FCC RF Test Report

APPLICANT	:	Ring LLC
EQUIPMENT	:	Ring Car Cam
BRAND NAME	:	Ring
MODEL NAME	:	5B28S9
FCC ID	:	2AEUPBHACC001
STANDARD	:	FCC Part 15 Subpart E §15.407
CLASSIFICATION	:	(NII) Unlicensed National Information Infrastructure
TEST DATE(S)	:	Nov. 01, 2021 ~ Mar. 01, 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.

Reviewed by: Jason Jia / Supervisor

Approved by: Alex Wang / Manager

Sporton International Inc. (Kunshan)
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
FR1O0826F	Rev. 01	Initial issue of report	Mar. 01, 2022

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	2.1049 & 15.403(i)	26dB & 99% Bandwidth	-	Report only	-
3.2	15.407(a)	Maximum Conducted Output Power	≤ 24 dBm	Pass	-
3.3	15.407(a)	Power Spectral Density	≤ 11 dBm	Pass	-
3.4	15.407(b)	Unwanted Emissions	15.407(b) & 15.209(a)	Pass	Under limit 3.06 dB at 5149.600 MHz
3.5	15.203 & 15.407(a)	Antenna Requirement	15.203 & 15.407(a)	Pass	-
-	15.207	AC Conducted Emission	15.207(a)	Not Required	-

Remark: Not required means after assessing, test items are not necessary to carry out.

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

Ring LLC
1523 26th Street, Santa Monica, CA 90404 USA

1.2 Manufacturer

Ring LLC
1523 26th Street, Santa Monica, CA 90404 USA

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Ring Car Cam
Brand Name	Ring
Model Name	5B28S9
FCC ID	2AEUPBHACC001
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 Frequency Range	5180 MHz ~ 5240 MHz
Maximum Output Power to Antenna	**<5180 MHz ~ 5240 MHz>** 802.11a : 15.08 dBm / 0.0322 W 802.11n HT20 : 14.96 dBm / 0.0313 W
99% Occupied Bandwidth	802.11a : 16.78 MHz 802.11n HT20 : 18.08 MHz
Antenna Type / Gain	**<5180 MHz ~ 5240 MHz>** IFA Antenna with gain 3.20 dBi
Type of Modulation	802.11a/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

<FCC>-KS

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.**
	03CH06-KS TH01-KS	CN1257	314309

1.7 Test Software

Item	Site	Manufacturer	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.
- 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: 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.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5180-5240 MHz U-NII-1	36	5180	44	5220
	48	5240		

Note:

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

2.2 Test Mode

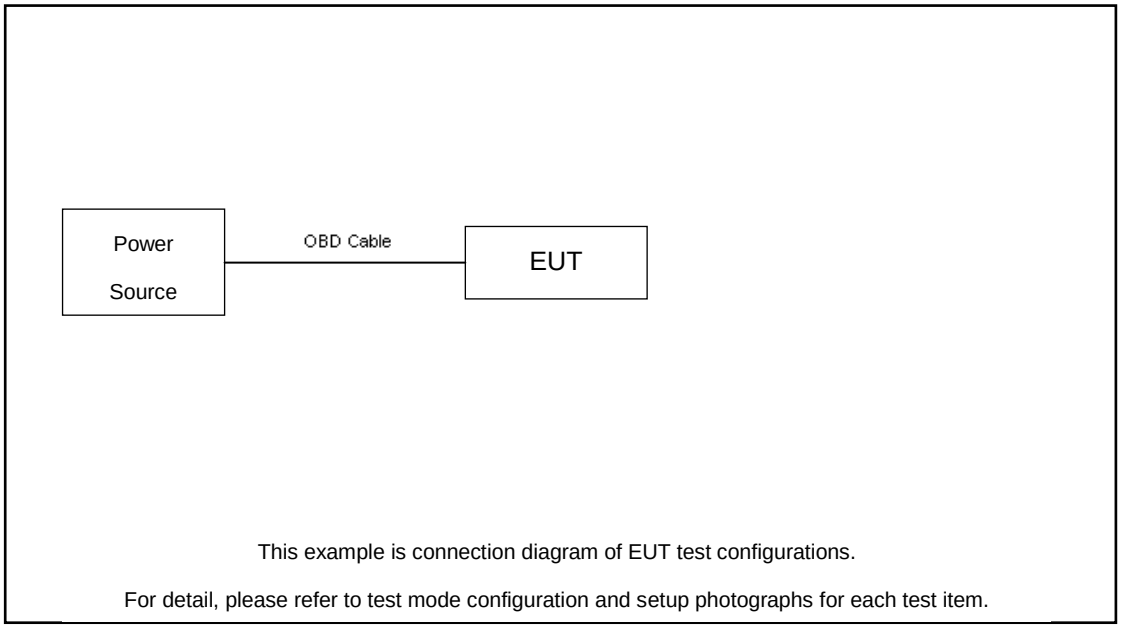
Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0

Ch. #		U-NII-1 : 5180-5240 MHz
		802.11a
L	Low	36
M	Middle	44
H	High	48

Ch. #		U-NII-1 : 5180-5240 MHz
		802.11n HT20
L	Low	36
M	Middle	44
H	High	48

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	DC Power Supply	N/A	N/A	N/A	N/A	N/A
2.	OBD cable	Ring	5B29S1	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.

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 7.00 dB.

Offset(dB) = RF cable loss(dB).

= 7.00 (dB)

3 Test Result

3.1 26dB & 99% Occupied Bandwidth Measurement

3.1.1 Description of 26dB & 99% Occupied Bandwidth

This section is for reporting purpose only.

There is no restriction limits for bandwidth.

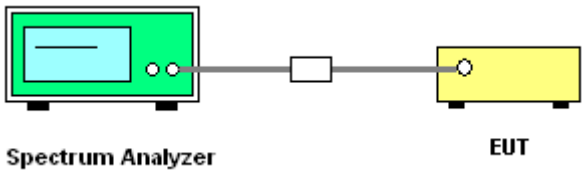
3.1.2 Measuring Instruments

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
2. Set RBW = approximately 1% of the emission bandwidth.
3. Set the VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
7. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1% to 5% of the OBW and set the Video bandwidth (VBW) ≥ 3 * RBW.
8. Measure and record the results in the test report.

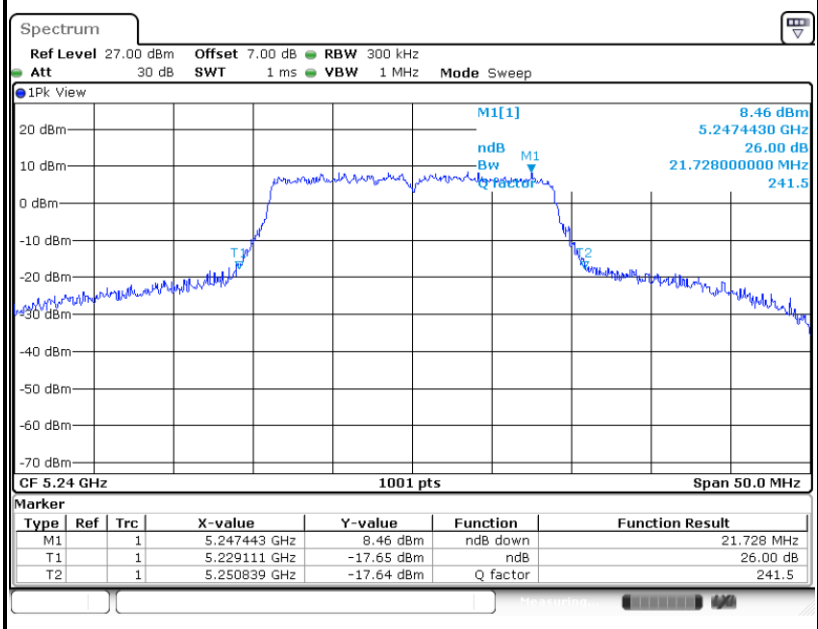
3.1.4 Test Setup



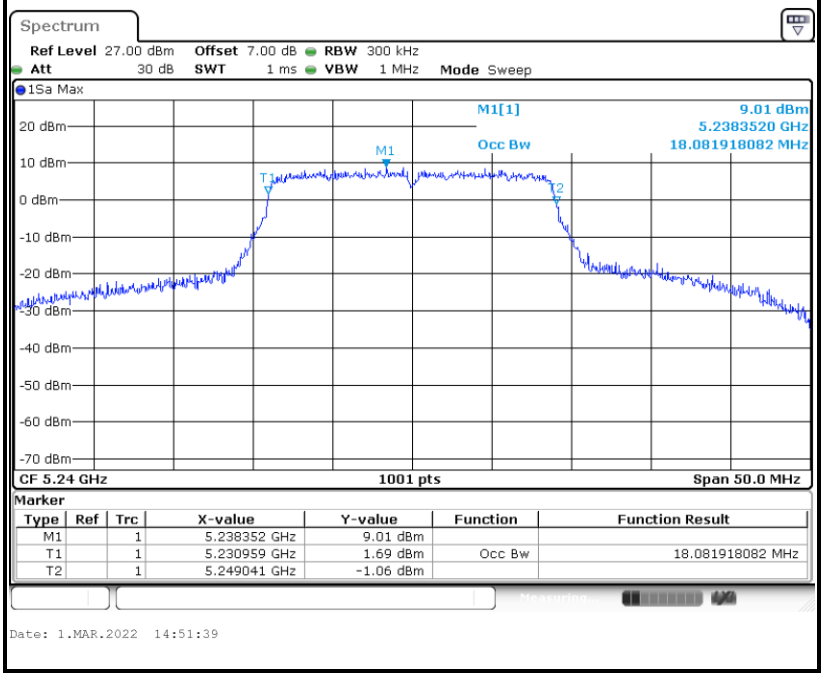
3.1.5 Test Result of 26dB & 99% Occupied Bandwidth

Please refer to Appendix A.

Maximum 26dB Bandwidth for 20M BW



Maximum 99% Occupied Bandwidth for 20M BW



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

<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.

3.2.2 Measuring Instruments

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

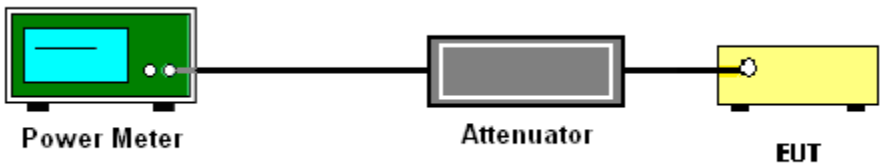
3.2.3 Test Procedures

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

<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.

3.3.2 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.

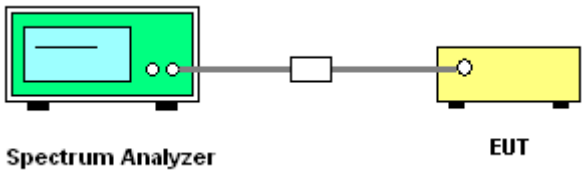
 # Method SA-2 #

(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 = 1 MHz.
- Set VBW ≥ 3 MHz.
- Number of points in sweep ≥ 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.

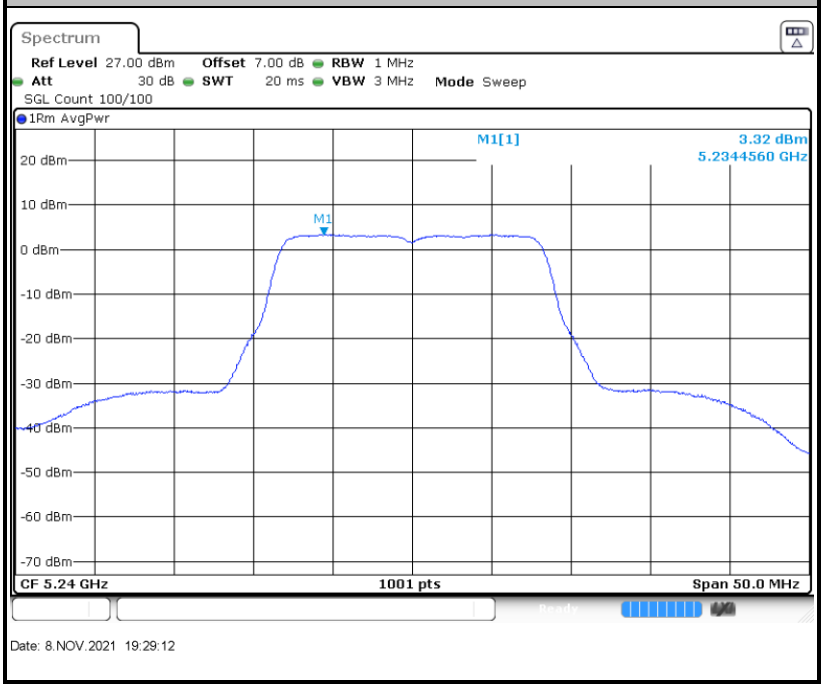
3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Density (dBm/MHz)



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

$$EIRP = E_{Meas} + 20\log(d_{Meas}) - 104.77$$

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

3.4.2 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 ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

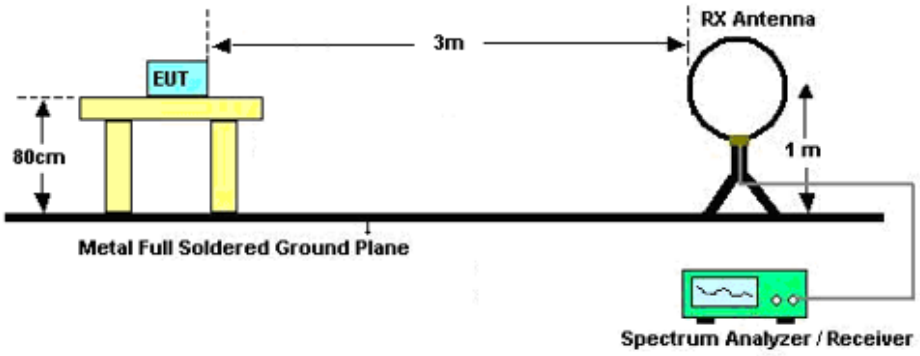
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 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.

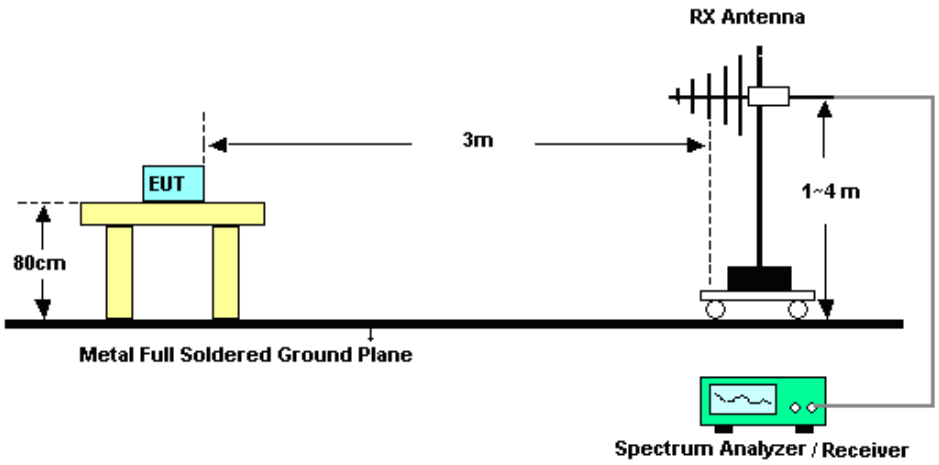
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband 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

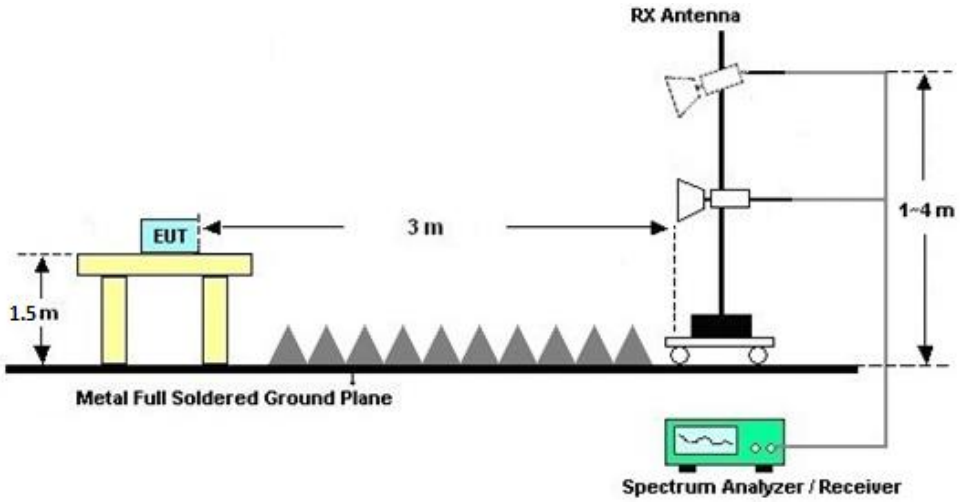
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.4.5 Test Results of Radiated 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.

3.4.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B.

3.4.7 Duty Cycle

Please refer to Appendix C.

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

Please refer to Appendix B.

3.5 Antenna Requirements

3.5.1 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.

3.5.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.5.3 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	Nov. 01, 2021~ Mar. 01, 2021	Oct. 13, 2022	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 08, 2021	Nov. 01, 2021~ Nov. 08, 2021	Jan. 07, 2022	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 05, 2022	Mar. 01, 2021	Jan. 04, 2023	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 08, 2021	Nov. 01, 2021~ Nov. 08, 2021	Jan. 07, 2022	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 05, 2022	Mar. 01, 2021	Jan. 04, 2023	Conducted (TH01-KS)
Temperature &humidity chamber	Hongzhan	LP-150U	H2014011440	-40~+150°C 20%~95%RH	Jul. 12, 2021	Nov. 01, 2021~ Mar. 01, 2021	Jul. 11, 2022	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY56400004	3Hz~8.5GHz;Max 30dBm	Oct. 16, 2021	Feb. 21, 2022	Oct. 15, 2022	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150208	10Hz-44GHz	Apr. 12, 2021	Feb. 21, 2022	Apr. 11, 2022	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 30, 2021	Feb. 21, 2022	Oct. 29, 2022	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz-1GHz	May 27, 2021	Feb. 21, 2022	May 26, 2022	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218652	1GHz~18GHz	Apr. 25, 2021	Feb. 21, 2022	Apr. 24, 2022	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101093	18GHz~40GHz	Jan. 05, 2022	Feb. 21, 2022	Jan. 04, 2023	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	187289	9KHz ~1GHZ	Apr. 12, 2021	Feb. 21, 2022	Apr. 11, 2022	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 05, 2022	Feb. 21, 2022	Jan. 04, 2023	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2025788	1Ghz-18Ghz	Jul. 30, 2021	Feb. 21, 2022	Jul. 29, 2022	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	MY53270203	500MHz~26.5GHz	Apr. 13, 2021	Feb. 21, 2022	Apr. 12, 2022	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Feb. 21, 2022	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Feb. 21, 2022	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Feb. 21, 2022	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 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))	**5.0dB**

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

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

---------- THE END ----------

Appendix A. Conducted Test Results

Report Number : FR1O0826F

Test Engineer:	Albert shi	Temperature:	21~25	°C
Test Date:	2021/11/1~2022/3/1	Relative Humidity:	51~54	%

Report Number : FR1O0826F

TEST RESULTS DATA
26dB and 99% OBW

U-NII-1										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)	26 dB Bandwidth (MHz)	IC 99% Bandwidth Power Limit (dBm)	IC 99% Bandwidth EIRP Limit (dBm)		
11a	6Mbps	1	36	5180	16.63	21.18	-	22.21		
11a	6Mbps	1	44	5220	16.68	21.43	-	22.22		
11a	6Mbps	1	48	5240	16.78	21.43	-	22.25		
HT20	MCS0	1	36	5180	17.93	21.43	-	22.54		
HT20	MCS0	1	44	5220	17.93	21.58	-	22.54		
HT20	MCS0	1	48	5240	18.08	21.73	-	22.57		

TEST RESULTS DATA
Average Power Table

U-NII-1										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	FCC Conducted Power Limit (dBm)	DG (dBi)		Pass/Fail
11a	6Mbps	1	36	5180	0.30	12.11	24.00	3.20		Pass
11a	6Mbps	1	44	5220	0.30	14.42	24.00	3.20		Pass
11a	6Mbps	1	48	5240	0.30	15.08	24.00	3.20		Pass
HT20	MCS0	1	36	5180	0.34	11.32	24.00	3.20		Pass
HT20	MCS0	1	44	5220	0.34	13.66	24.00	3.20		Pass
HT20	MCS0	1	48	5240	0.34	14.96	24.00	3.20		Pass

TEST RESULTS DATA
Power Spectral Density

FCC U-NII-1										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Power Density (dBm/MHz)	Average PSD Limit (dBm/MHz)	DG (dBi)	-	Pass/Fail
11a	6Mbps	1	36	5180	0.30	1.30	11.00	3.20		Pass
11a	6Mbps	1	44	5220	0.30	2.81	11.00	3.20		Pass
11a	6Mbps	1	48	5240	0.30	3.62	11.00	3.20		Pass
HT20	MCS0	1	36	5180	0.34	0.16	11.00	3.20		Pass
HT20	MCS0	1	44	5220	0.34	1.46	11.00	3.20		Pass
HT20	MCS0	1	48	5240	0.34	3.40	11.00	3.20		Pass

Appendix B. Radiated Spurious Emission

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		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 36 5180MHz		5148.96	63.43	-10.57	74	49.56	35.03	10.65	31.81	100	191	P	H
		5149.6	50.48	-3.52	54	36.61	35.03	10.65	31.81	100	191	A	H
	*	5176	106.3	-	-	92.38	35.05	10.69	31.82	100	191	P	H
		5176	98.75	-	-	84.83	35.05	10.69	31.82	100	191	A	H
		5145.6	59.25	-14.75	74	45.38	35.03	10.65	31.81	294	138	P	V
		5149.92	47.94	-6.06	54	34.07	35.03	10.65	31.81	294	138	A	V
	*	5176	102.67	-	-	88.75	35.05	10.69	31.82	294	138	P	V
		5176	95.45	-	-	81.53	35.05	10.69	31.82	294	138	A	V
802.11a CH 44 5220MHz		5108.48	56.06	-17.94	74	42.25	34.98	10.61	31.78	327	188	P	H
		5149.12	46.27	-7.73	54	32.4	35.03	10.65	31.81	327	188	A	H
	*	5218	108.37	-	-	94.4	35.09	10.72	31.84	327	188	P	H
		5218	100.99	-	-	87.02	35.09	10.72	31.84	327	188	A	H
		5351.76	55.06	-18.94	74	40.99	35.22	10.78	31.93	327	188	P	H
		5361.3	45.03	-8.97	54	30.95	35.22	10.79	31.93	327	188	A	H
		5147.04	55.96	-18.04	74	42.09	35.03	10.65	31.81	306	134	P	V
		5126.24	46.08	-7.92	54	32.24	35	10.63	31.79	306	134	A	V
	*	5224	104.75	-	-	90.79	35.09	10.72	31.85	306	134	P	V
		5224	97.18	-	-	83.22	35.09	10.72	31.85	306	134	A	V
		5390.28	54.76	-19.24	74	40.65	35.26	10.8	31.95	306	134	P	V
		5357.34	44.94	-9.06	54	30.87	35.22	10.78	31.93	306	134	A	V

802.11a CH 48 5240MHz	*	5236	109.22	-	-	95.23	35.11	10.73	31.85	100	183	P	H
		5236	102.59	-	-	88.6	35.11	10.73	31.85	100	183	A	H
		5386.14	54.52	-19.48	74	40.41	35.26	10.8	31.95	100	183	P	H
		5365.98	45.21	-8.79	54	31.11	35.24	10.79	31.93	100	183	A	H
	*	5242	105.44	-	-	91.44	35.11	10.74	31.85	303	136	P	V
		5242	98.36	-	-	84.36	35.11	10.74	31.85	303	136	A	V
		5357.52	54.92	-19.08	74	40.85	35.22	10.78	31.93	303	136	P	V
		5358.78	44.96	-9.04	54	30.89	35.22	10.78	31.93	303	136	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

5150~5250MHz

WIFI 802.11a (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)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH 36 5180MHz		10355	51.42	-16.88	68.3	58.43	38.31	15.36	60.68	300	0	P	H
		15536	53.26	-20.74	74	53.01	40.85	19.22	59.82	100	254	P	H
		15536	40.38	-13.62	54	40.13	40.85	19.22	59.82	100	254	A	H
		10355	54.19	-14.11	68.3	61.2	38.31	15.36	60.68	100	0	P	V
		15536	55.6	-18.4	74	55.35	40.85	19.22	59.82	236	22	P	V
		15536	41.26	-12.74	54	41.01	40.85	19.22	59.82	236	22	A	V
802.11a CH 44 5220MHz		10443	53.13	-15.17	68.3	60.02	38.35	15.42	60.66	300	0	P	H
		15657	56.45	-17.55	74	55.82	41.09	19.32	59.78	100	265	P	H
		15657	45.15	-8.85	54	44.52	41.09	19.32	59.78	100	265	A	H
		10443	58.87	-9.43	68.3	65.76	38.35	15.42	60.66	100	0	P	V
		15657	58.95	-15.05	74	58.32	41.09	19.32	59.78	236	26	P	V
		15657	46.86	-7.14	54	46.23	41.09	19.32	59.78	236	26	A	V
802.11a CH 48 5240MHz		10476	53.88	-14.42	68.3	60.74	38.35	15.45	60.66	300	0	P	H
		15723	58.7	-15.3	74	57.85	41.22	19.38	59.75	100	274	P	H
		15723	46.05	-7.95	54	45.2	41.22	19.38	59.75	100	274	A	H
		10476	59.33	-8.97	68.3	66.19	38.35	15.45	60.66	100	0	P	V
		15723	60.26	-13.74	74	59.41	41.22	19.38	59.75	234	28	P	V
		15723	49.5	-4.5	54	48.65	41.22	19.38	59.75	234	28	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

5150~5250MHz

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)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		5148.48	62.32	-11.68	74	48.45	35.03	10.65	31.81	101	192	P	H
		5149.6	50.94	-3.06	54	37.07	35.03	10.65	31.81	101	192	A	H
802.11n	*	5176	105.55	-	-	91.63	35.05	10.69	31.82	101	192	P	H
HT20		5176	98.03	-	-	84.11	35.05	10.69	31.82	101	192	A	H
CH 36		5145.44	59.05	-14.95	74	45.18	35.03	10.65	31.81	369	142	P	V
5180MHz		5149.92	47.94	-6.06	54	34.07	35.03	10.65	31.81	369	142	A	V
	*	5182	100.12	-	-	86.19	35.06	10.69	31.82	369	142	P	V
		5182	92.54	-	-	78.61	35.06	10.69	31.82	369	142	A	V
		5132	56.57	-17.43	74	42.72	35.01	10.63	31.79	384	8	P	H
		5122.24	46.24	-7.76	54	32.42	35	10.61	31.79	384	8	A	H
	*	5218	107.66	-	-	93.69	35.09	10.72	31.84	384	8	P	H
		5218	100.54	-	-	86.57	35.09	10.72	31.84	384	8	A	H
802.11n		5392.98	54.1	-19.9	74	39.99	35.26	10.8	31.95	384	8	P	H
HT20		5364.36	45.21	-8.79	54	31.13	35.22	10.79	31.93	384	8	A	H
CH 44		5108.16	56.64	-17.36	74	42.83	34.98	10.61	31.78	335	310	P	V
5220MHz		5118.24	46.13	-7.87	54	32.3	35	10.61	31.78	335	310	A	V
	*	5218	103.16	-	-	89.19	35.09	10.72	31.84	335	310	P	V
		5218	96.52	-	-	82.55	35.09	10.72	31.84	335	310	A	V
		5374.26	54.67	-19.33	74	40.59	35.24	10.79	31.95	335	310	P	V
		5359.14	44.86	-9.14	54	30.79	35.22	10.78	31.93	335	310	A	V

802.11n HT20 CH 48 5240MHz	*	5236	109.52	-	-	95.53	35.11	10.73	31.85	357	360	P	H
		5236	102.43	-	-	88.44	35.11	10.73	31.85	357	360	A	H
		5354.82	53.81	-20.19	74	39.74	35.22	10.78	31.93	357	360	P	H
		5364	45.53	-8.47	54	31.45	35.22	10.79	31.93	357	360	A	H
	*	5248	106.22	-	-	92.22	35.13	10.74	31.87	373	300	P	V
		5248	98.87	-	-	84.87	35.13	10.74	31.87	373	300	A	V
		5393.88	54.11	-19.89	74	40	35.26	10.8	31.95	373	300	P	V
		5353.02	45.37	-8.63	54	31.3	35.22	10.78	31.93	373	300	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

5150~5250MHz

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)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		10355	49.59	-18.71	68.3	56.6	38.31	15.36	60.68	300	0	P	H
802.11n		15547	55.93	-18.07	74	55.64	40.88	19.23	59.82	142	274	P	H
HT20		15547	43.4	-10.6	54	43.11	40.88	19.23	59.82	142	274	A	H
CH 36		10366	53.89	-14.41	68.3	60.88	38.32	15.37	60.68	100	0	P	V
5180MHz		15536	57.66	-16.34	74	57.41	40.85	19.22	59.82	235	25	P	V
		15536	44.76	-9.24	54	44.51	40.85	19.22	59.82	235	25	A	V
		10432	52.1	-16.2	68.3	59	38.34	15.42	60.66	300	0	P	H
802.11n		15657	60.56	-13.44	74	59.93	41.09	19.32	59.78	261	319	P	H
HT20		15657	46.74	-7.26	54	46.11	41.09	19.32	59.78	261	319	A	H
CH 44		10443	58.78	-9.52	68.3	65.67	38.35	15.42	60.66	100	0	P	V
5220MHz		15657	60.26	-13.74	74	59.63	41.09	19.32	59.78	305	12	P	V
		15657	48.32	-5.68	54	47.69	41.09	19.32	59.78	305	12	A	V
		10476	54.8	-13.5	68.3	61.66	38.35	15.45	60.66	300	0	P	H
802.11n		15712	59.19	-14.81	74	58.37	41.22	19.36	59.76	251	323	P	H
HT20		15712	48.48	-5.52	54	47.66	41.22	19.36	59.76	251	323	A	H
CH 48		10476	58.47	-9.83	68.3	65.33	38.35	15.45	60.66	100	0	P	V
5240MHz		15723	60.9	-13.1	74	60.05	41.22	19.38	59.75	298	11	P	V
		15723	49.14	-4.86	54	48.29	41.22	19.38	59.75	298	11	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

5150~5250MHz

Emission below 1GHz

WIFI 802.11n HT20 (LF @ 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)
802.11n HT20 LF		59.1	22.54	-17.46	40	40.1	13.01	1.01	31.58	-	-	P	H
		263.77	29.92	-16.08	46	39.99	18.75	2.62	31.44	-	-	P	H
		312.27	34.64	-11.36	46	43.92	19.5	2.86	31.64	-	-	P	H
		353.01	37.93	-8.07	46	46.04	20.48	3.04	31.63	-	-	P	H
		408.3	40.44	-5.56	46	46.53	21.86	3.29	31.24	112	177	P	H
		839.95	30.75	-15.25	46	30.76	26.57	4.72	31.3	-	-	P	H
		59.1	33.7	-6.3	40	50.71	13.56	1.01	31.58	-	-	P	V
		121.18	30.49	-13.01	43.5	42.48	17.85	1.79	31.63	-	-	P	V
		312.27	29.66	-16.34	46	37.94	20.5	2.86	31.64	-	-	P	V
		345.25	34.22	-11.78	46	41.58	21.28	3.01	31.65	-	-	P	V
		408.3	34.85	-11.15	46	39.94	22.86	3.29	31.24	-	-	P	V
		518.88	29.24	-16.76	46	31.96	25.02	3.7	31.44	-	-	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	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 CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		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)

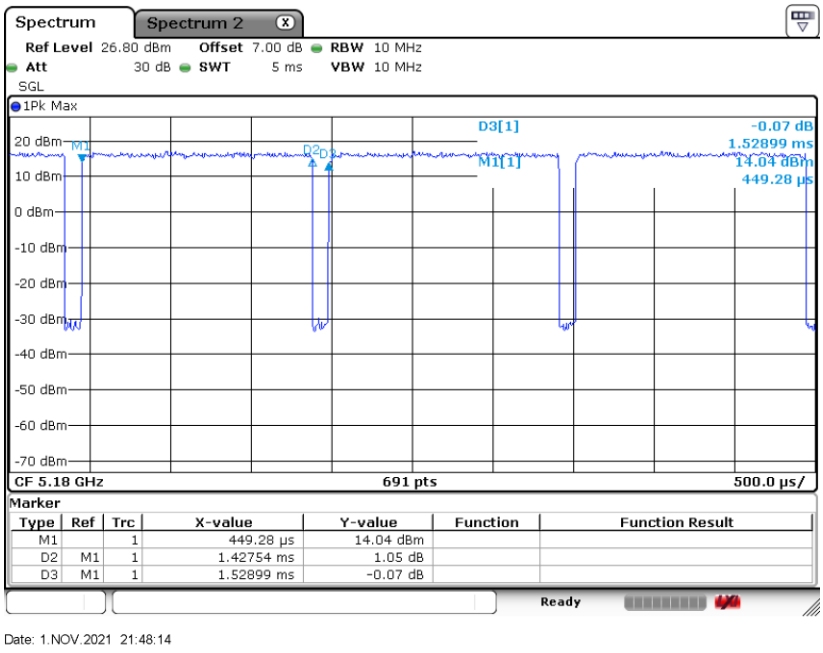
= -10.46(dB)

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

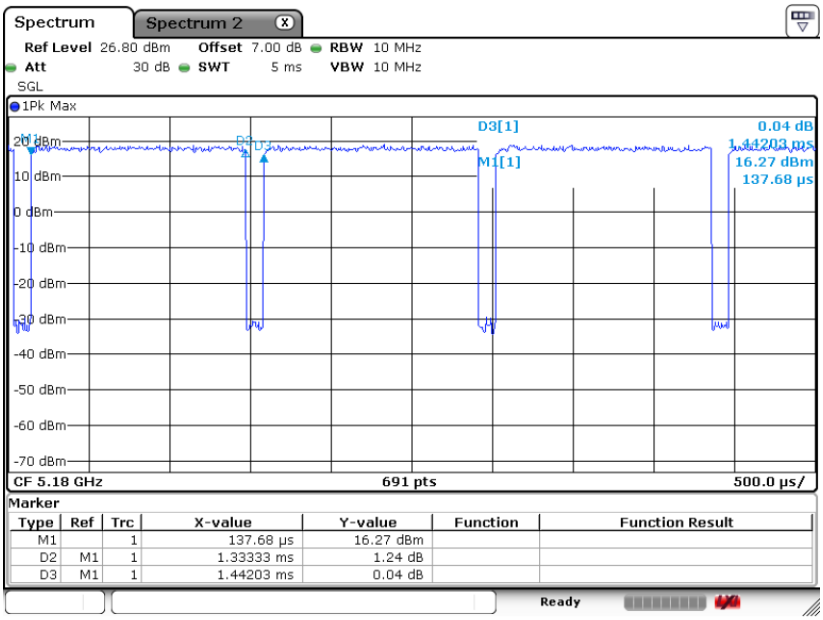
Appendix C. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11a	93.36	1.428	0.701	0.75KHz
802.11n HT20	92.46	1.333	0.750	0.82KHz

802.11a



802.11n HT20



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