FCC RF Test Report

APPLICANT	:	TP-LINK TECHNOLOGIES CO., LTD.
EQUIPMENT	:	AC1900 Wireless Dual Band Gigabit Access Point
BRAND NAME	:	TP-LINK
MODEL NAME	:	EAP330
FCC ID	:	TE7EAP330
STANDARD	:	FCC Part 15 Subpart E §15.407
CLASSIFICATION	:	(NII) Unlicensed National Information Infrastructure

The product was received on Apr. 05, 2016 and testing was completed on May 31, 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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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR640501B	Rev. 01	Initial issue of report	Jul. 08, 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 ≤17 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 0.04 dB at 5149.400 MHz
3.5	15.207	RSS-Gen 8.8	AC Conducted Emission	15.207(a)	Pass	Under limit 3.06 dB at 0.450 MHz
3.6	15.407(g)	-	Frequency Stability	Within Operation Band	Pass	-
3.7	15.407(c)	RSS-247 6.4(2)	Automatically Discontinue Transmission	Discontinue Transmission	Pass	-
3.8	15.203 & 15.407(a)	N/A	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

TP-LINK TECHNOLOGIES CO., LTD.
Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and Technology Park, Shennan Rd, Nanshan, Shenzhen, China

1.2 Manufacturer

TP-LINK TECHNOLOGIES CO., LTD.
Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and Technology Park, Shennan Rd, Nanshan, Shenzhen, China

1.3 Feature of Equipment Under Test

Product Feature & Specification	
Equipment	AC1900 Wireless Dual Band Gigabit Access Point
Brand Name	TP-LINK
Model Name	EAP330
FCC ID	TE7EAP330
EUT supports Radios application	WLAN2.4GHz 802.11b/g/n HT20/HT40/ WLAN2.4GHz 802.11ac VHT20/VHT40 WLAN5GHz 802.11a/n HT20/HT40/ WLAN5GHz 802.11ac VHT20/VHT40/VHT80
EUT Stage	Identical Prototype

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

<table>
<tr><th colspan="2">Product Specification subjective to this standard</th></tr>
<tr><td>Tx/Rx Frequency Range</td><td>5180 MHz ~ 5240 MHz</td></tr>
<tr><td>Maximum Output Power to Antenna</td><td><5180 MHz ~ 5240 MHz>
802.11a : 24.33 dBm / 0.2710 W
802.11n HT20 : 24.22 dBm / 0.2642 W
802.11n HT40 : 20.28 dBm / 0.1067 W
802.11ac VHT20 : 23.66 dBm / 0.2323 W
802.11ac VHT40 : 20.15 dBm / 0.1035 W
802.11ac VHT80 : 17.25 dBm / 0.0531 W</td></tr>
<tr><td>99% Occupied Bandwidth</td><td><5180 MHz ~ 5240 MHz>
802.11a : 17.95 MHz
802.11n HT20 : 18.70 MHz
802.11n HT40 : 36.70 MHz
802.11ac VHT20: 18.75 MHz
802.11ac VHT40 : 36.70 MHz
802.11ac VHT80 : 75.84 MHz</td></tr>
<tr><td>Antenna Type</td><td>Chain Port 1 : PIFA Antenna
Chain Port 2 : PIFA Antenna
Chain Port 3 : PIFA Antenna</td></tr>
<tr><td>Antenna Gain</td><td><5180 MHz ~ 5240 MHz>:
Chain Port 1 : 6.39 dBi
Chain Port 2 : 6.57 dBi
Chain Port 3 : 5.43 dBi</td></tr>
<tr><td>Type of Modulation</td><td>802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)
802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)</td></tr>
<tr><td>Antenna Function Description</td><td>
<table>
<tr><th></th><th>Chain Port 1</th><th>Chain Port 2</th><th>Chain Port 3</th></tr>
<tr><td>802.11a/n/ac MIMO</td><td>V</td><td>V</td><td>V</td></tr>
</table>
</td></tr>
</table>

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	CO01-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
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- FCC KDB 644545 D03 Guidance for IEEE 802 11ac New Rules v01
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

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).

The final configuration from all the combinations and the worst-case data rates were investigated by measuring the maximum power across all the data rates and modulation modes under section 2.2.

Based on the worst configuration found above, the RF power setting is set individually to meet FCC compliance limit for the final conducted and radiated tests shown in section 2.3.

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
	42	5210		

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. Final Output Power equals to Measured Output Power adds the duty factor.

WLAN 5GHz 802.11a Average Power (dBm)											
Power vs. Channel				Power vs. Data Rate							
Channel	Frequency (MHz)	Chain Port	Data Rate 6Mbps	Channel	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
CH 36	5180	1+2+3	24.17	CH 44	24.24	24.24	24.18	24.17	24.20	24.24	24.21
CH 44	5220	1+2+3	**24.33**								
CH 48	5240	1+2+3	24.08								

WLAN 5GHz 802.11n-HT20 Average Power (dBm)											
Power vs. Channel				Power vs. Data Rate							
Channel	Frequency (MHz)	Chain Port	MCS Index MCS0	Channel	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 36	5180	1+2+3	24.04	CH 44	24.14	24.10	24.09	24.08	24.04	24.05	24.04
CH 44	5220	1+2+3	**24.22**								
CH 48	5240	1+2+3	23.89								

WLAN 5GHz 802.11n-HT40 Average Power (dBm)											
Power vs. Channel				Power vs. Data Rate							
Channel	Frequency (MHz)	Chain Port	MCS Index MCS0	Channel	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 38	5190	1+2+3	**20.28**	CH 38	20.25	20.15	20.09	20.08	20.09	20.20	20.16
CH 46	5230	1+2+3	20.12								

WLAN 5GHz 802.11ac VHT20 Average Power (dBm)												
Power vs. Channel				Power vs. Data Rate								
Channel	Frequency (MHz)	Chain Port	MCS Index MCS0	Channel	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8
CH 36	5180	1+2+3	23.46	CH 44	23.60	23.57	23.54	23.59	23.52	23.53	23.48	23.52
CH 44	5220	1+2+3	**23.66**									
CH 48	5240	1+2+3	23.53									

WLAN 5GHz 802.11ac VHT40 Average Power (dBm)												
Power vs. Channel				Power vs. Data Rate								
Channel	Frequency (MHz)	Chain Port	MCS Index MCS0	Channel	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9
CH 38	5190	1+2+3	**20.15**	CH 38	20.07	20.05	20.01	20.03	20.04	20.01	19.98	20.00	20.00
CH 46	5230	1+2+3	20.06										

WLAN 5GHz 802.11ac VHT80 Average Power (dBm)													
Power vs. Channel				Power vs. Data Rate									
Channel	Frequency (MHz)	Chain Port	MCS Index MCS0	Channel	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9
CH 42	5210	1+2+3	**17.25**	CH 42	16.83	17.17	17.14	17.08	17.10	17.07	17.14	17.17	17.15

Note: Chain Port 1+2+3 is a calculated result from sum of the power Chain Port 1+2+3(1), Chain Port 1+2+3(2) and Chain Port 1+2+3(3).

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.

MIMO Antenna

Modulation	Data Rate
802.11n HT20	6 Mbps
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ac VHT80	MCS0

Test Cases	
AC Conducted Emission	Mode 1 : WLAN (5G) Link + Data Link (POE port) + Data Link (LAN port) + Adapter

Remark:

1. For Radiated TCs, the tests were performed with adapter.

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

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

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

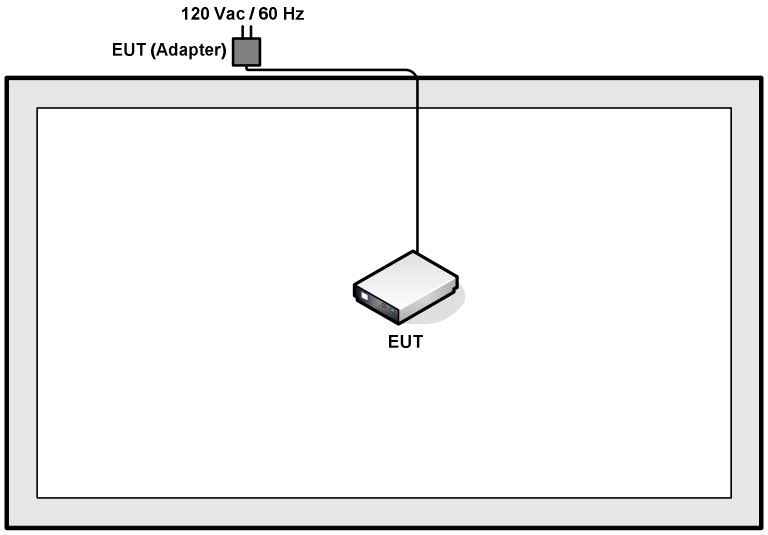
Ch. #		Band I : 5180-5240 MHz
		802.11ac VHT20
L	Low	36
M	Middle	44
H	High	48

Ch. #		Band I : 5180-5240 MHz
		802.11ac VHT40
L	Low	38
M	Middle	-
H	High	46

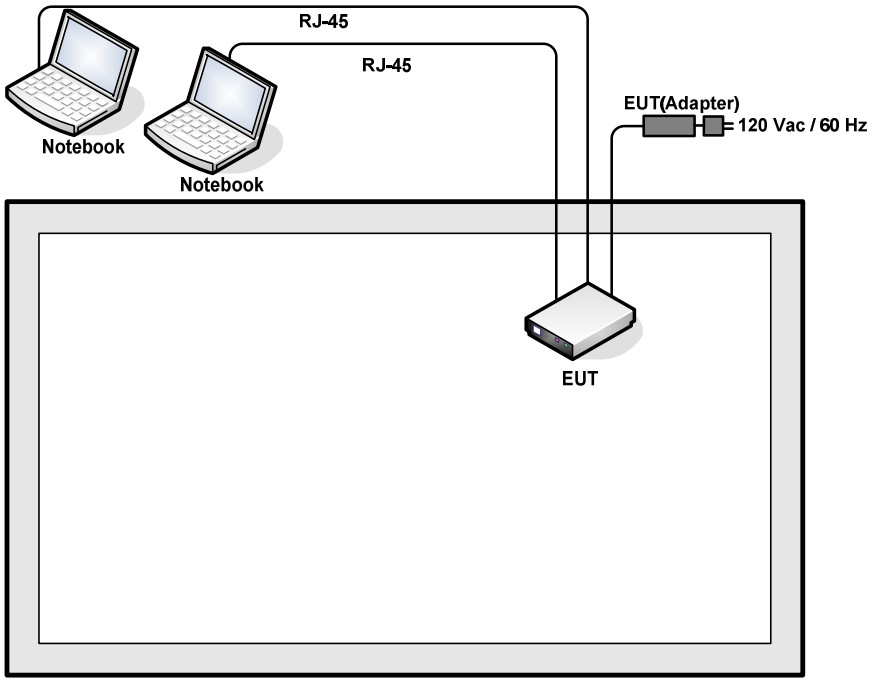
Ch. #		Band I : 5180-5240 MHz
		802.11ac VHT80
L	Low	-
M	Middle	42
H	High	-

2.4 Connection Diagram of Test System

<WLAN Tx Mode>



<AC Conducted Emission Mode>



2.5 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	Lenovo	E540	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
2.	Notebook	Dell	Vostro1440	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 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.

For AC power line conducted emissions, the EUT was set to connect with the Notebook under large package sizes transmission.

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.

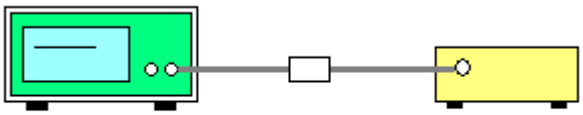
3.1.2 Measuring Instruments

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.

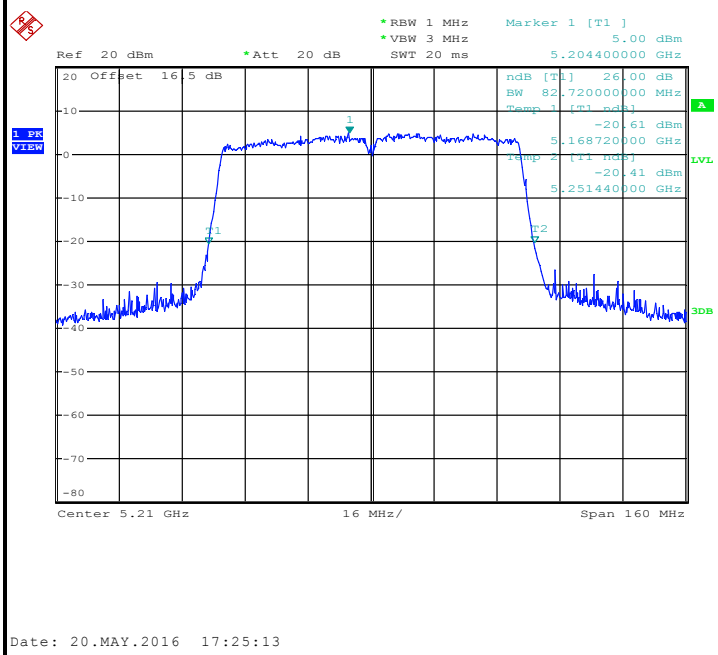
3.1.4 Test Setup



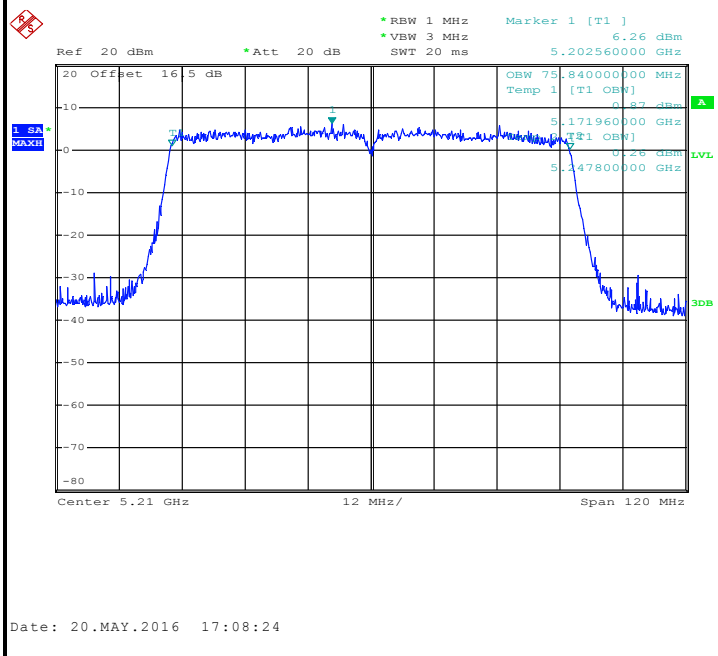
3.1.5 Test Result of 26dB & 99% Occupied Bandwidth

Please refer to Appendix A.

Maximum 26dB Bandwidth



Maximum 99% Occupied Bandwidth



Note : The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.2 Maximum Conducted Output Power Measurement

3.2.1 Limit of Maximum Conducted Output Power

For an indoor access point operating in the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1W.

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.

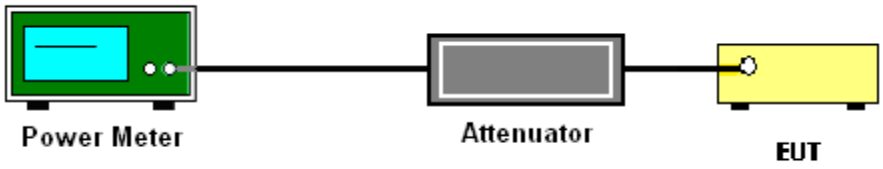
3.2.3 Test Procedures

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

For an indoor access point operating in the band 5.15–5.25GHz, The maximum power spectral density shall not exceed 17 dBm 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).

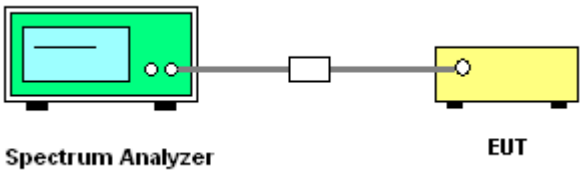
1. The testing follows Method SA-2 of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r02.
   - Measure the duty cycle.
   - Set span to encompass the entire emission bandwidth (EBW) of the signal.
   - Set RBW = 1 MHz.
   - Set VBW ≥ 3 MHz.
   - Number of points in sweep ≥ 2 Span / RBW.
   - 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.
4. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

Method (1): Measure and sum the spectra across the outputs.

The total final Power Spectral Density is from a device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

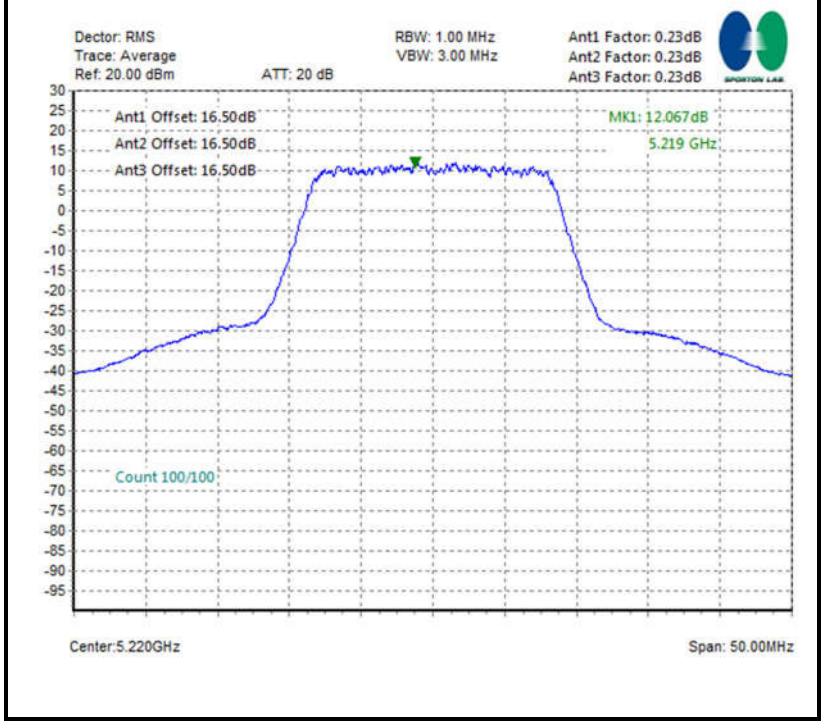
3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Spectral Density(dBm/MHz)



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 D02 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

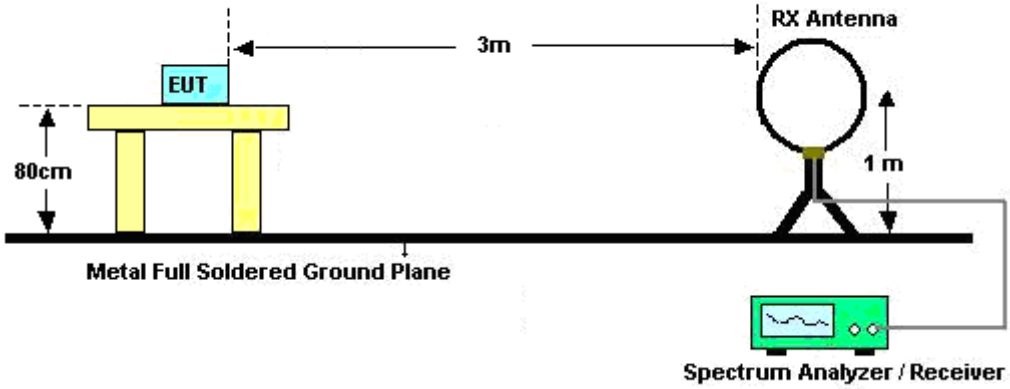
(3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

- 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.

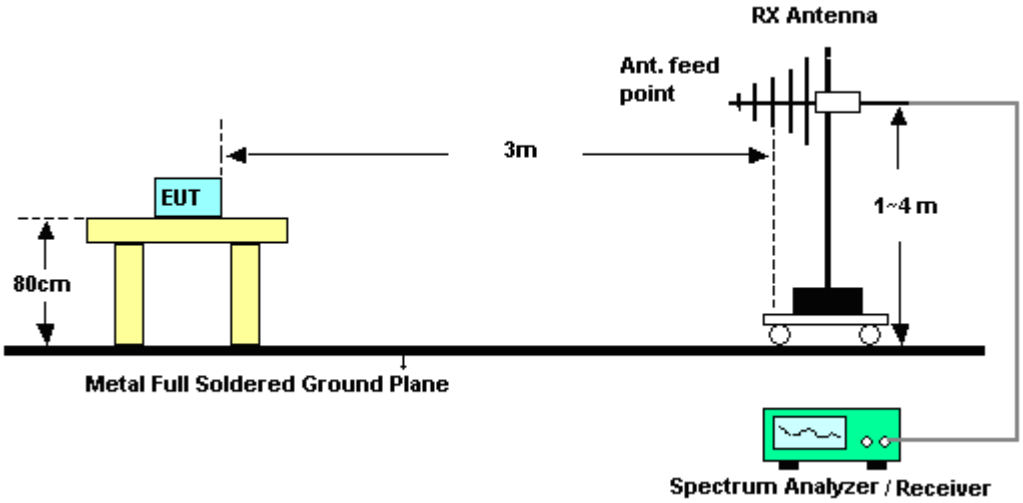
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband 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

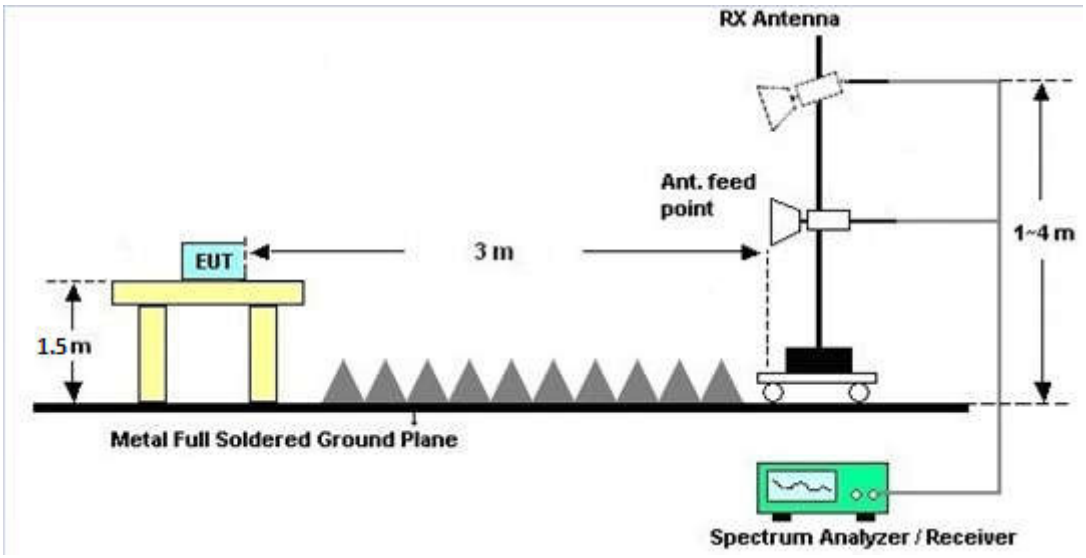
For radiated emissions below 30MHz



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 AC Conducted Emission Measurement

3.5.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

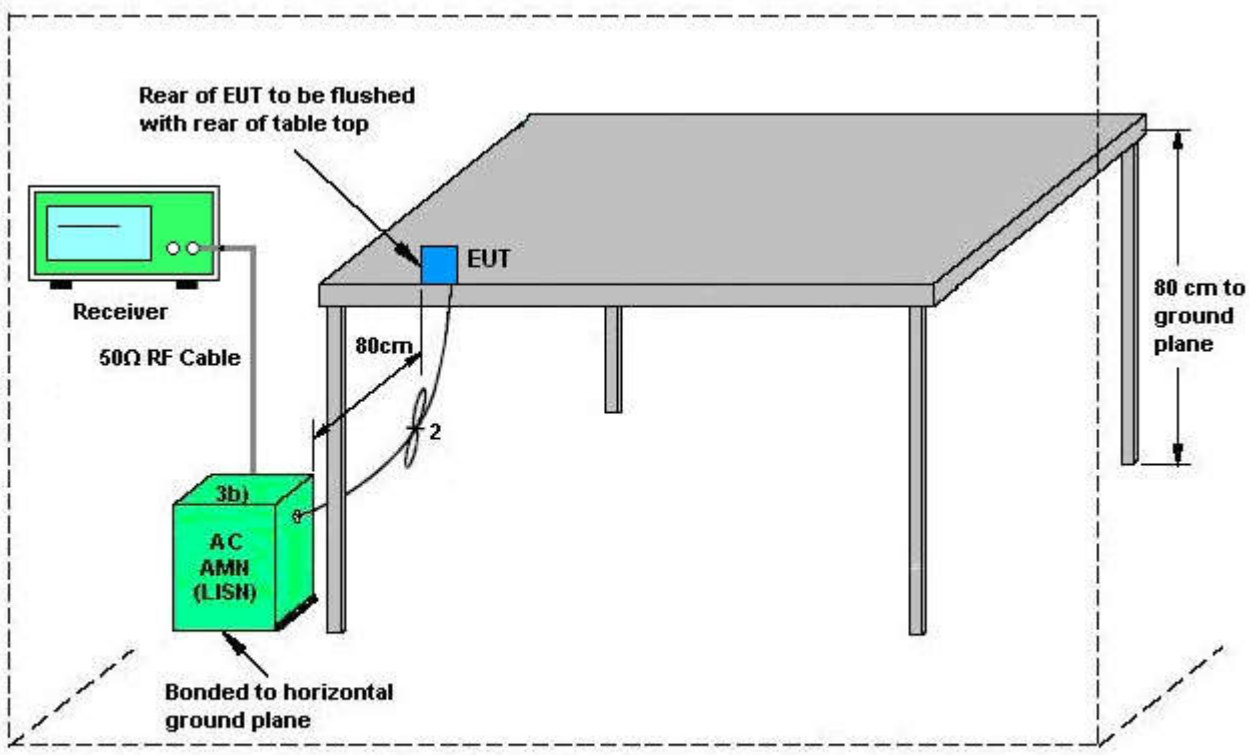
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

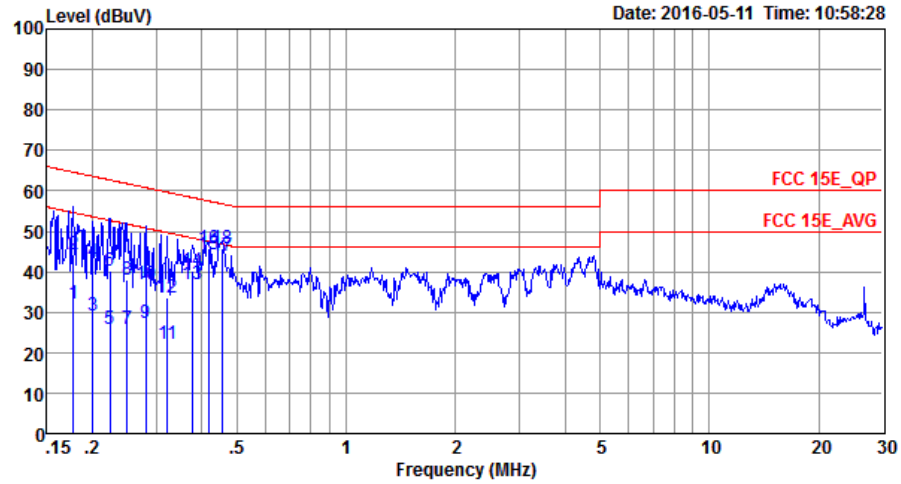
3.5.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.5.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	21~23℃
Test Engineer :	Tao Cheng	Relative Humidity :	41~42%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	WLAN (5G) Link + Data Link (POE port) + Data Link (LAN port) + Adapter		

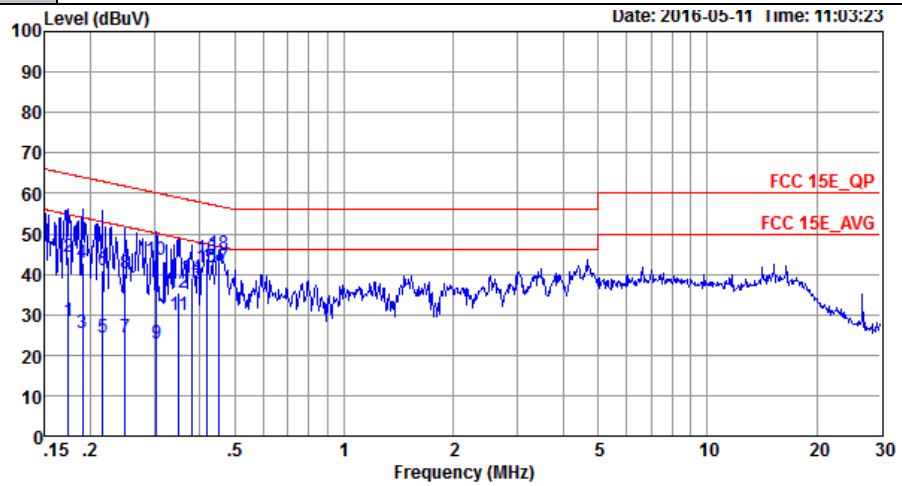


Site : CO01-SZ
Condition: FCC 15E_QP LISN_20160509 LINE

Mode : Mode 1

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.18	31.96	-22.63	54.59	21.30	0.12	10.54	Average
2	0.18	44.26	-20.33	64.59	33.60	0.12	10.54	QP
3	0.20	29.21	-24.37	53.58	18.60	0.11	10.50	Average
4	0.20	42.31	-21.27	63.58	31.70	0.11	10.50	QP
5	0.22	25.79	-26.91	52.70	15.20	0.11	10.48	Average
6	0.22	40.29	-22.41	62.70	29.70	0.11	10.48	QP
7	0.25	25.67	-26.11	51.78	15.10	0.11	10.46	Average
8	0.25	38.07	-23.71	61.78	27.50	0.11	10.46	QP
9	0.28	27.14	-23.67	50.81	16.60	0.11	10.43	Average
10	0.28	36.74	-24.07	60.81	26.20	0.11	10.43	QP
11	0.32	21.99	-27.67	49.66	11.50	0.11	10.38	Average
12	0.32	33.69	-25.97	59.66	23.20	0.11	10.38	QP
13	0.38	36.99	-11.35	48.34	26.60	0.11	10.28	Average
14	0.38	40.19	-18.15	58.34	29.80	0.11	10.28	QP
15	0.42	44.15	-3.36	47.51	33.80	0.11	10.24	Average
16	0.42	45.65	-11.86	57.51	35.30	0.11	10.24	QP
17 *	0.45	43.74	-3.06	46.80	33.40	0.11	10.23	Average
18	0.45	45.64	-11.16	56.80	35.30	0.11	10.23	QP

Test Mode :	Mode 1	Temperature :	21~23℃
Test Engineer :	Tao Cheng	Relative Humidity :	41~42%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	WLAN (5G) Link + Data Link (POE port) + Data Link (LAN port) + Adapter		



Site : CO01-SZ
Condition: FCC 15E_QP LISN_20160509 NEUTRAL

Mode : Mode 1

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.17	28.57	-26.20	54.77	17.90	0.12	10.55	Average
2	0.17	44.37	-20.40	64.77	33.70	0.12	10.55	QP
3	0.19	25.53	-28.49	54.02	14.89	0.12	10.52	Average
4	0.19	42.93	-21.09	64.02	32.29	0.12	10.52	QP
5	0.22	24.39	-28.57	52.96	13.80	0.11	10.48	Average
6	0.22	40.89	-22.07	62.96	30.30	0.11	10.48	QP
7	0.25	24.37	-27.41	51.78	13.80	0.11	10.46	Average
8	0.25	40.17	-21.61	61.78	29.60	0.11	10.46	QP
9	0.30	23.02	-27.13	50.15	12.50	0.11	10.41	Average
10	0.30	43.72	-16.43	60.15	33.20	0.11	10.41	QP
11	0.35	29.84	-19.12	48.96	19.40	0.11	10.33	Average
12	0.35	35.54	-23.42	58.96	25.10	0.11	10.33	QP
13	0.38	37.69	-10.61	48.30	27.30	0.11	10.28	Average
14	0.38	39.29	-19.01	58.30	28.90	0.11	10.28	QP
15	0.42	41.85	-5.66	47.51	31.50	0.11	10.24	Average
16	0.42	43.75	-13.76	57.51	33.40	0.11	10.24	QP
17 *	0.45	41.74	-5.11	46.85	31.40	0.11	10.23	Average
18	0.45	45.14	-11.71	56.85	34.80	0.11	10.23	QP

3.6 Frequency Stability Measurement

3.6.1 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.

3.6.2 Measuring Instruments

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

3.6.3 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.

3.6.4 Test Setup

3.6.5 Test Result of Frequency Stability

Please refer to Appendix A.

3.7 Automatically Discontinue Transmission

3.7.1 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.

3.7.2 Measuring Instruments

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

3.7.3 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.

3.8 Antenna Requirements

3.8.1 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.

3.8.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.8.3 Antenna Gain

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(N_{ANT}/N_{SS}=1) dB.

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$.

Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain;

The EUT supports CDD mode.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain “DG” is calculated as following table.

5.2G Band Antenna	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
1	6.39	6.39	0.39	0.39
2	6.57	6.57	0.57	0.57
3	5.43	5.43	0.00	0.00
1+2	6.57	9.49	0.57	3.49
1+3	6.39	8.93	0.39	2.93
2+3	6.57	9.03	0.57	3.03
1+2+3	6.57	10.92	0.57	4.92

Power Limit Reduction = DG(Power) – 6dBi, (min = 0)

PSD Limit Reduction = DG(PSD) – 6dBi, (min = 0)

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	May 20, 2016	May 06, 2017	Conducted (TH01-SZ)
Spectrum Analyzer	R&S	FSP30	101400	9kHz~40GHz	Jan. 12, 2016	May 20, 2016	Jan. 11, 2017	Conducted (TH01-SZ)
Pulse Power Senor	Anritsu	MA2411B	1207253	30MHz~40GHz	Jan. 12, 2016	May 20, 2016	Jan. 11, 2017	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Jan. 12, 2016	May 20, 2016	Jan. 11, 2017	Conducted (TH01-SZ)
Thermal Chamber	Ten Billion Hongzhangroup	LP-150U	H2014081803	-40~+150°C	Aug. 07, 2015	May 20, 2016	Aug. 06, 2016	Conducted (TH01-SZ)
EMI Test Receiver&SA	KEYSIGHT	N9038A	MY54450083	20Hz~8.4GHz	May 07, 2016	May 31, 2016	May 06, 2017	Radiation (03CH03-SZ)
EXA Spectrum Anaiyzer	KEYSIGHT	N9010A	MY55150246	10Hz~44GHz;	May 07, 2016	May 31, 2016	May 06, 2017	Radiation (03CH03-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	May 07, 2016	May 31, 2016	May 06, 2017	Radiation (03CH03-SZ)
Bilog Antenna	TeseQ	CBL6112D	35408	30MHz~2GHz	May 21, 2016	May 31, 2016	May 20, 2017	Radiation (03CH03-SZ)
Double Ridge Horn Antenna	SCHWARZBECK	BBHA9120 D	9120D-1355	1GHz~18GHz	May 07, 2016	May 31, 2016	May 06, 2017	Radiation (03CH03-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18GHz~40GHz	Aug. 19, 2015	May 31, 2016	Aug. 18, 2016	Radiation (03CH03-SZ)
Amplifier	PREAMP LIFIER	BPA-530	102210	0.01Hz ~3000MHz	Oct. 20, 2015	May 31, 2016	Oct. 19, 2016	Radiation (03CH03-SZ)
Amplifier	Agilent Technologies	83017A	MY39501302	500MHz~26.5GHz	Jan. 12, 2016	May 31, 2016	Jan. 11, 2017	Radiation (03CH03-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 18, 2015	May 31, 2016	Jul. 17, 2016	Radiation (03CH03-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	NCR	May 31, 2016	NCR	Radiation (03CH03-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	May 31, 2016	NCR	Radiation (03CH03-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	May 31, 2016	NCR	Radiation (03CH03-SZ)
EMI Test Receiver	R&S	ESR7	101404	9kHz~7GHz; Max 30dBm	Oct. 20, 2015	May 11, 2016	Oct. 19, 2016	Conduction (CO01-SZ)
AC LISN	EMCO	3816/2SH	00103892	9kHz~30MHz	Jan.12, 2016	May 11, 2016	Jan. 11, 2017	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	MessTec	3816/2SH	00103912	9kHz~30MHz	Jan. 12, 2016	May 11, 2016	Jan. 11, 2017	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Aug. 07, 2015	May 11, 2016	Aug. 06, 2016	Conduction (CO01-SZ)

NCR: No Calibration Required

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.3 dB**

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 : FR640501B

Test Engineer:	Mygai Mo	Temperature:	24~26	°C
Test Date:	2016/5/20	Relative Humidity:	50~53	%

Report Number : FR640501B

TEST RESULTS DATA
26dB and 99% OBW

Band I																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	26 dB Bandwidth (MHz)				99% Bandwidth (MHz)				IC 99% Bandwidth EIRP Limit (dBm)			
					Ant 1	Ant 2	Ant 3	Ant 4	Ant 1	Ant 2	Ant 3	Ant 4	Ant 1	Ant 2	Ant 3	Ant 4
11a	6Mbps	3	36	5180	21.95	21.70	21.90		17.90	17.85	17.75		22.53	22.52	22.49	
11a	6Mbps	3	44	5220	21.95	21.75	21.70		17.90	17.85	17.75		22.53	22.52	22.49	
11a	6Mbps	3	48	5240	22.05	21.80	21.75		17.95	17.75	17.75		22.54	22.49	22.49	
HT20	MCS0	3	36	5180	22.4	22.15	22.00		18.65	18.55	18.60		22.71	22.68	22.70	
HT20	MCS0	3	44	5220	22.55	22.15	22.05		18.65	18.50	18.55		22.71	22.67	22.68	
HT20	MCS0	3	48	5240	22.3	22.20	21.85		18.70	18.50	18.55		22.72	22.67	22.68	
HT40	MCS0	3	38	5190	41.31	41.04	41.04		36.70	36.60	36.60		23.01	23.01	23.01	
HT40	MCS0	3	46	5230	41.49	40.95	41.04		36.50	36.60	36.60		23.01	23.01	23.01	
VHT20	MCS0	3	36	5180	22.4	21.95	21.90		18.70	18.50	18.65		22.72	22.67	22.71	
VHT20	MCS0	3	44	5220	22.4	22.00	22.05		18.70	18.60	18.60		22.72	22.70	22.70	
VHT20	MCS0	3	48	5240	22.45	22.15	21.90		18.75	18.55	18.60		22.73	22.68	22.70	
VHT40	MCS0	3	38	5190	41.49	40.95	40.77		36.70	36.70	36.60		23.01	23.01	23.01	
VHT40	MCS0	3	46	5230	41.58	41.04	40.95		36.70	36.60	36.60		23.01	23.01	23.01	
VHT80	MCS0	3	42	5210	82.72	82.72	82.08		75.72	75.72	75.84		23.01	23.01	23.01	

TEST RESULTS DATA
Average Power Table

FCC Band I															
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Ant	Average Conducted Power with duty factor (dBm)					FCC Power Limit (dBm)	DG (dBi)	FCC EIRP Power (dBm)	FCC EIRP Power Limit (dBm)	Pass/Fail
						Ant 1	Ant 2	Ant 3	Ant 4	SUM					
11a	6Mbps	3	36	5180	1+2+3	19.29	18.74	20.05		24.17	29.43	6.57	30.74	-	Pass
11a	6Mbps	3	44	5220	1+2+3	19.48	18.89	20.21		24.33	29.43	6.57	30.90	-	Pass
11a	6Mbps	3	48	5240	1+2+3	19.25	18.57	19.98		24.08	29.43	6.57	30.65	-	Pass
HT20	MCS0	3	36	5180	1+2+3	19.12	18.58	20.00		24.04	29.43	6.57	30.61	-	Pass
HT20	MCS0	3	44	5220	1+2+3	19.32	18.76	20.15		24.22	29.43	6.57	30.79	-	Pass
HT20	MCS0	3	48	5240	1+2+3	19.07	18.45	19.74		23.89	29.43	6.57	30.46	-	Pass
HT40	MCS0	3	38	5190	1+2+3	15.34	15.14	15.99		20.28	29.43	6.57	26.85	-	Pass
HT40	MCS0	3	46	5230	1+2+3	15.28	14.93	15.80		20.12	29.43	6.57	26.69	-	Pass
VHT20	MCS0	3	36	5180	1+2+3	18.49	18.02	19.43		23.46	29.43	6.57	30.03	-	Pass
VHT20	MCS0	3	44	5220	1+2+3	18.77	18.27	19.51		23.66	29.43	6.57	30.23	-	Pass
VHT20	MCS0	3	48	5240	1+2+3	18.74	18.12	19.33		23.53	29.43	6.57	30.10	-	Pass
VHT40	MCS0	3	38	5190	1+2+3	15.29	15.02	15.78		20.15	29.43	6.57	26.72	-	Pass
VHT40	MCS0	3	46	5230	1+2+3	15.16	14.92	15.73		20.06	29.43	6.57	26.63	-	Pass
VHT80	MCS0	3	42	5210	1+2+3	12.41	12.16	12.82		17.25	29.43	6.57	23.82	-	Pass

TEST RESULTS DATA
Power Spectral Density

FCC Band I														
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Ant	Duty Factor (dB)				Average PSD with Duty Factor (dBm/MHz)	PSD Limit (dBm/ MHz)	DG (dBi)		Pass /Fail
						Ant 1	Ant 2	Ant 3	Ant 4					
11a	6Mbps	3	36	5180	1+2+3	0.23	0.23	0.23		12.017	12.08	10.92		Pass
11a	6Mbps	3	44	5220	1+2+3	0.23	0.23	0.23		12.067	12.08	10.92		Pass
11a	6Mbps	3	48	5240	1+2+3	0.23	0.23	0.23		11.901	12.08	10.92		Pass
HT20	MCS0	3	36	5180	1+2+3	0.20	0.22	0.22		11.931	12.08	10.92		Pass
HT20	MCS0	3	44	5220	1+2+3	0.20	0.22	0.22		11.811	12.08	10.92		Pass
HT20	MCS0	3	48	5240	1+2+3	0.20	0.22	0.22		11.74	12.08	10.92		Pass
HT40	MCS0	3	38	5190	1+2+3	0.45	0.48	0.42		4.098	12.08	10.92		Pass
HT40	MCS0	3	46	5230	1+2+3	0.45	0.48	0.42		5.105	12.08	10.92		Pass
VHT20	MCS0	3	36	5180	1+2+3	0.06	0.06	0.06		11.906	12.08	10.92		Pass
VHT20	MCS0	3	44	5220	1+2+3	0.06	0.06	0.06		11.964	12.08	10.92		Pass
VHT20	MCS0	3	48	5240	1+2+3	0.06	0.06	0.06		11.897	12.08	10.92		Pass
VHT40	MCS0	3	38	5190	1+2+3	0.10	0.14	0.14		5.977	12.08	10.92		Pass
VHT40	MCS0	3	46	5230	1+2+3	0.10	0.14	0.14		5.194	12.08	10.92		Pass
VHT80	MCS0	3	42	5210	1+2+3	0.29	0.25	0.29		0.345	12.08	10.92		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	5180.025	0.025	4.83	20	90	
11a	6Mbps	1	36	5180	5180.000	0.000	0.00	20	264	
11a	6Mbps	1	36	5180	5180.000	0.000	0.00	20	120	
11a	6Mbps	1	36	5180	5180.000	0.000	0.00	-30	120	
11a	6Mbps	1	36	5180	5180.000	0.000	0.00	50	120	

Appendix B. Radiated Spurious Emission

Band 1 - 5150~5250MHz

WIFI 802.11a (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2+3		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 36 5180MHz		5150	62.72	-11.28	74	57.82	31.5	7.07	33.67	250	260	P	H
		5150	49.99	-4.01	54	45.09	31.5	7.07	33.67	250	260	A	H
	*	5180	113.98	-	-	109	31.55	7.08	33.65	250	260	P	H
	*	5180	105.16	-	-	100.18	31.55	7.08	33.65	250	260	A	H
		5142.8	64.17	-9.83	74	59.29	31.5	7.07	33.69	250	171	P	V
		5149.4	53.96	-0.04	54	49.06	31.5	7.07	33.67	250	171	A	V
	*	5180	117.86	-	-	112.88	31.55	7.08	33.65	250	171	P	V
	*	5180	109.48	-	-	104.5	31.55	7.08	33.65	250	171	A	V
802.11a CH 44 5220MHz		5143.55	56.49	-17.51	74	51.61	31.5	7.07	33.69	250	260	P	H
		5142.65	48.13	-5.87	54	43.25	31.5	7.07	33.69	250	260	A	H
	*	5220	114.22	-	-	109.17	31.6	7.09	33.64	250	260	P	H
	*	5220	105.23	-	-	100.18	31.6	7.09	33.64	250	260	A	H
		5382.78	54.09	-19.91	74	48.65	31.83	7.13	33.52	250	260	P	H
		5382.23	46.19	-7.81	54	40.75	31.83	7.13	33.52	250	260	A	H
		5142.05	60.22	-13.78	74	55.34	31.5	7.07	33.69	250	122	P	V
		5141	53.02	-0.98	54	48.14	31.5	7.07	33.69	250	122	A	V
	*	5220	117.75	-	-	112.7	31.6	7.09	33.64	250	122	P	V
	*	5220	109.89	-	-	104.84	31.6	7.09	33.64	250	122	A	V
		5381.35	60.2	-13.8	74	54.76	31.83	7.13	33.52	250	122	P	V
		5380.8	52.63	-1.37	54	47.19	31.83	7.13	33.52	250	122	A	V

802.11a CH 48 5240MHz		5085.5	53.48	-20.52	74	48.73	31.41	7.06	33.72	250	263	P	H
		5083.25	44.43	-9.57	54	39.68	31.41	7.06	33.72	250	263	A	H
	*	5240	115.59	-	-	110.5	31.62	7.09	33.62	250	263	P	H
	*	5240	106.59	-	-	101.5	31.62	7.09	33.62	250	263	A	H
		5393.34	57.03	-16.97	74	51.59	31.83	7.13	33.52	250	263	P	H
		5402.58	47.51	-6.49	54	42.02	31.86	7.13	33.5	250	263	A	H
		5079.5	57.14	-16.86	74	52.39	31.41	7.06	33.72	250	190	P	V
		5079.5	48.51	-5.49	54	43.76	31.41	7.06	33.72	250	190	A	V
	*	5240	118.01	-	-	112.92	31.62	7.09	33.62	250	190	P	V
	*	5240	110.22	-	-	105.13	31.62	7.09	33.62	250	190	A	V
		5401.15	61.46	-12.54	74	55.97	31.86	7.13	33.5	250	190	P	V
		5400.82	53.53	-0.47	54	48.04	31.86	7.13	33.5	250	190	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant. 1+2+3	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH 36 5180MHz		10360	55.6	-18.4	74	65.91	38.62	10.07	59	175	230	P	H
		10360	48.11	-5.89	54	58.42	38.62	10.07	59	175	230	A	H
		15540	49.8	-24.2	74	58.18	38.54	12.77	59.69	150	250	P	H
		10360	57.38	-16.62	74	67.69	38.62	10.07	59	165	187	P	V
		10360	49.05	-4.95	54	59.36	38.62	10.07	59	165	187	A	V
		15540	50.11	-23.89	74	58.49	38.54	12.77	59.69	150	250	P	V
802.11a CH 44 5220MHz		10440	54.65	-19.35	74	64.82	38.72	10.13	59.02	155	223	P	H
		10440	49.79	-4.21	54	59.96	38.72	10.13	59.02	155	223	A	H
		15660	50.49	-23.51	74	59.14	38.17	12.93	59.75	150	0	P	H
		10440	56.6	-17.4	74	66.77	38.72	10.13	59.02	150	161	P	V
		10440	50.24	-3.76	54	60.41	38.72	10.13	59.02	150	161	A	V
		15660	50.75	-23.25	74	59.4	38.17	12.93	59.75	150	0	P	V
802.11a CH 48 5240MHz		10480	56.78	-17.22	74	66.87	38.79	10.15	59.03	150	135	P	H
		10480	47.03	-6.97	54	57.12	38.79	10.15	59.03	150	135	A	H
		15720	50.89	-23.11	74	59.69	37.96	13.03	59.79	150	0	P	H
		10480	60.9	-13.1	74	70.99	38.79	10.15	59.03	250	53	P	V
		10480	48.46	-5.54	54	58.55	38.79	10.15	59.03	250	53	A	V
		15720	50.9	-23.1	74	59.7	37.96	13.03	59.79	150	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI Ant. 1+2+3	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		5144.45	60.11	-13.89	74	55.21	31.5	7.07	33.67	250	262	P	H
		5148.5	48.58	-5.42	54	43.68	31.5	7.07	33.67	250	262	A	H
802.11n	*	5180	112.61	-	-	107.63	31.55	7.08	33.65	250	262	P	H
HT20	*	5180	103.18	-	-	98.2	31.55	7.08	33.65	250	262	A	H
CH 36		5148.5	62.95	-11.05	74	58.05	31.5	7.07	33.67	250	162	P	V
5180MHz		5147.6	53.8	-0.2	54	48.9	31.5	7.07	33.67	250	162	A	V
	*	5180	116.88	-	-	111.9	31.55	7.08	33.65	250	162	P	V
	*	5180	109.18	-	-	104.2	31.55	7.08	33.65	250	162	A	V
		5142.95	56.56	-17.44	74	51.68	31.5	7.07	33.69	250	264	P	H
		5142.8	48.5	-5.5	54	43.62	31.5	7.07	33.69	250	264	A	H
	*	5220	113.07	-	-	108.02	31.6	7.09	33.64	250	264	P	H
	*	5220	105.69	-	-	100.64	31.6	7.09	33.64	250	264	A	H
802.11n		5373.43	55.57	-18.43	74	50.15	31.81	7.13	33.52	250	264	P	H
HT20		5378.27	47.04	-6.96	54	41.6	31.83	7.13	33.52	250	264	A	H
CH 44		5142.35	61.54	-12.46	74	56.66	31.5	7.07	33.69	250	164	P	V
5220MHz		5147.6	53.86	-0.14	54	48.96	31.5	7.07	33.67	250	164	A	V
	*	5220	118.22	-	-	113.17	31.6	7.09	33.64	250	164	P	V
	*	5220	109.9	-	-	104.85	31.6	7.09	33.64	250	164	A	V
		5387.51	60.65	-13.35	74	55.21	31.83	7.13	33.52	250	164	P	V
		5378.05	52.38	-1.62	54	46.94	31.83	7.13	33.52	250	164	A	V

		5087.75	54.88	-19.12	74	50.13	31.41	7.06	33.72	250	263	P	H
		5077.85	45.97	-8.03	54	41.22	31.41	7.06	33.72	250	263	A	H
	*	5240	118.49	-	-	113.4	31.62	7.09	33.62	250	263	P	H
	*	5240	110.59	-	-	105.5	31.62	7.09	33.62	250	263	A	H
802.11n		5402.91	56.24	-17.76	74	50.75	31.86	7.13	33.5	250	263	P	H
HT20		5398.18	48.36	-5.64	54	42.89	31.86	7.13	33.52	250	263	A	H
CH 48		5082.5	59.97	-14.03	74	55.22	31.41	7.06	33.72	250	163	P	V
5240MHz		5077.55	50.99	-3.01	54	46.24	31.41	7.06	33.72	250	163	A	V
	*	5240	118.49	-	-	113.4	31.62	7.09	33.62	250	163	P	V
	*	5240	110.59	-	-	105.5	31.62	7.09	33.62	250	163	A	V
		5407.75	61.12	-12.88	74	55.61	31.86	7.15	33.5	250	163	P	V
		5397.96	53.53	-0.47	54	48.06	31.86	7.13	33.52	250	163	A	V

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

Band 1 5150~5250MHz

WIFI 802.11n HT20 (Harmonic @ 3m)

WIFI Ant. 1+2+3	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 36 5180MHz		10360	50.97	-23.03	74	61.28	38.62	10.07	59	250	0	P	H
		15540	49.24	-24.76	74	57.62	38.54	12.77	59.69	150	0	P	H
		10360	55.2	-18.8	74	65.51	38.62	10.07	59	152	98	P	V
		10360	46.84	-7.16	54	57.15	38.62	10.07	59	152	98	A	V
		15540	50.63	-23.37	74	59.01	38.54	12.77	59.69	150	0	P	V
802.11n HT20 CH 44 5220MHz		10440	54.52	-19.48	74	64.69	38.72	10.13	59.02	221	124	P	H
		10440	47.39	-6.61	54	57.56	38.72	10.13	59.02	221	124	A	H
		15660	49.76	-24.24	74	58.41	38.17	12.93	59.75	150	0	P	H
		10440	57.6	-16.4	74	67.77	38.72	10.13	59.02	150	185	P	V
		10440	48.98	-5.02	54	59.15	38.72	10.13	59.02	150	185	A	V
		15660	50.64	-23.36	74	59.29	38.17	12.93	59.75	150	0	P	V
802.11n HT20 CH 48 5240MHz		10480	59.2	-14.8	74	69.29	38.79	10.15	59.03	156	215	P	H
		10480	50.06	-3.94	54	60.15	38.79	10.15	59.03	156	215	A	H
		15720	50.72	-23.28	74	59.52	37.96	13.03	59.79	150	0	P	H
		10480	60.69	-13.31	74	70.78	38.79	10.15	59.03	250	155	P	V
		10480	51.45	-2.55	54	61.54	38.79	10.15	59.03	250	155	A	V
		15720	56.56	-17.44	74	65.36	37.96	13.03	59.79	150	84	P	V
		15720	49.74	-4.26	54	58.54	37.96	13.03	59.79	150	84	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11n HT40 (Band Edge @ 3m)

WIFI Ant. 1+2+3	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 38 5190MHz		5148.65	54.8	-19.2	74	49.9	31.5	7.07	33.67	250	261	P	H
		5148.5	47.77	-6.23	54	42.87	31.5	7.07	33.67	250	261	A	H
	*	5190	102.85	-	-	97.87	31.55	7.08	33.65	250	261	P	H
	*	5190	93.55	-	-	88.57	31.55	7.08	33.65	250	261	A	H
		5363.86	48.3	-25.7	74	42.9	31.81	7.12	33.53	250	261	P	H
		5353.3	39.55	-14.45	54	34.17	31.79	7.12	33.53	250	261	A	H
		5147.9	61.16	-12.84	74	56.26	31.5	7.07	33.67	250	118	P	V
		5149.85	53.62	-0.38	54	48.72	31.5	7.07	33.67	250	118	A	V
	*	5190	108.08	-	-	103.1	31.55	7.08	33.65	250	118	P	V
	*	5190	99.08	-	-	94.1	31.55	7.08	33.65	250	118	A	V
		5364.52	51.02	-22.98	74	45.62	31.81	7.12	33.53	250	118	P	V
		5355.17	43.5	-10.5	54	38.12	31.79	7.12	33.53	250	118	A	V
802.11n HT40 CH 46 5230MHz		5147.9	61.6	-12.4	74	56.7	31.5	7.07	33.67	150	231	P	H
		5147.45	52.76	-1.24	54	47.86	31.5	7.07	33.67	150	231	A	H
	*	5230	116.21	-	-	111.12	31.62	7.09	33.62	150	231	P	H
	*	5230	112.74	-	-	107.65	31.62	7.09	33.62	150	231	A	H
		5387.84	58.23	-15.77	74	52.79	31.83	7.13	33.52	150	231	P	H
		5387.95	50.11	-3.89	54	44.67	31.83	7.13	33.52	150	231	A	H
		5147.6	56.53	-17.47	74	51.63	31.5	7.07	33.67	150	195	P	V
		5147	48.44	-5.56	54	43.54	31.5	7.07	33.67	150	195	A	V
	*	5230	112.09	-	-	107	31.62	7.09	33.62	150	195	P	V
	*	5230	109.39	-	-	104.3	31.62	7.09	33.62	150	195	A	V
		5388.06	53.31	-20.69	74	47.87	31.83	7.13	33.52	150	195	P	V
		5372.66	45.03	-8.97	54	39.62	31.81	7.13	33.53	150	195	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11n HT40 (Harmonic @ 3m)

WIFI Ant. 1+2+3	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 38 5190MHz		10380	49.43	-24.57	74	59.69	38.65	10.1	59.01	250	0	P	H
		15570	50.13	-23.87	74	58.58	38.44	12.82	59.71	150	0	P	H
		10380	49.18	-24.82	74	59.44	38.65	10.1	59.01	250	0	P	V
		15570	49.51	-24.49	74	57.96	38.44	12.82	59.71	150	0	P	V
802.11n HT40 CH 46 5230MHz		10460	56.14	-17.86	74	66.28	38.74	10.15	59.03	150	213	P	H
		10460	46.71	-7.29	54	56.85	38.74	10.15	59.03	150	213	A	H
		15690	49.38	-24.62	74	58.11	38.06	12.98	59.77	150	0	P	H
		10460	55.71	-18.29	74	65.85	38.74	10.15	59.03	150	202	P	V
		10460	43.88	-10.12	54	54.02	38.74	10.15	59.03	150	202	A	V
		15690	50.85	-23.15	74	59.58	38.06	12.98	59.77	150	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI Ant. 1+2+3	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT80 CH 42 5210MHz		5142.5	54.73	-19.27	74	49.85	31.5	7.07	33.69	250	260	P	H
		5148.05	45.91	-8.09	54	41.01	31.5	7.07	33.67	250	260	A	H
		5210	97.34	-	-	92.29	31.6	7.09	33.64	250	260	P	H
		5210	88.24	-	-	83.19	31.6	7.09	33.64	250	260	A	H
		5437.56	46.78	-27.22	74	41.2	31.91	7.15	33.48	250	260	P	H
		5387.84	38.06	-15.94	54	32.62	31.83	7.13	33.52	250	260	A	H
		5147.6	61.09	-12.91	74	56.19	31.5	7.07	33.67	250	161	P	V
		5147.75	53.5	-0.5	54	48.6	31.5	7.07	33.67	250	161	A	V
		5210	104.74	-	-	99.69	31.6	7.09	33.64	250	161	P	V
		5210	95.5	-	-	90.45	31.6	7.09	33.64	250	161	A	V
		5382.56	49.48	-24.52	74	44.04	31.83	7.13	33.52	250	161	P	V
		5357.92	41.36	-12.64	54	35.98	31.79	7.12	33.53	250	161	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

WIFI Ant. 1+2+3	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac		10420	50.24	-23.76	74	60.43	38.69	10.13	59.01	250	0	P	H
VHT80		15630	49.61	-24.39	74	58.25	38.22	12.88	59.74	150	0	P	H
CH 42		10420	48.9	-25.1	74	59.09	38.69	10.13	59.01	250	0	P	V
5210MHz		15630	50.4	-23.6	74	59.04	38.22	12.88	59.74	150	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

WIFI 802.11a (LF @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2+3		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a LF		81.41	22.99	-17.01	40	45.62	9.62	1.14	33.39	100	300	P	H
		167.74	24.09	-19.41	43.5	44.97	10.8	1.53	33.21	-	-	P	H
		222.06	19.29	-26.71	46	39.69	10.93	1.8	33.13	-	-	P	H
		399.57	20.32	-25.68	46	34.48	16.5	2.12	32.78	-	-	P	H
		447.1	22.06	-23.94	46	35.32	17.16	2.22	32.64	-	-	P	H
		527.61	25.09	-20.91	46	36.92	18.14	2.41	32.38	-	-	P	H
		42.61	33.46	-6.54	40	54.04	11.81	1	33.39	100	360	P	V
		75.59	24.37	-15.63	40	48.06	8.55	1.14	33.38	-	-	P	V
		122.15	21.82	-21.68	43.5	41.94	11.81	1.38	33.31	-	-	P	V
		169.68	24.55	-18.95	43.5	45.47	10.76	1.53	33.21	-	-	P	V
		518.88	22.87	-23.13	46	34.81	18.07	2.41	32.42	-	-	P	V
		645.95	21.08	-24.92	46	31.34	19.12	2.64	32.02	-	-	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.
!	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	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(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)

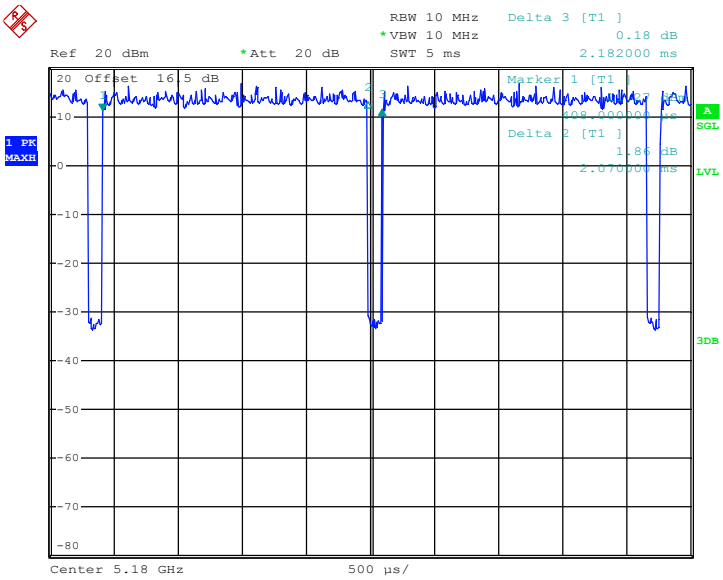
= -10.46(dB)

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

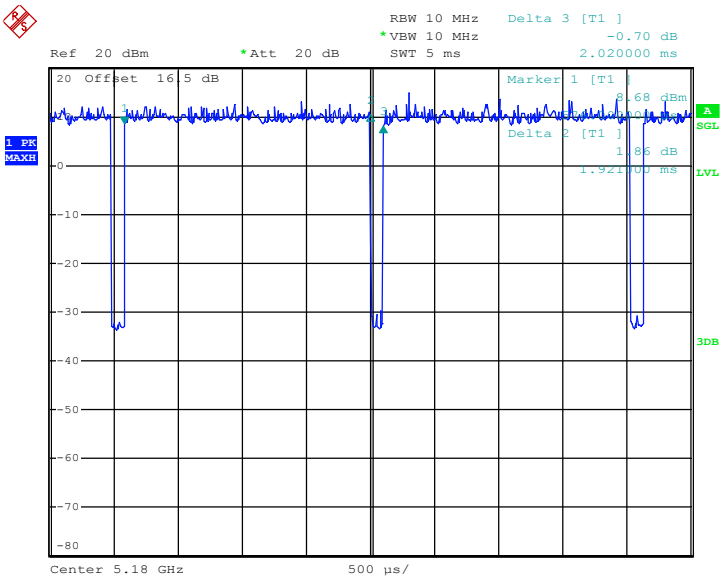
Appendix C. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
1+2+3	802.11a	94.87	2.07	0.48	1kHz
1+2+3	802.11n HT20	95.10	1.92	0.52	1kHz
1+2+3	802.11n HT40	91.86	0.95	1.05	3kHz
1+2+3	802.11ac VHT80	94.31	0.46	2.16	3kHz

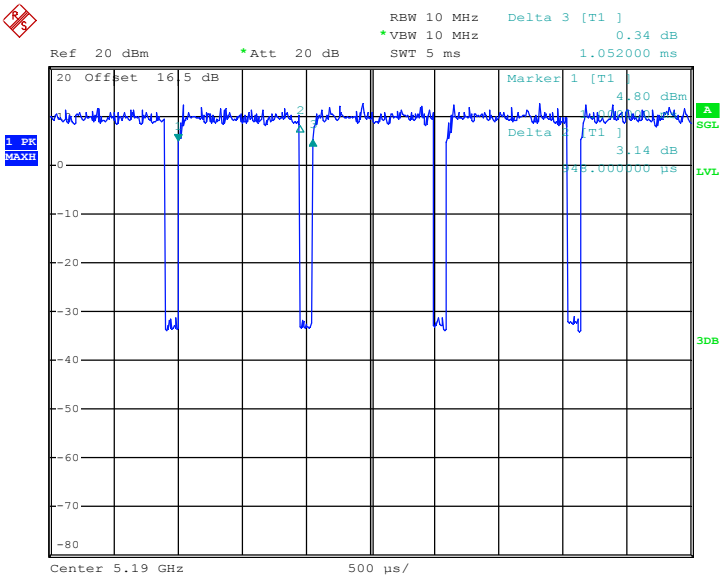
802.11a



802.11n HT20



802.11n HT40



802.11ac VHT80