



FCC RF Test Report

APPLICANT : Hugreen Co Ltd
EQUIPMENT : Smart Agriculture Monitoring System
BRAND NAME : Rockabye
MODEL NAME : GWY-A09L
FCC ID : 2APLT-GWY-A09L
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System

The product was received on Mar. 29, 2018 and testing was completed on Apr. 24, 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.



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
FR832902A	Rev. 01	Initial issue of report	May 21, 2018

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	$\geq 0.5\text{MHz}$	Pass	-
3.1	-	99% Bandwidth	-	Pass	-
3.2	15.247(b)	Power Output Measurement	$\leq 30\text{dBm}$	Pass	-
3.3	15.247(e)	Power Spectral Density	$\leq 8\text{dBm}/3\text{kHz}$	Pass	-
3.4	15.247(d)	Conducted Band Edges	$\leq 20\text{dBc}$	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 3.03 dB at 2483.500 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 18.10 dB at 0.680 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Hugreen Co Ltd

12F., No.1-1, Sec. 5, Zhongxiao E. Rd., Xinyi Dist., Taipei City 110, Taiwan (R.O.C.)

1.2 Manufacturer

Hugreen Co Ltd

12F., No.1-1, Sec. 5, Zhongxiao E. Rd., Xinyi Dist., Taipei City 110, Taiwan (R.O.C.)

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Smart Agriculture Monitoring System
Brand Name	Rockabye
Model Name	GWY-A09L
FCC ID	2APLT-GWY-A09L
EUT supports Radios application	WLAN2.4GHz 802.11b/g/n HT20/HT40 LoRa
HW Version	V2.1
SW Version	V2.1
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

Standards-related Product Specification	
Tx/Rx Channel Frequency Range	2412 MHz ~ 2462 MHz
Maximum (Peak) Output Power to antenna	802.11b : 11.18 dBm (0.0131 W) 802.11g : 23.05 dBm (0.2018 W) 802.11n HT20 : 23.12 dBm (0.2051 W) 802.11n HT40 : 17.13 dBm (0.0516 W)
99% Occupied Bandwidth	802.11b : 12.04MHz 802.11g : 18.48MHz 802.11n HT20 : 18.78MHz 802.11n HT40 : 37.06MHz
Antenna Type / Gain	FPC Antenna with gain 3.00 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)

1.5 Modification of EUT

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

1.6 Testing Location

Sporton International (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.
	03CH04-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
- ♦ ANSI C63.10-2013

Remark:

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

2 Test Configuration of Equipment Under Test

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).
- b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

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



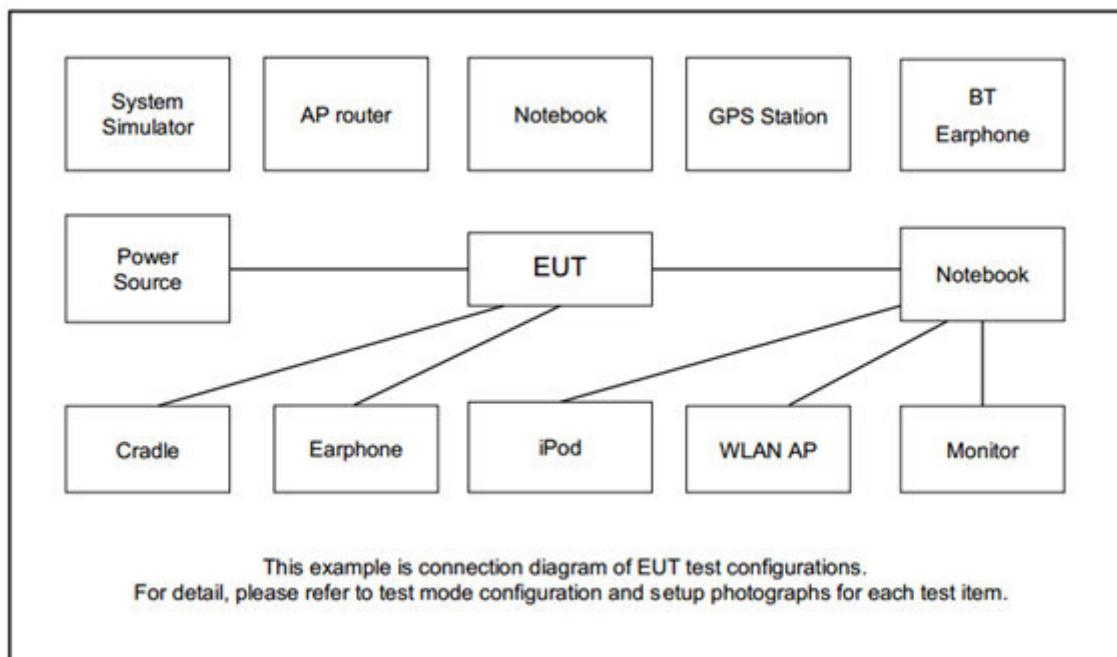
2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0

Test Cases	
AC Conducted Emission	Mode 1 :LoRa Tx(915MHz) + WLAN Link(2.4G) + USB Cable (Charging from Adapter)

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Mobile phone	Huawei	MATA9	QISEVA-L09	N/A	N/A

2.5 EUT Operation Test Setup

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

For AC power line conducted emissions, the EUT was set to connect with the Mobile phone 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 4.5 dB and 10dB attenuator.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 4.5 + 10 = 14.5 \text{ (dB)}\end{aligned}$$

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.

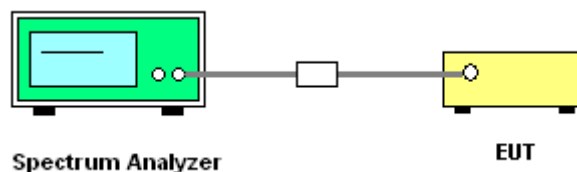
3.1.2 Measuring Instruments

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 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. 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.

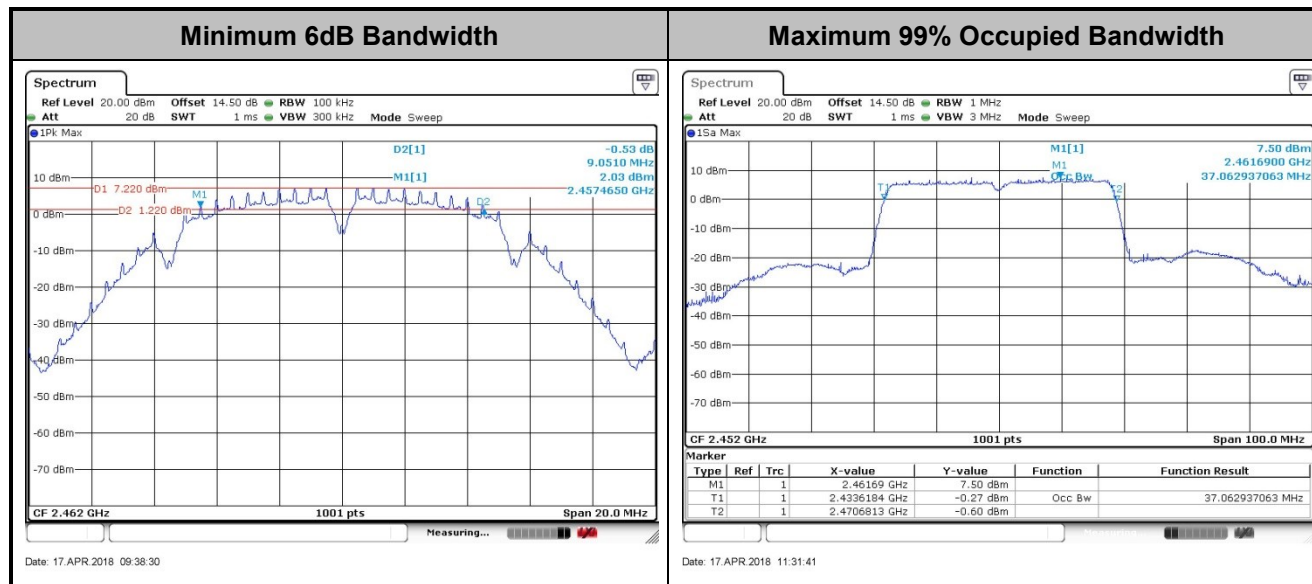
3.1.4 Test Setup





3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.



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

3.2 Output Power Measurement

3.2.1 Limit of Output Power

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

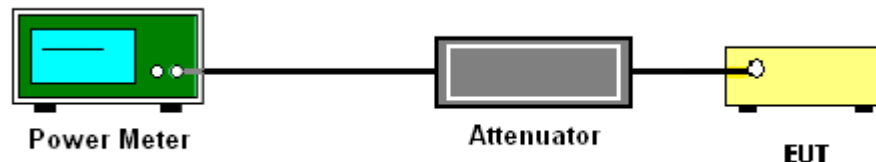
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

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

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.2.6 Test Result of Average output Power (Reporting Only)

Please refer to Appendix A.



3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

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

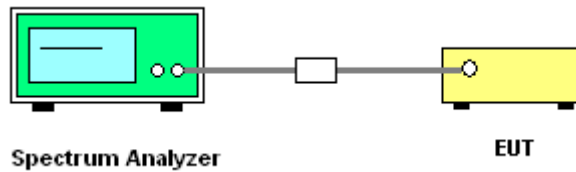
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

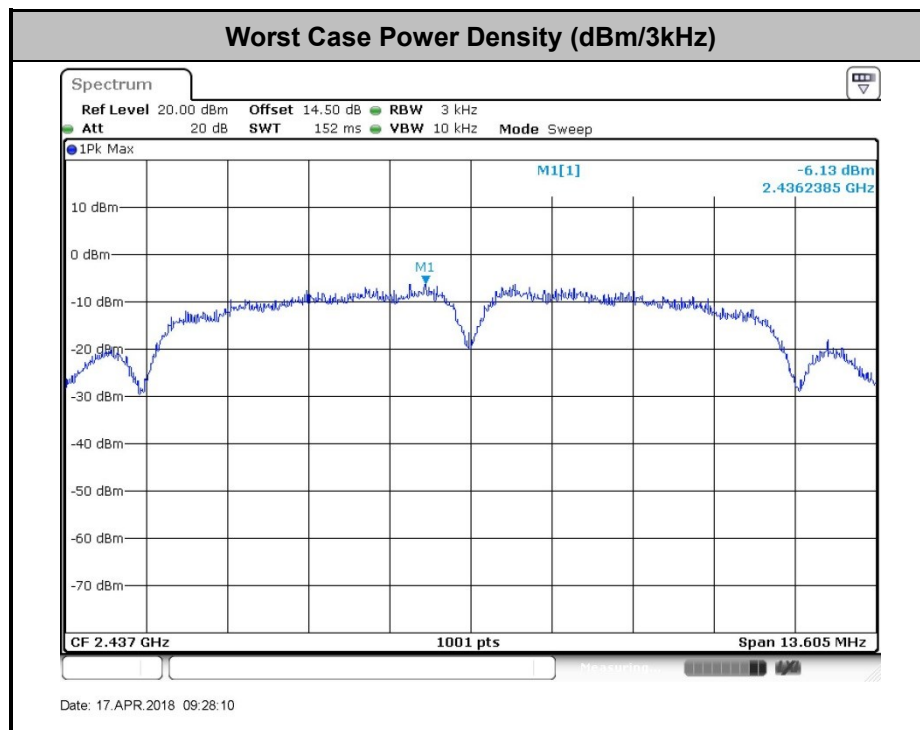
1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum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

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

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

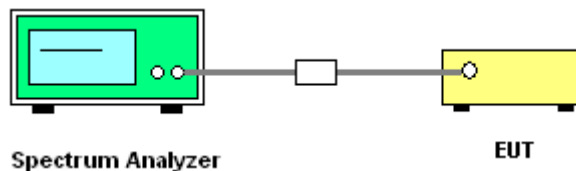
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

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

3.4.4 Test Setup

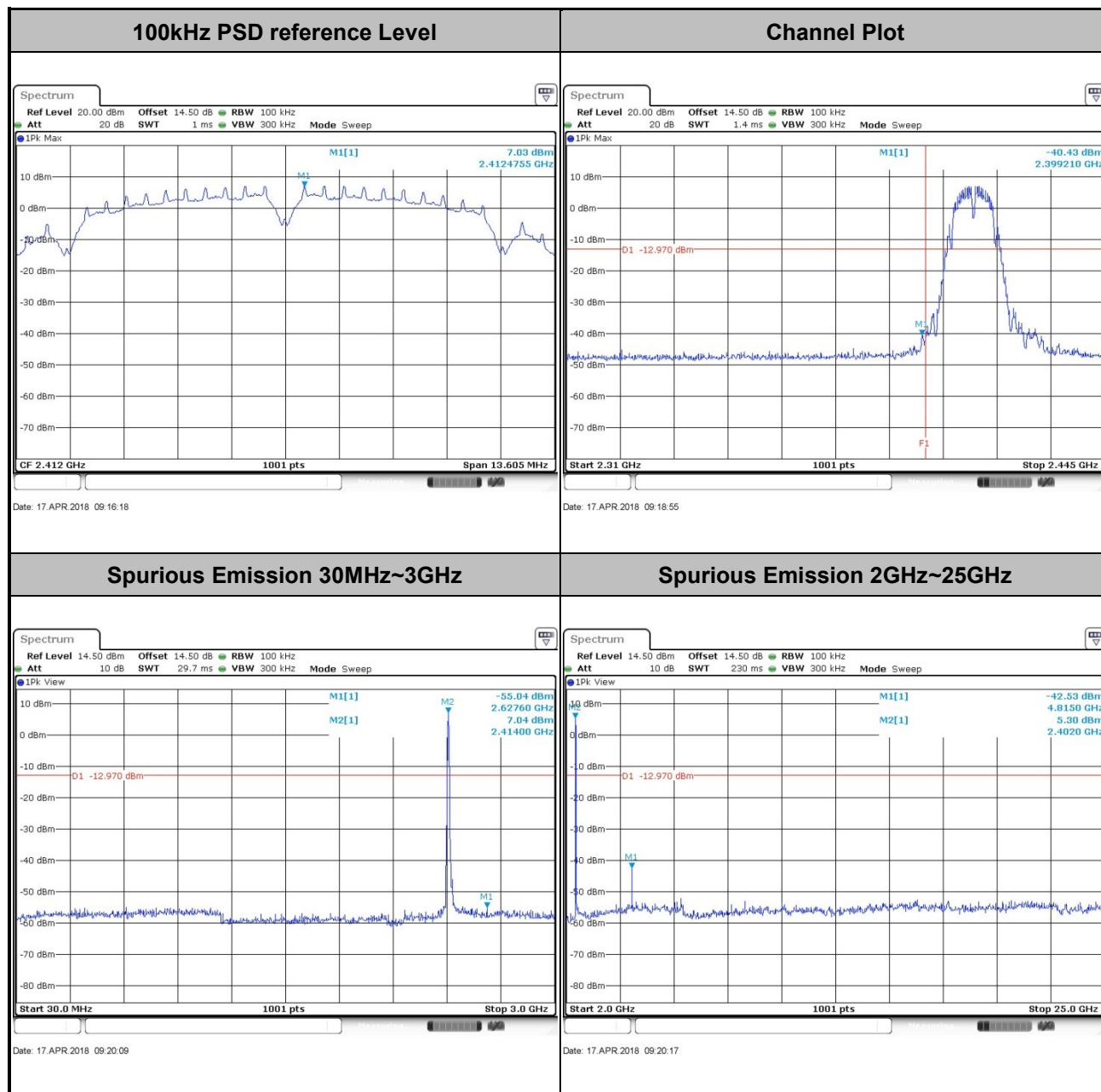




3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Engineer :	Sam Zheng	Temperature :	21~25°C
		Relative Humidity :	51~54%

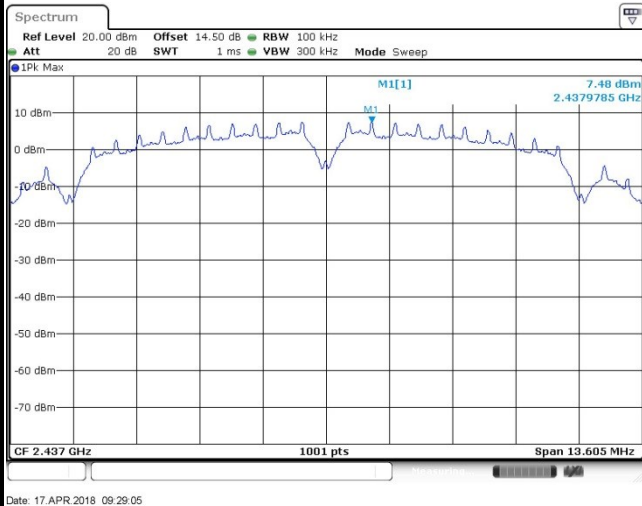
Test Mode :	802.11b	Test Channel :	01
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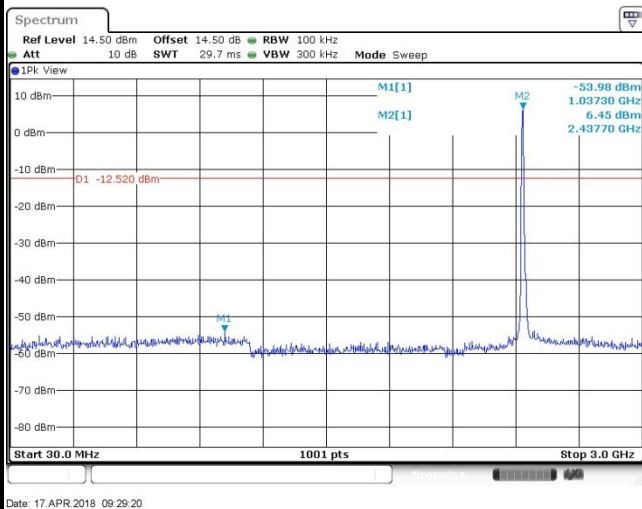


Test Mode :	802.11b	Test Channel :	06
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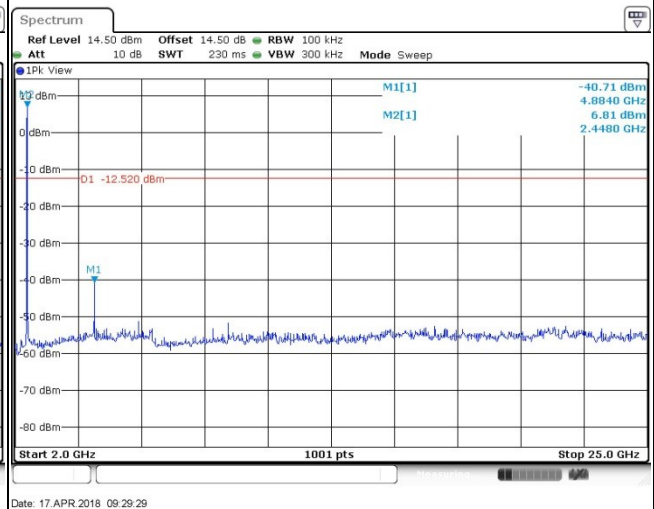
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz

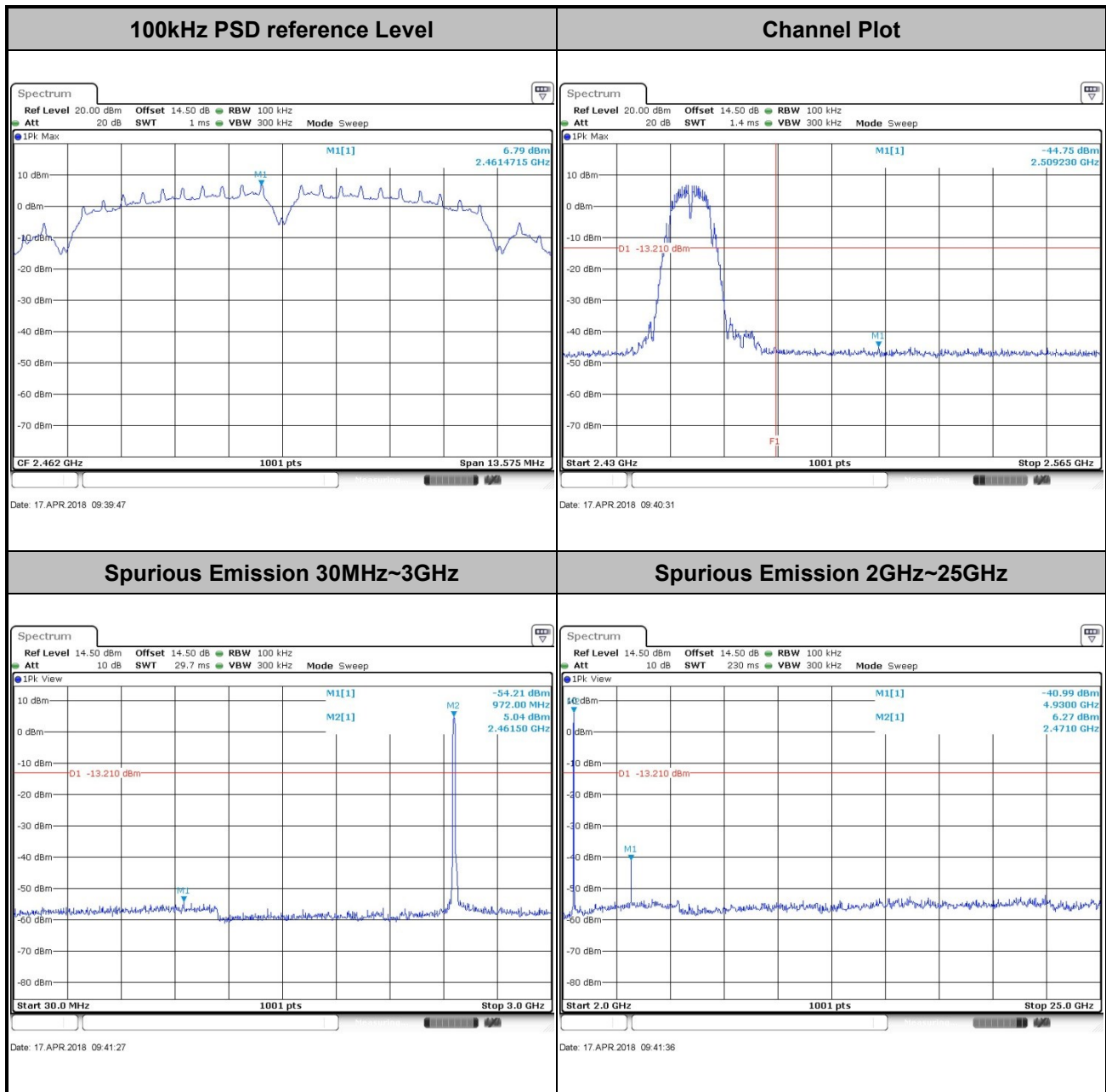


Spurious Emission 2GHz~25GHz





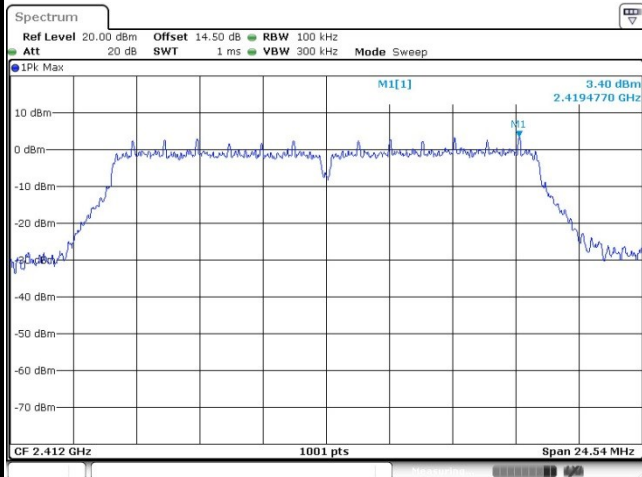
Test Mode :	802.11b	Test Channel :	11
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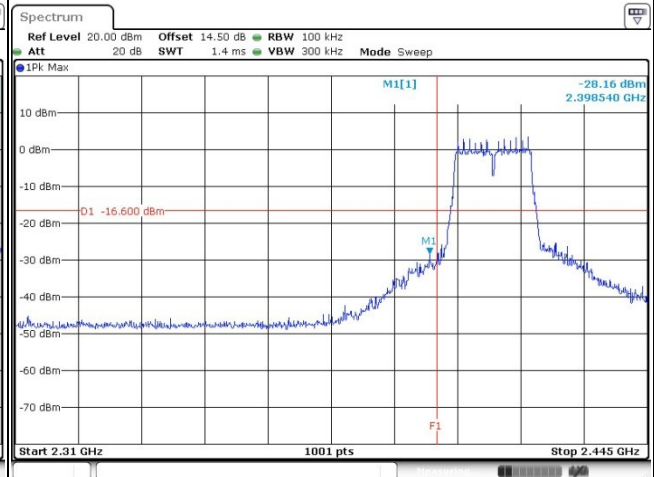


Test Mode :	802.11g	Test Channel :	01
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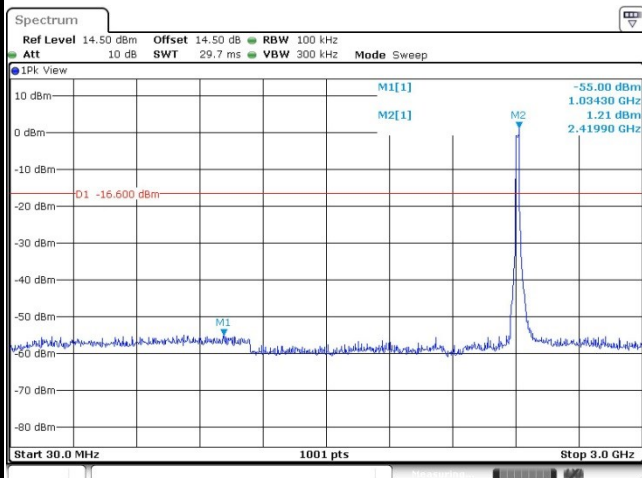
100kHz PSD reference Level



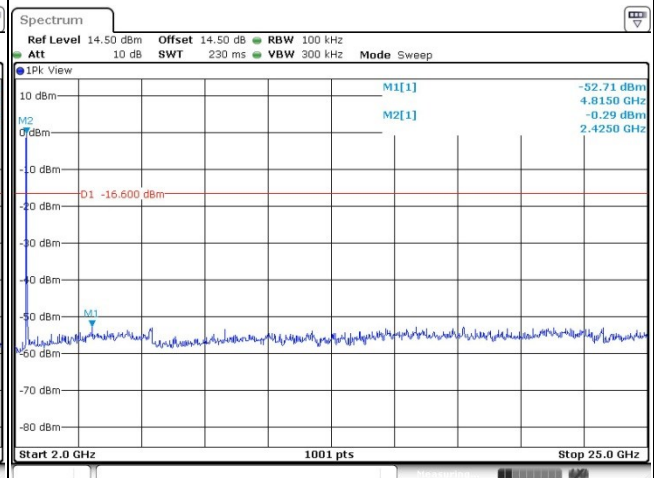
Channel Plot



Spurious Emission 30MHz~3GHz



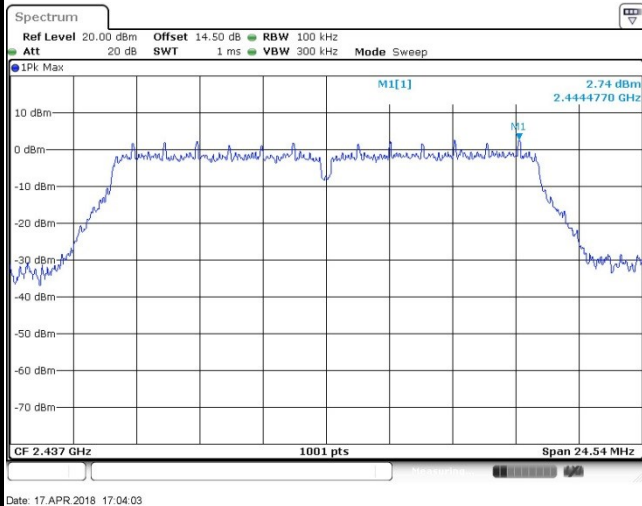
Spurious Emission 2GHz~25GHz



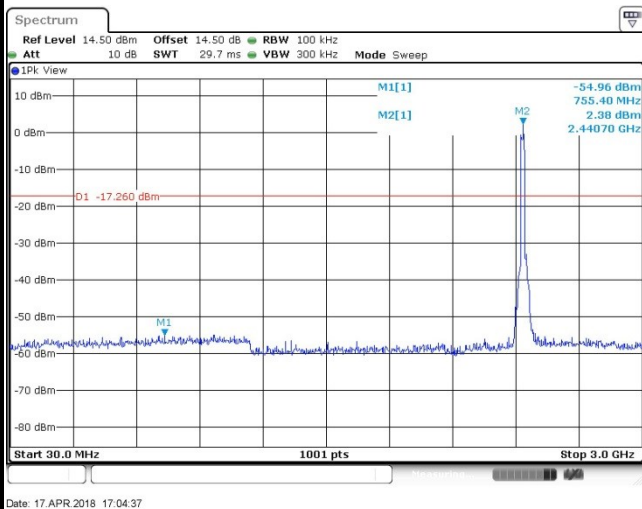


Test Mode :	802.11g	Test Channel :	06
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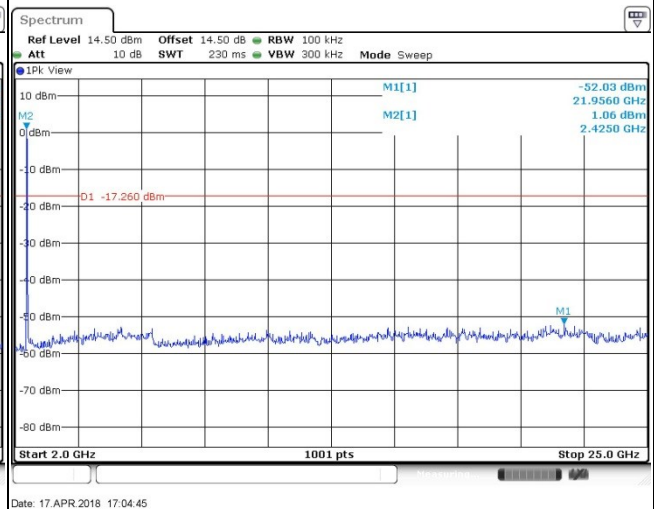
100kHz PSD reference Level

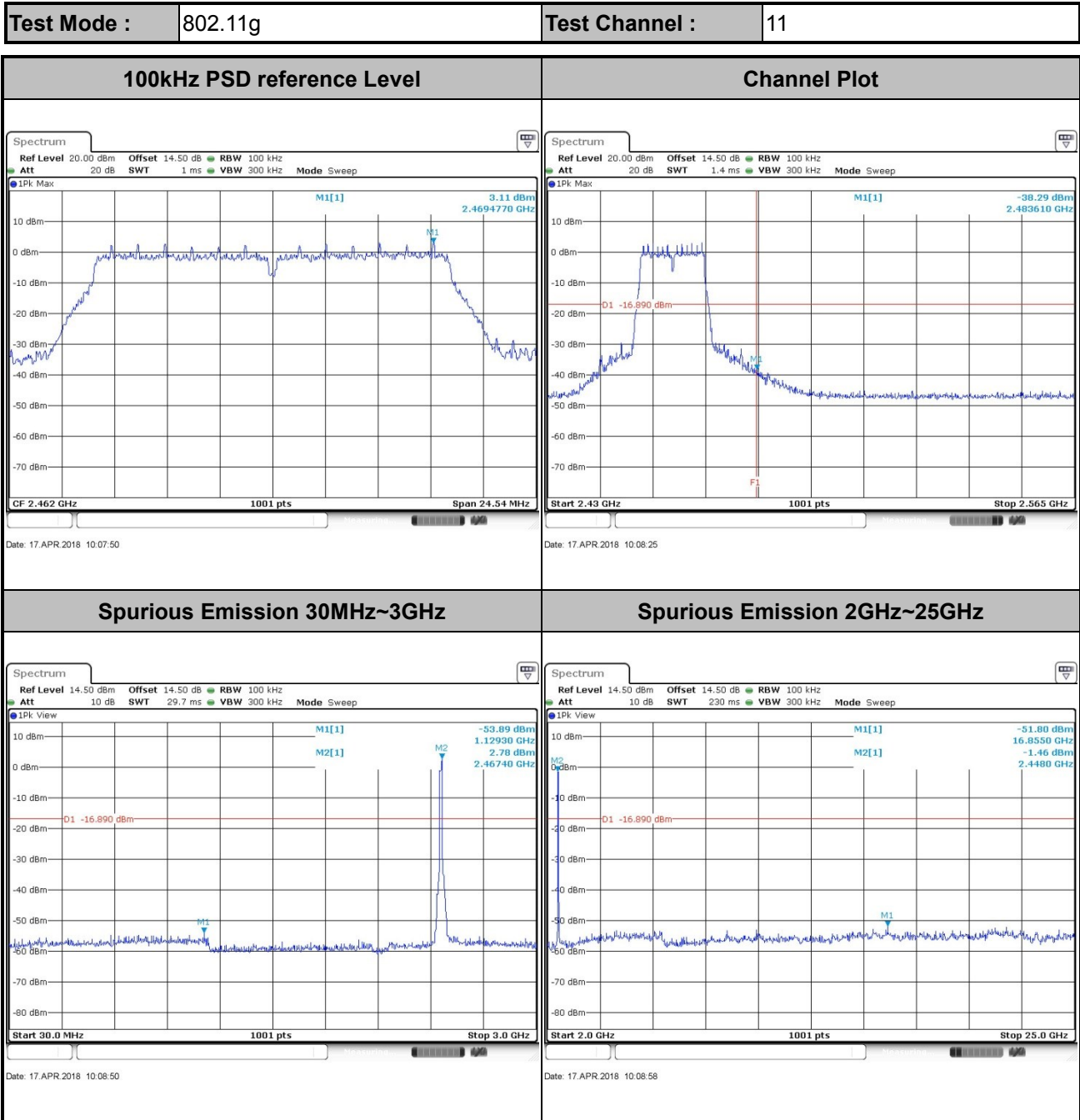


Spurious Emission 30MHz~3GHz



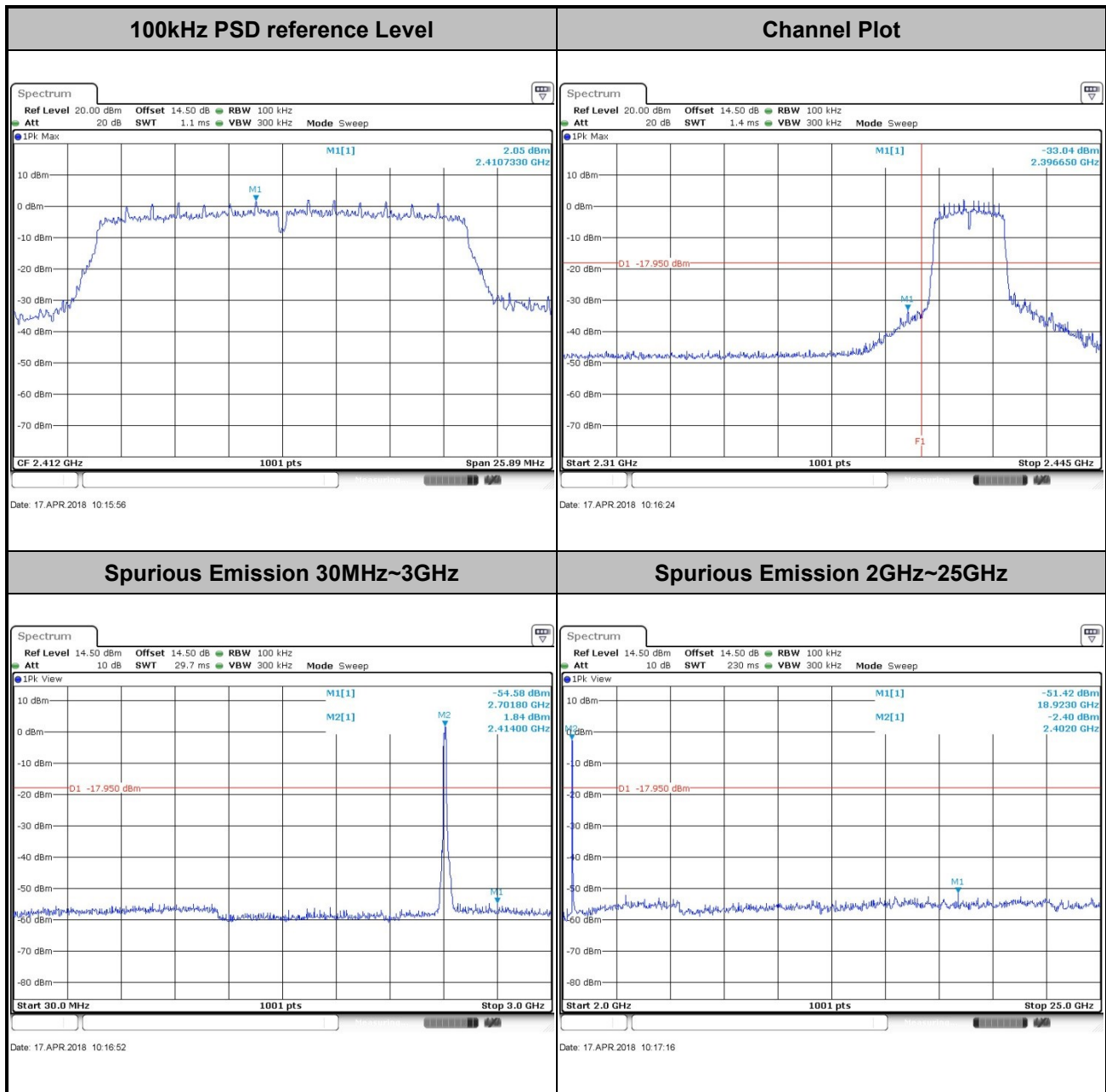
Spurious Emission 2GHz~25GHz





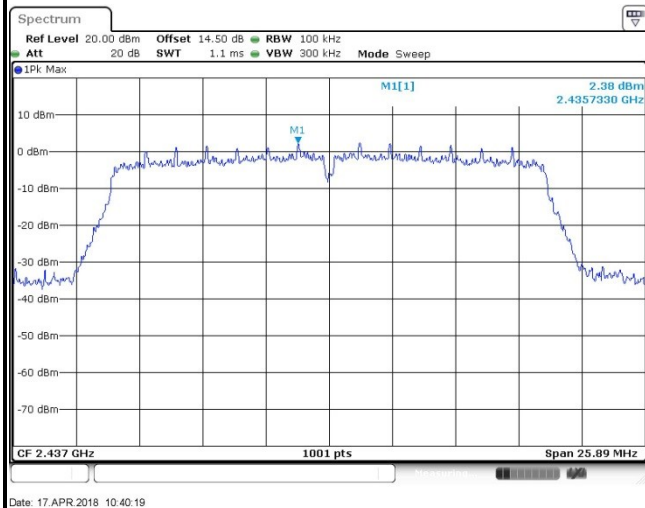


Test Mode :	802.11n HT20	Test Channel :	01
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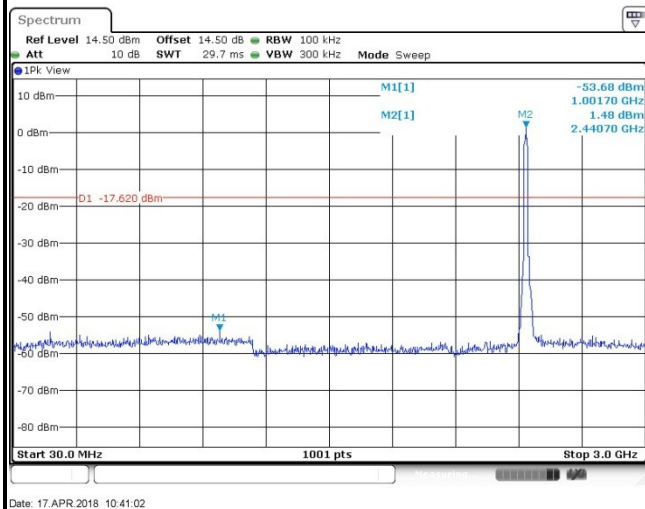


Test Mode :	802.11n HT20	Test Channel :	06
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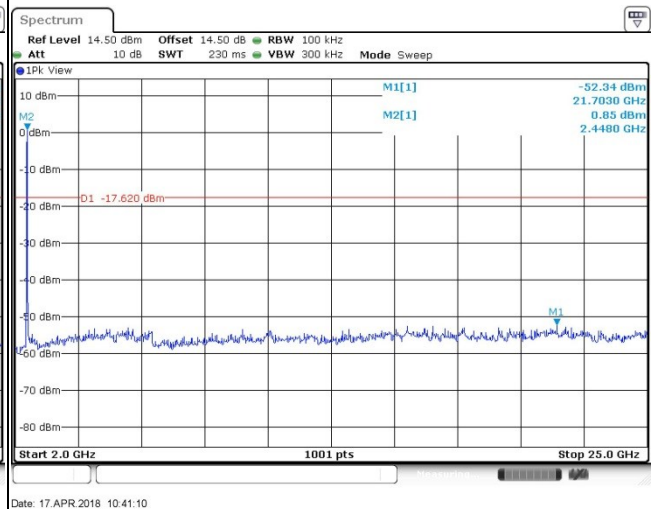
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz

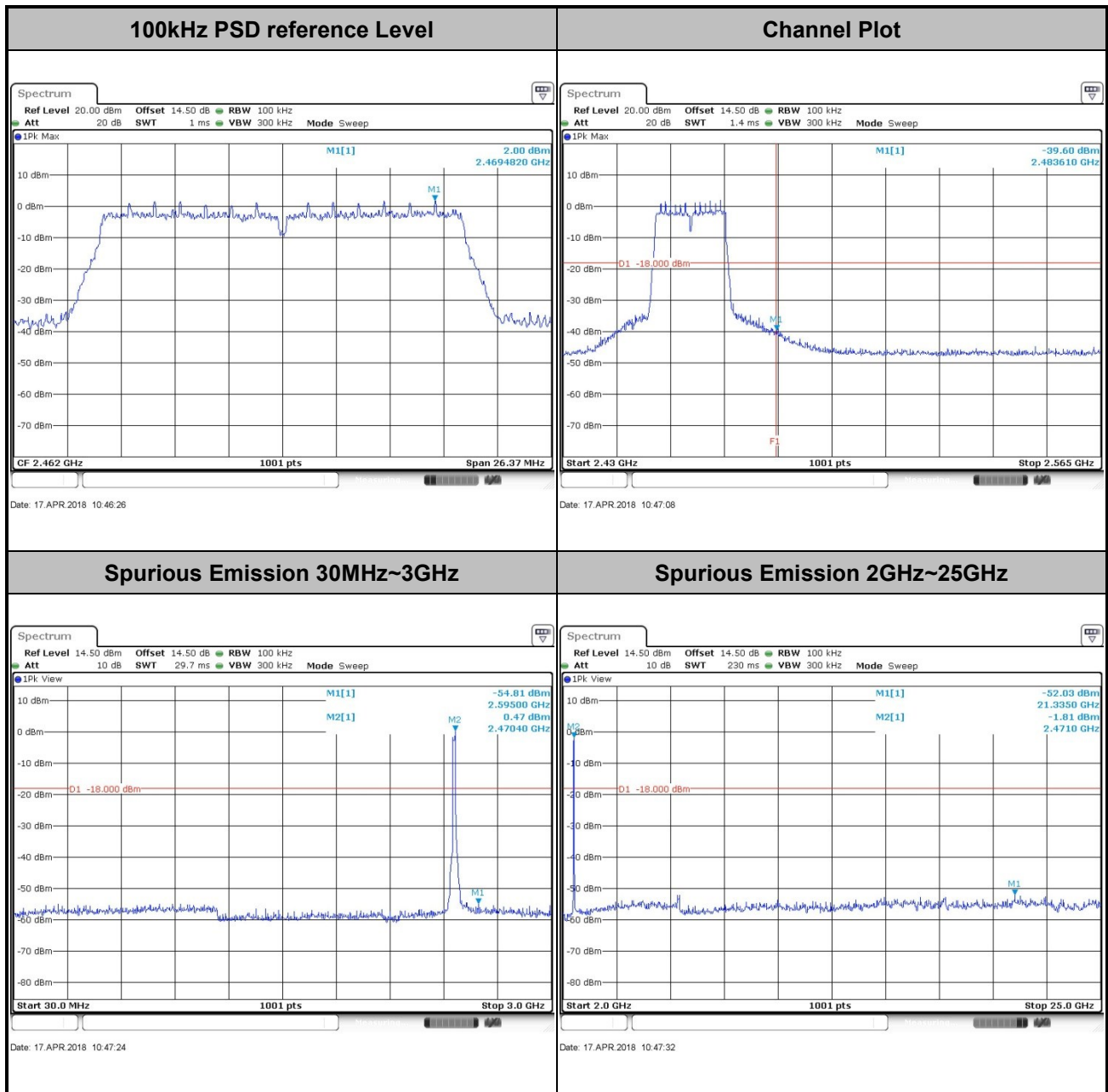


Spurious Emission 2GHz~25GHz





Test Mode :	802.11n HT20	Test Channel :	11
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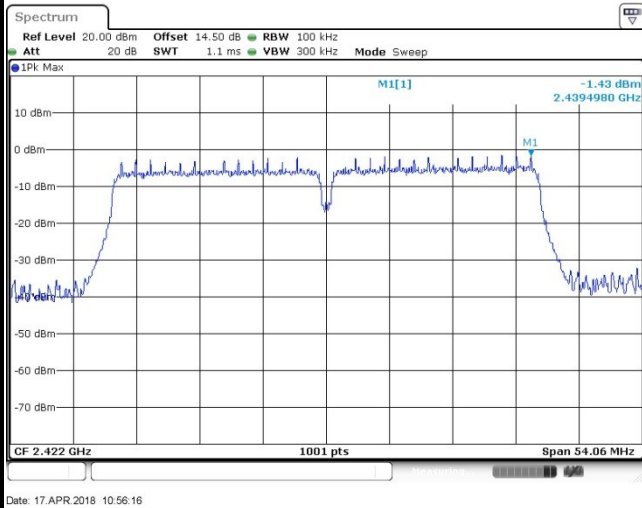




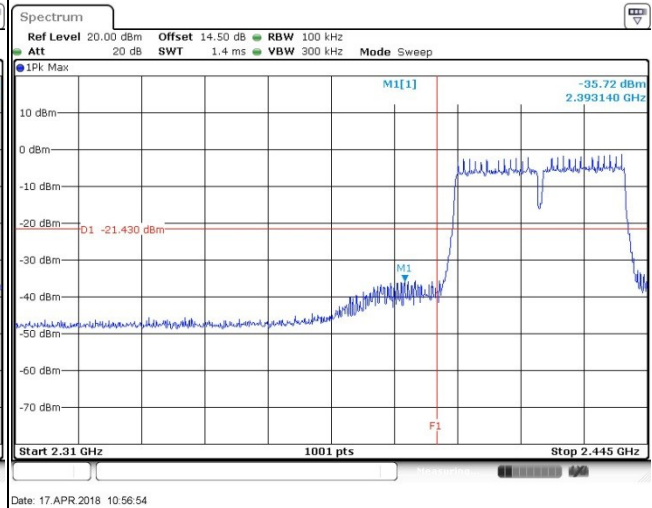
Test Mode : 802.11n HT40

Test Channel : 03

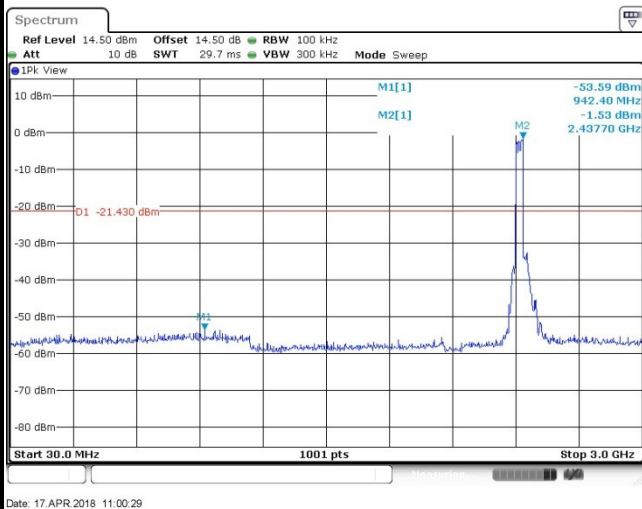
100kHz PSD reference Level



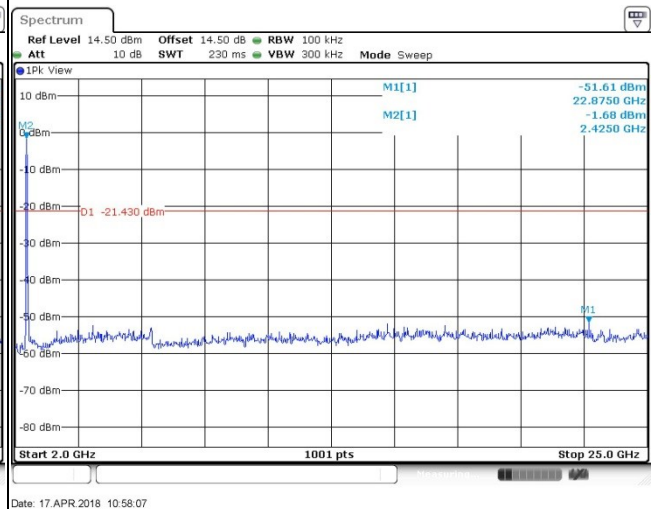
Channel Plot



Spurious Emission 30MHz~3GHz



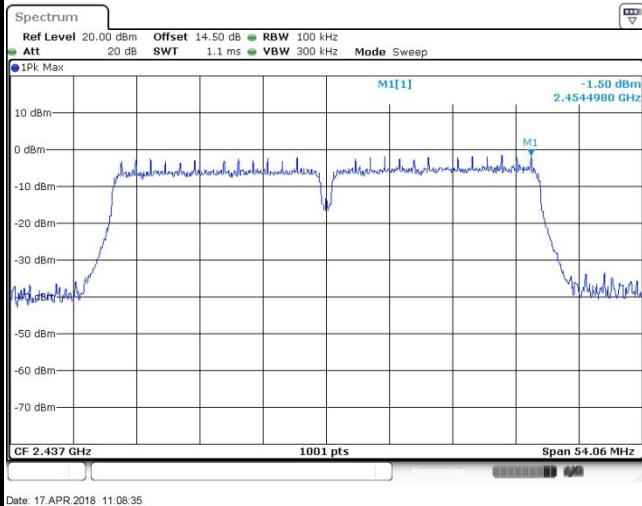
Spurious Emission 2GHz~25GHz



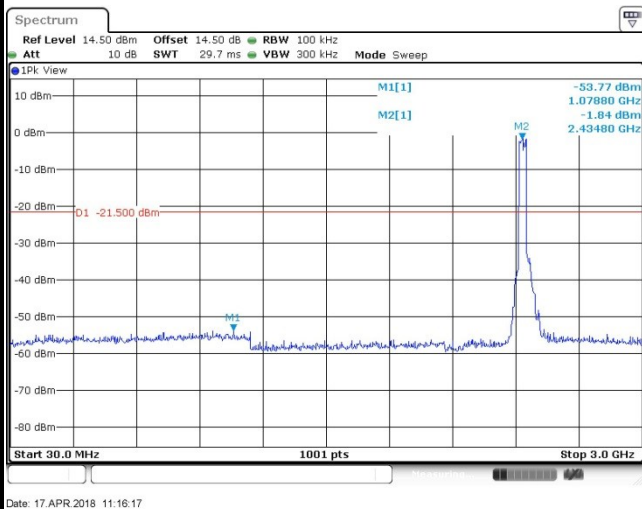


Test Mode :	802.11n HT40	Test Channel :	06
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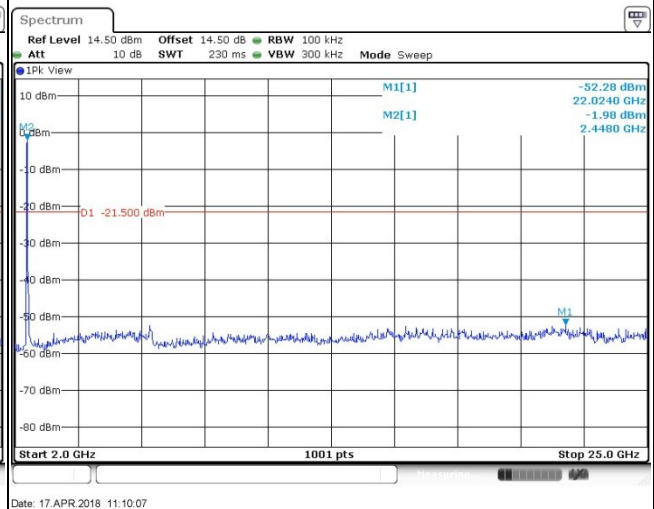
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



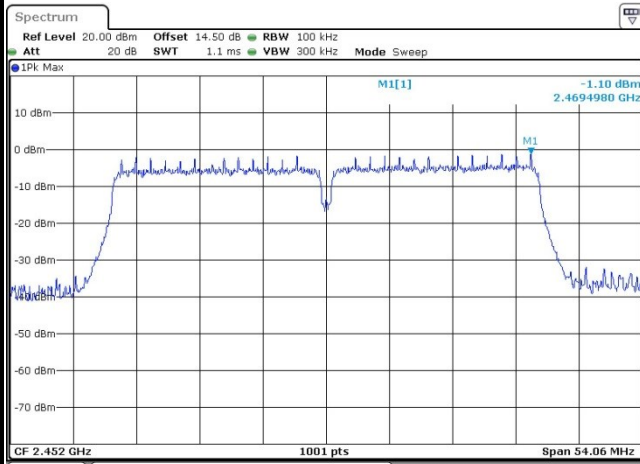
Spurious Emission 2GHz~25GHz



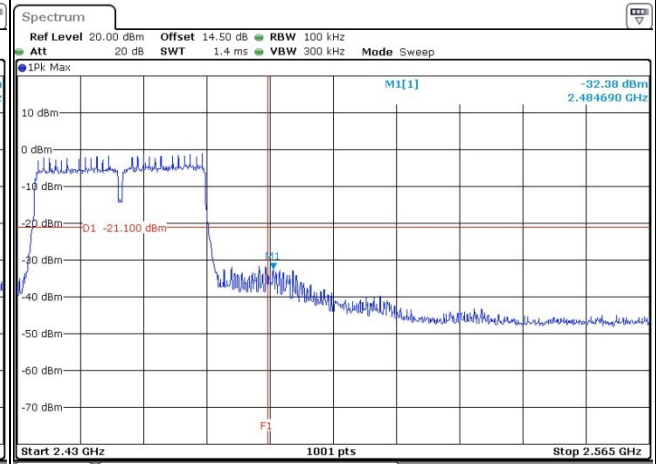


Test Mode :	802.11n HT40	Test Channel :	09
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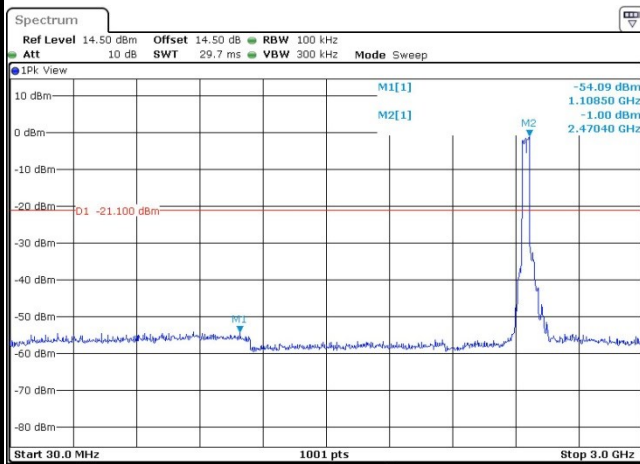
100kHz PSD reference Level



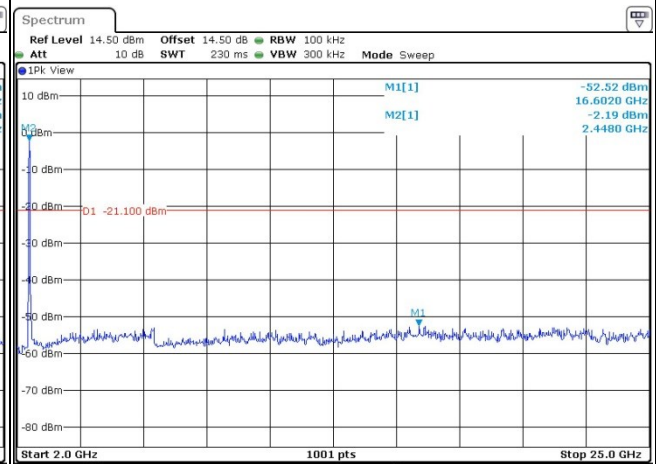
Channel Plot



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

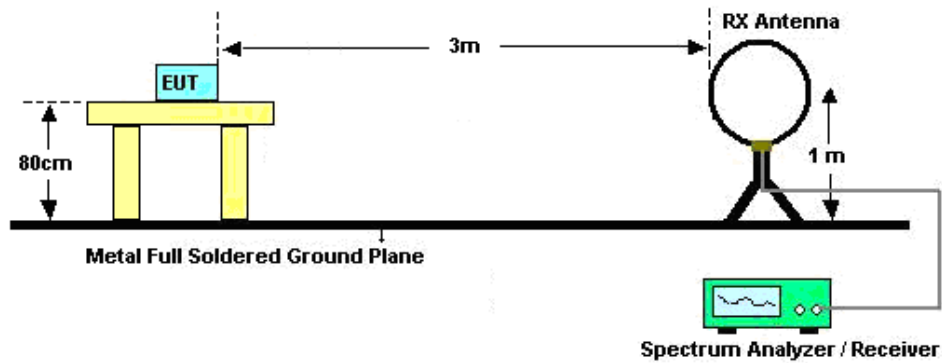
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test 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 testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz; VBW $\geq$ 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:

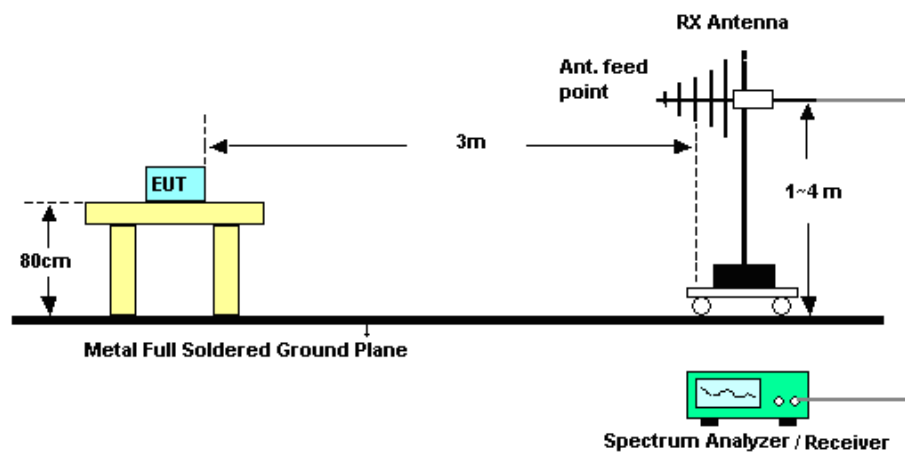
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

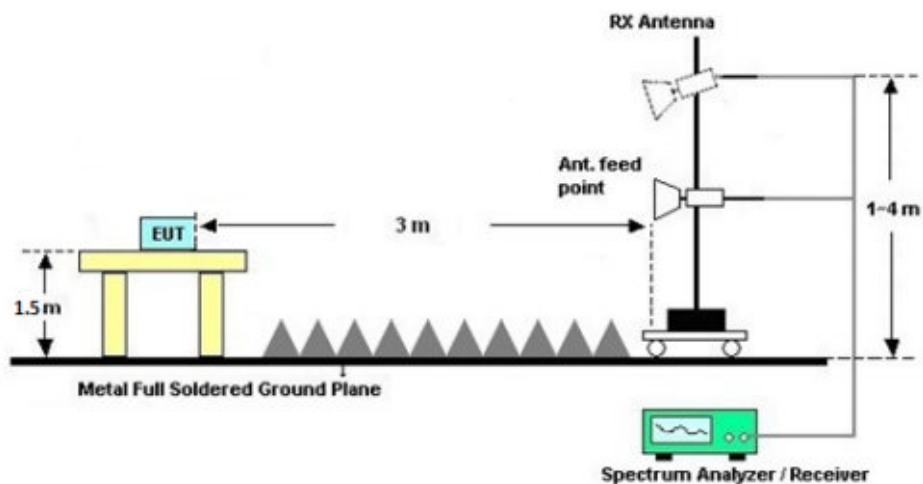
For radiated emissions below 30MHz



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 was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.5.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix C.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

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

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

*Decreases with the logarithm of the frequency.

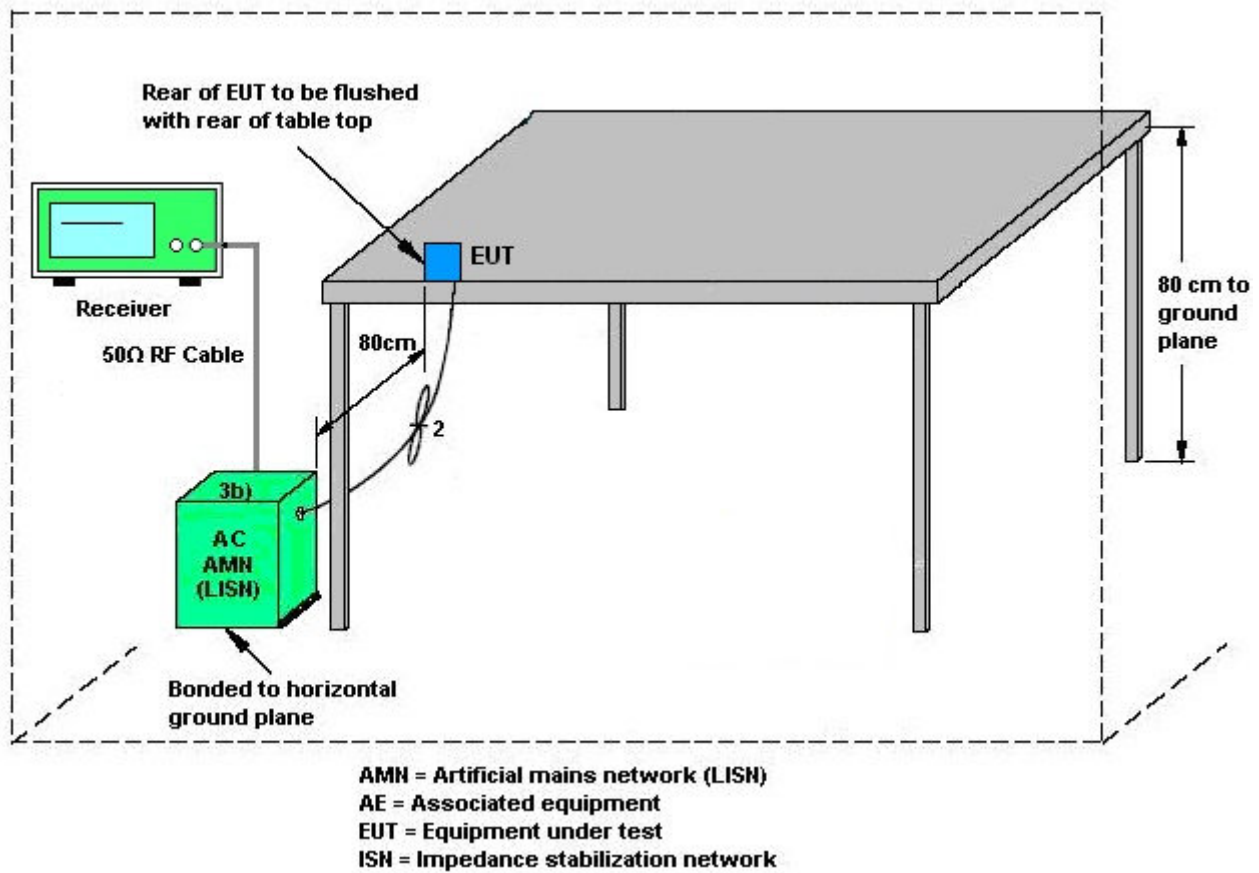
3.6.2 Measuring Instruments

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

3.6.3 Test Procedures

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

3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.7 Antenna Requirements

3.7.1 Standard Applicable

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

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

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



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101078	9kHz~40GHz	Apr. 20, 2017	Apr. 17, 2018	Apr. 19, 2018	Conducted (TH01-SZ)
Pulse Power Sensor	Anritsu	MA2411B	1207253	30MHz~40GHz	Dec. 26, 2017	Apr. 17, 2018	Dec. 25, 2018	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Dec. 26, 2017	Apr. 17, 2018	Dec. 25, 2018	Conducted (TH01-SZ)
EMI Test Receiver	R&S	ESR7	101404	9kHz~7GHz	Apr. 19, 2018	Apr. 23, 2018	Apr. 18, 2019	Radiation (03CH04-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150213	10Hz~44GHz	Apr. 19, 2018	Apr. 23, 2018	Apr. 18, 2019	Radiation (03CH04-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	May 14, 2017	Apr. 23, 2018	May 13, 2018	Radiation (03CH04-SZ)
Bilog Antenna	TeseQ	CBL6111D	41909	30MHz~1GHz	May 16, 2017	Apr. 23, 2018	May 15, 2018	Radiation (03CH04-SZ)
Double Ridge Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-1285	1GHz~18GHz	Dec. 13, 2017	Apr. 23, 2018	Dec. 12, 2018	Radiation (03CH04-SZ)
Horn Antenna	SCHWARZBECK	BBHA9170	9170#679	15GHz~40GHz	May 17, 2017	Apr. 23, 2018	May 16, 2018	Radiation (03CH04-SZ)
Amplifier	Burgeon	BPA-530	102211	0.01Hz~3000MHz	Oct. 19, 2017	Apr. 23, 2018	Oct. 18, 2018	Radiation (03CH04-SZ)
HF Amplifier	MITEQ	AMF-7D-00101800-30-10P-R	1989346	1GHz~18GHz	Jul. 27, 2017	Apr. 23, 2018	Jul. 26, 2018	Radiation (03CH04-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1988315	18GHz~40GHz	Jul. 27, 2017	Apr. 23, 2018	Jul. 26, 2018	Radiation (03CH04-SZ)
Amplifier	Agilent Technologies	83017A	MY53270156	500MHz~26.5GHz	Apr. 19, 2018	Apr. 23, 2018	Apr. 18, 2019	Radiation (03CH04-SZ)
AC Power Source	Chroma	61601	N/A	N/A	NCR	Apr. 23, 2018	NCR	Radiation (03CH04-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Apr. 23, 2018	NCR	Radiation (03CH04-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Apr. 23, 2018	NCR	Radiation (03CH04-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Dec. 26, 2017	Apr. 24, 2018	Dec. 25, 2018	Conduction (CO01-SZ)
AC LISN	EMCO	3816/2SH	00103912	9kHz~30MHz	Dec. 26, 2017	Apr. 24, 2018	Dec. 25, 2018	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	MessTec	3816/2SH	00103892	9kHz~30MHz	Nov. 01, 2017	Apr. 24, 2018	Oct. 31, 2018	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 19, 2017	Apr. 24, 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% ($U = 2U_c(y)$)	2.6 dB
--	--------

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	5.1 dB
--	--------

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	4.8 dB
--	--------

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	5.1 dB
--	--------



Appendix A. conducted test results

A1 - DTS Part

Test Engineer:	Sam Zheng	Temperature:	21~25	°C
Test Date:	2018/4/17	Relative Humidity:	51~54	%

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	12.04	9.07	0.50	Pass
11b	1Mbps	1	6	2437	12.04	9.07	0.50	Pass
11b	1Mbps	1	11	2462	11.94	9.05	0.50	Pass
11g	9Mbps	1	1	2412	18.48	16.36	0.50	Pass
11g	9Mbps	1	6	2437	18.13	16.36	0.50	Pass
11g	9Mbps	1	11	2462	18.18	16.36	0.50	Pass
HT20	MCS1	1	1	2412	18.78	17.26	0.50	Pass
HT20	MCS1	1	6	2437	18.53	17.26	0.50	Pass
HT20	MCS1	1	11	2462	18.78	17.58	0.50	Pass
HT40	MCS0	1	3	2422	36.96	36.04	0.50	Pass
HT40	MCS0	1	6	2437	36.86	36.04	0.50	Pass
HT40	MCS0	1	9	2452	37.06	36.04	0.50	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	0.20	6.67
11b	1Mbps	1	6	2437	0.20	6.85
11b	1Mbps	1	11	2462	0.20	7.77
11g	6Mbps	1	1	2412	1.13	11.87
11g	6Mbps	1	6	2437	1.13	14.55
11g	6Mbps	1	8	2447	1.13	13.08
11g	6Mbps	1	9	2452	1.13	8.36
11g	6Mbps	1	10	2457	1.13	7.80
11g	6Mbps	1	11	2462	1.13	7.35
HT20	MCS0	1	1	2412	1.20	8.00
HT20	MCS0	1	2	2417	1.20	12.40
HT20	MCS0	1	6	2437	1.20	13.85
HT20	MCS0	1	8	2447	1.20	13.35
HT20	MCS0	1	9	2452	1.20	8.62
HT20	MCS0	1	10	2457	1.20	7.80
HT20	MCS0	1	11	2462	1.20	6.25
HT40	MCS0	1	3	2422	2.14	5.67
HT40	MCS0	1	6	2437	2.14	6.51
HT40	MCS0	1	9	2452	2.14	4.38

TEST RESULTS DATA
Peak Power Table

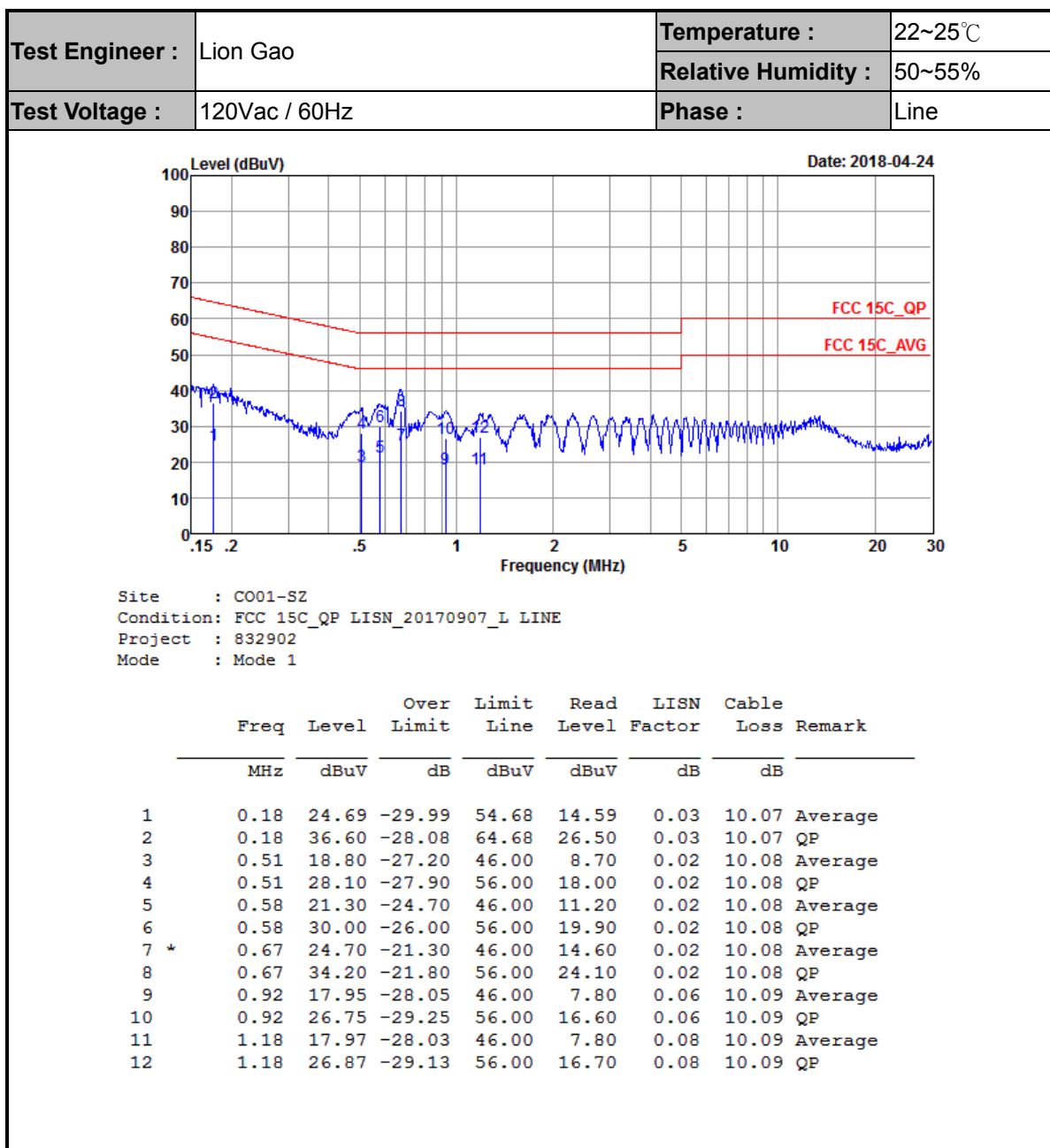
2.4GHz Band										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
11b	1Mbps	1	1	2412	10.08	30.00	3.00	13.08	36.00	Pass
11b	1Mbps	1	6	2437	10.25	30.00	3.00	13.25	36.00	Pass
11b	1Mbps	1	11	2462	11.18	30.00	3.00	14.18	36.00	Pass
11g	6Mbps	1	1	2412	21.97	30.00	3.00	24.97	36.00	Pass
11g	6Mbps	1	6	2437	23.05	30.00	3.00	26.05	36.00	Pass
11g	6Mbps	1	8	2447	22.90	30.00	3.00	25.90	36.00	Pass
11g	6Mbps	1	9	2452	17.67	30.00	3.00	20.67	36.00	Pass
11g	6Mbps	1	10	2457	17.06	30.00	3.00	20.06	36.00	Pass
11g	6Mbps	1	11	2462	16.37	30.00	3.00	19.37	36.00	Pass
HT20	MCS0	1	1	2412	16.63	30.00	3.00	19.63	36.00	Pass
HT20	MCS0	1	2	2417	22.33	30.00	3.00	25.33	36.00	Pass
HT20	MCS0	1	6	2437	23.12	30.00	3.00	26.12	36.00	Pass
HT20	MCS0	1	8	2447	23.09	30.00	3.00	26.09	36.00	Pass
HT20	MCS0	1	9	2452	17.70	30.00	3.00	20.70	36.00	Pass
HT20	MCS0	1	10	2457	17.00	30.00	3.00	20.00	36.00	Pass
HT20	MCS0	1	11	2462	16.22	30.00	3.00	19.22	36.00	Pass
HT40	MCS0	1	3	2422	16.59	30.00	3.00	19.59	36.00	Pass
HT40	MCS0	1	6	2437	17.13	30.00	3.00	20.13	36.00	Pass
HT40	MCS0	1	9	2452	15.23	30.00	3.00	18.23	36.00	Pass

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	-6.24	3.00	8.00	Pass
11b	1Mbps	1	6	2437	-6.13	3.00	8.00	Pass
11b	1Mbps	1	11	2462	-6.87	3.00	8.00	Pass
11g	9Mbps	1	1	2412	-10.32	3.00	8.00	Pass
11g	9Mbps	1	6	2437	-11.29	3.00	8.00	Pass
11g	9Mbps	1	11	2462	-10.28	3.00	8.00	Pass
HT20	MCS1	1	1	2412	-11.76	3.00	8.00	Pass
HT20	MCS1	1	6	2437	-11.68	3.00	8.00	Pass
HT20	MCS1	1	11	2462	-11.52	3.00	8.00	Pass
HT40	MCS0	1	3	2422	-15.57	3.00	8.00	Pass
HT40	MCS0	1	6	2437	-16.05	3.00	8.00	Pass
HT40	MCS0	1	9	2452	-15.19	3.00	8.00	Pass

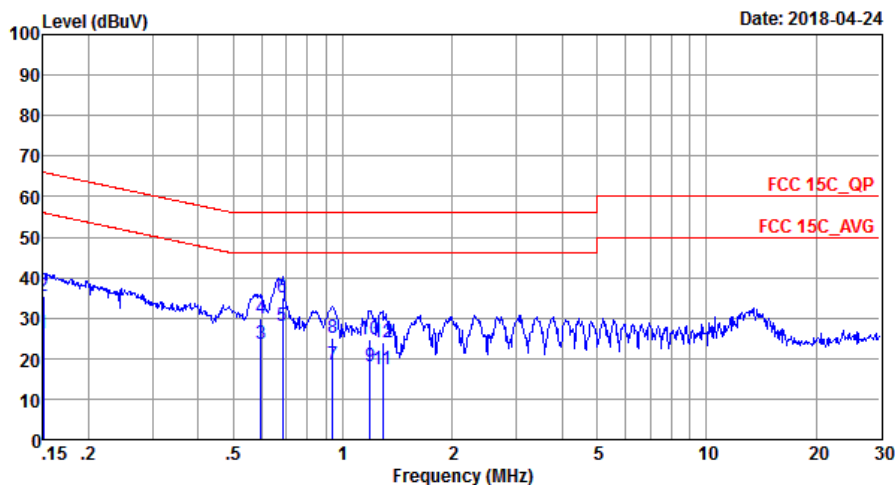


Appendix B. AC Conducted Emission Test Results





Test Engineer :	Lion Gao	Temperature :	22~25°C
		Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral



Site : CO01-SZ
Condition: FCC 15C_QP LISN_20170907_N NEUTRAL
Project : 832902
Mode : Mode 1

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.15	26.09	-29.91	56.00	16.00	0.03	10.06	Average
2	0.15	35.59	-30.41	66.00	25.50	0.03	10.06	QP
3	0.59	23.60	-22.40	46.00	13.50	0.02	10.08	Average
4	0.59	29.80	-26.20	56.00	19.70	0.02	10.08	QP
5 *	0.68	27.90	-18.10	46.00	17.80	0.02	10.08	Average
6	0.68	35.00	-21.00	56.00	24.90	0.02	10.08	QP
7	0.94	18.53	-27.47	46.00	8.40	0.04	10.09	Average
8	0.94	24.93	-31.07	56.00	14.80	0.04	10.09	QP
9	1.19	18.14	-27.86	46.00	8.00	0.05	10.09	Average
10	1.19	24.74	-31.26	56.00	14.60	0.05	10.09	QP
11	1.29	17.45	-28.55	46.00	7.30	0.05	10.10	Average
12	1.29	23.95	-32.05	56.00	13.80	0.05	10.10	QP



Appendix C. 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	Preamplifier Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2384.025	53.05	-20.95	74	49.09	27.72	4.72	28.48	176	86	P	H
		2389.8	43.04	-10.96	54	38.92	27.7	4.78	28.36	176	86	A	H
	*	2412	100.23	-	-	96.12	27.69	4.78	28.36	176	86	P	H
	*	2412	97.16	-	-	93.05	27.69	4.78	28.36	176	86	A	H
		2338.14	52.7	-21.3	74	48.99	27.75	4.66	28.7	100	58	P	V
		2388.75	42.34	-11.66	54	38.34	27.7	4.78	28.48	100	58	A	V
	*	2412	88.9	-	-	84.79	27.69	4.78	28.36	100	58	P	V
	*	2412	85.85	-	-	81.74	27.69	4.78	28.36	100	58	A	V
802.11b CH 06 2437MHz		2385.32	52.82	-21.18	74	48.8	27.72	4.78	28.48	117	62	P	H
		2387.7	42.42	-11.58	54	38.42	27.7	4.78	28.48	117	62	A	H
	*	2437	101.23	-	-	96.99	27.66	4.82	28.24	117	62	P	H
	*	2437	98.27	-	-	94.03	27.66	4.82	28.24	117	62	A	H
		2490.76	53.93	-20.07	74	49.48	27.61	4.85	28.01	117	62	P	H
		2489.22	43.11	-10.89	54	38.66	27.61	4.85	28.01	117	62	A	H
		2344.86	52.51	-21.49	74	48.69	27.75	4.66	28.59	126	59	P	V
		2384.48	42.13	-11.87	54	38.17	27.72	4.72	28.48	126	59	A	V
	*	2437	88.65	-	-	84.41	27.66	4.82	28.24	126	59	P	V
	*	2437	85.66	-	-	81.42	27.66	4.82	28.24	126	59	A	V
		2490.34	53.74	-20.26	74	49.29	27.61	4.85	28.01	126	59	P	V
		2496.85	42.81	-11.19	54	38.25	27.61	4.85	27.9	126	59	A	V



802.11b CH 11 2462MHz	*	2462	100.83	-	-	96.5	27.64	4.82	28.13	192	93	P	H
	*	2462	97.86	-	-	93.53	27.64	4.82	28.13	192	93	A	H
		2483.92	54.01	-19.99	74	49.54	27.63	4.85	28.01	192	93	P	H
		2483.56	44.47	-9.53	54	40	27.63	4.85	28.01	192	93	A	H
	*	2462	89.39	-	-	85.06	27.64	4.82	28.13	152	59	P	V
	*	2462	86.4	-	-	82.07	27.64	4.82	28.13	152	59	A	V
		2495.84	52.69	-21.31	74	48.13	27.61	4.85	27.9	152	59	P	V
		2483.52	42.39	-11.61	54	37.92	27.63	4.85	28.01	152	59	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b		4824	47.23	-26.77	74	68.11	31.76	5.55	58.19	161	360	P	H
CH 01		4824	52.89	-21.11	74	73.77	31.76	5.55	58.19	318	267	P	V
2412MHz		4824	50.74	-3.26	54	71.62	31.76	5.55	58.19	318	267	A	V
802.11b		4874	45.97	-28.03	74	66.54	31.88	5.65	58.1	114	148	P	H
CH 06		7311	45.36	-28.64	74	59.14	36.88	7.26	57.92	189	238	P	H
2437MHz		4874	53.11	-20.89	74	73.68	31.88	5.65	58.1	346	267	P	V
		4874	50.43	-3.57	54	71	31.88	5.65	58.1	346	267	A	V
		7311	42.66	-31.34	74	56.44	36.88	7.26	57.92	346	267	P	V
802.11b		4924	46.17	-27.83	74	66.33	32	5.86	58.02	150	269	P	H
CH 11		7386	44.82	-29.18	74	58.06	37.21	7.2	57.65	189	238	P	H
2462MHz		4924	52.94	-21.06	74	73.1	32	5.86	58.02	342	264	P	V
		4924	50.44	-3.56	54	70.6	32	5.86	58.02	342	197	A	V
		7386	42.51	-31.49	74	55.75	37.21	7.2	57.65	342	264	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



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

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		2389.485	61.21	-12.79	74	57.21	27.7	4.78	28.48	140	81	P	H
		2389.485	50.45	-3.55	54	46.45	27.7	4.78	28.48	140	81	A	H
	*	2412	103.96	-	-	99.85	27.69	4.78	28.36	140	81	P	H
	*	2412	97.02	-	-	92.91	27.69	4.78	28.36	140	81	A	H
		2389.485	52.31	-21.69	74	48.31	27.7	4.78	28.48	100	42	P	V
		2389.485	42.09	-11.91	54	38.09	27.7	4.78	28.48	100	42	A	V
	*	2412	93.27	-	-	89.16	27.69	4.78	28.36	100	42	P	V
	*	2412	86.56	-	-	82.45	27.69	4.78	28.36	100	42	A	V
802.11g CH 06 2437MHz		2387.98	54.43	-19.57	74	50.43	27.7	4.78	28.48	135	97	P	H
		2364.74	41.87	-12.13	54	37.89	27.74	4.72	28.48	135	97	A	H
	*	2437	108.28	-	-	104.04	27.66	4.82	28.24	135	97	P	H
	*	2437	100.57	-	-	96.33	27.66	4.82	28.24	135	97	A	H
		2483.56	65.77	-8.23	74	61.3	27.63	4.85	28.01	135	97	P	H
		2485.23	46.72	-7.28	54	42.25	27.63	4.85	28.01	135	97	A	H
		2380.84	50.35	-23.65	74	46.39	27.72	4.72	28.48	107	43	P	V
		2384.06	40.63	-13.37	54	36.67	27.72	4.72	28.48	107	43	A	V
	*	2437	97.61	-	-	93.37	27.66	4.82	28.24	107	43	P	V
	*	2437	91.65	-	-	87.41	27.66	4.82	28.24	107	43	A	V
		2484.18	55.48	-18.52	74	51.01	27.63	4.85	28.01	107	43	P	V
		2484.25	42.37	-11.63	54	37.9	27.63	4.85	28.01	107	43	A	V



802.11g CH 11 2462MHz	*	2462	100.03	-	-	95.7	27.64	4.82	28.13	127	89	P	H
	*	2462	94.21	-	-	89.88	27.64	4.82	28.13	127	89	A	H
		2484.92	62.06	-11.94	74	57.59	27.63	4.85	28.01	127	89	P	H
		2483.6	50.75	-3.25	54	46.28	27.63	4.85	28.01	127	89	A	H
	*	2462	91.22	-	-	86.89	27.64	4.82	28.13	108	58	P	V
	*	2462	84.02	-	-	79.69	27.64	4.82	28.13	108	58	A	V
		2483.64	52.67	-21.33	74	48.2	27.63	4.85	28.01	108	58	P	V
		2483.8	42.46	-11.54	54	37.99	27.63	4.85	28.01	108	58	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 (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 10 2457MHz		2457	103.42	-	-	99.09	27.64	4.82	28.13	163	73	P	H
		2457	95.79	-	-	91.46	27.64	4.82	28.13	163	73	A	H
	*	2484.88	64.35	-9.65	74	59.88	27.63	4.85	28.01	163	73	P	H
	*	2483.64	50.92	-3.08	54	46.45	27.63	4.85	28.01	163	73	A	H
		2457	94.27	-	-	89.94	27.64	4.82	28.13	100	51	P	V
		2457	86.89	-	-	82.56	27.64	4.82	28.13	100	51	A	V
	*	2485.44	60.95	-13.05	74	56.48	27.63	4.85	28.01	100	51	P	V
	*	2483.56	45.24	-8.76	54	40.77	27.63	4.85	28.01	100	51	A	V
802.11g CH 09 2452MHz		2364.18	52.18	-21.82	74	48.31	27.74	4.72	28.59	139	102	P	H
		2369.36	42.11	-11.89	54	38.15	27.72	4.72	28.48	139	102	A	H
	*	2452	103.45	-	-	99.1	27.66	4.82	28.13	139	102	P	H
	*	2452	95.85	-	-	91.5	27.66	4.82	28.13	139	102	A	H
		2486.77	67.15	-6.85	74	62.68	27.63	4.85	28.01	139	102	P	H
		2483.62	50.15	-3.85	54	45.68	27.63	4.85	28.01	139	102	A	H
		2381.54	52.88	-21.12	74	48.92	27.72	4.72	28.48	105	343	P	V
		2383.92	42.14	-11.86	54	38.18	27.72	4.72	28.48	105	343	A	V
	*	2454	94.78	-	-	90.45	27.64	4.82	28.13	105	343	P	V
	*	2452	87.43	-	-	83.08	27.66	4.82	28.13	105	343	A	V
		2485.72	58.84	-15.16	74	54.37	27.63	4.85	28.01	105	343	P	V
		2484.25	44.69	-9.31	54	40.22	27.63	4.85	28.01	105	343	A	V



802.11g CH 08 2447MHz		2328.2	52.63	-21.37	74	48.9	27.77	4.66	28.7	139	102	P	H
		2381.82	42.47	-11.53	54	38.51	27.72	4.72	28.48	139	102	A	H
	*	2447	107.79	-	-	103.44	27.66	4.82	28.13	139	102	P	H
	*	2447	100.16	-	-	95.81	27.66	4.82	28.13	139	102	A	H
		2485.3	67.88	-6.12	74	63.41	27.63	4.85	28.01	139	102	P	H
		2483.83	50.8	-3.2	54	46.33	27.63	4.85	28.01	139	102	A	H
		2375.66	51.77	-22.23	74	47.81	27.72	4.72	28.48	100	51	P	V
		2383.78	42.19	-11.81	54	38.23	27.72	4.72	28.48	100	51	A	V
	*	2447	98.73	-	-	94.38	27.66	4.82	28.13	100	51	P	V
	*	2447	91.28	-	-	86.93	27.66	4.82	28.13	100	51	A	V
		2484.88	60.43	-13.57	74	55.96	27.63	4.85	28.01	100	51	P	V
		2483.69	45.08	-8.92	54	40.61	27.63	4.85	28.01	100	51	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g		4824	47.07	-26.93	74	67.95	31.76	5.55	58.19	158	320	P	H
CH 01		4824	51.23	-22.77	74	72.11	31.76	5.55	58.19	141	214	P	V
2412MHz		4824	42.45	-11.55	54	63.33	31.76	5.55	58.19	150	243	A	V
802.11g		4874	47.27	-26.73	74	67.84	31.88	5.65	58.1	217	201	P	H
		7311	45.62	-28.38	74	59.4	36.88	7.26	57.92	100	140	P	H
CH 06		4874	53.19	-20.81	74	73.76	31.88	5.65	58.1	114	148	P	V
2437MHz		4874	44.09	-9.91	54	64.66	31.88	5.65	58.1	150	337	A	V
		7311	45.25	-28.75	74	59.03	36.88	7.26	57.92	189	238	P	V
802.11g		4924	41.33	-32.67	74	61.49	32	5.86	58.02	150	269	P	H
CH 11		7386	44.76	-29.24	74	58	37.21	7.2	57.65	189	238	P	H
2462MHz		4924	46.43	-27.57	74	66.86	31.73	5.86	58.02	185	287	P	V
		7386	44.53	-29.47	74	58.7	36.28	7.2	57.65	189	238	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 (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 10 2457MHz		4914	39.01	-34.99	74	59.33	31.96	5.76	58.04	163	360	P	H
		7371	45.64	-28.36	74	58.98	37.14	7.23	57.71	163	360	P	H
		4914	42.8	-31.2	74	63.39	31.69	5.76	58.04	163	360	P	V
		7371	43.7	-30.3	74	57.92	36.26	7.23	57.71	163	360	P	V
802.11g CH 09 2452MHz		4904	38.34	-35.66	74	58.66	31.96	5.76	58.04	163	360	P	H
		7356	45.52	-28.48	74	58.97	37.08	7.23	57.76	163	360	P	H
		4904	40.12	-33.88	74	60.71	31.69	5.76	58.04	163	360	P	V
		7356	44.48	-29.52	74	58.78	36.23	7.23	57.76	163	360	P	V
802.11g CH 08 2447MHz		4894	38.37	-35.63	74	58.76	31.92	5.76	58.07	163	360	P	H
		7341	44.18	-29.82	74	57.76	37.01	7.23	57.82	163	360	P	H
		4894	38.84	-35.16	74	59.5	31.65	5.76	58.07	163	360	P	V
		7341	42.68	-31.32	74	57.06	36.21	7.23	57.82	163	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz
WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		2388.54	66.57	-7.43	74	62.57	27.7	4.78	28.48	169	92	P	H
		2389.8	50.68	-3.32	54	46.56	27.7	4.78	28.36	169	92	A	H
	*	2412	102	-	-	97.89	27.69	4.78	28.36	169	92	P	H
	*	2412	94.39	-	-	90.28	27.69	4.78	28.36	169	92	A	H
		2388.75	56.72	-17.28	74	52.72	27.7	4.78	28.48	109	65	P	V
		2389.59	43.83	-10.17	54	39.83	27.7	4.78	28.48	109	65	A	V
	*	2412	91.68	-	-	87.57	27.69	4.78	28.36	109	65	P	V
	*	2412	83.92	-	-	79.81	27.69	4.78	28.36	109	65	A	V
802.11n HT20 CH 06 2437MHz		2388.12	55.09	-18.91	74	51.09	27.7	4.78	28.48	131	90	P	H
		2389.38	42.97	-11.03	54	38.97	27.7	4.78	28.48	131	90	A	H
	*	2437	107.98	-	-	103.74	27.66	4.82	28.24	131	90	P	H
	*	2437	100.53	-	-	96.29	27.66	4.82	28.24	131	90	A	H
		2483.9	65.22	-8.78	74	60.75	27.63	4.85	28.01	131	90	P	H
		2484.18	46.96	-7.04	54	42.49	27.63	4.85	28.01	131	90	A	H
		2330.16	51.48	-22.52	74	47.75	27.77	4.66	28.7	124	64	P	V
		2379.02	41.86	-12.14	54	37.9	27.72	4.72	28.48	124	64	A	V
	*	2437	97.59	-	-	93.35	27.66	4.82	28.24	124	64	P	V
	*	2437	90.15	-	-	85.91	27.66	4.82	28.24	124	64	A	V
		2484.18	53.85	-20.15	74	49.38	27.63	4.85	28.01	124	64	P	V
		2483.83	42.78	-11.22	54	38.31	27.63	4.85	28.01	124	64	A	V



802.11n HT20 CH 11 2462MHz	*	2462	101.56	-	-	97.23	27.64	4.82	28.13	130	89	P	H
	*	2462	93.84	-	-	89.51	27.64	4.82	28.13	130	89	A	H
		2483.52	69.77	-4.23	74	65.3	27.63	4.85	28.01	130	89	P	H
		2483.6	50.96	-3.04	54	46.49	27.63	4.85	28.01	130	89	A	H
	*	2462	88.7	-	-	84.37	27.64	4.82	28.13	105	47	P	V
	*	2462	82.76	-	-	78.43	27.64	4.82	28.13	105	47	A	V
		2483.64	55.2	-18.8	74	50.73	27.63	4.85	28.01	105	47	P	V
		2483.84	42.33	-11.67	54	37.86	27.63	4.85	28.01	105	47	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 (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 02 2417MHz		2384.025	66.71	-7.29	74	62.75	27.72	4.72	28.48	136	78	P	H
		2388.96	50.03	-3.97	54	46.03	27.7	4.78	28.48	136	78	A	H
	*	2417	106.98	-	-	102.75	27.69	4.78	28.24	136	78	P	H
	*	2417	99.48	-	-	95.25	27.69	4.78	28.24	136	78	A	H
		2388.54	53.2	-20.8	74	49.2	27.7	4.78	28.48	100	51	P	V
		2389.59	43.15	-10.85	54	39.15	27.7	4.78	28.48	100	51	A	V
	*	2417	96.5	-	-	92.27	27.69	4.78	28.24	100	51	P	V
	*	2417	88.92	-	-	84.69	27.69	4.78	28.24	100	51	P	V
802.11n HT20 CH 10 2457MHz	*	2457	102.37	-	-	98.04	27.64	4.82	28.13	136	103	P	H
	*	2457	95.05	-	-	90.72	27.64	4.82	28.13	136	103	A	H
		2484.08	64.42	-9.58	74	59.95	27.63	4.85	28.01	136	103	P	H
		2483.72	50.87	-3.13	54	46.4	27.63	4.85	28.01	136	103	A	H
	*	2457	93.56	-	-	89.23	27.64	4.82	28.13	122	52	P	V
	*	2457	85.77	-	-	81.44	27.64	4.82	28.13	122	52	A	V
		2494.84	53.82	-20.18	74	49.26	27.61	4.85	27.9	122	52	P	V
		2484.52	43.92	-10.08	54	39.45	27.63	4.85	28.01	122	52	A	V



802.11n HT20 CH 09 2452MHz		2381.26	51.97	-22.03	74	48.01	27.72	4.72	28.48	136	104	P	H
		2380	42.25	-11.75	54	38.29	27.72	4.72	28.48	136	104	A	H
	*	2452	103.44	-	-	99.11	27.64	4.82	28.13	136	104	P	H
	*	2452	95.71	-	-	91.38	27.64	4.82	28.13	136	104	A	H
		2486.07	68.69	-5.31	74	64.22	27.63	4.85	28.01	136	104	P	H
		2483.83	50.65	-3.35	54	46.18	27.63	4.85	28.01	136	104	A	H
		2384.34	53.04	-20.96	74	49.08	27.72	4.72	28.48	100	52	P	V
		2350.46	42.11	-11.89	54	38.23	27.75	4.72	28.59	100	52	A	V
	*	2452	93.79	-	-	89.46	27.64	4.82	28.13	100	52	P	V
	*	2452	86.02	-	-	81.67	27.66	4.82	28.13	100	52	A	V
		2483.97	61.52	-12.48	74	57.05	27.63	4.85	28.01	100	52	P	V
		2484.6	45.18	-8.82	54	40.71	27.63	4.85	28.01	100	52	A	V
802.11n HT20 CH 08 2447MHz		2388.96	52.75	-21.25	74	48.75	27.7	4.78	28.48	170	76	P	H
		2387.56	42.76	-11.24	54	38.76	27.7	4.78	28.48	170	76	A	H
	*	2447	108.56	-	-	104.21	27.66	4.82	28.13	170	76	P	H
	*	2447	101.11	-	-	96.76	27.66	4.82	28.13	170	76	A	H
		2484.32	67.05	-6.95	74	62.58	27.63	4.85	28.01	170	76	P	H
		2483.5	50.97	-3.03	54	46.5	27.63	4.85	28.01	170	76	A	H
		2380.14	52.57	-21.43	74	48.61	27.72	4.72	28.48	100	51	P	V
		2379.3	42.17	-11.83	54	38.21	27.72	4.72	28.48	100	51	A	V
	*	2448	98.72	-	-	94.37	27.66	4.82	28.13	100	51	P	V
	*	2448	91.07	-	-	86.72	27.66	4.82	28.13	100	51	A	V
		2483.97	60.28	-13.72	74	55.81	27.63	4.85	28.01	100	51	P	V
		2483.9	45.44	-8.56	54	40.97	27.63	4.85	28.01	100	51	A	V
Remark	3. No other spurious found. 4. All results are PASS against Peak and Average limit line.												



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

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		4824	44.16	-29.84	74	65.04	31.76	5.55	58.19	158	320	P	H
		4824	45.62	-28.38	74	66.77	31.49	5.55	58.19	141	214	P	V
802.11n HT20 CH 06 2437MHz		4874	48.05	-25.95	74	68.62	31.88	5.65	58.1	217	201	P	H
		7311	46.2	-27.8	74	59.98	36.88	7.26	57.92	100	140	P	H
		4874	52.76	-21.24	74	73.33	31.88	5.65	58.1	114	148	P	V
		4874	43.91	-10.09	54	64.48	31.88	5.65	58.1	151	231	A	V
		7311	45.3	-28.7	74	59.08	36.88	7.26	57.92	189	238	P	V
802.11n HT20 CH 11 2462MHz		4924	40.74	-33.26	74	60.9	32	5.86	58.02	150	269	P	H
		7386	45.58	-28.42	74	58.82	37.21	7.2	57.65	189	238	P	H
		4924	46.39	-27.61	74	66.82	31.73	5.86	58.02	185	287	P	V
		7386	44.1	-29.9	74	58.27	36.28	7.2	57.65	189	238	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 (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 02 2417MHz		4834	38.86	-35.14	74	59.67	31.8	5.55	58.16	163	360	P	H
		7251	44.31	-29.69	74	58.4	36.68	7.32	58.09	163	360	P	H
		4834	38.99	-35.01	74	60.07	31.53	5.55	58.16	163	360	P	V
		7251	45.17	-28.83	74	59.83	36.11	7.32	58.09	163	360	P	V
802.11n HT20 CH 10 2457MHz		4914	39.28	-34.72	74	59.6	31.96	5.76	58.04	163	360	P	H
		7371	44.16	-29.84	74	57.5	37.14	7.23	57.71	163	360	P	H
		4914	41.8	-32.2	74	62.39	31.69	5.76	58.04	163	360	P	V
		7371	43.97	-30.03	74	58.19	36.26	7.23	57.71	163	360	P	V
802.11n HT20 CH 09 2452MHz		4904	38.71	-35.29	74	59.03	31.96	5.76	58.04	163	360	P	H
		7356	44.13	-29.87	74	57.58	37.08	7.23	57.76	163	360	P	H
		4904	38.61	-35.39	74	59.2	31.69	5.76	58.04	163	360	4904	V
		7356	45.1	-28.9	74	59.4	36.23	7.23	57.76	163	360	7356	V
802.11n HT20 CH 08 2447 MHz		4894	38.34	-35.66	74	58.73	31.92	5.76	58.07	163	360	P	H
		7341	44.64	-29.36	74	58.22	37.01	7.23	57.82	163	360	P	H
		4894	39.88	-34.12	74	60.54	31.65	5.76	58.07	163	360	P	V
		7341	43.7	-30.3	74	58.08	36.21	7.23	57.82	163	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz
WIFI 802.11n HT40 (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 03 2422MHz		2388.12	65.22	-8.78	74	61.22	27.7	4.78	28.48	133	78	P	H
		2388.12	50.38	-3.62	54	46.38	27.7	4.78	28.48	133	78	A	H
	*	2422	95.1	-	-	90.89	27.67	4.78	28.24	133	78	P	H
	*	2422	88.33	-	-	84.12	27.67	4.78	28.24	133	78	A	H
		2484.39	61.97	-12.03	74	57.5	27.63	4.85	28.01	133	78	P	H
		2484.25	45.88	-8.12	54	41.41	27.63	4.85	28.01	133	78	A	H
		2387.98	54.4	-19.6	74	50.4	27.7	4.78	28.48	100	30	P	V
		2389.38	41.73	-12.27	54	37.73	27.7	4.78	28.48	100	30	A	V
	*	2422	84.23	-	-	80.02	27.67	4.78	28.24	100	30	P	V
	*	2422	77.77	-	-	73.56	27.67	4.78	28.24	100	30	A	V
		2493.14	51.63	-22.37	74	47.07	27.61	4.85	27.9	100	30	P	V
		2492.51	41.01	-12.99	54	36.45	27.61	4.85	27.9	100	30	A	V
802.11n HT40 CH 06 2437MHz		2389.8	51.29	-22.71	74	47.17	27.7	4.78	28.36	136	99	P	H
		2389.52	43.11	-10.89	54	39.11	27.7	4.78	28.48	136	99	A	H
	*	2437	95.77	-	-	91.53	27.66	4.82	28.24	136	99	P	H
	*	2437	89.57	-	-	85.33	27.66	4.82	28.24	136	99	A	H
		2485.51	62.88	-11.12	74	58.41	27.63	4.85	28.01	136	99	P	H
		2484.95	50.29	-3.71	54	45.82	27.63	4.85	28.01	136	99	A	H
		2337.86	49.8	-24.2	74	46.09	27.75	4.66	28.7	118	50	P	V
		2387.98	40.59	-13.41	54	36.59	27.7	4.78	28.48	118	50	A	V
	*	2437	84.71	-	-	80.47	27.66	4.82	28.24	118	50	P	V
	*	2437	78.79	-	-	74.55	27.66	4.82	28.24	118	50	A	V
		2486.14	52.68	-21.32	74	48.21	27.63	4.85	28.01	118	50	P	V
		2484.04	42.39	-11.61	54	37.92	27.63	4.85	28.01	118	50	A	V



802.11n HT40 CH 09 2452MHz		2321.34	49.64	-24.36	74	45.91	27.77	4.66	28.7	106	61	P	H
		2385.04	40.73	-13.27	54	36.71	27.72	4.78	28.48	106	61	A	H
	*	2452	94.65	-	-	90.3	27.66	4.82	28.13	106	61	P	H
	*	2452	87.81	-	-	83.46	27.66	4.82	28.13	106	61	A	H
		2483.5	59.52	-14.48	74	55.05	27.63	4.85	28.01	106	61	P	H
		2485.72	49.96	-4.04	54	45.49	27.63	4.85	28.01	106	61	A	H
		2354.24	49.51	-24.49	74	45.64	27.74	4.72	28.59	105	47	P	V
		2352.14	40.7	-13.3	54	36.83	27.74	4.72	28.59	105	47	A	V
	*	2452	84.09	-	-	79.74	27.66	4.82	28.13	105	47	P	V
	*	2452	78.03	-	-	73.68	27.66	4.82	28.13	105	47	A	V
		2484.67	52.21	-21.79	74	47.74	27.63	4.85	28.01	105	47	P	V
		2485.65	42.51	-11.49	54	38.04	27.63	4.85	28.01	105	47	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz
WIFI 802.11n HT40 (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 03 2422MHz		4844	40.4	-33.6	74	61.11	31.8	5.65	58.16	200	210	P	H
		7266	44.77	-29.23	74	58.76	36.75	7.29	58.03	105	269	P	H
		4844	41.79	-32.21	74	62.77	31.53	5.65	58.16	114	148	P	V
		7266	44.39	-29.61	74	59	36.13	7.29	58.03	189	238	P	V
802.11n HT40 CH 06 2437MHz		4874	41.33	-32.67	74	61.9	31.88	5.65	58.1	217	201	P	H
		7311	45.01	-28.99	74	58.79	36.88	7.26	57.92	100	140	P	H
		4874	43.88	-30.12	74	64.72	31.61	5.65	58.1	114	148	P	V
		7311	44.92	-29.08	74	59.41	36.17	7.26	57.92	189	238	P	V
802.11n HT40 CH 09 2452MHz		4904	39.07	-34.93	74	59.39	31.96	5.76	58.04	200	89	P	H
		7356	46.29	-27.71	74	59.74	37.08	7.23	57.76	181	318	P	H
		4904	41.8	-32.2	74	62.39	31.69	5.76	58.04	152	149	P	V
		7356	44.11	-29.89	74	58.41	36.23	7.23	57.76	180	225	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

Emission below 1GHz

2.4GHz WIFI 802.11n HT20 (LF)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz 802.11n HT20 LF		144.46	32.83	-10.67	43.5	45.83	17.31	1.25	31.56	-	-	P	H
		191.99	31.08	-12.42	43.5	45.73	15.18	1.53	31.36	-	-	P	H
		288.02	36.21	-9.79	46	46.45	19.16	1.82	31.22	-	-	P	H
		385.99	32.46	-13.54	46	39.96	21.56	2.14	31.2	-	-	P	H
		794.36	41.23	-4.77	46	40.86	28.4	3.14	31.17	-	-	P	H
		818.61	40.67	-5.33	46	40	28.65	3.19	31.17	100	84	QP	H
		30	32.11	-7.89	40	38.93	24.9	0.25	31.97	-	-	P	V
		43.58	34.68	-5.32	40	48.04	18.13	0.48	31.97	100	0	P	V
		143.49	25.51	-17.99	43.5	38.47	17.37	1.24	31.57	-	-	P	V
		288.02	27.12	-18.88	46	37.36	19.16	1.82	31.22	-	-	P	V
		794.36	38.41	-7.59	46	38.04	28.4	3.14	31.17	-	-	P	V
		818.61	37.72	-8.28	46	37.05	28.65	3.19	31.17	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

**Note symbol**

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



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

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

1. Level(dBμV/m) =

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

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

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

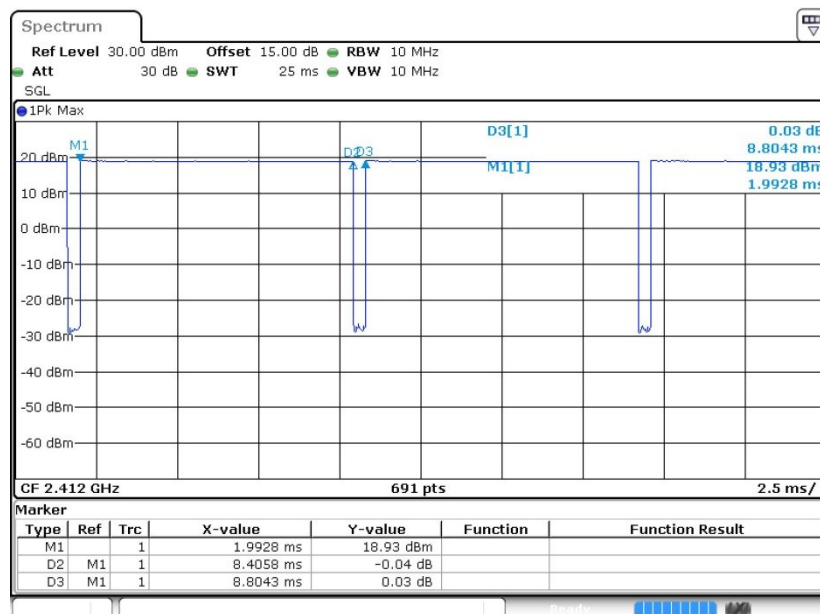
= -10.46(dB)

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

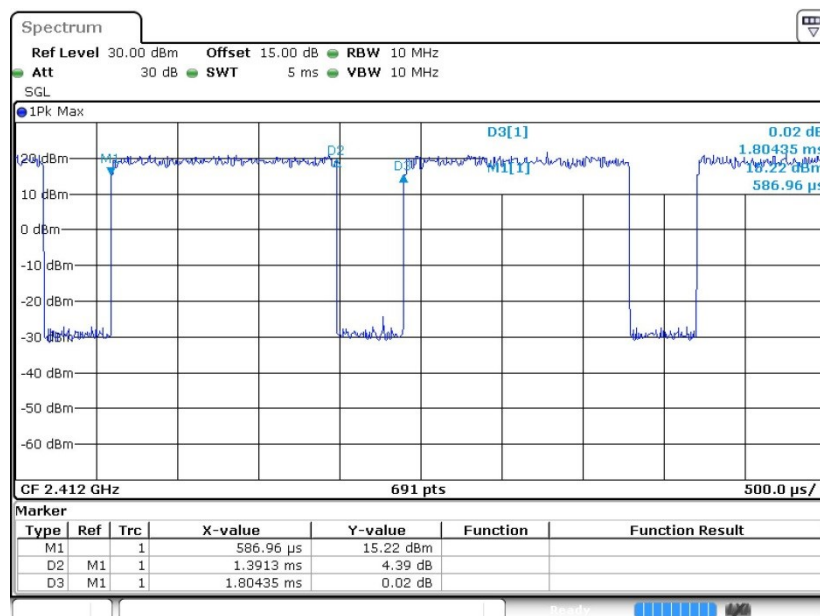
Appendix D. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
1	802.11b	95.47	8.406	0.119	300Hz
1	802.11g	77.11	1.391	0.719	1KHz
1	802.11n HT20	75.85	1.297	0.771	1KHz
1	802.11n HT40	61.12	0.649	1.540	3KHz

802.11b

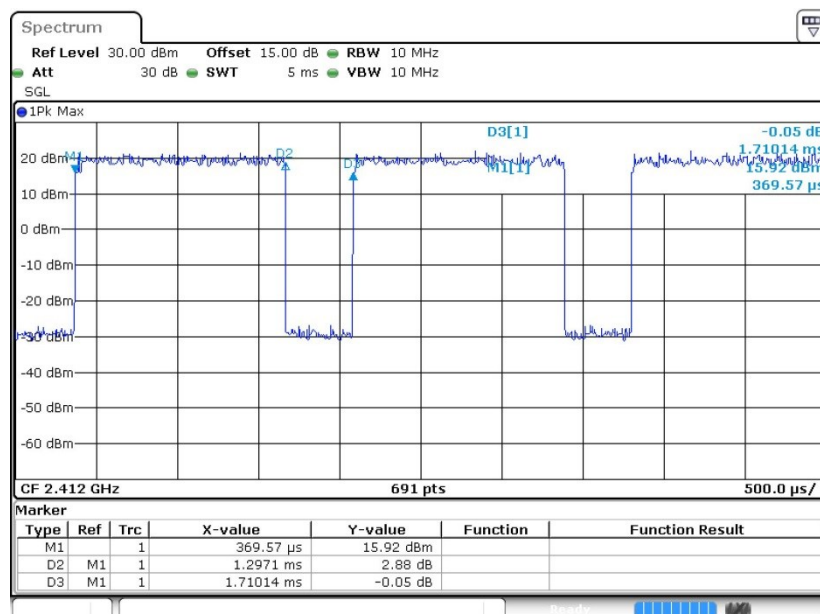


802.11g





802.11n HT20



802.11n HT40

