



# FCC CO-LOCATION RADIO TEST REPORT

FCC ID : 2AYXP-6253  
Equipment : Electronic Display Device  
Model Name : M2L4EK  
Applicant : Avalite Bakerite LLC  
101 East Park Boulevard  
Plano, TX 75074  
Standard : FCC Part 15 Subpart E §15.407

The product was received on Mar. 22, 2021 and testing was started from Apr. 01, 2021 and completed on Apr. 23, 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.)



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### History of this test report

Report No.	Version	Description	Issued Date
FR0N1024-01F	01	Initial issue of report	May 12, 2021



### Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)
3.1	15.407(b)	Unwanted Emissions	Pass
3.2	15.203 15.407(a)	Antenna Requirement	Pass

<b>Declaration of Conformity:</b> The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
<b>Comments and Explanations:</b> 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: **Wii Chang**

Report Producer: **Lucy Wu**



# 1 General Description

## 1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Electronic Display Device
Model Name	M2L4EK
FCC ID	2AYXP-6253
EUT supports Radios application	WLAN 11b/g/n HT20 WLAN 11a/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE WPC

## 1.2 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Channel Frequency Range	2400 MHz ~ 2483.5 MHz 5260 MHz ~ 5320 MHz
Antenna Gain / Gain	<b>Bluetooth:</b> IFA Antenna with gain 4.0 dBi <b>WLAN</b> <b>&lt;5260 MHz ~ 5320 MHz&gt;</b> Monopole Antenna with gain 3.2 dBi
Type of Modulation	Bluetooth - LE: GFSK 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)

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

## 1.3 Modification of EUT

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



### 1.4 Testing Location

<b>Test Site</b>	Sporton International Inc. Wensan Laboratory
<b>Test Site Location</b>	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
<b>Test Site No.</b>	<b>Sporton Site No.</b> 03CH13-HY

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

FCC Designation No.: TW3786

### 1.5 Applicable Standards

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

- ♦ FCC Part 15 Subpart E
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.
- ♦ 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.--



## 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 for 802.11ac VHT80; Y Plane for Bluetooth – LE 2Mbps) were recorded in this report.

### 2.1 Carrier Frequency and Channel

2400-2483.5 MHz	
Bluetooth – LE (2Mbps)	
Channel	Freq. (MHz)
39	2480

5250-5350 MHz	
802.11ac VHT80	
Channel	Freq. (MHz)
58	5290

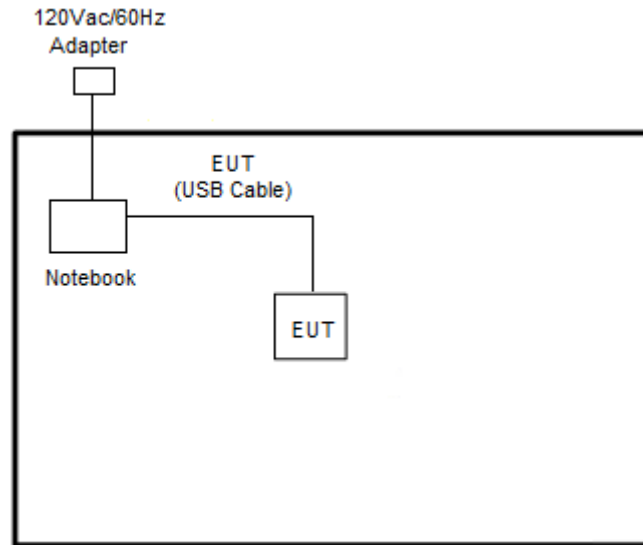
### 2.2 Test Mode

<Co-Location>

Modulation	Data Rate
Bluetooth – LE + 5GHz 802.11ac VHT80	GFSK + MCS0

Remark: All test items were performed with Adapter (AP15).

### 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.	Notebook	ACER	A515-54G-51QB	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

### 2.5 EUT Operation Test Setup

The RF test items, utility “CMD Version 10.0.18362.267” 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) For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.
- (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

**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.

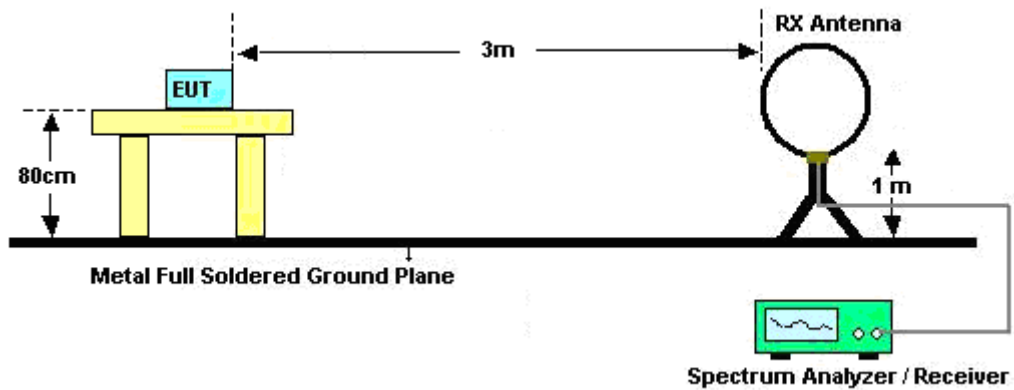
### 3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.
  - (1) Procedure for 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  $\geq$  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  $\geq$  1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 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.

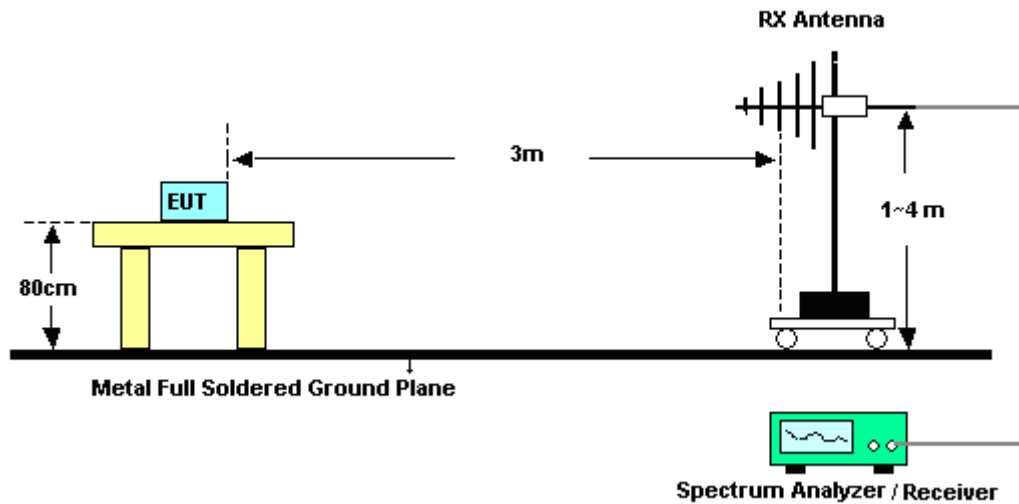
7. For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

### 3.1.4 Test Setup

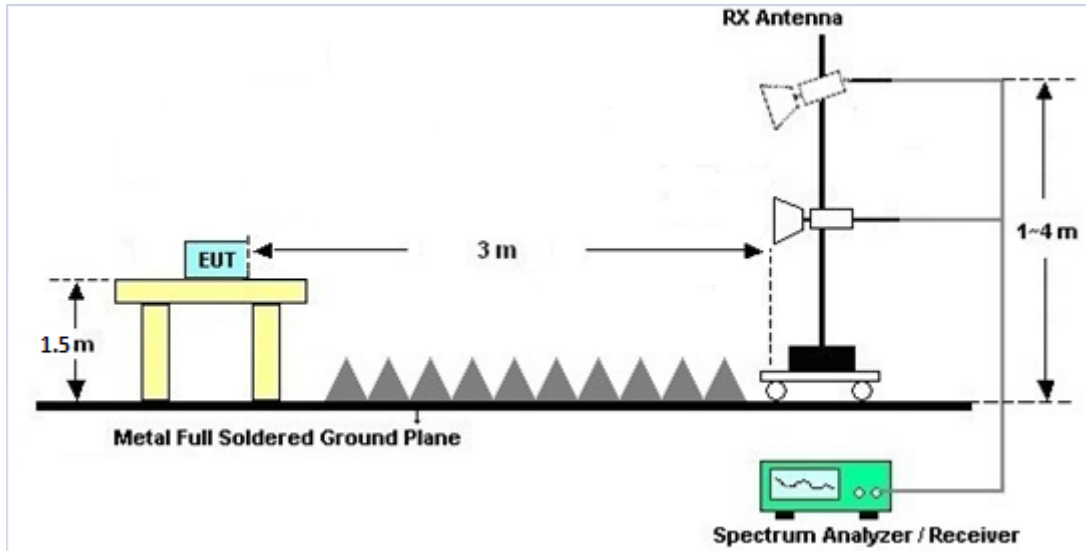
For radiated emissions below 30MHz



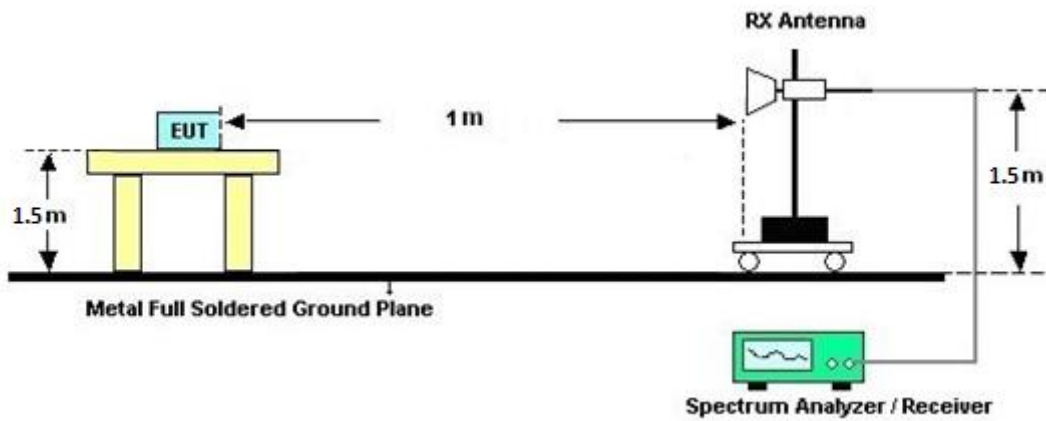
For radiated emissions from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz





### **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 (30MHz ~ 10th Harmonic)**

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
Amplifier	Sonoma-Instrument	310 N	187282	9KHz~1GHz	Dec. 16, 2020	Apr. 01, 2021~ Apr. 23, 2021	Dec. 15, 2021	Radiation (03CH13-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800 N1D01N-06	40103&07	30MHz to 1GHz	Apr. 29, 2020	Apr. 01, 2021~ Apr. 23, 2021	Apr. 28, 2021	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-121 2	1GHz ~ 18GHz	May 20, 2020	Apr. 01, 2021~ Apr. 23, 2021	May 19, 2021	Radiation (03CH13-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590074	1GHz~18GHz	May 19, 2020	Apr. 01, 2021~ Apr. 23, 2021	May 18, 2021	Radiation (03CH13-HY)
Preamplifier	Keysight	83017A	MY532701 47	1GHz~26.5GHz	Oct. 28, 2020	Apr. 01, 2021~ Apr. 23, 2021	Oct. 27, 2021	Radiation (03CH13-HY)
Signal Generator	Anritsu	MG3694C	163401	0.1Hz~40GHz	Jan. 31, 2021	Apr. 01, 2021~ Apr. 23, 2021	Jan. 30, 2022	Radiation (03CH13-HY)
Spectrum Analyzer	Keysight	N9010A	MY553705 26	10Hz~44GHz	Mar. 18, 2021	Apr. 01, 2021~ Apr. 23, 2021	Mar. 17, 2022	Radiation (03CH13-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Apr. 01, 2021~ Apr. 23, 2021	N/A	Radiation (03CH13-HY)
Antenna Mast	EMEC	AM-BS-4500- B	N/A	1m~4m	N/A	Apr. 01, 2021~ Apr. 23, 2021	N/A	Radiation (03CH13-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Apr. 01, 2021~ Apr. 23, 2021	N/A	Radiation (03CH13-HY)
Software	Audix	E3 6.2009-8-24	RK-00099 2	N/A	N/A	Apr. 01, 2021~ Apr. 23, 2021	N/A	Radiation (03CH13-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz ~ 40GHz	Dec. 11, 2020	Apr. 01, 2021~ Apr. 23, 2021	Dec. 10, 2021	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0030/126E	30M-18G	Feb. 10, 2021	Apr. 01, 2021~ Apr. 23, 2021	Feb. 09, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	804793/4	30M-18G	Feb. 10, 2021	Apr. 01, 2021~ Apr. 23, 2021	Feb. 09, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30M~40GHz	Feb. 22, 2021	Apr. 01, 2021~ Apr. 23, 2021	Feb. 21, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY4274/2	30MHz~40GHz	Mar. 11, 2021	Apr. 01, 2021~ Apr. 23, 2021	Mar. 10, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24961/ 4	30M-18G	Feb. 10, 2021	Apr. 01, 2021~ Apr. 23, 2021	Feb. 09, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4 PE	9kHz~30MHz	Mar. 11, 2021	Apr. 01, 2021~ Apr. 23, 2021	Mar. 10, 2022	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170 584	18GHz- 40GHz	Dec. 11, 2020	Apr. 01, 2021~ Apr. 23, 2021	Dec. 10, 2021	Radiation (03CH13-HY)
Filter	Wainwright	WLK4-1000-1 530-8000-40S S	SN12	1.53GHz Low Pass Filter	Sep. 15, 2020	Apr. 01, 2021~ Apr. 23, 2021	Sep. 14, 2021	Radiation (03CH13-HY)
Filter	Wainwright	WHKX8-5872. 5-6750-18000 -40ST	SN5	6.75GHz High Pass Filter	Mar. 11, 2021	Apr. 01, 2021~ Apr. 23, 2021	Mar. 10, 2022	Radiation (03CH13-HY)
Filter	Wainwright	WHKX12-270 0-3000-18000 -60SS	SN2	3GHz High Pass Filter	Jul. 13, 2020	Apr. 01, 2021~ Apr. 23, 2021	Jul. 12, 2021	Radiation (03CH13-HY)
Hygrometer	TECPEL	DTM-303A	TP182676	N/A	Nov. 18, 2020	Apr. 01, 2021~ Apr. 23, 2021	Nov. 17, 2021	Radiation (03CH13-HY)



## 5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	4.8
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### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	5.1
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### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	4.6
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### Appendix A. Radiated Spurious Emission

Test Engineer :	Daniel Lee, Jacky Hong and Wilson Wu	Temperature :	20~25°C
		Relative Humidity :	50~60%

**BLE (2M) CH39 + WLAN 802.11ac VHT80 CH58**

**2.4GHz 2400~2483.5MHz**

**BLE (Band Edge @ 3m)**

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 )
BLE CH39 2480MHz	*	2480	97.33	-	-	83.46	27.5	14.19	27.82	286	58	P	H
	*	2480	96.05	-	-	82.18	27.5	14.19	27.82	286	58	A	H
		2490.52	54.75	-19.25	74	40.87	27.5	14.2	27.82	286	58	P	H
		2484.08	46.92	-7.08	54	33.04	27.5	14.2	27.82	286	58	A	H
	*	2480	94.04	-	-	80.17	27.5	14.19	27.82	198	271	P	V
	*	2480	92.86	-	-	78.99	27.5	14.19	27.82	198	271	A	V
		2488.92	54.54	-19.46	74	40.66	27.5	14.2	27.82	198	271	P	V
		2495.36	46.88	-7.12	54	32.99	27.5	14.21	27.82	198	271	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



**Band 2 - 5250~5350MHz**

**WIFI 802.11ac VHT80 (Band Edge @ 3m)**

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)
<b>802.11ac VHT80 CH58 5290MHz</b>		5113.22	52.56	-21.44	74	41.74	31.97	6.27	27.42	100	164	P	H
		5108.46	45.55	-8.45	54	34.72	31.98	6.27	27.42	100	164	A	H
	*	5290	100.45	-	-	90.18	31.3	6.34	27.37	100	164	P	H
	*	5290	93.13	-	-	82.86	31.3	6.34	27.37	100	164	A	H
		5365.92	57.29	-16.71	74	46.91	31.36	6.37	27.35	100	164	P	H
		5353.92	50.83	-3.17	54	40.5	31.32	6.37	27.36	100	164	A	H
		5014.62	52.25	-21.75	74	41.9	31.56	6.24	27.45	349	335	P	V
		5130.22	45.64	-8.36	54	34.85	31.94	6.27	27.42	349	335	A	V
	*	5290	96.94	-	-	86.67	31.3	6.34	27.37	349	335	P	V
	*	5290	90.29	-	-	80.02	31.3	6.34	27.37	349	335	A	V
		5361.36	52.06	-21.94	74	41.7	31.35	6.37	27.36	349	335	P	V
		5350.32	45.3	-8.7	54	34.99	31.3	6.37	27.36	349	335	A	V
<b>Remark</b>	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



**BLE (2M) CH39 + WLAN 802.11ac VHT80 CH58 (Harmonic @ 3m)**

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)
BLE CH39 2480MHz + 802.11ac VHT80 CH58 5290MHz		4960	52.48	-21.52	74	42.38	31.42	6.13	27.45	110	156	P	H
		4960	42.53	-11.47	54	32.43	31.42	6.13	27.45	110	156	A	H
		7440	43.8	-30.2	74	55.28	36.82	8.19	57.28	100	0	P	H
		10580	47.06	-21.14	68.2	53.03	40.14	9.63	56.37	100	0	P	H
		15870	44.06	-29.94	74	49.83	37.83	11.62	55.67	100	0	P	H
		17989	55.59	-18.41	74	51.09	47.79	12.37	56.48	130	221	P	H
		17989	45.9	-8.1	54	41.4	47.79	12.37	56.48	130	221	A	H
		4960	52.77	-21.23	74	42.67	31.42	6.13	27.45	102	177	P	V
		4960	42.65	-11.35	54	32.55	31.42	6.13	27.45	102	177	A	V
		7440	44.45	-29.55	74	55.93	36.82	8.19	57.28	100	0	P	V
		10580	47.46	-20.74	68.2	53.43	40.14	9.63	56.37	100	0	P	V
		15870	43.56	-30.44	74	49.33	37.83	11.62	55.67	100	0	P	V
		18000	55.15	-18.85	74	50.32	48.1	12.38	56.47	139	214	P	V
		18000	45.35	-8.65	54	40.52	48.1	12.38	56.47	139	214	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



**Emission below 1GHz**

**BLE (2M) CH39 + WLAN 802.11ac VHT80 CH58 (LF)**

	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)
<b>BLE CH39 2480MHz + 802.11ac VHT80 CH58 5290MHz</b>		62.98	21	-19	40	40.62	11.91	0.74	32.27	-	-	P	H
		150.28	20.89	-22.61	43.5	34.59	17.39	1.16	32.25	-	-	P	H
		242.43	26.07	-19.93	46	39.29	17.45	1.43	32.1	-	-	P	H
		263.77	24.15	-21.85	46	34.88	19.79	1.49	32.01	-	-	P	H
		551.86	28.08	-17.92	46	32.69	25.58	2.09	32.28	-	-	P	H
		952.47	32.88	-13.12	46	30.25	30.61	2.8	30.78	100	0	P	H
		31.94	23.53	-16.47	40	31.61	23.62	0.53	32.23	-	-	P	V
		53.28	32.32	-7.68	40	50.78	13.16	0.67	32.29	-	-	P	V
		62.01	32.89	-7.11	40	52.56	11.88	0.73	32.28	100	0	P	V
		754.59	30.15	-15.85	46	31.29	28.05	2.48	31.67	-	-	P	V
		846.74	30.94	-15.06	46	30.58	28.92	2.63	31.19	-	-	P	V
	954.41	33.35	-12.65	46	30.63	30.68	2.81	30.77	-	-	P	V	
<b>Remark</b>	1. No other spurious found. 2. All results are PASS against limit line.												



Emission above 18GHz

BLE (2M) CH39 + WLAN 802.11ac VHT80 CH58 (SHF)

	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)
BLE CH39 2480MHz +		26030	40.31	-27.89	68.2	40.42	39.35	13.92	53.38	150	0	P	H
802.11ac VHT80 CH58 5290MHz		33884	43.27	-24.93	68.2	39.87	41.02	17.22	54.84	150	0	P	H
		29176	40.7	-27.5	68.2	39.88	40.37	15.12	54.67	150	0	P	V
		33334	43.41	-24.79	68.2	39.85	40.87	16.96	54.27	150	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



**Note symbol**

*	<b>Fundamental Frequency</b> which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is <b>over limit</b> line.
P/A	<b>Peak</b> or <b>Average</b>
H/V	<b>Horizontal</b> or <b>Vertical</b>



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

Ant.	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
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 :	Daniel Lee, Jacky Hong and Wilson Wu	Temperature :	20~25°C
		Relative Humidity :	50~60%

### Note symbol

-L	Low channel location
-R	High channel location

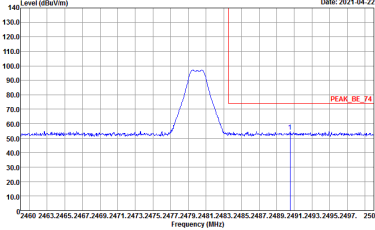
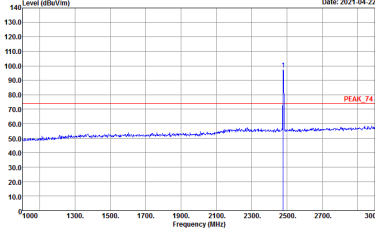
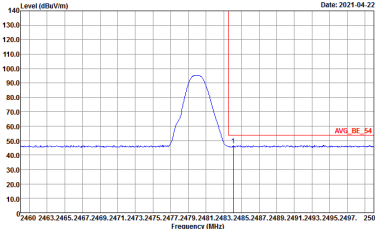
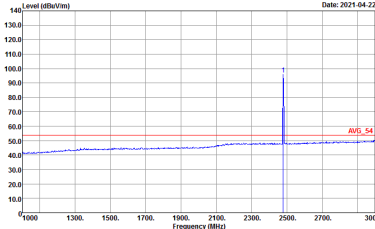




BLE (2M) CH39 + WLAN 802.11ac VHT80 Ch58

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

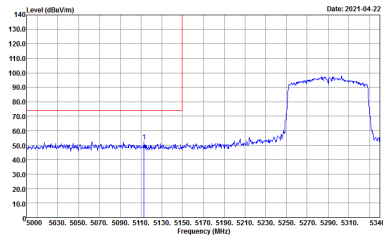
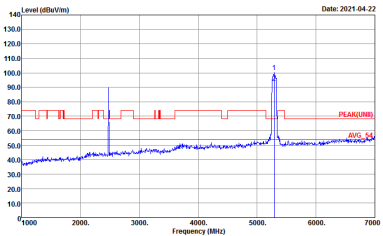
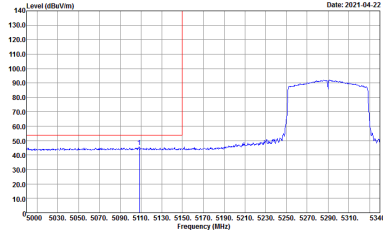
ANT	BLE (2M) CH39 + 802.11ac VHT80 Ch58	
Simultaneously	Horizontal	Fundamental
Peak	 <p>Date: 2021-04-22</p> <p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Date: 2021-04-22</p> <p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg.	 <p>Date: 2021-04-22</p> <p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>	 <p>Date: 2021-04-22</p> <p>Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>



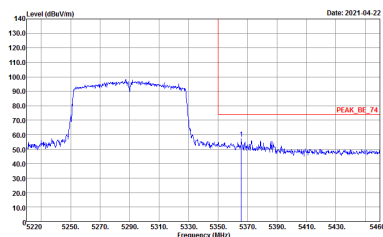
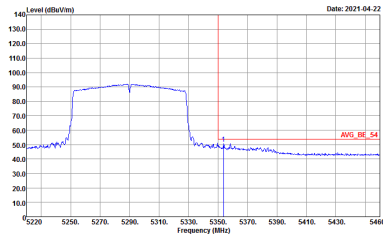
ANT	BLE (2M) CH39 + 802.11ac VHT80 Ch58	
Simultaneously	Vertical	Fundamental
<p style="text-align: center;"><b>Peak</b></p>	<p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>	<p>Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL : BBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p>
<p style="text-align: center;"><b>Avg.</b></p>	<p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWT:Auto</p>	<p>Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWT:Auto</p>



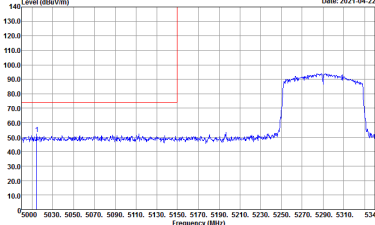
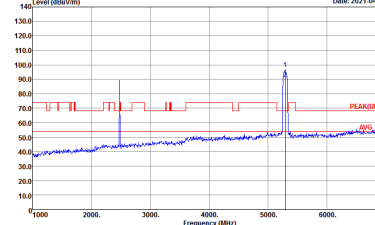
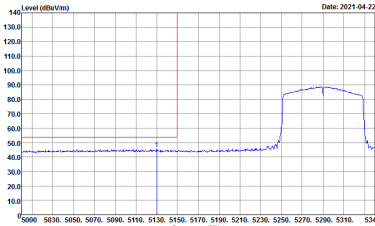
**Band 2 - 5250~5350MHz**  
**WIFI 802.11ac VHT80 (Band Edge @ 3m)**

ANT	BLE (2M) CH39 + 802.11ac VHT80 Ch58 - R	
Simultaneously	Horizontal	Fundamental
<p align="center"><b>Peak</b></p>	 <p>Site : 03CH13-HY            Condition : PEAK_BE_74 3m HORN_9120D_1241 HORIZONTAL            : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY            Condition : PEAK(FUN) 3m HORN_9120D_1241 HORIZONTAL            : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
<p align="center"><b>Avg.</b></p>	 <p>Site : 03CH13-HY            Condition : AVG_BE_54 3m HORN_9120D_1241 HORIZONTAL            : RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>	<p align="center"><b>Left blank</b></p>

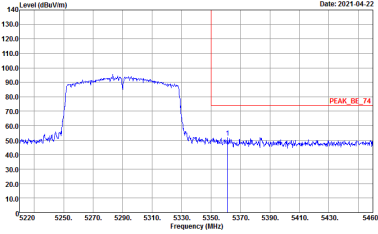
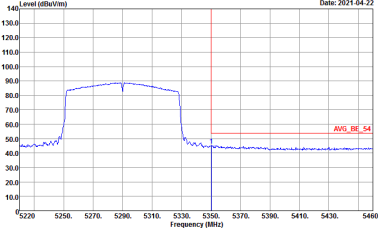


ANT	BLE (2M) CH39 + 802.11ac VHT80 Ch58 - L	
Simultaneously	Horizontal	Fundamental
<p style="text-align: center;"><b>Peak</b></p>	 <p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 HORIZONTAL : 88W:1000.000kHz VBW:3000.000kHz SWT:Auto</p>	<p style="text-align: center;">Left blank</p>
<p style="text-align: center;"><b>Avg.</b></p>	 <p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 HORIZONTAL : 88W:1000.000kHz VBW:3000.000kHz SWT:Auto</p>	<p style="text-align: center;">Left blank</p>



ANT	BLE (2M) CH39 + 802.11ac VHT80 Ch58 - R	
Simultaneously	Vertical	Fundamental
Peak	 <p>Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_91200_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>	 <p>Site : 03CH13-HY Condition : PEAK(UNT) 3m HORN_91200_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p>
Avg.	 <p>Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_91200_1241 VERTICAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p>	Left blank



ANT	BLE (2M) CH39 + 802.11ac VHT80 Ch58 - L	
Simultaneously	Vertical	Fundamental
<p data-bbox="293 696 352 725"><b>Peak</b></p>	 <p data-bbox="485 624 751 663">Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 VERTICAL : 88W:1000.000kHz VBW:3000.000kHz SWT:Auto</p>	<p data-bbox="1066 696 1209 725">Left blank</p>
<p data-bbox="293 1375 352 1404"><b>Avg.</b></p>	 <p data-bbox="485 1305 751 1344">Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 VERTICAL : 88W:1000.000kHz VBW:10.000kHz SWT:Auto</p>	<p data-bbox="1066 1375 1209 1404">Left blank</p>



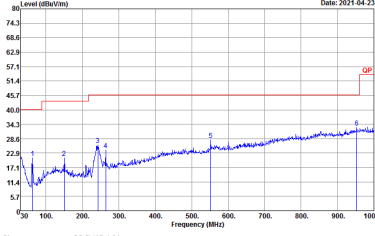
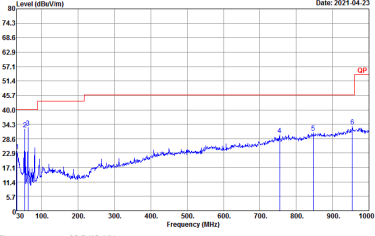
BLE (2M) CH39 + WLAN 802.11ac VHT80 Ch58 (Harmonic @ 3m)

ANT	BLE (2M) CH39 + 802.11ac VHT80 Ch58	
Simultaneously	Horizontal	Vertical
<b>Peak</b> <b>Avg.</b>	<p>Site : 03CH13-HY Condition : PEAK(UNIT) 3m HORN_9120D_1241 HORIZONTAL Detector : Peak</p>	<p>Site : 03CH13-HY Condition : PEAK(UNIT) 3m HORN_9120D_1241 VERTICAL Detector : Peak</p>



Emission below 1GHz

BLE (2M) CH39 + WLAN 802.11ac VHT80 Ch58 (LF)

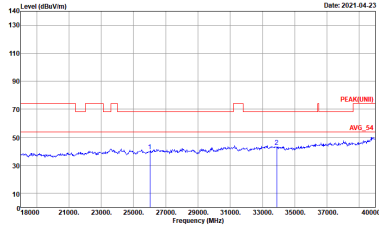
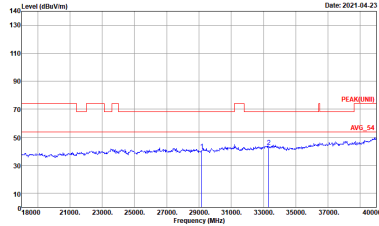
ANT	BLE (2M) CH39 + 802.11ac VHT80 Ch58	
Simultaneously	Horizontal	Vertical
QP / Peak	 <p>Site : 03CH13-HY Condition : QP 3m B1LOG_40103 HORIZONTAL Detector : Peak</p>	 <p>Site : 03CH13-HY Condition : QP 3m B1LOG_40103 VERTICAL Detector : Peak</p>





Emission above 18GHz

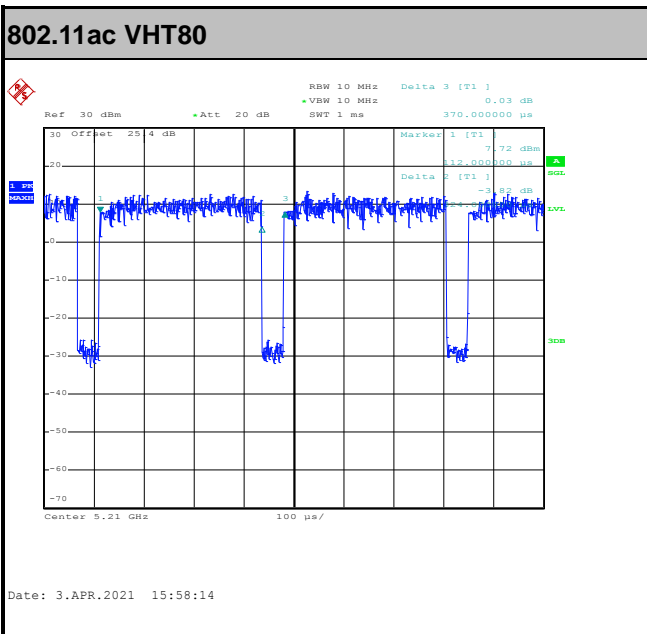
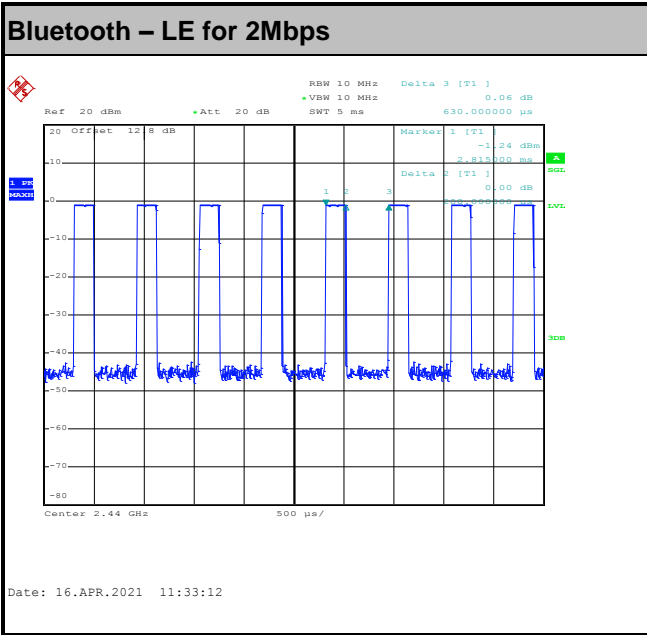
BLE (2M) CH39 + WLAN 802.11ac VHT80 Ch58 (SHF)

ANT	BLE (2M) CH39 + 802.11ac VHT80 Ch58	
Simultaneously	Horizontal	Vertical
QP / Peak	 <p>Site : :03CH3-HF Condition : :PEAK(UNIT) 1m SHF HORN 88HA9170584 HORIZONTAL</p>	 <p>Site : :03CH3-HF Condition : :PEAK(UNIT) 1m SHF HORN 88HA9170584 VERTICAL</p>



### Appendix C. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
Bluetooth –LE for 2Mbps	31.75	200	5.00	10kHz	4.98
5GHz 802.11ac VHT80	87.57	324	3.09	10kHz	0.58



————THE END————