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

(Class II Permissive Change)

SAR EVALUATION REPORT

For
Wireless Module
(Tested inside of Panasonic Tablet PC FZ-G1)

Model: WL13A
FCC ID: ACJ9TGWL13A

Report Number: 10258104H-A-R1
Issue Date: May 16, 2014

Prepared for
PANASONIC CORPORATION OF NORTH AMERICA
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Revision History

Rev.	Issue Date	Revisions	Revised By
--	05/13/2014	Initial Issue	T. Hatakeda
1	05/16/2014	Section 4.1 D2450V2 and D5GHzV2 were added. Section 8.1 to 8.3 Note is corrected. Section 8.1 Edge 4 Antenna-to-edge/surface is corrected. Section 8.2 and 8.3 Edge 3 Antenna-to-edge/surface is corrected. Section 13.2.1 Notes 4 is corrected. Section 17 Figure is corrected. WWAN antenna position was removed.	T. Hatakeda

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1. Attestation of Test Results

Applicant	Panasonic Corporation of North America
DUT description	Wireless Module (Tested inside of Panasonic Laptop PC FZ-G1)
Model	WL13A
Test device is	An identical prototype
Device category	Portable
Exposure category	General Population/Uncontrolled Exposure
Date tested	March 18 to April 14, 2014

Applicable Standards	Test Results
FCC 47 CFR Parts 1 & 2 FCC Published RF exposure KDB procedures, and TCB workshop updates IEEE Std 1528-2003 and IEEE Std 1528a-2005	Pass

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
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5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This report is a revised version of 10258104H-A. 10258104H-A is replaced with this report.

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1.1. Summary of Highest 1-g SAR Results

Worst Case SAR data for each Frequency Band

RF Exposure Rule	Freq. Range	Highest Reported SAR	Limit
15.247	2400-2480 MHz	Body: 0.520 W/kg (Edge 3)	1.6 W/kg
15.407	5150-5250 MHz	Body: 0.236 W/kg (Edge 4)	
	5250-5350 MHz	Body: 0.337 W/kg (Edge 3)	
	5500-5700 MHz	Body: 0.312 W/kg (Edge 3)	
15.247	5725-5850 MHz	Body: 0.369 W/kg (Edge 3)	
Simultaneous Transmission Condition		0.920 W/kg (refer to Section 14) (The highest across exposure conditions)	

LEGEND:

- Rear = Bottom Face
- Edge 1 = Top Edge
- Edge 2 = Left Edge
- Edge 3 = Bottom Edge
- Edge 4 = Right Edge

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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, TCB workshop updates, and the following KDB procedures:

- o 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
- o 865664 D02 SAR Reporting v01r01
- o 447498 D01 General RF Exposure Guidance v05r02
- o 248227 D01 SAR Meas for 802 11abg v01r02
- o 616217 D04 SAR for laptop and tablets v02

3. Facilities and Accreditation

*Shielded room for SAR testings
The test sites and measurement facilities used to collect data are located at 4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN.

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http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap

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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.

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
Power Meter	Anritsu	ML2495A	0825002	6	30	2014
Power Sensor	Anritsu	MA2411B	0738285	6	30	2014
Power Meter	Agilent	N1914A	MY53060017	6	30	2014
Power Sensor	Agilent	N8482H	MY53050001	6	30	2014
Power Sensor	Agilent	N8482H	MY52460010	4	30	2014
Signal Generator	Rohde & Schwarz	SMA100A	103764	6	30	2014
Pre Amplifier	R&K	CGA020M602-2633R	-	6	30	2014
Directional Coupler	Agilent	87300B	14893A	Pre Check		
Network Analyzer	Agilent/HP	E8358A	US41080381	9	30	2014
Digtal thermometer	LKM electronic	DTM3000	-	7	31	2014
Dielectric probe kit	Agilent	85070D	702	9	30	2014
Type N Calibration Kit	Agilent	85032F	MY41495257	9	30	2014
Dosimetric E-Field Probe	Schmid&Partner Engineering AG	EX3DV4	3825	12	31	2014
Data Acquisition Electronics	Schmid&Partner Engineering AG	DAE4	509	7	31	2014
Dipole Antenna	Schmid&Partner Engineering AG	D2450V2	713	9	10	2013
Dipole Antenna	Schmid&Partner Engineering AG	D5GHzV2	1020	1	17	2014
Thermo-Hygrometer	CUSTOM	CTH-201	A08Q29	5	31	2014
Digtal thermometer	HANNA	Checktemp-2	MOS-10	8	31	2014

4.2. Measurement Uncertainty

Per KDB 865664, when no measured SAR values exceed 1.5 W/kg, measurement uncertainty analysis does not need to be provided in the test report.

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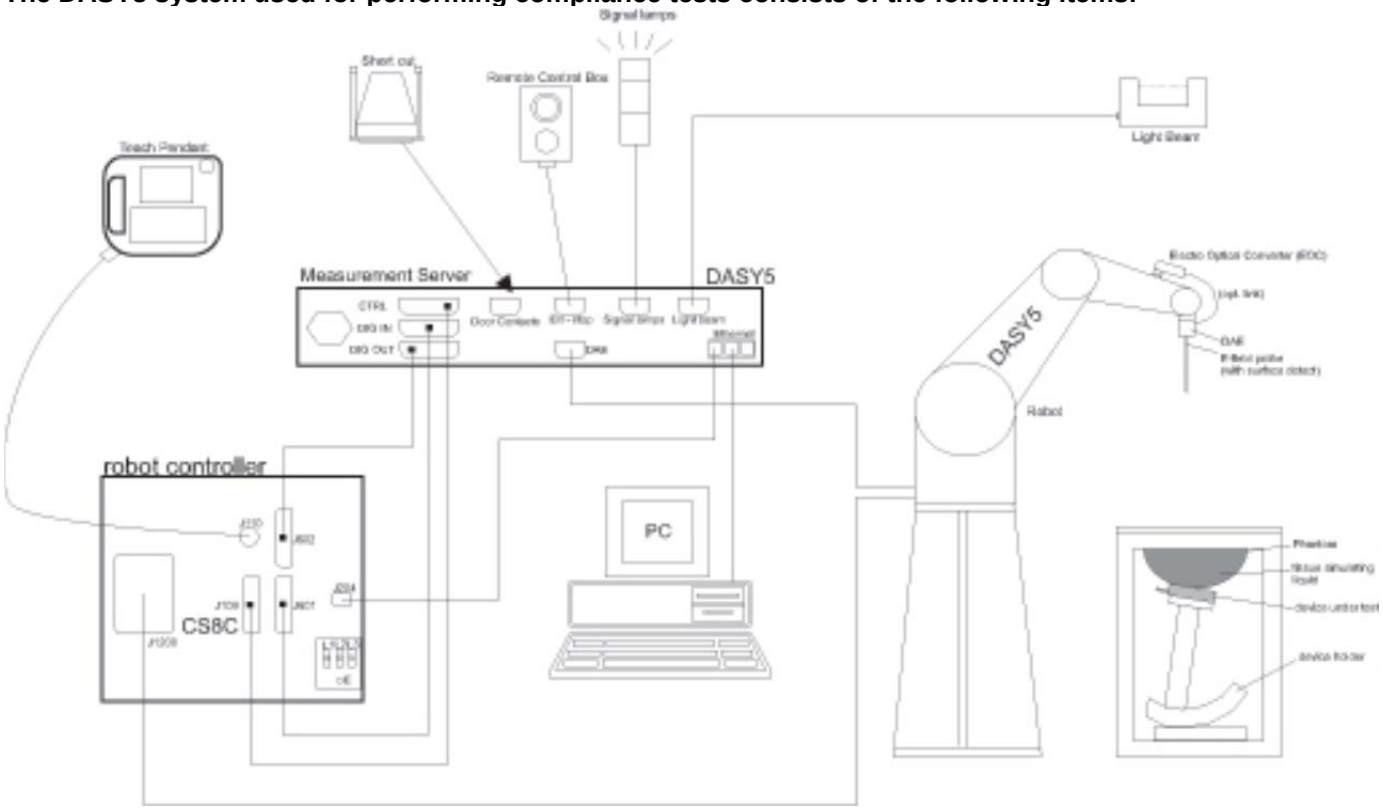
5. Measurement System Description and Setup

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.

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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 v01

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

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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 v01 (Draft)

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

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.

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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.

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7. Device Under Test

Wireless Network Adapter Module (Tested inside of Panasonic Tablet PC FZ-G1) Model: WL13A	
Operating Configuration(s)	• Tablet Mode
Exposure Condition(s)	• The device is used in close proximity to the body. Specific details of the required test positions are provided in Section 8 “Exposure Conditions”
Accessory	• None

7.1. Band and Air Interfaces

Tx Frequency Bands	• 802.11a/b/g/n/ac: 2412 - 2462 MHz, b / g / HT20 / HT40 5150 - 5250 MHz, a / HT20 / HT40 5250 - 5350 MHz, a / HT20 / HT40 5500 - 5700 MHz, a / HT20 / HT40 5725 - 5850 MHz, a / HT20 / HT40 / HT80 • Bluetooth: 2402 - 2480 MHz
Modulation	• 802.11a/b/g/n/ac : BPSK, QPSK, CCK, 16-QAM and 64-QAM and 256-QAM • Bluetooth 4.0+LE: GFSK, DQPSK, 8-DPSK
Duty Cycle	• WLAN: 100% • Bluetooth 89%

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7.2. Simultaneous Transmission

Usage Scenario	Modes	Mode of Operation	BAND	802.11b/g/n WLAN Main	802.11b/g/n WLAN Aux	802.11a/n/ac WLAN Main	802.11a/n/ac WLAN Aux	BT 2.4 GHz
Body SAR	2.4GHz WLAN SISO + BT (WLAN 1 Tx)	802.11b/g/n WLAN Main	2.4 GHz	YES	No	No	No	YES
		802.11b/g/n WLAN Aux	2.4 GHz	No	YES	No	No	No
	5 GHz Bands WLAN SISO + BT (WLAN 1 Tx)	802.11a/n/ac WLAN Main	5 GHz Bands	No	No	YES	No	YES
		802.11a/n/ac WLAN Aux	5 GHz Bands	No	No	No	YES	No
	2.4GHz WLAN MIMO (WLAN 2 Tx)	802.11n WLAN Main	2.4 GHz	YES	YES	No	No	No
		802.11n WLAN Aux	2.4 GHz	YES	YES	No	No	No
	5 GHz Bands WLAN MIMO (WLAN 2 Tx)	802.11n/ac WLAN Main	5 GHz Bands	No	No	YES	YES	No
		802.11n/ac WLAN Aux	5 GHz Bands	No	No	YES	YES	No

Notes:

1. Bluetooth transmits using the WLAN Aux Antenna
2. Bluetooth can transmit simultaneously with the WLAN Main Antenna, in either of the WLAN bands.
3. Bluetooth cannot transmit simultaneously with the WLAN Aux Antenna, in either of the WLAN bands; this also precludes the transmission of Bluetooth when WLAN is in MIMO mode.
4. With a maximum output power of **5.0 mW** (7.0 dBm), Bluetooth qualifies for Standalone SAR test exclusion based on the formula for Standalone SAR test exclusion considerations outlined in KDB 447498 D01 . For the exact value that this formula yields, please refer to **Section 14** of this report.

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8. Exposure Conditions

Refer to Section 17 “Antenna Dimensions and Separation Distances” for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

8.1. Test Configurations for the Main Antenna, SISO and MIMO Modes

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	13.0mm	Yes	
Front	-	No	SAR is not required as this is not a typical use scenario
Edge 1	31.5mm	Yes	
Edge 2	265.5mm	No	Refer to section 13.1.2 for SAR exclusion justification
Edge 3	139.0mm	No	Refer to section 13.1.2 for SAR exclusion justification
Edge 4	3.3mm	Yes	

8.2. Test Configurations for the Auxiliary Antenna, SISO and MIMO Modes

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	13mm	Yes	
Front	-	No	SAR is not required as this is not a typical use scenario
Edge 1	184.5mm	Yes	Though SAR was not required for standalone, the test was performed for simultaneous transmitting evaluation. Refer to section 13.2.1 Notes 4.
Edge 2	228.3mm	No	Refer to section 13.1.2 for SAR exclusion justification
Edge 3	3.3mm	Yes	
Edge 4	23.7mm	Yes	

8.3. Test Configurations for the Auxiliary Antenna, Bluetooth

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	13mm	No	Refer to section 13.1.1 for SAR exclusion justification
Front	-	No	SAR is not required as this is not a typical use scenario
Edge 1	184.5mm	Yes	Though SAR was not required for standalone, the test was performed for simultaneous transmitting evaluation. Refer to section 13.2.1 Notes 4.
Edge 2	228.3mm	No	Refer to section 13.1.2 for SAR exclusion justification
Edge 3	3.3mm	No	Refer to section 13.1.1 for SAR exclusion justification
Edge 4	23.7mm	No	Refer to section 13.1.1 for SAR exclusion justification

LEGEND:

- Rear = Bottom Face
- Edge 1 = Top Edge
- Edge 2 = Left Edge
- Edge 3 = Bottom Edge
- Edge 4 = Right Edge

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9. Summary of Required Test Modes

9.1. Wi-Fi 2.4 GHz Band

Mode	Number of Transmitters	Ch. #	Freq. (MHz)	Maximum Target Power from Original Approval (dBm)		Maximum Target Power for Host Approval (dBm)		SAR Test (Yes/No)	Surfaces/Edges requiring SAR evaluation
				Main	Aux	Main	Aux		
802.11b	1 Tx	1	2412	15.5		14.5		Yes	Rear, Edge 1, Edge4
		6	2437	15.5		14.5			
		11	2462	15.5		14.5			
		1	2412		15.5		14.5	Yes	Rear, Edge 1, Edge 3, Edge 4
		6	2437		15.5		12.5		
		11	2462		15.5		12.5		
802.11g	1 Tx	1	2412	13.5		11.5		Yes	Rear, Edge 1, Edge4
		6	2437	16.5		15.0			
		11	2462	13.5		11.5			
		1	2412		13.5		10.5	No	N/A
		6	2437		16.5		14.0		
		11	2462		13.5		12.0		
802.11n HT20	1 Tx	1	2412	13.5		11.5		Yes	Rear, Edge 1, Edge4
		6	2437	16.5		15.0			
		11	2462	13.5		11.5			
		1	2412		13.5		10.5	No	N/A
		6	2437		16.5		14.0		
		11	2462		13.5		12.0		
802.11n HT20	2 Tx	1	2412	13.5	13.5	9.5	9.5	Yes	Covered by testing in 802.11b/g/n 1Tx
		6	2437	16.5	16.5	12.0	12.0		
		11	2462	13.5	13.5	9.0	9.5		
802.11n HT40	1 Tx	3	2422	16.5		10.5		Yes	Rear, Edge 1, Edge4
		6	2437	16.5		15.0			
		9	2450	16.5		11.5			
		3	2422		16.5		8.5	No	N/A
		6	2437		16.5		12.5		
		9	2450		16.5		11.0		
802.11n HT40	2 Tx	3	2422	16.5	16.5	7.0	7.0	No	N/A
		6	2437	16.5	16.5	11.0	11.0		
		9	2450	16.5	16.5	10.5	7.0		

Note(s):

- Per KDB 248227, SAR is not required for 802.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.

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9.2. Wi-Fi 5.2 GHz Band

Mode	Number of Transmitters	Ch. #	Freq. (MHz)	Maximum Target Power from Original Approval (dBm)		Maximum Target Power for Host Approval (dBm)		SAR Test (Yes/No)	Surfaces/Edges requiring SAR evaluation
				Main	Aux	Main	Aux		
802.11a	1 Tx	36	5180	16.5		12.5		Yes	Rear, Edge 1, Edge 4
		40	5200	16.5		14.0			
		44	5220	16.5		14.0			
		48	5240	16.5		14.0			
		36	5180		16.5		11.0	Yes	Rear, Edge 1, Edge 3, Edge 4
		40	5200		16.5		14.0		
		44	5220		16.5		14.0		
		48	5240		16.5		14.0		
802.11n HT20	1 Tx	36	5180	16.5		12.5		No	N/A
		40	5200	16.5		14.0			
		44	5220	16.5		14.0			
		48	5240	16.5		14.0			
		36	5180		16.5		11.0	No	N/A
		40	5200		16.5		14.0		
		44	5220		16.5		14.0		
		48	5240		16.5		14.0		
802.11n HT20	2 Tx	36	5180	16.5	16.5	10.5	10.5	Yes	Coverd by testing in 802.11a
		40	5200	16.5	16.5	11.0	11.0		
		48	5240	16.5	16.5	11.0	11.0		
802.11n HT40	1 Tx	38	5190	16.5		9.5		No	N/A
		46	5230	16.5		14.0			
		38	5190		16.5		9.0	No	N/A
		46	5230		16.5		14.0		
802.11n HT40	2 Tx	38	5190	16.5	16.5	6.5	6.5	No	N/A
		46	5230	16.5	16.5	11.0	11.0		
802.11ac HT80	1 Tx	42	5210	11.0		8.0		No	N/A
		42	5210		11.0		8.0	No	N/A
802.11ac HT80	2 Tx	42	5210	11.0	11.0	6.5	6.5	No	N/A

Note(s):

- Per KDB 248227, SAR is not required for 802.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.

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9.3. Wi-Fi 5.3 GHz Band

Mode	Number of Transmitters	Ch. #	Freq. (MHz)	Maximum Target Power from Original Approval (dBm)		Maximum Target Power for Host Approval (dBm)		SAR Test (Yes/No)	Surfaces/Edges requiring SAR evaluation
				Main	Aux	Main	Aux		
802.11a	1 Tx	52	5260	16.5		14.5		Yes	Rear, Edge 1, Edge 4
		56	5280	16.5		14.5			
		60	5300	16.5		14.5			
		64	5320	16.5		12.0			
		52	5260		16.5		14.5	Yes	Rear, Edge1, Edge 3, Edge 4,
		56	5280		16.5		14.5		
		60	5300		16.5		14.5		
		64	5320		16.5		12.0		
802.11n HT20	1 Tx	52	5260	16.5		14.5		No	N/A
		56	5280	16.5		14.5			
		60	5300	16.5		14.5			
		64	5320	16.5		12.0			
		52	5260		16.5		14.5	No	N/A
		56	5280		16.5		14.5		
		60	5300		16.5		14.5		
		64	5320		16.5		12.0		
802.11n HT20	2 Tx	52	5260	16.5	16.5	11.5	11.5	Yes	Covered by testing in 802.11a
		60	5300	16.5	16.5	11.5	11.5		
		64	5320	16.5	16.5	11.0	11.0		
802.11n HT40	1 Tx	54	5270	16.5		9.5		No	N/A
		62	5310	16.5		11.0			
		54	5270		16.5		9.0	No	N/A
		62	5310		16.5		11.0		
802.11n HT40	2 Tx	54	5270	16.5	7.5	7.5	7.5	No	N/A
		62	5310	16.5	9.0	9.0	9.0		
802.11ac HT80	1 Tx	58	5290	11.0		9.5		No	N/A
		58	5290		11.0		10.0	No	N/A
802.11ac HT80	2 Tx	58	5290	11.0	11.0	7.5	7.5	No	N/A

Note(s):

- Per KDB 248227, SAR is not required for 802.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.

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9.4. Wi-Fi 5.5 GHz Band

Mode	Number of Transmitters	Ch. #	Freq. (MHz)	Maximum Target Power from Original Approval (dBm)		Maximum Target Power for Host Approval (dBm)		SAR Test (Yes/No)	Surfaces/Edges requiring SAR evaluation
				Main	Aux	Main	Aux		
802.11a	1 Tx	100	5500	16.5		12.0		Yes	Rear, Edge 1, Edge 4
		104	5520	16.5		15.0			
		108	5540	16.5		15.0			
		112	5560	16.5		15.0			
		116	5580	16.5		15.0			
		120	5600	16.5		15.0			
		124	5620	16.5		15.0			
		128	5640	16.5		15.0			
		132	5660	16.5		15.0			
		136	5680	16.5		15.0			
		140	5700	16.5		11.0			
		100	5500		16.5		12.0	Yes	Rear, Edge 1, Edge 3, Edge 4,
		104	5520		16.5		15.0		
		108	5540		16.5		15.0		
		112	5560		16.5		15.0		
		116	5580		16.5		15.0		
		120	5600		16.5		15.0		
		124	5620		16.5		15.0		
		128	5640		16.5		15.0		
		132	5660		16.5		15.0		
		136	5680		16.5		15.0		
		140	5700		16.5		11.0		
802.11n HT20	1 Tx	100	5500	16.5		12.0		No	N/A
		104	5520	16.5		15.0			
		108	5540	16.5		15.0			
		112	5560	16.5		15.0			
		116	5580	16.5		15.0			
		120	5600	16.5		15.0			
		124	5620	16.5		15.0			
		128	5640	16.5		15.0			
		132	5660	16.5		15.0			
		136	5680	16.5		15.0			
		140	5700	16.5		11.0			
		100	5500		16.5		12.0	No	N/A
		104	5520		16.5		15.0		
		108	5540		16.5		15.0		
		112	5560		16.5		15.0		
		116	5580		16.5		15.0		
		120	5600		16.5		15.0		
		124	5620		16.5		15.0		
		128	5640		16.5		15.0		
		132	5660		16.5		15.0		
		136	5680		16.5		15.0		
		140	5700		16.5		11.0		

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Mode	Number of Transmitters	Ch. #	Freq. (MHz)	Maximum Target Power from Original Approval (dBm)		Maximum Target Power for Host Approval (dBm)		SAR Test (Yes/No)	Surfaces/Edges requiring SAR evaluation
				Main	Aux	Main	Aux		
802.11n HT20	2 Tx	100	5500	16.5	16.5	9.0	9.0	Yes	Covered by testing in 802.11a
		116	5580	16.5	16.5	12.0	12.0		
		140	5700	16.5	16.5	9.0	9.0		
802.11n HT40	1 Tx	102	5510	16.5		9.0		No	N/A
		110	5550	16.5		15.0			
		118	5590	16.5		15.0			
		126	5630	16.5		15.0			
		134	5670	16.5		14.5			
		102	5510		16.5		9.5	No	N/A
		110	5550		16.5		15.0		
		118	5590		16.5		15.0		
		126	5630		16.5		15.0		
		134	5670		16.5		14.5		
802.11n HT40	2 Tx	102	5510	16.5	16.5	6.5	6.5	No	N/A
		110	5550	16.5	16.5	12.0	12.0		
		134	5670	16.5	16.5	11.5	11.5		
802.11ac HT80	1 Tx	106	5530	16.5		7.0		No	N/A
		122	5610	16.5		12.5			
		138	5690	16.5		12.5			
		106	5530		16.5		7.0	No	N/A
		122	5610		16.5		12.5		
		138	5690		16.5		12.5		
802.11ac HT80	2 Tx	106	5530	16.5	16.5	5.0	5.0	No	N/A
		122	5610	16.5	16.5	12.0	12.0	No	N/A
		138	5690	16.5	16.5	12.0	12.0	No	N/A

Note(s):

- Per KDB 248227, SAR is not required for 802.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.

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9.5. Wi-Fi 5.8 GHz Band

Mode	Number of Transmitters	Ch. #	Freq. (MHz)	Maximum Target Power from Original Approval (dBm)		Maximum Target Power for Host Approval (dBm)		SAR Test (Yes/No)	Surfaces/Edges requiring SAR evaluation
				Main	Aux	Main	Aux		
802.11a	1 Tx	149	5745	16.5		15.0		Yes	Rear, Edge 1, Edge 4
		153	5765	16.5		15.0			
		157	5785	16.5		15.0			
		161	5805	16.5		15.0			
		165	5825	16.5		15.0			
		149	5745		16.5		15.0	Yes	Rear, Edge 1, Edge 3, Edge 4
		153	5765		16.5		15.0		
		157	5785		16.5		15.0		
		161	5805		16.5		15.0		
		165	5825		16.5		15.0		
802.11n HT20	1 Tx	149	5745	16.5		15.0		No	N/A
		153	5765	16.5		15.0			
		157	5785	16.5		15.0			
		161	5805	16.5		15.0			
		165	5825	16.5		15.0			
		149	5745		16.5		15.0	No	N/A
		153	5765		16.5		15.0		
		157	5785		16.5		15.0		
		161	5805		16.5		15.0		
		165	5825		16.5		15.0		
802.11n HT20	2 Tx	149	5745	16.5	16.5	12.0	12.0	Yes	Covered by testing in 802.11a
		157	5785	16.5	16.5	12.0	12.0		
		165	5825	16.5	16.5	12.0	12.0		
802.11n HT40	1 Tx	151	5755	16.5		15.0		No	N/A
		159	5795	16.5		15.0			
		151	5755		16.5		15.0	No	N/A
		159	5795		16.5		15.0		
802.11n HT40	2 Tx	151	5755	16.5	16.5	12.0	12.0	No	N/A
		159	5795	16.5	16.5	12.0	12.0		
802.11ac HT80	1 Tx	155	5775	14.0		12.5		No	N/A
		155	5775		14.0		12.5		
802.11ac HT80	2 Tx	155	5775	14.0	14.0	12.0	12.0	No	N/A

Note(s):

- Per KDB 248227, SAR is not required for 802.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.

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10. RF Output Power Measurement

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#	√	∇
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"

∇ = 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.

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10.1 Output Power

The target power is the absolute maximum.

Tune-up Tolerance
The Target power is the upper limit of tune-up tolerance.

Mode	Antenna	BAND	Channel	Frequency (MHz)	Target Power (dBm)	Measured Power (dBm)
802.11b	Main	2400MHz	1	2412	14.5	14.20
			2	2417	14.5	14.39
			3	2422	14.5	14.36
			4	2427	14.5	14.36
			5	2432	14.5	14.33
			6	2437	14.5	14.19
			7	2442	14.5	14.31
			8	2447	14.5	14.31
			9	2452	14.5	14.29
			10	2457	14.5	14.29
			11	2462	14.5	14.19
802.11g		2400MHz	1	2412	11.5	11.49
			2	2417	14.0	13.76
			3	2422	15.0	14.66
			4	2427	15.0	14.65
			5	2432	15.0	14.62
			6	2437	15.0	14.61
			7	2442	15.0	14.64
			8	2447	15.0	14.65
			9	2452	15.0	14.67
			10	2457	14.5	14.20
			11	2462	11.5	11.41
802.11a		5200MHz	36	5180	12.5	12.33
			40	5200	14.0	13.61
			44	5220	14.0	13.71
			48	5240	14.0	13.74
		5300MHz	52	5260	14.5	14.16
			56	5280	14.5	14.21
			60	5300	14.5	14.16
			64	5320	12.0	11.67
		5500MHz	100	5500	12.0	11.98
			104	5520	15.0	14.89
			108	5540	15.0	14.93
			112	5560	15.0	14.85
			116	5580	15.0	14.76
			120	5600	15.0	14.67
			124	5620	15.0	14.61
			128	5640	15.0	14.79
			132	5660	15.0	14.71
			136	5680	15.0	14.55
			140	5700	11.0	10.61
		5800MHz	149	5745	15.0	14.90
			153	5765	15.0	14.79
			157	5785	15.0	14.74
			161	5805	15.0	14.63
			165	5825	15.0	14.56

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Output Power (continued)

Mode	Antenna	Band	Channel	Frequency (MHz)	Target Power (dBm)	Measured Power (dBm)
802.11b	Aux	2400MHz	1	2412	14.5	14.33
			2	2417	12.5	12.17
			3	2422	12.5	12.14
			4	2427	14.5	14.19
			5	2432	12.5	12.10
			6	2437	12.5	12.31
			7	2442	12.5	12.09
			8	2447	12.5	12.08
			9	2452	12.5	12.08
			10	2457	12.5	12.08
			11	2462	12.5	12.37
802.11g		2400MHz	1	2412	10.5	10.12
			2	2417	13.5	13.13
			3	2422	14.0	13.55
			4	2427	14.0	13.50
			5	2432	14.0	13.55
			6	2437	14.0	13.53
			7	2442	14.0	13.54
			8	2447	14.0	13.53
			9	2452	14.0	13.54
			10	2457	14.0	13.53
			11	2462	12.0	11.90
802.11a		5200MHz	36	5180	11.0	10.58
			40	5200	14.0	13.77
			44	5220	14.0	13.75
			48	5240	14.0	13.78
		5300MHz	52	5260	14.5	14.47
			56	5280	14.5	14.14
			60	5300	14.5	14.15
			64	5320	12.0	11.89
		5500MHz	100	5500	12.0	11.60
			104	5520	15.0	14.77
			108	5540	15.0	14.75
			112	5560	15.0	14.67
			116	5580	15.0	14.62
			120	5600	15.0	14.89
			124	5620	15.0	14.67
			128	5640	15.0	14.57
			132	5660	15.0	14.62
			136	5680	15.0	14.80
			140	5700	11.0	10.95
		5800MHz	149	5745	15.0	14.57
			153	5765	15.0	14.78
			157	5785	15.0	14.65
			161	5805	15.0	14.54
			165	5825	15.0	15.00

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Output Power (continued)

Mode	Antenna	Band	Channel	Frequency (MHz)	Target Power (dBm)	Measured Power (dBm)
802.11n 20MHz 1Tx	Main	2400MHz	1	2412	11.5	11.31
			6	2437	15.0	14.84
			11	2462	11.5	11.31
	Aux		1	2412	10.5	10.23
			6	2437	14.0	13.58
			11	2462	12.0	11.68
802.11n 20MHz 2Tx	Main	2400MHz	1	2412	9.5	9.24
			6	2437	12.0	11.78
			11	2462	9.0	8.70
	Aux		1	2412	9.5	9.29
			6	2437	12.0	11.69
			11	2462	9.5	9.00
802.11n 40MHz 1Tx	Main	2400MHz	3	2422	10.5	10.16
			6	2437	15.0	14.74
			9	2452	11.5	11.10
	Aux		3	2422	8.5	8.25
			6	2437	12.5	12.12
			9	2452	11.0	10.50
802.11n 40MHz 2Tx	Main	2400MHz	3	2422	7.0	6.92
			6	2437	11.0	10.74
			9	2452	10.5	10.38
	Aux		3	2422	7.0	6.58
			6	2437	11.0	10.84
			9	2452	7.0	6.51
802.11n 20MHz 1Tx	Main	5200MHz	36	5180	12.5	12.17
			40	5200	14.0	13.90
			44	5220	14.0	13.99
			48	5240	14.0	13.66
		5300MHz	52	5260	14.5	14.09
			56	5280	14.5	14.07
			60	5300	14.5	14.06
			64	5320	12.0	11.62
		5500MHz	100	5500	12.0	11.97
			104	5520	15.0	14.97
			108	5540	15.0	14.93
			112	5560	15.0	14.79
			116	5580	15.0	14.80
			120	5600	15.0	14.66
			124	5620	15.0	14.57
			128	5640	15.0	14.74
			132	5660	15.0	14.72
			136	5680	15.0	14.55
			140	5700	11.0	10.99
		5800MHz	149	5745	15.0	14.60
			153	5765	15.0	14.83
			157	5785	15.0	14.67
			161	5805	15.0	14.58
			165	5825	15.0	14.51

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Output Power (continued)

Mode	Antenna	Band	Channel	Frequency (MHz)	Target Power (dBm)	Measured Power (dBm)
802.11n 20MHz 1Tx	Aux	5200MHz	36	5180	11.0	10.91
			40	5200	14.0	13.76
			44	5220	14.0	13.78
			48	5240	14.0	13.75
		5300MHz	52	5260	14.5	14.16
			56	5280	14.5	14.11
			60	5300	14.5	14.21
			64	5320	12.0	11.85
		5500MHz	100	5500	12.0	11.60
			104	5520	15.0	14.78
			108	5540	15.0	14.75
			112	5560	15.0	14.62
			116	5580	15.0	14.52
			120	5600	15.0	14.84
			124	5620	15.0	14.74
			128	5640	15.0	14.59
			132	5660	15.0	14.86
			136	5680	15.0	14.88
			140	5700	11.0	10.93
		5800MHz	149	5745	15.0	14.68
			153	5765	15.0	14.77
			157	5785	15.0	14.68
			161	5805	15.0	14.55
			165	5825	15.0	15.00
802.11n 20MHz 2Tx	Main	5200MHz	36	5180	10.5	10.44
			40	5200	11.0	10.63
			48	5240	11.0	10.72
		5300MHz	52	5260	11.5	11.43
			60	5300	11.5	11.37
			64	5320	11.0	10.88
		5500MHz	100	5500	9.0	8.76
			116	5580	12.0	11.80
			140	5700	9.0	8.85
		5800MHz	149	5745	12.0	11.79
			157	5785	12.0	11.57
			165	5825	12.0	11.81
	Aux	5200MHz	36	5180	10.5	10.25
			40	5200	11.0	10.65
			48	5240	11.0	10.99
		5300MHz	52	5260	11.5	11.39
			60	5300	11.5	11.34
			64	5320	11.0	10.98
		5500MHz	100	5500	9.0	8.79
			116	5580	12.0	11.64
			140	5700	9.0	8.72
		5800MHz	149	5745	12.0	11.64
			157	5785	12.0	11.76
			165	5825	12.0	11.81

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Output Power (continued)

Mode	Antenna	Band	Channel	Frequency (MHz)	Target Power (dBm)	Measured Power (dBm)
802.11n 40MHz 1Tx	Main	5200MHz	38	5190	9.5	9.32
			46	5230	14.0	13.73
		5300MHz	54	5270	9.5	9.19
			62	5310	11.0	10.92
		5500MHz	102	5510	9.0	8.97
			110	5550	15.0	14.71
			118	5590	15.0	14.82
			126	5630	15.0	14.58
			134	5670	14.5	14.33
		5800MHz	151	5755	15.0	14.57
			159	5795	15.0	14.96
	Aux	5200MHz	38	5190	9.0	8.96
			46	5230	14.0	13.62
		5300MHz	54	5270	9.0	8.55
			62	5310	11.0	10.81
		5500MHz	102	5510	9.5	9.28
			110	5550	15.0	14.64
			118	5590	15.0	14.71
			126	5630	15.0	14.99
			134	5670	14.5	14.27
		5800MHz	151	5755	15.0	14.85
			159	5795	15.0	14.50
802.11n 40MHz 2Tx	Main	5200MHz	38	5190	6.5	6.07
			46	5230	11.0	10.55
		5300MHz	54	5270	7.5	7.32
			62	5310	9.0	8.53
		5500MHz	102	5510	6.5	6.38
			110	5550	12.0	11.86
			134	5670	11.5	11.27
		5800MHz	151	5755	12.0	11.62
			159	5795	12.0	11.86
	Aux	5200MHz	38	5190	6.5	6.35
			46	5230	11.0	10.65
		5300MHz	54	5270	7.5	7.47
			62	5310	9.0	8.80
		5500MHz	102	5510	6.5	6.05
			110	5550	12.0	11.65
			134	5670	11.5	11.25
		5800MHz	151	5755	12.0	11.82
			159	5795	12.0	11.57

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Mode	Antenna	Band	Channel	Frequency (MHz)	Target Power (dBm)	Measured Power (dBm)
802.11ac 80MHz 1Tx	Main	5200MHz	42	5210	8.0	8.00
		5300MHz	58	5290	9.5	9.15
		5500MHz	106	5530	7.0	6.89
			122	5610	12.5	12.49
			138	5690	12.5	12.27
		5800MHz	155	5775	12.5	12.49
	Aux	5200MHz	42	5210	8.0	7.67
		5300MHz	58	5290	10.0	9.94
		5500MHz	106	5530	7.0	6.86
			122	5610	12.5	12.29
			138	5690	12.5	12.31
		5800MHz	155	5775	12.5	12.33
802.11ac 80MHz 2Tx	Main	5200MHz	42	5210	6.5	6.49
		5300MHz	58	5290	7.5	7.49
		5500MHz	106	5530	5.0	4.97
			122	5610	12.0	11.73
			138	5690	12.0	11.82
		5800MHz	155	5775	12.0	11.75
	Aux	5200MHz	42	5210	6.5	6.05
		5300MHz	58	5290	7.5	7.33
		5500MHz	106	5530	5.0	4.80
			122	5610	12.0	11.59
			138	5690	12.0	11.81
		5800MHz	155	5775	12.0	11.76

Mode	Antenna	Band	Channel	Frequency (MHz)	Target Power (dBm)	Measured Power (dBm)
Bluetooth	Aux	2400MHz	0	2402	7.0	5.64
			39	2441	7.0	5.52
			78	2480	7.0	5.34

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11. 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

KDB865664 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

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11.1. 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

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11.2. 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 ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

Date	Freq. (MHz)	Liquid Parameters	Measured	Target	Delta (%)	Limit ±(%)
2014/3/18	Body 2450	Relative Permittivity (ε_r):	50.27	52.70	-4.61	5
		Conductivity (σ):	1.90	1.95	-2.56	5
	Body 2410	Relative Permittivity (ε_r):	50.37	52.76	-4.53	5
		Conductivity (σ):	1.89	1.91	-0.92	5
	Body 2435	Relative Permittivity (ε_r):	50.38	52.73	-4.46	5
		Conductivity (σ):	1.89	1.93	-2.13	5
	Body 2460	Relative Permittivity (ε_r):	50.12	52.69	-4.87	5
		Conductivity (σ):	1.90	1.96	-3.26	5
2014/4/10	Body 2450	Relative Permittivity (ε_r):	52.38	52.70	-0.61	5
		Conductivity (σ):	1.98	1.95	1.54	5
	Body 2410	Relative Permittivity (ε_r):	52.64	52.76	-0.23	5
		Conductivity (σ):	1.99	1.91	4.33	5
	Body 2435	Relative Permittivity (ε_r):	52.59	52.73	-0.26	5
		Conductivity (σ):	1.99	1.93	3.05	5
	Body 2460	Relative Permittivity (ε_r):	52.17	52.69	-0.98	5
		Conductivity (σ):	1.98	1.96	0.81	5
2014/4/14	Body 2450	Relative Permittivity (ε_r):	51.12	52.70	-3.00	5
		Conductivity (σ):	1.97	1.95	1.03	5
	Body 2410	Relative Permittivity (ε_r):	51.39	52.76	-2.60	5
		Conductivity (σ):	1.98	1.91	3.80	5
	Body 2435	Relative Permittivity (ε_r):	51.34	52.73	-2.63	5
		Conductivity (σ):	1.98	1.93	2.53	5
	Body 2460	Relative Permittivity (ε_r):	50.90	52.69	-3.39	5
		Conductivity (σ):	1.97	1.96	0.30	5
2014/3/19	Body 5180	Relative Permittivity (ε_r):	49.28	49.05	0.48	10
		Conductivity (σ):	5.15	5.27	-2.30	5
	Body 5200	Relative Permittivity (ε_r):	49.24	49.02	0.45	10
		Conductivity (σ):	5.17	5.30	-2.45	5
	Body 5500	Relative Permittivity (ε_r):	48.87	48.61	0.53	10
		Conductivity (σ):	5.61	5.65	-0.71	5
	Body 5800	Relative Permittivity (ε_r):	48.37	48.20	0.35	10
		Conductivity (σ):	6.03	6.00	0.50	5
	Body 5825	Relative Permittivity (ε_r):	48.33	48.20	0.27	10
		Conductivity (σ):	6.07	6.00	1.17	5
2014/3/19	Body 5180	Relative Permittivity (ε_r):	47.98	49.05	-2.17	10
		Conductivity (σ):	5.18	5.27	-1.73	5
	Body 5200	Relative Permittivity (ε_r):	48.21	49.02	-1.65	10
		Conductivity (σ):	5.19	5.30	-2.08	5
	Body 5500	Relative Permittivity (ε_r):	47.28	48.61	-2.74	10
		Conductivity (σ):	5.51	5.65	-2.48	5
	Body 5800	Relative Permittivity (ε_r):	47.13	48.20	-2.22	10
		Conductivity (σ):	5.98	6.00	-0.32	5
	Body 5825	Relative Permittivity (ε_r):	47.30	48.20	-1.87	10
		Conductivity (σ):	5.96	6.00	-0.67	5

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Date	Freq. (MHz)	Liquid Parameters	Measured	Target	Delta (%)	Limit ±(%)
2014/3/20	Body 5180	Relative Permittivity (ϵ_r):	47.92	49.05	-2.30	10
		Conductivity (σ):	5.33	5.27	1.11	5
	Body 5200	Relative Permittivity (ϵ_r):	48.07	49.02	-1.94	10
		Conductivity (σ):	5.34	5.30	0.75	5
	Body 5500	Relative Permittivity (ϵ_r):	48.04	48.61	-1.18	10
		Conductivity (σ):	5.76	5.65	1.95	5
	Body 5800	Relative Permittivity (ϵ_r):	46.73	48.20	-3.05	10
		Conductivity (σ):	6.22	6.00	3.65	5
	Body 5825	Relative Permittivity (ϵ_r):	47.14	48.20	-2.20	10
		Conductivity (σ):	6.11	6.00	1.83	5
2014/4/10	Body 5180	Relative Permittivity (ϵ_r):	47.64	49.05	-2.87	10
		Conductivity (σ):	5.32	5.27	0.92	5
	Body 5200	Relative Permittivity (ϵ_r):	47.61	49.02	-2.88	10
		Conductivity (σ):	5.35	5.30	0.94	5
	Body 5500	Relative Permittivity (ϵ_r):	46.61	48.61	-4.12	10
		Conductivity (σ):	5.74	5.65	1.59	5
	Body 5800	Relative Permittivity (ϵ_r):	46.12	48.20	-4.32	10
		Conductivity (σ):	6.10	6.00	1.60	5
	Body 5825	Relative Permittivity (ϵ_r):	46.08	48.20	-4.39	10
		Conductivity (σ):	6.13	6.00	2.17	5

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12. 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.

12.1. System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±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 ± 0.5 cm for SAR measurements.
- 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 3GHz), 12 mm (1GHz to 3GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 12 mm (1GHz to 3GHz) and15 mm (below 1GHz) 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(For 5GHz band) or 250 mW(For 2.4GHz band).
- The results are normalized to 1 W input power.

12.2. Reference SAR Values for System Performance Check

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	713	9/10/2013	2450	1g	52.0	50.4
				10g	24.2	23.6
D5GHV2	1020	1/17/2014	5.2GHz	1g	81.2	75.0
				10g	23.3	20.9
			5.3GHz	1g	84.1	76.3
				10g	24.2	21.4
			5.5GHz	1g	86.1	79.7
				10g	24.5	22.2
			5.6GHz	1g	86.0	80.8
				10g	24.4	22.4
			5.8GHz	1g	81.3	75.3
				10g	23.1	20.8

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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.

Date Tested	System Dipole		T.S. Liquid		Measured Results		Target (Ref. Value)	Delta ±10 %
	Type	Serial #			Zoom Scan	Normalize to 1 W		
3/18/2014	D2450V2	713	Body	1g	12.60	50.4	50.4	0.00
				10g	5.73	22.9	23.6	-2.88
4/10/2014	D2450V2	713	Body	1g	12.60	50.4	50.4	0.00
				10g	5.85	23.4	23.6	-0.85
4/14/2014	D2450V2	713	Body	1g	12.60	50.4	50.4	0.00
				10g	5.67	22.7	23.6	-3.90
3/19/2014	D5GHzV2 5.2 GHz	1020	Body	1g	7.93	79.3	75.0	5.73
				10g	2.19	21.9	20.9	4.78
3/19/2014	D5GHzV2 5.6 GHz	1020	Body	1g	8.12	81.2	80.8	0.50
				10g	2.24	22.4	22.4	0.00
3/20/2014	D5GHzV2 5.8 GHz	1020	Body	1g	8.02	80.2	75.3	6.51
				10g	2.20	22.0	20.8	5.77
4/10/2014	D5GHzV2 5.2 GHz	1020	Body	1g	7.83	78.3	75.0	4.40
				10g	2.14	21.4	20.9	2.39
4/10/2014	D5GHzV2 5.6 GHz	1020	Body	1g	8.79	87.9	80.8	8.79
				10g	2.42	24.2	22.4	8.04
4/10/2014	D5GHzV2 5.8 GHz	1020	Body	1g	7.15	71.5	75.3	-5.05
				10g	1.98	19.8	20.8	-4.81

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13. SAR Test Results

13.1. Standalone SAR Test Exclusion Considerations

Standalone SAR test exclusion was based upon the following criteria:

1. According to KDB 447498 § 4.1.5 if the antenna is at close proximity to user then the outer surface of the DUT should be treated as the radiating surface. The test separation distance is then determined by the smallest distance between the outer surface of the device and the user. For the purposes of this report close proximity has been defined as closer than 50 mm. For antennas <50 mm from the rear or edge the separation distance used for the SAR exclusion calculations is 0mm.
2. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.
3. If the antenna to DUT adjacent edge or bottom separation distance is >50mm the actual antenna to user separation distance is used to determine SAR exclusion and estimated SAR value
4. As the SISO (1 Tx) mode powers are higher than the MIMO (2Tx) powers separate testing of the MIMO (2 Tx) SAR was considered unnecessary. The reported stand-alone values for 1Tx mode are used to cover simultaneous conditions.

13.1.1. SAR exclusion calculations for Wi-Fi SISO (1 Tx) and Bluetooth for antenna <50mm from the user

Antenna	Tx	Frequency	Output power		Separation distances(mm)						Calcurated Threshold Value					
		(MHz)	dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
WiFi - Main Antenna																
WLAN Main	WiFi	2462	15.00	32	0.00	0.00	265.50	139.00	0.00		**10.0**	**10.0**	>50mm	>50mm	**10.0**	N/A
WLAN Main	WiFi	5240	14.00	25	0.00	0.00	265.50	139.00	0.00		**11.4**	**11.4**	>50mm	>50mm	**11.4**	N/A
WLAN Main	WiFi	5320	14.50	28	0.00	0.00	265.50	139.00	0.00		**12.9**	**12.9**	>50mm	>50mm	**12.9**	N/A
WLAN Main	WiFi	5700	15.00	32	0.00	0.00	265.50	139.00	0.00		**15.3**	**15.3**	>50mm	>50mm	**15.3**	N/A
WLAN Main	WiFi	5825	15.00	32	0.00	0.00	265.50	139.00	0.00		**15.4**	**15.4**	>50mm	>50mm	**15.4**	N/A
Bluetooth / WiFi - Aux Antenna																
WLAN Aux	WiFi	2462	14.50	28	0.00	184.50	228.30	0.00	0.00		**8.8**	>50mm	>50mm	**8.8**	**8.8**	N/A
WLAN Aux	WiFi	5240	14.00	25	0.00	184.50	228.30	0.00	0.00		**11.4**	>50mm	>50mm	**11.4**	**11.4**	N/A
WLAN Aux	WiFi	5320	14.50	28	0.00	184.50	228.30	0.00	0.00		**12.9**	>50mm	>50mm	**12.9**	**12.9**	N/A
WLAN Aux	WiFi	5700	15.00	32	0.00	184.50	228.30	0.00	0.00		**15.3**	>50mm	>50mm	**15.3**	**15.3**	N/A
WLAN Aux	WiFi	5825	15.00	32	0.00	184.50	228.30	0.00	0.00		**15.4**	>50mm	>50mm	**15.4**	**15.4**	N/A
WLAN Aux	Bluetooth	2480	7.00	5	0.00	184.50	228.30	0.00	0.00		1.6	>50mm	>50mm	1.6	1.6	N/A

Note(s):

1. According to KDB 447498, if the calculated threshold value is >3 then SAR testing is required.
2. SAR exclusion was not assessed for 2 Tx (MIMO) as the higher 1 Tx (SISO) SAR values were used for simultaneous transmission analysis.

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13.1.2. SAR exclusion calculations for Wi-Fi SISO (1 Tx) and Bluetooth for antenna >50mm from the user

Antenna	Tx	Frequency	Output power		Separation distances(mm)						Power Threshold (mW)					
		(MHz)	dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
WiFi - Main Antenna																
WLAN Main	WiFi	2462	15.00	32	0.00	0.00	265.50	139.00	0.00		<50mm	<50mm	2250.6	985.6	<50mm	N/A
WLAN Main	WiFi	5240	14.00	25	0.00	0.00	265.50	139.00	0.00		<50mm	<50mm	2220.5	955.5	<50mm	N/A
WLAN Main	WiFi	5320	14.50	28	0.00	0.00	265.50	139.00	0.00		<50mm	<50mm	2220.0	955.0	<50mm	N/A
WLAN Main	WiFi	5700	15.00	32	0.00	0.00	265.50	139.00	0.00		<50mm	<50mm	2217.8	952.8	<50mm	N/A
WLAN Main	WiFi	5825	15.00	32	0.00	0.00	265.50	139.00	0.00		<50mm	<50mm	2217.2	952.2	<50mm	N/A
Bluetooth / WiFi - Aux Antenna																
WLAN Aux	WiFi	2462	14.50	28	0.00	184.50	228.30	0.00	0.00		<50mm	1440.6	1878.6	<50mm	<50mm	N/A
WLAN Aux	WiFi	5240	14.00	25	0.00	184.50	228.30	0.00	0.00		<50mm	1410.5	1848.5	<50mm	<50mm	N/A
WLAN Aux	WiFi	5320	14.50	28	0.00	184.50	228.30	0.00	0.00		<50mm	1410.0	1848.0	<50mm	<50mm	N/A
WLAN Aux	WiFi	5700	15.00	32	0.00	184.50	228.30	0.00	0.00		<50mm	1407.8	1845.8	<50mm	<50mm	N/A
WLAN Aux	WiFi	5825	15.00	32	0.00	184.50	228.30	0.00	0.00		<50mm	1407.2	1845.2	<50mm	<50mm	N/A
WLAN Aux	Bluetooth	2480	7.00	5	0.00	184.50	228.30	0.00	0.00		<50mm	1440.3	1878.3	<50mm	<50mm	N/A

Note(s):

1. According to KDB 447498, if the calculated Power threshold is less than the output power then SAR testing is required.
2. SAR exclusion was not assessed for 2 Tx (MIMO) as the higher 1 Tx (SISO) SAR values were used for simultaneous transmission analysis

Conclusion:

- As the calculated Power Threshold is greater than the DUT output power for Edge2 and 3 of WIFI Main antenna and Edge1 ,2 of WIFI Aux antenna, SAR testing is not required for these configurations

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13.2. Estimated SAR for Simultaneous Transmission SAR Analysis

Considerations for using estimated SAR values:

1. According to KDB 447498 § 4.1.5 if the antenna is at close proximity to user then the outer surface of the DUT should be treated as the radiating surface. The test separation distance is then determined by the smallest distance between the outer surface of the device and the user. For the purposes of this report close proximity has been defined as closer than 50 mm. For antennas <50 mm from the rear or edge the separation distance used for the estimated SAR calculations is 0mm.
2. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.
3. Output power is the maximum rated power (including tune-up or manufacturing tolerances) and includes source-based averaging.
4. If the antenna separation distance is > 50mm then the estimated SAR value is 0.4 W/Kg.
5. Formulas round separation distance to nearest mm and power to nearest mW before calculating estimated SAR

13.2.1. Estimated SAR for Wi-Fi 1 Tx (SISO) and Bluetooth

Antenna	Tx	Frequency	Output power		Separation distances(mm)						Estimated SAR Value					
		(MHz)	dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
WiFi - Main Antenna																
WLAN Main	WiFi	2462	15.00	32	0.00	0.00	265.50	139.00	0.00		Measure	Measure	>200 mm	0.400	Measure	N/A
WLAN Main	WiFi	5240	14.00	25	0.00	0.00	265.50	139.00	0.00		Measure	Measure	>200 mm	0.400	Measure	N/A
WLAN Main	WiFi	5320	14.50	28	0.00	0.00	265.50	139.00	0.00		Measure	Measure	>200 mm	0.400	Measure	N/A
WLAN Main	WiFi	5700	15.00	32	0.00	0.00	265.50	139.00	0.00		Measure	Measure	>200 mm	0.400	Measure	N/A
WLAN Main	WiFi	5825	15.00	32	0.00	0.00	265.50	139.00	0.00		Measure	Measure	>200 mm	0.400	Measure	N/A
Bluetooth / WiFi - Aux Antenna																
WLAN Aux	WiFi	2462	14.50	28	0.00	184.50	228.30	0.00	0.00		Measure	Measure	>200 mm	Measure	Measure	N/A
WLAN Aux	WiFi	5240	14.00	25	0.00	184.50	228.30	0.00	0.00		Measure	Measure	>200 mm	Measure	Measure	N/A
WLAN Aux	WiFi	5320	14.50	28	0.00	184.50	228.30	0.00	0.00		Measure	Measure	>200 mm	Measure	Measure	N/A
WLAN Aux	WiFi	5700	15.00	32	0.00	184.50	228.30	0.00	0.00		Measure	Measure	>200 mm	Measure	Measure	N/A
WLAN Aux	WiFi	5825	15.00	32	0.00	184.50	228.30	0.00	0.00		Measure	Measure	>200 mm	Measure	Measure	N/A
WLAN Aux	Bluetooth	2480	7.00	5	0.00	184.50	228.30	0.00	0.00		0.210	Measure	>200 mm	0.210	0.210	N/A

Notes:

1. Estimated SAR for 2 Tx (MIMO) was not assessed as the higher 1 Tx (SISO) SAR values were used for simultaneous transmission analysis.
2. As Simultaneous Transmission SAR of the DUT was compliant under the higher power conditions of Wi-Fi 1 Tx, it was judged that such analyses would be unnecessary for Wi-Fi 2 Tx (MIMO), given the substantially lower MIMO power levels and considerable separation distance between WLAN Main and the WLAN Auxiliary antennas.
3. Wherever appropriate, Wi-Fi 1 Tx (SISO) SAR values were used to represent those of Wi-Fi 2 Tx (MIMO); if compliance can be shown with the more conservative Wi-Fi 1 Tx values, then there is no need to perform separate assessment for Wi-Fi 2 Tx.
4. Though SAR for Bluetooth/WiFi Aux antenna in edge 1 was not required for standalone, test was performed. The reason is as follows.
   The WLAN model in which only the WLAN module(EUT) was installed. The WLAN+WWAN model in which WLAN module(EUT) and WWAN module were installed. The host device(M/N: FZ-G1) has these two models.
   Since Edge 1 of WLAN Aux/BT was measured standalone SAR for simultaneous transmitting evaluation of a WLAN+WWAN model, measured standalone SAR value was used in this report.
   When considering simultaneous transmitting exclusion of Edge1, 0.4W/kg had very large estimated SAR of Edge1 of WLAN Aux/BT, and since the sum of SAR value exceeded 1.6W/kg, estimated SAR was not used in this report.
   Evaluation of simultaneous transmission of a WLAN+WWAN model is included in the application of WWAN module, and it is not contained in this report.

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13.3. Wi-Fi 2.4 GHz Band

Main Antenna

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	802.11b	0	1	2412	14.50	14.20	0.088	0.094	1	
			6	2437	14.50	14.19				1
			11	2462	14.50	14.19				1
	802.11g	0	1	2412	11.50	11.49				1
			6	2437	15.00	14.61	0.118	0.129	2	
			11	2462	11.50	11.41				1
	802.11n20	0	1	2412	11.50	11.31				1
			6	2437	15.00	14.84	0.122	0.127	3	
			11	2462	11.50	11.31				1
	802.11n40	0	3	2422	10.50	10.16				1
			6	2437	15.00	14.74	0.119	0.126	4	
			9	2452	11.50	11.10				1
Edge 1	802.11b	0	1	2412	14.50	14.20	0.041	0.044	5	
			6	2437	14.50	14.19				1
			11	2462	14.50	14.19				1
	802.11g	0	1	2412	11.50	11.49				1
			6	2437	15.00	14.61	0.052	0.057	6	
			11	2462	11.50	11.41				1
	802.11n20	0	1	2412	11.50	11.31				1
			6	2437	15.00	14.84	0.054	0.056	7	
			11	2462	11.50	11.31				1
	802.11n40	0	3	2422	10.50	10.16				1
			6	2437	15.00	14.74	0.052	0.055	8	
			9	2452	11.50	11.10				1
Edge 4	802.11b	0	1	2412	14.50	14.20	0.319	0.342	9	
			6	2437	14.50	14.19				1
			11	2462	14.50	14.19				1
	802.11g	0	1	2412	11.50	11.49				1
			6	2437	15.00	14.61	0.427	0.467	10	
			11	2462	11.50	11.41				1
	802.11n20	0	1	2412	11.50	11.31				1
			6	2437	15.00	14.84	0.392	0.407	11	
			11	2462	11.50	11.31				1
	802.11n40	0	3	2422	10.50	10.16				1
			6	2437	15.00	14.74	0.379	0.402	12	
			9	2452	11.50	11.10				1

Note(s):

According to KDB 447498 D01 General RF Exposure Guidance v05, 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

1. ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
2. ≤ 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
3. ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

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Auxiliary Antenna

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	802.11b	0	1	2412	14.5	14.33	0.188	0.196	13	
			6	2437	12.5	12.31				1
			11	2462	12.5	12.37				1
Edge 1	802.11b	0	1	2412	14.5	14.33	0.00196	0.00204	14	
			6	2437	12.5	12.31				1
			11	2462	12.5	12.37				1
Edge 3	802.11b	0	1	2412	14.5	14.33	0.500	0.520	15	
			6	2437	12.5	12.31				1
			11	2462	12.5	12.37				1
Edge 4	802.11b	0	1	2412	14.5	14.33	0.077	0.080	16	
			6	2437	12.5	12.31				1
			11	2462	12.5	12.37				1

Note(s):

According to KDB 447498 D01 General RF Exposure Guidance v05, 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

1. ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
2. ≤ 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
3. ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

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13.4. Wi-Fi 5.2 GHz Band

Main Antenna

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	802.11a	0	40	5200	14.00	13.61				1
			48	5240	14.00	13.74	0.038	0.040	1	
Edge1	802.11a	0	40	5200	14.00	13.61				1
			48	5240	14.00	13.74	0.030	0.032	2	
Edge4	802.11a	0	40	5200	14.00	13.61				1
			48	5240	14.00	13.74	0.222	0.236	3	

Auxiliary Antenna

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	802.11a	0	40	5200	14.00	13.77				1
			48	5240	14.00	13.78	0.101	0.106	4	
Edge1	802.11a	0	40	5200	14.00	13.77				1
			48	5240	14.00	13.78	0.015	0.016	5	
Edge3	802.11a	0	40	5200	14.00	13.77				1
			48	5240	14.00	13.78	0.208	0.219	6	
Edge4	802.11a	0	40	5200	14.00	13.77				1
			48	5240	14.00	13.78	0.030	0.032	7	

Note(s):

According to KDB 447498 D01 General RF Exposure Guidance v05, 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

1. ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
2. ≤ 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
3. ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

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13.5. Wi-Fi 5.3 GHz Band

Main Antenna

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	802.11a	0	56	5280	14.50	14.21	0.044	0.047	8	
			60	5300	14.50	14.16				1
Edge1	802.11a	0	56	5280	14.50	14.21	0.023	0.025	9	
			60	5300	14.50	14.16				1
Edge4	802.11a	0	56	5280	14.50	14.21	0.213	0.228	10	
			60	5300	14.50	14.16				1

Auxiliary Antenna

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	802.11a	0	52	5260	14.50	14.47	0.161	0.162	11	
			60	5300	14.50	14.15				1
Edge1	802.11a	0	52	5260	14.50	14.47	0.013	0.013	12	
			60	5300	14.50	14.15				1
Edge3	802.11a	0	52	5260	14.50	14.47	0.335	0.337	13	
			60	5300	14.50	14.15				1
Edge4	802.11a	0	52	5260	14.50	14.47	0.039	0.039	14	
			60	5300	14.50	14.15				1

Note(s):

According to KDB 447498 D01 General RF Exposure Guidance v05, 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

1. ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
2. ≤ 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
3. ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

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13.6. Wi-Fi 5.5 GHz Band

Main Antenna

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	802.11a	0	104	5520	15.00	14.89				3
			108	5540	15.00	14.93	0.058	0.059	15	
			112	5560	15.00	14.85				3
			128	5640	15.00	14.79				3
			132	5660	15.00	14.71				3
Edge1	802.11a	0	104	5520	15.00	14.89				3
			108	5540	15.00	14.93	0.037	0.038	16	
			112	5560	15.00	14.85				3
			128	5640	15.00	14.79				3
			132	5660	15.00	14.71				3
Edge4	802.11a	0	104	5520	15.00	14.89				3
			108	5540	15.00	14.93	0.301	0.306	17	
			112	5560	15.00	14.85				3
			128	5640	15.00	14.79				3
			132	5660	15.00	14.71				3

Auxiliary Antenna

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	802.11a	0	104	5520	15.00	14.77				3
			120	5600	15.00	14.89	0.139	0.143	18	
			136	5680	15.00	14.80				3
Edge1	802.11a	0	104	5520	15.00	14.77				3
			120	5600	15.00	14.89	0.018	0.018	19	
			136	5680	15.00	14.80				3
Edge3	802.11a	0	104	5520	15.00	14.77				3
			120	5600	15.00	14.89	0.304	0.312	20	
			136	5680	15.00	14.80				3
Edge4	802.11a	0	104	5520	15.00	14.77				3
			120	5600	15.00	14.89	0.025	0.026	21	
			136	5680	15.00	14.80				3

Note(s):

According to KDB 447498 D01 General RF Exposure Guidance v05, 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

1. ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
2. ≤ 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
3. ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

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13.7. Wi-Fi 5.8 GHz Band

Main Antenna

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	802.11a	0	149	5745	15.00	14.90	0.040	0.041	22	
			153	5765	15.00	14.79				1
			161	5805	15.00	14.63				1
Edge1	802.11a	0	149	5745	15.00	14.90	0.00702	0.00718	23	
			153	5765	15.00	14.79				1
			161	5805	15.00	14.63				1
Edge4	802.11a	0	149	5745	15.00	14.90	0.260	0.266	24	
			153	5765	15.00	14.79				1
			161	5805	15.00	14.63				1

Auxiliary Antenna

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Rear	802.11a	0	153	5765	15.00	14.78				1
			157	5785	15.00	14.65				1
			165	5825	15.00	15.00	0.162	0.162	25	
Edge1	802.11a	0	153	5765	15.00	14.78				1
			157	5785	15.00	14.65				1
			165	5825	15.00	15.00	0.020	0.020	26	
Edge3	802.11a	0	153	5765	15.00	14.78				1
			157	5785	15.00	14.65				1
			165	5825	15.00	15.00	0.369	0.369	27	
Edge4	802.11a	0	153	5765	15.00	14.78				1
			157	5785	15.00	14.65				1
			165	5825	15.00	15.00	0.021	0.021	28	

Note(s):

According to KDB 447498 D01 General RF Exposure Guidance v05, 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

1. ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
2. ≤ 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
3. ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

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13.8. Bluetooth

Auxiliary Antenna

Test Position	Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		Plot No.	Note
					Tune-up limit	Meas.	Meas.	Scaled		
Edge1	DH5	0	0	2402	7.00	5.64	0.0000938	0.000128	1	
			39	2441	7.00	5.52				1
			78	2480	7.00	5.34				1

Note(s):

According to KDB 447498 D01 General RF Exposure Guidance v05, 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

1. ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
2. ≤ 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
3. ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

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Summary of Highest SAR Values

Results for the highest measured SAR values in each frequency band and mode

Technology/ Band	Test configuration			Mode	Dist. (mm)	Freq. (Mhz)	Power (dBm)	1g SAR (W/kg)
	Transmit Antenna	Exposure	Position					
Wi-Fi 2.4 GHz	Auxiliary	Body	Edge 3	802.11b	0	2412	14.33	0.500
Wi-Fi 5.2 GHz	Main	Body	Edge 4	802.11a	0	5240	13.74	0.222
Wi-Fi 5.3 GHz	Auxiliary	Body	Edge 3	802.11a	0	5260	14.47	0.335
Wi-Fi 5.5 GHz	Auxiliary	Body	Edge 3	802.11a	0	5600	14.89	0.304
Wi-Fi 5.8 GHz	Auxiliary	Body	Edge 3	802.11a	0	5825	15.00	0.369
Bluetooth	Auxiliary	Body	Edge 1	DH5	0	2402	5.64	0.0000938

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13.9. SAR Measurement Variability and Uncertainty

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.

Repeated measurement was not performed since the original highest measured SAR is < 0.80 W/kg

Wireless Technologies	Test Configuration			Mode	Dist. (mm)	Ch #.	Freq. (MHz)	Meas. SAR (W/kg)		Largest to Smallest SAR Ratio	Plot No.
	Transmit Antenna	Exposure	Position					Original	Repeated		
Wi-Fi 2.4 GHz	Auxiliary	Body	Edge 3	802.11b 1Mbps	0	1	2412	0.500	N/A	N/A	
Wi-Fi 5.2 GHz	Main	Body	Edge 4	802.11a 6 Mbps	0	48	5240	0.222	N/A	N/A	
Wi-Fi 5.3 GHz	Auxiliary	Body	Edge 3	802.11a 6 Mbps	0	52	5260	0.335	N/A	N/A	
Wi-Fi 5.5 GHz	Auxiliary	Body	Edge 3	802.11a 6 Mbps	0	120	5600	0.304	N/A	N/A	
Wi-Fi 5.8 GHz	Auxiliary	Body	Edge 4	802.11a 6 Mbps	0	165	5825	0.369	N/A	N/A	

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.

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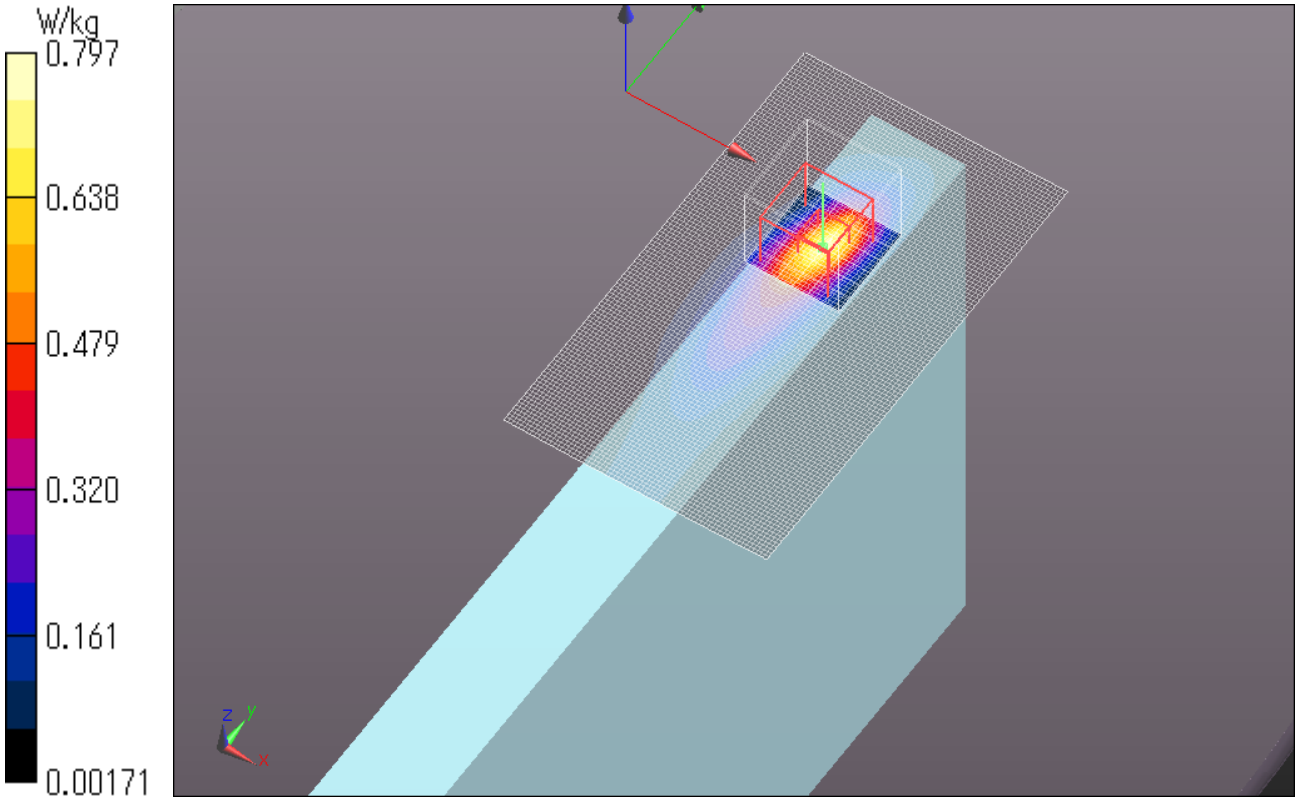
13.10. SAR Plots (from Summary of Highest Measured SAR Values)

WLAN 11b 1Mbps Aux Ant. Edge 3 2412MHz
Communication System: UID 0, WLAN 11a/b/g/n (0); Communication System Band: 11b/g/n (2.4G); Frequency: 2412 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.887 S/m; ε_r = 50.378; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3825; ConvF(7.23, 7.23, 7.23); Calibrated: 2013/12/13;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509; Calibrated: 2013/07/16
Phantom: ELI 4.0; Type: QDOVA001BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (71x121x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.766 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.812 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 1.09 W/kg
SAR(1 g) = 0.500 W/kg; SAR(10 g) = 0.220 W/kg
Maximum value of SAR (measured) = 0.797 W/kg



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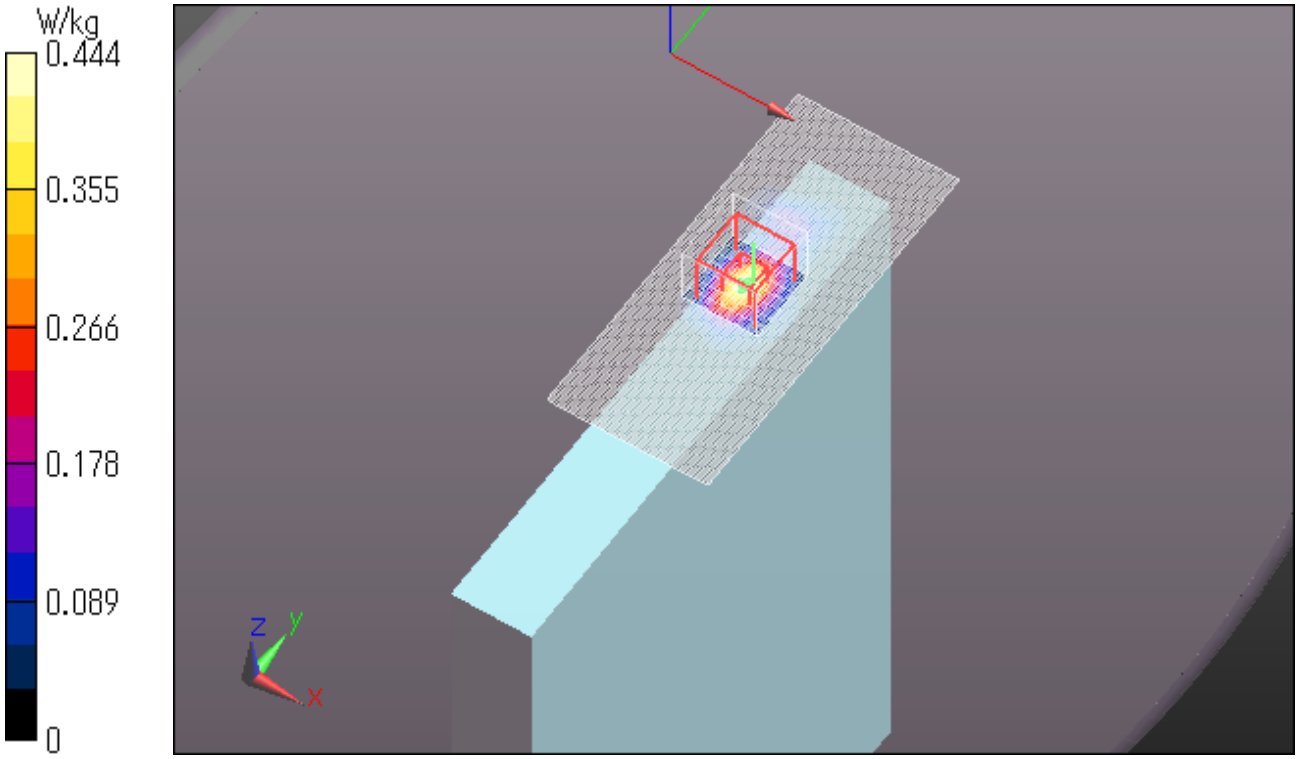
WLAN 11a 6Mbps Main Ant. Edge 4 5240MHz

Communication System: UID 0, WLAN 11a/b/g/n (0); Communication System Band: 11a/n (W52 53); Frequency: 5240 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5240 MHz; σ = 5.242 S/m; ε_r = 49.203; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3825; ConvF(4.38, 4.38, 4.38); Calibrated: 2013/12/13;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509; Calibrated: 2013/07/16
Phantom: ELI 4.0; Type: QDOVA001BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (61x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.465 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 10.568 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 0.851 W/kg
SAR(1 g) = 0.222 W/kg; SAR(10 g) = 0.066 W/kg
Maximum value of SAR (measured) = 0.444 W/kg



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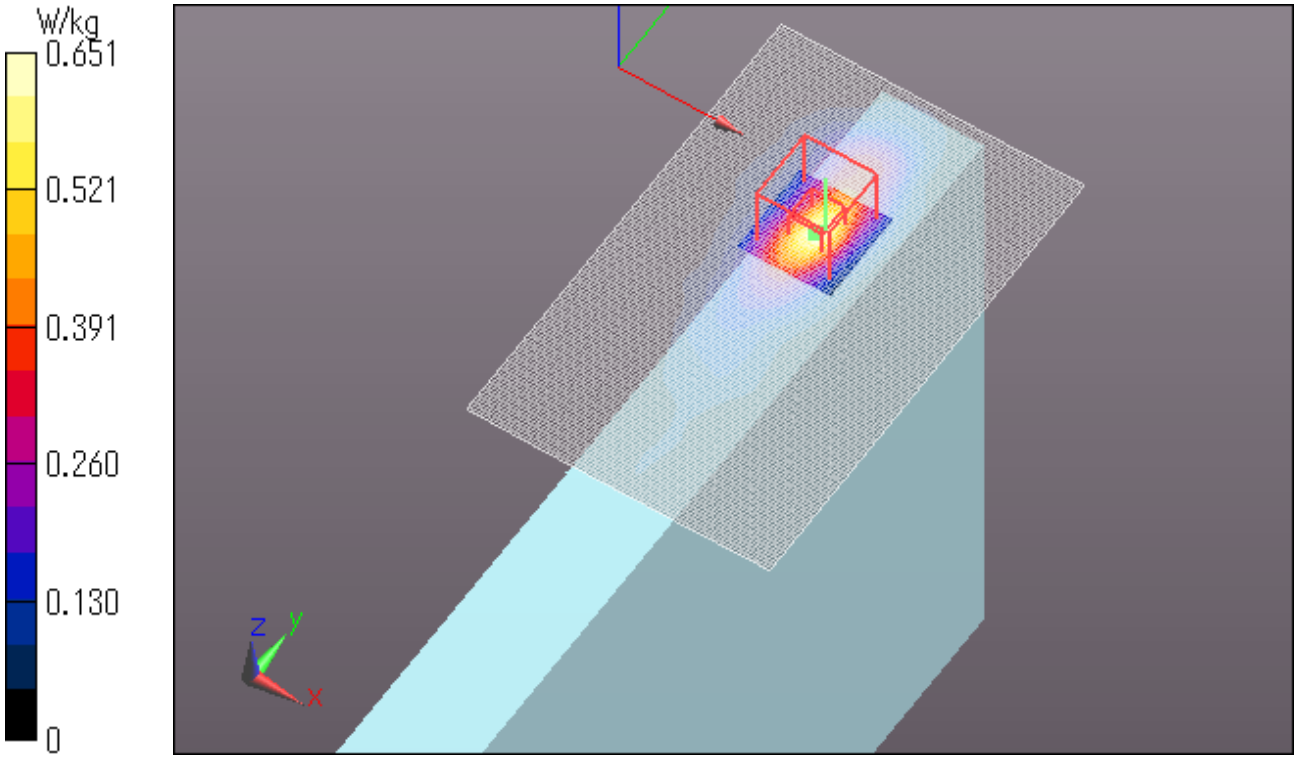
WLAN 11a 6Mbps Aux Ant. 5260MHz Edge 3

Communication System: UID 0, WLAN 11a/b/g/n (0); Communication System Band: 11a/n (W52 53); Frequency: 5260 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5260 MHz; σ = 5.267 S/m; ε_r = 49.191; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3825; ConvF(4.23, 4.23, 4.23); Calibrated: 2013/12/13;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509; Calibrated: 2013/07/16
Phantom: ELI 4.0; Type: QDOVA001BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (91x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.599 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 12.332 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 1.24 W/kg
SAR(1 g) = 0.335 W/kg; SAR(10 g) = 0.112 W/kg
Maximum value of SAR (measured) = 0.651 W/kg



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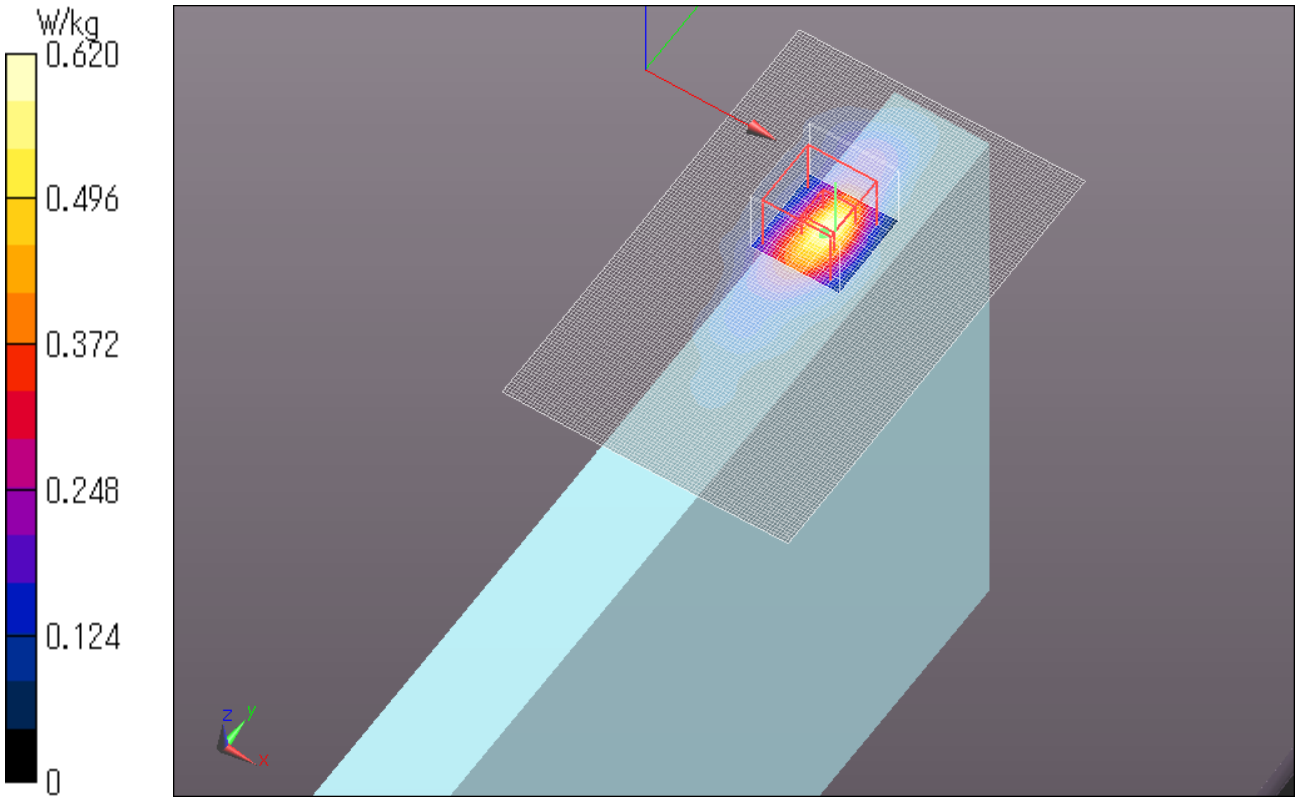
WLAN 11a 6Mbps Aux Ant. 5600MHz Edge 3

Communication System: UID 0, WLAN 11a/b/g/n (0); Communication System Band: 11a/n (W56); Frequency: 5600 MHz; Duty Cycle: 1:1
Medium parameters used: f = 5600 MHz; σ = 5.68 S/m; ε_r = 47.406; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3825; ConvF(3.9, 3.9, 3.9); Calibrated: 2013/12/13;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509; Calibrated: 2013/07/16
Phantom: ELI 4.0; Type: QDOVA001BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (91x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.612 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 11.534 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.22 W/kg
SAR(1 g) = 0.304 W/kg; SAR(10 g) = 0.099 W/kg
Maximum value of SAR (measured) = 0.620 W/kg



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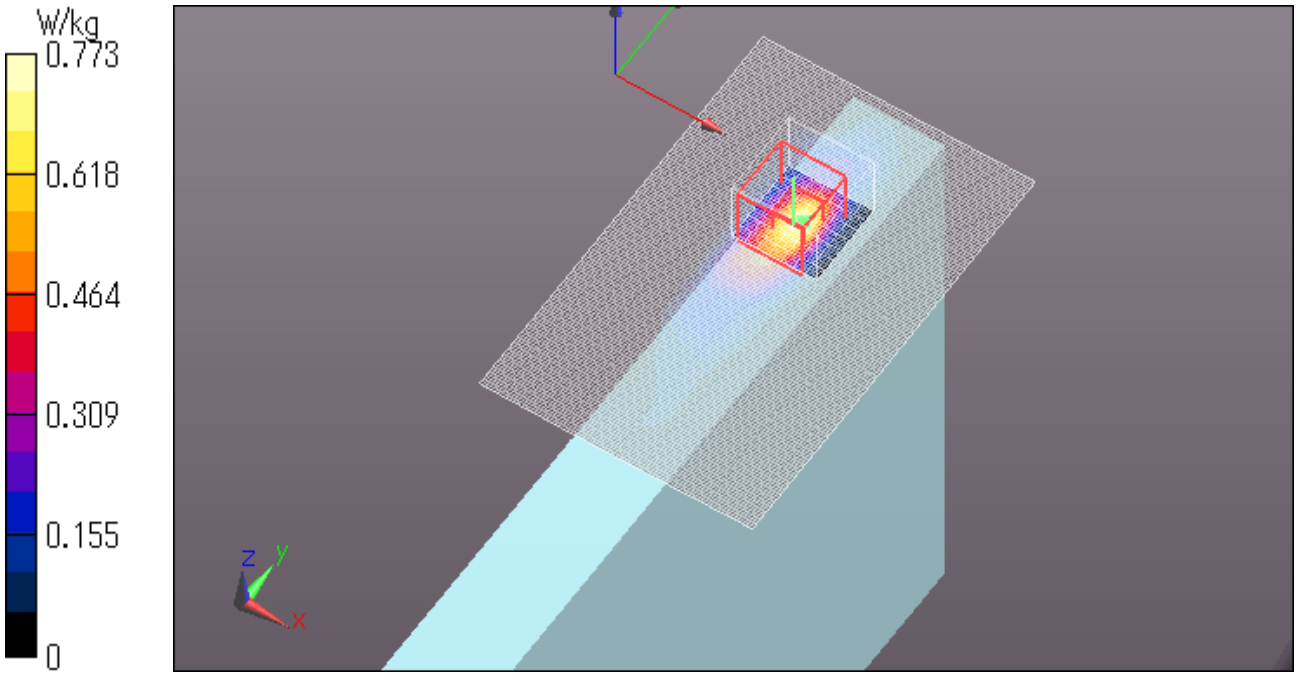
WLAN 11a 6Mbps Aux Ant. 5825MHz Edge 3

Communication System: UID 0, WLAN 11a/b/g/n (0); Communication System Band: 11a/n (W58); Frequency: 5825 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5825 MHz; σ = 6.111 S/m; ε_r = 47.143; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3825; ConvF(4.05, 4.05, 4.05); Calibrated: 2013/12/13;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509; Calibrated: 2013/07/16
Phantom: ELI 4.0; Type: QDOVA001BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (91x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.862 W/kg

Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 12.569 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 2.38 W/kg
SAR(1 g) = 0.369 W/kg; SAR(10 g) = 0.117 W/kg
Maximum value of SAR (measured) = 0.773 W/kg



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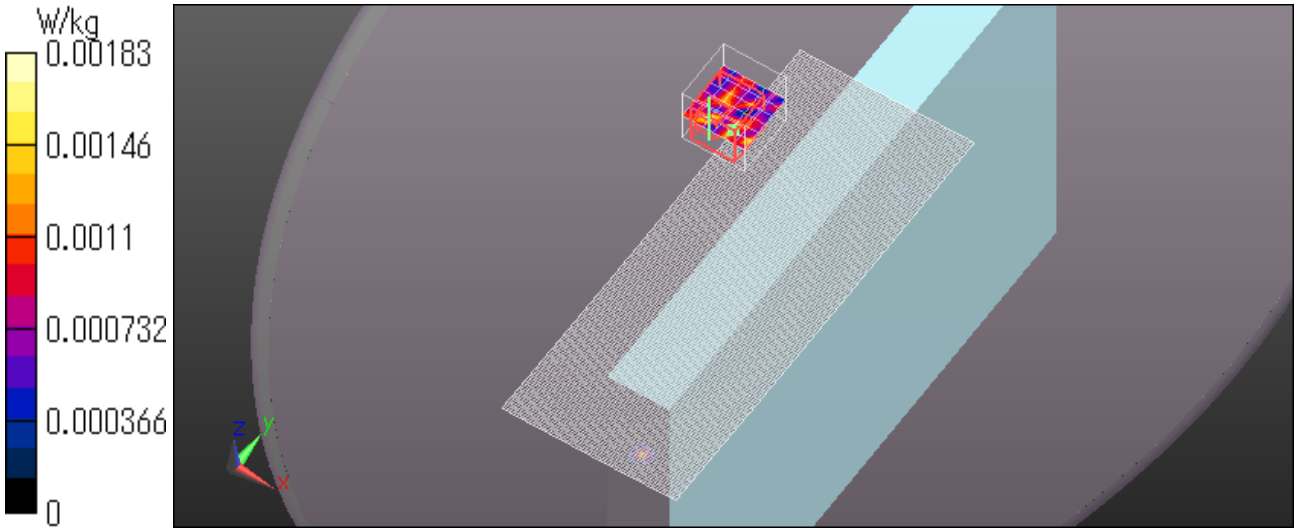
Bluetooth DH5 Aux Ant. Edge1 2402MHz

Communication System: UID 0, Buletooth (0); Communication System Band: DH5; Frequency: 2402 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2402 MHz; σ = 1.962 S/m; ε_r = 51.368; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration
Probe: EX3DV4 - SN3825; ConvF(7.23, 7.23, 7.23); Calibrated: 2013/12/13;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn509; Calibrated: 2013/07/16
Phantom: ELI 4.0; Type: QDOVA001BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Area Scan (71x181x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.00170 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.374 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.00183 W/kg
SAR(1 g) = 9.38e-005 W/kg; SAR(10 g) = 2.7e-005 W/kg

Maximum value of SAR (measured) = 0.00183 W/kg
Date: 2014/04/14
Ambient Temp. : 24.0 degree.C. Liquid Temp.; 23.5 degree.C.



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14. Simultaneous Transmission SAR Analysis

14.1. Rear for WLAN 2 Tx (MIMO)

Test Position	WiFi Main	WiFi Aux	Bluetooth	∑ 1-g SAR (mW/g)
Rear, 2.4 GHz	0.129	0.196		0.325
	0.129		0.210	0.339
Rear, 5.2 GHz	0.040	0.106		0.146
	0.040		0.210	0.250
Rear, 5.3 GHz	0.047	0.162		0.209
	0.047		0.210	0.257
Rear, 5.5 GHz	0.059	0.143		0.202
	0.059		0.210	0.269
Rear, 5.8 GHz	0.041	0.162		0.203
	0.041		0.210	0.251

Note(s):
1. Bluetooth and Wi-Fi Aux cannot simultaneously transmit
2. Values shaded green are estimated SAR

14.2. Edge1 for WLAN 2 Tx (MIMO)

Test Position	WiFi Main	WiFi Aux	Bluetooth	∑ 1-g SAR (mW/g)
Edge1, 2.4 GHz	0.057	0.00204		0.059
	0.057		0.000128	0.057
Edge1, 5.2 GHz	0.032	0.016		0.048
	0.032		0.000128	0.032
Edge1, 5.3 GHz	0.025	0.013		0.038
	0.025		0.000128	0.025
Edge1, 5.5 GHz	0.038	0.018		0.056
	0.038		0.000128	0.038
Edge1, 5.8 GHz	0.00718	0.020		0.027
	0.00718		0.000128	0.007

Note(s):
1. Bluetooth and Wi-Fi Aux cannot simultaneously transmit

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14.3. Edge3 for WLAN 2 Tx (MIMO)

Test Position	WiFi Main	WiFi Aux	Bluetooth	∑ 1-g SAR (mW/g)
Edge3, 2.4 GHz	0.400	0.520		0.920
	0.400		0.210	0.610
Edge3, 5.2 GHz	0.400	0.219		0.619
	0.400		0.210	0.610
Edge3, 5.3 GHz	0.400	0.337		0.737
	0.400		0.210	0.610
Edge3, 5.5 GHz	0.400	0.312		0.712
	0.400		0.210	0.610
Edge3, 5.8 GHz	0.400	0.369		0.769
	0.400		0.210	0.610

Note(s):
1. Bluetooth and Wi-Fi Aux cannot simultaneously transmit
2. Values shaded green are estimated SAR

14.4. Edge4 for WLAN 2 Tx (MIMO)

Test Position	WiFi Main	WiFi Aux	Bluetooth	∑ 1-g SAR (mW/g)
Edge4, 2.4 GHz	0.467	0.080		0.547
	0.467		0.210	0.677
Edge4, 5.2 GHz	0.236	0.032		0.268
	0.236		0.210	0.446
Edge4, 5.3 GHz	0.228	0.039		0.267
	0.228		0.210	0.438
Edge4, 5.5 GHz	0.306	0.026		0.332
	0.306		0.210	0.516
Edge4, 5.8 GHz	0.266	0.021		0.287
	0.266		0.210	0.476

Note(s):
3. Bluetooth and Wi-Fi Aux cannot simultaneously transmit
4. Values shaded green are estimated SAR

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15. Appendixes

Refer to separated files for the following appendixes.

15.1. System Performance Check Plots

15.2. SAR Test Plots for Wi-Fi 2.4 GHz Band

15.3. SAR Test Plots for Wi-Fi 5 GHz Bands

15.4. SAR Test Plots for Bluetooth

15.5. Calibration Certificate for E-Field Probe EX3DV4 - SN 3825

15.6. Calibration Certificate for D2450V2 - SN 713

15.7. Calibration Certificate for D5GHzV2 - SN 1020

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