FCC RF Test Report

APPLICANT	**:**	**Innowi Inc.**
EQUIPMENT	**:**	**ChecOut M**
BRAND NAME	**:**	**Innowi**
MODEL NAME	**:**	**IWCHT-M101**
FCC ID	**:**	**2AO2Y-IWCHTM101**
STANDARD	**:**	**FCC Part 15 Subpart C §15.247**
CLASSIFICATION	**:**	**(DTS) Digital Transmission System**

The product was received on Dec. 01, 2017 and testing was completed on Feb. 01, 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
FR7D0101C	Rev. 01	Initial issue of report	Apr. 23, 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 3.29 dB at 2483.840 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 13.27 dB at 0.460 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Innowi Inc.
3240 Scott Blvd. Santa Clara CA 95054 USA

1.2 Manufacturer

Innowi Inc.
3240 Scott Blvd. Santa Clara CA 95054 USA

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	ChecOut M
Brand Name	Innowi
Model Name	IWCHT-M101
FCC ID	2AO2Y-IWCHTM101
EUT supports Radios application	NFC WLAN 2.4GHz 802.11b/g/n HT20 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT80 Bluetooth v2.0+EDR / Bluetooth v4.1 LE
HW Version	HW Rev.4
SW Version	Android 6.0 , Microsoft Windows 10, Payment Firmware 1.10.1
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

<table>
<tr><th colspan="2">Standards-related Product Specification</th></tr>
<tr><td>Tx/Rx Channel Frequency Range</td><td>2412 MHz ~ 2462 MHz</td></tr>
<tr><td>Maximum (Peak) Output Power to antenna</td><td><Ant. 1>
802.11b : 21.88 dBm (0.1542 W)
802.11g : 21.87 dBm (0.1538 W)
802.11n HT20 : 19.65 dBm (0.0923 W)
<Ant. 2>
802.11b : 21.22 dBm (0.1324 W)
802.11g : 21.30 dBm (0.1349 W)
802.11n HT20 : 19.10 dBm (0.0813 W)
MIMO <Ant. 1 + 2>
802.11b : 24.28 dBm (0.2679 W)
802.11g : 24.32 dBm (0.2704 W)
802.11n HT20 : 22.33 dBm (0.1710 W)</td></tr>
<tr><td>Antenna Type / Gain</td><td>Ant. 1: Internal Inverted-L (PCB) Antenna with gain -0.09 dBi
Ant. 2: Internal Inverted-F (Top Bezel) Antenna with gain -2.31 dBi</td></tr>
<tr><td>Type of Modulation</td><td>802.11b : DSSS (DBPSK / DQPSK / CCK)
802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)</td></tr>
<tr><td>Antenna Function Description</td><td>
<table>
<tr><td></td><td>Ant. 1</td><td>Ant. 2</td></tr>
<tr><td>802.11 b/g/n SISO</td><td>V</td><td>V</td></tr>
<tr><td>802.11 b/g/n MIMO</td><td>V</td><td>V</td></tr>
</table>
</td></tr>
</table>

Note:

1. MIMO Ant. 1+2 is a calculated result from sum of the power MIMO Ant. 1 and MIMO Ant. 2.
2. For SISO & MIMO mode, the whole testing has assessed only MIMO mode by referring to their higher conducted power

1.5 Modification of EUT

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

1.6 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.**
	03CH01-SZ	577730

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

1.7 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
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- 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

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: conducted emission (150 kHz to 30 MHz) and radiated emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Z plane) were recorded in this report.

2.1 Carrier Frequency and Channel

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

2.2 Test Mode

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

SISO Antenna

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

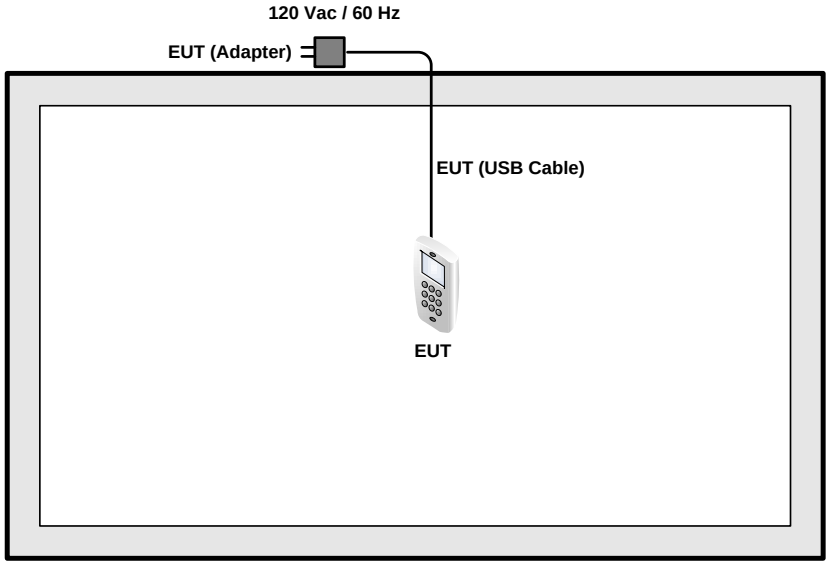
MIMO Antenna

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

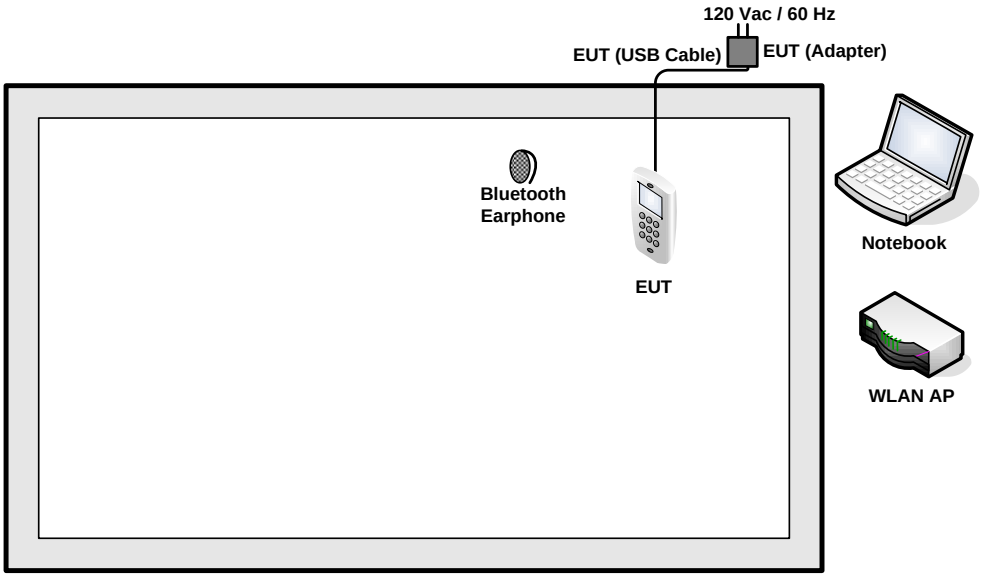
Test Cases	
AC Conducted Emission	Mode 1 : Bluetooth Link + WLAN Link(2.4G) + USB Cable (Charging from Adapter1)
Remark: For Radiated TCs, The tests were performed with Adapter1 and USB Cable.	

2.3 Connection Diagram of Test System

<WLAN Tx Mode>



<AC Conducted Emission Mode>



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-820L	KA2IR820LA1	N/A	Unshielded,1.8m
2.	NOTE BOOK	Lenovo	E450	FCC DoC	N/A	AC I/P：Unshielded, 1.2m DC O/P：Shielded, 1.8m
3.	Bluetooth Earphone	Samsung	EO-MG900	N/A	N/A	N/A

2.5 EUT Operation Test Setup

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

For AC power line conducted emissions, the EUT was set to connect with the Notebook 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 dB and 10dB attenuator.

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

= 5 + 10 = 15 (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.

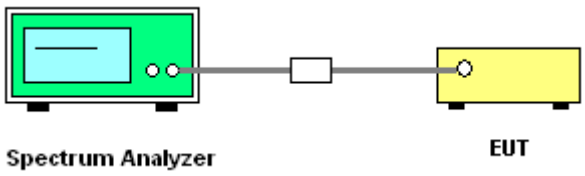
3.1.2 Measuring Instruments

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.

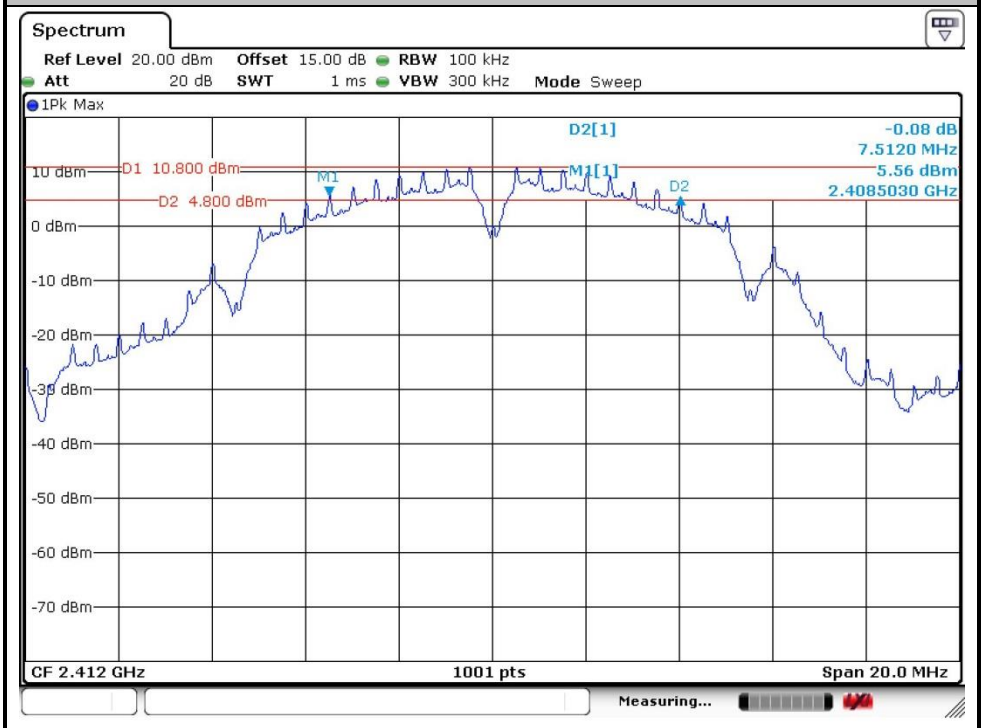
3.1.4 Test Setup



3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

Minimum 6dB Bandwidth



3.2 Output Power Measurement

3.2.1 Limit of Output Power

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

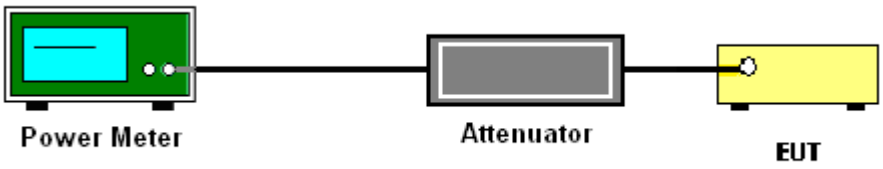
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04 section 9.1.2 PKPM1 Peak power meter method.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.2.6 Test Result of Average output Power (Reporting Only)

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

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

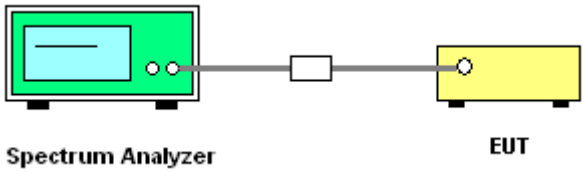
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

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

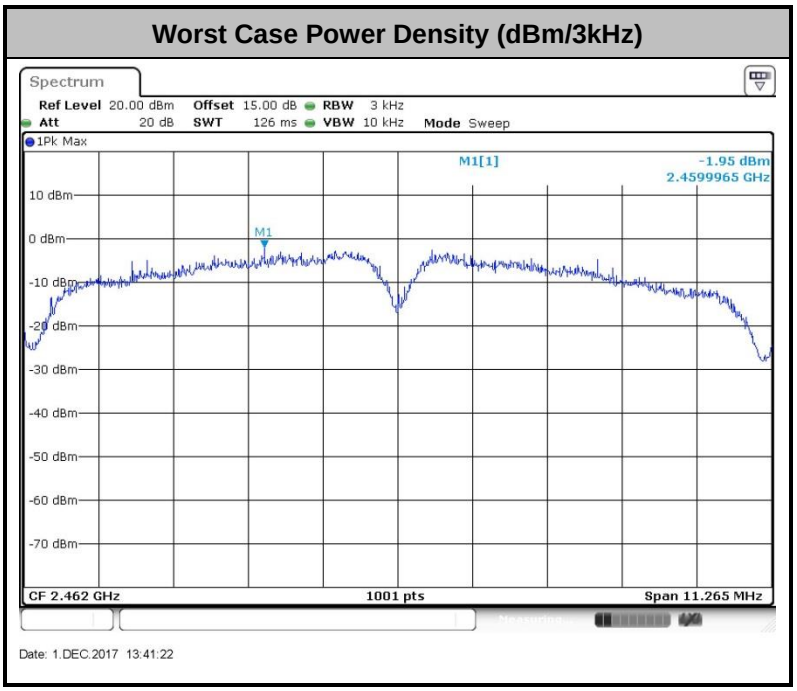
3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Density (dBm/3kHz)



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

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

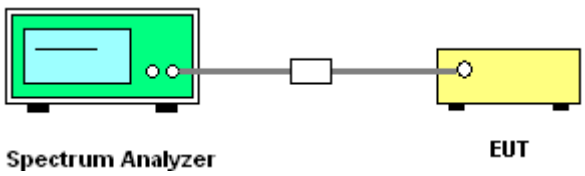
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

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



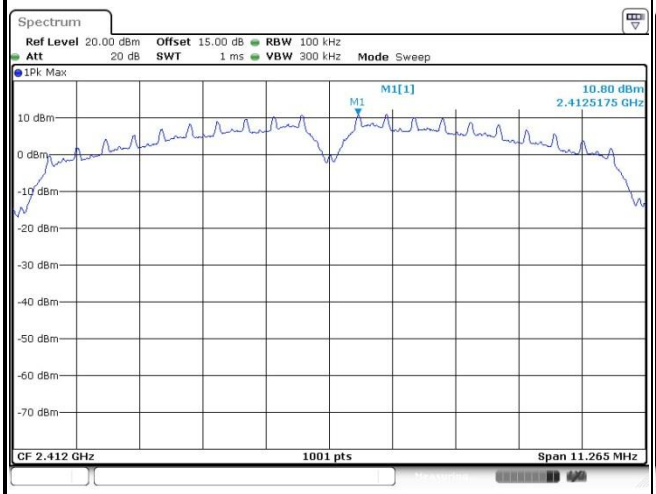
3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Number of TX = 2, Ant. 1 (Measured)

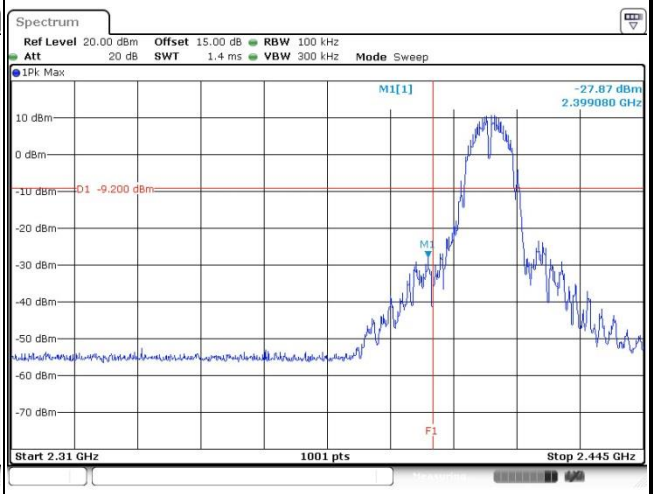
Number of TX	2	**Ant. :**	1
Test Mode :	802.11b	**Temperature :**	24~26℃
Test Band :	2.4GHz Low	**Relative Humidity :**	50~53%
Test Channel :	01	**Test Engineer :**	Rain Wang

WLAN 802.11b Channel 01

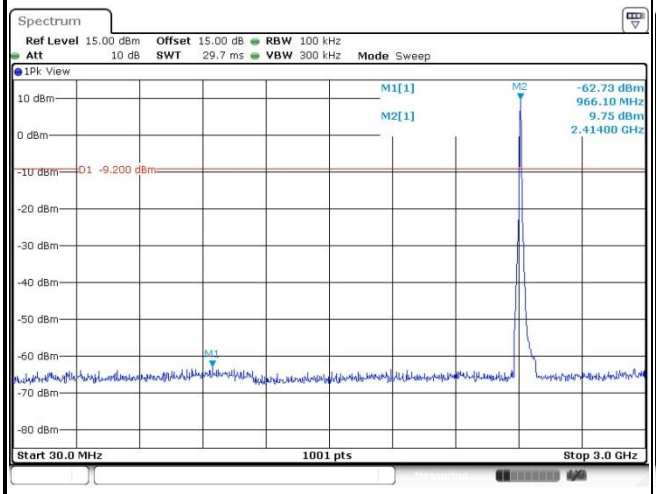
100kHz PSD reference Level



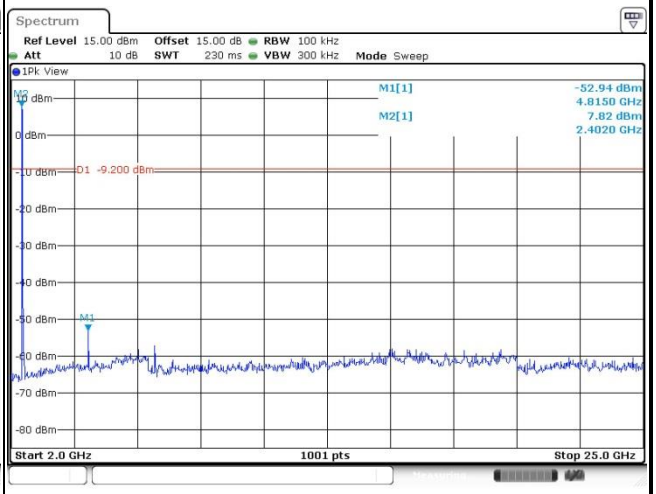
Low Channel Plot



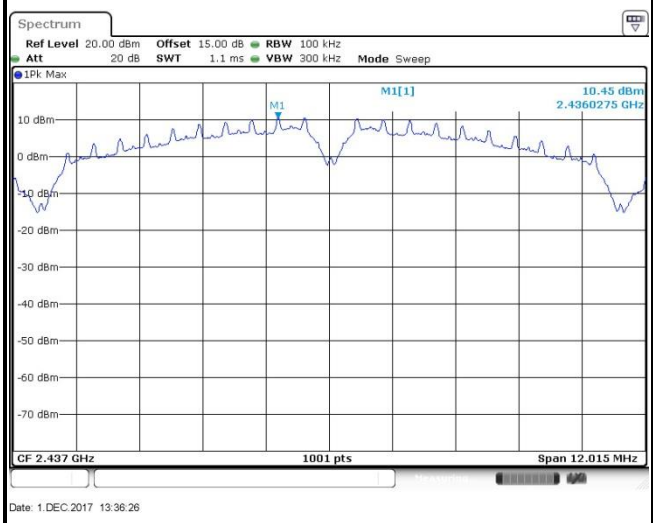
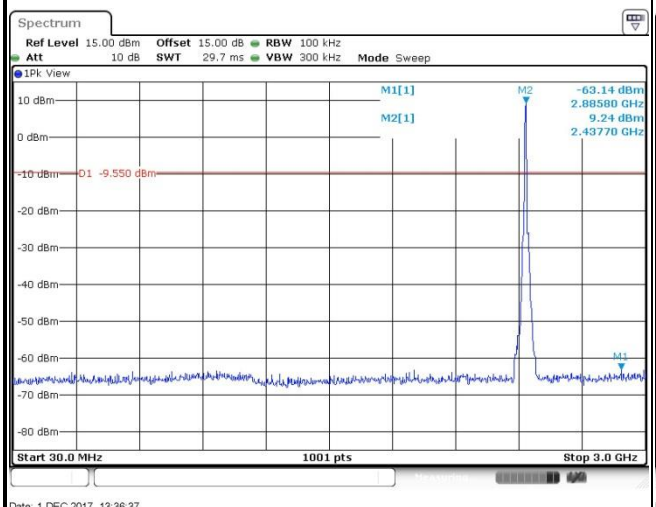
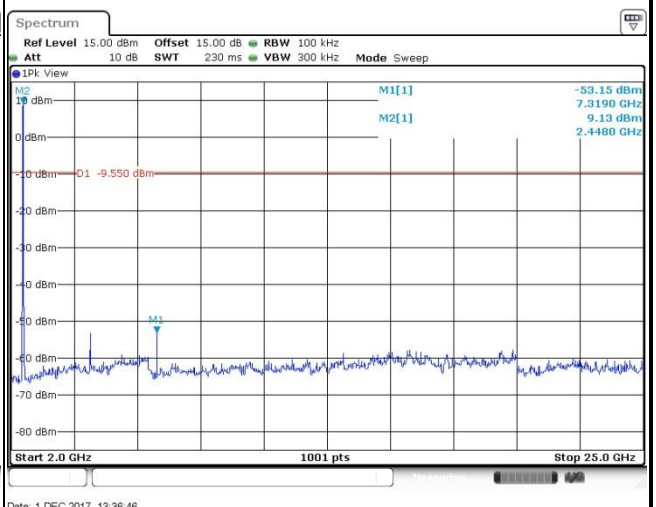
Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz



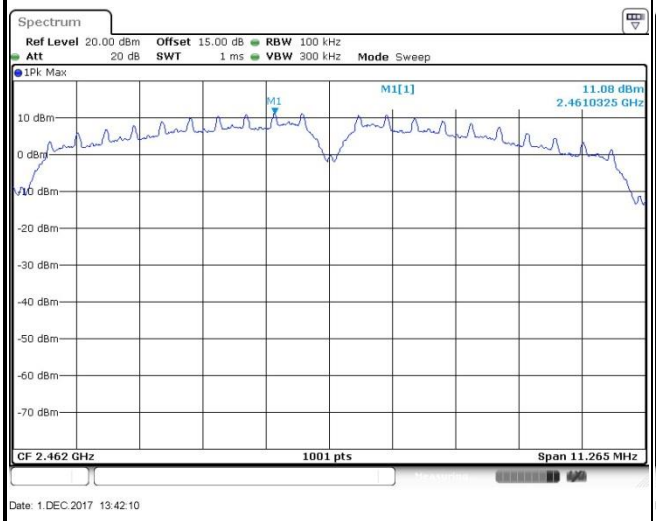
Number of TX :	2	Ant. :	1
Test Mode :	802.11b	Temperature :	24~26℃
Test Band :	2.4GHz Mid	Relative Humidity :	50~53%
Test Channel :	06	Test Engineer :	Rain Wang

WLAN 802.11b Channel 06	
100kHz PSD reference Level	-
	
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

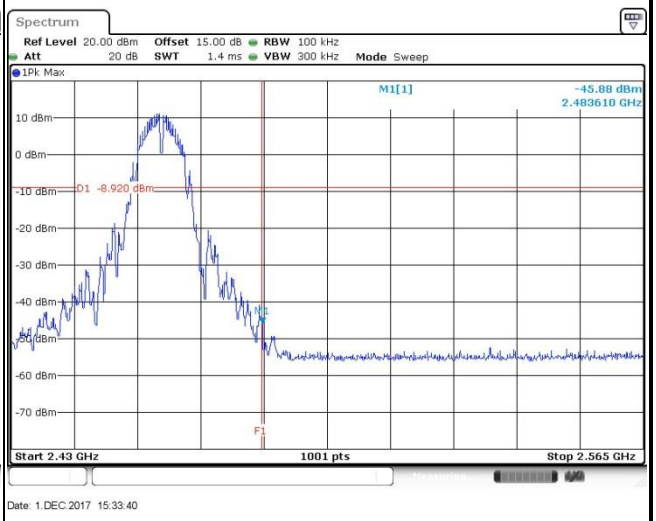
Number of TX :	2	**Ant. :**	1
Test Mode :	802.11b	**Temperature :**	24~26℃
Test Band :	2.4GHz High	**Relative Humidity :**	50~53%
Test Channel :	11	**Test Engineer :**	Rain Wang

WLAN 802.11b Channel 11

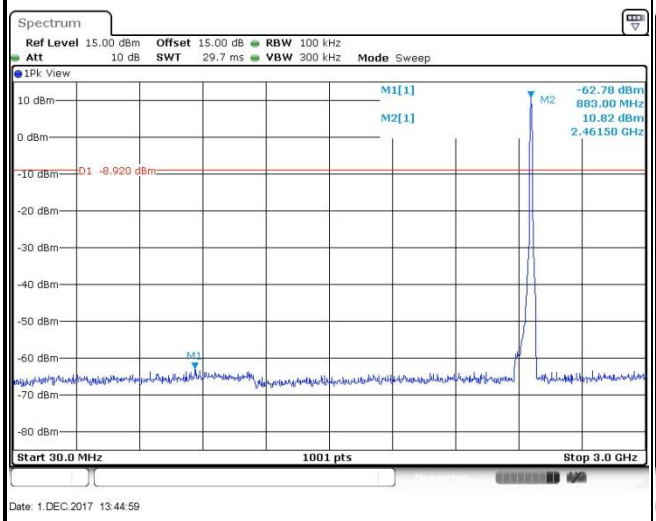
100kHz PSD reference Level



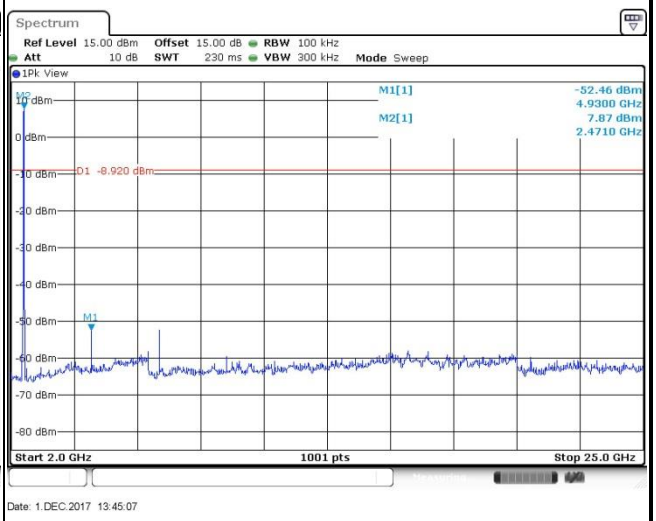
High Channel Plot



Spurious Emission 30MHz~3GHz



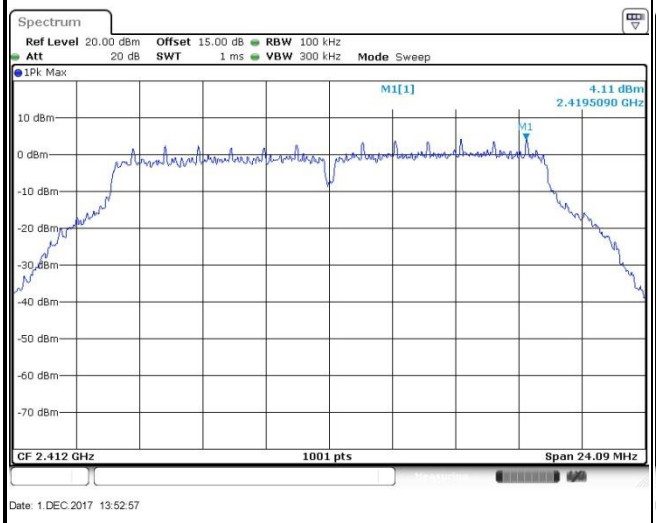
Spurious Emission 2GHz~25GHz



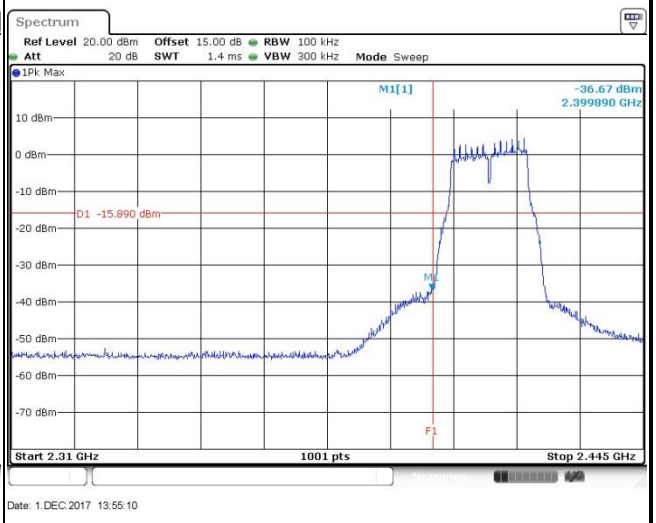
Number of TX :	2	**Ant. :**	1
Test Mode :	802.11g	**Temperature :**	24~26℃
Test Band :	2.4GHz Low	**Relative Humidity :**	50~53%
Test Channel :	01	**Test Engineer :**	Rain Wang

WLAN 802.11g Channel 01

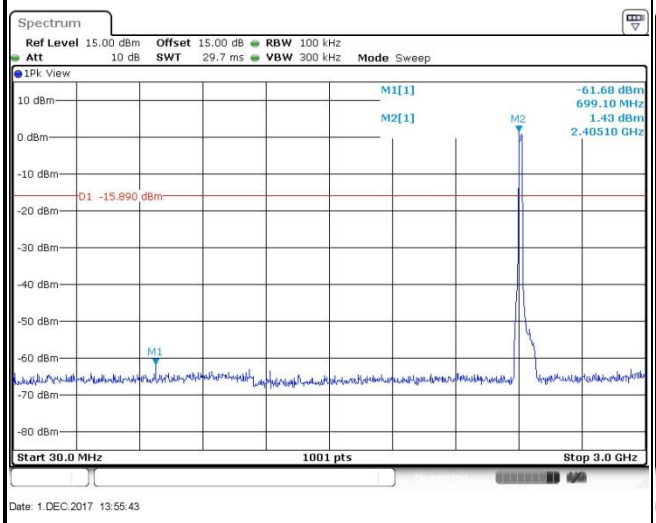
100kHz PSD reference Level



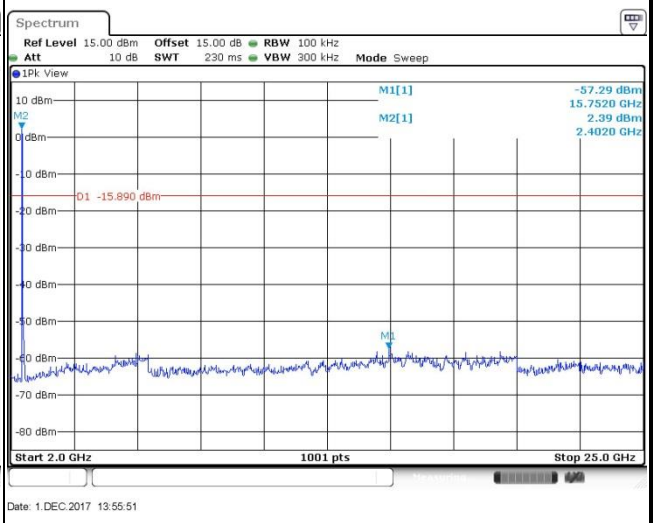
Low Channel Plot



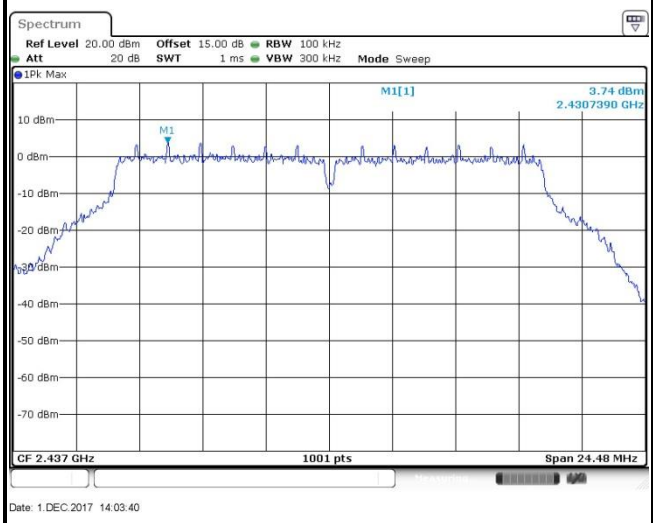
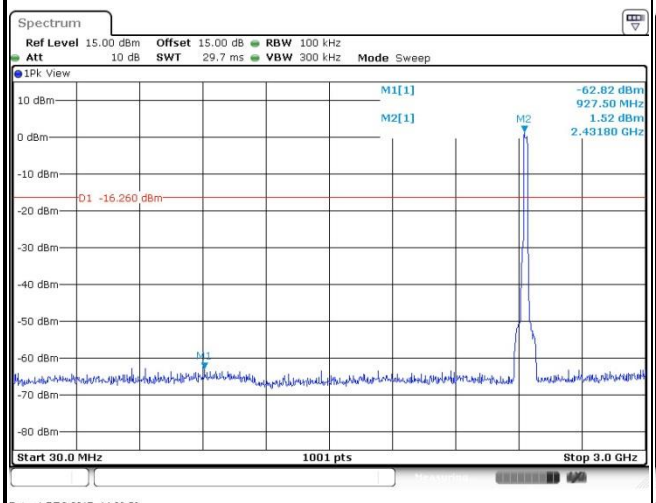
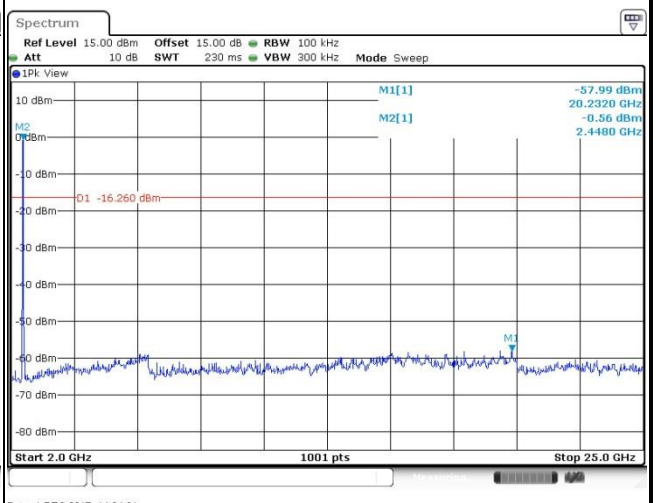
Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz



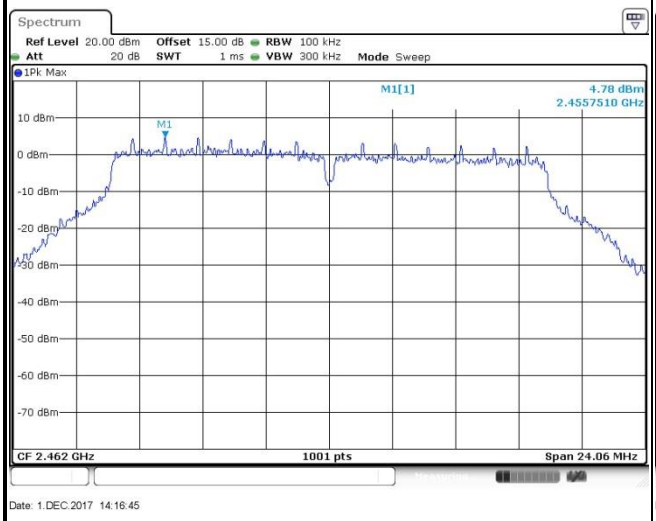
Number of TX :	2	**Ant. :**	1
Test Mode :	802.11g	**Temperature :**	24~26℃
Test Band :	2.4GHz Mid	**Relative Humidity :**	50~53%
Test Channel :	06	**Test Engineer :**	Rain Wang

WLAN 802.11g Channel 06	
100kHz PSD reference Level	
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

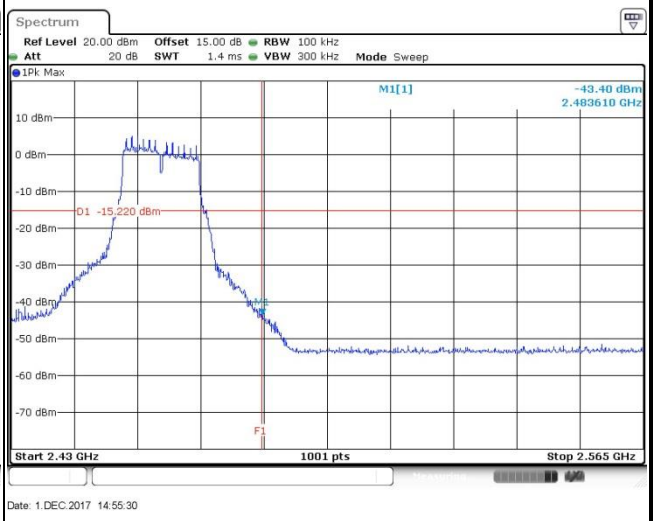
Number of TX :	2	**Ant. :**	1
Test Mode :	802.11g	**Temperature :**	24~26℃
Test Band :	2.4GHz High	**Relative Humidity :**	50~53%
Test Channel :	11	**Test Engineer :**	Rain Wang

WLAN 802.11g Channel 11

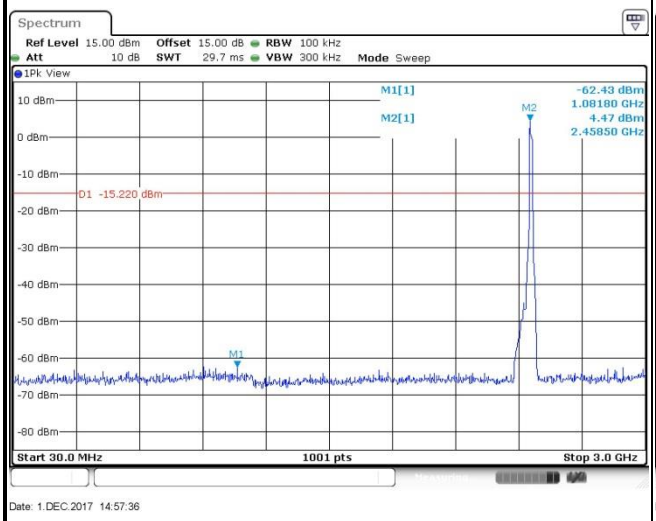
100kHz PSD reference Level



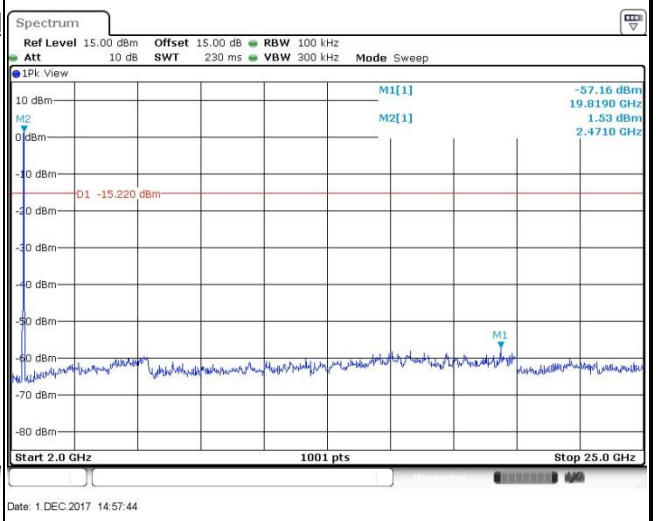
High Channel Plot



Spurious Emission 30MHz~3GHz



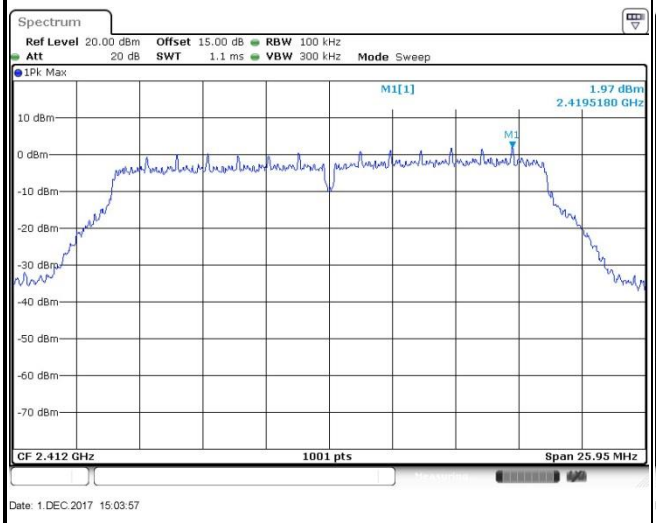
Spurious Emission 2GHz~25GHz



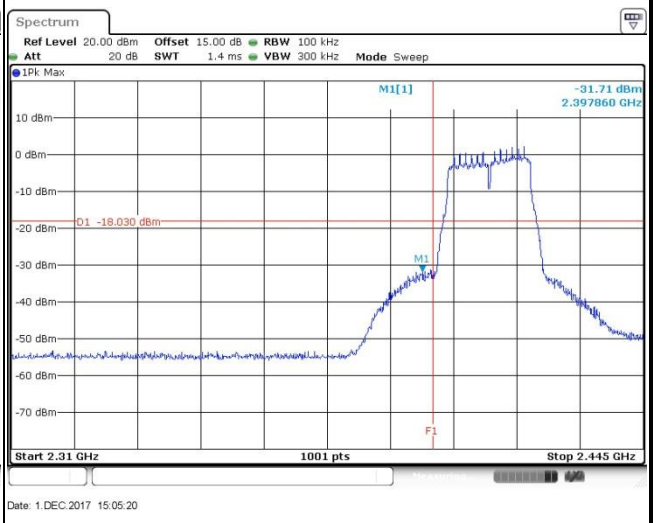
Number of TX :	2	**Ant. :**	1
Test Mode :	802.11n HT20	**Temperature :**	24~26℃
Test Band :	2.4GHz Low	**Relative Humidity :**	50~53%
Test Channel :	01	**Test Engineer :**	Rain Wang

WLAN 802.11n HT20 Channel 01

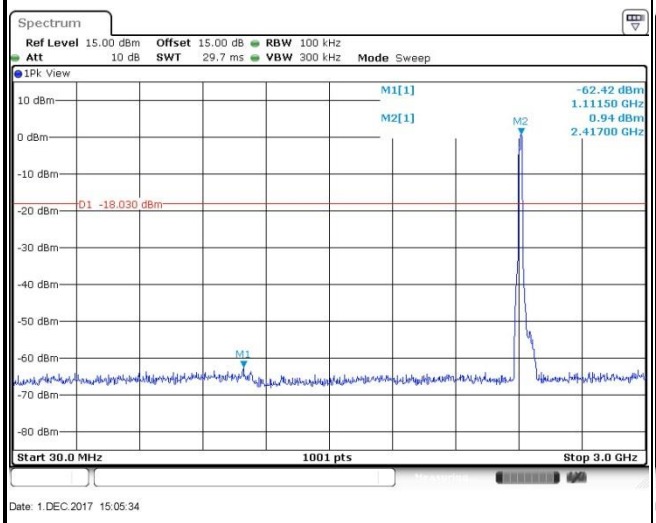
100kHz PSD reference Level



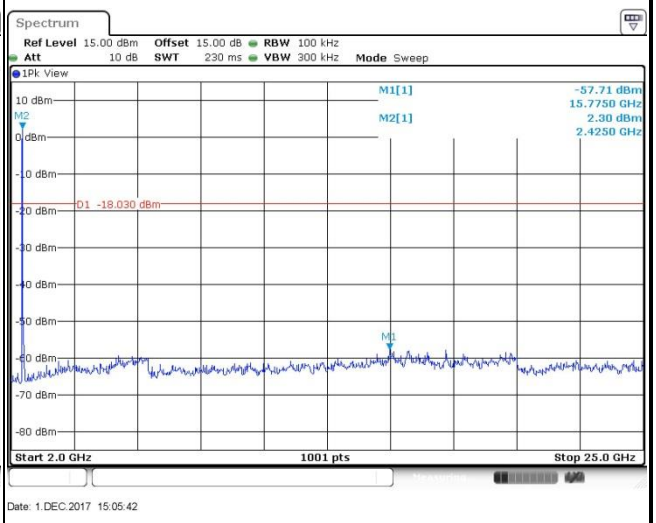
Low Channel Plot



Spurious Emission 30MHz~3GHz



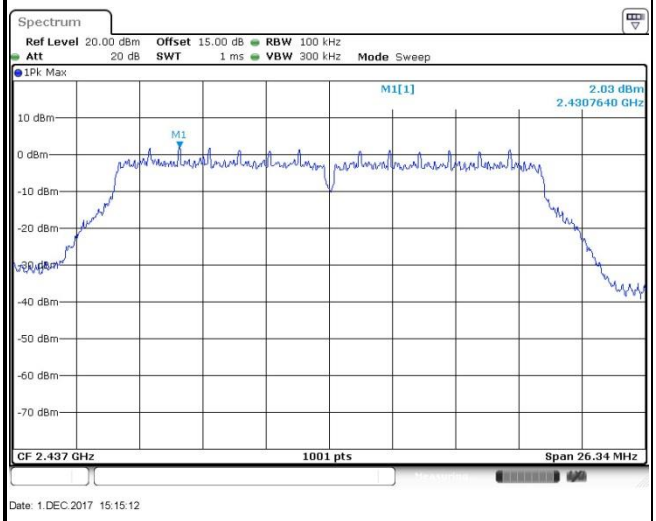
Spurious Emission 2GHz~25GHz



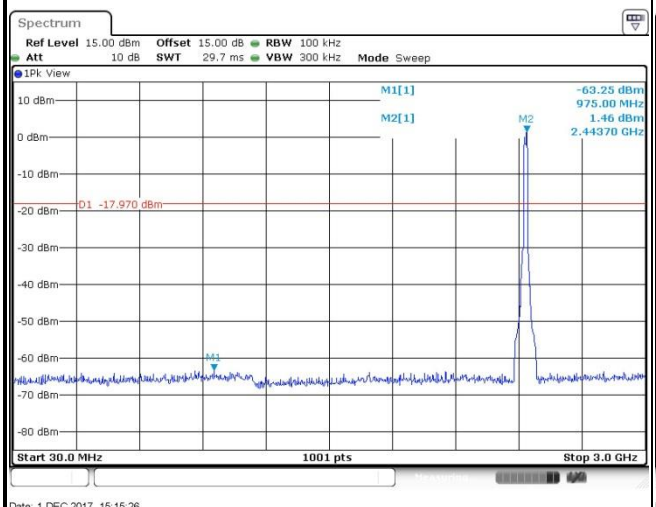
Number of TX :	2	**Ant. :**	1
Test Mode :	802.11n HT20	**Temperature :**	24~26℃
Test Band :	2.4GHz Mid	**Relative Humidity :**	50~53%
Test Channel :	06	**Test Engineer :**	Rain Wang

WLAN 802.11n HT20 Channel 06

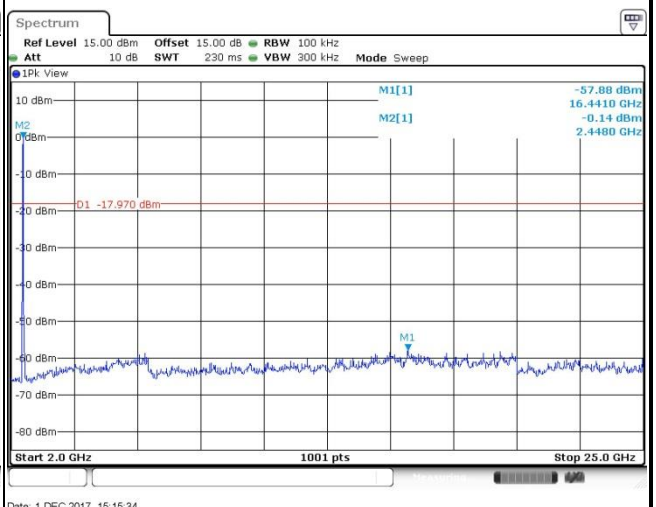
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



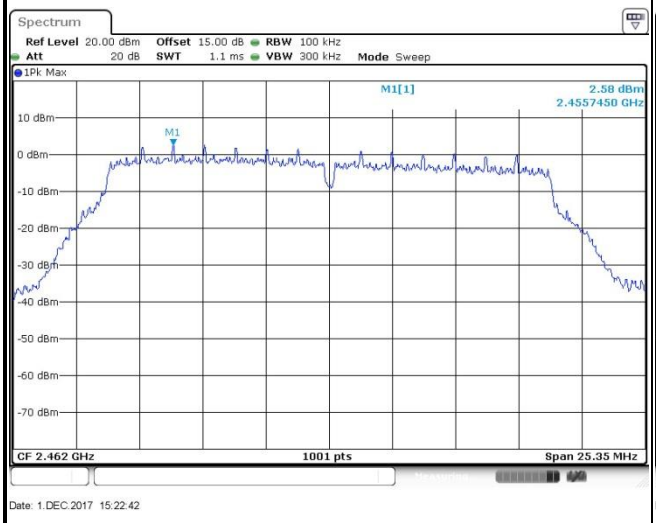
Spurious Emission 2GHz~25GHz



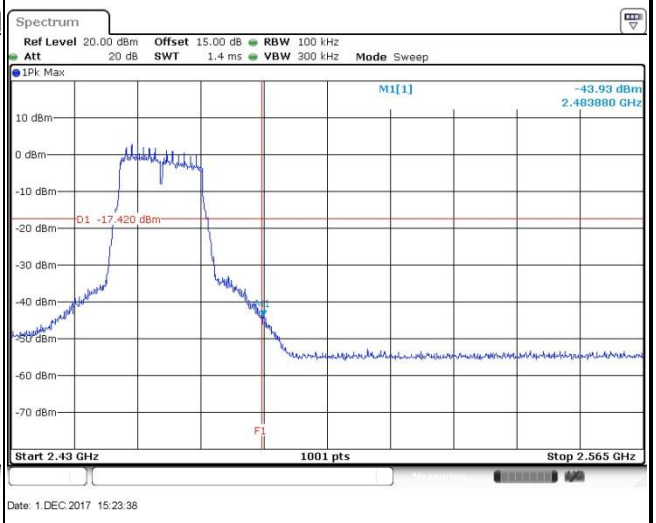
Number of TX :	2	**Ant. :**	1
Test Mode :	802.11n HT20	**Temperature :**	24~26℃
Test Band :	2.4GHz High	**Relative Humidity :**	50~53%
Test Channel :	11	**Test Engineer :**	Rain Wang

WLAN 802.11n HT20 Channel 11

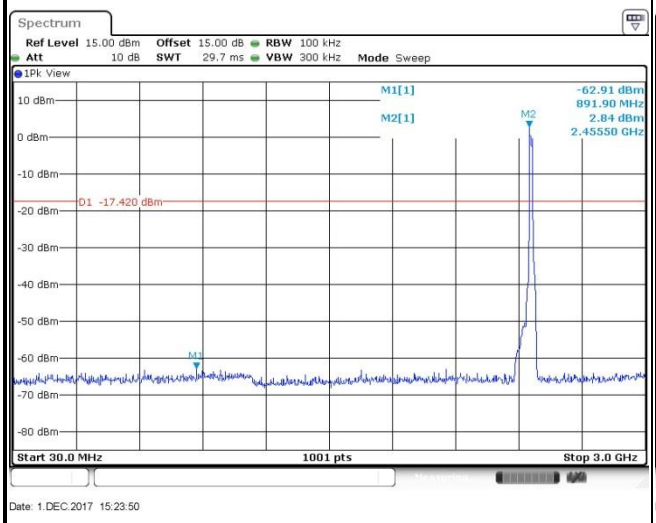
100kHz PSD reference Level



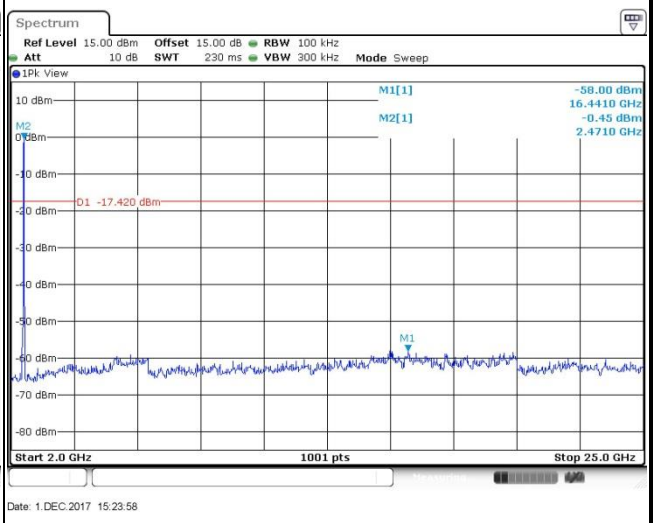
High Channel Plot



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz

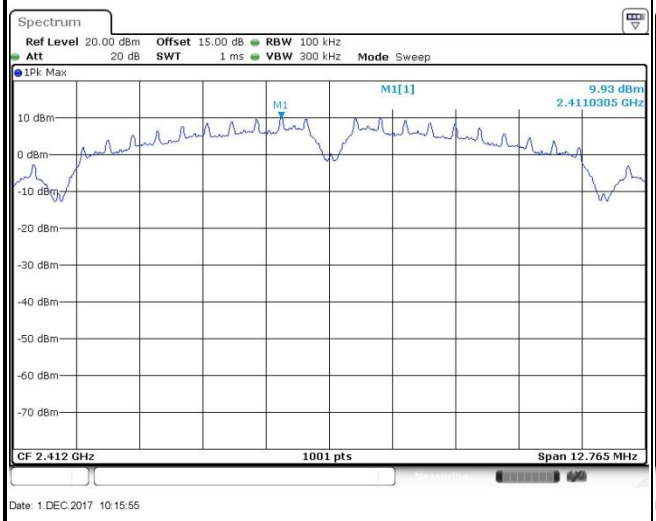


Number of TX = 2, Ant. 2 (Measured)

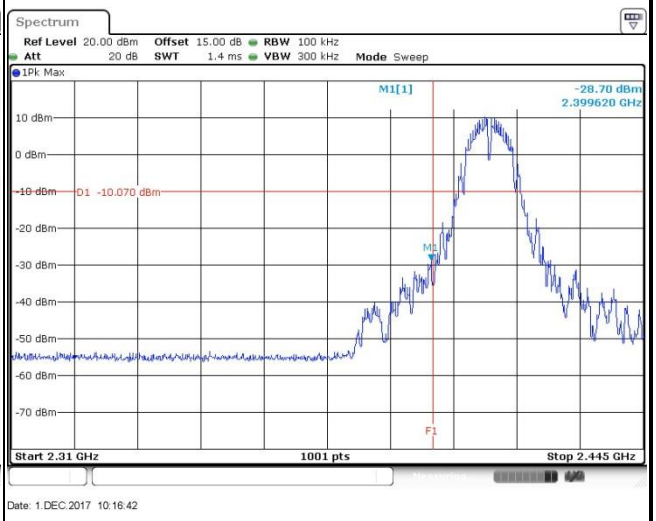
Number of TX :	2	**Ant. :**	2
Test Mode :	802.11b	**Temperature :**	24~26℃
Test Band :	2.4GHz Low	**Relative Humidity :**	50~53%
Test Channel :	01	**Test Engineer :**	Rain Wang

WLAN 802.11b Channel 01

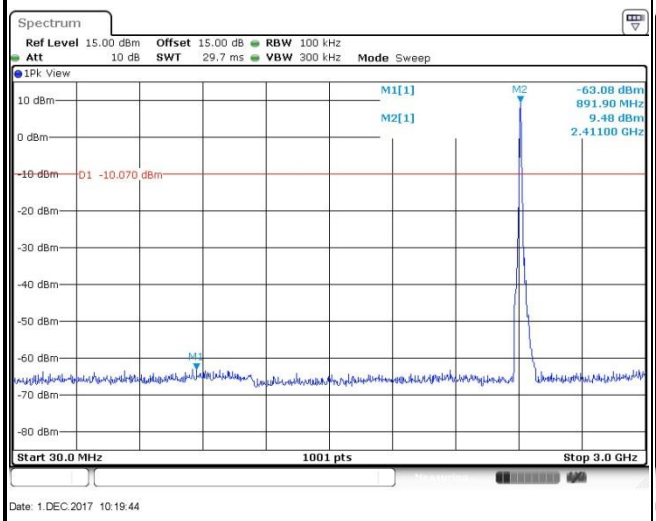
100kHz PSD reference Level



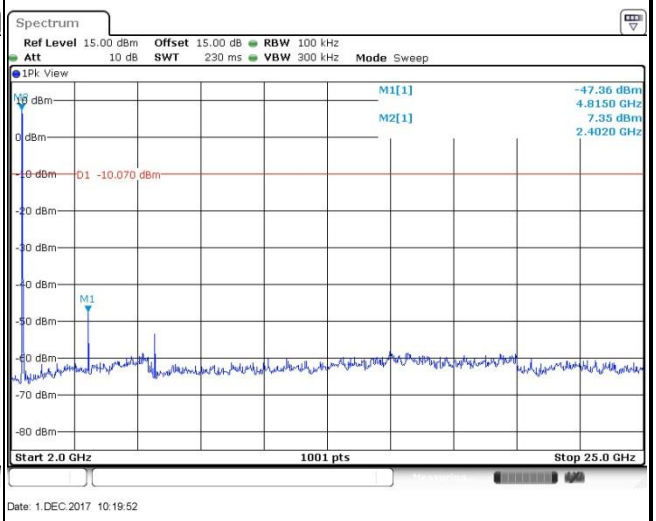
Low Channel Plot



Spurious Emission 30MHz~3GHz



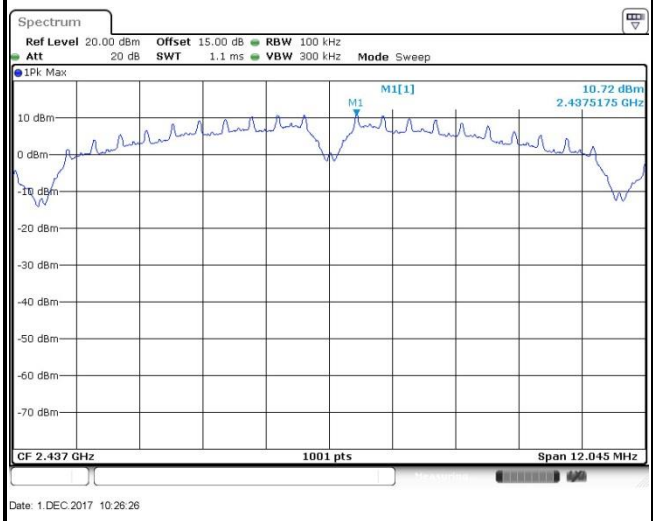
Spurious Emission 2GHz~25GHz



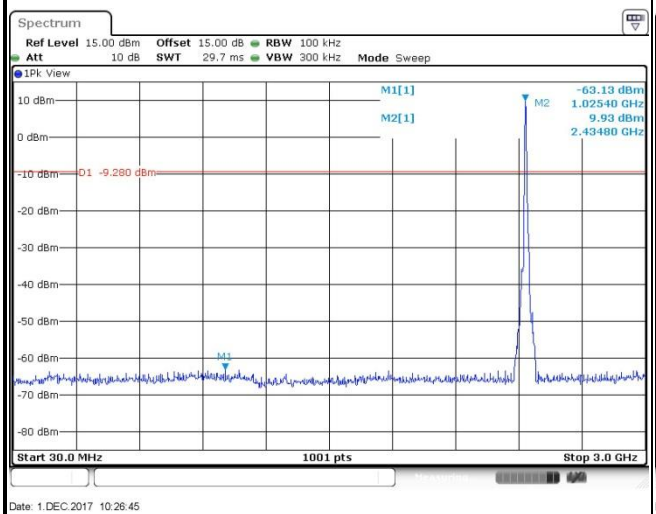
Number of TX :	2	**Ant. :**	2
Test Mode :	802.11b	**Temperature :**	24~26℃
Test Band :	2.4GHz Mid	**Relative Humidity :**	50~53%
Test Channel :	06	**Test Engineer :**	Rain Wang

WLAN 802.11b Channel 06

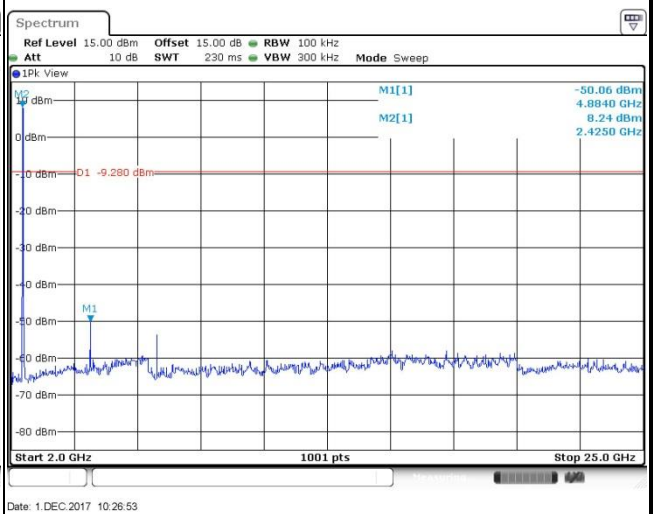
100kHz PSD reference Level



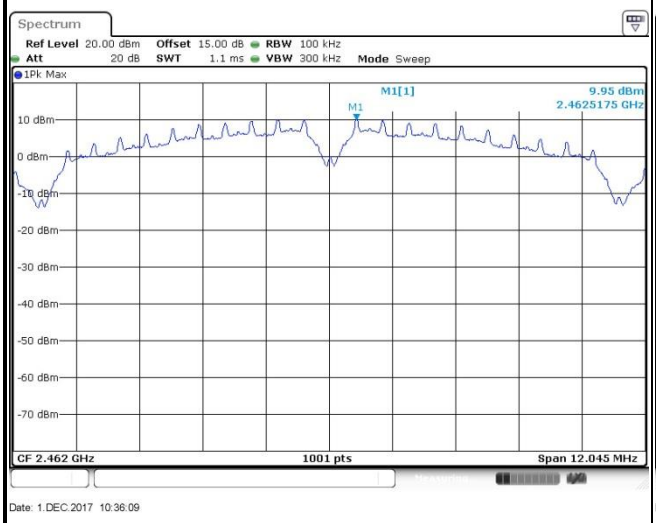
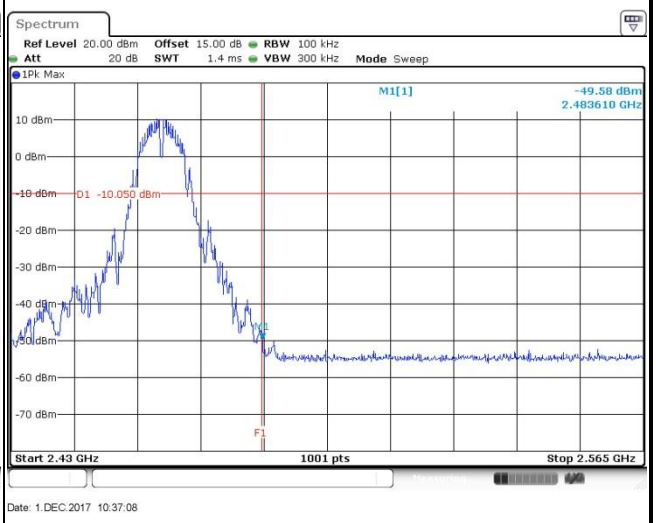
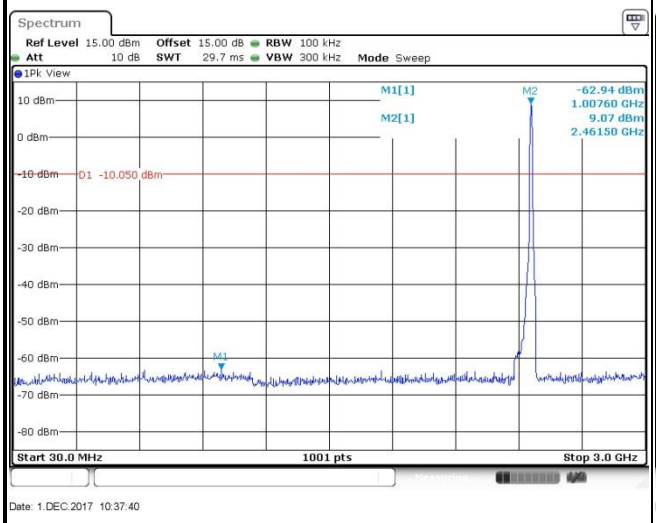
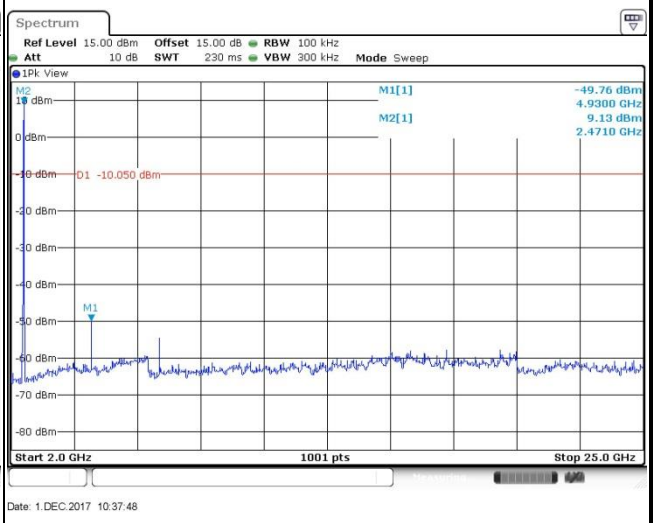
Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz



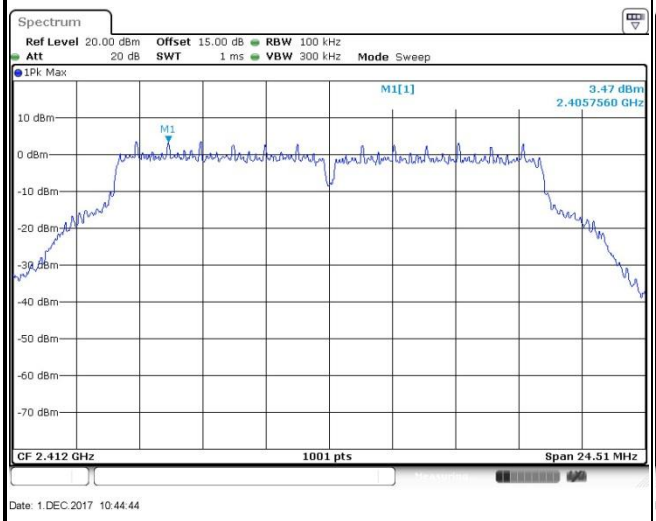
Number of TX :	2	Ant. :	2
Test Mode :	802.11b	Temperature :	24~26℃
Test Band :	2.4GHz High	Relative Humidity :	50~53%
Test Channel :	11	Test Engineer :	Rain Wang

WLAN 802.11b Channel 11	
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

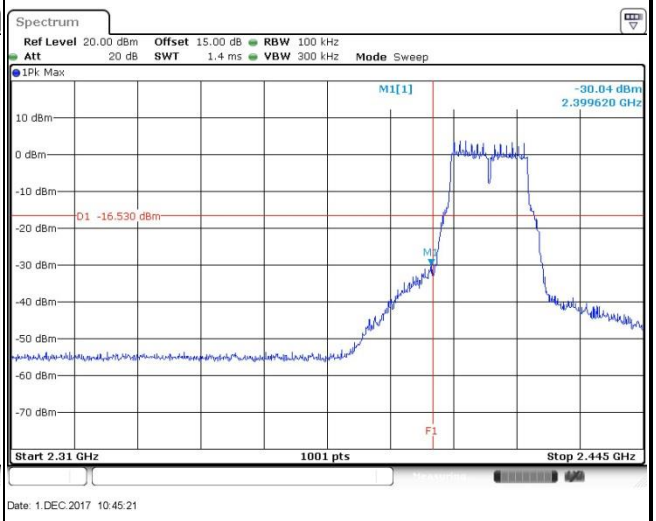
Number of TX :	2	**Ant. :**	2
Test Mode :	802.11g	**Temperature :**	24~26℃
Test Band :	2.4GHz Low	**Relative Humidity :**	50~53%
Test Channel :	01	**Test Engineer :**	Rain Wang

WLAN 802.11g Channel 01

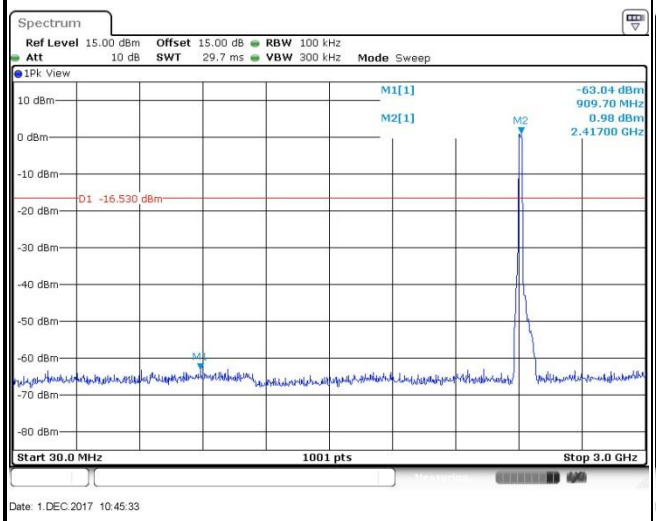
100kHz PSD reference Level



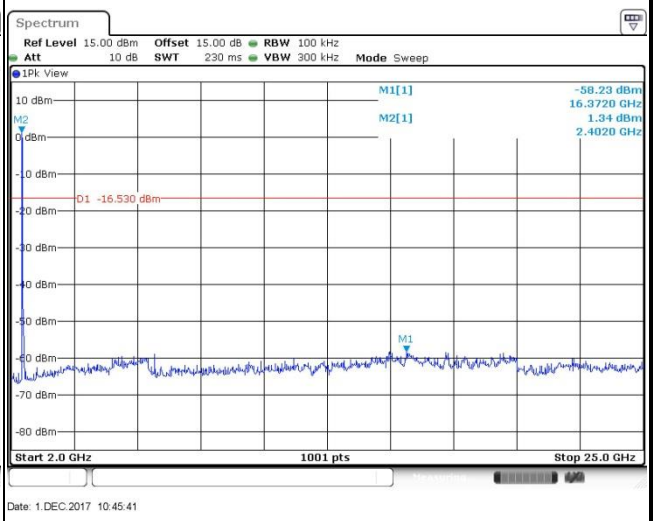
Low Channel Plot



Spurious Emission 30MHz~3GHz



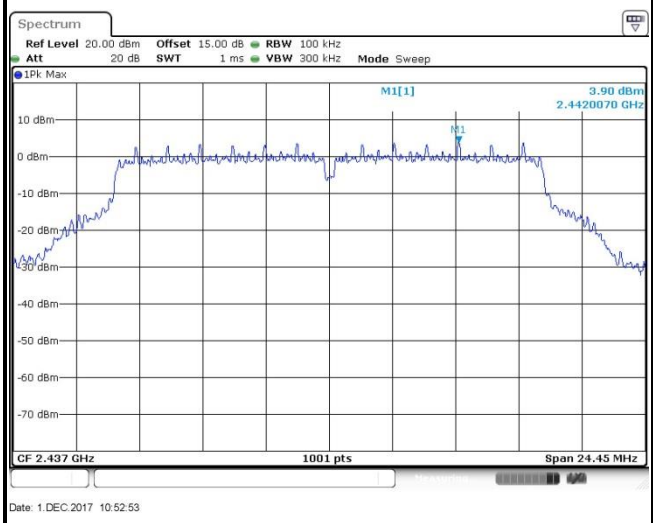
Spurious Emission 2GHz~25GHz



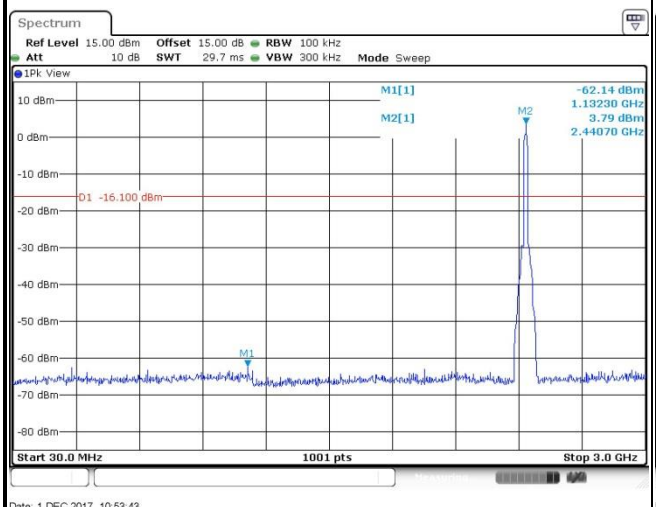
Number of TX :	2	**Ant. :**	2
Test Mode :	802.11g	**Temperature :**	24~26℃
Test Band :	2.4GHz Mid	**Relative Humidity :**	50~53%
Test Channel :	06	**Test Engineer :**	Rain Wang

WLAN 802.11g Channel 06

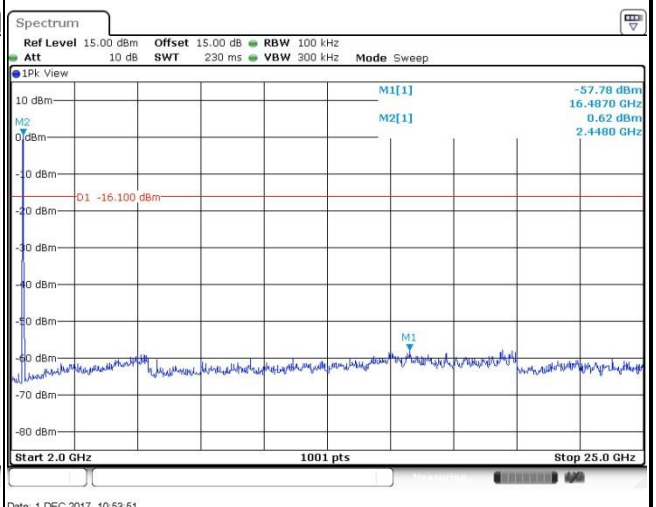
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



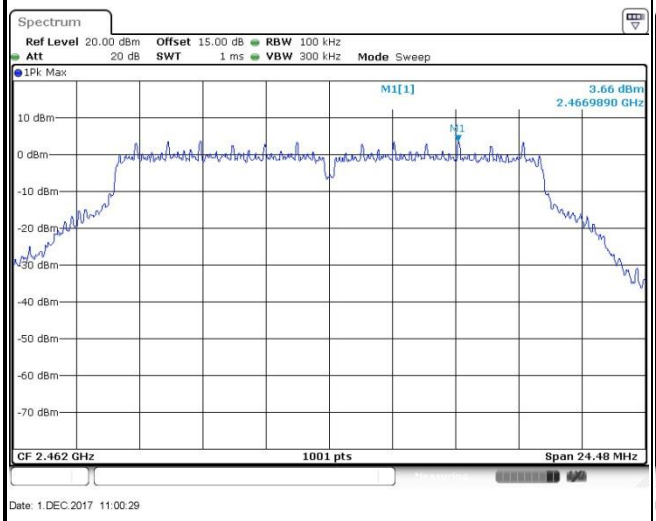
Spurious Emission 2GHz~25GHz



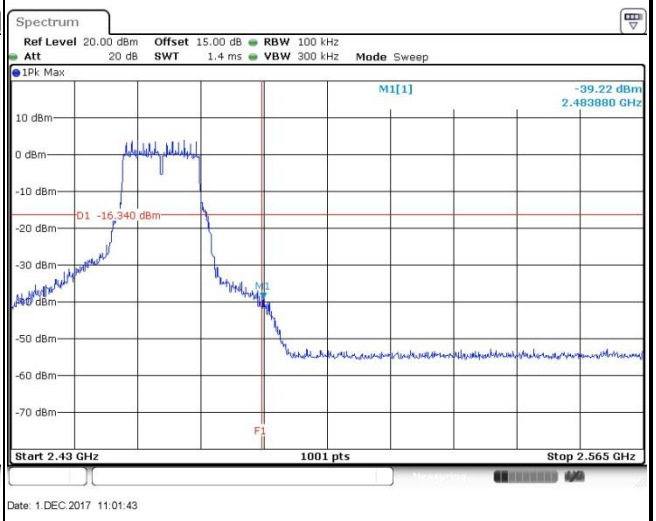
Number of TX :	2	**Ant. :**	2
Test Mode :	802.11g	**Temperature :**	24~26℃
Test Band :	2.4GHz High	**Relative Humidity :**	50~53%
Test Channel :	11	**Test Engineer :**	Rain Wang

WLAN 802.11g Channel 11

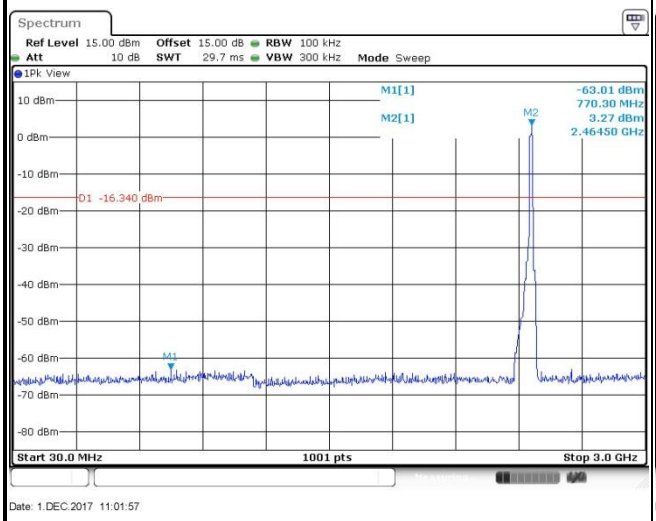
100kHz PSD reference Level



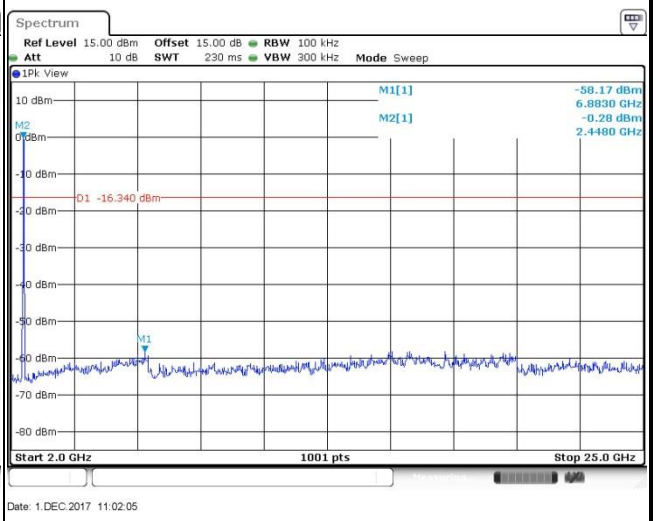
High Channel Plot



Spurious Emission 30MHz~3GHz



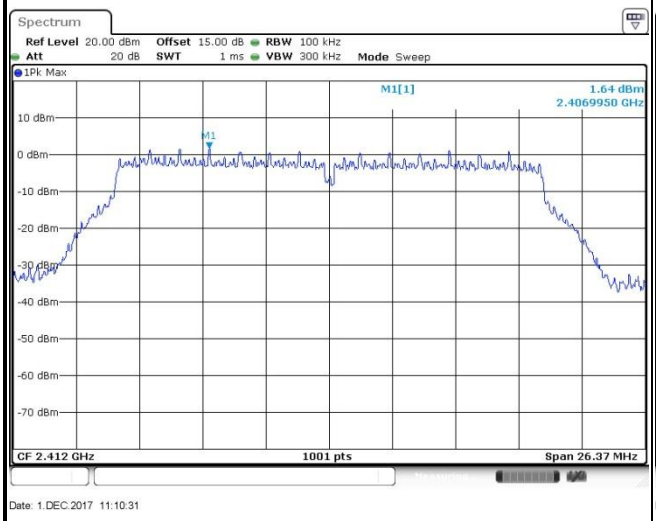
Spurious Emission 2GHz~25GHz



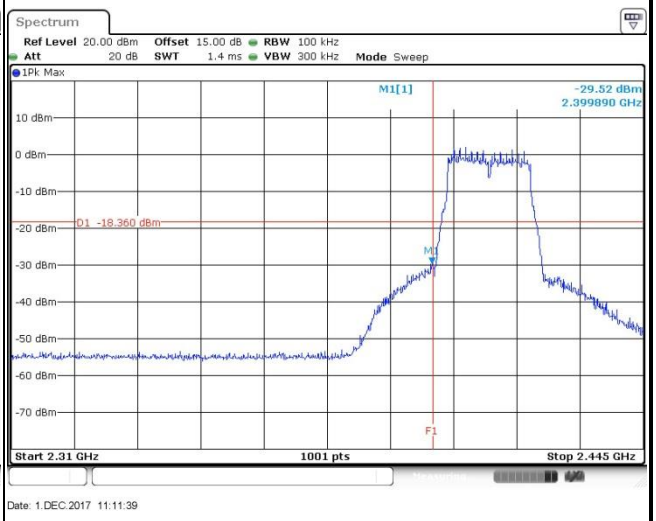
Number of TX :	2	**Ant. :**	2
Test Mode :	802.11n HT20	**Temperature :**	24~26℃
Test Band :	2.4GHz Low	**Relative Humidity :**	50~53%
Test Channel :	01	**Test Engineer :**	Rain Wang

WLAN 802.11n HT20 Channel 01

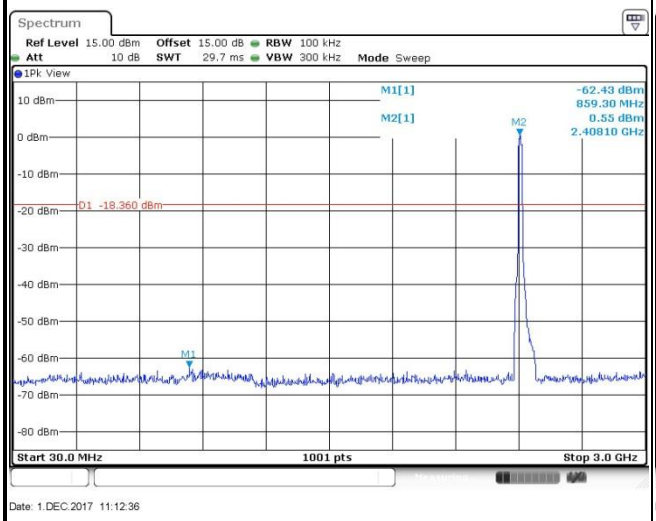
100kHz PSD reference Level



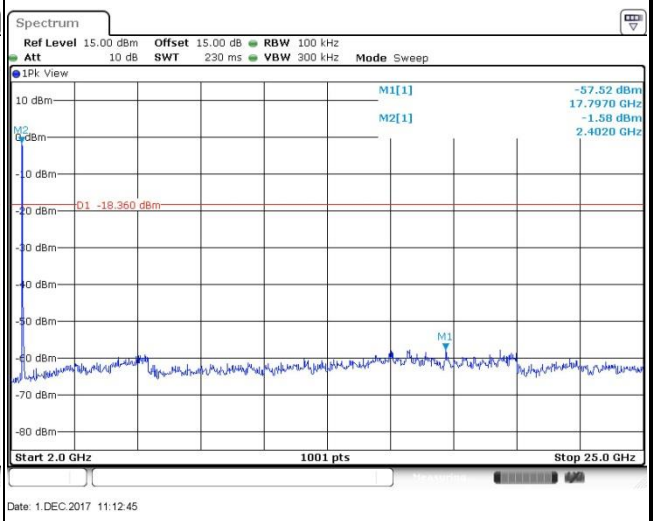
Low Channel Plot



Spurious Emission 30MHz~3GHz



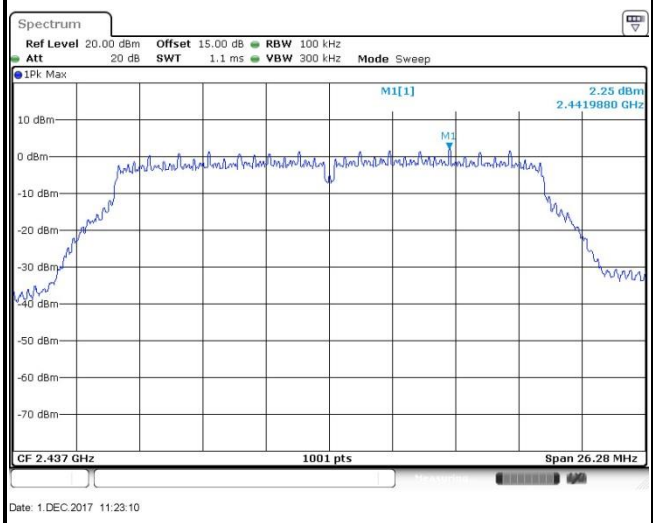
Spurious Emission 2GHz~25GHz



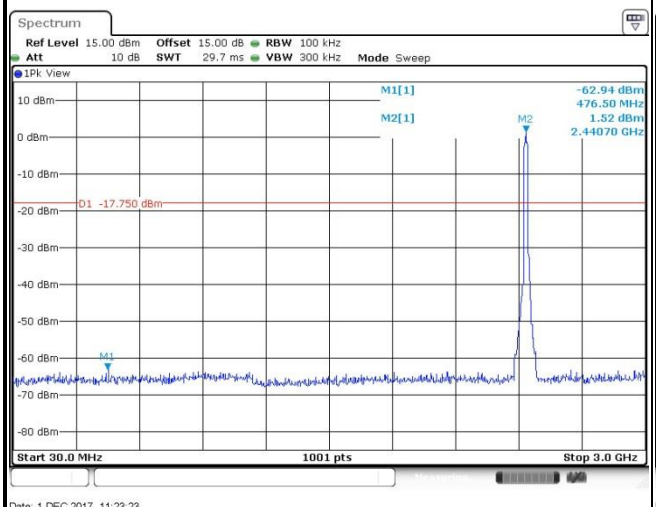
Number of TX :	2	**Ant. :**	2
Test Mode :	802.11n HT20	**Temperature :**	24~26℃
Test Band :	2.4GHz Mid	**Relative Humidity :**	50~53%
Test Channel :	06	**Test Engineer :**	Rain Wang

WLAN 802.11n HT20 Channel 06

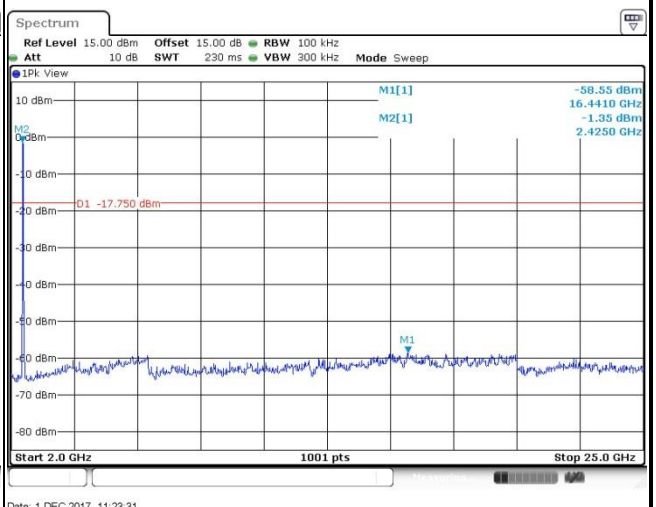
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



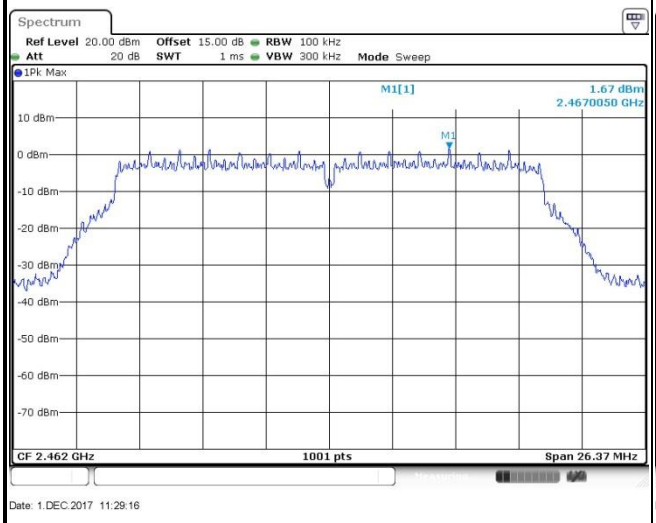
Spurious Emission 2GHz~25GHz



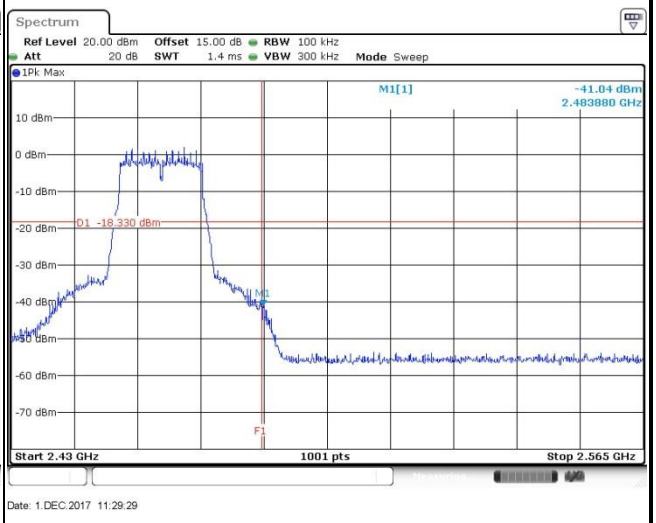
Number of TX :	2	**Ant. :**	2
Test Mode :	802.11n HT20	**Temperature :**	24~26℃
Test Band :	2.4GHz High	**Relative Humidity :**	50~53%
Test Channel :	11	**Test Engineer :**	Rain Wang

WLAN 802.11n HT20 Channel 11

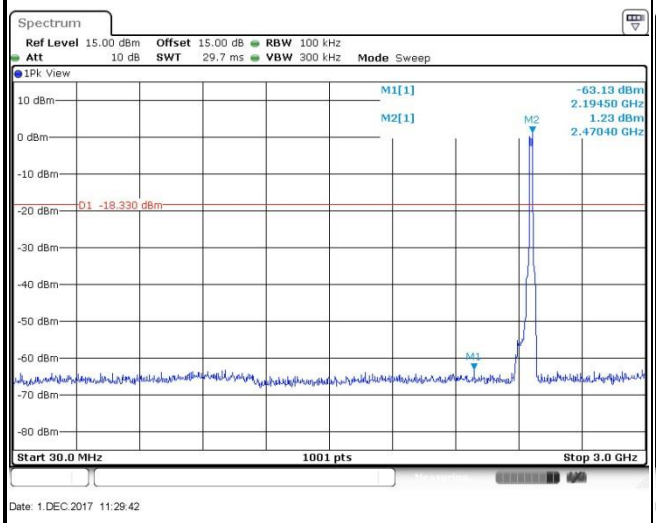
100kHz PSD reference Level



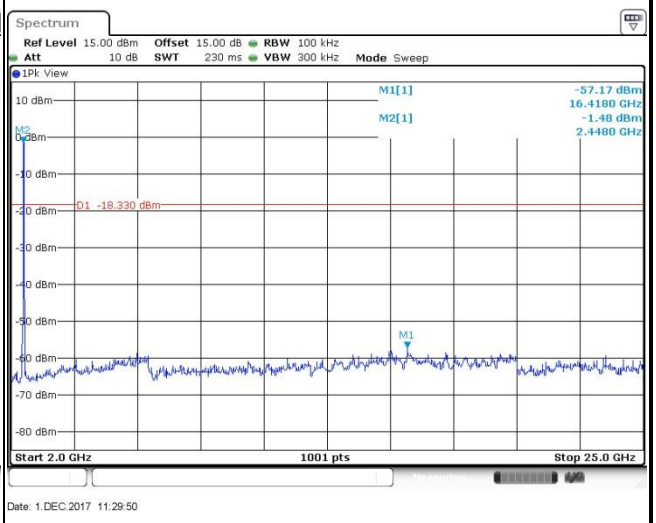
High Channel Plot



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz



3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

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

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

3.5.2 Measuring Instruments

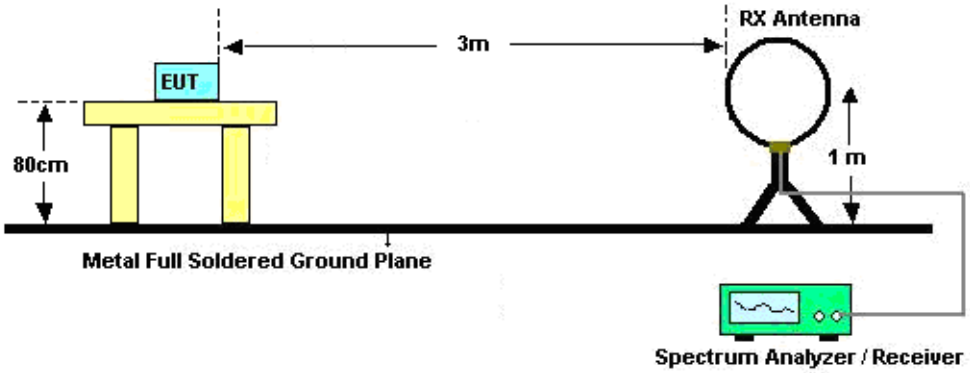
The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

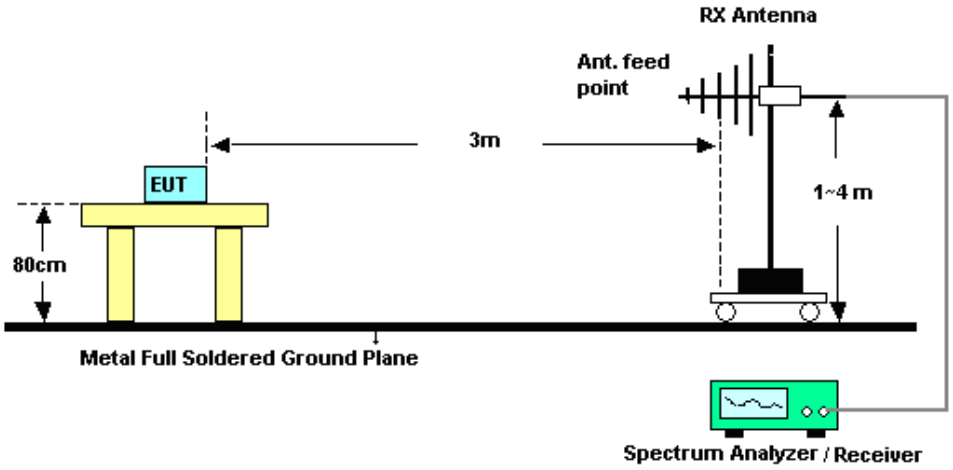
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test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

3.5.4 Test Setup

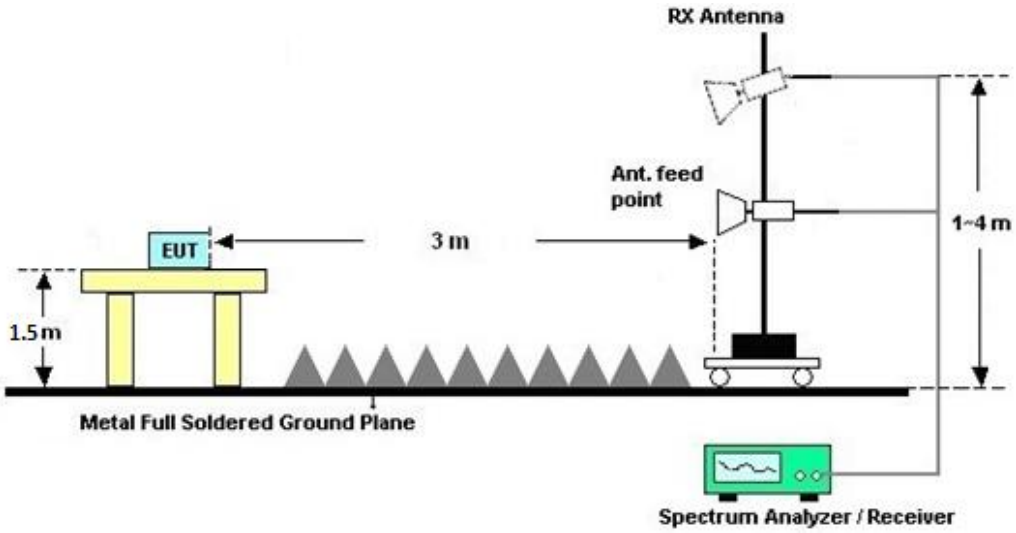
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

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

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B.

3.5.7 Duty Cycle

Please refer to Appendix C.

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

Please refer to Appendix B.

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.

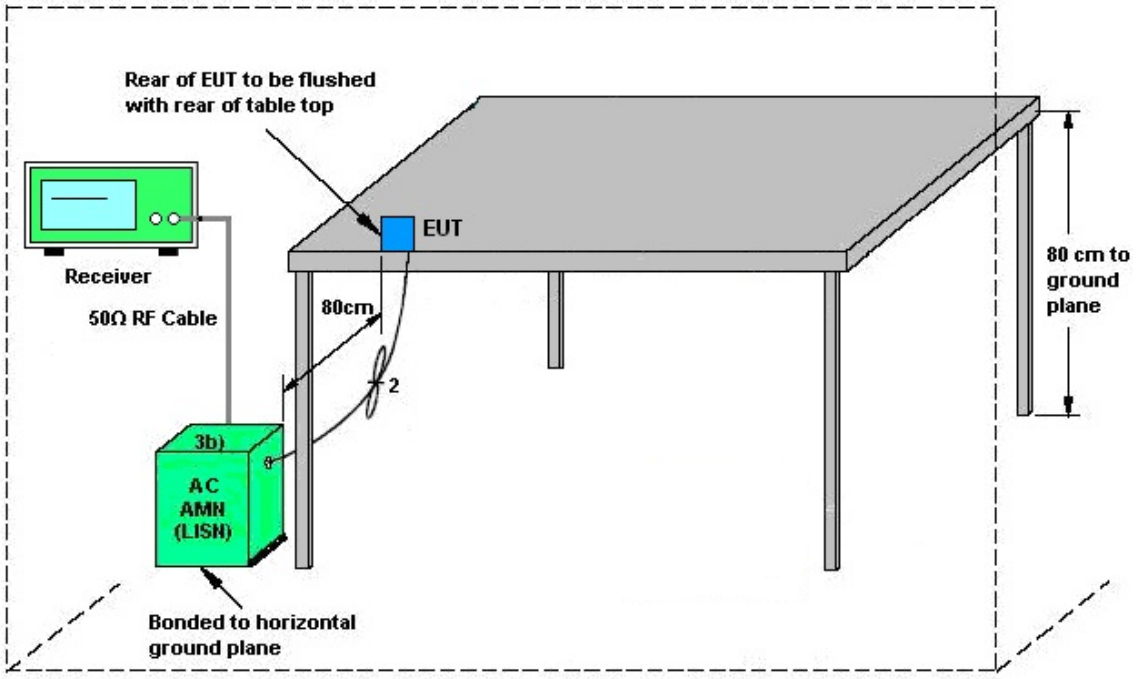
3.6.2 Measuring Instruments

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.

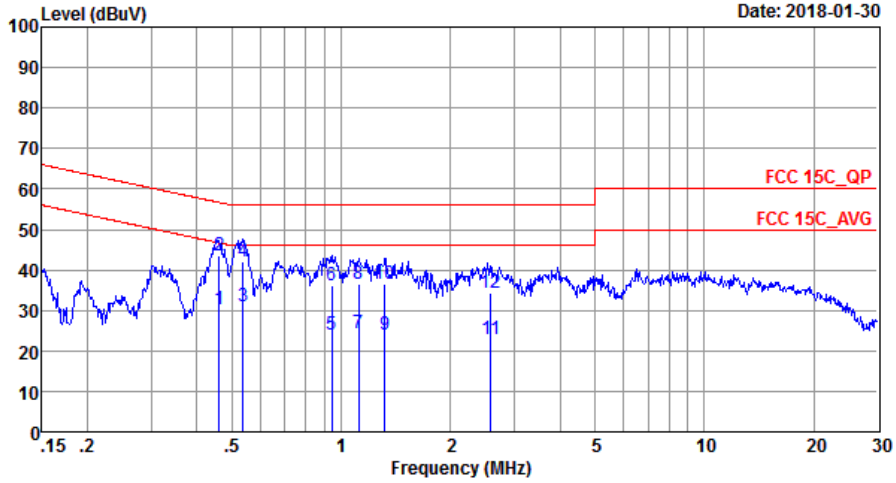
3.6.4 Test Setup



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

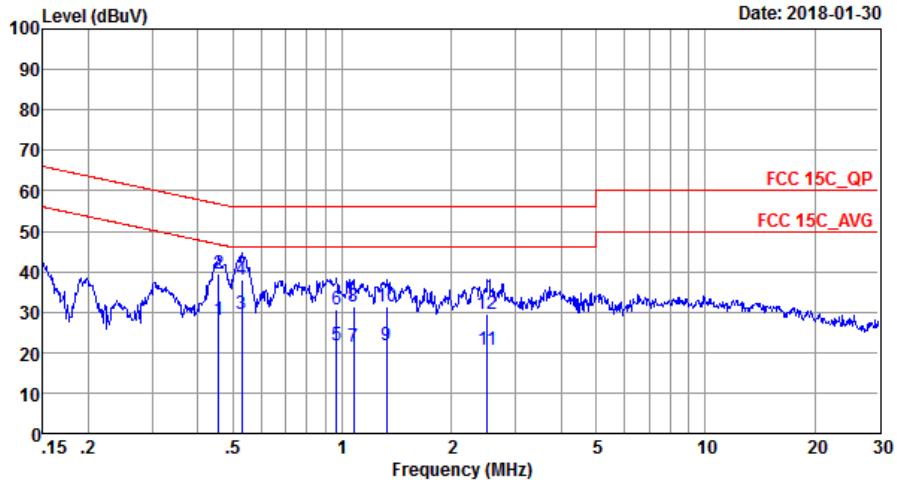
Test Mode :	Mode 1	Temperature :	22~25℃
Test Engineer :	Peng Wang	Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	Bluetooth Link + WLAN Link(2.4G) + USB Cable (Charging from Adapter1)		



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

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1		0.46	30.30	-16.37	46.67	20.20	0.02	10.08	Average
2	*	0.46	43.40	-13.27	56.67	33.30	0.02	10.08	QP
3		0.54	31.10	-14.90	46.00	21.00	0.02	10.08	Average
4		0.54	42.00	-14.00	56.00	31.90	0.02	10.08	QP
5		0.94	24.05	-21.95	46.00	13.90	0.06	10.09	Average
6		0.94	36.25	-19.75	56.00	26.10	0.06	10.09	QP
7		1.12	24.27	-21.73	46.00	14.10	0.08	10.09	Average
8		1.12	36.47	-19.53	56.00	26.30	0.08	10.09	QP
9		1.32	23.98	-22.02	46.00	13.79	0.09	10.10	Average
10		1.32	36.68	-19.32	56.00	26.49	0.09	10.10	QP
11		2.58	22.77	-23.23	46.00	12.50	0.14	10.13	Average
12		2.58	34.37	-21.63	56.00	24.10	0.14	10.13	QP

Test Mode :	Mode 1	Temperature :	22~25℃
Test Engineer :	Peng Wang	Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	Bluetooth Link + WLAN Link(2.4G) + USB Cable (Charging from Adapter1)		



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

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1		0.46	28.20	-18.56	46.76	18.10	0.02	10.08	Average
2		0.46	39.30	-17.46	56.76	29.20	0.02	10.08	QP
3	*	0.53	29.50	-16.50	46.00	19.40	0.02	10.08	Average
4		0.53	37.90	-18.10	56.00	27.80	0.02	10.08	QP
5		0.96	21.64	-24.36	46.00	11.50	0.05	10.09	Average
6		0.96	30.64	-25.36	56.00	20.50	0.05	10.09	QP
7		1.08	21.54	-24.46	46.00	11.40	0.05	10.09	Average
8		1.08	31.34	-24.66	56.00	21.20	0.05	10.09	QP
9		1.32	21.75	-24.25	46.00	11.60	0.05	10.10	Average
10		1.32	31.55	-24.45	56.00	21.40	0.05	10.10	QP
11		2.51	20.76	-25.24	46.00	10.59	0.04	10.13	Average
12		2.51	29.46	-26.54	56.00	19.29	0.04	10.13	QP

3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting Antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the Antenna exceeds 6 dBi. The use of a permanently attached Antenna or of an Antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(N_{ANT}/N_{SS}=1) dB.

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$.

Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain;

The EUT supports CDD mode.

For power, the directional gain G_{ANT} is set equal to the antenna having the highest gain, i.e., F)2)f)i).

For PSD, the directional gain calculation is following F)2)f)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain “DG” is calculated as following table.

	Ant. 1 (dBi)	Ant. 2 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
2.4 GHz	-0.09	-2.31	-0.09	1.88	0.00	0.00

Power Limit Reduction = DG(Power) – 6dBi, (min = 0)

PSD Limit Reduction = DG(PSD) – 6dBi, (min = 0)

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101078	9kHz~40GHz	Apr. 20, 2017	Dec. 01, 2017	Apr. 19, 2018	Conducted (TH01-SZ)
Pulse Power Senor	Anritsu	MA2411B	1207253	30MHz~40GHz	Jan. 06, 2017	Dec. 01, 2017	Jan. 05, 2018	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Jan. 06, 2017	Dec. 01, 2017	Jan. 05, 2018	Conducted (TH01-SZ)
EMI Test Receiver&SA	Agilent	N9038A	MY52260185	20Hz~26.5GHz	Apr. 20, 2017	Feb. 01, 2018	Apr. 19, 2018	Radiation (03CH01-SZ)
EXA Spectrum Anaiyzer	KEYSIGHT	N9010A	MY55150246	10Hz~44GHz;	Apr. 20, 2017	Feb. 01, 2018	Apr. 19, 2018	Radiation (03CH01-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	May 14, 2017	Feb. 01, 2018	May 13, 2018	Radiation (03CH01-SZ)
Bilog Antenna	TeseQ	CBL6112D	23188	30MHz-2GHz	Apr. 25, 2017	Feb. 01, 2018	Apr. 24, 2018	Radiation (03CH01-SZ)
Double Ridge Horn Antenna	ETS Lindgren	3117	00119436	1GHz~18GHz	Jul. 28, 2017	Feb. 01, 2018	Jul. 27, 2018	Radiation (03CH01-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18GHz~40GHz	Jun. 16, 2017	Feb. 01, 2018	Jun. 15, 2018	Radiation (03CH01-SZ)
LF Amplifier	Burgeon	BPA-530	102209	0.01~3000Mhz	Apr. 20, 2017	Feb. 01, 2018	Apr. 19, 2018	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	AMF-7D-00101800-30-10P-R	1707137	1GHz~18GHz	Oct. 19, 2017	Feb. 01, 2018	Oct. 18, 2018	Radiation (03CH01-SZ)
HF Amplifier	KEYSIGHT	83017A	MY53270104	0.5GHz~26.5Ghz	Oct. 19, 2017	Feb. 01, 2018	Oct. 18, 2018	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 18, 2017	Feb. 01, 2018	Jul. 17, 2018	Radiation (03CH01-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	NCR	Feb. 01, 2018	NCR	Radiation (03CH01-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Feb. 01, 2018	NCR	Radiation (03CH01-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Feb. 01, 2018	NCR	Radiation (03CH01-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Dec. 26, 2017	Jan. 30, 2018	Dec. 25, 2018	Conduction (CO01-SZ)
AC LISN	EMCO	3816/2SH	00103912	9kHz~30MHz	Dec. 26, 2017	Jan. 30, 2018	Dec. 25, 2018	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	MessTec	3816/2SH	00103892	9kHz~30MHz	Dec. 26, 2017	Jan. 30, 2018	Dec. 25, 2018	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 19, 2017	Jan. 30, 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))	**4.8dB**

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))	**4.3dB**

Appendix A. Conducted Test Results

Report Number : FR7D0101C

Test Engineer:	Rain Wang	Temperature:	24~26	°C
Test Date:	2017/12/1	Relative Humidity:	50~53	%

Report Number : FR7D0101C

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

2.4GHz Band										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)		6dB BW (MHz)		6dB BW Limit (MHz)	Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2		
11b	1Mbps	2	1	2412	11.14	12.29	7.51	8.51	0.50	Pass
11b	1Mbps	2	6	2437	11.29	11.74	8.01	8.03	0.50	Pass
11b	1Mbps	2	11	2462	11.94	11.94	7.51	8.03	0.50	Pass
11g	6Mbps	2	1	2412	18.68	18.88	16.06	16.34	0.50	Pass
11g	6Mbps	2	6	2437	18.98	18.78	16.32	16.30	0.50	Pass
11g	6Mbps	2	11	2462	18.73	18.73	16.04	16.32	0.50	Pass
HT20	MCS0	2	1	2412	19.58	19.18	17.30	17.58	0.50	Pass
HT20	MCS0	2	6	2437	19.73	18.93	17.56	17.52	0.50	Pass
HT20	MCS0	2	11	2462	19.38	19.18	16.90	17.58	0.50	Pass

Report Number : FR7D0101C

TEST RESULTS DATA
Peak Output Power

2.4GHz Band																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
11b	1Mbps	1	1	2412	20.85	21.22		30.00	30.00	-0.09	-2.31	20.76	18.91	36.00	36.00	Pass
11b	1Mbps	1	6	2437	21.85	21.02		30.00	30.00	-0.09	-2.31	21.76	18.71	36.00	36.00	Pass
11b	1Mbps	1	11	2462	21.88	21.02		30.00	30.00	-0.09	-2.31	21.79	18.71	36.00	36.00	Pass
11g	6Mbps	1	1	2412	21.48	21.30		30.00	30.00	-0.09	-2.31	21.39	18.99	36.00	36.00	Pass
11g	6Mbps	1	6	2437	21.84	21.05		30.00	30.00	-0.09	-2.31	21.75	18.74	36.00	36.00	Pass
11g	6Mbps	1	11	2462	21.87	21.29		30.00	30.00	-0.09	-2.31	21.78	18.98	36.00	36.00	Pass
HT20	MCS0	1	1	2412	19.18	19.10		30.00	30.00	-0.09	-2.31	19.09	16.79	36.00	36.00	Pass
HT20	MCS0	1	6	2437	19.65	18.99		30.00	30.00	-0.09	-2.31	19.56	16.68	36.00	36.00	Pass
HT20	MCS0	1	11	2462	19.41	18.83		30.00	30.00	-0.09	-2.31	19.32	16.52	36.00	36.00	Pass
11b	1Mbps	2	1	2412	20.85	20.53	23.70	30.00		-0.09		23.61		36.00		Pass
11b	1Mbps	2	6	2437	21.62	20.88	24.28	30.00		-0.09		24.19		36.00		Pass
11b	1Mbps	2	11	2462	21.47	20.42	23.99	30.00		-0.09		23.90		36.00		Pass
11g	6Mbps	2	1	2412	21.28	21.07	24.19	30.00		-0.09		24.10		36.00		Pass
11g	6Mbps	2	6	2437	21.38	21.12	24.26	30.00		-0.09		24.17		36.00		Pass
11g	6Mbps	2	11	2462	21.70	20.88	24.32	30.00		-0.09		24.23		36.00		Pass
HT20	MCS0	2	1	2412	19.35	18.98	22.18	30.00		-0.09		22.09		36.00		Pass
HT20	MCS0	2	6	2437	19.72	18.87	22.33	30.00		-0.09		22.24		36.00		Pass
HT20	MCS0	2	11	2462	19.31	18.56	21.96	30.00		-0.09		21.87		36.00		Pass

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

TEST RESULTS DATA
Average Output Power

2.4GHz Band									
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power (dBm)		
					Ant 1	Ant 2	Ant 1	Ant 2	SUM
11b	1Mbps	1	1	2412	0.00	0.00	17.68	18.26	
11b	1Mbps	1	6	2437	0.00	0.00	18.46	18.19	
11b	1Mbps	1	11	2462	0.00	0.00	18.88	18.20	
11g	6Mbps	1	1	2412	0.05	0.08	14.35	14.49	
11g	6Mbps	1	6	2437	0.05	0.08	14.63	14.65	
11g	6Mbps	1	11	2462	0.05	0.08	14.93	14.82	
HT20	MCS0	1	1	2412	0.05	0.05	12.31	12.46	
HT20	MCS0	1	6	2437	0.05	0.05	12.73	12.50	
HT20	MCS0	1	11	2462	0.05	0.05	12.62	12.35	
11b	1Mbps	2	1	2412	0.00	0.00	17.80	17.94	20.88
11b	1Mbps	2	6	2437	0.00	0.00	18.65	18.09	21.39
11b	1Mbps	2	11	2462	0.00	0.00	18.73	17.75	21.28
11g	6Mbps	2	1	2412	0.06	0.05	14.28	14.29	17.29
11g	6Mbps	2	6	2437	0.06	0.05	14.51	14.61	17.57
11g	6Mbps	2	11	2462	0.06	0.05	14.82	14.28	17.57
HT20	MCS0	2	1	2412	0.10	0.09	12.35	12.22	15.30
HT20	MCS0	2	6	2437	0.10	0.09	12.58	12.29	15.45
HT20	MCS0	2	11	2462	0.10	0.09	12.66	12.18	15.44

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

Report Number : FR7D0101C

TEST RESULTS DATA
Peak Power Spectral Density

2.4GHz Band												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm/3kHz)			DG (dBi)		Peak PSD Limit (dBm/3kHz)		Pass/Fail
					Ant 1	Ant 2	Worse + 3.01	Ant 1	Ant 2	Ant 1	Ant 2	
11b	1Mbps	2	1	2412	-2.60	-4.30	0.41	1.88		8.00		Pass
11b	1Mbps	2	6	2437	-2.42	-2.28	0.73	1.88		8.00		Pass
11b	1Mbps	2	11	2462	-1.95	-2.70	1.06	1.88		8.00		Pass
11g	6Mbps	2	1	2412	-10.14	-10.00	-6.99	1.88		8.00		Pass
11g	6Mbps	2	6	2437	-9.67	-9.78	-6.66	1.88		8.00		Pass
11g	6Mbps	2	11	2462	-8.55	-9.96	-5.54	1.88		8.00		Pass
HT20	MCS0	2	1	2412	-11.26	-11.62	-8.25	1.88		8.00		Pass
HT20	MCS0	2	6	2437	-11.81	-11.89	-8.80	1.88		8.00		Pass
HT20	MCS0	2	11	2462	-11.63	-12.14	-8.62	1.88		8.00		Pass

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

Appendix B. Radiated Spurious Emission

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+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	52.28	-21.72	74	46.97	31.5	6.81	33	187	55	P	H
		2387.28	45.87	-8.13	54	40.56	31.5	6.81	33	187	55	A	H
	*	2412	106.19	-	-	100.81	31.57	6.81	33	187	55	P	H
	*	2412	103.24	-	-	97.86	31.57	6.81	33	187	55	A	H
		2389.065	49.08	-24.92	74	43.77	31.5	6.81	33	188	248	P	V
		2390	41.76	-12.24	54	36.45	31.5	6.81	33	188	248	A	V
	*	2412	103.36	-	-	97.98	31.57	6.81	33	188	248	P	V
	*	2412	100.4	-	-	95.02	31.57	6.81	33	188	248	A	V
802.11b CH 06 2437MHz		2386.16	48.31	-25.69	74	43	31.5	6.81	33	100	158	P	H
		2389.94	37.96	-16.04	54	32.65	31.5	6.81	33	100	158	A	H
	*	2437	108.17	-	-	102.6	31.71	6.86	33	100	158	P	H
	*	2437	105.08	-	-	99.51	31.71	6.86	33	100	158	A	H
		2484.88	49.19	-24.81	74	43.42	31.86	6.91	33	100	158	P	H
		2483.5	37.92	-16.08	54	32.15	31.86	6.91	33	100	158	A	H
		2323.72	47.29	-26.71	74	42.07	31.57	6.65	33	100	201	P	V
		2389.94	37.07	-16.93	54	31.76	31.5	6.81	33	100	201	A	V
	*	2437	96.97	-	-	91.4	31.71	6.86	33	100	201	P	V
	*	2437	93.65	-	-	88.08	31.71	6.86	33	100	201	A	V
		2486.7	47.52	-26.48	74	41.75	31.86	6.91	33	100	201	P	V
		2483.5	36.67	-17.33	54	30.9	31.86	6.91	33	100	201	A	V

802.11b CH 11 2462MHz	*	2462	106.38	-	-	100.73	31.79	6.86	33	160	55	P	H
	*	2462	103.51	-	-	97.86	31.79	6.86	33	160	55	A	H
		2483.64	52.98	-21.02	74	47.21	31.86	6.91	33	160	55	P	H
		2484.8	39.94	-14.06	54	34.17	31.86	6.91	33	160	55	A	H
	*	2462	104.93	-	-	99.28	31.79	6.86	33	195	239	P	V
	*	2462	102.06	-	-	96.41	31.79	6.86	33	195	239	A	V
		2484	49.69	-24.31	74	43.92	31.86	6.91	33	195	239	P	V
		2484.76	37.87	-16.13	54	32.1	31.86	6.91	33	195	239	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+2	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	48.65	-25.35	74	62.18	33.77	10.89	58.19	185	255	P	H
		4824	47.45	-26.55	74	60.98	33.77	10.89	58.19	185	255	P	V
802.11b CH 06 2437MHz		4874	44.49	-29.51	74	57.92	33.75	10.92	58.1	165	106	P	H
		7311	48.69	-25.31	74	57.86	35.46	13.29	57.92	174	100	P	H
		4874	45.47	-28.53	74	58.9	33.75	10.92	58.1	165	106	P	V
		7311	48.82	-25.18	74	57.99	35.46	13.29	57.92	174	100	P	V
802.11b CH 11 2462MHz		4924	45.42	-28.58	74	58.72	33.73	10.99	58.02	150	285	P	H
		7386	46.94	-27.06	74	55.86	35.61	13.12	57.65	155	274	P	H
		4924	44.99	-29.01	74	58.29	33.73	10.99	58.02	150	285	P	V
		7386	46.22	-27.78	74	55.14	35.61	13.12	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+2	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		2389.275	62.31	-11.69	74	57	31.5	6.81	33	113	132	P	H
		2389.59	49.46	-4.54	54	44.15	31.5	6.81	33	113	132	A	H
	*	2412	104.65	-	-	99.27	31.57	6.81	33	261	130	P	H
	*	2412	97.76	-	-	92.38	31.57	6.81	33	261	130	A	H
		2390	60.53	-13.47	74	55.22	31.5	6.81	33	100	68	P	V
		2390	48.02	-5.98	54	42.71	31.5	6.81	33	100	68	A	V
	*	2412	102.45	-	-	97.07	31.57	6.81	33	327	236	P	V
	*	2412	95.47	-	-	90.09	31.57	6.81	33	327	236	A	V
802.11g CH 06 2437MHz		2387.7	49.4	-24.6	74	44.09	31.5	6.81	33	100	158	P	H
		2389.94	39.56	-14.44	54	34.25	31.5	6.81	33	100	158	A	H
	*	2437	105.11	-	-	99.54	31.71	6.86	33	100	158	P	H
	*	2437	97.87	-	-	92.3	31.71	6.86	33	100	158	A	H
		2484.39	48.19	-25.81	74	42.42	31.86	6.91	33	100	158	P	H
		2483.5	38.92	-15.08	54	33.15	31.86	6.91	33	100	158	A	H
		2388.26	47.62	-26.38	74	42.31	31.5	6.81	33	100	201	P	V
		2389.94	37.86	-16.14	54	32.55	31.5	6.81	33	100	201	A	V
	*	2437	99.2	-	-	93.63	31.71	6.86	33	100	201	P	V
	*	2437	91.58	-	-	86.01	31.71	6.86	33	100	201	A	V
		2487.68	47.58	-26.42	74	41.74	31.93	6.91	33	100	201	P	V
		2483.5	37.22	-16.78	54	31.45	31.86	6.91	33	100	201	A	V

802.11g CH 11 2462MHz	*	2462	106.09	-	-	100.44	31.79	6.86	33	104	131	P	H
	*	2462	99.72	-	-	94.07	31.79	6.86	33	104	131	A	H
		2485.04	63.01	-10.99	74	57.24	31.86	6.91	33	104	131	P	H
		2483.84	50.71	-3.29	54	44.94	31.86	6.91	33	104	131	A	H
	*	2462	103.22	-	-	97.57	31.79	6.86	33	129	117	P	V
	*	2462	97.7	-	-	92.05	31.79	6.86	33	129	117	A	V
		2483.64	58.06	-15.94	74	52.29	31.86	6.91	33	129	117	P	V
		2483.96	46.63	-7.37	54	40.86	31.86	6.91	33	129	117	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+2	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	46.6	-27.4	74	60.13	33.77	10.89	58.19	185	255	P	H
		4824	47.17	-26.83	74	60.7	33.77	10.89	58.19	185	255	P	V
802.11g CH 06 2437MHz		4874	45.25	-28.75	74	58.68	33.75	10.92	58.1	165	106	P	H
		7311	48.07	-25.93	74	57.24	35.46	13.29	57.92	174	100	P	H
		4874	44.67	-29.33	74	58.1	33.75	10.92	58.1	165	106	P	V
		7311	48.82	-25.18	74	57.99	35.46	13.29	57.92	174	100	P	V
802.11g CH 11 2462MHz		4924	44.41	-29.59	74	57.71	33.73	10.99	58.02	150	285	P	H
		7386	49.02	-24.98	74	57.94	35.61	13.12	57.65	155	274	P	H
		4924	45.16	-28.84	74	58.46	33.73	10.99	58.02	150	285	P	V
		7386	47.12	-26.88	74	56.04	35.61	13.12	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+2	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)
		2390	61.24	-12.76	74	55.93	31.5	6.81	33	108	207	P	H
		2390	48.86	-5.14	54	43.55	31.5	6.81	33	108	207	A	H
802.11n	*	2412	101.34	-	-	95.96	31.57	6.81	33	108	207	P	H
HT20	*	2412	94.26	-	-	88.88	31.57	6.81	33	108	207	A	H
CH 01		2389.275	57.28	-16.72	74	51.97	31.5	6.81	33	126	116	P	V
2412MHz		2389.905	48.28	-5.72	54	42.97	31.5	6.81	33	126	116	A	V
	*	2412	97.98	-	-	92.6	31.57	6.81	33	126	116	P	V
	*	2412	92.74	-	-	87.36	31.57	6.81	33	126	116	A	V
		2389.66	49.61	-24.39	74	44.3	31.5	6.81	33	100	158	P	H
		2389.52	41.98	-12.02	54	36.67	31.5	6.81	33	100	158	A	H
	*	2437	100.85	-	-	95.28	31.71	6.86	33	100	158	P	H
	*	2437	91.97	-	-	86.4	31.71	6.86	33	100	158	A	H
802.11n		2484.32	49.55	-24.45	74	43.78	31.86	6.91	33	100	158	P	H
HT20		2484.6	41.98	-12.02	54	36.21	31.86	6.91	33	100	158	A	H
CH 06		2383.5	48.24	-25.76	74	42.99	31.52	6.73	33	100	202	P	V
2437MHz		2389.52	38.82	-15.18	54	33.51	31.5	6.81	33	100	202	A	V
	*	2437	96.44	-	-	90.87	31.71	6.86	33	100	202	P	V
	*	2437	89.52	-	-	83.95	31.71	6.86	33	100	202	A	V
		2485.58	47.45	-26.55	74	41.68	31.86	6.91	33	100	202	P	V
		2484.11	38.48	-15.52	54	32.71	31.86	6.91	33	100	202	A	V

802.11n HT20 CH 11 2462MHz	*	2462	99.89	-	-	94.24	31.79	6.86	33	330	243	P	H
	*	2462	92.71	-	-	87.06	31.79	6.86	33	330	243	A	H
		2483.72	58.6	-15.4	74	52.83	31.86	6.91	33	330	243	P	H
		2483.56	47.64	-6.36	54	41.87	31.86	6.91	33	330	243	A	H
	*	2462	97.79	-	-	92.14	31.79	6.86	33	172	250	P	V
	*	2462	89.12	-	-	83.47	31.79	6.86	33	172	250	A	V
		2483.6	54.89	-19.11	74	49.12	31.86	6.91	33	172	250	P	V
		2483.56	44.34	-9.66	54	38.57	31.86	6.91	33	172	250	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+2	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	47.4	-26.6	74	60.93	33.77	10.89	58.19	185	255	P	H
		4824	47.01	-26.99	74	60.54	33.77	10.89	58.19	185	255	P	V
802.11n HT20 CH 06 2437MHz		4874	44.75	-29.25	74	58.18	33.75	10.92	58.1	165	106	P	H
		7311	48.48	-25.52	74	57.65	35.46	13.29	57.92	174	100	P	H
		4874	45.85	-28.15	74	59.28	33.75	10.92	58.1	165	106	P	V
		7311	50.34	-23.66	74	59.51	35.46	13.29	57.92	174	100	P	V
802.11n HT20 CH 11 2462MHz		4924	44.78	-29.22	74	58.08	33.73	10.99	58.02	150	285	P	H
		7386	46.55	-27.45	74	55.47	35.61	13.12	57.65	155	274	P	H
		4924	44.79	-29.21	74	58.09	33.73	10.99	58.02	150	285	P	V
		7386	46.46	-27.54	74	55.38	35.61	13.12	57.65	155	274	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	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz 802.11g LF		30	26.55	-13.45	40	30.22	27.7	0.23	31.6	-	-	P	H
		78.5	28.9	-11.1	40	43.98	15.77	0.7	31.55	-	-	P	H
		158.04	34.68	-8.82	43.5	46.66	18.02	1.36	31.36	-	-	P	H
		255.04	38.88	-7.12	46	47.69	20.32	1.88	31.01	100	0	P	H
		342.34	34.79	-11.21	46	42.58	21.12	2.19	31.1	-	-	P	H
		700.27	31.05	-14.95	46	31.28	27.7	3.27	31.2	-	-	P	H
		33.88	35.76	-4.24	40	40.48	26.58	0.3	31.6	-	-	P	V
		78.5	34.05	-5.95	40	49.13	15.77	0.7	31.55	100	136	QP	V
		158.04	32.15	-11.35	43.5	44.13	18.02	1.36	31.36	-	-	P	V
		255.04	31	-15	46	39.81	20.32	1.88	31.01	-	-	P	V
		447.1	28.63	-17.37	46	30.6	26.57	2.56	31.1	-	-	P	V
		695.42	31.79	-14.21	46	32.06	27.67	3.26	31.2	-	-	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+2		(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)

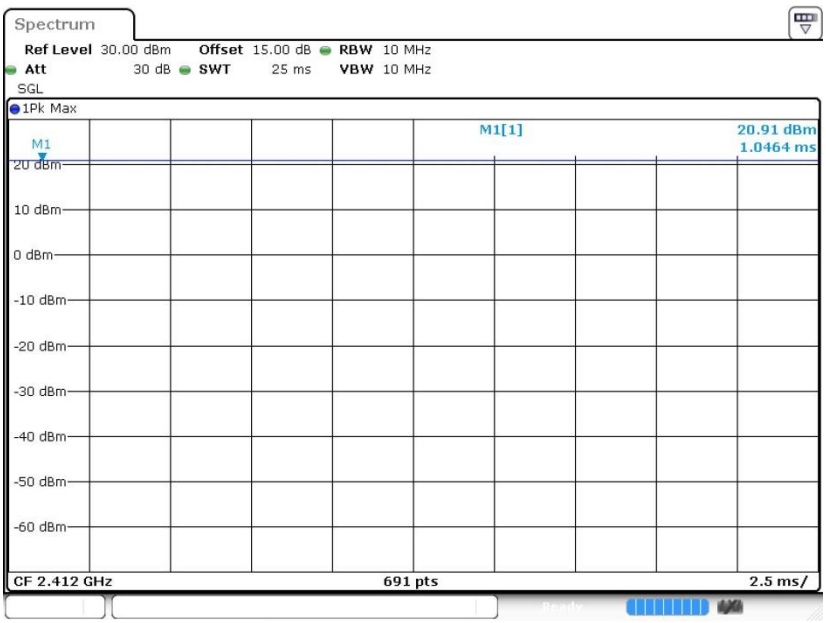
= -10.46(dB)

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

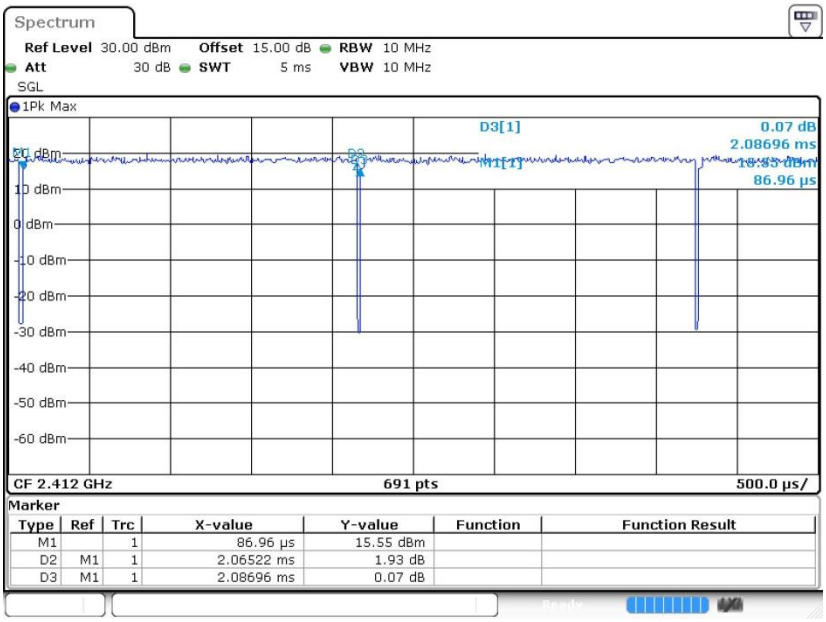
Appendix C. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
1+2	802.11b	100	-	-	10Hz
1+2	802.11g	98.96	-	-	10Hz
1+2	802.11n HT20	97.84	0.983	1.017	3KHz

802.11b Ant.1+2



802.11g Ant.1+2



802.11n20 Ant.1+2