

### FCC 47 CFR PART 15 SUBPART E

### **CLASS II PERMISSIVE CHANGE**

FOR

802.11a/b/g/n/ac WLAN + BLUETOOTH PCI-E MINI CARD

MODEL NUMBER: BCM94352Z

FCC ID: QDS-BRCM1076

REPORT NUMBER: 15U22567-E1V3

**ISSUE DATE: JANUARY 20, 2016** 

Prepared for BROADCOM CORPORATION 190 MATHILDA PLACE SUNNYVALE CA, 94086, USA

Prepared by UL VERIFICATION SERVICES INC. 47173 BENICIA STREET FREMONT, CA 94538, U.S.A. TEL: (510) 771-1000 FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

### **Revision History**

Rev.	Issue Date	Revisions	Revised By
V1	1/7/16	Initial Issue	H. Mustapha
V2	1/19/16	Updated section 6 with equipment list from original report Added Note 2 to sections 8.2.1 and 8.3.1 Updated section 9.1 with the test procedure	H. Mustapha
V3	1/20/16	Updated section 5.7 with justification statement regarding antenna port tests	H. Mustapha

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 2 of 98

# **TABLE OF CONTENTS**

1.	ATT	ESTATION OF TEST RESULTS	5
2.	TES	T METHODOLOGY	7
3.	FAC	ILITIES AND ACCREDITATION	. 7
4.	CAL	IBRATION AND UNCERTAINTY	7
4	.1.	MEASURING INSTRUMENT CALIBRATION	7
4	.2.	SAMPLE CALCULATION	. 7
4	.3.	MEASUREMENT UNCERTAINTY	8
5.	EQU	IIPMENT UNDER TEST	. 9
5	5.1.	DESCRIPTION OF EUT	. 9
5	5.2.	MAXIMUM OUTPUT POWER	9
5	5.3.	LIST OF TEST REDUCTION AND MODES COVERING OTHER MODES	.10
5	5.4.	DESCRIPTION OF AVAILABLE ANTENNAS	.11
5	5.5.	SOFTWARE AND FIRMWARE	.11
5	5.6.	DESCRIPTION OF CLASS II PERMISSIVE CHANGE	.11
5	5.7.	WORST-CASE CONFIGURATION AND MODE	.12
5	5.8.	DESCRIPTION OF TEST SETUP	.13
6.	TES	T AND MEASUREMENT EQUIPMENT	.15
6. 7.	TES <sup>®</sup>	T AND MEASUREMENT EQUIPMENT	.15
6. 7. 8.	TES MEA ANT	T AND MEASUREMENT EQUIPMENT ASUREMENT METHODS ENNA PORT TEST RESULTS	.15 .16 .17
6. 7. 8.	TES <sup>•</sup> MEA ANT 3.1.	T AND MEASUREMENT EQUIPMENT ASUREMENT METHODS TENNA PORT TEST RESULTS ON TIME AND DUTY CYCLE	.15 .16 .17 .17
6. 7. 8. 8	TES MEA ANT 8.1. 8.2.1 8.2.1	T AND MEASUREMENT EQUIPMENT ASUREMENT METHODS TENNA PORT TEST RESULTS ON TIME AND DUTY CYCLE	.15 .16 .17 .17 .20 .20
6. 7. 8. 8 8	TES MEA ANT 8.1. 8.2. 8.2.1 8.2.1 8.2.1	T AND MEASUREMENT EQUIPMENT ASUREMENT METHODS ENNA PORT TEST RESULTS ON TIME AND DUTY CYCLE	.15 .16 .17 .17 .20 .20 .22
6. 7. 8. 8 8	<b>MEA</b> <b>ANT</b> 8.1. 8.2. 8.2.1 8.3.1	T AND MEASUREMENT EQUIPMENT	.15 .16 .17 .17 .20 .20 .22 .22
6. 7. 8. 8 8 8 8	TES   MEA   ANT   8.1.   8.2.1   8.2.1   8.3.1   8.4.1   8.4.1	T AND MEASUREMENT EQUIPMENT ASUREMENT METHODS ENNA PORT TEST RESULTS ON TIME AND DUTY CYCLE 802.11a SISO MODE IN THE 5.8 GHz BAND OUTPUT POWER 802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND OUTPUT POWER 802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND 6 dB BANDWIDTH	.15 .16 .17 .20 .20 .22 .22 .22 .24 .24
6. 7. 8. 8 8 8 8 8 8	TES MEA ANT 8.1. 8.2. 8.2.1 8.3.1 8.3.1 8.4.1 8.4.2	ASUREMENT METHODS TENNA PORT TEST RESULTS ON TIME AND DUTY CYCLE 802.11a SISO MODE IN THE 5.8 GHz BAND OUTPUT POWER 802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND OUTPUT POWER 802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND 0 UTPUT POWER 802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND 0 UTPUT POWER	.15 .16 .17 .20 .20 .22 .22 .22 .22 .24 .24 .24
6. 7. 8. 8 8 8 8 8	TES MEA ANT 8.1. 8.2. 8.3.1 8.3.1 8.4.1 8.4.2 8.4.3	ASUREMENT METHODS ASUREMENT METHODS TENNA PORT TEST RESULTS ON TIME AND DUTY CYCLE 802.11a SISO MODE IN THE 5.8 GHz BAND OUTPUT POWER 802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND OUTPUT POWER 802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND 0 UTPUT POWER 802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND 0 UTPUT POWER 802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND 0 UTPUT POWER 802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND 802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND 802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND 802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND	.15 .16 .17 .20 .22 .22 .22 .24 .24 .28 .30
6. 7. 8. 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	TES MEA ANT 2.1. 8.2. 8.3.1 8.4.1 8.4.2 8.4.3 8.4.3 8.4.3 8.4.3 8.5.1	T AND MEASUREMENT EQUIPMENT   ASUREMENT METHODS   SENNA PORT TEST RESULTS   ON TIME AND DUTY CYCLE   802.11a SISO MODE IN THE 5.8 GHz BAND   OUTPUT POWER   802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND   OUTPUT POWER   802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND   6 dB BANDWIDTH   2. OUTPUT POWER   3. Maximum Power Spectral Density (PSD)   802.11n HT40 SISO MODE IN THE 5.8 GHz BAND   1. OUTPUT POWER	.15 .16 .17 .20 .22 .22 .22 .22 .24 .24 .28 .30 .35 .35
6. 7. 8. 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	TES   MEA   ANT   2.1.   8.2.1   8.2.1   8.2.1   8.2.1   8.2.1   8.2.1   8.2.1   8.2.1   8.3.1   8.4.2   8.4.3   8.4.3   8.5.1   8.6.   8.6.	T AND MEASUREMENT EQUIPMENT   ASUREMENT METHODS   SENNA PORT TEST RESULTS   ON TIME AND DUTY CYCLE   802.11a SISO MODE IN THE 5.8 GHz BAND   I. OUTPUT POWER   802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND   I. OUTPUT POWER   802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND   I. OUTPUT POWER   802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND   I. OUTPUT POWER   802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND   I. OUTPUT POWER   3. Maximum Power Spectral Density (PSD)   802.11n HT40 SISO MODE IN THE 5.8 GHz BAND   I. OUTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   I. OUTPUT POWER	.15 .16 .17 .20 .22 .22 .22 .22 .22 .24 .24 .28 .30 .35 .35 .35 .37
6. 7. 8. 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	TES MEA ANT 2.1. 8.2.1 8.2.1 8.2.1 8.3.1 8.4.2 8.4.1 8.4.2 8.4.3 8.5.1 8.5.1 8.6.1 8.6.1 8.6.1	T AND MEASUREMENT EQUIPMENT   ASUREMENT METHODS   SUREMENT METHODS   PENNA PORT TEST RESULTS   ON TIME AND DUTY CYCLE   802.11a SISO MODE IN THE 5.8 GHz BAND   OUTPUT POWER   802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND   OUTPUT POWER   802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND   OUTPUT POWER   802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND   6 dB BANDWIDTH   2. OUTPUT POWER   3. Maximum Power Spectral Density (PSD)   802.11n HT40 SISO MODE IN THE 5.8 GHz BAND   0. OUTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   6 dB BANDWIDTH   6 dB BANDWIDTH   7 OUTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   1 6 dB BANDWIDTH   2 OUTPUT POWER	.15 .16 .17 .20 .20 .22 .22 .22 .22 .22 .22 .22 .22
6. 7. 8. 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	TES MEA ANT 3.1. 3.2. 8.2.1 3.3. 8.3.1 3.4. 8.4.1 8.4.2 8.4.3 8.4.1 8.4.2 8.5.1 8.5.1 8.6.1 8.6.2 8.6.3	TAND MEASUREMENT EQUIPMENT   ASUREMENT METHODS   SUREMENT METHODS   ENNA PORT TEST RESULTS   ON TIME AND DUTY CYCLE   802.11a SISO MODE IN THE 5.8 GHz BAND   OUTPUT POWER   802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND   I. OUTPUT POWER   802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND   I. OUTPUT POWER   802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND   I. 6 dB BANDWIDTH   2. OUTPUT POWER   3. Maximum Power Spectral Density (PSD)   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   I. 0UTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   I. 0UTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   I. 0UTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   I. 0UTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   I. 6 dB BANDWIDTH   2. 0UTPUT POWER   3. Maximum Power Spectral Density (PSD)	.15 .16 .17 .20 .22 .22 .24 .24 .24 .28 .30 .35 .35 .37 .37 .40 .42
6. 7. 8. 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	TES MEA ANT 2.1. 8.2. 8.3.1 8.4.1 8.4.2 8.4.3 8.4.1 8.4.2 8.4.3 8.5.1 8.5.1 8.6.2 8.6.1 8.6.2 8.6.3 8.6.2 8.6.3 8.6.3 8.6.3	TAND MEASUREMENT EQUIPMENT   ASUREMENT METHODS   SUREMENT METHODS   ENNA PORT TEST RESULTS   ON TIME AND DUTY CYCLE   802.11a SISO MODE IN THE 5.8 GHz BAND   OUTPUT POWER   802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND   OUTPUT POWER   802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND   6 dB BANDWIDTH   2 OUTPUT POWER   3. Maximum Power Spectral Density (PSD)   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   1. OUTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   1. OUTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   1. OUTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   1. OUTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   2. OUTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   3. Maximum Power Spectral Density (PSD)   802.11a CHT80 SISO MODE IN THE 5.8 GHz BAND   802.11a CHT80 SISO MODE IN THE 5.8 GHz BAND	.15 .16 .17 .20 .22 .22 .24 .24 .24 .24 .22 .22 .24 .24
6. 7. 8. 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	TES MEA ANT 2.1. 2.2. 8.2.1 2.3. 8.3.1 2.4. 8.4.1 8.4.2 8.4.3 2.5. 8.5.1 8.6.1 8.6.2 8.6.1 8.6.2 8.6.3 8.6.2 8.6.3 8.7.	AND MEASUREMENT EQUIPMENT   ASUREMENT METHODS   ENNA PORT TEST RESULTS   ON TIME AND DUTY CYCLE   802.11a SISO MODE IN THE 5.8 GHz BAND   OUTPUT POWER   802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND   OUTPUT POWER   802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND   OUTPUT POWER   802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND   OUTPUT POWER   802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND   6 dB BANDWIDTH   2. OUTPUT POWER   3. Maximum Power Spectral Density (PSD)   802.11n HT40 SISO MODE IN THE 5.8 GHz BAND   . OUTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   . OUTPUT POWER   802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND   . OUTPUT POWER   802.11n HT40 SISO MODE IN THE 5.8 GHz BAND   . OUTPUT POWER   3. Maximum Power Spectral Density (PSD)   802.11ac HT80 SISO MODE IN THE 5.8 GHz BAND   . Page 3 of 98   ICATION SERVICES INC.	.15   .16   .17   .20   .22   .24   .28   .30   .35   .37   .40   .42   .46   .01.1

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

8	.7.1.	OUTPUT POWER	.46
8.8	. 802	2.11n HT80 CDD 2Tx MODE IN THE 5.8 GHz BAND	.48
8	.8.1.		.48
8	.8.3.	Maximum Power Spectral Density (PSD)	.50
0 5			55
Э. Г	ADIAI		.55
9.1	. LIM	IITS AND PROCEDURE	.55
9.2	. TX	ABOVE 1 GHz 802.11a MODE SISO IN THE 5.8 GHz BAND	.56
9.3	. TX	ABOVE 1 GHz 802.11n HT20 MODE 1Tx IN THE 5.8 GHz BAND	.59
9.4	. TX	ABOVE 1 GHz 802.11n HT20 MODE 2Tx IN THE 5.8 GHz BAND	.61
9.5	. TX	ABOVE 1 GHz 802.11n HT40 MODE 1Tx IN THE 5.8 GHz BAND	.71
9.6	. TX	ABOVE 1 GHz 802.11n HT40 MODE 2Tx IN THE 5.8 GHz BAND	.73
9.7	. TX	ABOVE 1 GHz 802.11ac HT80 MODE 1Tx IN THE 5.8 GHz BAND	.79
9.8	. TX	ABOVE 1 GHz 802.11ac HT80 MODE 2Tx IN THE 5.8 GHz BAND	.81
9.9	. WC	DRST-CASE BELOW 1 GHz	.85
9.1	0. V	VORST-CASE ABOVE 18GHz	.88
10.	AC PC	OWER LINE CONDUCTED EMISSIONS	.92
11.	SETU	P PHOTOS	.95

Page 4 of 98

### **1. ATTESTATION OF TEST RESULTS**

COMPANY NAME:	BROADCOM CORPORATION 190 MATHILDA PLACE SUNNYVALE, CA 94086, U.S.A.	
EUT DESCRIPTION:	802.11a/b/g/n/ac WLAN + Bluetoo	th PCI-E Mini Card
MODEL:	BCM94352Z	
SERIAL NUMBER:	SN145	
DATE TESTED:	January 5 ~ 7, 2016 May 22 ~ 31, 2013	
	APPLICABLE STANDARDS	
STA	NDARD	TEST RESULTS
CFR 47 Pa	art 15 Subpart E	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.

Page 5 of 98

Approved & Released For UL Verification Services Inc. By:

Huda Mustapha

HUDA MUSTAPHA PROJECT LEAD UL Verification Services Inc.



FRANK IBRAHIM PROGRAM MANAGER UL Verification Services Inc. Tested By:

Lionel Lara

LIONEL LARA EMC ENGINEER UL Verification Services Inc.

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 6 of 98

# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033 D02 v01, KDB 662911 D01 v02r01 and ANSI C63.10-2013.

# 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street		
Chamber A	Chamber D		
🖂 Chamber B	🗌 Chamber E		
Chamber C	Chamber F		
	🗌 Chamber G		
	Chamber H		

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through H are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-8, respectively.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <u>http://ts.nist.gov/standards/scopes/2000650.htm</u>.

# 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.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided: Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) - Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB - 26.9 dB = 28.9 dBuV/m

Page 7 of 98

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	± 3.52 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.94 dB
Radiated Disturbance, 1 to 6 GHz	± 3.86 dB
Radiated Disturbance, 6 to 18 GHz	± 4.23 dB
Radiated Disturbance, 18 to 26 GHz	± 5.30 dB
Radiated Disturbance, 26 to 40 GHz	± 5.23 dB

Uncertainty figures are valid to a confidence level of 95%.

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 8 of 98

# 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is an 802.11 a/b/g/n/ac WLAN + Bluetooth PCI-E Mini Card.

The radio module is manufactured by Broadcom.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Power, Chain 0 (dBm)	Power, Chain 1 (dBm)	Output Power (dBm)	Output Power (mW)	
5.8 GHz band, 1TX						
5745-5825	802.11a Legacy	20.15	N/A	20.15	103.51	
5745-5825	802.11n HT20	20.22	N/A	20.22	105.20	
5755-5795	802.11n HT40	20.03	N/A	20.03	100.69	
5775	802.11ac VHT80	15.13	N/A	15.13	32.58	
5.8 GHz band, 2TX						
5745-5825	802.11n HT20 CDD	19.98	19.87	22.94	196.59	
5755-5795	802.11n HT40 CDD	18.77	18.33	21.57	143.41	
5775	802.11ac VHT80 CDD	13.65	13.51	16.59	45.61	

Page 9 of 98

# 5.3. LIST OF TEST REDUCTION AND MODES COVERING OTHER MODES

### List of test reduction (Non Beam-Forming modes)

Antenna Port Testing					
Band	Mode	Covered by			
5 GHz bands	802.11a Legacy 1TX	802.11n HT20 CDD 2TX			
5 GHz bands	802.11a CDD 2TX	802.11n HT20 CDD 2TX			
5 GHz bands	802.11n HT20 CDD 1TX	802.11n HT20 CDD 2TX			
5 GHz bands	802.11n HT40 1TX	802.11n HT40 CDD 2TX			
5 GHz bands	802.11ac VHT80 1TX	802.11ac VHT80 CDD 2TX			

Radiated Testing						
Band	Mode	Covered by				
5 GHz bands	802.11a Legacy 1TX (Harmonics)	802.11n HT20 CDD 2TX (Harmonics)				
5 GHz bands	802.11a CDD 2TX	802.11n HT20 CDD 2TX				
5 GHz bands	802.11n HT20 CDD 1TX (Harmonics)	802.11n HT20 CDD 2TX (Harmonics)				
5 GHz bands	802.11n HT40 1TX (Harmonics)	802.11n HT40 CDD 2TX (Harmonics)				
5 GHz bands	802.11ac VHT80 1TX (Harmonics)	802.11ac VHT80 CDD 2TX (Harmonics)				

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 10 of 98

### 5.4. DESCRIPTION OF AVAILABLE ANTENNAS

Set No.	Antenna Manufacturer	Antenna Type	Model	Peakgain (2400 - 2462 MHz) @2462MHz	Peak gain (5150- 5250MH z) (@5180MHz	Peak gain (5250- 5350MHz) @5320MHz	Peak gain (5470-5725MHz) @5580	Peak gain (5725- 5850MHz) @5745MHz
1	Ethertronics	802.11bgn WLAN Anterna	1000802	3.8	N/a	N/a	N∕a	N∕a
1	Ethertronics	802.11bgn WLAN Anterna	1000802	3.8	N/a	N/a	N∕a	N∕a
2	Ethertronics	802.11 5 GHz WLAN antenna	1000615a	N∕a	42	4.5	6.6	5.4
2	Ethertronics	802.11 5 GHz WLAN antenna	1000615a	N∕a	42	4.5	6.6	5.4

### Note:

This table includes two sets of antennas, first set is identified by number (1) in the first column, and the second set is identified by number (2) in the first column.

### 5.5. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, rev. 6.30.223.98.

The test utility software used during testing was BCM Internal, rev. 6.30.RC223.98.

### 5.6. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The purpose of this C2PC is to upgrade the device described under section 5.1 of this report to the new rules per KDB 789033 D02 v01.

All data in this report is for operation in the UNII-3 band.

For UNII-1, UNII-2 and UNII-2C bands, we have reviewed the original test report for (report no. 13U15029-2B) and are hereby attesting that all the current technical requirements are still met and all applicable test procedures remain the same. Therefore, the original test report is still applicable and no additional testing is done.

Page 11 of 98

### 5.7. WORST-CASE CONFIGURATION AND MODE

The EUT was tested as an external module installed in a test jig board connected to a host Laptop PC.

Worst-Case data rates, as provided by the client, were as follows:

For 5.8 GHz Band: 802.11a: 6 Mb/s. 802.11n 20MHz: MCS0. 802.11n 40MHz: MCS0. 802.11ac VHT80MHz: MCS0.

Worst-case mode and channel used for 30-1000 MHz radiated and power line conducted emissions was the mode and channel with the highest output power.

For Radiated Band Edge measurements, preliminary testing showed that the worst case was horizontal polarization, so final measurements were performed with horizontal polarization only.

For all modes with single chain, chain 0 (connector J0, Main port) was selected per the software provided by the client.

For antenna port testing, 2TX modes were considered worst case, where testing was performed at power levels, per transmit chain, greater than or equal to the maximum power in any 1TX mode.

Page 12 of 98

### 5.8. DESCRIPTION OF TEST SETUP

#### SUPPORT EQUIPMENT

Support Equipment List							
Description   Manufacturer   Model   Serial Number   FCC ID							
Laptop	Lenovo	G560	CB06427441	DoC			
AC Adapter	Lenovo	PA-1650-56LC	11S36001651ZZ40008KCMA	DoC			
Adapter Board	Broadcom	BCM9NGFF2EC_1	1822863	N/A			

### I/O CABLES

I/O Cable List							
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks	
1	AC	2	US 115V	Unshielded	1	NA	
2	DC	2	DC	Unshielded	1.8	Ferrite at laptop's end	

#### TEST SETUP

The EUT is attached to a jig board which is installed in the PCI-E slot of a host laptop computer during the tests. Test software exercised the radio card.

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 13 of 98

### SETUP DIAGRAM FOR TESTS



# 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List						
Description	Manufacturer	Model	T No.	Cal Date	Cal Due	
Radiated Software	UL	UL EMC	V	er 9.5, June 6,	2015	
Conducted Software	UL	UL EMC	V	'er 9.5, May 17	2012	
Horn Antenna 1-18GHz	ETS	3117	136	01/15/15	01/15/16	
Horn Antenna 18-26GHz	ARA	MWH-1826	447	05/12/15	05/12/16	
Horn Antenna 26.5- 40GHz	ARA	MWH-2640/B	90	07/28/15	07/28/16	
Preamp 10kHz-1000MHz	HP	8447D	10	01/16/15	01/16/16	
Preamp 1-8GHz	Miteq	AMF-4D-01000800-30-29P	782	10/22/15	10/22/16	
Preamp 1-26.5GHz	Agilent	8449B	404	04/13/15	04/13/16	
Amplifier, 26-40GHz	Miteq	NSP4000-SP2	88	04/07/15	04/07/16	
Spectrum Analyzer 3kHz - 44GHz	Agilent	N9030A	907	05/15/15	05/15/16	
3GHz HPF	Micro-Tronics	HPM17543	485	01/16/15	01/16/16	
5GHz LPF	Micro-Tronics	LPS17541	482	01/16/15	01/16/16	
6GHz HPF	Micro-Tronics	HPS17542	483	01/16/15	01/16/16	
EMI Test Receiver	Rohde & Schwarz	ECSI 7	1124	09/30/15	09/30/16	
Power Meter	Agilent	N1911A	T1268	06/07/15	06/07/16	
Power Sensor	Agilent	N1921A	1223	06/07/15	02/06/16	
LISN for Conducted Emission	FCC	50/250-25-2	24	01/16/15	01/16/16	

### Equipment list from original report 13U15029-2B

Test Equipment List								
Description	Manufacturer	Model	Asset	Cal Date	Cal Due			
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/13/11	12/13/13			
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00986	04/01/13	04/01/14			
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	1000741	07/13/12	07/06/13			
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/08/12	08/08/13			
Peak Power Meter	Agilent / HP	E4416A	C00963	12/13/11	12/13/13			
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/13/11	12/13/13			
Antenna, Horn, 18 GHz	ETS	3117	C01022	02/21/13	02/21/14			
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00946	11/12/12	11/12/13			
Antenna, Horn, 40 GHz *	ARA	MWH-2640/B	C00981	06/14/12	06/14/13			
Antenna, Horn, 40GHz	ARA	MWH-2640/B	F00194	05/14/13	05/14/14			
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	C00885	08/14/12	08/14/13			
Preamplifier, 1300 MHz	Agilent / HP	8447D	C01016	01/16/13	01/16/14			
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	10/22/12	10/22/13			
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	08/02/11	08/02/13			
LISN, 30 MHz	FCC	50/250-25-2	N02396	08/08/12	08/08/13			
Reject Filter, 5.15-5.35 GHz	Micro-Tronics	BRC13190	N02680	CNR	CNR			
Reject Filter, 5.47-5.725 GHz	Micro-Tronics	BRC13191	N02678	CNR	CNR			
Reject Filter, 5.725-5.825 GHz	Micro-Tronics	BRC13192	N02676	CNR	CNR			

\* Equipment not used after 6/14/2013

Page 15 of 98

## 7. MEASUREMENT METHODS

On Time and Duty Cycle: KDB 789033 D02 v01, Section B.

6 dB Emission BW: KDB 789033 D02 v01, Section C.2.

Conducted Output Power: KDB 789033 D02 v01, Section E.3.b (Method PM-G), and KDB 662911 D01 v02r01.

Power Spectral Density: KDB 789033 D02 v01, Section F, and KDB 662911 D01 v02r01.

Unwanted emissions in restricted bands: KDB 789033 D02 v01, Sections G.2, G.3, G.4, G.5, and G.6.

<u>Unwanted emissions in non-restricted bands</u>: KDB 789033 D02 v01, Sections G.2, G.3, G.4, and G.5.

AC Power-line conducted emissions: ANSI C63.10-2013, Section 6.2.

Page 16 of 98

# 8. ANTENNA PORT TEST RESULTS

### 8.1. ON TIME AND DUTY CYCLE

### **LIMITS**

None; for reporting purposes only.

### **ON TIME AND DUTY CYCLE RESULTS**

Mode	<b>ON</b> Time	Period	Duty Cycle	Duty	Duty Cycle	1/B
	В		x	Cycle	<b>Correction Factor</b>	Minimum VBW
	(msec)	(msec)	(linear)	(%)	(dB)	(kHz)
5GHz Band						
802.11a 1TX	2.064	2.082	0.991	99.14%	0.00	0.010
802.11n HT20 CDD 2TX	1.920	1.938	0.991	99.07%	0.00	0.010
802.11n HT40 CDD 2TX	0.942	0.960	0.981	98.13%	0.00	0.010
802.11ac VHT80 CDD 2TX	0.460	0.477	0.964	96.44%	0.16	2.174

Page 17 of 98

### DUTY CYCLE PLOTS





Page 18 of 98





Page 19 of 98

### 8.2. 802.11a SISO MODE IN THE 5.8 GHz BAND

### 8.2.1. OUTPUT POWER

### <u>LIMITS</u>

FCC §15.407 (a) (3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **DIRECTIONAL ANTENNA GAIN**

This is SISO mode, AG is the highest (worst-case) = 5.4 dBi

Page 20 of 98

### **RESULTS**

#### Antenna Gain and Limit

Channel	Frequency	Directional	Power
		Gain	Limit
		for Power	
	(MHz)	(dBi)	(dBm)
Low	5745	5.40	30.00
153	5765	5.40	30.00
High	5825	5.40	30.00

### **Output Power Results**

Channel	Frequency	Chain 0	Total	Power	Power
		Meas	Corr'd	Limit	Margin
		Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5745	19.03	19.03	30.00	-10.97
153	5765	20.11	20.11	30.00	-9.89
High	5825	20.15	20.15	30.00	-9.85

<u>Note 1:</u> the power readings above were measured with gated method, and the measurement was taken only during the ON time. No duty cycle correction was necessary.

Note 2: Mid channel was not tested as it was considered covered by testing 11n HT20 2Tx (CDD).

Page 21 of 98

### 8.3. 802.11n HT20 CDD SISO MODE IN THE 5.8 GHz BAND

### 8.3.1. OUTPUT POWER

### <u>LIMITS</u>

FCC §15.407 (a) (3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **DIRECTIONAL ANTENNA GAIN**

This is SISO mode, AG is the highest (worst-case) = 5.4 dBi

Page 22 of 98

#### **RESULTS**

#### Antenna Gain and Limit

Channel	Frequency	Directional	Power
		Gain	Limit
		for Power	
	(MHz)	(dBi)	(dBm)
Low	5745	5.40	30.00
High	5825	5 40	30.00

### **Output Power Results**

Channel	Frequency	Chain 0	Total	Power	Power
		Meas	Corr'd	Limit	Margin
		Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5745	17.53	17.53	30.00	-12.47
High	5825	20.22	20.22	30.00	-9 78

<u>Note 1:</u> the power readings above were measured with gated method, and the measurement was taken only during the ON time. No duty cycle correction was necessary.

<u>Note 2:</u> Mid channel was not tested as it was considered covered by testing 11n HT20 2Tx (CDD).

Page 23 of 98

### 8.4. 802.11n HT20 CDD 2Tx MODE IN THE 5.8 GHz BAND

### 8.4.1. 6 dB BANDWIDTH

### <u>LIMITS</u>

FCC §15.247 (a) (2)

The minimum 6 dB bandwidth shall be at least 500 kHz.

### **RESULTS**

Channel	Frequency	6 dB BW	6 dB BW	Minimum
		Chain 0	Chain 1	Limit
	(MHz)	(MHz)	(MHz)	(MHz)
Low	5745	17.355	17.628	0.5
Mid	5785	17.472	17.615	0.5
High	5825	17.667	17.381	0.5

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 24 of 98

#### 6 dB BANDWIDTH, Chain 0





Page 25 of 98



#### 6 dB BANDWIDTH, Chain 1



Page 26 of 98





UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 27 of 98

### 8.4.2. OUTPUT POWER

#### **LIMITS**

FCC §15.407 (a) (3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### **DIRECTIONAL ANTENNA GAIN**

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain, 5.4 dBi

Page 28 of 98

#### **RESULTS**

#### Antenna Gain and Limit

Channel	Frequency	Directional	Power
		Gain	Limit
		for Power	
	(MHz)	(dBi)	(dBm)
Low	5745	5.40	30.00
153	5765	5.40	30.00
Mid	5785	5.40	30.00
High	5825	5.40	30.00

#### **Output Power Results**

Channel	Frequency	Chain 0	Chain 1	Total	Power	Power
		Meas	Meas	Corr'd	Limit	Margin
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5745	15.62	15.74	18.69	30.00	-11.31
153	5765	19.83	19.86	22.86	30.00	-7.14
Mid	5785	19.98	19.87	22.94	30.00	-7.06
High	5825	19.02	18.66	21.85	30.00	-8.15

**Note:** the power readings above were measured with gated method, and the measurement was taken only during the ON time. No duty cycle correction was necessary.

Page 29 of 98

### 8.4.3. Maximum Power Spectral Density (PSD)

#### <u>LIMITS</u>

FCC §15.407 (a) (3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### **DIRECTIONAL ANTENNA GAIN**

The TX chains are correlated and the antenna gain is the same for each chain. The directional gain is:

Antenna	10 * Log (2 chains)	<b>Correlated Chains</b>
Gain		<b>Directional Gain</b>
(dBi)	(dB)	(dBi)
5.40	3.01	8.41

Page 30 of 98

#### **RESULTS**

#### Antenna Gain and Limits

Channel	Frequency	Directional	PSD
		Gain	Limit
	(MHz)	(dBi)	(dBm)
Low	5745	8.41	27.59
Mid	5785	8.41	27.59
High	5825	8.41	27.59

Duty Cycle CF (dB) 0.00 Included in Calculations of Corr'd PSD

#### **PSD Results**

Channel	Frequency	Chain 0	Chain 1	Total	PSD	PSD
		Meas	Meas	Corr'd	Limit	Margin
		PSD	PSD	PSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5745	5.241	5.134	8.198	27.59	-19.39
Mid	5785	5.764	5.374	8.584	27.59	-19.01
High	5825	5.791	5.396	8.608	27.59	-18.98

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 31 of 98

### PSD, Chain 0





Page 32 of 98



#### PSD, Chain 1



Page 33 of 98





Page 34 of 98

### 8.5. 802.11n HT40 SISO MODE IN THE 5.8 GHz BAND

### 8.5.1. OUTPUT POWER

### <u>LIMITS</u>

FCC §15.407 (a) (3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **DIRECTIONAL ANTENNA GAIN**

This is SISO mode, AG is the highest (worst-case) = 5.4 dBi

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 35 of 98

### **RESULTS**

#### Antenna Gain and Limit

Channel	Frequency	Directional	Power	
		Gain	Limit	
	(MHz)	(dBi)	(dBm)	
Low	5755	5.40	30.00	
High	5795	5.40	30.00	

### **Output Power Results**

Channel	Frequency	Chain 0	Total	Power	Power
		Meas	Corr'd	Limit	Margin
		Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5755	16.35	16.35	30.00	-13.65
High	5795	20.03	20.03	30.00	-9.97

**Note:** the power readings above were measured with gated method, and the measurement was taken only during the ON time. No duty cycle correction was necessary.

Page 36 of 98
# 8.6. 802.11n HT40 CDD 2Tx MODE IN THE 5.8 GHz BAND

## 8.6.1. 6 dB BANDWIDTH

## <u>LIMITS</u>

FCC §15.247 (a) (2)

The minimum 6 dB bandwidth shall be at least 500 kHz.

## **RESULTS**

Channel	Frequency	6 dB BW	6 dB BW	Minimum
		Chain 0	Chain 1	Limit
	(MHz)	(MHz)	(MHz)	(MHz)
Low	5755	36.210	36.480	0.5
High	5795	36.547	36.245	0.5

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 37 of 98

### 6 dB BANDWIDTH, Chain 0





Page 38 of 98

### 6 dB BANDWIDTH, Chain 1





Page 39 of 98

## 8.6.2. OUTPUT POWER

### **LIMITS**

FCC §15.407 (a) (3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **DIRECTIONAL ANTENNA GAIN**

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain, 5.4 dBi

Page 40 of 98

## **RESULTS**

#### Antenna Gain and Limit

Channel	Frequency	Directional	Power
		Gain	Limit
	(MHz)	(dBi)	(dBm)
Low	5755	5.40	30.00
High	5795	5.40	30.00

## **Output Power Results**

Channel	Frequency	Chain 0	Chain 1	Total	Power	Power
		Meas	Meas	Corr'd	Limit	Margin
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5755	14.39	14.18	17.30	30.00	-12.70
High	5795	18 77	18.33	21.57	30.00	-8 43

**Note:** the power readings above were measured with gated method, and the measurement was taken only during the ON time. No duty cycle correction was necessary.

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 41 of 98

# 8.6.3. Maximum Power Spectral Density (PSD)

## **LIMITS**

FCC §15.407 (a) (3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **DIRECTIONAL ANTENNA GAIN**

The TX chains are correlated and the antenna gain is the same for each chain. The directional gain is:

Antenna	10 * Log (2 chains)	<b>Correlated Chains</b>
Gain		<b>Directional Gain</b>
(dBi)	(dB)	(dBi)

Page 42 of 98

#### **RESULTS**

#### Antenna Gain and Limit

Channel	Frequency	Directional	PSD
		Gain	Limit
	(MHz)	(dBi)	(dBm)
Low	5755	8.41	27.59
High	5795	8.41	27.59

#### Duty Cycle CF (dB) 0.00 Included in Calculations of Corr'd PSD

#### **PSD Results**

Channel	Frequency	Chain 0	Chain 1	Total	PSD	PSD
		Meas	Meas	Corr'd	Limit	Margin
		PSD	PSD	PSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5755	2.984	2.743	5.875	27.59	-21.71
High	5795	2.959	3.194	6.088	27.59	-21.50

Page 43 of 98

#### PSD, Chain 0





Page 44 of 98

### PSD, Chain 1





Page 45 of 98

# 8.7. 802.11ac HT80 SISO MODE IN THE 5.8 GHz BAND

# 8.7.1. OUTPUT POWER

## <u>LIMITS</u>

FCC §15.407 (a) (3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## **DIRECTIONAL ANTENNA GAIN**

This is SISO mode, AG is the highest (worst-case) = 5.4 dBi

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 46 of 98

## **RESULTS**

#### Antenna Gain and Limit

Channel	Frequency	Directional	Power
		Gain	Limit
			(dDma)
		(аы)	(авт)

#### **Output Power Results**

Channel	Frequency	Chain 0	Total	Power	Power
		Meas	Corr'd	Limit	Margin
		Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Mid	5775	15.13	15.13	30.00	-14.87

**Note:** the power readings above were measured with gated method, and the measurement was taken only during the ON time. No duty cycle correction was necessary.

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 47 of 98

# 8.8. 802.11n HT80 CDD 2Tx MODE IN THE 5.8 GHz BAND

## 8.8.1. 6 dB BANDWIDTH

## <u>LIMITS</u>

FCC §15.247 (a) (2)

The minimum 6 dB bandwidth shall be at least 500 kHz.

## **RESULTS**

Channel	Frequency	6 dB BW	6 dB BW	Minimum
		Chain 0	Chain 1	Limit
	(MHz)	(MHz)	(MHz)	(MHz)
Mid	5775	75.555	75.613	0.5

Page 48 of 98

## 6 dB BANDWIDTH, Chain 0



#### 6 dB BANDWIDTH, Chain 1



Page 49 of 98

## 8.8.2. OUTPUT POWER

### <u>LIMITS</u>

FCC §15.407 (a) (3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **DIRECTIONAL ANTENNA GAIN**

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain, 5.4 dBi

Page 50 of 98

## **RESULTS**

#### Antenna Gain and Limit

Channel	Frequency	Directional	Power
		Gain	Limit
	(MHz)	(dBi)	(dBm)
Low	5775	5.40	30.00

### **Output Power Results**

Channel	Frequency	Chain 0	Chain 1	Total	Power	Power
		Meas	Meas	Corr'd	Limit	Margin
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Low	5775	13.65	13.51	16.59	30.00	-13.41

<u>Note:</u> the power readings above were measured with gated method, and the measurement was taken only during the ON time. No duty cycle correction was necessary.

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 51 of 98

# 8.8.3. Maximum Power Spectral Density (PSD)

## **LIMITS**

FCC §15.407 (a) (3)

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **DIRECTIONAL ANTENNA GAIN**

The TX chains are correlated and the antenna gain is the same for each chain. The directional gain is:

Antenna	10 * Log (2 chains)	<b>Correlated Chains</b>
Gain		<b>Directional Gain</b>
(dBi)	(dB)	(dBi)
5.40	3.01	8.41

Page 52 of 98

### **RESULTS**

#### Antenna Gain and Limit

Channel	Frequency	Directional	PSD
		Gain	Limit
	(MHz)	(dBi)	(dBm)
Mid	5755	8.41	27.59

Duty Cycle CF (dB)	0.16	Included in Calculations of Corr'd PSD
--------------------	------	--

### **PSD Results**

Channel	Frequency	Chain 0	Chain 1	Total	PSD	PSD
		Meas	Meas	Corr'd	Limit	Margin
		PSD	PSD	PSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
Mid	5755	-0.157	-0.341	2.922	27.59	-24.67

Page 53 of 98

### PSD, Chain 0



#### PSD, Chain 1



Page 54 of 98

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

# 9. RADIATED TEST RESULTS

## 9.1. LIMITS AND PROCEDURE

#### <u>LIMITS</u>

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz and 150 cm for above 1GHz. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

Reference to KDB 789033 UNII part G) 6) c) Method AD:

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and add duty cycle factor to the reading offset for average measurements.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

Page 55 of 98

# 9.2. TX ABOVE 1 GHz 802.11a MODE SISO IN THE 5.8 GHz BAND

## **RESTRICTED BANDEDGE (LOW CHANNEL)**



#### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	5.713	20.55	Pk	35	7.3	0	62.85	-	-	74	-11.15	290	133	н
1	5.715	17.77	Pk	35	7.3	0	60.07	-	-	74	-13.93	290	133	н
5	5.715	5.82	RMS	35	7.3	0	48.12	54	-5.88	-	-	290	133	Н
6	5.715	5.95	RMS	35	7.3	0	48.25	54	-5.75	-	-	290	133	Н
3	5.725	33.51	Pk	35	7.4	0	75.91	-	-	78.2	-2.29	290	133	н
4	5.725	35.01	Pk	35	7.4	0	77.41	-	-	78.2	79	290	133	н

Pk - Peak detector

**RMS - RMS detection** 

Page 56 of 98

## **RESTRICTED BANDEDGE (CHANNEL 153)**



#### **Trace Markers**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6	5.638	6.19	RMS	34.8	7.3	0	48.29	54	-5.71	-	-	293	127	н
2	5.644	18.62	Pk	34.8	7.3	0	60.72	-	-	74	-13.28	293	127	Н
1	5.715	13.91	Pk	35	7.3	0	56.21	-	-	74	-17.79	293	127	н
5	5.715	4.53	RMS	35	7.3	0	46.83	54	-7.17	-	-	293	127	н
4	5.723	18.39	Pk	35	7.4	0	60.79	-	-	78.2	-17.41	293	127	н
3	5.725	15.7	Pk	35	7.4	0	58.1	-	-	78.2	-20.1	293	127	н

Pk - Peak detector

**RMS - RMS detection** 

Page 57 of 98

## **AUTHORIZED BANDEDGE (HIGH CHANNEL)**



#### **Trace Markers**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	5.85	27.94	Pk	35.4	7.5	0	70.84	-	-	78.2	-7.36	271	187	н
4	5.851	29.79	Pk	35.4	7.5	0	72.69	-	-	78.2	-5.51	271	187	н
1	5.86	17.18	Pk	35.4	7.5	0	60.08	-	-	74	-13.92	271	187	н
5	5.86	5.52	RMS	35.4	7.5	0	48.42	54	-5.58	-	-	271	187	н
2	5.861	19.96	Pk	35.4	7.5	0	62.86	-	-	74	-11.14	271	187	н
6	5.987	6.8	RMS	35.6	7.5	0	49.9	54	-4.1	-	-	271	187	н

Pk - Peak detector

Page 58 of 98

# 9.3. TX ABOVE 1 GHz 802.11n HT20 MODE 1Tx IN THE 5.8 GHz BAND

### **RESTRICTED BANDEDGE (LOW CHANNEL)**



## Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	5.714	18.93	Pk	35	7.3	0	61.23	-	-	74	-12.77	290	131	Н
6	5.714	5.26	RMS	35	7.3	0	47.56	54	-6.44	-	-	290	131	н
1	5.715	16.19	Pk	35	7.3	0	58.49	-	-	74	-15.51	290	131	н
5	5.715	4.81	RMS	35	7.3	0	47.11	54	-6.89	-	-	290	131	н
4	5.724	35.34	Pk	35	7.4	0	77.74	-	-	78.2	46	290	131	н
3	5.725	33.17	Pk	35	7.4	0	75.57	-	-	78.2	-2.63	290	131	Н

Pk - Peak detector

**RMS - RMS detection** 

Page 59 of 98

## **AUTHORIZED BANDEDGE (HIGH CHANNEL)**



#### **Trace Markers**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	5.85	30.44	Pk	35.4	7.5	0	73.34	-	-	78.2	-4.86	281	212	н
4	5.85	32.64	Pk	35.4	7.5	0	75.54	-	-	78.2	-2.66	281	212	н
1	5.86	20.23	Pk	35.4	7.5	0	63.13	-	-	74	-10.87	281	212	н
5	5.86	5.68	RMS	35.4	7.5	0	48.58	54	-5.42	-	-	281	212	н
2	5.861	26.16	Pk	35.4	7.5	0	69.06	-	-	74	-4.94	281	212	н
6	5.986	6.83	RMS	35.6	7.5	0	49.93	54	-4.07	-	-	281	212	н

Pk - Peak detector

Page 60 of 98

# 9.4. TX ABOVE 1 GHz 802.11n HT20 MODE 2Tx IN THE 5.8 GHz BAND

## **RESTRICTED BANDEDGE (LOW CHANNEL)**



## Trace Markers

Marker	Frequency (GHz)	Meter Reading	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading	Average Limit	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
		(dBuV)					(dBuV/m)	(dBuV/m)						
1	5.715	17.86	Pk	35	7.3	0	60.16	-	-	74	-13.84	107	196	н
2	5.715	20.9	Pk	35	7.3	0	63.2	-	-	74	-10.8	107	196	Н
5	5.715	6.69	RMS	35	7.3	0	48.99	54	-5.01	-	-	107	196	Н
6	5.715	7.08	RMS	35	7.3	0	49.38	54	-4.62	-	-	107	196	Н
4	5.724	35.59	Pk	35	7.4	0	77.99	-	-	78.2	21	107	196	Н
3	5.725	30.52	Pk	35	7.4	0	72.92	-	-	78.2	-5.28	107	196	Н

Pk - Peak detector

**RMS - RMS detection** 

Page 61 of 98

## **RESTRICTED BANDEDGE (CHANNEL 153)**



#### **Trace Markers**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	5.647	19.55	Pk	34.8	7.3	0	61.65	-	-	74	-12.35	112	190	н
6	5.647	7.9	RMS	34.8	7.3	0	50	54	-4	-	-	112	190	Н
1	5.715	16.08	Pk	35	7.3	0	58.38	-	-	74	-15.62	112	190	Н
5	5.715	5.53	RMS	35	7.3	0	47.83	54	-6.17	-	-	112	190	Н
4	5.723	20.82	Pk	35	7.4	0	63.22	-	-	78.2	-14.98	112	190	Н
3	5.725	20.13	Pk	35	7.4	0	62.53	-	-	78.2	-15.67	112	190	Н

Pk - Peak detector

**RMS - RMS detection** 

Page 62 of 98

## AUTHORIZED BANDEDGE (MID CHANNEL)



#### **Trace Markers**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	5.85	15.14	Pk	35.4	7.5	0	58.04	-	-	78.2	-20.16	103	221	н
4	5.852	17.41	Pk	35.4	7.5	0	60.31	-	-	78.2	-17.89	103	221	н
1	5.86	16.18	Pk	35.4	7.5	0	59.08	-	-	74	-14.92	103	221	н
5	5.86	4.9	RMS	35.4	7.5	0	47.8	54	-6.2	-	-	103	221	н
2	5.944	20.83	Pk	35.6	7.5	0	63.93	-	-	74	-10.07	103	221	н
6	5.944	9.66	RMS	35.6	7.5	0	52.76	54	-1.24	-	-	103	221	н

Pk - Peak detector

Page 63 of 98

## **AUTHORIZED BANDEDGE (HIGH CHANNEL)**



### **Trace Markers**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	5.85	34.78	Pk	35.4	7.5	0	77.68	-	-	78.2	52	77	103	Н
4	5.85	34.03	Pk	35.4	7.5	0	76.93	-	-	78.2	-1.27	77	103	Н
1	5.86	22.01	Pk	35.4	7.5	0	64.91	-	-	74	-9.09	77	103	Н
5	5.86	8.57	RMS	35.4	7.5	0	51.47	54	-2.53	-	-	77	103	Н
6	5.86	8.76	RMS	35.4	7.5	0	51.66	54	-2.34	-	-	77	103	Н
2	5.861	25.23	Pk	35.4	7.5	0	68.13	-	-	74	-5.87	77	103	Н

Pk - Peak detector

Page 64 of 98

#### HARMONICS AND SPURIOUS EMISSIONS

#### LOW CHANNEL





Page 65 of 98

#### Trace Markers

Marker	Frequency (GHz)	Meter Reading	Det	AF T345 (dB/m)	Amp/Cbl/Fltr /Pad (dB)	Corrected Reading	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non- Restricted	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	()	(dBuV)		(,,	,,	(dBuV/m)	(0000,000)	()	(,,	()	(dBuV/m)	()	(= =8=)	()	
9	* 11.492	44.83	PK-U	38.3	-25.4	57.73	-	-	74	-16.27	-	-	351	182	V
	* 11.49	30.71	ADR	38.3	-25.4	43.61	54	-10.39	-	-	-	-	351	182	V
10	* 7.66	41.74	PK-U	35.5	-29.9	47.34	-	-	74	-26.66	-	-	235	208	V
	* 7.66	33.02	ADR	35.5	-29.9	38.62	54	-15.38	-	-	-	-	235	208	V
1	5.265	44.38	PK-U	34.3	-19.5	59.18	-	-	-	-	68.2	-9.02	227	246	Н
2	5.508	46.89	PK-U	34.5	-20.7	60.69	-	-	-	-	68.2	-7.51	229	214	н
3	5.586	49.08	PK-U	34.7	-20.7	63.08	-	-	-	-	68.2	-5.12	233	244	Н
4	5.628	46.04	PK-U	34.8	-20.6	60.24	-	-	-	-	68.2	-7.96	230	246	н
5	5.864	45.6	PK-U	35.4	-20.7	60.3	-	-	-	-	68.2	-7.9	5	198	н
6	5.906	49.67	PK-U	35.5	-20.7	64.47	-	-	-	-	68.2	-3.73	227	218	н
7	5.983	44.44	PK-U	35.6	-21	59.04	-	-	-	-	68.2	-9.16	218	250	Н
8	6.223	48.26	PK-U	35.5	-31.4	52.36	-	-	-	-	68.2	-15.84	11	335	Н

\* - indicates frequency in CFR15.205 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

Page 66 of 98

### MID CHANNEL





Page 67 of 98

## Trace Markers

Marker	Frequency (GHz)	Meter Reading	Det	AF T345 (dB/m)	Amp/Cbl/Fitr /Pad (dB)	Corrected	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non- Restricted	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	(0)	(dBuV)		(,,	,,	(dBuV/m)	()	()	(,,	()	(dBuV/m)	()	(= -8-)	(,	
9	* 11.57	44.21	PK-U	38.4	-24.6	58.01	-	-	74	-15.99	-	-	224	230	V
	* 11.569	31.11	ADR	38.4	-24.6	44.91	54	-9.09	-	-	-	-	224	230	V
1	5.303	43.38	PK-U	34.4	-19.5	58.28	-	-	-	-	68.2	-9.92	223	199	н
2	5.544	46.35	PK-U	34.6	-20.4	60.55	-	-	-	-	68.2	-7.65	201	231	н
3	5.627	49.04	PK-U	34.8	-20.8	63.04	-	-	-	-	68.2	-5.16	204	241	н
4	5.667	45.1	PK-U	34.9	-21	59	-	-	-	-	68.2	-9.2	4	236	н
5	5.907	46.12	PK-U	35.5	-20.8	60.82	-	-	-	-	68.2	-7.38	233	238	н
6	5.944	48.81	PK-U	35.6	-20.7	63.71	-	-	-	-	68.2	-4.49	226	234	н
7	6.019	42.63	PK-U	35.6	-20.8	57.43	-	-	-	-	68.2	-10.77	221	268	н
8	6.267	50.86	PK-U	35.5	-31.6	54.76	-	-	-	-	68.2	-13.44	14	119	Н

\* - indicates frequency in CFR15.205 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

Page 68 of 98

### HIGH CHANNEL





Page 69 of 98

## **Trace Markers**

Marker	Frequency	Meter	Det	AF T345	Amp/Cbl/Fltr /Rod (dR)	Corrected	Avg Limit	Margin	Peak Limit	PK Margin	UNII Non-	PK Margin	Azimuth (Dogs)	Height (cm)	Polarity
	(0112)	(dBuV)		(00/11)	/Fau (ub)	(dBuV/m)	(ubuv/iii)	(00)	(ubuv/iii)	(00)	(dBuV/m)	(00)	(Degs)	(ciii)	
9	* 11.65	42.29	PK-U	38.5	-24.8	55.99	-	-	74	-18.01	-	-	13	248	V
	* 11.65	29.25	ADR	38.5	-24.8	42.95	54	-11.05	-	-	-	-	13	248	V
1	5.338	44.17	PK-U	34.4	-19.8	58.77	-	-	-	-	68.2	-9.43	226	215	н
2	5.579	47.08	PK-U	34.7	-20.8	60.98	-	-	-	-	68.2	-7.22	230	245	н
3	5.668	45.83	PK-U	34.9	-21.1	59.63	-	-	-	-	68.2	-8.57	357	140	н
4	5.707	44.9	PK-U	35	-21	58.9	-	-	-	-	68.2	-9.3	229	198	н
5	5.946	46.08	PK-U	35.6	-20.9	60.78	-	-	-	-	68.2	-7.42	226	251	н
6	5.984	49.56	PK-U	35.6	-20.9	64.26	-	-	-	-	68.2	-3.94	228	229	н
7	6.067	43.82	PK-U	35.5	-20.6	58.72	-	-	-	-	68.2	-9.48	14	359	н
8	6.311	53.15	PK-U	35.6	-31.3	57.45	-	-	-	-	68.2	-10.75	235	233	н

\* - indicates frequency in CFR15.205 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

Page 70 of 98

# 9.5. TX ABOVE 1 GHz 802.11n HT40 MODE 1Tx IN THE 5.8 GHz BAND

## **RESTRICTED BANDEDGE (LOW CHANNEL)**



## Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.715	26.03	Pk	35	7.3	0	68.33	-	-	74	-5.67	290	135	н
2	5.715	29.92	Pk	35	7.3	0	72.22	-	-	74	-1.78	290	135	Н
5	5.715	10.92	RMS	35	7.3	0	53.22	54	78	-	-	290	135	н
6	5.715	11.65	RMS	35	7.3	0	53.95	54	05	-	-	290	135	н
4	5.724	33.43	Pk	35	7.4	0	75.83	-	-	78.2	-2.37	290	135	н
3	5.725	30.7	Pk	35	7.4	0	73.1	-	-	78.2	-5.1	290	135	н

Pk - Peak detector

**RMS - RMS detection** 

Page 71 of 98

## AUTHORIZED BANDEDGE (HIGH CHANNEL)



### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	5.85	24.81	Pk	35.4	7.5	0	67.71	-	-	78.2	-10.49	282	213	н
4	5.851	28.54	Pk	35.4	7.5	0	71.44	-	-	78.2	-6.76	282	213	н
1	5.86	23.6	Pk	35.4	7.5	0	66.5	-	-	74	-7.5	282	213	н
5	5.86	6.7	RMS	35.4	7.5	0	49.6	54	-4.4	-	-	282	213	н
2	5.861	24.41	Pk	35.4	7.5	0	67.31	-	-	74	-6.69	282	213	Н
6	5.861	7.69	RMS	35.4	7.5	0	50.59	54	-3.41	-	-	282	213	н

Pk - Peak detector

**RMS - RMS detection** 

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 72 of 98
# 9.6. TX ABOVE 1 GHz 802.11n HT40 MODE 2Tx IN THE 5.8 GHz BAND

#### **RESTRICTED BANDEDGE (LOW CHANNEL)**



### **Trace Markers**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	5.712	28.03	Pk	35	7.3	0	70.33	-	-	74	-3.67	77	123	Н
1	5.715	24.72	Pk	35	7.3	0	67.02	-	-	74	-6.98	77	123	Н
5	5.715	10.92	RMS	35	7.3	0	53.22	54	78	-	-	77	123	Н
6	5.715	11.34	RMS	35	7.3	0	53.64	54	36	-	-	77	123	Н
4	5.724	33.71	Pk	35	7.4	0	76.11	-	-	78.2	-2.09	77	123	Н
3	5.725	28.6	Pk	35	7.4	0	71	-	-	78.2	-7.2	77	123	Н

Pk - Peak detector

**RMS - RMS detection** 

Page 73 of 98

### AUTHORIZED BANDEDGE (HIGH CHANNEL)



## **Trace Markers**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	5.85	28.94	Pk	35.4	7.5	0	71.84	-	-	78.2	-6.36	77	107	н
4	5.854	31.09	Pk	35.4	7.4	0	73.89	-	-	78.2	-4.31	77	107	н
1	5.86	27.76	Pk	35.4	7.5	0	70.66	-	-	74	-3.34	77	107	н
5	5.86	10.52	RMS	35.4	7.5	0	53.42	54	58	-	-	77	107	н
6	5.86	10.88	RMS	35.4	7.5	0	53.78	54	22	-	-	77	107	н
2	5.862	28.98	Pk	35.4	7.5	0	71.88	-	-	74	-2.12	77	107	н

Pk - Peak detector

**RMS - RMS detection** 

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 74 of 98

#### HARMONICS AND SPURIOUS EMISSIONS

#### LOW CHANNEL





Page 75 of 98

Marker	Frequency (GHz)	Meter Reading	Det	AF T345 (dB/m)	Amp/Cbi/Fitr /Pad (dB)	Corrected	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non- Restricted	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	()	(dBuV)		(//	,,	(dBuV/m)	(,,	()	(,,	()	(dBuV/m)	()	(= -8-7	()	
7	* 11.512	38.45	PK-U	38.3	-25.2	51.55	-	-	74	-22.45	-	-	35	361	н
	* 11.51	26.58	ADR	38.3	-25.3	39.58	54	-14.42	-	-	-	-	35	361	н
8	* 11.51	43.71	PK-U	38.3	-25.3	56.71	-	-	74	-17.29	-	-	223	207	V
	* 11.51	30.87	ADR	38.3	-25.3	43.87	54	-10.13	-	-	-	-	223	207	V
1	2.124	50.75	PK-U	31.6	-35	47.35	-	-	-	-	68.2	-20.85	155	113	V
2	3	49.5	PK-U	32.5	-33.6	48.4	-	-	-	-	68.2	-19.8	285	222	V
3	5.591	48.51	PK-U	34.7	-20.5	62.71	-	-	-	-	68.2	-5.49	235	243	Н
4	5.899	45.53	PK-U	35.5	-20.8	60.23	-	-	-	-	68.2	-7.97	360	297	Н
5	6.235	43.2	PK-U	35.5	-31.6	47.1	-	-	-	-	68.2	-21.1	225	207	Н
6	6.714	43.59	PK-U	35.9	-31	48.49	-	-	-	-	68.2	-19.71	235	202	Н

\* - indicates frequency in CFR15.205 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

Page 76 of 98

#### HIGH CHANNEL





Page 77 of 98

Marker	Frequency (GHz)	Meter Reading	Det	AF T345 (dB/m)	Amp/Cbl/Fltr /Pad (dB)	Corrected Reading	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non- Restricted	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	* 11.59	40.95	PK-U	38.4	-24.7	(dBuV/m) 54.65	-	-	74	-19.35	(dBuV/m) -	-	357	265	v
	* 11.59	28.28	ADR	38.4	-24.7	41.98	54	-12.02	-	-	-	-	357	265	V
6	* 7.727	39.46	PK-U	35.5	-29.3	45.66	-	-	74	-28.34	-	-	347	113	V
	* 7.727	29.7	ADR	35.5	-29.3	35.9	54	-18.1	-	-	-	-	347	113	V
1	5.633	48.79	PK-U	34.8	-20.7	62.89	-	-	-	-	68.2	-5.31	206	228	н
2	5.952	45.88	PK-U	35.6	-20.8	60.68	-	-	-	-	68.2	-7.52	0	252	н
3	6.278	46.56	PK-U	35.5	-31.6	50.46	-	-	-	-	68.2	-17.74	15	190	Н
4	6.761	43.48	PK-U	35.9	-30.9	48.48	-	-	-	-	68.2	-19.72	236	207	Н

\* - indicates frequency in CFR15.205 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

Page 78 of 98

# 9.7. TX ABOVE 1 GHz 802.11ac HT80 MODE 1Tx IN THE 5.8 GHz BAND

## **RESTRICTED BANDEDGE (LOW EDGE)**



### **Trace Markers**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	5.715	23.45	Pk	35	7.3	0	65.75	-	-	74	-8.25	271	209	н
2	5.715	25.82	Pk	35	7.3	0	68.12	-	-	74	-5.88	271	209	Н
5	5.715	10.65	RMS	35	7.3	.16	53.11	54	89	-	-	271	209	н
6	5.715	11.36	RMS	35	7.3	.16	53.82	54	18	-	-	271	209	н
4	5.72	29.43	Pk	35	7.4	0	71.83	-	-	78.2	-6.37	271	209	н
3	5.725	28.04	Pk	35	7.4	0	70.44	-	-	78.2	-7.76	271	209	н

Pk - Peak detector

**RMS - RMS detection** 

Page 79 of 98

#### AUTHORIZED BANDEDGE (HIGH EDGE)



#### **Trace Markers**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	5.85	20.26	Pk	35.4	7.5	0	63.16	-	-	78.2	-15.04	269	330	н
4	5.854	26.16	Pk	35.4	7.4	0	68.96	-	-	78.2	-9.24	269	330	н
1	5.86	19.94	Pk	35.4	7.5	0	62.84	-	-	74	-11.16	269	330	н
5	5.86	7.48	RMS	35.4	7.5	.16	50.54	54	-3.46	-	-	269	330	н
6	5.861	8.53	RMS	35.4	7.5	.16	51.59	54	-2.41	-	-	269	330	н
2	5.871	23.11	Pk	35.4	7.5	0	66.01	-	-	74	-7.99	269	330	Н

Pk - Peak detector

**RMS - RMS detection** 

Page 80 of 98

# 9.8. TX ABOVE 1 GHz 802.11ac HT80 MODE 2Tx IN THE 5.8 GHz BAND

# **RESTRICTED BANDEDGE (LOW EDGE)**



### Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	5.714	25.79	Pk	35	7.3	0	68.09	-	-	74	-5.91	109	205	н
6	5.714	10.97	RMS	35	7.3	.16	53.43	54	57	-	-	109	205	н
1	5.715	20.37	Pk	35	7.3	0	62.67	-	-	74	-11.33	109	205	н
5	5.715	8.86	RMS	35	7.3	.16	51.32	54	-2.68	-	-	109	205	Н
4	5.724	30.79	Pk	35	7.4	0	73.19	-	-	78.2	-5.01	109	205	н
3	5.725	23.34	Pk	35	7.4	0	65.74	-	-	78.2	-12.46	109	205	Н

Pk - Peak detector RMS - RMS detection

Page 81 of 98

#### AUTHORIZED BANDEDGE (HIGH EDGE)



### **Trace Markers**

Marker	Frequency (GHz)	Meter Reading	Det	AF T345 (dB/m)	Bypass (dB)	DC Corr (dB)	Corrected Reading	Average Limit	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
		(ubuv)					(ubuv/iii)	(ubuv/iii)						
3	5.85	22.89	Pk	35.4	7.5	0	65.79	-	-	78.2	-12.41	77	103	н
4	5.851	26.59	Pk	35.4	7.5	0	69.49	-	-	78.2	-8.71	77	103	н
1	5.86	21.38	Pk	35.4	7.5	0	64.28	-	-	74	-9.72	77	103	н
2	5.86	23.27	Pk	35.4	7.5	0	66.17	-	-	74	-7.83	77	103	н
5	5.86	7.97	RMS	35.4	7.5	.16	51.03	54	-2.97	-	-	77	103	н
6	5.86	8.46	RMS	35.4	7.5	.16	51.52	54	-2.48	-	-	77	103	н

Pk - Peak detector

**RMS - RMS detection** 

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 82 of 98

#### HARMONICS AND SPURIOUS EMISSIONS

#### <u>CH155</u>





Page 83 of 98

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbi/ Fitr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	UNII Non- Restricted (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 3.85	46.9	PK-U	33.4	-33	0	47.3	-	-	74	-26.7	-	-	18	141	н
	* 3.85	41.09	ADR	33.4	-33	.16	41.65	54	-12.35	-	-	-	-	18	141	Н
6	* 1.097	48.07	PK-U	27.6	-35.6	0	40.07	-	-	74	-33.93	-	-	259	374	Н
	* 1.099	32.92	ADR	27.6	-35.5	.16	25.18	54	-28.82	-	-	-	-	259	374	Н
4	* 11.563	37.61	PK-U	38.4	-24.6	0	51.41	-	-	74	-22.59	-	-	358	172	v
	* 11.561	25.3	ADR	38.4	-24.6	.16	39.26	54	-	-	-	-	-	358	172	v
5	2.125	54.42	PK-U	31.6	-35	0	51.02	-	-14.74	-	-	68.2	-17.18	248	134	Н
1	3	49.84	PK-U	32.5	-33.6	0	48.74	-	-	-	-	68.2	-19.46	287	229	V
3	6.417	49.35	PK-U	35.7	-29.9	0	55.15	-	-	-	-	68.2	-13.05	5	316	н

\* - indicates frequency in CFR15.205 Restricted Band

PK-U - U-NII: Maximum Peak

ADR - U-NII AD primary method, RMS average

Page 84 of 98

# 9.9. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 85 of 98

#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)



UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 86 of 98

# <u>DATA</u>

**Trace Markers** 

Marker	Frequency (MHz)	Meter Reading	Det	AF T130 (dB/m)	Amp/Cbl (dB)	Corrected Reading	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
	(11112)	(dBuV)		(00/11)		(dBuV/m)	(ubuv/iii)	(00)	(0053)	(em)	
1	199.1623	53.09	Qp	16.5	-27	42.59	43.52	93	198	182	Н
2	214.3866	41.62	Qp	14.5	-26.9	29.22	43.52	-14.3	194	166	н
3	299.754	47.23	Qp	17.3	-26.2	38.33	46.02	-7.69	219	106	Н
4	398.2	40.34	Pk	19.4	-26.3	33.44	46.02	-12.58	0-360	101	Н
5	497.82	35.6	Qp	21.7	-26.3	31	46.02	-15.02	38	207	н
6	498.3	40.7	Pk	21.7	-26.2	36.2	46.02	-9.82	0-360	199	V

Pk - Peak detector

Qp - Quasi-Peak detector

Page 87 of 98

# 9.10. WORST-CASE ABOVE 18GHz

### SPURIOUS EMISSIONS 18 – 26GHz

		RF Emissions
95 85		Order Number:15U22567 Client:Broadcom Configuration:EUT with Laptop Mode:Worst case Tested by / SN:R.Z
75	Peak Limit (dBuV/m)	
65		
55	Avg Limit (dBuV/m)	
45		
35	mar work and marked	and Marken werder Marken and San and Provider and Provider and Provider and Provider and the second and the second se
25		
15		
18	8	26
		Frequency (GHz)
	Ronge (RHz) RBW/VBW Ref/Attn Det/Avg Typ 1:18-25 1H(-3dB)/3H 97/8 PEAK/ -	Sweep Pts 45xpx/Mode Label Borge (Gtz) RBU/ABU Ref/Attn Det/Arg Typ Sweep Pts 45xps/Mode Label 160beec(Auto) 1282 NVH Horizontal
lz '	Test.TST 30915 6 Jan 2015	Rev 9.5 16 Mc

Peak Limit (dBuU/m)           65           66           67           68           68           68           68           68           68           68           68           68           68           68           706           706 <th>5</th> <th>RF Emissions Order Number:15U22567 Client:Broadcom Configuration:EUT with Laptop Mode:Worst case Tested by / SN:R.Z</th>	5	RF Emissions Order Number:15U22567 Client:Broadcom Configuration:EUT with Laptop Mode:Worst case Tested by / SN:R.Z
65 Avg Limit (dBuV/m) 45 45 45 45 45 45 45 45 45 45	₽eak Limit (dBuV/m)	
55         Avg Limit (dBuU/m)           45         2           35         2           35         2           15         2           18         Frequency (GHz)           Ronge (GHz)         Ref/Rtin         Det/Reg Type           18         Frequency (GHz)           Ronge (GHz)         Ref/Rtin         Det/Reg Type           18         Frequency (GHz)	5	
45     25       15     15       18     Frequency (GHz)       Range (GHz)     Refrétin       18     Frequency (GHz)	Avg Limit (dBuV/m)	
25 15 18 Frequency (GHz) Range (9tz) R8V/BU Ref/Rtin Det/Ang Tup Sweep Pits #Saps/Rtide Label 218-25 197.05 PEB/ Pits #Saps/Rtide Label 218-25 197.05 PEB/ - 10 Sweep Pits #Saps/Rtide Label 18 - 10 Sweep Pits #Saps/Rtide Label 19 - 10 Sweep Pits #Saps/Rtide Label 19 - 10 Sweep Pits #Saps/Rtide Label 18 - 10 Sweep Pi	5 	2 Marine and
15 18 Frequency (GHz) Range (Btz) RBI/VBU Ref/Rttn Det/Rrg Typ Sweep Pts #Saps/Node Label 218-25 MIC-348/73H 97/8 FERK/- Typ Tige Sweep Pts #Saps/Node Label 218-25 MIC-348/73H 97/8 FERK/- Typ Tige Sweep Pts #Saps/Node Label	5	
18 Frequency (GHz) Range (Bitz) RBI/ABU Ref/Attn Det/Ang Typ Sweep Pts #Seps/Mode Label 218-25 IM (-345)/28 PER/ - If Basec (Auto) 1282 HAW Vert	5	
Ronge (Btz)         RBI/UBU         Ref/Attin         Det/Ang Typ         Sweep         Pts         #Swpa/Mode         Label         Rouge (GHz)         RBI/UBU         Ref/Attin         Det/Ang Typ         Sweep         Pts         #Swpa/Mode         Label         Rouge (GHz)         RBI/UBU         Ref/Attin         Det/Ang Typ         Sweep         Pts         #Swpa/Mode         Label         Ref/Attin         Det/Ang Typ         Sweep         Pts         #Swpa/Mode         Label         2:18-25         III(-348)/31         97/8         PEeV/         158         Sweep         Pts         #Swpa/Mode         Label         2:18-25         III(-348)/31         97/8         PEeV/         158         Sweep         Pts         #Swpa/Mode         Label         2:18-25         III(-348)/31         97/8         PEeV/         158         Sweep         Pts         #Swpa/Mode         Label         2:18-25         III(-348)/31         97/8         PEeV/         158         Sweep         Pts         2:18-25         III(-348)/31         97/8         PEeV/         158         Sweep         Pts         2:18-25         III(-348)/31         97/8         PEeV/         158         Sweep         Pts         2:18-25         III(-348)/31         2:18-25         2:18-25         2:18-25 </td <td>18</td> <td>Erequencu (GHz)</td>	18	Erequencu (GHz)
	Rome (Bitz) RBW/URW Ref/Attn Dat/Ava	Typ         Sweep         Pts         #Syps/Mode         Label         Royse (RHz)         RBW/VBU         Ref/Rtm         Det/Avg Typ         Sweep         Pts         #Syps/Mode         Label           2:19-26         111/1-380/341         97/8         PDBV/-         106asec(Auto)         1322         N0H         Vertical
Hz Test.TST 30915 6 Jan 2015 Rev	in the second second	

Page 88 of 98

Marker	Frequency	Meter	Det	T477 AF	Amp/Cbl	Dist Corr	Corrected	Avg Limit	Margin	Peak Limit	PK Margin
	(GHz)	Reading		(dB/m)	(dB)	(dB)	Reading	(dBuV/m)	(dB)	(dBuV/m)	(dB)
		(dBuV)					(dBuVolts)				
1	22.989	43.63	Pk	33.1	-24.9	-9.5	42.33	54	-11.67	74	-31.67
2	25.121	44.57	Pk	34.2	-24.6	-9.5	44.67	54	-9.33	74	-29.33

Pk - Peak detector

Page 89 of 98

#### **SPURIOUS EMISSIONS 26 – 40GHz**

35       Million Science         35       Order Number: SU22567         26       Clientic CdBuU/m)         35       Frequency (GHz)         26       Frequency (GHz)         27       Frequency (GHz)         28       Frequency (GHz)         29       Frequency (GHz)         20       Rev 9.5 16 Mar	45 <sub>1</sub>				011 2010 10,00,02
20     Peok Limit (dBuU/m)       25     Avg Limit (dBuU/m)       45     1       35     1       26     Frequency (GHz)       11     26       12     10       13     10       14     10       15     26       16     10       17     10       18     10       19     10       10     100       10     100       11     10       12     10       13     10       14     10       15     10       16     10       17     10       18     10       19     10       10     10       10     10       11     10       12     10       12     10       12     10       12     10       12     10       12     10       12     10       12     10       12     10       12     10       12     10       12     10       12     10	95			NT Emissions Order Number:15U22567 Client:Broadcom Configuration:EUT with Laptop Mode:Worst cose Tested bu / SN.R Z	
73       Peak Limit (dBuU/m)         65       Avg Limit (dBuU/m)         65       1         75       Avg Limit (dBuU/m)         75       1         76       1         77       1         78       1         79       1	00			in leaded by / shints	
65       Avg Limit (dBuU/m)         45       1         45       1         45       1         45       1         45       1         45       1         45       1         45       1         46       1         47       1         48       1         26       1         10       1         11       1         12       1         13       1         26       1         14       1         15       1         16       1         17       1         180       1         180       1         180       1         180       1         180       1         180       1         180       1         180       1         180       1         180       1         180       1         180       1         180       1         180       1         180       1	75	Peak Limit (dBuU/m)			
55       Avg Limit (dBuU/m)         45       1         45       1         46       1         47       1         48       1         25       1         26       1         26       1         26       1         11       1         26       1         26       1         11       1         12       1         13       1         26       1         15       1         26       1         15       1         16       1         17       1         18       1         19       1         10       1         11       1         12       1         13       1         14       1         15       1         16       1         17       1         18       1         18       1         18       1         18       1         18       1	65				
45 	55	Avg Limit (dBuV/m)			
35 25 26 70 70 70 70 70 70 70 70 70 70	45				1 Branzissin March Susan Martin Martin
35     25       25     25       26     Frequency (GHz)       15     26       16     100       17     100       18     100       19     100       11     100       12     100       13     100       14     100       15     100       16     100       16     100       17     100       18     100       18     100       18 </td <td></td> <td>all an a second and a second the plant adjace for all the state of the second second second second second second</td> <td>uning hyber have not a non-horizon and have a set of the set of the</td> <td>han an a</td> <td></td>		all an a second and a second the plant adjace for all the state of the second second second second second second	uning hyber have not a non-horizon and have a set of the	han an a	
25 15 26 Frequency (GHz) 1880/081 Ref/Rtin Det/Reg Type Sweep Pts #Supe/Node Label 1280-180 Wild Michael Label 1280-180 Wild Ref/Rtin Det/Reg Type Sweep Pts #Supe/Node Label 1280-180 Wild Interizented 1280-180 Wild Ref/Rtin Det/Reg Type Sweep Pts #Supe/Node Label 1280-180 Wild Ref/Rtin Det/Ref Type Sweep Pts #Supe/Node Label 1280-180 Wild Ref Type Sweep Pts #Supe/Node La	35				
15 26 Frequency (GHz) Range (Btz) 185/181 Bef/Rtin Det/Ang Typ Sweep Pts 45xps/Adde Label 1:25-48 Biz 185/381 Bef/Rtin Det/Ang Typ Sweep Pts 45xps/Adde Label 1:25-48 Biz 185/381 Bef/Rtin Det/Ang Typ Sweep Pts 45xps/Adde Label 1:25-48 Biz 185/381 Bef/Rtin Det/Ang Typ Sweep Pts 45xps/Adde Label 1:25-48 Biz 185/381 Bef/Rtin Det/Ang Typ Sweep Pts 45xps/Adde Label 1:25-48 Biz 185/381 Bef/Rtin Det/Ang Typ Sweep Pts 45xps/Adde Label 1:25-48 Biz 185/381 Biz	25				
26         48           Frequency (GHz)           1:26-46         111(-36)/34           97/9         7/9           1:26-46         111(-36)/34           97/9         7/9           1:26-46         111(-36)/34           1:26-46         111(-36)/34           1:26-46         111(-36)/34           1:26-46         111(-36)/34           1:26-46         111(-36)/34           1:26-46         111(-36)/34           1:26-46         111(-36)/34           1:26-46         111(-36)/34           1:26-47         111(-36)/34           1:26-48         111(-36)/34           1:26-48         111(-36)/34           1:26-48         111(-36)/34           1:26-48         111(-36)/34           1:26-48         111(-36)/34           1:26-48         111(-36)/34           1:26-48         111(-36)/34           1:26-48         111(-36)/34           1:26-48         111(-36)/34           1:26-48         111(-36)/34           1:26-48         111(-36)/34           1:26-48         111(-36)/34           1:26-48         111(-36)/34           1:26-48 <td< td=""><td></td><td></td><td></td><td></td><td></td></td<>					
26 Frequency (GHz) 48 Range (GHz) 884/841 Ref/Rttn Det/frag Type Sweep Pts Häge/Mode Label 11:26-46 194:348/781 97/8 97/8 97/8 97/8 97/8 1928/282000000000000000000000000000000000	15				
Proquency (GHz)     Rev/Rtin     Det/Ang Tup     Summe     Piss #SupportCode     Label       11:26-18     11K-340//3K     Str/Attin     Det/Ang Tup     Summe     Piss #SupportCode     Label       11:26-18     11K-340//3K     Str/Attin     Det/Ang Tup     Summe     Piss #SupportCode     Label       11:26-18     11K-340//3K     Str/Attin     Det/Ang Tup     Summe     Piss #SupportCode     Label	15				
Ronge (Btz)         RBU/RBU         Ref/Rtit         Det/Reg Type         Sweep         Pts         Hisps/Rode         Label           1:2:	15	6			40
Iz Test.TST 38915 6 Jan 2015 Rev 9.5 16 Man	15 2	6	Frequency (	GHz)	40
	15 21	6 Range (Btz) RBK/RBU Ref/Attn Det/Ang Typ Sweet 1:28-46 1HK-3461/3H 97/70 PERK/ 2282ae	Frequency ( > Pla tSopoMade Label ac(Au2) 1883 1989 Herizontal	GHz) nge (QHz) RSW/USW Ref/Attn Det/Ang Typ Sweep	Pts 4Sups/Node Label
	15 21	6 Range (912) 1994/V&U Ref/Nthn Det/Ang Typ Sweet 1.28–46 11K-3385/34 97/8 PDK/- 225ar Test.TST 38915 6 Jan 2815	Frequency ( > Pis ISaps/Node Label Ra eec(Auta) 1860 MXXII Horizantal Ra	GHz) GHz) RBW/NBW Ref/Ritin Det/Roy Typ Sweep	Pts #Seps/Node Label Rev 9.5 16 Mar
	15 21	6 Range (912) 899/100 8ef/Httn Det/Ang Typ Sweet 1:29–16 11K-348/34 9//8 POK/- 285w Test.TST 38915 6 Jan 2815	Frequency ( Pis HSups/Node Label Re dec(Auta) 1863 (MRH Horizante)	GHz) ge (gitz) RBW/UBU Ref/Rttn Det/évg Typ Sweep	Pts #Seps/Node Label Rev 9.5 16 Mar

Page 90 of 98

N5UL EM	С							7 Jan 2016	15:06:02
						RF Emiss	ions		
95						Order Numbe Client:Broo Configurati Made:Wacat	n:15U22567 idcom on:EUT with Laptop		
85							SN:R.Z		
75	≺ Limit (dBu	U/m)							
65									
55 <mark>. Avg</mark>	Limit (dBuV/	(m)							
45							burder i dine	2	an service and an and a service of
mun	an and the second second	manushabarah	delleriletoneourses	an and the second second	White and the second	and intermediation and the second	Makered and the second s		
35									
25									
15									
26			i		Frequenci	(GHz)			40
Range	(GHz) RBW/VBW	Ref/Attn Det/Avg Typ	Sweep	Pts #Swps/Node	Label	Range (GHz) RBN/UBN	Ref/Attn Det/Avg Typ	Sweep Pts #Swps/Nod	e Label
						2:26-48 1N(-3d8)73	4 9778 PEAK7 -	282wee (Auto) 1883 MAXH	Vertical
Hz Test.T	ST 30915 6 Jar	n 2015							Rev 9.5 16 M

Marker	Frequency (GHz)	Meter Reading	Det	T90 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
		(dBuV)					(dBuVolts)				
1	37.405	50.97	Pk	37.3	-33.1	-9.5	45.67	54	-8.33	74	-28.333
2	37.778	50.93	Pk	37	-32.6	-9.5	45.83	54	-8.17	74	-28.17

Pk - Peak detector

Page 91 of 98

## LIMITS

FCC §15.207 (a)

REPORT NO: 15U22567-E1V3

FCC ID: QDS-BRCM1076

Frequency of Emission (MHz)	Conducted L	.imit (dBuV)
	Quasi-peak	Average
0.15-0.5	66 to 56 °	56 to 46 *
0.5-5	56	46
5-30	60	50

\* Decreases with the logarithm of the frequency.

UL VERIFICATION SERVICES INC. 47173 BENICIA STREET, FREMONT, CA 94538, USA This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc. .

Page 92 of 98

## LINE 1 & LINE 2 RESULTS



Page 93 of 98

#### 6 WORST EMISSIONS

Client Name: Config: Test Volt/Freq: Test Bv:	Broadcom								
Config: Test Volt/Freq: Test Bv:									
Test Volt/Freq: Test Bv:	EUT with Lapt	op; Tx Worst	Case						
Test By:	120VAC / 60 H	z							
	K. Nguyen								
				-					
Line-L1 .15 - 30M	lHz								
Test Frequency (MHz)	Meter Reading (dBuV)	Detector	T24 IL L1(dB)	LC Cables(dB )	dB(uVolts)	CISPR 11/22 Class B Quasi- peak	Peak Margin	CISPR 11/22 Class B Average	Average Margin
0.15	52.79	PK	0.1	0	52.89	66	-13.11	-	-
0.15	15.7	Av	0.1	0	15.8	-	-	56	-40.2
0.456	36.67	PK	0.1	0	36.77	56.8	-20.03	-	-
0.456	16.75	Av	0.1	0	16.85	-	-	46.8	-29.95
9.06	29.76	РК	0.1	0.1	29.96	60	-30.04	-	-
9.06	12.52	Av	0.1	0.1	12.72	-	-	50	-37.28
15.675	43.28	PK	0.2	0.2	43.68	60	-16.32	-	-
					20.00			=0	40.00
15.675 .ine-L2 .15 - 30M	29.68	Av	0.2	0.2	30.08	-	-	50	-19.92
15.675 Line-L2 .15 - 30M Test Frequency	29.68	Av	0.2	LC Cables (dB)	dB(uVolts)	CISPR 11/22 Class B Quasi- peak	Peak Margin	CISPR 11/22 Class B Average	-19.92 Average Margin
15.675 Line-L2 .15 - 30W Test Frequency 0.15	29.68	Av Detector PK	0.2	0.2 LC Cables (dB)	30.08 dB(uVolts) 51.98	CISPR 11/22 Class B Quasipeak 66	Peak Margin	CISPR 11/22 Class B Average	-19.92 Average Margin
15.675 Line-L2 .15 - 30W Test Frequency 0.15 0.15	29.68	Av Detector PK Av	0.2 T24 IL L2 (dB)	0.2 LC Cables (dB) 0 0	30.08 dB(uVolts) 51.98 14.94	CISPR 11/22 Class B Quasipeak 66	Peak Margin -14.02	CISPR 11/22 Class B Average	-19.92 Average Margin - -41.06
15.675 Line-L2 .15 - 30W Test Frequency 0.15 0.15 0.447	29.68	Av Detector PK Av PK	0.2 T24 IL L2 (dB) 0.1 0.1 0.1	0.2 LC Cables (dB) 0 0 0	30.08 dB(uVolts) 51.98 14.94 38.55	CISPR 11/22 Class B Quasipeak 66 - 56.9	- Peak Margin -14.02 - - 18.35	CISPR 11/22 Class B Average - 56 -	-19.92 Average Margin - -41.06
15.675 Line-L2 .15 - 30W Test Frequency 0.15 0.15 0.447 0.447	29.68 IHz Meter Reading 51.88 14.84 38.45 18.42	Av Detector PK Av PK Av	0.2 T24 IL L2 (dB) 0.1 0.1 0.1 0.1	0.2 LC Cables (dB) 0 0 0 0	30.08 dB(uVolts) 51.98 14.94 38.55 18.52	CISPR 11/22 Class B Quasipeak 66  56.9 -	- Peak Margin -14.02 - 18.35	CISPR 11/22 Class B Average - 56 - 46.9	-19.92 Average Margin - -41.06 - -28.38
15.675 Line-L2 .15 - 30lv Test Frequency 0.15 0.15 0.447 0.447 4.749	29.68 IHz Meter Reading 51.88 14.84 38.45 18.42 26.99	Av Detector PK Av PK Av PK	0.2 T24 IL L2 (dB) 0.1 0.1 0.1 0.1 0.1 0.1	0.2 LC Cables (dB) 0 0 0 0 0 0 0 0 0	30.08 dB(uVolts) 51.98 14.94 38.55 18.52 27.19	- CISPR 11/22 Class B Quasi- peak 66 - 56.9 - 56.9	- Peak Margin -14.02 - 18.35 - 2.28.81	CISPR 11/22 Class B Average - 56 - 46.9 -	-19.92 Average Margin - -41.06 - - 28.38 -
15.675 Line-L2 .15 - 30W Test Frequency 0.15 0.15 0.447 0.447 4.749 4.749	29.68 IHz Meter Reading 51.88 14.84 38.45 18.42 26.99 13.29	Av Detector PK Av PK Av PK Av	0.2 T24 IL L2 (dB) 0.1 0.1 0.1 0.1 0.1 0.1 0.1	0.2 LC Cables (dB) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	30.08 dB(uVolts) 51.98 14.94 38.55 18.52 27.19 13.49	- CISPR 11/22 Class B Quasi- peak 66 - 56.9 - 56 56 - 56 -	- Peak Margin -14.02 - 18.35 - - 28.81 -	CISPR 11/22 Class B Average - 56 - 46.9 - 46	-19.92 Average Margin - -41.06 - - 28.38 - - -32.51
15.675 Line-L2 .15 - 30IV Test Frequency 0.15 0.15 0.447 0.447 4.749 4.749 15.675	29.68 IHz Meter Reading 51.88 14.84 38.45 18.42 26.99 13.29 38.39	Av Detector PK Av PK Av PK Av PK	0.2 T24 IL L2 (dB) 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	0.2 LC Cables (dB) 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	30.08 dB(uVolts) 51.98 14.94 38.55 18.52 27.19 13.49 38.79	- CISPR 11/22 Class B Quasi- peak 66 - 56.9 - 56.9 - 56 - 56 - 60	- Peak Margin -14.02 - 18.35 - 28.81 - 28.81 - 21.21	CISPR 11/22 Class B Average - 56 - 46.9 - 46 - 46 -	-19.92 Average Margin - -41.06 - - 28.38 - - -32.51 - -

Page 94 of 98