FCC CO-LOCATION RADIO TEST REPORT

FCC ID	:	**2ASD3-7878**
Equipment	:	**Digital Media Receiver**
Model Name	:	**C77A68**
Applicant	:	**H.C. China X LLC** **3450 N. Triumph Blvd., Suite 102** **Lehi, Utah 84043**
Standard	:	**FCC Part 15 Subpart E §15.407**

The product was received on Apr. 15, 2019 and testing was started from Aug. 02, 2019 and completed on Aug. 07, 2019. 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 report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

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, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FR941514-01G	01	Initial issue of report	Aug. 27, 2019

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)
3.1	15.407(b)	Unwanted Emissions	Pass
-	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: Wii Chang

Report Producer: Ann Lee

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Digital Media Receiver
Model Name	C77A68
FCC ID	2ASD3-7878
EUT supports Radios application	WLAN 11b/g/n HT20 WLAN 11a/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE

1.2 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	WLAN 802.11n: 2412 MHz ~ 2472 MHz WLAN 802.11ac: 5180 MHz ~ 5240 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Antenna Type / Gain	Bluetooth : PCB IFA Antenna with gain 1.0 dBi **<2412 MHz ~ 2472 MHz>** PCB Loop Antenna with gain 1.8 dBi **<5180 MHz ~ 5240 MHz>** PCB Loop Antenna with gain 4.7 dBi
Type of Modulation	Bluetooth LE : GFSK 802.11n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)

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. EMC & Wireless Communications Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, 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. TW0007

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 789033 D02 General UNII Test Procedures New Rules v02r01.
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

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 two configurations, with accessories and without accessories. The worst case (with accessories) was recorded in this report.

2.1 Carrier Frequency and Channel

2400-2483.5 MHz Bluetooth - LE		2400-2483.5 MHz 802.11n	
Channel	**Freq. (MHz)**	**Channel**	**Channel**
39	2480	11	2462

5150-5250 MHz 802.11ac	
Channel	**Channel**
42	5210

2.2 Test Mode

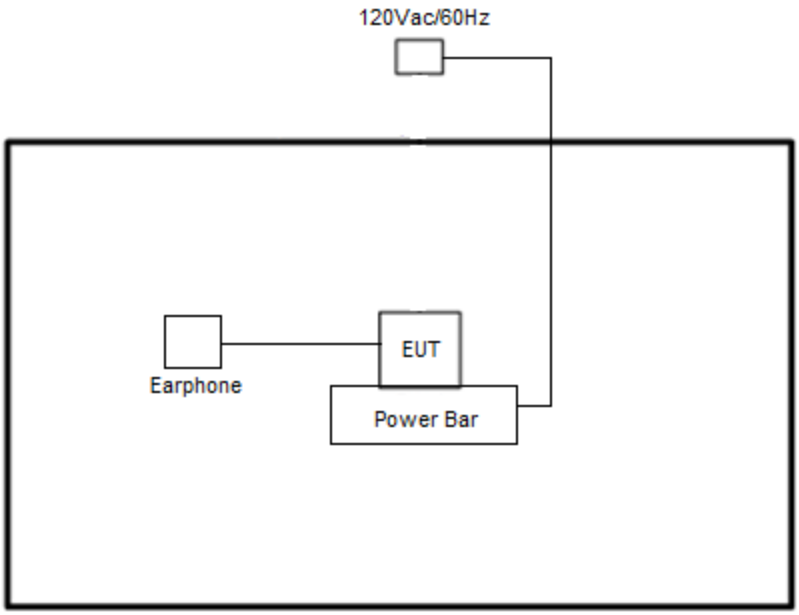
Final test modes are considering the modulation and worse data rates as below table.

<Co-Location>

Modulation	Data Rate
BLE 2Mbps + 2.4GHz 802.11n HT20 CH11	**2Mbps + MCS0**
BLE 2Mbps + 5GHz 802.11ac VHT80 CH42	**2Mbps + MCS0**

2.3 Connection Diagram of Test System

<Co-Location Mode>



2.4 EUT Operation Test Setup

The RF test items, utility “Tool_1.0.0.54” 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) Section 15.407(b)(1) to (b)(3) specify the unwanted emission limits 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.[3]

(ii) Section 15.407(b)(4) specifies the unwanted emission limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are in terms of a Peak detector. An alternative to the band emissions mask is specified in Section 15.407(b)(4)(ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the devices using the alternative limit.[4]

Note 3: An out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz peak emission limit.

Note 4: Only devices with antenna gains of 10 dBi or less may be approved using the emission limits specified in Section 15.247(d) till March 2, 2018; all other devices operating in this band must use the mask specified in Section 15.407(b)(4)(i).

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 1000MHz

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

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

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

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

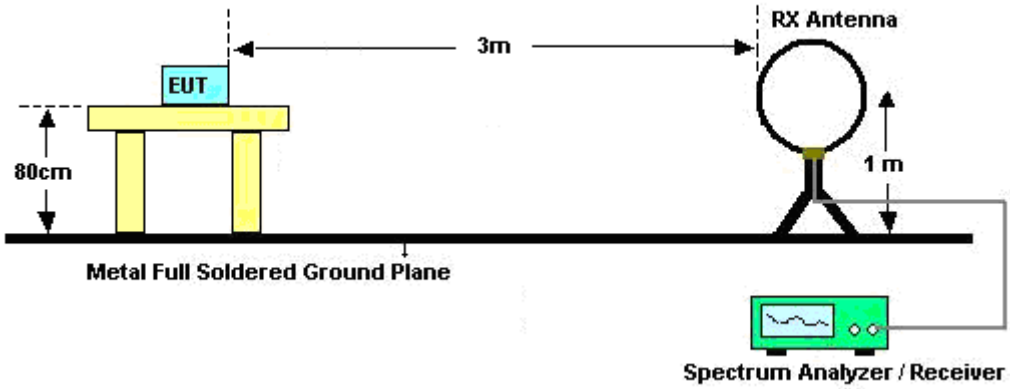
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.

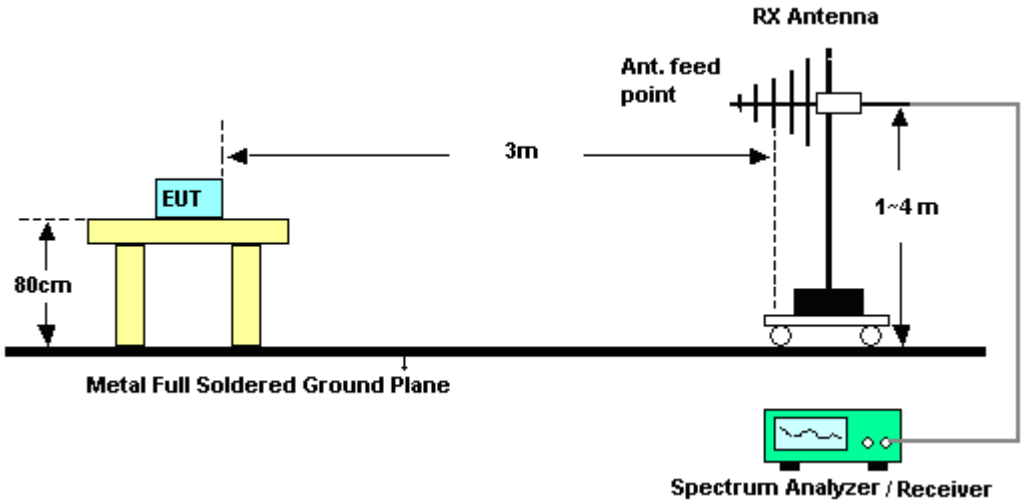
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than 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

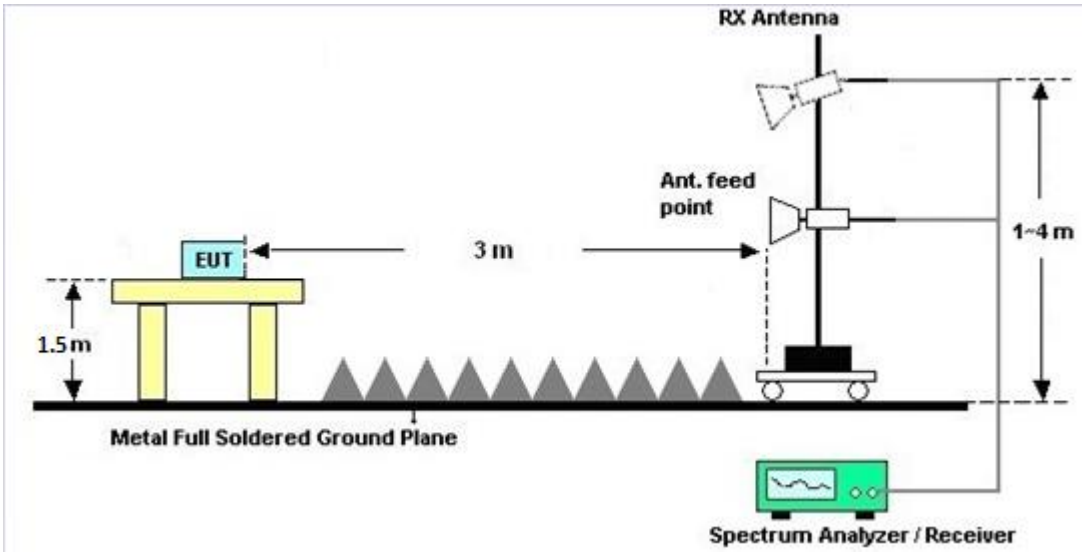
For radiated emissions below 30MHz



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 (30MHz ~ 10th Harmonic)

Please refer to Appendix A and B.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Jan. 07, 2019	Aug. 02, 2019~ Aug. 07, 2019	Jan. 06, 2020	Radiation (03CH15-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz ~ 40GHz	Dec. 06, 2018	Aug. 02, 2019~ Aug. 07, 2019	Dec. 05, 2019	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL6111D&00800N1D01N-06	41912&05	30MHz to 1GHz	Feb. 12, 2019	Aug. 02, 2019~ Aug. 07, 2019	Feb. 11, 2020	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1620	1G~18GHz	Oct. 17, 2018	Aug. 02, 2019~ Aug. 07, 2019	Oct. 16, 2019	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Dec. 05, 2018	Aug. 02, 2019~ Aug. 07, 2019	Dec. 04, 2019	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	363440	9kHz~1GHz	Dec. 28, 2018	Aug. 02, 2019~ Aug. 07, 2019	Dec. 27, 2019	Radiation (03CH15-HY)
Preamplifier	Jet-Power	JPA0118-55-303	17100018000550006	1GHz~18GHz	Jul. 09, 2019	Aug. 02, 2019~ Aug. 07, 2019	Jul. 08, 2020	Radiation (03CH15-HY)
Preamplifier	Jet-Power	JPA0118-55-303	1710001800054001	1GHz~18GHz	May 19, 2019	Aug. 02, 2019~ Aug. 07, 2019	May 18, 2020	Radiation (03CH15-HY)
Preamplifier	Keysight	83017A	MY53270195	1GHz~26.5GHz	Aug. 23, 2018	Aug. 02, 2019~ Aug. 07, 2019	Aug. 22, 2019	Radiation (03CH15-HY)
EMI Test Receiver	Keysight	N9038A (MXE)	MY54130085	20Hz ~ 8.4GHz	Nov. 01, 2018	Aug. 02, 2019~ Aug. 07, 2019	Oct. 31, 2019	Radiation (03CH15-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100390	20Hz ~ 26.5GHz	Dec. 27, 2018	Aug. 02, 2019~ Aug. 07, 2019	Dec. 26, 2019	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Aug. 02, 2019~ Aug. 07, 2019	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Aug. 02, 2019~ Aug. 07, 2019	N/A	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24(k5)	RK-000451	N/A	N/A	Aug. 02, 2019~ Aug. 07, 2019	N/A	Radiation (03CH15-HY)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY36980/4	30M-18G	Apr. 15, 2019	Aug. 02, 2019~ Aug. 07, 2019	Apr. 14, 2020	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9838/4	30M-18G	Apr. 15, 2019	Aug. 02, 2019~ Aug. 07, 2019	Apr. 14, 2020	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY802430/4	30M~18GHz	May 13, 2019	Aug. 02, 2019~ Aug. 07, 2019	May 12, 2020	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz-40GHz	Mar. 13, 2019	Aug. 02, 2019~ Aug. 07, 2019	Mar. 12, 2020	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY4274/2	30MHz-40GHz	Mar. 13, 2019	Aug. 02, 2019~ Aug. 07, 2019	Mar. 12, 2020	Radiation (03CH15-HY)
Notch Filter	Wainwright	WRCJV12-5120-5150-5350-5380-40SS	SN1	5G Band 1~2	Mar. 15, 2019	Aug. 02, 2019~ Aug. 07, 2019	Mar. 14, 2020	Radiation (03CH15-HY)
Filter	Wainwright	WLK4-1000-1530-8000-40SS	SN11	1G Low Pass	Sep. 16, 2018	Aug. 02, 2019~ Aug. 07, 2019	Sep. 15, 2019	Radiation (03CH15-HY)
Filter	Wainwright	WHKX8-5872.5-6750-18000-40ST	SN3	6.75 GHz Highpass	Sep. 16, 2018	Aug. 02, 2019~ Aug. 07, 2019	Sep. 15, 2019	Radiation (03CH15-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN1	3 GHz Highpass	Sep. 16, 2018	Aug. 02, 2019~ Aug. 07, 2019	Sep. 15, 2019	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))	3.37

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.67

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.03

Appendix A. Radiated Spurious Emission

Test Engineer :	Karl Hou and BigShow Wang	Temperature :	23~26°C
		Relative Humidity :	50~65%

BLE (Band Edge @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
Mode 1 Ant 1 BLE 2M Ch39 + Ant 0 11n HT20 Ch11	*	2480	103.28	-	-	90.51	27.47	16.25	30.95	100	169	P	H
	*	2480	101.71	-	-	88.94	27.47	16.25	30.95	100	169	A	H
		2484.64	61.39	-12.61	74	48.62	27.47	16.25	30.95	100	169	P	H
		2483.52	50.33	-3.67	54	37.56	27.47	16.25	30.95	100	169	A	H
	*	2480	99.3	-	-	86.53	27.47	16.25	30.95	335	72	P	V
	*	2480	97.76	-	-	84.99	27.47	16.25	30.95	335	72	A	V
		2483.68	59.18	-14.82	74	46.41	27.47	16.25	30.95	335	72	P	V
		2483.56	47.35	-6.65	54	34.58	27.47	16.25	30.95	335	72	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz (Band Edge @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
Mode 1 Ant 1 BLE 2M Ch39 + Ant 0 11n HT20 Ch11	*	2462	107.78	-	-	94.98	27.53	16.23	30.96	301	79	P	H
	*	2462	100.93	-	-	88.13	27.53	16.23	30.96	301	79	A	H
		2483.68	61.53	-12.47	74	48.76	27.47	16.25	30.95	301	79	P	H
		2483.52	49.33	-4.67	54	36.56	27.47	16.25	30.95	301	79	A	H
	*	2462	102.83	-	-	90.03	27.53	16.23	30.96	132	201	P	V
	*	2462	94.52	-	-	81.72	27.53	16.23	30.96	132	201	A	V
		2486.64	55.7	-18.3	74	42.92	27.47	16.26	30.95	132	201	P	V
		2483.52	45.82	-8.18	54	33.05	27.47	16.25	30.95	132	201	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

BLE (Band Edge @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
Mode 2 Ant 1 BLE 2M Ch39 + Ant 0 11ac VHT80 Ch42	*	2480	104.34	-	-	91.57	27.47	16.25	30.95	151	86	P	H
	*	2480	102.79	-	-	90.02	27.47	16.25	30.95	151	86	A	H
		2483.56	56.08	-17.92	74	43.31	27.47	16.25	30.95	151	86	P	H
		2483.52	48.35	-5.65	54	35.58	27.47	16.25	30.95	151	86	A	H
	*	2480	100.41	-	-	87.64	27.47	16.25	30.95	400	232	P	V
	*	2480	98.92	-	-	86.15	27.47	16.25	30.95	400	232	A	V
		2483.56	54.97	-19.03	74	42.2	27.47	16.25	30.95	400	232	P	V
		2483.52	46.64	-7.36	54	33.87	27.47	16.25	30.95	400	232	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Band 1 5150~5250MHz (Band Edge @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
Mode 2 Ant 1 BLE 2M Ch39 + Ant 0 11ac VHT80 Ch42		5145.34	54.56	-19.44	74	43.78	31.8	9.25	30.27	315	83	P	H
		5150	44.02	-9.98	54	33.23	31.8	9.26	30.27	315	83	A	H
	*	5210	97.81	-	-	87.23	31.53	9.32	30.27	315	83	P	H
	*	5210	88.97	-	-	78.39	31.53	9.32	30.27	315	83	A	H
		5403.16	50.77	-23.23	74	39.96	31.6	9.47	30.26	315	83	P	H
		5460	40.37	-13.63	54	29.35	31.7	9.58	30.26	315	83	A	H
		5146.64	57.2	-16.8	74	46.42	31.8	9.25	30.27	245	82	P	V
		5150	46.59	-7.41	54	35.8	31.8	9.26	30.27	245	82	A	V
	*	5210	100.74	-	-	90.16	31.53	9.32	30.27	245	82	P	V
	*	5210	92.49	-	-	81.91	31.53	9.32	30.27	245	82	A	V
		5350.52	50.48	-23.52	74	39.93	31.4	9.42	30.27	245	82	P	V
		5356.4	40.61	-13.39	54	30.05	31.4	9.43	30.27	245	82	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz (Harmonic @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
Mode 1 Ant 1 BLE 2M Ch39 + Ant 0 11n HT20 Ch11		3720	43.1	-30.9	74	64.35	29.33	8.69	59.27	100	0	P	H
		4924	39.67	-34.33	74	57.02	31.37	9.57	58.29	100	0	P	H
		4960	41.45	-32.55	74	58.74	31.47	9.56	58.32	100	0	P	H
		7386	44.96	-29.04	74	55.34	36.5	11.67	58.55	100	0	P	H
		7440	45.45	-28.55	74	55.68	36.6	11.7	58.53	100	0	P	H
		3720	39.82	-34.18	74	61.07	29.33	8.69	59.27	100	0	P	V
		4924	39.21	-34.79	74	56.56	31.37	9.57	58.29	100	0	P	V
		4960	41.11	-32.89	74	58.4	31.47	9.56	58.32	100	0	P	V
		7386	45.19	-28.81	74	55.57	36.5	11.67	58.55	100	0	P	V
		7440	46.12	-27.88	74	56.35	36.6	11.7	58.53	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz + Band 1 5150~5250MHz (Harmonic @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
Mode 2 Ant 1 BLE 2M Ch39 + Ant 0 11ac VHT80 Ch42		4960	35.34	-38.66	74	51.21	31.47	10.8	58.14	100	0	P	H
		7440	47.13	-26.87	74	54.41	36.6	13.45	57.33	100	0	P	H
		10420	50.3	-17.9	68.2	55.34	39.52	14.76	59.32	100	0	P	H
		15630	47.51	-26.49	74	52.27	37.5	17.64	59.9	100	0	P	H
												P	H
		4960	37.04	-36.96	74	52.91	31.47	10.8	58.14	100	0	P	V
		7440	47.75	-26.25	74	55.03	36.6	13.45	57.33	100	0	P	V
		10420	48.67	-19.53	68.2	53.71	39.52	14.76	59.32	100	0	P	V
		15630	46.3	-27.7	74	51.06	37.5	17.64	59.9	100	0	P	V
												P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz 2400~2483.5MHz (LF @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
Simultaneously		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Mode 1 Ant 1 BLE 2M Ch39 + Ant 0 11n HT20 Ch11		30	22.82	-17.18	40	29.54	25.2	0.7	32.62	-	-	P	H
		149.31	32.92	-10.58	43.5	46.58	17.17	1.67	32.5	-	-	P	H
		202.66	33.61	-9.89	43.5	49.04	15.11	1.95	32.49	-	-	P	H
		263.77	38.05	-7.95	46	48.36	20	2.21	32.52	100	0	P	H
		384.05	28.61	-17.39	46	37.36	21.26	2.54	32.55	-	-	P	H
		579.99	29.63	-16.37	46	33.03	26	3.19	32.59	-	-	P	H
		40.67	33.45	-6.55	40	45.81	19.4	0.84	32.6	100	0	P	V
		147.37	25.74	-17.76	43.5	39.23	17.36	1.65	32.5	-	-	P	V
		196.84	29.44	-14.06	43.5	45.08	14.9	1.95	32.49	-	-	P	V
		260.86	37.43	-8.57	46	47.76	20	2.19	32.52	-	-	P	V
		382.11	26.1	-19.9	46	34.94	21.18	2.53	32.55	-	-	P	V
		804.06	30.84	-15.16	46	31.09	28.22	3.71	32.18	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Emission below 1GHz

2.4GHz 2400~2483.5MHz + Band 1 5150~5250MHz (LF @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
Simultaneously		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
Mode 2 Ant 1 BLE 2M Ch39 + Ant 0 11ac VHT80 Ch42		30.97	23.13	-16.87	40	30.23	24.81	0.71	32.62	-	-	P	H
		88.2	21.84	-21.66	43.5	38.65	14.44	1.28	32.53	-	-	P	H
		146.4	32.39	-11.11	43.5	45.91	17.34	1.64	32.5	-	-	P	H
		207.51	33.82	-9.68	43.5	49.16	15.2	1.95	32.49	-	-	P	H
		263.77	37.79	-8.21	46	48.1	20	2.21	32.52	100	0	P	H
		910.76	37.45	-8.55	46	35.72	29.32	3.97	31.56	-	-	P	H
		41.64	31.62	-8.38	40	44.44	18.94	0.84	32.6	-	-	P	V
		148.34	25.47	-18.03	43.5	39.04	17.27	1.66	32.5	-	-	P	V
		199.75	29.2	-14.3	43.5	44.76	14.98	1.95	32.49	-	-	P	V
		259.89	37.78	-8.22	46	48.13	19.98	2.19	32.52	100	0	P	V
		380.17	25.75	-20.25	46	34.66	21.11	2.53	32.55	-	-	P	V
		780.78	32.2	-13.8	46	32.41	28.4	3.63	32.24	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

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

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
Simultaneously		(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”.

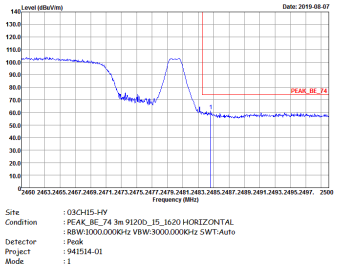
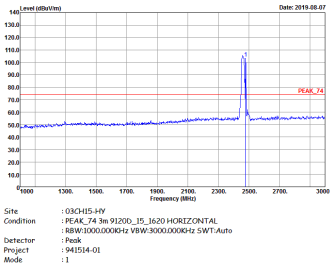
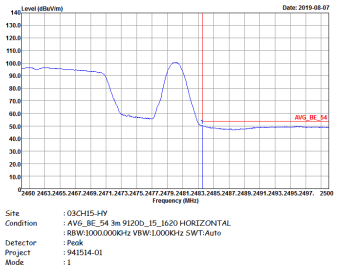
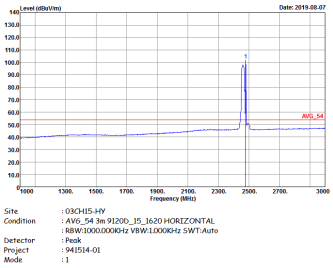
Appendix B. Radiated Spurious Emission Plots

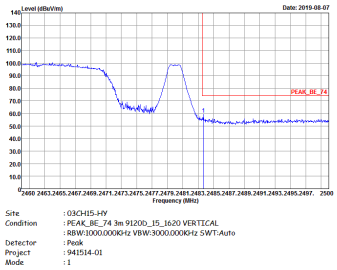
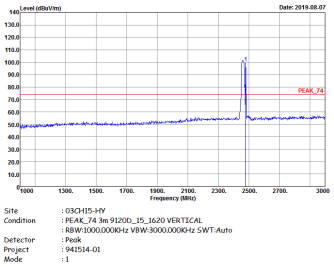
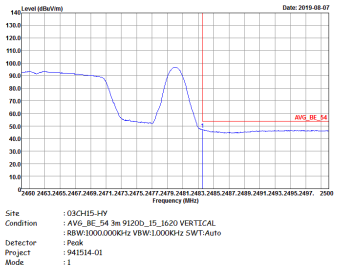
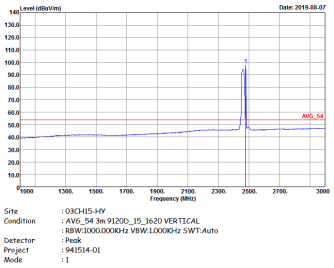
Test Engineer :	Karl Hou and BigShow Wang	**Temperature :**	23~26°C
		Relative Humidity :	50~65%

Note symbol

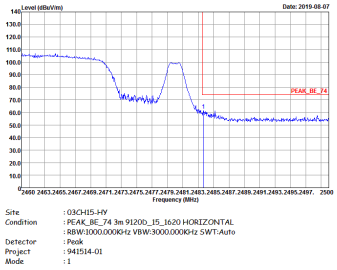
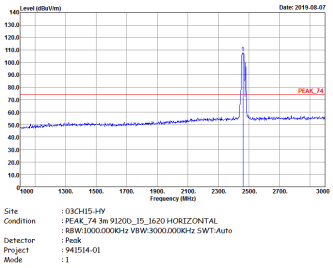
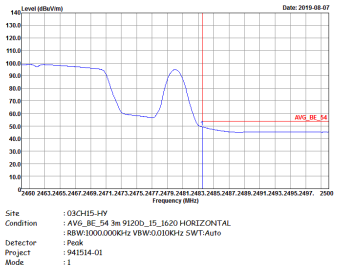
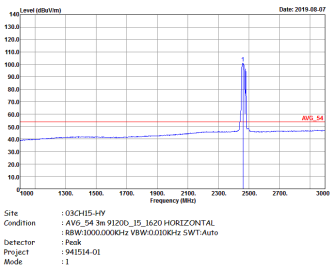
-L	**Low channel location**
-R	**High channel location**

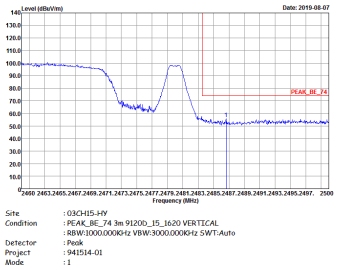
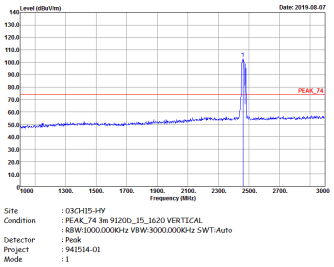
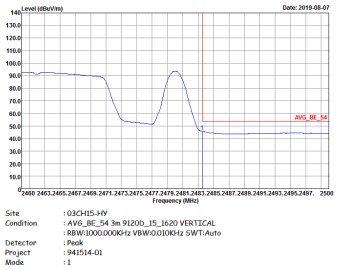
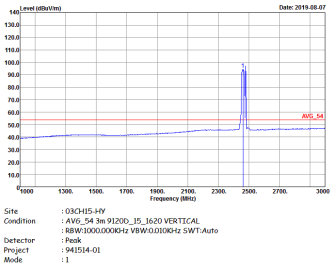
BLE (Band Edge @ 3m)

ANT	Mode 1: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11n HT20_Tx_Ch11	
Simultaneously	Horizontal	Fundamental
Peak		
Avg.		

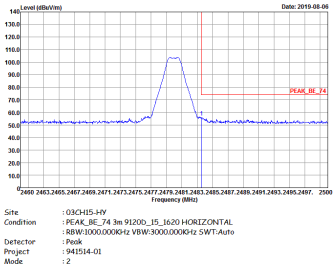
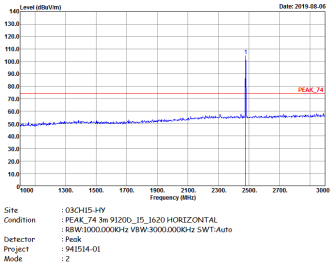
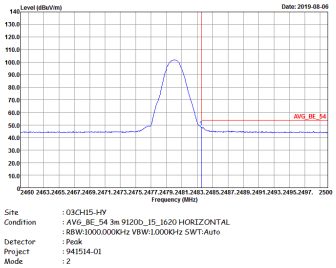
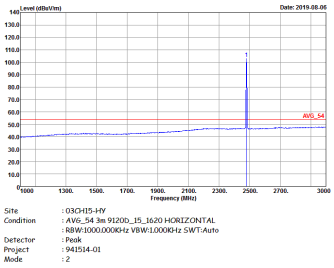
ANT	Mode 1: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11n HT20_Tx_Ch11	
Simultaneously	Vertical	Fundamental
Peak		
Avg.		

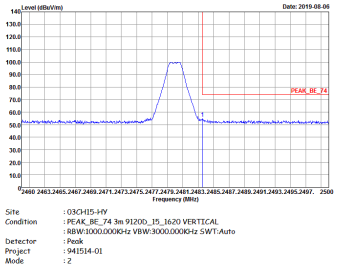
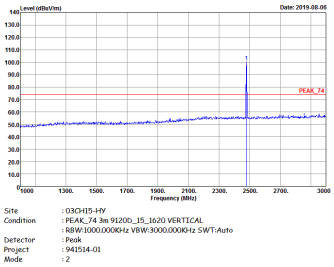
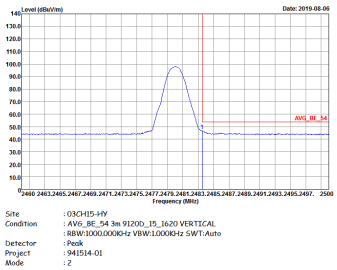
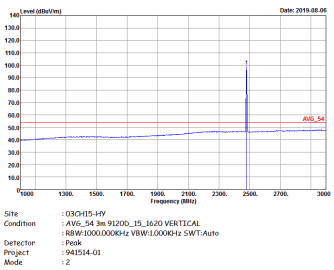
2.4GHz 2400~2483.5MHz (Band Edge @ 3m)

ANT	Mode 1: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11n HT20_Tx_Ch11	
Simultaneously	Horizontal	Fundamental
Peak		
Avg.		

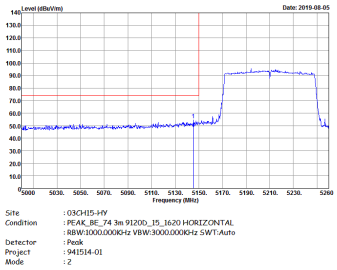
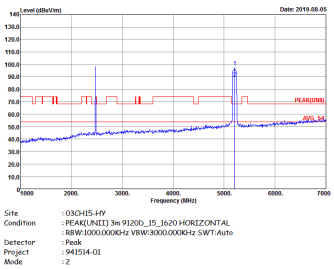
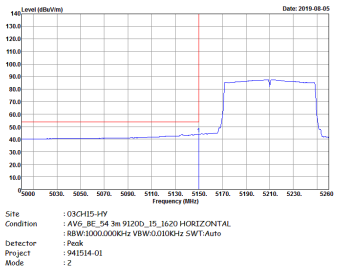
ANT	Mode 1: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11n HT20_Tx_Ch11	
Simultaneously	Vertical	Fundamental
Peak		
Avg.		

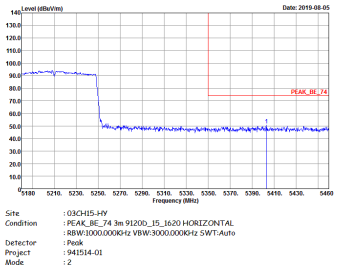
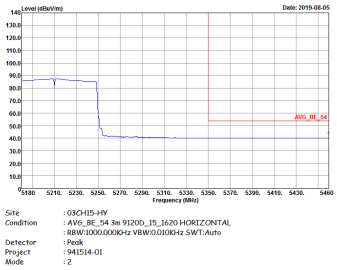
BLE (Band Edge @ 3m)

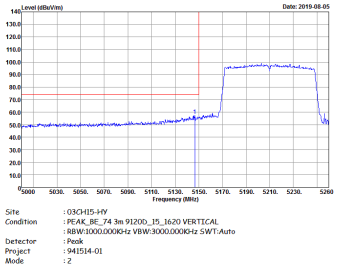
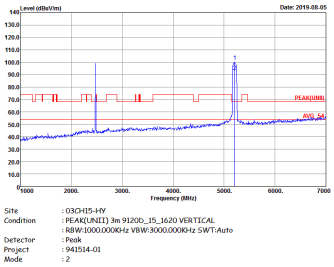
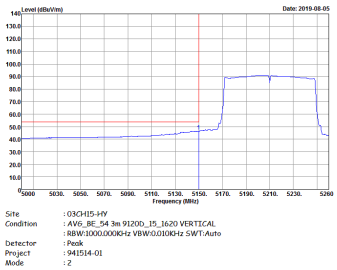
ANT	Mode 2: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11ac VHT80_Tx_Ch42	
Simultaneously	Horizontal	Fundamental
Peak		
Avg.		

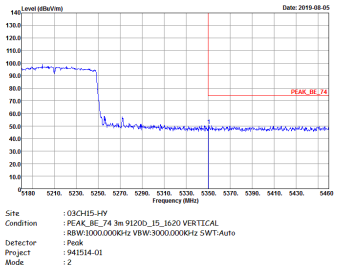
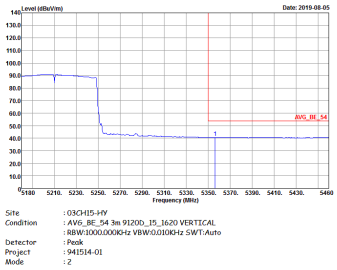
ANT	Mode 2: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11ac VHT80_Tx_Ch42	
Simultaneously	Vertical	Fundamental
Peak		
Avg.		

Band 1 5150~5250MHz (Band Edge @ 3m)

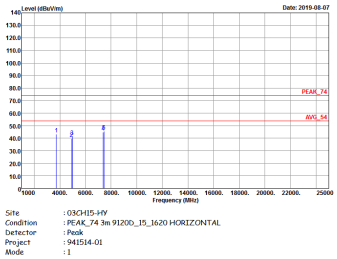
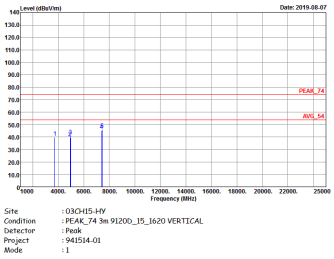
ANT	Mode 2: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11ac VHT80_Tx_Ch42 - L	
Simultaneously	**Horizontal**	**Fundamental**
Peak		
Avg.		Left blank

ANT	Mode 2: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11ac VHT80_Tx_Ch42 - R	
Simultaneously	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

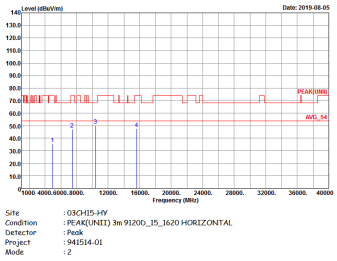
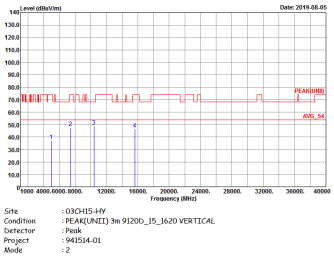
ANT	Mode 2: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11ac VHT80_Tx_Ch42 - L	
Simultaneously	Vertical	Fundamental
Peak		
Avg.		Left blank

ANT	Mode 2: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11ac VHT80_Tx_Ch42 - R	
Simultaneously	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

2.4GHz 2400~2483.5MHz (Harmonic @ 3m)

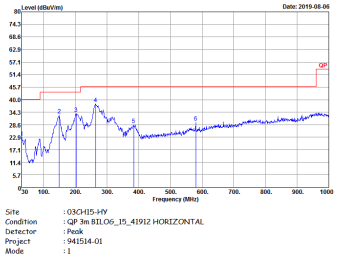
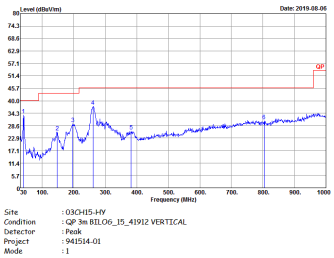
ANT	Mode 1: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11n HT20_Tx_Ch11	
Simultaneously	Horizontal	Vertical
Peak Avg.		

2.4GHz 2400~2483.5MHz + Band 1 5150~5250MHz (Harmonic @ 3m)

ANT	Mode 2: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11ac VHT80_Tx_Ch42	
Simultaneously	Horizontal	Vertical
Peak Avg.		

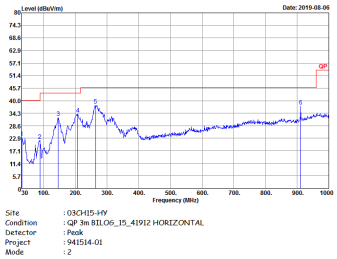
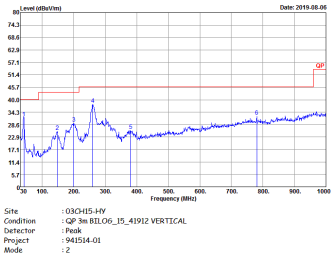
Emission below 1GHz

2.4GHz 2400~2483.5MHz (LF @ 3m)

ANT	Mode 1: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11n HT20_Tx_Ch11	
Simultaneously	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

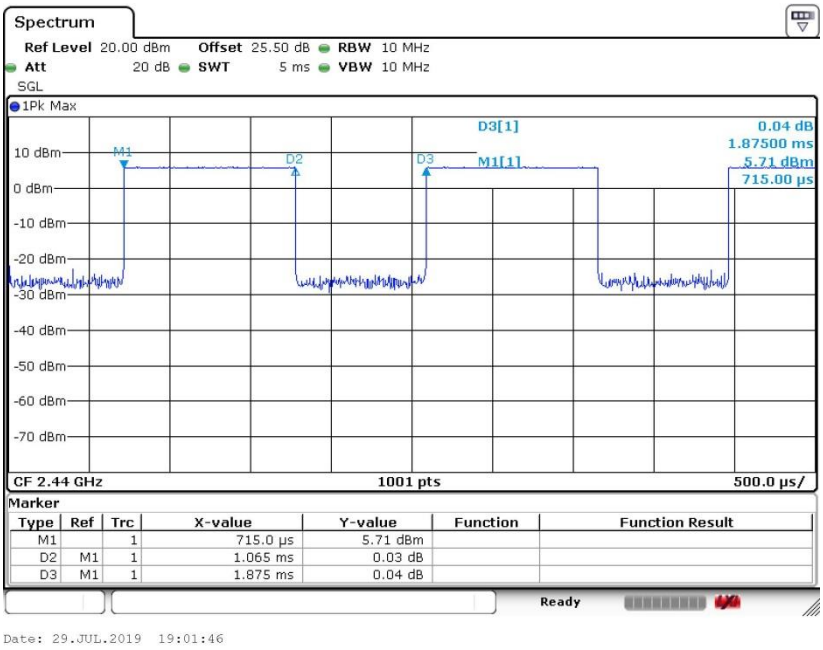
2.4GHz 2400~2483.5MHz + Band 1 5150~5250MHz (LF @ 3m)

ANT	Mode 2: Ant 1 BLE 2M_Tx_Ch39 + Ant 0 11ac VHT80_Tx_Ch42	
Simultaneously	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 2Mbps	56.8	1065	0.94	1kHz	2.46
0	2.4GHz 802.11n HT20	100.00	-	-	10Hz	0.00
0	5GHz 802.11ac VHT80	100.00	-	-	10Hz	0.00

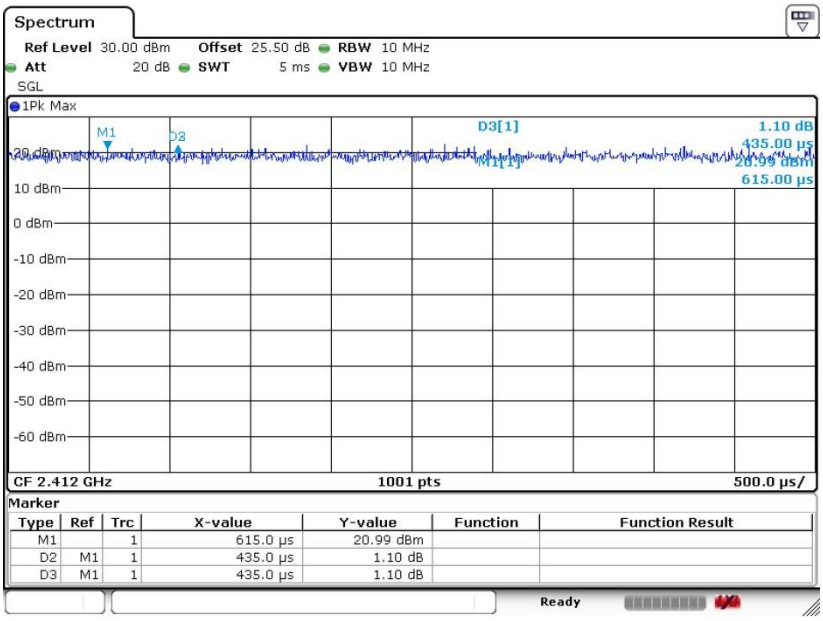
Bluetooth – LE for 2Mbps



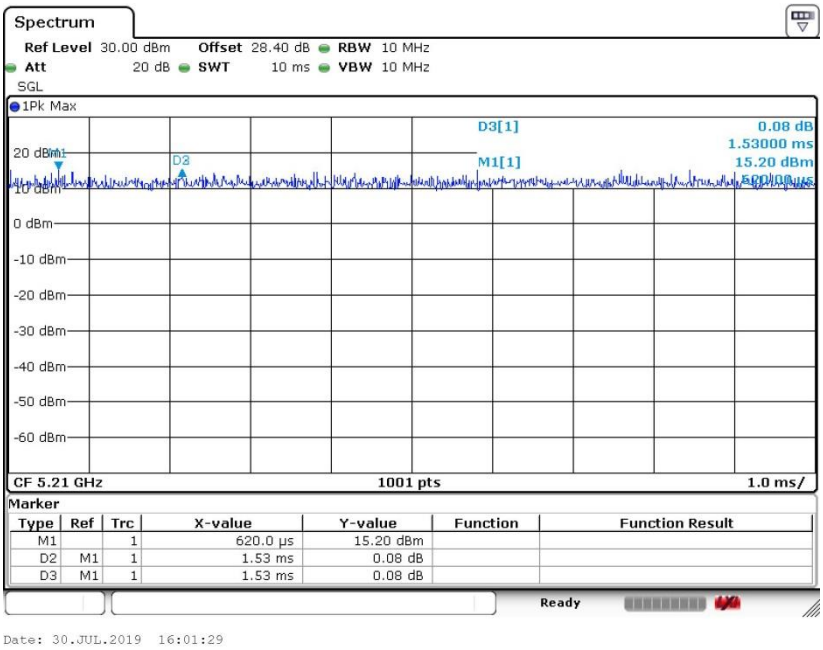
Date: 29.JUL.2019 19:01:46

<Ant. 0>

2.4GHz 802.11n HT20



5GHz 802.11ac VHT80



————THE END————