

SAR EVALUATION REPORT

FCC 47 CFR § 2.1093 IEEE Std 1528-2013

For

Smart Watch + CDMA

Model: LG-VC100, VC100, LGVC100, LG-VC100P, LGVC100P, VC100P, LGL50C

FCC ID: ZNFVC100

Report Number: 14U18514-S1 Issue Date: 10/2/2014

Prepared for

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REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
	10/2/2014	Initial Issue	

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1. Attestation of Test Results

Applicant Name	LG ELECTRONICS MOBILECOMM U.S.A., INC.				
Application Purpose	☐ Original Grant ☒ Class II Po	☐ Original Grant ⊠ Class II Permissive Change			
FCC ID	ZNFVC100				
DUT Description	Smart Watch + CDMA				
Exposure Category	General Population/Uncontrolled Exposure (1g / 10g SAR limit: 1.6 / 4 W/kg respectively)				
The Highest Reported	RF Exposure Conditions	Equipment Class			
SAR		Licensed			
	Extremity (wrist)	<mark>2.303</mark> W/kg (10g)			
	Next-to-Mouth	<mark>0.539</mark> W/kg (1g)			
Applicable Standards	FCC 47 CFR § 2.1093				
	KDB publications				
IEEE Std 1528-2013					
Test Results	Pass				
Dates tested	09/29/2014 – 09/30/2014				

UL Verification Services Inc. 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 Verification Services Inc. 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.

Note: 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. 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 NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.

Approved	&	Re	leased	Ву	/ :
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2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2003 & 2013, the following FCC Published RF exposure KDB procedures, and TCB workshop updates:

- o 447498 D01 General RF Exposure Guidance v05r02
- o 941225 D01 SAR test for 3G devices v02
- o 248227 D01 SAR Meas for 802 11abg v01r02
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- o 865664 D02 SAR Reporting v01r01
- o 690783 D01 SAR Listings on Grants v01r03

3. Facilities and Accreditation

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

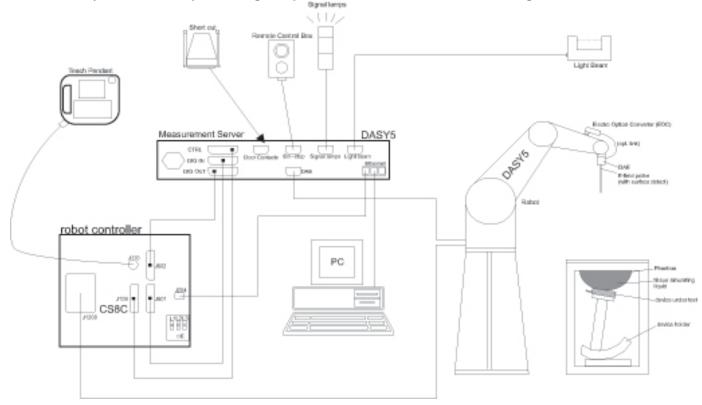
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

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, ADconversion, 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. 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	E5071B	MY42100131	2/24/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1087	11/13/2014
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	EXTECH	445703	CCS-200	3/24/2015
Thermometer	Cole-Parmer Instrument Co.	91100-50	1007	7/31/2015

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Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
HP Signal Generator	HP	8665B	3546A00784	6/23/2015
Power Meter	HP	437B	3125U16345	6/16/2015
Power Meter	Agilent	N1911A	MY53060016	8/7/2015
Power Sensor	Agilent	8481A	2702A60780	6/16/2015
Power Sensor	Agilent	E9323A	MY53070003	5/1/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1622052	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2711	N/A
DC Power Supply	Sorensen Ametek	XT20-3	1318A00530	N/A
E-Field Probe (SAR 3)	SPEAG	EX3DV4	3773	4/22/2015
Data Acquisition Electronics (SAR 3)	SPEAG	DAE4	1380	7/23/2015
System Validation Dipole	SPEAG	D835V2	4d117	5/16/2015
System Validation Dipole	SPEAG	D1900V2	5d043	11/12/2015
Thermometer (SAR Lab 3)	EXTECH	445703	CCS-237	6/3/2015

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R&S	CMW500	137873-WG	7/14/2015

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 1528-2003 & 2013 is not required in SAR reports submitted for equipment approval.

6. Device Under Test (DUT) Information

6.1. DUT Description

Model: LG-VC100, VC100, LGVC100, LG-VC100P, LGVC100P, VC100P, LGL50C			
Intended Use This device should be restricted to wrist-worn and no other operation configuration should be used			
Device Dimension Overall (Length x Width): 57.7 mm x 35.5 mm (excluding strap)			

6.2. Wireless Technologies

Wireless	Frequency bands	Operating mode	Duty Cycle used for SAR testing
technologies			
CDMA2000	BC0 and BC1	1xRTT (Voice & Data)	1xRTT: 100%

6.3. Nominal and Maximum Output Power

Upper limit (dB):	0.5 ~ -1.5	RF Output Pow er (dBm)		
RF Air interface	Mode	Target	Max. tune-up tolerance limit	
CDMA BC0	1xRTT	24.0	24.5	
CDMA BC1	1xRTT	20.7	21.2	

6.4. Simultaneous Transmission Condition

Simultaneous transmission is not supported

7. RF Exposure Conditions (Test Configurations)

Based on guidance provided by the FCC, a non-standard test setup was used for SAR testing. Refer to the operational description for more information.

Refer to Appendix 14.1 "Photos and Antenna Locations" for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

7.1. Extremity (Wrist)

Test Configurations	SAR Required	Note
Rear	Yes	

7.2. Next-to-Mouth Exposure

Test Configurations	SAR Required	Note
Front	Yes	

8. Conducted Output Power Measurements

8.1. CDMA BC0 and BC1

1xRTT Measured Results

Band	Mode	Ch	Freq. (MHz)	Avg Pwr (dBm)
	DO4 0055	1013	824.70	24.5
	RC1 SO55 (Loopback)	384	836.52	24.3
	(Еборьаск)	777	848.31	24.3
	RC3 SO55	1013	824.70	24.4
BC 0	(Loopback)	384	836.52	24.4
	(Еворьаск)	777	848.31	24.4
	DC2 5022	1013	824.70	24.5
	RC3 SO32 (+F-SCH)	384	836.52	24.3
	(+1 -5011)	777	848.31	24.5
	RC1 SO55	25	1851.25	20.9
	(Loopback)	600	1880.00	20.8
	(Еборьаск)	1175	1908.75	20.9
	RC3 SO55	25	1851.25	20.8
BC 1	(Loopback)	600	1880.00	20.7
	(Еборьаск)	1175	1908.75	20.7
	RC3 SO32	25	1851.25	20.9
	(+F-SCH)	600	1880.00	20.7
	(11 3011)	1175	1908.75	20.7

9. 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°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.

9.1. Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Н	ead	Body		
raiget Frequency (IVII 12)	ε _r	σ (S/m)	ε_{r}	σ (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 in IEEE Std 1528-2013

9.2. Dielectric Property Measurements Results

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within \pm 2°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.

SAR Lab 3

Date	Freq. (MHz)		Liq	uid Parameters	Measured	Target	Delta (%)	Limit ±(%)
	Body 1900	e'	51.7100	Relative Permittivity (ε_r):	51.71	53.30	-2.98	5
	Body 1900	e"	14.2500	Conductivity (σ):	1.51	1.52	-0.96	5
9/29/2014 Body 1850	Body 1850	e'	51.8900	Relative Permittivity (ε_r):	51.89	53.30	-2.65	5
	e"	14.1400	Conductivity (σ):	1.45	1.52	-4.31	5	
	Body 1910	e'	51.6800	Relative Permittivity (ε_r):	51.68	53.30	-3.04	5
	Body 1910	e"	14.2900	Conductivity (σ):	1.52	1.52	-0.16	5
	Head 1900	e'	38.9200	Relative Permittivity (ε_r):	38.92	40.00	-2.70	5
	Tieau 1900	e"	13.4000	Conductivity (σ):	1.42	1.40	1.12	5
9/29/2014	Head 1850	e'	39.1200	Relative Permittivity (ε_r):	39.12	40.00	-2.20	5
9/29/2014	Tieau 1030	e"	13.2500	Conductivity (σ):	1.36	1.40	-2.64	5
	Head 1910	e'	38.8900	Relative Permittivity (ε_r):	38.89	40.00	-2.78	5
	Head 1910	e"	13.4200	Conductivity (σ):	1.43	1.40	1.80	5
	Body 835	e'	53.7000	Relative Permittivity (ε_r):	53.70	55.20	-2.72	5
	Body 655	e"	21.9200	Conductivity (σ):	1.02	0.97	4.92	5
9/30/2014	Body 820	e'	53.7700	Relative Permittivity (ε_r):	53.77	55.28	-2.73	5
3/30/2014	Body 020	e"	21.9200	Conductivity (σ):	1.00	0.97	3.20	5
	Body 850	e'	53.5500	Relative Permittivity (ε_r):	53.55	55.16	-2.91	5
	Body 656	e"	21.9100	Conductivity (σ):	1.04	0.99	4.90	5
	Head 835	e'	40.6100	Relative Permittivity (ε_r):	40.61	41.50	-2.14	5
	Head 655	e"	19.9300	Conductivity (σ):	0.93	0.90	2.81	5
9/29/2014	Head 820	e'	40.8100	Relative Permittivity (ε_r):	40.81	41.60	-1.91	5
3/23/2014	ricad 020	e"	19.9900	Conductivity (σ):	0.91	0.90	1.44	5
	Head 850	e'	40.4200	Relative Permittivity (ε_r):	40.42	41.50	-2.60	5
	ricad 650	e"	19.8700	Conductivity (σ):	0.94	0.92	2.63	5

10. 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 remeasured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

10.1. 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.

10.2. 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 F		Frog (MHz)	Target SAR Values (W/kg)		
System Dipole	Serial No.	Cai. Date	Freq. (MHz)	1g/10g	Head	Body
D1900V2	5d043	11/12/2013	1900	1g	40.1	39.0
D1900V2	30043	11/12/2013	1900	10g	21.1	20.8
D835V2	4d117	5/16/2014	835	1g	9.23	9.61
203372	 4117	3/10/2014	5/16/2014 835	10g	5.98	6.31

10.3. 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 Lab 3

	System Dipole		T.S		M	easured Resi	ults	Target	Dolta	Dlot			
Date Tested	Туре	Гуре Serial #		id	Area Scan	Zoom Scan	Normalize to 1 W	(Ref. Value)	Delta ±10 %	Plot No.			
9/29/2014	1900	5d043	Head	1g	3.85	3.74	37.4	40.1	-6.73	1,2			
9/29/2014	1900	50043	Heau	10g	2.01	1.93	19.3	21.1	-8.53	1,2			
9/29/2014	1900	5d043	Body	1g	3.84	3.77	37.70	39.0	-3.33				
9/29/2014	1900	30043	3u0 4 3	3u0 4 3	Ju043	Бойу	10g	1.92	1.95	19.50	20.8	-6.25	
9/30/2014	835	4d117	Head	1g	0.987	0.959	9.6	9.23	3.90				
9/30/2014	033	4 u117	Heau	10g	0.664	0.629	6.3	5.98	5.18				
9/30/2014	835	4d117	Body	1g	1.04	1.01	10.1	9.61	5.10	3,4			
9/30/2014	030	4 u117	Боау	10g	0.693	0.664	6.64	6.31	5.23	5,4			

11. 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:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 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
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

11.1. CDMA BC0

RF Exposure	re		Dist		Dist		Freq.	Power (dBm)		10-g SAR (W/kg)		Plot
Conditions	Mode	(mm)	Test Position	Ch #.	(MHz)	Tune-up limit	Meas.	Meas.	Scaled	No.		
Extremity	1xRTT (RC3 SO32)	0	Neck	384	836.5	24.5	24.3	0.677	0.709	1		
PE Evposure		Diet			Fred	Power	(dBm)	1-g SAF	R (W/kg)	Dlot		
RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power Tune-up limit	(dBm) Meas.	1-g SAF Meas.	R (W/kg) Scaled	Plot No.		

11.2. CDMA BC1

RF Exposure		Dist.			Freq.	Power	(dBm)	10-g SA	R (W/kg)	Plot					
Conditions	Mode	(mm)	Test Position	Ch #.	(MHz)	Tune-up limit	Meas.	Meas.	Scaled	No.					
	4DTT			25	1851.3	21.2	20.8	2.10	2.303	3					
Extremity	1xRTT (RC3 SO32)	0	Neck	600	1880.0	21.2	20.7	1.92	2.154						
	(1100 0002)			1175	1908.8	21.2	20.7	1.88	2.109						
RF Exposure		Diet	Diet	Dist.	Diet	Diet	Diet			Freq.	Power (dBm)		1-g SAR (W/kg)		Plot
Conditions	Mode	(mm)	Test Position	Ch #.	(MHz)	Tune-up limit	Meas.	Meas.	Scaled	No.					
Next-to-Mouth	1xRTT (RC3 SO55)	10	Flat	600	1880.0	21.2	20.7	0.469	0.526	4					

12. SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01. 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 <1.6 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
- When the original highest measured SAR is ≥ 1.6 or 2 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 3 (1-g or 10-g respectively) or when the original or repeated measurement is ≥ 1.45 or 3.6 W/kg (~ 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 ≥ 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 or 3 (1-g or 10-g respectively).

12.1. The Highest Measured SAR Configuration in Each Frequency Band

Frequency Band (MHz)	Air Interface	Extremity (W/kg)	Repeated SAR (Yes/No)
850	CDMA BC0	0.677	No
1900	CDMA BC1	2.10	Yes

Frequency Band (MHz)	Air Interface	Next-to-Mouth (W/kg)	Repeated SAR (Yes/No)
850	CDMA BC0	0.515	No
1900	CDMA BC1	0.469	No

12.2. Repeated Measurement Results

Extremity

	Extromity									
	Frequency band	Test Position	Mode	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR	Note	
						Original	Repeated	Ratio	Note	
	CDMA BC1	Neck	1xRTT (RC3 SO32)	600	1880.0	2.10	1.870	1.12	1	

Note(s):

1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20 or 3 (1-g or 10-g respectively).

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Report No.: 14U18514-S1 Issue Date: 10/2/2014 **Simultaneous Transmission SAR Analysis** 13. Simultaneous transmission is not supported.

14. Appendixes

Refer to separated files for the following appendixes.

- 14.1. Photos and Antenna Locations
- 14.2. System Performance Check Plots
- 14.3. Highest SAR Test Plots
- 14.4. Tissue Material Ingredients
- 14.5. Calibration Certificate for E-Field Probe EX3DV4 SN 3773
- 14.6. Calibration Certificate for D835V2 SN 4d117
- 14.7. Calibration Certificate for D1900V2 SN 5d043

END OF REPORT