



FCC RF Test Report

APPLICANT : Samsara Networks
EQUIPMENT : VG33
BRAND NAME : SAMSARA
MODEL NAME : 010-0033
MARKETING NAME : VG33
FCC ID : 2AIHD0033
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System

The product was received on May 20, 2016 and testing was completed on Jul. 07, 2016. 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.

Prepared by: Ken Chen / Manager

Approved by: Jones Tsai / Manager



SPORTON INTERNATIONAL (SHENZHEN) INC.

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TABLE OF CONTENTS

REVISION HISTORY	3
SUMMARY OF TEST RESULT	4
1 GENERAL DESCRIPTION	5
1.1 Applicant	5
1.2 Manufacturer	5
1.3 Product Feature of Equipment Under Test	5
1.4 Product Specification of Equipment Under Test	6
1.5 Modification of EUT	6
1.6 Testing Location	7
1.7 Applicable Standards	7
2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST	8
2.1 Carrier Frequency Channel	8
2.2 Pre-Scanned RF Power	9
2.3 Test Mode	10
2.4 Connection Diagram of Test System	10
2.5 Support Unit used in test configuration and system	11
2.6 EUT Operation Test Setup	11
2.7 Measurement Results Explanation Example	11
3 TEST RESULT	12
3.1 6dB and 99% Bandwidth Measurement	12
3.2 Output Power Measurement	14
3.3 Power Spectral Density Measurement	15
3.4 Conducted Band Edges and Spurious Emission Measurement	17
3.5 Radiated Band Edges and Spurious Emission Measurement	27
3.6 Antenna Requirements	31
4 LIST OF MEASURING EQUIPMENT	32
5 UNCERTAINTY OF EVALUATION	33
APPENDIX A. CONDUCTED TEST RESULTS	
APPENDIX B. RADIATED TEST RESULTS	
APPENDIX C. DUTY CYCLE PLOTS	
APPENDIX D. SETUP PHOTOGRAPHS	



REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR652039C	Rev. 01	Initial issue of report	Aug. 03, 2016

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	RSS-247 5.2(1)	6dB Bandwidth	$\geq 0.5\text{MHz}$	Pass	-
3.1	-	RSS-Gen 6.6	99% Bandwidth	-	Pass	-
3.2	15.247(b)	RSS-247 A5.4(4)	Power Output Measurement	$\leq 30\text{dBm}$	Pass	-
3.3	15.247(e)	RSS-247 5.2(2)	Power Spectral Density	$\leq 8\text{dBm}/3\text{kHz}$	Pass	-
3.4	15.247(d)	RSS-247 5.5	Conducted Band Edges	$\leq 20\text{dBc}$	Pass	-
			Conducted Spurious Emission		Pass	-
3.5	15.247(d)	RSS-247 5.5	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 0.41 dB at 2389.695 MHz
3.6	15.203 & 15.247(b)	N/A	Antenna Requirement	N/A	Pass	-



1 General Description

1.1 Applicant

Samsara Networks

501 York St, San Francisco, CA 94110

1.2 Manufacturer

Samsara Networks

501 York St, San Francisco, CA 94110

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	VG33
Brand Name	SAMSARA
Model Name	010-0033
Marketing Name	VG33
FCC ID	2AIHD0033
EUT supports Radios application	GPRS/EGPRS/WCDMA/HSPA WLAN2.4GHz 802.11b/g/n HT20 WLAN5GHz 802.11a/n HT20/HT40 Bluetooth v3.0+EDR Bluetooth v4.0 LE
HW Version	1.0
SW Version	1.0
EUT Stage	Production Unit

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

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Channel Frequency Range	802.11b/g/n : 2412 MHz ~ 2462 MHz
Maximum (Peak) Output Power to Antenna	802.11b : 18.85 dBm (0.0767 W) 802.11g : 24.53 dBm (0.2838 W) 802.11n HT20 : 24.32 dBm (0.2704 W)
99% Occupied Bandwidth	802.11b : 12.19MHz 802.11g : 17.83MHz 802.11n HT20 : 17.78MHz
Antenna Type/Gain	802.11b/g/n : PIFA Antenna with gain 2.80 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)

1.5 Modification of EUT

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

1.6 Testing Location

Test Site	SPORTON INTERNATIONAL (SHENZHEN) INC.
Test Site Location	1F & 2F,Building A, Morning Business Center, No. 4003 ShiGu Rd., Xili Town, Nanshan District, Shenzhen, Guangdong, P. R. China TEL: +86-755-8637-9589 FAX: +86-755-8637-9595
Test Site No.	Sporton Site No. TH01-SZ

Test Site	SPORTON INTERNATIONAL (SHENZHEN) INC.	
Test Site Location	No. 3 Building, the third floor of south, Shahe River west, Fengzeyuan warehouse, Nanshan District, Shenzhen, Guangdong, P. R. China TEL: +86-755- 3320-2398	
Test Site No.	Sporton Site No. 03CH03-SZ	FCC/IC Registration No. 565805/4086F

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 v03r05
- ANSI C63.10-2013
- IC RSS-247 Issue 1
- IC RSS-Gen Issue 4

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: 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 (Y plane) were recorded in this report.

2.1 Carrier Frequency 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 Pre-Scanned RF Power

Preliminary tests were performed in different data rate and data rate associated with the highest power were chosen for full test shown in the following tables.

2.4GHz 802.11b mode				
Data Rate (MHz)	1M bps	2M bps	5.5M bps	11M bps
Peak Power (dBm)	18.85	18.78	18.76	18.68

2.4GHz 802.11g mode								
Data Rate (MHz)	6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
Peak Power (dBm)	24.53	24.25	24.12	23.86	23.72	23.88	23.76	23.87

2.4GHz 802.11n HT20 mode								
Data Rate (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
Peak Power (dBm)	24.32	24.06	24.00	23.88	23.72	23.77	23.72	23.55

2.3 Test Mode

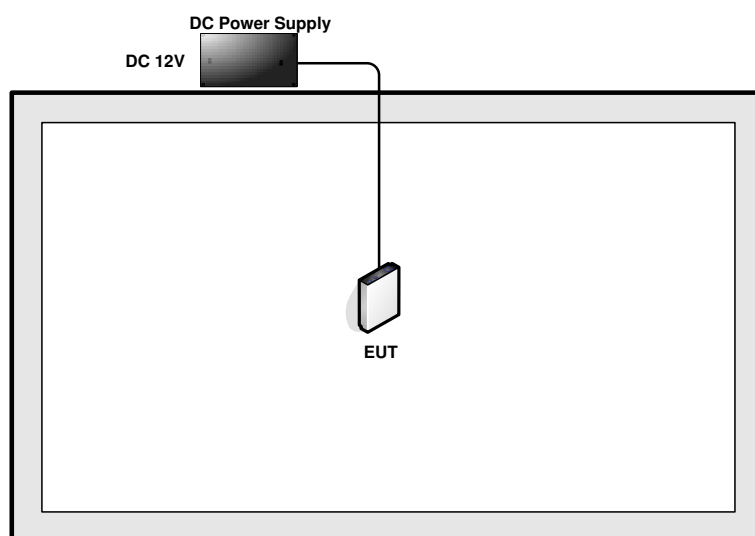
Final test mode of conducted test items and radiated spurious emissions are considering the modulation and worse data rates from the power table described in section 2.2.

<2.4GHz>

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

2.4 Connection Diagram of Test System

<WLAN Tx Mode>



2.5 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	DC Power Supply	Topward	3303DR	N/A	N/A	Unshielded, 1.8 m

2.6 EUT Operation Test Setup

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

2.7 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.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 5.0 + 10 = 15.0 \text{ (dB)}\end{aligned}$$

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

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

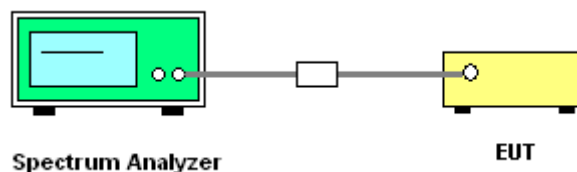
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v03r05.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 1MHz and set the Video bandwidth (VBW) = 3MHz.
6. Measure and record the results in the test report.

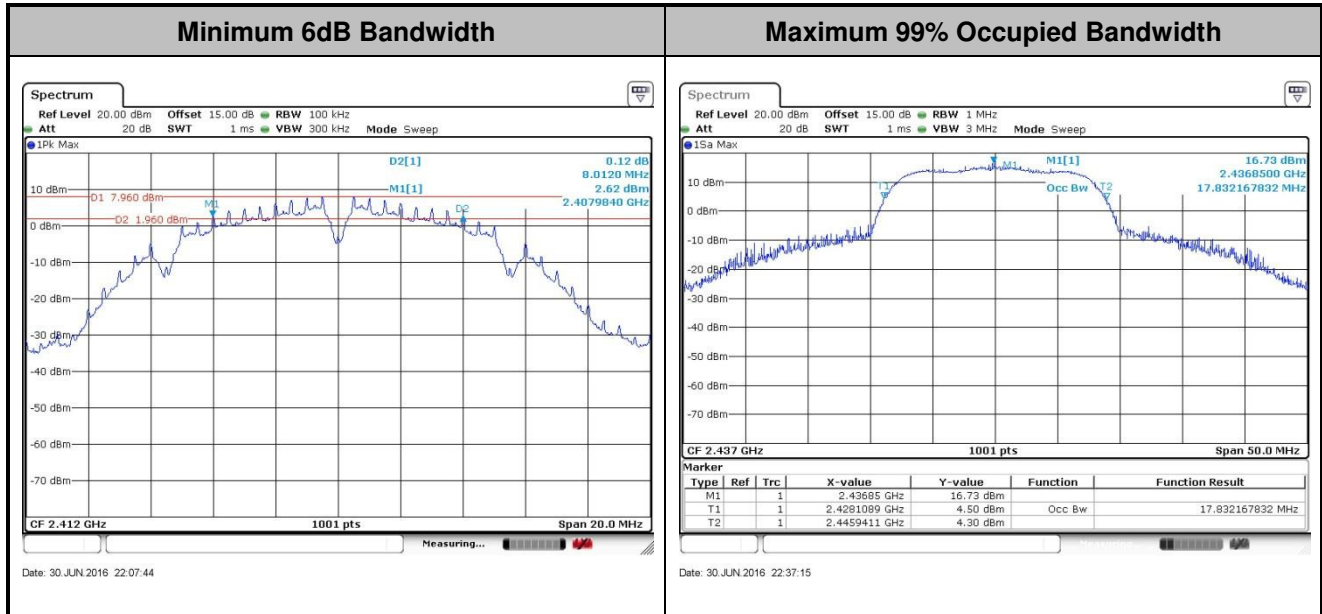
3.1.4 Test Setup





3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A of this test report.



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

3.2 Output Power Measurement

3.2.1 Limit of Output Power

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

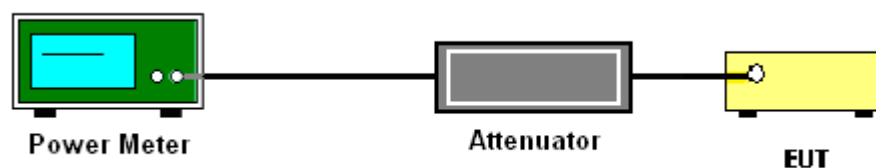
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v03r05 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 of this test report.

3.2.6 Test Result of Average output Power (Reporting Only)

Please refer to Appendix A of this test report.

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.

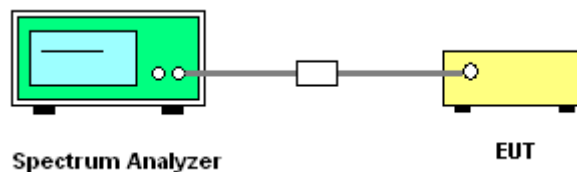
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

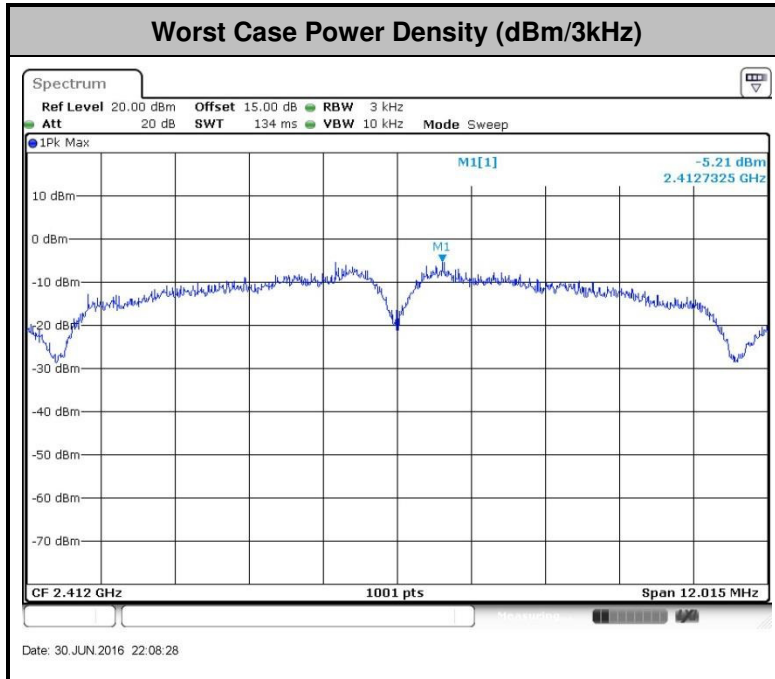
1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum 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 of this test report.



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 and radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

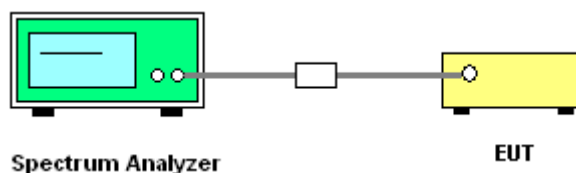
3.4.2 Measuring Instruments

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 v03r05.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

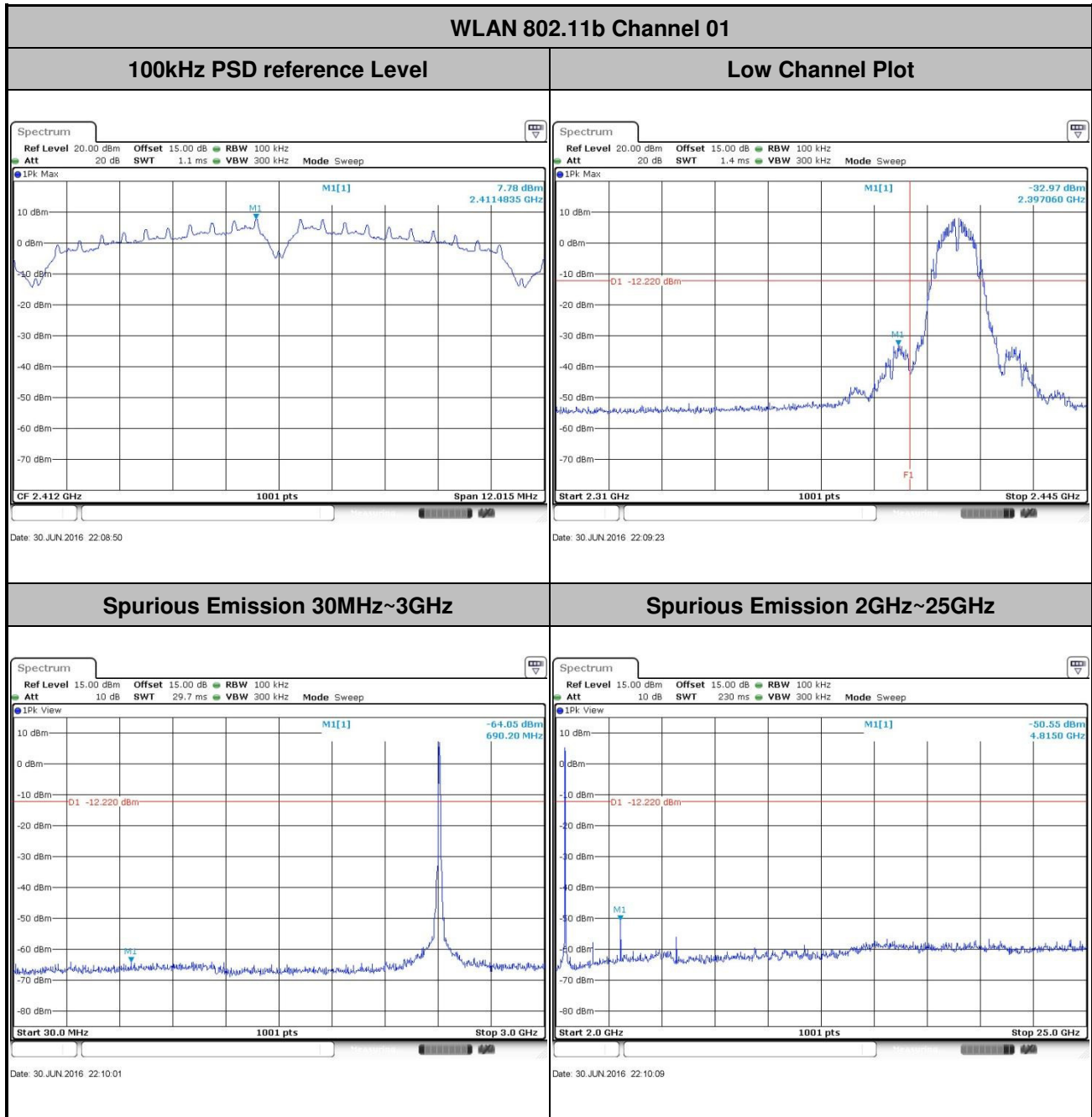
3.4.4 Test Setup





3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Mode :	802.11b	Temperature :	24~26℃
Test Band :	2.4GHz Low	Relative Humidity :	50~53%
Test Channel :	01	Test Engineer :	Sam Zheng

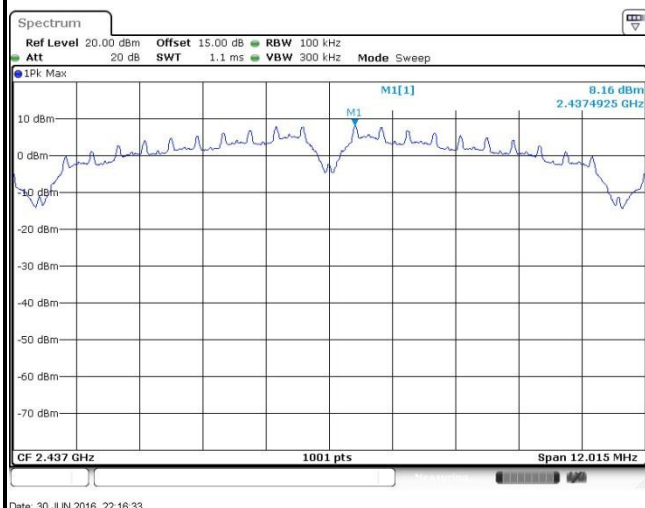




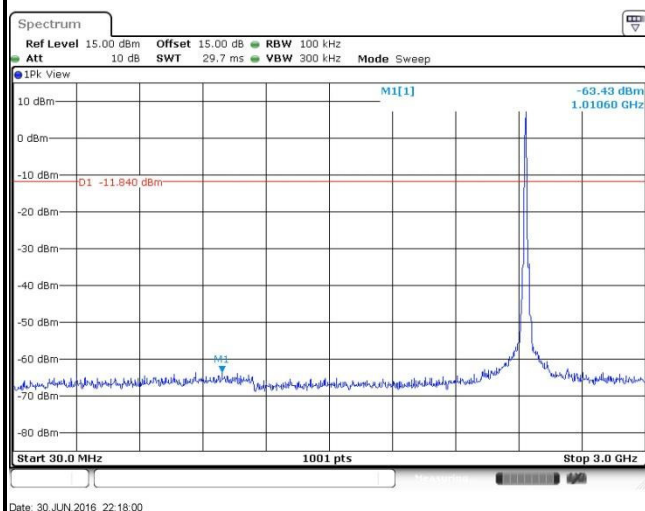
Test Mode :	802.11b	Temperature :	24~26°C
Test Band :	2.4GHz Mid	Relative Humidity :	50~53%
Test Channel :	06	Test Engineer :	Sam Zheng

WLAN 802.11b Channel 06

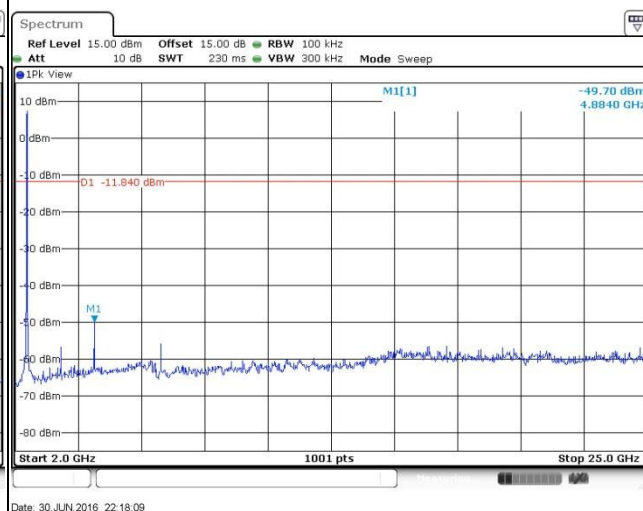
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz

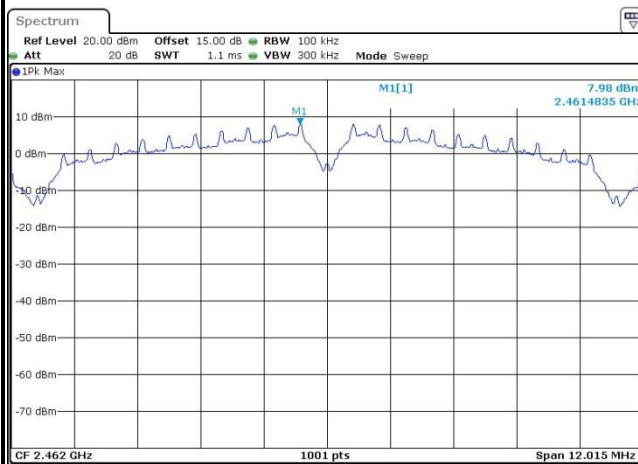


Spurious Emission 2GHz~25GHz

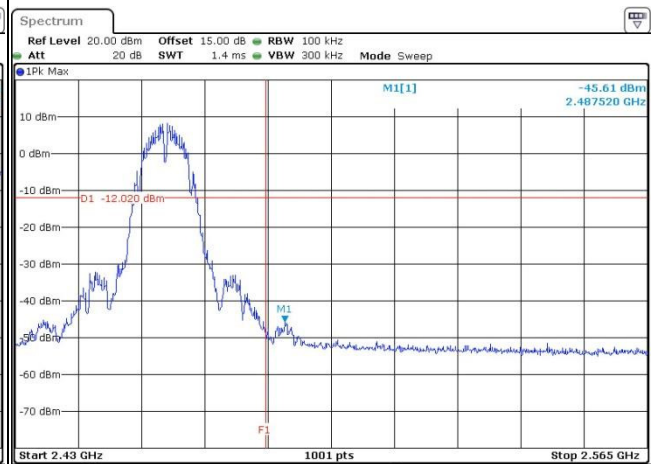




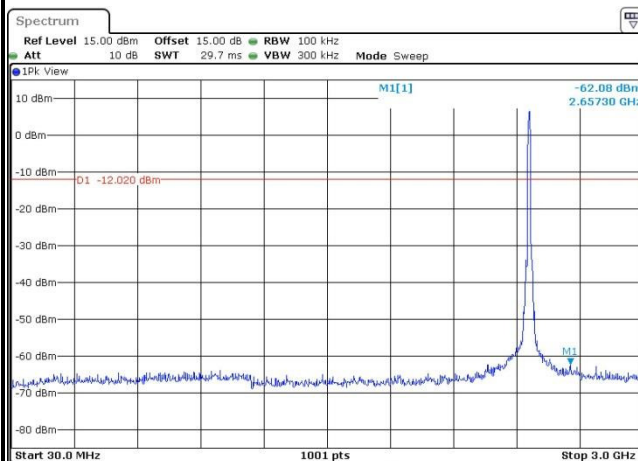
Test Mode :	802.11b	Temperature :	24~26°C
Test Band :	2.4GHz High	Relative Humidity :	50~53%
Test Channel :	11	Test Engineer :	Sam Zheng

WLAN 802.11b Channel 11**100kHz PSD reference Level**

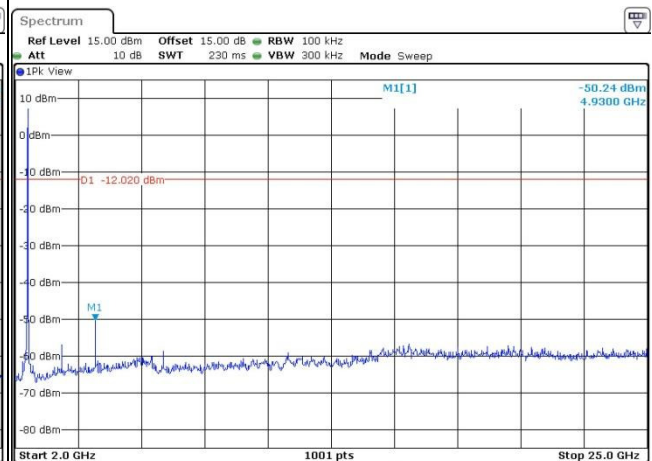
Date: 30 JUN 2016 22:20:57

High Channel Plot

Date: 30 JUN 2016 22:22:25

Spurious Emission 30MHz~3GHz

Date: 30 JUN 2016 22:23:02

Spurious Emission 2GHz~25GHz

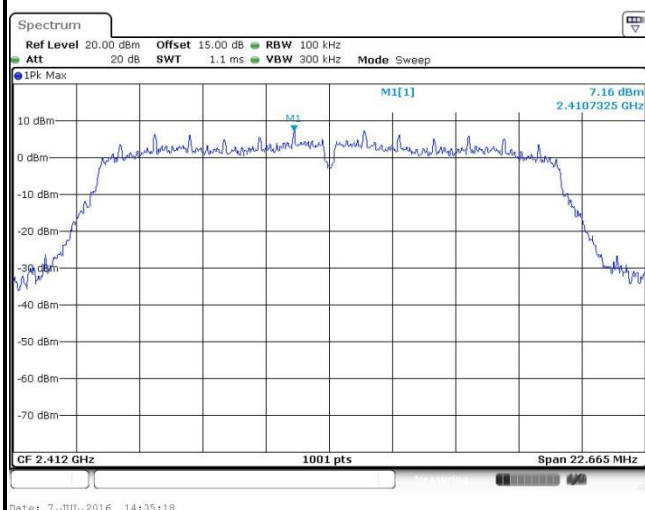
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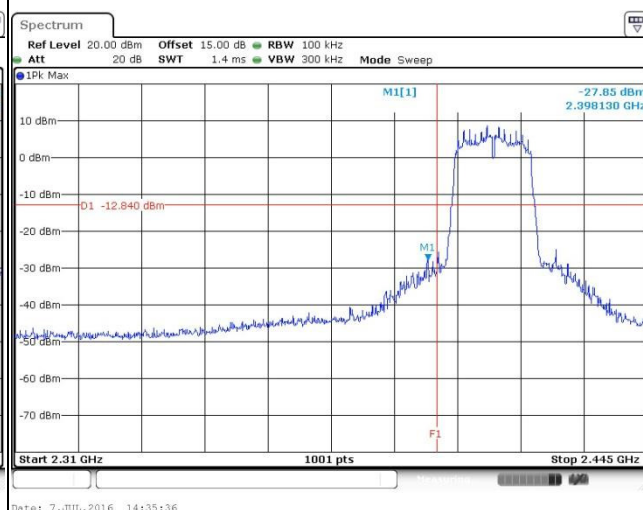
Test Mode :	802.11g	Temperature :	24~26°C
Test Band :	2.4GHz Low	Relative Humidity :	50~53%
Test Channel :	01	Test Engineer :	Sam Zheng

WLAN 802.11g Channel 01

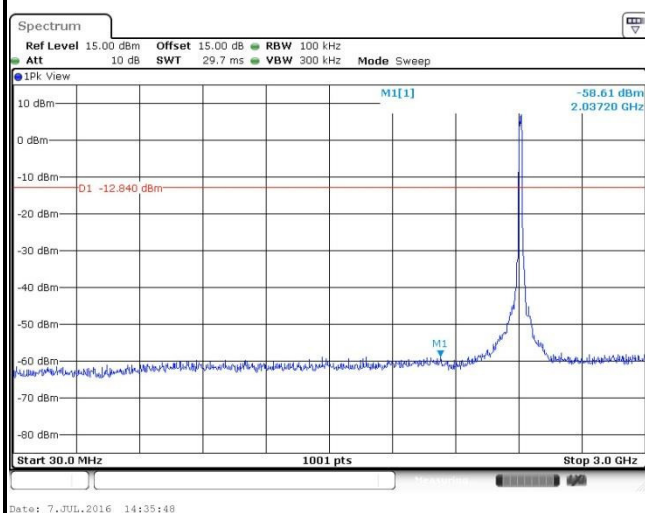
100kHz PSD reference Level



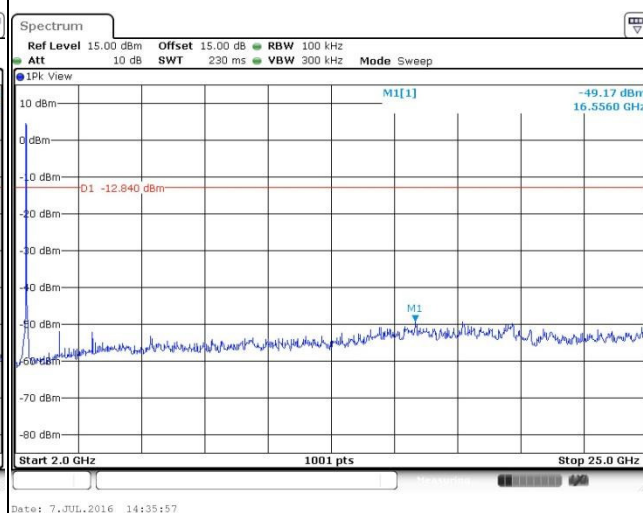
Low Channel Plot



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz

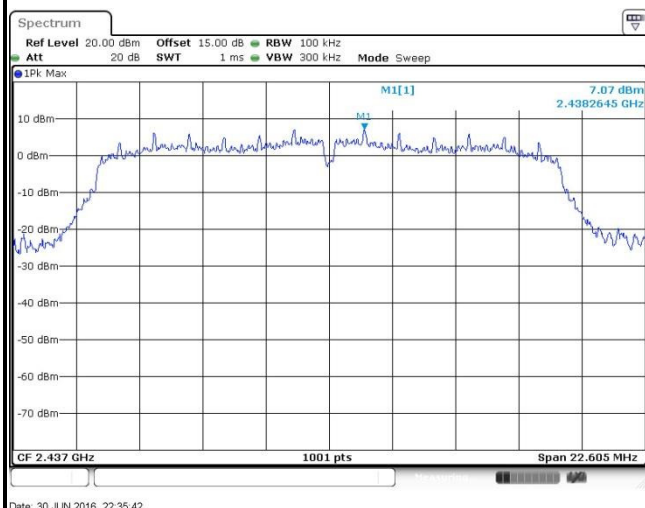




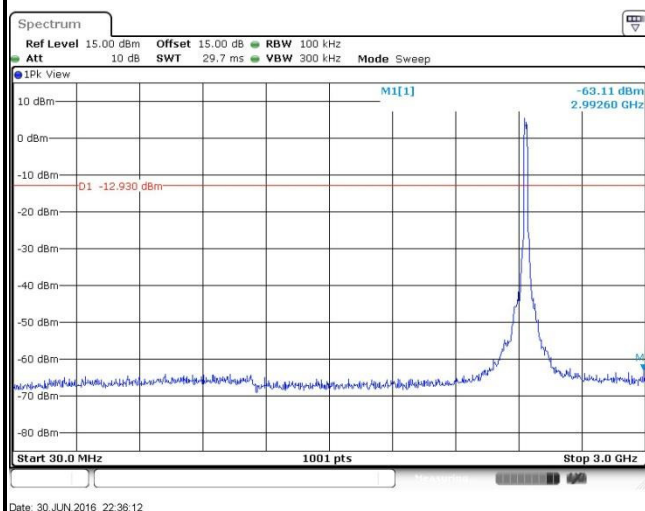
Test Mode :	802.11g	Temperature :	24~26°C
Test Band :	2.4GHz Mid	Relative Humidity :	50~53%
Test Channel :	06	Test Engineer :	Sam Zheng

WLAN 802.11g Channel 06

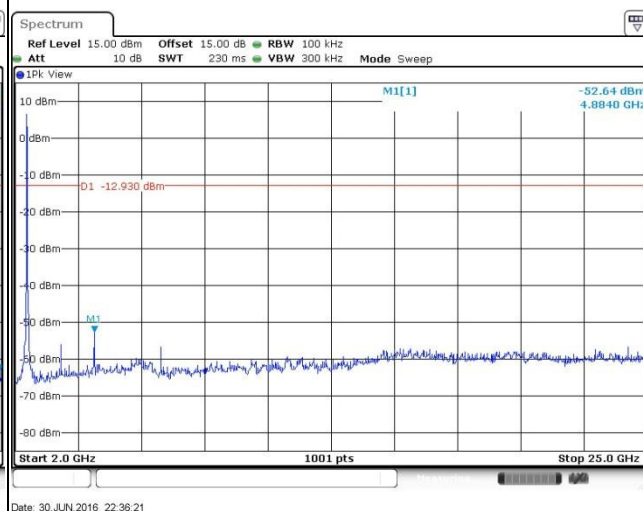
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz

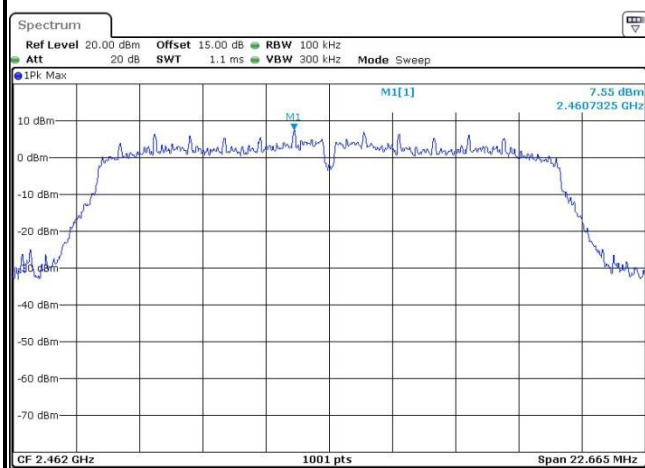




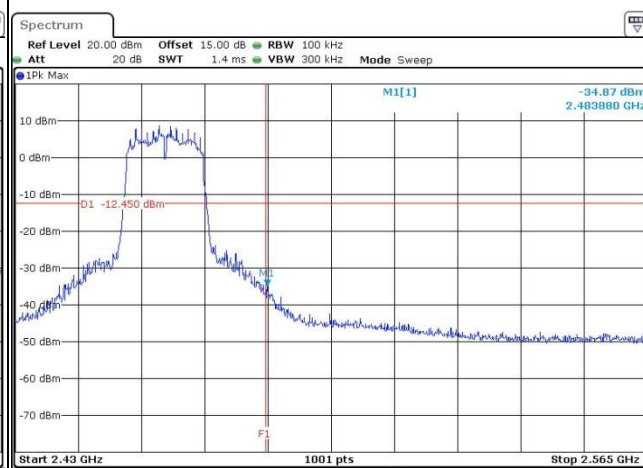
Test Mode :	802.11g	Temperature :	24~26°C
Test Band :	2.4GHz High	Relative Humidity :	50~53%
Test Channel :	11	Test Engineer :	Sam Zheng

WLAN 802.11g Channel 11

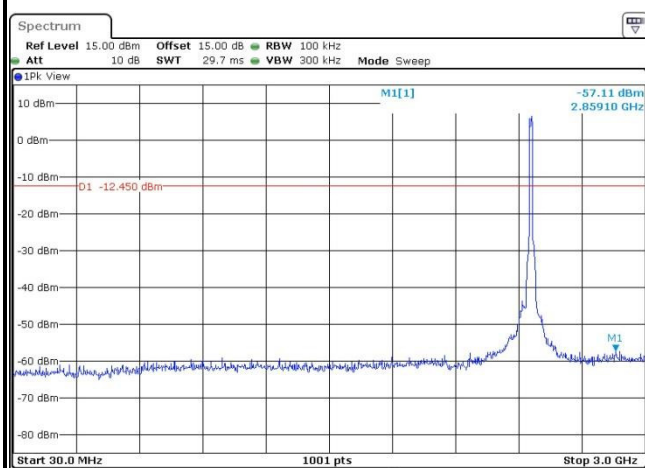
100kHz PSD reference Level



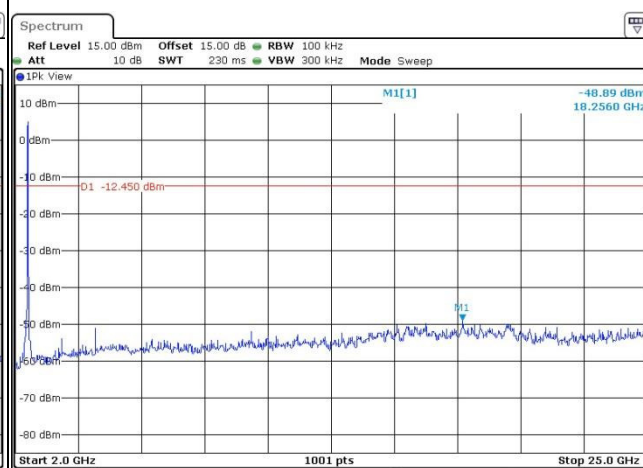
High Channel Plot



Spurious Emission 30MHz~3GHz

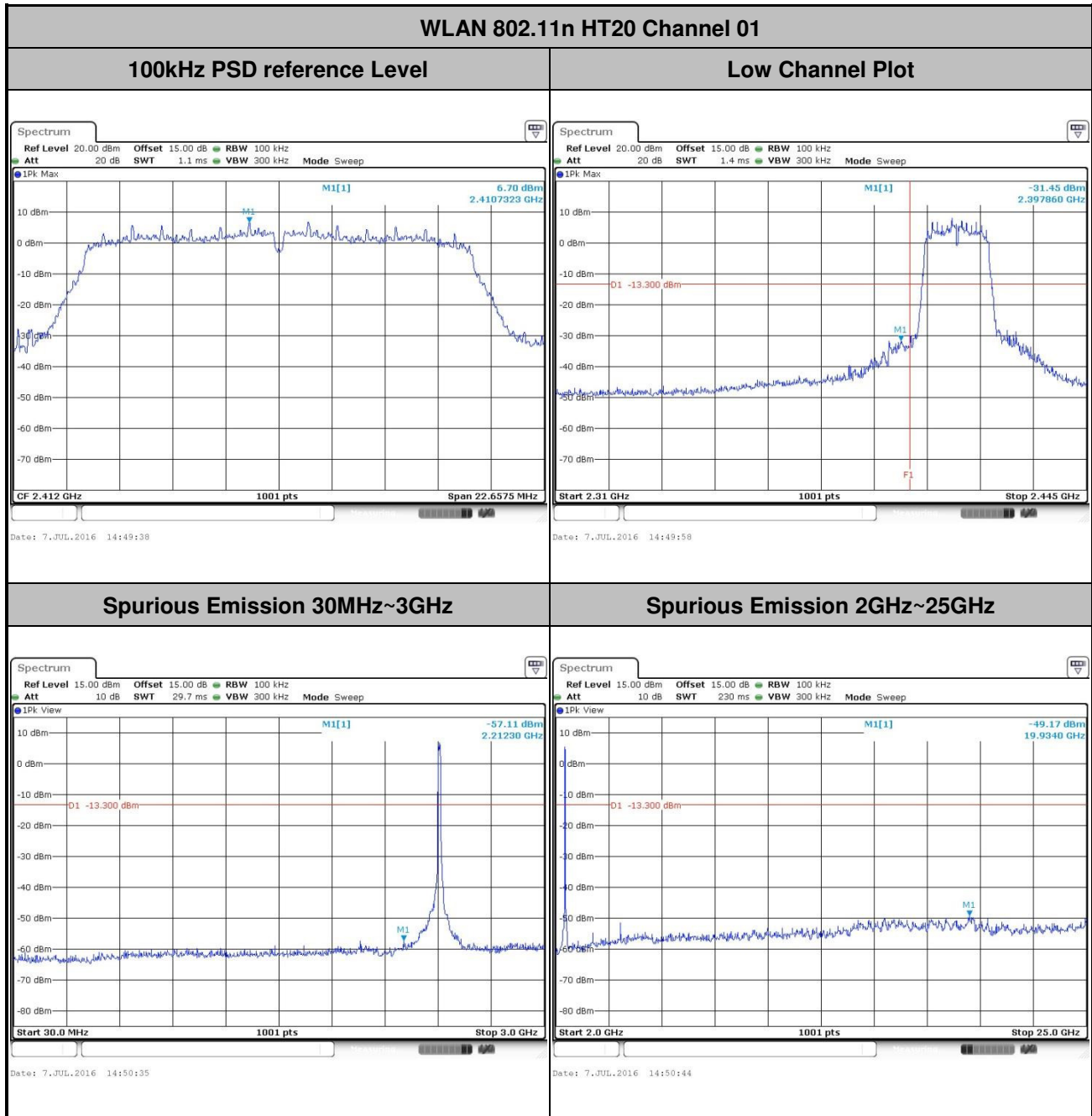


Spurious Emission 2GHz~25GHz





Test Mode :	802.11n HT20	Temperature :	24~26°C
Test Band :	2.4GHz Low	Relative Humidity :	50~53%
Test Channel :	01	Test Engineer :	Sam Zheng

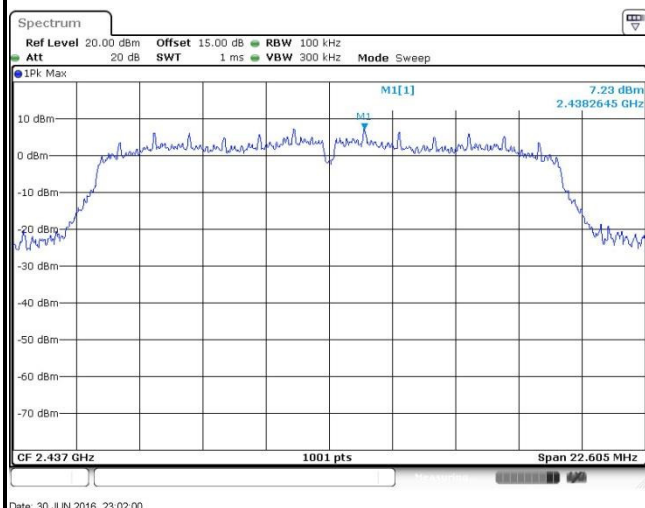




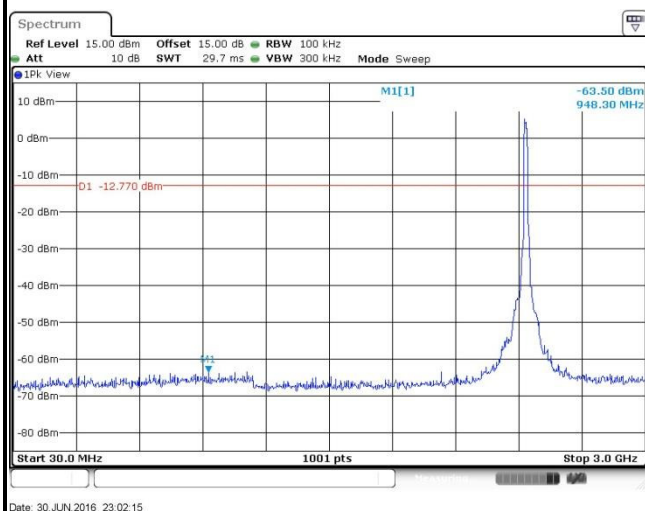
Test Mode :	802.11n HT20	Temperature :	24~26°C
Test Band :	2.4GHz Mid	Relative Humidity :	50~53%
Test Channel :	06	Test Engineer :	Sam Zheng

WLAN 802.11n HT20 Channel 06

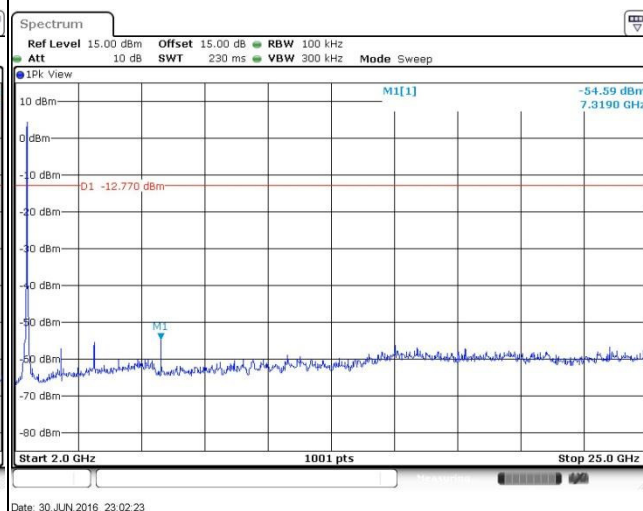
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz

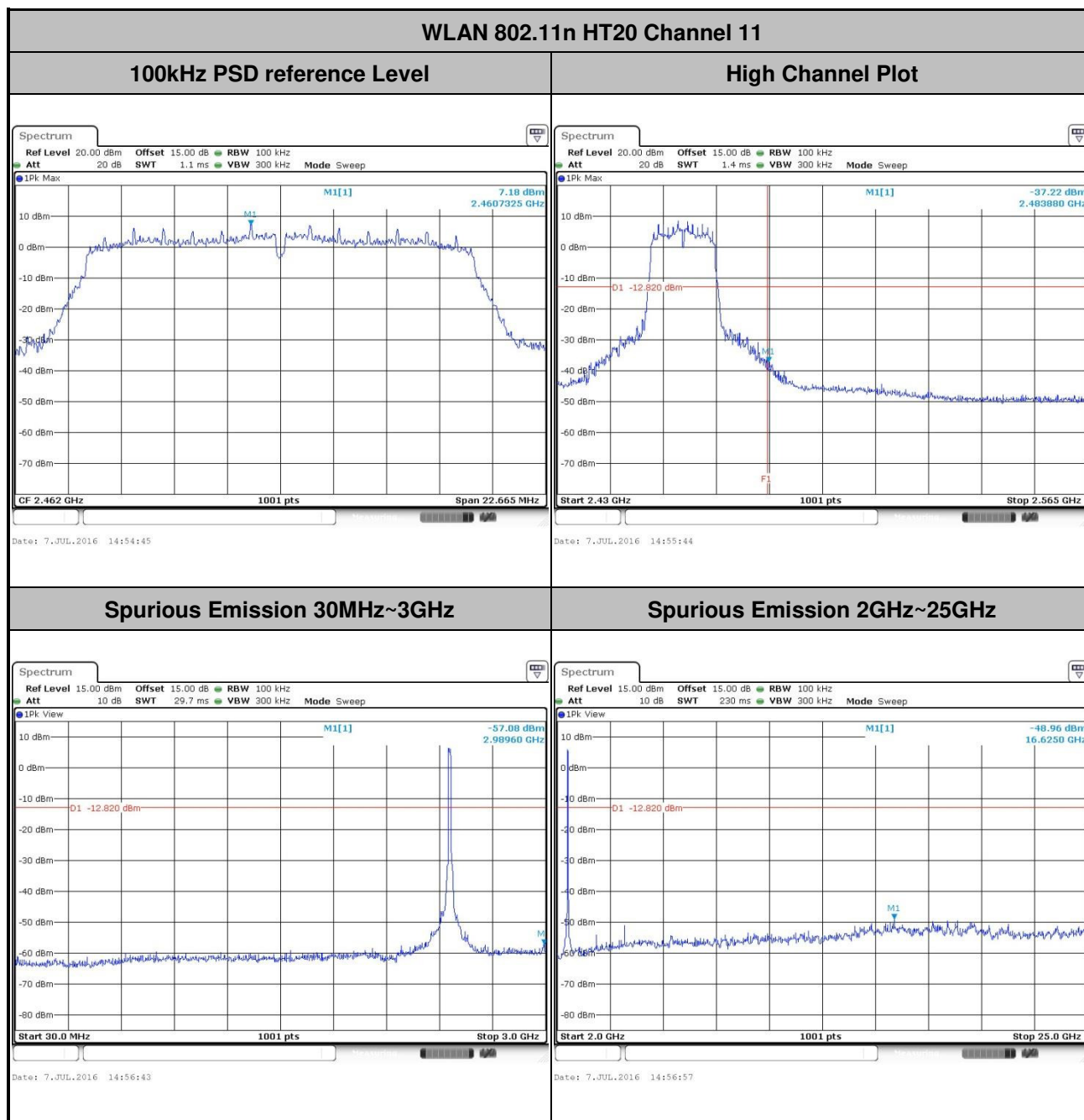


Spurious Emission 2GHz~25GHz





Test Mode :	802.11n HT20	Temperature :	24~26°C
Test Band :	2.4GHz High	Relative Humidity :	50~53%
Test Channel :	11	Test Engineer :	Sam Zheng



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 FCC section 15.209 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

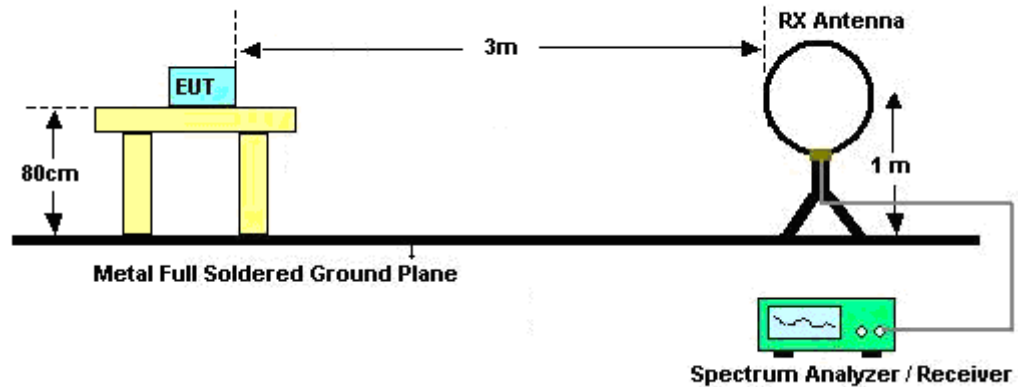
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the 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 $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement.

For average measurement:

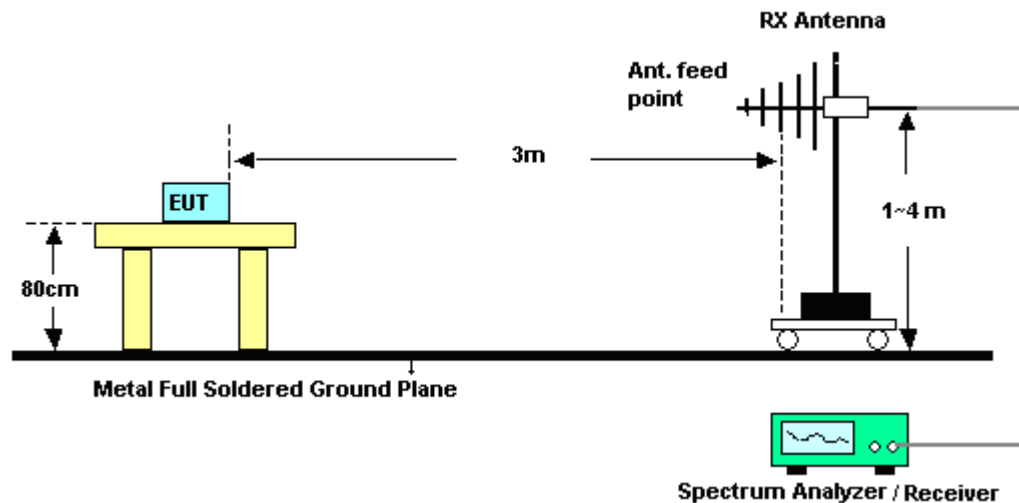
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

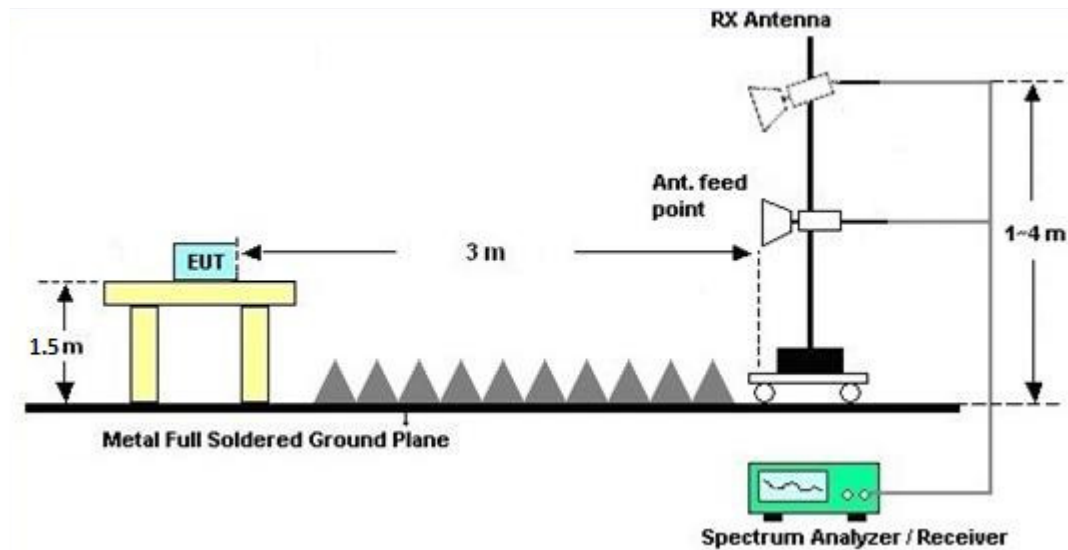
For radiated emissions below 30MHz



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 per 15.31(o) 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 Antenna Requirements

3.6.1 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 FCC rule.

3.6.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.6.3 Antenna Gain

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



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101078	9kHz~40GHz	May 07, 2016	Jun. 30, 2016~ Jul. 07, 2016	May 06, 2017	Conducted (TH01-SZ)
Spectrum Analyzer	R&S	FSP30	101400	9kHz~30GHz	Jan. 12, 2016	Jun. 30, 2016~ Jul. 07, 2016	Jan. 11, 2017	Conducted (TH01-SZ)
Pulse Power Sensor	Anritsu	MA2411B	1207253	30MHz~40GHz	Jan. 12, 2016	Jun. 30, 2016~ Jul. 07, 2016	Jan. 11, 2017	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Jan. 12, 2016	Jun. 30, 2016~ Jul. 07, 2016	Jan. 11, 2017	Conducted (TH01-SZ)
EMI Test Receiver&SA	KEYSIGHT	N9038A	MY544500 83	20Hz~8.4GHz	May 07, 2016	Jul. 06, 2016	May 06, 2017	Radiation (03CH03-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY551502 46	10Hz~44GHz;	May 07, 2016	Jul. 06, 2016	May 06, 2017	Radiation (03CH03-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	May 07, 2016	Jul. 06, 2016	May 06, 2017	Radiation (03CH03-SZ)
Bilog Antenna	TeseQ	CBL6112D	35408	30MHz~2GHz	May 21, 2016	Jul. 06, 2016	May 20, 2017	Radiation (03CH03-SZ)
Double Ridge Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-135 5	1GHz~18GHz	May 07, 2016	Jul. 06, 2016	May 06, 2017	Radiation (03CH03-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18GHz~40GHz	Aug. 19, 2015	Jul. 06, 2016	Aug. 18, 2016	Radiation (03CH03-SZ)
Amplifier	PREAMPLIFIER	BPA-530	102210	0.01Hz ~3000MHz	Oct. 20, 2015	Jul. 06, 2016	Oct. 19, 2016	Radiation (03CH03-SZ)
Amplifier	Agilent Technologies	83017A	MY395013 02	500MHz~26.5G Hz	Jan. 12, 2016	Jul. 06, 2016	Jan. 11, 2017	Radiation (03CH03-SZ)
AC Power Source	Chroma	61601	616010001 985	N/A	NCR	Jul. 06, 2016	NCR	Radiation (03CH03-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Jul. 06, 2016	NCR	Radiation (03CH03-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Jul. 06, 2016	NCR	Radiation (03CH03-SZ)

NCR: No Calibration Required



5 Uncertainty of Evaluation

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

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

Uncertainty of Radiated Emission Measurement (1GHz ~ 18GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.8 dB
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Uncertainty of Radiated Emission Measurement (18GHz ~ 40GHz)

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



Appendix A. Conducted Test Results

A1 - DTS Part

Test Engineer:	Sam Zheng	Temperature:	24~26	°C
Test Date:	2016/06/30~2016/07/07	Relative Humidity:	50~53	%

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
11b	1Mbps	1	1	2412	12.19	8.01	0.50	Pass
11b	1Mbps	1	6	2437	12.19	8.01	0.50	Pass
11b	1Mbps	1	11	2462	12.19	8.01	0.50	Pass
11g	6Mbps	1	1	2412	17.23	15.11	0.50	Pass
11g	6Mbps	1	6	2437	17.83	15.07	0.50	Pass
11g	6Mbps	1	11	2462	17.28	15.11	0.50	Pass
HT20	MCS0	1	1	2412	17.28	15.11	0.50	Pass
HT20	MCS0	1	6	2437	17.78	15.07	0.50	Pass
HT20	MCS0	1	11	2462	17.18	15.11	0.50	Pass

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	18.73	30.00	2.80	21.53	36.00	Pass
11b	1Mbps	1	6	2437	18.78	30.00	2.80	21.58	36.00	Pass
11b	1Mbps	1	11	2462	18.85	30.00	2.80	21.65	36.00	Pass
11g	6Mbps	1	1	2412	24.46	30.00	2.80	27.26	36.00	Pass
11g	6Mbps	1	6	2437	24.53	30.00	2.80	27.33	36.00	Pass
11g	6Mbps	1	11	2462	24.23	30.00	2.80	27.03	36.00	Pass
HT20	MCS0	1	1	2412	24.16	30.00	2.80	26.96	36.00	Pass
HT20	MCS0	1	6	2437	24.32	30.00	2.80	27.12	36.00	Pass
HT20	MCS0	1	11	2462	24.23	30.00	2.80	27.03	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

2.4GHz Band						
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
11b	1Mbps	1	1	2412	0.29	15.83
11b	1Mbps	1	6	2437	0.29	15.89
11b	1Mbps	1	11	2462	0.29	15.92
11g	6Mbps	1	1	2412	0.29	15.01
11g	6Mbps	1	6	2437	0.29	17.09
11g	6Mbps	1	11	2462	0.29	15.17
HT20	MCS0	1	1	2412	0.30	14.31
HT20	MCS0	1	6	2437	0.30	17.11
HT20	MCS0	1	11	2462	0.30	14.96

TEST RESULTS DATA
Peak Power Density

2.4GHz Band								
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
11b	1Mbps	1	1	2412	-5.21	2.80	8.00	Pass
11b	1Mbps	1	6	2437	-5.92	2.80	8.00	Pass
11b	1Mbps	1	11	2462	-6.57	2.80	8.00	Pass
11g	6Mbps	1	1	2412	-5.79	2.80	8.00	Pass
11g	6Mbps	1	6	2437	-5.87	2.80	8.00	Pass
11g	6Mbps	1	11	2462	-5.84	2.80	8.00	Pass
HT20	MCS0	1	1	2412	-6.72	2.80	8.00	Pass
HT20	MCS0	1	6	2437	-7.16	2.80	8.00	Pass
HT20	MCS0	1	11	2462	-5.85	2.80	8.00	Pass



Appendix B. Radiated Spurious Emission

15C 2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preampl	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		2385.915	54.23	-19.77	74	45.9	32.6	5.07	29.34	226	105	P	H
		2386.23	47.87	-6.13	54	39.54	32.6	5.07	29.34	226	105	A	H
	*	2412	105.32	-	-	96.97	32.61	5.12	29.38	226	105	P	H
	*	2412	103.73	-	-	95.38	32.61	5.12	29.38	226	105	A	H
		2386.545	50.8	-23.2	74	42.47	32.6	5.07	29.34	246	258	P	V
		2386.335	43.44	-10.56	54	35.11	32.6	5.07	29.34	246	258	A	V
	*	2412	102.63	-	-	94.28	32.61	5.12	29.38	246	258	P	V
	*	2412	101.01	-	-	92.66	32.61	5.12	29.38	246	258	A	V
802.11b CH 06 2437MHz		2386.86	47.45	-26.55	74	39.12	32.6	5.07	29.34	150	328	P	H
		2389.66	38.6	-15.4	54	30.27	32.6	5.07	29.34	150	328	A	H
	*	2436	103.77	-	-	95.37	32.63	5.12	29.35	150	328	P	H
	*	2436	102.04	-	-	93.64	32.63	5.12	29.35	150	328	A	H
		2495.45	48.45	-25.55	74	39.82	32.7	5.21	29.28	150	328	P	H
		2497.76	38.27	-15.73	54	29.64	32.7	5.21	29.28	150	328	A	H
		2384.62	47.74	-26.26	74	39.43	32.58	5.07	29.34	150	258	P	V
		2389.24	37.85	-16.15	54	29.52	32.6	5.07	29.34	150	258	A	V
	*	2436	101.6	-	-	93.2	32.63	5.12	29.35	150	258	P	V
	*	2436	99.84	-	-	91.44	32.63	5.12	29.35	150	258	A	V
		2493.98	48.16	-25.84	74	39.53	32.7	5.21	29.28	150	258	P	V
		2487.68	38.39	-15.61	54	29.84	32.7	5.16	29.31	150	258	A	V



802.11b CH 11 2462MHz	*	2462	104.28	-	-	95.78	32.67	5.16	29.33	150	105	P	H
	*	2462	102.92	-	-	94.42	32.67	5.16	29.33	150	105	A	H
		2488.04	53.04	-20.96	74	44.49	32.7	5.16	29.31	150	105	P	H
		2487.72	45.86	-8.14	54	37.31	32.7	5.16	29.31	150	105	A	H
	*	2462	101.2	-	-	92.7	32.67	5.16	29.33	215	235	P	V
	*	2462	99.65	-	-	91.15	32.67	5.16	29.33	215	235	A	V
		2488.76	49.61	-24.39	74	41.01	32.7	5.21	29.31	215	235	P	V
		2487.76	40.83	-13.17	54	32.28	32.7	5.16	29.31	215	235	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



15C 2.4GHz 2400~2483.5MHz
WIFI 802.11b (Harmonic @ 3m)

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		4824	54.32	-19.68	74	69.06	34.4	7.46	56.6	150	360	P	H
		4824	52.28	-1.72	54	67.02	34.4	7.46	56.6	150	360	A	H
		4824	48	-26	74	62.74	34.4	7.46	56.6	150	360	P	V
802.11b CH 06 2437MHz		4874	54.27	-19.73	74	69.26	34.43	7.49	56.91	150	360	P	H
		4874	52.16	-1.84	54	67.15	34.43	7.49	56.91	150	360	A	H
		7311	47.24	-26.76	74	59.32	36.22	9.7	58	174	100	P	H
		4874	48.81	-25.19	74	63.8	34.43	7.49	56.91	150	360	P	V
		7311	47.03	-26.97	74	59.11	36.22	9.7	58	174	100	P	V
802.11b CH 11 2462MHz		4924	55.11	-18.89	74	69.2	34.46	7.53	56.08	150	347	P	H
		4924	52.86	-1.14	54	66.95	34.46	7.53	56.08	150	347	A	H
		7386	46.16	-27.84	74	58.11	36.26	9.8	58.01	150	274	P	H
		4924	49.36	-24.64	74	63.45	34.46	7.53	56.08	150	347	P	V
		7386	46.84	-27.16	74	58.79	36.26	9.8	58.01	150	274	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



15C 2.4GHz 2400~2483.5MHz
WIFI 802.11g (Band Edge @ 3m)

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)
802.11g CH 01 2412MHz		2386.23	66.66	-7.34	74	58.33	32.6	5.07	29.34	214	72	P	H
		2389.91	53.12	-0.88	54	44.83	32.6	5.07	29.38	214	72	A	H
	*	2412	108.61	-	-	100.26	32.61	5.12	29.38	214	72	P	H
	*	2412	102.13	-	-	93.78	32.61	5.12	29.38	214	72	A	H
		2389.275	57.73	-16.27	74	49.4	32.6	5.07	29.34	196	229	P	V
		2390	44.06	-9.94	54	35.77	32.6	5.07	29.38	196	229	A	V
	*	2412	102.14	-	-	93.79	32.61	5.12	29.38	196	229	P	V
	*	2412	95.41	-	-	87.06	32.61	5.12	29.38	196	229	A	V
802.11g CH 06 2437MHz		2388.12	62.73	-11.27	74	54.4	32.6	5.07	29.34	243	64	P	H
		2389.94	51.93	-2.07	54	43.64	32.6	5.07	29.38	243	64	A	H
	*	2437	110.31	-	-	101.89	32.65	5.12	29.35	243	64	P	H
	*	2437	103.57	-	-	95.15	32.65	5.12	29.35	243	64	A	H
		2484.67	61.29	-12.71	74	52.76	32.68	5.16	29.31	243	64	P	H
		2484.11	48.6	-5.4	54	40.07	32.68	5.16	29.31	243	64	A	H
		2382.1	55.42	-18.58	74	47.11	32.58	5.07	29.34	248	22	P	V
		2389.94	45.68	-8.32	54	37.39	32.6	5.07	29.38	248	22	A	V
	*	2437	105	-	-	96.58	32.65	5.12	29.35	248	22	P	V
	*	2437	98.16	-	-	89.74	32.65	5.12	29.35	248	22	A	V
		2486.35	52.87	-21.13	74	44.34	32.68	5.16	29.31	248	22	P	V
		2484.95	44.03	-9.97	54	35.5	32.68	5.16	29.31	248	22	A	V



802.11g CH 11 2462MHz	*	2462	108.59	-	-	100.09	32.67	5.16	29.33	240	59	P	H
	*	2462	102.27	-	-	93.77	32.67	5.16	29.33	240	59	A	H
		2483.56	69.5	-4.5	74	60.97	32.68	5.16	29.31	240	59	P	H
		2483.88	53.14	-0.86	54	44.61	32.68	5.16	29.31	240	59	A	H
	*	2462	103.17	-	-	94.67	32.67	5.16	29.33	217	256	P	V
	*	2462	96.89	-	-	88.39	32.67	5.16	29.33	217	256	A	V
		2483.96	63.63	-10.37	74	55.1	32.68	5.16	29.31	217	256	P	V
		2483.52	48.72	-5.28	54	40.19	32.68	5.16	29.31	217	256	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



15C 2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

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)
802.11g		4824	47.89	-26.11	74	62.63	34.4	7.46	56.6	150	360	P	H
CH 01		4824	52.31	-21.69	74	67.05	34.4	7.46	56.6	150	360	P	V
2412MHz		4824	44.15	-9.85	54	58.89	34.4	7.46	56.6	150	360	A	V
802.11g		4874	48.72	-25.28	74	63.71	34.43	7.49	56.91	150	360	P	H
CH 06		7311	47.49	-26.51	74	59.57	36.22	9.7	58	174	100	P	H
2437MHz		4874	50.2	-23.8	74	65.19	34.43	7.49	56.91	150	360	P	V
		7311	49.76	-24.24	74	61.84	36.22	9.7	58	174	100	P	V
802.11g		4924	47.45	-26.55	74	61.54	34.46	7.53	56.08	150	347	P	H
CH 11		7386	46.17	-27.83	74	58.12	36.26	9.8	58.01	150	274	P	H
2462MHz		4924	50.99	-23.01	74	65.08	34.46	7.53	56.08	150	347	P	V
		7386	50.67	-23.33	74	62.62	36.26	9.8	58.01	150	274	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



15C 2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

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)
802.11n HT20 CH 01 2412MHz		2389.8	69.5	-4.5	74	61.21	32.6	5.07	29.38	154	112	P	H
		2389.695	53.59	-0.41	54	45.26	32.6	5.07	29.34	154	112	A	H
	*	2412	108.99	-	-	100.64	32.61	5.12	29.38	154	112	P	H
	*	2412	101.91	-	-	93.56	32.61	5.12	29.38	154	112	A	H
		2385.18	62.21	-11.79	74	53.9	32.58	5.07	29.34	154	112	P	V
		2386.965	44.75	-9.25	54	36.42	32.6	5.07	29.34	154	112	A	V
	*	2412	104.25	-	-	95.9	32.61	5.12	29.38	154	112	P	V
	*	2412	97.61	-	-	89.26	32.61	5.12	29.38	154	112	A	V
802.11n HT20 CH 06 2437MHz		2389.66	61.16	-12.84	74	52.83	32.6	5.07	29.34	244	59	P	H
		2389.94	50.15	-3.85	54	41.86	32.6	5.07	29.38	244	59	A	H
	*	2437	110.5	-	-	102.08	32.65	5.12	29.35	244	59	P	H
	*	2437	103.62	-	-	95.2	32.65	5.12	29.35	244	59	A	H
		2484.6	58.94	-15.06	74	50.41	32.68	5.16	29.31	244	59	P	H
		2483.55	48.13	-5.87	54	39.6	32.68	5.16	29.31	244	59	A	H
		2384.76	52.21	-21.79	74	43.9	32.58	5.07	29.34	223	258	P	V
		2386.44	42.81	-11.19	54	34.48	32.6	5.07	29.34	223	258	A	V
	*	2437	103.04	-	-	94.62	32.65	5.12	29.35	223	258	P	V
	*	2437	97.12	-	-	88.7	32.65	5.12	29.35	223	258	A	V
		2484.95	53.36	-20.64	74	44.83	32.68	5.16	29.31	223	258	P	V
		2483.62	43.71	-10.29	54	35.18	32.68	5.16	29.31	223	258	A	V



802.11n HT20 CH 11 2462MHz	*	2462	107.66	-	-	99.16	32.67	5.16	29.33	239	58	P	H
	*	2462	101.54	-	-	93.04	32.67	5.16	29.33	239	58	A	H
		2483.52	70.1	-3.9	74	61.57	32.68	5.16	29.31	239	58	P	H
		2483.8	53.15	-0.85	54	44.62	32.68	5.16	29.31	239	58	A	H
	*	2462	103.02	-	-	94.52	32.67	5.16	29.33	216	260	P	V
	*	2462	96.29	-	-	87.79	32.67	5.16	29.33	216	260	A	V
		2483.84	64.3	-9.7	74	55.77	32.68	5.16	29.31	216	260	P	V
		2484.16	47.14	-6.86	54	38.61	32.68	5.16	29.31	216	260	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



15C 2.4GHz 2400~2483.5MHz
WIFI 802.11n HT20 (Harmonic @ 3m)

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)
802.11n HT20 CH 01 2412MHz		4824	47.34	-26.66	74	62.08	34.4	7.46	56.6	150	360	P	H
		4824	52.19	-21.81	74	66.93	34.4	7.46	56.6	150	360	P	V
		4824	43.94	-10.06	54	58.68	34.4	7.46	56.6	150	360	A	V
802.11n HT20 CH 06 2437MHz		4874	47.62	-26.38	74	62.61	34.43	7.49	56.91	150	360	P	H
		7311	48.69	-25.31	74	60.77	36.22	9.7	58	174	100	P	H
		4874	49.05	-24.95	74	64.04	34.43	7.49	56.91	150	360	P	V
		7311	49.26	-24.74	74	61.34	36.22	9.7	58	174	100	P	V
802.11n HT20 CH 11 2462MHz		4924	48.31	-25.69	74	62.4	34.46	7.53	56.08	150	347	P	H
		7386	47.06	-26.94	74	59.01	36.26	9.8	58.01	150	274	P	H
		4924	50.49	-23.51	74	64.58	34.46	7.53	56.08	150	347	P	V
		7386	50.38	-23.62	74	62.33	36.26	9.8	58.01	150	274	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



15C Emission below 1GHz

2.4GHz WIFI 802.11n HT20 (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		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz 802.11n HT20 LF		30.97	28.83	-11.17	40	27.92	26.22	0.75	26.06	-	-	P	H
		101.78	22.07	-21.43	43.5	28.14	18.56	1.14	25.77	-	-	P	H
		300.63	23.18	-22.82	46	27.99	18.53	1.71	25.05	-	-	P	H
		454.86	29.5	-16.5	46	29.16	24.32	2.12	26.1	-	-	P	H
		676.99	31.38	-14.62	46	29.21	25.95	2.61	26.39	-	-	P	H
		897.18	35.05	-10.95	46	29.47	28.38	3.08	25.88	100	350	P	H
		30	29.43	-10.57	40	28.15	26.6	0.75	26.07	-	-	P	V
		49.4	26.19	-13.81	40	35.82	15.6	0.75	25.98	-	-	P	V
		104.69	22.12	-21.38	43.5	28.23	18.5	1.14	25.75	-	-	P	V
		438.37	29.79	-16.21	46	29.54	24.18	2.08	26.01	-	-	P	V
		722.58	32.35	-13.65	46	29.3	26.73	2.65	26.33	-	-	P	V
		905.91	35.58	-10.42	46	29.87	28.46	3.08	25.83	100	200	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 per 15.209(c).
!	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)

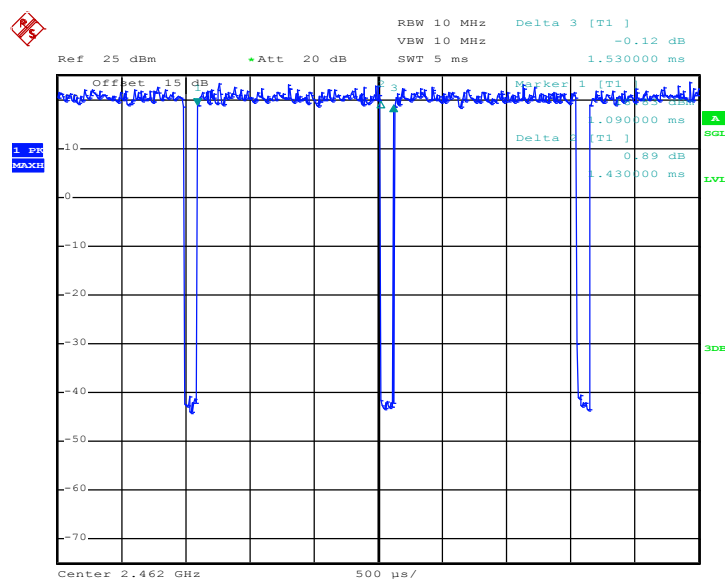
= -10.46(dB)

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

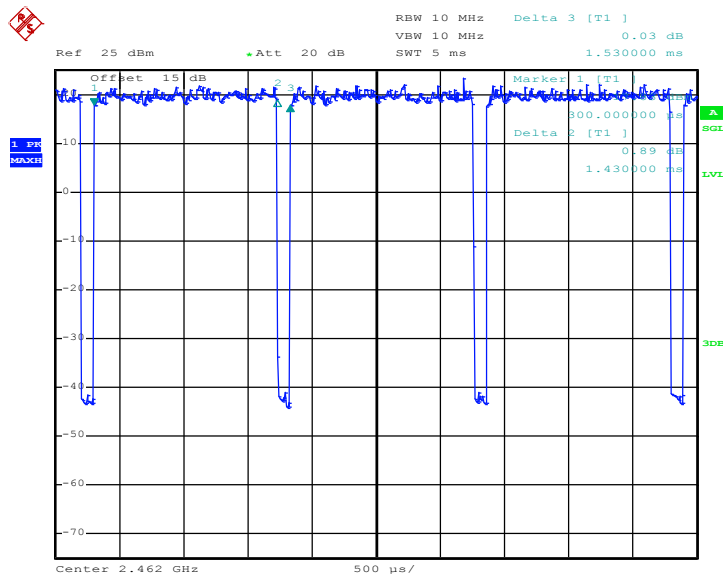
Appendix C. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
1	802.11b	93.46	1.43	0.699	1KHz
1	802.11g	93.46	1.43	0.699	1KHz
1	802.11n HT20	93.36	1.42	0.704	1KHz

802.11b



802.11g



802.11n20

