



FCC RF Test Report

APPLICANT : IEI Integration Corp.
EQUIPMENT : Tablet PC
BRAND NAME : iEi
MODEL NAME : TRN-3200T
FCC ID : RFH-TRN3200T
STANDARD : FCC Part 15 Subpart E §15.407
CLASSIFICATION : (NII) Unlicensed National Information Infrastructure

This is a variant report. The product was received on Sep. 22, 2017 and testing was completed on Nov. 15, 2017. We, SPORTON INTERNATIONAL 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 INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager



Testing Laboratory
1190

SPORTON INTERNATIONAL INC.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR690221-01E	Rev. 01	Initial issue of report	Nov. 02, 2017
FR690221-01E	Rev. 02	Revising power in Appendix A.	Nov. 17, 2017



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.407(a)	Maximum Conducted Output Power	≤ 30 dBm (depend on band)	Pass	-
3.2	15.407(b)	Unwanted Emissions	$\leq -17, -27$ dBm (depend on band)&15.209(a)	Pass	Under limit 4.57 dB at 81.030 MHz
3.3	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 13.40 dB at 4.542 MHz
3.4	15.203 & 15.407(a)	Antenna Requirement	N/A	Pass	-

Remark: This is a variant report which can be referred Product Equality Declaration. All the test cases were performed on original report which can be referred to Sporton Report Number FR690221E. Based on the original report, only worst case was verified.



1 General Description

1.1 Applicant

IEI Integration Corp.

No.29, Zhongxing Rd., Xizhi Dist., New Taipei City 221. Taiwan (R.O.C)

1.2 Manufacturer

IEI Integration Corp.

No.29, Zhongxing Rd., Xizhi Dist., New Taipei City 221. Taiwan (R.O.C)

1.3 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n, Wi-Fi 5GHz 802.11a/n/ac

Product Specification subjective to this standard	
Antenna Type	WLAN: PCB Antenna Bluetooth: PCB Antenna

1.4 Modification of EUT

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



1.5 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1190 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.		
Test Site Location	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978		
Test Site No.	Sporton Site No.		
	TH05-HY	CO05-HY	03CH07-HY

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

1.6 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 v01r04.
- ♦ 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

- a. 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: conduction emission (150 kHz to 30 MHz), radiation 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 (Z plane) were recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5725-5850 MHz Band 4 (U-NII-3)	149	5745	157	5785
	151*	5755	159*	5795
	153	5765	161	5805
	155 [#]	5775	165	5825

Note:

1. The above Frequency and Channel in "*" were 802.11n HT40 and 802.11ac VHT40.
2. The above Frequency and Channel in "[#]" were 802.11ac VHT80.



2.2 Test Mode

Final test mode of conducted test items and radiated spurious emissions are considering the modulation and worse data rates as below table.

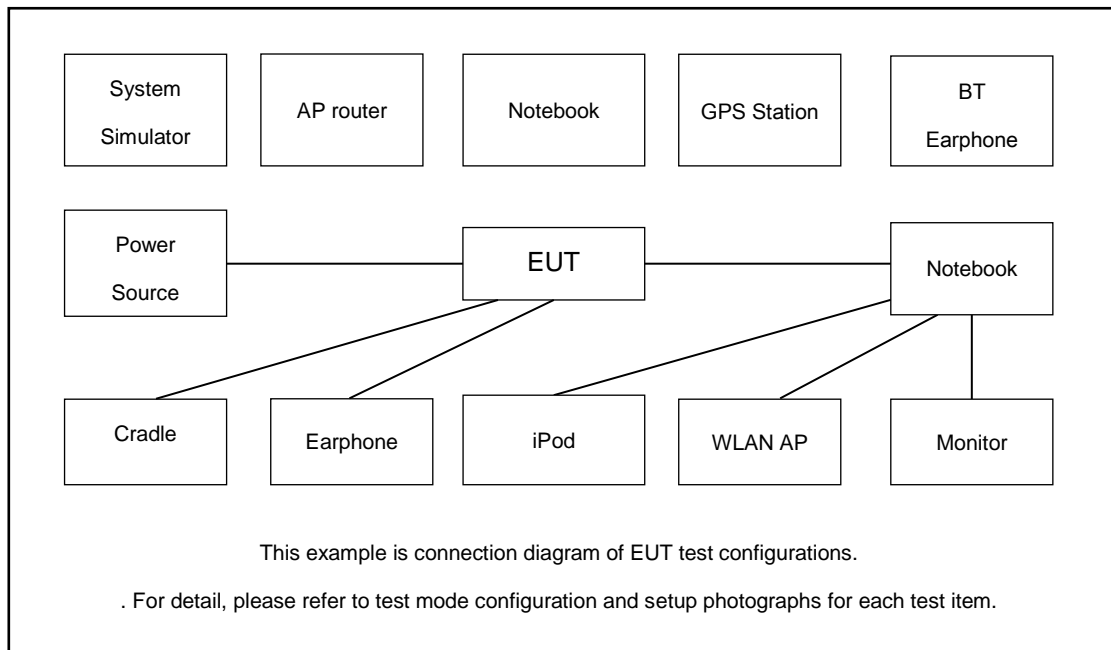
Modulation	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ac VHT80	MCS0

Test Cases	
AC Conducted Emission	Mode 1 : Bluetooth Link + WLAN (5GHz) Link + TC + TF + New Adapter
Remark:	
1. TC stands for Test Configuration, and consists of SD Card, Earphone, LCD Monitor (Mini HDMI out), USB HD, RJ-45 Link, Ultrasound Probe (Load) and Adapter.	
2. TF stands for Test Function, and consists of H-Pattern, MPEG4, and Camera.	

Ch. #		Band IV : 5725-5850 MHz		
		802.11a	802.11n HT20	802.11n HT40
L	Low	149	149	151
M	Middle	157	157	-
H	High	165	165	159

Ch. #		Band IV : 5725-5850 MHz		
		802.11ac VHT20	802.11ac VHT40	802.11ac VHT80
L	Low	149	151	-
M	Middle	157	-	155
H	High	165	159	-

2.3 Connection Diagram of Test System





2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
2.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8m
3.	iPod Earphone	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
4.	Notebook	DELL	P20G	FCC DoC/ Contains FCC ID: QDS-BRCM1051	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
5.	LCD Monitor	DELL	U2410	FCC DoC	Shielded, 1.6 m	Unshielded, 1.8 m
6.	USB2.0 HD	WD	WDBAAR3200A BK-PESN	FCC DoC	Unshielded, 0.5 m	N/A
7.	USB HD	DigiFusion	HD-326U3S	FCC DoC	Shielded, 0.5m	N/A
8.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

The programmed RF utility “MPTool”, is installed in EUT to provide channel selection, power level, data rate and the application type. RF Utility can send transmitting signal for all testing. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.



2.6 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 4.2 dB and 10dB attenuator.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\ &= 4.2 + 10 = 14.2 \text{ (dB)} \end{aligned}$$



3 Test Result

3.1 Maximum Conducted Output Power Measurement

3.1.1 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.

For the 5.25–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm $10 \log B$, where B is the 26 dB emission bandwidth in megahertz.

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

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.

3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

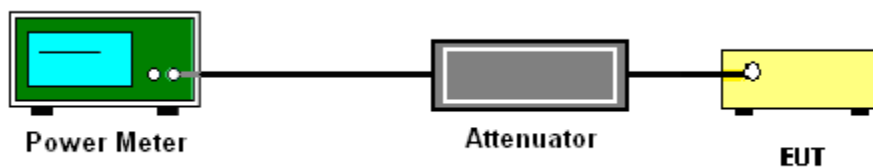
The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04.

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.

3.1.4 Test Setup

For normal channel:



3.1.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.



3.2 Unwanted Radiated Emission Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.2.1 Limit of Unwanted Emissions

- (1) For transmitters operating in the 5.725-5.85 GHz band:
15.407(b)(4)(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
- (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.

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



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

(3) KDB789033 D02 v01r04 G)2)c)

- (i) Section 15.407(b)(1-3) specifies the unwanted emissions limit for the U-NII-1 and 2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz. However, an out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz dBm/MHz peak emission limit.
- (ii) Section 15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). An alternative to the band emissions mask is specified in Section 15.407(b)(4)(ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the alternative limit.

Note 3: An out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz peak emission limit.

Note 4: Only devices with antenna gains of 10 dBi or less may be approved using the emission limits specified in Section 15.247(d) till March 2, 2018; all other devices operating in this band must use the mask specified in Section 15.407(b)(4)(i).

3.2.2 Measuring Instruments

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



3.2.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04.
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 \geq 3 MHz
- Detector = Peak
- Sweep time = auto
- Trace mode = max hold

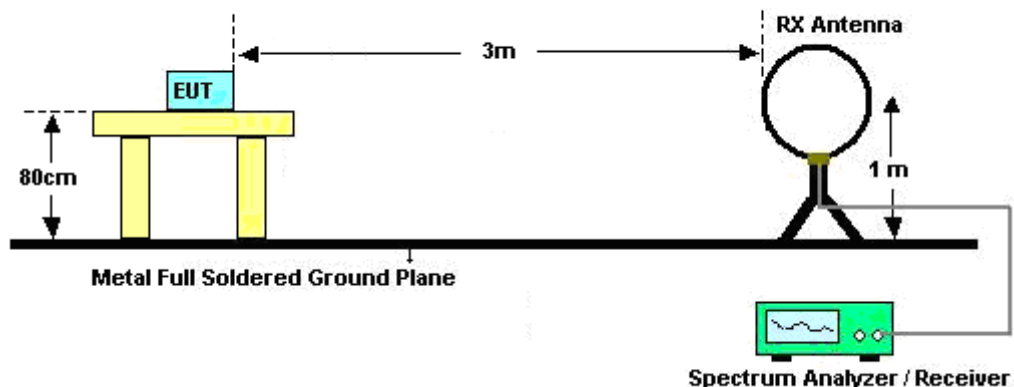
(3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

- RBW = 1 MHz
- VBW = 10 Hz, when duty cycle is no less than 98 percent.
- VBW \geq 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.

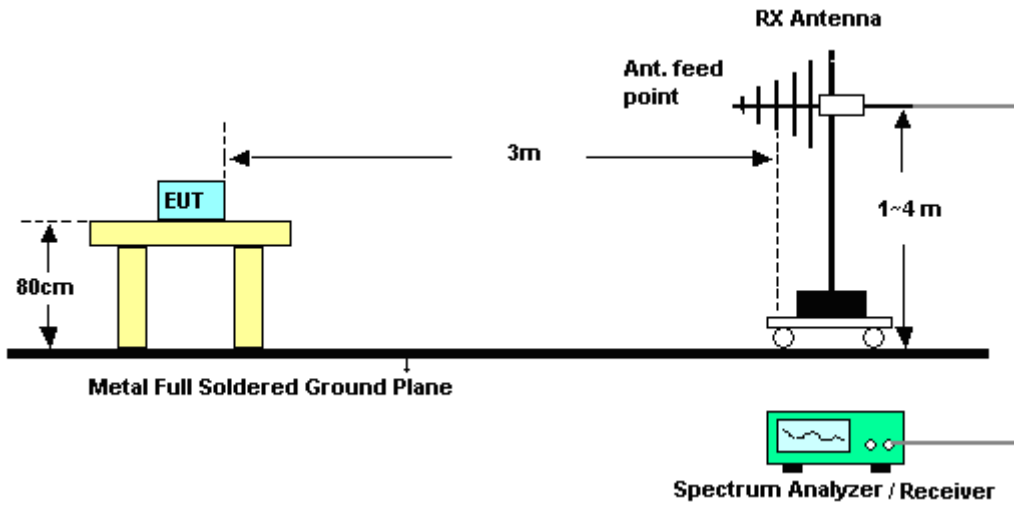
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband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

3.2.4 Test Setup

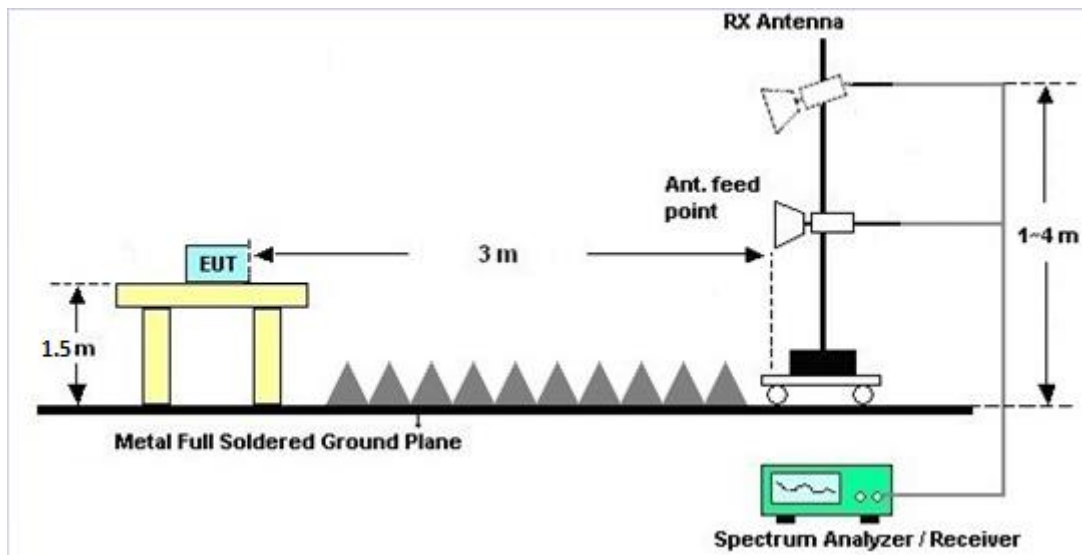
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz





3.2.5 Test Results of Radiated Spurious 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 was not reported.

3.2.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.2.7 Duty Cycle

Please refer to Appendix E.

3.2.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix C and D.



3.3 AC Conducted Emission Measurement

3.3.1 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 (dB μ V)	
	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.

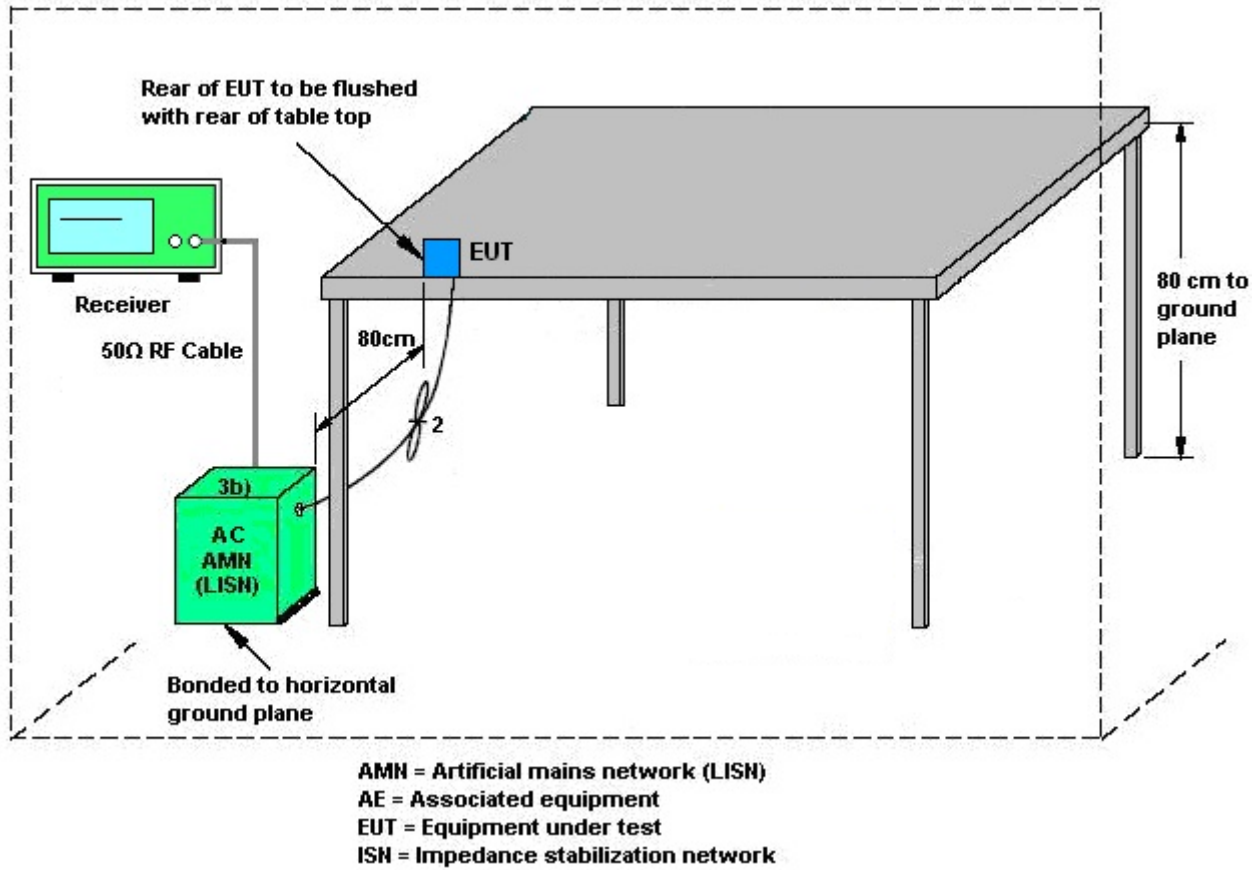
3.3.2 Measuring Instruments

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

3.3.3 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.

3.3.4 Test Setup



3.3.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.4 Antenna Requirements

3.4.1 Standard Applicable

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.

3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.4.3 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
Power Sensor	DARE	RadiPower	15I00041SN009	10MHz~6GHz	May 03, 2017	Oct. 13, 2017~ Nov. 15, 2017	May 02, 2018	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 04, 2016	Oct. 13, 2017~ Nov. 02, 2017	Nov. 03, 2017	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 07, 2017	Nov. 07, 2017~ Nov. 15, 2017	Nov. 06, 2018	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101067	9kHz~30GHz	Nov. 17, 2016	Oct. 13, 2017~ Nov. 15, 2017	Nov. 16, 2017	Conducted (TH05-HY)
Temperature Chamber	ESPEC	SU-241	92003713	-30℃ ~95℃	Jun. 07, 2017	Oct. 13, 2017~ Nov. 15, 2017	Jun. 06, 2018	Conducted (TH05-HY)
Programmable Power Supply	GW Instek	PSS-2005	EL890001	1V~20V 0.5A~4A	Oct. 03, 2017	Oct. 13, 2017~ Nov. 15, 2017	Oct. 02, 2018	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Oct. 23, 2017	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Sep. 20, 2017	Oct. 23, 2017	Sep. 19, 2018	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 29, 2016	Oct. 23, 2017	Nov. 28, 2017	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Dec. 06, 2016	Oct. 23, 2017	Dec. 05, 2017	Conduction (CO05-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	May 15, 2017	Oct. 24, 2017	May 14, 2019	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-00101 800-30-10P	1590075	1GHz ~ 18GHz	Apr. 25, 2017	Oct. 24, 2017	Apr. 24, 2018	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz-1GHz	Mar. 14, 2017	Oct. 24, 2017	Mar. 13, 2018	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~ 26.5GHz	Oct. 13, 2017	Oct. 24, 2017	Oct. 12, 2018	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Apr. 17, 2017	Oct. 24, 2017	Apr. 16, 2018	Radiation (03CH07-HY)
Antenna Mast	Max-Full	MFA520BS	N/A	1m~4m	N/A	Oct. 24, 2017	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Oct. 24, 2017	N/A	Radiation (03CH07-HY)
Amplifier	MITEQ	TTA1840-35-H G	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 18, 2017	Oct. 24, 2017	Jul. 17, 2018	Radiation (03CH07-HY)
EMI Test Receiver	Agilent	N9038A(MXE)	MY53290053	20Hz to 26.5GHz	Jan. 12, 2017	Oct. 24, 2017	Jan. 11, 2018	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 08, 2016	Oct. 24, 2017	Nov. 07, 2017	Radiation (03CH07-HY)



5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.70
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.70
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.50
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.20
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Appendix A. Test Result of Conducted Test Items

Test Engineer:	Reece Lin	Temperature:	21~25	°C
Test Date:	2017/10/13 ~ 2017/11/15	Relative Humidity:	51~54	%

TEST RESULTS DATA
Average Power Table

Band IV										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	FCC Conducted Power Limit (dBm)	DG (dBi)		Pass/Fail
11a	6M bps	1	149	5745	0.00	12.73	30.00	2.00		Pass
11a	6Mbps	1	157	5785	0.00	12.67	30.00	2.00		Pass
11a	6Mbps	1	161	5805	0.00	12.75	30.00	2.00		Pass
HT20	MCS 0	1	149	5745	0.00	11.67	30.00	2.00		Pass
HT20	MCS 0	1	157	5785	0.00	11.70	30.00	2.00		Pass
HT20	MCS 0	1	161	5805	0.00	11.70	30.00	2.00		Pass
HT40	MCS 0	1	151	5755	0.00	11.48	30.00	2.00		Pass
HT40	MCS 0	1	159	5795	0.00	11.40	30.00	2.00		Pass
VHT20	MCS 0	1	149	5745	0.00	11.60	30.00	2.00		Pass
VHT20	MCS 0	1	157	5785	0.00	11.72	30.00	2.00		Pass
VHT20	MCS 0	1	161	5805	0.00	11.73	30.00	2.00		Pass
VHT40	MCS 0	1	151	5755	0.00	11.60	30.00	2.00		Pass
VHT40	MCS 0	1	159	5795	0.00	11.58	30.00	2.00		Pass
VHT80	MCS 0	1	155	5775	0.00	9.99	30.00	2.00		Pass



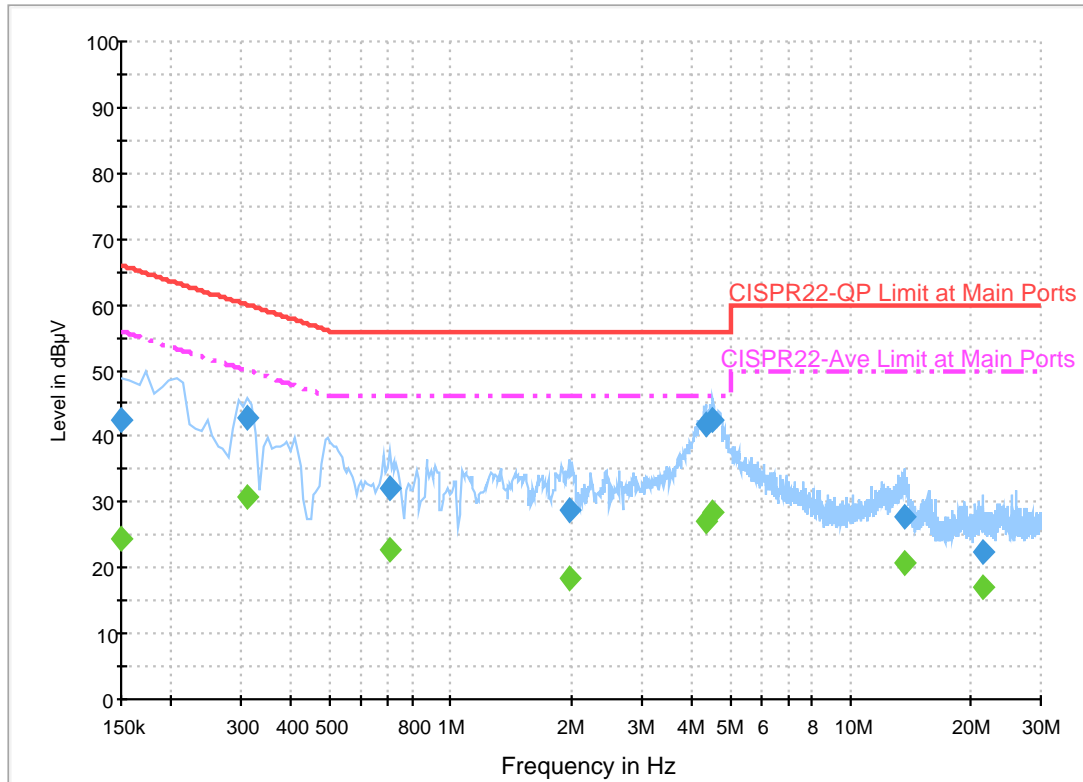
Appendix B. AC Conducted Emission Test Results

Test Engineer :	Blue Lan	Temperature :	23~24°C
		Relative Humidity :	37~38%

EUT Information

Report NO : 690221-01
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Line

ENV216 Auto Test-L



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	42.6	Off	L1	19.6	23.4	66.0
0.310000	42.7	Off	L1	19.5	17.3	60.0
0.702000	32.2	Off	L1	19.5	23.8	56.0
1.982000	28.8	Off	L1	19.6	27.2	56.0
4.342000	41.7	Off	L1	19.6	14.3	56.0
4.542000	42.6	Off	L1	19.6	13.4	56.0
13.702000	27.9	Off	L1	19.7	32.1	60.0
21.390000	22.4	Off	L1	19.8	37.6	60.0

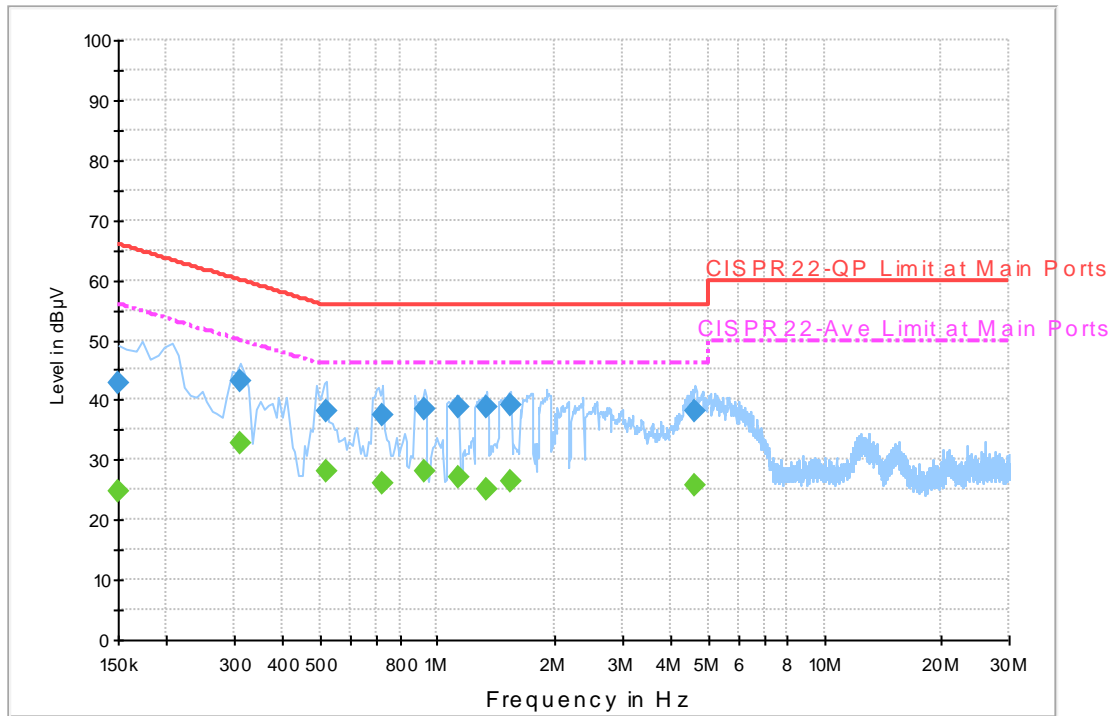
Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	24.6	Off	L1	19.6	31.4	56.0
0.310000	30.8	Off	L1	19.5	19.2	50.0
0.702000	22.6	Off	L1	19.5	23.4	46.0
1.982000	18.4	Off	L1	19.6	27.6	46.0
4.342000	27.0	Off	L1	19.6	19.0	46.0
4.542000	28.5	Off	L1	19.6	17.5	46.0
13.702000	20.8	Off	L1	19.7	29.2	50.0
21.390000	17.1	Off	L1	19.8	32.9	50.0

EUT Information

Report NO : 690221-01
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Neutral

ENV216 Auto Test-N



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	42.7	Off	N	19.5	23.3	66.0
0.310000	43.2	Off	N	19.5	16.8	60.0
0.518000	38.2	Off	N	19.5	17.8	56.0
0.726000	37.6	Off	N	19.5	18.4	56.0
0.926000	38.6	Off	N	19.5	17.4	56.0
1.134000	38.8	Off	N	19.5	17.2	56.0
1.342000	38.9	Off	N	19.5	17.1	56.0
1.550000	39.2	Off	N	19.5	16.8	56.0
4.654000	38.3	Off	N	19.6	17.7	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	24.7	Off	N	19.5	31.3	56.0
0.310000	32.9	Off	N	19.5	17.1	50.0
0.518000	28.1	Off	N	19.5	17.9	46.0
0.726000	26.1	Off	N	19.5	19.9	46.0
0.926000	28.0	Off	N	19.5	18.0	46.0
1.134000	27.1	Off	N	19.5	18.9	46.0
1.342000	25.1	Off	N	19.5	20.9	46.0
1.550000	26.5	Off	N	19.5	19.5	46.0
4.654000	25.9	Off	N	19.6	20.1	46.0



Appendix C. Radiated Spurious Emission

Test Engineer :	Jesse Wang and James Chiu	Temperature :	23~24°C
		Relative Humidity :	54~55%



Band 4 - 5725~5850MHz
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		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)	
802.11a CH 149 5745MHz		5646	53.43	-14.77	68.2	40.13	35.09	12.61	34.4	302	178	P	H	
		5684	54.63	-38.77	93.4	41.21	35.17	12.67	34.42	302	178	P	H	
		5717.8	53.71	-56.47	110.18	40.19	35.21	12.73	34.42	302	178	P	H	
		5723.8	61.53	-57.93	119.46	48.01	35.21	12.73	34.42	302	178	P	H	
	*	5745	105.09	-	-	91.49	35.24	12.79	34.43	302	178	P	H	
	*	5745	97.4	-	-	83.8	35.24	12.79	34.43	302	178	A	H	
														H
														H
			5644.4	54.37	-13.83	68.2	41.07	35.09	12.61	34.4	202	228	P	V
			5694.8	54.88	-46.49	101.37	41.46	35.17	12.67	34.42	202	228	P	V
			5719.4	58.69	-51.94	110.63	45.17	35.21	12.73	34.42	202	228	P	V
			5724.4	67.66	-53.17	120.83	54.14	35.21	12.73	34.42	202	228	P	V
	*		5745	108.94	-	-	95.34	35.24	12.79	34.43	202	228	P	V
	*		5745	101.35	-	-	87.75	35.24	12.79	34.43	202	228	A	V
														V
													V	



Band 4 5725~5850MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant. 1	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 149 5745MHz		11490	45.33	-28.67	74	45.41	38.38	18.88	57.34	100	0	P	H
		17235	50.84	-17.36	68.2	41.49	41.77	23.38	55.8	100	0	P	H
													H
													H
		11490	46.68	-27.32	74	46.76	38.38	18.88	57.34	100	0	P	V
		17235	50.72	-17.48	68.2	41.37	41.77	23.38	55.8	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Emission below 1GHz
5GHz 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		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)	
5GHz 802.11a LF		81.03	35.43	-4.57	40	51.47	13.43	2.11	31.58	100	58	P	H	
		186.06	33.72	-9.78	43.5	47.76	14.71	2.72	31.47	-	-	P	H	
		291.63	39.39	-6.61	46	48.39	19.03	3.28	31.31	-	-	P	H	
		323.8	38.36	-7.64	46	46.7	19.49	3.43	31.26	-	-	P	H	
		356.7	38.3	-7.7	46	45.37	20.56	3.57	31.2	-	-	P	H	
		576.5	38.2	-7.8	46	39.3	25.57	4.2	30.87	-	-	P	H	
														H
														H
														H
														H
														H
			82.65	30.66	-9.34	40	46.6	13.53	2.11	31.58	-	-	P	V
			186.87	25.49	-18.01	43.5	39.53	14.7	2.72	31.46	-	-	P	V
			291.63	28.14	-17.86	46	37.14	19.03	3.28	31.31	-	-	P	V
			453.3	35.36	-10.64	46	39.48	23.05	3.88	31.05	-	-	P	V
			517.7	35.14	-10.86	46	38.05	23.91	4.13	30.95	-	-	P	V
			575.8	37.85	-8.15	46	38.95	25.57	4.2	30.87	100	102	P	V
														V
													V	
													V	
													V	
													V	
													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	Peak or Average
H/V	Horizontal or Vertical



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		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

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

For Peak Limit @ 2390MHz:

- 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)
- Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 55.45(dBμV/m) – 74(dBμV/m)
= -18.55(dB)

For Average Limit @ 2390MHz:

- 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)
- 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 D. Radiated Spurious Emission Plots

Note symbol

-L	Low channel location
-R	High channel location



Band 4 - 5725~5850MHz
WIFI 802.11a (Band Edge @ 3m)

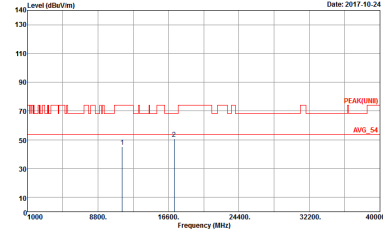
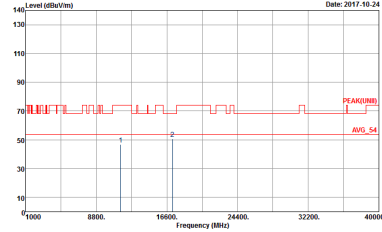
WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11a CH149 5745MHz	
1	Horizontal	Fundamental
Peak	<p> Date: 2017-10-24 PEAK_BE(84)_16-24 </p> <p> Site : 03CH07-14Y Condition : PEAK_BE(84)_16-24 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 690221-01 Mode : 30 </p>	<p> Date: 2017-10-24 PEAK(FUN) </p> <p> Site : 03CH07-14Y Condition : PEAK(FUN) 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 690221-01 Mode : 30 </p>



WIFI	Band 4 5725~5850MHz Band Edge @ 3m	
ANT	802.11a CH149 5745MHz	
1	Vertical	Fundamental
Peak	<p> Site : 03CH07-HY Condition : PEAK_BE(B4)_16-24 3m HF_ANT_00075962 VERTICAL Detector : Peak Project : 690221-01 Mode : 30 </p>	<p> Site : 03CH07-HY Condition : PEAK(UNI) 3m HF_ANT_00075962 VERTICAL Detector : Peak Project : 690221-01 Mode : 30 </p>



**Band 4 - 5725~5850MHz
WIFI 802.11a (Harmonic @ 3m)**

WIFI	Band 4 5725~5850MHz Harmonic @ 3m	
ANT	802.11a CH149 5745MHz	
1	Horizontal	Vertical
<p>Peak</p> <p>Avg.</p>	 <p>Date: 2017.10.24</p> <p>Site : 03CH07-1#Y Condition : PEAK(LINEI) 3m SHF-EHF_131029 HORIZONTAL Detector : Peak Project : 690221-01 Mode : 30</p>	 <p>Date: 2017.10.24</p> <p>Site : 03CH07-1#Y Condition : PEAK(LINEI) 3m SHF-EHF_131029 VERTICAL Detector : Peak Project : 690221-01 Mode : 30</p>



Emission below 1GHz
5GHz WIFI 802.11a (LF)

WIFI	5GHz 5725~5850MHz	
ANT	802.11a LF	
1	Horizontal	Vertical
QP / Peak	<p>Site : 03CH07-11F Condition : QP 3m LF-ANT-35419(6) HORIZONTAL Detector : Peak Project : 690221-01 Mode : 39</p>	<p>Site : 03CH07-11F Condition : QP 3m LF-ANT-35419(6) VERTICAL Detector : Peak Project : 690221-01 Mode : 39</p>

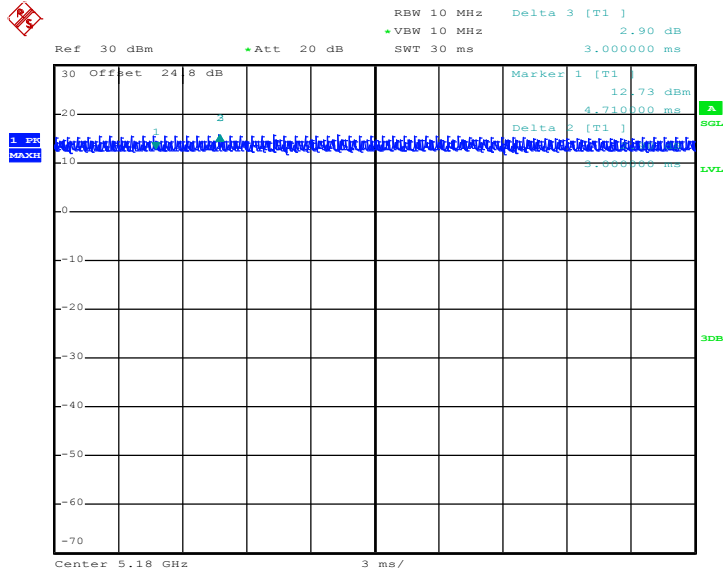


Appendix E. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
802.11a	100	-	-	10Hz
5GHz 802.11n HT20	100	-	-	
5GHz 802.11n HT40	100	-	-	
5GHz 802.11ac VHT20	100	-	-	
5GHz 802.11ac VHT40	100	-	-	
5GHz 802.11ac VHT80	100	-	-	

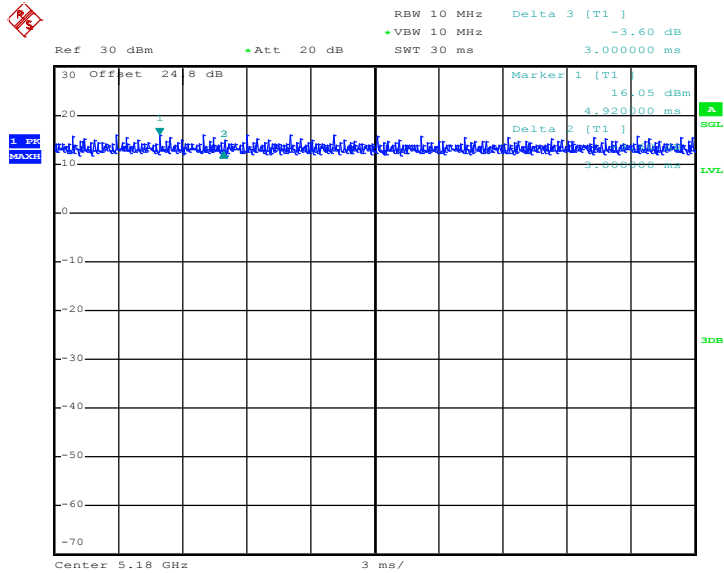


802.11a



Date: 13.OCT.2017 11:42:15

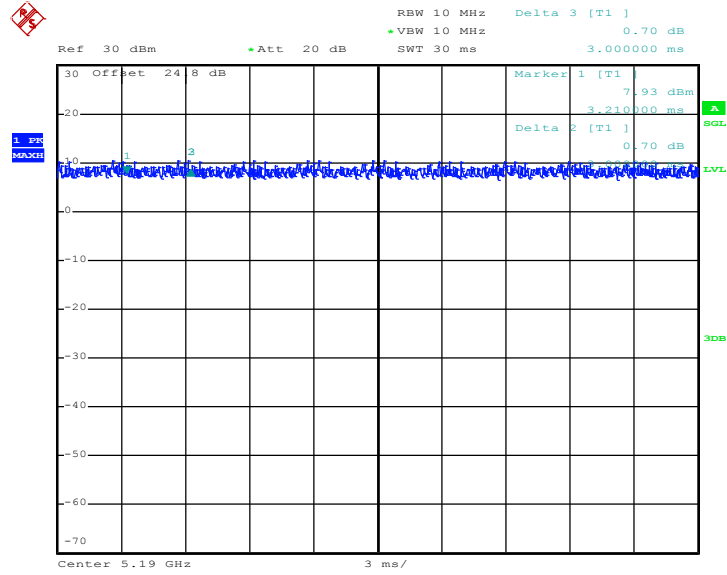
802.11n HT20



Date: 13.OCT.2017 11:43:09

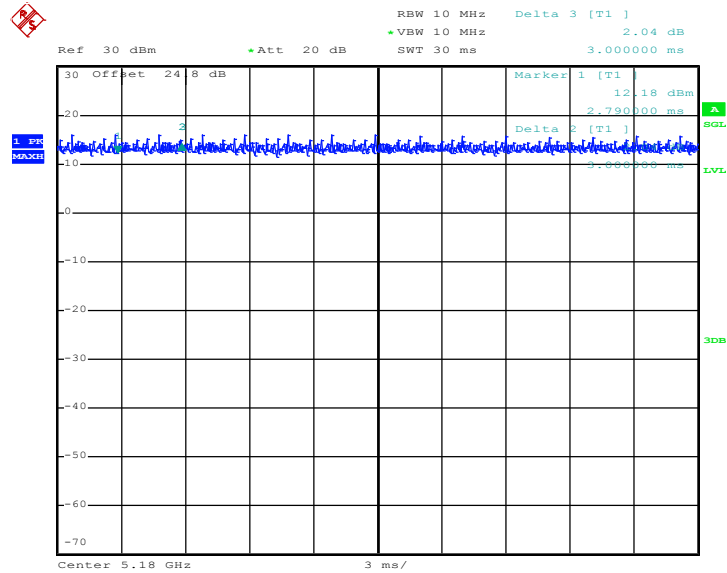


802.11n HT40



Date: 13.OCT.2017 11:45:52

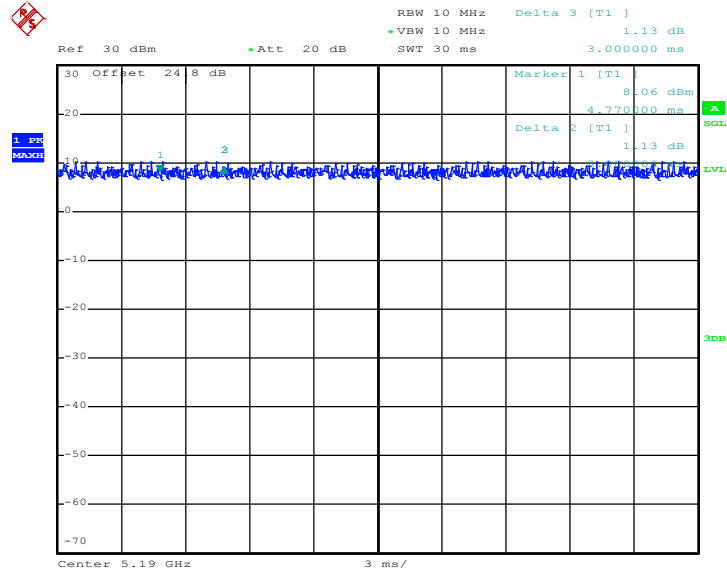
802.11ac VHT20



Date: 13.OCT.2017 11:46:41

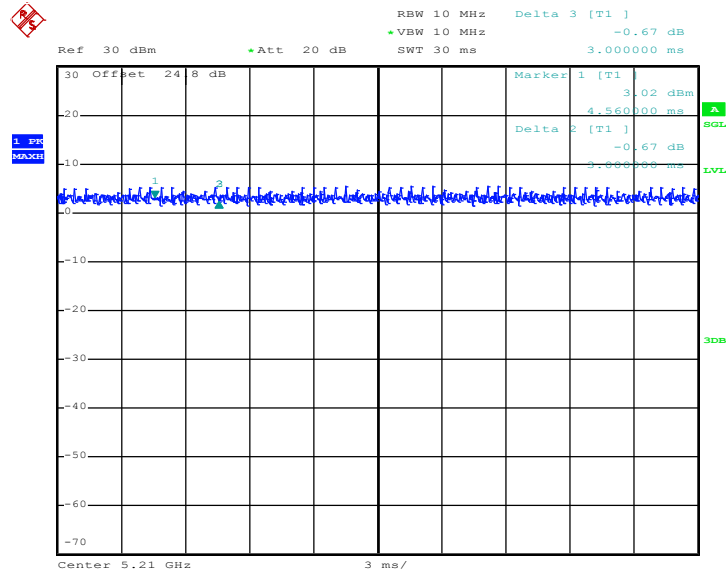


802.11ac VHT40



Date: 13.OCT.2017 11:47:57

802.11ac VHT80



Date: 13.OCT.2017 11:48:34