

FCC RF Test Report

APPLICANT : Verifone, Inc.
EQUIPMENT : Point of Sale Terminal
BRAND NAME : Verifone
MODEL NAME : X990
FCC ID : B32X990
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System

The product was received on Dec. 14, 2019 and testing was completed on Mar. 11, 2020. 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.

This report contains data that were produced under subcontract by Laboratory Sporton International (Kunshan) Inc.

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.



Reviewed by: Derreck Chen / Supervisor



Approved by: Eric Shih / Manager



Sporton International (ShenZhen) Inc.

1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055

People's Republic of China



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR9D1403C	Rev. 01	Initial issue of report	Apr. 03, 2020

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 3.66 dB at 2484.530 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 7.41 dB at 0.680 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.



1 General Description

1.1 Applicant

Verifone, Inc.

Suite 200 1400 W Stanford Ranch Rd Rocklin CA 95765 USA

1.2 Manufacturer

Verifone Systems (China) Inc.

Rm 318, south of Bld C18, Startup Headquarters Base, North of Fuyuan Road, Wuqing Development Area, Tianjin, China, 301700.

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Point of Sale Terminal
Brand Name	Verifone
Model Name	X990
FCC ID	B32X990
EUT supports Radios application	GSM/WCDMA/LTE WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 Bluetooth BR / EDR / LE GNSS/NFC
IMEI Code	Conducted:N/A Conduction: 869091030298516/869091030298524 Radiation: 869091030296114/869091030296122
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. There are four types of EUT, the difference between them is different suppliers for the LCD Panel. We only choose the sample 1 to perform full tests.



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 : 18.69 dBm (0.0740 W) 802.11g : 22.81 dBm (0.1910 W) 802.11n HT20 : 21.85 dBm (0.1531 W) 802.11n HT40 : 21.97 dBm (0.1574 W)
99% Occupied Bandwidth	802.11b : 13.64MHz 802.11g : 19.03MHz 802.11n HT20 : 19.43MHz 802.11n HT40 : 37.06MHz
Antenna Type / Gain	FPC Antenna with gain 1.39 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 (Kunshan) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International (Kunshan) Inc.		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	TH01-KS	CN1257	314309

Note: Test data subcontracted: Conducted test items in section 3.1~3.4 of this report.

Sporton International (Shenzhen) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Test Firm	Sporton International (Shenzhen) Inc.		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	CO01-SZ	CN1256	421272

Test Firm	Sporton International (Shenzhen) Inc.		
Test Site Location	No. 3 Bldg the third floor of south, Shahe River west, Fengzeyuan Warehouse, Nanshan Shenzhen, 518055 People's Republic of China TEL: +86-755-33202398		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	03CH02-SZ	CN1256	421272

1.7 Test Software

Item	Site	Manufacture	Name	Version
1.	03CH02-SZ	AUDIX	E3	6.2009-8-24a
2.	CO01-SZ	AUDIX	E3	6.120613b



1.8 Applicable Standards

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

- ♦ 47 CFR Part 15 Subpart C §15.247
- ♦ FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ♦ ANSI C63.10-2013

Remark:

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

2 Test Configuration of Equipment Under Test

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

2.1 Carrier Frequency and Channel

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

2.2 Test Mode

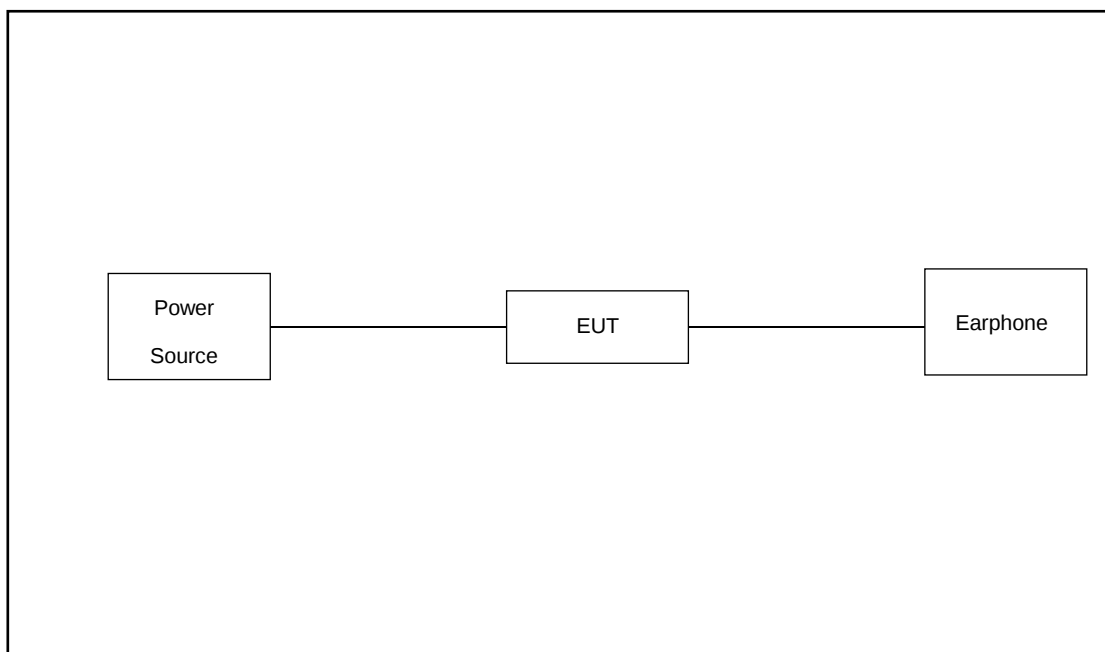
Final test modes are considering the modulation and worse data rates as below table.

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

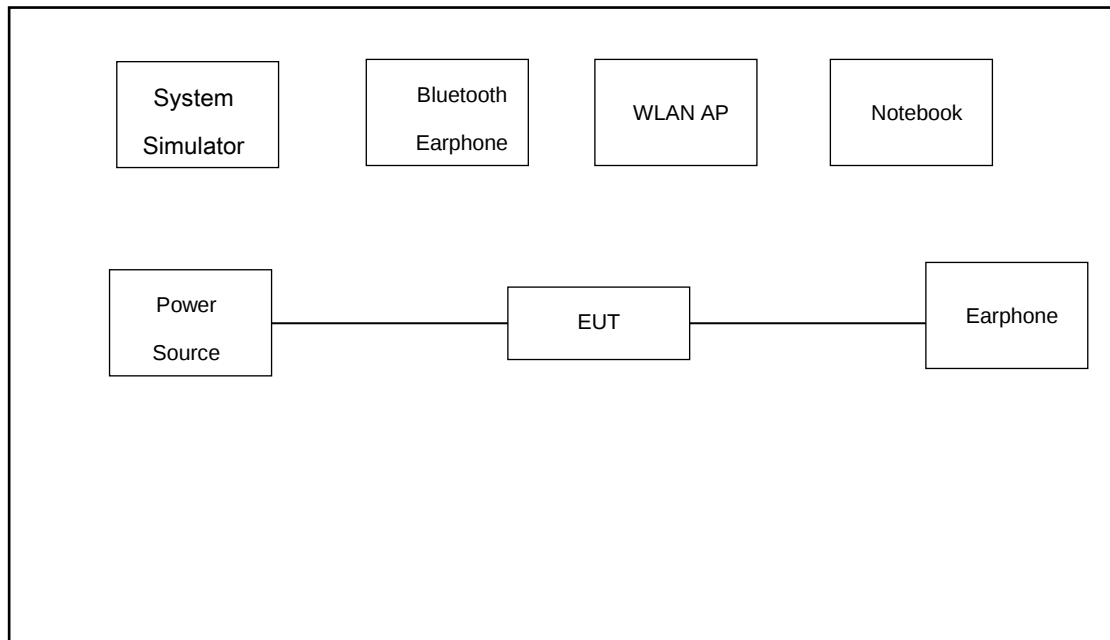
Test Cases	
AC Conducted Emission	Mode 1 :PCS1900 Idle + Bluetooth Link + WLAN Link (2.4G) + USB Cable (Charging from Adapter 1) + Earphone + SIM1
Remark: For Radiated Test Cases, The tests were performed with Adapter 1, Earphone and USB Cable	

2.3 Connection Diagram of Test System

For Radiation



For Conducted Emission



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded,1.8m
2.	WLAN AP	D-link	DIR-820L	KA2IR820LA1	N/A	Unshielded,1.8m
3.	Bluetooth Earphone	Samsung	EO-MG900	N/A	N/A	N/A
4.	Earphone	apple	DCAY1V-A9007ZJW3-000	N/A	shielded,1.2m	N/A
5.	Notebook	Lenovo	E540	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

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.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

2.6 Measurement Results Explanation Example

For all conducted test items:

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

Example:

The spectrum analyzer offset is derived from RF cable loss.

Offset = RF cable loss

Following shows an offset computation example with cable loss 5.4 dB.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)}. \\ &= 5.4 \text{ (dB)} \end{aligned}$$

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.

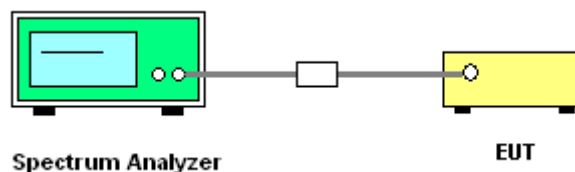
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.8
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.

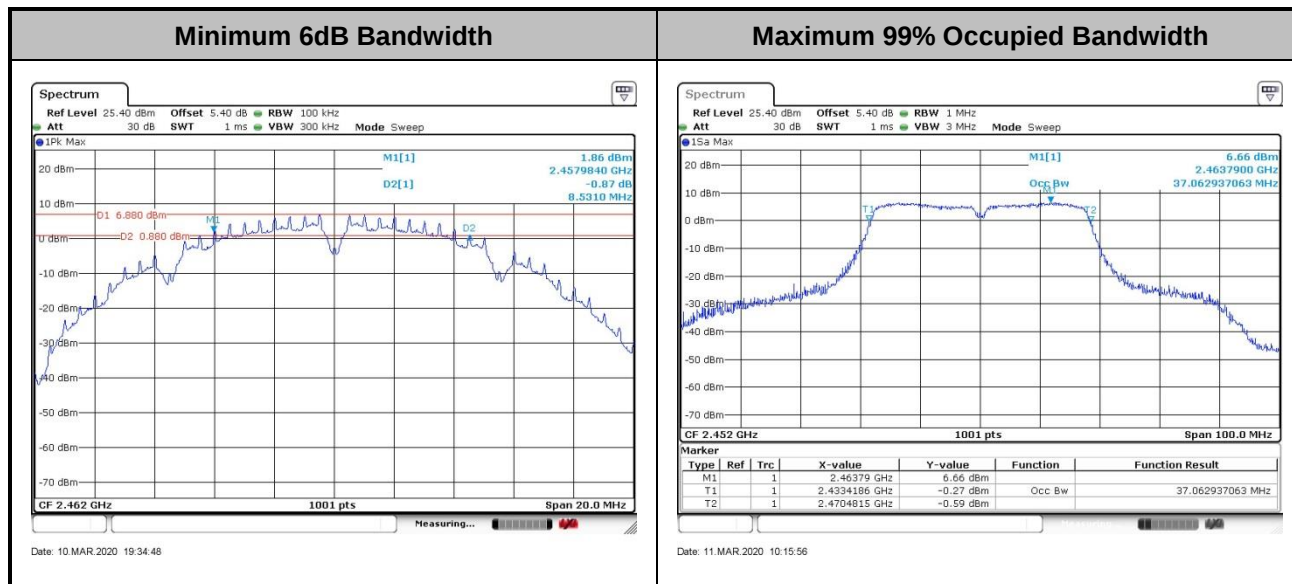
3.1.4 Test Setup





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.

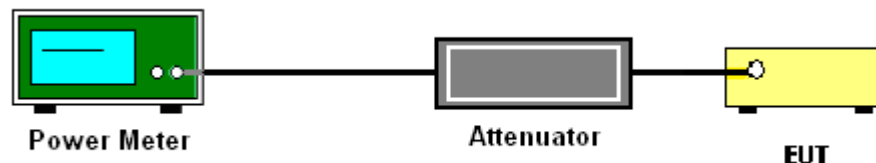
3.2.2 Measuring Instruments

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 ANSI C63.10-2013 clause 11.9.1.3 PKPM1 Peak power meter or ANSI C63.10-2013 clause 11.9.2.3.2 Method AVGPM-G 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.

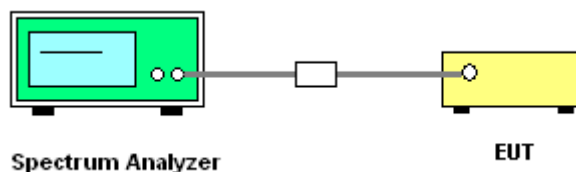
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.2 Method PKPSD.
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.

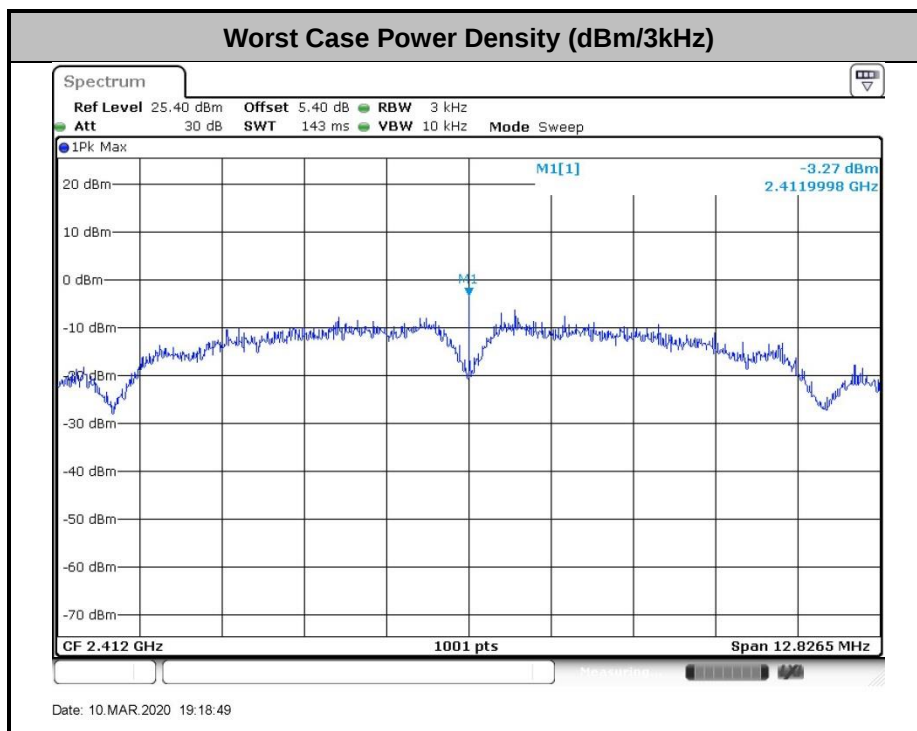
3.3.4 Test Setup





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.

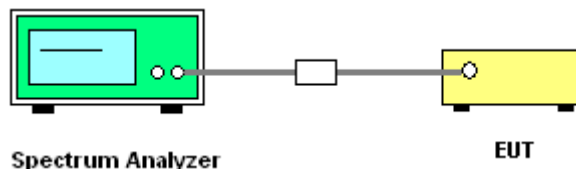
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.13
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

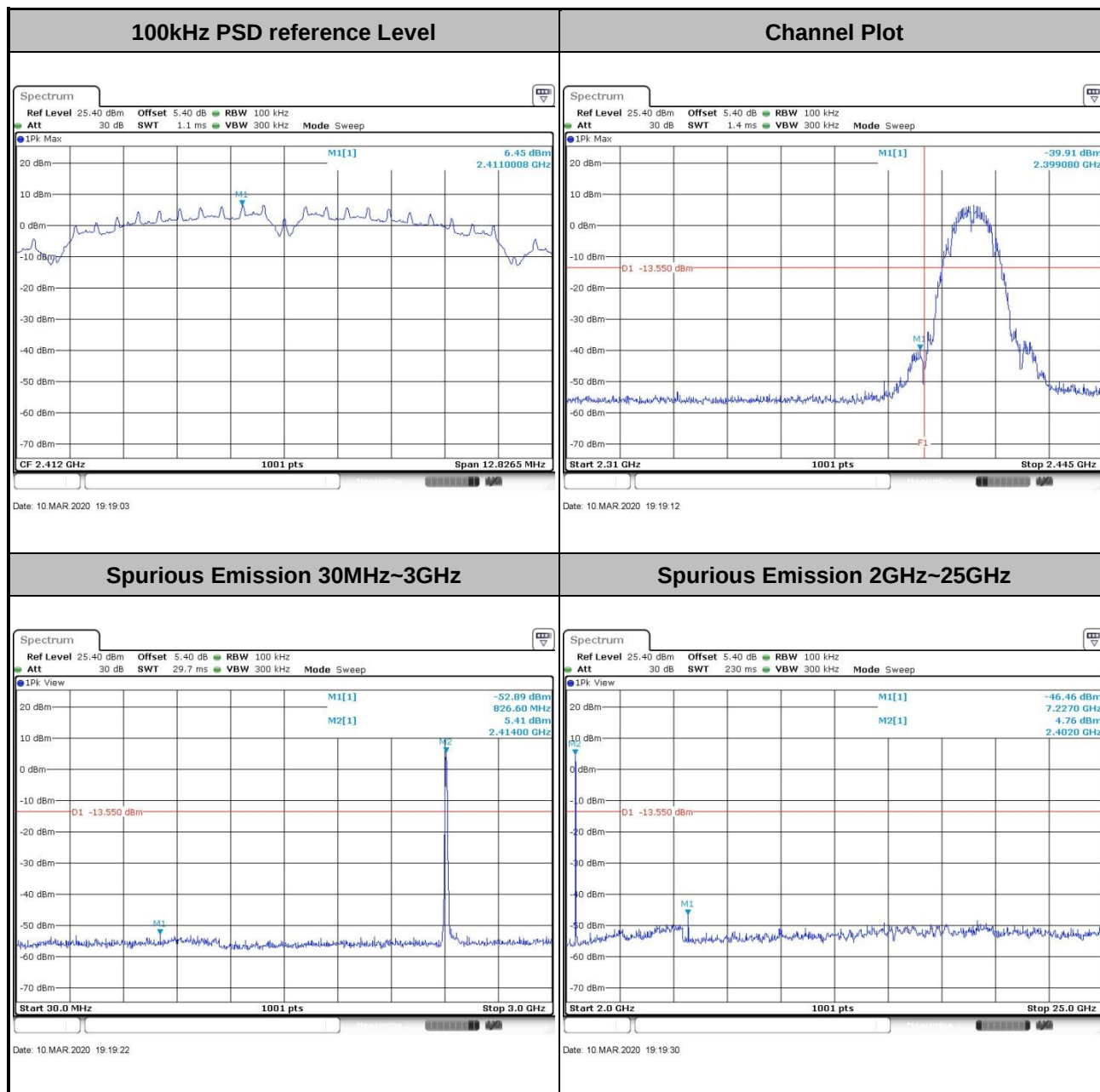




3.4.5 Test Result of Conducted Band Edges and Spurious Emission

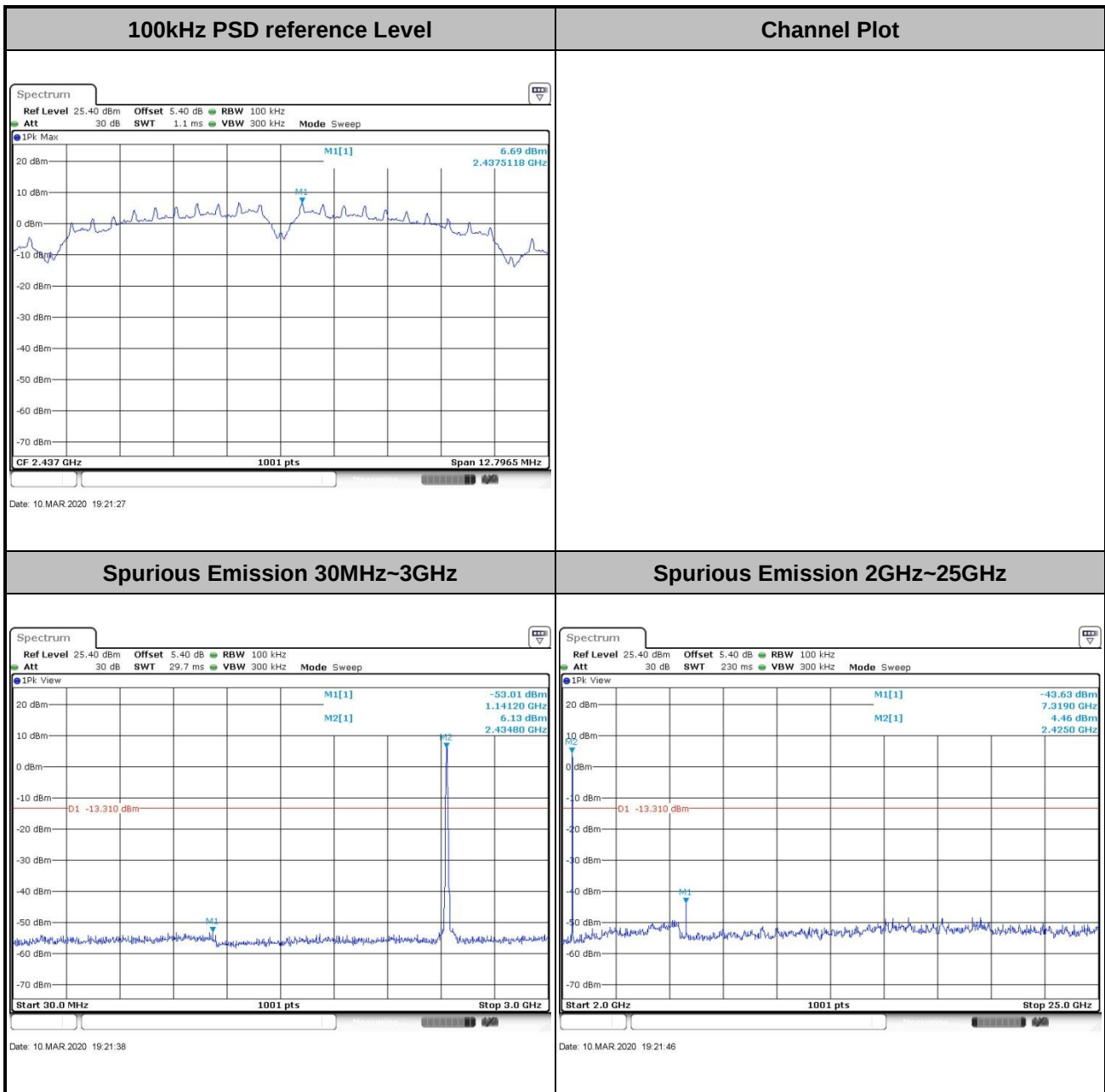
Test Engineer :	Lex Wu	Temperature :	21~25°C
		Relative Humidity :	51~54%

Test Mode :	802.11b	Test Channel :	01
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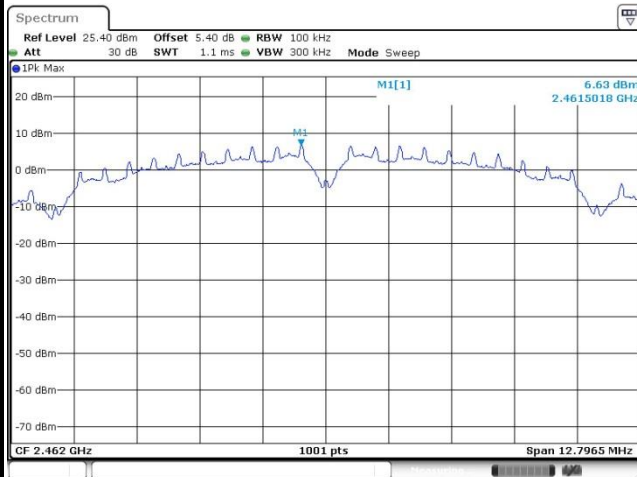
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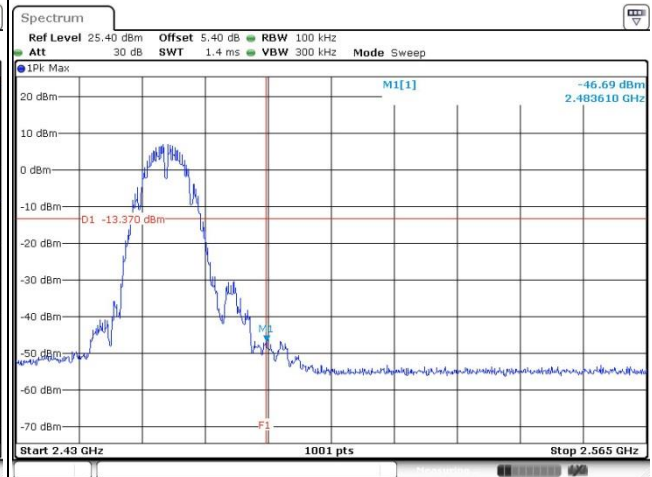
Test Mode :	802.11b	Test Channel :	11
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100kHz PSD reference Level



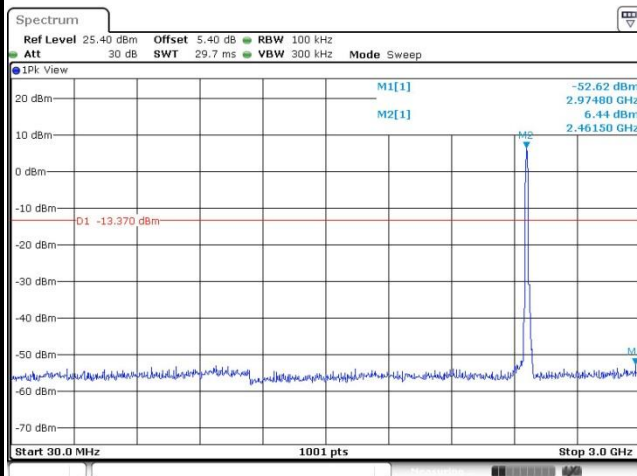
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Channel Plot



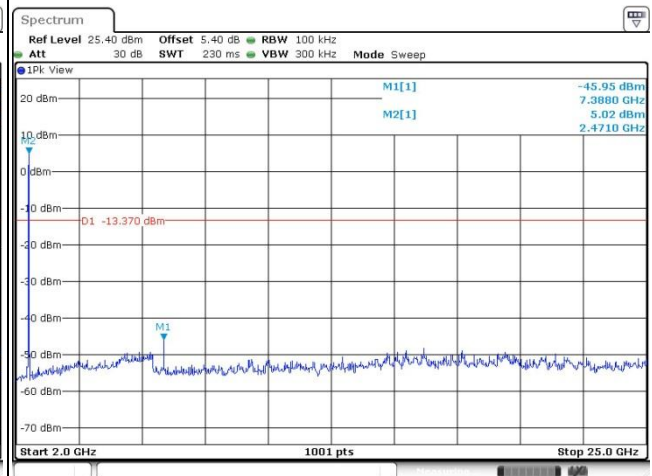
Date: 10 MAR 2020 20:00:32

Spurious Emission 30MHz~3GHz



Date: 10 MAR 2020 20:00:43

Spurious Emission 2GHz~25GHz

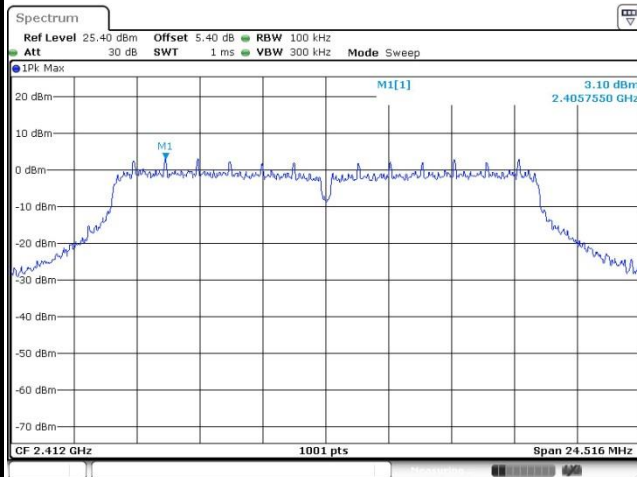


Date: 10 MAR 2020 20:00:51

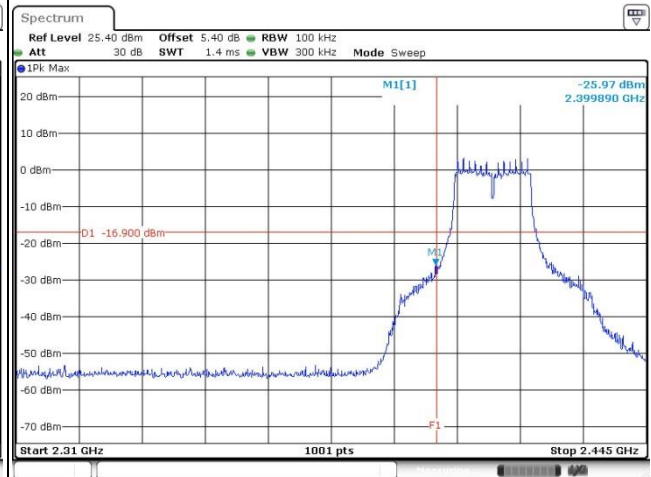


Test Mode :	802.11g	Test Channel :	01
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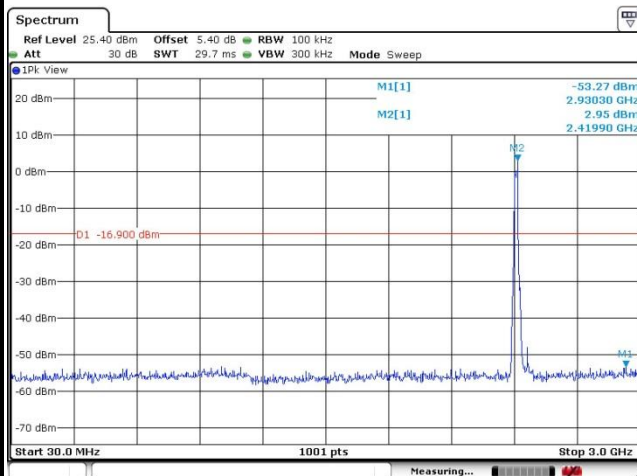
100kHz PSD reference Level



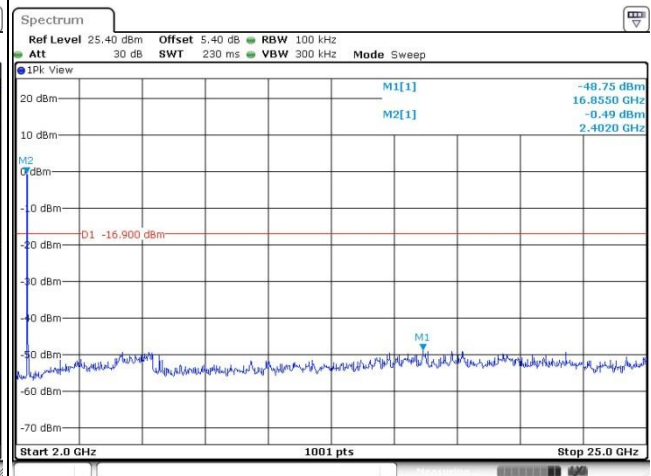
Channel Plot



Spurious Emission 30MHz~3GHz

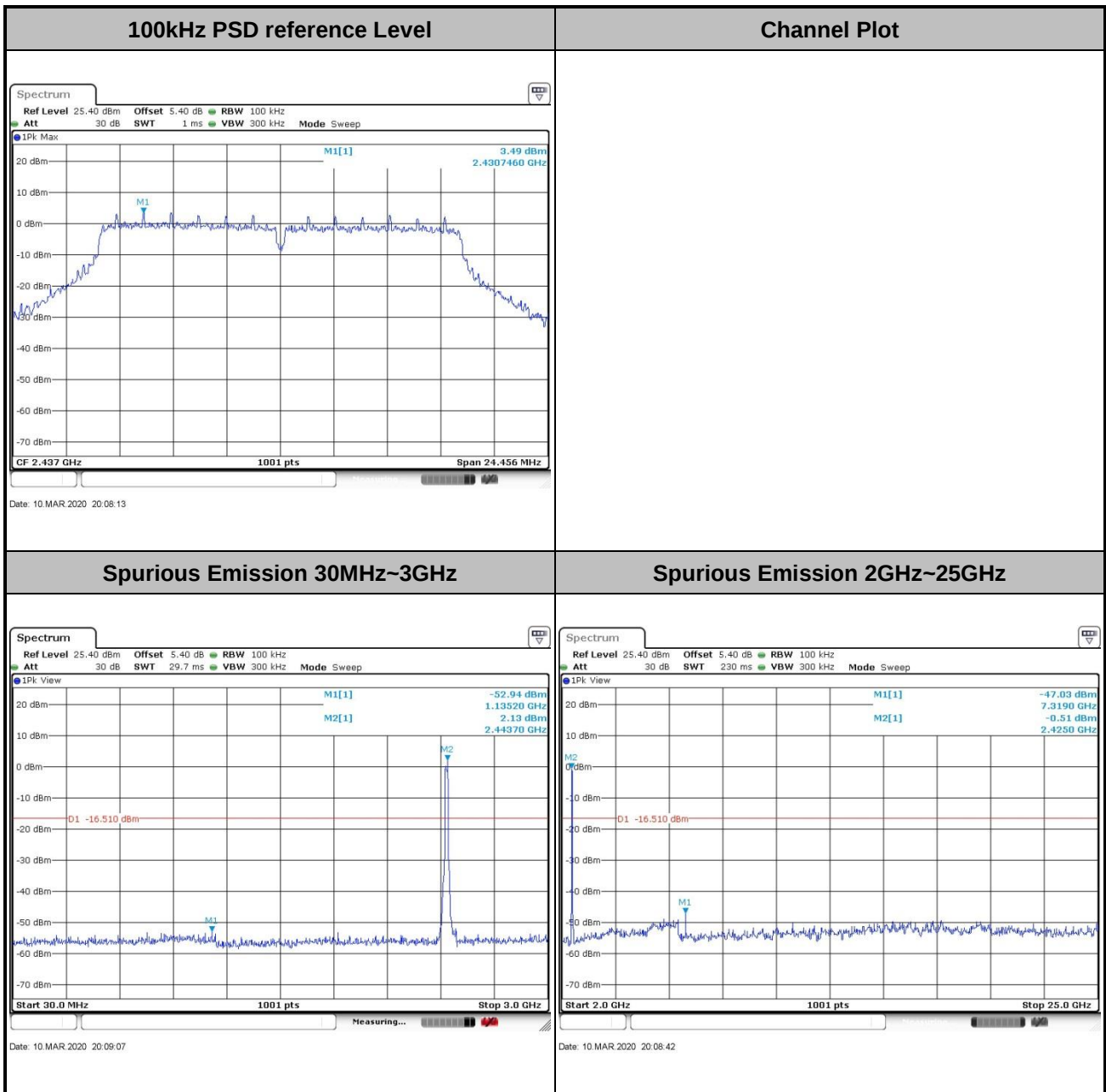


Spurious Emission 2GHz~25GHz





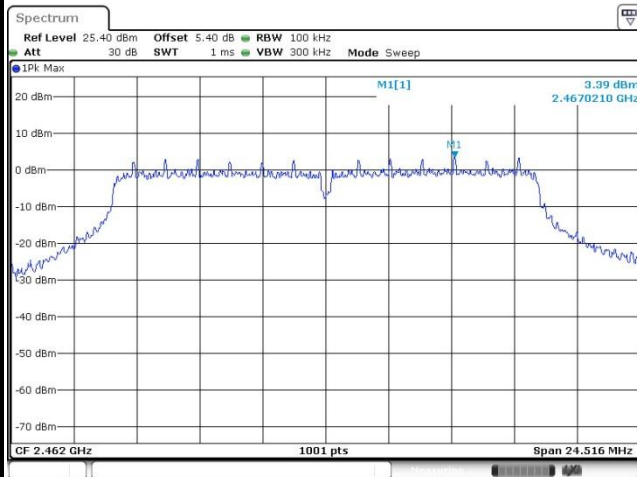
Test Mode :	802.11g	Test Channel :	06
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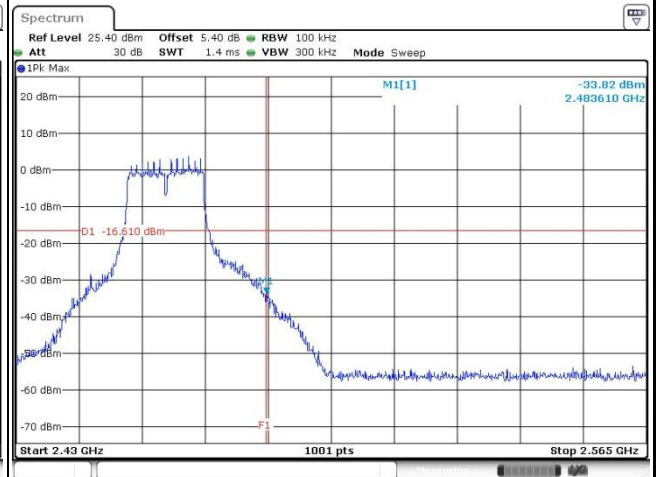


Test Mode :	802.11g	Test Channel :	11
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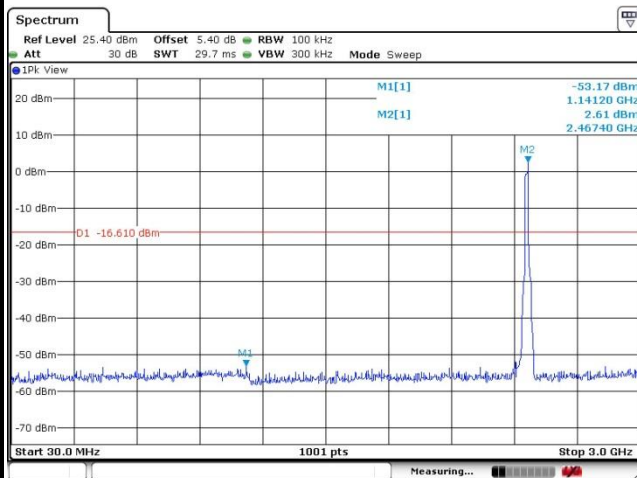
100kHz PSD reference Level



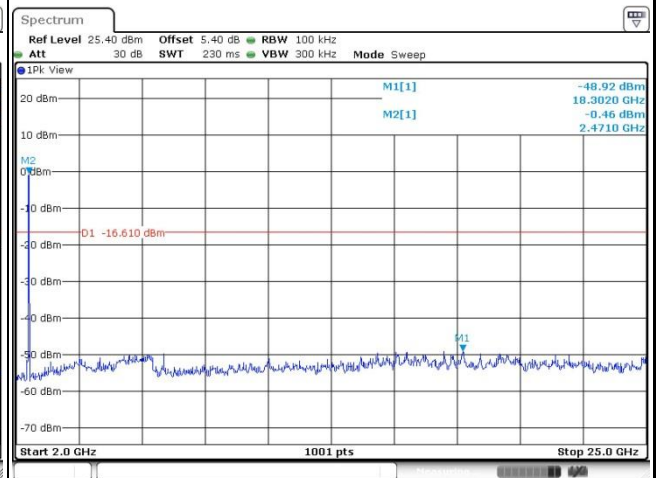
Channel Plot



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz

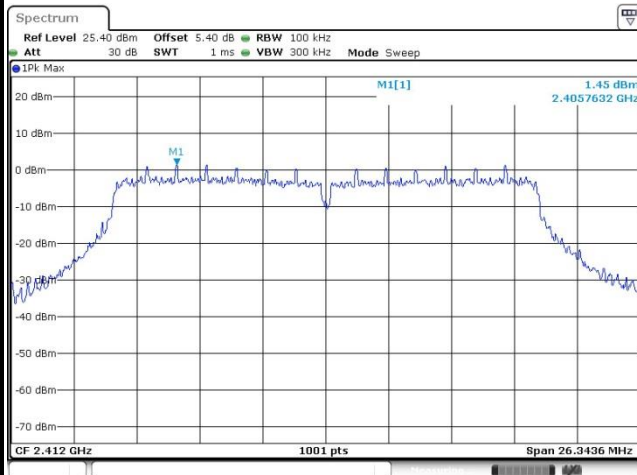




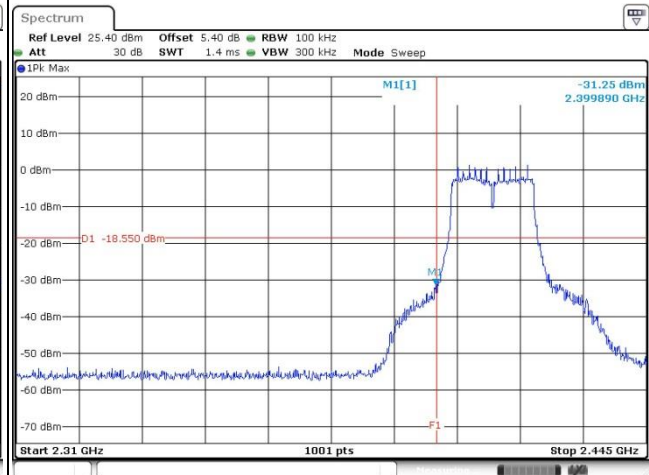
Test Mode : 802.11n HT20

Test Channel : 01

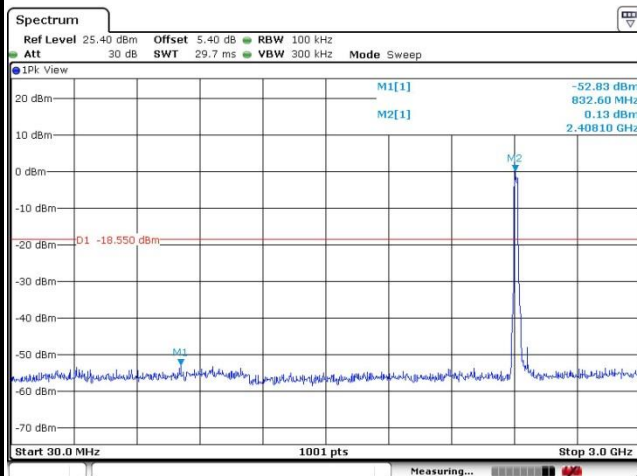
100kHz PSD reference Level



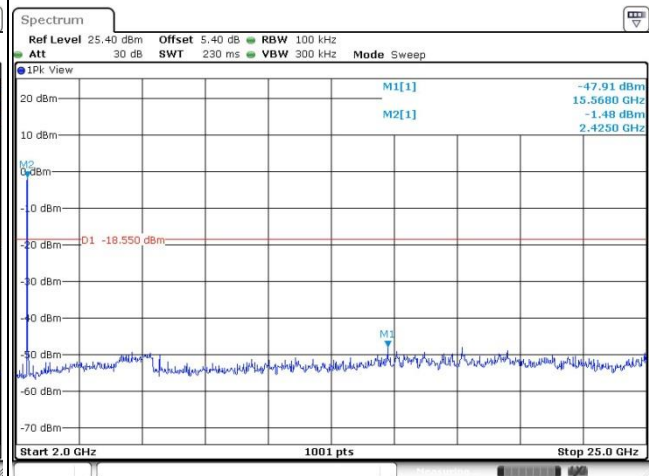
Channel Plot



Spurious Emission 30MHz~3GHz

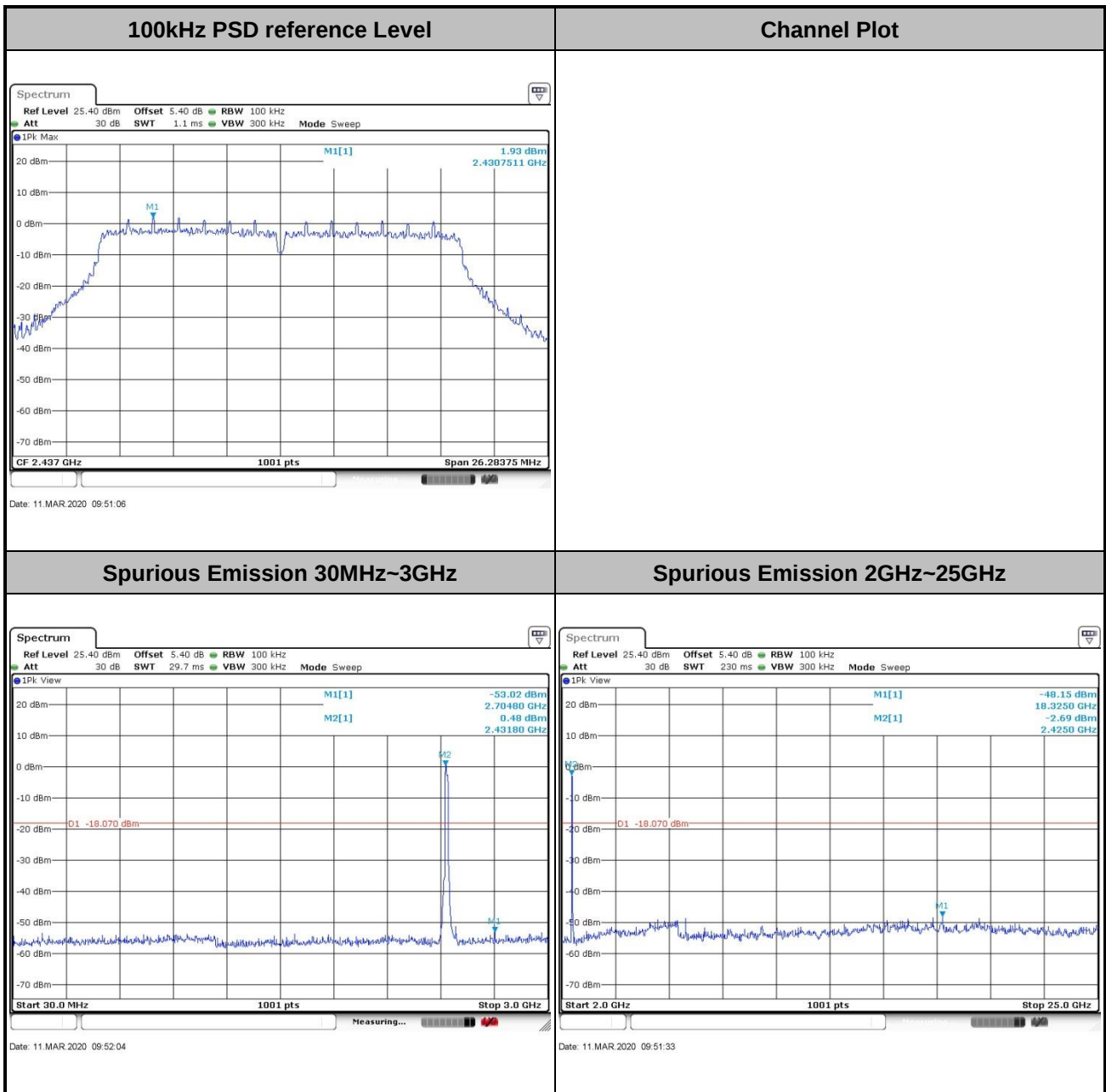


Spurious Emission 2GHz~25GHz





Test Mode :	802.11n HT20	Test Channel :	06
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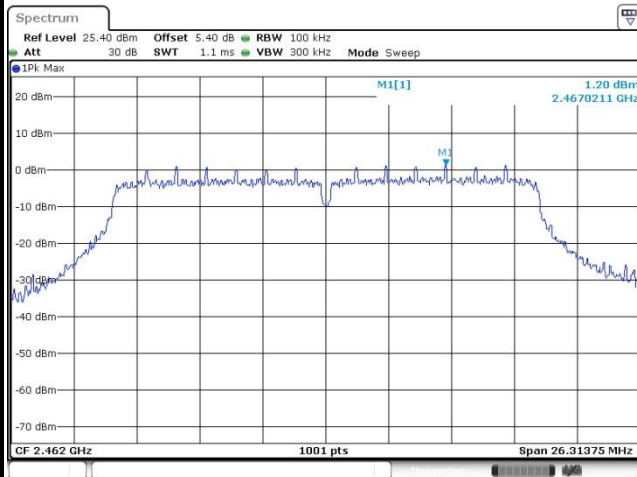




Test Mode : 802.11n HT20

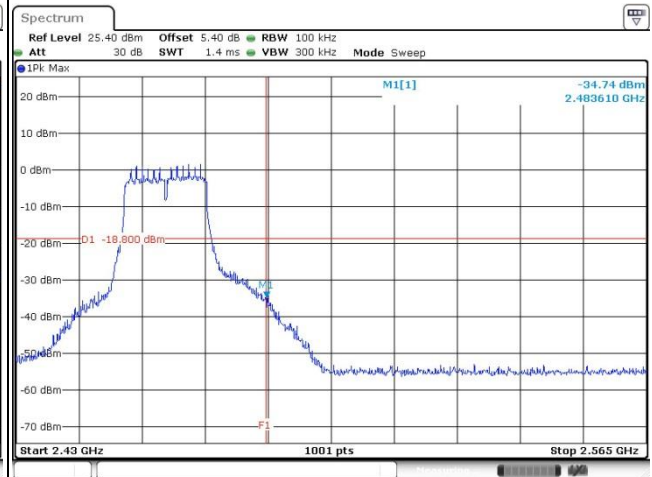
Test Channel : 11

100kHz PSD reference Level



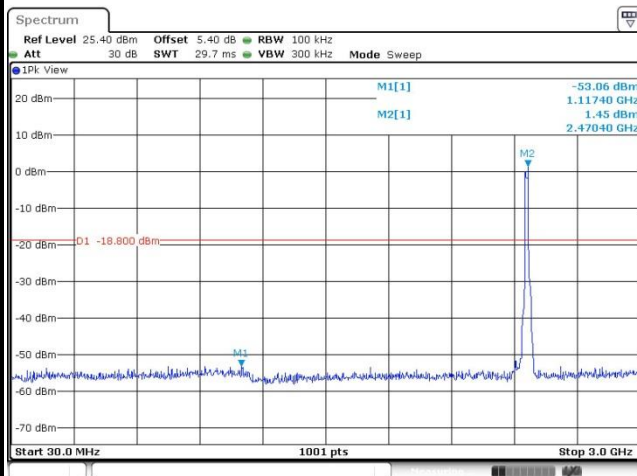
Date: 11.MAR.2020 09:56:01

Channel Plot



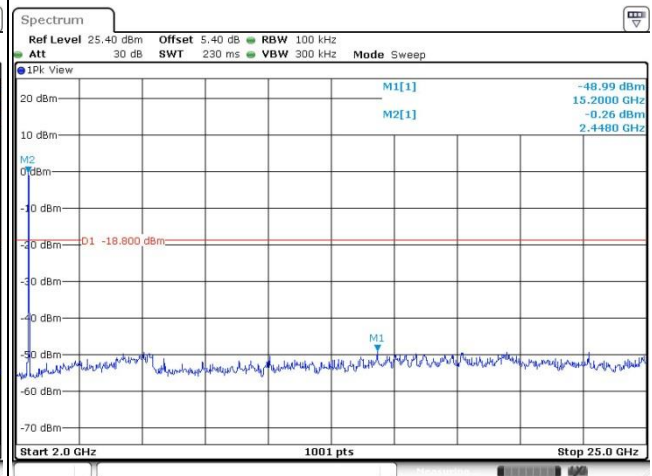
Date: 11.MAR.2020 09:56:44

Spurious Emission 30MHz~3GHz



Date: 11.MAR.2020 09:56:54

Spurious Emission 2GHz~25GHz



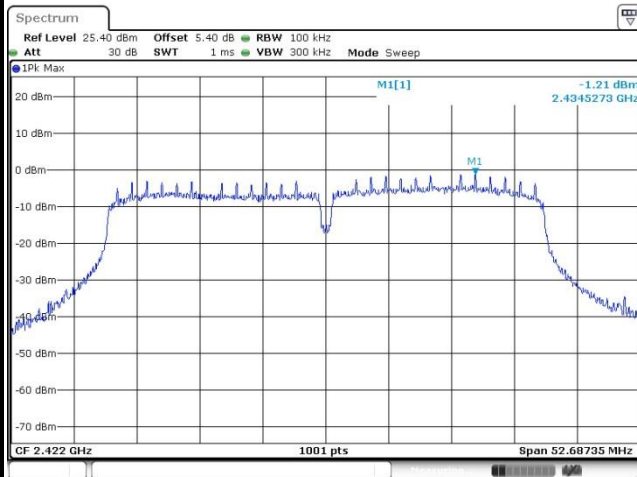
Date: 11.MAR.2020 09:57:02



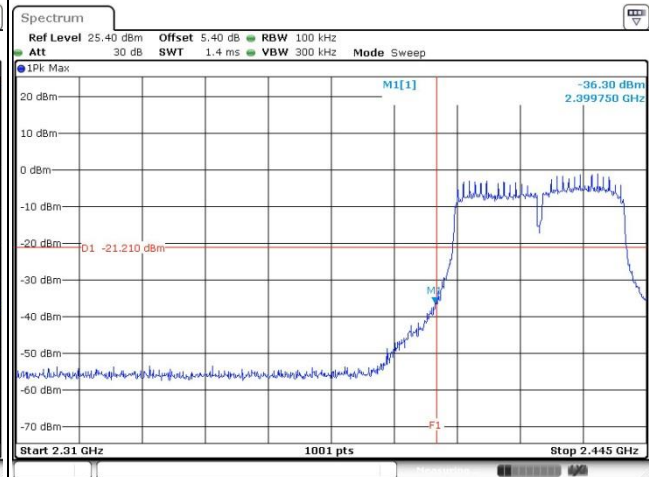
Test Mode : 802.11n HT40

Test Channel : 03

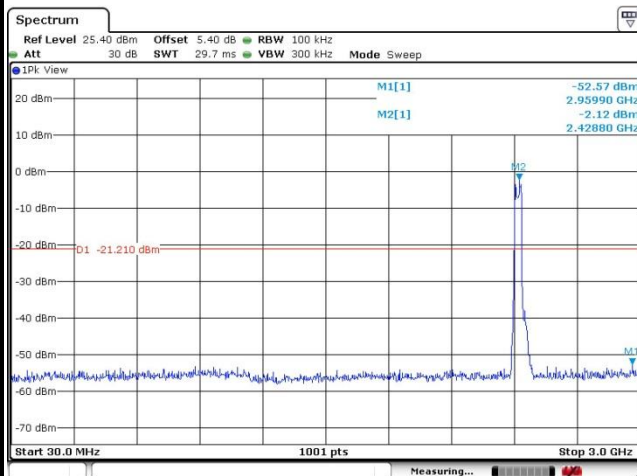
100kHz PSD reference Level



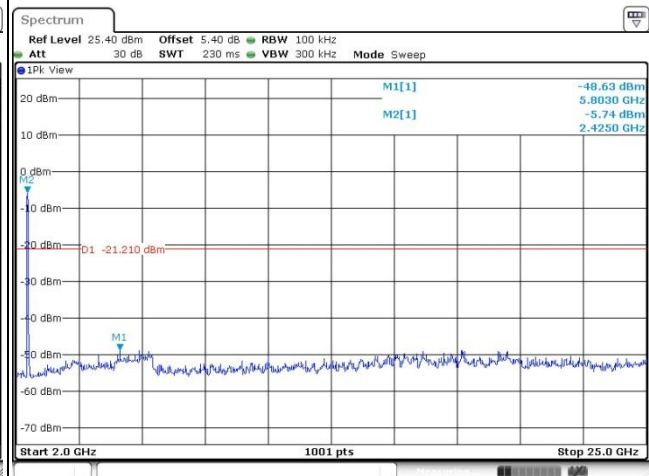
Channel Plot



Spurious Emission 30MHz~3GHz

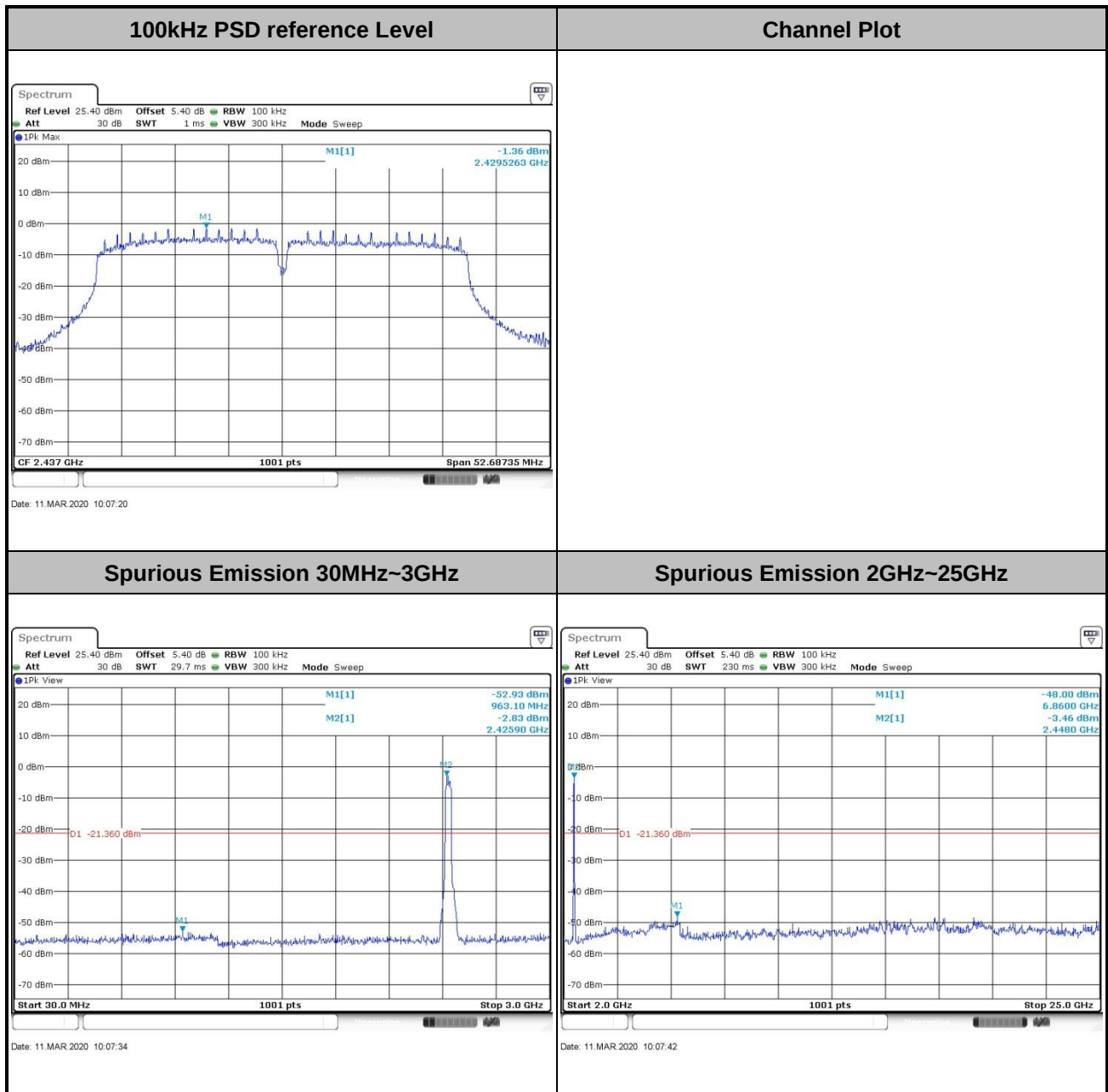


Spurious Emission 2GHz~25GHz





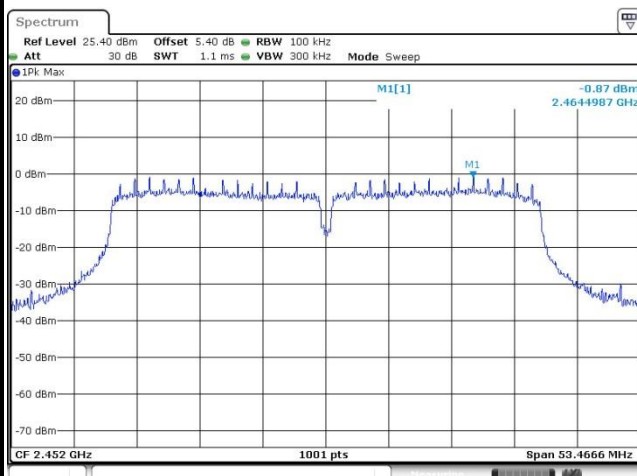
Test Mode :	802.11n HT40	Test Channel :	06
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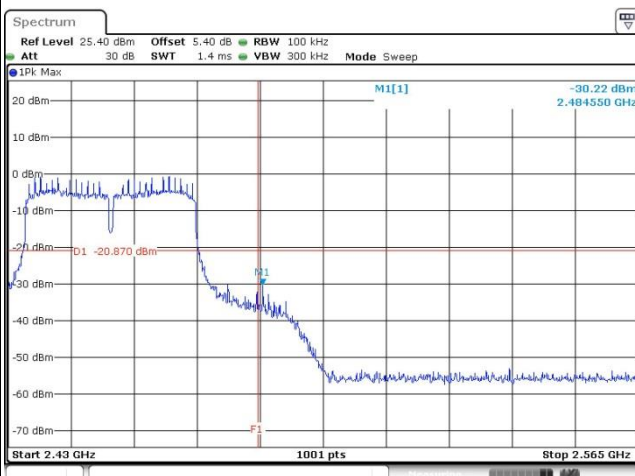
Test Mode :	802.11n HT40	Test Channel :	09
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100kHz PSD reference Level



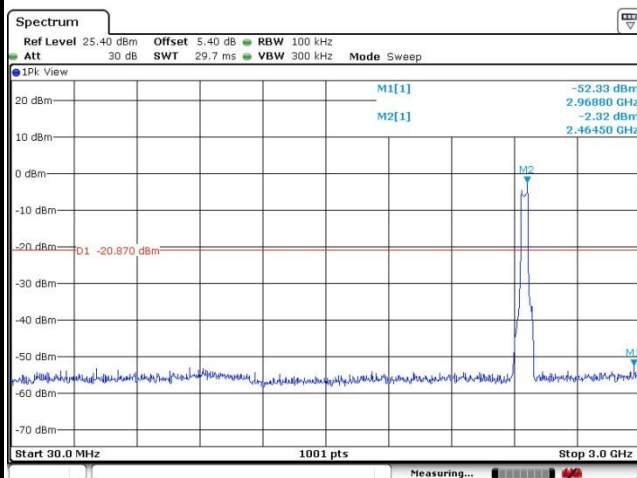
Date: 11.MAR.2020 10:14:31

Channel Plot



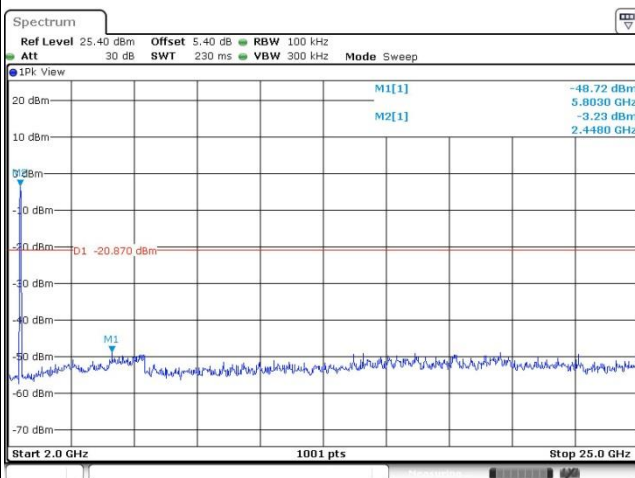
Date: 11.MAR.2020 10:14:40

Spurious Emission 30MHz~3GHz



Date: 11.MAR.2020 10:15:22

Spurious Emission 2GHz~25GHz



Date: 11.MAR.2020 10:15:00



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

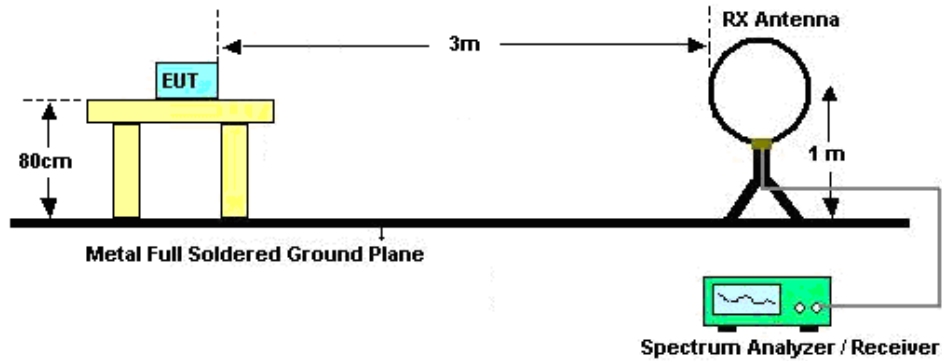
1. The testing follows ANSI C63.10-2013 clause 11.11 & 11.12
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better 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:

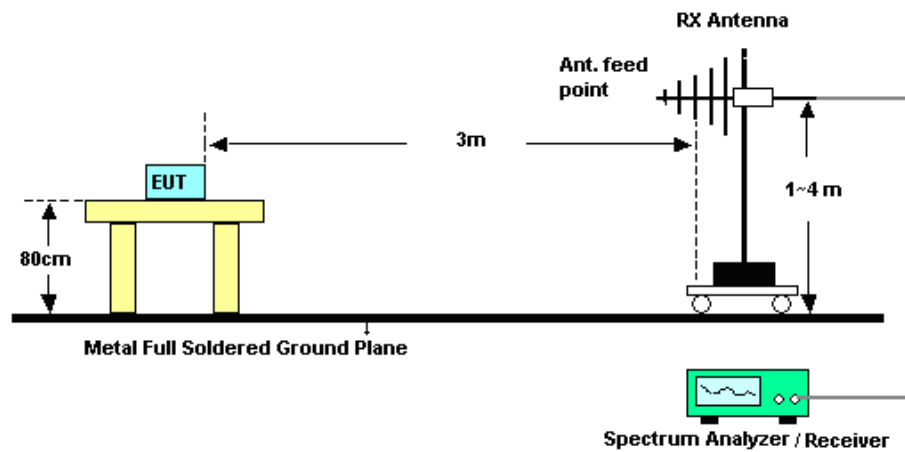
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

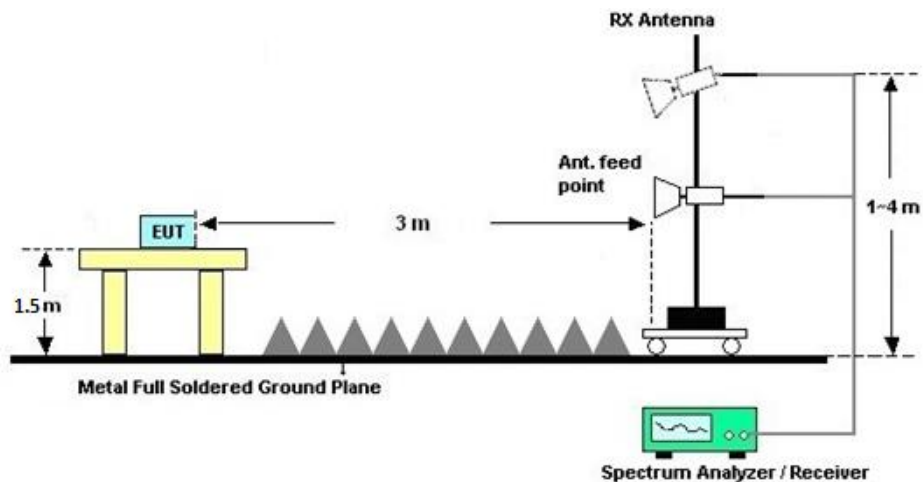
For radiated emissions below 30MHz



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.

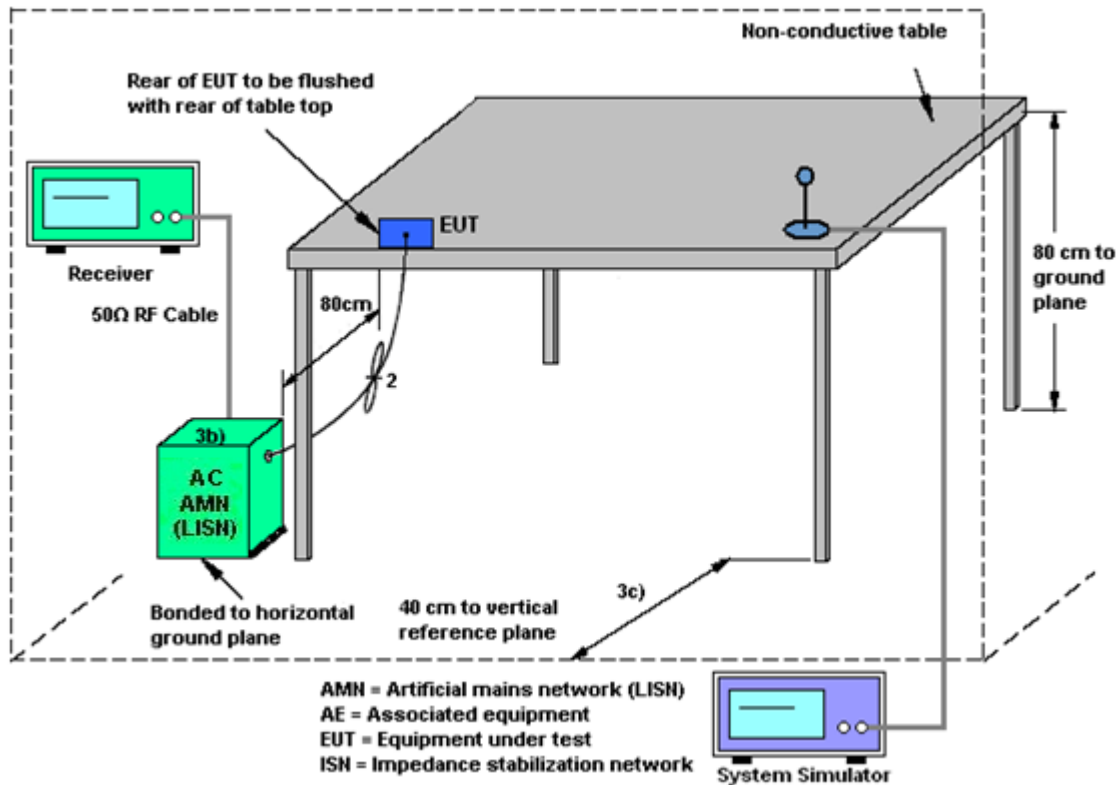
3.6.2 Measuring Instruments

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	101040	10Hz~40GHz	Nov. 02, 2019	Mar. 10, 2020~ Mar. 11, 2020	Nov. 01, 2020	Conducted (TH01-KS)
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 08, 2020	Mar. 10, 2020~ Mar. 11, 2020	Jan. 07, 2021	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 08, 2020	Mar. 10, 2020~ Mar. 11, 2020	Jan. 07, 2021	Conducted (TH01-KS)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150213	10Hz~44GHz	Apr. 19, 2019	Jan. 11, 2020	Apr. 18, 2020	Radiation (03CH02-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	May 29, 2019	Jan. 11, 2020	May 28, 2020	Radiation (03CH02-SZ)
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz~2GHz	Jul. 19, 2019	Jan. 11, 2020	Jul. 18, 2020	Radiation (03CH02-SZ)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00119436	1GHz~18GHz	Aug. 27, 2019	Jan. 11, 2020	Aug. 26, 2020	Radiation (03CH02-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 22, 2019	Jan. 11, 2020	Jul. 21, 2020	Radiation (03CH02-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18GHz~40GHz	Apr. 18, 2019	Jan. 11, 2020	Apr. 17, 2020	Radiation (03CH02-SZ)
LF Amplifier	Burgeon	BPA-530	102211	0.01~3000Mhz	Oct. 18, 2019	Jan. 11, 2020	Oct. 17, 2020	Radiation (03CH02-SZ)
HF Amplifier	MITEQ	AMF-7D-0010 1800-30-10P-R	1943528	1GHz~18GHz	Oct. 18, 2019	Jan. 11, 2020	Oct. 17, 2020	Radiation (03CH02-SZ)
HF Amplifier	KEYSIGHT	83017A	MY53270105	0.5GHz~26.5GHz	Oct. 18, 2019	Jan. 11, 2020	Oct. 17, 2020	Radiation (03CH02-SZ)
AC Power Source	Chroma	61601	616010002470	N/A	NCR	Jan. 11, 2020	NCR	Radiation (03CH02-SZ)
Turn Table	Chaintek	T-200	N/A	0~360 degree	NCR	Jan. 11, 2020	NCR	Radiation (03CH02-SZ)
Antenna Mast	Chaintek	MBS-400	N/A	1 m~4 m	NCR	Jan. 11, 2020	NCR	Radiation (03CH02-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Dec. 26, 2019	Jan. 08, 2020	Dec. 25, 2020	Conduction (CO01-SZ)
AC LISN	EMCO	3816/2SH	00103912	9kHz~30MHz	Oct. 17, 2019	Jan. 08, 2020	Oct. 16, 2020	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	EMCO	3816/2SH	00103892	9kHz~30MHz	Dec. 26, 2019	Jan. 08, 2020	Dec. 25, 2020	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 23, 2019	Jan. 08, 2020	Jul. 22, 2020	Conduction (CO01-SZ)

NCR: No Calibration Required

5 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage $K=2$ to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.6dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.4dB
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Appendix A. Conducted Test Results

Report Number : FR9D1403C

A1 - DTS Part

Test Engineer:	Lex Wu	Temperature:	21~25	°C
Test Date:	2020/3/10~2020/3/11	Relative Humidity:	51~54	%

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

2.4GHz Band								
Mod.	Data Rate	N _{TX}	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
11b	1Mbps	1	1	2412	13.64	8.55	0.50	Pass
11b	1Mbps	1	6	2437	13.49	8.53	0.50	Pass
11b	1Mbps	1	11	2462	13.54	8.53	0.50	Pass
11g	6Mbps	1	1	2412	18.63	16.34	0.50	Pass
11g	6Mbps	1	6	2437	18.28	16.30	0.50	Pass
11g	6Mbps	1	11	2462	19.03	16.34	0.50	Pass
HT20	MCS0	1	1	2412	19.43	17.56	0.50	Pass
HT20	MCS0	1	6	2437	19.33	17.52	0.50	Pass
HT20	MCS0	1	11	2462	19.18	17.54	0.50	Pass
HT40	MCS0	1	3	2422	36.66	35.12	0.50	Pass
HT40	MCS0	1	6	2437	36.46	35.12	0.50	Pass
HT40	MCS0	1	9	2452	37.06	35.64	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	17.86	30.00	1.39	19.25	36.00	Pass
11b	1Mbps	1	6	2437	18.69	30.00	1.39	20.08	36.00	Pass
11b	1Mbps	1	11	2462	18.64	30.00	1.39	20.03	36.00	Pass
11g	6Mbps	1	1	2412	22.11	30.00	1.39	23.50	36.00	Pass
11g	6Mbps	1	6	2437	22.81	30.00	1.39	24.20	36.00	Pass
11g	6Mbps	1	11	2462	21.63	30.00	1.39	23.02	36.00	Pass
HT20	MCS0	1	1	2412	21.11	30.00	1.39	22.50	36.00	Pass
HT20	MCS0	1	6	2437	21.85	30.00	1.39	23.24	36.00	Pass
HT20	MCS0	1	11	2462	21.01	30.00	1.39	22.40	36.00	Pass
HT40	MCS0	1	3	2422	21.36	30.00	1.39	22.75	36.00	Pass
HT40	MCS0	1	6	2437	21.24	30.00	1.39	22.63	36.00	Pass
HT40	MCS0	1	9	2452	21.97	30.00	1.39	23.36	36.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

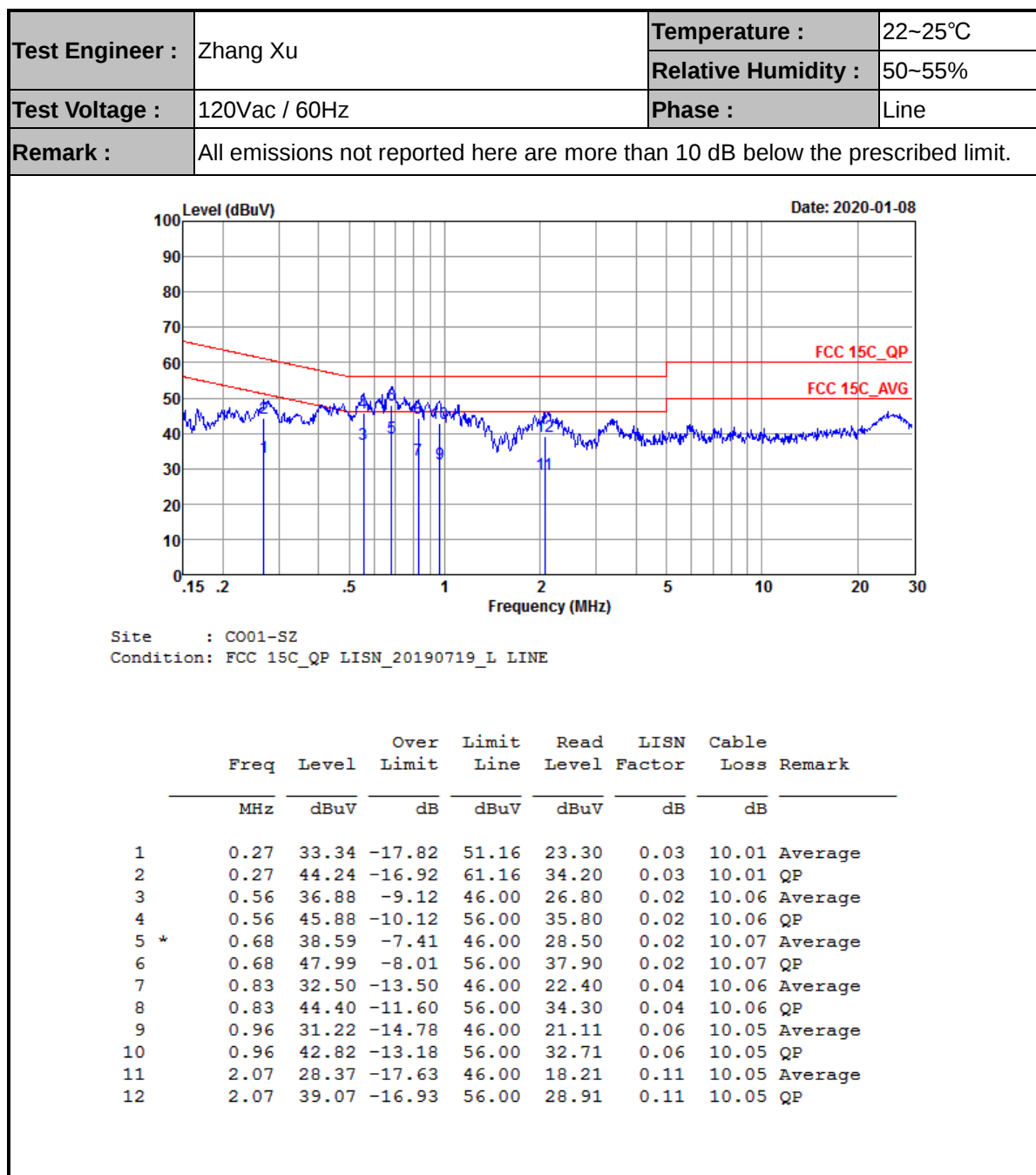
2.4GHz Band						
Mod.	Data Rate	N _{TX}	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)
11b	1Mbps	1	1	2412	0.11	15.20
11b	1Mbps	1	6	2437	0.11	15.30
11b	1Mbps	1	11	2462	0.11	15.00
11g	6Mbps	1	1	2412	0.58	14.10
11g	6Mbps	1	6	2437	0.58	14.20
11g	6Mbps	1	11	2462	0.58	13.80
HT20	MCS0	1	1	2412	0.62	12.40
HT20	MCS0	1	6	2437	0.62	12.30
HT20	MCS0	1	11	2462	0.62	12.00
HT40	MCS0	1	3	2422	0.67	11.90
HT40	MCS0	1	6	2437	0.67	11.80
HT40	MCS0	1	9	2452	0.67	12.40

TEST RESULTS DATA
Peak Power Density

2.4GHz Band								
Mod.	Data Rate	N _{TX}	CH.	Freq. (MHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
11b	1Mbps	1	1	2412	-3.27	1.39	8.00	Pass
11b	1Mbps	1	6	2437	-7.24	1.39	8.00	Pass
11b	1Mbps	1	11	2462	-5.34	1.39	8.00	Pass
11g	6Mbps	1	1	2412	-11.50	1.39	8.00	Pass
11g	6Mbps	1	6	2437	-10.10	1.39	8.00	Pass
11g	6Mbps	1	11	2462	-10.68	1.39	8.00	Pass
HT20	MCS0	1	1	2412	-11.56	1.39	8.00	Pass
HT20	MCS0	1	6	2437	-12.43	1.39	8.00	Pass
HT20	MCS0	1	11	2462	-13.89	1.39	8.00	Pass
HT40	MCS0	1	3	2422	-15.80	1.39	8.00	Pass
HT40	MCS0	1	6	2437	-14.90	1.39	8.00	Pass
HT40	MCS0	1	9	2452	-14.69	1.39	8.00	Pass

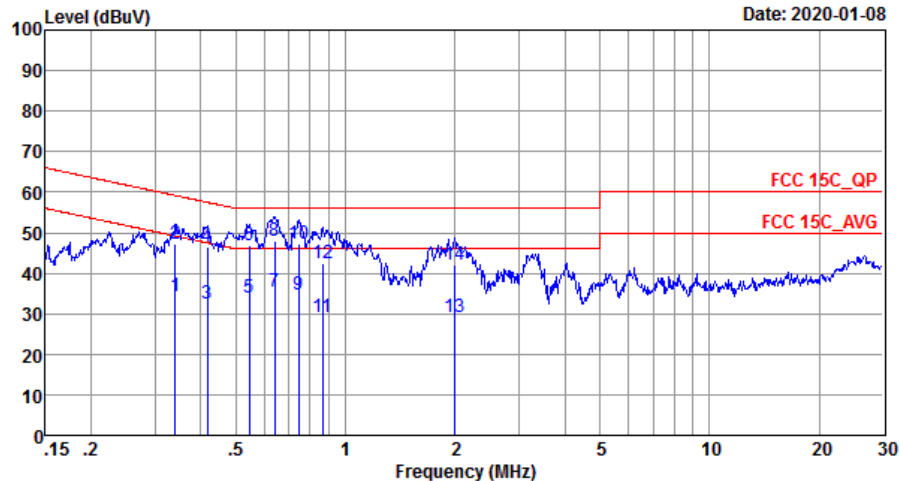


Appendix B. AC Conducted Emission Test Results





Test Engineer :	Zhang Xu	Temperature :	22~25°C
		Relative Humidity :	50~55%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : C001-SZ
Condition: FCC 15C QP LISN 20190719 N NEUTRAL

	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			dB	dBuV	dBuV	dB	dB	
1	0.34	34.44	-14.74	49.18	24.40	0.03	10.01	Average
2	0.34	47.24	-11.94	59.18	37.20	0.03	10.01	QP
3	0.42	32.54	-14.97	47.51	22.50	0.02	10.02	Average
4	0.42	46.64	-10.87	57.51	36.60	0.02	10.02	QP
5	0.54	34.08	-11.92	46.00	24.00	0.02	10.06	Average
6	0.54	46.78	-9.22	56.00	36.70	0.02	10.06	QP
7	0.64	35.49	-10.51	46.00	25.40	0.02	10.07	Average
8 *	0.64	47.89	-8.11	56.00	37.80	0.02	10.07	QP
9	0.74	34.59	-11.41	46.00	24.50	0.02	10.07	Average
10	0.74	47.09	-8.91	56.00	37.00	0.02	10.07	QP
11	0.87	29.00	-17.00	46.00	18.90	0.04	10.06	Average
12	0.87	42.60	-13.40	56.00	32.50	0.04	10.06	QP
13	1.99	29.20	-16.80	46.00	19.10	0.05	10.05	Average
14	1.99	42.10	-13.90	56.00	32.00	0.05	10.05	QP

Note:

1. Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
2. Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)



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	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2389.905	47.29	-26.71	74	45.77	27.7	6.6	32.78	168	48	P	H
		2389.695	36.42	-17.58	54	34.92	27.7	6.6	32.8	168	48	A	H
	*	2412	100.83	-	-	99.34	27.67	6.6	32.78	168	48	P	H
	*	2412	97.6	-	-	96.11	27.67	6.6	32.78	168	48	A	H
		2388.645	46.43	-27.57	74	44.93	27.7	6.6	32.8	125	5	P	V
		2389.905	36.04	-17.96	54	34.52	27.7	6.6	32.78	125	5	A	V
	*	2412	98.58	-	-	97.09	27.67	6.6	32.78	125	5	P	V
	*	2412	95.21	-	-	93.72	27.67	6.6	32.78	125	5	A	V
802.11b CH 06 2437MHz		2350.18	46.62	-27.38	74	45.01	27.9	6.53	32.82	217	354	P	H
		2389.94	35.99	-18.01	54	34.47	27.7	6.6	32.78	217	354	A	H
	*	2437	101.8	-	-	100.33	27.6	6.63	32.76	217	354	P	H
	*	2437	98.6	-	-	97.13	27.6	6.63	32.76	217	354	A	H
		2485.79	48.2	-25.8	74	46.75	27.47	6.7	32.72	217	354	P	H
		2484.11	36.61	-17.39	54	35.16	27.47	6.7	32.72	217	354	A	H
		2329.46	46.45	-27.55	74	44.86	27.93	6.5	32.84	137	89	P	V
		2359.28	35.95	-18.05	54	34.41	27.83	6.53	32.82	137	89	A	V
	*	2437	97.79	-	-	96.32	27.6	6.63	32.76	137	89	P	V
	*	2437	94.62	-	-	93.15	27.6	6.63	32.76	137	89	A	V
		2491.53	45.73	-28.27	74	44.32	27.4	6.73	32.72	137	89	P	V
		2486.56	36.04	-17.96	54	34.59	27.47	6.7	32.72	137	89	A	V



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 11 2462MHz	*	2462	101.17	-	-	99.71	27.53	6.67	32.74	216	354	P	H
	*	2462	98.16	-	-	96.7	27.53	6.67	32.74	216	354	A	H
		2487.72	53.45	-20.55	74	52.04	27.4	6.73	32.72	216	354	P	H
		2487.4	48.9	-5.1	54	47.45	27.47	6.7	32.72	216	354	A	H
	*	2462	98.42	-	-	96.96	27.53	6.67	32.74	110	9	P	V
	*	2462	95.36	-	-	93.9	27.53	6.67	32.74	110	9	A	V
		2487.4	50.99	-23.01	74	49.54	27.47	6.7	32.72	110	9	P	V
		2487.44	45.11	-8.89	54	43.66	27.47	6.7	32.72	110	9	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	40.99	-33.01	74	57.67	31.15	9.65	57.48	185	255	P	H
		4824	40.64	-33.36	74	57.32	31.15	9.65	57.48	160	200	P	V
802.11b CH 06 2437MHz		4874	41.27	-32.73	74	57.95	31.13	9.71	57.52	165	106	P	H
		7311	46.12	-27.88	74	56.63	36.4	12.01	58.92	174	100	P	H
		4874	40.6	-33.4	74	57.28	31.13	9.71	57.52	165	106	P	V
		7311	46.88	-27.12	74	57.39	36.4	12.01	58.92	174	100	P	V
802.11b CH 11 2462MHz		4924	41.63	-32.37	74	58.18	31.23	9.77	57.55	150	285	P	H
		7386	45.71	-28.29	74	56.29	36.3	12.08	58.96	155	274	P	H
		4924	40.95	-33.05	74	57.5	31.23	9.77	57.55	150	285	P	V
		7386	44.99	-29.01	74	55.57	36.3	12.08	58.96	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		2389.38	57.86	-16.14	74	56.36	27.7	6.6	32.8	173	82	P	H
		2389.90	45.7	-8.3	54	44.18	27.7	6.6	32.78	173	82	A	H
	*	2412	100.51	-	-	99.02	27.67	6.6	32.78	173	82	P	H
	*	2412	93.02	-	-	91.53	27.67	6.6	32.78	173	82	A	H
		2389.90	59.86	-14.14	74	58.34	27.7	6.6	32.78	198	120	P	V
		2389.90	46.44	-7.56	54	44.92	27.7	6.6	32.78	198	120	A	V
	*	2412	101.87	-	-	100.38	27.67	6.6	32.78	198	120	P	V
	*	2412	94.18	-	-	92.69	27.67	6.6	32.78	198	120	A	V
802.11g CH 06 2437MHz		2388.12	46.33	-27.67	74	44.83	27.7	6.6	32.8	244	151	P	H
		2367.82	36.25	-17.75	54	34.65	27.83	6.57	32.8	244	151	A	H
	*	2437	99.82	-	-	98.35	27.6	6.63	32.76	244	151	P	H
	*	2437	92.08	-	-	90.61	27.6	6.63	32.76	244	151	A	H
		2490.41	46.1	-27.9	74	44.69	27.4	6.73	32.72	244	151	P	H
		2489.29	37.15	-16.85	54	35.74	27.4	6.73	32.72	244	151	A	H
		2350.6	46.97	-27.03	74	45.36	27.9	6.53	32.82	110	75	P	V
		2358.86	36.52	-17.48	54	34.98	27.83	6.53	32.82	110	75	A	V
	*	2437	102.4	-	-	100.93	27.6	6.63	32.76	110	75	P	V
	*	2437	94.72	-	-	93.25	27.6	6.63	32.76	110	75	A	V
		2488.87	47.62	-26.38	74	46.21	27.4	6.73	32.72	110	75	P	V
		2489.36	38.93	-15.07	54	37.52	27.4	6.73	32.72	110	75	A	V



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 11 2462MHz	*	2462	96.7	-	-	95.24	27.53	6.67	32.74	106	16	P	H
	*	2462	88.88	-	-	87.42	27.53	6.67	32.74	106	16	A	H
		2483.68	62.57	-11.43	74	61.12	27.47	6.7	32.72	106	16	P	H
		2483.56	48.68	-5.32	54	47.23	27.47	6.7	32.72	106	16	A	H
	*	2462	97.43	-	-	95.97	27.53	6.67	32.74	104	17	P	V
	*	2462	89.83	-	-	88.37	27.53	6.67	32.74	104	17	A	V
		2483.6	63.2	-10.8	74	61.75	27.47	6.7	32.72	104	17	P	V
		2483.64	50.01	-3.99	54	48.56	27.47	6.7	32.72	104	17	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	39.62	-34.38	74	56.3	31.15	9.65	57.48	185	255	P	H
		4824	38.88	-35.12	74	55.56	31.15	9.65	57.48	185	255	P	V
802.11g CH 06 2437MHz		4874	38.37	-35.63	74	55.05	31.13	9.71	57.52	165	106	P	H
		7311	46.58	-27.42	74	57.09	36.4	12.01	58.92	174	100	P	H
		7311	47.7	-26.3	74	58.21	36.4	12.01	58.92	174	100	P	V
802.11g CH 11 2462MHz		4924	39.58	-34.42	74	56.13	31.23	9.77	57.55	185	240	P	H
		7836	45.54	-28.46	74	55.61	36.57	12.49	59.13	130	225	P	H
		4924	40.86	-33.14	74	57.41	31.23	9.77	57.55	156	120	P	V
		7836	45.45	-28.55	74	55.52	36.57	12.49	59.13	179	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

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		2389.8	55.24	-18.76	74	52.78	27.7	7.54	32.78	100	64	P	H
		2389.91	42.42	-11.58	54	39.96	27.7	7.54	32.78	100	64	A	H
	*	2412	97.63	-	-	95.2	27.67	7.54	32.78	100	64	P	H
	*	2412	90.68	-	-	88.25	27.67	7.54	32.78	100	64	A	H
		2390	50.03	-23.97	74	47.57	27.7	7.54	32.78	105	74	P	V
		2389.8	39.61	-14.39	54	37.15	27.7	7.54	32.78	105	74	A	V
	*	2412	92.37	-	-	89.94	27.67	7.54	32.78	105	74	P	V
	*	2412	86.31	-	-	83.88	27.67	7.54	32.78	105	74	A	V
802.11n HT20 CH 06 2437MHz		2328.2	46.63	-27.37	74	45.04	27.93	6.5	32.84	129	17	P	H
		2347.8	37.38	-16.62	54	35.77	27.9	6.53	32.82	129	17	A	H
	*	2437	97.23	-	-	95.76	27.6	6.63	32.76	129	17	P	H
	*	2437	90.68	-	-	89.21	27.6	6.63	32.76	129	17	A	H
		2489.36	50.04	-23.96	74	48.63	27.4	6.73	32.72	129	17	P	H
		2488.59	41.73	-12.27	54	40.32	27.4	6.73	32.72	129	17	A	H
		2389.8	46.68	-27.32	74	45.16	27.7	6.6	32.78	128	6	P	V
		2311.68	37.36	-16.64	54	35.78	27.97	6.47	32.86	128	6	A	V
	*	2437	94.19	-	-	92.72	27.6	6.63	32.76	128	6	P	V
	*	2437	86.66	-	-	85.19	27.6	6.63	32.76	128	6	A	V
		2486	49.15	-24.85	74	47.7	27.47	6.7	32.72	128	6	P	V
		2488.66	40.22	-13.78	54	38.81	27.4	6.73	32.72	128	6	A	V



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 11 2462MHz	*	2462	95.65	-	-	93.32	27.53	7.54	32.74	100	23	P	H
	*	2462	87.71	-	-	85.38	27.53	7.54	32.74	100	23	A	H
		2483.8	64.46	-9.54	74	62.18	27.47	7.53	32.72	100	23	P	H
		2483.6	49.64	-4.36	54	47.36	27.47	7.53	32.72	100	23	A	H
	*	2462	93.73	-	-	91.4	27.53	7.54	32.74	260	65	P	V
	*	2462	85.9	-	-	83.57	27.53	7.54	32.74	260	65	A	V
		2483.68	63.42	-10.58	74	61.14	27.47	7.53	32.72	260	65	P	V
		2483.52	48.82	-5.18	54	46.54	27.47	7.53	32.72	260	65	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	38.93	-35.07	74	55.61	31.15	9.65	57.48	162	100	P	H
		4824	39.78	-34.22	74	56.46	31.15	9.65	57.48	162	100	P	V
802.11n HT20 CH 06 2437MHz		4874	37.94	-36.06	74	54.62	31.13	9.71	57.52	180	175	P	H
		7311	45.44	-28.56	74	55.95	36.4	12.01	58.92	166	100	P	H
		4874	38.54	-35.46	74	55.22	31.13	9.71	57.52	123	223	P	V
		7311	45.58	-28.42	74	56.09	36.4	12.01	58.92	188	312	P	V
802.11n HT20 CH 11 2462MHz		4924	39.06	-34.94	74	55.61	31.23	9.77	57.55	160	65	P	H
		7836	44.69	-29.31	74	54.76	36.57	12.49	59.13	177	24	P	H
		4924	40.11	-33.89	74	56.66	31.23	9.77	57.55	160	65	P	V
		7836	45.5	-28.5	74	55.57	36.57	12.49	59.13	177	24	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		2389.94	51	-23	74	49.48	27.7	6.6	32.78	100	82	P	H
		2389.8	41.01	-12.99	54	39.49	27.7	6.6	32.78	100	82	A	H
	*	2422	95.14	-	-	93.64	27.63	6.63	32.76	100	82	P	H
	*	2422	87.62	-	-	86.12	27.63	6.63	32.76	100	82	A	H
		2484.53	49.52	-24.48	74	48.07	27.47	6.7	32.72	100	82	P	H
		2485.51	39.1	-14.9	54	37.65	27.47	6.7	32.72	100	82	A	H
		2389.24	52.98	-21.02	74	51.48	27.7	6.6	32.8	152	88	P	V
		2389.8	41.13	-12.87	54	39.61	27.7	6.6	32.78	152	88	A	V
	*	2422	94.4	-	-	92.9	27.63	6.63	32.76	152	88	P	V
		2422	87.29	-	-	85.79	27.63	6.63	32.76	152	88	A	V
		2486.77	46.79	-27.21	74	45.34	27.47	6.7	32.72	152	88	P	V
		2486.14	38.22	-15.78	54	36.77	27.47	6.7	32.72	152	88	A	V
802.11n HT40 CH 06 2437MHz		2389.52	47.21	-26.79	74	45.71	27.7	6.6	32.8	100	84	P	H
		2389.8	37.41	-16.59	54	35.89	27.7	6.6	32.78	100	84	A	H
	*	2437	94.44	-	-	92.97	27.6	6.63	32.76	100	84	P	H
	*	2437	86.96	-	-	85.49	27.6	6.63	32.76	100	84	A	H
		2483.9	49.64	-24.36	74	48.19	27.47	6.7	32.72	100	84	P	H
		2483.83	39.26	-14.74	54	37.81	27.47	6.7	32.72	100	84	A	H
		2364.04	46.39	-27.61	74	44.81	27.83	6.57	32.82	186	88	P	V
		2389.94	37.52	-16.48	54	36	27.7	6.6	32.78	186	88	A	V
	*	2437	93.82	-	-	92.35	27.6	6.63	32.76	186	88	P	V
	*	2437	86.23	-	-	84.76	27.6	6.63	32.76	186	88	A	V
		2489.43	46.87	-27.13	74	45.46	27.4	6.73	32.72	186	88	P	V
		2483.76	38.28	-15.72	54	36.83	27.47	6.7	32.72	186	88	A	V



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 09 2452MHz		2357.46	48.16	-25.84	74	45.64	27.83	7.51	32.82	263	70	P	H
		2316.3	37.89	-16.11	54	35.28	27.97	7.48	32.84	263	70	A	H
	*	2452	92.97	-	-	90.57	27.6	7.54	32.74	263	70	P	H
	*	2452	85.16	-	-	82.76	27.6	7.54	32.74	263	70	A	H
		2485.09	59.94	-14.06	74	57.66	27.47	7.53	32.72	263	70	P	H
		2484.53	50.34	-3.66	54	48.06	27.47	7.53	32.72	263	70	A	H
		2329.46	47.45	-26.55	74	44.88	27.93	7.48	32.84	212	65	P	V
		2331.56	38.02	-15.98	54	35.45	27.93	7.48	32.84	212	65	A	V
	*	2452	91.16	-	-	88.76	27.6	7.54	32.74	212	65	P	V
	*	2452	83.59	-	-	81.19	27.6	7.54	32.74	212	65	A	V
		2485.02	57.43	-16.57	74	55.15	27.47	7.53	32.72	212	65	P	V
		2484.53	47.98	-6.02	54	45.7	27.47	7.53	32.72	212	65	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



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

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n		4844	39.22	-34.78	74	55.83	31.2	9.68	57.49	165	25	P	H
HT40		7266	45.67	-28.33	74	56.19	36.4	11.99	58.91	196	36	P	H
CH 03		4844	40.27	-33.73	74	56.88	31.2	9.68	57.49	175	38	P	V
2422MHz		7266	46.34	-27.66	74	56.86	36.4	11.99	58.91	188	12	P	V
802.11n		4874	38.77	-35.23	74	55.45	31.13	9.71	57.52	154	85	P	H
HT40		7311	45.19	-28.81	74	55.7	36.4	12.01	58.92	180	150	P	H
CH 06		4874	39.32	-34.68	74	56	31.13	9.71	57.52	166	48	P	V
2437MHz		7311	45.66	-28.34	74	56.17	36.4	12.01	58.92	185	122	P	V
802.11n		4904	38.9	-35.1	74	55.53	31.17	9.74	57.54	155	184	P	H
HT40		7356	45.42	-28.58	74	55.9	36.4	12.06	58.94	150	179	P	H
CH 09		4904	39.97	-34.03	74	56.6	31.17	9.74	57.54	187	152	P	V
2452MHz		7356	45.72	-28.28	74	56.2	36.4	12.06	58.94	144	300	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Emission below 1GHz

2.4GHz WIFI 802.11n HT40 (LF)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz 802.11n HT40 LF		30	23.12	-16.88	40	29.06	24.8	0.56	31.3	144	253	P	H
		107.6	22.29	-21.21	43.5	36.2	16.6	1.07	31.58	-	-	P	H
		162.89	21.67	-21.83	43.5	35.51	16.2	1.33	31.37	-	-	P	H
		323.91	23.51	-22.49	46	32.98	19.98	1.9	31.35	-	-	P	H
		404.42	25.12	-20.88	46	32.5	21.9	2.13	31.41	-	-	P	H
		515.97	26.15	-19.85	46	30.75	24.2	2.44	31.24	-	-	P	H
		30	29.59	-10.41	40	35.53	24.8	0.56	31.3	109	257	P	V
		61.04	25.71	-14.29	40	44.63	11.88	0.8	31.6	-	-	P	V
		130.88	23.25	-20.25	43.5	36.09	17.45	1.19	31.48	-	-	P	V
		257.95	20.54	-25.46	46	30.38	20.12	1.69	31.65	-	-	P	V
		398.6	21.96	-24.04	46	29.45	21.78	2.12	31.39	-	-	P	V
		460.68	24.07	-21.93	46	30.14	23.07	2.29	31.43	-	-	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)

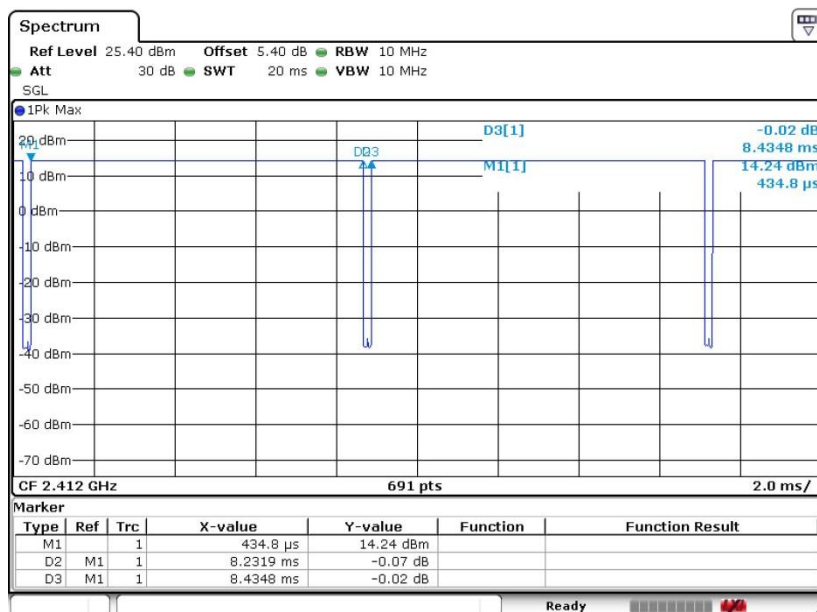
= -10.46(dB)

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

Appendix D. Duty Cycle Plots

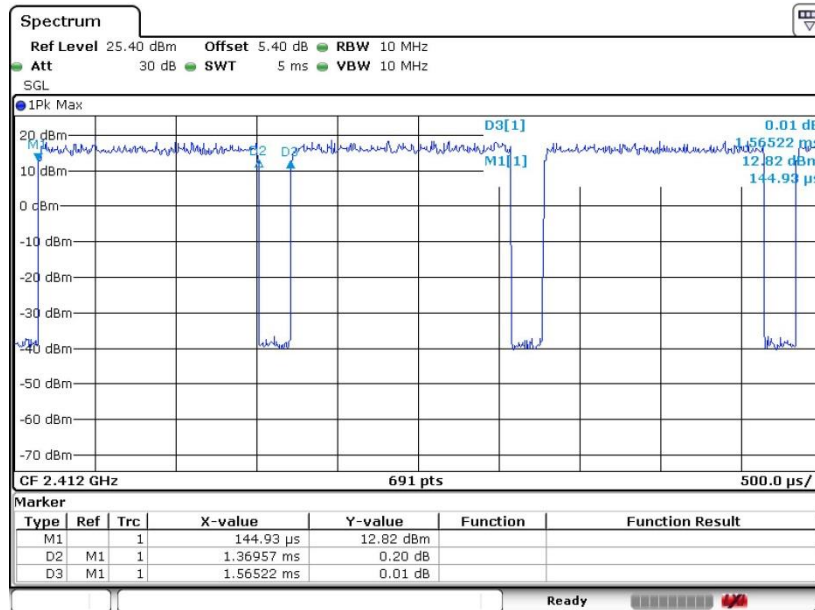
Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11b	97.59	8.232	0.121	300Hz
802.11g	87.50	1.370	0.730	1kHz
802.11n HT20	86.70	1.275	0.784	1kHz
802.11n HT40	85.79	1.225	0.816	1kHz

802.11b

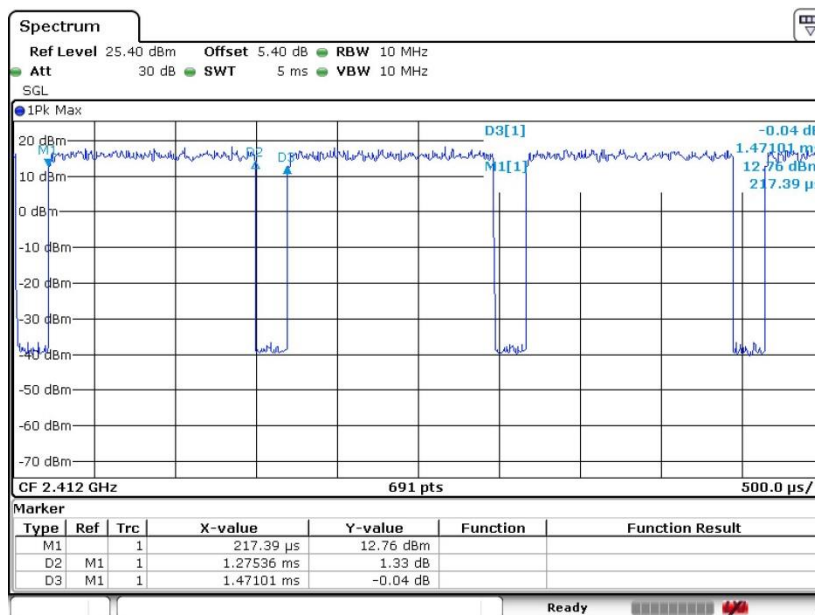




802.11g



802.11n HT20



802.11n HT40

