SAR EVALUATION REPORT
CLASS II PERMISSIVE CHANGE

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

For
W-CDMA/GSM Portable Biometric Device

FCC ID: Q9YSENTRY3
Model Name: PHS8-P

Report Number: 4787541910-S1V3
Issue Date: 10/26/2016

Prepared for
CROSS MATCH TECHNOLOGIES INC.
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Date	Revisions	Revised By
V1	9/30/2016	Initial Issue	--
V2	10/5/2016	Section 7: Updated Table and added notes Appendix A: Updated Antenna Diagram Revised Model number	Coltyce Sanders
V3	10/26/16	Revised Software Version.	David Weaver

Table of Contents

1. Attestation of Test Results

Applicant Name	CROSS MATCH TECHNOLOGIES INC.			
FCC ID	Q9YSENTRY3			
Model Name	PHS8-P			
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	
RF Exposure Conditions	Equipment Class - Highest Reported SAR (W/kg)			
	PCE	DTS	NII	DSS
Body-worn	1.201	N/A	N/A	N/A
Extremity	3.697			
Date Tested	8/15/2016 to 8/18/2016 and 9/29/2016 to 9/30/2016			
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:
	
David Weaver Program Manager UL Verification Services Inc.	Coltyce Sanders Laboratory Engineer 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
- 447498 D03 Supplement C Cross-Reference v01
- 648474 D04 Handset SAR 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

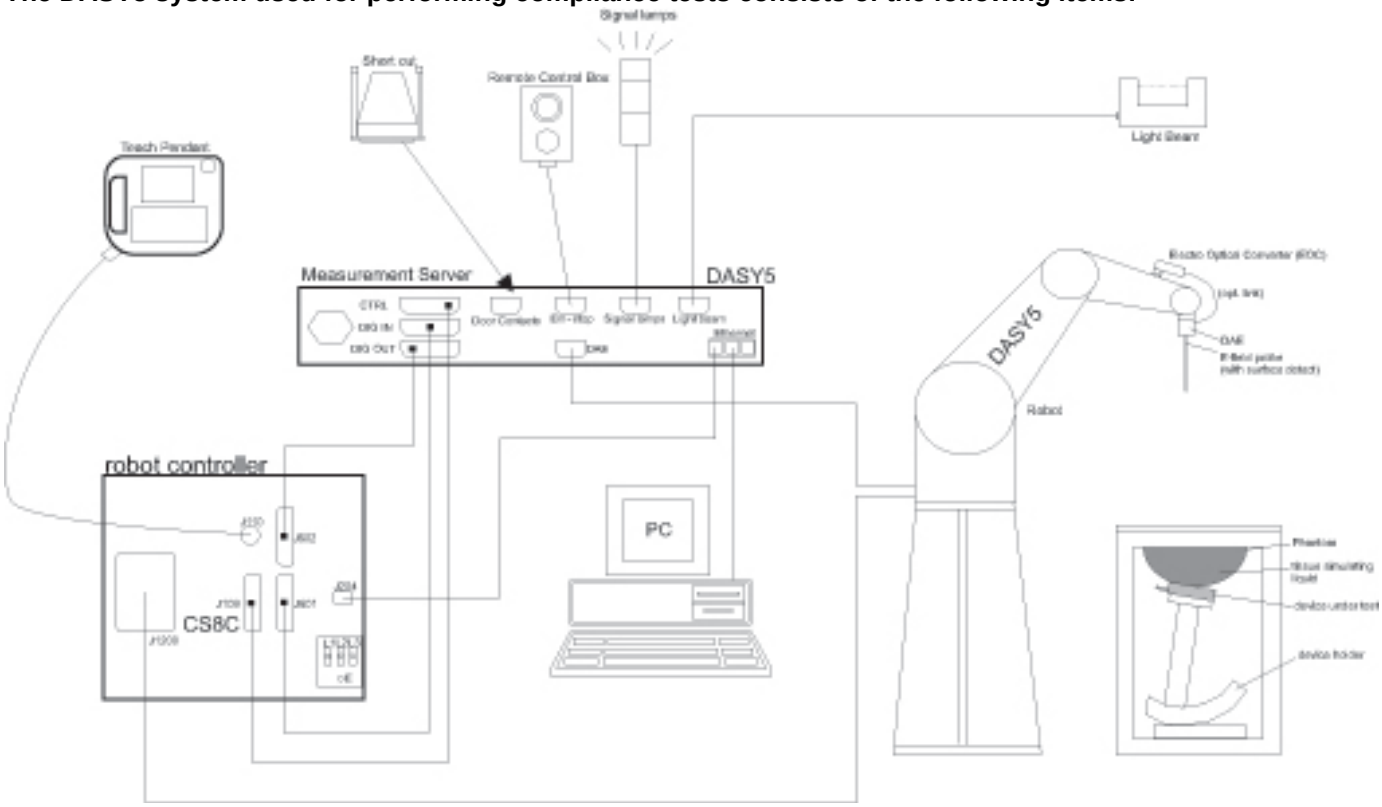
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	
SAR Lab F	
SAR Lab G	
SAR Lab H	

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.

Test Equipment used for Test Dates 8/15/2016 to 8/18/2016:

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	8753ES	MY40000980	4/27/2017
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	CONTROL COMPANY	T311	122529162	10/2/2016

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	Agilent	N5181A	MY50140610	5/9/2017
Power Meter	Agilent	N1912A	MY50001018	10/19/2016
Power Sensor	Agilent	E9323A	MY53070007	2/27/2017
Power Sensor	Agilent	E9323A	MY53070002	3/22/2017
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	Agilent	N5181A	MY50140630	5/9/2017
Power Meter	Agilent	N1912A	MY55196009	5/3/2017
Power Sensor	Agilent	E9323A	MY53070009	6/13/2017
Power Sensor	Agilent	E9323A	MY53070002	3/22/2017
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Directional coupler	Werlatone	C01217	3141	N/A
DC Power Supply	HP	6296A	2841A-05955	N/A

Lab Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
E-Field Probe (SAR Lab D)	SPEAG	EX3DV4	3885	9/18/2016
E-Field Probe (SAR Lab G)	SPEAG	EX3DV4	3990	3/22/2017
Data Acquisition Electronics (SAR Lab D)	SPEAG	DAE4	1433	3/17/2017
Data Acquisition Electronics (SAR Lab G)	SPEAG	DAE4	1359	2/19/2017
System Validation Dipole	SPEAG	D835V2	4d117	5/12/2017
System Validation Dipole	SPEAG	D1900V2	5d140	4/12/2017

Other

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	134851-LL	3/2/2017
Base Station Simulator	R & S	CMW500	137873-WG	7/8/2017

Test Equipment used for Test Dates 9/29/2016 to 9/30/2016:

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	8753ES	MY40000980	4/27/2017
Dielectric Probe kit	SPEAG	DAK-3.5	1103	2/23/2017
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Traceable Calibration Control Co.	4242	122529162	10/2/2016

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	Agilent	N5181A	MY50140610	5/9/2017
Power Meter	Agilent	N1912A	MY55196008	5/3/2017
Power Sensor	Agilent	N1912A	MY52200012	10/10/2016
Power Sensor	Agilent	N1912A	MY52270022	12/17/2016
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Directional coupler	Werlatone	C8060-102	2149	N/A
DC Power Supply	BK PRECISION	1161	512-02292	N/A

Lab Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
E-Field Probe (SAR Lab G)	SPEAG	EX3DV4	3990	3/22/2017
Data Acquisition Electronics (SAR Lab G)	SPEAG	DAE4	1359	2/19/2017
System Validation Dipole	SPEAG	D835V2	4d117	5/12/2017
System Validation Dipole	SPEAG	D1900V2	5d140	4/12/2017

Other

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	134851-LL	3/2/2017
Base Station Simulator	R & S	CMW500	137873-WG	7/8/2017

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 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): 208 mm x 94 mm Overall Diagonal: 215 mm Display Diagonal: 109.2 mm		
Back Cover	☒ Normal Battery Cover		
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.6Vdc, 16.2Wh.		
Test sample information	**S/N**	**IMEI**	**Notes**
	VS-002541	359998041983646	Conducted Unit
	VS-002542	359998041983554	Radiated Unit
Hardware Version	Rev A		
Software Version	4.0.14		

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	GSM Voice: 12.5% (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 V	UMTS Rel. 99 (Voice & Data) HSDPA (Rel. 5) HSUPA (Rel. 6)		100%

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

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

RF Air interface	Mode	Max. RF Output Power (dBm)	
		Burst	Frame
GSM850	GPRS (1 slot)	**33.5**	**24.5**
	GPRS 2 slots	**30.5**	**24.5**
	EGPRS 1 slot	**27.5**	**18.5**
	EGPRS 2 slots	**24.5**	**18.5**
GSM1900	GPRS (1 slot)	**30.5**	**21.5**
	GPRS 2 slots	**27.5**	**21.5**
	EGPRS 1 slot	**26.5**	**17.5**
	EGPRS 2 slots	**23.5**	**17.5**

RF Air interface	Mode	Max. RF Output Power (dBm)
W-CDMA Band V	R99	**24.5**
	HSDPA	**24.5**
	HSUPA	**24.5**
W-CDMA Band II	R99	**22.0**
	HSDPA	**22.0**
	HSUPA	**22.0**

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	Note
WWAN	Extremity	0 mm	Rear	< 25 mm	Yes	
			Front	> 25 mm	No	2
			Edge 1 (Top)	> 25 mm	No	2
			Edge 2 (Right)	> 25 mm	No	2
			Edge 3 (Bottom)	> 25 mm	No	2
			Edge 4 (Left)	< 25 mm	Yes	
	Body-worn With Pouch	14 mm	Rear	< 25 mm	Yes	1
			Front	< 25 mm	Yes	1

Notes:

1. The Body-worn distance is 14mm due to the pouch distance from the body.
2. 10-g Extremity SAR is only required for surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge.

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.

For SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for εr and σ may be relaxed to ± 10%. This is limited to frequencies ≤ 3 GHz.

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 Room	Date	Tissue Type	Band (MHz)	Frequency (MHz)	Relative Permittivity (εr)			Conductivity (σ)		
					Measured	Target	Delta ±5 %	Measured	Target	Delta ±5 %
D	8/15/2016	1900	Body	1900	51.82	53.30	-2.78	1.55	1.52	1.84
				1850	52.02	53.30	-2.40	1.49	1.52	-1.97
				1920	51.72	53.30	-2.96	1.57	1.52	3.29
G	8/17/2016	835	Body	835	53.36	55.20	-3.33	1.01	0.97	3.61
				805	53.69	55.33	-2.97	0.97	0.97	0.49
				905	52.62	55.00	-4.33	1.08	1.05	2.14
G	9/29/2016	1900	Body	1900	51.24	53.30	-3.86	1.52	1.52	-0.20
				1850	51.41	53.30	-3.55	1.47	1.52	-3.49
				1920	51.17	53.30	-4.00	1.54	1.52	1.05
G	9/29/2016	835	Body	835	53.55	55.20	-2.99	0.99	0.97	1.71
				805	53.82	55.33	-2.74	0.96	0.97	-1.22
				905	52.82	55.00	-3.96	1.06	1.05	0.43

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.

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 Room	Date	Tissue Type	Dipole Type _Serial #	Dipole Cal. Due Data	Measured Results for 1g SAR				Measured Results for 10g SAR				Plot No.
					Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10 %	Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10 %	
D	8/15/2016	Body	D1900V2 SN:5d140	4/12/2017	4.120	41.20	39.30	4.83	2.140	21.40	20.80	2.88	1,2
G	8/17/2016	Body	D835V2 SN:4d117	5/12/2017	1.020	10.20	9.44	8.05	0.668	6.68	6.21	7.57	3, 4
G	9/29/2016	Body	D835V2 SN:4d117	5/12/2017	0.991	9.91	9.44	4.98	0.655	6.55	6.21	5.48	
G	9/29/2016	Body	D1900V2 SN:5d140	4/12/2017	3.820	38.20	39.30	-2.80	1.970	19.70	20.80	-5.29	5, 6

9. Conducted Output Power Measurements

9.1. GSM

Per KDB 941225 D01 3G SAR Procedures:

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.

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	31.8	22.8
				190	836.6	31.8	22.8
				251	848.8	31.7	22.7
			2	128	824.2	28.8	22.8
				190	836.6	28.7	22.7
				251	848.8	28.5	22.5
	EGPRS (8PSK)	MCS5	1	128	824.2	26.0	17.0
				190	836.6	25.8	16.8
				251	848.8	25.6	16.6
			2	128	824.2	22.8	16.8
				190	836.6	22.7	16.7
				251	848.8	22.5	16.5

Notes:

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

- GMSK (GPRS) mode with 2 time slots, based on the Tune-up Procedure.
- SAR is not required for EGPRS (8PSK) mode because the maximum output power and tune-up limit is ≤ 1/4db higher than GMSK GPRS or the adjusted SAR of the highest reported SAR of GMSK GPRS is ≤ 1.2W/kg.

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Avg. Pwr	
						Burst (dBm)	Frame (dBm)
1900	GPRS (GMSK)	CS1	1	512	1850.2	28.9	19.9
				661	1880.0	29.9	20.9
				810	1909.8	29.8	20.8
			2	512	1850.2	26.9	20.9
				661	1880.0	26.9	20.9
				810	1909.8	27.0	21.0
	EGPRS (8PSK)	MCS5	1	512	1850.2	24.5	15.5
				661	1880.0	24.7	15.7
				810	1909.8	24.9	15.9
			2	512	1850.2	21.5	15.5
				661	1880.0	21.6	15.6
				810	1909.8	21.7	15.7

Notes:

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

- GMSK (GPRS) mode with 2 time slots, based on the Tune-up Procedure.
- SAR is not required for EGPRS (8PSK) mode because the maximum output power and tune-up limit is ≤ 1/4db higher than GMSK GPRS or the adjusted SAR of the highest reported SAR of GMSK GPRS is ≤ 1.2W/kg.

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

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 section 5.2 of 3GPP TS34.121. 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	15/1
	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	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI (from 34.121 Table C.11.1.3)	75	67	92	71	81
	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)	MPR (dB)	Max. Pwr (dBm)
W-CDMA Band II	Rel 99	RMC, 12.2 kbps	9262	1852.4	N/A	21.4
			9400	1880.0	N/A	21.2
			9538	1907.6	N/A	21.4
	HSDPA	Subtest 1	9262	1852.4	0	21.0
			9400	1880.0	0	21.0
			9538	1907.6	0	21.2
		Subtest 2	9262	1852.4	0	20.9
			9400	1880.0	0	20.8
			9538	1907.6	0	20.8
		Subtest 3	9262	1852.4	0.5	20.4
			9400	1880.0	0.5	20.5
			9538	1907.6	0.5	20.4
		Subtest 4	9262	1852.4	0.5	20.6
			9400	1880.0	0.5	20.3
			9538	1907.6	0.5	20.4
	HSUPA	Subtest 1	9262	1852.4	0	20.9
			9400	1880.0	0	20.9
			9538	1907.6	0	20.6
		Subtest 2	9262	1852.4	2	19.7
			9400	1880.0	2	19.7
			9538	1907.6	2	19.9
		Subtest 3	9262	1852.4	1	20.0
			9400	1880.0	1	20.1
			9538	1907.6	1	20.1
		Subtest 4	9262	1852.4	2	19.3
			9400	1880.0	2	19.5
			9538	1907.6	2	19.6
		Subtest 5	9262	1852.4	0	20.9
			9400	1880.0	0	20.9
			9538	1907.6	0	20.6

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	23.7
			4183	836.6	N/A	24.0
			4233	846.6	N/A	23.4
	HSDPA	Subtest 1	4132	826.4	0	23.0
			4183	836.6	0	23.4
			4233	846.6	0	23.4
		Subtest 2	4132	826.4	0	23.1
			4183	836.6	0	23.3
			4233	846.6	0	23.2
		Subtest 3	4132	826.4	0.5	22.8
			4183	836.6	0.5	23.0
			4233	846.6	0.5	22.9
		Subtest 4	4132	826.4	0.5	22.2
			4183	836.6	0.5	22.5
			4233	846.6	0.5	22.4
	HSUPA	Subtest 1	4132	826.4	0	22.5
			4183	836.6	0	22.8
			4233	846.6	0	22.7
		Subtest 2	4132	826.4	2	21.3
			4183	836.6	2	21.2
			4233	846.6	2	21.3
		Subtest 3	4132	826.4	1	22.3
			4183	836.6	1	22.3
			4233	846.6	1	21.8
		Subtest 4	4132	826.4	2	21.8
			4183	836.6	2	21.5
			4233	846.6	2	21.5
		Subtest 5	4132	826.4	0	22.5
			4183	836.6	0	22.8
			4233	846.6	0	22.7

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

10.1. GSM850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Extremity	GPRS 2 Slots	0	Rear	190	836.6	30.5	28.7			0.228	0.345	
			Edge 4	190	836.6	30.5	28.7			0.235	**0.356**	1
Body-worn with Pouch	GPRS 2 Slots	14	Rear	190	836.6	30.5	28.7	0.188	**0.285**			2
			Front	190	836.6	30.5	28.7	0.117	0.177			

10.2. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Extremity	GPRS 2 Slots	0	Rear	512	1850.2	27.5	26.9			1.680	1.929	
				661	1880.0	27.5	26.9			2.210	2.537	
				810	1909.8	27.5	27.0			3.210	**3.602**	3
			Edge 4	512	1850.2	27.5	26.9			1.230	1.412	
				661	1880.0	27.5	26.9			1.600	1.837	
				810	1909.8	27.5	27.0			2.490	2.794	
Body-worn with Pouch	GPRS 2 Slots	14	Rear	512	1850.2	27.5	26.9	0.508	0.583			
				661	1880.0	27.5	26.9	0.725	0.832			
				810	1909.8	27.5	27.0	1.070	**1.201**			4
			Front	661	1880.0	27.5	26.9	0.078	0.090			

10.3. W-CDMA Band II

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Extremity	Rel 99 RMC	0	Rear	9262	1852.4	22.0	21.4			3.090	3.548	
				9400	1880.0	22.0	21.2			2.880	3.463	
				9538	1907.6	22.0	21.4			3.220	**3.697**	5
			Edge 4	9262	1852.4	22.0	21.4			2.320	2.664	
				9400	1880.0	22.0	21.2			2.230	2.681	
				9538	1907.6	22.0	21.4			2.500	2.870	
Body-worn with Pouch	Rel 99 RMC	14	Rear	9262	1852.4	22.0	21.4	0.769	0.883			
				9400	1880.0	22.0	21.2	0.709	0.852			
				9538	1907.6	22.0	21.4	0.816	**0.937**			6
			Front	9400	1880.0	22.0	21.2	0.097	0.117			

10.4. W-CDMA Band V

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Extremity	Rel 99 RMC	0	Rear	4183	836.6	24.5	24.0			0.380	0.426	
			Edge 4	4183	836.6	24.5	24.0			0.392	**0.440**	7
Body-worn with Pouch	Rel 99 RMC	14	Rear	4183	836.6	24.5	24.0	0.291	**0.327**			8
			Front	4183	836.6	24.5	24.0	0.131	0.147			

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).

Body-worn:

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	GSM 850	Body-worn	Rear	No	0.188	N/A	N/A
	WCDMA Band V	Body-worn	Rear	No	0.291	N/A	N/A
1900	GSM 1900	Body-worn	Rear	Yes	1.070	1.040	1.03
	WCDMA Band II	Body-worn	Rear	No	0.816	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 < 1.20 or 3 (1-g or 10-g respectively).

Extremity:

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	GSM 850	Extremity	Edge 4	No	0.235	N/A	N/A
	WCDMA Band V	Extremity	Edge 4	No	0.392	N/A	N/A
1900	GSM 1900	Extremity	Rear	No	3.210	N/A	N/A
	WCDMA Band II	Extremity	Rear	Yes	3.220	3.190	1.01

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 < 1.20 or 3 (1-g or 10-g respectively).

12. Simultaneous Transmission SAR Analysis

Device does not support Simultaneous Transmission.

Appendixes

Refer to separated files for the following appendixes.

4787541910-S1V2 SAR_App A Setup Photos

4787541910-S1V1 SAR_App B System Check Plots

4787541910-S1V1 SAR_App C Highest Test Plots

4787541910-S1V1 SAR_App D Tissue Ingredients

4787541910-S1V1 SAR_App E Probe Cal. Certificates

4787541910-S1V1 SAR_App F Dipole Cal. Certificates

END OF REPORT