MCS levels that produce 8-PSK modulation do not have an impact on output power.

GSM Class: B
GPRS Multislot class: 10 (Max 2 Tx uplink slots)
EDGE Multislot class: 10 (Max 2 Tx uplink slots)
DTM Multislot Class: N/A

Figure 9-1
Power Measurement Setup

9.2 UMTS Conducted Powers

Table 9-2
Maximum Conducted Power

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			AWS Band [dBm]			PCS Band [dBm]			MPR [dB]
			4132	4183	4233	1312	1412	1513	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	25.06	25.11	25.13	24.51	24.54	24.53	24.69	24.64	24.63	-
99		12.2 kbps AMR	25.11	25.16	25.09	24.53	24.56	24.53	24.69	24.62	24.65	-
6	HSDPA	Subtest 1	24.20	24.16	24.19	23.70	23.63	23.64	23.70	23.70	23.65	1
6		Subtest 2	24.20	24.11	24.11	23.69	23.58	23.60	23.68	23.64	23.68	1
6		Subtest 3	23.70	23.62	23.63	23.18	23.07	23.10	23.18	23.15	23.19	1.5
6		Subtest 4	23.68	23.61	23.62	23.18	23.07	23.08	23.17	23.13	23.17	1.5
6	HSUPA	Subtest 1	22.06	21.98	21.98	21.67	21.53	21.58	21.70	21.62	21.63	3
6		Subtest 2	22.05	21.99	21.96	21.66	21.55	21.56	21.70	21.61	21.65	3
6		Subtest 3	23.03	22.95	22.95	22.66	22.56	22.58	22.67	22.62	22.64	2
6		Subtest 4	21.57	21.49	21.50	21.20	21.09	21.12	21.20	21.17	21.20	3.5
6		Subtest 5	23.00	22.90	22.92	22.66	22.55	22.56	22.69	22.61	22.62	2

This device does not support DC-HSDPA.

Figure 9-2
Power Measurement Setup

9.3 LTE Conducted Powers

9.3.1 LTE Band 12

Table 9-3
LTE Band 12 Conducted Powers - 10 MHz Bandwidth

LTE Band 12 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 23095 (707.5 MHz) Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
QPSK	1	0	24.37	0	0
	1	25	**24.55**		0
	1	49	24.38		0
	25	0	23.45	0-1	1
	25	12	23.44		1
	25	25	**23.47**		1
	50	0	23.46		1
16QAM	1	0	23.69	0-1	1
	1	25	23.84		1
	1	49	23.66		1
	25	0	22.51	0-2	2
	25	12	22.50		2
	25	25	22.51		2
	50	0	22.51		2

Note: LTE Band 12 at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Table 9-4
LTE Band 12 Conducted Powers - 5 MHz Bandwidth

LTE Band 12 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 23035 (701.5 MHz)	Mid Channel 23095 (707.5 MHz)	High Channel 23155 (713.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.37	24.19	24.36	0	0
	1	12	24.39	24.42	24.51		0
	1	24	24.12	24.36	24.35		0
	12	0	23.25	23.33	23.44	0-1	1
	12	6	23.35	23.36	23.32		1
	12	13	23.37	23.35	23.30		1
	25	0	23.28	23.30	23.34		1
16QAM	1	0	23.36	23.10	23.71	0-1	1
	1	12	23.49	23.34	23.95		1
	1	24	23.40	23.40	23.70		1
	12	0	22.38	22.36	22.34	0-2	2
	12	6	22.46	22.39	22.38		2
	12	13	22.31	22.38	22.27		2
	25	0	22.35	22.39	22.31		2

Table 9-5
LTE Band 12 Conducted Powers - 3 MHz Bandwidth

LTE Band 12 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 23025 (700.5 MHz)	Mid Channel 23095 (707.5 MHz)	High Channel 23165 (714.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.51	24.54	24.47	0	0
	1	7	24.70	24.72	24.64		0
	1	14	24.61	24.53	24.50		0
	8	0	23.58	23.62	23.61	0-1	1
	8	4	23.67	23.64	23.66		1
	8	7	23.64	23.58	23.59		1
	15	0	23.65	23.58	23.55		1
16QAM	1	0	23.96	23.44	23.27	0-1	1
	1	7	24.11	23.60	23.44		1
	1	14	23.96	23.45	23.26		1
	8	0	22.79	22.65	22.52	0-2	2
	8	4	22.85	22.68	22.63		2
	8	7	22.81	22.64	22.53		2
	15	0	22.72	22.64	22.49		2

Table 9-6
LTE Band 12 Conducted Powers -1.4 MHz Bandwidth

LTE Band 12 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 23017 (699.7 MHz)	Mid Channel 23095 (707.5 MHz)	High Channel 23173 (715.3 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.42	24.47	24.59	0	0
	1	2	24.51	24.54	24.72		0
	1	5	24.46	24.48	24.63		0
	3	0	24.65	24.56	24.60		0
	3	2	24.70	24.61	24.65		0
	3	3	24.68	24.56	24.61		0
	6	0	23.59	23.56	23.63	0-1	1
16QAM	1	0	23.34	23.83	23.30	0-1	1
	1	2	23.39	23.95	23.40		1
	1	5	23.35	23.84	23.33		1
	3	0	23.72	23.82	23.62		1
	3	2	23.76	23.85	23.68		1
	3	3	23.76	23.86	23.64		1
	6	0	22.86	22.47	22.74	0-2	2

9.3.2 LTE Band 14

Table 9-7
LTE Band 14 Conducted Powers - 10 MHz Bandwidth

LTE Band 14 10 MHz Bandwidth					
Modulation	**RB Size**	**RB Offset**	**Mid Channel** **23330** **(793.0 MHz)** **Conducted Power [dBm]**	**MPR Allowed per 3GPP [dB]**	**MPR [dB]**
QPSK	1	0	24.36	0	0
	1	25	**24.54**		0
	1	49	24.38		0
	25	0	23.39	0-1	1
	25	12	**23.48**		1
	25	25	23.45		1
	50	0	23.43		1
16QAM	1	0	23.30	0-1	1
	1	25	23.50		1
	1	49	23.37		1
	25	0	22.59	0-2	2
	25	12	22.55		2
	25	25	22.57		2
	50	0	22.43		2

Table 9-8
LTE Band 14 Conducted Powers - 5 MHz Bandwidth

LTE Band 14 5 MHz Bandwidth					
Modulation	**RB Size**	**RB Offset**	**Mid Channel** **23330 (793.0 MHz)** **Conducted Power [dBm]**	**MPR Allowed per 3GPP [dB]**	**MPR [dB]**
QPSK	1	0	24.28	0	0
	1	12	24.38		0
	1	24	24.18		0
	12	0	23.30	0-1	1
	12	6	23.42		1
	12	13	23.35		1
	25	0	23.33		1
16QAM	1	0	23.37	0-1	1
	1	12	23.62		1
	1	24	23.33		1
	12	0	22.36	0-2	2
	12	6	22.45		2
	12	13	22.40		2
	25	0	22.35		2

Note: LTE Band 14 at 5 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

9.3.3 LTE Band 5 (Cell)

Table 9-9
LTE Band 5 (Cell) Conducted Powers - 10 MHz Bandwidth

LTE Band 5 (Cell) 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 20525 (836.5 MHz) Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
QPSK	1	0	24.30	0	0
	1	25	**24.43**		0
	1	49	24.32		0
	25	0	23.43	0-1	1
	25	12	**23.50**		1
	25	25	23.44		1
	50	0	23.45		1
16QAM	1	0	23.19	0-1	1
	1	25	23.33		1
	1	49	23.17		1
	25	0	22.58	0-2	2
	25	12	22.60		2
	25	25	22.55		2
	50	0	22.51		2

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

Table 9-10
LTE Band 5 (Cell) Conducted Powers - 5 MHz Bandwidth

LTE Band 5 (Cell) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20425 (826.5 MHz)	Mid Channel 20525 (836.5 MHz)	High Channel 20625 (846.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.33	24.36	24.23	0	0
	1	12	24.53	24.56	24.50		0
	1	24	24.27	24.34	24.17		0
	12	0	23.43	23.40	23.44	0-1	1
	12	6	23.48	23.44	23.49		1
	12	13	23.41	23.37	23.35		1
	25	0	23.40	23.40	23.46		1
16QAM	1	0	23.35	23.96	23.35	0-1	1
	1	12	23.50	24.18	23.62		1
	1	24	23.31	23.89	23.35		1
	12	0	22.45	22.52	22.48	0-2	2
	12	6	22.52	22.53	22.49		2
	12	13	22.43	22.49	22.41		2
	25	0	22.42	22.50	22.40		2

Table 9-11
LTE Band 5 (Cell) Conducted Powers - 3 MHz Bandwidth

LTE Band 5 (Cell) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20415 (825.5 MHz)	Mid Channel 20525 (836.5 MHz)	High Channel 20635 (847.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.38	24.37	24.31	0	0
	1	7	24.52	24.40	24.41		0
	1	14	24.31	24.25	24.30		0
	8	0	23.35	23.39	23.43	0-1	1
	8	4	23.41	23.41	23.44		1
	8	7	23.38	23.34	23.40		1
	15	0	23.39	23.35	23.42		1
16QAM	1	0	23.79	23.36	23.32	0-1	1
	1	7	23.89	23.45	23.32		1
	1	14	23.82	23.27	23.14		1
	8	0	22.48	22.44	22.39	0-2	2
	8	4	22.54	22.47	22.42		2
	8	7	22.47	22.39	22.36		2
	15	0	22.39	22.42	22.38		2

Table 9-12
LTE Band 5 (Cell) Conducted Powers -1.4 MHz Bandwidth

LTE Band 5 (Cell) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20407 (824.7 MHz)	Mid Channel 20525 (836.5 MHz)	High Channel 20643 (848.3 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.32	24.42	24.40	0	0
	1	2	24.43	24.49	24.36		0
	1	5	24.38	24.42	24.25		0
	3	0	24.49	24.41	24.43		0
	3	2	24.47	24.43	24.51		0
	3	3	24.46	24.43	24.44		0
	6	0	23.41	23.41	23.48	0-1	1
16QAM	1	0	23.76	23.21	23.35	0-1	1
	1	2	23.86	23.27	23.21		1
	1	5	23.75	23.21	23.37		1
	3	0	23.72	23.56	23.51		1
	3	2	23.75	23.60	23.55		1
	3	3	23.75	23.55	23.54		1
	6	0	22.41	22.64	22.61	0-2	2

9.3.4 LTE Band 4 (AWS)

Table 9-13
LTE Band 4 (AWS) Conducted Powers - 20 MHz Bandwidth

LTE Band 4 (AWS) 20 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel 20175 (1732.5 MHz) Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
QPSK	1	0	24.19	0	0
	1	50	**24.53**		0
	1	99	24.25		0
	50	0	23.30	0-1	1
	50	25	**23.35**		1
	50	50	23.24		1
	100	0	23.28		1
16QAM	1	0	23.43	0-1	1
	1	50	23.65		1
	1	99	23.38		1
	50	0	22.33	0-2	2
	50	25	22.38		2
	50	50	22.26		2
	100	0	22.31		2

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

Table 9-14
LTE Band 4 (AWS) Conducted Powers - 15 MHz Bandwidth

LTE Band 4 (AWS) 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20025 (1717.5 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20325 (1747.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.27	24.20	24.34	0	0
	1	36	24.32	24.28	24.40		0
	1	74	24.27	24.29	24.24		0
	36	0	23.41	23.42	23.34	0-1	1
	36	18	23.44	23.45	23.36		1
	36	37	23.43	23.38	23.33		1
	75	0	23.45	23.41	23.36		1
16QAM	1	0	23.64	23.18	23.20	0-1	1
	1	36	23.68	23.25	23.30		1
	1	74	23.58	23.13	23.30		1
	36	0	22.45	22.41	22.31	0-2	2
	36	18	22.43	22.41	22.36		2
	36	37	22.43	22.37	22.28		2
	75	0	22.48	22.36	22.32		2

Table 9-15
LTE Band 4 (AWS) Conducted Powers - 10 MHz Bandwidth

LTE Band 4 (AWS) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 20000 (1715.0 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20350 (1750.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.30	24.22	24.28	0	0
	1	25	24.47	24.42	24.33		0
	1	49	24.24	24.25	24.23		0
	25	0	23.34	23.34	23.38	0-1	1
	25	12	23.41	23.35	23.30		1
	25	25	23.37	23.27	23.23		1
	50	0	23.38	23.32	23.28		1
16QAM	1	0	23.66	23.16	23.35	0-1	1
	1	25	23.69	23.38	23.37		1
	1	49	23.60	23.16	23.30		1
	25	0	22.44	22.44	22.50	0-2	2
	25	12	22.47	22.47	22.47		2
	25	25	22.50	22.45	22.36		2
	50	0	22.41	22.36	22.38		2

Table 9-16
LTE Band 4 (AWS) Conducted Powers - 5 MHz Bandwidth

LTE Band 4 (AWS) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 19975 (1712.5 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20375 (1752.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.36	24.32	24.29	0	0
	1	12	24.51	24.36	24.41		0
	1	24	24.29	24.37	24.39		0
	12	0	23.35	23.27	23.28	0-1	1
	12	6	23.37	23.34	23.33		1
	12	13	23.33	23.26	23.25		1
	25	0	23.32	23.29	23.22		1
16QAM	1	0	23.70	23.24	23.31	0-1	1
	1	12	23.69	23.46	23.30		1
	1	24	23.65	23.26	23.27		1
	12	0	22.39	22.36	22.38	0-2	2
	12	6	22.47	22.41	22.39		2
	12	13	22.41	22.35	22.31		2
	25	0	22.40	22.29	22.28		2

Table 9-17
LTE Band 4 (AWS) Conducted Powers - 3 MHz Bandwidth

LTE Band 4 (AWS) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 19965 (1711.5 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20385 (1753.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.35	24.28	24.32	0	0
	1	7	24.42	24.34	24.30		0
	1	14	24.22	24.26	24.37		0
	8	0	23.35	23.30	23.26	0-1	1
	8	4	23.33	23.35	23.29		1
	8	7	23.29	23.27	23.27		1
	15	0	23.27	23.28	23.24		1
16QAM	1	0	23.66	23.21	23.35	0-1	1
	1	7	23.68	23.29	23.32		1
	1	14	23.62	23.13	23.40		1
	8	0	22.45	22.35	22.23	0-2	2
	8	4	22.52	22.39	22.28		2
	8	7	22.38	22.34	22.23		2
	15	0	22.32	22.35	22.25		2

Table 9-18
LTE Band 4 (AWS) Conducted Powers -1.4 MHz Bandwidth

LTE Band 4 (AWS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 19957 (1710.7 MHz)	Mid Channel 20175 (1732.5 MHz)	High Channel 20393 (1754.3 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.35	24.25	24.27	0	0
	1	2	24.28	24.23	24.34		0
	1	5	24.41	24.39	24.26		0
	3	0	24.30	24.26	24.28		0
	3	2	24.40	24.30	24.31		0
	3	3	24.31	24.31	24.29		0
	6	0	23.37	23.25	23.24	0-1	1
16QAM	1	0	23.50	23.55	23.57	0-1	1
	1	2	23.51	23.62	23.55		1
	1	5	23.44	23.52	23.48		1
	3	0	23.32	23.51	23.35		1
	3	2	23.34	23.52	23.39		1
	3	3	23.32	23.55	23.37		1
	6	0	22.46	22.27	22.46	0-2	2

9.3.5 LTE Band 2 (PCS)

Table 9-19
LTE Band 2 (PCS) Conducted Powers - 20 MHz Bandwidth

LTE Band 2 (PCS) 20 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18700 (1860.0 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19100 (1900.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.33	24.31	24.32	0	0
	1	50	24.56	**24.62**	24.59		0
	1	99	24.29	24.26	24.40		0
	50	0	23.39	**23.48**	23.45	0-1	1
	50	25	23.45	23.45	23.44		1
	50	50	23.42	23.37	23.39		1
	100	0	23.42	23.47	23.46		1
16QAM	1	0	23.57	23.58	23.47	0-1	1
	1	50	23.43	23.60	23.40		1
	1	99	23.52	23.50	23.40		1
	50	0	22.46	22.52	22.48	0-2	2
	50	25	22.52	22.51	22.47		2
	50	50	22.55	22.37	22.44		2
	100	0	22.50	22.48	22.50		2

Table 9-20
LTE Band 2 (PCS) Conducted Powers - 15 MHz Bandwidth

LTE Band 2 (PCS) 15 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18675 (1857.5 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19125 (1902.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.25	24.23	24.42	0	0
	1	36	24.27	24.28	24.51		0
	1	74	24.25	24.23	24.42		0
	36	0	23.42	23.51	23.52	0-1	1
	36	18	23.41	23.49	23.50		1
	36	37	23.46	23.44	23.50		1
	75	0	23.42	23.45	23.52		1
16QAM	1	0	23.66	23.16	23.68	0-1	1
	1	36	23.70	23.25	23.69		1
	1	74	23.62	23.08	23.46		1
	36	0	22.67	22.48	22.45	0-2	2
	36	18	22.48	22.43	22.49		2
	36	37	22.46	22.36	22.43		2
	75	0	22.45	22.44	22.48		2

Table 9-21
LTE Band 2 (PCS) Conducted Powers - 10 MHz Bandwidth

LTE Band 2 (PCS) 10 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18650 (1855.0 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19150 (1905.0 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.29	24.38	24.39	0	0
	1	25	24.42	24.49	24.63		0
	1	49	24.38	24.34	24.53		0
	25	0	23.42	23.46	23.49	0-1	1
	25	12	23.40	23.46	23.51		1
	25	25	23.47	23.39	23.44		1
	50	0	23.42	23.45	23.49		1
16QAM	1	0	23.40	23.69	23.29	0-1	1
	1	25	23.59	23.70	23.49		1
	1	49	23.32	23.67	23.15		1
	25	0	22.59	22.50	22.57	0-2	2
	25	12	22.57	22.56	22.59		2
	25	25	22.65	22.46	22.53		2
	50	0	22.59	22.51	22.53		2

Table 9-22
LTE Band 2 (PCS) Conducted Powers - 5 MHz Bandwidth

LTE Band 2 (PCS) 5 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18625 (1852.5 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19175 (1907.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.27	24.31	24.24	0	0
	1	12	24.44	24.48	24.50		0
	1	24	24.27	24.30	24.38		0
	12	0	23.32	23.35	23.43	0-1	1
	12	6	23.39	23.40	23.42		1
	12	13	23.35	23.34	23.38		1
	25	0	23.34	23.35	23.36		1
16QAM	1	0	23.40	23.70	23.68	0-1	1
	1	12	23.58	23.65	23.64		1
	1	24	23.37	23.69	23.35		1
	12	0	22.40	22.53	22.52	0-2	2
	12	6	22.49	22.54	22.52		2
	12	13	22.44	22.50	22.49		2
	25	0	22.36	22.45	22.44		2

Table 9-23
LTE Band 2 (PCS) Conducted Powers - 3 MHz Bandwidth

LTE Band 2 (PCS) 3 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18615 (1851.5 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19185 (1908.5 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.30	24.46	24.32	0	0
	1	7	24.42	24.48	24.47		0
	1	14	24.31	24.34	24.28		0
	8	0	23.35	23.38	23.33	0-1	1
	8	4	23.38	23.44	23.35		1
	8	7	23.38	23.36	23.35		1
	15	0	23.33	23.36	23.34		1
16QAM	1	0	23.67	23.24	23.70	0-1	1
	1	7	23.68	23.33	23.69		1
	1	14	23.66	23.17	23.67		1
	8	0	22.50	22.50	22.45	0-2	2
	8	4	22.49	22.52	22.54		2
	8	7	22.46	22.45	22.48		2
	15	0	22.43	22.40	22.42		2

Table 9-24
LTE Band 2 (PCS) Conducted Powers -1.4 MHz Bandwidth

LTE Band 2 (PCS) 1.4 MHz Bandwidth							
Modulation	RB Size	RB Offset	Low Channel 18607 (1850.7 MHz)	Mid Channel 18900 (1880.0 MHz)	High Channel 19193 (1909.3 MHz)	MPR Allowed per 3GPP [dB]	MPR [dB]
			Conducted Power [dBm]				
QPSK	1	0	24.33	24.36	24.63	0	0
	1	2	24.49	24.55	24.69		0
	1	5	24.34	24.44	24.70		0
	3	0	24.52	24.46	24.53		0
	3	2	24.61	24.53	24.57		0
	3	3	24.55	24.55	24.48		0
	6	0	23.50	23.55	23.68	0-1	1
16QAM	1	0	23.40	23.65	23.38	0-1	1
	1	2	23.48	23.70	23.48		1
	1	5	23.43	23.68	23.35		1
	3	0	23.61	23.65	23.44		1
	3	2	23.64	23.62	23.40		1
	3	3	23.66	23.63	23.38		1
	6	0	22.61	22.42	22.63	0-2	2

9.3.6 LTE Band 30

Table 9-25
LTE Band 30 Conducted Powers - 10 MHz Bandwidth

LTE Band 30 10 MHz Bandwidth					
Modulation	**RB Size**	**RB Offset**	**Mid Channel** **27710** **(2310.0 MHz)** **Conducted Power [dBm]**	**MPR Allowed per 3GPP [dB]**	**MPR [dB]**
QPSK	1	0	23.68	0	0
	1	25	**23.84**		0
	1	49	23.67		0
	25	0	22.73	0-1	1
	25	12	**22.76**		1
	25	25	22.63		1
	50	0	22.71		1
16QAM	1	0	22.61	0-1	1
	1	25	22.83		1
	1	49	22.60		1
	25	0	21.90	0-2	2
	25	12	21.94		2
	25	25	21.86		2
	50	0	21.87		2

Table 9-26
LTE Band 30 Conducted Powers - 5 MHz Bandwidth

LTE Band 30 5 MHz Bandwidth					
Modulation	**RB Size**	**RB Offset**	**Mid Channel** **27710** **(2310.0 MHz)** **Conducted Power [dBm]**	**MPR Allowed per 3GPP [dB]**	**MPR [dB]**
QPSK	1	0	23.45	0	0
	1	12	23.77		0
	1	24	23.50		0
	12	0	22.55	0-1	1
	12	6	22.66		1
	12	13	22.61		1
	25	0	22.62		1
16QAM	1	0	22.67	0-1	1
	1	12	22.99		1
	1	24	22.66		1
	12	0	21.78	0-2	2
	12	6	21.83		2
	12	13	21.74		2
	25	0	21.72		2

Note: LTE Band 30 at 5 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Figure 9-3
Power Measurement Setup

9.4 WLAN Conducted Powers

Table 9-27
2.4 GHz WLAN Maximum Average RF Power

2.4GHz Conducted Power [dBm]				
Freq [MHz]	Channel	IEEE Transmission Mode		
		802.11b	802.11g	802.11n
		Average	Average	Average
2412	1	18.45	15.34	14.95
2437	6	18.47	17.95	17.39
2462	11	18.43	14.94	14.38

Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02:

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

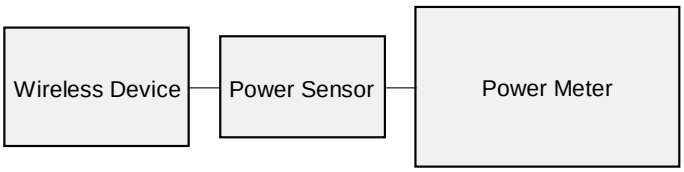


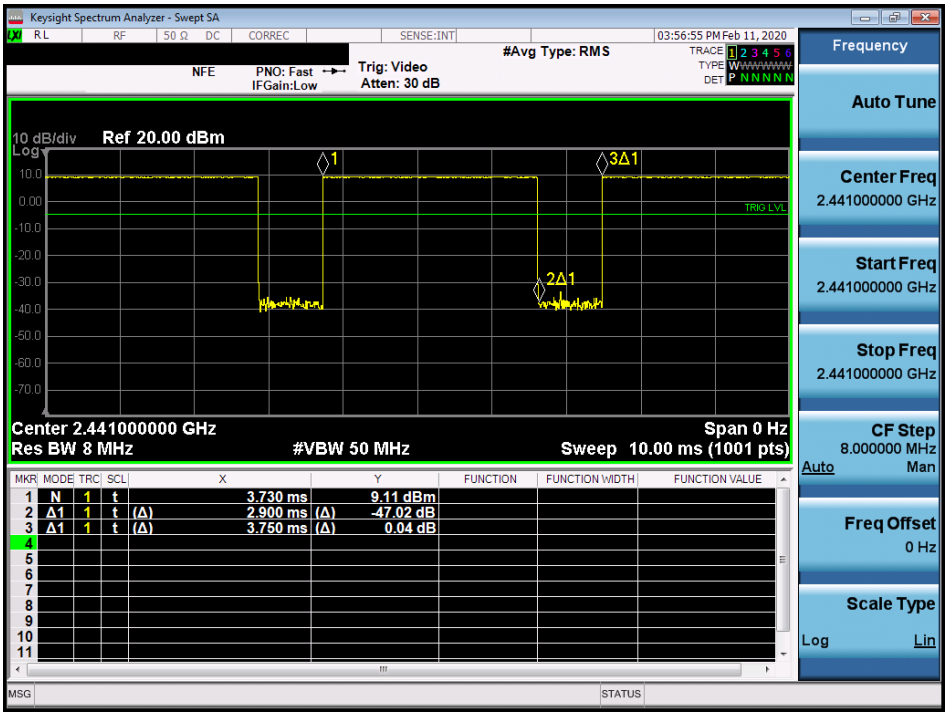
Figure 9-4
Power Measurement Setup

9.5 Bluetooth Conducted Powers

Table 9-28
Bluetooth Average RF Power

Frequency [MHz]	Data Rate [Mbps]	Channel No.	Avg Conducted Power	
			[dBm]	[mW]
2402	1.0	0	8.27	6.715
2441	1.0	39	9.83	9.621
2480	1.0	78	8.12	6.491
2402	2.0	0	8.09	6.441
2441	2.0	39	9.29	8.490
2480	2.0	78	7.90	6.169
2402	3.0	0	8.14	6.514
2441	3.0	39	9.34	8.586
2480	3.0	78	7.93	6.211

Figure 9-5
Bluetooth Transmission Plot



Equation 9-1
Bluetooth Duty Cycle Calculation

$$Duty\ Cycle = \frac{Pulse\ Width}{Period} * 100\% = \frac{2.900ms}{3.750ms} * 100\% = 77.3\%$$

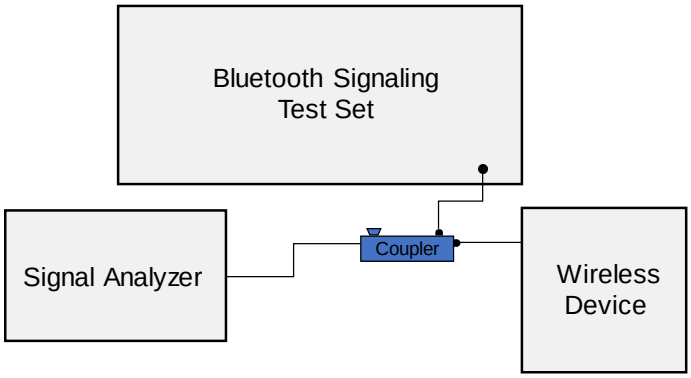


Figure 9-6
Power Measurement Setup

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
02/05/2020	750 Head	20.6	680	0.859	41.552	0.888	42.305	-3.27%	-1.78%
			695	0.864	41.516	0.889	42.227	-2.81%	-1.68%
			700	0.866	41.503	0.889	42.201	-2.59%	-1.65%
			710	0.869	41.476	0.890	42.149	-2.36%	-1.60%
			725	0.874	41.424	0.891	42.071	-1.91%	-1.54%
			740	0.879	41.363	0.893	41.994	-1.57%	-1.50%
			750	0.883	41.320	0.894	41.942	-1.23%	-1.48%
			755	0.884	41.304	0.894	41.916	-1.12%	-1.46%
			770	0.889	41.260	0.895	41.838	-0.67%	-1.38%
			785	0.895	41.214	0.896	41.760	-0.11%	-1.31%
			800	0.900	41.170	0.897	41.682	0.33%	-1.23%
2/9/2020	835 Head	20.5	820	0.911	40.105	0.899	41.578	1.33%	-3.54%
			835	0.916	40.063	0.900	41.500	1.78%	-3.46%
			850	0.922	40.024	0.916	41.500	0.66%	-3.56%
01/29/2020	1750 Head	20.8	1710	1.339	39.978	1.348	40.142	-0.67%	-0.41%
			1720	1.346	39.960	1.354	40.126	-0.59%	-0.41%
			1745	1.361	39.922	1.368	40.087	-0.51%	-0.41%
			1750	1.364	39.913	1.371	40.079	-0.51%	-0.41%
			1770	1.375	39.880	1.383	40.047	-0.58%	-0.42%
			1790	1.385	39.842	1.394	40.016	-0.65%	-0.43%
02/03/2020	1900 Head	19.4	1850	1.405	39.288	1.400	40.000	0.36%	-1.78%
			1860	1.412	39.273	1.400	40.000	0.86%	-1.82%
			1880	1.424	39.245	1.400	40.000	1.71%	-1.89%
			1900	1.436	39.218	1.400	40.000	2.57%	-1.95%
			1905	1.439	39.212	1.400	40.000	2.79%	-1.97%
			1910	1.442	39.204	1.400	40.000	3.00%	-1.99%
01/30/2020	2450 Head	21.0	2300	1.693	41.215	1.670	39.500	1.38%	4.34%
			2310	1.700	41.202	1.679	39.480	1.25%	4.36%
			2320	1.707	41.189	1.687	39.460	1.19%	4.38%
2/5/2020	2450 Head	22.5	2400	1.788	38.896	1.756	39.289	1.82%	-1.00%
			2450	1.823	38.835	1.800	39.200	1.28%	-0.93%
			2500	1.857	38.769	1.855	39.136	0.11%	-0.94%
02/08/2020	2400 Head	21.5	2400	1.806	39.657	1.756	39.289	2.85%	0.94%
			2450	1.847	39.584	1.800	39.200	2.61%	0.98%
			2500	1.886	39.514	1.855	39.136	1.67%	0.97%

Table 10-2
Measured Tissue Properties Continued

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
01/29/2020	750 Body	19.6	680	0.932	53.185	0.958	55.804	-2.71%	-4.69%
			695	0.937	53.148	0.959	55.745	-2.29%	-4.66%
			700	0.938	53.136	0.959	55.726	-2.19%	-4.65%
			710	0.942	53.111	0.960	55.687	-1.88%	-4.63%
			725	0.947	53.071	0.961	55.629	-1.46%	-4.60%
			740	0.953	53.023	0.963	55.570	-1.04%	-4.58%
			750	0.957	52.993	0.964	55.531	-0.73%	-4.57%
			755	0.959	52.980	0.964	55.512	-0.52%	-4.56%
			770	0.964	52.935	0.965	55.453	-0.10%	-4.54%
			785	0.971	52.894	0.966	55.395	0.52%	-4.51%
			800	0.977	52.858	0.967	55.336	1.03%	-4.48%
01/31/2020	750 Body	22.0	680	0.913	56.667	0.958	55.804	-4.70%	1.55%
			695	0.918	56.637	0.959	55.745	-4.28%	1.60%
			700	0.919	56.626	0.959	55.726	-4.17%	1.62%
			710	0.922	56.605	0.960	55.687	-3.96%	1.65%
			725	0.927	56.571	0.961	55.629	-3.54%	1.69%
			740	0.932	56.534	0.963	55.570	-3.22%	1.73%
			750	0.935	56.507	0.964	55.531	-3.01%	1.76%
			755	0.937	56.493	0.964	55.512	-2.80%	1.77%
			770	0.942	56.452	0.965	55.453	-2.38%	1.80%
			785	0.948	56.416	0.966	55.395	-1.86%	1.84%
			800	0.954	56.387	0.967	55.336	-1.34%	1.90%
01/23/2020	835 Body	21.6	820	0.945	54.407	0.969	55.258	-2.48%	-1.54%
			835	0.951	54.362	0.970	55.200	-1.96%	-1.52%
			850	0.958	54.320	0.988	55.154	-3.04%	-1.51%
01/27/2020	835 Body	19.8	820	0.962	53.196	0.969	55.258	-0.72%	-3.73%
			835	0.969	53.145	0.970	55.200	-0.10%	-3.72%
			850	0.976	53.102	0.988	55.154	-1.21%	-3.72%
01/31/2020	835 Body	21.0	820	0.944	54.604	0.969	55.258	-2.58%	-1.18%
			835	0.961	54.458	0.970	55.200	-0.93%	-1.34%
			850	0.976	54.299	0.988	55.154	-1.21%	-1.55%
02/10/2020	1750 Body	20.5	1710	1.445	55.236	1.463	53.537	-1.23%	3.17%
			1720	1.457	55.198	1.469	53.511	-0.82%	3.15%
			1745	1.486	55.118	1.485	53.445	0.07%	3.13%
			1750	1.492	55.102	1.488	53.432	0.27%	3.13%
			1770	1.514	55.031	1.501	53.379	0.87%	3.09%
			1790	1.536	54.961	1.514	53.326	1.45%	3.07%
01/21/2020	1900 Body	22.5	1850	1.522	52.071	1.520	53.300	0.13%	-2.31%
			1860	1.533	52.035	1.520	53.300	0.86%	-2.37%
			1880	1.554	51.971	1.520	53.300	2.24%	-2.49%
			1900	1.576	51.912	1.520	53.300	3.68%	-2.60%
			1905	1.581	51.897	1.520	53.300	4.01%	-2.63%
			1910	1.587	51.882	1.520	53.300	4.41%	-2.66%
01/27/2020	1900 Body	24.2	1850	1.496	51.681	1.520	53.300	-1.58%	-3.04%
			1860	1.507	51.650	1.520	53.300	-0.86%	-3.10%
			1880	1.529	51.580	1.520	53.300	0.59%	-3.23%
			1900	1.551	51.507	1.520	53.300	2.04%	-3.36%
			1905	1.556	51.488	1.520	53.300	2.37%	-3.40%
			1910	1.561	51.469	1.520	53.300	2.70%	-3.44%
02/09/2020	1900 Body	22.7	1850	1.481	52.957	1.520	53.300	-2.57%	-0.64%
			1860	1.492	52.927	1.520	53.300	-1.84%	-0.70%
			1880	1.514	52.868	1.520	53.300	-0.39%	-0.81%
			1900	1.536	52.801	1.520	53.300	1.05%	-0.94%
			1905	1.542	52.784	1.520	53.300	1.45%	-0.97%
			1910	1.547	52.769	1.520	53.300	1.78%	-1.00%
01/27/2020	2450 Body	21.5	2300	1.843	52.053	1.809	52.900	1.88%	-1.60%
			2310	1.856	52.019	1.816	52.887	2.20%	-1.64%
			2320	1.869	51.985	1.826	52.873	2.35%	-1.68%
			2400	1.974	51.690	1.902	52.767	3.79%	-2.04%
			2450	2.043	51.497	1.950	52.700	4.77%	-2.28%
			2500	2.112	51.296	2.021	52.636	4.50%	-2.55%

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 D01v01r04 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 D.

Table 10-3
System Verification Results

System Verification TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Source SN	Probe SN	Measured SAR_{1g} (W/kg)	1 W Target SAR_{1g} (W/kg)	1 W Normalized SAR_{1g} (W/kg)	$Deviation_{1g}$ (%)
L	750	HEAD	02/05/2020	22.3	20.6	0.200	1161	7410	1.740	8.030	8.700	8.34%
L	835	HEAD	02/09/2020	21.4	20.5	0.200	4d133	7410	2.030	9.430	10.150	7.64%
D	1750	HEAD	01/29/2020	21.7	20.8	0.100	1008	3914	3.830	36.200	38.300	5.80%
L	1900	HEAD	02/03/2020	21.9	19.4	0.100	5d148	7410	4.000	39.100	40.000	2.30%
E	2300	HEAD	01/30/2020	22.5	21.6	0.100	1073	7417	5.020	49.200	50.200	2.03%
E	2450	HEAD	02/05/2020	23.6	21.0	0.100	981	3589	5.130	52.300	51.300	-1.91%
E	2450	HEAD	02/08/2020	22.2	21.5	0.100	981	3589	5.240	52.300	52.400	0.19%
P	750	BODY	01/29/2020	21.5	19.6	0.200	1161	7551	1.770	8.430	8.850	4.98%
P	750	BODY	01/31/2020	20.8	21.0	0.200	1161	7551	1.820	8.430	9.100	7.95%
P	835	BODY	01/23/2020	23.1	21.6	0.200	4d133	7551	2.000	9.750	10.000	2.56%
P	835	BODY	01/27/2020	20.5	19.8	0.200	4d047	7551	2.050	9.470	10.250	8.24%
H	835	BODY	01/31/2020	22.8	21.0	0.200	4d047	7406	2.020	9.470	10.100	6.65%
I	1750	BODY	02/10/2020	21.5	20.5	0.100	1148	7357	3.810	37.700	38.100	1.06%
P	1900	BODY	01/21/2020	22.0	21.4	0.100	5d080	7551	4.010	39.200	40.100	2.30%
J	1900	BODY	01/27/2020	23.3	23.0	0.100	5d148	7571	4.210	39.100	42.100	7.67%
J	1900	BODY	02/09/2020	22.7	24.7	0.100	5d149	7571	4.220	39.400	42.200	7.11%
L	2300	BODY	01/27/2020	20.5	21.5	0.100	1073	7410	4.850	47.700	48.500	1.68%
L	2450	BODY	01/27/2020	20.5	21.5	0.100	981	7410	4.890	50.900	48.900	-3.93%

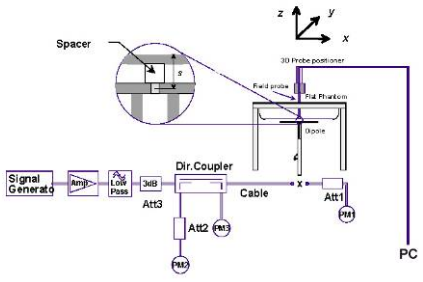


Figure 10-1
System Verification Setup Diagram

Figure 10-2
System Verification Setup Photo

11 SAR DATA SUMMARY

11.1 Standalone Head SAR Data

Table 11-1
GSM 850 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	# of Time Slots	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	32.7	32.70	0.04	Right	Cheek	01347	1	1:8.3	0.348	1.000	0.348	
836.60	190	GSM 850	GSM	32.7	32.70	0.01	Right	Tilt	01347	1	1:8.3	0.218	1.000	0.218	
836.60	190	GSM 850	GSM	32.7	32.70	0.06	Left	Cheek	01347	1	1:8.3	0.322	1.000	0.322	
836.60	190	GSM 850	GSM	32.7	32.70	0.00	Left	Tilt	01347	1	1:8.3	0.185	1.000	0.185	
836.60	190	GSM 850	GPRS	31.7	31.36	0.08	Right	Cheek	01347	2	1:4.15	0.393	1.081	**0.425**	A1
836.60	190	GSM 850	GPRS	31.7	31.36	0.01	Right	Tilt	01347	2	1:4.15	0.246	1.081	0.266	
836.60	190	GSM 850	GPRS	31.7	31.36	0.03	Left	Cheek	01347	2	1:4.15	0.360	1.081	0.389	
836.60	190	GSM 850	GPRS	31.7	31.36	0.05	Left	Tilt	01347	2	1:4.15	0.223	1.081	0.241	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11-2
GSM 1900 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	# of Time Slots	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
1880.00	661	GSM 1900	GSM	30.7	30.55	0.20	Right	Cheek	01347	1	1:8.3	0.078	1.035	0.081	
1880.00	661	GSM 1900	GSM	30.7	30.55	0.07	Right	Tilt	01347	1	1:8.3	0.058	1.035	0.060	
1880.00	661	GSM 1900	GSM	30.7	30.55	0.07	Left	Cheek	01347	1	1:8.3	0.105	1.035	0.109	
1880.00	661	GSM 1900	GSM	30.7	30.55	0.21	Left	Tilt	01347	1	1:8.3	0.045	1.035	0.047	
1880.00	661	GSM 1900	GPRS	28.7	28.35	0.03	Right	Cheek	01347	2	1:4.15	0.079	1.084	0.086	
1880.00	661	GSM 1900	GPRS	28.7	28.35	0.12	Right	Tilt	01347	2	1:4.15	0.057	1.084	0.062	
1880.00	661	GSM 1900	GPRS	28.7	28.35	-0.12	Left	Cheek	01347	2	1:4.15	0.138	1.084	0.150	A2
1880.00	661	GSM 1900	GPRS	28.7	28.35	-0.11	Left	Tilt	01347	2	1:4.15	0.060	1.084	0.065	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11-3
UMTS 850 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	25.2	25.11	-0.07	Right	Cheek	01347	1:1	0.245	1.021	0.250	
836.60	4183	UMTS 850	RMC	25.2	25.11	0.09	Right	Tilt	01347	1:1	0.130	1.021	0.133	
836.60	4183	UMTS 850	RMC	25.2	25.11	0.01	Left	Cheek	01347	1:1	0.248	1.021	0.253	A3
836.60	4183	UMTS 850	RMC	25.2	25.11	0.05	Left	Tilt	01347	1:1	0.141	1.021	0.144	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11-4
UMTS 1750 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1732.40	1412	UMTS 1750	RMC	24.7	24.54	0.15	Right	Cheek	01313	1:1	0.158	1.038	0.164	
1732.40	1412	UMTS 1750	RMC	24.7	24.54	0.11	Right	Tilt	01313	1:1	0.124	1.038	0.129	
1732.40	1412	UMTS 1750	RMC	24.7	24.54	-0.02	Left	Cheek	01313	1:1	0.250	1.038	0.260	A4
1732.40	1412	UMTS 1750	RMC	24.7	24.54	0.16	Left	Tilt	01313	1:1	0.145	1.038	0.151	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11-5
UMTS 1900 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1880.00	9400	UMTS 1900	RMC	24.7	24.64	-0.01	Right	Cheek	01347	1:1	0.198	1.014	0.201	
1880.00	9400	UMTS 1900	RMC	24.7	24.64	-0.01	Right	Tilt	01347	1:1	0.153	1.014	0.155	
1880.00	9400	UMTS 1900	RMC	24.7	24.64	0.07	Left	Cheek	01347	1:1	0.237	1.014	0.240	A5
1880.00	9400	UMTS 1900	RMC	24.7	24.64	0.13	Left	Tilt	01347	1:1	0.106	1.014	0.107	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11-6
LTE Band 12 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	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
707.50	23095	Mid	LTE Band 12	10	25.2	24.55	0.03	0	Right	Cheek	QPSK	1	25	01347	1:1	0.240	1.161	0.279	
707.50	23095	Mid	LTE Band 12	10	24.2	23.47	0.10	1	Right	Cheek	QPSK	25	25	01347	1:1	0.188	1.183	0.222	
707.50	23095	Mid	LTE Band 12	10	25.2	24.55	0.03	0	Right	Tilt	QPSK	1	25	01347	1:1	0.121	1.161	0.140	
707.50	23095	Mid	LTE Band 12	10	24.2	23.47	0.09	1	Right	Tilt	QPSK	25	25	01347	1:1	0.095	1.183	0.112	
707.50	23095	Mid	LTE Band 12	10	25.2	24.55	0.11	0	Left	Cheek	QPSK	1	25	01347	1:1	0.330	1.161	0.383	A6
707.50	23095	Mid	LTE Band 12	10	24.2	23.47	0.03	1	Left	Cheek	QPSK	25	25	01347	1:1	0.259	1.183	0.306	
707.50	23095	Mid	LTE Band 12	10	25.2	24.55	-0.15	0	Left	Tilt	QPSK	1	25	01347	1:1	0.195	1.161	0.226	
707.50	23095	Mid	LTE Band 12	10	24.2	23.47	-0.05	1	Left	Tilt	QPSK	25	25	01347	1:1	0.147	1.183	0.174	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-7
LTE Band 14 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	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
793.00	23330	Mid	LTE Band 14	10	25.2	24.54	-0.03	0	Right	Cheek	QPSK	1	25	01347	1:1	0.258	1.164	0.300	A7
793.00	23330	Mid	LTE Band 14	10	24.2	23.48	0.05	1	Right	Cheek	QPSK	25	12	01347	1:1	0.210	1.180	0.248	
793.00	23330	Mid	LTE Band 14	10	25.2	24.54	0.05	0	Right	Tilt	QPSK	1	25	01347	1:1	0.137	1.164	0.159	
793.00	23330	Mid	LTE Band 14	10	24.2	23.48	0.18	1	Right	Tilt	QPSK	25	12	01347	1:1	0.112	1.180	0.132	
793.00	23330	Mid	LTE Band 14	10	25.2	24.54	0.04	0	Left	Cheek	QPSK	1	25	01347	1:1	0.243	1.164	0.283	
793.00	23330	Mid	LTE Band 14	10	24.2	23.48	0.02	1	Left	Cheek	QPSK	25	12	01347	1:1	0.205	1.180	0.242	
793.00	23330	Mid	LTE Band 14	10	25.2	24.54	-0.21	0	Left	Tilt	QPSK	1	25	01347	1:1	0.143	1.164	0.166	
793.00	23330	Mid	LTE Band 14	10	24.2	23.48	0.18	1	Left	Tilt	QPSK	25	12	01347	1:1	0.121	1.180	0.143	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-8
LTE Band 5 (Cell) 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	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.2	24.43	0.03	0	Right	Cheek	QPSK	1	25	01347	1:1	0.302	1.194	0.361	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.2	23.50	0.06	1	Right	Cheek	QPSK	25	12	01347	1:1	0.232	1.175	0.273	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.2	24.43	0.18	0	Right	Tilt	QPSK	1	25	01347	1:1	0.168	1.194	0.201	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.2	23.50	0.08	1	Right	Tilt	QPSK	25	12	01347	1:1	0.121	1.175	0.142	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.2	24.43	-0.13	0	Left	Cheek	QPSK	1	25	01347	1:1	0.303	1.194	0.362	A8
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.2	23.50	0.13	1	Left	Cheek	QPSK	25	12	01347	1:1	0.246	1.175	0.289	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.2	24.43	0.03	0	Left	Tilt	QPSK	1	25	01347	1:1	0.175	1.194	0.209	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.2	23.50	0.04	1	Left	Tilt	QPSK	25	12	01347	1:1	0.134	1.175	0.157	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-9
LTE Band 4 (AWS) 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	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.53	0.19	0	Right	Cheek	QPSK	1	50	01313	1:1	0.165	1.040	0.172	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.35	0.15	1	Right	Cheek	QPSK	50	25	01313	1:1	0.129	1.084	0.140	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.53	-0.02	0	Right	Tilt	QPSK	1	50	01313	1:1	0.107	1.040	0.111	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.35	0.05	1	Right	Tilt	QPSK	50	25	01313	1:1	0.086	1.084	0.093	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.53	0.07	0	Left	Cheek	QPSK	1	50	01313	1:1	0.236	1.040	0.245	A9
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.35	0.14	1	Left	Cheek	QPSK	50	25	01313	1:1	0.183	1.084	0.198	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.53	0.09	0	Left	Tilt	QPSK	1	50	01313	1:1	0.132	1.040	0.137	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.35	0.11	1	Left	Tilt	QPSK	50	25	01313	1:1	0.108	1.084	0.117	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram									

Table 11-10
LTE Band 2 (PCS) 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	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.7	24.62	-0.11	0	Right	Cheek	QPSK	1	50	01347	1:1	0.171	1.019	0.174	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.7	23.48	0.00	1	Right	Cheek	QPSK	50	0	01347	1:1	0.144	1.052	0.151	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.7	24.62	0.02	0	Right	Tilt	QPSK	1	50	01347	1:1	0.127	1.019	0.129	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.7	23.48	0.20	1	Right	Tilt	QPSK	50	0	01347	1:1	0.093	1.052	0.098	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.7	24.62	0.07	0	Left	Cheek	QPSK	1	50	01347	1:1	0.212	1.019	0.216	A10
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.7	23.48	0.07	1	Left	Cheek	QPSK	50	0	01347	1:1	0.155	1.052	0.163	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.7	24.62	0.11	0	Left	Tilt	QPSK	1	50	01347	1:1	0.107	1.019	0.109	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.7	23.48	0.20	1	Left	Tilt	QPSK	50	0	01347	1:1	0.079	1.052	0.083	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram									

Table 11-11
LTE Band 30 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	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
2310.00	27710	Mid	LTE Band 30	10	24.2	23.84	0.14	0	Right	Cheek	QPSK	1	25	01321	1:1	0.161	1.086	0.175	
2310.00	27710	Mid	LTE Band 30	10	23.2	22.76	0.09	1	Right	Cheek	QPSK	25	12	01321	1:1	0.130	1.107	0.144	
2310.00	27710	Mid	LTE Band 30	10	24.2	23.84	0.18	0	Right	Tilt	QPSK	1	25	01321	1:1	0.141	1.086	0.153	
2310.00	27710	Mid	LTE Band 30	10	23.2	22.76	0.16	1	Right	Tilt	QPSK	25	12	01321	1:1	0.104	1.107	0.115	
2310.00	27710	Mid	LTE Band 30	10	24.2	23.84	0.21	0	Left	Cheek	QPSK	1	25	01321	1:1	0.209	1.086	0.227	A11
2310.00	27710	Mid	LTE Band 30	10	23.2	22.76	0.14	1	Left	Cheek	QPSK	25	12	01321	1:1	0.155	1.107	0.172	
2310.00	27710	Mid	LTE Band 30	10	24.2	23.84	0.07	0	Left	Tilt	QPSK	1	25	01321	1:1	0.126	1.086	0.137	
2310.00	27710	Mid	LTE Band 30	10	23.2	22.76	0.13	1	Left	Tilt	QPSK	25	12	01321	1:1	0.103	1.107	0.114	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram									

Table 11-12
DTS Head SAR

MEASUREMENT RESULTS																		
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.												W/kg	(W/kg)			(W/kg)	
2412	1	802.11b	DSSS	22	19.0	18.45	0.12	Right	Cheek	01255	1	99.0	0.853	0.541	1.135	1.010	0.620	
2437	6	802.11b	DSSS	22	19.0	18.47	-0.19	Right	Cheek	01255	1	99.0	0.863	0.555	1.130	1.010	**0.633**	A12
2462	11	802.11b	DSSS	22	19.0	18.43	0.12	Right	Cheek	01255	1	99.0	0.709	0.441	1.140	1.010	0.508	
2437	6	802.11b	DSSS	22	19.0	18.47	0.17	Right	Tilt	01255	1	99.0	0.512	0.368	1.130	1.010	0.420	
2437	6	802.11b	DSSS	22	19.0	18.47	0.19	Left	Cheek	01255	1	99.0	0.397	-	1.130	1.010	-	
2437	6	802.11b	DSSS	22	19.0	18.47	0.14	Left	Tilt	01255	1	99.0	0.384	-	1.130	1.010	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**								**Head** **1.6 W/kg (mW/g)** averaged over 1 gram										

Table 11-13
DSS Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	SAR (1g)	Scaling Factor (Cond Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)			(W/kg)	
2441.00	39	Bluetooth	FHSS	10.0	9.83	0.13	Right	Cheek	01255	1	77.3	0.033	1.040	1.294	**0.044**	A13
2441.00	39	Bluetooth	FHSS	10.0	9.83	0.12	Right	Tilt	01255	1	77.3	0.021	1.040	1.294	0.028	
2441.00	39	Bluetooth	FHSS	10.0	9.83	0.15	Left	Cheek	01255	1	77.3	0.015	1.040	1.294	0.020	
2441.00	39	Bluetooth	FHSS	10.0	9.83	0.15	Left	Tilt	01255	1	77.3	0.014	1.040	1.294	0.019	
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 11-14
GSM/UMTS Body-Worn SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of Time Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	32.7	32.70	-0.12	10 mm	01321	1	1:8.3	back	0.384	1.000	0.384	
836.60	190	GSM 850	GPRS	31.7	31.36	-0.14	10 mm	01321	2	1:4.15	back	0.541	1.081	0.585	A14
1880.00	661	GSM 1900	GSM	30.7	30.55	-0.18	10 mm	01347	1	1:8.3	back	0.226	1.035	0.234	
1880.00	661	GSM 1900	GPRS	28.7	28.35	-0.20	10 mm	01347	2	1:4.15	back	0.301	1.084	0.326	A15
836.60	4183	UMTS 850	RMC	25.2	25.11	0.01	10 mm	01313	N/A	1:1	back	0.291	1.021	0.297	A17
1712.40	1312	UMTS 1750	RMC	24.7	24.51	-0.01	10 mm	01339	N/A	1:1	back	0.717	1.045	0.749	
1732.40	1412	UMTS 1750	RMC	24.7	24.54	-0.10	10 mm	01339	N/A	1:1	back	0.727	1.038	**0.755**	A18
1752.60	1513	UMTS 1750	RMC	24.7	24.53	-0.03	10 mm	01339	N/A	1:1	back	0.653	1.040	0.679	
1880.00	9400	UMTS 1900	RMC	24.7	24.64	-0.02	10 mm	01313	N/A	1:1	back	0.577	1.014	0.585	A19
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**												**Body** **1.6 W/kg (mW/g)** averaged over 1 gram			

Table 11-15
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	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
707.50	23095	Mid	LTE Band 12	10	25.2	24.55	0.01	0	01339	QPSK	1	25	10 mm	back	1:1	0.469	1.161	0.545	A21
707.50	23095	Mid	LTE Band 12	10	24.2	23.47	0.05	1	01339	QPSK	25	25	10 mm	back	1:1	0.368	1.183	0.435	
793.00	23330	Mid	LTE Band 14	10	25.2	24.54	-0.12	0	01339	QPSK	1	25	10 mm	back	1:1	0.409	1.164	0.476	A23
793.00	23330	Mid	LTE Band 14	10	24.2	23.48	0.05	1	01339	QPSK	25	12	10 mm	back	1:1	0.311	1.180	0.367	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.2	24.43	0.02	0	01321	QPSK	1	25	10 mm	back	1:1	0.392	1.194	0.468	A25
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.2	23.50	0.04	1	01321	QPSK	25	12	10 mm	back	1:1	0.299	1.175	0.351	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.53	0.04	0	01321	QPSK	1	50	10 mm	back	1:1	0.705	1.040	0.733	A27
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.35	0.04	1	01321	QPSK	50	25	10 mm	back	1:1	0.563	1.084	0.610	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.7	24.62	-0.09	0	01313	QPSK	1	50	10 mm	back	1:1	0.503	1.019	0.513	A29
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.7	23.48	0.06	1	01313	QPSK	50	0	10 mm	back	1:1	0.415	1.052	0.437	
2310.00	27710	Mid	LTE Band 30	10	24.2	23.84	0.12	0	01313	QPSK	1	25	10 mm	back	1:1	0.548	1.086	0.595	A31
2310.00	27710	Mid	LTE Band 30	10	23.2	22.76	0.12	1	01313	QPSK	25	12	10 mm	back	1:1	0.436	1.107	0.483	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**																**Body** **1.6 W/kg (mW/g)** averaged over 1 gram			

Table 11-16
DTS Body-Worn SAR

MEASUREMENT RESULTS																		
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.												W/kg	(W/kg)			(W/kg)	
2437	6	802.11b	DSSS	22	19.0	18.47	-0.14	10 mm	01255	1	back	99.0	0.478	0.288	1.130	1.010	0.329	A33
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 Hotspot SAR Data

Table 11-17
GPRS/UMTS Hotspot SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of Time Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	190	GSM 850	GPRS	31.7	31.36	-0.14	10 mm	01321	2	1:4.15	back	0.541	1.081	0.585	A14
836.60	190	GSM 850	GPRS	31.7	31.36	0.14	10 mm	01321	2	1:4.15	front	0.397	1.081	0.429	
836.60	190	GSM 850	GPRS	31.7	31.36	0.15	10 mm	01321	2	1:4.15	bottom	0.190	1.081	0.205	
836.60	190	GSM 850	GPRS	31.7	31.36	-0.12	10 mm	01321	2	1:4.15	left	0.392	1.081	0.424	
1880.00	661	GSM 1900	GPRS	28.7	28.35	-0.20	10 mm	01347	2	1:4.15	back	0.301	1.084	0.326	
1880.00	661	GSM 1900	GPRS	28.7	28.35	-0.10	10 mm	01347	2	1:4.15	front	0.317	1.084	0.344	
1880.00	661	GSM 1900	GPRS	28.7	28.35	-0.06	10 mm	01347	2	1:4.15	bottom	0.397	1.084	0.430	A16
1880.00	661	GSM 1900	GPRS	28.7	28.35	0.03	10 mm	01347	2	1:4.15	right	0.095	1.084	0.103	
836.60	4183	UMTS 850	RMC	25.2	25.11	0.01	10 mm	01313	N/A	1:1	back	0.291	1.021	0.297	A17
836.60	4183	UMTS 850	RMC	25.2	25.11	0.01	10 mm	01313	N/A	1:1	front	0.254	1.021	0.259	
836.60	4183	UMTS 850	RMC	25.2	25.11	-0.17	10 mm	01313	N/A	1:1	bottom	0.147	1.021	0.150	
836.60	4183	UMTS 850	RMC	25.2	25.11	0.02	10 mm	01313	N/A	1:1	left	0.239	1.021	0.244	
1712.40	1312	UMTS 1750	RMC	24.7	24.51	-0.01	10 mm	01339	N/A	1:1	back	0.717	1.045	0.749	
1732.40	1412	UMTS 1750	RMC	24.7	24.54	-0.10	10 mm	01339	N/A	1:1	back	0.727	1.038	0.755	A18
1752.60	1513	UMTS 1750	RMC	24.7	24.53	-0.03	10 mm	01339	N/A	1:1	back	0.653	1.040	0.679	
1732.40	1412	UMTS 1750	RMC	24.7	24.54	-0.06	10 mm	01339	N/A	1:1	front	0.669	1.038	0.694	
1732.40	1412	UMTS 1750	RMC	24.7	24.54	-0.02	10 mm	01339	N/A	1:1	bottom	0.713	1.038	0.740	
1732.40	1412	UMTS 1750	RMC	24.7	24.54	0.14	10 mm	01339	N/A	1:1	right	0.164	1.038	0.170	
1880.00	9400	UMTS 1900	RMC	24.7	24.64	-0.02	10 mm	01313	N/A	1:1	back	0.577	1.014	0.585	
1880.00	9400	UMTS 1900	RMC	24.7	24.64	-0.03	10 mm	01313	N/A	1:1	front	0.578	1.014	0.586	
1852.40	9262	UMTS 1900	RMC	24.7	24.69	-0.01	10 mm	01313	N/A	1:1	bottom	0.705	1.002	0.706	A20
1880.00	9400	UMTS 1900	RMC	24.7	24.64	0.01	10 mm	01313	N/A	1:1	bottom	0.598	1.014	0.606	
1907.60	9538	UMTS 1900	RMC	24.7	24.63	0.03	10 mm	01313	N/A	1:1	bottom	0.613	1.016	0.623	
1880.00	9400	UMTS 1900	RMC	24.7	24.64	0.03	10 mm	01313	N/A	1:1	right	0.193	1.014	0.196	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11-18
LTE Band 12 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	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
707.50	23095	Mid	LTE Band 12	10	25.2	24.55	0.01	0	01339	QPSK	1	25	10 mm	back	1:1	0.469	1.161	0.545	
707.50	23095	Mid	LTE Band 12	10	24.2	23.47	0.05	1	01339	QPSK	25	25	10 mm	back	1:1	0.368	1.183	0.435	
707.50	23095	Mid	LTE Band 12	10	25.2	24.55	0.00	0	01339	QPSK	1	25	10 mm	front	1:1	0.388	1.161	0.450	
707.50	23095	Mid	LTE Band 12	10	24.2	23.47	0.03	1	01339	QPSK	25	25	10 mm	front	1:1	0.290	1.183	0.343	
707.50	23095	Mid	LTE Band 12	10	25.2	24.55	0.01	0	01339	QPSK	1	25	10 mm	bottom	1:1	0.134	1.161	0.156	
707.50	23095	Mid	LTE Band 12	10	24.2	23.47	0.06	1	01339	QPSK	25	25	10 mm	bottom	1:1	0.107	1.183	0.127	
707.50	23095	Mid	LTE Band 12	10	25.2	24.55	-0.03	0	01339	QPSK	1	25	10 mm	left	1:1	0.488	1.161	0.567	A22
707.50	23095	Mid	LTE Band 12	10	24.2	23.47	0.04	1	01339	QPSK	25	25	10 mm	left	1:1	0.345	1.183	0.408	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Body 1.6 W/kg (mW/g) averaged over 1 gram									

Table 11-19
LTE Band 14 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	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
793.00	23330	Mid	LTE Band 14	10	25.2	24.54	-0.12	0	01339	QPSK	1	25	10 mm	back	1:1	0.409	1.164	0.476	
793.00	23330	Mid	LTE Band 14	10	24.2	23.48	0.05	1	01339	QPSK	25	12	10 mm	back	1:1	0.311	1.180	0.367	
793.00	23330	Mid	LTE Band 14	10	25.2	24.54	-0.02	0	01339	QPSK	1	25	10 mm	front	1:1	0.412	1.164	0.480	
793.00	23330	Mid	LTE Band 14	10	24.2	23.48	0.02	1	01339	QPSK	25	12	10 mm	front	1:1	0.315	1.180	0.372	
793.00	23330	Mid	LTE Band 14	10	25.2	24.54	0.01	0	01339	QPSK	1	25	10 mm	bottom	1:1	0.166	1.164	0.193	
793.00	23330	Mid	LTE Band 14	10	24.2	23.48	-0.06	1	01339	QPSK	25	12	10 mm	bottom	1:1	0.128	1.180	0.151	
793.00	23330	Mid	LTE Band 14	10	25.2	24.54	-0.12	0	01339	QPSK	1	25	10 mm	left	1:1	0.468	1.164	0.545	A24
793.00	23330	Mid	LTE Band 14	10	24.2	23.48	-0.02	1	01339	QPSK	25	12	10 mm	left	1:1	0.349	1.180	0.412	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Body 1.6 W/kg (mW/g) averaged over 1 gram									

Table 11-20
LTE Band 5 (Cell) 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	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.2	24.43	0.02	0	01321	QPSK	1	25	10 mm	back	1:1	0.392	1.194	0.468	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.2	23.50	0.04	1	01321	QPSK	25	12	10 mm	back	1:1	0.299	1.175	0.351	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.2	24.43	0.00	0	01321	QPSK	1	25	10 mm	front	1:1	0.394	1.194	0.470	A26
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.2	23.50	0.01	1	01321	QPSK	25	12	10 mm	front	1:1	0.306	1.175	0.360	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.2	24.43	0.01	0	01321	QPSK	1	25	10 mm	bottom	1:1	0.239	1.194	0.285	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.2	23.50	-0.01	1	01321	QPSK	25	12	10 mm	bottom	1:1	0.188	1.175	0.221	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.2	24.43	0.00	0	01321	QPSK	1	25	10 mm	left	1:1	0.381	1.194	0.455	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.2	23.50	0.02	1	01321	QPSK	25	12	10 mm	left	1:1	0.302	1.175	0.355	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population													Body 1.6 W/kg (mW/g) averaged over 1 gram						

Table 11-21
LTE Band 4 (AWS) 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	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.53	0.04	0	01321	QPSK	1	50	10 mm	back	1:1	0.705	1.040	0.733	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.35	0.04	1	01321	QPSK	50	25	10 mm	back	1:1	0.563	1.084	0.610	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.53	0.07	0	01321	QPSK	1	50	10 mm	front	1:1	0.657	1.040	0.683	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.35	0.02	1	01321	QPSK	50	25	10 mm	front	1:1	0.513	1.084	0.556	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.53	-0.01	0	01321	QPSK	1	50	10 mm	bottom	1:1	0.731	1.040	0.760	A28
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.35	0.02	1	01321	QPSK	50	25	10 mm	bottom	1:1	0.579	1.084	0.628	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.7	24.53	0.05	0	01321	QPSK	1	50	10 mm	right	1:1	0.174	1.040	0.181	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.7	23.35	0.10	1	01321	QPSK	50	25	10 mm	right	1:1	0.141	1.084	0.153	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population													Body 1.6 W/kg (mW/g) averaged over 1 gram						

Table 11-22
LTE Band 2 (PCS) 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	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.7	24.62	-0.09	0	01313	QPSK	1	50	10 mm	back	1:1	0.503	1.019	0.513	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.7	23.48	0.06	1	01313	QPSK	50	0	10 mm	back	1:1	0.415	1.052	0.437	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.7	24.62	-0.04	0	01313	QPSK	1	50	10 mm	front	1:1	0.568	1.019	0.579	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.7	23.48	-0.04	1	01313	QPSK	50	0	10 mm	front	1:1	0.463	1.052	0.487	
1860.00	18700	Low	LTE Band 2 (PCS)	20	24.7	24.56	-0.03	0	01313	QPSK	1	50	10 mm	bottom	1:1	0.626	1.033	0.647	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.7	24.62	-0.13	0	01313	QPSK	1	50	10 mm	bottom	1:1	0.654	1.019	0.666	A30
1900.00	19100	High	LTE Band 2 (PCS)	20	24.7	24.59	-0.11	0	01313	QPSK	1	50	10 mm	bottom	1:1	0.624	1.026	0.640	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.7	23.48	0.02	1	01313	QPSK	50	0	10 mm	bottom	1:1	0.532	1.052	0.560	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.7	24.62	0.01	0	01313	QPSK	1	50	10 mm	right	1:1	0.173	1.019	0.176	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.7	23.48	0.00	1	01313	QPSK	50	0	10 mm	right	1:1	0.152	1.052	0.160	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population													Body 1.6 W/kg (mW/g) averaged over 1 gram						

Table 11-23
LTE Band 30 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	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
2310.00	27710	Mid	LTE Band 30	10	24.2	23.84	0.12	0	01313	QPSK	1	25	10 mm	back	1:1	0.548	1.086	0.595	
2310.00	27710	Mid	LTE Band 30	10	23.2	22.76	0.12	1	01313	QPSK	25	12	10 mm	back	1:1	0.436	1.107	0.483	
2310.00	27710	Mid	LTE Band 30	10	24.2	23.84	-0.03	0	01313	QPSK	1	25	10 mm	front	1:1	0.484	1.086	0.526	
2310.00	27710	Mid	LTE Band 30	10	23.2	22.76	-0.03	1	01313	QPSK	25	12	10 mm	front	1:1	0.383	1.107	0.424	
2310.00	27710	Mid	LTE Band 30	10	24.2	23.84	-0.09	0	01313	QPSK	1	25	10 mm	bottom	1:1	0.751	1.086	**0.816**	A32
2310.00	27710	Mid	LTE Band 30	10	23.2	22.76	-0.08	1	01313	QPSK	25	12	10 mm	bottom	1:1	0.592	1.107	0.655	
2310.00	27710	Mid	LTE Band 30	10	23.2	22.71	-0.07	1	01313	QPSK	50	0	10 mm	bottom	1:1	0.583	1.119	0.652	
2310.00	27710	Mid	LTE Band 30	10	24.2	23.84	0.00	0	01313	QPSK	1	25	10 mm	right	1:1	0.239	1.086	0.260	
2310.00	27710	Mid	LTE Band 30	10	23.2	22.76	0.00	1	01313	QPSK	25	12	10 mm	right	1:1	0.190	1.107	0.210	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population													Body 1.6 W/kg (mW/g) averaged over 1 gram						

Table 11-24
WLAN Hotspot SAR

MEASUREMENT RESULTS																		
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.												W/kg	(W/kg)			(W/kg)	
2437	6	802.11b	DSSS	22	19.0	18.47	-0.14	10 mm	01255	1	back	99.0	0.478	0.288	1.130	1.010	0.329	A33
2437	6	802.11b	DSSS	22	19.0	18.47	-0.05	10 mm	01255	1	front	99.0	0.124	-	1.130	1.010	-	
2437	6	802.11b	DSSS	22	19.0	18.47	0.11	10 mm	01255	1	top	99.0	0.172	-	1.130	1.010	-	
2437	6	802.11b	DSSS	22	19.0	18.47	-0.04	10 mm	01255	1	left	99.0	0.162	-	1.130	1.010	-	
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 1528-2013, and FCC KDB Publication 447498 D01v06.
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 D01v06.
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 D04v01r03, 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 Publication 865664 D01v01r04, variability SAR tests were not required since measured SAR results for all frequency bands were less than 0.8 W/kg. Please see Section 13 for variability analysis.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v02r01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.7 for more details).

GSM Test Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
2. Justification for reduced test configurations per KDB Publication 941225 D01v03r01 and October 2013 TCB Workshop Notes: The source-based frame-averaged output power was evaluated for all GPRS/EDGE slot configurations. The configuration with the highest target frame averaged output power was evaluated for hotspot SAR. When the maximum frame-averaged powers are equivalent across two or more slots (within 0.25 dB), the configuration with the most number of time slots was tested.
3. Per FCC KDB Publication 447498 D01v06, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg for 1g evaluations then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel was used.
4. GPRS was additionally evaluated for head and body-worn exposure conditions to address possible VoIP scenarios.

UMTS Notes:

1. UMTS mode was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v03r01. AMR and HSPA SAR was not required per the 3G Test Reduction Procedure in KDB Publication 941225 D01v03r01.
2. Per FCC KDB Publication 447498 D01v06, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg for 1g evaluations then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel was used.

LTE Notes:

1. LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r04. The general test procedures used for testing can be found in Section 8.5.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).
4. Per KDB Publication 941225 D05Av01r02, SAR for downlink only LTE CA operations was not needed since the maximum average output power in LTE CA mode was not >0.25 dB higher than the maximum output power when downlink carrier aggregation was inactive

WLAN Notes:

1. For held-to-ear and hotspot operations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg for 1g evaluations, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.
2. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 2.4 GHz WIFI single transmission chain operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 8.6.3 for more information.
3. When the maximum reported 1g averaged SAR is ≤0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg for 1g evaluations or all test channels were measured.
4. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. Procedures used to measure the duty factor are identical to that in the associated EMC test reports.

Bluetooth Notes

1. Bluetooth SAR was measured with the device connected to a call box with hopping disabled with DH5 operation and Tx Tests test mode type. Per October 2016 TCB Workshop Notes, the reported SAR was scaled to the 100% transmission duty factor to determine compliance. See Section 9.5 for the time domain plot and calculation for the duty factor of the device.
2. Bluetooth Head SAR was evaluated for BT BR tethering applications.

12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

12.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v06 are applicable to devices with built-in unlicensed transmitters such as 802.11 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 Publication 447498 D01v06 4.3.2 and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤1.6 W/kg. The different test positions in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1g or 10g SAR.

When standalone SAR is not required to be measured, per FCC KDB 447498 D01v06 4.3.2 b), the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

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

Table 12-1
Estimated SAR

Mode	Frequency	Maximum Allowed Power	Separation Distance (Body)	Estimated SAR (Body)
	[MHz]	[dBm]	[mm]	[W/kg]
Bluetooth	2480	10.00	10	0.210

Note: Per KDB Publication 447498 D01v06, the maximum power of the channel was rounded to the nearest mW before calculation.

12.3 Head SAR Simultaneous Transmission Analysis

For test positions that were not required to be evaluated for WLAN SAR per FCC KDB publication 248227, the worst case WLAN SAR result for the applicable exposure conditions was used for simultaneous transmission analysis.

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

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Head SAR	GSM/GPRS 850	0.425	0.633	**1.058**
	GSM/GPRS 1900	0.150	0.633	0.783
	UMTS 850	0.253	0.633	0.886
	UMTS 1750	0.260	0.633	0.893
	UMTS 1900	0.240	0.633	0.873
	LTE Band 12	0.383	0.633	1.016
	LTE Band 14	0.300	0.633	0.933
	LTE Band 5 (Cell)	0.362	0.633	0.995
	LTE Band 4 (AWS)	0.245	0.633	0.878
	LTE Band 2 (PCS)	0.216	0.633	0.849
	LTE Band 30	0.227	0.633	0.860

Table 12-3
Simultaneous Transmission Scenario with Bluetooth (Held to Ear)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Head SAR	GSM/GPRS 850	0.425	0.044	**0.469**
	GSM/GPRS 1900	0.150	0.044	0.194
	UMTS 850	0.253	0.044	0.297
	UMTS 1750	0.260	0.044	0.304
	UMTS 1900	0.240	0.044	0.284
	LTE Band 12	0.383	0.044	0.427
	LTE Band 14	0.300	0.044	0.344
	LTE Band 5 (Cell)	0.362	0.044	0.406
	LTE Band 4 (AWS)	0.245	0.044	0.289
	LTE Band 2 (PCS)	0.216	0.044	0.260
	LTE Band 30	0.227	0.044	0.271

12.4 Body-Worn Simultaneous Transmission Analysis

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

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body-Worn	GSM/GPRS 850	0.585	0.329	0.914
	GSM/GPRS 1900	0.326	0.329	0.655
	UMTS 850	0.297	0.329	0.626
	UMTS 1750	0.755	0.329	**1.084**
	UMTS 1900	0.585	0.329	0.914
	LTE Band 12	0.545	0.329	0.874
	LTE Band 14	0.476	0.329	0.805
	LTE Band 5 (Cell)	0.468	0.329	0.797
	LTE Band 4 (AWS)	0.733	0.329	1.062
	LTE Band 2 (PCS)	0.513	0.329	0.842
	LTE Band 30	0.595	0.329	0.924

Table 12-5
Simultaneous Transmission Scenario with Bluetooth (Body-Worn at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Body-Worn	GSM/GPRS 850	0.585	0.210	0.795
	GSM/GPRS 1900	0.326	0.210	0.536
	UMTS 850	0.297	0.210	0.507
	UMTS 1750	0.755	0.210	**0.965**
	UMTS 1900	0.585	0.210	0.795
	LTE Band 12	0.545	0.210	0.755
	LTE Band 14	0.476	0.210	0.686
	LTE Band 5 (Cell)	0.468	0.210	0.678
	LTE Band 4 (AWS)	0.733	0.210	0.943
	LTE Band 2 (PCS)	0.513	0.210	0.723
	LTE Band 30	0.595	0.210	0.805

Note: Bluetooth SAR was not required to be measured per FCC KDB Publication 447498 D01v06. 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 D06v02r01, the devices edges with antennas more than 2.5 cm from edge are not required to be evaluated for SAR.

For test positions that were not required to be evaluated for WLAN SAR per FCC KDB publication 248227, the worst case WLAN SAR result for the applicable exposure conditions was used for simultaneous transmission analysis.

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

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Hotspot SAR	GPRS 850	0.585	0.329	0.914
	GPRS 1900	0.430	0.329	0.759
	UMTS 850	0.297	0.329	0.626
	UMTS 1750	0.755	0.329	1.084
	UMTS 1900	0.706	0.329	1.035
	LTE Band 12	0.567	0.329	0.896
	LTE Band 14	0.545	0.329	0.874
	LTE Band 5 (Cell)	0.470	0.329	0.799
	LTE Band 4 (AWS)	0.760	0.329	1.089
	LTE Band 2 (PCS)	0.666	0.329	0.995
	LTE Band 30	0.816	0.329	**1.145**

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

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
		1	2	1+2
Hotspot SAR	GPRS 850	0.585	0.210	0.795
	GPRS 1900	0.430	0.210	0.640
	UMTS 850	0.297	0.210	0.507
	UMTS 1750	0.755	0.210	0.965
	UMTS 1900	0.706	0.210	0.916
	LTE Band 12	0.567	0.210	0.777
	LTE Band 14	0.545	0.210	0.755
	LTE Band 5 (Cell)	0.470	0.210	0.680
	LTE Band 4 (AWS)	0.760	0.210	0.970
	LTE Band 2 (PCS)	0.666	0.210	0.876
	LTE Band 30	0.816	0.210	**1.026**

Note: Bluetooth SAR was not required to be measured per FCC KDB Publication 447498 D01v06. Estimated SAR results were used in the above table to determine simultaneous transmission SAR test exclusion.

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 D01v06 and IEEE 1528-2013 Section 6.3.4.1.2.

13 SAR MEASUREMENT VARIABILITY

13.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01r04, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

1) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
2) A second repeated measurement was performed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1g SAR limit).
3) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

13.2 Measurement Uncertainty

The measured SAR was <1.5 W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE 1528-2013 was not required.

14 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	3/11/2019	Annual	3/11/2020	US39170122
Agilent	8753ES	S-Parameter Network Analyzer	8/26/2019	Annual	8/26/2020	MY40000670
Agilent	8753ES	S-Parameter Vector Network Analyzer	9/19/2019	Annual	9/19/2020	MY40003841
Agilent	E4438C	ESG Vector Signal Generator	5/22/2019	Annual	5/22/2020	MY45091346
Agilent	E4438C	ESG Vector Signal Generator	5/23/2019	Annual	5/23/2020	MY47270002
Agilent	E4438C	ESG Vector Signal Generator	3/8/2019	Biennial	3/8/2021	MY42082385
Agilent	E4438C	ESG Vector Signal Generator	3/11/2019	Biennial	3/11/2021	MY45090700
Agilent	E5515C	Wireless Communications Test Set	6/26/2019	Annual	6/26/2020	MY50267125
Agilent	E5515C	Wireless Communications Test Set	9/25/2019	Annual	9/25/2020	GB43304278
Agilent	E5515C	Wireless Communications Test Set	2/7/2018	Triennial	2/7/2021	GB43304447
Agilent	N5182A	MXG Vector Signal Generator	7/10/2019	Annual	7/10/2020	MY47420800
Agilent	N9020A	MXA Signal Analyzer	4/20/2019	Annual	4/20/2020	US46470561
Agilent	N9030A	PXA Signal Analyzer (44GHz)	6/12/2019	Annual	6/12/2020	MY52350166
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433974
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433975
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433976
Anritsu	MA24106A	USB Power Sensor	3/5/2019	Annual	3/5/2020	1344555
Anritsu	MA24106A	USB Power Sensor	4/17/2019	Annual	4/17/2020	1344556
Anritsu	MA24106A	USB Power Sensor	7/15/2019	Annual	7/15/2020	1349513
Anritsu	MA2411B	Pulse Power Sensor	3/6/2019	Annual	3/6/2020	1339018
Anritsu	MA2411B	Pulse Power Sensor	6/11/2019	Annual	6/11/2020	1207364
Anritsu	MA2411B	Pulse Power Sensor	8/8/2019	Annual	8/8/2020	1339008
Anritsu	ML2496A	Power Meter	11/6/2019	Annual	11/6/2020	1405003
Anritsu	ML2495A	Power Meter	12/17/2019	Annual	12/17/2020	941001
Anritsu	MT8820C	Radio Communication Analyzer	3/29/2019	Annual	3/29/2020	6201300731
Anritsu	MT8821C	Radio Communication Analyzer	3/6/2019	Annual	3/6/2020	6201381794
Anritsu	MT8821C	Radio Communication Analyzer	5/13/2019	Annual	5/13/2020	6201524637
Anritsu	MT8862A	Wireless Connectivity Test Set	8/8/2019	Annual	8/8/2020	6261782395
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291470
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291455
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291460
Control Company	4040	Therm./Clock/Humidity Monitor	6/29/2019	Biennial	6/29/2021	192291463
Control Company	4352	Long Stem Thermometer	6/26/2019	Biennial	6/26/2021	192282744
Control Company	4352	Long Stem Thermometer	6/26/2019	Biennial	6/26/2021	192282753
Control Company	4352	Ultra Long Stem Thermometer	11/29/2018	Biennial	11/29/2020	181766801
Control Company	4352	Ultra Long Stem Thermometer	11/29/2018	Biennial	11/29/2020	181766777
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	7/2/2019	Annual	7/2/2020	MY53401181
Keysight Technologies	N6705B	DC Power Analyzer	4/27/2019	Biennial	4/27/2021	MY53004059
Narda	4772-3	Attenuator (3dB)	N/A	N/A	N/A	9406
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Pasternack	NC-100	Torque Wrench	5/23/2018	Biennial	5/23/2020	N/A
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	CMW500	Radio Communication Tester	8/26/2019	Annual	8/26/2020	100976
Rohde & Schwarz	CMW500	Radio Communication Tester	8/27/2019	Annual	8/27/2020	116743
Rohde & Schwarz	CMW500	Radio Communication Tester	10/4/2019	Annual	10/4/2020	166462
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	10/11/2019	Annual	10/11/2020	101307
Rohde& Schwarz	CMW500	Wideband Radio Communication Tester	7/12/2019	Annual	7/12/2020	145645
Rohde& Schwarz	CMW500	Wideband Radio Communication Tester	7/24/2019	Annual	7/24/2020	151849
Seekonk	NC-100	Torque Wrench (8" lb)	5/10/2018	Biennial	5/10/2020	21053
SPEAG	D750V3	750 MHz SAR Dipole	10/19/2018	Biennial	10/19/2020	1161
SPEAG	D835V2	835 MHz SAR Dipole	3/13/2019	Annual	3/13/2020	4d047
SPEAG	D835V2	835 MHz SAR Dipole	10/19/2020	Biennial	10/19/2020	4d133
SPEAG	D1750V2	1750 MHz SAR Dipole	5/15/2019	Annual	5/15/2020	1148
SPEAG	D1765V2	1765 MHz SAR Dipole	5/23/2018	Biennial	5/23/2020	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	10/23/2018	Biennial	10/23/2020	5d080
SPEAG	D1900V2	1900 MHz SAR Dipole	10/23/2018	Biennial	10/23/2020	5d149
SPEAG	D1900V2	1900 MHz SAR Dipole	2/21/2019	Biennial	2/21/2021	5d148
SPEAG	D2300V2	2300 MHz SAR Dipole	8/13/2018	Biennial	8/13/2020	1073
SPEAG	D2450V2	2450 MHz SAR Dipole	8/16/2018	Biennial	8/16/2020	981
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/7/2019	Annual	5/7/2020	1070
SPEAG	DAK-3.5	Dielectric Assessment Kit	10/22/2019	Annual	10/22/2020	1091
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/13/2019	Annual	2/13/2020	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/14/2019	Annual	2/14/2020	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/18/2019	Annual	4/18/2020	1407
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2019	Annual	7/11/2020	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/8/2019	Annual	5/8/2020	728
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/17/2019	Annual	9/17/2020	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/13/2020	Annual	1/13/2021	1558
SPEAG	DAE4	Dasy Data Acquisition Electronics	12/5/2019	Annual	12/5/2020	1533
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	3914
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	7417
SPEAG	EX3DV4	SAR Probe	4/24/2019	Annual	4/24/2020	7357
SPEAG	EX3DV4	SAR Probe	5/16/2019	Annual	5/16/2020	7406
SPEAG	EX3DV4	SAR Probe	1/21/2020	Annual	1/21/2021	3589
SPEAG	EX3DV4	SAR Probe	7/16/2019	Annual	7/16/2020	7410
SPEAG	EX3DV4	SAR Probe	9/19/2019	Annual	9/19/2020	7551
SPEAG	EX3DV4	SAR Probe	12/11/2019	Annual	12/11/2020	7571

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	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i 1gm**	**c_i 10 gms**	**1gm u_i (± %)**	**10gms u_i (± %)**	**v_i**
Measurement System								
Probe Calibration	6.55	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	1.3	N	1	0.7	0.7	0.9	0.9	∞
Boundary Effect	2.0	R	1.73	1.0	1.0	1.2	1.2	∞
Linearity	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	0.25	R	1.73	1.0	1.0	0.1	0.1	∞
Readout Electronics	0.3	N	1	1.0	1.0	0.3	0.3	∞
Response Time	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions - Noise	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
RF Ambient Conditions - Reflections	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	6.7	R	1.73	1.0	1.0	3.9	3.9	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Test Sample Related								
Test Sample Positioning	2.7	N	1	1.0	1.0	2.7	2.7	35
Device Holder Uncertainty	1.67	N	1	1.0	1.0	1.7	1.7	5
Output Power Variation - SAR drift measurement	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
SAR Scaling	0.0	R	1.73	1.0	1.0	0.0	0.0	∞
Phantom & Tissue Parameters								
Phantom Uncertainty (Shape & Thickness tolerances)	7.6	R	1.73	1.0	1.0	4.4	4.4	∞
Liquid Conductivity - measurement uncertainty	4.2	N	1	0.78	0.71	3.3	3.0	10
Liquid Permittivity - measurement uncertainty	4.1	N	1	0.23	0.26	1.0	1.1	10
Liquid Conductivity - Temperature Uncertainty	3.4	R	1.73	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Unceritainty	0.6	R	1.73	0.23	0.26	0.1	0.1	∞
Liquid Conductivity - deviation from target values	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)		RSS				11.5	11.3	60
Expanded Uncertainty (95% CONFIDENCE LEVEL)		k=2				23.0	22.6	

16 CONCLUSION

16.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Innovation, Science, and Economic Development 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]

17 REFERENCES

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

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

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

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

[5] IEEE Standards Coordinating Committee 39 –Standards Coordinating Committee 34 – IEEE Std. 1528-2013, IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

[20] IEC 62209-1, Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1: Devices used next to the ear (Frequency range of 300 MHz to 6 GHz), July 2016.

[21] Innovation, Science, Economic Development Canada RSS-102 Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 5, March 2015.

[22] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2015

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

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

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

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

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

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

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

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