Variant IC RF Test Report

APPLICANT	**:**	**Texas Instruments Incorporated**
EQUIPMENT	**:**	**WiFi and Bluetooth Module**
BRAND NAME	**:**	**Texas Instruments**
MODEL NAME	**:**	**WL18MODGB**
IC	**:**	**451I-WL18SBMOD**
STANDARD	**:**	**IC RSS-247 issue 1**

The product was received on Oct. 23, 2014 and testing was completed on Aug. 14, 2015. 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 test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager

SPORTON INTERNATIONAL INC.
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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
CR4O2349B	Rev. 01	This is a variant report by adding 6 new antennas. All the test cases were performed on original report which can be referred to Sporton Report Number CR3N2752-01BTX. Based on the original report, only the peak output power and conducted spurious emission and cabinet radiation were performed.	Aug. 28, 2015

SUMMARY OF TEST RESULT

Report Section	IC Rule	Description	Limit	Result	Remark
3.1	RSS-247 A5.4(4)	Power Output Measurement	≤ 30dBm	Pass	-
3.2	RSS-247 5.5	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 0.61 dB at 4806.000 MHz
3.3	N/A	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Texas Instruments Incorporated
12500 TI Boulevard, M/S 8751, Dallas, TX 75243, USA

1.2 Manufacturer

Jorjin Technologies Inc
17F, No.239, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	WiFi and Bluetooth Module
Brand Name	Texas Instruments
Model Name	WL18MODGB
IC	451I-WL18SBMOD
EUT supports Radios application	WLAN 11b/g/n HT20/HT40 Bluetooth v4.0 EDR/LE
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification subjective to this standard

Product Specification subjective to this standard	
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz
Number of Channels	40
Carrier Frequency of Each Channel	40 Channel(37 hopping + 3 advertising channel)
Maximum Output Power to Antenna	6.95 dBm (0.0050 W)
Type of Modulation	Bluetooth LE : GFSK

Antenna Information		
Antenna Type	**Brand**	**2.4GHz~2.5GHz**
PCB	Ethertronics	-0.6
Dipole	LSR	2
PCB	Laird	2
Chip	Pulse	3.2
PIFA	LSR	2

1.5 Modification of EUT

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

1.6 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1022 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	TH05-HY

Test Site	SPORTON INTERNATIONAL INC.	
Test Site Location	No. 58 , Aly. 75, Ln. 564, Wenhua 3rd Rd., Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-0855	
Test Site No.	**Sporton Site No.**	**IC Registration No.**
	03CH10	4086H-1

Note: The test site complies with ANSI C63.4 2009 requirement.

1.7 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 KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03
- 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. FCC permits the use of the 1.5 meter table as an alternative in C63.10-2013 through inquiry tracking number 961829.
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

2.1 Descriptions of Test Mode

The RF output power was recorded in the following table:

Channel	Frequency	Bluetooth 4.0 – LE RF Output Power
		Data Rate / Modulation
		GFSK
		1Mbps
Ch00	2402MHz	**6.95** dBm
Ch19	2440MHz	6.71 dBm
Ch39	2480MHz	6.28 dBm

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 (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

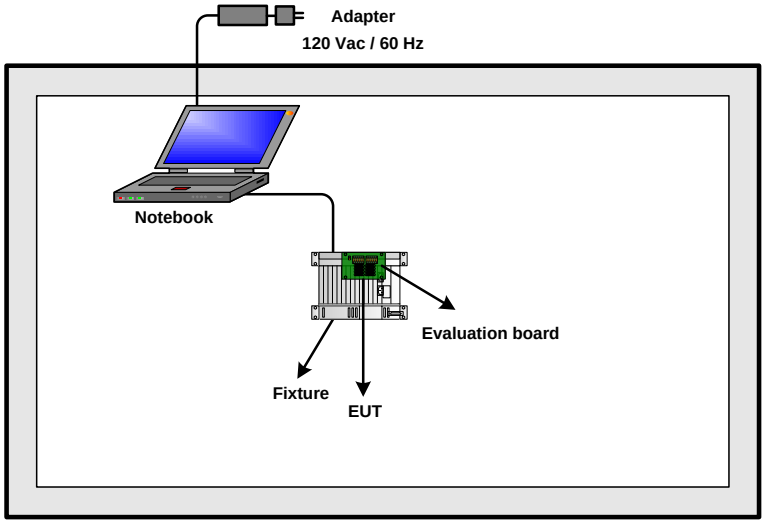
2.2 Test Mode

The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases	
Test Item	Data Rate / Modulation
	Bluetooth 4.0 – LE / GFSK
Conducted TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
Radiated TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps

2.3 Connection Diagram of Test System

<Bluetooth 4.0 – LE Tx Mode>



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	Lenovo	E335 (with WiFi module TP00034A)	FCC DoC/ Contains FCC ID:QDS-BRCM1058	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

For Bluetooth function, programmed RF utility, “HCI Tester” installed in the EUT make the EUT provide functions like channel selection and power level for continuous transmitting and receiving signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :
The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Offset = RF cable loss + attenuator factor.
Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).
= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 Peak Output Power Measurement

3.1.1 Limit of Peak Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

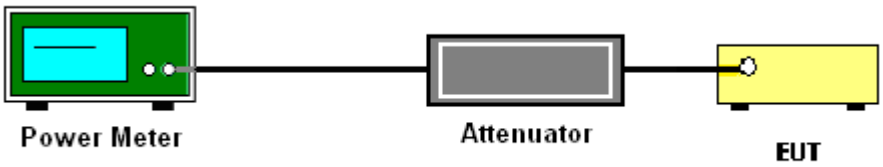
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v03r03 section 9.1.2 PKPM1 Peak power meter method.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of Peak Output Power

Test Mode :	Bluetooth 4.0 - LE	Temperature :	24-26℃
Test Engineer :	Bill Kuo	Relative Humidity :	48-52%

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	6.95	30.00	Pass
19	2440	6.71	30.00	Pass
39	2480	6.28	30.00	Pass

3.2 Radiated Band Edges and Spurious Emission Measurement

3.2.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

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

3.2.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

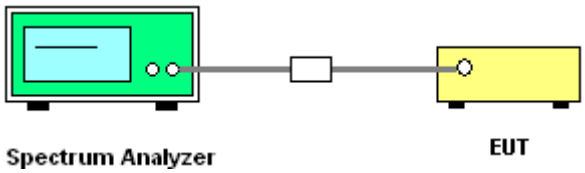
3.2.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. 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.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - 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.

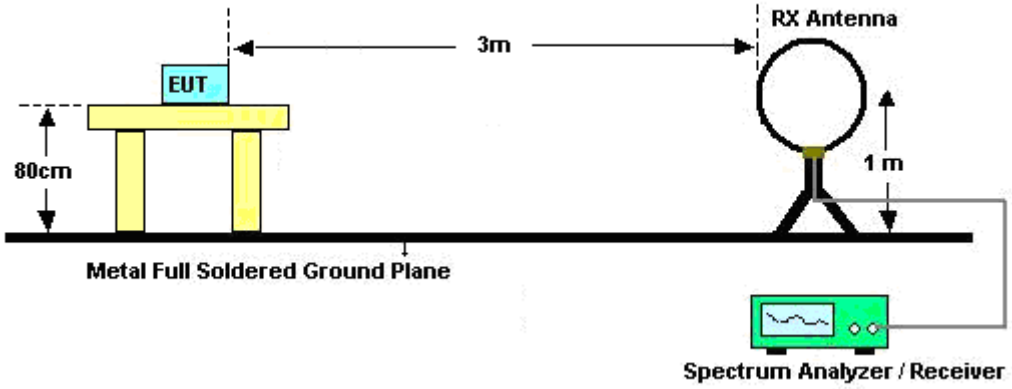
Band	Duty Cycle(%)	T(μs)	1/T(kHz)	VBW Setting
Bluetooth 4.0 - LE	100	-	-	10Hz

3.2.4 Test Setup

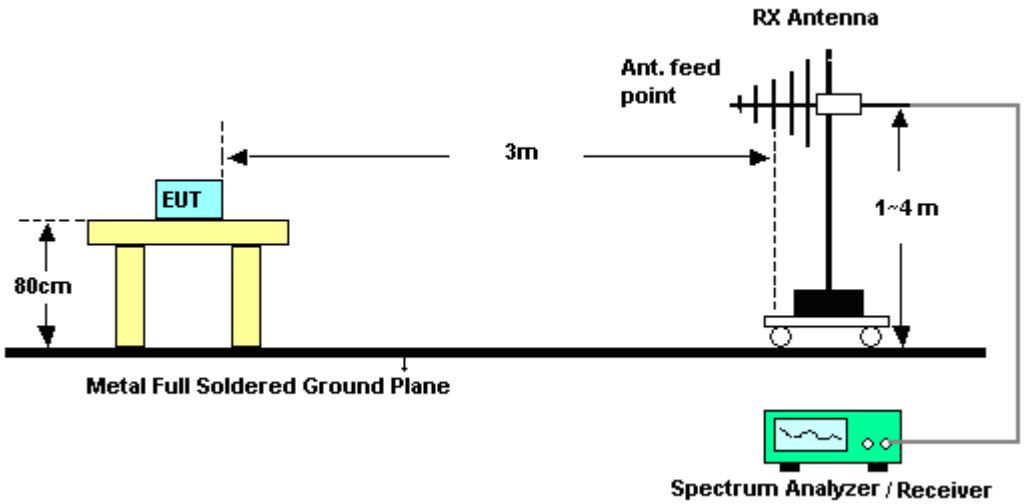
For Conducted Measurement Setup:



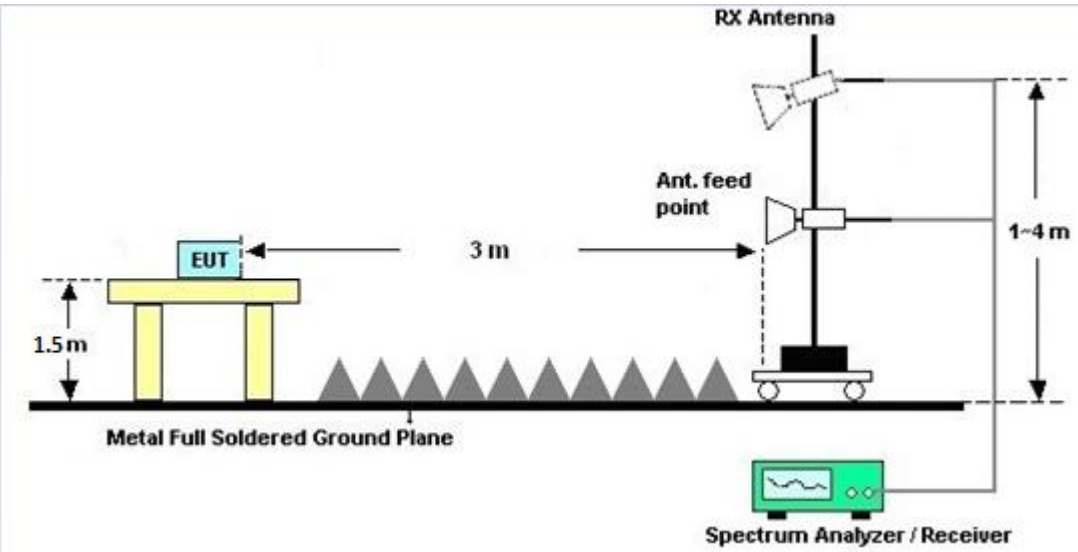
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.2.5 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 per 15.31(o) was not reported.

3.2.6 Test Result of Conducted Spurious at Band Edges in the Restricted Band

Please refer to Appendix A.

3.2.7 Test Result of Conducted Spurious Emission in the Restricted Band

Please refer to Appendix A.

3.2.8 Test Result of Cabinet Radiated Spurious at Band Edges

Please refer to Appendix B.

3.2.9 Test Result of Cabinet Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix B.

3.3 Antenna Requirements

3.3.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

3.3.2 Antenna Anti-Replacement Construction

Non-standard antenna connector is used.

3.3.3 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
Power Meter	Agilent	E4416A	GB41292344	300MHz~40GHz	Jan. 14, 2015	Aug. 12, 2015	Jan. 13, 2016	Conducted (TH05-HY)
Power Sensor	Agilent	E9327A	US40441548	300MHz~40GHz	Jan. 14, 2015	Aug. 12, 2015	Jan. 13, 2016	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz-40GHz	Jun. 18, 2015	Aug. 12, 2015	Jun. 17, 2016	Conducted (TH05-HY)
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 03, 2014	Aug. 13, 2015~ Aug. 14, 2015	Nov. 02, 2015	Radiation (03CH10-HY)
Loop Antenna	TESEQ	HLA 6120	31244	9kHZ~30MHz	Feb. 02, 2015	Aug. 13, 2015~ Aug. 14, 2015	Feb. 01, 2016	Radiation (03CH10-HY)
Amplifier	SONOMA	310N	187311	9kHz~1GHz	Nov. 24, 2014	Aug. 13, 2015~ Aug. 14, 2015	Nov. 23, 2015	Radiation (03CH10-HY)
Bilog Antenna	TESEQ	CBL 6111D	35413	30MHz~1GHz	Oct. 24, 2014	Aug. 13, 2015~ Aug. 14, 2015	Oct. 23, 2015	Radiation (03CH10-HY)
EMI Test Receiver	Keysight	N9038A	MY54130085	20Hz ~ 8.4GHz	Nov. 05, 2014	Aug. 13, 2015~ Aug. 14, 2015	Nov. 04, 2015	Radiation (03CH10-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1325	1GHz ~ 18GHz	Oct. 03, 2014	Aug. 13, 2015~ Aug. 14, 2015	Oct. 02, 2015	Radiation (03CH10-HY)
Preamplifier	Keysight	83017A	MY53270078	1GHz~26.5GHz	Nov. 20, 2014	Aug. 13, 2015~ Aug. 14, 2015	Nov. 19, 2015	Radiation (03CH10-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200485	10Hz ~ 44GHZ	Oct. 14, 2014	Aug. 13, 2015~ Aug. 14, 2015	Oct. 13, 2015	Radiation (03CH10-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Aug. 13, 2015~ Aug. 14, 2015	N/A	Radiation (03CH10-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Aug. 13, 2015~ Aug. 14, 2015	N/A	Radiation (03CH10-HY)
Turn Table	EMEC	TT 2200	N/A	0-360 degree	N/A	Aug. 13, 2015~ Aug. 14, 2015	N/A	Radiation (03CH10-HY)
Preamplifier	MITEQ	JS44-18004000-33-8P	1840917	18GHz ~ 40GHz	Jun. 02, 2015	Aug. 13, 2015~ Aug. 14, 2015	Jun. 01, 2016	Radiation (03CH10-HY)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.26**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.90**

Appendix A. Test Result of Conducted Spurious

Test Result of Conducted Spurious at Band Edges in the Restricted Band

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Gain	Cable Loss	Grounding Factor	Peak Avg
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dBi)	(dB)	(dB)	(P/A)
BLE CH00 2402MHz		2364.36	-44.91	-23.71	-21.2	-49.37	3.2	1.26	0	P
		2389.74	-59.65	-18.45	-41.2	-64.12	3.2	1.27	0	A
	*	2401.753	13.13	-	-	8.66	3.2	1.27	0	P
	*	2402.004	12.4	-	-	7.93	3.2	1.27	0	A
BLE CH19 2440MHz		2390.01	-49.9	-28.7	-21.2	-54.37	3.2	1.27	0	P
		2389.11	-62.83	-21.63	-41.2	-67.3	3.2	1.27	0	A
	*	2440.748	12.79	-	-	8.31	3.2	1.28	0	P
	*	2440.999	12.1	-	-	7.62	3.2	1.28	0	A
		2492.16	-44.48	-23.28	-21.2	-48.97	3.2	1.29	0	P
		2483.52	-62.59	-21.39	-41.2	-67.07	3.2	1.28	0	A
BLE CH39 2480MHz	*	2479.742	12.52	-	-	8.04	3.2	1.28	0	P
	*	2480.076	11.8	-	-	7.32	3.2	1.28	0	A
		2483.52	-25.76	-4.56	-21.2	-30.24	3.2	1.28	0	P
		2483.52	-55.70	-14.50	-41.2	-60.18	3.2	1.28	0	A

Note: Integration method is used to determine the BLE channel 39 band edge emission average level.

Test Result of Conducted Spurious Emission in the Restricted Band

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Gain	Cable Loss	Grounding Factor	Peak Avg
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dBi)	(dB)	(dB)	(P/A)
BLE CH00 2402MHz		32.91	-70.44	-15.24	-55.2	-78.51	3.2	0.17	4.7	P
		273.47	-71.36	-22.16	-49.2	-79.65	3.2	0.39	4.7	P
		412.18	-70.66	-21.46	-49.2	-78.99	3.2	0.43	4.7	P
		612.97	-71.08	-21.88	-49.2	-79.51	3.2	0.53	4.7	P
		711.91	-70.82	-21.62	-49.2	-79.29	3.2	0.57	4.7	P
		801.15	-51.85	-2.65	-49.2	-60.32	3.2	0.57	4.7	P
		4804	-44.33	-23.13	-21.2	-49.2	3.2	1.67	0	P
		7206	-51.92	-30.72	-21.2	-57	3.2	1.88	0	P
BLE CH19 2440MHz		32.91	-70.48	-15.28	-55.2	-78.55	3.2	0.17	4.7	P
		155.13	-71.56	-19.86	-51.7	-79.73	3.2	0.27	4.7	P
		312.27	-71.99	-22.79	-49.2	-80.27	3.2	0.38	4.7	P
		496.57	-71.72	-22.52	-49.2	-80.06	3.2	0.44	4.7	P
		638.19	-71.45	-22.25	-49.2	-79.89	3.2	0.54	4.7	P
		813.76	-51.12	-1.92	-49.2	-59.61	3.2	0.59	4.7	P
		4880	-32.27	-11.07	-21.2	-37.17	3.2	1.70	0	P
		4880	-42.13	-0.93	-41.2	-47.03	3.2	1.70	0	A
		7320	-50.41	-29.21	-21.2	-55.58	3.2	1.97	0	P
BLE CH39 2480MHz		33.88	-70.2	-15	-55.2	-78.27	3.2	0.17	4.7	P
		287.05	-71.64	-22.44	-49.2	-79.93	3.2	0.39	4.7	P
		421.88	-71.42	-22.22	-49.2	-79.75	3.2	0.43	4.7	P
		574.17	-71.41	-22.21	-49.2	-79.82	3.2	0.51	4.7	P
		745.86	-70.54	-21.34	-49.2	-79.03	3.2	0.59	4.7	P
		827.34	-50.07	-0.87	-49.2	-58.56	3.2	0.59	4.7	P
		4960	-37.56	-16.36	-21.2	-42.49	3.2	1.73	0	P
		4960	-56.1	-14.9	-41.2	-61.03	3.2	1.73	0	A
		7440	-54.13	-32.93	-21.2	-59.4	3.2	2.07	0	P

Appendix B. Radiated Spurious Emission

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz		2364.81	50.96	-23.04	74	51.67	27.14	5.39	33.24	122	225	P	H
		2354.28	42.5	-11.5	54	43.28	27.14	5.33	33.25	122	225	A	H
	*	2402.254	91.58	-	-	92.18	27.23	5.39	33.22	122	225	P	H
	*	2402.004	91.08	-	-	91.68	27.23	5.39	33.22	122	225	A	H
													H
													H
		2317.83	51.2	-22.8	74	52.14	27.05	5.27	33.26	345	10	P	V
		2350.32	42.38	-11.62	54	43.2	27.1	5.33	33.25	345	10	A	V
	*	2402.254	89	-	-	89.6	27.23	5.39	33.22	345	10	P	V
	*	2402.004	88.51	-	-	89.11	27.23	5.39	33.22	345	10	A	V
													V
													V
BLE CH 19 2440MHz		2371.38	50.7	-23.3	74	51.36	27.19	5.39	33.24	110	214	P	H
		2353.29	42.82	-11.18	54	43.6	27.14	5.33	33.25	110	214	A	H
	*	2439.746	88.74	-	-	89.16	27.37	5.42	33.21	110	214	P	H
	*	2439.997	88.24	-	-	88.66	27.37	5.42	33.21	110	214	A	H
		2487.88	51.55	-22.45	74	51.77	27.5	5.46	33.18	110	214	P	H
		2494.72	43.04	-10.96	54	43.25	27.5	5.46	33.17	110	214	A	H
		2363.64	50.91	-23.09	74	51.63	27.14	5.39	33.25	338	330	P	V
		2327.55	42.68	-11.32	54	43.56	27.05	5.33	33.26	338	330	A	V
	*	2439.746	87.02	-	-	87.44	27.37	5.42	33.21	338	330	P	V
	*	2439.997	86.5	-	-	86.92	27.37	5.42	33.21	338	330	A	V
		2491	51.04	-22.96	74	51.26	27.5	5.46	33.18	338	330	P	V
		2487.2	42.88	-11.12	54	43.14	27.46	5.46	33.18	338	330	A	V

BLE CH 39 2480MHz	*	2479.742	87.07	-	-	87.35	27.46	5.44	33.18	108	216	P	H
	*	2479.993	86.5	-	-	86.78	27.46	5.44	33.18	108	216	A	H
		2498.16	52.3	-21.7	74	52.51	27.5	5.46	33.17	108	216	P	H
		2486.68	43.05	-10.95	54	43.31	27.46	5.46	33.18	108	216	A	H
													H
													H
	*	2479.993	84.49	-	-	84.77	27.46	5.44	33.18	370	328	P	V
	*	2479.993	83.95	-	-	84.23	27.46	5.44	33.18	370	328	A	V
		2492	52.01	-21.99	74	52.22	27.5	5.46	33.17	370	328	P	V
		2485.24	43.46	-10.54	54	43.72	27.46	5.46	33.18	370	328	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		4806	55.52	-18.48	74	77.16	31.42	7.58	60.64	300	145	P	H
		4806	53.39	-0.61	54	75.03	31.42	7.58	60.64	300	145	A	H
													H
													H
		4806	53.19	-20.81	74	74.83	31.42	7.58	60.64	301	0	P	V
		4806	50.58	-3.42	54	72.22	31.42	7.58	60.64	301	0	A	V
													V
													V
BLE CH 19 2440MHz		4878	54.38	-19.62	74	75.64	31.56	7.7	60.52	100	144	P	H
		4878	52.23	-1.77	54	73.49	31.56	7.7	60.52	100	144	A	H
		7320	44.75	-29.25	74	60.02	36.22	9.49	60.98	100	0	P	H
													H
		4878	53.94	-20.06	74	75.2	31.56	7.7	60.52	144	298	P	V
		4878	51.7	-2.3	54	72.96	31.56	7.7	60.52	144	298	A	V
		7320	46.93	-27.07	74	62.2	36.22	9.49	60.98	100	0	P	V
													V
BLE CH 39 2480MHz		4962	42.35	-31.65	74	62.93	31.73	8.05	60.36	100	0	P	H
		7440	43.67	-30.33	74	58.91	36.49	9.61	61.34	100	0	P	H
													H
													H
		4962	43.84	-30.16	74	64.42	31.73	8.05	60.36	100	0	P	V
		7440	44.25	-29.75	74	59.49	36.49	9.61	61.34	100	0	P	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
				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)
2.4GHz BLE LF		63.48	30.66	-9.34	40	56.13	6.34	0.93	32.74	100	99	P	H
		144.75	30.19	-13.31	43.5	49.77	11.76	1.33	32.67			P	H
		216.84	35.17	-10.83	46	56.02	10.26	1.62	32.73			P	H
		361.6	32.83	-13.17	46	48.18	15.51	1.94	32.8			P	H
		602.4	34.7	-11.3	46	45.54	19.62	2.57	33.03			P	H
		771.1	30.22	-15.78	46	38.35	21.81	2.97	32.91			P	H
													H
													H
													H
													H
													H
													H
		51.33	35.07	-4.93	40	58.03	8.89	0.93	32.78	158	41	P	V
		68.88	27.81	-12.19	40	52.96	6.64	0.93	32.72			P	V
		293.52	27	-19	46	44.17	13.68	1.88	32.73			P	V
		361.6	25.21	-20.79	46	40.56	15.51	1.94	32.8			P	V
		399.4	27.32	-18.68	46	41.53	16.5	2.13	32.84			P	V
		602.4	31.68	-14.32	46	42.52	19.62	2.57	33.03			P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

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

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

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	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. Level(dBµV/m) =

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

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

For Peak Limit @ 2390MHz:

1. Level(dBµV/m)

= Antenna Factor(dB/m) + Cable 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) + Cable 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 C. Setup Photographs

<Radiated Emission>

LF

HF