FCC RF Test Report

APPLICANT	:	Espressif Systems (Shanghai) Co.,Ltd.
EQUIPMENT	:	2.4G Wi-Fi & Bluetooth IoT Module
BRAND NAME	:	ESPRESSIF
MODEL NAME	:	EK058
FCC ID	:	2AC7Z-EK058
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System
TEST DATE(S)	:	Jul. 26, 2022 ~ Aug. 08, 2022

We, Sporton International Inc. (Kunshan), 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. (Kunshan), the test report shall not be reproduced except in full.

Jason Jia

Approved by: Jason Jia

ACCREDITED
Cert #5145.02

Sporton International Inc. (Kunshan)
No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR263001C	Rev. 01	Initial issue of report	Sep. 09, 2022

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	-	Report Only	-
3.2	15.247(b)	Power Output Measurement	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	Conducted Band Edges	≤ 20dBc	Pass	-
		Conducted Spurious Emission		Pass	-
3.5	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 1.51 dB at 2483.500 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 9.05 dB at 0.155 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits.
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.

1 General Description

1.1 Applicant

Espressif Systems (Shanghai) Co.,Ltd.
Suite 204, Block 2, 690 Bibo Road, Zhang Jiang Hi-Tech Park, Shanghai, China

1.2 Manufacturer

Espressif Systems (Shanghai) Co.,Ltd.
Suite 204, Block 2, 690 Bibo Road, Zhang Jiang Hi-Tech Park, Shanghai, China

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	2.4G Wi-Fi & Bluetooth IoT Module
Brand Name	ESPRESSIF
Model Name	EK058
FCC ID	2AC7Z-EK058
HW Version	V1.1
SW Version	V1.1.3.0
SN Code	Radiation:C4DEE21CF9B8 Conducted: C4DEE21D2530 Conduction: C4DEE21D4618
EUT Stage	Production Unit

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Channel Frequency Range	2412 MHz ~ 2462 MHz
Maximum (Peak) Output Power to antenna	802.11b : 21.09 dBm (0.1285 W) 802.11g : 22.38 dBm (0.1730 W) 802.11n HT20 : 22.70 dBm (0.1862 W) 802.11n HT40 : 21.90 dBm (0.1549 W)
99% Occupied Bandwidth	802.11b : 13.24MHz 802.11g : 16.93MHz 802.11n HT20 : 17.43MHz 802.11n HT40 : 34.27MHz
Antenna Type / Gain	PCB Antenna with gain 3.26 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)

1.5 Modification of EUT

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

1.6 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	CO01-KS 03CH05-KS TH01-KS	CN1257	314309

1.7 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH05-KS	AUDIX	E3	6.2009-8-24al
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.8 Applicable Standards

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

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

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
802.11n HT40	MCS0

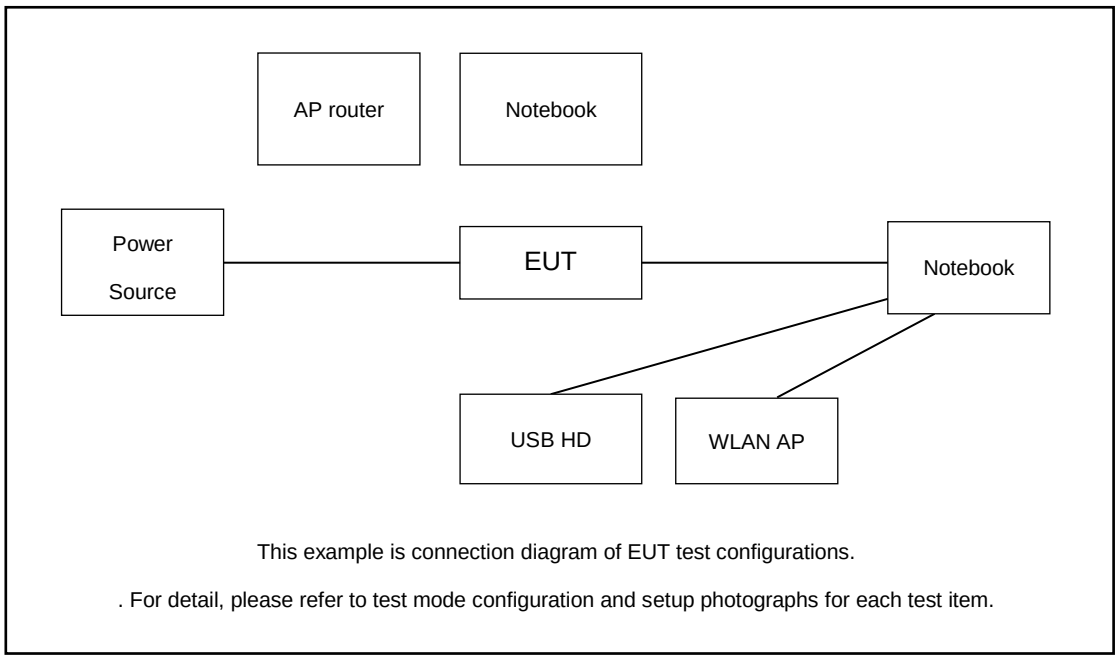
Test Cases	
AC Conducted Emission	Mode 1 :Bluetooth TX + WLAN Link (2.4G) + Notebook Charging

Remark:

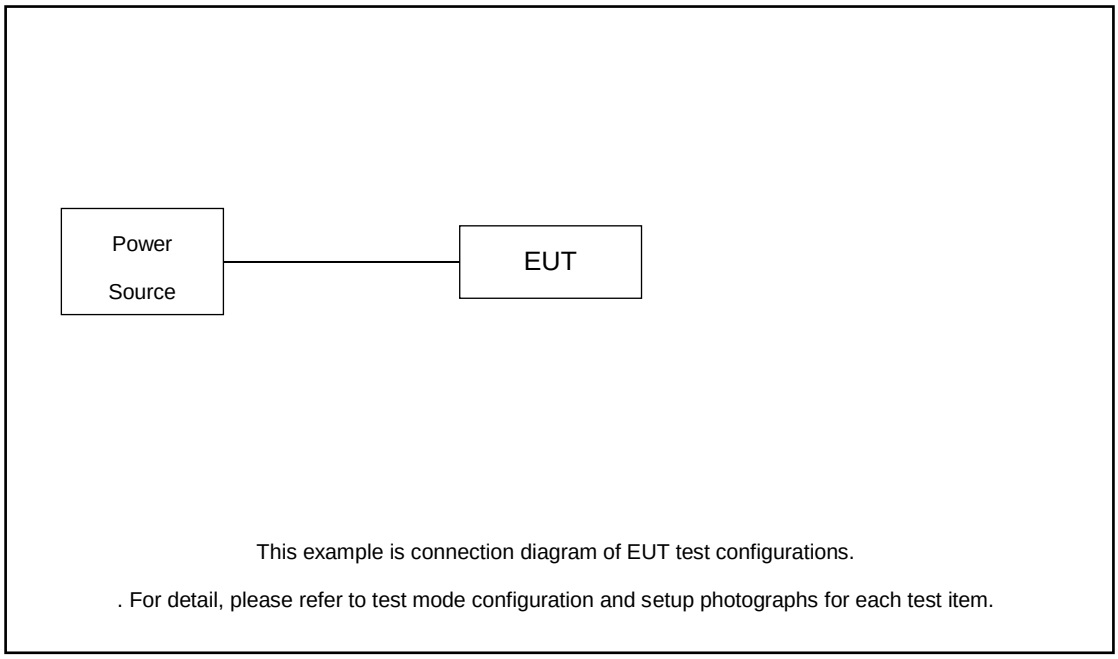
1. For Radiated Test Cases, The tests were performed with Notebook.

2.3 Connection Diagram of Test System

< **AC Conducted Emission** >



< **Radiated Emission** >



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
2.	Notebook	Lenovo	V130-14IKB004	N/A	N/A	shielded cable DC O/P 1.8m , Unshielded AC I/P cable 1.8m
3.	Test Jig	N/A	N/A	N/A	N/A	N/A
4.	Hard Disk	Lenovo	F310	DoC	Shielded, 1.2m	N/A

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuous transmit.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

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 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.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 5.6 dB.

Offset(dB) = RF cable loss(dB).

=5.6 (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.

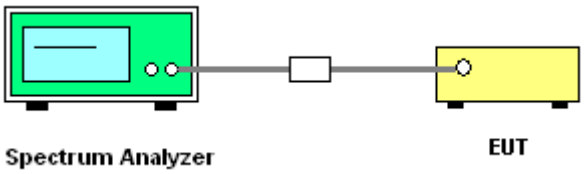
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

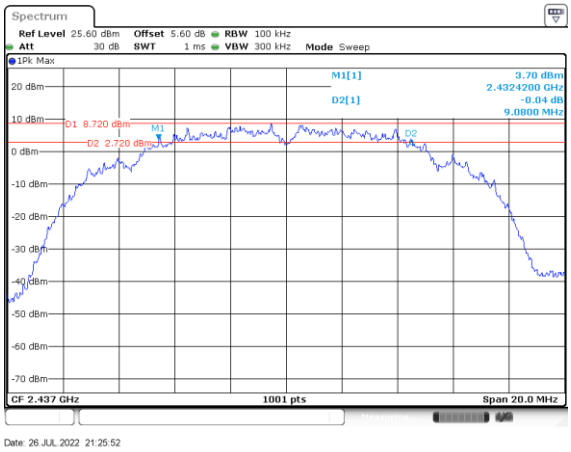
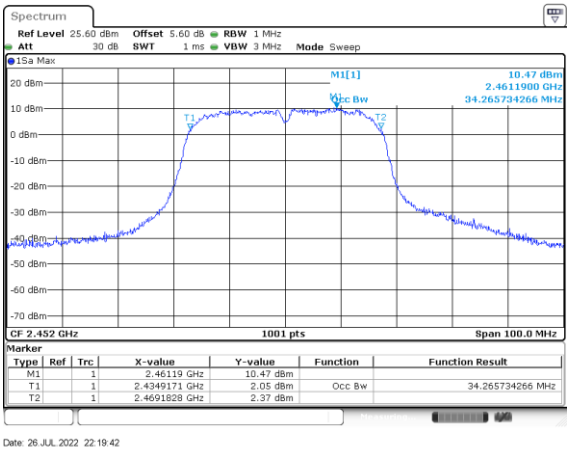
1. The testing follows ANSI C63.10-2013 clause 11.8
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement 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% to 5% of the 99% OBW and the VBW is set to 3 times of the RBW.
6. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.

Minimum 6dB Bandwidth	Maximum 99% Occupied Bandwidth
	

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

3.2 Output Power Measurement

3.2.1 Limit of Output Power

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

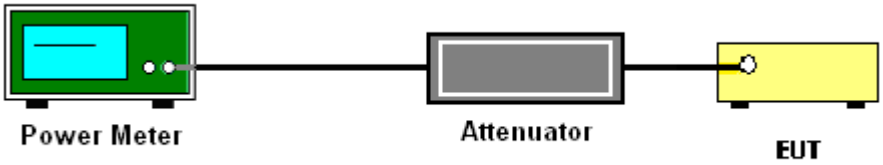
3.2.2 Measuring Instruments

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 ANSI C63.10-2013 clause 11.9.1.3 PKPM1 Peak power meter or ANSI C63.10-2013 clause 11.9.2.3.1 Method AVGPM 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.

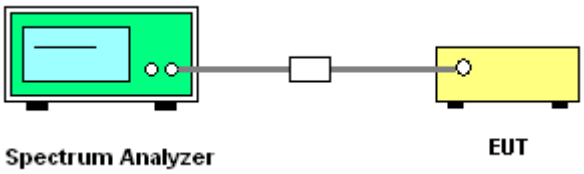
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 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.

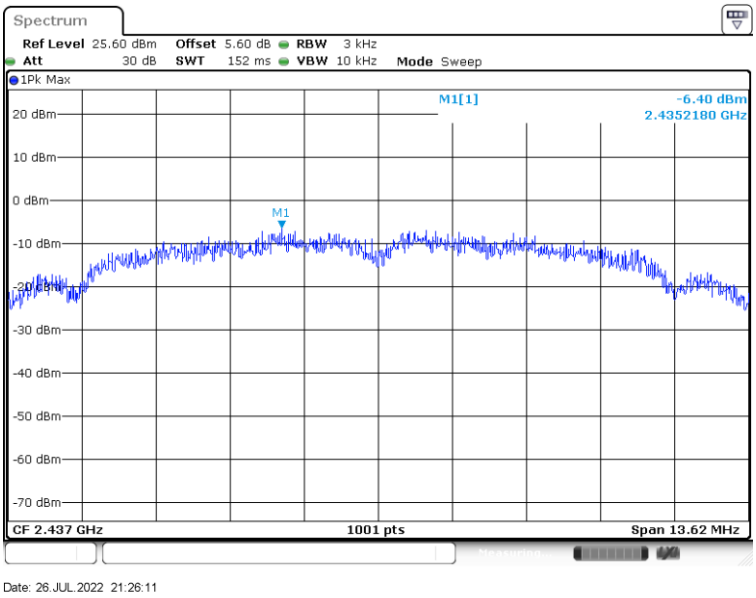
3.3.4 Test Setup



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.

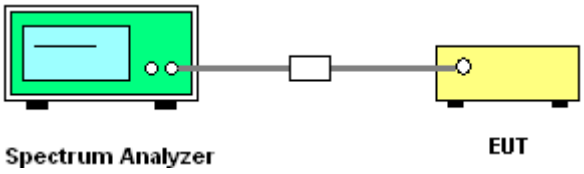
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.13
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

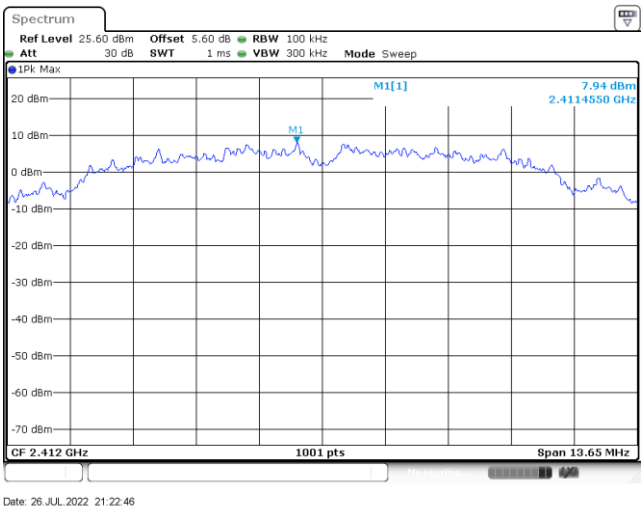


3.4.5 Test Result of Conducted Band Edges and Spurious Emission

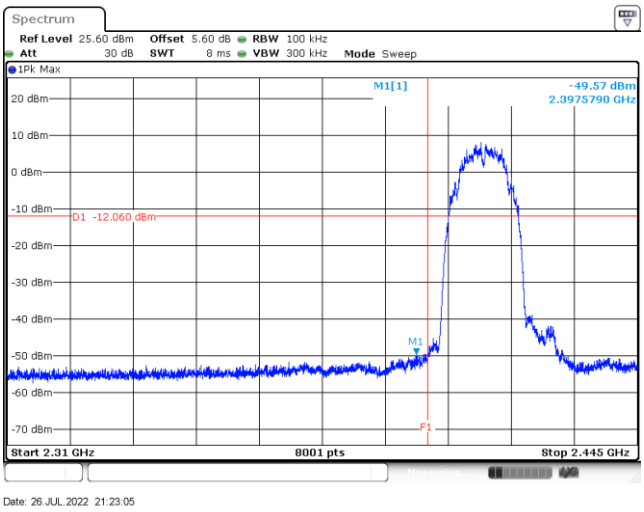
Test Engineer :	Jacob Zhang	**Temperature :**	21~25℃
		Relative Humidity :	51~54%

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

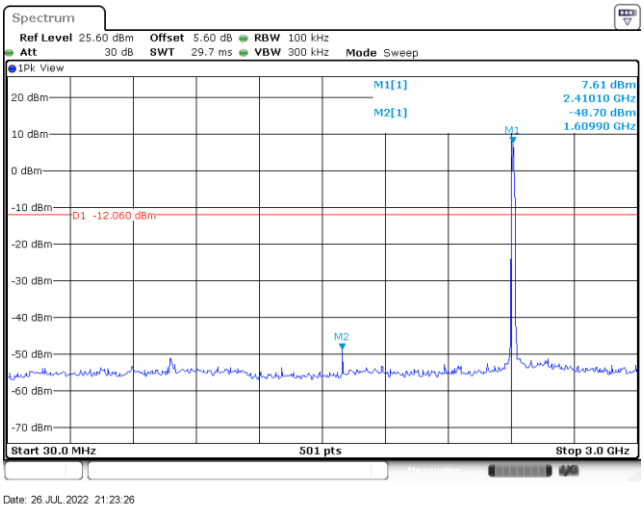
100kHz PSD reference Level



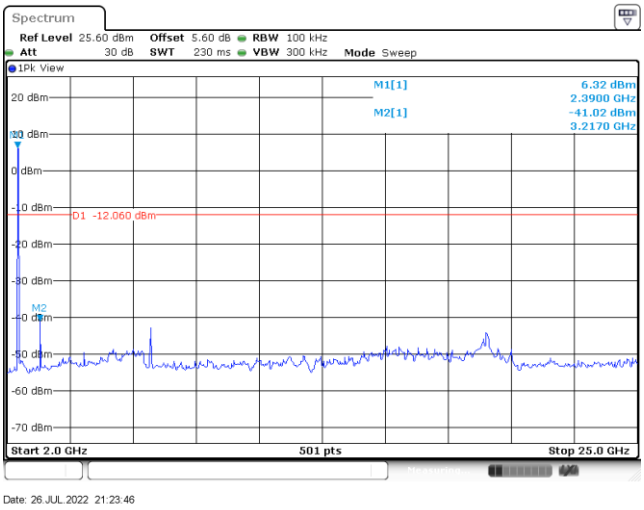
Channel Plot



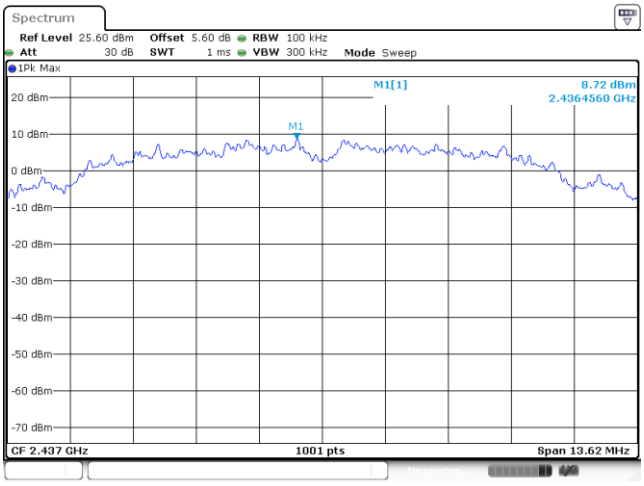
Spurious Emission 30MHz~3GHz

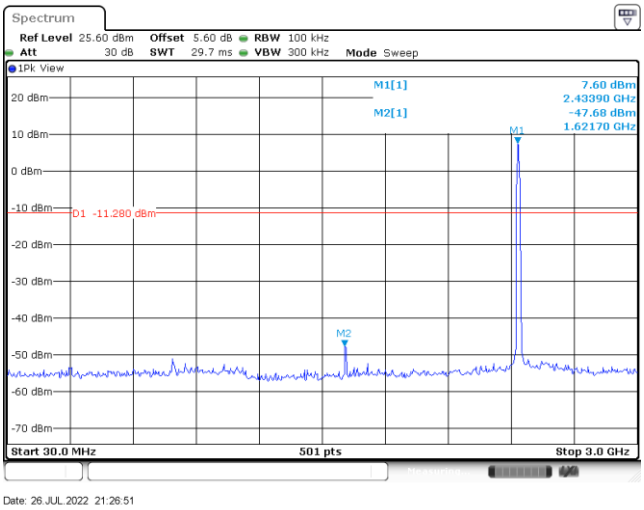
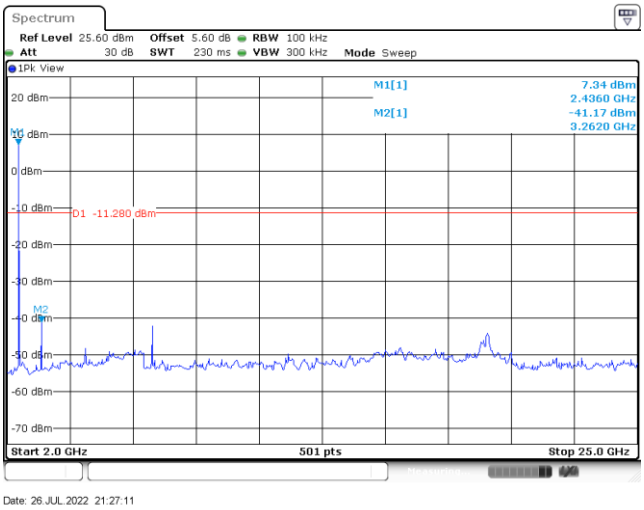


Spurious Emission 2GHz~25GHz

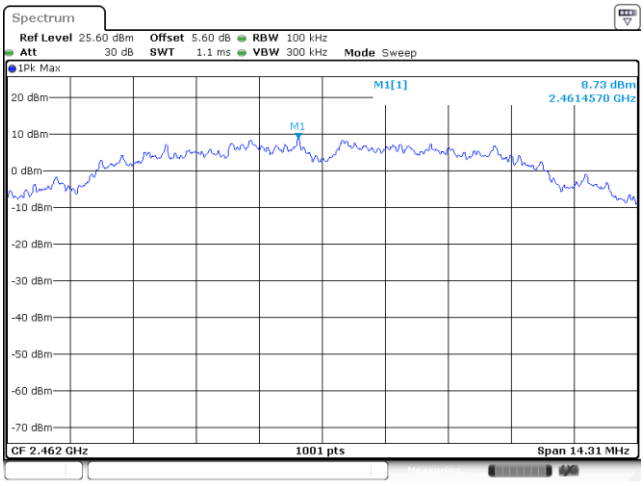
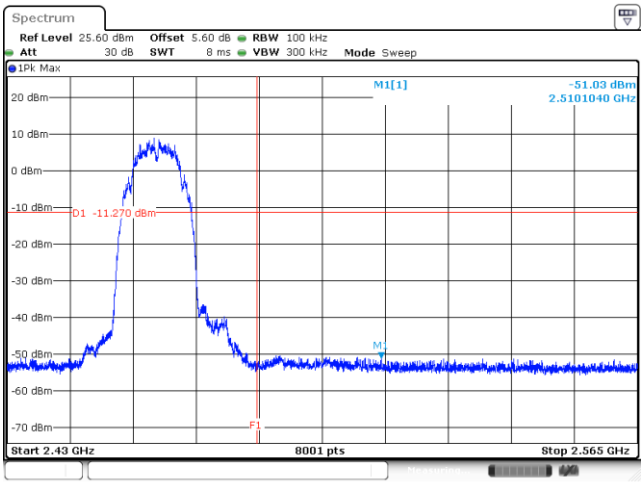
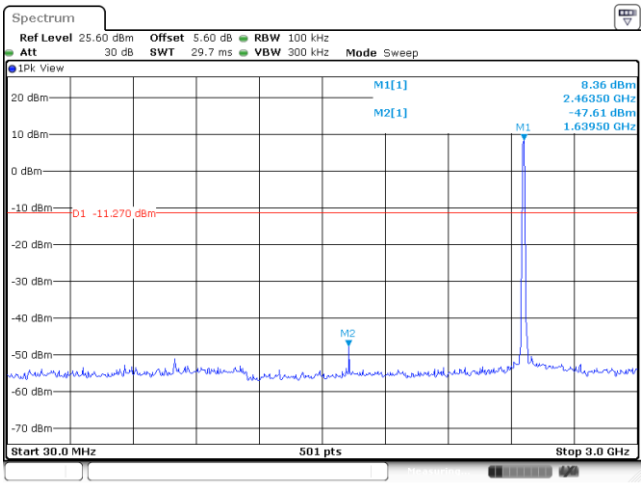
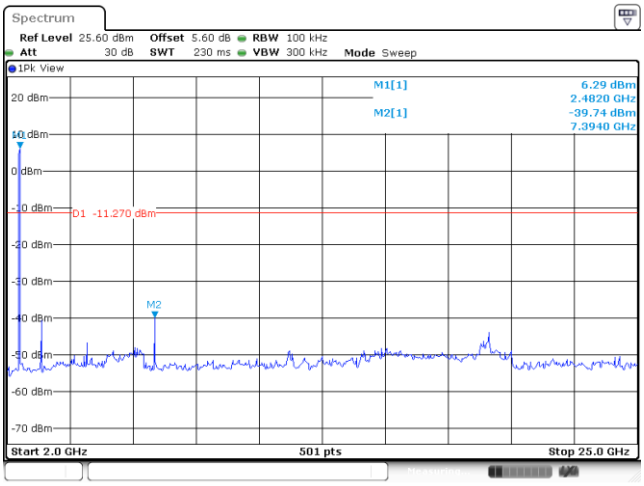


Test Mode :	802.11b	Test Channel :	06

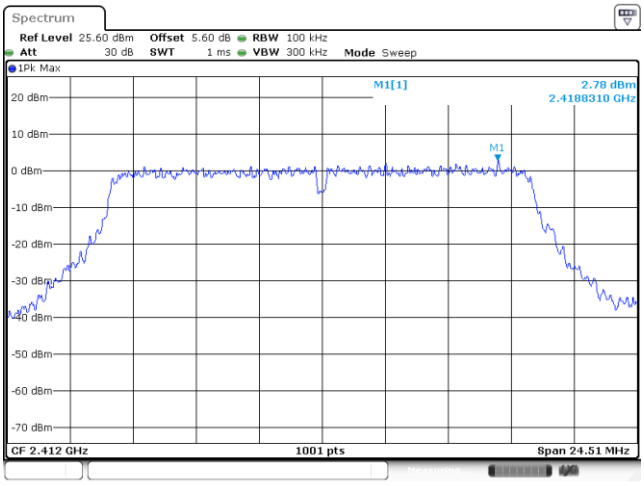
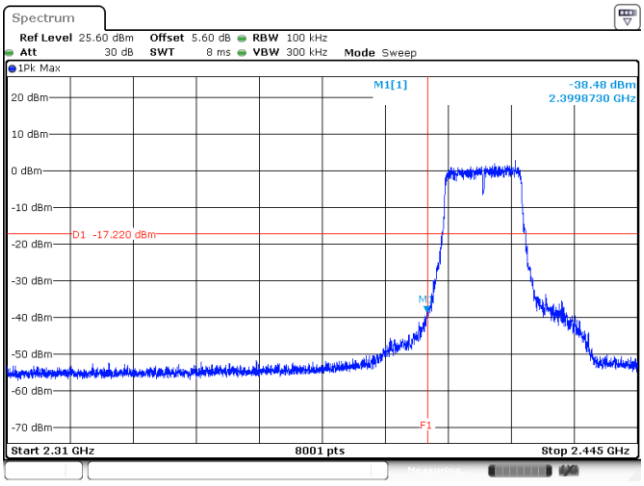
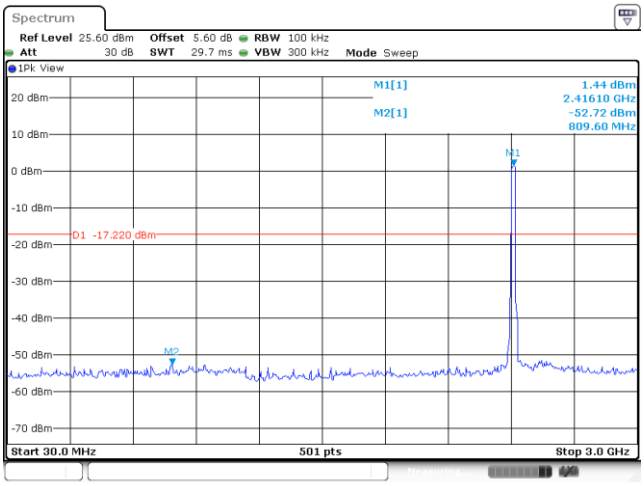
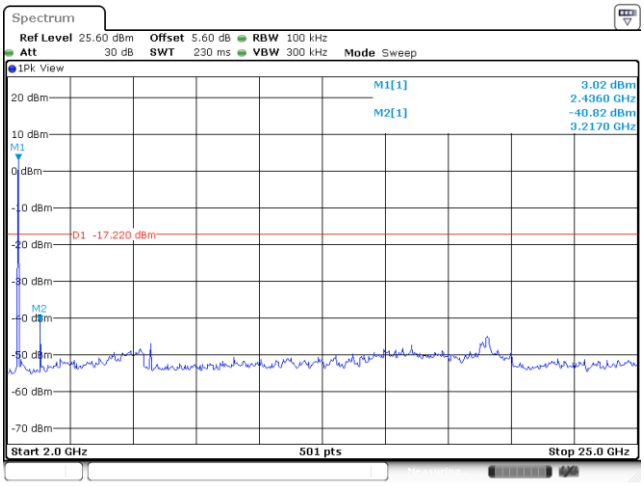
100kHz PSD reference Level	Channel Plot
	

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

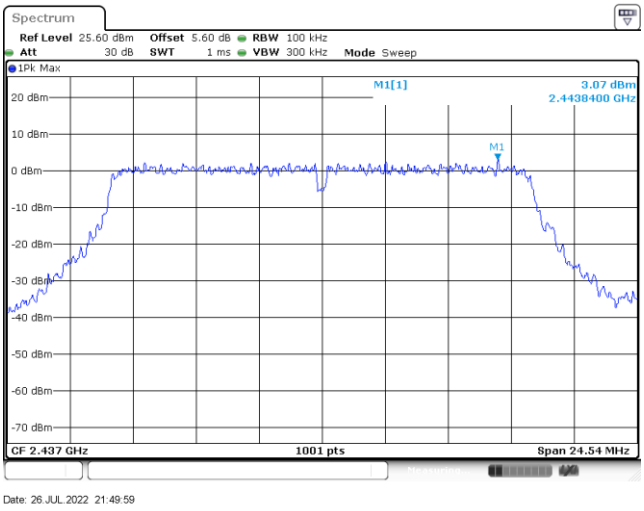
Test Mode :	802.11b	Test Channel :	11

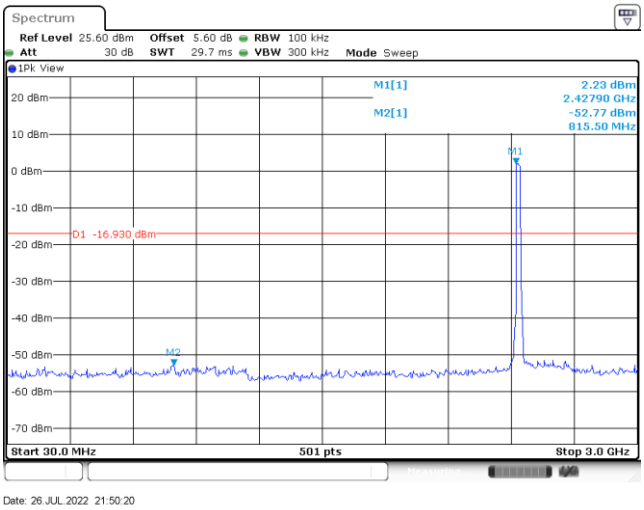
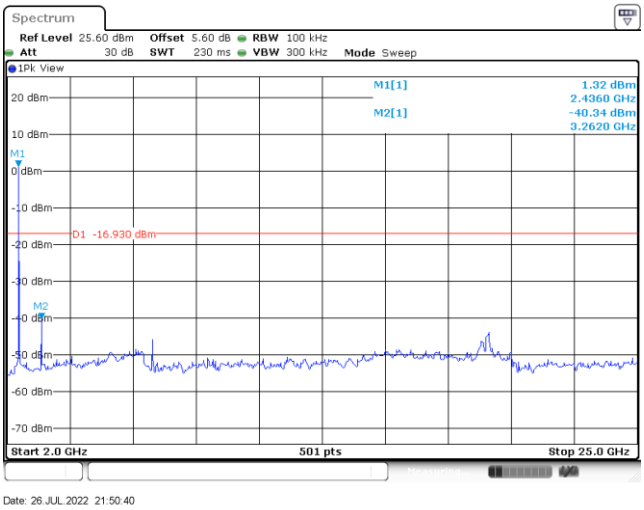
100kHz PSD reference Level	Channel Plot
	
Date: 26.JUL.2022 21:43:02	Date: 26.JUL.2022 21:43:21
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 26.JUL.2022 21:43:41	Date: 26.JUL.2022 21:44:01

Test Mode :	802.11g	Test Channel :	01

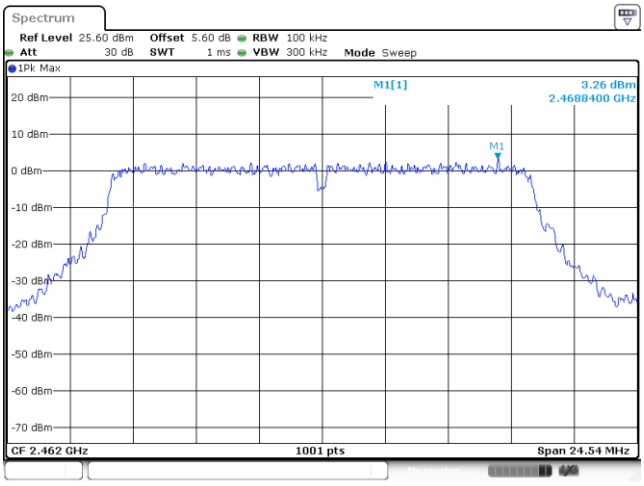
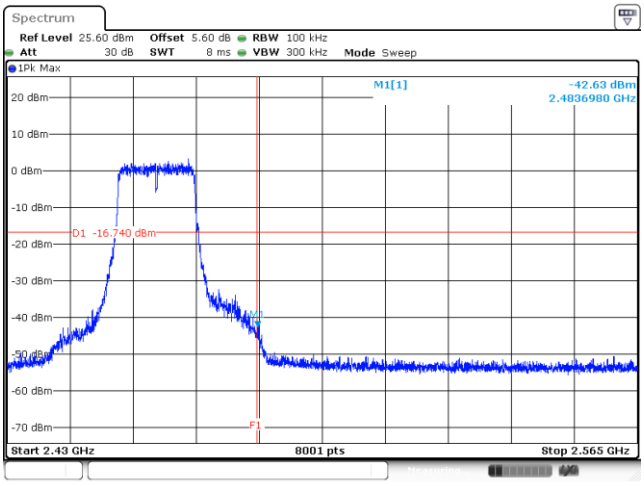
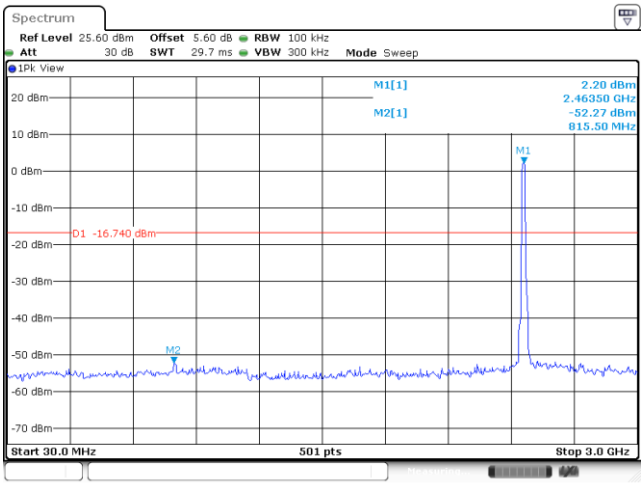
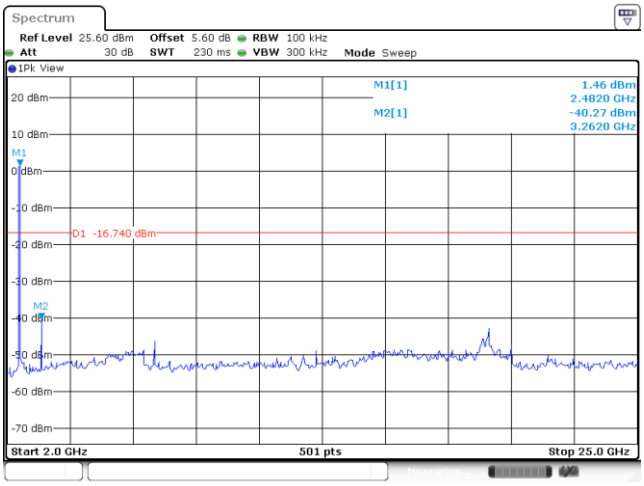
100kHz PSD reference Level	Channel Plot
	
Date: 26.JUL.2022 21:46:24	Date: 26.JUL.2022 21:46:42
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 26.JUL.2022 21:47:03	Date: 26.JUL.2022 21:47:23

Test Mode :	802.11g	Test Channel :	06

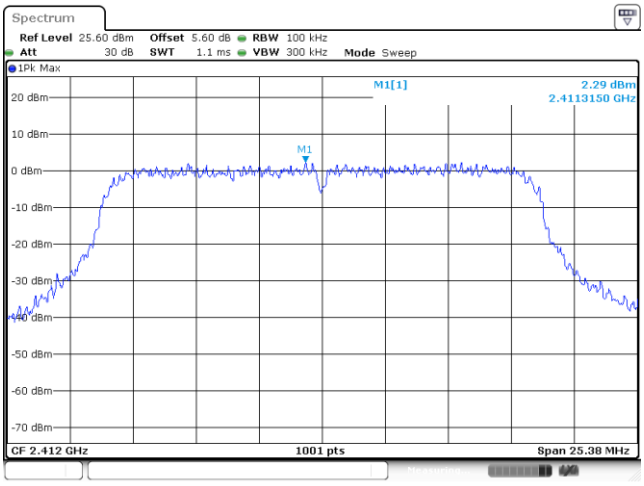
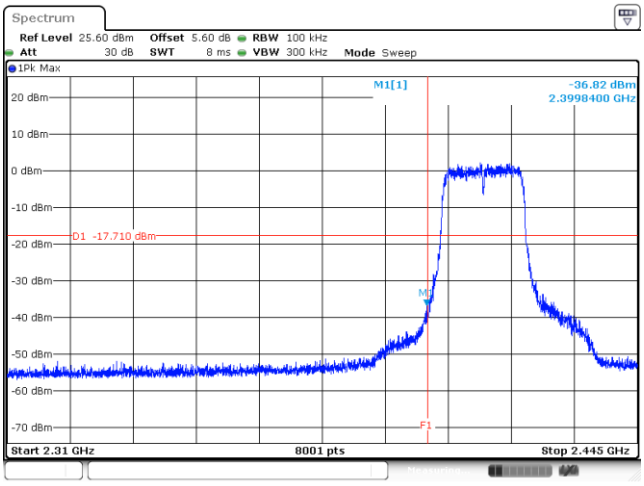
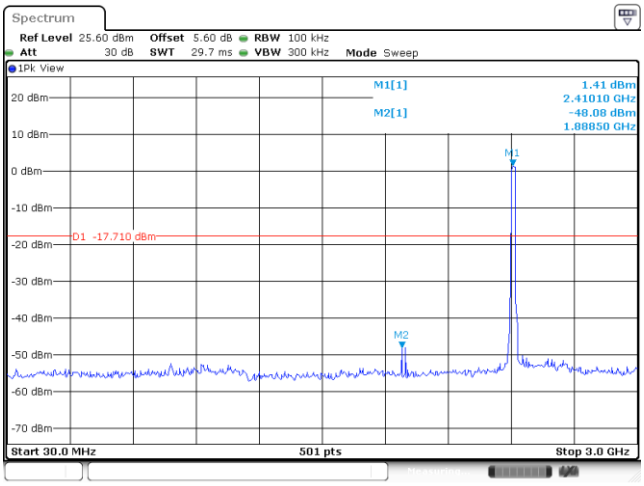
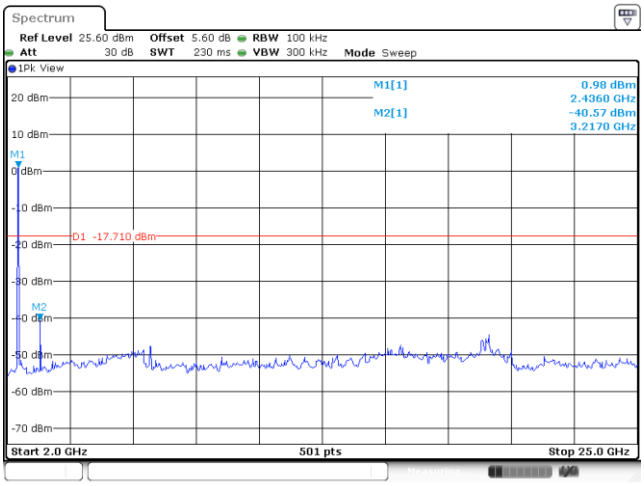
100kHz PSD reference Level	Channel Plot
	

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

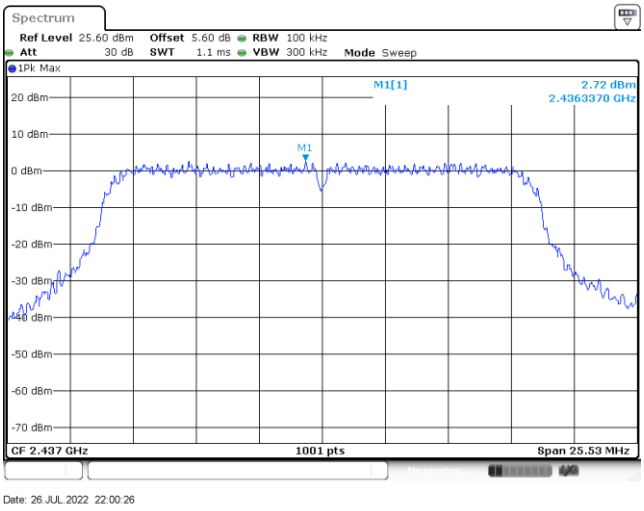
Test Mode :	802.11g	Test Channel :	11

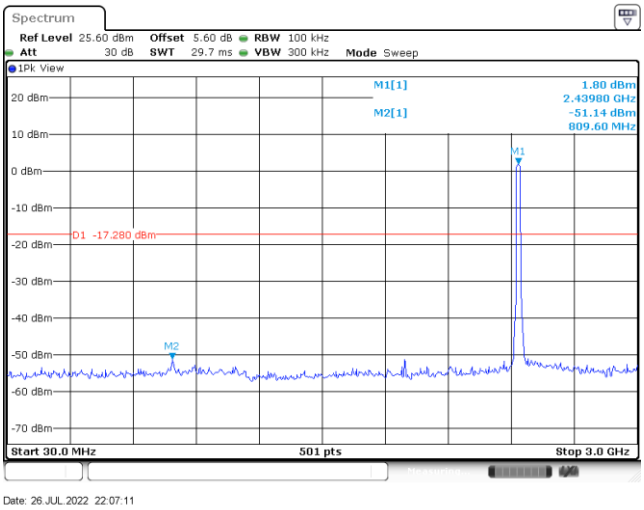
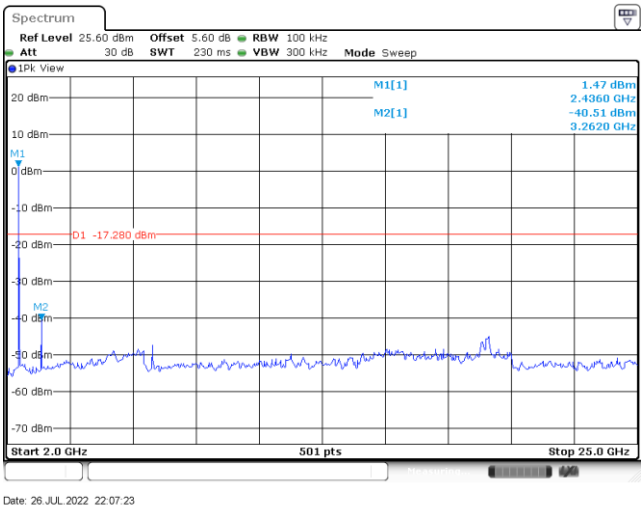
100kHz PSD reference Level	Channel Plot
	
Date: 26.JUL.2022 21:52:55	Date: 26.JUL.2022 21:53:14
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 26.JUL.2022 21:53:34	Date: 26.JUL.2022 21:53:54

Test Mode :	802.11n HT20	Test Channel :	01

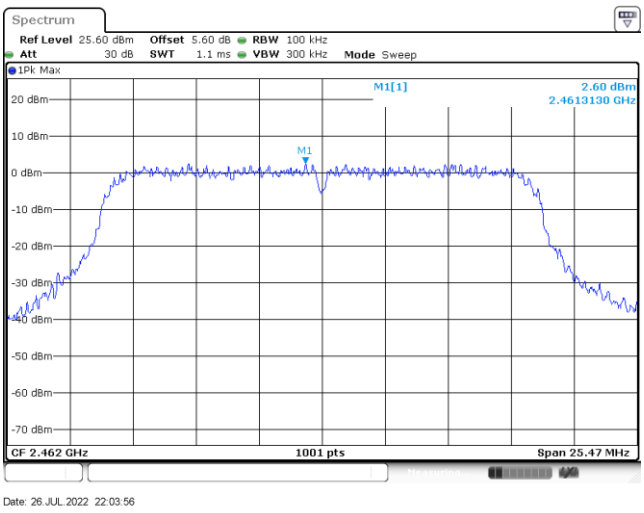
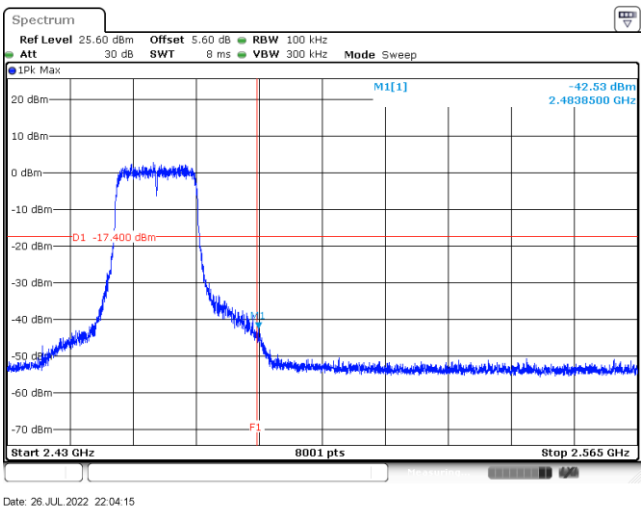
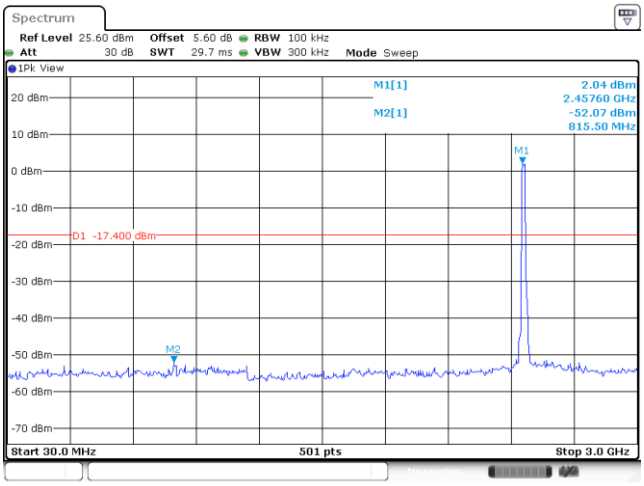
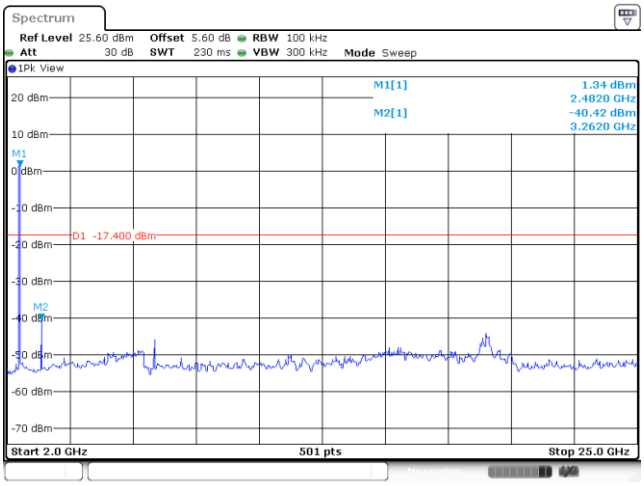
100kHz PSD reference Level	Channel Plot
	
Date: 26.JUL.2022 21:57:49	Date: 26.JUL.2022 21:58:08
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 26.JUL.2022 21:58:29	Date: 26.JUL.2022 21:58:49

Test Mode :	802.11n HT20	Test Channel :	06

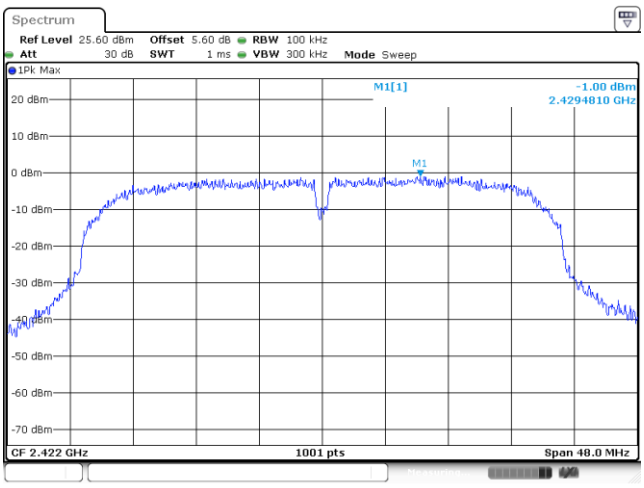
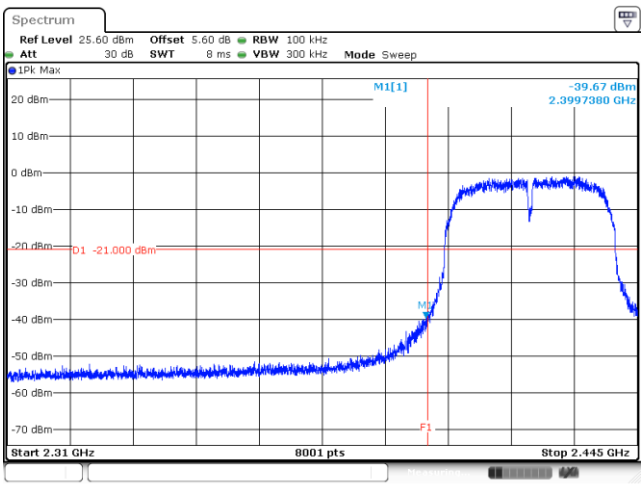
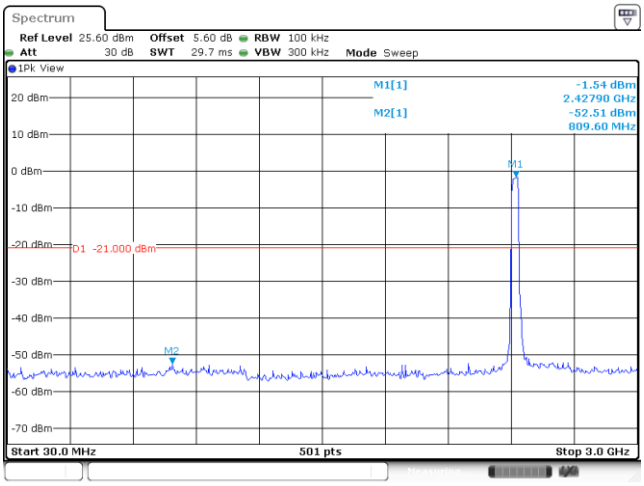
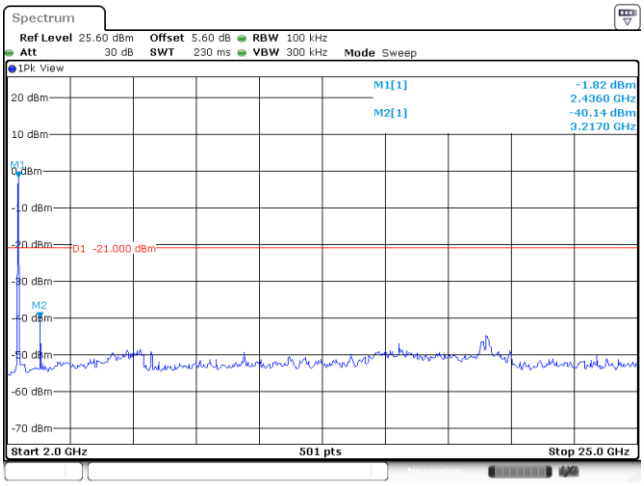
100kHz PSD reference Level	Channel Plot
	

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

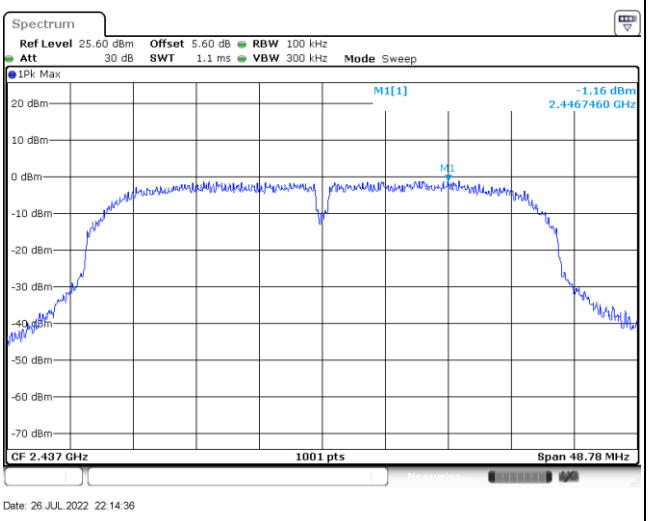
Test Mode :	802.11n HT20	Test Channel :	11

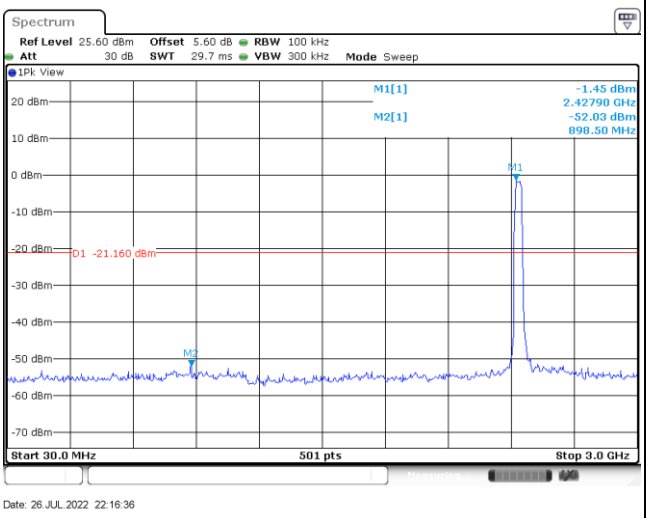
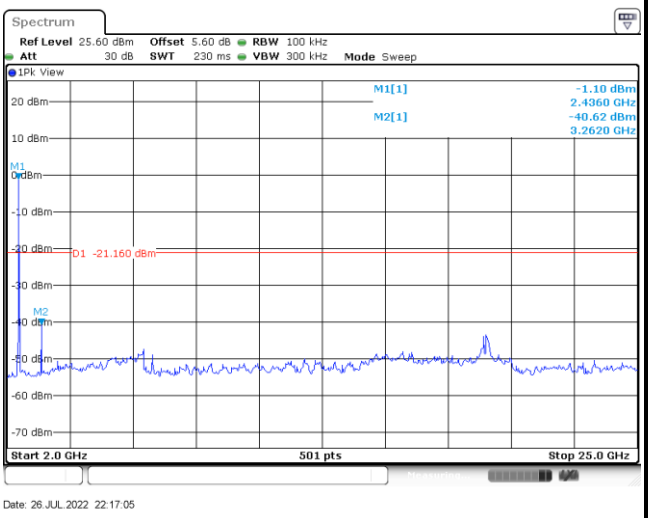
100kHz PSD reference Level	Channel Plot
	
Date: 26.JUL.2022 22:03:56	Date: 26.JUL.2022 22:04:15
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 26.JUL.2022 22:04:36	Date: 26.JUL.2022 22:04:56

Test Mode :	802.11n HT40	Test Channel :	03

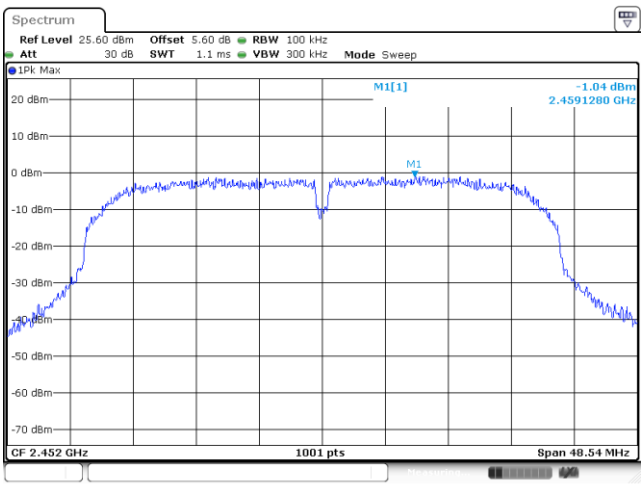
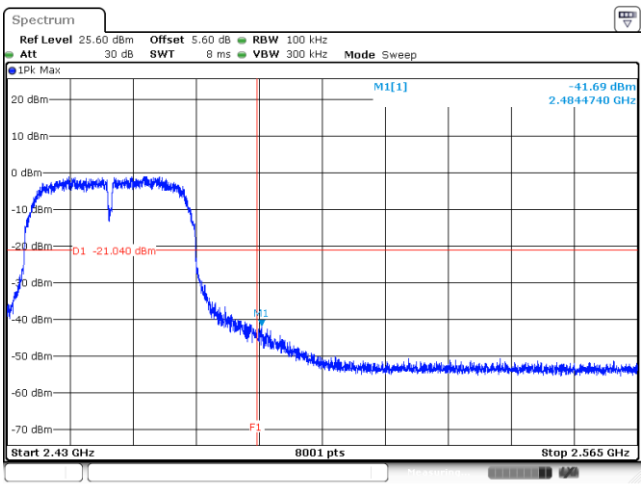
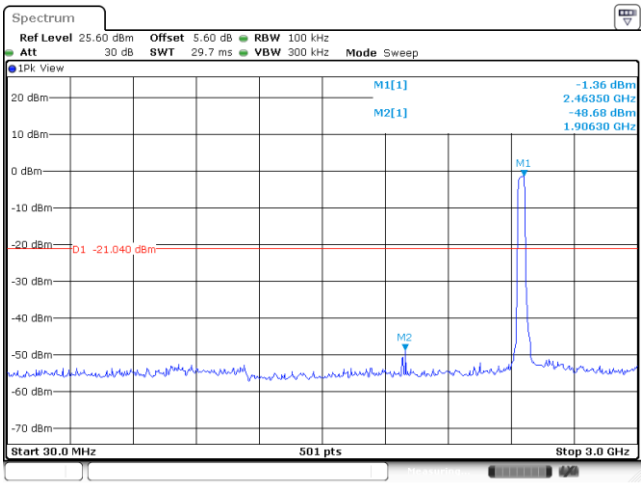
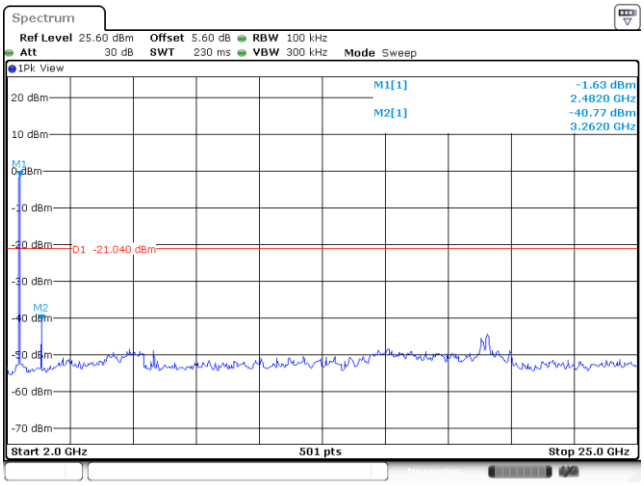
100kHz PSD reference Level	Channel Plot
	
Date: 26.JUL.2022 22:10:52	Date: 26.JUL.2022 22:11:11
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 26.JUL.2022 22:11:32	Date: 26.JUL.2022 22:11:52

Test Mode :	802.11n HT40	Test Channel :	06

100kHz PSD reference Level	Channel Plot
	

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

Test Mode :	802.11n HT40	Test Channel :	09

100kHz PSD reference Level	Channel Plot
	
Date: 26.JUL.2022 22:18:34	Date: 26.JUL.2022 22:18:53
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 26.JUL.2022 22:19:14	Date: 26.JUL.2022 22:19:34

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

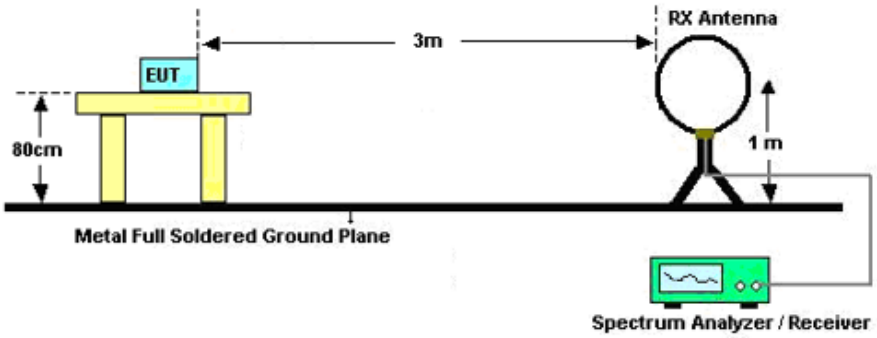
The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

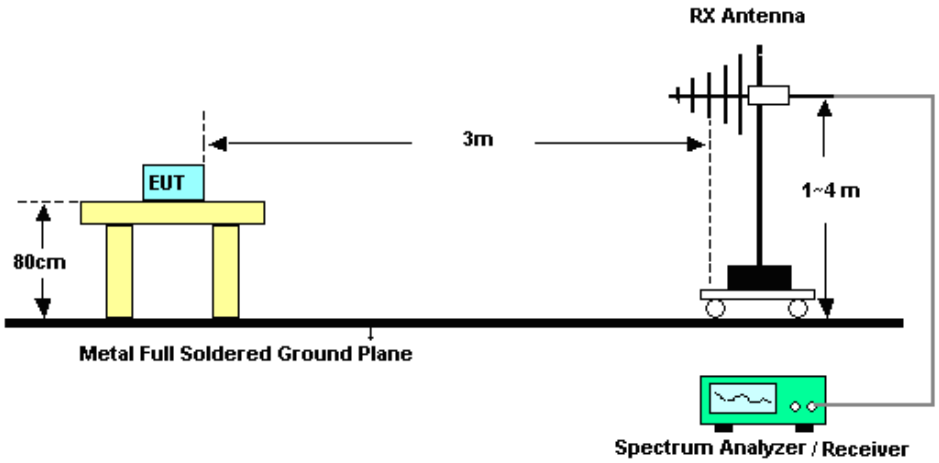
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better 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 peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

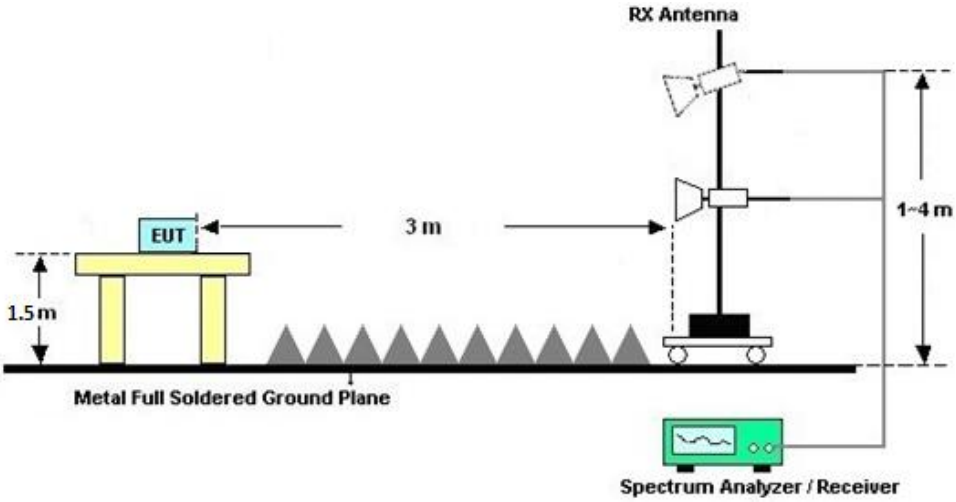
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

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

There is a comparison data of both open-field test site and semi-Anechoic chamber, 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 or 40GHz, whichever is lower)

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.

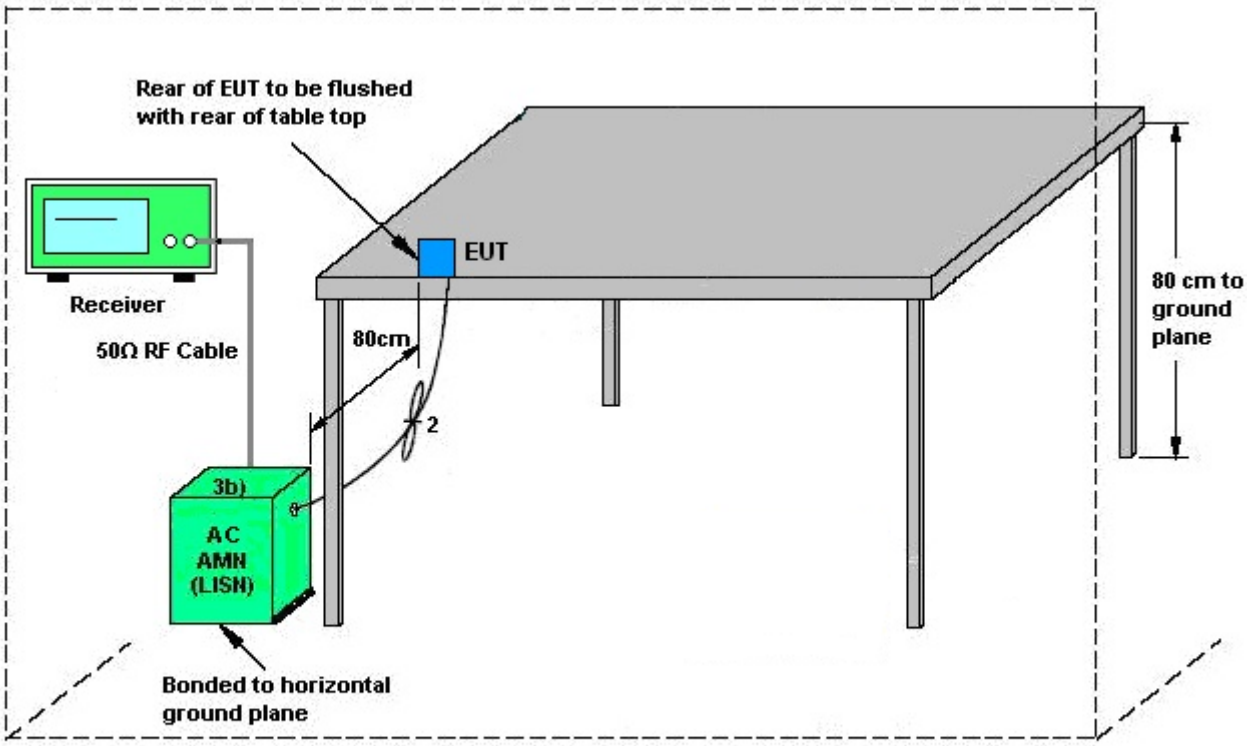
3.6.2 Measuring Instruments

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



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

3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.7 Antenna Requirements

3.7.1 Standard Applicable

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

3.7.2 Antenna Anti-Replacement Construction

Non-standard antenna connector 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
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 14, 2021	Jul. 26, 2022	Oct. 13, 2022	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 05, 2022	Jul. 26, 2022	Jan. 04, 2023	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 05, 2022	Jul. 26, 2022	Jan. 04, 2023	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY56400004	3Hz~8.5GHz;Max 30dBm	Oct. 16, 2021	Aug. 08, 2022	Oct. 15, 2022	Radiation (03CH05-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150244	10Hz-44G,MAX 30dB	Mar. 24, 2022	Aug. 08, 2022	Mar. 23, 2023	Radiation (03CH05-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 30, 2021	Aug. 08, 2022	Oct. 29, 2022	Radiation (03CH05-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz-1GHz	May 24, 2022	Aug. 08, 2022	May 23, 2023	Radiation (03CH05-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75957	1GHz~18GHz	Nov. 08, 2021	Aug. 08, 2022	Nov. 07, 2022	Radiation (03CH05-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 05, 2022	Aug. 08, 2022	Jan. 04, 2023	Radiation (03CH05-KS)
Amplifier	SONOMA	310N	380826	9KHz-1GHz	Jul. 11, 2022	Aug. 08, 2022	Jul. 10, 2023	Radiation (03CH05-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 05, 2022	Aug. 08, 2022	Jan. 04, 2023	Radiation (03CH05-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2012228	1Ghz-18Ghz	Oct. 16, 2021	Aug. 08, 2022	Oct. 15, 2022	Radiation (03CH05-KS)
Amplifier	Keysight	83017A	MY53270316	500MHz~26.5GHz	Oct. 16, 2021	Aug. 08, 2022	Oct. 15, 2022	Radiation (03CH05-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Aug. 08, 2022	NCR	Radiation (03CH05-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Aug. 08, 2022	NCR	Radiation (03CH05-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Aug. 08, 2022	NCR	Radiation (03CH05-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 24, 2022	Jul. 27, 2022	May 23, 2023	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 14, 2021	Jul. 27, 2022	Oct. 13, 2022	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 24, 2022	Jul. 27, 2022	May 23, 2023	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 14, 2021	Jul. 27, 2022	Oct. 13, 2022	Conduction (CO01-KS)

NCR: No Calibration Required

5 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Test Item	Uncertainty
Conducted Power	±0.56 dB
Conducted Emissions	±0.92 dB
Occupied Channel Bandwidth	±0.03 %
Conducted Power Spectral Density	±0.54 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.94dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0dB

---------- THE END ----------

Appendix A. Conducted Test Results

Report Number : FR263001C

A1 - DTS Part

Test Engineer:	Jacob Zhang	Temperature:	21~25	°C
Test Date:	2022/7/26	Relative Humidity:	51~54	%

Report Number : FR263001C

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

2.4GHz Band								
Mod.	Data Rate	N_{TX}	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
11b	1Mbps	1	1	2412	13.19	9.10	0.50	Pass
11b	1Mbps	1	6	2437	13.24	9.08	0.50	Pass
11b	1Mbps	1	11	2462	13.19	9.54	0.50	Pass
11g	6Mbps	1	1	2412	16.88	16.34	0.50	Pass
11g	6Mbps	1	6	2437	16.93	16.36	0.50	Pass
11g	6Mbps	1	11	2462	16.88	16.36	0.50	Pass
HT20	MCS0	1	1	2412	17.43	16.92	0.50	Pass
HT20	MCS0	1	6	2437	17.43	17.02	0.50	Pass
HT20	MCS0	1	11	2462	17.43	16.98	0.50	Pass
HT40	MCS0	1	3	2422	33.97	32.00	0.50	Pass
HT40	MCS0	1	6	2437	34.17	32.52	0.50	Pass
HT40	MCS0	1	9	2452	34.27	32.36	0.50	Pass

Report Number : FR263001C

TEST RESULTS DATA
Peak Power Table

2.4GHz Band										
Mod.	Data Rate	N_{TX}	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
11b	1Mbps	1	1	2412	20.07	30.00	3.26	23.33	36.00	Pass
11b	1Mbps	1	6	2437	21.06	30.00	3.26	24.32	36.00	Pass
11b	1Mbps	1	11	2462	21.09	30.00	3.26	24.35	36.00	Pass
11g	6Mbps	1	1	2412	21.64	30.00	3.26	24.90	36.00	Pass
11g	6Mbps	1	6	2437	22.38	30.00	3.26	25.64	36.00	Pass
11g	6Mbps	1	11	2462	22.04	30.00	3.26	25.30	36.00	Pass
HT20	MCS0	1	1	2412	22.22	30.00	3.26	25.48	36.00	Pass
HT20	MCS0	1	6	2437	22.70	30.00	3.26	25.96	36.00	Pass
HT20	MCS0	1	11	2462	22.32	30.00	3.26	25.58	36.00	Pass
HT40	MCS0	1	3	2422	21.87	30.00	3.26	25.13	36.00	Pass
HT40	MCS0	1	6	2437	21.90	30.00	3.26	25.16	36.00	Pass
HT40	MCS0	1	9	2452	21.72	30.00	3.26	24.98	36.00	Pass

Report Number : FR263001C

TEST RESULTS DATA
Average Power Table
(Reporting Only)

2.4GHz Band						
Mod.	Data Rate	N_{TX}	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
11b	1Mbps	1	1	2412	0.00	17.02
11b	1Mbps	1	6	2437	0.00	18.14
11b	1Mbps	1	11	2462	0.00	18.10
11g	6Mbps	1	1	2412	0.00	15.95
11g	6Mbps	1	6	2437	0.00	16.84
11g	6Mbps	1	11	2462	0.00	16.57
HT20	MCS0	1	1	2412	0.00	15.96
HT20	MCS0	1	6	2437	0.00	16.65
HT20	MCS0	1	11	2462	0.00	16.06
HT40	MCS0	1	3	2422	0.00	15.72
HT40	MCS0	1	6	2437	0.00	16.01
HT40	MCS0	1	9	2452	0.00	15.66

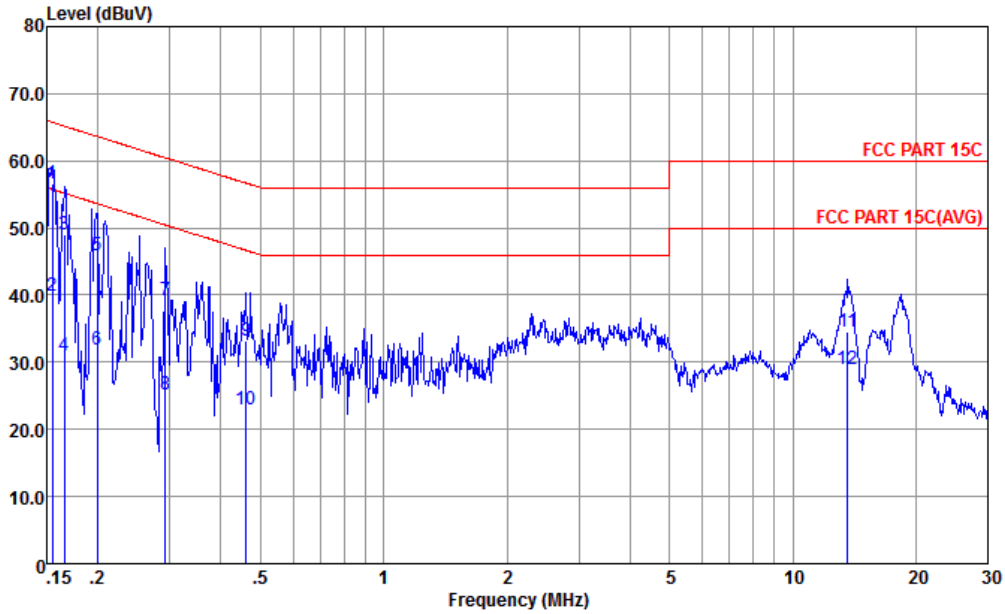
Report Number : FR263001C

TEST RESULTS DATA
Peak Power Density

2.4GHz Band								
Mod.	Data Rate	N_{TX}	CH.	Freq. (MHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
11b	1Mbps	1	1	2412	-7.31	3.26	8.00	Pass
11b	1Mbps	1	6	2437	-6.40	3.26	8.00	Pass
11b	1Mbps	1	11	2462	-6.51	3.26	8.00	Pass
11g	6Mbps	1	1	2412	-12.73	3.26	8.00	Pass
11g	6Mbps	1	6	2437	-12.49	3.26	8.00	Pass
11g	6Mbps	1	11	2462	-12.29	3.26	8.00	Pass
HT20	MCS0	1	1	2412	-12.18	3.26	8.00	Pass
HT20	MCS0	1	6	2437	-11.90	3.26	8.00	Pass
HT20	MCS0	1	11	2462	-12.04	3.26	8.00	Pass
HT40	MCS0	1	3	2422	-13.72	3.26	8.00	Pass
HT40	MCS0	1	6	2437	-13.47	3.26	8.00	Pass
HT40	MCS0	1	9	2452	-13.28	3.26	8.00	Pass

Appendix B. AC Conducted Emission Test Results

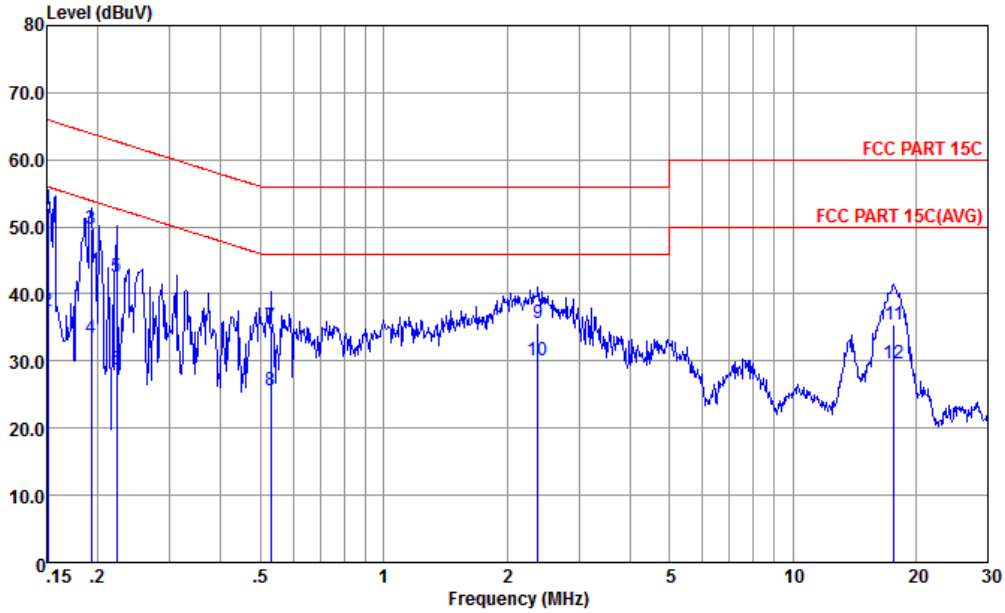
Test Engineer :	Amos Zhang	**Temperature :**	25.3~26.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS
Condition : FCC PART 15C LISN-060105-L LINE

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	*	0.155	56.69	-9.05	65.74	46.20	0.02	10.47	QP
2		0.155	39.79	-15.95	55.74	29.30	0.02	10.47	Average
3		0.166	49.07	-16.09	65.16	38.60	0.03	10.44	QP
4		0.166	31.07	-24.09	55.16	20.60	0.03	10.44	Average
5		0.200	46.01	-17.61	63.62	35.61	0.04	10.36	QP
6		0.200	31.91	-21.71	53.62	21.51	0.04	10.36	Average
7		0.292	39.18	-21.28	60.46	28.80	0.07	10.31	QP
8		0.292	25.18	-25.28	50.46	14.80	0.07	10.31	Average
9		0.461	33.14	-23.53	56.67	22.79	0.10	10.25	QP
10		0.461	22.94	-23.73	46.67	12.59	0.10	10.25	Average
11		13.623	34.46	-25.54	60.00	23.80	0.28	10.38	QP
12		13.623	28.86	-21.14	50.00	18.20	0.28	10.38	Average

Test Engineer :	Amos Zhang	**Temperature :**	25.3~26.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	**Phase :**	Neutral
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS
Condition : FCC PART 15C LISN-060105-N NEUTRAL

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	*	0.151	52.79	-13.17	65.96	42.20	0.11	10.48	QP
2		0.151	37.49	-18.47	55.96	26.90	0.11	10.48	Average
3		0.192	49.68	-14.25	63.93	39.20	0.10	10.38	QP
4		0.192	33.38	-20.55	53.93	22.90	0.10	10.38	Average
5		0.222	42.65	-20.09	62.74	32.20	0.10	10.35	QP
6		0.222	28.65	-24.09	52.74	18.20	0.10	10.35	Average
7		0.529	35.25	-20.75	56.00	24.90	0.11	10.24	QP
8		0.529	25.65	-20.35	46.00	15.30	0.11	10.24	Average
9		2.384	35.58	-20.42	56.00	25.21	0.14	10.23	QP
10		2.384	29.98	-16.02	46.00	19.61	0.14	10.23	Average
11		17.661	35.51	-24.49	60.00	24.63	0.43	10.45	QP
12		17.661	29.68	-20.32	50.00	18.80	0.43	10.45	Average

Note:

1. Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
2. Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)

Appendix C. Radiated Spurious Emission

Test Engineer :	Carry Xu	**Temperature :**	22~23°C
		Relative Humidity :	41~42%

Channel	Power setting
11b CH01	0
11b CH06	0
11b CH11	0
11g CH01	0
11g CH06	0
11g CH11	1
11n20 CH01	0
11n20 CH06	0
11n20 CH11	2
11n40 CH03	0
11n40 CH06	0
11n40 CH09	1

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2371.1	54.3	-19.7	74	51.24	32.86	7.07	36.87	134	177	P	H
		2371.23	43.47	-10.53	54	40.41	32.86	7.07	36.87	134	177	A	H
	*	2412	114.63	-	-	111.45	32.9	7.13	36.85	134	177	P	H
	*	2412	107.28	-	-	104.1	32.9	7.13	36.85	134	177	A	H
		2380.33	53.4	-20.6	74	50.31	32.86	7.1	36.87	392	232	P	V
		2389.43	41.89	-12.11	54	38.77	32.88	7.1	36.86	392	232	A	V
	*	2410	111.97	-	-	108.79	32.9	7.13	36.85	392	232	P	V
	*	2410	104.55	-	-	101.37	32.9	7.13	36.85	392	232	A	V
802.11b CH 11 2462MHz		2483.68	53.61	-20.39	74	50.2	32.98	7.25	36.82	268	183	P	H
		2484.52	43.73	-10.27	54	40.32	32.98	7.25	36.82	268	183	A	H
	*	2460	114.78	-	-	111.43	32.96	7.22	36.83	268	183	P	H
	*	2460	107.22	-	-	103.87	32.96	7.22	36.83	268	183	A	H
		2483.86	52.72	-21.28	74	49.31	32.98	7.25	36.82	379	224	P	V
		2483.5	42.65	-11.35	54	39.24	32.98	7.25	36.82	379	224	A	V
	*	2460	111.25	-	-	107.9	32.96	7.22	36.83	379	224	P	V
	*	2462	103.78	-	-	100.43	32.96	7.22	36.83	379	224	A	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		3210	52.17	-34.09	86.26	75.58	33.02	8.3	64.73	300	0	P	H
		4830	48.22	-25.78	74	69.15	34.2	10.25	65.38	300	0	P	H
		3210	49.52	-35.88	85.40	72.93	33.02	8.3	64.73	100	0	P	V
		4830	43.88	-30.12	74	64.81	34.2	10.25	65.38	100	0	P	V
802.11b CH 06 2437MHz		3255	51.62	-34.84	86.46	74.96	33	8.37	64.71	300	0	P	H
		4875	49.39	-24.61	74	70.29	34.23	10.29	65.42	100	84	P	H
		4875	44.39	-9.61	54	65.29	34.23	10.29	65.42	100	84	A	H
		7305	50.48	-23.52	74	67.81	35.86	12.72	65.91	108	281	P	H
		3255	47.62	-35.78	83.40	70.96	33	8.37	64.71	100	0	P	V
		4875	44.74	-29.26	74	65.64	34.23	10.29	65.42	100	0	P	V
		7305	45.04	-28.96	74	62.37	35.86	12.72	65.91	100	0	P	V
802.11b CH 11 2462MHz		3285	51.7	-35.6	87.30	75.03	32.99	8.39	64.71	300	0	P	H
		4920	46.89	-27.11	74	67.74	34.26	10.34	65.45	300	0	P	H
		7380	48.45	-25.55	74	65.95	35.88	12.73	66.11	300	0	P	H
		4920	44.42	-29.58	74	65.27	34.26	10.34	65.45	100	0	P	V
		7380	45.94	-28.06	74	63.44	35.88	12.73	66.11	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. Non-restricted frequency bands limit is 100KHz PSD down 20dB												

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		2389.3	58.51	-15.49	74	55.39	32.88	7.1	36.86	311	275	P	H
		2389.95	48.16	-5.84	54	45.04	32.88	7.1	36.86	311	275	A	H
	*	2412	110.26	-	-	107.08	32.9	7.13	36.85	311	275	P	H
	*	2418	102.91	-	-	99.7	32.9	7.16	36.85	311	275	A	H
		2389.43	57.49	-16.51	74	54.37	32.88	7.1	36.86	391	227	P	V
		2389.95	47.25	-6.75	54	44.13	32.88	7.1	36.86	391	227	A	V
	*	2406	108.48	-	-	105.3	32.9	7.13	36.85	391	227	P	V
	*	2408	101.04	-	-	97.86	32.9	7.13	36.85	391	227	A	V
802.11g CH 11 2462MHz		2483.74	62.82	-11.18	74	59.41	32.98	7.25	36.82	159	182	P	H
		2483.5	52.49	-1.51	54	49.08	32.98	7.25	36.82	159	182	A	H
	*	2456	111.17	-	-	107.82	32.96	7.22	36.83	159	182	P	H
	*	2456	103.52	-	-	100.17	32.96	7.22	36.83	159	182	A	H
		2483.74	61.95	-12.05	74	58.54	32.98	7.25	36.82	376	219	P	V
		2483.5	51.42	-2.58	54	48.01	32.98	7.25	36.82	376	219	A	V
	*	2456	108.59	-	-	105.24	32.96	7.22	36.83	376	219	P	V
	*	2456	100.9	-	-	97.55	32.96	7.22	36.83	376	219	A	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		3210	52.11	-31.13	83.24	75.52	33.02	8.3	64.73	300	0	P	H
		4830	43.71	-30.29	74	64.64	34.2	10.25	65.38	300	0	P	H
		3210	49.74	-31.21	80.95	73.15	33.02	8.3	64.73	100	0	P	V
		4830	40.84	-33.16	74	61.77	34.2	10.25	65.38	100	0	P	V
802.11g CH 06 2437MHz		3255	48.9	-32.57	81.47	105.24	0	8.37	64.71	300	0	P	H
		4875	43.28	-30.72	74	64.18	34.23	10.29	65.42	300	0	P	H
		7320	47.44	-26.56	74	64.81	35.87	12.72	65.96	300	0	P	H
		3255	47.19	-29.98	77.17	70.53	33	8.37	64.71	100	0	P	V
		4875	42.11	-31.89	74	63.01	34.23	10.29	65.42	100	0	P	V
		7305	43.47	-30.53	74	60.8	35.86	12.72	65.91	100	0	P	V
802.11g CH 11 2462MHz		3285	48.79	-32.48	81.27	72.12	32.99	8.39	64.71	300	0	P	H
		4920	42.72	-31.28	74	63.57	34.26	10.34	65.45	300	0	P	H
		7395	47.2	-26.8	74	64.75	35.88	12.73	66.16	300	0	P	H
		4920	40.72	-33.28	74	61.57	34.26	10.34	65.45	100	0	P	V
		7380	43.01	-30.99	74	60.51	35.88	12.73	66.11	100	0	P	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		2389.69	61.07	-12.93	74	57.95	32.88	7.1	36.86	135	175	P	H
		2389.95	49.03	-4.97	54	45.91	32.88	7.1	36.86	135	175	A	H
	*	2416	111.75	-	-	108.54	32.9	7.16	36.85	135	175	P	H
	*	2418	103.66	-	-	100.45	32.9	7.16	36.85	135	175	A	H
		2389.69	59.52	-14.48	74	56.4	32.88	7.1	36.86	391	228	P	V
		2389.95	47.68	-6.32	54	44.56	32.88	7.1	36.86	391	228	A	V
	*	2412	108.51	-	-	105.33	32.9	7.13	36.85	391	228	P	V
	*	2406	100.95	-	-	97.77	32.9	7.13	36.85	391	228	A	V
802.11n HT20 CH 11 2462MHz		2483.56	64.49	-9.51	74	61.08	32.98	7.25	36.82	160	174	P	H
		2483.5	52.07	-1.93	54	48.66	32.98	7.25	36.82	160	174	A	H
	*	2458	110.89	-	-	107.54	32.96	7.22	36.83	160	174	P	H
	*	2456	103.48	-	-	100.13	32.96	7.22	36.83	160	174	A	H
		2483.5	63.41	-10.59	74	60	32.98	7.25	36.82	376	214	P	V
		2483.5	50.28	-3.72	54	46.87	32.98	7.25	36.82	376	214	A	V
	*	2454	107.8	-	-	104.45	32.96	7.22	36.83	376	214	P	V
	*	2456	99.93	-	-	96.58	32.96	7.22	36.83	376	214	A	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		3210	52.14	-30.01	82.15	75.55	33.02	8.3	64.73	300	0	P	H
		4830	43.75	-30.25	74	64.68	34.2	10.25	65.38	300	0	P	H
		3210	49.49	-31.5	80.99	72.9	33.02	8.3	64.73	100	0	P	V
		4830	41.16	-32.84	74	62.09	34.2	10.25	65.38	100	0	P	V
802.11n HT20 CH 06 2437MHz		3255	51.03	-31	82.03	74.37	33	8.37	64.71	300	0	P	H
		4875	43.88	-30.12	74	64.78	34.23	10.29	65.42	300	0	P	H
		7305	45.9	-28.1	74	63.23	35.86	12.72	65.91	300	0	P	H
		3255	47.38	-32.86	80.24	70.72	33	8.37	64.71	100	0	P	V
		4875	42.58	-31.42	74	63.48	34.23	10.29	65.42	100	0	P	V
		7305	43.29	-30.71	74	60.62	35.86	12.72	65.91	100	0	P	V
802.11n HT20 CH 11 2462MHz		3285	51.64	-31.21	82.85	74.97	32.99	8.39	64.71	300	0	P	H
		4920	41.72	-32.28	74	62.57	34.26	10.34	65.45	300	0	P	H
		7380	45.6	-28.4	74	63.1	35.88	12.73	66.11	300	0	P	H
		4920	40.97	-33.03	74	61.82	34.26	10.34	65.45	100	0	P	V
		7380	42.49	-31.51	74	59.99	35.88	12.73	66.11	100	0	P	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 HT40 (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 HT40 CH 03 2422MHz		2389.82	61.99	-12.01	74	58.87	32.88	7.1	36.86	163	174	P	H
		2389.04	50.04	-3.96	54	46.92	32.88	7.1	36.86	163	174	A	H
		2499.76	53.86	-20.14	74	50.39	33	7.28	36.81	163	174	P	H
		2496.7	41.67	-12.33	54	38.2	33	7.28	36.81	163	174	A	H
	*	2432	108.78	-	-	105.55	32.92	7.16	36.85	163	174	P	H
	*	2430	100.8	-	-	97.57	32.92	7.16	36.85	163	174	A	H
		2389.69	55.24	-18.76	74	52.12	32.88	7.1	36.86	385	208	P	V
		2389.82	44.4	-9.6	54	41.28	32.88	7.1	36.86	385	208	A	V
		2489.38	50.33	-23.67	74	46.89	33	7.25	36.81	385	208	P	V
		2483.56	39.45	-14.55	54	36.04	32.98	7.25	36.82	385	208	A	V
	*	2432	105.72	-	-	102.49	32.92	7.16	36.85	385	208	P	V
	*	2430	98.09	-	-	94.86	32.92	7.16	36.85	385	208	A	V
802.11n HT40 CH 06 2437MHz		2389.43	57.22	-16.78	74	54.1	32.88	7.1	36.86	163	173	P	H
		2389.69	46.96	-7.04	54	43.84	32.88	7.1	36.86	163	173	A	H
		2492.62	54.64	-19.36	74	51.17	33	7.28	36.81	163	173	P	H
		2492.38	42.38	-11.62	54	38.91	33	7.28	36.81	163	173	A	H
	*	2428	109	-	-	105.77	32.92	7.16	36.85	163	173	P	H
	*	2428	100.52	-	-	97.29	32.92	7.16	36.85	163	173	A	H
		2386.57	52.13	-21.87	74	49.01	32.88	7.1	36.86	337	209	P	V
		2389.95	42.02	-11.98	54	38.9	32.88	7.1	36.86	337	209	A	V
		2490.04	51.9	-22.1	74	48.46	33	7.25	36.81	337	209	P	V
		2483.56	41.48	-12.52	54	38.07	32.98	7.25	36.82	337	209	A	V
	*	2446	106.09	-	-	102.8	32.94	7.19	36.84	337	209	P	V
	*	2446	98.11	-	-	94.82	32.94	7.19	36.84	337	209	A	V
802.11n HT40 CH 09 2452MHz		2388.65	52.67	-21.33	74	49.55	32.88	7.1	36.86	131	175	P	H
		2370.19	41.49	-12.51	54	38.43	32.86	7.07	36.87	131	175	A	H
		2483.56	62.58	-11.42	74	59.17	32.98	7.25	36.82	131	175	P	H
		2483.5	52.4	-1.6	54	48.99	32.98	7.25	36.82	131	175	A	H
	*	2444	108.13	-	-	104.84	32.94	7.19	36.84	131	175	P	H
	*	2444	99.96	-	-	96.67	32.94	7.19	36.84	131	175	A	H

		2384.49	50.63	-23.37	74	47.54	32.86	7.1	36.87	337	207	P	V
		2389.56	40.05	-13.95	54	36.93	32.88	7.1	36.86	337	207	A	V
		2483.74	58.32	-15.68	74	54.91	32.98	7.25	36.82	337	207	P	V
		2483.5	47.86	-6.14	54	44.45	32.98	7.25	36.82	337	207	A	V
	*	2444	106.27	-	-	102.98	32.94	7.19	36.84	337	207	P	V
	*	2444	98.11	-	-	94.82	32.94	7.19	36.84	337	207	A	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 HT40 (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 HT40 CH 03 2422MHz		3225	51.54	-27.22	78.76	74.93	33.01	8.32	64.72	300	0	P	H
		4860	43.46	-30.54	74	64.37	34.22	10.27	65.4	300	0	P	H
		7266	42.99	-31.01	74	60.22	35.86	12.72	65.81	300	0	P	H
		3225	48.71	-28.24	76.95	72.1	33.01	8.32	64.72	100	0	P	V
		4845	41.1	-32.9	74	62.03	34.21	10.25	65.39	100	0	P	V
		7266	42.62	-31.38	74	59.85	35.86	12.72	65.81	100	0	P	V
802.11n HT40 CH 06 2437MHz		3255	51.08	-27.87	78.95	74.42	33	8.37	64.71	300	0	P	H
		4875	42.35	-31.65	74	63.25	34.23	10.29	65.42	300	0	P	H
		7305	43.93	-30.07	74	61.26	35.86	12.72	65.91	300	0	P	H
		3255	46.77	-30.25	77.02	70.11	33	8.37	64.71	100	0	P	V
		4875	41.54	-32.46	74	62.44	34.23	10.29	65.42	100	0	P	V
		7305	43.43	-30.57	74	60.76	35.86	12.72	65.91	100	0	P	V
802.11n HT40 CH 09 2452MHz		3270	51.07	-27.83	78.90	74.42	32.99	8.37	64.71	300	0	P	H
		4905	40.82	-33.18	74	61.67	34.25	10.34	65.44	300	0	P	H
		7356	42.9	-31.1	74	60.36	35.87	12.73	66.06	300	0	P	H
		4905	41.39	-32.61	74	62.24	34.25	10.34	65.44	100	0	P	V
		7356	43.04	-30.96	74	60.5	35.87	12.73	66.06	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz WIFI 802.11g (LF)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
2.4GHz 802.11g LF		30	26.06	-13.94	40	32.55	25.5	0.71	32.7	-	-	P	H
		159.98	19.86	-23.64	43.5	33.53	17.26	1.93	32.86	-	-	P	H
		240.49	21.91	-24.09	46	33.84	18.8	2.37	33.1	-	-	P	H
		320.03	30.81	-15.19	46	40.31	20.68	2.72	32.9	-	-	P	H
		480.08	28.54	-17.46	46	33.81	24.14	3.35	32.76	-	-	P	H
		759.44	26.92	-19.08	46	28.78	26.58	4.22	32.66	-	-	P	H
		37.76	26.08	-13.92	40	36.89	21.1	0.85	32.76	-	-	P	V
		71.71	23.64	-16.36	40	41.97	13.35	1.28	32.96	-	-	P	V
		239.52	22	-24	46	34	18.74	2.36	33.1	-	-	P	V
		320.03	28.51	-17.49	46	38.01	20.68	2.72	32.9	-	-	P	V
		480.08	24.74	-21.26	46	30.01	24.14	3.35	32.76	-	-	P	V
		640.13	27.73	-18.27	46	30.71	25.82	3.86	32.66	-	-	P	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”.

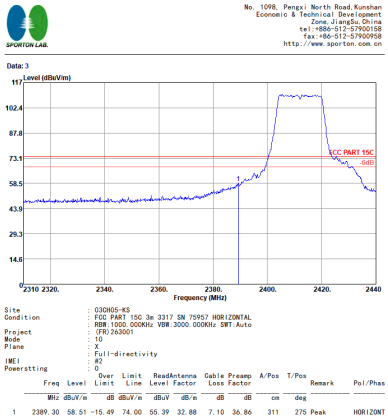
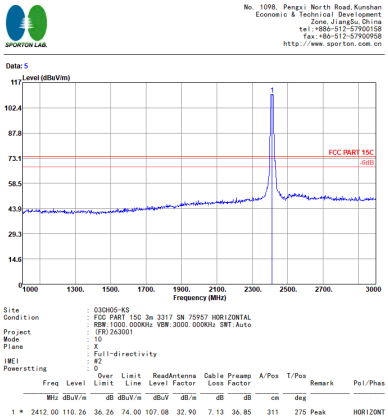
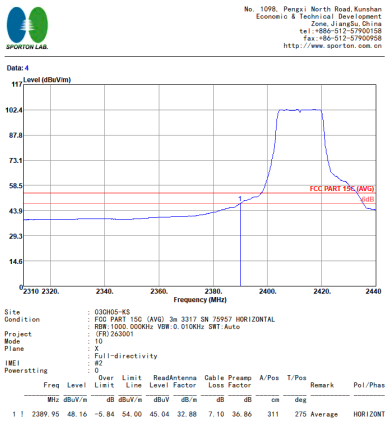
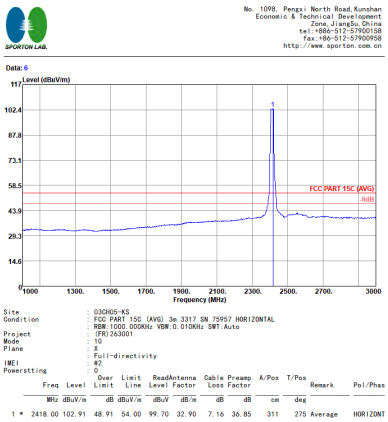
Appendix D. Radiated Spurious Emission Plots

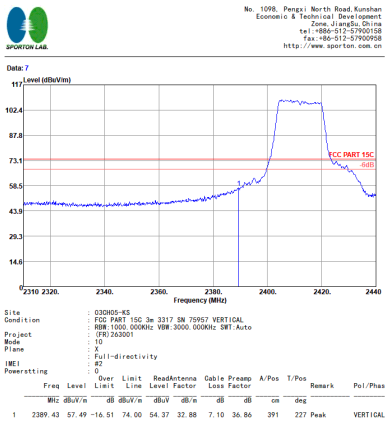
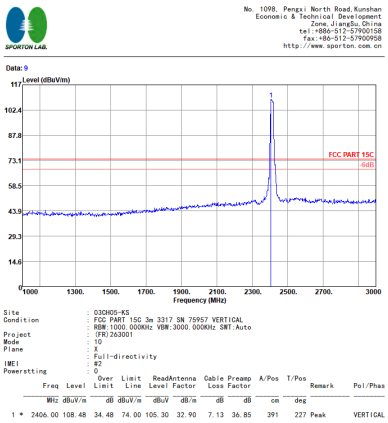
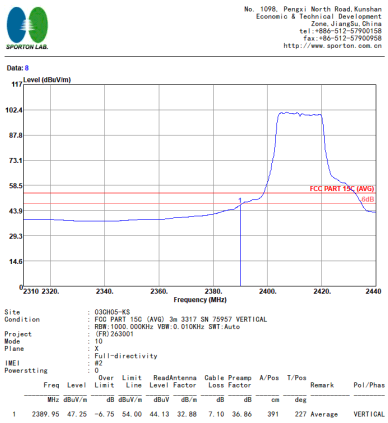
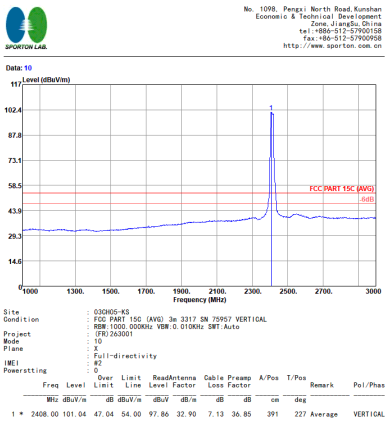
Note symbol

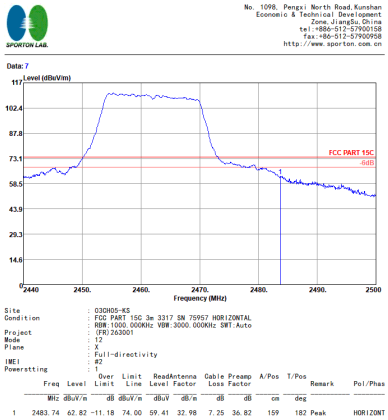
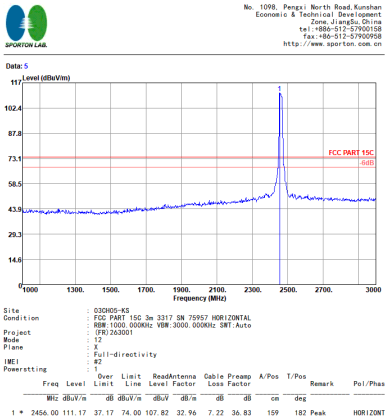
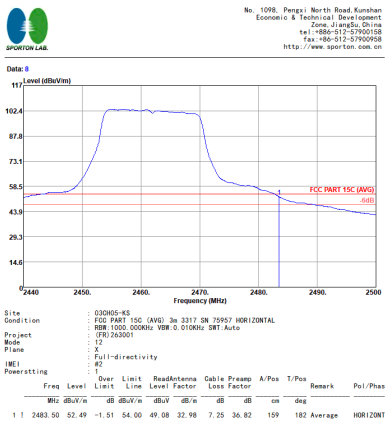
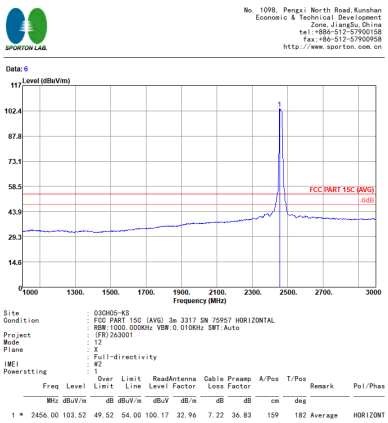
-L	**Low channel location**
-R	**High channel location**

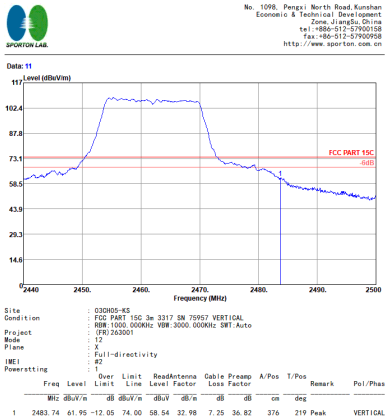
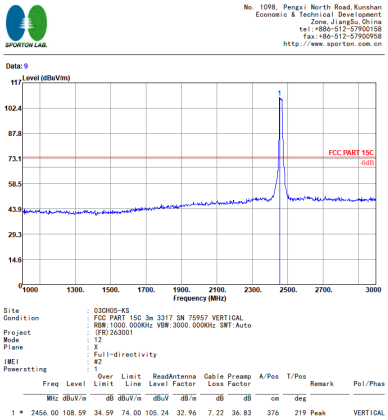
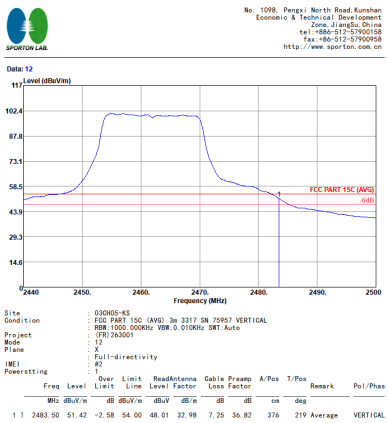
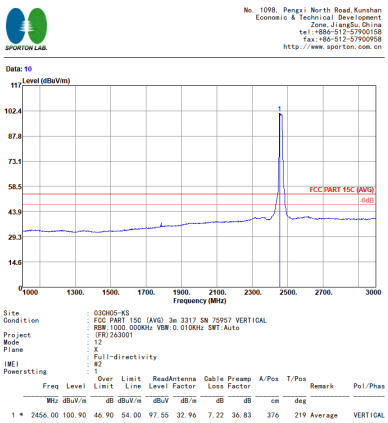
2.4GHz 2400~2483.5MHz

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.		

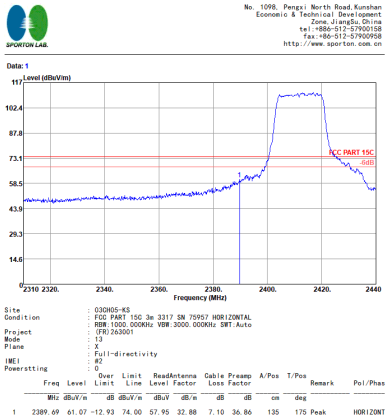
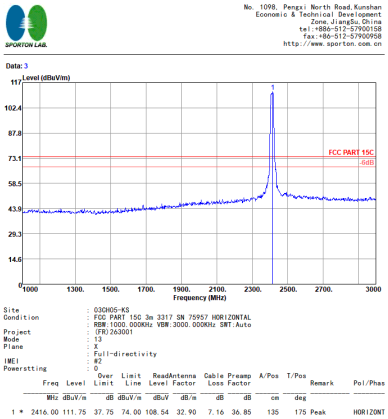
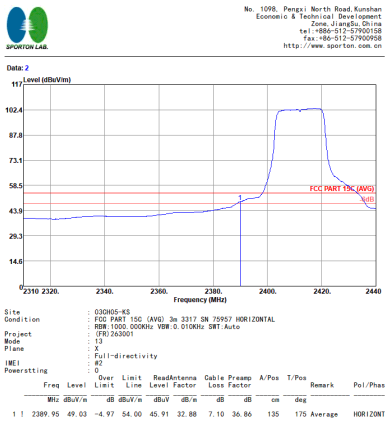
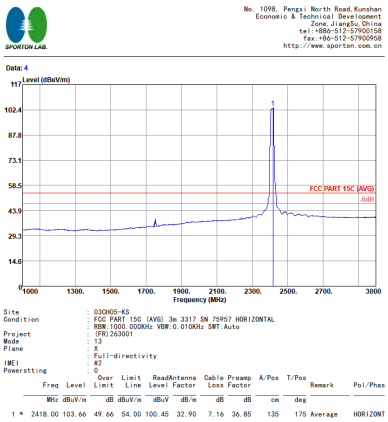
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

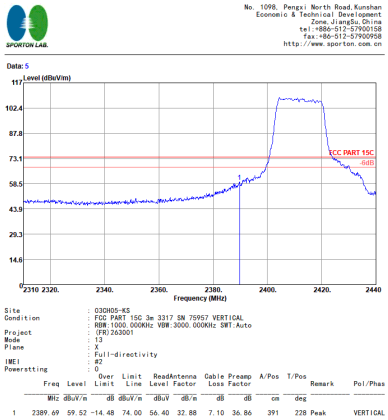
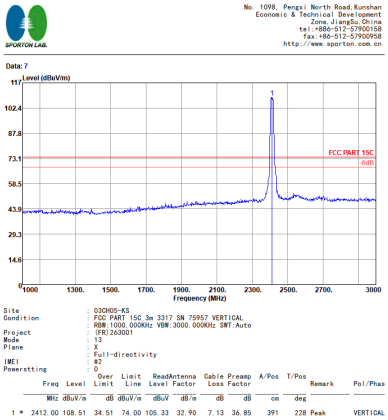
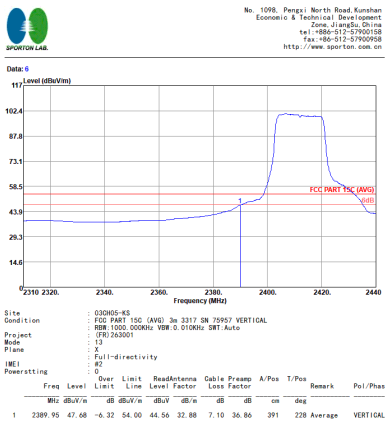
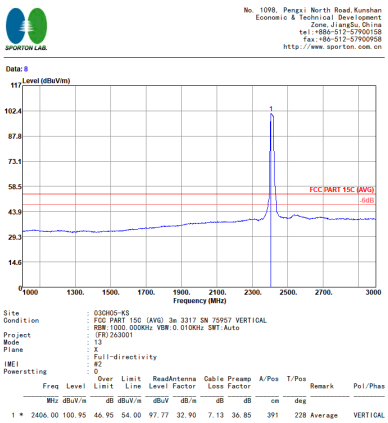
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

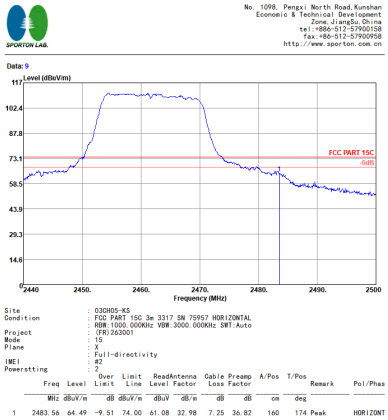
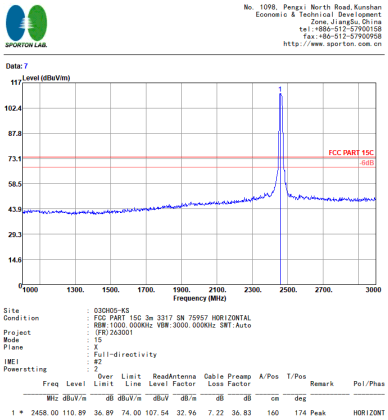
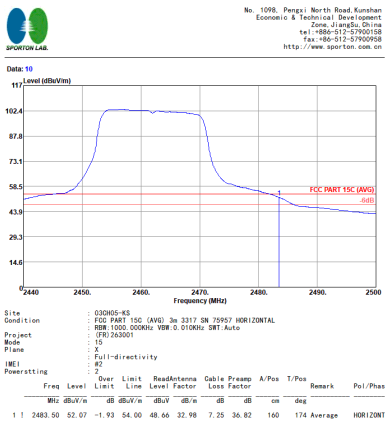
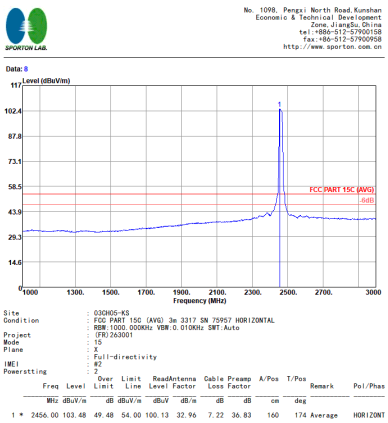
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1	Vertical	Fundamental
Peak		
Avg.		

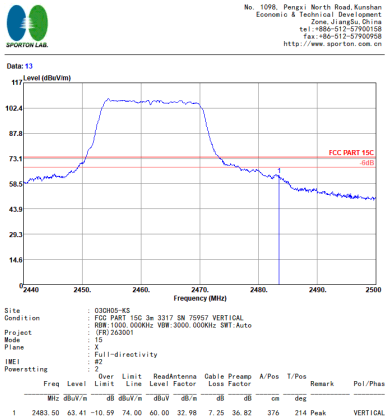
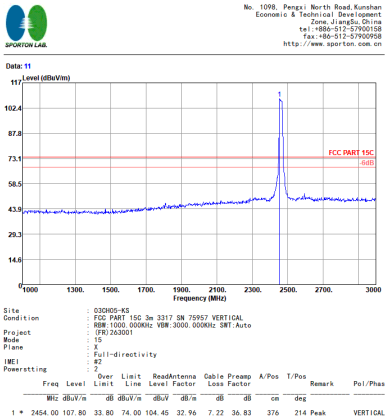
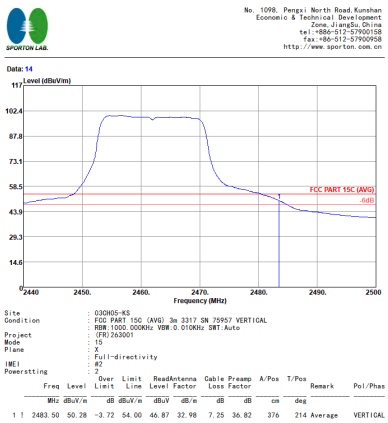
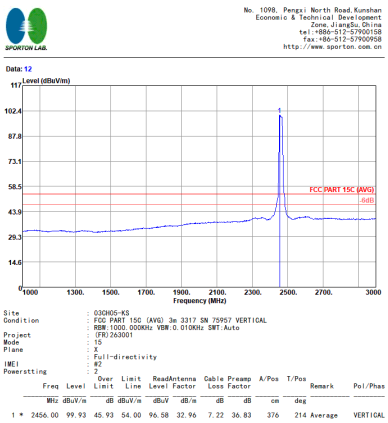
2.4GHz 2400~2483.5MHz

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.		

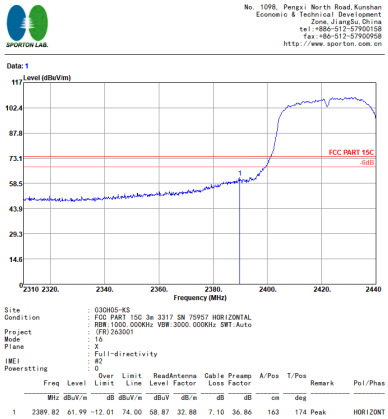
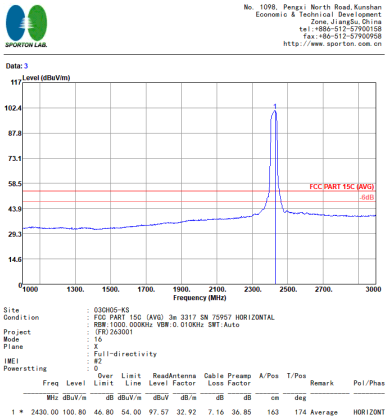
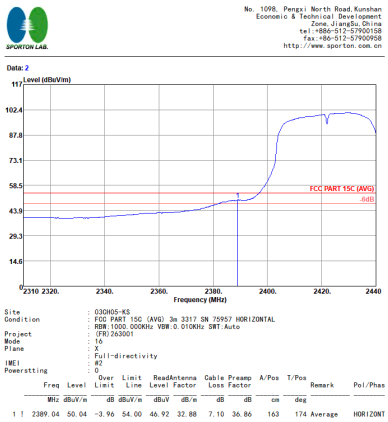
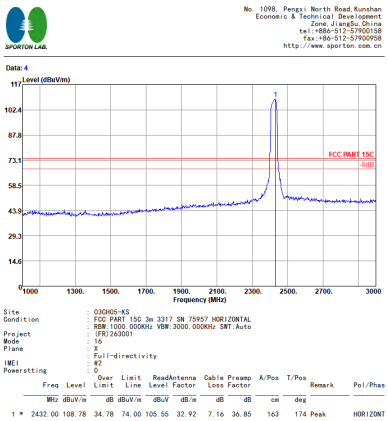
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1	Vertical	Fundamental
Peak		
Avg.		

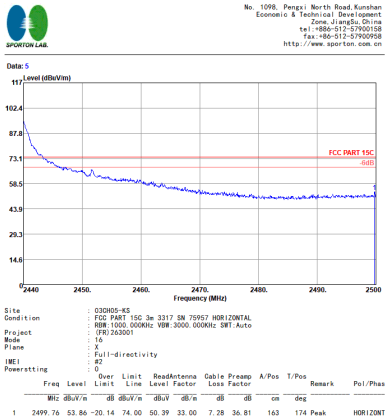
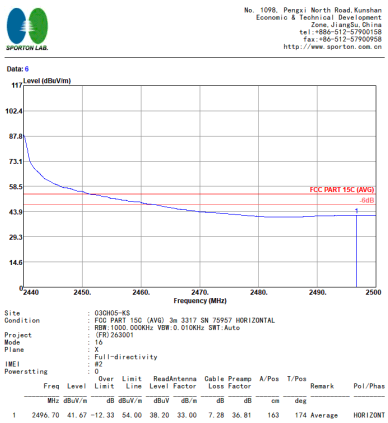
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1	Horizontal	Fundamental
Peak		
Avg.		

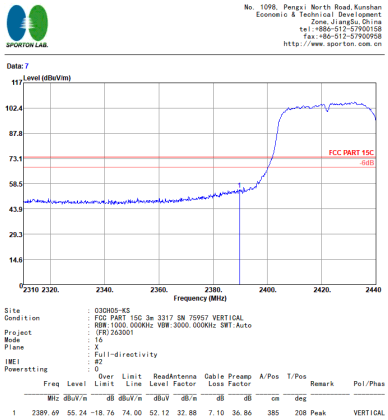
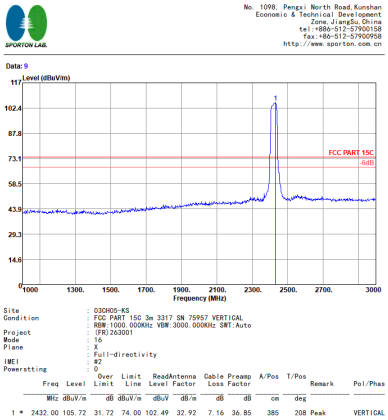
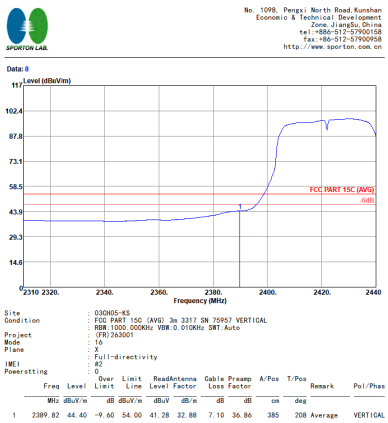
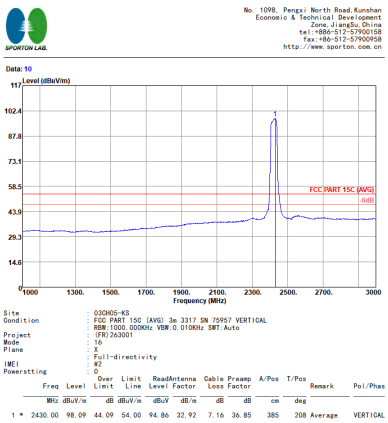
WIFI	2.4GHz 2400~2483.5MHz Fundamental @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1	Vertical	Fundamental
Peak		
Avg.		

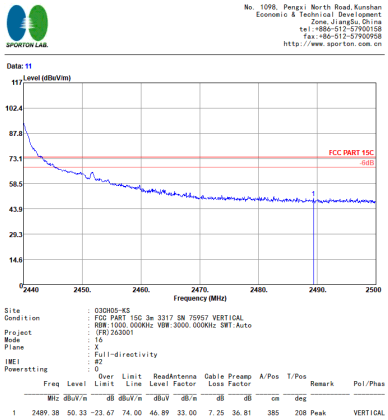
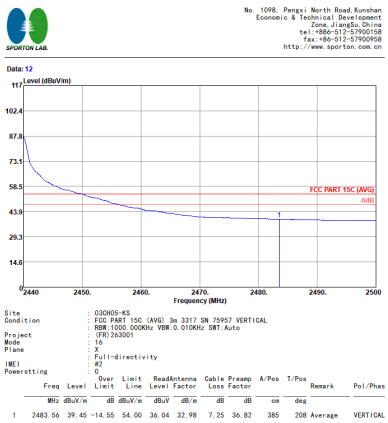
2.4GHz 2400~2483.5MHz

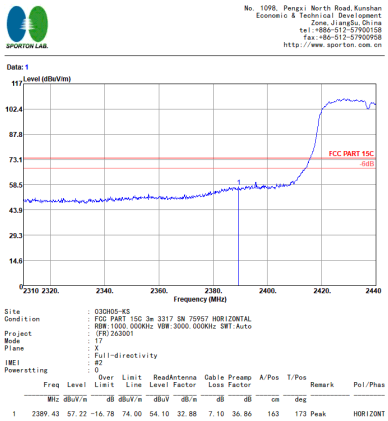
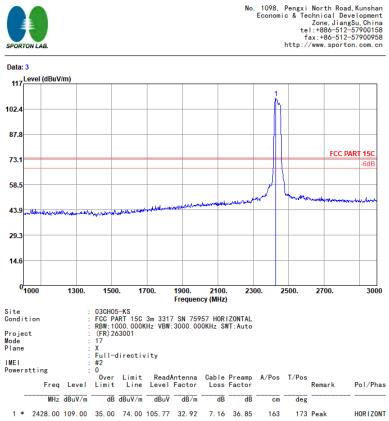
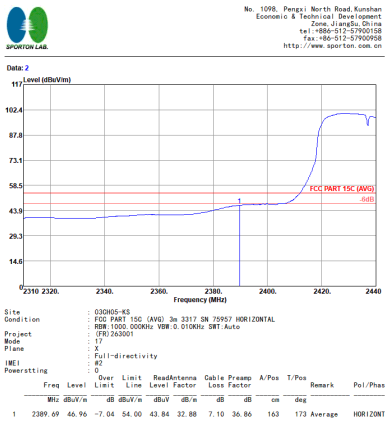
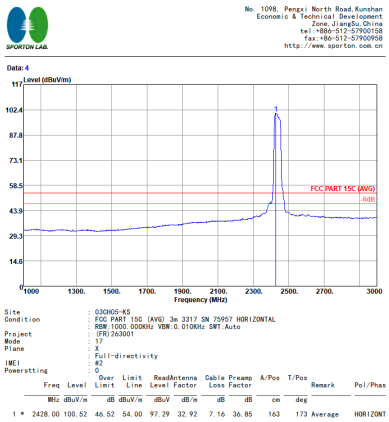
WIFI 802.11n HT40 (Band Edge @ 3m)

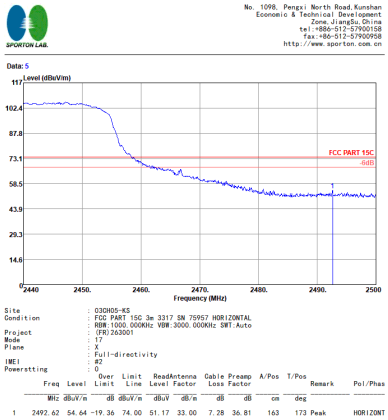
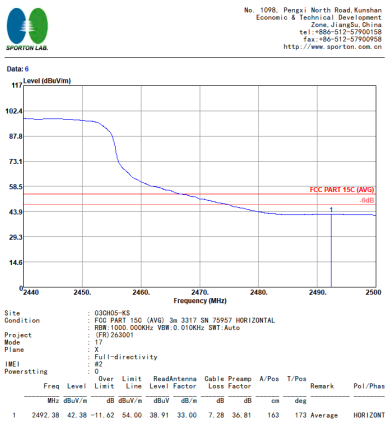
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH03 2422MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

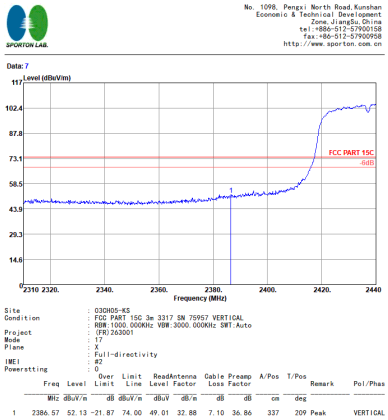
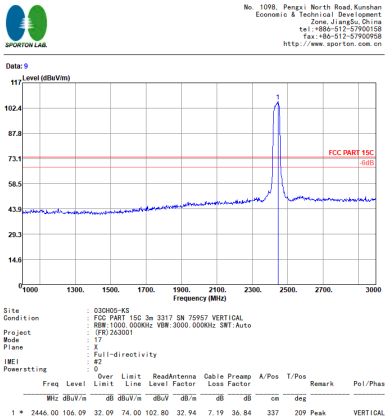
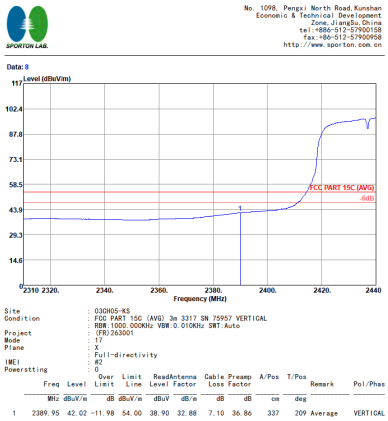
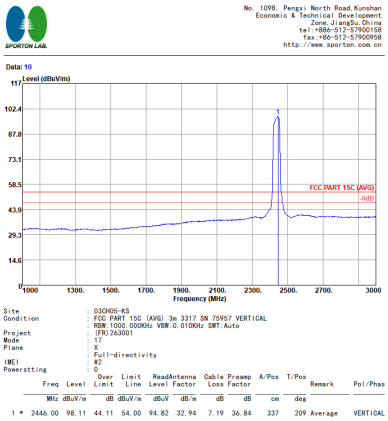
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH03 2422MHz - R	
1	Horizontal	Fundamental
Peak		Left Blank
Avg.		Left Blank

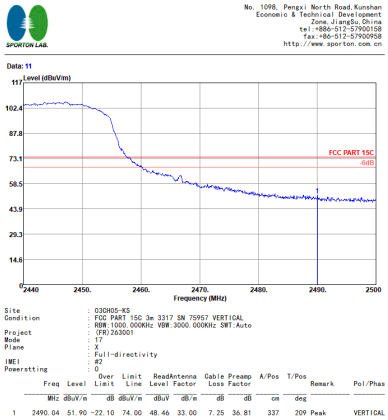
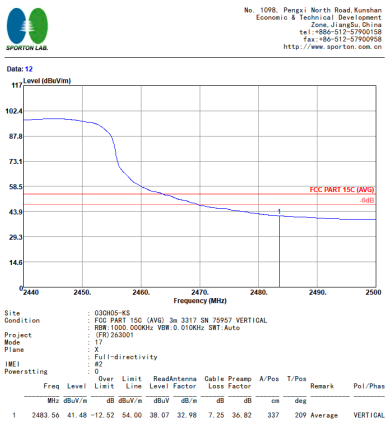
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH03 2422MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		

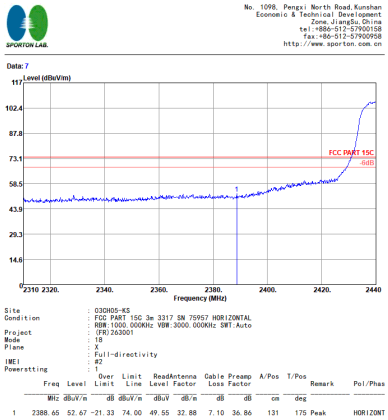
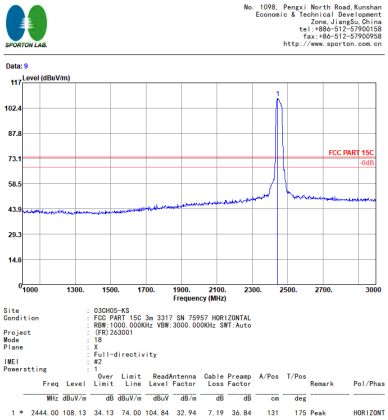
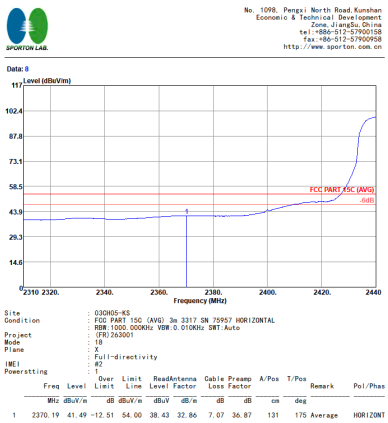
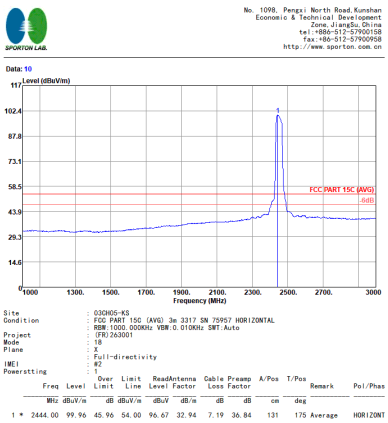
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH03 2422MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

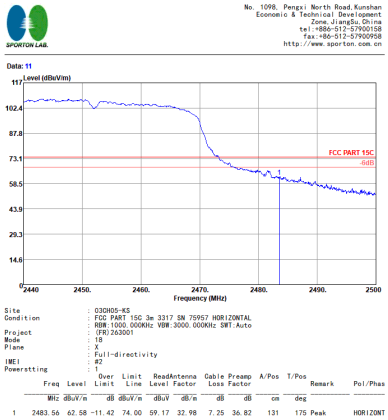
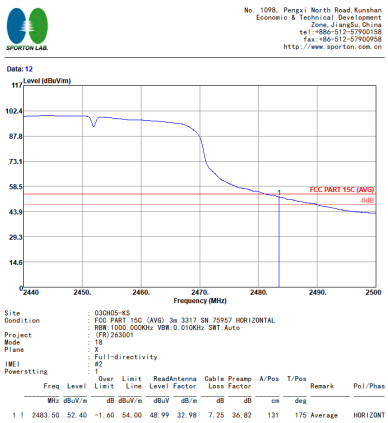
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH06 2437MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

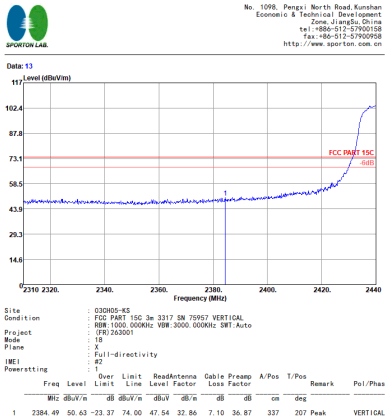
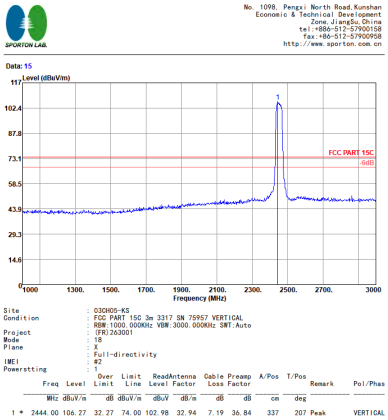
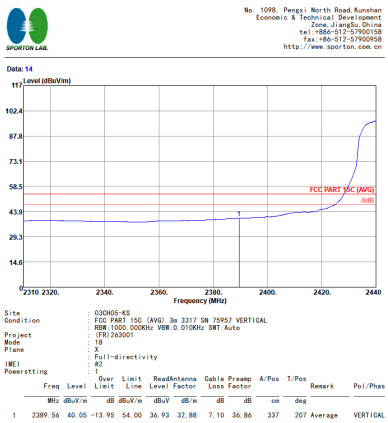
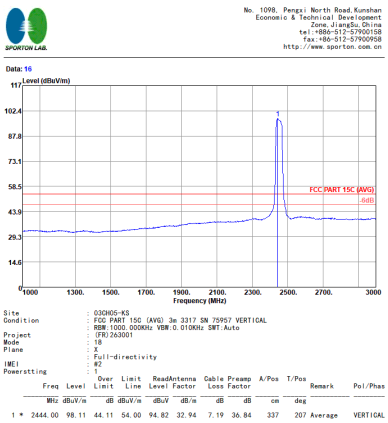
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH06 2437MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

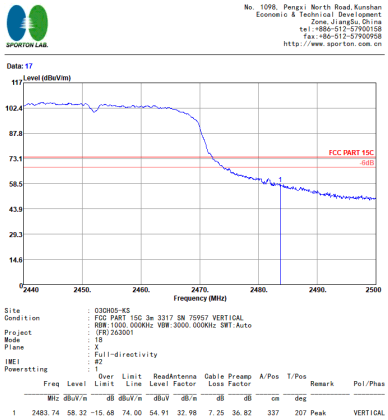
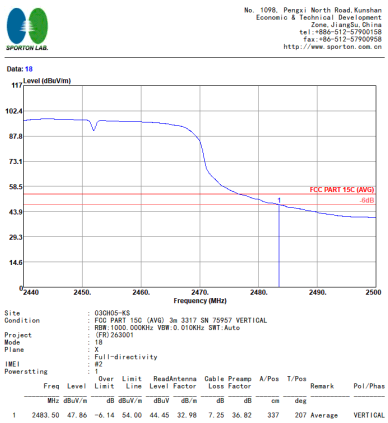
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH06 2437MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH06 2437MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH09 2452MHz - L	
1	Horizontal	Fundamental
Peak		
Avg.		

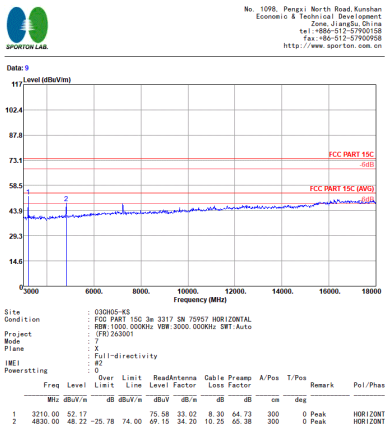
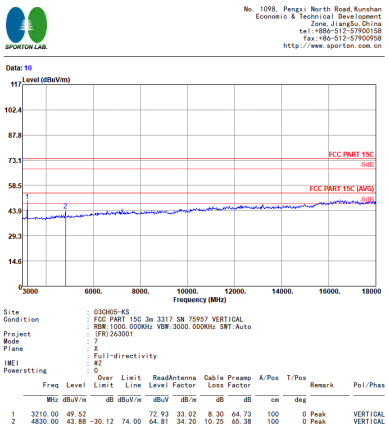
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH09 2452MHz - R	
1	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

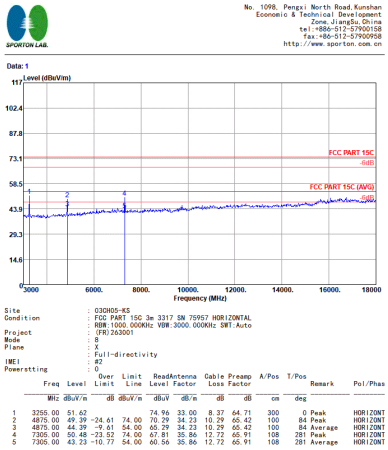
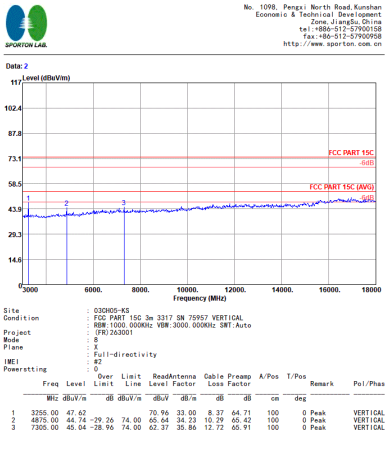
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH09 2452MHz - L	
1	Vertical	Fundamental
Peak		
Avg.		

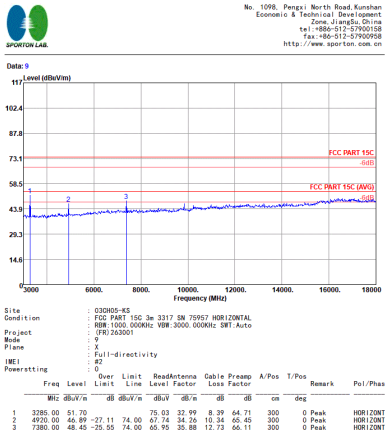
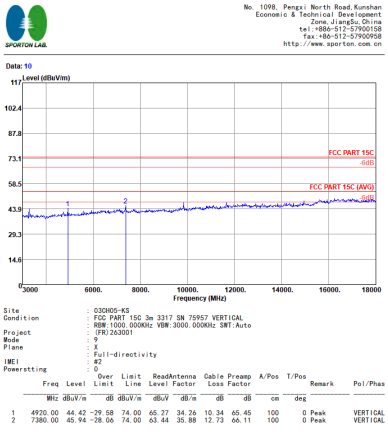
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT40 CH09 2452MHz - R	
1	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

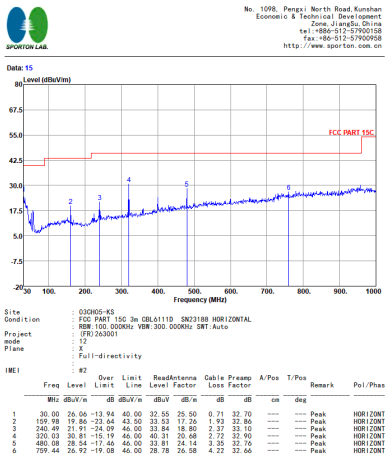
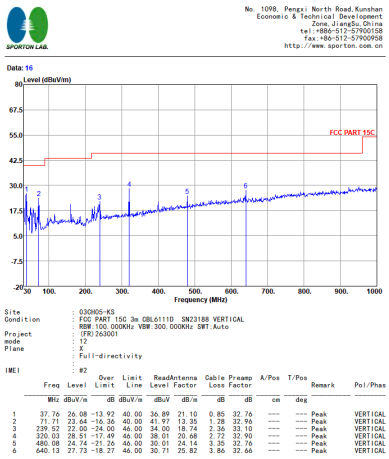
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH01 2412MHz	
1	Horizontal	Vertical
Peak Avg.	 No. 1098, Pengxi North Road,Kunshan Economic & Technical Development Zone,JiangSu,China tel:+86-512-57900158 fax:+86-512-57900958 http://www.sporton.com.cn Data: 9 Level (dBuV/m) FCC PART 15C -6dB FCC PART 15C (AVG) -6dB Frequency (MHz) Site : 03CH05-KS Condition : FCC PART 15C 3m 3317 SN 75957 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : (FR)263001 Mode : 7 Plane : X : Full-directivity IMEI : #2 Powerstting : 0 Freq Level Over Limit Limit Line ReadAntenna Level Cable Loss Preamp Factor A/Pos T/Pos Remark Pol/Phas MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 3210.00 52.17 75.58 33.02 8.30 64.73 300 0 Peak HORIZONT 2 4830.00 48.22 -25.78 74.00 69.15 34.20 10.25 65.38 300 0 Peak HORIZONT	 No. 1098, Pengxi North Road,Kunshan Economic & Technical Development Zone,JiangSu,China tel:+86-512-57900158 fax:+86-512-57900958 http://www.sporton.com.cn Data: 10 Level (dBuV/m) FCC PART 15C -6dB FCC PART 15C (AVG) -6dB Frequency (MHz) Site : 03CH05-KS Condition : FCC PART 15C 3m 3317 SN 75957 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : (FR)263001 Mode : 7 Plane : X : Full-directivity IMEI : #2 Powerstting : 0 Freq Level Over Limit Limit Line ReadAntenna Level Cable Loss Preamp Factor A/Pos T/Pos Remark Pol/Phas MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 3210.00 49.52 72.93 33.02 8.30 64.73 100 0 Peak VERTICAL 2 4830.00 43.88 -30.12 74.00 64.81 34.20 10.25 65.38 100 0 Peak VERTICAL

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH06 2437MHz	
1	Horizontal	Vertical
Peak Avg.	 Site : 03CH05-KS Condition : FCC PART 15C 3m 3317 SN 75957 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : (FR)263001 Mode : 8 Plane : X : Full-directivity IMEI : #2 Powerstting : 0 Freq Level Over Limit Limit Line ReadAntenna Level Factor Cable Loss Factor Preamp Factor A/Pos cm T/Pos deg Remark Pol/Phas MHz dBuV/m dB dBuV/m dBuV dB/m dB dB 1 3255.00 51.62 74.96 33.00 8.37 64.71 300 0 Peak HORIZONT 2 4875.00 49.39 -24.61 74.00 70.29 34.23 10.29 65.42 100 84 Peak HORIZONT 3 4875.00 44.39 -9.61 54.00 65.29 34.23 10.29 65.42 100 84 Average HORIZONT 4 7305.00 50.48 -23.52 74.00 67.81 35.86 12.72 65.91 108 281 Peak HORIZONT 5 7305.00 43.23 -10.77 54.00 60.56 35.86 12.72 65.91 108 281 Average HORIZONT	 Site : 03CH05-KS Condition : FCC PART 15C 3m 3317 SN 75957 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : (FR)263001 Mode : 8 Plane : X : Full-directivity IMEI : #2 Powerstting : 0 Freq Level Over Limit Limit Line ReadAntenna Level Factor Cable Loss Factor Preamp Factor A/Pos cm T/Pos deg Remark Pol/Phas MHz dBuV/m dB dBuV/m dBuV dB/m dB dB 1 3255.00 47.62 70.96 33.00 8.37 64.71 100 0 Peak VERTICAL 2 4875.00 44.74 -29.26 74.00 65.64 34.23 10.29 65.42 100 0 Peak VERTICAL 3 7305.00 45.04 -28.96 74.00 62.37 35.86 12.72 65.91 100 0 Peak VERTICAL

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH11 2462MHz	
1	Horizontal	Vertical
Peak Avg.	 No. 1098, Pengxi North Road,Kunshan Economic & Technical Development Zone,JiangSu,China tel:+886-512-57900158 fax:+86-512-57900958 http://www.sporton.com.cn Data: 9 Level (dBuV/m) FCC PART 15C -6dB FCC PART 15C (AVG) -6dB Frequency (MHz) Site : 03CH05-KS Condition : FCC PART 15C 3m 3317 SN 75957 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : (FR)263001 Mode : 9 Plane : X : Full-directivity IMEI : #2 Powersetting : 0 Freq Level Over Limit Limit Line ReadAntenna Level Factor Cable Loss Factor Preamp Factor A/Pos T/Pos Remark Pol/Phas MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 3285.00 51.70 75.03 32.99 8.39 64.71 300 0 Peak HORIZONT 2 4920.00 46.89 -27.11 74.00 67.74 34.26 10.34 65.45 300 0 Peak HORIZONT 3 7380.00 48.45 -25.55 74.00 65.95 35.88 12.73 66.11 300 0 Peak HORIZONT	 No. 1098, Pengxi North Road,Kunshan Economic & Technical Development Zone,JiangSu,China tel:+886-512-57900158 fax:+86-512-57900958 http://www.sporton.com.cn Data: 10 Level (dBuV/m) FCC PART 15C -6dB FCC PART 15C (AVG) -6dB Frequency (MHz) Site : 03CH05-KS Condition : FCC PART 15C 3m 3317 SN 75957 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : (FR)263001 Mode : 9 Plane : X : Full-directivity IMEI : #2 Powersetting : 0 Freq Level Over Limit Limit Line ReadAntenna Level Factor Cable Loss Factor Preamp Factor A/Pos T/Pos Remark Pol/Phas MHz dBuV/m dB dBuV/m dBuV dB/m dB dB cm deg 1 4920.00 44.42 -29.58 74.00 65.27 34.26 10.34 65.45 100 0 Peak VERTICAL 2 7380.00 45.94 -28.06 74.00 63.44 35.88 12.73 66.11 100 0 Peak VERTICAL

Emission below 1GHz

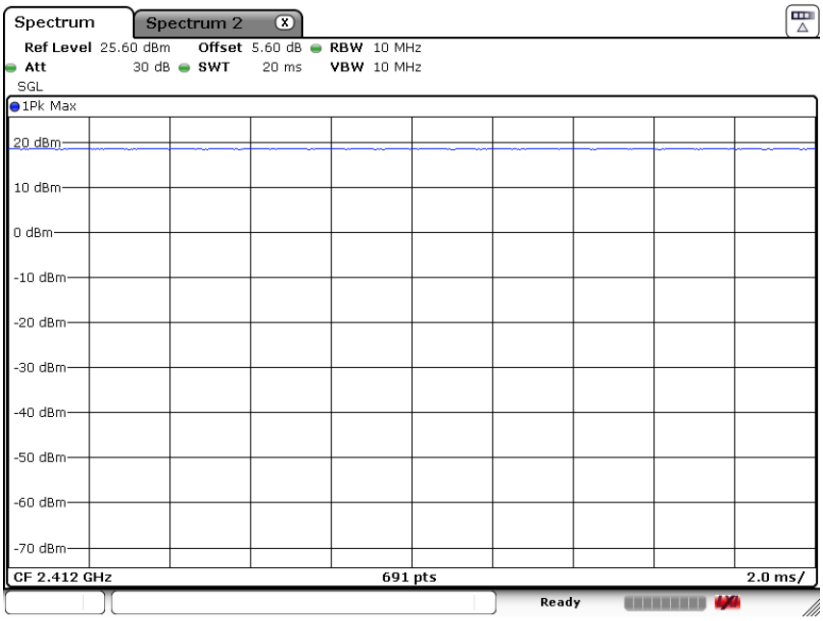
2.4GHz WIFI 802.11g (LF)

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

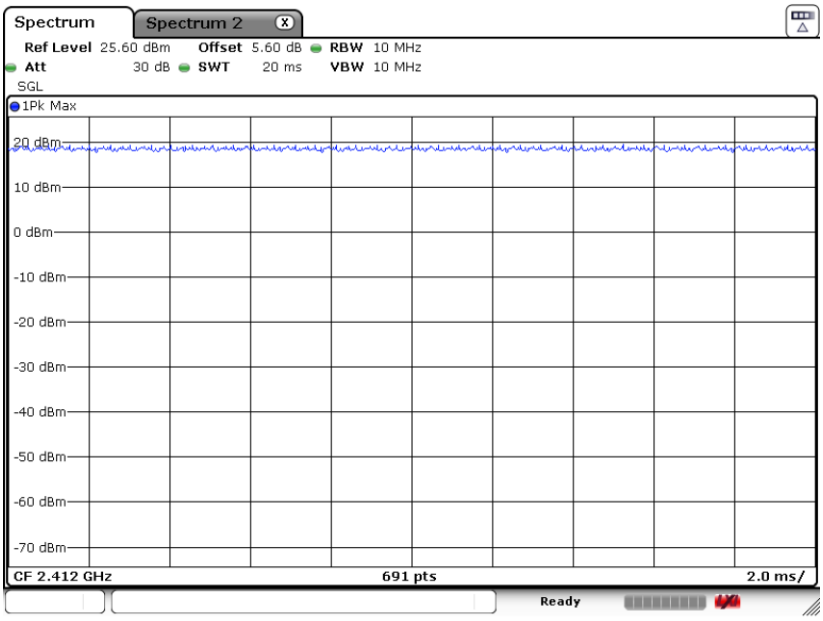
Appendix E. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11b	100	-	-	10Hz
802.11g	100	-	-	10Hz
802.11n HT20	100	-	-	10Hz
802.11n HT40	100	-	-	10Hz

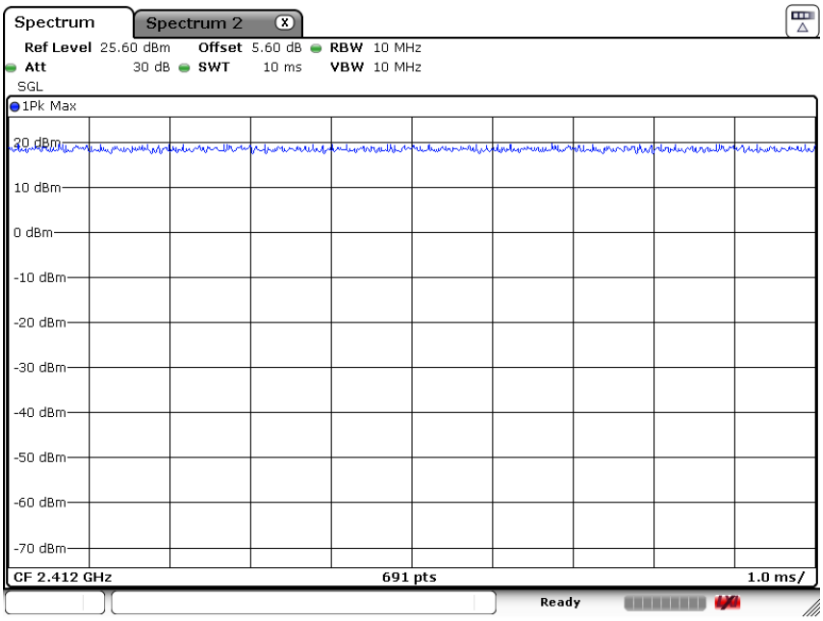
802.11b



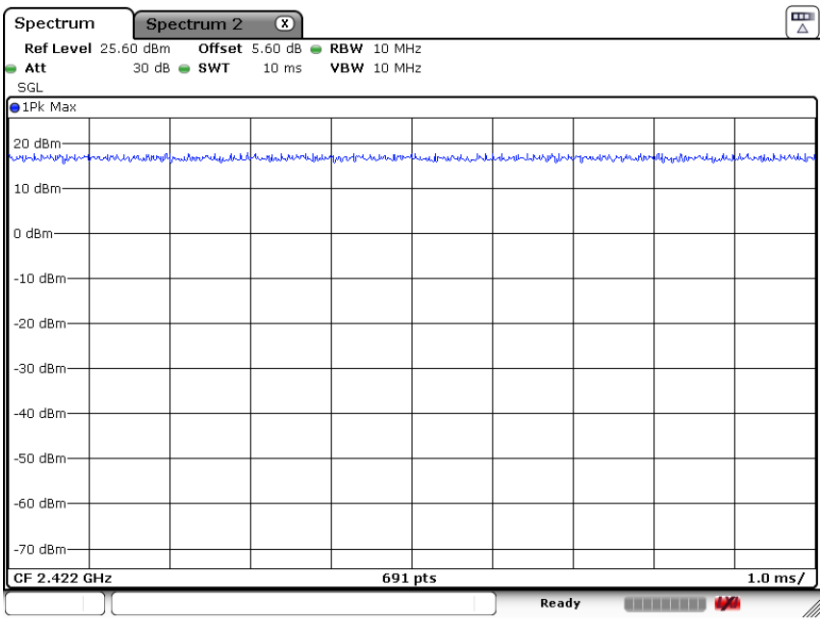
802.11g



802.11n HT20



802.11n HT40


Spectrum
Spectrum 2
Ref Level 25.60 dBm Offset 5.60 dB RBW 10 MHz
Att 30 dB SWT 10 ms VBW 10 MHz
SGL
1Pk Max
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.422 GHz
691 pts
1.0 ms/
Ready