FCC CO-LOCATION RADIO TEST REPORT

FCC ID	:	**UZ7MC330X**
Equipment	:	**Mobile Computer**
Brand Name	:	**Zebra**
Model Name	:	**MC330X**
Applicant	:	**Zebra Technologies Corporation 1 Zebra Plaza, Holtsville, NY 11742**
Manufacturer	:	**Zebra Technologies Corporation 1 Zebra Plaza, Holtsville, NY 11742**
Standard	:	**FCC Part 15 Subpart E §15.407**

The product was received on Apr. 06, 2021 and testing was started from May 26, 2021 and completed on May 26, 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

Report No.	Version	Description	Issued Date
FR131009-01G	01	Initial issue of report	Jun. 30, 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 1.65 dB at 5459.980 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: Wei Chen

Report Producer: Amy Chen

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Computer
Brand Name	Zebra
Model Name	MC330X
FCC ID	UZ7MC330X
SKU 1	Gun 29key
SKU 2	Gun 38key
SKU 3	Gun 47key
SKU 4	Brick 29key SE4850
SKU 5	Brick 38key
SKU 6	Brick 47key
SKU 7	Brick 29key SE4770
EUT supports Radios application	NFC WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 WLAN 11ax HE20/HE40/HE80 Bluetooth BR/EDR/LE
HW Version	EV
SW Version	Android Version 11
FW Version	11-10-12.00-RG-U00-PRD-HEL-04
MFD	20MAR21
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer.

Specification of Accessories				
Adapter	**Brand Name**	Zebra	**Part Number**	PWR-WUA5V12W0US
U cable	**Brand Name**	Symbol	**Model Name**	CBL-MC33-USBCHG-01
MC33 1X battery (Inventus)	**Brand Name**	ZEBRA	**Model Number**	BT-000338
MC33 2X battery (Inventus)	**Brand Name**	ZEBRA	**Model Number**	BT-000337
MC33 2X battery (TWS)	**Brand Name**	ZEBRA	**Model Number**	BT-000337A
MC33 7000mA 2X (Inventus)	**Brand Name**	ZEBRA	**Model Number**	BT-000375
MC33 Extended Capacity Battery (BT Battery)	**Brand Name**	ZEBRA	**Model Number**	BT-000444
Holster for MC3XXX Gun configuration	**Brand Name**	Zebra	**Model Number**	SG-MC3021212-01R
Rigid holster for MC3XXX Gun configuration	**Brand Name**	Zebra	**Model Number**	SG-MC33-RDHLST-01
Holster for MC3XXXX Brick configuration	**Brand Name**	Zebra	**Model Number**	11-69293-01R
Rigid holster for MC3XXX Brick configuration	**Brand Name**	Zebra	**Model Number**	SG-MC33-RDHLST-01

1.2 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz 5500 MHz ~ 5720 MHz
Antenna Type / Gain	**Bluetooth** Patch Antenna with gain 3.10 dBi **WLAN** **<5500 MHz ~ 5720 MHz>** Ant. 1 : Patch Antenna with gain 4.80 dBi Ant. 2 : Patch Antenna with gain 5.20 dBi
Type of Modulation	Bluetooth LE : GFSK 802.11ax : OFDM (BPSK/QPSK/16QAM/64QAM/256QAM/1024QAM)

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

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.**
	03CH15-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 C §15.247
- 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.
- 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). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Z plane) were recorded in this report.

2.1 Carrier Frequency and Channel

2400-2483.5 MHz		5500 MHz-5720 MHz	
Bluetooth-LE		802.11ax HE80	
Channel	Freq. (MHz)	Channel	Freq. (MHz)
19	2440	138	5690

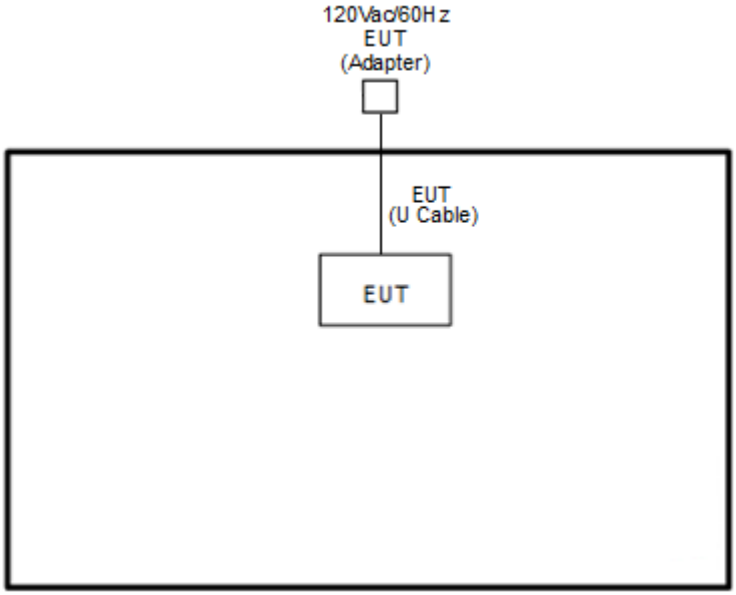
2.2 Test Mode

<Co-Location>

Modulation	Data Rate
Bluetooth-LE + 5GHz 802.11ax HE80 Partial 484 66 for MIMO Ant. 1+2	GFSK + MCS 0

Remark: For Radiated Test Cases, the tests were performed with MC33 1x Battery (Inventus) and SKU 4.

2.3 Connection Diagram of Test System



2.4 EUT Operation Test Setup

The RF test items, utility “Command” 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

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

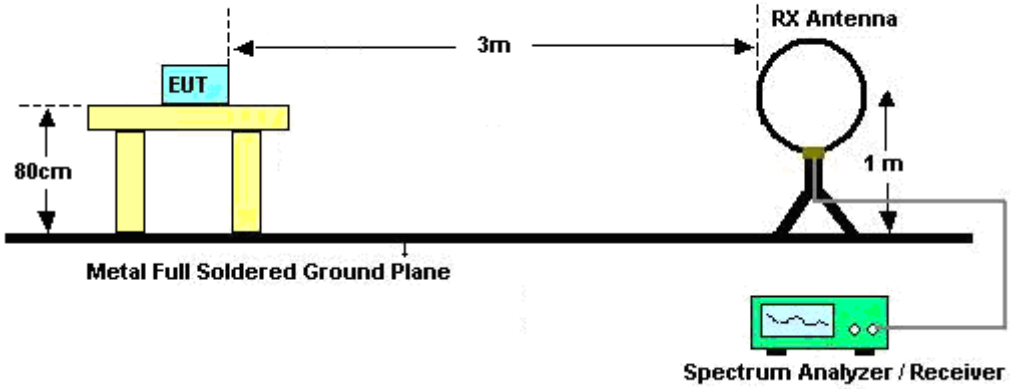
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000 MHz

   - 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.

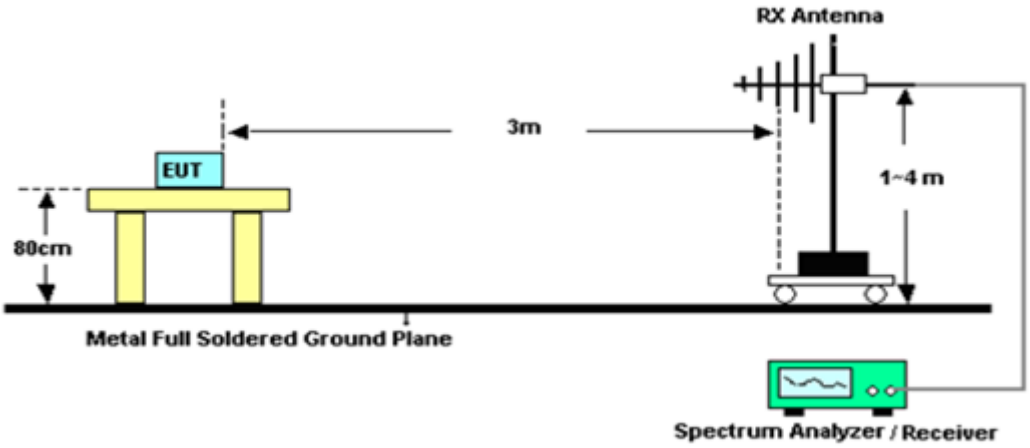
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband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

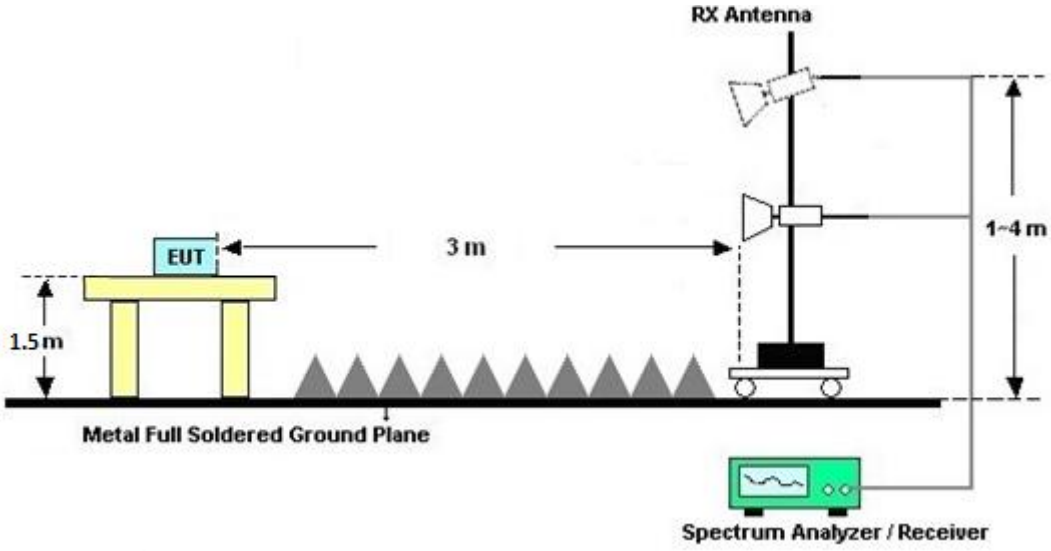
For radiated emissions below 30MHz



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 adequate comparison measurement 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	100488	9 kHz~30 MHz	Jul. 14, 2020	May 26, 2021	Jul. 13, 2021	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01 N-06	41912 & 05	30MHz~1GHz	Feb. 08, 2021	May 26, 2021	Feb. 07, 2022	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	363440	9kHz~1GHz	Dec. 28, 2020	May 26, 2021	Dec. 27, 2021	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-01620	1GHz~18GHz	Nov. 03, 2020	May 26, 2021	Nov. 02, 2021	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz~40GHz	Dec. 02, 2020	May 26, 2021	Dec. 01, 2021	Radiation (03CH15-HY)
Preamplifier	Jet-Power	JPA0118-55-303	1710001800055006	1GHz~18GHz	May 06, 2021	May 26, 2021	May 05, 2022	Radiation (03CH15-HY)
Preamplifier	Keysight	83017A	MY53270195	1GHz~26.5GHz	Aug. 21, 2020	May 26, 2021	Aug. 20, 2021	Radiation (03CH15-HY)
Preamplifier	EMEC	EM18G40G	0600789	18-40GHz	Oct. 27, 2020	May 26, 2021	Oct. 26, 2021	Radiation (03CH15-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY54130085	20MHz~8.4GHz	Nov. 02, 2020	May 26, 2021	Nov. 01, 2021	Radiation (03CH15-HY
Spectrum Analyzer	Keysight	N9010A	MY54200485	10Hz~44GHz	Mar. 05, 2021	May 26, 2021	Mar. 04, 2022	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	May 26, 2021	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	May 26, 2021	N/A	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24 (k5)	RK-000451	N/A	N/A	May 26, 2021	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104, 102E	MY36980/4, MY9838/4PE,508405/2E	30MHz~18G	Nov. 16, 2020	May 26, 2021	Nov. 15, 2021	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz-40GHz	Feb. 22, 2021	May 26, 2021	Feb. 21, 2022	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz-40GHz	Feb. 22, 2021	May 26, 2021	Feb. 21, 2022	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4PE	9kHz~30MHz	Mar. 11, 2021	May 26, 2021	Mar. 10, 2022	Radiation (03CH15-HY)
Filter	Wainwright	WLJ4-1000-1530-6000-40ST	SN4	1.53GHz Low Pass Filter	Jul. 03, 2020	May 26, 2021	Jul. 02, 2021	Radiation (03CH15-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN4	3GHz High Pass Filter	Sep. 16, 2020	May 26, 2021	Sep. 15, 2021	Radiation (03CH15-HY)
Filter	Wainwright	WHKX8-5872.5-6750-18000-40ST	SN6	6.75GHz High Pass Filter	Jul. 01, 2020	May 26, 2021	Jun. 30, 2021	Radiation (03CH15-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 dB**

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

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

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.9 dB**

Appendix A. Radiated Spurious Emission

Test Engineer :	Leo Lee, Mancy Chou, and Bigshow Wang	**Temperature :**	22.1~23.1°C
		Relative Humidity :	55~60%

BLE (1M)_CH19 + WLAN 802.11ax HE80_CH138 Partial RU 484 66 for MIMO Ant. 1+2

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 CH 19 2440MHz		2342.48	55.76	-18.24	74	42.25	27.72	16.73	30.94	117	358	P	H
		2339.4	49.35	-4.65	54	35.85	27.72	16.72	30.94	117	358	P	H
	*	2440	96.34	-	-	82.86	27.5	16.88	30.9	117	358	P	H
	*	2440	96.06	-	-	82.58	27.5	16.88	30.9	117	358	A	H
		2494.61	54.79	-19.21	74	41.28	27.41	16.97	30.87	117	358	P	H
		2491.25	49.72	-4.28	54	36.21	27.42	16.96	30.87	117	358	A	H
		2323.86	55.55	-18.45	74	42.05	27.75	16.69	30.94	100	252	P	V
		2310.14	49.96	-4.04	54	36.46	27.78	16.67	30.95	100	252	A	V
	*	2440	90.36	-	-	76.88	27.5	16.88	30.9	100	252	P	V
	*	2440	90.11	-	-	76.63	27.5	16.88	30.9	100	252	A	V
		2496.22	54.64	-19.36	74	41.13	27.41	16.97	30.87	100	252	P	V
		2492.37	49.33	-4.67	54	35.82	27.42	16.96	30.87	100	252	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 3 5470~5725MHz

WIFI 802.11ax HE80 Partial 484 66 (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)
802.11ax HE80 Partial 484/66 CH 138 5690MHz		5455.3	60.89	-13.11	74	48.43	31.6	10.85	29.99	110	45	P	H
		5467.39	60.39	-7.81	68.2	47.92	31.6	10.86	29.99	110	45	P	H
		5459.98	52.35	-1.65	54	39.89	31.6	10.85	29.99	110	45	A	H
	*	5710	111.1	-	-	98.47	31.72	11.05	30.14	110	45	P	H
	*	5710	102	-	-	89.37	31.72	11.05	30.14	110	45	A	H
		5878	56.86	-11.34	68.2	43.89	32.06	11.17	30.26	110	45	P	H
		5446.72	58.87	-15.13	74	46.44	31.59	10.83	29.99	400	90	P	V
		5468.56	58.6	-9.6	68.2	46.13	31.6	10.86	29.99	400	90	P	V
		5459.2	50.06	-3.94	54	37.6	31.6	10.85	29.99	400	90	A	V
	*	5710	111.23	-	-	98.6	31.72	11.05	30.14	400	90	P	V
	*	5710	100.83	-	-	88.2	31.72	11.05	30.14	400	90	A	V
		5856.1	54.83	-13.37	68.2	41.91	32.01	11.16	30.25	400	90	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

BLE (1M)_CH19 + WLAN 802.11ax HE80_CH138 Partial RU 484 66 for MIMO Ant. 1+2

(Harmonic @ 3m)

Ant.	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Chain	Table	Peak	Pol.
Simultaneously				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE (1M) CH19 2440MHz + 802.11ax HE80 Partial 484/66 CH 138 5690MHz		4880	54.38	-19.62	74	42.24	31.04	11.15	30.05	200	163	P	H
		4880	44.2	-9.8	54	32.06	31.04	11.15	30.05	200	163	A	H
		7320	43.79	-30.21	74	53.27	36.3	12.63	58.41	100	0	P	H
		11380	49.03	-24.97	74	54.94	39.98	14.98	60.87	100	0	P	H
		17070	51.02	-17.18	68.2	50.72	40.6	18.36	58.66	100	0	P	H
													H
		4880	53.96	-20.04	74	41.82	31.04	11.15	30.05	200	25	P	V
		4880	44.11	-9.89	54	31.97	31.04	11.15	30.05	200	163	A	V
		7320	43.33	-30.67	74	52.81	36.3	12.63	58.41	100	0	P	V
		11380	48.35	-25.65	74	54.26	39.98	14.98	60.87	100	0	P	V
		17070	50.7	-17.5	68.2	50.4	40.6	18.36	58.66	100	0	P	V
													V

BLE (1M)_CH19 + WLAN 802.11ax HE80_CH138 Partial RU 484 66 for MIMO Ant. 1+2

Emission below 1GHz (LF@ 3m)

Ant.	Note	Frequency	Level	Over	Limit	Read	Chainenna	Path	Preamp	Chain	Table	Peak	Pol.
Simultaneously				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE (1M) CH19 2440MHz + 802.11ax HE80 Partial 484/66 CH 138 5690MHz		47.46	29.18	-10.82	40	45.51	15.39	0.87	32.59	100	0	P	H
		108.57	32.06	-11.44	43.5	46.31	16.78	1.49	32.52	-	-	P	H
		124.09	32.06	-11.44	43.5	45.52	17.49	1.59	32.54	-	-	P	H
		256.98	24.9	-21.1	46	35.59	19.42	2.3	32.41	-	-	P	H
		584.84	29.43	-16.57	46	32.95	25.66	3.33	32.51	-	-	P	H
		896.21	33.88	-12.12	46	32.51	28.87	4.15	31.65	-	-	P	H
		41.64	33.16	-6.84	40	46.32	18.59	0.82	32.57	100	0	P	V
		110.51	27.93	-15.57	43.5	42.15	16.8	1.51	32.53	-	-	P	V
		122.15	32.62	-10.88	43.5	46.2	17.39	1.57	32.54	-	-	P	V
		263.77	21.84	-24.16	46	31.99	19.95	2.32	32.42	-	-	P	V
		426.73	25.83	-20.17	46	32.52	22.93	2.79	32.41	-	-	P	V
		866.14	31.56	-14.44	46	30.27	29.01	4.08	31.8	-	-	P	V

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	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

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

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Chain	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b 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

Test Engineer :	Leo Lee, Mancy Chou, and Bigshow Wang	**Temperature :**	22.1~23.1°C
		Relative Humidity :	55~60%

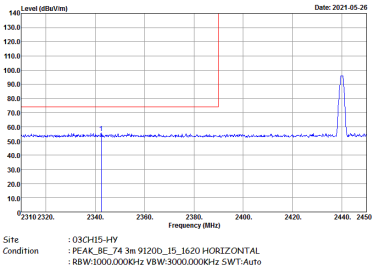
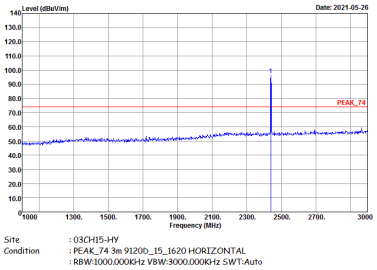
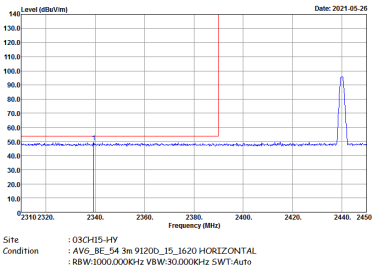
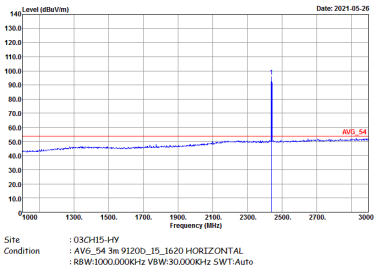
Note symbol

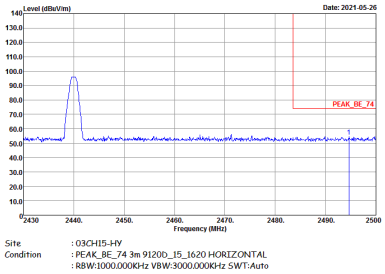
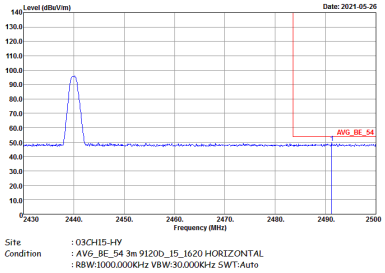
-L	**Low channel location**
-R	**High channel location**

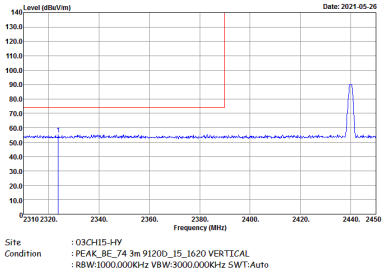
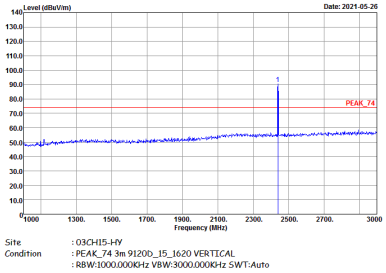
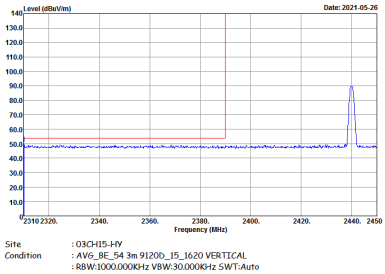
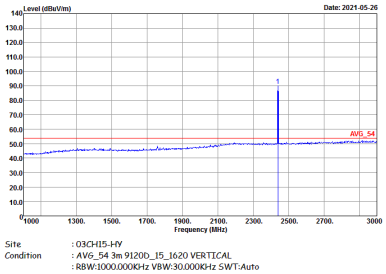
BLE (1M)_CH19 + 802.11ax HE80_CH138 Partial RU 484 66 for MIMO Ant. 1+2

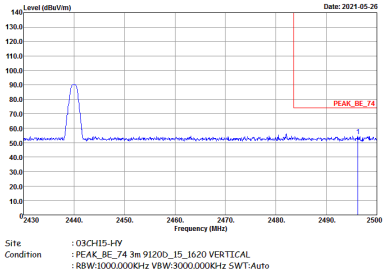
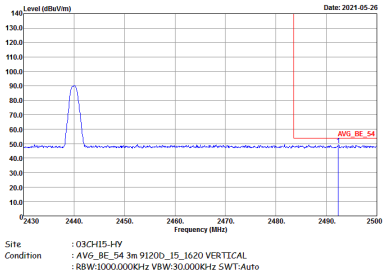
2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - L	
	Horizontal	Fundamental
Peak		
Avg.		

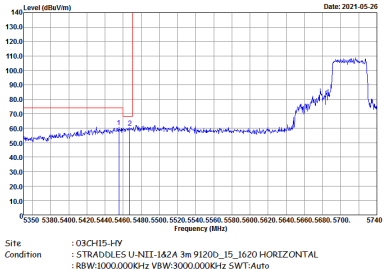
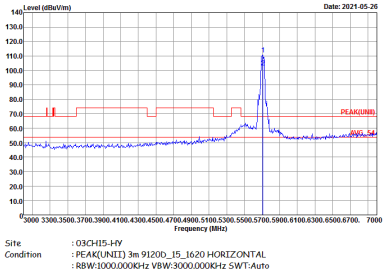
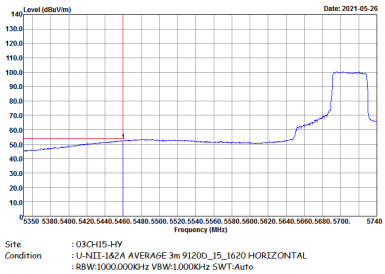
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - R	
	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

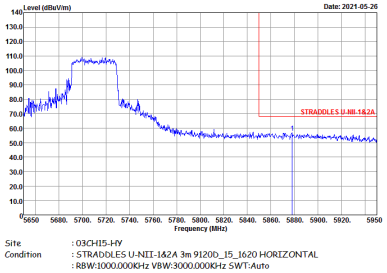
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - L	
	Vertical	Fundamental
Peak		
Avg.		

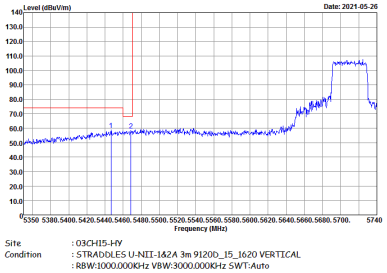
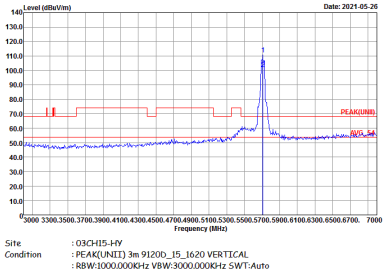
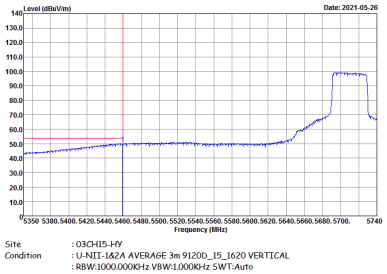
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - R	
	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

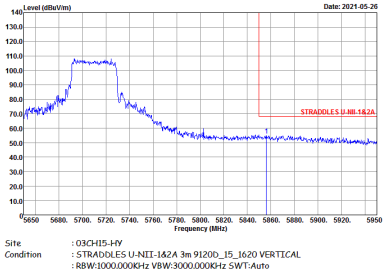
Band 3 – Straddle Channel

WIFI 802.11ax HE80 Partial 484 66 (Band Edge @ 3m)

WIFI	Band 3 Straddle Channel Band Edge @ 3m	
ANT	802.11ax HE80 Partial 484/66 CH138 5690MHz - L	
1+2	Horizontal	Fundamental
Peak		
Avg.		Left blank

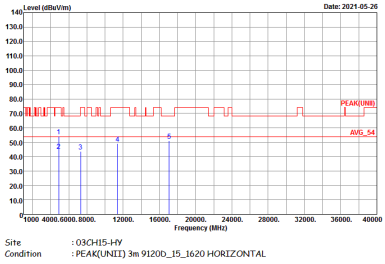
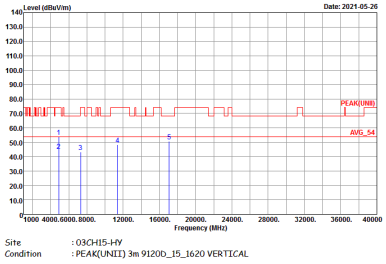
WIFI	Band 3 Straddle Channel Band Edge @ 3m	
ANT	802.11ax HE80 Partial 484/66 CH138 5690MHz - R	
1+2	Horizontal	Fundamental
Peak		Left blank

WIFI	Band 3 Straddle Channel Band Edge @ 3m	
ANT	802.11ax HE80 Partial 484/66 CH138 5690MHz - L	
1+2	Vertical	Fundamental
Peak		
Avg.		Left blank

WIFI	Band 3 Straddle Channel Band Edge @ 3m	
ANT	802.11ax HE80 Partial 484/66 CH138 5690MHz - R	
1+2	Vertical	Fundamental
Peak		Left blank

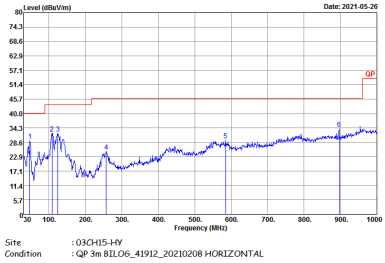
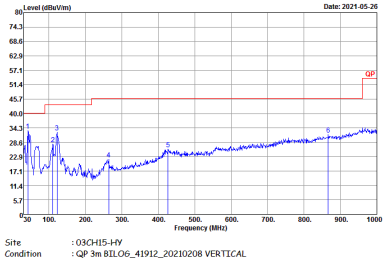
BLE (1M)_CH19 + 802.11ax HE80_CH138 Partial RU 484 66 for MIMO Ant. 1+2

(Harmonic @ 3m)

ANT	BLE (1M)_CH19 + 802.11ax HE80_Ch138 Partial RU 484 66	
1+2	Horizontal	Vertical
Peak Avg.		

BLE (1M)_CH19 + 802.11ax HE80_CH138 Partial RU 484 66 for MIMO Ant. 1+2

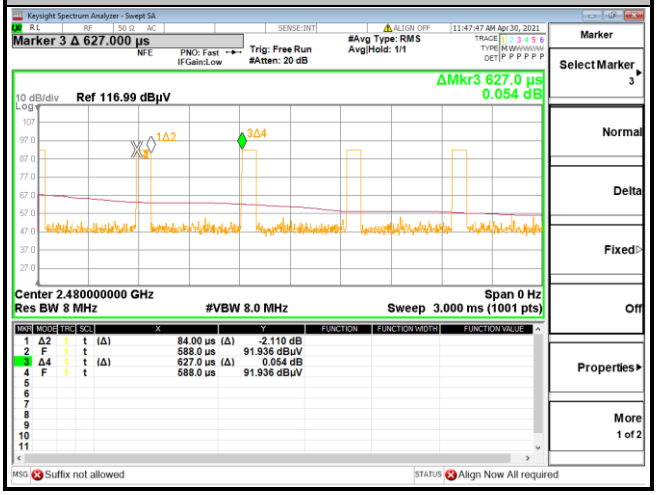
Emission below 1GHz (LF@ 3m)

ANT	BLE (1M)_CH19 + 802.11ax HE80_CH138 Partial RU 484 66	
1+2	Horizontal	Vertical
Peak Avg.		

Appendix C. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
-	Bluetooth –LE for 1Mbps	13.40	84	11.90	30kHz	-
1+2	5GHz 802.11ax HE80 484 RU	50.98	1040	0.96	1kHz	2.93

Bluetooth – LE



MIMO <Ant. 1+2>

802.11ax HE80 484 RU