



## **SAR EVALUATION REPORT**

**FCC 47 CFR § 2.1093  
IEEE Std 1528-2013**

*For*

**CDMA Wrist Device + Bluetooth & WLAN 2.4GHz b/g/n**

**FCC ID: A3LSMR735C  
Model Name: SM-R735V**

**Report Number: 16K22865-S1V1  
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## 1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO.,LTD.			
FCC ID	A3LSMR735C			
Model Name	SM-R735V			
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013			
<b>SAR Limits (W/Kg)</b>				
Exposure Category	Peak spatial-average(1g of tissue)	Extremities (hands, wrists, ankles, etc.) (10g of tissue)		
General population / Uncontrolled exposure	1.6	4.0		
<b>The Highest Reported SAR (W/kg)</b>				
<b>RF Exposure Conditions</b>	<b>Equipment Class</b>			
	<b>Licensed</b>	<b>DTS</b>	<b>U-NII</b>	
Next-to-Mouth 1g SAR	1.068	0.297	N/A	
Extremity (Wrist) 10g SAR	1.726	0.277		
Simultaneous TX	Next-to-Mouth 1-g SAR	1.365		1.173
	Extremity (Wrist) 10-g SAR	2.003		1.864
Date Tested	2/17/2016 to 2/19/2016			
Test Results	Pass			
<p>UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.</p> <p><b>Note:</b> The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.</p>				
Approved & Released By:		Prepared By:		
				
JiHo Choi Operations Manager UL Korea, Ltd Suwon Laboratory		Justin Park Engineer UL Korea, Ltd Suwon Laboratory		

## 2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2013, the following FCC Published RF exposure [KDB](#) procedures:

- 248227 D01 802.11 Wi-Fi SAR v02r02
- 447498 D01 General RF Exposure Guidance v06
- 690783 D01 SAR Listings on Grants v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02
- 941225 D01 3G SAR Procedures v03r01

## 3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at

Suwon
SAR 1 Room
SAR 2 Room
SAR 3 Room

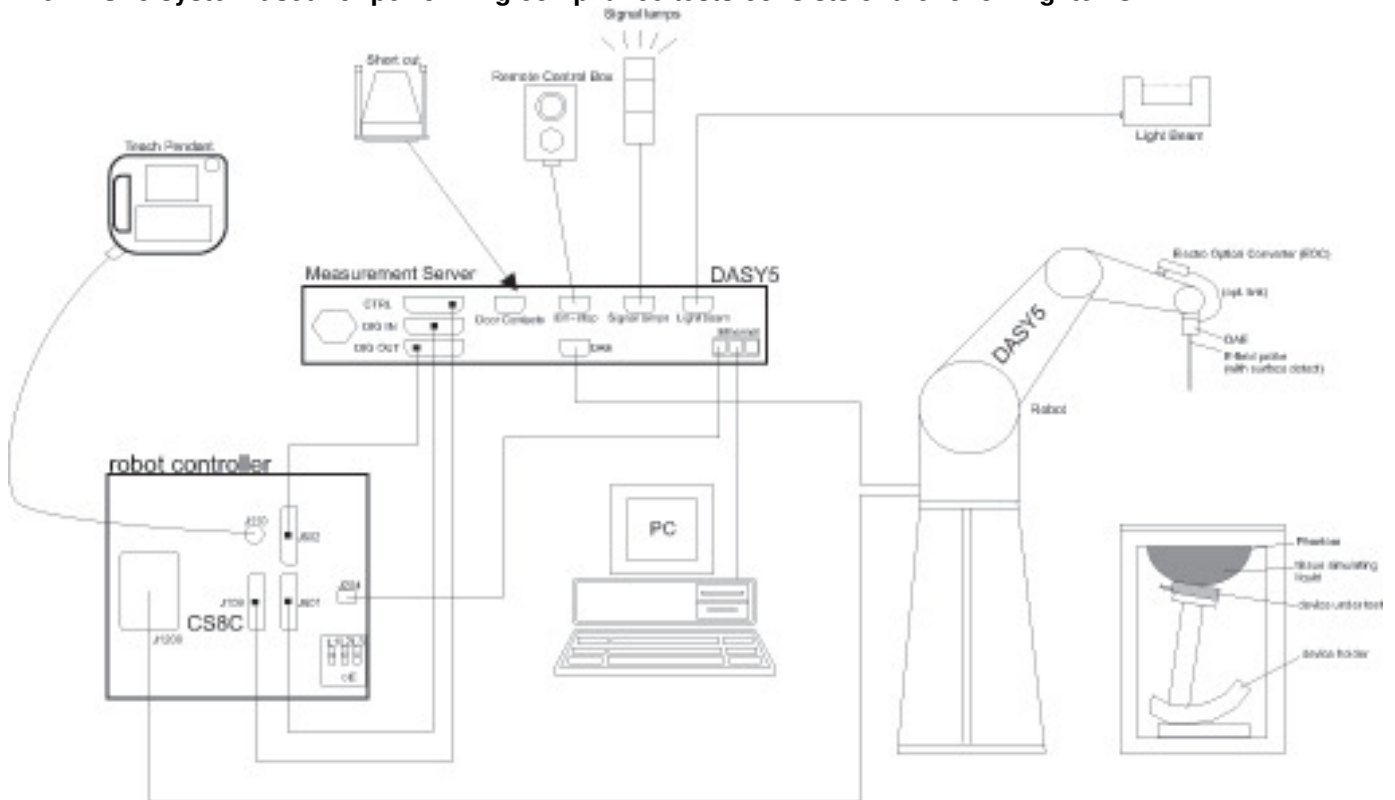
UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637.

The full scope of accreditation can be viewed at <http://www.iasonline.org/PDF/TL/TL-637.pdf>.

## 4. SAR Measurement System & Test Equipment

### 4.1. SAR Measurement System

The DASY5 system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

## 4.2. SAR Scan Procedures

### Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

### Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

	$\leq 3$ GHz	$> 3$ GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	$5 \pm 1$ mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ 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: $\Delta x_{Area}$ , $\Delta y_{Area}$	$\leq 2$ GHz: $\leq 15$ mm 2 – 3 GHz: $\leq 12$ mm	3 – 4 GHz: $\leq 12$ mm 4 – 6 GHz: $\leq 10$ 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.	

**Step 3: Zoom Scan**

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

		$\leq 3$ GHz	$> 3$ GHz	
Maximum zoom scan spatial resolution: $\Delta x_{Zoom}, \Delta y_{Zoom}$		$\leq 2$ GHz: $\leq 8$ mm 2 – 3 GHz: $\leq 5$ mm *	3 – 4 GHz: $\leq 5$ mm* 4 – 6 GHz: $\leq 4$ mm*	
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$	$\leq 5$ mm	3 – 4 GHz: $\leq 4$ mm 4 – 5 GHz: $\leq 3$ mm 5 – 6 GHz: $\leq 2$ mm	
	graded grid	$\Delta z_{Zoom}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface	$\leq 4$ mm	3 – 4 GHz: $\leq 3$ mm 4 – 5 GHz: $\leq 2.5$ mm 5 – 6 GHz: $\leq 2$ mm
		$\Delta z_{Zoom}(n>1)$ : between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z	$\geq 30$ mm	3 – 4 GHz: $\geq 28$ mm 4 – 5 GHz: $\geq 25$ mm 5 – 6 GHz: $\geq 22$ mm	
Note: $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.				
* When zoom scan is required and the <i>reported</i> SAR from the area scan based <i>1-g SAR estimation</i> procedures of KDB 447498 is $\leq 1.4$ W/kg, $\leq 8$ mm, $\leq 7$ mm and $\leq 5$ 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.				

**Step 4: Power drift measurement**

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

**Step 5: Z-Scan (FCC only)**

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z-direction.

### 4.3. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

#### Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	E5071C	MY46522054	8-18-2016
Dielectric Assessment Kit	SPEAG	DAK-3.5	1196	8-4-2016
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	LKM	DTM3000	3424	8-19-2016
Thermometer	Lutron	MHB-382SD	AH.91478	8-12-2016

#### System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
MXG Analog Signal Generator	Agilent	N5181A	MY50145882	8-18-2016
Power Sensor	Agilent	U2000A	MY54260010	8-18-2016
Power Sensor	Agilent	U2000A	MY54260007	8-18-2016
Power Amplifier	EXODUS	1410025-AMP2027-10003	10003	8-18-2016
Directional Coupler	Agilent	772D	MY52180193	8-18-2016
Directional Coupler	Agilent	778D	MY52180432	8-18-2016
Low Pass Filter	MICROLAB	LA-15N	03943	8-18-2016
Low Pass Filter	FILTRON	L14012FL	1410003S	8-18-2016
Attenuator	Agilent	8491B/003	MY39269292	8-18-2016
Attenuator	Agilent	8491B/010	MY39269315	8-18-2016
Attenuator	Agilent	8491B/020	MY39269298	8-18-2016
E-Field Probe (SAR1)	SPEAG	EX3DV4	7314	9-25-2016
E-Field Probe (SAR2)	SPEAG	EX3DV4	7376	9-2-2016
E-Field Probe (SAR3)	SPEAG	EX3DV4	7313	12-30-2016
Data Acquisition Electronics (SAR1)	SPEAG	DAE4	1447	9-23-2016
Data Acquisition Electronics (SAR2)	SPEAG	DAE4	1468	9-15-2016
Data Acquisition Electronics (SAR3)	SPEAG	DAE4	1494	11-11-2016
System Validation Dipole	SPEAG	D835V2	4d194	9-17-2016
System Validation Dipole	SPEAG	D1900V2	5d190	9-29-2016
System Validation Dipole	SPEAG	D2450V2	939	9-28-2016
Thermometer (SAR1)	Lutron	MHB-382SD	AH.91463	8-12-2016
Thermometer (SAR2)	Lutron	MHB-382SD	AH.50215	8-19-2016
Thermometer (SAR3)	Lutron	MHB-382SD	AH.50213	8-24-2016

#### Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	150313	8-18-2016
Base Station Simulator	R & S	CMW500	150314	8-18-2016
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	8-18-2016

### 5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

## 6. Device Under Test (DUT) Information

### 6.1. DUT Description

Intended Use	This device should be restricted to wrist-worn and no other operation configuration should be used		
Device Dimension	Overall (Length x Width): 44.0 mm x 51.0 mm Overall Diagonal: 51.0 mm Display Diagonal: 32.0 mm		
Back Cover	<input checked="" type="checkbox"/> The rechargeable battery is not user accessible.		
Battery Options	<input checked="" type="checkbox"/> The rechargeable battery is not user accessible.		
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. <input checked="" type="checkbox"/> Mobile Hotspot is not supported		
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 2.4 GHz)		
Test sample information	<b>No.</b>	<b>S/N</b>	<b>Notes</b>
	1	A0000047485159	Conduction
	2	A0000047485157	Conduction
	3	A0000047485153	SAR
	4	A0000047485154	SAR

### 6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
CDMA2000	BC0	1xRTT (Voice & Data)	100%
	BC1	1xEV-DO Rel. 0 1xEV-DO Rev. A	
Does this device SV-DO (1xRTT-1xEVDO)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	100%
Bluetooth	2.4 GHz	Version 4.1 LE	76.99% (DH5)

### 6.3. Nominal and Maximum Output Power

KDB 447498 sec.4.1.(3) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit

Upper limit (dB): -1.5 ~ 0.5		Max. RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
			Burst
CDMA BC0	1xRTT	24.5	<b>25.0</b>
	1xEV-DO Rel. 0	24.5	<b>25.0</b>
	1xEV-DO Rev.A	24.5	<b>25.0</b>
CDMA BC1	1xRTT	24.5	<b>25.0</b>
	1xEV-DO Rel. 0	24.5	<b>25.0</b>
	1xEV-DO Rev.A	24.5	<b>25.0</b>
Upper limit (dB): 0.5		Max. RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
WiFi 2.4 GHz	802.11b	17.0	<b>17.5</b>
	802.11g	13.0	<b>13.5</b>
	802.11n HT20	12.0	<b>12.5</b>
Bluetooth		14.0	<b>14.5</b>
Bluetooth LE		4.0	<b>4.5</b>

## 7. RF Exposure Conditions (Test Configurations)

Refer to “SAR Photos and Ant locations” Appendix for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

Wireless technologies	RF Exposure Conditions	DUT-to-User Separation	Test Position	Antenna-to-edge/surface	SAR Required	Note
WWAN	Extremity (Hand/Wrist/Ankle)	0 mm	Rear	N/A	Yes	
	Next-to-Mouth	10 mm	Front	N/A	Yes	
WLAN / Bluetooth	Extremity (Hand/Wrist/Ankle)	0 mm	Rear	N/A	Yes	
	Next-to-Mouth	10 mm	Front	N/A	Yes	

## 8. Dielectric Property Measurements & System Check

### 8.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within  $\pm 2^\circ\text{C}$  of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

#### Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head		Body	
	$\epsilon_r$	$\sigma$ (S/m)	$\epsilon_r$	$\sigma$ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

#### IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

**Dielectric Property Measurements Results:****SAR 1 Room**

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
2-15-2016	Body 835	e'	53.7200	Relative Permittivity ( $\epsilon_r$ ):	53.72	55.20	-2.68	5
		e"	21.5500	Conductivity ( $\sigma$ ):	1.00	0.97	3.15	5
	Body 820	e'	53.8300	Relative Permittivity ( $\epsilon_r$ ):	53.83	55.28	-2.62	5
		e"	21.6900	Conductivity ( $\sigma$ ):	0.99	0.97	2.12	5
	Body 850	e'	53.5700	Relative Permittivity ( $\epsilon_r$ ):	53.57	55.16	-2.88	5
		e"	21.4200	Conductivity ( $\sigma$ ):	1.01	0.99	2.56	5
2-15-2016	Head 2450	e'	39.9300	Relative Permittivity ( $\epsilon_r$ ):	39.93	39.20	1.86	5
		e"	13.6400	Conductivity ( $\sigma$ ):	1.86	1.80	3.23	5
	Head 2410	e'	40.0600	Relative Permittivity ( $\epsilon_r$ ):	40.06	39.28	1.99	5
		e"	13.5500	Conductivity ( $\sigma$ ):	1.82	1.76	3.14	5
	Head 2475	e'	39.8600	Relative Permittivity ( $\epsilon_r$ ):	39.86	39.17	1.77	5
		e"	13.7000	Conductivity ( $\sigma$ ):	1.89	1.83	3.19	5
2-18-2016	Body 2450	e'	51.8900	Relative Permittivity ( $\epsilon_r$ ):	51.89	52.70	-1.54	5
		e"	14.5700	Conductivity ( $\sigma$ ):	1.98	1.95	1.79	5
	Body 2410	e'	51.9800	Relative Permittivity ( $\epsilon_r$ ):	51.98	52.76	-1.48	5
		e"	14.4600	Conductivity ( $\sigma$ ):	1.94	1.91	1.58	5
	Body 2475	e'	51.8500	Relative Permittivity ( $\epsilon_r$ ):	51.85	52.67	-1.55	5
		e"	14.6500	Conductivity ( $\sigma$ ):	2.02	1.99	1.56	5

**SAR 2 Room**

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
2-15-2016	Head 835	e'	42.4700	Relative Permittivity ( $\epsilon_r$ ):	42.47	41.50	2.34	5
		e"	19.6000	Conductivity ( $\sigma$ ):	0.91	0.90	1.11	5
	Head 820	e'	42.6400	Relative Permittivity ( $\epsilon_r$ ):	42.64	41.60	2.49	5
		e"	19.6300	Conductivity ( $\sigma$ ):	0.90	0.90	-0.38	5
	Head 850	e'	42.3200	Relative Permittivity ( $\epsilon_r$ ):	42.32	41.50	1.98	5
		e"	19.5700	Conductivity ( $\sigma$ ):	0.92	0.92	1.09	5
2-15-2016	Body 2450	e'	52.3300	Relative Permittivity ( $\epsilon_r$ ):	52.33	52.70	-0.70	5
		e"	14.5600	Conductivity ( $\sigma$ ):	1.98	1.95	1.72	5
	Body 2410	e'	52.4800	Relative Permittivity ( $\epsilon_r$ ):	52.48	52.76	-0.53	5
		e"	14.4100	Conductivity ( $\sigma$ ):	1.93	1.91	1.23	5
	Body 2475	e'	52.2400	Relative Permittivity ( $\epsilon_r$ ):	52.24	52.67	-0.81	5
		e"	14.6600	Conductivity ( $\sigma$ ):	2.02	1.99	1.63	5
2-19-2016	Head 835	e'	41.6900	Relative Permittivity ( $\epsilon_r$ ):	41.69	41.50	0.46	5
		e"	19.2500	Conductivity ( $\sigma$ ):	0.89	0.90	-0.69	5
	Head 820	e'	41.8600	Relative Permittivity ( $\epsilon_r$ ):	41.86	41.60	0.62	5
		e"	19.2800	Conductivity ( $\sigma$ ):	0.88	0.90	-2.16	5
	Head 850	e'	41.5300	Relative Permittivity ( $\epsilon_r$ ):	41.53	41.50	0.07	5
		e"	19.2100	Conductivity ( $\sigma$ ):	0.91	0.92	-0.77	5

**SAR 3 Room**

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
2-15-2016	Body 1900	e'	54.1400	Relative Permittivity ( $\epsilon_r$ ):	54.14	53.30	1.58	5
		e''	14.9700	Conductivity ( $\sigma$ ):	1.58	1.52	4.05	5
	Body 1850	e'	54.2600	Relative Permittivity ( $\epsilon_r$ ):	54.26	53.30	1.80	5
		e''	14.9200	Conductivity ( $\sigma$ ):	1.53	1.52	0.97	5
	Body 1910	e'	54.1000	Relative Permittivity ( $\epsilon_r$ ):	54.10	53.30	1.50	5
		e''	14.9800	Conductivity ( $\sigma$ ):	1.59	1.52	4.66	5
2-16-2016	Head 1900	e'	40.9600	Relative Permittivity ( $\epsilon_r$ ):	40.96	40.00	2.40	5
		e''	13.6000	Conductivity ( $\sigma$ ):	1.44	1.40	2.63	5
	Head 1850	e'	41.0600	Relative Permittivity ( $\epsilon_r$ ):	41.06	40.00	2.65	5
		e''	13.6400	Conductivity ( $\sigma$ ):	1.40	1.40	0.22	5
	Head 1910	e'	40.9300	Relative Permittivity ( $\epsilon_r$ ):	40.93	40.00	2.33	5
		e''	13.6200	Conductivity ( $\sigma$ ):	1.45	1.40	3.32	5

## 8.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

### System Performance Check Measurement Conditions:

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.  
For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.
- Distance between probe sensors and phantom surface was set to 3 mm.  
For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

### Reference Target SAR Values

The reference SAR values can be obtained from the calibration certificate of system validation dipoles

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D835V2	4d194	9-17-2015	835	1g	9.38	9.49
				10g	6.09	6.18
D1900V2	5d190	9-29-2015	1900	1g	39.70	39.60
				10g	20.70	20.80
D2450V2	939	9-28-2015	2450	1g	51.60	50.70
				10g	23.90	23.70

**System Check Results**

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target.

**SAR 1 Room**

Date Tested	System Dipole		T.S. Liquid	Measured Results		Target (Ref. Value)	Delta $\pm 10\%$	Plot No.	
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W				
02-15-2016	D835V2	4d194	Body	1g	0.98	9.84	9.49	3.69	
				10g	0.65	6.47	6.18	4.69	
02-15-2016	D2450V2	939	Head	1g	5.59	55.90	51.60	8.33	1, 2
				10g	2.53	25.30	23.90	5.86	
02-18-2016	D2450V2	939	Body	1g	4.81	48.10	50.70	-5.13	
				10g	2.21	22.10	23.70	-6.75	

**SAR 2 Room**

Date Tested	System Dipole		T.S. Liquid	Measured Results		Target (Ref. Value)	Delta $\pm 10\%$	Plot No.	
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W				
02-15-2016	D835V2	4d194	Head	1g	1.01	10.10	9.38	7.68	3, 4
				10g	0.66	6.60	6.09	8.37	
02-15-2016	D2450V2	939	Body	1g	5.41	54.10	50.70	6.71	
				10g	2.45	24.50	23.70	3.38	
02-19-2016	D835V2	4d194	Head	1g	0.97	9.71	9.38	3.52	
				10g	0.64	6.39	6.09	4.93	

**SAR 3 Room**

Date Tested	System Dipole		T.S. Liquid	Measured Results		Target (Ref. Value)	Delta $\pm 10\%$	Plot No.	
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W				
02-15-2016	D1900V2	5d190	Body	1g	4.08	40.80	39.60	3.03	
				10g	2.07	20.70	20.80	-0.48	
02-16-2016	D1900V2	5d190	Head	1g	3.85	38.50	39.70	-3.02	5, 6
				10g	2.00	20.00	20.70	-3.38	

## 9. Conducted Output Power Measurements

### 9.1. CDMA

#### CDMA BC0 Measured Results

Band	Mode		Ch No.	Freq. (MHz)	Max. Pwr (dBm)
BC 0	1xRTT	RC1 SO55 (Loopback)	1013	824.70	24.6
			384	836.52	24.6
			777	848.31	24.6
		RC3 SO55 (Loopback)	1013	824.70	24.6
			384	836.52	24.6
			777	848.31	24.6
		RC3 SO32 (+F-SCH)	1013	824.70	24.5
			384	836.52	24.5
			777	848.31	24.5
	1xEVDO Rel. 0	FTAP Rate: 307.2 kbps(2 slot, QPSK) RTAP Rate: 153.6 kbps	1013	824.70	24.7
			384	836.52	24.7
			777	848.31	24.7
	1xEVDO Rev. A	FETAP: 307.2k, QPSK/ ACK RETAP: 4096	1013	824.70	24.7
			384	836.52	24.7
			777	848.31	24.7

#### CDMA BC1 Measured Results

Band	Mode		Ch No.	Freq. (MHz)	Max. Pwr (dBm)
BC 1	1xRTT	RC1 SO55 (Loopback)	25	1851.25	24.6
			600	1880.00	24.5
			1175	1908.75	24.5
		RC3 SO55 (Loopback)	25	1851.25	24.6
			600	1880.00	24.6
			1175	1908.75	24.6
		RC3 SO32 (+F-SCH)	25	1851.25	24.6
			600	1880.00	24.6
			1175	1908.75	24.7
	1xEVDO Rel. 0	FTAP Rate: 307.2 kbps(2 slot, QPSK) RTAP Rate: 153.6 kbps	25	1851.25	24.6
			600	1880.00	24.6
			1175	1908.75	24.7
	1xEVDO Rev. A	FETAP: 307.2k, QPSK/ ACK RETAP: 4096	25	1851.25	24.6
			600	1880.00	24.7
			1175	1908.75	24.7

## 9.2. Wi-Fi 2.4GHz (DTS Band)

### Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
2.4	802.11b	1 Mbps	1	2412	16.6	17.5	Yes	
			6	2437	16.6			
			11	2462	16.7			
	802.11g	6 Mbps	1	2412	Not PWR Meas. require	13.5	No	1
			6	2437				
			11	2462				
	802.11n (HT20)	6.5 Mbps	1	2412	Not PWR Meas. require	12.5	No	1
			6	2437				
			11	2462				

### Note(s):

- Output Power and SAR is not required for 802.11g/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 adjusted SAR is  $\leq 1.2$  W/kg.

## 9.3. Bluetooth

Band (GHz)	Mode	Ch #	Freq. (MHz)	Avg Pwr (dBm)
2.4	V3.0 + BDR, GFSK	0	2402	14.3
		39	2441	13.8
		78	2480	13.7
	V3.0 + EDR, $\pi/4$ DQPSK	0	2402	10.3
		39	2441	9.8
		78	2480	10.5
	V3.0 + EDR, 8-DPSK	0	2402	10.4
		39	2441	9.9
		78	2480	10.6
	V4.0 LE, GFSK	0	2402	3.0
		19	2440	3.0
		39	2480	2.4

## 10. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

### KDB 447498 D01 General RF Exposure Guidance:

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- $\leq 0.8$  W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\leq 100$  MHz
- $\leq 0.6$  W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- $\leq 0.4$  W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\geq 200$  MHz

### KDB 941225 D01 SAR test for 3G devices:

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is  $\leq \frac{1}{4}$  dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is  $\leq 1.2$  W/kg, SAR measurement is not required for the secondary mode

### KDB 248227 D01 SAR meas for 802.11 v02:

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the initial test position(s) by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The initial test position(s) is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the reported SAR for the initial test position is:

- $\leq 0.4$  W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- $> 0.4$  W/kg, SAR is repeated using the same wireless mode test configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the reported SAR is  $\leq 0.8$  W/kg or all required test positions are tested.
  - For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
  - When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is  $> 0.8$  W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is  $\leq 1.2$  W/kg or all required test channels are considered.
  - The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.
- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is  $\leq 1.2$  W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is  $\leq 1.2$  W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

To determine the initial test position, Area Scans were performed to determine the position with the *Maximum Value of SAR (measured)*. The position that produced the highest *Maximum Value of SAR* is considered the worst case position; thus used as the initial test position.

### 10.1. CDMA BC0

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Next-to-Mouth	1xRTT (RC3 SO55)	10	Flat / Front	384	836.5	25.0	24.6	0.068	0.074			
	1xEV-DO (Rel. 0)	10		384	836.5	25.0	24.7	0.068	0.074			1
Extremity	1xRTT (RC3 SO32)	0	Flat / Rear	384	836.5	25.0	24.5			0.441	0.491	2

### 10.2. CDMA BC1

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Next-to-Mouth	1xRTT (RC3 SO55)	10	Flat / Front	25	1851.3	25.0	24.6	0.688	0.763			
				600	1880.0	25.0	24.6	0.928	1.029			
				1175	1908.8	25.0	24.6	0.963	1.068			3
	1xEV-DO (Rel. 0)	10		25	1851.3	25.0	24.6	0.681	0.747			
				600	1880.0	25.0	24.6	0.790	0.860			
				1175	1908.8	25.0	24.7	0.768	0.825			
Extremity	1xRTT (RC3 SO32)	0	Flat / Rear	600	1880.0	25.0	24.6			1.560	1.726	4

### 10.3. Wi-Fi (DTS Band)

Frequency Band	Mode	RF Exposure Conditions	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
								Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
2.4GHz	802.11b 1 Mbps	Next-to-Mouth	10	Flat / Front	11	2462.0	0.339	17.5	16.7	0.245	0.297			5
		Extremity	0	Flat / Rear	11	2462.0	0.607	17.5	16.7			0.229	0.277	6

#### Note(s):

- Highest reported SAR is  $\leq 0.4/1.0$  W/kg, 1-g and 10-g respectively. Therefore, further SAR measurements within this exposure condition are not required.
- Highest reported SAR is  $> 0.4/1.0$  W/kg, 1-g and 10-g respectively. Due to the highest reported SAR for this test position, other test positions in Head exposure condition were evaluated until a SAR  $\leq 0.8/2.0$  W/kg, for 1-g and 10-g respectively, was reported.
- Testing for a second channel was required because the reported SAR for this test position was  $>0.8/2.0$  W/kg, for 1-g and 10-g respectively.
- Additional testing required in order satisfying FCC simultaneous transmission limit criteria.

### 10.4. Bluetooth

Frequency Band	Mode	RF Exposure Conditions	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
2.4GHz	GFSK	Next-to-Mouth	10	Flat / Front	0	2402.0	14.5	14.3	0.099	0.105			7
		Extremity	0	Flat / Rear	0	2402.0	14.5	14.3			0.130	0.138	8

## 11. SAR Measurement Variability

In accordance with published RF Exposure KDB 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

- 1) Repeated measurement is not required when the original highest measured SAR is  $< 0.80$  or  $2.0$  W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is  $\geq 0.80$  or  $2.0$  W/kg (1-g or 10-g respectively), repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is  $> 1.20$  or when the original or repeated measurement is  $\geq 1.45$  or  $3.6$  W/kg ( $\sim 10\%$  from the 1-g or 10-g respective SAR limit).
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5$  or  $3.75$  W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .

### Next-to-Mouth

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	Repeated Measured SAR (W/kg)	Largest to Smallest SAR Ratio
835	CDMA BC0	Next to Mouth	Flat	No	0.068	N/A	N/A
1900	CDMA BC1	Next to Mouth	Flat	Yes	0.963	0.904	1.07
2400	Wi-Fi 802.11b/g/n	Next to Mouth	Flat	No	0.245	N/A	N/A
	Bluetooth	Next to Mouth	Flat	No	0.099	N/A	N/A

### Note(s):

Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not  $> 1.2$ .

### Extremity

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	Repeated Measured SAR (W/kg)	Largest to Smallest SAR Ratio
835	CDMA BC0	Extremity (Hand/Wrist/Ankle)	Flat	No	0.441	N/A	N/A
1900	CDMA BC1	Extremity (Hand/Wrist/Ankle)	Flat	No	1.560	N/A	N/A
2400	Wi-Fi 802.11b/g/n	Extremity (Hand/Wrist/Ankle)	Flat	No	0.229	N/A	N/A
	Bluetooth	Extremity (Hand/Wrist/Ankle)	Flat	No	0.130	N/A	N/A

### Note(s):

Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not  $> 1.2$ .

## 12. Simultaneous Transmission SAR Analysis

KDB 447498 D01 General RF Exposure Guidance introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$SPLSR = (SAR_1 + SAR_2)^{1.5} / Ri$$

Where:

**SAR<sub>1</sub>** is the highest measured or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

**SAR<sub>2</sub>** is the highest measured or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

**Ri** is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of  $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$

In order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$(SAR_1 + SAR_2)^{1.5} / Ri < 0.04$$

### Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations		
Next-to-Mouth	1	CDMA	+	DTS
	2	CDMA	+	BT
Extremity	3	CDMA	+	DTS
	4	CDMA	+	BT
Notes:				
1. VoIP is supported in CDMA				
2. DTS Radio cannot transmit simultaneously with Bluetooth Radio.				

**12.1. Sum of the SAR for WWAN & Wi-Fi & BT in Next-to-Mouth**

RF Exposure conditions	Band	① WWAN	② DTS	③ BT	① + ② WWAN + DTS		① + ③ WWAN + BT	
					∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
					Next-to-Mouth	CDMA BC0	0.074	0.297
	CDMA BC1	1.068	0.297	0.105	1.365	No	1.173	No

**12.2. Sum of the SAR for WWAN & Wi-Fi & BT in Extremity**

RF Exposure conditions	Band	① WWAN	② DTS	③ BT	① + ② WWAN + DTS		① + ③ WWAN + BT	
					∑ 10-g SAR (mW/g)	SPLSR (Yes/ No)	∑ 10-g SAR (mW/g)	SPLSR (Yes/ No)
					Extremity	CDMA BC0	0.491	0.277
	CDMA BC1	1.726	0.277	0.138	2.003	No	1.864	No

**Conclusion:**

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg(10-g SAR is < 4.0 W/kg) or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

## **Appendixes**

**Refer to separated files for the following appendixes.**

**16K22865-S1V1 FCC Report SAR\_App A\_Photos & Ant. Locations**

**16K22865-S1V1 FCC Report SAR\_App B\_Highest SAR Test Plots**

**16K22865-S1V1 FCC Report SAR\_App C\_System Check Plots**

**16K22865-S1V1 FCC Report SAR\_App D\_SAR Tissue Ingredients**

**16K22865-S1V1 FCC Report SAR\_App E\_Probe Cal. Certificates**

**16K22865-S1V1 FCC Report SAR\_App F\_Dipole Cal. Certificates**

**END OF REPORT**