FCC RF Test Report

APPLICANT	:	**Bullitt Group**
EQUIPMENT	:	**Rugged Smart Phone**
BRAND NAME	:	**CAT**
MODEL NAME	:	**S48c**
FCC ID	:	**ZL5S48C**
STANDARD	:	**FCC Part 15 Subpart C §15.247**
CLASSIFICATION	:	**(DTS) Digital Transmission System**

The product was received on Jun. 06, 2018 and testing was completed on Jun. 26, 2018. We, Sporton International (Shenzhen) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Shenzhen) Inc., the test report shall not be reproduced except in full.

Eric Shih

TESTING
NVLAP LAB CODE 600156-0

Approved by: Eric Shih / Manager

Sporton International (Shenzhen) Inc.
1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan Shenzhen City Guangdong Province 518055 China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR850804-02C	Rev. 01	Initial issue of report	Jul. 06, 2018

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.2	15.247(b)	Power Output Measurement	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	Conducted Band Edges	≤ 20dBc	Pass	-
		Conducted Spurious Emission		Pass	-
3.5	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 5.94 dB at 2389.380 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 19.20 dB at 0.630 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

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

1.2 Product Feature of Equipment Under Test

Product Feature	
Equipment	Rugged Smart Phone
Brand Name	CAT
Model Name	S48c
FCC ID	ZL5S48C
EUT supports Radios application	CDMA/EVDO/GSM/GPRS/EGPRS/WCDMA/HSPA/DC-HSDPA/HSPA+/LTE/NFC WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
IMEI Code	Conducted: N/A Conduction: 358016090005806 Radiation: 358016090009337
EUT Stage	Identical Prototype

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

1.3 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 : 16.84 dBm (0.0483 W) 802.11g : 18.77 dBm (0.0753 W) 802.11n HT20 : 18.75 dBm (0.0750 W) 802.11n HT40 : 20.29 dBm (0.1069 W)
Antenna Type / Gain	IFA Antenna with gain 0.50 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)

1.4 Modification of EUT

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

1.5 Testing Location

Sporton International (Shenzhen) Inc. is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600156-0) and the FCC designation No. are CN5018 and CN5019.

Test Site	Sporton International (Shenzhen) Inc.		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan Shenzhen City Guangdong Province 518055 China TEL: +86-755-8637-9589 FAX: +86-755-8637-9595		
Test Site No.	**Sporton Site No.**		**FCC Test Firm Registration No.**
	TH01-SZ	CO01-SZ	251365

Test Site	Sporton International (Shenzhen) Inc.	
Test Site Location	No. 3 Bldg the third floor of south, Shahe River west, Fengzeyuan Warehouse, Nanshan District Shenzhen City Guangdong Province 518055 China TEL: +86-755-3320-2398	
Test Site No.	**Sporton Site No.**	**FCC Test Firm Registration No.**
	03CH02-SZ	577730

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

1.6 Applicable Standards

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

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

Remark:

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

2 Test Configuration of Equipment Under Test

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

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

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

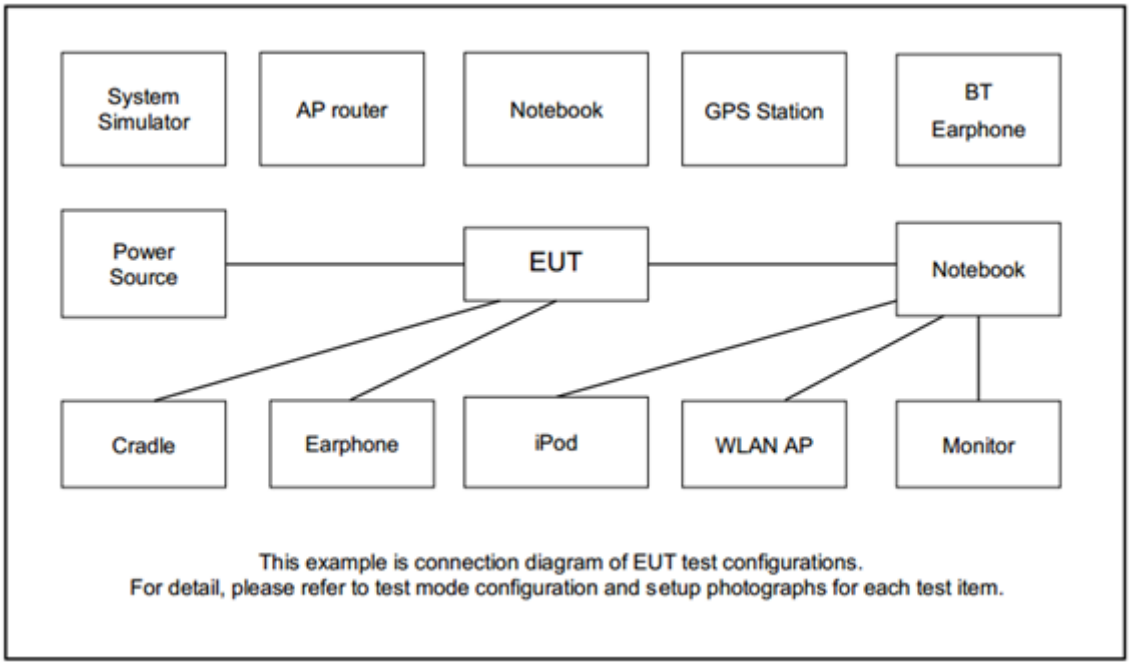
2.2 Test Mode

Final test 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: GSM 1900 Idle + Bluetooth Link + WLAN Link (2.4G) + USB Cable (Charging from Adapter) + Earphone
Remark: For Radiated Test Cases, The tests were performance with Adapter, Earphone and USB Cable.	

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,1.8m
2.	BT Base Station	R&S	CBT	N/A	N/A	Unshielded, 1.8 m
3.	WLAN AP	D-Link	DIR-820L	KA2IR820LA1	N/A	Unshielded, 1.8 m
4.	Notebook	Lenovo	E540	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
5.	Bluetooth Earphone	Samsung	EO-MG900	PYAHS-107W	N/A	N/A
6.	Earphone	Apple	DCAY1V-A9007ZJW3-000	N/A	N/A	Unshielded,1.8m
7.	SD Card	N/A	MicroSD HC	FCC DoC	N/A	N/A
8.	iPod	Apple	MC69029/A	N/A	N/A	N/A

2.5 EUT Operation Test Setup

For WLAN function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.

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 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 5.0 dB and 10dB attenuator.

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

= 5.0 + 10 = 15.0 (dB)

3 Test Result

3.1 6dB Bandwidth Measurement

3.1.1 Limit of 6dB Bandwidth

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

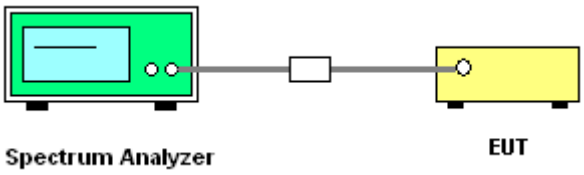
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v04.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. Measure and record the results in the test report.

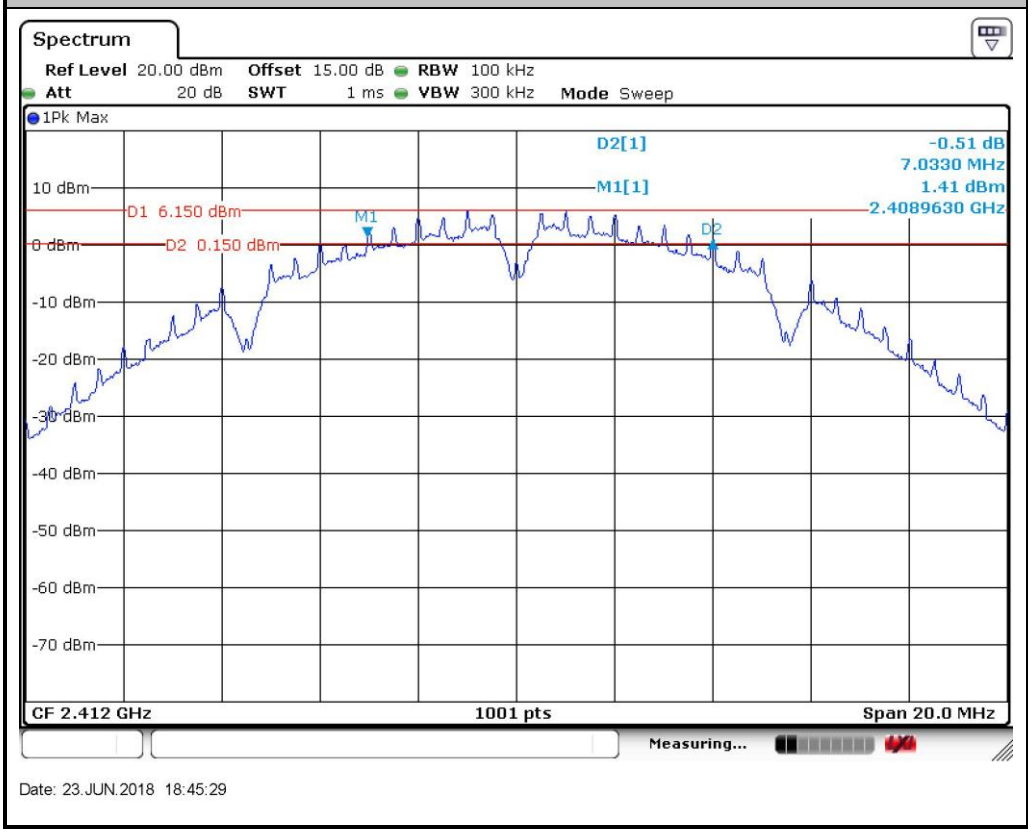
3.1.4 Test Setup



3.1.5 Test Result of 6dB Occupied Bandwidth

Please refer to Appendix A.

Minimum 6dB 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.

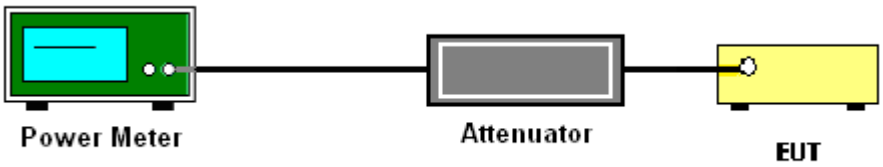
3.2.2 Measuring Instruments

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 FCC KDB No. 558074 DTS D01 Meas. Guidance v04 section 9.1.3 PKPM1 Peak power meter method.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.2.6 Test Result of Average output Power (Reporting Only)

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

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

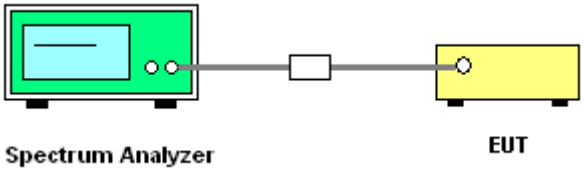
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.

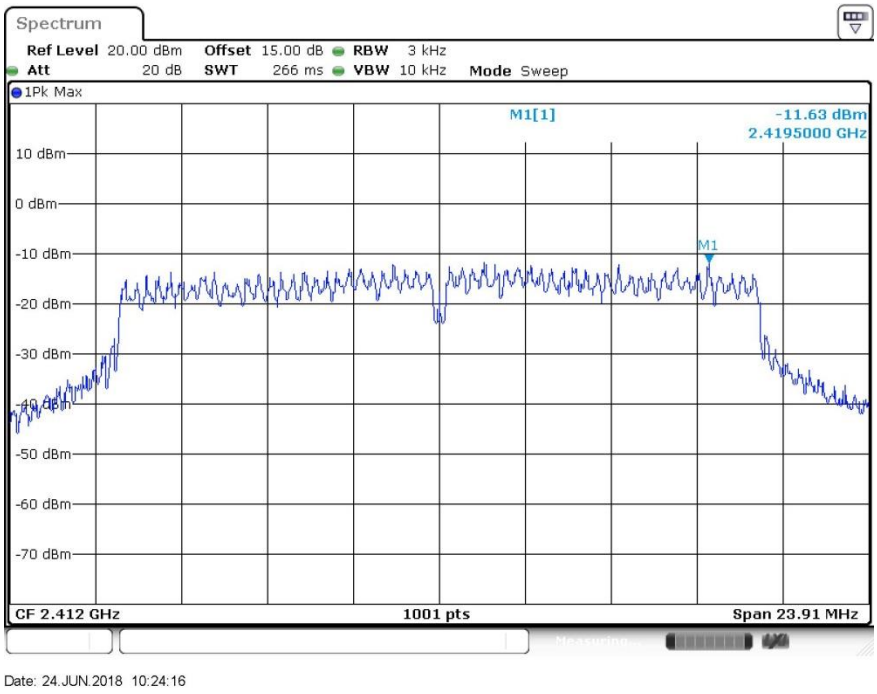
3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Density (dBm/3kHz)



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

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

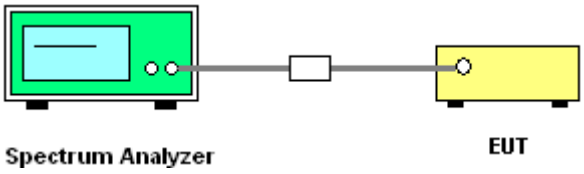
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup

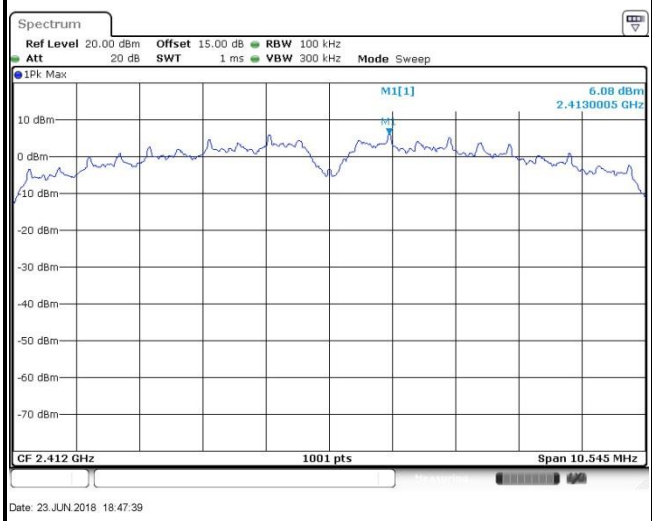


3.4.5 Test Result of Conducted Band Edges and Spurious Emission

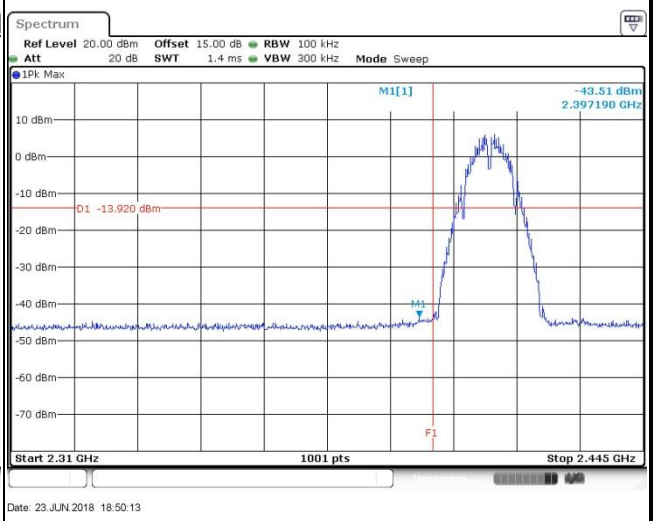
Test Engineer :	Sam Zheng	**Temperature :**	21~25℃
		Relative Humidity :	51~54%

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

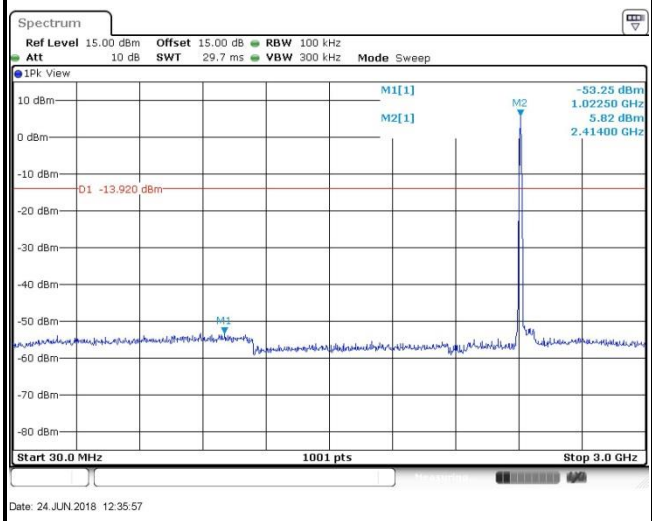
100kHz PSD reference Level



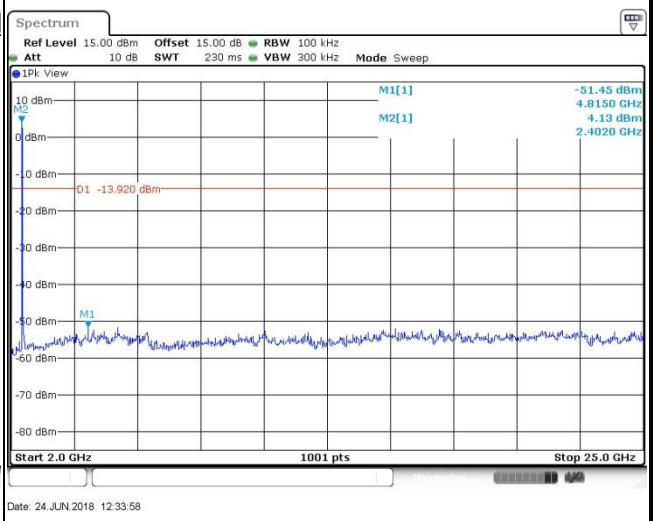
Channel Plot



Spurious Emission 30MHz~3GHz

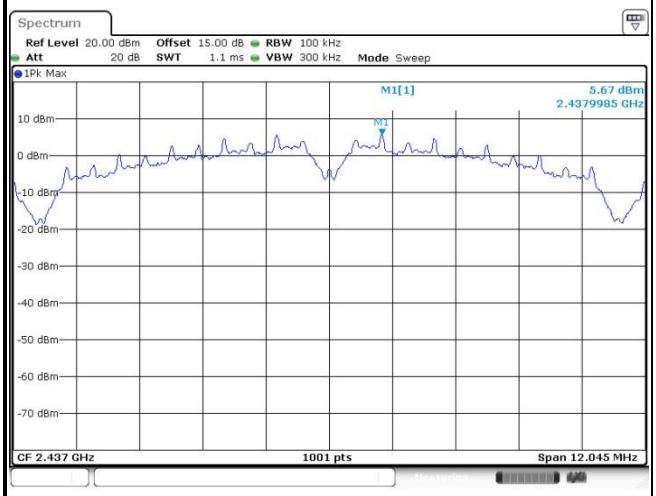


Spurious Emission 2GHz~25GHz

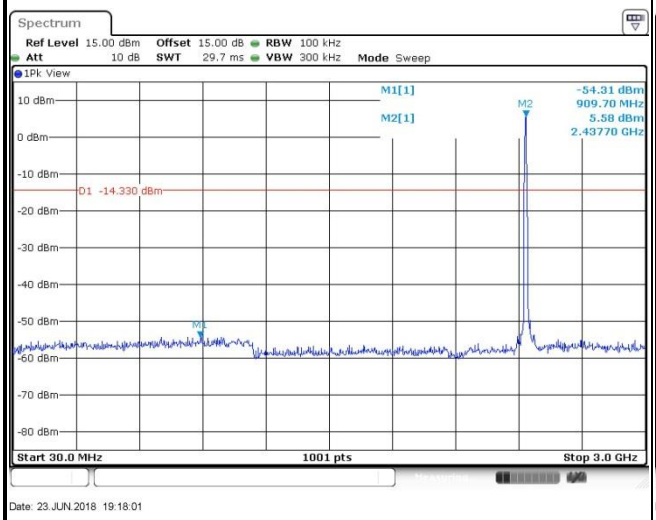


Test Mode :	802.11b	Test Channel :	06

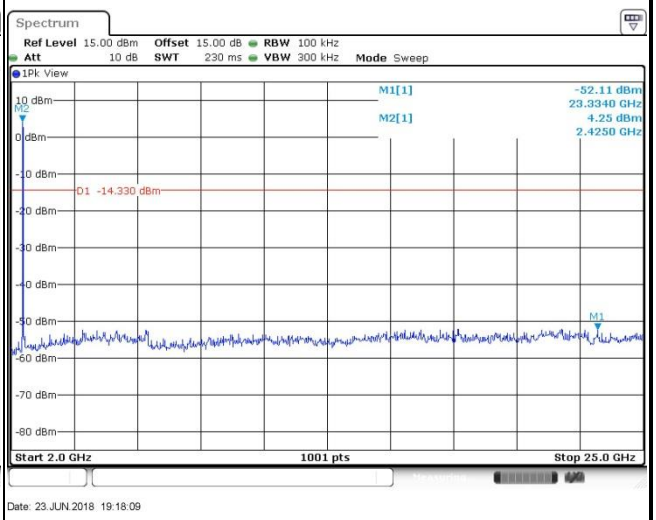
100kHz PSD reference Level



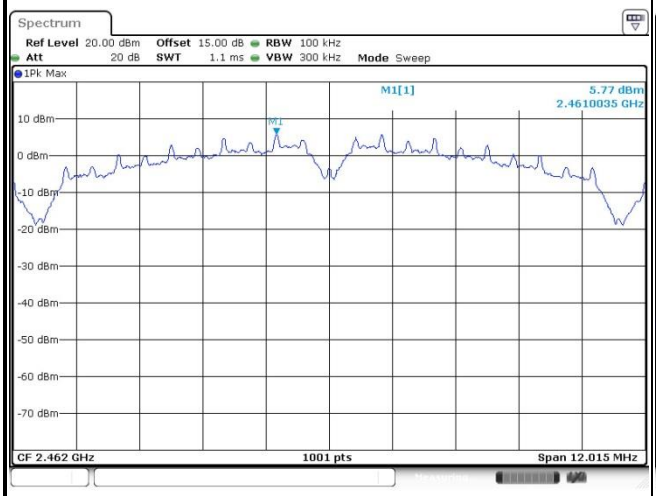
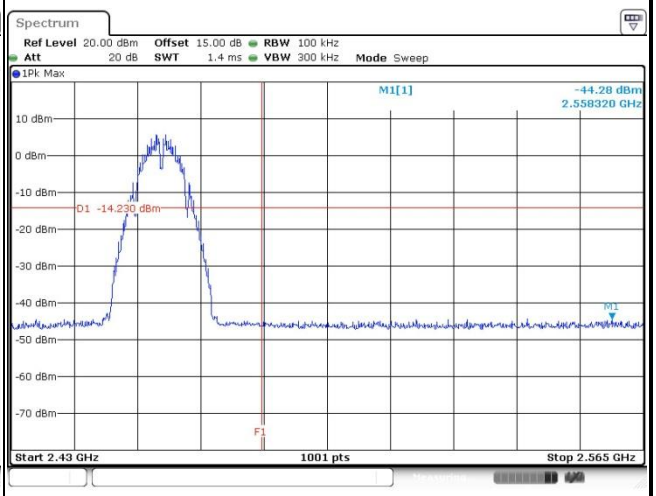
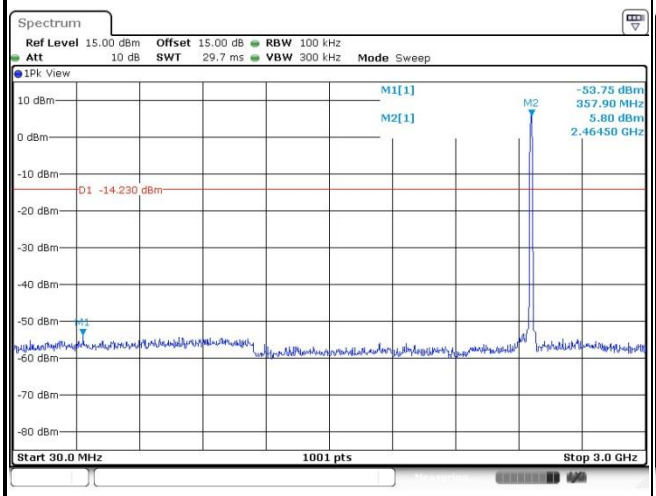
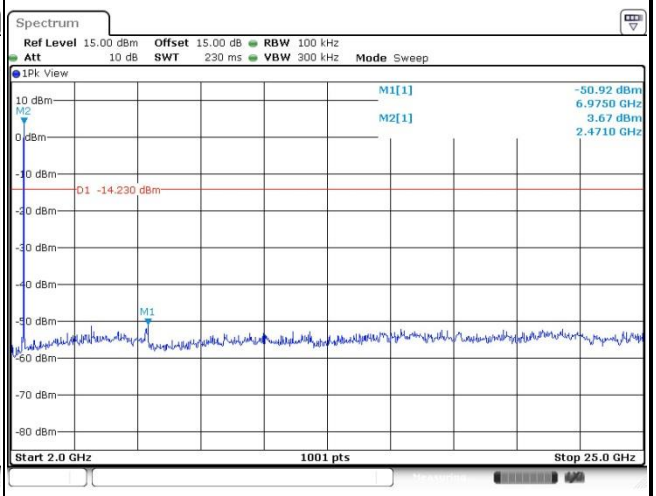
Spurious Emission 30MHz~3GHz



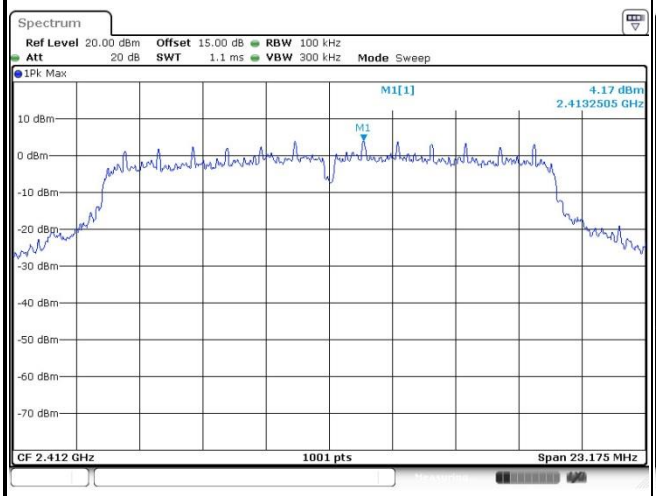
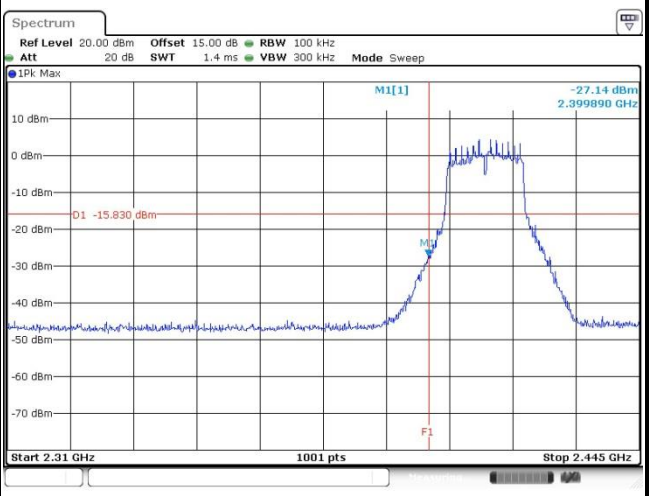
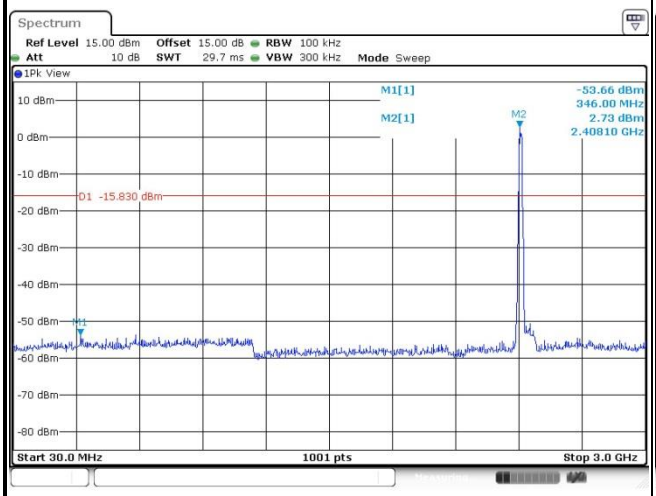
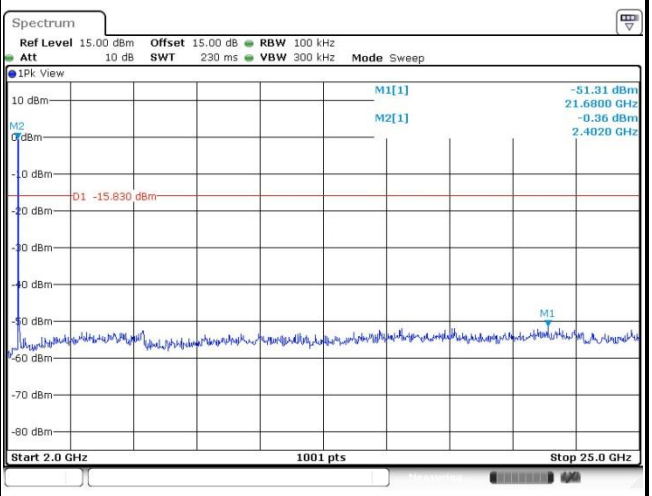
Spurious Emission 2GHz~25GHz



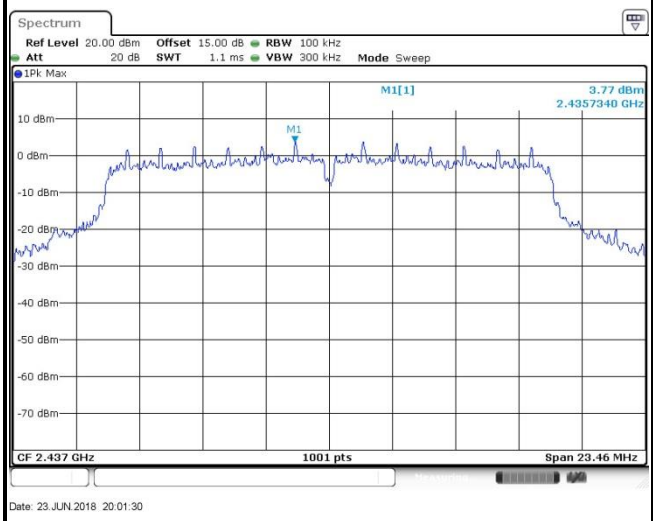
Test Mode :	802.11b	Test Channel :	11

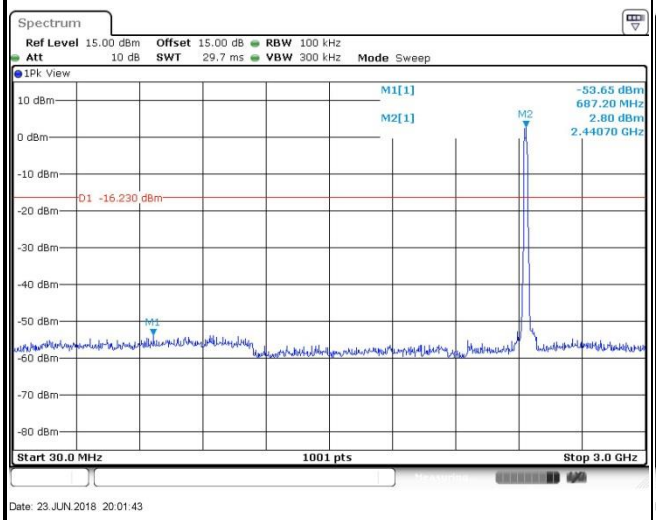
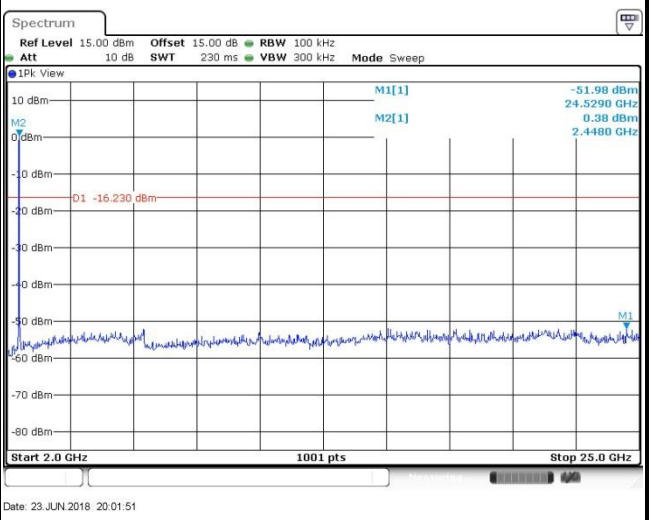
100kHz PSD reference Level	Channel Plot
	
Date: 23.JUN.2018 19:25:57	Date: 23.JUN.2018 19:26:53
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 23.JUN.2018 19:28:04	Date: 23.JUN.2018 19:28:12

Test Mode :	802.11g	Test Channel :	01

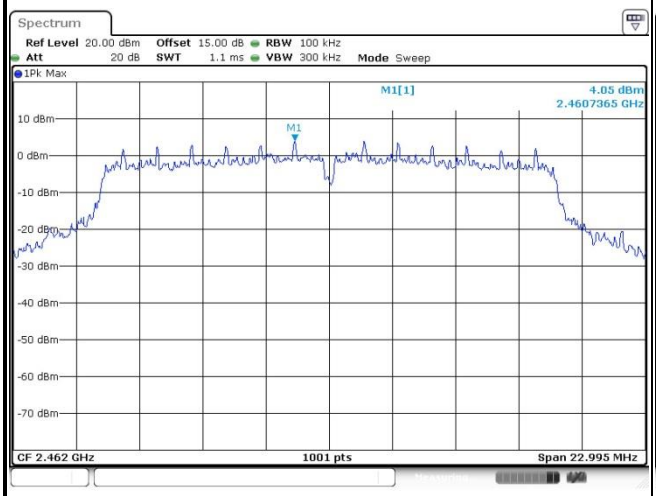
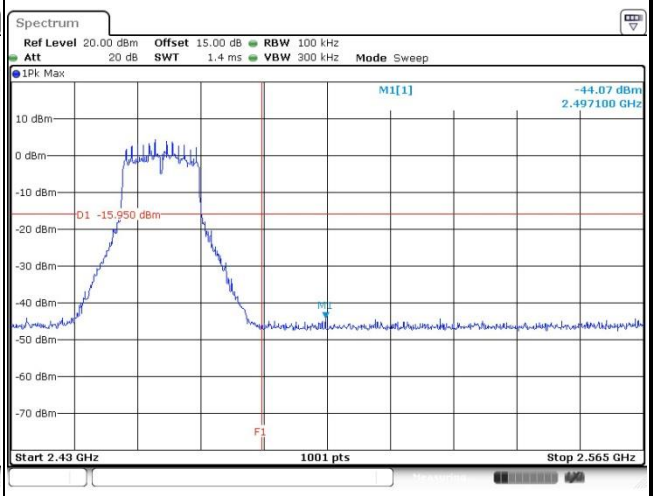
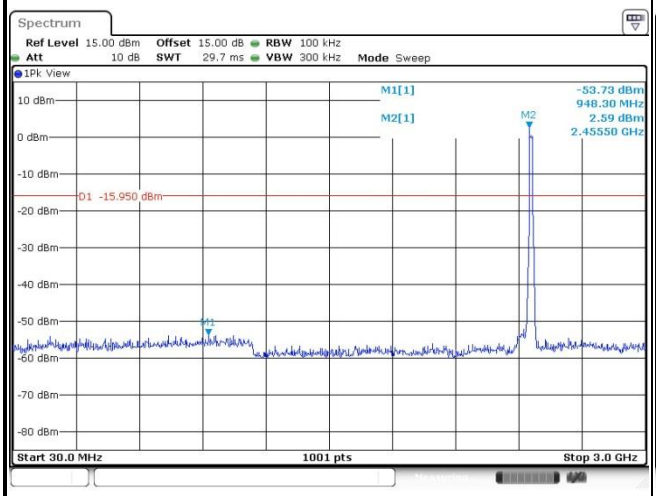
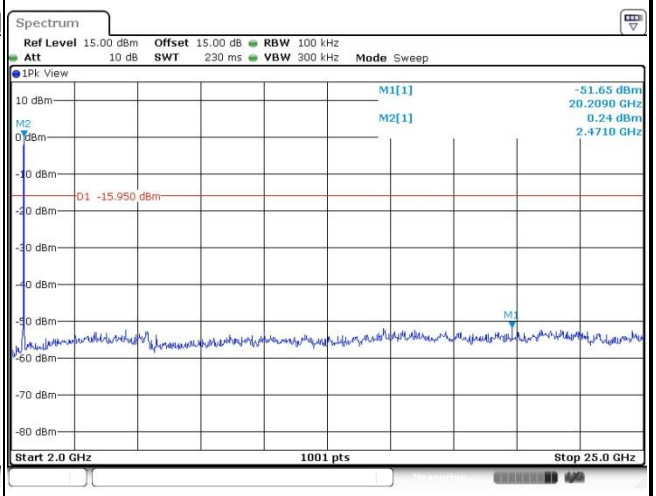
100kHz PSD reference Level	Channel Plot
	
Date: 23.JUN.2018 19:39:54	Date: 23.JUN.2018 19:41:15
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 23.JUN.2018 19:53:50	Date: 23.JUN.2018 19:53:58

Test Mode :	802.11g	Test Channel :	06

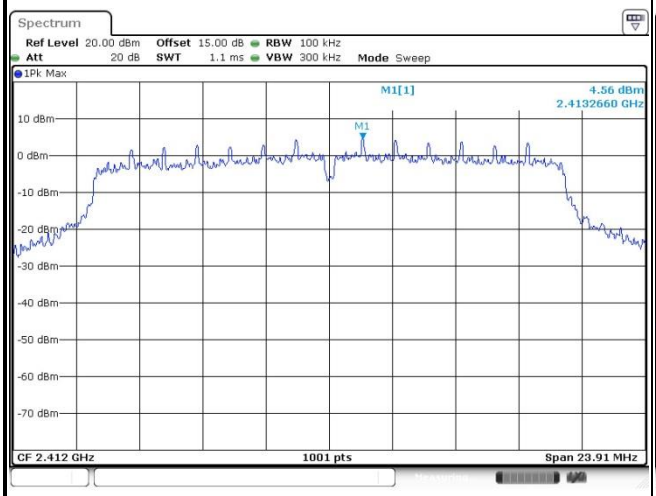
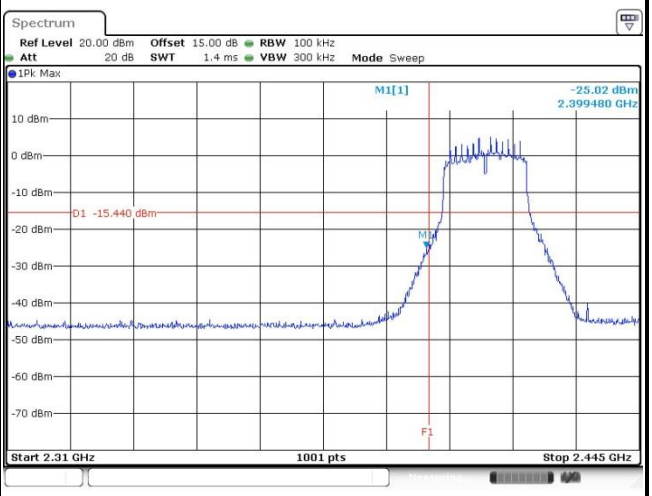
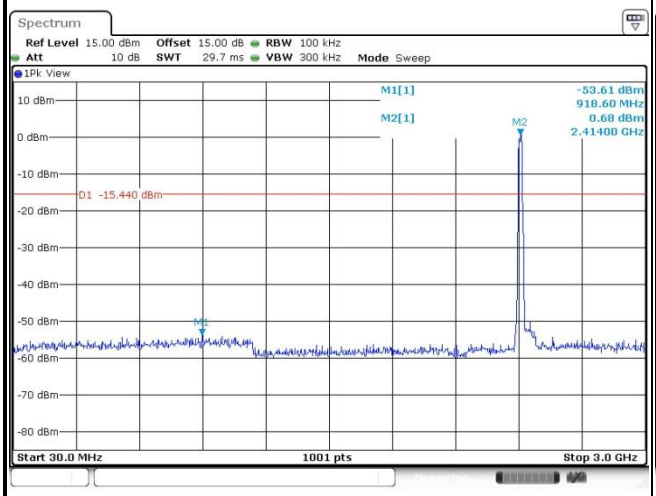
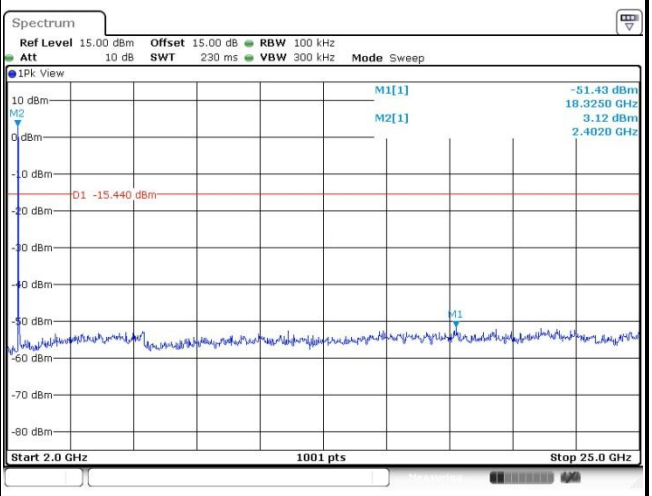
100kHz PSD reference Level	
	

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

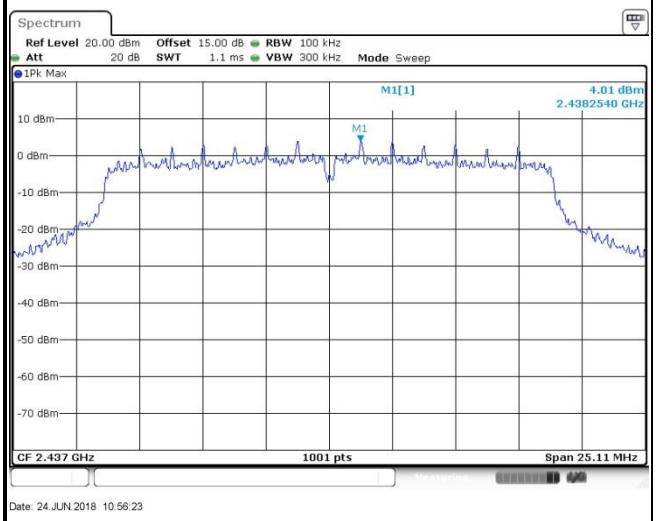
Test Mode :	802.11g	Test Channel :	11

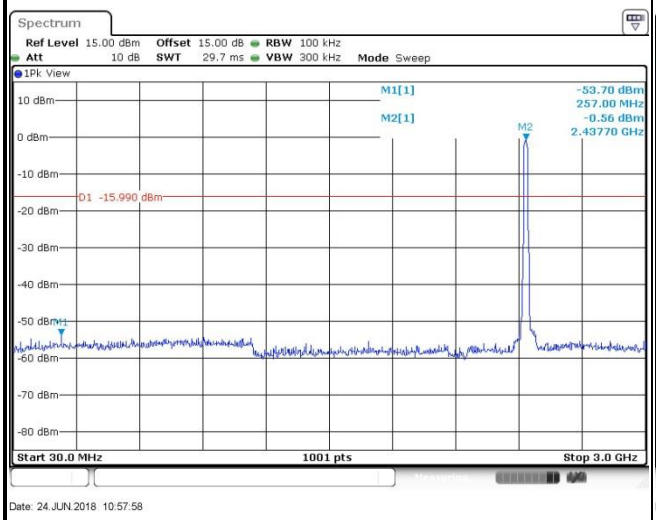
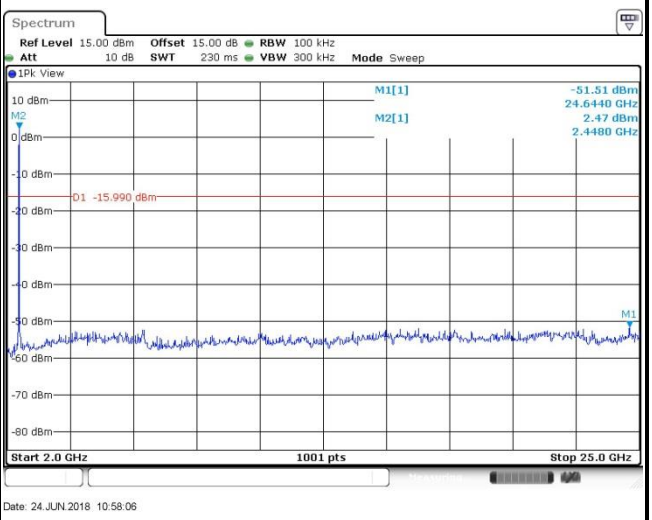
100kHz PSD reference Level	Channel Plot
	
Date: 23.JUN.2018 20:06:30	Date: 23.JUN.2018 20:07:15
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 23.JUN.2018 20:07:27	Date: 23.JUN.2018 20:07:35

Test Mode :	802.11n HT20	Test Channel :	01

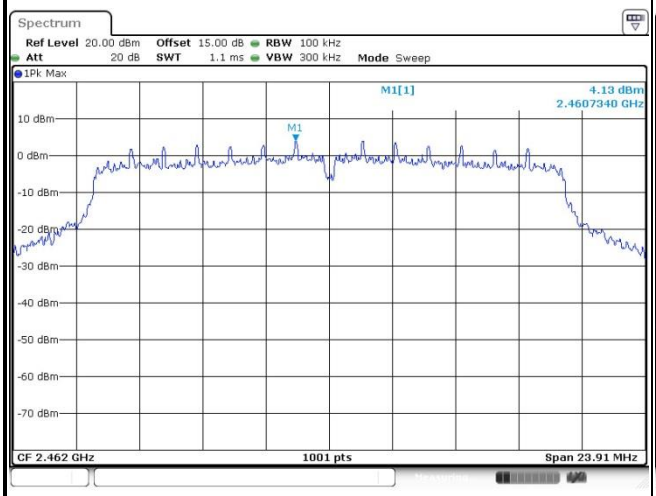
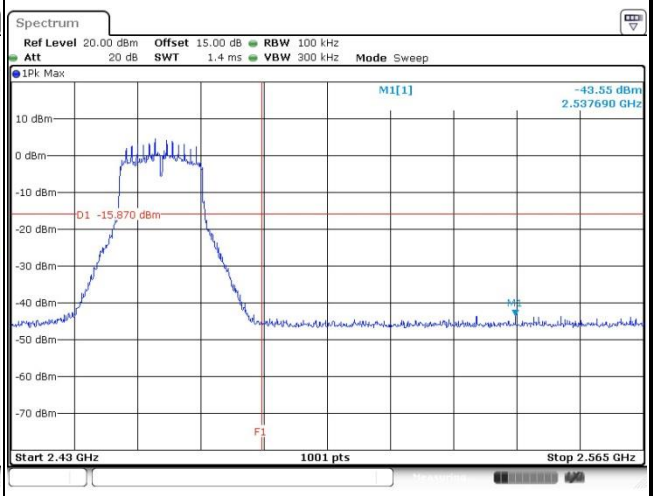
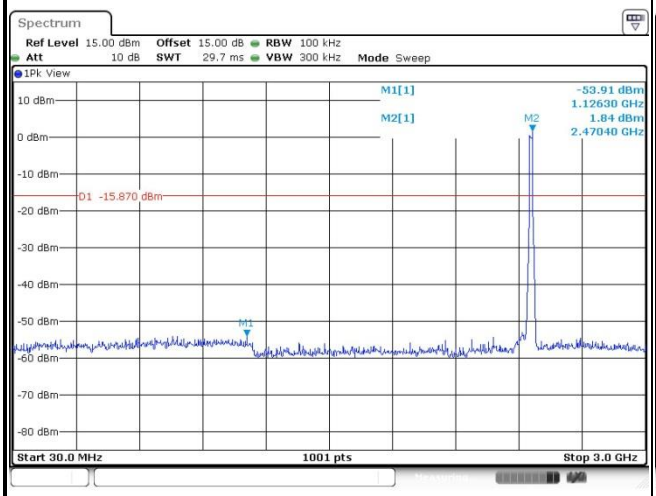
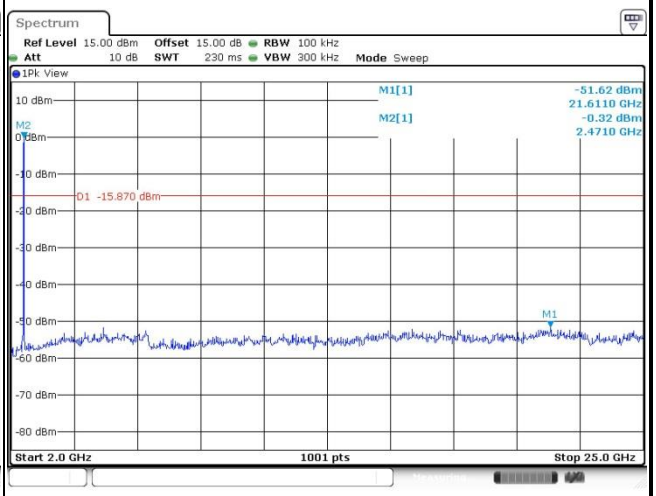
100kHz PSD reference Level	Channel Plot
 Date: 24.JUN.2018 10:26:30	 Date: 24.JUN.2018 10:29:48
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
 Date: 24.JUN.2018 10:33:17	 Date: 24.JUN.2018 10:33:25

Test Mode :	802.11n HT20	Test Channel :	06

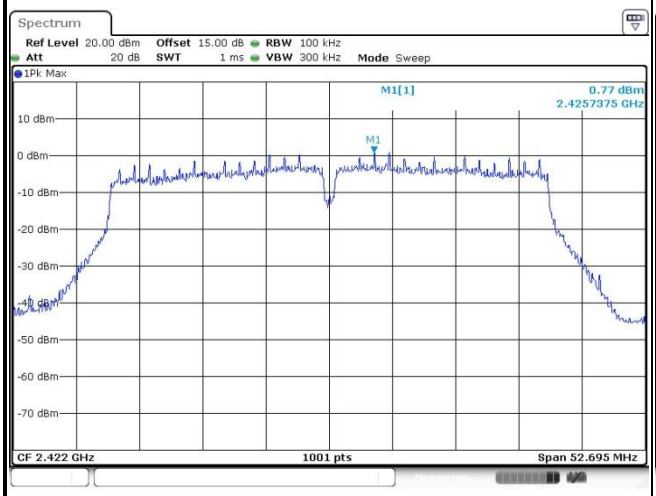
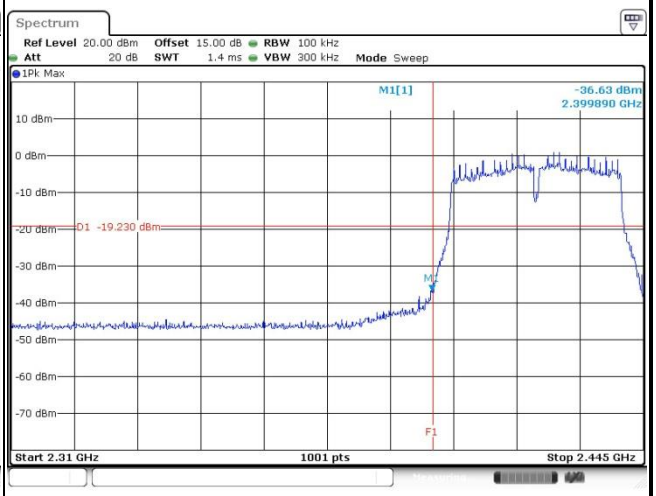
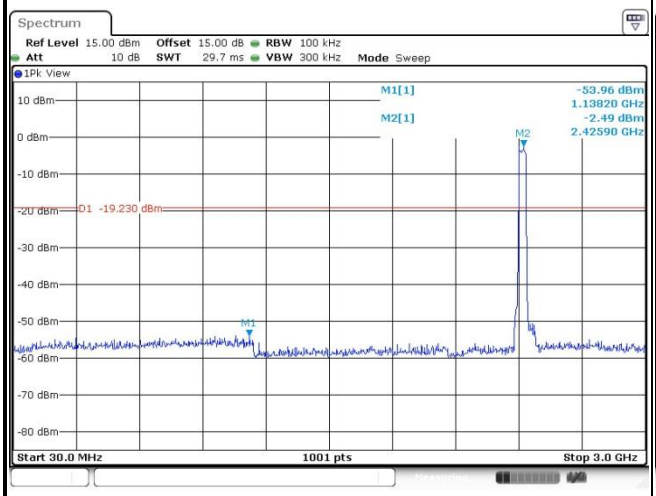
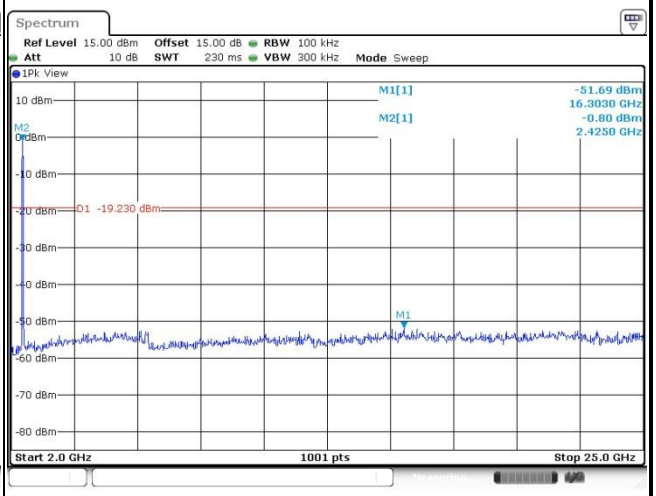
100kHz PSD reference Level	
	

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

Test Mode :	802.11n HT20	Test Channel :	11

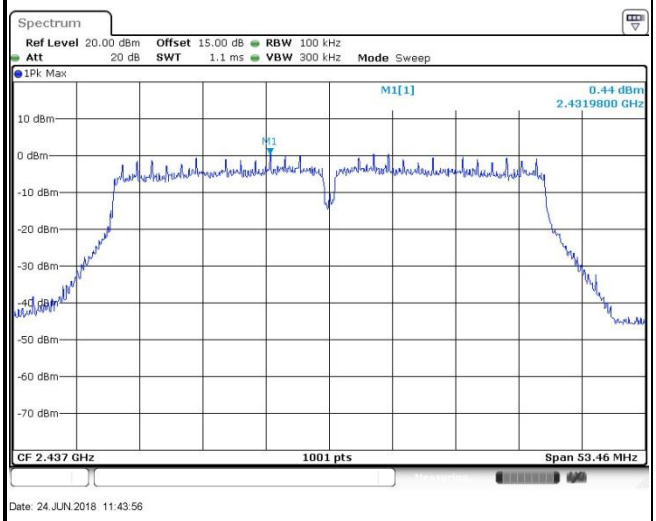
100kHz PSD reference Level	Channel Plot
 Date: 24.JUN.2018 11:11:52	 Date: 24.JUN.2018 11:13:31
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
 Date: 24.JUN.2018 11:14:44	 Date: 24.JUN.2018 11:14:53

Test Mode :	802.11n HT40	Test Channel :	03

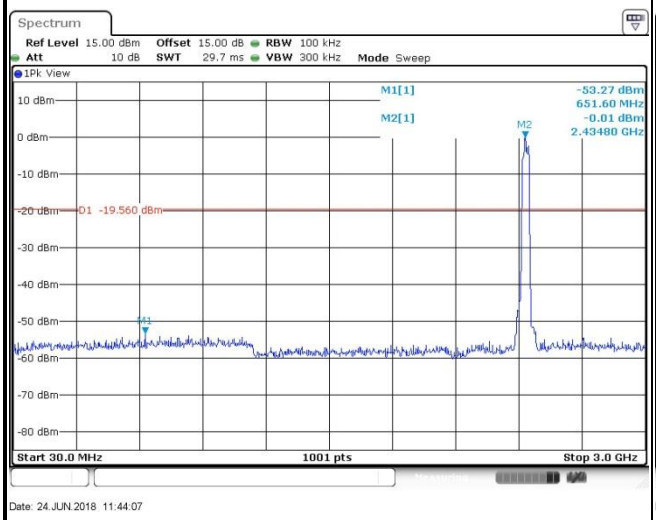
100kHz PSD reference Level	Channel Plot
 Date: 24.JUN.2018 11:28:21	 Date: 24.JUN.2018 11:30:31
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
 Date: 24.JUN.2018 11:33:28	 Date: 24.JUN.2018 11:33:36

Test Mode :	802.11n HT40	Test Channel :	06

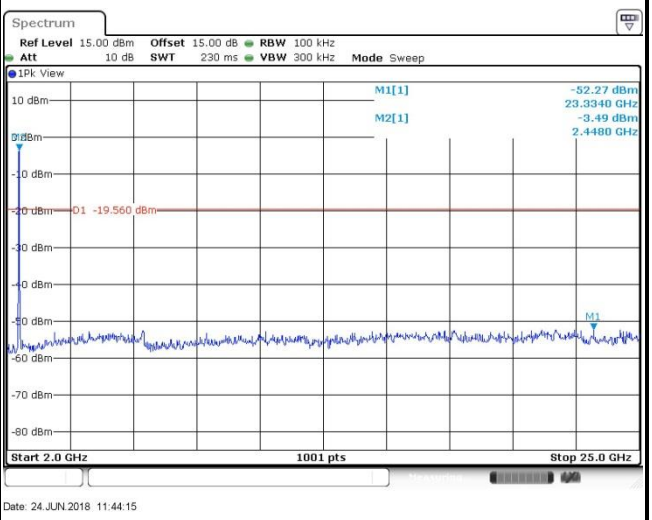
100kHz PSD reference Level



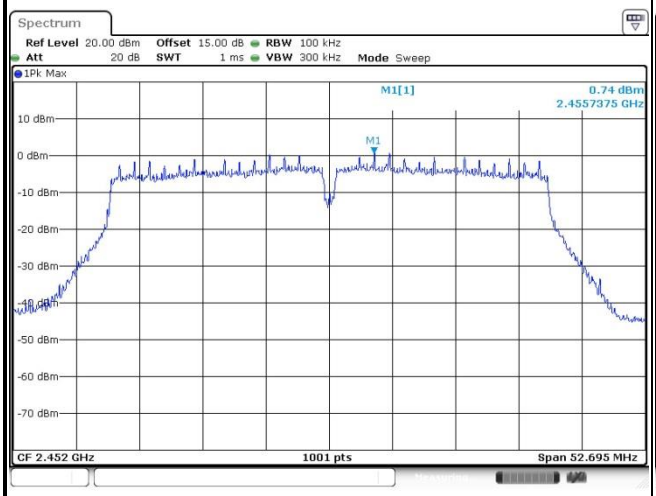
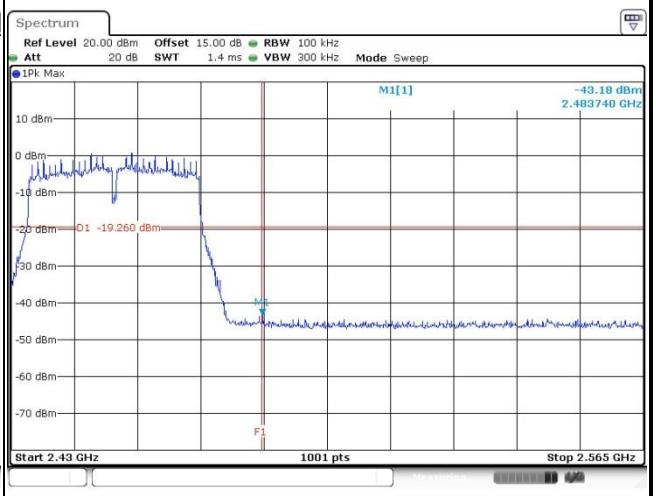
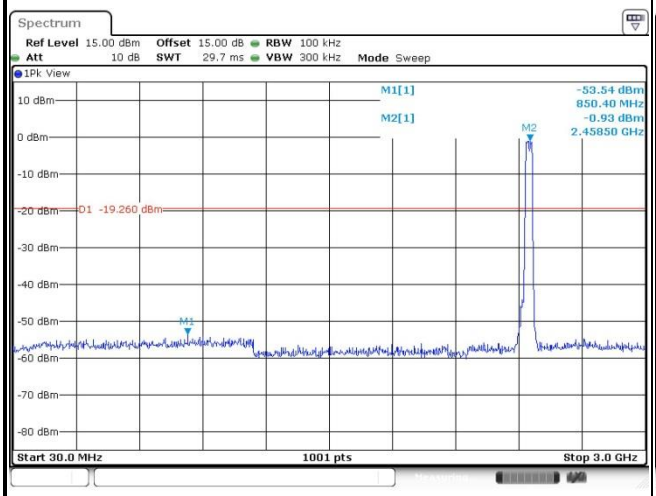
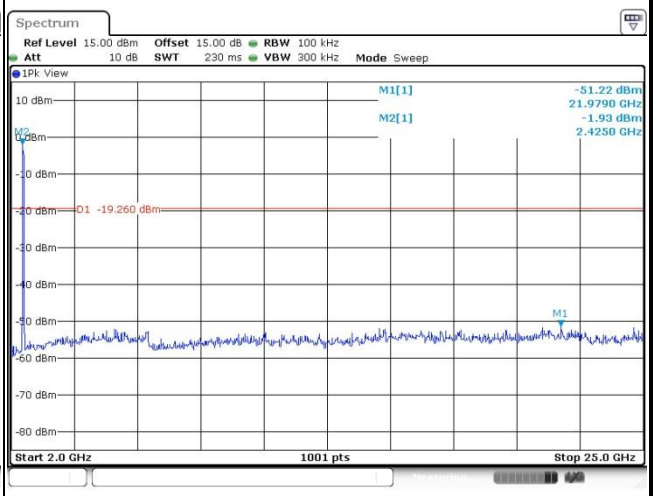
Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz



Test Mode :	802.11n HT40	Test Channel :	09

100kHz PSD reference Level	Channel Plot
	
Date: 24.JUN.2018 11:55:48	Date: 24.JUN.2018 11:56:39
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	
Date: 24.JUN.2018 11:59:45	Date: 24.JUN.2018 11:59:53

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

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

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

3.5.2 Measuring Instruments

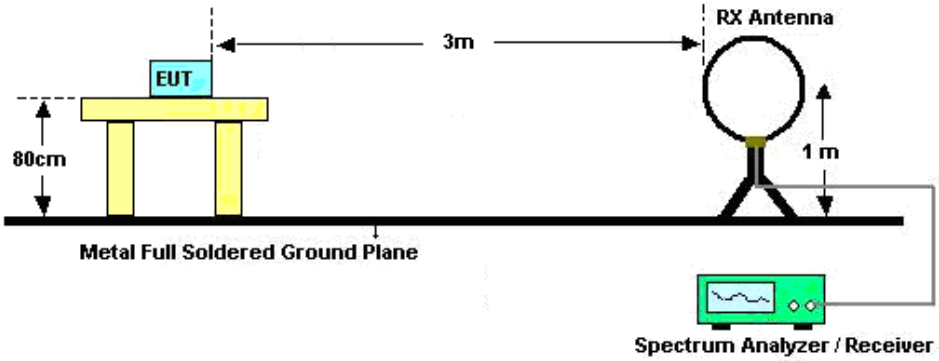
The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

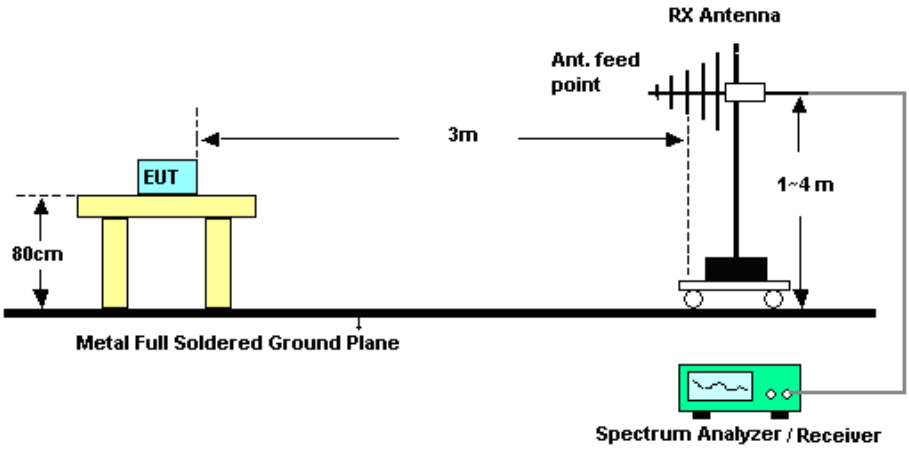
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

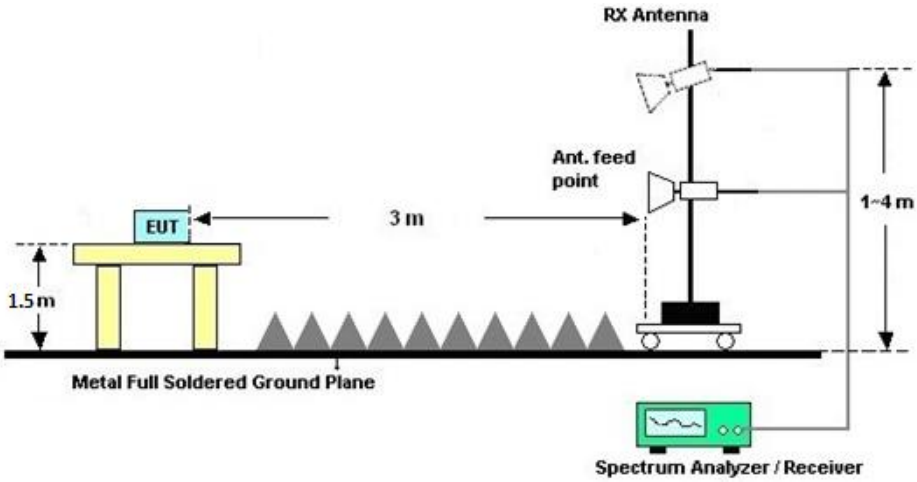
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

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

There is a comparison data of both open-field test site and 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.

3.5.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix C.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

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

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

*Decreases with the logarithm of the frequency.

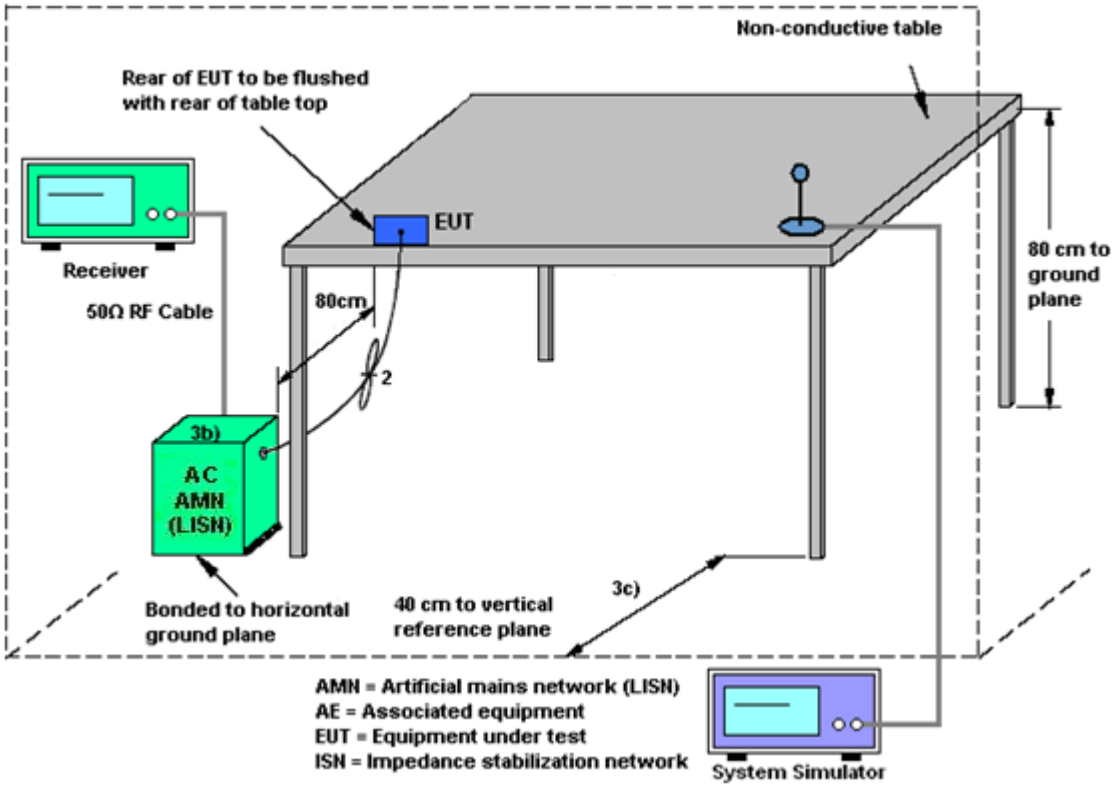
3.6.2 Measuring Instruments

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

3.6.3 Test Procedures

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

3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.7 Antenna Requirements

3.7.1 Standard Applicable

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

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

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

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSP30	101400	9kHz~30GHz	Dec. 26, 2017	Jun. 23, 2018~ Jun. 24, 2018	Dec. 25, 2018	Conducted (TH01-SZ)
Spectrum Analyzer	R&S	FSV40	101078	9kHz~40GHz	Apr. 19, 2018	Jun. 23, 2018~ Jun. 24, 2018	Apr. 18, 2019	Conducted (TH01-SZ)
Pulse Power Senor	Anritsu	MA2411B	1207253	30MHz~40GHz	Dec. 26, 2017	Jun. 23, 2018~ Jun. 24, 2018	Dec. 25, 2018	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Dec. 26, 2017	Jun. 23, 2018~ Jun. 24, 2018	Dec. 25, 2018	Conducted (TH01-SZ)
Spectrum Analyzer	R&S	FSV40	101041	10kHz~40GHz; Max 30dBm	Oct. 19, 2017	Jun. 11, 2018~ Jun. 26, 2018	Oct. 18, 2018	Radiation (03CH02-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	May 14, 2018	Jun. 11, 2018~ Jun. 26, 2018	May 13, 2019	Radiation (03CH02-SZ)
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz-2GHz	May 10, 2018	Jun. 11, 2018~ Jun. 26, 2018	May 09, 2019	Radiation (03CH02-SZ)
Double Ridge Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1285	1GHz~18GHz	Dec. 13, 2017	Jun. 11, 2018~ Jun. 26, 2018	Dec. 12, 2018	Radiation (03CH02-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18Ghz-40GHz	Mar. 30, 2018	Jun. 11, 2018~ Jun. 26, 2018	Mar. 29, 2019	Radiation (03CH02-SZ)
LF Amplifier	Burgeon	BPA-530	102211	0.01~3000Mhz	Oct. 19, 2017	Jun. 11, 2018~ Jun. 26, 2018	Oct. 18, 2018	Radiation (03CH02-SZ)
HF Amplifier	MITEQ	AMF-7D-00101800-30-10P-R	1707137	1GHz~18GHz	Oct. 19, 2017	Jun. 11, 2018~ Jun. 26, 2018	Oct. 18, 2018	Radiation (03CH02-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 21, 2017	Jun. 11, 2018~ Jun. 26, 2018	Jul. 20, 2018	Radiation (03CH02-SZ)
Amplifier	Agilent	8449B	3008A01023	1GHz~26.5GHz	Oct. 19, 2017	Jun. 11, 2018~ Jun. 26, 2018	Oct. 18, 2018	Radiation (03CH02-SZ)
AC Power Source	Chroma	61601	616010002470	N/A	NCR	Jun. 11, 2018~ Jun. 26, 2018	NCR	Radiation (03CH02-SZ)
Turn Table	Chaintek	T-200	N/A	0~360 degree	NCR	Jun. 11, 2018~ Jun. 26, 2018	NCR	Radiation (03CH02-SZ)
Antenna Mast	Chaintek	MBS-400	N/A	1 m~4 m	NCR	Jun. 11, 2018~ Jun. 26, 2018	NCR	Radiation (03CH02-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Dec. 26, 2017	Jun. 19, 2018	Dec. 25, 2018	Conduction (CO01-SZ)
AC LISN	EMCO	3816/2SH	00103912	9kHz~30MHz	Dec. 26, 2017	Jun. 19, 2018	Dec. 25, 2018	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	MessTec	3816/2SH	00103892	9kHz~30MHz	Nov. 01, 2017	Jun. 19, 2018	Oct. 31, 2018	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 19, 2017	Jun. 19, 2018	Jul. 18, 2018	Conduction (CO01-SZ)

NCR: No Calibration Required

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.6dB

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))	4.4dB

Appendix A. Conducted Test Results

A1 - DTS Part

Test Engineer:	Sam Zheng	Temperature:	21~25	°C
Test Date:	2018/6/23~2018/6/24	Relative Humidity:	51~54	%

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	12.79	7.03	0.50	Pass
11b	1Mbps	1	6	2437	12.84	8.03	0.50	Pass
11b	1Mbps	1	11	2462	12.79	8.01	0.50	Pass
11g	6Mbps	1	1	2412	17.58	15.45	0.50	Pass
11g	6Mbps	1	6	2437	17.68	15.64	0.50	Pass
11g	6Mbps	1	11	2462	17.53	15.33	0.50	Pass
HT20	MCS0	1	1	2412	18.93	15.94	0.50	Pass
HT20	MCS0	1	6	2437	18.93	16.74	0.50	Pass
HT20	MCS0	1	11	2462	18.73	15.94	0.50	Pass
HT40	MCS0	1	3	2422	36.46	35.13	0.50	Pass
HT40	MCS0	1	6	2437	36.66	35.64	0.50	Pass
HT40	MCS0	1	9	2452	36.56	35.13	0.50	Pass

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	0.05	14.15
11b	1Mbps	1	6	2437	0.05	14.05
11b	1Mbps	1	11	2462	0.05	14.00
11g	6Mbps	1	1	2412	0.24	14.12
11g	6Mbps	1	6	2437	0.24	14.04
11g	6Mbps	1	11	2462	0.24	14.09
HT20	MCS0	1	1	2412	0.25	14.00
HT20	MCS0	1	6	2437	0.25	13.85
HT20	MCS0	1	11	2462	0.25	13.90
HT40	MCS0	1	3	2422	0.45	13.78
HT40	MCS0	1	6	2437	0.45	13.87
HT40	MCS0	1	9	2452	0.45	13.77

TEST RESULTS DATA
Peak Power Table

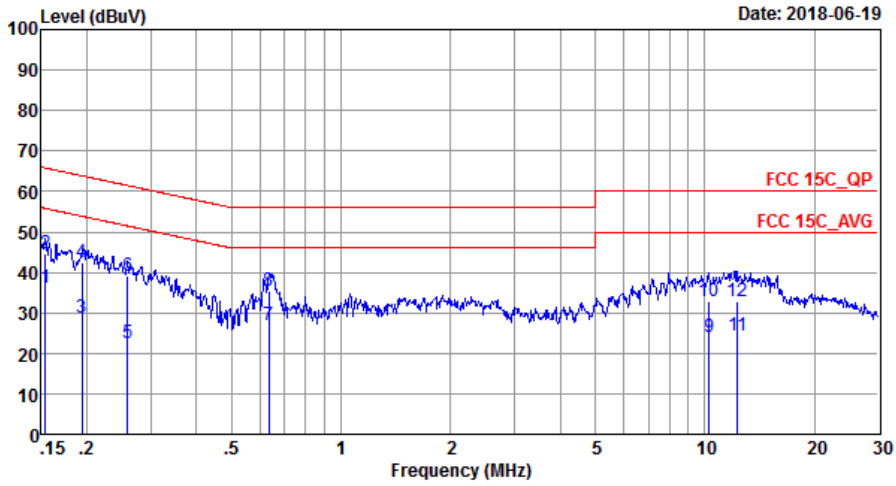
2.4GHz Band										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
11b	1Mbps	1	1	2412	16.84	30.00	0.50	17.34	36.00	Pass
11b	1Mbps	1	6	2437	16.81	30.00	0.50	17.31	36.00	Pass
11b	1Mbps	1	11	2462	16.77	30.00	0.50	17.27	36.00	Pass
11g	6Mbps	1	1	2412	18.77	30.00	0.50	19.27	36.00	Pass
11g	6Mbps	1	6	2437	18.52	30.00	0.50	19.02	36.00	Pass
11g	6Mbps	1	11	2462	18.75	30.00	0.50	19.25	36.00	Pass
HT20	MCS0	1	1	2412	18.75	30.00	0.50	19.25	36.00	Pass
HT20	MCS0	1	6	2437	18.51	30.00	0.50	19.01	36.00	Pass
HT20	MCS0	1	11	2462	18.70	30.00	0.50	19.20	36.00	Pass
HT40	MCS0	1	3	2422	19.82	30.00	0.50	20.32	36.00	Pass
HT40	MCS0	1	6	2437	20.29	30.00	0.50	20.79	36.00	Pass
HT40	MCS0	1	9	2452	20.27	30.00	0.50	20.77	36.00	Pass

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	-11.90	0.50	8.00	Pass
11b	1Mbps	1	6	2437	-12.13	0.50	8.00	Pass
11b	1Mbps	1	11	2462	-13.18	0.50	8.00	Pass
11g	6Mbps	1	1	2412	-12.38	0.50	8.00	Pass
11g	6Mbps	1	6	2437	-13.46	0.50	8.00	Pass
11g	6Mbps	1	11	2462	-13.03	0.50	8.00	Pass
HT20	MCS0	1	1	2412	-11.63	0.50	8.00	Pass
HT20	MCS0	1	6	2437	-12.14	0.50	8.00	Pass
HT20	MCS0	1	11	2462	-11.80	0.50	8.00	Pass
HT40	MCS0	1	3	2422	-15.21	0.50	8.00	Pass
HT40	MCS0	1	6	2437	-14.94	0.50	8.00	Pass
HT40	MCS0	1	9	2452	-14.61	0.50	8.00	Pass

Appendix B. AC Conducted Emission Test Results

Test Engineer :	ZhangXu	**Temperature :**	22~25℃
		Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line

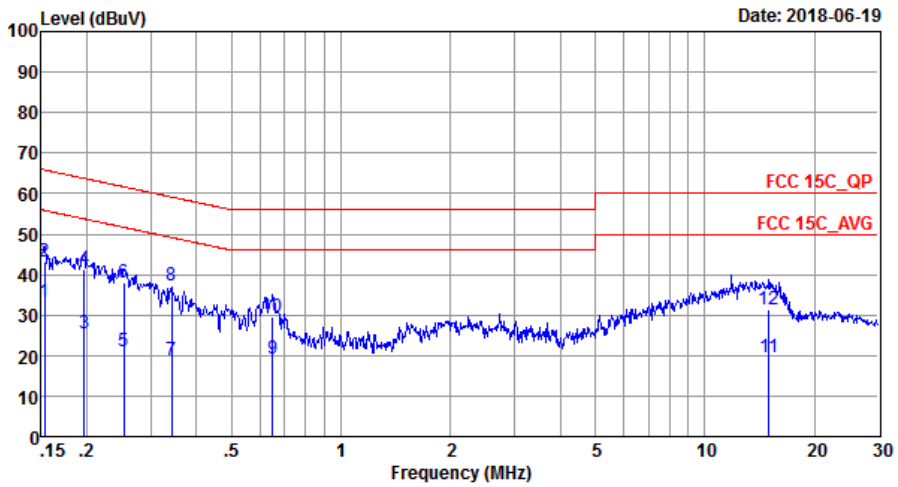


Site : CO01-SZ
Condition: FCC 15C_QP LISN_20170907_L LINE

IMEI : 358016090005806

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1		0.15	35.99	-19.79	55.78	25.90	0.03	10.06	Average
2		0.15	44.59	-21.19	65.78	34.50	0.03	10.06	QP
3		0.19	28.69	-25.15	53.84	18.59	0.03	10.07	Average
4		0.19	42.30	-21.54	63.84	32.20	0.03	10.07	QP
5		0.26	22.41	-29.06	51.47	12.30	0.03	10.08	Average
6		0.26	39.01	-22.46	61.47	28.90	0.03	10.08	QP
7	*	0.63	26.80	-19.20	46.00	16.70	0.02	10.08	Average
8		0.63	35.30	-20.70	56.00	25.20	0.02	10.08	QP
9		10.29	24.11	-25.89	50.00	13.40	0.37	10.34	Average
10		10.29	32.91	-27.09	60.00	22.20	0.37	10.34	QP
11		12.32	24.21	-25.79	50.00	13.40	0.44	10.37	Average
12		12.32	33.01	-26.99	60.00	22.20	0.44	10.37	QP

Test Engineer :	ZhangXu	**Temperature :**	22~25℃
		Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	**Phase :**	Neutral



Site : CO01-SZ
Condition: FCC 15C_QP LISN_20170907_N NEUTRAL

IMEI : 358016090005806

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1		0.15	33.29	-22.53	55.82	23.20	0.03	10.06	Average
2		0.15	43.19	-22.63	65.82	33.10	0.03	10.06	QP
3		0.20	25.40	-28.36	53.76	15.30	0.03	10.07	Average
4		0.20	41.30	-22.46	63.76	31.20	0.03	10.07	QP
5		0.25	20.90	-30.74	51.64	10.80	0.03	10.07	Average
6		0.25	38.00	-23.64	61.64	27.90	0.03	10.07	QP
7		0.34	18.81	-30.32	49.13	8.70	0.03	10.08	Average
8	*	0.34	37.31	-21.82	59.13	27.20	0.03	10.08	QP
9		0.65	19.10	-26.90	46.00	9.00	0.02	10.08	Average
10		0.65	29.50	-26.50	56.00	19.40	0.02	10.08	QP
11		14.99	19.64	-30.36	50.00	8.90	0.33	10.41	Average
12		14.99	31.44	-28.56	60.00	20.70	0.33	10.41	QP

Appendix C. Radiated Spurious Emission

Test Engineer :	Reid Huang	**Temperature :**	24~25°C
		Relative Humidity :	48~49%

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable 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		2389.8	48.18	-25.82	74	45.72	27.09	6.65	31.28	241	94	P	H
		2389.91	39.39	-14.61	54	36.93	27.09	6.65	31.28	241	94	A	H
	*	2412	104.84	-	-	102.3	27.14	6.66	31.26	241	94	P	H
	*	2412	102.77	-	-	100.23	27.14	6.66	31.26	241	94	A	H
		2389.07	47.69	-26.31	74	45.23	27.09	6.65	31.28	270	145	P	V
		2388.96	37.5	-16.5	54	35.04	27.09	6.65	31.28	270	145	A	V
	*	2412	99.99	-	-	97.45	27.14	6.66	31.26	270	145	P	V
	*	2412	97.28	-	-	94.74	27.14	6.66	31.26	270	145	A	V
802.11b CH 06 2437MHz		2360.26	46.86	-27.14	74	44.57	26.99	6.61	31.31	261	95	P	H
		2368.24	37.74	-16.26	54	35.45	26.99	6.61	31.31	261	95	A	H
	*	2437	104.78	-	-	102.17	27.24	6.63	31.26	261	95	P	H
	*	2437	102.29	-	-	99.68	27.24	6.63	31.26	261	95	A	H
		2486.91	48.12	-25.88	74	45.41	27.35	6.58	31.22	261	95	P	H
		2484.74	38.8	-15.2	54	36.09	27.35	6.58	31.22	261	95	A	H
		2326.8	46.58	-27.42	74	44.5	26.88	6.55	31.35	263	146	P	V
		2389.38	37.05	-16.95	54	34.59	27.09	6.65	31.28	263	146	A	V
	*	2437	98.98	-	-	96.37	27.24	6.63	31.26	263	146	P	V
	*	2437	96.37	-	-	93.76	27.24	6.63	31.26	263	146	A	V
		2494.4	48.53	-25.47	74	45.75	27.4	6.58	31.2	263	146	P	V
		2485.44	37.67	-16.33	54	34.96	27.35	6.58	31.22	263	146	A	V

802.11b CH 11 2462MHz	*	2462	105.01	-	-	102.34	27.3	6.61	31.24	219	92	P	H
	*	2462	101.56	-	-	98.89	27.3	6.61	31.24	219	92	A	H
		2484.44	50.35	-23.65	74	47.64	27.35	6.58	31.22	219	92	P	H
		2483.52	41.43	-12.57	54	38.72	27.35	6.58	31.22	219	92	A	H
	*	2462	99.75	-	-	97.08	27.3	6.61	31.24	290	164	P	V
	*	2462	97.08	-	-	94.41	27.3	6.61	31.24	290	164	A	V
		2497.04	48.03	-25.97	74	45.25	27.4	6.58	31.2	290	164	P	V
		2483.68	38.79	-15.21	54	36.08	27.35	6.58	31.22	290	164	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		4824	38.69	-35.31	74	56.02	31.42	9.44	58.19	185	255	P	H
		4824	38.63	-35.37	74	55.96	31.42	9.44	58.19	185	255	P	V
802.11b CH 06 2437MHz		4874	38.73	-35.27	74	55.92	31.51	9.4	58.1	165	106	P	H
		7311	46.54	-27.46	74	56.1	36.36	12	57.92	174	100	P	H
		4874	39.02	-34.98	74	56.21	31.51	9.4	58.1	165	106	P	V
		7311	46.14	-27.86	74	55.7	36.36	12	57.92	174	100	P	V
802.11b CH 11 2462MHz		4924	38.91	-35.09	74	55.91	31.59	9.43	58.02	150	285	P	H
		7386	46.45	-27.55	74	55.44	36.65	12.01	57.65	155	274	P	H
		4924	38.56	-35.44	74	55.56	31.59	9.43	58.02	150	285	P	V
		7386	45.39	-28.61	74	54.38	36.65	12.01	57.65	155	274	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 802.11g (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		2389.07	51.3	-22.7	74	48.84	27.09	6.65	31.28	211	93	P	H
		2389.91	41.63	-12.37	54	39.17	27.09	6.65	31.28	211	93	A	H
	*	2412	104.94	-	-	102.4	27.14	6.66	31.26	211	93	P	H
	*	2412	97.28	-	-	94.74	27.14	6.66	31.26	211	93	A	H
		2389.59	48.45	-25.55	74	45.99	27.09	6.65	31.28	225	140	P	V
		2389.8	38.72	-15.28	54	36.26	27.09	6.65	31.28	225	140	A	V
	*	2412	97.95	-	-	95.41	27.14	6.66	31.26	225	140	P	V
	*	2412	91	-	-	88.46	27.14	6.66	31.26	225	140	A	V
802.11g CH 06 2437MHz		2389.8	47.92	-26.08	74	45.46	27.09	6.65	31.28	180	88	P	H
		2389.52	39.08	-14.92	54	36.62	27.09	6.65	31.28	180	88	A	H
	*	2437	105.05	-	-	102.44	27.24	6.63	31.26	180	88	P	H
	*	2437	98.38	-	-	95.77	27.24	6.63	31.26	180	88	A	H
		2483.97	51.25	-22.75	74	48.54	27.35	6.58	31.22	180	88	P	H
		2483.9	41.5	-12.5	54	38.79	27.35	6.58	31.22	180	88	A	H
		2328.62	46.96	-27.04	74	44.88	26.88	6.55	31.35	233	149	P	V
		2389.66	37.61	-16.39	54	35.15	27.09	6.65	31.28	233	149	A	V
	*	2437	98.25	-	-	95.64	27.24	6.63	31.26	233	149	P	V
	*	2437	90.73	-	-	88.12	27.24	6.63	31.26	233	149	A	V
		2488.31	46.73	-27.27	74	43.97	27.4	6.58	31.22	233	149	P	V
		2486.91	37.89	-16.11	54	35.18	27.35	6.58	31.22	233	149	A	V

802.11g CH 11 2462MHz	*	2462	105.46	-	-	102.79	27.3	6.61	31.24	184	92	P	H
	*	2462	98.24	-	-	95.57	27.3	6.61	31.24	184	92	A	H
		2483.76	51.85	-22.15	74	49.14	27.35	6.58	31.22	184	92	P	H
		2483.52	41.62	-12.38	54	38.91	27.35	6.58	31.22	184	92	A	H
	*	2462	97.03	-	-	94.36	27.3	6.61	31.24	203	165	P	V
	*	2462	90.25	-	-	87.58	27.3	6.61	31.24	203	165	A	V
		2487.28	47.98	-26.02	74	45.27	27.35	6.58	31.22	203	165	P	V
		2484.4	38.07	-15.93	54	35.36	27.35	6.58	31.22	203	165	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		4824	38.71	-35.29	74	56.04	31.42	9.44	58.19	185	255	P	H
		4824	38.59	-35.41	74	55.92	31.42	9.44	58.19	185	255	P	V
802.11g CH 06 2437MHz		4874	38.93	-35.07	74	56.12	31.51	9.4	58.1	165	106	P	H
		7311	46.66	-27.34	74	56.22	36.36	12	57.92	174	100	P	H
		4874	38.4	-35.6	74	55.59	31.51	9.4	58.1	165	106	P	V
		7311	46.05	-27.95	74	55.61	36.36	12	57.92	174	100	P	V
802.11g CH 11 2462MHz		4924	38.76	-35.24	74	55.76	31.59	9.43	58.02	150	285	P	H
		7386	46.14	-27.86	74	55.13	36.65	12.01	57.65	155	274	P	H
		4924	38.47	-35.53	74	55.47	31.59	9.43	58.02	150	285	P	V
		7386	45.05	-28.95	74	54.04	36.65	12.01	57.65	155	274	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		2389.91	52.81	-21.19	74	50.35	27.09	6.65	31.28	343	268	P	H
		2389.91	43.21	-10.79	54	40.75	27.09	6.65	31.28	343	268	A	H
	*	2412	107.44	-	-	104.9	27.14	6.66	31.26	343	268	P	H
	*	2412	99.63	-	-	97.09	27.14	6.66	31.26	343	268	A	H
		2367.02	47.52	-26.48	74	45.23	26.99	6.61	31.31	388	352	P	V
		2389.59	37.99	-16.01	54	35.53	27.09	6.65	31.28	388	352	A	V
	*	2412	96.71	-	-	94.17	27.14	6.66	31.26	388	352	P	V
	*	2412	88.93	-	-	86.39	27.14	6.66	31.26	388	352	A	V
802.11n HT20 CH 06 2437MHz		2386.44	47.47	-26.53	74	45.01	27.09	6.65	31.28	386	264	P	H
		2389.94	38.47	-15.53	54	36.01	27.09	6.65	31.28	386	264	A	H
	*	2437	107.15	-	-	104.54	27.24	6.63	31.26	386	264	P	H
	*	2437	99.18	-	-	96.57	27.24	6.63	31.26	386	264	A	H
		2484.32	48.83	-25.17	74	46.12	27.35	6.58	31.22	386	264	P	H
		2483.5	40.2	-13.8	54	37.49	27.35	6.58	31.22	386	264	A	H
		2357.18	47.27	-26.73	74	45	26.99	6.61	31.33	388	352	P	V
		2389.94	37.18	-16.82	54	34.72	27.09	6.65	31.28	388	352	A	V
	*	2437	99.05	-	-	96.44	27.24	6.63	31.26	388	352	P	V
	*	2437	91.34	-	-	88.73	27.24	6.63	31.26	388	352	A	V
		2496.43	48.06	-25.94	74	45.28	27.4	6.58	31.2	388	352	P	V
		2483.55	37.72	-16.28	54	35.01	27.35	6.58	31.22	388	352	A	V

802.11n HT20 CH 11 2462MHz	*	2462	107.75	-	-	105.08	27.3	6.61	31.24	337	268	P	H
	*	2462	99.43	-	-	96.76	27.3	6.61	31.24	337	268	A	H
		2483.84	49.76	-24.24	74	47.05	27.35	6.58	31.22	337	268	P	H
		2483.96	40.5	-13.5	54	37.79	27.35	6.58	31.22	337	268	A	H
	*	2462	98.06	-	-	95.39	27.3	6.61	31.24	333	357	P	V
	*	2462	89.94	-	-	87.27	27.3	6.61	31.24	333	357	A	V
		2488.24	48.23	-25.77	74	45.47	27.4	6.58	31.22	333	357	P	V
		2486.64	37.74	-16.26	54	35.03	27.35	6.58	31.22	333	357	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		4824	39.43	-34.57	74	56.76	31.42	9.44	58.19	185	255	P	H
		4824	39.02	-34.98	74	56.35	31.42	9.44	58.19	185	255	P	V
802.11n HT20 CH 06 2437MHz		4874	39.49	-34.51	74	56.68	31.51	9.4	58.1	165	106	P	H
		7311	46.09	-27.91	74	55.65	36.36	12	57.92	174	100	P	H
		4874	38.85	-35.15	74	56.04	31.51	9.4	58.1	165	106	P	V
		7311	46.28	-27.72	74	55.84	36.36	12	57.92	174	100	P	V
802.11n HT20 CH 11 2462MHz		4924	39.63	-34.37	74	56.63	31.59	9.43	58.02	150	285	P	H
		7386	45.87	-28.13	74	54.86	36.65	12.01	57.65	155	274	P	H
		4924	39.36	-34.64	74	56.36	31.59	9.43	58.02	150	285	P	V
		7386	45.58	-28.42	74	54.57	36.65	12.01	57.65	155	274	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 03 2422MHz		2388.82	56.65	-17.35	74	54.19	27.09	6.65	31.28	347	271	P	H
		2389.38	48.06	-5.94	54	45.6	27.09	6.65	31.28	347	271	A	H
	*	2422	105.66	-	-	103.07	27.19	6.66	31.26	347	271	P	H
	*	2422	97.24	-	-	94.65	27.19	6.66	31.26	347	271	P	H
		2485.02	49.65	-24.35	74	46.94	27.35	6.58	31.22	347	271	P	H
		2484.88	39.69	-14.31	54	36.98	27.35	6.58	31.22	119	215	A	H
		2389.66	48.96	-25.04	74	46.5	27.09	6.65	31.28	389	299	P	V
		2389.8	41.47	-12.53	54	39.01	27.09	6.65	31.28	389	299	A	V
	*	2422	99.22	-	-	96.63	27.19	6.66	31.26	389	299	P	V
	*	2422	90.96	-	-	88.37	27.19	6.66	31.26	389	299	P	V
		2494.19	47.68	-26.32	74	44.9	27.4	6.58	31.2	389	299	P	V
		2483.76	39.1	-14.9	54	36.39	27.35	6.58	31.22	389	299	A	V
802.11n HT40 CH 06 2437MHz		2389.8	50.98	-23.02	74	48.52	27.09	6.65	31.28	347	269	P	H
		2389.94	42.67	-11.33	54	40.21	27.09	6.65	31.28	347	269	A	H
	*	2437	105.46	-	-	102.85	27.24	6.63	31.26	347	269	P	H
	*	2437	97.59	-	-	94.98	27.24	6.63	31.26	347	269	P	H
		2484.11	49.46	-24.54	74	46.75	27.35	6.58	31.22	347	269	P	H
		2484.04	41.81	-12.19	54	39.1	27.35	6.58	31.22	347	269	A	H
		2335.06	47.14	-26.86	74	44.99	26.93	6.55	31.33	389	299	P	V
		2389.8	38.49	-15.51	54	36.03	27.09	6.65	31.28	389	299	A	V
	*	2437	99.32	-	-	96.71	27.24	6.63	31.26	389	299	P	V
	*	2437	91.25	-	-	88.64	27.24	6.63	31.26	389	299	P	V
		2484.04	49.01	-24.99	74	46.3	27.35	6.58	31.22	389	299	P	V
		2483.5	39.27	-14.73	54	36.56	27.35	6.58	31.22	389	299	A	V

802.11n HT40 CH 09 2452MHz		2388.26	47.84	-26.16	74	45.38	27.09	6.65	31.28	338	269	P	H
		2387.98	38.91	-15.09	54	36.45	27.09	6.65	31.28	338	269	A	H
	*	2452	105.38	-	-	102.77	27.24	6.61	31.24	338	269	P	H
	*	2452	97.79	-	-	95.18	27.24	6.61	31.24	338	269	P	H
		2483.48	53.39	-96.61	150	50.68	27.35	6.58	31.22	338	269	P	H
		2483.62	44.59	-9.41	54	41.88	27.35	6.58	31.22	338	269	A	H
		2383.08	46.79	-27.21	74	44.41	27.04	6.65	31.31	389	299	P	V
		2388.54	37.97	-16.03	54	35.51	27.09	6.65	31.28	389	299	A	V
	*	2452	98.87	-	-	96.26	27.24	6.61	31.24	389	299	P	V
	*	2452	91.1	-	-	88.49	27.24	6.61	31.24	389	299	P	V
		2484.25	49.68	-24.32	74	46.97	27.35	6.58	31.22	389	299	P	V
		2484.32	40.44	-13.56	54	37.73	27.35	6.58	31.22	389	299	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n		4844	40.46	-33.54	74	57.74	31.45	9.43	58.16	150	350	P	H
HT40		7266	46.57	-27.43	74	56.4	36.24	11.96	58.03	200	360	P	H
CH 03		4844	39.03	-34.97	74	56.31	31.45	9.43	58.16	150	350	P	V
2422MHz		7266	46.32	-27.68	74	56.15	36.24	11.96	58.03	200	360	P	V
802.11n		4874	40.71	-33.29	74	57.9	31.51	9.4	58.1	165	230	P	H
HT40		7311	46.29	-27.71	74	55.85	36.36	12	57.92	186	323	P	H
CH 06		4874	39.62	-34.38	74	56.81	31.51	9.4	58.1	165	230	P	V
2437MHz		7311	47.06	-26.94	74	56.62	36.36	12	57.92	186	323	P	V
802.11n		4904	39.47	-34.53	74	56.57	31.56	9.38	58.04	150	360	P	H
HT40		7356	46.36	-27.64	74	55.58	36.53	12.01	57.76	165	335	P	H
CH 09		4904	39.84	-34.16	74	56.94	31.56	9.38	58.04	150	360	P	V
2452MHz		7356	46.48	-27.52	74	55.7	36.53	12.01	57.76	165	335	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 802.11n HT40 (LF)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
2.4GHz 802.11n HT40 LF		32.91	26.18	-13.82	40	31.28	-5.1	0.28	31.6	140	150	P	H
		90.14	21.71	-21.79	43.5	34.74	-13.03	0.77	31.5	-	-	P	H
		159.01	29.14	-14.36	43.5	40.81	-11.67	1.37	31.36	-	-	P	H
		259.89	24.96	-21.04	46	36.17	-11.21	1.9	31.02	-	-	P	H
		581.93	28.77	-17.23	46	31.99	-3.22	2.95	31.2	-	-	P	H
		720.64	30.67	-15.33	46	30.91	-0.24	3.35	31.24	-	-	P	H
		40.67	32.89	-7.11	40	42.02	-9.13	0.39	31.7	145	122	P	V
		87.23	29.9	-10.1	40	43.62	-13.72	0.74	31.5	-	-	P	V
		160.95	26.16	-17.34	43.5	37.88	-11.72	1.38	31.35	-	-	P	V
		257.95	26.63	-19.37	46	37.91	-11.28	1.89	31.02	-	-	P	V
		727.43	32.05	-13.95	46	32.14	-0.09	3.37	31.26	-	-	P	V
		1000	33.08	-20.92	54	30.07	3.01	4.21	31.5	-	-	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	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Level(dBμV/m) =

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

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

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

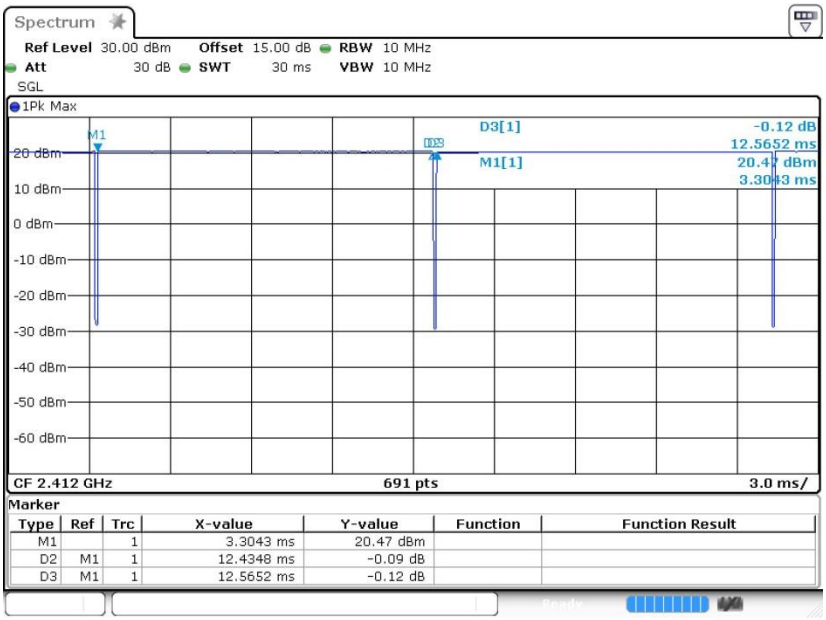
= -10.46(dB)

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

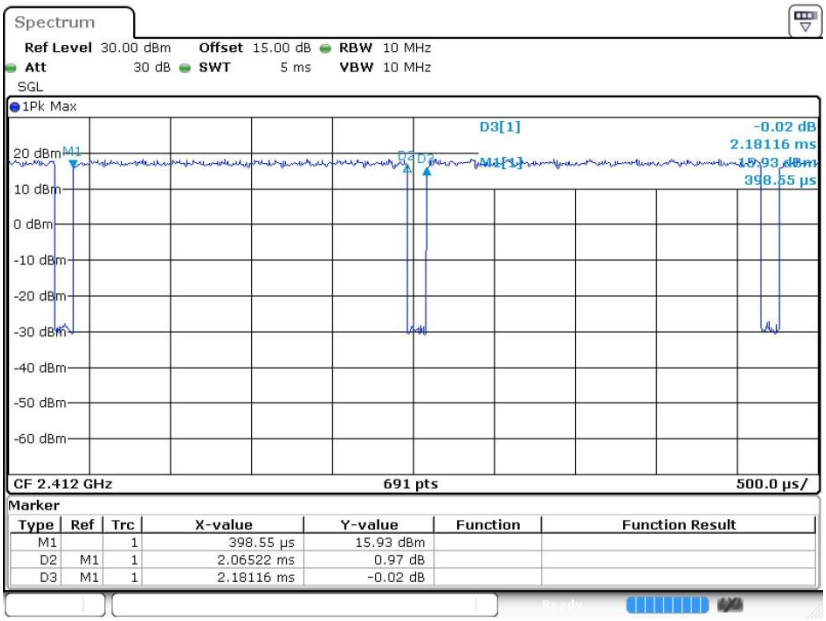
Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11b	98.96	-	-	10Hz
802.11g	94.68	2.065	0.484	1KHz
802.11n HT20	94.33	1.928	0.519	1KHz
802.11n HT40	90.22	0.949	1.053	3KHz

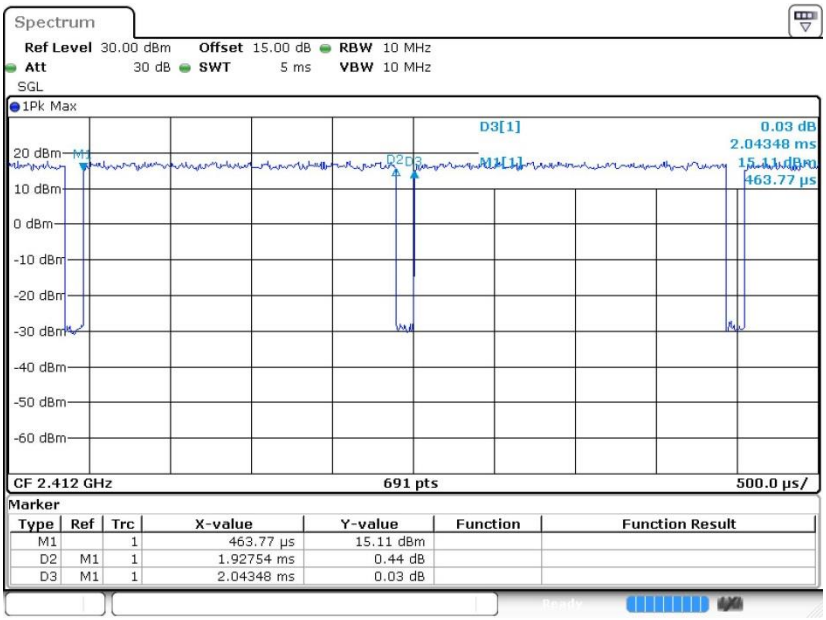
802.11b



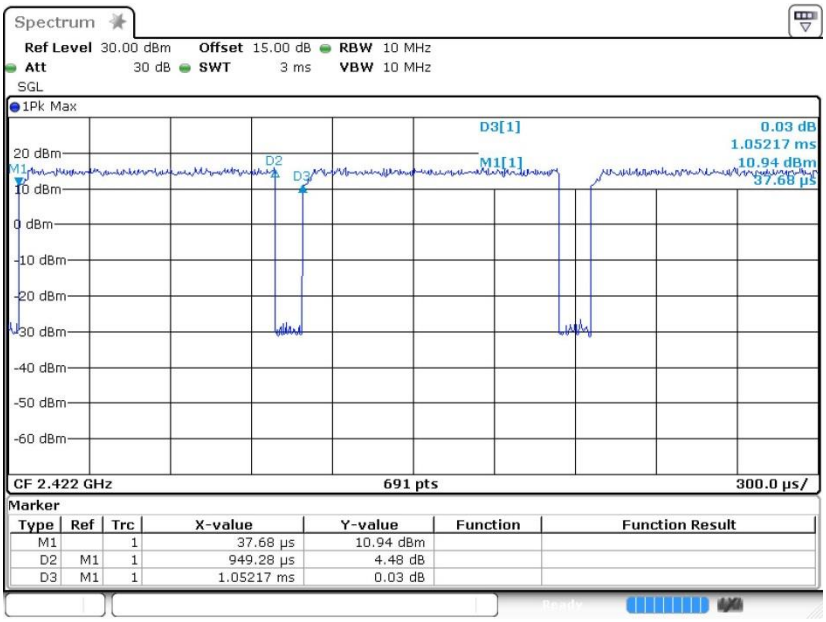
802.11g



802.11n HT20



802.11n HT40


Spectrum
Ref Level 30.00 dBm Offset 15.00 dB RBW 10 MHz
Att 30 dB SWT 3 ms VBW 10 MHz
SGL
1Pk Max
D3[1] 0.03 dB
1.05217 ms
M1[1] 10.94 dBm
37.68 µs
D2
D3
M1
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 2.422 GHz
691 pts
300.0 µs/
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 37.68 µs 10.94 dBm
D2 M1 1 949.28 µs 4.48 dB
D3 M1 1 1.05217 ms 0.03 dB