FCC RADIO TEST REPORT

FCC ID	:	**ZL5S62PROE**
Equipment	:	**Rugged Smart Phone**
Brand Name	:	**CAT**
Model Name	:	**S62 Pro**
Applicant	:	**Bullitt Group** **One Valpy, Valpy Street, Reading, Berkshire, England RG1 1AR**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on May 05, 2020 and testing was started from May 22, 2020 and completed on Jun. 25, 2020. We, SPORTON INTERNATIONAL INC., EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

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

Louis Wu

Approved by: Louis Wu

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

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History of this test report

Report No.	Version	Description	Issued Date
FR042406-02C	01	Initial issue of report	Jul. 10, 2020

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(2)	6dB Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Reporting only	-
3.2	15.247(b)	Power Output Measurement	Pass	-
3.3	15.247(e)	Power Spectral Density	Pass	-
3.4	15.247(d)	Conducted Band Edges	Pass	-
		Conducted Spurious Emission	Pass	-
3.5	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	Under limit 1.21 dB at 4924.000 MHz
3.6	15.207	AC Conducted Emission	Pass	Under limit 19.30 dB at 0.503 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	Pass	-

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

Reviewed by: Wii Chang

Report Producer: Lucy Wu

1 General Description

1.1 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 GNSS.

Product Specification subjective to this standard	
Sample 1	Dual SIM
Sample 2	Single SIM
Antenna Type	WWAN **<Main 1>:** PIFA Antenna **<Main 2>:** PIFA Antenna **<Diversity 1>:** PIFA Antenna **<Diversity 2>:** Loop Antenna WLAN 2.4GHz: PIFA Antenna WLAN 5GHz: Mono Pole Antenna Bluetooth: PIFA Antenna GPS/Glonass/BDS/Galileo/SBAS: PIFA Antenna NFC: Loop Antenna

Remark:

1. The samples have same layout, circuit and components but different SIM tray. The phone software will identify the loaded sim card combinations whether with single sim card or dual sim cards.
2. The tests were performed with Sample 1.

1.2 Modification of EUT

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

1.3 Testing Location

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory	
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	**Sporton Site No.**	
	TH05-HY	CO05-HY

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

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	03CH16-HY

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

FCC designation No.: TW1190 and TW0007

1.4 Applicable Standards

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

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. 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 modes are considering the modulation and worse data rates as below table.

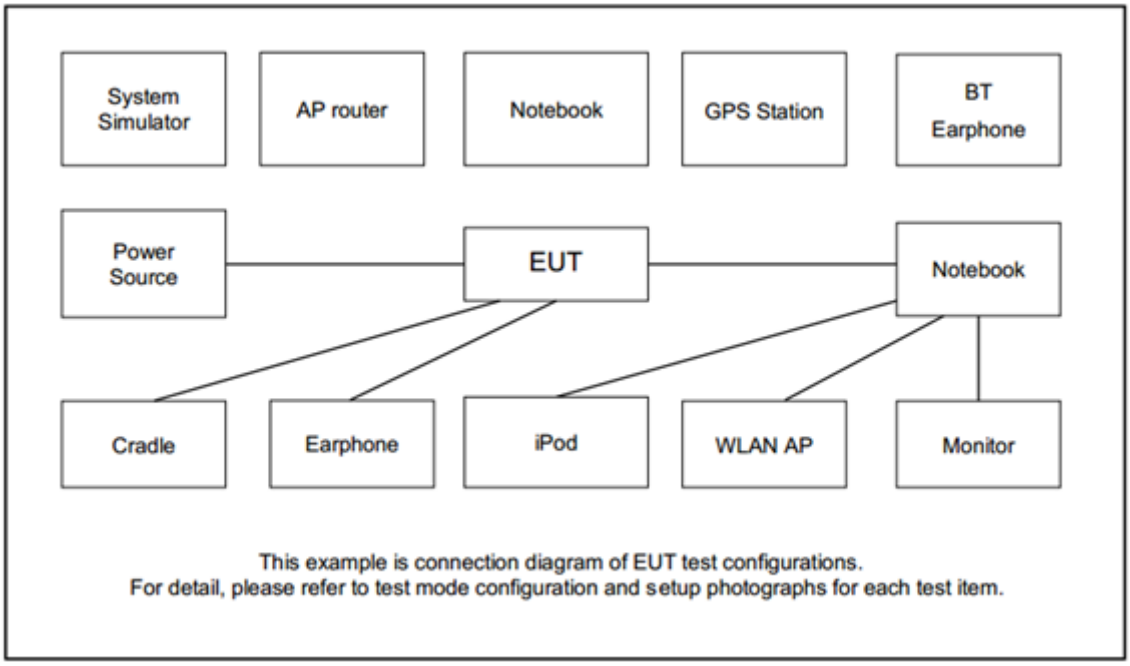
Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20	MCS0

Test Cases	
AC Conducted Emission	Mode 1 :GSM850 Idle + Bluetooth Link + WLAN (2.4GHz) Link + NFC On + MPEG4 + USB Cable (Charging from AC Adapter) + SIM 1

Ch. #	2400-2483.5 MHz		
	802.11b	802.11g	802.11n HT20
Low	01	01	01
Middle	06	06	06
High	11	11	11

Remark: For radiation spurious emission, the final modulation and the worst data rate was reference the max RF conducted power.

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.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
3.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
4.	Notebook	DELL	Latitude 3400	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
5.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “QRCT v4.0 00142.0” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

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

= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

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

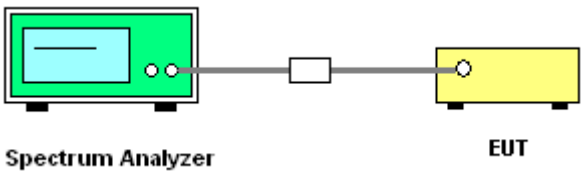
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

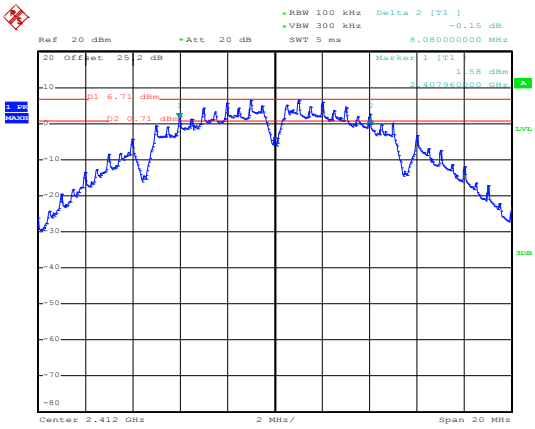
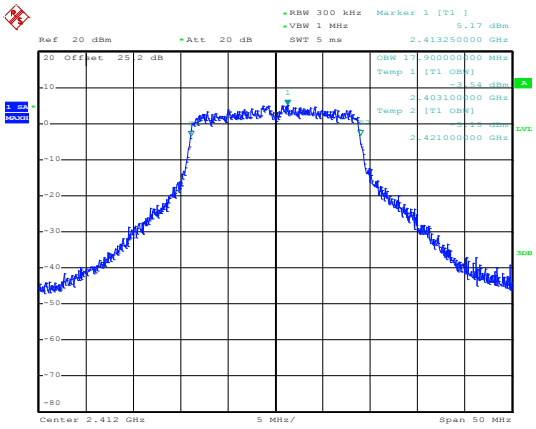
1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) ≥ 3 * RBW.
6. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.

Minimum 6dB Bandwidth	Maximum 99% Occupied Bandwidth
	
Date: 25.JUN.2020 11:41:26	Date: 25.JUN.2020 12:37:06

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

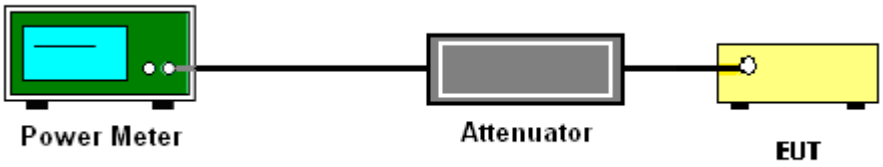
3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

3.2.3 Test Procedures

1. For Peak Power, the testing follows ANSI C63.10 Section 11.9.1.3 PKPM1
2. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
3. 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.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. 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.

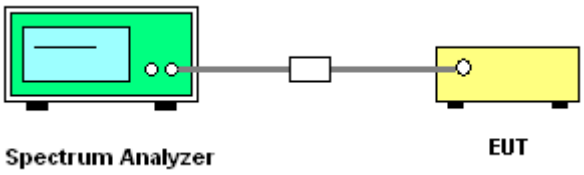
3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

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

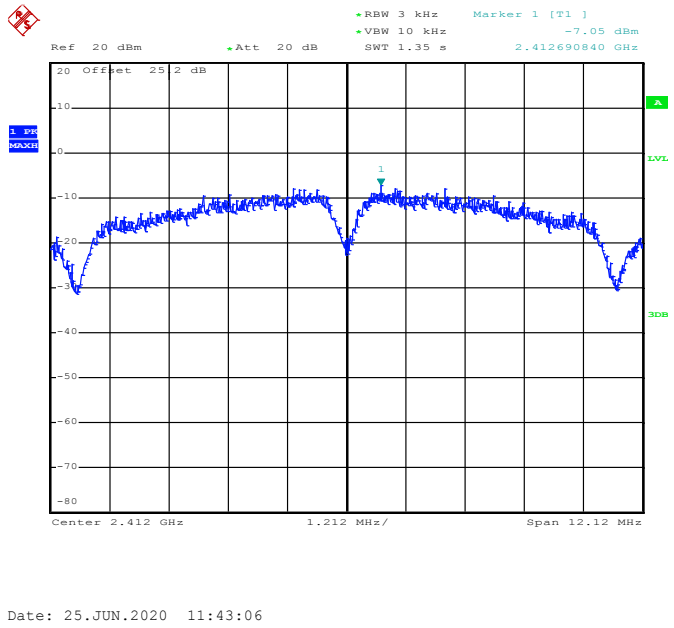
3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Density (dBm/3kHz)



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

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

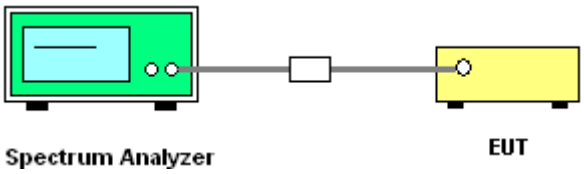
3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedures

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

3.4.4 Test Setup



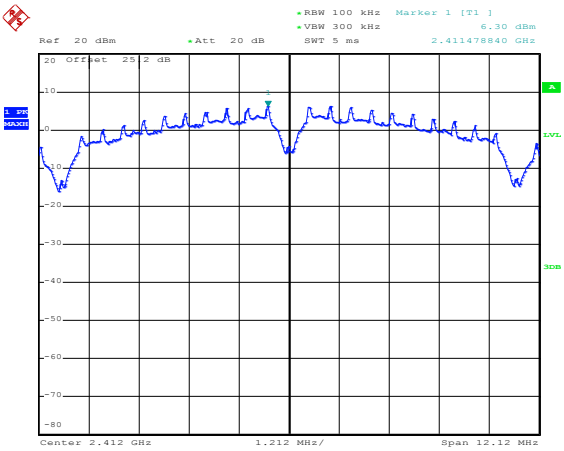
3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Engineer :	Andy Kao	**Temperature :**	22.2~24.1℃
		Relative Humidity :	51~53.6%

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

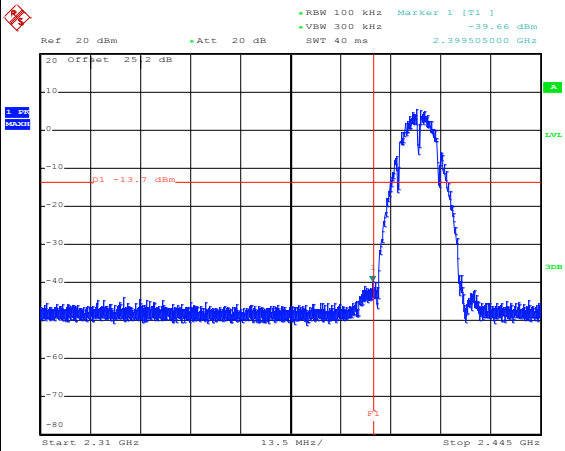
Test Mode :	802.11b	**Test Channel :**	01

100kHz PSD reference Level



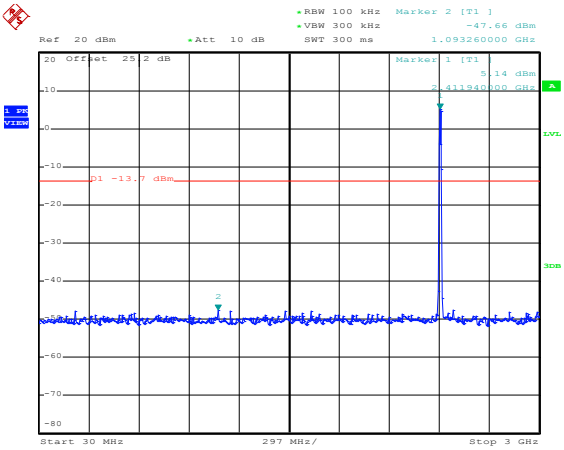
Date: 25.JUN.2020 11:43:20

Low Channel Plot



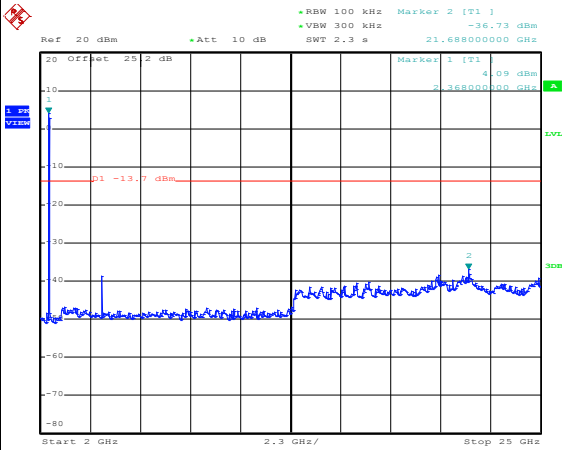
Date: 25.JUN.2020 12:43:34

Spurious Emission 30MHz~3GHz



Date: 25.JUN.2020 12:45:08

Spurious Emission 2GHz~25GHz



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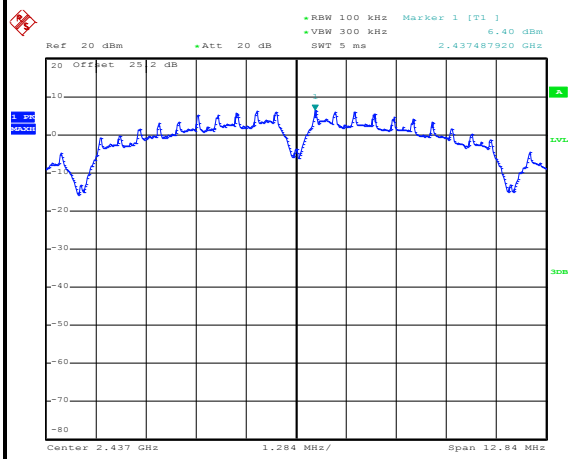
Test Mode :	802.11b	Test Channel :	06

100kHz PSD reference Level	Mid Channel Plot
	

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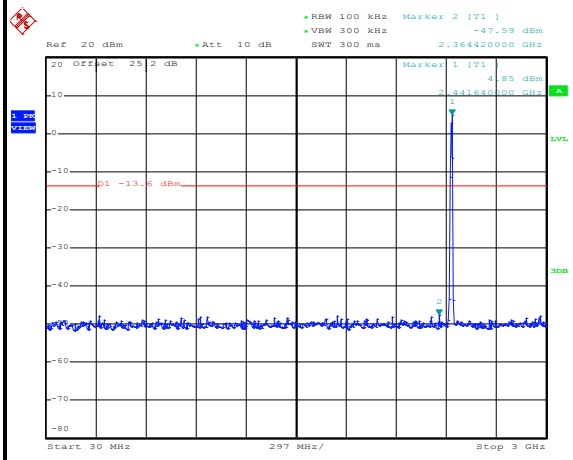
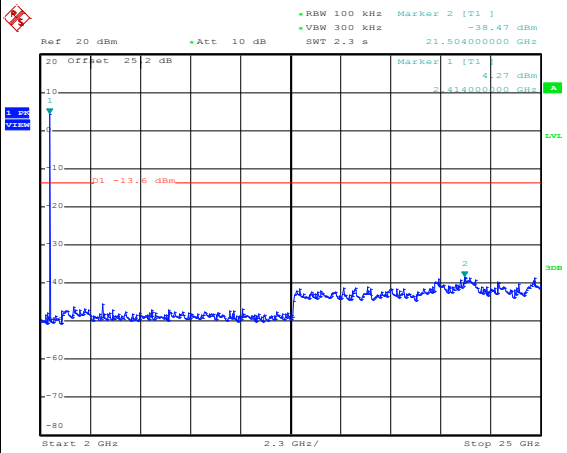
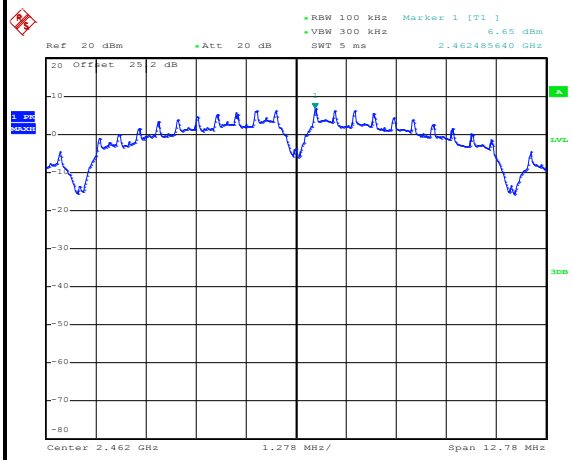
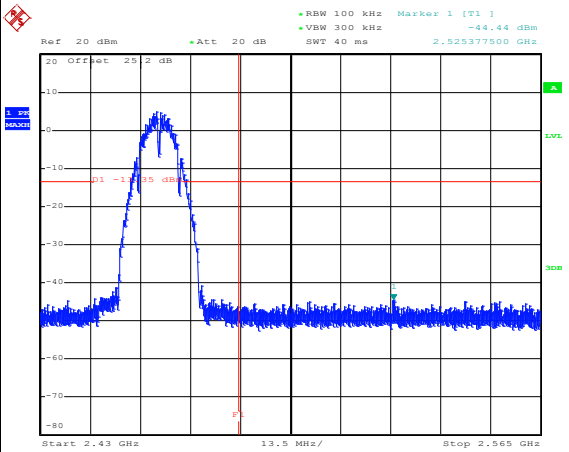
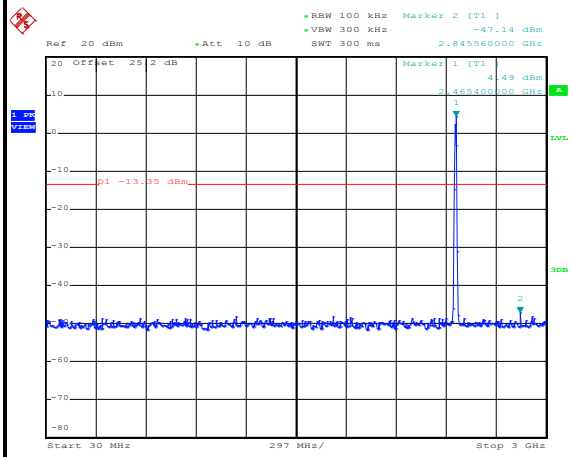
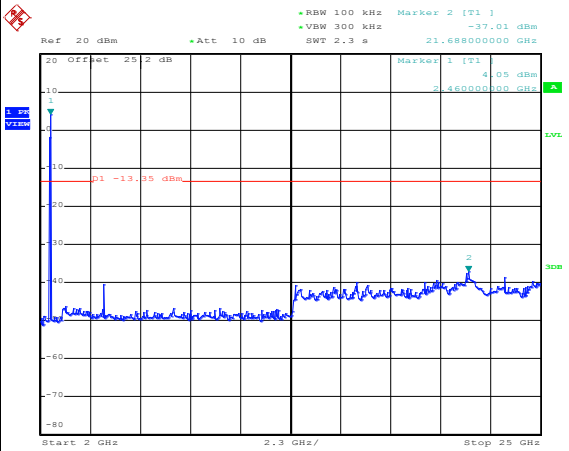
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

Date: 25.JUN.2020 12:46:09

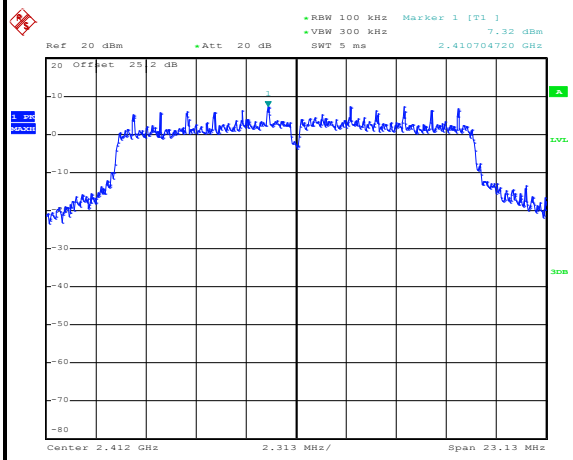
Date: 25.JUN.2020 12:46:27

Test Mode :	802.11b	Test Channel :	11

100kHz PSD reference Level	High Channel Plot
	
Date: 25.JUN.2020 11:56:18	Date: 25.JUN.2020 12:47:06
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 25.JUN.2020 12:47:39	Date: 25.JUN.2020 12:47:57

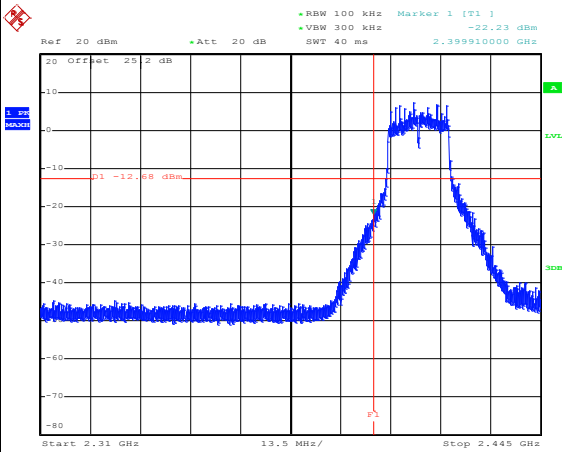
Test Mode :	802.11g	Test Channel :	01

100kHz PSD reference Level



Date: 25.JUN.2020 12:03:01

Low Channel Plot



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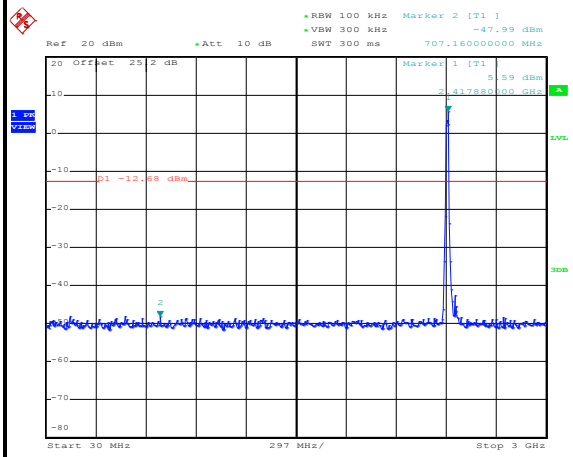
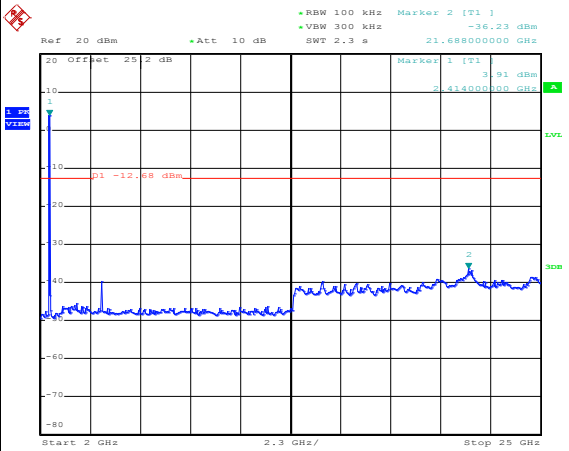
Spurious Emission 30MHz~3GHz



Date: 25.JUN.2020 12:04:21

Spurious Emission 2GHz~25GHz



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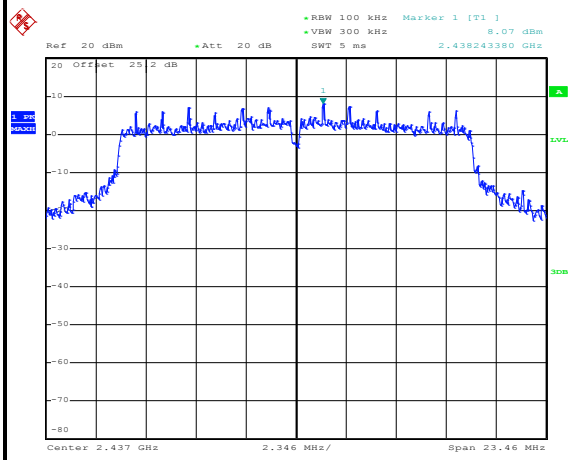
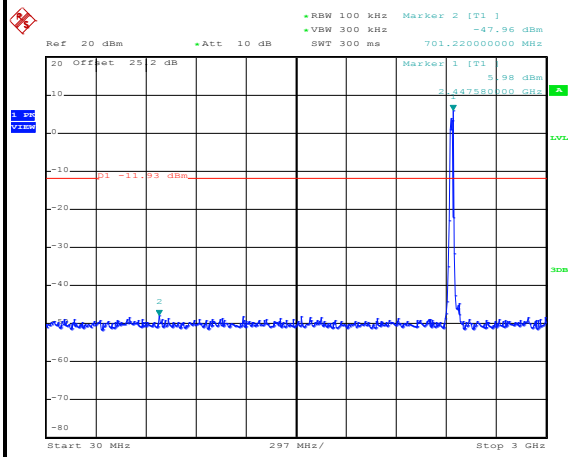
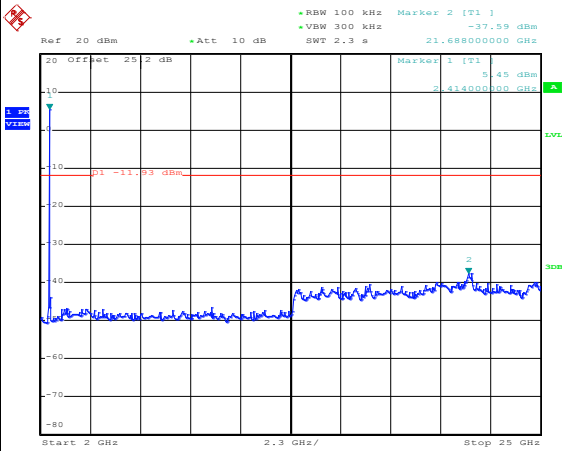
Test Mode :	802.11g	Test Channel :	06

100kHz PSD reference Level	Mid Channel Plot
	

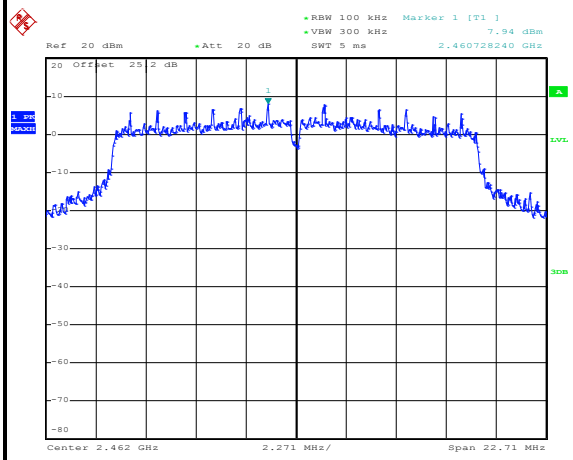
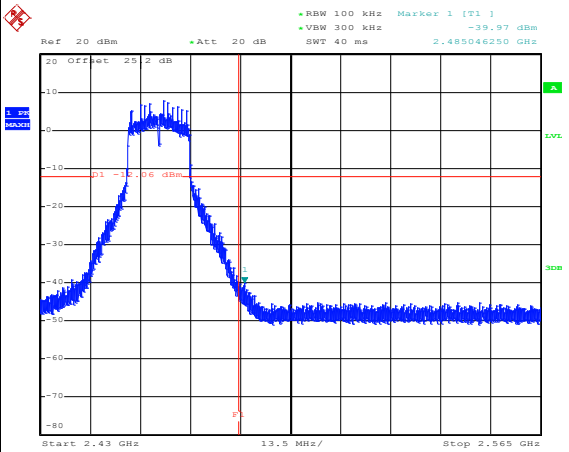
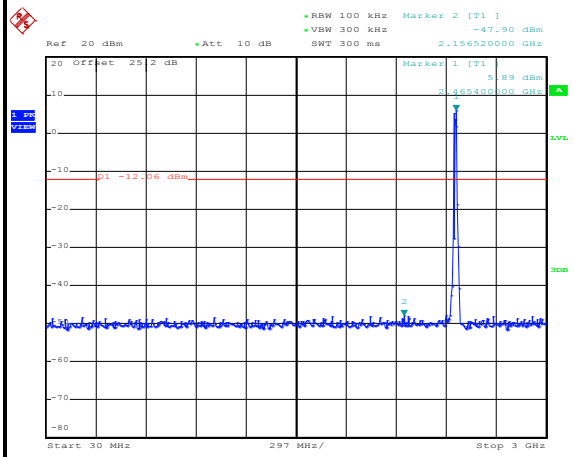
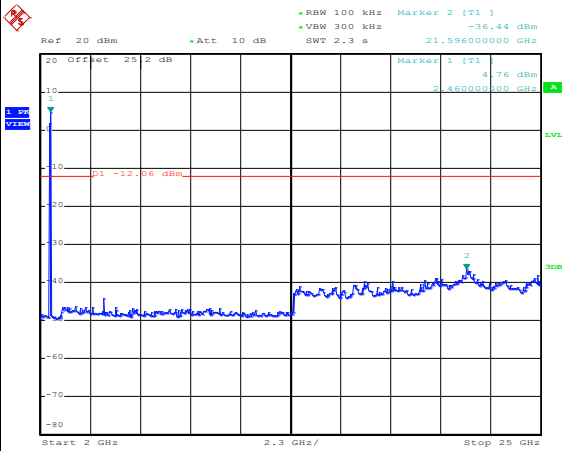
Date: 25.JUN.2020 12:10:20

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

Date: 25.JUN.2020 12:10:49

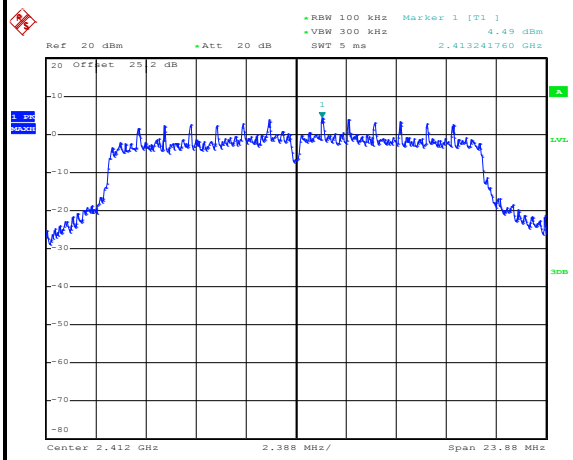
Date: 25.JUN.2020 12:11:10

Test Mode :	802.11g	Test Channel :	11

100kHz PSD reference Level	High Channel Plot
	
Date: 25.JUN.2020 12:15:14	Date: 25.JUN.2020 12:16:16
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 25.JUN.2020 12:17:05	Date: 25.JUN.2020 12:18:47

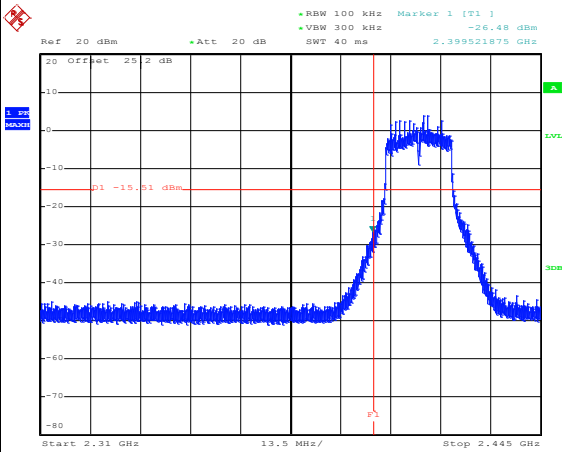
Test Mode :	802.11n HT20	Test Channel :	01

100kHz PSD reference Level



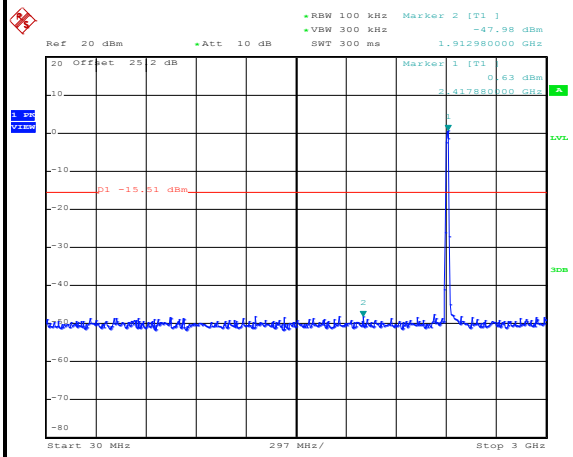
Date: 25.JUN.2020 12:39:23

Low Channel Plot



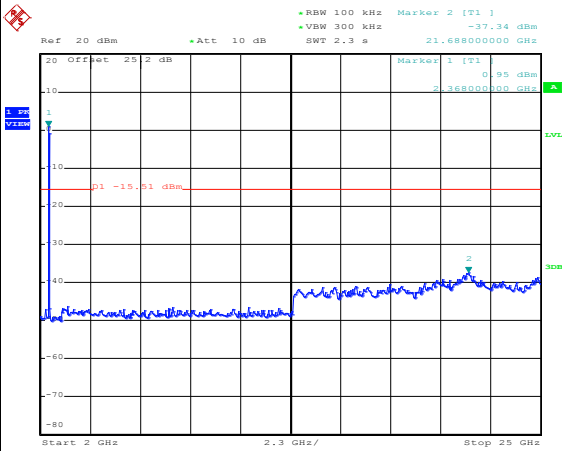
Date: 25.JUN.2020 12:39:58

Spurious Emission 30MHz~3GHz



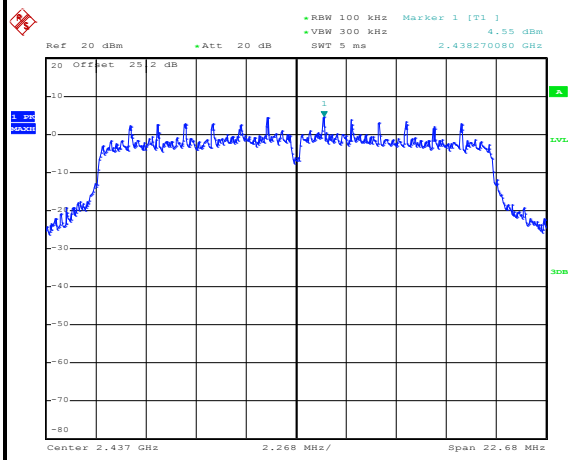
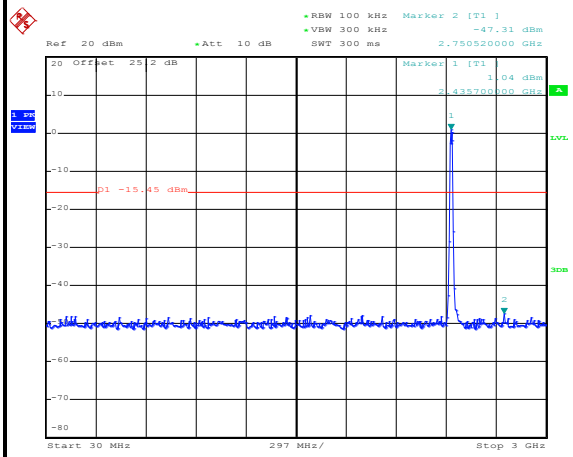
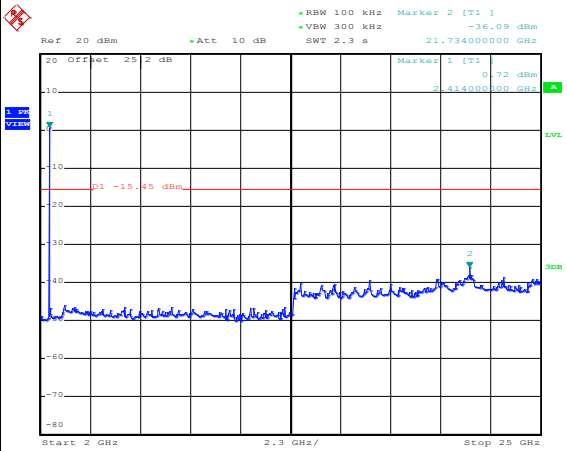
Date: 25.JUN.2020 12:41:24

Spurious Emission 2GHz~25GHz

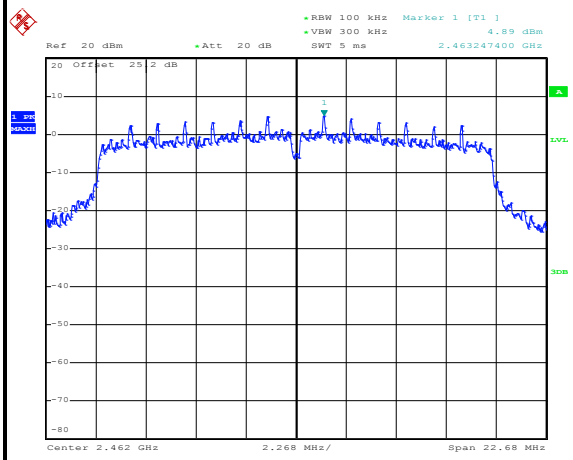
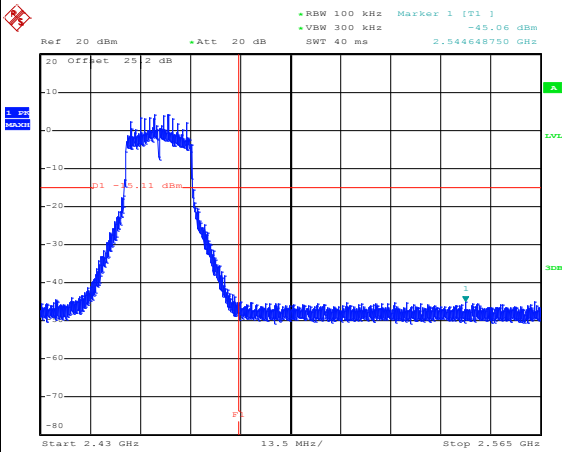
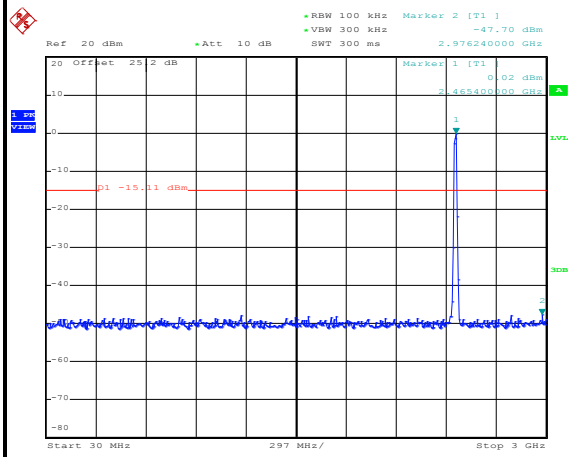
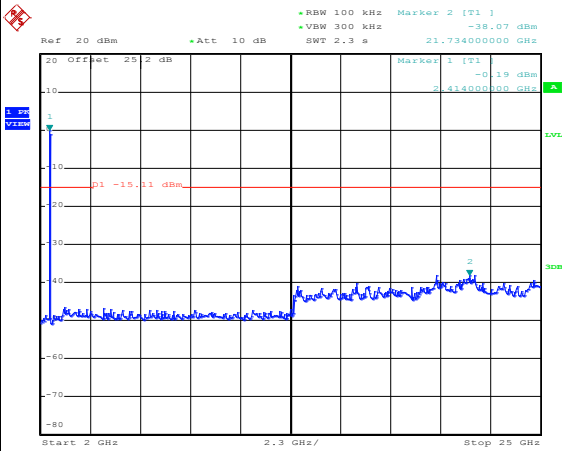


Date: 25.JUN.2020 12:42:24

Test Mode :	802.11n HT20	Test Channel :	06

100kHz PSD reference Level	Mid Channel Plot
 Date: 25.JUN.2020 12:35:41	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
 Date: 25.JUN.2020 12:36:00	 Date: 25.JUN.2020 12:36:43

Test Mode :	802.11n HT20	Test Channel :	11

100kHz PSD reference Level	High Channel Plot
	
Date: 25.JUN.2020 12:27:23	Date: 25.JUN.2020 12:27:58
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 25.JUN.2020 12:29:20	Date: 25.JUN.2020 12:30:15

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

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

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.5.2 Measuring Instruments

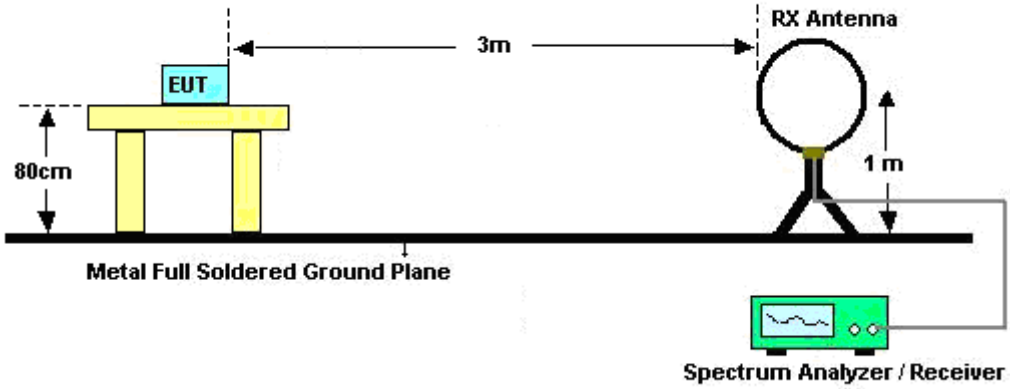
See list of measuring equipment of this test report.

3.5.3 Test Procedures

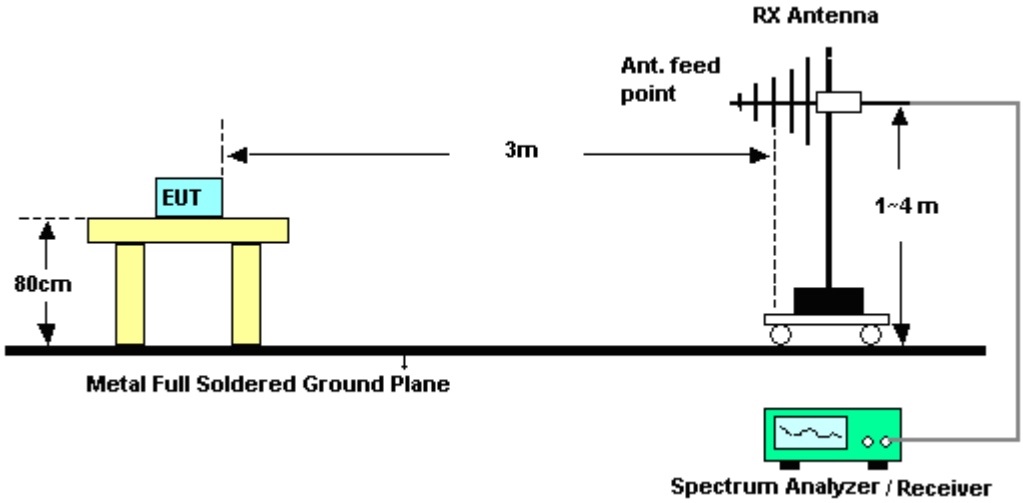
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

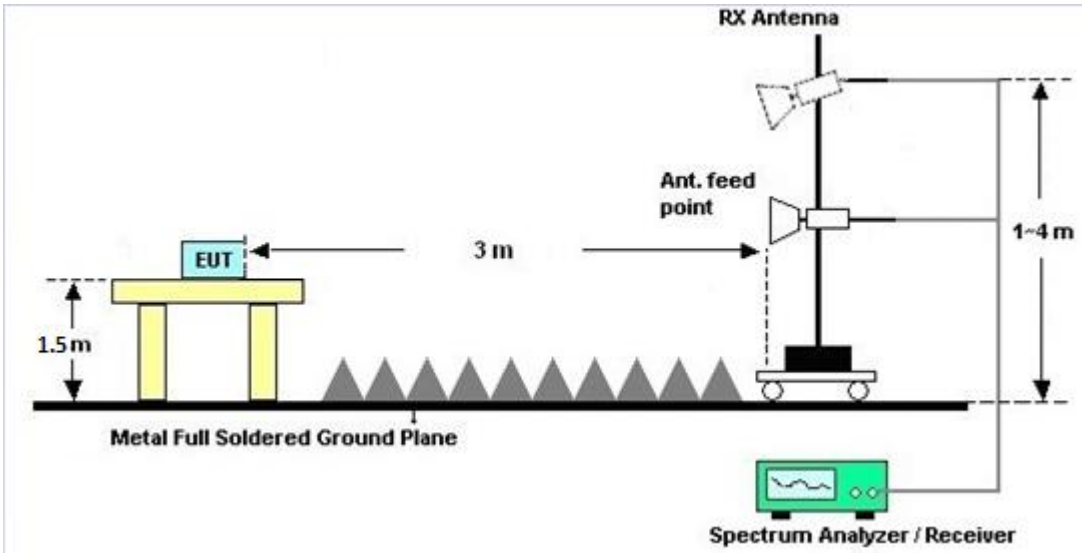
For radiated emissions below 30MHz



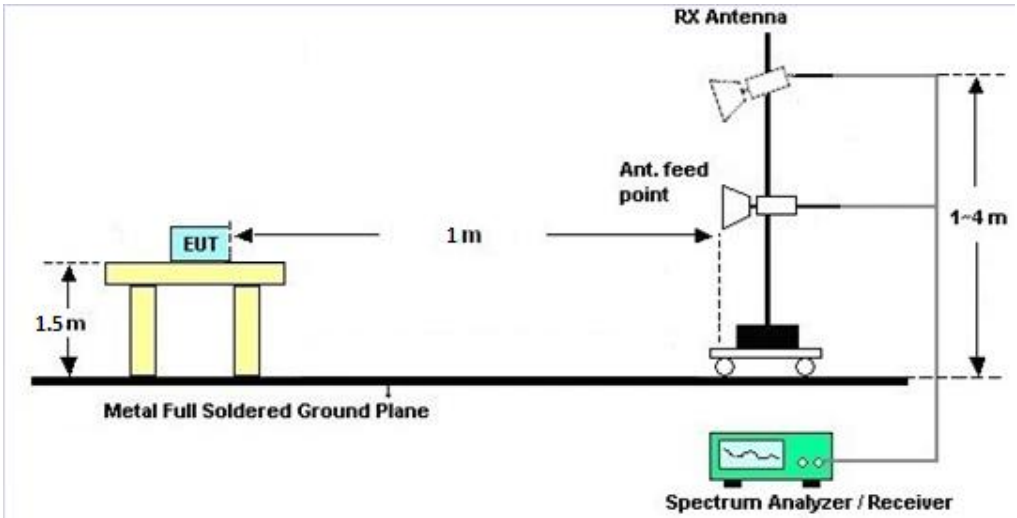
For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



For radiated emissions above 18GHz



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

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

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

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.5.7 Duty Cycle

Please refer to Appendix E.

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

Please refer to Appendix C and D.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

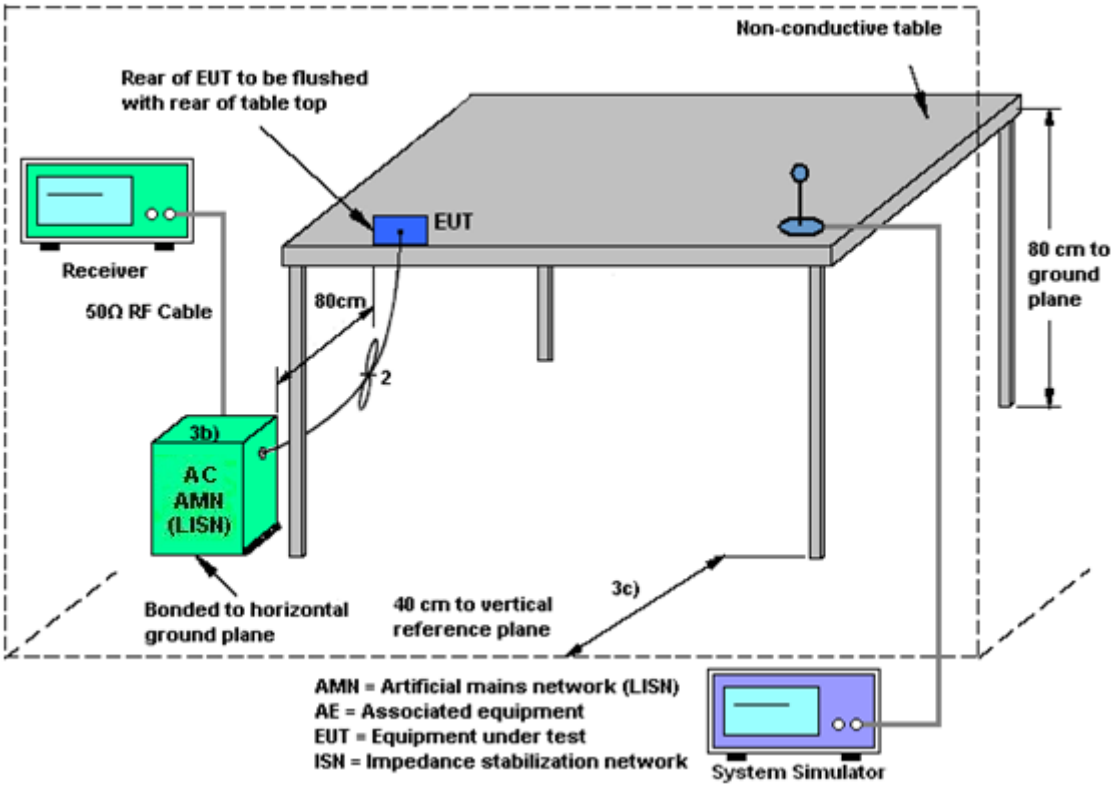
3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

3.6.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.

3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.7 Antenna Requirements

3.7.1 Standard Applicable

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

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

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

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	Testo	608-H1	34893241	N/A	Mar. 02, 2020	May 29, 2020~ Jun. 25, 2020	Mar. 01, 2021	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	16I00054SNO10	10MHz~6GHz	Dec. 23, 2019	May 29, 2020~ Jun. 25, 2020	Dec. 22, 2020	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz-40GHz	Aug. 14, 2019	May 29, 2020~ Jun. 25, 2020	Aug. 13, 2020	Conducted (TH05-HY)
Switch Control Manframe	Burgeon	ETF-058	EC1300484	N/A	Aug. 22, 2019	May 29, 2020~ Jun. 25, 2020	Aug. 21, 2020	Conducted (TH05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	May 22, 2020	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Nov. 15, 2019	May 22, 2020	Nov. 14, 2020	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Nov. 07, 2019	May 22, 2020	Nov. 06, 2020	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 15, 2019	May 22, 2020	Nov. 14, 2020	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	May 22, 2020	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Jan. 02, 2020	May 22, 2020	Jan. 01, 2021	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Jan. 02, 2020	May 22, 2020	Jan. 01, 2021	Conduction (CO05-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Jan. 09, 2020	Jun. 16, 2020~ Jun. 21, 2020	Jan. 08, 2021	Radiation (03CH16-HY)
Bilog Antenna	TESEQ	CBL6111D&00802N1D01N-06	47020&06	30MHz to 1GHz	Oct. 12, 2019	Jun. 16, 2020~ Jun. 21, 2020	Oct. 11, 2020	Radiation (03CH16-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1522	1G~18GHz	Sep. 19, 2019	Jun. 16, 2020~ Jun. 21, 2020	Sep. 18, 2020	Radiation (03CH16-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170980	18GHz~40GHz	Jan. 10, 2020	Jun. 16, 2020~ Jun. 21, 2020	Jan. 09, 2021	Radiation (03CH16-HY)
Amplifier	SONOMA	310N	371607	9kHz~1G	Oct. 01, 2019	Jun. 16, 2020~ Jun. 21, 2020	Sep. 30, 2020	Radiation (03CH16-HY)
Preamplifier	Jet-Power	JPA0118-55-303	1710001800055006	1GHz~18GHz	May 07, 2020	Jun. 16, 2020~ Jun. 21, 2020	May 06, 2021	Radiation (03CH16-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz ~40GHz	Dec. 13, 2019	Jun. 16, 2020~ Jun. 21, 2020	Dec. 12, 2020	Radiation (03CH16-HY)
Preamplifier	Keysight	83017A	MY53270264	1GHz~26.5GHz	Dec. 11, 2019	Jun. 16, 2020~ Jun. 21, 2020	Dec. 10, 2020	Radiation (03CH16-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY57290111	3Hz~26.5GHz	Dec. 05, 2019	Jun. 16, 2020~ Jun. 21, 2020	Dec. 04, 2020	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY11680/4PE	NA	Aug. 30, 2019	Jun. 16, 2020~ Jun. 21, 2020	Aug. 29, 2020	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY11688/4PE	NA	Aug. 30, 2019	Jun. 16, 2020~ Jun. 21, 2020	Aug. 29, 2020	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	EC-A5-300-5757	NA	Aug. 30, 2019	Jun. 16, 2020~ Jun. 21, 2020	Aug. 29, 2020	Radiation (03CH16-HY)
Hygrometer	TECPEL	DTM-303B	TP162965	N/A	Oct. 25, 2019	Jun. 16, 2020~ Jun. 21, 2020	Oct. 24, 2020	Radiation (03CH16-HY)
Software	Audix	E3 6.2009-8-24	RK-001136	N/A	N/A	Jun. 16, 2020~ Jun. 21, 2020	N/A	Radiation (03CH16-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.3

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

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

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	6.7

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.9

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Andy Kao	Temperature:	22.2 ~ 24.1	°C
Test Date:	2020/05/29 ~ 2020/06/25	Relative Humidity:	51 ~ 53.6	%

Report Number : FR042406-02C

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

2.4GHz Band Single Antenna										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)		6dB BW (MHz)		6dB BW Limit (MHz)	Pass/Fail
					Ant1	Ant2	Ant1	Ant2		
11b	1Mbps	1	1	2412	13.80	-	8.08	-	0.50	Pass
11b	1Mbps	1	6	2437	13.85	-	8.56	-	0.50	Pass
11b	1Mbps	1	11	2462	13.60	-	8.52	-	0.50	Pass
11g	6Mbps	1	1	2412	16.85	-	15.42	-	0.50	Pass
11g	6Mbps	1	6	2437	16.90	-	15.64	-	0.50	Pass
11g	6Mbps	1	11	2462	16.80	-	15.14	-	0.50	Pass
HT20	MCS0	1	1	2412	17.90	-	15.92	-	0.50	Pass
HT20	MCS0	1	6	2437	17.90	-	15.12	-	0.50	Pass
HT20	MCS0	1	11	2462	17.80	-	15.12	-	0.50	Pass

TEST RESULTS DATA
Peak Output Power

2.4GHz Band Single Antenna																
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
					Ant1	Ant2	SUM	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	
11b	1Mbps	1	1	2412	18.09	-		30.00	-	1.20	-	19.29	-	36.00	-	Pass
11b	1Mbps	1	6	2437	17.76	-		30.00	-	1.20	-	18.96	-	36.00	-	Pass
11b	1Mbps	1	11	2462	17.60	-		30.00	-	1.20	-	18.80	-	36.00	-	Pass
11g	6Mbps	1	1	2412	22.52	-		30.00	-	1.20	-	23.72	-	36.00	-	Pass
11g	6Mbps	1	6	2437	22.64	-		30.00	-	1.20	-	23.84	-	36.00	-	Pass
11g	6Mbps	1	11	2462	22.54	-		30.00	-	1.20	-	23.74	-	36.00	-	Pass
HT20	MCS0	1	1	2412	19.15	-		30.00	-	1.20	-	20.35	-	36.00	-	Pass
HT20	MCS0	1	6	2437	19.30	-		30.00	-	1.20	-	20.50	-	36.00	-	Pass
HT20	MCS0	1	11	2462	19.13	-		30.00	-	1.20	-	20.33	-	36.00	-	Pass

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

TEST RESULTS DATA
Average Output Power
(Reporting Only)

2.4GHz Band Single Antenna											
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			DG (dBi)		EIRP Power (dBm)	
					Ant1	Ant2	SUM	Ant1	Ant2	Ant1	Ant2
11b	1Mbps	1	1	2412	15.80	-		1.20	-	17.00	-
11b	1Mbps	1	6	2437	15.80	-		1.20	-	17.00	-
11b	1Mbps	1	11	2462	15.50	-		1.20	-	16.70	-
11g	6Mbps	1	1	2412	18.80	-		1.20	-	20.00	-
11g	6Mbps	1	6	2437	18.90	-		1.20	-	20.10	-
11g	6Mbps	1	11	2462	18.70	-		1.20	-	19.90	-
HT20	MCS0	1	1	2412	14.80	-		1.20	-	16.00	-
HT20	MCS0	1	6	2437	14.90	-		1.20	-	16.10	-
HT20	MCS0	1	11	2462	14.80	-		1.20	-	16.00	-

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

TEST RESULTS DATA
Peak Power Spectral Density

2.4GHz Band Single Antenna											
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm/3kHz)		DG (dBi)		Peak PSD Limit (dBm/3kHz)		Pass/Fail
					Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	
11b	1Mbps	1	1	2412	-7.05	-	1.20	-	8.00	-	Pass
11b	1Mbps	1	6	2437	-7.54	-	1.20	-	8.00	-	Pass
11b	1Mbps	1	11	2462	-8.26	-	1.20	-	8.00	-	Pass
11g	6Mbps	1	1	2412	-8.25	-	1.20	-	8.00	-	Pass
11g	6Mbps	1	6	2437	-8.18	-	1.20	-	8.00	-	Pass
11g	6Mbps	1	11	2462	-9.04	-	1.20	-	8.00	-	Pass
HT20	MCS0	1	1	2412	-11.87	-	1.20	-	8.00	-	Pass
HT20	MCS0	1	6	2437	-12.96	-	1.20	-	8.00	-	Pass
HT20	MCS0	1	11	2462	-12.38	-	1.20	-	8.00	-	Pass

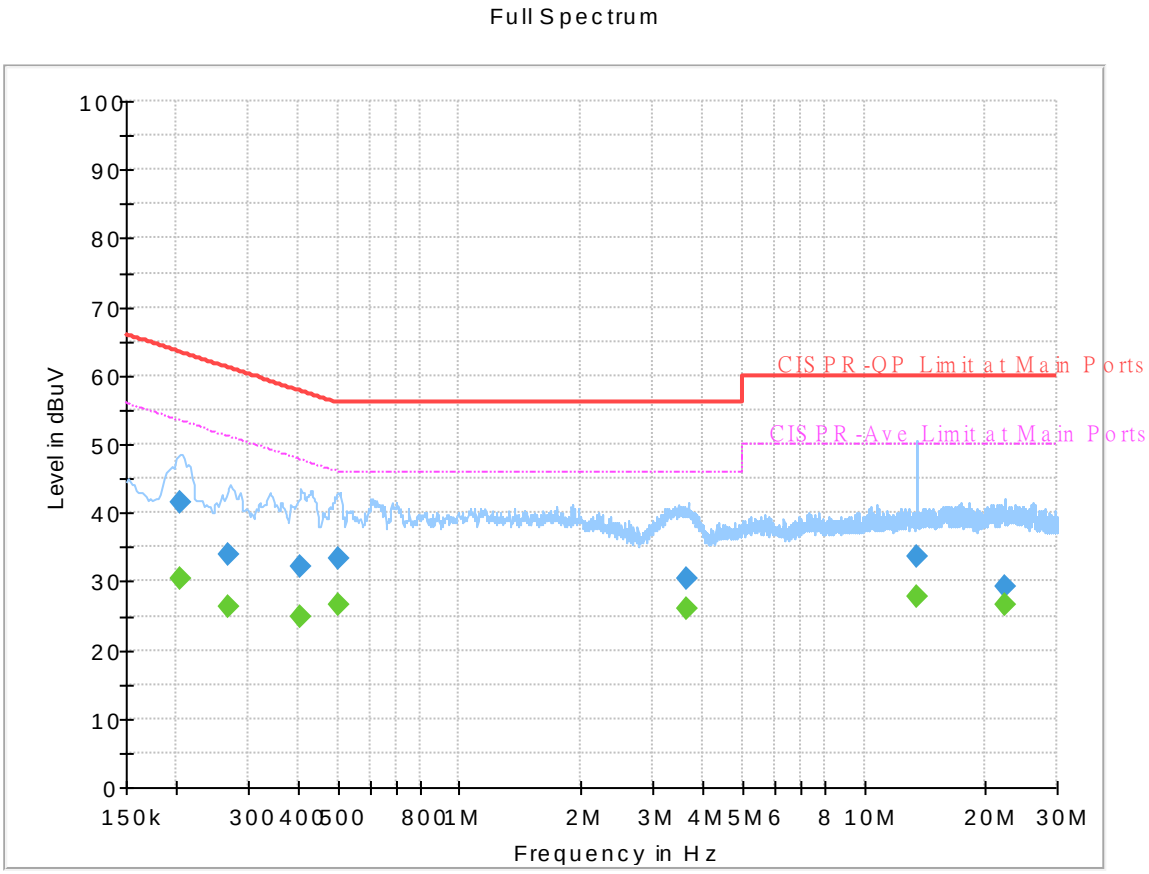
Note: Measured power density (dBm) has offset with cable loss.

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Tom Lee	**Temperature :**	21~25℃
		Relative Humidity :	42~50%

EUT Information

Report NO :	042406-02
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line

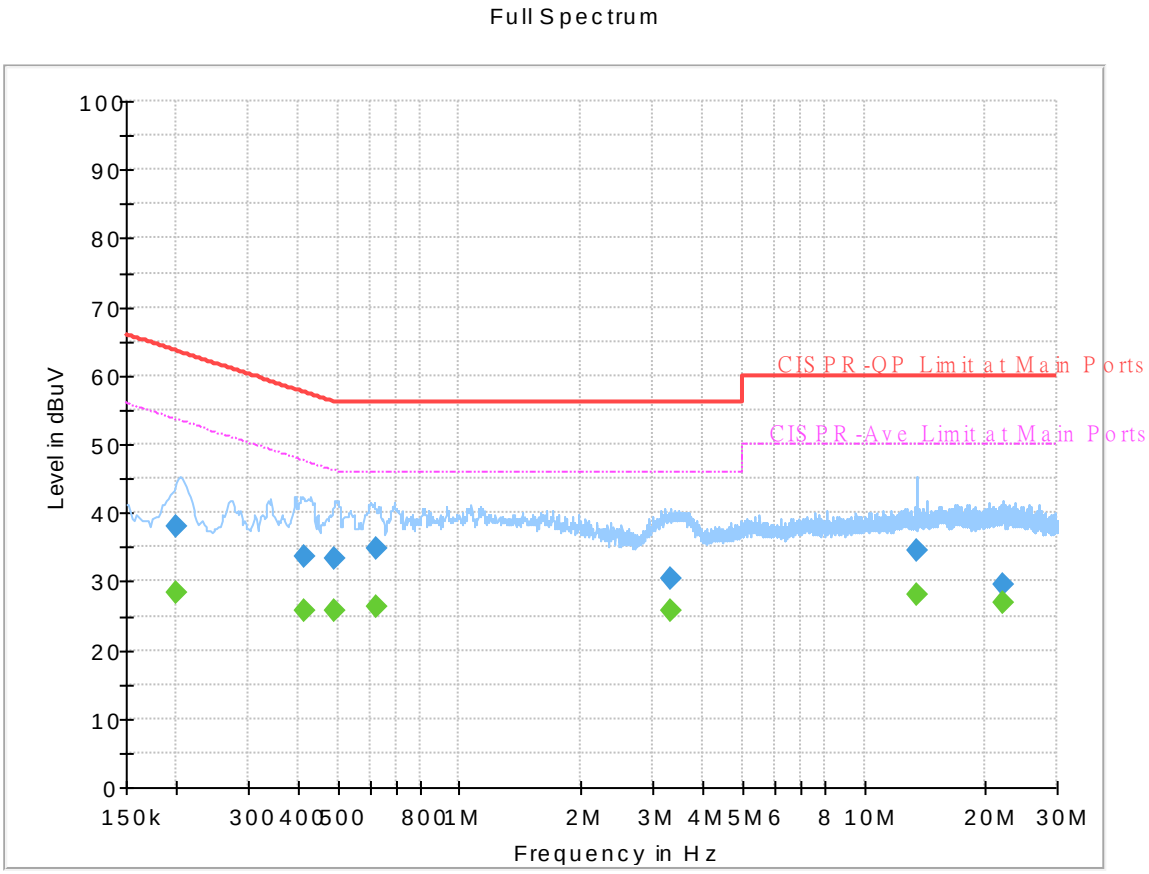


Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.202920	---	30.42	53.49	23.07	L1	OFF	19.6
0.202920	41.63	---	63.49	21.86	L1	OFF	19.6
0.267000	---	26.27	51.21	24.94	L1	OFF	19.6
0.267000	34.03	---	61.21	27.18	L1	OFF	19.6
0.402000	---	24.95	47.81	22.86	L1	OFF	19.6
0.402000	32.18	---	57.81	25.63	L1	OFF	19.6
0.503250	---	26.70	46.00	19.30	L1	OFF	19.6
0.503250	33.27	---	56.00	22.73	L1	OFF	19.6
3.664500	---	26.04	46.00	19.96	L1	OFF	19.7
3.664500	30.32	---	56.00	25.68	L1	OFF	19.7
13.560000	---	27.85	50.00	22.15	L1	OFF	20.2
13.560000	33.53	---	60.00	26.47	L1	OFF	20.2
22.326000	---	26.71	50.00	23.29	L1	OFF	20.5
22.326000	29.38	---	60.00	30.62	L1	OFF	20.5

EUT Information

Report NO :	042406-02
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.200400	---	28.43	53.59	25.16	N	OFF	19.6
0.200400	38.13	---	63.59	25.46	N	OFF	19.6
0.412440	---	25.72	47.60	21.88	N	OFF	19.6
0.412440	33.51	---	57.60	24.09	N	OFF	19.6
0.492720	---	25.73	46.12	20.39	N	OFF	19.6
0.492720	33.29	---	56.12	22.83	N	OFF	19.6
0.620250	---	26.17	46.00	19.83	N	OFF	19.6
0.620250	34.79	---	56.00	21.21	N	OFF	19.6
3.309000	---	25.87	46.00	20.13	N	OFF	19.7
3.309000	30.28	---	56.00	25.72	N	OFF	19.7
13.560000	---	28.00	50.00	22.00	N	OFF	20.2
13.560000	34.41	---	60.00	25.59	N	OFF	20.2
22.085970	---	26.79	50.00	23.21	N	OFF	20.5
22.085970	29.45	---	60.00	30.55	N	OFF	20.5

Appendix C. Radiated Spurious Emission

Test Engineer :	Andy Yang, Karl Hou and CR Liao	Temperature :	20~25°C
		Relative Humidity :	50~65%

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

WIFI Ant.	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		2310	57.4	-16.6	74	41.23	27.96	17.96	29.75	100	115	P	H
		2389.59	44.46	-9.54	54	28.51	27.64	18.09	29.78	100	115	A	H
	*	2412	107.07	-	-	91.13	27.6	18.13	29.79	100	115	P	H
	*	2412	104.1	-	-	88.16	27.6	18.13	29.79	100	115	A	H
													H
													H
		2335.62	56.96	-17.04	74	40.86	27.86	18	29.76	369	82	P	V
		2315.04	44.47	-9.53	54	28.31	27.94	17.97	29.75	369	82	A	V
	*	2412	104.65	-	-	88.71	27.6	18.13	29.79	369	82	P	V
	*	2412	101.65	-	-	85.71	27.6	18.13	29.79	369	82	A	V
													V
													V
802.11b CH 06 2437MHz		2322.88	57.03	-16.97	74	40.9	27.91	17.98	29.76	112	115	P	H
		2311.68	44.48	-9.52	54	28.32	27.95	17.96	29.75	112	115	A	H
	*	2437	105.32	-	-	89.35	27.6	18.17	29.8	112	115	P	H
	*	2437	102.14	-	-	86.17	27.6	18.17	29.8	112	115	A	H
		2484.88	60.06	-13.94	74	44.1	27.53	18.25	29.82	112	115	P	H
		2483.69	44.86	-9.14	54	28.91	27.53	18.24	29.82	112	115	A	H
		2366.14	57.55	-16.45	74	41.53	27.74	18.05	29.77	363	83	P	V
		2315.18	44.45	-9.55	54	28.29	27.94	17.97	29.75	363	83	A	V
	*	2437	102.4	-	-	86.43	27.6	18.17	29.8	363	83	P	V
	*	2437	99.24	-	-	83.27	27.6	18.17	29.8	363	83	A	V
		2484.39	57.2	-16.8	74	41.24	27.53	18.25	29.82	363	83	P	V
		2484.74	44.62	-9.38	54	28.66	27.53	18.25	29.82	363	83	A	V

802.11b CH 11 2462MHz	*	2462	106.8	-	-	90.82	27.58	18.21	29.81	100	115	P	H
	*	2462	103.63	-	-	87.65	27.58	18.21	29.81	100	115	A	H
		2485.8	60.45	-13.55	74	44.49	27.53	18.25	29.82	100	115	P	H
		2486.92	44.84	-9.16	54	28.88	27.53	18.25	29.82	100	115	A	H
													H
													H
	*	2462	104.05	-	-	88.07	27.58	18.21	29.81	361	81	P	V
	*	2462	100.92	-	-	84.94	27.58	18.21	29.81	361	81	A	V
		2484.72	58.57	-15.43	74	42.61	27.53	18.25	29.82	361	81	P	V
		2483.56	44.68	-9.32	54	28.73	27.53	18.24	29.82	361	81	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		4824	52.83	-21.17	74	68.32	31.15	12.45	59.09	100	57	P	H
		4824	50.29	-3.71	54	65.78	31.15	12.45	59.09	100	57	A	H
													H
													H
		4824	54.9	-19.1	74	70.39	31.15	12.45	59.09	100	3	P	V
		4824	52.42	-1.58	54	67.91	31.15	12.45	59.09	100	3	A	V
													V
													V
802.11b CH 06 2437MHz		4874	51.97	-22.03	74	67.49	31.1	12.5	59.12	100	278	P	H
		4874	48.91	-5.09	54	64.43	31.1	12.5	59.12	100	278	A	H
		7311	44.82	-29.18	74	51.34	36.44	15.6	58.56	100	0	P	H
													H
		4874	54.52	-19.48	74	70.04	31.1	12.5	59.12	100	193	P	V
		4874	52.1	-1.9	54	67.62	31.1	12.5	59.12	100	193	A	V
		7311	44.58	-29.42	74	51.1	36.44	15.6	58.56	100	0	P	V
													V
802.11b CH 11 2462MHz		4924	51.29	-22.71	74	66.81	31.1	12.53	59.15	100	303	P	H
		4924	48.36	-5.64	54	63.88	31.1	12.53	59.15	100	303	A	H
		7311	45.51	-28.49	74	52.03	36.44	15.6	58.56	100	0	P	H
													H
		4924	55.16	-18.84	74	70.68	31.1	12.53	59.15	100	188	P	V
		4924	52.79	-1.21	54	68.31	31.1	12.53	59.15	100	188	A	V
		7311	44.08	-29.92	74	50.6	36.44	15.6	58.56	100	0	P	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		2388.855	58.11	-15.89	74	42.16	27.64	18.09	29.78	100	120	P	H
		2390	45.3	-8.7	54	29.35	27.64	18.09	29.78	100	120	A	H
	*	2412	111.08	-	-	95.14	27.6	18.13	29.79	100	120	P	H
	*	2412	108.14	-	-	92.2	27.6	18.13	29.79	100	120	A	H
													H
													H
		2337.3	56.83	-17.17	74	40.73	27.85	18.01	29.76	377	74	P	V
		2390	44.98	-9.02	54	29.03	27.64	18.09	29.78	377	74	A	V
	*	2412	108.97	-	-	93.03	27.6	18.13	29.79	377	74	P	V
	*	2412	105.89	-	-	89.95	27.6	18.13	29.79	377	74	A	V
													V
													V
802.11g CH 06 2437MHz		2389.8	61.24	-12.76	74	45.29	27.64	18.09	29.78	117	116	P	H
		2388.82	45.95	-8.05	54	30	27.64	18.09	29.78	117	116	A	H
	*	2437	111.95	-	-	95.98	27.6	18.17	29.8	117	116	P	H
	*	2437	103.77	-	-	87.8	27.6	18.17	29.8	117	116	A	H
		2485.37	66.73	-7.27	74	50.77	27.53	18.25	29.82	117	116	P	H
		2483.55	48.63	-5.37	54	32.68	27.53	18.24	29.82	117	116	A	H
		2389.94	58.75	-15.25	74	42.8	27.64	18.09	29.78	371	78	P	V
		2389.66	45.92	-8.08	54	29.97	27.64	18.09	29.78	371	78	A	V
	*	2437	109.77	-	-	93.8	27.6	18.17	29.8	371	78	P	V
	*	2437	101.73	-	-	85.76	27.6	18.17	29.8	371	78	A	V
		2483.55	63.59	-10.41	74	47.64	27.53	18.24	29.82	371	78	P	V
		2484.74	46.57	-7.43	54	30.61	27.53	18.25	29.82	371	78	A	V

802.11g CH 11 2462MHz	*	2462	111.13	-	-	95.15	27.58	18.21	29.81	100	114	P	H
	*	2462	103.44	-	-	87.46	27.58	18.21	29.81	100	114	A	H
		2484.64	66.51	-7.49	74	50.55	27.53	18.25	29.82	100	114	P	H
		2483.96	49.69	-4.31	54	33.74	27.53	18.24	29.82	100	114	A	H
													H
													H
	*	2462	108.99	-	-	93.01	27.58	18.21	29.81	361	83	P	V
	*	2462	101.25	-	-	85.27	27.58	18.21	29.81	361	83	A	V
		2485.2	63.83	-10.17	74	47.87	27.53	18.25	29.82	361	83	P	V
		2483.92	48.39	-5.61	54	32.44	27.53	18.24	29.82	361	83	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		4824	53.47	-20.53	74	68.96	31.15	12.45	59.09	100	57	P	H
		4824	44.62	-9.38	54	60.11	31.15	12.45	59.09	100	57	A	H
													H
													H
		4824	54.72	-19.28	74	70.21	31.15	12.45	59.09	100	3	P	V
		4824	44.77	-9.23	54	60.26	31.15	12.45	59.09	100	3	A	V
													V
													V
802.11g CH 06 2437MHz		4874	55.44	-18.56	74	70.96	31.1	12.5	59.12	100	282	P	H
		4874	45.37	-8.63	54	60.89	31.1	12.5	59.12	100	282	A	H
		7311	46.17	-27.83	74	52.69	36.44	15.6	58.56	100	0	P	H
													H
		4874	57.67	-16.33	74	73.19	31.1	12.5	59.12	100	189	P	V
		4874	47.38	-6.62	54	62.9	31.1	12.5	59.12	100	189	A	V
		7311	46.42	-27.58	74	52.94	36.44	15.6	58.56	100	0	P	V
													V
802.11g CH 11 2462MHz		4924	54.8	-19.2	74	70.32	31.1	12.53	59.15	100	302	P	H
		4924	43.72	-10.28	54	59.24	31.1	12.53	59.15	100	302	A	H
		7386	46.34	-27.66	74	52.67	36.53	15.6	58.46	100	0	P	H
													H
		4924	57.62	-16.38	74	73.14	31.1	12.53	59.15	100	187	P	V
		4924	46.51	-7.49	54	62.03	31.1	12.53	59.15	100	187	A	V
		7386	46.33	-27.67	74	52.66	36.53	15.6	58.46	100	0	P	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		2389.59	57.5	-16.5	74	41.55	27.64	18.09	29.78	100	115	P	H
		2390	47.13	-6.87	54	31.18	27.64	18.09	29.78	100	115	A	H
	*	2412	108.81	-		92.87	27.6	18.13	29.79	100	115	P	H
	*	2412	101.24	-		85.3	27.6	18.13	29.79	100	115	A	H
													H
													H
		2334.36	57.13	-16.87	74	41.03	27.86	18	29.76	370	80	P	V
		2389.8	46.39	-7.61	54	30.44	27.64	18.09	29.78	370	80	A	V
	*	2412	106.68	-	-	90.74	27.6	18.13	29.79	370	80	P	V
	*	2412	98.79	-	-	82.85	27.6	18.13	29.79	370	80	A	V
													V
													V
802.11n HT20 CH 06 2437MHz		2359.28	55.45	-18.55	74	39.42	27.76	18.04	29.77	134	116	P	H
		2319.38	44.93	-9.07	54	28.78	27.92	17.98	29.75	134	116	A	H
	*	2437	105.66	-		89.69	27.6	18.17	29.8	134	116	P	H
	*	2437	97.87	-		81.9	27.6	18.17	29.8	134	116	A	H
		2483.83	61.73	-12.27	74	45.78	27.53	18.24	29.82	134	116	P	H
		2484.81	45.8	-8.2	54	29.84	27.53	18.25	29.82	134	116	A	H
		2387.28	56.51	-17.49	74	40.55	27.65	18.09	29.78	369	82	P	V
		2381.26	45.41	-8.59	54	29.44	27.67	18.08	29.78	369	82	A	V
	*	2437	103.96	-		87.99	27.6	18.17	29.8	369	82	P	V
	*	2437	96.04	-		80.07	27.6	18.17	29.8	369	82	A	V
		2485.09	60.66	-13.34	74	44.7	27.53	18.25	29.82	369	82	P	V
		2484.11	45.56	-8.44	54	29.61	27.53	18.24	29.82	369	82	A	V

	*	2462	106.49	-		90.51	27.58	18.21	29.81	100	115	P	H
	*	2462	98.59	-		82.61	27.58	18.21	29.81	100	115	A	H
		2483.64	63.05	-10.95	74	47.1	27.53	18.24	29.82	100	115	P	H
		2483.8	46.21	-7.79	54	30.26	27.53	18.24	29.82	100	115	A	H
802.11n													H
HT20													H
CH 11	*	2462	103.21	-		87.23	27.58	18.21	29.81	360	83	P	V
2462MHz	*	2462	95.79	-		79.81	27.58	18.21	29.81	360	83	A	V
		2485.16	59.47	-14.53	74	43.51	27.53	18.25	29.82	360	83	P	V
		2483.96	45.43	-8.57	54	29.48	27.53	18.24	29.82	360	83	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		4824	51.72	-22.28	74	67.23	31.15	12.43	59.09	299	108	P	V
		4824	42.65	-11.35	54	58.16	31.15	12.43	59.09	299	108	A	V
													H
													H
		4824	51.72	-22.28	74	67.23	31.15	12.43	59.09	299	108	P	V
		4824	42.65	-11.35	54	58.16	31.15	12.43	59.09	299	108	A	V
													V
													V
802.11n HT20 CH 06 2437MHz		4874	48.15	-25.85	74	63.69	31.1	12.48	59.12	100	0	P	H
		7311	45.95	-28.05	74	52.39	36.44	15.68	58.56	100	0	P	H
													H
													H
		4874	51.94	-22.06	74	67.48	31.1	12.48	59.12	100	196	P	V
		4874	40.74	-13.26	54	56.28	31.1	12.48	59.12	100	196	A	V
		7311	45.68	-28.32	74	52.12	36.44	15.68	58.56	100	0	P	V
													V
802.11n HT20 CH 11 2462MHz		4924	45.98	-28.02	74	61.51	31.1	12.52	59.15	100	0	P	H
		7386	46.31	-27.69	74	52.58	36.53	15.66	58.46	100	0	P	H
													H
													H
		4924	48.22	-25.78	74	63.75	31.1	12.52	59.15	100	0	P	V
		7386	45.94	-28.06	74	52.21	36.53	15.66	58.46	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission above 18GHz

2.4GHz WIFI 802.11b (SHF)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz 802.11b SHF		18322	37.44	-36.56	74	43.4	37.42	10.94	54.32	150	0	P	H
													H
													H
													H
													H
													H
		24300	39.87	-34.13	74	39.88	40.22	13.19	53.42	150	0	P	V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Emission below 1GHz

2.4GHz WIFI 802.11b (LF)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
2.4GHz 802.11b LF		49.4	26.1	-13.9	40	42.89	14.47	1.16	32.42	-	-	P	H
		83.35	32.15	-7.85	40	49.15	13.77	1.54	32.31	-	-	P	H
		149.31	36.53	-6.97	43.5	49.6	17.05	2.16	32.28	100	0	P	H
		166.77	31.71	-11.79	43.5	45.96	15.77	2.28	32.3	-	-	P	H
		256.98	33.04	-12.96	46	42.99	19.59	2.8	32.34	-	-	P	H
		895.24	32.75	-13.25	46	30.57	28.98	5.14	31.94	-	-	P	H
													H
													H
													H
													H
													H
													H
		49.4	35.85	-4.15	40	52.64	14.47	1.16	32.42	100	213	Q	V
		66.86	33.92	-6.08	40	53.08	11.83	1.38	32.37	-	-	P	V
		83.35	38.39	-1.61	40	55.39	13.77	1.54	32.31	100	333	Q	V
		99.84	29.37	-14.13	43.5	44.17	15.76	1.69	32.25	-	-	P	V
		149.31	29.57	-13.93	43.5	42.64	17.05	2.16	32.28	-	-	P	V
		165.8	32.59	-10.91	43.5	46.76	15.85	2.28	32.3	-	-	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =

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

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

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

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

Appendix D. Radiated Spurious Emission Plots

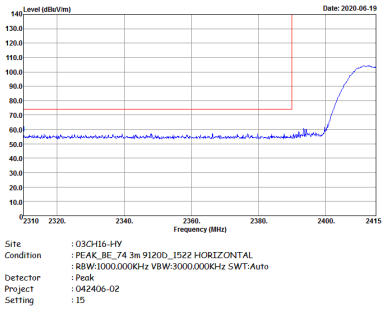
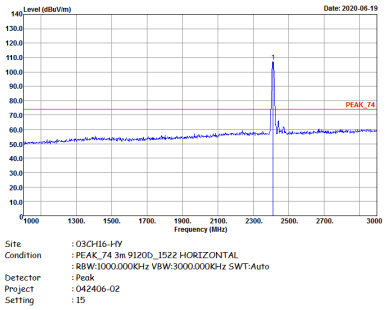
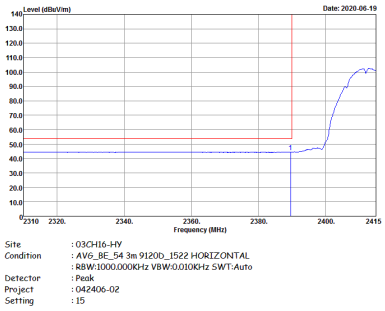
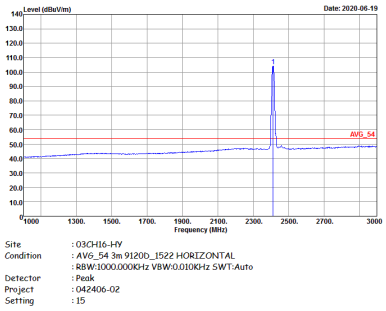
Test Engineer :	Andy Yang, Karl Hou and CR Liao	**Temperature :**	20~25°C
		Relative Humidity :	50~65%

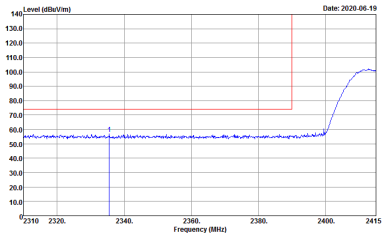
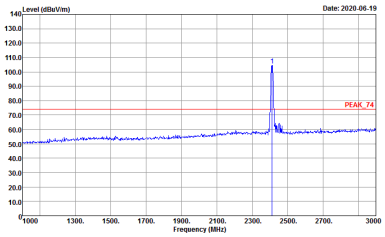
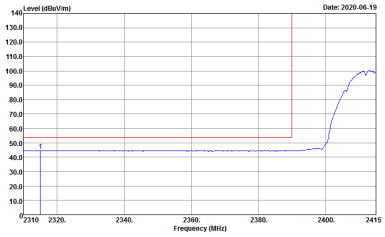
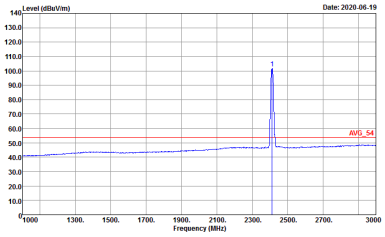
Note symbol

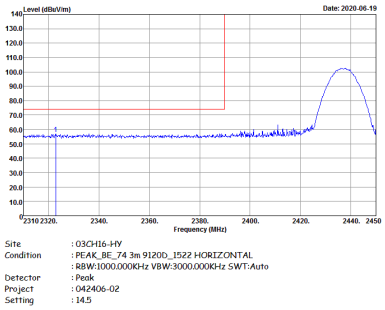
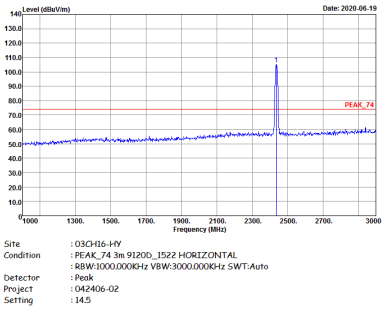
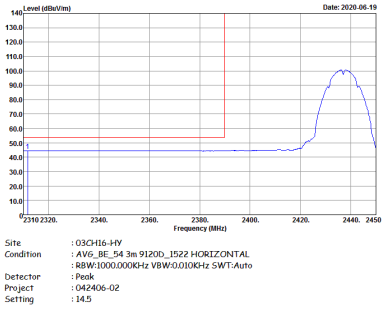
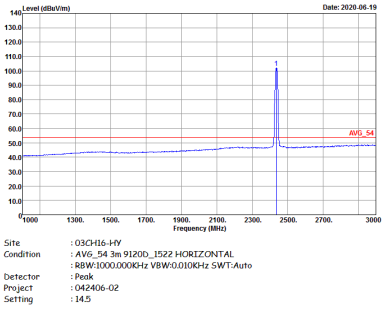
-L	**Low channel location**
-R	**High channel location**

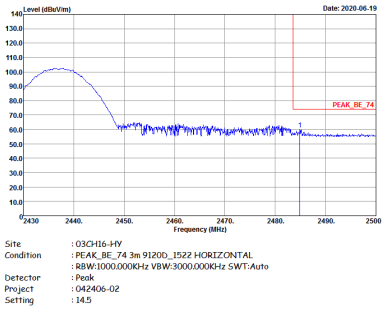
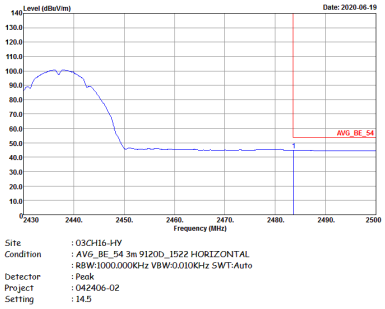
2.4GHz 2400~2483.5MHz

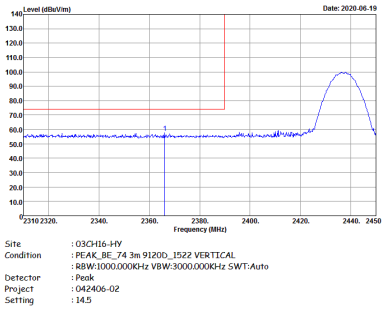
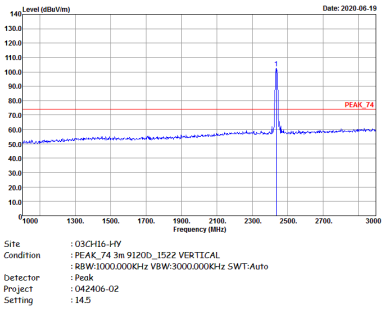
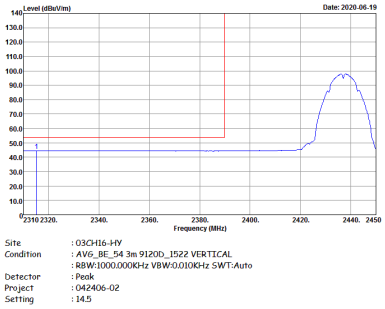
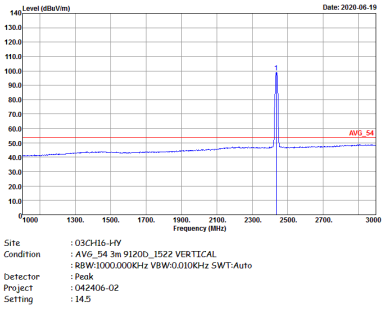
WIFI 802.11b (Band Edge @ 3m)

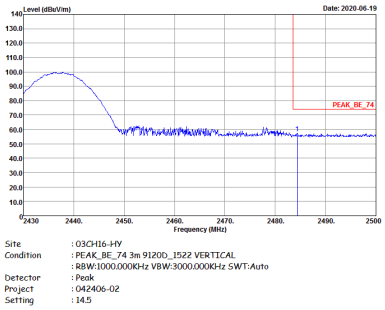
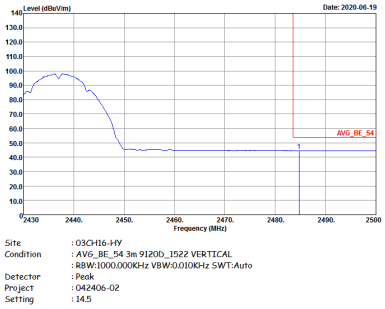
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

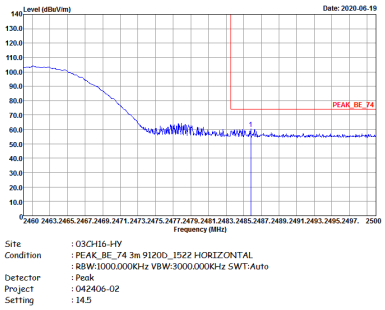
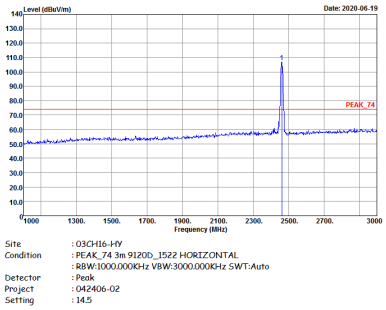
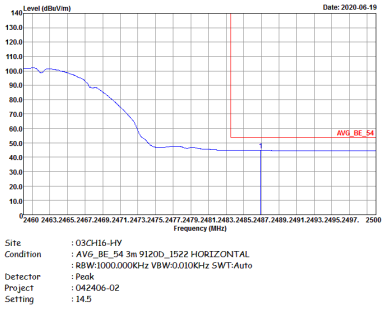
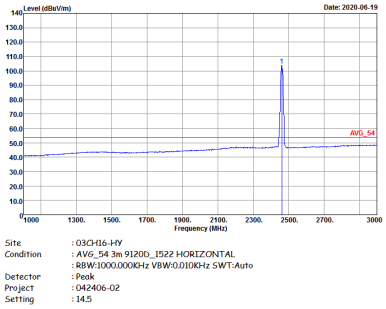
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 9120D_1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 042406-02 Setting : 15	 Site : 03CH16-HY Condition : PEAK_74 3m 9120D_1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 042406-02 Setting : 15
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 9120D_1522 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 042406-02 Setting : 15	 Site : 03CH16-HY Condition : AVG_54 3m 9120D_1522 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 042406-02 Setting : 15

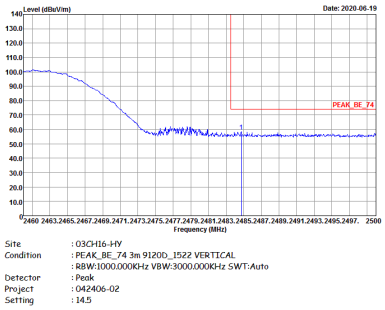
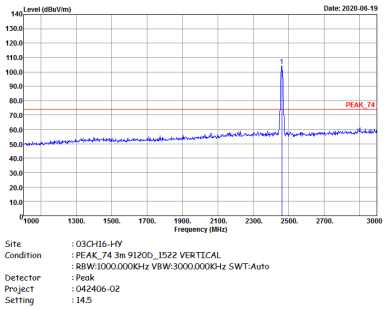
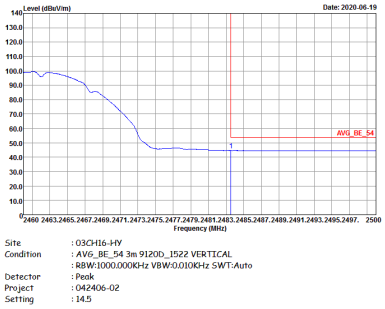
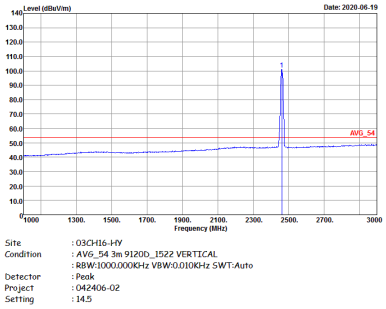
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

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

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

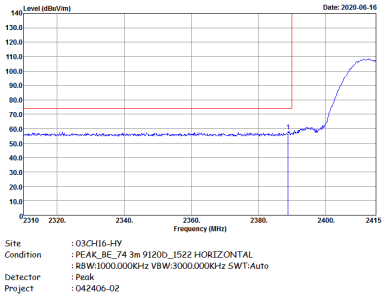
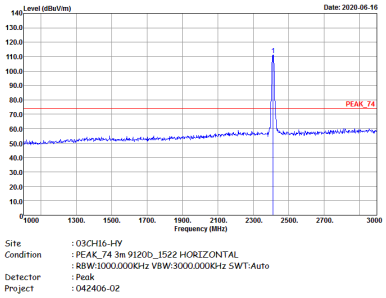
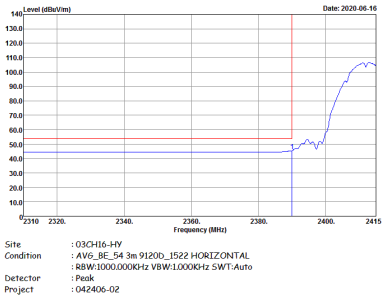
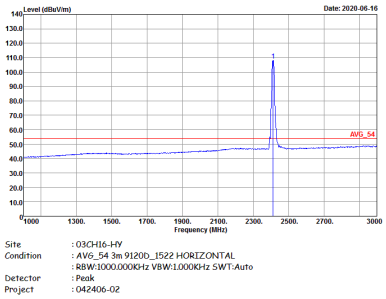
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

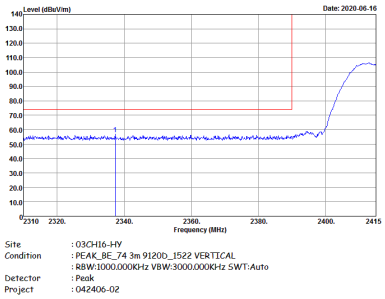
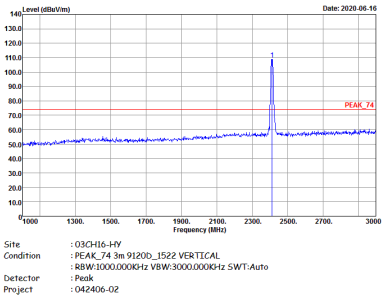
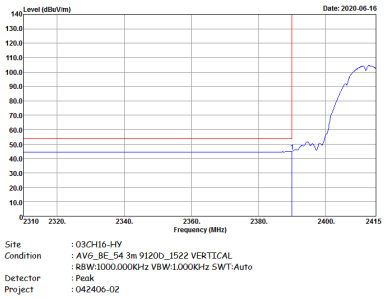
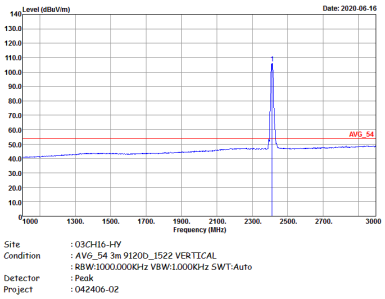
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

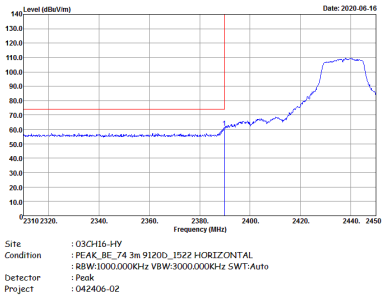
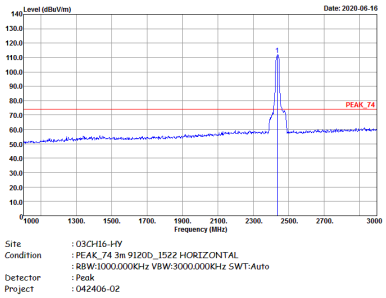
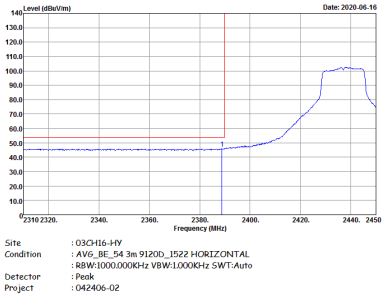
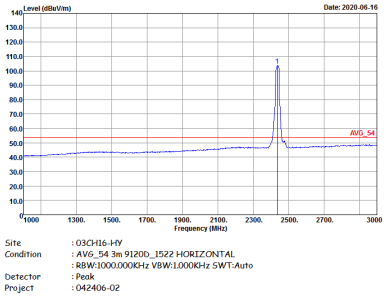
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
1	Vertical	Fundamental
Peak		
Avg.		

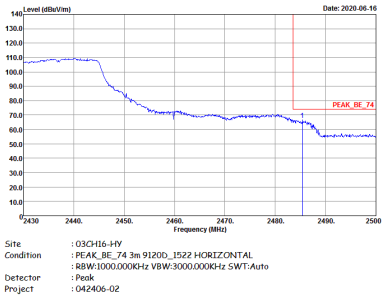
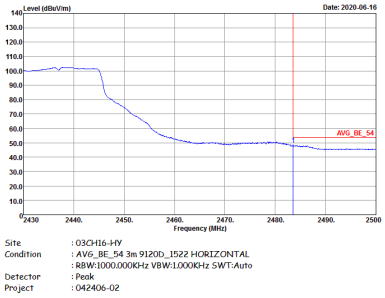
2.4GHz 2400~2483.5MHz

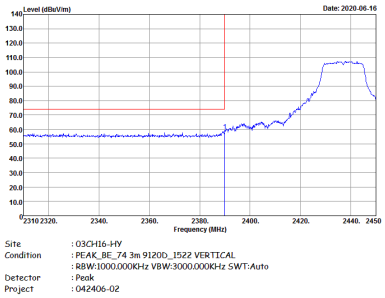
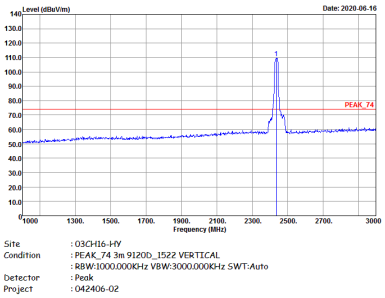
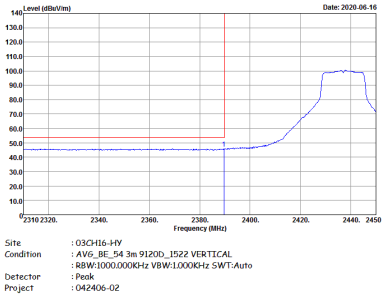
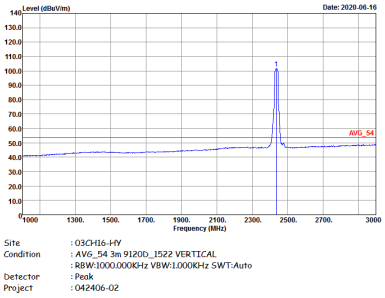
WIFI 802.11g (Band Edge @ 3m)

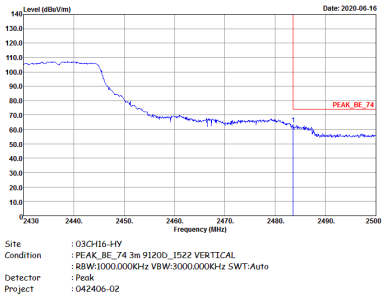
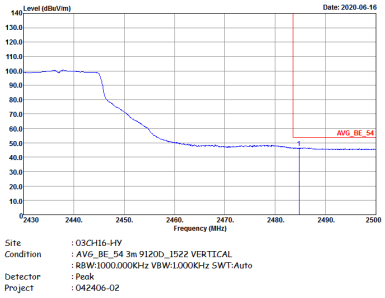
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

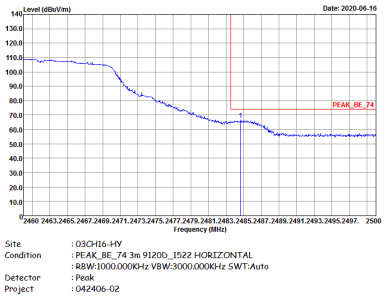
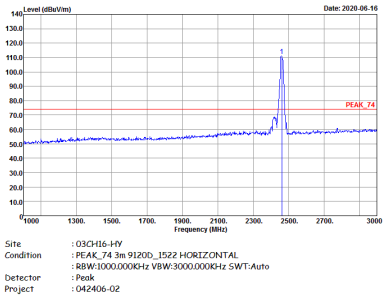
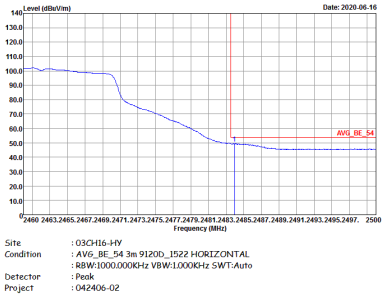
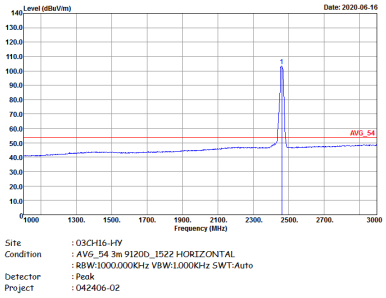
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

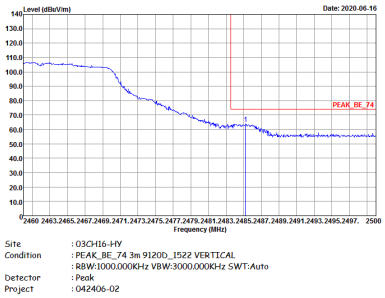
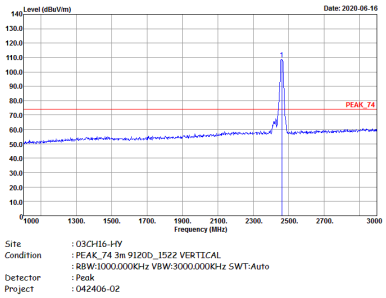
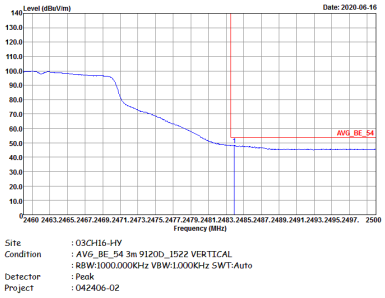
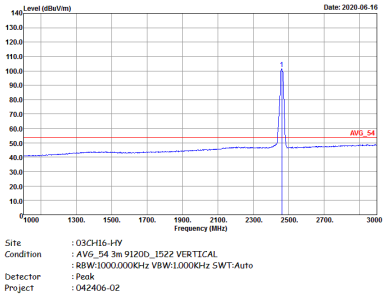
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

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

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

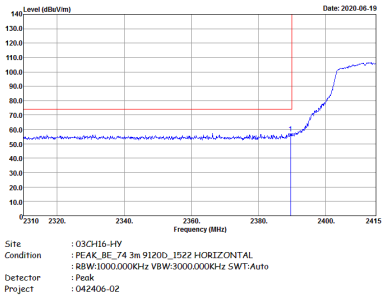
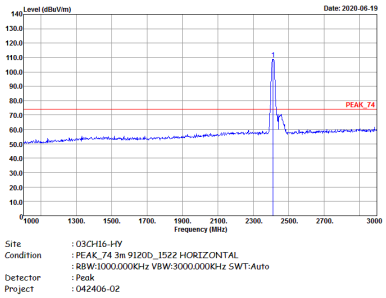
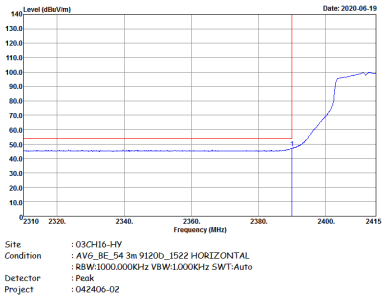
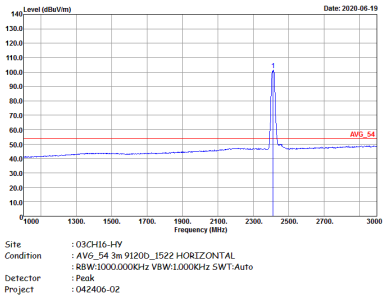
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - R	
1	Vertical	Fundamental
Peak		Left Blank
Avg.		Left Blank

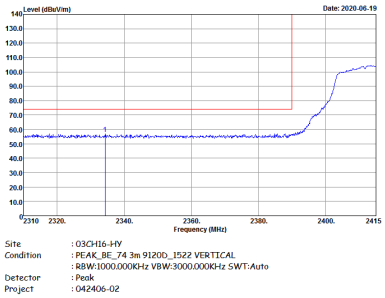
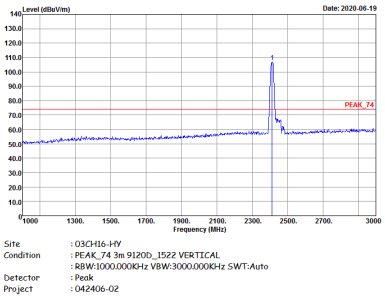
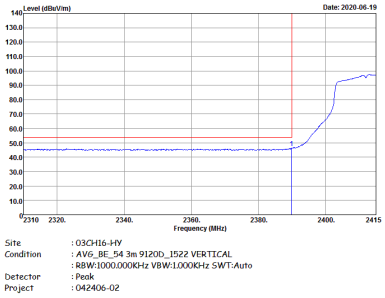
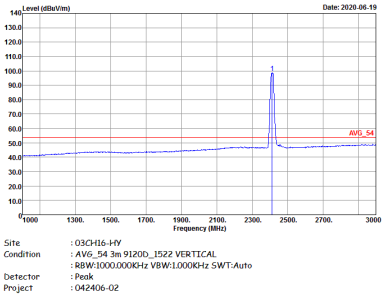
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

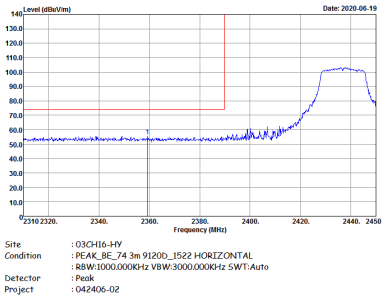
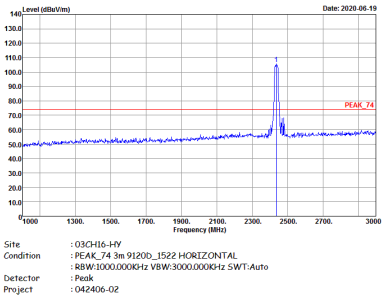
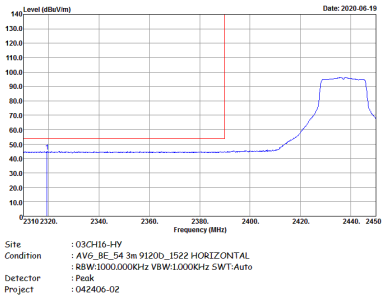
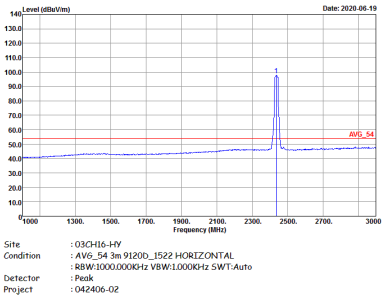
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1	Vertical	Fundamental
Peak		
Avg.		

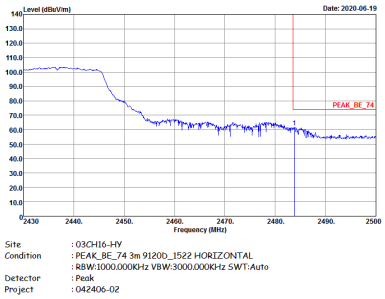
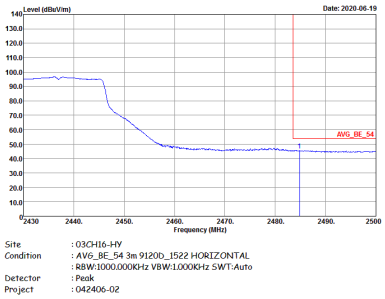
2.4GHz 2400~2483.5MHz

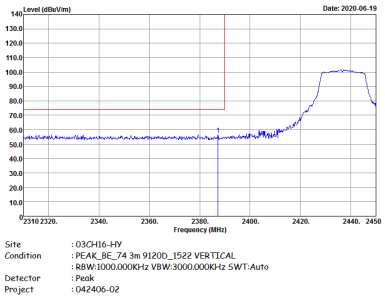
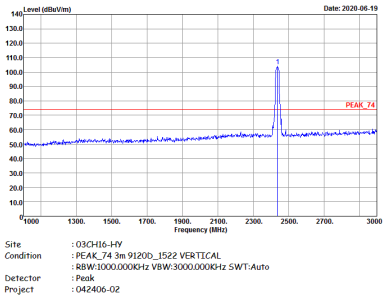
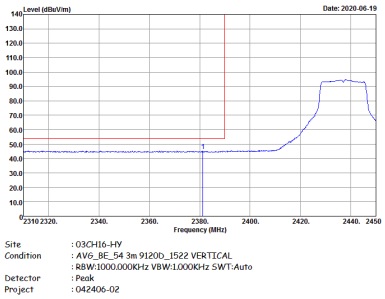
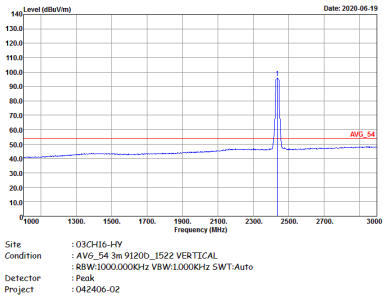
WIFI 802.11n HT20 (Band Edge @ 3m)

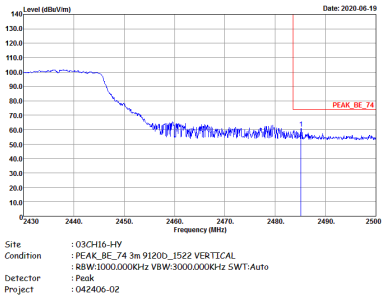
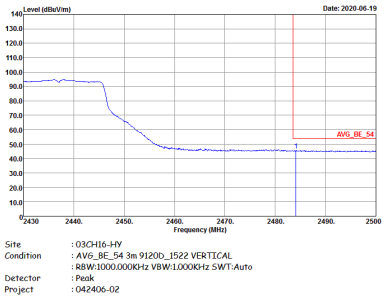
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

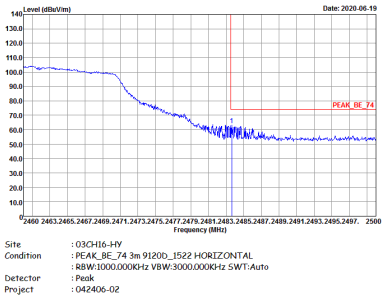
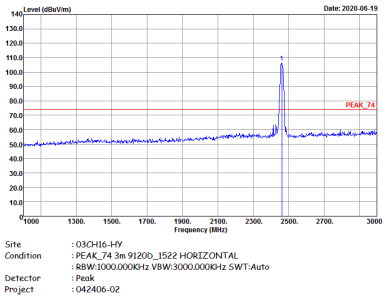
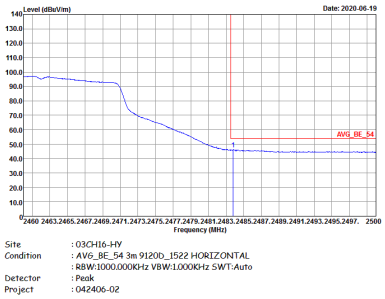
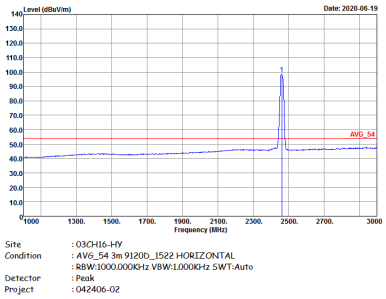
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

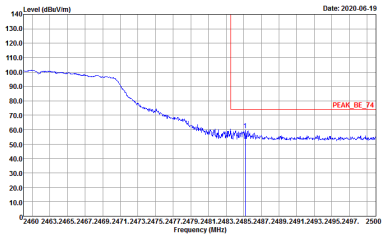
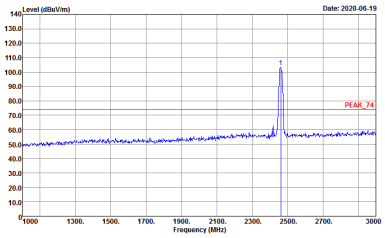
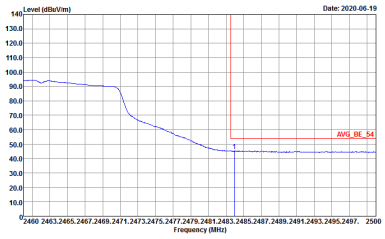
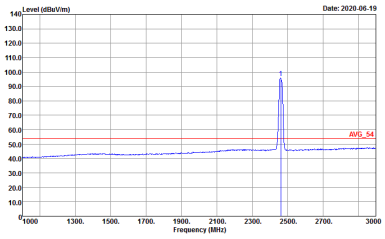
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

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

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

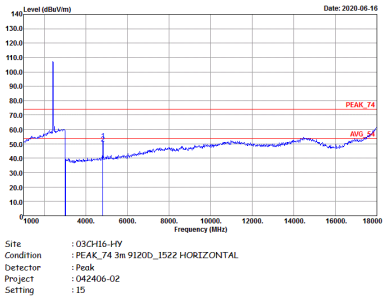
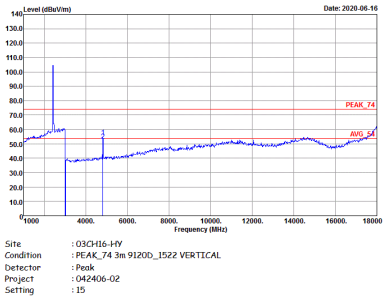
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - R	
1	Vertical	Fundamental
Peak		Left Blank
Avg.		Left Blank

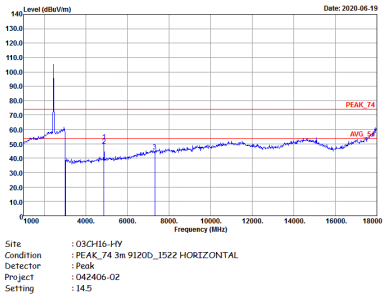
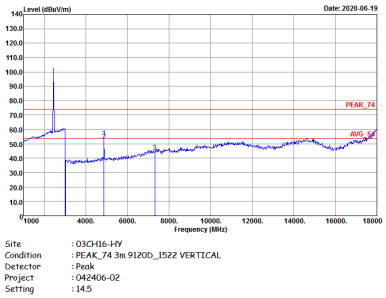
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

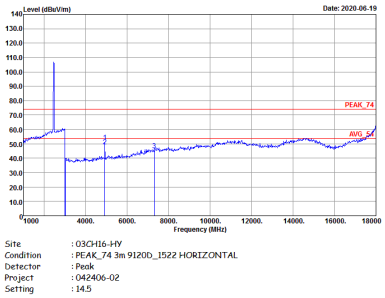
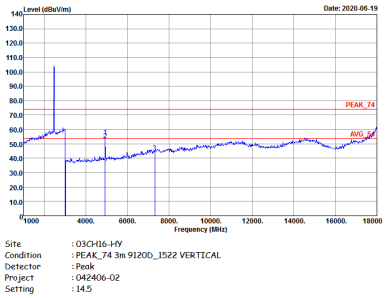
WIFI	2.4GHz 2400~2483.5MHz Fundamental @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 9120D_1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 042406-02	 Site : 03CH16-HY Condition : PEAK_74 3m 9120D_1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 042406-02
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 9120D_1522 VERTICAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 042406-02	 Site : 03CH16-HY Condition : AVG_54 3m 9120D_1522 VERTICAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 042406-02

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

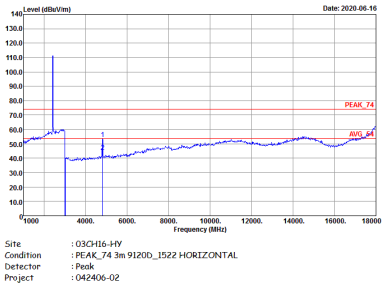
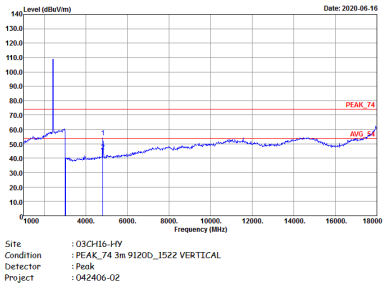
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH01 2412MHz	
1	Horizontal	Vertical
Peak Avg.		

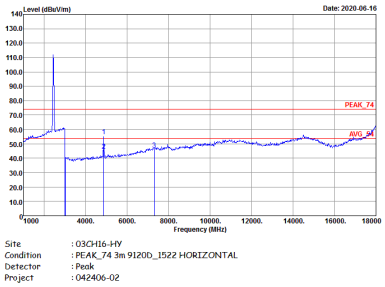
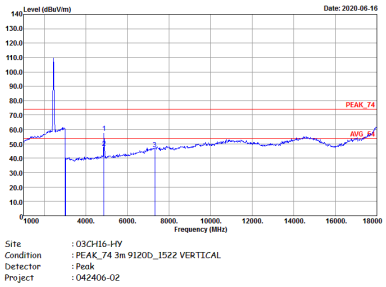
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH06 2437MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH16-HY Condition : PEAK_74 3m 9120D_1522 HORIZONTAL Detector : Peak Project : 042406-02 Setting : 14.5	 Site : 03CH16-HY Condition : PEAK_74 3m 9120D_1522 VERTICAL Detector : Peak Project : 042406-02 Setting : 14.5

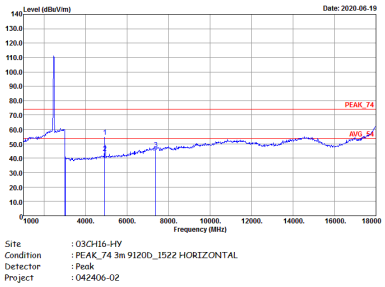
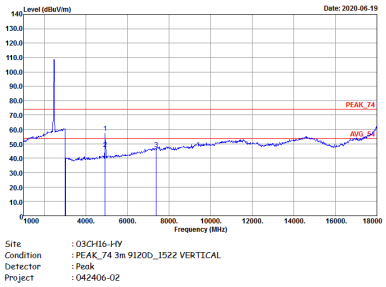
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH11 2462MHz	
1	Horizontal	Vertical
Peak Avg.		

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

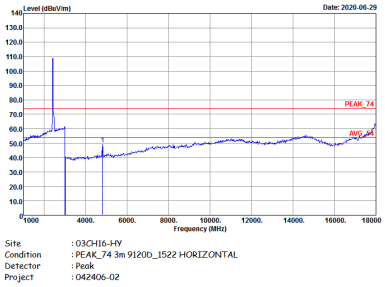
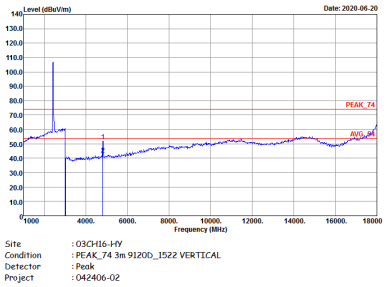
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH01 2412MHz	
1	Horizontal	Vertical
Peak Avg.		

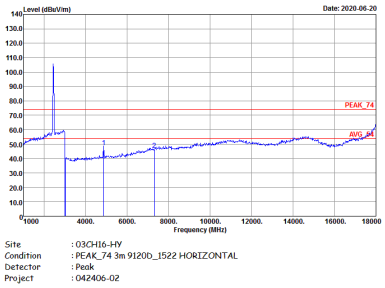
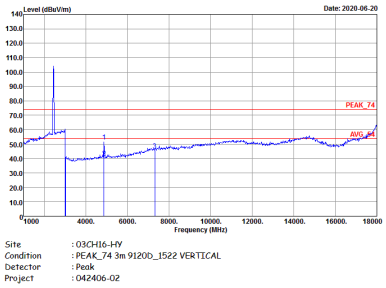
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH06 2437MHz	
1	Horizontal	Vertical
Peak Avg.		

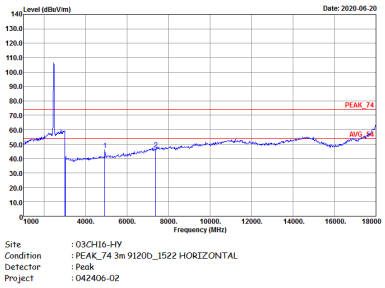
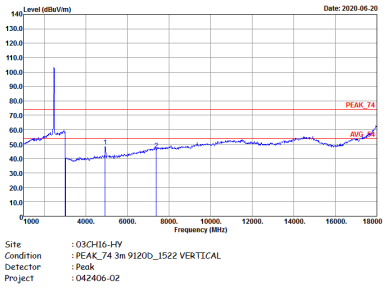
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH11 2462MHz	
1	Horizontal	Vertical
Peak Avg.		

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Harmonic @ 3m)

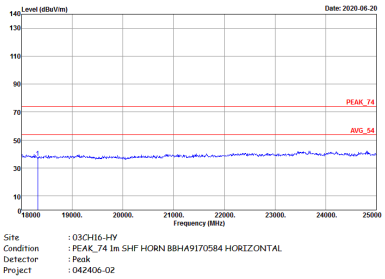
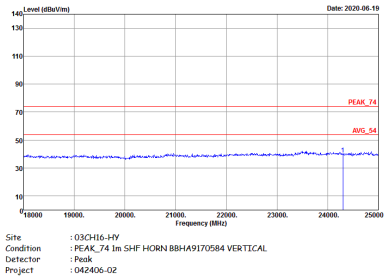
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Horizontal	Vertical
Peak Avg.		

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.		

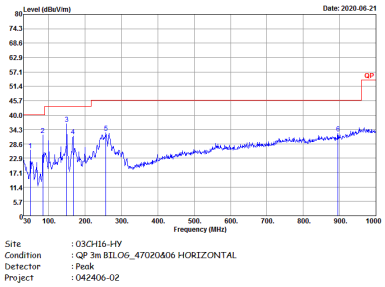
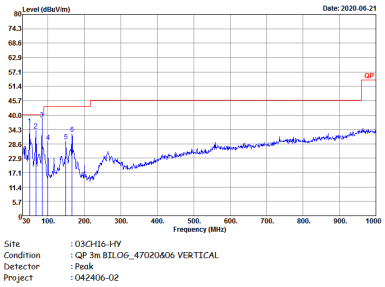
Emission above 18GHz

2.4GHz WIFI 802.11b (SHF)

WIFI	2.4GHz 2400~2483.5MHz	
ANT	802.11b SHF	
1	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

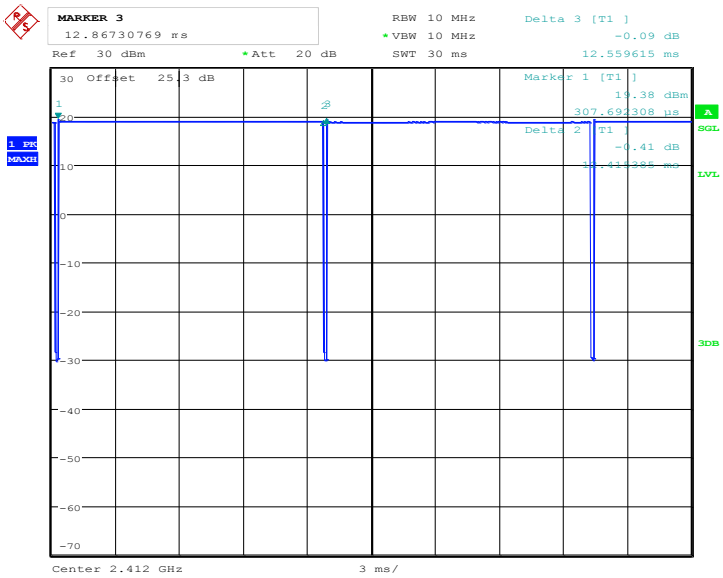
2.4GHz WIFI 802.11b (LF)

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

Appendix E. Duty Cycle Plots

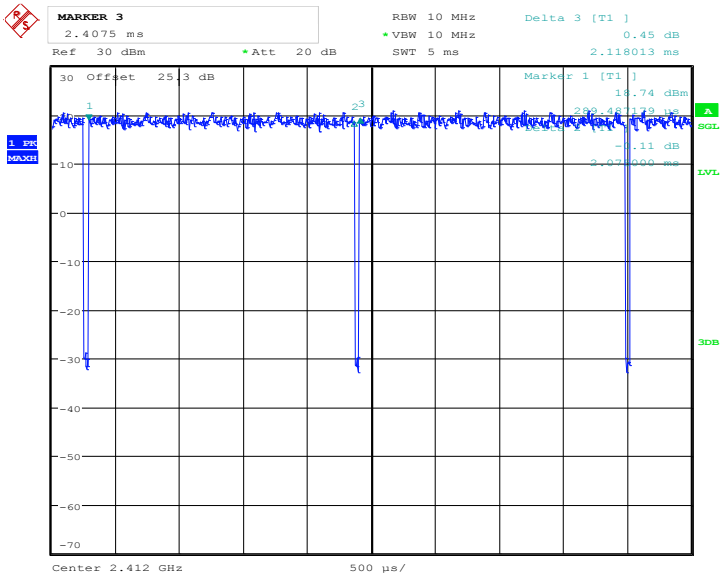
Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
1	802.11b	98.85	-	-	10Hz	0.05
1	802.11g	97.97	2075	0.48	1kHz	0.09
1	2.4GHz 802.11n HT20	97.57	1927	0.52	1kHz	0.11

802.11b



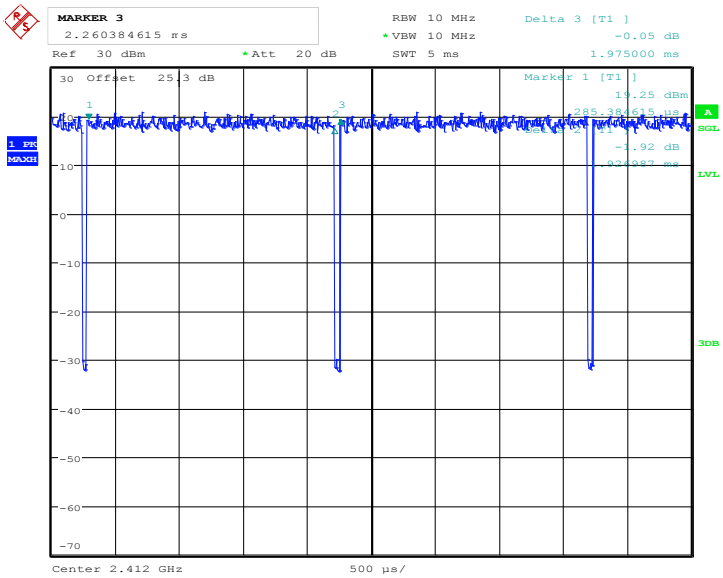
Date: 29.MAY.2020 14:10:48

802.11g



Date: 29.MAY.2020 14:20:59

802.11n HT20



Date: 29.MAY.2020 14:28:51