



SAR EVALUATION REPORT

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

For
Mobile Point of Sale Terminal

**FCC ID: B32V200T3GDE
Model Name: V200t 3G/D/E**

**Report Number: 11955389-S1V3
Issue Date: 1/30/2018**

Prepared for
**VERIFONE INC
1400 WEST STANDFORD RANCH RD, SUITE 200
ROCKLIN, CA, 95765 USA**

Prepared by
**UL VERIFICATION SERVICES INC.
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888**



NVLAP LAB CODE 200065-0

Revision History

Rev.	Date	Revisions	Revised By
V1	1/16/2018	Initial Issue	--
V2	1/23/2018	Updated model name	Coltyce Sanders
V3	1/30/2018	Section 6.1: Updated device dimensions	Coltyce Sanders

Table of Contents



1.	Attestation of Test Results	5
2.	Test Specification, Methods and Procedures.....	6
3.	Facilities and Accreditation	6
4.	SAR Measurement System & Test Equipment	7
4.1.	<i>SAR Measurement System.....</i>	7
4.2.	<i>SAR Scan Procedures.....</i>	8
4.3.	<i>Test Equipment.....</i>	10
5.	Measurement Uncertainty.....	10
6.	Device Under Test (DUT) Information	11
6.1.	<i>DUT Description</i>	11
6.2.	<i>Wireless Technologies.....</i>	11
6.3.	<i>Maximum Output Power from Tune-up Procedure</i>	12
7.	RF Exposure Conditions (Test Configurations).....	13
7.1.	<i>Standalone SAR Test Exclusion Considerations.....</i>	13
7.2.	<i>Required Test Configurations</i>	13
8.	Dielectric Property Measurements & System Check	14
8.1.	<i>Dielectric Property Measurements</i>	14
8.2.	<i>System Check.....</i>	15
9.	Conducted Output Power Measurements.....	16
9.1.	<i>GSM</i>	16
9.2.	<i>W-CDMA</i>	18
10.	Measured and Reported (Scaled) SAR Results.....	22
10.1.	<i>GSM 850 Measured SAR Results</i>	22
10.2.	<i>GSM 1900 Measured SAR Results</i>	22
10.3.	<i>W-CDMA Band II Measured SAR Results</i>	22
10.4.	<i>W-CDMA Band V Measured SAR Results.....</i>	23
11.	SAR Measurement Variability.....	24
12.	Simultaneous Transmission SAR Analysis	24
	Appendixes	25
	<i>11955389-S1V1 Appendix A: SAR Setup Photos.....</i>	25
	<i>11955389-S1V1 Appendix B: SAR System Check Plots.....</i>	25
	<i>11955389-S1V1 Appendix C: Highest SAR Test Plots</i>	25

11955389-S1V1 Appendix D: SAR Liquid Tissue Ingredients..... 25

11955389-S1V1 Appendix E: SAR Probe Calibration Certificates 25

11955389-S1V1 Appendix F: SAR Dipole Calibration Certificates..... 25

1. Attestation of Test Results

Applicant Name	Verifone Inc			
FCC ID	B32V200T3GDE			
Model Name	V200t 3G/D/E			
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)			
	PCB	DTS	NII	DSS
Extremity	2.490	N/A	N/A	N/A
Date Tested	11/8/2017 to 11/11/2017			
Test Results	Pass			
<p>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.</p> <p>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.</p>				
Approved & Released By:		Prepared By:		
				
Devin Chang Senior Test Engineer UL Verification Services Inc.		AJ Newcomer 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
- 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

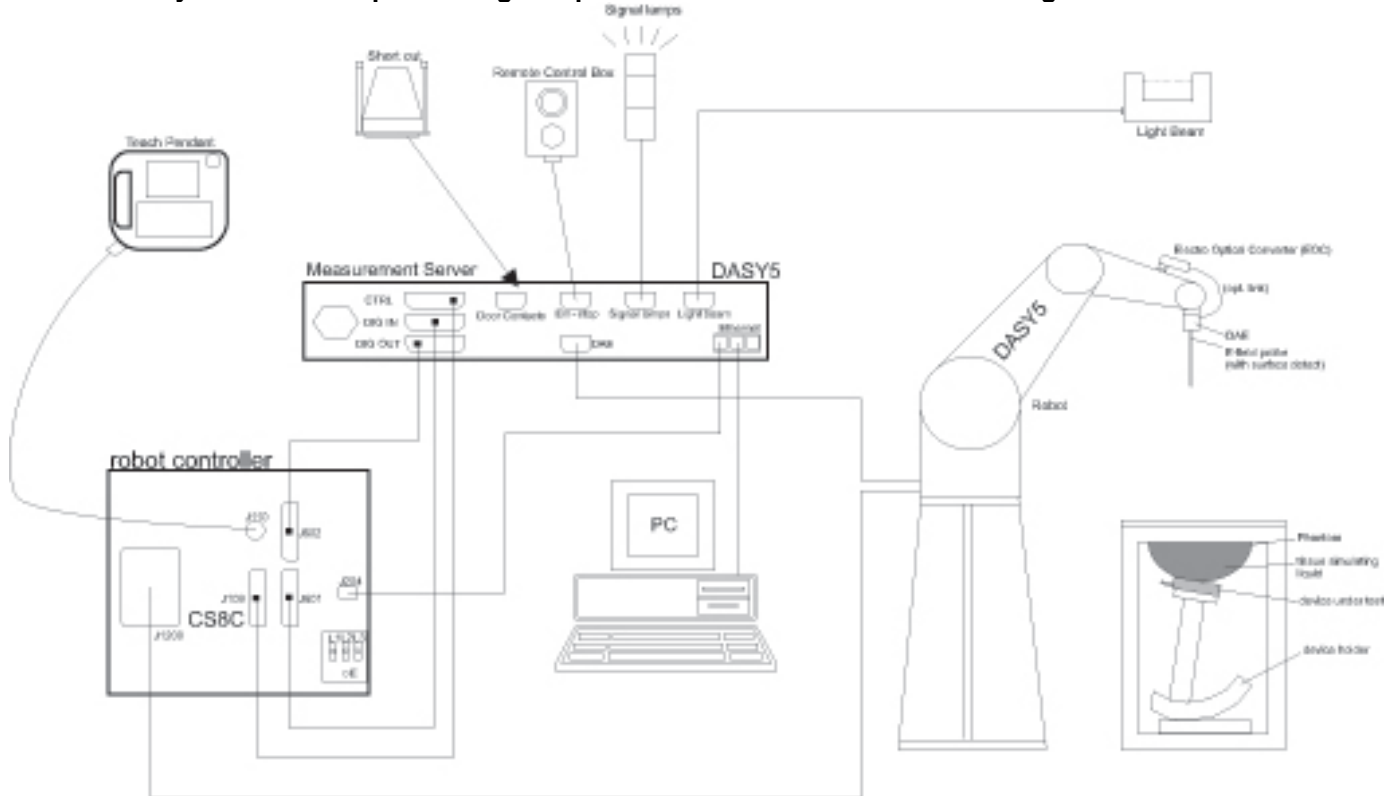
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	
SAR Lab F	
SAR Lab G	
SAR Lab H	

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	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$	≤ 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 \leq the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan

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

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

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$			≤ 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: $\Delta z_{\text{Zoom}}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{\text{Zoom}}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{\text{Zoom}}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1)$	
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 <u>reported</u> SAR from the <i>area scan based 1-g SAR estimation</i> 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
PNA Network Analyzer	Keysight	N5227A	US51270480	7/27/2018
Network Analyzer	Keysight	8753ES	MY40001647	9/15/2018
Dielectric Probe kit*	SPEAG	DAK-3.5	1087	11/8/2017
Dielectric Probe kit	SPEAG	DAK-3.5	1103	2/16/2018
Thermometer	Control Company	Traceable	170064398	1/30/2018

Note:

*Equipment not used past calibration date

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	Agilent	N5181A	MY50140630	5/16/2018
Power Meter	HP	437B	3125U12345	8/10/2018
Power Meter	HP	437B	3125U11347	8/15/2018
Power Sensor	HP	8481A	3318A92374	8/15/2018
Power Sensor	HP	8482A	2349A08568	12/5/2017
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1622052	N/A
Directional coupler	Werlatone	C8060-102	2141	N/A
DC Power Supply	Xantrex	XHR 60-18	27519	N/A

Lab Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
E-Field Probe (SAR Lab B)	SPEAG	EX3DV4	7335	3/15/2018
Data Acquisition Electronics (SAR Lab B)	SPEAG	DAE4	1380	7/24/2018
System Validation Dipole	SPEAG	D900V2	1d143	10/5/2018
System Validation Dipole	SPEAG	D1900V2	5d163	10/5/2018
Thermometer (SAR B)	EXTECH	445703	T1441	4/4/2018

Other

Name of Equipment	Manufacturer	Type/Model	T Number	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	T958	134855	6/12/2018

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 x Height): 185 mm x 78 mm x 54 mm Overall Diagonal: 198 mm Display Diagonal: 72 mm		
Back Cover	<input checked="" type="checkbox"/> Normal Battery Cover		
Battery Options	<input checked="" type="checkbox"/> Standard – Lithium-ion battery, Rating 8.0Vdc, 6.4Wh		
Test sample information	S/N	IMEI	Notes
	401-429-097	357042067316985	SAR Conducted unit
	401-429-132	357042067317785	SAR Radiated unit
Hardware Version	DVT-2		
Software Version	VOS2 30640xxx		

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: <input type="checkbox"/> Class 8 - 1 Up, 4 Down <input type="checkbox"/> Class 10 - 2 Up, 4 Down <input checked="" type="checkbox"/> Class 12 - 4 Up, 4 Down <input type="checkbox"/> Class 33 - 4 Up, 5 Down	(E)GPRS: 1 Slot: 12.5% 2 Slots: 25% 3 Slots: 37.5% 4 Slots: 50%
			Does this device support DTM (Dual Transfer Mode)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
W-CDMA (UMTS)	Band II Band V	UMTS Rel. 99 (Data) HSDPA (Rel. 5) HSUPA (Rel. 6)		100%

6.3. Maximum Output Power from Tune-up Procedure

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.

RF Air interface	Mode	Time Slots	Max. RF Output Power (dBm)	
			Tune-up Limit	Frame Pwr
GSM850	GPRS	1	33.5	24.47
	GPRS	2	30.5	24.48
	GPRS	3	28.5	24.24
	GPRS	4	27.5	24.49
	EGPRS	1	27.5	18.47
	EGPRS	2	24.5	18.48
	EGPRS	3	23.0	18.74
	EGPRS	4	21.5	18.49
GSM1900	GPRS	1	30.5	21.47
	GPRS	2	27.5	21.48
	GPRS	3	25.0	20.74
	GPRS	4	24.5	21.49
	EGPRS	1	26.5	17.47
	EGPRS	2	23.5	17.48
	EGPRS	3	22.0	17.74
	EGPRS	4	20.5	17.49

RF Air interface	Mode		Max. RF Output Power (dBm)
W-CDMA Band II	Release 99		23.5
	HSDPA	Subtest 1	23.5
		Subtest 2	23.5
		Subtest 3	23.0
		Subtest 4	23.0
	HSUPA	Subtest 1	23.5
		Subtest 2	21.5
		Subtest 3	22.5
		Subtest 4	21.5
		Subtest 5	23.5
W-CDMA Band V	Release 99		24.0
	HSDPA	Subtest 1	24.0
		Subtest 2	24.0
		Subtest 3	23.5
		Subtest 4	23.5
	HSUPA	Subtest 1	24.0
		Subtest 2	22.0
		Subtest 3	23.0
		Subtest 4	22.0
		Subtest 5	24.0

7. RF Exposure Conditions (Test Configurations)

Refer to Appendix A for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

7.1. Standalone SAR Test Exclusion Considerations

Since the *Dedicated Host Approach* is applied, the standalone SAR test exclusion procedure in KDB 447498 § 4.3.1 is applied to determine the minimum test separation distance:

- When the separation distance from the antenna to an adjacent edge is ≤ 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.
- When the separation distance from the antenna to an adjacent edge is > 5 mm, the actual antenna-to-edge separation distance is applied to determine SAR test exclusion.

SAR Test Exclusion Calculations for WWAN

Antennas < 50mm to adjacent edges

Antenna	Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)							Calculated Threshold Value						
			dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 3 Slant	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 3 Slant	Edge 4	Front
WWAN	GPRS 4 Slots	848.8	27.50	281	5.00	142.63	4.00	3.30	3.30	21.21	10.00	51.8 -MEASURE-	> 50 mm	51.8 -MEASURE-	51.8 -MEASURE-	51.8 -MEASURE-	12.3 -MEASURE-	25.9 -MEASURE-
WWAN	GPRS 4 Slots	1909.8	24.50	141	5.00	142.63	4.00	3.30	3.30	21.21	10.00	39 -MEASURE-	> 50 mm	39 -MEASURE-	39 -MEASURE-	39 -MEASURE-	9.3 -MEASURE-	19.5 -MEASURE-
WWAN	W-CDMA II	1907.6	23.50	224	5.00	142.63	4.00	3.30	3.30	21.21	10.00	61.9 -MEASURE-	> 50 mm	61.9 -MEASURE-	61.9 -MEASURE-	61.9 -MEASURE-	14.7 -MEASURE-	30.9 -MEASURE-
WWAN	W-CDMA V	846.6	24.00	251	5.00	142.63	4.00	3.30	3.30	21.21	10.00	46.2 -MEASURE-	> 50 mm	46.2 -MEASURE-	46.2 -MEASURE-	46.2 -MEASURE-	11 -MEASURE-	23.1 -MEASURE-

Note(s):

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

Antennas > 50mm to adjacent edges

Antenna	Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)							Calculated Threshold Value						
			dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 3 Slant	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 3 Slant	Edge 4	Front
WWAN	GPRS 4 Slots	848.8	27.50	281	5.00	142.63	4.00	3.30	3.30	21.21	10.00	< 50 mm	687 mW -EXEMPT-	< 50 mm	< 50 mm	< 50 mm	< 50 mm	< 50 mm
WWAN	GPRS 4 Slots	1909.8	24.50	141	5.00	142.63	4.00	3.30	3.30	21.21	10.00	< 50 mm	1034.8 mW -EXEMPT-	< 50 mm	< 50 mm	< 50 mm	< 50 mm	< 50 mm
WWAN	W-CDMA 2	1907.6	23.50	224	5.00	142.63	4.00	3.30	3.30	21.21	10.00	< 50 mm	1034.9 mW -EXEMPT-	< 50 mm	< 50 mm	< 50 mm	< 50 mm	< 50 mm
WWAN	W-CDMA 5	846.6	24.00	251	5.00	142.63	4.00	3.30	3.30	21.21	10.00	< 50 mm	685.8 mW -EXEMPT-	< 50 mm	< 50 mm	< 50 mm	< 50 mm	< 50 mm

Note(s):

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

7.2. Required Test Configurations

The table below identifies the standalone test configurations required for this device according to the findings in Section 7.1:

Antenna	Test Configurations	Rear	Edge 1	Edge 2	Edge 3	Edge 3 Slant	Edge 4	Front
			(Top Edge)	(Right Edge)	(Bottom Edge)	(Bottom Edge)	(Left Edge)	
WWAN	GSM 850	Yes	No	Yes	Yes	Yes	Yes	Yes
	GSM 1900	Yes	No	Yes	Yes	Yes	Yes	Yes
	W-CDMA Band 2	Yes	No	Yes	Yes	Yes	Yes	Yes
	W-CDMA Band 5	Yes	No	Yes	Yes	Yes	Yes	Yes

Note(s):

Yes = Testing is required.

No = Testing is not required.

8. Dielectric Property Measurements & System Check

8.1. Dielectric Property Measurements

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

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

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

The dielectric constant (ϵ_r) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within $\pm 5\%$ of the required target values; but 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 ϵ_r and σ may be relaxed to $\pm 10\%$. This is limited to frequencies $\leq 3\text{ GHz}$.

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 Lab	Date	Band (MHz)	Tissue Type	Frequency (MHz)	Relative Permittivity (ϵ_r)			Conductivity (σ)		
					Measured	Target	Delta (%)	Measured	Target	Delta (%)
B	11/8/2017	1900	Body	1900	53.09	53.30	-0.39	1.58	1.52	4.01
				1850	53.22	53.30	-0.15	1.54	1.52	1.18
				1920	53.02	53.30	-0.53	1.59	1.52	4.87
B	11/9/2017	900	Body	900	53.56	55.00	-2.62	1.07	1.05	2.00
				805	54.50	55.33	-1.51	0.98	0.97	1.54
				915	53.42	55.00	-2.87	1.09	1.06	2.64

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 \pm 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 \geq 15.0 cm for SAR measurements \leq 3 GHz and \geq 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 Lab	Date	Tissue Type	Dipole Type _Serial #	Dipole Cal. Due Date	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 \pm 10 %	Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta \pm 10 %	
B	11/8/2017	Body	D1900V2 SN:5d163	10/5/2018	4.330	43.30	42.99	0.72	2.230	22.30	21.97	1.50	1,2
B	11/9/2017	Body	D900V2 SN:1d143	10/5/2018	1.140	11.40	10.94	4.20	0.735	7.35	7.12	3.23	3,4

9. Conducted Output Power Measurements

9.1.GSM

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Measured Max Pwr	
						Burst (dBm)	Frame (dBm)
850	GPRS (GMSK)	CS1	1	128	824.2	32.8	23.7
				190	836.6	32.8	23.8
				251	848.8	32.8	23.7
			2	128	824.2	30.0	24.0
				190	836.6	30.1	24.0
				251	848.8	30.0	23.9
			3	128	824.2	28.2	24.0
				190	836.6	28.3	24.0
				251	848.8	28.2	23.9
			4	128	824.2	27.1	24.1
				190	836.6	27.1	24.1
				251	848.8	27.1	24.1
	EGPRS (8PSK)	MCS5	1	128	824.2	26.9	17.9
				190	836.6	26.9	17.9
				251	848.8	26.9	17.9
			2	128	824.2	24.0	18.0
				190	836.6	24.0	18.0
				251	848.8	24.0	18.0
			3	128	824.2	22.1	17.8
				190	836.6	22.2	17.9
				251	848.8	22.1	17.8
			4	128	824.2	21.0	18.0
				190	836.6	21.0	18.0
				251	848.8	21.0	18.0

Notes:

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

- GMSK (GPRS) mode with 4 time slots, based on the Tune-up Procedure. Refer to §6.3.
- SAR is not required for EGPRS (8PSK) mode because the maximum output power and tune-up limit is $\leq 1/4\text{db}$ higher than GMSK GPRS or the adjusted SAR of the highest reported SAR of GMSK GPRS is $\leq 1.2\text{W/kg}$.

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Measured Max. Pwr	
						Burst (dBm)	Frame (dBm)
1900	GPRS (GMSK)	CS1	1	512	1850.2	29.1	20.1
				661	1880.0	29.4	20.4
				810	1909.8	29.3	20.3
			2	512	1850.2	26.6	20.6
				661	1880.0	26.6	20.6
				810	1909.8	26.5	20.5
			3	512	1850.2	24.8	20.5
				661	1880.0	24.8	20.5
				810	1909.8	24.7	20.4
			4	512	1850.2	23.6	20.6
				661	1880.0	23.6	20.6
				810	1909.8	23.5	20.5
	EGPRS (8PSK)	MCS5	1	512	1850.2	25.4	16.4
				661	1880.0	25.4	16.4
				810	1909.8	25.3	16.3
			2	512	1850.2	22.3	16.3
				661	1880.0	22.4	16.4
				810	1909.8	22.3	16.3
			3	512	1850.2	20.7	16.4
				661	1880.0	20.5	16.2
				810	1909.8	20.4	16.1
			4	512	1850.2	19.5	16.5
				661	1880.0	19.5	16.5
				810	1909.8	19.2	16.2

Notes:

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

- GMSK (GPRS) mode with 4 time slots, based on the Tune-up Procedure. Refer to §6.3.
- SAR is not required for EGPRS (8PSK) mode because the maximum output power and tune-up limit is $\leq 1/4\text{db}$ higher than GMSK GPRS or the adjusted SAR of the highest reported SAR of GMSK GPRS is $\leq 1.2\text{W/kg}$.

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
	β_c/β_d	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			
	β_c	2/15	11/15	15/15	15/15
	β_d	15/15	15/15	8/15	4/15
	Bd (SF)	64			
	β_c/β_d	2/15	11/15	15/8	15/4
	β_{hs}	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			
	$A_{hs}=\beta_{hs}/\beta_c$	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
	β_c	11/15	6/15	15/15	2/15	15/15
	β_d	15/15	15/15	9/15	15/15	0
	β_{ec}	209/225	12/15	30/15	2/15	5/15
	β_c/β_d	11/15	6/15	15/9	2/15	-
	β_{hs}	22/15	12/15	30/15	4/15	5/15
	β_{ed}	1309/225	94/75	47/15	56/75	47/15
HSDPA Specific Settings	CM (dB)	1	3	2	3	1
	MPR (dB)	0	2	1	2	0
	DACK	8				0
	DNAK	8				0
	DCQI	8				0
	Ack-Nack repetition factor	3				
	CQI Feedback (Table 5.2B.4)	4ms				
HSUPA Specific Settings	CQI Repetition Factor (Table 5.2B.4)	2				
	$A_{hs} = \beta_{hs}/\beta_c$	30/15				
	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)	MPR (dB)	Max. Meas. Avg Pwr (dBm)
W-CDMA Band II	Rel 99	RMC, 12.2 kbps	9262	1852.4	N/A	23.5
			9400	1880.0	N/A	23.5
			9538	1907.6	N/A	23.2
	HSDPA	Subtest 1	9262	1852.4	0	22.9
			9400	1880.0	0	23.0
			9538	1907.6	0	22.4
		Subtest 2	9262	1852.4	0	21.5
			9400	1880.0	0	21.7
			9538	1907.6	0	21.5
		Subtest 3	9262	1852.4	0.5	21.4
			9400	1880.0	0.5	21.6
			9538	1907.6	0.5	21.0
		Subtest 4	9262	1852.4	0.5	21.4
			9400	1880.0	0.5	21.6
			9538	1907.6	0.5	21.0
	HSUPA	Subtest 1	9262	1852.4	0	22.8
			9400	1880.0	0	23.1
			9538	1907.6	0	22.8
		Subtest 2	9262	1852.4	2	20.4
			9400	1880.0	2	20.6
			9538	1907.6	2	20.1
		Subtest 3	9262	1852.4	1	21.4
			9400	1880.0	1	21.7
			9538	1907.6	1	21.7
		Subtest 4	9262	1852.4	2	21.2
			9400	1880.0	2	21.4
			9538	1907.6	2	20.9
		Subtest 5	9262	1852.4	0	22.8
			9400	1880.0	0	23.1
			9538	1907.6	0	22.8

W-CDMA Band V Measured Results

Band	Mode		UL Ch No.	Freq. (MHz)	MPR (dB)	Max. Meas. Avg Pwr (dBm)
W-CDMA Band V	Rel 99	RMC, 12.2 kbps	4132	826.4	N/A	24.0
			4183	836.6	N/A	24.0
			4233	846.6	N/A	24.0
	HSDPA	Subtest 1	4132	826.4	0	23.8
			4183	836.6	0	23.8
			4233	846.6	0	23.8
		Subtest 2	4132	826.4	0	22.1
			4183	836.6	0	22.2
			4233	846.6	0	22.1
		Subtest 3	4132	826.4	0.5	21.9
			4183	836.6	0.5	22.0
			4233	846.6	0.5	21.6
		Subtest 4	4132	826.4	0.5	21.9
			4183	836.6	0.5	22.0
			4233	846.6	0.5	21.6
	HSUPA	Subtest 1	4132	826.4	0	23.2
			4183	836.6	0	23.2
			4233	846.6	0	23.2
		Subtest 2	4132	826.4	2	21.2
			4183	836.6	2	21.2
			4233	846.6	2	21.2
		Subtest 3	4132	826.4	1	22.2
			4183	836.6	1	22.3
			4233	846.6	1	22.2
		Subtest 4	4132	826.4	2	21.4
			4183	836.6	2	21.5
			4233	846.6	2	21.4
		Subtest 5	4132	826.4	0	23.2
			4183	836.6	0	23.2
			4233	846.6	0	23.2

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

10.1. GSM 850 Measured SAR Results

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Extremity	GPRS 4 Slots	0	Rear	190	836.6	27.5	27.1	0.283	0.307	1
			Front	190	836.6	27.5	27.1	0.353	0.384	
			Edge 2	190	836.6	27.5	27.1	0.769	0.835	
			Edge 3	190	836.6	27.5	27.1	0.697	0.757	
			Edge 3 Slant	190	836.6	27.5	27.1	0.695	0.755	
			Edge 4	190	836.6	27.5	27.1	0.306	0.332	

10.2. GSM 1900 Measured SAR Results

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Extremity	GPRS 4 Slots	0	Rear	661	1880.0	24.5	23.6	0.261	0.321	2
			Front	661	1880.0	24.5	23.6	0.121	0.149	
			Edge 2	661	1880.0	24.5	23.6	0.096	0.119	
			Edge 3	661	1880.0	24.5	23.6	1.020	1.255	
			Edge 3 Slant	661	1880.0	24.5	23.6	0.751	0.924	
			Edge 4	661	1880.0	24.5	23.6	0.216	0.266	

10.3. W-CDMA Band II Measured SAR Results

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Extremity	Rel 99 RMC 12.2 kbps	0	Rear	9400	1880.0	23.5	23.5	0.513	0.513	3
			Front	9400	1880.0	23.5	23.5	0.284	0.284	
			Edge 2	9400	1880.0	23.5	23.5	0.170	0.170	
			Edge 3	9262	1852.4	23.5	23.5	1.920	1.920	
				9400	1880.0	23.5	23.5	2.490	2.490	
				9538	1907.6	23.5	23.2	2.080	2.229	
			Edge 3 Slant	9400	1880.0	23.5	23.5	1.070	1.070	
			Edge 4	9400	1880.0	23.5	23.5	0.444	0.444	

10.4. W-CDMA Band V Measured SAR Results

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Extremity	Rel 99 RMC 12.2 kbps	0	Rear	4183	836.6	24.0	24.0	0.241	0.241	
			Front	4183	836.6	24.0	24.0	0.266	0.266	
			Edge 2	4183	836.6	24.0	24.0	0.588	0.588	
			Edge 3	4183	836.6	24.0	24.0	0.699	0.699	4
			Edge 3 Slant	4183	836.6	24.0	24.0	0.622	0.622	
			Edge 4	4183	836.6	24.0	24.0	0.228	0.228	

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 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 .

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 2	No	0.769	N/A	N/A
	WCDMA Band V	Extremity	Edge 3	No	0.699	N/A	N/A
1900	GSM 1900	Extremity	Edge 3	No	1.020	N/A	N/A
	WCDMA Band II	Extremity	Edge 3	Yes	2.490	2.380	1.05

Note(s):

Second repeated measurement not required since the ratio of largest to smallest SAR is < 1.20 .

12. Simultaneous Transmission SAR Analysis

This device does not support Simultaneous Transmission.

Appendixes

Refer to separated files for the following appendixes.

11955389-S1V1 Appendix A: SAR Setup Photos

11955389-S1V1 Appendix B: SAR System Check Plots

11955389-S1V1 Appendix C: Highest SAR Test Plots

11955389-S1V1 Appendix D: SAR Liquid Tissue Ingredients

11955389-S1V1 Appendix E: SAR Probe Calibration Certificates

11955389-S1V1 Appendix F: SAR Dipole Calibration Certificates

END OF REPORT