



FCC RF Test Report

APPLICANT : Mobile Devices Ingénierie
EQUIPMENT : Telematics embedded system
BRAND NAME : Mobile Devices Ingenierie /MUNIC
MODEL NAME : C4D-4G4USAA_V6+
MARKETING NAME : C4D-4G4USAA_V6+
FCC ID : A6GC4D-4G4USV6
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System

The product was received on Sep. 25, 2018 and testing was completed on Oct. 04, 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**



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	5
1.5 Modification of EUT	5
1.6 Testing Location	6
1.7 Applicable Standards	6
2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST	7
2.1 Carrier Frequency and Channel	7
2.2 Test Mode	7
2.3 Connection Diagram of Test System	8
2.4 Support Unit used in test configuration and system	8
2.5 EUT Operation Test Setup	8
2.6 Measurement Results Explanation Example	9
3 TEST RESULT	10
3.1 6dB Bandwidth Measurement	10
3.2 Output Power Measurement	12
3.3 Power Spectral Density Measurement	13
3.4 Conducted Band Edges and Spurious Emission Measurement	15
3.5 Radiated Band Edges and Spurious Emission Measurement	25
3.6 Antenna Requirements	29
4 LIST OF MEASURING EQUIPMENT	30
5 UNCERTAINTY OF EVALUATION	31
APPENDIX A. CONDUCTED TEST RESULTS	
APPENDIX B. RADIATED SPURIOUS EMISSION	
APPENDIX C. DUTY CYCLE PLOTS	
APPENDIX D. SETUP PHOTOGRAPHS	



REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR892506B	Rev. 01	Initial issue of report	Oct. 19, 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	-
3.2	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 3.94 dB at 2390.00 MHz
-	15.207	AC Conducted Emission	15.207(a)	Not Required	-
3.6	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Mobile Devices Ingénierie

100 Avenue de Stalingrad 94800 Villejuif FRANCE

1.2 Manufacturer

Mobile Devices Ingénierie

100 Avenue de Stalingrad 94800 Villejuif FRANCE

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Telematics embedded system
Brand Name	Mobile Devices Ingenierie /MUNIC
Model Name	C4D-4G4USAA_V6+
Marketing Name	C4D-4G4USAA_V6+
FCC ID	A6GC4D-4G4USV6
EUT supports Radios application	WCDMA/HSPA/LTE WLAN 2.4GHz 802.11b/g/n HT20 Bluetooth LE
IMEI Code	Conducted: 358148061168279 Radiation: N/A
HW Version	SAP00362+SAP00398
SW Version	V2093
EUT Stage	Identical Prototype

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

1.4 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 : 15.58 dBm (0.0361 W) 802.11g : 18.49 dBm (0.0706 W) 802.11n HT20 : 18.28 dBm (0.0673 W)
Antenna Type / Gain	Stamping Element Antenna with gain 2.40 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM)

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).

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 designation No.	FCC Test Firm Registration No.
	TH01-SZ	CN5018	337463

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 designation No.	FCC Test Firm Registration No.
	03CH02-SZ	CN5019	577730

1.7 Applicable Standards

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

- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05
- ♦ ANSI C63.10-2013

Remark:

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

2 Test Configuration of Equipment Under Test

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

2.1 Carrier Frequency and Channel

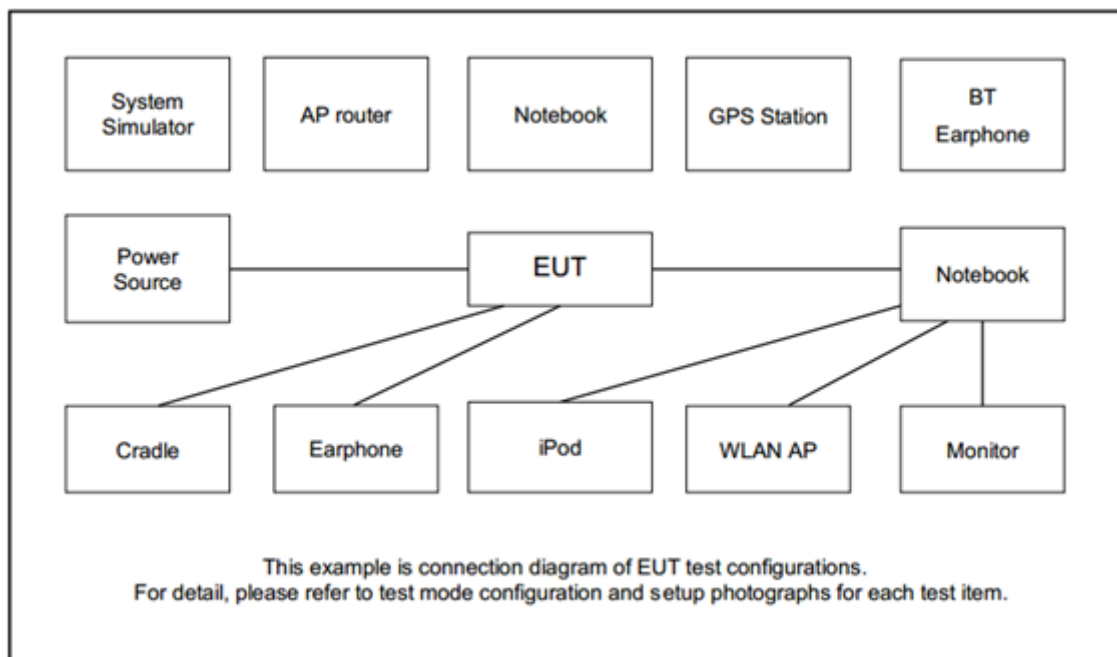
Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

2.2 Test Mode

Final test 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

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.	DC Power Supply	Topward	3303DR	N/A	N/A	Unshielded,1.8m

2.5 EUT Operation Test Setup

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



2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 5.0 dB and 10dB attenuator.

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

3 Test Result

3.1 6dB Bandwidth Measurement

3.1.1 Limit of 6dB Bandwidth

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

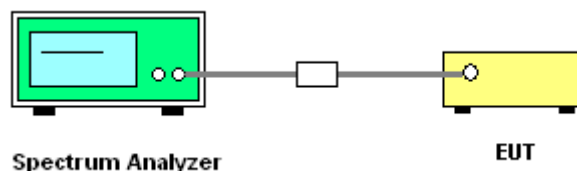
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

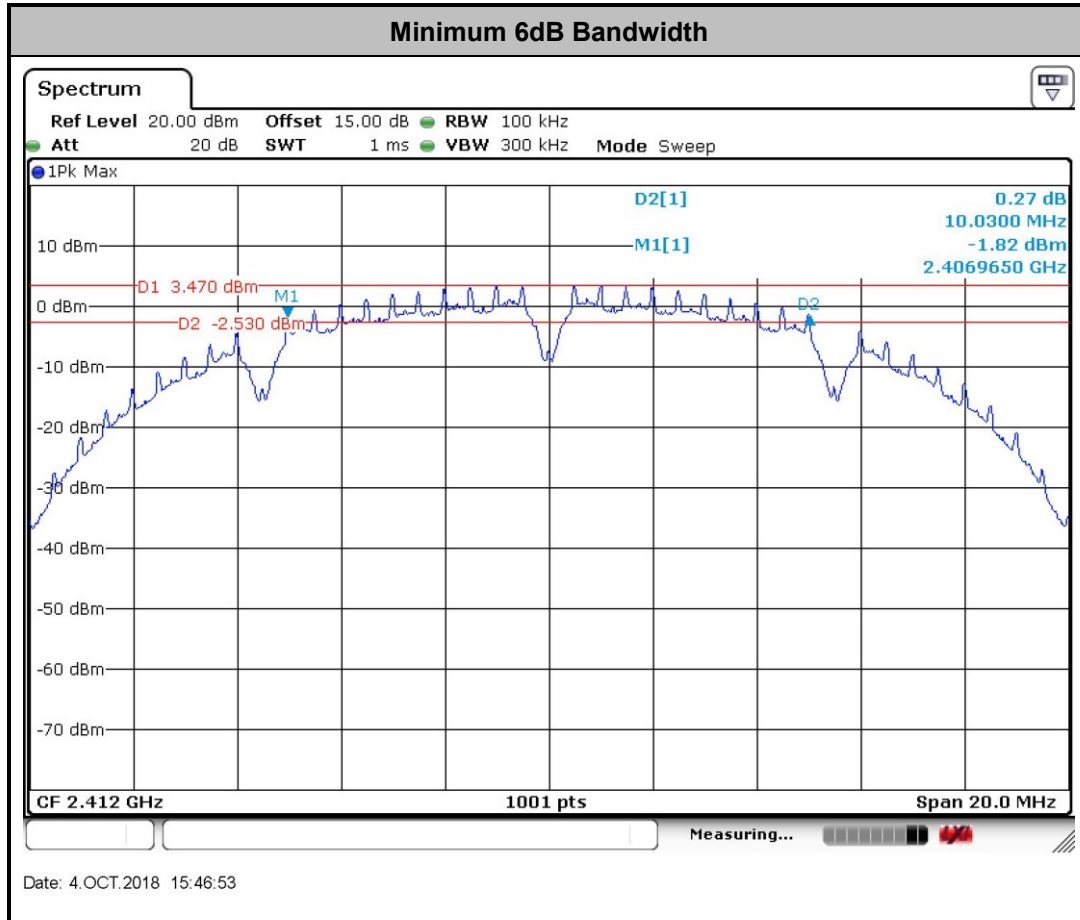
1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v05.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB Occupied Bandwidth

Please refer to Appendix A.



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.

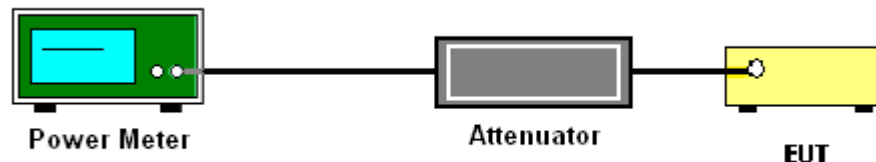
3.2.2 Measuring Instruments

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 v05 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.

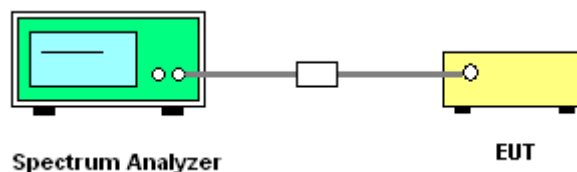
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

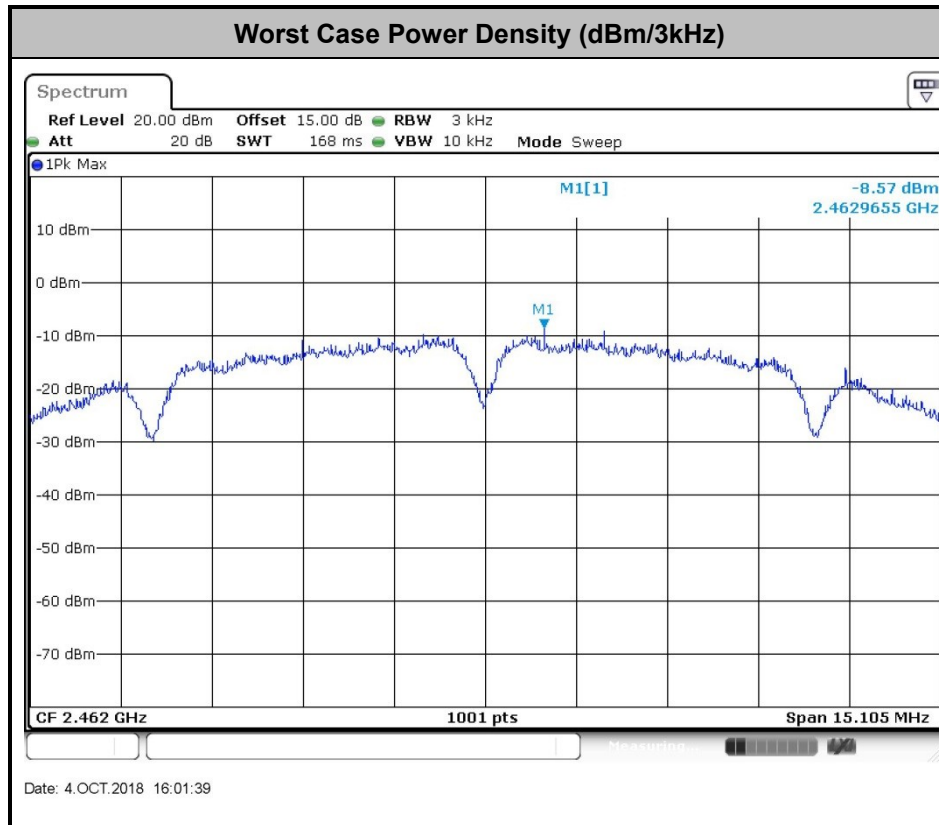
1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum 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.

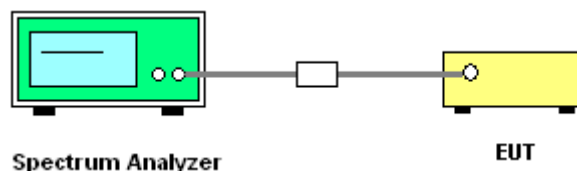
3.4.2 Measuring Instruments

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 v05.
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

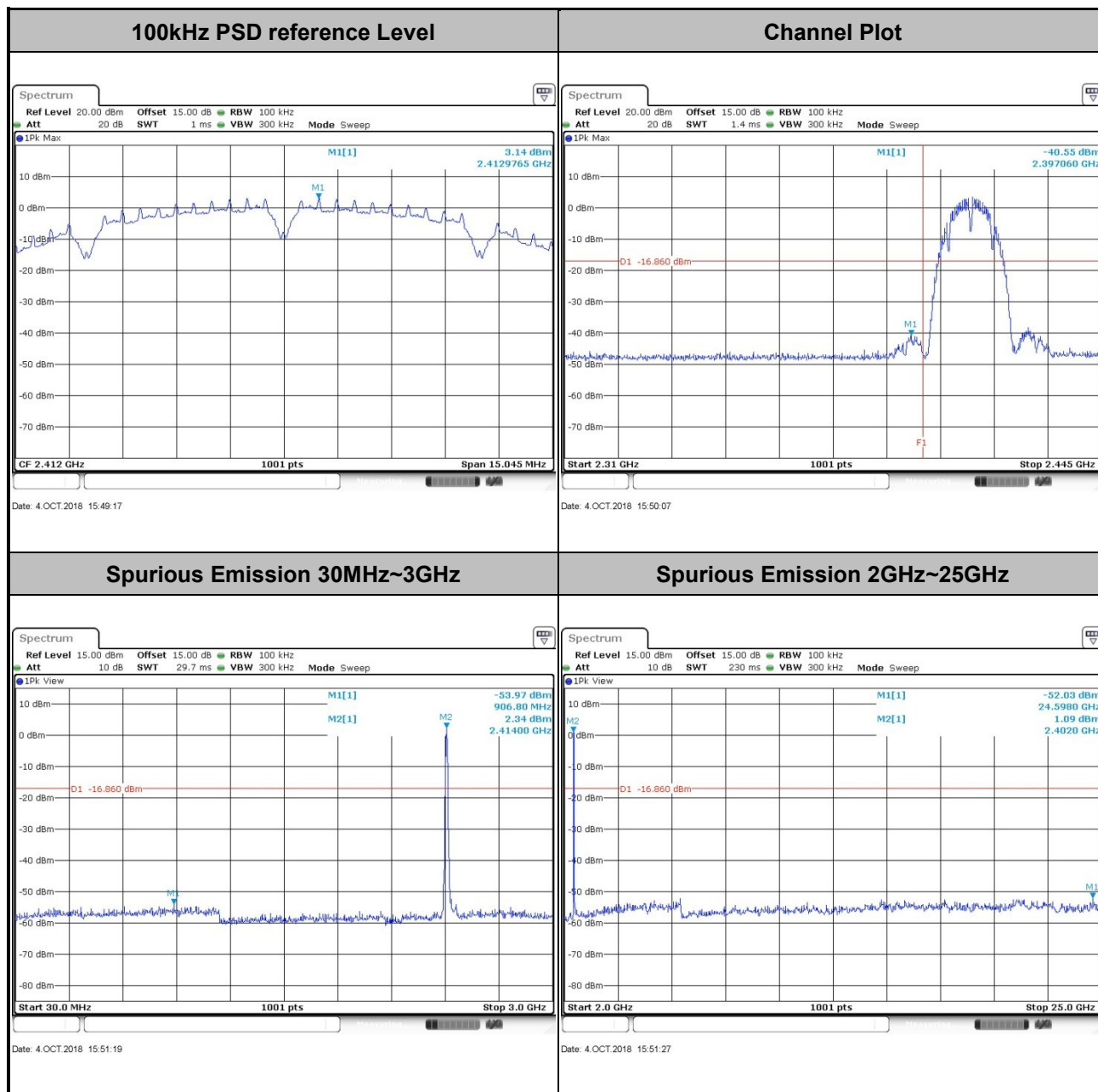




3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Engineer :	Shuai Qian	Temperature :	24~26°C
		Relative Humidity :	50~53%

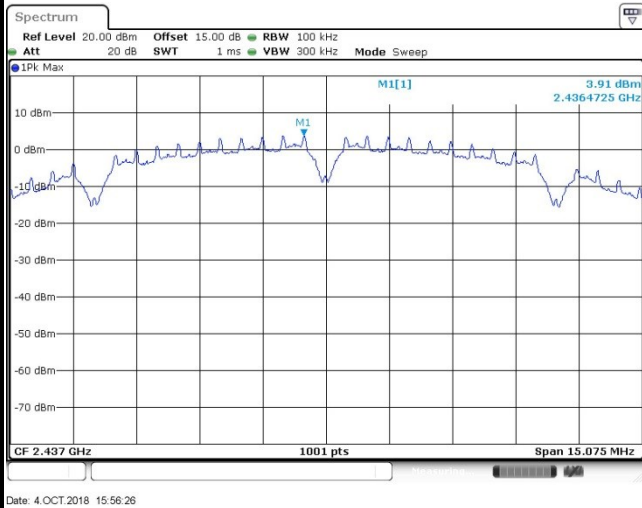
Test Mode :	802.11b	Test Channel :	01
-------------	---------	----------------	----



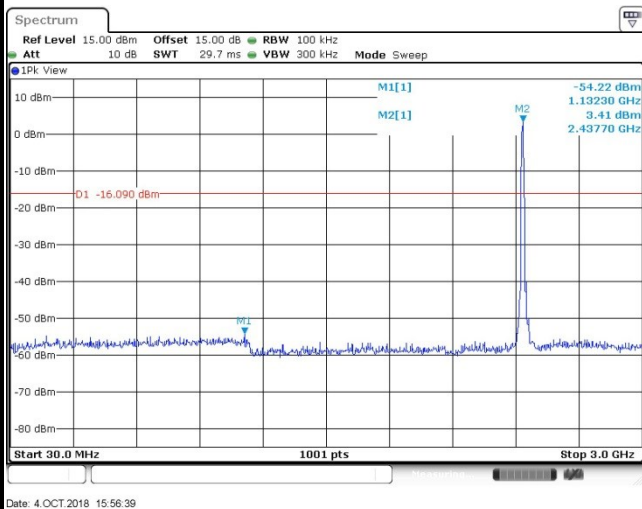


Test Mode :	802.11b	Test Channel :	06
-------------	---------	----------------	----

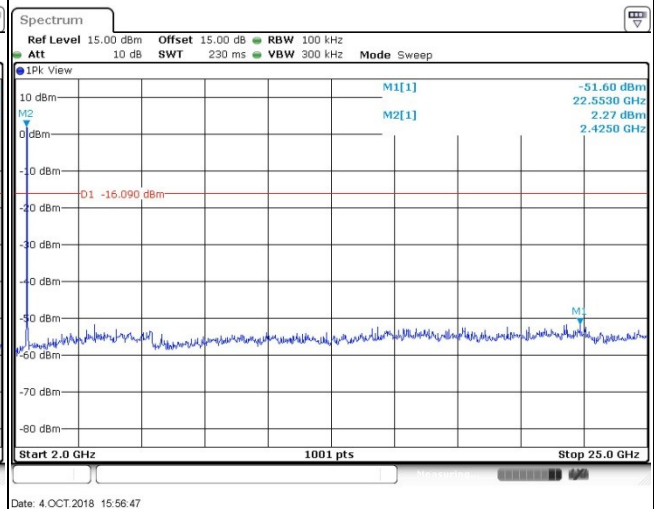
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz

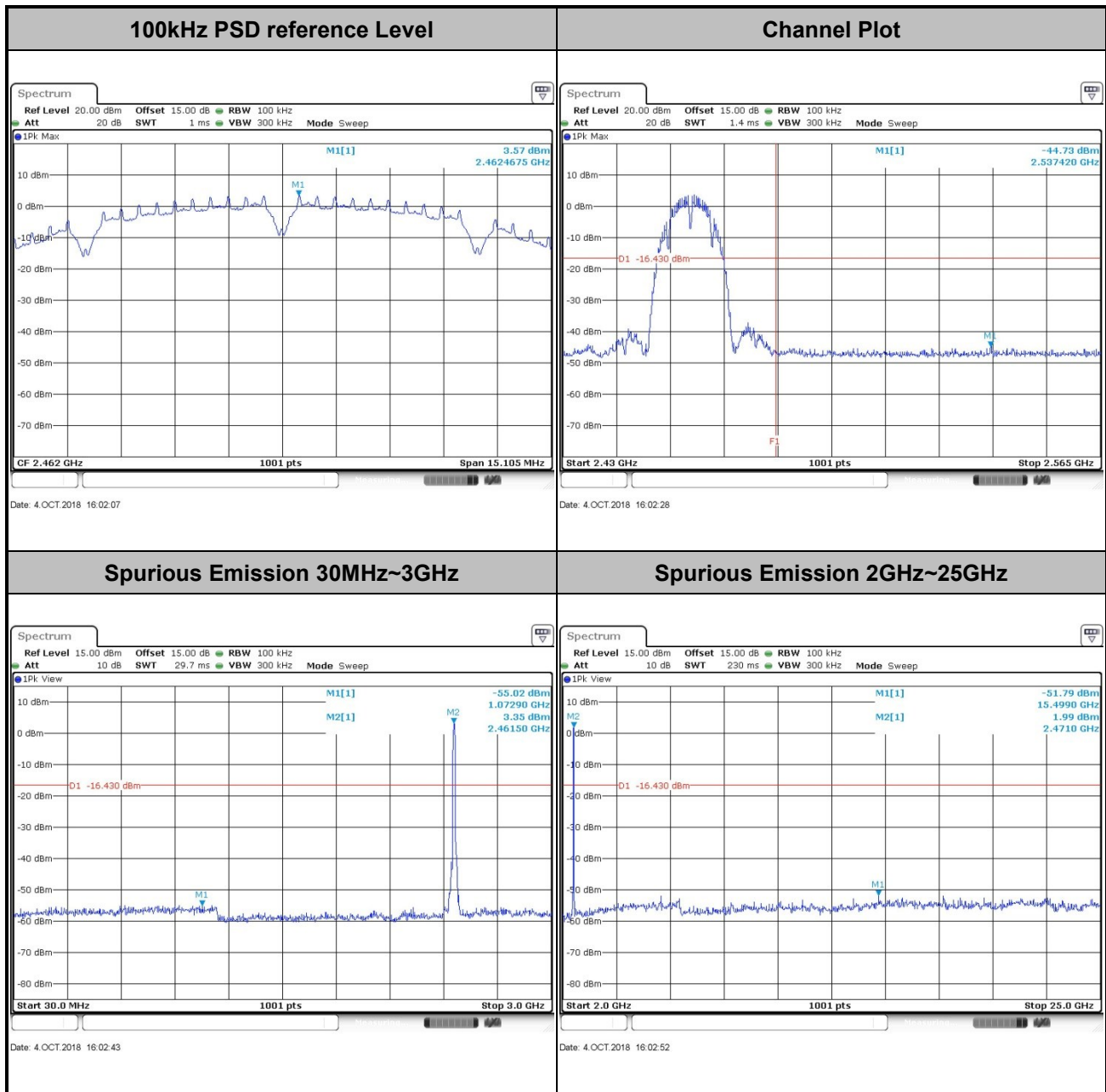


Spurious Emission 2GHz~25GHz





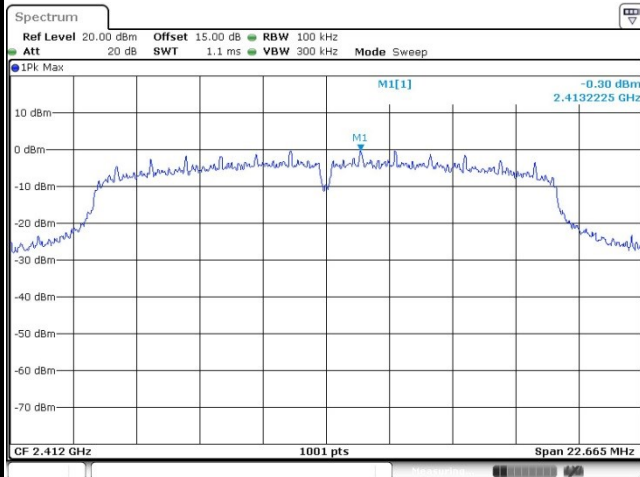
Test Mode :	802.11b	Test Channel :	11
-------------	---------	----------------	----





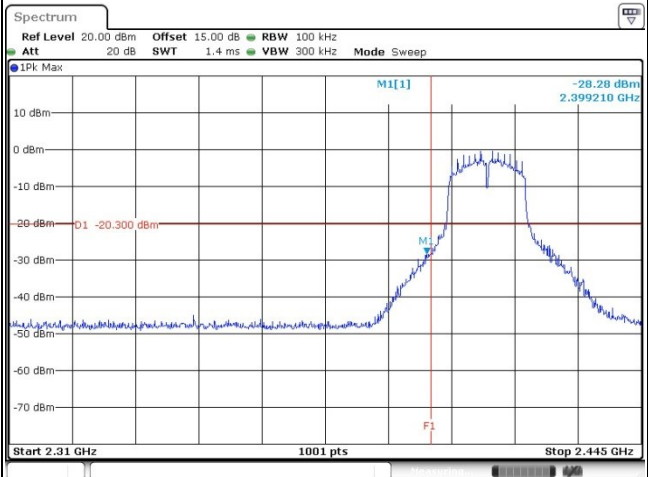
Test Mode :	802.11g	Test Channel :	01
-------------	---------	----------------	----

100kHz PSD reference Level



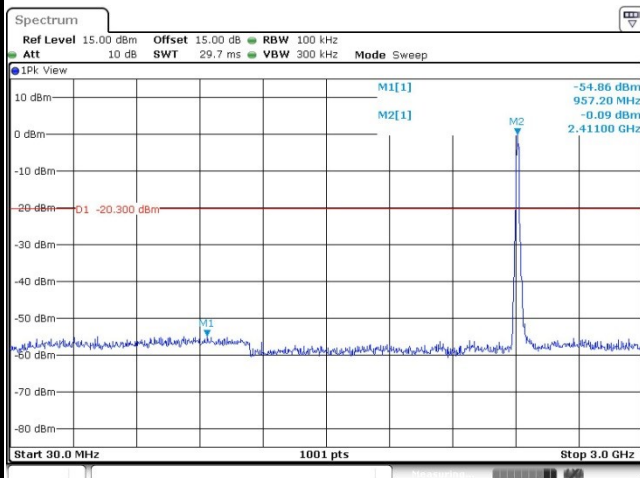
Date: 4.OCT.2018 16:09:13

Channel Plot



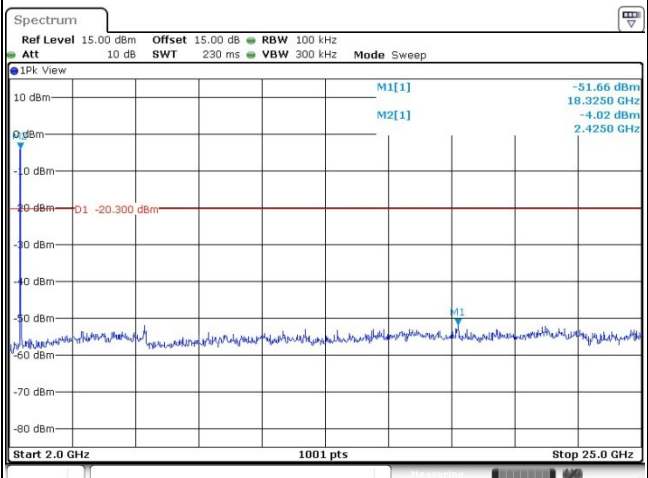
Date: 4.OCT.2018 16:10:31

Spurious Emission 30MHz~3GHz



Date: 4.OCT.2018 16:10:46

Spurious Emission 2GHz~25GHz

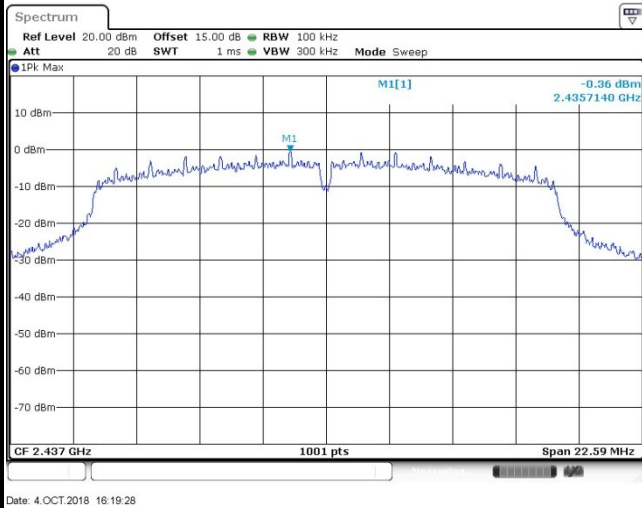


Date: 4.OCT.2018 16:10:54

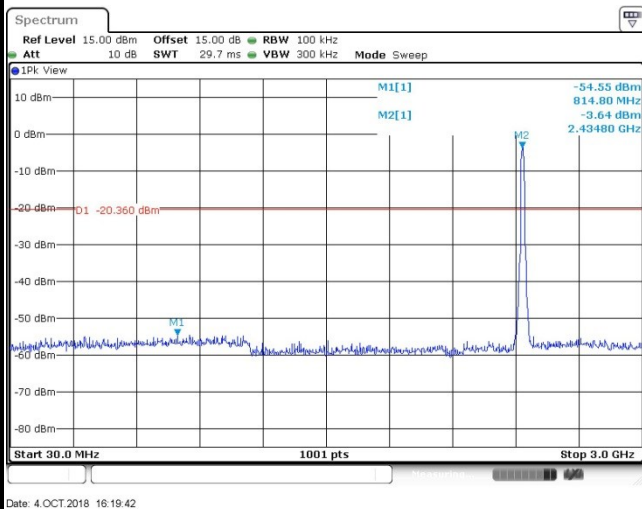


Test Mode :	802.11g	Test Channel :	06
-------------	---------	----------------	----

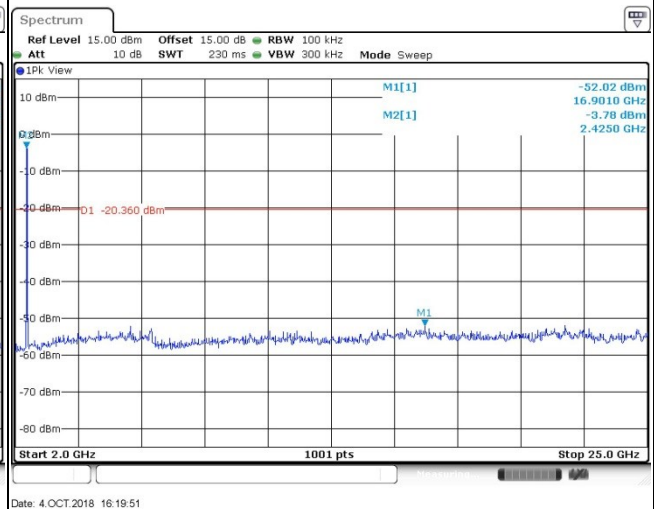
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz

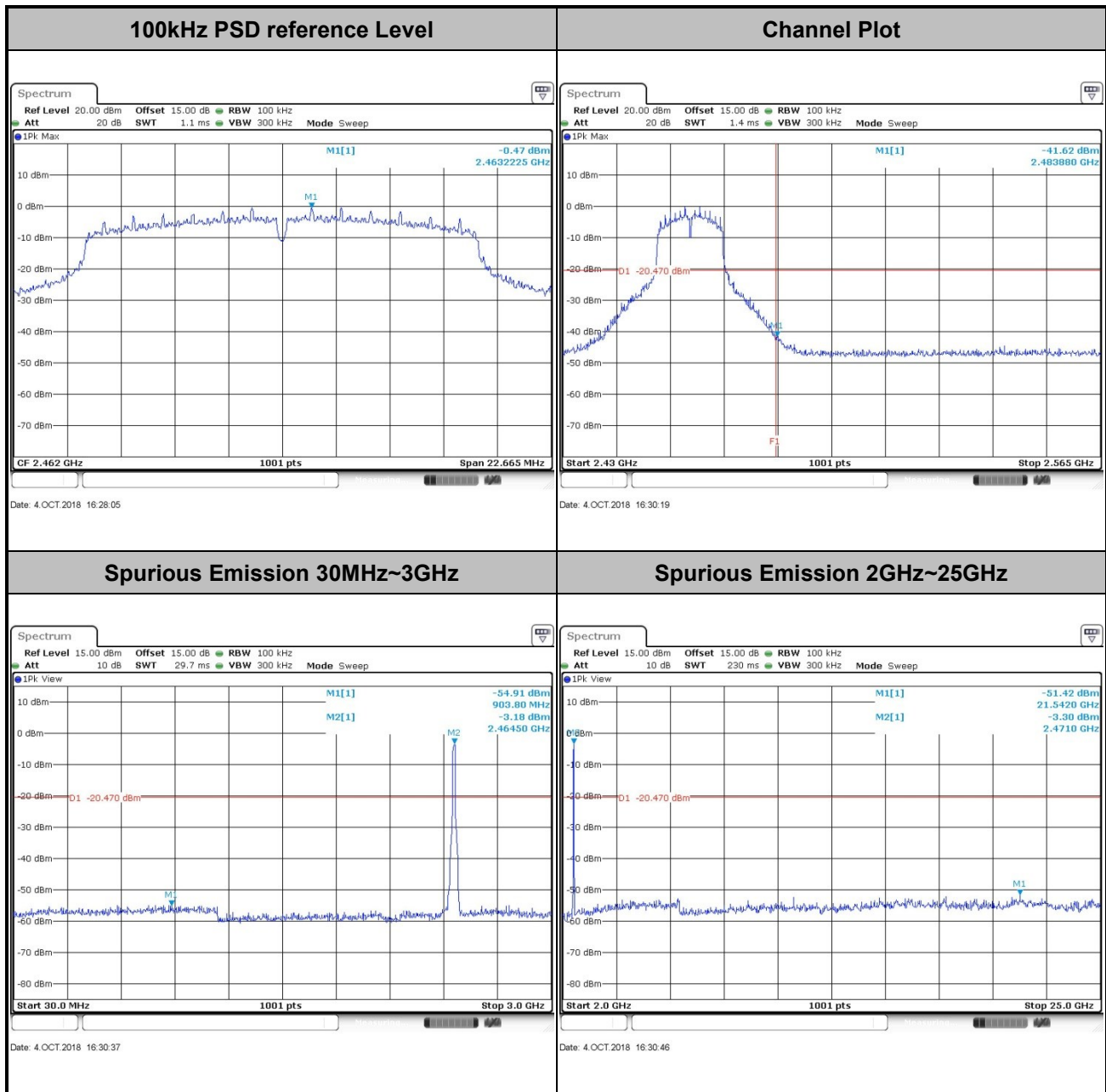


Spurious Emission 2GHz~25GHz





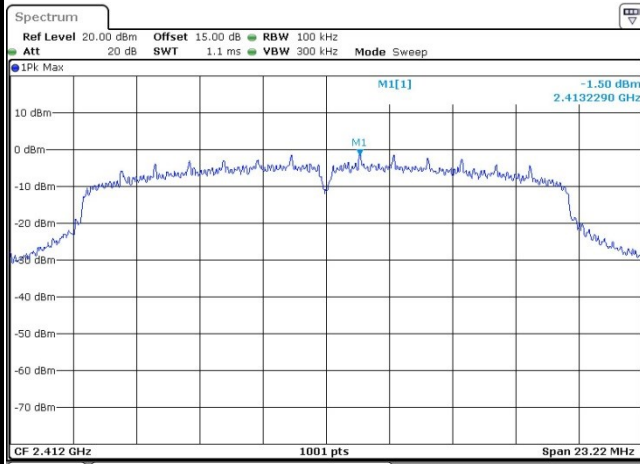
Test Mode :	802.11g	Test Channel :	11
-------------	---------	----------------	----





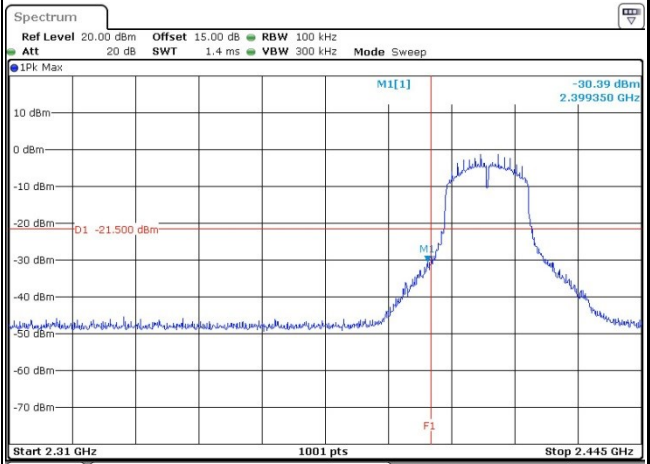
Test Mode :	802.11n HT20	Test Channel :	01
-------------	--------------	----------------	----

100kHz PSD reference Level



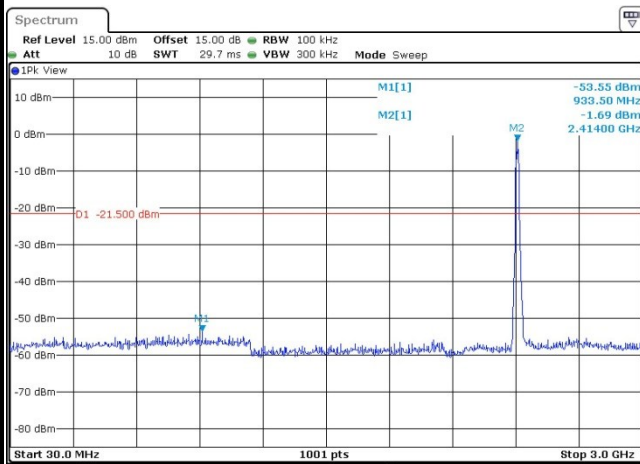
Date: 4.OCT.2018 16:37:04

Channel Plot



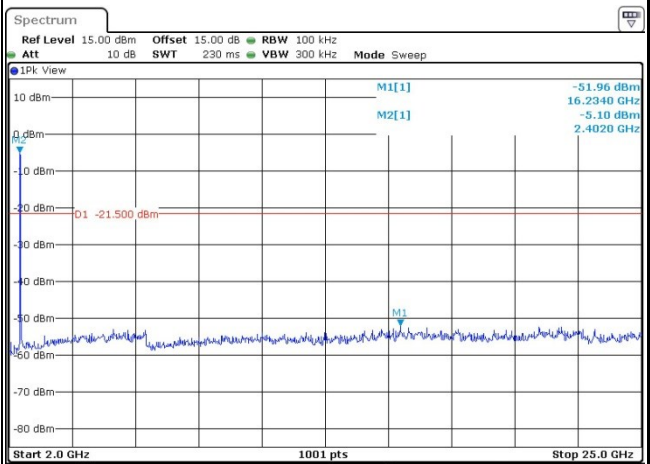
Date: 4.OCT.2018 16:37:28

Spurious Emission 30MHz~3GHz



Date: 4.OCT.2018 16:37:46

Spurious Emission 2GHz~25GHz



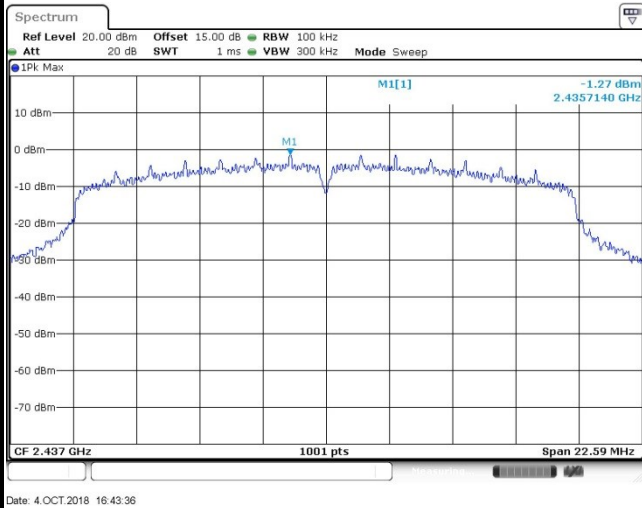
Date: 4.OCT.2018 16:37:54



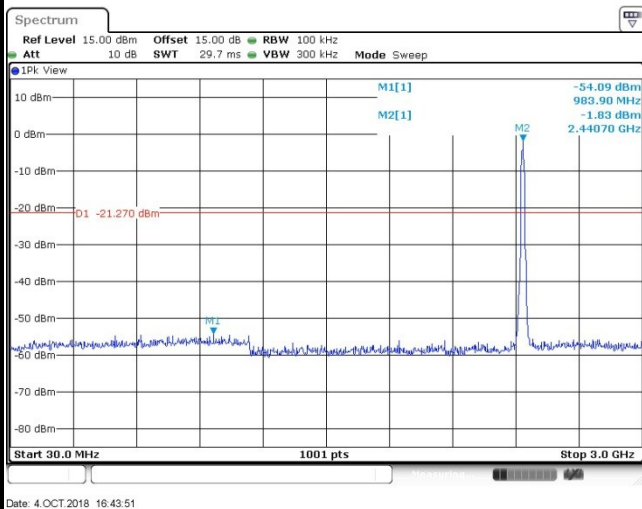
Test Mode : 802.11n HT20

Test Channel : 06

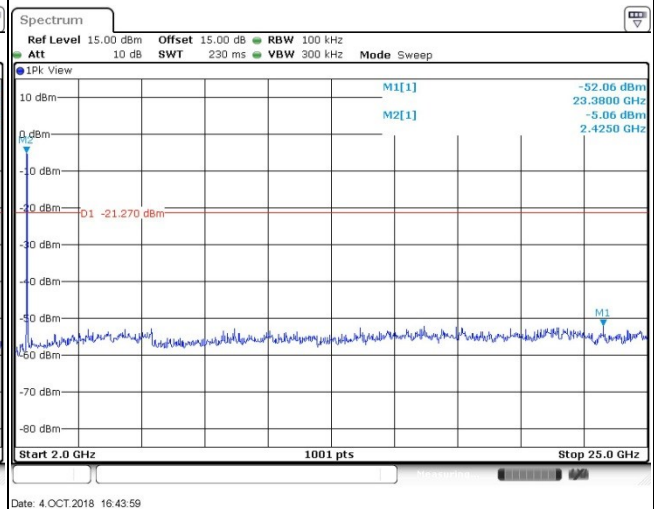
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz

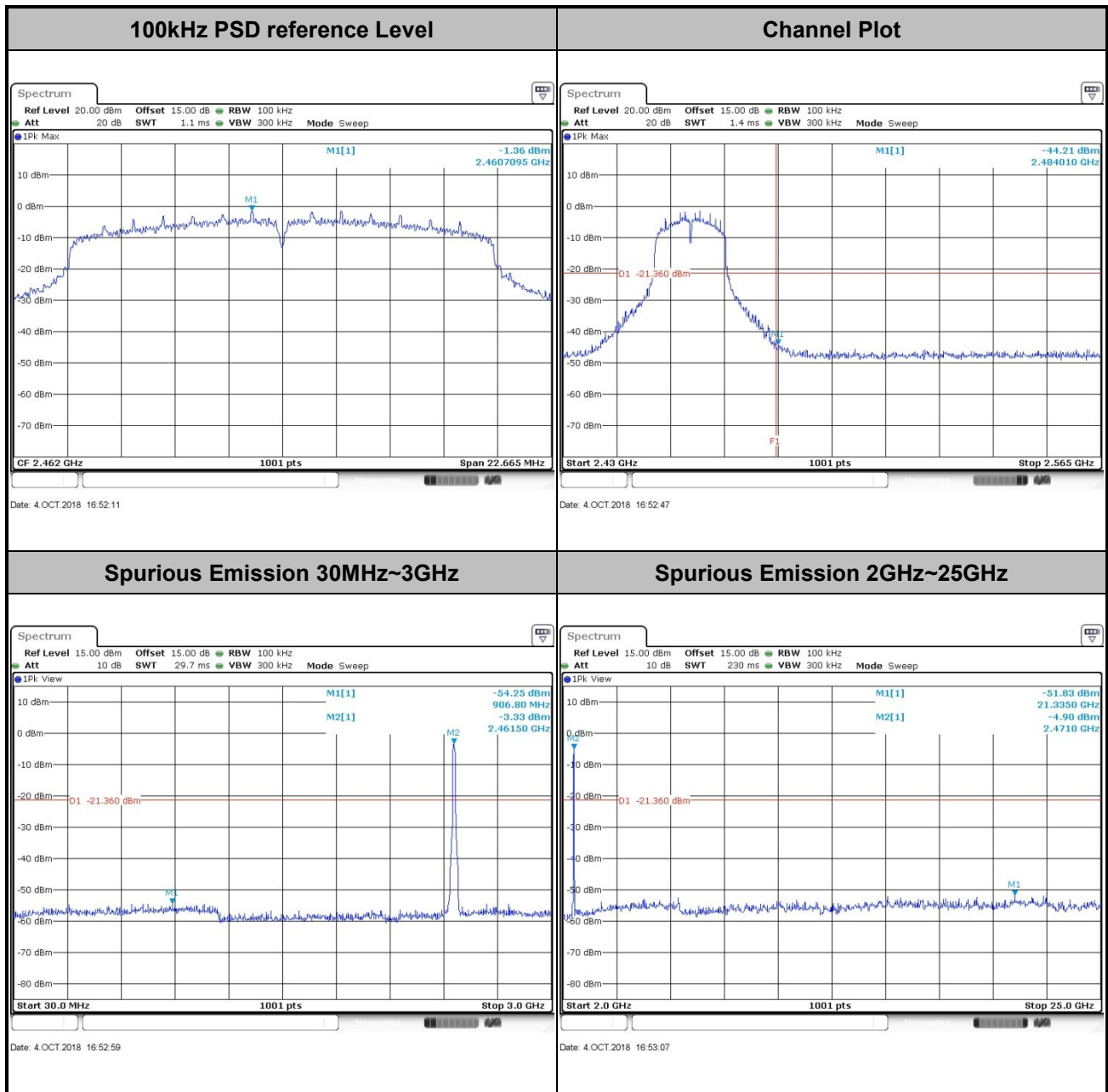


Spurious Emission 2GHz~25GHz





Test Mode :	802.11n HT20	Test Channel :	11
-------------	--------------	----------------	----



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

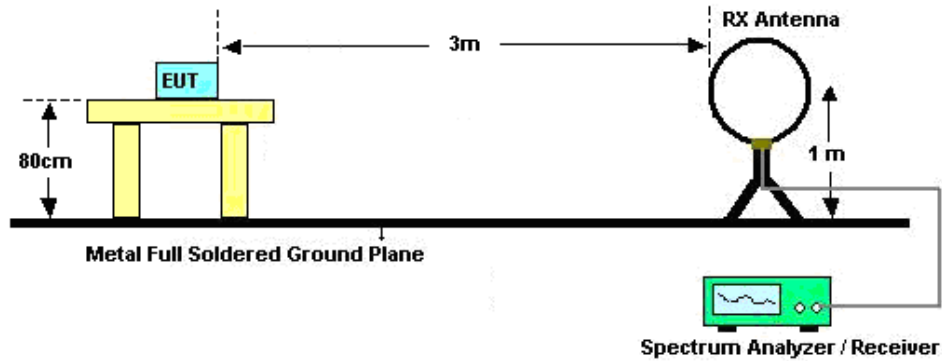
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test 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:

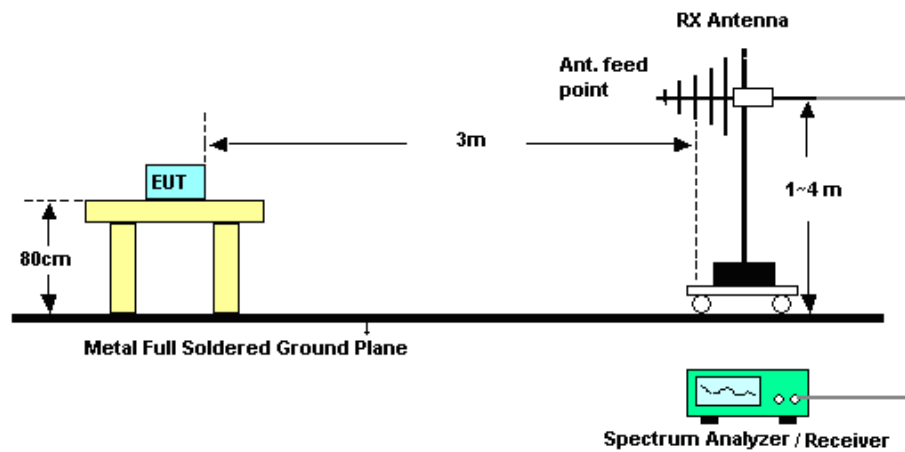
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

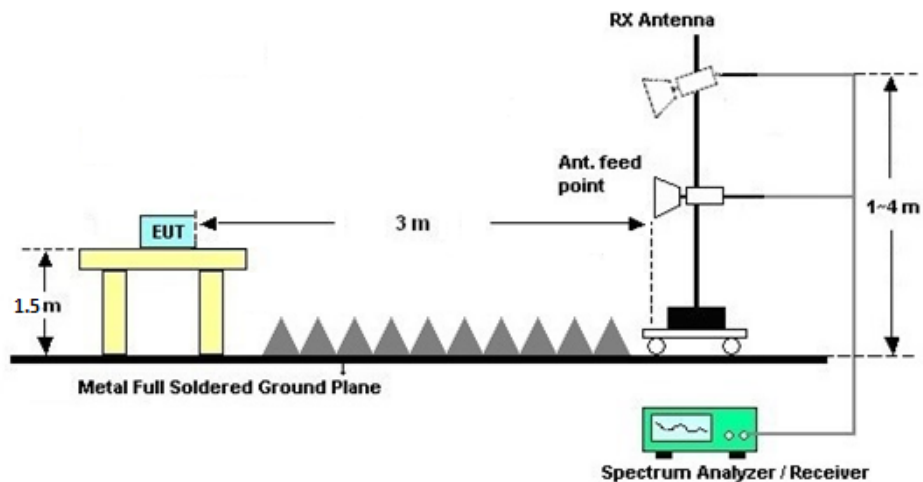
For radiated emissions below 30MHz



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 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. 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.

3.6.2 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	Apr. 19, 2018	Oct. 04, 2018	Apr. 18, 2019	Conducted (TH01-SZ)
Pulse Power Sensor	Anritsu	MA2411B	1207253	30MHz~40GHz	Dec. 26, 2017	Oct. 04, 2018	Dec. 25, 2018	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1218010	50MHz Bandwidth	Dec. 26, 2017	Oct. 04, 2018	Dec. 25, 2018	Conducted (TH01-SZ)
Spectrum Analyzer	R&S	FSV40	101041	10kHz~40GHz; Max 30dBm	Oct. 19, 2017	Sep. 13, 2018~ Oct. 03, 2018	Oct. 18, 2018	Radiation (03CH02-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	May 14, 2018	Sep. 13, 2018~ Oct. 03, 2018	May 13, 2019	Radiation (03CH02-SZ)
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz~2GHz	May 10, 2018	Sep. 13, 2018~ Oct. 03, 2018	May 09, 2019	Radiation (03CH02-SZ)
Double Ridge Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1285	1GHz~18GHz	Dec. 13, 2017	Sep. 13, 2018~ Oct. 03, 2018	Dec. 12, 2018	Radiation (03CH02-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18GHz~40GHz	Mar. 30, 2018	Sep. 13, 2018~ Oct. 03, 2018	Mar. 29, 2019	Radiation (03CH02-SZ)
LF Amplifier	Burgeon	BPA-530	102211	0.01~3000Mhz	Oct. 19, 2017	Sep. 13, 2018~ Oct. 03, 2018	Oct. 18, 2018	Radiation (03CH02-SZ)
HF Amplifier	MITEQ	AMF-7D-0010 1800-30-10P-R	1707137	1GHz~18GHz	Oct. 19, 2017	Sep. 13, 2018~ Oct. 03, 2018	Oct. 18, 2018	Radiation (03CH02-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 30, 2018	Sep. 13, 2018~ Oct. 03, 2018	Jul. 29, 2019	Radiation (03CH02-SZ)
Amplifier	Agilent	8449B	3008A01023	1GHz~26.5GHz	Oct. 19, 2017	Sep. 13, 2018~ Oct. 03, 2018	Oct. 18, 2018	Radiation (03CH02-SZ)
AC Power Source	Chroma	61601	616010002470	N/A	NCR	Sep. 13, 2018~ Oct. 03, 2018	NCR	Radiation (03CH02-SZ)
Turn Table	Chaintek	T-200	N/A	0~360 degree	NCR	Sep. 13, 2018~ Oct. 03, 2018	NCR	Radiation (03CH02-SZ)
Antenna Mast	Chaintek	MBS-400	N/A	1 m~4 m	NCR	Sep. 13, 2018~ Oct. 03, 2018	NCR	Radiation (03CH02-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 (1000 MHz ~ 18000 MHz)

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

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.4 dB
--	--------



Appendix A. Conducted test results

A1 - DTS Part

Test Engineer:	Shuai Qian	Temperature:	24~26	°C
Test Date:	2018/10/4	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	14.74	10.03	0.50	Pass
11b	1Mbps	1	6	2437	14.69	10.05	0.50	Pass
11b	1Mbps	1	11	2462	14.84	10.07	0.50	Pass
11g	6Mbps	1	1	2412	20.13	15.11	0.50	Pass
11g	6Mbps	1	6	2437	19.33	15.07	0.50	Pass
11g	6Mbps	1	11	2462	20.13	15.11	0.50	Pass
HT20	MCS0	1	1	2412	20.18	15.49	0.50	Pass
HT20	MCS0	1	6	2437	19.78	15.07	0.50	Pass
HT20	MCS0	1	11	2462	20.08	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	15.17	30.00	2.40	17.57	36.00	Pass
11b	1Mbps	1	6	2437	15.52	30.00	2.40	17.92	36.00	Pass
11b	1Mbps	1	11	2462	15.58	30.00	2.40	17.98	36.00	Pass
11g	6Mbps	1	1	2412	17.76	30.00	2.40	20.16	36.00	Pass
11g	6Mbps	1	6	2437	18.49	30.00	2.40	20.89	36.00	Pass
11g	6Mbps	1	11	2462	18.07	30.00	2.40	20.47	36.00	Pass
HT20	MCS0	1	1	2412	17.75	30.00	2.40	20.15	36.00	Pass
HT20	MCS0	1	6	2437	18.28	30.00	2.40	20.68	36.00	Pass
HT20	MCS0	1	11	2462	17.89	30.00	2.40	20.29	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	0.06	13.30
11b	1Mbps	1	6	2437	0.06	13.68
11b	1Mbps	1	11	2462	0.06	13.74
11g	6Mbps	1	1	2412	0.42	11.42
11g	6Mbps	1	6	2437	0.42	11.44
11g	6Mbps	1	11	2462	0.42	11.49
HT20	MCS0	1	1	2412	0.61	10.46
HT20	MCS0	1	6	2437	0.61	10.42
HT20	MCS0	1	11	2462	0.61	10.34

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	-9.72	2.40	8.00	Pass
11b	1Mbps	1	6	2437	-9.64	2.40	8.00	Pass
11b	1Mbps	1	11	2462	-8.57	2.40	8.00	Pass
11g	6Mbps	1	1	2412	-14.00	2.40	8.00	Pass
11g	6Mbps	1	6	2437	-14.12	2.40	8.00	Pass
11g	6Mbps	1	11	2462	-13.59	2.40	8.00	Pass
HT20	MCS0	1	1	2412	-15.43	2.40	8.00	Pass
HT20	MCS0	1	6	2437	-15.95	2.40	8.00	Pass
HT20	MCS0	1	11	2462	-15.35	2.40	8.00	Pass



Appendix B. Radiated Spurious Emission

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	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		2386.65	49.99	-24.01	74	47.61	27.09	31.28	6.57	227	334	P	H
		2390	41.9	-12.1	54	39.49	27.09	31.28	6.6	227	334	A	H
	*	2412	106.01	-	-	103.53	27.14	31.26	6.6	227	334	P	H
	*	2412	103.02	-	-	100.54	27.14	31.26	6.6	227	334	A	H
		2389.38	48.31	-25.69	74	45.9	27.09	31.28	6.6	224	265	P	V
		2390	38.38	-15.62	54	35.97	27.09	31.28	6.6	224	265	A	V
	*	2412	99.79	-	-	97.31	27.14	31.26	6.6	224	265	P	V
	*	2412	96.83	-	-	94.35	27.14	31.26	6.6	224	265	A	V
802.11b CH 06 2437MHz		2387.56	47.81	-26.19	74	50.77	27.09	36.65	6.6	100	294	P	H
		2389.94	38.19	-15.81	54	41.14	27.09	36.64	6.6	100	294	A	H
	*	2437	106.28	-	-	109.06	27.24	36.65	6.63	100	294	P	H
	*	2437	103.23	-	-	106.01	27.24	36.65	6.63	100	294	P	H
		2486.77	49.07	-24.93	74	51.7	27.35	36.68	6.7	100	294	P	H
		2483.62	38.52	-15.48	54	41.15	27.35	36.68	6.7	100	294	A	H
		2385.04	47.61	-26.39	74	50.65	27.04	36.65	6.57	359	266	P	V
		2389.94	37.36	-16.64	54	40.31	27.09	36.64	6.6	359	266	A	V
	*	2437	102.46	-	-	105.24	27.24	36.65	6.63	359	266	P	V
	*	2437	99.41	-	-	102.19	27.24	36.65	6.63	359	266	P	V
		2487.33	47.45	-26.55	74	50.08	27.35	36.68	6.7	359	266	P	V
		2484.67	37.35	-16.65	54	39.98	27.35	36.68	6.7	359	266	A	V



802.11b CH 11 2462MHz	*	2462	105.81	-	-	103.08	27.3	31.24	6.67	245	336	P	H
	*	2462	102.78	-	-	100.05	27.3	31.24	6.67	245	336	A	H
		2486.96	52.87	-21.13	74	50.04	27.35	31.22	6.7	245	336	P	H
		2487.4	46.47	-7.53	54	43.64	27.35	31.22	6.7	245	336	A	H
	*	2462	99.54	-	-	96.81	27.3	31.24	6.67	247	269	P	V
	*	2462	96.46	-	-	93.73	27.3	31.24	6.67	247	269	A	V
		2487.36	49.76	-24.24	74	46.93	27.35	31.22	6.7	247	269	P	V
		2487.36	40.5	-13.5	54	37.67	27.35	31.22	6.7	247	269	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		4824	46.74	-27.26	74	63.86	31.42	58.19	9.65	185	255	P	H
		4824	45.28	-28.72	74	62.4	31.42	58.19	9.65	185	255	P	V
802.11b CH 06 2437MHz		4874	44.72	-29.28	74	61.6	31.51	58.1	9.71	165	106	P	H
		7311	45.59	-28.41	74	55.14	36.36	57.92	12.01	174	100	P	H
		4874	45.24	-28.76	74	62.12	31.51	58.1	9.71	165	106	P	V
		7311	46.06	-27.94	74	55.61	36.36	57.92	12.01	174	100	P	V
802.11b CH 11 2462MHz		4924	49.17	-24.83	74	65.83	31.59	58.02	9.77	150	285	P	H
		7386	47.06	-26.94	74	55.98	36.65	57.65	12.08	155	274	P	H
		4924	47.83	-26.17	74	64.49	31.59	58.02	9.77	150	285	P	V
		7386	47	-27	74	55.92	36.65	57.65	12.08	155	274	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



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

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		2389.59	64.59	-9.41	74	62.18	27.09	31.28	6.6	234	334	P	H
		2390	50.06	-3.94	54	47.65	27.09	31.28	6.6	234	334	A	H
	*	2412	105.58	-	-	103.1	27.14	31.26	6.6	234	334	P	H
	*	2412	97.68	-	-	95.2	27.14	31.26	6.6	234	334	A	H
		2390	57.46	-16.54	74	55.05	27.09	31.28	6.6	234	42	P	V
		2390	45.03	-8.97	54	42.62	27.09	31.28	6.6	234	42	A	V
	*	2412	99.51	-	-	97.03	27.14	31.26	6.6	234	42	P	V
	*	2412	92	-	-	89.52	27.14	31.26	6.6	234	42	A	V
802.11g CH 06 2437MHz		2378.46	47.07	-26.93	74	44.77	27.04	31.31	6.57	195	332	P	H
		2388.4	37.63	-16.37	54	35.22	27.09	31.28	6.6	195	332	A	H
	*	2437	105.42	-	-	102.81	27.24	31.26	6.63	195	332	P	H
	*	2437	97.59	-	-	94.98	27.24	31.26	6.63	195	332	A	H
		2483.55	48.91	-25.09	74	46.08	27.35	31.22	6.7	195	332	P	H
		2483.76	39.13	-14.87	54	36.3	27.35	31.22	6.7	195	332	A	H
		2389.94	48.05	-25.95	74	45.64	27.09	31.28	6.6	230	44	P	V
		2389.94	37.07	-16.93	54	34.66	27.09	31.28	6.6	230	44	A	V
	*	2437	100.02	-	-	97.41	27.24	31.26	6.63	230	44	P	V
	*	2437	92.17	-	-	89.56	27.24	31.26	6.63	230	44	A	V
		2486	47.89	-26.11	74	45.06	27.35	31.22	6.7	230	44	P	V
		2484.11	37.93	-16.07	54	35.1	27.35	31.22	6.7	230	44	A	V



802.11g CH 11 2462MHz	*	2462	105.5	-	-	102.77	27.3	31.24	6.67	161	332	P	H
	*	2462	97.58	-	-	94.85	27.3	31.24	6.67	161	332	A	H
		2483.52	65.44	-8.56	74	62.61	27.35	31.22	6.7	161	332	P	H
		2483.52	49.92	-4.08	54	47.09	27.35	31.22	6.7	161	332	A	H
	*	2462	100.37	-	-	97.64	27.3	31.24	6.67	180	42	P	V
	*	2462	92.71	-	-	89.98	27.3	31.24	6.67	180	42	A	V
		2484.04	60.91	-13.09	74	58.08	27.35	31.22	6.7	180	42	P	V
		2483.52	46.41	-7.59	54	43.58	27.35	31.22	6.7	180	42	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		4824	39.89	-34.11	74	57.01	31.42	58.19	9.65	185	255	P	H
		4824	39.39	-34.61	74	56.51	31.42	58.19	9.65	185	255	P	V
802.11g CH 06 2437MHz		4874	41.26	-32.74	74	58.14	31.51	58.1	9.71	165	106	P	H
		7311	47.26	-26.74	74	56.81	36.36	57.92	12.01	174	100	P	H
		4874	39.05	-34.95	74	55.93	31.51	58.1	9.71	165	106	P	V
		7311	46.15	-27.85	74	55.7	36.36	57.92	12.01	174	100	P	V
802.11g CH 11 2462MHz		4924	41.12	-32.88	74	57.78	31.59	58.02	9.77	150	285	P	H
		7386	46.14	-27.86	74	55.06	36.65	57.65	12.08	155	274	P	H
		4924	41.08	-32.92	74	57.74	31.59	58.02	9.77	150	285	P	V
		7386	45.93	-28.07	74	54.85	36.65	57.65	12.08	155	274	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		2389.90	64.82	-9.18	74	62.41	27.09	31.28	6.6	229	332	P	H
		2390.01	49.1	-100.9	150	46.69	27.09	31.28	6.6	229	332	A	H
	*	2412	104.89	-	-	102.41	27.14	31.26	6.6	229	332	P	H
	*	2412	96.86	-	-	94.38	27.14	31.26	6.6	229	332	A	H
		2389.48	59.36	-14.64	74	56.95	27.09	31.28	6.6	278	264	P	V
		2390.01	43.56	-106.44	150	41.15	27.09	31.28	6.6	278	264	A	V
	*	2412	100.43	-	-	97.95	27.14	31.26	6.6	278	264	P	V
	*	2412	92.18	-	-	89.7	27.14	31.26	6.6	278	264	A	V
802.11n HT20 CH 06 2437MHz		2389.52	47.57	-26.43	74	45.16	27.09	31.28	6.6	224	332	P	H
		2389.24	37.54	-16.46	54	35.13	27.09	31.28	6.6	224	332	A	H
	*	2437	104.69	-	-	102.08	27.24	31.26	6.63	224	332	P	H
	*	2437	96.5	-	-	93.89	27.24	31.26	6.63	224	332	A	H
		2486.49	48.21	-25.79	74	45.38	27.35	31.22	6.7	224	332	P	H
		2485.58	38.72	-15.28	54	35.89	27.35	31.22	6.7	224	332	A	H
		2389.52	47.58	-26.42	74	45.17	27.09	31.28	6.6	251	266	P	V
		2389.8	37.29	-16.71	54	34.88	27.09	31.28	6.6	251	266	A	V
	*	2437	99.21	-	-	96.6	27.24	31.26	6.63	251	266	P	V
	*	2437	91.48	-	-	88.87	27.24	31.26	6.63	251	266	A	V
		2485.65	47.01	-26.99	74	44.18	27.35	31.22	6.7	251	266	P	V
		2483.69	37.55	-16.45	54	34.72	27.35	31.22	6.7	251	266	A	V



802.11n HT20 CH 11 2462MHz	*	2462	105.88	-	-	103.15	27.3	31.24	6.67	162	334	P	H
	*	2462	96.97	-	-	94.24	27.3	31.24	6.67	162	334	A	H
		2484.48	65.68	-8.32	74	62.85	27.35	31.22	6.7	162	334	P	H
		2483.6	48.38	-5.62	54	45.55	27.35	31.22	6.7	162	334	A	H
	*	2462	98.46	-	-	95.73	27.3	31.24	6.67	250	266	P	V
	*	2462	90.61	-	-	87.88	27.3	31.24	6.67	250	266	A	V
		2484.08	59.7	-14.3	74	56.87	27.35	31.22	6.7	250	266	P	V
		2483.52	42.3	-11.7	54	39.47	27.35	31.22	6.7	250	266	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



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

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		4824	39.92	-34.08	74	57.04	31.42	58.19	9.65	185	255	P	H
		4824	39.68	-34.32	74	56.8	31.42	58.19	9.65	185	255	P	V
802.11n HT20 CH 06 2437MHz		4874	39.21	-34.79	74	56.09	31.51	58.1	9.71	165	106	P	H
		7311	46.02	-27.98	74	55.57	36.36	57.92	12.01	174	100	P	H
		4874	39.32	-34.68	74	56.2	31.51	58.1	9.71	165	106	P	V
		7311	46.57	-27.43	74	56.12	36.36	57.92	12.01	174	100	P	V
802.11n HT20 CH 11 2462MHz		4924	41.79	-32.21	74	58.45	31.59	58.02	9.77	150	285	P	H
		7386	46.48	-27.52	74	55.4	36.65	57.65	12.08	155	274	P	H
		4924	39.8	-34.2	74	56.46	31.59	58.02	9.77	150	285	P	V
		7386	46.44	-27.56	74	55.36	36.65	57.65	12.08	155	274	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

Emission below 1GHz

2.4GHz WIFI 802.11g (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 802.11g LF		30	22.48	-17.52	40	29.4	24.8	0.25	31.97	-	-	P	H
		64.92	25.35	-14.65	40	44.25	12.2	0.8	31.9	-	-	P	H
		114.39	33.22	-10.28	43.5	46.75	17.03	1.12	31.68	100	248	P	H
		180.35	27.69	-15.81	43.5	42.69	15	1.41	31.41	-	-	P	H
		301.6	23.69	-22.31	46	33.6	19.45	1.86	31.22	-	-	P	H
		811.82	31.24	-14.76	46	30.67	28.56	3.18	31.17	-	-	P	H
		30	23.98	-16.02	40	30.9	24.8	0.25	31.97	-	-	P	V
		64.92	33.7	-6.3	40	52.6	12.2	0.8	31.9	178	269	P	V
		114.39	30.16	-13.34	43.5	43.69	17.03	1.12	31.68	-	-	P	V
		179.38	24.96	-18.54	43.5	39.91	15.07	1.4	31.42	-	-	P	V
		501.42	25.84	-20.16	46	30.72	23.92	2.43	31.23	-	-	P	V
		838.01	31.11	-14.89	46	30.37	28.69	3.23	31.18	-	-	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)

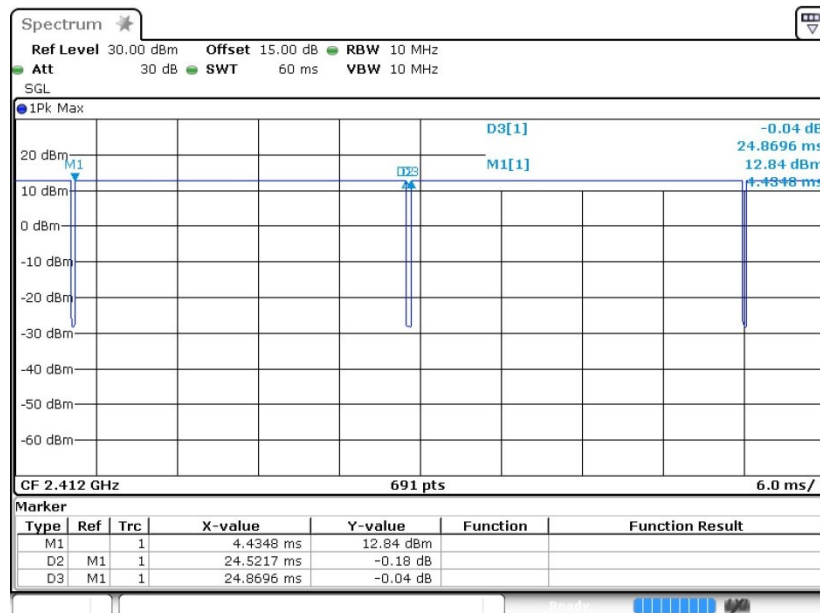
= -10.46(dB)

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

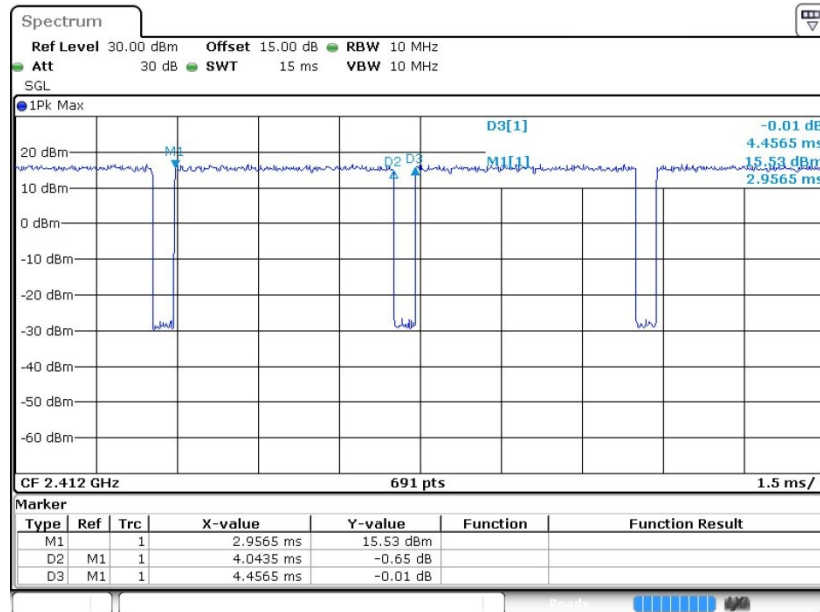
Appendix C. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
11b	98.60	-	-	10Hz
11g	90.73	4.044	0.247	300Hz
11n HT20	89.14	3.391	0.295	300Hz

11b



11g



11n HT20

