FCC RADIO TEST REPORT

FCC ID	:	**WR92221123114**
Equipment	:	**thermostat**
Brand Name	:	**ecobee**
Model Name	:	**ECB402**
Applicant	:	**ecobee Inc.** **207 Queens Quay West, Suite 600, Toronto, ON, Canada**
Manufacturer	:	**ecobee Inc.** **207 Queens Quay West, Suite 600, Toronto, ON, Canada**
Standard	:	**FCC Part 15 Subpart E §15.407**

The product was received on Jan. 17, 2019 and testing was started from Feb. 13, 2019 and completed on Mar. 29, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, 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 report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Jones Tsai

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FR911708E	01	Initial issue of report	Apr. 18, 2019

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.403(i)	26dB Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Reporting only	-
3.2	15.407(a)	Maximum Conducted Output Power	Pass	-
3.3	15.407(a)	Power Spectral Density	Pass	-
3.4	15.407(b)	Unwanted Emissions	Pass	Under limit 3.37 dB at 32.430 MHz
3.5	15.207	AC Conducted Emission	Pass	Under limit 21.76 dB at 3.984 MHz
3.6	15.407(c)	Automatically Discontinue Transmission	Pass	-
3.7	15.203 15.407(a)	Antenna Requirement	Pass	-

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang

Report Producer: Maggie Chiang

1 General Description

1.1 Product Feature of Equipment Under Test

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

Product Specification subjective to this standard	
Antenna Type	WLAN: Ceramic Chip Antenna Bluetooth: FPC Antenna Proprietary Sensor: IFA Meander Printed PCB Type Antenna

1.2 Modification of EUT

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

1.3 Testing Location

Test Site	SPORTON INTERNATIONAL INC.	
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan 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

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

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	03CH13-HY

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

FCC Designation No. TW1190 and TW0007

1.4 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 v02r01.
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- 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 (Y plane) were recorded in this report.

b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5150-5250 MHz Band 1 (U-NII-1)	36	5180	44	5220
	38*	5190	46*	5230
	40	5200	48	5240
	42#	5210		

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

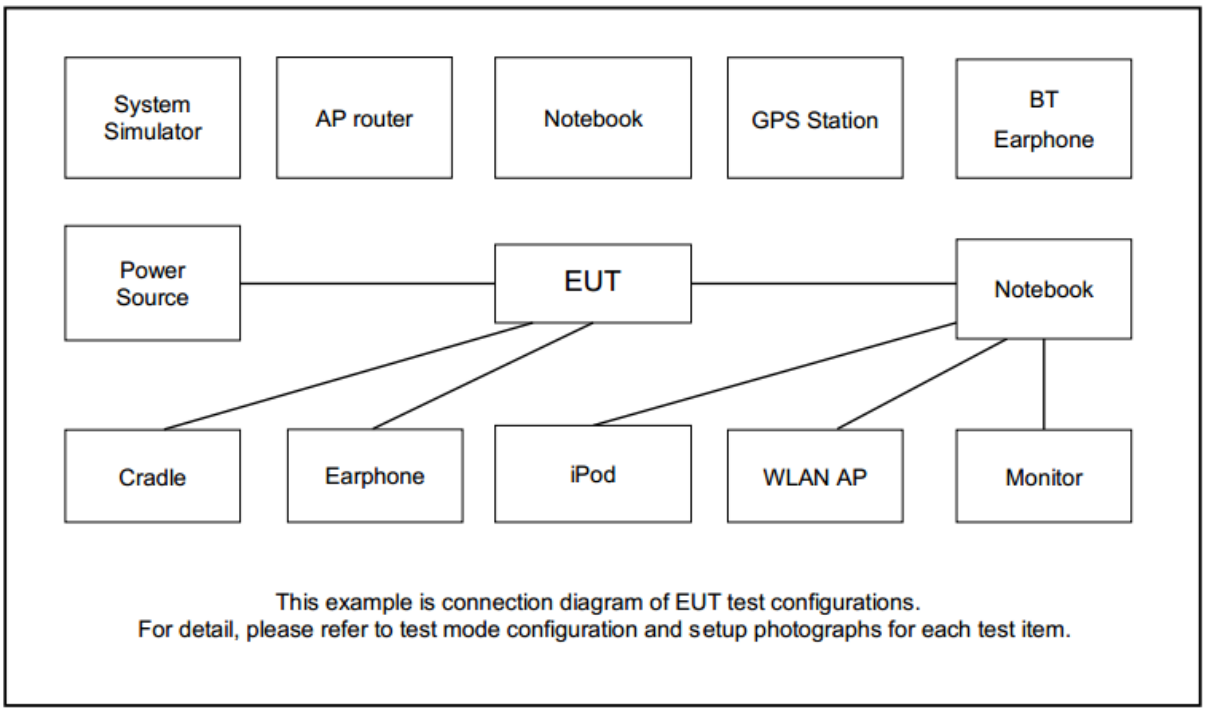
Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20 (Covered by HT20)	MCS0
802.11ac VHT40 (Covered by HT40)	MCS0
802.11ac VHT80	MCS0

Test Cases	
AC Conducted Emission	Mode 1 : WLAN (5GHz) Link + Bluetooth Link + Sub-gigahertz on + Infrared on + PEK with Adapter

Ch. #		Band I：5150-5250 MHz			
		802.11a	802.11n HT20	802.11n HT40	802.11ac VHT80
L	Low	36	36	38	-
M	Middle	44	44	-	42
H	High	48	48	46	-

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 Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m
2.	Adapter	Jameco	ADU240050	FCC DoC	N/A	AC I/P: Unshielded, 6m
3.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8m
4.	Notebook	DELL	Latitude E6320	FCC DoC/ Contains FCC ID: QDS-BRCM1054	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

The RF test items, utility “Putty” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

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.

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

= 4.2 + 10 = 14.2 (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.

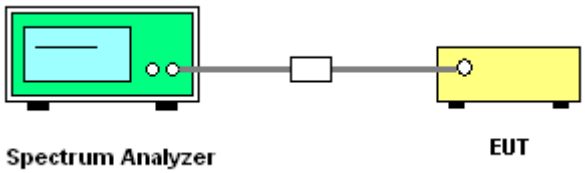
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. 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 1-5% of the emission bandwidth and set the Video bandwidth (VBW) ≥ 3 * RBW.
8. Measure and record the results in the test report.

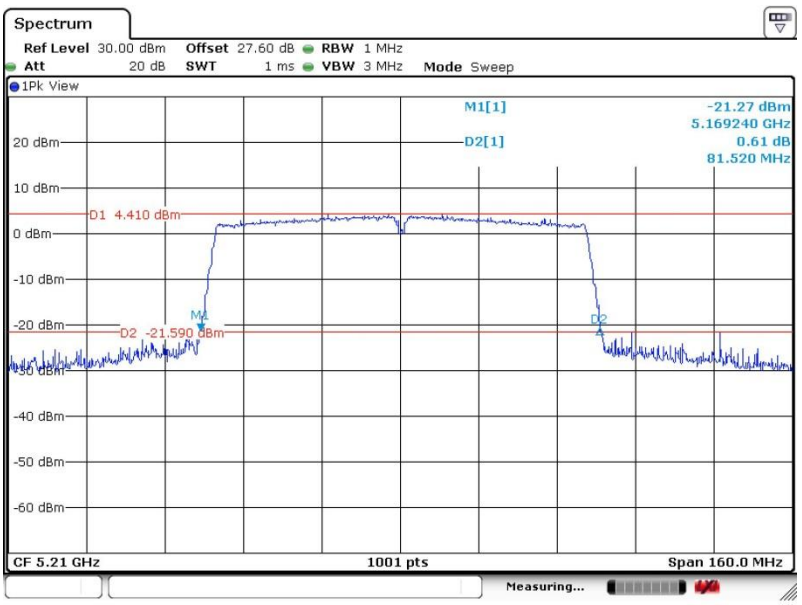
3.1.4 Test Setup



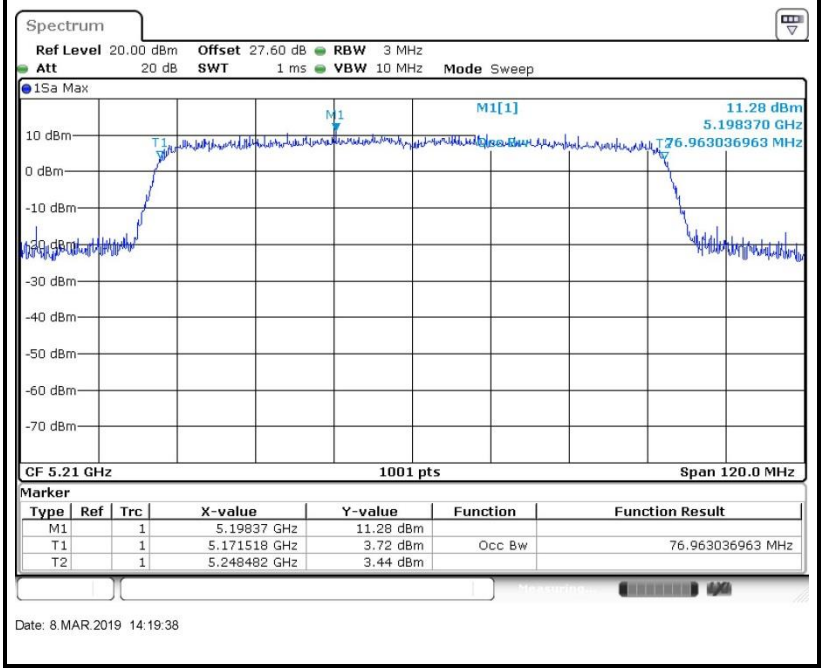
3.1.5 Test Result of 26dB & 99% Occupied Bandwidth

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

<FCC 14-30 CFR 15.407>

For the 5.15–5.25 GHz bands:

■ 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 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 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.

3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

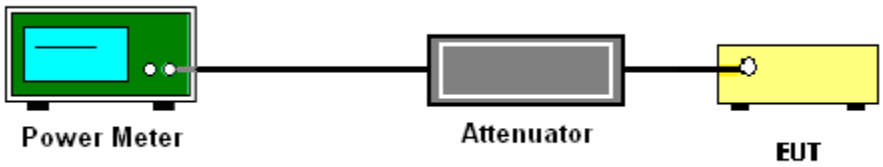
3.2.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

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 the 5.15–5.25 GHz bands:

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1.0 MHz band. For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1.0 MHz 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

See list of measuring equipment of this test report.

3.3.3 Test Procedures

The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Section F) Maximum power spectral density.

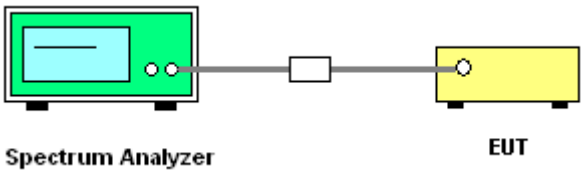
 # Method SA-2 #

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

- 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.

1. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
2. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.

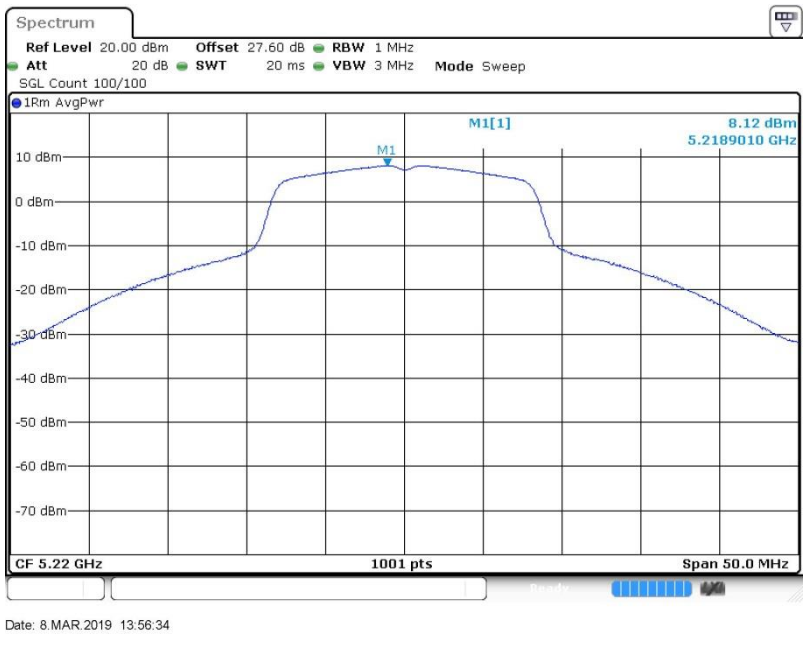
3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Density (dBm/MHz)



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

3.4 Unwanted Emissions Measurement

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

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 shall comply with the general field strength limits 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)
- 27	68.3

(3) KDB789033 D02 v02r01 G)2)c)

(i) Section 15.407(b)(1) to (b)(3) specify the unwanted emission limits for the U-NII-1 and U-NII-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.[3]

(ii) Section 15.407(b)(4) specifies the unwanted emission limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are in terms of a Peak detector. 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 devices using the alternative limit.[4]

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).

3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. 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

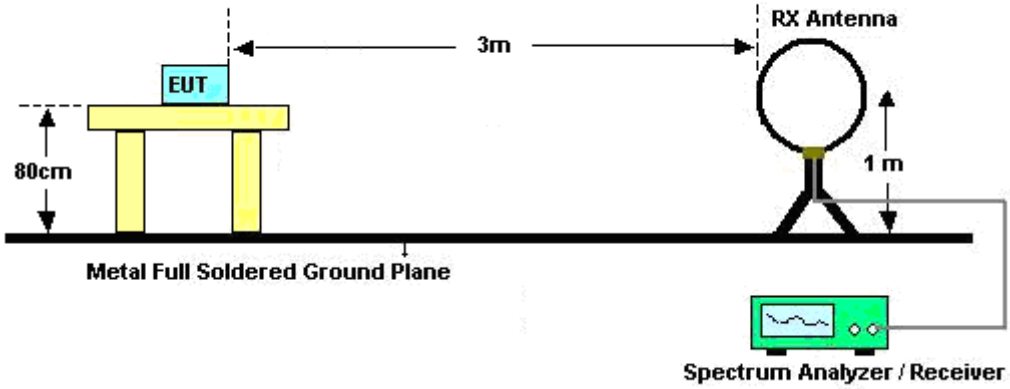
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

   - 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.

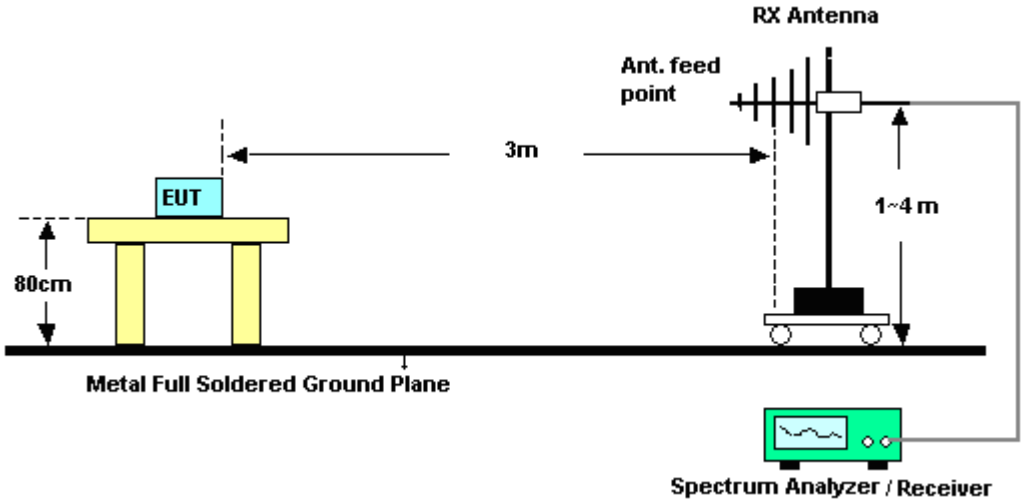
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband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

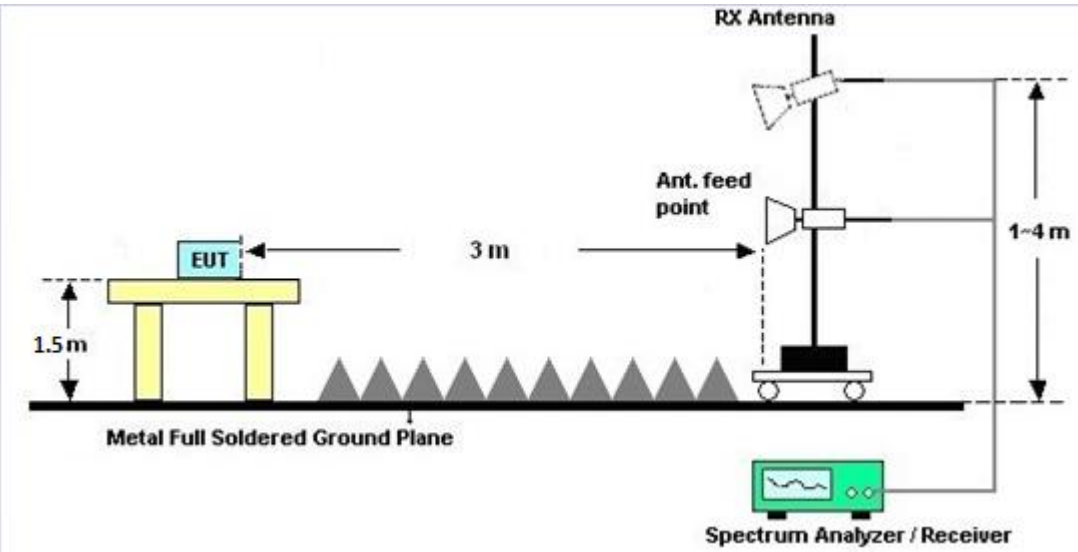
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.4.5 Test Results of Radiated 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.

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.4.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.4.7 Duty Cycle

Please refer to Appendix E.

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

Please refer to Appendix C and D.

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.

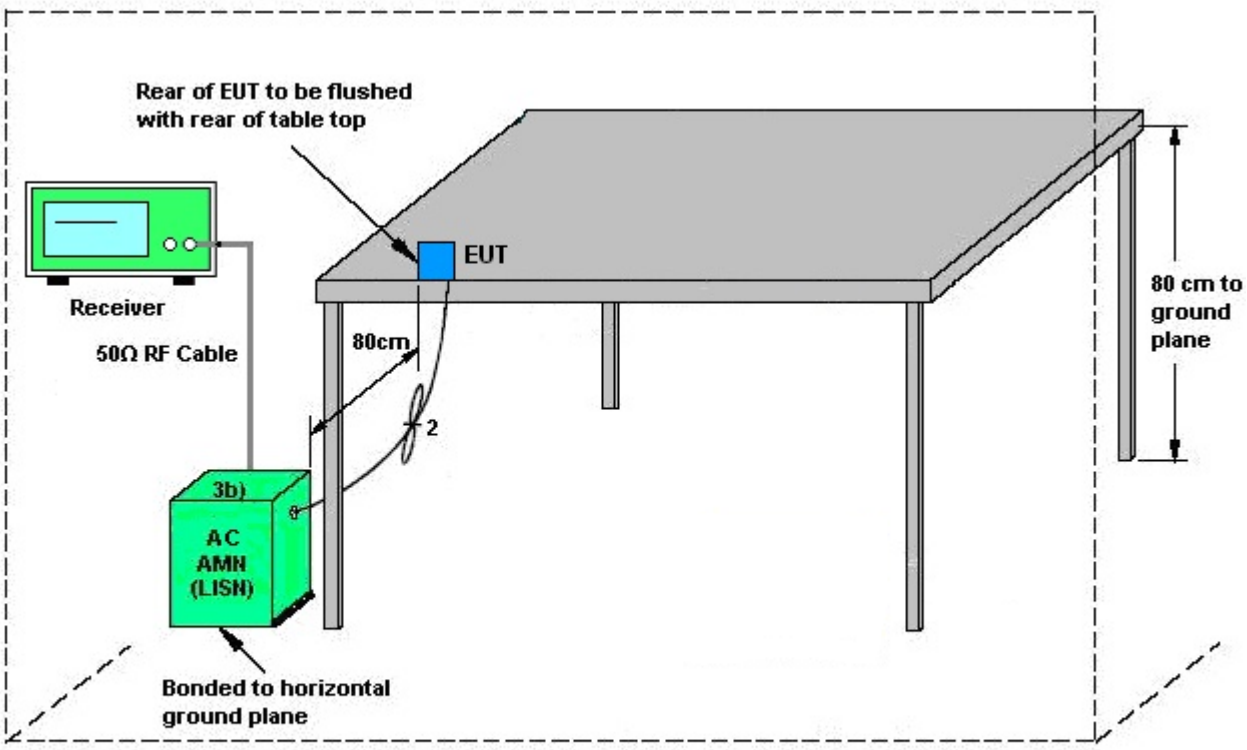
3.5.2 Measuring Instruments

See list of measuring equipment 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

Please refer to Appendix B.

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

See list of measuring equipment 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

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

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Power Meter	Anritsu	ML2495A	1132003	N/A	Aug. 16, 2018	Feb. 13, 2019~ Mar. 08, 2019	Aug. 15, 2019	Conducted (TH05-HY)
Power Sensor	Anritsu	MA2411B	1126017	300MHz~40GHz	Aug. 16, 2018	Feb. 13, 2019~ Mar. 08, 2019	Aug. 15, 2019	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSV 30	100895	9kHz~30GHz	Apr. 20, 2018	Feb. 13, 2019~ Mar. 08, 2019	Apr. 19, 2019	Conducted (TH05-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC1300484	N/A	Apr. 17, 2018	Feb. 13, 2019~ Mar. 08, 2019	Apr. 16, 2019	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Mar. 05, 2019	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9KHz~3.6GHz	Nov. 12, 2018	Mar. 05, 2019	Nov. 11, 2019	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 14, 2018	Mar. 05, 2019	Nov. 13, 2019	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 09, 2018	Mar. 05, 2019	Nov. 08, 2019	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Mar. 05, 2019	N/A	Conduction (CO05-HY)
RF Cable	HUBER + SUHNER	RG 214/U	1358175	9kHz~30MHz	Sep. 14, 2018	Mar. 05, 2019	Sep. 13, 2019	Conduction (CO05-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	9561-F N00373	9kHz-200MHz	Nov. 08, 2018	Mar. 05, 2019	Nov. 07, 2019	Conduction (CO05-HY)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Jan. 07, 2019	Feb. 15, 2019~ Mar. 29, 2019	Jan. 06, 2020	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1241	1GHz ~ 18GHz	Jun. 29, 2018	Feb. 15, 2019~ Mar. 29, 2019	Jun. 28, 2019	Radiation (03CH13-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800 N1D01N-06	37059&01	30MHz~1GHz	Oct. 13, 2018	Feb. 15, 2019~ Mar. 29, 2019	Oct. 12, 2019	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Dec. 05, 2018	Feb. 15, 2019~ Mar. 29, 2019	Dec. 04, 2019	Radiation (03CH13-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 14, 2018	Feb. 15, 2019~ Mar. 29, 2019	Nov. 13, 2020	Radiation (03CH13-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590074	1GHz~18GHz	May 21, 2018	Feb. 15, 2019~ Mar. 29, 2019	May 20, 2019	Radiation (03CH13-HY)
Amplifier	Sonoma-Instrument	310 N	187282	9KHz~1GHz	Dec. 18, 2018	Feb. 15, 2019~ Mar. 29, 2019	Dec. 17, 2019	Radiation (03CH13-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 16, 2018	Feb. 15, 2019~ Mar. 29, 2019	Jul. 15, 2019	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0030/126E	30M-18G	Feb. 13, 2019	Feb. 15, 2019~ Mar. 29, 2019	Feb. 12, 2020	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	804793/4	30M-18G	Feb. 13, 2019	Feb. 15, 2019~ Mar. 29, 2019	Feb. 12, 2020	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24961/4	30M-18G	Feb. 13, 2019	Feb. 15, 2019~ Mar. 29, 2019	Feb. 12, 2020	Radiation (03CH13-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Apr. 17, 2018	Feb. 15, 2019~ Mar. 29, 2019	Apr. 16, 2019	Radiation (03CH13-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Feb. 15, 2019~ Mar. 29, 2019	N/A	Radiation (03CH13-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Feb. 15, 2019~ Mar. 29, 2019	N/A	Radiation (03CH13-HY)
Software	AUDIX	E3 6.2009-8-24c	RK-001124	N/A	N/A	Feb. 15, 2019~ Mar. 29, 2019	N/A	Radiation (03CH13-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY54130085	20Hz ~ 8.4GHz	Nov. 01, 2018	Feb. 15, 2019~ Mar. 29, 2019	Oct. 31, 2019	Radiation (03CH13-HY)
Filter	Woken	WHKX8-5872.5-6750-18000-40ST	SN3	6.75G Highpass	Sep.17, 2018	Feb. 15, 2019~ Mar. 29, 2019	Sep.16, 2019	Radiation (03CH13-HY)
Filter	Wainwright	WHKX12-1080-1200-15000-60ST	SN3	1.2G Low Pass	Jul. 05, 2018	Feb. 15, 2019~ Mar. 29, 2019	Jul. 04, 2019	Radiation (03CH13-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.2**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.9**

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.4**

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.3**

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Howard Lin	Temperature:	21~25	°C
Test Date:	2019/2/13~2019/3/8	Relative Humidity:	51~54	%

Report Number : FR911708E

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)			Note
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	36	5180	22.03	-	41.07	-	-		23.01	-		
11a	6Mbps	1	44	5220	23.38	-	41.68	-	-		23.01	-		
11a	6Mbps	1	48	5240	19.03	-	41.15	-	-		22.79	-		
HT20	MCS0	1	36	5180	19.18	-	36.91	-	-		22.83	-		
HT20	MCS0	1	44	5220	19.38	-	38.53	-	-		22.87	-		
HT20	MCS0	1	48	5240	18.23	-	40.02	-	-		22.61	-		
HT40	MCS0	1	38	5190	36.76	-	44.32	-	-		23.01	-		
HT40	MCS0	1	46	5230	36.66	-	46.19	-	-		23.01	-		
VHT80	MCS0	1	42	5210	76.96	-	81.52	-	-		23.01	-		

TEST RESULTS DATA
Average Power Table

FCC Band I													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)			Pass/Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	36	5180	19.10	-		24.00	-	4.50	-		Pass
11a	6Mbps	1	44	5220	19.10	-		24.00	-	4.50	-		Pass
11a	6Mbps	1	48	5240	19.10	-		24.00	-	4.50	-		Pass
HT20	MCS0	1	36	5180	18.30	-		24.00	-	4.50	-		Pass
HT20	MCS0	1	44	5220	18.30	-		24.00	-	4.50	-		Pass
HT20	MCS0	1	48	5240	18.30	-		24.00	-	4.50	-		Pass
HT40	MCS0	1	38	5190	14.90	-		24.00	-	4.50	-		Pass
HT40	MCS0	1	46	5230	18.00	-		24.00	-	4.50	-		Pass
VHT20	MCS0	1	36	5180	18.20	-		24.00	-	4.50	-		Pass
VHT20	MCS0	1	44	5220	18.20	-		24.00	-	4.50	-		Pass
VHT20	MCS0	1	48	5240	18.20	-		24.00	-	4.50	-		Pass
VHT40	MCS0	1	38	5190	14.80	-		24.00	-	4.50	-		Pass
VHT40	MCS0	1	46	5230	17.90	-		24.00	-	4.50	-		Pass
VHT80	MCS0	1	42	5210	13.70	-		24.00	-	4.50	-		Pass

Report Number : FR911708E

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
					Ant 1	Ant 2	Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	36	5180	0.00	-	7.95	-		11.00	-	4.50	-		Pass
11a	6Mbps	1	44	5220	0.00	-	8.12	-		11.00	-	4.50	-		Pass
11a	6Mbps	1	48	5240	0.00	-	8.09	-		11.00	-	4.50	-		Pass
HT20	MCS0	1	36	5180	0.00	-	6.74	-		11.00	-	4.50	-		Pass
HT20	MCS0	1	44	5220	0.00	-	6.77	-		11.00	-	4.50	-		Pass
HT20	MCS0	1	48	5240	0.00	-	6.87	-		11.00	-	4.50	-		Pass
HT40	MCS0	1	38	5190	0.00	-	0.07	-		11.00	-	4.50	-		Pass
HT40	MCS0	1	46	5230	0.00	-	-0.07	-		11.00	-	4.50	-		Pass
VHT80	MCS0	1	42	5210	0.00	-	-4.37	-		11.00	-	4.50	-		Pass

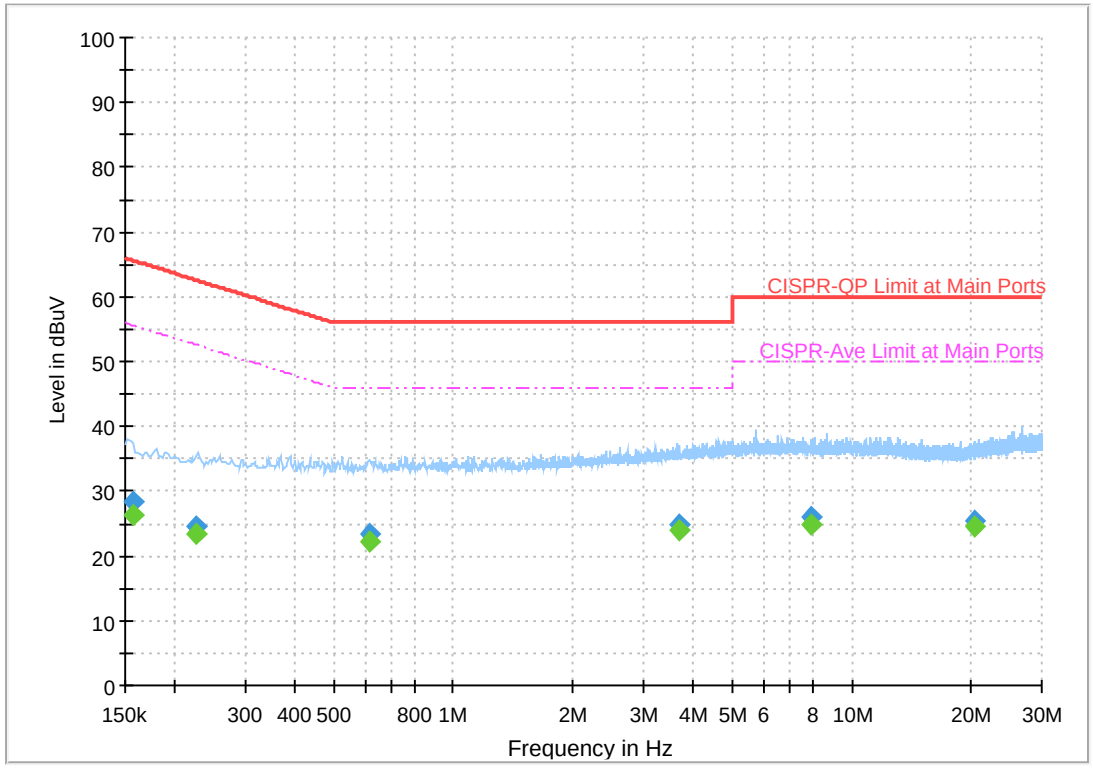
Appendix B. AC Conducted Emission Test Results

Test Engineer :	Jimmy Chang	**Temperature :**	24~26℃
		Relative Humidity :	51~53%

EUT Information

Report NO :	911708
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line

Full Spectrum



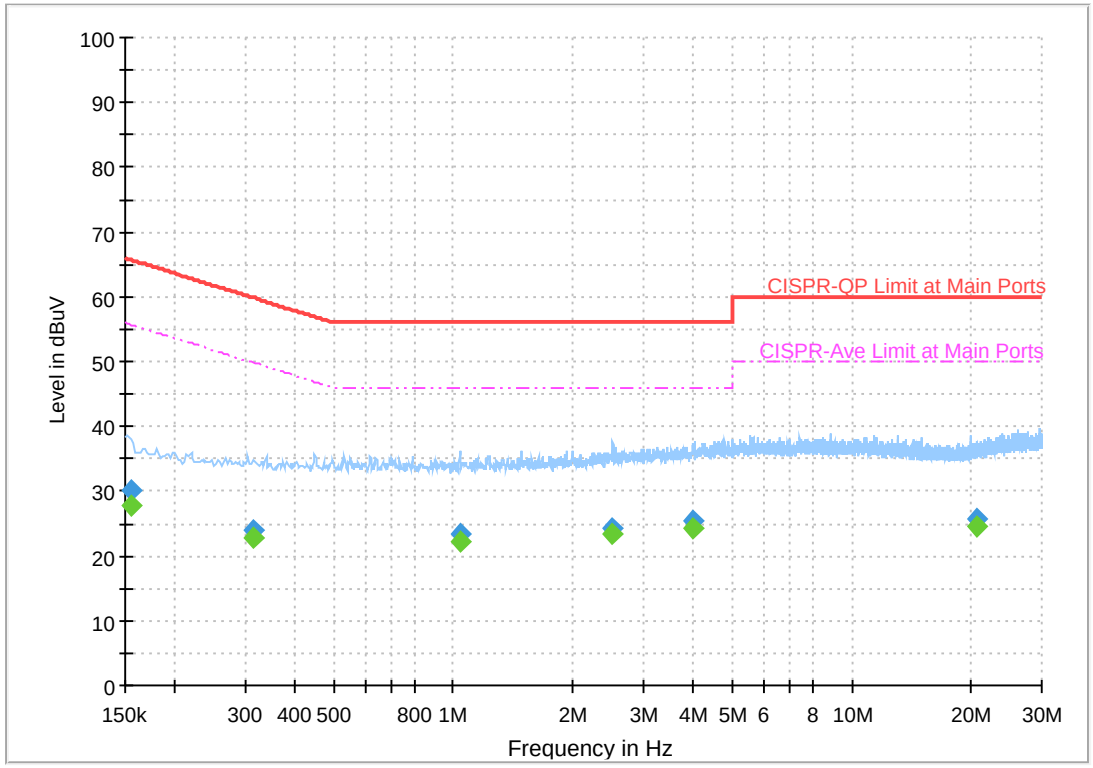
Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.156750	28.22	---	65.63	37.41	L1	OFF	19.5
0.156750	---	26.35	55.63	29.28	L1	OFF	19.5
0.226500	24.46	---	62.58	38.12	L1	OFF	19.5
0.226500	---	23.37	52.58	29.20	L1	OFF	19.5
0.618000	23.46	---	56.00	32.54	L1	OFF	19.6
0.618000	---	22.31	46.00	23.69	L1	OFF	19.6
3.696000	24.91	---	56.00	31.09	L1	OFF	19.7
3.696000	---	24.04	46.00	21.96	L1	OFF	19.7
7.941750	26.09	---	60.00	33.91	L1	OFF	19.8
7.941750	---	24.98	50.00	25.02	L1	OFF	19.8
20.323500	25.40	---	60.00	34.60	L1	OFF	20.3
20.323500	---	24.43	50.00	25.57	L1	OFF	20.3

EUT Information

Report NO :	911708
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral

Full Spectrum



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.154500	30.07	---	65.75	35.68	N	OFF	19.5
0.154500	---	27.89	55.75	27.87	N	OFF	19.5
0.314250	23.99	---	59.86	35.87	N	OFF	19.5
0.314250	---	22.75	49.86	27.11	N	OFF	19.5
1.041000	23.36	---	56.00	32.64	N	OFF	19.6
1.041000	---	22.33	46.00	23.67	N	OFF	19.6
2.514750	24.24	---	56.00	31.76	N	OFF	19.6
2.514750	---	23.36	46.00	22.64	N	OFF	19.6
3.984000	25.43	---	56.00	30.57	N	OFF	19.7
3.984000	---	24.24	46.00	21.76	N	OFF	19.7
20.481000	25.61	---	60.00	34.39	N	OFF	20.3
20.481000	---	24.51	50.00	25.49	N	OFF	20.3

Appendix C. Radiated Spurious Emission

Test Engineer :	Alex Jheng, Fu Chen, and Wilson Wu	Temperature :	24~26°C
		Relative Humidity :	50~55%

Band 1 - 5150~5250MHz

WIFI 802.11a (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH 36 5180MHz		5148.72	58.06	-15.94	74	49.78	31.69	6.08	29.49	207	30	P	H
		5150	46.65	-7.35	54	38.37	31.69	6.08	29.49	207	30	A	H
	*	5180	107.79	-	-	99.47	31.71	6.1	29.49	207	30	P	H
	*	5180	100.3	-	-	91.98	31.71	6.1	29.49	207	30	A	H
													H
													H
		5149.5	62.7	-11.3	74	54.42	31.69	6.08	29.49	267	180	P	V
		5150	47.89	-6.11	54	39.61	31.69	6.08	29.49	267	180	A	V
	*	5180	111.33	-	-	103.01	31.71	6.1	29.49	267	180	P	V
	*	5180	103.1	-	-	94.78	31.71	6.1	29.49	267	180	A	V
													V
													V
802.11a CH 44 5220MHz		5134.16	50.52	-23.48	74	42.25	31.68	6.07	29.48	217	28	P	H
		5149.76	40.23	-13.77	54	31.95	31.69	6.08	29.49	217	28	A	H
	*	5220	109.91	-	-	101.57	31.73	6.11	29.5	217	28	P	H
	*	5220	101.89	-	-	93.55	31.73	6.11	29.5	217	28	A	H
		5438.72	49.45	-24.55	74	40.97	31.86	6.16	29.54	217	28	P	H
		5351.92	38.76	-15.24	54	30.35	31.81	6.12	29.52	217	28	A	H
		5119.6	52.07	-21.93	74	43.81	31.67	6.07	29.48	284	175	P	V
		5148.72	41.36	-12.64	54	33.08	31.69	6.08	29.49	284	175	A	V
	*	5220	112.36	-	-	104.02	31.73	6.11	29.5	284	175	P	V
	*	5220	104.81	-	-	96.47	31.73	6.11	29.5	284	175	A	V
		5352.76	49.34	-24.66	74	40.93	31.81	6.12	29.52	284	175	P	V
		5350	40.01	-13.99	54	31.6	31.81	6.12	29.52	284	175	A	V

802.11a CH 48 5240MHz		5120.38	50.21	-23.79	74	41.95	31.67	6.07	29.48	206	29	P	H
		5145.86	40.22	-13.78	54	31.94	31.69	6.08	29.49	206	29	A	H
	*	5240	108.63	-	-	100.28	31.74	6.11	29.5	206	29	P	H
	*	5240	101.04	-	-	92.69	31.74	6.11	29.5	206	29	A	H
		5397	48.74	-25.26	74	40.31	31.84	6.12	29.53	206	29	P	H
		5352.2	39.23	-14.77	54	30.82	31.81	6.12	29.52	206	29	A	H
		5050.44	51.13	-22.87	74	42.94	31.63	6.03	29.47	276	171	P	V
		5127.92	41.03	-12.97	54	32.76	31.68	6.07	29.48	276	171	A	V
	*	5240	112.46	-	-	104.11	31.74	6.11	29.5	276	171	P	V
	*	5240	104.3	-	-	95.95	31.74	6.11	29.5	276	171	A	V
		5352.48	49.62	-24.38	74	41.21	31.81	6.12	29.52	276	171	P	V
		5351.92	40.9	-13.1	54	32.49	31.81	6.12	29.52	276	171	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.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 36 5180MHz		10360	58.89	-9.31	68.2	66.18	39.76	9.91	56.96	100	0	P	H
		15540	46.95	-27.05	74	52.33	38.62	12.65	56.65	100	0	P	H
													H
													H
		10360	60.19	-8.01	68.2	67.48	39.76	9.91	56.96	100	0	P	V
		15540	48.63	-25.37	74	54.01	38.62	12.65	56.65	100	0	P	V
													V
													V
802.11a CH 44 5220MHz		10440	58.99	-9.21	68.2	66.08	39.88	9.95	56.92	100	0	P	H
		15660	48.13	-25.87	74	53.59	38.33	12.72	56.51	100	0	P	H
													H
													H
		10440	60.97	-7.23	68.2	68.06	39.88	9.95	56.92	100	0	P	V
		15660	49.97	-24.03	74	55.43	38.33	12.72	56.51	100	0	P	V
													V
													V
802.11a CH 48 5240MHz		10480	60.42	-7.78	68.2	67.39	39.97	9.97	56.91	100	0	P	H
		15720	48.26	-25.74	74	53.8	38.16	12.74	56.44	100	0	P	H
													H
													H
		10480	60.25	-7.95	68.2	67.22	39.97	9.97	56.91	100	0	P	V
		15720	50.53	-23.47	74	56.07	38.16	12.74	56.44	100	0	P	V
													V
													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.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
		5150	58.19	-15.81	74	49.91	31.69	6.08	29.49	205	21	P	H
		5150	47.15	-6.85	54	38.87	31.69	6.08	29.49	205	21	A	H
	*	5180	107.44	-	-	99.12	31.71	6.1	29.49	205	21	P	H
	*	5180	99.89	-	-	91.57	31.71	6.1	29.49	205	21	A	H
802.11n													H
HT20													H
CH 36		5147.42	61	-13	74	52.72	31.69	6.08	29.49	269	175	P	V
5180MHz		5150	49.51	-4.49	54	41.23	31.69	6.08	29.49	269	175	A	V
	*	5180	111.03	-	-	102.71	31.71	6.1	29.49	269	175	P	V
	*	5180	103.09	-	-	94.77	31.71	6.1	29.49	269	175	A	V
													V
													V
		5113.88	50.67	-23.33	74	42.42	31.67	6.06	29.48	218	28	P	H
		5149.76	40.48	-13.52	54	32.2	31.69	6.08	29.49	218	28	A	H
	*	5220	108.36	-	-	100.02	31.73	6.11	29.5	218	28	P	H
	*	5220	100.75	-	-	92.41	31.73	6.11	29.5	218	28	A	H
802.11n		5431.16	48.78	-25.22	74	40.31	31.86	6.15	29.54	218	28	P	H
HT20		5350	38.94	-15.06	54	30.53	31.81	6.12	29.52	218	28	A	H
CH 44		5114.66	51.19	-22.81	74	42.94	31.67	6.06	29.48	286	173	P	V
5220MHz		5149.76	41.59	-12.41	54	33.31	31.69	6.08	29.49	286	173	A	V
	*	5220	111.19	-	-	102.85	31.73	6.11	29.5	286	173	P	V
	*	5220	103.46	-	-	95.12	31.73	6.11	29.5	286	173	A	V
		5353.04	50.05	-23.95	74	41.64	31.81	6.12	29.52	286	173	P	V
		5351.08	40.24	-13.76	54	31.83	31.81	6.12	29.52	286	173	A	V

		5136.5	50.01	-23.99	74	41.73	31.68	6.08	29.48	205	29	P	H
		5149.76	40.35	-13.65	54	32.07	31.69	6.08	29.49	205	29	A	H
	*	5240	108.74	-	-	100.39	31.74	6.11	29.5	205	29	P	H
	*	5240	100.44	-	-	92.09	31.74	6.11	29.5	205	29	A	H
802.11n		5437.32	49.39	-24.61	74	40.91	31.86	6.16	29.54	205	29	P	H
HT20		5351.92	39.3	-14.7	54	30.89	31.81	6.12	29.52	205	29	A	H
CH 48		5129.74	51.58	-22.42	74	43.31	31.68	6.07	29.48	277	171	P	V
5240MHz		5128.18	41.21	-12.79	54	32.94	31.68	6.07	29.48	277	171	A	V
	*	5240	111.5	-	-	103.15	31.74	6.11	29.5	277	171	P	V
	*	5240	103.73	-	-	95.38	31.74	6.11	29.5	277	171	A	V
		5360.04	50.37	-23.63	74	41.96	31.81	6.12	29.52	277	171	P	V
		5351.64	41.11	-12.89	54	32.7	31.81	6.12	29.52	277	171	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.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
		10360	56.61	-11.59	68.2	63.9	39.76	9.91	56.96	100	0	P	H
		15540	46.14	-27.86	74	51.52	38.62	12.65	56.65	100	0	P	H
802.11n													H
HT20													H
CH 36		10360	57.12	-11.08	68.2	64.41	39.76	9.91	56.96	100	0	P	V
5180MHz		15540	48.19	-25.81	74	53.57	38.62	12.65	56.65	100	0	P	V
													V
													V
		10440	57.7	-10.5	68.2	64.79	39.88	9.95	56.92	100	0	P	H
		15660	46.19	-27.81	74	51.65	38.33	12.72	56.51	100	0	P	H
802.11n													H
HT20													H
CH 44		10440	60.17	-8.03	68.2	67.26	39.88	9.95	56.92	100	0	P	V
5220MHz		15660	49.29	-24.71	74	54.75	38.33	12.72	56.51	100	0	P	V
													V
													V
		10480	59.62	-8.58	68.2	66.59	39.97	9.97	56.91	100	0	P	H
		15720	47.86	-26.14	74	53.4	38.16	12.74	56.44	100	0	P	H
802.11n													H
HT20													H
CH 48		10480	57.64	-10.56	68.2	64.61	39.97	9.97	56.91	100	0	P	V
5240MHz		15720	47.68	-26.32	74	53.22	38.16	12.74	56.44	100	0	P	V
													V
													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.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11n HT40 CH 38 5190MHz		5149.5	61.92	-12.08	74	53.64	31.69	6.08	29.49	221	29	P	H
		5150	48.21	-5.79	54	39.93	31.69	6.08	29.49	221	29	A	H
	*	5190	101.7	-	-	93.38	31.71	6.1	29.49	221	29	P	H
	*	5190	94.12	-	-	85.8	31.71	6.1	29.49	221	29	A	H
		5360.88	48.51	-25.49	74	40.09	31.82	6.12	29.52	221	29	P	H
		5459.16	38.67	-15.33	54	30.16	31.87	6.18	29.54	221	29	A	H
		5148.98	63.69	-10.31	74	55.41	31.69	6.08	29.49	270	172	P	V
		5150	50.44	-3.56	54	42.16	31.69	6.08	29.49	270	172	A	V
	*	5190	104.02	-	-	95.7	31.71	6.1	29.49	270	172	P	V
	*	5190	96.66	-	-	88.34	31.71	6.1	29.49	270	172	A	V
		5381.04	49.56	-24.44	74	41.14	31.83	6.12	29.53	270	172	P	V
		5350	39.59	-14.41	54	31.18	31.81	6.12	29.52	270	172	A	V
802.11n HT40 CH 46 5230MHz		5142.74	50.84	-23.16	74	42.56	31.69	6.08	29.49	215	28	P	H
		5150	42.45	-11.55	54	34.17	31.69	6.08	29.49	215	28	A	H
	*	5230	104.42	-	-	96.07	31.74	6.11	29.5	215	28	P	H
	*	5230	97.04	-	-	88.69	31.74	6.11	29.5	215	28	A	H
		5412.4	48.79	-25.21	74	40.34	31.85	6.13	29.53	215	28	P	H
		5351.08	38.99	-15.01	54	30.58	31.81	6.12	29.52	215	28	A	H
		5146.64	54.74	-19.26	74	46.46	31.69	6.08	29.49	280	170	P	V
		5150	43.6	-10.4	54	35.32	31.69	6.08	29.49	280	170	A	V
	*	5230	107.36	-	-	99.01	31.74	6.11	29.5	280	170	P	V
	*	5230	99.7	-	-	91.35	31.74	6.11	29.5	280	170	A	V
		5354.16	49.51	-24.49	74	41.1	31.81	6.12	29.52	280	170	P	V
		5350	40.61	-13.39	54	32.2	31.81	6.12	29.52	280	170	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.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
		10380	51.62	-16.58	68.2	58.86	39.79	9.92	56.95	100	0	P	H
		15570	45.93	-28.07	74	51.36	38.53	12.66	56.62	100	0	P	H
802.11n													H
HT40													H
CH 38		10380	50.66	-17.54	68.2	57.9	39.79	9.92	56.95	100	0	P	V
5190MHz		15570	46.2	-27.8	74	51.63	38.53	12.66	56.62	100	0	P	V
													V
													V
		10460	55.58	-12.62	68.2	62.63	39.91	9.96	56.92	100	0	P	H
		15690	45.66	-28.34	74	51.17	38.24	12.72	56.47	100	0	P	H
802.11n													H
HT40													H
CH 46		10460	56.49	-11.71	68.2	63.54	39.91	9.96	56.92	100	0	P	V
5230MHz		15690	45.48	-28.52	74	50.99	38.24	12.72	56.47	100	0	P	V
													V
													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.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11ac VHT80 CH 42 5210MHz		5150	56.86	-17.14	74	48.58	31.69	6.08	29.49	203	29	P	H
		5150	48.04	-5.96	54	39.76	31.69	6.08	29.49	203	29	A	H
	*	5210	97.57	-	-	89.23	31.73	6.11	29.5	203	29	P	H
	*	5210	89.24	-	-	80.9	31.73	6.11	29.5	203	29	A	H
		5405.12	48.51	-25.49	74	40.07	31.84	6.13	29.53	203	29	P	H
		5459.16	38.55	-15.45	54	30.04	31.87	6.18	29.54	203	29	A	H
		5140.4	63.23	-10.77	74	54.95	31.69	6.08	29.49	264	170	P	V
		5150	49.94	-4.06	54	41.66	31.69	6.08	29.49	264	170	A	V
	*	5210	99.72	-	-	91.38	31.73	6.11	29.5	264	170	P	V
	*	5210	92.13	-	-	83.79	31.73	6.11	29.5	264	170	A	V
		5426.12	49.27	-24.73	74	40.81	31.85	6.15	29.54	264	170	P	V
		5350.52	39.66	-14.34	54	31.25	31.81	6.12	29.52	264	170	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.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
		10420	48.33	-19.87	68.2	55.47	39.85	9.94	56.93	100	0	P	H
		15630	46.63	-27.37	74	52.1	38.37	12.7	56.54	100	0	P	H
802.11ac													H
VHT80													H
CH 42		10420	48.87	-19.33	68.2	56.01	39.85	9.94	56.93	100	0	P	V
5210MHz		15630	45.05	-28.95	74	50.52	38.37	12.7	56.54	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

WIFI 802.11n HT40 (LF @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	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)
802.11n HT40 LF		32.7	23.15	-16.85	40	32.03	22.98	0.43	32.29	-	-	P	H
		91.02	25.45	-18.05	43.5	41.92	14.95	0.8	32.22	-	-	P	H
		95.88	33.08	-10.42	43.5	49.05	15.39	0.86	32.22	-	-	P	H
		342	37.21	-8.79	46	47.72	20.12	1.52	32.15	-	-	P	H
		663.3	40.39	-5.61	46	43.97	26.36	2.21	32.15	100	0	P	H
		872.6	32.97	-13.03	46	32.77	29.17	2.57	31.54	-	-	P	H
													H
													H
													H
													H
													H
													H
		32.43	36.63	-3.37	40	45.39	23.1	0.43	32.29	100	0	P	V
		46.2	29.52	-10.48	40	45.13	16.15	0.53	32.29	-	-	P	V
		51.06	27.11	-12.89	40	45.06	13.8	0.54	32.29	-	-	P	V
		348.3	28.87	-17.13	46	39.17	20.32	1.53	32.15	-	-	P	V
		662.6	37.31	-8.69	46	40.89	26.35	2.22	32.15	-	-	P	V
		955.2	32.32	-13.68	46	29.95	30.71	2.6	30.94	-	-	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	**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	Path	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. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path 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) + Path 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 D. Radiated Spurious Emission Plots

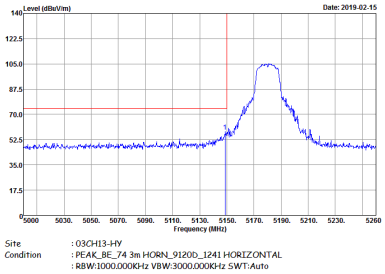
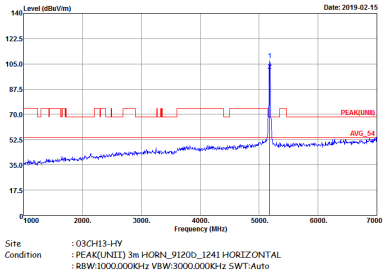
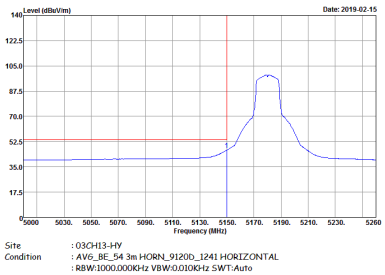
Test Engineer :	Alex Jheng, Fu Chen, and Wilson Wu	**Temperature :**	24~26°C
		Relative Humidity :	50~55%

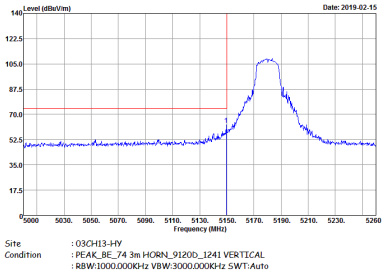
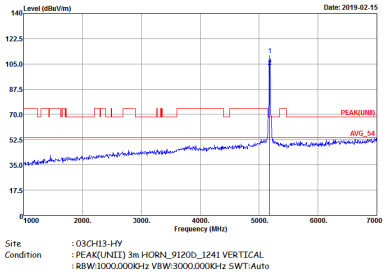
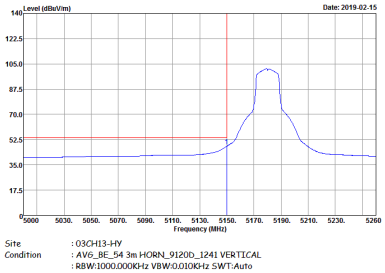
Note symbol

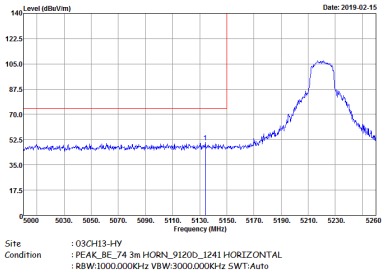
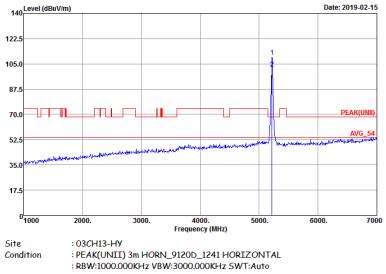
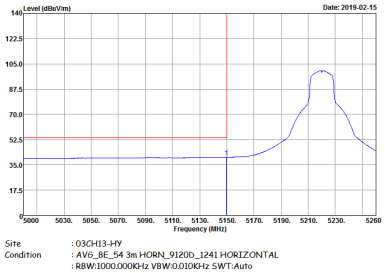
-L	**Low channel location**
-R	**High channel location**

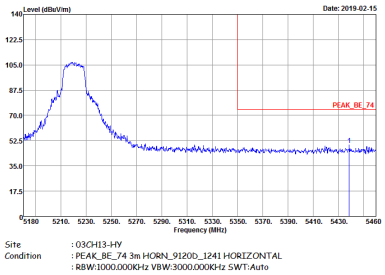
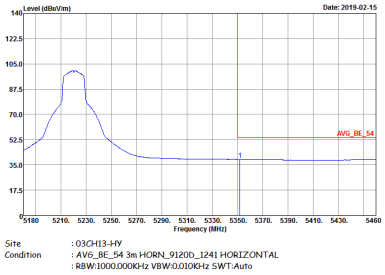
Band 1 - 5150~5250MHz

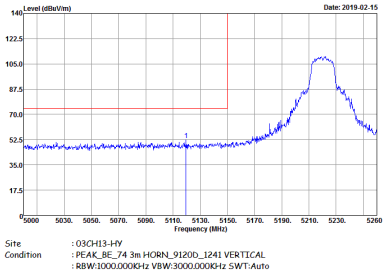
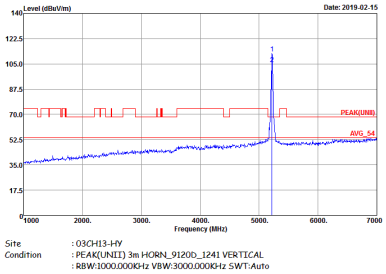
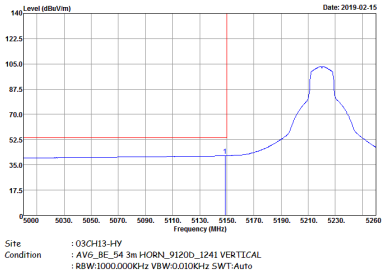
WIFI 802.11a (Band Edge @ 3m)

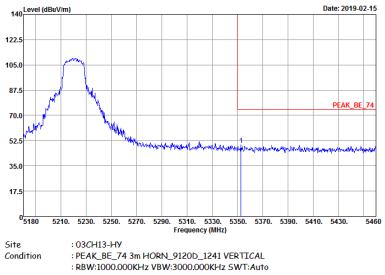
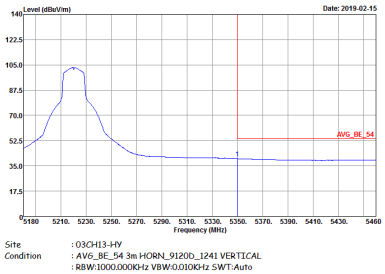
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH36 5180MHz	
1	Horizontal	Fundamental
Peak		
Avg.		Left blank

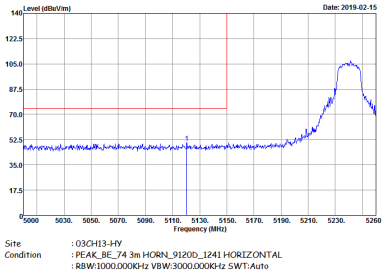
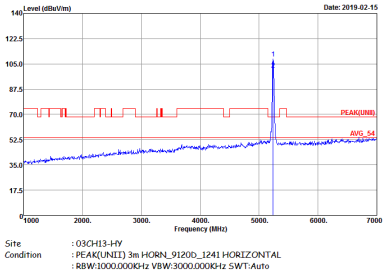
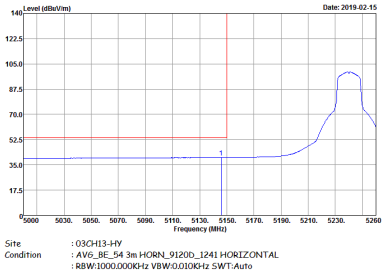
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH36 5180MHz	
1	Vertical	Fundamental
Peak		
Avg.		Left blank

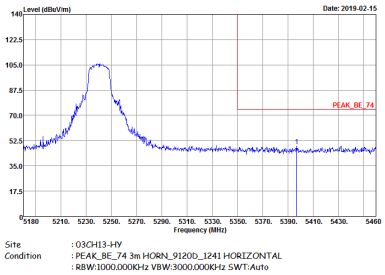
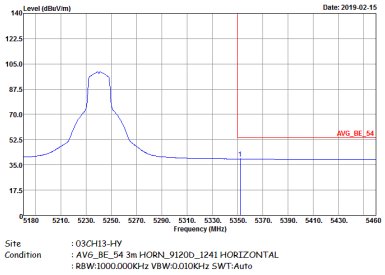
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH44 5220MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		Left blank

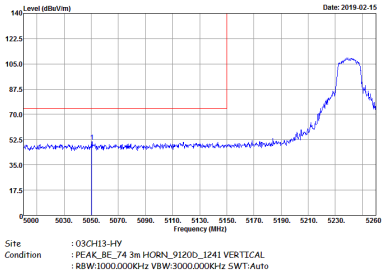
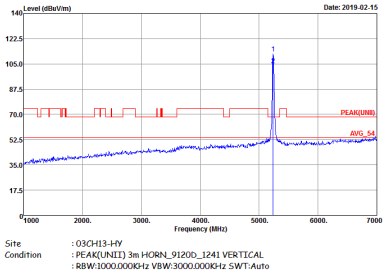
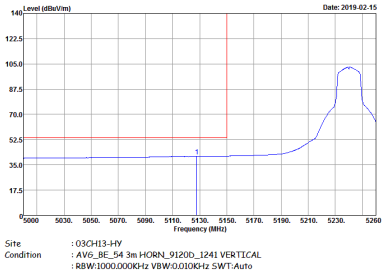
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH44 5220MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

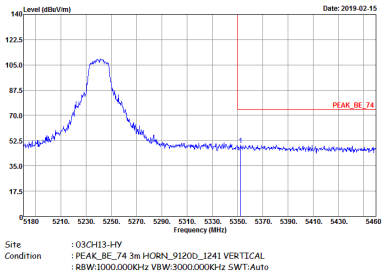
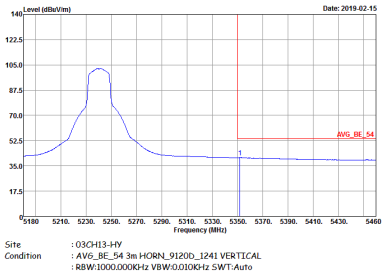
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH44 5220MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH44 5220MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH48 5240MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		Left blank

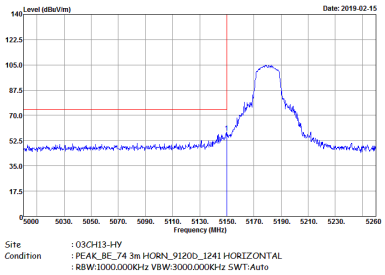
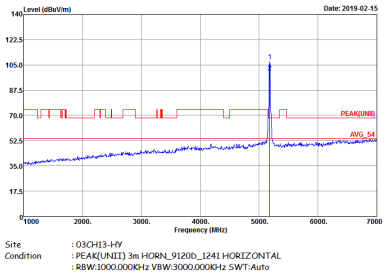
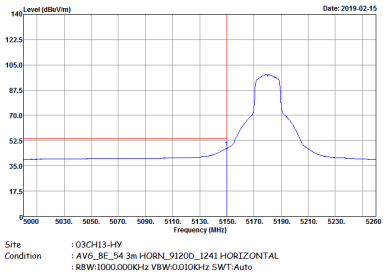
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH48 5240MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

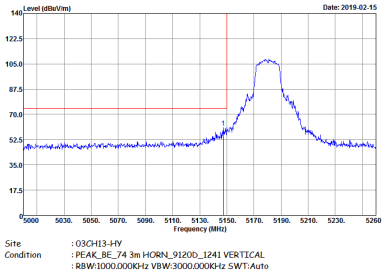
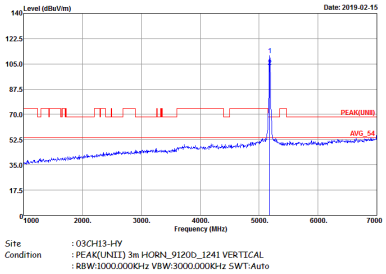
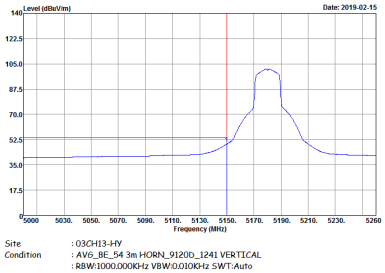
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH48 5240MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		Left blank

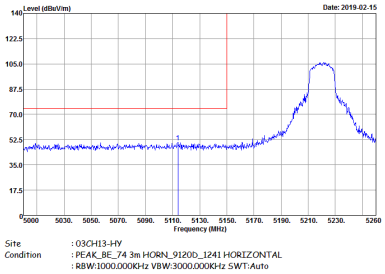
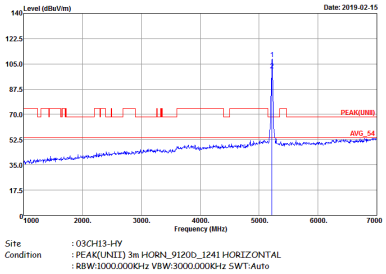
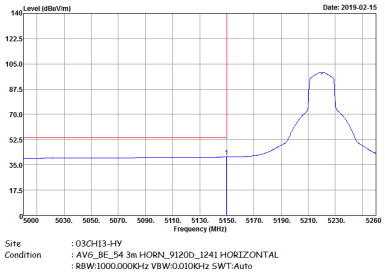
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH48 5240MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

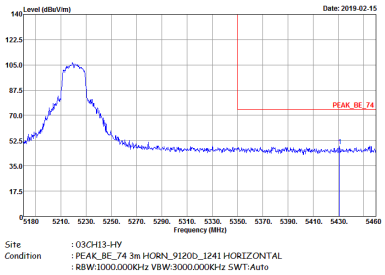
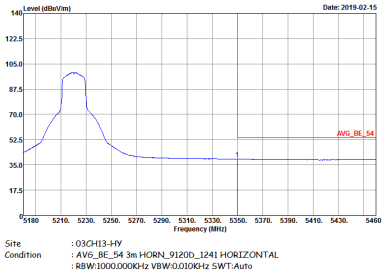
Band 1 5150~5250MHz

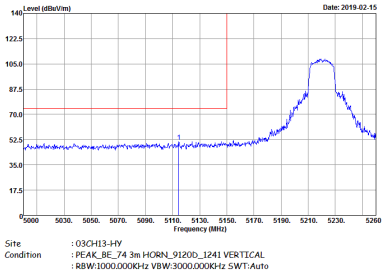
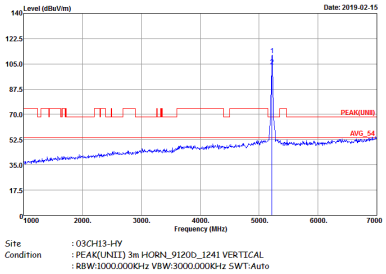
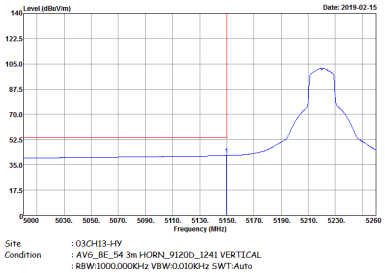
WIFI 802.11n HT20 (Band Edge @ 3m)

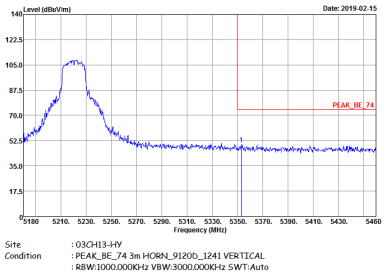
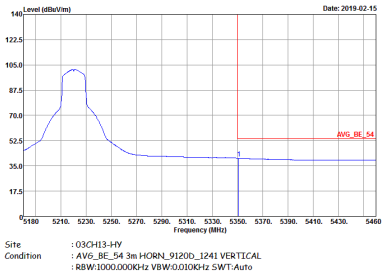
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH36 5180MHz	
1	Horizontal	Fundamental
Peak		
Avg.		Left blank

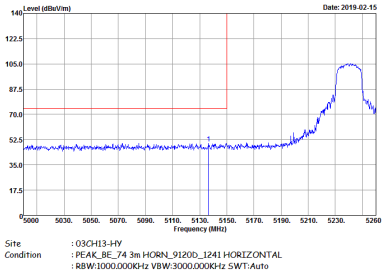
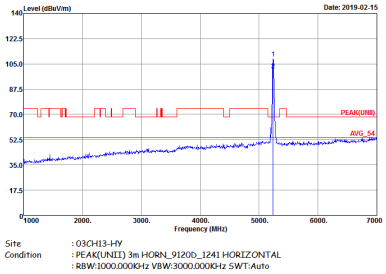
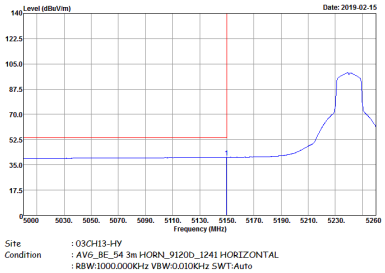
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH36 5180MHz	
1	Vertical	Fundamental
Peak		
Avg.		Left blank

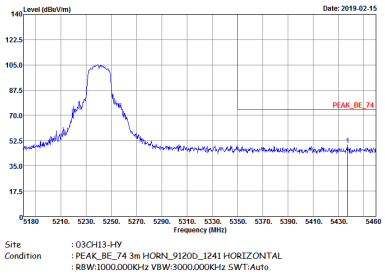
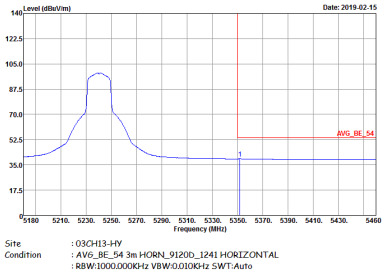
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH44 5220MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		Left blank

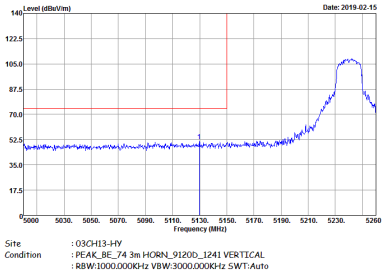
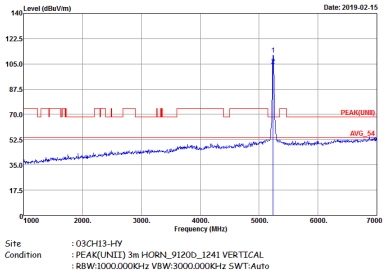
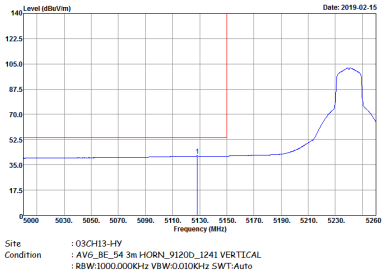
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH44 5220MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

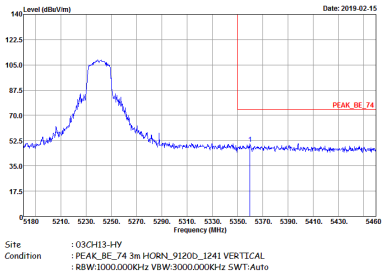
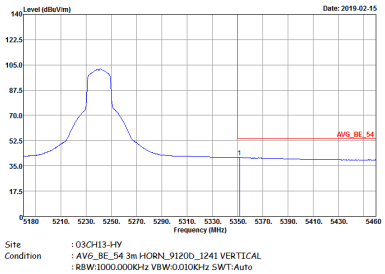
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH44 5220MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH44 5220MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH48 5240MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		Left blank

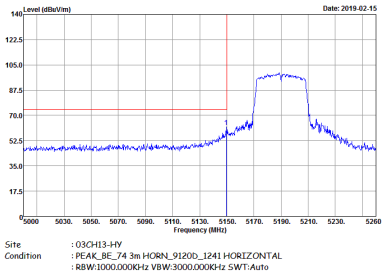
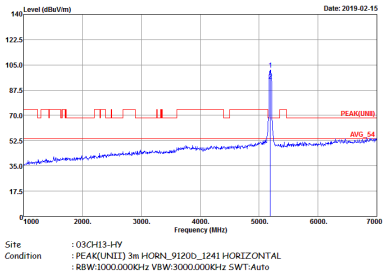
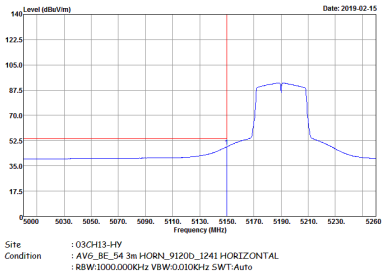
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH48 5240MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

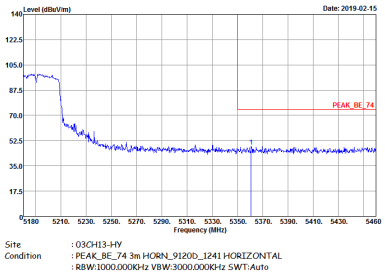
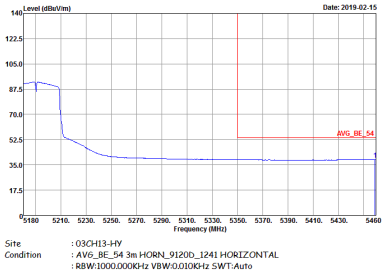
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH48 5240MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		Left blank

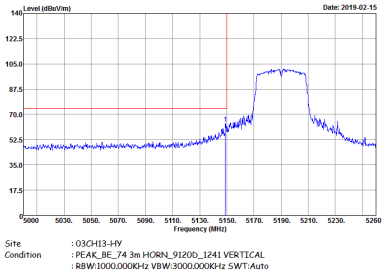
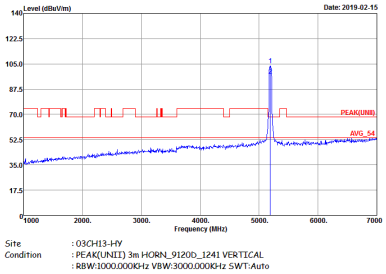
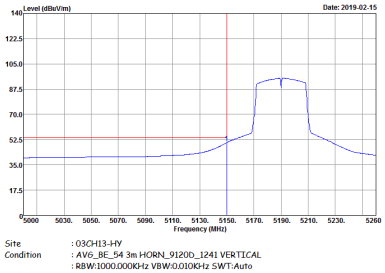
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT20 CH48 5240MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

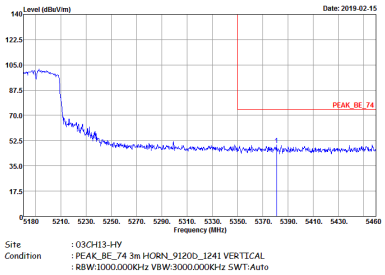
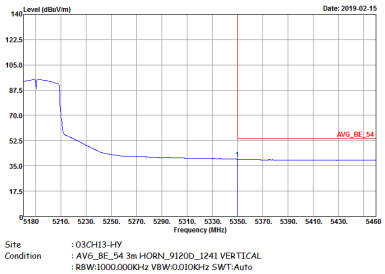
Band 1 5150~5250MHz

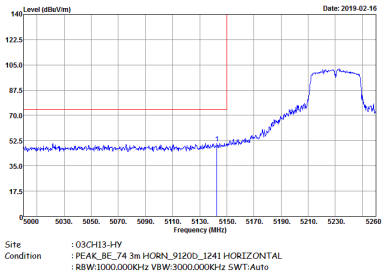
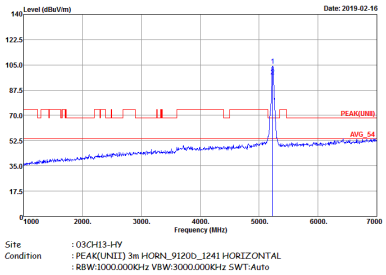
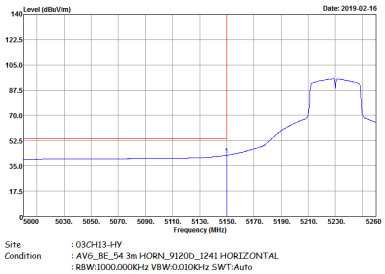
WIFI 802.11n HT40 (Band Edge @ 3m)

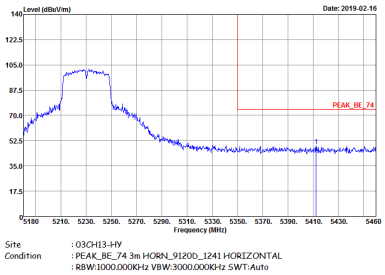
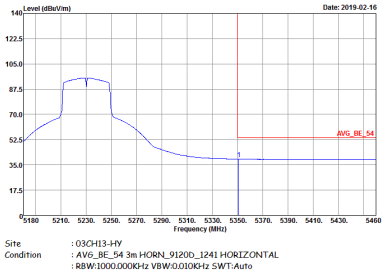
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT40 CH38 5190MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		Left blank

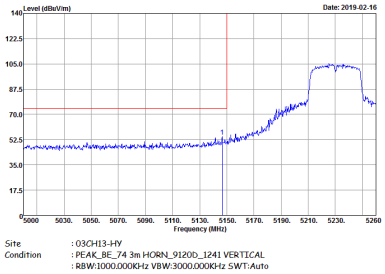
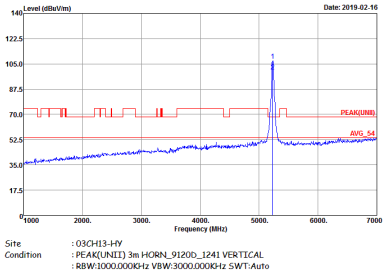
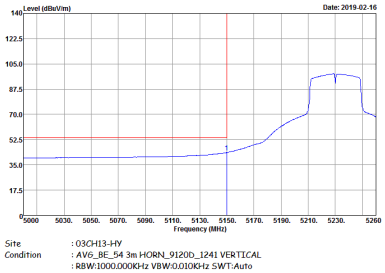
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT40 CH38 5190MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

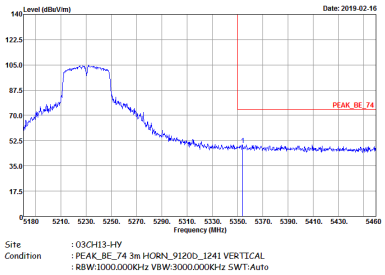
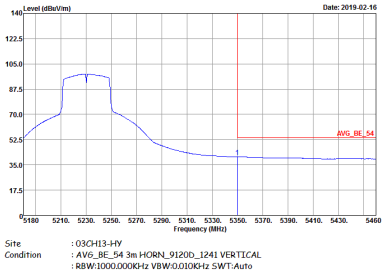
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT40 CH38 5190MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT40 CH38 5190MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT40 CH46 5230MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		Left blank

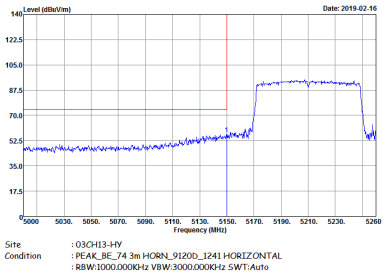
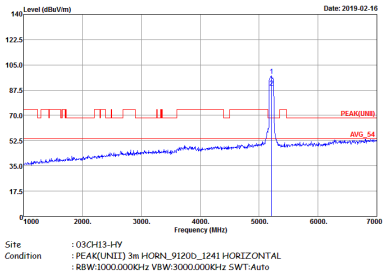
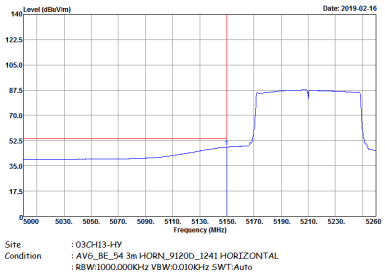
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT40 CH46 5230MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

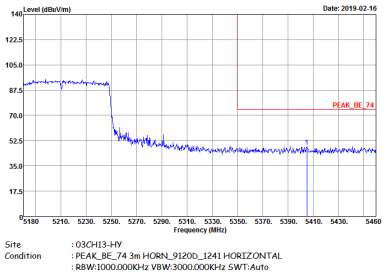
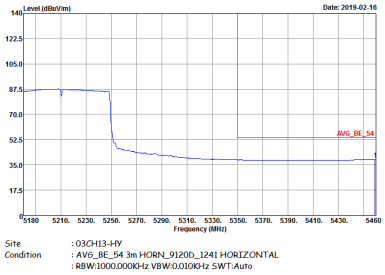
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT40 CH46 5230MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		Left blank

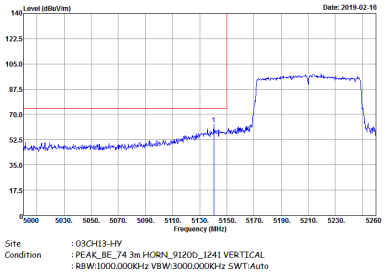
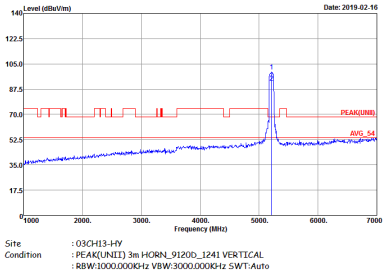
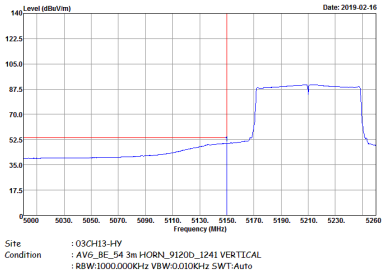
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11n HT40 CH46 5230MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

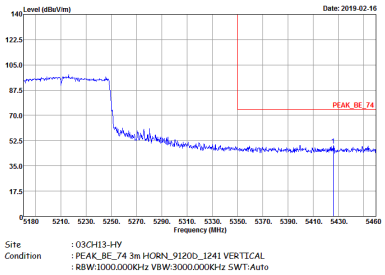
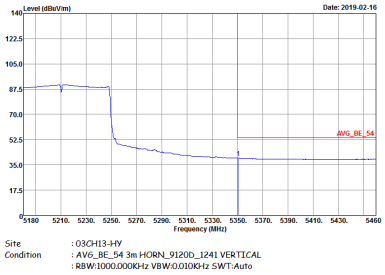
Band 1 5150~5250MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz - L	
1	Horizontal	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH13-HY Condition : PEAK(UNII) 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	Left blank

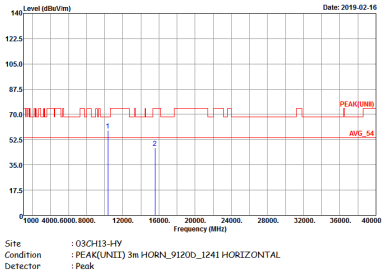
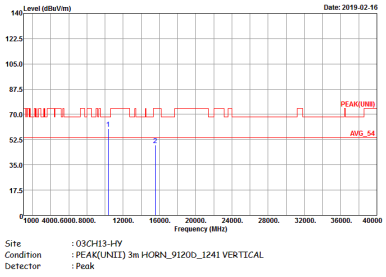
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

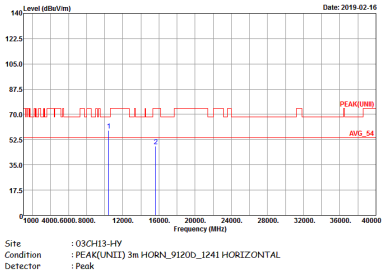
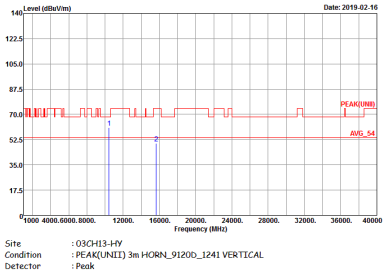
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		Left blank

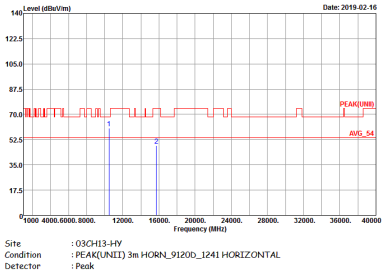
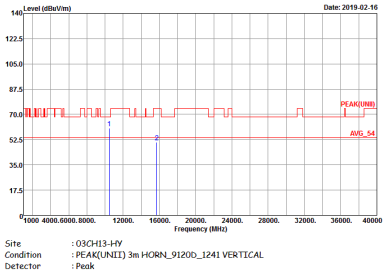
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

Band 1 - 5150~5250MHz

WIFI 802.11a (Harmonic @ 3m)

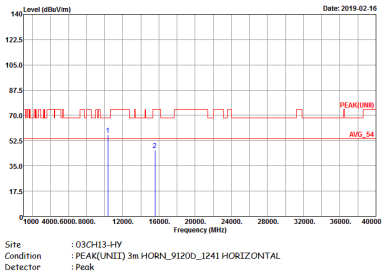
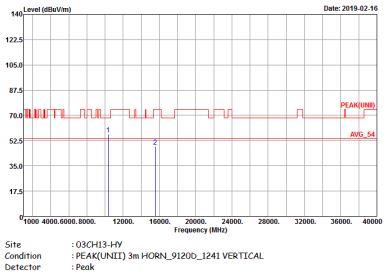
WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11a CH36 5180MHz	
1	Horizontal	Vertical
Peak Avg.		

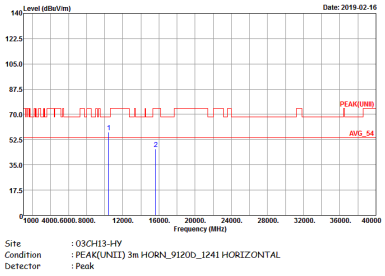
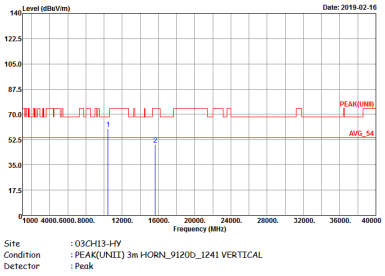
WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11a CH44 5220MHz	
1	Horizontal	Vertical
Peak Avg.		

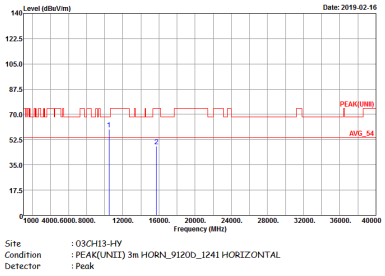
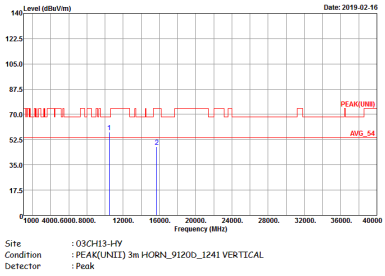
WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11a CH48 5240MHz	
1	Horizontal	Vertical
Peak Avg.		

Band 1 5150~5250MHz

WIFI 802.11n HT20 (Harmonic @ 3m)

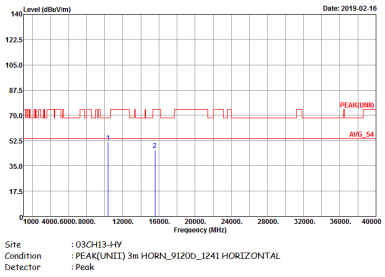
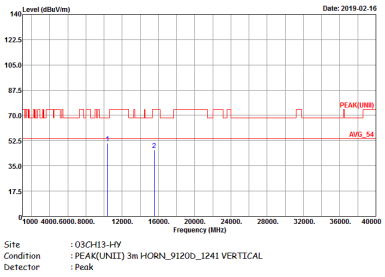
WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11n HT20 CH36 5180MHz	
1	Horizontal	Vertical
Peak Avg.		

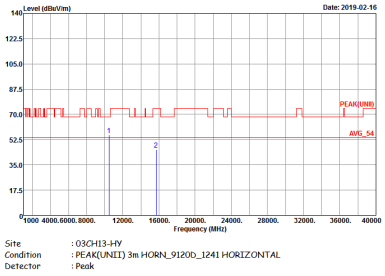
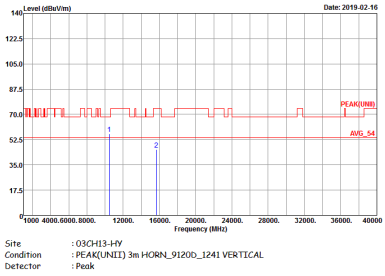
WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11n HT20 CH44 5220MHz	
1	Horizontal	Vertical
Peak Avg.		

WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11n HT20 CH48 5240MHz	
1	Horizontal	Vertical
Peak Avg.		

Band 1 5150~5250MHz

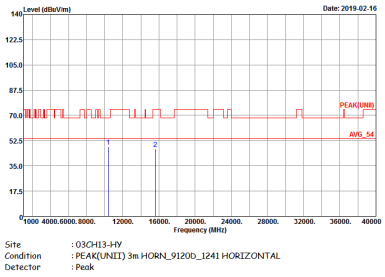
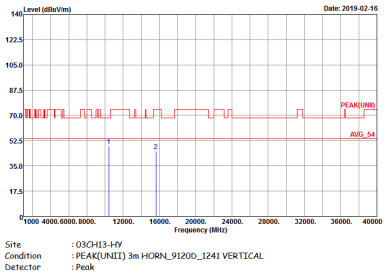
WIFI 802.11n HT40 (Harmonic @ 3m)

WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11n HT40 CH38 5190MHz	
1	Horizontal	Vertical
Peak Avg.		

WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11n HT40 CH46 5230MHz	
1	Horizontal	Vertical
Peak Avg.		

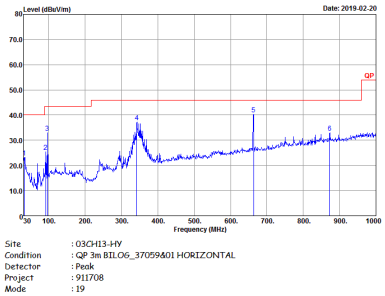
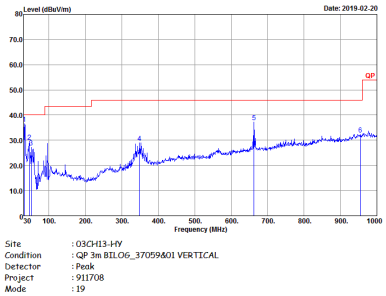
Band 1 5150~5250MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

WIFI	Band 1 5150~5250MHz Harmonic @ 3m	
ANT	802.11ac VHT80 CH42 5210MHz	
1	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

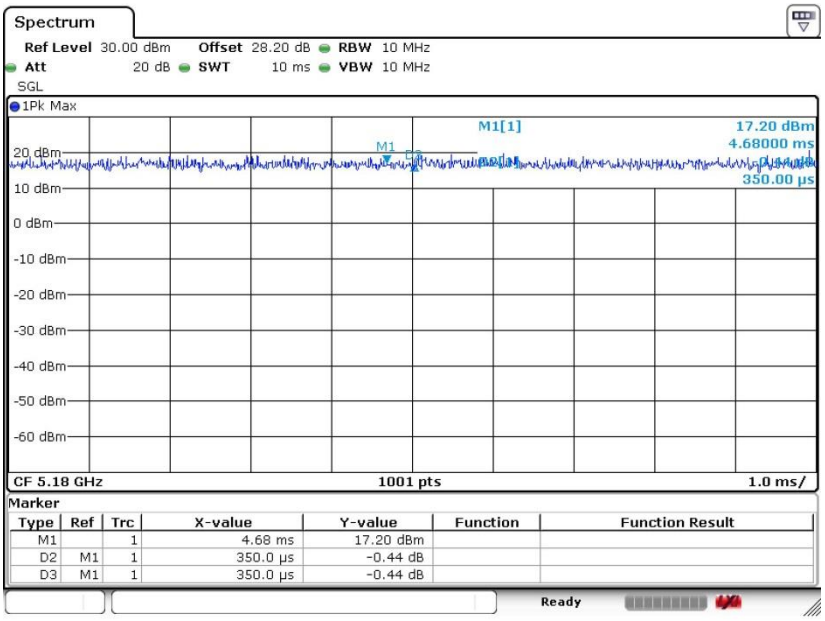
5GHz WIFI 802.11n HT40 (LF)

WIFI	5GHz WIFI	
ANT	802.11n HT40 LF	
1	Horizontal	Vertical
QP / Peak		

Appendix E. Duty Cycle Plots

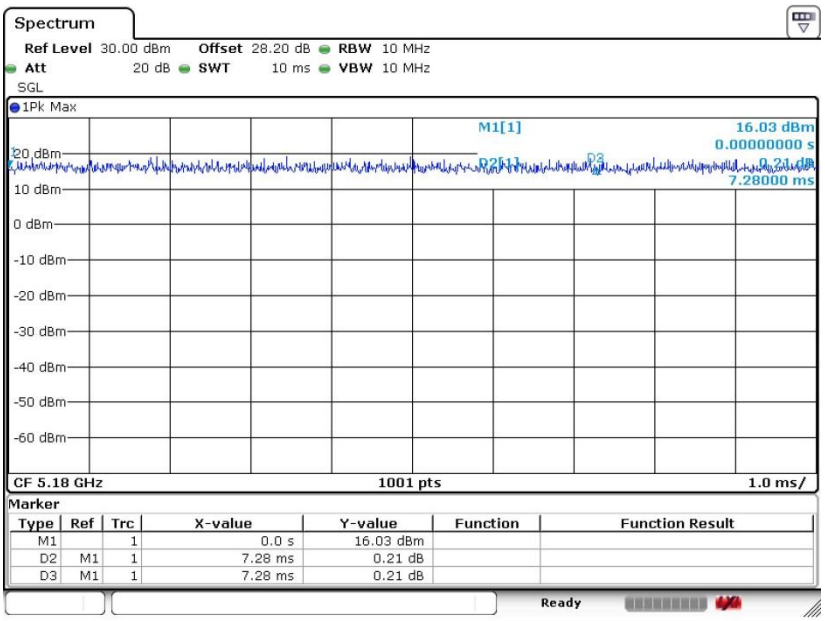
Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
802.11a	100.00	350	2.86	10Hz	0.00
5GHz 802.11n HT20	100.00	7280	0.14	10Hz	0.00
5GHz 802.11n HT40	100.00	5330	0.19	10Hz	0.00
5GHz 802.11ac VHT20	100.00	2520	0.40	10Hz	0.00
5GHz 802.11ac VHT40	100.00	2200	0.45	10Hz	0.00
5GHz 802.11ac VHT80	100.00	150	6.67	10Hz	0.00

802.11a



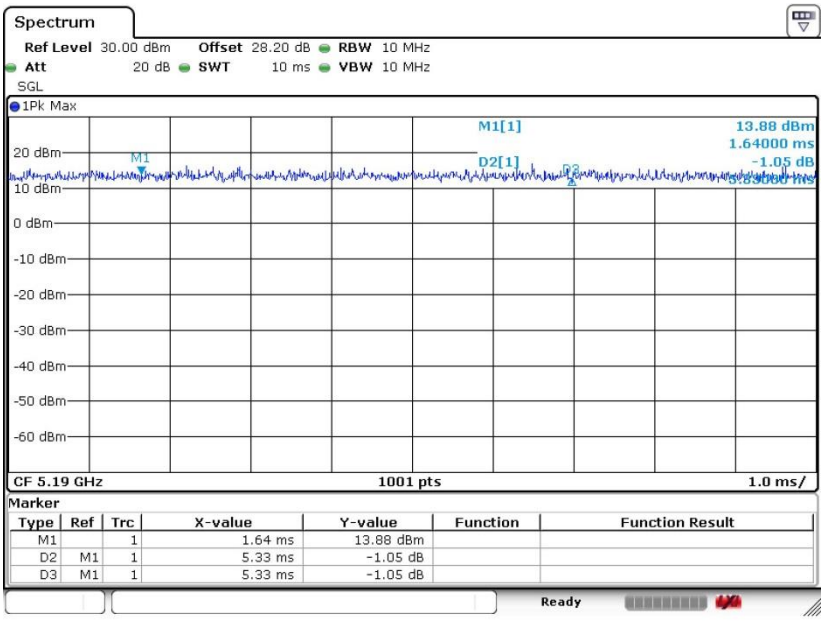
Date: 13.FEB.2019 09:13:34

802.11n HT20



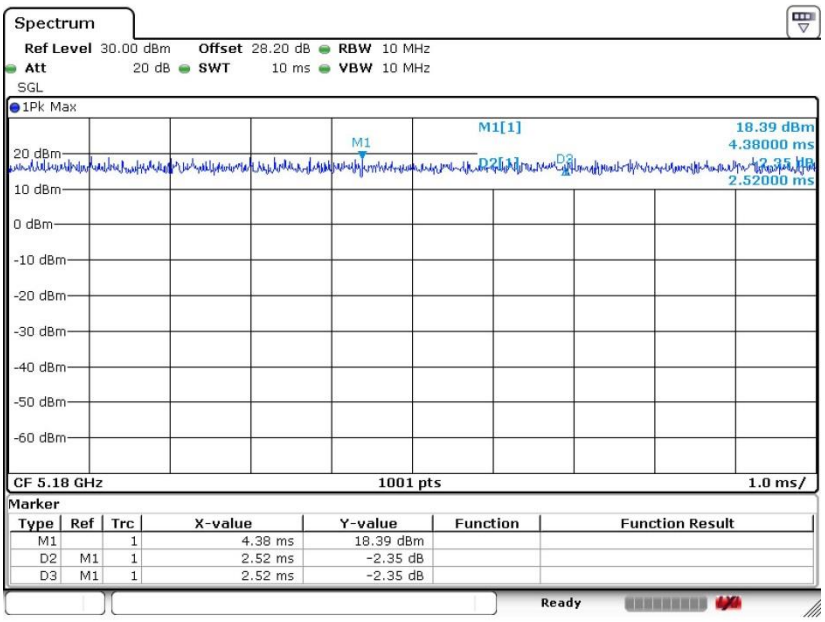
Date: 13.FEB.2019 09:15:17

802.11n HT40



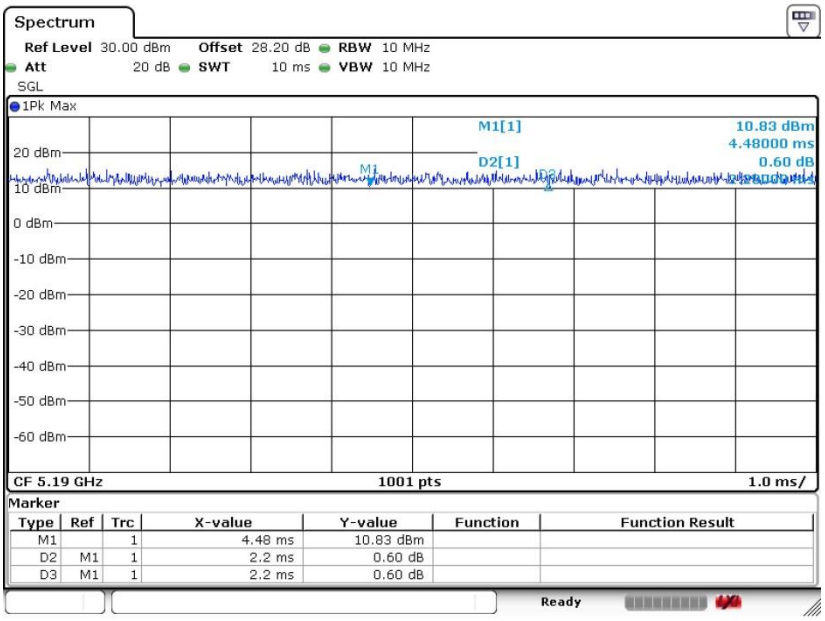
Date: 13.FEB.2019 09:18:09

802.11ac VHT20



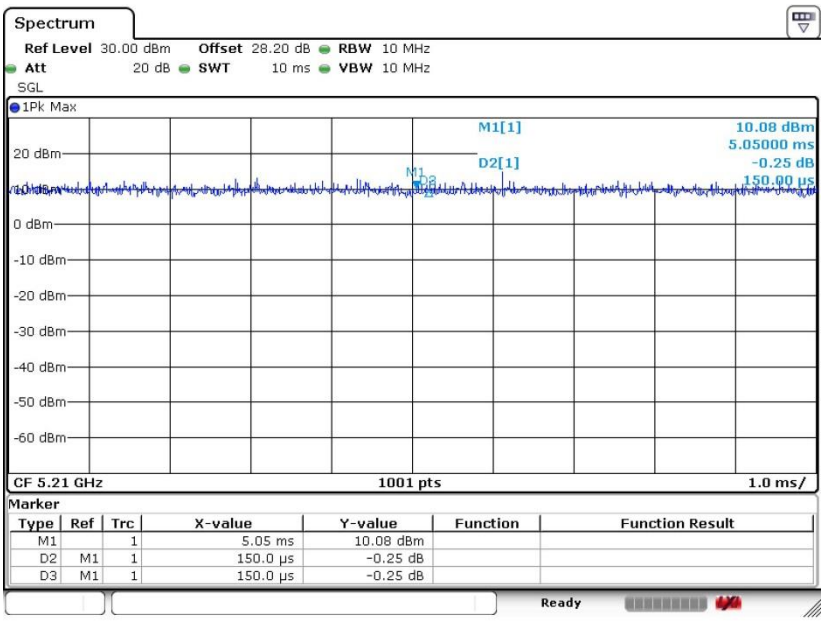
Date: 13.FEB.2019 09:16:42

802.11ac VHT40



Date: 13.FEB.2019 09:19:03

802.11ac VHT80



Date: 13.FEB.2019 09:22:09

THE END