FCC RF Test Report

APPLICANT	:	SHARP CORPORATION
EQUIPMENT	:	Smart Phone
BRAND NAME	:	SHARP
MODEL NAME	:	X1
FCC ID	:	APYHRO00247
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System

The product was received on Apr. 01, 2017 and testing was completed on May 31, 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

SPORTON INTERNATIONAL INC.

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR740122C	Rev. 01	Initial issue of report	Jun. 09, 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 3.47 dB at 85.350 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 6.00 dB at 0.606 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

SHARP CORPORATION
Takumi-Cho, Sakai-Ku, Sakai-Shi, 2, Osaka 590-852, Japan

1.2 Manufacturer

SHARP CORPORATION
Takumi-Cho, Sakai-Ku, Sakai-Shi, 2, Osaka 590-852, Japan

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/ac, NFC, and GPS.

Product Specification subjective to this standard	
Sample 1	EUT with Memory 1
Sample 2	EUT with Memory 2
Antenna Type	WWAN: ILA Antenna WLAN: ILA Antenna Bluetooth: ILA Antenna GPS / Glonass : ILA Antenna NFC: Loop Antenna

1.4 Modification of EUT

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

1.5 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. 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.**
	03CH10-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 (X 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

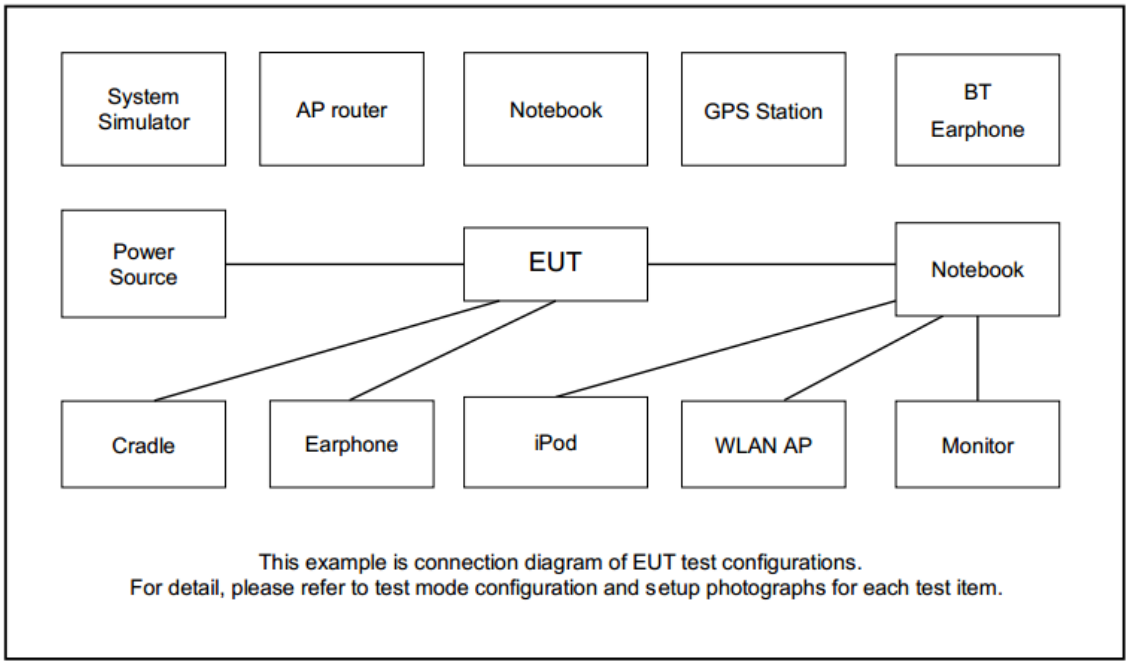
Final test mode of conducted test items and radiated spurious emissions are considering the modulation and worse data rates as below table.

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

Remark: All the tests were performed with sample 1.

Test Cases	
AC Conducted Emission	Mode 1: GSM850 Idle + Bluetooth Link + WLAN (2.4GHz) Link + NFC On + Earphone + USB Cable (Charging from Adapter) for Sample 2

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.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
3.	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
4.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
5.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, programmed RF utility, “Tera Term” installed in the notebook make the EUT provide functions like channel selection and power level for continuous transmitting and receiving 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.

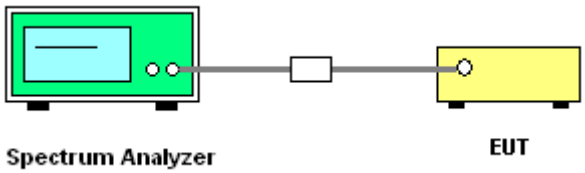
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

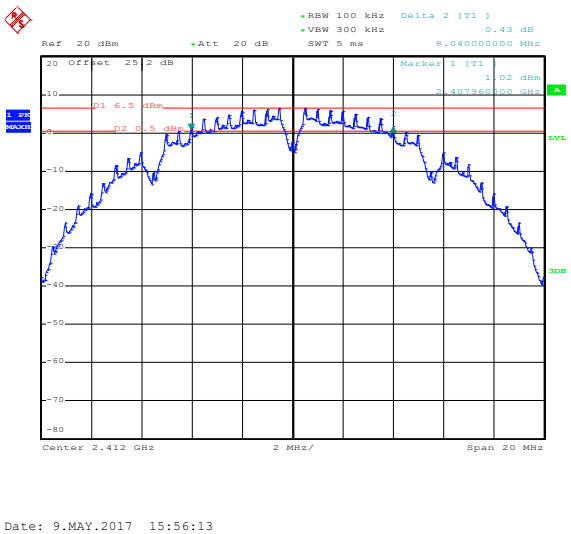
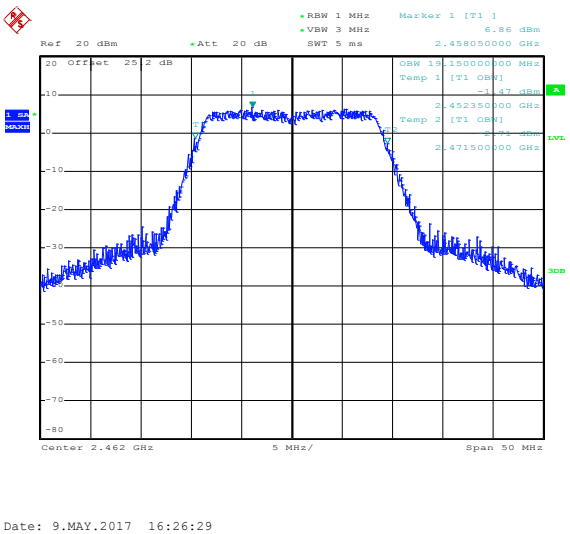
1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v04.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit 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
	

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.

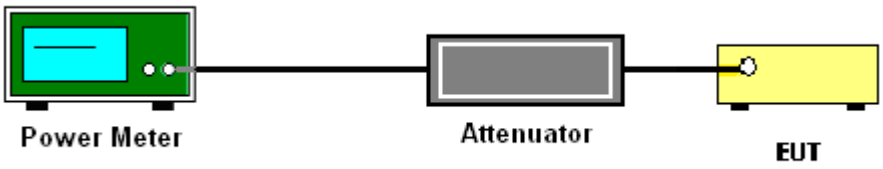
3.2.2 Measuring Instruments

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.

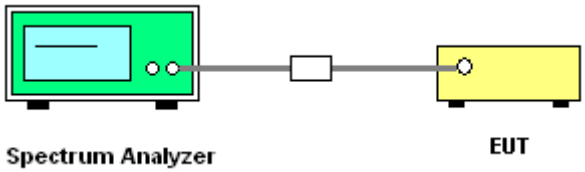
3.3.2 Measuring Instruments

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.

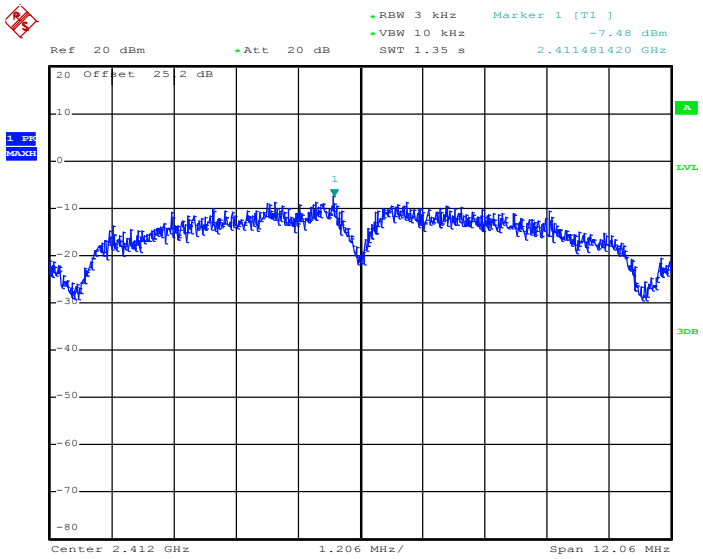
3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Density (dBm/3kHz)



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.

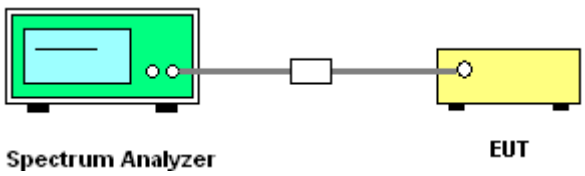
3.4.2 Measuring Instruments

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

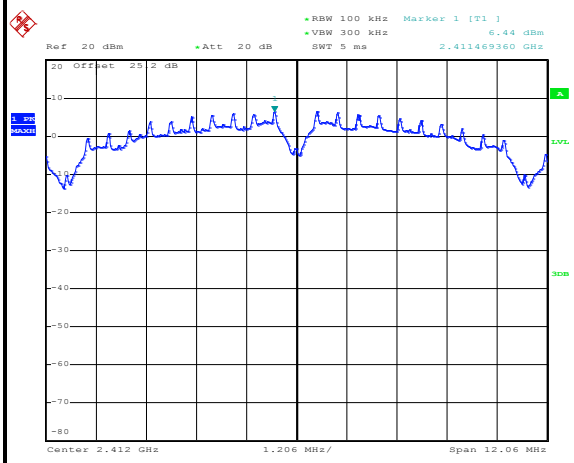


3.4.5 Test Result of Conducted Band Edges and Spurious Emission

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

WLAN 802.11b Channel 01

100kHz PSD reference Level



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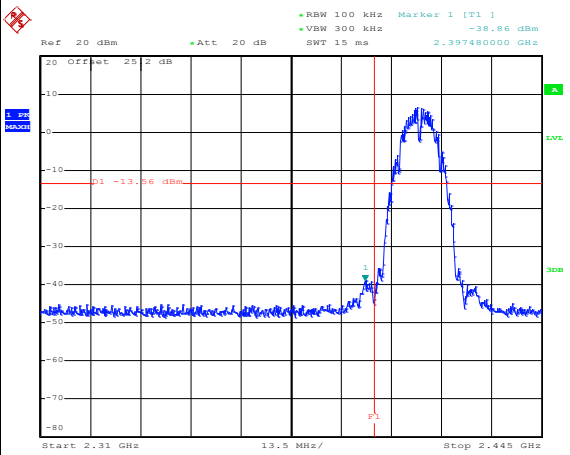
Low Channel Plot



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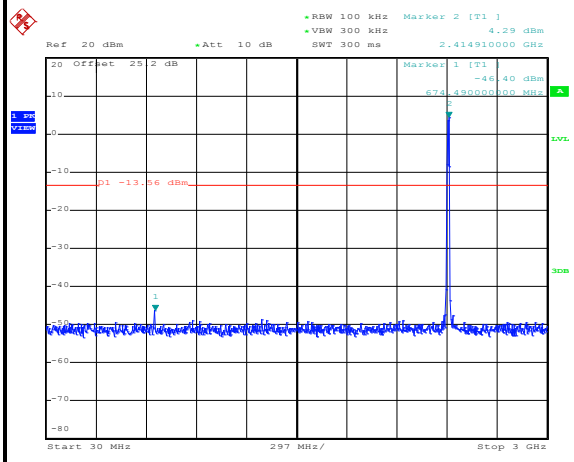
Spurious Emission 30MHz~3GHz



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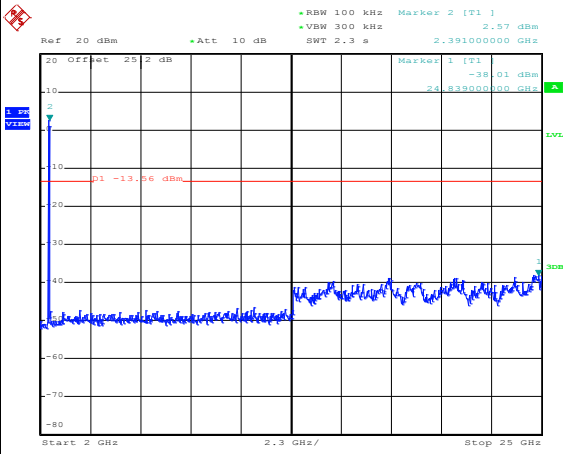
Spurious Emission 2GHz~25GHz



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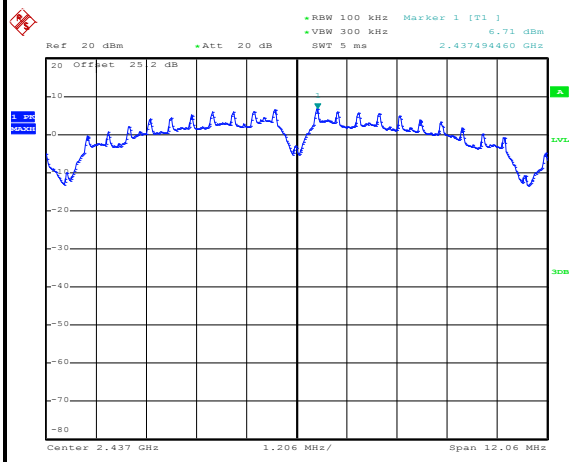
Test Mode :	802.11b	**Temperature :**	21~25°C
Test Band :	2.4GHz Mid	**Relative Humidity :**	51~54%
Test Channel :	06	**Test Engineer :**	Allen Lin

WLAN 802.11b Channel 06

100kHz PSD reference Level



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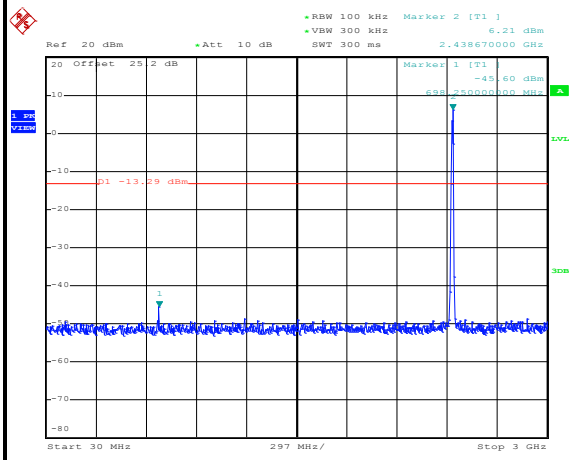
Spurious Emission 30MHz~3GHz



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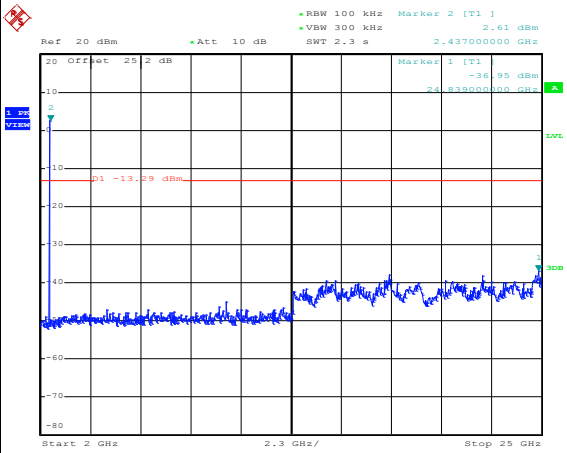
Spurious Emission 2GHz~25GHz

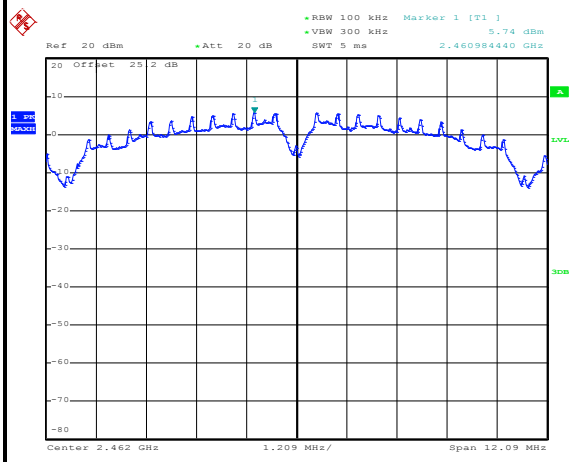


Date: 9.MAY.2017 16:00:19

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

WLAN 802.11b Channel 11

100kHz PSD reference Level



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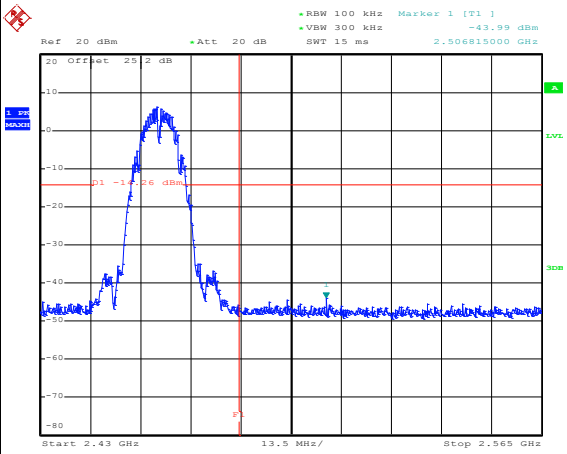
High Channel Plot



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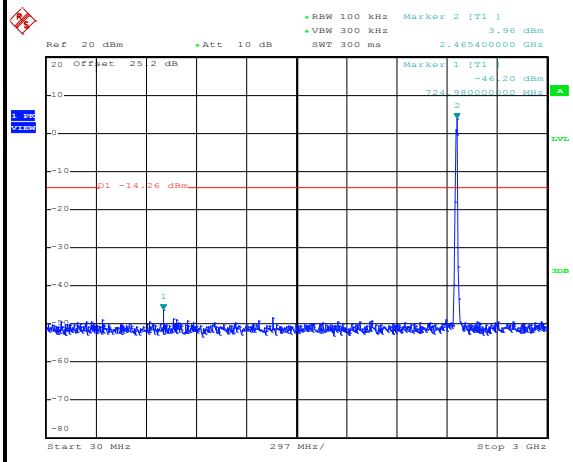
Spurious Emission 30MHz~3GHz



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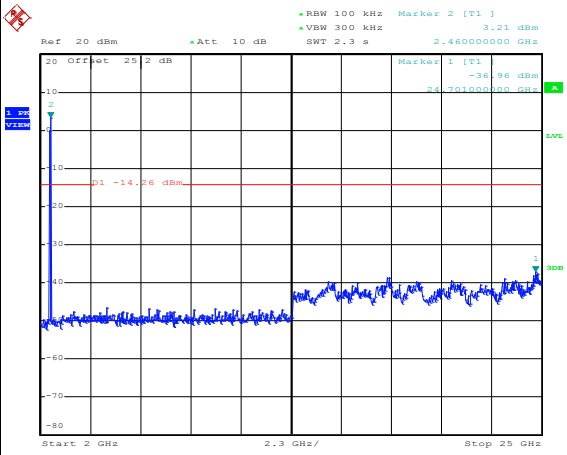
Spurious Emission 2GHz~25GHz

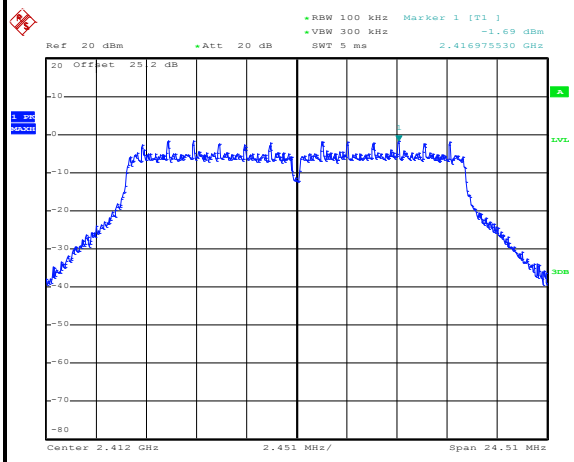


Date: 9.MAY.2017 16:03:23

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

WLAN 802.11g Channel 01

100kHz PSD reference Level



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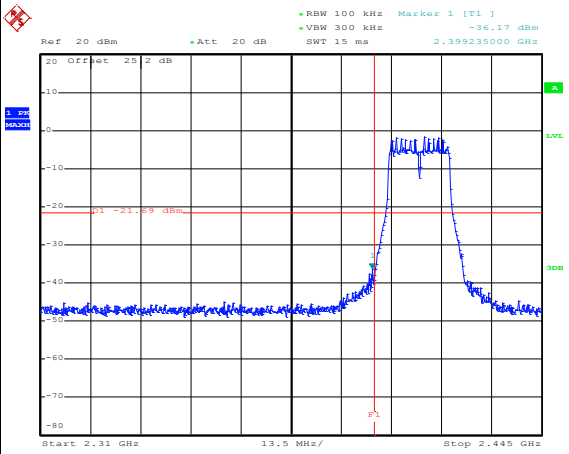
Low Channel Plot



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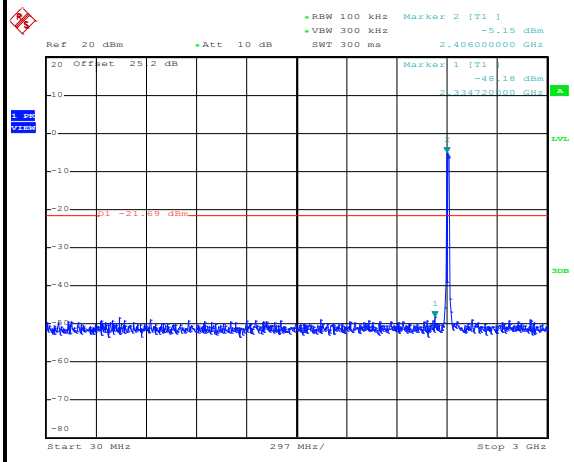
Spurious Emission 30MHz~3GHz



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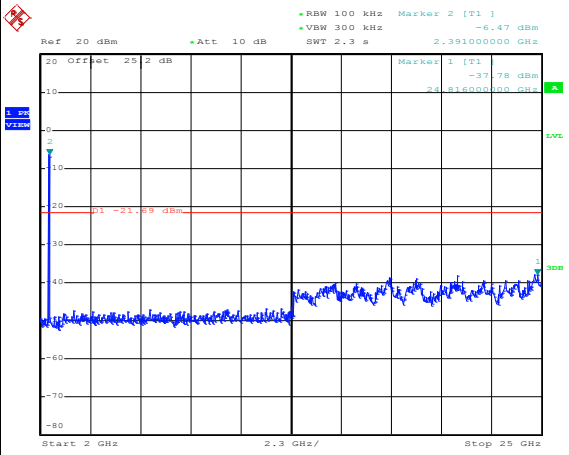
Spurious Emission 2GHz~25GHz



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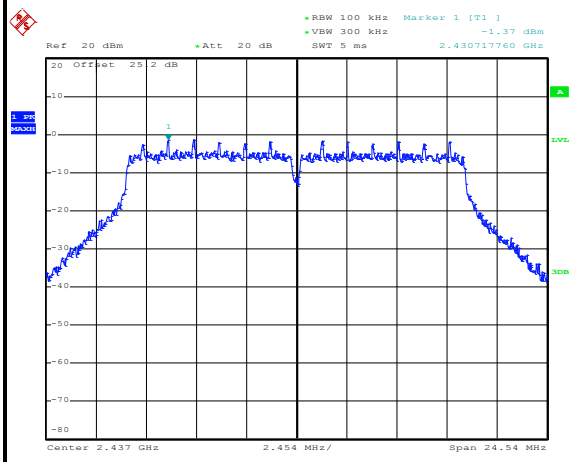
Test Mode :	802.11g	Temperature :	21~25°C
Test Band :	2.4GHz Mid	Relative Humidity :	51~54%
Test Channel :	06	Test Engineer :	Allen Lin

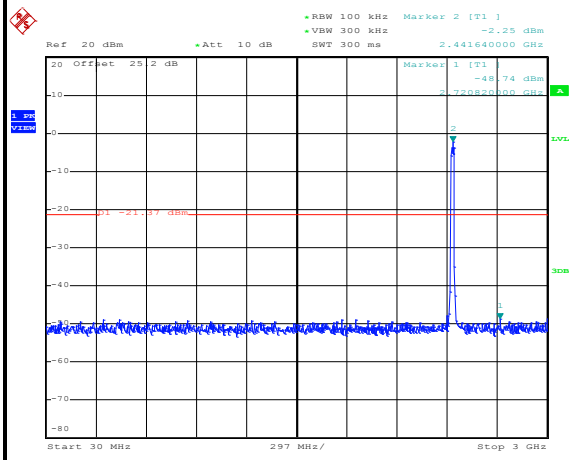
WLAN 802.11g Channel 06

100kHz PSD reference Level



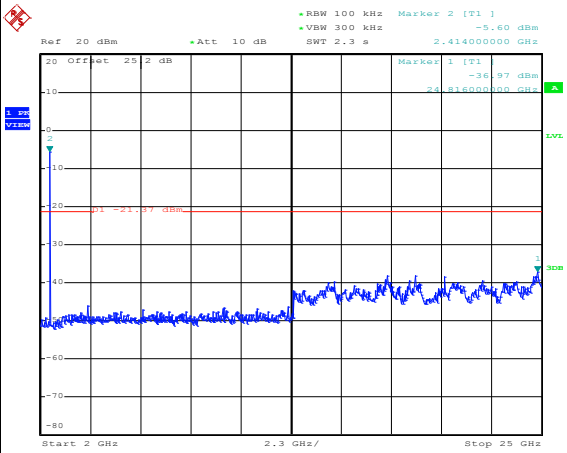
Date: 9.MAY.2017 16:10:02

Spurious Emission 30MHz~3GHz



Date: 9.MAY.2017 16:10:17

Spurious Emission 2GHz~25GHz

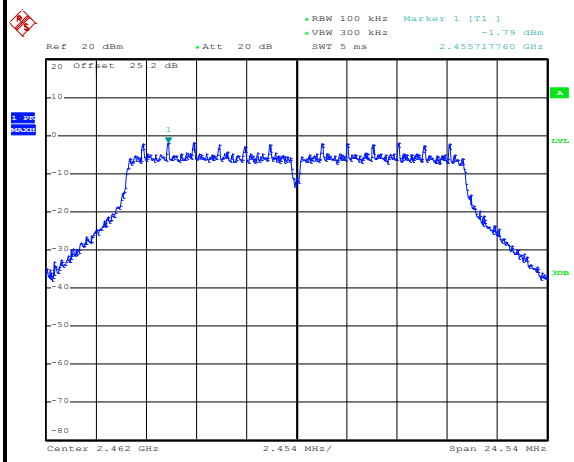


Date: 9.MAY.2017 16:10:25

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

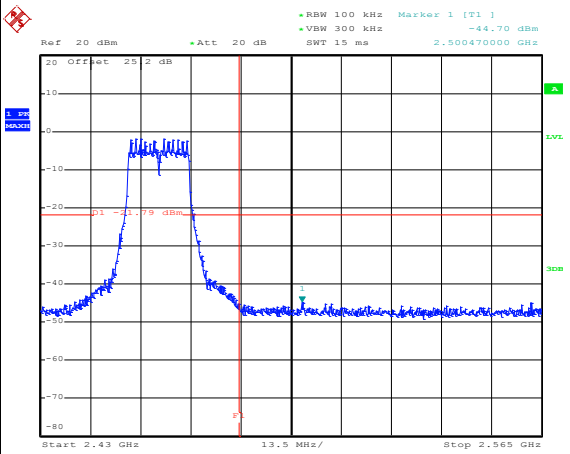
WLAN 802.11g Channel 11

100kHz PSD reference Level



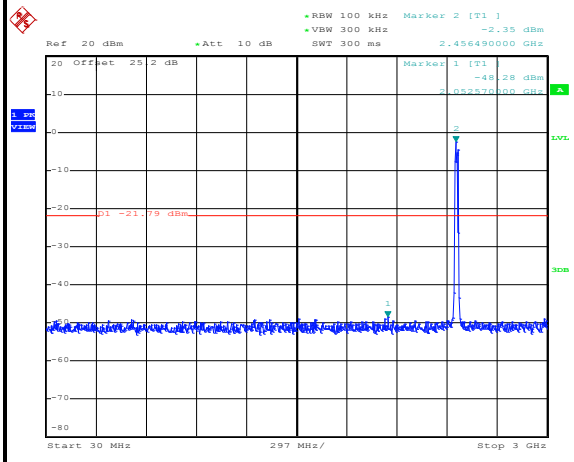
Date: 9.MAY.2017 16:13:03

High Channel Plot



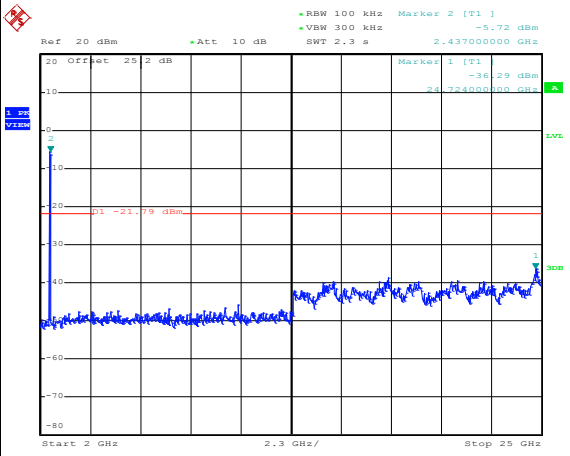
Date: 9.MAY.2017 16:13:28

Spurious Emission 30MHz~3GHz



Date: 9.MAY.2017 16:14:06

Spurious Emission 2GHz~25GHz

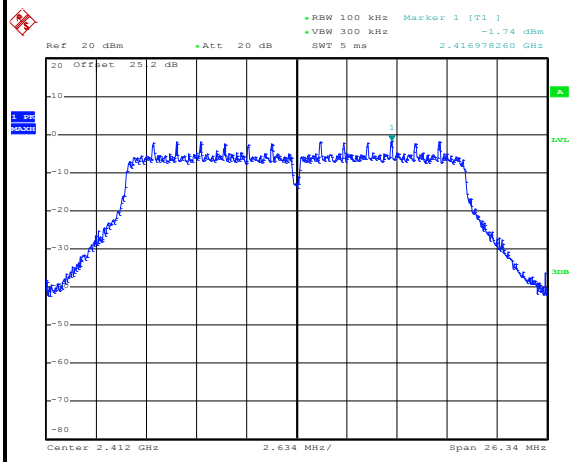


Date: 9.MAY.2017 16:14:15

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

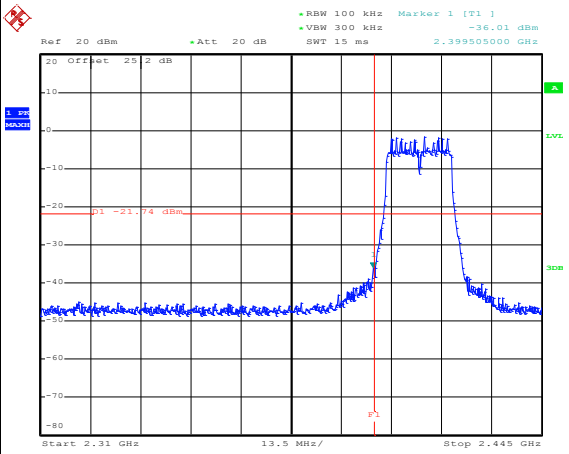
WLAN 802.11n HT20 Channel 01

100kHz PSD reference Level



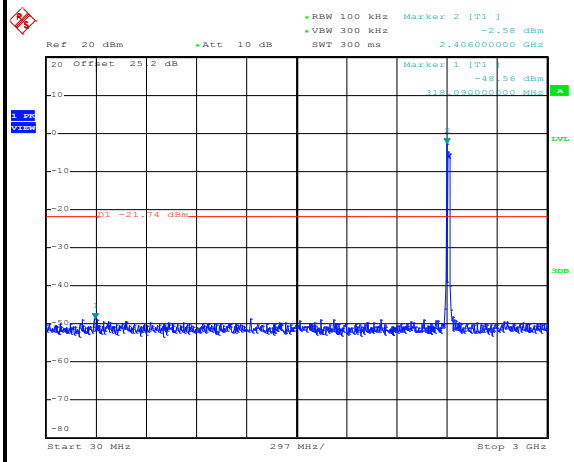
Date: 9.MAY.2017 16:19:33

Low Channel Plot



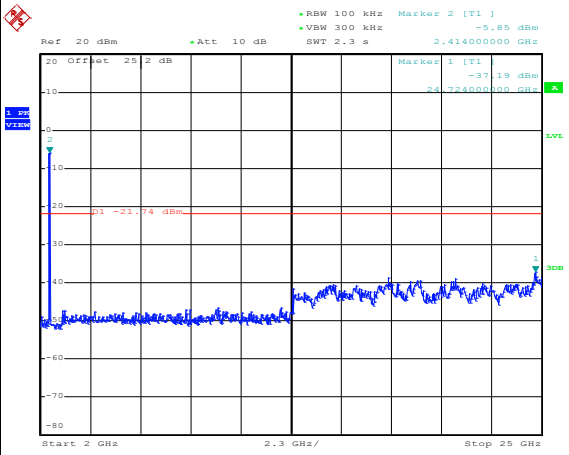
Date: 9.MAY.2017 16:19:55

Spurious Emission 30MHz~3GHz



Date: 9.MAY.2017 16:20:30

Spurious Emission 2GHz~25GHz

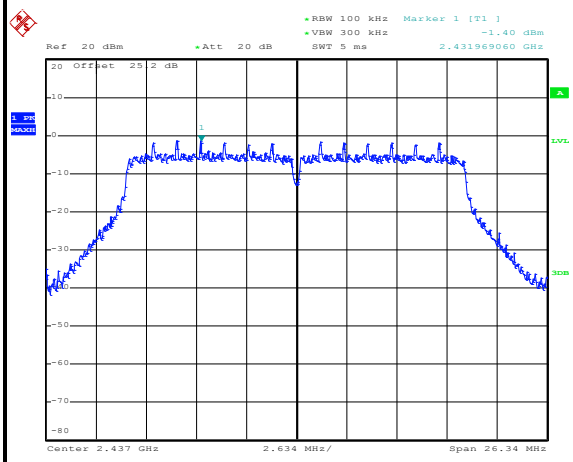


Date: 9.MAY.2017 16:20:38

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

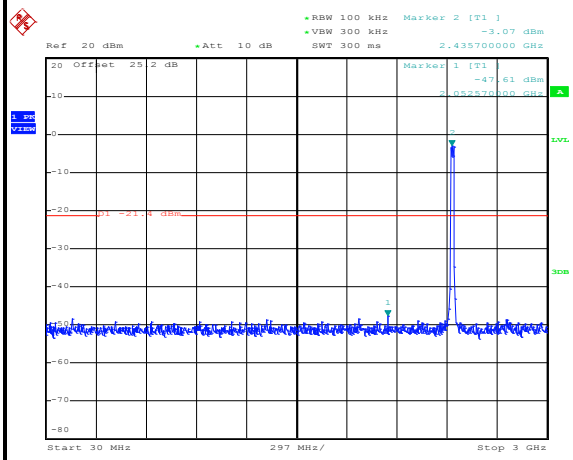
WLAN 802.11n HT20 Channel 06

100kHz PSD reference Level



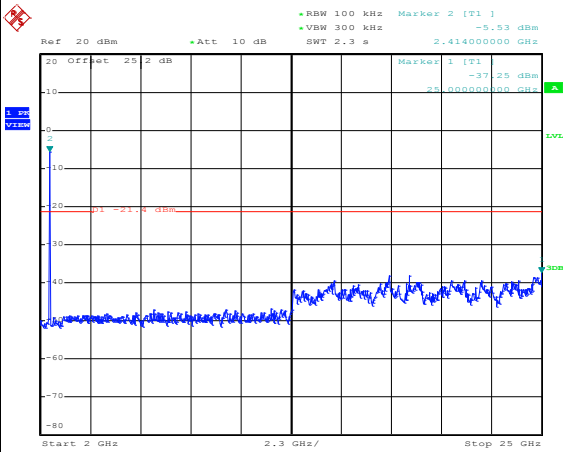
Date: 9.MAY.2017 16:22:49

Spurious Emission 30MHz~3GHz



Date: 9.MAY.2017 16:23:01

Spurious Emission 2GHz~25GHz

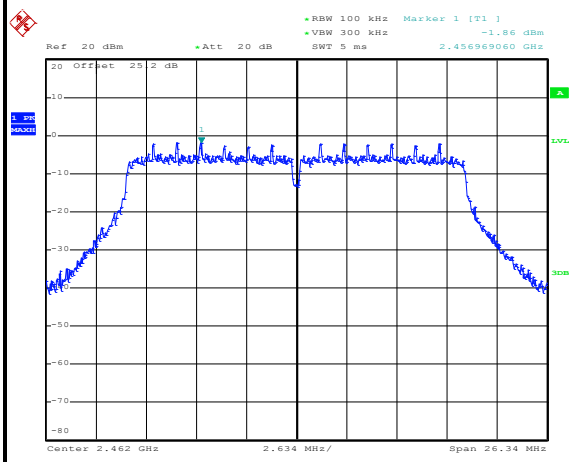


Date: 9.MAY.2017 16:23:09

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

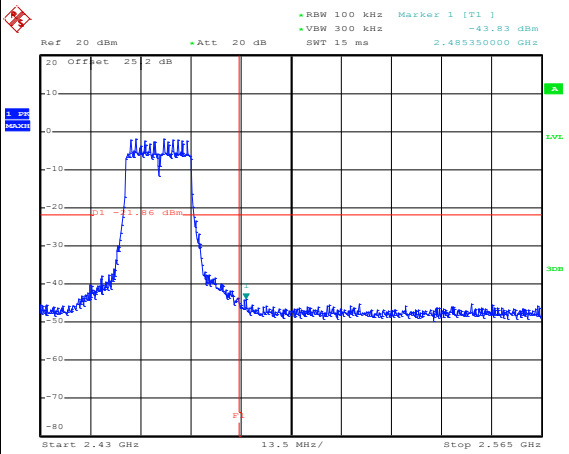
WLAN 802.11n HT20 Channel 11

100kHz PSD reference Level



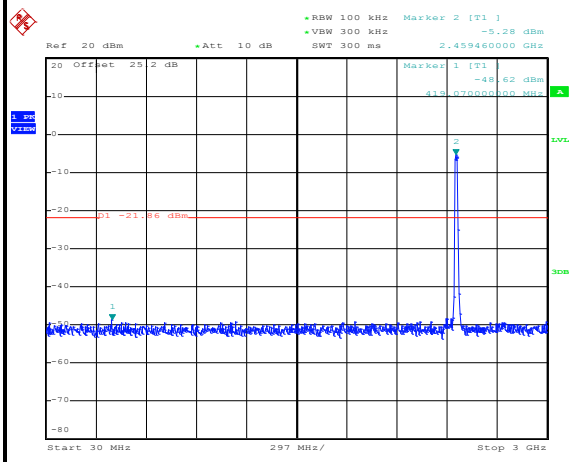
Date: 9.MAY.2017 16:25:15

High Channel Plot



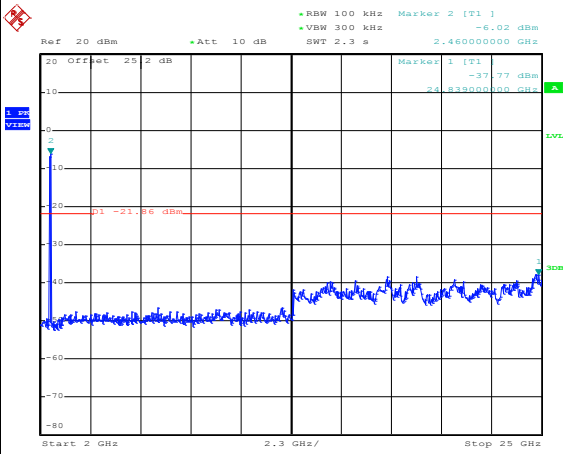
Date: 9.MAY.2017 16:25:43

Spurious Emission 30MHz~3GHz



Date: 9.MAY.2017 16:25:58

Spurious Emission 2GHz~25GHz



Date: 9.MAY.2017 16:26:07

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

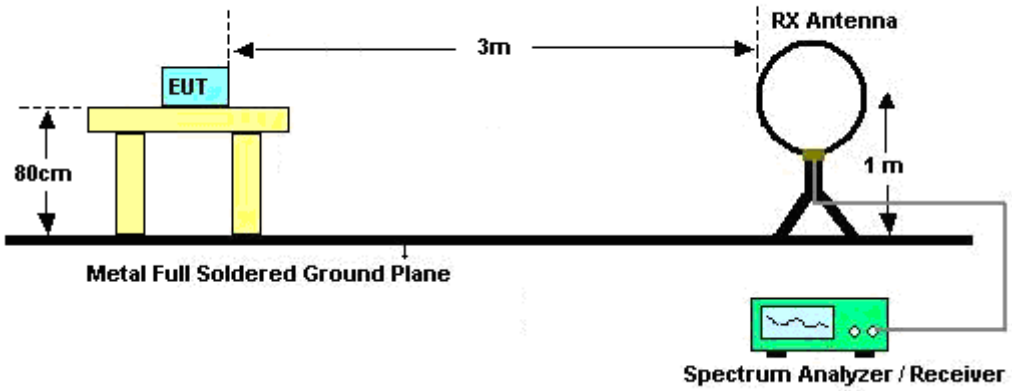
The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

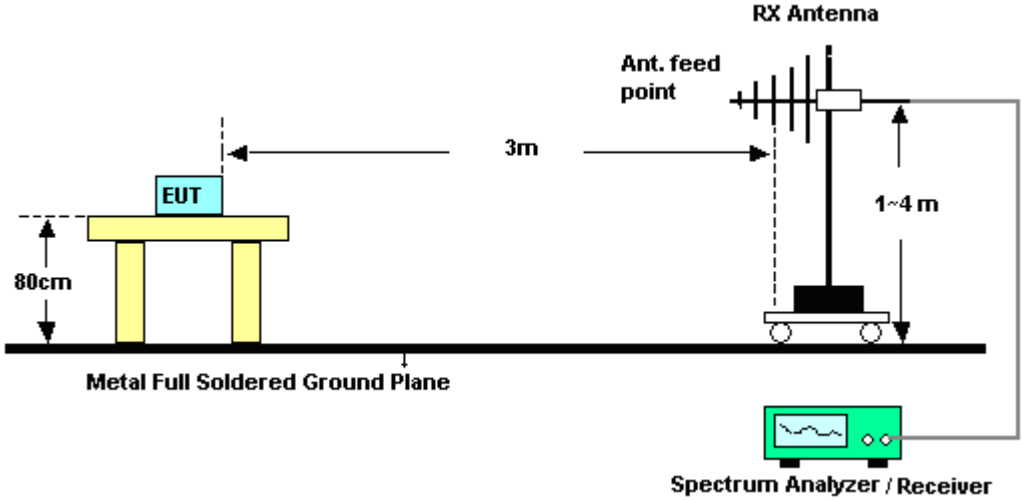
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test 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

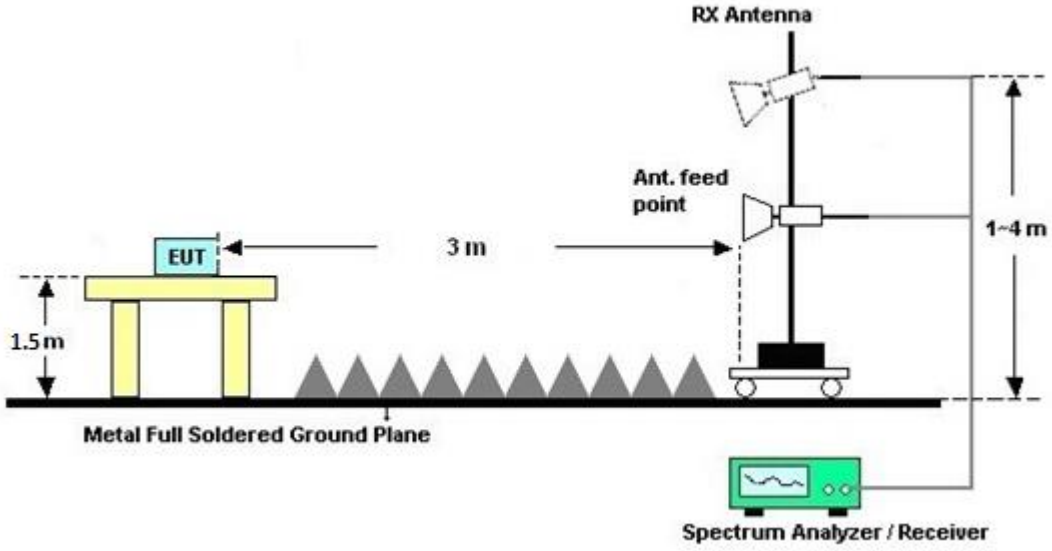
For radiated emissions below 30MHz



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.

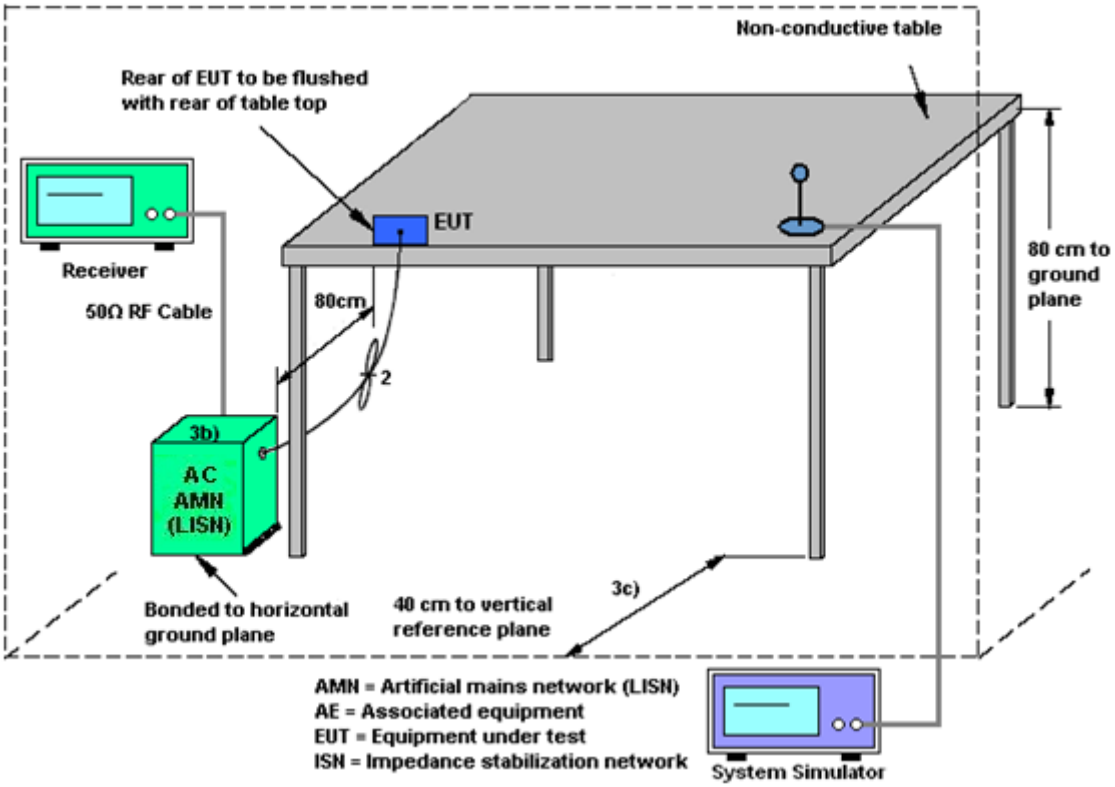
3.6.2 Measuring Instruments

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. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. 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	300MHz~40GHz	Sep. 29, 2016	May 04, 2017 ~ May 18, 2017	Sep. 28, 2017	Conducted (TH05-HY)
Power Sensor	Anritsu	MA2411B	0846202	300MHz~40GHz	Sep. 29, 2016	May 04, 2017 ~ May 18, 2017	Sep. 28, 2017	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz-40GHz	Jul. 17, 2016	May 04, 2017 ~ May 18, 2017	Jul. 16, 2017	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	May 10, 2017	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Aug. 30, 2016	May 10, 2017	Aug. 29, 2017	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 29, 2016	May 10, 2017	Nov. 28, 2017	Conduction (CO05-HY)
Amplifier	SONOMA	310N	187311	9kHz~1GHz	Oct. 26, 2016	May 16, 2017 ~ May 31, 2017	Oct. 25, 2017	Radiation (03CH10-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800N1D01N-06	35413&02	30MHz~1GHz	Jan. 07, 2017	May 16, 2017 ~ May 31, 2017	Jan. 06, 2018	Radiation (03CH10-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1325	1GHz ~ 18GHz	Sep. 30, 2016	May 16, 2017 ~ May 31, 2017	Sep. 29, 2017	Radiation (03CH10-HY)
Preamplifier	Keysight	83017A	MY53270078	1GHz~26.5GHz	Oct. 26, 2016	May 16, 2017 ~ May 31, 2017	Oct. 25, 2017	Radiation (03CH10-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200485	10Hz ~ 44GHz	Oct. 17, 2016	May 16, 2017 ~ May 31, 2017	Oct. 16, 2017	Radiation (03CH10-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	May 16, 2017 ~ May 31, 2017	N/A	Radiation (03CH10-HY)
Turn Table	EMEC	TT 2200	N/A	0~360 Degree	N/A	May 16, 2017 ~ May 31, 2017	N/A	Radiation (03CH10-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Oct. 20, 2016	May 16, 2017 ~ May 31, 2017	Oct. 19, 2018	Radiation (03CH10-HY)
EMI Test Receiver	Keysight	N9038A MXE)	MY55420170	N/A	Mar. 03, 2017	May 16, 2017 ~ May 31, 2017	Mar. 02, 2018	Radiation (03CH10-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170576	18GHz ~ 40GHz	Apr. 27, 2017	May 16, 2017 ~ May 31, 2017	Apr. 26, 2018	Radiation (03CH10-HY)
Preamplifier	MITEQ	JS44-18004000-33-8P	1840917	18GHz ~ 40GHz	Jun. 14, 2016	May 16, 2017 ~ May 31, 2017	Jun. 13, 2017	Radiation (03CH10-HY)
Preamplifier	Jet-Power	JAP00101800-30-10P	160118550004	1GHZ~18GHZ	Apr. 13, 2017	May 16, 2017 ~ May 31, 2017	Apr. 12, 2018	Radiation (03CH10-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.7**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.6**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.9**

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. Conducted Test Results

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Allen Lin	Temperature:	21~25	°C
Test Date:	2017/5/4~2017/5/18	Relative Humidity:	51~54	%

Report Number : FR740122C

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	13.60		8.04		0.50	Pass
11b	1Mbps	1	6	2437	13.60		8.04		0.50	Pass
11b	1Mbps	1	11	2462	13.65		8.06		0.50	Pass
11g	6Mbps	1	1	2412	18.35		16.34		0.50	Pass
11g	6Mbps	1	6	2437	18.45		16.36		0.50	Pass
11g	6Mbps	1	11	2462	18.40		16.36		0.50	Pass
HT20	MCS0	1	1	2412	19.00		17.56		0.50	Pass
HT20	MCS0	1	6	2437	19.10		17.56		0.50	Pass
HT20	MCS0	1	11	2462	19.15		17.56		0.50	Pass

Report Number : FR740122C

TEST RESULTS DATA
Peak Output Power

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
					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	17.13			30.00	30.00	-2.90	0.00	14.23		36.00	36.00	Pass
11b	1Mbps	1	6	2437	17.30			30.00	30.00	-2.90	0.00	14.40		36.00	36.00	Pass
11b	1Mbps	1	11	2462	16.83			30.00	30.00	-2.90	0.00	13.93		36.00	36.00	Pass
11g	6Mbps	1	1	2412	19.01			30.00	30.00	-2.90	0.00	16.11		36.00	36.00	Pass
11g	6Mbps	1	6	2437	18.93			30.00	30.00	-2.90	0.00	16.03		36.00	36.00	Pass
11g	6Mbps	1	11	2462	18.26			30.00	30.00	-2.90	0.00	15.36		36.00	36.00	Pass
HT20	MCS0	1	1	2412	18.83			30.00	30.00	-2.90	0.00	15.93		36.00	36.00	Pass
HT20	MCS0	1	6	2437	18.93			30.00	30.00	-2.90	0.00	16.03		36.00	36.00	Pass
HT20	MCS0	1	11	2462	18.32			30.00	30.00	-2.90	0.00	15.42		36.00	36.00	Pass

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

TEST RESULTS DATA
Average Output Power

2.4GHz Band									
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power (dBm)		
					Ant 1	Ant 2	Ant 1	Ant 2	SUM
11b	1Mbps	1	1	2412	0.00		14.54		
11b	1Mbps	1	6	2437	0.00		14.62		
11b	1Mbps	1	11	2462	0.00		14.17		
11g	6Mbps	1	1	2412	0.06		9.43		
11g	6Mbps	1	6	2437	0.06		9.49		
11g	6Mbps	1	11	2462	0.06		9.09		
HT20	MCS0	1	1	2412	0.10		9.54		
HT20	MCS0	1	6	2437	0.10		9.60		
HT20	MCS0	1	11	2462	0.10		9.16		

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

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	-7.48		-	-2.90	0.00	8.00	8.00	Pass
11b	1Mbps	1	6	2437	-7.72			-2.90	0.00	8.00	8.00	Pass
11b	1Mbps	1	11	2462	-8.12			-2.90	0.00	8.00	8.00	Pass
11g	6Mbps	1	1	2412	-15.21			-2.90	0.00	8.00	8.00	Pass
11g	6Mbps	1	6	2437	-15.75			-2.90	0.00	8.00	8.00	Pass
11g	6Mbps	1	11	2462	-15.75			-2.90	0.00	8.00	8.00	Pass
HT20	MCS0	1	1	2412	-16.02			-2.90	0.00	8.00	8.00	Pass
HT20	MCS0	1	6	2437	-16.21			-2.90	0.00	8.00	8.00	Pass
HT20	MCS0	1	11	2462	-16.33			-2.90	0.00	8.00	8.00	Pass

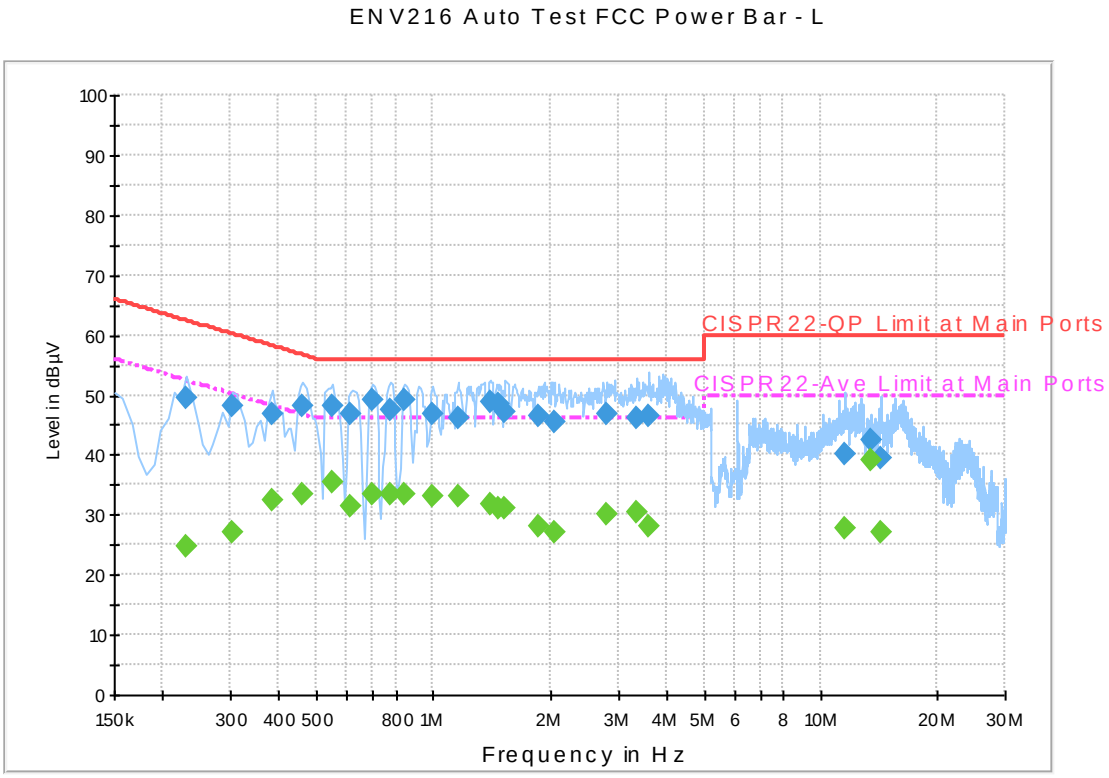
Measured power density (dBm) has offset with cable loss.

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Eric Jeng	**Temperature :**	23~25℃
		Relative Humidity :	52~54%

EUT Information

Report NO :	740122
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line



Final Result 1

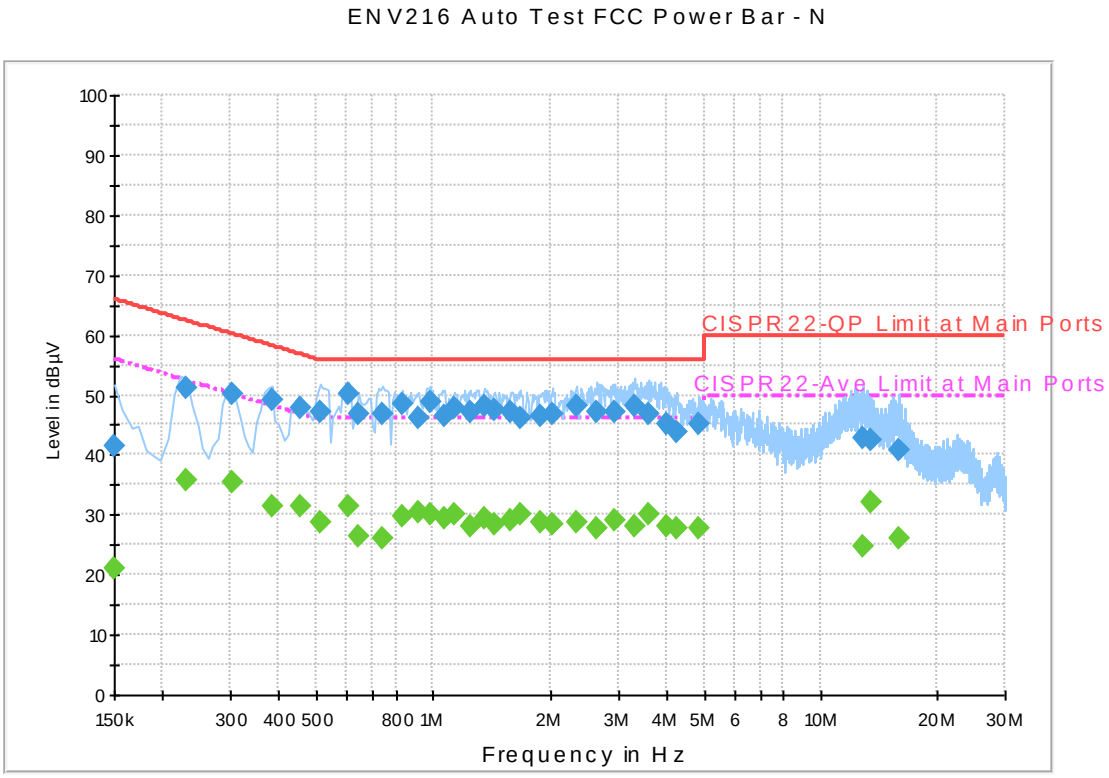
Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.230000	49.6	Off	L1	19.6	12.8	62.4
0.302000	48.0	Off	L1	19.6	12.2	60.2
0.382000	47.0	Off	L1	19.6	11.2	58.2
0.462000	48.3	Off	L1	19.6	8.4	56.7
0.550000	48.0	Off	L1	19.6	8.0	56.0
0.614000	46.8	Off	L1	19.6	9.2	56.0
0.694000	49.1	Off	L1	19.6	6.9	56.0
0.774000	47.6	Off	L1	19.6	8.4	56.0
0.846000	49.1	Off	L1	19.6	6.9	56.0
0.998000	46.8	Off	L1	19.6	9.2	56.0
1.158000	46.3	Off	L1	19.6	9.7	56.0
1.406000	49.0	Off	L1	19.6	7.0	56.0
1.478000	48.5	Off	L1	19.6	7.5	56.0
1.534000	47.1	Off	L1	19.6	8.9	56.0
1.870000	46.5	Off	L1	19.6	9.5	56.0
2.054000	45.4	Off	L1	18.5	10.6	56.0
2.806000	46.8	Off	L1	19.5	9.2	56.0
3.350000	46.0	Off	L1	19.6	10.0	56.0
3.606000	46.4	Off	L1	19.7	9.6	56.0
11.574000	40.3	Off	L1	20.1	19.7	60.0
13.558000	42.6	Off	L1	20.2	17.4	60.0
14.278000	39.6	Off	L1	20.3	20.4	60.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.230000	24.8	Off	L1	19.6	27.6	52.4
0.302000	27.0	Off	L1	19.6	23.2	50.2
0.382000	32.4	Off	L1	19.6	15.8	48.2
0.462000	33.5	Off	L1	19.6	13.2	46.7
0.550000	35.6	Off	L1	19.6	10.4	46.0
0.614000	31.3	Off	L1	19.6	14.7	46.0
0.694000	33.4	Off	L1	19.6	12.6	46.0
0.774000	33.5	Off	L1	19.6	12.5	46.0
0.846000	33.6	Off	L1	19.6	12.4	46.0
0.998000	33.3	Off	L1	19.6	12.7	46.0
1.158000	33.0	Off	L1	19.6	13.0	46.0
1.406000	31.8	Off	L1	19.6	14.2	46.0
1.478000	31.2	Off	L1	19.6	14.8	46.0
1.534000	31.1	Off	L1	19.6	14.9	46.0
1.870000	28.0	Off	L1	19.6	18.0	46.0
2.054000	27.0	Off	L1	18.5	19.0	46.0
2.806000	30.1	Off	L1	19.5	15.9	46.0
3.350000	30.3	Off	L1	19.6	15.7	46.0
3.606000	28.0	Off	L1	19.7	18.0	46.0
11.574000	27.8	Off	L1	20.1	22.2	50.0
13.558000	39.0	Off	L1	20.2	11.0	50.0
14.278000	27.1	Off	L1	20.3	22.9	50.0

EUT Information

Report NO :	740122
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	41.4	Off	N	19.5	24.6	66.0
0.230000	51.1	Off	N	19.5	11.3	62.4
0.302000	50.1	Off	N	19.5	10.1	60.2
0.382000	49.0	Off	N	19.5	9.2	58.2
0.454000	47.9	Off	N	19.5	8.9	56.8
0.510000	47.2	Off	N	19.5	8.8	56.0
0.606000	50.0	Off	N	19.5	6.0	56.0
0.638000	46.7	Off	N	19.5	9.3	56.0
0.742000	46.9	Off	N	19.6	9.1	56.0
0.830000	48.4	Off	N	19.6	7.6	56.0
0.918000	46.2	Off	N	19.5	9.8	56.0
0.982000	48.7	Off	N	19.6	7.3	56.0
1.070000	46.4	Off	N	19.6	9.6	56.0
1.134000	47.7	Off	N	19.6	8.3	56.0
1.246000	47.1	Off	N	19.6	8.9	56.0
1.350000	48.1	Off	N	19.6	7.9	56.0
1.438000	47.5	Off	N	19.6	8.5	56.0
1.590000	47.3	Off	N	19.6	8.7	56.0
1.678000	46.2	Off	N	19.6	9.8	56.0
1.886000	46.4	Off	N	19.6	9.6	56.0
2.038000	46.8	Off	N	19.2	9.2	56.0
2.342000	48.0	Off	N	18.9	8.0	56.0
2.638000	47.2	Off	N	19.4	8.8	56.0
2.942000	47.2	Off	N	19.5	8.8	56.0
3.310000	48.0	Off	N	19.6	8.0	56.0

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
3.614000	46.9	Off	N	19.7	9.1	56.0
4.014000	45.3	Off	N	19.7	10.7	56.0
4.270000	43.9	Off	N	19.7	12.1	56.0
4.878000	45.0	Off	N	19.7	11.0	56.0
12.862000	42.9	Off	N	20.2	17.1	60.0
13.558000	42.5	Off	N	20.3	17.5	60.0
15.926000	41.0	Off	N	20.4	19.0	60.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	21.2	Off	N	19.5	34.8	56.0
0.230000	35.9	Off	N	19.5	16.5	52.4
0.302000	35.5	Off	N	19.5	14.7	50.2
0.382000	31.3	Off	N	19.5	16.9	48.2
0.454000	31.5	Off	N	19.5	15.3	46.8
0.510000	28.8	Off	N	19.5	17.2	46.0
0.606000	31.6	Off	N	19.5	14.4	46.0
0.638000	26.4	Off	N	19.5	19.6	46.0
0.742000	26.0	Off	N	19.6	20.0	46.0
0.830000	29.9	Off	N	19.6	16.1	46.0
0.918000	30.4	Off	N	19.5	15.6	46.0
0.982000	30.1	Off	N	19.6	15.9	46.0
1.070000	29.5	Off	N	19.6	16.5	46.0
1.134000	30.1	Off	N	19.6	15.9	46.0
1.246000	28.0	Off	N	19.6	18.0	46.0
1.350000	29.3	Off	N	19.6	16.7	46.0
1.438000	28.4	Off	N	19.6	17.6	46.0
1.590000	29.0	Off	N	19.6	17.0	46.0
1.678000	30.0	Off	N	19.6	16.0	46.0
1.886000	28.7	Off	N	19.6	17.3	46.0
2.038000	28.4	Off	N	19.2	17.6	46.0
2.342000	28.9	Off	N	18.9	17.1	46.0
2.638000	27.9	Off	N	19.4	18.1	46.0
2.942000	29.2	Off	N	19.5	16.8	46.0
3.310000	28.2	Off	N	19.6	17.8	46.0
3.614000	30.0	Off	N	19.7	16.0	46.0
4.014000	28.3	Off	N	19.7	17.7	46.0
4.270000	27.9	Off	N	19.7	18.1	46.0
4.878000	27.8	Off	N	19.7	18.2	46.0
12.862000	24.8	Off	N	20.2	25.2	50.0
13.558000	32.0	Off	N	20.3	18.0	50.0
15.926000	26.0	Off	N	20.4	24.0	50.0

Appendix C. Radiated Spurious Emission

Test Engineer :	Tsung Lee, Stan Hsieh, Kyle Chuang	Temperature :	22~24°C
		Relative Humidity :	45~47%

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		2386.965	50.73	-23.27	74	42.61	26.93	4.43	33.22	102	76	P	H
		2389.59	40.74	-13.26	54	32.62	26.93	4.43	33.22	102	76	A	H
	*	2412	101.69	-	-	93.46	26.99	4.47	33.21	102	76	P	H
	*	2412	98.12	-	-	89.89	26.99	4.47	33.21	102	76	A	H
													H
													H
		2351.37	50.18	-23.82	74	42.29	26.74	4.4	33.23	393	260	P	V
		2390	39.98	-14.02	54	31.85	26.93	4.43	33.21	393	260	A	V
	*	2412	96.43	-	-	88.2	26.99	4.47	33.21	393	260	P	V
	*	2412	93.26	-	-	85.03	26.99	4.47	33.21	393	260	A	V
													V
													V
802.11b CH 06 2437MHz		2387.7	51.21	-22.79	74	43.09	26.93	4.43	33.22	100	74	P	H
		2389.94	40.26	-13.74	54	32.13	26.93	4.43	33.21	100	74	A	H
	*	2437	101.61	-	-	93.23	27.11	4.48	33.19	100	74	P	H
	*	2437	98.37	-	-	89.99	27.11	4.48	33.19	100	74	A	H
		2492.16	51.19	-22.81	74	42.54	27.3	4.53	33.16	100	74	P	H
		2493.14	41.15	-12.85	54	32.5	27.3	4.53	33.16	100	74	A	H
		2371.88	51.61	-22.39	74	43.56	26.87	4.42	33.22	342	259	P	V
		2387.98	39.95	-14.05	54	31.83	26.93	4.43	33.22	342	259	A	V
	*	2437	97.58	-	-	89.2	27.11	4.48	33.19	342	259	P	V
	*	2437	94.41	-	-	86.03	27.11	4.48	33.19	342	259	A	V
		2484.04	51.32	-22.68	74	42.74	27.24	4.53	33.17	342	259	P	V
		2493.84	40.44	-13.56	54	31.79	27.3	4.53	33.16	342	259	A	V

802.11b CH 11 2462MHz	*	2462	101.92	-	-	93.44	27.18	4.5	33.18	100	71	P	H
	*	2462	98.72	-	-	90.24	27.18	4.5	33.18	100	71	A	H
		2495.24	51.8	-22.2	74	43.15	27.3	4.53	33.16	100	71	P	H
		2484.2	41.55	-12.45	54	32.97	27.24	4.53	33.17	100	71	A	H
													H
													H
	*	2462	95.79	-	-	87.31	27.18	4.5	33.18	289	197	P	V
	*	2462	92.62	-	-	84.14	27.18	4.5	33.18	289	197	A	V
		2494.8	51.08	-22.92	74	42.43	27.3	4.53	33.16	289	197	P	V
		2484.68	40.44	-13.56	54	31.86	27.24	4.53	33.17	289	197	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	44.54	-29.46	74	69.96	32.09	6.36	64.36	100	0	P	H
													H
													H
													H
		4824	44.72	-29.28	74	70.14	32.09	6.36	64.36	100	0	P	V
													V
													V
													V
802.11b CH 06 2437MHz		4874	43.54	-30.46	74	68.84	32.21	6.41	64.4	100	0	P	H
		7311	49.73	-24.27	74	70.06	36.86	7.96	65.55	100	0	P	H
													H
													H
		4874	44.5	-29.5	74	69.8	32.21	6.41	64.4	100	0	P	V
		7311	49.7	-24.3	74	70.03	36.86	7.96	65.55	100	0	P	V
													V
													V
802.11b CH 11 2462MHz		4924	44.56	-29.44	74	69.77	32.33	6.43	64.44	100	0	P	H
		7386	49.75	-24.25	74	69.85	37.15	8.02	65.62	100	0	P	H
													H
													H
		4924	43.5	-30.5	74	68.71	32.33	6.43	64.44	100	0	P	V
		7386	49.09	-24.91	74	69.19	37.15	8.02	65.62	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)	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	51.79	-22.21	74	43.66	26.93	4.43	33.21	100	75	P	H
		2390	42	-12	54	33.87	26.93	4.43	33.21	100	75	A	H
	*	2412	99.55	-	-	91.32	26.99	4.47	33.21	100	75	P	H
	*	2412	91.26	-	-	83.03	26.99	4.47	33.21	100	75	A	H
													H
													H
		2389.275	50.98	-23.02	74	42.86	26.93	4.43	33.22	392	259	P	V
		2390	40.4	-13.6	54	32.27	26.93	4.43	33.21	392	259	A	V
	*	2412	93.59	-	-	85.36	26.99	4.47	33.21	392	259	P	V
	*	2412	85.06	-	-	76.83	26.99	4.47	33.21	392	259	A	V
													V
													V
802.11g CH 06 2437MHz		2379.72	50.63	-23.37	74	42.57	26.87	4.43	33.22	100	71	P	H
		2384.9	40.67	-13.33	54	32.61	26.87	4.43	33.22	100	71	A	H
	*	2437	100.17	-	-	91.79	27.11	4.48	33.19	100	71	P	H
	*	2437	91.96	-	-	83.58	27.11	4.48	33.19	100	71	A	H
		2489.57	52.16	-21.84	74	43.52	27.3	4.53	33.17	100	71	P	H
		2489.22	41.93	-12.07	54	33.29	27.3	4.53	33.17	100	71	A	H
		2383.78	50.68	-23.32	74	42.62	26.87	4.43	33.22	341	259	P	V
		2384.76	40.23	-13.77	54	32.17	26.87	4.43	33.22	341	259	A	V
	*	2437	94.01	-	-	85.63	27.11	4.48	33.19	341	259	P	V
	*	2437	86.26	-	-	77.88	27.11	4.48	33.19	341	259	A	V
		2498.95	51.85	-22.15	74	43.2	27.3	4.53	33.16	341	259	P	V
		2489.15	40.69	-13.31	54	32.05	27.3	4.53	33.17	341	259	A	V

802.11g CH 11 2462MHz	*	2462	100.21	-	-	91.73	27.18	4.5	33.18	100	74	P	H
	*	2462	91.79	-	-	83.31	27.18	4.5	33.18	100	74	A	H
		2483.84	55.88	-18.12	74	47.3	27.24	4.53	33.17	100	74	P	H
		2483.52	43.52	-10.48	54	34.94	27.24	4.53	33.17	100	74	A	H
													H
													H
	*	2462	94.36	-	-	85.88	27.18	4.5	33.18	298	198	P	V
	*	2462	85.72	-	-	77.24	27.18	4.5	33.18	298	198	A	V
		2484.76	52.01	-21.99	74	43.43	27.24	4.53	33.17	298	198	P	V
		2483.52	41	-13	54	32.42	27.24	4.53	33.17	298	198	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	44.24	-29.76	74	69.66	32.09	6.36	64.36	100	0	P	H
													H
													H
													H
		4824	44.52	-29.48	74	69.94	32.09	6.36	64.36	100	0	P	V
													V
													V
													V
802.11g CH 06 2437MHz		4874	43.8	-30.2	74	69.1	32.21	6.41	64.4	100	0	P	H
		7311	48.36	-25.64	74	68.69	36.86	7.96	65.55	100	0	P	H
													H
													H
		4874	43.22	-30.78	74	68.52	32.21	6.41	64.4	100	0	P	V
		7311	48.79	-25.21	74	69.12	36.86	7.96	65.55	100	0	P	V
													V
													V
802.11g CH 11 2462MHz		4924	44	-30	74	69.21	32.33	6.43	64.44	100	0	P	H
		7386	49	-25	74	69.1	37.15	8.02	65.62	100	0	P	H
													H
													H
		4924	44.43	-29.57	74	69.64	32.33	6.43	64.44	100	0	P	V
		7386	49.58	-24.42	74	69.68	37.15	8.02	65.62	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)
		2388.43	55.8	-18.2	74	47.68	26.93	4.43	33.22	100	77	P	H
		2390	43.85	-10.15	54	35.72	26.93	4.43	33.21	100	77	A	H
	*	2412	99.47	-	-	91.24	26.99	4.47	33.21	100	77	P	H
	*	2412	91.14	-	-	82.91	26.99	4.47	33.21	100	77	A	H
802.11n													H
HT20													H
CH 01		2389.9	53.86	-20.14	74	45.73	26.93	4.43	33.21	392	259	P	V
2412MHz		2390	41.47	-12.53	54	33.34	26.93	4.43	33.21	392	259	A	V
	*	2412	93.47	-	-	85.24	26.99	4.47	33.21	392	259	P	V
	*	2412	84.81	-	-	76.58	26.99	4.47	33.21	392	259	A	V
													V
													V
		2377.2	50.59	-23.41	74	42.53	26.87	4.43	33.22	100	74	P	H
		2385.32	41.56	-12.44	54	33.5	26.87	4.43	33.22	100	74	A	H
	*	2437	100.28	-	-	91.9	27.11	4.48	33.19	100	74	P	H
	*	2437	91.95	-	-	83.57	27.11	4.48	33.19	100	74	A	H
802.11n		2484.67	51.96	-22.04	74	43.38	27.24	4.53	33.17	100	74	P	H
HT20		2488.8	42.78	-11.22	54	34.14	27.3	4.53	33.17	100	74	A	H
CH 06		2349.9	50.31	-23.69	74	42.42	26.74	4.4	33.23	329	259	P	V
2437MHz		2385.04	40.81	-13.19	54	32.75	26.87	4.43	33.22	329	259	A	V
	*	2437	94.46	-	-	86.08	27.11	4.48	33.19	329	259	P	V
	*	2437	85.95	-	-	77.57	27.11	4.48	33.19	329	259	A	V
		2494.89	51.23	-22.77	74	42.58	27.3	4.53	33.16	329	259	P	V
		2488.66	41.64	-12.36	54	33	27.3	4.53	33.17	329	259	A	V

	*	2462	100.1	-	-	91.62	27.18	4.5	33.18	100	73	P	H
	*	2462	91.85	-	-	83.37	27.18	4.5	33.18	100	73	A	H
		2483.88	58.05	-15.95	74	49.47	27.24	4.53	33.17	100	73	P	H
		2483.56	45.53	-8.47	54	36.95	27.24	4.53	33.17	100	73	A	H
802.11n													H
HT20													H
CH 11	*	2462	94.02	-	-	85.54	27.18	4.5	33.18	291	265	P	V
2462MHz	*	2462	85.95	-	-	77.47	27.18	4.5	33.18	291	265	A	V
		2485.28	53.52	-20.48	74	44.94	27.24	4.53	33.17	291	265	P	V
		2483.56	43.34	-10.66	54	34.76	27.24	4.53	33.17	291	265	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		4824	44.77	-29.23	74	70.19	32.09	6.36	64.36	100	0	P	H
													H
802.11n													H
HT20													H
CH 01		4824	45.45	-28.55	74	70.87	32.09	6.36	64.36	100	0	P	V
2412MHz													V
													V
													V
		4874	44.73	-29.27	74	70.03	32.21	6.41	64.4	100	0	P	H
		7311	49.43	-24.57	74	69.76	36.86	7.96	65.55	100	0	P	H
802.11n													H
HT20													H
CH 06		4874	44.37	-29.63	74	69.67	32.21	6.41	64.4	100	0	P	V
2437MHz		7311	50.04	-23.96	74	70.37	36.86	7.96	65.55	100	0	P	V
													V
													V
		4924	44.8	-29.2	74	70.01	32.33	6.43	64.44	100	0	P	H
		7386	51.43	-22.57	74	71.53	37.15	8.02	65.62	100	0	P	H
802.11n													H
HT20													H
CH 11		4924	45.21	-28.79	74	70.42	32.33	6.43	64.44	100	0	P	V
2462MHz		7386	49.58	-24.42	74	69.68	37.15	8.02	65.62	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 802.11n HT20 (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)
		86.7	33.43	-6.57	40	50.97	14.11	0.86	32.76	100	0	P	H
		136.92	34.88	-8.62	43.5	48.8	17.4	1.12	32.76	-	-	P	H
		187.68	34.09	-9.41	43.5	50.24	14.8	1.39	32.75	-	-	P	H
		326.6	29.03	-16.97	46	39.99	19.63	1.73	32.72	-	-	P	H
		781.6	31.44	-14.56	46	32.84	28.31	2.58	32.92	-	-	P	H
		895.7	38.81	-7.19	46	38.58	29.09	2.74	32.31	-	-	P	H
													H
													H
													H
													H
2.4GHz													H
802.11n													H
HT20		36.48	31.94	-8.06	40	43.08	20.98	0.53	32.75	-	-	P	V
LF		66.72	34.08	-5.92	40	53.83	12.07	0.77	32.75	-	-	P	V
		85.35	36.53	-3.47	40	54.21	13.97	0.86	32.76	100	0	P	V
		575.1	27.72	-18.28	46	32.16	25.74	2.21	32.97	-	-	P	V
		731.2	30.07	-15.93	46	32.18	27.78	2.48	32.96	-	-	P	V
		896.4	36.26	-9.74	46	36.03	29.09	2.74	32.31	-	-	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

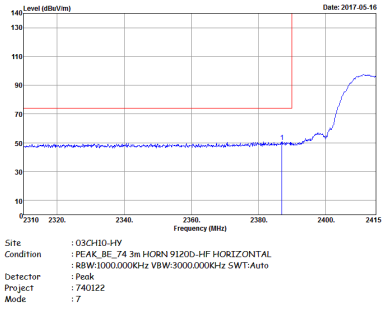
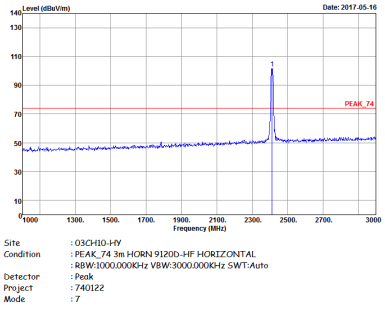
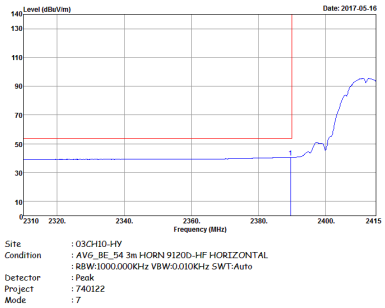
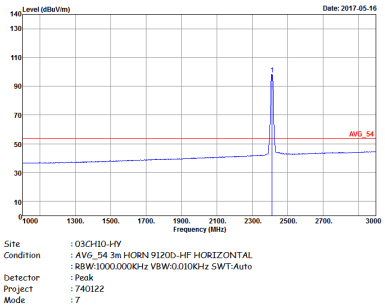
Test Engineer :	Tsung Lee, Stan Hsieh, and Kyle Chuang	**Temperature :**	22~24°C
		Relative Humidity :	45~47%

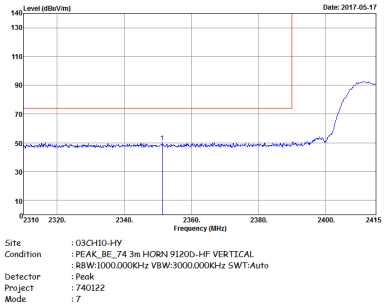
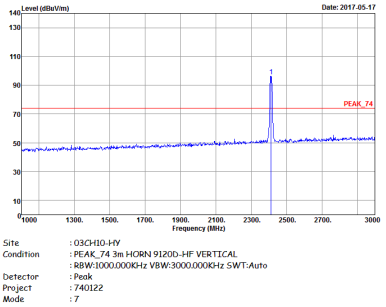
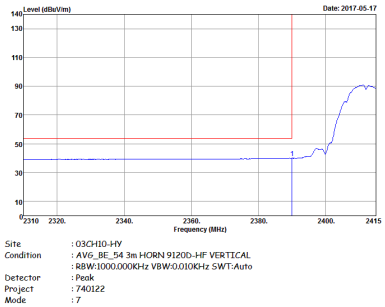
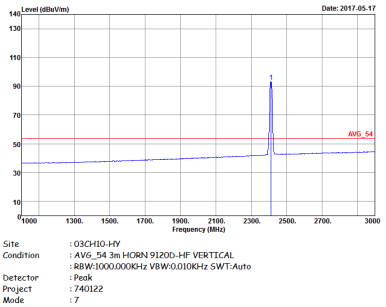
Note symbol

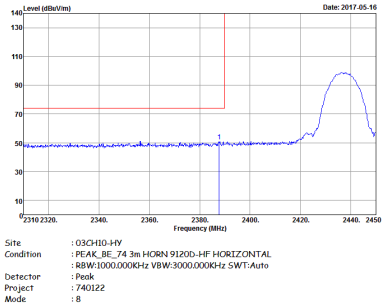
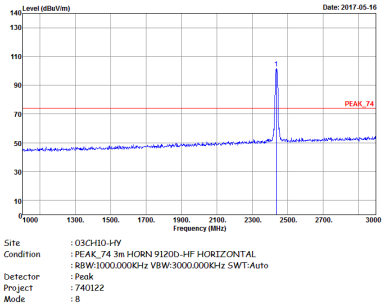
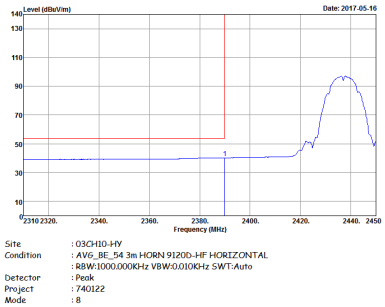
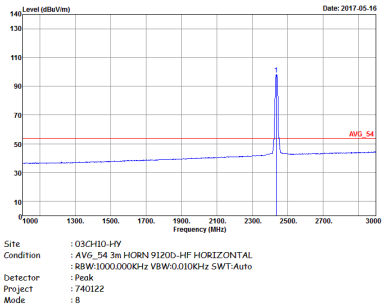
-L	**Low channel location**
-R	**High channel location**

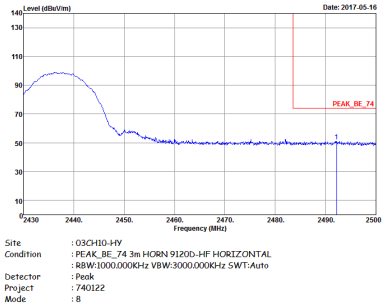
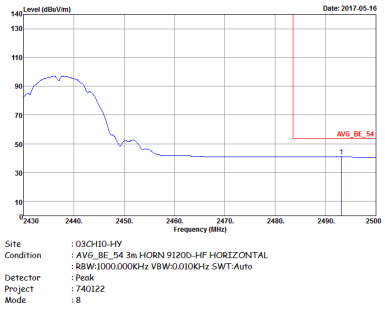
2.4GHz 2400~2483.5MHz

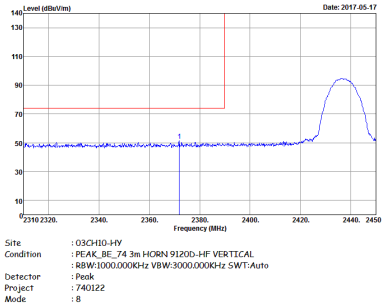
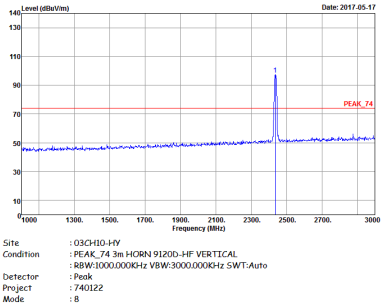
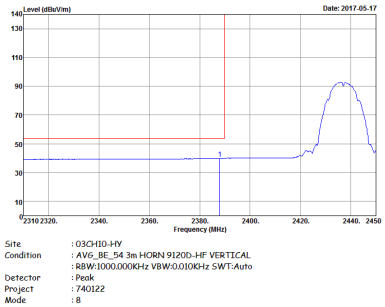
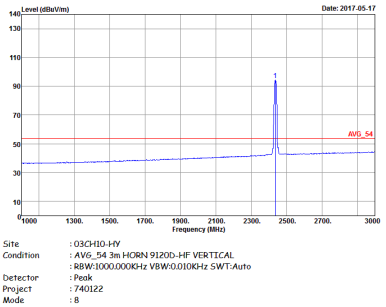
WIFI 802.11b (Band Edge @ 3m)

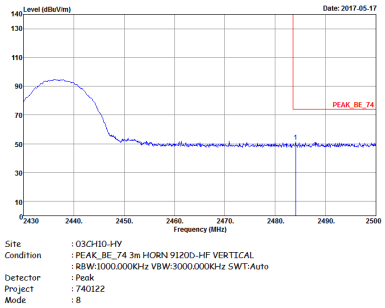
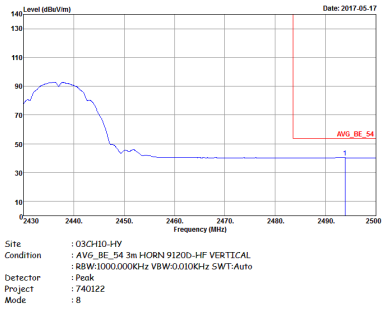
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

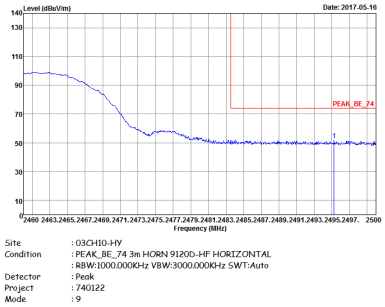
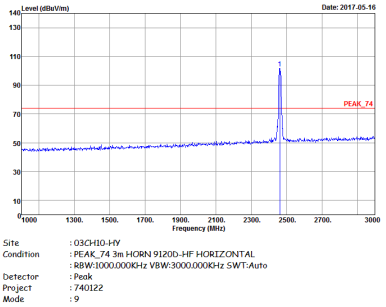
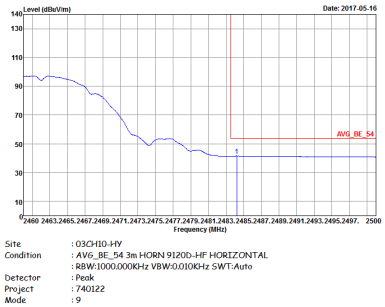
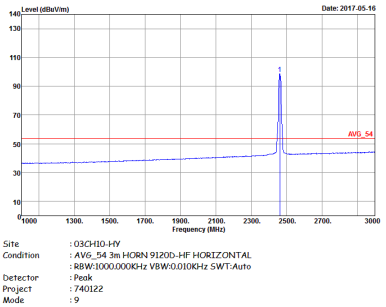
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

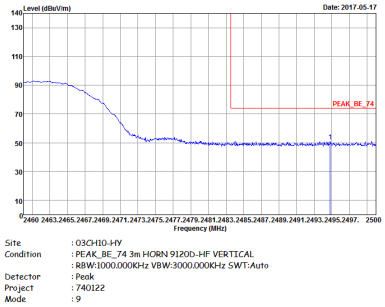
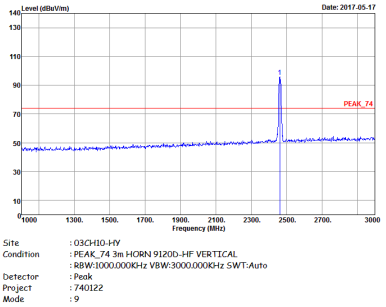
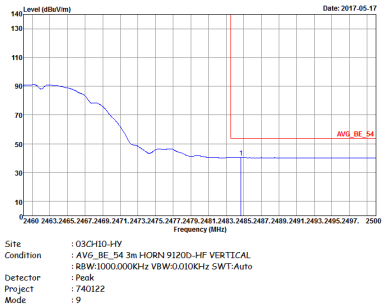
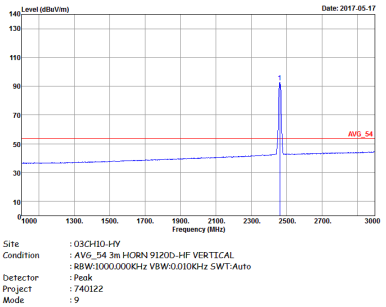
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

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.		

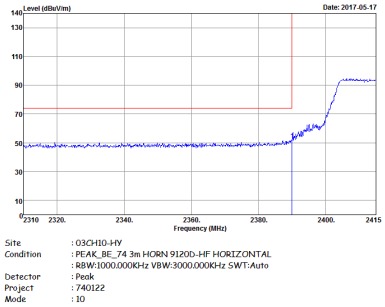
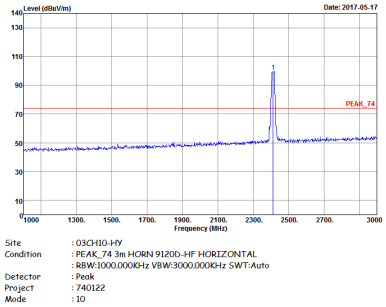
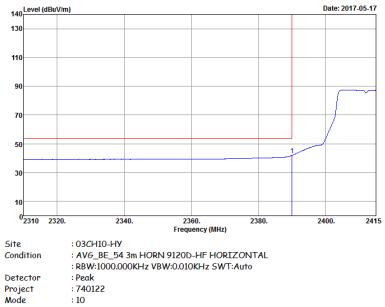
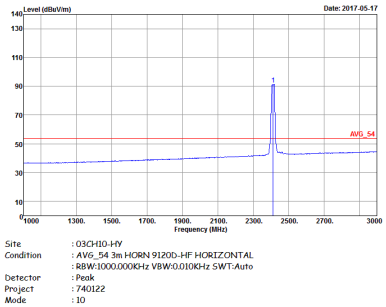
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

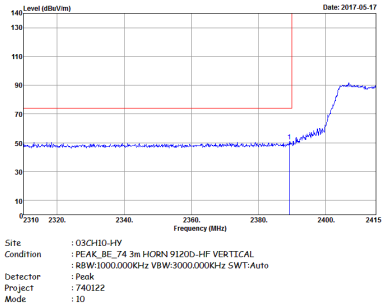
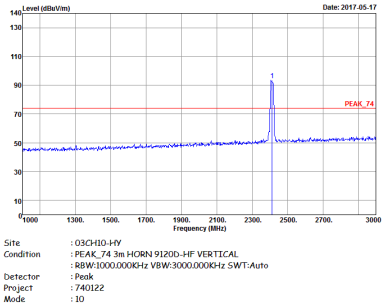
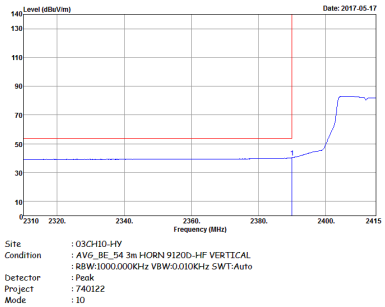
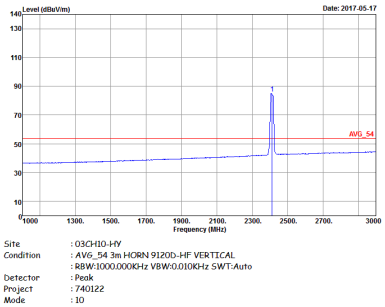
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

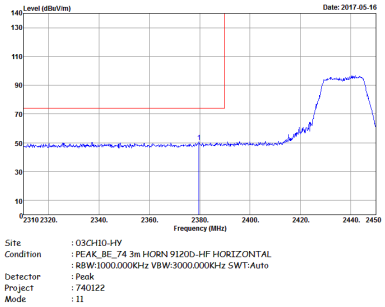
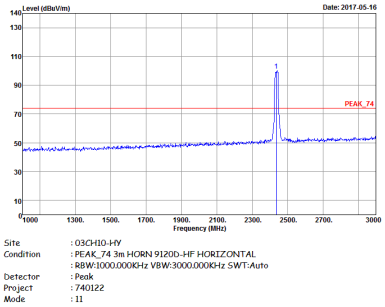
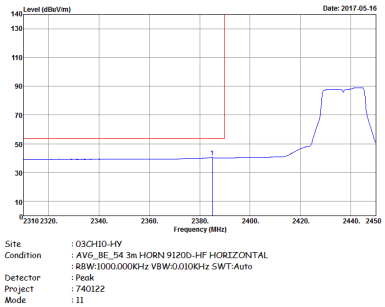
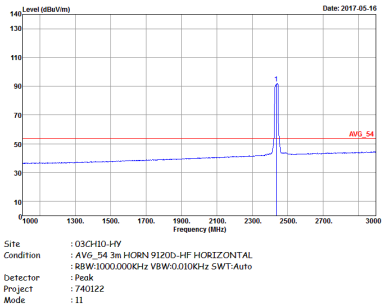
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH10-HY Condition : PEAK_BE_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 9	 Site : 03CH10-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 9
Avg.	 Site : 03CH10-HY Condition : AVG_BE_54 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 740122 Mode : 9	 Site : 03CH10-HY Condition : AVG_54 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 740122 Mode : 9

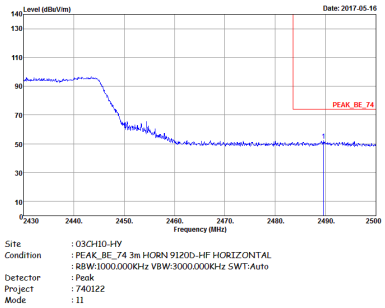
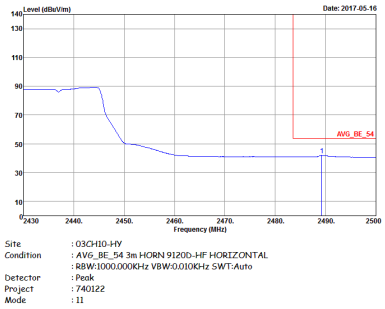
2.4GHz 2400~2483.5MHz

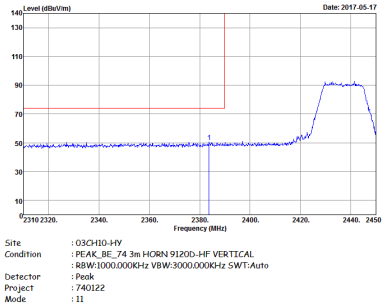
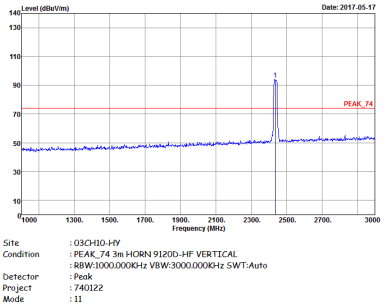
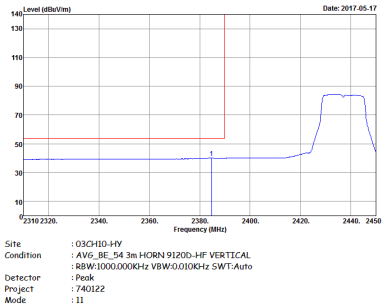
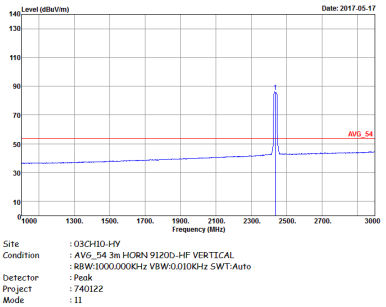
WIFI 802.11g (Band Edge @ 3m)

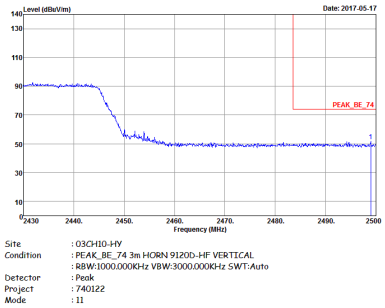
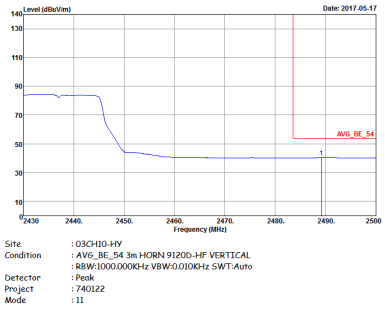
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

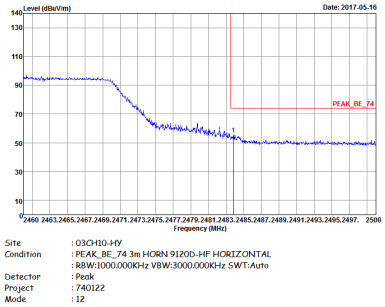
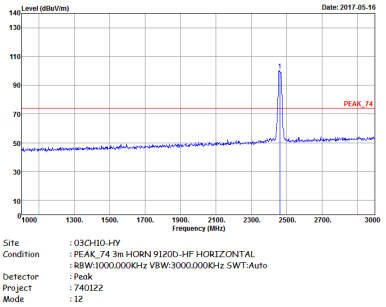
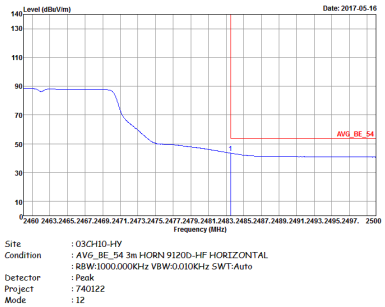
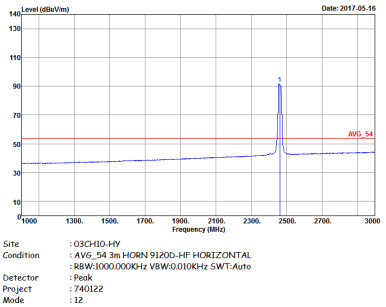
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

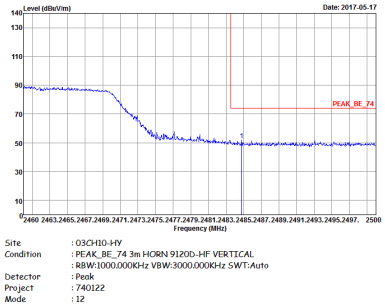
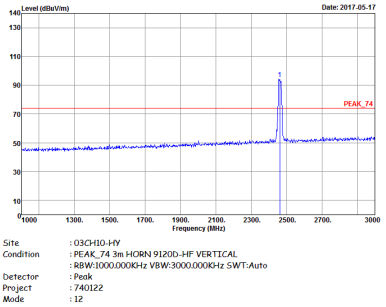
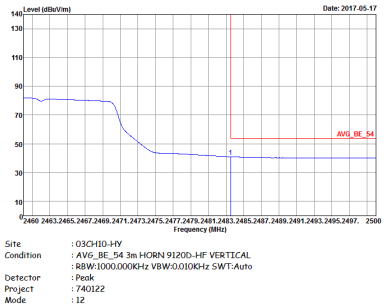
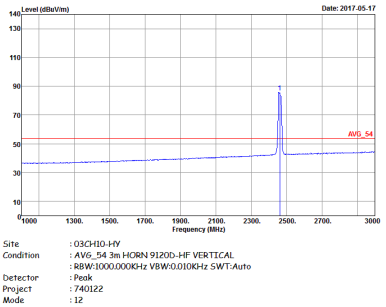
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

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.		

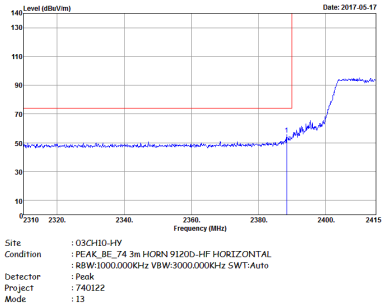
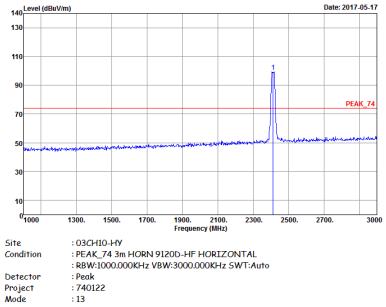
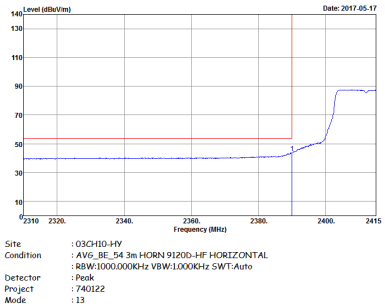
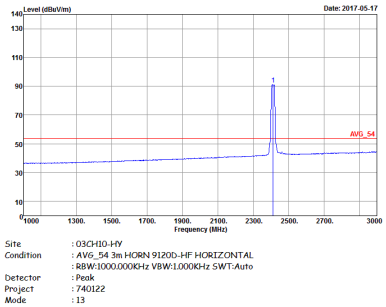
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - R	
1	Vertical	Fundamental
Peak		Left Blank
Avg.		Left Blank

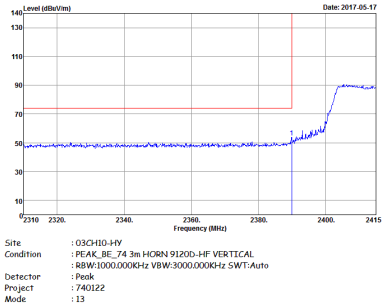
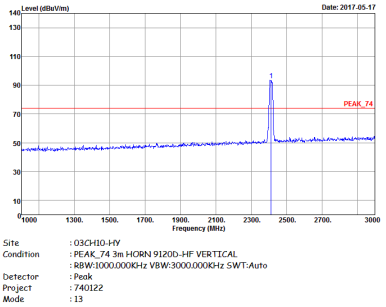
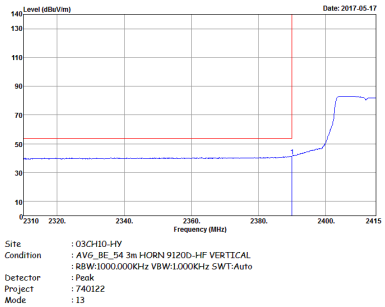
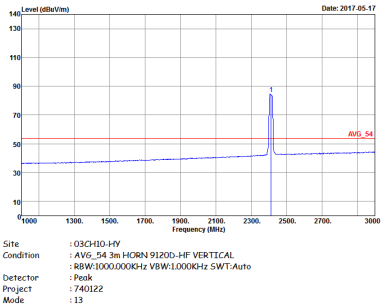
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH10-HY Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 12	 Site : 03CH10-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 12
Avg.	 Site : 03CH10-HY Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 740122 Mode : 12	 Site : 03CH10-HY Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 740122 Mode : 12

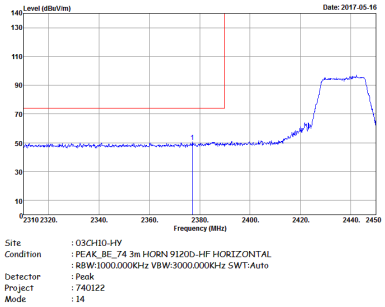
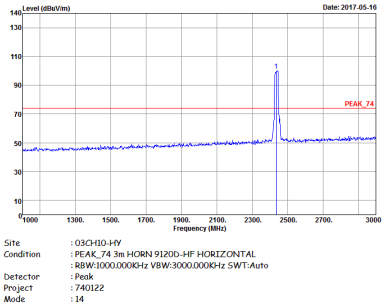
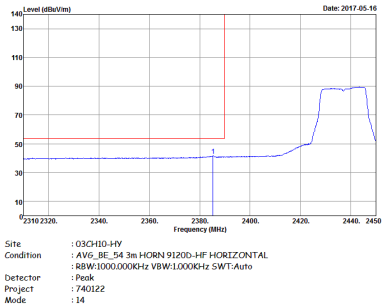
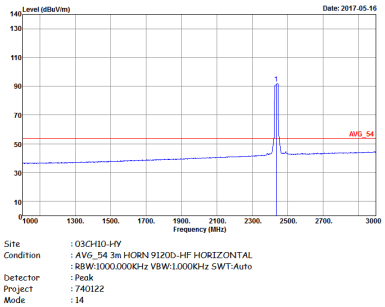
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH10-HY Condition : PEAK_BE_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 12	 Site : 03CH10-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 12
Avg.	 Site : 03CH10-HY Condition : AVG_BE_54 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 740122 Mode : 12	 Site : 03CH10-HY Condition : AVG_54 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 740122 Mode : 12

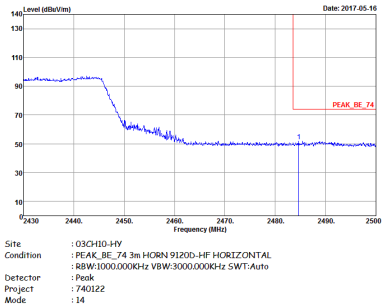
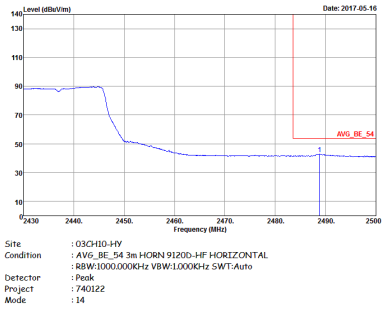
2.4GHz 2400~2483.5MHz

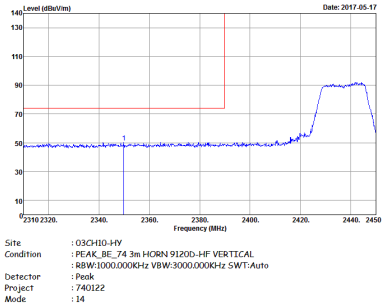
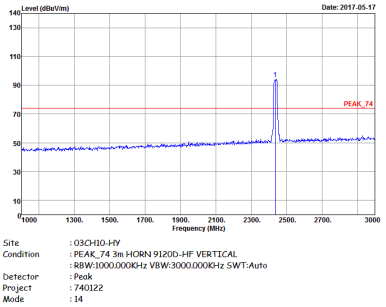
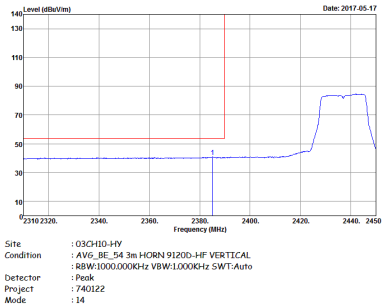
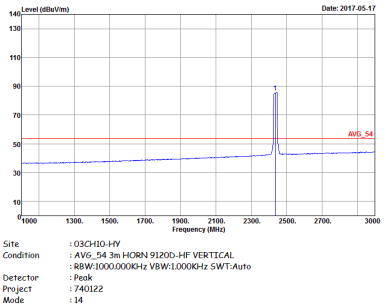
WIFI 802.11n HT20 (Band Edge @ 3m)

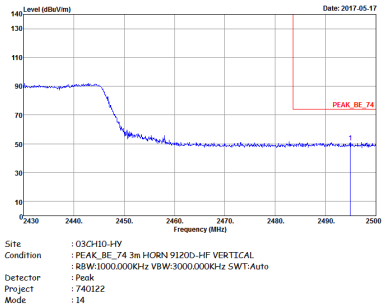
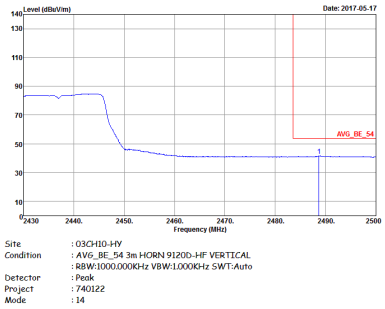
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

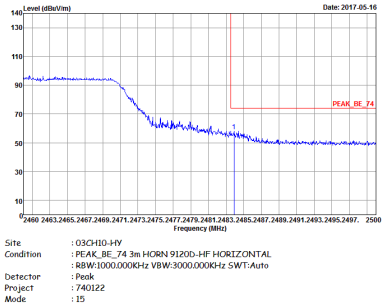
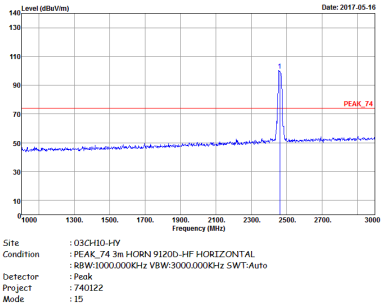
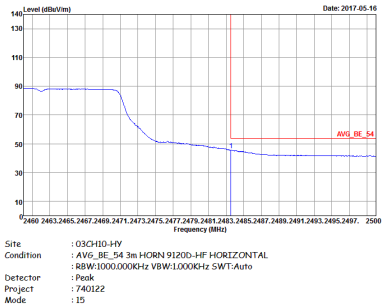
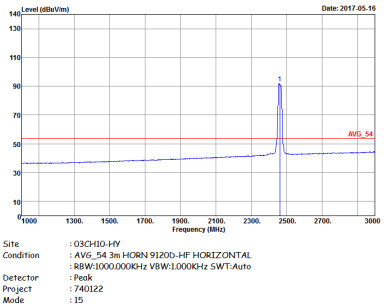
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

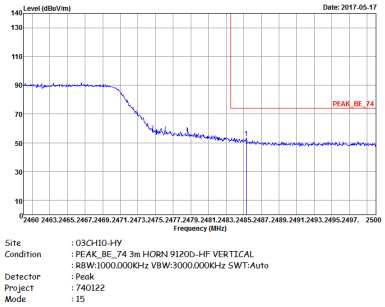
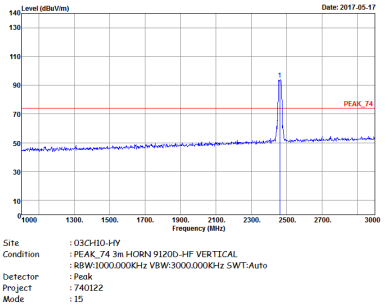
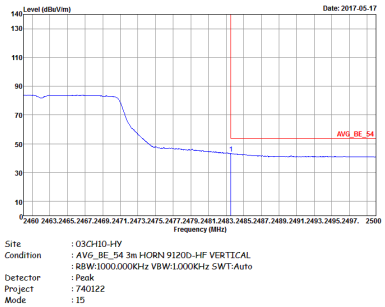
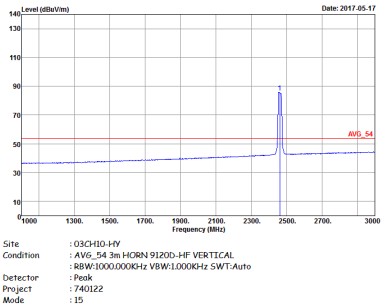
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

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.		

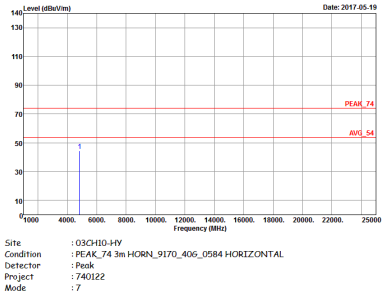
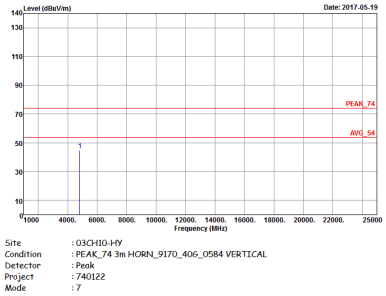
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - R	
1	Vertical	Fundamental
Peak		Left Blank
Avg.		Left Blank

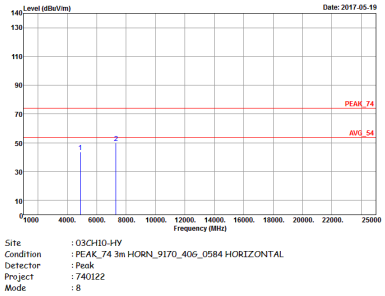
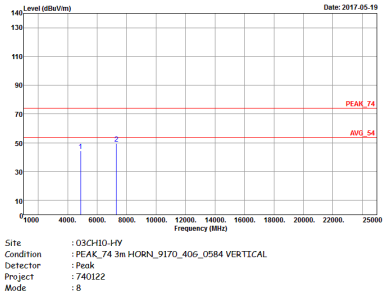
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH10-HY Condition : PEAK_BE_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 15	 Site : 03CH10-HY Condition : PEAK_74 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 15
Avg.	 Site : 03CH10-HY Condition : AVG_BE_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 15	 Site : 03CH10-HY Condition : AVG_54 3m HORN 9120D-HF HORIZONTAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 15

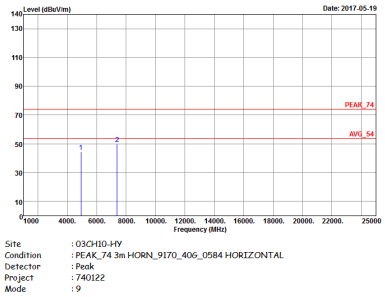
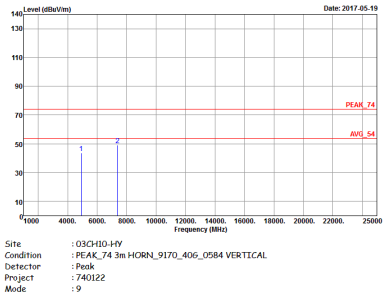
WIFI	2.4GHz 2400~2483.5MHz Fundamental @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH10-HY Condition : PEAK_BE_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 15	 Site : 03CH10-HY Condition : PEAK_74 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 15
Avg.	 Site : 03CH10-HY Condition : AVG_BE_54 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 15	 Site : 03CH10-HY Condition : AVG_54 3m HORN 9120D-HF VERTICAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 740122 Mode : 15

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

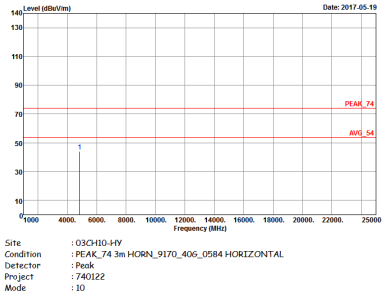
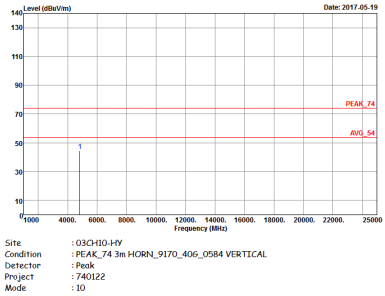
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH01 2412MHz	
1	Horizontal	Vertical
Peak Avg.		

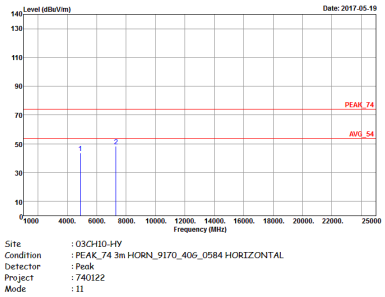
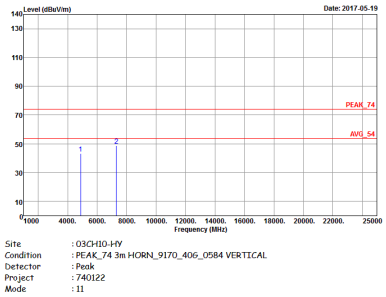
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH06 2437MHz	
1	Horizontal	Vertical
Peak Avg.		

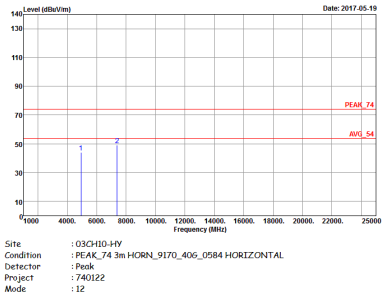
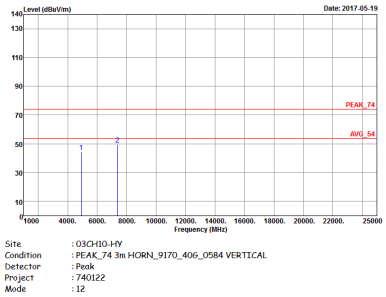
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH11 2462MHz	
1	Horizontal	Vertical
Peak Avg.		

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

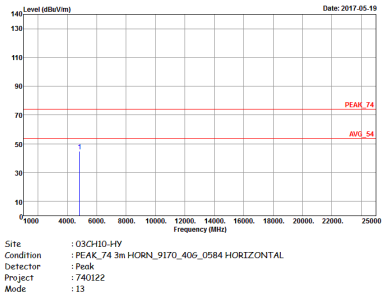
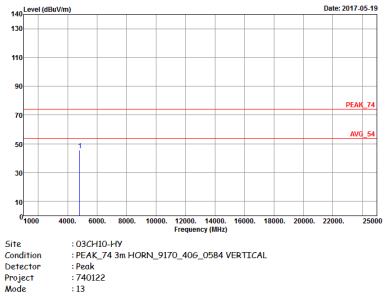
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH01 2412MHz	
1	Horizontal	Vertical
Peak Avg.		

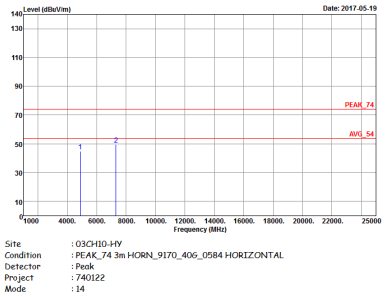
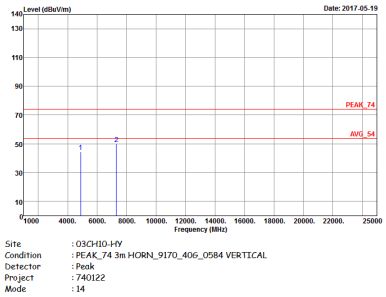
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH06 2437MHz	
1	Horizontal	Vertical
Peak Avg.		

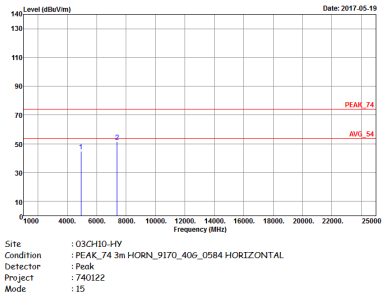
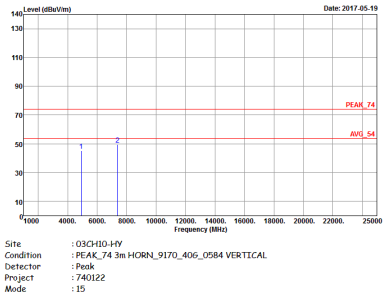
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH11 2462MHz	
1	Horizontal	Vertical
Peak Avg.		

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Harmonic @ 3m)

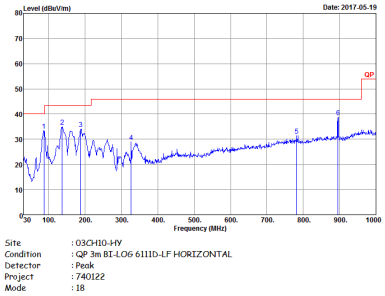
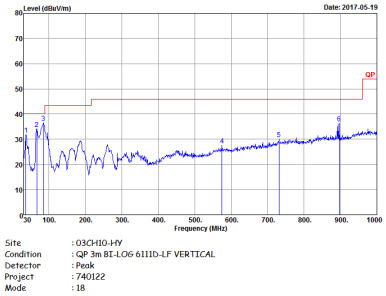
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Horizontal	Vertical
Peak Avg.		

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

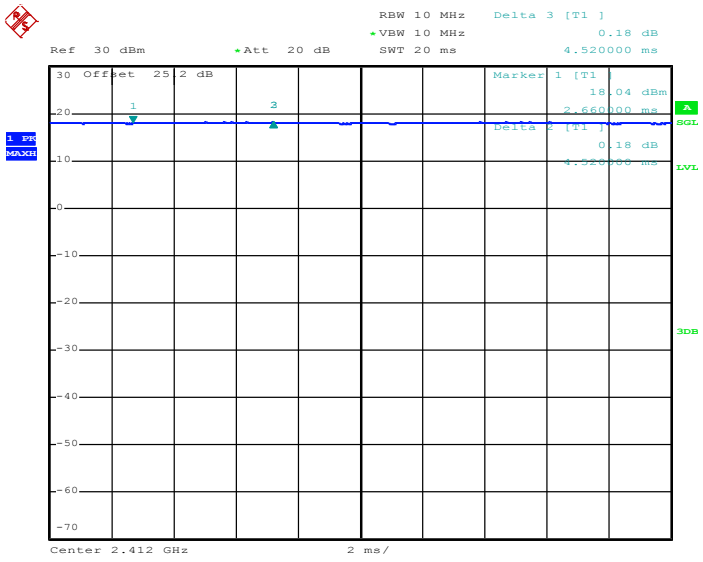
2.4GHz WIFI 802.11n HT20 (LF)

WIFI	2.4GHz 2400~2483.5MHz	
ANT	802.11n HT20 LF	
1	Horizontal	Vertical
QP / Peak		

Appendix E. Duty Cycle Plots

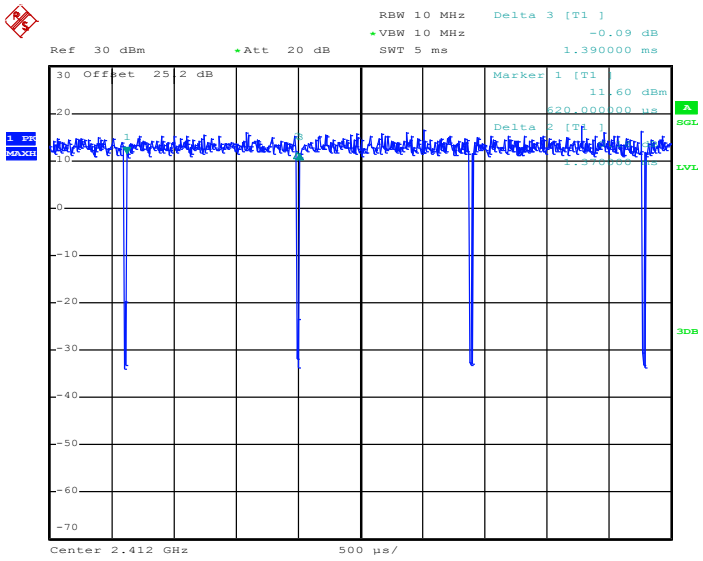
Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting
802.11b	100.00	-	-	10Hz
802.11g	98.56	1370.00	0.73	10Hz
2.4GHz 802.11n HT20	97.71	1280.00	0.78	1kHz

802.11b



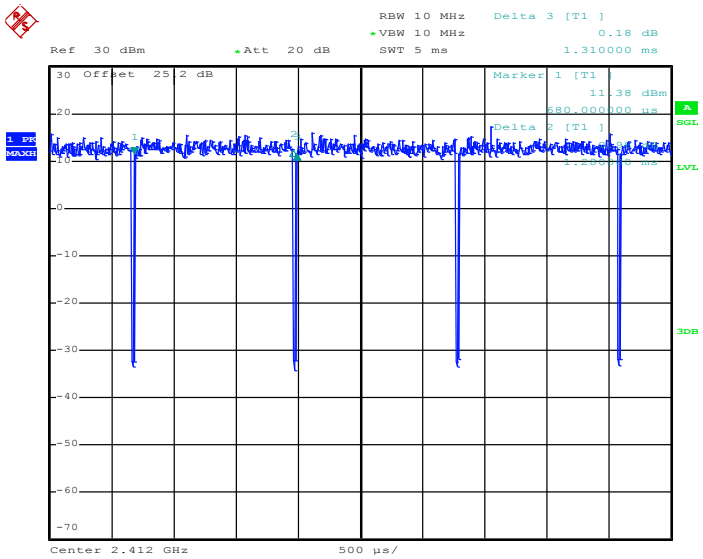
Date: 4.MAY.2017 14:24:15

802.11g



Date: 4.MAY.2017 14:26:12

802.11n HT20



Date: 4.MAY.2017 14:27:08