



**FCC 47 CFR Parts 1 & 2
Published RF Exposure KDB Procedures
IEEE Std 1528-2003 and IEEE 1528a-2005**

SAR EVALUATION REPORT

For
Tablet with IEEE 802.11a/b/g/n (MIMO 2X2) and Bluetooth radio

**Model: A1489
FCC ID: BCGA1489**

**Report Number: 13U15668-13A
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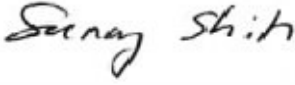
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1. Attestation of Test Results

Applicant	Apple Inc.			
DUT description	Tablet with IEEE 802.11a/b/g/n (MIMO 2X2) and Bluetooth radio			
Model	A1489			
Test device is	An identical prototype			
Device category	Portable			
Exposure category	General Population/Uncontrolled Exposure			
Date tested	8/12/2013 – 8/30/2013			
The highest reported SAR values	RF exposure condition	Licensed	DTS	UNII
	Body	N/A W/kg	1.170 W/kg (2.4GHz) 1.110 W/kg (5.8GHz)	1.190 W/kg
	Simultaneous Transmission	N/A W/kg	1.377 W/kg	1.457 W/kg
Applicable Standards	FCC 47 CFR Parts 1 & 2 Published RF Exposure KDB Procedures, and TCB workshop updates IEEE Std 1528-2003 and IEEE Std 1528a-2005			
Test Results	Pass			
UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report. Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government (NIST Handbook 150, Annex A). This report is written to support regulatory compliance of the applicable standards stated above.				
Approved & Released By:		Prepared By:		
				
Sunny Shih WiSE Operations Manager UL Verification Services Inc.		Bobby Bayani WiSE Engineer UL Verification Services Inc.		

2. Test Methodology

The tests documented in this report were performed in accordance with FCC 47 CFR Parts 1 & 2, IEEE STD 1528-2003, IEEE Std 1528a-2005, the following FCC Published RF exposure KDB procedures and TCB workshop updates:

- o KDB 447498 D01 General RF Exposure Guidance v05r01
- o KDB 616217 D04 SAR for laptop and tablets v01r01
- o KDB 248227 D01 SAR meas for 802 11abg v01r02
- o KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r01
- o KDB 865664 D02 SAR Reporting v01r01
- o KDB 690783 D01 SAR Listings on Grants v01r02

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at 18920 Forge Drive, Cupertino, California, USA.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

4. Calibration and Uncertainty

4.1. Measuring Instrument Calibration

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.

Tissue Dielectric Properties

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
S-Parameter Network Analyzer	Agilent	N5230C	MY49001813	4/30/2014
Thermometer	Control Company	4353	122102412	2/24/2014
Dielectronic Probe kit	SPEAG	DAK-3.5	1055	4/30/2014

System Performance Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Vector Signal Generator	R & S	SMU200A	104592	7/27/2014
Vector Signal Generator	R & S	SMU200A	104591	7/26/2014
Power Meter	R & S	NRP2	102822	6/18/2014
Power Meter	R & S	NRP2	102823	6/18/2014
Power Sensor	R & S	NRP - Z81	112143	6/18/2014
Power Sensor	R & S	NRP - Z81	112142	6/18/2014
Amplifier	Amplifier Research	15S1G4M41, 0.7-4.2 GHz	335565	N/A
Amplifier	Amplifier Research	35S4G8A, 4-8 GHz	336934	N/A
Amplifier	Amplifier Research	15S1G4M41, 0.7-4.2 GHz	320316	N/A
Amplifier	Amplifier Research	35S4G8A, 4-8 GHz	341209	N/A
Directional coupler	KRYTAR	158010	142253	N/A
Directional coupler	KRYTAR	158010	92552	N/A
E-Field Probe	SPEAG	EX3DV4	3778	1/14/2014
E-Field Probe	SPEAG	EX3DV4	3720	1/14/2014
E-Field Probe	SPEAG	EX3DV4	3871	7/29/2014
E-Field Probe	SPEAG	EX3DV4	3676	1/14/2014
Data Acquisition Electronics	SPEAG	DAE4	1263	1/14/2014
Data Acquisition Electronics	SPEAG	DAE4	1264	1/14/2014
Data Acquisition Electronics	SPEAG	DAE4	1261	1/16/2014
Data Acquisition Electronics	SPEAG	DAE4	1278	1/30/2014
System Validation Dipole	SPEAG	D2450V2	900	10/5/2013
System Validation Dipole	SPEAG	D5GHzV2	1139	10/9/2013
System Validation Dipole	SPEAG	D5GHzV2	1072	2/8/2014

Others

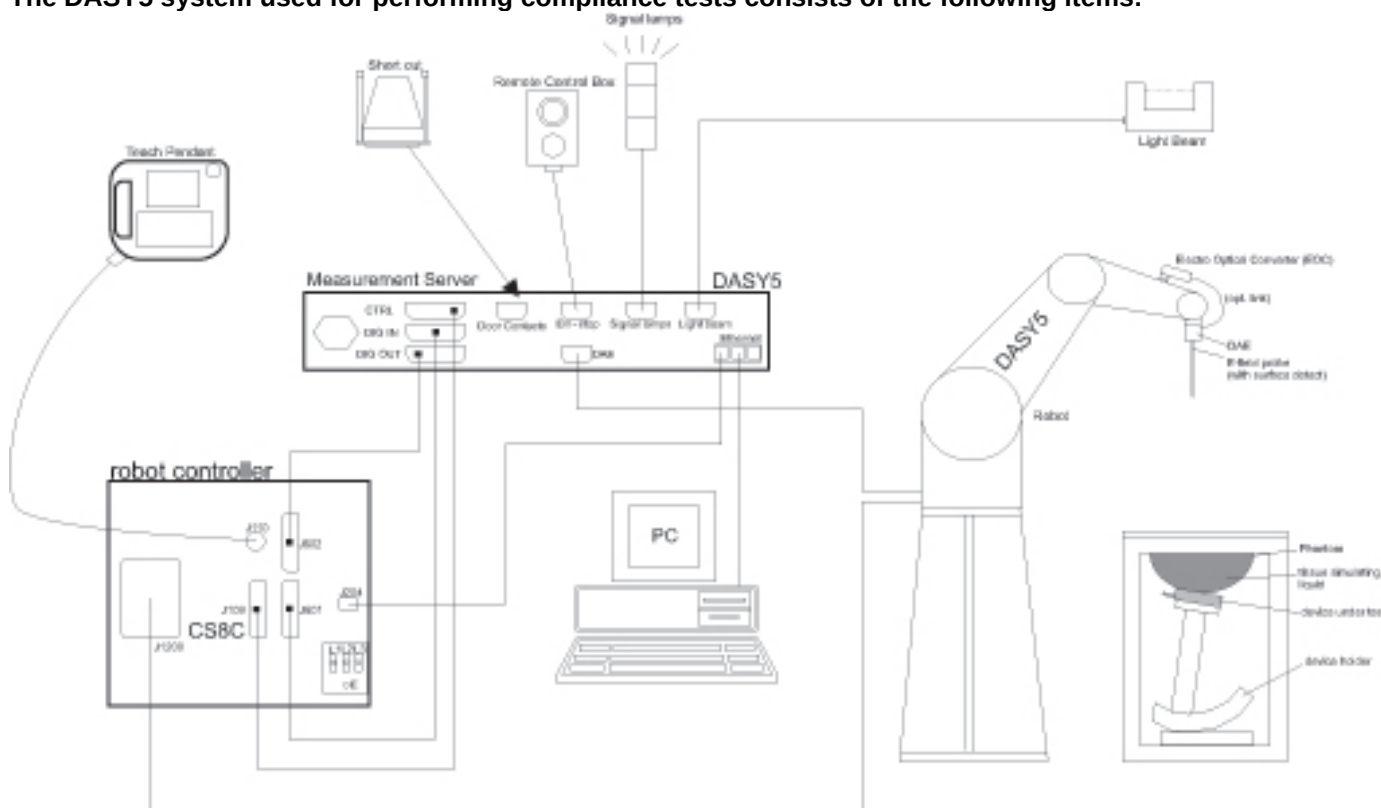
Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	R & S	NRP2	101663	4/24/2014
Power Meter	R & S	NRP2	101664	4/24/2014
Power Sensor	R & S	NRP - Z81	101298	4/24/2014
Power Sensor	R & S	NRP - Z81	112138	4/26/2014

4.2. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01 Section 2.8.1., 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 is not required in SAR reports submitted for equipment approval.

5. Measurement System Description and Setup

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.

6. SAR Measurement Procedure

6.1. Normal SAR Measurement 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 v01r01

	≤ 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 v01r01

			≤ 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 <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.

6.2. Volume Scan Procedures

Step 1: Repeat Step 1-4 in Section 6.1

Step 2: Volume Scan

Volume Scans are used to assess peak SAR and averaged SAR measurements in largely extended 3-dimensional volumes within any phantom. This measurement does not need any previous area scan. The grid can be anchored to a user specific point or to the current probe location.

Step 3: 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.

7. Device Under Test

7.1. General Information

Model A1489 is a tablet with multimedia functions (music, application support, and video), IEEE 802.11a/b/g/n, MIMO 2x2, Bluetooth radio	
AirPlay	AirPlay mode enabled devices transfer data directly between each other ☒ AirPlay (WiFi 2.4 GHz) ☒ AirPlay (WiFi 5 GHz)
RF Exposure Condition(s)	Body Exposure with all surfaces and edges. Refer to Section 9 for details.
Device dimension	Overall (Length x Width): 200.14mm x 134.75mm Overall Diagonal: 230mm Display Diagonal: 200mm

Notes:

There are two vendors of the Wi-Fi/Bluetooth radio modules to support the production volumes of the device. The two variants are referenced in this report as:

BOM #1 = Wi-Fi/BT module vendor 1

BOM #2 = Wi-Fi/BT module vendor 2

The Wi-Fi/Bluetooth radio modules have the same mechanical outline (e.g., the same package dimension and pin-out layout), use the same on-board antenna matching circuit, have an identical antenna structure, and are built and tested to conform to the same specifications and to operate within the same tolerances.

Complete SAR evaluation is performed on the device with one Wi-Fi/Bluetooth radio module and then, the test is repeated on the device with the other Wi-Fi/Bluetooth module at the highest peak SAR value.

7.2. Wireless Technologies

Wireless Technology and Frequency Bands	WiFi: 2.4 / 5 GHz Bluetooth: 2.4 GHz.
Mode	WiFi 2.4GHz (802.11b/g/n) - ☒ 802.11b - ☒ 802.11g - ☒ 802.11n (20MHz) - ☐ 802.11n (40MHz) WiFi 5GHz - ☒ 802.11a - ☒ 802.11n (20MHz) - ☒ 802.11n (40MHz) Bluetooth Ver. 4.0 (LE)
Duty Cycle	WiFi 802.11a/b/g/n: 100% Bluetooth: 77.52% (GFSK)

7.3. Simultaneous Transmission Condition

RF Exposure Condition	Capable Transmit Configurations
Body	SISO (1TX) 1. 5GHz (WiFi1) + BT (WiFi1) 2. 5GHz (WiFi2) + BT (WiFi1) MIMO (2TX) 3. DTS 5GHz (WiFi1+WiFi2) + BT (WiFi1) 4. UNII 5GHz (WiFi1+WiFi2) + BT (WiFi1)
Refer to Appendix for WiFi 1 and WiFi 2 antenna locations. 2.4 GHz cannot transmit simultaneously with Bluetooth.	

8. RF Output Power Measurement

8.1. Wi-Fi (2.4 GHz Band)

Required Test Channels per KDB 248227 D01

Mode	Band	GHz	Channel	"Default Test Channels"	
				802.11b	802.11g
802.11b/g	2.4 GHz	2.412	1 [#]	√	▽
		2.437	6	√	▽
		2.462	11 [#]	√	▽

Notes:

√ = "default test channels"

▽ = possible 802.11g channels with maximum average output ¼ dB ≥ the "default test channels"

[#] = when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

Measured Results

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Avg Pwr (dBm)		SAR Test (Yes/No)
					Wi-Fi 1	Wi-Fi 2	
2.4 (DTS)	802.11b	1 Tx	1	2412	16.5	16.3	Yes
			6	2437	16.5	16.5	
			11	2462	16.5	16.0	
			12	2467	15.5	15.5	
			13	2472	14.5	14.5	
	802.11g	1 Tx	1	2412	16.0	16.0	No
			2	2417	16.5	16.5	
			6	2437	16.5	16.5	
			10	2457	16.5	16.5	
			11	2462	15.5	15.5	
			12	2467	11.5	11.5	
			13	2472	4.0	4.0	
	802.11g CDD	2 Tx	1	2412	15.0	15.0	Yes
			2	2417	16.5	16.4	
			6	2437	16.5	16.4	
			10	2457	16.5	16.3	
			11	2462	14.5	14.5	
			12	2467	9.5	9.5	
			13	2472	2.0	2.0	

Note(s):

- Per KDB 248227 D01, SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.
- 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.

Wi-Fi 2.4 GHz Measured Results continued

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Avg Pwr (dBm)		SAR Test (Yes/No)
					Wi-Fi 1	Wi-Fi 2	
2.4 (DTS)	802.11n HT20	1 Tx	1	2412	16.0	16.0	No
			2	2422	16.5	16.4	
			6	2437	16.5	16.4	
			10	2457	16.5	16.5	
			11	2462	16.5	16.5	
			12	2467	11.5	11.5	
			13	2472	4.0	4.0	
	802.11n HT MCS0 CDD	2 Tx	1	2412	15.0	15.0	No
			2	2417	16.5	16.5	
			6	2437	16.5	16.5	
			10	2457	16.5	16.5	
			11	2462	14.5	14.5	
			12	2467	9.5	9.5	
			13	2472	2.0	2.0	
	802.11n HT20 MCS0 STBC	2 Tx	1	2412	15.0	15.0	No
			2	2417	16.5	16.5	
			6	2437	16.5	16.5	
			10	2457	16.5	16.5	
			11	2462	14.5	14.5	
			12	2467	9.5	9.5	
			13	2472	2.0	2.0	
	802.11n HT20 MCS0 SDM	2 Tx	1	2412	15.0	15.0	No
			2	2417	16.5	16.5	
			6	2437	16.5	16.5	
			10	2457	16.5	16.4	
			11	2462	14.5	14.5	
			12	2467	9.5	9.5	
			13	2472	2.0	2.0	

Note(s):

1. Per KDB 248227 D01, SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.
2. 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.

8.2. Wi-Fi (5 GHz Bands)

Required Test Channels per KDB 248227 D01

Mode		Band	GHz	Channel	"Default Test Channels"	
					802.11a	
802.11a	UNII (15.407)	5.2 GHz	5.180	36	√	
			5.200	40		*
			2.220	44		*
			5.240	48	√	
		5.3 GHz	5.260	52	√	
			5.280	56		*
			5.300	60		*
			5.320	64	√	
		5.5 GHz	5.500	100		
			5.520	104	√	
			5.540	108		*
			5.560	112		*
			5.580	116	√	
			5.600	120		*
			5.620	124	√	
			5.640	128		*
			5.660	132		*
			5.680	136	√	
			5.700	140		*
	DTS (15.247)	5.8 GHz	5.745	149	√	
			5.765	153		*
			5.785	157	√	
			5.805	161		*
			5.825	165	√	

√ = "default test channels"

* = possible 802.11a channels with maximum average output > the "default test channels"

= when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

Wi-Fi 5 GHz Bands Measured Results

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Avg Pwr (dBm)		SAR Test (Yes/No)
					Wi-Fi 1	Wi-Fi 2	
5.2 (UNII)	802.11a	1 Tx	36	5180	14.0	14.0	Yes
			40	5200	14.0	14.0	
			44	5220	14.0	14.0	
			48	5240	14.0	14.0	
	802.11a CDD	2 Tx	36	5180	11.0	10.9	Yes
			40	5200	11.0	10.9	
			44	5220	11.0	11.0	
			48	5240	11.0	11.0	
	802.11n HT20 SISO	1 Tx	36	5180	14.0	13.9	No
			40	5200	14.0	14.0	
	802.11n HT40 SISO	1 Tx	38	5180	13.5	13.5	No
			46	5230	16.0	16.0	Yes
	802.11n HT20 CDD	2 Tx	36	5180	10.9	11.0	No
			40	5200	10.9	11.0	
	802.11n HT20 STBC	2 Tx	36	5180	11.0	11.0	No
			40	5200	11.0	10.9	
	802.11n HT20 SDM	2 Tx	48	5240	11.0	11.0	No
			36	5180	11.0	11.0	
	802.11n HT40 CDD	2 Tx	38	5190	11.5	11.4	Yes
			46	5230	13.5	13.4	
5.3 (UNII)	802.11a	1 Tx	52	5260	16.0	16.0	Yes
			56	5280	16.0	16.0	
			60	5300	16.0	16.0	
			64	5320	15.0	15.0	
	802.11a CDD	2 Tx	52	5260	16.0	16.0	Yes
			56	5280	16.0	16.0	
			60	5300	16.0	16.0	
			64	5320	14.0	14.0	
	802.11n HT20 SISO	1 Tx	52	5260	16.0	15.9	No
			60	5300	16.0	16.0	
	802.11n HT40 SISO	1 Tx	64	5320	15.0	15.0	No
			54	5270	15.9	16.0	
	802.11n HT20 CDD	2 Tx	62	5310	14.5	14.5	No
			52	5260	15.9	16.0	
			56	5280	15.9	16.0	
			60	5300	16.0	16.0	
	802.11n HT20 STBC	2 Tx	64	5320	14.0	14.0	No
			52	5260	16.0	16.0	
			56	5280	16.0	16.0	
			60	5300	16.0	16.0	
	802.11n HT20 SDM	2 Tx	64	5320	14.0	14.0	No
			52	5260	16.0	16.0	
			56	5280	16.0	16.0	
			60	5300	15.9	16.0	
	802.11n HT40 CDD	2 Tx	64	5320	14.0	14.0	No
			54	5270	16.0	16.0	
	802.11n HT40 STBC	2 Tx	62	5310	12.5	12.5	No
			54	5270	16.0	16.0	
	802.11n HT40 SDM	2 Tx	62	5310	12.5	12.5	No
			54	5270	15.9	16.0	

Note(s):

Per KDB 248227, SAR is not required for 802.11n HT20/HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a/b channels.

Wi-Fi 5 GHz Bands Measured Results continued

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Avg Pwr (dBm)		SAR Test (Yes/No)
					Wi-Fi 1	Wi-Fi 2	
5.5 (UNII)	802.11a	1 Tx	100	5500	14.0	14.0	Yes
			104	5520	15.5	15.5	
			108	5540	15.4	15.5	
			112	5560	15.4	15.5	
			116	5580	15.5	15.5	
			120	5600	15.5	15.5	
			124	5620	15.5	15.5	
			128	5640	15.4	15.5	
			132	5660	15.5	15.5	
			136	5680	15.5	15.5	
	802.11a CDD	2 Tx CDD	140	5700	14.0	14.0	Yes
			100	5500	13.5	13.5	
			104	5520	15.5	15.5	
			108	5540	15.5	15.4	
			112	5560	15.5	15.5	
			116	5580	15.4	15.5	
			120	5600	15.5	15.5	
			124	5620	15.5	15.5	
			128	5640	15.5	15.4	
			132	5660	15.5	15.5	
	802.11n HT20 SISO	1 Tx	136	5680	15.5	15.5	No
			140	5700	13.0	13.0	
			100	5500	14.0	14.0	
			104	5520	15.4	15.5	
	802.11n HT40 SISO	1 Tx	120	5600	15.5	15.5	No
			134	5670	15.5	15.5	
			110	5550	15.5	15.5	
	802.11n HT20 CDD	2 Tx	102	5510	14.0	14.0	No
			100	5500	13.5	13.5	
			104	5520	15.5	15.4	
			120	5600	15.5	15.5	
			136	5680	15.5	15.5	
	802.11n HT20 STBC	2 Tx	140	5700	13.0	13.0	No
			100	5500	13.5	13.5	
			104	5520	15.5	15.4	
			120	5600	15.5	15.5	
	802.11n HT20 SDM	2 Tx	136	5680	15.5	15.5	No
			140	5700	13.0	13.0	
			100	5500	13.5	13.5	
			104	5520	15.5	15.5	
			120	5600	15.5	15.5	
	802.11n HT40 CDD	2 Tx	136	5680	15.5	15.5	No
			140	5700	13.0	13.0	
			102	5510	12.0	12.0	
	802.11n HT40 STBC	2 Tx	110	5550	15.5	15.5	No
			134	5670	15.0	15.0	
			102	5510	12.0	12.0	
	802.11n HT40 SDM	2 Tx	110	5550	15.5	15.5	No
			134	5670	15.0	15.0	
			102	5510	12.0	12.0	

Note(s):

Per KDB 248227, SAR is not required for 802.11n HT20/HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a/b channels.

Wi-Fi 5 GHz Bands Measured Results continued

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Avg Pwr (dBm)		SAR Test (Yes/No)
					Wi-Fi 1	Wi-Fi 2	
5.8 (DTS)	802.11a	1 Tx	149	5745	15.5	15.5	Yes
			153	5765	15.4	15.5	
			157	5785	15.5	15.5	
			161	5805	15.5	15.4	
			165	5825	15.5	15.5	
	802.11a CDD	2 Tx CDD	149	5745	15.5	15.5	Yes
			153	5765	15.4	15.5	
			157	5785	15.5	15.5	
			161	5805	15.5	15.5	
			165	5825	15.5	15.5	
	802.11n HT20 SISO	1 Tx	149	5745	15.5	15.5	No
			157	5785	15.5	15.5	
			165	5825	15.5	15.5	
	802.11n HT40	1 Tx	151	5755	15.4	15.5	No
			159	5795	15.5	15.4	
	802.11n HT20 CDD	2 Tx	149	5745	15.4	15.5	No
			157	5785	15.4	15.5	
			165	5825	15.5	15.5	
	802.11n HT20 STBC	2 Tx	149	5745	15.5	15.5	No
			157	5785	15.5	15.5	
			165	5825	15.5	15.5	
	802.11n HT20 SDM	2 Tx	149	5745	15.4	15.5	No
			157	5785	15.5	15.5	
			165	5825	15.5	15.5	
	802.11n HT40 CDD	2 Tx	151	5755	15.4	15.5	No
			159	5795	15.5	15.5	
	802.11n HT40 STBC	2 Tx	151	5755	15.5	15.5	No
			159	5795	15.5	15.5	
	802.11n HT40 SDM	2 Tx	151	5755	15.5	15.5	No
			159	5795	15.5	15.5	

Note(s):

Per KDB 248227, SAR is not required for 802.11n HT20/HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a/b channels.

8.3. Bluetooth

Band (GHz)	Mode	Channel #	Freq. (MHz)	Avg Pwr (dBm)	SAR Test (Yes/No)
2.4 (DTS)	V3.0 + EDR, GFSK	0	2402	11.8	Yes
		39	2441	11.8	
		78	2480	11.8	
	V3.0 + EDR, $\pi/4$ DQPSK	0	2402	10.0	No
		39	2441	10.0	
		78	2480	10.0	
	V3.0 + EDR, 8-DPSK	0	2402	10.0	No
		39	2441	10.0	
		78	2480	10.0	
	V4.0 LE, GFSK	0	2402	8.0	No
		19	2440	8.0	
		39	2480	8.0	

9. Exposure Conditions

9.1. 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.

Refer to Appendix for the specific details on the antenna-to-antenna and antenna-to-edge(s) distances used for test exclusion calculations.

9.1.1. SAR Test Exclusion Calculations for Wi-Fi SISO (1 Tx) Transmit Conditions

Antennas < 50 mm to adjacent edges

Antenna	Tx Interface	Frequency (M Hz)	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
WiFi 1 / Bluetooth																
WiFi 1	Wi-Fi 2.4 GHz	2462	16.50	45	6.5	1813	93.5	5	9.8		10.1 -MEASURE-	>50 mm	>50 mm	14.1 -MEASURE-	7.1 -MEASURE-	N/A
WiFi 1	Wi-Fi 5.2 GHz	5240	14.00	25	6.5	1813	93.5	5	9.8		8.2 -MEASURE-	>50 mm	>50 mm	11.4 -MEASURE-	5.7 -MEASURE-	N/A
WiFi 1	Wi-Fi 5.3 GHz	5300	16.00	40	6.5	1813	93.5	5	9.8		13.2 -MEASURE-	>50 mm	>50 mm	18.4 -MEASURE-	9.2 -MEASURE-	N/A
WiFi 1	Wi-Fi 5.5 GHz	5680	15.50	35	6.5	1813	93.5	5	9.8		11.9 -MEASURE-	>50 mm	>50 mm	16.7 -MEASURE-	8.3 -MEASURE-	N/A
WiFi 1	Wi-Fi 5.8 GHz	5825	15.50	35	6.5	1813	93.5	5	9.8		12.1 -MEASURE-	>50 mm	>50 mm	16.9 -MEASURE-	8.4 -MEASURE-	N/A
WiFi 1	Bluetooth	2480	12.00	16	6.5	1813	93.5	5	9.8		3.6 -MEASURE-	>50 mm	>50 mm	5 -MEASURE-	3 -EXEMPT-	N/A
WiFi 2																
WiFi 2	Wi-Fi 2.4 GHz	2462	16.50	45	6.5	1911	14.4	5	93.5		10.1 -MEASURE-	>50 mm	5 -MEASURE-	14.1 -MEASURE-	>50 mm	N/A
WiFi 2	Wi-Fi 5.2 GHz	5240	14.00	25	6.5	1911	14.4	5	93.5		8.2 -MEASURE-	>50 mm	4.1 -MEASURE-	11.4 -MEASURE-	>50 mm	N/A
WiFi 2	Wi-Fi 5.3 GHz	5300	16.00	40	6.5	1911	14.4	5	93.5		13.2 -MEASURE-	>50 mm	6.6 -MEASURE-	18.4 -MEASURE-	>50 mm	N/A
WiFi 2	Wi-Fi 5.5 GHz	5680	15.50	35	6.5	1911	14.4	5	93.5		11.9 -MEASURE-	>50 mm	6 -MEASURE-	16.7 -MEASURE-	>50 mm	N/A
WiFi 2	Wi-Fi 5.8 GHz	5825	15.50	35	6.5	1911	14.4	5	93.5		12.1 -MEASURE-	>50 mm	6 -MEASURE-	16.9 -MEASURE-	>50 mm	N/A

Note(s):

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

Antennas > 50 mm 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 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Wi-Fi 1 / Bluetooth																
WiFi 1	Wi-Fi 2.4 GHz	2462	16.50	45	6.5	1813	93.5	5	9.8		< 50 mm	1408.6 mW -EXEMPT-	530.6 mW -EXEMPT-	< 50 mm	< 50 mm	N/A
WiFi 1	Wi-Fi 5.2 GHz	5240	14.00	25	6.5	1813	93.5	5	9.8		< 50 mm	1378.5 mW -EXEMPT-	500.5 mW -EXEMPT-	< 50 mm	< 50 mm	N/A
WiFi 1	Wi-Fi 5.3 GHz	5300	16.00	40	6.5	1813	93.5	5	9.8		< 50 mm	1378.2 mW -EXEMPT-	500.2 mW -EXEMPT-	< 50 mm	< 50 mm	N/A
WiFi 1	Wi-Fi 5.5 GHz	5680	15.50	35	6.5	1813	93.5	5	9.8		< 50 mm	1375.9 mW -EXEMPT-	497.9 mW -EXEMPT-	< 50 mm	< 50 mm	N/A
WiFi 1	Wi-Fi 5.8 GHz	5825	15.50	35	6.5	1813	93.5	5	9.8		< 50 mm	1375.2 mW -EXEMPT-	497.2 mW -EXEMPT-	< 50 mm	< 50 mm	N/A
WiFi 1	Bluetooth	2480	12.00	16	6.5	1813	93.5	5	9.8		< 50 mm	1408.3 mW -EXEMPT-	530.3 mW -EXEMPT-	< 50 mm	< 50 mm	N/A
Wi-Fi 2																
WiFi 2	Wi-Fi 2.4 GHz	2462	16.50	45	6.5	1911	14.4	5	93.5		< 50 mm	1506.6 mW -EXEMPT-	< 50 mm	< 50 mm	530.6 mW -EXEMPT-	N/A
WiFi 2	Wi-Fi 5.2 GHz	5240	14.00	25	6.5	1911	14.4	5	93.5		< 50 mm	1476.5 mW -EXEMPT-	< 50 mm	< 50 mm	500.5 mW -EXEMPT-	N/A
WiFi 2	Wi-Fi 5.3 GHz	5300	16.00	40	6.5	1911	14.4	5	93.5		< 50 mm	1476.2 mW -EXEMPT-	< 50 mm	< 50 mm	500.2 mW -EXEMPT-	N/A
WiFi 2	Wi-Fi 5.5 GHz	5680	15.50	35	6.5	1911	14.4	5	93.5		< 50 mm	1473.9 mW -EXEMPT-	< 50 mm	< 50 mm	497.9 mW -EXEMPT-	N/A
WiFi 2	Wi-Fi 5.8 GHz	5825	15.50	35	6.5	1911	14.4	5	93.5		< 50 mm	1473.2 mW -EXEMPT-	< 50 mm	< 50 mm	497.2 mW -EXEMPT-	N/A

Note(s):

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

9.1.2. SAR Test Exclusion Calculations for Wi-Fi MIMO (2 Tx) Transmit Conditions

Antennas < 50mm to adjacent edges

Antenna	Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Calculated Threshold Value					
					Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Wi-Fi 1																
WiFi 1	Wi-Fi 2.4 GHz	2457	16.50	45	6.5	1813	93.5	5	9.8		10.1 -MEASURE-	>50 mm	>50 mm	14.1 -MEASURE-	7.1 -MEASURE-	N/A
WiFi 1	Wi-Fi 5.2 GHz	5230	13.50	22	6.5	1813	93.5	5	9.8		7.2 -MEASURE-	>50 mm	>50 mm	10.1 -MEASURE-	5 -MEASURE-	N/A
WiFi 1	Wi-Fi 5.3 GHz	5300	16.00	40	6.5	1813	93.5	5	9.8		13.2 -MEASURE-	>50 mm	>50 mm	18.4 -MEASURE-	9.2 -MEASURE-	N/A
WiFi 1	Wi-Fi 5.5 GHz	5680	15.50	35	6.5	1813	93.5	5	9.8		11.9 -MEASURE-	>50 mm	>50 mm	16.7 -MEASURE-	8.3 -MEASURE-	N/A
WiFi 1	Wi-Fi 5.8 GHz	5825	15.50	35	6.5	1813	93.5	5	9.8		12.1 -MEASURE-	>50 mm	>50 mm	16.9 -MEASURE-	8.4 -MEASURE-	N/A
Wi-Fi 2																
WiFi 2	Wi-Fi 2.4 GHz	2457	16.30	43	6.5	1911	14.4	5	93.5		9.6 -MEASURE-	>50 mm	4.8 -MEASURE-	13.5 -MEASURE-	>50 mm	N/A
WiFi 2	Wi-Fi 5.2 GHz	5230	13.50	22	6.5	1911	14.4	5	93.5		7.2 -MEASURE-	>50 mm	3.6 -MEASURE-	10.1 -MEASURE-	>50 mm	N/A
WiFi 2	Wi-Fi 5.3 GHz	5300	16.00	40	6.5	1911	14.4	5	93.5		13.2 -MEASURE-	>50 mm	6.6 -MEASURE-	18.4 -MEASURE-	>50 mm	N/A
WiFi 2	Wi-Fi 5.5 GHz	5680	15.50	35	6.5	1911	14.4	5	93.5		11.9 -MEASURE-	>50 mm	6 -MEASURE-	16.7 -MEASURE-	>50 mm	N/A
WiFi 2	Wi-Fi 5.8 GHz	5825	15.50	35	6.5	1911	14.4	5	93.5		12.1 -MEASURE-	>50 mm	6 -MEASURE-	16.9 -MEASURE-	>50 mm	N/A

Note(s):

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

Antennas > 50mm to adjacent edges

Antenna	Tx Interface	Frequency (MHz)	Output Power dBm mW		Separation Distances (mm)						Calculated Threshold Value					
					Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
WiFi 1																
WiFi 1	Wi-Fi 2.4 GHz	2457	16.50	45	6.5	18.13	93.5	5	9.8		< 50 mm	1408.7 mW -EXEMPT-	530.7 mW -EXEMPT-	< 50 mm	< 50 mm	N/A
WiFi 1	Wi-Fi 5.2 GHz	5230	13.50	22	6.5	18.13	93.5	5	9.8		< 50 mm	1378.6 mW -EXEMPT-	500.6 mW -EXEMPT-	< 50 mm	< 50 mm	N/A
WiFi 1	Wi-Fi 5.3 GHz	5300	16.00	40	6.5	18.13	93.5	5	9.8		< 50 mm	1378.2 mW -EXEMPT-	500.2 mW -EXEMPT-	< 50 mm	< 50 mm	N/A
WiFi 1	Wi-Fi 5.5 GHz	5680	15.50	35	6.5	18.13	93.5	5	9.8		< 50 mm	1375.9 mW -EXEMPT-	497.9 mW -EXEMPT-	< 50 mm	< 50 mm	N/A
WiFi 1	Wi-Fi 5.8 GHz	5825	15.50	35	6.5	18.13	93.5	5	9.8		< 50 mm	1375.2 mW -EXEMPT-	497.2 mW -EXEMPT-	< 50 mm	< 50 mm	N/A
WiFi 2																
WiFi 2	Wi-Fi 2.4 GHz	2457	16.30	43	6.5	19.11	14.4	5	93.5		< 50 mm	1506.7 mW -EXEMPT-	< 50 mm	< 50 mm	530.7 mW -EXEMPT-	N/A
WiFi 2	Wi-Fi 5.2 GHz	5230	13.50	22	6.5	19.11	14.4	5	93.5		< 50 mm	1476.6 mW -EXEMPT-	< 50 mm	< 50 mm	500.6 mW -EXEMPT-	N/A
WiFi 2	Wi-Fi 5.3 GHz	5300	16.00	40	6.5	19.11	14.4	5	93.5		< 50 mm	1476.2 mW -EXEMPT-	< 50 mm	< 50 mm	500.2 mW -EXEMPT-	N/A
WiFi 2	Wi-Fi 5.5 GHz	5680	15.50	35	6.5	19.11	14.4	5	93.5		< 50 mm	1473.9 mW -EXEMPT-	< 50 mm	< 50 mm	497.9 mW -EXEMPT-	N/A
WiFi 2	Wi-Fi 5.8 GHz	5825	15.50	35	6.5	19.11	14.4	5	93.5		< 50 mm	1473.2 mW -EXEMPT-	< 50 mm	< 50 mm	497.2 mW -EXEMPT-	N/A

Note(s):

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

9.2. Required Test Configurations

Based on Section 9.1, the test configurations required for this device were determined to be as follows:

Test Configurations	Wi-Fi 1 (SISO)	Wi-Fi 2 (SISO)	Wi-Fi 1 (MIMO)	Wi-Fi 2 (MIMO)
Rear	Yes	Yes	Yes	Yes
Edge 1 (Top)	No	No	No	No
Edge 2 (Right)	No	Yes	No	Yes
Edge 3 (Bottom)	Yes	Yes	Yes	Yes
Edge 4 (Left)	Yes	No	Yes	No

10. Tissue Dielectric Properties

IEEE Std 1528-2003 Table 2

Target Frequency (MHz)	Head	
	ϵ_r	σ (S/m)
300	45.3	0.87
450	43.5	0.87
835	41.5	0.90
900	41.5	0.97
1450	40.5	1.20
1800 – 2000	40.0	1.40
2450	39.2	1.80
2600	39.0	1.96
3000	38.5	2.40

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r01

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

10.1. Composition of Ingredients for the Tissue Material Used in the SAR Tests

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

Salt: 99+% Pure Sodium Chloride

Sugar: 98+% Pure Sucrose

Water: De-ionized, 16 MΩ+ resistivity

HEC: Hydroxyethyl Cellulose

DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100 (ultra pure): Polyethylene glycol mono [4-(1,1, 3, 3-tetramethylbutyl)phenyl]ether

Simulating Liquids for 5 GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

10.2. Tissue Dielectric Parameter Check Results

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.

LAB A

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
8/12/2013	Body 5180	e'	47.5700	Relative Permittivity (ϵ_r):	47.57	49.05	-3.01	5
		e"	18.4800	Conductivity (σ):	5.32	5.27	0.97	5
	Body 5200	e'	47.5700	Relative Permittivity (ϵ_r):	47.57	49.02	-2.96	5
		e"	18.5200	Conductivity (σ):	5.35	5.29	1.14	5
	Body 5500	e'	47.1100	Relative Permittivity (ϵ_r):	47.11	48.61	-3.09	5
		e"	18.7200	Conductivity (σ):	5.72	5.64	1.43	5
	Body 5800	e'	46.6700	Relative Permittivity (ϵ_r):	46.67	48.20	-3.17	5
		e"	18.9800	Conductivity (σ):	6.12	6.00	2.02	5
	Body 5825	e'	46.6200	Relative Permittivity (ϵ_r):	46.62	48.20	-3.28	5
		e"	18.9900	Conductivity (σ):	6.15	6.00	2.51	5
8/15/2013	Body 5180	e'	47.6800	Relative Permittivity (ϵ_r):	47.68	49.05	-2.79	5
		e"	18.5800	Conductivity (σ):	5.35	5.27	1.52	5
	Body 5200	e'	47.6500	Relative Permittivity (ϵ_r):	47.65	49.02	-2.79	5
		e"	18.6000	Conductivity (σ):	5.38	5.29	1.57	5
	Body 5500	e'	47.1500	Relative Permittivity (ϵ_r):	47.15	48.61	-3.01	5
		e"	18.8400	Conductivity (σ):	5.76	5.64	2.08	5
	Body 5800	e'	46.6600	Relative Permittivity (ϵ_r):	46.66	48.20	-3.20	5
		e"	19.1400	Conductivity (σ):	6.17	6.00	2.88	5
	Body 5825	e'	46.6200	Relative Permittivity (ϵ_r):	46.62	48.20	-3.28	5
		e"	19.1600	Conductivity (σ):	6.21	6.00	3.43	5
8/19/2013	Body 5180	e'	47.4300	Relative Permittivity (ϵ_r):	47.43	49.05	-3.30	5
		e"	18.3200	Conductivity (σ):	5.28	5.27	0.10	5
	Body 5200	e'	47.4000	Relative Permittivity (ϵ_r):	47.40	49.02	-3.30	5
		e"	18.3500	Conductivity (σ):	5.31	5.29	0.21	5
	Body 5500	e'	46.9200	Relative Permittivity (ϵ_r):	46.92	48.61	-3.48	5
		e"	18.5600	Conductivity (σ):	5.68	5.64	0.56	5
	Body 5800	e'	46.4400	Relative Permittivity (ϵ_r):	46.44	48.20	-3.65	5
		e"	18.8700	Conductivity (σ):	6.09	6.00	1.43	5
	Body 5825	e'	46.4100	Relative Permittivity (ϵ_r):	46.41	48.20	-3.71	5
		e"	18.8900	Conductivity (σ):	6.12	6.00	1.97	5

Tissue Dielectric Parameter Check Results (continued)

LAB B

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)	
8/12/2013	Body 5180	e'	47.9200	Relative Permittivity (ϵ_r):	47.92	49.05	-2.30	5	
		e"	18.5900	Conductivity (σ):	5.35	5.27	1.57	5	
	Body 5200	e'	47.9000	Relative Permittivity (ϵ_r):	47.90	49.02	-2.28	5	
		e"	18.6100	Conductivity (σ):	5.38	5.29	1.63	5	
	Body 5500	e'	47.4200	Relative Permittivity (ϵ_r):	47.42	48.61	-2.45	5	
		e"	18.8400	Conductivity (σ):	5.76	5.64	2.08	5	
	Body 5800	e'	46.9500	Relative Permittivity (ϵ_r):	46.95	48.20	-2.59	5	
		e"	19.1200	Conductivity (σ):	6.17	6.00	2.77	5	
	Body 5825	e'	46.9100	Relative Permittivity (ϵ_r):	46.91	48.20	-2.68	5	
		e"	19.1400	Conductivity (σ):	6.20	6.00	3.32	5	
8/15/2013	Body 5180	e'	48.3000	Relative Permittivity (ϵ_r):	48.30	49.05	-1.52	5	
		e"	18.3100	Conductivity (σ):	5.27	5.27	0.04	5	
	Body 5200	e'	48.2800	Relative Permittivity (ϵ_r):	48.28	49.02	-1.51	5	
		e"	18.3300	Conductivity (σ):	5.30	5.29	0.10	5	
	Body 5500	e'	47.8100	Relative Permittivity (ϵ_r):	47.81	48.61	-1.65	5	
		e"	18.5700	Conductivity (σ):	5.68	5.64	0.61	5	
	Body 5800	e'	47.3500	Relative Permittivity (ϵ_r):	47.35	48.20	-1.76	5	
		e"	18.8600	Conductivity (σ):	6.08	6.00	1.37	5	
	Body 5825	e'	47.3100	Relative Permittivity (ϵ_r):	47.31	48.20	-1.85	5	
		e"	18.8700	Conductivity (σ):	6.11	6.00	1.86	5	
8/19/2013	Body 2450	e'	51.5100	Relative Permittivity (ϵ_r):	51.51	52.70	-2.26	5	
		e"	14.5400	Conductivity (σ):	1.98	1.95	1.58	5	
	Body 2410	e'	51.6300	Relative Permittivity (ϵ_r):	51.63	52.76	-2.14	5	
		e"	14.4200	Conductivity (σ):	1.93	1.91	1.30	5	
	Body 2435	e'	51.5600	Relative Permittivity (ϵ_r):	51.56	52.73	-2.21	5	
		e"	14.4900	Conductivity (σ):	1.96	1.93	1.59	5	
8/22/2013	Body 2450	e'	51.4200	Relative Permittivity (ϵ_r):	51.42	52.67	-2.37	5	
		e"	14.6100	Conductivity (σ):	2.01	1.99	1.28	5	
	Body 2410	e'	51.9800	Relative Permittivity (ϵ_r):	51.98	52.70	-1.37	5	
		e"	14.4500	Conductivity (σ):	1.97	1.95	0.95	5	
	Body 2410	e'	52.1200	Relative Permittivity (ϵ_r):	52.12	52.76	-1.21	5	
		e"	14.3300	Conductivity (σ):	1.92	1.91	0.67	5	
8/26/2013	Body 2435	e'	52.0300	Relative Permittivity (ϵ_r):	52.03	52.73	-1.32	5	
		e"	14.4000	Conductivity (σ):	1.95	1.93	0.96	5	
	Body 2475	e'	51.8800	Relative Permittivity (ϵ_r):	51.88	52.67	-1.50	5	
		e"	14.5300	Conductivity (σ):	2.00	1.99	0.73	5	
	8/26/2013	Body 5180	e'	48.5100	Relative Permittivity (ϵ_r):	48.51	49.05	-1.09	5
			e"	17.9200	Conductivity (σ):	5.16	5.27	-2.09	5
Body 5200		e'	48.5300	Relative Permittivity (ϵ_r):	48.53	49.02	-1.00	5	
		e"	17.9300	Conductivity (σ):	5.18	5.29	-2.09	5	
Body 5500		e'	47.9900	Relative Permittivity (ϵ_r):	47.99	48.61	-1.28	5	
		e"	18.1000	Conductivity (σ):	5.54	5.64	-1.93	5	
Body 5800	e'	47.6300	Relative Permittivity (ϵ_r):	47.63	48.20	-1.18	5		
	e"	18.5100	Conductivity (σ):	5.97	6.00	-0.51	5		
Body 5825	e'	47.6000	Relative Permittivity (ϵ_r):	47.60	48.20	-1.24	5		
	e"	18.5000	Conductivity (σ):	5.99	6.00	-0.13	5		

Tissue Dielectric Parameter Check Results (continued)

LAB B

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit $\pm$ (%)
8/29/2013	Body 5180	e'	48.0200	Relative Permittivity (ϵ_r):	48.02	49.05	-2.09	5
		e"	18.0600	Conductivity (σ):	5.20	5.27	-1.32	5
	Body 5200	e'	48.0100	Relative Permittivity (ϵ_r):	48.01	49.02	-2.06	5
		e"	18.0700	Conductivity (σ):	5.22	5.29	-1.32	5
	Body 5500	e'	47.4900	Relative Permittivity (ϵ_r):	47.49	48.61	-2.31	5
		e"	18.2800	Conductivity (σ):	5.59	5.64	-0.96	5
	Body 5800	e'	47.0500	Relative Permittivity (ϵ_r):	47.05	48.20	-2.39	5
		e"	18.6800	Conductivity (σ):	6.02	6.00	0.40	5
	Body 5825	e'	47.0100	Relative Permittivity (ϵ_r):	47.01	48.20	-2.47	5
		e"	18.7000	Conductivity (σ):	6.06	6.00	0.95	5

Tissue Dielectric Parameter Check Results (continued)

LAB C

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit $\pm$ (%)
8/13/2013	Body 5180	e'	47.9500	Relative Permittivity (ϵ_r):	47.95	49.05	-2.24	5
		e"	18.4100	Conductivity (σ):	5.30	5.27	0.59	5
	Body 5200	e'	47.9400	Relative Permittivity (ϵ_r):	47.94	49.02	-2.20	5
		e"	18.4500	Conductivity (σ):	5.33	5.29	0.75	5
	Body 5500	e'	47.4500	Relative Permittivity (ϵ_r):	47.45	48.61	-2.39	5
		e"	18.7100	Conductivity (σ):	5.72	5.64	1.37	5
	Body 5800	e'	46.9900	Relative Permittivity (ϵ_r):	46.99	48.20	-2.51	5
		e"	19.0200	Conductivity (σ):	6.13	6.00	2.23	5
	Body 5825	e'	46.9300	Relative Permittivity (ϵ_r):	46.93	48.20	-2.63	5
		e"	19.0300	Conductivity (σ):	6.16	6.00	2.73	5
8/15/2013	Body 5180	e'	48.4200	Relative Permittivity (ϵ_r):	48.42	49.05	-1.28	5
		e"	18.3400	Conductivity (σ):	5.28	5.27	0.21	5
	Body 5200	e'	48.3500	Relative Permittivity (ϵ_r):	48.35	49.02	-1.37	5
		e"	18.3500	Conductivity (σ):	5.31	5.29	0.21	5
	Body 5500	e'	47.8700	Relative Permittivity (ϵ_r):	47.87	48.61	-1.53	5
		e"	18.6500	Conductivity (σ):	5.70	5.64	1.05	5
	Body 5800	e'	47.4800	Relative Permittivity (ϵ_r):	47.48	48.20	-1.49	5
		e"	18.9300	Conductivity (σ):	6.10	6.00	1.75	5
	Body 5825	e'	47.4100	Relative Permittivity (ϵ_r):	47.41	48.20	-1.64	5
		e"	18.9100	Conductivity (σ):	6.12	6.00	2.08	5
8/19/2013	Body 5180	e'	48.0220	Relative Permittivity (ϵ_r):	48.02	49.05	-2.09	5
		e"	18.1236	Conductivity (σ):	5.22	5.27	-0.97	5
	Body 5200	e'	48.0220	Relative Permittivity (ϵ_r):	48.02	49.02	-2.04	5
		e"	18.1576	Conductivity (σ):	5.25	5.29	-0.84	5
	Body 5500	e'	47.5128	Relative Permittivity (ϵ_r):	47.51	48.61	-2.26	5
		e"	18.3542	Conductivity (σ):	5.61	5.64	-0.56	5
	Body 5800	e'	47.0673	Relative Permittivity (ϵ_r):	47.07	48.20	-2.35	5
		e"	18.6687	Conductivity (σ):	6.02	6.00	0.34	5
	Body 5825	e'	47.0517	Relative Permittivity (ϵ_r):	47.05	48.20	-2.38	5
		e"	18.7107	Conductivity (σ):	6.06	6.00	1.00	5

Tissue Dielectric Parameter Check Results (continued)

LAB D

Date	Freq. (MHz)	Liquid Parameters			Measured	Target	Delta (%)	Limit ±(%)
8/12/2013	Body 5180	e'	48.0400	Relative Permittivity (ϵ_r):	48.04	49.05	-2.05	5
		e"	18.3500	Conductivity (σ):	5.29	5.27	0.26	5
	Body 5200	e'	48.0300	Relative Permittivity (ϵ_r):	48.03	49.02	-2.02	5
		e"	18.3800	Conductivity (σ):	5.31	5.29	0.37	5
	Body 5500	e'	47.5400	Relative Permittivity (ϵ_r):	47.54	48.61	-2.21	5
		e"	18.6200	Conductivity (σ):	5.69	5.64	0.88	5
	Body 5800	e'	47.1000	Relative Permittivity (ϵ_r):	47.10	48.20	-2.28	5
		e"	18.9200	Conductivity (σ):	6.10	6.00	1.69	5
	Body 5825	e'	47.0400	Relative Permittivity (ϵ_r):	47.04	48.20	-2.41	5
		e"	18.9400	Conductivity (σ):	6.13	6.00	2.24	5
8/15/2013	Body 5180	e'	48.3729	Relative Permittivity (ϵ_r):	48.37	49.05	-1.37	5
		e"	18.6135	Conductivity (σ):	5.36	5.27	1.70	5
	Body 5200	e'	48.3317	Relative Permittivity (ϵ_r):	48.33	49.02	-1.40	5
		e"	18.6250	Conductivity (σ):	5.39	5.29	1.71	5
	Body 5500	e'	47.8290	Relative Permittivity (ϵ_r):	47.83	48.61	-1.61	5
		e"	18.8832	Conductivity (σ):	5.77	5.64	2.31	5
	Body 5800	e'	47.4400	Relative Permittivity (ϵ_r):	47.44	48.20	-1.58	5
		e"	19.1133	Conductivity (σ):	6.16	6.00	2.73	5
	Body 5825	e'	47.3800	Relative Permittivity (ϵ_r):	47.38	48.20	-1.70	5
		e"	19.1062	Conductivity (σ):	6.19	6.00	3.14	5
8/19/2013	Body 5180	e'	48.4600	Relative Permittivity (ϵ_r):	48.46	49.05	-1.20	5
		e"	18.2400	Conductivity (σ):	5.25	5.27	-0.34	5
	Body 5200	e'	48.4600	Relative Permittivity (ϵ_r):	48.46	49.02	-1.14	5
		e"	18.2700	Conductivity (σ):	5.28	5.29	-0.23	5
	Body 5500	e'	47.9700	Relative Permittivity (ϵ_r):	47.97	48.61	-1.32	5
		e"	18.4600	Conductivity (σ):	5.65	5.64	0.02	5
	Body 5800	e'	47.4900	Relative Permittivity (ϵ_r):	47.49	48.20	-1.47	5
		e"	18.8100	Conductivity (σ):	6.07	6.00	1.10	5
	Body 5825	e'	47.4900	Relative Permittivity (ϵ_r):	47.49	48.20	-1.47	5
		e"	18.8600	Conductivity (σ):	6.11	6.00	1.81	5

11. System Performance 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.

11.1. 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 ≥ 15.0 cm $\pm$ 0.5 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm $\pm$ 0.5 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.

11.2. System Performance Check Measurement Conditions

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 (mW/g)		
				1g/10g	Head	Body
D2450V2	900	10/5/2012	2450	1g	52.9	51.7
				10g	24.8	24.2
D5GHzV2	1139	10/9/2012	5200	1g	80.1	74.5
				10g	22.9	20.8
			5500	1g	84.3	79.3
				10g	23.9	22.1
			5800	1g	79.0	73.7
				10g	22.5	20.4
D5GHzV2	1072	2/8/2013	5200	1g	77.0	75.1
				10g	21.8	21.0
			5500	1g	80.7	79.4
				10g	22.7	22.0
			5800	1g	72.9	73.3
				10g	20.6	20.3

11.3. System Performance 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.

LAB A

Date Tested	System Dipole		T.S. Liquid	Measured Results			Target (Ref. Value)	Delta ±10 %	Est./Zoom Ratio ±3 %	Plot No.	
	Type	Serial #		Area Scan	Zoom Scan	Normalize to 1 W					
8/12/2013	D5GHzV2 (5.2GHz)	1139	Body	1g	7.49	7.73	77.3	74.5	3.76	-3.20	
				10g	2.02	2.16	21.6	20.8	3.85		
8/15/2013	D5GHzV2 (5.2GHz)	1139	Body	1g	6.97	7.39	73.9	74.5	-0.81	-6.03	
				10g	1.88	2.07	20.7	20.8	-0.48		
8/19/2013	D5GHzV2 (5.2GHz)	1139	Body	1g	7.29	7.79	77.9	74.5	4.56	-6.86	1,2
				10g	1.99	2.18	21.8	20.8	4.81		

LAB B

Date Tested	System Dipole		T.S. Liquid		Measured Results			Target (Ref. Value)	Delta ±10 %	Est./Zoom Ratio ±3 %	Plot No.
	Type	Serial #			Area Scan	Zoom Scan	Normalize to 1 W				
8/12/2013	D5GHzV2 (5.2GHz)	1139	Body	1g	7.66	7.84	78.4	74.5	5.23	-2.35	3,4
				10g	2.17	2.19	21.9	20.8	5.29		
8/15/2013	D5GHzV2 (5.2GHz)	1139	Body	1g	7.38	7.79	77.9	74.5	4.56	-5.56	
				10g	2.04	2.18	21.8	20.8	4.81		
8/19/2013	2.4GHz	900	Body	1g	5.28	5.40	54.0	51.7	4.45	-2.27	5,6
				10g	2.26	2.49	24.9	24.2	2.89		
8/22/2013	2.4GHz	900	Body	1g	4.95	5.14	51.4	51.7	-0.58	-3.84	
				10g	2.09	2.37	23.7	24.2	-2.07		
8/26/2013	D5GHzV2 (5.2GHz)	1139	Body	1g	7.88	7.72	77.2	74.5	3.62	2.03	
				10g	2.23	2.16	21.6	20.8	3.85		
8/29/2013	D5GHzV2 (5.2GHz)	1139	Body	1g	7.33	7.83	78.3	74.5	5.10	-6.82	
				10g	2.04	2.19	21.9	20.8	5.29		

LAB C

Date Tested	System Dipole		T.S. Liquid		Measured Results			Target (Ref. Value)	Delta ±10 %	Est./Zoom Ratio ±3 %	Plot No.
	Type	Serial #			Area Scan	Zoom Scan	Normalize to 1 W				
8/13/2013	D5GHzV2 (5.5GHz)	1072	Body	1g	6.90	7.56	75.6	79.4	-4.79	-9.57	
				10g	1.88	2.12	21.2	22.0	-3.64		
8/13/2013	D5GHzV2 (5.6GHz)	1072	Body	1g	7.35	8.05	80.5	79.4	1.39	-9.52	
				10g	2.01	2.24	22.4	22.0	1.82		
8/15/2013	D5GHzV2 (5.5GHz)	1072	Body	1g	7.27	8.00	80.0	79.4	0.76	-10.04	
				10g	2.01	2.23	22.3	22.0	1.36		
8/15/2013	D5GHzV2 (5.6GHz)	1072	Body	1g	7.64	8.37	83.7	79.4	5.42	-9.55	7,8
				10g	2.11	2.34	23.4	22.0	6.36		
8/19/2013	D5GHzV2 (5.5GHz)	1072	Body	1g	7.03	7.70	77.0	79.4	-3.02	-9.53	
				10g	1.92	2.15	21.5	22.0	-2.27		
8/19/2013	D5GHzV2 (5.6GHz)	1072	Body	1g	7.51	8.30	83.0	79.4	4.53	-10.52	
				10g	2.03	2.30	23.0	22.0	4.55		

System Performance Check Results

LAB D

Date Tested	System Dipole		T.S. Liquid		Measured Results			Target (Ref. Value)	Delta ±10 %	Est./Zoom Ratio ±3 %	Plot No.
	Type	Serial #			Area Scan	Zoom Scan	Normalize to 1 W				
8/12/2013	D5GHzV2 (5.8GHz)	1072	Body	1g	8.25	7.79	77.9	73.3	6.28	5.58	9,10
				10g	2.22	2.17	21.7	20.3	6.90		
8/15/2013	D5GHzV2 (5.8GHz)	1072	Body	1g	7.34	7.60	76.0	73.3	3.68	-3.54	
				10g	1.96	2.10	21.0	20.3	3.45		
8/19/2013	D5GHzV2 (5.8GHz)	1072	Body	1g	7.89	7.48	74.8	73.3	2.05	5.20	
				10g	2.11	2.06	20.6	20.3	1.48		

12. SAR Test Results

12.1. Wi-Fi DTS Bands

12.1.1. 2.4 GHz Band

BOM #1

Band	Mode	No. of Transmitters	Test Position	Dist. (mm)	Ch #	Freq. (MHz)	Power (dBm)				SAR (W/kg)								Plot No.	
							WiFi 1		WiFi 2		WiFi 1				WiFi 2					
							Tune-up Limit	Measured	Tune-up Limit	Measured	Measured		Scaled		Measured		Scaled			
											1-g	10-g	1-g	10-g	1-g	10-g	1-g	10-g		
2.4GHz	802.11b	1 Tx	Rear	0	6	2437	16.5	16.5			0.062	0.028	0.062	0.028						
			Edge 3	0	1	2412	16.5	16.5			0.968	0.310	0.968	0.310						
					6	2437	16.5	16.5			0.933	0.296	0.933	0.296						
					11	2462	16.5	16.5			1.030	0.327	1.030	0.327						
			Edge 4	0	6	2437	16.5	16.5			0.175	0.081	0.175	0.081						
			Rear	0	6	2437			16.5	16.5						0.053	0.022	0.053	0.022	
			Edge 2	0	6	2437			16.5	16.5						0.086	0.032	0.086	0.032	
			Edge 3	0	1	2412			16.5	16.3						0.579	0.180	0.606	0.188	
	6	2437					16.5	16.5					0.803	0.252	0.803	0.252				
	11	2462					16.5	16.5					0.999	0.312	0.999	0.312				
	802.11g CDD	2 Tx	Rear	0	6	2437	16.5	16.5	16.5	16.4	0.062	0.029	0.062	0.029	0.055	0.022	0.057	0.023		
			Edge 2	0	6	2437	16.5	16.5	16.5	16.4					0.090	0.036	0.093	0.037		
			Edge 3	0	2	2417	16.5	16.5	16.5	16.4	0.985	0.316	0.985	0.316	0.723	0.229	0.747	0.237		
					6	2437	16.5	16.5	16.5	16.4	1.020	0.328	1.020	0.328	0.752	0.238	0.775	0.245		
					10	2457	16.5	16.5	16.5	16.3	1.170	0.375	1.170	0.375	0.934	0.297	0.969	0.308	1	
			Edge 4	0	6	2437	16.5	16.5	16.5	16.4	0.193	0.089	0.193	0.089						

BOM #2

Band	Mode	No. of Transmitters	Test Position	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)				SAR (W/kg)								Plot No.
							WiFi 1		WiFi 2		WiFi 1				WiFi 2				
							Tune-up Limit	Measured	Tune-up Limit	Measured	Measured		Scaled		Measured		Scaled		
											1-g	10-g	1-g	10-g	1-g	10-g	1-g	10-g	
2.4GHz	802.11g CDD	2 Tx	Edge 3	0	10	2457	16.5	16.5	16.5	16.5	1.160	0.369	1.160	0.369	0.781	0.248	0.781	0.248	

Note(s):

- 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

12.1.2. 5.8 GHz Band

BOM #1

Band	Mode	No. of Transmitters	Test Position	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)				SAR (W/kg)								Plot No.
							WiFi 1		WiFi 2		WiFi 1				WiFi 2				
							Tune-up Limit	Measured	Tune-up Limit	Measured	Measured		Scaled		Measured		Scaled		
											1-g	10-g	1-g	10-g	1-g	10-g	1-g	10-g	
5.8GHz	802.11a	1 Tx	Rear	0	157	5785	15.5	15.5			0.086	0.035	0.086	0.035					
			Edge 3	0	149	5745	15.5	15.5			0.625	0.209	0.625	0.209					
					157	5785	15.5	15.5			0.680	0.228	0.680	0.228					
					165	5825	15.5	15.5			0.726	0.247	0.726	0.247					
			Edge 4	0	157	5785	15.5	15.5			0.093	0.031	0.093	0.031					
			Rear	0	157	5785			15.5	15.5					0.112	0.040	0.112	0.040	
			Edge 2	0	157	5785			15.5	15.5					0.041	0.014	0.041	0.014	
			Edge 3	0	149	5745			15.5	15.5					0.852	0.263	0.852	0.263	
	157	5785					15.5	15.5					0.968	0.299	0.968	0.299			
	165	5825					15.5	15.5					1.110	0.346	1.110	0.346	2		
	802.11a CDD	2 Tx	Rear	0	157	5785	15.5	15.5	15.5	15.5	0.057	0.023	0.057	0.023	0.120	0.043	0.120	0.043	
			Edge 2	0	157	5785	15.5	15.5	15.5	15.5					0.041	0.015	0.041	0.015	
			Edge 3	0	149	5745	15.5	15.5	15.5	15.5	0.565	0.187	0.565	0.187	0.873	0.267	0.873	0.267	
					157	5785	15.5	15.5	15.5	15.5	0.586	0.194	0.586	0.194	0.960	0.294	0.960	0.294	
					165	5825	15.5	15.5	15.5	15.5	0.684	0.221	0.684	0.221	1.040	0.322	1.040	0.322	
			Edge 4	0	157	5785	15.5	15.5	15.5	15.5	0.086	0.027	0.086	0.027					

BOM #2

Band	Mode	No. of Transmitters	Test Position	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)				SAR (W/kg)								Plot No.
							WiFi 1		WiFi 2		WiFi 1				WiFi 2				
							Tune-up Limit	Measured	Tune-up Limit	Measured	Measured		Scaled		Measured		Scaled		
											1-g	10-g	1-g	10-g	1-g	10-g	1-g	10-g	
5.8GHz	802.11a	1 Tx	Edge 3	0	165	5825			15.5	15.5					0.732	0.229	0.732	0.229	

Note(s):

- 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

12.2. Wi-Fi UNII Bands

12.2.1. 5.2 GHz Band

BOM #1

Band	Mode	No. of Transmitters	Test Position	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)				SAR (W/kg)								Plot No.
							WiFi 1		WiFi 2		WiFi 1				WiFi 2				
							Tune-up Limit	Measured	Tune-up Limit	Measured	Measured		Scaled		Measured		Scaled		
											1-g	10-g	1-g	10-g	1-g	10-g	1-g	10-g	
5.2GHz	802.11a	1 Tx	Rear	0	48	5240	14.0	14.0			0.041	0.016	0.041	0.016					
			Edge 3	0	48	5240	14.0	14.0			0.470	0.152	0.470	0.152					
			Edge 4	0	48	5240	14.0	14.0			0.088	0.026	0.088	0.026					
			Rear	0	48	5240			14.0	14.0					0.059	0.021	0.059	0.021	
			Edge 2	0	48	5240			14.0	14.0					0.041	0.014	0.041	0.014	
			Edge 3	0	48	5240			14.0	14.0					0.687	0.204	0.687	0.204	
	802.11a CDD	2 Tx	Rear	0	48	5240	11.0	11.0	11.0	11.0	0.024	0.007	0.024	0.007	0.037	0.016	0.037	0.016	
			Edge 2	0	48	5240	11.0	11.0	11.0	11.0					0.013	0.003	0.013	0.003	
			Edge 3	0	48	5240	11.0	11.0	11.0	11.0	0.206	0.064	0.206	0.064	0.271	0.082	0.271	0.082	
			Edge 4	0	48	5240	11.0	11.0	11.0	11.0	0.051	0.015	0.051	0.015					
	802.11n HT40 SISO	1 Tx	Rear	0	46	5230	16.0	16.0			0.068	0.024	0.068	0.024					
			Edge 3	0	46	5230	16.0	16.0			0.710	0.230	0.710	0.230					
			Edge 4	0	46	5230	16.0	16.0			0.135	0.044	0.135	0.044					
			Rear	0	46	5230			16.0	16.0					0.114	0.039	0.114	0.039	
			Edge 2	0	46	5230			16.0	16.0					0.053	0.014	0.053	0.014	
			Edge 3	0	46	5230			16.0	16.0					1.190	0.363	1.190	0.363	3
	802.11n HT40 CDD	2 Tx	Rear	0	46	5230	13.5	13.5	13.5	13.4	0.032	0.013	0.032	0.013	0.040	0.016	0.041	0.016	
			Edge 2	0	46	5230	13.5	13.5	13.5	13.4					0.015	0.003	0.015	0.003	
			Edge 3	0	46	5230	13.5	13.5	13.5	13.4	0.389	0.123	0.389	0.123	0.467	0.139	0.478	0.142	
			Edge 4	0	46	5230	13.5	13.5	13.5	13.4	0.051	0.013	0.051	0.013					

BOM #2

Band	Mode	No. of Transmitters	Test Position	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)				SAR (W/kg)								Plot No.
							WiFi 1		WiFi 2		WiFi 1				WiFi 2				
							Tune-up Limit	Measured	Tune-up Limit	Measured	Measured		Scaled		Measured		Scaled		
											1-g	10-g	1-g	10-g	1-g	10-g	1-g	10-g	
5.2GHz	802.11n HT40 SISO	1 Tx	Edge 3	0	46	5230			16.0	16.0					0.705	0.222	0.705	0.222	

12.2.2. 5.3 GHz Band

BOM #1

Band	Mode	No. of Transmitters	Test Position	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)				SAR (W/kg)								Plot No.
							WiFi 1		WiFi 2		WiFi 1				WiFi 2				
							Tune-up Limit	Measured	Tune-up Limit	Measured	Measured		Scaled		Measured		Scaled		
											1-g	10-g	1-g	10-g	1-g	10-g	1-g	10-g	
5.3GHz	802.11a	1 Tx	Rear	0	60	5300	16.0	16.0			0.040	0.015	0.040	0.015					
			Edge 3	0	60	5300	16.0	16.0			0.738	0.231	0.738	0.231					
			Edge 4	0	60	5300	16.0	16.0			0.108	0.036	0.108	0.036					
			Rear	0	60	5300			16.0	16.0					0.053	0.020	0.053	0.020	
			Edge 2	0	60	5300			16.0	16.0					0.091	0.033	0.091	0.033	
			Edge 3	0	52	5260			16.0	16.0					1.010	0.302	1.010	0.302	
				60	5300			16.0	16.0					0.897	0.277	0.897	0.277		
	802.11a CDD	2 Tx	Rear	0	60	5300	16.0	16.0	16.0	16.0	0.042	0.016	0.042	0.016	0.059	0.022	0.059	0.022	
			Edge 2	0	60	5300	16.0	16.0	16.0	16.0					0.047	0.018	0.047	0.018	
			Edge 3	0	52	5260	16.0	16.0	16.0	16.0	0.770	0.242	0.770	0.242	1.150	0.371	1.150	0.371	4
					60	5300	16.0	16.0	16.0	16.0	0.825	0.264	0.825	0.264	0.966	0.283	0.966	0.283	
			Edge 4	0	60	5300	16.0	16.0	16.0	16.0	0.117	0.041	0.117	0.041					

BOM #2

Band	Mode	No. of Transmitters	Test Position	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)				SAR (W/kg)								Plot No.
							WiFi 1		WiFi 2		WiFi 1				WiFi 2				
							Tune-up Limit	Measured	Tune-up Limit	Measured	Measured		Scaled		Measured		Scaled		
											1-g	10-g	1-g	10-g	1-g	10-g	1-g	10-g	
5.3GHz	802.11a CDD	2 Tx	Edge 3	0	52	5260	16.0	16.0	16.0	15.9	0.762	0.237	0.762	0.237	0.668	0.205	0.691	0.212	

12.2.3. 5.5 GHz Band

BOM #1

Band	Mode	No. of Transmitters	Test Position	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)				SAR (W/kg)								Plot No.
							WiFi 1		WiFi 2		WiFi 1				WiFi 2				
							Tune-up Limit	Measured	Tune-up Limit	Measured	Measured		Scaled		Measured		Scaled		
											1-g	10-g	1-g	10-g	1-g	10-g	1-g	10-g	
5.5GHz	802.11a	1 Tx	Rear	0	136	5680	15.5	15.5			0.063	0.024	0.063	0.024					
			Edge 3	0	104	5520	15.5	15.5			0.607	0.210	0.607	0.210					
					116	5580	15.5	15.5			0.605	0.206	0.605	0.206					
					124	5620	15.5	15.5			0.585	0.199	0.585	0.199					
					136	5680	15.5	15.5			0.583	0.199	0.583	0.199					
			Edge 4	0	136	5680	15.5	15.5			0.084	0.031	0.084	0.031					
			Rear	0	136	5680			15.5	15.5					0.147	0.051	0.147	0.051	
			Edge 2	0	136	5680			15.5	15.5					0.049	0.016	0.049	0.016	
			Edge 3	0	104	5520			15.5	15.5					0.608	0.190	0.608	0.190	
					116	5580			15.5	15.5					0.708	0.224	0.708	0.224	
					124	5620			15.5	15.5					0.754	0.239	0.754	0.239	
					136	5680			15.5	15.5					0.873	0.279	0.873	0.279	5
	802.11a CDD	2 Tx	Rear	0	136	5680	15.5	15.5	15.5	15.5	0.092	0.032	0.092	0.032	0.157	0.058	0.157	0.058	
			Edge 2	0	136	5680	15.5	15.5	15.5	15.5					0.058	0.025	0.058	0.025	
			Edge 3	0	104	5520	15.5	15.5	15.5	15.5	0.672	0.235	0.672	0.235	0.630	0.200	0.630	0.200	
					116	5580	15.5	15.5	15.5	15.5	0.664	0.229	0.664	0.229	0.704	0.217	0.704	0.217	
					124	5620	15.5	15.5	15.5	15.5	0.687	0.239	0.687	0.239	0.777	0.249	0.777	0.249	
					136	5680	15.5	15.5	15.5	15.5	0.636	0.213	0.636	0.213	0.843	0.266	0.843	0.266	
			Edge 4	0	136	5680	15.5	15.5	15.5	15.5	0.092	0.031	0.092	0.031					

BOM #2

Band	Mode	No. of Transmitters	Test Position	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)				SAR (W/kg)								Plot No.
							WiFi 1		WiFi 2		WiFi 1				WiFi 2				
							Tune-up Limit	Measured	Tune-up Limit	Measured	Measured		Scaled		Measured		Scaled		
											1-g	10-g	1-g	10-g	1-g	10-g	1-g	10-g	
5.5GHz	802.11a	1 Tx	Edge 3	0	136	5680			15.5	15.5					0.859	0.270	0.859	0.270	

Note(s):

- 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

12.3. Bluetooth (DTS Band)

BOM #1

Mode	Test Position	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		SAR (W/kg)				Plot No.
					WiFi 1		WiFi 1				
					Tune-up Limit	Measured	Measured		Scaled		
							1-g	10-g	1-g	10-g	
GFSK	Rear	0	39	2441	12.0	11.8	0.017	0.007	0.018	0.007	
	Edge 3	0	39	2441	12.0	11.8	0.255	0.080	0.267	0.084	6
	Edge 4	0	39	2441	12.0	11.8	0.052	0.023	0.054	0.024	

BOM #2

Mode	Test Position	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		SAR (W/kg)				Plot No.
					WiFi 1		WiFi 1				
					Tune-up Limit	Measured	Measured		Scaled		
							1-g	10-g	1-g	10-g	
GFSK	Edge 3	0	39	2441	12.0	12.0	0.252	0.080	0.252	0.080	

Note(s):

- 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

13. 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.

13.1. The Highest Measured SAR Configuration in Each Frequency Band

Frequency Band (MHz)	Air Interface	Body
2400	Wi-Fi 802.11b/g/n	1.170 W/kg
	Bluetooth	< 0.800 W/kg
5200	Wi-Fi 802.11a/n	1.190 W/kg
5300	Wi-Fi 802.11a/n	1.150 W/kg
5500	Wi-Fi 802.11a/n	0.873 W/kg
5800	Wi-Fi 802.11a/n	1.110 W/kg

13.2. Repeated Measurement Results

Band	Test Position	Mode	No. of Transmitters	Ch. #	Freq. (MHz)	1-g SAR (W/kg)		1-g SAR (W/kg)		Largest to Smallest SAR Ratio		Note
						Original		Repeated				
						WiFi 1	WiFi 2	WiFi 1	WiFi 2	WiFi 1	WiFi 2	
2.4GHz	Edge 3	802.11g CDD	2 Tx	10	2457	1.170	0.934	1.150	0.881	1.02	1.06	1
5.2GHz	Edge 3	802.11a HT40 SISO	1 Tx	46	5230		1.190		1.120		1.06	1
5.3GHz	Edge 3	802.11a CDD	2 Tx	52	5260	0.770	1.150	0.734	1.070	1.05	1.07	1
5.5GHz	Edge 3	802.11a	1 Tx	136	5680		0.873		0.844		1.03	1
5.8GHz	Edge 3	802.11a	1 Tx	165	5825		1.110		1.100		1.01	1

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.

14. Simultaneous Transmission SAR Analysis

KDB 447498 D01 General RF Exposure Guidance v05, introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$SPLSR = (SAR_1 + SAR_2)^{1.5} / Ri$$

Where:

SAR₁ is the highest measured or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR₂ is the highest measured or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

Ri is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$

A new threshold of 0.04 is also introduced in the draft KDB. Thus, in order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$(SAR_1 + SAR_2)^{1.5} / Ri < 0.04$$

14.1. Estimated SAR for Simultaneous Transmission SAR Analysis

Considerations for SAR estimation

1. When standalone SAR test exclusion applies, standalone SAR must also be estimated to determine simultaneous transmission SAR test exclusion.
2. Dedicated Host Approach criteria for SAR test exclusion is likewise applied to SAR estimation, with certain distinctions between test exclusion and SAR estimation:
 - o When the separation distance from the antenna to an adjacent edge is ≤ 5 mm, a distance of 5 mm is applied for SAR estimation; this is the same between test exclusion and SAR estimation calculations.
 - o When the separation distance from the antenna to an adjacent edge is > 5 mm but ≤ 50 mm, the actual antenna-to-edge separation distance is applied for SAR estimation.
 - o When the minimum test separation distance is > 50 mm, the estimated SAR value is 0.4 W/kg

14.1.1. Estimated SAR for WiFi and BT

Antenna	Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Estimated 1-g SAR Value (W/kg)					
			dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Wi-Fi 1 / Bluetooth																
Wi-Fi 1	Wi-Fi 2.4 GHz	2462	16.50	45	6.5	181.3	93.5	5	9.8		-MEASURE-	0.400	0.400	-MEASURE-	-MEASURE-	N/A
Wi-Fi 1	Wi-Fi 5.2 GHz	5240	14.00	25	6.5	181.3	93.5	5	9.8		-MEASURE-	0.400	0.400	-MEASURE-	-MEASURE-	N/A
Wi-Fi 1	Wi-Fi 5.3 GHz	5300	16.00	40	6.5	181.3	93.5	5	9.8		-MEASURE-	0.400	0.400	-MEASURE-	-MEASURE-	N/A
Wi-Fi 1	Wi-Fi 5.5 GHz	5680	15.50	35	6.5	181.3	93.5	5	9.8		-MEASURE-	0.400	0.400	-MEASURE-	-MEASURE-	N/A
Wi-Fi 1	Wi-Fi 5.8 GHz	5825	15.50	35	6.5	181.3	93.5	5	9.8		-MEASURE-	0.400	0.400	-MEASURE-	-MEASURE-	N/A
Wi-Fi 1	Bluetooth	2480	12.00	16	6.5	181.3	93.5	5	9.8		-MEASURE-	0.400	0.400	-MEASURE-	0.336	N/A
Wi-Fi 2																
Wi-Fi 2	Wi-Fi 2.4 GHz	2462	16.50	45	6.5	191.1	14.4	5	93.5		-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400	N/A
Wi-Fi 2	Wi-Fi 5.2 GHz	5240	14.00	25	6.5	191.1	14.4	5	93.5		-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400	N/A
Wi-Fi 2	Wi-Fi 5.3 GHz	5300	16.00	40	6.5	191.1	14.4	5	93.5		-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400	N/A
Wi-Fi 2	Wi-Fi 5.5 GHz	5680	15.50	35	6.5	191.1	14.4	5	93.5		-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400	N/A
Wi-Fi 2	Wi-Fi 5.8 GHz	5825	15.50	35	6.5	191.1	14.4	5	93.5		-MEASURE-	0.400	-MEASURE-	-MEASURE-	0.400	N/A

Use of WiFi estimated SAR in simultaneous transmission SAR analysis

- Edge 2 for Bluetooth: The estimated SAR value of **0.400** W/kg was used in Simultaneous Transmission Analysis, and distinguished from measured SAR values with green text.

14.2. Sum of the SAR for WiFi DTS Band & Bluetooth

14.2.1. 5.8 GHz Band

RF Exposure condition	Test Position	Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		DTS Band			Bluetooth		
		WiFi 1	WiFi 2	WiFi 1 + WiFi 2			
Body	Rear	0.086			0.018	0.104	No
			0.112		0.018	0.130	No
				0.120	0.018	0.138	No
	Edge 2		0.041		0.400	0.441	No
				0.041	0.400	0.441	No
	Edge 3	0.726			0.267	0.993	No
			1.110		0.267	1.377	No
				1.040	0.267	1.307	No
	Edge 4	0.093			0.054	0.147	No
					0.054	0.054	No
				0.086	0.054	0.140	No

SAR to Peak Location Separation Ratio (SPLSR)

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

14.3. Sum of the SAR for WiFi UNII Band & Bluetooth

RF Exposure condition	Test Position	Simultaneous Transmission Scenario				Σ 1-g SAR (mW/g)	SPLSR (Yes/ No)
		UNII Band			Bluetooth		
		WiFi 1	WiFi 2	WiFi 1 + WiFi 2			
Body	Rear	0.068			0.018	0.086	No
			0.147		0.018	0.165	No
				0.157	0.018	0.175	No
	Edge 2		0.053		0.400	0.453	No
				0.058	0.400	0.458	No
	Edge 3	0.738			0.267	1.005	No
			1.190		0.267	1.457	No
				1.150	0.267	1.417	No
	Edge 4	0.135			0.054	0.189	No
					0.054	0.054	No
				0.117	0.054	0.171	No

SAR to Peak Location Separation Ratio (SPLSR)

As the Sum of the SAR is not greater than 1.6 W/kg SPLSR assessment is not required.

15. Appendixes

Refer to separated files for the following appendixes.

- 15.1. DUT and SAR Set-up Photos (STC)**
- 15.2. Antenna Locations and Separation Distances (STC)**
- 15.3. System Performance Check Plots**
- 15.4. Highest SAR Test Plots**
- 15.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3778**
- 15.6. Calibration Certificate for E-Field Probe EX3DV4 - SN 3720**
- 15.7. Calibration Certificate for E-Field Probe EX3DV4 - SN 3871**
- 15.8. Calibration Certificate for E-Field Probe EX3DV4 - SN 3676**
- 15.9. Calibration Certificate for D2450V2 - SN 900**
- 15.10. Calibration Certificate for D5GHzV2 - SN 1139**
- 15.11. Calibration Certificate for D5GHzV2 - SN 1072**

END OF REPORT