SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Standard 1528-2013

For
GSM Phone + Bluetooth

Model: SM-B360E
FCC ID: A3LSMB360E

Report Number: 14I18850-S1A
Issue Date: 9/26/2014

Prepared for
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NVLAP LAB CODE 200065-0

REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
--	09/24/2014	Initial Issue	--
A	09/26/2014	Sec. 8.2: updated Bluetooth tune up tolerance Sec. 11.2.: Updated with appropriate separation distances	Yu Chen/Nathan Sousa

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1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO., LTD.	
Application Purpose	☒ Original Grant ☐ Class II Permissive Change	
FCC ID	A3LSMB360E	
DUT Description	GSM Phone + Bluetooth	
Exposure Category	General Population/Uncontrolled Exposure (1g SAR limit: 1.6 W/kg)	
The Highest Reported SAR Values	RF Exposure Conditions	Equipment Class
		Licensed
	Head	0.876 W/kg
	Body-worn Accessory	0.447 W/kg
	Simultaneous Transmission	N/A
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013	
Test Results	Pass	
Date tested	09/19/2014 – 09/22/2014	

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.

Approved & Released By:	Prepared By:
	
Dave Weaver Program Manager UL Verification Services Inc.	Nathan Sousa 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 1528-2003 & 2013, the following FCC Published RF exposure KDB procedures, and TCB workshop updates:

- 447498 D01 General RF Exposure Guidance v05r02
- 648474 D04 Handset SAR v01r02
- 941225 D03 SAR Test Reduction GSM GPRS EDGE v01
- 941225 D04 SAR for GSM E GPRS Dual Xfer Mode v01
- 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- 865664 D02 SAR Reporting v01r01
- 690783 D01 SAR Listings on Grants v01r03

3. Facilities and Accreditation

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

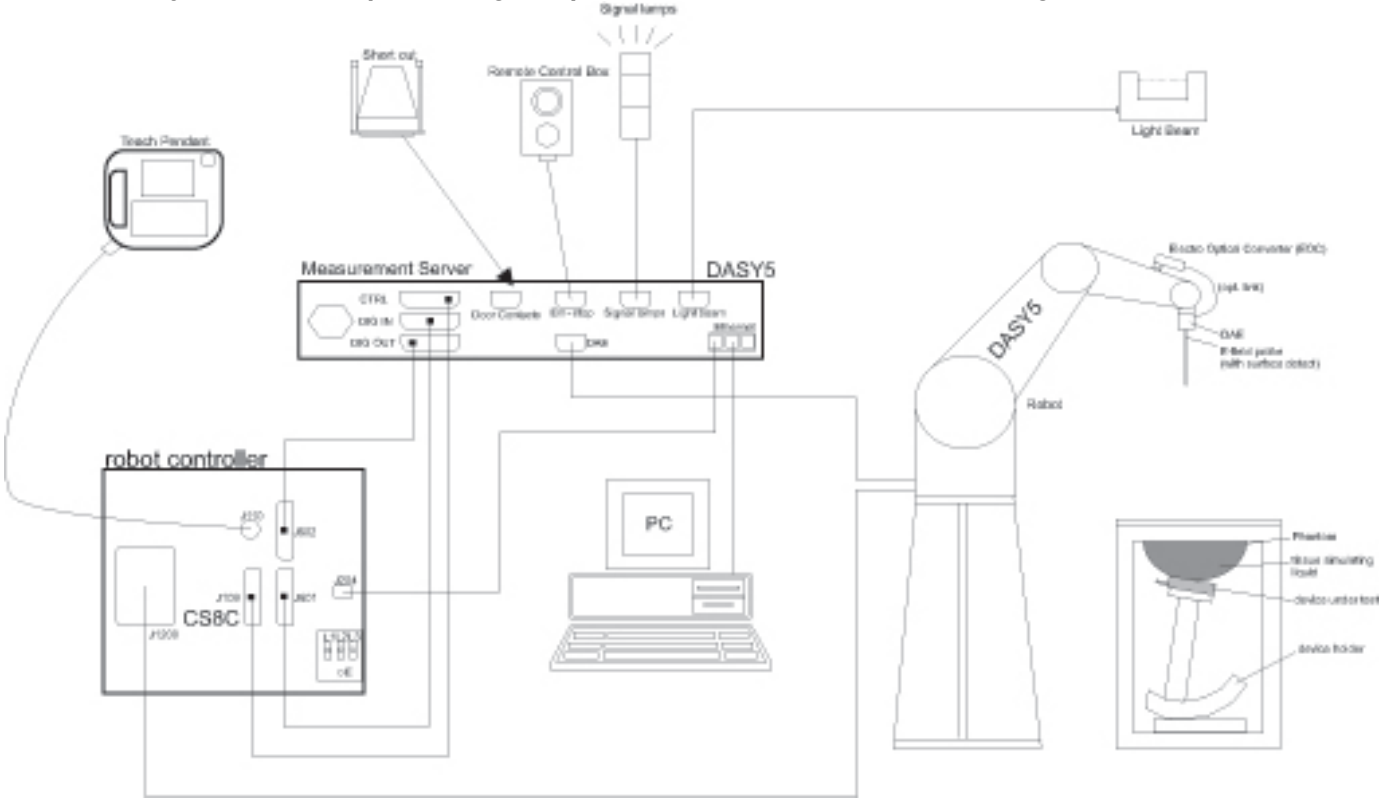
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

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

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY5 system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, 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 Procedure

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.

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Agilent	E5071B	MY42100131	2/24/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1087	11/13/2014
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	EXTECH	445703	CCS-200	3/24/2015

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
HP Signal Generator	HP	8665B	3546A00784	6/23/2015
Power Meter	HP	437B	3125U16345	6/16/2015
Power Meter	HP	437B	3125U09516	9/30/2014
Power Sensor	Agilent	8481A	2702A60780	6/16/2015
Power Sensor	Agilent	8481A	3318A95392	9/30/2014
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1622052	N/A
Bi-directional coupler	Werlatone, Inc.	C8060-102	2711	N/A
DC Power Supply	Sorensen Ametek	XT20-3	1318A00530	N/A
Synthesized Signal Generator	Agilent	8665B	3438A00633	8/29/2015
Power Meter	HP	438A	2822A05684	10/10/2104
Power Sensor	Agilent	8481A	2349A36506	9/30/2014
Power Sensor	Agilent	8481A	2237A31744	10/2/2014
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1808939	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 1)	SPEAG	EX3DV4	3902	5/19/2015
E-Field Probe (SAR 5)	SPEAG	EX3DV4	3991	5/16/2015
Data Acquisition Electronics (SAR 1)	SPEAG	DAE3	427	1/21/2015
Data Acquisition Electronics (SAR 5)	SPEAG	DAE4	1439	5/14/2015
System Validation Dipole	SPEAG	D835V2	4d117	5/16/2015
System Validation Dipole	SPEAG	D1900V2	5d043	11/12/2014
Thermometer (SAR Lab 1)	EXTECH	445703	CCS-205	3/24/2015
Thermometer (SAR Lab 5)	EXTECH	445703	CCS-239	6/3/2015

Others

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Base Station Simulator	R & S	CMW500	125236-es	5/29/2015
Base Station Simulator	R & S	CMW500	137873-wG	7/14/2015
Base Station Simulator	R & S	CMW500	104245-jz	3/26/2015

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2003 & 2013 is not required in SAR reports submitted for equipment approval.

6. Device Under Test (DUT) Information

6.1. DUT Description

Model: SM-B360E	
Device Dimension	Overall (Length x Width): 117.4 mm x 49.5 mm
Battery Back Cover	☒ Normal Battery Cover ☐ Normal Battery Cover with NFC ☐ Wireless Charger Battery Cover ☐ Wireless Charger Battery Cover with NFC.
Battery Options	☒ Standard – Lithium-ion battery, Rating 3.7Vdc, 3.70Wh ☐ Extended (large capacity)
Accessory	Headset

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
GSM	850, 1900	Voice (GMSK) GPRS (GMSK) EGPRS (8PSK)	GSM Voice: 12.5%; GPRS/EGPRS: 1 Slot: 12.5%; 2 Slots: 25%, 3 Slots: 37.5%, 4 Slots: 50%,
	GPRS Multi-Slot Class: ☐ Class 8 - One Up ☐ Class 10 - Two Up ☒ Class 12 - Four Up ☐ Class 33 - Four Up Is DTM (Dual Transfer Mode) supported: ☐ Yes ☒ No		
Bluetooth	2.4 GHz	Version 1.2 Version 2.0 + EDR Version 2.1 + EDR Version 3.0 + HS	32.25% (DH1), 66.68% (DH3), 77.52% (DH5)

6.3. Nominal and Maximum Output Power

Upper limit (dB): 0.5 ~ -1.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
GSM850	Voice	32.5	**33.0**
	GPRS 1 slot	32.5	**33.0**
	GPRS 2 slots	31.0	**31.5**
	GPRS 3 slots	29.0	**29.5**
	GPRS 4 slots	27.0	**27.5**
GSM1900	Voice	29.0	**29.5**
	GPRS 1 slot	29.0	**29.5**
	GPRS 2 slots	27.5	**28.0**
	GPRS 3 slots	26.0	**26.5**
	GPRS 4 slots	24.0	**24.5**

Upper limit (dB): 0.5		RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit
Bluetooth		7.6	**8.1**

6.4. Simultaneous Transmission Condition

Item	Capable Transmit Configurations	RF Exposure Condition		
		Head	Body-worn Accessory	Wireless Router (Hotspot) & Wi-Fi Direct
1	GSM 850/1900 Voice + BT		✓	

Notes:
- GPRS/EDGE do not support Hotspot.
- VoIP is not supported.

7. RF Exposure Conditions (Test Configurations)

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

7.1. Head

For WWAN, LTE and Wi-Fi

Test Configurations	SAR Required	Note
Left Touch	Yes	
Left Tilt (15°)	Yes	
Right Touch	Yes	
Right Tilt (15°)	Yes	

7.2. Body-worn Accessory

For WWAN

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	<25 mm	Yes	
Front	<25 mm	Yes	

8. Conducted Output Power Measurements

8.1. GSM850 and GSM1900

GSM850 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)
850	GSM (Voice)	CS1	1	128	824.2	32.5	23.5
				190	836.6	32.5	23.5
				251	848.8	32.5	23.5
	GPRS (GMSK)	CS1	1	128	824.2	32.5	23.5
				190	836.6	32.5	23.5
				251	848.8	32.5	23.5
			2	128	824.2	31.0	25.0
				190	836.6	31.0	25.0
				251	848.8	31.0	25.0
			3	128	824.2	29.4	25.1
				190	836.6	29.4	25.1
				251	848.8	29.4	25.1
			4	128	824.2	27.4	24.4
				190	836.6	27.4	24.4
				251	848.8	27.4	24.4

Notes:

1) EGPRS is Rx only. SAR testing is not required.
2) The worst-case configuration and mode for SAR testing is determined to be as follows:
   - Head & Body-worn Accessory: GMSK Voice Mode

GSM1900 Measured Results

Band	Mode	Coding Scheme	Time Slots	Ch No.	Freq. (MHz)	Burst Pwr (dBm)	Frame Pwr (dBm)
1900	GSM (Voice)	CS1	1	512	1850.2	29.3	20.3
				661	1880.0	29.3	20.3
				810	1909.8	29.1	20.1
	GPRS (GMSK)	CS1	1	512	1850.2	29.3	20.3
				661	1880.0	29.3	20.3
				810	1909.8	29.1	20.1
			2	512	1850.2	28.0	22.0
				661	1880.0	28.0	22.0
				810	1909.8	27.8	21.8
			3	512	1850.2	26.5	22.2
				661	1880.0	26.5	22.2
				810	1909.8	26.3	22.0
			4	512	1850.2	24.5	21.5
				661	1880.0	24.5	21.5
				810	1909.8	24.3	21.3

Notes:

1) EGPRS is Rx only. SAR testing is not required.
2) The worst-case configuration and mode for SAR testing is determined to be as follows:
   - Head & Body-worn Accessory: GMSK Voice Mode

8.2. Bluetooth

Maximum tune-up tolerance limit is 8.1 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing.

9. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.

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

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

9.1. Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	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

9.2. Dielectric Property Measurements Results

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

SAR Lab 1

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
9/22/2014	Head 835	e'	41.1500	Relative Permittivity (ϵ_r):	41.15	41.50	-0.84	5
		e''	19.9600	Conductivity (σ):	0.93	0.90	2.97	5
	Head 820	e'	41.3400	Relative Permittivity (ϵ_r):	41.34	41.60	-0.63	5
		e''	20.0100	Conductivity (σ):	0.91	0.90	1.55	5
	Head 850	e'	40.9600	Relative Permittivity (ϵ_r):	40.96	41.50	-1.30	5
		e''	19.9100	Conductivity (σ):	0.94	0.92	2.84	5
9/22/2014	Body 835	e'	53.8700	Relative Permittivity (ϵ_r):	53.87	55.20	-2.41	5
		e''	21.8800	Conductivity (σ):	1.02	0.97	4.73	5
	Body 820	e'	54.0100	Relative Permittivity (ϵ_r):	54.01	55.28	-2.29	5
		e''	21.9600	Conductivity (σ):	1.00	0.97	3.39	5
	Body 850	e'	53.7100	Relative Permittivity (ϵ_r):	53.71	55.16	-2.62	5
		e''	21.8100	Conductivity (σ):	1.03	0.99	4.42	5

SAR Lab 5

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
9/19/2014	Body 1900	e'	50.7400	Relative Permittivity (ϵ_r):	50.74	53.30	-4.80	5
		e''	14.4100	Conductivity (σ):	1.52	1.52	0.16	5
	Body 1850	e'	50.9200	Relative Permittivity (ϵ_r):	50.92	53.30	-4.47	5
		e''	14.2600	Conductivity (σ):	1.47	1.52	-3.50	5
	Body 1910	e'	50.7000	Relative Permittivity (ϵ_r):	50.70	53.30	-4.88	5
		e''	14.4400	Conductivity (σ):	1.53	1.52	0.89	5
9/22/2014	Head 1900	e'	38.9300	Relative Permittivity (ϵ_r):	38.93	40.00	-2.68	5
		e''	13.1100	Conductivity (σ):	1.39	1.40	-1.07	5
	Head 1850	e'	39.1600	Relative Permittivity (ϵ_r):	39.16	40.00	-2.10	5
		e''	13.0300	Conductivity (σ):	1.34	1.40	-4.26	5
	Head 1910	e'	38.8900	Relative Permittivity (ϵ_r):	38.89	40.00	-2.78	5
		e''	13.1300	Conductivity (σ):	1.39	1.40	-0.40	5

10. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are remeasured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

10.1. 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	4d117	5/16/2014	835	1g	9.23	9.61
				10g	5.98	6.31
D1900V2	5d043	11/12/2013	1900	1g	40.1	39.0
				10g	21.1	20.8

10.2. 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 %	Est./Zoom Ratio	Plot No.
	Type	Serial #			Area Scan	Zoom Scan	Normalize to 1 W				
9/22/2014	D835V2	4d117	Head	1g	0.90	0.88	8.8	9.23	-4.66	2.00	1,2
				10g	0.61	0.58	5.8	5.98	-3.34		
9/22/2014	D835V2	4d117	Body	1g	0.95	0.93	9.3	9.61	-3.23	2.31	
				10g	0.64	0.62	6.2	6.31	-2.38		

SAR Lab 5

Date Tested	System Dipole		T.S. Liquid		Measured Results			Target (Ref. Value)	Delta ±10 %	Est./Zoom Ratio	Plot No.
	Type	Serial #			Area Scan	Zoom Scan	Normalize to 1 W				
9/19/2014	D1900V2	5d043	Body	1g	4.07	4.11	41.1	39.0	5.38	-0.98	3,4
				10g	2.03	2.16	21.6	20.8	3.85		
9/22/2014	D1900V2	5d043	Head	1g	3.86	3.89	38.9	40.1	-2.99	-0.78	
				10g	2.02	2.02	20.2	21.1	-4.27		

11. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

KDB 648474 D04 Handset SAR:

With headset attached, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

11.1. GSM850

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	190	836.6	33.0	32.5	0.182	**0.204**	1
			Left Tilt	190	836.6	33.0	32.5	0.095	0.107	
			Right Touch	190	836.6	33.0	32.5	0.166	0.186	
			Right Tilt	190	836.6	33.0	32.5	0.090	0.101	
Body-worn	Voice	15	Rear	190	836.6	33.0	32.5	0.195	**0.219**	2
			Front	190	836.6	33.0	32.5	0.080	0.090	

11.2. GSM1900

RF Exposure Conditions	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	
Head	Voice	0	Left Touch	661	1880.0	29.5	29.3	0.688	0.720	
			Left Tilt	661	1880.0	29.5	29.3	0.147	0.154	
			Right Touch	512	1850.2	29.5	29.3	0.764	0.800	
				661	1880.0	29.5	29.3	0.833	0.872	
				810	1909.8	29.5	29.1	0.799	**0.876**	3
			Right Tilt	661	1880.0	29.5	29.3	0.135	0.141	
Body-worn	Voice	15	Rear	661	1880.0	29.5	29.3	0.251	0.263	
			Front	661	1880.0	29.5	29.3	0.427	**0.447**	4

11.3. Bluetooth

11.3.1. Standalone SAR Test Exclusion Considerations

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

The test exclusions are 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.

Body-worn Accessory Exposure Conditions

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	Result
(dBm)	(mW)			
8.1	6	15	2.480	0.6

Conclusion:

The computed value is < 3; therefore, Bluetooth qualifies for Standalone SAR test exclusion.

11.3.2. Estimated SAR

When the standalone SAR test exclusion is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

- *(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√$f_{(GHz)}$/x]* W/kg for test separation distances ≤ 50 mm;
  where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.
- 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.

Estimated SAR Result for Body-worn Accessory Conditions:

Test Configuration	Max. tune-up tolerance limit (mW)	Min. test separation distance (mm)	Frequency (GHz)	Estimated 1-g SAR (W/kg)
Rear/Front	6	15	2.480	0.084

12. SAR Measurement Variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

12.1. The Highest Measured SAR Configuration in Each Frequency Band

Frequency Band (MHz)	Air Interface	Head (W/kg)	Body-worn Accessory (W/kg)	Repeated SAR (Yes/No)
850	GSM 850		0.195	No
1900	GSM 1900	**0.833**		Yes

12.2. Repeated Measurement Results

Head

Frequency band	Test Position	Mode	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio	Note
					Original	Repeated		
GSM1900	Right Touch	GSM Voice	661	1880.0	**0.833**	0.814	1.02	1

Body-worn Accessory

N/A

Note(s):

1. Second Repeated Measurement is not required since the ratio of the largest to smallest SAR for the original and first repeated measurement is not > 1.20.

13. Simultaneous Transmission SAR Analysis

13.1. Sum of the SAR for GSM850 & BT

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario		∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		GSM850	Bluetooth		
Body-worn Accessory	Rear	0.219	0.084	0.303	No
	Front	0.090	0.084	0.174	No

13.2. Sum of the SAR for GSM1900 & BT

RF Exposure conditions	Test Position	Simultaneous Transmission Scenario		∑ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		GSM1900	Bluetooth		
Body-worn Accessory	Rear	0.263	0.084	0.347	No
	Front	0.447	0.084	0.531	No

Conclusion:

Simultaneous transmission SAR measurement (Volume Scan) is not required because the either sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

14. Appendixes

Refer to separated files for the following appendixes.

14.1. Photos and Antenna Locations

14.2. System Performance Check Plots

14.3. Highest SAR Test Plots

14.4. Calibration Certificate for E-Field Probe EX3DV4 - SN 3902

14.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3991

14.6. Calibration Certificate for D835V2 - SN 4d117

14.7. Calibration Certificate for D1900V2- SN 5d043

END OF REPORT