



**SAR EVALUATION REPORT  
CLASS II PERMISSIVE CHANGE**

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

*For*  
**Portable Computer**

**FCC ID: BCGA1534  
Model Name: A1534**

**Report Number: 16U22814-S1V4  
Issue Date: 2/25/2016**

*Prepared for*  
**APPLE INC.  
1 INFINITE LOOP, MS 26A  
CUPERTINO, CA 95014-2084**

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



NVLAP LAB CODE 200065-0

**Revision History**

Rev.	Date	Revisions	Revised By
V1	2/20/2016	Initial Issue	--
V2	2/22/2016	Report revised based on Reviewer's comments: 1. Sec. 1: Report revised. 2. Sec. 6.4: Updated table. 3. Sec. 12: Updated table. 4. Sec. 12.1: Added sum of SAR table.	Chakrit Thammanavarat
V3	2/24/2016	Report revised based on Reviewer's comments: 1. Sec.6.3 & 6.4: Updated table.	Chakrit Thammanavarat
V4	2/25/2016	Report revised based on Reviewer's comments: 1. Sec.9.1: Updated table.	Chakrit Thammanavarat

## Table of Contents

<b>1. Attestation of Test Results</b> .....	<b>5</b>
<b>2. Test Methodology</b> .....	<b>6</b>
<b>3. Facilities and Accreditation</b> .....	<b>6</b>
<b>4. SAR Measurement System &amp; Test Equipment</b> .....	<b>7</b>
4.1. SAR Measurement System.....	7
4.2. SAR Scan Procedures .....	8
4.3. Test Equipment.....	10
<b>5. Measurement Uncertainty</b> .....	<b>11</b>
<b>6. Device Under Test (DUT) Information</b> .....	<b>12</b>
6.1. DUT Description .....	12
6.2. Wireless Technologies.....	12
6.3. Possible Combinations of 802.11 Modes vs. Tx Diversity Configurations.....	13
6.4. Maximum Output Power .....	18
6.5. Antenna Dimensions and Separation Distances .....	31
<b>7. RF Exposure Conditions (Test Configurations)</b> .....	<b>32</b>
<b>8. Dielectric Property Measurements</b> .....	<b>33</b>
8.1. Tissue Dielectric Parameters .....	33
8.2. System Check Results.....	37
<b>9. Conducted Output Power Measurements</b> .....	<b>39</b>
9.1. Wi-Fi 2.4GHz (DTS Band) .....	39
9.2. Wi-Fi 5GHz (U-NII Bands).....	39
9.3. Bluetooth .....	39
<b>10. SAR Test Results</b> .....	<b>40</b>
10.1. Wi-Fi (DTS Band).....	41
10.2. Wi-Fi (U-NII Band).....	42
10.3. Bluetooth.....	43
<b>11. SAR Measurement Variability</b> .....	<b>44</b>
<b>12. Simultaneous Transmission SAR Analysis</b> .....	<b>45</b>
12.1. Sum of the SAR for DTS Band & BT .....	46
12.2. Sum of the SAR for U-NII Band & BT .....	46
<b>Appendixes</b> .....	<b>47</b>
16U22814-S1V1 SAR_App A Photos & Ant. Locations .....	47

---



<i>16U22814-S1V1 SAR_App B System Check Plots .....</i>	<i>47</i>
<i>16U22814-S1V1 SAR_App C Highest Test Plots .....</i>	<i>47</i>
<i>16U22814-S1V1 SAR_App D Tissue Ingredients .....</i>	<i>47</i>
<i>16U22814-S1V1 SAR_App E Probe Cal. Certificates.....</i>	<i>47</i>
<i>16U22814-S1V1 SAR_App F Dipole Cal. Certificates .....</i>	<i>47</i>

# 1. Attestation of Test Results

Applicant Name	APPLE INC			
FCC ID	BCGA1534			
Model Name	A1534			
Applicable Standards	FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013			
Exposure Category	SAR Limits (W/Kg)			
	Peak spatial-average(1g of tissue)			
General population / Uncontrolled exposure	1.6			
RF Exposure Conditions	Equipment Class - Highest Reported SAR (W/kg)			
	PCT	DTS	NII	DSS
Standalone	N/A	1.120	1.100	0.187
Simultaneous TX	N/A	1.307	1.287	1.307
Date Tested	2/3/2016 – 2/19/2016			
Test Results	Pass			

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

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

Approved & Released By:  	Prepared By:  
Bobby Bayani Senior Engineer UL Verification Services Inc.	Jose Abadilla Laboratory Technician 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 1528-2013, the following FCC Published RF exposure KDB procedures, and TCB workshop updates:

- 248227 D01 802.11 Wi-Fi SAR v02r02
- 447498 D01 General RF Exposure Guidance v06
- 616217 D04 SAR for laptop and tablets v01r02
- 690783 D01 SAR Listings on Grants v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02

## 3. Facilities and Accreditation

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

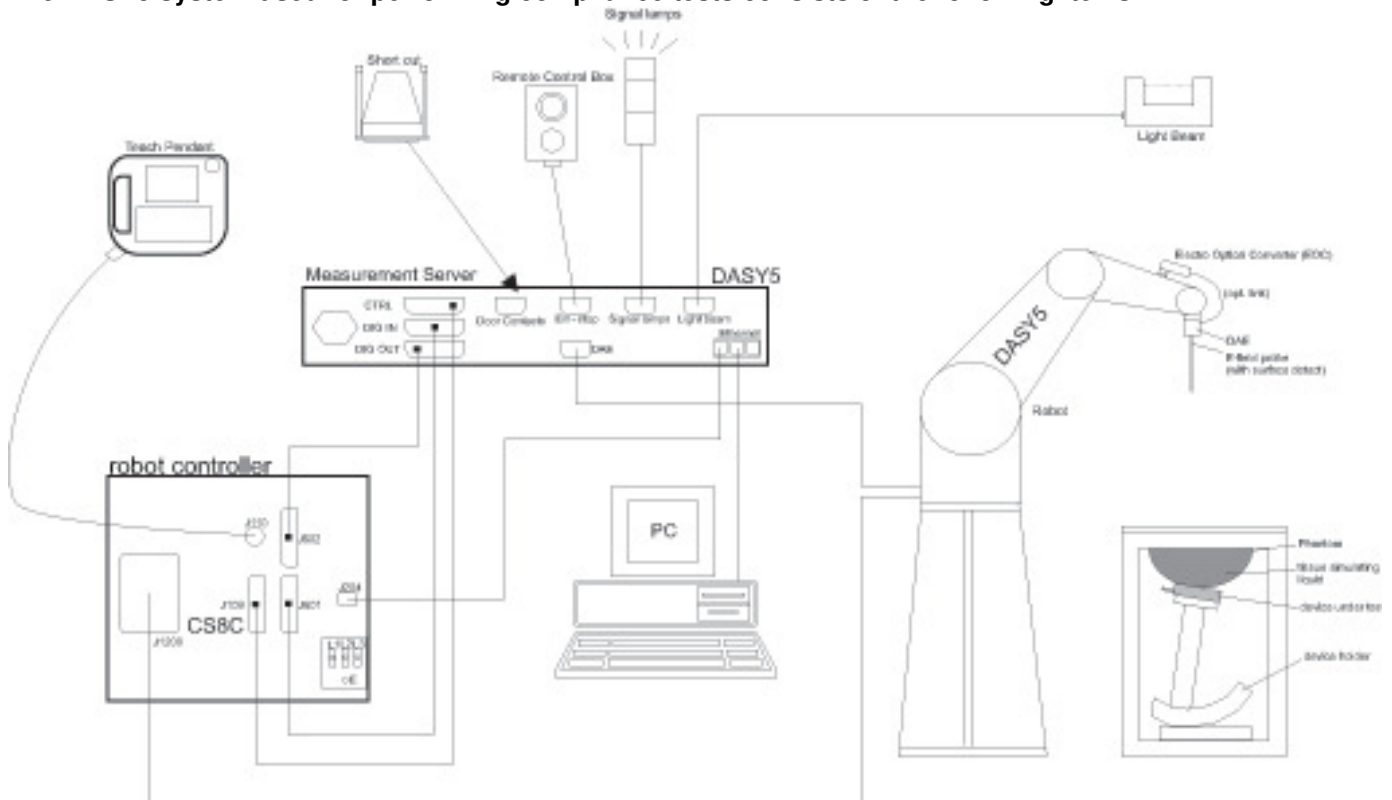
47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	
SAR Lab F	
SAR Lab G	
SAR Lab H	

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

## 4. SAR Measurement System & Test Equipment

### 4.1. SAR Measurement System

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



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

## 4.2. SAR Scan Procedures

### Step 1: Power Reference Measurement

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

### Step 2: Area Scan

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

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

	$\leq 3$ GHz	$> 3$ GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	$5 \pm 1$ 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: $\Delta x_{Area}$ , $\Delta y_{Area}$	$\leq 2$ GHz: $\leq 15$ mm $2 - 3$ GHz: $\leq 12$ mm	$3 - 4$ GHz: $\leq 12$ mm $4 - 6$ GHz: $\leq 10$ 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

		$\leq 3$ GHz	$> 3$ GHz	
Maximum zoom scan spatial resolution: $\Delta x_{Zoom}, \Delta y_{Zoom}$		$\leq 2$ GHz: $\leq 8$ mm 2 – 3 GHz: $\leq 5$ mm*	3 – 4 GHz: $\leq 5$ mm* 4 – 6 GHz: $\leq 4$ mm*	
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$	$\leq 5$ mm	3 – 4 GHz: $\leq 4$ mm 4 – 5 GHz: $\leq 3$ mm 5 – 6 GHz: $\leq 2$ mm	
	graded grid	$\Delta z_{Zoom}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface	$\leq 4$ mm	3 – 4 GHz: $\leq 3$ mm 4 – 5 GHz: $\leq 2.5$ mm 5 – 6 GHz: $\leq 2$ mm
		$\Delta z_{Zoom}(n>1)$ : between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z	$\geq 30$ mm	3 – 4 GHz: $\geq 28$ mm 4 – 5 GHz: $\geq 25$ mm 5 – 6 GHz: $\geq 22$ mm	
Note: $\delta$ 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 <i>area scan based 1-g SAR estimation</i> procedures of KDB 447498 is $\leq 1.4$ W/kg, $\leq 8$ mm, $\leq 7$ mm and $\leq 5$ 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	MY40000980	4/17/2016
Dielectric Probe kit	SPEAG	DAK-3.5	1082	9/15/2016
Shorting block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	N/A
Thermometer	Traceable Calibration Control Co.	4242	140562250	8/24/2016

#### System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	HP	8665B	3744A01084	5/8/2016
Power Meter	Keysight Technologies	N1912A	MY55196004	7/1/2016
Power Meter	Agilent	N1912A	MY50001018	10/19/2017
Power Sensor	Agilent	E9323A	MY53070007	3/2/2016
Power Sensor	Agilent	E9323A	MY53070005	4/29/2016
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	3/18/2016
Power Meter	HP	437B	3125U16345	6/15/2016
Power Meter	HP	437B	3125U12345	7/31/2016
Power Sensor	HP	8481A	2702A76223	9/3/2016
Power Sensor	HP	8481A	1926A27048	8/3/2016
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 E)	SPEAG	EX3DV4	3902	5/19/2016
E-Field Probe (SAR Lab F)	SPEAG	EX3DV4	3929	4/22/2016
E-Field Probe (SAR Lab G)	SPEAG	EX3DV4	3991	5/19/2016
E-Field Probe (SAR Lab H)	SPEAG	EX3DV4	7335	3/13/2016
Data Acquisition Electronics (SAR Lab E)	SPEAG	DAE4	1439	7/30/2016
Data Acquisition Electronics (SAR Lab F)	SPEAG	DAE4	1359	11/11/2016
Data Acquisition Electronics (SAR Lab G)	SPEAG	DAE4	1433	3/12/2016
Data Acquisition Electronics (SAR Lab H)	SPEAG	DAE4	1472	3/5/2016
System Validation Dipole	SPEAG	D2450V2	899	3/13/2016
System Validation Dipole	SPEAG	D5GHzV2	1003	2/20/2016
System Validation Dipole	SPEAG	D5GHzV2	1138	9/23/2016
System Validation Dipole	SPEAG	D5GHzV2	1168	11/13/2016

#### Other

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Power Meter	Keysight	N1912A	MY55196004	7/1/2016
Power Sensor	Agilent	N1921A	MY52260009	12/17/2016
Power Sensor	Agilent	N1921A	MY52270022	12/17/2016

## 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

Operating Configurations (s)	Portable Computer
Antennas Tested	<u>Part Number</u> Wi-Fi & Bluetooth: eVT-110-am CTH4414005XG3R6E (Wi-Fi 1) Wi-Fi 2 eVT-110-AM CTH4414005XG3VR6E (Wi-Fi 2)

### 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) 802.11ac (VHT20))	100%
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40) 802.11ac (VHT20) 802.11ac (VHT40) 802.11ac (VHT80)	100%
	Does this device support bands 5.60 ~ 5.65 GHz? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
Does this device support Band gap channel(s)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Bluetooth	2.4 GHz	Version 2.1 BLE	77.5% (DH5)

### 6.3. Possible Combinations of 802.11 Modes vs. Tx Diversity Configurations

Band	802.11 Modes	Tx diversity configurations	Original Approval
2.4GHz (DSSS/OFDM)	11b	1 Tx	√
		2 Tx CDD	√
	11g	1 Tx	√
		2 Tx All non TXBF	√
		2 Tx (TXBF)	disabled
	11n	HT20 1 Tx	√
		HT20 2 Tx All non TXBF	√
		HT20 2 Tx (TXBF)	√
		HT40	disabled
	11ac	VHT20 (1 Tx)	√
		VHT40 (1 Tx)	disabled
		VHT80 (1 Tx)	disabled
		VHT20 non TXBF (2 Tx)	√
		VHT40 All/TXBF (2 Tx)	disabled
		VHT80 All/TXBF (2 Tx)	disabled
<b>Note(s):</b>			
The 11n/ac 2Tx VHT20/VHT40/VHT80 "All" modes detailed apply to all of CDD/STBC/SDM modes.			

**Possible Combinations of 802.11 Modes vs. Tx Diversity Configurations (2Tx) - Continued**

Band	802.11 Modes	Tx diversity configurations	Original Approval	
5.2GHz (OFDM) UNII-1	11a	1 Tx	√	
		2 Tx CDD	√	
	11n	HT20 (1 Tx)	√	
		HT40 (1 Tx)	√	
		HT20 CDD (2 Tx)	√	
		HT20 All non TXBF (2 Tx)	√	
		HT20 TXBF (2 Tx)	√	
		HT40 CDD (2 Tx)	√	
		HT40 All non TXBF (2 Tx)	√	
		HT40 TXBF (2 Tx)	√	
		11ac	VHT20 SISO (1 Tx)	√
			VHT40 SISO (1 Tx)	√
	VHT80 SISO (1 Tx)		√	
	VHT20 All non TXBF (2 Tx)		√	
	VHT20 TXBF (2 Tx)		√	
	VHT40 All non TXBF (2 Tx)		√	
	VHT40 TXBF (2 Tx)		√	
	VHT80 All non TXBF (2 Tx)		√	
	VHT80 TXBF (2 Tx)		√	

**Note(s):**

The 11n/ac 2Tx VHT20/VHT40/VHT80 "All" modes detailed apply to all of CDD/STBC/SDM modes.

**Possible Combinations of 802.11 Modes vs. Tx Diversity Configurations (2Tx) - Continued**

Band	802.11 Modes	Tx diversity configurations	Original Approval	
5.3GHz (OFDM) UNII-2A	11a	1 Tx	√	
		2 Tx CDD	√	
	11n	HT20 (1 Tx)	√	
		HT40 (1 Tx)	√	
		HT20 All non TXBF(2 Tx)	√	
		HT20 TXBF (2 Tx)	√	
		HT40 All non TXBF (2 Tx)	√	
		HT40 TXBF (2 Tx)	√	
	11ac	VHT20 (1 Tx)	√	
		VHT40 (1 Tx)	√	
		VHT80 (1 Tx)	√	
		VHT20 All non TXBF (2 Tx)	√	
		VHT20 TXBF (2 Tx)	√	
		VHT40 All non TXBF (2 Tx)	√	
		VHT40 TXBF (2 Tx)	√	
		VHT80 All non TXBF (2 Tx)	√	
		VHT80 TXBF (2 Tx)	√	
		VHT80 TXBF (2 Tx)	√	
	<b>Note(s):</b>			
	The 11n/ac 2Tx VHT20/VHT40/VHT80 "All" modes detailed apply to all of CDD/STBC/SDM modes.			

**Possible Combinations of 802.11 Modes vs. Tx Diversity Configurations (2Tx) - Continued**

Band	802.11 Modes	Tx diversity configurations	Original Approval
5.5GHz (OFDM) UNII-2C	11a	1 Tx	√
		2 Tx CDD	√
	11n	HT20 (1 Tx)	√
		HT40 (1 Tx)	√
		HT20 All non TXBF(2 Tx)	√
		HT20 TXBF (2 Tx)	√
		HT40 All non TXBF (2 Tx)	√
		HT40 TXBF (2 Tx)	√
	11ac	VHT20 (1 Tx)	√
		VHT40 (1 Tx)	√
		VHT80 (1 Tx)	√
		VHT20 All non TXBF (2 Tx)	√
		VHT20 TXBF (2 Tx)	√
		VHT40 All non TXBF (2 Tx)	√
		VHT40 TXBF (2 Tx)	√
		VHT80 All non TXBF (2 Tx)	√
		VHT80 TXBF (2 Tx)	√

**Note(s):**  
The 11n/ac 2Tx VHT20/VHT40/VHT80 "All" modes detailed apply to all of CDD/STBC/SDM modes.

**Possible Combinations of 802.11 Modes vs. Tx Diversity Configurations (2Tx) - Continued**

Band	802.11 Modes	Tx diversity configurations	Original Approval	
5.8GHz (OFDM) UNII-3	11a	1 Tx	√	
		2 Tx CDD	√	
	11n	HT20 (1 Tx)	√	
		HT40 (1 Tx)	√	
		HT20 All non TXBF (2 Tx)	√	
		HT20 TXBF (2 Tx)	√	
		HT40 All nonTXBF (2 Tx)	√	
		HT40 TXBF (2 Tx)	√	
	11ac	VHT20 (1 Tx)	√	
		VHT40 (1 Tx)	√	
		VHT80 (1 Tx)	√	
		VHT20 All non TXBF (2 Tx)	√	
		VHT20 TXBF (2 Tx)	√	
		VHT40 All nonTXBF (2 Tx)	√	
		VHT40 TXBF (2 Tx)	√	
		VHT80 All non TXBF (2 Tx)	√	
		VHT80 TXBF (2 Tx)	√	
		VHT80 TXBF (2 Tx)	√	
	<b>Note(s):</b>			
	The 11n/ac 2Tx VHT20/VHT40/VHT80 "All" modes detailed apply to all of CDD/STBC/SDM modes.			

### 6.4. Maximum Output Power

#### Wi-Fi 2.4GHz Band

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Max. RF Output Power (dBm)		SAR Test (Yes/No)
					Wi-Fi 1	Wi-Fi 2	
2.4	802.11b	1 Tx	1	2412	19.5	19.5	Yes
			6	2437	19.5	19.5	
			11	2462	19.5	19.5	
			12	2467	17.5	17.5	
			13	2472	15.0	15.0	
	802.11g	1 Tx	1	2412	15.5	15.5	No
			2	2417	17.5	17.5	
			3	2422	19.0	19.0	
			6	2437	19.0	19.0	
			9	2452	19.0	19.0	
			10	2457	18.0	18.0	
			11	2462	17.0	17.0	
			12	2467	14.0	14.0	
	802.11n	1 Tx HT20	1	2412	15.5	15.5	No
			2	2417	17.5	17.5	
			3	2422	19.0	19.0	
			6	2437	19.0	19.0	
			9	2452	19.0	19.0	
			10	2457	18.0	18.0	
			11	2462	17.0	17.0	
			12	2467	14.0	14.0	
	802.11ac	1 Tx HT20	1	2412	15.5	15.5	No
			2	2417	17.5	17.5	
			3	2422	19.0	19.0	
			6	2437	19.0	19.0	
			9	2452	19.0	19.0	
			10	2457	18.0	18.0	
			11	2462	17.0	17.0	
			12	2467	14.0	14.0	
	802.11b	2 Tx CDD	1	2412	19.5	19.5	Yes
			6	2437	19.5	19.5	
			10	2457	19.5	19.5	
			11	2462	18.0	18.0	
12			2467	15.5	15.5		
13			2472	13.0	13.0		
802.11g	2 Tx All non TXBF	1	2412	13.0	13.0	No	
		2	2417	16.0	16.0		
		3	2422	19.0	19.0		
		6	2437	19.0	19.0		
		9	2452	19.0	19.0		
		10	2457	17.0	17.0		
		11	2462	12.0	12.0		
		12	2467	9.0	9.0		
		13	2472	0.0	0.0		

**Wi-Fi 2.4GHz Band (continued)**

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Max. RF Output Power (dBm)		SAR Test (Yes/No)		
					Wi-Fi 1	Wi-Fi 2			
2.4	802.11n	2 Tx HT20 CDD	1	2412	13.0	13.0	No		
			2	2417	16.0	16.0			
			3	2422	19.0	19.0			
			6	2437	19.0	19.0			
			9	2452	19.0	19.0			
			10	2457	17.0	17.0			
			11	2462	12.0	12.0			
			12	2467	9.0	9.0			
		13	2472	0.0	0.0				
		2 Tx HT20 All nonTXBF	1	2412	13.0	13.0	No		
			2	2417	16.0	16.0			
			3	2422	19.0	19.0			
			6	2437	19.0	19.0			
			9	2452	19.0	19.0			
			10	2457	17.0	17.0			
			11	2462	12.0	12.0			
			12	2467	9.0	9.0			
		2 Tx HT20 TXBF	1	2412	13.0	13.0	No		
			2	2417	16.0	16.0			
			3	2422	16.5	16.5			
			4	2427	19.0	19.0			
			6	2437	19.0	19.0			
			9	2452	19.0	19.0			
			10	2457	17.0	17.0			
	11		2462	12.0	12.0				
	802.11ac	2 Tx VHT 20 CDD	1	2412	13.0	13.0	No		
			2	2417	16.0	16.0			
			3	2422	19.0	19.0			
			6	2437	19.0	19.0			
			9	2452	19.0	19.0			
			10	2457	17.0	17.0			
			11	2462	12.0	12.0			
			12	2467	9.0	9.0			
			13	2472	0.0	0.0			
			2 Tx VHT20 All nonTXBF	1	2412	13.0		13.0	No
				2	2417	16.0		16.0	
				3	2422	19.0		19.0	
		6		2437	19.0	19.0			
		9		2452	19.0	19.0			
		10		2457	17.0	17.0			
		11		2462	12.0	12.0			
		12		2467	9.0	9.0			
2 Tx VHT20 TXBF		1	2412	13.0	13.0	No			
		2	2417	16.0	16.0				
		3	2422	16.5	16.5				
		4	2427	19.0	19.0				
		6	2437	19.0	19.0				
		9	2452	19.0	19.0				
		10	2457	17.0	17.0				
	11	2462	12.0	12.0					
12	2467	9.0	9.0						
13	2472	0.0	0.0						

**Wi-Fi 5.2GHz Band**

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Max. RF Output Power (dBm)		SAR Test (Yes/No)
					Wi-Fi 1	Wi-Fi 2	
5.2	802.11a	1 Tx	36	5180	16.5	16.5	No
			40	5200	18.0	18.0	
			44	5220	18.0	18.0	
			48	5240	18.0	18.0	
	802.11n	1 Tx HT20	36	5180	16.5	16.5	No
			40	5200	18.0	18.0	
			44	5220	18.0	18.0	
			48	5240	18.0	18.0	
		1 Tx HT40	38	5190	13.5	13.5	No
	802.11ac	1 Tx VHT20	36	5180	16.5	16.5	No
			40	5200	18.0	18.0	
			44	5220	18.0	18.0	
			48	5240	18.0	18.0	
		1 Tx VHT40	38	5190	13.5	13.5	No
			46	5230	18.0	18.0	No
1 Tx VHT80	42	5210	12.0	12.0	No		

**Wi-Fi 5.2GHz Band (continued)**

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Max. RF Output Power (dBm)		SAR Test (Yes/No)		
					Wi-Fi 1	Wi-Fi 2			
5.2	802.11a	2 Tx CDD	36	5180	15.0	15.0	No		
			40	5200	16.0	16.0			
			44	5220	16.0	16.0			
			48	5240	16.0	16.0			
	802.11n	2 Tx HT20 CDD	2 Tx HT20 CDD	36	5180	15.0	15.0	No	
				40	5200	16.0	16.0		
				44	5220	16.0	16.0		
				48	5240	16.0	16.0		
		2 Tx HT20 STBC	2 Tx HT20 STBC	36	5180	15.0	15.0	No	
				40	5200	17.0	17.0		
				44	5220	17.0	17.0		
				48	5240	17.0	17.0		
		2 Tx HT20 SDM	2 Tx HT20 SDM	36	5180	15.0	15.0	No	
				40	5200	17.0	17.0		
				44	5220	17.0	17.0		
				48	5240	17.0	17.0		
		2 Tx HT20 TXBF	2 Tx HT20 TXBF	36	5180	13.5	13.5	No	
				40	5200	16.0	16.0		
				44	5220	16.0	16.0		
				48	5240	16.0	16.0		
			2 Tx HT40 CDD	2 Tx HT40 CDD	38	5190	13.0	13.0	No
					46	5230	16.0	16.0	
			2 Tx HT40 STBC	2 Tx HT40 STBC	38	5190	13.0	13.0	No
					46	5230	17.0	17.0	
	2 Tx HT40 SDM	2 Tx HT40 SDM	38	5190	13.0	13.0	No		
			46	5230	17.0	17.0			
	2 Tx HT40 TXBF	2 Tx HT40 TXBF	38	5190	10.0	10.0	No		
			46	5230	16.0	16.0			
	802.11ac	2 Tx VHT20 CDD	2 Tx VHT20 CDD	36	5180	15.0	15.0	No	
				40	5200	16.0	16.0		
				44	5220	16.0	16.0		
				48	5240	16.0	16.0		
		2 Tx VHT20 STBC	2 Tx VHT20 STBC	36	5180	15.0	15.0	No	
				40	5200	17.0	17.0		
				44	5220	17.0	17.0		
				48	5240	17.0	17.0		
		2 Tx VHT20 SDM	2 Tx VHT20 SDM	36	5180	15.0	15.0	No	
				40	5200	17.0	17.0		
				44	5220	17.0	17.0		
				48	5240	17.0	17.0		
		2 Tx VHT20 TXBF	2 Tx VHT20 TXBF	36	5180	13.5	13.5	No	
				40	5200	16.0	16.0		
44				5220	16.0	16.0			
48				5240	16.0	16.0			
2 Tx VHT40 CDD		2 Tx VHT40 CDD	38	5190	13.0	13.0	No		
			46	5230	16.0	16.0			
2 Tx VHT40 STBC		2 Tx VHT40 STBC	38	5190	13.0	13.0	No		
			46	5230	17.0	17.0			
2 Tx VHT40 SDM		2 Tx VHT40 SDM	38	5190	13.0	13.0	No		
			46	5230	17.0	17.0			
2 Tx VHT40 TXBF		2 Tx VHT40 TXBF	38	5190	10.0	10.0	No		
			46	5230	16.0	16.0			
2 Tx VHT80 CDD	2 Tx VHT80 CDD	42	5210	11.0	11.0	No			
		42	5210	11.0	11.0				
2 Tx VHT80 STBC	2 Tx VHT80 STBC	42	5210	11.0	11.0	No			
		42	5210	11.0	11.0				
2 Tx VHT80 SDM	2 Tx VHT80 SDM	42	5210	11.0	11.0	No			
		42	5210	11.0	11.0				
2 Tx VHT80 TXBF	2 Tx VHT80 TXBF	42	5210	9.5	9.5	No			
		42	5210	9.5	9.5				

**Wi-Fi 5.3GHz Band**

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Max. RF Output Power (dBm)		SAR Test (Yes/No)
					Wi-Fi 1	Wi-Fi 2	
5.3	802.11a	1 Tx	52	5260	18.0	18.0	No
			56	5280	18.0	18.0	
			60	5300	18.0	18.0	
			64	5320	16.0	16.0	
	802.11n	1 Tx HT20	52	5260	18.0	18.0	No
			56	5280	18.0	18.0	
			60	5300	18.0	18.0	
			64	5320	16.0	16.0	
		1 Tx HT40	54	5270	18.0	18.0	Yes
	62	5310	13.0	13.0			
	802.11ac	1 Tx VHT20	52	5260	18.0	18.0	No
			56	5280	18.0	18.0	
			60	5300	18.0	18.0	
			64	5320	16.0	16.0	
		1 Tx VHT40	54	5270	18.0	18.0	No
62			5310	13.0	13.0		
1 Tx VHT80		58	5290	11.0	11.0	No	

**Wi-Fi 5.3GHz Band (continued)**

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Max. RF Output Power (dBm)		SAR Test (Yes/No)		
					Wi-Fi 1	Wi-Fi 2			
5.3	802.11a	2 Tx CDD	52	5260	16.0	16.0	No		
			56	5280	16.0	16.0			
			60	5300	16.0	16.0			
			64	5320	15.0	15.0			
	802.11n	2 Tx HT20 CDD	2 Tx HT20 CDD	52	5260	16.0	16.0	No	
				56	5280	16.0	16.0		
				60	5300	16.0	16.0		
				64	5320	15.0	15.0		
		2 Tx HT20 STBC	2 Tx HT20 STBC	52	5260	17.0	17.0	No	
				56	5280	17.0	17.0		
				60	5300	17.0	17.0		
				64	5320	15.0	15.0		
		2 Tx HT20 SDM	2 Tx HT20 SDM	52	5260	17.0	17.0	No	
				56	5280	17.0	17.0		
				60	5300	17.0	17.0		
				64	5320	15.0	15.0		
		2 Tx HT20 TXBF	2 Tx HT20 TXBF	52	5260	16.0	16.0	No	
				56	5280	16.0	16.0		
				60	5300	16.0	16.0		
				64	5320	14.0	14.0		
			2 Tx HT40 CDD	2 Tx HT40 CDD	54	5270	16.0	16.0	No
					62	5310	11.5	11.5	
			2 Tx HT40 STBC	2 Tx HT40 STBC	54	5270	17.0	17.0	Yes
					62	5310	12.0	12.0	
	2 Tx HT40 SDM	2 Tx HT40 SDM	54	5270	17.0	17.0	No		
			62	5310	12.0	12.0			
	2 Tx HT40 TXBF	2 Tx HT40 TXBF	54	5270	16.0	16.0	No		
			62	5310	12.5	12.5			
	802.11ac	2 Tx VHT20 CDD	2 Tx VHT20 CDD	52	5260	16.0	16.0	No	
				56	5280	16.0	16.0		
				60	5300	16.0	16.0		
				64	5320	15.0	15.0		
		2 Tx VHT20 STBC	2 Tx VHT20 STBC	52	5260	17.0	17.0	No	
				56	5280	17.0	17.0		
				60	5300	17.0	17.0		
				64	5320	15.0	15.0		
		2 Tx VHT20 SDM	2 Tx VHT20 SDM	52	5260	17.0	17.0	No	
				56	5280	17.0	17.0		
				60	5300	17.0	17.0		
				64	5320	15.0	15.0		
2 Tx VHT20 TXBF		2 Tx VHT20 TXBF	52	5260	16.0	16.0	No		
			56	5280	16.0	16.0			
			60	5300	16.0	16.0			
			64	5320	14.0	14.0			
2 Tx VHT40 CDD		2 Tx VHT40 CDD	54	5270	16.0	16.0	No		
			62	5310	11.5	11.5			
2 Tx VHT40 STBC		2 Tx VHT40 STBC	54	5270	17.0	17.0	No		
			62	5310	12.0	12.0			
2 Tx VHT40 SDM	2 Tx VHT40 SDM	54	5270	17.0	17.0	No			
		62	5310	12.0	12.0				
2 Tx VHT40 TXBF	2 Tx VHT40 TXBF	54	5270	16.0	16.0	No			
		62	5310	12.5	12.5				
2 Tx VHT80 CDD	2 Tx VHT80 CDD	58	5290	8.5	8.5	No			
		58	5290	9.5	9.5				
		58	5290	9.5	9.5				
		58	5290	9.5	9.5				

**Wi-Fi 5.5GHz Band**

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Max. RF Output Power (dBm)		SAR Test (Yes/No)
					Wi-Fi 1	Wi-Fi 2	
5.5	802.11a	1 Tx	100	5500	16.5	16.5	No
			104	5520	18.0	18.0	
			108	5540	18.0	18.0	
			112	5560	18.0	18.0	
			116	5580	18.0	18.0	
			120	5600	18.0	18.0	
			124	5620	18.0	18.0	
			128	5640	18.0	18.0	
			132	5660	18.0	18.0	
			136	5680	18.0	18.0	
			140	5700	15.5	15.5	
	144	5720	16.0	16.0			
	802.11n	1 Tx HT20	100	5500	16.5	16.5	No
			104	5520	18.0	18.0	
			108	5540	18.0	18.0	
			112	5560	18.0	18.0	
			116	5580	18.0	18.0	
			120	5600	18.0	18.0	
			124	5620	18.0	18.0	
			128	5640	18.0	18.0	
			132	5660	18.0	18.0	
			136	5680	18.0	18.0	
			140	5700	15.5	15.5	
		144	5720	16.0	16.0		
		1 Tx HT40	102	5510	15.0	15.0	No
			110	5550	18.0	18.0	
			118	5590	18.0	18.0	
			126	5630	18.0	18.0	
			134	5670	17.0	17.0	
			142	5710	17.0	17.0	
		802.11ac	1 Tx VHT20	100	5500	16.5	16.5
	104			5520	18.0	18.0	
	108			5540	18.0	18.0	
	112			5560	18.0	18.0	
	116			5580	18.0	18.0	
	120			5600	18.0	18.0	
	124			5620	18.0	18.0	
	128			5640	18.0	18.0	
	132			5660	18.0	18.0	
	136			5680	18.0	18.0	
	140			5700	15.5	15.5	
	144		5720	16.0	16.0		
1 Tx VHT40	102		5510	15.0	15.0	No	
	110		5550	18.0	18.0		
	118		5590	18.0	18.0		
	126		5630	18.0	18.0		
	134		5670	17.0	17.0		
	142		5710	17.0	17.0		
1 Tx VHT80	106		5530	10.5	10.5	Yes	
	122		5610	18.0	18.0		
	138		5690	18.0	18.0		

**Wi-Fi 5.5GHz Band (continued)**

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Max. RF Output Power (dBm)		SAR Test (Yes/No)			
					Wi-Fi 1	Wi-Fi 2				
5.5	802.11a	2 Tx CDD	100	5500	14.5	14.5	No			
			104	5520	14.5	14.5				
			108	5540	14.5	14.5				
			112	5560	14.5	14.5				
			116	5580	14.5	14.5				
			120	5600	14.5	14.5				
			124	5620	14.5	14.5				
			128	5640	14.5	14.5				
			132	5660	14.5	14.5				
			136	5680	14.5	14.5				
			140	5700	14.5	14.5				
			144	5720	14.5	14.5				
			802.11n	2 Tx HT20 CDD	100	5500		14.5	14.5	No
					104	5520		14.5	14.5	
	108	5540			14.5	14.5				
	112	5560			14.5	14.5				
	116	5580			14.5	14.5				
	120	5600			14.5	14.5				
	124	5620			14.5	14.5				
	128	5640			14.5	14.5				
	132	5660			14.5	14.5				
	136	5680			14.5	14.5				
	140	5700			14.5	14.5				
	144	5720			14.5	14.5				
	2 Tx HT20 STBC	100			5500	15.5	15.5	No		
		104			5520	17.0	17.0			
		108		5540	17.0	17.0				
		112		5560	17.0	17.0				
		116		5580	17.0	17.0				
		120		5600	17.0	17.0				
		124		5620	17.0	17.0				
		128		5640	17.0	17.0				
		132		5660	17.0	17.0				
		136		5680	17.0	17.0				
		140		5700	15.0	15.0				
		144		5720	16.5	16.5				
		2 Tx HT20 SDM		100	5500	15.5	15.5		No	
				104	5520	17.0	17.0			
	108			5540	17.0	17.0				
	112			5560	17.0	17.0				
	116		5580	17.0	17.0					
	120		5600	17.0	17.0					
	124		5620	17.0	17.0					
	128		5640	17.0	17.0					
132	5660		17.0	17.0						
136	5680		17.0	17.0						
140	5700		15.0	15.0						
144	5720		16.5	16.5						
2 Tx HT20 TXBF	100		5500	13.5	13.5	No				
	104		5520	14.5	14.5					
	108	5540	14.5	14.5						
	112	5560	14.5	14.5						
	116	5580	14.5	14.5						
	120	5600	14.5	14.5						
	124	5620	14.5	14.5						
	128	5640	14.5	14.5						
	132	5660	14.5	14.5						
	136	5680	14.5	14.5						
140	5700	14.5	14.5							
144	5720	14.5	14.5							

**Wi-Fi 5.5GHz Band (continued)**

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Max. RF Output Power (dBm)		SAR Test (Yes/No)		
					Wi-Fi 1	Wi-Fi 2			
5.5	802.11n	2 Tx HT40 CDD	102	5510	12.0	12.0	No		
			110	5550	14.5	14.5			
			118	5590	14.5	14.5			
			126	5630	14.5	14.5			
			134	5670	14.5	14.5			
			142	5710	14.5	14.5			
		2 Tx HT40 STBC	102	5510	12.0	12.0	No		
			110	5550	17.0	17.0			
			118	5590	17.0	17.0			
			126	5630	17.0	17.0			
			134	5670	15.0	15.0			
			142	5710	16.5	16.5			
		2 Tx HT40 SDM	102	5510	12.0	12.0	No		
			110	5550	17.0	17.0			
			118	5590	17.0	17.0			
			126	5630	17.0	17.0			
			134	5670	15.0	15.0			
			142	5710	16.5	16.5			
	2 Tx HT40 TXBF	102	5510	9.5	9.5	No			
		110	5550	14.5	14.5				
		118	5590	14.5	14.5				
		126	5630	14.5	14.5				
		134	5670	14.5	14.5				
		142	5710	14.5	14.5				
	802.11ac	2 Tx VHT20 CDD	100	5500	14.5	14.5	No		
			104	5520	14.5	14.5			
			108	5540	14.5	14.5			
			112	5560	14.5	14.5			
			116	5580	14.5	14.5			
			120	5600	14.5	14.5			
			124	5620	14.5	14.5			
			128	5640	14.5	14.5			
			132	5660	14.5	14.5			
			136	5680	14.5	14.5			
			140	5700	14.5	14.5			
			144	5720	14.5	14.5			
			2 Tx VHT20 STBC	100	5500	15.5		15.5	No
				104	5520	17.0		17.0	
		108		5540	17.0	17.0			
		112		5560	17.0	17.0			
		116		5580	17.0	17.0			
		120		5600	17.0	17.0			
124		5620		17.0	17.0				
128		5640		17.0	17.0				
132		5660		17.0	17.0				
136		5680		17.0	17.0				
2 Tx VHT20 SDM		100	5500	15.5	15.5	No			
		104	5520	17.0	17.0				
		108	5540	17.0	17.0				
		112	5560	17.0	17.0				
		116	5580	17.0	17.0				
		120	5600	17.0	17.0				
		124	5620	17.0	17.0				
		128	5640	17.0	17.0				
	132	5660	17.0	17.0					
	136	5680	17.0	17.0					
140	5700	15.0	15.0						
144	5720	16.5	16.5						

**Wi-Fi 5.5GHz Band (continued)**

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Max. RF Output Power (dBm)		SAR Test (Yes/No)
					Wi-Fi 1	Wi-Fi 2	
5.5	802.11ac	2 Tx VHT20 TXBF	100	5500	13.5	13.5	No
			104	5520	14.5	14.5	
			108	5540	14.5	14.5	
			112	5560	14.5	14.5	
			116	5580	14.5	14.5	
			120	5600	14.5	14.5	
			124	5620	14.5	14.5	
			128	5640	14.5	14.5	
			132	5660	14.5	14.5	
			136	5680	14.5	14.5	
			140	5700	14.5	14.5	
			144	5720	14.5	14.5	
		2 Tx VHT40 CDD	102	5510	12.0	12.0	No
			110	5550	14.5	14.5	
			118	5590	14.5	14.5	
			126	5630	14.5	14.5	
			134	5670	14.5	14.5	
		2 Tx VHT40 STBC	102	5510	12.0	12.0	No
			110	5550	17.0	17.0	
			118	5590	17.0	17.0	
			126	5630	17.0	17.0	
			134	5670	15.0	15.0	
		2 Tx VHT40 SDM	142	5710	16.5	16.5	No
			102	5510	12.0	12.0	
			110	5550	17.0	17.0	
			118	5590	17.0	17.0	
			126	5630	17.0	17.0	
		2 Tx VHT40 TXBF	134	5670	15.0	15.0	No
			142	5710	16.5	16.5	
			102	5510	9.5	9.5	
			110	5550	14.5	14.5	
			118	5590	14.5	14.5	
		2 Tx VHT80 CDD	126	5630	14.5	14.5	Yes
			134	5670	14.5	14.5	
			142	5710	14.5	14.5	
		2 Tx VHT80 STBC	106	5530	10.0	10.0	No
			122	5610	18.0	18.0	
			138	5690	18.0	18.0	
		2 Tx VHT80 SDM	106	5530	10.0	10.0	No
			122	5610	18.0	18.0	
			138	5690	18.0	18.0	
		2 Tx VHT80 TXBF	106	5530	8.5	8.5	No
122	5610		17.0	17.0			
138	5690		17.0	17.0			

**Wi-Fi 5.8GHz Band**

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Max. RF Output Power (dBm)		SAR Test (Yes/No)
					Wi-Fi 1	Wi-Fi 2	
5.8	802.11a	1 Tx	149	5745	16.0	16.0	Yes
			153	5765	18.0	18.0	
			157	5785	18.0	18.0	
			161	5805	18.0	18.0	
			165	5825	16.5	16.5	
	802.11n	1 Tx HT20	149	5745	16.0	16.0	No
			153	5765	18.0	18.0	
			157	5785	18.0	18.0	
			161	5805	18.0	18.0	
			165	5825	16.5	16.5	
		1 Tx HT40	151	5755	15.0	15.0	No
	802.11ac	1 Tx VHT20	149	5745	16.0	16.0	No
			153	5765	18.0	18.0	
			157	5785	18.0	18.0	
			161	5805	18.0	18.0	
			165	5825	16.5	16.5	
		1 Tx VHT40	151	5755	15.0	15.0	No
		1 Tx VHT80	159	5795	16.5	16.5	No
		1 Tx VHT80	155	5775	13.5	13.5	No

**Wi-Fi 5.8GHz Band (continued)**

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Max. RF Output Power (dBm)		SAR Test (Yes/No)
					Wi-Fi 1	Wi-Fi 2	
5.8	802.11a	2 Tx CDD	149	5745	15.5	15.5	Yes
			153	5765	18.0	18.0	
			157	5785	18.0	18.0	
			161	5805	18.0	18.0	
			165	5825	16.0	16.0	
	802.11n	2 Tx HT20 CDD	149	5745	15.5	15.5	No
			153	5765	18.0	18.0	
			157	5785	18.0	18.0	
			161	5805	18.0	18.0	
			165	5825	16.0	16.0	
		2 Tx HT20 STBC	149	5745	15.5	15.5	No
			153	5765	18.0	18.0	
			157	5785	18.0	18.0	
			161	5805	18.0	18.0	
			165	5825	16.0	16.0	
		2 Tx HT20 SDM	149	5745	15.5	15.5	No
			153	5765	18.0	18.0	
			157	5785	18.0	18.0	
			161	5805	18.0	18.0	
			165	5825	16.0	16.0	
		2 Tx HT20 TXBF	149	5745	13.0	13.0	No
			153	5765	18.0	18.0	
			157	5785	18.0	18.0	
			161	5805	18.0	18.0	
			165	5825	14.0	14.0	
		2 Tx HT40 CDD	151	5755	12.5	12.5	No
			159	5795	15.0	15.0	
			151	5755	12.5	12.5	
			159	5795	16.0	16.0	
			151	5755	12.5	12.5	
	159		5795	16.0	16.0		
	151		5755	9.5	9.5		
	159	5795	15.5	15.5			
	802.11ac	2 Tx HT20 CDD	149	5745	15.5	15.5	No
			153	5765	18.0	18.0	
			157	5785	18.0	18.0	
			161	5805	18.0	18.0	
			165	5825	16.0	16.0	
		2 Tx HT20 STBC	149	5745	15.5	15.5	No
			153	5765	18.0	18.0	
			157	5785	18.0	18.0	
			161	5805	18.0	18.0	
			165	5825	16.0	16.0	
		2 Tx HT20 SDM	149	5745	15.5	15.5	No
			153	5765	18.0	18.0	
157			5785	18.0	18.0		
161			5805	18.0	18.0		
165			5825	16.0	16.0		
2 Tx HT20 TXBF		149	5745	13.0	13.0	No	
		153	5765	18.0	18.0		
		157	5785	18.0	18.0		
		161	5805	18.0	18.0		
		165	5825	14.0	14.0		

**Wi-Fi 5.8GHz Band (continued)**

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Max. RF Output Power (dBm)		SAR Test (Yes/No)
					Wi-Fi 1	Wi-Fi 2	
5.8	802.11ac	2 Tx HT40 CDD	151	5755	12.5	12.5	No
			159	5795	15.0	15.0	
		2 Tx HT40 STBC	151	5755	12.5	12.5	No
			159	5795	16.0	16.0	
		2 Tx HT40 SDM	151	5755	12.5	12.5	No
			159	5795	16.0	16.0	
		2 Tx HT40 TXBF	151	5755	9.5	9.5	No
			159	5795	15.5	15.5	
		2 Tx VHT80 CDD	155	5775	12.0	12.0	No
		2 Tx VHT80 STBC	155	5775	12.0	12.0	No
		2 Tx VHT80 SDM	155	5775	12.0	12.0	No
		2 Tx VHT80 TXBF	155	5775	8.5	8.5	No

**Bluetooth Maximum Output Power**

Band (GHz)	Mode	Ch #	Freq. (MHz)	Avg Power (dBm)
2.4	V2.1 + EDR, GFSK	0	2402	12.0
		39	2441	12.0
		78	2480	12.0
	V2.1 + EDR, QPSK	0	2402	10.0
		39	2441	10.0
		78	2480	10.0
	V2.1 BLE, 8-DPSK	0	2402	10.0
		19	2440	10.0
		39	2480	10.0

## **6.5. Antenna Dimensions and Separation Distances**

Refer to separate filing document.

## 7. RF Exposure Conditions (Test Configurations)

Wireless technologies	RF Exposure Conditions	DUT-to-User Separation	Test Position	Antenna-to-edge/surface	SAR Required	Note
WLAN	Body	0.64 mm	Rear	N/A	Yes	

## 8. Dielectric Property Measurements

### 8.1. Tissue Dielectric Parameters

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	
	$\epsilon_r$	$\sigma$ (S/m)	$\epsilon_r$	$\sigma$ (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

**Dielectric Property Measurements Results:****SAR Lab E**

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
2/17/2016	Body 5180	e'	46.7100	Relative Permittivity ( $\epsilon_r$ ):	46.71	49.05	-4.76	5
		e"	18.7700	Conductivity ( $\sigma$ ):	5.41	5.27	2.56	5
	Body 5200	e'	46.7400	Relative Permittivity ( $\epsilon_r$ ):	46.74	49.02	-4.65	5
		e"	18.8100	Conductivity ( $\sigma$ ):	5.44	5.29	2.72	5

**SAR Lab F**

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)		
2/3/2016	Body 5180	e'	47.0800	Relative Permittivity ( $\epsilon_r$ ):	47.08	49.05	-4.01	5	
		e"	18.7000	Conductivity ( $\sigma$ ):	5.39	5.27	2.18	5	
	Body 5200	e'	47.0500	Relative Permittivity ( $\epsilon_r$ ):	47.05	49.02	-4.02	5	
		e"	18.6700	Conductivity ( $\sigma$ ):	5.40	5.29	1.95	5	
	Body 5600	e'	46.4200	Relative Permittivity ( $\epsilon_r$ ):	46.42	48.48	-4.24	5	
		e"	19.0300	Conductivity ( $\sigma$ ):	5.93	5.76	2.86	5	
	Body 5800	e'	46.0900	Relative Permittivity ( $\epsilon_r$ ):	46.09	48.20	-4.38	5	
		e"	19.2500	Conductivity ( $\sigma$ ):	6.21	6.00	3.47	5	
	Body 5825	e'	46.0200	Relative Permittivity ( $\epsilon_r$ ):	46.02	48.20	-4.52	5	
		e"	19.2200	Conductivity ( $\sigma$ ):	6.23	6.00	3.75	5	
	2/8/2016	Body 5180	e'	48.5400	Relative Permittivity ( $\epsilon_r$ ):	48.54	49.05	-1.03	5
			e"	18.3300	Conductivity ( $\sigma$ ):	5.28	5.27	0.15	5
Body 5200		e'	48.6500	Relative Permittivity ( $\epsilon_r$ ):	48.65	49.02	-0.75	5	
		e"	18.3400	Conductivity ( $\sigma$ ):	5.30	5.29	0.15	5	
Body 5600		e'	48.2100	Relative Permittivity ( $\epsilon_r$ ):	48.21	48.48	-0.55	5	
		e"	18.5000	Conductivity ( $\sigma$ ):	5.76	5.76	-0.01	5	
Body 5800		e'	47.8600	Relative Permittivity ( $\epsilon_r$ ):	47.86	48.20	-0.71	5	
		e"	18.6700	Conductivity ( $\sigma$ ):	6.02	6.00	0.35	5	
Body 5825		e'	47.8600	Relative Permittivity ( $\epsilon_r$ ):	47.86	48.20	-0.71	5	
		e"	18.6200	Conductivity ( $\sigma$ ):	6.03	6.00	0.51	5	
2/12/2016		Body 5180	e'	48.3400	Relative Permittivity ( $\epsilon_r$ ):	48.34	49.05	-1.44	5
			e"	18.8000	Conductivity ( $\sigma$ ):	5.41	5.27	2.72	5
	Body 5200	e'	48.3100	Relative Permittivity ( $\epsilon_r$ ):	48.31	49.02	-1.45	5	
		e"	18.8800	Conductivity ( $\sigma$ ):	5.46	5.29	3.10	5	
	Body 5600	e'	47.7400	Relative Permittivity ( $\epsilon_r$ ):	47.74	48.48	-1.52	5	
		e"	19.2000	Conductivity ( $\sigma$ ):	5.98	5.76	3.77	5	
	Body 5800	e'	47.3700	Relative Permittivity ( $\epsilon_r$ ):	47.37	48.20	-1.72	5	
		e"	19.3800	Conductivity ( $\sigma$ ):	6.25	6.00	4.17	5	
	Body 5825	e'	47.4200	Relative Permittivity ( $\epsilon_r$ ):	47.42	48.20	-1.62	5	
		e"	19.4100	Conductivity ( $\sigma$ ):	6.29	6.00	4.78	5	
	2/17/2016	Body 5180	e'	48.3200	Relative Permittivity ( $\epsilon_r$ ):	48.32	49.05	-1.48	5
			e"	18.6000	Conductivity ( $\sigma$ ):	5.36	5.27	1.63	5
Body 5200		e'	48.2900	Relative Permittivity ( $\epsilon_r$ ):	48.29	49.02	-1.49	5	
		e"	18.6300	Conductivity ( $\sigma$ ):	5.39	5.29	1.74	5	
Body 5600		e'	47.5900	Relative Permittivity ( $\epsilon_r$ ):	47.59	48.48	-1.83	5	
		e"	18.9800	Conductivity ( $\sigma$ ):	5.91	5.76	2.59	5	
Body 5800		e'	47.3000	Relative Permittivity ( $\epsilon_r$ ):	47.30	48.20	-1.87	5	
		e"	19.2000	Conductivity ( $\sigma$ ):	6.19	6.00	3.20	5	
Body 5825		e'	47.2400	Relative Permittivity ( $\epsilon_r$ ):	47.24	48.20	-1.99	5	
		e"	19.2600	Conductivity ( $\sigma$ ):	6.24	6.00	3.97	5	

**SAR Lab G**

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
2/3/2016	Body 5180	e'	46.7600	Relative Permittivity ( $\epsilon_r$ ):	46.76	49.05	-4.66	5
		e"	19.1400	Conductivity ( $\sigma$ ):	5.51	5.27	4.58	5
	Body 5200	e'	46.7700	Relative Permittivity ( $\epsilon_r$ ):	46.77	49.02	-4.59	5
		e"	19.0200	Conductivity ( $\sigma$ ):	5.50	5.29	3.87	5
	Body 5600	e'	46.2600	Relative Permittivity ( $\epsilon_r$ ):	46.26	48.48	-4.57	5
		e"	19.2800	Conductivity ( $\sigma$ ):	6.00	5.76	4.21	5

**SAR Lab H**

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
2/3/2016	Body 2450	e'	52.0300	Relative Permittivity ( $\epsilon_r$ ):	52.03	52.70	-1.27	5
		e"	14.5800	Conductivity ( $\sigma$ ):	1.99	1.95	1.86	5
	Body 2410	e'	52.1700	Relative Permittivity ( $\epsilon_r$ ):	52.17	52.76	-1.12	5
		e"	14.4300	Conductivity ( $\sigma$ ):	1.93	1.91	1.37	5
	Body 2475	e'	51.9300	Relative Permittivity ( $\epsilon_r$ ):	51.93	52.67	-1.40	5
		e"	14.6900	Conductivity ( $\sigma$ ):	2.02	1.99	1.84	5
2/8/2016	Body 2450	e'	51.7600	Relative Permittivity ( $\epsilon_r$ ):	51.76	52.70	-1.78	5
		e"	14.4400	Conductivity ( $\sigma$ ):	1.97	1.95	0.88	5
	Body 2410	e'	51.9000	Relative Permittivity ( $\epsilon_r$ ):	51.90	52.76	-1.63	5
		e"	14.2100	Conductivity ( $\sigma$ ):	1.90	1.91	-0.17	5
	Body 2475	e'	51.6800	Relative Permittivity ( $\epsilon_r$ ):	51.68	52.67	-1.88	5
		e"	14.4800	Conductivity ( $\sigma$ ):	1.99	1.99	0.38	5

## 8.2. System Check Results

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

### System Performance Check Measurement Conditions:

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

**System Check Results**

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target.

**SAR Lab E**

SAR Room	Date	Tissue Type	Dipole Type _Serial #	Dipole Cal. Due Data	Measured Results for 1g SAR				Measured Results for 10g SAR				Plot No.
					Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10 %	Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10 %	
E	2/17/2016	Body	D5GHzV2 SN:1138 (5.2 GHz)	9/23/2016	7.95	79.5	76.9	3.38	2.26	22.6	21.5	5.12	1,2

**SAR Lab F**

SAR Room	Date	Tissue Type	Dipole Type _Serial #	Dipole Cal. Due Data	Measured Results for 1g SAR				Measured Results for 10g SAR				Plot No.
					Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10 %	Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10 %	
F	2/3/2016	Body	D5GHzV2 SN:1168 (5.6 GHz)	11/13/2016	8.40	84.0	82.5	1.82	2.35	23.5	23.0	2.17	
F	2/8/2016	Body	D5GHzV2 SN:1168 (5.2 GHz)	11/13/2016	7.38	73.8	75.0	-1.60	2.10	21.0	21.0	0.00	
F	2/8/2016	Body	D5GHzV2 SN:1168 (5.6 GHz)	11/13/2016	8.39	83.9	82.5	1.70	2.35	23.5	23.0	2.17	
F	2/12/2016	Body	D5GHzV2 SN:1168 (5.6 GHz)	11/13/2016	8.86	88.6	82.5	7.39	2.47	24.7	23.0	7.39	3,4
F	2/17/2016	Body	D5GHzV2 SN:1168 (5.8 GHz)	11/13/2016	7.55	75.5	78.1	-3.33	2.12	21.2	21.6	-1.85	

**SAR Lab G**

SAR Room	Date	Tissue Type	Dipole Type _Serial #	Dipole Cal. Due Data	Measured Results for 1g SAR				Measured Results for 10g SAR				Plot No.
					Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10 %	Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10 %	
G	2/3/2016	Body	D5GHzV2 SN:1003 (5.6 GHz)	2/20/2016	8.11	81.1	77.0	5.32	2.26	22.6	21.3	6.10	5,6

**SAR Lab H**

SAR Room	Date	Tissue Type	Dipole Type _Serial #	Dipole Cal. Due Data	Measured Results for 1g SAR				Measured Results for 10g SAR				Plot No.
					Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10 %	Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10 %	
H	2/3/2016	Body	D2450V2 SN:899	3/13/2016	5.23	52.3	48.8	7.17	2.39	23.9	22.7	5.29	7,8
H	2/8/2016	Body	D2450V2 SN:899	3/13/2016	5.15	51.50	48.80	5.53	2.36	23.60	22.70	3.96	

## 9. Conducted Output Power Measurements

### 9.1. Wi-Fi 2.4GHz (DTS Band)

#### Measured Results

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Average Power (dBm)	
					Wi-Fi 1	Wi-Fi 2
2.4	802.11b	1 Tx	1	2412	19.5	19.5
			6	2437	19.5	19.5
			11	2462	19.5	19.5
			12	2467	17.5	17.5
			13	2472	15.0	15.0
	802.11b CDD	2 Tx	1	2412	19.5	19.5
			6	2437	19.5	19.5
			10	2457	19.5	19.5
			11	2462	18.0	18.0
			12	2467	15.5	15.5
			13	2472	13.0	13.0

### 9.2. Wi-Fi 5GHz (U-NII Bands)

#### Measured Results

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Average Power (dBm)	
					Wi-Fi 1	Wi-Fi 2
5.3	802.11n HT40	1 Tx	54	5270	17.9	17.9
			62	5310	13.0	13.0
	802.11n HT40 STBC	2 Tx	54	5270	17.0	17.0
Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Average Power (dBm)	
					Wi-Fi 1	Wi-Fi 2
5.5	802.11ac VHT80	1 Tx	122	5610	18.0	17.8
			138	5690	18.0	18.0
	802.11ac VHT80 CDD	2 Tx	122	5610	18.0	17.8
			138	5690	18.0	17.8
Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Average Power (dBm)	
					Wi-Fi 1	Wi-Fi 2
5.8	802.11a	1 Tx	157	5785	18.0	18.0
			161	5805	18.0	18.0
	802.11a CDD	2 Tx	157	5785	18.0	18.0
			161	5805	18.0	18.0

### 9.3. Bluetooth

Band (GHz)	Mode	Ch #	Freq. (MHz)	Avg Power (dBm)
2.4	V2.1 + EDR, GFSK	0	2402	10.6
		39	2441	10.8
		78	2480	10.7

## 10. SAR Test Results

### KDB 248227 D01 SAR meas for 802.11:

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:

- $\leq 0.4$  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  $\leq 0.8$  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  $\leq 1.2$  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  $\leq 1.2$  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  $\leq 1.2$  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)**

Band	Mode	No. of Transmitters	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)				SAR (W/kg)								Plot No.		
							Wi-Fi 1		Wi-Fi 2		Wi-Fi 1				Wi-Fi 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			
2.4	802.11b	1 Tx	0	Rear	6	2437	19.5	19.5			0.992	0.517	0.992	0.517							
					11	2462	19.5	19.5			0.883	0.456	0.883	0.456							
				Rear	6	2437			19.5	19.5					1.120	0.578	1.120	0.578			1
					11	2462			19.5	19.5					0.991	0.502	0.991	0.502			
		2 Tx	0	Rear	6	2437	19.5	19.5	19.5	19.5	0.974	0.508	0.974	0.508	1.050	0.542	1.050	0.542			
					10	2457	19.5	19.5	19.5	19.5	0.818	0.424	0.818	0.424	0.902	0.458	0.902	0.458			

10.2. Wi-Fi (U-NII Band)

Band	Mode	No. of Transmitters	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)				SAR (W/kg)								Plot No.		
							Wi-Fi 1		Wi-Fi 2		Wi-Fi 1				Wi-Fi 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	802.11n	1 Tx HT40	0	Rear	54	5270	18.0	17.9			0.795	0.302	0.814	0.309					2		
					62	5310	13.0	13.0			0.284	0.102	0.284	0.102							
		54	5270			18.0	17.9					0.901	0.343	0.922	0.351						
		62	5310			13.0	13.0					0.306	0.115	0.306	0.115						
		2 Tx HT40 STBC	0	Rear	54	5270	17.0	17.0	17.0	17.0	0.664	0.249	0.664	0.249	0.618	0.232	0.618	0.232			
Band	Mode	No. of Transmitters	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)				SAR (W/kg)								Plot No.		
							Wi-Fi 1		Wi-Fi 2		Wi-Fi 1				Wi-Fi 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	802.11ac	1 Tx VHT80	0	Rear	122	5610	18.0	18.0			1.100	0.406	1.100	0.406					3		
					138	5690	18.0	18.0			0.937	0.360	0.937	0.360							
					122	5610			18.0	17.8					0.758	0.288	0.794	0.302			
					138	5690			18.0	18.0					0.844	0.307	0.844	0.307			
		122	5610	18.0	18.0	18.0	17.8	0.943	0.352	0.943	0.369	0.756	0.276	0.792	0.289						
		138	5690	18.0	18.0	18.0	17.8	0.992	0.378	0.992	0.396	0.963	0.351	1.008	0.368						
5.8GHz	802.11a	1 Tx	0	Rear	157	5785	18.0	18.0			0.841	0.304	0.841	0.304					4		
					161	5785	18.0	18.0			0.802	0.290	0.802	0.290							
					157	5785			18.0	18.0					0.986	0.346	0.986	0.346			
					161	5785			18.0	18.0					0.879	0.308	0.879	0.308			
802.11a	2 Tx CDD	0	Rear	157	5785	18.0	18.0	18.0	18.0	0.784	0.287	0.784	0.287	0.817	0.288	0.817	0.288				
				161	5805	18.0	18.0	18.0	18.0	0.813	0.297	0.813	0.297	0.833	0.293	0.833	0.293				

**10.3. Bluetooth**

Mode	Test Position	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		SAR (W/kg)				Plot No.
					Wi-Fi 1		Wi-Fi 1				
					Tune-up Limit	Measured	Measured		Scaled		
							1-g	10-g	1-g	10-g	
GFSK	Rear	0	39	2441	12.0	10.8	0.142	0.074	0.187	0.097	5

## 11. SAR Measurement Variability

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

- 1) Repeated measurement is not required when the original highest measured SAR is  $<0.8$  or  $2$  W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is  $\geq 0.8$  or  $2$  W/kg (1-g or 10-g respectively), repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is  $> 1.20$  or  $3$  (1-g or 10-g respectively) or when the original or repeated measurement is  $\geq 1.45$  or  $3.6$  W/kg (~ 10% from the 1-g or 10-g respective SAR limit).
- 4) Perform a third repeated measurement only if the original, first, or second repeated measurement is  $\geq 1.5$  or  $3.75$  W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$  or  $3$  (1-g or 10-g respectively).

Frequency Band (MHz)	Air Interface	RF Exposure Conditions	Test Position	Repeated SAR (Yes/No)	Highest Measured SAR (W/kg)	First Repeated	
						Measured SAR (W/kg)	Largest to Smallest SAR Ratio
2400	Wi-Fi 802.11b/g/n	Standalone	Rear	Yes	1.120	1.080	1.04
	BT	Standalone	Rear	No	0.142	N/A	N/A
5300	Wi-Fi 802.11n	Standalone	Rear	Yes	0.901	0.882	1.02
5500	Wi-Fi 802.11ac	Standalone	Rear	Yes	1.100	1.090	1.05
5800	Wi-Fi 802.11n	Standalone	Rear	Yes	0.986	0.912	1.08

### 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  $> 1.20$  or  $3$  (1-g or 10-g respectively).

## 12. Simultaneous Transmission SAR Analysis

KDB 447498 D01 General RF Exposure Guidance 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:

**SAR<sub>1</sub>** 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

**SAR<sub>2</sub>** 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  $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$

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:

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

### Simultaneous Transmission Condition

RF Exposure Condition	Item	Capable Transmit Configurations	
Standalone	1	Wi-Fi 2 2.4GHz SISO	+ Wi-Fi 1 BT
	2	Wi-Fi 2 5GHz SISO	+ Wi-Fi 1 BT
	3	Wi-Fi 1 + 2 5GHz MIMO	+ Wi-Fi 1 BT
Notes:			
1. Wi-Fi 2.4GHz Radio on Wi-Fi 1 cannot transmit simultaneously with Bluetooth Radio.			

**12.1. Sum of the SAR for DTS Band & BT**

Band (GHz)	RF Exposure condition	Test Position	Simultaneous Transmission Scenario		Σ 1-g SAR (W/kg)
			DTS (Wi-Fi 2)	Bluetooth (Wi-Fi 1)	
2.4GHz DTS	Body	Rear	1.120	0.187	1.307

**12.2. Sum of the SAR for U-NII Band & BT**

Band (GHz)	RF Exposure condition	Test Position	Simultaneous Transmission Scenario			Bluetooth (Wi-Fi 1)	Σ 1-g SAR (W/kg)
			UNII Band				
			Wi-Fi 1	Wi-Fi 2	Wi-Fi 1 + Wi-Fi 2		
5.3GHz (OFDM) U-NII-2A	Body	Rear	0.814			0.187	1.001
				0.922		0.187	1.109
					0.664	0.187	0.851
Band (GHz)	RF Exposure condition	Test Position	Simultaneous Transmission Scenario			Bluetooth (Wi-Fi 1)	Σ 1-g SAR (W/kg)
			UNII Band				
			Wi-Fi 1	Wi-Fi 2	Wi-Fi 1 + Wi-Fi 2		
5.5GHz (OFDM) U-NII-2C	Body	Rear	1.100			0.187	1.287
				0.844		0.187	1.031
					1.008	0.187	1.195
Band (GHz)	RF Exposure condition	Test Position	Simultaneous Transmission Scenario			Bluetooth (Wi-Fi 1)	Σ 1-g SAR (W/kg)
			UNII Band				
			Wi-Fi 1	Wi-Fi 2	Wi-Fi 1 + Wi-Fi 2		
5.8GHz (OFDM) U-NII-3	Body	Rear	0.841			0.187	1.028
				0.986		0.187	1.173
					0.833	0.187	1.020

**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.

## **Appendixes**

**Refer to separated files for the following appendixes.**

**16U22814-S1V1 SAR\_App A Photos & Ant. Locations**

**16U22814-S1V1 SAR\_App B System Check Plots**

**16U22814-S1V1 SAR\_App C Highest Test Plots**

**16U22814-S1V1 SAR\_App D Tissue Ingredients**

**16U22814-S1V1 SAR\_App E Probe Cal. Certificates**

**16U22814-S1V1 SAR\_App F Dipole Cal. Certificates**

**END OF REPORT**