



SAR EVALUATION REPORT

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

For
BT/BLE, DTS/UNII a/b/g/n and ANT+ Tablet

**FCC ID: A3LSMT550
Model Name: SM-T550**

**Report Number: 15119879-S1E
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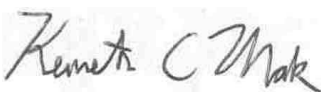
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1. Attestation of Test Results

Applicant Name		SAMSUNG ELECTRONICS CO., LTD.			
FCC ID		A3LSMT550			
Model Name		SM-T550			
Applicable Standards		FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013			
SAR Limits (W/Kg)					
Exposure Category		Peak spatial-average(1g of tissue)			
General population / Uncontrolled exposure		1.6			
The Highest Reported SAR (W/kg)					
RF Exposure Conditions		Equipment Class			
		Licensed	DTS	U-NII	DSS (BT)
Standalone		N/A	1.020	1.040	0.446
Hotspot/Wi-Fi Direct		N/A	1.020	N/A	N/A
Simultaneous Tx	Standalone	N/A	N/A	N/A	N/A
	Hotspot/Wi-Fi Direct	N/A	N/A	N/A	N/A
Date Tested		1/29/2015 to 2/16/2015; 3/10/2015 to 3/13/2015			
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:		
					
Bobby Bayani Senior Engineer UL Verification Services Inc.			Kenneth Mak 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:

- 248227 D01 SAR meas for 802.11 v02
- 447498 D01 General RF Exposure Guidance v05r02
- 447498 D03 Supplement C Cross-Reference
- 616217 D04 SAR for laptop and tablets v01r01
- 690783 D01 SAR Listings on Grants v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r03
- 865664 D02 RF Exposure Reporting v01r01
- 941225 D06 Hotspot Mode v02

3. Facilities and Accreditation

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

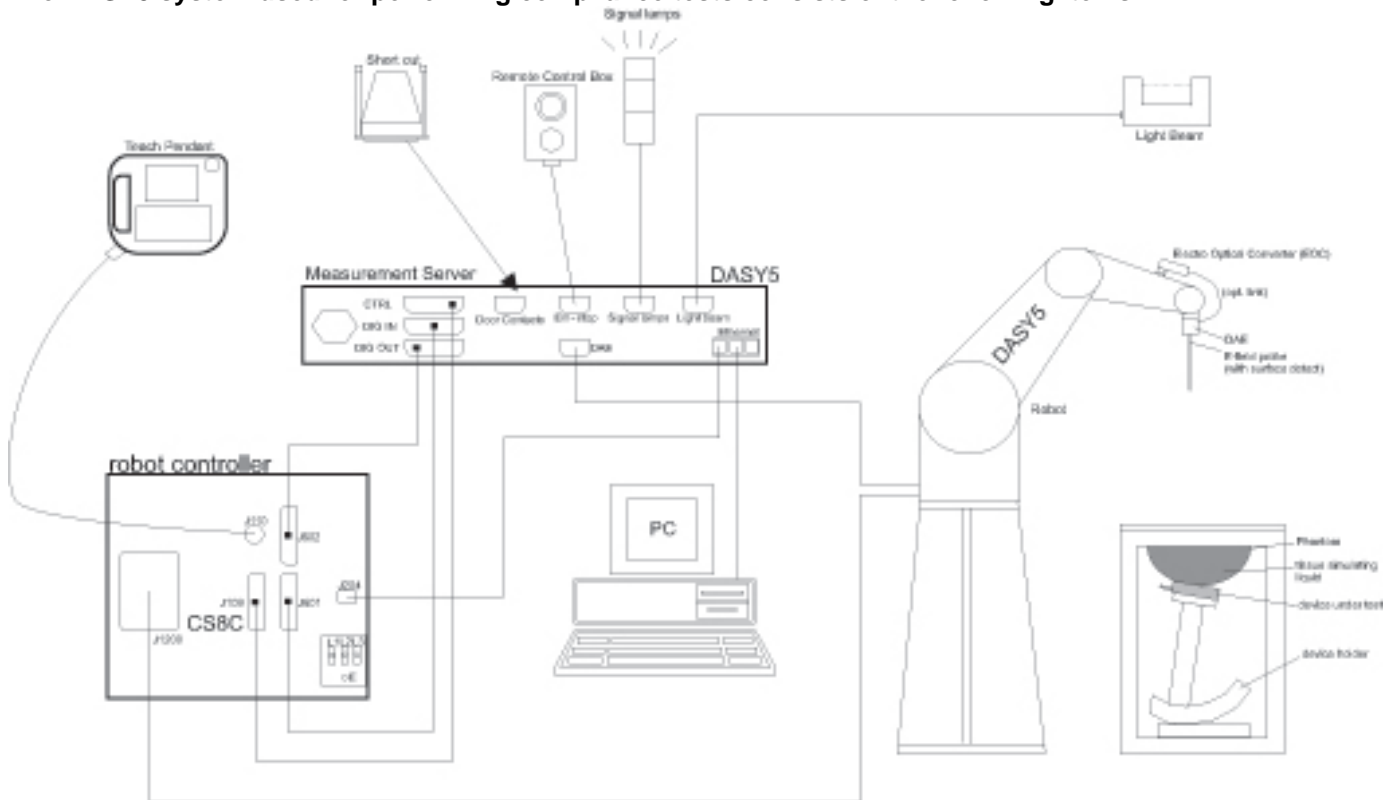
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	
SAR Lab G	
SAR Lab H	

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

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

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



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

4.2. SAR Scan Procedures

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

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

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ 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: 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 \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: $\Delta x_{Zoom}, \Delta y_{Zoom}$		≤ 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 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
		$\Delta z_{Zoom}(n>1)$: 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 <i>reported</i> SAR from the area scan based <i>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
Network Analyzer	Agilent	8753ES	MY40001647	7/17/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1103	2/18/2015
Dielectronic Probe kit	SPEAG	DAK-3.5	1087	11/11/2015
Dielectronic Probe kit	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Traceable Calibration Control Co.	4242	122529162	10/8/2015

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	HP	8665B	3744A01084	5/20/2015
Power Meter	Agilent	N1912A	MY53040016	5/5/2015
Power Sensor	Agilent	E9323A	MY53070005	5/1/2015
Power Sensor	Agilent	E9323A	MY53070009	5/28/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795093	N/A
Directional coupler	Werlatone	C8060-102	2149	N/A
DC Power Supply	AMETEK	XT 15-4	1319A02778	N/A
Synthesized Signal Generator	HP	8665B	3744A01155	3/12/2015
Power Meter	HP	437B	3125U11364	8/27/2015
Power Meter	HP	437B	3125U12345	8/15/2015
Power Sensor	HP	8481A	1926A27048	8/15/2015
Power Sensor	HP	8481A	2702A76223	9/17/2015
Amplifier	MITEQ	AMF-4D-00400600-50-30P	1795092	N/A
Directional coupler	Werlatone	C8060-102	2141	N/A
DC Power Supply	BK PRECISION	1611	215-02292	N/A
E-Field Probe (SAR Lab A)	SPEAG	EX3DV4	3772	2/26/2015
E-Field Probe (SAR Lab E)	SPEAG	EX3DV4	3772	2/23/2016
E-Field Probe (SAR Lab E)	SPEAG	EX3DV4	3989	4/15/2015
E-Field Probe (SAR Lab G)	SPEAG	EX3DV4	3990	4/15/2015
Data Acquisition Electronics (SAR Lab A)	SPEAG	DAE4	1433	4/14/2015
Data Acquisition Electronics (SAR Lab E)	SPEAG	DAE4	1257	9/29/2015
Data Acquisition Electronics (SAR Lab G)	SPEAG	DAE3	1434	4/14/2015
System Validation Dipole	SPEAG	D2450V2	706	5/20/2015
System Validation Dipole	SPEAG	D2450V2	899	9/10/2015
System Validation Dipole	SPEAG	D5GHzV2	1138	9/18/2015

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 1528-2013 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): 243 mm x 166.5 mm Overall Diagonal: 285.52 mm Display Diagonal: 246.38 mm
Battery Back Cover	<input checked="" type="checkbox"/> The rechargeable battery is not user accessible.
Battery Options	<input checked="" type="checkbox"/> The rechargeable battery is not user accessible.
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. <input checked="" type="checkbox"/> Mobile Hotspot (Wi-Fi 2.4 GHz) <input type="checkbox"/> Mobile Hotspot (Wi-Fi 5 GHz)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 2.4 GHz) <input checked="" type="checkbox"/> Wi-Fi Direct (Wi-Fi 5 GHz)

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20)	100%
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40)	100%
	TDWR (Terminal Doppler Weather Radar): Not Supported.		
	Band gap channel : Not supported		
Bluetooth	2.4 GHz	Version 4.1 LE	77.52%

6.3. Nominal and Maximum Output Power

KDB 447498 sec.4.1.(3) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit

Upper limit (dB):		~ 0.5		Max RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit		
WiFi 2.4 GHz	802.11b	17.0	17.5		
	802.11g	14.0	14.5		
	802.11n HT20	13.0	13.5		
WiFi 5 GHz	802.11a	12.0	12.5		
	802.11n HT20	12.0	12.5		
	802.11n HT40	10.0	10.5		
Bluetooth		10.0	10.5		
Bluetooth LE		2.5	3.0		
Upper limit (dB):		~ 0.5		Reduced RF Output Power (dBm)	
RF Air interface	Mode	Target	Max. tune-up tolerance limit		
WiFi 2.4 GHz	802.11b	10.0	10.5		
	802.11g	10.0	10.5		
	802.11n HT20	10.0	10.5		
WiFi 5 GHz	802.11a	9.0	9.5		
	802.11n HT20	9.0	9.5		
	802.11n HT40	9.0	9.5		

6.4. Power Reduction by Proximity Sensing

6.4.1. Proximity Sensor Triggering Distance (KDB 616217 §6.2)

Rear surface of the DUT was placed directly below the flat phantom. The DUT was moved toward the phantom in accordance with the steps outlined in KDB 616217 §6.2 to determine the trigger distance for enabling power reduction. The DUT was moved away from the phantom to determine the trigger distance for resuming full power.

The DUT featured a visual indicator on its display that showed the status of the proximity sensor (Triggered or not triggered). This was used to determine the status of the sensor during the proximity sensor assessment as monitoring the output power directly was not practical without affecting the measurement.

It was confirmed separately that the output power was altered according to the proximity sensor status indication. This was achieved by observing the proximity sensor status at the same time as monitoring the conducted power. Section 9 contains both the full and reduced conducted power measurements.



Proximity Sensor Trigger Distance Assessment
KDB 616217 §6.2, Rear

LEGEND

- Direction of DUT travel for determination of power reduction triggering point
- Direction of DUT travel for determination of full power resumption triggering point

Summary of Trigger Distances

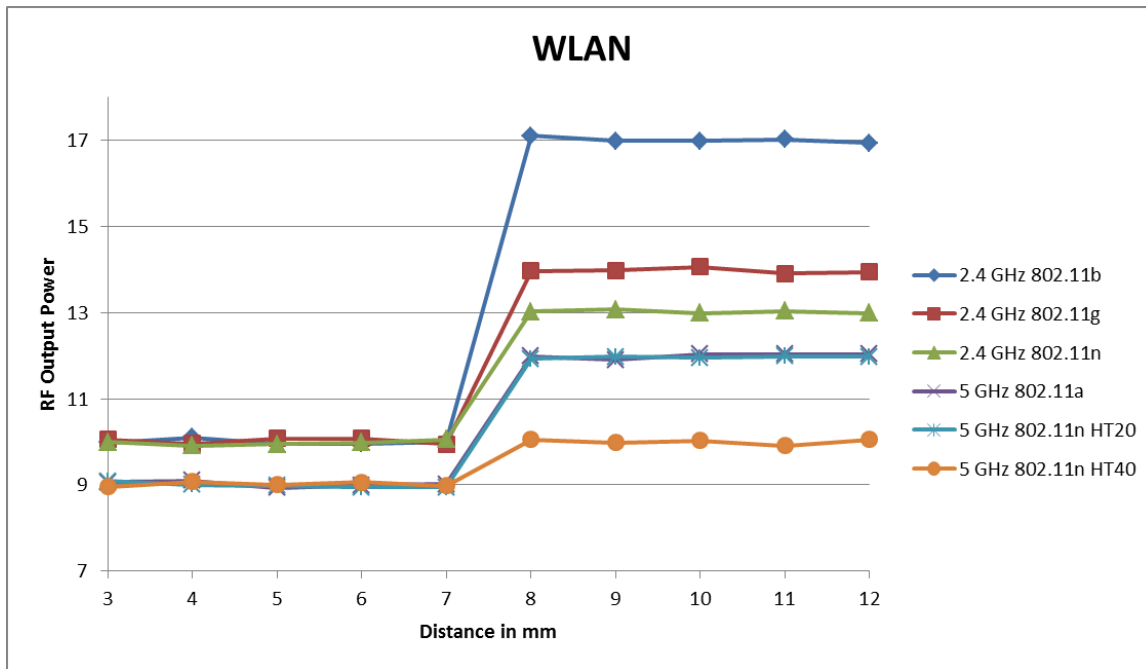
Tissue simulating liquid	Trigger distance - Rear	
	Moving toward phantom	Moving from phantom
2450 muscle	7mm	7mm
5000 muscle	7mm	7mm

6.4.2. Proximity Sensor Triggering Distance Measurement Results

Wi-Fi 2.4GHz and 5GHz

Rear, DUT Moving Toward (Trigger) and Away (Release) from the Phantom

Distance to DUT vs. Output Power in dBm										
Distance	12	11	10	9	8	7	6	5	4	3
2.4 GHz 802.11b	16.94	17.02	16.99	16.98	17.10	10.01	9.96	9.96	10.10	9.98
2.4 GHz 802.11g	13.94	13.91	14.06	13.98	13.97	9.95	10.08	10.08	9.96	10.05
2.4 GHz 802.11n	12.99	13.04	12.99	13.07	13.03	10.05	9.98	9.95	9.91	9.99
5 GHz 802.11a	12.04	12.03	12.03	11.90	11.99	9.02	8.99	8.94	9.10	9.07
5 GHz 802.11n HT20	11.97	11.99	11.95	11.97	11.93	8.95	8.95	8.98	9.00	9.09
5 GHz 802.11n HT40	10.06	9.91	10.03	9.98	10.05	8.98	9.06	9.00	9.08	8.96



6.4.3. Proximity Sensor Coverage (KDB 616217 §6.3)

As there is no spatial offset between the antenna and the proximity sensor element, proximity sensor coverage did not need to be assessed.

6.4.4. Proximity Sensor Tilt Angle Assessment (KDB 616217 §6.4)

N/A

6.4.5. Resulting test positions for SAR measurements

Wireless technologies	Position	§6.2 Triggering Distance	§6.3 Coverage	§6.4 Tilt Angle	Worst case distance for SAR
WLAN	Rear	7 mm	N/A	N/A	6 mm

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.

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 in conjunction with KDB 616217 § 4.3 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 WLAN

Antennas < 50mm to adjacent edges

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Calculated Threshold Value					
		dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Full Power, Proximity Sensor Off.															
Wi-Fi 2.4 GHz	2462	17.50	56	7.28	4.47	12.58	228.15	135.76		12.6 -MEASURE-	17.6 -MEASURE-	6.8 -MEASURE-	> 50 mm	> 50 mm	
Wi-Fi 5.2 GHz	5240	12.50	18	7.28	4.47	12.58	228.15	135.76		5.9 -MEASURE-	8.2 -MEASURE-	3.2 -MEASURE-	> 50 mm	> 50 mm	
Wi-Fi 5.3 GHz	5320	12.50	18	7.28	4.47	12.58	228.15	135.76		5.9 -MEASURE-	8.3 -MEASURE-	3.2 -MEASURE-	> 50 mm	> 50 mm	
Wi-Fi 5.5 GHz	5700	12.50	18	7.28	4.47	12.58	228.15	135.76		6.1 -MEASURE-	8.6 -MEASURE-	3.3 -MEASURE-	> 50 mm	> 50 mm	
Wi-Fi 5.8 GHz	5825	12.50	18	7.28	4.47	12.58	228.15	135.76		6.2 -MEASURE-	8.7 -MEASURE-	3.3 -MEASURE-	> 50 mm	> 50 mm	
Bluetooth	2480	10.50	11	7.28	4.47	12.58	228.15	135.76		2.5 -EXEMPT-	3.5 -MEASURE-	1.3 -EXEMPT-	> 50 mm	> 50 mm	
Power Back-off, Proximity Sensor On															
Wi-Fi 2.4 GHz	2462	10.50	11	1.28	4.47	12.58	228.15	135.76		3.5 -MEASURE-	3.5 -MEASURE-	1.3 -EXEMPT-	> 50 mm	> 50 mm	
Wi-Fi 5.2 GHz	5240	9.50	9	1.28	4.47	12.58	228.15	135.76		4.1 -MEASURE-	4.1 -MEASURE-	1.6 -EXEMPT-	> 50 mm	> 50 mm	
Wi-Fi 5.3 GHz	5320	9.50	9	1.28	4.47	12.58	228.15	135.76		4.2 -MEASURE-	4.2 -MEASURE-	1.6 -EXEMPT-	> 50 mm	> 50 mm	
Wi-Fi 5.5 GHz	5700	9.50	9	1.28	4.47	12.58	228.15	135.76		4.3 -MEASURE-	4.3 -MEASURE-	1.7 -EXEMPT-	> 50 mm	> 50 mm	
Wi-Fi 5.8 GHz	5825	9.50	9	1.28	4.47	12.58	228.15	135.76		4.3 -MEASURE-	4.3 -MEASURE-	1.7 -EXEMPT-	> 50 mm	> 50 mm	
Bluetooth	2480	10.50	11	1.28	4.47	12.58	228.15	135.76		3.5 -MEASURE-	3.5 -MEASURE-	1.3 -EXEMPT-	> 50 mm	> 50 mm	

Note(s):

1. According to KDB 447498, if the calculated threshold value is >3 then SAR testing is required.

Antennas > 50mm to adjacent edges

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Calculated Threshold Value					
		dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Full Power, Proximity Sensor Off.															
Wi-Fi 2.4 GHz	2462	17.50	56	7.28	4.47	12.58	228.15	135.76		< 50 mm	< 50 mm	< 50 mm	877.1mW -EXEMPT-	953.2 mW -EXEMPT-	
Wi-Fi 5.2 GHz	5240	12.50	18	7.28	4.47	12.58	228.15	135.76		< 50 mm	< 50 mm	< 50 mm	847 mW -EXEMPT-	923.1mW -EXEMPT-	
Wi-Fi 5.3 GHz	5320	12.50	18	7.28	4.47	12.58	228.15	135.76		< 50 mm	< 50 mm	< 50 mm	846.5 mW -EXEMPT-	922.6 mW -EXEMPT-	
Wi-Fi 5.5 GHz	5700	12.50	18	7.28	4.47	12.58	228.15	135.76		< 50 mm	< 50 mm	< 50 mm	844.3 mW -EXEMPT-	920.4 mW -EXEMPT-	
Wi-Fi 5.8 GHz	5825	12.50	18	7.28	4.47	12.58	228.15	135.76		< 50 mm	< 50 mm	< 50 mm	843.7 mW -EXEMPT-	919.8 mW -EXEMPT-	
Bluetooth	2480	10.50	11	7.28	4.47	12.58	228.15	135.76		< 50 mm	< 50 mm	< 50 mm	876.8 mW -EXEMPT-	952.9 mW -EXEMPT-	
Power Back-off, Proximity Sensor On															
Wi-Fi 2.4 GHz	2462	10.50	11	1.28	4.47	12.58	228.15	135.76		< 50 mm	< 50 mm	< 50 mm	877.1mW -EXEMPT-	953.2 mW -EXEMPT-	
Wi-Fi 5.2 GHz	5240	9.50	9	1.28	4.47	12.58	228.15	135.76		< 50 mm	< 50 mm	< 50 mm	847 mW -EXEMPT-	923.1mW -EXEMPT-	
Wi-Fi 5.3 GHz	5320	9.50	9	1.28	4.47	12.58	228.15	135.76		< 50 mm	< 50 mm	< 50 mm	846.5 mW -EXEMPT-	922.6 mW -EXEMPT-	
Wi-Fi 5.5 GHz	5700	9.50	9	1.28	4.47	12.58	228.15	135.76		< 50 mm	< 50 mm	< 50 mm	844.3 mW -EXEMPT-	920.4 mW -EXEMPT-	
Wi-Fi 5.8 GHz	5825	9.50	9	1.28	4.47	12.58	228.15	135.76		< 50 mm	< 50 mm	< 50 mm	843.7 mW -EXEMPT-	919.8 mW -EXEMPT-	
Bluetooth	2480	10.50	11	1.28	4.47	12.58	228.15	135.76		< 50 mm	< 50 mm	< 50 mm	876.8 mW -EXEMPT-	952.9 mW -EXEMPT-	

Note(s):

1. 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:

Test Configurations	Rear	Edge 1	Edge 2	Edge 3	Edge 4
		(Top Edge)	(Right Edge)	(Bottom Edge)	(Left Edge)
Wi-Fi 2.4 GHz Full Power	Yes	Yes	Yes	No	No
Wi-Fi 2.4 GHz w / Power Reduction	Yes	Yes	No	No	No
Wi-Fi 5 GHz Full Power	Yes	Yes	Yes	No	No
Wi-Fi 5 GHz w / Power Reduction	Yes	Yes	No	No	No
Bluetooth	Yes	Yes	No	No	No

Note(s):

1. Yes = Testing is required.
2. 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.

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 A

	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)		
1/29/2015	Body 2450	e'	51.4000	Relative Permittivity (ϵ_r):	51.40	52.70	-2.47	5	
		e"	14.6200	Conductivity (σ):	1.99	1.95	2.14	5	
	Body 2410	e'	51.5300	Relative Permittivity (ϵ_r):	51.53	52.76	-2.33	5	
		e"	14.4900	Conductivity (σ):	1.94	1.91	1.79	5	
	Body 2475	e'	51.3400	Relative Permittivity (ϵ_r):	51.34	52.67	-2.52	5	
		e"	14.6400	Conductivity (σ):	2.01	1.99	1.49	5	
2/2/2015	Body 5180	e'	48.9400	Relative Permittivity (ϵ_r):	48.94	49.05	-0.22	5	
		e"	17.6100	Conductivity (σ):	5.07	5.27	-3.78	5	
	Body 5200	e'	48.9100	Relative Permittivity (ϵ_r):	48.91	49.02	-0.22	5	
		e"	17.6000	Conductivity (σ):	5.09	5.29	-3.89	5	
	Body 5600	e'	48.6800	Relative Permittivity (ϵ_r):	48.68	48.48	0.42	5	
		e"	18.2900	Conductivity (σ):	5.70	5.76	-1.14	5	
	Body 5800	e'	48.2500	Relative Permittivity (ϵ_r):	48.25	48.20	0.10	5	
		e"	18.5300	Conductivity (σ):	5.98	6.00	-0.40	5	
	Body 5825	e'	48.1600	Relative Permittivity (ϵ_r):	48.16	48.20	-0.08	5	
		e"	18.5300	Conductivity (σ):	6.00	6.00	0.03	5	
	2/4/2015	Body 2450	e'	52.8000	Relative Permittivity (ϵ_r):	52.80	52.70	0.19	5
			e"	13.9800	Conductivity (σ):	1.90	1.95	-2.34	5
Body 2410		e'	53.2200	Relative Permittivity (ϵ_r):	53.22	52.76	0.87	5	
		e"	13.7400	Conductivity (σ):	1.84	1.91	-3.47	5	
Body 2475		e'	53.1300	Relative Permittivity (ϵ_r):	53.13	52.67	0.88	5	
		e"	14.0700	Conductivity (σ):	1.94	1.99	-2.46	5	
2/9/2015	Body 2450	e'	50.7900	Relative Permittivity (ϵ_r):	50.79	52.70	-3.62	5	
		e"	14.8400	Conductivity (σ):	2.02	1.95	3.67	5	
	Body 2410	e'	50.8900	Relative Permittivity (ϵ_r):	50.89	52.76	-3.54	5	
		e"	14.5900	Conductivity (σ):	1.96	1.91	2.50	5	
	Body 2475	e'	50.7900	Relative Permittivity (ϵ_r):	50.79	52.67	-3.57	5	
		e"	14.8600	Conductivity (σ):	2.04	1.99	3.02	5	
2/9/2015	Body 5180	e'	48.2400	Relative Permittivity (ϵ_r):	48.24	49.05	-1.64	5	
		e"	18.6000	Conductivity (σ):	5.36	5.27	1.63	5	
	Body 5200	e'	48.2400	Relative Permittivity (ϵ_r):	48.24	49.02	-1.59	5	
		e"	18.6900	Conductivity (σ):	5.40	5.29	2.06	5	
	Body 5600	e'	47.7000	Relative Permittivity (ϵ_r):	47.70	48.48	-1.60	5	
		e"	19.0900	Conductivity (σ):	5.94	5.76	3.18	5	
	Body 5800	e'	47.4700	Relative Permittivity (ϵ_r):	47.47	48.20	-1.51	5	
		e"	19.2400	Conductivity (σ):	6.20	6.00	3.41	5	
	Body 5825	e'	47.4100	Relative Permittivity (ϵ_r):	47.41	48.20	-1.64	5	
		e"	19.2800	Conductivity (σ):	6.24	6.00	4.08	5	

SAR Lab E

	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)		
2/10/2015	Body 5180	e'	47.7000	Relative Permittivity (ϵ_r):	47.70	49.05	-2.75	5	
		e"	17.5300	Conductivity (σ):	5.05	5.27	-4.22	5	
	Body 5200	e'	47.6300	Relative Permittivity (ϵ_r):	47.63	49.02	-2.83	5	
		e"	17.5000	Conductivity (σ):	5.06	5.29	-4.44	5	
	Body 5600	e'	47.0500	Relative Permittivity (ϵ_r):	47.05	48.48	-2.95	5	
		e"	17.8400	Conductivity (σ):	5.55	5.76	-3.58	5	
	Body 5800	e'	46.7900	Relative Permittivity (ϵ_r):	46.79	48.20	-2.93	5	
		e"	17.9800	Conductivity (σ):	5.80	6.00	-3.36	5	
	Body 5825	e'	46.7400	Relative Permittivity (ϵ_r):	46.74	48.20	-3.03	5	
		e"	18.0200	Conductivity (σ):	5.84	6.00	-2.73	5	
	3/10/2015	Body 5180	e'	49.4200	Relative Permittivity (ϵ_r):	49.42	49.05	0.76	5
			e"	17.8900	Conductivity (σ):	5.15	5.27	-2.25	5
Body 5200		e'	49.3100	Relative Permittivity (ϵ_r):	49.31	49.02	0.59	5	
		e"	17.8400	Conductivity (σ):	5.16	5.29	-2.58	5	
Body 5600		e'	48.9100	Relative Permittivity (ϵ_r):	48.91	48.48	0.89	5	
		e"	18.1300	Conductivity (σ):	5.65	5.76	-2.01	5	
Body 5800		e'	48.7300	Relative Permittivity (ϵ_r):	48.73	48.20	1.10	5	
		e"	18.3000	Conductivity (σ):	5.90	6.00	-1.64	5	
Body 5825		e'	48.6800	Relative Permittivity (ϵ_r):	48.68	48.20	1.00	5	
		e"	18.2300	Conductivity (σ):	5.90	6.00	-1.59	5	
3/12/2015		Body 5180	e'	49.0700	Relative Permittivity (ϵ_r):	49.07	49.05	0.05	5
			e"	18.0900	Conductivity (σ):	5.21	5.27	-1.16	5
	Body 5200	e'	49.1100	Relative Permittivity (ϵ_r):	49.11	49.02	0.18	5	
		e"	18.1300	Conductivity (σ):	5.24	5.29	-0.99	5	
	Body 5600	e'	47.9700	Relative Permittivity (ϵ_r):	47.97	48.48	-1.05	5	
		e"	18.5300	Conductivity (σ):	5.77	5.76	0.15	5	
	Body 5800	e'	47.3300	Relative Permittivity (ϵ_r):	47.33	48.20	-1.80	5	
		e"	18.8500	Conductivity (σ):	6.08	6.00	1.32	5	
	Body 5825	e'	47.3300	Relative Permittivity (ϵ_r):	47.33	48.20	-1.80	5	
		e"	18.9400	Conductivity (σ):	6.13	6.00	2.24	5	
	3/13/2015	Body 2450	e'	52.3600	Relative Permittivity (ϵ_r):	52.36	52.70	-0.65	5
			e"	14.7000	Conductivity (σ):	2.00	1.95	2.69	5
Body 2410		e'	52.0800	Relative Permittivity (ϵ_r):	52.08	52.76	-1.29	5	
		e"	14.6900	Conductivity (σ):	1.97	1.91	3.20	5	
Body 2475		e'	52.3600	Relative Permittivity (ϵ_r):	52.36	52.67	-0.59	5	
		e"	14.7000	Conductivity (σ):	2.02	1.99	1.91	5	

SAR Lab G

	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
2/16/2015	Body 2450	e'	51.6700	Relative Permittivity (ϵ_r):	51.67	52.70	-1.95	5
		e"	14.8300	Conductivity (σ):	2.02	1.95	3.60	5
	Body 2410	e'	51.8100	Relative Permittivity (ϵ_r):	51.81	52.76	-1.80	5
		e"	14.6800	Conductivity (σ):	1.97	1.91	3.13	5
	Body 2475	e'	51.5500	Relative Permittivity (ϵ_r):	51.55	52.67	-2.12	5
		e"	14.9100	Conductivity (σ):	2.05	1.99	3.36	5

8.2. System Check

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

System Performance Check Measurement Conditions:

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.
- Distance between probe sensors and phantom surface was set to 3 mm.
For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

Reference Target SAR Values

The reference SAR values can be obtained from the calibration certificate of system validation dipoles

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D2450V2	706	5/20/2014	2450	1g	53.0	50.2
				10g	24.5	23.4
D2450V2	899	9/10/2014	2450	1g	52.3	50.5
				10g	24.3	23.5
D5GHzV2	1138	9/18/2014	5200	1g	81.4	75.4
				10g	23.3	21.0
			5600	1g	85.1	81.9
				10g	24.2	22.6
			5800	1g	80.6	75.2
				10g	23.0	20.8

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 A

Date Tested	System Dipole		T.S. Liquid	Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.	
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W				
1/29/2015	D2450V2	706	Body	1g	5.21	52.1	50.2	3.78	1,2
				10g	2.37	23.7	23.4	1.28	
2/2/2015	D5GHzV2 (5.2 GHz)	1138	Body	1g	7.57	75.7	75.4	0.40	
				10g	2.14	21.4	21.0	1.90	
2/2/2015	D5GHzV2 (5.6 GHz)	1138	Body	1g	8.70	87.0	81.9	6.23	
				10g	2.43	24.3	22.6	7.52	
2/2/2015	D5GHzV2 (5.8 GHz)	1138	Body	1g	7.33	73.3	75.2	-2.53	
				10g	2.06	20.6	20.8	-0.96	
2/4/2015	D2450V2	899	Body	1g	5.25	52.50	50.5	3.96	
				10g	2.40	24.00	23.5	2.13	
2/9/2015	D2450V2	899	Body	1g	5.36	53.60	50.5	6.14	3,4
				10g	2.45	24.50	23.5	4.26	
2/9/2015	D5GHzV2 (5.2 GHz)	1138	Body	1g	7.79	77.90	75.4	3.32	
				10g	2.19	21.90	21.0	4.29	
2/9/2015	D5GHzV2 (5.6 GHz)	1138	Body	1g	8.13	81.30	81.9	-0.73	
				10g	2.24	22.40	22.6	-0.88	
2/9/2015	D5GHzV2 (5.8 GHz)	1138	Body	1g	6.95	69.50	75.2	-7.58	5,6
				10g	1.93	19.30	20.8	-7.21	

SAR Lab E

Date Tested	System Dipole		T.S. Liquid	Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.	
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W				
2/10/2015	D5GHzV2 (5.2 GHz)	1138	Body	1g	7.33	73.3	75.4	-2.79	
				10g	2.09	20.9	21.0	-0.48	
2/10/2015	D5GHzV2 (5.6 GHz)	1138	Body	1g	7.58	75.8	81.9	-7.45	7,8
				10g	2.11	21.1	22.6	-6.64	
2/10/2015	D5GHzV2 (5.8 GHz)	1138	Body	1g	7.05	70.5	75.2	-6.25	
				10g	1.98	19.8	20.8	-4.81	
3/10/2015	D5GHzV2 (5.6 GHz)	1138	Body	1g	7.82	78.20	81.9	-4.52	
				10g	2.19	21.90	22.6	-3.10	
3/12/2015	D5GHzV2 (5.2 GHz)	1138	Body	1g	7.06	70.60	75.4	-6.37	
				10g	2.02	20.20	21.0	-3.81	
3/12/2015	D5GHzV2 (5.8 GHz)	1138	Body	1g	7.71	77.10	75.2	2.53	
				10g	2.18	21.80	20.8	4.81	
3/13/2015	D2450V2	706	Body	1g	5.27	52.70	50.2	4.98	9,10
				10g	2.45	24.50	23.4	4.70	

SAR Lab G

Date Tested	System Dipole		T.S. Liquid	Measured Results		Target (Ref. Value)	Delta ±10 %	Plot No.	
	Type	Serial #		Zoom Scan to 100 mW	Normalize to 1 W				
2/16/2015	D2450V2	706	Body	1g	4.85	48.5	50.2	-3.39	11,12
				10g	2.24	22.4	23.4	-4.27	

9. Conducted Output Power Measurements

9.1. Wi-Fi 2.4GHz

Max Power

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)		
2.4	802.11b	1 Mbps	1	2412	17.1	17.5	Yes			
			6	2437	17.5					
			11	2462	17.4					
			12	2467	Not Required	4.5			No	2
			13	2472		3.5				
	802.11g	6 Mbps	1	2412	Not Required	14.5	No	1		
			6	2437						
			11	2462						
			12	2467		4.5			No	2
			13	2472		1.5				
	802.11n (HT20)	MCS0	1	2412	Not Required	13.5	No	1		
			6	2437						
			11	2462						
12			2467	4.5		No			2	
13			2472	1.5						

With Power Back-Off

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)		
2.4	802.11b	1 Mbps	1	2412	9.3	10.5	Yes			
			6	2437	10.0					
			11	2462	9.8					
			12	2467	Not Required	4.5			No	2
			13	2472		3.5				
	802.11g	6 Mbps	1	2412	Not Required	10.5	No	1		
			6	2437						
			11	2462						
			12	2467		4.5			No	2
			13	2472		1.5				
	802.11n (HT20)	MCS0	1	2412	Not Required	10.5	No	1		
			6	2437						
			11	2462						
12			2467	4.5		No			2	
13			2472	1.5						

Note(s):

Per KDB 248227 D01 v02:

- Output Power and SAR is not required for 802.11g/n HT20 channels when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
- Additionally, SAR is not required for Channels 12 and 13 because the tune-up limit and the measured output power for these two channels are no greater than those for the default test channels.

9.2. Wi-Fi 5GHz

Max Power

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
5.2 (U-NII 1)	802.11a	6 Mbps	36	5180	11.6	12.5	No	3
			40	5200	11.2			
			44	5220	12.0			
			48	5240	12.5			
	802.11n (HT20)	6.5 Mbps	36	5180	11.6	12.5	No	3
			40	5200	11.3			
			44	5220	12.3			
			48	5240	12.4			
	802.11n (HT40)	13.5 Mbps	38-46	5190 - 5230	Not Required	10.5	No	1
5.3 (U-NII 2A)	802.11a	6 Mbps	52	5260	12.3	12.5	Yes	
			56	5280	12.5			
			60	5300	11.7			
			64	5320	11.9			
	802.11n (HT20)	6.5 Mbps	52	5260	12.4	12.5	No	2
			56	5280	12.5			
			60	5300	11.8			
			64	5320	12.0			
	802.11n (HT40)	13.5 Mbps	54-62	5270 - 5310	Not Required	10.5	No	1
5.5 (U-NII 2C)	802.11a	6 Mbps	100	5500	12.2	12.5	Yes	
			116	5580	12.5			
			124	5620	Not Supported			
			140	5700	12.5			
	802.11n (HT20)	6.5 Mbps	100	5500	12.3	12.5	No	2
			116	5580	12.2			
			124	5620	Not Supported			
			140	5700	11.8			
	802.11n (HT40)	13.5 Mbps	102-134	5510-5670	Not Required	10.5	No	1
5.8 (U-NII 3)	802.11a	6 Mbps	149	5745	12.4	12.5	Yes	
			157	5785	12.3			
			165	5825	12.5			
	802.11n (HT20)	6.5 Mbps	149	5745	12.4	12.5	No	2
			157	5785	12.2			
			165	5825	11.5			
	802.11n (HT40)	13.5 Mbps	151-159	5755-5795	Not Required	10.5	No	1

Note(s):

- Output Power and SAR is not required for 802.11n HT20/HT40 channels when the specified tune-up tolerances for 802.11n HT20/HT40 are lower than 802.11a by more than ½ dB and the measured SAR is ≤ 1.2 W/Kg.
- When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n then ac) is selected.
- When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest reported SAR for UNII band 2A is
 - ≤ 1.2 W/kg, SAR is not required for UNII band I
 - > 1.2 W/kg, both bands should be tested independently for SAR.

With Power Back-Off

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)	Note(s)
5.2 (U-NII 1)	802.11a	6 Mbps	36-48	5180-5240	Not Required	9.5	No	
	802.11n (HT20)	6.5 Mbps	36-48	5180 - 5240		9.5	No	1
	802.11n (HT40)	13.5 Mbps	38	5190	8.8	9.5	No	2
			46	5230	9.1			
5.3 (U-NII 2A)	802.11a	6 Mbps	52-64	5260-5320	Not required	9.5	No	
	802.11n (HT20)	6.5 Mbps	52-64	5260 - 5320		9.5	No	1
	802.11n (HT40)	13.5 Mbps	54	5270	9.5	9.5	Yes	1
			62	5310	8.8			
5.5 (U-NII 2C)	802.11a	6 Mbps	100-140	5500-5700	Not Required	9.5	No	
	802.11n (HT20)	6.5 Mbps	100-140	5500-5700		9.5	No	1
	802.11n (HT40)	13.5 Mbps	102	5510	9.5	9.5	Yes	1
			110	5550	9.5			
			134	5670	9.5			
5.8 (U-NII 3)	802.11a	6 Mbps	149-165	5745-5825	Not Required	9.5	No	
	802.11n (HT20)	6.5 Mbps	149-165	5745-5825		9.5	No	1
	802.11n (HT40)	13.5 Mbps	151	5755	8.7	9.5	Yes	1
			159	5795	8.7			

Note(s):

1. Output Power and SAR is not required for 802.11a and 802.11n HT20 channels because the specified tune-up tolerances for 802.11a and 802.11n HT20 are lower than or equal to 802.11n HT40 and the measured SAR is ≤ 1.2 W/Kg.
2. When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest *reported* SAR for UNII band 2A is
 - a. ≤ 1.2 W/kg, SAR is not required for UNII band I
 - b. > 1.2 W/kg, both bands should be tested independently for SAR.

9.3. Bluetooth

Band (GHz)	Mode	Ch #	Freq. (MHz)	Avg Pwr (dBm)
2.4	V3.0 + EDR, GFSK	0	2402	10.5
		39	2441	10.4
		78	2480	8.9
	V3.0 + EDR, $\pi/4$ DQPSK	0	2402	8.3
		39	2441	8.3
		78	2480	6.7
	V3.0 + EDR, 8-DPSK	0	2402	8.3
		39	2441	8.3
		78	2480	6.7
	V4.1 LE, GFSK	0	2402	2.7
		19	2440	2.9
		39	2480	1.7

10. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

KDB 248227 D01 SAR meas for 802.11 v02:

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the initial test position(s) by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The initial test position(s) is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the reported SAR for the initial test position is:

- ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions are tested.
 - For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
 - When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required test channels are considered.
 - The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.
- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

To determine the initial test position, Area Scans were performed to determine the position with the *Maximum Value of SAR (measured)*. The position that produced the highest *Maximum Value of SAR* is considered the worst case position; thus used as the initial test position.

10.1. Wi-Fi (DTS Band)

Frequency Band	Mode	Pwr Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Notes	Plot No.
								Tune-up limit	Meas.	Meas.	Scaled		
2.4GHz	802.11b 1 Mbps	ON	0	Rear	6	2437	0.531	10.5	10.0	0.389	0.436		
				Edge 1	6	2437	0.068	10.5	10.0	0.049	0.055	2	
		OFF	6	Rear	6	2437	1.460	17.5	17.5	1.020	1.020		1
					11	2462		17.5	17.4	0.944	0.966	3	
			0	Edge 1	6	2437	0.452						
			0	Edge 2	6	2437	0.467	17.5	17.5	0.338	0.338	2	

Note(s):

1. Highest reported SAR is ≤ 0.4 W/kg. Therefore, further SAR measurements within this exposure condition are not required.
2. Highest reported SAR is > 0.4 W/kg. Due to the highest reported SAR for this test position, other test positions in this exposure condition were evaluated until a SAR ≤ 0.8 W/kg was reported.
3. Testing for a second channel was required because the reported SAR for this test position was >0.8 W/kg.
4. Additional testing required in order satisfying FCC simultaneous transmission limit criteria.

10.2. Wi-Fi (U-NII Band)

Frequency Band	Mode	Pwr Back-off	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Notes	Plot No.	
								Tune-up limit	Meas.	Meas.	Scaled			
5.3 GHz U-NII 2A	802.11n HT40	ON	0	Rear	54	5270	0.730	9.5	9.5	0.557	0.557			
				Edge 1	54	5270	0.680	9.5	9.5	0.369	0.369	2		
	802.11a 6 Mbps	OFF	6	Rear	56	5280	0.894	12.5	12.5	0.625	0.625	2	2	
				0	Edge 1	56	5280	1.170	12.5	12.5	0.607	0.607		
5.5 GHz U-NII 2C	802.11n HT40	ON	0	Rear	110	5550	2.190	9.5	9.5	1.020	1.020			
					134	5670		9.5	9.5	1.040	1.040	3	3	
				Edge 1	110	5550	1.140	9.5	9.5	0.794	0.794	2		
	802.11a 6 Mbps	OFF	6	Rear	116	5580	0.838	12.5	12.5	0.582	0.582	2		
				0	Edge 1	116	5580	1.810	12.5	12.5	0.455	0.455		
				0	Edge 2	116	5580	0.359						
5.8 GHz U-NII 3	802.11n HT40	ON	0	Rear	151	5755.0		9.5	8.7	0.825	0.992	3	4	
					159	5795.0	1.500	9.5	8.7	0.788	0.947			
				Edge 1	159	5795.0	0.689	9.5	8.7	0.544	0.654	2		
	802.11a 6 Mbps	OFF	6	Rear	165	5825.0	0.800	12.5	12.5	0.559	0.559	2		
				0	Edge 1	165	5825.0	0.637	12.5	12.5	0.333	0.333		
				0	Edge 2	165	5825.0	0.215						

Note(s):

1. Highest reported SAR is ≤ 0.4 W/kg. Therefore, further SAR measurements within this exposure condition are not required.
2. Highest reported SAR is > 0.4 W/kg. Due to the highest reported SAR for this test position, other test positions in this exposure condition were evaluated until a SAR ≤ 0.8 W/kg was reported.
3. Testing for a second channel was required because the reported SAR for this test position was >0.8 W/kg.
4. Additional testing required in order satisfying FCC simultaneous transmission limit criteria.

10.3. Bluetooth

Frequency Band	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Power (dBm)		1-g SAR (W/kg)		Plot No.
							Tune-up limit	Meas.	Meas.	Scaled	
2.4 GHz	GFSK	0	Rear	0	2402	0.516	10.5	10.5	0.446	0.446	5
			Edge 1	0	2402	0.078	10.5	10.5	0.066	0.066	

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 < 0.80 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 .

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	Repeated Measured SAR (W/kg)	Largest to Smallest SAR Ratio
2400	Wi-Fi 802.11b/g/n	Standalone	Rear	Yes	1.020	0.997	1.02
	Bluetooth	Standalone	Rear	No	0.446	N/A	N/A
5300	Wi-Fi 802.11a/n	Standalone	Edge 1	No	N/A	N/A	N/A
5500	Wi-Fi 802.11a/n	Standalone	Rear	Yes	1.040	1.020	1.02
5800	Wi-Fi 802.11a/n	Standalone	Rear	Yes	0.825	0.817	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 not > 1.20 .

12. Simultaneous Transmission SAR Analysis

N/A

Wi-Fi 2.4 & 5GHz Radio cannot transmit simultaneously with Bluetooth Radio.

Appendixes

Refer to separated files for the following appendixes.

A_15I19879v2 SAR Photos & Ant. Locations

B_15I19879v1 SAR System Check Plots

C_15I19879v1 SAR Highest Test Plots

D_15I19879v0 SAR Tissue Ingredients

E_15I19879v1 SAR Probe Cal. Certificates

F_15I19879v0 SAR Dipole Cal. Certificates

END OF REPORT