



**FCC OET BULLETIN 65 SUPPLEMENT C 01-01
IEEE Std 1528-2003 and IEEE Std 1528a-2005**

Class II Permissive Change

SAR EVALUATION REPORT

For

**802.11a/g/n/ac 2X2 MIMO WLAN + Bluetooth PCI-E Mini Card
(Tested inside of 11-inch MacBook Air Model A1465)**

**Model: BCM94360CS2
FCC ID: QDS-BRCM1072**

**Report Number: 13U14922-1A
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Prepared for

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NVLAP LAB CODE 200065-0

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	5/10/2013	Initial Issue	--
A	5/20/2013	Revision based on Reviewer's comment: 1. Sec. 7: Revised Simultaneous Transmission Condition 2. Sec. 11.6 & 12.6: Added Bluetooth Maximum tune-up tolerance limit 3. Sec. 15.5: Added Bluetooth Estimated SAR 4. Sec. 17: Added Simultaneous Transmission SAR Analysis	Bobby Bayani

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1. Attestation of Test Results

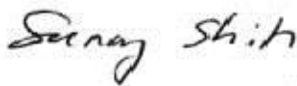
Applicant	BROADCOM CORPORATION			
DUT description	802.11a/g/n/ac 2X2 MIMO WLAN + BT combo PCI-E Mini Card (Tested inside of 11-inch MacBook Air Model A1465)			
Model numbers	BCM94360CS2			
Test device is	An identical prototype			
Device category	Portable device			
Exposure category	General Population/Uncontrolled Exposure			
Date tested	3/20/2013 – 5/1/2013			
The highest reported SAR values	RF exposure conditions	Licensed	DTS	UNII
	Lap Held (Antenna Vendor A)	N/A W/kg	1.190 W/kg	1.190 W/kg
	Lap Held (Antenna Vendor B)	N/A W/kg	1.170 W/kg	1.050 W/kg
Applicable Standards	OET Bulletin 65 Supplement C IEEE Std 1528-2003 and IEEE Std 1528a-2005 FCC Published RF exposure KDB procedures, and TCB workshop updates			
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:




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 WiSE Engineer
 UL Verification Services Inc.

2. Test Methodology

The tests documented in this report were performed in accordance with FCC OET Bulletin 65 Supplement C Edition 01-01, IEEE STD 1528-2003, and the following KDB Procedures.

- KDB 447498 D01 General RF Exposure Guidance v05
- KDB 616217 D04 SAR for laptop and tablets v01
- KDB 248227 D01 SAR meas for 802 11abg v01r02
- KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01
- KDB 865664 D02 SAR Reporting v01
- April 2013 TCB Workshop Updates

3. Facilities and Accreditation

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

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

4. Calibration and Uncertainty

4.1. Measuring Instrument Calibration

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due date		
				MM	DD	Year
S-Parameter Network Analyzer	Agilent	N5230C	MY49001783	8	31	2013
Thermometer	Control Company	4353	122102412	2	24	2014
Dielectronic Probe kit	SPEAG	DAK-3.5	1103	2	5	2014
Vector Signal Generator	R & S	SMU200A	104592	7	27	2014
Vector Signal Generator	R & S	SMU200A	104591	7	26	2014
Power Meter	R & S	NRP2	101663	9	4	2013
Power Meter	R & S	NRP2	101664	9	7	2013
Power Sensor	R & S	NRP - Z81	101298	9	7	2013
Power Sensor	R & S	NRP - Z81	101302	9	4	2013
Amplifier	Amplifier Research	15S1G4M41, 0.7-4.2 GHz	335565	N/A		
Amplifier	Amplifier Research	35S4G8A, 4-8 GHz	336934	N/A		
Directional coupler	KRYTAR	158010	92552	N/A		
Directional coupler	KRYTAR	158010	142253	N/A		
E-Field Probe	SPEAG	EX3DV4	3720	1	14	2014
E-Field Probe	SPEAG	EX3DV4	3778	1	14	2014
Data Acquisition Electronics	SPEAG	DAE4	1264	1	14	2014
Data Acquisition Electronics	SPEAG	DAE4	1263	1	14	2014
System Validation Dipole	SPEAG	D2450V2	826	1	30	2014
System Validation Dipole	SPEAG	D5GHzV2	1003	9	18	2013

4.2. Measurement Uncertainty

LAB A

Measurement uncertainty for 30 MHz to 6 GHz averaged over 1 gram (Body)

Component	Error, ±%	Prob Dist	Divisor	Sensitivity	U (X), %
Measurement System					
Probe Calibration (k=1)	6.00	Normal	1	1	6.00
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
Modulation Response	2.40	Rectangular	1.732	1	1.39
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner	0.80	Rectangular	1.732	1	0.46
Probe Positioning	6.70	Rectangular	1.732	1	3.87
Post-processing	4.00	Rectangular	1.732	1	2.31
Test Sample Related					
Device Holder	3.60	Normal	1	1	3.60
Test Sample Positioning	3.00	Normal	1	1	3.00
Power Scaling	1.00	Rectangular	1.732	1	0.58
Power Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Setup					
Phantom Uncertainty	7.90	Rectangular	1.732	1	4.56
SAR Correction	1.90	Rectangular	1.732	1	1.10
Liquid Conductivity - measurement	4.45	Rectangular	1.732	0.78	2.00
Liquid Permittivity - measurement	-4.16	Rectangular	1.732	0.26	-0.62
Liquid Conductivity - temperature uncertainty	5.22	Rectangular	1.732	0.78	2.35
Liquid Permittivity - temperature uncertainty	0.84	Rectangular	1.732	0.23	0.11
Combined Standard Uncertainty $U_c(y) =$					11.58
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				23.15 %	
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.81 dB	

Measurement Uncertainty (continued)

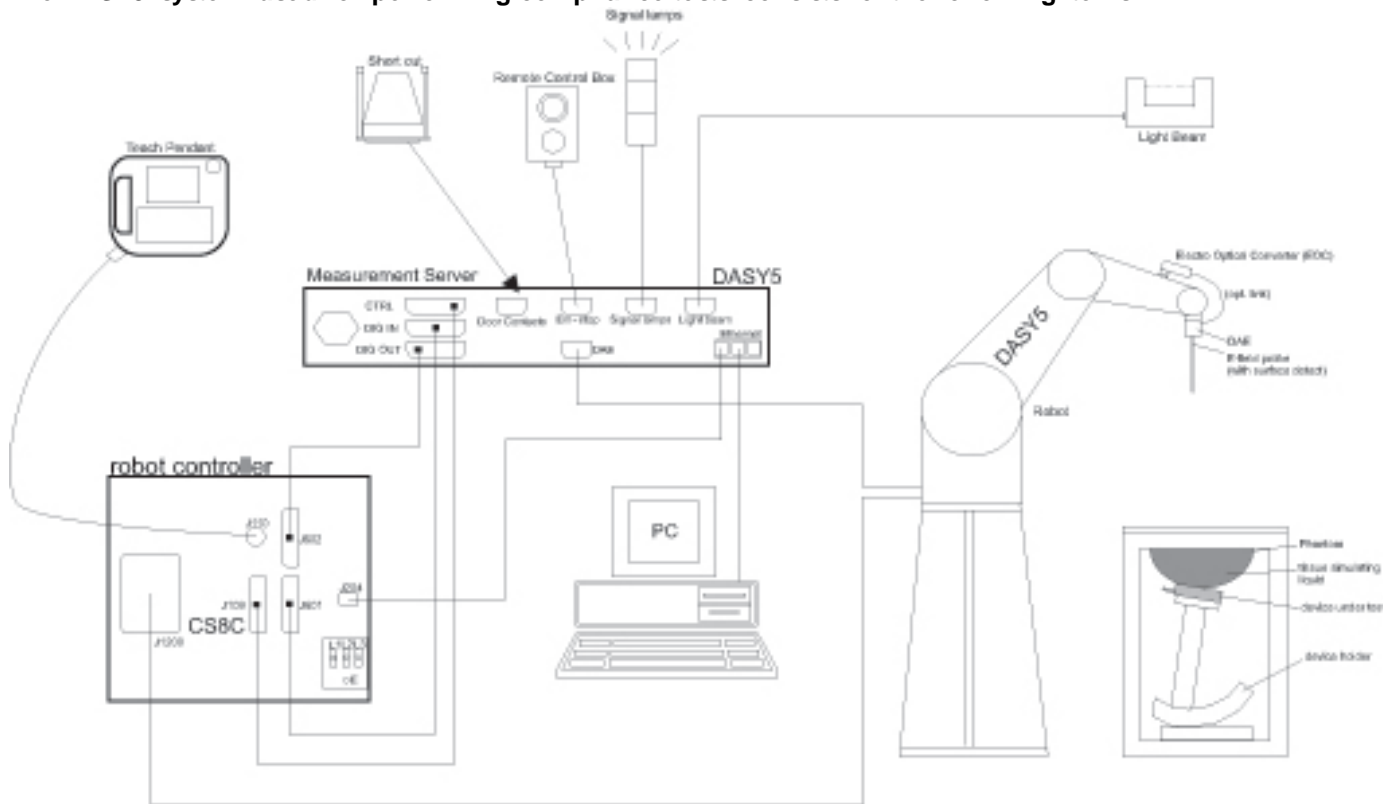
LAB B

Measurement uncertainty for 30 MHz to 6 GHz averaged over 1 gram (Body)

Component	Error, ±%	Prob Dist	Divisor	Sensitivity	U (X), %
Measurement System					
Probe Calibration (k=1)	6.00	Normal	1	1	6.00
Axial Isotropy	1.15	Rectangular	1.732	0.7071	0.47
Hemispherical Isotropy	2.30	Rectangular	1.732	0.7071	0.94
Boundary Effect	0.90	Rectangular	1.732	1	0.52
Probe Linearity	3.45	Rectangular	1.732	1	1.99
Modulation Response	2.40	Rectangular	1.732	1	1.39
System Detection Limits	1.00	Rectangular	1.732	1	0.58
Readout Electronics	0.30	Normal	1	1	0.30
Response Time	0.80	Rectangular	1.732	1	0.46
Integration Time	2.60	Rectangular	1.732	1	1.50
RF Ambient Noise	3.00	Rectangular	1.732	1	1.73
RF Ambient Reflections	3.00	Rectangular	1.732	1	1.73
Probe Positioner	0.80	Rectangular	1.732	1	0.46
Probe Positioning	6.70	Rectangular	1.732	1	3.87
Post-processing	4.00	Rectangular	1.732	1	2.31
Test Sample Related					
Device Holder	3.60	Normal	1	1	3.60
Test Sample Positioning	3.00	Normal	1	1	3.00
Power Scaling	1.00	Rectangular	1.732	1	0.58
Power Drift	5.00	Rectangular	1.732	1	2.89
Phantom and Setup					
Phantom Uncertainty	7.90	Rectangular	1.732	1	4.56
SAR Correction	1.90	Rectangular	1.732	1	1.10
Liquid Conductivity - measurement	4.45	Rectangular	1.732	0.78	2.00
Liquid Permittivity - measurement	-4.33	Rectangular	1.732	0.26	-0.65
Liquid Conductivity - temperature uncertainty	5.22	Rectangular	1.732	0.78	2.35
Liquid Permittivity - temperature uncertainty	0.84	Rectangular	1.732	0.23	0.11
Combined Standard Uncertainty $U_c(y) =$					11.58
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				23.16 %	
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =				1.81 dB	

5. Measurement System Description and Setup

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



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

6. SAR Measurement Procedures

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

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01

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

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z-direction.

6.2. Volume Scan Procedures

Step 1: Repeat Step 1-4 in Section 6.1

Step 2: Volume Scan

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

Step 3: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

7. Device Under Test

7.1. General Information

802.11a/g/n/ac 2X2 MIMO WLAN + BT combo PCI-E Mini Card (Tested inside of 11-inch MacBook Air Model A1465) Model: BCM94360CS2							
Operating Configuration(s)	Laptop Mode (Notebook)						
Antennas tested	<table border="0"> <tr> <td><u>Vendor</u></td> <td><u>Part Number</u></td> </tr> <tr> <td>Pulse (A) / Amphenol (B)</td> <td>WiFi 2: 631-1547 (for chain 0) WiFi 1 & Bluetooth: 631-1547 (for chain 1)</td> </tr> <tr> <td colspan="2">The Antenna-to-module mapping: Chain 0 - WiFi Antenna 2 Chain 1 - WiFi Antenna 1</td> </tr> </table>	<u>Vendor</u>	<u>Part Number</u>	Pulse (A) / Amphenol (B)	WiFi 2: 631-1547 (for chain 0) WiFi 1 & Bluetooth: 631-1547 (for chain 1)	The Antenna-to-module mapping: Chain 0 - WiFi Antenna 2 Chain 1 - WiFi Antenna 1	
<u>Vendor</u>	<u>Part Number</u>						
Pulse (A) / Amphenol (B)	WiFi 2: 631-1547 (for chain 0) WiFi 1 & Bluetooth: 631-1547 (for chain 1)						
The Antenna-to-module mapping: Chain 0 - WiFi Antenna 2 Chain 1 - WiFi Antenna 1							

7.2. Wireless Technologies

Wireless Mode and Frequency Bands	WiFi 802.11a/b/g/n/ac Bluetooth 2.4 GHz
Modulation	WiFi 802.11a/b/g/n HT20/HT40/HT80 /ac VHT20/VHT40/VHT80 Bluetooth Ver. 4.0
Duty Cycle	WiFi 802.11a/b/g/n/ac: 100%
Simultaneous Transmission Condition	WiFi 5 GHz Bands can transmit simultaneously with BT WiFi 2.4 GHz Band cannot transmit simultaneously with BT

7.3. Possible Combinations of 802.11 Modes vs. Tx Diversity Configurations

Band(GHz)	802.11 Modes	Tx diversity configurations	Original	C2PC
2.4	11b	1 Tx	√	√
		2 Tx CDD	√	√
	11g	1 Tx	√	√
		2 Tx (CDD)	√	√
		2 Tx (TXBF)	√	√
	11n	HT20 (1 Tx)	√	√
		HT40 (1 Tx)	disabled	disabled
		HT20 All non TXBF (2 Tx)	√	√
		HT20 TXBF (2 Tx)	√	√
	11ac	VHT20 (1 Tx)	√	√
		VHT40 (1 Tx)	disabled	disabled
		VHT80 (1 Tx)	disabled	disabled
		VHT20 All (1 Tx)	√	√
		VHT20 TXBF (2 Tx)	√	√
		VHT40 All/TXBF 2 Tx)	disabled	disabled
		VHT80 All/TXBF (2 Tx)	disabled	disabled
*Note: The 11n 2Tx, 11ac 2 Tx VHT20/VHT40/VHT80 "All" modes detailed apply to all of CDD/STBC/SDM modes.				
Band(GHz)	802.11 modes	Tx diversity configurations	Original	C2PC
5.2	11a	1 Tx	√	√
		2 Tx CDD	√	√
		2 Tx TXBF	√	√
	11n	HT20 SISO (1 Tx)	√	√
		HT40 SISO (1 Tx)	√	√
		HT20 CDD (2 Tx)	√	√
		HT20 STBC/SDM (2 Tx)	√	√
		HT20 TXBF (2 Tx)	√	√
		HT40 CDD (2 Tx)	√	√
		HT40 STBC/SDM (2 Tx)	√	√
		HT40 TXBF (2 Tx)	√	√
	11ac	VHT20 SISO (1 Tx)	√	√
		VHT40 SISO (1 Tx)	√	√
		VHT80 SISO (1 Tx)	√	√
		VHT20 CDD (2 Tx)	√	√
		VHT20 STBC/SDM (2 Tx)	√	√
		VHT20 TXBF (2 Tx)	√	√
		VHT40 CDD (2 Tx)	√	√
		VHT40 STBC/SDM (2 Tx)	√	√
		VHT40 TXBF (2 Tx)	√	√
		VHT80 CDD (2 Tx)	√	√
		VHT80 STBC/SDM (2 Tx)	√	√
		VHT80 TXBF (2 Tx)	√	√

Possible Combinations of 802.11 Modes vs. Tx Diversity Configurations (continued)

Band(GHz)	802.11 modes	Tx diversity configurations	Original	C2PC
5.3	11a	1 Tx	√	√
		2 Tx CDD	√	√
		2 Tx TXBF	√	√
	11n	HT20 SISO (1 Tx)	√	√
		HT40 SISO (1 Tx)	√	√
		HT20 CDD (2 Tx)	√	√
		HT20 STBC/SDM (2 Tx)	√	√
		HT20 TXBF (2 Tx)	√	√
		HT40 CDD (2 Tx)	√	√
		HT40 STBC/SDM (2 Tx)	√	√
		HT40 TXBF (2 Tx)	√	√
	11ac	VHT20 SISO (1 Tx)	√	√
		VHT40 SISO (1 Tx)	√	√
		VHT80 SISO (1 Tx)	√	√
		VHT20 CDD (2 Tx)	√	√
		VHT20 STBC/SDM (2 Tx)	√	√
		VHT20 TXBF (2 Tx)	√	√
		VHT40 CDD (2 Tx)	√	√
		VHT40 STBC/SDM (2 Tx)	√	√
		VHT40 TXBF (2 Tx)	√	√
VHT80 CDD (2 Tx)		√	√	
VHT80 STBC/SDM (2 Tx)		√	√	
VHT80 TXBF (2 Tx)	√	√		
Band(GHz)	802.11 modes	Tx diversity configurations	Original	C2PC
5.5	11a	1 Tx	√	√
		2 Tx CDD	√	√
		2 Tx TXBF	√	√
	11n	HT20 SISO (1 Tx)	√	√
		HT40 SISO (1 Tx)	√	√
		HT20 CDD (2 Tx)	√	√
		HT20 STBC/SDM (2 Tx)	√	√
		HT20 TXBF (2 Tx)	√	√
		HT40 CDD (2 Tx)	√	√
		HT40 STBC/SDM (2 Tx)	√	√
		HT40 TXBF (2 Tx)	√	√
	11ac	VHT20 SISO (1 Tx)	√	√
		VHT40 SISO (1 Tx)	√	√
		VHT80 SISO (1 Tx)	√	√
		VHT20 CDD (2 Tx)	√	√
		VHT20 STBC/SDM (2 Tx)	√	√
		VHT20 TXBF (2 Tx)	√	√
		VHT40 CDD (2 Tx)	√	√
		VHT40 STBC/SDM (2 Tx)	√	√
		VHT40 TXBF (2 Tx)	√	√
VHT80 CDD (2 Tx)		√	√	
VHT80 STBC/SDM (2 Tx)		√	√	
VHT80 TXBF (2 Tx)	√	√		

Possible Combinations of 802.11 Modes vs. Tx Diversity Configurations (continued)

Band(GHz)	802.11 modes	Tx diversity configurations	Original	C2PC
5.8	11a	1 Tx	√	√
		2 Tx CDD	√	√
		2 Tx TXBF	√	√
	11n	HT20 SISO (1 Tx)	√	√
		HT40 SISO (1 Tx)	√	√
		HT20 CDD (2 Tx)	√	√
		HT20 STBC/SDM (2 Tx)	√	√
		HT20 TXBF (2 Tx)	√	√
		HT40 CDD (2 Tx)	√	√
		HT40 STBC/SDM (2 Tx)	√	√
		HT40 TXBF (2 Tx)	√	√
	11ac	VHT20 SISO (1 Tx)	√	√
		VHT40 SISO (1 Tx)	√	√
		VHT80 SISO (1 Tx)	√	√
		VHT20 CDD (2 Tx)	√	√
		VHT20 STBC/SDM (2 Tx)	√	√
		VHT20 TXBF (2 Tx)	√	√
		VHT40 CDD (2 Tx)	√	√
		VHT40 STBC/SDM (2 Tx)	√	√
		VHT40 TXBF (2 Tx)	√	√
		VHT80 CDD (2 Tx)	√	√
VHT80 STBC/SDM (2 Tx)	√	√		
VHT80 TXBF (2 Tx)	√	√		

8. RF Exposure Conditions

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

8.1. Lap-Held

Chain 0 and Chain 1

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	7.64 mm	Yes	

9. Summary of Required Test Modes

Selected Test Modes were based on specific C2PC Host.

9.1. 2.4 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Maximum Target power setting from original approval (*1 See Note) (dBm)		Maximum Target power setting from C2PC/A1465 Host (dBm)		SAR Test (Yes/No)	Note		
				WiFi 1	WiFi 2	WiFi 1	WiFi 2				
				Chain 0	Chain 1	Chain 0	Chain 1				
802.11b Legacy	1 Tx	1	2412	19.5		19.0		Yes			
		2	2417	20.0		19.0					
		6	2437	20.0		19.0					
		11	2462	20.0		19.0					
		1	2412		19.5		19.5				
		2	2417		20.0		20.0				
		6	2437		20.0		20.0				
		11	2462		20.0		20.0				
	2 Tx CDD	1	2412	19.5	19.5	19.0	19.5	Yes			
		2	2417	20.0	20.0	19.0	20.0				
		6	2437	20.0	20.0	19.0	20.0				
		11	2462	20.0	20.0	19.0	20.0				
		1	2412	17.5		17.5				No (Test reduction per KDB)	
		2	2417	19.5		19.0					
3	2422	20.0		19.0							
6	2437	20.0		19.0							
10	2457	20.0		19.0							
11	2462	17.5		17.5							
802.11g	1 Tx	1	2412		17.5		17.5	No (Test reduction per KDB)			
		2	2417		19.5		19.5				
		3	2422		20.0		20.0				
		6	2437		20.0		20.0				
		10	2457		20.0		20.0				
		11	2462		17.5		17.5				
		2 Tx CDD	1	2412	15.5	15.5	15.5		15.5		No (Test reduction per KDB)
			2	2417	19.0	19.0	19.0		19.0		
			3	2422	20.0	20.0	19.0		20.0		
			6	2437	20.0	20.0	19.0		20.0		
			9	2452	20.0	20.0	19.0		20.0		
	10		2457	19.5	19.5	19.0	19.5				
	11		2462	16.0	16.0	16.0	16.0				
	2 Tx TXBF	1	2412	16.5	16.5	16.5	16.5	No (Test reduction per KDB)			
		2	2417	19.0	19.0	19.0	19.0				
		3	2422	20.0	20.0	19.0	20.0				
		6	2437	20.0	20.0	19.0	20.0				
		9	2452	20.0	20.0	19.0	20.0				
10		2457	19.5	19.5	19.0	19.5					
11		2462	16.0	16.0	16.0	16.0					

Summary of Required Test Modes for 2.4 GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Maximum Target power setting from original approval (*1 See Note) (dBm)		Maximum Target power setting from C2PC/A1465 Host (dBm)		SAR Test (Yes/No)	Note
				WiFi 1	WiFi 2	WiFi 1	WiFi 2		
				Chain 0	Chain 1	Chain 0	Chain 1		
802.11n	1 Tx HT20	1	2412	17.5		17.5		No (Test reduction per KDB)	
		2	2422	19.5		19.0			
		3	2422	20.0		19.0			
		6	2437	20.0		19.0			
		10	2457	20.0		19.0			
		11	2462	17.5		17.5			
		1	2412		17.5		17.5		
		2	2422		19.5		19.5		
		3	2422		20.0		20.0		
		6	2437		20.0		20.0		
		10	2457		20.0		20.0		
	11	2462		17.5		17.5			
	1 Tx HT40	40MHz Transmission disabled in the 2.4GHz Band							
	2 Tx HT20 AI ² nonTXBF	1	2412	15.5	15.5	15.5	15.5	No (Test reduction per KDB)	
		2	2422	19.0	19.0	19.0	19.0		
		3	2422	20.0	20.0	19.0	20.0		
		6	2437	20.0	20.0	19.0	20.0		
		9	2452	20.0	20.0	19.0	20.0		
		10	2457	19.5	19.5	19.0	19.5		
	2 Tx HT20 TXBF	1	2412	16.5	16.5	16.5	16.5	No (Test reduction per KDB)	
		2	2422	19.0	19.0	19.0	19.0		
		3	2422	20.0	20.0	19.0	20.0		
6		2437	20.0	20.0	19.0	20.0			
9		2452	20.0	20.0	19.0	20.0			
10		2457	19.5	19.5	19.0	19.5			
2 Tx HT40 AI ² /TXBF	40MHz Transmission disabled in the 2.4GHz Band								

Summary of Required Test Modes for 2.4 GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Maximum Target power setting from original approval (*1 See Note) (dBm)		Maximum Target power setting from C2PC/A1465 Host (dBm)		SAR Test (Yes/No)	Note			
				WiFi 1	WiFi 2	WiFi 1	WiFi 2					
				Chain 0	Chain 1	Chain 0	Chain 1					
802.11ac	1 Tx VHT20	1	2412	17.5		17.5		No (Test reduction per KDB)				
		2	2422	19.5		19.0						
		3	2422	20.0		19.0						
		6	2437	20.0		19.0						
		10	2457	20.0		19.0						
		11	2462	17.5		17.5						
		1	2412		17.5		17.5					
		2	2422		19.5		19.5					
		3	2422		20.0		20.0					
		6	2437		20.0		20.0					
		10	2457		20.0		20.0					
		11	2462		17.5		17.5					
		1 Tx VHT40	40MHz Transmission disabled in the 2.4GHz Band									
		1 Tx VHT80	80MHz Transmission disabled in the 2.4GHz Band									
	2 Tx VHT20 AI ²	1	2412	15.5	15.5	15.5	15.5	No (Test reduction per KDB)				
		2	2422	19.0	19.0	19.0	19.0					
		3	2422	20.0	20.0	19.0	20.0					
		6	2437	20.0	20.0	19.0	20.0					
		9	2452	20.0	20.0	19.0	20.0					
		10	2457	19.5	19.5	19.0	19.5					
		11	2462	16.0	16.0	16.0	16.0					
	2 Tx VHT20 TXBF	1	2412	16.5	16.5	16.5	16.5	No (Test reduction per KDB)				
		2	2422	19.0	19.0	19.0	19.0					
		3	2422	20.0	20.0	19.0	20.0					
		6	2437	20.0	20.0	19.0	20.0					
		9	2452	20.0	20.0	19.0	20.0					
		10	2457	19.5	19.5	19.0	19.5					
		11	2462	16.0	16.0	16.0	16.0					
2 Tx VHT40 AI ² /TXBF	40MHz Transmission disabled in the 2.4GHz Band											
2 Tx VHT80 AI ² /TXBF	80MHz Transmission disabled in the 2.4GHz Band											

Note(s):

- The "Original Approval" power levels were based upon FCC modular approval testing of the BCM9436 0CS2 radio. These power levels were approved up to maximum regulatory levels to cover a number of different potential applications. The original maximum regulatory power levels may be reduced further by the driver for one of the following two reasons:
 - For performance (i.e. non-regulatory) reasons to ensure that PER and EVM of the radio meet internal specifications.
 - For application specifics. In this case the power is reduced to meet the specific SAR requirement per transmit chain over frequency band/channel. SAR specifics are addressed in a Class II permissive change as applicable.
- The 11n 2Tx HT20/HT40 and 11ac 2Tx VHT20/VHT40/VHT80 "AI" modes detailed apply to all of the CDD/STBC/SDM non-transmit beamforming modes.
- SAR evaluation is required at HT20 STBC/SDM mode because output power is higher vs others data rate modes.
- SAR evaluation for 802.11ac is required based on the highest 802.11a configuration per April 2013 TCB Workshop.
 - Antenna Vendor A
 - Antenna Vendor B

9.2. 5.2 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Maximum Target power setting from original approval (*1 See Note) (dBm)		Maximum Target power setting from C2PC/A1465 Host (dBm)		SAR Test (Yes/No)	Note
				WiFi 1	WiFi 2	WiFi 1	WiFi 2		
				Chain 0	Chain 1	Chain 0	Chain 1		
802.11a	1 Tx	36	5180	16.0		16.0		Yes	
		40	5200	16.0		16.0			
		44	5220	16.0		16.0			
		48	5240	16.0		16.0			
		36	5180		16.0		15.5		
		40	5200		16.0		15.5		
		44	5220		16.0		15.5		
		48	5240		16.0		15.5		
	2 Tx CDD	36	5180	11.5	11.5	11.5	11.5	Yes	
		40	5200	11.5	11.5	11.5	11.5		
		44	5220	11.5	11.5	11.5	11.5		
		48	5240	11.5	11.5	11.5	11.5		
2 Tx TXBF	36	5180	11.5	11.5	11.5	11.5	No (Test reduction per KDB)		
	40	5200	11.5	11.5	11.5	11.5			
	44	5220	11.5	11.5	11.5	11.5			
	48	5240	11.5	11.5	11.5	11.5			
802.11n	1 Tx HT20 SISO	36	5180	16.0		16.0		No (Test reduction per KDB)	
		44	5220	16.0		16.0			
		48	5240	16.0		16.0			
		36	5180		16.0		15.5		
		44	5220		16.0		15.5		
		48	5240		16.0		15.5		
	1 Tx HT40 SISO	38	5190	16.5		16.0		No (Test reduction per KDB)	
		46	5230	16.5		16.0			
		38	5190		16.5		15.5		
		46	5230		16.5		15.5		
	2 Tx HT20 CDD	36	5180	11.5	11.5	11.5	11.5	No (Test reduction per KDB)	
		40	5200	11.5	11.5	11.5	11.5		
		48	5240	11.5	11.5	11.5	11.5		
	2 Tx HT20 STBC/SDM	36	5180	13.5	13.5	13.5	13.5	Yes	3
		40	5200	13.5	13.5	13.5	13.5		
		48	5240	13.5	13.5	13.5	13.5		
	2 Tx HT20 TXBF	36	5180	11.5	11.5	11.5	11.5	No (Test reduction per KDB)	
		40	5200	11.5	11.5	11.5	11.5		
		48	5240	11.5	11.5	11.5	11.5		
	2 Tx HT40 CDD	38	5190	13.5	13.5	13.5	13.5	No (Test reduction per KDB)	
		46	5230	13.5	13.5	13.5	13.5		
	2 Tx HT40 STBC/SDM	38	5190	13.5	13.5	13.5	13.5	No (Test reduction per KDB)	
		46	5230	13.5	13.5	13.5	13.5		
	2 Tx HT40 TXBF	38	5190	11.0	11.0	11.0	11.0	No (Test reduction per KDB)	
46		5230	11.0	11.0	11.0	11.0			

Summary of Required Test Modes for 5.2 GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Maximum Target power setting from original approval (*1 See Note) (dBm)		Maximum Target power setting from C2PC/A1465 Host (dBm)		SAR Test (Yes/No)	Note
				WiFi 1	WiFi 2	WiFi 1	WiFi 2		
				Chain 0	Chain 1	Chain 0	Chain 1		
802.11ac	1 Tx VHT20 SISO	36	5180	16.0		16.0		Yes	4a
		44	5220	16.0		16.0		No	4
		48	5240	16.0		16.0		Yes	4b
		36	5180		16.0		15.5	No	4
		44	5220		16.0		15.5		
		48	5240		16.0		15.5		
	1 Tx VHT40 SISO	38	5190	16.5		16.0		No	4
		46	5230	16.5		16.0		No	4
		38	5190		16.5		15.5		
		46	5230		16.5		15.5		
	1 Tx VHT80 SISO	42	5210	15.5		15.5		No	4
		42	5210		15.5		15.5		
	2 Tx VHT20 CDD	36	5180	11.5	11.5	11.5	11.5	No	4
		40	5200	11.5	11.5	11.5	11.5		
		48	5240	11.5	11.5	11.5	11.5		
	2 Tx VHT20 STBC/SDM	36	5180	13.5	13.5	13.5	13.5	No	4
		40	5200	13.5	13.5	13.5	13.5		
		48	5240	13.5	13.5	13.5	13.5		
	2 Tx VHT20 TXBF	36	5180	11.5	11.5	11.5	11.5	No	4
		40	5200	11.5	11.5	11.5	11.5		
		48	5240	11.5	11.5	11.5	11.5		
	2 Tx VHT40 CDD	38	5190	13.5	13.5	13.5	13.5	No	4
		46	5230	13.5	13.5	13.5	13.5		
	2 Tx VHT40 STBC/SDM	38	5190	13.5	13.5	13.5	13.5	No	4
		46	5230	13.5	13.5	13.5	13.5		
	2 Tx VHT40 TXBF	38	5190	11.0	11.0	11.0	11.0	No	4
		46	5230	11.0	11.0	11.0	11.0		
	2 Tx VHT80 CDD	42	5210	13.5	13.5	13.5	13.5	No	4
2 Tx VHT80 STBC/SDM	42	5210	13.5	13.5	13.5	13.5	No	4	
	42	5210	13.5	13.5	13.5	13.5			
2 Tx VHT80 TXBF	42	5210	11.5	11.5	11.5	11.5	No	4	

Note(s):

- The "Original Approval" power levels were based upon FCC modular approval testing of the BCM94360CS2 radio. These power levels were approved up to maximum regulatory levels to cover a number of different potential applications. The original maximum regulatory power levels may be reduced further by the driver for one of the following two reasons:
 - For performance (i.e. non-regulatory) reasons to ensure that PER and EVM of the radio meet internal specifications.
 - For application specifics. In this case the power is reduced to meet the specific SAR requirement per transmit chain over frequency band/channel. SAR specifics are addressed in a Class II permissive change as applicable.
- The 11n 2Tx HT20/HT40 and 11ac 2Tx VHT20/VHT40/VHT80 "All" modes detailed apply to all of the CDD/STBC/SDM non-transmit beamforming modes.
- SAR evaluation is required at HT20 STBC/SDM mode because output power is higher vs others data rate modes.
- SAR evaluation for 802.11ac is required based on the highest 802.11a configuration per April 2013 TCB Workshop.
 - Antenna Vendor A
 - Antenna Vendor B

9.3. 5.3 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Maximum Target power setting from original approval (*1 See Note) (dBm)		Maximum Target power setting from C2PC/A1465 Host (dBm)		SAR Test (Yes/No)	Note
				WiFi 1	WiFi 2	WiFi 1	WiFi 2		
				Chain 0	Chain 1	Chain 0	Chain 1		
802.11a	1 Tx	52	5260	20.0		17.5		Yes	
		56	5280	20.0		17.5			
		60	5300	20.0		17.5			
		64	5320	20.0		17.5			
		52	5260		20.0		17.5		
		56	5280		20.0		17.5		
		60	5300		20.0		17.5		
		64	5320		20.0		17.5		
	2 Tx CDD	52	5260	19.0	19.0	17.5	17.5	Yes	
		56	5280	18.5	18.5	17.5	17.5		
		60	5300	18.5	18.5	17.5	17.5		
		64	5320	18.5	18.5	17.5	17.5		
2 Tx TXBF	52	5260	19.0	19.0	17.5	17.5	No (Test reduction per KDB)		
	56	5280	19.0	19.0	17.5	17.5			
	60	5300	18.5	18.5	17.5	17.5			
	64	5320	18.5	18.5	17.5	17.5			
802.11n	1 Tx HT20 SISO	52	5260	20.0		17.5		No (Test reduction per KDB)	
		60	5300	20.0		17.5			
		64	5320	20.0		17.5			
		52	5260		20.0		17.5		
		60	5300		20.0		17.5		
		64	5320		20.0		17.5		
	1 Tx HT40 SISO	54	5270	20.0		17.5		No (Test reduction per KDB)	
		62	5310	18.0		17.5			
		54	5270		20.0		17.5		
		62	5310		18.0		17.5		
	2 Tx HT20 CDD	52	5260	19.0	19.0	17.5	17.5	No (Test reduction per KDB)	
		60	5300	18.5	18.5	17.5	17.5		
		64	5320	18.5	18.5	17.5	17.5		
	2 Tx HT20 STBC/SDM	52	5260	20.0	20.0	17.5	17.5	No (Test reduction per KDB)	
		56	5280	20.0	20.0	17.5	17.5		
		64	5320	19.0	19.0	17.5	17.5		
	2 Tx HT20 TXBF	52	5260	19.0	19.0	17.5	17.5	No (Test reduction per KDB)	
		56	5280	19.0	19.0	17.5	17.5		
		64	5320	18.5	18.5	17.5	17.5		
	2 Tx HT40 CDD	54	5270	20.0	20.0	17.5	17.5	No (Test reduction per KDB)	
		62	5310	14.5	14.5	14.5	14.5		
	2 Tx HT40 STBC/SDM	54	5270	20.0	20.0	17.5	17.5	No (Test reduction per KDB)	
		62	5310	14.5	14.5	14.5	14.5		
	2 Tx HT40 TXBF	54	5270	18.0	18.0	17.5	17.5	No (Test reduction per KDB)	
62		5310	15.0	15.0	15.0	15.0			

Summary of Required Test Modes for 5.3 GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Maximum Target power setting from original approval (*1 See Note) (dBm)		Maximum Target power setting from C2PC/A1465 Host (dBm)		SAR Test (Yes/No)	Note
				WiFi 1	WiFi 2	WiFi 1	WiFi 2		
				Chain 0	Chain 1	Chain 0	Chain 1		
802.11ac	1 Tx VHT20 SISO	52	5260	20.0		17.5		No	4
		60	5300	20.0		17.5			
		64	5320	20.0		17.5			
		52	5260		20.0		17.5		
		60	5300		20.0		17.5		
		64	5320		20.0		17.5		
	1 Tx VHT40 SISO	54	5270	20.0		17.5		No	4
		62	5310	18.0		17.5			
		54	5270		20.0		17.5		
		62	5310		18.0		17.5		
	1 Tx VHT80 SISO	58	5290	17.5		17.5		No	4
		58	5290		17.5		17.5		
	2 Tx VHT20 CDD	52	5260	19.0	19.0	17.5	17.5	Yes	4a, 4b
		60	5300	18.5	18.5	17.5	17.5	No	4
		64	5320	18.5	18.5	17.5	17.5	No	4
	2 Tx VHT20 STBC/SDM	52	5260	20.0	20.0	17.5	17.5	No	4
		56	5280	20.0	20.0	17.5	17.5		
		64	5320	19.0	19.0	17.5	17.5		
	2 Tx VHT20 TXBF	52	5260	19.0	19.0	17.5	17.5	No	4
		56	5280	19.0	19.0	17.5	17.5		
		64	5320	18.5	18.5	17.5	17.5		
	2 Tx VHT40 CDD	54	5270	20.0	20.0	17.5	17.5	No	4
		62	5310	14.5	14.5	14.5	14.5		
	2 Tx VHT40 STBC/SDM	54	5270	20.0	20.0	17.5	17.5	No	4
62		5310	14.5	14.5	14.5	14.5			
2 Tx VHT40 TXBF	54	5270	18.0	18.0	17.5	17.5	No	4	
	62	5310	15.0	15.0	15.0	15.0			
2 Tx VHT80 CDD	58	5290	14.5	14.5	14.5	14.5	No	4	
2 Tx VHT80 STBC/SDM	58	5290	14.5	14.5	14.5	14.5	No	4	
2 Tx VHT80 TXBF	58	5290	14.0	14.0	14.0	14.0	No	4	

Note(s):

- The "Original Approval" power levels were based upon FCC modular approval testing of the BCM94360CS2 radio. These power levels were approved up to maximum regulatory levels to cover a number of different potential applications. The original maximum regulatory power levels may be reduced further by the driver for one of the following two reasons:
 - For performance (i.e. non-regulatory) reasons to ensure that PER and EVM of the radio meet internal specifications.
 - For application specifics. In this case the power is reduced to meet the specific SAR requirement per transmit chain over frequency band/channel. SAR specifics are addressed in a Class II permissive change as applicable.
- The 11n 2Tx HT20/HT40 and 11ac 2Tx VHT20/VHT40/VHT80 "All" modes detailed apply to all of the CDD/STBC/SDM non-transmit beamforming modes.
- SAR evaluation is required at HT20 STBC/SDM mode because output power is higher vs others data rate modes.
- SAR evaluation for 802.11ac is required based on the highest 802.11a configuration per April 2013 TCB Workshop.
 - Antenna Vendor A
 - Antenna Vendor B

9.4. 5.5 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Maximum Target power setting from original approval (*1 See Note) (dBm)		Maximum Target power setting from C2PC/A1465 Host (dBm)		SAR Test (Yes/No)	Note	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2			
				Chain 0	Chain 1	Chain 0	Chain 1			
802.11a	1 Tx	100	5500	20.0		17.0		Yes		
		104	5520	20.0		17.0				
		108	5540	20.0		17.0				
		112	5560	20.0		17.0				
		116	5580	20.0		17.0				
		120	5600	20.0		17.0				
		124	5620	20.0		17.0				
		128	5640	20.0		17.0				
		132	5660	20.0		17.0				
		136	5680	20.0		17.0				
		140	5700	20.0		17.0				
		144	5720	18.5		17.0				
		100	5500		20.0		18.0			
		104	5520		20.0		18.0			
	108	5540		20.0		18.0				
	112	5560		20.0		18.0				
	116	5580		20.0		18.0				
	120	5600		20.0		18.0				
	124	5620		20.0		18.0				
	128	5640		20.0		18.0				
	132	5660		20.0		18.0				
	136	5680		20.0		18.0				
	140	5700		20.0		18.0				
	144	5720		18.5		18.0				
	100	5500	18.0	18.0	17.0	18.0	Yes			
	104	5520	17.5	17.5	17.0	17.5				
	108	5540	17.5	17.5	17.0	17.5				
	112	5560	17.5	17.5	17.0	17.5				
	116	5580	17.5	17.5	17.0	17.5				
	120	5600	17.5	17.5	17.0	17.5				
	124	5620	17.5	17.5	17.0	17.5				
	128	5640	17.5	17.5	17.0	17.5				
	132	5660	17.5	17.5	17.0	17.5				
136	5680	17.5	17.5	17.0	17.5					
140	5700	15.0	15.0	15.0	15.0					
144	5720	18.5	18.5	17.0	18.0					
2 Tx TXBF	100	5500	18.0	18.0	17.0	18.0	No (Test reduction per KDB)			
	104	5520	17.5	17.5	17.0	17.5				
	108	5540	17.5	17.5	17.0	17.5				
	112	5560	17.5	17.5	17.0	17.5				
	116	5580	17.5	17.5	17.0	17.5				
	120	5600	17.5	17.5	17.0	17.5				
	124	5620	17.5	17.5	17.0	17.5				
	128	5640	17.5	17.5	17.0	17.5				
	132	5660	17.5	17.5	17.0	17.5				
	136	5680	17.5	17.5	17.0	17.5				
140	5700	15.5	15.5	15.5	15.5	Yes				
144	5720	18.5	18.5	17.0	18.0	No (Test reduction per KDB)				

Summary of Required Test Modes for 5.5 GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Maximum Target power setting from original approval (*1 See Note) (dBm)		Maximum Target power setting from C2PC/A1465 Host (dBm)		SAR Test (Yes/No)	Note
				WiFi 1	WiFi 2	WiFi 1	WiFi 2		
				Chain 0	Chain 1	Chain 0	Chain 1		
802.11n	1 Tx HT20 SISO	100	5500	20.0		17.0		No (Test reduction per KDB)	
		104	5520	20.0		17.0			
		120	5600	20.0		17.0			
		136	5680	20.0		17.0			
		140	5700	20.0		17.0			
		144	5720	18.5		17.0			
		100	5500		20.0		18.0		
		104	5520		20.0		18.0		
		120	5600		20.0		18.0		
		136	5680		20.0		18.0		
	140	5700		20.0		18.0			
	144	5720		18.5		18.0			
	1 Tx HT40 SISO	102	5510	17.5		17.0		No (Test reduction per KDB)	
		110	5550	20.0		17.0			
		134	5670	20.0		17.0			
		142	5710	20.0		17.0			
		102	5510		17.5		17.5		
		110	5550		20.0		18.0		
	2 Tx HT20 CDD	100	5500	18.0	18.0	17.0	18.0	No (Test reduction per KDB)	
		104	5520	17.5	17.5	17.0	17.5		
		120	5600	17.5	17.5	17.0	17.5		
		136	5680	17.5	17.5	17.0	17.5		
		140	5700	15.0	15.0	15.0	15.0		
	2 Tx HT20 STBC/SDM	100	5500	20.0	20.0	17.0	18.0	Yes	3
		104	5520	20.0	20.0	17.0	18.0		
		120	5600	20.0	20.0	17.0	18.0		
		136	5680	20.0	20.0	17.0	18.0		
		140	5700	15.0	15.0	15.0	15.0		
	2 Tx HT20 TXBF	100	5500	18.0	18.0	17.0	17.5	No (Test reduction per KDB)	
		104	5520	17.5	17.5	17.0	17.5		
		120	5600	17.5	17.5	17.0	17.5		
		136	5680	17.5	17.5	17.0	17.5		
		140	5700	15.5	15.5	15.5	15.5		
	2 Tx HT40 CDD	102	5510	14.5	14.5	14.5	14.5	No (Test reduction per KDB)	
		110	5550	20.0	20.0	17.0	18.0		
		134	5670	20.0	20.0	17.0	18.0		
142		5710	20.0	20.0	17.0	18.0			
2 Tx HT40 STBC/SDM	102	5510	14.5	14.5	14.5	14.5	No (Test reduction per KDB)		
	110	5550	20.0	20.0	17.0	18.0			
	134	5670	20.0	20.0	17.0	18.0			
2 Tx HT40 TXBF	102	5510	13.5	13.5	13.5	13.5	No (Test reduction per KDB)		
	110	5550	17.5	17.5	17.0	17.5			
	134	5670	17.5	17.5	17.0	17.5			
	142	5710	20.0	20.0	17.0	18.0			

Summary of Required Test Modes for 5.5 GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Maximum Target power setting from original approval (*1 See Note) (dBm)		Maximum Target power setting from C2PC/A1465 Host (dBm)		SAR Test (Yes/No)	Note
				WiFi 1	WiFi 2	WiFi 1	WiFi 2		
				Chain 0	Chain 1	Chain 0	Chain 1		
802.11ac	1 Tx VHT20 SISO	100	5500	20.0		17.0		No	4
		104	5520	20.0		17.0			
		120	5600	20.0		17.0			
		136	5680	20.0		17.0			
		140	5700	20.0		17.0			
		144	5720	18.5		17.0			
		100	5500		20.0		18.0		
		104	5520		20.0		18.0		
		120	5600		20.0		18.0		
		136	5680		20.0		18.0		
		140	5700		20.0		18.0		
		144	5720		18.5		18.0		
	1 Tx VHT40 SISO	102	5510	17.5		17.0		No	4
		110	5550	20.0		17.0			
		134	5670	20.0		17.0			
		142	5710	20.0		17.0			
		102	5510		17.5		17.5		
		110	5550		20.0		18.0		
		134	5670		20.0		18.0		
	1 Tx VHT80 SISO	106	5530	16.5		16.5		No	4
		122	5610	19.0		17.0			
		138	5690	20.0		17.0			
		106	5530		16.5		16.5		
		122	5610		19.0		18.0		
	2 Tx VHT20 CDD	100	5500	18.0	18.0	17.0	18.0	No	4
		104	5520	17.5	17.5	17.0	17.5		
		120	5600	17.5	17.5	17.0	17.5		
		124	5620	17.5	17.5	17.0	17.5		
		136	5680	17.5	17.5	17.0	17.5		
		140	5700	15.0	15.0	15.0	15.0		
		144	5720	18.5	18.5	17.0	18.0		
	2 Tx VHT20 STBC/SDM	100	5500	20.0	20.0	17.0	18.0	No	4
		104	5520	20.0	20.0	17.0	18.0		
		120	5600	20.0	20.0	17.0	18.0		
		124	5620	20.0	20.0	17.0	18.0		
		136	5680	20.0	20.0	17.0	18.0		
140		5700	15.0	15.0	15.0	15.0			
144		5720	20.0	20.0	17.0	18.0			
2 Tx VHT20 TXBF	100	5500	18.0	18.0	17.0	18.0	No	4	
	104	5520	17.5	17.5	17.0	17.5			
	120	5600	17.5	17.5	17.0	17.5			
	124	5620	17.5	17.5	17.0	17.5			
	136	5680	17.5	17.5	17.0	17.5			
	140	5700	15.5	15.5	15.5	15.5			
2 Tx VHT40 CDD	102	5510	14.5	14.5	14.5	14.5	No	4	
	110	5550	20.0	20.0	17.0	18.0			
	134	5670	20.0	20.0	17.0	18.0			
	142	5710	20.0	20.0	17.0	18.0			

Summary of Required Test Modes for 5.5 GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Maximum Target power setting from original approval (*1 See Note) (dBm)		Maximum Target power setting from C2PC/A1465 Host (dBm)		SAR Test (Yes/No)	Note
				WiFi 1	WiFi 2	WiFi 1	WiFi 2		
				Chain 0	Chain 1	Chain 0	Chain 1		
802.11ac	2 Tx VHT40 STBC/SDM	102	5510	14.5	14.5	14.5	14.5	No	4
		110	5550	20.0	20.0	17.0	18.0		
		134	5670	20.0	20.0	17.0	18.0		
		142	5710	20.0	20.0	17.0	18.0		
	2 Tx VHT40 TXBF	102	5510	13.5	13.5	13.5	13.5	No	4
		110	5550	17.5	17.5	17.0	17.5		
		134	5670	17.5	17.5	17.0	17.5		
	2 Tx VHT80 CDD	106	5530	14.0	14.0	14.0	14.0	No	4
		122	5610	19.0	19.0	17.0	18.0		
		138	5690	20.0	20.0	17.0	18.0		
	2 Tx VHT80 STBC/SDM	106	5530	14.0	14.0	14.0	14.0	No	4
		122	5610	19.0	19.0	17.0	18.0		
		138	5690	20.0	20.0	17.0	18.0		
	2 Tx VHT80 TXBF	106	5530	12.5	12.5	12.5	12.5	No	4
		122	5610	19.0	19.0	17.0	18.0		
		138	5690	20.0	20.0	17.0	18.0		

Note(s):

- The "Original Approval" power levels were based upon FCC modular approval testing of the BCM94360CS2 radio. These power levels were approved up to maximum regulatory levels to cover a number of different potential applications. The original maximum regulatory power levels may be reduced further by the driver for one of the following two reasons:
 - For performance (i.e. non-regulatory) reasons to ensure that PER and EVM of the radio meet internal specifications.
 - For application specifics. In this case the power is reduced to meet the specific SAR requirement per transmit chain over frequency band/channel. SAR specifics are addressed in a Class II permissive change as applicable.
- The 11n 2Tx HT20/HT40 and 11ac 2Tx VHT20/VHT40/VHT80 "All" modes detailed apply to all of the CDD/STBC/SDM non-transmit beamforming modes.
- SAR evaluation is required at HT20 STBC/SDM mode because output power is higher vs others data rate modes.
- SAR evaluation for 802.11ac is required based on the highest 802.11a configuration per April 2013 TCB Workshop.
 - Antenna Vendor A
 - Antenna Vendor B

9.5. 5.8 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Maximum Target power setting from original approval (*1 See Note) (dBm)		Maximum Target power setting from C2PC/A1465 Host (dBm)		SAR Test (Yes/No)	Note
				WiFi 1	WiFi 2	WiFi 1	WiFi 2		
				Chain 0	Chain 1	Chain 0	Chain 1		
802.11a	1 Tx	149	5745	20.0		17.5		Yes	
		153	5765	20.0		17.5			
		157	5785	20.0		17.5			
		161	5805	20.0		17.5			
		165	5825	20.0		17.5			
		149	5745		20.0		18.0		
		153	5765		20.0		18.0		
		157	5785		20.0		18.0		
		161	5805		20.0		18.0		
		165	5825		20.0		18.0		
	2 Tx CDD	149	5745	20.0	20.0	17.5	18.0	Yes	
		153	5765	20.0	20.0	17.5	18.0		
		157	5785	20.0	20.0	17.5	18.0		
		161	5805	20.0	20.0	17.5	18.0		
		165	5825	20.0	20.0	17.5	18.0		
2 Tx TXBF	149	5745	20.0	20.0	17.5	18.0	No (Test reduction per KDB)		
	153	5765	20.0	20.0	17.5	18.0			
	157	5785	20.0	20.0	17.5	18.0			
	161	5805	20.0	20.0	17.5	18.0			
	165	5825	20.0	20.0	17.5	18.0			
802.11n	1 Tx HT20 SISO	149	5745	20.0		17.5		No (Test reduction per KDB)	
		157	5785	20.0		17.5			
		165	5825	20.0		17.5			
		149	5745		20.0		18.0		
		157	5785		20.0		18.0		
		165	5825		20.0		18.0		
	1 Tx HT40 SISO	151	5755	18.0		17.5		No (Test reduction per KDB)	
		159	5795	20.0		17.5			
		151	5755		18.0		18.0		
		159	5795		20.0		18.0		
	2 Tx HT20 CDD/STBC/SDM	149	5745	20.0	20.0	17.5	18.0	No (Test reduction per KDB)	
		157	5785	20.0	20.0	17.5	18.0		
		165	5825	20.0	20.0	17.5	18.0		
	2 Tx HT20 TXBF	149	5745	20.0	20.0	17.5	18.0	No (Test reduction per KDB)	
		157	5785	20.0	20.0	17.5	18.0		
		165	5825	20.0	20.0	17.5	18.0		
	2 Tx HT40 CDD/STBC/SDM	151	5755	16.5	16.5	16.5	16.5	No (Test reduction per KDB)	
		159	5795	20.0	20.0	17.5	18.0		
2 Tx HT40 TXBF	151	5755	16.5	16.5	16.5	16.5	No (Test reduction per KDB)		
	159	5795	20.0	20.0	17.5	18.0			

Summary of Required Test Modes for 5.8 GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Maximum Target power setting from original approval (*1 See Note) (dBm)		Maximum Target power setting from C2PC/A1465 Host (dBm)		SAR Test (Yes/No)	Note
				WiFi 1	WiFi 2	WiFi 1	WiFi 2		
				Chain 0	Chain 1	Chain 0	Chain 1		
802.11ac	1 Tx VHT20 SISO	149	5745	20.0		17.5		No	4
		157	5785	20.0		17.5			
		165	5825	20.0		17.5			
		149	5745		20.0		18.0		
		157	5785		20.0		18.0		
		165	5825		20.0		18.0		
	1 Tx VHT40 SISO	151	5755	18.0		17.5		No	4
		159	5795	20.0		17.5			
		151	5755		18.0		18.0		
		159	5795		20.0		18.0		
	1 Tx VHT80 SISO	155	5775	18.0		17.5		No	4
		155	5775		18.0		18.0		
	2 Tx VHT20 CDD/STBC/SDM	149	5745	20.0	20.0	17.5	18.0	Yes	4a, 4b
		157	5785	20.0	20.0	17.5	18.0	No	4
		165	5825	20.0	20.0	17.5	18.0	No	4
	2 Tx VHT20 TXBF	149	5745	20.0	20.0	17.5	18.0	No	4
		157	5785	20.0	20.0	17.5	18.0		
		165	5825	20.0	20.0	17.5	18.0		
	2 Tx VHT40 CDD/STBC/SDM	151	5755	16.5	16.5	16.5	16.5	No	4
		159	5795	20.0	20.0	17.5	18.0		
2 Tx VHT40 TXBF	151	5755	16.5	16.5	16.5	16.5	No	4	
	159	5795	20.0	20.0	17.5	18.0			
2 Tx VHT80 CDD/STBC/SDM	155	5775	17.0	17.0	17.0	17.0	No	4	
2 Tx VHT80 TXBF	155	5775	17.0	17.0	17.0	17.0	No	4	

Note(s):

- The "Original Approval" power levels were based upon FCC modular approval testing of the BCM94360CS2 radio. These power levels were approved up to maximum regulatory levels to cover a number of different potential applications. The original maximum regulatory power levels may be reduced further by the driver for one of the following two reasons:
 - For performance (i.e. non-regulatory) reasons to ensure that PER and EVM of the radio meet internal specifications.
 - For application specifics. In this case the power is reduced to meet the specific SAR requirement per transmit chain over frequency band/channel. SAR specifics are addressed in a Class II permissive change as applicable.
- The 11n 2Tx HT20/HT40 and 11ac 2Tx VHT20/VHT40/VHT80 "All" modes detailed apply to all of the CDD/STBC/SDM non-transmit beamforming modes.
- SAR evaluation is required at HT20 STBC/SDM mode because output power is higher vs others data rate modes.
- SAR evaluation for 802.11ac is required based on the highest 802.11a configuration per April 2013 TCB Workshop.
 - Antenna Vendor A
 - Antenna Vendor B

10. 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 [#]	√	∇
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.

11. RF Output Power Measurement (Antenna Vendor A)

Highlighted Channels correspond to Sec. 9 Summary of Required Test Modes.

11.1. 2.4 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)		
				WiFi 1	WiFi 2	WiFi 1	WiFi 2	
				Chain 0	Chain 1	Chain 0	Chain 1	
802.11b Legacy	1 Tx	1	2412	19.0		19.0		
		2	2417	19.0		19.0		
		6	2437	19.0		19.0		
		11	2462	19.0		19.0		
		1	2412		19.5		19.5	
		2	2417		20.0		20.0	
		6	2437		20.0		20.0	
		11	2462		20.0		20.0	
	2 Tx CDD	1	2412	19.0	19.5	19.0	19.5	
		2	2417	19.0	20.0	19.0	20.0	
		6	2437	19.0	20.0	19.0	20.0	
		11	2462	19.0	20.0	19.0	20.0	
		1	2412	17.5		17.5		
		2	2417	19.0		19.0		
802.11g	1 Tx	3	2422	19.0		19.0		
		6	2437	19.0		19.0		
		10	2457	19.0		19.0		
		11	2462	17.5		17.5		
		1	2412		17.5		17.5	
		2	2417		19.5		19.5	
		3	2422		20.0		20.0	
		6	2437		20.0		20.0	
		10	2457		20.0		20.0	
		11	2462		17.5		17.5	
		2 Tx CDD	1	2412	15.5	15.5	15.5	15.5
			2	2417	19.0	19.0	19.0	19.0
			3	2422	19.0	20.0	19.0	20.0
			6	2437	19.0	20.0	19.0	20.0
	9		2452	19.0	20.0	19.0	20.0	
	10		2457	19.0	19.5	19.0	19.5	
	11		2462	16.0	16.0	16.0	16.0	
	2 Tx TXBF	1	2412	16.5	16.5	16.5	16.5	
		2	2417	19.0	19.0	19.0	19.0	
		3	2422	19.0	20.0	19.0	20.0	
		6	2437	19.0	20.0	19.0	20.0	
		9	2452	19.0	20.0	19.0	20.0	
		10	2457	19.0	19.5	19.0	19.5	
	11	2462	16.0	16.0	16.0	16.0		

Power Measurement for 2.4GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11n	1 Tx HT20	1	2412	17.5		17.5	
		2	2422	19.0		19.0	
		3	2422	19.0		19.0	
		6	2437	19.0		19.0	
		10	2457	19.0		19.0	
		11	2462	17.5		17.5	
		1	2412		17.5		17.5
		2	2422		19.5		19.5
		3	2422		20.0		20.0
		6	2437		20.0		20.0
		10	2457		20.0		20.0
		11	2462		17.5		17.5
	1 Tx HT40	40MHz Transmission disabled in the 2.4GHz Band					
	2 Tx HT20 All nonTXBF	1	2412	15.5	15.5	15.5	15.5
		2	2422	19.0	19.0	19.0	19.0
		3	2422	19.0	20.0	19.0	20.0
		6	2437	19.0	20.0	19.0	20.0
		9	2452	19.0	20.0	19.0	20.0
		10	2457	19.0	19.5	19.0	19.5
	2 Tx HT20 TXBF	1	2412	16.5	16.5	16.5	16.5
		2	2422	19.0	19.0	19.0	19.0
		3	2422	19.0	20.0	19.0	20.0
		6	2437	19.0	20.0	19.0	20.0
		9	2452	19.0	20.0	19.0	20.0
		10	2457	19.0	19.5	19.0	19.5
	2 Tx HT40 All/TXBF	40MHz Transmission disabled in the 2.4GHz Band					

Power Measurement for 2.4GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)		
				WiFi 1	WiFi 2	WiFi 1	WiFi 2	
				Chain 0	Chain 1	Chain 0	Chain 1	
802.11ac	1 Tx VHT20	1	2412	17.5		17.5		
		2	2422	19.0		19.0		
		3	2422	19.0		19.0		
		6	2437	19.0		19.0		
		10	2457	19.0		19.0		
		11	2462	17.5		17.5		
		1	2412		17.5		17.5	
		2	2422		19.5		19.5	
		3	2422		20.0		20.0	
		6	2437		20.0		20.0	
		10	2457		20.0		20.0	
		11	2462		17.5		17.5	
	1 Tx VHT40	40MHz Transmission disabled in the 2.4GHz Band						
	1 Tx VHT80	80MHz Transmission disabled in the 2.4GHz Band						
	2 Tx VHT20 All	1	2412	15.5	15.5	15.5	15.5	
		2	2422	19.0	19.0	19.0	19.0	
		3	2422	19.0	20.0	19.0	20.0	
		6	2437	19.0	20.0	19.0	20.0	
		9	2452	19.0	20.0	19.0	20.0	
		10	2457	19.0	19.5	19.0	19.5	
		11	2462	16.0	16.0	16.0	16.0	
	2 Tx VHT20 TXBF	1	2412	16.5	16.5	16.5	16.5	
		2	2422	19.0	19.0	19.0	19.0	
		3	2422	19.0	20.0	19.0	20.0	
		6	2437	19.0	20.0	19.0	20.0	
		9	2452	19.0	20.0	19.0	20.0	
		10	2457	19.0	19.5	19.0	19.5	
		11	2462	16.0	16.0	16.0	16.0	
	2 Tx VHT40 All/TXBF	40MHz Transmission disabled in the 2.4GHz Band						
	2 Tx VHT80 All/TXBF	80MHz Transmission disabled in the 2.4GHz Band						

11.2. 5.2 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11a	1 Tx	36	5180	16.0		16.0	
		40	5200	16.0		16.0	
		44	5220	16.0		16.0	
		48	5240	16.0		16.0	
		36	5180		15.5		15.5
		40	5200		15.5		15.5
		44	5220		15.5		15.5
		48	5240		15.5		15.5
	2 Tx CDD	36	5180	11.5	11.5	11.5	11.5
		40	5200	11.5	11.5	11.5	11.5
		44	5220	11.5	11.5	11.5	11.5
		48	5240	11.5	11.5	11.5	11.5
2 Tx TXBF	36	5180	11.5	11.5	11.5	11.5	
	40	5200	11.5	11.5	11.5	11.5	
	44	5220	11.5	11.5	11.5	11.5	
	48	5240	11.5	11.5	11.5	11.5	
802.11n	1 Tx HT20 SISO	36	5180	16.0		16.0	
		44	5220	16.0		16.0	
		48	5240	16.0		16.0	
		36	5180		15.5		15.5
		44	5220		15.5		15.5
		48	5240		15.5		15.5
	1 Tx HT40 SISO	38	5190	16.0		16.0	
		46	5230	16.0		16.0	
		38	5190		15.5		15.5
		46	5230		15.5		15.5
	2 Tx HT20 CDD	36	5180	11.5	11.5	11.5	11.5
		40	5200	11.5	11.5	11.5	11.5
		48	5240	11.5	11.5	11.5	11.5
	2 Tx HT20 STBC/SDM	36	5180	13.5	13.5	13.5	13.5
		40	5200	13.5	13.5	13.5	13.5
		48	5240	13.5	13.5	13.5	13.5
	2 Tx HT20 TXBF	36	5180	11.5	11.5	11.5	11.5
		40	5200	11.5	11.5	11.5	11.5
		48	5240	11.5	11.5	11.5	11.5
	2 Tx HT40 CDD	38	5190	13.5	13.5	13.5	13.5
		46	5230	13.5	13.5	13.5	13.5
	2 Tx HT40 STBC/SDM	38	5190	13.5	13.5	13.5	13.5
		46	5230	13.5	13.5	13.5	13.5
	2 Tx HT40 TXBF	38	5190	11.0	11.0	11.0	11.0
46		5230	11.0	11.0	11.0	11.0	

Power Measurement for 5.2GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11ac	1 Tx VHT20 SISO	36	5180	16.0		16.0	
		44	5220	16.0		16.0	
		48	5240	16.0		16.0	
		36	5180		15.5		15.5
		44	5220		15.5		15.5
		48	5240		15.5		15.5
	1 Tx VHT40 SISO	38	5190	16.0		16.0	
		46	5230	16.0		16.0	
		38	5190		15.5		15.5
		46	5230		15.5		15.5
	1 Tx VHT80 SISO	42	5210	15.5		15.5	
		42	5210		15.5		15.5
	2 Tx VHT20 CDD	36	5180	11.5	11.5	11.5	11.5
		40	5200	11.5	11.5	11.5	11.5
		48	5240	11.5	11.5	11.5	11.5
	2 Tx VHT20 STBC/SDM	36	5180	13.5	13.5	13.5	13.5
		40	5200	13.5	13.5	13.5	13.5
		48	5240	13.5	13.5	13.5	13.5
	2 Tx VHT20 TXBF	36	5180	11.5	11.5	11.5	11.5
		40	5200	11.5	11.5	11.5	11.5
		48	5240	11.5	11.5	11.5	11.5
	2 Tx VHT40 CDD	38	5190	13.5	13.5	13.5	13.5
		46	5230	13.5	13.5	13.5	13.5
	2 Tx VHT40 STBC/SDM	38	5190	13.5	13.5	13.5	13.5
		46	5230	13.5	13.5	13.5	13.5
	2 Tx VHT40 TXBF	38	5190	11.0	11.0	11.0	11.0
46		5230	11.0	11.0	11.0	11.0	
2 Tx VHT80 CDD	42	5210	13.5	13.5	13.5	13.5	
2 Tx VHT80 STBC/SDM	42	5210	13.5	13.5	13.5	13.5	
2 Tx VHT80 TXBF	42	5210	11.5	11.5	11.5	11.5	

11.3. 5.3 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11a	1 Tx	52	5260	17.5		17.5	
		56	5280	17.5		17.5	
		60	5300	17.5		17.5	
		64	5320	17.5		17.5	
	2 Tx CDD	52	5260	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5
		60	5300	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx TXBF	52	5260	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5
		60	5300	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
802.11n	1 Tx HT20 SISO	52	5260	17.5		17.5	
		60	5300	17.5		17.5	
		64	5320	17.5		17.5	
		52	5260		17.5		17.5
	1 Tx HT40 SISO	54	5270	17.5		17.5	
		62	5310	17.5		17.5	
		54	5270		17.5		17.5
		62	5310		17.5		17.5
	2 Tx HT20 CDD	52	5260	17.5	17.5	17.5	17.5
		60	5300	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx HT20 STBC/SDM	52	5260	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx HT20 TXBF	52	5260	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx HT40 CDD	54	5270	17.5	17.5	17.5	17.5
		62	5310	14.5	14.5	14.5	14.5
	2 Tx HT40 STBC/SDM	54	5270	17.5	17.5	17.5	17.5
		62	5310	14.5	14.5	14.5	14.5
	2 Tx HT40 TXBF	54	5270	17.5	17.5	17.5	17.5
		62	5310	15.0	15.0	15.0	15.0

Power Measurement for 5.3GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11ac	1 Tx VHT20 SISO	52	5260	17.5		17.5	
		60	5300	17.5		17.5	
		64	5320	17.5		17.5	
		52	5260		17.5		17.5
		60	5300		17.5		17.5
		64	5320		17.5		17.5
	1 Tx VHT40 SISO	54	5270	17.5		17.5	
		62	5310	17.5		17.5	
		54	5270		17.5		17.5
		62	5310		17.5		17.5
	1 Tx VHT80 SISO	58	5290	17.5		17.5	
		58	5290		17.5		17.5
	2 Tx VHT20 CDD	52	5260	17.5	17.5	17.5	17.5
		60	5300	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx VHT20 STBC/SDM	52	5260	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx VHT20 TXBF	52	5260	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx VHT40 CDD	54	5270	17.5	17.5	17.5	17.5
		62	5310	14.5	14.5	14.5	14.5
	2 Tx VHT40 STBC/SDM	54	5270	17.5	17.5	17.5	17.5
		62	5310	14.5	14.5	14.5	14.5
	2 Tx VHT40 TXBF	54	5270	17.5	17.5	17.5	17.5
		62	5310	15.0	15.0	15.0	15.0
	2 Tx VHT80 CDD	58	5290	14.5	14.5	14.5	14.5
2 Tx VHT80 STBC/SDM	58	5290	14.5	14.5	14.5	14.5	
2 Tx VHT80 TXBF	58	5290	14.0	14.0	14.0	14.0	

11.4. 5.5 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)		
				WiFi 1	WiFi 2	WiFi 1	WiFi 2	
				Chain 0	Chain 1	Chain 0	Chain 1	
802.11a	1 Tx	100	5500	17.0		17.0		
		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	17.0		17.0		
		144	5720	17.0		17.0		
			100	5500		18.0		18.0
			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		18.0		18.0
			144	5720		18.0		18.0
		2 Tx CDD	100	5500	17.0	18.0	17.0	18.0
			104	5520	17.0	17.5	17.0	17.5
			108	5540	17.0	17.5	17.0	17.5
			112	5560	17.0	17.5	17.0	17.5
			116	5580	17.0	17.5	17.0	17.5
			120	5600	17.0	17.5	17.0	17.5
			124	5620	17.0	17.5	17.0	17.5
			128	5640	17.0	17.5	17.0	17.5
			132	5660	17.0	17.5	17.0	17.5
			136	5680	17.0	17.5	17.0	17.5
			140	5700	15.0	15.0	15.0	15.0
			144	5720	17.0	18.0	17.0	18.0
	2 Tx TXBF	100	5500	17.0	18.0	17.0	18.0	
		104	5520	17.0	17.5	17.0	17.5	
		108	5540	17.0	17.5	17.0	17.5	
		112	5560	17.0	17.5	17.0	17.5	
		116	5580	17.0	17.5	17.0	17.5	
		120	5600	17.0	17.5	17.0	17.5	
		124	5620	17.0	17.5	17.0	17.5	
		128	5640	17.0	17.5	17.0	17.5	
		132	5660	17.0	17.5	17.0	17.5	
		136	5680	17.0	17.5	17.0	17.5	
		140	5700	15.5	15.5	15.5	15.5	
		144	5720	17.0	18.0	17.0	18.0	

Power Measurement for 5.5GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)		
				WiFi 1	WiFi 2	WiFi 1	WiFi 2	
				Chain 0	Chain 1	Chain 0	Chain 1	
802.11n	1 Tx HT20 SISO	100	5500	17.0		17.0		
		104	5520	17.0		17.0		
		120	5600	17.0		17.0		
		136	5680	17.0		17.0		
		140	5700	17.0		17.0		
		144	5720	17.0		17.0		
		100	5500		18.0		18.0	
		104	5520		18.0		18.0	
		120	5600		18.0		18.0	
		136	5680		18.0		18.0	
		140	5700		18.0		18.0	
		144	5720		18.0		18.0	
		1 Tx HT40 SISO	102	5510	17.0		17.0	
			110	5550	17.0		17.0	
	134		5670	17.0		17.0		
	142		5710	17.0		17.0		
	102		5510		17.5		17.5	
	110		5550		18.0		18.0	
	134		5670		18.0		18.0	
	2 Tx HT20 CDD	100	5500	17.0	18.0	17.0	18.0	
		104	5520	17.0	17.5	17.0	17.5	
		120	5600	17.0	17.5	17.0	17.5	
		136	5680	17.0	17.5	17.0	17.5	
		140	5700	15.0	15.0	15.0	15.0	
		144	5710	17.0	18.0	17.0	18.0	
	2 Tx HT20 STBC/SDM	100	5500	17.0	18.0	17.0	18.0	
		104	5520	17.0	18.0	17.0	18.0	
		120	5600	17.0	18.0	17.0	18.0	
		136	5680	17.0	18.0	17.0	18.0	
		140	5700	15.0	15.0	15.0	15.0	
		144	5710	17.0	18.0	17.0	18.0	
	2 Tx HT20 TXBF	100	5500	17.0	17.5	17.0	17.5	
		104	5520	17.0	17.5	17.0	17.5	
		120	5600	17.0	17.5	17.0	17.5	
		136	5680	17.0	17.5	17.0	17.5	
		140	5700	15.5	15.5	15.5	15.5	
		144	5710	17.0	18.0	17.0	18.0	
	2 Tx HT40 CDD	102	5510	14.5	14.5	14.5	14.5	
		110	5550	17.0	18.0	17.0	18.0	
		134	5670	17.0	18.0	17.0	18.0	
142		5710	17.0	18.0	17.0	18.0		
2 Tx HT40 STBC/SDM	102	5510	14.5	14.5	14.5	14.5		
	110	5550	17.0	18.0	17.0	18.0		
	134	5670	17.0	18.0	17.0	18.0		
	142	5710	17.0	18.0	17.0	18.0		
2 Tx HT40 TXBF	102	5510	13.5	13.5	13.5	13.5		
	110	5550	17.0	17.5	17.0	17.5		
	134	5670	17.0	17.5	17.0	17.5		
	142	5710	17.0	18.0	17.0	18.0		

Power Measurement for 5.5GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)		
				WiFi 1	WiFi 2	WiFi 1	WiFi 2	
				Chain 0	Chain 1	Chain 0	Chain 1	
802.11ac	1 Tx VHT20 SISO	100	5500	17.0		17.0		
		104	5520	17.0		17.0		
		120	5600	17.0		17.0		
		136	5680	17.0		17.0		
		140	5700	17.0		17.0		
		144	5720	17.0		17.0		
		100	5500		18.0		18.0	
		104	5520		18.0		18.0	
		120	5600		18.0		18.0	
		136	5680		18.0		18.0	
		140	5700		18.0		18.0	
		144	5720		18.0		18.0	
		1 Tx VHT40 SISO	102	5510	17.0		17.0	
			110	5550	17.0		17.0	
	134		5670	17.0		17.0		
	142		5710	17.0		17.0		
	102		5510		17.5		17.5	
	110		5550		18.0		18.0	
	134		5670		18.0		18.0	
	1 Tx VHT80 SISO	106	5530	16.5		16.5		
		122	5610	17.0		17.0		
		138	5690	17.0		17.0		
		106	5530		16.5		16.5	
		122	5610		18.0		18.0	
		138	5690		18.0		18.0	
	2 Tx VHT20 CDD	100	5500	17.0	18.0	17.0	18.0	
		104	5520	17.0	17.5	17.0	17.5	
		120	5600	17.0	17.5	17.0	17.5	
		124	5620	17.0	17.5	17.0	17.5	
		136	5680	17.0	17.5	17.0	17.5	
		140	5700	15.0	15.0	15.0	15.0	
		144	5720	17.0	18.0	17.0	18.0	
		100	5500	17.0	18.0	17.0	18.0	
	2 Tx VHT20 STBC/SDM	104	5520	17.0	18.0	17.0	18.0	
		120	5600	17.0	18.0	17.0	18.0	
		124	5620	17.0	18.0	17.0	18.0	
		136	5680	17.0	18.0	17.0	18.0	
		140	5700	15.0	15.0	15.0	15.0	
		144	5720	17.0	18.0	17.0	18.0	
		100	5500	17.0	18.0	17.0	18.0	
	2 Tx VHT20 TXBF	104	5520	17.0	17.5	17.0	17.5	
		120	5600	17.0	17.5	17.0	17.5	
124		5620	17.0	17.5	17.0	17.5		
136		5680	17.0	17.5	17.0	17.5		
140		5700	15.5	15.5	15.5	15.5		
144		5720	17.0	18.0	17.0	18.0		
102		5510	14.5	14.5	14.5	14.5		
2 Tx VHT40 CDD	110	5550	17.0	18.0	17.0	18.0		
	134	5670	17.0	18.0	17.0	18.0		
	142	5710	17.0	18.0	17.0	18.0		
	142	5710	17.0	18.0	17.0	18.0		

Power Measurement for 5.5GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11ac	2 Tx VHT40 STBC/SDM	102	5510	14.5	14.5	14.5	14.5
		110	5550	17.0	18.0	17.0	18.0
		134	5670	17.0	18.0	17.0	18.0
		142	5710	17.0	18.0	17.0	18.0
	2 Tx VHT40 TXBF	102	5510	13.5	13.5	13.5	13.5
		110	5550	17.0	17.5	17.0	17.5
		134	5670	17.0	17.5	17.0	17.5
		142	5710	17.0	18.0	17.0	18.0
	2 Tx VHT80 CDD	106	5530	14.0	14.0	14.0	14.0
		122	5610	17.0	18.0	17.0	18.0
		138	5690	17.0	18.0	17.0	18.0
	2 Tx VHT80 STBC/SDM	106	5530	14.0	14.0	14.0	14.0
		122	5610	17.0	18.0	17.0	18.0
		138	5690	17.0	18.0	17.0	18.0
	2 Tx VHT80 TXBF	106	5530	12.5	12.5	12.5	12.5
		122	5610	17.0	18.0	17.0	18.0
		138	5690	17.0	18.0	17.0	18.0

11.5. 5.8 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Pwr (See note1, 2 and 3) (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11a	1 Tx	149	5745	17.5		17.5	
		153	5765	17.5		17.5	
		157	5785	17.5		17.5	
		161	5805	17.5		17.5	
		165	5825	17.5		17.5	
	2 Tx CDD	149	5745		18.0		18.0
		153	5765		18.0		18.0
		157	5785		18.0		18.0
		161	5805		18.0		18.0
		165	5825		18.0		18.0
	2 Tx TXBF	149	5745	17.5	18.0	17.5	18.0
		153	5765	17.5	18.0	17.5	18.0
		157	5785	17.5	18.0	17.5	18.0
		161	5805	17.5	18.0	17.5	18.0
		165	5825	17.5	18.0	17.5	18.0
802.11n	1 Tx HT20 SISO	149	5745	17.5		17.5	
		157	5785	17.5		17.5	
		165	5825	17.5		17.5	
	1 Tx HT40 SISO	149	5745		18.0		18.0
		157	5785		18.0		18.0
		165	5825		18.0		18.0
		151	5755	17.5		17.5	
	2 Tx HT20 CDD/STBC/SDM	159	5795	17.5		17.5	
		151	5755		18.0		18.0
		159	5795		18.0		18.0
		149	5745	17.5	18.0	17.5	18.0
	2 Tx HT20 TXBF	157	5785	17.5	18.0	17.5	18.0
		165	5825	17.5	18.0	17.5	18.0
		149	5745	17.5	18.0	17.5	18.0
	2 Tx HT40 CDD/STBC/SDM	157	5785	17.5	18.0	17.5	18.0
		151	5755	16.5	16.5	16.5	16.5
	2 Tx HT40 TXBF	159	5795	17.5	18.0	17.5	18.0
		151	5755	16.5	16.5	16.5	16.5
		159	5795	17.5	18.0	17.5	18.0

Power Measurement for 5.8GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Pwr (See note1, 2 and 3) (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11ac	1 Tx VHT20 SISO	149	5745	17.5		17.5	
		157	5785	17.5		17.5	
		165	5825	17.5		17.5	
		149	5745		18.0		18.0
		157	5785		18.0		18.0
		165	5825		18.0		18.0
	1 Tx VHT40 SISO	151	5755	17.5		17.5	
		159	5795	17.5		17.5	
		151	5755		18.0		18.0
		159	5795		18.0		18.0
	1 Tx VHT80 SISO	155	5775	17.5		17.5	
		155	5775		18.0		18.0
	2 Tx VHT20 CDD/STBC/SDM	149	5745	17.5	18.0	17.5	18.0
		157	5785	17.5	18.0	17.5	18.0
		165	5825	17.5	18.0	17.5	18.0
	2 Tx VHT20 TXBF	149	5745	17.5	18.0	17.5	18.0
		157	5785	17.5	18.0	17.5	18.0
		165	5825	17.5	18.0	17.5	18.0
	2 Tx VHT40 CDD/STBC/SDM	151	5755	16.5	16.5	16.5	16.5
		159	5795	17.5	18.0	17.5	18.0
	2 Tx VHT40 TXBF	151	5755	16.5	16.5	16.5	16.5
159		5795	17.5	18.0	17.5	18.0	
2 Tx VHT80 CDD/STBC/SDM	155	5775	17.0	17.0	17.0	17.0	
2 Tx VHT80 TXBF	155	5775	17.0	17.0	17.0	17.0	

11.6. Bluetooth

Maximum tune-up tolerance limit is 4 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing. Refer to Standalone SAR Test Exclusion Considerations

12. RF Output Power Measurement (Antenna Vendor B)

Highlighted Channels correspond to Sec. 9 Summary of Required Test Modes.

12.1. 2.4 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)		
				WiFi 1	WiFi 2	WiFi 1	WiFi 2	
				Chain 0	Chain 1	Chain 0	Chain 1	
802.11b Legacy	1 Tx	1	2412	19.0		19.0		
		2	2417	19.0		19.0		
		6	2437	19.0		19.0		
		11	2462	19.0		19.0		
		1	2412		19.5		19.5	
		2	2417		20.0		20.0	
		6	2437		20.0		20.0	
	11	2462		20.0		20.0		
	2 Tx CDD	1	2412	19.0	19.5	19.0	19.5	
		2	2417	19.0	20.0	19.0	20.0	
		6	2437	19.0	20.0	19.0	20.0	
		11	2462	19.0	20.0	19.0	20.0	
		1	2412	17.5		17.5		
		2	2417	19.0		19.0		
6		2437	19.0		19.0			
802.11g	1 Tx	10	2457	19.0		19.0		
		11	2462	17.5		17.5		
		1	2412		17.5		17.5	
		2	2417		19.5		19.5	
		3	2422		20.0		20.0	
		6	2437		20.0		20.0	
		10	2457		20.0		20.0	
		11	2462		17.5		17.5	
		2 Tx CDD	1	2412	15.5	15.5	15.5	15.5
			2	2417	19.0	19.0	19.0	19.0
			3	2422	19.0	20.0	19.0	20.0
			6	2437	19.0	20.0	19.0	20.0
			9	2452	19.0	20.0	19.0	20.0
			10	2457	19.0	19.5	19.0	19.5
	11		2462	16.0	16.0	16.0	16.0	
	2 Tx TXBF	1	2412	16.5	16.5	16.5	16.5	
		2	2417	19.0	19.0	19.0	19.0	
		3	2422	19.0	20.0	19.0	20.0	
		6	2437	19.0	20.0	19.0	20.0	
		9	2452	19.0	20.0	19.0	20.0	
		10	2457	19.0	19.5	19.0	19.5	
		11	2462	16.0	16.0	16.0	16.0	

Power Measurement for 2.4GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)		
				WiFi 1	WiFi 2	WiFi 1	WiFi 2	
				Chain 0	Chain 1	Chain 0	Chain 1	
802.11n	1 Tx HT20	1	2412	17.5		17.5		
		2	2422	19.0		19.0		
		3	2422	19.0		19.0		
		6	2437	19.0		19.0		
		10	2457	19.0		19.0		
		11	2462	17.5		17.5		
		1	2412		17.5		17.5	
		2	2422		19.5		19.5	
		3	2422		20.0		20.0	
		6	2437		20.0		20.0	
		10	2457		20.0		20.0	
		11	2462		17.5		17.5	
	1 Tx HT40	40MHz Transmission disabled in the 2.4GHz Band						
	2 Tx HT20 All nonTXBF	1	2412	15.5	15.5	15.5	15.5	
		2	2422	19.0	19.0	19.0	19.0	
		3	2422	19.0	20.0	19.0	20.0	
		6	2437	19.0	20.0	19.0	20.0	
		9	2452	19.0	20.0	19.0	20.0	
		10	2457	19.0	19.5	19.0	19.5	
	2 Tx HT20 TXBF	1	2412	16.5	16.5	16.5	16.5	
		2	2422	19.0	19.0	19.0	19.0	
		3	2422	19.0	20.0	19.0	20.0	
		6	2437	19.0	20.0	19.0	20.0	
		9	2452	19.0	20.0	19.0	20.0	
		10	2457	19.0	19.5	19.0	19.5	
	2 Tx HT40 All/TXBF	40MHz Transmission disabled in the 2.4GHz Band						

Power Measurement for 2.4GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)		
				WiFi 1	WiFi 2	WiFi 1	WiFi 2	
				Chain 0	Chain 1	Chain 0	Chain 1	
802.11ac	1 Tx VHT20	1	2412	17.5		17.5		
		2	2422	19.0		19.0		
		3	2422	19.0		19.0		
		6	2437	19.0		19.0		
		10	2457	19.0		19.0		
		11	2462	17.5		17.5		
		1	2412		17.5		17.5	
		2	2422		19.5		19.5	
		3	2422		20.0		20.0	
		6	2437		20.0		20.0	
		10	2457		20.0		20.0	
		11	2462		17.5		17.5	
	1 Tx VHT40	40MHz Transmission disabled in the 2.4GHz Band						
	1 Tx VHT80	80MHz Transmission disabled in the 2.4GHz Band						
	2 Tx VHT20 All	1	2412	15.5	15.5	15.5	15.5	
		2	2422	19.0	19.0	19.0	19.0	
		3	2422	19.0	20.0	19.0	20.0	
		6	2437	19.0	20.0	19.0	20.0	
		9	2452	19.0	20.0	19.0	20.0	
		10	2457	19.0	19.5	19.0	19.5	
		11	2462	16.0	16.0	16.0	16.0	
	2 Tx VHT20 TXBF	1	2412	16.5	16.5	16.5	16.5	
		2	2422	19.0	19.0	19.0	19.0	
		3	2422	19.0	20.0	19.0	20.0	
		6	2437	19.0	20.0	19.0	20.0	
		9	2452	19.0	20.0	19.0	20.0	
		10	2457	19.0	19.5	19.0	19.5	
		11	2462	16.0	16.0	16.0	16.0	
	2 Tx VHT40 All/TXBF	40MHz Transmission disabled in the 2.4GHz Band						
	2 Tx VHT80 All/TXBF	80MHz Transmission disabled in the 2.4GHz Band						

12.2. 5.2 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11a	1 Tx	36	5180	16.0		16.0	
		40	5200	16.0		16.0	
		44	5220	16.0		16.0	
		48	5240	16.0		16.0	
		36	5180		15.5		15.5
		40	5200		15.5		15.5
		44	5220		15.5		15.5
		48	5240		15.5		15.5
	2 Tx CDD	36	5180	11.5	11.5	11.5	11.5
		40	5200	11.5	11.5	11.5	11.5
		44	5220	11.5	11.5	11.5	11.5
		48	5240	11.5	11.5	11.5	11.5
2 Tx TXBF	36	5180	11.5	11.5	11.5	11.5	
	40	5200	11.5	11.5	11.5	11.5	
	44	5220	11.5	11.5	11.5	11.5	
	48	5240	11.5	11.5	11.5	11.5	
802.11n	1 Tx HT20 SISO	36	5180	16.0		16.0	
		44	5220	16.0		16.0	
		48	5240	16.0		16.0	
		36	5180		15.5		15.5
		44	5220		15.5		15.5
		48	5240		15.5		15.5
	1 Tx HT40 SISO	38	5190	16.0		16.0	
		46	5230	16.0		16.0	
		38	5190		15.5		15.5
		46	5230		15.5		15.5
	2 Tx HT20 CDD	36	5180	11.5	11.5	11.5	11.5
		40	5200	11.5	11.5	11.5	11.5
		48	5240	11.5	11.5	11.5	11.5
	2 Tx HT20 STBC/SDM	36	5180	13.5	13.5	13.5	13.5
		40	5200	13.5	13.5	13.5	13.5
		48	5240	13.5	13.5	13.5	13.5
	2 Tx HT20 TXBF	36	5180	11.5	11.5	11.5	11.5
		40	5200	11.5	11.5	11.5	11.5
		48	5240	11.5	11.5	11.5	11.5
	2 Tx HT40 CDD	38	5190	13.5	13.5	13.5	13.5
		46	5230	13.5	13.5	13.5	13.5
	2 Tx HT40 STBC/SDM	38	5190	13.5	13.5	13.5	13.5
		46	5230	13.5	13.5	13.5	13.5
	2 Tx HT40 TXBF	38	5190	11.0	11.0	11.0	11.0
46		5230	11.0	11.0	11.0	11.0	

Power Measurement for 5.2GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11ac	1 Tx VHT20 SISO	36	5180	16.0		16.0	
		44	5220	16.0		16.0	
		48	5240	16.0		16.0	
		36	5180		15.5		15.5
		44	5220		15.5		15.5
		48	5240		15.5		15.5
	1 Tx VHT40 SISO	38	5190	16.0		16.0	
		46	5230	16.0		16.0	
		38	5190		15.5		15.5
		46	5230		15.5		15.5
	1 Tx VHT80 SISO	42	5210	15.5		15.5	
		42	5210		15.5		15.5
	2 Tx VHT20 CDD	36	5180	11.5	11.5	11.5	11.5
		40	5200	11.5	11.5	11.5	11.5
		48	5240	11.5	11.5	11.5	11.5
	2 Tx VHT20 STBC/SDM	36	5180	13.5	13.5	13.5	13.5
		40	5200	13.5	13.5	13.5	13.5
		48	5240	13.5	13.5	13.5	13.5
	2 Tx VHT20 TXBF	36	5180	11.5	11.5	11.5	11.5
		40	5200	11.5	11.5	11.5	11.5
		48	5240	11.5	11.5	11.5	11.5
	2 Tx VHT40 CDD	38	5190	13.5	13.5	13.5	13.5
		46	5230	13.5	13.5	13.5	13.5
	2 Tx VHT40 STBC/SDM	38	5190	13.5	13.5	13.5	13.5
		46	5230	13.5	13.5	13.5	13.5
	2 Tx VHT40 TXBF	38	5190	11.0	11.0	11.0	11.0
46		5230	11.0	11.0	11.0	11.0	
2 Tx VHT80 CDD	42	5210	13.5	13.5	13.5	13.5	
2 Tx VHT80 STBC/SDM	42	5210	13.5	13.5	13.5	13.5	
2 Tx VHT80 TXBF	42	5210	11.5	11.5	11.5	11.5	

12.3. 5.3 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11a	1 Tx	52	5260	17.5		17.5	
		56	5280	17.5		17.5	
		60	5300	17.5		17.5	
		64	5320	17.5		17.5	
	2 Tx CDD	52	5260	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5
		60	5300	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx TXBF	52	5260	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5
		60	5300	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
802.11n	1 Tx HT20 SISO	52	5260	17.5		17.5	
		60	5300	17.5		17.5	
		64	5320	17.5		17.5	
		52	5260		17.5		17.5
	1 Tx HT40 SISO	54	5270	17.5		17.5	
		62	5310	17.5		17.5	
		54	5270		17.5		17.5
		62	5310		17.5		17.5
	2 Tx HT20 CDD	52	5260	17.5	17.5	17.5	17.5
		60	5300	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx HT20 STBC/SDM	52	5260	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx HT20 TXBF	52	5260	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx HT40 CDD	54	5270	17.5	17.5	17.5	17.5
		62	5310	14.5	14.5	14.5	14.5
	2 Tx HT40 STBC/SDM	54	5270	17.5	17.5	17.5	17.5
		62	5310	14.5	14.5	14.5	14.5
	2 Tx HT40 TXBF	54	5270	17.5	17.5	17.5	17.5
		62	5310	15.0	15.0	15.0	15.0

Power Measurement for 5.3GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11ac	1 Tx VHT20 SISO	52	5260	17.5		17.5	
		60	5300	17.5		17.5	
		64	5320	17.5		17.5	
		52	5260		17.5		17.5
		60	5300		17.5		17.5
		64	5320		17.5		17.5
	1 Tx VHT40 SISO	54	5270	17.5		17.5	
		62	5310	17.5		17.5	
		54	5270		17.5		17.5
		62	5310		17.5		17.5
	1 Tx VHT80 SISO	58	5290	17.5		17.5	
		58	5290		17.5		17.5
	2 Tx VHT20 CDD	52	5260	17.5	17.5	17.5	17.5
		60	5300	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx VHT20 STBC/SDM	52	5260	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx VHT20 TXBF	52	5260	17.5	17.5	17.5	17.5
		56	5280	17.5	17.5	17.5	17.5
		64	5320	17.5	17.5	17.5	17.5
	2 Tx VHT40 CDD	54	5270	17.5	17.5	17.5	17.5
		62	5310	14.5	14.5	14.5	14.5
	2 Tx VHT40 STBC/SDM	54	5270	17.5	17.5	17.5	17.5
		62	5310	14.5	14.5	14.5	14.5
	2 Tx VHT40 TXBF	54	5270	17.5	17.5	17.5	17.5
		62	5310	15.0	15.0	15.0	15.0
	2 Tx VHT80 CDD	58	5290	14.5	14.5	14.5	14.5
2 Tx VHT80 STBC/SDM	58	5290	14.5	14.5	14.5	14.5	
2 Tx VHT80 TXBF	58	5290	14.0	14.0	14.0	14.0	

12.4. 5.5 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)		
				WiFi 1	WiFi 2	WiFi 1	WiFi 2	
				Chain 0	Chain 1	Chain 0	Chain 1	
802.11a	1 Tx	100	5500	17.0		17.0		
		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	17.0		17.0		
		144	5720	17.0		17.0		
			100	5500		18.0		18.0
			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		18.0		18.0
			144	5720		18.0		18.0
		2 Tx CDD	100	5500	17.0	18.0	17.0	18.0
			104	5520	17.0	17.5	17.0	17.5
			108	5540	17.0	17.5	17.0	17.5
			112	5560	17.0	17.5	17.0	17.5
			116	5580	17.0	17.5	17.0	17.5
			120	5600	17.0	17.5	17.0	17.5
			124	5620	17.0	17.5	17.0	17.5
			128	5640	17.0	17.5	17.0	17.5
			132	5660	17.0	17.5	17.0	17.5
			136	5680	17.0	17.5	17.0	17.5
			140	5700	15.0	15.0	15.0	15.0
			144	5720	17.0	18.0	17.0	18.0
	2 Tx TXBF	100	5500	17.0	18.0	17.0	18.0	
		104	5520	17.0	17.5	17.0	17.5	
		108	5540	17.0	17.5	17.0	17.5	
		112	5560	17.0	17.5	17.0	17.5	
		116	5580	17.0	17.5	17.0	17.5	
		120	5600	17.0	17.5	17.0	17.5	
		124	5620	17.0	17.5	17.0	17.5	
		128	5640	17.0	17.5	17.0	17.5	
		132	5660	17.0	17.5	17.0	17.5	
		136	5680	17.0	17.5	17.0	17.5	
		140	5700	15.5	15.5	15.5	15.5	
		144	5720	17.0	18.0	17.0	18.0	

Power Measurement for 5.5GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)		
				WiFi 1	WiFi 2	WiFi 1	WiFi 2	
				Chain 0	Chain 1	Chain 0	Chain 1	
802.11n	1 Tx HT20 SISO	100	5500	17.0		17.0		
		104	5520	17.0		17.0		
		120	5600	17.0		17.0		
		136	5680	17.0		17.0		
		140	5700	17.0		17.0		
		144	5720	17.0		17.0		
		100	5500		18.0		18.0	
		104	5520		18.0		18.0	
		120	5600		18.0		18.0	
		136	5680		18.0		18.0	
		140	5700		18.0		18.0	
		144	5720		18.0		18.0	
		1 Tx HT40 SISO	102	5510	17.0		17.0	
			110	5550	17.0		17.0	
	134		5670	17.0		17.0		
	142		5710	17.0		17.0		
	102		5510		17.5		17.5	
	110		5550		18.0		18.0	
	134		5670		18.0		18.0	
	2 Tx HT20 CDD	100	5500	17.0	18.0	17.0	18.0	
		104	5520	17.0	17.5	17.0	17.5	
		120	5600	17.0	17.5	17.0	17.5	
		136	5680	17.0	17.5	17.0	17.5	
		140	5700	15.0	15.0	15.0	15.0	
		144	5710	17.0	18.0	17.0	18.0	
	2 Tx HT20 STBC/SDM	100	5500	17.0	18.0	17.0	18.0	
		104	5520	17.0	18.0	17.0	18.0	
		120	5600	17.0	18.0	17.0	18.0	
		136	5680	17.0	18.0	17.0	18.0	
		140	5700	15.0	15.0	15.0	15.0	
		144	5710	17.0	18.0	17.0	18.0	
	2 Tx HT20 TXBF	100	5500	17.0	17.5	17.0	17.5	
		104	5520	17.0	17.5	17.0	17.5	
		120	5600	17.0	17.5	17.0	17.5	
		136	5680	17.0	17.5	17.0	17.5	
		140	5700	15.5	15.5	15.5	15.5	
		144	5710	17.0	18.0	17.0	18.0	
	2 Tx HT40 CDD	102	5510	14.5	14.5	14.5	14.5	
		110	5550	17.0	18.0	17.0	18.0	
		134	5670	17.0	18.0	17.0	18.0	
142		5710	17.0	18.0	17.0	18.0		
2 Tx HT40 STBC/SDM	102	5510	14.5	14.5	14.5	14.5		
	110	5550	17.0	18.0	17.0	18.0		
	134	5670	17.0	18.0	17.0	18.0		
	142	5710	17.0	18.0	17.0	18.0		
2 Tx HT40 TXBF	102	5510	13.5	13.5	13.5	13.5		
	110	5550	17.0	17.5	17.0	17.5		
	134	5670	17.0	17.5	17.0	17.5		
	142	5710	17.0	18.0	17.0	18.0		

Power Measurement for 5.5GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)		
				WiFi 1	WiFi 2	WiFi 1	WiFi 2	
				Chain 0	Chain 1	Chain 0	Chain 1	
802.11ac	1 Tx VHT20 SISO	100	5500	17.0		17.0		
		104	5520	17.0		17.0		
		120	5600	17.0		17.0		
		136	5680	17.0		17.0		
		140	5700	17.0		17.0		
		144	5720	17.0		17.0		
		100	5500		18.0		18.0	
		104	5520		18.0		18.0	
		120	5600		18.0		18.0	
		136	5680		18.0		18.0	
		140	5700		18.0		18.0	
		144	5720		18.0		18.0	
		1 Tx VHT40 SISO	102	5510	17.0		17.0	
			110	5550	17.0		17.0	
	134		5670	17.0		17.0		
	142		5710	17.0		17.0		
	102		5510		17.5		17.5	
	110		5550		18.0		18.0	
	134		5670		18.0		18.0	
	1 Tx VHT80 SISO	106	5530	16.5		16.5		
		122	5610	17.0		17.0		
		138	5690	17.0		17.0		
		106	5530		16.5		16.5	
		122	5610		18.0		18.0	
		138	5690		18.0		18.0	
	2 Tx VHT20 CDD	100	5500	17.0	18.0	17.0	18.0	
		104	5520	17.0	17.5	17.0	17.5	
		120	5600	17.0	17.5	17.0	17.5	
		124	5620	17.0	17.5	17.0	17.5	
		136	5680	17.0	17.5	17.0	17.5	
		140	5700	15.0	15.0	15.0	15.0	
		144	5720	17.0	18.0	17.0	18.0	
	2 Tx VHT20 STBC/SDM	100	5500	17.0	18.0	17.0	18.0	
		104	5520	17.0	18.0	17.0	18.0	
		120	5600	17.0	18.0	17.0	18.0	
		124	5620	17.0	18.0	17.0	18.0	
		136	5680	17.0	18.0	17.0	18.0	
		140	5700	15.0	15.0	15.0	15.0	
		144	5720	17.0	18.0	17.0	18.0	
	2 Tx VHT20 TXBF	100	5500	17.0	18.0	17.0	18.0	
104		5520	17.0	17.5	17.0	17.5		
120		5600	17.0	17.5	17.0	17.5		
124		5620	17.0	17.5	17.0	17.5		
136		5680	17.0	17.5	17.0	17.5		
140		5700	15.5	15.5	15.5	15.5		
144		5720	17.0	18.0	17.0	18.0		
2 Tx VHT40 CDD	102	5510	14.5	14.5	14.5	14.5		
	110	5550	17.0	18.0	17.0	18.0		
	134	5670	17.0	18.0	17.0	18.0		
	142	5710	17.0	17.5	17.0	17.5		

Power Measurement for 5.5GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11ac	2 Tx VHT40 STBC/SDM	102	5510	14.5	14.5	14.5	14.5
		110	5550	17.0	18.0	17.0	18.0
		134	5670	17.0	18.0	17.0	18.0
		142	5710	17.0	18.0	17.0	18.0
	2 Tx VHT40 TXBF	102	5510	13.5	13.5	13.5	13.5
		110	5550	17.0	17.5	17.0	17.5
		134	5670	17.0	17.5	17.0	17.5
		142	5710	17.0	18.0	17.0	18.0
	2 Tx VHT80 CDD	106	5530	14.0	14.0	14.0	14.0
		122	5610	17.0	18.0	17.0	18.0
		138	5690	17.0	18.0	17.0	18.0
	2 Tx VHT80 STBC/SDM	106	5530	14.0	14.0	14.0	14.0
		122	5610	17.0	18.0	17.0	18.0
		138	5690	17.0	18.0	17.0	18.0
	2 Tx VHT80 TXBF	106	5530	12.5	12.5	12.5	12.5
		122	5610	17.0	18.0	17.0	18.0
		138	5690	17.0	18.0	17.0	18.0

12.5. 5.8 GHz Band

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11a	1 Tx	149	5745	17.5		17.5	
		153	5765	17.5		17.5	
		157	5785	17.5		17.5	
		161	5805	17.5		17.5	
		165	5825	17.5		17.5	
	2 Tx CDD	149	5745	17.5	18.0	17.5	18.0
		153	5765	17.5	18.0	17.5	18.0
		157	5785	17.5	18.0	17.5	18.0
		161	5805	17.5	18.0	17.5	18.0
		165	5825	17.5	18.0	17.5	18.0
	2 Tx TXBF	149	5745	17.5	18.0	17.5	18.0
		153	5765	17.5	18.0	17.5	18.0
		157	5785	17.5	18.0	17.5	18.0
		161	5805	17.5	18.0	17.5	18.0
		165	5825	17.5	18.0	17.5	18.0
802.11n	1 Tx HT20 SISO	149	5745	17.5		17.5	
		157	5785	17.5		17.5	
		165	5825	17.5		17.5	
	1 Tx HT40 SISO	149	5745		18.0		18.0
		157	5785		18.0		18.0
		165	5825		18.0		18.0
	1 Tx HT40 SISO	151	5755	17.5		17.5	
		159	5795	17.5		17.5	
	2 Tx HT20 CDD/STBC/SDM	151	5755		18.0		18.0
		159	5795		18.0		18.0
		149	5745	17.5	18.0	17.5	18.0
	2 Tx HT20 TXBF	157	5785	17.5	18.0	17.5	18.0
		165	5825	17.5	18.0	17.5	18.0
		149	5745	17.5	18.0	17.5	18.0
	2 Tx HT40 CDD/STBC/SDM	151	5755	16.5	16.5	16.5	16.5
		159	5795	17.5	18.0	17.5	18.0
	2 Tx HT40 TXBF	151	5755	16.5	16.5	16.5	16.5
		159	5795	17.5	18.0	17.5	18.0

Power Measurement for 5.8GHz (continued)

Mode	No. of Transmitters	Ch. #	Freq. (MHz)	Target Maximum Average Power per chain for C2PC (dBm)		Measured Power (dBm)	
				WiFi 1	WiFi 2	WiFi 1	WiFi 2
				Chain 0	Chain 1	Chain 0	Chain 1
802.11ac	1 Tx VHT20 SISO	149	5745	17.5		17.5	
		157	5785	17.5		17.5	
		165	5825	17.5		17.5	
		149	5745		18.0		18.0
		157	5785		18.0		18.0
		165	5825		18.0		18.0
	1 Tx VHT40 SISO	151	5755	17.5		17.5	
		159	5795	17.5		17.5	
		151	5755		18.0		18.0
		159	5795		18.0		18.0
	1 Tx VHT80 SISO	155	5775	17.5		17.5	
		155	5775		18.0		18.0
	2 Tx VHT20 CDD/STBC/SDM	149	5745	17.5	18.0	17.5	18.0
		157	5785	17.5	18.0	17.5	18.0
		165	5825	17.5	18.0	17.5	18.0
	2 Tx VHT20 TXBF	149	5745	17.5	18.0	17.5	18.0
		157	5785	17.5	18.0	17.5	18.0
		165	5825	17.5	18.0	17.5	18.0
	2 Tx VHT40 CDD/STBC/SDM	151	5755	16.5	16.5	16.5	16.5
		159	5795	17.5	18.0	17.5	18.0
	2 Tx VHT40 TXBF	151	5755	16.5	16.5	16.5	16.5
		159	5795	17.5	18.0	17.5	18.0
	2 Tx VHT80 CDD/STBC/SDM	155	5775	17.0	17.0	17.0	17.0
2 Tx VHT80 TXBF	155	5775	17.0	17.0	17.0	17.0	

12.6. Bluetooth

Maximum tune-up tolerance limit is 4 dBm from the rated nominal maximum output power. This power level qualifies for exclusion of SAR testing. Refer to Standalone SAR Test Exclusion Considerations

13. Tissue Dielectric Property

IEEE Std 1528-2003 Table 2

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

FCC OET Bulletin 65 Supplement C 01-01 & IC RSS-102

Target Frequency (MHz)	Head		Body	
	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
150	52.3	0.76	61.9	0.8
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.9	55.2	0.97
900	41.5	0.97	55	1.05
915	41.5	0.98	55	1.06
1450	40.5	1.2	54	1.3
1610	40.3	1.29	53.8	1.4
1800 – 2000	40	1.4	53.3	1.52
2450	39.2	1.8	52.7	1.95
3000	38.5	2.4	52	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

13.1. 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

13.2. Tissue dielectric parameters 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.

LAB A

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
3/20/2013	Body 5180	e'	48.0500	Relative Permittivity (ϵ_r):	48.05	49.05	-2.03	10
		e"	18.7500	Conductivity (σ):	5.40	5.27	2.45	5
	Body 5200	e'	48.0100	Relative Permittivity (ϵ_r):	48.01	49.02	-2.06	10
		e"	18.7700	Conductivity (σ):	5.43	5.29	2.50	5
	Body 5500	e'	47.4900	Relative Permittivity (ϵ_r):	47.49	48.61	-2.31	10
		e"	19.0100	Conductivity (σ):	5.81	5.64	3.00	5
	Body 5800	e'	47.0200	Relative Permittivity (ϵ_r):	47.02	48.20	-2.45	10
		e"	19.3300	Conductivity (σ):	6.23	6.00	3.90	5
	Body 5825	e'	46.9900	Relative Permittivity (ϵ_r):	46.99	48.20	-2.51	10
		e"	19.3500	Conductivity (σ):	6.27	6.00	4.45	5
3/23/2013	Body 5180	e'	47.9000	Relative Permittivity (ϵ_r):	47.90	49.05	-2.34	10
		e"	17.9000	Conductivity (σ):	5.16	5.27	-2.20	5
	Body 5200	e'	47.8700	Relative Permittivity (ϵ_r):	47.87	49.02	-2.35	10
		e"	17.9100	Conductivity (σ):	5.18	5.29	-2.20	5
	Body 5500	e'	47.4000	Relative Permittivity (ϵ_r):	47.40	48.61	-2.50	10
		e"	18.1300	Conductivity (σ):	5.54	5.64	-1.77	5
	Body 5800	e'	46.9800	Relative Permittivity (ϵ_r):	46.98	48.20	-2.53	10
		e"	18.4200	Conductivity (σ):	5.94	6.00	-0.99	5
	Body 5825	e'	46.9500	Relative Permittivity (ϵ_r):	46.95	48.20	-2.59	10
		e"	18.4400	Conductivity (σ):	5.97	6.00	-0.46	5
3/29/2013	Body 5180	e'	47.4900	Relative Permittivity (ϵ_r):	47.49	49.05	-3.17	10
		e"	17.6500	Conductivity (σ):	5.08	5.27	-3.56	5
	Body 5200	e'	47.4900	Relative Permittivity (ϵ_r):	47.49	49.02	-3.12	10
		e"	17.6900	Conductivity (σ):	5.11	5.29	-3.40	5
	Body 5500	e'	47.0500	Relative Permittivity (ϵ_r):	47.05	48.61	-3.22	10
		e"	17.8400	Conductivity (σ):	5.46	5.64	-3.34	5
	Body 5800	e'	46.6200	Relative Permittivity (ϵ_r):	46.62	48.20	-3.28	10
		e"	18.1400	Conductivity (σ):	5.85	6.00	-2.50	5
	Body 5825	e'	46.5900	Relative Permittivity (ϵ_r):	46.59	48.20	-3.34	10
		e"	18.1700	Conductivity (σ):	5.89	6.00	-1.92	5
4/1/2013	Body 5180	e'	47.4600	Relative Permittivity (ϵ_r):	47.46	49.05	-3.24	10
		e"	18.0400	Conductivity (σ):	5.20	5.27	-1.43	5
	Body 5200	e'	47.4400	Relative Permittivity (ϵ_r):	47.44	49.02	-3.22	10
		e"	18.0600	Conductivity (σ):	5.22	5.29	-1.38	5
	Body 5500	e'	46.9500	Relative Permittivity (ϵ_r):	46.95	48.61	-3.42	10
		e"	18.2200	Conductivity (σ):	5.57	5.64	-1.28	5
	Body 5800	e'	46.5300	Relative Permittivity (ϵ_r):	46.53	48.20	-3.46	10
		e"	18.4600	Conductivity (σ):	5.95	6.00	-0.78	5
	Body 5825	e'	46.5000	Relative Permittivity (ϵ_r):	46.50	48.20	-3.53	10
		e"	18.4800	Conductivity (σ):	5.99	6.00	-0.24	5

Tissue dielectric parameters check results continued

LAB A

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)		
4/10/2013	Body 5180	e'	47.9200	Relative Permittivity (ϵ_r):	47.92	49.05	-2.30	10	
		e"	18.0800	Conductivity (σ):	5.21	5.27	-1.21	5	
	Body 5200	e'	47.8900	Relative Permittivity (ϵ_r):	47.89	49.02	-2.30	10	
		e"	18.1000	Conductivity (σ):	5.23	5.29	-1.16	5	
	Body 5500	e'	47.4200	Relative Permittivity (ϵ_r):	47.42	48.61	-2.45	10	
		e"	18.3200	Conductivity (σ):	5.60	5.64	-0.74	5	
	Body 5800	e'	46.9800	Relative Permittivity (ϵ_r):	46.98	48.20	-2.53	10	
		e"	18.6300	Conductivity (σ):	6.01	6.00	0.14	5	
	Body 5825	e'	46.9500	Relative Permittivity (ϵ_r):	46.95	48.20	-2.59	10	
		e"	18.6500	Conductivity (σ):	6.04	6.00	0.68	5	
	4/19/2013	Body 5180	e'	47.5200	Relative Permittivity (ϵ_r):	47.52	49.05	-3.11	10
			e"	17.6600	Conductivity (σ):	5.09	5.27	-3.51	5
Body 5200		e'	47.5300	Relative Permittivity (ϵ_r):	47.53	49.02	-3.04	10	
		e"	17.6700	Conductivity (σ):	5.11	5.29	-3.51	5	
Body 5500		e'	47.0600	Relative Permittivity (ϵ_r):	47.06	48.61	-3.19	10	
		e"	17.8300	Conductivity (σ):	5.45	5.64	-3.40	5	
Body 5800		e'	46.7100	Relative Permittivity (ϵ_r):	46.71	48.20	-3.09	10	
		e"	18.1400	Conductivity (σ):	5.85	6.00	-2.50	5	
Body 5825		e'	46.6900	Relative Permittivity (ϵ_r):	46.69	48.20	-3.13	10	
		e"	18.1500	Conductivity (σ):	5.88	6.00	-2.02	5	
4/24/2013	Body 5180	e'	50.0300	Relative Permittivity (ϵ_r):	50.03	49.05	2.00	10	
		e"	18.1500	Conductivity (σ):	5.23	5.27	-0.83	5	
	Body 5200	e'	50.1200	Relative Permittivity (ϵ_r):	50.12	49.02	2.24	10	
		e"	18.2500	Conductivity (σ):	5.28	5.29	-0.34	5	
	Body 5500	e'	49.2800	Relative Permittivity (ϵ_r):	49.28	48.61	1.37	10	
		e"	18.0100	Conductivity (σ):	5.51	5.64	-2.42	5	
	Body 5800	e'	47.9900	Relative Permittivity (ϵ_r):	47.99	48.20	-0.44	10	
		e"	18.3600	Conductivity (σ):	5.92	6.00	-1.32	5	
	Body 5825	e'	48.0200	Relative Permittivity (ϵ_r):	48.02	48.20	-0.37	10	
		e"	18.5700	Conductivity (σ):	6.01	6.00	0.24	5	
4/29/2013	Body 5180	e'	49.9700	Relative Permittivity (ϵ_r):	49.97	49.05	1.88	10	
		e"	18.0700	Conductivity (σ):	5.20	5.27	-1.27	5	
	Body 5200	e'	50.0500	Relative Permittivity (ϵ_r):	50.05	49.02	2.10	10	
		e"	18.1900	Conductivity (σ):	5.26	5.29	-0.67	5	
	Body 5500	e'	49.2600	Relative Permittivity (ϵ_r):	49.26	48.61	1.33	10	
		e"	17.9600	Conductivity (σ):	5.49	5.64	-2.69	5	
	Body 5800	e'	47.9900	Relative Permittivity (ϵ_r):	47.99	48.20	-0.44	10	
		e"	18.2900	Conductivity (σ):	5.90	6.00	-1.69	5	
	Body 5825	e'	48.0300	Relative Permittivity (ϵ_r):	48.03	48.20	-0.35	10	
		e"	18.5100	Conductivity (σ):	6.00	6.00	-0.08	5	
4/29/2013	Body 2450	e'	50.5100	Relative Permittivity (ϵ_r):	50.51	52.70	-4.16	5	
		e"	13.9300	Conductivity (σ):	1.90	1.95	-2.68	5	
	Body 2410	e'	50.7000	Relative Permittivity (ϵ_r):	50.70	52.76	-3.90	5	
		e"	13.7400	Conductivity (σ):	1.84	1.91	-3.47	5	
	Body 2435	e'	50.5400	Relative Permittivity (ϵ_r):	50.54	52.73	-4.15	5	
		e"	13.8500	Conductivity (σ):	1.88	1.93	-2.89	5	
	Body 2475	e'	50.5000	Relative Permittivity (ϵ_r):	50.50	52.67	-4.12	5	
		e"	14.0100	Conductivity (σ):	1.93	1.99	-2.88	5	

Tissue dielectric parameters check results continued

LAB B

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)		
3/20/2013	Body 5180	e'	48.0500	Relative Permittivity (ϵ_r):	48.05	49.05	-2.03	10	
		e"	18.7500	Conductivity (σ):	5.40	5.27	2.45	5	
	Body 5200	e'	48.0100	Relative Permittivity (ϵ_r):	48.01	49.02	-2.06	10	
		e"	18.7700	Conductivity (σ):	5.43	5.29	2.50	5	
	Body 5500	e'	47.4900	Relative Permittivity (ϵ_r):	47.49	48.61	-2.31	10	
		e"	19.0100	Conductivity (σ):	5.81	5.64	3.00	5	
	Body 5800	e'	47.0200	Relative Permittivity (ϵ_r):	47.02	48.20	-2.45	10	
		e"	19.3300	Conductivity (σ):	6.23	6.00	3.90	5	
	Body 5825	e'	46.9900	Relative Permittivity (ϵ_r):	46.99	48.20	-2.51	10	
		e"	19.3500	Conductivity (σ):	6.27	6.00	4.45	5	
	3/23/2013	Body 5180	e'	47.3200	Relative Permittivity (ϵ_r):	47.32	49.05	-3.52	10
			e"	17.9300	Conductivity (σ):	5.16	5.27	-2.03	5
Body 5200		e'	47.2900	Relative Permittivity (ϵ_r):	47.29	49.02	-3.53	10	
		e"	17.9500	Conductivity (σ):	5.19	5.29	-1.98	5	
Body 5500		e'	46.8200	Relative Permittivity (ϵ_r):	46.82	48.61	-3.69	10	
		e"	18.1700	Conductivity (σ):	5.56	5.64	-1.55	5	
Body 5800		e'	46.3900	Relative Permittivity (ϵ_r):	46.39	48.20	-3.76	10	
		e"	18.4400	Conductivity (σ):	5.95	6.00	-0.89	5	
Body 5825		e'	46.3500	Relative Permittivity (ϵ_r):	46.35	48.20	-3.84	10	
		e"	18.4700	Conductivity (σ):	5.98	6.00	-0.30	5	
3/25/2013	Body 5180	e'	47.0800	Relative Permittivity (ϵ_r):	47.08	49.05	-4.01	10	
		e"	17.7000	Conductivity (σ):	5.10	5.27	-3.29	5	
	Body 5200	e'	47.0500	Relative Permittivity (ϵ_r):	47.05	49.02	-4.02	10	
		e"	17.7200	Conductivity (σ):	5.12	5.29	-3.23	5	
	Body 5500	e'	46.5800	Relative Permittivity (ϵ_r):	46.58	48.61	-4.18	10	
		e"	17.8700	Conductivity (σ):	5.46	5.64	-3.18	5	
	Body 5800	e'	46.1600	Relative Permittivity (ϵ_r):	46.16	48.20	-4.23	10	
		e"	18.0800	Conductivity (σ):	5.83	6.00	-2.82	5	
	Body 5825	e'	46.1200	Relative Permittivity (ϵ_r):	46.12	48.20	-4.32	10	
		e"	18.1000	Conductivity (σ):	5.86	6.00	-2.29	5	
3/29/2013	Body 5180	e'	47.5500	Relative Permittivity (ϵ_r):	47.55	49.05	-3.05	10	
		e"	17.5600	Conductivity (σ):	5.06	5.27	-4.05	5	
	Body 5200	e'	47.5400	Relative Permittivity (ϵ_r):	47.54	49.02	-3.02	10	
		e"	17.6000	Conductivity (σ):	5.09	5.29	-3.89	5	
	Body 5500	e'	47.1200	Relative Permittivity (ϵ_r):	47.12	48.61	-3.07	10	
		e"	17.7600	Conductivity (σ):	5.43	5.64	-3.78	5	
	Body 5800	e'	46.7100	Relative Permittivity (ϵ_r):	46.71	48.20	-3.09	10	
		e"	18.0400	Conductivity (σ):	5.82	6.00	-3.04	5	
	Body 5825	e'	46.6700	Relative Permittivity (ϵ_r):	46.67	48.20	-3.17	10	
		e"	18.0700	Conductivity (σ):	5.85	6.00	-2.46	5	
4/1/2013	Body 5180	e'	47.0900	Relative Permittivity (ϵ_r):	47.09	49.05	-3.99	10	
		e"	18.0300	Conductivity (σ):	5.19	5.27	-1.49	5	
	Body 5200	e'	47.0800	Relative Permittivity (ϵ_r):	47.08	49.02	-3.96	10	
		e"	18.0400	Conductivity (σ):	5.22	5.29	-1.49	5	
	Body 5500	e'	46.5100	Relative Permittivity (ϵ_r):	46.51	48.61	-4.33	10	
		e"	18.1500	Conductivity (σ):	5.55	5.64	-1.66	5	
	Body 5800	e'	46.1400	Relative Permittivity (ϵ_r):	46.14	48.20	-4.27	10	
		e"	18.4100	Conductivity (σ):	5.94	6.00	-1.05	5	
	Body 5825	e'	46.1200	Relative Permittivity (ϵ_r):	46.12	48.20	-4.32	10	
		e"	18.4100	Conductivity (σ):	5.96	6.00	-0.62	5	

Tissue dielectric parameters check results continued

LAB B

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)		
4/4/2013	Body 5180	e'	48.3700	Relative Permittivity (ϵ_r):	48.37	49.05	-1.38	10	
		e"	18.1200	Conductivity (σ):	5.22	5.27	-0.99	5	
	Body 5200	e'	48.3500	Relative Permittivity (ϵ_r):	48.35	49.02	-1.37	10	
		e"	18.1400	Conductivity (σ):	5.24	5.29	-0.94	5	
	Body 5500	e'	47.8600	Relative Permittivity (ϵ_r):	47.86	48.61	-1.55	10	
		e"	18.3200	Conductivity (σ):	5.60	5.64	-0.74	5	
	Body 5800	e'	47.4300	Relative Permittivity (ϵ_r):	47.43	48.20	-1.60	10	
		e"	18.6000	Conductivity (σ):	6.00	6.00	-0.03	5	
	Body 5825	e'	47.4000	Relative Permittivity (ϵ_r):	47.40	48.20	-1.66	10	
		e"	18.6200	Conductivity (σ):	6.03	6.00	0.51	5	
	4/8/2013	Body 5180	e'	49.3000	Relative Permittivity (ϵ_r):	49.30	49.05	0.52	10
			e"	17.5000	Conductivity (σ):	5.04	5.27	-4.38	5
Body 5200		e'	49.3100	Relative Permittivity (ϵ_r):	49.31	49.02	0.59	10	
		e"	17.5300	Conductivity (σ):	5.07	5.29	-4.27	5	
Body 5500		e'	48.7900	Relative Permittivity (ϵ_r):	48.79	48.61	0.36	10	
		e"	17.7100	Conductivity (σ):	5.42	5.64	-4.05	5	
Body 5800		e'	48.4100	Relative Permittivity (ϵ_r):	48.41	48.20	0.44	10	
		e"	18.0300	Conductivity (σ):	5.81	6.00	-3.09	5	
Body 5825		e'	48.3800	Relative Permittivity (ϵ_r):	48.38	48.20	0.37	10	
		e"	18.0500	Conductivity (σ):	5.85	6.00	-2.56	5	
4/10/2013	Body 5180	e'	47.8091	Relative Permittivity (ϵ_r):	47.81	49.05	-2.52	10	
		e"	17.8612	Conductivity (σ):	5.14	5.27	-2.41	5	
	Body 5200	e'	47.7769	Relative Permittivity (ϵ_r):	47.78	49.02	-2.54	10	
		e"	17.8798	Conductivity (σ):	5.17	5.29	-2.36	5	
	Body 5500	e'	47.3317	Relative Permittivity (ϵ_r):	47.33	48.61	-2.64	10	
		e"	18.1027	Conductivity (σ):	5.54	5.64	-1.92	5	
	Body 5800	e'	49.9056	Relative Permittivity (ϵ_r):	49.91	48.20	3.54	10	
		e"	18.3807	Conductivity (σ):	5.93	6.00	-1.20	5	
	Body 5825	e'	46.8703	Relative Permittivity (ϵ_r):	46.87	48.20	-2.76	10	
		e"	18.4036	Conductivity (σ):	5.96	6.00	-0.65	5	
4/19/2013	Body 5180	e'	47.0300	Relative Permittivity (ϵ_r):	47.03	49.05	-4.11	10	
		e"	17.5900	Conductivity (σ):	5.07	5.27	-3.89	5	
	Body 5200	e'	47.0300	Relative Permittivity (ϵ_r):	47.03	49.02	-4.06	10	
		e"	17.6000	Conductivity (σ):	5.09	5.29	-3.89	5	
	Body 5500	e'	46.5800	Relative Permittivity (ϵ_r):	46.58	48.61	-4.18	10	
		e"	17.7600	Conductivity (σ):	5.43	5.64	-3.78	5	
	Body 5800	e'	46.2500	Relative Permittivity (ϵ_r):	46.25	48.20	-4.05	10	
		e"	18.0500	Conductivity (σ):	5.82	6.00	-2.98	5	
	Body 5825	e'	46.2200	Relative Permittivity (ϵ_r):	46.22	48.20	-4.11	10	
		e"	18.0600	Conductivity (σ):	5.85	6.00	-2.51	5	
4/25/2013	Body 5180	e'	49.8800	Relative Permittivity (ϵ_r):	49.88	49.05	1.70	10	
		e"	18.0900	Conductivity (σ):	5.21	5.27	-1.16	5	
	Body 5200	e'	49.9600	Relative Permittivity (ϵ_r):	49.96	49.02	1.92	10	
		e"	18.1900	Conductivity (σ):	5.26	5.29	-0.67	5	
	Body 5500	e'	49.1300	Relative Permittivity (ϵ_r):	49.13	48.61	1.06	10	
		e"	17.9500	Conductivity (σ):	5.49	5.64	-2.75	5	
	Body 5800	e'	47.8500	Relative Permittivity (ϵ_r):	47.85	48.20	-0.73	10	
		e"	18.2900	Conductivity (σ):	5.90	6.00	-1.69	5	
	Body 5825	e'	47.8800	Relative Permittivity (ϵ_r):	47.88	48.20	-0.66	10	
		e"	18.5100	Conductivity (σ):	6.00	6.00	-0.08	5	

Tissue dielectric parameters check results continued

LAB B

Date	Freq. (MHz)	Liquid Parameters		Measured	Target	Delta (%)	Limit ±(%)	
4/29/2013	Body 5180	e'	50.0100	Relative Permittivity (ϵ_r):	50.01	49.05	1.96	10
		e"	17.9700	Conductivity (σ):	5.18	5.27	-1.81	5
	Body 5200	e'	50.0900	Relative Permittivity (ϵ_r):	50.09	49.02	2.18	10
		e"	18.0900	Conductivity (σ):	5.23	5.29	-1.21	5
	Body 5500	e'	49.3100	Relative Permittivity (ϵ_r):	49.31	48.61	1.43	10
		e"	17.8600	Conductivity (σ):	5.46	5.64	-3.23	5
	Body 5800	e'	48.0400	Relative Permittivity (ϵ_r):	48.04	48.20	-0.33	10
		e"	18.1900	Conductivity (σ):	5.87	6.00	-2.23	5
Body 5825	e'	48.0800	Relative Permittivity (ϵ_r):	48.08	48.20	-0.25	10	
	e"	18.4100	Conductivity (σ):	5.96	6.00	-0.62	5	

14. 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.

14.1. 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 ≤ 3 GHz and ≥ 10.0 cm ± 0.5 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
 For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.
- Distance between probe sensors and phantom surface was set to 3 mm.
 For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

14.2. 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	826	1/30/2013	2450	1g	53.3	50.0
				10g	24.7	23.4
D5GHzV2	1003	9/18/2012	5200	1g	76.5	74.8
				10g	21.9	20.9
			5600	1g	82.8	79.0
				10g	23.6	22.0
			5800	1g	76.9	77.0
				10g	22.0	21.4

14.3. System Performance Check Results

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

LAB A

Date Tested	System Dipole		T.S. Liquid	Measured Results			Target (Ref. Value)	Delta ±10 %	Plot No.	
	Type	Serial #		Area Scan	Zoom Scan	Normalize to 1 W				
3/20/2013	D5GHzV2 (5.6GHz)	1003	Body	1g	7.03	7.68	76.8	79.0	-2.78	1,2
				10g	1.94	2.15	21.5	22.0	-2.27	
3/20/2013	D5GHzV2 (5.8GHz)	1003	Body	1g	6.73	7.15	71.5	77.0	-7.14	
				10g	1.83	2.01	20.1	21.4	-6.07	
3/23/2013	D5GHzV2 (5.2GHz)	1003	Body	1g	6.66	7.06	70.6	74.8	-5.61	
				10g	1.81	1.98	19.8	20.9	-5.26	
3/29/2013	D5GHzV2 (5.8GHz)	1003	Body	1g	6.87	7.23	72.3	77.0	-6.10	
				10g	1.87	2.03	20.3	21.4	-5.14	
4/1/2013	D5GHzV2 (5.8GHz)	1003	Body	1g	6.73	7.21	72.1	77.0	-6.36	
				10g	1.84	2.02	20.2	21.4	-5.61	
4/1/2013	D5GHzV2 (5.6GHz)	1003	Body	1g	7.14	7.55	75.5	79.0	-4.43	
				10g	1.95	2.11	21.1	22.0	-4.09	
4/1/2013	D5GHzV2 (5.2GHz)	1003	Body	1g	6.71	7.08	70.8	74.8	-5.35	
				10g	1.82	1.99	19.9	20.9	-4.78	
4/10/2013	D5GHzV2 (5.2GHz)	1003	Body	1g	6.91	7.28	72.8	74.8	-2.67	
				10g	1.87	2.03	20.3	20.9	-2.87	
4/10/2013	D5GHzV2 (5.6GHz)	1003	Body	1g	7.62	8.07	80.7	79.0	2.15	
				10g	2.05	2.25	22.5	22.0	2.27	
4/10/2013	D5GHzV2 (5.8GHz)	1003	Body	1g	6.80	7.20	72.0	77.0	-6.49	
				10g	1.86	2.02	20.2	21.4	-5.61	
4/19/2013	D5GHzV2 (5.6GHz)	1003	Body	1g	7.33	7.68	76.8	79.0	-2.78	
				10g	1.96	2.14	21.4	22.0	-2.73	
4/25/2013	D5GHzV2 (5.2GHz)	1003	Body	1g	6.96	7.34	73.4	74.8	-1.87	
				10g	1.89	2.05	20.5	20.9	-1.91	
4/25/2013	D5GHzV2 (5.6GHz)	1003	Body	1g	7.75	8.04	80.4	79.0	1.77	
				10g	2.08	2.24	22.4	22.0	1.82	
4/29/2013	D5GHzV2 (5.2GHz)	1003	Body	1g	6.84	7.26	72.6	74.8	-2.94	
				10g	1.86	2.03	20.3	20.9	-2.87	
4/29/2013	2.4GHz	826	Body	1g	5.09	5.17	51.7	50.0	3.40	3,4
				10g	2.20	2.42	24.2	23.4	3.42	

System Performance check results continued

LAB B

Date Tested	System Dipole		T.S. Liquid	Measured Results			Target (Ref. Value)	Delta ±10 %	Plot No.	
	Type	Serial #		Area Scan	Zoom Scan	Normalize to 1 W				
3/20/2013	D5GHzV2 (5.6GHz)	1003	Body	1g	7.51	8.23	82.3	79.0	4.18	
				10g	2.12	2.30	23.0	22.0	4.55	
3/23/2013	D5GHzV2 (5.8GHz)	1003	Body	1g	6.67	7.41	74.1	77.0	-3.77	
				10g	1.90	2.07	20.7	21.4	-3.27	
3/25/2013	D5GHzV2 (5.2GHz)	1003	Body	1g	7.74	7.56	75.6	74.8	1.07	
				10g	2.12	2.12	21.2	20.9	1.44	
3/29/2013	D5GHzV2 (5.8GHz)	1003	Body	1g	7.05	7.58	75.8	77.0	-1.56	
				10g	1.94	2.13	21.3	21.4	-0.47	
3/29/2013	D5GHzV2 (5.6GHz)	1003	Body	1g	7.02	7.79	77.9	79.0	-1.39	
				10g	1.97	2.17	21.7	22.0	-1.36	
4/1/2013	D5GHzV2 (5.6GHz)	1003	Body	1g	7.14	7.80	78.0	79.0	-1.27	
				10g	1.99	2.17	21.7	22.0	-1.36	
4/1/2013	D5GHzV2 (5.2GHz)	1003	Body	1g	7.10	7.67	76.7	74.8	2.54	
				10g	2.00	2.16	21.6	20.9	3.35	
4/4/2013	D5GHzV2 (5.2GHz)	1003	Body	1g	6.72	7.14	71.4	74.8	-4.55	
				10g	1.83	2.00	20.0	20.9	-4.31	
4/8/2013	D5GHzV2 (5.8GHz)	1003	Body	1g	7.06	7.55	75.5	77.0	-1.95	
				10g	1.94	2.12	21.2	21.4	-0.93	
4/10/2013	D5GHzV2 (5.2GHz)	1003	Body	1g	7.18	7.80	78.0	74.8	4.28	
				10g	1.99	2.18	21.8	20.9	4.31	
4/10/2013	D5GHzV2 (5.6GHz)	1003	Body	1g	7.57	8.02	80.2	79.0	1.52	
				10g	2.07	2.24	22.4	22.0	1.82	
4/19/2013	D5GHzV2 (5.6GHz)	1003	Body	1g	7.10	7.97	79.7	79.0	0.89	
				10g	2.01	2.22	22.2	22.0	0.91	
4/19/2013	D5GHzV2 (5.8GHz)	1003	Body	1g	7.20	7.15	71.5	77.0	-7.14	5,6
				10g	2.03	2.01	20.1	21.4	-6.07	
4/25/2013	D5GHzV2 (5.2GHz)	1003	Body	1g	7.29	7.89	78.9	74.8	5.48	
				10g	2.04	2.20	22.0	20.9	5.26	
4/25/2013	D5GHzV2 (5.6GHz)	1003	Body	1g	7.48	8.22	82.2	79.0	4.05	
				10g	2.10	2.28	22.8	22.0	3.64	
4/29/2013	D5GHzV2 (5.2GHz)	1003	Body	1g	7.25	7.87	78.7	74.8	5.21	
				10g	2.03	2.21	22.1	20.9	5.74	

15. SAR Test Results

15.1. 2.4GHz Band (Antenna Vendor A)

From KDB 447498, Sec. 4.3.3, SAR Test Reduction Considerations: Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

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

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Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Power (dBm)				1-g SAR (W/kg)				Plot No.	Note
					Tune-up limit		Measured		Measured		Scaled			
					Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1		
2.4	802.11b Legacy	1 Tx	1	2412	19.0		19.0		0.795		0.795			
			6	2437	19.0		19.0		0.800		0.800			
			11	2462	19.0		19.0		0.978		0.978			
			2	2417		20.0		20.0		0.854		0.854		
			6	2437		20.0		20.0		0.884		0.884		
			11	2462		20.0		20.0		1.000		1.000		1
		2 Tx	2	2417	19.0	20.0	19.0	20.0	0.988	0.613	0.988	0.613		
			6	2437	19.0	20.0	19.0	20.0	1.030	0.666	1.030	0.666		
			11	2462	19.0	20.0	19.0	20.0	1.190	0.820	1.190	0.820	1	

Note(s):

1. Highest Report SAR results for the given mode in the corresponding frequencyband.

15.2. 5 GHz Bands (Antenna Vendor A)

Lap-Held

Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Power (dBm)				1-g SAR (W/kg)				Plot No.	Note	
					Tune-up limit		Measured		Measured		Scaled				
					Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1			
5.2	802.11a Legacy	1 Tx	36	5180	16.0		16.0		0.676		0.676				
			48	5240	16.0		16.0		0.728		0.728				
			36	5180		15.5		15.5		0.779		0.779			
			48	5240		15.5		15.5		0.809		0.809	2	1	
	802.11a CDD	2 Tx	36	5180	11.5	11.5	11.5	11.5	0.297	0.341	0.297	0.341		1	
			48	5240	11.5	11.5	11.5	11.5	0.323	0.321	0.323	0.321			
	802.11n HT20 STBC/SDM	2 Tx	36	5180	13.5	13.5	13.5	13.5	0.513	0.554	0.513	0.554		1	
			48	5240	13.5	13.5	13.5	13.5	0.540	0.554	0.540	0.554			
	802.11ac VHT20 SISO	1 Tx	48	5240		15.5		15.5		0.780		0.780		1	

Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Power (dBm)				1-g SAR (W/kg)				Plot No.	Note	
					Tune-up limit		Measured		Measured		Scaled				
					Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1			
5.3	802.11a Legacy	1 Tx	52	5260	17.5		17.5		0.891		0.891				
			64	5320	17.5		17.5		1.080		1.080				
			52	5260		17.5		17.5		1.090		1.09			
			64	5320		17.5		17.5		1.130		1.13		1	
	802.11a CDD	2 Tx	52	5260	17.5	17.5	17.5	17.5	1.010	1.130	1.010	1.13			
			64	5320	17.5	17.5	17.5	17.5	1.010	1.140	1.010	1.14	3	1	
	802.11ac VHT20 CDD	2 Tx	64	5320	17.5	17.5	17.5	17.5	1.050	1.090	1.050	1.09		1	

Note(s):

- Highest Report SAR results for the given mode in the corresponding frequencyband.

5 GHz Bands continued

Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Power (dBm)				1-g SAR (W/kg)				Plot No.	Note
					Tune-up limit		Measured		Measured		Scaled			
					Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1		
5.5	802.11a Legacy	1 Tx	104	5520	17.0		17.0		1.020		1.020			
			116	5580	17.0		17.0		1.140		1.140			
			124	5620	17.0		17.0		0.899		0.899			
			136	5680	17.0		17.0		1.090		1.090			
			104	5520		18.0		18.0		1.180		1.180		
			116	5580		18.0		18.0		1.130		1.130		
			124	5620		18.0		18.0		1.080		1.080		
			136	5680		18.0		18.0		1.190		1.190	4	1
	802.11a CDD	2 Tx	100	5500	17.0	18.0	17.0	18.0	1.080	1.160	1.080	1.160		1
			116	5580	17.0	17.5	17.0	17.5	1.080	0.974	1.080	0.974		
			124	5620	17.0	17.5	17.0	17.5	0.961	0.887	0.961	0.887		
			136	5680	17.0	17.5	17.0	17.5	1.150	1.080	1.150	1.080		
			144	5720	17.0	18.0	17.0	18.0	0.926	0.960	0.926	0.960		
	802.11a TXBF	2 Tx	140	5700	15.5	15.5	15.5	15.5	0.787	0.634	0.787	0.634		1
	802.11n HT20 STBC/SDM	2 Tx	100	5500	17.0	18.0	17.0	18.0	1.050	1.160	1.050	1.160		1
			120	5600	17.0	18.0	17.0	18.0	1.120	1.140	1.120	1.140		
144			5710	17.0	18.0	17.0	18.0	1.020	0.921	1.020	0.921			
802.11ac VHT20 SISO	1 Tx	136	5680		18.0		18.0		1.060		1.060		1	

Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Power (dBm)				1-g SAR (W/kg)				Plot No.	Note
					Tune-up limit		Measured		Measured		Scaled			
					Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1		
5.8	802.11a Legacy	1 Tx	149	5745	17.5		17.5		0.949		0.949			
			157	5785	17.5		17.5		0.927		0.927			
			165	5825	17.5		17.5		1.010		1.010			1
			149	5745		18.0		18.0		0.901		0.901		
			157	5785		18.0		18.0		0.875		0.875		
			165	5825		18.0		18.0		0.863		0.863		
	802.11a CDD	2 Tx	149	5745	17.5	18.0	17.5	18.0	1.020	0.869	1.020	0.869		
			157	5785	17.5	18.0	17.5	18.0	0.995	0.823	0.995	0.823		
			165	5825	17.5	18.0	17.5	18.0	1.040	0.851	1.040	0.851	5	1
	802.11ac VHT20 CDD/STBC/SDM	2 Tx	165	5825	17.5	18.0	17.5	18.0	0.914	0.792	0.914	0.792		1

Note(s):

- Highest Report SAR results for the given mode in the corresponding frequencyband.

15.3. 2.4GHz Band (Antenna Vendor B)

From KDB 447498, Sec. 4.3.3, SAR Test Reduction Considerations: Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

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

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Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Power (dBm)				1-g SAR (W/kg)				Plot No.	Note
					Tune-up limit		Measured		Measured		Scaled			
					Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1		
2.4	802.11b Legacy	1 Tx	1	2412	19.0		19.0		0.842		0.842			
			6	2437	19.0		19.0		0.828		0.828			
			11	2462	19.0		19.0		0.987		0.987			1
			2	2417		20.0		20.0		0.903		0.903		
			6	2437		20.0		20.0		0.880		0.880		
			11	2462		20.0		20.0		0.970		0.970		
		2 Tx	2	2417	19.0	20.0	19.0	20.0	1.130	0.757	1.130	0.757		
			6	2437	19.0	20.0	19.0	20.0	1.100	0.793	1.100	0.793		
			11	2462	19.0	20.0	19.0	20.0	1.170	0.752	1.170	0.752	1	1

Note(s):

1. Highest Report SAR results for the given mode in the corresponding frequencyband.

15.4. 5 GHz Bands (Antenna Vendor B)

Lap-Held

Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Power (dBm)				1-g SAR (W/kg)				Plot No.	Note	
					Tune-up limit		Measured		Measured		Scaled				
					Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1			
5.2	802.11a Legacy	1 Tx	36	5180	16.0		16.0		0.523		0.523				
			48	5240	16.0		16.0		0.552		0.552		2	1	
			36	5180		15.5		15.5		0.526		0.526			
			48	5240		15.5		15.5		0.542		0.542			
	802.11a CDD	2 Tx	36	5180	11.5	11.5	11.5	11.5	0.197	0.255	0.197	0.255		1	
			48	5240	11.5	11.5	11.5	11.5	0.228	0.254	0.228	0.254			
	802.11n HT20 STBC/SDM	2 Tx	36	5180	13.5	13.5	13.5	13.5	0.334	0.407	0.334	0.407		1	
			48	5240	13.5	13.5	13.5	13.5	0.392	0.400	0.392	0.400			
	802.11ac VHT20 SISO	1 Tx	48	5240	16.0		16.0		0.551		0.551			1	

Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Power (dBm)				1-g SAR (W/kg)				Plot No.	Note	
					Tune-up limit		Measured		Measured		Scaled				
					Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1			
5.3	802.11a Legacy	1 Tx	52	5260	17.5		17.5		0.765		0.765				
			64	5320	17.5		17.5		0.853		0.853			1	
			52	5260		17.5		17.5		0.733		0.733			
			64	5320		17.5		17.5		0.737		0.737			
	802.11a CDD	2 Tx	52	5260	17.5	17.5	17.5	17.5	1.040	1.050	1.040	1.050	3	1	
			64	5320	17.5	17.5	17.5	17.5	0.974	1.030	0.974	1.030			
	802.11ac VHT20 CDD	2 Tx	52	5260	17.5	17.5	17.5	17.5	0.759	0.893	0.759	0.893		1	

Note(s):

- Highest Report SAR results for the given mode in the corresponding frequencyband.

5 GHz Bands continued

Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Power (dBm)				1-g SAR (W/kg)				Plot No.	Note
					Tune-up limit		Measured		Measured		Scaled			
					Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1		
5.5	802.11a Legacy	1 Tx	104	5520	17.0		17.0		0.837		0.837			
			116	5580	17.0		17.0		0.838		0.838			
			124	5620	17.0		17.0		0.884		0.884			
			136	5680	17.0		17.0		0.843		0.843			
			104	5520		18.0		18.0		0.931		0.931		
			116	5580		18.0		18.0		0.975		0.975		1
			124	5620		18.0		18.0		0.955		0.955		
			136	5680		18.0		18.0		0.853		0.853		
	802.11a CDD	2 Tx	100	5500	17.0	18.0	17.0	18.0	0.866	0.959	0.866	0.959		
			116	5580	17.0	17.0	17.0	17.0	0.928	0.945	0.928	0.945		
			124	5620	17.0	17.5	17.0	17.5	0.914	0.906	0.914	0.906		
			136	5680	17.0	17.5	17.0	17.5	1.030	0.899	1.030	0.899	4	1
			144	5720	17.0	18.0	17.0	18.0	0.716	0.808	0.716	0.808		
	802.11a TXBF	2 Tx	140	5700	15.5	15.5	15.5	15.5	0.581	0.478	0.581	0.478		1
	802.11n HT20 STBC/SDM	2 Tx	100	5500	17.0	18.0	17.0	18.0	0.895	0.942	0.895	0.942		1
			120	5600	17.0	18.0	17.0	18.0	0.927	0.940	0.927	0.940		
144			5720	17.0	18.0	17.0	18.0	0.856	0.784	0.856	0.784			
802.11ac VHT20 CDD	2 Tx	136	5680	17.0	17.5	17.0	17.5	0.880	0.894	0.880	0.894		1	

Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Power (dBm)				1-g SAR (W/kg)				Plot No.	Note
					Tune-up limit		Measured		Measured		Scaled			
					Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1		
5.8	802.11a Legacy	1 Tx	149	5745	17.5		17.5		0.815		0.815			
			157	5785	17.5		17.5		0.753		0.753			
			165	5825	17.5		17.5		0.828		0.828		1	
			149	5745		18.0		18.0		0.677		0.677		
			157	5785		18.0		18.0		0.669		0.669		
			165	5825		18.0		18.0		0.665		0.665		
	802.11a CDD	2 Tx	149	5745	17.5	18.0	17.5	18.0	0.939	0.801	0.939	0.801	5	1
			157	5785	17.5	18.0	17.5	18.0	0.888	0.773	0.888	0.773		
			165	5825	17.5	18.0	17.5	18.0	0.866	0.899	0.866	0.899		
	802.11ac VHT20 CDD/STBC/SDM	2 Tx	149	5745	17.5	18.0	17.5	18.0	0.859	0.756	0.859	0.756		1

Note(s):

- Highest Report SAR results for the given mode in the corresponding frequencyband.

15.5. Bluetooth

15.5.1. Standalone SAR Test Exclusion Considerations

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$, for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- $f_{(\text{GHz})}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Lap-Held

Max. tune-up tolerance limit		Min. test separation distance (mm)	Frequency (GHz)	Result
(dBm)	(mW)			
4.0	3	5	2.480	0.791

Conclusion:

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

15.5.2. Estimated SAR

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

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

Estimated SAR Result for Body-worn Accessory Conditions:

Test Configuration	Max. tune-up tolerance limit (mW)	Min. test separation distance (mm)	Frequency (GHz)	Estimated 1-g SAR (W/kg)
Lap-Held	3	5	2.480	0.126

16. SAR Measurement Variability

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

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

16.1. The Highest Measured SAR Configuration in Each Frequency Band (Antenna Vendor A)

Band (GHz)	Test Position	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	1-g SAR (W/kg)	
						Measured	
						Chain 0	Chain 1
2.4	Lap Held	802.11b Legacy	2 Tx	11	2462	1.190	0.820

Band (GHz)	Test Position	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	1-g SAR (W/kg)	
						Measured	
						Chain 0	Chain 1
5.2	Lap Held	802.11a Legacy	1 Tx	48	5240		0.809
5.3	Lap Held	802.11a CDD	2 Tx	64	5320	1.010	1.140
5.5	Lap Held	802.11a Legacy	1 Tx	136	5680		1.190
5.8	Lap Held	802.11a CDD	2 Tx	165	5825	1.040	0.851

16.2. Repeated Measurement Results (Antenna Vendor A)

Band (GHz)	Test Position	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	1-g SAR (W/kg)		1-g SAR (W/kg)		Largest to Smallest SAR Ratio		Note
						Measured		Repeated		Chain 0	Chain 1	
						Chain 0	Chain 1	Chain 0	Chain 1			
2.4	Lap Held	802.11b Legacy	2 Tx	11	2462	1.190	0.820	1.170	0.800	1.02	1.03	2

Band (GHz)	Test Position	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	1-g SAR (W/kg)		1-g SAR (W/kg)		Largest to Smallest SAR Ratio		Note
						Measured		Repeated		Chain 0	Chain 1	
						Chain 0	Chain 1	Chain 0	Chain 1			
5.2	Lap Held	802.11a Legacy	1 Tx	48	5240		0.809		0.760		1.06	2
5.3	Lap Held	802.11a CDD	2 Tx	64	5320	1.010	1.140	0.944	1.080	1.07	1.06	2
5.5	Lap Held	802.11a Legacy	1 Tx	136	5680		1.190		1.110		1.07	2
5.8	Lap Held	802.11a CDD	2 Tx	165	5825	1.040	0.851	0.976	0.797	1.07	1.07	2

Note(s):

1. Not Applicable. Highest measured SAR is < 0.80 W/kg.

-
2. 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.

16.3. The Highest Measured SAR Configuration in Each Frequency Band (Antenna Vendor B)

Band (GHz)	Test Position	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	1-g SAR (W/kg)	
						Measured	
						Chain 0	Chain 1
2.4	Lap Held	802.11b Legacy	2 Tx	11	2462	1.170	0.752

Band (GHz)	Test Position	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	1-g SAR (W/kg)	
						Measured	
						Chain 0	Chain 1
5.2	Lap Held	802.11a Legacy	1 Tx	48	5240	0.552	
5.3	Lap Held	802.11a CDD	2 Tx	52	5260	1.040	1.050
5.5	Lap Held	802.11a CDD	2 Tx	136	5680	1.030	0.895
5.8	Lap Held	802.11a CDD	2 Tx	149	5745	0.939	0.801

16.4. Repeated Measurement Results (Antenna Vendor B)

Band (GHz)	Test Position	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	1-g SAR (W/kg)		1-g SAR (W/kg)		Largest to Smallest SAR Ratio		Note
						Measured		Repeated				
						Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	
2.4	Lap Held	802.11b Legacy	2 Tx	11	2462	1.170	0.752	1.110	0.736	1.05	1.02	2

Band (GHz)	Test Position	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	1-g SAR (W/kg)		1-g SAR (W/kg)		Largest to Smallest SAR Ratio		Note
						Measured		Repeated				
						Chain 0	Chain 1	Chain 0	Chain 1	Chain 0	Chain 1	
5.2	Lap Held	802.11a Legacy	1 Tx	48	5240	0.552		N/A		N/A		1
5.3	Lap Held	802.11a CDD	2 Tx	52	5260	1.040	1.050	1.020	1.020	1.02	1.03	2
5.5	Lap Held	802.11a CDD	2 Tx	136	5680	1.030	0.899	0.995	0.866	1.04	1.04	2
5.8	Lap Held	802.11a CDD	2 Tx	149	5745	0.939	0.801	0.881	0.751	1.07	1.07	2

Note(s):

1. Not Applicable. Highest measured SAR is < 0.80 W/kg.
2. 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.

17. Simultaneous Transmission SAR Analysis

KDB 447498 D01 General RF Exposure Guidance v05 requires the following equation for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

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

Where:

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

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

Ri is the separation distance between the pair of simultaneous transmitting antennas in millimeters. 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:

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

17.1. Sum of the SAR for WiFi 5 GHz Bands & Bluetooth (Antenna Vendor A)

Lap-Held

Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Data			Σ 1-g SAR (mW/g)
					Chain 0	Chain 1	Bluetooth	
5.2	802.11a Legacy	1 Tx	36	5180	0.676		0.126	0.802
			48	5240	0.728		0.126	0.854
			36	5180		0.779	0.126	0.905
			48	5240		0.809	0.126	0.935
	802.11a CDD	2 Tx	36	5180	0.297		0.126	0.423
						0.341	0.126	0.467
			48	5240	0.323		0.126	0.449
						0.321	0.126	0.447
	802.11n HT20 STBC/SDM	2 Tx	36	5180	0.513		0.126	0.639
						0.554	0.126	0.680
			48	5240	0.540		0.126	0.666
						0.554	0.126	0.680
802.11ac VHT20 SISO	1 Tx	36	5180	0.780		0.126	0.906	
Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Data			Σ 1-g SAR (mW/g)
					Chain 0	Chain 1	Bluetooth	
5.3	802.11a Legacy	1 Tx	52	5260	0.891		0.126	1.017
			64	5320	1.080		0.126	1.206
			52	5260		1.090	0.126	1.216
			64	5320		1.130	0.126	1.256
	802.11a CDD	2 Tx	52	5260	1.010		0.126	1.136
						1.130	0.126	1.256
			64	5320	1.010		0.126	1.136
						1.140	0.126	1.266
	802.11ac VHT20 CDD	2 Tx			1.050		0.126	1.176
			52	5260		1.090	0.126	1.216

Sum of the SAR with Scaled Values for the Worst-case Configuration

As the SAR for these configurations were measured at the maximum of tune-up tolerance limit, SAR scaling does not need to be applied.

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.

Conclusion:

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

Sum of the SAR for WiFi 5 GHz Bands & Bluetooth (Antenna Vendor A) continued

Lap-Held

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Data			Σ 1-g SAR (mW/g)
					Chain 0	Chain 1	Bluetooth	
5.5	802.11a Legacy	1 Tx	104	5520	1.020		0.126	1.146
			116	5580	1.140		0.126	1.266
			124	5620	0.899		0.126	1.025
			136	5680	1.090		0.126	1.216
			104	5520		1.180	0.126	1.306
			116	5580		1.130	0.126	1.256
			124	5620		1.080	0.126	1.206
			136	5680		1.190	0.126	1.316
	802.11a CDD	2 Tx	100	5500	1.080		0.126	1.206
						1.160	0.126	1.286
			116	5580	1.080		0.126	1.206
						0.974	0.126	1.100
			124	5620	0.961		0.126	1.087
						0.887	0.126	1.013
	802.11a TXBF	2 Tx	140	5700	0.787		0.126	0.913
						0.634	0.126	0.760
	802.11n HT20 STBC/SDM	2 Tx	100	5500	1.050		0.126	1.176
						1.160	0.126	1.286
			120	5600	1.120		0.126	1.246
						1.140	0.126	1.266
802.11ac VHT20 SISO	1 Tx	144	5710	1.020		0.126	1.146	
					0.921	0.126	1.047	
		136	5680		1.060	0.126	1.186	

Sum of the SAR with Scaled Values for the Worst-case Configuration

As the SAR for these configurations were measured at the maximum of tune-up tolerance limit, SAR scaling does not need to be applied.

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.

Conclusion:

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

Sum of the SAR for WiFi 5 GHz Bands & Bluetooth (Antenna Vendor A) continued

Lap-Held

Band (GHz)	Mode	No. of Transmitters	Ch #	Freq. (MHz)	Data			Σ 1-g SAR (mW/g)
					Chain 0	Chain 1	Bluetooth	
5.8	802.11a Legacy	1 Tx	149	5745	0.949		0.126	1.075
			157	5785	0.927		0.126	1.053
			165	5825	1.010		0.126	1.136
			149	5745		0.901	0.126	1.027
			157	5785		0.875	0.126	1.001
			165	5825		0.863	0.126	0.989
	802.11a CDD	2 Tx	149	5745	1.020		0.126	1.146
						0.869	0.126	0.995
			157	5785	0.995		0.126	1.121
						0.823	0.126	0.949
			165	5825	1.040		0.126	1.166
						0.851	0.126	0.977
802.11ac VHT20 CDD/STBC/SDM	2 Tx	149	5745	0.914		0.126	1.040	
					0.792	0.126	0.918	

Sum of the SAR with Scaled Values for the Worst-case Configuration

As the SAR for these configurations were measured at the maximum of tune-up tolerance limit, SAR scaling does not need to be applied.

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.

Conclusion:

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

17.2. Sum of the SAR for WiFi 5 GHz Bands & Bluetooth (Antenna Vendor B)

Lap-Held

Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Data			Σ 1-g SAR (mW/g)
					Chain 0	Chain 1	Bluetooth	
5.2	802.11a Legacy	1 Tx	36	5180	0.523		0.126	0.649
			48	5240	0.552		0.126	0.678
			36	5180		0.526	0.126	0.652
			48	5240		0.542	0.126	0.668
	802.11a CDD	2 Tx	36	5180	0.197		0.126	0.323
			48	5240	0.228		0.126	0.354
			36	5180		0.255	0.126	0.381
			48	5240		0.254	0.126	0.380
	802.11n HT20 STBC/SDM	2 Tx	36	5180	0.334		0.126	0.460
			48	5240	0.392		0.126	0.518
36			5180		0.407	0.126	0.533	
48			5240		0.400	0.126	0.526	
802.11ac VHT20 SISO	1 Tx	48	5240	0.551		0.126	0.677	

Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Data			Σ 1-g SAR (mW/g)
					Chain 0	Chain 1	Bluetooth	
5.3	802.11a Legacy	1 Tx	52	5260	0.765		0.126	0.891
			64	5320	0.853		0.126	0.979
			52	5260		0.733	0.126	0.859
			64	5320		0.737	0.126	0.863
	802.11a CDD	2 Tx	52	5260	1.040		0.126	1.166
			64	5320	0.974		0.126	1.100
			52	5260		1.050	0.126	1.176
			64	5320		1.030	0.126	1.156
	802.11ac VHT20 CDD	2 Tx	52	5260	0.759		0.126	0.885
			64	5320		0.893	0.126	1.019

Sum of the SAR with Scaled Values for the Worst-case Configuration

As the SAR for these configurations were measured at the maximum of tune-up tolerance limit, SAR scaling does not need to be applied.

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.

Conclusion:

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

Sum of the SAR for WiFi 5 GHz Bands & Bluetooth (Antenna Vendor B) continued

Lap-Held

Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Data			Σ 1-g SAR (mW/g)
					Chain 0	Chain 1	Bluetooth	
5.5	802.11a Legacy	1 Tx	104	5520	0.837		0.126	0.963
			116	5580	0.838		0.126	0.964
			124	5620	0.884		0.126	1.010
			136	5680	0.843		0.126	0.969
			104	5520		0.931	0.126	1.057
			116	5580		0.975	0.126	1.101
			124	5620		0.955	0.126	1.081
			136	5680		0.853	0.126	0.979
	802.11a CDD	2 Tx	100	5500	0.866		0.126	0.992
						0.959	0.126	1.085
			116	5580	0.928		0.126	1.054
						0.945	0.126	1.071
			124	5620	0.914		0.126	1.040
						0.906	0.126	1.032
	136	5680	1.03		0.126	1.156		
				0.899	0.126	1.025		
	144	5720	0.716		0.126	0.842		
				0.808	0.126	0.934		
	802.11a TXBF	2 Tx	140	5700	0.581		0.126	0.707
	802.11n HT20 STBC/SDM	2 Tx	100	5500	0.895		0.126	1.021
						0.942	0.126	1.068
			120	5600	0.927		0.126	1.053
						0.940	0.126	1.066
	144	5710	0.856		0.126	0.982		
			0.784	0.126	0.910			
802.11ac VHT20 CDD	2 Tx	136	5680	0.880		0.126	1.006	
					0.894	0.126	1.020	

Sum of the SAR with Scaled Values for the Worst-case Configuration

As the SAR for these configurations were measured at the maximum of tune-up tolerance limit, SAR scaling does not need to be applied.

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.

Conclusion:

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

Sum of the SAR for WiFi 5 GHz Bands & Bluetooth (Antenna Vendor B) continued

Lap-Held

Band (GHz)	Mode	No. of Transmitters	Ch #.	Freq. (MHz)	Data			Σ 1-g SAR (mW/g)
					Chain 0	Chain 1	Bluetooth	
5.8	802.11a Legacy	1 Tx	149	5745	0.815		0.126	0.941
			157	5785	0.753		0.126	0.879
			165	5825	0.828		0.126	0.954
			149	5745		0.677	0.126	0.803
			157	5785		0.669	0.126	0.795
			165	5825		0.665	0.126	0.791
	802.11a CDD	2 Tx	149	5745	0.939		0.126	1.065
						0.801	0.126	0.927
			157	5785	0.888		0.126	1.014
						0.773	0.126	0.899
			165	5825	0.866		0.126	0.992
						0.899	0.126	1.025
802.11ac VHT20 CDD/STBC/SDM	2 Tx	149	5745	0.859		0.126	0.985	
					0.756	0.126	0.882	

Sum of the SAR with Scaled Values for the Worst-case Configuration

As the SAR for these configurations were measured at the maximum of tune-up tolerance limit, SAR scaling does not need to be applied.

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.

Conclusion:

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

18. Appendixes

Refer to separated files for the following appendixes.

18.1. System Performance Check Plots

SAR system verification plot with the largest deviation from the dipole SAR target, for each dipole, SAR probe calibration point and SAR system combination is provided.

18.2. Highest SAR Test Plots for Antenna Vendor A

18.3. Highest SAR Test Plots for Antenna Vendor B

18.4. Calibration certificate for E-Field Probe EX3DV4 SN 3720

18.5. Calibration certificate for E-Field Probe EX3DV4 SN 3778

18.6. Calibration certificate for D2450V2 SN 826

18.7. Calibration certificate for D5GHzV2 SN 1003