



FCC RF Test Report

APPLICANT : Inseego Corp.
EQUIPMENT : wireless device
BRAND NAME : Inseego
MODEL NAME : FX20003, FX2000e-3
FCC ID : PKRISGFX20003
STANDARD : FCC Part 15 Subpart E §15.407
CLASSIFICATION : (NII) Unlicensed National Information Infrastructure

The testing was completed on Feb. 26, 2021. We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc., the test report shall not be reproduced except in full.

Jason Jia

Reviewed by: Jason Jia / Supervisor

Alex Wang

Approved by: Alex Wang / Manager



Sporton International (Kunshan) Inc.

No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR121027B	Rev. 01	Initial issue of report	Mar. 12, 2021



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.407(a)	Maximum Conducted Output Power	≤ 24 dBm	Pass	
3.2	15.407(a)	Power Spectral Density	≤ 11 dBm	Pass	
3.3	15.407(b)	Unwanted Emissions	15.407(b) & 15.209(a)	Pass	Under limit 0.08 dB at 5149.980 MHz
3.4	15.407(c)	Automatically Discontinue Transmission	Discontinue Transmission	Pass	-
3.5	15.203 & 15.407(a)	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

Inseego Corp.
9710 Scranton Road, Suite 200 San Diego, CA 92121

1.2 Manufacturer

MeiG Smart Technology Co., Ltd
Floor 2, Office Building No.5, Lingxia Road, Fenghuang Community, Fuyong Street, Bao 'an District, Shenzhen

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	wireless device
Brand Name	Inseego
Model Name	FX20003, FX2000e-3
FCC ID	PKRISGFX20003
EUT supports Radios application	WCDMA/LTE/5G NR/GNSS WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 2.4GHz 802.11ac VHT20/VHT40 WLAN 2.4GHz 802.11ax HE20/HE40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 WLAN 5GHz 802.11ax HE20/HE40/HE80
IMEI Code	Conducted: N/A Radiation: 990016670003779
HW Version	Rev1
FVIN	1
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. This is a variant report for FX20003, FX2000e-3. The change note could be referred to the product equality declaration which is exhibit separately. Based on the similarity between current and previous project, only the related test cases from original report (Sporton Report Number FR082812-01B) were verified for the differences.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification										
Tx/Rx Frequency Range	5180 MHz ~ 5240 MHz									
Maximum Output Power to Antenna	MIMO <Ant.1+2> 802.11a : 13.50 dBm / 0.0224 W 802.11n HT20 : 13.86 dBm / 0.0243 W 802.11n HT40 : 16.46 dBm / 0.0443 W 802.11ac VHT20 : 13.83 dBm / 0.0242 W 802.11ac VHT40 : 16.34 dBm / 0.0431 W 802.11ac VHT80 : 17.28 dBm / 0.0535 W 802.11ax HE20 : 13.92 dBm / 0.0247 W 802.11ax HE40 : 16.69 dBm / 0.0467 W 802.11ax HE80 : 17.58 dBm / 0.0573 W									
Antenna Type / Gain	<5180 MHz ~ 5240 MHz> <Ant. 1> : IFA Antenna with gain 4.23 dBi <Ant. 2> : Monopole Antenna with gain 4.6 dBi									
Type of Modulation	802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac/ax : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM)									
Antenna Function Description	<table border="1"> <thead> <tr> <th></th> <th>Ant. 1</th> <th>Ant. 2</th> </tr> </thead> <tbody> <tr> <td>802.11a/n/ac/ax SISO</td> <td style="text-align: center;">V</td> <td style="text-align: center;">V</td> </tr> <tr> <td>802.11a/n/ac/ax MIMO</td> <td colspan="2" style="text-align: center;">V</td> </tr> </tbody> </table>		Ant. 1	Ant. 2	802.11a/n/ac/ax SISO	V	V	802.11a/n/ac/ax MIMO	V	
	Ant. 1	Ant. 2								
802.11a/n/ac/ax SISO	V	V								
802.11a/n/ac/ax MIMO	V									

Note: For RSE testing, 802.11n HT20 / ac VHT20 / ax HE20 and 802.11n HT40 / ac VHT40 / ax HE40 mode and 802.11ac VHT80 / ax HE80, the whole testing have assessed only 802.11ax HE20/ HE40/ HE80 by referring to their maximum conducted power and Partial RU were verified for Radiated Band edge which is lower conducted power than full RU mode.

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.
	03CH06-KS TH01-KS	CN1257	314309

1.7 Test Software

Item	Site	Manufacture	Name	Version
1.	03CH06-KS	AUDIX	E3	6.2009-8-24al

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 E
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output 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 (X 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)
5180-5240 MHz Band 1 (U-NII-1)	36	5180	44	5220
	38*	5190	46*	5230
	40	5200	48	5240
	42#	5210		

Note:

1. The above Frequency and Channel in "*" were 802.11n HT40 and 802.11ac VHT40 and 802.11ax HE 40
2. The above Frequency and Channel in "#n" were 802.11ac VHT80 and 802.11ax HE 80



2.2 Test Mode

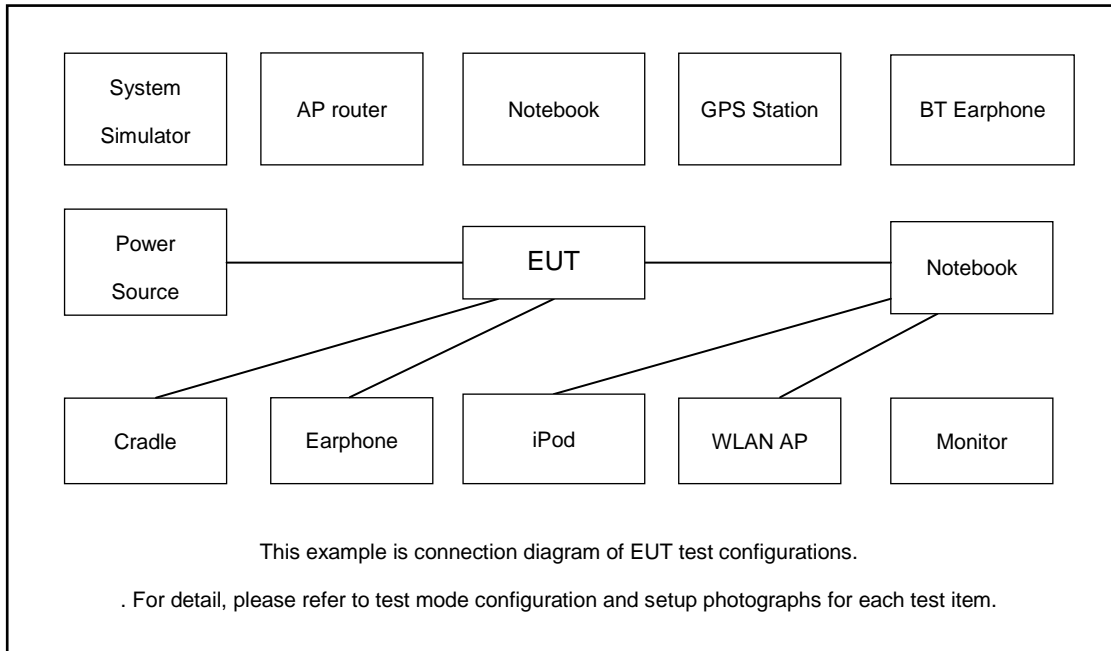
Final test modes are considering the modulation and worse data rates as below table.

MIMO Mode

Modulation	Data Rate
802.11a	6 Mbps
802.11ax HE20	MCS0
802.11ax HE40	MCS0
802.11ax HE80	MCS0

Ch. #		Band I : 5180-5240 MHz			
		802.11a	802.11ax HE20	802.11ax HE40	802.11ax HE80
L	Low	36	36	38	-
M	Middle	44	44	-	42
H	High	48	48	46	-

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.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
2.	Notebook	Lenovo	V130-15IKB005	N/A	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
3.	Hard DISK	WD	C6B	N/A	N/A	N/A
4.	Earphone	Lenovo	P121	N/A	Unshielded,1.2m	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.

3 Test Result

3.1 Maximum Conducted Output Power Measurement

3.1.1 Limit of Maximum Conducted Output Power

<FCC 14-30 CFR 15.407>

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW.

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.

3.1.2 Measuring Instruments

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

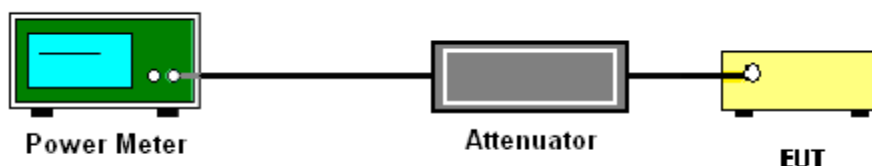
3.1.3 Test Procedures

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.

3.1.4 Test Setup



3.1.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.



3.2 Power Spectral Density Measurement

3.2.1 Limit of Power Spectral Density

<FCC 14-30 CFR 15.407>

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band.

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

Method SA-2

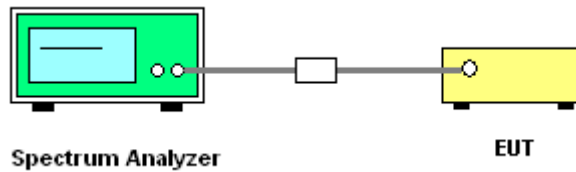
(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

- Measure the duty cycle.
 - Set span to encompass the entire emission bandwidth (EBW) of the signal.
 - Set RBW = 1 MHz.
 - Set VBW \geq 3 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 $10 \log(1/x)$, 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. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

Method (a): Measure and sum the spectra across the outputs.

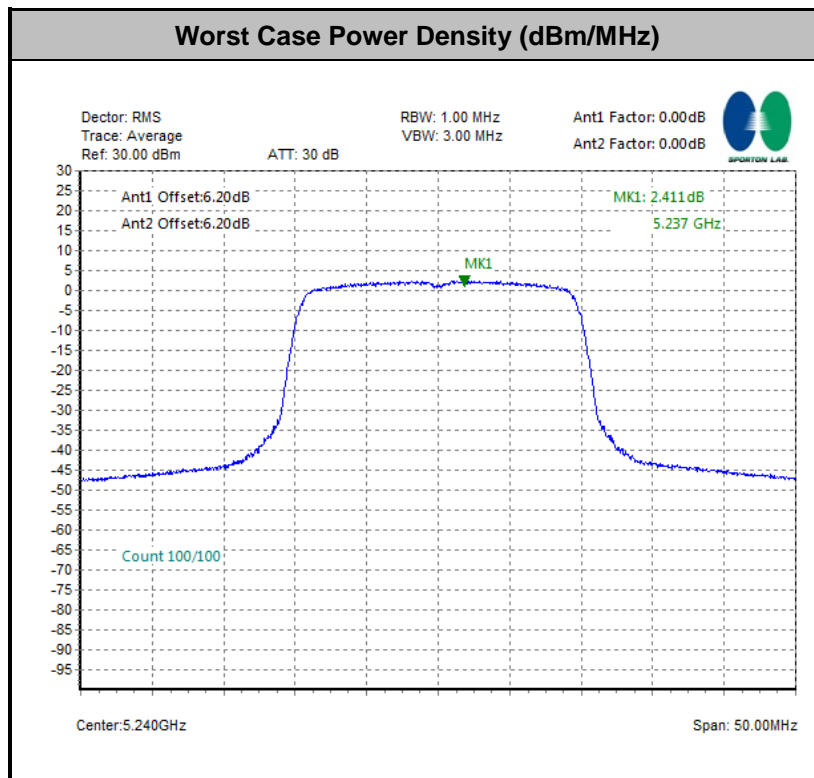
The total final Power Spectral Density is from a device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

3.2.4 Test Setup



3.2.5 Test Result of Power Spectral Density

Please refer to Appendix A.





3.3 Unwanted Emissions Measurement

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

3.3.1 Limit of Unwanted Emissions

- (1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27dBm/MHz.
- (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	68.3

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

3.3.2 Measuring Instruments

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

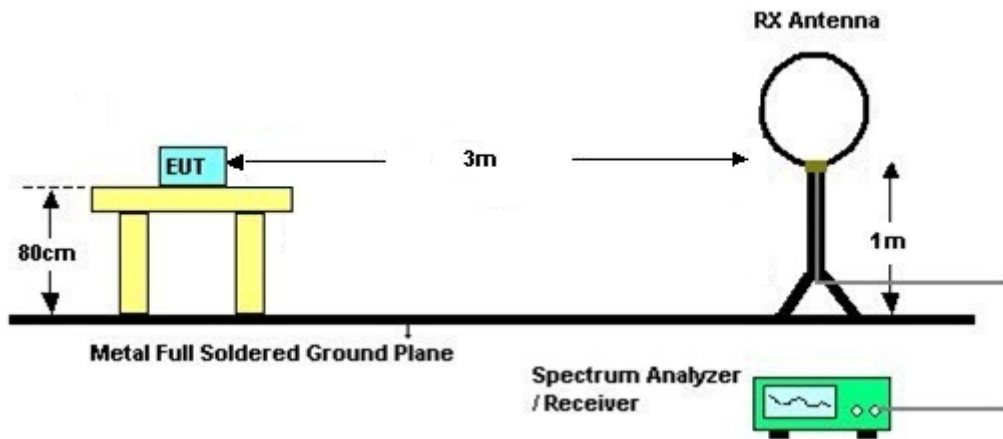


3.3.3 Test Procedures

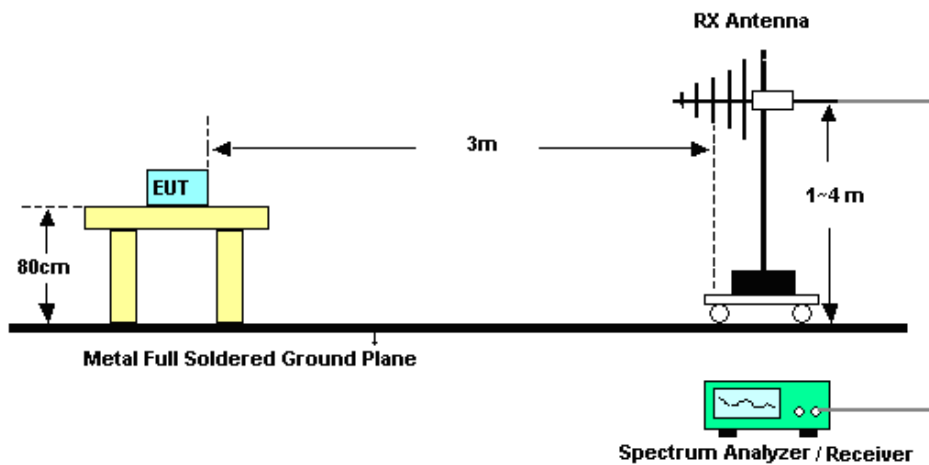
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.
 - (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
 - (2) Procedure for Peak 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.

3.3.4 Test Setup

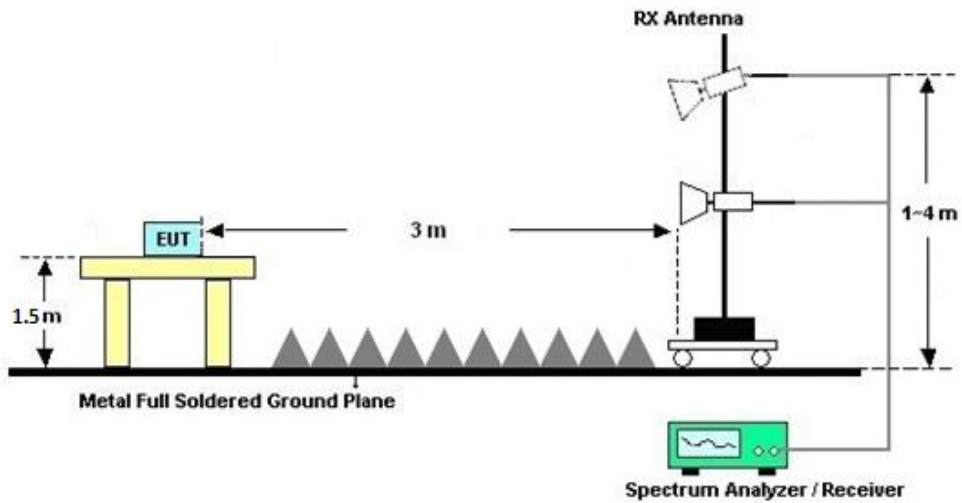
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.3.5 Test Results of Radiated Spurious 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.

3.3.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B.

3.3.7 Duty Cycle

Please refer to Appendix C.

3.3.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix B.



3.4 Automatically Discontinue Transmission

3.4.1 Limit of Automatically Discontinue Transmission

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization to describe how this requirement is met.

3.4.2 Measuring Instruments

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

3.4.3 Test Result of Automatically Discontinue Transmission

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.



3.5 Antenna Requirements

3.5.1 Standard Applicable

If transmitting antenna directional gain is greater than 6 dBi for UNII-3, 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.

3.5.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.5.3 Antenna Gain

<CDD Modes >

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

Directional gain = GANT + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(NANT/NSS=1) dB.

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4.

Directional gain may be calculated by using the formulas applicable to equal gain antennas with GANT set equal to the gain of the antenna having the highest gain;

The EUT supports CDD mode.

For power, the directional gain GANT is set equal to the antenna having the highest gain, i.e., F)2)f)i).

For PSD, the directional gain calculation is following F)2)f)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain "DG" is calculated as following table.

<CDD Modes>						
			DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
	Ant. 1 (dBi)	Ant. 2 (dBi)				
Band I	4.23	4.60	4.60	7.43	0.00	1.43



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. 01, 2020	Feb. 04, 2021	Oct. 31, 2021	Conducted (TH01-KS)
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 07, 2021	Feb. 04, 2021	Jan. 06, 2022	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 07, 2021	Feb. 04, 2021	Jan. 06, 2022	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY56400004	3Hz~8.5GHz;Max 30dBm	Oct. 17, 2020	Feb. 26, 2021	Oct. 16, 2021	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150208	10Hz~44GHz	Apr. 14, 2020	Feb. 26, 2021	Apr. 13, 2021	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 01, 2020	Feb. 26, 2021	Oct. 31, 2021	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz~1GHz	May 29, 2020	Feb. 26, 2021	May 28, 2021	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218652	1GHz~18GHz	Apr. 27, 2020	Feb. 26, 2021	Apr. 26, 2021	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101115	18GHz~40GHz	Nov. 10, 2020	Feb. 26, 2021	Nov. 09, 2021	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	187289	9KHz ~1GHZ	Apr. 14, 2020	Feb. 26, 2021	Apr. 13, 2021	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 06, 2021	Feb. 26, 2021	Jan. 05, 2022	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2025788	1Ghz-18Ghz	Jan. 06, 2021	Feb. 26, 2021	Jan. 05, 2022	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	MY53270203	500MHz~26.5GHz	Apr. 15, 2020	Feb. 26, 2021	Apr. 14, 2021	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Feb. 26, 2021	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Feb. 26, 2021	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Feb. 26, 2021	NCR	Radiation (03CH06-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))	2.9dB
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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
---	-------

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

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



Appendix A. Conducted Test Results

TEST RESULTS DATA
Average Power Table

FCC Band I														
Mod.	Data Rate	Ntx	CH.	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	2	36	5180	0.00	0.00	10.13	10.81	13.49	24.00	4.60		Pass	
11a	6Mbps	2	44	5220	0.00	0.00	9.92	10.99	13.50	24.00	4.60		Pass	
11a	6Mbps	2	48	5240	0.00	0.00	9.95	10.67	13.34	24.00	4.60		Pass	
HT20	MCS0	2	36	5180	0.00	0.00	10.06	10.81	13.46	24.00	4.60		Pass	
HT20	MCS0	2	44	5220	0.00	0.00	10.21	11.12	13.70	24.00	4.60		Pass	
HT20	MCS0	2	48	5240	0.00	0.00	10.28	11.35	13.86	24.00	4.60		Pass	
HT40	MCS0	2	38	5190	0.00	0.00	12.92	13.93	16.46	24.00	4.60		Pass	
HT40	MCS0	2	46	5230	0.00	0.00	12.72	13.81	16.31	24.00	4.60		Pass	
VHT20	MCS0	2	36	5180	0.00	0.00	10.02	10.77	13.42	24.00	4.60		Pass	
VHT20	MCS0	2	44	5220	0.00	0.00	10.16	11.07	13.65	24.00	4.60		Pass	
VHT20	MCS0	2	48	5240	0.00	0.00	10.25	11.32	13.83	24.00	4.60		Pass	
VHT40	MCS0	2	38	5190	0.00	0.00	12.81	13.79	16.34	24.00	4.60		Pass	
VHT40	MCS0	2	46	5230	0.00	0.00	12.68	13.72	16.24	24.00	4.60		Pass	
VHT80	MCS0	2	42	5210	0.00	0.00	13.76	14.73	17.28	24.00	4.60		Pass	
HE20	MCS0	2	36	5180	0.00	0.00	10.12	10.85	13.51	24.00	4.60		Pass	
HE20-26RU	MCS0	2	36	5180	0.00	0.00	7.85	7.71	10.79	24.00	4.60		Pass	
HE20-52RU	MCS0	2	36	5180	0.00	0.00	9.73	9.96	12.86	24.00	4.60		Pass	
HE20-106RU	MCS0	2	36	5180	0.00	0.00	9.98	10.05	13.03	24.00	4.60		Pass	
HE20	MCS0	2	44	5220	0.00	0.00	10.23	11.18	13.74	24.00	4.60		Pass	
HE20	MCS0	2	48	5240	0.00	0.00	10.39	11.37	13.92	24.00	4.60		Pass	
HE20-26RU	MCS0	2	48	5240	0.00	0.00	7.73	7.48	10.63	24.00	4.60		Pass	
HE20-52RU	MCS0	2	48	5240	0.00	0.00	10.05	9.65	12.86	24.00	4.60		Pass	
HE20-106RU	MCS0	2	48	5240	0.00	0.00	9.93	9.62	12.79	24.00	4.60		Pass	
HE40	MCS0	2	38	5190	0.00	0.00	13.18	14.12	16.69	24.00	4.60		Pass	
HE40-242RU	MCS0	2	38	5190	0.00	0.00	12.94	13.04	16.00	24.00	4.60		Pass	
HE40	MCS0	2	46	5230	0.00	0.00	12.97	13.93	16.49	24.00	4.60		Pass	
HE40-242RU	MCS0	2	46	5230	0.00	0.00	12.73	12.42	15.59	24.00	4.60		Pass	
HE80	MCS0	2	42	5210	0.00	0.00	14.06	15.02	17.58	24.00	4.60		Pass	
HE80-484RU-L	MCS0	2	42	5210	0.00	0.00	13.35	13.56	16.47	24.00	4.60		Pass	
HE80-484RU-R	MCS0	2	42	5210	0.00	0.00	13.77	13.48	16.64	24.00	4.60		Pass	

TEST RESULTS DATA
Power Spectral Density

FCC Band I														
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)		Average Power Density (dBm/MHz)			Average PSD Limit (dBm/MHz)		DG (dBi)		Pass /Fail
					Ant 1	Ant 2	Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	2	36	5180	0.00	0.00			2.40	9.57	7.43		Pass	
11a	6Mbps	2	44	5220	0.00	0.00			2.11	9.57	7.43		Pass	
11a	6Mbps	2	48	5240	0.00	0.00			2.22	9.57	7.43		Pass	
HE20	MCS0	2	36	5180	0.00	0.00			2.02	9.57	7.43		Pass	
HE20-26RU	MCS0	2	36	5180	0.00	0.00			1.97	9.57	7.43		Pass	
HE20-52RU	MCS0	2	36	5180	0.00	0.00			1.42	9.57	7.43		Pass	
HE20-106RU	MCS0	2	36	5180	0.00	0.00			-1.50	9.57	7.43		Pass	
HE20	MCS0	2	44	5220	0.00	0.00			2.10	9.57	7.43		Pass	
HE20	MCS0	2	48	5240	0.00	0.00			2.41	9.57	7.43		Pass	
HE20-26RU	MCS0	2	48	5240	0.00	0.00			1.97	9.57	7.43		Pass	
HE20-52RU	MCS0	2	48	5240	0.00	0.00			1.10	9.57	7.43		Pass	
HE20-106RU	MCS0	2	48	5240	0.00	0.00			-1.87	9.57	7.43		Pass	
HE40	MCS0	2	38	5190	0.00	0.00			2.26	9.57	7.43		Pass	
HE40-242RU	MCS0	2	38	5190	0.00	0.00			-1.05	9.57	7.43		Pass	
HE40	MCS0	2	46	5230	0.00	0.00			2.30	9.57	7.43		Pass	
HE40-242RU	MCS0	2	46	5230	0.00	0.00			-1.66	9.57	7.43		Pass	
HE80	MCS0	2	42	5210	0.00	0.00			0.35	9.57	7.43		Pass	
HE80-484RU-L	MCS0	2	42	5210	0.00	0.00			-3.86	9.57	7.43		Pass	
HE80-484RU-R	MCS0	2	42	5210	0.00	0.00			-3.88	9.57	7.43		Pass	



Appendix B. Radiated Spurious Emission

Band 1 - 5150~5250MHz 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+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 36 5180MHz		5132.16	54.85	-19.15	74	41.65	34.91	11.02	32.73	103	199	P	H
		5147.84	45.08	-8.92	54	31.85	34.93	11.02	32.72	103	199	A	H
	*	5176	108.5	-	-	95.22	34.96	11.03	32.71	103	199	P	H
		5176	100.93	-	-	87.65	34.96	11.03	32.71	103	199	A	H
		5141.6	55.12	-18.88	74	41.89	34.93	11.02	32.72	100	139	P	V
		5149.98	45.41	-8.59	54	32.18	34.93	11.02	32.72	100	139	A	V
	*	5182	110.84	-	-	97.56	34.96	11.03	32.71	100	139	P	V
		5182	102.4	-	-	89.12	34.96	11.03	32.71	100	139	A	V
802.11a CH 44 5220MHz		5108	55.61	-18.39	74	42.44	34.9	11.01	32.74	100	186	P	H
		5113.6	44.88	-9.12	54	31.71	34.9	11.01	32.74	100	186	A	H
	*	5218	107.46	-	-	94.11	34.99	11.05	32.69	100	186	P	H
		5218	99.93	-	-	86.58	34.99	11.05	32.69	100	186	A	H
		5372.46	54.72	-19.28	74	40.99	35.14	11.23	32.64	100	186	P	H
		5396.04	44.34	-9.66	54	30.53	35.17	11.27	32.63	100	186	A	H
		5105.76	56.3	-17.7	74	43.13	34.9	11.01	32.74	102	136	P	V
		5110.56	44.95	-9.05	54	31.78	34.9	11.01	32.74	102	136	A	V
	*	5224	110.9	-	-	97.55	34.99	11.05	32.69	102	136	P	V
		5224	103.37	-	-	90.02	34.99	11.05	32.69	102	136	A	V
		5357.88	54.17	-19.83	74	40.48	35.12	11.21	32.64	102	136	P	V
		5395.68	44.41	-9.59	54	30.6	35.17	11.27	32.63	102	136	A	V



WIFI Ant. 1+2	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)
802.11a CH 48 5240MHz		5102.88	55.37	-18.63	74	42.22	34.88	11.01	32.74	100	187	P	H
		5111.36	45.15	-8.85	54	31.98	34.9	11.01	32.74	100	187	A	H
	*	5236	107.67	-	-	94.28	35.01	11.07	32.69	100	187	P	H
		5236	100.33	-	-	86.94	35.01	11.07	32.69	100	187	A	H
		5365.62	54.54	-19.46	74	40.81	35.14	11.23	32.64	100	187	P	H
		5393.88	44.57	-9.43	54	30.79	35.16	11.25	32.63	100	187	A	H
		5110.88	55.77	-18.23	74	42.6	34.9	11.01	32.74	100	134	P	V
		5106.08	45.31	-8.69	54	32.14	34.9	11.01	32.74	100	134	A	V
	*	5248	111.06	-	-	97.63	35.03	11.09	32.69	100	134	P	V
		5248	104.08	-	-	90.65	35.03	11.09	32.69	100	134	A	V
		5394.78	54.83	-19.17	74	41.02	35.17	11.27	32.63	100	134	P	V
		5378.58	44.74	-9.26	54	30.96	35.16	11.25	32.63	100	134	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 1 5150~5250MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant. 1+2	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)
802.11a CH 36 5180MHz		10358.36	44.11	-24.19	68.3	52.92	37.76	16.04	62.61	300	0	P	H
		10358.36	43.79	-24.51	68.3	52.6	37.76	16.04	62.61	100	360	P	V
802.11a CH 44 5220MHz		10438.44	43.53	-24.77	68.3	52.26	37.82	16.11	62.66	300	0	P	H
		10438.44	44.44	-23.86	68.3	53.17	37.82	16.11	62.66	100	360	P	V
802.11a CH 48 5240MHz		10478.47	43.74	-24.56	68.3	52.42	37.86	16.15	62.69	300	0	P	H
		10478.47	43.77	-24.53	68.3	52.45	37.86	16.15	62.69	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 1 5150~5250MHz
WIFI 802.11ax HE20 Full (Band Edge @ 3m)

Table with 14 columns: WIFI Ant. 1+2, 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 802.11ax HE20 Full CH 36 5180MHz and a Remark section.



Band 1 5150~5250MHz
WIFI 802.11ax HE20 Partial 106 (Band Edge @ 3m)

Table with 14 columns: WIFI Ant. 1+2, 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 802.11ax HE20 Partial 106/53 CH 36 5180MHz and a Remark section.



Band 1 5150~5250MHz
WIFI 802.11ax HE40 Full (Band Edge @ 3m)

Table with 14 columns: WIFI Ant. 1+2, 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 802.11ax HE40 Full CH 38 5190MHz and a Remark section.



Band 1 5150~5250MHz
WIFI 802.11ax HE40 Partial 242 (Band Edge @ 3m)

Table with 14 columns: WIFI Ant. 1+2, 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 frequencies like 5139.36, 5150, 5188, 5373, 5397.84, 5131.2, 5149.92, 5176, 5379.12, 5396.04.

Remark
1. No other spurious found.
2. All results are PASS against Peak and Average limit line.



Band 1 5150~5250MHz
WIFI 802.11ax HE80 Full (Band Edge @ 3m)

Table with 14 columns: WIFI Ant. 1+2, 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 802.11ax HE80 Full CH 42 5210MHz and a Remark section.



Band 1 5150~5250MHz
WIFI 802.11ax HE80 Partial 484 (Band Edge @ 3m)

Table with 14 columns: WIFI Ant. 1+2, 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 frequency measurements for 802.11ax HE80 Partial 484/65 CH 42 5210MHz and a Remark section.



Emission below 1GHz

WIFI 802.11ax HE80 Partial 484 (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+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
WIFI 802.11ax HE80 Partial 484 LF		33.88	27.22	-12.78	40	36.55	22.76	0.76	32.85	-	-	P	H
		71.71	29.35	-10.65	40	48.6	12.55	1.16	32.96	100	0	P	H
		120.21	29.26	-14.24	43.5	43.63	16.92	1.57	32.86	-	-	P	H
		217.21	31.1	-14.9	46	45.47	16.54	2.19	33.1	-	-	P	H
		268.62	26.49	-19.51	46	38.26	18.8	2.46	33.03	-	-	P	H
		371.44	22.72	-23.28	46	31.56	21.1	2.92	32.86	-	-	P	H
		33.88	31.41	-8.59	40	40.08	23.42	0.76	32.85	100	360	P	V
		70.74	31.34	-8.66	40	49.9	13.27	1.15	32.98	-	-	P	V
		123.12	28.06	-15.44	43.5	41.5	17.82	1.59	32.85	-	-	P	V
		217.21	27.36	-18.64	46	40.9	17.37	2.19	33.1	-	-	P	V
		268.62	29.41	-16.59	46	40.28	19.7	2.46	33.03	-	-	P	V
		605.21	26.3	-19.7	46	29.5	25.54	3.78	32.52	-	-	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+2		(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”.

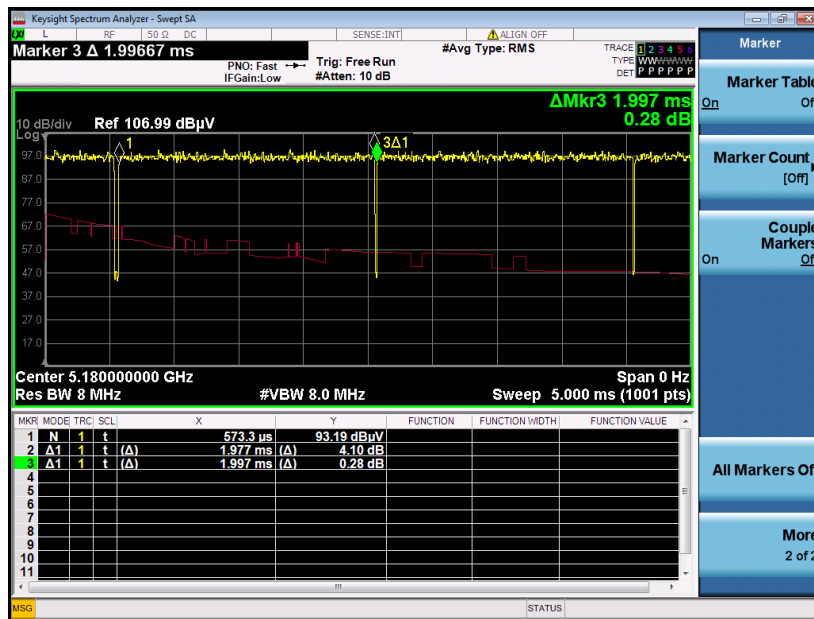


Appendix C. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
1+2	802.11a	99.00	-	-	10Hz
1+2	802.11ax HE20	100	-	-	10Hz
1+2	802.11ax HE40	100	-	-	10Hz
1+2	802.11ax HE80	100	-	-	10Hz

<MIMO Ant.1+2>

802.11a

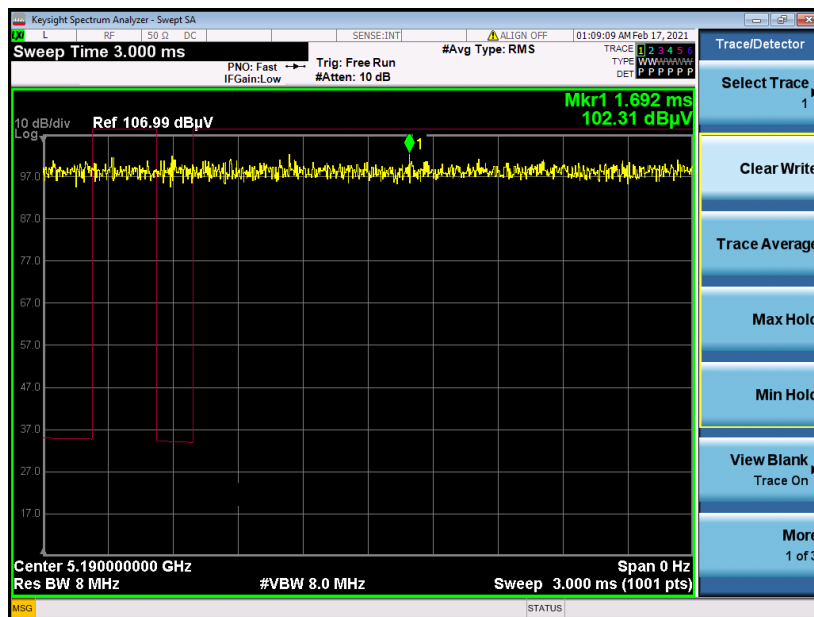




802.11ax HE20



802.11ax HE40





802.11ax HE80

