



FCC RADIO TEST REPORT

FCC ID : 2AG7G-G1A
Equipment : Plume Adaptive WiFi
Brand Name : Plume Design Inc
Model Name : G1A
Applicant : Plume Design Inc
325 Lytton Ave., Palo Alto, CA 94301
Manufacturer : Plume Design Inc
325 Lytton Ave., Palo Alto, CA 94301
Standard : FCC Part 15 Subpart E §15.407

The product was received on Mar. 23, 2021 and testing was started from Apr. 19, 2021 and completed on Jul. 12, 2021. We, Sporton International Inc. Wensan Laboratory, 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. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory

No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)



Table of Contents

History of this test report.....	3
Summary of Test Result.....	4
1 General Description	5
1.1 Product Feature of Equipment Under Test.....	5
1.2 Modification of EUT	5
1.3 Testing Location	6
1.4 Applicable Standards.....	6
2 Test Configuration of Equipment Under Test	7
2.1 Carrier Frequency and Channel	7
2.2 Test Mode.....	7
2.3 Connection Diagram of Test System.....	8
2.4 EUT Operation Test Setup	8
3 Test Result	9
3.1 Unwanted Emissions Measurement	9
3.2 Antenna Requirements.....	12
4 List of Measuring Equipment.....	13
5 Uncertainty of Evaluation	14
Appendix A. Radiated Spurious Emission	
Appendix B. Radiated Spurious Emission Plots	
Appendix C. Duty Cycle Plots	
Appendix D. Setup Photographs	



History of this test report

Report No.	Version	Description	Issued Date
FR111911F	01	Initial issue of report	Jul. 21, 2021

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.407(b)	Unwanted Emissions	Pass	Under limit 1.67 dB at 5149.240 MHz
3.2	15.203 15.407(a)	Antenna Requirement	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.

Reviewed by: Keven Cheng

Report Producer: Cindy Liu

1 General Description

1.1 Product Feature of Equipment Under Test

Bluetooth - LE, Wi-Fi 2.4GHz 802.11b/g/n/ac/ax, and Wi-Fi 5GHz 802.11a/n/ac/ax.

Product Specification subjective to this standard			
Antenna Type	WLAN <2400 MHz ~ 2483.5 MHz> <Ant. 1>: IFA Antenna <Ant. 2>: IFA Antenna <5180 MHz ~ 5320 MHz> <Ant. 1>: IFA Antenna <Ant. 2>: IFA Antenna <Ant. 3>: IFA Antenna <Ant. 4>: IFA Antenna <5500 MHz ~ 5825 MHz> <Ant. 1>: IFA Antenna <Ant. 2>: IFA Antenna Bluetooth - LE: IFA Antenna		
	Antenna information		
	2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	Bluetooth - LE: 2.4 WLAN: Ant. 1: 3.5: Ant. 2: 2.7
			Ant. 1: 4.0 Ant. 2: 2.5 Ant. 3: 3.8 Ant. 4: 3.0
	5150 MHz ~ 5250 MHz	Peak Gain (dBi)	

Remark: The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.2 Modification of EUT

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

1.3 Testing Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	Sporton Site No. 03CH16-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW3786

1.4 Applicable Standards

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

- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC Part 15 Subpart E
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- ♦ 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. The TAF code is not including all the FCC KDB listed without accreditation.
3. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). The measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find Y plane as worst plane.

2.1 Carrier Frequency and Channel

2400-2483.5 MHz	
Bluetooth - LE (1Mbps)	
Channel	Freq. (MHz)
39	2441

2400-2483.5 MHz	
802.11ax HE20	
Channel	Freq. (MHz)
01	2412

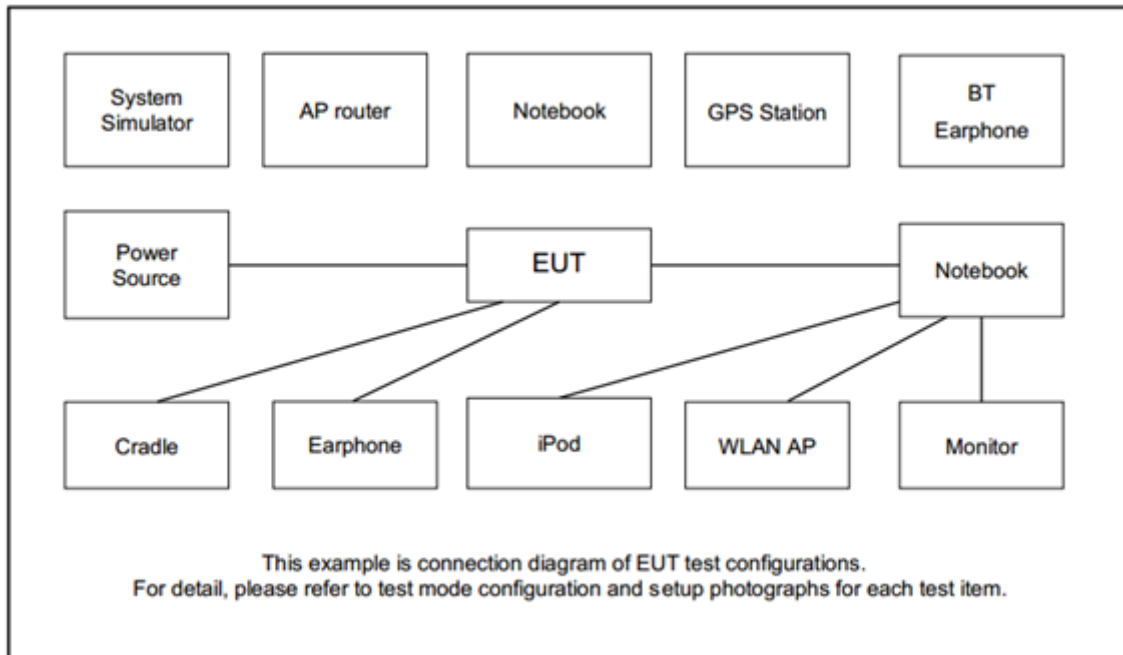
5150-5250 MHz	
802.11a	
Channel	Freq. (MHz)
36	5180

2.2 Test Mode

<Co-Location>

Modulation	Data Rate
802.11ax HE20 for MIMO Ant. 1+2 + 802.11a for MIMO Ant. 1+2+3+4	MCS0 + 6 Mbps
802.11ax HE20 for MIMO Ant. 1+2 + 802.11a for Ant. 1+2+3+4 + Bluetooth-LE	MCS0 + 6 Mbps + GFSK

2.3 Connection Diagram of Test System



2.4 EUT Operation Test Setup

The RF test items, utility “accessMTool_REL_3_1_0_1” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

3 Test Result

3.1 Unwanted Emissions Measurement

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

3.1.1 Limit of Unwanted Emissions

(1) 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

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

$$E = \frac{1000000\sqrt{30P}}{3} \text{ } \mu\text{V/m, where P is the eirp (Watts)}$$

EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27	68.3

(3) KDB789033 D02 v02r01 G)2)c)

(i) Sections 15.407(b)(1-3) specifies the unwanted emissions limit for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz.

(ii) Section 15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are based on the use of a peak detector.

3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

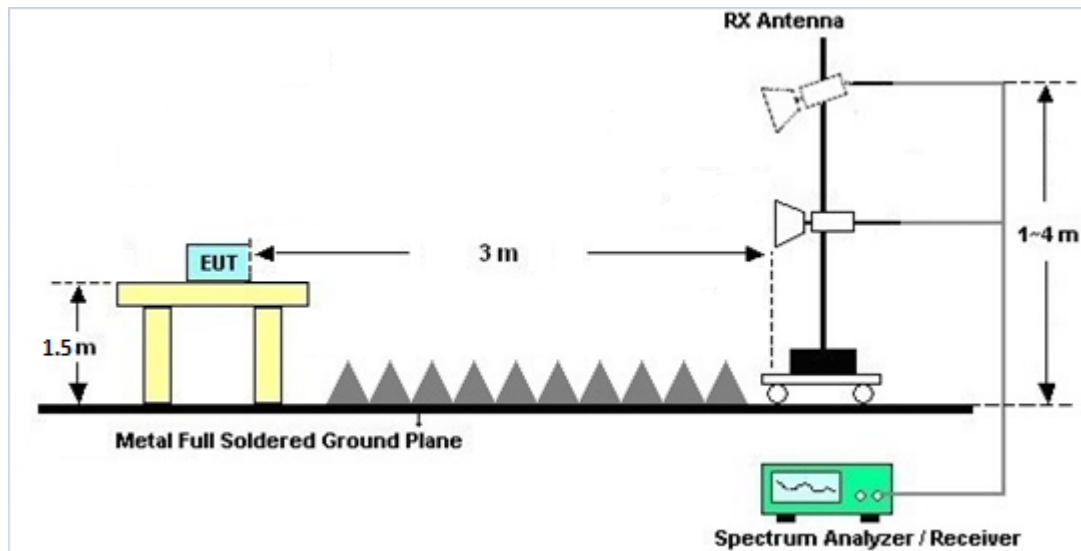


3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section G) Unwanted emissions measurement.
(1) 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(2) Procedures for Average Unwanted Emissions Measurements Above 1000 MHz
 - 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 1.5 meter for frequency above 1 GHz 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 above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.1.4 Test Setup

For radiated test above 1GHz



3.1.5 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

3.1.6 Duty Cycle

Please refer to Appendix C.

3.1.7 Test Result of Radiated Spurious Emissions

Please refer to Appendix A and B.



3.2 Antenna Requirements

3.2.1 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.

3.2.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.2.3 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	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1522	1G~18GHz	Sep. 29, 2020	Apr. 19, 2021~Jul. 12, 2021	Sep. 28, 2021	Radiation (03CH16-HY)
Amplifier	EMCI	EMC051845SE	980729	1-18GHz	Jul. 10, 2020	Apr. 19, 2021~Jul. 12, 2021	Jul. 09, 2021	Radiation (03CH16-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	00993	18GHz ~40GHz	Nov. 19, 2020	Apr. 19, 2021~Jul. 12, 2021	Nov. 18, 2021	Radiation (03CH16-HY)
Preamplifier	Keysight	83017A	MY53270264	1GHz~26.5GHz	Dec. 10, 2020	Apr. 19, 2021~Jul. 12, 2021	Dec. 09, 2021	Radiation (03CH16-HY)
EMI Test Receiver	Keysight	N9038A	MY59053012	3Hz~26.5GHz	Nov. 18, 2020	Apr. 19, 2021~Jul. 12, 2021	Nov. 17, 2021	Radiation (03CH16-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Jan. 15, 2021	Apr. 19, 2021~Jul. 12, 2021	Jan. 14, 2022	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY11680/4PE	NA	Aug. 29, 2020	Apr. 19, 2021~Jul. 12, 2021	Aug. 28, 2021	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY11688/4PE	NA	Aug. 29, 2020	Apr. 19, 2021~Jul. 12, 2021	Aug. 28, 2021	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	EC-A5-300-5757	NA	Aug. 29, 2020	Apr. 19, 2021~Jul. 12, 2021	Aug. 28, 2021	Radiation (03CH16-HY)
Software	Audix	E3 6.2009-8-24	RK-001136	N/A	N/A	Apr. 19, 2021~Jul. 12, 2021	N/A	Radiation (03CH16-HY)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Apr. 19, 2021~Jul. 12, 2021	N/A	Radiation (03CH16-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Apr. 19, 2021~Jul. 12, 2021	N/A	Radiation (03CH16-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Apr. 19, 2021~Jul. 12, 2021	N/A	Radiation (03CH16-HY)



5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	6.8 dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.7 dB
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Appendix A. Radiated Spurious Emission

Test Engineer :	Karl Hou and Andy Yang	Temperature :	20~25°C
		Relative Humidity :	50~60%

WIFI 2.4G 802.11ax HE20_Tx_CH01 + WIFI 5G 802.11a_Tx_CH36

2.4GHz 2400~2483.5MHz

WIFI 802.11ax HE20 (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)
802.11ax HE20 CH 01 2412MHz		2389.59	66.08	-7.92	74	50.32	27.56	8.56	30.28	100	83	P	H
		2389.695	51.93	-2.07	54	36.17	27.56	8.56	30.28	100	83	A	H
	*	2412	116.08	-	-	100.35	27.48	8.6	30.27	100	83	P	H
	*	2412	106.92	-	-	91.19	27.48	8.6	30.27	100	83	A	H
												P	H
												A	H
		2389.905	64.29	-9.71	74	48.53	27.56	8.56	30.28	294	105	P	V
		2389.485	50.49	-3.51	54	34.73	27.56	8.56	30.28	294	105	A	V
	*	2412	114.81	-	-	99.08	27.48	8.6	30.27	294	105	P	V
	*	2412	106.26	-	-	90.53	27.48	8.6	30.27	294	105	A	V
												P	V
												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 (Band Edge @ 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+3+4		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a Ch36 5180MHz		5147.42	63.54	-10.46	74	48.37	31.8	13.04	29.67	284	258	P	H
		5150	48.29	-5.71	54	33.11	31.8	13.05	29.67	284	258	A	H
	*	5180	118.11	-	-	103.02	31.68	13.09	29.68	284	258	P	H
	*	5180	110.82	-	-	95.73	31.68	13.09	29.68	284	258	A	H
													H
													H
		5149.24	67.35	-6.65	74	52.17	31.8	13.05	29.67	278	153	P	V
		5149.24	52.33	-1.67	54	37.15	31.8	13.05	29.67	278	153	A	V
	*	5180	120.02	-	-	104.93	31.68	13.09	29.68	278	153	P	V
	*	5180	112.42	-	-	97.33	31.68	13.09	29.68	278	153	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



WIFI 2.4G 802.11ax HE20_Tx_CH01 + WIFI 5G 802.11a_Tx_CH36

(Harmonic @ 3m)

WIFI Ant. Simultaneously	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)
802.11ax HE20 CH 01 2412MHz+ 802.11a Ch36 5180MHz		4824	55.67	-18.33	74	39.61	31.15	14.53	29.62	100	0	P	H
		4824	44.82	-9.18	54	28.76	31.15	14.53	29.62	100	0	A	H
		10360	48.17	-20.03	68.2	45.57	39.44	19.39	56.23	100	0	P	H
		15540	46.97	-27.03	74	41.18	37.98	23.22	55.41	100	0	P	H
													H
													H
													H
		4824	55.37	-18.63	74	39.31	31.15	14.53	29.62	100	0	P	V
		4824	44.3	-9.7	54	28.24	31.15	14.53	29.62	100	0	A	V
		10360	48.82	-19.38	68.2	46.22	39.44	19.39	56.23	100	0	P	V
		15540	48.54	-25.46	74	42.75	37.98	23.22	55.41	100	0	P	V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

**WIFI 2.4G 802.11ax HE20 Full_Tx_CH01 + WIFI 5G 802.11a_Tx_CH36 +****BLE (1M)_Tx_CH39****2.4GHz 2400~2483.5MHz****BLE (Band Edge @ 3m)**

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE (1M) CH 39 2480MHz	*	2480	108.92	-	-	93.12	27.4	8.74	30.26	100	225	P	H
	*	2480	108.41	-	-	92.61	27.4	8.74	30.26	100	225	A	H
		2483.56	62.47	-11.53	74	46.66	27.4	18.66	30.25	100	225	P	H
		2483.56	52.29	-1.71	54	36.48	27.4	18.66	30.25	100	225	A	H
													H
													H
	*	2480	108.09	-	-	92.29	27.4	8.74	30.26	302	164	P	V
	*	2480	107.43	-	-	91.63	27.4	8.74	30.26	302	164	A	V
		2483.52	61.23	-12.77	74	45.42	27.4	18.66	30.25	302	164	P	V
		2483.52	51.53	-2.47	54	35.72	27.4	18.66	30.25	302	164	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



2.4GHz 2400~2483.5MHz

WIFI 802.11ax HE20 Full (Band Edge @ 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.	
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11ax HE20 Full CH 01 2412MHz		2389.485	65.66	-8.34	74	49.9	27.56	18.48	30.28	100	79	P	H
		2389.59	51.43	-2.57	54	35.67	27.56	18.48	30.28	100	79	A	H
	*	2412	116.42	-	-	100.69	27.48	18.52	30.27	100	79	P	H
	*	2412	107.97	-	-	92.24	27.48	18.52	30.27	100	79	A	H
													H
													H
		2389.38	64.36	-9.64	74	48.6	27.56	18.48	30.28	287	105	P	V
		2389.485	49.84	-4.16	54	34.08	27.56	18.48	30.28	287	105	A	V
	*	2412	114.01	-	-	98.28	27.48	18.52	30.27	287	105	P	V
	*	2412	106.26	-	-	90.53	27.48	18.52	30.27	287	105	A	V
													V
													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 (Band Edge @ 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.	
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a Ch36 5180MHz		5149.24	69.03	-4.97	74	53.85	31.8	13.05	29.67	285	256	P	H
		5150.02	49.12	-100.88	150	33.94	31.8	13.05	29.67	285	256	A	H
	*	5180	118.25	-	-	103.16	31.68	13.09	29.68	285	256	P	H
	*	5180	110.81	-	-	95.72	31.68	13.09	29.68	285	256	A	H
													H
													H
		5150.02	72.17	-77.83	150	56.99	31.8	13.05	29.67	248	147	P	V
		5149.5	51.82	-2.18	54	36.64	31.8	13.05	29.67	248	147	A	V
	*	5180	120.46	-	-	105.37	31.68	13.09	29.68	248	147	P	V
	*	5180	112.53	-	-	97.44	31.68	13.09	29.68	248	147	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



WIFI 2.4G 802.11ax HE20 Full_Tx_CH01 + WIFI 5G 802.11a_Tx_CH36 + BLE (1M)_Tx_CH39

(Harmonic @ 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.	
Simultaneously		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11ax HE20 Full CH 01 2412MHz+ 802.11a Ch36 5180MHz+ BLE (1M) CH39 2480MHz		4824	55.53	-18.47	74	39.22	31.15	14.78	29.62	100	0	P	H
		4824	44.96	-9.04	54	28.65	31.15	14.78	29.62	100	0	A	H
		4960	55.73	-18.27	74	39.24	31.34	14.79	29.64	100	0	P	H
		4960	45.24	-8.76	54	28.75	31.34	14.79	29.64	100	0	A	H
		7440	44.98	-29.02	74	48.12	36.4	16.75	56.29	100	0	P	H
		10360	48.79	-19.41	68.2	46.19	39.44	19.39	56.23	100	0	P	H
		15540	46.76	-27.24	74	40.97	37.98	23.22	55.41	100	0	P	H
		4824	56.64	-17.36	74	40.33	31.15	16.2	29.62	100	0	P	V
		4824	45.14	-8.86	54	28.83	31.15	16.2	29.62	100	0	A	V
		4960	55.78	-18.22	74	39.29	31.34	16.22	29.64	100	0	P	V
		4960	45.2	-8.8	54	28.71	31.34	16.22	29.64	100	0	A	V
		7440	45.27	-28.73	74	48.41	36.4	16.75	56.29	100	0	P	V
		10360	48.7	-19.5	68.2	46.1	39.44	19.39	56.23	100	0	P	V
		15540	47.16	-26.84	74	41.37	37.98	23.22	55.41	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average 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.
-	The signal is Unintentional Radiators .
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.	
Simultaneously		(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 B. Radiated Spurious Emission Plots

Test Engineer :	Karl Hou and Andy Yang	Temperature :	20~25°C
		Relative Humidity :	50~60%



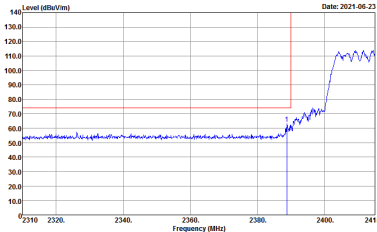
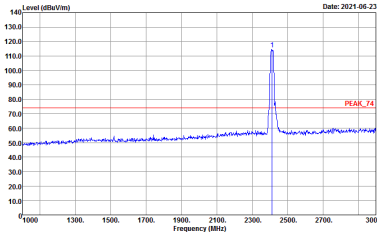
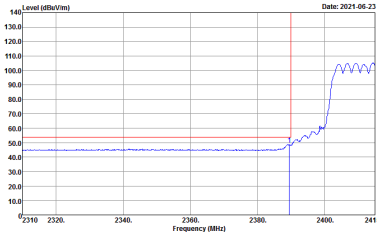
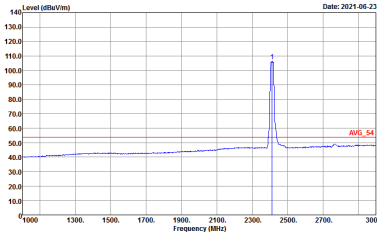
WIFI 2.4G 802.11ax HE20_Tx_CH01 + WIFI 5G 802.11a_Tx_CH36

2.4GHz 2400~2483.5MHz

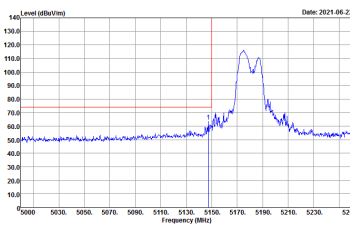
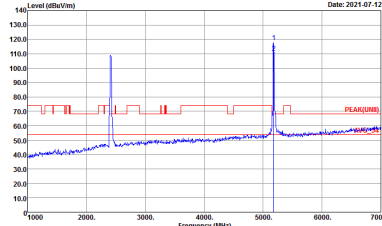
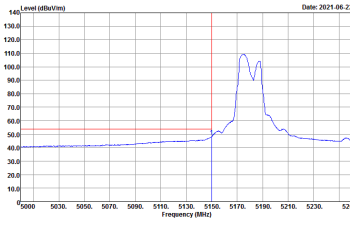
WIFI 802.11ax HE20 (Band Edge @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	802.11ax HE20 CH01 2412MHz	
ANT	Simultaneously	
1+2	Horizontal	Fundamental
Peak	Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 HORIZONTAL : RBW:1000.000KHz VBW:1000KHz SWT:Auto	Site : 03CH16-HY Condition : AVG_54 3m 91200_1522 HORIZONTAL : RBW:1000.000KHz VBW:1000KHz SWT:Auto



WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	802.11ax HE20 CH01 2412MHz	
ANT	Simultaneously	
1+2	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 VERTICAL : RBW:1000.000KHz VBW:1000KHz SWT:Auto	 Site : 03CH16-HY Condition : AVG_54 3m 91200_1522 VERTICAL : RBW:1000.000KHz VBW:1000KHz SWT:Auto

Band 1 - 5150~5250MHz
WIFI 802.11a (Band Edge @ 3m)

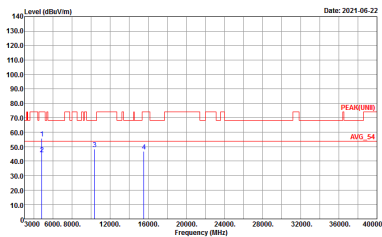
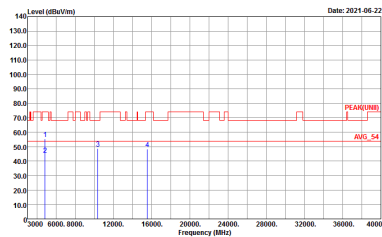
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH36 5180MHz	
1+2+3+4	Horizontal	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	 Site : 03CH16-HY Condition : PEAK(FUND) 3m 91200_1522 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 HORIZONTAL : RBW:1000.000kHz VBW:0.300kHz SWT:Auto	Left blank



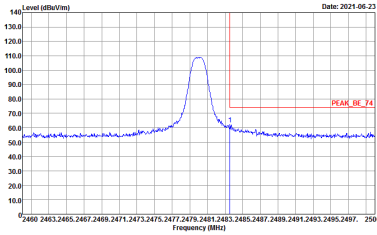
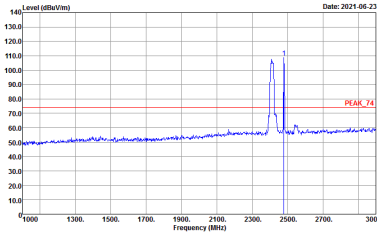
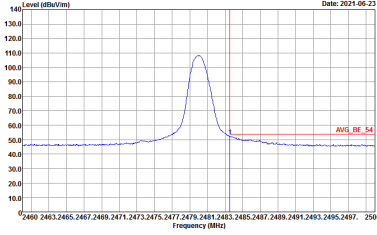
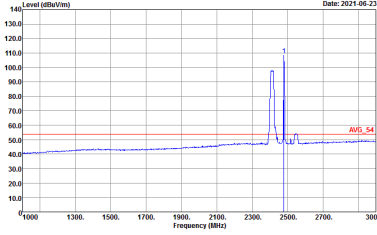
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH36 5180MHz	
1+2+3+4	Vertical	Fundamental
Peak	Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 VERTICAL : RBW:1000.000KHz VBW:0.300KHz SWT:Auto	Site : 03CH16-HY Condition : PEAK(UNIT) 3m 91200_1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 VERTICAL : RBW:1000.000KHz VBW:0.300KHz SWT:Auto	Left blank

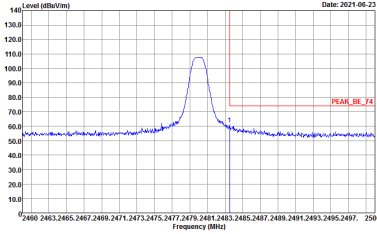
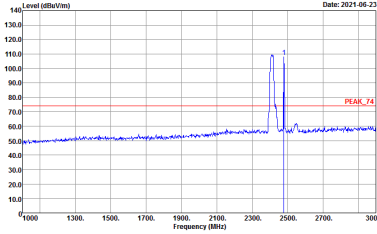
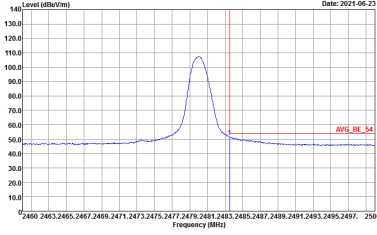
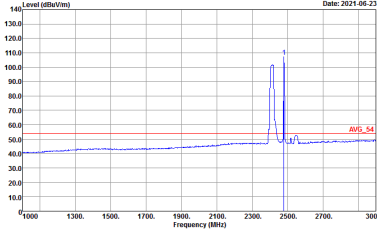


WIFI 2.4G 802.11ax HE20_Tx_CH01 + WIFI 5G 802.11a_Tx_CH36
(Harmonic @ 3m)

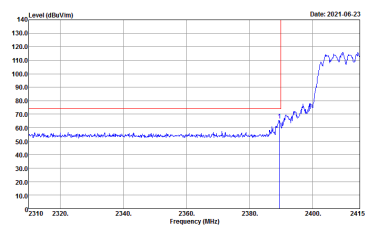
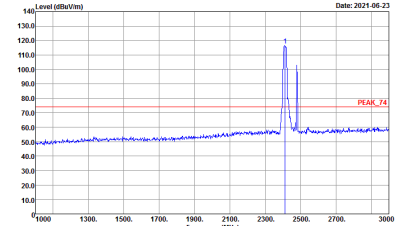
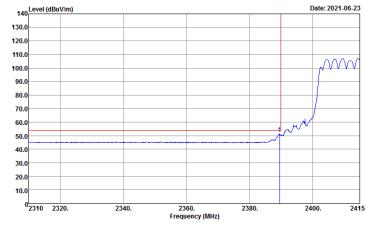
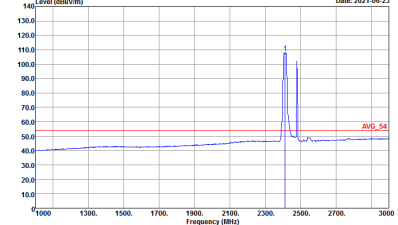
WIFI	WIFI 2.4G 802.11ax HE20 CH01 Tx+ WIFI 5G 802.11a CH36 Tx	
ANT	Simultaneously	
	Horizontal	Vertical
Peak Avg.	 Site Condition : 03C116-14V : PEAK(UNIT) 3m 91200.1522 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site Condition : 03C116-14V : PEAK(UNIT) 3m 91200.1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto

WIFI 2.4G 802.11ax HE20 Full_Tx_CH01 + WIFI 5G 802.11a_Tx_CH36 +
BLE (1M)_Tx_CH39
2.4GHz 2400~2483.5MHz
BLE (Band Edge @ 3m)

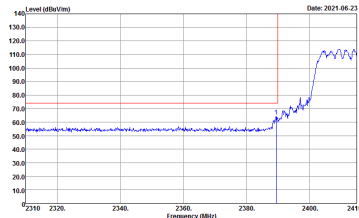
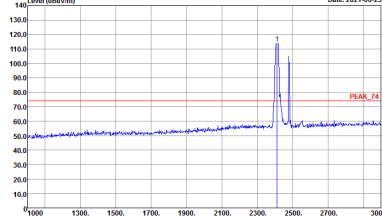
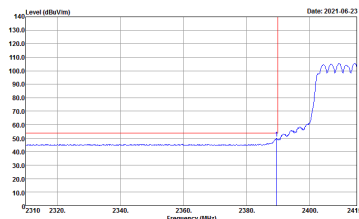
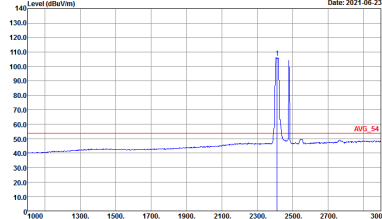
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
1	Horizontal	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	 Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto
	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	 Site : 03CH16-HY Condition : AVG_54 3m 91200_1522 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto
Avg.		

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	BLE CH39 2480MHz	
1	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH16-HY Condition : AVG_54 3m 91200_1522 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.		

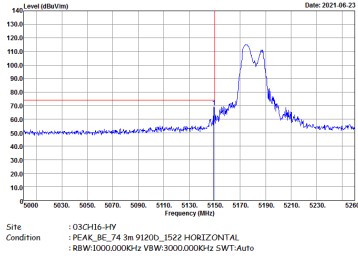
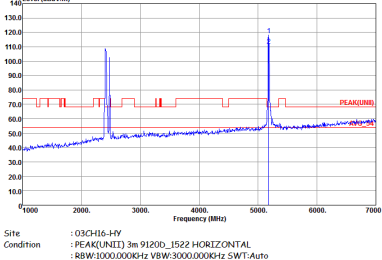
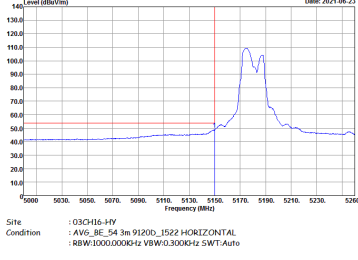
2.4GHz 2400~2483.5MHz
WIFI 802.11ax HE20 (Band Edge @ 3m)

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	802.11ax HE20 CH01 2412MHz	
ANT	Simultaneously	
1+2	Horizontal	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 HORIZONTAL RBW:1000.000KHz VBW:1000KHz SWT:Auto	 Site : 03CH16-HY Condition : AVG_54 3m 91200_1522 HORIZONTAL RBW:1000.000KHz VBW:1000KHz SWT:Auto

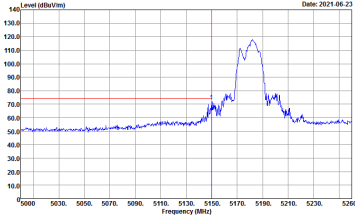
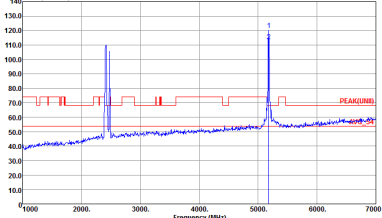
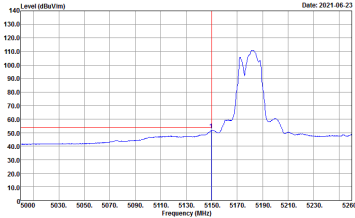


WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	802.11ax HE20 CH01 2412MHz	
ANT	Simultaneously	
1+2	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto	 Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 VERTICAL : RBW:1000.000kHz VBW:10000kHz SWT:Auto	 Site : 03CH16-HY Condition : AVG_54 3m 91200_1522 VERTICAL : RBW:1000.000kHz VBW:10000kHz SWT:Auto

Band 1 - 5150~5250MHz
WIFI 802.11a (Band Edge @ 3m)

WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH36 5180MHz	
1+2+3+4	Horizontal	Fundamental
Peak		
Avg.		Left blank



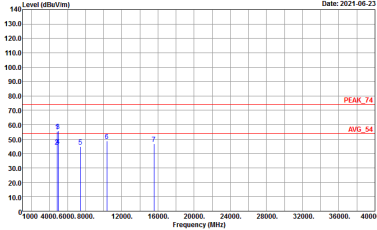
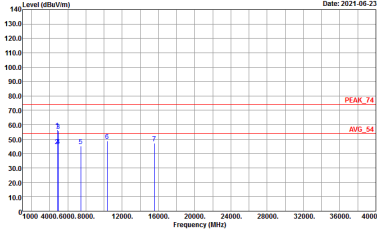
WIFI	Band 1 5150~5250MHz Band Edge @ 3m	
ANT	802.11a CH36 5180MHz	
1+2+3+4	Vertical	Fundamental
Peak	 Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH16-HY Condition : PEAK(UNIT) 3m 91200_1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH16-HY Condition : AVG_BE_54 3m 91200_1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank



WIFI 2.4G 802.11ax HE20 Full_Tx_CH01 + WIFI 5G 802.11a_Tx_CH36 +

BLE (1M)_Tx_CH39

(Harmonic @ 3m)

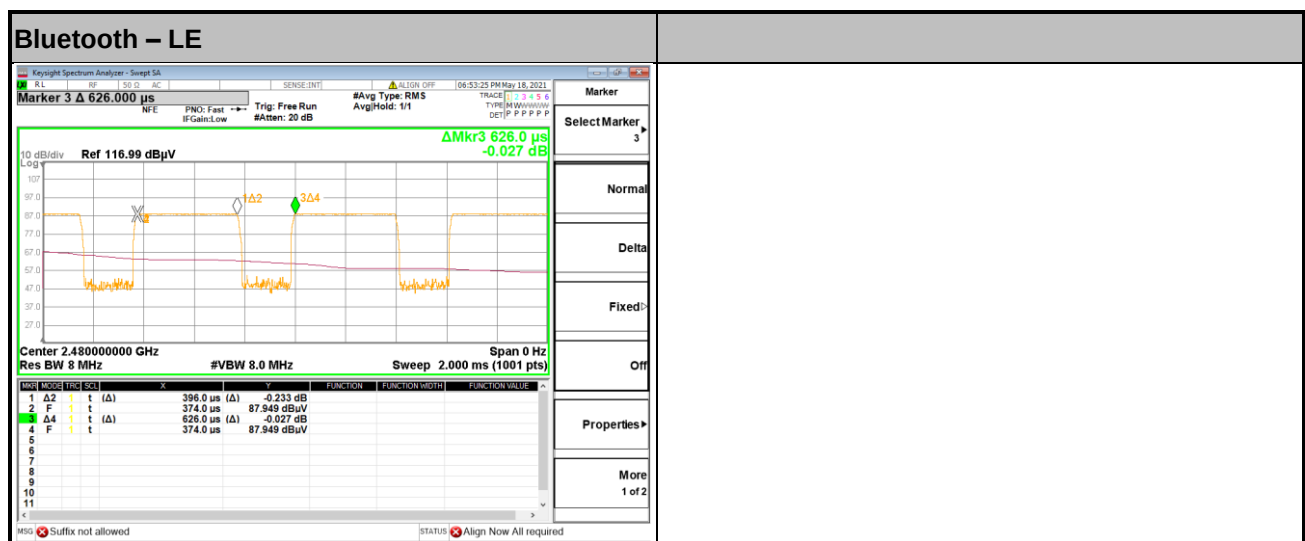
WIFI	WIFI 2.4G 802.11ax HE20 CH01 Tx+ WIFI 5G 802.11a CH36 Tx + BLE(1M) CH39 Tx	
ANT	Simultaneously	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 HORIZONTAL Detector : Peak	 Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 VERTICAL Detector : Peak



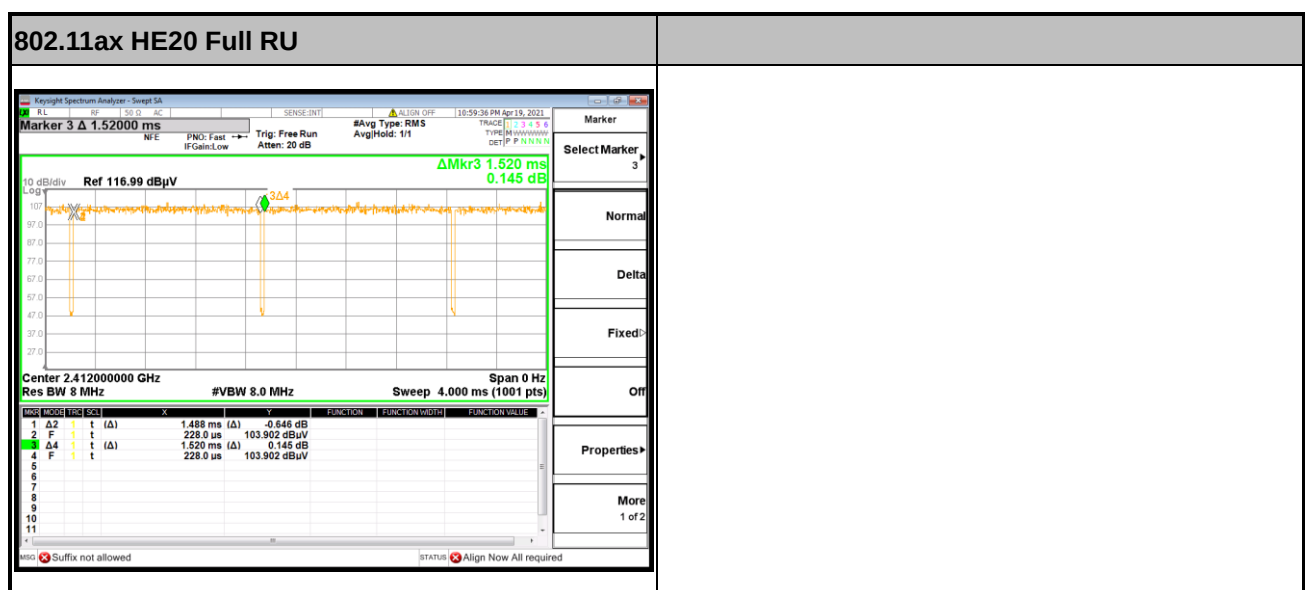
Appendix C. Duty Cycle Plots

Mode	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
1x1	Bluetooth -LE	63.26	396	2.53	3kHz	1.99
2x2	2.4GHz 802.11ax HE20 Full RU	97.89	1488	0.67	1kHz	0.09
4x4	802.11a	95.16	2065	0.48	1kHz	0.22

<For 1x1>



<For 2x2>





<For 4x4>

802.11a

