FCC CO-LOCATION RADIO TEST REPORT

FCC ID	:	2AOAI-5432
EQUIPMENT	:	Digital Media Receiver
MODEL NAME	:	L9D29R
Applicant	:	Reny7 LLC 6701 Democracy Blvd. Suite 300 Bethesda, Maryland, 20817
STANDARD	:	FCC Part 15 Subpart E §15.407

The product was completed on Jul. 12, 2018. We, SPORTON INTERNATIONAL INC., 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 INTERTIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Jones Tsai

Approved by: Jones Tsai

SPORTON INTERTIONAL 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
FR830922-01G	01	Initial issue of report	Jul. 17, 2018

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

Reviewed by: Louis Wu

Report Producer: Fish Liu

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Digital Media Receiver
Model Name	L9D29R
FCC ID	2AOAI-5432
EUT supports Radios application	WLAN 11b/g/n HT20 WLAN 11a/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE Zigbee
Antenna Type	**<2412 MHz ~ 2472 MHz>** Ant. 1 : Fixed Internal Antenna Ant. 2 : Fixed Internal Antenna **<5745 MHz ~ 5825 MHz>** Ant. 1 : Fixed Internal Antenna Ant. 2 : Fixed Internal Antenna Bluetooth LE : Fixed Internal Antenna Zigbee: Fixed Internal Antenna

1.2 Modification of EUT

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

1.3 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.
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.**
	03CH12-HY

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

1.4 Applicable Standards

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

- FCC Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
- 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).

2.1 Carrier Frequency and Channel

2400-2483.5 MHz 802.11b		5725-5850 MHz Band 4 (U-NII-3)	
Channel	**Channel**	**Channel**	**Freq. (MHz)**
13	13	165	5825

2400-2483.5 MHz Bluetooth LE (1Mbps)	
Channel	**Freq. (MHz)**
39	2480

2.2 Test Mode

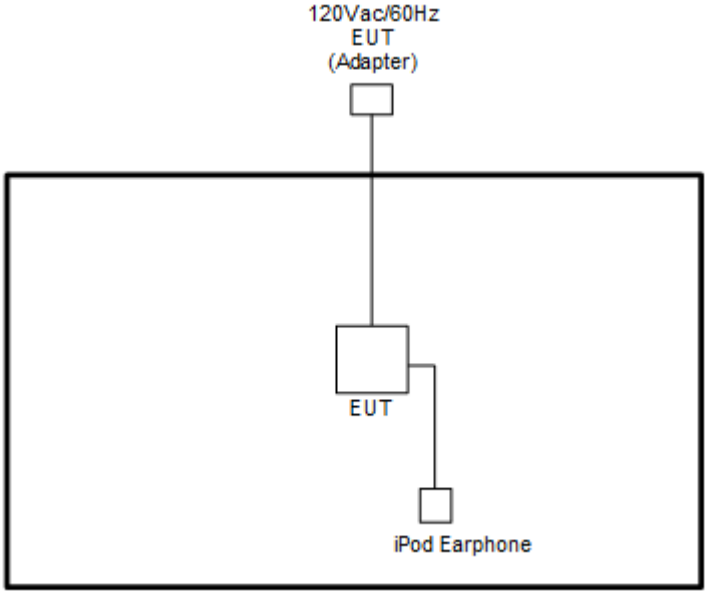
Final test modes are considering the modulation and worse data rates as below table.

<Co-Location>

Modulation	Data Rate
802.11b + Bluetooth LE	**1 Mbps + 1 Mbps**
802.11a + Bluetooth LE	**6 Mbps + 1 Mbps**

2.3 Connection Diagram of Test System

<Co-Location Mode>



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A

2.5 EUT Operation Test Setup

The RF test items, programmed RF utility, “Compliance.exe” installed in the notebook make the EUT provide functions like channel selection and power level for continuous transmitting and receiving signals.

3 Test Result

3.1 Unwanted Emissions Measurement

3.1.1 Limit of Unwanted Emissions

(1) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

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

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

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

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

(i) Sections 15.407(b)(1) 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

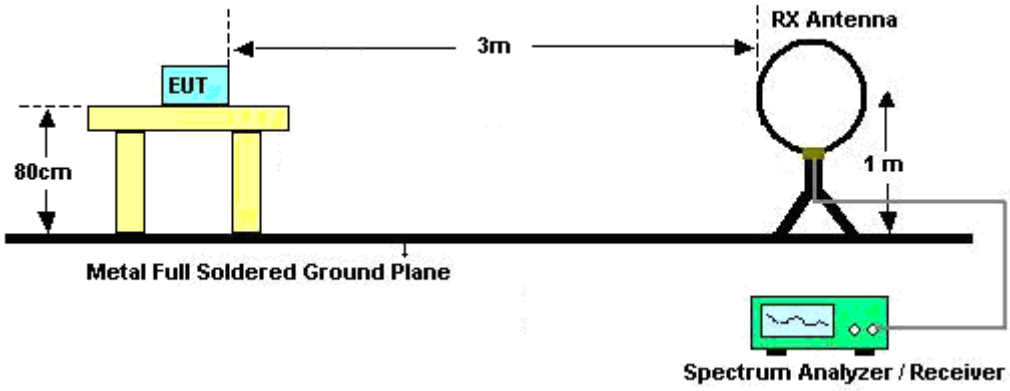
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

2. he 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.

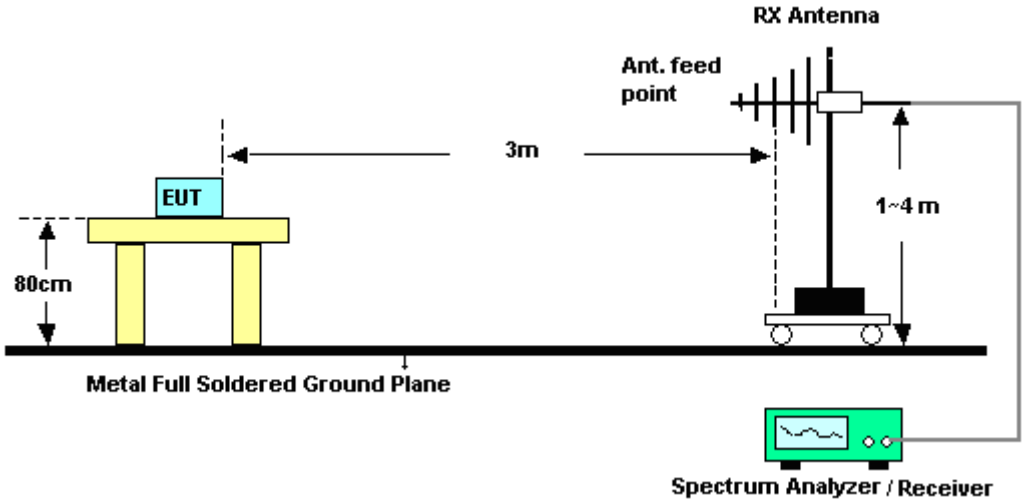
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level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

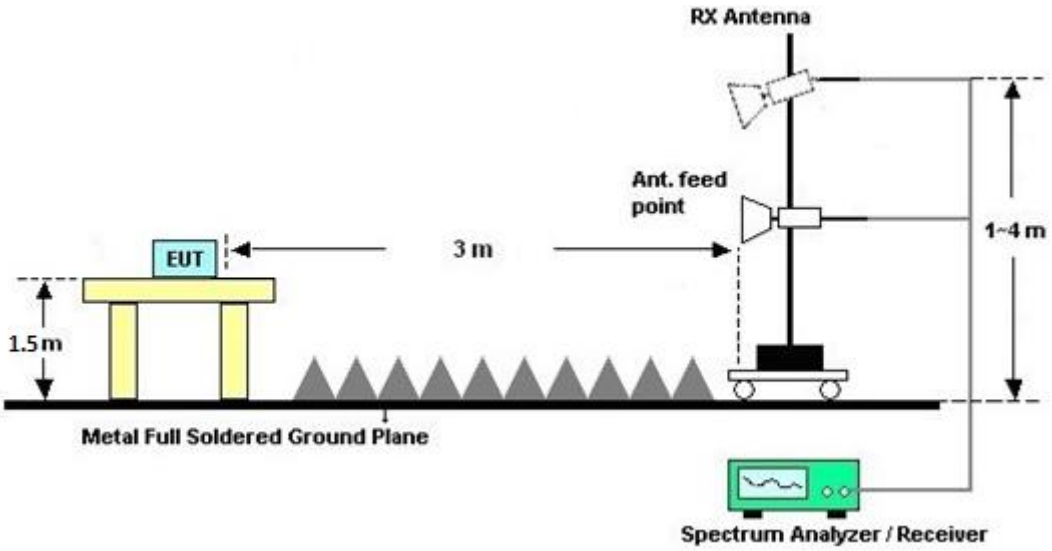
For radiated emissions below 30MHz



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 semi-Anechoic chamber, 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	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 23, 2017	Jul. 08, 2018~ Jul. 12, 2018	Nov. 22, 2018	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800 N1D01N-06	37059&01	30MHz~1GHz	Oct. 14, 2017	Jul. 08, 2018~ Jul. 12, 2018	Oct. 13, 2018	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1328	1GHz ~ 18GHz	Oct. 20, 2017	Jul. 08, 2018~ Jul. 12, 2018	Oct. 19, 2018	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz ~ 40GHz	Nov. 27, 2017	Jul. 08, 2018~ Jul. 12, 2018	Nov. 26, 2018	Radiation (03CH12-HY)
Preamplifier	COM-POWER	PA-103	161075	10MHz~1GHz	Mar. 26, 2018	Jul. 08, 2018~ Jul. 12, 2018	Mar. 25, 2019	Radiation (03CH12-HY)
Preamplifier	Keysight	83017A	MY53270148	1GHz~26.5GHz	Jan. 15, 2018	Jul. 08, 2018~ Jul. 12, 2018	Jan. 14, 2019	Radiation (03CH12-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590074	1GHz~18GHz	May 21, 2018	Jul. 08, 2018~ Jul. 12, 2018	May 20, 2019	Radiation (03CH12-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VSWR : 2.5:1 max	Jul. 18, 2017	Jul. 08, 2018~ Jul. 12, 2018	Jul. 17, 2018	Radiation (03CH12-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100390	20Hz~26.5GHz	Dec. 25, 2017	Jul. 08, 2018~ Jul. 12, 2018	Dec. 24, 2018	Radiation (03CH12-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200485	10Hz ~ 44GHz	Oct. 31, 2017	Jul. 08, 2018~ Jul. 12, 2018	Oct. 30, 2018	Radiation (03CH12-HY)
Filter	Wainwright	WLKS1200-12SS	SN2	1.2G Low Pass	Jul. 17, 2017	Jul. 08, 2018~ Jul. 12, 2018	Jul. 16, 2018	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN2	3 GHz Highpass	Jul. 17, 2017	Jul. 08, 2018~ Jul. 12, 2018	Jul. 16, 2018	Radiation (03CH12-HY)
Filter	Woken	WHKX8-5272.5-6750-18000-40ST	SN2	6.75G Highpass	Jul. 17, 2017	Jul. 08, 2018~ Jul. 12, 2018	Jul. 16, 2018	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30M-18G	Mar. 14, 2018	Jul. 08, 2018~ Jul. 12, 2018	Mar. 13, 2019	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30M~40GHz	Oct. 17, 2017	Jul. 08, 2018~ Jul. 12, 2018	Oct. 16, 2018	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30M~40GHz	Oct. 17, 2017	Jul. 08, 2018~ Jul. 12, 2018	Oct. 16, 2018	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Jul. 08, 2018~ Jul. 12, 2018	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Jul. 08, 2018~ Jul. 12, 2018	N/A	Radiation (03CH12-HY)
Software	Audix	E3 6.2009-8-24	RK-000989	N/A	N/A	Jul. 08, 2018~ Jul. 12, 2018	N/A	Radiation (03CH12-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))	5.10

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.20

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.70

Appendix A. Radiated Spurious Emission

Test Engineer :	Peter Liao and Jacky Hung	Temperature :	22~25°C
		Relative Humidity :	58~67 %

Co-location Mode

WIFI 802.11b and Bluetooth LE (Band edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
Simultaneously		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11g CH13 2472MHz + BLE 1Mbps CH39 2480MHz	*	2472	105.68	31.68	74	93.08	27.36	16.8	31.56	100	0	P	H
	*	2480	105.72	31.72	74	93.1	27.36	16.82	31.56	100	124	P	H
	*	2472	101.4	47.4	54	88.8	27.36	16.8	31.56	100	0	A	H
	*	2480	101.4	47.4	54	88.78	27.36	16.82	31.56	100	124	A	H
		2487.4	60.11	-13.89	74	47.48	27.36	16.83	31.56	100	124	P	H
		2487.32	53.61	-0.39	54	40.98	27.36	16.83	31.56	100	124	A	H
	*	2472	90.9	16.9	74	78.3	27.36	16.8	31.56	100	0	P	V
	*	2480	93.78	19.78	74	81.16	27.36	16.82	31.56	100	141	P	V
	*	2472	86.53	32.53	54	73.93	27.36	16.8	31.56	100	0	A	V
	*	2480	92.45	38.45	54	79.83	27.36	16.82	31.56	100	141	A	V
		2484.2	56.77	-17.23	74	44.15	27.36	16.82	31.56	100	141	P	V
		2487.32	46.07	-7.93	54	33.44	27.36	16.83	31.56	100	141	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

802.11a and Bluetooth LE (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)
802.11a CH165 5825MHz + BLE 1Mbps CH39 2480MHz	*	2480	97.12	23.12	74	84.5	27.36	16.82	31.56	103	101	P	H
	*	2480	96.09	42.09	54	83.47	27.36	16.82	31.56	103	101	A	H
		2493.6	56.96	-17.04	74	44.27	27.4	16.84	31.55	103	101	P	H
		2494.52	45.93	-8.07	54	33.24	27.4	16.84	31.55	103	101	A	H
	*	2480	94.23	20.23	74	81.61	27.36	16.82	31.56	338	189	P	V
	*	2480	92.49	38.49	54	79.87	27.36	16.82	31.56	338	189	A	V
		2487.68	56.94	-17.06	74	44.27	27.4	16.83	31.56	338	189	P	V
		2493.28	45.64	-8.36	54	32.95	27.4	16.84	31.55	338	189	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

WIFI 802.11b and Bluetooth LE (Harmonic @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH13 2472MHz + BLE 1Mbps CH39 2480MHz		4944	45.6	-28.4	74	60.81	31.6	10.5	57.31	100	0	P	H
		4960	40.86	-33.14	74	56	31.63	10.51	57.28	100	0	P	H
		7416	44.91	-29.09	74	53.2	36.38	12.73	57.4	100	0	P	H
		7440	45.48	-28.52	74	53.64	36.47	12.8	57.43	100	0	P	H
		4944	43.6	-30.4	74	58.81	31.6	10.5	57.31	100	0	P	V
		4960	40.88	-33.12	74	56.02	31.63	10.51	57.28	100	0	P	V
		7416	45.51	-28.49	74	53.8	36.38	12.73	57.4	100	0	P	V
		7440	45.22	-28.78	74	53.38	36.47	12.8	57.43	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

802.11a and Bluetooth LE (Harmonic @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH165 5825MHz + BLE 1Mbps CH39 2480MHz		4960	40.34	-33.66	74	55.48	31.63	10.51	57.28	100	0	P	H
		7440	46.41	-27.59	74	54.57	36.47	12.8	57.43	100	0	P	H
		11650	66.88	-7.12	74	66.79	39.77	16.62	56.3	150	6	P	H
		11650	53.44	-0.56	54	53.35	39.77	16.62	56.3	150	6	A	H
		17475	50.54	-17.66	68.2	44.24	42.38	20.97	57.05	100	0	P	H
		4960	40.66	-33.34	74	55.8	31.63	10.51	57.28	100	0	P	V
		7440	45.51	-28.49	74	53.67	36.47	12.8	57.43	100	0	P	V
		11650	61.4	-12.6	74	61.31	39.77	16.62	56.3	211	108	P	V
		11650	47.85	-6.15	54	47.76	39.77	16.62	56.3	211	108	A	V
		17475	50.26	-17.94	68.2	43.96	42.38	20.97	57.05	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

WIFI 802.11b and Bluetooth LE (LF @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH13 2472MHz + BLE 1Mbps CH39 2480MHz		30	24.44	-15.56	40	29.35	24.57	0.7	30.18	-	-	P	H
		118.56	23.71	-19.79	43.5	35.43	17.17	1.52	30.41	-	-	P	H
		257.34	21.52	-24.48	46	29.92	19.48	2.34	30.22	-	-	P	H
		624.1	32.22	-13.78	46	32.43	25.89	3.5	29.6	-	-	P	H
		902	37.09	-8.91	46	33.03	28.94	4.25	29.13	100	0	P	H
		975.5	36.63	-17.37	54	30.35	30.73	4.47	28.92	-	-	P	H
		30.27	29.7	-10.3	40	34.61	24.57	0.7	30.18	-	-	P	V
		131.52	26.76	-16.74	43.5	38.34	17.21	1.61	30.4	-	-	P	V
		261.12	21.77	-24.23	46	29.78	19.85	2.35	30.21	-	-	P	V
		624.1	37.57	-8.43	46	37.78	25.89	3.5	29.6	100	0	P	V
		832	34.51	-11.49	46	31.74	27.97	4.04	29.24	-	-	P	V
		969.9	36.19	-17.81	54	29.83	30.84	4.46	28.94	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

802.11a and Bluetooth LE (LF @ 3m)

WIFI Ant. Simultaneously	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH165 5825MHz + BLE 1Mbps CH39 2480MHz		30	24.43	-15.57	40	29.34	24.57	0.7	30.18	-	-	P	H
		201.99	23.71	-19.79	43.5	37	14.95	2.08	30.32	-	-	P	H
		274.62	22.24	-23.76	46	31.09	18.95	2.39	30.19	-	-	P	H
		624.1	32.57	-13.43	46	32.78	25.89	3.5	29.6	-	-	P	H
		885.2	33.81	-12.19	46	29.79	28.97	4.21	29.16	100	0	P	H
		984.6	36.13	-17.87	54	29.99	30.55	4.49	28.9	-	-	P	H
		34.32	29.47	-10.53	40	36.48	22.49	0.76	30.26	-	-	P	V
		126.93	29.35	-14.15	43.5	40.77	17.4	1.58	30.4	-	-	P	V
		257.34	22.07	-23.93	46	30.47	19.48	2.34	30.22	-	-	P	V
		624.1	38.39	-7.61	46	38.6	25.89	3.5	29.6	100	0	P	V
		901.3	37.37	-8.63	46	33.35	28.91	4.25	29.14	-	-	P	V
		960.8	36.27	-17.73	54	29.84	30.94	4.45	28.96	-	-	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.
-	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 Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

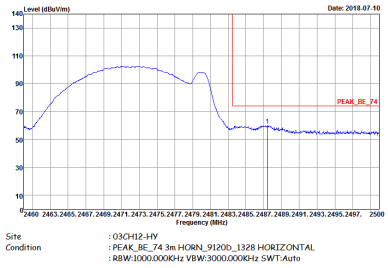
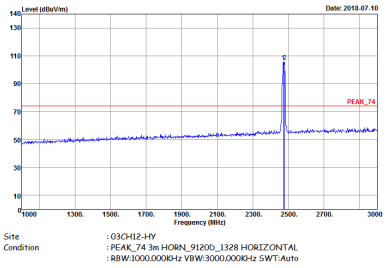
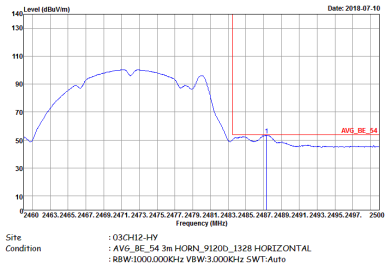
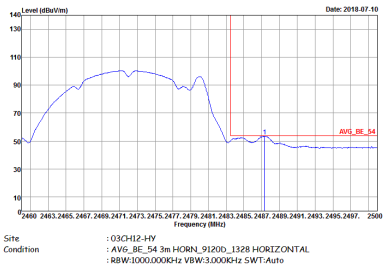
= -10.46(dB)

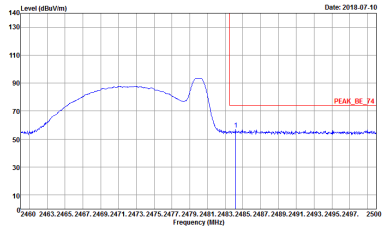
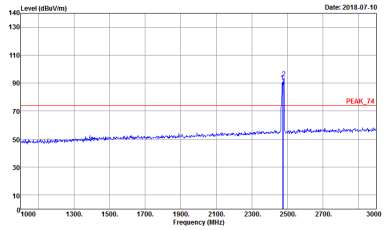
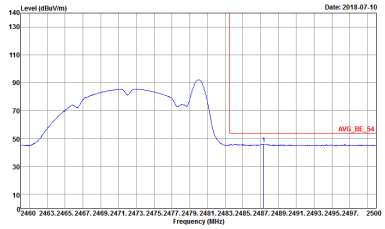
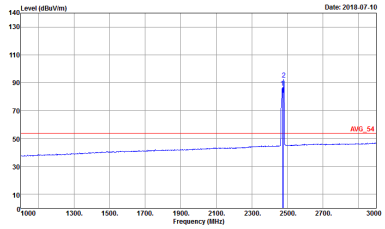
Both peak and average measured complies with the limit line, so test result is "PASS".

Appendix B. Radiated Spurious Emission Plots

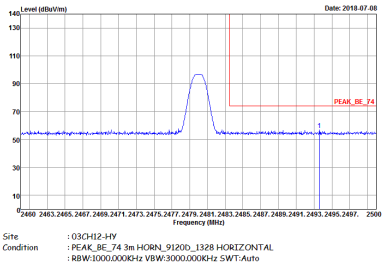
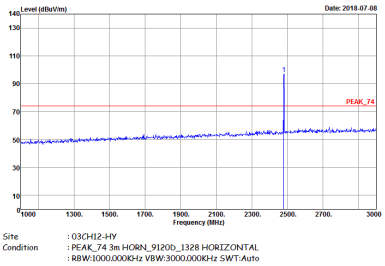
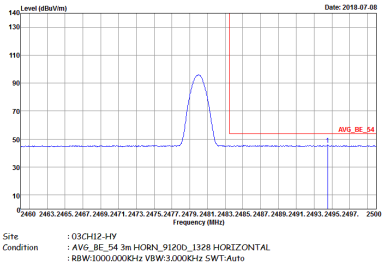
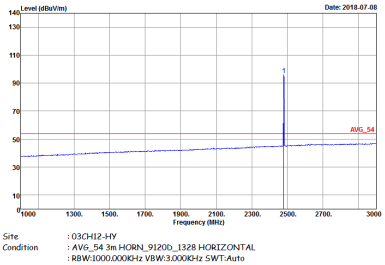
Test Engineer :	Peter Liao and Jacky Hung	Temperature :	22~25°C
		Relative Humidity :	58~67 %

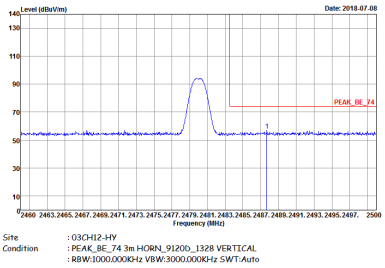
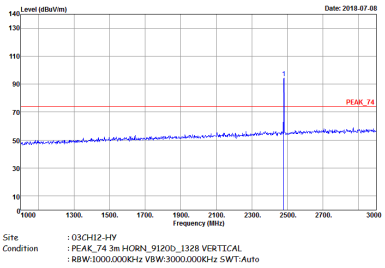
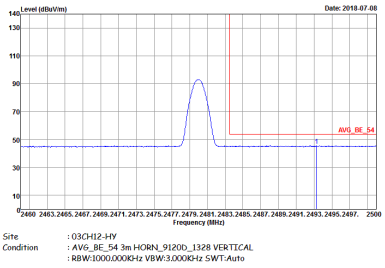
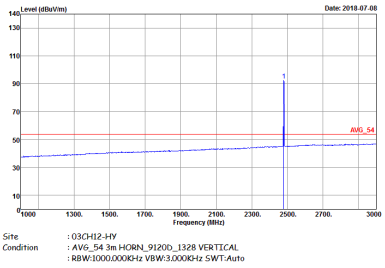
WIFI 802.11b and Bluetooth LE (Band Edge @ 3m)

Ant.	802.11b CH13 2472MHz and BLE 1Mbps CH39 2480MHz	
Simultaneously	Horizontal	Fundamental
Peak		
Avg.		

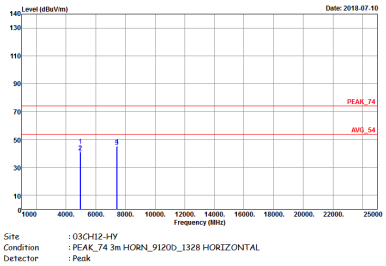
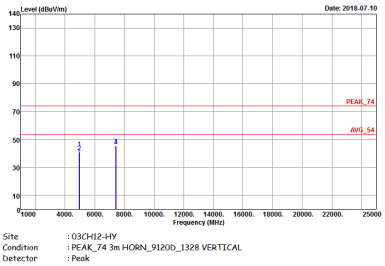
Ant.	802.11b CH13 2472MHz and BLE 1Mbps CH39 2480MHz	
Simultaneously	Vertical	Fundamental
Peak		
Avg.		

802.11a and Bluetooth LE (Band Edge @ 3m)

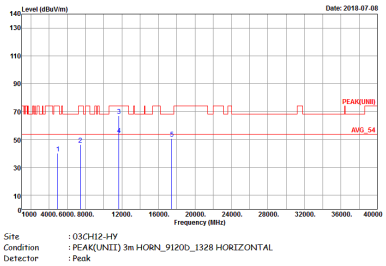
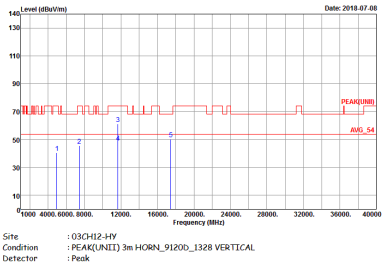
Ant.	802.11a CH165 5825MHz and BLE 1Mbps CH39 2480MHz	
Simultaneously	Horizontal	Fundamental
Peak		
Avg.		

Ant.	802.11a CH165 5825MHz and BLE 1Mbps CH39 2480MHz	
Simultaneously	Vertical	Fundamental
Peak		
Avg.		

WIFI 802.11b and Bluetooth LE (Harmonic @ 3m)

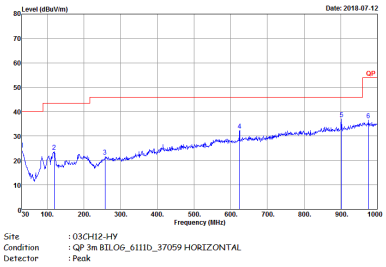
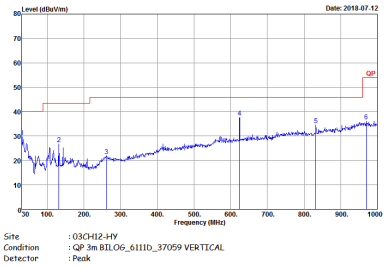
Ant.	802.11b CH13 2472MHz and BLE 1Mbps CH39 2480MHz	
Simultaneously	Horizontal	Vertical
Peak Avg.		

802.11a and Bluetooth LE (Harmonic @ 3m)

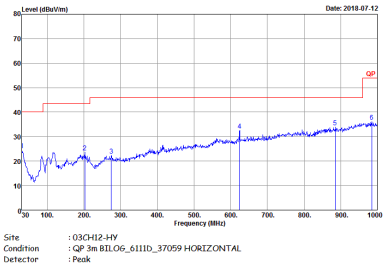
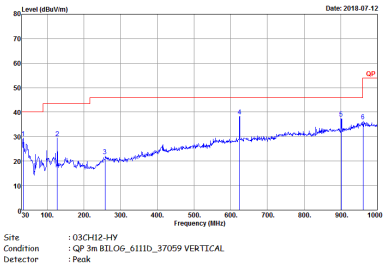
Ant.	802.11a CH165 5825MHz and BLE 1Mbps CH39 2480MHz	
Simultaneously	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

WIFI 802.11b and Bluetooth LE (LF)

Ant.	802.11b CH13 2472MHz and BLE 1Mbps CH39 2480MHz	
Simultaneously	Horizontal	Vertical
QP / Peak		

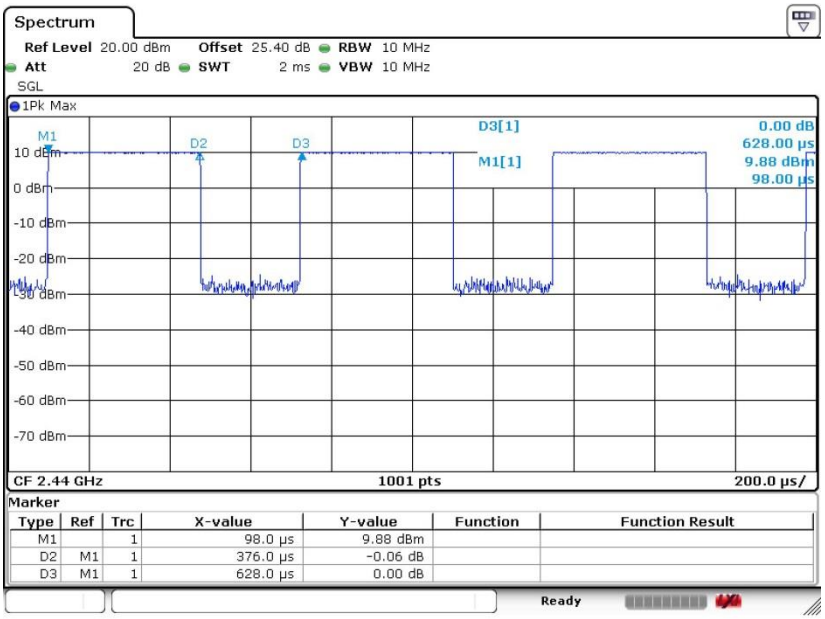
802.11a CH165 5825MHz and BLE 1Mbps CH39 2480MHz (LF)

Ant.	802.11a CH165 5825MHz and BLE 1Mbps CH39 2480MHz	
Simultaneously	Horizontal	Vertical
QP / Peak		

Appendix C. Duty Cycle Plots

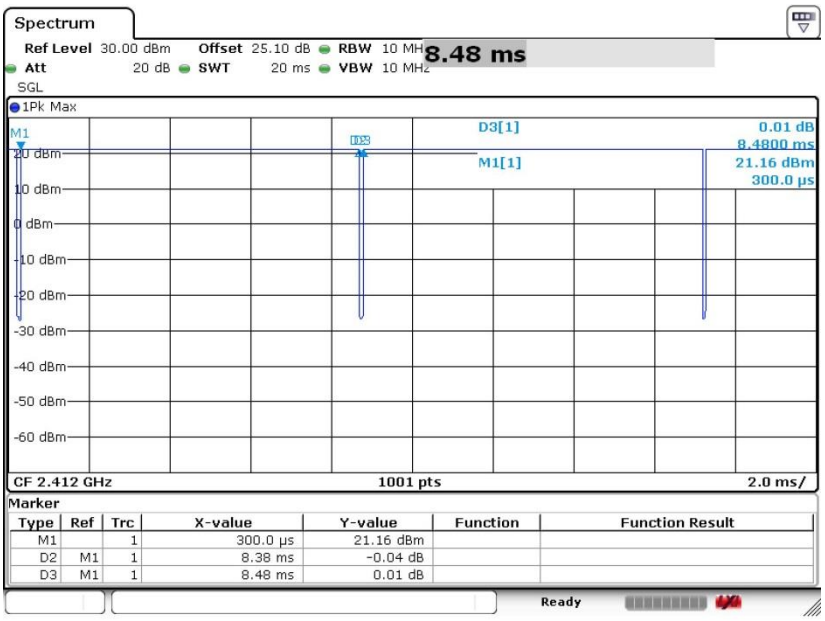
Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting	Duty Factor(dB)
Bluetooth – LE (1Mbps)	59.87	376	2.66	3kHz	2.23
802.11b for Ant. 1	98.82	-	-	10Hz	0.05
802.11a for Ant. 1	93.31	1395.00	0.72	1kHz	0.30

Bluetooth – LE (1Mbps)



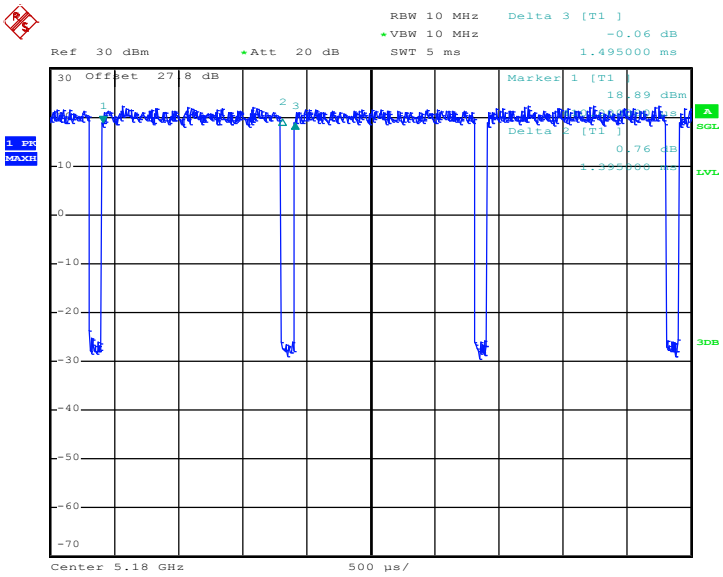
<Ant. 1>

802.11b



Date: 14.JUN.2018 12:00:15

802.11a



Date: 16.JUN.2018 01:20:09