

TEST REPORT



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1. Report No : DRRFCC1808-0086
2. Customer
 - Name : LG Electronics USA, Inc.
 - Address : 1000 Sylvan Ave. Englewood Cliffs, New Jersey, United States 07632
3. Use of Report : FCC Original Grant
4. Product Name / Model Name : Mobile Phone / LET
FCC ID : ZNFLET
5. Test Method Used : IEEE 1528-2013, FCC SAR KDB Publications (Details in test report)
Test Specification : CFR §2.1093
6. Date of Test : 2018.07.24 ~ 2018.08.08
7. Testing Environment : Refer to appended test report.
8. Test Result : Refer to attached test report.

Affirmation	Tested by		Reviewed by	
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Test Report Version

Test Report No.	Date	Description
DRRFCC1808-0086	Aug. 13, 2018	Initial issue

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1. DESCRIPTION OF DEVICE

1.1 General Information

EUT type	Mobile Phone				
FCC ID	ZNFLET				
Equipment model name	LET				
Equipment add model name	N/A				
Equipment serial no.	Identical prototype				
Mode(s) of Operation	GSM 850, GSM 1900, WCDMA 850, LTE Band 17, 2.4 G W-LAN (802.11b/g/n-HT20), 5 G W-LAN (802.11a/n-HT20/n-HT40/ac-VHT20/ac-VHT40/ac-VHT80), Bluetooth				
TX Frequency Range	Band	Mode	Operating Modes	Bandwidth	Frequency
	GSM 850	GSM/GPRS/EDGE	Voice/Data	-	824.2 ~ 848.8 MHz
	GSM 1900	GSM/GPRS/EDGE	Voice/Data	-	1850.2 ~ 1909.8 MHz
	WCDMA 850	WCDMA	Voice/Data	-	826.4 ~ 846.6 MHz
	LTE Band 17	LTE	Voice/Data	5/10MHz	706.5 ~ 713.5 MHz
	2.4 GHz W-LAN	802.11b/g/n	Voice/Data	HT20	2412 ~ 2472 MHz
	5.2 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5180 ~ 5240 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5190 ~ 5230 MHz
		802.11ac	Voice/Data	VHT80	5210 MHz
	5.3 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5260 ~ 5320 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5270 ~ 5310 MHz
		802.11ac	Voice/Data	VHT80	5290 MHz
	5.6 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5500 ~ 5700 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5510 ~ 5670 MHz
		802.11ac	Voice/Data	VHT80	5530 ~ 5610 MHz
	5.8 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5745 ~ 5825 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5755 ~ 5795 MHz
		802.11ac	Voice/Data	VHT80	5775 MHz
	Bluetooth	-	Data	-	2402 ~ 2480 MHz
RX Frequency Range	GSM 850	GSM/GPRS/EDGE	Voice/Data	-	869.2 ~ 893.8 MHz
	GSM 1900	GSM/GPRS/EDGE	Voice/Data	-	1930.2 ~ 1989.8 MHz
	WCDMA 850	WCDMA	Voice/Data	-	871.4 ~ 891.6 MHz
	LTE Band 17	LTE	Voice/Data	5/10MHz	736.5 ~ 743.5 MHz
	2.4 GHz W-LAN	802.11b/g/n	Voice/Data	HT20	2412 ~ 2472 MHz
	5.2 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5180 ~ 5240 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5190 ~ 5230 MHz
		802.11ac	Voice/Data	VHT80	5210 MHz
	5.3 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT200	5260 ~ 5320 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5270 ~ 5310 MHz
		802.11ac	Voice/Data	VHT80	5290 MHz
	5.6 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5500 ~ 5700 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5510 ~ 5670 MHz
		802.11ac	Voice/Data	VHT80	5530 ~ 5610 MHz
	5.8 GHz W-LAN	802.11a/n/ac	Voice/Data	HT20/VHT20	5745 ~ 5825 MHz
		802.11n/ac	Voice/Data	HT40/VHT40	5755 ~ 5795 MHz
		802.11ac	Voice/Data	VHT80	5775 MHz
	Bluetooth	-	Data	-	2402 ~ 2480 MHz

SAR Summary Table

Equipment Class	Band	Reported SAR		
		1g SAR (W/kg)		
		Head	Body-Worn	Hotspot
PCE	GSM 850	0.50	0.62	-
PCE	GPRS 850	0.59	0.77	0.77
PCE	GSM 1900	0.26	0.26	-
PCE	GPRS 1900	0.38	0.38	0.38
PCE	WCDMA 850	0.61	0.74	0.74
PCE	LTE Band 17	0.40	0.65	0.65
DTS	2.4 GHz W-LAN	0.91	0.18	0.18
U-NII-1	5.2 GHz W-LAN	-	-	0.27
U-NII-2A	5.3 GHz W-LAN	0.70	0.25	-
U-NII-2C	5.6 GHz W-LAN	0.79	0.25	-
U-NII-3	5.8 GHz W-LAN	0.48	0.16	0.19
DSS	Bluetooth	0.30	< 0.1	< 0.1
Simultaneous SAR per KDB 690783 D01v01r03		1.56	1.06	1.03
FCC Equipment Class	Licensed Portable Transmitter Held to Ear (PCE) Part 15 Spread Spectrum Transmitter(DSS) Digital Transmission System(DTS) Unlicensed National Information Infrastructure (UNII)			
Date(s) of Tests	2018.07.24 ~ 2018.08.08			
Antenna Type	Internal Antenna			
Functions	- GSM/GPRS/EDGE (GPRS/EDGE Class: 12) supported. * DTM not supported. - No simultaneous transmission between BT & 2.4GHz WLAN - Simultaneous transmission between GSM, WCDMA voice & WLAN / GPRS, WCDMA & WLAN / LTE & WLAN. - VoIP is supported. - W-LAN 2.4GHz is supported Hotspot. - W-LAN 5 GHz is supported WiFi-Direct GC/GO in UNII B1, B3.			

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

The Nominal and Maximum Output Power Specifications are in section 9 of this test report.

1.4 DUT Antenna Locations

The overall dimensions of this device are > 9 x 5 cm. A diagram showing the location of the device of the device antenna can be found in ZNFLET_Antenna Location. Since the diagonal dimension of this device is < 160 mm and the diagonal display is < 150 mm, it is not considered a "phablet".

Mode	Device Sides for SAR Testing					
	Top	Bottom	Front	Rear	Right	Left
GSM/GPRS/EDGE 850	X	O	O	O	O	O
GSM/GPRS/EDGE 1900	X	O	O	O	X	O
WCDMA 850	X	O	O	O	O	O
LTE Band 17	X	O	O	O	O	O
2.4G W-LAN	O	X	O	O	O	X
5G W-LAN	O Note 2	X	O	O	O Note 2	X
Bluetooth	O	X	O	O	O	X

Note 1: Particular DUT edges were not required to be evaluated for Hotspot SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v02r01. The antenna document shows the distances between the transmit antennas and the edges of the device.

Note 2: W-LAN 5 GHz is supported WiFi-Direct GC/GO in UNII B1, B3.

Note 3: O - Test / X - Not test.

1.5 Simultaneous Transmission Capabilities

The Simultaneous Transmission Capabilities are in section 12 of this test report.

1.6 Miscellaneous SAR Test Considerations

(A) WiFi/BT

Since U-NII-1 and U-NII-2A bands have the same maximum output power and the highest reported SAR for U-NII-2A is less than 1.2 W/kg, SAR is not required for U-NII-1 band according to FCC KDB publication 248227 D01v02r02.

Since Wireless Router operations are not allowed by the chipset firmware using U-NII-1 & U-NII-2A & U-NII-2C & U-NII-3 WIFI, only 2.4GHz WIFI Hotspot SAR tests and combinations are considered for SAR with respect to Wireless Router configurations according to FCC KDB 941225 D06v02r01.

The WLAN Operational description states the device supports Wifi Direct Group Owner for UNII 1 and UNII 3(except CH165). As the function of group owner allows the device to operate as a wireless router, so we performed SAR test as a wireless router to demonstrate the device is compliant while this capability is being used.

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

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

Based on the maximum conducted power of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, body-worn and hotspot **Bluetooth SAR were not required; [(6/10)*√2.480] = 1.0 (< 3.0)**. Per KDB Publication 447498 D01 v06, 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 Data.

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.

1.7 Guidance Applied

- IEEE 1528-2013
- FCC KDB Publication 941225 D01v03r01 (3G SAR Procedures)
- FCC KDB Publication 941225 D05v02r05 (SAR for LTE Devices)
- FCC KDB Publication 941225 D05Av01r02 (LTE Rel.10 KDB Inquiry Sheet)
- FCC KDB Publication 941225 D06v02r01 (Hotspot Mode)
- FCC KDB Publication 248227 D01v02r02 (802.11 Wi-Fi SAR)
- FCC KDB Publication 447498 D01v06 (General RF Exposure Guidance)
- FCC KDB Publication 648474 D04v01r03 (Handset SAR)
- FCC KDB Publication 690783 D01v01r03 (SAR Listings on Grants)
- FCC KDB Publication 865664 D01v01r04 (SAR Measurement 100 MHz to 6 GHz)
- FCC KDB Publication 865664 D02v01r02 (RF Exposure Reporting)
- October 2013 TCB Workshop Notes (GPRS testing criteria)
- April 2015 TCB Workshop Notes (Simultaneous transmission summation clarified)
- October 2016 TCB Workshop Notes (Bluetooth Duty Factor)

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					
FCC ID	ZNFLET				
Form Factor	Mobile Phone				
Frequency Range of each LTE transmission Band	LTE Band 17 (706.5 ~ 713.5 MHz)				
Channel Bandwidths	LTE Band 17 : 5 MHz, 10 MHz				
Channel Number and Frequencies(MHz)	Low	Low-Mid	Mid	Mid-High	High
LTE Band 17: 5 MHz	706.5(23755)	N/A	710.0(23790) ^{Note1}	N/A	713.5(23825)
LTE Band 17: 10 MHz	709.0(23780)	N/A	710.0(23790) ^{Note1}	N/A	711.0(23800)
UE Category	LTE Rel.10, UE Category 4				
Modulations Supported in UL	QPSK, 16QAM				
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	Yes				
A-MPR (Additional MPR) disabled for SAR Testing?	Yes				
LTE Carrier Aggregation Possible Combinations	LTE Carrier Aggregation is not supported.				
LTE Additional Information	This device does not support CA features on 3GPP Release 10. All uplink communications are identical to the Release 8 Specifications. The following LTE Release 10 Features are not supported: Relay, HetNet, Enhanced MIMO, eICIC, WIFI Offloading, MDH, eMBMS, Cross-Carrier Scheduling, Enhanced SC-FDMA.				

Note(s)

1. LTE Band 17 at 10 MHz / 5MHz bandwidth does not support three non-overlapping channels.

Per KDB 941225 D05v02r05, 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.

3. INTROCUCTION

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

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. 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. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave is used for guidance in measuring 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 National Council on Radiation Protection and Measurements (NCRP) in Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86 NCRP, 1986, Bethesda, MD 20814. 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.

SAR Definition

Specific Absorption Rate (SAR) 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 Fig. 3.1)

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

Fig. 3.1 SAR Mathematical Equation

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

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

where:

- σ = conductivity of the tissue-simulating material (S/m)
- ρ = mass density of the tissue-simulating material (kg/m³)
- E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations 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.

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:

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 IEEE1528-2013.
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.

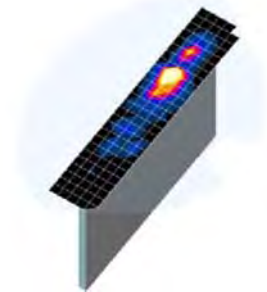


Figure 4.1
Sample SAR Area Scan

			$\leq 3 \text{ GHz}$	$> 3 \text{ GHz}$
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			$5 \text{ mm} \pm 1 \text{ mm}$	$\frac{1}{2} \cdot \delta \cdot \ln(2) \text{ mm} \pm 0.5 \text{ mm}$
Maximum probe angle from probe axis to phantom surface normal at the measurement location			$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: Δx_{Area} , Δy_{Area}			$\leq 2 \text{ GHz}: \leq 15 \text{ mm}$ $2 - 3 \text{ GHz}: \leq 12 \text{ mm}$	$3 - 4 \text{ GHz}: \leq 12 \text{ mm}$ $4 - 6 \text{ GHz}: \leq 10 \text{ mm}$
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom} , Δy_{Zoom}			$\leq 2 \text{ GHz}: \leq 8 \text{ mm}$ $2 - 3 \text{ GHz}: \leq 5 \text{ mm}^*$	$3 - 4 \text{ GHz}: \leq 5 \text{ mm}^*$ $4 - 6 \text{ GHz}: \leq 4 \text{ mm}^*$
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		$\leq 5 \text{ mm}$	$3 - 4 \text{ GHz}: \leq 4 \text{ mm}$ $4 - 5 \text{ GHz}: \leq 3 \text{ mm}$ $5 - 6 \text{ GHz}: \leq 2 \text{ mm}$
	graded grid	$\Delta z_{Zoom}(1)$: between 1 st two points closest to phantom surface	$\leq 4 \text{ mm}$	$3 - 4 \text{ GHz}: \leq 3 \text{ mm}$ $4 - 5 \text{ GHz}: \leq 2.5 \text{ mm}$ $5 - 6 \text{ GHz}: \leq 2 \text{ mm}$
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1) \text{ mm}$	
Minimum zoom scan volume	x, y, z		$\geq 30 \text{ mm}$	$3 - 4 \text{ GHz}: \geq 28 \text{ mm}$ $4 - 5 \text{ GHz}: \geq 25 \text{ mm}$ $5 - 6 \text{ GHz}: \geq 22 \text{ mm}$
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.				
* When zoom scan is required and the <u>reported</u> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB Publication 447498 is $\leq 1.4 \text{ W/kg}$, $\leq 8 \text{ mm}$, $\leq 7 \text{ mm}$ and $\leq 5 \text{ mm}$ zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

Table 4.1 Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04*

5. DEFINITION OF REFERENCE POINTS

5.1 Ear Reference Point

Figure 5.1 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 ERPs are 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) is perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (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.

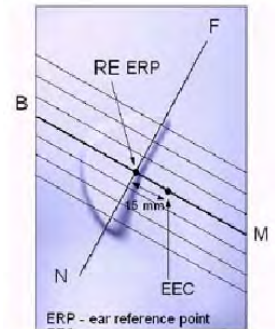


Figure 5.1
Close-up side view
of ERP

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 “test device reference point” located along the “vertical centerline” on the front of the device aligned to the “ear reference point” (See Fig. 5.3). The “test device reference point” was then located at the same level as the center of the ear reference point. The test device was positioned so that the “vertical centerline” was bisecting the front surface of the handset at it’s 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 SAM Twin Phantom

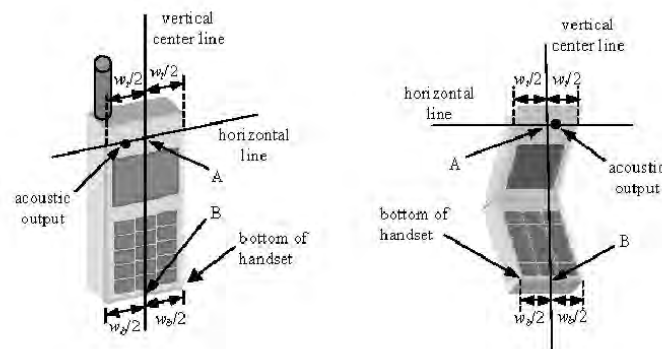


Figure 5.3 Handset Vertical Center & Horizontal Line Reference Points

6. TEST CONFIGURATION POSITIONS FOR HANDSETS

6.1 Device Holder

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

6.2 Positioning for Cheek/Touch

1. The test device was positioned with the handset 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/Touch Position

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (reference plane).
4. The phone was then rotated around the vertical centerline until the phone (horizontal line) was symmetrical with respect to the line NF.
5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, the handset was rotated about the line NF 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 / 15 ° Tilt

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

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15 degree.
2. The phone was then rotated around the horizontal line by 15 degree.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the phone touches 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. 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 6.3).

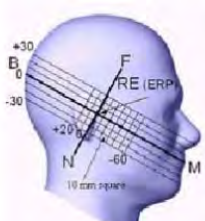


Figure 6.2 Side view w/relevant markings



Figure 6.3 Front, Side and Top View of Ear/15° Position

6.4 Body-Worn Accessory Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 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 $> 1.2 \text{ W/kg}$, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

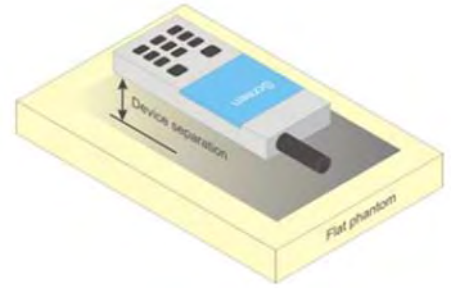


Figure 6.4 Sample Body-Worn Diagram

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.

6.5 Extremity Exposure Configurations

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

6.6 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 ($L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$) are based on a composite test separation distance of 10 mm from the front, rear 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. When the same wireless transmission configuration is used for testing body-worn accessory and hotspot mode SAR, respectively, in voice and data mode, SAR results for the most conservative test separation distance configuration may be used to support both SAR conditions.

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 transmitter 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 KDB Publication 447498 D01v06 procedures. The "Portable Hotspot" feature on the handset was not activated during SAR assessment, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

7. RF EXPOSURE LIMITS

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.

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 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

	HUMAN EXPOSURE LIMITS	
	General Public Exposure (W/kg) or (mW/g)	Occupational Exposure (W/kg) or (mW/g)
SPATIAL PEAK SAR * (Brain)	1.60	8.00
SPATIAL AVERAGE SAR ** (Whole Body)	0.08	0.40
SPATIAL PEAK SAR *** (Hands / Feet / Ankle / Wrist)	4.00	20.0

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.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

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).

8. FCC MEASUREMENT PROCEDURES

Power measurements were 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 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01v03r01.

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

8.3 SAR Measurement Conditions for WCDMA (UMTS)

8.3.1 Output Power Verification

Maximum output power is measured on the High, Middle and Low channels for each applicable transmission band according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all “1s”.

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 (release 5), 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.

8.3.2 Head SAR Measurements for Handsets

SAR for head exposure configurations is measured using the 12.2 kbps RMC with TPC bits configured to all “1s”. SAR in AMR configurations is not required when the maximum average output of each RF channel for 12.2 kbps AMR is less than 0.25 dB higher than that measured in 12.2 kbps RMC. Otherwise, SAR is measured on the maximum output channel in 12.2 AMR with a 3.4 kbps SRB (signaling radio bearer) using the exposure configuration that resulted in the highest SAR for that RF channel in the 12.2 kbps RMC mode.

8.3.3 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all "1s".

8.3.4 Release 5 HSDPA Data Devices

The following procedures are applicable to HSDPA data devices operating under 3GPP Release 5. SAR is required for devices in body-worn accessory and other body exposure conditions, including handsets and data modems operating in various electronic devices. HSDPA operates in conjunction with WCDMA and requires an active DPCCH. The default test configuration is to measure SAR in WCDMA with HSDPA remain inactive, to establish a radio link between the test device and a communication test set using a 12.2 kbps RMC configured in Test Loop Mode 1. SAR for HSDPA is selectively measured using the highest reported SAR configuration in WCDMA, with an FRC in H-set 1 and a 12.2 kbps RMC. SAR is selectively confirmed for other physical channel configurations (DPCCH & DPDCHn) according to exposure conditions, device operating capabilities and maximum output power specified for production units, including tune-up tolerance by applying the 3G SAR test reduction procedures. Maximum output power is verified according to the applicable versions of 3GPP TS 34.121. SAR must be measured based on these maximum output conditions and requirements in KDB Publication 447498, with respect to the UE Categories, and explained in the SAR report. When Maximum Power Reduction (MPR) applies, the implementations must be clearly identified in the SAR report to support test results according to Cubic Metric (CM) and, as appropriate, Enhanced MPR (E-MPR) requirements.

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	$\beta_{hs}^{(1)}$	CM (dB) ⁽²⁾
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15 ⁽³⁾	15/15 ⁽³⁾	64	12/15 ⁽³⁾	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5
Note 1: $\Delta_{ACK}, \Delta_{NACK}$ and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$ Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$.						

Figure 9.1 Table 1

8.3.5 Release 6 HSUPA Data Devices

The following procedures are applicable to HSPA (HSUPA/HSDPA) data devices operating under 3GPP Release 6. SAR is required for devices in body-worn accessory and other body exposure conditions, including handsets and data modems operating in various electronic devices. HSUPA operates in conjunction with WCDMA and HSDPA. SAR is initially measured in WCDMA test configurations with HSPA remain inactive. The default test configuration is to establish a radio link between the test device and a communication test set to configure a 12.2 kbps RMC in Test Loop Mode 1. SAR for HSPA is selectively measured with HS-DPCCH, E-DPCCH and E-DPDCH, all enabled, along with a 12.2 kbps RMC using the highest reported SAR configuration in WCDMA with 12.2 kbps RMC only.

An FRC is configured according to HS-DPCCH Sub-test 1 using H-set 1 and QPSK. HSPA is configured according to E-DCH Sub-test 5 requirements. SAR for other HSPA sub-test configurations is confirmed selectively according to exposure conditions, E-DCH UE Category and maximum output power of production units, including tune-up tolerance by applying the 3G SAR test reduction procedure. Maximum output power is verified according to procedures in applicable versions of 3GPP TS 34.121. SAR must be measured based on these maximum output conditions and requirements in KDB Publication 447498, with respect to the UE Categories for HS-DPCCH and HSPA, and explained in the SAR report. When Maximum Power Reduction (MPR) applies, the implementations must be clearly identified in the SAR report to support test results according to Cubic Metric (CM) and, as appropriate, Enhanced MPR (E-MPR) requirements.

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	$\beta_{hs}^{(1)}$	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM ⁽²⁾ (dB)	MPR (dB)	AG ⁽⁴⁾ Index	E-TFCI
1	11/15 ⁽³⁾	15/15 ⁽³⁾	64	11/15 ⁽³⁾	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}: 47/15$ $\beta_{ed}: 47/15$	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 ⁽⁴⁾	15/15 ⁽⁴⁾	64	15/15 ⁽⁴⁾	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK} , Δ_{NACK} and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$.
Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCCH, HS-DPCCCH, E-DPDCH and E-DPCCCH the MPR is based on the relative CM difference.
Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$.
Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$.
Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.
Note 6: β_{ed} cannot be set directly; it is set by Absolute Grant Value.

Figure 9.2 Table 2

8.4 SAR Measurement Conditions for LTE

LTE modes were tested according to FCC KDB 941225 D05v02r05 publication. Please see notes after the tabulated SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR. The call simulator was used for LTE output power measurement 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).

8.4.1 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.

8.4.2 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.

8.4.3 A-MPR

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

8.4.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r05:

- Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
 - The required channel and offset combination with the highest maximum output power is required for SAR.
 - When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channel 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.
 - 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.
- 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.
- 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. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
- 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 0.5 dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is < 1.45 W/kg.

8.5 SAR Testing with 802.11 Transmitters

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

8.5.1 General Device Setup

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

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.

8.5.2 U-NII and U-NII-2A

For devices that operate in only one of the U-NII-1 and U-NII-2A bands, the normally required SAR procedures for OFDM configurations are applied. For devices that operate in both U-NII bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following, with respect to the highest reported SAR and maximum output power specified for production units. The procedures are applied independently to each exposure configuration; for example, head, body, hotspot mode etc.

- 1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.
- 2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.

8.5.3 U-NII-2C and U-NII-3

The frequency range covered by U-NII-2C and U-NII-3 is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements.

When Terminal Doppler Weather Rader (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification.

Unless band gap channels are permanently disabled, SAR must be considered for these channels. When band gap channels are disabled, each band is tested independently according to the normally required OFDM SAR measurements and probe calibration frequency points requirements.

8.5.4 Initial Test Position Procedure

For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all position 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 position until the reported SAR result is ≤ 0.8 W/kg or all test position are measured.

8.5.5 2.4 GHz SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a 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 exposure configuration 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.

8.5.6 OFDM Transmission Mode and SAR Test Channel Selection

For the 2.4 GHz and 5 GHz bands, when the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11a and 802.11n or 802.11g and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 802.11a, then 802.11g then 802.11n is used for SAR measurement. When the maximum output power were 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.

8.5.7 Initial Test Configuration Procedure

For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output 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, and lowest data rate. 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.

8.5.8 Subsequent Test Configuration Procedures

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

9. RF CONDUCTED POWERS

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

9.1 GSM Nominal and Maximum Output Power Spec and Conducted Powers

Band & Mode		Voice[dBm]	Burst Average GMSK [dBm]				Burst Average 8-PSK [dBm]			
		1 TX Slot	1 TX Slot	2 TX Slot	3 TX Slot	4 TX Slot	1 TX Slot	2 TX Slot	3 TX Slot	4 TX Slot
GSM/GPRS/EDGE 850	Maximum	33.2	33.2	31.7	29.7	27.7	27.7	26.7	25.2	24.2
	Nominal	32.7	32.7	31.2	29.2	27.2	27.2	26.2	24.7	23.7
GSM/GPRS/EDGE 1900	Maximum	30.2	30.2	28.7	26.7	25.2	26.7	25.7	24.7	23.7
	Nominal	29.7	29.7	28.2	26.2	24.7	26.2	25.2	24.2	23.2

Table 9.1.1 GSM Nominal and Maximum Output Power Spec

Band	Channel	Maximum Burst-Averaged Output Power (dBm)								
		Voice	GPRS/EDGE Data (GMSK)				EDGE Data (8-PSK)			
		GSM CS 1 Slot	GPRS 1 TX Slot	GPRS 2 TX Slot	GPRS 3 TX Slot	GPRS 4 TX Slot	EDGE 1 TX Slot	EDGE 2 TX Slot	EDGE 3 TX Slot	EDGE 4 TX Slot
GSM850	128	33.0	33.0	31.4	29.1	27.4	27.3	26.4	24.8	23.7
	190	33.1	33.1	31.6	29.2	27.2	27.3	26.3	24.7	23.5
	251	33.2	33.2	31.4	29.1	27.3	27.4	26.4	24.8	23.6
PCS 1900	512	30.0	30.0	28.6	26.5	25.0	26.0	25.0	23.8	22.8
	661	29.9	29.9	28.6	26.4	25.0	26.1	25.0	23.9	22.9
	810	30.0	30.0	28.6	26.4	25.0	26.1	25.0	23.8	22.8
Band	Channel	Calculated Maximum Frame-Averaged Output Power (dBm)								
		Voice	GPRS/EDGE Data (GMSK)				EDGE Data (8-PSK)			
		GSM CS 1 Slot	GPRS 1 TX Slot	GPRS 2 TX Slot	GPRS 3 TX Slot	GPRS 4 TX Slot	EDGE 1 TX Slot	EDGE 2 TX Slot	EDGE 3 TX Slot	EDGE 4 TX Slot
GSM850	128	23.97	23.97	25.38	24.84	24.39	18.27	20.38	20.54	20.69
	190	24.07	24.11	25.58	24.94	24.19	18.27	20.28	20.44	20.49
	251	24.17	24.17	25.38	24.84	24.29	18.37	20.38	20.54	20.59
PCS 1900	512	20.97	20.97	22.58	22.24	21.99	16.97	18.98	19.54	19.79
	661	20.87	20.87	22.58	22.14	21.99	17.07	18.98	19.64	19.89
	810	20.97	20.97	22.58	22.14	21.99	17.07	18.98	19.54	19.79
GSM850	Frame Avg. Targets:	23.67	23.67	25.18	24.94	24.19	18.17	20.18	20.44	20.69
PCS 1900		20.67	20.67	22.18	21.94	21.69	17.17	19.18	19.94	20.19

Table 9.1.2 GSM Conducted Power

Note:

- 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 time slots.
- GPRS (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.
- 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 8PSK modulation do not have an impact on output power.

GPRS Multislot class: 12 (max 4 TX Uplink slots)
EDGE Multislot class: 12 (max 4 TX Uplink slots)
DTM Multislot Class: N/A



Figure 9.1 Power Measurement Setup

9.2 WCDMA Nominal and Maximum Output Power Spec and Conducted Powers

Band & Mode		Modulated Average [dBm]		
		3GPP WCDMA (Rel.99)	3GPP HSDPA	3GPP HSUPA
WCDMA 850 (Cell)	Maximum	24.2	24.2	24.2
	Nominal	23.7	23.7	23.7

Table 9.2.1 WCDMA Nominal and Maximum Output Power Spec

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band (dBm)			3GPP MPR (dB)
			4132	4183	4233	
99	WCDMA	12.2 kbps RMC	24.18	24.20	24.17	-
99		12.2 kbps AMR	24.16	24.18	24.16	-
5	HSDPA	Subtest 1	24.12	24.18	24.15	0
5		Subtest 2	24.13	24.17	24.16	0
5		Subtest 3	23.56	23.66	23.63	0.5
5		Subtest 4	23.56	23.66	23.63	0.5
6	HSUPA	Subtest 1	23.39	23.36	23.39	0
6		Subtest 2	22.19	22.17	22.17	2
6		Subtest 3	22.82	22.82	23.03	1
6		Subtest 4	22.15	22.16	22.18	2
6		Subtest 5	24.13	24.18	24.17	0

Table 9.2.2 WCDMA Conducted Power

WCDMA SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v03r01. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.

The manufacturer declares that the HSDPA and HSUPA transmitter's power will not exceed the R99 maximum transmit power in devices based on Qualcomm's HSPA chipset solutions.



Figure 9.2 Power Measurement Setup

9.3 LTE Nominal and Maximum Output Power Spec and Conducted Powers

Band & Mode		Modulated Average [dBm]
LTE Band 17	Maximum	24.2
	Nominal	23.7

Table 9.3.21 Nominal and Maximum Output Power Spec

3) LTE Band 17

LTE Band 17 Conducted Power– 10 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			23790 (710.0 MHz)		
			Conducted Power (dBm)		
QPSK	1	0	23.94	0	0
	1	25	23.98		
	1	49	23.81		
	25	0	22.88	0-1	1
	25	12	22.89		
	25	25	22.82		
16QAM	50	0	22.79	0-1	1
	1	0	22.91	0-1	1
	1	25	22.93		
	1	49	22.83		
	25	0	21.79	0-2	2
	25	12	21.82		
	25	25	21.84		
	50	0	21.74	0-2	2

Table 9.3.22 LTE Conducted Power

Note 1: LTE Band 17 at 10 MHz bandwidth does not support three non-overlapping channels.

Per KDB 941225 D05v02r05, 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.

LTE Band 17 Conducted Power– 5 MHz Bandwidth					
Modulation	RB Size	RB Offset	Mid Channel	MPR Allowed Per 3GPP(dB)	MPR (dB)
			23790 (710.0 MHz)		
			Conducted Power (dBm)		
QPSK	1	0	23.92	0	0
	1	12	23.97		
	1	24	23.88		
	12	0	22.75	0-1	1
	12	6	22.83		
	12	13	22.76		
16QAM	25	0	22.74	0-1	1
	1	0	22.91	0-1	1
	1	12	22.98		
	1	24	22.87		
	12	0	21.63	0-2	2
	12	6	21.69		
	12	13	21.66		
	25	0	21.57	0-2	2

Table 9.3.23 LTE Conducted Power

Note 1: LTE Band 17 at 5 MHz bandwidth does not support three non-overlapping channels.

Per KDB 941225 D05v02r05, 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.

9.4 WLAN Nominal and Maximum Output Power Spec and Conducted Powers

Band (GHz)	Mode	Ch	Modulated Average[dBm]	
			Maximum	Nominal
2.4	802.11b	1~11	15.5	14.5
		12~13	-2.0	-3.0
	802.11g	1~11	13.5	12.5
		12~13	-3.0	-4.0
	802.11n	1~11	12.5	11.5
		12~13	-3.0	-4.0

Table 9.4.1 Nominal and Maximum Output Power Spec

Mode	Freq. (MHz)	Channel	IEEE 802.11 (2.4 GHz) Conducted Power[dBm]
802.11b	2412	1	14.32
	2437	6	14.56
	2462	11	14.26
	2472	13	-3.22
802.11g	2412	1	12.75
	2437	6	12.67
	2462	11	12.37
	2472	13	-4.86
802.11n (HT-20)	2412	1	11.51
	2437	6	11.82
	2462	11	11.41
	2472	13	-4.95

Table 9.4.2 IEEE 802.11 Average RF Power

Band (GHz)	Mode	Ch	Modulated Average[dBm]	
			Maximum	Nominal
5 (UNII)	802.11a	36~165	12.5	11.5
	802.11n (20MHz)	36~165	12.0	11.0
	802.11n(40MHz) 802.11ac(20MHz/40MHz/80MHz)	36~165	11.0	10.0

Table 9.4.3 Nominal and Maximum Output Power Spec

Mode	Freq. (MHz)	Channel	IEEE 802.11a (5 GHz) Conducted Power[dBm]
802.11a	5180	36	12.23
	5200	40	12.02
	5220	44	12.08
	5240	48	12.10
	5260	52	11.95
	5280	56	11.85
	5300	60	11.92
	5320	64	11.76
	5500	100	11.75
	5600	120	12.04
	5660	132	11.87
	5700	140	11.65
	5745	149	11.96
	5785	157	11.88
	5825	165	11.78

Table 9.4.4 IEEE 802.11a Average RF Power

Mode	Freq. (MHz)	Channel	IEEE 802.11n HT20 (5 GHz) Conducted Power[dBm]
802.11n (HT-20)	5180	36	11.18
	5200	40	10.85
	5220	44	11.03
	5240	48	10.98
	5260	52	10.85
	5280	56	10.80
	5300	60	10.81
	5320	64	10.73
	5500	100	10.74
	5600	120	10.97
	5660	132	10.77
	5700	140	10.71
	5745	149	10.71
	5785	157	10.84
	5825	165	10.85

Table 9.4.5 IEEE 802.11n HT20 Average RF Power

Mode	Freq. (MHz)	Channel	IEEE 802.11ac VHT20 (5 GHz) Conducted Power[dBm]
802.11ac (VHT-20)	5180	36	10.02
	5200	40	9.72
	5220	44	9.81
	5240	48	9.88
	5260	52	9.76
	5280	56	9.59
	5300	60	9.44
	5320	64	9.51
	5500	100	9.56
	5600	120	9.77
	5660	132	9.65
	5700	140	9.60
	5745	149	9.82
	5785	157	9.67
	5825	165	9.92

Table 9.4.6 IEEE 802.11ac VHT20 Average RF Power

Mode	Freq. (MHz)	Channel	IEEE 802.11n HT40 (5 GHz) Conducted Power[dBm]
802.11n (HT-40)	5190	38	9.75
	5230	46	9.84
	5270	54	9.97
	5310	62	9.96
	5510	102	9.86
	5590	118	10.02
	5670	134	10.07
	5755	151	9.39
	5795	159	9.44

Table 9.4.7 IEEE 802.11n HT40 Average RF Power

Mode	Freq. (MHz)	Channel	IEEE 802.11ac VHT40 (5 GHz) Conducted Power[dBm]
802.11ac (VHT-40)	5190	38	9.81
	5230	46	9.84
	5270	54	10.01
	5310	62	10.01
	5510	102	10.01
	5590	118	10.08
	5670	134	10.02
	5755	151	9.45
	5795	159	9.34

Table 9.4.8 IEEE 802.11ac VHT40 Average RF Power

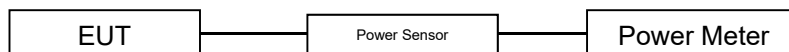
Mode	Freq. (MHz)	Channel	IEEE 802.11ac VHT80 (5 GHz) Conducted Power[dBm]
802.11ac (VHT-80)	5210	42	10.45
	5290	58	10.36
	5530	106	9.78
	5610	122	10.55
	5775	155	9.88

Table 9.4.9 IEEE 802.11ac VHT80 Average RF Power

Justification for reduced test configurations for WIFI channels 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.
- Output Power and SAR is not required for 802.11 g/n HT20 channels when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjust SAR is ≤ 1.2 W/kg.
- The underlined data rate and channel above were tested for SAR.

The average output powers of this device were tested by below configuration.


Figure 9.4 Power Measurement Setup

9.5 Bluetooth Conducted Powers

Modulated Average[dBm]		
Bluetooth 1 Mbps	Maximum	9.0
	Nominal	8.0
Bluetooth 2 Mbps	Maximum	8.5
	Nominal	7.5
Bluetooth 3 Mbps	Maximum	8.5
	Nominal	7.5
Bluetooth LE	Maximum	-1.0
	Nominal	-2.0

Table 9.5.1 Nominal and Maximum Output Power Spec

Channel	Frequency	Frame AVG Output Power (1Mbps)	Frame AVG Output Power (2Mbps)	Frame AVG Output Power (3Mbps)
	(MHz)	(dBm)	(dBm)	(dBm)
Low	2402	5.85	5.27	5.27
Mid	2441	7.98	7.40	7.40
High	2480	5.51	4.93	4.92

Table 9.5.2 Bluetooth Frame Average RF Power

Channel	Frequency	Frame AVG Output Power(LE)
	(MHz)	(dBm)
Low	2402	-3.96
Mid	2440	-2.19
High	2480	-4.29

Table 9.5.3 Bluetooth LE Frame Average RF Power

● Bluetooth Conducted Powers procedures

1. Bluetooth (BDR, EDR)

- 1) Enter DUT mode in EUT and operate it.

When it operating, The EUT is transmitting at maximum power level and duty cycle fixed.

- 2) Instruments and EUT were connected like Figure 9.5.1(A).
- 3) The maximum output powers of BDR(1 Mbps), EDR(2, 3 Mbps) and each frequency were set by a Bluetooth Tester.
- 4) Power levels were measured by a Power Meter.

2. Bluetooth (LE)

- 1) Enter LE mode in EUT and operate it.

When it operating, The EUT is transmitting at maximum power level and duty cycle fixed.

- 2) Instruments and EUT were connected like Figure 9.5.1(B).
- 3) The average conducted output powers of LE and each frequency can measurement according to setting program in EUT.
- 4) Power levels were measured by a Power Meter.

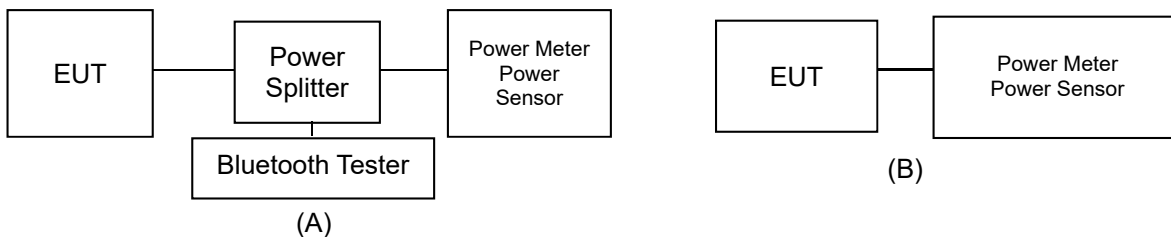


Figure 9.5.1 Average Power Measurement Setup

The average conducted output powers of Bluetooth were measured using above test setup and a wideband gated RF power meter when the EUT is transmitting at its maximum power level.

10. SYSTEM VERIFICATION

10.1 Tissue Verification

Date(s)	Tissue Type	Ambient Temp.[°C]	Liquid Temp.[°C]	MEASURED TISSUE PARAMETERS						
				Measured Frequency [MHz]	Target Dielectric Constant, ϵ_r	Target Conductivity, σ (S/m)	Measured Dielectric Constant, ϵ_r	Measured Conductivity, σ (S/m)	Er Deviation [%]	σ Deviation [%]
Jul. 27. 2018	750 Head	20.7	21.1	710.0	42.113	0.887	43.146	0.859	2.45	-3.16
				750.0	41.900	0.890	42.687	0.895	1.88	0.56
Jul. 27. 2018	750 Body	20.7	21.2	710.0	55.687	0.960	56.340	0.935	1.17	-2.60
				750.0	55.531	0.963	55.891	0.974	0.65	1.14
Jul. 24. 2018	835 Head	20.3	20.9	824.2	41.552	0.899	42.063	0.904	1.23	0.56
				835.0	41.500	0.900	41.943	0.914	1.07	1.56
				836.6	41.500	0.901	41.929	0.916	1.03	1.66
				848.8	41.500	0.914	41.779	0.926	0.67	1.31
Jul. 24. 2018	835 Body	20.3	20.7	824.2	55.243	0.969	54.452	0.996	-1.43	2.79
				835.0	55.200	0.970	54.351	1.006	-1.54	3.71
				836.6	55.197	0.971	54.340	1.007	-1.55	3.71
				848.8	55.160	0.986	54.228	1.017	-1.69	3.14
Jul. 26. 2018	835 Head	20.5	21.0	826.4	41.542	0.899	41.844	0.904	0.73	0.56
				835.0	41.500	0.900	41.751	0.912	0.60	1.33
				836.6	41.500	0.901	41.737	0.913	0.57	1.33
				846.6	41.500	0.912	41.614	0.923	0.27	1.21
Jul. 26. 2018	835 Body	20.5	21.1	826.4	55.235	0.969	54.543	0.999	-1.25	3.10
				835.0	55.200	0.970	54.463	1.006	-1.34	3.71
				836.6	55.197	0.971	54.450	1.008	-1.35	3.81
				846.6	55.166	0.984	54.359	1.016	-1.46	3.25
Jul. 25. 2018	1900 Head	20.6	21.2	1850.2	40.000	1.400	39.587	1.400	-1.03	0.00
				1880.0	40.000	1.400	39.489	1.426	-1.28	1.86
				1900.0	40.000	1.400	39.394	1.440	-1.52	2.86
				1909.8	40.000	1.400	39.349	1.448	-1.63	3.43
Jul. 25. 2018	1900 Body	20.6	21.0	1850.2	53.300	1.520	51.676	1.463	-3.05	-3.75
				1880.0	53.300	1.520	51.621	1.488	-3.15	-2.11
				1900.0	53.300	1.520	51.569	1.505	-3.25	-0.99
				1909.8	53.300	1.520	51.540	1.513	-3.30	-0.46
Jul. 31. 2018	2450 Head	21.2	20.9	2402.0	39.282	1.757	39.400	1.771	0.30	0.80
				2412.0	39.265	1.766	39.359	1.781	0.24	0.85
				2437.0	39.222	1.788	39.268	1.809	0.12	1.17
				2441.0	39.215	1.792	39.252	1.814	0.09	1.23
				2450.0	39.200	1.800	39.220	1.825	0.05	1.39
				2462.0	39.184	1.813	39.191	1.839	0.02	1.43
				2472.0	39.171	1.823	39.163	1.850	-0.02	1.48
				2480.0	39.160	1.832	39.133	1.859	-0.07	1.47
Jul. 30. 2018	2450 Body	21.1	21.4	2402.0	52.764	1.904	52.365	1.876	-0.76	-1.47
				2412.0	52.751	1.914	52.347	1.888	-0.77	-1.36
				2437.0	52.717	1.938	52.294	1.919	-0.80	-0.98
				2441.0	52.712	1.941	52.283	1.923	-0.81	-0.93
				2450.0	52.700	1.950	52.263	1.935	-0.83	-0.77
				2462.0	52.685	1.967	52.238	1.949	-0.85	-0.92
				2472.0	52.672	1.981	52.213	1.960	-0.87	-1.06
				2480.0	52.662	1.993	52.194	1.970	-0.89	-1.15

MEASURED TISSUE PARAMETERS										
Date(s)	Tissue Type	Ambient Temp.[°C]	Liquid Temp.[°C]	Measured Frequency [MHz]	Target Dielectric Constant, ϵ_r	Target Conductivity, σ (S/m)	Measured Dielectric Constant, ϵ_r	Measured Conductivity, σ (S/m)	ϵ_r Deviation [%]	σ Deviation [%]
Aug. 01. 2018	5200 Body	21.3	21.0	5180.0	49.041	5.276	47.888	5.196	-2.35	-1.52
				5190.0	49.028	5.288	47.863	5.207	-2.38	-1.53
				5200.0	49.014	5.299	47.833	5.221	-2.41	-1.47
				5210.0	49.001	5.311	47.813	5.237	-2.42	-1.39
				5220.0	48.987	5.323	47.793	5.251	-2.44	-1.35
				5230.0	48.974	5.334	47.773	5.264	-2.45	-1.31
				5240.0	48.960	5.346	47.752	5.276	-2.47	-1.31
Aug. 02. 2018	5300 Head	20.9	21.1	5260.0	35.940	4.720	35.175	4.659	-2.13	-1.29
				5270.0	35.930	4.730	35.151	4.671	-2.17	-1.25
				5280.0	35.920	4.740	35.136	4.683	-2.18	-1.20
				5290.0	35.910	4.750	35.127	4.691	-2.18	-1.24
				5300.0	35.900	4.760	35.103	4.698	-2.22	-1.30
				5310.0	35.890	4.770	35.071	4.709	-2.28	-1.28
				5320.0	35.880	4.780	35.046	4.722	-2.32	-1.21
Aug. 01. 2018	5300 Body	21.3	21.0	5260.0	48.933	5.369	47.710	5.305	-2.50	-1.19
				5270.0	48.919	5.381	47.687	5.320	-2.52	-1.13
				5280.0	48.906	5.393	47.673	5.335	-2.52	-1.08
				5290.0	48.892	5.404	47.662	5.346	-2.52	-1.07
				5300.0	48.879	5.416	47.634	5.357	-2.55	-1.09
				5310.0	48.865	5.428	47.607	5.370	-2.57	-1.07
				5320.0	48.851	5.439	47.584	5.386	-2.59	-0.97
Aug. 03. 2018	5600 Head	21.3	21.6	5500.0	35.650	4.965	35.957	5.129	0.86	3.30
				5510.0	35.635	4.976	35.942	5.136	0.86	3.22
				5530.0	35.605	4.997	35.885	5.157	0.79	3.20
				5590.0	35.515	5.060	35.758	5.224	0.68	3.24
				5600.0	35.500	5.070	35.734	5.237	0.66	3.29
				5610.0	35.490	5.080	35.727	5.249	0.67	3.33
				5660.0	35.440	5.130	35.617	5.302	0.50	3.35
				5670.0	35.430	5.140	35.598	5.311	0.47	3.33
				5700.0	35.400	5.170	35.526	5.347	0.36	3.42
Aug. 06. 2018	5600 Body	21.0	21.5	5500.0	48.607	5.650	48.239	5.676	-0.76	0.46
				5510.0	48.594	5.661	48.232	5.689	-0.74	0.49
				5530.0	48.566	5.685	48.223	5.723	-0.71	0.67
				5590.0	48.485	5.755	48.074	5.809	-0.85	0.94
				5600.0	48.471	5.766	48.058	5.825	-0.85	1.02
				5610.0	48.458	5.778	48.052	5.840	-0.84	1.07
				5660.0	48.390	5.836	47.961	5.906	-0.89	1.20
				5670.0	48.376	5.848	47.944	5.918	-0.89	1.20
				5700.0	48.336	5.883	47.874	5.962	-0.96	1.34

MEASURED TISSUE PARAMETERS										
Date(s)	Tissue Type	Ambient Temp.[°C]	Liquid Temp.[°C]	Measured Frequency [MHz]	Target Dielectric Constant, ϵ_r	Target Conductivity, σ (S/m)	Measured Dielectric Constant, ϵ_r	Measured Conductivity, σ (S/m)	Er Deviation [%]	σ Deviation [%]
Aug. 07. 2018	5800 Head	21.4	21.2	5745.0	35.355	5.215	34.317	5.221	-2.94	0.12
				5755.0	35.345	5.225	34.292	5.234	-2.98	0.17
				5775.0	35.325	5.245	34.260	5.254	-3.01	0.17
				5785.0	35.315	5.255	34.235	5.263	-3.06	0.15
				5795.0	35.305	5.265	34.208	5.275	-3.11	0.19
				5800.0	35.300	5.270	34.196	5.280	-3.13	0.19
				5825.0	35.275	5.296	34.148	5.311	-3.19	0.28
Aug. 06. 2018	5800 Body	21.0	21.5	5745.0	48.275	5.936	47.796	6.021	-0.99	1.43
				5755.0	48.261	5.947	47.778	6.037	-1.00	1.51
				5775.0	48.234	5.971	47.752	6.062	-1.00	1.52
				5785.0	48.220	5.982	47.729	6.075	-1.02	1.55
				5795.0	48.207	5.994	47.708	6.089	-1.04	1.58
				5800.0	48.200	6.000	47.698	6.097	-1.04	1.62
				5825.0	48.166	6.029	47.658	6.133	-1.05	1.72

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 865664 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

Measurement Procedure for Tissue verification:

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

$$Y = \frac{j2\omega\epsilon_r\epsilon_0}{[\ln(b/a)]^2} \int_a^b \int_a^b \int_0^\pi \cos\phi' \frac{\exp[-j\omega r(\mu_0\epsilon_r\epsilon_0)^{1/2}]}{r} d\phi' d\rho' d\rho$$

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

10.2 Test System Verification

Prior to assessment, the system is verified to the $\pm 10\%$ of the specifications at using the SAR Dipole kit(s). (Graphic Plots Attached)

Table 10.2.1 System Verification Results (1g)

SYSTEM DIPOLE VERIFICATION TARGET & MEASURED												
SAR System #	Freq. [MHz]	SAR Dipole kits	Date(s)	Tissue Type	Ambient Temp. [°C]	Liquid Temp. [°C]	Probe S/N	Input Power (mW)	1 W Target SAR _{1g} (W/kg)	Measured SAR _{1g} (W/kg)	1 W Normalized SAR _{1g} (W/kg)	Deviation [%]
D	750	D750V3, SN:1049	Jul. 27. 2018	Head	20.7	21.1	3328	250	8.32	2.10	8.40	0.96
D	750	D750V3, SN:1049	Jul. 27. 2018	Body	20.7	21.2	3328	250	8.70	2.30	9.20	5.75
D	835	D835V2, SN:464	Jul. 24. 2018	Head	20.3	20.9	3328	250	9.38	2.42	9.68	3.20
D	835	D835V2, SN:464	Jul. 24. 2018	Body	20.3	20.7	3328	250	9.45	2.42	9.68	2.43
D	835	D835V2, SN:464	Jul. 26. 2018	Head	20.5	21.0	3328	250	9.38	2.22	8.88	-5.33
D	835	D835V2, SN:464	Jul. 26. 2018	Body	20.5	21.1	3328	250	9.45	2.33	9.32	-1.38
D	1900	D1900V2, SN:5d029	Jul. 25. 2018	Head	20.6	21.2	3328	100	39.2	3.84	38.40	-2.04
D	1900	D1900V2, SN:5d029	Jul. 25. 2018	Body	20.6	21.0	3328	100	39.6	4.07	40.70	2.78
C	2450	D2450V2, SN: 726	Jul. 31. 2018	Head	21.2	20.9	3866	100	51.9	4.95	49.50	-4.62
C	2450	D2450V2, SN: 726	Jul. 30. 2018	Body	21.1	21.4	3866	100	50.3	5.14	51.40	2.19
C	5200	D5GHzV2, SN:1212	Aug. 01. 2018	Body	21.3	21.0	3866	100	72.7	7.20	72.00	-0.96
C	5300	D5GHzV2, SN:1212	Aug. 02. 2018	Head	20.9	21.1	3866	100	81.1	7.92	79.20	-2.34
C	5300	D5GHzV2, SN:1212	Aug. 01. 2018	Body	21.3	21.0	3866	100	75.2	7.24	72.40	-3.72
C	5600	D5GHzV2, SN:1212	Aug. 03. 2018	Head	21.3	21.6	3866	100	83.6	7.83	78.30	-6.34
C	5600	D5GHzV2, SN:1212	Aug. 06. 2018	Body	21.0	21.5	3866	100	78.9	7.94	79.40	0.63
C	5800	D5GHzV2, SN:1212	Aug. 07. 2018	Head	21.4	21.2	3866	100	79.5	7.76	77.60	-2.39
C	5800	D5GHzV2, SN:1212	Aug. 06. 2018	Body	21.0	21.5	3866	100	75.7	7.75	77.50	2.38

Note1 : System Verification was measured with input 250 mW, 100 mW and normalized to 1W.

Note2 : Full system validation status and results can be found in Attachment 3.

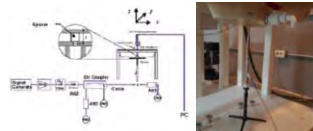


Figure 10.1 Dipole Verification Test Setup Diagram & Photo

11. SAR TEST RESULTS

11.1 Head SAR Results

Table 11.1.1 GSM/GPRS 850 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/ Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	# of Time Slots	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)	Plots #
MHz	Ch													
836.6	190	GSM850	GSM	33.20	33.10	0.180	Left Touch	FCC #1	1	1:8.3	0.405	1.023	0.414	
836.6	190	GSM850	GSM	33.20	33.10	-0.070	Right Touch	FCC #1	1	1:8.3	0.488	1.023	0.499	A1
836.6	190	GSM850	GSM	33.20	33.10	0.150	Left Tilt	FCC #1	1	1:8.3	0.242	1.023	0.248	
836.6	190	GSM850	GSM	33.20	33.10	0.070	Right Tilt	FCC #1	1	1:8.3	0.245	1.023	0.251	
836.6	190	GSM850	GPRS	31.70	31.60	0.110	Left Touch	FCC #1	2	1:4.15	0.460	1.023	0.471	
836.6	190	GSM850	GPRS	31.70	31.60	-0.040	Right Touch	FCC #1	2	1:4.15	0.576	1.023	0.589	A2
836.6	190	GSM850	GPRS	31.70	31.60	-0.000	Left Tilt	FCC #1	2	1:4.15	0.281	1.023	0.287	
836.6	190	GSM850	GPRS	31.70	31.60	-0.110	Right Tilt	FCC #1	2	1:4.15	0.308	1.023	0.315	
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Head 1.6 W/kg (mW/g) averaged over 1 gram						

Table 11.1.2 PCS/GPRS 1900 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/ Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	# of Time Slots	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)	Plots #
MHz	Ch													
1880.0	661	PCS1900	PCS	30.20	29.90	-0.030	Left Touch	FCC #1	1	1:8.3	0.243	1.072	0.260	A3
1880.0	661	PCS1900	PCS	30.20	29.90	0.090	Right Touch	FCC #1	1	1:8.3	0.118	1.072	0.126	
1880.0	661	PCS1900	PCS	30.20	29.90	-0.130	Left Tilt	FCC #1	1	1:8.3	0.101	1.072	0.108	
1880.0	661	PCS1900	PCS	30.20	29.90	0.170	Right Tilt	FCC #1	1	1:8.3	0.083	1.072	0.089	
1880.0	661	PCS1900	GPRS	28.70	28.60	0.110	Left Touch	FCC #1	2	1:4.15	0.370	1.023	0.379	A4
1880.0	661	PCS1900	GPRS	28.70	28.60	0.180	Right Touch	FCC #1	2	1:4.15	0.179	1.023	0.183	
1880.0	661	PCS1900	GPRS	28.70	28.60	0.080	Left Tilt	FCC #1	2	1:4.15	0.155	1.023	0.159	
1880.0	661	PCS1900	GPRS	28.70	28.60	0.080	Right Tilt	FCC #1	2	1:4.15	0.126	1.023	0.129	
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Head 1.6 W/kg (mW/g) averaged over 1 gram						

Table 11.1.3 WCDMA 850 Head SAR
MEASUREMENT RESULTS

FREQUENCY		Mode/ Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)	Plots #
MHz	Ch												
836.6	4183	WCDMA 850	RMC	24.20	24.20	-0.080	Left Touch	FCC #1	1:1	0.474	1.000	0.474	
836.6	4183	WCDMA 850	RMC	24.20	24.20	0.050	Right Touch	FCC #1	1:1	0.607	1.000	0.607	A5
836.6	4183	WCDMA 850	RMC	24.20	24.20	0.060	Left Tilt	FCC #1	1:1	0.294	1.000	0.294	
836.6	4183	WCDMA 850	RMC	24.20	24.20	0.150	Right Tilt	FCC #1	1:1	0.304	1.000	0.304	
ANSI / IEEE C95.1-2005- SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Head 1.6 W/kg (mW/g) averaged over 1 gram					

Table 11.1.5 LTE Band 17 Head SAR
MEASUREMENT RESULTS

MEASUREMENT RESULTS																	
FREQUENCY		Mode/ Band	BW [MHz]	Max Allowed Power [dBm]	Cond. PWR [dBm]	Drift Power [dB]	MPR	Position	Device Serial Number	Mod.	RB Size	RB Offs.	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)	Plots #
MHz	Ch																
710.0	23790	LTE B17	10	24.20	23.98	-0.040	0	Left Touch	FCC #1	QPSK	1	25	1:1	0.359	1.052	0.378	
710.0	23790	LTE B17	10	23.20	22.89	0.190	1	Left Touch	FCC #1	QPSK	25	12	1:1	0.251	1.074	0.270	
710.0	23790	LTE B17	10	24.20	23.98	0.190	0	Right Touch	FCC #1	QPSK	1	25	1:1	0.378	1.052	0.398	A6
710.0	23790	LTE B17	10	23.20	22.89	0.120	1	Right Touch	FCC #1	QPSK	25	12	1:1	0.273	1.074	0.293	
710.0	23790	LTE B17	10	24.20	23.98	0.000	0	Left Tilt	FCC #1	QPSK	1	25	1:1	0.179	1.052	0.188	
710.0	23790	LTE B17	10	23.20	22.89	0.040	1	Left Tilt	FCC #1	QPSK	25	12	1:1	0.149	1.074	0.160	
710.0	23790	LTE B17	10	24.20	23.98	-0.180	0	Right Tilt	FCC #1	QPSK	1	25	1:1	0.212	1.052	0.223	
710.0	23790	LTE B17	10	23.20	22.89	0.100	1	Right Tilt	FCC #1	QPSK	25	12	1:1	0.147	1.074	0.158	
ANSI / IEEE C95.1-1992- SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure									Head 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11.1.6 DTS Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode (Antenna)	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	1g Scaled SAR (W/kg)	Plot s #
MHz	Ch														
2412.0	1	802.11b	15.50	14.32	0.030	Left Touch	FCC #2	0.755	1	99.8	0.690	1.312	1.002	0.907	
2437.0	6	802.11b	15.50	14.56	0.050	Left Touch	FCC #2	0.767	1	99.8	0.729	1.242	1.002	0.907	A7
2437.0	6	802.11b	15.50	14.56	-0.070	Right Touch	FCC #2	0.308	1	99.8	0.287	1.242	1.002	0.357	
2437.0	6	802.11b	15.50	14.56	0.080	Left Tilt	FCC #2	0.423	1	99.8	0.395	1.242	1.002	0.492	
2437.0	6	802.11b	15.50	14.56	0.010	Right Tilt	FCC #2	0.264	1	99.8	0.265	1.242	1.002	0.330	
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Head 1.6 W/kg (mW/g) averaged over 1 gram							

Adjusted SAR results for OFDM SAR												
FREQUENCY		Mode/ Antenna	Service	Maximum Allowed Power [dBm]	1g Scaled SAR (W/kg)	FREQUENCY [MHz]	Mode	Service	Maximum Allowed Power [dBm]	Ratio of OFDM to DSSS	1g Adjusted SAR (W/kg)	Determine OFDM SAR
MHz	Ch											
2437.0	6	802.11b	DSSS	15.5	0.907	2437	802.11g	OFDM	13.5	0.631	0.572	X
2437.0	6	802.11b	DSSS	15.5	0.907	2437	802.11n	OFDM	12.5	0.501	0.454	X
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure						Head 1.6 W/kg (mW/g) averaged over 1 gram						

Note: SAR is not required for the following 2.4 GHz OFDM conditions. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

Table 11.1.7 UNII Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode (Antenna)	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	1g Scaled SAR (W/kg)	Plots #
MHz	Ch														
5260.0	52	802.11a	12.50	11.95	0.000	Left Touch	FCC #2	0.566	1	98.5	0.603	1.135	1.015	0.695	A8
5260.0	52	802.11a	12.50	11.95	0.000	Right Touch	FCC #2	0.455	1	98.5	0.470	1.135	1.015	0.542	
5260.0	52	802.11a	12.50	11.95	0.000	Left Tilt	FCC #2	0.384	1	98.5	0.433	1.135	1.015	0.499	
5260.0	52	802.11a	12.50	11.95	0.000	Right Tilt	FCC #2	0.378	1	98.5	0.384	1.135	1.015	0.442	
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Head 1.6 W/kg (mW/g) averaged over 1 gram							

Adjusted SAR results for UNII-1 and UNII-2A SAR												
FREQUENCY		Mode/ Antenna	Service	Maximum Allowed Power [dBm]	1g Scaled SAR (W/kg)	FREQUENCY [MHz]	Mode	Service	Maximum Allowed Power [dBm]	Adjusted Factor	1g Adjusted SAR (W/kg)	SAR for the band with lower maximum output power
MHz	Ch											
5260.0	52	802.11a	OFDM	12.5	0.695	5180	802.11a	OFDM	12.5	1.000	0.695	X
ANSI / IEEE C95.1-1992- SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure						Head 1.6 W/kg (mW/g) averaged over 1 gram						

Note(s):

1. U-NII-1 and U-NII-2A Bands: When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration.

Table 11.1.8 UNII Head SAR
MEASUREMENT RESULTS

FREQUENCY		Mode (Antenna)	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	1g Scaled SAR (W/kg)	Plots #
MHz	Ch														
5600.0	120	802.11a	12.50	12.04	0.000	Left Touch	FCC #2	0.651	1	98.5	0.696	1.112	1.015	0.786	A9
5600.0	120	802.11a	12.50	12.04	0.000	Right Touch	FCC #2	0.547	1	98.5	0.577	1.112	1.015	0.651	
5600.0	120	802.11a	12.50	12.04	0.000	Left Tilt	FCC #2	0.452	1	98.5	0.504	1.112	1.015	0.569	
5600.0	120	802.11a	12.50	12.04	0.000	Right Tilt	FCC #2	0.487	1	98.5	0.454	1.112	1.015	0.513	
5745.0	149	802.11a	12.50	11.96	0.000	Left Touch	FCC #2	0.429	1	98.5	0.421	1.132	1.015	0.484	A10
5745.0	149	802.11a	12.50	11.96	0.000	Right Touch	FCC #2	0.412	1	98.5	0.402	1.132	1.015	0.462	
5745.0	149	802.11a	12.50	11.96	0.000	Left Tilt	FCC #2	0.316	1	98.5	0.335	1.132	1.015	0.385	
5745.0	149	802.11a	12.50	11.96	0.000	Right Tilt	FCC #2	0.309	1	98.5	0.309	1.132	1.015	0.355	
ANSI / IEEE C95.1-1992- SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11.1.9 Bluetooth Head SAR
MEASUREMENT RESULTS

MEASUREMENT RESULTS														
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Rate [Mbps]	Duty Cycle (%)	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	1g Scaled SAR (W/kg)	Plots #
MHz	Ch													
2441.0	39	Bluetooth	9.00	7.98	0.020	Left Touch	FCC #2	1	76.8	0.181	1.265	1.302	0.298	A11
2441.0	39	Bluetooth	9.00	7.98	-0.180	Right Touch	FCC #2	1	76.8	0.069	1.265	1.302	0.114	
2441.0	39	Bluetooth	9.00	7.98	-0.100	Left Tilt	FCC #2	1	76.8	0.096	1.265	1.302	0.158	
2441.0	39	Bluetooth	9.00	7.98	0.150	Right Tilt	FCC #2	1	76.8	0.060	1.265	1.302	0.099	
ANSI / IEEE C95.1-1992- SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Head 1.6 W/kg (mW/g) averaged over 1 gram						

11.2 Standalone Body-Worn SAR Worn SAR Results

Table 11.2.1 GSM/PCS/GPRS/WCDMA Body-Worn SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/ Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Spacing [Side]	Device Serial Number	# of Time Slot s	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)	Plots #
MHz	Ch													
836.6	190	GSM850	GSM	33.20	33.10	-0.050	10 mm [Front]	FCC #1	1	1:8.3	0.509	1.023	0.521	
836.6	190	GSM850	GSM	33.20	33.10	-0.040	10 mm [Rear]	FCC #1	1	1:8.3	0.605	1.023	0.619	A12
836.6	190	GSM850	GPRS	31.70	31.60	-0.010	10 mm [Front]	FCC #1	2	1:4.15	0.597	1.023	0.611	
836.6	190	GSM850	GPRS	31.70	31.60	0.030	10 mm [Rear]	FCC #1	2	1:4.15	0.749	1.023	0.766	A13
1880.0	661	PCS1900	PCS	30.20	29.90	0.090	10 mm [Front]	FCC #1	1	1:8.3	0.244	1.072	0.262	A14
1880.0	661	PCS1900	PCS	30.20	29.90	-0.040	10 mm [Rear]	FCC #1	1	1:8.3	0.234	1.072	0.251	
1880.0	661	PCS1900	GPRS	28.70	28.60	-0.000	10 mm [Front]	FCC #1	2	1:4.15	0.373	1.023	0.382	A15
1880.0	661	PCS1900	GPRS	28.70	28.60	0.070	10 mm [Rear]	FCC #1	2	1:4.15	0.348	1.023	0.356	
836.6	4183	WCDMA 850	RMC	24.20	24.20	-0.010	10 mm [Front]	FCC #1	N/A	1:1	0.591	1.000	0.591	
836.6	4183	WCDMA 850	RMC	24.20	24.20	-0.040	10 mm [Rear]	FCC #1	N/A	1:1	0.736	1.000	0.736	A16
ANSI / IEEE C95.1-1992- SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Body 1.6 W/kg (mW/g) averaged over 1 gram						

Table 11.2.2 LTE B17 Body-Worn SAR

MEASUREMENT RESULTS																	
FREQUENCY		Mode/ Band	BW [MHz]	Max Allowed Power [dBm]	Cond. PWR [dBm]	Drift Power [dB]	MPR	Position	Device Serial Number	Mod.	RB Size	RB Offs.	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)	Plots #
MHz	Ch																
710.0	23790	LTE B17	10	24.20	23.98	-0.060	0	10 mm [Front]	FCC #1	QPSK	1	25	1:1	0.405	1.052	0.426	
710.0	23790	LTE B17	10	23.20	22.89	0.000	1	10 mm [Front]	FCC #1	QPSK	25	12	1:1	0.291	1.074	0.313	
710.0	23790	LTE B17	10	24.20	23.98	0.020	0	10 mm [Rear]	FCC #1	QPSK	1	25	1:1	0.614	1.052	0.646	A17
710.0	23790	LTE B17	10	23.20	22.89	-0.000	1	10 mm [Rear]	FCC #1	QPSK	25	12	1:1	0.495	1.074	0.532	
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure									Body 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11.2.3 DTS Body-Worn SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	SAR (W/kg)	Plots #
MHz	Ch														
2437.0	6	802.11b	15.50	14.56	-0.020	10 mm [Front]	FCC #2	0.113	1	99.8	0.116	1.242	1.002	0.144	
2437.0	6	802.11b	15.50	14.56	0.000	10 mm [Rear]	FCC #2	0.155	1	99.8	0.148	1.242	1.002	0.184	A18
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Body 1.6 W/kg (mW/g) averaged over 1 gram							

Adjusted SAR results for OFDM SAR												
FREQUENCY		Mode/ Antenna	Service	Maximum Allowed Power [dBm]	1g Scaled SAR (W/kg)	FREQUENCY [MHz]	Mode	Service	Maximum Allowed Power [dBm]	Ratio of OFDM to DSSS	1g Adjusted SAR (W/kg)	Determine OFDM SAR
MHz	Ch											
2437.0	6	802.11b	DSSS	15.5	0.184	2437	802.11g	OFDM	13.5	0.631	0.116	X
2437.0	6	802.11b	DSSS	15.5	0.184	2437	802.11n	OFDM	12.5	0.501	0.092	X
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure						Body 1.6 W/kg (mW/g) averaged over 1 gram						

Note: SAR is not required for the following 2.4 GHz OFDM conditions. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

Table 11.2.4 UNII Body-Worn SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	1g Scaled SAR (W/kg)	Plots #
MHz	Ch														
5260.0	52	802.11a	12.50	11.95	0.040	10 mm [Front]	FCC #2	0.171	1	98.5	0.173	1.135	1.015	0.199	
5260.0	52	802.11a	12.50	11.95	-0.030	10 mm [Rear]	FCC #2	0.216	1	98.5	0.215	1.135	1.015	0.248	A19
ANSI / IEEE C95.1-2005– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Body 1.6 W/kg (mW/g) averaged over 1 gram							

Adjusted SAR results for UNII-1 and UNII-2A SAR												
FREQUENCY		Mode/ Antenna	Service	Maximum Allowed Power [dBm]	1g Scaled SAR (W/kg)	FREQUENCY [MHz]	Mode	Service	Maximum Allowed Power [dBm]	Adjusted Factor	1g Adjusted SAR (W/kg)	SAR for the band with lower maximum output power
MHz	Ch											
5260.0	52	802.11a	OFDM	12.5	0.248	5180	802.11a	OFDM	12.5	1.000	0.248	X
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure						Body 1.6 W/kg (mW/g) averaged over 1 gram						

Note(s):

1. U-NII-1 and U-NII-2A Bands: When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration.

Table 11.2.5 UNII Body-Worn SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	1g Scaled SAR (W/kg)	Plots #
MHz	Ch														
5600.0	120	802.11a	12.50	12.04	0.020	10 mm [Front]	FCC #2	0.205	1	98.5	0.205	1.112	1.015	0.231	
5600.0	120	802.11a	12.50	12.04	-0.110	10 mm [Rear]	FCC #2	0.224	1	98.5	0.218	1.112	1.015	0.246	A20
5745.0	149	802.11a	12.50	11.96	0.080	10 mm [Front]	FCC #2	0.133	1	98.5	0.141	1.132	1.015	0.162	A21
5745.0	149	802.11a	12.50	11.96	-0.040	10 mm [Rear]	FCC #2	0.150	1	98.5	0.139	1.132	1.015	0.160	
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Body 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11.2.6 Bluetooth Body-Worn SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Rate [Mbps]	Duty Cycle (%)	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	1g Scaled SAR (W/kg)	Plots #
MHz	Ch													
2441.0	39	Bluetooth	9.00	7.98	-0.100	10 mm [Front]	FCC #2	1	76.8	0.024	1.265	1.302	0.040	
2441.0	39	Bluetooth	9.00	7.98	-0.160	10 mm [Rear]	FCC #2	1	76.8	0.030	1.265	1.302	0.049	A22
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Body 1.6 W/kg (mW/g) averaged over 1 gram						

11.3 Standalone Hotspot SAR Results

Table 11.3.1 GPRS/WCDMA Hotspot SAR
MEASUREMENT RESULTS

FREQUENCY		Mode/ Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Spacing [Side]	Device Serial Number	# of Time Slot s	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)	Plots #
MHz	Ch													
836.6	190	GSM850	GPRS	31.70	31.60	-0.020	10 mm [Bottom]	FCC #1	2	1:4.15	0.206	1.023	0.211	
836.6	190	GSM850	GPRS	31.70	31.60	-0.010	10 mm [Front]	FCC #1	2	1:4.15	0.597	1.023	0.611	
836.6	190	GSM850	GPRS	31.70	31.60	0.030	10 mm [Rear]	FCC #1	2	1:4.15	0.749	1.023	0.766	A13
836.6	190	GSM850	GPRS	31.70	31.60	0.040	10 mm [Right]	FCC #1	2	1:4.15	0.669	1.023	0.684	
836.6	190	GSM850	GPRS	31.70	31.60	-0.120	10 mm [Left]	FCC #1	2	1:4.15	0.383	1.023	0.392	
1880.0	661	PCS1900	GPRS	28.70	28.60	-0.170	10 mm [Bottom]	FCC #1	2	1:4.15	0.114	1.023	0.117	
1880.0	661	PCS1900	GPRS	28.70	28.60	-0.000	10 mm [Front]	FCC #1	2	1:4.15	0.373	1.023	0.382	A15
1880.0	661	PCS1900	GPRS	28.70	28.60	0.070	10 mm [Rear]	FCC #1	2	1:4.15	0.348	1.023	0.356	
1880.0	661	PCS1900	GPRS	28.70	28.60	-0.140	10 mm [Left]	FCC #1	2	1:4.15	0.276	1.023	0.282	
836.6	4183	WCDMA 850	RMC	24.20	24.20	0.010	10 mm [Bottom]	FCC #1	N/A	1:1	0.259	1.000	0.259	
836.6	4183	WCDMA 850	RMC	24.20	24.20	-0.010	10 mm [Front]	FCC #1	N/A	1:1	0.591	1.000	0.591	
836.6	4183	WCDMA 850	RMC	24.20	24.20	-0.040	10 mm [Rear]	FCC #1	N/A	1:1	0.736	1.000	0.736	A16
836.6	4183	WCDMA 850	RMC	24.20	24.20	0.070	10 mm [Right]	FCC #1	N/A	1:1	0.702	1.000	0.702	
836.6	4183	WCDMA 850	RMC	24.20	24.20	-0.060	10 mm [Left]	FCC #1	N/A	1:1	0.455	1.000	0.455	
ANSI / IEEE C95.1-1992- SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Body 1.6 W/kg (mW/g) averaged over 1 gram						

Table 11.3.2 LTE B17 Hotspot SAR
MEASUREMENT RESULTS

FREQUENCY		Mode/ Band	BW [MHz]	Max Allowed Power [dBm]	Cond. PWR [dBm]	Drift Power [dB]	MPR	Position	Device Serial Number	Mod.	RB Size	RB Offs.	Duty Cycle	1g SAR (W/kg)	Scaling Factor	1g Scaled SAR (W/kg)	Plots #
MHz	Ch																
710.0	23790	LTE B17	10	24.20	23.98	0.140	0	10 mm [Bottom]	FCC #1	QPSK	1	25	1:1	0.122	1.052	0.128	
710.0	23790	LTE B17	10	23.20	22.89	-0.030	1	10 mm [Bottom]	FCC #1	QPSK	25	12	1:1	0.089	1.074	0.096	
710.0	23790	LTE B17	10	24.20	23.98	-0.060	0	10 mm [Front]	FCC #1	QPSK	1	25	1:1	0.405	1.052	0.426	
710.0	23790	LTE B17	10	23.20	22.89	0.000	1	10 mm [Front]	FCC #1	QPSK	25	12	1:1	0.291	1.074	0.313	
710.0	23790	LTE B17	10	24.20	23.98	0.020	0	10 mm [Rear]	FCC #1	QPSK	1	25	1:1	0.614	1.052	0.646	A17
710.0	23790	LTE B17	10	23.20	22.89	마이너스0	1	10 mm [Rear]	FCC #1	QPSK	25	12	1:1	0.495	1.074	0.532	
710.0	23790	LTE B17	10	24.20	23.98	-0.040	0	10 mm [Right]	FCC #1	QPSK	1	25	1:1	0.329	1.052	0.346	
710.0	23790	LTE B17	10	23.20	22.89	-0.010	1	10 mm [Right]	FCC #1	QPSK	25	12	1:1	0.274	1.074	0.294	
710.0	23790	LTE B17	10	24.20	23.98	-0.130	0	10 mm [Left]	FCC #1	QPSK	1	25	1:1	0.185	1.052	0.195	
710.0	23790	LTE B17	10	23.20	22.89	-0.100	1	10 mm [Left]	FCC #1	QPSK	25	12	1:1	0.156	1.074	0.168	
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure									Body 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11.3.3 DTS Hotspot SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	SAR (W/kg)	Plots #
MHz	Ch														
2437.0	6	802.11b	15.50	14.56	-0.110	10 mm [Top]	FCC #2	0.057	1	99.8	0.056	1.242	1.002	0.070	
2437.0	6	802.11b	15.50	14.56	-0.020	10 mm [Front]	FCC #2	0.113	1	99.8	0.116	1.242	1.002	0.144	
2437.0	6	802.11b	15.50	14.56	0.000	10 mm [Rear]	FCC #2	0.155	1	99.8	0.148	1.242	1.002	0.184	A18
2437.0	6	802.11b	15.50	14.56	0.080	10 mm [Right]	FCC #2	0.073	1	99.8	0.073	1.242	1.002	0.091	
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Body 1.6 W/kg (mW/g) averaged over 1 gram							

Adjusted SAR results for OFDM SAR												
FREQUENCY		Model/ Antenna	Service	Maximum Allowed Power [dBm]	1g Scaled SAR (W/kg)	FREQUENCY [MHz]	Mode	Service	Maximum Allowed Power [dBm]	Ratio of OFDM to DSSS	1g Adjusted SAR (W/kg)	Determine OFDM SAR
MHz	Ch											
2437.0	6	802.11b	DSSS	15.5	0.184	2437	802.11g	OFDM	13.5	0.631	0.116	X
2437.0	6	802.11b	DSSS	15.5	0.184	2437	802.11n	OFDM	12.5	0.501	0.092	X
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure						Body 1.6 W/kg (mW/g) averaged over 1 gram						

Note: SAR is not required for the following 2.4 GHz OFDM conditions. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

Table 11.3.4 UNII Hotspot SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	1g Scaled SAR (W/kg)	Plots #
MHz	Ch														
5180.0	36	802.11a	12.50	12.23	-0.060	10 mm [Top]	FCC #2	0.110	1	98.5	0.100	1.064	1.015	0.108	
5180.0	36	802.11a	12.50	12.23	-0.120	10 mm [Front]	FCC #2	0.169	1	98.5	0.163	1.064	1.015	0.176	
5180.0	36	802.11a	12.50	12.23	0.080	10 mm [Rear]	FCC #2	0.199	1	98.5	0.201	1.064	1.015	0.217	
5180.0	36	802.11a	12.50	12.23	-0.070	10 mm [Right]	FCC #2	0.249	1	98.5	0.249	1.064	1.015	0.269	A23
ANSI / IEEE C95.1-1992- SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Body 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11.3.5 UNII Hotspot SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Peak SAR of Area Scan	Data Rate [Mbps]	Duty Cycle	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	1g Scaled SAR (W/kg)	Plots #
MHz	Ch														
5745.0	149	802.11a	12.50	11.96	-0.190	10 mm [Top]	FCC #2	0.073	1	98.5	0.060	1.132	1.015	0.069	
5745.0	149	802.11a	12.50	11.96	0.080	10 mm [Front]	FCC #2	0.133	1	98.5	0.141	1.132	1.015	0.162	
5745.0	149	802.11a	12.50	11.96	-0.040	10 mm [Rear]	FCC #2	0.150	1	98.5	0.139	1.132	1.015	0.160	
5745.0	149	802.11a	12.50	11.96	0.180	10 mm [Right]	FCC #2	0.166	1	98.5	0.163	1.132	1.015	0.187	A24
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								Body 1.6 W/kg (mW/g) averaged over 1 gram							

Note : UNII-3 Band CH 165(5825 MHz) is not support Hotspot mode as described on operational description, so other required CHs are tested.

Table 11.3.6 Bluetooth Hotspot SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Drift Power [dB]	Phantom Position	Device Serial Number	Rate [Mbps]	Duty Cycle (%)	1g SAR (W/kg)	Scaling Factor	Scaling Factor (Duty Cycle)	1g Scaled SAR (W/kg)	Plots #
MHz	Ch													
2441.0	39	Bluetooth	9.00	7.98	-0.160	10 mm [Top]	FCC #2	1	76.8	0.011	1.265	1.302	0.018	
2441.0	39	Bluetooth	9.00	7.98	-0.100	10 mm [Front]	FCC #2	1	76.8	0.024	1.265	1.302	0.040	
2441.0	39	Bluetooth	9.00	7.98	-0.160	10 mm [Rear]	FCC #2	1	76.8	0.030	1.265	1.302	0.049	A22
2441.0	39	Bluetooth	9.00	7.98	0.160	10 mm [Right]	FCC #2	1	76.8	0.017	1.265	1.302	0.028	
ANSI / IEEE C95.1-1992– SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population Exposure								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. A standard battery was used for all 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 not > 1.2 W/kg, no additional body-worn SAR evaluations using a headset cable were performed.
8. 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.
9. SAR measurements were performed using the DASY5 automated system. The procedure for spatial peak SAR evaluation has been implemented according to the IEEE 1528 standard. During a maximum search, global and local maxima searches are automatically performed in 2-D after each area scan measurement. The algorithm will find the global maximum and all local maxima within 2 dB of the global maxima for all SAR distributions. All local maxima within 2 dB of the global maximum were searched and passed for the Zoom Scan measurement.

GSM Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
2. This device supports GSM VOIP in the head and body-worn configurations; therefore GPRS was additionally evaluated for head and body-worn compliance.
3. 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.
4. 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 then testing at the other channels is not required for such test configuration(s). Since the maximum output power variation across the required test channels is not > $\frac{1}{2}$ dB, the middle channel was used for testing.

WCDMA (UMTS) Notes:

1. WCDMA (UMTS) mode in was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v03r01. AMR and HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.
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 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 $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel was used.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r05. The general test procedures used for testing can be found in Section 5.
2. According to FCC KDB 941225 D05v02r05, when the reported SAR is ≤ 0.8 W/kg, testing of the 100% RB allocation and required test channels is not required.
Otherwise, SAR is required for the remaining required test channels using the 1 RB, 50% RB and 100% RB allocation with highest output power for that channel.
Only one channel, and as reported SAR values for 1 RB allocation and 50% RB allocation were less than 1.45 W/kg only the highest power RB offset for each allocation was required.
3. 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.
4. A-MPR was disabled for all SAR tests by setting NS=1 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).
5. Per KDB Publication 941225 D05Av01r02, 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.
6. SAR test reduction is applied using the following criteria:
Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB, and 50% RB allocation, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is > 0.8 W/kg, testing for other channels is performed at the highest output power level for 1 RB, and 50% RB configuration for that channel. Testing for 100% RB configuration is performed at the highest output power level for 100% RB configuration across the Low, Mid and High channel when the highest reported SAR for 1 RB and 50% RB are > 0.8 W/kg, Testing for the remaining required channels is not needed because the reported SAR for 100% RB Allocation < 1.45 W/kg. Testing for 16QAM modulation is not required because the reported SAR for QPSK is < 1.45 W/kg and its output power is not more than 0.5 dB higher than that a QPSK. Testing for the other channel bandwidths is not required because the reported SAR for the highest channel bandwidth is < 1.45 W/kg and its output power is not more than 0.5 dB higher than that of the highest channel bandwidth.

WLAN Notes:

1. 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, 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 when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output and the adjust SAR is ≤ 1.2 W/kg.
3. Justification for test configurations for WLAN per KDB Publication 248227 D01v02r02 for 5 GHz WIFI single transmission chain operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed powers. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than 1.2 W/kg.
4. When the maximum reported 1g averaged SAR ≤ 0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg or all test channels were measured.
5. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor to determine compliance.

Bluetooth Notes:

1. Bluetooth SAR was measured with the device connected to a call with hopping disabled with DH5 operation. Per October 2016 TCB Workshop Notes, the reported SAR was scaled to the 100% transmission duty factor to determine compliance. Refer to section 10.5 for the time-domain plot and calculation for the duty factor of the device.

12. FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

12.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v06 are applicable to handsets with built-in unlicensed transmitters such as 802.11b/g/n and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

12.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 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 sum 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤ 1.6 W/kg. The different test position in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1-g or 10-g SAR.

12.3 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01v06, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the DUT are shown in Figure 13.1 and are color-coded to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.



Figure 12.1 Simultaneous Transmission Paths

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

Table 12.3.1 Simultaneous Transmission Scenarios

No.	Capable TX Configuration	GSM 850/1900 (Voice)	GPRS/EDGE 850/1900 (Data)	WCDMA B5 (Voice)	WCDMA B5 (Data)	LTE B17	WiFi 2.4GHz 802.11b/g/n	WiFi 5GHz 802.11a/n/ac	Bluetooth 2.4GHz
1	GSM 850/1900 (Voice)		No	No	No	No	Yes	Yes	Yes
2	GPRS/EDGE 850/1900 (Data)	No		No	No	No	Yes	Yes	Yes
3	WCDMA B5 (Voice)	No	No		No	No	Yes	Yes	Yes
4	WCDMA B5 (Data)	No	No	No		No	Yes	Yes	Yes
5	LTE B17	No	No	No	No		Yes	Yes	Yes
6	WiFi 2.4GHz 802.11b/g/n	Yes	Yes	Yes	Yes	Yes		No	No
7	WiFi 5GHz 802.11a/n/ac	Yes	Yes	Yes	Yes	Yes	No		Yes
8	Bluetooth 2.4GHz	Yes	Yes	Yes	Yes	Yes	No	Yes	

Table 12.3.2 Simultaneous SAR Cases

No.	Capable Transmit Configuration	Head SAR	Body-Worn SAR	Hotspot SAR	Note
1	GSM Voice + Wi-Fi 2.4 GHz	Yes	Yes	N/A	
2	GSM Voice + Wi-Fi 5 GHz	Yes	Yes	N/A	
3	GSM Voice + Bluetooth 2.4 GHz	Yes	Yes	N/A	
4	GSM Voice + Bluetooth 2.4 GHz + Wi-Fi 5GHz	Yes	Yes	N/A	
5	WCDMA + Wi-Fi 2.4 GHz	Yes	Yes	Yes	
6	WCDMA + Wi-Fi 5 GHz	Yes	Yes	Yes*	* WiFi-Direct (GC / GO) of UNII-1 & UNII-3 can be operated simultaneous transmission.
7	WCDMA + Bluetooth 2.4 GHz	Yes	Yes	Yes	
8	WCDMA + Bluetooth 2.4 GHz + Wi-Fi 5GHz	Yes	Yes	Yes*	* WiFi-Direct (GC / GO) of UNII-1 & UNII-3 can be operated simultaneous transmission.
9	LTE + Wi-Fi 2.4 GHz	Yes	Yes	Yes	
10	LTE + Wi-Fi 5 GHz	Yes	Yes	Yes*	* WiFi-Direct (GC / GO) of UNII-1 & UNII-3 can be operated simultaneous transmission.
11	LTE + Bluetooth 2.4 GHz	Yes	Yes	Yes	
12	LTE + Bluetooth 2.4 GHz + Wi-Fi 5GHz	Yes	Yes	Yes*	* WiFi-Direct (GC / GO) of UNII-1 & UNII-3 can be operated simultaneous transmission.
13	GPRS/EDGE + Wi-Fi 2.4 GHz	Yes	Yes	Yes	
14	GPRS/EDGE + Wi-Fi 5 GHz	Yes	Yes	Yes*	* WiFi-Direct (GC / GO) of UNII-1 & UNII-3 can be operated simultaneous transmission.
15	GPRS/EDGE + Bluetooth 2.4 GHz	Yes	Yes	Yes	
16	GPRS/EDGE + Bluetooth 2.4 GHz + Wi-Fi 5GHz	Yes	Yes	Yes*	* WiFi-Direct (GC / GO) of UNII-1 & UNII-3 can be operated simultaneous transmission.

Notes:

- WiFi 2.4GHz is supported Hotspot and WiFi-Direct(GO/GC).
- WiFi 5GHz is not supported Hotspot
- WiFi 5GHz is supported WiFi-Direct(GO/GC) in UNII B1,B3.
- LTE, WCDMA, GPRS/EDGE is supported Hotspot.
- VoIP is supported in LTE, WCDMA, GSM
- Bluetooth and WiFi can not transmit simultaneously at 2.4G band.
- GSM, WCDMA and LTE can not transmit simultaneously since they share the same chip.
- 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 [DPCH]) 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.
- Per the manufacturer, WiFi Direct is expected to be used in conjunction with a held-to-ear or body-worn accessory voice call. Simultaneous transmission scenarios involving WiFi direct are included in the above table.

12.4 Head SAR Simultaneous Transmission Analysis

Table 12.4.1 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.3 GHz W-LAN (Held to Ear)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.3G W-LAN SAR (W/kg)	ΣSAR (W/kg)		
			1	2	3	1+2	1+3	1+2+3
Head SAR	GSM 850	Left Touch	0.414	0.298	0.695	0.712	1.109	1.407
		Right Touch	0.499	0.114	0.542	0.613	1.041	1.155
		Left Tilt	0.248	0.158	0.499	0.406	0.747	0.905
		Right Tilt	0.251	0.099	0.442	0.350	0.693	0.792
	GPRS 850	Left Touch	0.471	0.298	0.695	0.769	1.166	1.464
		Right Touch	0.589	0.114	0.542	0.703	1.131	1.245
		Left Tilt	0.287	0.158	0.499	0.445	0.786	0.944
		Right Tilt	0.315	0.099	0.442	0.414	0.757	0.856
	GSM 1900	Left Touch	0.260	0.298	0.695	0.558	0.955	1.253
		Right Touch	0.126	0.114	0.542	0.240	0.668	0.782
		Left Tilt	0.108	0.158	0.499	0.266	0.607	0.765
		Right Tilt	0.089	0.099	0.442	0.188	0.531	0.630
	GPRS 1900	Left Touch	0.379	0.298	0.695	0.677	1.074	1.372
		Right Touch	0.183	0.114	0.542	0.297	0.725	0.839
		Left Tilt	0.159	0.158	0.499	0.317	0.658	0.816
		Right Tilt	0.129	0.099	0.442	0.228	0.571	0.670
	WCDMA 850	Left Touch	0.474	0.298	0.695	0.772	1.169	1.467
		Right Touch	0.607	0.114	0.542	0.721	1.149	1.263
		Left Tilt	0.294	0.158	0.499	0.452	0.793	0.951
		Right Tilt	0.304	0.099	0.442	0.403	0.746	0.845
	LTE Band 17	Left Touch	0.378	0.298	0.695	0.676	1.073	1.371
		Right Touch	0.398	0.114	0.542	0.512	0.940	1.054
		Left Tilt	0.188	0.158	0.499	0.346	0.687	0.845
		Right Tilt	0.223	0.099	0.442	0.322	0.665	0.764

Table 12.4.2 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.6 GHz W-LAN (Held to Ear)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.6G W-LAN SAR (W/kg)	ΣSAR (W/kg)		
			1	2	3	1+2	1+3	1+2+3
Head SAR	GSM 850	Left Touch	0.414	0.298	0.786	0.712	1.200	1.498
		Right Touch	0.499	0.114	0.651	0.613	1.150	1.264
		Left Tilt	0.248	0.158	0.569	0.406	0.817	0.975
		Right Tilt	0.251	0.099	0.513	0.350	0.764	0.863
	GPRS 850	Left Touch	0.471	0.298	0.786	0.769	1.257	1.555
		Right Touch	0.589	0.114	0.651	0.703	1.240	1.354
		Left Tilt	0.287	0.158	0.569	0.445	0.856	1.014
		Right Tilt	0.315	0.099	0.513	0.414	0.828	0.927
	GSM 1900	Left Touch	0.260	0.298	0.786	0.558	1.046	1.344
		Right Touch	0.126	0.114	0.651	0.240	0.777	0.891
		Left Tilt	0.108	0.158	0.569	0.266	0.677	0.835
		Right Tilt	0.089	0.099	0.513	0.188	0.602	0.701
	GPRS 1900	Left Touch	0.379	0.298	0.786	0.677	1.165	1.463
		Right Touch	0.183	0.114	0.651	0.297	0.834	0.948
		Left Tilt	0.159	0.158	0.569	0.317	0.728	0.886
		Right Tilt	0.129	0.099	0.513	0.228	0.642	0.741
	WCDMA 850	Left Touch	0.474	0.298	0.786	0.772	1.260	1.558
		Right Touch	0.607	0.114	0.651	0.721	1.258	1.372
		Left Tilt	0.294	0.158	0.569	0.452	0.863	1.021
		Right Tilt	0.304	0.099	0.513	0.403	0.817	0.916
	LTE Band 17	Left Touch	0.378	0.298	0.786	0.676	1.164	1.462
		Right Touch	0.398	0.114	0.651	0.512	1.049	1.163
		Left Tilt	0.188	0.158	0.569	0.346	0.757	0.915
		Right Tilt	0.223	0.099	0.513	0.322	0.736	0.835

Table 12.4.3 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.8 GHz W-LAN (Held to Ear)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.8G W-LAN SAR (W/kg)	Σ SAR (W/kg)		
			1	2	3	1+2	1+3	1+2+3
Head SAR	GSM 850	Left Touch	0.414	0.298	0.484	0.712	0.898	1.196
		Right Touch	0.499	0.114	0.462	0.613	0.961	1.075
		Left Tilt	0.248	0.158	0.385	0.406	0.633	0.791
		Right Tilt	0.251	0.099	0.355	0.350	0.606	0.705
	GPRS 850	Left Touch	0.471	0.298	0.484	0.769	0.955	1.253
		Right Touch	0.589	0.114	0.462	0.703	1.051	1.165
		Left Tilt	0.287	0.158	0.385	0.445	0.672	0.830
		Right Tilt	0.315	0.099	0.355	0.414	0.670	0.769
	GSM 1900	Left Touch	0.260	0.298	0.484	0.558	0.744	1.042
		Right Touch	0.126	0.114	0.462	0.240	0.588	0.702
		Left Tilt	0.108	0.158	0.385	0.266	0.493	0.651
		Right Tilt	0.089	0.099	0.355	0.188	0.444	0.543
	GPRS 1900	Left Touch	0.379	0.298	0.484	0.677	0.863	1.161
		Right Touch	0.183	0.114	0.462	0.297	0.645	0.759
		Left Tilt	0.159	0.158	0.385	0.317	0.544	0.702
		Right Tilt	0.129	0.099	0.355	0.228	0.484	0.583
	WCDMA 850	Left Touch	0.474	0.298	0.484	0.772	0.958	1.256
		Right Touch	0.607	0.114	0.462	0.721	1.069	1.183
		Left Tilt	0.294	0.158	0.385	0.452	0.679	0.837
		Right Tilt	0.304	0.099	0.355	0.403	0.659	0.758
	LTE Band 17	Left Touch	0.378	0.298	0.484	0.676	0.862	1.160
		Right Touch	0.398	0.114	0.462	0.512	0.860	0.974
		Left Tilt	0.188	0.158	0.385	0.346	0.573	0.731
		Right Tilt	0.223	0.099	0.355	0.322	0.578	0.677

Table 12.4.4 Simultaneous Transmission Scenario : 2G/3G/4G + 2.4 GHz W-LAN (Held to Ear)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	2.4G W-LAN SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Head SAR	GSM 850	Left Touch	0.414	0.907	1.321
		Right Touch	0.499	0.357	0.856
		Left Tilt	0.248	0.492	0.740
		Right Tilt	0.251	0.330	0.581
	GPRS 850	Left Touch	0.471	0.907	1.378
		Right Touch	0.589	0.357	0.946
		Left Tilt	0.287	0.492	0.779
		Right Tilt	0.315	0.330	0.645
	GSM 1900	Left Touch	0.260	0.907	1.167
		Right Touch	0.126	0.357	0.483
		Left Tilt	0.108	0.492	0.600
		Right Tilt	0.089	0.330	0.419
	GPRS 1900	Left Touch	0.379	0.907	1.286
		Right Touch	0.183	0.357	0.540
		Left Tilt	0.159	0.492	0.651
		Right Tilt	0.129	0.330	0.459
	WCDMA 850	Left Touch	0.474	0.907	1.381
		Right Touch	0.607	0.357	0.964
		Left Tilt	0.294	0.492	0.786
		Right Tilt	0.304	0.330	0.634
	LTE Band 17	Left Touch	0.378	0.907	1.285
		Right Touch	0.398	0.357	0.755
		Left Tilt	0.188	0.492	0.680
		Right Tilt	0.223	0.330	0.553

Table 12.4.5 Simultaneous Transmission Scenario : 2G/3G/4G + 5.3 GHz W-LAN (Held to Ear)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	5.3G W-LAN SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Head SAR	GSM 850	Left Touch	0.414	0.695	1.109
		Right Touch	0.499	0.542	1.041
		Left Tilt	0.248	0.499	0.747
		Right Tilt	0.251	0.442	0.693
	GPRS 850	Left Touch	0.471	0.695	1.166
		Right Touch	0.589	0.542	1.131
		Left Tilt	0.287	0.499	0.786
		Right Tilt	0.315	0.442	0.757
	GSM 1900	Left Touch	0.260	0.695	0.955
		Right Touch	0.126	0.542	0.668
		Left Tilt	0.108	0.499	0.607
		Right Tilt	0.089	0.442	0.531
	GPRS 1900	Left Touch	0.379	0.695	1.074
		Right Touch	0.183	0.542	0.725
		Left Tilt	0.159	0.499	0.658
		Right Tilt	0.129	0.442	0.571
	WCDMA 850	Left Touch	0.474	0.695	1.169
		Right Touch	0.607	0.542	1.149
		Left Tilt	0.294	0.499	0.793
		Right Tilt	0.304	0.442	0.746
	LTE Band 17	Left Touch	0.378	0.695	1.073
		Right Touch	0.398	0.542	0.940
		Left Tilt	0.188	0.499	0.687
		Right Tilt	0.223	0.442	0.665

Table 12.4.6 Simultaneous Transmission Scenario : 2G/3G/4G + 5.6 GHz W-LAN (Held to Ear)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	5.6G W-LAN SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Head SAR	GSM 850	Left Touch	0.414	0.786	1.200
		Right Touch	0.499	0.651	1.150
		Left Tilt	0.248	0.569	0.817
		Right Tilt	0.251	0.513	0.764
	GPRS 850	Left Touch	0.471	0.786	1.257
		Right Touch	0.589	0.651	1.240
		Left Tilt	0.287	0.569	0.856
		Right Tilt	0.315	0.513	0.828
	GSM 1900	Left Touch	0.260	0.786	1.046
		Right Touch	0.126	0.651	0.777
		Left Tilt	0.108	0.569	0.677
		Right Tilt	0.089	0.513	0.602
	GPRS 1900	Left Touch	0.379	0.786	1.165
		Right Touch	0.183	0.651	0.834
		Left Tilt	0.159	0.569	0.728
		Right Tilt	0.129	0.513	0.642
	WCDMA 850	Left Touch	0.474	0.786	1.260
		Right Touch	0.607	0.651	1.258
		Left Tilt	0.294	0.569	0.863
		Right Tilt	0.304	0.513	0.817
	LTE Band 17	Left Touch	0.378	0.786	1.164
		Right Touch	0.398	0.651	1.049
		Left Tilt	0.188	0.569	0.757
		Right Tilt	0.223	0.513	0.736

Table 12.4.7 Simultaneous Transmission Scenario : 2G/3G/4G + 5.8 GHz W-LAN (Held to Ear)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	5.8G W-LAN SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Head SAR	GSM 850	Left Touch	0.414	0.484	0.898
		Right Touch	0.499	0.462	0.961
		Left Tilt	0.248	0.385	0.633
		Right Tilt	0.251	0.355	0.606
	GPRS 850	Left Touch	0.471	0.484	0.955
		Right Touch	0.589	0.462	1.051
		Left Tilt	0.287	0.385	0.672
		Right Tilt	0.315	0.355	0.670
	GSM 1900	Left Touch	0.260	0.484	0.744
		Right Touch	0.126	0.462	0.588
		Left Tilt	0.108	0.385	0.493
		Right Tilt	0.089	0.355	0.444
	GPRS 1900	Left Touch	0.379	0.484	0.863
		Right Touch	0.183	0.462	0.645
		Left Tilt	0.159	0.385	0.544
		Right Tilt	0.129	0.355	0.484
	WCDMA 850	Left Touch	0.474	0.484	0.958
		Right Touch	0.607	0.462	1.069
		Left Tilt	0.294	0.385	0.679
		Right Tilt	0.304	0.355	0.659
	LTE Band 17	Left Touch	0.378	0.484	0.862
		Right Touch	0.398	0.462	0.860
		Left Tilt	0.188	0.385	0.573
		Right Tilt	0.223	0.355	0.578

Table 12.4.8 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth (Held to Ear)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Head SAR	GSM 850	Left Touch	0.414	0.298	0.712
		Right Touch	0.499	0.114	0.613
		Left Tilt	0.248	0.158	0.406
		Right Tilt	0.251	0.099	0.350
	GPRS 850	Left Touch	0.471	0.298	0.769
		Right Touch	0.589	0.114	0.703
		Left Tilt	0.287	0.158	0.445
		Right Tilt	0.315	0.099	0.414
	GSM 1900	Left Touch	0.260	0.298	0.558
		Right Touch	0.126	0.114	0.240
		Left Tilt	0.108	0.158	0.266
		Right Tilt	0.089	0.099	0.188
	GPRS 1900	Left Touch	0.379	0.298	0.677
		Right Touch	0.183	0.114	0.297
		Left Tilt	0.159	0.158	0.317
		Right Tilt	0.129	0.099	0.228
	WCDMA 850	Left Touch	0.474	0.298	0.772
		Right Touch	0.607	0.114	0.721
		Left Tilt	0.294	0.158	0.452
		Right Tilt	0.304	0.099	0.403
	LTE Band 17	Left Touch	0.378	0.298	0.676
		Right Touch	0.398	0.114	0.512
		Left Tilt	0.188	0.158	0.346
		Right Tilt	0.223	0.099	0.322

Table 12.4.9 Simultaneous Transmission Scenario : Bluetooth + 5 GHz W-LAN (Held to Ear)

Exposure Condition	Mode	Configuration	Bluetooth SAR (W/kg)	5G W-LAN SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Head SAR	5.3G W-LAN	Left Touch	0.298	0.695	0.993
		Right Touch	0.114	0.542	0.656
		Left Tilt	0.158	0.499	0.657
		Right Tilt	0.099	0.442	0.541
	5.6G W-LAN	Left Touch	0.298	0.786	1.084
		Right Touch	0.114	0.651	0.765
		Left Tilt	0.158	0.569	0.727
		Right Tilt	0.099	0.513	0.612
	5.8G W-LAN	Left Touch	0.298	0.484	0.782
		Right Touch	0.114	0.462	0.576
		Left Tilt	0.158	0.385	0.543
		Right Tilt	0.099	0.355	0.454

12.5 Body-Worn Simultaneous Transmission Analysis

Table 12.5.1 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.3 GHz W-LAN (Body-Worn at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.3G W-LAN SAR (W/kg)	ΣSAR (W/kg)		
			1	2	3	1+2	1+3	1+2+3
Body-Worn SAR	GSM 850	Front	0.521	0.040	0.199	0.561	0.720	0.760
		Rear	0.619	0.049	0.248	0.668	0.867	0.916
	GPRS 850	Front	0.611	0.040	0.199	0.651	0.810	0.850
		Rear	0.766	0.049	0.248	0.815	1.014	1.063
	GSM 1900	Front	0.262	0.040	0.199	0.302	0.461	0.501
		Rear	0.251	0.049	0.248	0.300	0.499	0.548
	GPRS 1900	Front	0.382	0.040	0.199	0.422	0.581	0.621
		Rear	0.356	0.049	0.248	0.405	0.604	0.653
	WCDMA 850	Front	0.591	0.040	0.199	0.631	0.790	0.830
		Rear	0.736	0.049	0.248	0.785	0.984	1.033
	LTE Band 17	Front	0.426	0.040	0.199	0.466	0.625	0.665
		Rear	0.646	0.049	0.248	0.695	0.894	0.943

Table 12.5.2 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.6 GHz W-LAN (Body-Worn at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.6G W-LAN SAR (W/kg)	ΣSAR (W/kg)		
			1	2	3	1+2	1+3	1+2+3
Body-Worn SAR	GSM 850	Front	0.521	0.040	0.231	0.561	0.752	0.792
		Rear	0.619	0.049	0.246	0.668	0.865	0.914
	GPRS 850	Front	0.611	0.040	0.231	0.651	0.842	0.882
		Rear	0.766	0.049	0.246	0.815	1.012	1.061
	GSM 1900	Front	0.262	0.040	0.231	0.302	0.493	0.533
		Rear	0.251	0.049	0.246	0.300	0.497	0.546
	GPRS 1900	Front	0.382	0.040	0.231	0.422	0.613	0.653
		Rear	0.356	0.049	0.246	0.405	0.602	0.651
	WCDMA 850	Front	0.591	0.040	0.231	0.631	0.822	0.862
		Rear	0.736	0.049	0.246	0.785	0.982	1.031
	LTE Band 17	Front	0.426	0.040	0.231	0.466	0.657	0.697
		Rear	0.646	0.049	0.246	0.695	0.892	0.941

Table 12.5.3 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.8 GHz W-LAN (Body-Worn at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.8G W-LAN SAR (W/kg)	ΣSAR (W/kg)		
			1	2	3	1+2	1+3	1+2+3
Body-Worn SAR	GSM 850	Front	0.521	0.040	0.162	0.561	0.683	0.723
		Rear	0.619	0.049	0.160	0.668	0.779	0.828
	GPRS 850	Front	0.611	0.040	0.162	0.651	0.773	0.813
		Rear	0.766	0.049	0.160	0.815	0.926	0.975
	GSM 1900	Front	0.262	0.040	0.162	0.302	0.424	0.464
		Rear	0.251	0.049	0.160	0.300	0.411	0.460
	GPRS 1900	Front	0.382	0.040	0.162	0.422	0.544	0.584
		Rear	0.356	0.049	0.160	0.405	0.516	0.565
	WCDMA 850	Front	0.591	0.040	0.162	0.631	0.753	0.793
		Rear	0.736	0.049	0.160	0.785	0.896	0.945
	LTE Band 17	Front	0.426	0.040	0.162	0.466	0.588	0.628
		Rear	0.646	0.049	0.160	0.695	0.806	0.855

Table 12.5.4 Simultaneous Transmission Scenario : 2G/3G/4G + 2.4 GHz W-LAN (Body-Worn at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	2.4G W-LAN SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Body-Worn SAR	GSM 850	Front	0.521	0.144	0.665
		Rear	0.619	0.184	0.803
	GPRS 850	Front	0.611	0.144	0.755
		Rear	0.766	0.184	0.950
	GSM 1900	Front	0.262	0.144	0.406
		Rear	0.251	0.184	0.435
	GPRS 1900	Front	0.382	0.144	0.526
		Rear	0.356	0.184	0.540
	WCDMA 850	Front	0.591	0.144	0.735
		Rear	0.736	0.184	0.920
	LTE Band 17	Front	0.426	0.144	0.570
		Rear	0.646	0.184	0.830

Table 12.5.5 Simultaneous Transmission Scenario : 2G/3G/4G + 5.3 GHz W-LAN (Body-Worn at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	5.3G W-LAN SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Body-Worn SAR	GSM 850	Front	0.521	0.199	0.720
		Rear	0.619	0.248	0.867
	GPRS 850	Front	0.611	0.199	0.810
		Rear	0.766	0.248	1.014
	GSM 1900	Front	0.262	0.199	0.461
		Rear	0.251	0.248	0.499
	GPRS 1900	Front	0.382	0.199	0.581
		Rear	0.356	0.248	0.604
	WCDMA 850	Front	0.591	0.199	0.790
		Rear	0.736	0.248	0.984
	LTE Band 17	Front	0.426	0.199	0.625
		Rear	0.646	0.248	0.894

Table 12.5.6 Simultaneous Transmission Scenario : 2G/3G/4G + 5.6 GHz W-LAN (Body-Worn at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	5.6G W-LAN SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Body-Worn SAR	GSM 850	Front	0.521	0.231	0.752
		Rear	0.619	0.246	0.865
	GPRS 850	Front	0.611	0.231	0.842
		Rear	0.766	0.246	1.012
	GSM 1900	Front	0.262	0.231	0.493
		Rear	0.251	0.246	0.497
	GPRS 1900	Front	0.382	0.231	0.613
		Rear	0.356	0.246	0.602
	WCDMA 850	Front	0.591	0.231	0.822
		Rear	0.736	0.246	0.982
	LTE Band 17	Front	0.426	0.231	0.657
		Rear	0.646	0.246	0.892

Table 12.5.7 Simultaneous Transmission Scenario : 2G/3G/4G + 5.8 GHz W-LAN (Body-Worn at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	5.8G W-LAN SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Body-Worn SAR	GSM 850	Front	0.521	0.162	0.683
		Rear	0.619	0.160	0.779
	GPRS 850	Front	0.611	0.162	0.773
		Rear	0.766	0.160	0.926
	GSM 1900	Front	0.262	0.162	0.424
		Rear	0.251	0.160	0.411
	GPRS 1900	Front	0.382	0.162	0.544
		Rear	0.356	0.160	0.516
	WCDMA 850	Front	0.591	0.162	0.753
		Rear	0.736	0.160	0.896
	LTE Band 17	Front	0.426	0.162	0.588
		Rear	0.646	0.160	0.806

Table 12.5.8 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth (Body-Worn at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Body-Worn SAR	GSM 850	Front	0.521	0.040	0.561
		Rear	0.619	0.049	0.668
	GPRS 850	Front	0.611	0.040	0.651
		Rear	0.766	0.049	0.815
	GSM 1900	Front	0.262	0.040	0.302
		Rear	0.251	0.049	0.300
	GPRS 1900	Front	0.382	0.040	0.422
		Rear	0.356	0.049	0.405
	WCDMA 850	Front	0.591	0.040	0.631
		Rear	0.736	0.049	0.785
	LTE Band 17	Front	0.426	0.040	0.466
		Rear	0.646	0.049	0.695

Table 12.5.9 Simultaneous Transmission Scenario : Bluetooth + 5 GHz W-LAN (Body-Worn at 10 mm)

Exposure Condition	Mode	Configuration	Bluetooth SAR (W/kg)	5G W-LAN SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Body-Worn SAR	5.3G W-LAN	Front	0.144	0.199	0.343
		Rear	0.184	0.248	0.432
	5.6G W-LAN	Front	0.144	0.231	0.375
		Rear	0.184	0.246	0.430
	5.8G W-LAN	Front	0.144	0.162	0.306
		Rear	0.184	0.160	0.344

12.6 Hotspot SAR Simultaneous Transmission Analysis

Per FCC KDB Publication 941225 D06v02r01, the device edges with antennas more than 2.5 cm from edge are not required to be evaluated for SAR ("").

Table 12.6.1 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.2 GHz W-LAN (Hotspot at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.2G W-LAN SAR (W/kg)	ΣSAR (W/kg)		
			1	2	3	1+2	1+3	1+2+3
Hotspot SAR	GPRS 850	Top	-	0.018	0.108	0.018	0.108	0.126
		Bottom	0.211	-	-	0.211	0.211	0.211
		Front	0.611	0.040	0.176	0.651	0.787	0.827
		Rear	0.766	0.049	0.217	0.815	0.983	1.032
		Right	0.684	0.028	0.269	0.712	0.953	0.981
		Left	0.392	-	-	0.392	0.392	0.392
	GPRS 1900	Top	-	0.018	0.108	0.018	0.108	0.126
		Bottom	0.117	-	-	0.117	0.117	0.117
		Front	0.382	0.040	0.176	0.422	0.558	0.598
		Rear	0.356	0.049	0.217	0.405	0.573	0.622
		Right	-	0.028	0.269	0.028	0.269	0.297
		Left	0.282	-	-	0.282	0.282	0.282
	WCDMA 850	Top	-	0.018	0.108	0.018	0.108	0.126
		Bottom	0.259	-	-	0.259	0.259	0.259
		Front	0.591	0.040	0.176	0.631	0.767	0.807
		Rear	0.736	0.049	0.217	0.785	0.953	1.002
		Right	0.702	0.028	0.269	0.730	0.971	0.999
		Left	0.455	-	-	0.455	0.455	0.455
	LTE Band 17	Top	-	0.018	0.108	0.018	0.108	0.126
		Bottom	0.128	-	-	0.128	0.128	0.128
		Front	0.426	0.040	0.176	0.466	0.602	0.642
		Rear	0.646	0.049	0.217	0.695	0.863	0.912
		Right	0.346	0.028	0.269	0.374	0.615	0.643
		Left	0.195	-	-	0.195	0.195	0.195

Table 12.6.2 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth + 5.8 GHz W-LAN (Hotspot at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	5.8G W-LAN SAR (W/kg)	ΣSAR (W/kg)		
			1	2	3	1+2	1+3	1+2+3
Hotspot SAR	GPRS 850	Top	-	0.018	0.069	0.018	0.069	0.087
		Bottom	0.211	-	-	0.211	0.211	0.211
		Front	0.611	0.040	0.162	0.651	0.773	0.813
		Rear	0.766	0.049	0.160	0.815	0.926	0.975
		Right	0.684	0.028	0.187	0.712	0.871	0.899
		Left	0.392	-	-	0.392	0.392	0.392
	GPRS 1900	Top	-	0.018	0.069	0.018	0.069	0.087
		Bottom	0.117	-	-	0.117	0.117	0.117
		Front	0.382	0.040	0.162	0.422	0.544	0.584
		Rear	0.356	0.049	0.160	0.405	0.516	0.565
		Right	-	0.028	0.187	0.028	0.187	0.215
		Left	0.282	-	-	0.282	0.282	0.282
	WCDMA 850	Top	-	0.018	0.069	0.018	0.069	0.087
		Bottom	0.259	-	-	0.259	0.259	0.259
		Front	0.591	0.040	0.162	0.631	0.753	0.793
		Rear	0.736	0.049	0.160	0.785	0.896	0.945
		Right	0.702	0.028	0.187	0.730	0.889	0.917
		Left	0.455	-	-	0.455	0.455	0.455
	LTE Band 17	Top	-	0.018	0.069	0.018	0.069	0.087
		Bottom	0.128	-	-	0.128	0.128	0.128
		Front	0.426	0.040	0.162	0.466	0.588	0.628
		Rear	0.646	0.049	0.160	0.695	0.806	0.855
		Right	0.346	0.028	0.187	0.374	0.533	0.561
		Left	0.195	-	-	0.195	0.195	0.195

Table 12.6.3 Simultaneous Transmission Scenario : 2G/3G/4G + 2.4 GHz W-LAN (Hotspot at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	2.4G W-LAN SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Hotspot SAR	GPRS 850	Top	-	0.070	0.070
		Bottom	0.211	-	0.211
		Front	0.611	0.144	0.755
		Rear	0.766	0.184	0.950
		Right	0.684	0.091	0.775
		Left	0.392	-	0.392
	GPRS 1900	Top	-	0.070	0.070
		Bottom	0.117	-	0.117
		Front	0.382	0.144	0.526
		Rear	0.356	0.184	0.540
		Right	-	0.091	0.091
		Left	0.282	-	0.282
	WCDMA 850	Top	-	0.070	0.070
		Bottom	0.259	-	0.259
		Front	0.591	0.144	0.735
		Rear	0.736	0.184	0.920
		Right	0.702	0.091	0.793
		Left	0.455	-	0.455
	LTE Band 17	Top	-	0.070	0.070
		Bottom	0.128	-	0.128
		Front	0.426	0.144	0.570
		Rear	0.646	0.184	0.830
		Right	0.346	0.091	0.437
		Left	0.195	-	0.195

Table 12.6.4 Simultaneous Transmission Scenario : 2G/3G/4G + 5.2 GHz W-LAN (Hotspot at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	5.2G W-LAN SAR (W/kg)	ΣSAR (W/kg)
			1	2	1+2
Hotspot SAR	GPRS 850	Top	-	0.108	0.108
		Bottom	0.211	-	0.211
		Front	0.611	0.176	0.787
		Rear	0.766	0.217	0.983
		Right	0.684	0.269	0.953
		Left	0.392	-	0.392
	GPRS 1900	Top	-	0.108	0.108
		Bottom	0.117	-	0.117
		Front	0.382	0.176	0.558
		Rear	0.356	0.217	0.573
		Right	-	0.269	0.269
		Left	0.282	-	0.282
	WCDMA 850	Top	-	0.108	0.108
		Bottom	0.259	-	0.259
		Front	0.591	0.176	0.767
		Rear	0.736	0.217	0.953
		Right	0.702	0.269	0.971
		Left	0.455	-	0.455
	LTE Band 17	Top	-	0.108	0.108
		Bottom	0.128	-	0.128
		Front	0.426	0.176	0.602
		Rear	0.646	0.217	0.863
		Right	0.346	0.269	0.615
		Left	0.195	-	0.195

Table 12.6.5 Simultaneous Transmission Scenario : 2G/3G/4G + 5.8 GHz W-LAN (Hotspot at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	5.8G W-LAN SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Hotspot SAR	GPRS 850	Top	-	0.069	0.069
		Bottom	0.211	-	0.211
		Front	0.611	0.162	0.773
		Rear	0.766	0.160	0.926
		Right	0.684	0.187	0.871
		Left	0.392	-	0.392
	GPRS 1900	Top	-	0.069	0.069
		Bottom	0.117	-	0.117
		Front	0.382	0.162	0.544
		Rear	0.356	0.160	0.516
		Right	-	0.187	0.187
		Left	0.282	-	0.282
	WCDMA 850	Top	-	0.069	0.069
		Bottom	0.259	-	0.259
		Front	0.591	0.162	0.753
		Rear	0.736	0.160	0.896
		Right	0.702	0.187	0.889
		Left	0.455	-	0.455
	LTE Band 17	Top	-	0.069	0.069
		Bottom	0.128	-	0.128
		Front	0.426	0.162	0.588
		Rear	0.646	0.160	0.806
		Right	0.346	0.187	0.533
		Left	0.195	-	0.195

Table 12.6.6 Simultaneous Transmission Scenario : 2G/3G/4G + Bluetooth (Hotspot at 10 mm)

Exposure Condition	Mode	Configuration	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Hotspot SAR	GPRS 850	Top	-	0.018	0.018
		Bottom	0.211	-	0.211
		Front	0.611	0.040	0.651
		Rear	0.766	0.049	0.815
		Right	0.684	0.028	0.712
		Left	0.392	-	0.392
	GPRS 1900	Top	-	0.018	0.018
		Bottom	0.117	-	0.117
		Front	0.382	0.040	0.422
		Rear	0.356	0.049	0.405
		Right	-	0.028	0.028
		Left	0.282	-	0.282
	WCDMA 850	Top	-	0.018	0.018
		Bottom	0.259	-	0.259
		Front	0.591	0.040	0.631
		Rear	0.736	0.049	0.785
		Right	0.702	0.028	0.730
		Left	0.455	-	0.455
	LTE Band 17	Top	-	0.018	0.018
		Bottom	0.128	-	0.128
		Front	0.426	0.040	0.466
		Rear	0.646	0.049	0.695
		Right	0.346	0.028	0.374
		Left	0.195	-	0.195

Table 12.6.7 Simultaneous Transmission Scenario : Bluetooth + 5 GHz W-LAN (Hotspot at 10 mm)

Exposure Condition	Mode	Configuration	Bluetooth SAR (W/kg)	5G W-LAN Ant.2 SAR (W/kg)	Σ SAR (W/kg)
			1	2	1+2
Hotspot SAR	5.2G W-LAN	Top	0.018	0.108	0.126
		Bottom	-	-	-
		Front	0.040	0.176	0.216
		Rear	0.049	0.217	0.266
		Right	0.028	0.269	0.297
		Left	-	-	-
	5.8G W-LAN	Top	0.018	0.069	0.087
		Bottom	-	-	-
		Front	0.040	0.162	0.202
		Rear	0.049	0.160	0.209
		Right	0.028	0.187	0.215
		Left	-	-	-

12.7 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 1-g SAR limit).
3. A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .
4. Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg
5. The same procedures should be adapted for measurements according to extremity exposure limits by applying a factor of 2.5 for extremity exposure to the corresponding SAR thresholds.

13.2 Measurement Uncertainty

The measured SAR was < 1.5 W/kg for 1g and < 3.75 W/kg for 10g 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

Table 14.1.1 Test Equipment Calibration

	Type	Manufacturer	Model	Cal.Date	Next.Cal.Date	S/N
☒	SEMITEC Engineering	SEMITEC	N/A	N/A	N/A	Shield Room
☒	SEMITEC Engineering	SEMITEC	N/A	N/A	N/A	Shield Room
☒	Robot	SCHMID	TX90XL	N/A	N/A	F13/5P9GA1/A/01
☒	Robot	SCHMID	TX90XL	N/A	N/A	F13/5RR2A1/A/01
☒	Robot Controller	SCHMID	CS8C	N/A	N/A	F13/5P9GA1/C/01
☒	Robot Controller	SCHMID	CS8C	N/A	N/A	F13/5RR2A1/C/01
☒	Joystick	SCHMID	N/A	N/A	N/A	S-12450905
☒	Joystick	SCHMID	N/A	N/A	N/A	S-13200990
☒	IntelCorei7-3770 3.40 GHz Windows 7 Professional	N/A	N/A	N/A	N/A	N/A
☒	IntelCorei7-3770 3.40 GHz Windows 7 Professional	N/A	N/A	N/A	N/A	N/A
☒	Probe Alignment Unit LB	N/A	N/A	N/A	N/A	SE UKS 030 AA
☒	Probe Alignment Unit LB	N/A	N/A	N/A	N/A	SE UKS 030 AA
☒	Device Holder	SCHMID	Holder	N/A	N/A	SD000H01HA
☒	Device Holder	SCHMID	Holder	N/A	N/A	SD000H01HA
☒	Twin SAM Phantom	SCHMID	QD000P40CD	N/A	N/A	1783
☒	Twin SAM Phantom	SCHMID	QD000P40CD	N/A	N/A	1782
☒	Twin SAM Phantom	SCHMID	QD000P40CD	N/A	N/A	1786
☒	Data Acquisition Electronics	SCHMID	DAE3V1	2017-11-17	2018-11-17	520
☒	Data Acquisition Electronics	SCHMID	DAE4V1	2018-03-19	2019-03-19	1394
☒	Dosimetric E-Field Probe	SCHMID	ES3DV3	2018-03-21	2019-03-21	3328
☒	Dosimetric E-Field Probe	SCHMID	EX3DV4	2018-05-31	2019-05-31	3866
☒	750MHz SAR Dipole	SCHMID	D750V3	2018-01-18	2020-01-18	1049
☒	835MHz SAR Dipole	SCHMID	D835V2	2017-09-21	2019-09-21	464
☒	1900MHz SAR Dipole	SCHMID	D1900V2	2017-09-20	2019-09-20	5d029
☒	2450MHz SAR Dipole	SCHMID	D2450V2	2017-09-19	2019-09-19	726
☒	5GHz SAR Dipole	SCHMID	D5GHZV2	2018-02-15	2020-02-15	1212
☒	Network Analyzer	Agilent	E5071C	2018-02-02	2019-02-02	MY46111534
☒	Signal Generator	Agilent	E4438C	2018-07-04	2019-07-04	US41461520
☒	Amplifier	EMPOWER	BBS3Q7ELU	2017-09-06 2018-07-10	2018-09-06 2019-07-10	1020
☒	High Power RF Amplifier	EMPOWER	BBS3Q8CCJ	2018-07-06	2019-07-06	1005
☒	Power Meter	HP	EPM-442A	2017-12-27	2018-12-27	GB37170267
☒	Power Meter	HP	EPM-442A	2017-12-27	2018-12-27	GB37170413
☒	Power Meter	Anritsu	ML2495A	2018-07-04	2019-07-04	1435003
☒	Power Sensor	Anritsu	MA2490A	2018-07-04	2019-07-04	1409034
☒	Power Sensor	HP	8481A	2017-12-27	2018-12-27	US37294267
☒	Power Sensor	HP	8481A	2017-12-27	2018-12-27	3318A96566
☒	Power Sensor	HP	8481A	2017-12-27	2018-12-27	2702A65976
☒	Dual Directional Coupler	Agilent	778D-012	2017-12-27	2018-12-27	50228
☒	Directional Coupler	HP	772D	2018-07-03	2019-07-03	2889A01064
☒	Low Pass Filter 1GHz	Wainwright Instruments	WLK6-1000-1400-9000-60SS	2018-07-05	2019-07-05	165
☒	Low Pass Filter 1.5GHz	Micro LAB	LA-15N	2017-12-27	2018-12-27	N/A
☒	Low Pass Filter 3.0GHz	Micro LAB	LA-30N	2018-07-05	2019-07-05	N/A
☒	Low Pass Filter 6.0GHz	Micro LAB	LA-60N	2017-12-27	2018-12-27	03942
☒	Attenuators(3 dB)	Agilent	8491B	2017-12-27	2018-12-27	MY39260700
☒	Attenuators(10 dB)	WEINSCHEL	23-10-34	2017-12-27	2018-12-27	BP4387
☒	Dielectric Probe kit	SCHMID	DAK-3.5	2017-11-21	2018-11-21	1092
☒	8960 Series 10 Wireless Comms. Test Set	Agilent	E5515C	2018-07-04	2019-07-04	GB41321164
☒	Wideband Radio Communication Tester	Rohde Schwarz	CMW500	2018-02-05	2019-02-05	101414
☒	Power Splitter	Anritsu	K241B	2017-12-27	2018-12-27	1301183
☒	Bluetooth Tester	TESCOM	TC-3000B	2017-12-26	2018-12-26	3000B770243

NOTE(S):

1. The E-field probe was calibrated by SPEAG, by temperature measurement procedure. Dipole Verification measurement is performed by DT&C before each test. The brain and muscle simulating material are calibrated by DT&C using the dielectric probe system and network analyzer to determine the conductivity and permittivity (dielectric constant) of the brain and muscle-equivalent material. Each equipment item was used solely within its respective calibration period.
2. 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. 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

750 MHz Head (SN: 3328)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	$\pm 6.0 \%$	$\pm 6.0 \%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3 \%$	$\pm 1.3 \%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14 \%$	$\pm 0.14 \%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5 \%$	$\pm 1.5 \%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9 \%$	$\pm 3.9 \%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3 \%$	$\pm 2.3 \%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6 \%$	$\pm 3.6 \%$	5
Power Drift	± 5.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	∞
SAR Scaling	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4 \%$	$\pm 4.4 \%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8 \%$	$\pm 1.2 \%$	∞
Liquid conductivity (Meas.)	± 4.3	Normal	1	0.78	0.71	$\pm 3.4 \%$	$\pm 3.1 \%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7 \%$	$\pm 1.4 \%$	∞
Liquid permittivity (Meas.)	± 4.1	Normal	1	0.23	0.26	$\pm 0.9 \%$	$\pm 1.1 \%$	10
Temp. unc. - Conductivity	± 1.9	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.9 \%$	$\pm 0.8 \%$	∞
Temp. unc. - Permittivity	± 1.9	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Combined Standard Uncertainty						$\pm 11.7 \%$	$\pm 11.5 \%$	330
Expanded Uncertainty (k=2)						$\pm 23.4 \%$	$\pm 23.0 \%$	

The above measurement uncertainties are according to IEEE Std 1528

750 MHz Body (SN: 3328)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	$\pm 6.0 \%$	$\pm 6.0 \%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3 \%$	$\pm 1.3 \%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14 \%$	$\pm 0.14 \%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5 \%$	$\pm 1.5 \%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9 \%$	$\pm 3.9 \%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3 \%$	$\pm 2.3 \%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6 \%$	$\pm 3.6 \%$	5
Power Drift	± 5.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	∞
SAR Scaling	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4 \%$	$\pm 4.4 \%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8 \%$	$\pm 1.2 \%$	∞
Liquid conductivity (Meas.)	± 4.2	Normal	1	0.78	0.71	$\pm 3.3 \%$	$\pm 3.0 \%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7 \%$	$\pm 1.4 \%$	∞
Liquid permittivity (Meas.)	± 4.1	Normal	1	0.23	0.26	$\pm 0.9 \%$	$\pm 1.1 \%$	10
Temp. unc. - Conductivity	± 1.9	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.9 \%$	$\pm 0.8 \%$	∞
Temp. unc. - Permittivity	± 1.9	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Combined Standard Uncertainty						$\pm 11.7 \%$	$\pm 11.5 \%$	330
Expanded Uncertainty (k=2)						$\pm 23.4 \%$	$\pm 23.0 \%$	

The above measurement uncertainties are according to IEEE Std 1528

835 MHz Head (SN: 3328)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	$\pm 6.0 \%$	$\pm 6.0 \%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3 \%$	$\pm 1.3 \%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14 \%$	$\pm 0.14 \%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5 \%$	$\pm 1.5 \%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9 \%$	$\pm 3.9 \%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3 \%$	$\pm 2.3 \%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6 \%$	$\pm 3.6 \%$	5
Power Drift	± 5.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	∞
SAR Scaling	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4 \%$	$\pm 4.4 \%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8 \%$	$\pm 1.2 \%$	∞
Liquid conductivity (Meas.)	± 3.9	Normal	1	0.78	0.71	$\pm 3.0 \%$	$\pm 2.8 \%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7 \%$	$\pm 1.4 \%$	∞
Liquid permittivity (Meas.)	± 4.2	Normal	1	0.23	0.26	$\pm 1.0 \%$	$\pm 1.1 \%$	10
Temp. unc. - Conductivity	± 1.9	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.9 \%$	$\pm 0.8 \%$	∞
Temp. unc. - Permittivity	± 1.9	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Combined Standard Uncertainty						$\pm 11.6 \%$	$\pm 11.4 \%$	330
Expanded Uncertainty (k=2)						$\pm 23.2 \%$	$\pm 22.8 \%$	

The above measurement uncertainties are according to IEEE Std 1528

835 MHz Body (SN: 3328)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	$\pm 6.0 \%$	$\pm 6.0 \%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3 \%$	$\pm 1.3 \%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14 \%$	$\pm 0.14 \%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5 \%$	$\pm 1.5 \%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9 \%$	$\pm 3.9 \%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3 \%$	$\pm 2.3 \%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6 \%$	$\pm 3.6 \%$	5
Power Drift	± 5.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	∞
SAR Scaling	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4 \%$	$\pm 4.4 \%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8 \%$	$\pm 1.2 \%$	∞
Liquid conductivity (Meas.)	± 3.8	Normal	1	0.78	0.71	$\pm 3.0 \%$	$\pm 2.7 \%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7 \%$	$\pm 1.4 \%$	∞
Liquid permittivity (Meas.)	± 4.2	Normal	1	0.23	0.26	$\pm 1.0 \%$	$\pm 1.1 \%$	10
Temp. unc. - Conductivity	± 1.8	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.8 \%$	$\pm 0.7 \%$	∞
Temp. unc. - Permittivity	± 1.7	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.2 \%$	$\pm 0.3 \%$	∞
Combined Standard Uncertainty						$\pm 11.6 \%$	$\pm 11.4 \%$	330
Expanded Uncertainty (k=2)						$\pm 23.2 \%$	$\pm 22.8 \%$	

The above measurement uncertainties are according to IEEE Std 1528

1900 MHz Head (SN: 3328)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	$\pm 6.0 \%$	$\pm 6.0 \%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3 \%$	$\pm 1.3 \%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14 \%$	$\pm 0.14 \%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5 \%$	$\pm 1.5 \%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9 \%$	$\pm 3.9 \%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3 \%$	$\pm 2.3 \%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6 \%$	$\pm 3.6 \%$	5
Power Drift	± 5.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	∞
SAR Scaling	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4 \%$	$\pm 4.4 \%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8 \%$	$\pm 1.2 \%$	∞
Liquid conductivity (Meas.)	± 3.8	Normal	1	0.78	0.71	$\pm 3.0 \%$	$\pm 2.7 \%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7 \%$	$\pm 1.4 \%$	∞
Liquid permittivity (Meas.)	± 4.1	Normal	1	0.23	0.26	$\pm 0.9 \%$	$\pm 1.1 \%$	10
Temp. unc. - Conductivity	± 1.7	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.8 \%$	$\pm 0.7 \%$	∞
Temp. unc. - Permittivity	± 1.9	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Combined Standard Uncertainty						$\pm 11.6 \%$	$\pm 11.4 \%$	330
Expanded Uncertainty (k=2)						$\pm 23.2 \%$	$\pm 22.8 \%$	

The above measurement uncertainties are according to IEEE Std 1528

1900 MHz Body (SN: 3328)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	$\pm 6.0 \%$	$\pm 6.0 \%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3 \%$	$\pm 1.3 \%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14 \%$	$\pm 0.14 \%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5 \%$	$\pm 1.5 \%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9 \%$	$\pm 3.9 \%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3 \%$	$\pm 2.3 \%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6 \%$	$\pm 3.6 \%$	5
Power Drift	± 5.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	∞
SAR Scaling	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4 \%$	$\pm 4.4 \%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8 \%$	$\pm 1.2 \%$	∞
Liquid conductivity (Meas.)	± 4.0	Normal	1	0.78	0.71	$\pm 3.1 \%$	$\pm 2.8 \%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7 \%$	$\pm 1.4 \%$	∞
Liquid permittivity (Meas.)	± 3.8	Normal	1	0.23	0.26	$\pm 0.9 \%$	$\pm 1.0 \%$	10
Temp. unc. - Conductivity	± 1.8	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.8 \%$	$\pm 0.7 \%$	∞
Temp. unc. - Permittivity	± 1.8	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.2 \%$	$\pm 0.3 \%$	∞
Combined Standard Uncertainty						$\pm 11.6 \%$	$\pm 11.4 \%$	330
Expanded Uncertainty (k=2)						$\pm 23.2 \%$	$\pm 22.8 \%$	

The above measurement uncertainties are according to IEEE Std 1528

2450 MHz Head (SN: 3866)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	$\pm 6.0 \%$	$\pm 6.0 \%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3 \%$	$\pm 1.3 \%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14 \%$	$\pm 0.14 \%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5 \%$	$\pm 1.5 \%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9 \%$	$\pm 3.9 \%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3 \%$	$\pm 2.3 \%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6 \%$	$\pm 3.6 \%$	5
Power Drift	± 5.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	∞
SAR Scaling	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4 \%$	$\pm 4.4 \%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8 \%$	$\pm 1.2 \%$	∞
Liquid conductivity (Meas.)	± 3.8	Normal	1	0.78	0.71	$\pm 3.0 \%$	$\pm 2.7 \%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7 \%$	$\pm 1.4 \%$	∞
Liquid permittivity (Meas.)	± 4.3	Normal	1	0.23	0.26	$\pm 1.0 \%$	$\pm 1.1 \%$	10
Temp. unc. - Conductivity	± 1.8	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.8 \%$	$\pm 0.7 \%$	∞
Temp. unc. - Permittivity	± 2.0	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Combined Standard Uncertainty						$\pm 11.6 \%$	$\pm 11.4 \%$	330
Expanded Uncertainty (k=2)						$\pm 23.2 \%$	$\pm 22.8 \%$	

The above measurement uncertainties are according to IEEE Std 1528

2450 MHz Body (SN: 3866)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.0	Normal	1	1	1	$\pm 6.0 \%$	$\pm 6.0 \%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3 \%$	$\pm 1.3 \%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14 \%$	$\pm 0.14 \%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5 \%$	$\pm 1.5 \%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9 \%$	$\pm 3.9 \%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3 \%$	$\pm 2.3 \%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6 \%$	$\pm 3.6 \%$	5
Power Drift	± 5.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	∞
SAR Scaling	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4 \%$	$\pm 4.4 \%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8 \%$	$\pm 1.2 \%$	∞
Liquid conductivity (Meas.)	± 4.1	Normal	1	0.78	0.71	$\pm 3.2 \%$	$\pm 2.9 \%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7 \%$	$\pm 1.4 \%$	∞
Liquid permittivity (Meas.)	± 4.2	Normal	1	0.23	0.26	$\pm 1.0 \%$	$\pm 1.1 \%$	10
Temp. unc. - Conductivity	± 1.9	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.9 \%$	$\pm 0.8 \%$	∞
Temp. unc. - Permittivity	± 1.9	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Combined Standard Uncertainty						$\pm 11.6 \%$	$\pm 11.4 \%$	330
Expanded Uncertainty (k=2)						$\pm 23.2 \%$	$\pm 22.8 \%$	

The above measurement uncertainties are according to IEEE Std 1528

5200 MHz Head (SN: 3866)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.55	Normal	1	1	1	$\pm 6.6 \%$	$\pm 6.6 \%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3 \%$	$\pm 1.3 \%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14 \%$	$\pm 0.14 \%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5 \%$	$\pm 1.5 \%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9 \%$	$\pm 3.9 \%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3 \%$	$\pm 2.3 \%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6 \%$	$\pm 3.6 \%$	5
Power Drift	± 5.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	∞
SAR Scaling	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4 \%$	$\pm 4.4 \%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8 \%$	$\pm 1.2 \%$	∞
Liquid conductivity (Meas.)	± 4.0	Normal	1	0.78	0.71	$\pm 3.1 \%$	$\pm 2.8 \%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7 \%$	$\pm 1.4 \%$	∞
Liquid permittivity (Meas.)	± 4.2	Normal	1	0.23	0.26	$\pm 1.0 \%$	$\pm 1.1 \%$	10
Temp. unc. - Conductivity	± 1.8	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.8 \%$	$\pm 0.7 \%$	∞
Temp. unc. - Permittivity	± 1.9	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Combined Standard Uncertainty						$\pm 11.9 \%$	$\pm 11.7 \%$	330
Expanded Uncertainty (k=2)						$\pm 23.8 \%$	$\pm 23.4 \%$	

The above measurement uncertainties are according to IEEE Std 1528

5200 MHz Body (SN: 3866)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.55	Normal	1	1	1	$\pm 6.6 \%$	$\pm 6.6 \%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3 \%$	$\pm 1.3 \%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14 \%$	$\pm 0.14 \%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5 \%$	$\pm 1.5 \%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9 \%$	$\pm 3.9 \%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3 \%$	$\pm 2.3 \%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6 \%$	$\pm 3.6 \%$	5
Power Drift	± 5.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	∞
SAR Scaling	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4 \%$	$\pm 4.4 \%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8 \%$	$\pm 1.2 \%$	∞
Liquid conductivity (Meas.)	± 3.9	Normal	1	0.78	0.71	$\pm 3.0 \%$	$\pm 2.8 \%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7 \%$	$\pm 1.4 \%$	∞
Liquid permittivity (Meas.)	± 4.3	Normal	1	0.23	0.26	$\pm 1.0 \%$	$\pm 1.1 \%$	10
Temp. unc. - Conductivity	± 1.8	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.8 \%$	$\pm 0.7 \%$	∞
Temp. unc. - Permittivity	± 1.8	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.2 \%$	$\pm 0.3 \%$	∞
Combined Standard Uncertainty						$\pm 11.9 \%$	$\pm 11.7 \%$	330
Expanded Uncertainty (k=2)						$\pm 23.8 \%$	$\pm 23.4 \%$	

The above measurement uncertainties are according to IEEE Std 1528

5300 MHz Head (SN: 3866)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.55	Normal	1	1	1	$\pm 6.6\%$	$\pm 6.6\%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3\%$	$\pm 1.3\%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2\%$	$\pm 1.2\%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3\%$	$\pm 0.3\%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14\%$	$\pm 0.14\%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3\%$	$\pm 0.3\%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46\%$	$\pm 0.46\%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5\%$	$\pm 1.5\%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46\%$	$\pm 0.46\%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9\%$	$\pm 3.9\%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3\%$	$\pm 2.3\%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9\%$	$\pm 2.9\%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6\%$	$\pm 3.6\%$	5
Power Drift	± 5.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9\%$	$\pm 2.9\%$	∞
SAR Scaling	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4\%$	$\pm 4.4\%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0\%$	$\pm 0.0\%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8\%$	$\pm 1.2\%$	∞
Liquid conductivity (Meas.)	± 3.8	Normal	1	0.78	0.71	$\pm 3.0\%$	$\pm 2.7\%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7\%$	$\pm 1.4\%$	∞
Liquid permittivity (Meas.)	± 4.1	Normal	1	0.23	0.26	$\pm 0.9\%$	$\pm 1.1\%$	10
Temp. unc. - Conductivity	± 1.9	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.9\%$	$\pm 0.8\%$	∞
Temp. unc. - Permittivity	± 1.9	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.3\%$	$\pm 0.3\%$	∞
Combined Standard Uncertainty						$\pm 11.9\%$	$\pm 11.7\%$	330
Expanded Uncertainty (k=2)						$\pm 23.8\%$	$\pm 23.4\%$	

The above measurement uncertainties are according to IEEE Std 1528

5300 MHz Body (SN: 3866)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.55	Normal	1	1	1	$\pm 6.6\%$	$\pm 6.6\%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3\%$	$\pm 1.3\%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2\%$	$\pm 1.2\%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3\%$	$\pm 0.3\%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14\%$	$\pm 0.14\%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3\%$	$\pm 0.3\%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46\%$	$\pm 0.46\%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5\%$	$\pm 1.5\%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46\%$	$\pm 0.46\%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9\%$	$\pm 3.9\%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3\%$	$\pm 2.3\%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9\%$	$\pm 2.9\%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6\%$	$\pm 3.6\%$	5
Power Drift	± 5.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9\%$	$\pm 2.9\%$	∞
SAR Scaling	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4\%$	$\pm 4.4\%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0\%$	$\pm 0.0\%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8\%$	$\pm 1.2\%$	∞
Liquid conductivity (Meas.)	± 3.9	Normal	1	0.78	0.71	$\pm 3.0\%$	$\pm 2.8\%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7\%$	$\pm 1.4\%$	∞
Liquid permittivity (Meas.)	± 4.0	Normal	1	0.23	0.26	$\pm 0.9\%$	$\pm 1.0\%$	10
Temp. unc. - Conductivity	± 1.8	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.8\%$	$\pm 0.7\%$	∞
Temp. unc. - Permittivity	± 1.8	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.2\%$	$\pm 0.3\%$	∞
Combined Standard Uncertainty						$\pm 11.9\%$	$\pm 11.7\%$	330
Expanded Uncertainty (k=2)						$\pm 23.8\%$	$\pm 23.4\%$	

The above measurement uncertainties are according to IEEE Std 1528

5500 MHz Head (SN: 3866)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.55	Normal	1	1	1	$\pm 6.6\%$	$\pm 6.6\%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3\%$	$\pm 1.3\%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2\%$	$\pm 1.2\%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3\%$	$\pm 0.3\%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14\%$	$\pm 0.14\%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3\%$	$\pm 0.3\%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46\%$	$\pm 0.46\%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5\%$	$\pm 1.5\%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7\%$	$\pm 1.7\%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46\%$	$\pm 0.46\%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9\%$	$\pm 3.9\%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3\%$	$\pm 2.3\%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9\%$	$\pm 2.9\%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6\%$	$\pm 3.6\%$	5
Power Drift	± 5.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.9\%$	$\pm 2.9\%$	∞
SAR Scaling	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0\%$	$\pm 0.0\%$	∞
Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4\%$	$\pm 4.4\%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0\%$	$\pm 0.0\%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8\%$	$\pm 1.2\%$	∞
Liquid conductivity (Meas.)	± 4.2	Normal	1	0.78	0.71	$\pm 3.3\%$	$\pm 3.0\%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7\%$	$\pm 1.4\%$	∞
Liquid permittivity (Meas.)	± 3.8	Normal	1	0.23	0.26	$\pm 0.9\%$	$\pm 1.0\%$	10
Temp. unc. - Conductivity	± 1.7	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.8\%$	$\pm 0.7\%$	∞
Temp. unc. - Permittivity	± 1.8	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.2\%$	$\pm 0.3\%$	∞
Combined Standard Uncertainty						$\pm 11.9\%$	$\pm 11.7\%$	330
Expanded Uncertainty (k=2)						$\pm 23.8\%$	$\pm 23.4\%$	

The above measurement uncertainties are according to IEEE Std 1528

5500 MHz Body (SN: 3866)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.55	Normal	1	1	1	$\pm 6.6 \%$	$\pm 6.6 \%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3 \%$	$\pm 1.3 \%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14 \%$	$\pm 0.14 \%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5 \%$	$\pm 1.5 \%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9 \%$	$\pm 3.9 \%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3 \%$	$\pm 2.3 \%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	145
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Expanded Uncertainty (k=2)						$\pm 23.8 \%$	$\pm 23.4 \%$	

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5600 MHz Head (SN: 3866)

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Measurement System								
Probe calibration	± 6.55	Normal	1	1	1	$\pm 6.6\%$	$\pm 6.6\%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3\%$	$\pm 1.3\%$	∞
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Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3\%$	$\pm 0.3\%$	∞
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Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14\%$	$\pm 0.14\%$	∞
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Liquid permittivity (Meas.)	± 3.8	Normal	1	0.23	0.26	$\pm 0.9\%$	$\pm 1.0\%$	10
Temp. unc. - Conductivity	± 1.8	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.8\%$	$\pm 0.7\%$	∞
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5600 MHz Body (SN: 3866)

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Measurement System								
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Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14 \%$	$\pm 0.14 \%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5 \%$	$\pm 1.5 \%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
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Physical Parameters								
Phantom Shell	± 7.6	Rectangular	$\sqrt{3}$	1	1	$\pm 4.4 \%$	$\pm 4.4 \%$	∞
SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8 \%$	$\pm 1.2 \%$	∞
Liquid conductivity (Meas.)	± 3.7	Normal	1	0.78	0.71	$\pm 2.9 \%$	$\pm 2.6 \%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7 \%$	$\pm 1.4 \%$	∞
Liquid permittivity (Meas.)	± 4.2	Normal	1	0.23	0.26	$\pm 1.0 \%$	$\pm 1.1 \%$	10
Temp. unc. - Conductivity	± 2.0	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.9 \%$	$\pm 0.8 \%$	∞
Temp. unc. - Permittivity	± 1.9	Rectangular	$\sqrt{3}$	0.23	0.26	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Combined Standard Uncertainty						$\pm 11.9 \%$	$\pm 11.7 \%$	330
Expanded Uncertainty (k=2)						$\pm 23.8 \%$	$\pm 23.4 \%$	

The above measurement uncertainties are according to IEEE Std 1528

5800 MHz Head (SN: 3866)

Error Description	Uncertainty value $\pm\%$	Probability Distribution	Divisor	(Ci) 1g	(Ci) 10g	Standard (1g)	Standard (10g)	vi 2 or Veff
Measurement System								
Probe calibration	± 6.55	Normal	1	1	1	$\pm 6.6 \%$	$\pm 6.6 \%$	∞
Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3 \%$	$\pm 1.3 \%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Detection limits	± 0.25	Rectangular	$\sqrt{3}$	1	1	$\pm 0.14 \%$	$\pm 0.14 \%$	∞
Readout Electronics	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Response time	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Integration time	± 2.6	Rectangular	$\sqrt{3}$	1	1	$\pm 1.5 \%$	$\pm 1.5 \%$	∞
RF Ambient Conditions – Noise	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
RF Ambient Conditions – Reflections	± 3.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.7 \%$	$\pm 1.7 \%$	∞
Probe Positioner	± 0.8	Rectangular	$\sqrt{3}$	1	1	$\pm 0.46 \%$	$\pm 0.46 \%$	∞
Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9 \%$	$\pm 3.9 \%$	∞
Algorithms for Max. SAR Eval.	± 4.0	Rectangular	$\sqrt{3}$	1	1	$\pm 2.3 \%$	$\pm 2.3 \%$	∞
Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6 \%$	$\pm 3.6 \%$	5
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Physical Parameters								
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SAR correction	± 0.0	Normal	1	1	0.84	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
Liquid conductivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.64	0.43	$\pm 1.8 \%$	$\pm 1.2 \%$	∞
Liquid conductivity (Meas.)	± 3.8	Normal	1	0.78	0.71	$\pm 3.0 \%$	$\pm 2.7 \%$	10
Liquid permittivity (Target)	± 5.0	Rectangular	$\sqrt{3}$	0.60	0.49	$\pm 1.7 \%$	$\pm 1.4 \%$	∞
Liquid permittivity (Meas.)	± 4.1	Normal	1	0.23	0.26	$\pm 0.9 \%$	$\pm 1.1 \%$	10
Temp. unc. - Conductivity	± 1.8	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.8 \%$	$\pm 0.7 \%$	∞
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The above measurement uncertainties are according to IEEE Std 1528

5800 MHz Body (SN: 3866)

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Measurement System								
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Isotropy	± 1.3	Normal	1	1	1	$\pm 1.3 \%$	$\pm 1.3 \%$	∞
Boundary Effects	± 2.0	Rectangular	$\sqrt{3}$	1	1	$\pm 1.2 \%$	$\pm 1.2 \%$	∞
Probe Linearity	± 0.3	Normal	1	1	1	$\pm 0.3 \%$	$\pm 0.3 \%$	∞
Probe modulation response	± 0.0	Rectangular	$\sqrt{3}$	1	1	$\pm 0.0 \%$	$\pm 0.0 \%$	∞
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Probe Positioning	± 6.7	Rectangular	$\sqrt{3}$	1	1	$\pm 3.9 \%$	$\pm 3.9 \%$	∞
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Test Sample Related								
Device Positioning	± 2.9	Normal	1	1	1	$\pm 2.9 \%$	$\pm 2.9 \%$	145
Device Holder	± 3.6	Normal	1	1	1	$\pm 3.6 \%$	$\pm 3.6 \%$	5
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Liquid permittivity (Meas.)	± 4.2	Normal	1	0.23	0.26	$\pm 1.0 \%$	$\pm 1.1 \%$	10
Temp. unc. - Conductivity	± 1.8	Rectangular	$\sqrt{3}$	0.78	0.71	$\pm 0.8 \%$	$\pm 0.7 \%$	∞
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16. CONCLUSION

Measurement Conclusion

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

Please note that the absorption and distribution of electromagnetic energy in the body are every 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 impossible biological effect 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 innumerable factors may interact to determine the specific biological outcome of an exposure to electromagnetic fields, any protection guide shall consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

17. REFERENCES

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APPENDIX A. – Probe Calibration Data

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



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client DT&C (Dymstec)

Certificate No: ES3-3328_Mar18

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3328

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

Calibration date: March 21, 2018

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02525)	Apr-18
Reference 20 dB Attenuator	SN: S5277 (20x)	07-Apr-17 (No. 217-02528)	Apr-18
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642J01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
			Issued: March 24, 2018
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

Calibration Laboratory of
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Engineering AG
 Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: SCS 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "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)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

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

ES3DV3 – SN:3328

March 21, 2018

Probe ES3DV3

SN:3328

Manufactured: January 24, 2012
Calibrated: March 21, 2018

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

ES3DV3– SN:3328

March 21, 2018

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3328

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.02	1.05	1.08	± 10.1 %
DCP (mV) ^B	108.8	103.7	103.9	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	195.9	±3.5 %
		Y	0.0	0.0	1.0		191.3	
		Z	0.0	0.0	1.0		190.8	

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

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

^B Numerical linearization parameter: uncertainty not required.

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

ES3DV3– SN:3328

March 21, 2018

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3328

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	41.9	0.89	6.61	6.61	6.61	0.41	1.53	± 12.0 %
835	41.5	0.90	6.35	6.35	6.35	0.32	1.78	± 12.0 %
900	41.5	0.97	6.23	6.23	6.23	0.45	1.48	± 12.0 %
1750	40.1	1.37	5.56	5.56	5.56	0.64	1.30	± 12.0 %
1900	40.0	1.40	5.26	5.26	5.26	0.72	1.29	± 12.0 %
2450	39.2	1.80	4.82	4.82	4.82	0.66	1.35	± 12.0 %
2600	39.0	1.96	4.60	4.60	4.60	0.71	1.33	± 12.0 %

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

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

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

ES3DV3– SN:3328

March 21, 2018

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3328

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	55.5	0.96	6.29	6.29	6.29	0.80	1.14	± 12.0 %
835	55.2	0.97	6.23	6.23	6.23	0.80	1.14	± 12.0 %
900	55.0	1.05	6.18	6.18	6.18	0.80	1.18	± 12.0 %
1750	53.4	1.49	5.10	5.10	5.10	0.66	1.37	± 12.0 %
1900	53.3	1.52	4.88	4.88	4.88	0.48	1.66	± 12.0 %
2450	52.7	1.95	4.48	4.48	4.48	0.80	1.20	± 12.0 %
2600	52.5	2.16	4.32	4.32	4.32	0.80	1.09	± 12.0 %

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

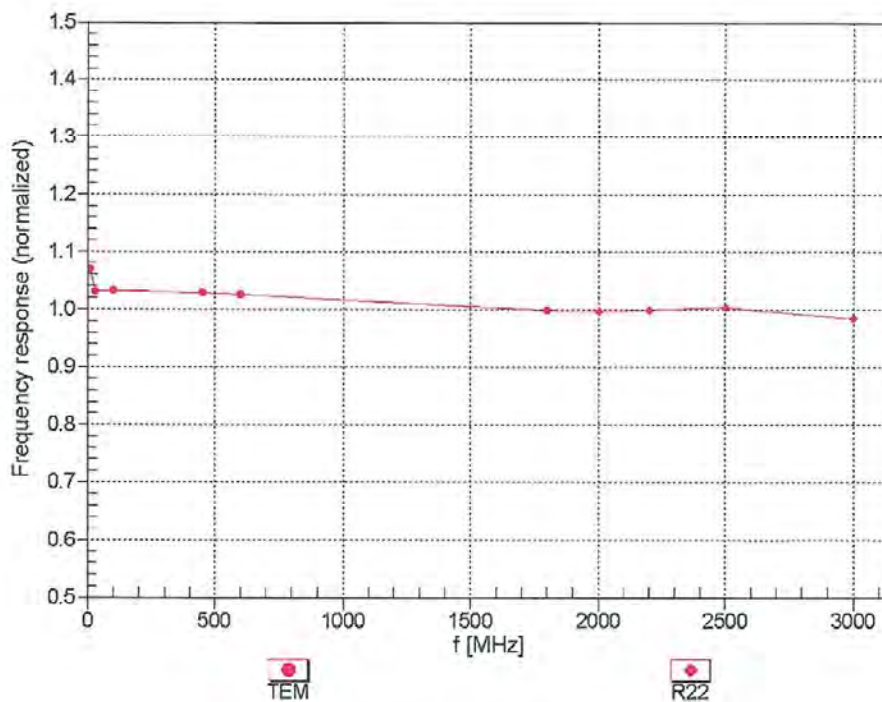
^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty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

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

ES3DV3--SN:3328

March 21, 2018

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



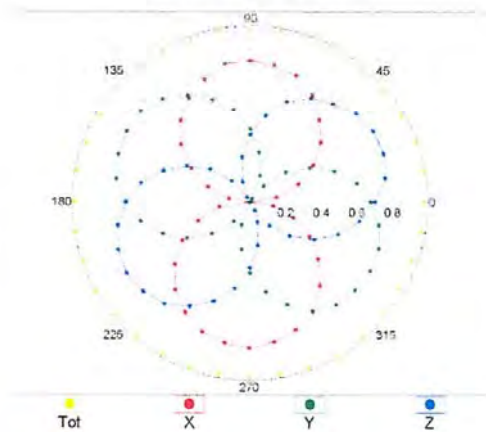
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

ES3DV3- SN:3328

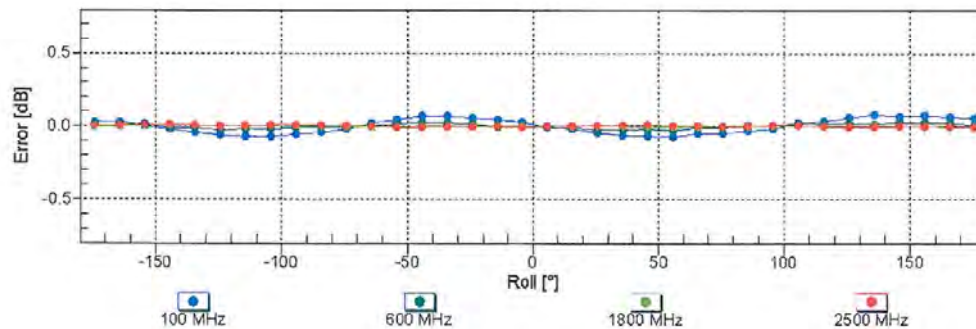
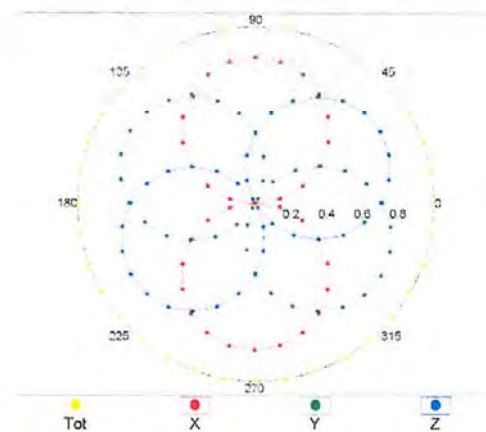
March 21, 2018

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

f=600 MHz,TEM



f=1800 MHz,R22

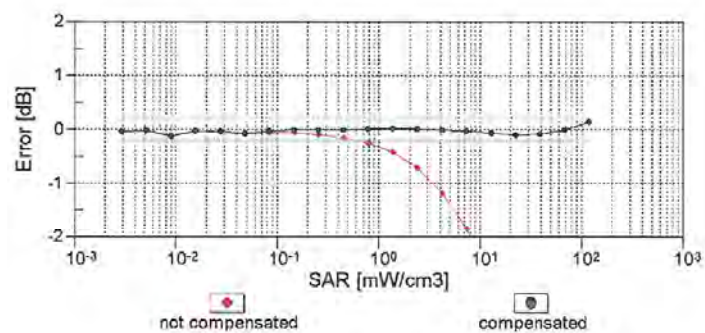
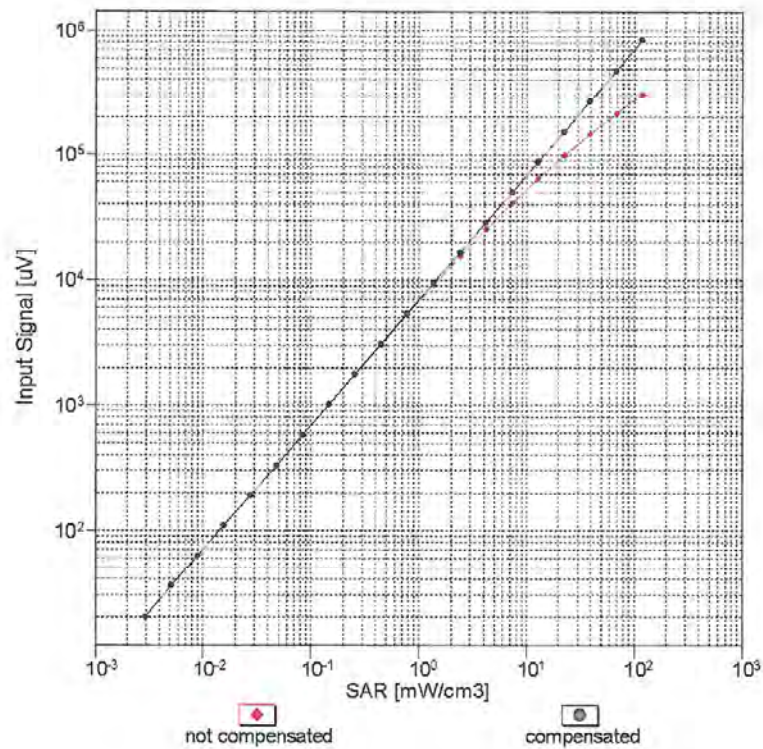


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

ES3DV3- SN:3328

March 21, 2018

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

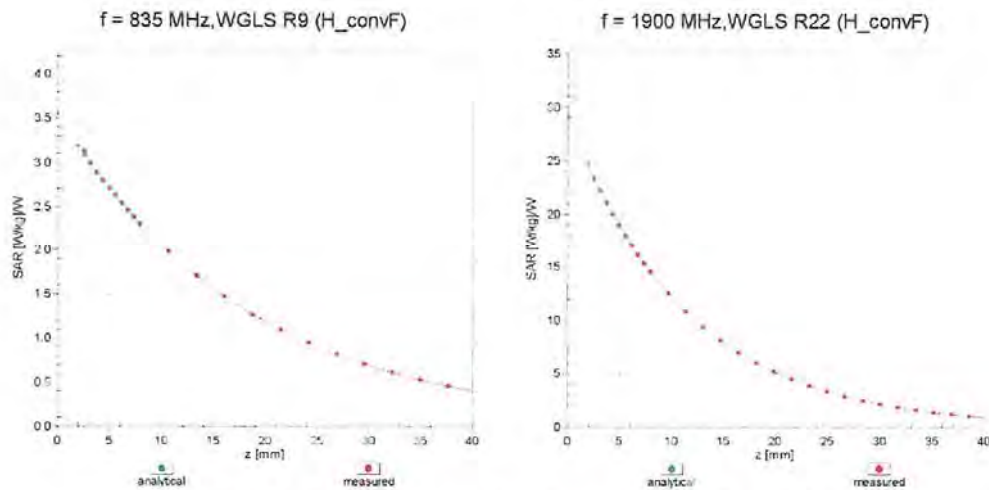


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

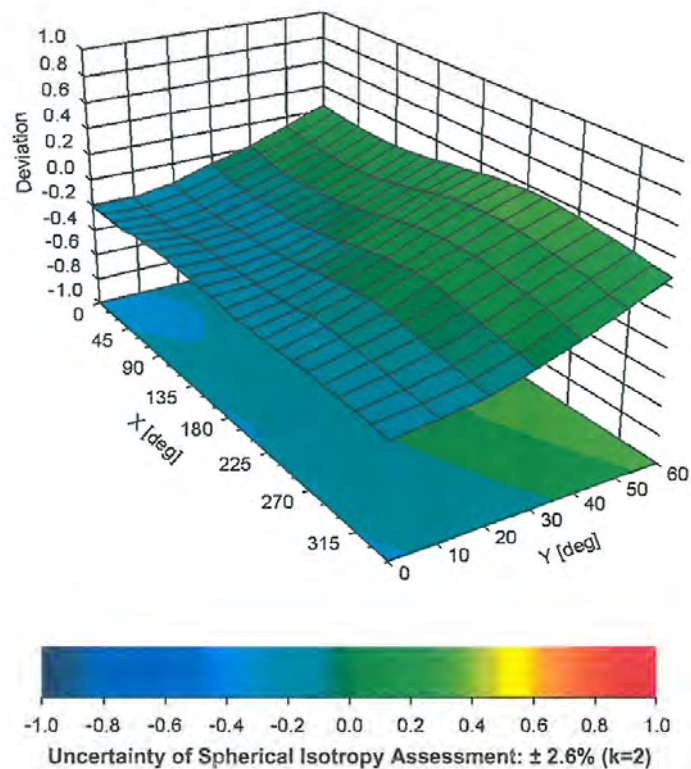
ES3DV3- SN:3328

March 21, 2018

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, θ), $f = 900$ MHz



ES3DV3- SN:3328

March 21, 2018

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3328

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-23.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

**Calibration Laboratory of
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Accreditation No.: **SCS 0108**

Client **DT&C (Dymstec)**

Certificate No: **EX3-3866_May18**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3866**

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

Calibration date: **May 31, 2018**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
Issued: May 31, 2018			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

Certificate No: **EX3-3866_May18**

Page 1 of 39

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Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "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)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

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

EX3DV4 – SN:3866

May 31, 2018

Probe EX3DV4

SN:3866

Manufactured: February 2, 2012
Calibrated: May 31, 2018

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

EX3DV4– SN:3866

May 31, 2018

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3866

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.43	0.32	0.35	± 10.1 %
DCP (mV) ^B	98.7	101.4	105.4	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	129.5	±3.3 %
		Y	0.0	0.0	1.0		142.9	
		Z	0.0	0.0	1.0		132.3	

Note: For details on UID parameters see Appendix.

Sensor Model Parameters

	C1 fF	C2 fF	α V^{-1}	T1 $\text{ms}\cdot\text{V}^{-2}$	T2 $\text{ms}\cdot\text{V}^{-1}$	T3 ms	T4 V^{-2}	T5 V^{-1}	T6
X	61.34	450.3	34.79	20.71	0.897	5.071	0.953	0.532	1.007
Y	35.97	270.0	35.93	7.616	0.990	4.996	0.120	0.508	1.005
Z	34.59	248.7	33.42	8.463	0.617	4.987	2.000	0.071	1.005

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

^A The uncertainties of Norm X,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter; uncertainty not required.

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

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3866

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	41.9	0.89	10.16	10.16	10.16	0.49	0.80	± 12.0 %
835	41.5	0.90	9.62	9.62	9.62	0.39	0.93	± 12.0 %
900	41.5	0.97	9.40	9.40	9.40	0.40	0.92	± 12.0 %
1750	40.1	1.37	8.38	8.38	8.38	0.34	0.84	± 12.0 %
1900	40.0	1.40	8.03	8.03	8.03	0.27	0.87	± 12.0 %
2300	39.5	1.67	7.86	7.86	7.86	0.30	0.85	± 12.0 %
2450	39.2	1.80	7.45	7.45	7.45	0.34	0.82	± 12.0 %
2600	39.0	1.96	7.22	7.22	7.22	0.38	0.85	± 12.0 %
3500	37.9	2.91	6.89	6.89	6.89	0.20	1.25	± 13.1 %
5200	36.0	4.66	5.14	5.14	5.14	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.95	4.95	4.95	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.61	4.61	4.61	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.52	4.52	4.52	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.69	4.69	4.69	0.40	1.80	± 13.1 %

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

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

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

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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3866

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k=2)
750	55.5	0.96	9.69	9.69	9.69	0.33	0.97	± 12.0 %
835	55.2	0.97	9.43	9.43	9.43	0.42	0.80	± 12.0 %
900	55.0	1.05	9.57	9.57	9.57	0.48	0.80	± 12.0 %
1750	53.4	1.49	7.95	7.95	7.95	0.39	0.80	± 12.0 %
1900	53.3	1.52	7.68	7.68	7.68	0.30	0.85	± 12.0 %
2300	52.9	1.81	7.50	7.50	7.50	0.39	0.85	± 12.0 %
2450	52.7	1.95	7.40	7.40	7.40	0.43	0.90	± 12.0 %
2600	52.5	2.16	7.28	7.28	7.28	0.25	1.05	± 12.0 %
3500	51.3	3.31	6.43	6.43	6.43	0.28	1.20	± 13.1 %
5200	49.0	5.30	4.69	4.69	4.69	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.50	4.50	4.50	0.50	1.90	± 13.1 %
5500	48.6	5.65	3.95	3.95	3.95	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.87	3.87	3.87	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.16	4.16	4.16	0.50	1.90	± 13.1 %

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

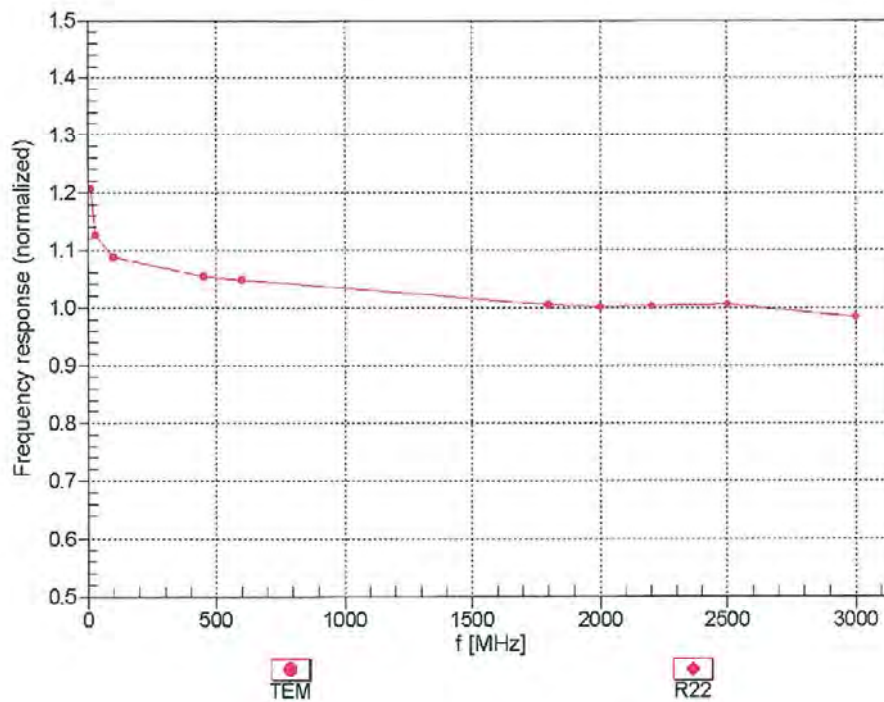
^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty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

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

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

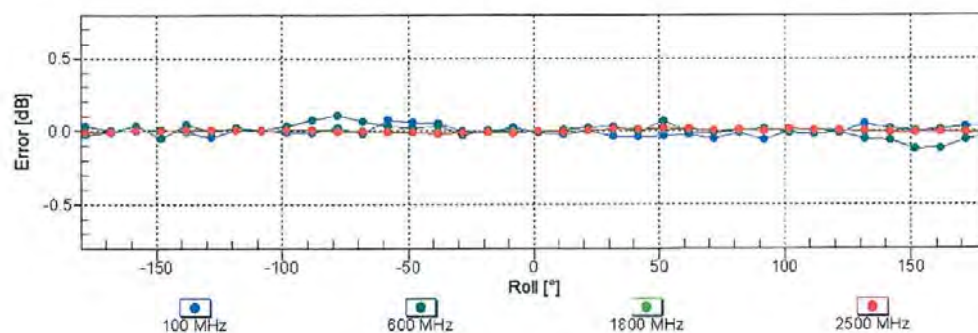
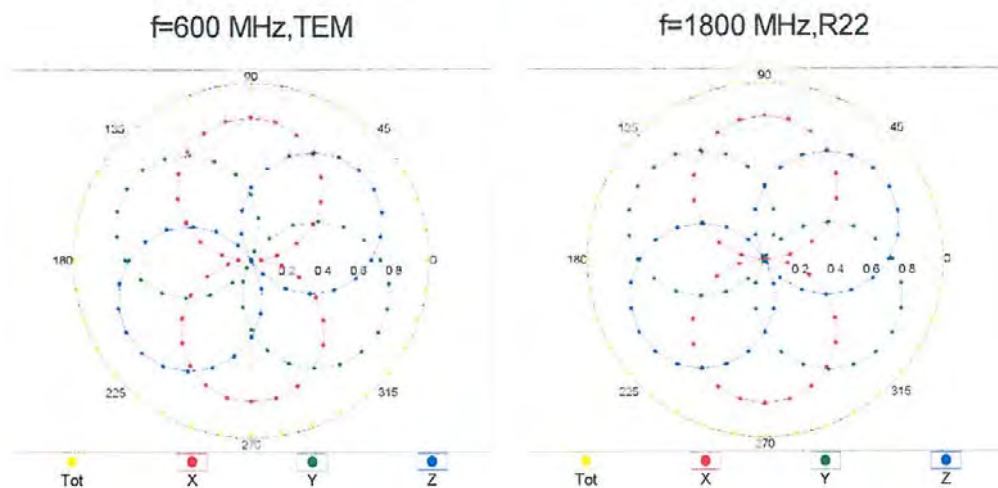


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

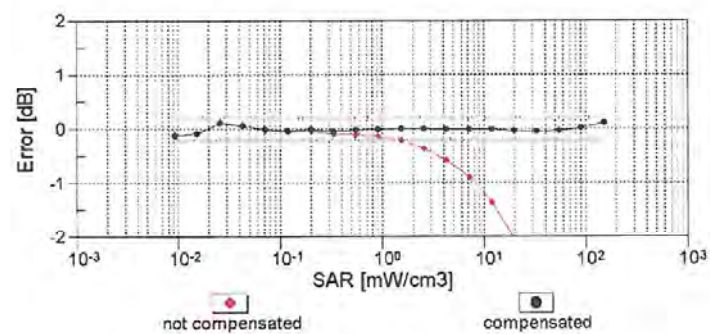
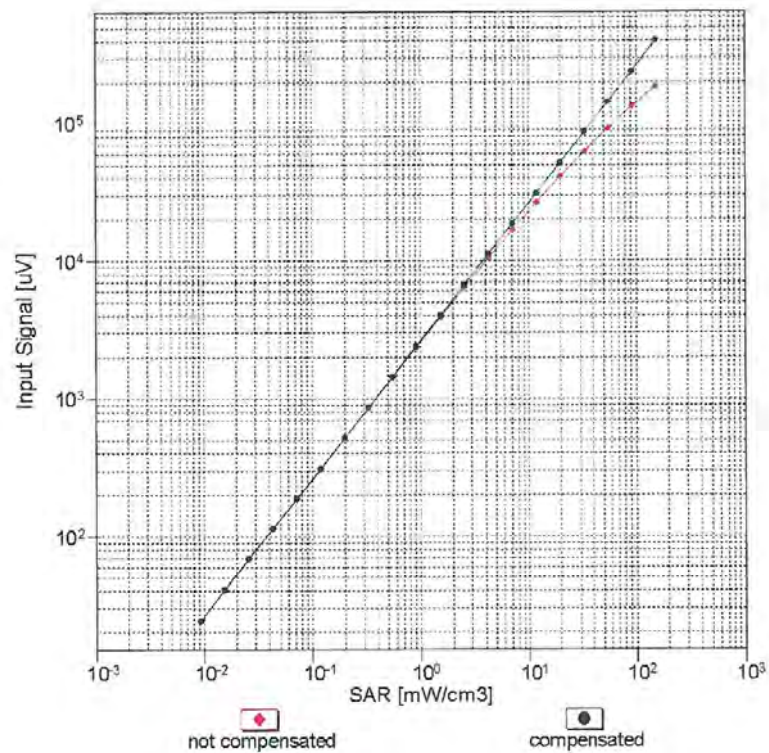


Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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

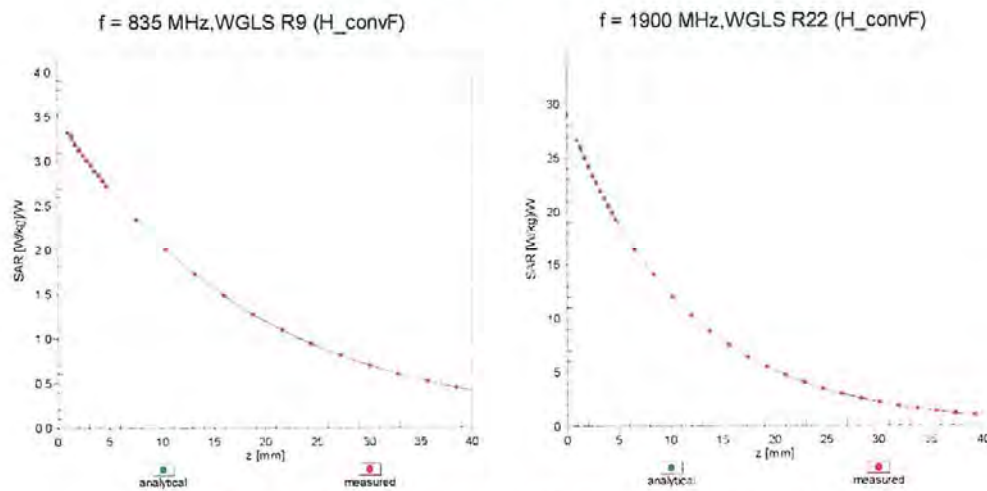


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

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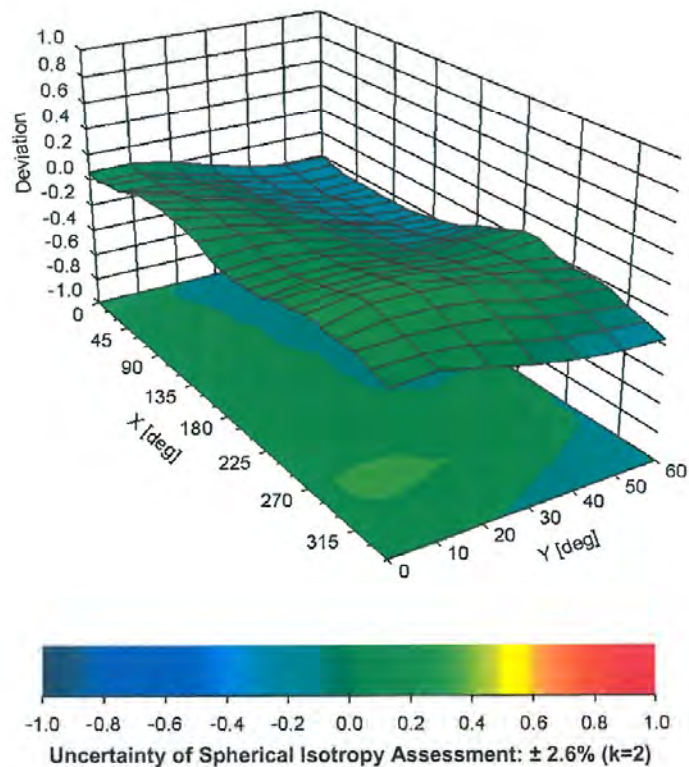
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Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ , θ), f = 900 MHz



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DASY/EASY - Parameters of Probe: EX3DV4 - SN:3866**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	61.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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Appendix: Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB/μV	C	D dB	VR mV	Max Unc ^E (k=2)
0	CW	X	0.00	0.00	1.00	0.00	129.5	± 3.3 %
		Y	0.00	0.00	1.00		142.9	
		Z	0.00	0.00	1.00		132.3	
10010- CAA	SAR Validation (Square, 100ms, 10ms)	X	4.96	74.03	14.55	10.00	20.0	± 9.6 %
		Y	1.96	62.67	8.25		20.0	
		Z	1.98	63.61	8.75		20.0	
10011- CAB	UMTS-FDD (WCDMA)	X	1.46	74.36	19.19	0.00	150.0	± 9.6 %
		Y	0.84	66.93	14.18		150.0	
		Z	1.06	69.91	16.41		150.0	
10012- CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	1.27	66.19	17.07	0.41	150.0	± 9.6 %
		Y	1.01	63.39	14.61		150.0	
		Z	1.12	64.44	15.48		150.0	
10013- CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	5.02	66.95	17.37	1.46	150.0	± 9.6 %
		Y	4.56	66.54	16.75		150.0	
		Z	4.61	66.83	16.87		150.0	
10021- DAC	GSM-FDD (TDMA, GMSK)	X	100.00	116.34	28.99	9.39	50.0	± 9.6 %
		Y	4.35	71.51	13.58		50.0	
		Z	10.49	82.17	17.30		50.0	
10023- DAC	GPRS-FDD (TDMA, GMSK, TN 0)	X	100.00	116.24	28.99	9.57	50.0	± 9.6 %
		Y	4.08	70.51	13.19		50.0	
		Z	7.34	77.92	15.91		50.0	
10024- DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	100.00	114.37	27.13	6.56	60.0	± 9.6 %
		Y	2.47	68.27	11.00		60.0	
		Z	99.64	104.22	21.52		60.0	
10025- DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	X	7.29	85.63	33.51	12.57	50.0	± 9.6 %
		Y	3.34	62.89	20.63		50.0	
		Z	4.59	72.89	26.66		50.0	
10026- DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	X	19.51	108.37	37.98	9.56	60.0	± 9.6 %
		Y	6.99	84.48	28.68		60.0	
		Z	7.40	87.18	30.26		60.0	
10027- DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	100.00	114.69	26.54	4.80	80.0	± 9.6 %
		Y	1.47	65.78	9.10		80.0	
		Z	100.00	103.55	20.47		80.0	
10028- DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	100.00	116.57	26.68	3.55	100.0	± 9.6 %
		Y	0.75	62.53	6.91		100.0	
		Z	100.00	103.86	19.98		100.0	
10029- DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	X	10.84	94.12	31.96	7.80	80.0	± 9.6 %
		Y	4.68	76.74	24.63		80.0	
		Z	4.76	77.76	25.40		80.0	
10030- CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	X	100.00	113.28	26.21	5.30	70.0	± 9.6 %
		Y	1.50	64.87	8.87		70.0	
		Z	14.61	85.51	16.17		70.0	
10031- CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	X	100.00	120.46	26.88	1.88	100.0	± 9.6 %
		Y	0.28	60.00	3.77		100.0	
		Z	100.00	97.01	16.04		100.0	

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10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	100.00	134.94	31.61	1.17	100.0	± 9.6 %
		Y	2.98	214.36	19.03		100.0	
		Z	100.00	96.12	15.00		100.0	
10033-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	X	100.00	129.71	35.52	5.30	70.0	± 9.6 %
		Y	3.37	73.07	15.63		70.0	
		Z	5.18	79.83	18.59		70.0	
10034-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	X	38.25	116.38	31.11	1.88	100.0	± 9.6 %
		Y	1.32	66.13	11.17		100.0	
		Z	2.19	72.52	14.56		100.0	
10035-CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	X	10.07	97.58	26.00	1.17	100.0	± 9.6 %
		Y	1.02	64.74	10.26		100.0	
		Z	1.68	70.82	13.73		100.0	
10036-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	X	100.00	130.10	35.71	5.30	70.0	± 9.6 %
		Y	3.79	74.73	16.33		70.0	
		Z	6.44	82.95	19.72		70.0	
10037-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	X	33.36	114.28	30.54	1.88	100.0	± 9.6 %
		Y	1.25	65.67	10.94		100.0	
		Z	1.95	71.33	14.08		100.0	
10038-CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	X	11.00	99.37	26.64	1.17	100.0	± 9.6 %
		Y	1.03	65.03	10.52		100.0	
		Z	1.72	71.30	14.06		100.0	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.41	85.41	21.99	0.00	150.0	± 9.6 %
		Y	0.86	64.63	9.97		150.0	
		Z	1.99	74.44	15.11		150.0	
10042-CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	X	100.00	112.07	26.26	7.78	50.0	± 9.6 %
		Y	2.24	65.83	9.99		50.0	
		Z	4.60	73.72	13.31		50.0	
10044-CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	X	0.01	122.05	4.07	0.00	150.0	± 9.6 %
		Y	0.35	142.03	0.00		150.0	
		Z	0.02	123.73	10.80		150.0	
10048-CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	X	100.00	117.95	31.07	13.80	25.0	± 9.6 %
		Y	4.50	67.37	13.41		25.0	
		Z	5.19	70.06	14.31		25.0	
10049-CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	X	100.00	116.36	29.33	10.79	40.0	± 9.6 %
		Y	4.23	69.49	13.02		40.0	
		Z	5.27	72.87	14.27		40.0	
10056-CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	X	77.81	121.32	33.78	9.03	50.0	± 9.6 %
		Y	6.03	75.76	17.19		50.0	
		Z	9.07	82.59	19.86		50.0	
10058-DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	X	7.57	86.51	28.41	6.55	100.0	± 9.6 %
		Y	3.72	73.02	22.40		100.0	
		Z	3.78	73.63	22.92		100.0	
10059-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	X	1.41	68.44	18.21	0.61	110.0	± 9.6 %
		Y	1.03	64.26	15.02		110.0	
		Z	1.14	65.37	15.93		110.0	
10060-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	X	100.00	140.28	36.98	1.30	110.0	± 9.6 %
		Y	5.52	92.10	22.15		110.0	
		Z	23.32	116.45	30.29		110.0	

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10061-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	X	32.15	121.96	35.02	2.04	110.0	± 9.6 %
		Y	2.04	75.39	19.12		110.0	
		Z	2.36	78.14	20.85		110.0	
10062-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	4.83	66.99	16.83	0.49	100.0	± 9.6 %
		Y	4.37	66.55	16.24		100.0	
		Z	4.43	66.90	16.40		100.0	
10063-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	X	4.85	67.11	16.95	0.72	100.0	± 9.6 %
		Y	4.38	66.62	16.31		100.0	
		Z	4.44	66.97	16.47		100.0	
10064-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	X	5.19	67.41	17.17	0.86	100.0	± 9.6 %
		Y	4.62	66.81	16.50		100.0	
		Z	4.67	67.13	16.63		100.0	
10065-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	X	5.05	67.34	17.29	1.21	100.0	± 9.6 %
		Y	4.49	66.66	16.55		100.0	
		Z	4.54	66.96	16.68		100.0	
10066-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	X	5.08	67.39	17.47	1.46	100.0	± 9.6 %
		Y	4.50	66.65	16.68		100.0	
		Z	4.54	66.92	16.80		100.0	
10067-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	X	5.35	67.39	17.83	2.04	100.0	± 9.6 %
		Y	4.79	66.90	17.13		100.0	
		Z	4.82	67.14	17.23		100.0	
10068-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	X	5.44	67.63	18.14	2.55	100.0	± 9.6 %
		Y	4.82	66.81	17.26		100.0	
		Z	4.85	67.03	17.35		100.0	
10069-CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	X	5.51	67.49	18.27	2.67	100.0	± 9.6 %
		Y	4.89	66.85	17.46		100.0	
		Z	4.91	67.04	17.53		100.0	
10071-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	X	5.12	67.05	17.68	1.99	100.0	± 9.6 %
		Y	4.66	66.59	17.01		100.0	
		Z	4.70	66.85	17.11		100.0	
10072-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	X	5.14	67.52	17.95	2.30	100.0	± 9.6 %
		Y	4.62	66.83	17.17		100.0	
		Z	4.65	67.08	17.27		100.0	
10073-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	X	5.21	67.69	18.29	2.83	100.0	± 9.6 %
		Y	4.68	67.01	17.47		100.0	
		Z	4.71	67.23	17.56		100.0	
10074-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	X	5.18	67.59	18.46	3.30	100.0	± 9.6 %
		Y	4.69	66.95	17.60		100.0	
		Z	4.71	67.17	17.70		100.0	
10075-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	X	5.26	67.87	18.86	3.82	90.0	± 9.6 %
		Y	4.73	66.99	17.83		90.0	
		Z	4.74	67.18	17.92		90.0	
10076-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	X	5.23	67.53	18.89	4.15	90.0	± 9.6 %
		Y	4.77	66.89	18.00		90.0	
		Z	4.78	67.06	18.08		90.0	
10077-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	X	5.25	67.58	18.98	4.30	90.0	± 9.6 %
		Y	4.81	66.98	18.11		90.0	
		Z	4.81	67.15	18.19		90.0	