FCC 47 CFR § 2.1093
IEEE Std 1528-2013

SAR EVALUATION REPORT

FOR

3G wireless modem

MODEL NUMBER: mBFT17(V)-WCDMA

FCC ID: 2AL3AHDJC-1802

REPORT NUMBER: 4788319770-S1V2

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ACCREDITED
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TL-637

Revision History

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V1	3/13/2018	Initial Issue	Sunghoon Kim
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1. Attestation of Test Results

Applicant Name	HYUNDAI J-COMM. CO., LTD.	
FCC ID	2AL3AHDJC-1802	
Model Number	mBFT17(V)-WCDMA	
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013	
Exposure Category	SAR Limits (W/Kg)	
	Peak spatial-average(1g of tissue)	Extremities (hands, wrists, ankles, etc.) (10g of tissue)
General population / Uncontrolled exposure	1.6	4.0
RF Exposure Conditions	Equipment Class - Highest Reported SAR (W/kg)	
	Licensed	
Body 1g SAR	N/A	
Extremity (hands) 10g SAR	1.92	
Date Tested	1/3/2018 to 1/9/2018	
Test Results	Pass	

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.

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 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.

Approved & Released By:	Prepared By:
	
Justin Park Lead Test Engineer UL Korea, Ltd. Suwon Laboratory	Sunghoon Kim Associate Test 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:

- 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

Additional Guidance: KDB inquiry

- Consideration of SAR test – KDB guidance to identify that SAR test configuration of both body-worn and extremity exposure conditions.

3. Facilities and Accreditation

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

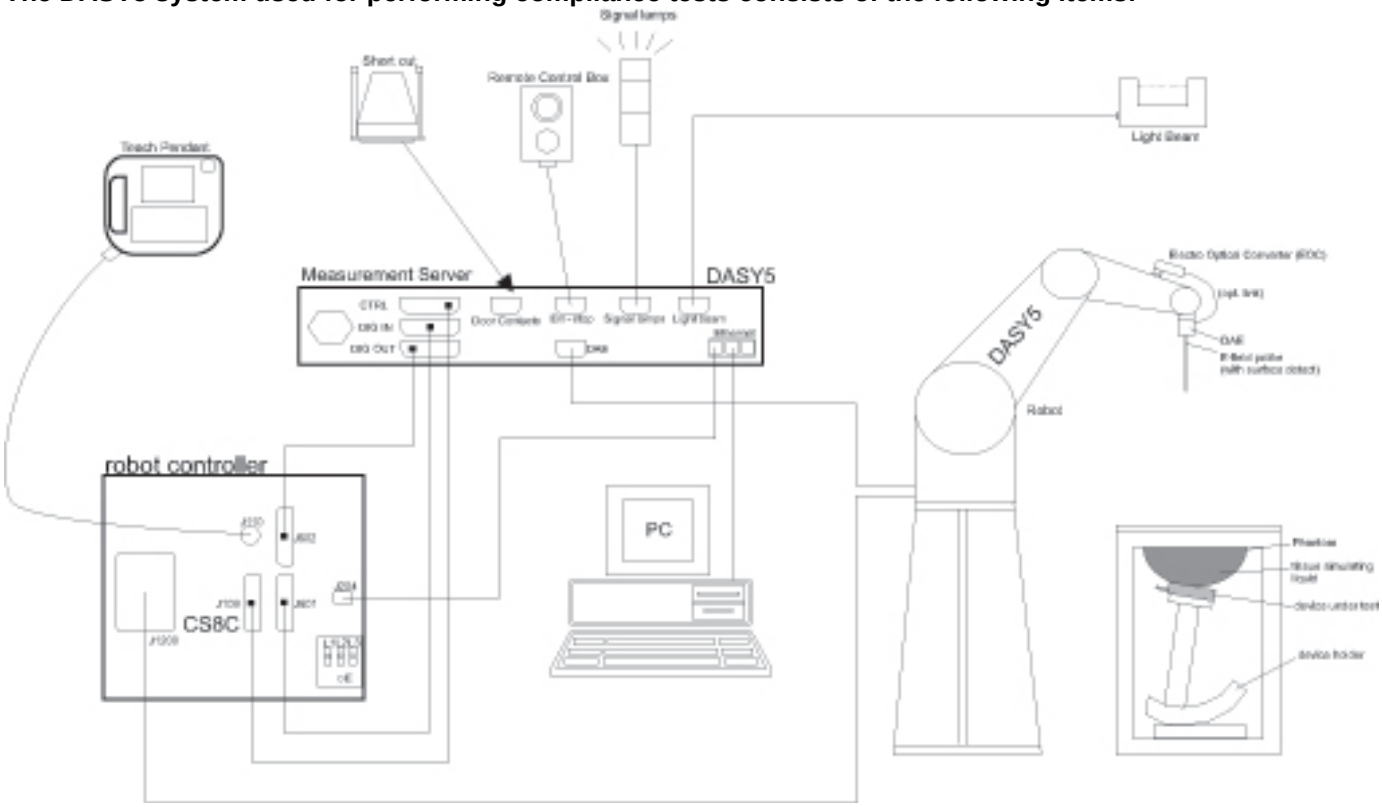
Suwon
SAR 1 Room
SAR 2 Room
SAR 3 Room

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

<table>
<tr><td></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td>Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">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 ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
</table>

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

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ 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 *reported* SAR from the area scan based *1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 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	8-8-2018
Dielectric Assessment Kit	SPEAG	DAK-3.5	1196	8-2-2018
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	LKM	DTM3000	3424	8-11-2018
Thermometer	Lutron	MHB-382SD	AH.91478	8-10-2018

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
MXG Analog Signal Generator	Agilent	N5181A	MY50145882	8-7-2018
Power Sensor	Agilent	U2000A	MY54260010	8-8-2018
Power Sensor	Agilent	U2000A	MY54260007	8-8-2018
Power Amplifier	EXODUS	1410025-AMP2027-10003	10003	8-8-2018
Directional Coupler	Agilent	778D	MY52180432	8-7-2018
Low Pass Filter	MICROLAB	LA-15N	03943	8-7-2018
Low Pass Filter	FILTRON	L14012FL	1410003S	8-7-2018
Attenuator	Agilent	8491B/003	MY39269292	8-7-2018
Attenuator	Agilent	8491B/010	MY39269315	8-7-2018
Attenuator	Agilent	8491B/020	MY39269298	8-7-2018
E-Field Probe (SAR2)	SPEAG	EX3DV4	7313	1-30-2018
E-Field Probe (SAR3)	SPEAG	EX3DV4	7314	9-28-2018
Data Acquisition Electronics (SAR2)	SPEAG	DAE4	1447	11-22-2018
Data Acquisition Electronics (SAR3)	SPEAG	DAE4	1494	7-20-2018
System Validation Dipole	SPEAG	D835V2	4d194	7-19-2018
System Validation Dipole	SPEAG	D1750V2	1125	8-26-2017
System Validation Dipole	SPEAG	D1900V2	5d199	2-21-2018
Thermometer (SAR2)	Lutron	MHB-382SD	AH.50215	8-16-2018
Thermometer (SAR3)	Lutron	MHB-382SD	AH.50213	8-16-2018

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	150313	12-08-2018
Base Station Simulator	R & S	CMW500	150314	12-05-2018

Note(s):

Refer to Appendix F that mentioned about justification for Extended SAR Dipole Calibrations(D1750V2, SN : 1125)

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 and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, 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

Device Dimension	Refer of 4788319770-S1V1 FCC Report SAR_App A_Photos & Ant. Locations		
Back Cover	☒ Normal Battery Cover		
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.7V, 5800mAh		
Wireless Router (Hotspot)	Hotspot mode is not support		
Test sample information	**No.**	**S/N**	**Notes**
	1	0008	Conduction & SAR

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
W-CDMA (UMTS)	Band II Band IV Band V	UMTS Rel. 99 (Voice & Data) HSDPA (Release 7) HSUPA (Release 6)	100.00 %

6.3. Nominal and Maximum Output Power from Tune-up Procedure

KDB 447498 sec.4.1. 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
W-CDMA Band II	R99	23.0	**23.5**
	HSDPA	22.0	**22.5**
	HSUPA	22.0	**22.5**
W-CDMA Band IV	R99	23.0	**23.5**
	HSDPA	23.0	**23.5**
	HSUPA	23.0	**23.5**
W-CDMA Band V	R99	23.0	**23.5**
	HSDPA	23.0	**23.5**
	HSUPA	23.0	**23.5**

7. RF Exposure Conditions (Test Configurations)

7.1. Standalone SAR Test Exclusion Considerations

According to the applicant's description, 3G wireless modem is only operating with special device (FCC ID: 2AL3AHDJC-1801). This 3G wireless modem can use attached to backside of the device. and It is only support to data transmission. So Body-worn exposure condition is not required related to voice function. So SAR test are consider to only in hand scenario (Hand-held use) according to the special device (FCC ID: 2AL3AHDJC-1801). Therefore SAR test exclusion is considered Both Body and Extremity (Hand) exposure conditions.
And the RF exposure test configuration was confirmed through a KDB inquiry, details please refer to KDB inquiry filed under operational description category.

1) Body SAR test exclusion considerations for Condition 1 & 2

The body SAR tests are excluded according to the KDB 447498 as below.

When the user uses this device in hand, the Edge 3(Bottom) side can only be touched to user's body.

In this case, the user's body shall be separated from the closet edges of the antenna.

It refer Appendix A to detail of antenna location in the device.

Body SAR Test Exclusion Calculations

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)	Calculated Threshold Value
		dBm	mW	Edge 3(Bottom)	Edge 3(Bottom)
W-CDMA Ⅱ	1907.6	23.50	224	124.2	850.6 mW -EXEMPT-
W-CDMA Ⅳ	1752.6	23.50	224	124.2	855.3 mW -EXEMPT-
W-CDMA Ⅴ	848.6	23.50	224	124.2	582.6 mW -EXEMPT-

Note(s):

According to KDB 447498, if the calculated Power threshold is less than the output power then SAR testing is required.

2) Extremity SAR test exclusion considerations

When the user uses this device in hand, the Rear side can be touched to user's hand.

In this case, the user's hand shall be separated from the closet edges of the antenna.

It refer Appendix A to detail of antenna location in the device.

Extremity SAR Test Exclusion Calculations

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)	Calculated Threshold Value
		dBm	mW	Rear	Rear
W-CDMA Ⅱ	1907.6	23.50	224	0	61.9 -MEASURE-
W-CDMA Ⅳ	1752.6	23.50	224	0	59.3 -MEASURE-
W-CDMA Ⅴ	848.6	23.50	224	0	41.3 -MEASURE-

Note(s):

According to KDB 447498, if the calculated threshold value is >7.5 then SAR testing is required.

7.2. Required Test Configurations

The table below identifies both body and extremity test configurations required for this device according to the findings in Section 7.1:

RF Exposure Conditions	Wireless technologies	Ant-to-User Separation	Test Position	SAR Required	Note
Body	WCDMA Band II	124.2 mm	Edge 3(Bottom)	No	
	WCDMA Band IV	124.2 mm	Edge 3(Bottom)	No	
	WCDMA Band V	124.2 mm	Edge 3(Bottom)	No	
Extremity	WCDMA Band II	0 mm	Rear	Yes	1
	WCDMA Band IV	0 mm	Rear	Yes	1
	WCDMA Band V	0 mm	Rear	Yes	1

Note(s):

1. 3G wireless modem has External Antenna with rotate. The antenna orientation was configuration through a KDB inquiry. Details please refer to the KDB inquiry filed under operational description category.

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 ± 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.

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head		Body	
	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 within the IEEE Std 1528-2013

Dielectric Property Measurements Results:

SAR 2 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
1-3-2018	Body 1750	e'	53.1300	Relative Permittivity (ϵ_r):	53.13	53.44	-0.58	5
		e''	14.6700	Conductivity (σ):	1.43	1.49	-3.95	5
	Body 1710	e'	53.2000	Relative Permittivity (ϵ_r):	53.20	53.54	-0.64	5
		e''	14.6400	Conductivity (σ):	1.39	1.46	-4.76	5
	Body 1755	e'	53.1300	Relative Permittivity (ϵ_r):	53.13	53.43	-0.56	5
		e''	14.6700	Conductivity (σ):	1.43	1.49	-3.87	5
1-3-2018	Body 1900	e'	52.6500	Relative Permittivity (ϵ_r):	52.65	53.30	-1.22	5
		e''	14.9800	Conductivity (σ):	1.58	1.52	4.12	5
	Body 1850	e'	52.8500	Relative Permittivity (ϵ_r):	52.85	53.30	-0.84	5
		e''	14.8900	Conductivity (σ):	1.53	1.52	0.77	5
	Body 1910	e'	52.6000	Relative Permittivity (ϵ_r):	52.60	53.30	-1.31	5
		e''	14.9900	Conductivity (σ):	1.59	1.52	4.73	5

SAR 3 Room

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
1-8-2018	Body 835	e'	53.5200	Relative Permittivity (ϵ_r):	53.52	55.20	-3.04	5
		e''	21.3100	Conductivity (σ):	0.99	0.97	2.00	5
	Body 820	e'	53.6800	Relative Permittivity (ϵ_r):	53.68	55.28	-2.89	5
		e''	21.3700	Conductivity (σ):	0.97	0.97	0.61	5
	Body 850	e'	53.3700	Relative Permittivity (ϵ_r):	53.37	55.16	-3.24	5
		e''	21.2400	Conductivity (σ):	1.00	0.99	1.69	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 2.5 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 1.4 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	Body
D835V2	4d194	7-19-2017	835	1g	9.30
				10g	6.09
D1750V2	1125	8-26-2016	1750	1g	37.20
				10g	19.80
D1900V2	5d199	2-21-2017	1900	1g	40.40
				10g	21.30

Note(s):

Refer to Appendix F that mentioned about justification for Extended SAR Dipole Calibrations(D1750V2, SN : 1125)

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 2 Room

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
1-3-2017	D1750V2	1125	Body	1g	3.56	35.60	37.20	-4.30	1,2
				10g	1.90	19.00	19.80	-4.04	
1-3-2017	D1900V2	5d199	Body	1g	4.16	41.60	40.40	2.97	3,4
				10g	2.13	21.30	21.30	0.00	

SAR 3 Room

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.
	Type	Serial #			Zoom Scan to 100 mW	Normalize to 1 W			
1-8-2017	D835V2	4d194	Body	1g	0.97	9.72	9.30	4.52	7,8
				10g	0.64	6.37	6.09	4.60	

9. Conducted Output Power Measurements

9.1. W-CDMA

Release 99 Setup Procedures used to establish the test signals

The following tests were completed according to the test requirements outlined in section 5.2 of the 3GPP TS34.121-1 specification. The DUT supports power Class 3, which has a nominal maximum output power of 24 dBm (+1.7/-3.7).

Mode	Subtest	Rel99
WCDMA General Settings	Loopback Mode	Test Mode 2
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	βc/βd	8/15

HSDPA Setup Procedures used to establish the test signals

The following 4 Sub-tests were completed according to Release 5 procedures in section 5.2 of 3GPP TS34.121. A summary of these settings are illustrated below:

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subtest	1	2	3	4
W-CDMA General Settings	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set 1			
	Power Control Algorithm	Algorithm 2			
	βc	2/15	11/15	15/15	15/15
	βd	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	βc/βd	2/15	11/15	15/8	15/4
	βhs	4/15	24/15	30/15	30/15
	MPR (dB)	0	0	0.5	0.5
HSDPA Specific Settings	D_{ACK}	8			
	D_{NAK}	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback (Table 5.2B.4)	4ms			
	CQI Repetition Factor (Table 5.2B.4)	2			
	Ahs=βhs/βc	30/15			

HSPA (HSDPA & HSUPA) Setup Procedures used to establish the test signals

The following 5 Sub-tests were completed according to Release 6 procedures in table C,11.1.3 of 3GPP TS 34.121-1 v13.
A summary of these settings are illustrated below:

	Mode	HSPA				
	Subtest	1	2	3	4	5
WCDMA General Settings	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2 kbps RMC				
	HSDPA FRC	H-Set 1				
	HSUPA Test	HSPA				
	Power Control Algorithm	Algorithm 2				Algorithm 1
	βc	11/15	6/15	15/15	2/15	15/15
	βd	15/15	15/15	9/15	15/15	0
	βec	209/225	12/15	30/15	2/15	5/15
	βc/βd	11/15	6/15	15/9	2/15	-
	βhs	22/15	12/15	30/15	4/15	5/15
	βed	1309/225	94/75	47/15	56/75	47/15
	CM (dB)	1	3	2	3	1
	MPR (dB)	0	2	1	2	0
HSDPA Specific Settings	DACK	8				0
	DNAK	8				0
	DCQI	8				0
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
	CQI Repetition Factor (Table 5.2B.4)	2				
	Ahs = βhs/βc	30/15				
HSUPA Specific Settings	E-DPDCCH	6	8	8	5	0
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	12
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	67
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E-TFCIs	5	5	2	5	1
	Reference E-TFCI	11	11	11	11	67
	Reference E-TFCI PO	4	4	4	4	18
	Reference E-TFCI	67	67	92	67	67
	Reference E-TFCI PO	18	18	18	18	18
	Reference E-TFCI	71	71	71	71	71
	Reference E-TFCI PO	23	23	23	23	23
	Reference E-TFCI	75	75	75	75	75
	Reference E-TFCI PO	26	26	26	26	26
	Reference E-TFCI	81	81	81	81	81
	Reference E-TFCI PO	27	27	27	27	27
	Maximum Channelization Codes	2xSF2				SF4

W-CDMA Band II Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	Max. Pwr	
					MPR (dB)	Avg. Pwr (dBm)
W-CDMA Band II	Rel 99	RMC, 12.2 kbps	9262	1852.4	0	22.5
			9400	1880.0	0	22.5
			9538	1907.6	0	23.0
	HSDPA	Subtest 1	9262	1852.4	0	22.0
			9400	1880.0	0	22.0
			9538	1907.6	0	22.5
		Subtest 2	9262	1852.4	0	20.7
			9400	1880.0	0	20.7
			9538	1907.6	0	21.2
		Subtest 3	9262	1852.4	0.5	20.9
			9400	1880.0	0.5	20.4
			9538	1907.6	0.5	20.9
		Subtest 4	9262	1852.4	0.5	20.1
			9400	1880.0	0.5	20.1
			9538	1907.6	0.5	20.6
	HSUPA	Subtest 1	9262	1852.4	0	21.0
			9400	1880.0	0	20.9
			9538	1907.6	0	21.4
		Subtest 2	9262	1852.4	2	19.0
			9400	1880.0	2	18.9
			9538	1907.6	2	19.5
		Subtest 3	9262	1852.4	1	19.8
			9400	1880.0	1	19.8
			9538	1907.6	1	20.3
		Subtest 4	9262	1852.4	2	19.2
			9400	1880.0	2	19.3
			9538	1907.6	2	19.8
		Subtest 5	9262	1852.4	0	21.0
			9400	1880.0	0	21.1
			9538	1907.6	0	21.5

W-CDMA Band IV Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	Max. Pwr	
					MPR (dB)	Avg. Pwr (dBm)
W-CDMA Band IV	Rel 99	RMC, 12.2 kbps	1312	1712.4	0	23.1
			1413	1732.6	0	23.4
			1513	1752.6	0	23.2
	HSDPA	Subtest 1	1312	1712.4	0	22.9
			1413	1732.6	0	23.1
			1513	1752.6	0	22.9
		Subtest 2	1312	1712.4	0	21.7
			1413	1732.6	0	21.8
			1513	1752.6	0	21.6
		Subtest 3	1312	1712.4	0.5	21.3
			1413	1732.6	0.5	21.6
			1513	1752.6	0.5	21.3
		Subtest 4	1312	1712.4	0.5	21.0
			1413	1732.6	0.5	21.3
			1513	1752.6	0.5	21.0
	HSUPA	Subtest 1	1312	1712.4	0	21.7
			1413	1732.6	0	22.0
			1513	1752.6	0	21.8
		Subtest 2	1312	1712.4	2	19.9
			1413	1732.6	2	20.0
			1513	1752.6	2	19.9
		Subtest 3	1312	1712.4	1	20.7
			1413	1732.6	1	20.9
			1513	1752.6	1	20.7
		Subtest 4	1312	1712.4	2	20.1
			1413	1732.6	2	20.3
			1513	1752.6	2	20.2
		Subtest 5	1312	1712.4	0	21.9
			1413	1732.6	0	22.1
			1513	1752.6	0	22.0

W-CDMA Band V Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	Max. Pwr	
					MPR (dB)	Avg. Pwr (dBm)
W-CDMA Band V	Rel 99	RMC, 12.2 kbps	4132	826.4	0	23.2
			4183	836.6	0	23.2
			4233	846.6	0	23.2
	HSDPA	Subtest 1	4132	826.4	0	22.9
			4183	836.6	0	22.9
			4233	846.6	0	22.9
		Subtest 2	4132	826.4	0	21.7
			4183	836.6	0	21.7
			4233	846.6	0	21.6
		Subtest 3	4132	826.4	0.5	21.4
			4183	836.6	0.5	21.4
			4233	846.6	0.5	21.3
		Subtest 4	4132	826.4	0.5	21.1
			4183	836.6	0.5	21.1
			4233	846.6	0.5	21.0
	HSUPA	Subtest 1	4132	826.4	0	22.0
			4183	836.6	0	21.9
			4233	846.6	0	21.9
		Subtest 2	4132	826.4	2	19.9
			4183	836.6	2	20.0
			4233	846.6	2	20.0
		Subtest 3	4132	826.4	1	20.8
			4183	836.6	1	20.8
			4233	846.6	1	20.7
		Subtest 4	4132	826.4	2	20.3
			4183	836.6	2	20.3
			4233	846.6	2	20.2
		Subtest 5	4132	826.4	0	22.1
			4183	836.6	0	22.0
			4233	846.6	0	22.0

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:

- ≤ 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

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 ≤ ¼ 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 ≤ 1.2/3.0 W/kg, 1-g and 10-g respectively, SAR measurement is not required for the secondary mode

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These types of consumer products are not designed to be worn or used on the user's body;

- There is typically at least several cm or more of separation
- Such use conditions can easily qualify for SAR test exclusion to support potential portable exposure conditions

10.1. W-CDMA Band II

RF Exposure Conditins	Mode	Dist. (mm)	Test Position	Antenna Degree	Ch #.	Freq. (MHz)	Power (dBm)		10-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
Extremity	Rel 99 RMC	0	Rear	0	9400	1880.0	23.5	22.5	1.220	1.532	1
				45	9400	1880.0	23.5	22.5	0.945	1.187	
				90	9400	1880.0	23.5	22.5	0.953	1.197	
				135	9400	1880.0	23.5	22.5	0.959	1.205	
				180	9400	1880.0	23.5	22.5	1.220	1.532	

10.2. W-CDMA Band IV

RF Exposure Conditins	Mode	Dist. (mm)	Test Position	Antenna Degree	Ch #.	Freq. (MHz)	Power (dBm)		10-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
Extremity	Rel 99 RMC	0	Rear	0	1413	1732.6	23.5	23.4	1.850	1.915	2
				45	1413	1732.6	23.5	23.4	1.360	1.408	
				90	1413	1732.6	23.5	23.4	1.420	1.470	
				135	1413	1732.6	23.5	23.4	1.500	1.553	
				180	1413	1732.6	23.5	23.4	1.660	1.718	

10.3. W-CDMA Band V

RF Exposure Conditins	Mode	Dist. (mm)	Test Position	Antenna Degree	Ch #.	Freq. (MHz)	Power (dBm)		10-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
Extremity	Rel 99 RMC	0	Rear	0	4183	836.6	23.5	23.2	1.110	1.181	3
				45	4183	836.6	23.5	23.2	1.010	1.075	
				90	4183	836.6	23.5	23.2	0.919	0.978	
				135	4183	836.6	23.5	23.2	0.889	0.946	
				180	4183	836.6	23.5	23.2	1.090	1.160	

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.

10-g SAR Measurement Variability

1) Repeated measurement is not required when the original highest measured SAR is < 2.0 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 2.0 W/kg, 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 ≥ 3.6 W/kg (~ 10% from the 10-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥3.75 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	First Repeated	
						Measured SAR (W/kg)	Largest to Smallest SAR Ratio
850	WCDMA Band V	Extremity	Rear	No	1.110	N/A	N/A
1700	WCDMA Band IV	Extremity	Rear	No	1.850	N/A	N/A
1900	WCDMA Band II	Extremity	Rear	No	1.220	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 > 1.20.

12. Simultaneous Transmission SAR Analysis

N/A.

Appendixes

Refer to separated files for the following appendixes.

4788319770-S1V2 FCC Report SAR_App A_Photos & Ant. Locations

4788319770-S1V2 FCC Report SAR_App B_Highest SAR Test Plots

4788319770-S1V2 FCC Report SAR_App C_System Check Plots

4788319770-S1V2 FCC Report SAR_App D_SAR Tissue Ingredients

4788319770-S1V2 FCC Report SAR_App E_Probe Cal. Certificates

4788319770-S1V2 FCC Report SAR_App F_Dipole Cal. Certificates

END OF REPORT