



FCC RF Test Report

APPLICANT : Motorola Mobility LLC
EQUIPMENT : Mobile Cellular Phone
BRAND NAME : Motorola
MODEL NAME : XT2221-1
FCC ID : IHDT56AE1
STANDARD : FCC Part 15 Subpart E §15.407
CLASSIFICATION : (NII) Unlicensed National Information Infrastructure
TEST DATE(S) : Jan. 21, 2022 ~ Feb. 16, 2022

We, Sporton International Inc. (Kunshan), 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 Inc. (Kunshan), the test report shall not be reproduced except in full.

Jason Jia

Reviewed by: Jason Jia / Supervisor

Alex Wang

Approved by: Alex Wang / Manager



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People's Republic of China**



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR1D1023F	Rev. 01	Initial issue of report	Feb. 18, 2022



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.403(i)	6dB, 26dB and 99% Occupied Bandwidth	> 500kHz	Pass	-
3.2	15.407(a)	Maximum Conducted Output Power	≤ 30 dBm	Pass	-
3.3	15.407(a)	Power Spectral Density	≤ 30 dBm/500kHz	Pass	-
3.4	15.407(b)	Unwanted Emissions	15.407(b)(4)(i) & 15.209(a)	Pass	Under limit 9.90 dB at 5925.60 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 11.97 dB at 0.193 MHz
3.6	15.203 & 15.407(a)	Antenna Requirement	15.203 & 15.407(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

Motorola Mobility LLC
222 W,Merchandise Mart Plaza, Chicago IL 60654 USA

1.2 Manufacturer

Motorola Mobility LLC
222 W,Merchandise Mart Plaza, Chicago IL 60654 USA

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Cellular Phone
Brand Name	Motorola
Model Name	XT2221-1
FCC ID	IHDT56AE1
IMEI Code	Conducted:358026320083036/358026320083044 Conduction:358026320007456/358026320007464 Radiation: 358026320007456/358026320007464
HW Version	DVT2
SW Version	S1SR32.16
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	5745 MHz ~ 5825 MHz
Maximum Output Power	<5745 MHz ~ 5825 MHz> 802.11a : 18.17 dBm / 0.0656 W 802.11n HT20 : 17.83 dBm / 0.0607 W 802.11n HT40 : 16.82 dBm / 0.0481 W 802.11ac VHT20: 16.04 dBm / 0.0402 W 802.11ac VHT40: 14.86 dBm / 0.0306 W 802.11ac VHT80: 14.36 dBm / 0.0273 W
99% Occupied Bandwidth	802.11a : 16.78 MHz 802.11n HT20 : 18.08 MHz 802.11n HT40 : 36.56 MHz 802.11ac VHT80 : 75.64 MHz
Type of Modulation	802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)
Antenna Type / Gain	PIFA Antenna with gain -5.30 dBi

Note: For 802.11n HT20 / ac VHT20 and 802.11n HT40 / ac VHT40 mode, the whole testing have assessed only 802.11n HT20/HT40 by referring to their maximum conducted power.



1.5 Modification of EUT

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

1.6 Specification of Accessory

Specification of Accessory				
AC Adapter 1(US)	Brand Name	Motorola (Salcomp)	Model Name	MC-331
AC Adapter 1(EU)	Brand Name	Motorola (Salcomp)	Model Name	MC-332
AC Adapter 1(UK)	Brand Name	Motorola (Salcomp)	Model Name	MC-333
AC Adapter 1(IN)	Brand Name	Motorola (Salcomp)	Model Name	MC-334
AC Adapter 1(AU)	Brand Name	Motorola (Salcomp)	Model Name	MC-335
AC Adapter 1(AR)	Brand Name	Motorola (Salcomp)	Model Name	MC-336
AC Adapter 1(BR)	Brand Name	Motorola (Salcomp)	Model Name	MC-337
AC Adapter 1(Chile)	Brand Name	Motorola (Salcomp)	Model Name	MC-339
AC Adapter 2(US)	Brand Name	Motorola (Acbel)	Model Name	MC-331
AC Adapter 2(EU)	Brand Name	Motorola (Acbel)	Model Name	MC-332
AC Adapter 2(UK)	Brand Name	Motorola (Acbel)	Model Name	MC-333
AC Adapter 3(US)	Brand Name	Motorola (Aohai)	Model Name	MC-331
AC Adapter 3(EU)	Brand Name	Motorola (Aohai)	Model Name	MC-332
AC Adapter 3(UK)	Brand Name	Motorola (Aohai)	Model Name	MC-333
Battery	Brand Name	Motorola (Sunwoda)	Model Name	NE50
Earphone 1	Brand Name	Motorola (NEW LEADER)	Model Name	NLD-EM313A-09SF
Earphone 2	Brand Name	Motorola (NEW LEADER)	Model Name	NLD-EM313A-19SF
Earphone 3	Brand Name	Motorola (LYAND ACOUSTIC)	Model Name	LYM239-76C-006
Earphone 4	Brand Name	Motorola (LYAND ACOUSTIC)	Model Name	LYM528-76C-001
USB Cable 1	Brand Name	Motorola (Saibao)	Model Name	SHQ-A110A
USB Cable 2	Brand Name	Motorola (Chuantuo)	Model Name	K235



1.7 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)		
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.
	CO01-KS 03CH04-KS TH01-KS	CN1257	314309

1.8 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH04-KS	AUDIX	E3	6.2009-8-24a
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.9 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 E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ANSI C63.10-2013

Remark:

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



2 Test Configuration of Equipment Under Test

- 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)
5745-5825 MHz U-NII-3	149	5745	157	5785
	151*	5755	159*	5795
	153	5765	161	5805
	155#	5775	165	5825

Note:

1. The above Frequency and Channel in "*" were 802.11n HT40 and 802.11ac VHT40.
2. The above Frequency and Channel in "#n" were 802.11ac VHT80.



2.2 Test Mode

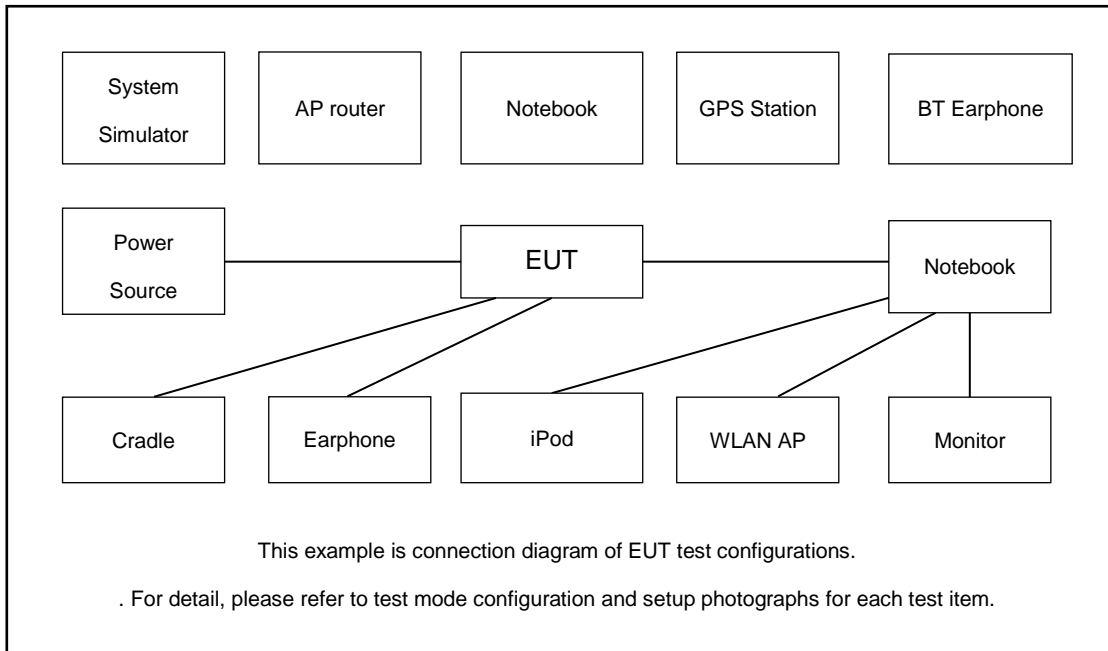
Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ac VHT80	MCS0

AC Conducted Emission	Mode 1 : GSM850 Idle + Bluetooth Link + WLAN(5G)Link + USB Cable 1(Charging from Adapter 1) +Earphone1
Remark: For Radiated Test Cases, The tests were performance with Adapter 1, Earphone 1, USB Cable 1	

Ch. #		U-NII-3 : 5745-5825 MHz			
		802.11a	802.11n HT20	802.11n HT40	802.11ac VHT80
L	Low	149	149	151	-
M	Middle	157	157	-	155
H	High	165	165	159	-

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.	LTE Base Station	Anritus	MT8821C	N/A	N/A	Unshielded,1.8m
2.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
3.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
4.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A
5.	Earphone	Motorola	N/A	N/A	N/A	N/A
6.	Adapter	N/A	N/A	N/A	N/A	N/A
7.	SD Card	Kingston	8GB	N/A	N/A	N/A



2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT 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 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 7.0dB.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)}. \\ &= 7.0 \text{ (dB)} \end{aligned}$$

3 Test Result

3.1 6dB and 26dB and 99% Occupied Bandwidth Measurement

3.1.1 Description of 6dB and 26dB and 99% Occupied Bandwidth

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

26dB and 99% Occupied bandwidth are reporting only.

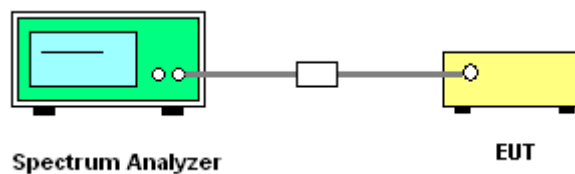
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

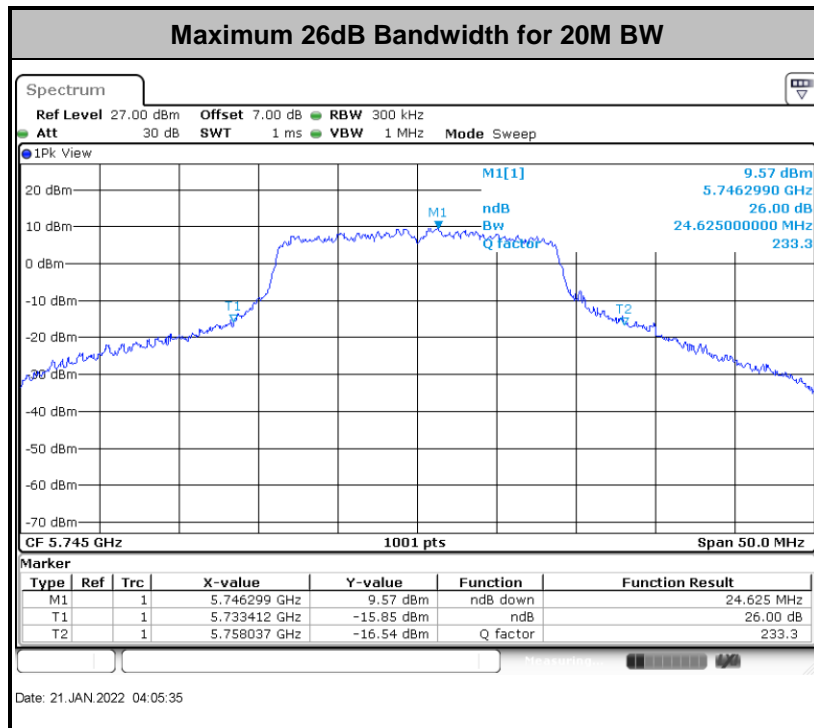
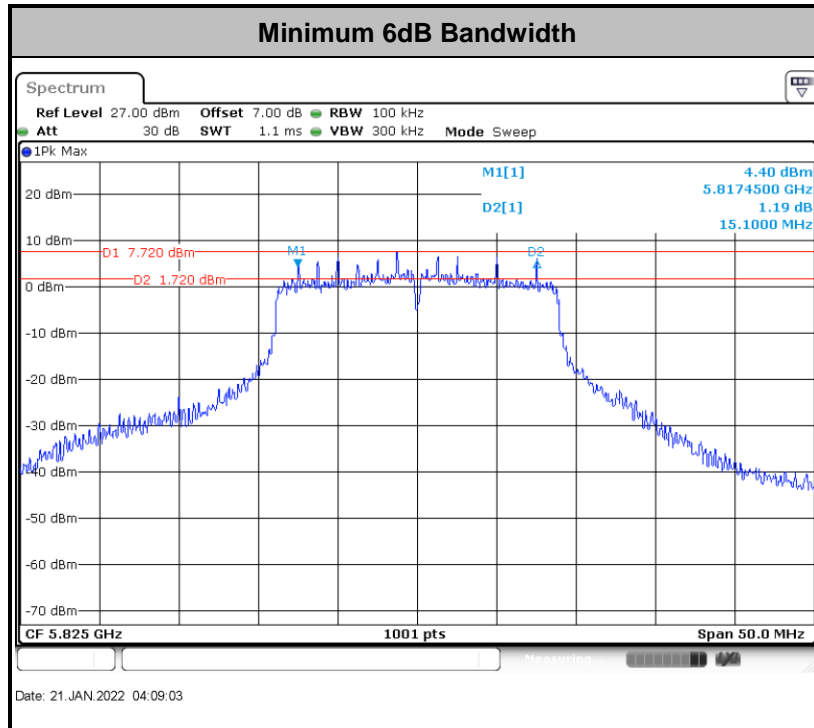
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section C) Emission bandwidth for the band 5.725-5.85GHz
2. For 6dB BW, Set RBW = 100kHz.
For 26dB BW, Set RBW = approximately 1% of the emission bandwidth.
For 99% OBW, Set RBW = 1% to 5% of the OBW.
3. For 26dB BW, Set the VBW > RBW.
For 6dB BW & 99% OBW, Set the VBW $\geq 3 \times$ RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 6 dB down from the peak of the emission.
7. Measure and record the results in the test report.

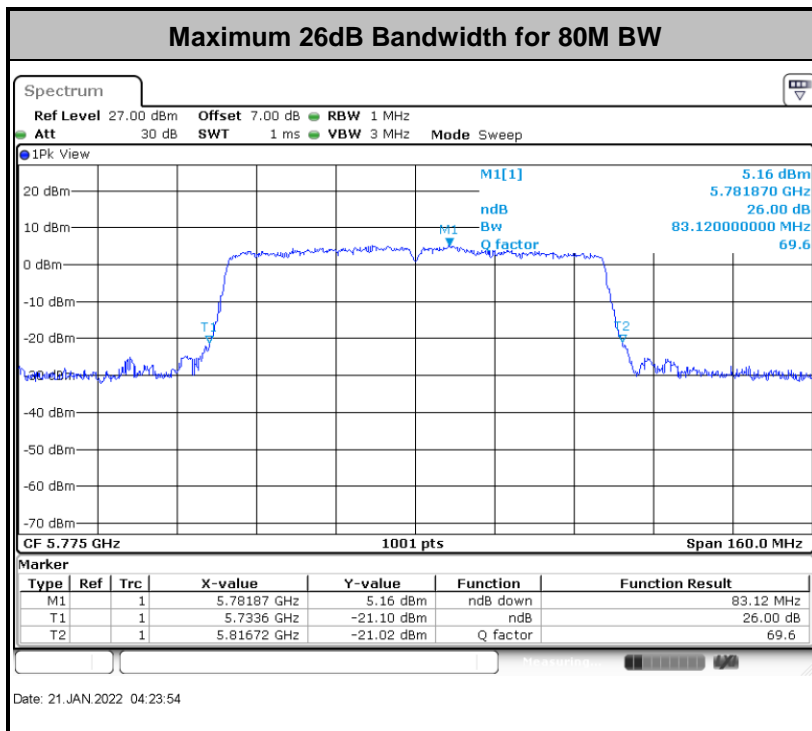
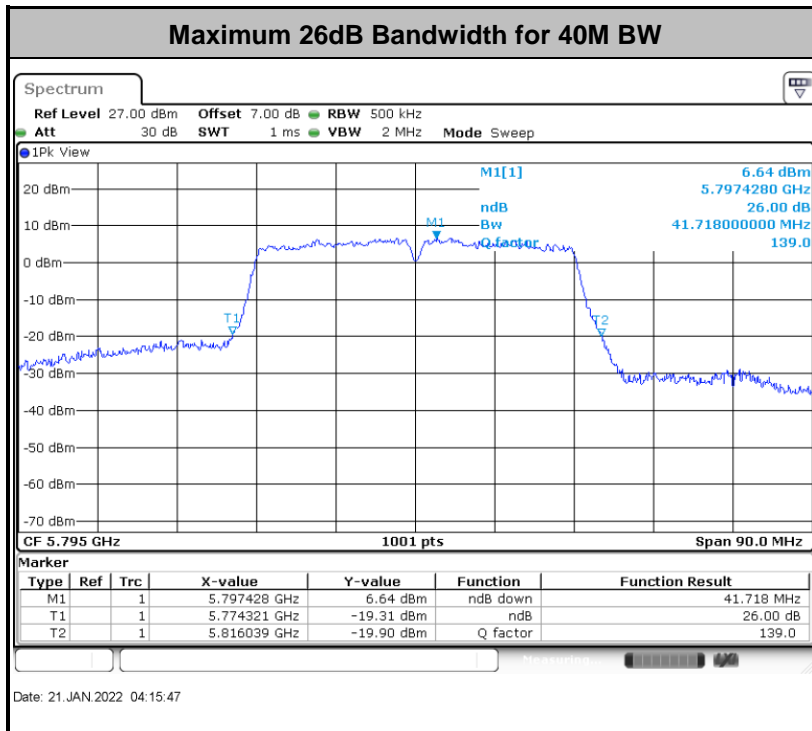
3.1.4 Test Setup

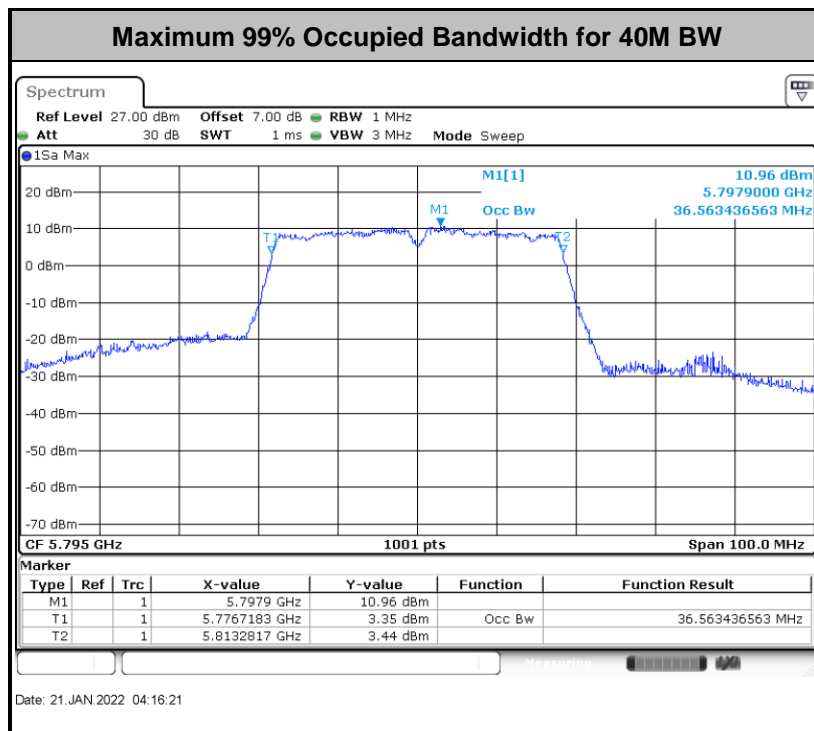
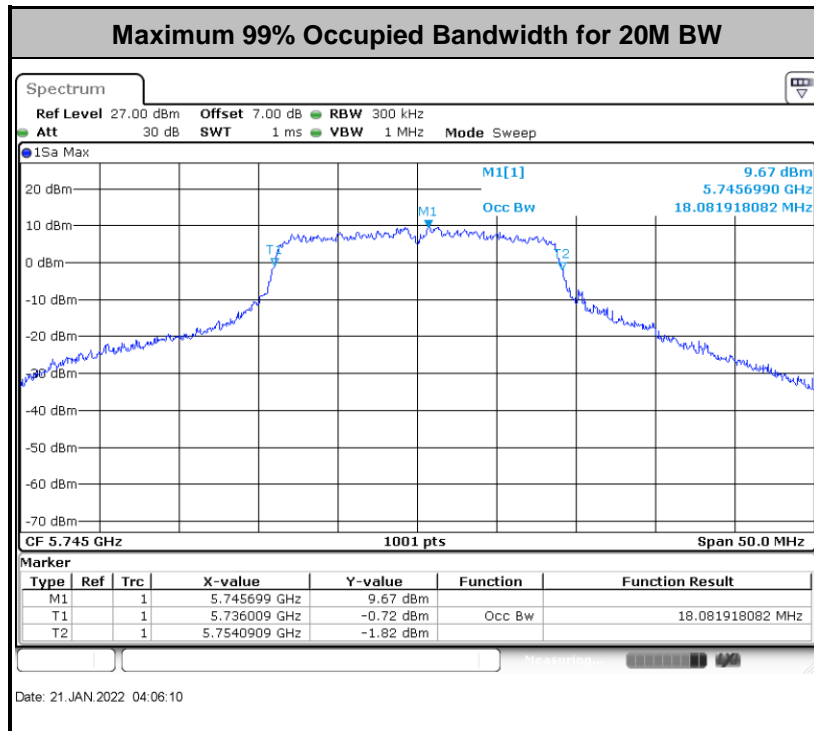


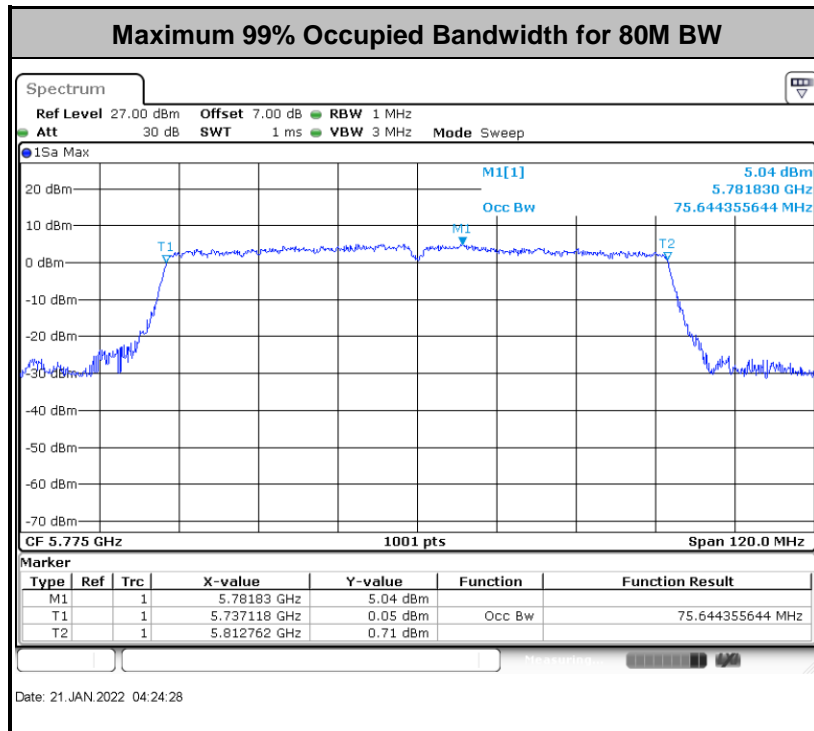
3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.









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

3.2 Maximum Conducted Output Power Measurement

3.2.1 Limit of Maximum Conducted Output Power

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

For Straddle Channel, According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.2.2 Measuring Instruments

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

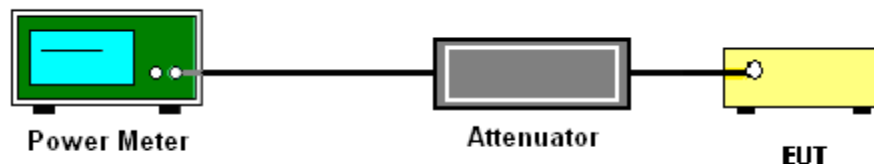
3.2.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, $10 \log(1/x)$, where x is the duty cycle.
4. For MIMO mode, the measure-and-sum technique should be used for measuring the in-band transmit power of a device.

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.



3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

For Straddle Channel, According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

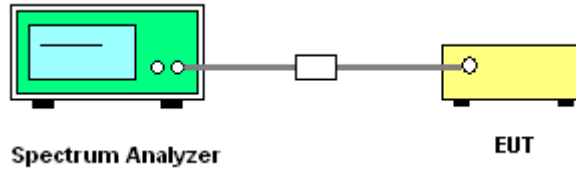
The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section F) Maximum power spectral density.

Method SA-2

(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

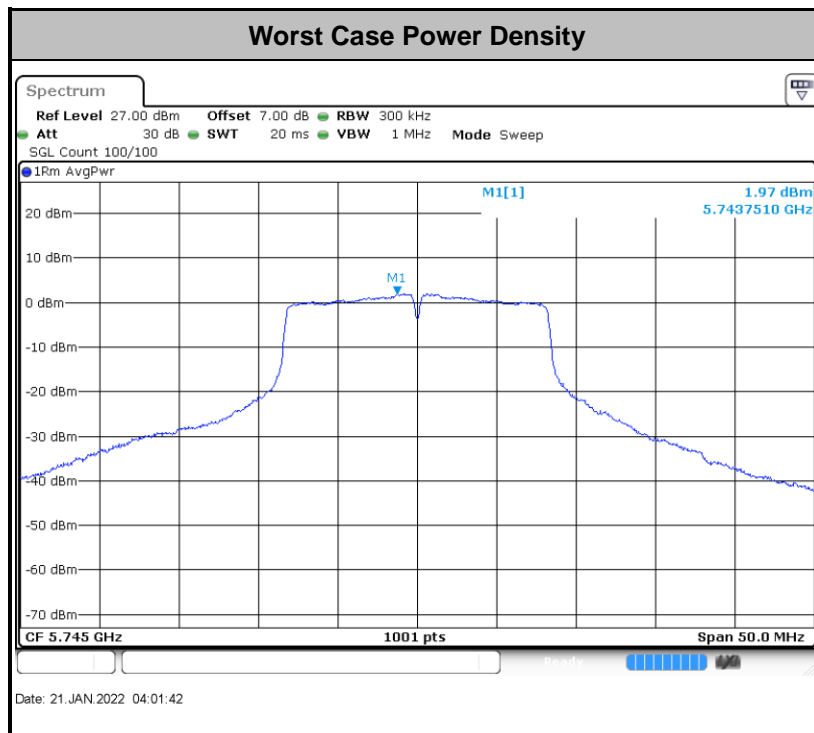
- Measure the duty cycle.
 - Set span to encompass the entire emission bandwidth (EBW) of the signal.
 - Set RBW = 300 kHz.
 - Set VBW \geq 1 MHz.
 - Number of points in sweep \geq 2 Span / RBW.
 - Sweep time = auto.
 - Detector = RMS
 - Trace average at least 100 traces in power averaging mode.
 - Add $10 \log(500\text{kHz}/\text{RBW})$ to the test result.
 - Add $10 \log(1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add $10 \log(1/0.25) = 6$ dB if the duty cycle is 25 percent.
1. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
 2. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



Note: Average Power Density (dB) = Measured value + Duty Factor + RBW Factor



3.4 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.4.1 Limit of Unwanted Emissions

- (1) For transmitters operating in the 5.725-5.85 GHz band:
 15.407(b)(4)(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
- (2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

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



EIRP (dBm)	Field Strength at 3m (dBµV/m)
- 27	68.2

Note: The following formula is used to convert the EIRP to field strength.

$$EIRP = E_{Meas} + 20\log (d_{Meas}) - 104.7$$

where

EIRP is the equivalent isotropically radiated power, in dBm

E_{Meas} is the field strength of the emission at the measurement distance, in dBµV/m

d_{Meas} is the measurement distance, in m

(3) ANSI C63.10-2013 clause 12.7.3 note 97

As specified by regulatory requirements, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit. However, an out-of-band emission that complies with both the average and peak general regulatory limits is not required to satisfy the peak emission limit.

3.4.2 Measuring Instruments

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

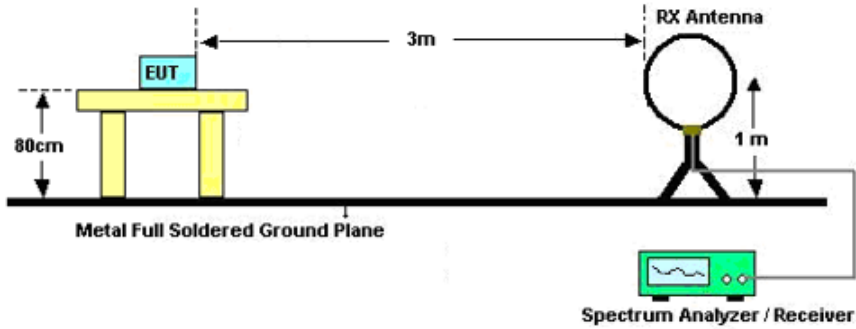


3.4.3 Test Procedures

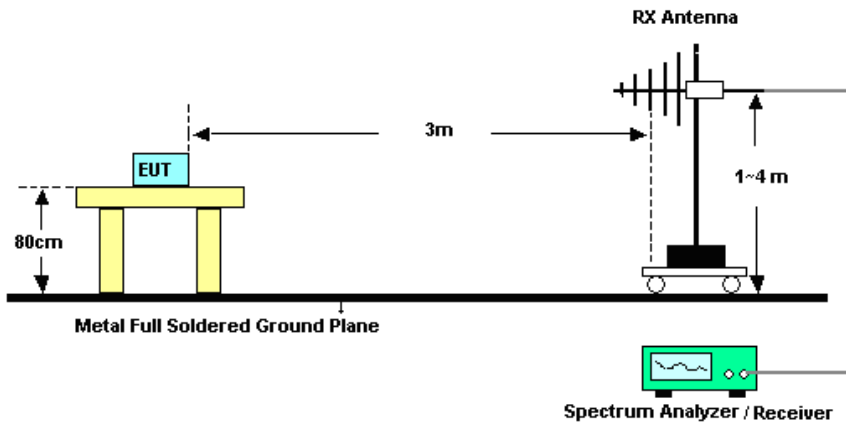
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.
 - (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
 - (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
 - RBW = 1 MHz
 - VBW \geq 3 MHz
 - Detector = Peak
 - Sweep time = auto
 - Trace mode = max hold
 - (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz
 - RBW = 1 MHz
 - 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.
2. 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.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
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 peak 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.

3.4.4 Test Setup

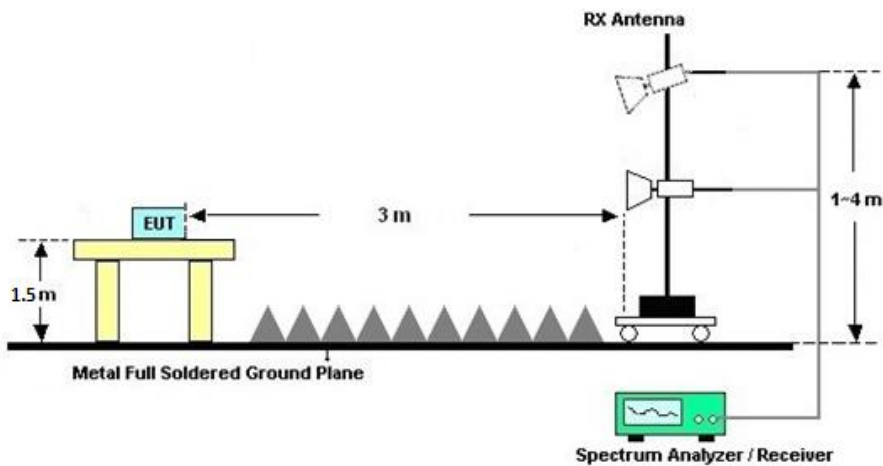
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz





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

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.

3.4.6 Test Result of Radiated Band Edges

Please refer to Appendix C.

3.4.7 Duty Cycle

Please refer to Appendix D.

3.4.8 Test Result of Unwanted Radiated Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.



3.5 AC Conducted Emission Measurement

3.5.1 Limit of AC Conducted Emission

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

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room 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 with Maximum Hold Mode.

3.5.4 Test Setup



3.5.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.6 Antenna Requirements

3.6.1 Standard Applicable

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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	101040	10Hz~40GHz	Oct. 14, 2021	Jan. 21, 2022	Oct. 13, 2022	Conducted (TH01-KS)
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 07, 2022	Jan. 21, 2022	Jan. 06, 2023	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 07, 2022	Jan. 21, 2022	Jan. 06, 2023	Conducted (TH01-KS)
Temperature & humidity chamber	Hongzhan	LP-150U	H2014011440	-40~+150°C 20%~95%RH	Jul. 12, 2021	Jan. 21, 2022	Jul. 11, 2022	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY57290151	3Hz~8.5GHz; Max 30dBm	Jul. 12, 2021	Feb. 16, 2022	Jul. 11, 2022	Radiation (03CH04-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150244	10Hz~44G, MAX 30dB	Apr. 13, 2021	Feb. 16, 2022	Apr. 12, 2022	Radiation (03CH04-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 30, 2021	Feb. 16, 2022	Oct. 29, 2022	Radiation (03CH04-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz~1GHz	May 30, 2021	Feb. 16, 2022	May 29, 2022	Radiation (03CH05-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	1356	1GHz~18GHz	Apr. 18, 2021	Feb. 16, 2022	Apr. 17, 2022	Radiation (03CH04-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 05, 2022	Feb. 16, 2022	Jan. 04, 2023	Radiation (03CH04-KS)
Amplifier	Burgeon	BPA-530	102219	0.01MHz~3000MHz	Nov. 01, 2021	Feb. 16, 2022	Oct. 31, 2022	Radiation (03CH04-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 05, 2022	Feb. 16, 2022	Jan. 04, 2023	Radiation (03CH04-KS)
high gain Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	2025788	1Ghz-18Ghz	Jul. 30, 2021	Feb. 16, 2022	Jul. 29, 2022	Radiation (03CH04-KS)
Amplifier	Keysight	83017A	MY57280106	500MHz~26.5GHz	Oct. 12, 2021	Feb. 16, 2022	Oct. 11, 2022	Radiation (03CH04-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Feb. 16, 2022	NCR	Radiation (03CH04-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Feb. 16, 2022	NCR	Radiation (03CH04-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Feb. 16, 2022	NCR	Radiation (03CH04-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 21, 2021	Jan. 22, 2022	Apr. 20, 2022	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 14, 2021	Jan. 22, 2022	Oct. 13, 2022	Conduction (CO01-KS)
AC LISN	R&S	ENV216	100334	9kHz~30MHz	Oct. 14, 2021	Jan. 22, 2022	Oct. 13, 2022	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000811	AC 0V~300V, 45Hz~1000Hz	Oct. 14, 2021	Jan. 22, 2022	Oct. 13, 2022	Conduction (CO01-KS)

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))	2.94dB
---	--------

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

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

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.1dB
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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))	5.1dB
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———— THE END ————



Appendix A. Conducted Test Results

A1. Conducted Test Results

Test Engineer:	Jacob Zhang	Temperature:	21~25	°C
Test Date:	2022/1/21	Relative Humidity:	51~54	%

TEST RESULTS DATA
6dB and 26dB EBW and 99% OBW

U-NII-3 single antenna												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)		26dB Bandwidth (MHz)		6 dB Bandwidth (MHz)		6 dB Bandwidth Min. Limit (MHz)	Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	149	5745	16.78	-	22.53	-	15.60	-	0.5	Pass
11a	6Mbps	1	157	5785	16.78	-	22.53	-	15.75	-	0.5	Pass
11a	6Mbps	1	165	5825	16.68	-	21.48	-	15.50	-	0.5	Pass
HT20	MCS0	1	149	5745	18.08	-	24.63	-	15.95	-	0.5	Pass
HT20	MCS0	1	157	5785	17.98	-	23.23	-	16.15	-	0.5	Pass
HT20	MCS0	1	165	5825	17.83	-	22.78	-	15.10	-	0.5	Pass
HT40	MCS0	1	151	5755	36.56	-	41.45	-	35.10	-	0.5	Pass
HT40	MCS0	1	159	5795	36.56	-	41.72	-	35.19	-	0.5	Pass
VHT80	MCS0	1	155	5775	75.64	-	83.12	-	75.20	-	0.5	Pass

TEST RESULTS DATA
Average Power Table

U-NII-3 single antenna												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power with duty factor (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		Pass/Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	149	5745	17.90	-		30.00	-	-5.30	-	Pass
11a	6Mbps	1	157	5785	18.17	-		30.00	-	-5.30	-	Pass
11a	6Mbps	1	165	5825	17.71	-		30.00	-	-5.30	-	Pass
HT20	MCS0	1	149	5745	17.78	-		30.00	-	-5.30	-	Pass
HT20	MCS0	1	157	5785	17.83	-		30.00	-	-5.30	-	Pass
HT20	MCS0	1	165	5825	17.63	-		30.00	-	-5.30	-	Pass
HT40	MCS0	1	151	5755	16.82	-		30.00	-	-5.30	-	Pass
HT40	MCS0	1	159	5795	16.56	-		30.00	-	-5.30	-	Pass
VHT20	MCS0	1	149	5745	15.95	-		30.00	-	-5.30	-	Pass
VHT20	MCS0	1	157	5785	16.04	-		30.00	-	-5.30	-	Pass
VHT20	MCS0	1	165	5825	15.78	-		30.00	-	-5.30	-	Pass
VHT40	MCS0	1	151	5755	14.86	-		30.00	-	-5.30	-	Pass
VHT40	MCS0	1	159	5795	14.65	-		30.00	-	-5.30	-	Pass
VHT80	MCS0	1	155	5775	14.36	-		30.00	-	-5.30	-	Pass

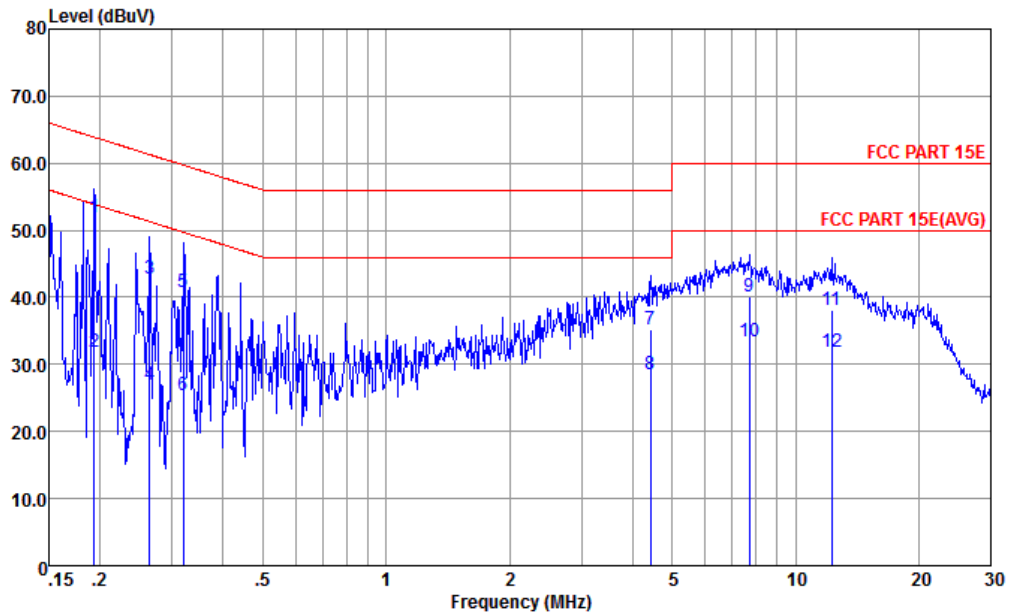
TEST RESULTS DATA
Power Spectral Density

U-NII-3 single antenna														
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	10log (500kHz /RBW) Factor (dB)		Average Power Density (dBm/500kHz)			Average PSD Limit (dBm/500kHz)		DG (dBi)		Pass /Fail
					Ant 1	Ant 2	Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	149	5745	2.22	-	4.19	-		30.00	-	-5.30	-	Pass
11a	6Mbps	1	157	5785	2.22	-	4.06	-		30.00	-	-5.30	-	Pass
11a	6Mbps	1	165	5825	2.22	-	3.71	-		30.00	-	-5.30	-	Pass
HT20	MCS0	1	149	5745	2.22	-	3.91	-		30.00	-	-5.30	-	Pass
HT20	MCS0	1	157	5785	2.22	-	3.69	-		30.00	-	-5.30	-	Pass
HT20	MCS0	1	165	5825	2.22	-	3.32	-		30.00	-	-5.30	-	Pass
HT40	MCS0	1	151	5755	2.22	-	-0.68	-		30.00	-	-5.30	-	Pass
HT40	MCS0	1	159	5795	2.22	-	-1.12	-		30.00	-	-5.30	-	Pass
VHT80	MCS0	1	155	5775	2.22	-	-6.38	-		30.00	-	-5.30	-	Pass



Appendix B. AC Conducted Emission Test Results

Test Engineer :	Amos Zhang	Temperature :	25.3~26.2°C
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	Phase :	Line

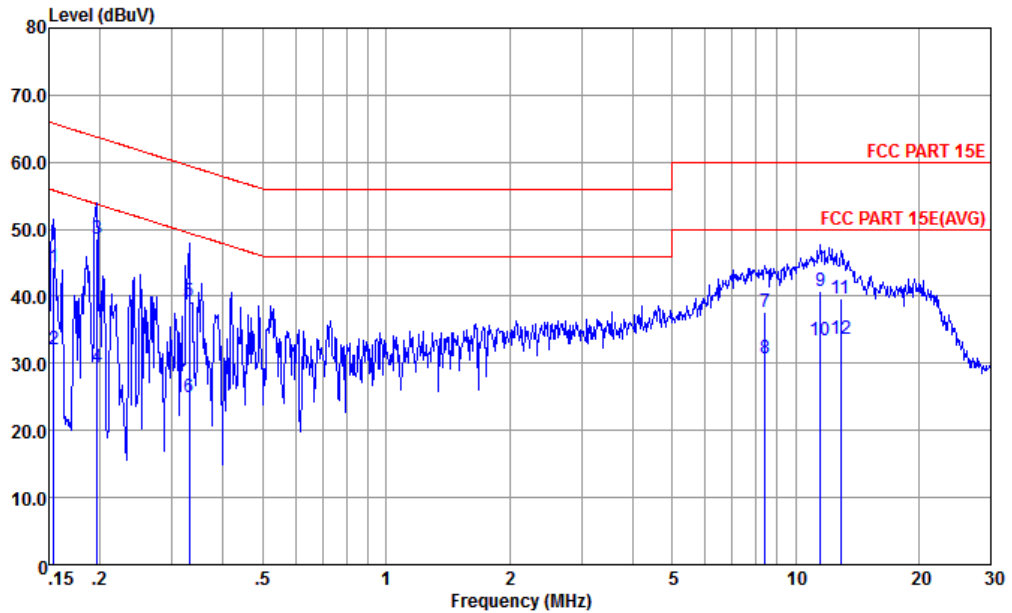


Site : CO01-KS
 Condition : FCC PART 15E LISN-060105-L LINE

	Freq	Level	Over	Limit	Read	LISN	Cable	Remark
	MHz	dBuV	Limit	Line	Level	Factor	Loss	
			dB	dBuV	dBuV	dB	dB	
1 *	0.193	51.92	-11.97	63.89	41.50	0.04	10.38	QP
2	0.193	31.92	-21.97	53.89	21.50	0.04	10.38	Average
3	0.264	42.89	-18.40	61.29	32.51	0.06	10.32	QP
4	0.264	26.89	-24.40	51.29	16.51	0.06	10.32	Average
5	0.320	40.87	-18.84	59.71	30.50	0.07	10.30	QP
6	0.320	25.47	-24.24	49.71	15.10	0.07	10.30	Average
7	4.430	35.23	-20.77	56.00	24.80	0.17	10.26	QP
8	4.430	28.63	-17.37	46.00	18.20	0.17	10.26	Average
9	7.728	40.01	-19.99	60.00	29.50	0.20	10.31	QP
10	7.728	33.41	-16.59	50.00	22.90	0.20	10.31	Average
11	12.253	38.13	-21.87	60.00	27.50	0.26	10.37	QP
12	12.253	31.83	-18.17	50.00	21.20	0.26	10.37	Average



Test Engineer :	Amos Zhang	Temperature :	25.3~26.2°C
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral



Site : CO01-KS
 Condition : FCC PART 15E LISN-060105-N NEUTRAL

	Freq	Level	Over	Limit	Read	LISN	Cable	Remark
	MHz	dBuV	Limit	Line	Level	Factor	Loss	
			dB	dBuV	dBuV	dB	dB	
1	0.154	44.38	-21.40	65.78	33.80	0.11	10.47	QP
2	0.154	32.08	-23.70	55.78	21.50	0.11	10.47	Average
3 *	0.197	48.67	-15.09	63.76	38.20	0.10	10.37	QP
4	0.197	29.37	-24.39	53.76	18.90	0.10	10.37	Average
5	0.330	39.30	-20.14	59.44	28.91	0.10	10.29	QP
6	0.330	24.90	-24.54	49.44	14.51	0.10	10.29	Average
7	8.412	37.74	-22.26	60.00	27.20	0.22	10.32	QP
8	8.412	30.74	-19.26	50.00	20.20	0.22	10.32	Average
9	11.498	40.82	-19.18	60.00	30.20	0.26	10.36	QP
10	11.498	33.42	-16.58	50.00	22.80	0.26	10.36	Average
11	12.920	39.56	-20.44	60.00	28.90	0.28	10.38	QP
12	12.920	33.56	-16.44	50.00	22.90	0.28	10.38	Average

Note:

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



Appendix C. Radiated Spurious Emission

For each bandwidth, only the worst cases are shown in the report.

UNII-3 5725~5850MHz

WIFI 802.11a (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path 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)
802.11a CH 165 5825MHz		5852	67.05	-50.69	117.74	50.82	34.6	11.38	29.75	114	166	P	H
		5855.2	63.15	-47.69	110.84	46.88	34.63	11.39	29.75	114	166	P	H
		5884.8	58.34	-39.68	98.02	42.09	34.65	11.4	29.8	114	166	P	H
		5997.2	57.78	-10.52	68.3	41.4	34.8	11.47	29.89	114	166	P	H
		5824	109.8	—	—	93.6	34.58	11.38	29.76	114	166	P	H
		5824	102.5	—	—	86.3	34.58	11.38	29.76	114	166	A	H
		5851.6	66.59	-52.06	118.65	50.36	34.6	11.38	29.75	281	170	P	V
		5854.8	61.23	-50.13	111.36	44.96	34.63	11.39	29.75	281	170	P	V
		5878.4	57.93	-44.84	102.77	41.65	34.65	11.4	29.77	281	170	P	V
		5975.6	57.49	-10.81	68.3	41.11	34.78	11.46	29.86	281	170	P	V
		5830	107.99	—	—	91.79	34.58	11.38	29.76	281	170	P	V
		5830	100.92	—	—	84.72	34.58	11.38	29.76	281	170	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



UNII-3 5725~5850MHz
WIFI 802.11a (Harmonic @ 3m)

Table with 14 columns: WIFI Ant., Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Path Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). It contains two data rows for 802.11a CH 165 at 5825MHz and a Remark section.



UNII-3 5725~5850MHz
WIFI 802.11n HT40 (Band Edge @ 3m)

Table with 14 columns: WIFI Ant. 1, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Path Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include test data for 802.11n HT40 CH 159 5795MHz and a Remark section.



UNII-3 5725~5850MHz
WIFI 802.11n HT40 (Harmonic @ 3m)

Table with 14 columns: WIFI Ant. 1, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Path Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include data for 802.11n HT40 CH 159 5795MHz and a Remark section.



UNII-3 5725~5850MHz
WIFI 802.11ac VHT80 (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)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT80 CH 155 5775MHz		5604.8	58.16	-10.14	68.3	42.39	34.42	11.13	29.78	102	345	P	H
		5695.2	70.84	-30.92	101.76	54.97	34.44	11.23	29.8	102	345	P	H
		5717.6	72.74	-37.49	110.23	56.79	34.47	11.27	29.79	102	345	P	H
		5722	73.97	-41.49	115.46	58.02	34.47	11.27	29.79	102	345	P	H
		5782	101.35	—	—	85.26	34.51	11.34	29.76	102	345	P	H
		5782	94.37	—	—	78.28	34.51	11.34	29.76	102	345	A	H
		5850.4	66.27	-55.12	121.39	50.04	34.6	11.38	29.75	102	345	P	H
		5861.6	65.75	-43.3	109.05	49.5	34.63	11.39	29.77	102	345	P	H
		5874.8	61.39	-43.97	105.36	45.11	34.65	11.4	29.77	102	345	P	H
		5928.8	57.69	-10.61	68.3	41.36	34.72	11.43	29.82	102	345	P	H
		5609.6	56.9	-11.4	68.3	41.13	34.42	11.13	29.78	302	359	P	V
		5695.6	63.82	-38.24	102.06	47.95	34.44	11.23	29.8	302	359	P	V
		5720	67.86	-43.04	110.9	51.91	34.47	11.27	29.79	302	359	P	V
		5720.8	67.05	-45.67	112.72	51.1	34.47	11.27	29.79	302	359	P	V
		5782	97.77	—	—	81.68	34.51	11.34	29.76	302	359	P	V
		5782	90.72	—	—	74.63	34.51	11.34	29.76	302	359	A	V
		5850.8	64.35	-56.13	120.48	48.12	34.6	11.38	29.75	302	359	P	V
		5866	64.59	-43.23	107.82	48.34	34.63	11.39	29.77	302	359	P	V
	5878.4	61.11	-41.66	102.77	44.83	34.65	11.4	29.77	302	359	P	V	
	5982.4	57.63	-10.67	68.3	41.25	34.78	11.46	29.86	302	359	P	V	
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



UNII-3 5725~5850MHz
WIFI 802.11ac VHT80 (Harmonic @ 3m)

Table with 14 columns: WIFI Ant. 1, Note, Frequency (MHz), Level (dBµV/m), Over Limit (dB), Limit Line (dBµV/m), Read Level (dBµV), Antenna Factor (dB/m), Path Loss (dB), Preamp Factor (dB), Ant Pos (cm), Table Pos (deg), Peak Avg. (P/A), Pol. (H/V). Rows include test results for 802.11ac VHT80 and CH 155 5775MHz, and a Remark section.



Emission below 1GHz
WIFI 802.11n HT40 (LF @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11n HT40 LF		50.37	22.73	-17.27	40	39.57	14.33	1.02	32.19	-	-	P	H
		96.93	23.53	-19.97	43.5	38.71	15.55	1.46	32.19	-	-	P	H
		106.63	22.15	-21.35	43.5	36.46	16.38	1.5	32.19	-	-	P	H
		177.44	21.65	-21.85	43.5	36.82	15.02	1.94	32.13	-	-	P	H
		190.05	21.69	-21.81	43.5	36.98	14.81	2.01	32.11	-	-	P	H
		309.36	24.21	-21.79	46	34.49	19.21	2.58	32.07	-	-	P	H
		39.7	25.48	-14.52	40	37.23	19.56	0.88	32.19	-	-	P	V
		99.84	28.01	-15.49	43.5	42.85	15.9	1.45	32.19	-	-	P	V
		176.47	29.5	-14	43.5	44.62	15.08	1.94	32.14	-	-	P	V
		190.05	27.21	-16.29	43.5	42.5	14.81	2.01	32.11	-	-	P	V
		311.3	19.89	-26.11	46	30.16	19.22	2.58	32.07	-	-	P	V
		831.22	30.08	-15.92	46	28.59	28.8	4.22	31.53	-	-	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	Peak or Average
H/V	Horizontal or Vertical



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

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	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. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)
= Antenna Factor(dB/m) + Path 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) + Path 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)

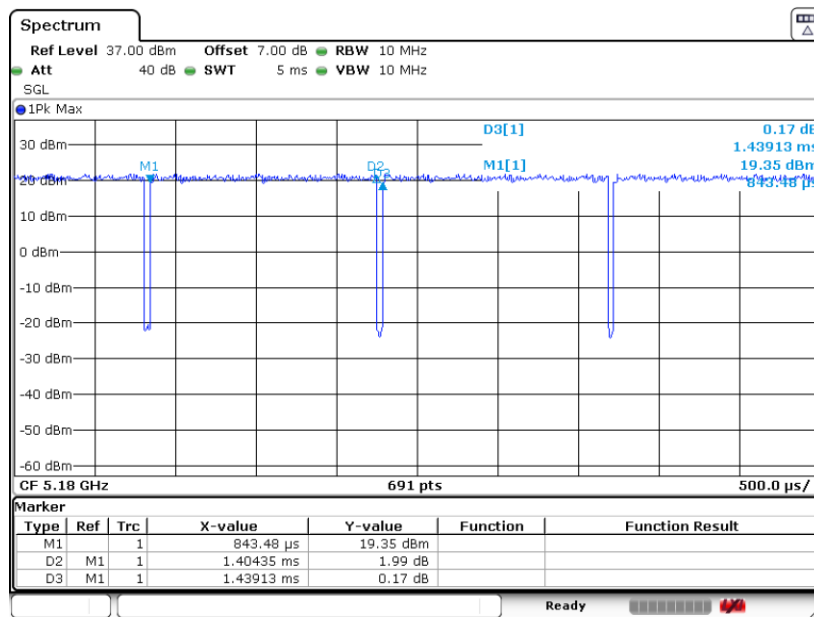
Both peak and average measured complies with the limit line, so test result is “PASS”.



Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11a	97.58	1.404	0.712	0.75KHz
802.11n HT20	97.41	1.310	0.763	0.82KHz
802.11n HT40	94.53	0.651	1.537	1.6KHz
802.11ac VHT80	90.32	0.325	3.080	3.3KHz

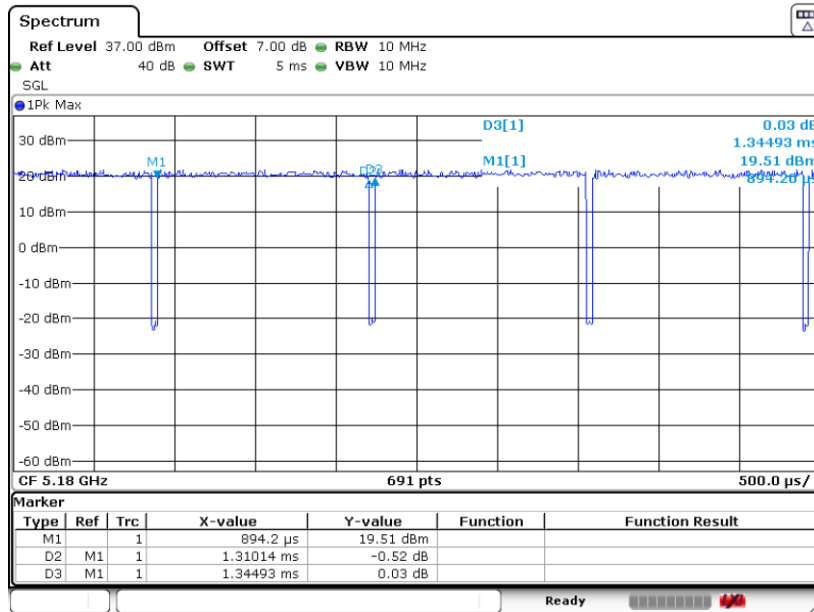
802.11a



Date: 18 JAN 2022 16:10:39

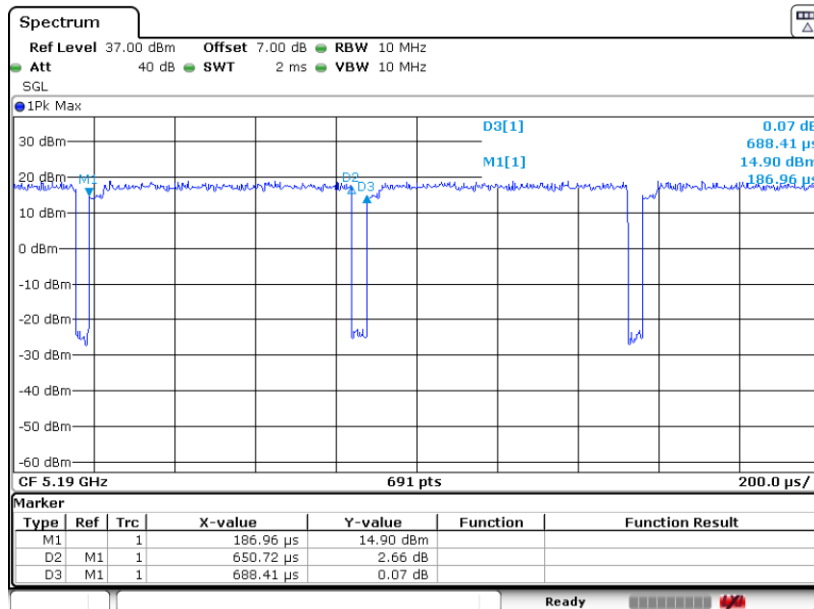


802.11n HT20



Date: 18 JAN 2022 17:03:19

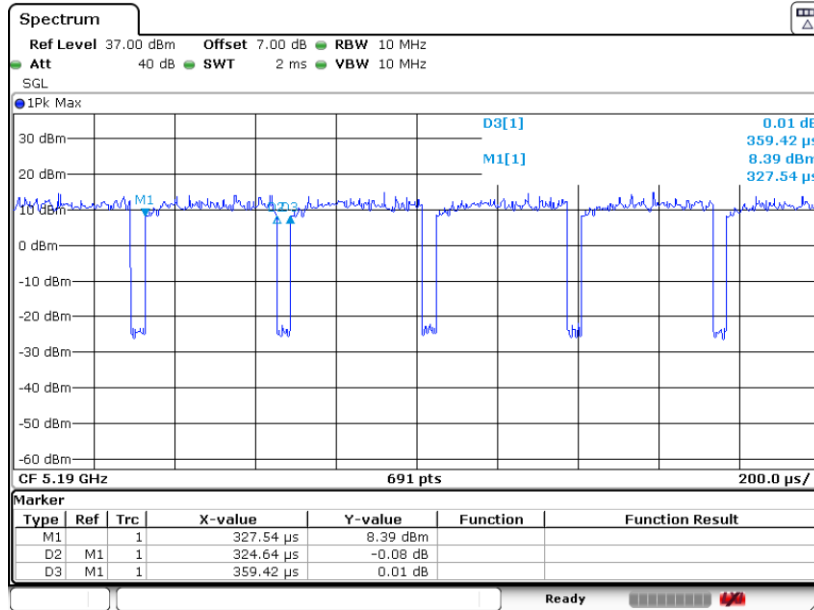
802.11n HT40



Date: 18 JAN 2022 17:14:22



802.11ac VHT80



Date: 18 JAN 2022 18:30:56