FCC RADIO TEST REPORT

FCC ID	:	**2AP4W-ALITE**
Equipment	:	**mPERS**
Brand Name	:	**Belle**
Model Name	:	**Belle X ATT**
Marketing Name	:	**Belle X**
Applicant	:	**Freeus, LLC** **640 W 1100 S Suite 4, Ogden, Utah, United States 84404**
Manufacturer	:	**Wistron Corporation** **21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist, New Taipei City 221,Taiwan R.O.C**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Aug. 23, 2019 and testing was started from Aug. 29, 2019 and completed on Sep. 06, 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.

Louis Wu

Approved by: Louis Wu

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
FR982310	01	Initial issue of report	Oct. 17, 2019

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(2)	6dB Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Reporting only	-
3.2	15.247(b)	Power Output Measurement	Pass	-
3.3	15.247(e)	Power Spectral Density	Pass	-
3.4	15.247(d)	Conducted Band Edges	Pass	-
		Conducted Spurious Emission	Pass	-
3.5	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	Under limit 2.69 dB at 237.580 MHz
3.6	15.207	AC Conducted Emission	Pass	Under limit 8.27 dB at 0.152 MHz
3.7	15.203 & 15.247(b)	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: Jessie Ho

1 General Description

1.1 Product Feature of Equipment Under Test

LTE, Wi-Fi 2.4GHz 802.11b/g/n, and GNSS.

Product Specification subjective to this standard	
Antenna Type	WWAN: LDS Antenna WLAN: LDS Antenna GPS / Glonass : LDS 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. EMC & Wireless Communications Laboratory	
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.**	
	TH05HY	CO05-HY

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

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
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.**
	03CH11-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 C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- 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)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

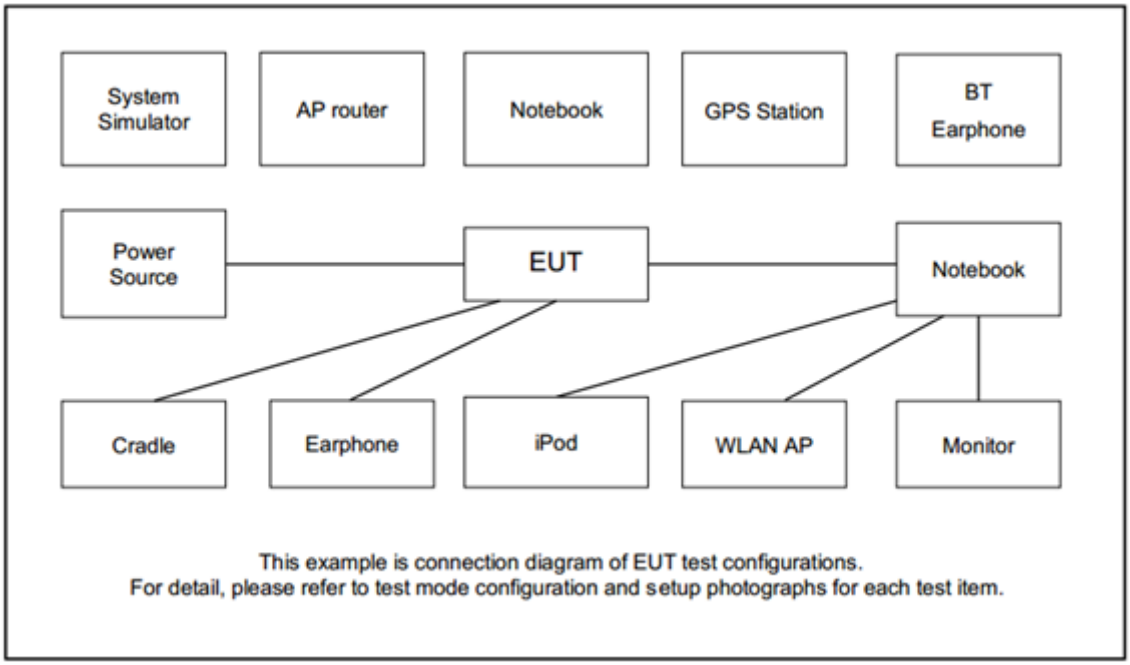
2.2 Test Mode

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

Modulation	Data Rate
802.11b	**1 Mbps**
802.11g	**6 Mbps**
802.11n HT20	**MCS0**

Test Cases	
AC Conducted Emission	Mode 1 :WLAN Tx + Cradle with Notebook

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.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded,1.8m
2.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
3.	Notebook	DELL	Latitude E5480	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	Notebook	ASUS	P2430U	NA	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “QRCT4_v 4.0-00108” 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 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

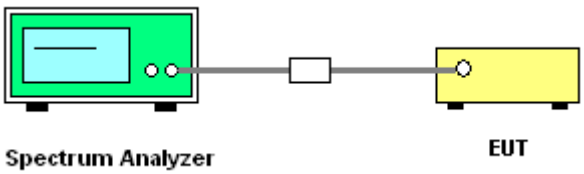
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

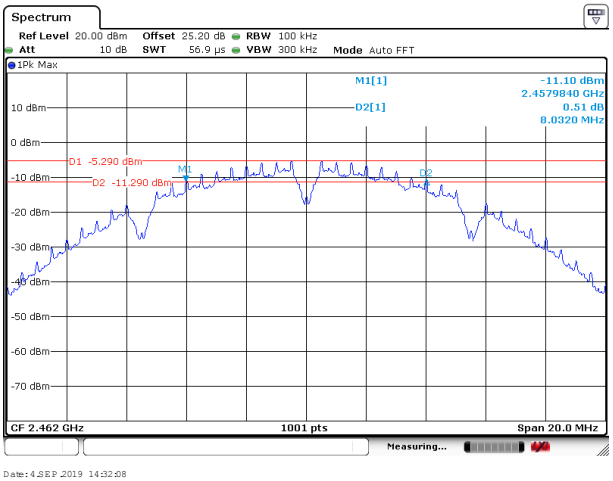
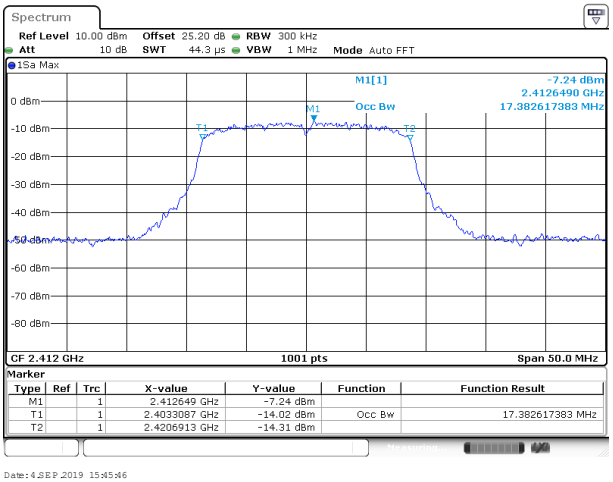
1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. 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.
6. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.

Minimum 6dB Bandwidth	Maximum 99% Occupied Bandwidth
	

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

3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

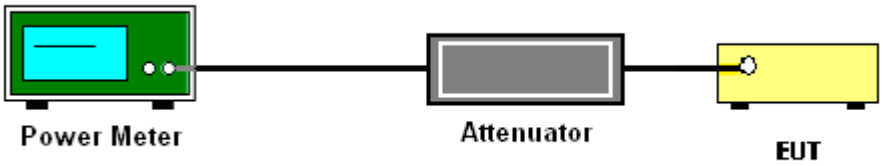
3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

3.2.3 Test Procedures

1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Average Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

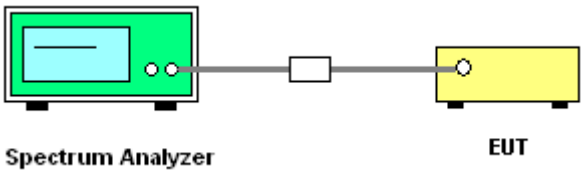
3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.

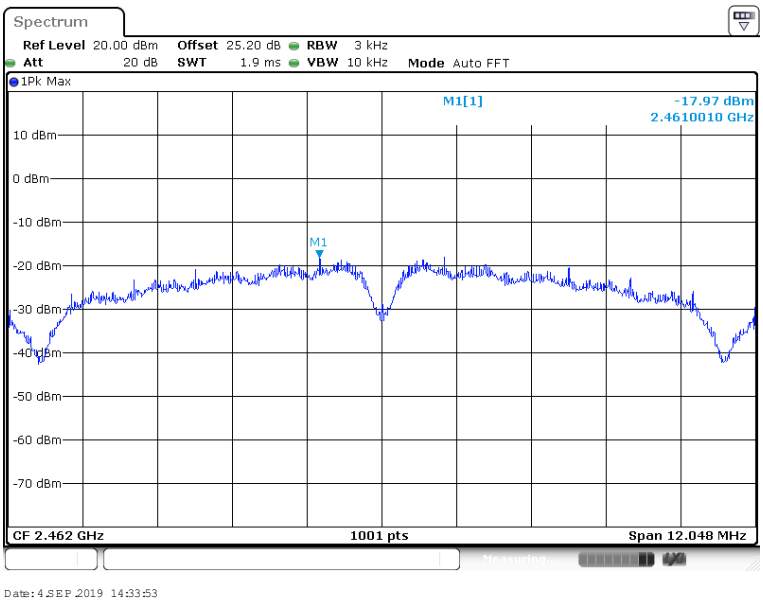
3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Density (dBm/3kHz)



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

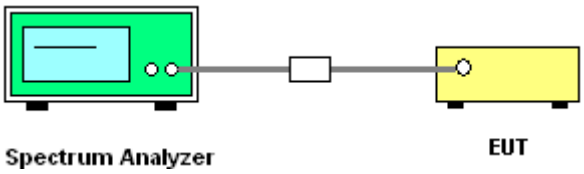
3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup



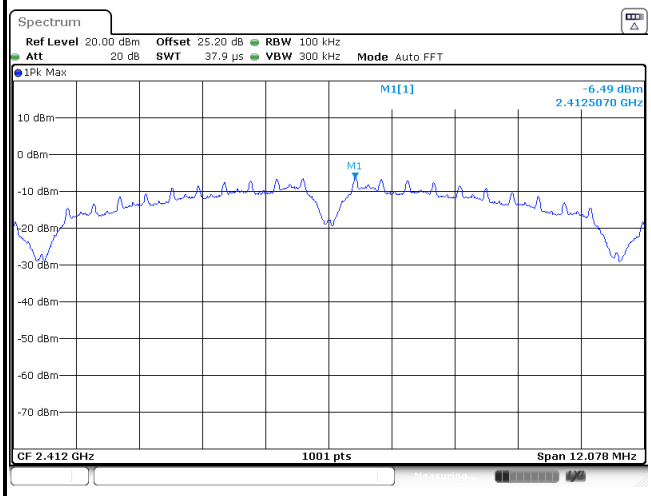
3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Engineer :	Amber Cheng	**Temperature :**	21~25℃
		Relative Humidity :	51~54%

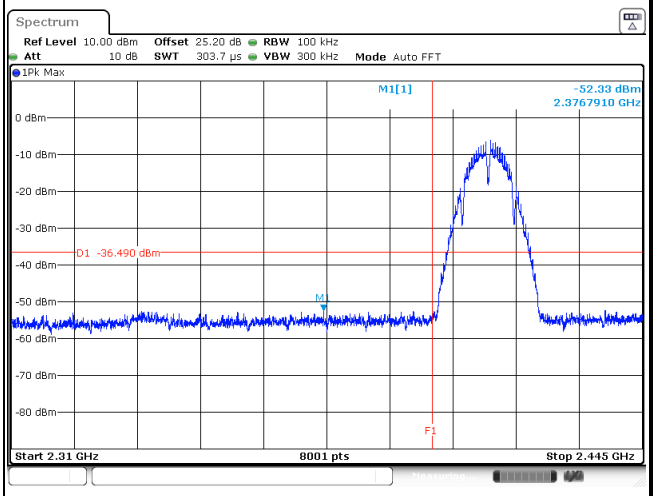
Number of TX = 1, Ant. 1 (Measured)

Test Mode :	802.11b	**Test Channel :**	01

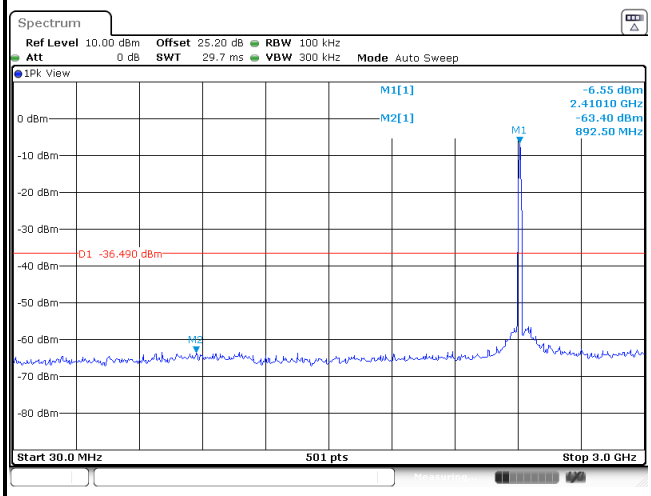
100kHz PSD reference Level



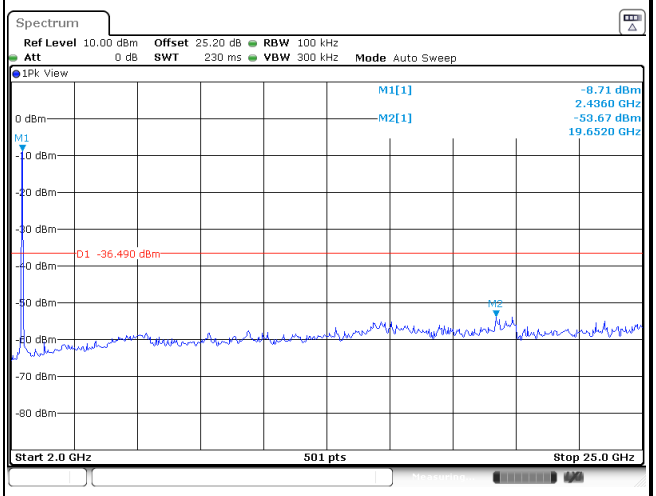
Channel Plot



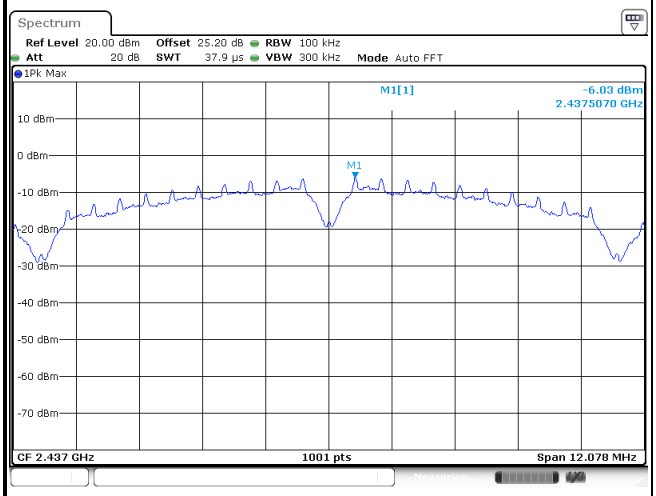
Spurious Emission 30MHz~3GHz

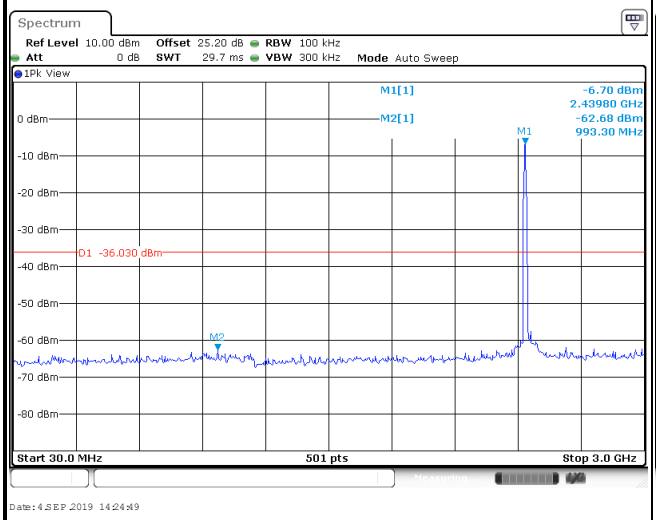
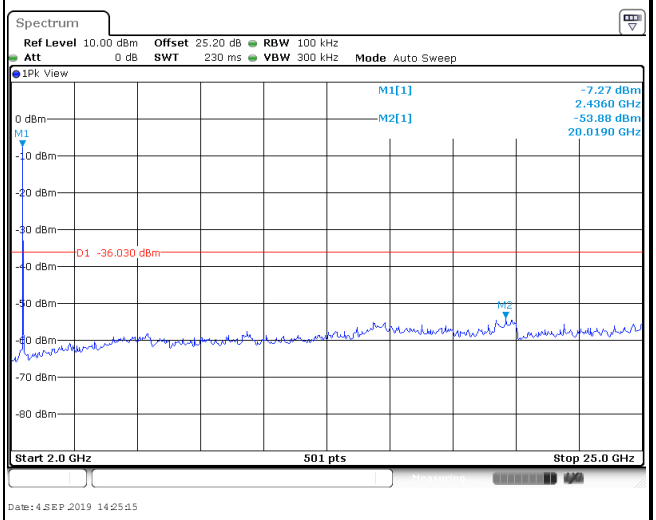


Spurious Emission 2GHz~25GHz



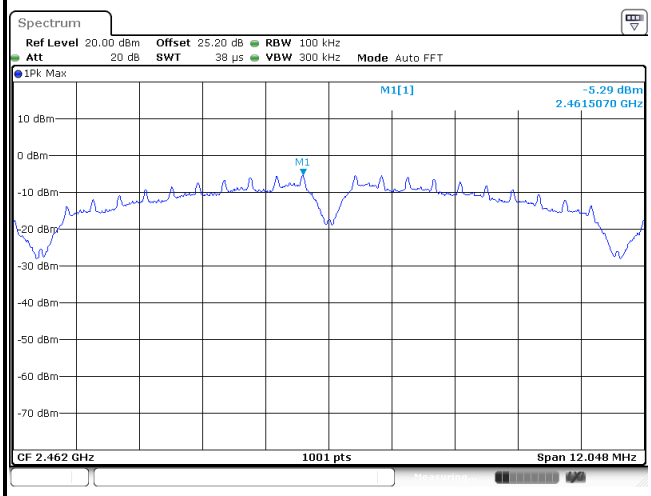
Test Mode :	802.11b	Test Channel :	06

100kHz PSD reference Level	Channel Plot
	

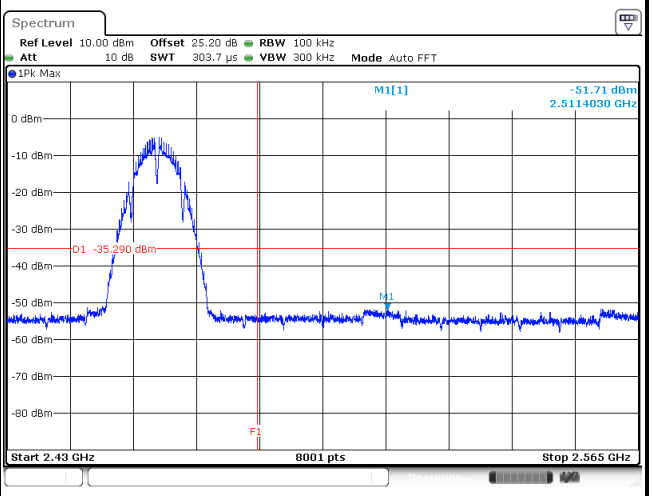
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

Test Mode :	802.11b	Test Channel :	11

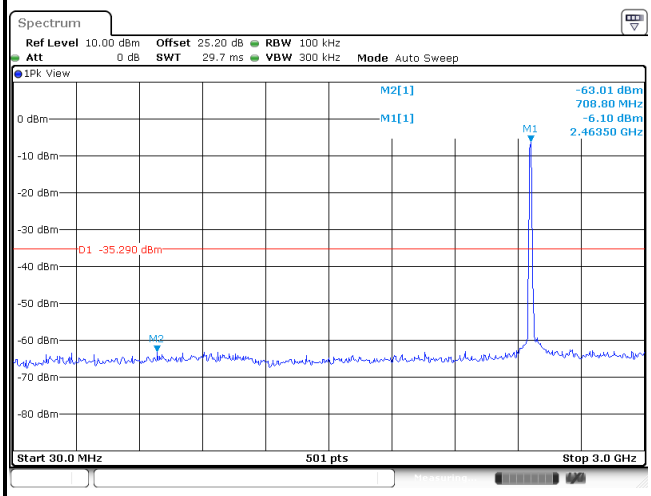
100kHz PSD reference Level



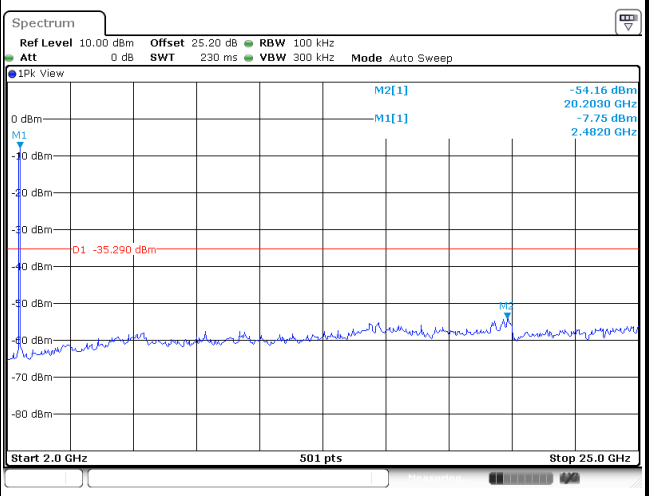
Channel Plot



Spurious Emission 30MHz~3GHz

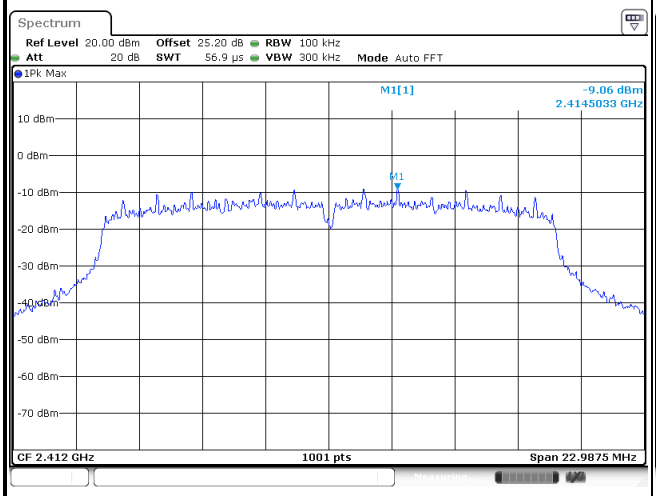


Spurious Emission 2GHz~25GHz



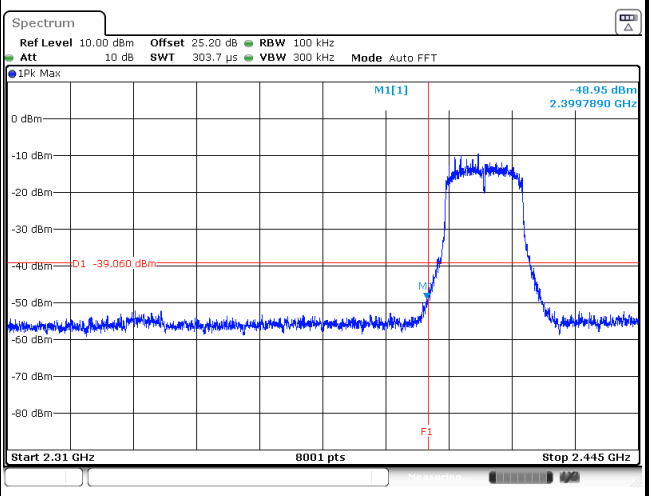
Test Mode :	802.11g	Test Channel :	01

100kHz PSD reference Level



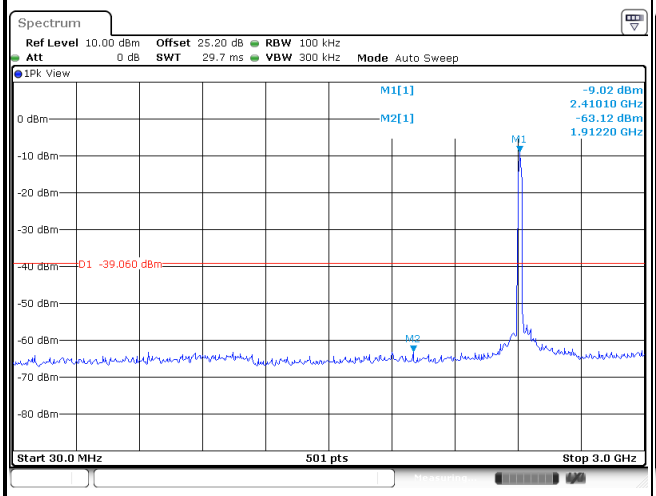
Date: 4.SEP.2019 14:55:00

Channel Plot



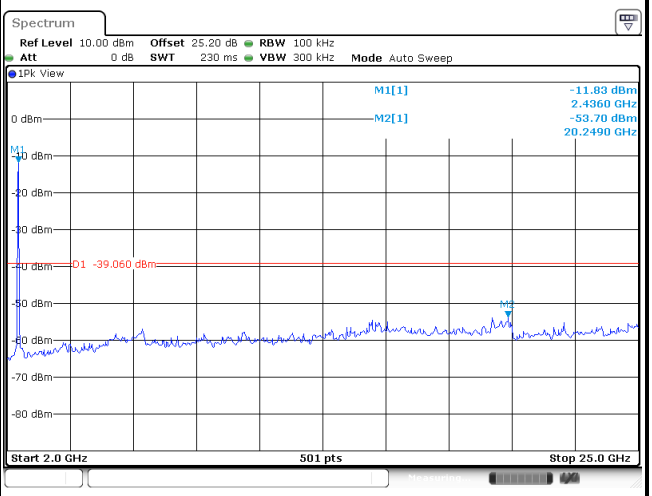
Date: 4.SEP.2019 18:37:35

Spurious Emission 30MHz~3GHz



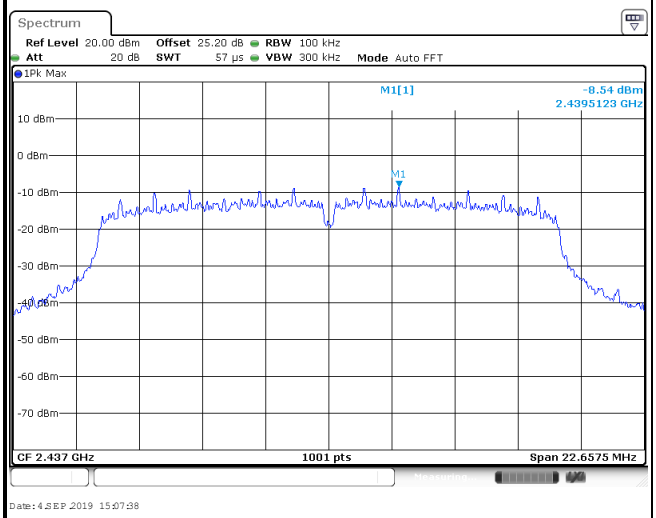
Date: 4.SEP.2019 14:58:58

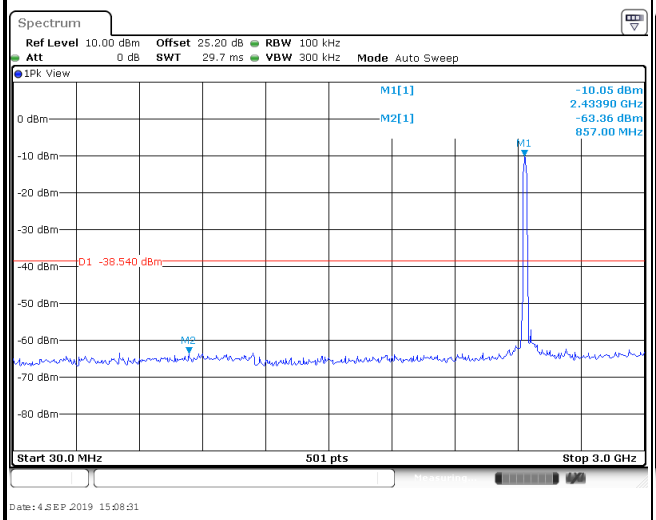
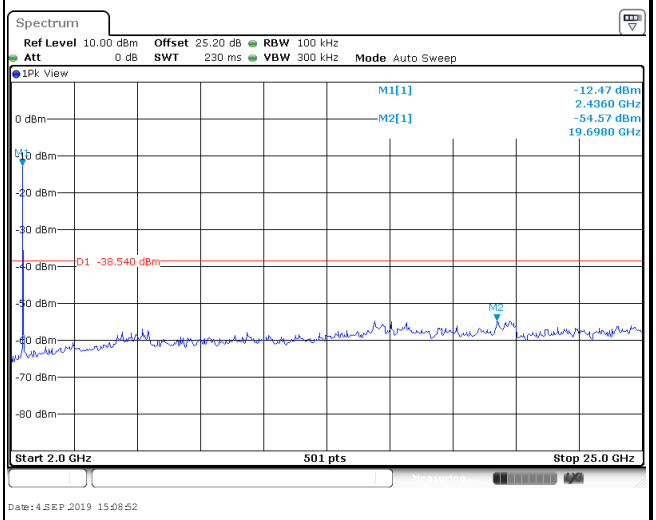
Spurious Emission 2GHz~25GHz



Date: 4.SEP.2019 14:59:41

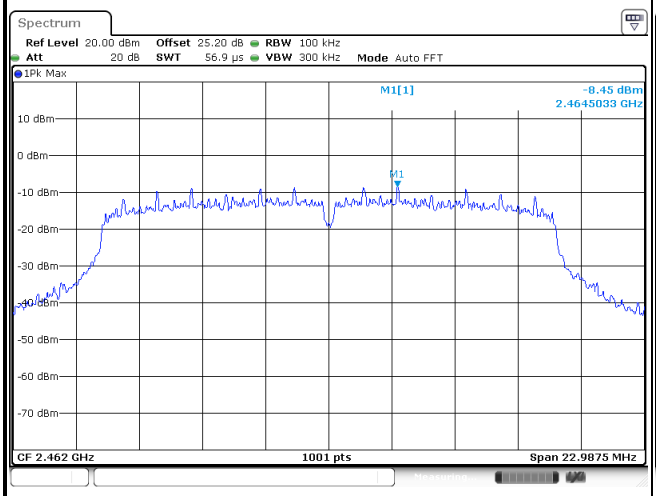
Test Mode :	802.11g	Test Channel :	06

100kHz PSD reference Level	Channel Plot
	

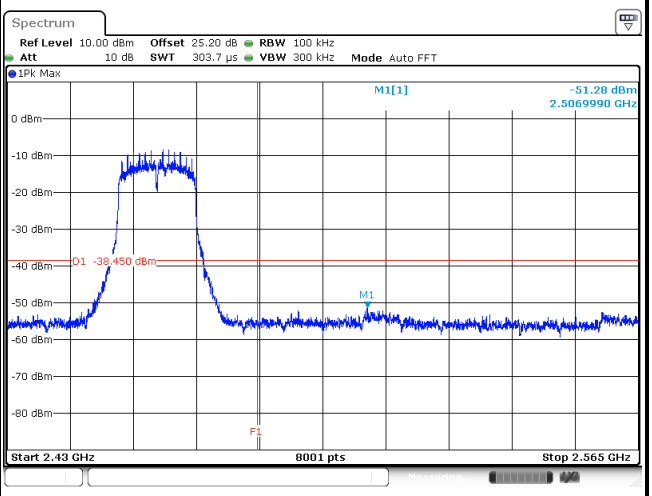
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

Test Mode :	802.11g	Test Channel :	11

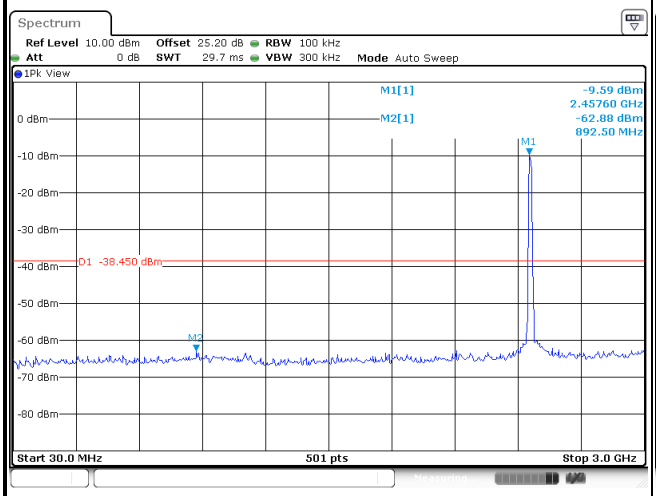
100kHz PSD reference Level



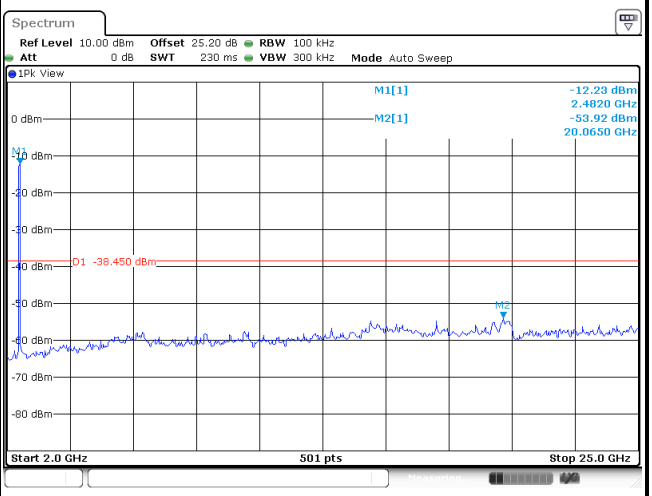
Channel Plot



Spurious Emission 30MHz~3GHz

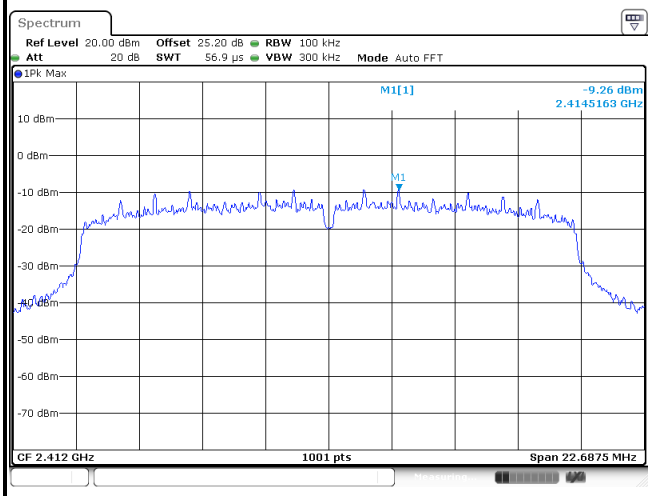


Spurious Emission 2GHz~25GHz

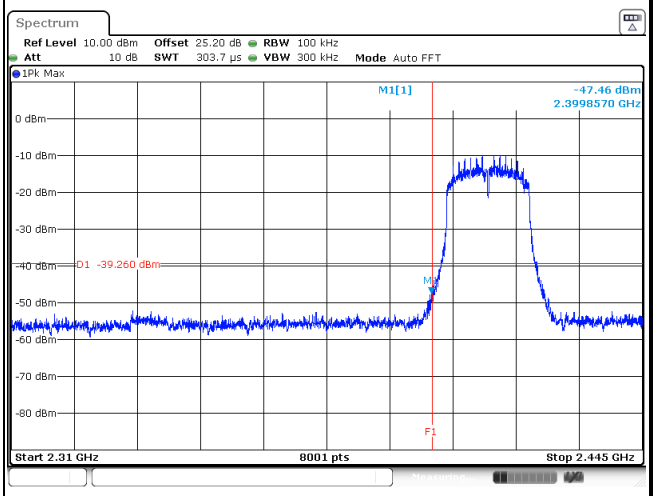


Test Mode :	802.11n HT20	Test Channel :	01

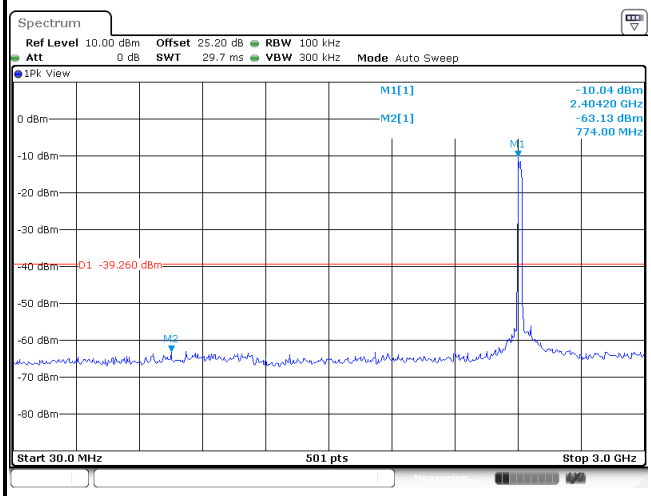
100kHz PSD reference Level



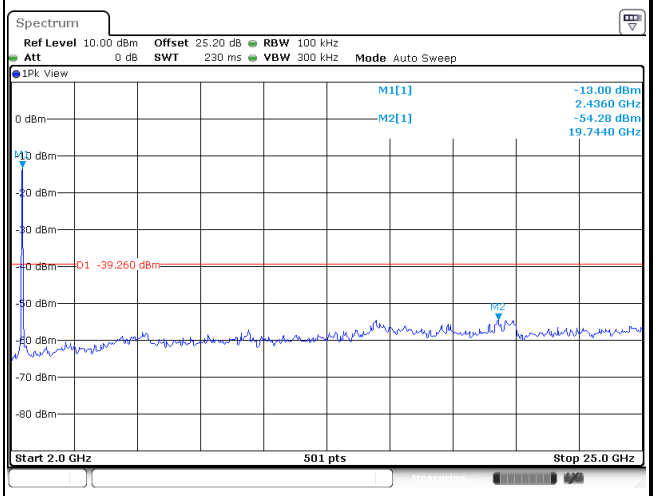
Channel Plot



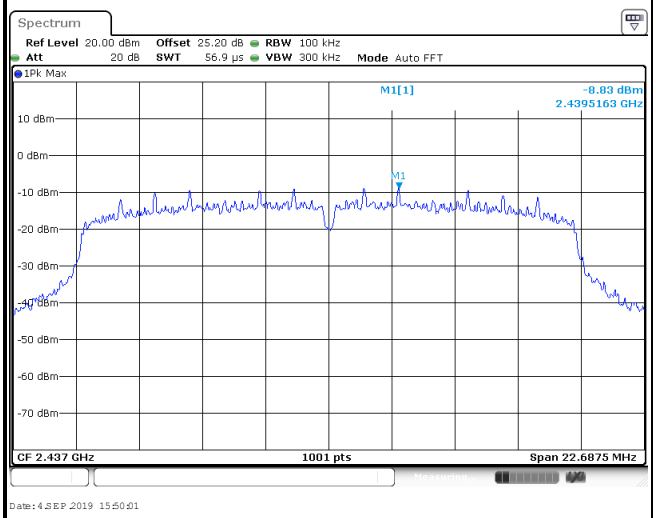
Spurious Emission 30MHz~3GHz

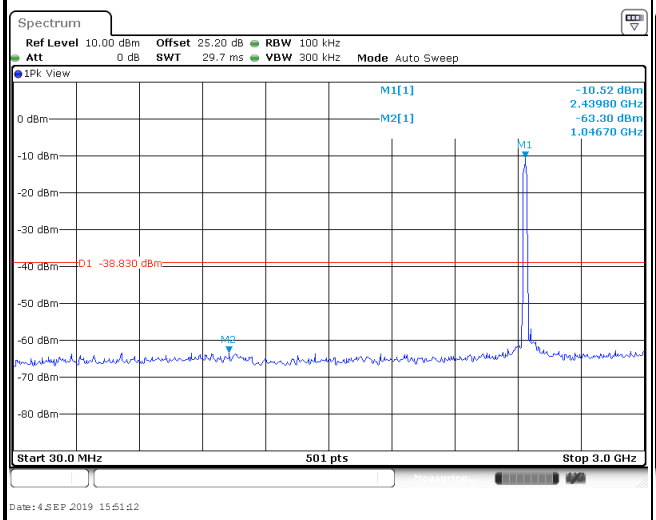
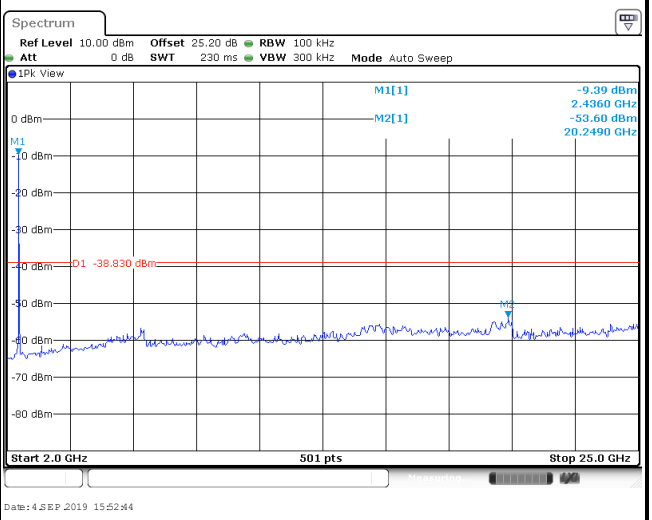


Spurious Emission 2GHz~25GHz



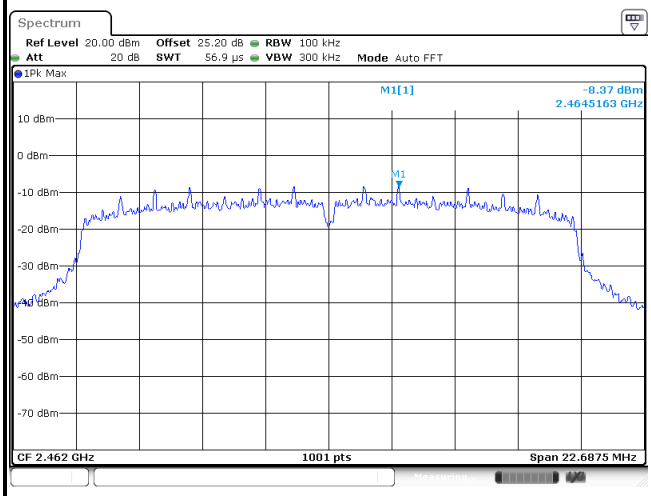
Test Mode :	802.11n HT20	Test Channel :	06

100kHz PSD reference Level	Channel Plot
	

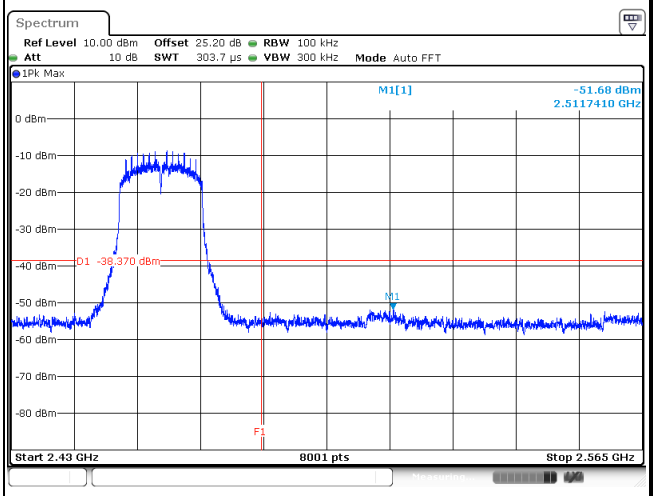
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

Test Mode :	802.11n HT20	Test Channel :	11

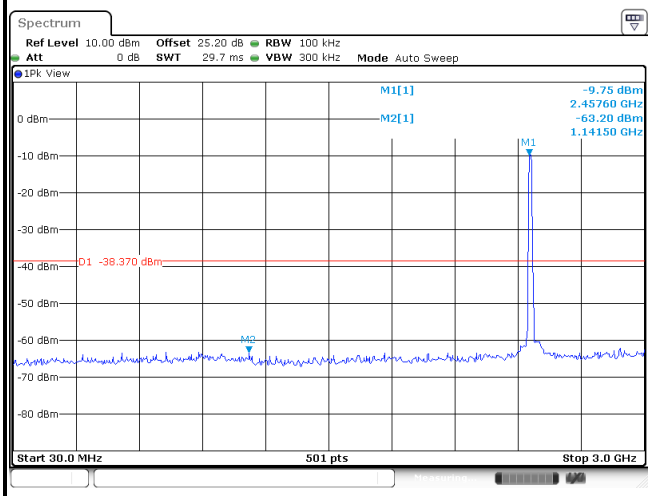
100kHz PSD reference Level



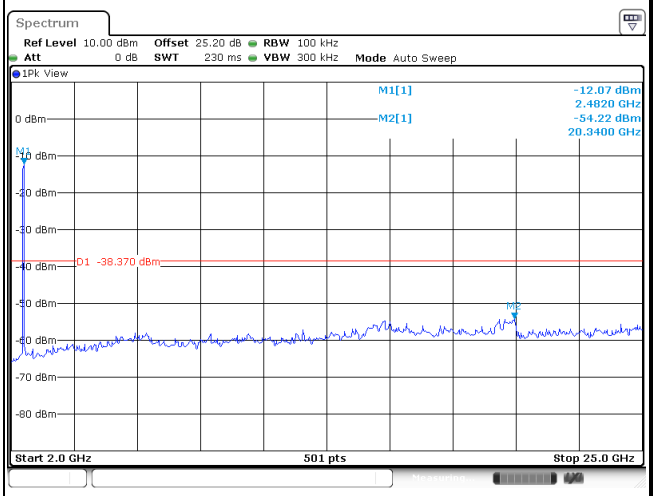
Channel Plot



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz



3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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

3.5.2 Measuring Instruments

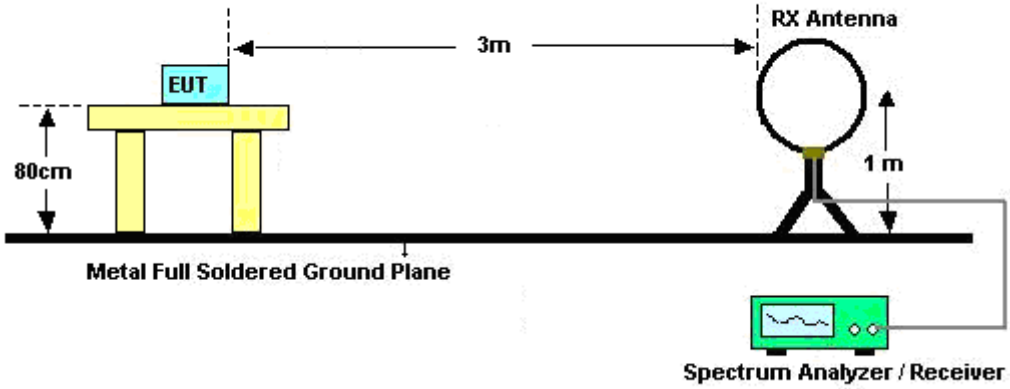
See list of measuring equipment of this test report.

3.5.3 Test Procedures

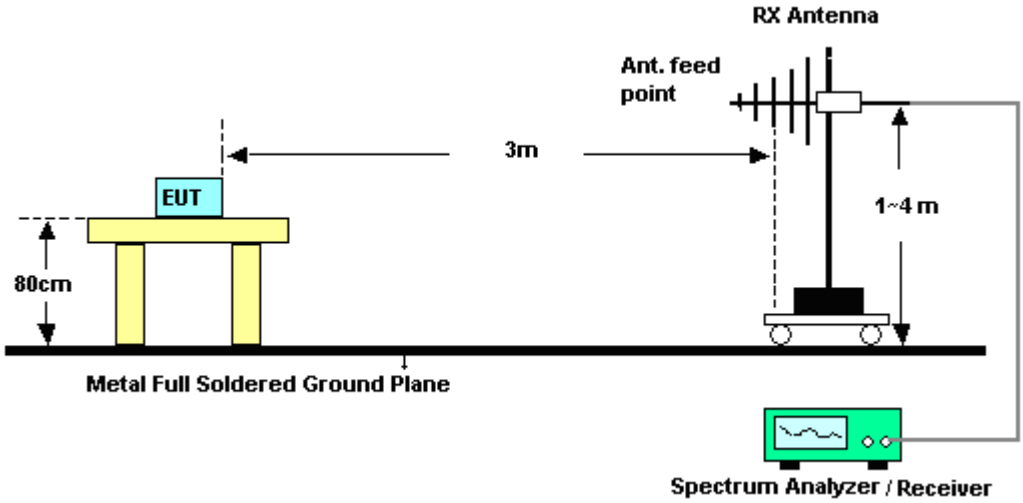
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. 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.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
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.
8. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - 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.

3.5.4 Test Setup

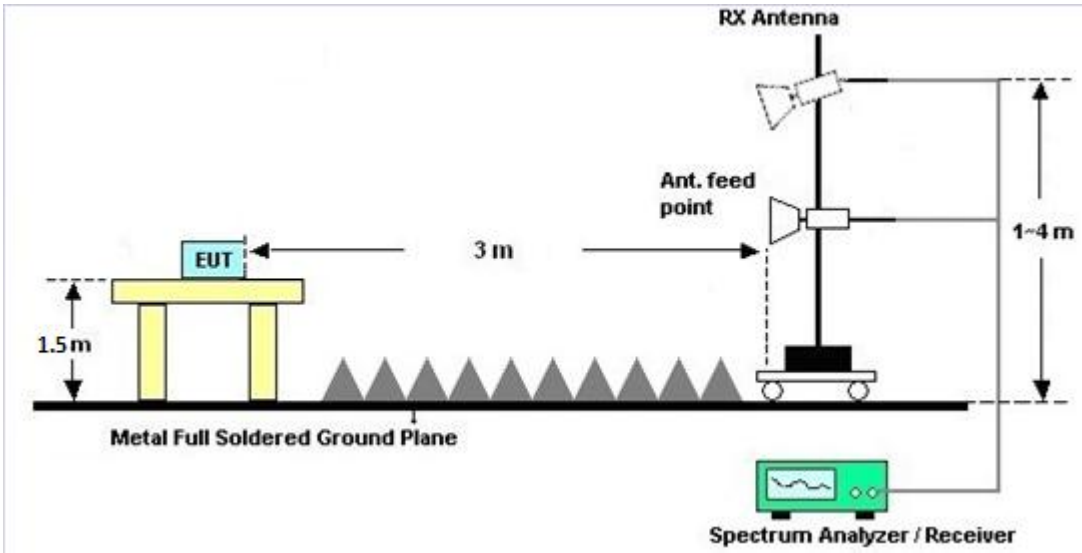
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

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.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.5.7 Duty Cycle

Please refer to Appendix E.

3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix C and D.

3.6 AC Conducted Emission Measurement

3.6.1 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.

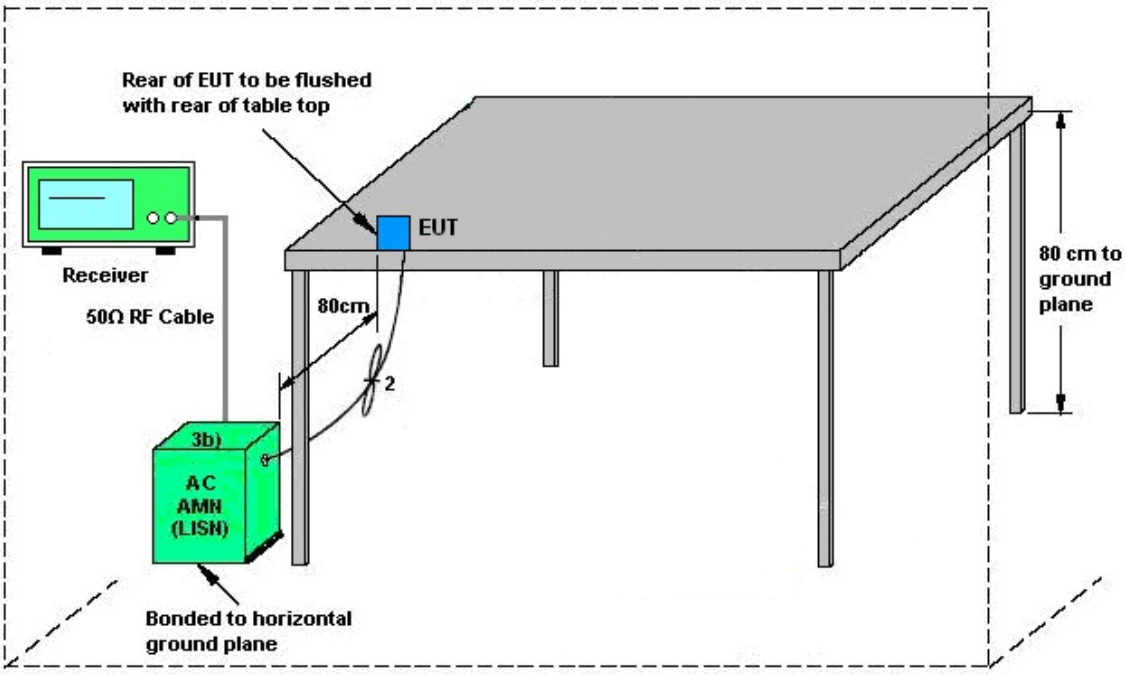
3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

3.6.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it 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 (IF bandwidth = 9kHz) with Maximum Hold Mode.

3.6.4 Test Setup



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

3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting Antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached Antenna or of an Antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

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 Sensor	DARE	RPR3006W	13I00030SNO32	9kHz~6GHz	Dec. 03, 2018	Sep. 03, 2019~ Sep. 04, 2019	Dec. 02, 2019	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 13, 2018	Sep. 03, 2019~ Sep. 04, 2019	Nov. 12, 2019	Conducted (TH05-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC1208382	N/A	Mar. 27, 2019	Sep. 03, 2019~ Sep. 04, 2019	Mar. 26, 2020	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Sep. 06, 2019	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Nov. 12, 2018	Sep. 06, 2019	Nov. 11, 2019	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 14, 2018	Sep. 06, 2019	Nov. 13, 2019	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Sep. 06, 2019	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Dec. 31, 2018	Sep. 06, 2019	Dec. 30, 2019	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Dec. 31, 2018	Sep. 06, 2019	Dec. 30, 2019	Conduction (CO05-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz ~ 40GHz	Dec. 06, 2018	Aug. 29, 2019~ Aug. 31, 2019	Dec. 05, 2019	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Dec. 04, 2018	Aug. 29, 2019~ Aug. 31, 2019	Dec. 03, 2019	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-06	35414&AT-N0602	30MHz~1GHz	Oct. 13, 2018	Aug. 29, 2019~ Aug. 31, 2019	Oct. 12, 2019	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 30, 2018	Aug. 29, 2019~ Aug. 31, 2019	Oct. 29, 2019	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 22, 2018	Aug. 29, 2019~ Aug. 31, 2019	Nov. 21, 2019	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 14, 2018	Aug. 29, 2019~ Aug. 31, 2019	Nov. 13, 2020	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Oct. 19, 2018	Aug. 29, 2019~ Aug. 31, 2019	Oct. 18, 2019	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Aug. 29, 2019~ Aug. 31, 2019	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Aug. 29, 2019~ Aug. 31, 2019	N/A	Radiation (03CH11-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590074	1GHz~18GHz	May 20, 2019	Aug. 29, 2019~ Aug. 31, 2019	May 19, 2020	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Dec. 05, 2018	Aug. 29, 2019~ Aug. 31, 2019	Dec. 04, 2019	Radiation (03CH11-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY55420170	20MHz~8.4GHz	Mar. 08, 2019	Aug. 29, 2019~ Aug. 31, 2019	Mar. 07, 2020	Radiation (03CH11-HY)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Software	Audix	E3 6.2009-8-24	RK-001042	N/A	N/A	Aug. 29, 2019~ Aug. 31, 2019	N/A	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz-30MHz	Mar. 13, 2019	Aug. 29, 2019~ Aug. 31, 2019	Mar. 12, 2020	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz-40GHz	Mar. 13, 2019	Aug. 29, 2019~ Aug. 31, 2019	Mar. 12, 2020	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	30M-18G	Mar. 13, 2019	Aug. 29, 2019~ Aug. 31, 2019	Mar. 12, 2020	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY4274/2	30MHz-40GHz	Mar. 13, 2019	Aug. 29, 2019~ Aug. 31, 2019	Mar. 12, 2020	Radiation (03CH11-HY)
Filter	Wainwright	WLK4-1000-1530-8000-40SS	SN11	1.53G Low Pass	Sep. 16, 2018	Aug. 29, 2019~ Aug. 31, 2019	Sep. 15, 2019	Radiation (03CH11-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60SS	SN3	3G High Pass	Sep. 16, 2018	Aug. 29, 2019~ Aug. 31, 2019	Sep. 15, 2019	Radiation (03CH11-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))	5.2

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.5

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.2

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Amber Cheng	Temperature:	21~25	°C
Test Date:	2019/9/3-2019/9/4	Relative Humidity:	51~54	%

Report Number : FR982310

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

2.4GHz Band										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)		6dB BW (MHz)		6dB BW Limit (MHz)	Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2		
11b	1Mbps	1	1	2412	13.04	-	8.05	-	0.50	Pass
11b	1Mbps	1	6	2437	13.04	-	8.05	-	0.50	Pass
11b	1Mbps	1	11	2462	13.04	-	8.03	-	0.50	Pass
11g	6Mbps	1	1	2412	16.28	-	15.33	-	0.50	Pass
11g	6Mbps	1	6	2437	16.28	-	15.11	-	0.50	Pass
11g	6Mbps	1	11	2462	16.28	-	15.33	-	0.50	Pass
HT20	MCS0	1	1	2412	17.38	-	15.12	-	0.50	Pass
HT20	MCS0	1	6	2437	17.38	-	15.12	-	0.50	Pass
HT20	MCS0	1	11	2462	17.38	-	15.12	-	0.50	Pass

Report Number : FR982310

TEST RESULTS DATA
Average Output Power

2.4GHz Band																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
11b	1Mbps	1	1	2412	2.90	-	-	30.00	-	-1.00	-	1.90	-	36.00	-	Pass
11b	1Mbps	1	6	2437	2.90	-		30.00	-	-1.00	-	1.90	-	36.00	-	Pass
11b	1Mbps	1	11	2462	2.40	-		30.00	-	-1.00	-	1.40	-	36.00	-	Pass
11g	6Mbps	1	1	2412	2.70	-		30.00	-	-1.00	-	1.70	-	36.00	-	Pass
11g	6Mbps	1	6	2437	2.80	-		30.00	-	-1.00	-	1.80	-	36.00	-	Pass
11g	6Mbps	1	11	2462	2.90	-		30.00	-	-1.00	-	1.90	-	36.00	-	Pass
HT20	MCS0	1	1	2412	2.40	-		30.00	-	-1.00	-	1.40	-	36.00	-	Pass
HT20	MCS0	1	6	2437	2.50	-		30.00	-	-1.00	-	1.50	-	36.00	-	Pass
HT20	MCS0	1	11	2462	2.90	-		30.00	-	-1.00	-	1.90	-	36.00	-	Pass

Note: Measured power (dBm) has offset with cable loss.

Report Number : FR982310

TEST RESULTS DATA
Peak Power Spectral Density

2.4GHz Band												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm/3kHz)			DG (dBi)		Peak PSD Limit (dBm/3kHz)		Pass/Fail
					Ant 1	Ant 2	Worse + 3.01	Ant 1	Ant 2	Ant 1	Ant 2	
11b	1Mbps	1	1	2412	-18.67	-	-	-1.00	-	8.00	-	Pass
11b	1Mbps	1	6	2437	-19.05	-	-	-1.00	-	8.00	-	Pass
11b	1Mbps	1	11	2462	-17.97	-	-	-1.00	-	8.00	-	Pass
11g	6Mbps	1	1	2412	-23.76	-	-	-1.00	-	8.00	-	Pass
11g	6Mbps	1	6	2437	-21.99	-	-	-1.00	-	8.00	-	Pass
11g	6Mbps	1	11	2462	-23.13	-	-	-1.00	-	8.00	-	Pass
HT20	MCS0	1	1	2412	-23.10	-	-	-1.00	-	8.00	-	Pass
HT20	MCS0	1	6	2437	-23.14	-	-	-1.00	-	8.00	-	Pass
HT20	MCS0	1	11	2462	-21.84	-	-	-1.00	-	8.00	-	Pass

Measured power density (dBm) has offset with cable loss.

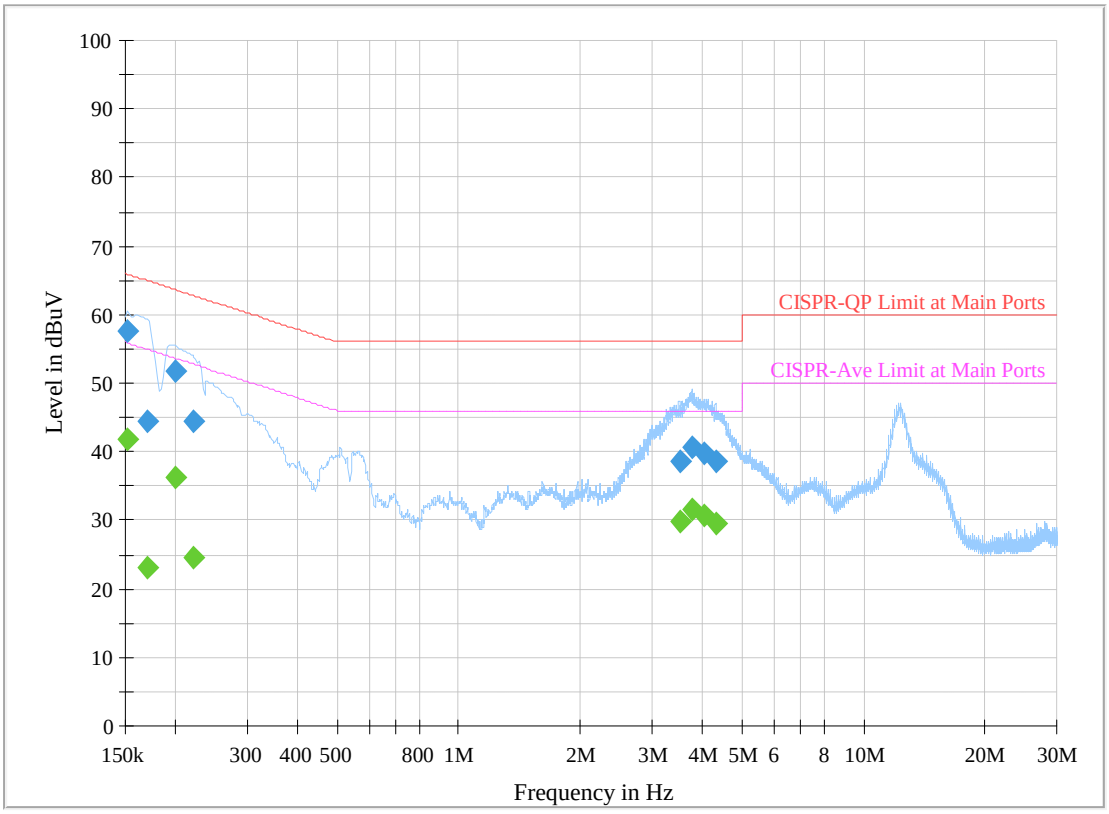
Appendix B. AC Conducted Emission Test Results

Test Engineer :	Louis Chung	**Temperature :**	25.9~26.2℃
		Relative Humidity :	46.8~50%

EUT Information

Report NO :	982310
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line

Full Spectrum



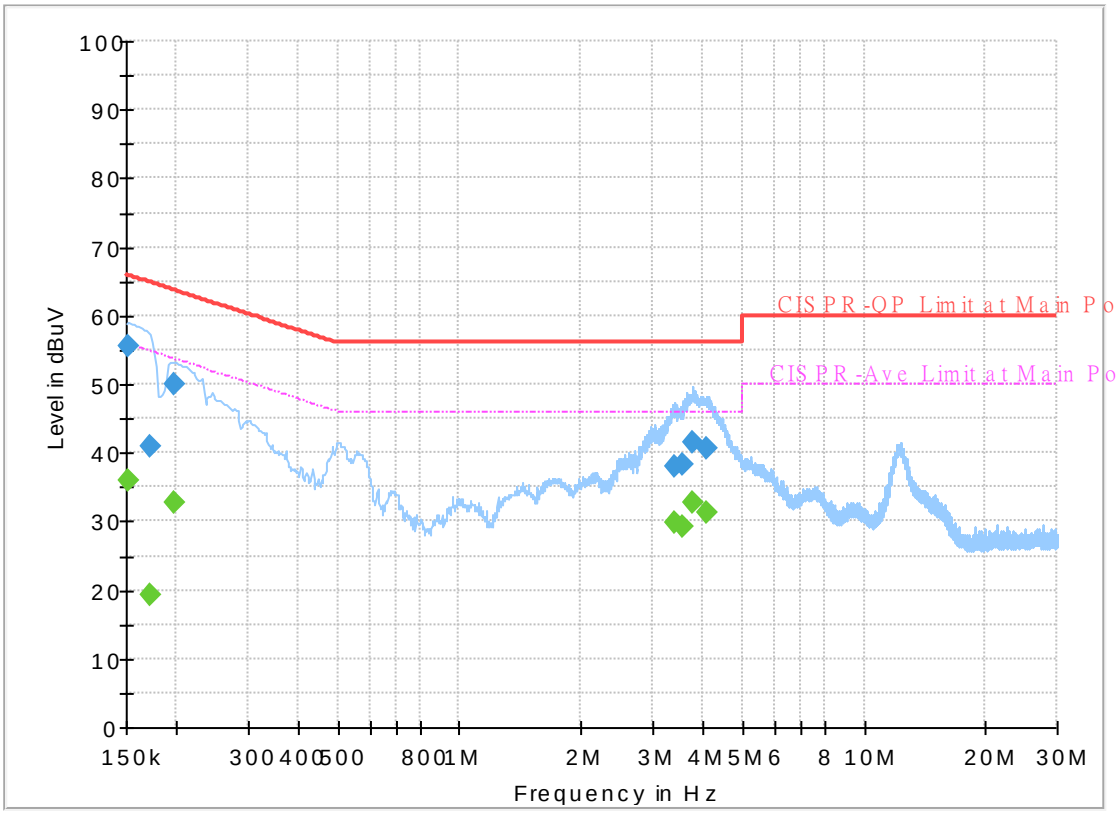
Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	57.61	---	65.88	8.27	L1	OFF	19.4
0.152250	---	41.76	55.88	14.12	L1	OFF	19.4
0.170250	44.46	---	64.95	20.49	L1	OFF	19.4
0.170250	---	23.02	54.95	31.93	L1	OFF	19.4
0.199500	51.76	---	63.63	11.87	L1	OFF	19.4
0.199500	---	36.20	53.63	17.43	L1	OFF	19.4
0.219750	44.38	---	62.83	18.45	L1	OFF	19.4
0.219750	---	24.56	52.83	28.27	L1	OFF	19.4
3.502500	38.63	---	56.00	17.37	L1	OFF	19.5
3.502500	---	29.82	46.00	16.18	L1	OFF	19.5
3.752250	40.67	---	56.00	15.33	L1	OFF	19.5
3.752250	---	31.70	46.00	14.30	L1	OFF	19.5
4.044750	39.66	---	56.00	16.34	L1	OFF	19.5
4.044750	---	30.59	46.00	15.41	L1	OFF	19.5
4.301250	38.60	---	56.00	17.40	L1	OFF	19.5
4.301250	---	29.58	46.00	16.42	L1	OFF	19.5

EUT Information

Report NO :	982310
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)
0.152250	55.41	---	65.88	10.47	N	OFF	19.4
0.152250	---	36.05	55.88	19.83	N	OFF	19.4
0.172500	41.06	---	64.84	23.78	N	OFF	19.4
0.172500	---	19.24	54.84	35.60	N	OFF	19.4
0.197250	50.05	---	63.73	13.68	N	OFF	19.4
0.197250	---	32.65	53.73	21.08	N	OFF	19.4
3.394500	38.12	---	56.00	17.88	N	OFF	19.5
3.394500	---	29.72	46.00	16.28	N	OFF	19.5
3.581250	38.39	---	56.00	17.61	N	OFF	19.5
3.581250	---	29.29	46.00	16.71	N	OFF	19.5
3.786000	41.61	---	56.00	14.39	N	OFF	19.5
3.786000	---	32.78	46.00	13.22	N	OFF	19.5
4.074000	40.66	---	56.00	15.34	N	OFF	19.5
4.074000	---	31.38	46.00	14.62	N	OFF	19.5

Appendix C. Radiated Spurious Emission

Test Engineer :	Bill Kuo and Troye Hsieh	Temperature :	21.3~25.8°C
		Relative Humidity :	53.4~65.3%

2.4GHz 2400~2483.5MHz

WIFI 802.11b (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)
802.11b CH 01 2412MHz		2323.44	52.98	-21.02	74	42.36	27.71	16.56	33.65	358	26	P	H
		2332.26	43.31	-10.69	54	32.72	27.67	16.57	33.65	358	26	A	H
	*	2412	92.35	-	-	81.93	27.38	16.66	33.62	358	26	P	H
	*	2412	88.78	-	-	78.36	27.38	16.66	33.62	358	26	A	H
													H
													H
		2356.62	52.84	-21.16	74	42.31	27.57	16.6	33.64	310	114	P	V
		2315.46	43.3	-10.7	54	32.67	27.74	16.55	33.66	310	114	A	V
	*	2412	91.48	-	-	81.06	27.38	16.66	33.62	310	114	P	V
	*	2412	87.66	-	-	77.24	27.38	16.66	33.62	310	114	A	V
													V
													V
802.11b CH 06 2437MHz		2338.96	53.39	-20.61	74	42.82	27.64	16.58	33.65	352	18	P	H
		2311.76	43.23	-10.77	54	32.59	27.75	16.55	33.66	352	18	A	H
	*	2437	92.42	-	-	82.01	27.33	16.69	33.61	352	18	P	H
	*	2437	88.5	-	-	78.09	27.33	16.69	33.61	352	18	A	H
		2495.92	52.42	-21.58	74	41.96	27.3	16.75	33.59	352	18	P	H
		2486	43.19	-10.81	54	32.75	27.3	16.74	33.6	352	18	A	H
		2352.08	52.83	-21.17	74	42.29	27.59	16.59	33.64	300	104	P	V
		2319.6	43.22	-10.78	54	32.59	27.72	16.56	33.65	300	104	A	V
	*	2437	89.17	-	-	78.76	27.33	16.69	33.61	300	104	P	V
	*	2437	86.11	-	-	75.7	27.33	16.69	33.61	300	104	A	V
		2490.4	52.35	-21.65	74	41.9	27.3	16.74	33.59	300	104	P	V
		2497.12	43.2	-10.8	54	32.74	27.3	16.75	33.59	300	104	A	V

802.11b CH 11 2462MHz	*	2462	90.65	-	-	80.23	27.3	16.72	33.6	326	0	P	H
	*	2462	89.71	-	-	79.29	27.3	16.72	33.6	326	0	A	H
		2492.84	53.27	-20.73	74	42.81	27.3	16.75	33.59	326	0	P	H
		2483.52	42.71	-11.29	54	32.27	27.3	16.74	33.6	326	0	A	H
													H
													H
	*	2462	90.03	-	-	79.61	27.3	16.72	33.6	309	103	P	V
	*	2462	86.9	-	-	76.48	27.3	16.72	33.6	309	103	A	V
		2484.08	52.85	-21.15	74	42.41	27.3	16.74	33.6	309	103	P	V
		2485.4	41.89	-12.11	54	31.45	27.3	16.74	33.6	309	103	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11b (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)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		4824	38.96	-35.04	74	60.11	31.1	11.02	63.27	100	0	P	H
													H
													H
													H
		4824	39.02	-34.98	74	60.17	31.1	11.02	63.27	100	0	P	V
													V
													V
													V
802.11b CH 06 2437MHz		4874	39.77	-34.23	74	60.91	31.05	11.06	63.25	100	0	P	H
		7311	43.32	-30.68	74	53.87	36.52	13.66	60.73	100	0	P	H
													H
													H
		4874	39.73	-34.27	74	60.87	31.05	11.06	63.25	100	0	P	V
		7311	43.12	-30.88	74	53.67	36.52	13.66	60.73	100	0	P	V
													V
													V
802.11b CH 11 2462MHz		4924	40.52	-33.48	74	61.52	31.14	11.09	63.23	100	0	P	H
		7386	42.79	-31.21	74	53.39	36.46	13.58	60.64	100	0	P	H
													H
													H
		4924	39.6	-34.4	74	60.6	31.14	11.09	63.23	100	0	P	V
		7386	42	-32	74	52.6	36.46	13.58	60.64	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11g (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)
802.11g CH 01 2412MHz		2313.99	52.56	-21.44	74	41.93	27.74	16.55	33.66	364	33	P	H
		2322.075	43.31	-10.69	54	32.69	27.71	16.56	33.65	364	33	A	H
	*	2412	91.59	-	-	81.17	27.38	16.66	33.62	364	33	P	H
	*	2412	84.67	-	-	74.25	27.38	16.66	33.62	364	33	A	H
													H
													H
		2376.885	52.78	-21.22	74	42.3	27.49	16.62	33.63	300	104	P	V
		2334.465	43.21	-10.79	54	32.63	27.66	16.57	33.65	300	104	A	V
	*	2412	91.19	-	-	80.77	27.38	16.66	33.62	300	104	P	V
	*	2412	83.09	-	-	72.67	27.38	16.66	33.62	300	104	A	V
													V
													V
802.11g CH 06 2437MHz		2314.32	52.54	-21.46	74	41.91	27.74	16.55	33.66	355	18	P	H
		2355.76	43.27	-10.73	54	32.73	27.58	16.6	33.64	355	18	A	H
	*	2437	92.99	-	-	82.58	27.33	16.69	33.61	355	18	P	H
	*	2437	85.18	-	-	74.77	27.33	16.69	33.61	355	18	A	H
		2498.64	52.77	-21.23	74	42.31	27.3	16.75	33.59	355	18	P	H
		2495.36	43.07	-10.93	54	32.61	27.3	16.75	33.59	355	18	A	H
		2366.16	53.1	-20.9	74	42.59	27.54	16.61	33.64	300	102	P	V
		2387.44	43.15	-10.85	54	32.69	27.45	16.64	33.63	300	102	A	V
	*	2437	90	-	-	79.59	27.33	16.69	33.61	300	102	P	V
	*	2437	82.55	-	-	72.14	27.33	16.69	33.61	300	102	A	V
		2493.28	52.47	-21.53	74	42.01	27.3	16.75	33.59	300	102	P	V
		2493.84	43.09	-10.91	54	32.63	27.3	16.75	33.59	300	102	A	V

802.11g CH 11 2462MHz	*	2462	94.69	-	-	84.27	27.3	16.72	33.6	345	21	P	H
	*	2462	87.27	-	-	76.85	27.3	16.72	33.6	345	21	A	H
		2486	52.75	-21.25	74	42.31	27.3	16.74	33.6	345	21	P	H
		2483.76	43.57	-10.43	54	33.13	27.3	16.74	33.6	345	21	A	H
													H
													H
	*	2462	90.53	-	-	80.11	27.3	16.72	33.6	300	112	P	V
	*	2462	83.42	-	-	73	27.3	16.72	33.6	300	112	A	V
		2490.56	52.65	-21.35	74	42.19	27.3	16.75	33.59	300	112	P	V
		2489.76	43.27	-10.73	54	32.82	27.3	16.74	33.59	300	112	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11g (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)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		4824	39.23	-34.77	74	60.38	31.1	11.02	63.27	100	0	P	H
													H
													H
													H
		4824	38.92	-35.08	74	60.07	31.1	11.02	63.27	100	0	P	V
													V
													V
													V
802.11g CH 06 2437MHz		4874	39.79	-34.21	74	60.93	31.05	11.06	63.25	100	0	P	H
		7311	43.09	-30.91	74	53.64	36.52	13.66	60.73	100	0	P	H
													H
													H
		4874	39.41	-34.59	74	60.55	31.05	11.06	63.25	100	0	P	V
		7311	42.26	-31.74	74	52.81	36.52	13.66	60.73	100	0	P	V
													V
													V
802.11g CH 11 2462MHz		4924	40.04	-33.96	74	61.04	31.14	11.09	63.23	100	0	P	H
		7386	41.63	-32.37	74	52.23	36.46	13.58	60.64	100	0	P	H
													H
													H
		4924	39.58	-34.42	74	60.58	31.14	11.09	63.23	100	0	P	V
		7386	42.39	-31.61	74	52.99	36.46	13.58	60.64	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (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)
802.11n HT20 CH 01 2412MHz		2335.515	52.63	-21.37	74	42.04	27.66	16.58	33.65	359	28	P	H
		2366.595	43.33	-10.67	54	32.83	27.53	16.61	33.64	359	28	A	H
	*	2412	93.17	-	-	82.75	27.38	16.66	33.62	359	28	P	H
	*	2412	85.32	-	-	74.9	27.38	16.66	33.62	359	28	A	H
													H
													H
		2375.205	53.33	-20.67	74	42.84	27.5	16.62	33.63	313	114	P	V
		2315.145	43.38	-10.62	54	32.75	27.74	16.55	33.66	313	114	A	V
	*	2412	90.7	-	-	80.28	27.38	16.66	33.62	313	114	P	V
	*	2412	84.17	-	-	73.75	27.38	16.66	33.62	313	114	A	V
													V
													V
802.11n HT20 CH 06 2437MHz		2337.36	52.33	-21.67	74	41.75	27.65	16.58	33.65	350	16	P	H
		2341.84	43.17	-10.83	54	32.61	27.63	16.58	33.65	350	16	A	H
	*	2437	93.92	-	-	83.51	27.33	16.69	33.61	350	16	P	H
	*	2437	86.32	-	-	75.91	27.33	16.69	33.61	350	16	A	H
		2483.52	52.28	-21.72	74	41.84	27.3	16.74	33.6	350	16	P	H
		2492.32	43.25	-10.75	54	32.79	27.3	16.75	33.59	350	16	A	H
		2350.48	53.08	-20.92	74	42.53	27.6	16.59	33.64	304	108	P	V
		2359.28	43.36	-10.64	54	32.84	27.56	16.6	33.64	304	108	A	V
	*	2437	90.03	-	-	79.62	27.33	16.69	33.61	304	108	P	V
	*	2437	82.29	-	-	71.88	27.33	16.69	33.61	304	108	A	V
		2494.88	53.08	-20.92	74	42.62	27.3	16.75	33.59	304	108	P	V
		2490.72	43.08	-10.92	54	32.62	27.3	16.75	33.59	304	108	A	V

	*	2462	93.8	-	-	83.38	27.3	16.72	33.6	300	161	P	H
	*	2462	86.59	-	-	76.17	27.3	16.72	33.6	300	161	A	H
		2485.32	53.05	-20.95	74	42.61	27.3	16.74	33.6	300	161	P	H
		2495.88	43.35	-10.65	54	32.89	27.3	16.75	33.59	300	161	A	H
802.11n													H
HT20													H
CH 11	*	2462	91.11	-	-	80.69	27.3	16.72	33.6	296	116	P	V
2462MHz	*	2462	83.86	-	-	73.44	27.3	16.72	33.6	296	116	A	V
		2493.24	53.73	-20.27	74	43.27	27.3	16.75	33.59	296	116	P	V
		2485.92	43.21	-10.79	54	32.77	27.3	16.74	33.6	296	116	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (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)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		4824	39.55	-34.45	74	60.7	31.1	11.02	63.27	100	0	P	H
													H
													H
													H
		4824	39.1	-34.9	74	60.25	31.1	11.02	63.27	100	0	P	V
													V
													V
													V
802.11n HT20 CH 06 2437MHz		4874	40.29	-33.71	74	61.43	31.05	11.06	63.25	100	0	P	H
		7311	42.57	-31.43	74	53.12	36.52	13.66	60.73	100	0	P	H
													H
													H
		4874	39.81	-34.19	74	60.95	31.05	11.06	63.25	100	0	P	V
		7311	42.35	-31.65	74	52.9	36.52	13.66	60.73	100	0	P	V
													V
													V
802.11n HT20 CH 11 2462MHz		4924	39.26	-34.74	74	60.26	31.14	11.09	63.23	100	0	P	H
		7386	42.65	-31.35	74	53.25	36.46	13.58	60.64	100	0	P	H
													H
													H
		4924	39.81	-34.19	74	60.81	31.14	11.09	63.23	100	0	P	V
		7386	41.89	-32.11	74	52.49	36.46	13.58	60.64	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

2.4GHz WIFI 802.11g (LF)

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)
2.4GHz 802.11g LF		76.56	35.2	-4.8	40	53.64	12.7	1.2	32.34	-	-	P	H
		139.61	34.7	-8.8	43.5	48.28	17.14	1.57	32.29	-	-	P	H
		237.58	43.31	-2.69	46	56.65	16.77	2.11	32.22	100	0	P	H
		720.64	35.22	-10.78	46	36.52	27.08	3.7	32.08	-	-	P	H
		904.94	32.74	-13.26	46	30.84	29	4.2	31.3	-	-	P	H
		968.96	33.99	-20.01	54	29.36	30.98	4.37	30.72	-	-	P	H
													H
													H
													H
													H
													H
													H
		33.88	33.34	-6.66	40	42.61	22.3	0.8	32.37	-	-	P	V
		139.61	37.01	-6.49	43.5	50.59	17.14	1.57	32.29	-	-	P	V
		237.58	40.79	-5.21	46	54.13	16.77	2.11	32.22	100	0	P	V
		559.62	26.99	-19.01	46	29.9	26.05	3.23	32.19	-	-	P	V
		715.79	35.97	-10.03	46	37.47	26.91	3.68	32.09	-	-	P	V
		970.9	34.51	-19.49	54	29.86	30.97	4.38	30.7	-	-	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

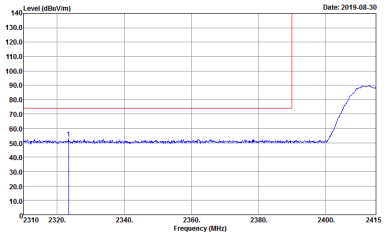
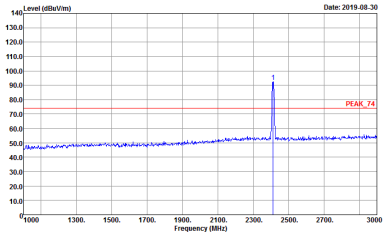
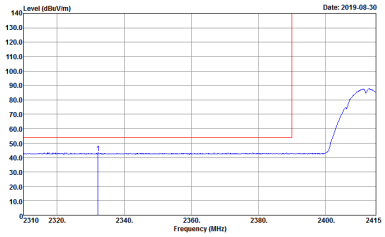
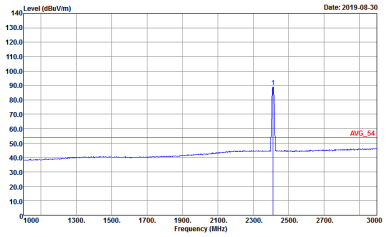
Test Engineer :	Bill Kuo and Troye Hsieh	**Temperature :**	21.3~25.8°C
		Relative Humidity :	53.4~65.3%

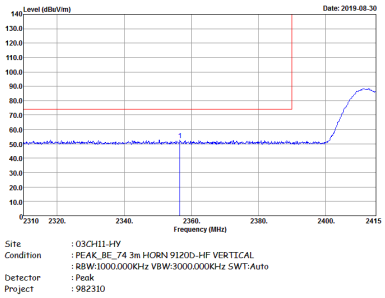
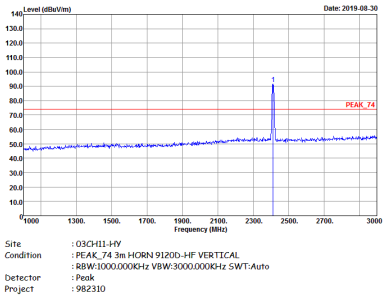
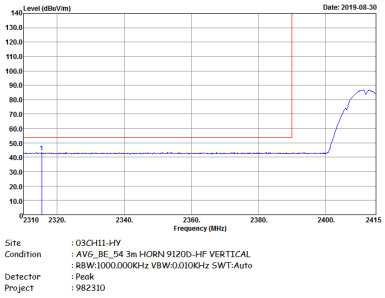
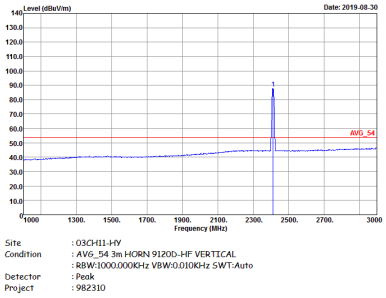
Note symbol

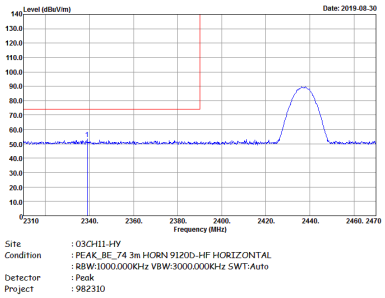
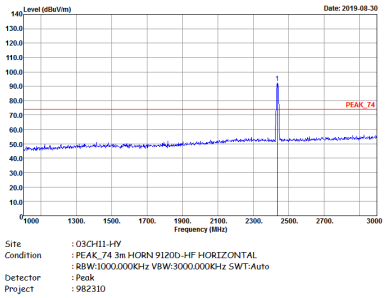
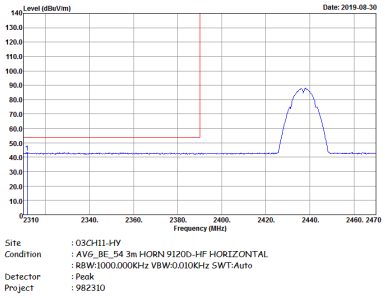
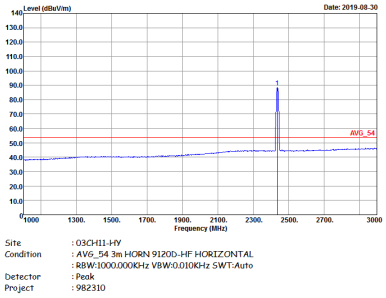
-L	**Low channel location**
-R	**High channel location**

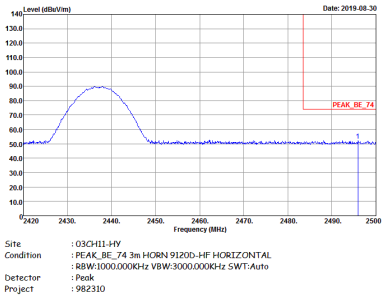
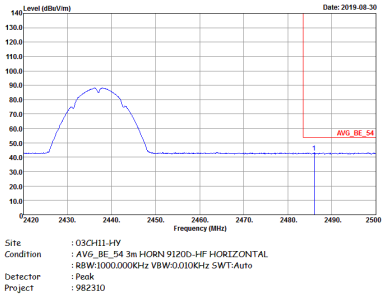
2.4GHz 2400~2483.5MHz

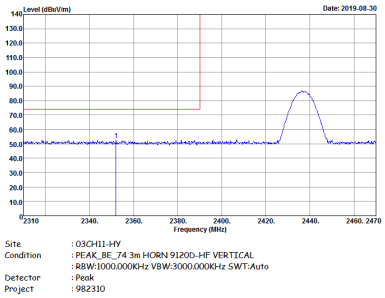
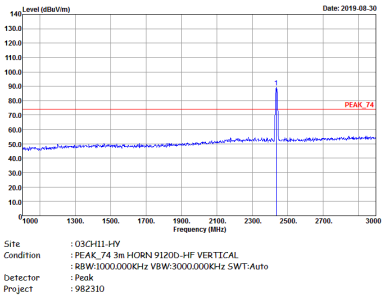
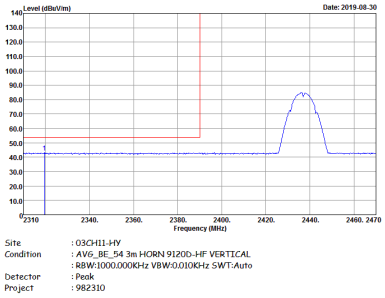
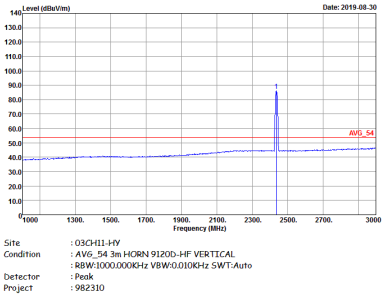
WIFI 802.11b (Band Edge @ 3m)

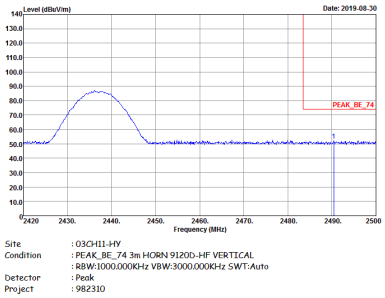
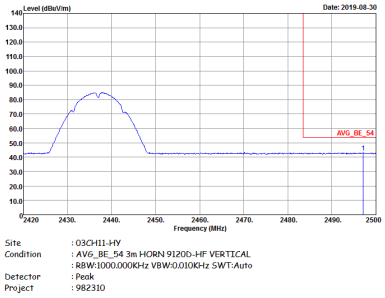
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 982310	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 982310
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 982310	 Site : 03CH11-HY Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 982310

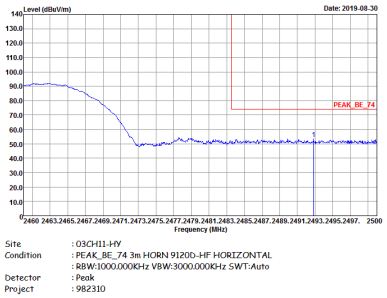
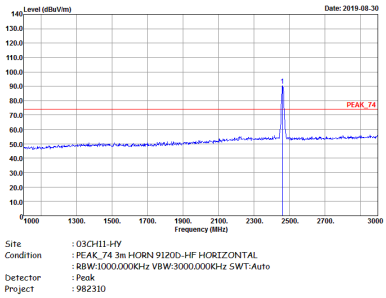
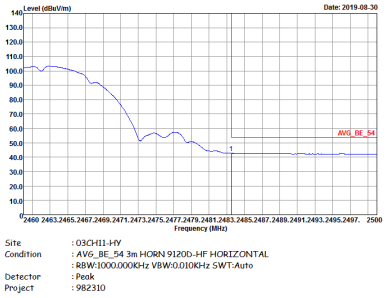
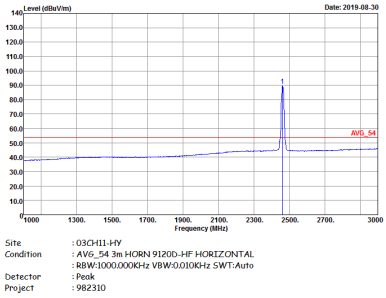
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

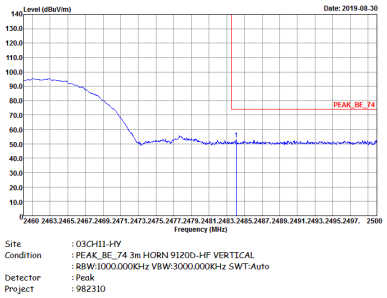
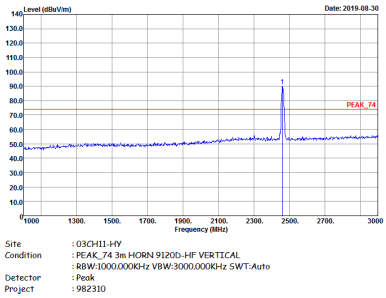
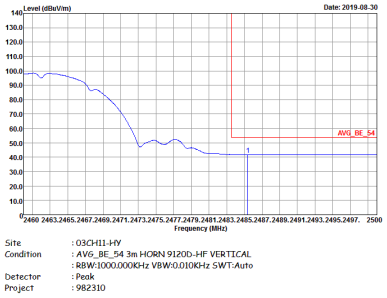
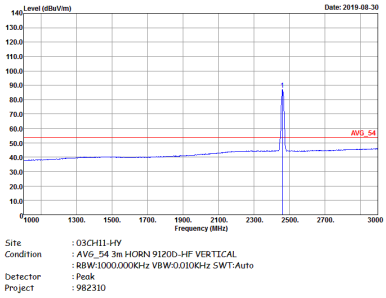
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		

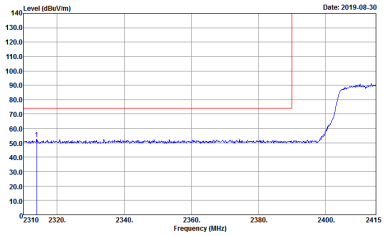
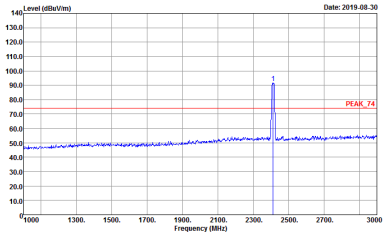
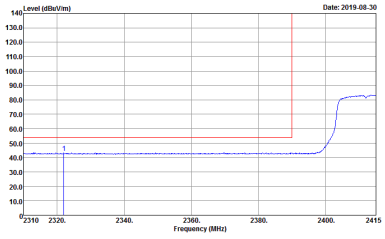
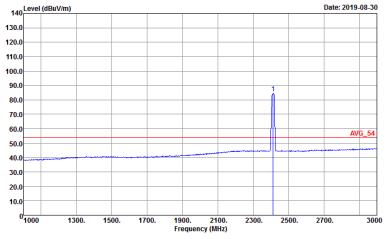
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

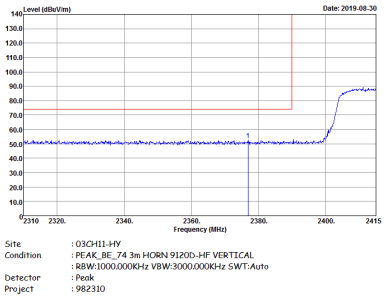
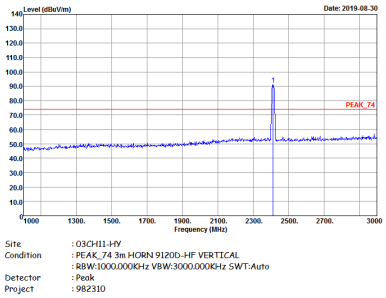
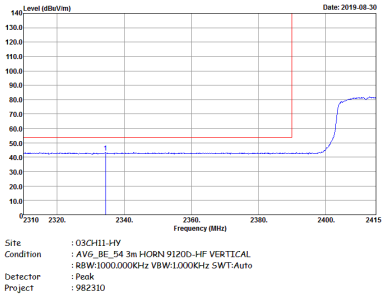
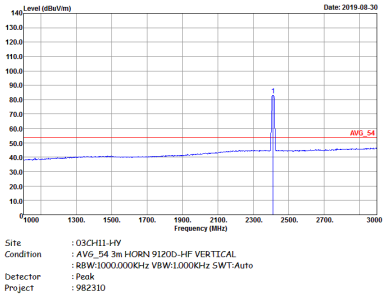
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

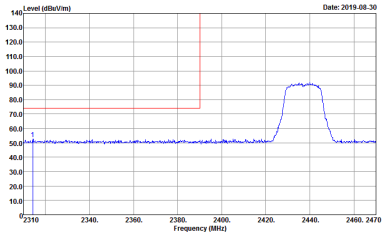
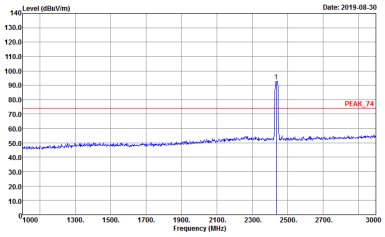
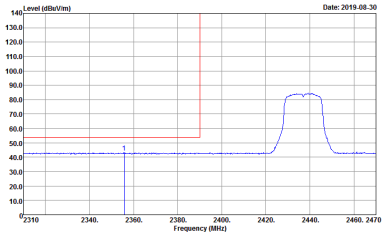
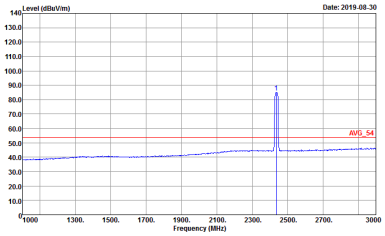
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
1	Vertical	Fundamental
Peak		
Avg.		

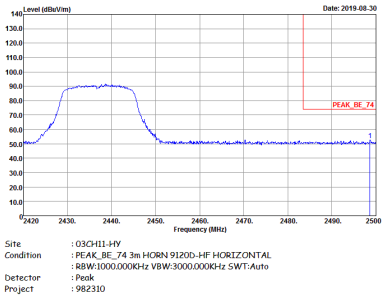
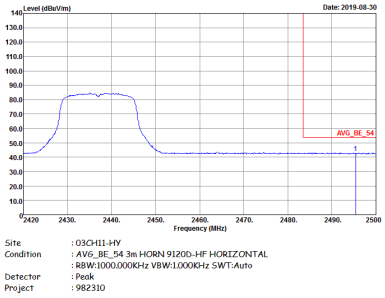
2.4GHz 2400~2483.5MHz

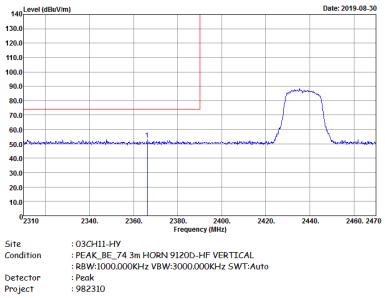
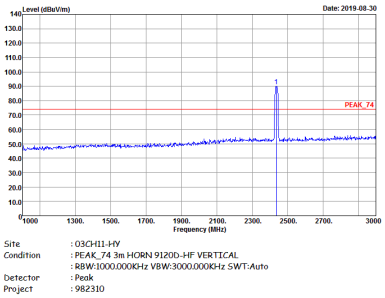
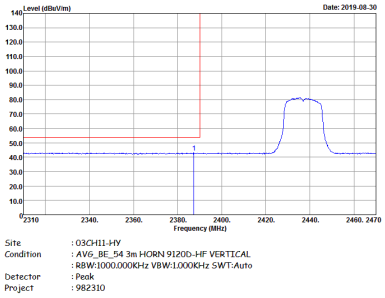
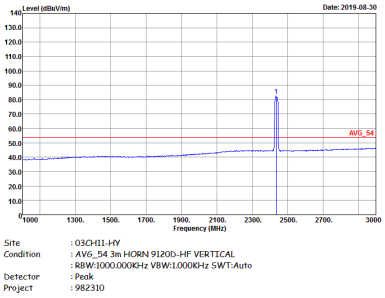
WIFI 802.11g (Band Edge @ 3m)

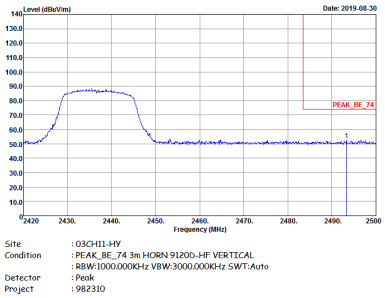
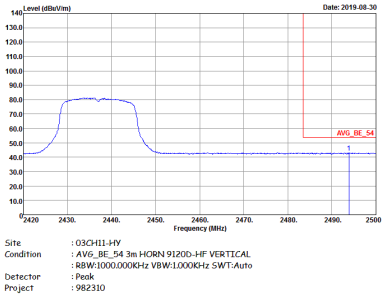
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

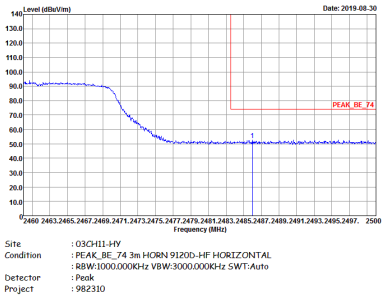
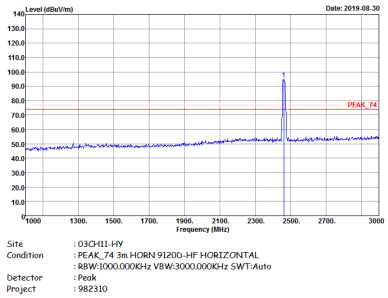
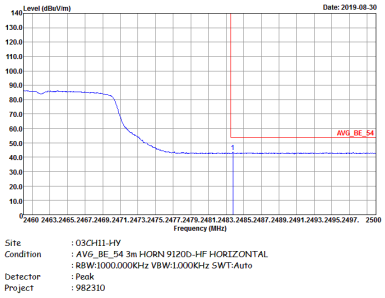
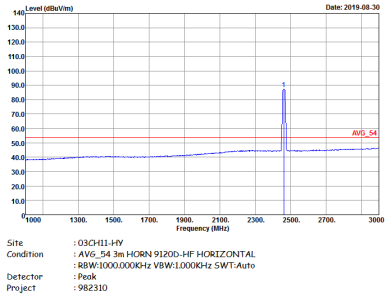
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

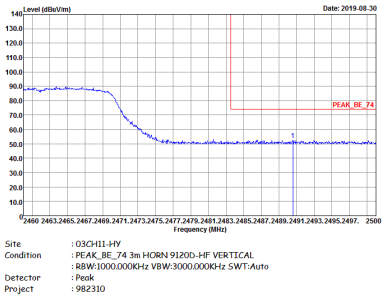
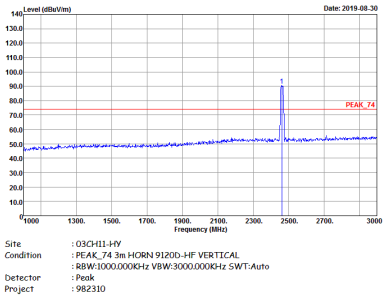
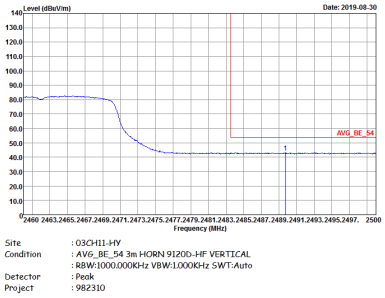
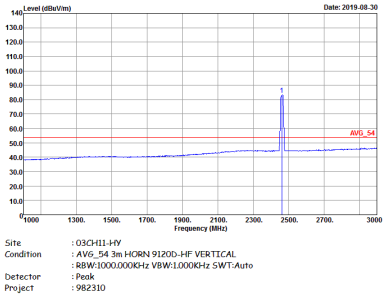
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		

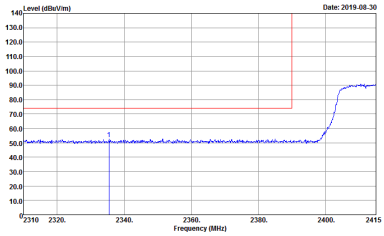
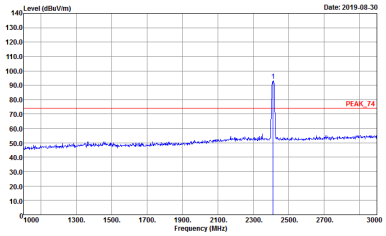
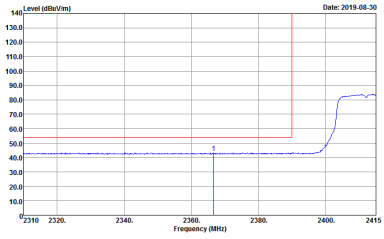
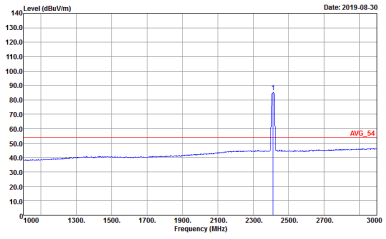
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - R	
1	Vertical	Fundamental
Peak		Left Blank
Avg.		Left Blank

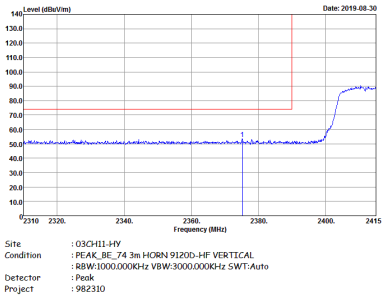
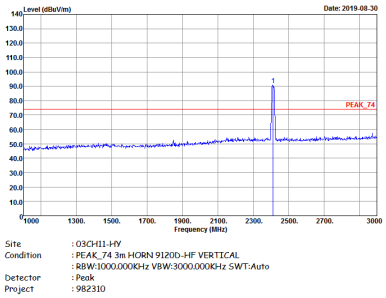
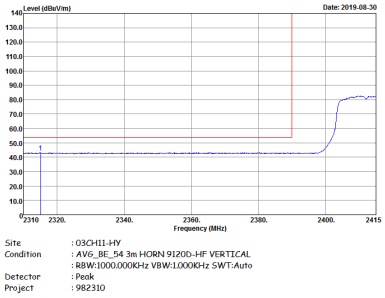
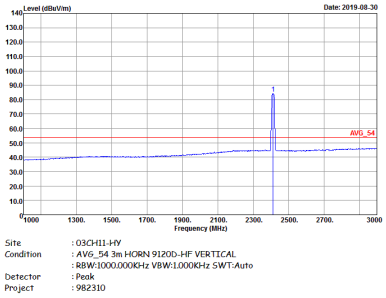
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

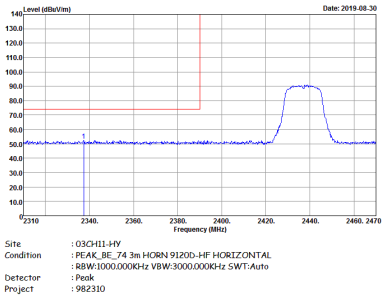
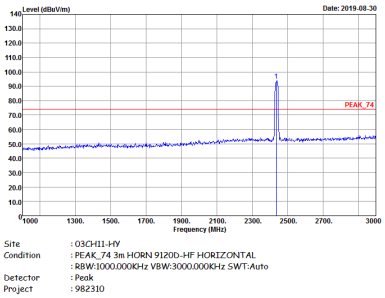
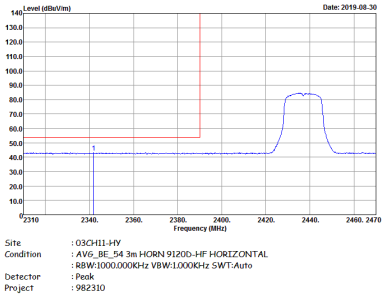
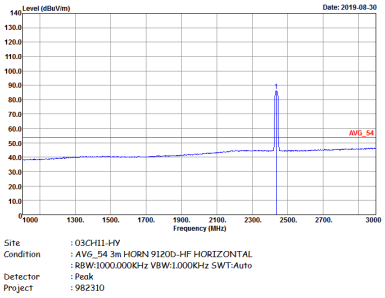
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1	Vertical	Fundamental
Peak		
Avg.		

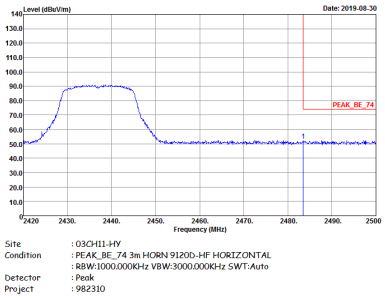
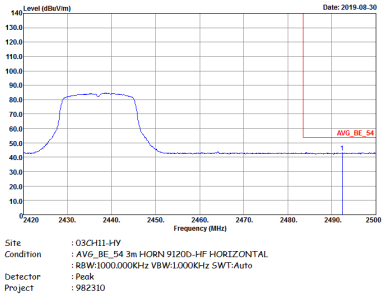
2.4GHz 2400~2483.5MHz

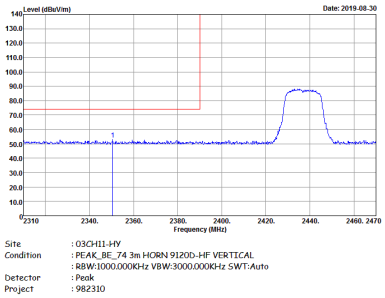
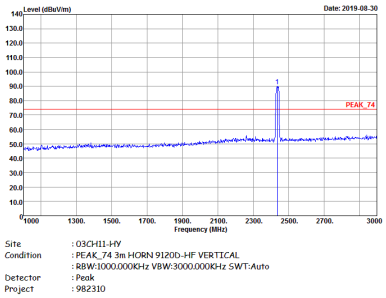
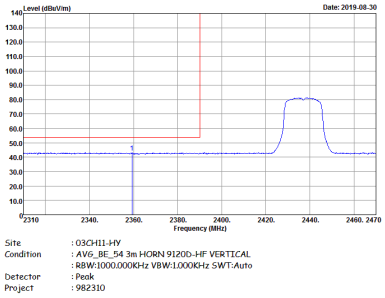
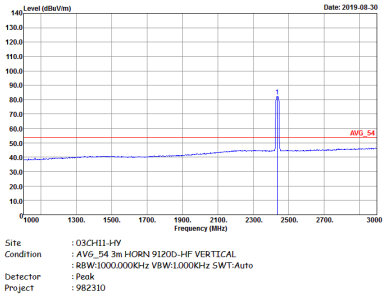
WIFI 802.11n HT20 (Band Edge @ 3m)

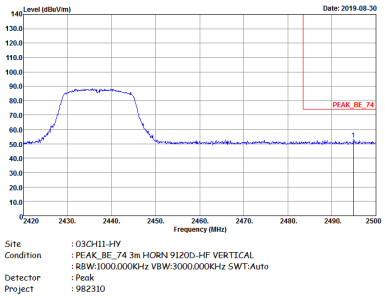
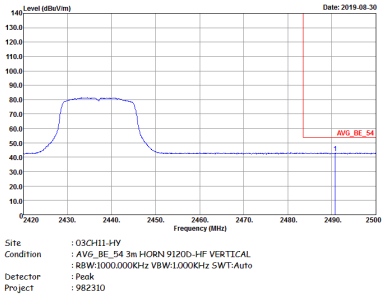
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

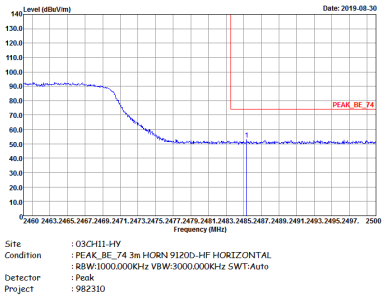
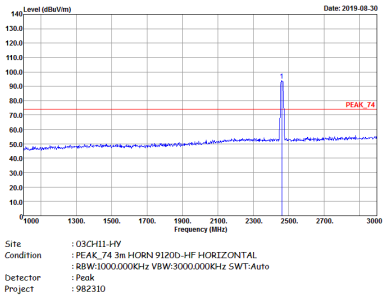
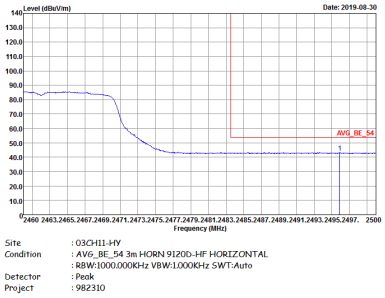
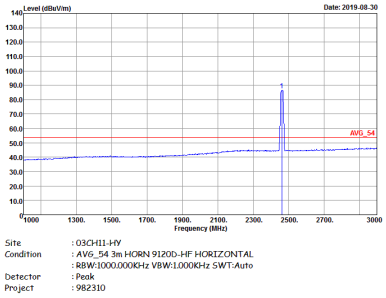
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

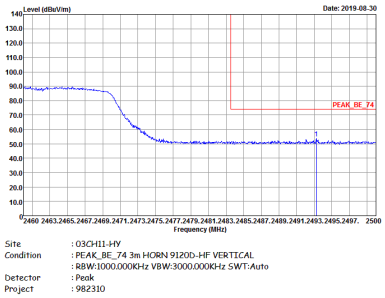
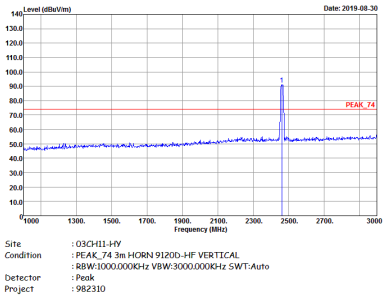
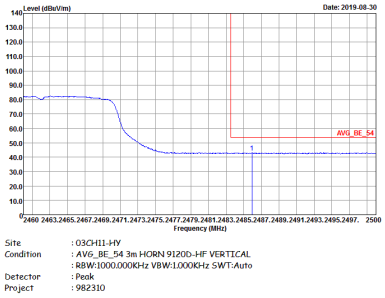
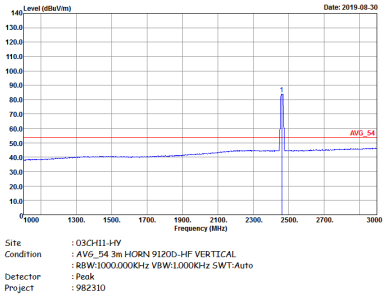
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		

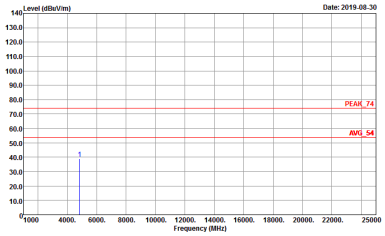
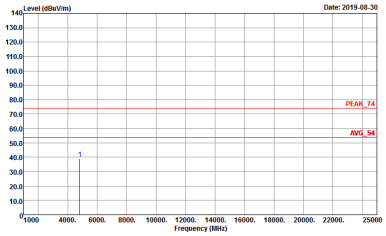
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - R	
1	Vertical	Fundamental
Peak		Left Blank
Avg.		Left Blank

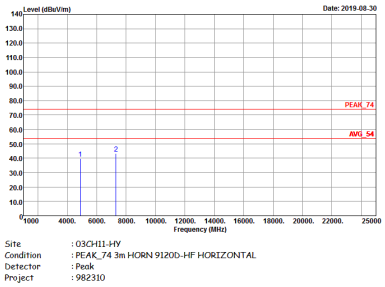
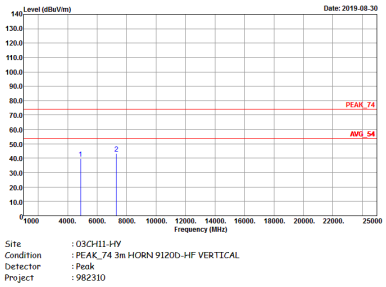
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

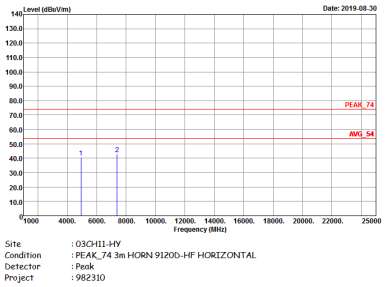
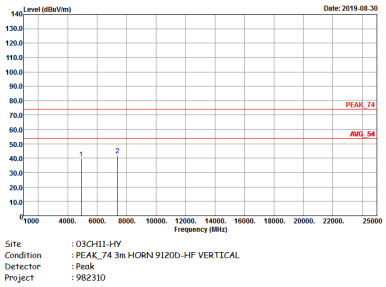
WIFI	2.4GHz 2400~2483.5MHz Fundamental @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1	Vertical	Fundamental
Peak		
Avg.		

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

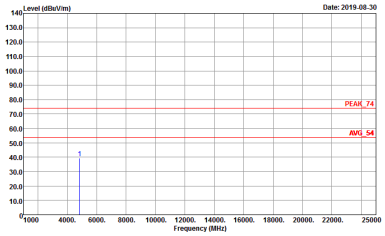
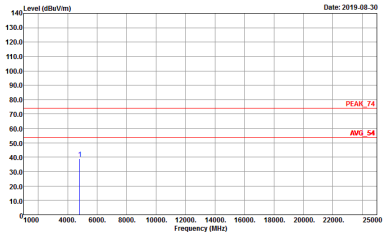
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH01 2412MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 982310	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 982310

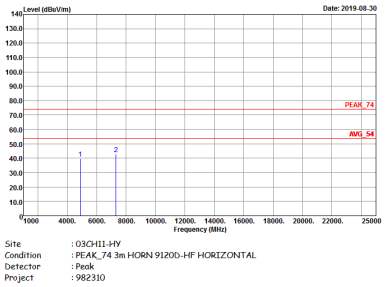
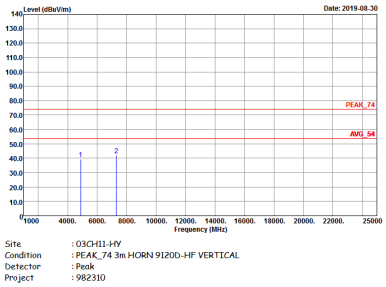
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH06 2437MHz	
1	Horizontal	Vertical
Peak Avg.		

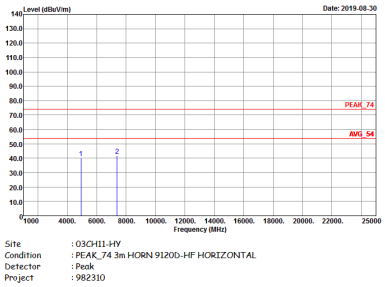
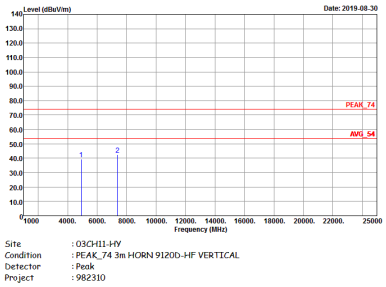
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH11 2462MHz	
1	Horizontal	Vertical
Peak Avg.		

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

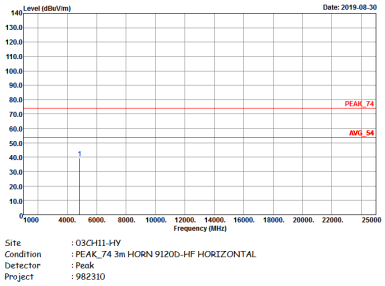
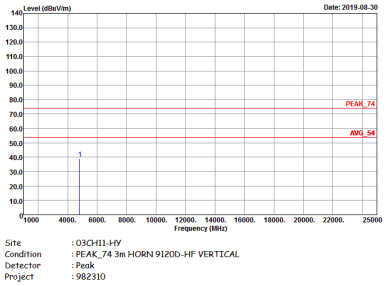
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH01 2412MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 982310	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 982310

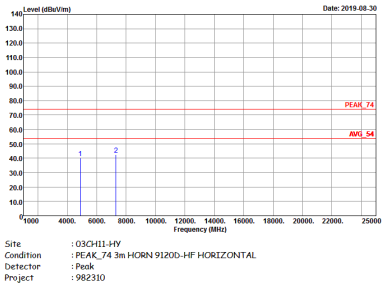
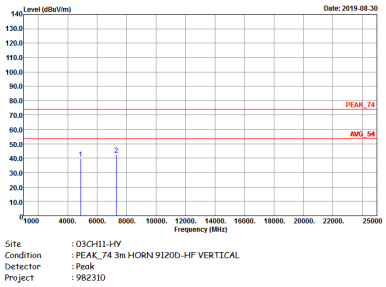
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH06 2437MHz	
1	Horizontal	Vertical
Peak Avg.		

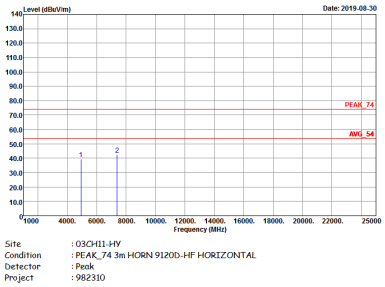
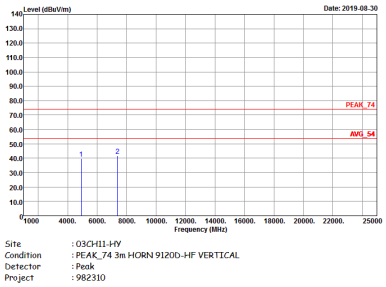
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH11 2462MHz	
1	Horizontal	Vertical
Peak Avg.		

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Harmonic @ 3m)

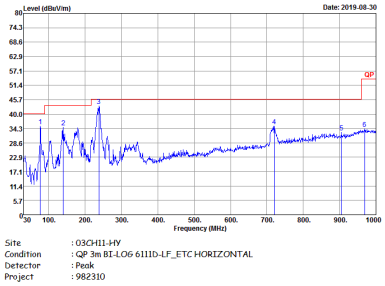
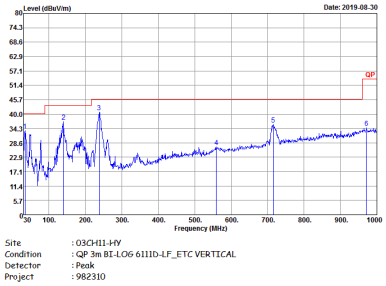
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Horizontal	Vertical
Peak Avg.		

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11n HT20 CH06 2437MHz	
1	Horizontal	Vertical
Peak Avg.		

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

2.4GHz WIFI 802.11g (LF)

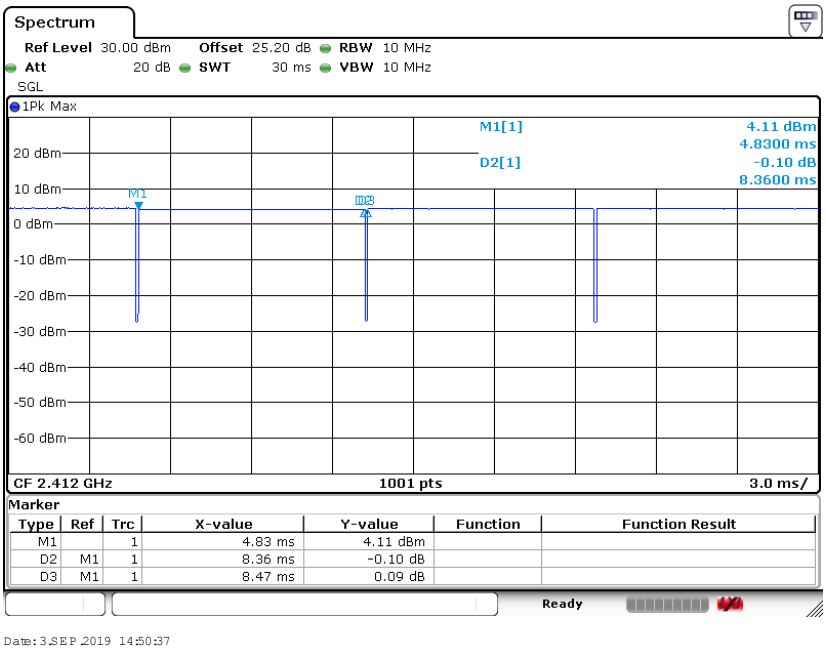
WIFI	2.4GHz 2400~2483.5MHz	
ANT	802.11g LF	
1	Horizontal	Vertical
QP / Peak		

Appendix E. Duty Cycle Plots

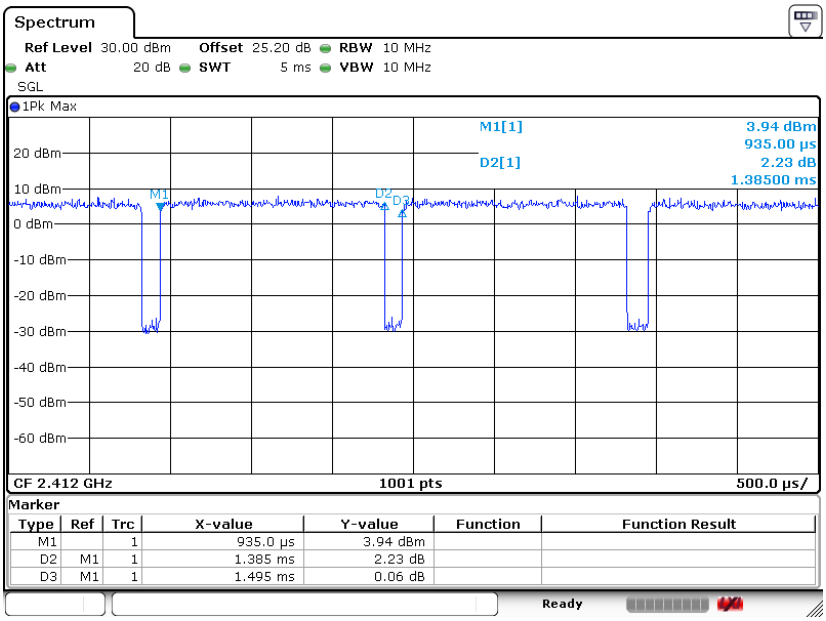
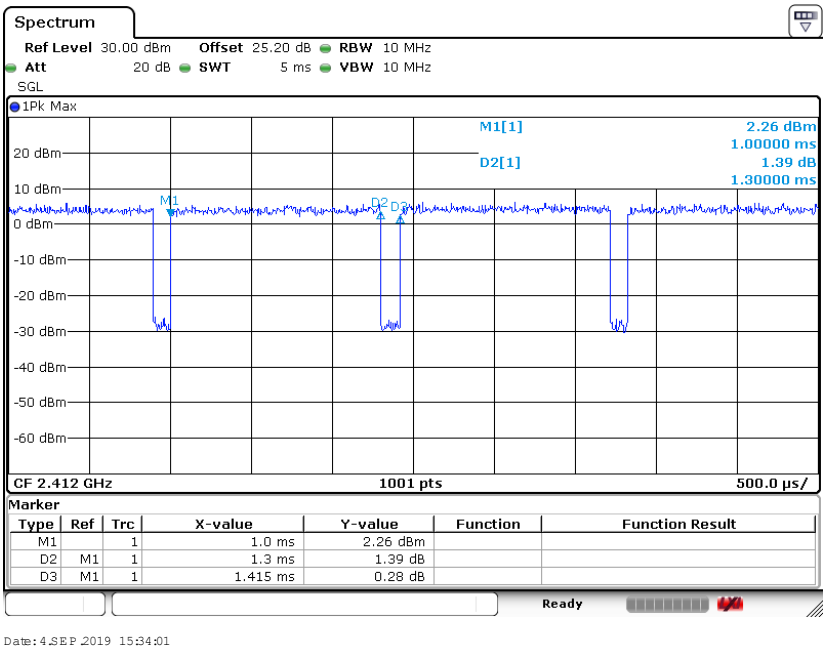
Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
1	802.11b	98.70	-	-	10Hz	0.06
1	802.11g	92.64	1385	0.72	1kHz	0.33
1	2.4GHz 802.11n HT20	91.87	1300	0.77	1kHz	0.37

<Ant. 1>

802.11b



802.11g



802.11n HT20