SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

For
GERAN/UMTS/2.4 GHz Qollector Activity Monitor

FCC ID: C9O-QOLL2
Model Name: QOLLECTOR2

Report Number: 15U21180-S1V4
Issue Date: 11/19/2015

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Date	Revisions	Revised By
V1	9/15/2015	Initial Issue	--
V2	11/2/2015	1. Duty Cycle updated 2. Section 7 updated 3. FCC ID updated 4. Added ANT+	Lance Fleischer
V3	11/4/2015	1. Added data for Front Test Position 2. Updated Appendices A/B/C/E/F to V2 3. Section 12: Added Simultaneous Analysis	Coltyce Sanders
V4	11/19/2015	1. Added data for Edges 2/3/4 Test Positions 2. Updated Appendices A/B/C/E/F to V3	Coltyce Sanders

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1. Attestation of Test Results

Applicant Name	SRAM LLC			
FCC ID	C9O-QOLL2			
Model Name	QOLLECTOR2			
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013			
SAR Limits (W/Kg)				
Exposure Category	Peak spatial-average(1g of tissue)			
General population / Uncontrolled exposure	1.6			
The Highest Reported SAR (W/kg)				
RF Exposure Conditions	**Equipment Class**			
	Licensed	**DTS**	**U-NII**	**ANT+**
Body-worn	1.268	N/A	N/A	N/A
Simultaneous Transmission	1.394			
Date Tested	8/3/2015 to 9/1/2015 and 11/3/2015 to 11/4/2015 and 11/18/2015 to 11/19/2015			
Test Results	Pass			

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 & Released By:	Prepared By:
	
Devin Chang Senior Engineer UL Verification Services Inc.	Lance Fleischer Laboratory Technician UL Verification Services Inc.

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

3. Facilities and Accreditation

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

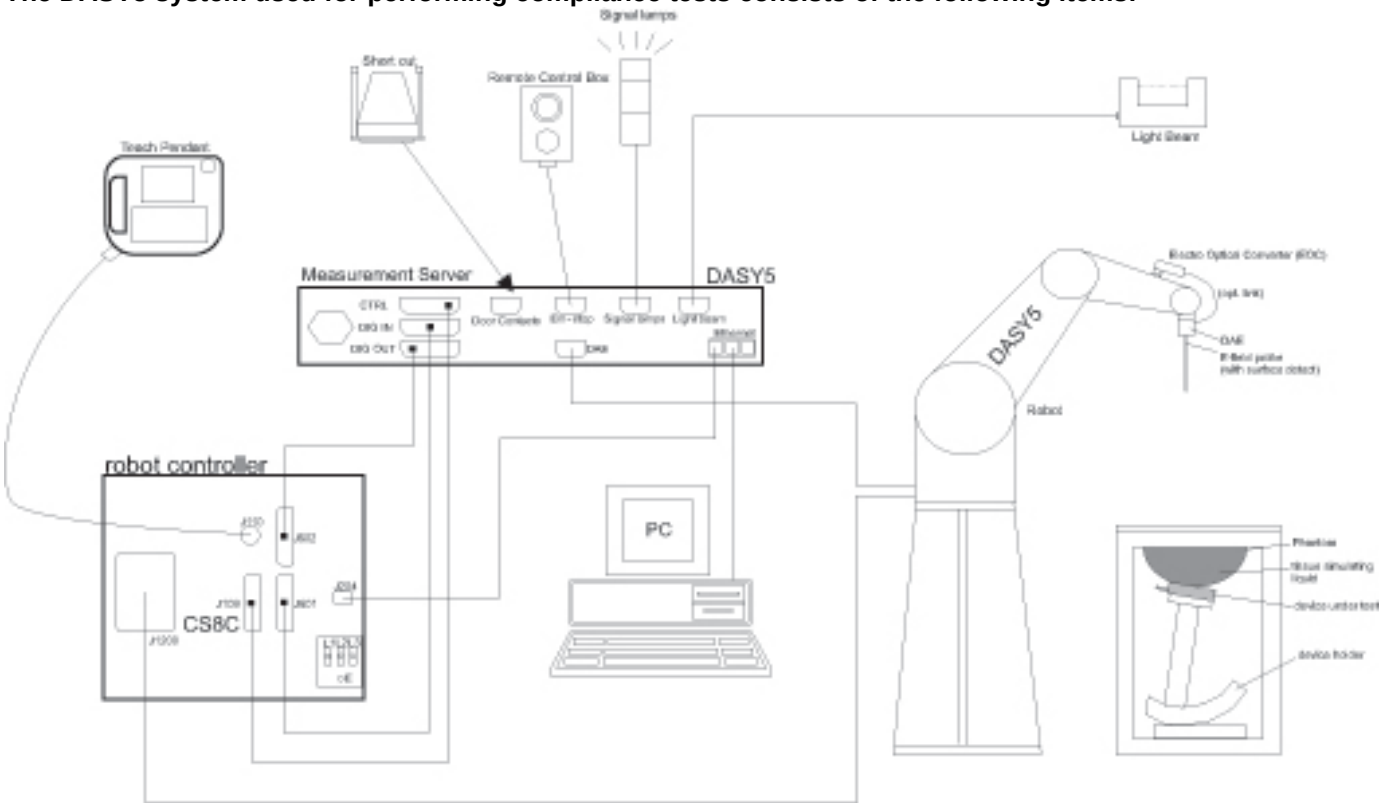
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

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

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 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 ≤ 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

			≤ 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.

The following test equipment was used during test dates 08/03/2015 to 09/01/2015

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	8753ES	MY40001647	7/28/2016
Dielectric Probe kit	SPEAG	DAK-3.5	1082	9/16/2015
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Control Company	Traceable	140493798	8/4/2016

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
HP Signal Generator	HP	8665B	3546A00784	6/27/2016
Power Meter	Agilent	N1911A	MY53060007	9/15/2015
Power Meter	Agilent	N1911A	MY53060016	8/7/2015
Power Sensor	Agilent	N1921A	MY53020038	3/16/2016
Power Sensor	Agilent	N10149	MY52260009	12/15/2015
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	XT15-4	1319A02780	N/A
Synthesized Signal Generator	Agilent	8665B	3438A00633	8/29/2015
Power Meter	HP	437B	3125U09516	8/27/2015
Power Meter	HP	437B	3125U11347	10/6/2015
Power Sensor	HP	8481A	3318A95392	10/6/2015
Power Sensor	HP	8481A	1926A16917	10/10/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1808938	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2710	N/A
DC Power Supply	HP	6296A	2841A-05955	N/A
E-Field Probe (SAR Lab 1)	SPEAG	EX3DV4	7356	4/22/2016
E-Field Probe (SAR Lab 2)	SPEAG	EX3DV4	3990	3/18/2016
E-Field Probe (SAR Lab 3)	SPEAG	EX3DV4	3749	1/26/2016
E-Field Probe (SAR Lab 5)	SPEAG	EX3DV4	3773	4/22/2016
Data Acquisition Electronics (SAR Lab 1)	SPEAG	DAE4	1352	11/7/2015
Data Acquisition Electronics (SAR Lab 2)	SPEAG	DAE4	1259	1/14/2016
Data Acquisition Electronics (SAR Lab 3)	SPEAG	DAE4	1434	4/16/2016
Data Acquisition Electronics (SAR Lab 5)	SPEAG	DAE4	1239	4/16/2016
System Validation Dipole	SPEAG	D835V2	4d142	9/9/2015
System Validation Dipole	SPEAG	D1750V2	1050	4/15/2016
System Validation Dipole	SPEAG	D1750V2	1053	8/11/2016
System Validation Dipole	SPEAG	D1900V2	5d163	9/11/2015
Thermometer (SAR Lab 1)	EXTECH	445703	CCS-205	3/20/2016
Thermometer (SAR Lab 2)	EXTECH	445703	CCS-203	3/19/2016
Thermometer (SAR Lab 3)	EXTECH	445703	CCS-237	6/5/2016
Thermometer (SAR Lab 5)	EXTECH	445703	CCS-239	6/5/2016

Other

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	137875	6/25/2016

The following test equipment was used during test dates 11/03/2015 to 11/04/2015

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	8753ES	MY40000980	4/17/2016
Dielectric Probe kit	SPEAG	DAK-3.5	1087	11/11/2015
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Traceable Calibration Control Co.	4242	140562250	8/24/2016

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	HP	8665B	3744A01084	5/8/2016
Power Meter	Keysight	N1912A	MY55196004	7/1/2016
Power Meter	Agilent	N1912A	MY50001018	10/19/2016
Power Sensor	Agilent	E9323A	MY53070007	3/2/2016
Power Sensor	Agilent	E9323A	MY53070005	4/29/2016
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Directional coupler	Werlatone	C8060-102	2149	N/A
DC Power Supply	AMETEK	XT 15-4	1319A02778	N/A
Synthesized Signal Generator	HP	8665B	3744A01155	3/18/2016
Power Meter	HP	437B	3125U16345	6/15/2016
Power Meter	HP	437B	3125U12345	7/31/2016
Power Sensor	HP	8481A	2702A76223	9/3/2016
Power Sensor	HP	8481A	1926A27048	8/3/2016
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795092	N/A
Directional coupler	Werlatone	C8060-102	2141	N/A
DC Power Supply	BK PRECISION	1611	215-02292	N/A
E-Field Probe (SAR Lab F)	SPEAG	EX3DV4	3929	4/22/2016
E-Field Probe (SAR Lab G)	SPEAG	EX3DV4	3991	5/19/2016
Data Acquisition Electronics (SAR Lab F)	SPEAG	DAE4	1359	2/18/2016
Data Acquisition Electronics (SAR Lab G)	SPEAG	DAE4	1433	3/12/2016
System Validation Dipole	SPEAG	D835V2	4d002	11/13/2015
System Validation Dipole	SPEAG	D1750V2	1053	8/11/2016
System Validation Dipole	SPEAG	D1900V2	5d043	11/7/2015

The following test equipment was used during test dates 11/18/2015 to 11/19/2015

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	8753ES	MY40000980	4/17/2016
Dielectric Probe kit	SPEAG	DAK-3.5	1082	9/15/2016
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Traceable Calibration Control Co.	4242	140562250	8/24/2016

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	HP	8665B	3744A01084	5/8/2016
Power Meter	Keysight	N1912A	MY55196004	7/1/2016
Power Meter	Agilent	N1912A	MY50001018	10/19/2016
Power Sensor	Agilent	E9323A	MY53070007	3/2/2016
Power Sensor	Agilent	E9323A	MY53070005	4/29/2016
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Directional coupler	Werlatone	C8060-102	2149	N/A
DC Power Supply	AMETEK	XT 15-4	1319A02778	N/A
Synthesized Signal Generator	HP	8665B	3744A01155	3/18/2016
Power Meter	HP	437B	3125U16345	6/15/2016
Power Meter	HP	437B	3125U12345	7/31/2016
Power Sensor	HP	8481A	2702A76223	9/3/2016
Power Sensor	HP	8481A	1926A27048	8/3/2016
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795092	N/A
Directional coupler	Werlatone	C8060-102	2141	N/A
DC Power Supply	BK PRECISION	1611	215-02292	N/A
E-Field Probe (SAR Lab E)	SPEAG	EX3DV4	3772	2/23/2016
E-Field Probe (SAR Lab G)	SPEAG	EX3DV4	3991	5/19/2016
Data Acquisition Electronics (SAR Lab E)	SPEAG	DAE4	1439	7/30/2016
Data Acquisition Electronics (SAR Lab G)	SPEAG	DAE4	1433	3/12/2016
System Validation Dipole	SPEAG	D835V2	4d117	5/18/2016
System Validation Dipole	SPEAG	D1750V2	1053	8/11/2016
System Validation Dipole	SPEAG	D1900V2	5d163	9/21/2016

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

Device Dimension	Overall (Length x Width): 98.9 mm x 55.6 mm Overall Diagonal: 101.4 mm		
Back Cover	☒ The rechargeable battery is not user accessible.		
Battery Options	☒ The rechargeable battery is not user accessible.		
Wireless Router (Hotspot)	Device does not support Hotspot mode		
Wi-Fi Direct	Device does not support Wi-Fi Direct		
Test sample information	**S/N**	**IMEI**	**Notes**
	ADR21520	351579055495624	SAR Radiated Test Sample
	ADR11179	351579055511529	SAR Radiated Test Sample
Hardware Version	Qollector2		
Software Version	12.00.026		

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode		Duty Cycle used for SAR testing
GSM	850 1900	GPRS (GMSK) EGPRS (8PSK)	GPRS Multi-Slot Class: ☐ Class 8 - 1 Up, 4 Down ☒ Class 10 - 2 Up, 4 Down ☐ Class 12 - 4 Up, 4 Down ☐ Class 33 - 4 Up, 5 Down	(E)GPRS: 1 Slot: 12.5% 2 Slots: 25%
	Does this device support DTM (Dual Transfer Mode)? ☐ Yes ☒ No			
W-CDMA (UMTS)	Band II Band IV Band V	UMTS Rel. 99 (Voice & Data)		100%
ANT+	2.4 GHz	ANT+		N/A

6.3. Testing Rationale

A Reduced Duty Cycle is used in order to determine the Final Reported SAR. Per manufacturer's Theory of Operation document, the device will operate with a 33% worst case Duty Cycle for GSM and WCDMA.

6.4. 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): -1.0 ~ 0.5		Max. RF Output Power (dBm)		
RF Air interface	Mode	Target	Max. tune-up tolerance limit	
			Burst	Frame
GSM850	GPRS 1 slot	32.5	**33.0**	**23.97**
	GPRS 2 slots	32.5	**33.0**	**26.98**
	EGPRS 1 slot	26.5	**27.0**	**17.97**
	EGPRS 2 slots	26.5	**27.0**	**20.98**
GSM1900	GPRS 1 slot	29.5	**30.0**	**20.97**
	GPRS 2 slots	29.5	**30.0**	**23.98**
	EGPRS 1 slot	25.0	**25.5**	**16.47**
	EGPRS 2 slots	25.0	**25.5**	**19.48**

Upper limit (dB): -0.5 ~ 0.5		Max. RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
W-CDMA Band V	R99	22.0	**22.5**
W-CDMA Band IV	R99	22.0	**22.5**
W-CDMA Band II	R99	22.0	**22.5**

RF Air interface	Mode	Max tune-up limit (dBm)
ANT+		**4.0**

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
WWAN	Body	0 mm	Rear		N/A	Yes
		0 mm	Front		N/A	Yes
		0 mm	Edge 2		N/A	Yes
		0 mm	Edge 3		N/A	Yes
		0 mm	Edge 4		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 ± 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 Lab 1

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
8/10/2015	Body 835	e'	52.7400	Relative Permittivity (ϵ_r):	52.74	55.20	-4.46	5
		e''	21.8800	Conductivity (σ):	1.02	0.97	4.73	5
	Body 820	e'	52.8900	Relative Permittivity (ϵ_r):	52.89	55.28	-4.32	5
		e''	21.9600	Conductivity (σ):	1.00	0.97	3.39	5
	Body 850	e'	52.5800	Relative Permittivity (ϵ_r):	52.58	55.16	-4.67	5
		e''	21.8800	Conductivity (σ):	1.03	0.99	4.76	5

SAR Lab 2

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
8/11/2015	Body 1750	e'	52.0200	Relative Permittivity (ϵ_r):	52.02	53.44	-2.66	5
		e''	15.1600	Conductivity (σ):	1.48	1.49	-0.74	5
	Body 1710	e'	52.1500	Relative Permittivity (ϵ_r):	52.15	53.54	-2.60	5
		e''	15.1000	Conductivity (σ):	1.44	1.46	-1.77	5
	Body 1755	e'	52.0000	Relative Permittivity (ϵ_r):	52.00	53.43	-2.67	5
		e''	15.1700	Conductivity (σ):	1.48	1.49	-0.60	5
8/28/2015	Body 1750	e'	51.8000	Relative Permittivity (ϵ_r):	51.80	53.44	-3.07	5
		e''	15.4300	Conductivity (σ):	1.50	1.49	1.03	5
	Body 1710	e'	51.8800	Relative Permittivity (ϵ_r):	51.88	53.54	-3.11	5
		e''	15.3800	Conductivity (σ):	1.46	1.46	0.06	5
	Body 1755	e'	51.7900	Relative Permittivity (ϵ_r):	51.79	53.43	-3.07	5
		e''	15.4600	Conductivity (σ):	1.51	1.49	1.30	5

SAR Lab 3

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
8/3/2015	Body 1900	e'	50.9800	Relative Permittivity (ϵ_r):	50.98	53.30	-4.35	5
		e''	14.3000	Conductivity (σ):	1.51	1.52	-0.61	5
	Body 1850	e'	51.2500	Relative Permittivity (ϵ_r):	51.25	53.30	-3.85	5
		e''	14.1200	Conductivity (σ):	1.45	1.52	-4.44	5
	Body 1910	e'	50.8700	Relative Permittivity (ϵ_r):	50.87	53.30	-4.56	5
		e''	14.2800	Conductivity (σ):	1.52	1.52	-0.23	5
8/11/2015	Body 1900	e'	52.0200	Relative Permittivity (ϵ_r):	52.02	53.30	-2.40	5
		e''	14.3800	Conductivity (σ):	1.52	1.52	-0.05	5
	Body 1850	e'	52.2500	Relative Permittivity (ϵ_r):	52.25	53.30	-1.97	5
		e''	14.2400	Conductivity (σ):	1.46	1.52	-3.63	5
	Body 1910	e'	51.9300	Relative Permittivity (ϵ_r):	51.93	53.30	-2.57	5
		e''	14.3800	Conductivity (σ):	1.53	1.52	0.47	5
8/31/2015	Body 1900	e'	51.1900	Relative Permittivity (ϵ_r):	51.19	53.30	-3.96	5
		e''	14.3200	Conductivity (σ):	1.51	1.52	-0.47	5
	Body 1850	e'	51.4000	Relative Permittivity (ϵ_r):	51.40	53.30	-3.56	5
		e''	14.1300	Conductivity (σ):	1.45	1.52	-4.38	5
	Body 1910	e'	51.0800	Relative Permittivity (ϵ_r):	51.08	53.30	-4.17	5
		e''	14.3500	Conductivity (σ):	1.52	1.52	0.26	5

SAR Lab 5

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
9/1/2015	Body 835	e'	53.6400	Relative Permittivity (ϵ_r):	53.64	55.20	-2.83	5
		e''	21.6900	Conductivity (σ):	1.01	0.97	3.82	5
	Body 820	e'	53.8500	Relative Permittivity (ϵ_r):	53.85	55.28	-2.58	5
		e''	21.9200	Conductivity (σ):	1.00	0.97	3.20	5
	Body 850	e'	53.5200	Relative Permittivity (ϵ_r):	53.52	55.16	-2.97	5
		e''	21.6400	Conductivity (σ):	1.02	0.99	3.61	5

SAR Lab E

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
11/16/2015	Body 835	e'	53.5900	Relative Permittivity (ϵ_r):	53.59	55.20	-2.92	5
		e''	21.1500	Conductivity (σ):	0.98	0.97	1.23	5
	Body 820	e'	53.7000	Relative Permittivity (ϵ_r):	53.70	55.28	-2.85	5
		e''	21.2600	Conductivity (σ):	0.97	0.97	0.09	5
	Body 850	e'	53.4000	Relative Permittivity (ϵ_r):	53.40	55.16	-3.19	5
		e''	21.1600	Conductivity (σ):	1.00	0.99	1.31	5

SAR Lab F

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
11/2/2015	Body 835	e'	53.1800	Relative Permittivity (ϵ_r):	53.18	55.20	-3.66	5
		e''	21.8100	Conductivity (σ):	1.01	0.97	4.39	5
	Body 820	e'	53.3400	Relative Permittivity (ϵ_r):	53.34	55.28	-3.50	5
		e''	21.8900	Conductivity (σ):	1.00	0.97	3.06	5
	Body 850	e'	53.0100	Relative Permittivity (ϵ_r):	53.01	55.16	-3.89	5
		e''	21.7400	Conductivity (σ):	1.03	0.99	4.09	5

SAR Lab G

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
11/2/2015	Body 1900	e'	51.3800	Relative Permittivity (ϵ_r):	51.38	53.30	-3.60	5
		e''	14.8600	Conductivity (σ):	1.57	1.52	3.28	5
	Body 1850	e'	51.5100	Relative Permittivity (ϵ_r):	51.51	53.30	-3.36	5
		e''	14.8300	Conductivity (σ):	1.53	1.52	0.36	5
	Body 1910	e'	51.3400	Relative Permittivity (ϵ_r):	51.34	53.30	-3.68	5
		e''	14.8700	Conductivity (σ):	1.58	1.52	3.90	5
11/3/2015	Body 1750	e'	51.1500	Relative Permittivity (ϵ_r):	51.15	53.44	-4.29	5
		e''	15.2700	Conductivity (σ):	1.49	1.49	-0.02	5
	Body 1710	e'	51.2900	Relative Permittivity (ϵ_r):	51.29	53.54	-4.21	5
		e''	15.2200	Conductivity (σ):	1.45	1.46	-0.99	5
	Body 1755	e'	51.1400	Relative Permittivity (ϵ_r):	51.14	53.43	-4.28	5
		e''	15.2600	Conductivity (σ):	1.49	1.49	-0.01	5
11/16/2015	Body 1900	e'	51.9000	Relative Permittivity (ϵ_r):	51.90	53.30	-2.63	5
		e''	14.6700	Conductivity (σ):	1.55	1.52	1.96	5
	Body 1850	e'	52.0100	Relative Permittivity (ϵ_r):	52.01	53.30	-2.42	5
		e''	14.7400	Conductivity (σ):	1.52	1.52	-0.25	5
	Body 1910	e'	51.8300	Relative Permittivity (ϵ_r):	51.83	53.30	-2.76	5
		e''	14.6600	Conductivity (σ):	1.56	1.52	2.43	5
11/18/2015	Body 1750	e'	51.4800	Relative Permittivity (ϵ_r):	51.48	53.44	-3.67	5
		e''	15.0900	Conductivity (σ):	1.47	1.49	-1.20	5
	Body 1710	e'	51.5300	Relative Permittivity (ϵ_r):	51.53	53.54	-3.76	5
		e''	15.0300	Conductivity (σ):	1.43	1.46	-2.22	5
	Body 1755	e'	51.4700	Relative Permittivity (ϵ_r):	51.47	53.43	-3.67	5
		e''	15.0900	Conductivity (σ):	1.47	1.49	-1.12	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	4d002	11/13/2014	835	1g	9.23	9.33
				10g	5.99	6.12
D835V2	4d142	9/9/2014	835	1g	8.91	9.22
				10g	5.77	6.05
D835V2	4d117	5/18/2015	835	1g	9.08	9.38
				10g	5.93	6.20
D1750V2	1050	4/15/2015	1750	1g	36.40	37.00
				10g	19.30	19.90
D1750V2	1053	8/11/2015	1750	1g	37.10	37.50
				10g	19.80	20.30
D1900V2	5d163	9/11/2014	1900	1g	40.80	40.60
				10g	21.20	21.40
D1900V2	5d043	11/7/2014	1900	1g	40.60	40.00
				10g	21.10	21.30
D1900V2	5d163	9/21/2015	1900	1g	40.10	39.90
				10g	21.00	21.00

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 1

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			
8/10/2015	D835V2	4d142	Body	1g	0.86	8.64	9.22	**-6.29**	1,2
				10g	0.57	5.71	6.05	-5.62	

SAR Lab 2

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			
8/11/2015	D1750V2	1050	Body	1g	3.89	38.90	37.00	**5.14**	3,4
				10g	2.07	20.70	19.90	4.02	
8/28/2015	D1750V2	1053	Body	1g	3.90	39.00	37.50	**4.00**	5,6
				10g	2.08	20.80	20.30	2.46	

SAR Lab 3

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			
8/3/2105	D1900V2	5d163	Body	1g	4.14	41.40	40.60	1.97	
				10g	2.15	21.50	21.40	0.47	
8/11/2105	D1900V2	5d163	Body	1g	4.19	41.90	40.60	**3.20**	7,8
				10g	2.18	21.80	21.40	1.87	
8/31/2015	D1900V2	5d163	Body	1g	3.96	39.60	40.60	-2.46	
				10g	2.05	20.50	21.40	-4.21	

SAR Lab 5

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			
9/1/2015	D835V2	4d142	Body	1g	0.96	9.59	9.22	**4.01**	9,10
				10g	0.63	6.32	6.05	4.46	

SAR Lab E

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			
11/16/2015	D835V2	4d117	Body	1g	0.93	9.33	9.38	**-0.53**	11,12
				10g	0.62	6.15	6.20	-0.81	

SAR Lab F

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			
11/2/2015	D835V2	4d002	Body	1g	0.98	9.84	9.33	**5.47**	13,14
				10g	0.65	6.51	6.12	6.37	

SAR Lab G

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			
11/2/2015	D1900V2	5d043	Body	1g	4.11	41.10	40.00	**2.75**	15,16
				10g	2.12	21.20	21.30	-0.47	
11/3/2015	D1750V2	1053	Body	1g	3.83	38.3	37.50	**2.13**	17,18
				10g	2.03	20.3	20.3	0.00	
11/16/2015	D1900V2	5d163	Body	1g	4.10	41.00	39.90	**2.76**	19,20
				10g	2.10	21.00	21.00	0.00	
11/18/2015	D1750V2	1053	Body	1g	3.99	39.90	37.50	**6.40**	21,22
				10g	2.12	21.20	20.3	4.43	

9. Conducted Output Power Measurements

9.1. GSM

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Max. Pwr	
						Burst (dBm)	Frame (dBm)
850	GPRS (GMSK)	CS1	1	128	824.2	32.3	23.3
				190	836.6	32.1	23.1
				251	848.8	32.1	23.1
			2	128	824.2	32.3	26.3
				190	836.6	32.1	26.1
				251	848.8	32.1	26.1
	EGPRS (8PSK)	MCS5	1	128	824.2	26.7	17.7
				190	836.6	26.4	17.4
				251	848.8	26.4	17.4
			2	128	824.2	26.6	20.6
				190	836.6	26.3	20.3
				251	848.8	26.3	20.3

Notes:

The worst-case configuration and mode for SAR testing is determined to be as follows:

- Body-worn: GMSK (GPRS) mode with 2 time slots for Max power, based on the output power measurements above.
- SAR is not required for EGPRS (8PSK) mode because its output power is less than that of GPRS Mode

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Max. Pwr	
						Burst (dBm)	Frame (dBm)
1900	GPRS (GMSK)	CS1	1	512	1850.2	29.0	20.0
				661	1880.0	29.1	20.1
				810	1909.8	29.2	20.2
			2	512	1850.2	29.0	23.0
				661	1880.0	29.1	23.1
				810	1909.8	29.2	23.2
	EGPRS (8PSK)	MCS5	1	512	1850.2	25.1	16.1
				661	1880.0	25.2	16.2
				810	1909.8	25.3	16.3
			2	512	1850.2	25.1	19.1
				661	1880.0	25.2	19.2
				810	1909.8	25.3	19.3

Notes:

The worst-case configuration and mode for SAR testing is determined to be as follows:

- Body-worn: GMSK (GPRS) mode with 2 time slots for Max power, based on the output power measurements above.
- SAR is not required for EGPRS (8PSK) mode because its output power is less than that of GPRS Mode

9.2. 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

W-CDMA Band II Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Max. Pwr (dBm)
W-CDMA Band II	Rel 99	RMC, 12.2 kbps	9262	1852.4	N/A	22.2
			9400	1880.0	N/A	22.4
			9538	1907.6	N/A	21.9

W-CDMA Band IV Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Max. Pwr (dBm)
W-CDMA Band IV	Rel 99	RMC, 12.2 kbps	1312	1712.4	N/A	22.1
			1413	1732.6	N/A	22.1
			1513	1752.6	N/A	21.7

W-CDMA Band V Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Max. Pwr (dBm)
W-CDMA Band V	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	22.4
			4183	836.6	N/A	22.3
			4233	846.6	N/A	22.2

9.3. ANT+

Maximum tune-up tolerance limit is 4dBm. This power level qualifies for exclusion of SAR testing.

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

SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

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 W/kg, SAR measurement is not required for the secondary mode

10.1. GSM850

Results with Time Based Averaging Applied:

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Duty Cycle	Final Reported SAR	Plot No.
						Tune-up limit	Meas.	Meas.	Scaled			
Body-worn	GPRS 2 Slots	0	Rear	128	824.2	33.0	32.3	3.270	3.842	33%	**1.268**	1
				190	836.6	33.0	32.1	2.950	3.629	33%	1.198	
				251	848.8	33.0	32.1	2.790	3.432	33%	1.133	
			Front	190	836.6	33.0	32.1	1.620	1.993	33%	**0.658**	2
			Edge 2	190	836.6	33.0	32.1	1.710	2.104	33%	**0.694**	3
			Edge 3	190	836.6	33.0	32.1	0.420	0.517	33%	**0.171**	4
			Edge 4	128	824.2	33.0	32.3	2.120	2.491	33%	**0.822**	5
				190	836.6	33.0	32.1	1.990	2.448	33%	0.808	
				251	848.8	33.0	32.1	1.950	2.399	33%	0.792	

10.2. GSM1900

Results with Time Based Averaging Applied:

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Duty Cycle	Final Reported SAR	Plot No.
						Tune-up limit	Meas.	Meas.	Scaled			
Body-worn	GPRS 2 Slots	0	Rear	661	1880.0	30.0	29.1	1.870	2.301	33%	**0.759**	6
			Front	661	1880.0	30.0	29.1	1.050	1.292	33%	**0.426**	7
			Edge 2	661	1880.0	30.0	29.1	0.937	1.153	33%	**0.380**	8
			Edge 3	661	1880.0	30.0	29.1	0.363	0.447	33%	**0.147**	9
			Edge 4	661	1880.0	30.0	29.1	1.740	2.141	33%	**0.706**	10

10.3. W-CDMA Band II

Results with Time Based Averaging Applied:

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Duty Cycle	Final Reported SAR	Plot No.
						Tune-up limit	Meas.	Meas.	Scaled			
Body-worn	Rel 99 RMC	0	Rear	9400	1880.0	22.5	22.4	2.140	2.190	33%	**0.723**	11
			Front	9400	1880.0	22.5	22.4	2.010	2.057	33%	**0.679**	12
			Edge 2	9400	1880.0	22.5	22.4	0.946	0.968	33%	**0.319**	13
			Edge 3	9400	1880.0	22.5	22.4	0.356	0.364	33%	**0.120**	14
			Edge 4	9400	1880.0	22.5	22.4	1.820	1.862	33%	**0.615**	15

10.4. W-CDMA Band IV

Results with Time Based Averaging Applied:

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Duty Cycle	Final Reported SAR	Plot No.
						Tune-up limit	Meas.	Meas.	Scaled			
Body-worn	Rel 99 RMC	0	Rear	1413	1732.6	22.5	22.1	1.900	2.083	33%	**0.687**	16
			Front	1413	1732.6	22.5	22.1	1.830	2.007	33%	**0.662**	17
			Edge 2	1413	1732.6	22.5	22.1	1.270	1.393	33%	**0.460**	18
			Edge 3	1413	1732.6	22.5	22.1	0.566	0.621	33%	**0.205**	19
			Edge 4	1413	1732.6	22.5	22.1	0.915	1.003	33%	**0.331**	20

10.5. W-CDMA Band V

Results with Time Based Averaging Applied:

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Duty Cycle	Final Reported SAR	Plot No.
						Tune-up limit	Meas.	Meas.	Scaled			
Body-worn	Rel 99 RMC	0	Rear	4183	836.6	22.5	22.3	1.420	1.487	33%	**0.491**	21
			Front	4183	836.6	22.5	22.3	1.640	1.717	33%	**0.567**	22
			Edge 2	4183	836.6	22.5	22.3	0.790	0.827	33%	**0.273**	23
			Edge 3	4183	836.6	22.5	22.3	0.194	0.203	33%	**0.067**	24
			Edge 4	4183	836.6	22.5	22.3	0.947	0.992	33%	**0.327**	25

10.6. ANT+

SAR test exclusion in accordance with KDB 447498.

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances

≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√f(GHz)] ≤ 3.0, for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

This test exclusion is applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

SAR Exclusion Calculation Table for Portable Devices (separation distance < 50mm)

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	SAR test exclusion Result*	Estimated 1-g SAR (W/kg)
(dBm)	(mW)				
4.0	3	5	2.480	0.9	0.126

Conclusion:

*: The computed value is ≤ 3; therefore, ANT+ qualifies for Standalone SAR test exclusion.

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 <0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.8 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).

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	First Repeated		Second Repeated		Third Repeated
						Measured SAR (W/kg)	Largest to Smallest SAR Ratio	Measured SAR (W/kg)	Largest to Smallest SAR Ratio	Measured SAR (W/kg)
850	GSM 850	Body	Rear	Yes	3.270	3.110	1.05	3.270	1.00	N/A
	WCDMA Band V	Body	Front	No	1.640	N/A	N/A	N/A	N/A	N/A
1900	GSM 1900	Body	Rear	No	1.870	N/A	N/A	N/A	N/A	N/A
	WCDMA Band II	Body	Rear	Yes	2.140	2.080	1.03	2.020	1.06	N/A
1700	WCDMA Band IV	Body	Rear	Yes	1.900	1.890	1.01	1.870	1.02	N/A

Note(s):

Third Repeated Measurement is not required since the original, first, or second repeated measurement is not ≥ 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 not > 1.20 or 3 (1-g or 10-g respectively).

12. Simultaneous Transmission SAR Analysis

RF Exposure Condition	Item	Capable Transmit Configurations		
Body-worn	1	GSM(GPRS/EDGE)	+	ANT+
	2	W-CDMA	+	ANT+

12.1. Sum of the SAR for GSM850 & ANT+

RF Exposure conditions	Test Position	Standalone SAR (W/kg)		∑ 1-g SAR (W/kg)
		WWAN	ANT+	WWAN + ANT+
		①	②	① + ②
Body-worn	Rear	1.268	0.126	**1.394**
	Front	0.658	0.126	0.784
	Edge 2	0.694	0.126	0.820
	Edge 3	0.171	0.126	0.297
	Edge 4	0.822	0.126	0.948

12.2. Sum of the SAR for GSM1900 & ANT+

RF Exposure conditions	Test Position	Standalone SAR (W/kg)		∑ 1-g SAR (W/kg)
		WWAN	ANT+	WWAN + ANT+
		①	②	① + ②
Body-worn	Rear	0.759	0.126	0.885
	Front	0.426	0.126	0.552
	Edge 2	0.380	0.126	0.506
	Edge 3	0.147	0.126	0.273
	Edge 4	0.706	0.126	0.832

12.3. Sum of the SAR for W-CDMA Band II & ANT+

RF Exposure conditions	Test Position	Standalone SAR (W/kg)		∑ 1-g SAR (W/kg)
		WWAN	ANT+	WWAN + ANT+
		①	②	① + ②
Body-worn	Rear	0.723	0.126	0.849
	Front	0.679	0.126	0.805
	Edge 2	0.319	0.126	0.445
	Edge 3	0.120	0.126	0.246
	Edge 4	0.615	0.126	0.741

12.4. Sum of the SAR for W-CDMA Band IV & ANT+

RF Exposure conditions	Test Position	Standalone SAR (W/kg)		∑ 1-g SAR (W/kg)
		WWAN	ANT+	WWAN + ANT+
		①	②	① + ②
Body-worn	Rear	0.687	0.126	0.813
	Front	0.662	0.126	0.788
	Edge 2	0.460	0.126	0.586
	Edge 3	0.205	0.126	0.331
	Edge 4	0.331	0.126	0.457

12.5. Sum of the SAR for W-CDMA Band V & ANT+

RF Exposure conditions	Test Position	Standalone SAR (W/kg)		∑ 1-g SAR (W/kg)
		WWAN	ANT+	WWAN + ANT+
		①	②	① + ②
Body-worn	Rear	0.491	0.126	0.617
	Front	0.567	0.126	0.693
	Edge 2	0.273	0.126	0.399
	Edge 3	0.067	0.126	0.193
	Edge 4	0.327	0.126	0.453

Conclusion:

Simultaneous transmission SAR measurement (Volume Scan) is not required because the sum of the 1-g SAR is < 1.6 W/kg.

Appendixes

Refer to separated files for the following appendixes.

15U21180-S1V3 SAR_App A Photos & Ant. Locations

15U21180-S1V3 SAR_App B System Check Plots

15U21180-S1V3 SAR_App C Highest Test Plots

15U21180-S1V1 SAR_App D Tissue Ingredients

15U21180-S1V3 SAR_App E Probe Cal. Certificates (1 of 2)

15U21180-S1V3 SAR_App E Probe Cal. Certificates (2 of 2)

15U21180-S1V3 SAR_App F Dipole Cal. Certificates

END OF REPORT