FCC RF Test Report

APPLICANT	**:**	**Samsara Networks**
EQUIPMENT	**:**	**VG33**
BRAND NAME	**:**	**SAMSARA**
MODEL NAME	**:**	**010-0033**
MARKETING NAME	**:**	**VG33**
FCC ID	**:**	**2AIHD0033**
STANDARD	**:**	**FCC Part 15 Subpart E §15.407**
CLASSIFICATION	**:**	**(NII) Unlicensed National Information Infrastructure**

The product was received on May 20, 2016 and testing was completed on Jul. 06, 2016. We, SPORTON INTERNATIONAL (SHENZHEN) INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL (SHENZHEN) INC., the test report shall not be reproduced except in full.

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Approved by: Jones Tsai / Manager

Testing Laboratory
2353

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TABLE OF CONTENTS

REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR652039D	Rev. 01	Initial issue of report	Aug. 03, 2016

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	2.1049 15.403(i)	RSS-247 Section 6	26dB & 99% Bandwidth	-	Pass	-
3.2	15.407(a)	RSS-247 Section 6	Maximum Conducted Output Power	FCC ≤24 dBm (depend on band) IC RSS-247 Section 6 Limit	Pass	-
3.3	15.407(a)	RSS-247 Section 6	Power Spectral Density	FCC ≤11 dBm (depend on band) IC RSS-247 Section 6 Limit	Pass	-
3.4	15.407(b)	RSS-247 Section 6	Unwanted Emissions	≤ -17, -27 dBm (depend on band)&15.209(a)	Pass	Under limit 0.21 dB at 5149.900 MHz
3.5	15.407(g)	-	Frequency Stability	Within Operation Band	Pass	-
3.6	15.407(c)	RSS-247 6.4(2)	Automatically Discontinue Transmission	Discontinue Transmission	Pass	-
3.7	15.203 & 15.407(a)	N/A	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Samsara Networks
501 York St, San Francisco, CA 94110

1.2 Manufacturer

Samsara Networks
501 York St, San Francisco, CA 94110

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	VG33
Brand Name	SAMSARA
Model Name	010-0033
Marketing Name	VG33
FCC ID	2AIHD0033
EUT supports Radios application	GPRS/EGPRS/WCDMA/HSPA/ WLAN 2.4GHz 802.11b/g/n HT20/ WLAN 5GHz 802.11a/n HT20/HT40/ Bluetooth v3.0 + EDR/Bluetooth v4.0 LE
HW Version	1.0
SW Version	1.0
EUT Stage	Production Unit

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	5180 MHz ~ 5240 MHz
Maximum Output Power to Antenna	802.11a : 13.97 dBm / 0.0249 W 802.11n HT20 : 14.48 dBm / 0.0281 W 802.11n HT40 : 13.35 dBm / 0.0216 W
99% Occupied Bandwidth	802.11a : 18.73 MHz 802.11n HT20 : 18.58 MHz 802.11n HT40 : 36.86 MHz
Antenna Type/Gain	PIFA Antenna with gain 4.0 dBi
Type of Modulation	OFDM (BPSK / QPSK / 16QAM / 64QAM)

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

Test Site	SPORTON INTERNATIONAL (SHENZHEN) INC.
Test Site Location	1F & 2F, Building A, Morning Business Center, No. 4003 ShiGu Rd., Xili Town, Nanshan District, Shenzhen, Guangdong, P. R. China TEL: +86-755-8637-9589 FAX: +86-755-8637-9595
Test Site No.	**Sporton Site No.**
	TH01-SZ

Test Site	SPORTON INTERNATIONAL (SHENZHEN) INC.	
Test Site Location	No. 3 Building, the third floor of south, Shahe River west, Fengzeyuan warehouse, Nanshan District, Shenzhen, Guangdong, P. R. China TEL: +86-755- 3320-2398	
Test Site No.	**Sporton Site No.**	**FCC/IC Registration No.**
	03CH03-SZ	565805/4086F

Note: The test site complies with ANSI C63.4 2014 requirement.

1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r02
- ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

2 Test Configuration of Equipment Under Test

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conducted emission (150 kHz to 30 MHz) and radiated emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report.

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5180- 5240 MHz Band 1 (U-NII-1)	36	5180	44	5220
	38	**5190**	**46**	**5230**
	40	5200	48	5240

Note: The above Frequency and Channel in boldface were 802.11n HT40.

2.2 Pre-Scanned RF Power

Preliminary tests were performed in different data rate and data rate associated with the highest power were chosen for full test in the following tables.

WLAN 5GHz 802.11a Average Power (dBm)									
Power vs. Channel			Power vs. Data Rate						
Channel	Frequency (MHz)	Data Rate 6Mbps	Channel	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
CH 36	5180	13.83	CH 48	13.95	13.94	13.91	13.90	13.93	12.95	12.93
CH 44	5220	13.59								
CH 48	5240	**13.97**								

WLAN 5GHz 802.11n-HT20 Average Power (dBm)									
Power vs. Channel			Power vs. Data Rate						
Channel	Frequency (MHz)	MCS Index MCS0	Channel	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 36	5180	14.14	CH 48	14.45	14.43	14.44	14.42	14.41	14.42	14.45
CH 44	5220	14.16								
CH 48	5240	**14.48**								

WLAN 5GHz 802.11n-HT40 Average Power (dBm)									
Power vs. Channel			Power vs. Data Rate						
Channel	Frequency (MHz)	MCS Index MCS0	Channel	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 38	5190	12.69	CH 46	13.31	13.33	13.33	13.32	13.34	13.31	13.33
CH 46	5230	**13.35**								

2.3 Test Mode

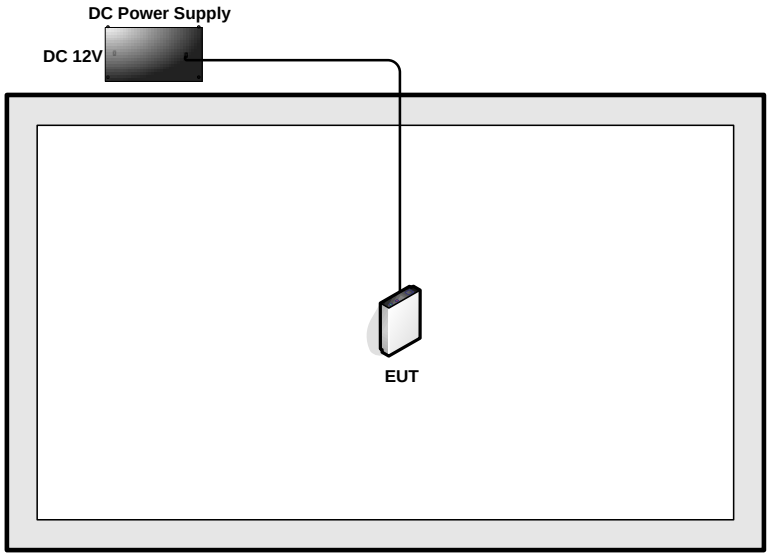
Final test mode of conducted test items and radiated spurious emissions are considering the modulation and worse data rates from the power table described in section 2.2.

Modulation	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0

Ch. #		Band I：5180-5240 MHz		
		802.11a	802.11n HT20	802.11n HT40
L	Low	36	36	38
M	Middle	44	44	-
H	High	48	48	46

2.4 Connection Diagram of Test System

<WLAN Tx Mode>



2.5 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	DC Power Supply	Topward	3303DR	N/A	N/A	Unshielded, 1.8 m

2.6 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuously transmit/receive.

2.7 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 6.5 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 6.5 + 10 = 16.5 (dB)

3 Test Result

3.1 26dB & 99% Occupied Bandwidth Measurement

3.1.1 Description of 26dB & 99% Occupied Bandwidth

This section is for reporting purpose only.

There is no restriction limits for bandwidth.

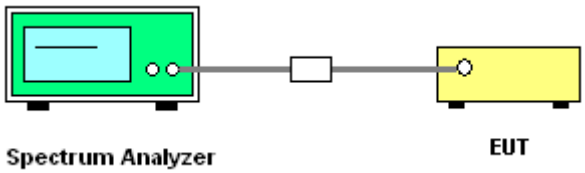
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r02. Section C) Emission bandwidth
2. Set RBW = approximately 1% of the emission bandwidth.
3. Set the VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
7. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1MHz and set the Video bandwidth (VBW) ≥ 3 * RBW.
8. Measure and record the results in the test report.

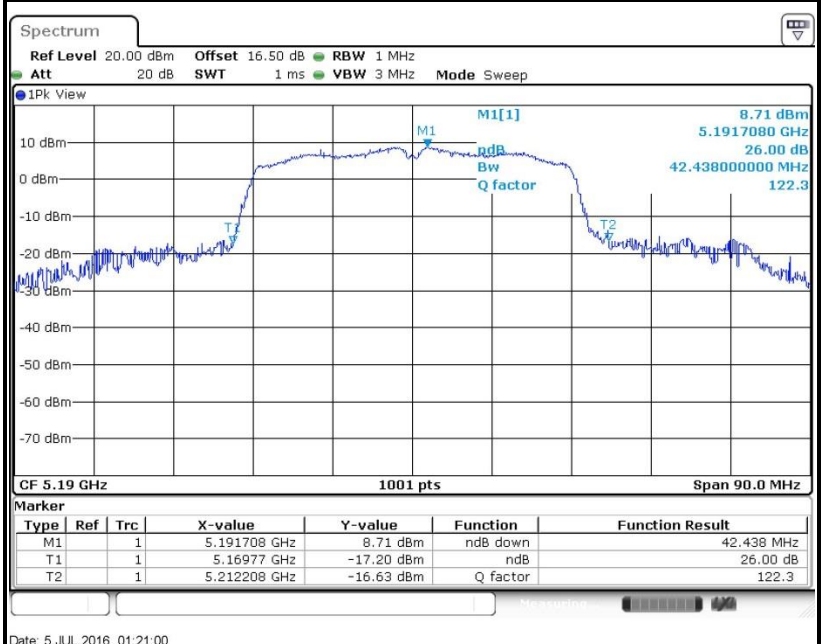
3.1.4 Test Setup



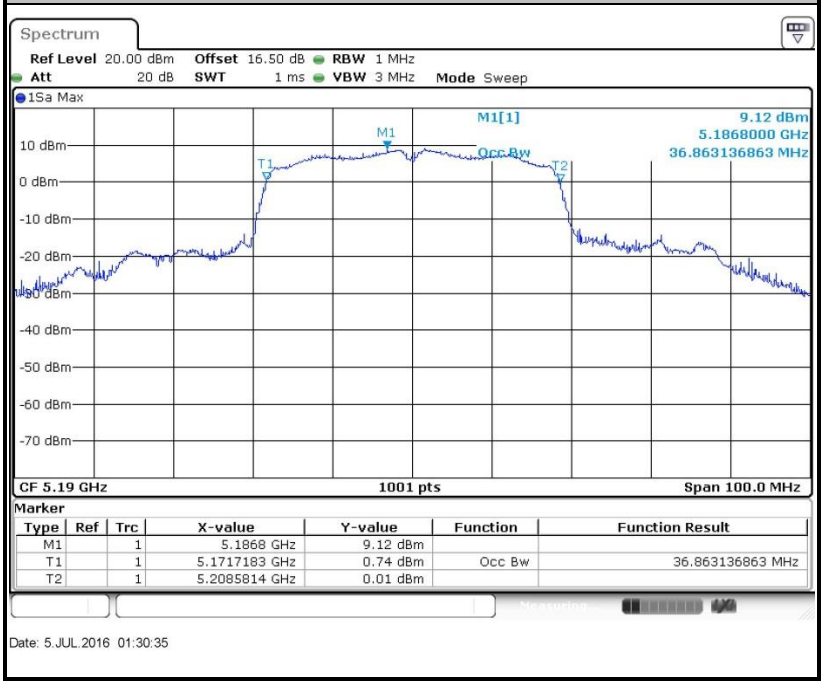
3.1.5 Test Result of 26dB & 99% Occupied Bandwidth Plots

Please refer to Appendix A.

Maximum 26dB Bandwidth



Maximum 99% Occupied Bandwidth



3.2 Maximum Conducted Output Power Measurement

3.2.1 Limit of Maximum Conducted Output Power

<FCC 14-30 CFR 15.407>

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note that U-NII-2 band, devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

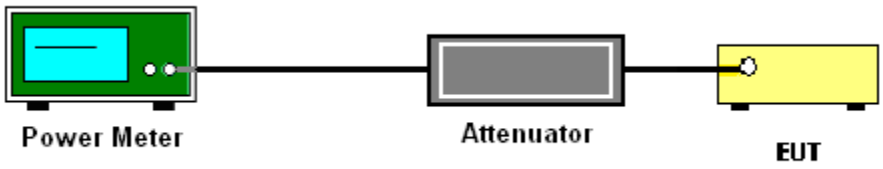
3.2.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r02.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, 10 log(1/x), where x is the duty cycle.

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

<FCC 14-30 CFR 15.407>

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

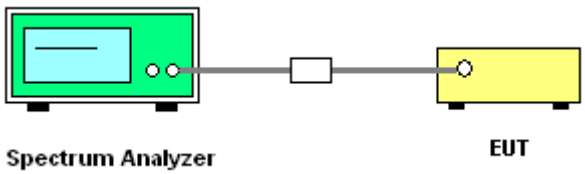
The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r02. Section F) Maximum power spectral density.

 # Method SA-2 #

(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

1. The testing follows Method SA-2 of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r02.
   - Measure the duty cycle.
   - Set span to encompass the entire emission bandwidth (EBW) of the signal.
   - Set RBW = 1 MHz.
   - Set VBW ≥ 3 MHz.
   - Number of points in sweep ≥ 2 Span / RBW.
   - Sweep time = auto.
   - Detector = RMS
   - Trace average at least 100 traces in power averaging mode.
   - Add 10 log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add 10 log(1/0.25) = 6 dB if the duty cycle is 25 percent.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.

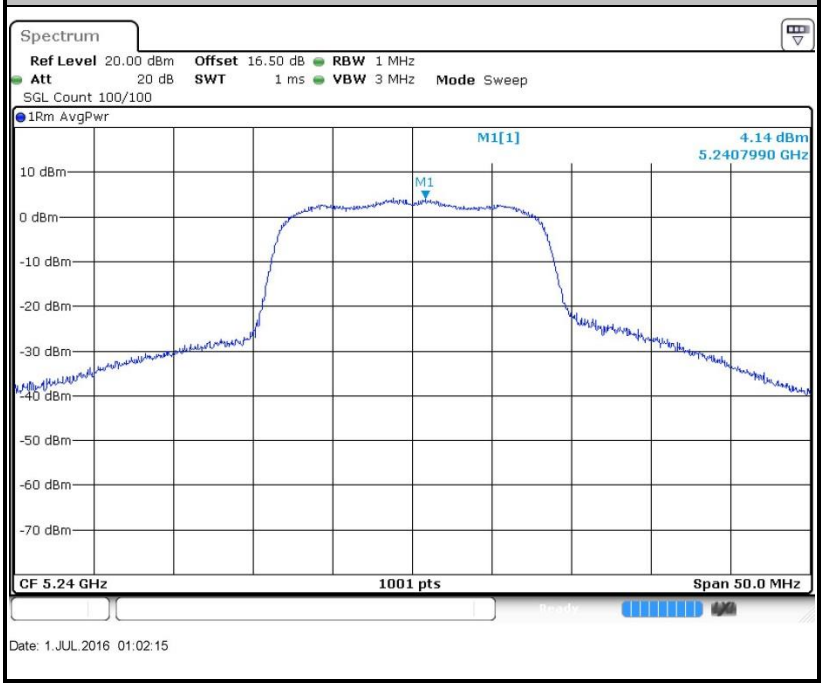
3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Spectral Density(dBm/MHz)



Note: Average Power Density (dB) = Measured value+ Duty Factor

3.4 Unwanted Radiated Emission Measurement

This section as specified in FCC Part 15.407(b) is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement. The unwanted emissions shall comply with 15.407(b)(1) to (6), and restricted bands per FCC Part15.205.

3.4.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz.

(2) Unwanted spurious emissions fallen in restricted bands per FCC Part15.205 shall comply with the general field strength limits set forth in § 15.209 as below table,

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

Note: The following formula is used to convert the EIRP to field strength.

$$E=\frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts)

EIRP (dBm)	Field Strength at 3m (dBμV/m)
-17	78.3
- 27	68.3

(3) KDB789033 D01 v01r02 G)2)c) As specified in 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz (or -17 dBm/MHz as specified in 15.407(b)(4)). However, an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.

3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r02. Section G) Unwanted emissions measurement.

   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz

   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

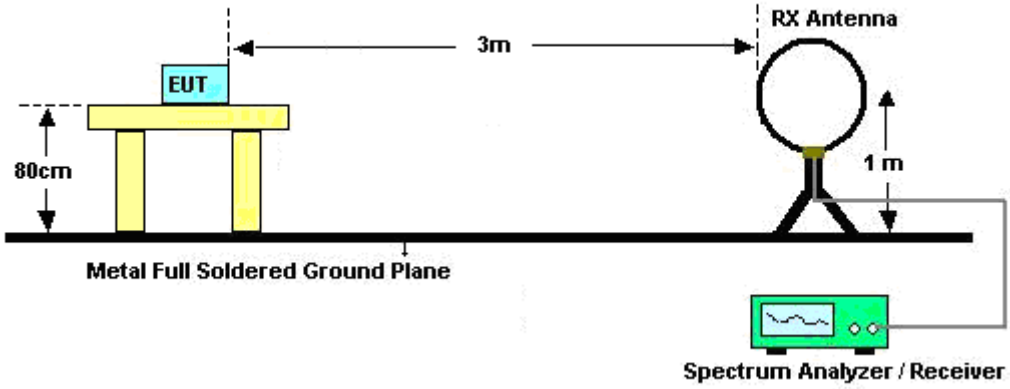
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be

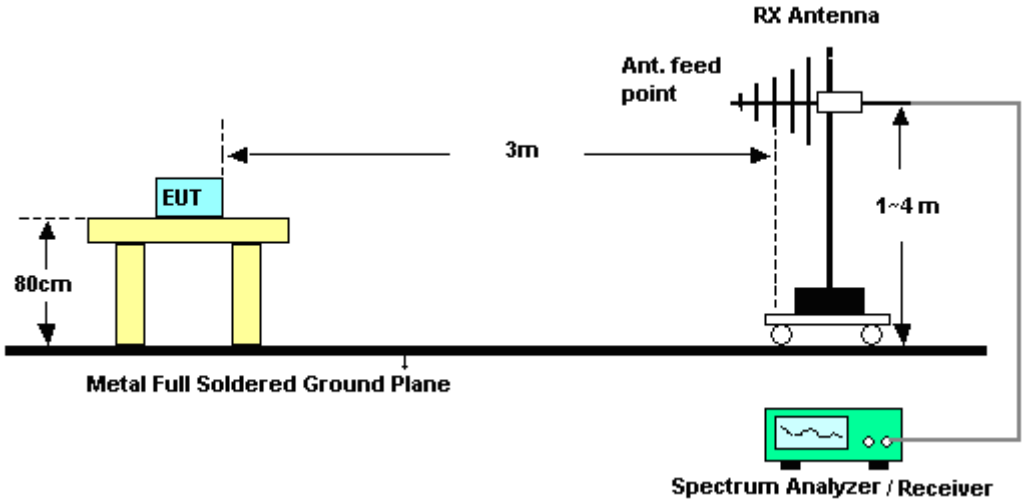
measured in average mode again and reported.

3.4.4 Test Setup

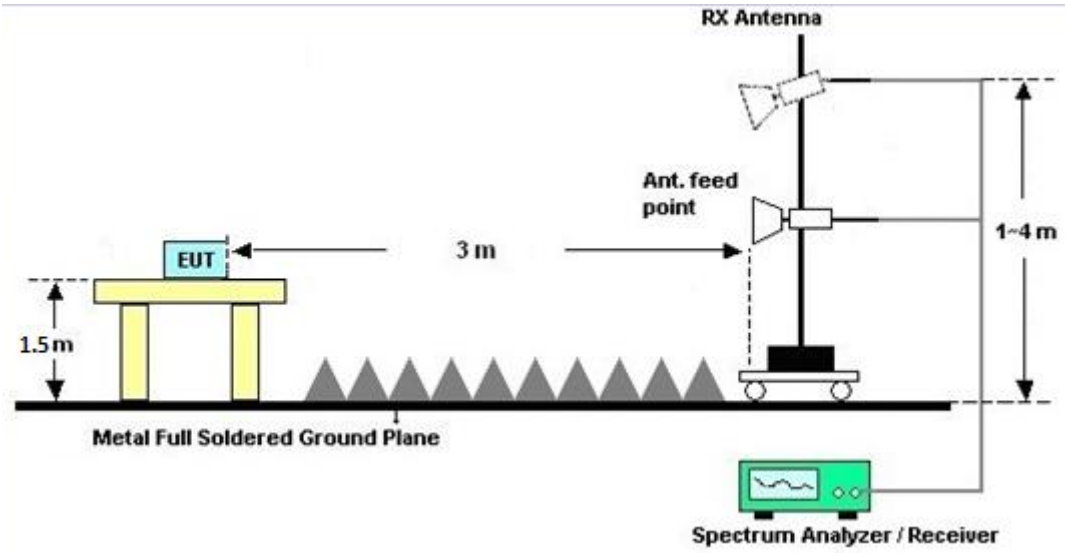
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.4.5 Test Results of Radiated Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

3.4.6 Test Result of Radiated Band Edges

Please refer to Appendix B.

3.4.7 Duty Cycle

Please refer to Appendix C

3.4.8 Test Result of Unwanted Radiated Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix B.

3.5 Frequency Stability Measurement

3.5.1 Limit of Frequency Stability

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.

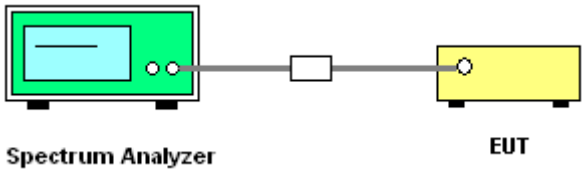
3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

1. To ensure emission at the band edge is maintained within the authorized band, those values shall be measured by radiation emissions at upper and lower frequency points, and finally compensated by frequency deviation as procedures below.
2. The EUT was operated at the maximum output power, and connected to the spectrum analyzer, which is set to maximum hold function and peak detector. The peak value of the power envelope was measured and noted. The upper and lower frequency points were respectively measured relatively 10dB lower than the measured peak value.
3. The frequency deviation was calculated by adding the upper frequency point and the lower frequency point divided by two. Those detailed values of frequency deviation are provided in table below.

3.5.4 Test Setup



3.5.5 Test Result of Frequency Stability

Please refer to Appendix A.

3.6 Automatically Discontinue Transmission

3.6.1 Limit of Automatically Discontinue Transmission

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization to describe how this requirement is met.

3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Result of Automatically Discontinue Transmission

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.

3.7 Antenna Requirements

3.7.1 Standard Applicable

According to FCC 47 CFR Section 15.407(a)(1)(2) ,if transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

The antenna gain is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipments

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101078	9kHz~40GHz	May 07, 2016	Jun. 16, 2016~ Jul. 05, 2016	May 06, 2017	Conducted (TH01-SZ)
Pulse Power Senor	Anritsu	MA2411B	1207253	30MHz~40GHz	Jan. 12, 2016	Jun. 16, 2016~ Jul. 05, 2016	Jan. 11, 2017	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Jan. 12, 2016	Jun. 16, 2016~ Jul. 05, 2016	Jan. 11, 2017	Conducted (TH01-SZ)
Thermal Chamber	Ten Billion Hongzhangroup	LP-150U	H2014081803	-40~+150°C	Aug. 07, 2015	Jun. 16, 2016~ Jul. 05, 2016	Aug. 06, 2016	Conducted (TH01-SZ)
EMI Test Receiver&SA	KEYSIGHT	N9038A	MY54450083	20Hz~8.4GHz	May 07, 2016	Jun. 16, 2016~ Jul. 06, 2016	May 06, 2017	Radiation (03CH03-SZ)
EXA Spectrum Anaiyzer	KEYSIGHT	N9010A	MY55150246	10Hz~44GHz;	May 07, 2016	Jun. 16, 2016~ Jul. 06, 2016	May 06, 2017	Radiation (03CH03-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	May 07, 2016	Jun. 16, 2016~ Jul. 06, 2016	May 06, 2017	Radiation (03CH03-SZ)
Bilog Antenna	TeseQ	CBL6112D	35408	30MHz~2GHz	May 21, 2016	Jun. 16, 2016~ Jul. 06, 2016	May 20, 2017	Radiation (03CH03-SZ)
Double Ridge Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-1355	1GHz~18GHz	May 07, 2016	Jun. 16, 2016~ Jul. 06, 2016	May 06, 2017	Radiation (03CH03-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18GHz~40GHz	Aug. 19, 2015	Jun. 16, 2016~ Jul. 06, 2016	Aug. 18, 2016	Radiation (03CH03-SZ)
Amplifier	PREAMP LIFIER	BPA-530	102210	0.01Hz ~3000MHz	Oct. 20, 2015	Jun. 16, 2016~ Jul. 06, 2016	Oct. 19, 2016	Radiation (03CH03-SZ)
Amplifier	Agilent Technologies	83017A	MY39501302	500MHz~26.5GHz	Jan. 12, 2016	Jun. 16, 2016~ Jul. 06, 2016	Jan. 11, 2017	Radiation (03CH03-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 18, 2015	Jun. 16, 2016~ Jul. 06, 2016	Jul. 17, 2016	Radiation (03CH03-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	NCR	Jun. 16, 2016~ Jul. 06, 2016	NCR	Radiation (03CH03-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Jun. 16, 2016~ Jul. 06, 2016	NCR	Radiation (03CH03-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Jun. 16, 2016~ Jul. 06, 2016	NCR	Radiation (03CH03-SZ)

NCR: No Calibration Required

5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.0 dB**

Uncertainty of Radiated Emission Measurement (1GHz ~ 18GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.8dB**

Uncertainty of Radiated Emission Measurement (18GHz ~ 40GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.0dB**

Appendix A. Conducted Test Results

Report Number : FR652039D

Test Engineer:	Sam Zheng	Temperature:	24~26	°C
Test Date:	2016/6/16 ~ 2016/7/5	Relative Humidity:	50~53	%

Report Number : FR652039D

TEST RESULTS DATA
26dB and 99% OBW

Band I										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)	26 dB Bandwidth (MHz)	IC 99% Bandwidth Power Limit (dBm)	IC 99% Bandwidth EIRP Limit (dBm)	-	-
11a	6Mbps	1	36	5180	17.93	22.83	-	22.54	-	-
11a	6Mbps	1	44	5220	17.88	22.38	-	22.52	-	-
11a	6Mbps	1	48	5240	18.73	24.23	-	22.73	-	-
HT20	MCS0	1	36	5180	18.03	24.03	-	22.56	-	-
HT20	MCS0	1	44	5220	18.43	23.68	-	22.66	--	-
HT20	MCS0	1	48	5240	18.58	25.33	-	22.69	-	-
HT40	MCS0	1	38	5190	36.86	42.44	-	23.01	-	-
HT40	MCS0	1	46	5230	36.76	41.99	-	23.01	-	-

TEST RESULTS DATA
Average Power Table

FCC Band I										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	FCC Conducted Power Limit (dBm)	DG (dBi)	-	Pass/Fail
11a	6Mbps	1	36	5180	0.29	13.83	24.00	4.00		Pass
11a	6Mbps	1	44	5220	0.29	13.59	24.00	4.00		Pass
11a	6Mbps	1	48	5240	0.29	13.97	24.00	4.00		Pass
HT20	MCS0	1	36	5180	0.35	14.14	24.00	4.00		Pass
HT20	MCS0	1	44	5220	0.35	14.16	24.00	4.00	-	Pass
HT20	MCS0	1	48	5240	0.35	14.48	24.00	4.00		Pass
HT40	MCS0	1	38	5190	0.58	12.69	24.00	4.00		Pass
HT40	MCS0	1	46	5230	0.58	13.35	24.00	4.00		Pass

Report Number : FR652039D

TEST RESULTS DATA
Power Spectral Density

FCC Band I										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Power Density (dBm/MHz)	Average PSD Limit (dBm/MHz)	DG (dBi)	-	Pass/Fail
11a	6Mbps	1	36	5180	0.29	3.87	11.00	4.00		Pass
11a	6Mbps	1	44	5220	0.29	3.70	11.00	4.00		Pass
11a	6Mbps	1	48	5240	0.29	4.20	11.00	4.00		Pass
HT20	MCS0	1	36	5180	0.35	4.23	11.00	4.00		Pass
HT20	MCS0	1	44	5220	0.35	4.44	11.00	4.00	-	Pass
HT20	MCS0	1	48	5240	0.35	4.49	11.00	4.00		Pass
HT40	MCS0	1	38	5190	0.58	1.26	11.00	4.00		Pass
HT40	MCS0	1	46	5230	0.58	1.02	11.00	4.00		Pass

TEST RESULTS DATA
Frequency Stability

Band I										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Center Frequency (MHz)	Frequency Deviation (MHz)	Frequency Stablility (ppm)	Temperature (°C)	Voltage (V)	Note
11a	6Mbps	1	36	5180	5180.000	0.000	0.00	20	7	-
11a	6Mbps	1	36	5180	5180.000	0.000	0.00	20	24	-
11a	6Mbps	1	36	5180	5180.000	0.000	0.00	20	12	-
11a	6Mbps	1	36	5180	5179.950	-0.050	-9.65	-30	12	-
11a	6Mbps	1	36	5180	5179.975	-0.025	-4.83	50	12	-

Appendix B. Radiated Spurious Emission

15E Band 1 - 5150~5250MHz

WIFI 802.11a

(Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 36 5180MHz		5143	66.71	-7.29	74	52.51	34.68	7.72	28.2	216	331	P	H
		5149.24	50.05	-3.95	54	35.86	34.68	7.72	28.21	216	331	A	H
	*	5180	108.11	-	-	93.85	34.72	7.76	28.22	216	331	P	H
	*	5180	98.41	-	-	84.15	34.72	7.76	28.22	216	331	A	H
		5149.76	58.82	-15.18	74	44.63	34.68	7.72	28.21	185	193	P	V
		5150	45.9	-8.1	54	31.71	34.68	7.72	28.21	185	193	A	V
	*	5180	101.01	-	-	86.75	34.72	7.76	28.22	185	193	P	V
	*	5180	92.69	-	-	78.43	34.72	7.76	28.22	185	193	A	V
802.11a CH 44 5220MHz		5150	53.01	-20.99	74	38.82	34.68	7.72	28.21	178	332	P	H
		5149.5	42.58	-11.42	54	28.39	34.68	7.72	28.21	178	332	A	H
	*	5220	107.84	-	-	93.51	34.76	7.79	28.22	178	332	P	H
	*	5220	99.19	-	-	84.86	34.76	7.79	28.22	178	332	A	H
		5352.24	52.15	-21.85	74	37.61	34.92	7.89	28.27	178	332	P	H
		5373.12	41.3	-12.7	54	26.71	34.94	7.92	28.27	178	332	A	H
		5125.84	51.42	-22.58	74	37.27	34.66	7.69	28.2	250	130	P	V
		5149.76	41.24	-12.76	54	27.05	34.68	7.72	28.21	250	130	A	V
	*	5220	100.86	-	-	86.53	34.76	7.79	28.22	250	130	P	V
	*	5220	93.11	-	-	78.78	34.76	7.79	28.22	250	130	A	V
		5427.84	51.28	-22.72	74	36.61	35	7.96	28.29	250	130	P	V
		5388.48	40.94	-13.06	54	26.33	34.96	7.92	28.27	250	130	A	V

802.11a CH 48 5240MHz		5149.76	52.22	-21.78	74	38.03	34.68	7.72	28.21	190	331	P	H
		5141.7	41.38	-12.62	54	27.18	34.68	7.72	28.2	190	331	A	H
	*	5240	107.59	-	-	93.25	34.78	7.79	28.23	190	331	P	H
	*	5240	99.38	-	-	85.04	34.78	7.79	28.23	190	331	A	H
		5381.28	51.46	-22.54	74	36.85	34.96	7.92	28.27	190	331	P	H
		5350.32	41.68	-12.32	54	27.14	34.92	7.89	28.27	190	331	A	H
		5020.54	51.2	-22.8	74	37.22	34.54	7.62	28.18	229	213	P	V
		5132.6	41.08	-12.92	54	26.9	34.66	7.72	28.2	229	213	A	V
	*	5240	102.55	-	-	88.21	34.78	7.79	28.23	229	213	P	V
	*	5240	94.52	-	-	80.18	34.78	7.79	28.23	229	213	A	V
		5389.92	51.63	-22.37	74	37.02	34.96	7.92	28.27	229	213	P	V
		5376	41.02	-12.98	54	26.43	34.94	7.92	28.27	229	213	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

15E band 1 5150~5250MHz

WIFI 802.11a

(Harmonic @ 3m)

WIFI	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 36 5180MHz		10360	50.13	-23.87	74	55.98	38.39	12.21	56.45	152	260	P	H
		15540	50.81	-23.19	74	49.92	41.29	15.34	55.74	189	238	P	H
		10360	50.3	-23.7	74	56.15	38.39	12.21	56.45	152	260	P	V
		15540	50.03	-23.97	74	49.14	41.29	15.34	55.74	189	238	P	V
802.11a CH 44 5220MHz		10440	50.56	-23.44	74	56.35	38.45	12.26	56.5	150	230	P	H
		15660	50.65	-23.35	74	49.65	41.24	15.19	55.43	150	225	P	H
		10440	50.25	-23.75	74	56.04	38.45	12.26	56.5	150	230	P	V
		15660	50.46	-23.54	74	49.46	41.24	15.19	55.43	150	225	P	V
802.11a CH 48 5240MHz		10480	50.15	-23.85	74	55.93	38.49	12.28	56.55	150	289	P	H
		15720	50.94	-23.06	74	49.89	41.21	15.09	55.25	150	291	P	H
		10480	50.06	-23.94	74	55.84	38.49	12.28	56.55	150	289	P	V
		15720	50.94	-23.06	74	49.89	41.21	15.09	55.25	150	291	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

15E band 1 5150~5250MHz

WIFI 802.11n HT20

(Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11n HT20 CH 36 5180MHz		5148.72	66.43	-7.57	74	52.24	34.68	7.72	28.21	194	293	P	H
		5149.9	50.83	-3.17	54	36.64	34.68	7.72	28.21	194	293	A	H
	*	5180	109.86	-	-	95.6	34.72	7.76	28.22	194	293	P	H
	*	5180	101.12	-	-	86.86	34.72	7.76	28.22	194	293	A	H
		5149.24	63.83	-10.17	74	49.64	34.68	7.72	28.21	150	297	P	V
		5149.9	48.62	-5.38	54	34.43	34.68	7.72	28.21	150	297	A	V
	*	5180	105.57	-	-	91.31	34.72	7.76	28.22	150	297	P	V
	*	5180	96.82	-	-	82.56	34.72	7.76	28.22	150	297	A	V
802.11n HT20 CH 44 5220MHz		5148.2	53.95	-20.05	74	39.76	34.68	7.72	28.21	187	296	P	H
		5149.98	43.26	-10.74	54	29.07	34.68	7.72	28.21	187	296	A	H
	*	5220	109.98	-	-	95.65	34.76	7.79	28.22	187	296	P	H
	*	5220	99.93	-	-	85.6	34.76	7.79	28.22	187	296	A	H
		5365.44	52.73	-21.27	74	38.17	34.94	7.89	28.27	187	296	P	H
		5373.36	41.45	-12.55	54	26.86	34.94	7.92	28.27	187	296	A	H
		5143.52	56.21	-17.79	74	42.01	34.68	7.72	28.2	190	295	P	V
		5149.5	43.99	-10.01	54	29.8	34.68	7.72	28.21	190	295	A	V
	*	5220	108.34	-	-	94.01	34.76	7.79	28.22	190	295	P	V
	*	5220	98.5	-	-	84.17	34.76	7.79	28.22	190	295	A	V
		5354.64	50.91	-23.09	74	36.37	34.92	7.89	28.27	190	295	P	V
		5380.32	41.01	-12.99	54	26.4	34.96	7.92	28.27	190	295	A	V

		5148.2	52.7	-21.3	74	38.51	34.68	7.72	28.21	172	295	P	H
		5149.5	42.1	-11.9	54	27.91	34.68	7.72	28.21	172	295	A	H
	*	5240	111.08	-	-	96.74	34.78	7.79	28.23	172	295	P	H
	*	5240	100.19	-	-	85.85	34.78	7.79	28.23	172	295	A	H
802.11n		5367.36	52.47	-21.53	74	37.88	34.94	7.92	28.27	172	295	P	H
HT20		5350.08	41.74	-12.26	54	27.2	34.92	7.89	28.27	172	295	A	H
CH 48		5143	51.73	-22.27	74	37.53	34.68	7.72	28.2	202	296	P	V
5240MHz		5149.9	41.82	-12.18	54	27.63	34.68	7.72	28.21	202	296	A	V
	*	5240	110.56	-	-	96.22	34.78	7.79	28.23	202	296	P	V
	*	5240	100.01	-	-	85.67	34.78	7.79	28.23	202	296	A	V
		5361.84	52.58	-21.42	74	38.02	34.94	7.89	28.27	202	296	P	V
		5357.52	42.19	-11.81	54	27.65	34.92	7.89	28.27	202	296	A	V

Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.

15E band 1 5150~5250MHz

WIFI 802.11n HT20

(Harmonic @ 3m)

WIFI	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11n HT20 CH 36 5180MHz		10360	50.17	-23.83	74	56.02	38.39	12.21	56.45	152	260	P	H
		15540	50.88	-23.12	74	49.99	41.29	15.34	55.74	189	238	P	H
		10360	50.06	-23.94	74	55.91	38.39	12.21	56.45	152	260	P	V
		15540	50.38	-23.62	74	49.49	41.29	15.34	55.74	189	238	P	V
802.11n HT20 CH 44 5220MHz		10440	50.88	-23.12	74	56.67	38.45	12.26	56.5	150	230	P	H
		15660	50.45	-23.55	74	49.45	41.24	15.19	55.43	160	225	P	H
		10440	50.32	-23.68	74	56.11	38.45	12.26	56.5	150	230	P	V
		15660	50.71	-23.29	74	49.71	41.24	15.19	55.43	160	225	P	V
802.11n HT20 CH 48 5240MHz		10480	50.05	-23.95	74	55.83	38.49	12.28	56.55	150	289	P	H
		15720	50.64	-23.36	74	49.59	41.21	15.09	55.25	150	291	P	H
		10480	50.38	-23.62	74	56.16	38.49	12.28	56.55	150	289	P	V
		15720	50.68	-23.32	74	49.63	41.21	15.09	55.25	150	291	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

15E band 1 5150~5250MHz
WIFI 802.11n HT40
(Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11n HT40 CH 38 5190MHz		5148.2	70.11	-3.89	74	55.92	34.68	7.72	28.21	190	295	P	H
		5150	53.75	-0.25	54	39.56	34.68	7.72	28.21	190	295	A	H
	*	5190	104.65	-	-	90.39	34.72	7.76	28.22	190	295	P	H
	*	5190	96.64	-	-	82.38	34.72	7.76	28.22	190	295	A	H
		5419.44	51.77	-22.23	74	37.09	35	7.96	28.28	190	295	P	H
		5350.32	42.03	-11.97	54	27.49	34.92	7.89	28.27	190	295	A	H
		5146.12	68.64	-5.36	74	54.45	34.68	7.72	28.21	204	294	P	V
		5149.9	53.79	-0.21	54	39.6	34.68	7.72	28.21	204	294	A	V
	*	5190	104.49	-	-	90.23	34.72	7.76	28.22	204	294	P	V
	*	5190	96.38	-	-	82.12	34.72	7.76	28.22	204	294	A	V
		5370	50.87	-23.13	74	36.28	34.94	7.92	28.27	204	294	P	V
		5351.04	41.58	-12.42	54	27.04	34.92	7.89	28.27	204	294	A	V
802.11n HT40 CH 46 5230MHz		5148.72	56.25	-17.75	74	42.06	34.68	7.72	28.21	165	295	P	H
		5148.98	45.39	-8.61	54	31.2	34.68	7.72	28.21	165	295	A	H
	*	5230	105.74	-	-	91.4	34.78	7.79	28.23	165	295	P	H
	*	5230	97.63	-	-	83.29	34.78	7.79	28.23	165	295	A	H
		5355.84	52.48	-21.52	74	37.94	34.92	7.89	28.27	165	295	P	H
		5350.56	42.85	-11.15	54	28.31	34.92	7.89	28.27	165	295	A	H
		5146.9	59.15	-14.85	74	44.96	34.68	7.72	28.21	200	295	P	V
		5148.2	45.39	-8.61	54	31.2	34.68	7.72	28.21	200	295	A	V
	*	5230	105.31	-	-	90.97	34.78	7.79	28.23	200	295	P	V
	*	5230	98.01	-	-	83.67	34.78	7.79	28.23	200	295	A	V
		5350.8	52.5	-21.5	74	37.96	34.92	7.89	28.27	200	295	P	V
		5350.56	42.77	-11.23	54	28.23	34.92	7.89	28.27	200	295	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

15E band 1 5150~5250MHz

WIFI 802.11n HT40

(Harmonic @ 3m)

WIFI	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11n HT40 CH 38 5190MHz		10380	50.79	-23.21	74	56.61	38.41	12.23	56.46	150	360	P	H
		15570	50.99	-23.01	74	50.08	41.27	15.29	55.65	155	360	P	H
		10380	50.54	-23.46	74	56.36	38.41	12.23	56.46	150	360	P	V
		15570	50.67	-23.33	74	49.76	41.27	15.29	55.65	155	360	P	V
802.11n HT40 CH 46 5230MHz		10460	49.88	-24.12	74	55.66	38.46	12.28	56.52	100	360	P	H
		15690	50.93	-23.07	74	49.91	41.22	15.14	55.34	100	225	P	H
		10460	50.52	-23.48	74	56.3	38.46	12.28	56.52	100	360	P	V
		15690	50.27	-23.73	74	49.25	41.22	15.14	55.34	100	225	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

15E Emission Below 1GHz

WIFI 802.11n HT40

(LF @ 3m)

WIFI	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11n HT40 LF		30	29.29	-10.71	40	28.01	26.6	0.75	26.07	100	0	P	H
		116.33	22.38	-21.12	43.5	28.66	18.27	1.14	25.69	-	-	P	H
		449.04	28.84	-17.16	46	28.36	24.47	2.08	26.07	-	-	P	H
		752.65	34.1	-11.9	46	30.58	27.02	2.77	26.27	-	-	P	H
		812.79	33.96	-12.04	46	29.56	27.58	2.95	26.13	-	-	P	H
		922.4	34.78	-11.22	46	28.77	28.63	3.08	25.7	-	-	P	H
		30	28.66	-11.34	40	27.38	26.6	0.75	26.07	-	-	P	V
		50.37	28.11	-11.89	40	38.11	15	0.98	25.98	-	-	P	V
		111.48	22.49	-21.01	43.5	28.7	18.37	1.14	25.72	-	-	P	V
		442.25	28.9	-17.1	46	28.57	24.28	2.08	26.03	-	-	P	V
		705.12	32.01	-13.99	46	29.17	26.55	2.65	26.36	-	-	P	V
		855.47	34.86	-11.14	46	29.71	28.13	3.02	26	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency per 15.209(c).
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

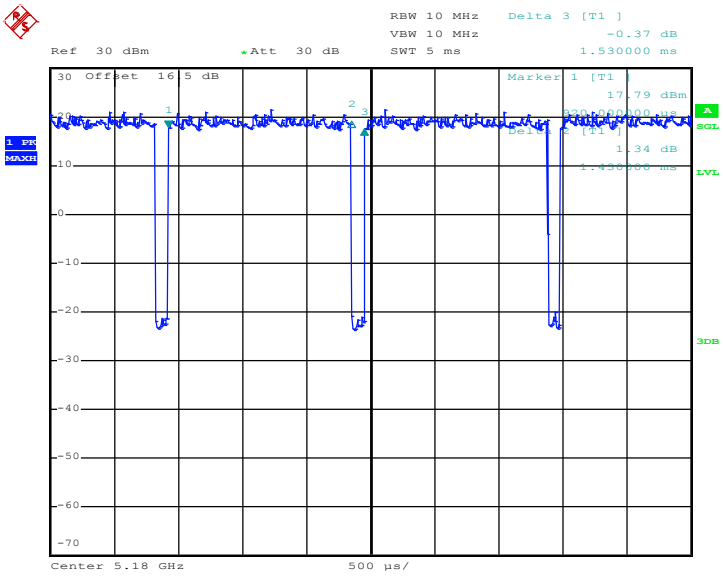
= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is "PASS".

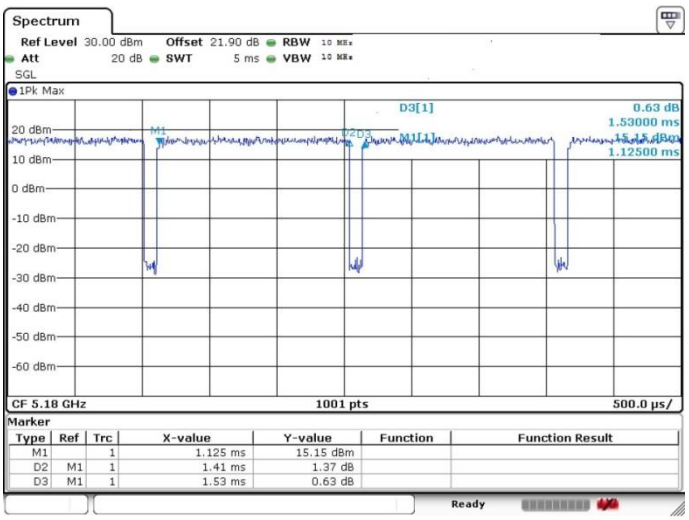
Appendix C. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11a	93.46	1.43	0.70	1kHz
802.11n HT20	92.16	1.41	0.71	1kHz
802.11n HT40	87.40	0.67	1.50	3kHz

802.11a



802.11n HT20



802.11n HT40