

# Emissions Test Report

 EUT Name:
 Wi-Fi Router

 Model No.:
 D010001 (USA), D010002 (IC)

 CFR 47 Part 15.407 2016 and RSS 247: 2017

Prepared for:

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Note: Latest revision report will replace all previous reports.

## **Statement of Compliance**

Manufacturer: Requester / Applicant:	eero inc. 500 Howard Street, Suite 900 San Francisco, CA 94105 (415) 738-7972 Clifford Clarke
Name of Equipment:	Wi-Fi Router
Model No.	D010001 (USA), D010002 (IC)
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.407 2016 and RSS 247: 2017
Test Dates:	07 Mar 2017 to 24 Mar 2017

#### Guidance Documents:

Emissions: ANSI C63.10-2013, KDB 789033 D02 General UNII Test Procedures New Rules v01, KDB 662911 D01 Multiple Transmitter Output v02r01

#### Test Methods:

Emissions: ANSI C63.10-2013, KDB 789033 D02 General UNII Test Procedures New Rules v01, KDB 662911 D01 Multiple Transmitter Output v02r01

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that the equipment described above has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

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1 Ex	xecutive Summary	8
1.1	Scope	8
1.2	Purpose	8
1.3	Summary of Test Results	9
1.4	Special Accessories	
1.5	Equipment Modifications	
2 La	aboratory Information	
2.1	Accreditations & Endorsements	10
2.1	1.1 US Federal Communications Commission	10
2.1 2.1		10
2.1		
2.1	1.5 Acceptance by Mutual Recognition Arrangement	11
2.2	Test Facilities	11
2.2	2.1 Emission Test Facility	11
2.2	2.2 Immunity Test Facility	11
2.3	Measurement Uncertainty	11
2.3 2.3	3.1 Sample Calculation – radiated & conducted emissions	12
2.3		
2.4	Calibration Traceability	
	roduct Information	
3.1	Product Description	
	-	
3.2	Equipment Configuration	14
3.3	Operating Mode	14
3.4	Unique Antenna Connector	
3.4	4.1 Results	15
4 Er	missions	16
4.1	Output Power Requirements	16
4.1	1.1 Test Method	16
4.1		
4.2	Occupied Bandwidth	35
4.2 4.2		
<b>4.3</b> 4.3	Peak Power Spectral Density	
4.3		
4.4	Undesirable Emission Limits	
<b>4.4</b>		60
4.4		

4.5	Transmitter Spurious Emissions	80
4.5.1	1 Test Methodology	80
4.5.2		81
4.5.3		
4.6	AC Conducted Emissions	110
4.6.1	1 Test Methodology	110
4.6.2	2 Test Results	110
4.7	Frequency Stability	119
4.7.1		
4.7.2		119
4.7.3		
4.7.4	4 Test results:	120
4.8	Voltage Variation	122
4.8.1		
4.8.2	2 Test results	122
4.9	Maximum Permissible Exposure	124
4.9.1	1 Test Methodology	124
4.9.2	2 RF Exposure Limit	124
4.9.3		
4.9.4	4 Classification	125
4.9.	5 Test Results	125
4.9.6	5 Sample Calculation	125
5 Tes	t Equipment List	126
5.1	Equipment List	126
6 EM	IC Test Plan	
6.1	Introduction	
6.2	Customer	
6.3	Equipment Under Test (EUT)	
6.4	Test Specifications	133

Table 1: Summary of Test Results	9
Table 2: RF Output Power at the Antenna Port – Test Results – Non Beamforming	17
Table 3: RF Output Power at the Antenna Port – Test Results – Non Beamforming Continued	18
Table 4: RF Output Power at the Antenna Port – Test Results – Non Beamforming Continued	19
Table 5: RF Output Power at the Antenna Port – Test Results – Non Beamforming Continued	20
Table 6: RF Output Power at the Antenna Port – Test Results – Beamforming	21
Table 7: RF Output Power at the Antenna Port – Test Results – Beamforming Continued	22
Table 8: RF Output Power at the Antenna Port – Test Results – Beamforming Continued	23
Table 9: RF Output Power at the Antenna Port – Test Results – Beamforming Continued	24
Table 10: Occupied Bandwidth – Test Results	36
Table 11: Occupied Bandwidth – Test Results Continued	37
Table 12: Peak Power Spectral Density – Test Results – Non Beamforming	42
Table 13: Peak Power Spectral Density – Test Results – Non Beamforming Continued	43
Table 14: Peak Power Spectral Density – Test Results – Non Beamforming Continued	44
Table 15: Peak Power Spectral Density – Test Results – Non Beamforming Continued	45
Table 16: Peak Power Spectral Density – Test Results – Beamforming	46
Table 17: Peak Power Spectral Density – Test Results – Beamforming Continued	47
Table 18: Peak Power Spectral Density – Test Results – Beamforming Continued	48
Table 19: Peak Power Spectral Density – Test Results – Beamforming Continued	49
Table 20: Emissions at the Band-Edge – Test Results	61
Table 21: Emissions at the Band-Edge – Test Results Continued	62
Table 22: Transmit Spurious Emission at Band-Edge Requirements	82
Table 23: Transmit Spurious Emission at Band-Edge Requirements Continued	83
Table 24: AC Conducted Emissions – Test Results	110
Table 25: Frequency Stability – Test Results	120
Table 26: Voltage Variation – Test Results	122
Table 27: Customer Information	127
Table 28: Technical Contact Information	127
Table 29: EUT Specifications	128
Table 30: Antenna Information	129
Table 31: EUT Channel Power Specifications	130
Table 32: Interface Specifications	132
Table 33: Supported Equipment	132

Table 34: Description of Sample used for Testing	132
Table 35: Description of Test Configuration used for Radiated Measurement	132
Table 36: Test Specifications	133

## **1** Executive Summary

### 1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR 47 Part 15.407 2016 and RSS 247: 2017 based on the results of testing performed on 07 Mar 2017 to 24 Mar 2017 on the Wi-Fi Router Model D010001 (USA), D010002 (IC) manufactured by eero inc. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

### 1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report. The 5180 MHz to 5240 MHz frequency band is covered in this document.

#### 1.3 Summary of Test Results

Table 1: Summary of Test Results

Test	Test Method ANSI C63.4	Test Parameters (Measured)	Result
Spurious Emission in Transmitted Mode	CFR47 15.209, CFR47 15.407 (b) RSS-GEN Sect.8.9, RSS 247 Sect. 6.2.1.2	Class B	Complied
Restricted Bands of Operation	CFR47 15.205, RSS GEN Sect.8.10	Class B	Complied
AC Power Conducted Emission	CFR47 15.207, RSS-GEN Sect.8.8	Class B	Complied
Occupied Bandwidth	CFR47 15.407 (a), RSS GEN Sect.6.6	See plots	Complied
Maximum Output Power	CFR47 15.407 (a) [see note 2]	27.14 dBm (11a mode) 27.14 dBm (HT 20) 27.87 dBm (HT 40) 27.78 dBm (VHT 40) 22.73 dBm (VHT80)	Complied
Maximum Output Power	RSS 247 Sect.6.2.1.1 [see note 2]	27.86 mW (11a mode) 27.23 mW (HT 20) 43.45 mW (HT 40) 44.26 mW (VHT 40) 41.40 mW (VHT80)	Complied
Peak Power Spectral Density	CFR47 15.407 (a)	< 17 dBm/MHz	Complied
Peak Power Spectral Density	RSS 247 Sect.6.2.1.1	< 10  dBm/MHz (e.i.r.p)	Complied
Conducted Emission – Antenna Port	CFR47 15.407 (b), RSS 247 Sect.6.2.2.2	30 MHz - 40 GHz < -27 dBm/MHz	Complied
Frequency Stability	CFR47 15.407 (g), RSS GEN Sect. 6.11	±20 ppm	Complied
RF Exposure	CFR47 15.407 (f), 2.1091 RSS-102 Issue 5	General Population	Complied

Note: 1. This test report covers 5150 MHz to 5250MHz band.

2. Measurements are conducted for 2x2 MIMO total power non-beamforming.

#### 1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

#### 1.5 Equipment Modifications

None

#### Laboratory Information 2

#### 2.1 Accreditations & Endorsements

#### 2.1.1 US Federal Communications Commission



TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 is recognized by the commission for performing testing services for the general public on a fee basis. These laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (US1131). The laboratory scope of accreditation includes: Title 47 CFR Parts 15, 18, and 90. The accreditation is updated every 3 years.

#### 2.1.2 NIST / A2LA



TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 17025:1999 and ISO 9002 (Lab Code

Testing Cert #3331.02). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

#### 2.1.3 Canada – Industry Canada

Industry Canada Industrie Canada

TUV Rheinland of North America at the 1279 Quarry Ln, Pleasanton, CA 94566 address is accredited by Industry Canada for performing testing services for the general public on a fee basis. This laboratory test

facilities have been fully described in reports submitted to and accepted by Industry Canada (File Number 2932M). This reference number is the indication to the Industry Canada Certification Officers that the site meets the requirements of RSS 212, Issue 1 (Provisional). The accreditation is updated every 3 years.

#### 2.1.4 Japan – VCCI

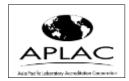


The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from

Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 has been assessed and approved in accordance with the Regulations for Voluntary Control Measures.

VCCI Registration No. for Pleasanton: A-0261

#### 2.1.5 Acceptance by Mutual Recognition Arrangement



The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland at 1279 Quarry Ln, Pleasanton, CA 94566 test results and test reports within the scope of the laboratory NIST / A2LA accreditation will be accepted by each member

country.

### 2.2 Test Facilities

All of the test facilities are located at 1279 Quarry Lane, Pleasanton, California 94566, USA. The 2305 Mission College, Santa Clara, 95054, USA location is considered a Pleasanton annex.

#### 2.2.1 Emission Test Facility

The Semi-Anechoic chamber and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 and 5 meters. The site is listed with the FCC and accredited by A2LA (Lab Code Testing Cert #3331.02). The 3/5-meter semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

#### 2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7 m x 4.8 m x 3.175 mm thick aluminum floor connected to PE ground.

For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of  $10^9$  Ohms/square on a 1.6 m x 0.8 m x 0.8 m high non-conductive table with a 3.175 mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470-k $\Omega$  resistors. The Vertical Coupling Plane consists of an aluminum plate 50 cm x 50 cm x 3.175 mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470-k $\Omega$  resistors.

For EFT, Surge, PQF, the HCP and VCP are removed.

RF Field Immunity testing is performed in a 7.3m x 4.3m x 4.1m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.8m x 3.7m x 3.175mm thick aluminum ground plane.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

#### 2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1<sup>st</sup> Edition, 1995.

*The Combined Standard Uncertainty* is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities; it is equal to the positive square root of the sum of the variances or co-variances of these other quantities, weighted according to how the measurement result varies with changes in these quantities. The term *standard uncertainty* is the result of a measurement expressed as a standard deviation.

#### **2.3.1** Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength  $(dB\mu V/m) = RAW - AMP + CBL + ACF$ 

Where: RAW = Measured level before correction (dB $\mu$ V)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor-Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB - 20 dB + 1.0 dB = 23.5 dBuV/m

#### 2.3.2 Measurement Uncertainty

Per CISPR 16-4-2	Ulab	Ucispr
Radiated Disturbance @ 1	0 meters	
30 – 1,000 MHz	2.25 dB	4.51 dB
Radiated Disturbance @ 3 meters		
30 – 1,000 MHz	2.26 dB	4.52 dB
1 – 6 GHz	2.12 dB	4.25 dB
6 – 18 GHz	2.47 dB	4.93 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	1.09 dB	2.18 dB
Disturbance Power		
30 MHz – 300 MHz	3.92 dB	4.3 dB

#### Voltech PM6000A

The estimated combined standard uncertainty for harmonic current and flicker measurements is $\pm$ 5.0%.	Per CISPR 16-4-2 Methods
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#### 2.3.3 Measurement Uncertainty Immunity

The estimated combined standard uncertainty for ESD immunity measurements is $\pm$ 8.2%.	Per IEC 61000-4-2
The estimated combined standard uncertainty for radiated immunity measurements is $\pm 4.10$ dB.	Per IEC 61000-4-3
The estimated combined standard uncertainty for conducted immunity measurements with CDN is $\pm$ 3.66 dB	Per IEC 61000-4-6
The estimated combined standard uncertainty for power frequency magnetic field immunity is $\pm 2.9\%$ .	Per IEC 61000-4-8

#### Thermo KeyTek EMC Pro

The estimated combined standard uncertainty for EFT fast trans	ient immunity measurements is $\pm 2.6\%$ .
The estimated combined standard uncertainty for surge immunit	y measurements is $\pm 2.6\%$ .
The estimated combined standard uncertainty for voltage variati	on and interruption measurements is $\pm 1.74\%$ .

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

#### 2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

## **3 Product Information**

#### 3.1 Product Description

The Model D010001 (USA), D010002 (IC), Wi-Fi Router, is a Wi-Fi router for the home capable of operating in the 2.4 GHz and 5 GHz frequency bands over 20 MHz, 40 MHz and 80 MHz channels.

### 3.2 Equipment Configuration

A description of the equipment configuration is given in the Test Plan Section. The EUT was tested as called for in the test standard and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to reach intended operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce the worst case radiation for emissions testing and to place the EUT in the most susceptible state for immunity testing.

#### 3.3 Operating Mode

A description of the operation mode is given in the Test Plan Section. In the case of an EUT that can operate in more than one state, preliminary testing was performed to determine the operating mode that produced maximum radiation.

The final operating mode was selected to produce the worst case radiation for emissions testing and to place the EUT in the most susceptible state for immunity testing.

#### 3.4 Unique Antenna Connector

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of CFR47 Parts 15.211, 15.213, 15.217, 15.219, or 15.221.

#### 3.4.1 Results

The Wi-Fi Router has five FPCB antennas. The 5150 - 5250 MHz band uses Flex Printed Circuit Board (FPCB) dipole antennas, Antenna 1 and Antenna 2, and has maximum gain of + 6.29 dBi.

Refer to Table 30 for additional antenna information.

There are no additional antenna available.

## 4 **Emissions**

Testing was performed in accordance with CFR 47 Part 15.407: 2016 and RSS 247: 2017. These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Procedures described in section 8 of the standard were used.

#### 4.1 Output Power Requirements

The maximum output power requirement is the maximum equivalent isotropic radiated power delivering at the transmitting antenna under specified conditions of measurements in the presence of modulation.

The maximum output power and harmonics shall not exceed CFR47 Part 15.407 (a):2016 and RSS 247 Sect. 6.2.1.1: 2017.

The maximum transmitted powers are

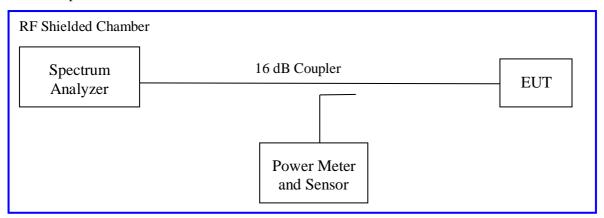
Part 15.407(a)(ii) – Band 5150-5250 MHz (conducted output power) : 1 W.

RSS 247 – Band 5150-5250 MHz (e.i.r.p.): 200 mW or 10 + 10Log(B) where B is the 99% emission bandwidth.

#### 4.1.1 Test Method

The ANSI C63.10-2013 Section 12.3.2.2 conducted method was used to measure the channel power output. The preliminary investigation was performed at different data rate/ chain to determine the highest power output for each mode. The worst findings were conducted on 3 channels in each operating range per CFR47 Part 15.407(a) and RSS 247 Sect. 6.2.1.1; 5150 MHz to 5250 MHz. The worst mode results indicated below.

Test Setup:



Method SA-1 of "KDB 789033 D02 – Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices" applies since the EUT continuously transmit; where duty cycle is greater than 98%. Sample detector was used.

Each chain was measured individually and applied the measure-and-sum approach per KDB662911.

The total directional gain (8.67 dBi) was calculated by summing Antenna 1 (6.29 dBi) and Antenna 2 (4.97 dBi).

#### 4.1.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

<b>Table 2:</b> RF Output Power at the Antenna Port – Test Results – Non Beamforming
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Test Conditions: Conducted Measurement, Normal Temperature and Voltage Only						
Antenna Type:	Antenna Type: FPCBPower Setting: See test plan					
Max. Direction	al Gain: An	tenna $1 = +6.2$	9 dBi; Antenna 2	2 = +4.97  dBi		
Signal State: M	lodulated at	100%.				
Ambient Temp	<b>.:</b> 22° C		R	elative Humidity:39	%	
		802.11	a (FCC Limit)			
Operating Channel (MHz)	Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]	
5180.00	29.71	21.44	21.09	24.28	-5.43	
5240.00	29.71	24.07	<mark>24.19</mark>	27.14	-2.57	
		802.11	a (RSS Limit)			
Operating Channel (MHz)	Power Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]	
5180.00	16.71	<mark>11.55</mark>	11.11	14.34	-2.37	
5240.00	16.71	11.33	11.54	14.45	-2.26	
Note:       1.The highest output power was observed at 6Mbps, 1 Data Stream.         2. The sum of Ch0 and Ch1 = Total Power.         3. FCC Limit = 30 dBm - (6.29 dBi - 6 dBi) = 29.71 dBm.         4. RSS-247 Limit = 23 dBm - 6.29 dBi = 16.71 dBm.         5. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.						

Table 3: RF Output Power at the Antenna Port – Test Results -	- Non Beamforming Continued
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Test Conditions:	Conducted 2	Measurement,	Normal Ter	mperature and '	Voltage Only	
I cot conditions.	conducted	wiedbure meine,	i tormar i ci	inperature and	vonage only	

Power Setting: See test plan

**Max. Directional Gain:** Antenna 1 = +6.29 dBi; Antenna 2 = +4.97 dBi

Signal State: Modulated at 100%.

**Ambient Temp.:** 22° C

**Relative Humidity:**39%

802.11n (FCC Limit)						
Operating Channel (MHz)	Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]	
5180.00	29.71	21.53	21.19	24.37	-5.34	
5240.00	29.71	24.01	<mark>24.24</mark>	27.14	-2.57	
802.11n (RSS Limit)						

602.1111 (KSS Linit)						
Operating Channel (MHz)	Power Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]	
5180.00	16.71	11.31	11.11	14.22	-2.49	
5240.00	16.71	11.20	<mark>11.48</mark>	14.35	-2.36	
Note: 1 The highest output newer was observed at HT20 MCS0 1 Date Stream						

Note: 1. The highest output power was observed at HT20 MCS0, 1 Data Stream.

2. The sum of Ch0 and Ch1 = Total Power.

3. FCC Limit = 30 dBm - (6.29 dBi - 6 dBi) = 29.71 dBm.

4. RSS-247 Limit = 23 dBm – 6.29 dBi = 16.71 dBm.

Table 4: RF Output Power at the Antenna Port – Test Results – Non Beamformi
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Test Conditions: Conducted Measurement, Normal Temperature and Voltage Only	
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Power Setting: See test plan

**Max. Directional Gain:** Antenna 1 = +6.29 dBi; Antenna 2 = +4.97 dBi

Signal State: Modulated at 100%.

**Ambient Temp.:** 22° C

**Relative Humidity:**39%

802.11n (FCC Limit)						
Operating Channel (MHz)	Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]	
5190.00	29.71	19.79	19.72	22.77	-6.94	
5230.00	29.71	24.85	<mark>24.86</mark>	27.87	-1.84	
802.11n (RSS Limit)						

Operating Channel (MHz)	Power Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]		
5190.00	16.71	13.33	13.22	16.29	-0.42		
5230.00	16.71	13.27	<mark>13.47</mark>	16.38	-0.33		
Note: 1. The highest output power was observed at HT40 MCS0, 1 Data Stream.							
2. The sum of Ch0 and Ch1 = Total Power.							
				17			

3. FCC Limit = 30 dBm - (6.29 dBi - 6 dBi) = 29.71 dBm.

4. RSS-247 Limit = 23 dBm – 6.29 dBi = 16.71 dBm.

		Test Conditions: Conducted Measurement, Normal	Temperature and Voltage Only	
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Power Setting: See test plan

**Max. Directional Gain:** Antenna 1 = +6.29 dBi; Antenna 2 = +4.97 dBi

Signal State: Modulated at 100%.

**Ambient Temp.:** 22° C

**Relative Humidity:**39%

802.11ac (FCC Limit)							
Operating Channel (MHz)	Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]		
5190.00	29.71	19.80	19.59	22.71	-7.00		
5230.00	29.71	24.72	<mark>24.81</mark>	27.78	-1.93		
	802 11ac (DSS I imit)						

802.11ac ( <b>K</b> 88 Limit)							
Operating Channel (MHz)	Power Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]		
5190.00	16.71	13.43	13.25	16.35	-0.36		
5230.00	16.71	13.34	<mark>13.55</mark>	16.46	-0.25		

Note: The highest output power was observed at VHT40 MCS0, 1 Data Stream.

802.11ac	(FCC Limit)
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Operating Channel (MHz)	Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]	
5210	29.71	19.70	<mark>19.74</mark>	22.73	-6.98	
802.11ac (RSS Limit)						
Operating Channel (MHz)	Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]	
5210	16.71	<mark>13.17</mark>	13.15	16.17	-0.54	

Note: 1. The highest output power was observed at VHT80 MCS0, 1 Data Stream.

2. The sum of Ch0 and Ch1 = Total Power.

3. FCC Limit = 30 dBm - (6.29 dBi - 6 dBi) = 29.71 dBm.

4. RSS-247 Limit = 23 dBm – 6.29 dBi = 16.71 dBm.

Table 6: RF Output Power at the Antenna Port – Test Results – Beamforming
---

Test Conditions: Conducted Measurement, Normal Temperature and Voltage Only
---

**Power Setting:** See test plan

Total Directional Gain: + 8.67 dBi

Signal State: Modulated at 100%.

Ambient Temp.: 22° C

**Relative Humidity:**39%

802.11a (FCC Limit)							
Operating Channel (MHz)	Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]		
5180.00	27.33	21.44	21.09	24.28	-3.06		
5240.00	27.33	21.26	<mark>21.65</mark>	24.47	-2.87		
802.11a (RSS Limit)							
Operating	Power						

Operating Channel (MHz)	Power Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]		
5180.00	14.33	8.97	8.82	11.91	-2.43		
5240.00	14.33	8.74	<mark>8.99</mark>	11.88	-2.46		
Note: 1 The highest output never was observed at 6Mhrs. 2 Data Straams							

Note: 1. The highest output power was observed at 6Mbps, 2 Data Streams.

2. The sum of Ch0 and Ch1 = Total Power.

3. FCC Limit = 30 dBm - (8.67 dBi - 6 dBi) = 27.33 dBm

4. RSS-247 Limit = 23 dBm - 8.67 dBi = 14.33 dBm.

Table 7: RF Output Power at the Antenna Port – Test Results – Beam	forming Continued
--	-------------------

**Power Setting:** See test plan

Total Directional Gain: + 8.67 dBi

Signal State: Modulated at 100%.

Ambient Temp.: 22° C

**Relative Humidity:**39%

802.11n (FCC Limit)						
Operating Channel (MHz)	Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]	
5180.00	27.33	21.53	21.19	24.37	-2.96	
5240.00	27.33	21.24	<mark>21.60</mark>	24.43	-2.90	
802.11n (RSS Limit)						

Operating Channel (MHz)	Power Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]
5180.00	14.33	<mark>8.91</mark>	8.71	11.82	-2.51
5240.00	14.33	8.63	8.87	11.76	-2.57

Note: 1. The highest output power was observed at HT20 MCS0, 2 Data Streams.

2. The sum of Ch0 and Ch1 = Total Power.

3. FCC Limit = 30 dBm - (8.67 dBi - 6 dBi) = 27.33 dBm

4. RSS-247 Limit = 23 dBm - 8.67 dBi = 14.33 dBm.

Table 8: RF Output Power at the Antenna Port – Test Results – Beamfe	orming Continued
--	------------------

**Power Setting:** See test plan

Total Directional Gain: + 8.67 dBi

Signal State: Modulated at 100%.

Ambient Temp.: 22° C

**Relative Humidity:**39%

802.11n (FCC Limit)					
Operating Channel (MHz)	Limit [dBm]	Ch0 [dBm] Ch1 [dBm] Total Power [dBm]		Total Power [dBm]	Margin [dB]
5190.00	27.33	19.79	19.72	22.77	-4.57
5230.00	27.33	24.26	<mark>24.36</mark>	27.32	-2.39
802.11n (RSS Limit)					

Operating Channel (MHz)	Power Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]
5190.00	14.33	10.82	10.77	13.81	-0.53
5230.00	14.33	10.81	<mark>11.09</mark>	13.96	-0.37
Note: 1. The highest output power was observed at HT40 MCS0, 2 Data Streams.					

2. The sum of Ch0 and Ch1 = Total Power.

3. FCC Limit = 30 dBm - (8.67 dBi - 6 dBi) = 27.33 dBm

4. RSS-247 Limit = 23 dBm - 8.67 dBi = 14.33 dBm.

Table 9: RF Out	put Power at	the Antenna Po	ort – Test Results	s – Beamforming Co	ntinued
Test Condition	s: Conducted	d Measurement,	Normal Temper	cature and Voltage O	nly
Antenna Type: FPCBPower Setting: See test plan			n		
Total Direction	nal Gain: + 8	3.67 dBi			
Signal State: M	Iodulated at	100%.			
Ambient Temp.: 22° CRelative Humidity:39%				%	
		802.11a	ac (FCC Limit)		
Operating Channel (MHz)	Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]
5190.00	27.33	19.80	19.59	22.71	-4.63
5230.00	27.33	24.21	<mark>24.28</mark>	27.26	-2.45
		802.11:	ac (RSS Limit)		
Operating Channel (MHz)	Power Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]
5190.00	14.33	10.81	10.76	13.80	-0.54
5230.00	14.33	10.80	<mark>11.07</mark>	13.95	-0.39
Note: The high	est output po	ower was observ	ved at VHT40 M	CS0, 1 Data Stream.	
		802.11a	ac (FCC Limit)		
Operating Channel (MHz)	Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]
5210	27.33	19.70	<mark>19.74</mark>	22.73	-4.60
	-	802.11:	ac (RSS Limit)		
Operating Channel (MHz)	Limit [dBm]	Ch0 [dBm]	Ch1 [dBm]	Total Power [dBm]	Margin [dB]
5210	14.33	10.73	<mark>10.79</mark>	13.77	-0.56
2. The su 3. FCC L 4. RSS-2 5. Plots f	fm of Ch0 and fm of Ch0 and fm of Ch0 and fm	d Ch1 = Total I 3m – (8.67 dBi - 3 dBm – 8.67 d asurements stat	Power. - 6 dBi) = 27.33 Bi = 14.33 dBm	ken, to reduce comp	



Figure 2: Non-Beamforming Max Transmitted Power (RSS), 5180 MHz at 11a, Chain 0

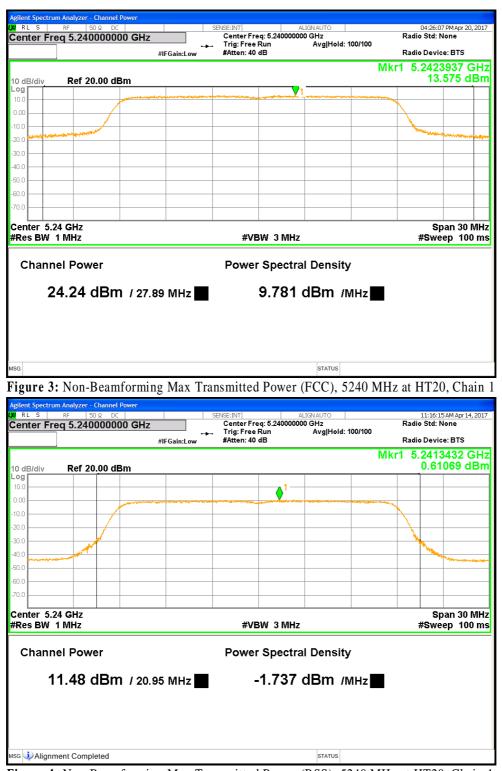


Figure 4: Non-Beamforming Max Transmitted Power (RSS), 5240 MHz at HT20, Chain 1

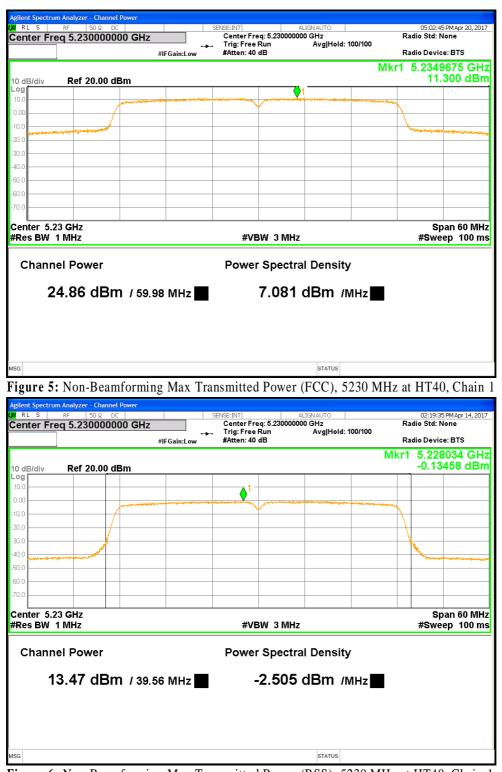


Figure 6: Non-Beamforming Max Transmitted Power (RSS), 5230 MHz at HT40, Chain 1

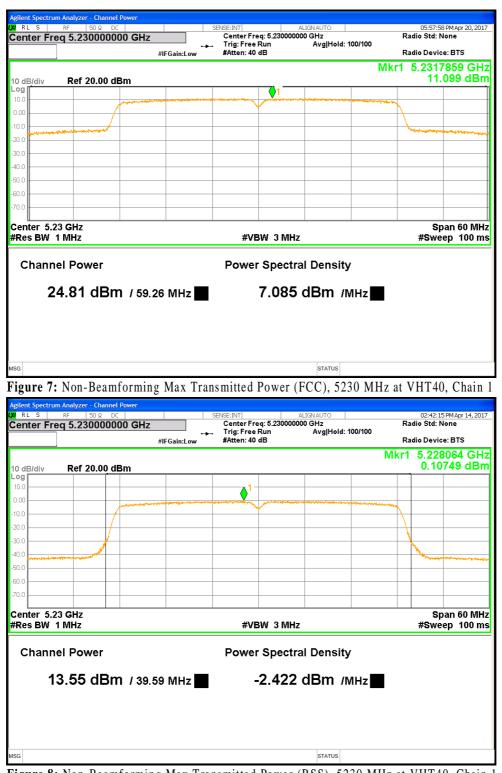


Figure 8: Non-Beamforming Max Transmitted Power (RSS), 5230 MHz at VHT40, Chain 1

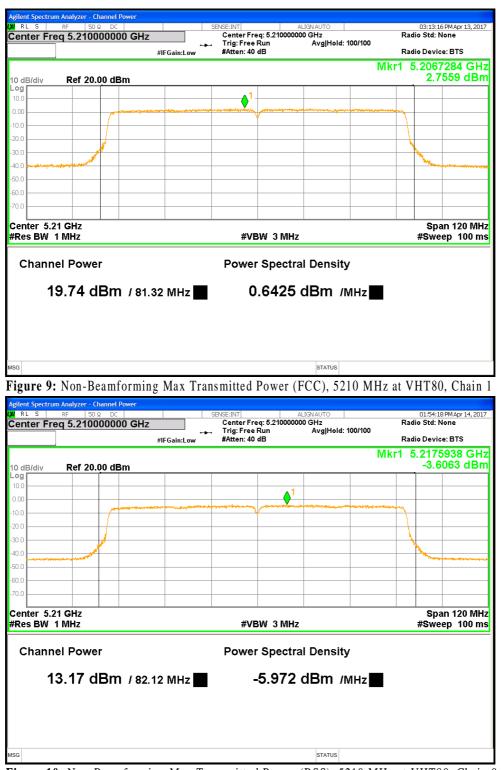


Figure 10: Non-Beamforming Max Transmitted Power (RSS), 5210 MHz at VHT80, Chain 0

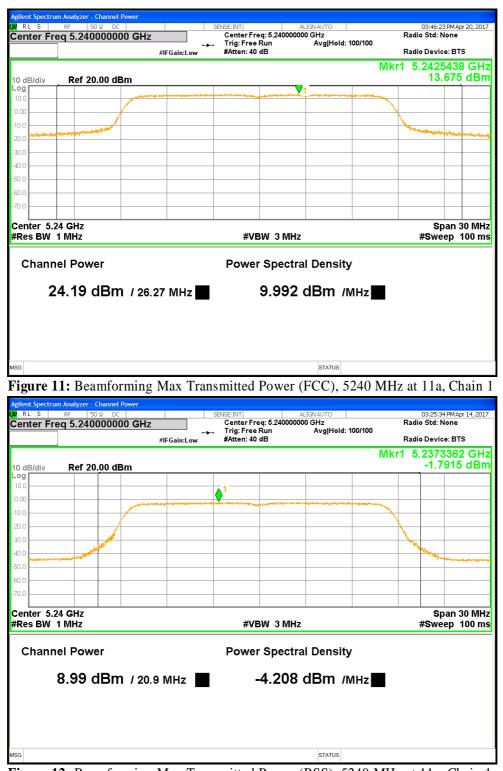


Figure 12: Beamforming Max Transmitted Power (RSS), 5240 MHz at 11a, Chain 1

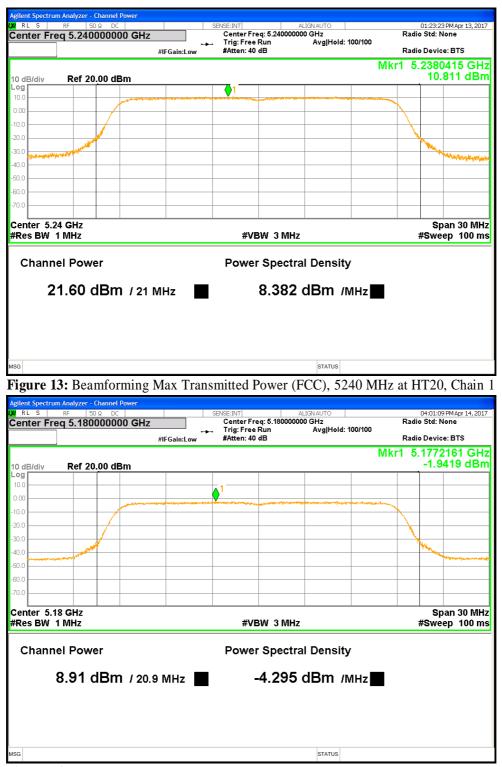


Figure 14: Beamforming Max Transmitted Power (RSS), 5180 MHz at HT20, Chain 0

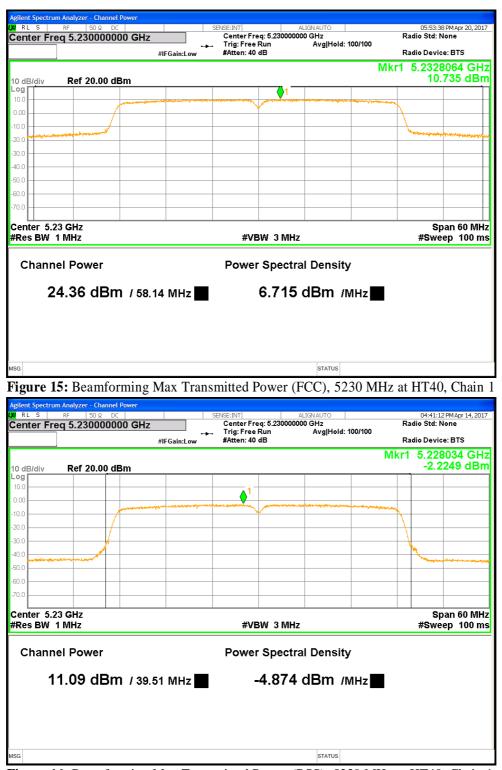


Figure 16: Beamforming Max Transmitted Power (RSS), 5230 MHz at HT40, Chain 1

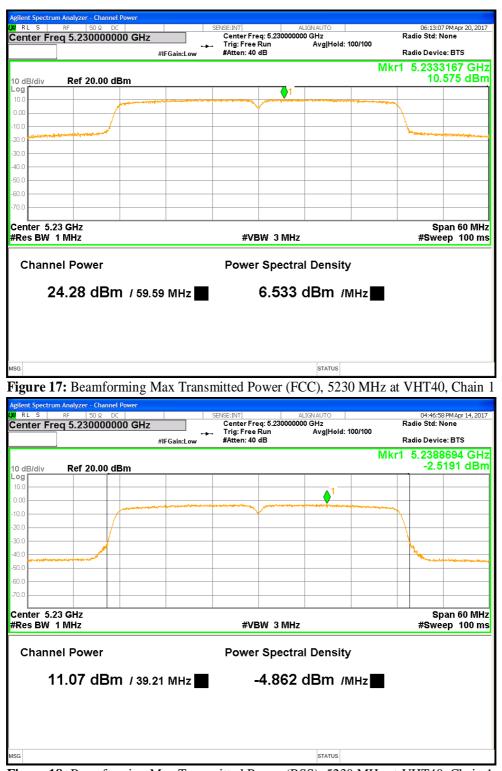


Figure 18: Beamforming Max Transmitted Power (RSS), 5230 MHz at VHT40, Chain 1

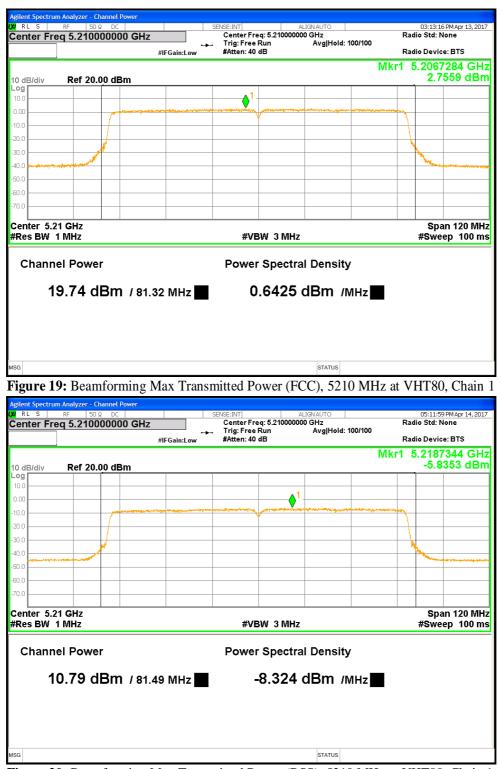


Figure 20: Beamforming Max Transmitted Power (RSS), 5210 MHz at VHT80, Chain 1

#### 4.2 Occupied Bandwidth

The occupied bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency.

The 99% bandwidth is the bandwidth in which 99% of the transmitted power occupied.

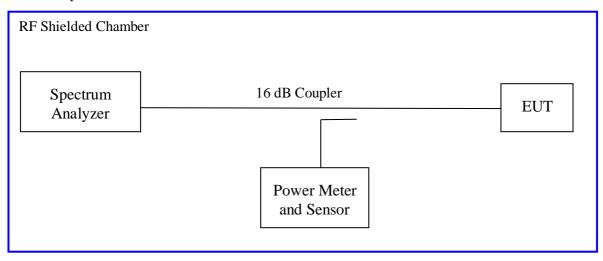
The 26 dB bandwidth is defined the bandwidth of 26 dBr from highest transmitted level of the fundamental frequency.

*There is no restriction limits for the bandwidth. The 26 dB bandwidth was used to determine the limit for maximum conducted output power per CFR47 Part 15.407(a).* 

#### 4.2.1 Test Method

The conducted method was used to measure the occupied bandwidth. The measurement was performed with modulation per CFR47 15.407(a) and RSS Gen Sect.6.6. The preliminary investigation was performed to find the narrowest 26 dB bandwidth for each operational mode at different data rates. This worst finding was performed on 3 channels in each operating frequency range; 5150 MHz to 5250 MHz. The worst results indicated below.

Test Setup:



#### 4.2.2 Results

These occupied bandwidth measurements were taken for references only.

Table 10: (	Occupied Bandwidth –	- Test Results			
Test Con	ditions: Conducted M	easurement, Normal Te	mperature and Voltage	only	
Antenna Type: FPCBPower Setting: See test plan					
Max. Dir	ectional Gain: Antenr	a 1 = +6.29  dBi; Anter	nna $2 = +4.97 \text{ dBi}$		
Total Dir	ectional Gain: + 8.67	dBi			
Signal Sta	ate: Modulated at 100	%.			
Ambient	<b>Temp.:</b> 22° C		<b>Relative Humidity:</b>	39%	
		802.11a	L		
Freq.	Freq.26dB Bandwidth (MHz)99% Bandwidth (MHz)				
(MHz)	Ch0	Ch1	Ch0	Ch1	
5180	19.398	<mark>19.438</mark>	16.391	<mark>16.391</mark>	
5240	19.297	19.214	16.384	16.390	
		Plots are placed in the r 802.11n vidth (MHz)	-	width (MHz)	
Freq. (MHz)	Ch0	Ch1	Ch0	Ch1	
5180	20.224	20.230	17.580	17.580	
5240	20.152	20.179	17.579	17.576	
2.1	Plots for all the measur	asured at HT20 MCS0, rements stated above we Plots are placed in the r 802.11n	ere taken, to reduce con report.	nplexity and bulkiness	
Freq.   26dB Bandwidth (MHz)			99% Bandwidth (MHz)		
(MHz)	Ch0	Ch1	Ch0	Ch1	
5190	39.376	39.301	35.932	35.946	
5230	39.350	<mark>39.546</mark>	35.946	<mark>35.951</mark>	
2.1	Plots for all the measur	asured at HT40 MCS0, rements stated above we Plots are placed in the r	ere taken, to reduce cor	nplexity and bulkiness	

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only							
Antenna Type: FPCBPower Setting: See test plan							
<b>Max. Directional Gain:</b> Antenna $1 = +6.29$ dBi; Antenna $2 = +4.97$ dBi							
Total Directional Gain: + 8.67 dBi							
Signal State: Modulated at 100%.							
Ambient Temp.: 22° CRelative Humidity:39%							
802.11ac							
Freq.	26dB Bandy	vidth (MHz)	th (MHz) 99% Bandwidth (M				
(MHz)	Ch0	Ch1	Ch0	Ch1			
5190	39.329	39.324	35.927	35.939			
5230	<mark>39.345</mark>	39.311	<mark>35.946</mark>	35.920			
<ul> <li>Note: 1. The bandwidth was measured at VHT40 MCS0, 1 Data Stream.</li> <li>2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.</li> </ul>							
802.11ac							
Freq.	26dB Bandy	vidth (MHz)	99% Band	lwidth (MHz)			
(MHz)	Ch0	Ch1	Ch0	Ch1			
5210	83.444	<mark>83.059</mark>	75.669	<mark>75.688</mark>			
S210     S5.444     S5.059     75.069     75.088       Note: 1. The bandwidth was measured at VHT80 MCS0, 1 Data Stream.     2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.     1000							

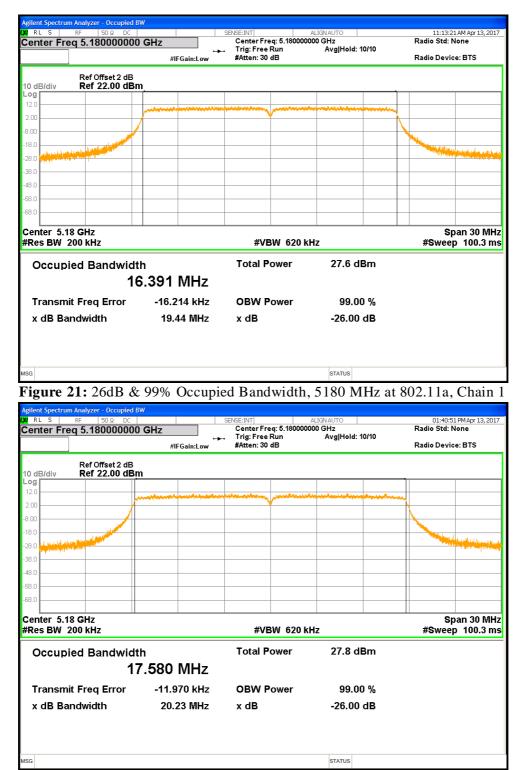


Figure 22: 26dB & 99% Occupied Bandwidth, 5180 MHz at HT20, Chain 1

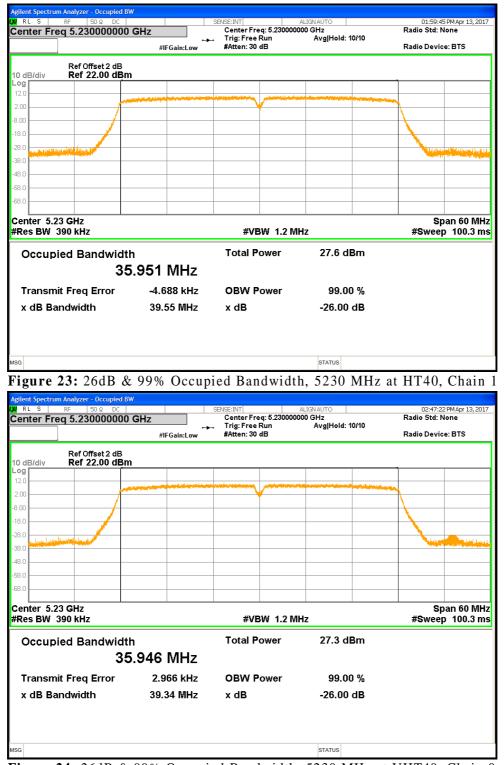


Figure 24: 26dB & 99% Occupied Bandwidth, 5230 MHz at VHT40, Chain 0

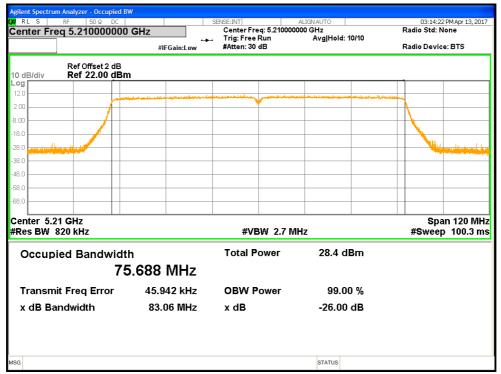


Figure 25: 26dB & 99% Occupied Bandwidth, 5210 MHz at VHT80, Chain 1

# 4.3 Peak Power Spectral Density

According to the CFR47 Part 15.407 (a) and RSS 247 Sect. 6.2.1.1 in the 5.15 - 5.25 GHz band, the spectral power density output of the antenna port shall be as followed listed below during any time interval of continuous transmission.

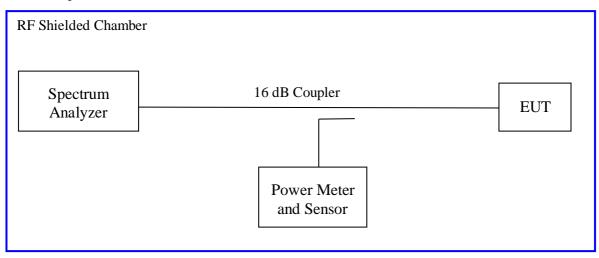
Part 15.407 (a): 17 dBm in any 1 MHz band

RSS 247 Section 6.2.1.1: 10 dBm in any 1 MHz band, E.I.R.P.

# 4.3.1 Test Method

The conducted method was used to measure the channel power output per ANSI C63.10-2013 Section 12.3.2.2. The measurement was performed with modulation per CFR47 Part 15.407 (a) and RSS 247 Sect. 6.2.1.1. The pre-evaluation was performed to find the worst modes. The worst findings were conducted on 3 channels in each operating frequency range of 5150 MHz to 5250 MHz. The worst sample result indicated below.

Test Setup:



## 4.3.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 12: Peak Power S	pectral Density – Test	Results – Non Beamforming

Power Setting: See test plan

**Max. Directional Gain:** Antenna 1 = +6.29 dBi; Antenna 2 = +4.97 dBi

Signal State: Modulated at 100%.

**Ambient Temp.:** 22° C

**Relative Humidity:**39%

802.11a (FCC Limit)						
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]	
5180	11.09	10.76	13.94	16.71	-2.77	
5240	<mark>13.71</mark>	13.65	16.69	16.71	-0.02	
	1	1		1	1	

802.11a	(RSS	Limit)
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Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]
5180	<mark>1.02</mark>	<mark>0.22</mark>	3.65	3.71	-0.06
5240	3.75	3.07	3.62	3.71	-0.09

Note: 1. The highest output power was observed at 6Mbps, 1 Data Stream.

2. The sum of Ch0 and Ch1 = Total PSD.

3. FCC Limit = 17 dBm - (6.29 dBi - 6 dBi) = 16.71 dBm.

4. RSS-247 Limit = 10 dBm – 6.29 dBi = 3.71 dBm.

	Table 13: Peak Po	ower Spectral Density	v – Test Results – Non	Beamforming Continued
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Power Setting: See test plan

**Max. Directional Gain:** Antenna 1 = +6.29 dBi; Antenna 2 = +4.97 dBi

Signal State: Modulated at 100%.

**Ambient Temp.:** 22° C

5240

**Relative Humidity:**39%

3.71

802.11n (FCC Limit)						
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]	
5180	10.59	10.50	13.56	16.71	-3.15	
5240	13.27	<mark>13.53</mark>	16.41	16.71	-0.30	
		000 11				

		802.11	n (RSS Limit)		
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]
5180	<mark>0.68</mark>	0.44	3.57	3.71	-0.14

Note: 1. The highest output power was observed at HT20 MCS0, 1 Data Stream.

2. The sum of Ch0 and Ch1 = Total PSD.

0.53

3. FCC Limit = 17 dBm - (6.29 dBi - 6 dBi) = 16.71 dBm.

0.51

4. RSS-247 Limit = 10 dBm - 6.29 dBi = 3.71 dBm.

5. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.

3.53

-0.18

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only									
Antenna Type: FPCBPower Setting: See test plan									
<b>Max. Directional Gain:</b> Antenna $1 = +6.29$ dBi; Antenna $2 = +4.97$ dBi									
Signal State: Modulated at 100%.									
Ambient Temp.: 22° CRelative Humidity:39%									
Peak Power Spectral Density									
802.11n (FCC Limit)									
Freq.Ch0Ch1Total PSDLimitMargin(MHz)[dBm][dBm][dBm][dBm][dB]									
5190	6.20	6.26	9.24	16.71	-7.47				
5230	<mark>11.56</mark>	11.50	14.54	16.71	-2.17				
802.11n (RSS Limit)									
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]				
5190	<mark>0.07</mark>	-0.47	2.81	3.71	-0.90				
5230	-0.32	-0.06	2.82	3.71	-0.89				
2. The 3. FC0	sum of Ch0 and C Limit = $17 \text{ dB}$	d Ch1 = Total P	6  dBi) = 16.71 dI		1.				
			d above were take ots are placed in th		plexity and				

## Table 14: Peak Power Spectral Density – Test Results – Non Beamforming Continued

Table 15: Peak Power Spectral Density – Test Results – Non Beamforming Cont	tinued
---	--------

Antenna Type: FPCB	<b>Power Setting:</b> See test plan
	i onei setting. see test plan

**Max. Directional Gain:** Antenna 1 = +6.29 dBi; Antenna 2 = +4.97 dBi

Signal State: Modulated at 100%.

Ambient Temp.:	22° C	
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**Relative Humidity:**39%

802.11ac (FCC Limit)									
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]				
5190	6.20	5.87	9.05	16.71	-7.66				
5230	<mark>11.43</mark>	11.32	14.39	16.71	-2.32				
802.11ac (RSS Limit)									
Freq.	Ch0	Ch1	Total PSD	Limit	Margin				

(MHz)	[dBm]	[dBm]	[dBm]	[dBm]	[dB]
5190	-0.21	-0.22	2.80	3.71	-0.91
5230	0.07	<mark>0.09</mark>	3.09	3.71	-0.62

**Note:** The highest output power was observed at VHT40 MCS0, 1 Data Stream.

	802.11ac (FCC Limit)								
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]				
5210	<mark>2.87</mark>	2.66	5.78	16.71	-10.93				
		802.11a	ac (RSS Limit)						
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]				
5210	<mark>-3.50</mark>	-3.81	-0.64	3.71	-4.35				

Note: 1.The highest output power was observed at VHT80 MCS0, 1 Data Stream.

2. The sum of Ch0 and Ch1 = Total PSD.

3. FCC Limit = 17 dBm - (6.29 dBi - 6 dBi) = 16.71 dBm.

4. RSS-247 Limit = 10 dBm – 6.29 dBi = 3.71 dBm.

<b>Table 16:</b> Peak Power Spectral Density – Test Results – Beamforming	Table	16: Peak	Power S	pectral	Density -	Test	Results -	Beamforming
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**Power Setting:** See test plan

#### **Total Directional Gain:** + 8.67 dBi

Signal State: Modulated at 100%.

Ambient Temp.: 22° C

**Relative Humidity:**39%

		802.11	a (FCC Limit)		
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]
5180	11.09	10.76	13.94	14.33	-0.39
5240	10.68	<mark>11.15</mark>	13.93	14.33	-0.40

802.11a (RS	SS Limit)
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Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]
5180	<mark>-1.76</mark>	<mark>-2.00</mark>	1.13	1.33	-0.20
5240	-2.01	-1.50	1.26	1.33	-0.08

**Note:** 1. The highest output power was observed at 6Mbps, 2 Data Streams.

2. The sum of Ch0 and Ch1 = Total PSD.

3. FCC Limit = 17 dBm - (8.67 dBi - 6 dBi) = 14.33 dBm.

4. RSS-247 Limit = 10 dBm – 8.67 dBi = 1.33 dBm.

**Power Setting:** See test plan

### **Total Directional Gain:** + 8.67 dBi

Signal State: Modulated at 100%.

Ambient Temp.: 22° C

**Relative Humidity:**39%

		802.11	n (FCC Limit)		
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]
5180	10.59	10.50	13.56	14.33	-0.77
5240	10.35	<mark>10.86</mark>	13.62	14.33	-0.71
		802.11	n (RSS Limit)		

Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]			
5180	-1.89	-2.18	0.98	1.33	-0.36			
5240	-1.93	-1.75	1.17	1.33	-0.16			

Note: 1.The highest output power was observed at HT20 MCS0, 2 Data Streams.

2. The sum of Ch0 and Ch1 = Total PSD.

3. FCC Limit = 17 dBm - (8.67 dBi - 6 dBi) = 14.33 dBm.

4. RSS-247 Limit = 10 dBm - 8.67 dBi = 1.33 dBm.

Table 18: Peal	x Power Spectra	l Density – Tes	t Results – Beamf	orming Continue	d
Test Conditi	ons: Conducted	Measurement,	Normal Temperat	ure and Voltage of	only
Antenna Typ	e: FPCB		Power Se	tting: See test pl	an
Total Directi	onal Gain: + 8	.67 dBi			
Signal State:	Modulated at 1	00%.			
Ambient Ter	<b>np.:</b> 22° C		Rela	tive Humidity:3	9%
		Peak Powe	r Spectral Densit	y	
		802.11r	n (FCC Limit)		
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]
5190	6.20	6.26	9.24	14.33	-5.09
5230	10.89	<mark>10.93</mark>	13.92	14.33	-0.41
		802.11	n (RSS Limit)		
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]
5190	-2.73	-2.94	0.18	1.33	-1.16
5230	-2.60	<mark>-2.48</mark>	0.47	1.33	-0.86
2. The 3. FCC 4. RSS 5. Plot	sum of Ch0 and C Limit = $17 \text{ dB}$ C Limit = $100000000000000000000000000000000000$	l Ch1 = Total P m – (8.67 dBi – ) dBm – 8.67 dI surements state	6  dBi) = 14.33 dl	3m. en, to reduce com	

Fable 19: Peak	Power Spectra	l Density – Test	Results – Beamfo	orming Continued	t l
Test Condition	ons: Conducted	Measurement, M	Normal Temperatu	re and Voltage of	only
Antenna Typ	e: FPCB		Power Set	tting: See test pla	an
Total Directi	onal Gain: + 8.	67 dBi			
Signal State:	Modulated at 1	00%.			
Ambient Ten	<b>np.:</b> 22° C		Relat	tive Humidity:3	9%
		802.11a	c (FCC Limit)		
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]
5190	6.20	5.87	9.05	14.33	-5.28
5230	10.88	<mark>10.91</mark>	13.91	14.33	-0.42
		802.11a	c (RSS Limit)		
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]
5190	-2.72	-2.75	0.28	1.33	-1.06
5230	-2.73	<mark>-2.47</mark>	0.41	1.33	-0.92
Note: The high	ghest output pov	wer was observe	ed at VHT40 MCS	0, 1 Data Stream	1.
		802.11a	c (FCC Limit)		
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]
5210	2.87	2.66	5.78	14.33	-8.55
		802.11a	c (RSS Limit)		
Freq. (MHz)	Ch0 [dBm]	Ch1 [dBm]	Total PSD [dBm]	Limit [dBm]	Margin [dB]
5210	-6.03	<mark>-5.95</mark>	-2.98	1.33	-4.31
2. The 3. FCC 4. RSS	sum of Ch0 and C Limit = $17 \text{ dBr}$ -247 Limit = $10$	l Ch1 = Total PS m – (8.67 dBi – ) dBm – 8.67 dB	6 dBi) = 14.33 dB	sm.	
			to are placed in th		pickity and

bulkiness of the report Highlighted Plots are placed in the report.

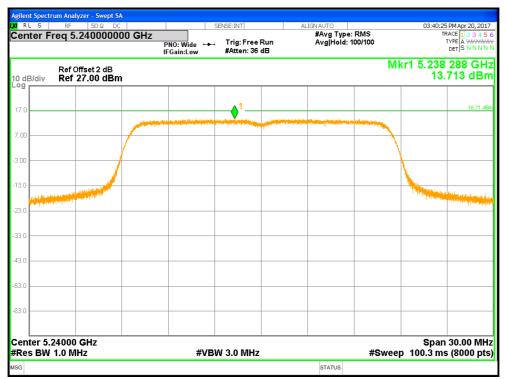


Figure 26: Non-Beamforming Power Spectral Density (FCC), 5240 MHz at 802.11a, Chain 0

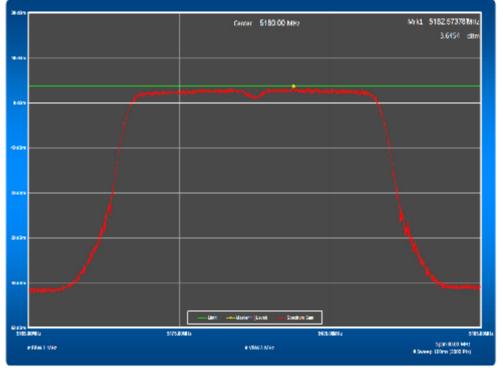


Figure 27: Non-Beamforming Power Spectral Density (RSS), 5180 MHz at 802.11a, Chain 0 & 1



Figure 28: Non-Beamforming Power Spectral Density (FCC), 5240 MHz at HT20, Chain 1



Figure 29: Non-Beamforming Power Spectral Density (RSS), 5180 MHz at HT20, Chain 0

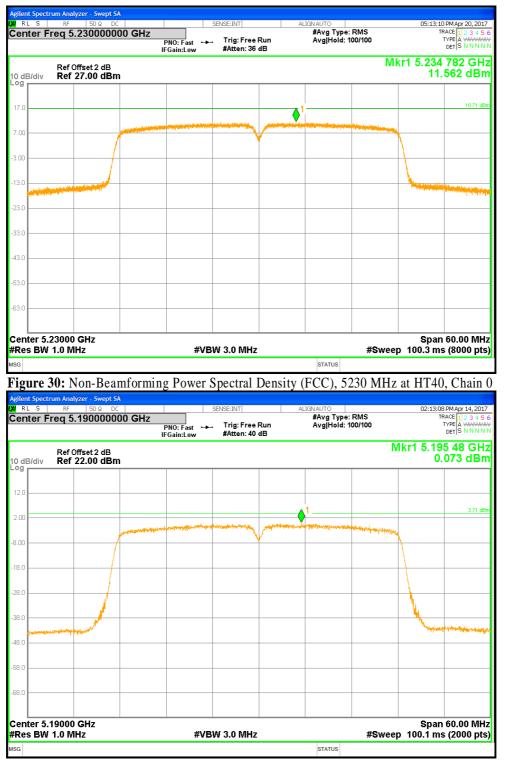


Figure 31: Non-Beamforming Power Spectral Density (RSS), 5190 MHz at HT40, Chain 0

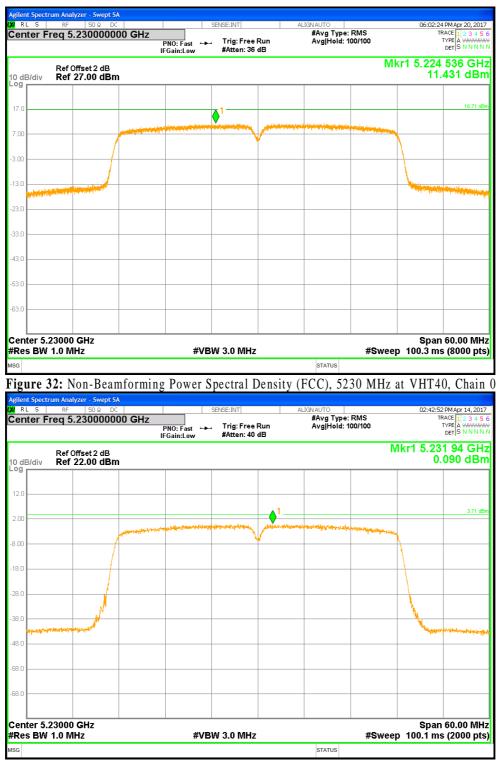


Figure 33: Non-Beamforming Power Spectral Density (RSS), 5230 MHz at VHT40, Chain 1

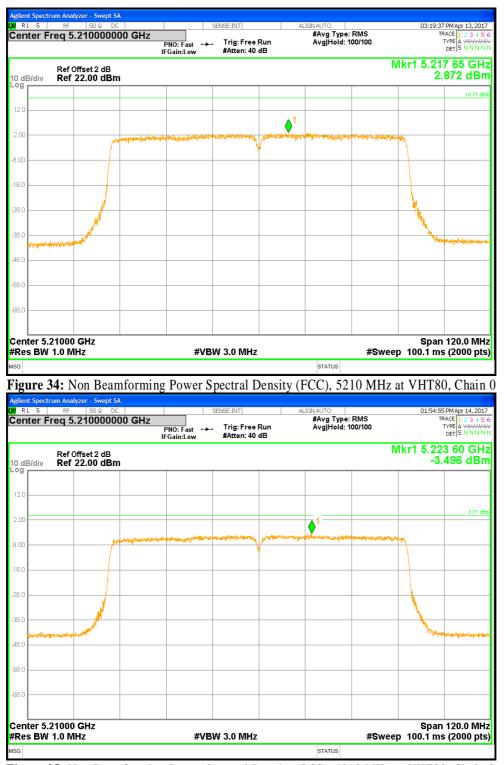


Figure 35: Non Beamforming Power Spectral Density (RSS), 5210 MHz at VHT80, Chain 0



Figure 36: Beamforming Power Spectral Density (FCC), 5240 MHz at 802.11a, Chain 1

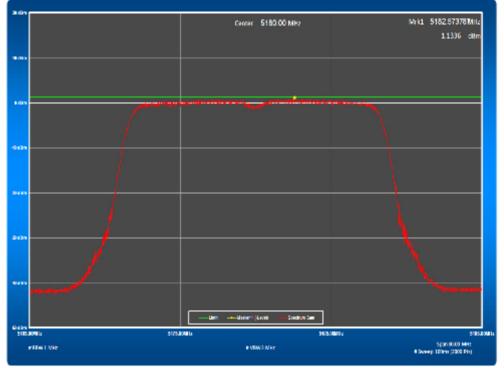
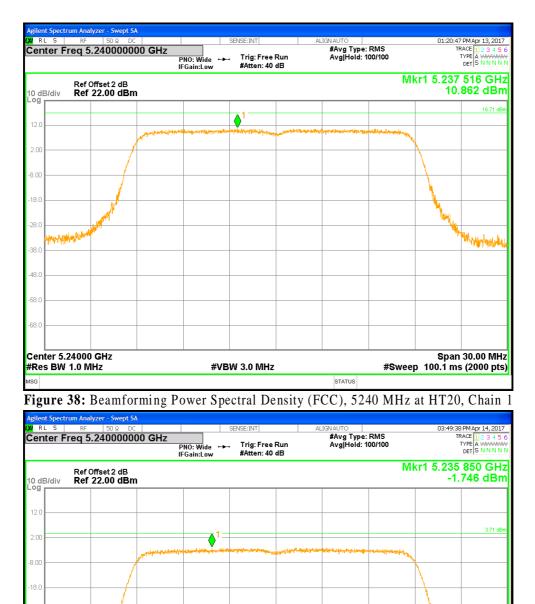


Figure 37: Beamforming Power Spectral Density (RSS), 5180 MHz at 802.11a, Chain 0 & 1



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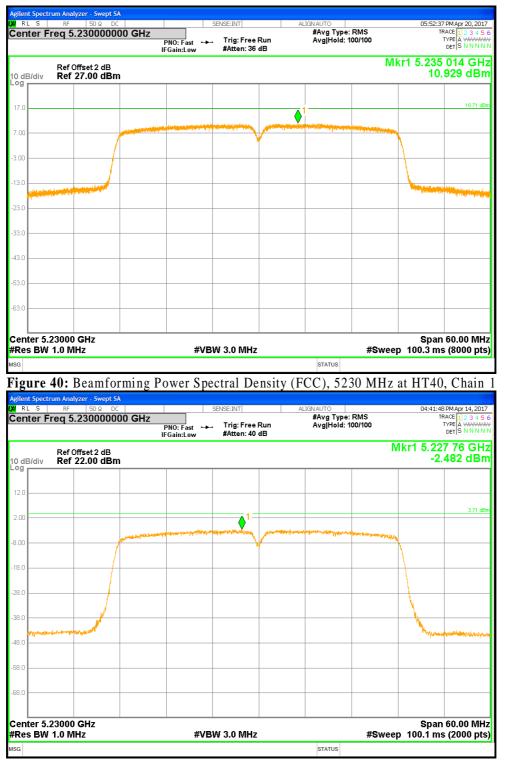


Figure 41: Beamforming Power Spectral Density (RSS), 5230 MHz at HT40, Chain 1

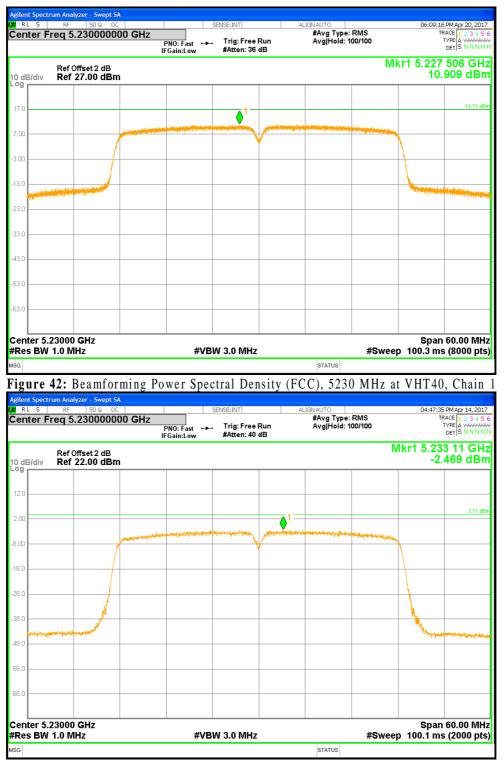


Figure 43: Beamforming Power Spectral Density (RSS), 5230 MHz at VHT40, Chain 1

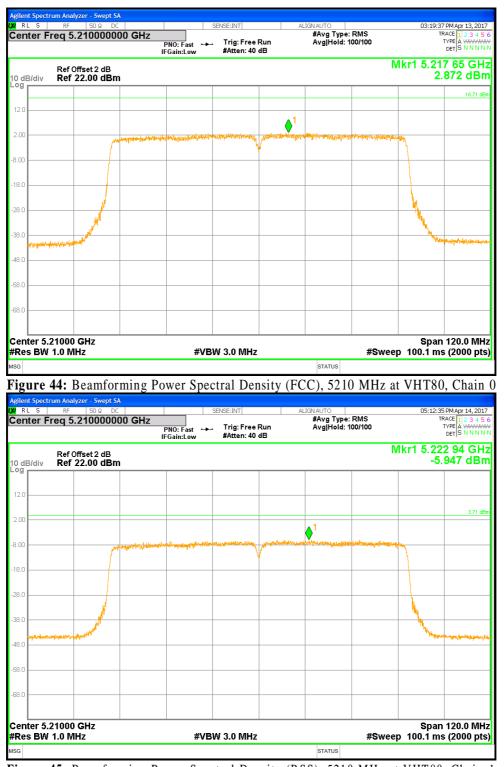


Figure 45: Beamforming Power Spectral Density (RSS), 5210 MHz at VHT80, Chain 1

# 4.4 Undesirable Emission Limits

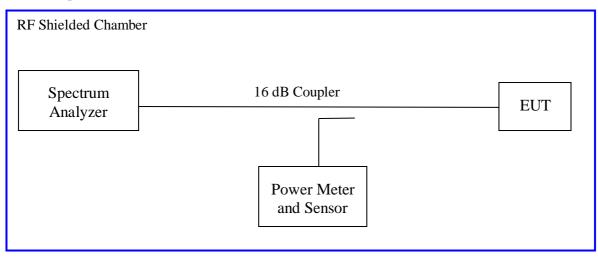
*CFR47* 15.407 (b) and RSS 247 Sect.6.2.1.2: The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

# 4.4.1 Test Method

The conducted method was used to measure the undesirable emission requirement. The measurement was performed with modulation. This test was conducted on 3 channels of Sample in each mode on Sample. The worst sample result indicated below.

Test Setup:



Measurement Procedure AVG2 of KDB 662911

# 4.4.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only

Antenna Type: FPCB

Power Setting: See test plan

**Max. Directional Gain:** Antenna 1 = +6.29 dBi; Antenna 2 = +4.97 dBi

Total Directional Gain: + 8.67 dBi

Signal State: Modulated at 100%.

**Ambient Temp.:** 22° C

**Relative Humidity:**39%

Non-Restricted Frequency Band Emission							
Freq. (MHz)	Mode	Chain	Measured (dBm)	Limit (dBm)	Plots	Comments	
5147.57	6Mbps	0	-28.59	-27.00	Fig. 46, 47	Pass TX at 5180 MHz; TP22	
5148.40	6Mbps	1	-27.90	-27.00	Fig. 48, 49	Pass TX at 5180 MHz; TP22	
5149.82	6Mbps	0	-30.91	-27.00	Fig. 50	Pass TX at 5200 MHz; TP25	
5148.05	6Mbps	1	-31.66	-27.00	Fig. 51	Pass TX at 5200 MHz; TP25	
5248.18	6Mbps	0	N/A	N/A	Fig. 52	Pass In-band-edge. No DFS needed.	
5248.17	6Mbps	1	N/A	N/A	Fig. 53	Pass In-band-edge. No DFS needed	
5148.90	HT20-MCS0	0	-29.21	-27.00	Fig. 54, 55	Pass TX at 5180 MHz; TP22	
5149.22	HT20-MCS0	1	-29.53	-27.00	Fig. 56, 57	Pass TX at 5180 MHz; TP22	
5140.50	HT20-MCS0	0	-31.68	-27.00	Fig. 58	Pass TX at 5200 MHz; TP25	
5148.73	HT20-MCS0	1	-31.67	-27.00	Fig. 59	Pass TX at 5200 MHz; TP25	
5248.80	HT20-MCS0	0	N/A	N/A	Fig. 60	Pass In-band-edge. No DFS needed	
5248.81	HT20-MCS0	1	N/A	N/A	Fig. 61	Pass In-band-edge. No DFS needed	
5148.57	HT40 MCS0	0	-29.17	-27.00	Fig. 62, 63	Pass TX at 5190 MHz; TP20.5	
5150	HT40 MCS0	1	-33.07	-27.00	Fig. 64, 65	Pass TX at 5190 MHz; TP20.5	

Note: 1. All out of band emissions are lower than the 27dBr level.

2. The maximum out of band emission on each individual output is at least 27 dB below the maximum in-band PSD on that output per KDB 662911.

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only

Antenna Type: FPCB

**Power Setting:** See test plan

**Max. Directional Gain:** Antenna 1 = +6.29 dBi; Antenna 2 = +4.97 dBi

Total Directional Gain: + 8.67 dBi

Signal State: Modulated at 100%.

**Ambient Temp.:** 22° C

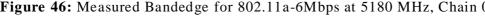
**Relative Humidity:**39%

	Non-Restricted Frequency Band Emission							
Freq. (MHz)	Mode	Chain	Measured (dBm)	Limit (dBm)	Plots	Comments		
5248.03	HT40 MCS0	0	N/A	N/A	Fig. 66	Pass In-band-edge. No DFS needed.		
5248.05	HT40 MCS0	1	N/A	N/A	Fig. 67	Pass In-band-edge. No DFS needed.		
5143.20	VHT40 MCS0	0	-30.27	-27.00	Fig. 68, 69	Pass TX at 5190 MHz; TP20.5		
5148.94	VHT40 MCS0	1	-28.95	-27.00	Fig. 70, 71	Pass TX at 5190 MHz; TP20.5		
5248.03	VHT40 MCS0	0	N/A	N/A	Fig. 72	Pass In-band-edge. No DFS needed.		
5248.03	VHT40 MCS0	1	N/A	N/A	Fig. 73	Pass In-band-edge. No DFS needed.		
5138.60	VHT80 MCS0	0	-30.58	-27.00	Fig. 74, 75	Pass TX at 5210 MHz; TP21		
5148.81	VHT80 MCS0	1	-27.75	-27.00	Fig. 76, 77	Pass TX at 5210 MHz; TP21		
5248.03	VHT80 MCS0	0	N/A	N/A	Fig. 78	Pass In-band-edge. No DFS needed.		
5248.04	VHT80 MCS0	1	N/A	N/A	Fig. 79	Pass In-band-edge. No DFS needed.		

Note: 1. All out of band emissions are lower than the 27dBr level.

2. The maximum out of band emission on each individual output is at least 27 dB below the maximum in-band PSD on that output per KDB 662911.

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N 1 f	5.150 000 GHz				
N 1 f 2 N 1 f 3 N 1 f	5.250 000 GHz	-40.541 dBm			
N 1 f 2 N 1 f 3 N 1 f 4 N 1 f 5		-40.541 dBm -28.591 dBm			
N 1 F 2 N 1 F 3 N 1 F 4 N 1 F 5 6	5.250 000 GHz				
N         1         f           2         N         1         f           3         N         1         f           4         N         1         f           5         6         7         7	5.250 000 GHz				
N 1 f 2 N 1 f 3 N 1 f 4 N 1 f 5 6 7 8 9 0	5.250 000 GHz				
N 1 f 2 N 1 f 3 N 1 f	5.250 000 GHz				>



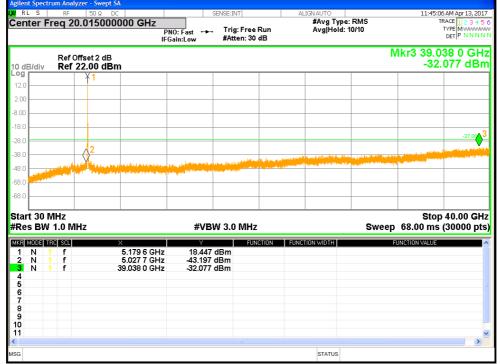


Figure 47: Undesirable Emission for 802.11a-6Mbps at 5180 MHz, Chain 0

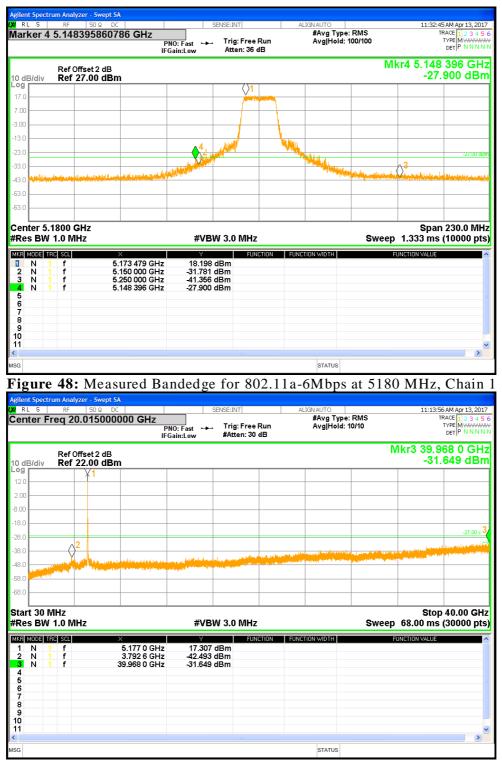


Figure 49: Undesirable Emission for 802.11a-6Mbps at 5180 MHz, Chain 1

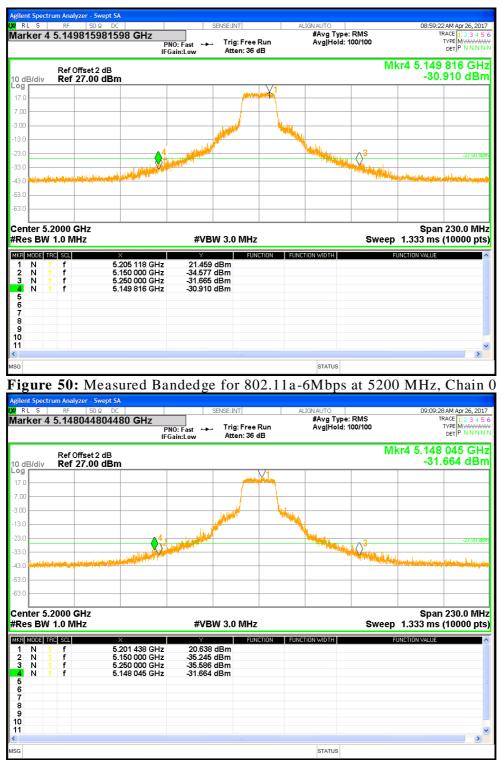


Figure 51: Measured Bandedge for 802.11a-6Mbps at 5200 MHz, Chain 1



Figure 53: Measured In-Band edge for 802.11a-6Mbps at 5240 MHz, Chain 1

- wh	S		RF 50 Ω			SENSE:INT	AL	IGNAUTO		12:49:	04 PM Apr 13, 20
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1	N										
1			f f	5.150 000 GHz 5.250 000 GHz	-30.170 -39.146						
1 2 3 <mark>4</mark>	N N		f	5.150 000 GHz		dBm					
1 2 3 4 5 6	N N N		f f	5.150 000 GHz 5.250 000 GHz	-39.146	dBm					
1 2 3 4 5 6 7	N N N		f f	5.150 000 GHz 5.250 000 GHz	-39.146	dBm					
1 2 3 4 5 6 7	N N N		f f	5.150 000 GHz 5.250 000 GHz	-39.146	dBm					
1 2 3 4 5 6	N N N		f f	5.150 000 GHz 5.250 000 GHz	-39.146	dBm					

Figure 54: Measured Bandedge for HT20-MCS0 at 5180 MHz, Chain 0

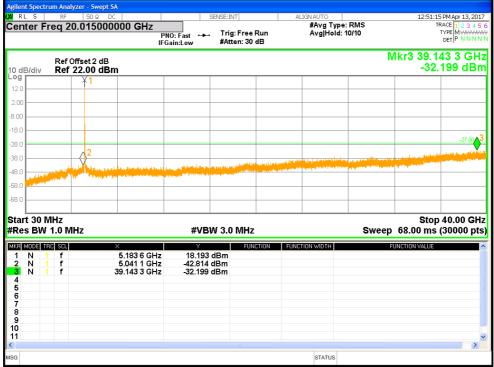


Figure 55: Undesirable Emission for HT20-MCS0 at 5180 MHz, Chain 0

	6 RF	50 Ω DC	SENSE:IN	AL AL	.IGN AUTO	01:37:51 PM Apr 13	
larke	r 4 5.14	9224001100 GHz		g: Free Run en: 36 dB	#Avg Type: RMS Avg Hold: 100/100	TRACE 123 TYPE MW DET PN	ARARA
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1 N 2 N 3 N	1 f 1 f	5.250 000 GH					
1 N 2 N 3 N 4 N		5.250 000 GH 5.149 224 GH					
N 2 N 3 N 4 N 5 6	1 f						
N 2 N 3 N 4 N 5 6 7	1 f						
N 2 N 3 N 4 N 5 6 7 8 9	1 f						
N 2 N 3 N 4 N 5 6 7	1 f						

Figure 56: Measured Bandedge for HT20-MCS0 at 5180 MHz, Chain 1

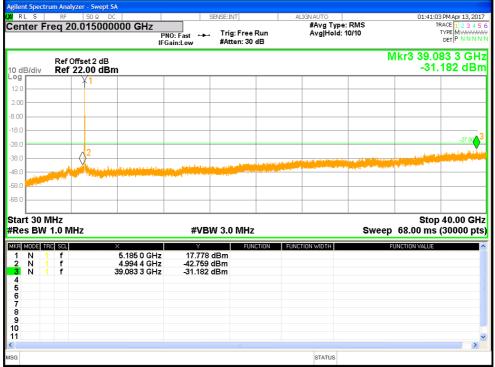


Figure 57: Undesirable Emission for HT20-MCS0 at 5180 MHz, Chain 1

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		000 GH								Spar	n 230.0 MH
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_	DE TRO		×		Y		NCTION FUI	NCTION WIDTH		UNCTION VALUE	
1 N 2 N		f f	5.202 10 5.150 00		20.935						
3 N	1	f	5.250 00	0 GHz	-31.813	dBm					
4 N	1	Т	5.140 50	UGHZ	-31.676 (	авт					
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6 7											
6 7 8 9											
6 7											>

Figure 58: Measured Bandedge for HT20-MCS0 at 5200 MHz, Chain 0

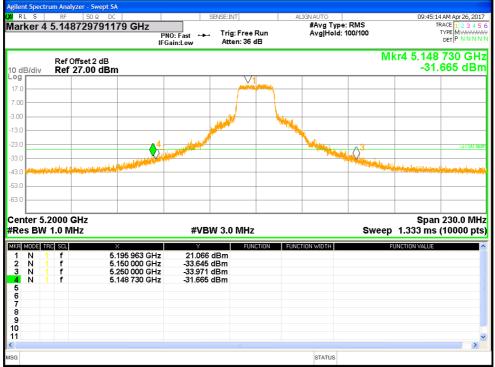


Figure 59: Undesirable Emission for HT20-MCS0 at 5200 MHz, Chain 1

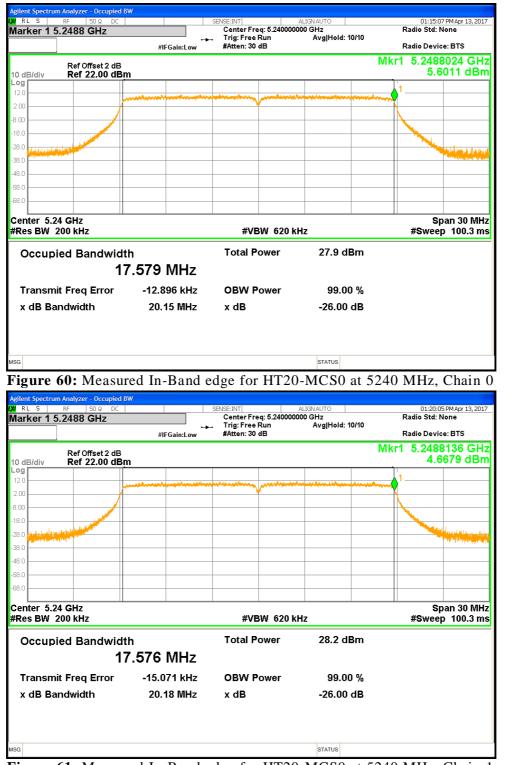


Figure 61: Measured In-Band edge for HT20-MCS0 at 5240 MHz, Chain 1

RL 9 RF 507 larker 4 5.1485728	PHO	SENSE: INT Tast Trig: Free Ru n:Low Atten: 36 dB		MS	12:30:44 PMApr 13:301 17402 1 2:34 5 1746 Michael 1747 Physical 12:34 5 1746 Michael
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6					
5 6 7 9					
9 0 1					
					)

Figure 62: Measured Bandedge for HT40-MCS0 at 5190 MHz, Chain 0

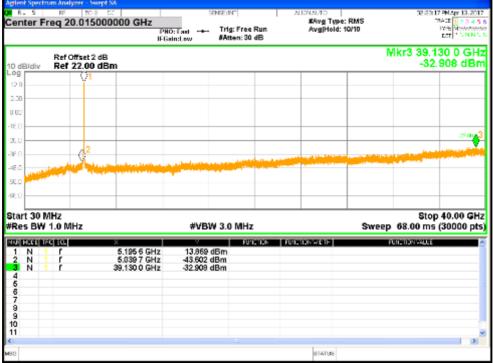


Figure 63: Undesirable Emission for HT40-MCS0 at 5190 MHz, Chain 0

RL 9 RF 507 Center Freq 5.1900	00000 GHz	SENSE:NC Trig: Free Ru In:Low Atten: 36 dB			01,48:55 PMApr 13,3 17445 12,34 1746 Mitwart Lot 111,114
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CTO MANAGEMENT					
0.0					
0.0					Span 230.0 M
≂.0 ≈.0 Center 5.1900 GHz Res BW 1.0 MHz		#VBW 3.0 MHz		Sweep	Span 230.0 M 1.333 ms (10000 p
enter 5.1900 GHz Res BW 1.0 MHz	*	Y FURCH	ok Function weth		Span 230.0 M 1.333 ms (10000 p
enter 5.1900 GHz Res BW 1.0 MHz CITXOPICO EC. 1 N 1 f 2 N 1 f	5.196 545 GHz 5.150 000 GHz	14.835 dBm -33.065 dBm	on Function with F		1.333 ms (10000 p
enter 5.1900 GHz Res BW 1.0 MHz SPICKOP ICO EKU 1 N 1 F 2 N 1 F 3 N 1 F 4 N 1 F	5.196 545 GHz	14.835 dBm	Sk PUTCHSKWCH		1.333 ms (10000 p
E U enter 5.1900 GHz Res BW 1.0 MHz CELENT FOLCO CELENT CE	5.196 545 GHz 5.150 000 GHz 5.250 000 GHz	14,835 dBm -33,065 dBm -36,535 dBm	SK FUIDION WOIF		1.333 ms (10000 p
Enter 5.1900 GHz Res BW 1.0 MHz CITCH FO ECC 1 N 1 F 2 N 1 F 3 N 1 F 4 N 1 F 5 6	5.196 545 GHz 5.150 000 GHz 5.250 000 GHz	14,835 dBm -33,065 dBm -36,535 dBm	5 FUIDINA CIF		1.333 ms (10000 p
EU enter 5.1900 GHz Res BW 1.0 MHz SEIXED TO EU 1 N 1 F 2 N 1 F 3 N 1 F 4 N 1 F 5 6 7 9 9	5.196 545 GHz 5.150 000 GHz 5.250 000 GHz	14,835 dBm -33,065 dBm -36,535 dBm			1.333 ms (10000 p
EU enter 5.1900 GHz Res BW 1.0 MHz SEIXE9 TO EU 1 N 1 F 2 N 1 F 3 N 1 F 4 N 1 F	5.196 545 GHz 5.150 000 GHz 5.250 000 GHz	14,835 dBm -33,065 dBm -36,535 dBm	36 FURCION W CIF		1.333 ms (10000 p

Figure 64: Measured Bandedge for HT40-MCS0 at 5190 MHz, Chain 1

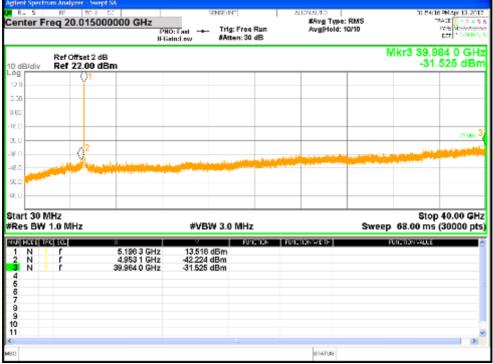


Figure 65: Undesirable Emission for HT40-MCS0 at 5190 MHz, Chain 1

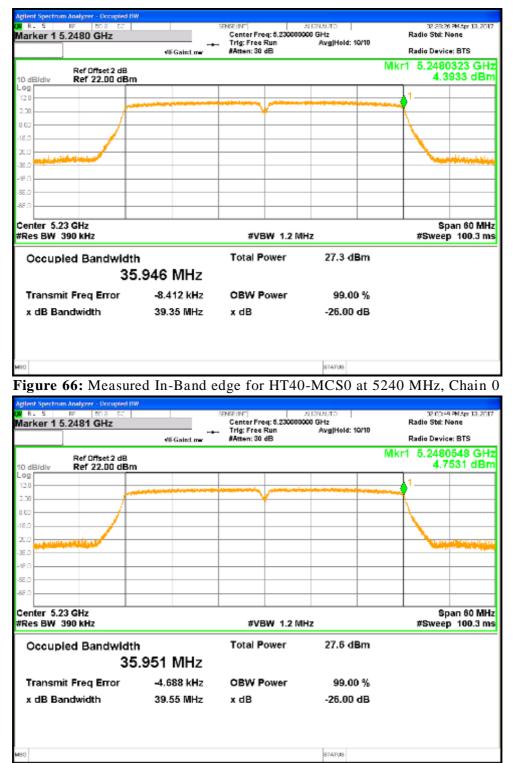


Figure 67: Measured In-Band edge for HT40-MCS0 at 5240 MHz, Chain 1

R.S № 50 Marker 4 5.1431973	R 52 297230 GHz PHO: Fa IFGain:L		AUGNAUTO #Avg Type: RMS Avg/Hold: 100/100	02 H2:38 PM Apr 13, 201 174 CE 1 2 3 4 5 174 E Mitaataa LCT 11 N N 1
Ref Offset 2 0 dB/div Ref 27.00			М	kr4 5.143 197 GH -30.271 dBr
0g 17.0				
7.00			<u> </u>	
100				
0.8.0				
0.02	<b>♦</b> 4≎	e audit	Male al al and a state	-2/10/8
80	البارا فستستبط الاختلسات الماليان	- Andrew	and the second	have a sure of the second second
G.0 <b>1999 1999 1999 1999</b>				
8.0				
Center 5.1900 GHz		#VBW 3.0 MHz	Sweep	Span 250.0 MH 1.333 ms (10000 pt
Res BW 1.0 MHz		A NUMBER OF	FUNCTION WIDTH	UNCTION VALUE
KALINGCE TRO ECL	5 175 495 CHz		For the second second	
	5.176 496 GHz 5.150 000 GHz	14.739 dBm 29.566 dBm		
72 HAGE HEO EQU 0 N 1 F 2 N 1 F 3 N 1 F 4 N 1 F	5.176 486 GHz 5.150 000 GHz 5.250 000 GHz	14.739 dBm		
I HAGE HEO EQU N 1 F 2 N 1 F 3 N 1 F 4 N 1 F	5.176 486 GHz 5.150 000 GHz 5.250 000 GHz	14.739 dBm 29.566 dBm 37.570 dBm		
I HAGE HEO EQU N 1 F 2 N 1 F 3 N 1 F 4 N 1 F	5.176 486 GHz 5.150 000 GHz 5.250 000 GHz	14.739 dBm 29.566 dBm 37.570 dBm		
E EXCENEL EC. N 1 F 2 N 1 F 3 N 1 F 6 7 9 9 00	5.176 486 GHz 5.150 000 GHz 5.250 000 GHz	14.739 dBm 29.566 dBm 37.570 dBm		
I HAGE HEO EQU N 1 F 2 N 1 F 3 N 1 F 4 N 1 F	5.176 486 GHz 5.150 000 GHz 5.250 000 GHz	14.739 dBm 29.566 dBm 37.570 dBm		

Figure 68: Measured Bandedge for VHT40-MCS0 at 5190 MHz, Chain 0

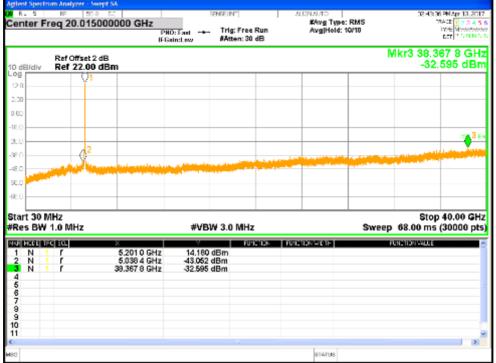


Figure 69: Undesirable Emission for VHT40-MCS0 at 5190 MHz, Chain 0

arker 4 5.1489438 Marker 4 5.1489438	51885 GHz	SENSE:INT : Fast Trig: Free Ru In:Law Atten: 36 dB	in Avg Hol	19e: RMS d: 100/100	02:50:42 PM Apr 13, 201 1784 02 1 2 3 4 5 1786 01 2 3 4 5 1786 01 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Ref Offset 2 10 dB/div Ref 27.00				M	kr4 5.148 944 GH -28.948 dBr
.0g 17.0			() <sup>1</sup>		
7.00			and a second sec		
3.00					
18.0			- <u> </u>		
20.0		States -	VIII III		-27.00 8
350	and the second second			al mainte	All the second second second second
43.0 <b>GARAGENE</b> 53.0					
8:0					
Center 5.1900 GHz Res BW 1.0 MHz		#VBW 3.0 MHz		Sweep	Span 250.0 MH 1.333 ms (10000 pt
REF HOLE THE ECC	×		ON FUNCTION WIDTH	;	UNCTION VALUE
N 1 F 2 N 1 F 3 N 1 F	5.202 714 GHz 5.150 000 GHz 5.250 000 GHz	13.674 dBm -34.786 dBm -39.623 dBm			
4 N 1 F 5	5.148 944 GHz	-26.948 dBm			
6 7					
9 9					
10					
i i		5			3
90			STATUS		

Figure 70: Measured Bandedge for VHT40-MCS0 at 5190 MHz, Chain 1

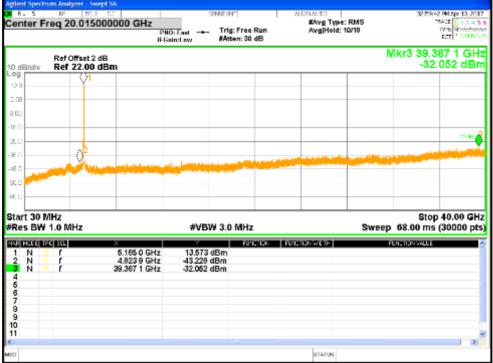


Figure 71: Undesirable Emission for VHT40-MCS0 at 5190 MHz, Chain 1

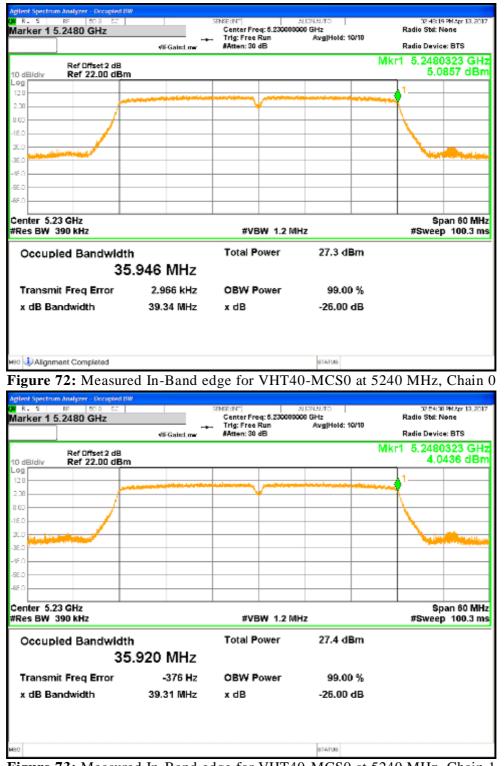


Figure 73: Measured In-Band edge for VHT40-MCS0 at 5240 MHz, Chain 1

RLS RF 501 Marker 4 5.1386018	8 52 860186 GHz PHD: Fa IFGaint		AUGNAUTO #Avg Type: RMS Avg/Hold: 100/100	03:17:49 PM Apr 13, 201 18425 1 2 3 4 5 17:6 Michaelan 1975 1 1 N N 1
Ref Offset 2 IO dBidiv Ref 27.00			M	kr4 5.138 602 GH -30.577 dBn
.0g 17.0			01	
7.00			and the second s	
1.00				
15.0				
21.0	4			-2/10/2
19.0	A STATE AND A STATE AND A STATE AND	/	Anna Agentempter	Sand and and a second sec
G.O. CO. CO. CO. CO. CO. CO. CO. CO. CO.	autor includes and			and the second
52.0				
0.58				
Center 5.2100 GHz Res BW 1.0 MHz		#VBW 3.0 MHz		Span 290.0 MH 1.333 ms (10000 pt
	× 5.240 903 GHz	12,000 dBm	FUNCTION WICH F	UNETTON WALLE
2 N 1 F 3 N 1 F	5.150 000 GHz	-36.537 dBm -39.054 dBm		
		-30.577 dBm		
5 6 7 9				

Figure 74: Measured Bandedge for VHT80-MCS0 at 5210 MHz, Chain 0

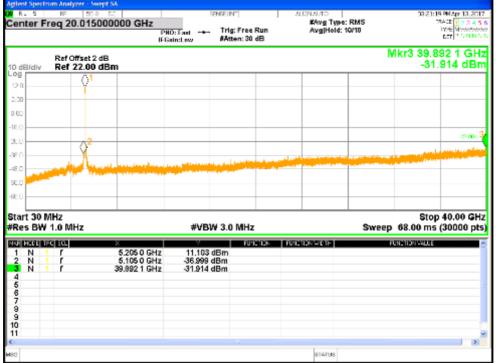
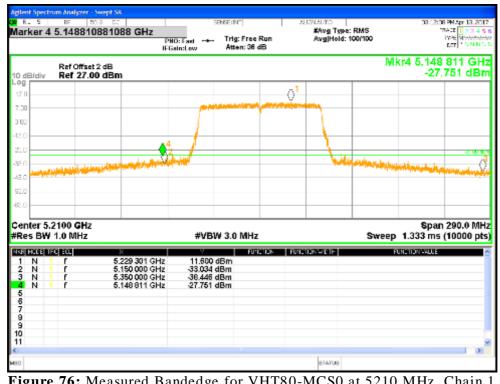


Figure 75: Undesirable Emission for VHT80-MCS0 at 5210 MHz, Chain 0



03:15:11 PMApr 13, 2013 Center Freq: 5.210000000 GHz Marker 1 5.2480 GHz Radio Std: None Trig: Free Run #Atten: 30 dB Avg/Hold: 10/10 Radio Device: BTS vi≣Gain:Low Mkr1 5.2480448 GHz Ref Offset 2 dB 5.3244 dBm Ref 22.00 dBm 10 dB/dh .og 2.0 8.00 18.0 75.1 38.0 18 55.0 20 Center 5.21 GHz Span 120 MHz #Res BW 820 kHz #VBW 2.7 MHz #Sweep 100.3 ms 28.4 dBm Occupied Bandwidth Total Power 75.688 MHz 45.942 kHz **OBW Power** 99.00 % Transmit Freg Error x dB Bandwidth 83.06 MHz x dB -26.00 dB STATIS

Figure 76: Measured Bandedge for VHT80-MCS0 at 5210 MHz, Chain 1

Figure 77: Undesirable Emission for VHT80-MCS0 at 5210 MHz, Chain 1

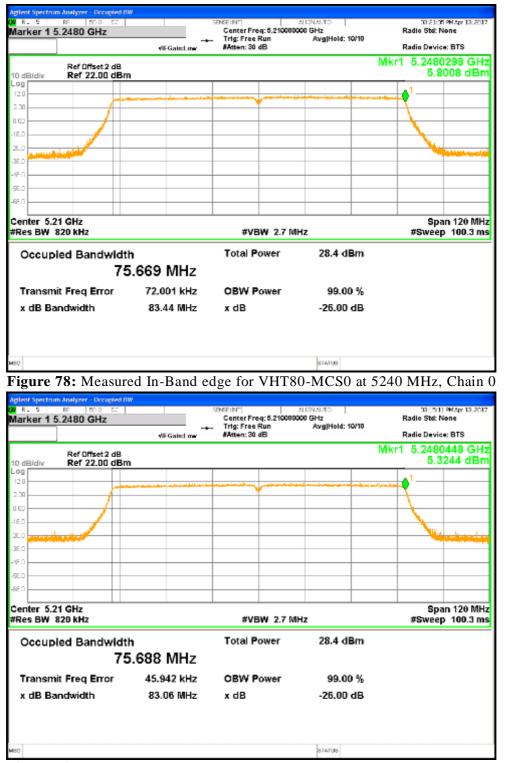


Figure 79: Measured In-Band edge for VHT80-MCS0 at 5240 MHz, Chain 1

# 4.5 Transmitter Spurious Emissions

*Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmit mode; per requirement of CFR47 15.205:2016, 15.209:2016, 15.407(b:2016), RSS 247 Sect. 6:2017, RSS GEN Sect.8.9 and 8.10:2014* 

## 4.5.1 Test Methodology

### 4.5.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 120 kHz and provide a reading at each frequency for no more than  $12^{\circ}$  of turntable rotation. For each frequency sub-range the turntable was rotated  $360^{\circ}$  while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

Pres-scans were performed to determine the worst, data rate/ chains for 802.11a, 802.11n (HT20 and HT40), 802.11ac (VHT20, VHT40 and VHT80).

## 4.5.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

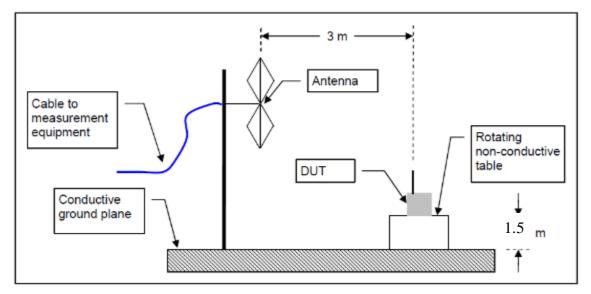
Final results are:

- 1. 802.11a at 6Mbps with 2 Chains (covering HT20 & VHT20)
- 2. HT40 at MCS0 with 2 Chains (covering VHT40)
- 3. VHT80 at MCS0 with 2 Chains

### 4.5.1.3 Deviations

None.

#### **Test Setup:**



### 4.5.2 Transmitter Spurious Emission Limit

The spurious emissions of the transmitter shall not exceed the values in CFR47 Part 15.205, 15.209, RSS 247 Sect. 6, RSS GEN Sect. 8.9 and 8.10

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz) 24000/F(kHz)	300 30
1.705-30.0	30	30
30-88 88-216	100 ** 150 **	3
216-960	200 **	3
Above 960	500	3

According to CFR47 15.407 (b) and RSS 247 Sect. 6.2.1.2, all harmonics and spurious emissions which are outside the 5150 MHz - 5250 MHz, 5250 MHz - 5350 MHz, or 5470 MHz - 5725 MHz shall not exceed -27 dBm/MHz. This is equivalent to 68.2 dBuV/m at 3 meter distance.

### 4.5.3 Results

The final measurement data was taken under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and test plan.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

#### **Table 22:** Transmit Spurious Emission at Band-Edge Requirements

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only

Antenna Type: FPCB

Power Setting: See test plan

**Max. Directional Gain:** Antenna 1 = +6.29 dBi; Antenna 2 = +4.97 dBi

Total Directional Gain: + 8.67 dBi

Signal State: Modulated at 100%.

Ambient Temp.: 19° C

**Relative Humidity:**35%

				Band	Edge I	Results		
Freq.	Level	Pol.	Limit	Margin	Det.	Table	Tower	Note
(MHz)	(dBuV/m)	(H/V)	(dBuV/m)	(dB)	Det.	Deg.	(cm)	note
5149.7	72.18	Н	74.00	-1.82	Pk	21	165	PLOT 76: 11a-6Mbps-5180MHz-TP22- Ch0 & Ch1
5150.0	53.72	Н	54.00	-0.28	Ave	21	165	PLOT 77: 11a-6Mbps-5180MHz- TP22- Ch0 & Ch1
5149.7	70.25	V	74.00	-3.75	Pk	358	200	PLOT 78: 11a-6Mbps-5180MHz- TP22- Ch0 & Ch1
5150.0	52.18	V	54.00	-1.82	Ave	358	200	PLOT 79: 11a-6Mbps-5180MHz- TP22- Ch0 & Ch1
5148.9	70.04	V	74.00	-3.96	Pk	353	198	PLOT 80: HT20-MCS0-5180MHz- TP22- Ch0_Ch1
5150.0	52.16	V	54.00	-1.84	Ave	353	198	PLOT 81: HT20-MCS0-5180MHz- TP22- Ch0_Ch1
5149.7	71.84	Н	74.00	-2.16	Pk	34	179	PLOT 82: HT20-MCS0-5180MHz- TP22- Ch0_Ch1
5150.0	53.63	Н	54.00	-0.37	Ave	34	179	PLOT 83: HT20-MCS0-5180MHz- TP22- Ch0_Ch1
5148.7	72.60	Н	74.00	-1.40	Pk	23	171	PLOT 84: HT40-MCS0-5190MHz-TP20.5- Ch0_Ch1
5150.0	53.71	Н	54.00	-0.29	Ave	23	171	PLOT 85: HT40-MCS0-5190MHz-TP20.5- Ch0_Ch1
5147.5	68.63	V	74.00	-5.37	Pk	347	191	PLOT 86: HT40-MCS0-5190MHz-TP20.5- Ch0_Ch1
5150.0	51.71	V	54.00	-2.29	Ave	347	191	PLOT 87: HT40-MCS0-5190MHz-TP20.5- Ch0_Ch1

Note: 1. Band-edge frequencies were taken at 5150 MHz since 5250-5350 MHz band is not a restricted band.

2. All the band-edge measurements met the restricted band requirements of CFR47 15.205.

3. For 5250 MHz In-band-edge, refer to Section 4.4.2.

4. Power level is the same for both HT20 & VHT20. HT20 found as worst case, therefore VHT20 is covered for band-edge measurements.

Table 23: Transmit S	purious Emission at Band-Ed	lge Requirements Continued

Test Conditions: Radiated Measurer	nent, Normal Temperature and Voltage only
Antenna Type: FPCB	Power Setting: See test plan
Max. Directional Gain: Antenna 1 =	+ 6.29  dBi; Antenna 2 = $+ 4.97  dBi$
<b>Total Directional Gain:</b> + 8.67 dBi	

Signal State: Modulated at 100%.

**Ambient Temp.:** 19° C

**Relative Humidity:**35%

	Band-Edge Results												
Freq.	Level	Pol.	Limit	Margin	Det.	Table	Tower	Note					
(MHz)	(dBuV/m)	(H/V)	(dBuV/m)	(dB)	Det.	Deg.	(cm)	Note					
5150.0	73.78	Н	74.00	-0.22	Pk	30	182	PLOT 88: VHT40-MCS0-5190MHz- TP20.5-Ch0 Ch1					
5150.0	53.74	Н	54.00	-0.26	Ave	30	182	PLOT 89: VHT40-MCS0-5190MHz-					
5150.0	55.74	П	54.00	-0.20	Ave	50	102	TP20.5-Ch0_Ch1					
5150.0	67.99	V	74.00	-6.01	Pk	347	193	PLOT 90: VHT40-MCS0-5190MHz-					
								TP20.5-Ch0_Ch1					
5150.0	51.98	V	54.00	-2.02	Ave	347	193	PLOT 91: VHT40-MCS0-5190MHz-					
								TP20.5-Ch0_Ch1					
5147.4	72.24	Н	74.00	-1.76	Pk	30	195	PLOT 92: VHT80-MCS0-5210MHz-TP21- Ch0 Ch1					
								PLOT 93: VHT80-MCS0-5210MHz-TP21-					
5150.0	53.42	Η	54.00	-0.58	Ave	30	195	Ch0 Ch1					
		•••			D1		100	PLOT 94: VHT80-MCS0-5210MHz-TP21-					
5121.3	68.55	V	74.00	-5.45	Pk	354	199	Ch0_Ch1					
5150.0	51.67	V	54.00	-2.33	Ave	354	199	PLOT 95: VHT80-MCS0-5210MHz-TP21-					
5150.0	51.07	v	54.00	-2.33	Ave	554	199	Ch0_Ch1					

Note: 1. Band-edge frequencies were taken at 5150 MHz since 5250-5350 MHz band is not a restricted band.

2. All the band-edge measurements met the restricted band requirements of CFR47 15.205.

3. For 5250 MHz In-band-edge, refer to Section 4.4.2.

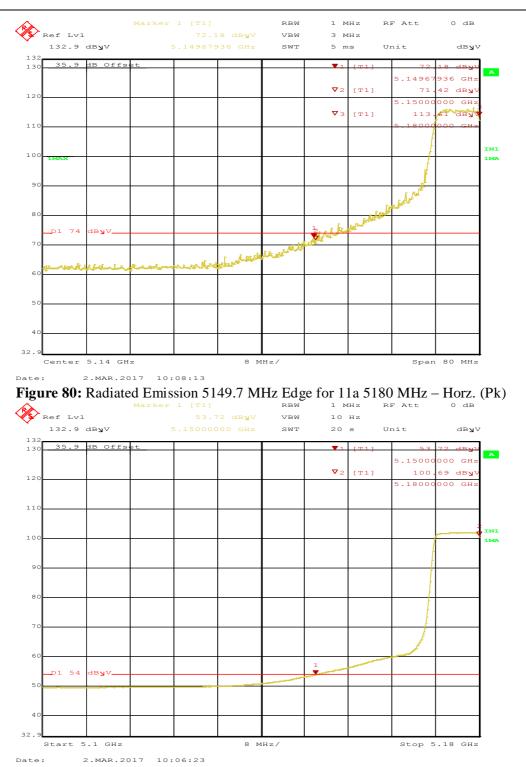
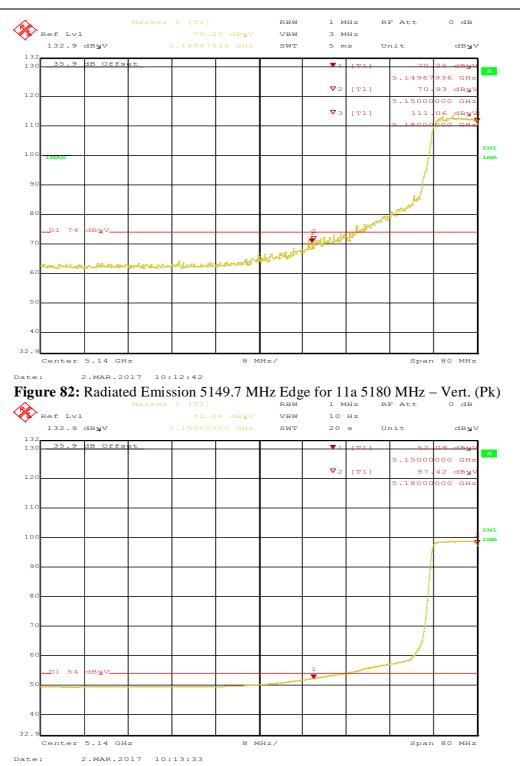
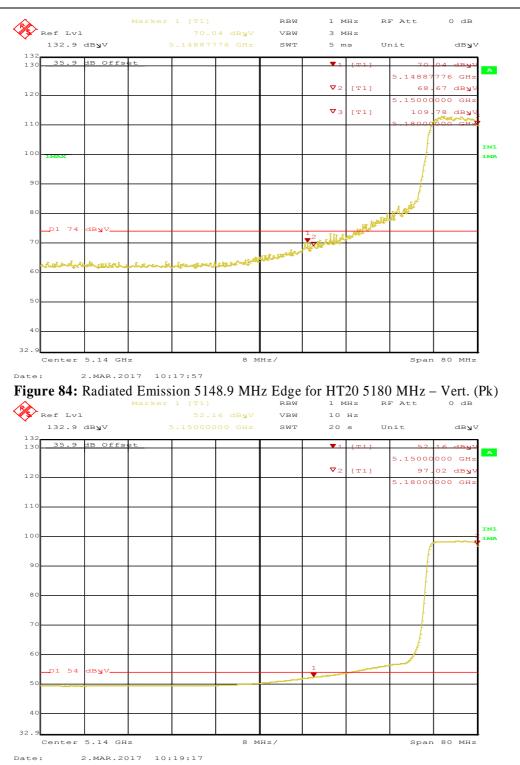
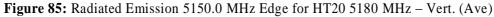


Figure 81: Radiated Emission 5150.0 MHz Edge for 11a 5180 MHz – Horz. (Ave)

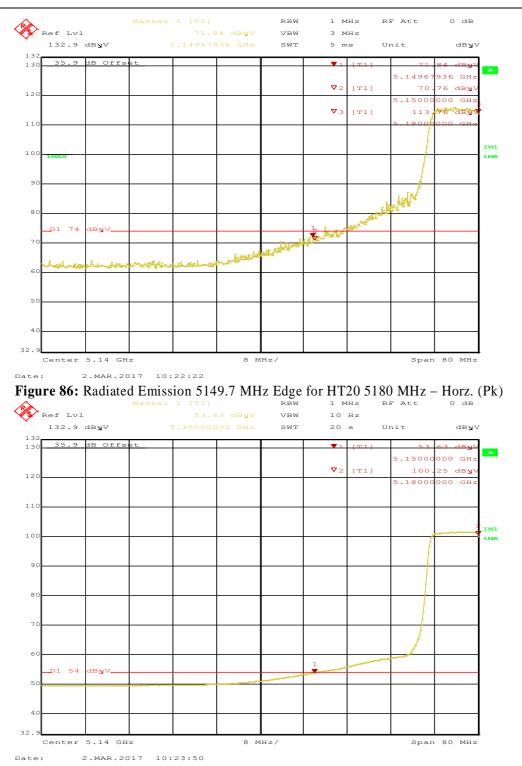


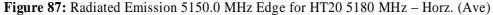


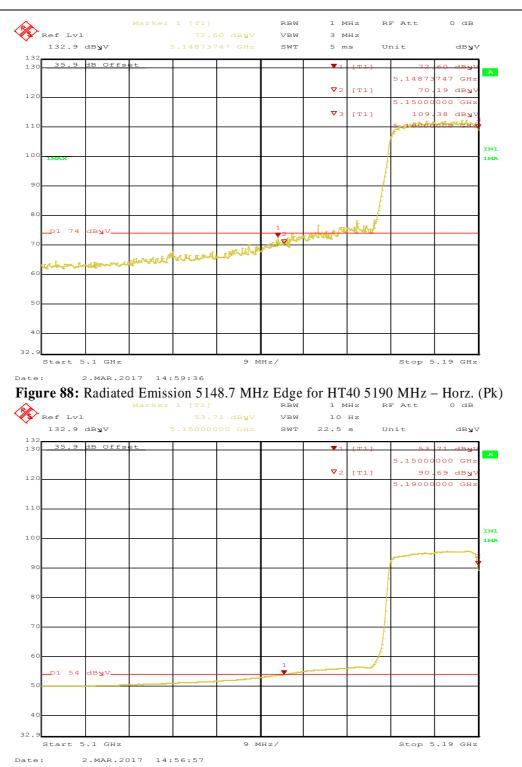


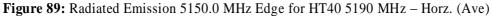


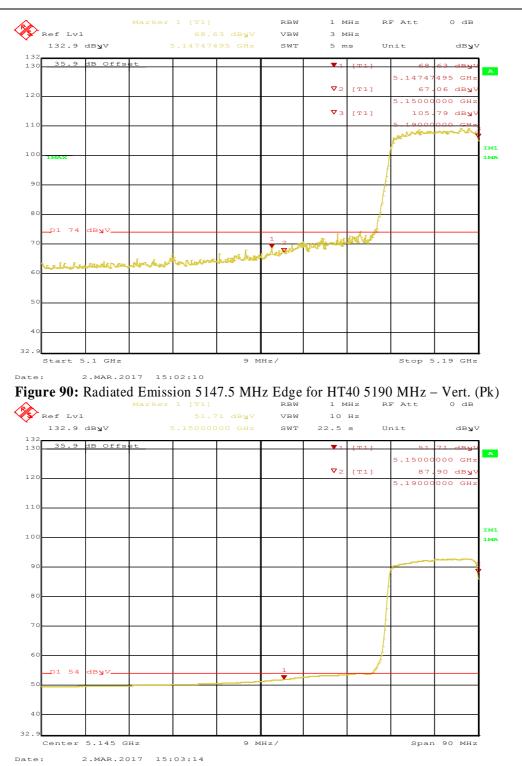
Report Number: 31760709.001 EUT: Wi-Fi Router Model: D010001 (USA), D010002 (IC) EMC / Rev 1.0

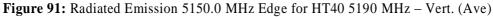


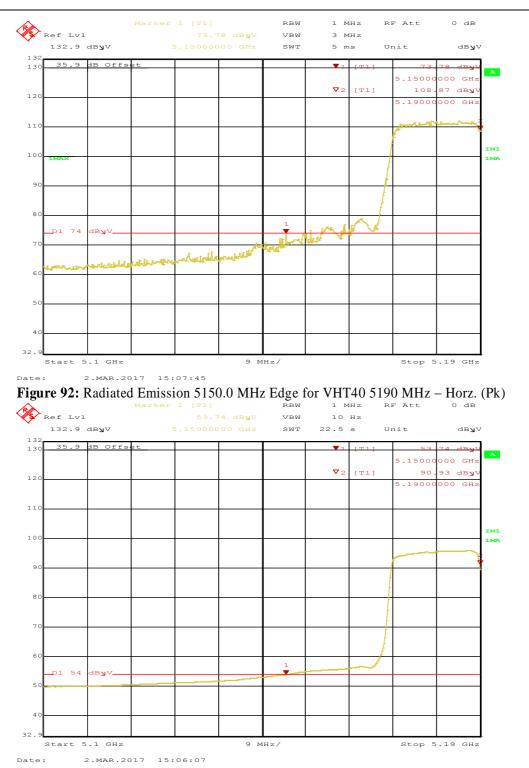




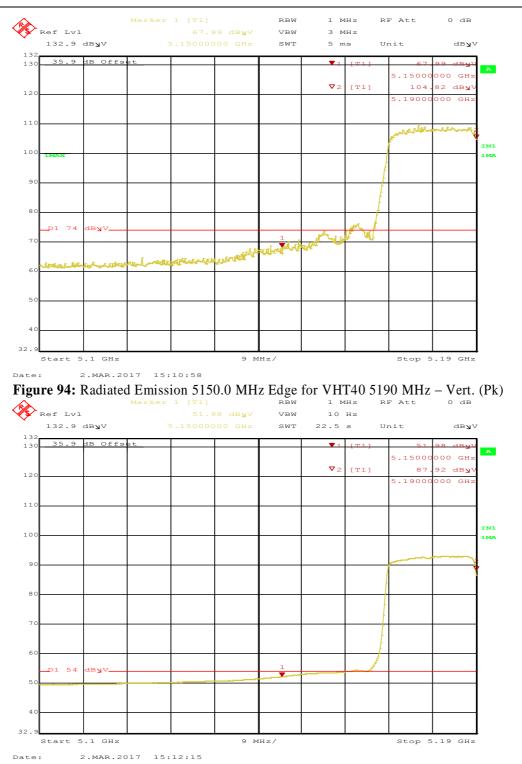


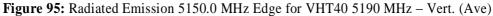


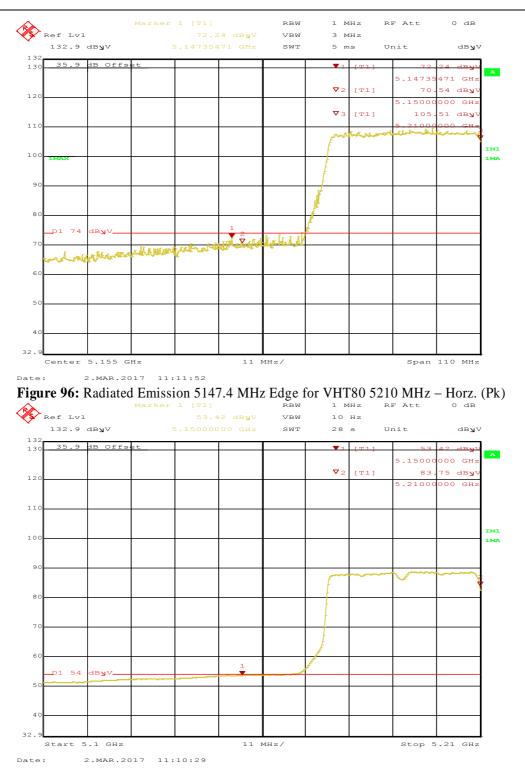




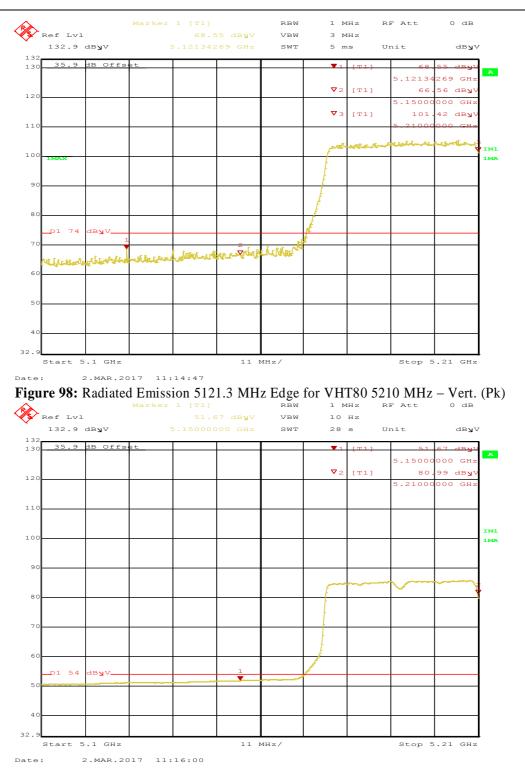


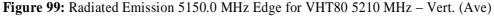




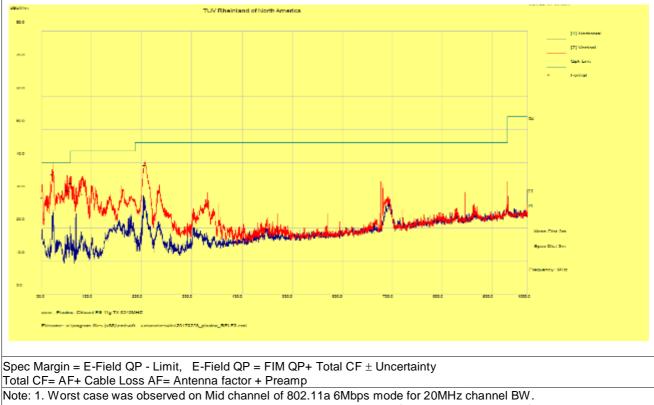








SOP 1 Ra	diated E	missions				Т	Tracking # 31760709.001 Page 1 of 16					of 16
EUT Name	Wi-F	i Router					Date Feb 28, 201			28, 2017		
EUT Model	D010	0001 (USA), [	0010002	2 (IC)			Temp / Hum in 21° C / 38%rh					
EUT Serial	MF7	MF701114110316						mp / Hւ	um out	N/A		
EUT Config	. 802.	11a at 6Mbps	(chain (	0 & 1) / C	hicony PS	SU	Lir	ne AC /	Freq	120	Vac / 60 H	Z
Standard	CFR	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN						BW / VB	W	120	kHz/ 300 k	Hz
Dist/Ant Us							Ре	rforme	d by	Ric	hard Deckei	ŕ
			30 MF	lz – 1 G⊦	lz Transm	nit at 5	524(	0 MHz				
Frequency	Raw	Cable Loss	AF	Level	Detector	Polar	rity	Height	Azimu	uth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/\	/	cm	deg	J	dBuV/m	dB
51.79	58.80	1.71	-24.09	36.42	QP	V		105	210	)	40.00	-3.58
81.49	54.14	1.88	-24.48	31.55	QP	V		195	324	ŀ	40.00	-8.45
87.66	56.52	1.92	-24.73	33.71	QP	V		117	361		40.00	-6.29
235.97	56.71	2.49	-19.99	39.22	QP	V		256	344	ŀ	46.00	-6.78
31.44	39.93	1.57	-12.17	29.34	QP	V		139	254	ŀ	40.00	-10.67
111.40	47.47	2.03	-19.14	30.36	QP	V		135	60		43.50	-13.14

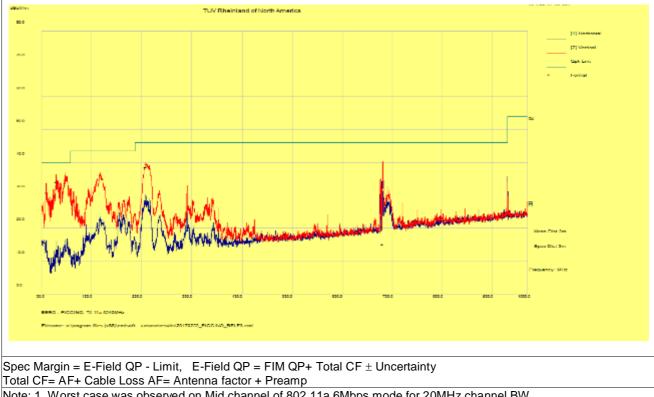


2. Mode tested are 802.11a, HT20, VHT20, HT40, VHT40 & VHT80 (low, mid & high channel).

- 3. No significant emission was observed below 30MHz.
- 4. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.

Report Number: 31760709.001 EUT: Wi-Fi Router Model: D010001 (USA), D010002 (IC) EMC / Rev 1.0 Page 94 of 133

SOP 1 Ra	diated E	missions				Т	rac	king #	317607	09.0	01 Page 2	of 16
EUT Name	Wi-F	i Router					Date Feb 22, 201			22, 2017		
EUT Model	D010	D010001 (USA), D010002 (IC)						Temp / Hum in 20° C / 36%rh				
EUT Serial	MF7	01114110316	6				Те	$\overline{\mathbf{Femp}/\mathbf{Hum}\mathbf{out}\overline{\mathbf{N}}}$		N/A		
EUT Config	802.	11a at 6Mbps	(chain (	0&1)/F	oxLink PS	SU	Line AC / Freq			120	Vac / 60 H	Z
Standard	CFR	47 Part 15 Sι	, RSS-24	7, RSS-C	BEN	RE	BW / VB	W	120	kHz/ 300 k	Hz	
Dist/Ant Us	· · · · · · · · · · · · · · · · · · ·						Performed by Richard Decker					r
			30 MF	lz – 1 G⊦	lz Transn	nit at 5	524(	0 MHz				
Frequency	Raw	Cable Loss	AF	Level	Detector	Pola	rity	Height	Azimu	uth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		Η/\	/	cm	deg		dBuV/m	dB
77.20	55.19	1.86	-24.05	33.00	QP	V		189	192	2	40.00	-7.00
58.71	56.94	1.76	-24.58	34.12	QP	V		150	86		40.00	-5.88
710.84	22.53	3.64	-11.14	15.04	QP	V		267	200		46.00	-30.97
709.86	28.02	3.64	-11.17	20.50	QP	V		150	38		46.00	-25.50
39.51	46.66	1.64	-17.52	30.77	QP	V		125 268		8	40.00	-9.23
237.86	56.01	2.50	-19.91	38.61	QP	V		293	352	2	46.00	-7.40



Note: 1. Worst case was observed on Mid channel of 802.11a 6Mbps mode for 20MHz channel BW.

2. Mode tested are 802.11a, HT20, VHT20, HT40, VHT40 & VHT80 (low, mid & high channel).

- 3. No significant emission was observed below 30MHz.
- 4. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.

Report Number: 31760709.001 EUT: Wi-Fi Router Model: D010001 (USA), D010002 (IC) EMC / Rev 1.0

Page 95 of 133

SOP	1 Ra	diated E	Emissions				Trac	cking #	31760709.0	01 Page 3	of 16
EUT N	lame	Wi-F	ï Router				Da	ate	Feb	25, 2017	
EUT N	lodel	D010	0001 (USA), I	D010002	2 (IC)		Τe	emp / H		C / 37%rh	
EUT S	Serial	MF70	01114110316	6			Τe	emp/H	um out N/A	١	
EUT C	Config	<b>.</b> 802.1	11a at 6Mbps	s / chain	0&1		Li	ne AC /	Freq 120	) Vac / 60 H	Z
Stand	lard	CFR	<b>W</b> 1 M	1Hz / 3 MHz							
Dist/A	nt Us	ed 3m -	EMCO3115	/ 1m – A	HA-840		Pe	erforme	d by Ric	hard Decke	r
			1	– 18 GH	z Transm	nit at 5180	) MHz (L	ow Char	nnel)		
Frequ	iency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
M	Ηz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
1796	7.29	39.85	3.77	-3.02	40.60	Average	V	184	358	54.00	-13.40
6098	8.01	50.47	2.01	-18.60	33.88	Average	Н	149	60	54.00	-20.12
1430	1.26	40.47	3.21	-8.24	35.44	Average	Н	120	12	54.00	-18.56
difference -				TUV Rheinland (	of North America						
80.0						_				[1] Hariman	
80.0										[7] Vericel	
	<u> </u>									e PA Lot	
70.0										Av Lint	
										- Forma	
800											
80.0										2	
									Mar 1		
						m and	and the second		where where		
36.0	10		day and manager and	فيجود بعبو بالطويدية		V			•		
20.0	-12-0-	and the second								Mana Dist Are	
										Apon Divi Sm	
160										Cheshenov: Mile	
80											
	anana, Pinatras,	The TX STREAMS							120		
	Pleasance only	regnes films (vM)/amis	with a second	insing_REFECtional							
			AVG - Limit, E				al CF ± Ur	ncertainty	/		
Total C	F= AF	+ Cable Lo	oss AF= Anten	na factor	+ Preamp	)					
			s observed on		6Mbps mo	ode.					
	∠. IVIOde	es coverec	d are HT20 and	, v⊓120.							

2. Modes covered are HT20 and VHT20.

3. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.

	_												
SOP 1	Rad	liated E	missions				Т	rac	king #	317607	09.0	001 Page 4	of 16
EUT Nar	-		Router					Da				r 02, 2017	
EUT Mo			0001 (USA), E		2 (IC)			_ Temp / Hum in 22° C / 40%rh Temp / Hum out N/A					
EUT Ser			01114110316						•		-	) Vac / 60 H	
	• i i												
Standar												1Hz / 3 MHz	
DISTANT	Ant Used 3m - EMCO3115 / 1m – AHA-840 Performed by Rid 18 – 40 GHz Transmit at 5180 MHz (Low Channel)											hard Decker	
		_						<u>`</u>		/	_		
Frequen	-	Raw	Cable Loss	AF	Level	Detector			Height			Limit	Margin
MHz		dBuV/m	dB	dB	dBuV/m		H/\	/	cm	deg		dBuV/m	dB
39886.3	36	47.65	10.89	-13.53	45.01	Average	V		100	292		54.00	-8.99
34156.2	22	43.43	9.66	-12.43	40.66	Average	V		101	122	2	54.00	-13.34
and the second sec				W Rheinland	of North America								
100.0												[1] Hadavas	
800												[7] Verial	
												Av Lost	
												<ul> <li>Formal</li> </ul>	
												0er	
MC O												Trace	
85.0									<b>~</b> .		hand	9 9 Tites costore	
					-	and the second second	have	- Anna	and the	م مل ا		are 1040.	
-20			AL STRUCTURE						•	-		VDw 1000kd tz	
	and the second	and the stand of the	and a start of the	- manana	www.							KUW 1000KHZ	
20												Mode Hard	
-												Spore Divi Sm	
-													
50												Cassancy: Milt	
18000.3											2000		
anarras,		. TX DIROMH.	0 a manufamatini 20170202_pi	and an and the second second									
P.J.M.	and the second	teres and the second											
			AVG - Limit, E bss AF= Anteni				al CF ±	Un	certainty	1			
			s observed on a										
			aro UT20 and										

2. Modes covered are HT20 and VHT20.

3. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.

SOP 1 Ra	adiated E	Emissions				Tra	acking #	31760709.0	01 Page 5	of 16
EUT Name		ï Router					Date		25, 2017	
EUT Mode		0001 (USA), E		2 (IC)			remp / Hւ		C / 37%rh	
EUT Serial		01114110316		<u> </u>			•	um out N/A		
EUT Confi		11a at 6Mbps			7 000 0		_ine AC / RBW / VB	· ·	) Vac / 60 H 1Hz / 3 MHz	
Standard		47 Part 15 Su EMCO3115 /			7, 835-6		Performe		hard Decke	
	seu on -				nit at 5240				Halu Decke	
Frequency	Raw	Cable Loss	AF	Level	Detector	`		Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
17940.50	40.15	3.74	-3.15	40.74	Average	V	178	361	54.00	-13.26
		-			_	-				
10477.96	44.25	2.72	-12.73	34.25	Average	H	228	46	54.00	-19.76
14330.97	40.29	3.20	-8.28	35.22	Average	Н	137	44	54.00	-18.79
and the second se			TUV Rheinland o	of North America						
800					_				[1] Hariman	~
80.0									[7] Versioni	
									Av Lost	
75.0									- Portal	
800										
800					1				~	
							i i	A. I	8	
						بمتبسعاه	المختله بالجاجعة	www. wyw		
	1 1		لمبتعه لماسينه	المعينة المرجريه	v.			•		
land of	Maryan barren	Mary Manual Constant								
m.0									Manage Chief Area	
10.0									Ryon Divi Sm	
									Chargemony: Mile	
80										
10000	e He TX CHOMHE						10000.0	1000	×.,	
Flexance of		anti u ananakarnaka (2012022). Pi	inside_EFICE2 and							
Spec Margin	= E-Field /	AVG - Limit, E	-Field A	/G = FIM	AVG+ Tota	al CF + I	Incertainty	,		
		oss AF= Anten								
Note: 1. Woi	rst case was	s observed on	802.11a							
		d are HT20 and		the repor	t Worst oo	no Ploto	are placed	l in the report		

- 3. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.
- 4. Emission near the Spurious Limit is the Fundamental.

SOP 1	1 Ra	diated	Emissions				Т	rac	king #	3176070	09.0	01 Page 6	of 16
EUT Na	ame		Fi Router						ate			r 02, 2017	
EUT M			10001 (USA), I		2 (IC)				emp / Hu	_		C / 40%rh	
EUT Se			701114110316							um out			
EUT C			2.11a at 6Mbps						ne AC /			) Vac / 60 H	
Standa			R47 Part 15 St			7, RSS-0	GEN		BW / VB	-		IHz / 3 MHz	
Dist/Ar	nt Us	ed 3m	- EMCO3115						erforme		Ric	hard Decker	,
				1	Iz Transm		1	•	Ť I				
Freque	-	Raw	Cable Loss	AF	Level	Detector			Height	Azimu	th	Limit	Margin
MH	z	dBuV/ı	n dB	dB	dBuV/m		H/\	/	cm	deg		dBuV/m	dB
39864	4.03	47.89	10.88	-13.53	45.23	Average	e V		123	266		54.00	-8.77
34310	0.69	43.91	9.64	-12.44	41.11	Average	e H		122	56		54.00	-12.89
difference of the second s				TUV Rheinland	of North America	1	1		1 1				
100.0													
80												[1] Hadavas [7] Veriesi	•
-												Ar Lost	
												+ Format	
												Der	
96 O												Trace	
80.0											and a	040 #0.100#	
-						میں بلون ال		when	www.w	Law Mar		Are 1040	
45.0					~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~					<b>~</b>		VEw 1000kHz	
*	at the weather	فسعدونا زورافاصاته	www.articlitericaliteria	down on the	when							KUM 1000KHZ	
												Mode P2HA	
20.0												Mana Dist (es	
-												Aport Divi Ser	
												Chargemony: Mills	
5.0 18000											2000		
	ana, Mastras,	нь та врномны											
-	Second of the	ngom film (vM)	enineft seneralisenalis/20170202_p	index_REHEIO em	·								
			d AVG - Limit, E				al CF ±	Un	certainty	/			
			Loss AF= Anten										
			as observed on			ode.							

2. Modes covered are HT20 and VHT20.

3. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.

SOP 1 Ra	diated E	missions				Т	rac	king # 3	317607	09.0	01 Page 7	of 16
EUT Name	Wi-F	i Router					Da	ate		Feb	28, 2017	
EUT Model		0001 (USA), E	010002	2 (IC)				emp / Hu	ım in		C / 38%rh	
EUT Serial		01114110316		- ()				emp / Hu		_		
EUT Config	. 802.1	11n at HT40 I		hain 0 &	1) / Chico	ony		ne AC /			) Vac / 60 H	Z
	PSU											
Standard		47 Part 15 Su	ubpart C	, RSS-24	7, RSS-G	<u>SEN</u>		BW / VB		-	) kHz/ 300 k	
Dist/Ant Us	ed 3m /	JB3						erformed	by	Rici	hard Deckei	•
			1		lz Transm							
Frequency	Raw	Cable Loss	AF		Detector	Polar	ity	Height	Azimu	uth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/\	/	cm	deg		dBuV/m	dB
51.84	56.64	1.71	-24.10	34.25	QP	V		179	218	6	40.00	-5.75
81.21	55.23	1.88	-24.45	32.66	QP	V		129	316	i	40.00	-7.34
30.60	39.75	1.57	-11.62	29.69	QP	V		155	296	;	40.00	-10.31
87.62	56.49	1.92	-24.73	33.68	QP	V		101	272		40.00	-6.32
236.88	55.14	2.50	-19.95	37.68	QP	V		193	346	5	46.00	-8.32
110.75	49.36	2.03	-19.25	32.14	QP	V		111	360	)	43.50	-11.36
and the		,	UV Rheinland «	of North America								
					مربع مربع المربع مربع	<u> </u>					[1] Holdman     [2] Verdeni     [2] Verdeni     [2] Verdeni     [2] Verdeni     [2] Verdeni     [2] Verdeni     [2] Verdeni	-
Total CF= AF	= E-Field ( + Cable Lo	QP - Limit, E-I pss AF= Anten s observed on	Field QP na factor	+ Preamp					OMHz ch	nanne	el BW.	

- 2. Mode tested are 802.11a, HT20, VHT20, HT40, VHT40 & VHT80 (low, mid & high channel).
- 3. No significant emission was observed below 30MHz.
- 4. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.

Report Number: 31760709.001 EUT: Wi-Fi Router Model: D010001 (USA), D010002 (IC) EMC / Rev 1.0 Page 100 of 133

SOP 1 Ra	adiated E	Emissions				Т	rac	king # (	317607	09.0	01 Page 8	of 16
EUT Name	Wi-F	i Router					Da	ate		Feb	22, 2017	
EUT Model		0001 (USA), E	2010002	2 (IC)				emp / Hu		-	C / 36%rh	
EUT Serial		01114110316						emp / Hu				
EUT Config	<b>J.</b> 802.′ PSU	11n at HT40 I	MCS0 (c	hain 0 &	1) / FoxL	ink	Liı	ne AC /	Freq	120	) Vac / 60 H	Z
Standard	CFR	47 Part 15 Su	ubpart C	, RSS-24	7, RSS-0	BEN	RE	BW / VB	W	120	) kHz/ 300 k	Hz
Dist/Ant Us	sed 3m /	JB3					Ре	erformed	d by	Rich	hard Deckei	
			30 MH	lz – 1 G⊦	lz Transm	nit at 5	523	0 MHz				
Frequency	Raw	Cable Loss	AF	Level	Detector	Polai	rity	Height	Azimu	uth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/\	/	cm	deg		dBuV/m	dB
77.19313	56.82	1.86	-24.05	34.63	QP	V		111	106		40.00	-5.37
58.70938	57.69	1.76	-24.58	34.87	QP	V		116	10		40.00	-5.13
40.32438	48.32	1.64	-18.05	31.91	QP	V		104	42		40.00	-8.09
146.1794	50.43	2.17	-19.31	33.29	QP	V		110	20		43.50	-10.21
69.01906	53.09	1.82	-23.94	30.97	QP	V		112	16		40.00	-9.04
239.2606	55.15	2.51	-19.85	37.81	QP	V		275	302		46.00	-8.19
20 200 88800 - Pico							ببرادر				[1] Hoteen   [2] Verleet + Portal + Portal Second Det Ber Report Det Ber Creasercy : Mite	
Spec Margin Total CF= AF	= E-Field ( + Cable Lo	QP - Limit, E-l pss AF= Anten s observed on	Field QP na factor	+ Preamp							ol RW/	

Note: 1. Worst case was observed on Mid channel of 802.11n HT40 MCS0 mode for 40MHz channel BW.

- 2. Mode tested are 802.11a, HT20, VHT20, HT40, VHT40 & VHT80 (low, mid & high channel).
- 3. No significant emission was observed below 30MHz.
- 4. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.

Report Number: 31760709.001 EUT: Wi-Fi Router Model: D010001 (USA), D010002 (IC) EMC / Rev 1.0 Page 101 of 133

SOP 1 Radiated Emissions Tracking # 31760709.001	Page 9 of 16
ELIT Name M/: E: Deuter Dete	
	, 2017
	′ 37%rh
EUT Serial MF701114110316 Temp / Hum out N/A	( 00 )
•	ac / 60 Hz
	/ 3 MHz d Decker
1 - 18  GHz Transmit at 5190 MHz (Low Channel)	J Deckei
	Limit Margin
	BuV/m dB
	54.00 -13.54
	54.00 -16.38
14036.79 40.58 3.21 -8.76 35.02 Average V 202 288	54.00 -18.98
TLV Rheinland of North America	
	[1] Herizonal
E0	[7] Vertical
	Av Los
NO CONTRACTOR OF CONT	
	Dial Ser
20 (Tequet	
12003 12003 12000 1	
anna, Filadan, H740 TX SIBOMA. Filmann: Alympian Airs (AM/andra) - ananatarsalis/20170276_Filmina_FFFFF16 and	
Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF $\pm$ Uncertainty	
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp Note: 1. Worst case was observed on HT40 MCS0 mode.	
INDIA: L. WOISI CASE WAS ODSERVED OD HTAU WUSU MODE	
2. Mode covered is VHT40.	

To reduce complexity and bulkiness of the report Worst case Plots
 Emission above the Spurious Limit is the Fundamental.

SOP 1 Radiated Emissions Tracking # 31760709.001 Page 10 of 16												
		missions				Ira	acking #	317607		•	) of 16	
EUT Name		i Router					Date	_		r 02, 2017		
EUT Model		0001 (USA), [		2 (IC)			Temp / H			C / 40%rh		
EUT Serial		01114110316					Temp / H					
EUT Config	-	11n at HT40 I					Line AC	•	-	Vac / 60 H	Z	
Standard		47 Part 15 Su			7, RSS-G		RBW / VI			IHz / 3 MHz		
Dist/Ant Us	<b>sea</b> 3m -	EMCO3115					Performe		RIC	hard Decker		
_	_				it at 5190	```````````````````````````````````````	`	1 /				
Frequency	Raw	Cable Loss	AF		Detector		ty Height			Limit	Margin	
MHz	dBuV/m	dB	dB	dBuV/m		H/V		deg		dBuV/m	dB	
39887.83	47.68	10.89	-13.53	45.05	Average	V	100	361		54.00	-8.95	
34355.94	43.87	9.62	-12.44	41.05	Average	V	133	192		54.00	-12.95	
and the		,	UV Rheinland «	of North America								
100.0										10 Hodered		
800										[7] Verical		
										Av Lost		
										+ Format		
										Core:		
MC 40										Trace		
50.0							notes -		m	SWD R0.1008		
				the au	معجرية المعطر عالم	and the second	may m	Last -		AH 1040		
400		Land the second second								VDw 1000kHz		
	ومعرصيني فيارعن ويتلاويهما	wanter an an and and	the second second	entina						KUM 1000KHZ		
										Note Park		
20.0										Rear Divi Ser		
									1	Carguanoy: Mile		
8000.3									20000			
anna, Piantan	HT40 T2 0180MH4											
Pleasance (a)	pengeum files (eMI)/emit	afi sanandarnalin/20170202_pi	ades_REHE2 and									
Spec Margin	= E-Field /	AVG - Limit, E	-Field A	/G = FIM	AVG+ Tota	al CF + I	Uncertaint	v				
	Total CF= AF+ Cable Loss AF= Antenna factor + Preamp											
		s observed on	HT40 MC	CS0 mode								
	e covered	is VHT40. plexity and bul	kiness of	f the report	Moretea		are place	d in the r	anort			
3. 10 10	equice com	plexity and but	KIIIESS OI	i ine report	worst cas		are place		sport.	•		

									<u> </u>	
SOP 1	Radiated E	Emissions				Tra	icking #	31760709.	001 Page 1	1 of 16
EUT Nam EUT Moc EUT Seri	D010	ï Router 0001 (USA), [		2 (IC)		T	)ate Temp / Hu	um in 21	b 25, 2017 ° C / 37%rh	
EUT Con Standard	fig. 802.	01114110316 11n at HT40 I 47 Part 15 St	MCS0/			L	ine AC / BW / VB	· · ·	<u>A</u> 0 Vac / 60 H MHz / 3 MHz	
		EMCO3115		-	7,100 0		Performe		chard Decke	
	-				it at 5230					
Frequence	y Raw	Cable Loss	AF	Level	Detector	Polarity	y Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
17985.2	6 39.64	3.76	-2.94	40.46	Average	Н	139	258	54.00	-13.54
6090.47	<b>54.21</b>	2.02	-18.61	37.62	Average	Н	212	58	54.00	-16.38
14036.7	9 40.58	3.21	-8.76	35.02	Average	V	202	288	54.00	-18.98
distant		,	UV Rheinland (	of North America						
80.0									[1] Havivas [7] Venival	-
75.0									Av Lesi + Format	
850										
850									_	
-					1			لمحد والمجمعين	an a	
20	4 4			molena		فالمعطونين			1	
the second	נפועיביין אילעקטעלטא איינין	Marinetaneiseas								
16.0									Ryone Divi Ser	
30									Cheshenov: Milts	
12000 anna, Pi	ashaa, HT40 TX S180MHa						12000.2	10	mico	
Floren	r a'nagaan film (a <b>M</b> )lamb	anti kananatarradin 20120226_P	insing_EPHP10 and							
		AVG - Limit, E oss AF= Anten				al CF ± U	Incertainty			
2. M	ode covered									
		plexity and bul				se Plots a	are placed	i in the repor	rt.	

4. Emission above the Spurious Limit is the Fundamental.

SOP 1 Radiated Emissions Tracking # 31760709.001 Page 12 of 16												
	adiated E	missions				I ra	acking #		0	2 01 16		
EUT Name		i Router					Date	-	Mar 02, 2017			
EUT Model		0001 (USA), [		2 (IC)			Γemp / Hι	_	22° C / 40%rh			
EUT Serial		01114110316					Γemp / Hι					
EUT Config	-	11n at HT40 I					_ine AC /		120 Vac / 60 H			
Standard		47 Part 15 Su			7, RSS-6		RBW / VB	-	1 MHz / 3 MHz			
Dist/Ant Us	<b>sea</b> 3m -	EMCO3115					Performe		Richard Decke	ſ		
_	_					, in the second s	High Char	,				
Frequency	Raw	Cable Loss	AF		Detector		y Height	Azimu		Margin		
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB		
39891.16	47.65	10.89	-13.53	45.02	Average	H	108	96	54.00	-8.98		
34332.96	44.06	9.63	-12.44	41.25	Average	V	130	214	54.00	-12.75		
and the			UV Rheinland «	f North America								
100.0												
800									[7] Vertical			
									Ar Lost			
									+ Format			
									Car.			
56.0									Trace			
85.0												
				-	-	have a server	when when	hard	Arr 1040.			
400		L.L. Milliondation							VDw 1000kHz			
	المتحد مرام مودا والما	holo and the optimizer and	an weather and	er and					Hare toooking.			
									Node P24A			
20.0									Read Divi Sm			
									Checkenov: Mile			
18000.0									20000.000000000			
anna, Piantras	нте та сазамны											
Pleasance (a)	pengenen films (oMI/amin	afi sanandarnalin/20170202_pi	ades_REHEL and									
Spec Margin	= E-Field /	AVG - Limit, E	-Field A	/G = FIM /	AVG+ Tota	al CF + I	Jncertaintv					
		oss AF= Anten										
	Note: 1. Worst case was observed on HT40 MCS0 mode.											
	e covered	is VHT40. plexity and bul	kiness of	the report			are placed	l in the re	port			
3. 10 10	equice com	ipiexity and bui	KINESS OI	the report	i worst ca	Se PIUS	are placed	i in the re	pon.			

SOP 1 Ra	diated E	missions				Т	rac	king # 3	317607	09.0	01 Page 13	3 of 16
EUT Name	Wi-F	i Router					Da	ate		Feb	28, 2017	
EUT Model		001 (USA), E		2 (IC)				emp / Hu			C / 38%rh	
EUT Serial		01114110316						emp / Hu				
EUT Config		11ac at VHT8		) (chain 0	& 1) /		Lir	ne AC /	Freq	120	) Vac / 60 H	Z
Standard		ony PSU 47 Part 15 Su	ibpart C	DSS-24			PF	3W / VB	<b>A</b>	120	) kHz/ 300 k	·U7
Dist/Ant Us				, 1100-24	7, NOO-C			erformed		-	hard Deckei	
		000	30 MF	17 – 1 GF	lz Transm	nit at P			y	TRIO		
Frequency	Raw	Cable Loss	AF		Detector				Azimu	ıth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/\		cm	deg		dBuV/m	dB
51.81	58.86	1.71	-24.09	36.47	QP	V		101	258		40.00	-3.53
87.61	56.15	1.92	-24.73	33.33	QP	V		179	284		40.00	-6.67
81.19	55.92	1.88	-24.45	33.35	QP	v		153	360		40.00	-6.65
235.72	56.07	2.49	-20.00	38.57	QP	V		202	348		46.00	-7.43
104.79	49.77	2.00	-20.46	31.31	QP	V		116	361		43.50	-12.20
110.79	49.51	2.03	-19.24	32.29	QP	V		112	361		43.50	-11.21
dBuV/m		-	UV Rheinland o	North America							201 80 17 20.00	
										r 1000 0	(2) Vertical Qpk Lmt + Formal Cop Meas Dist 3m Spec Dist 3m Frequency: MHz	
Spec Margin Total CF= AF Note: 1. Wors	= E-Field ( + Cable Lo st case was	QP - Limit, E-loss AF= Antenis s observed on e 802.11a, HT	Field QP na factor Mid chan	+ Preamp nel of 802	.11ac VHT	80 MC	CS0	mode for				

- 2. Mode tested are 802.11a, HT20, VHT20, HT40, VHT40 & VHT80 (low, mid & high channel).
- 3. No significant emission was observed below 30MHz.
- 4. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.

Report Number: 31760709.001 EUT: Wi-Fi Router Model: D010001 (USA), D010002 (IC) EMC / Rev 1.0 Page 106 of 133

SOP 1 Ra	adiated E	missions				Т	rack	king #	317607	09.0	01 Page 14	4 of 16
EUT Name	Wi-Fi	Router					Dat	te		Feb	22, 2017	
EUT Mode		0001 (USA), [		2 (IC)				mp / Hı			C / 36%rh	
EUT Serial		01114110316			<b>•</b> • • •			mp/Ηι				
EUT Config	FoxL	11ac at VHT8 ink PSU		,	,			ne AC /			) Vac / 60 H	
Standard		47 Part 15 Sι	ubpart C	, RSS-24	7, RSS-C	<u>EN</u>		W/VB		_	) kHz/ 300 k	
Dist/Ant Us	<b>sed</b> 3m /	JB3						rforme	d by	Ric	hard Decke	ſ
			1		lz Transm							
Frequency	Raw	Cable Loss	AF	Level	Detector				Azimu		Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/\	_	cm	deg		dBuV/m	dB
704.96	22.55	3.64	-11.37	14.82	QP	V		199	286		46.00	-31.18
58.75	56.75	1.76	-24.58	33.93	QP	V		106	267	•	40.00	-6.07
77.19	56.60	1.86	-24.05	34.41	QP	V		105	346	5	40.00	-5.59
69.03	52.83	1.82	-23.94	30.71	QP	V		159	326	i	40.00	-9.29
38.88	44.28	1.63	-17.08	28.83	QP	V		173	36		40.00	-11.17
236.91	56.97	2.50	-19.95	39.52	QP	V		268	358	5	46.00	-6.48
				530 0 530 0		-				1000	C [1] Horizon [2] Vertical [2] Vertical [2] Qpk Lint + Formal  C [2]  Meas Dist 3m  Spec Dist 3m  Frequency: MHz 2	
30.0 EERO , PICO		oft - vasona\results\20170222_Pi		ni = FIM QP-	630.0	730.0		830.0	930.0	1000.0	Prequency: MHz	

Note: 1. Worst case was observed on Mid channel of 802.11ac VHT80 MCS0 mode for 80MHz channel BW.

- 2. Mode tested are 802.11a, HT20, VHT20, HT40, VHT40 & VHT80 (low, mid & high channel).
- 3. No significant emission was observed below 30MHz.
- 4. To reduce complexity and bulkiness of the report Worst case Plots are placed in the report.

Report Number: 31760709.001 EUT: Wi-Fi Router Model: D010001 (USA), D010002 (IC) EMC / Rev 1.0 Page 107 of 133

SOP 1 Ra	SOP 1 Radiated EmissionsTracking # 31760709.001 Page 15 of 16											
EUT Name		i Router				Da	ate		b 25, 2017			
EUT Mode		0001 (USA), [		2 (IC)			emp / Hı		° C / 37%rh			
EUT Serial		01114110316						um out N//				
EUT Confi		11n at VHT80					ine AC /		0 Vac / 60 H			
Standard		47 Part 15 Sι			7, RSS-G		BW / VB		MHz / 3 MHz			
Dist/Ant U	sed 3m -	EMCO3115	′ 1m – A	HA-840		P	erforme	<b>d by</b> Ric	chard Decke	r		
		1	– 18 GH	lz Transm	nit at 5210	) MHz (N	/lid Chan	nel)				
Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin		
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB		
5246.27	59.36	1.85	-19.43	41.78	Average	Н	200	52	54.00	-12.22		
17941.35	40.17	3.75	-3.15	40.76	Average	V	153	172	54.00	-13.24		
10427.85	42.58	2.71	-12.76	32.53	Average	Н	100	12	54.00	-21.47		
difference in the second s			UV Rheinland o	f North America								
85.0									[1] Hadava			
82.0									[7] Verial			
									Ar Lost			
75.0									+ Format			
80.0									-			
800												
-								and the second second	a			
					M. M	a presidentes	فعينهما لرمداعه	AND AND	1			
an stade	Andrew	المورس العابلة المحرب المالي	الجنجي فالمحرف عرمك والمه	a the second	· • ·							
mo velarita a									Massa Dine Are			
15.0									Spore Divi Ser			
									Chessency: Mile			
1000							12000.2		800.0			
anna, Pinain	, VHTED TX EDIDEHA											
Plename: a	njemgenim filers (eMf)/annis	ണ് നേഷത്തെങ്ങൾ20120226_ല്	NAME APPRICAGE									
Spec Margin	= E-Field A	AVG - Limit, E	-Field A	/G = FIM /	AVG+ Tota	al CF ± Ur	ncertainty					
		oss AF= Anten										
		plexity and bul e the Spurious				se Plots a	re placed	in the report	t.			
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SOP 1	Radia	ted E	missions				Tr	ackir	ng #	31760709	.001 Page 1	3 of 16
EUT Nam	ıe	Wi-F	i Router					Date			ar 02, 2017	
EUT Mod			0001 (USA), [		2 (IC)				p/Hu		2° C / 40%rh	
EUT Seri		-	01114110316						•	um out N/		
							20 Vac / 60 H					
Standard						7, RSS-0			V/VB		MHz / 3 MHz	
Dist/Ant	Used	3m -	EMCO3115						orme		ichard Decke	ŕ
	_			1	Iz Transm			<u>`</u>		· · ·		
Frequence	-	Raw	Cable Loss	AF	Level	Detector		-	-	Azimuth	Limit	Margin
MHz		uV/m	dB	dB	dBuV/m		H/V		cm	deg	dBuV/m	dB
39889.3	6 4	7.62	10.89	-13.53	44.98	Average	H		199	308	54.00	-9.02
34156.8	9 43	3.48	9.66	-12.43	40.71	Average	V		151	166	54.00	-13.29
21205.3	5 29	9.69	7.57	-9.37	27.89	Average	V		106	140	54.00	-26.11
distant.			,	TUV Rheinland	of North America							
100.0		_									[1] Harisse	
80.0											[7] Verical	
											Av Lord	
200												
96 C												
35.0 ····		_							m. x.	and the second	Aa	
450						Margan March	فالمطلح والمعام	and the	N.M	July		
youte	hermour	and a state of the	a have not a server a	تريطين مستعجد ينغين	when							
			•								_	
20.0											Mass Disc (m.	
-												
20											I MOLENCY MILE	
18000.0	index. TX VHTS										20000.000000000	
Pirnan			eft - several main 2017020 ("P	ineles REHER cont								
Spec Marg	in = F-	Field 4	AVG - Limit, E	-Field A	VG = FIM	AVG+ Tota	al CF + I	Unce	rtainty	,		
			oss AF= Anten					01100				
Note: To re	educe o	comple	exity and bulkin	ness of th	ne report W	orst case	Plots ar	re pla	aced in	the report.		

# 4.6 AC Conducted Emissions

Testing was performed in accordance with ANSI C63.4: 2014. These test methods are listed under the laboratory's A2LA Scope of Accreditation.

This test measures the levels emanating from the EUT's AC input port, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

The AC conducted emissions of equipment under test shall not exceed the values in CFR47 Part 15.207: 2016 and RSS GEN: 2014.

### 4.6.1 Test Methodology

A test program that controls instrumentation and data logging was used to automate the AC Power Line Conducted emission test procedure. The frequency range of interest was divided into sub-ranges such as to yield a frequency resolution of 9 kHz. Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a set of  $50\mu$ H /  $50\Omega$  LISNs.

Testing is performed in Lab 5. The setup photographs clearly identify which site was used. The vertical ground plane used in the semi-anechoic chamber is a 2m x 2m solid aluminum frame and panel, and it is bonded to the horizontal ground plane.

In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane. Support equipment was powered from a separate LISN.

## 4.6.1.1 Deviations

There were no deviations from this test methodology.

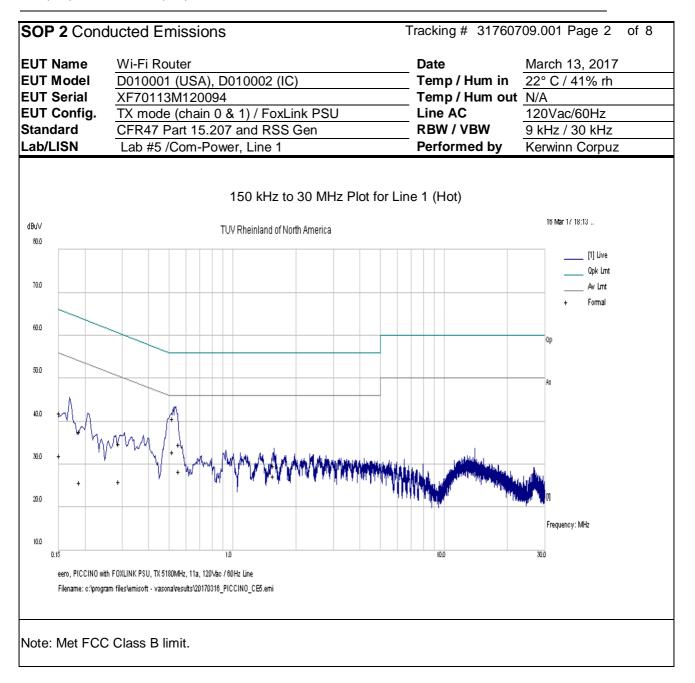
## 4.6.2 Test Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

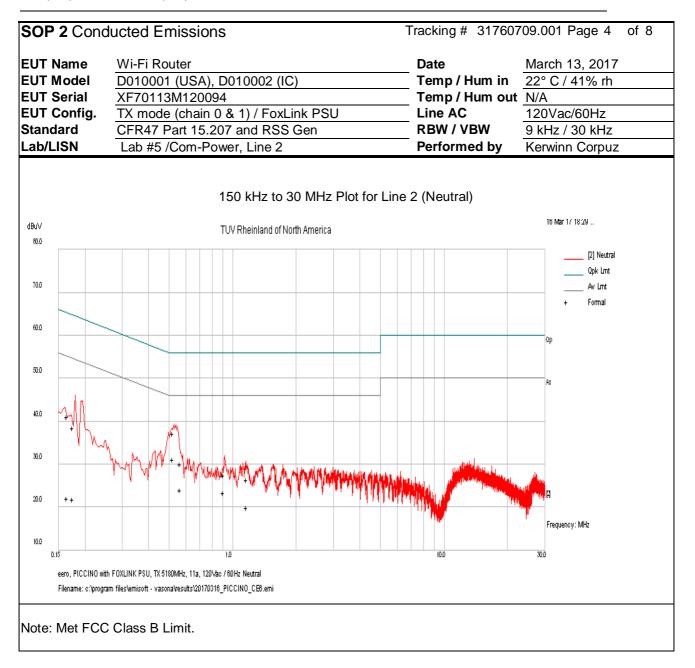
Test Conditions: Conducted Measurement at Normal Conditions only					
Antenna Type: Patch		Power Level: See Test Plan			
AC Power: 120 Vac/60 Hz		<b>Configuration:</b> T	abletop		
<b>Ambient Temperature:</b> 22° C		Relative Humidity: 41% RH			
<b>Configuration</b> Frequ		ency Range	Test Result		
Line 1 (Hot) 0.15		to 30 MHz	Pass		
Line 2 (Neutral) 0.15		to 30 MHz	Pass		

Table 24: AC Conducted Emissions - Test Results

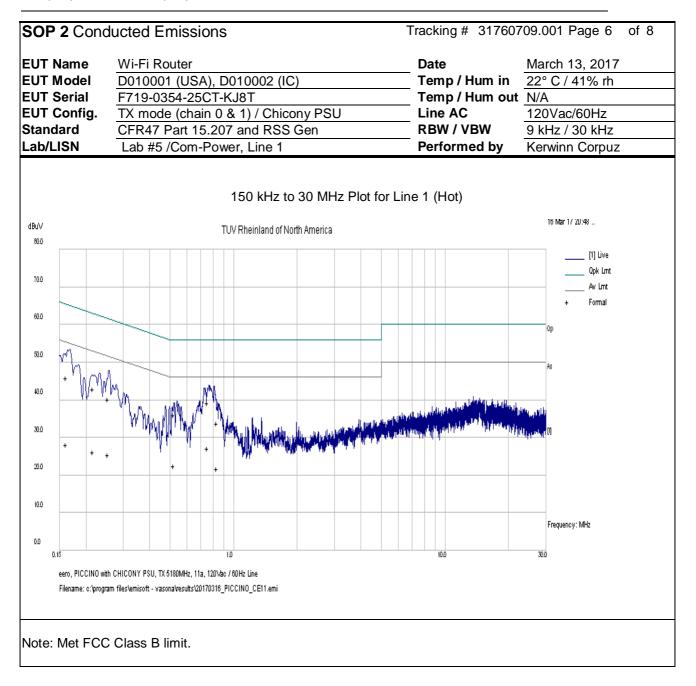
		outor			De	10	Marah	12 2017		
EUT Name EUT Model	Wi-Fi Ro		10000 /10	•)	Date March 13, 2017					
EUT Serial		<u>1 (USA), D(</u> 3M120094	010002 (IC	,)		Temp / Hum in 22° C / 41% rh Temp / Hum out N/A				
EUT Config.		e (chain 0 8	2 1) / Eavl i			e AC / Fre		c/60Hz		
Standard		e (chain 0 a Part 15.207				W / VBW		/ 30 kHz		
Lab/LISN		/Com-Powe		Gen		rformed b		n Corpuz		
				Larral		Line			Degrald	
Frequency	Raw	Limiter	Ins.	Level	Detector	Line	Limit	Margin	Result	
MHz	dBuV	dB	Loss dB	dBuV		Line	dBuV	dB		
					0.0					
0.152	31.64	9.97	0.25	41.85	QP	Live	65.89	-24.04	Pass	
0.152	21.76	9.97	0.25	31.98	Ave	Live	55.89	-23.91	Pass	
0.188	27.38	9.98	0.20	37.56	QP	Live	64.12	-26.56	Pass	
0.188	15.52	9.98	0.20	25.70	Ave	Live	54.12	-28.42	Pass	
0.290	24.68	9.99	0.13	34.80	QP	Live	60.53	-25.73	Pass	
0.290	15.92	9.99	0.13	26.05	Ave	Live	50.53	-24.48	Pass	
0.520	30.53	10.02	0.10	40.64	QP	Live	56.00	-15.36	Pass	
0.520	22.72	10.02	0.10	32.83	Ave	Live	46.00	-13.17	Pass	
0.558	24.47	10.03	0.09	34.58	QP	Live	56.00	-21.42	Pass	
0.558	18.11	10.03	0.09	28.23	Ave	Live	46.00	-17.77	Pass	
1.554	19.40	10.09	0.06	29.55	QP	Live	56.00	-26.45	Pass	
1.554	17.11	10.09	0.06	27.26	Ave	Live	46.00	-18.74	Pass	
Spec Margin = C					•				·	
Combined Standar Notes: The E							or 95% confide			



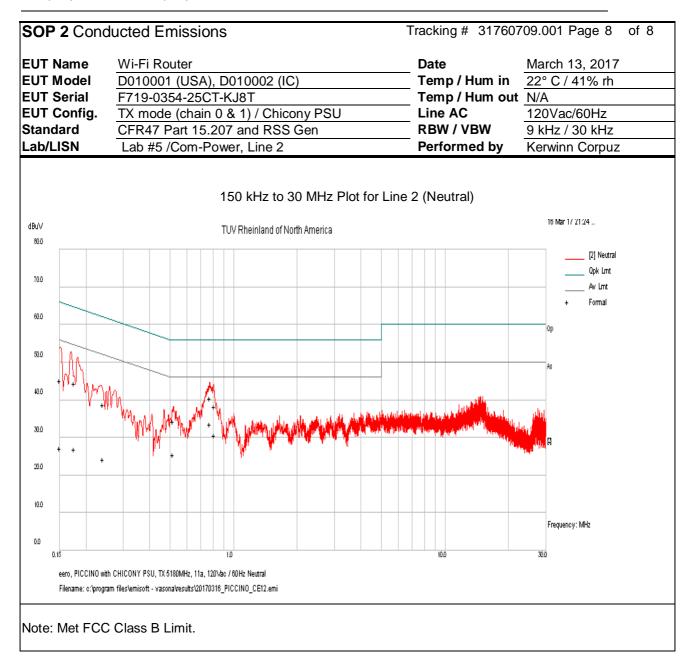
UT Name	Wi-Fi Ro					ate		h 13, 2017			
EUT Model	D01000	1 (USA), D0	10002 (IC)	)	Temp / Hum in 22° C / 41% rh						
EUT Serial		3M120094				Temp / Hum out N/A					
EUT Config.		e (chain 0 &				ine AC / Fr	•	/ac/60Hz			
Standard		CFR47 Part 15.207 and RSS Gen				BW / VBW	_	z / 30 kHz			
_ab/LISN	Lab #5 /	Lab #5 /Com-Power, Line 2			P	erformed I	-	inn Corpuz/			
Frequency	Raw	Limiter	Ins. Loss	Level	Detector	Line	Limit	Margin	Result		
MHz	dBuV	dB	dB	dBuV		Line	dBuV	dB			
0.164	30.92	9.98	0.23	41.12	QP	Neutral	65.26	-24.14	Pass		
0.164	11.93	9.98	0.23	22.14	Ave	Neutral	55.26	-33.12	Pass		
0.174	28.22	9.97	0.22	38.40	QP	Neutral	64.75	-26.35	Pass		
0.174	11.60	9.97	0.22	21.78	Ave	Neutral	54.75	-32.97	Pass		
0.521	26.96	10.02	0.10	37.08	QP	Neutral	56.00	-18.92	Pass		
0.521	20.90	10.02	0.10	31.02	Ave	Neutral	46.00	-14.98	Pass		
0.563	19.99	10.03	0.09	30.11	QP	Neutral	56.00	-25.89	Pass		
0.563	13.88	10.03	0.09	24.00	Ave	Neutral	46.00	-22.00	Pass		
0.903	17.33	10.06	0.07	27.46	QP	Neutral	56.00	-28.54	Pass		
0.903	13.20	10.06	0.07	23.33	Ave	Neutral	46.00	-22.67	Pass		
1.159	16.20	10.07	0.06	26.33	QP	Neutral	56.00	-29.67	Pass		
1.159	9.82	10.07	0.06	19.95	Ave	Neutral	46.00	-26.05	Pass		
Spec Margin = C	P./Ave Li	mit, ± Unce	rtainty	1	1	1					



SOP 2 Conc	lucted Er	nissions			Tracl	king # 317	760709.001	Page 5	of 8	
EUT Name	Wi-Fi Ro	outer			Date         March 13, 2017           Temp / Hum in         22° C / 41% rh					
EUT Model	D01000	1 (USA), D0	)10002 (IC	)						
EUT Serial		354-25CT-K				Temp / Hum out N/A				
EUT Config.		e (chain 0 8				e AC / Fre		ac/60Hz		
Standard		Part 15.207		Gen		W / VBW	-	/ 30 kHz		
Lab/LISN	Lab #5	/Com-Powe	er, Line 1		Pe	Performed by Kerwinn Corpuz				
Frequency	Raw	Limiter	Ins. Loss	Level	Detector	Line	Limit	Margin	Result	
MHz	dBuV	dB	dB	dBuV		Line	dBuV	dB		
0.161	35.75	9.98	0.23	45.96	QP	Live	65.40	-19.44	Pass	
0.161	17.88	9.98	0.23	28.09	Ave	Live	55.40	-27.31	Pass	
0.216	32.66	9.98	0.18	42.82	QP	Live	62.96	-20.14	Pass	
0.216	16.06	9.98	0.18	26.21	Ave	Live	52.96	-26.75	Pass	
0.254	29.95	9.99	0.15	40.08	QP	Live	61.62	-21.53	Pass	
0.254	15.30	9.99	0.15	25.43	Ave	Live	51.62	-26.19	Pass	
0.522	25.76	10.02	0.10	35.87	QP	Live	56.00	-20.13	Pass	
0.522	12.30	10.02	0.10	22.42	Ave	Live	46.00	-23.58	Pass	
0.751	29.13	10.04	0.08	39.26	QP	Live	56.00	-16.75	Pass	
0.751	16.88	10.04	0.08	27.00	Ave	Live	46.00	-19.00	Pass	
0.831	23.71	10.05	0.07	33.84	QP	Live	56.00	-22.17	Pass	
0.831	11.64	10.05	0.07	21.77	Ave	Live	46.00	-24.23	Pass	
Spec Margin = C Combined Standa					inty II - kuch	() $k = 2 + i$	or 0.5% confid	2000		
Notes: EUT w										



UT Name UT Model	Wi-Fi Ro D01000	outer 1 (USA), D0	10002 (IC	)		Date         March 13, 2017           Temp / Hum in         22° C / 41% rh				
UT Serial		54-25CT-K			Т	emp / Hum	out N/A			
EUT Config.		e (chain 0 &				ine AC / Fr		/ac/60Hz		
Standard		CFR47 Part 15.207 and RSS Gen Lab #5 /Com-Power, Line 2				BW / VBW		z / 30 kHz		
_ab/LISN						erformed I		inn Corpuz/		
Frequency	Raw	Limiter	Ins. Loss	Level	Detector	Line	Limit	Margin	Result	
MHz	dBuV	dB	dB	dBuV		Line	dBuV	dB		
0.150	34.92	9.97	0.25	45.14	QP	Neutral	66.00	-20.86	Pass	
0.150	16.78	9.97	0.25	27.00	Ave	Neutral	56.00	-29.00	Pass	
0.176	34.11	9.97	0.21	44.29	QP	Neutral	64.69	-20.39	Pass	
0.176	16.74	9.97	0.21	26.93	Ave	Neutral	54.69	-27.76	Pass	
0.240	28.65	9.98	0.16	38.79	QP	Neutral	62.08	-23.29	Pass	
0.240	14.03	9.98	0.16	24.18	Ave	Neutral	52.08	-27.90	Pass	
0.518	24.21	10.02	0.10	34.33	QP	Neutral	56.00	-21.67	Pass	
0.518	15.20	10.02	0.10	25.32	Ave	Neutral	46.00	-20.68	Pass	
0.775	30.37	10.05	0.08	40.50	QP	Neutral	56.00	-15.50	Pass	
0.775	23.31	10.05	0.08	33.44	Ave	Neutral	46.00	-12.56	Pass	
0.811	28.11	10.05	0.08	38.24	QP	Neutral	56.00	-17.76	Pass	
0.811	20.54	10.05	0.08	30.67	Ave	Neutral	46.00	-15.33	Pass	
Spec Margin = 0	QP./Ave Li	mit, ± Unce	rtainty							



# 4.7 Frequency Stability

In accordance with 47 CFR Part 15.407(g) and RSS GEN Sect. 6.11 the frequency stability of U-NII devices must be such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual. The Manufacturer calls out operating temperature ranges of  $+0^{\circ}$  to  $+35^{\circ}$  C

# 4.7.1 Test Methodology

The manufacturer of the equipment is responsible for ensuring that the frequency stability is such that emissions are always maintained within the band of operation under all conditions. This test performs according to ANSI C63.10-2013 Section 6.8

# 4.7.2 Manufacturer Declaration

The frequency stability of the reference oscillator sets the frequency stability of the RF transceiver signals. Therefore all of the RF signal should have  $\pm 20$  ppm stability.

This stability accounts for room temp tolerance of the crystal oscillator circuit, frequency variation across temperature, and crystal ageing.

Worst case: 5.180 GHz - ±20 ppm/104 kHz

 $\pm 20$  ppm at 5.18 GHz translates to a maximum frequency shift of  $\pm 104$  kHz. As the edge of the channels are at least one MHz from either of the band edges,  $\pm 103$  kHz is more than sufficient to guarantee that the intentional emission will remain in the band over the entire operating range of the radio.

# 4.7.3 Limit

CFR47 Part 15.407(g) and RSS GEN Sect. 6.11 - Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

### 4.7.4 **Test results:**

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s) since the maximum frequency drift was 14.38 ppm.

Temperature	Time	РРМ
	Start	13.22
0° C	2 Min.	-4.83
0 C	5 Min	6.37
	10 min	5.60
	Start	8.11
10° C	2 Min.	9.56
10 C	5 Min	8.59
	10 min	3.38
	Start	9.27
20° C	2 Min.	10.04
20 C	5 Min	10.04
	10 min	6.85
	Start	12.55
30° C	2 Min.	2.80
50 C	5 Min	2.61
	10 min	-1.25
	Start	8.11
40° C	2 Min.	3.57
40 C	5 Min	8.11
	10 min	8.49
	Start	14.38
50° C	2 Min.	7.14
50 C	5 Min	9.65
	10 min	11.68
Note: All frequency	drifts were less than $\pm 20$ pp	om. The worst frequency drift was 14.38 ppm

Table 25: Frequency Stability – Test Results



Figure 100: Frequency Stability – Worst Case

# 4.8 Voltage Variation

In accordance with 47 CFR Part 15.31 (e) intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

# 4.8.1 Test Methodology

The ac supply voltage was varied between 85% and 115% of the nominal rated supply voltage. The fundamental frequency was observed during the variation. The access point was powered 120 Vac / 60 Hz by programmable power supply. The voltage was varied from 102 Vac to 138 Vac mean while the fundamental frequencies were observed and record for the maximum drift in ppm; part per millions.

## 4.8.2 Test results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s). The fundamental frequencies drifted less than  $\pm 20$  ppm.

Frequency	Nominal (120Vac)	Lo Voltage (102Vac)	Hi Voltage (138Vac)	Max Drift
MHz	MHz	MHz	MHz	ppm
5180	-0.043	0.022	-0.037	8.20

 Table 26: Voltage Variation – Test Results

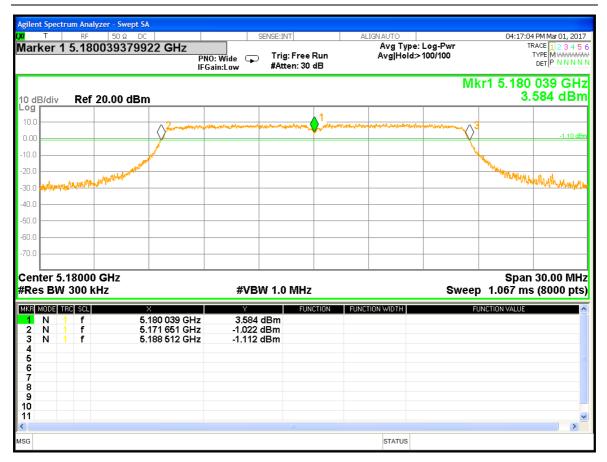


Figure 101: Voltage Variation – Worst Case

# 4.9 Maximum Permissible Exposure

### 4.9.1 Test Methodology

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this calculation is declared by the manufacturer, and the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

### 4.9.2 **RF Exposure Limit**

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm2)	Average Time (minutes)				
	(A)Limits For Occupational / Control Exposures							
0.3–3.0	614	1.63	*(100)	6				
3.0–30	1842/f	4.89/f	*(900/f <sup>2</sup> )	6				
30–300			1.0	6				
300 - 1500			f/300	6				
1500 - 100,000			5	6				
(B	B)Limits For Gene	ral Population / Un	controlled Exposu	re				
0.3–1.34	614	1.63	*(100)	30				
1.34-30	824/f	2.19/f	*(180/ f <sup>2</sup> )	30				
30–300	27.5	0.037	0.2	30				
300 - 1500			f/1500	30				
1500 - 100,000			1.0	30				

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

F = Frequency in MHz

\* = Plane-wave equivalent power density

### 4.9.3 EUT Operating Condition

The software provided by Manufacturer enabled the EUT to transmit data at lowest, middle and highest channel individually.

#### 4.9.4 Classification

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in user's manual. So, this device is classified as a **Mobile Device**.

See below calculation for 5.24 GHz, worse case, RF Exposure at a distance of 20cm.

## 4.9.5 Test Results

### 4.9.5.1 Antenna Gain

The 5.24 GHz transmitting beam forming antenna gain was +8.67 dBi or 7.36 (numeric).

#### 4.9.5.2 Output Power into Antenna & RF Exposure value at distance 20cm:

Calculations for this report are based on highest power measurement.

Limit for MPE (from FCC part 1.1310 table1) is 1.0 mW/cm<sup>2</sup>

The highest measured total power is +24.47 dBm or 279.90 mW (summed 2 chains)

Using the Friss transmission formula, the EIRP is Pout\*G, and R is 20cm.

 $Pd = (279.90*7.36) / (1600\pi) = 0.4098 \text{ mW/cm2}$ , which is 0.5902 mW/cm2 below to the limit.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

#### 4.9.6 Sample Calculation

The Friss transmission formula:  $Pd = (Pout^{*}G) / (4^{*}\pi^{*}R^{2})$ 

Where; Pd = power density in mW/cm<sup>2</sup> Pout = output power to antenna in mW G = gain of antenna in linear scale  $\pi \approx 3.1416$ R = distance between observation point and center of the radiator in cm

Ref. : David K. Cheng, Field and Wave Electromagnetics, Second Edition, Page 640, Eq. (11-133).

# 5 Test Equipment List

# 5.1 Equipment List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal mm/dd/yyyy	Next Cal mm/dd/yyyy
Bilog Antenna	Sunol Sciences	JB3	A102606	06/15/2016	06/15/2018
Horn Antenna	Sunol Sciences	3115	9710-5301	10/08/2015	10/08/2017
Antenna (18-40 GHz)	Com-Power	AHA-840	105005	07/08/2015	07/08/2017
Loop Antenna	EMCO	6502	9110-2683	06/13/2016	06/13/2017
Spectrum Analyzer	Rohde & Schwarz	FSL6	100169	01/13/2017	01/13/2018
Spectrum Analyzer	Agilent	N9038A	MY552260210	01/16/2017	01/16/2018
Spectrum Analyzer	Agilent	N9030A	MY52350885	05/17/2016	05/17/2017
Spectrum Analyzer	Rohde Schwarz	ESIB40	832427/002	01/16/2017	01/16/2018
Spectrum Analyzer	Rohde Schwarz	FSV40	1321.3008K40	08/30/2016	08/30/2017
Amplifier	Sonoma Instruments	310	165516	01/19/2017	01/19/2018
Amplifier	Miteq	TTA1800-30-HG	2020728	11/12/2016	11/12/2017
Amplifier	Rohde & Schwarz	TS-PR26	100011	11/04/2017	11/04/2018
Amplifier	Rohde & Schwarz	TS-PR40	100012	08/02/2017	08/02/2017
Power Meter	Agilent	E4418B	MY45103902	01/11/2017	01/11/2018
Power Sensor	Hewlett Packard	8482A	1925A04647	01/01/2017	01/01/2018
Thermometer	Fluke	5211	88650033	11/04/2016	11/04/2017
Thermo Chamber	Espec	BTZ-133	0613436	NCR	NCR
Multimeter	Fluke	177	92780312	01/11/2017	01/11/2018
DC Power Supply	Agilent	E3634A	MY400004331	01/12/2017	01/12/2018
Notch Filter	Micro-Tronics	BRM50702	037	07/18/2016	07/18/2017
Signal Generator	Anritsu	MG3694A	42803	01/13/2017	01/13/2018
Signal Generator	Rohde & Schwarz	SMF100A	1167.0000K02	09/06/2016	09/06/2017
Signal Generator	Rohde & Schwarz	SMBV100A	1407.6004K02	09/06/2016	09/06/2017
Power Sensors	Rohde & Schwarz	OSP120	1520.9010.02	09/06/2016	09/06/2017

\* Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.

# 6 EMC Test Plan

# 6.1 Introduction

This section provides a description of the Equipment Under Test (EUT), configurations, operating conditions, and performance acceptance criteria. It is an overview of information provided by the manufacturer so that the test laboratory may perform the requested testing.

# 6.2 Customer

Table 27: Customer Information

Company Name	eero inc.
Address	500 Howard Street, Suite 900
City, State, Zip	San Francisco, CA 94105
Country	USA
Phone	(415) 738-7972
Fax	

 Table 28: Technical Contact Information

Name	Clifford Clarke
E-mail	cliff@eero.com
Phone	(415) 738-7972
Fax	

# 6.3 Equipment Under Test (EUT)

# Table 29: EUT Specifications

EUT Specifications					
Dimensions	W: 2.875in (73mm) x D: 4.750in (121mm) x H: 1.188in (30mm)				
AC Input	100-240V AC, 50 – 60 Hz				
Environment	Indoor				
Operating Temperature Range:	0 to 35 degrees C				
Multiple Feeds:	Yes and how many No				
Product Marketing Name (PMN)	D010001 (USA), D010002 (IC)				
Hardware Version Identification Number (HVIN)	D010001 (USA), D010002 (IC)				
Firmware Version Identification Number (FVIN)	3.0.0				
802.11-radio modules					
Operating Mode	802.11a, 802.11n (HT20, HT40), 802.11ac (VHT20, VHT40, VHT80)				
Transmitter Frequency Band	5.150 GHz – 5.250 GHz, U-NII-1 band				
Max. Rated Power Output	See Channel Planning Table.				
Power Setting @ Operating Channel	See Channel Planning Table.				
Antenna Type	Qty 5 – 2 custom antennas at 5.18-5.24GHz. See Table 30 for details				
Antenna Gain	Antenna 5 = $\pm 1.11 \text{ dBi}$ , Antenna 6 = $\pm 2.13 \text{ dBi}$				
Modulation Type	AM FM DSSS OFDM Other describe: 16QAM and 64 QAM				
Data Rate	<ul> <li>802.11a:</li> <li>1 Spatial Streams: 6, 9, 12, 18, 24, 36, 48, 54 Mbps</li> <li>802.11n/ac HT20/VHT20:</li> <li>2 Spatial Streams: 13, 26, 39, 52, 78, 104, 117, 130 /156 Mbps (LGI)</li> <li>802.11n/ac HT40/VHT40:</li> <li>2 Spatial Streams: 27, 54, 81, 108, 162, 216, 243, 270 / 324, 370 Mbps (LGI)</li> <li>802.11ac VHT 80:</li> <li>2 Spatial Streams: 58.5, 117, 175.5, 234, 351, 468, 526.5, 585, 702, 780 Mbps (LGI)</li> </ul>				
TX/RX Chain (s)	MIMO (2x2)				

EUT Specifications				
Directional Gain Type	Correlated Beam-Forming Other describe:			
Type of Equipment     Table Top X Wall-mount     Floor standing cabinet       Other:     Other:				
Note: All 2 chains will be on / transmitted at all time.				

## Table 30: Antenna Information

Number	Antenna Type	Description	Max Gain (dBi)
Antenna 1	Flex PCB	5 GHz Wi-Fi U-NII-1 Band, Chain 0	6.29
Antenna 2	Flex PCB	5 GHz Wi-Fi U-NII-1 Band, Chain 1	4.97
Antenna 1	Flex PCB	5 GHz Wi-Fi U-NII-2A Band, Chain 0	5.96
Antenna 2	Flex PCB	5 GHz Wi-Fi U-NII-2A Band, Chain 1	4.86
Antenna 1	Flex PCB	5 GHz Wi-Fi U-NII-2C Band, Chain 0	4.74
Antenna 2	Flex PCB	5 GHz Wi-Fi U-NII-2C Band, Chain 1	5.13
Antenna 1	Flex PCB	5 GHz Wi-Fi U-NII-3 Band, Chain 0	4.94
Antenna 2	Flex PCB	5 GHz Wi-Fi U-NII-3 Band, Chain 1	5.22
Antenna 3	Flex PCB	2.4 GHz Wi-Fi Chain 0	4.08
Antenna 4	Flex PCB	2.4 GHz Wi-Fi Chain 1	3.64
Antenna 5	Flex PCB	Bluetooth LE or Thread (Zigbee)	4.14

# Table 31: EUT Channel Power Specifications

No.	Frequency		Target Power Value dBm				
	(MHz)	802.11a	802.11n HT20	802.11n HT40	802.11ac VHT40	802.11ac VHT80	
36	5180	24.28***	24.37***				
38	5190			22.77*	22.71*		
42	5210					22.73**	
46	5230			27.87****	27.78*****		
48	5240	27.14****	27.14****				

### FCC Total Power for Non-Beamforming Mode

#### **RSS Total Power for Non-Beamforming Mode**

No.	Frequency	Target Power Value dBm					
	(MHz)	802.11a	802.11n HT20	802.11n HT40	802.11ac VHT40	802.11ac VHT80	
36	5180	14.34*	14.22*				
38	5190			16.29**	16.35**		
42	5210					16.17***	
46	5230			16.38**	16.46**		
48	5240	14.45*	14.35*				
Note:	Note:       1. The adjusted power target values are updated at the evaluated frequencies.         2. TP setting: * = 12, ** = 14, *** = 14.5.						

No.	Frequency	Target Power Value dBm					
	(MHz)	802.11a	802.11n HT20	802.11n HT40	802.11ac VHT40	802.11ac VHT80	
36	5180	24.28***	24.37***				
38	5190			22.77*	22.71*		
42	5210					22.73**	
46	5230			27.32****	27.26****		
48	5240	24.47***	24.43***				
Note:     1. The adjusted power target values are updated at the evaluated frequencies.       2. TP setting:     * = 20.5, ** = 21, *** = 22, ****=25.							

### FCC Total Power for Beamforming Mode

#### **RSS Total Power for Beamforming Mode**

No.	Frequency	Target Power Value dBm					
	(MHz)	802.11a	802.11n HT20	802.11n HT40	802.11ac VHT40	802.11ac VHT80	
36	5180	11.91*	11.82*				
38	5190			13.81**	13.80**		
42	5210					13.77***	
46	5230			13.96**	13.95**		
48	5240	11.88*	11.76*				
Note:	Note:       1. The adjusted power target values are updated at the evaluated frequencies.         2. TP setting: * = 9.5, ** = 11.5, *** = 12.						

#### Table 32: Interface Specifications

Interface Type	Cabled with what type of cable?	Is the cable shielded?	Maximum potential length of the cable?	Metallic (M), Coax (C), Fiber (F), or Not Applicable?
Ethernet	RJ45	🖂 No	🖂 Metric: 2 m	□ N/A

### Table 33: Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Laptop	Dell	Latitude	35521341769	Setup EUT operating channel
Note: None.				

# Table 34: Description of Sample used for Testing

Device	Serial	<b>RF</b> Connection	CFR47 Part 15.407	
		FPCB Antenna	TX Emission,	
		I'r CD Antenna	AC Conducted Emission	
	MF70111411		Peak Transmit Power,	
Wi-Fi Router	0316	Direct Connection	Peak Power Spectral Density,	
	0310		Occupied Bandwidth	
			Band-Edge	
			Out-of-Band Emission	
Note: Chicony PSU S/N: F719-0354-25CT-KJ8T, FoxLink PSU S/N: XF70113M120094				

### Table 35: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Photo (X-Axis)	Setup Photo (Y-Axis)	Setup Photo (Z-Axis)
Wi-Fi Router	FPCB	Transmit	N/A	EUT standing up	N/A
Note: N/A					

# 6.4 Test Specifications

Testing requirements

# Table 36: Test Specifications

Emissions and Immunity				
Standard	Requirement			
CFR 47 Part 15.407: 2016	All			
RSS 247 Issue 2, 2017	All			

# **END OF REPORT**