FCC RF Test Report

APPLICANT	:	Bullitt Group
EQUIPMENT	:	Rugged Smart Phone
BRAND NAME	:	CAT
MODEL NAME	:	S41
MARKETING NAME	:	S41
FCC ID	:	ZL5S41
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System

The product was received on Jun. 09, 2017 and testing was completed on Aug. 11, 2017. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

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

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager

Testing Laboratory
1190

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

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR732839-01C	Rev. 01	Initial issue of report	Aug. 23, 2017

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.1	-	99% Bandwidth	-	Pass	-
3.2	15.247(b)	Power Output Measurement	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	Conducted Band Edges	≤ 20dBc	Pass	-
		Conducted Spurious Emission		Pass	-
3.5	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 1.41 dB at 4874.000 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 17.80 dB at 0.150 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Bullitt Group
One Valpy, Valpy Street, Reading, Berkshire, England RG1 1AR

1.2 Manufacturer

Compal Electronics, INC.
No. 385, Yangguang St. Neihu District, Taipei City 11491, Taiwan, R.O.C

1.3 Product Feature of Equipment Under Test

GSM/WCDMA/LTE, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n, Wi-Fi 5GHz 802.11a/n, FM Receiver, NFC, and GPS.

Product Specification subjective to this standard	
Antenna Type	WWAN: PIFA + Coupling type (LDS) Antenna WLAN: PIFA Antenna Bluetooth: PIFA Antenna GPS / Glonass : PIFA Antenna NFC: Loop Antenna FM: Integral Antenna (Earphone acting as FM antenna deemed as an integral antenna)

<Sample Information>

S41 has two different variant	
Sample 1	Dual SIM
Sample 2	Single SIM
For Dual-SIM or Single-SIM control by SW, the HW difference is SIM holder.	

Remark: All test items were performed with Sample 1.

1.4 Modification of EUT

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

1.5 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

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

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.**
	03CH11-HY

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

1.6 Applicable Standards

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

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
- ANSI C63.10-2013

Remark:

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

2 Test Configuration of Equipment Under Test

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

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

2.1 Carrier Frequency 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	-	-

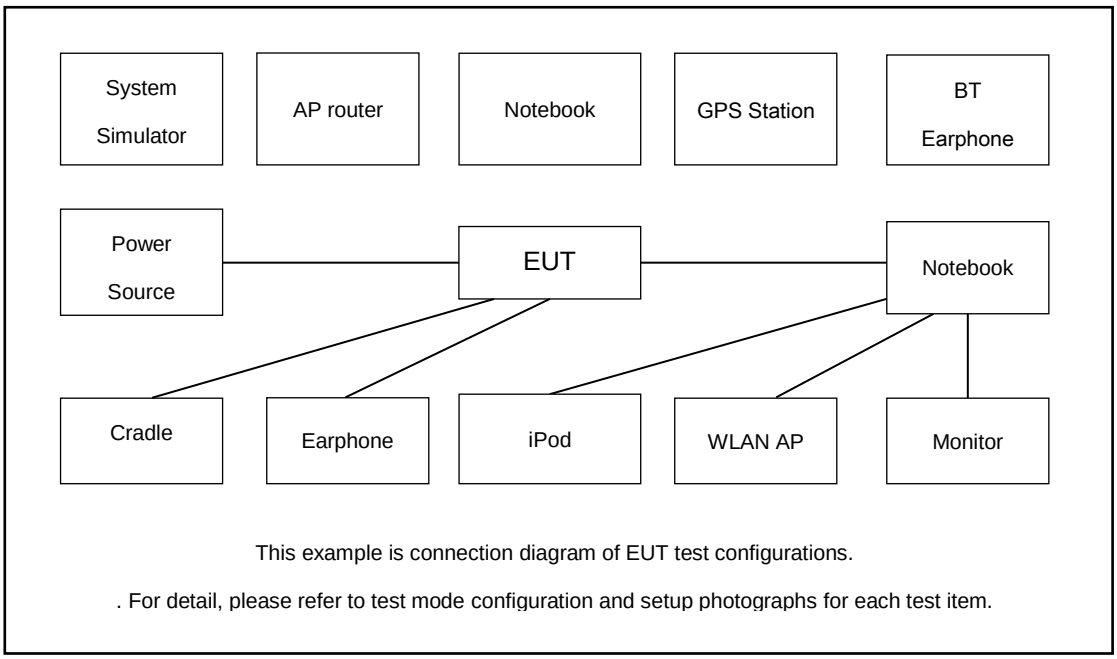
2.2 Test Mode

Final test mode of conducted test items and radiated spurious emissions 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:	LTE Band 7 Idle + Bluetooth Link + WIFI (2.4GHz) Link + NFC on + FM Rx (98MHz) + Earphone + Battery + USB Cable (Charging from Adapter) + SIM 1

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.	Base Station	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	Bluetooth Earphone	Sony Ericsson	MW600	PY700A2029	N/A	N/A
3.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
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
5.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, an engineering test program (SW####) was provided and enabled to make EUT continuous transmit/receive.

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.

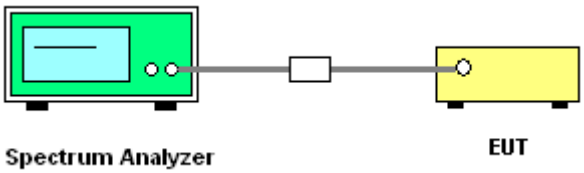
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

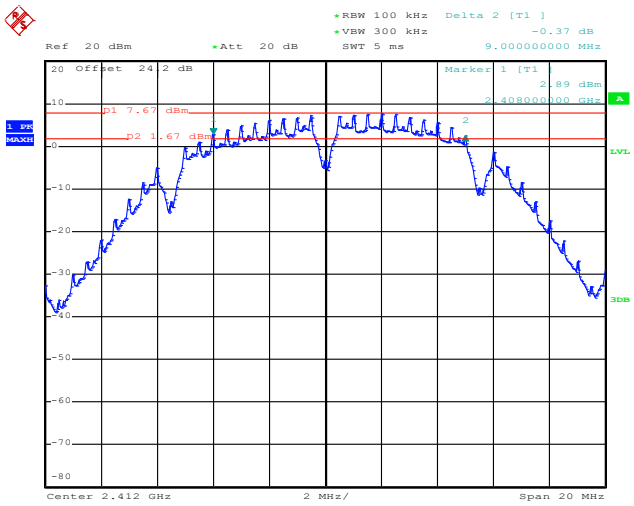
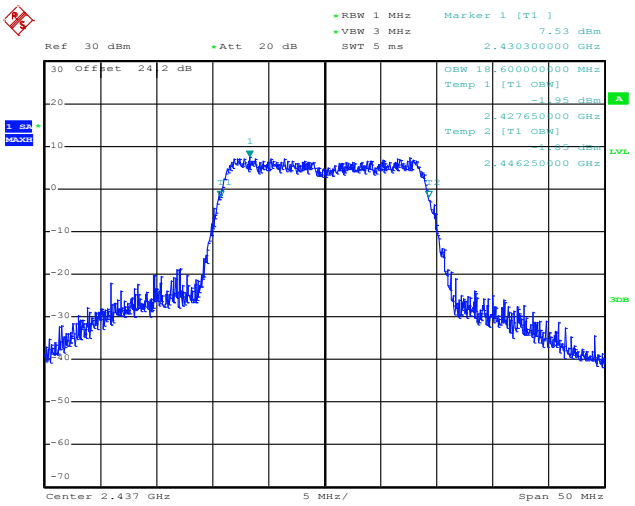
1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v04.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit 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) = 1MHz and set the Video bandwidth (VBW) = 3MHz.
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
	
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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 of directional gain greater than 6dBi are 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.

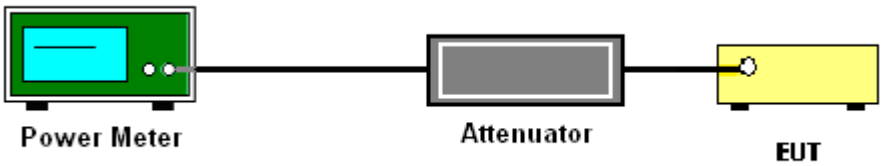
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04 section 9.1.2 PKPM1 Peak power meter method.
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 Peak Output Power

Please refer to Appendix A.

3.2.6 Test Result of Average output Power (Reporting Only)

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.

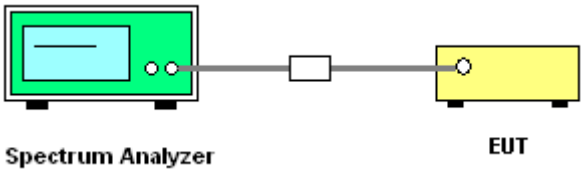
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
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.

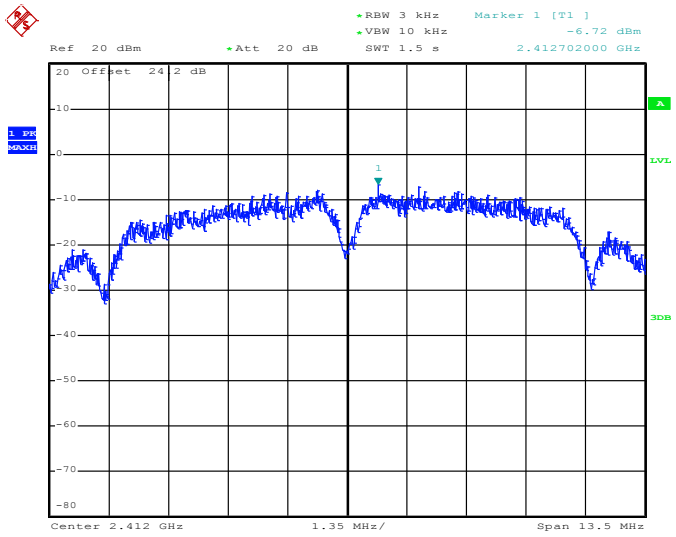
3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Density (dBm/3kHz)



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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.

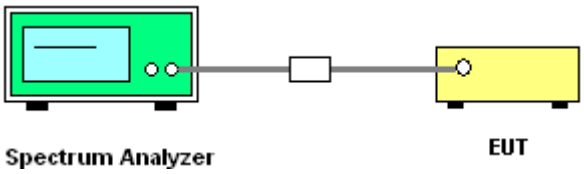
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
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

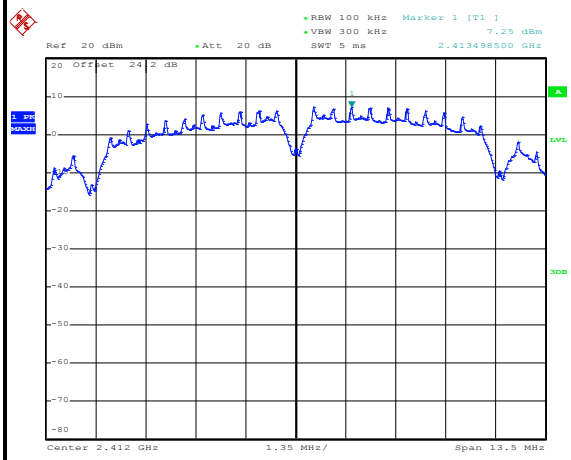


3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Mode :	802.11b	**Temperature :**	21~25°C
Test Band :	2.4GHz Low	**Relative Humidity :**	51~54%
Test Channel :	01	**Test Engineer :**	Reece Lin and Derek Hsu

WLAN 802.11b Channel 01

100kHz PSD reference Level



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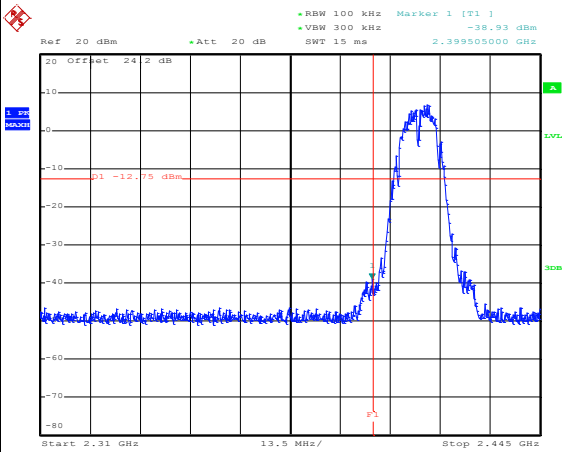
Low Channel Plot



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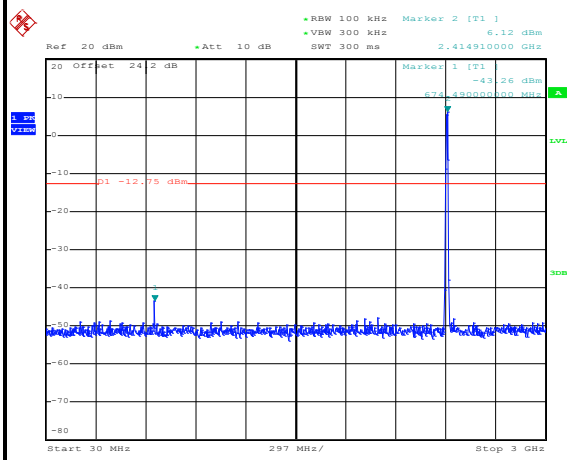
Spurious Emission 30MHz~3GHz



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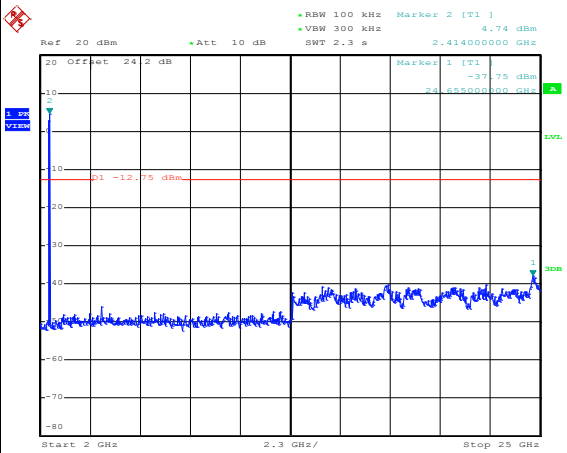
Spurious Emission 2GHz~25GHz



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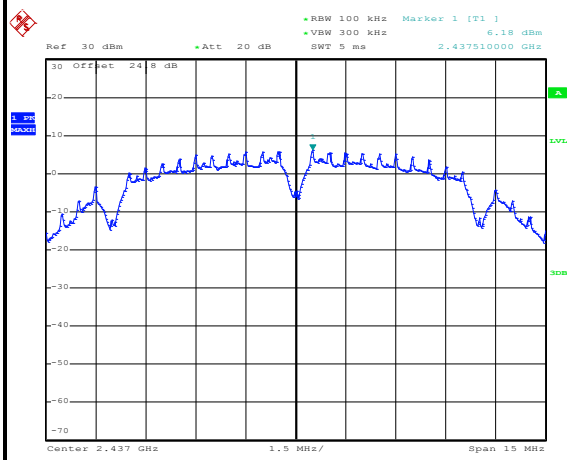
Test Mode :	802.11b	**Temperature :**	21~25°C
Test Band :	2.4GHz Mid	**Relative Humidity :**	51~54%
Test Channel :	06	**Test Engineer :**	Reece Lin and Derek Hsu

WLAN 802.11b Channel 06

100kHz PSD reference Level



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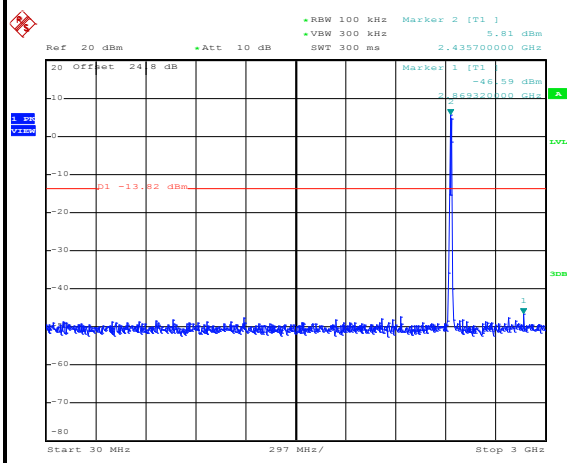
Mid Channel Plot

Spurious Emission 30MHz~3GHz



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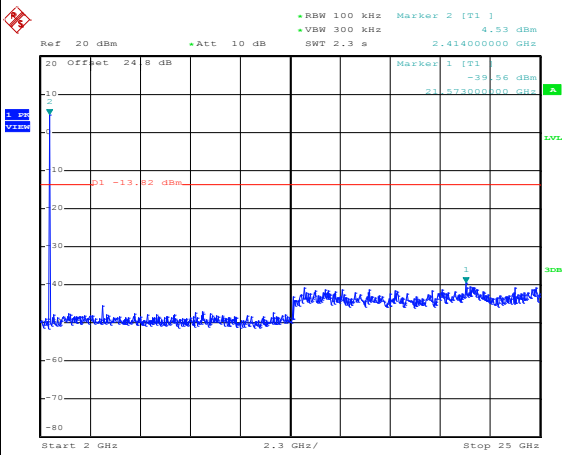
Spurious Emission 2GHz~25GHz

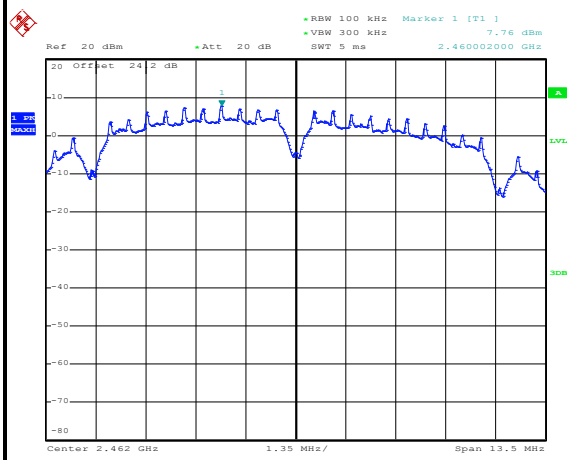


Date: 9.AUG.2017 22:28:26

Test Mode :	802.11b	**Temperature :**	21~25°C
Test Band :	2.4GHz High	**Relative Humidity :**	51~54%
Test Channel :	11	**Test Engineer :**	Reece Lin and Derek Hsu

WLAN 802.11b Channel 11

100kHz PSD reference Level



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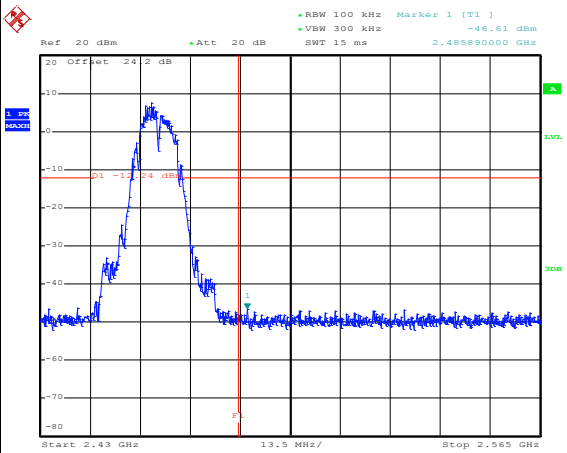
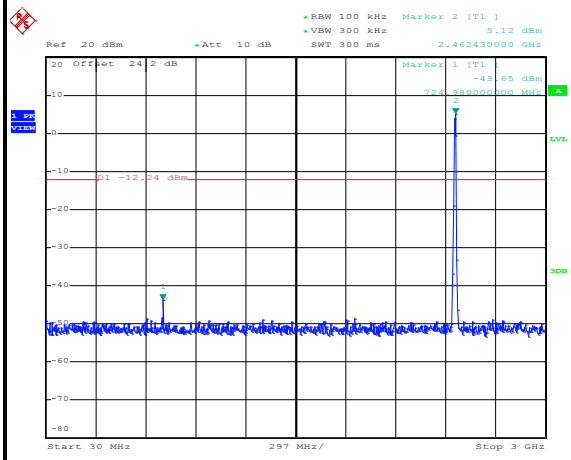
High Channel Plot



Date: 3.AUG.2017 19:59:39

Spurious Emission 30MHz~3GHz



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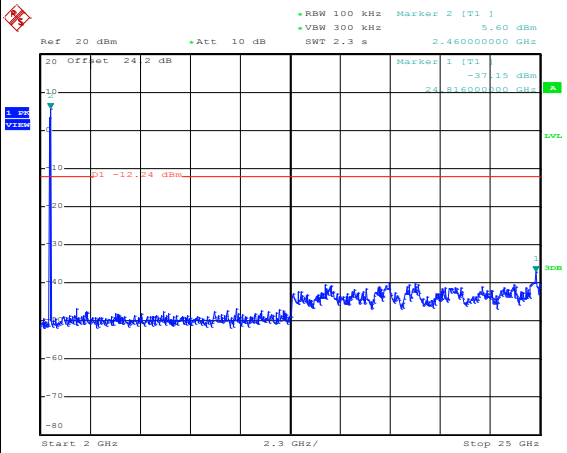
Spurious Emission 2GHz~25GHz

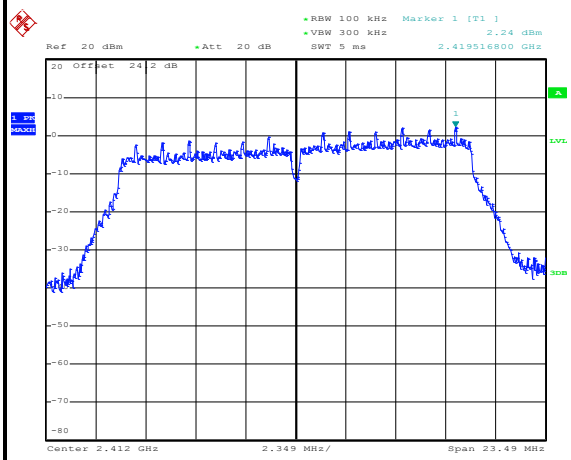


Date: 3.AUG.2017 19:59:59

Test Mode :	802.11g	**Temperature :**	21~25°C
Test Band :	2.4GHz Low	**Relative Humidity :**	51~54%
Test Channel :	01	**Test Engineer :**	Reece Lin and Derek Hsu

WLAN 802.11g Channel 01

100kHz PSD reference Level



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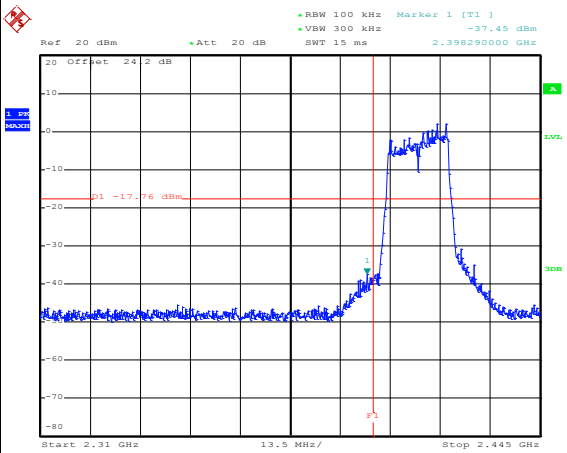
Low Channel Plot



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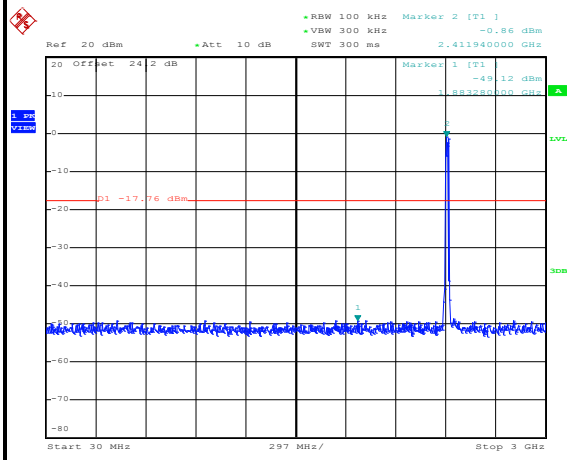
Spurious Emission 30MHz~3GHz



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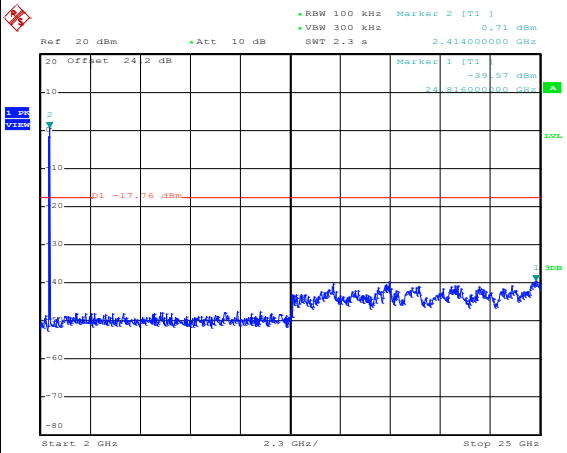
Spurious Emission 2GHz~25GHz



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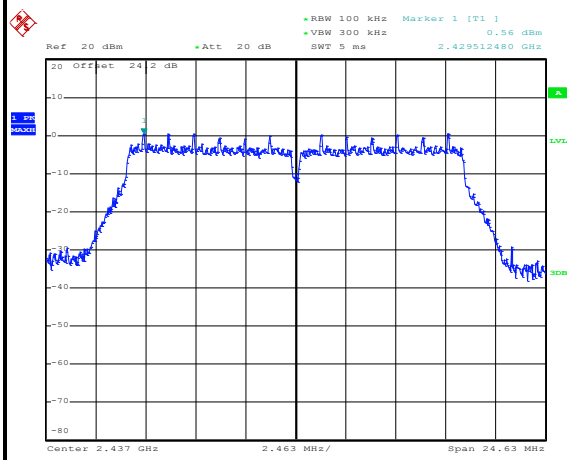
Test Mode :	802.11g	**Temperature :**	21~25°C
Test Band :	2.4GHz Mid	**Relative Humidity :**	51~54%
Test Channel :	06	**Test Engineer :**	Reece Lin and Derek Hsu

WLAN 802.11g Channel 06

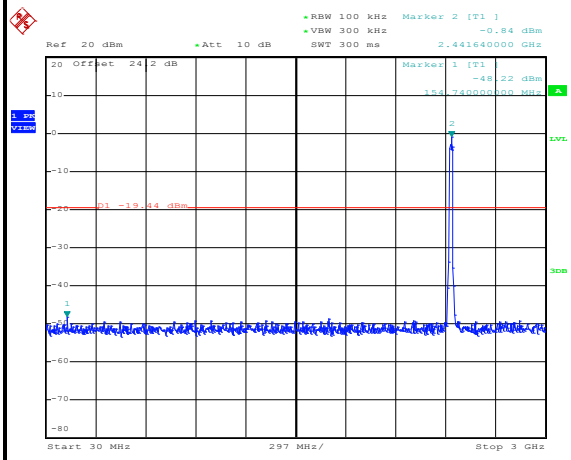
100kHz PSD reference Level



Date: 3.AUG.2017 20:14:13

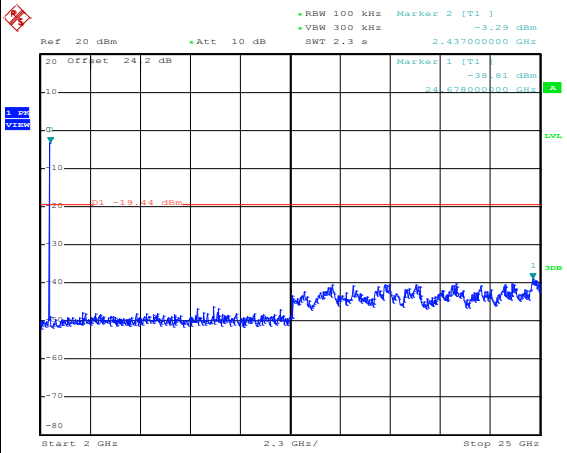
Mid Channel Plot

Spurious Emission 30MHz~3GHz



Date: 3.AUG.2017 20:14:36

Spurious Emission 2GHz~25GHz

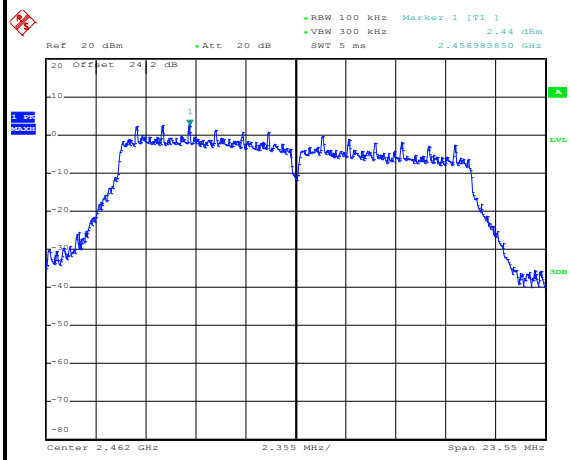


Date: 3.AUG.2017 20:14:44

Test Mode :	802.11g	**Temperature :**	21~25°C
Test Band :	2.4GHz High	**Relative Humidity :**	51~54%
Test Channel :	11	**Test Engineer :**	Reece Lin and Derek Hsu

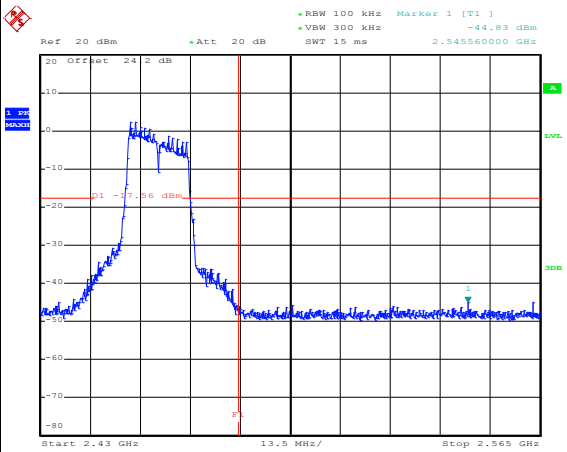
WLAN 802.11g Channel 11

100kHz PSD reference Level



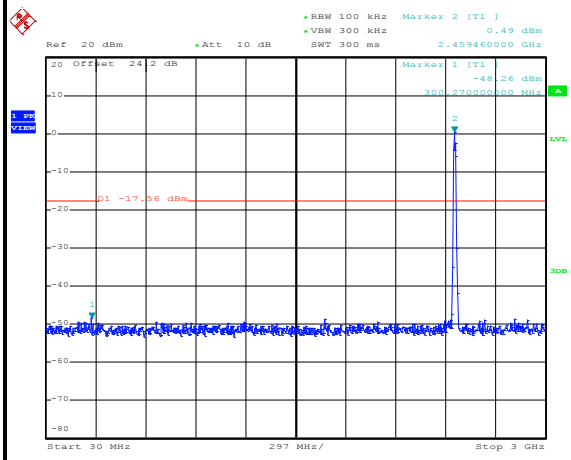
Date: 3.AUG.2017 20:18:53

High Channel Plot



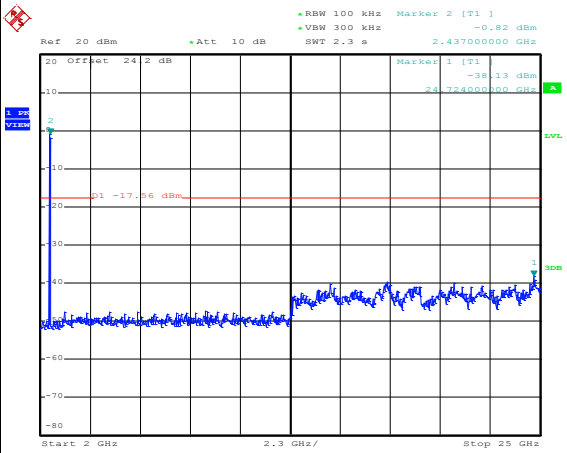
Date: 3.AUG.2017 20:19:15

Spurious Emission 30MHz~3GHz



Date: 3.AUG.2017 20:19:26

Spurious Emission 2GHz~25GHz

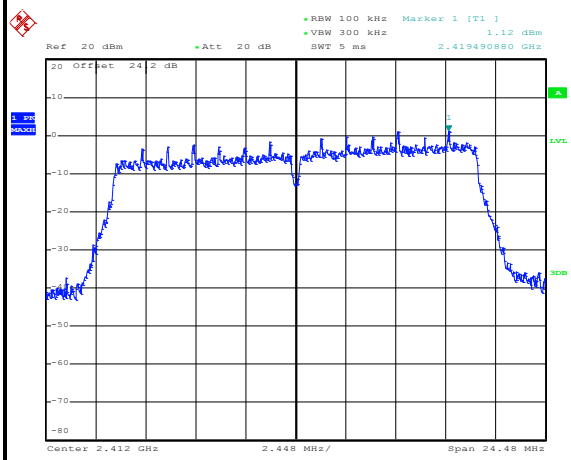


Date: 3.AUG.2017 20:19:34

Test Mode :	802.11n HT20	**Temperature :**	21~25°C
Test Band :	2.4GHz Low	**Relative Humidity :**	51~54%
Test Channel :	01	**Test Engineer :**	Reece Lin and Derek Hsu

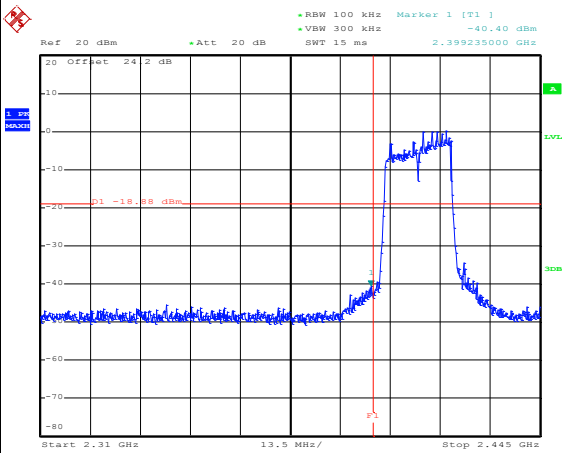
WLAN 802.11n HT20 Channel 01

100kHz PSD reference Level



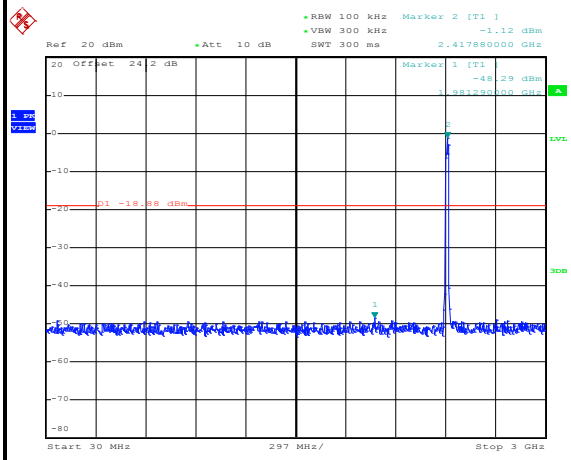
Date: 3.AUG.2017 20:25:34

Low Channel Plot



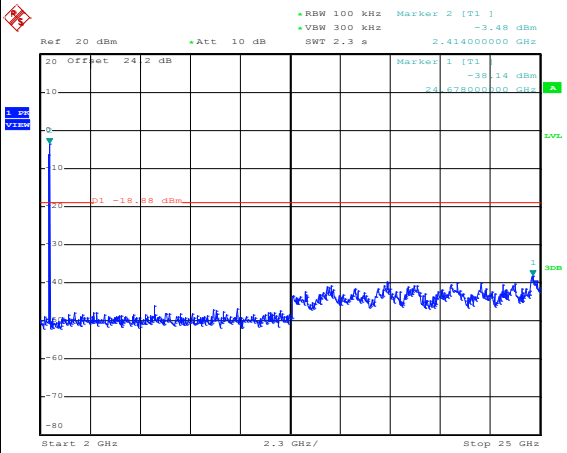
Date: 3.AUG.2017 20:25:45

Spurious Emission 30MHz~3GHz



Date: 3.AUG.2017 20:26:31

Spurious Emission 2GHz~25GHz

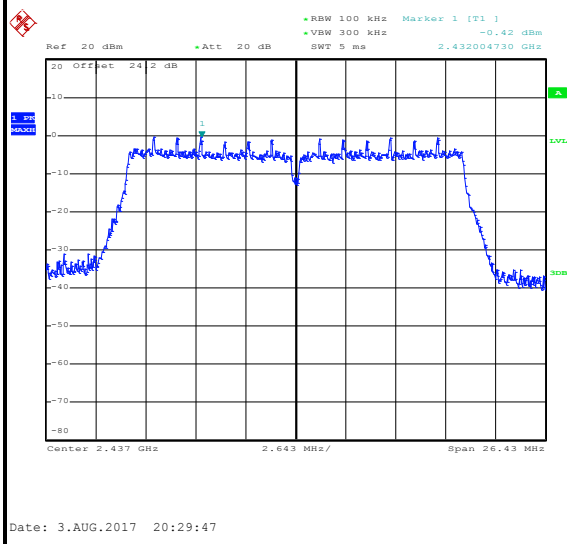


Date: 3.AUG.2017 20:26:39

Test Mode :	802.11n HT20	**Temperature :**	21~25°C
Test Band :	2.4GHz Mid	**Relative Humidity :**	51~54%
Test Channel :	06	**Test Engineer :**	Reece Lin and Derek Hsu

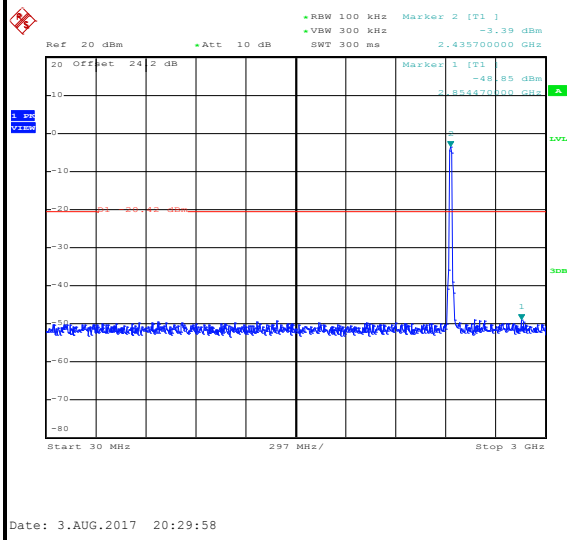
WLAN 802.11n HT20 Channel 06

100kHz PSD reference Level

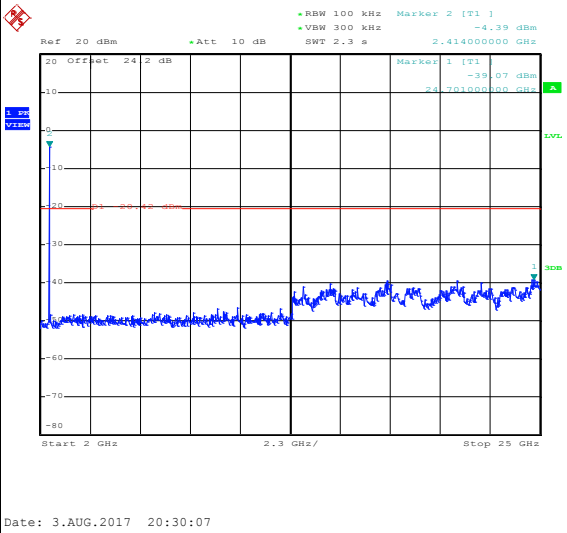


Mid Channel Plot

Spurious Emission 30MHz~3GHz



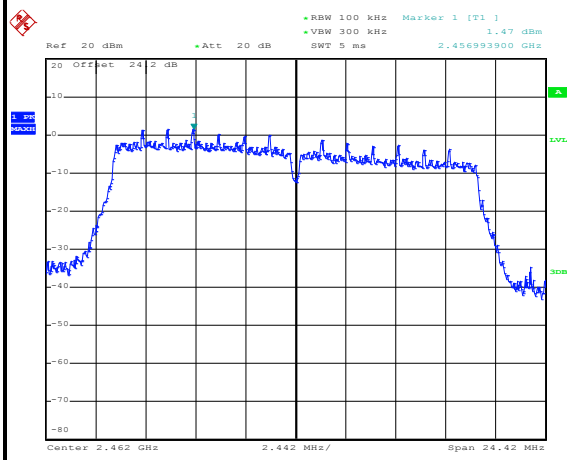
Spurious Emission 2GHz~25GHz



Test Mode :	802.11n HT20	**Temperature :**	21~25°C
Test Band :	2.4GHz High	**Relative Humidity :**	51~54%
Test Channel :	11	**Test Engineer :**	Reece Lin and Derek Hsu

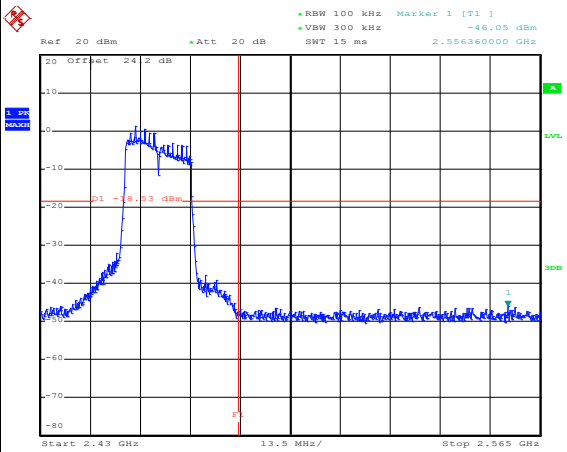
WLAN 802.11n HT20 Channel 11

100kHz PSD reference Level



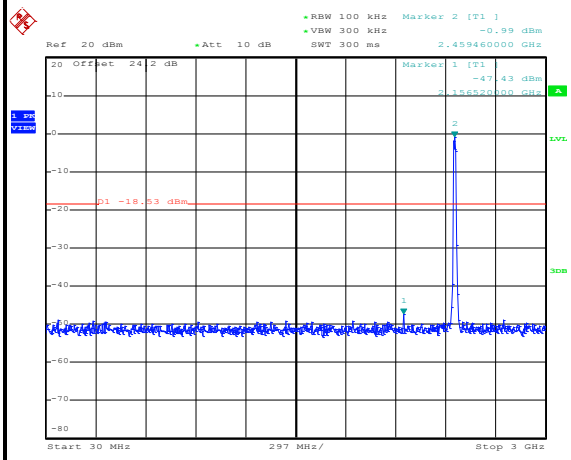
Date: 3.AUG.2017 20:34:14

High Channel Plot



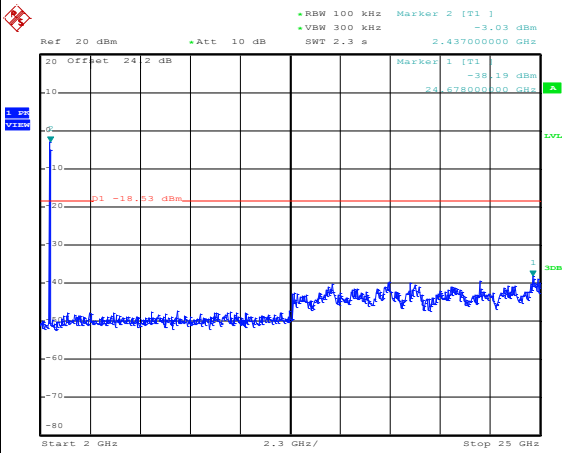
Date: 3.AUG.2017 20:34:28

Spurious Emission 30MHz~3GHz



Date: 3.AUG.2017 20:35:08

Spurious Emission 2GHz~25GHz



Date: 3.AUG.2017 20:35:16

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

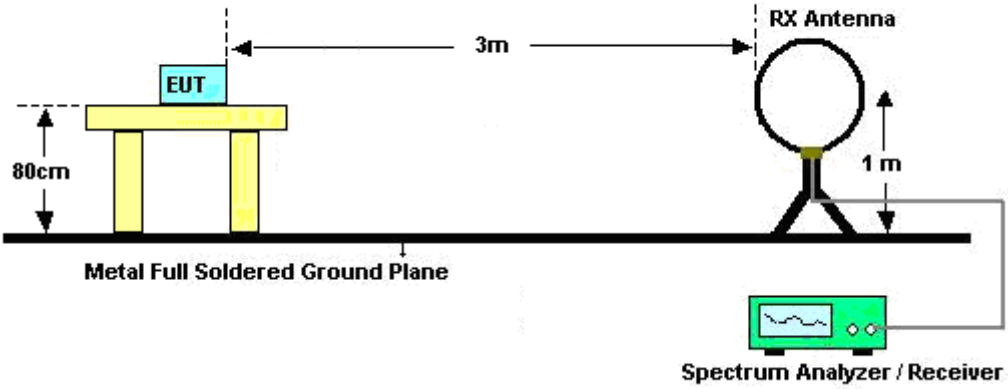
The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

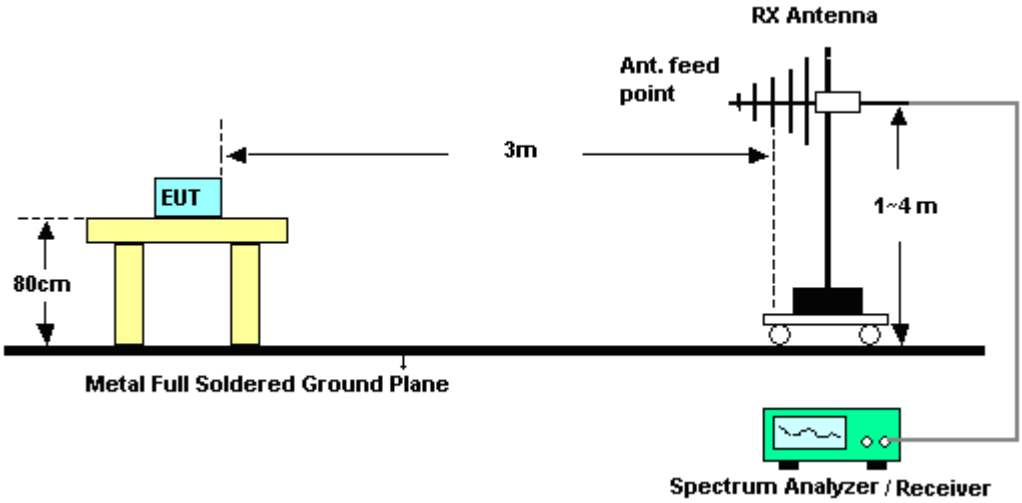
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test 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 measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. 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

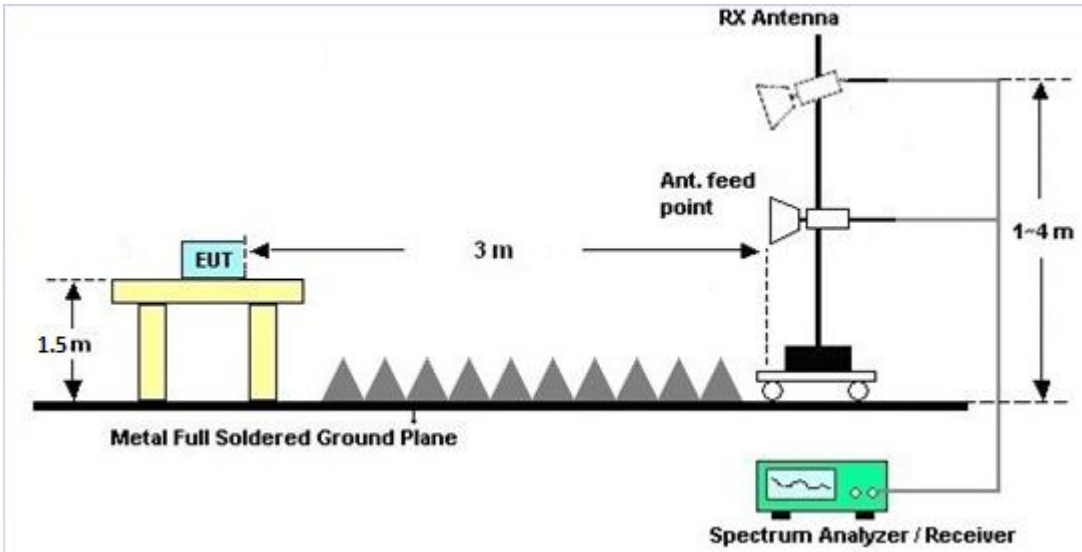
For radiated emissions below 30MHz



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.

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.

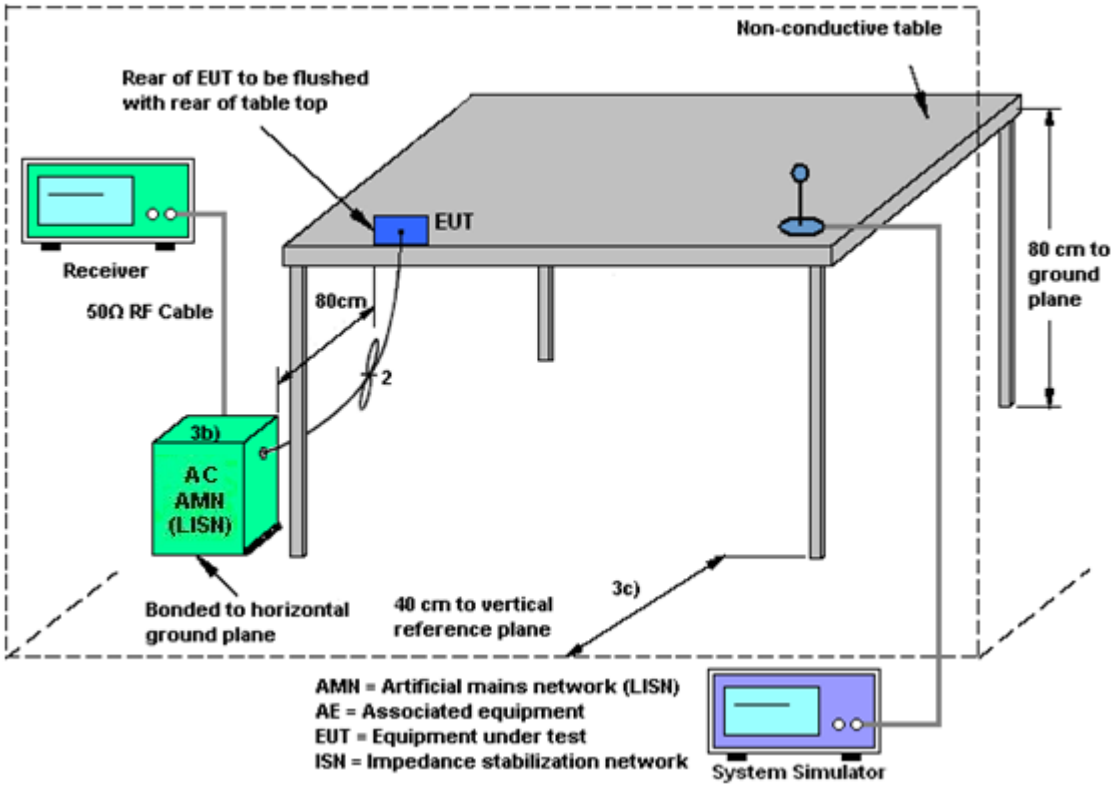
3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 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



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 Meter	Anritsu	ML2495A	0932001	N/A	Sep. 29, 2016	Jul. 27, 2017 ~ Aug. 09, 2017	Sep. 28, 2017	Conducted (TH05-HY)
Power Sensor	Anritsu	MA2411B	0846202	300MHz~40GHz	Sep. 29, 2016	Jul. 27, 2017 ~ Aug. 09, 2017	Sep. 28, 2017	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101067	9kHz ~ 30GHz	Nov. 17, 2016	Jul. 27, 2017 ~ Aug. 09, 2017	Nov. 16, 2017	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Aug. 04, 2017	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Aug. 30, 2016	Aug. 04, 2017	Aug. 29, 2017	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 29, 2016	Aug. 04, 2017	Nov. 28, 2017	Conduction (CO05-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 21, 2017	Aug. 04, 2017~ Aug.11, 2017	Jul. 20, 2018	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Nov. 10, 2016	Aug. 04, 2017~ Aug.11, 2017	Nov. 09, 2017	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-06	35414&AT-N0602	30MHz~1GHz	Oct. 15, 2016	Aug. 04, 2017~ Aug.11, 2017	Oct. 14, 2017	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 07, 2016	Aug. 04, 2017~ Aug.11, 2017	Oct. 06, 2017	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Oct. 20, 2016	Aug. 04, 2017~ Aug.11, 2017	Oct. 19, 2018	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 10, 2016	Aug. 04, 2017~ Aug.11, 2017	Nov. 09, 2017	Radiation (03CH11-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1902247	1GHz~18GHz	Jun. 23, 2017	Aug. 04, 2017~ Aug.11, 2017	Jun. 22, 2018	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Oct. 12, 2016	Aug. 04, 2017~ Aug.11, 2017	Oct. 11, 2017	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Aug. 04, 2017~ Aug.11, 2017	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Aug. 04, 2017~ Aug.11, 2017	N/A	Radiation (03CH11-HY)
EMI Test Receiver	Agilent	N9038A(MXE)	MY53290053	20Hz to 26.5GHz	Jan. 12, 2017	Aug. 04, 2017~ Aug.11, 2017	Jan. 11, 2018	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 08, 2016	Aug. 04, 2017~ Aug.11, 2017	Nov. 07, 2017	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))	2.70

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.20

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.50

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.20

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Reece Lin/Derek Hsu	Temperature:	21~25	°C
Test Date:	2017/7/27~2017/8/9	Relative Humidity:	51~54	%

Report Number : FR732839-01C

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
11b	1Mbps	1	1	2412	12.60	9.00	0.50	Pass
11b	1Mbps	1	6	2437	12.70	10.00	0.50	Pass
11b	1Mbps	1	11	2462	12.80	9.00	0.50	Pass
11g	6Mbps	1	1	2412	17.55	15.66	0.50	Pass
11g	6Mbps	1	6	2437	18.05	16.42	0.50	Pass
11g	6Mbps	1	11	2462	17.60	15.70	0.50	Pass
HT20	MCS0	1	1	2412	18.40	16.32	0.50	Pass
HT20	MCS0	1	6	2437	18.60	17.62	0.50	Pass
HT20	MCS0	1	11	2462	18.40	16.28	0.50	Pass

Report Number : FR732839-01C

TEST RESULTS DATA
Peak Power Table

2.4GHz Band										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
11b	1Mbps	1	1	2412	19.48	30.00	-0.72	18.76	36.00	Pass
11b	1Mbps	1	6	2437	19.32	30.00	-0.72	18.60	36.00	Pass
11b	1Mbps	1	11	2462	19.42	30.00	-0.72	18.70	36.00	Pass
11g	6Mbps	1	1	2412	21.50	30.00	-0.72	20.78	36.00	Pass
11g	6Mbps	1	6	2437	21.36	30.00	-0.72	20.64	36.00	Pass
11g	6Mbps	1	11	2462	21.47	30.00	-0.72	20.75	36.00	Pass
HT20	MCS0	1	1	2412	21.20	30.00	-0.72	20.48	36.00	Pass
HT20	MCS0	1	6	2437	20.99	30.00	-0.72	20.27	36.00	Pass
HT20	MCS0	1	11	2462	21.27	30.00	-0.72	20.55	36.00	Pass

Report Number : FR732839-01C

TEST RESULTS DATA
Average Power Table
(Reporting Only)

2.4GHz Band						
Mod.	Data Rate	N_{TX}	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
11b	1Mbps	1	1	2412	0.00	16.40
11b	1Mbps	1	6	2437	0.00	16.38
11b	1Mbps	1	11	2462	0.00	16.35
11g	6Mbps	1	1	2412	0.12	12.86
11g	6Mbps	1	6	2437	0.12	12.79
11g	6Mbps	1	11	2462	0.12	12.66
HT20	MCS0	1	1	2412	0.13	11.78
HT20	MCS0	1	6	2437	0.13	11.86
HT20	MCS0	1	11	2462	0.13	11.85

Report Number : FR732839-01C

TEST RESULTS DATA
Peak Power Density

2.4GHz Band								
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
11b	1Mbps	1	1	2412	-6.72	-0.72	8.00	Pass
11b	1Mbps	1	6	2437	-8.33	-0.72	8.00	Pass
11b	1Mbps	1	11	2462	-6.84	-0.72	8.00	Pass
11g	6Mbps	1	1	2412	-12.25	-0.72	8.00	Pass
11g	6Mbps	1	6	2437	-13.79	-0.72	8.00	Pass
11g	6Mbps	1	11	2462	-12.29	-0.72	8.00	Pass
HT20	MCS0	1	1	2412	-14.49	-0.72	8.00	Pass
HT20	MCS0	1	6	2437	-14.59	-0.72	8.00	Pass
HT20	MCS0	1	11	2462	-14.62	-0.72	8.00	Pass

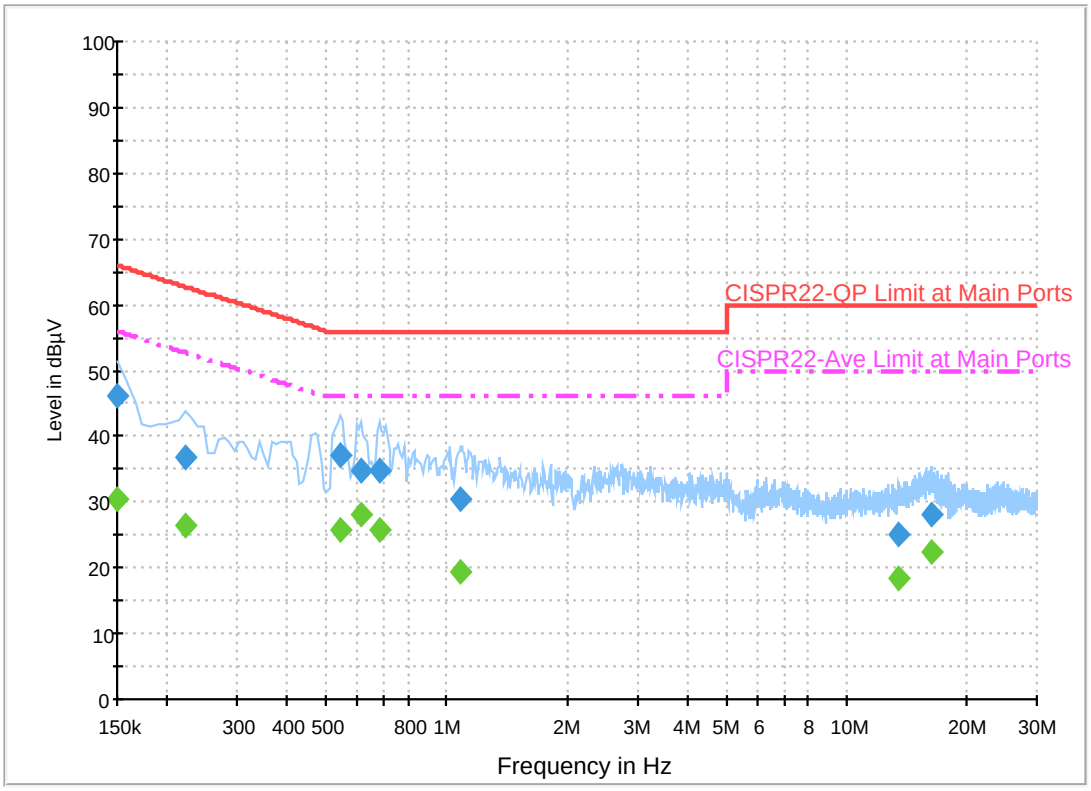
Appendix B. AC Conducted Emission Test Results

Test Engineer :	Shareef-Yu	**Temperature :**	26~27℃
		Relative Humidity :	40~42%

EUT Information

Report NO :	732839-01
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line

ENV216 Auto Test FCC Power Bar - L



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	46.0	Off	L1	19.6	20.0	66.0
0.222000	36.9	Off	L1	19.6	25.8	62.7
0.542000	37.2	Off	L1	19.6	18.8	56.0
0.614000	34.7	Off	L1	19.6	21.3	56.0
0.678000	34.7	Off	L1	19.6	21.3	56.0
1.086000	30.6	Off	L1	19.6	25.4	56.0
13.558000	25.2	Off	L1	19.8	34.8	60.0
16.366000	28.0	Off	L1	20.4	32.0	60.0

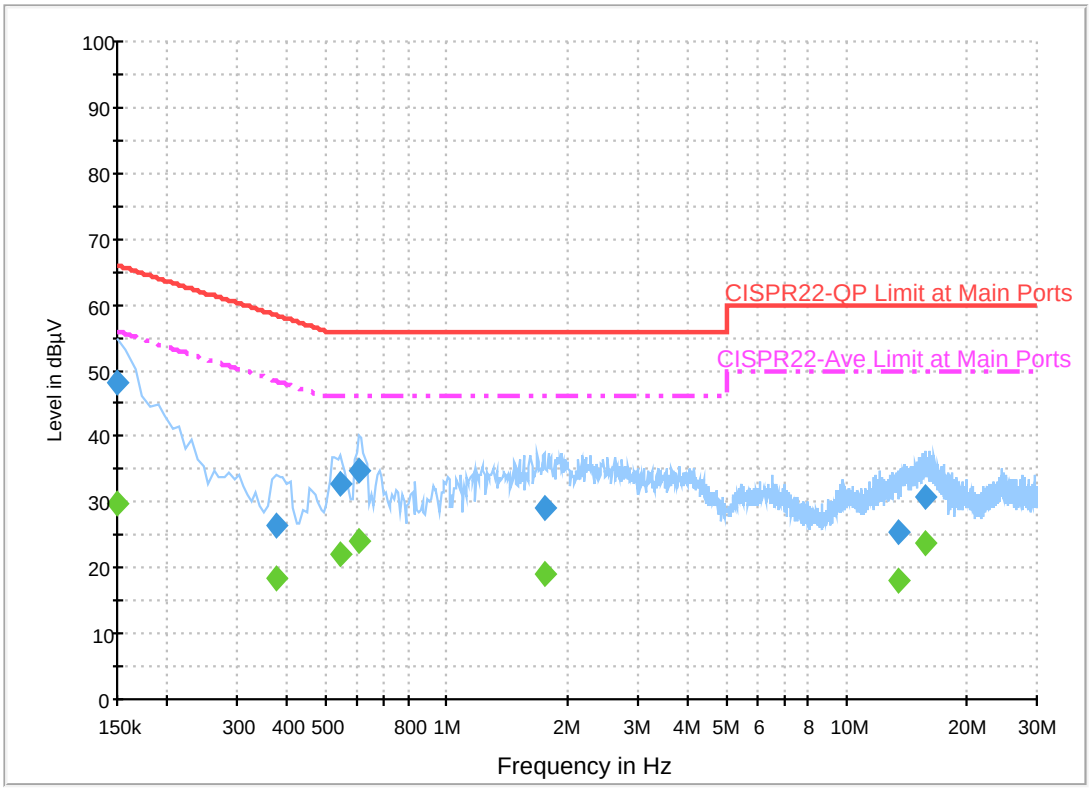
Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	30.3	Off	L1	19.6	25.7	56.0
0.222000	26.4	Off	L1	19.6	26.3	52.7
0.542000	25.9	Off	L1	19.6	20.1	46.0
0.614000	28.0	Off	L1	19.6	18.0	46.0
0.678000	25.9	Off	L1	19.6	20.1	46.0
1.086000	19.4	Off	L1	19.6	26.6	46.0
13.558000	18.5	Off	L1	19.8	31.5	50.0
16.366000	22.3	Off	L1	20.4	27.7	50.0

EUT Information

Report NO :	732839-01
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral

ENV216 Auto Test FCC Power Bar - N



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	48.2	Off	N	19.5	17.8	66.0
0.374000	26.6	Off	N	19.5	31.8	58.4
0.542000	32.8	Off	N	19.5	23.2	56.0
0.606000	34.6	Off	N	19.5	21.4	56.0
1.758000	29.2	Off	N	19.6	26.8	56.0
13.558000	25.4	Off	N	19.8	34.6	60.0
15.846000	30.6	Off	N	20.4	29.4	60.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	29.9	Off	N	19.5	26.1	56.0
0.374000	18.3	Off	N	19.5	30.1	48.4
0.542000	22.0	Off	N	19.5	24.0	46.0
0.606000	24.2	Off	N	19.5	21.8	46.0
1.758000	19.1	Off	N	19.6	26.9	46.0
13.558000	18.0	Off	N	19.8	32.0	50.0
15.846000	23.9	Off	N	20.4	26.1	50.0

Appendix C. Radiated Spurious Emission

Test Engineer :	J.C. Liang, Jacky Hung, and Ken Wu	Temperature :	24~26℃
		Relative Humidity :	50~55%

2.4GHz 2400~2483.5MHz

WIFI 802.11b (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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		2344.44	52.07	-21.93	74	42.82	26.7	6.22	33.6	167	180	P	H
		2390	41	-13	54	31.43	26.87	6.36	33.59	167	180	A	H
	*	2412	102.09	-	-	92.46	26.92	6.37	33.59	167	180	P	H
	*	2412	99.07	-	-	89.44	26.92	6.37	33.59	167	180	A	H
													H
													H
		2378.36	51.55	-22.45	74	42.12	26.81	6.29	33.6	121	238	P	V
		2390	41.34	-12.66	54	31.77	26.87	6.36	33.59	121	238	A	V
	*	2412	107.31	-	-	97.68	26.92	6.37	33.59	121	238	P	V
	*	2412	104.3	-	-	94.67	26.92	6.37	33.59	121	238	A	V
													V
													V
802.11b CH 06 2437MHz		2387.98	52.2	-21.8	74	42.64	26.87	6.36	33.6	260	183	P	H
		2389.94	41.02	-12.98	54	31.45	26.87	6.36	33.59	260	183	A	H
	*	2437	103.72	-	-	93.97	27.03	6.38	33.59	260	183	P	H
	*	2437	100.72	-	-	90.97	27.03	6.38	33.59	260	183	A	H
		2484.46	52.19	-21.81	74	42.31	27.14	6.39	33.58	260	183	P	H
		2484.25	41.91	-12.09	54	32.03	27.14	6.39	33.58	260	183	A	H
		2371.32	51.22	-22.78	74	41.79	26.81	6.29	33.6	102	232	P	V
		2389.94	41.52	-12.48	54	31.95	26.87	6.36	33.59	102	232	A	V
	*	2437	106.62	-	-	96.87	27.03	6.38	33.59	102	232	P	V
	*	2437	103.64	-	-	93.89	27.03	6.38	33.59	102	232	A	V
		2483.76	51.99	-22.01	74	42.12	27.14	6.38	33.58	102	232	P	V
		2485.79	42.27	-11.73	54	32.39	27.14	6.39	33.58	102	232	A	V

802.11b CH 11 2462MHz	*	2462	104.21	-	-	94.39	27.09	6.38	33.58	171	180	P	H
	*	2462	101.05	-	-	91.23	27.09	6.38	33.58	171	180	A	H
		2483.92	52.82	-21.18	74	42.95	27.14	6.38	33.58	171	180	P	H
		2484	41.94	-12.06	54	32.07	27.14	6.38	33.58	171	180	A	H
													H
													H
	*	2462	108.27	-	-	98.45	27.09	6.38	33.58	111	237	P	V
	*	2462	105.09	-	-	95.27	27.09	6.38	33.58	111	237	A	V
		2490.36	53.11	-20.89	74	43.17	27.2	6.39	33.58	111	237	P	V
		2484	42.93	-11.07	54	33.06	27.14	6.38	33.58	111	237	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		4824	51.51	-22.49	74	72.85	31.62	9.59	62.98	100	7	P	H
		4824	49.08	-4.92	54	70.42	31.62	9.59	62.98	100	7	A	H
													H
													H
		4824	50.15	-23.85	74	71.49	31.62	9.59	62.98	100	254	P	V
		4824	47.28	-6.72	54	68.62	31.62	9.59	62.98	100	254	A	V
													V
													V
802.11b CH 06 2437MHz		4874	54.63	-19.37	74	75.8	31.71	9.56	62.87	100	9	P	H
		4874	52.59	-1.41	54	73.76	31.71	9.56	62.87	100	9	A	H
		7311	44.16	-29.84	74	57.65	37.43	11.31	62.69	100	0	P	H
													H
		4874	53.56	-20.44	74	75.16	31.71	9.56	62.87	100	241	P	V
		4874	51.51	-2.49	54	73.11	31.71	9.56	62.87	100	241	A	V
		7311	43.61	-30.39	74	57.56	37.43	11.31	62.69	100	0	P	V
													V
802.11b CH 11 2462MHz		4924	53.62	-20.38	74	74.59	31.79	9.55	62.75	103	12	P	H
		4924	51.64	-2.36	54	72.61	31.79	9.55	62.75	103	12	A	H
		7386	43.49	-30.51	74	56.73	37.82	11.3	62.74	100	0	P	H
													H
		4924	52.93	-21.07	74	73.9	31.79	9.55	62.75	100	263	P	V
		4924	50.5	-3.5	54	71.47	31.79	9.55	62.75	100	263	A	V
		7386	42.92	-31.08	74	56.16	37.82	11.3	62.74	100	0	P	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		2390	52.01	-21.99	74	42.44	26.87	6.36	33.59	171	195	P	H
		2390	42.62	-11.38	54	33.05	26.87	6.36	33.59	171	195	A	H
	*	2412	101.46	-	-	91.83	26.92	6.37	33.59	171	195	P	H
	*	2412	93.65	-	-	84.02	26.92	6.37	33.59	171	195	A	H
													H
													H
		2388.23	51.74	-22.26	74	42.18	26.87	6.36	33.6	122	240	P	V
		2390	43.18	-10.82	54	33.61	26.87	6.36	33.59	122	240	A	V
	*	2412	105.34	-	-	95.71	26.92	6.37	33.59	122	240	P	V
	*	2412	97.57	-	-	87.94	26.92	6.37	33.59	122	240	A	V
													V
													V
802.11g CH 06 2437MHz		2361.8	51.5	-22.5	74	42.12	26.76	6.29	33.6	136	181	P	H
		2381.82	42	-12	54	32.5	26.81	6.36	33.6	136	181	A	H
	*	2437	102.51	-	-	92.76	27.03	6.38	33.59	136	181	P	H
	*	2437	94.94	-	-	85.19	27.03	6.38	33.59	136	181	A	H
		2491.74	52.49	-21.51	74	42.55	27.2	6.39	33.58	136	181	P	H
		2485.16	42.71	-11.29	54	32.83	27.14	6.39	33.58	136	181	A	H
		2368.66	51.88	-22.12	74	42.45	26.81	6.29	33.6	123	241	P	V
		2389.94	42.28	-11.72	54	32.71	26.87	6.36	33.59	123	241	A	V
	*	2437	106	-	-	96.25	27.03	6.38	33.59	123	241	P	V
	*	2437	98.33	-	-	88.58	27.03	6.38	33.59	123	241	A	V
		2485.44	53.18	-20.82	74	43.3	27.14	6.39	33.58	123	241	P	V
		2483.69	43.61	-10.39	54	33.74	27.14	6.38	33.58	123	241	A	V

802.11g CH 11 2462MHz	*	2462	104.11	-	-	94.29	27.09	6.38	33.58	172	180	P	H
	*	2462	96.5	-	-	86.68	27.09	6.38	33.58	172	180	A	H
		2483.72	53.94	-20.06	74	44.07	27.14	6.38	33.58	172	180	P	H
		2483.56	43.91	-10.09	54	34.04	27.14	6.38	33.58	172	180	A	H
													H
													H
	*	2462	107.97	-	-	98.15	27.09	6.38	33.58	110	238	P	V
	*	2462	100.24	-	-	90.42	27.09	6.38	33.58	110	238	A	V
		2483.52	57.47	-16.53	74	47.6	27.14	6.38	33.58	110	238	P	V
		2483.52	45.57	-8.43	54	35.7	27.14	6.38	33.58	110	238	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		4824	44.65	-29.35	74	65.99	31.62	9.59	62.98	100	0	P	H
													H
													H
													H
		4824	45.15	-28.85	74	66.49	31.62	9.59	62.98	100	0	P	V
													V
													V
													V
802.11g CH 06 2437MHz		4874	47.53	-26.47	74	68.7	31.71	9.56	62.87	100	0	P	H
		7311	43.29	-30.71	74	56.78	37.43	11.31	62.69	100	0	P	H
													H
													H
		4874	45.57	-28.43	74	67.17	31.71	9.56	62.87	100	0	P	V
		7311	43.35	-30.65	74	57.3	37.43	11.31	62.69	100	0	P	V
													V
													V
802.11g CH 11 2462MHz		4924	45.47	-28.53	74	66.44	31.79	9.55	62.75	100	0	P	H
		7386	43.52	-30.48	74	56.76	37.82	11.3	62.74	100	0	P	H
													H
													H
		4924	45.02	-28.98	74	66.43	31.79	9.55	62.75	100	0	P	V
		7386	42.88	-31.12	74	56.5	37.82	11.3	62.74	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		2389.91	52.63	-21.37	74	43.06	26.87	6.36	33.59	171	193	P	H
		2390	42.54	-11.46	54	32.97	26.87	6.36	33.59	171	193	A	H
	*	2412	100.18	-	-	90.55	26.92	6.37	33.59	171	193	P	H
	*	2412	92.52	-	-	82.89	26.92	6.37	33.59	171	193	A	H
													H
													H
		2390	55.84	-18.16	74	46.27	26.87	6.36	33.59	120	234	P	V
		2390	43.52	-10.48	54	33.95	26.87	6.36	33.59	120	234	A	V
	*	2412	104.24	-	-	94.61	26.92	6.37	33.59	120	234	P	V
	*	2412	96.59	-	-	86.96	26.92	6.37	33.59	120	234	A	V
													V
													V
802.11n HT20 CH 06 2437MHz		2373	52.12	-21.88	74	42.69	26.81	6.29	33.6	170	180	P	H
		2388.26	41.85	-12.15	54	32.29	26.87	6.36	33.6	170	180	A	H
	*	2437	101.25	-	-	91.5	27.03	6.38	33.59	170	180	P	H
	*	2437	93.42	-	-	83.67	27.03	6.38	33.59	170	180	A	H
		2485.16	51.85	-22.15	74	41.97	27.14	6.39	33.58	170	180	P	H
		2483.76	42.55	-11.45	54	32.68	27.14	6.38	33.58	170	180	A	H
		2373	52.12	-21.88	74	42.69	26.81	6.29	33.6	170	180	P	V
		2388.26	41.85	-12.15	54	32.29	26.87	6.36	33.6	170	180	A	V
	*	2437	101.25	-	-	91.5	27.03	6.38	33.59	170	180	P	V
	*	2437	93.42	-	-	83.67	27.03	6.38	33.59	170	180	A	V
		2485.16	51.85	-22.15	74	41.97	27.14	6.39	33.58	170	180	P	V
		2483.76	42.55	-11.45	54	32.68	27.14	6.38	33.58	170	180	A	V

802.11n HT20 CH 11 2462MHz	*	2462	103.19	-	-	93.37	27.09	6.38	33.58	172	181	P	H
	*	2462	95.23	-	-	85.41	27.09	6.38	33.58	172	181	A	H
		2484.56	53.43	-20.57	74	43.55	27.14	6.39	33.58	172	181	P	H
		2483.6	43.23	-10.77	54	33.36	27.14	6.38	33.58	172	181	A	H
													H
													H
	*	2462	106.35	-	-	96.53	27.09	6.38	33.58	122	238	P	V
	*	2462	98.72	-	-	88.9	27.09	6.38	33.58	122	238	A	V
		2483.64	57.22	-16.78	74	47.35	27.14	6.38	33.58	122	238	P	V
		2483.6	45.04	-8.96	54	35.17	27.14	6.38	33.58	122	238	A	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 802.11b (LF)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
2.4GHz 802.11b LF		98.04	28.99	-14.51	43.5	44.27	15.79	1.39	32.48	-	-	P	H
		120.72	29.83	-13.67	43.5	43.35	17.51	1.39	32.46	-	-	P	H
		145.29	35.73	-7.77	43.5	49.37	17.22	1.51	32.44	200	196	P	H
		302.8	24.2	-21.8	46	34.91	19.25	2.31	32.37	-	-	P	H
		565.3	27.34	-18.66	46	30.53	26.12	3.03	32.43	-	-	P	H
		946.1	34.06	-11.94	46	30.7	30.61	3.82	31.24	-	-	P	H
													H
													H
													H
													H
													H
													H
		46.2	33.93	-6.07	40	49.6	15.8	1.02	32.49	188	75	P	V
		49.98	33.35	-6.65	40	50.7	14.11	1.02	32.49	-	-	P	V
		63.48	28.11	-11.89	40	47.76	11.81	1.02	32.49	-	-	P	V
		475	25.12	-20.88	46	31	23.67	2.77	32.37	-	-	P	V
		738.9	30.01	-15.99	46	30.85	27.99	3.4	32.36	-	-	P	V
		928.6	33.95	-12.05	46	31.45	29.9	3.82	31.39	-	-	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	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

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

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

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

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

Appendix D. Radiated Spurious Emission Plots

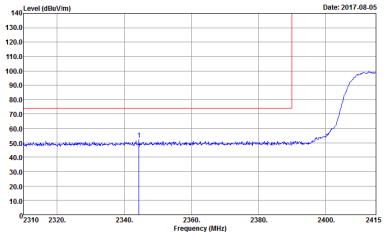
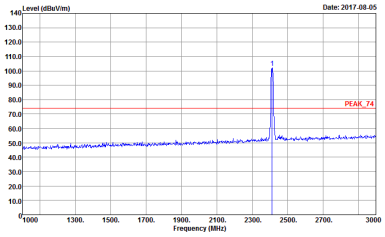
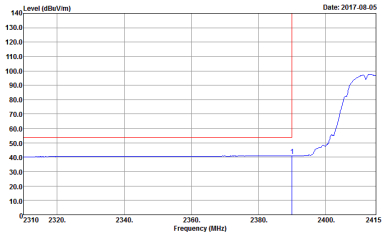
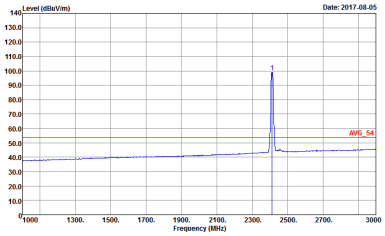
Test Engineer :	J.C. Liang, Jacky Hung, and Ken Wu	**Temperature :**	24~26℃
		Relative Humidity :	50~55%

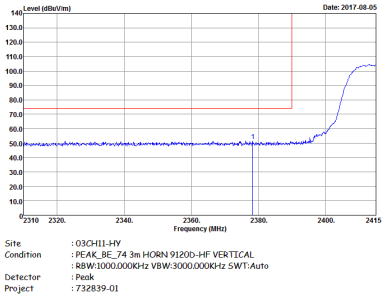
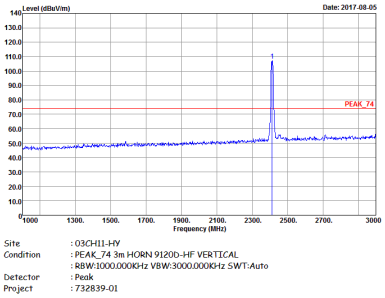
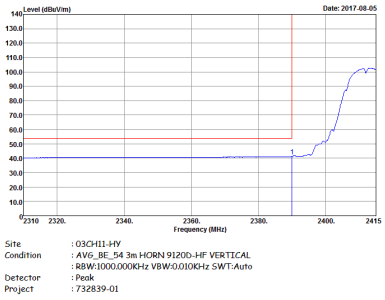
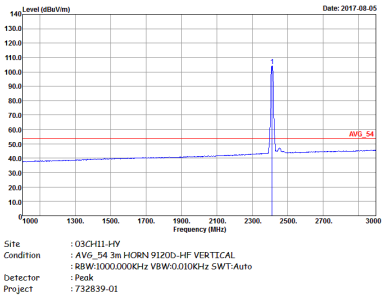
Note symbol

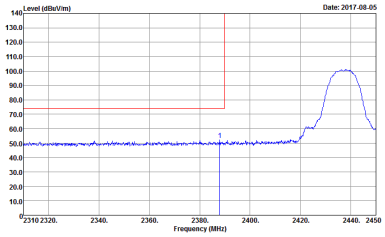
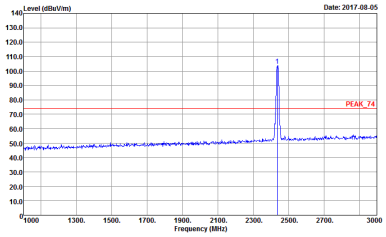
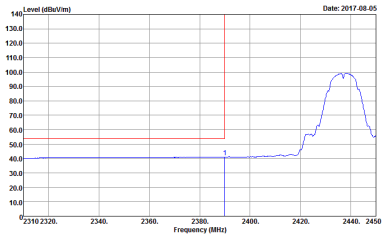
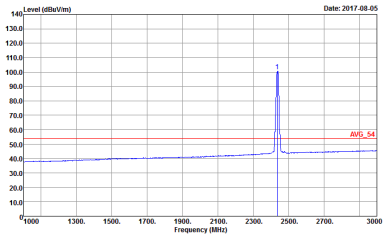
-L	**Low channel location**
-R	**High channel location**

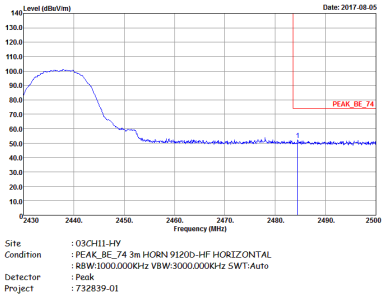
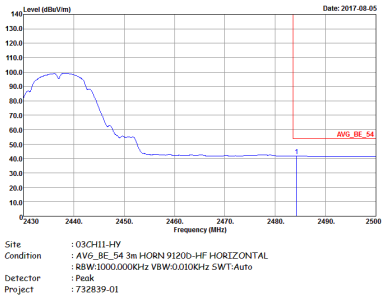
2.4GHz 2400~2483.5MHz

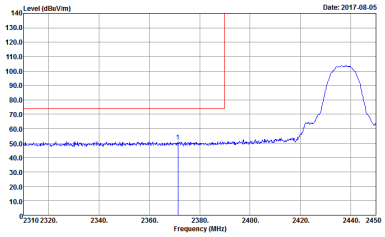
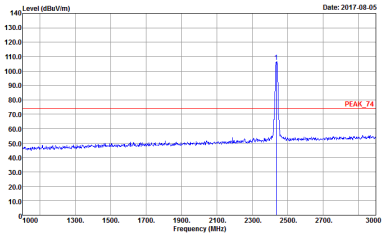
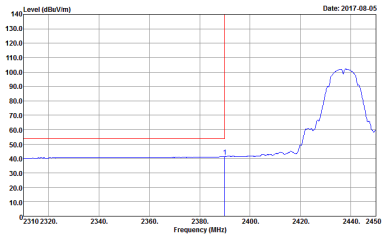
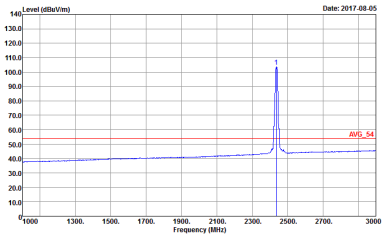
WIFI 802.11b (Band Edge @ 3m)

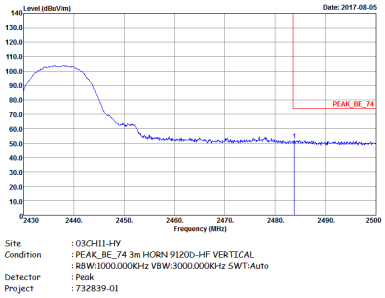
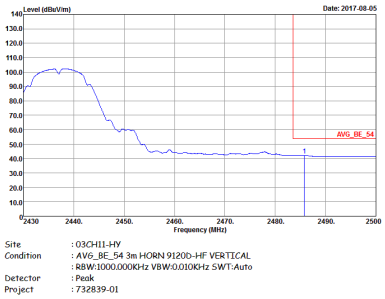
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 732839-01

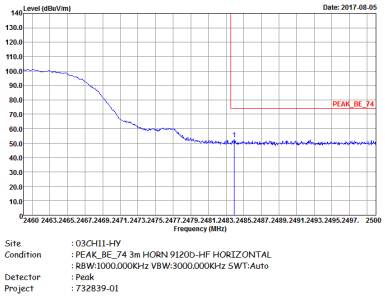
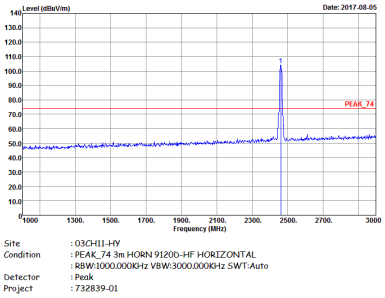
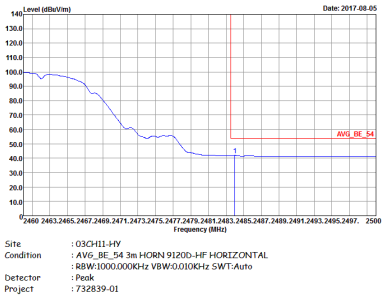
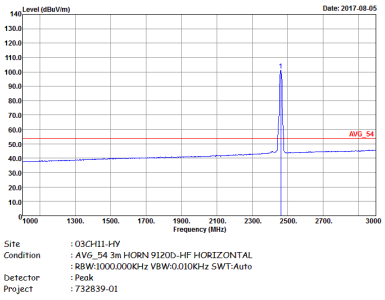
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

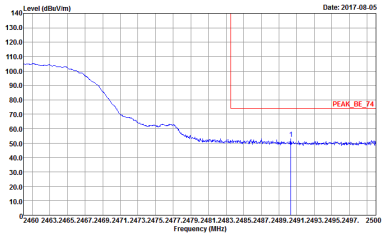
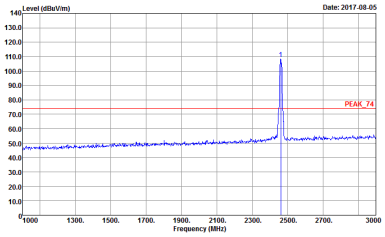
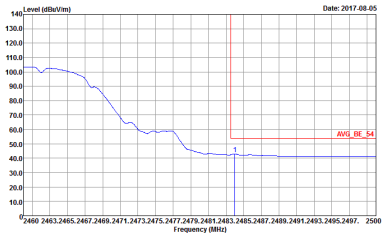
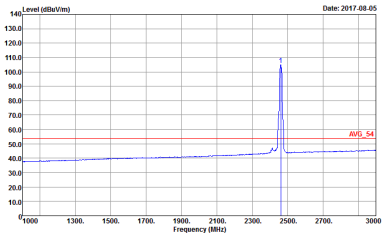
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - L	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 732839-01

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	 Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : AVG_54 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 732839-01

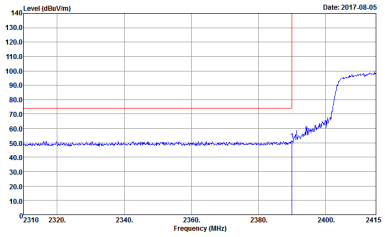
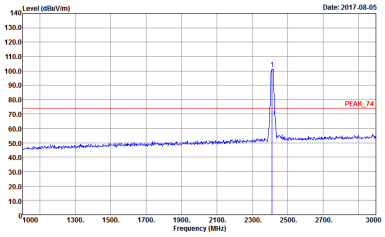
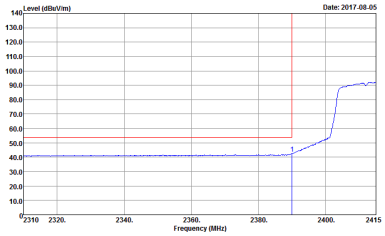
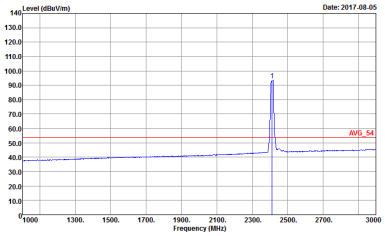
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

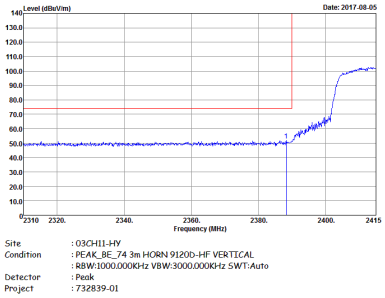
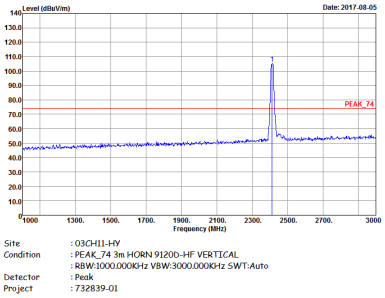
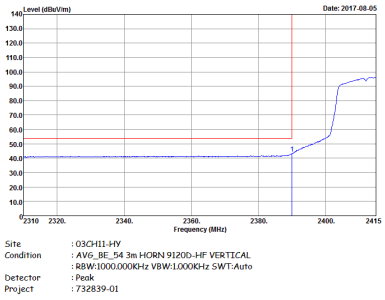
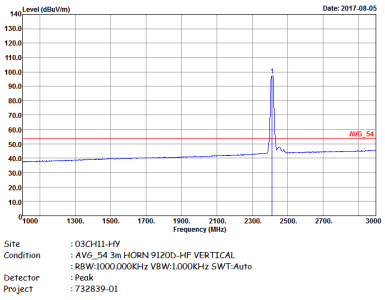
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

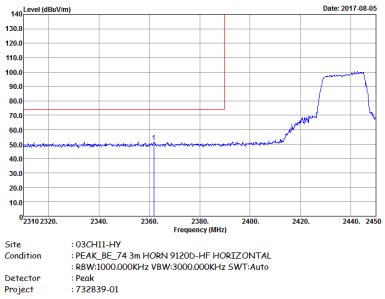
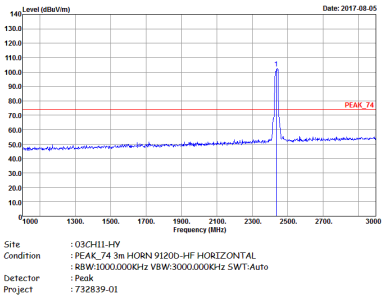
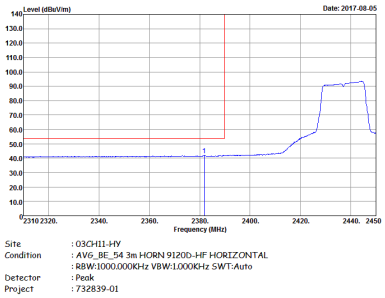
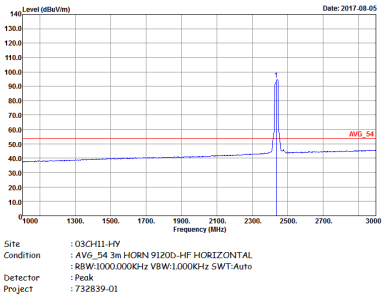
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : AVG_54 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 732839-01

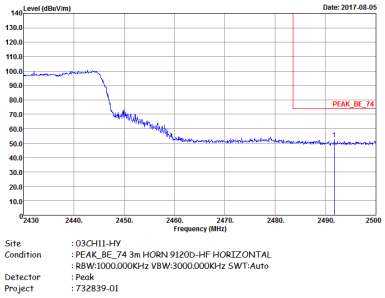
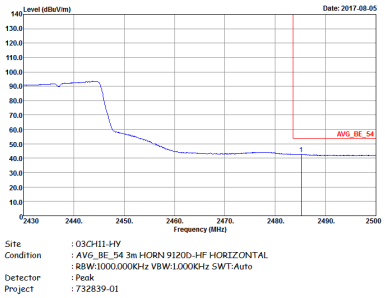
2.4GHz 2400~2483.5MHz

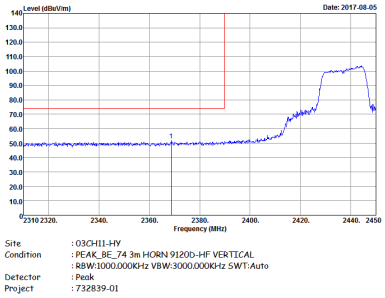
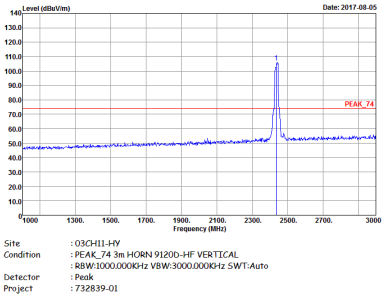
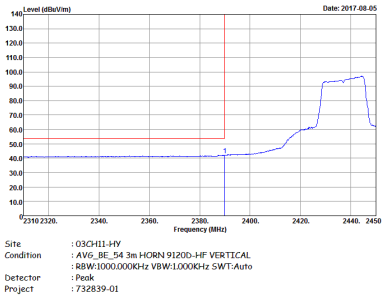
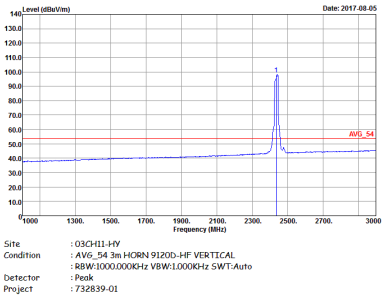
WIFI 802.11g (Band Edge @ 3m)

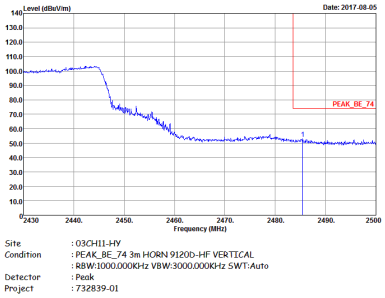
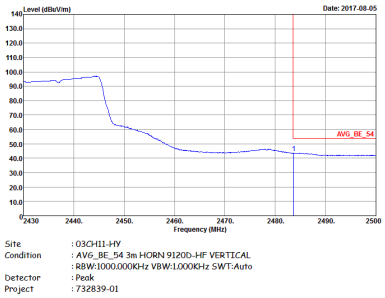
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 732839-01

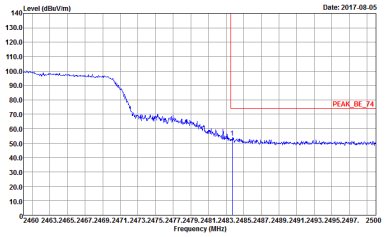
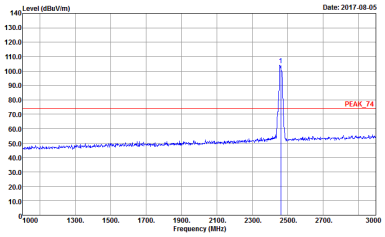
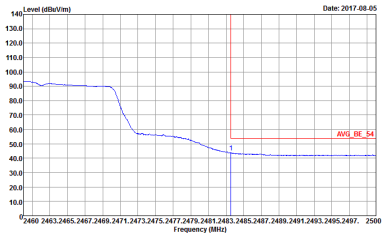
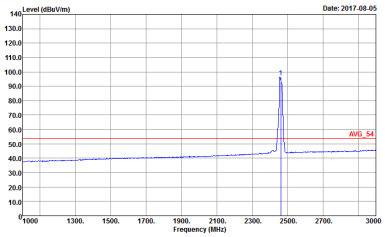
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

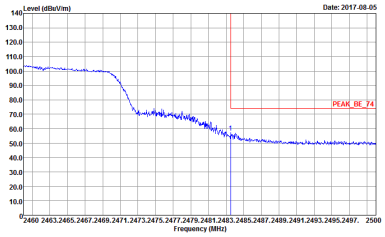
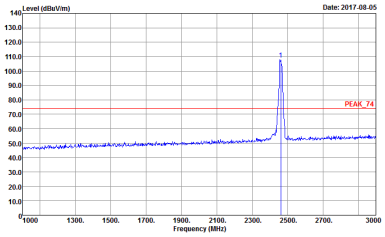
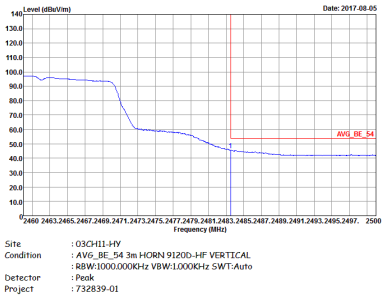
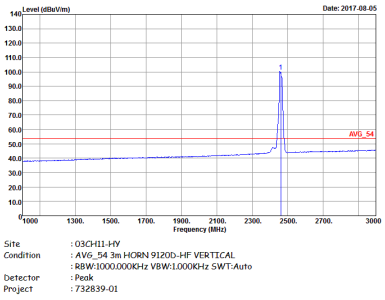
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

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.		

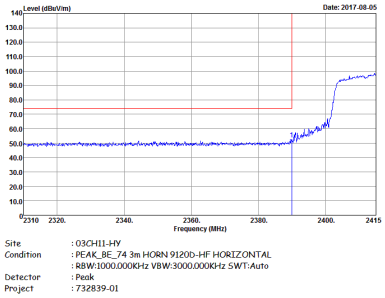
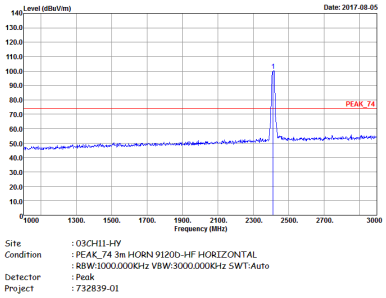
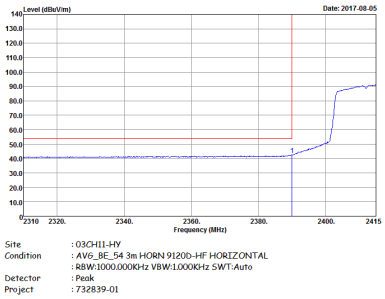
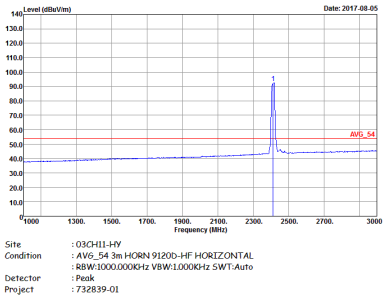
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - R	
1	Vertical	Fundamental
Peak		Left Blank
Avg.		Left Blank

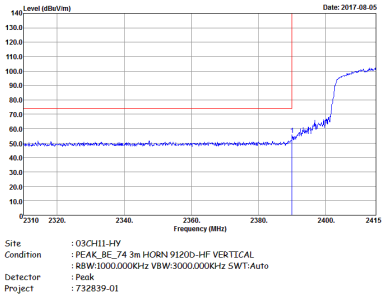
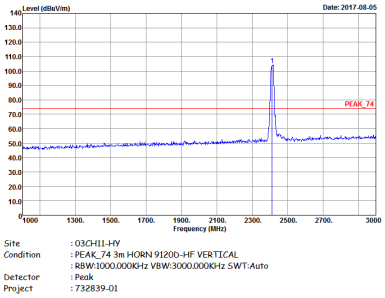
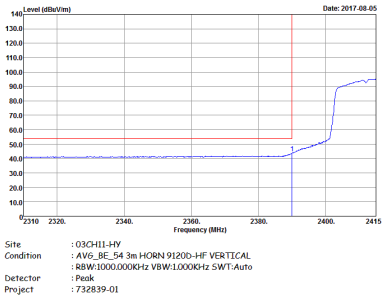
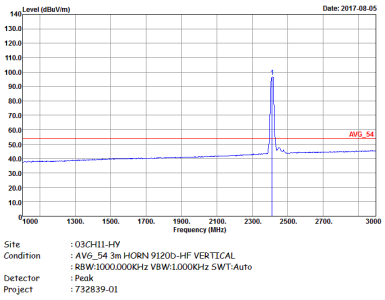
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 732839-01

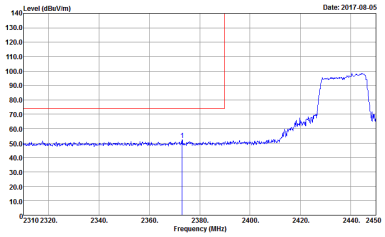
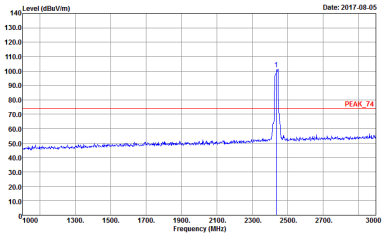
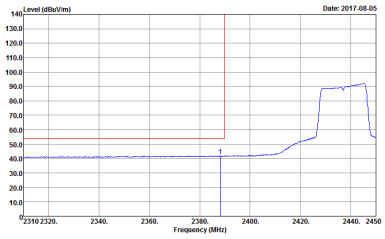
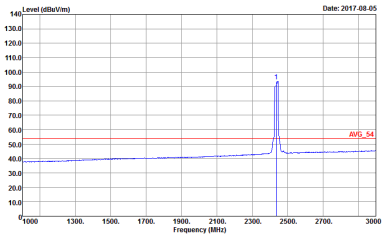
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1	Vertical	Fundamental
Peak		
Avg.		

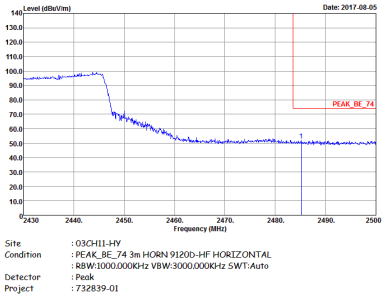
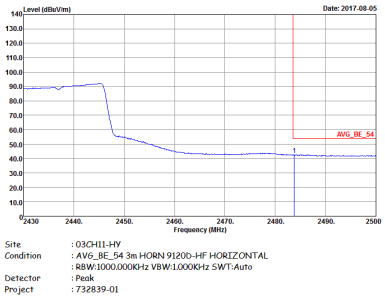
2.4GHz 2400~2483.5MHz

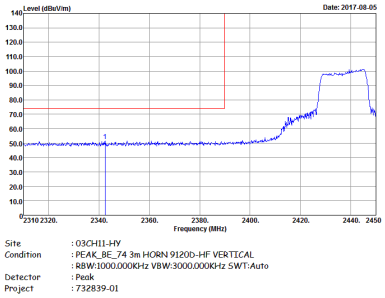
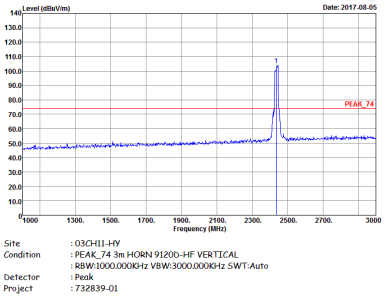
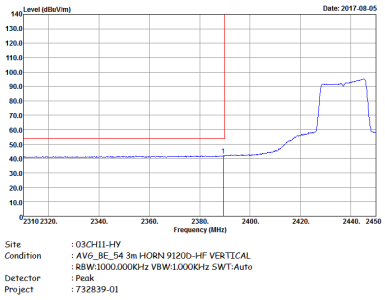
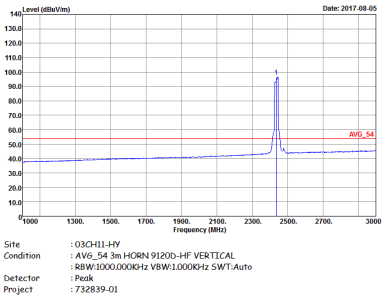
WIFI 802.11n HT20 (Band Edge @ 3m)

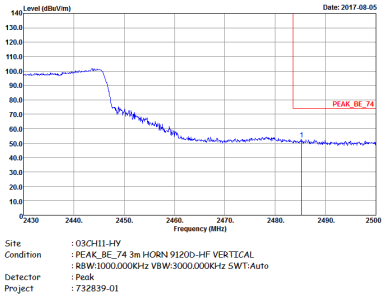
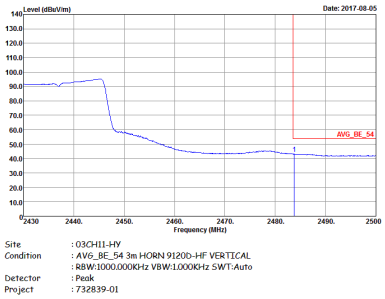
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

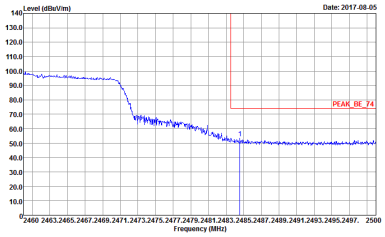
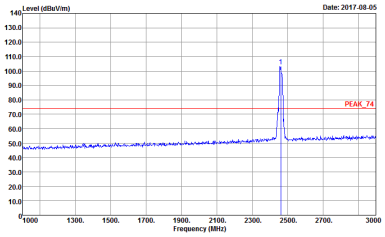
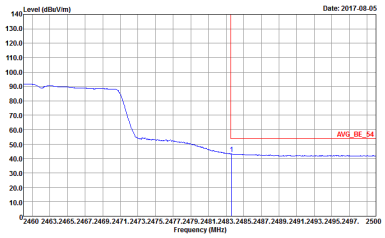
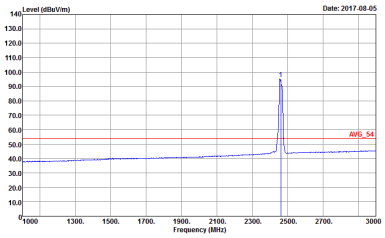
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

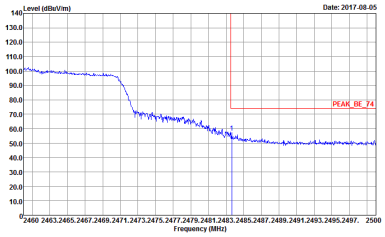
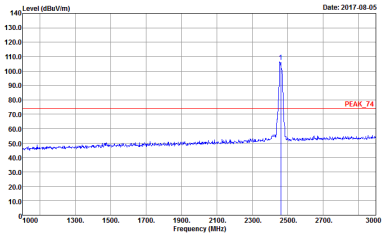
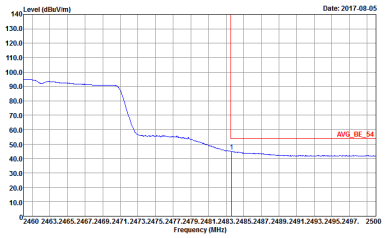
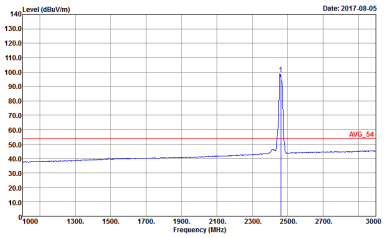
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - L	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HY Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01
Avg.	 Site : 03CH11-HY Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 732839-01

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.		

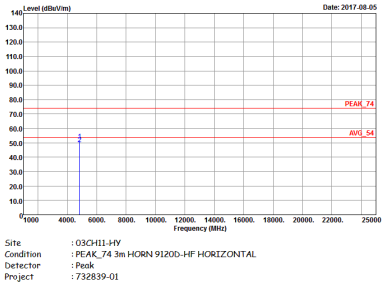
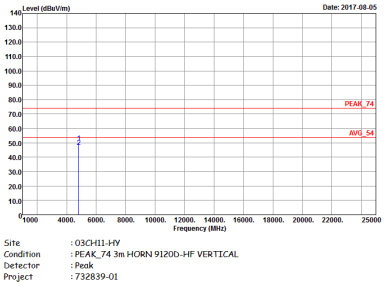
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - R	
1	Vertical	Fundamental
Peak		Left Blank
Avg.		Left Blank

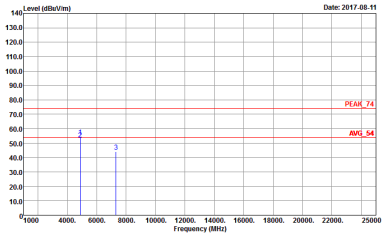
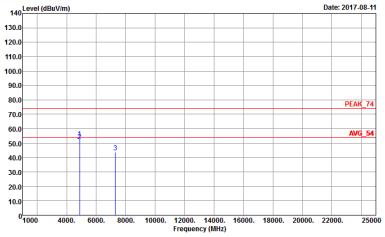
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH11-HV Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HV Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01
Avg.	 Site : 03CH11-HV Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HV Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 732839-01

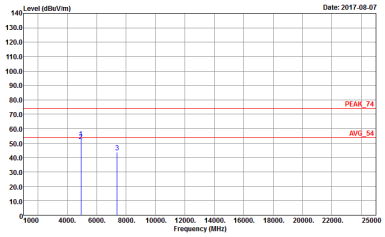
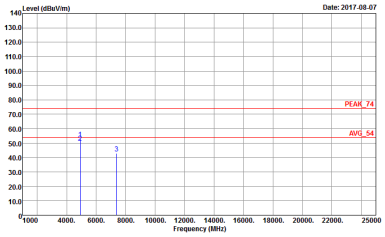
WIFI	2.4GHz 2400~2483.5MHz Fundamental @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH11-HV Condition : PEAK_BE_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HV Condition : PEAK_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 732839-01
Avg.	 Site : 03CH11-HV Condition : AVG_BE_54 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 732839-01	 Site : 03CH11-HV Condition : AVG_54 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 732839-01

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

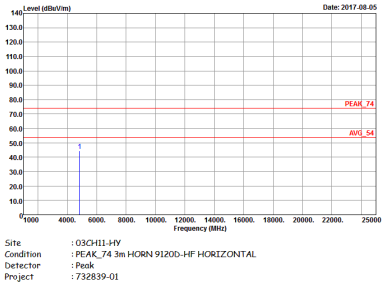
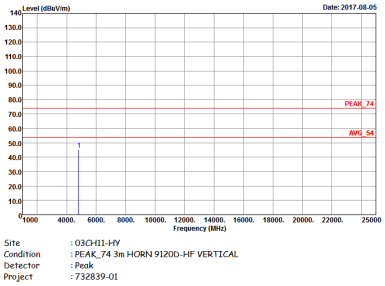
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH01 2412MHz	
1	Horizontal	Vertical
Peak Avg.		

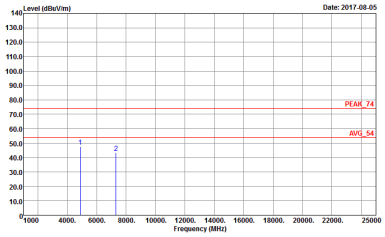
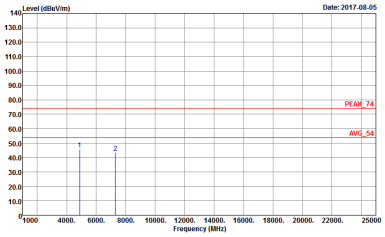
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH06 2437MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 732839-01

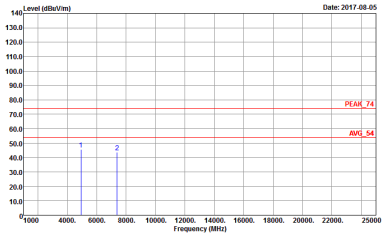
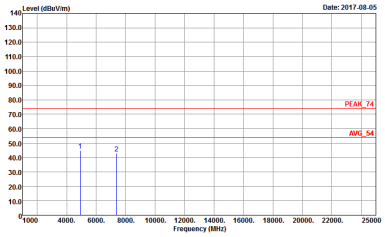
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH11 2462MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 732839-01

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

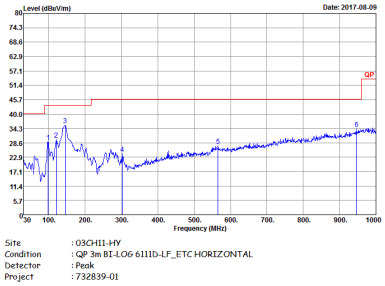
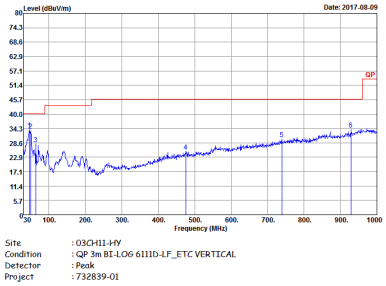
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH01 2412MHz	
1	Horizontal	Vertical
Peak Avg.		

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH06 2437MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 732839-01

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH11 2462MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL Detector : Peak Project : 732839-01	 Site : 03CH11-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL Detector : Peak Project : 732839-01

Emission below 1GHz

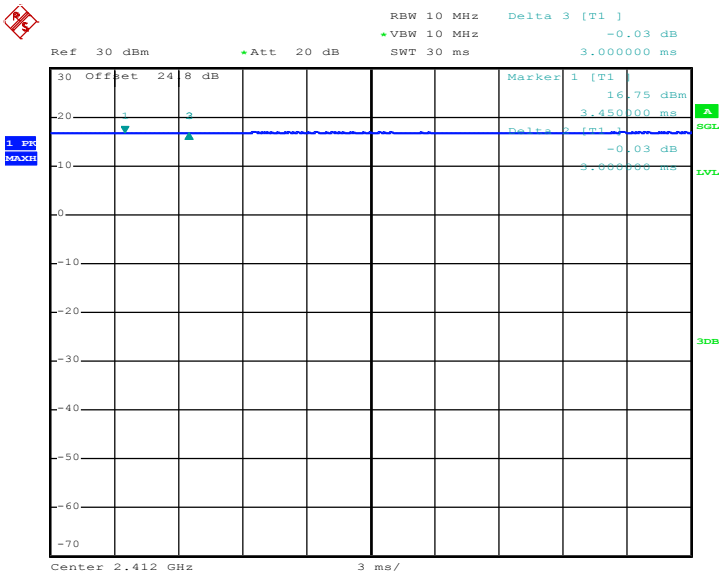
2.4GHz WIFI 802.11b (LF)

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

Appendix E. Duty Cycle Plots

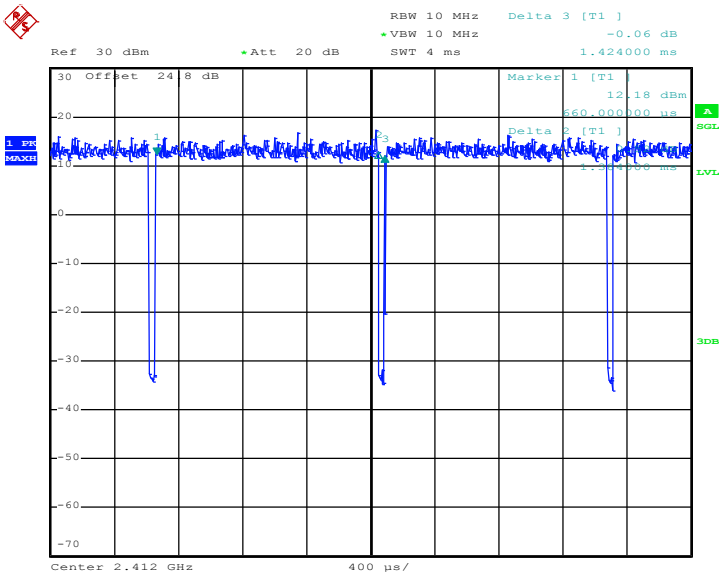
Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
802.11b	100.00	-	-	10Hz
802.11g	97.19	1384.00	0.72	1kHz
802.11n HT20	97.02	1300.00	0.77	

802.11b



Date: 27.JUL.2017 14:55:02

802.11g



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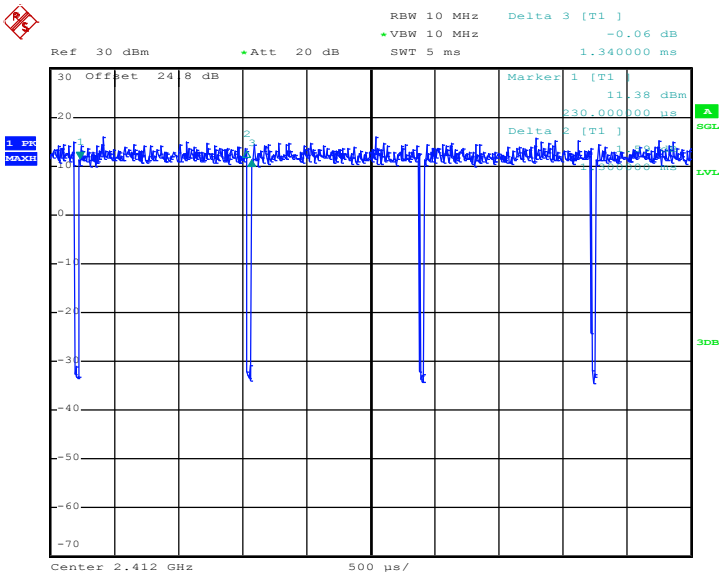
802.11n HT20



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