FCC CO-LOCATION RADIO TEST REPORT

FCC ID	:	**2AGOZ-K29W**
Equipment	:	**Media Receiver**
Brand Name	:	**FACEBOOK**
Model Name	:	**WT74BL**
Applicant	:	**Facebook Technologies, LLC 1 Hacker Way, Menlo Park, CA 94025, USA**
Standard	:	**FCC Part 15 Subpart E §15.407**

The product was received on Mar. 30, 2021 and testing was started from Apr. 16, 2021 and completed on Apr. 17, 2021. We, Sporton International Inc. EMC & Wireless Communications 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. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. EMC & Wireless Communications Laboratory
No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FR130215F	01	Initial issue of report	May 18, 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 1.37 dB at 5455.600 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: Danny Lee
Report Producer: Dara Chiu

1 General Description

1.1 Product Feature of Equipment Under Test

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

Product Specification subjective to this standard	
Antenna Type	WLAN <Ant. 1>: PIFA Antenna <Ant. 2>: PIFA Antenna Bluetooth: PIFA Antenna

Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	**Bluetooth:** 2.6 **WLAN:** <Ant. 1>: 4.9 <Ant. 2>: 4.7
5470 MHz ~ 5725 MHz	Peak Gain (dBi)	<Ant. 1>: 5.9 dBi <Ant. 2>: 5.8 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. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	03CH07-HY

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

FCC designation No.: TW1190

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 414788 D01 Radiated Test Site v01r01.
- 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 (1 GHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in two config (Panel Setting Tilt and Panel Setting Upright). The worst cases (Panel Setting Upright) were recorded in this report.

2.1 Carrier Frequency and Channel

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

<Ant. 2>

2400-2483.5 MHz	
802.11b	
Channel	Freq. (MHz)
11	2462

MIMO <Ant. 0+1>

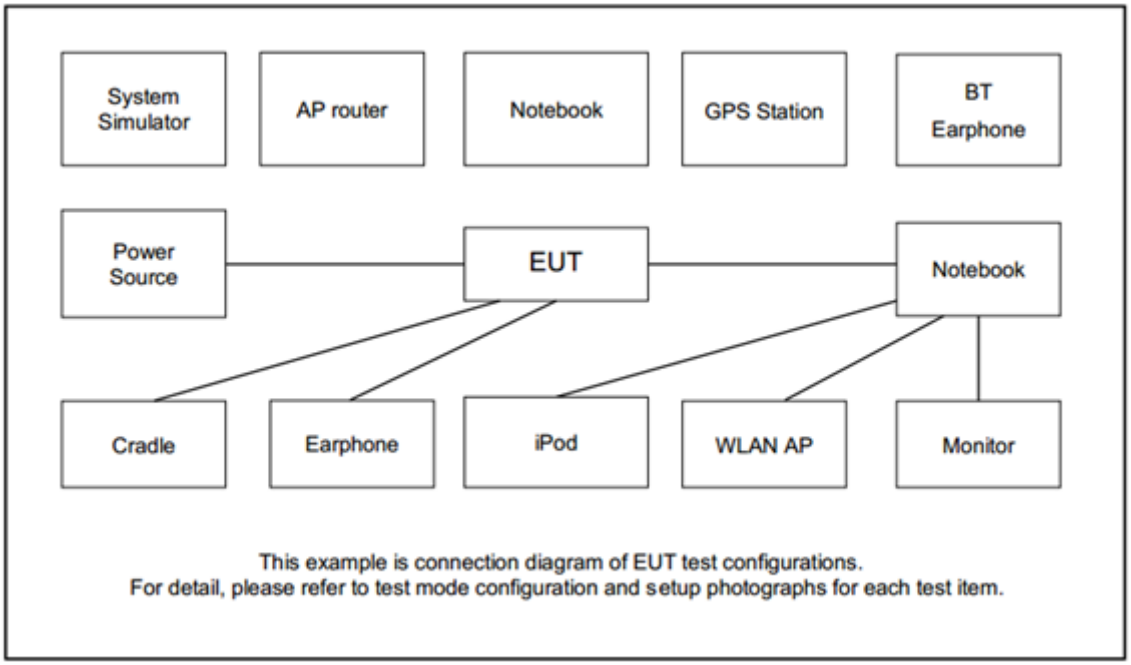
5470-5725 MHz	
802.11ac VHT80	
Channel	Freq. (MHz)
106	5530

2.2 Test Mode

<Co-Location>

Modulation	Data Rate
Bluetooth-LE + 5GHz 802.11ac VHT80 for MIMO Ant. 0+1	GFSK + MCS0
Bluetooth-LE + 2.4GHz 802.11b for Ant. 2	GFSK + 1 Mbps

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Phone	Samsung	SM-A730F/DS	NA	N/A	Unshielded, 1.8 m

2.5 EUT Operation Test Setup

The RF test items, utility “QRCT 4 V4.0-00182” 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.

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

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

(2) 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 Unwanted Emissions Measurements Below 1000 MHz

   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

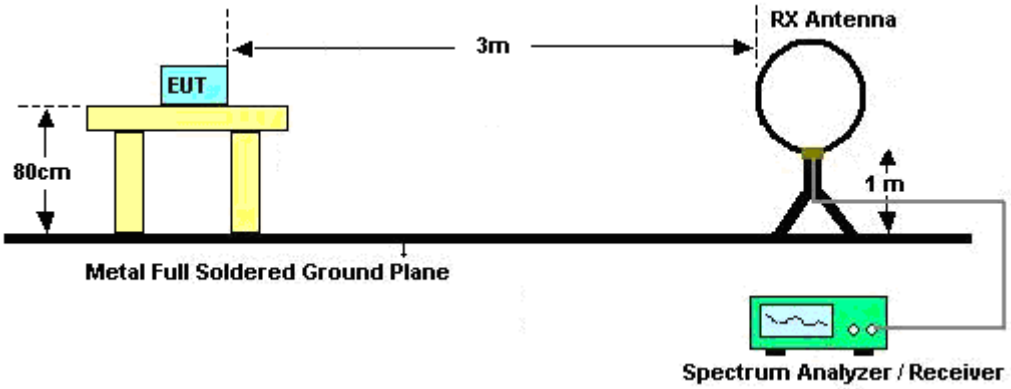
   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

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

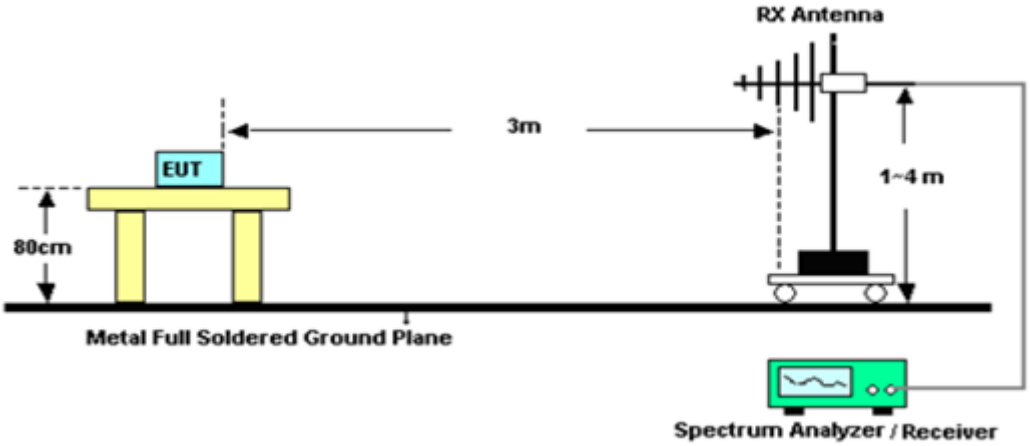
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1 GHz and 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 below 1 GHz, 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 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

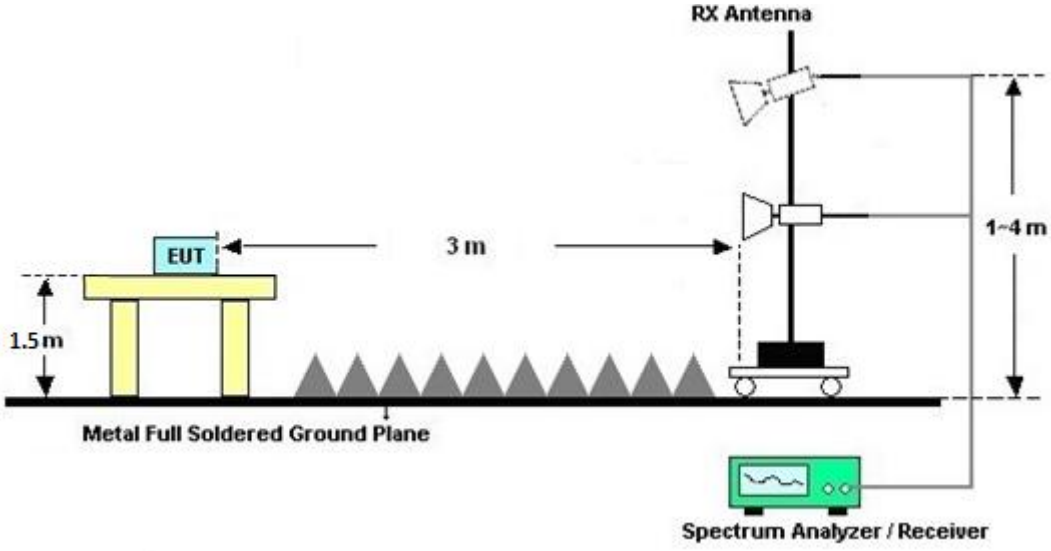
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.1.5 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 alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

3.1.7 Duty Cycle

Please refer to Appendix C.

3.1.8 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
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 04, 2021	Apr. 16, 2021~ Apr. 17, 2021	Jan. 03, 2022	Radiation (03CH07-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01 N-06	35419 & 03	30MHz~1GHz	Apr. 29, 2020	Apr. 16, 2021~ Apr. 17, 2021	Apr. 28, 2021	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Dec. 01, 2020	Apr. 16, 2021~ Apr. 17, 2021	Nov. 30, 2021	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170 251	18GHz~40GHz	Dec. 02, 2020	Apr. 16, 2021~ Apr. 17, 2021	Dec. 01, 2021	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz~1GHz	May 19, 2020	Apr. 16, 2021~ Apr. 17, 2021	May 18, 2021	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590075	1GHz~18GHz	Apr. 23, 2020	Apr. 16, 2021~ Apr. 17, 2021	Apr. 22, 2021	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A023 62	1GHz~26.5GHz	Oct. 31, 2020	Apr. 16, 2021~ Apr. 17, 2021	Oct. 30, 2021	Radiation (03CH07-HY)
Preamplifier	EMEC	EM18G40G	0600789	18-40GHz	Jul. 31, 2020	Apr. 16, 2021~ Apr. 17, 2021	Jul. 30, 2021	Radiation (03CH07-HY)
EMI Test Receiver	Agilent	N9038A (MXE)	MY532900 53	20Hz~26.5GHz	May 21, 2020	Apr. 16, 2021~ Apr. 17, 2021	May 20, 2021	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9030A	MY523502 76	3Hz~44GHz	Jun. 09, 2020	Apr. 16, 2021~ Apr. 17, 2021	Jun. 08, 2021	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15682-4	30MHz to 18GHz	Feb. 24, 2021	Apr. 16, 2021~ Apr. 17, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971-4	9kHz to 18GHz	Feb. 24, 2021	Apr. 16, 2021~ Apr. 17, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655-4	9kHz to 18GHz	Feb. 24, 2021	Apr. 16, 2021~ Apr. 17, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2, 801606/2	18GHz~40GHz	Feb. 24, 2021	Apr. 16, 2021~ Apr. 17, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126	532078/12 6E	30MHz~18GHz	Sep. 18, 2020	Apr. 16, 2021~ Apr. 17, 2021	Sep. 17, 2021	Radiation (03CH07-HY)
Antenna Mast	Max-Full	MFA520BS	N/A	1m~4m	N/A	Apr. 16, 2021~ Apr. 17, 2021	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Apr. 16, 2021~ Apr. 17, 2021	N/A	Radiation (03CH07-HY)
Software	Audix	E3 6.2009-8-24	N/A	N/A	N/A	Apr. 16, 2021~ Apr. 17, 2021	N/A	Radiation (03CH07-HY)
USB Data Logger	TECPEL	TR-32	HE17XB24 95	N/A	N/A	Apr. 16, 2021~ Apr. 17, 2021	N/A	Radiation (03CH07-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.7**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.3**

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

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

Appendix A. Radiated Spurious Emission

Test Engineer :	Jesse Wang and Stan Hsieh	Temperature :	22.7~24.6°C
		Relative Humidity :	51.6~57.5%

2.4GHz 2400~2483.5MHz + Band 3 – 5470~5725MHz

BLE 2Mbps_Tx_Ch39 + WIFI 802.11ac VHT80_Tx_Ch106_MIMO Ant 1+2 (Band Edge @ 3m)

BLE+WIFI 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)
BLE 2Mbps Ch39 2480MHz		2380.21	53.47	-20.53	74	38.94	31.87	18.07	35.41	373	66	P	H
		2384.46	45.96	-8.04	54	31.41	31.87	18.09	35.41	373	66	A	H
	*	2480	99.56	-	-	84.31	32.47	18.23	35.45	373	66	P	H
	*	2480	98.41	-	-	83.16	32.47	18.23	35.45	373	66	A	H
		2498.944	54.19	-19.81	74	38.8	32.6	18.25	35.46	373	66	P	H
		2483.72	47.26	-6.74	54	32.01	32.47	18.23	35.45	373	66	A	H
		2354.54	53.68	-20.32	74	39.29	31.83	17.96	35.4	290	314	P	V
		2379.53	46.23	-7.77	54	31.7	31.87	18.07	35.41	290	314	A	V
	*	2480	101.17	-	-	85.92	32.47	18.23	35.45	290	314	P	V
	*	2480	99.85	-	-	84.6	32.47	18.23	35.45	290	314	A	V
		2499.472	54.39	-19.61	74	39	32.6	18.25	35.46	290	314	P	V
		2492.96	47.1	-6.9	54	31.72	32.6	18.24	35.46	290	314	A	V

802.11ac VHT80 Ch106 5530MHz		5454.88	57.87	-16.13	74	46.34	34.6	12.06	35.13	307	334	P	H
		5466.16	60.23	-7.97	68.2	48.62	34.67	12.07	35.13	307	334	P	H
		5455.6	52.63	-1.37	54	41.1	34.6	12.06	35.13	307	334	A	H
	*	5530	103.89	-	-	92.08	34.77	12.17	35.13	307	334	P	H
	*	5530	98.36	-	-	86.55	34.77	12.17	35.13	307	334	A	H
		5743.265	48.7	-19.5	68.2	36.75	34.7	12.42	35.17	307	334	P	H
		5452.96	57.23	-16.77	74	45.71	34.6	12.05	35.13	400	65	P	V
		5468.56	59.93	-8.27	68.2	48.31	34.67	12.08	35.13	400	65	P	V
		5454.16	52.23	-1.77	54	40.71	34.6	12.05	35.13	400	65	A	V
	*	5530	102.79	-	-	90.98	34.77	12.17	35.13	400	65	P	V
	*	5530	96.73	-	-	84.92	34.77	12.17	35.13	400	65	A	V
		5744.21	49.95	-18.25	68.2	38	34.7	12.42	35.17	400	65	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

BLE 2Mbps_Tx_Ch39 + WIFI 802.11ac VHT80_Tx_Ch106_MIMO Ant 1+2 (Harmonic @ 3m)

BLE+WIFI 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)
Co-location		4960	55.21	-18.79	74	44.18	34.2	12.16	35.33	285	283	P	H
		4960	48.49	-5.51	54	37.46	34.2	12.16	35.33	285	283	A	H
		7440	41.27	-32.73	74	47.96	35.6	15.3	57.59	100	0	P	H
		11060	43.86	-30.14	74	45.62	37.9	18.89	58.55	100	0	P	H
		16590	49.07	-19.13	68.2	39.38	41.85	24.23	56.39	100	0	P	H
													H
		4960	55.72	-18.28	74	44.69	34.2	12.16	35.33	192	305	P	V
		4960	50.04	-3.96	54	39.01	34.2	12.16	35.33	192	305	A	V
		7440	41.85	-32.15	74	48.54	35.6	15.3	57.59	100	0	P	V
		11060	45.07	-28.93	74	46.83	37.9	18.89	58.55	100	0	P	V
		16590	48.25	-19.95	68.2	38.56	41.85	24.23	56.39	100	0	P	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

BLE 2Mbps_Tx_Ch39 + WIFI 802.11ac VHT80_Tx_Ch106_MIMO Ant 1+2 (LF @3m)

BLE+WIFI 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)
Co-location LF		143.13	33.86	-9.64	43.5	44.25	17.38	2.18	29.95	-	-	P	H
		147.45	36.97	-6.53	43.5	47.44	17.27	2.21	29.95	100	0	P	H
		182.82	35.97	-7.53	43.5	48.62	14.79	2.5	29.94	-	-	P	H
		365.1	29.77	-16.23	46	35.63	20.75	3.28	29.89	-	-	P	H
		524.7	28.95	-17.05	46	31.13	23.91	3.77	29.86	-	-	P	H
		953.1	33.46	-12.54	46	26.47	30.42	5.25	28.68	-	-	P	H
													H
													H
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													H
		30	33.68	-6.32	40	38.43	24.32	0.94	30.01	100	0	P	V
		66.99	28.99	-11.01	40	45.37	12.02	1.58	29.98	-	-	P	V
		158.25	28.86	-14.64	43.5	39.81	16.7	2.3	29.95	-	-	P	V
		442.8	28.54	-17.46	46	31.88	22.95	3.59	29.88	-	-	P	V
		870.5	31.63	-14.37	46	26.93	28.9	4.93	29.13	-	-	P	V
		951.7	34.01	-11.99	46	27.14	30.31	5.25	28.69	-	-	P	V
													V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.

2.4GHz 2400~2483.5MHz

BLE 2Mbps_Tx_Ch39 + WIFI 802.11b_Tx_Ch11_Ant 2 (Band Edge @ 3m)

BLE+WIFI 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)
BLE 2Mbps Ch39 2480MHz		2370.69	53.86	-20.14	74	39.38	31.87	18.02	35.41	369	57	P	H
		2387.86	46.46	-7.54	54	31.87	31.9	18.1	35.41	369	57	A	H
	*	2480	100.68	-	-	85.43	32.47	18.23	35.45	369	57	P	H
	*	2480	99.41	-	-	84.16	32.47	18.23	35.45	369	57	A	H
		2491.2	56.01	-17.99	74	40.62	32.6	18.24	35.45	369	57	P	H
		2488.824	48.7	-5.3	54	33.32	32.6	18.23	35.45	369	57	A	H
		2375.45	53.91	-20.09	74	39.4	31.87	18.05	35.41	285	300	P	V
		2388.88	46.24	-7.76	54	31.64	31.9	18.11	35.41	285	300	A	V
	*	2480	101.42	-	-	86.17	32.47	18.23	35.45	285	300	P	V
	*	2480	100.11	-	-	84.86	32.47	18.23	35.45	285	300	A	V
		2496.392	55.12	-18.88	74	39.74	32.6	18.24	35.46	285	300	P	V
		2483.544	47.6	-6.4	54	32.35	32.47	18.23	35.45	285	300	A	V
802.11b Ch11 2462MHz		2385.31	54.27	-19.73	74	39.72	31.87	18.09	35.41	153	20	P	H
		2387.01	44.63	-9.37	54	30.04	31.9	18.1	35.41	153	20	A	H
	*	2462	109.87	-	-	94.76	32.33	18.22	35.44	153	20	P	H
	*	2462	106.56	-	-	91.45	32.33	18.22	35.44	153	20	A	H
		2488.436	57.02	-16.98	74	41.64	32.6	18.23	35.45	153	20	P	H
		2488.73	49.14	-4.86	54	33.76	32.6	18.23	35.45	153	20	A	H
		2317.65	54.19	-19.81	74	40.01	31.77	17.8	35.39	386	2	P	V
		2390	43.15	-10.85	54	28.56	31.9	18.11	35.42	386	2	A	V
	*	2462	107.21	-	-	92.1	32.33	18.22	35.44	386	2	P	V
	*	2462	103.89	-	-	88.78	32.33	18.22	35.44	386	2	A	V
		2487.554	55.01	-18.99	74	39.63	32.6	18.23	35.45	386	2	P	V
		2487.652	46.22	-7.78	54	30.84	32.6	18.23	35.45	386	2	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

BLE 2Mbps_Tx_Ch39 + WIFI 802.11b_Tx_Ch11_Ant 2 (Harmonic @ 3m)

BLE+WIFI 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)
Co-location		4924	43.48	-30.52	74	55.49	34.17	12.46	58.64	100	0	P	H
		4960	52.67	-21.33	74	64.52	34.2	12.5	58.55	285	283	P	H
		4960	48.99	-5.01	54	60.84	34.2	12.5	58.55	285	283	A	H
		7386	40.23	-33.77	74	47.37	35.6	14.8	57.54	100	0	P	H
		7440	40.29	-33.71	74	47.38	35.6	14.9	57.59	100	0	P	H
													H
		4924	42.56	-31.44	74	54.57	34.17	12.46	58.64	100	0	P	V
		4960	48.91	-25.09	74	60.76	34.2	12.5	58.55	100	0	P	V
		7386	40.5	-33.5	74	47.64	35.6	14.8	57.54	100	0	P	V
		7440	40.43	-33.57	74	47.52	35.6	14.9	57.59	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

BLE 2Mbps_Tx_Ch39 + WIFI 802.11b_Tx_Ch11_Ant 2 (LF @ 3m)

BLE+WIFI 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)
		163.11	34.17	-9.33	43.5	45.49	16.28	2.34	29.94	-	-	P	H
		180.66	36.92	-6.58	43.5	49.45	14.92	2.49	29.94	100	0	P	H
		183.63	35.79	-7.71	43.5	48.44	14.79	2.5	29.94	-	-	P	H
		461.7	32.96	-13.04	46	35.93	23.27	3.63	29.87	-	-	P	H
		893.6	32.73	-13.27	46	28.12	28.6	5.03	29.02	-	-	P	H
		953.8	33.24	-12.76	46	26.24	30.42	5.26	28.68	-	-	P	H
													H
													H
													H
													H
													H
Co-location													H
LF		30	33	-7	40	37.75	24.32	0.94	30.01	100	0	P	V
		34.86	29.06	-10.94	40	35.81	22.13	1.13	30.01	-	-	P	V
		158.52	29.12	-14.38	43.5	40.07	16.7	2.3	29.95	-	-	P	V
		761.3	29.85	-16.15	46	27.07	27.8	4.51	29.53	-	-	P	V
		850.2	31.71	-14.29	46	27.34	28.74	4.85	29.22	-	-	P	V
		955.9	33.91	-12.09	46	26.82	30.5	5.26	28.67	-	-	P	V
													V
													V
													V
													V
													V
													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:

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)
802.11b 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 B. Radiated Spurious Emission Plots

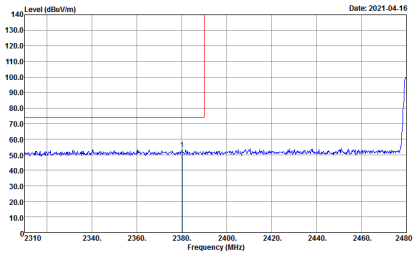
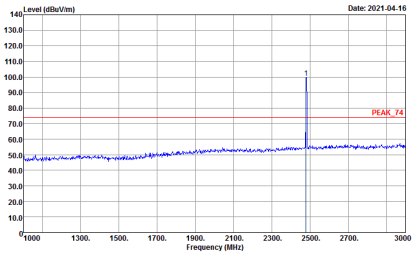
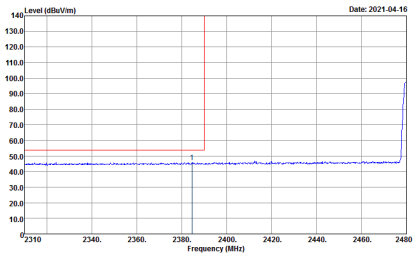
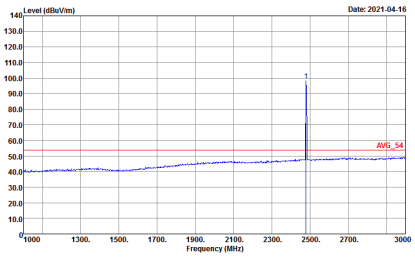
Test Engineer :	Jesse Wang and Stan Hsieh	**Temperature :**	22.7~24.6°C
		Relative Humidity :	51.6~57.5%

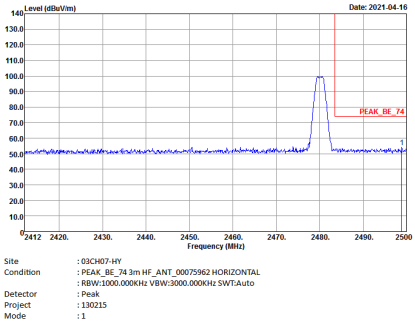
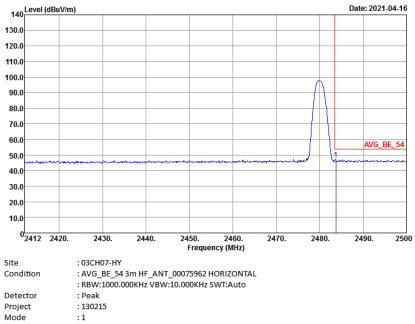
Note symbol

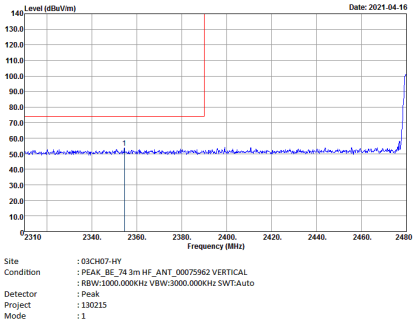
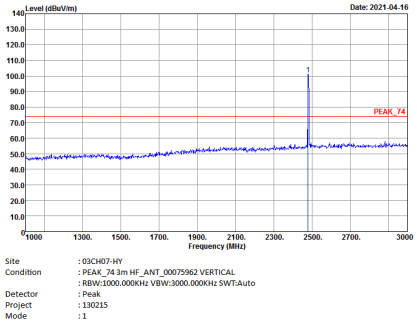
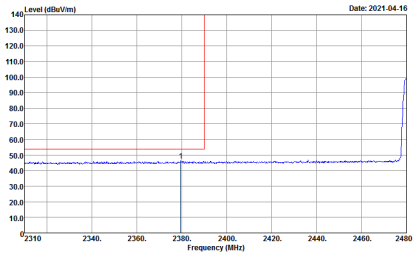
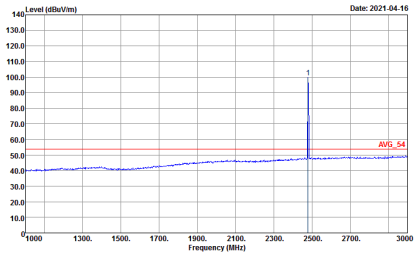
-L	**Low channel location**
-R	**High channel location**

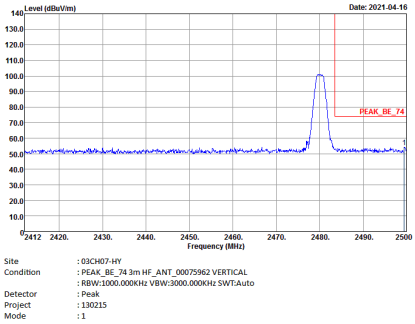
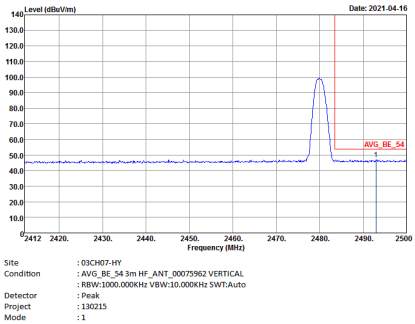
2.4GHz 2400~2483.5MHz + Band 3 – 5470~5725MHz

BLE (Band Edge @ 3m)

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE 2Mbps Ch39 2480MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 1	 Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 1
Avg.	 Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 1	 Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 1

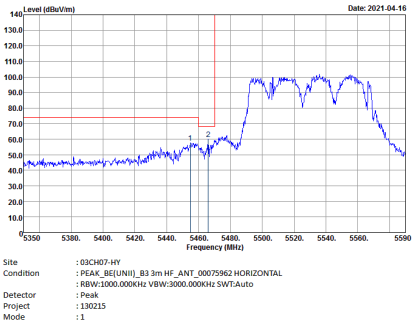
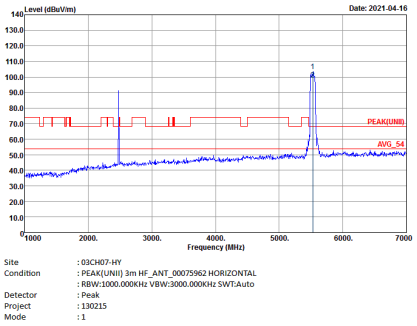
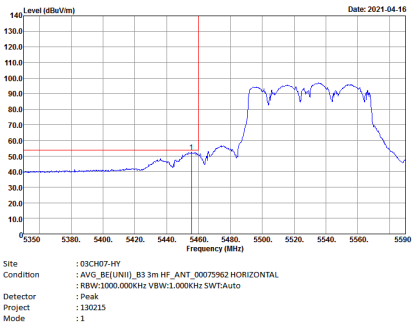
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE 2Mbps Ch39 2480MHz	
	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

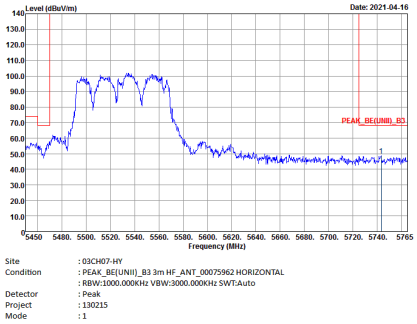
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE 2Mbps Ch39 2480MHz	
	Vertical	Fundamental
Peak	 Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 1	 Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 1
Avg.	 Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 1	 Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 1

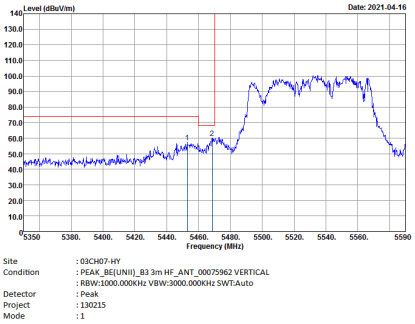
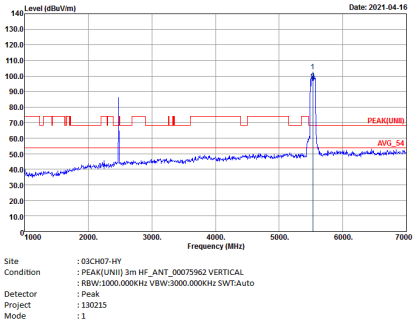
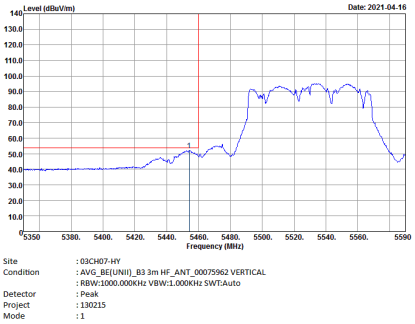
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE 2Mbps Ch39 2480MHz	
	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

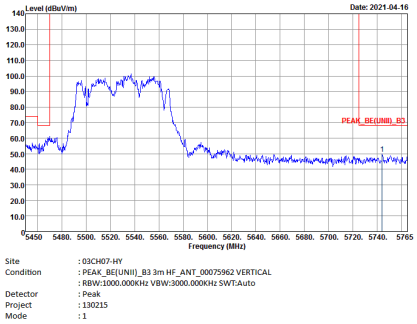
Band 3 – 5470~5725MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

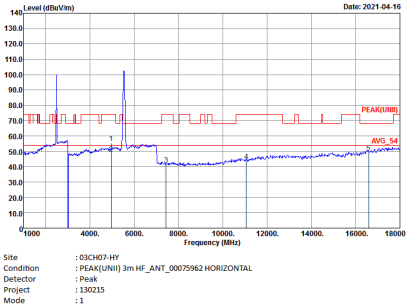
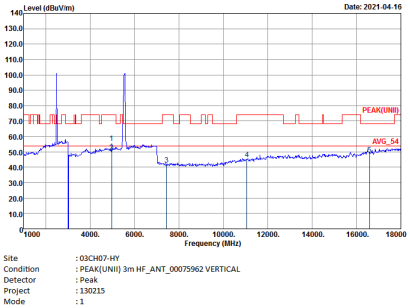
WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz	
1+2	Horizontal	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz	
1+2	Horizontal	Fundamental
Peak	 Site : 03CH07-HY Condition : PEAK_BE(UNII)_B3 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 1	Left blank

WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz	
1+2	Vertical	Fundamental
Peak		
Avg.		Left blank

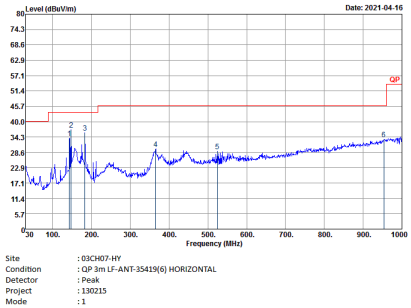
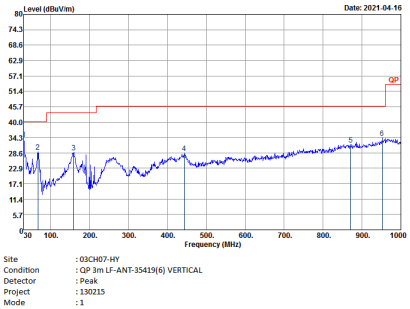
WIFI	Band 3 5470~5725MHz Band Edge @ 3m	
ANT	802.11ac VHT80 CH106 5530MHz	
1+2	Vertical	Fundamental
Peak	 Site : 03CH07-HY Condition : PEAK_BE(UNII)_B3 3m HF_ANT_00075962 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 1	Left blank

BLE 2Mbps_Tx_Ch39 + WIFI 802.11ac VHT80_Tx_Ch106_MIMO Ant 1+2 (Harmonic @ 3m)

	BLE 2Mbps_Tx_Ch39 + Ant 1+2_11ac VHT80_Tx_Ch106_Co-location	
	Horizontal	Vertical
Peak Avg.		

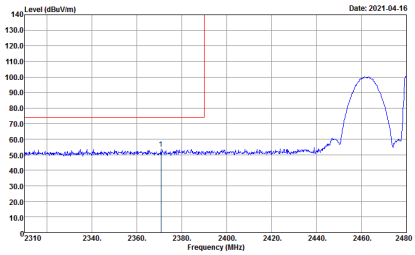
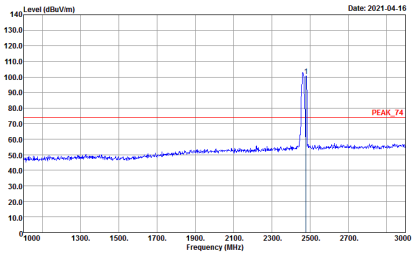
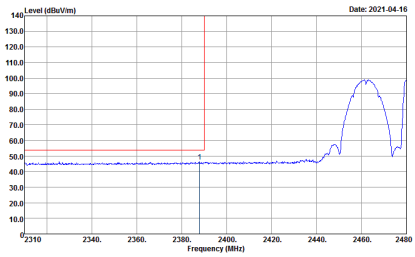
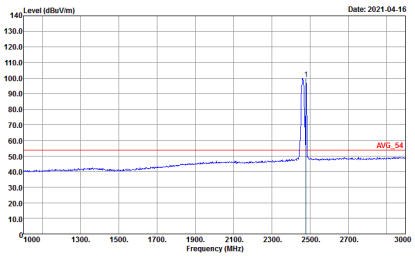
Emission below 1GHz

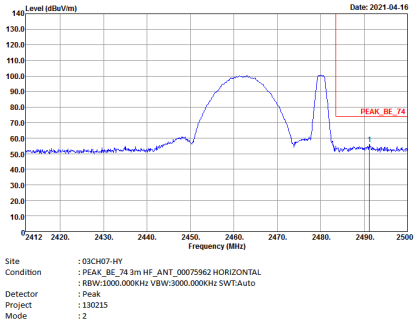
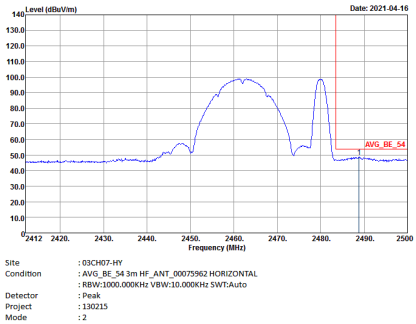
BLE 2Mbps_Tx_Ch39 + WIFI 802.11ac VHT80_Tx_Ch106_MIMO Ant 1+2 (LF @ 3m)

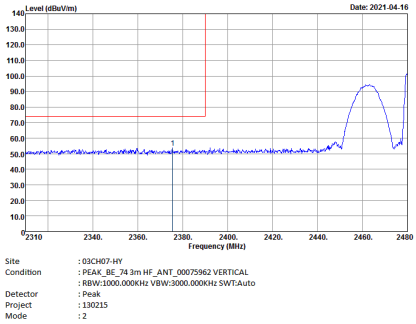
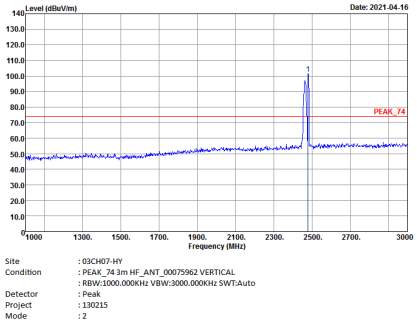
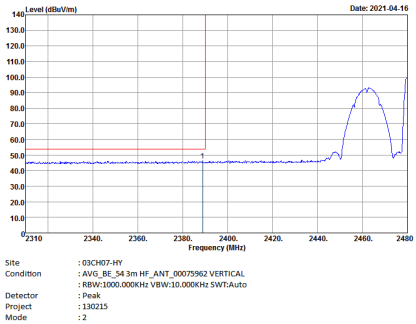
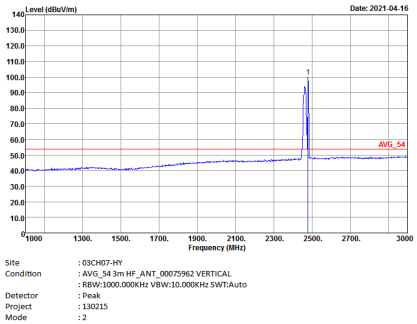
	Co-location LF	
	Horizontal	Vertical
QP / Peak		

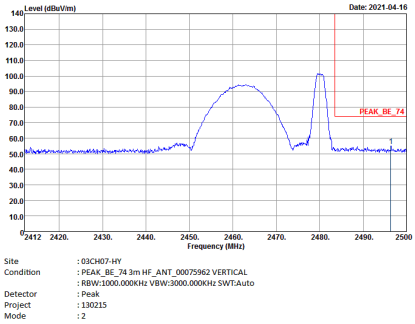
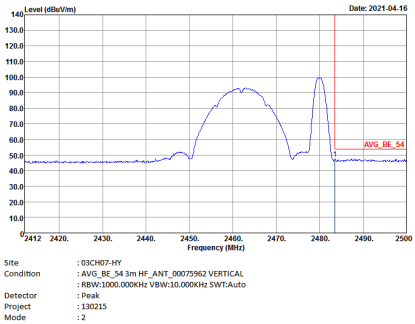
2.4GHz 2400~2483.5MHz

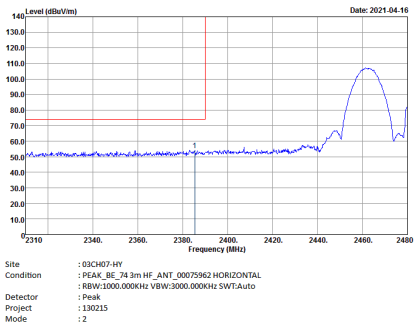
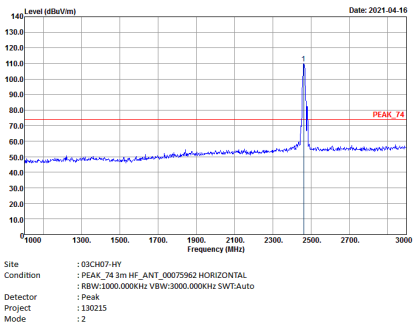
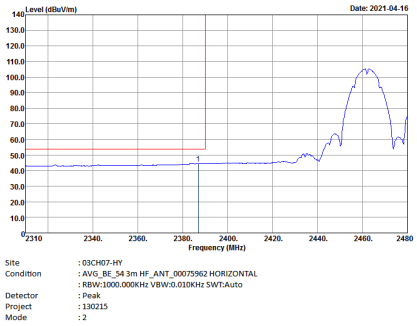
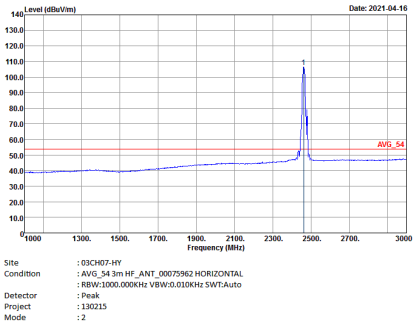
BLE (Band Edge @ 3m)

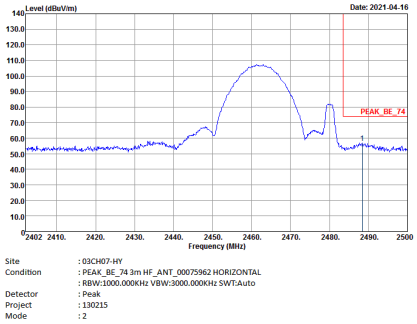
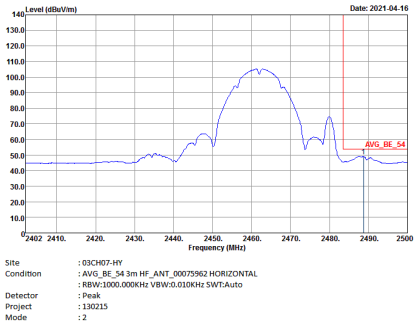
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE 2Mbps Ch39 2480MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 2	 Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 2
Avg.	 Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 2	 Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto Detector : Peak Project : 130215 Mode : 2

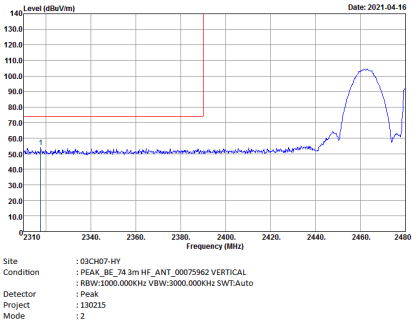
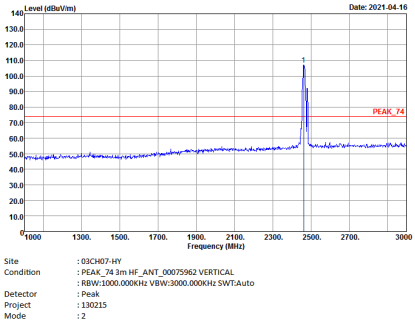
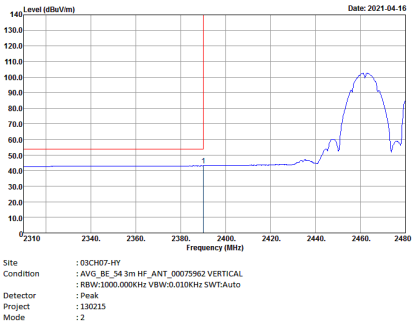
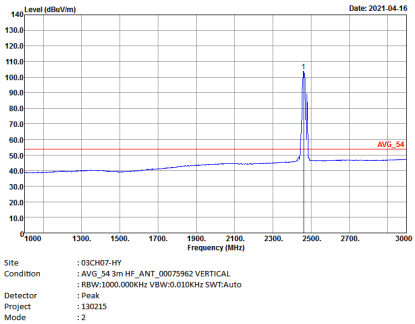
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE 2Mbps Ch39 2480MHz	
	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

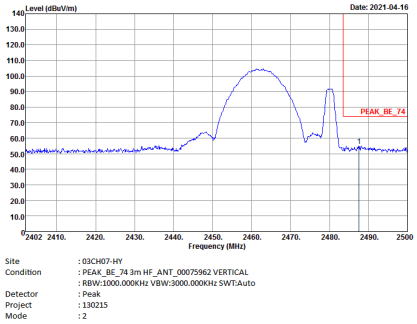
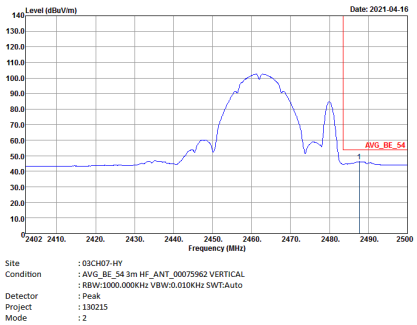
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE 2Mbps Ch39 2480MHz	
	Vertical	Fundamental
Peak		
Avg.		

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE 2Mbps Ch39 2480MHz	
	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

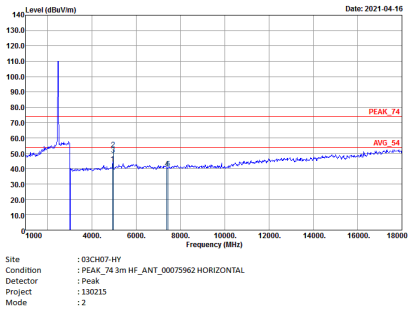
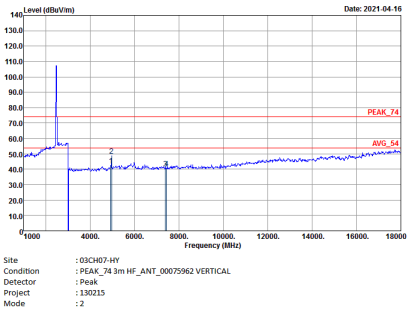
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
2	Horizontal	Fundamental
Peak		
Avg.		

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
2	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
2	Vertical	Fundamental
Peak		
Avg.		

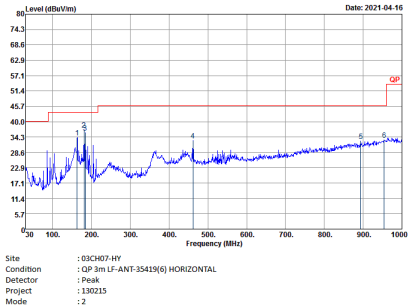
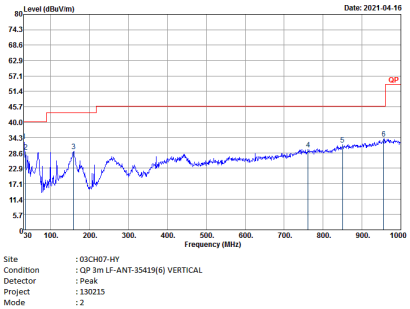
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
2	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

BLE 2Mbps_Tx_Ch39 + WIFI 802.11b_Tx_Ch11_Ant 2 (Harmonic @ 3m)

	BLE 2Mbps_Tx_Ch39 + Ant 2_11b_Tx_Ch11_Co-location	
	Horizontal	**Vertical**
Peak **Avg.**		

Emission below 1GHz

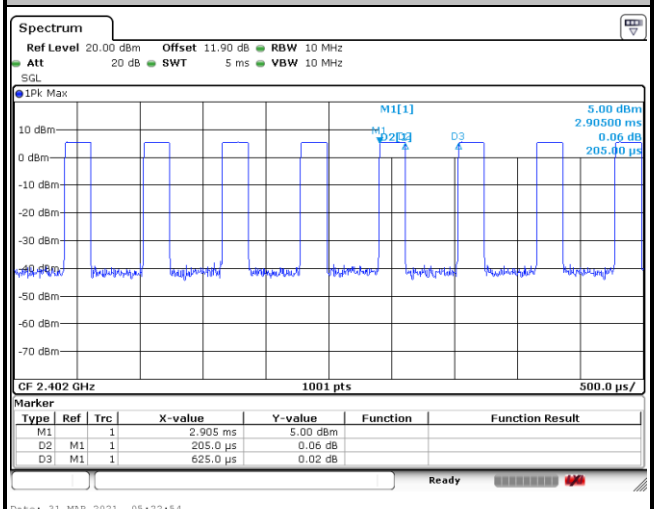
BLE 2Mbps_Tx_Ch39 + WIFI 802.11b_Tx_Ch11_Ant 2 (LF @ 3m)

	Co-location LF	
	Horizontal	Vertical
QP / Peak		

Appendix C. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
-	Bluetooth - LE for 2Mbps	32.8	205	4.88	10kHz	4.84
2	802.11b	99.15	-	-	10Hz	0.04
1+2	5GHz 802.11ac VHT80 for Ant 1	94.07	1110	0.90	1kHz	0.27
1+2	5GHz 802.11ac VHT80 for Ant 2	94.02	1100	0.91	1kHz	0.27

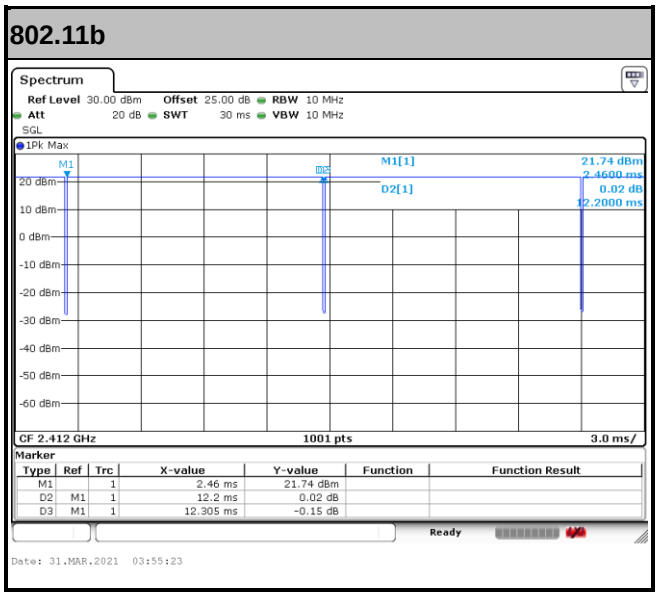
Bluetooth - LE for 2Mbps



-

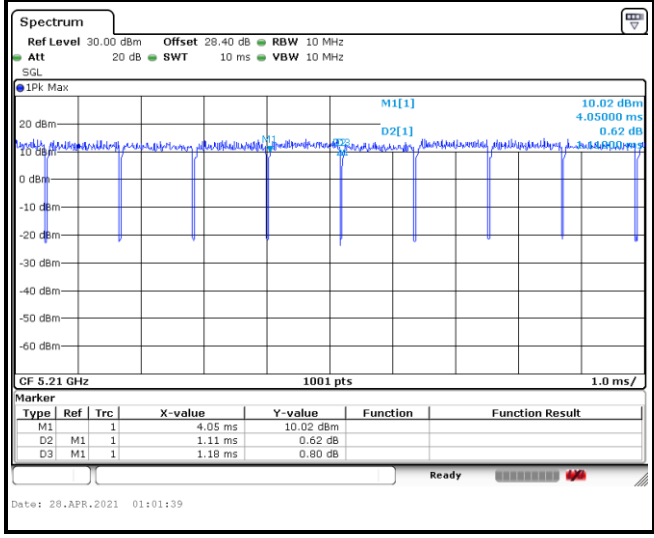
<Ant. 2>

802.11b



MIMO <Ant. 1>

802.11ac VHT80



MIMO <Ant. 2>

802.11ac VHT80