

FCC RF Test Report

APPLICANT : Franklin Cape Range Limited Liability Company
EQUIPMENT : Tablet PC
MODEL NAME : SV98LN
FCC ID : 2AETF-1013
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System

The testing was completed on Jun. 16, 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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Report No. : FR542915-01B

Report Version : Rev. 01

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Report Template No.: BU5-FR15CBT4.0 Version 1.0

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APPENDIX A. RADIATED TEST RESULTS

APPENDIX B. SETUP PHOTOGRAPHS

REVISION HISTORY

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	$\geq 0.5\text{MHz}$	Pass	-
3.2	15.247(b)(1)	Peak Output Power	$\leq 30\text{dBm}$	Pass	-
3.3	15.247(e)	Power Spectral Density	$\leq 8\text{dBm/3kHz}$	Pass	-
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	$\leq 20\text{dBc}$	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 11.53 dB at 2497.400 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 18.50 dB at 0.174 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Franklin Cape Range Limited Liability Company
11555 Heron Bay Blvd., Suite 200
Coral Springs, Florida, 33076

1.2 Product Feature of Equipment Under Test

Product Feature	
Equipment	Tablet PC
Model Name	SV98LN
FCC ID	2AETF-1013
EUT supports Radios application	WLAN 11b/g/n (HT20/HT40) Bluetooth v4.0 EDR/LE

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

1.3 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	-0.33 dBm (0.0009 W)
Antenna Type	Fixed Internal Antenna with gain 1.31 dB
Type of Modulation	Bluetooth LE : GFSK

1.4 Modification of EUT

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

1.5 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 1 st 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.	
	TH02-HY	CO05-HY

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd. Guishan Township, Taoyuan County, Taiwan (R.O.C.) TEL: +886-3-327-0855
Test Site No.	Sporton Site No. 03CH11-HY

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

1.6 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 C63.10-2009

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	-0.41 dBm
Ch19	2440MHz	-0.33 dBm
Ch39	2480MHz	-0.45 dBm

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction (150 kHz to 30 MHz), radiation (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). Pre-scanned tests, X, Y, Z in three orthogonal panels to determine the final configuration (Z plane as worst plane) from all possible combinations.

- b. AC power line Conducted Emission was tested under maximum output power.

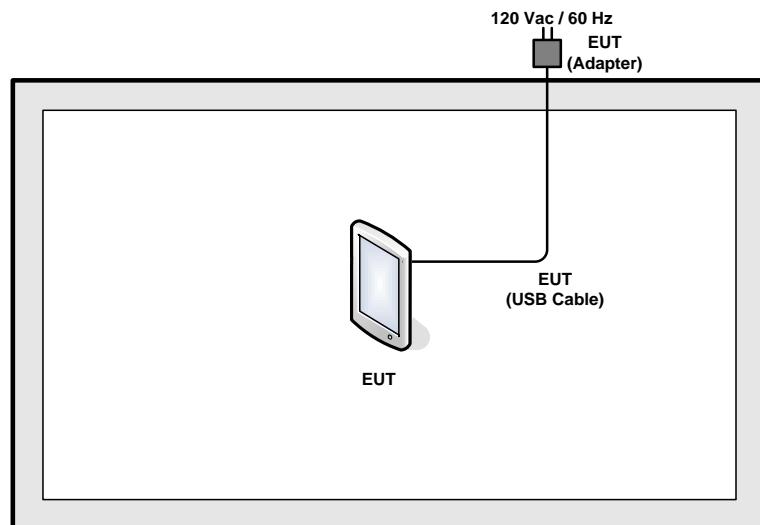
2.2 Test Mode

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

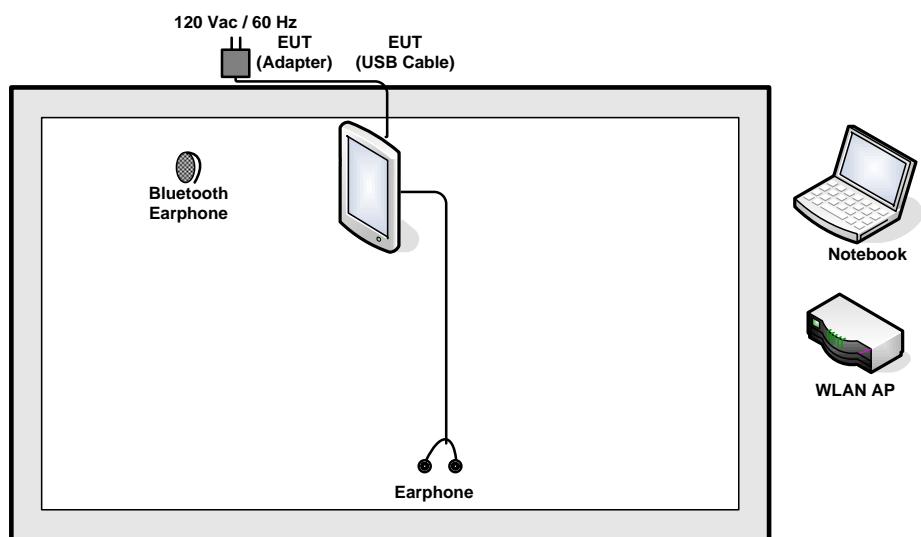
Summary table of Test Cases	
Test Item	Data Rate / Modulation
	Bluetooth 4.0 – LE / GFSK
Conducted TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
Radiated TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
AC Conducted Emission	Mode 1: WLAN (2.4GHz) Link + Bluetooth Link + H-Pattern + Earphone + Micro SD Card + USB Cable(Charging from Adapter)

2.3 Connection Diagram of Test System

<Bluetooth 4.0 – LE Tx Mode>



<AC Conducted Emission Mode>



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
2.	WLAN AP	D-Link	DIR-865L	KA2IR865LA1	N/A	Unshielded, 1.8 m
3.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A
4.	Notebook	DELL	Latitude E6320	FCC DoC/ Contains FCC ID: QDS-BRCM1054	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
5.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

For Bluetooth function, the RF utility, “adb command” was installed in EUT which was programmed in order to make the EUT get into the engineering modes to contact with Bluetooth base station 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).

$$= 4.2 + 10 = 14.2 \text{ (dB)}$$

3 Test Result

3.1 6dB Bandwidth Measurement

3.1.1 Limit of 6dB Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

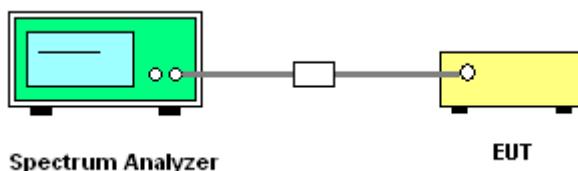
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03.
2. The RF output of EUT was connected to the spectrum analyzer 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. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. Measure and record the results in the test report.

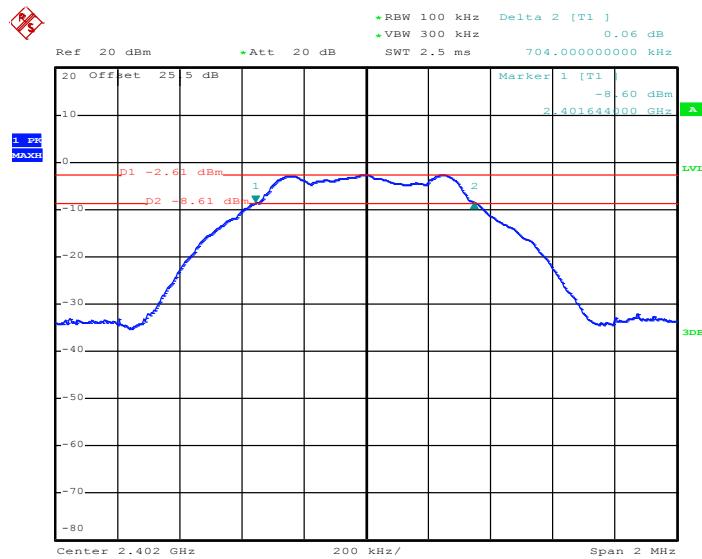
3.1.4 Test Setup



3.1.5 Test Result of 6dB Bandwidth

Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~25°C	
Test Engineer :	Luffy Lin	Relative Humidity :	51~55%	
Channel	Frequency (MHz)	6dB Bandwidth (MHz)	6dB Bandwidth Min. Limit (MHz)	Pass/Fail
00	2402	0.704	0.5	Pass
19	2440	0.688	0.5	Pass
39	2480	0.702	0.5	Pass

6 dB Bandwidth Plot on Channel 00



Date: 9.MAY.2015 10:44:14

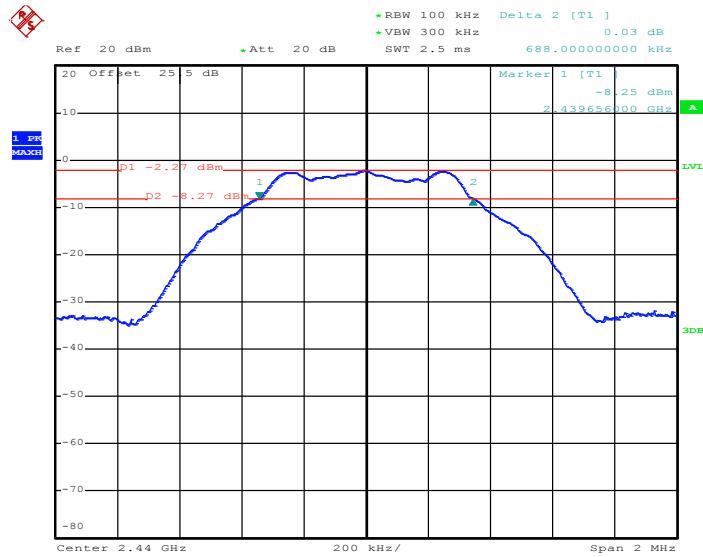
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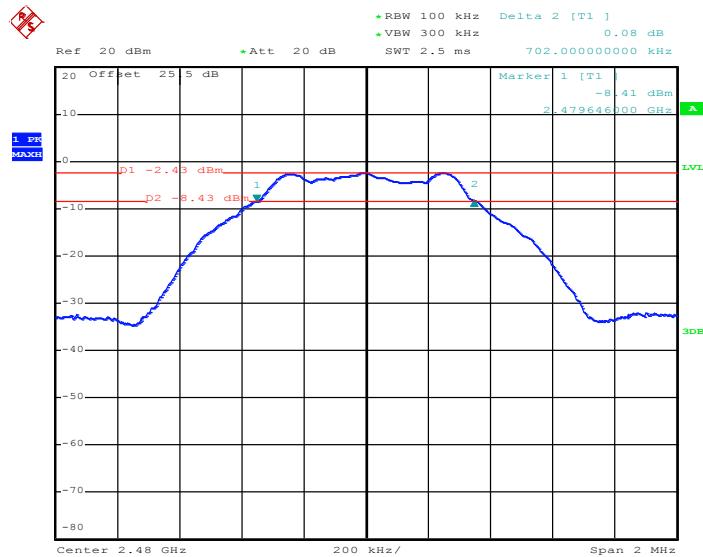
Report Template No.: BU5-FR15CBT4.0 Version 1.0

6 dB Bandwidth Plot on Channel 19



Date: 9.MAY.2015 10:50:32

6 dB Bandwidth Plot on Channel 39



Date: 9.MAY.2015 10:55:57

3.2 Peak Output Power Measurement

3.2.1 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 of 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.

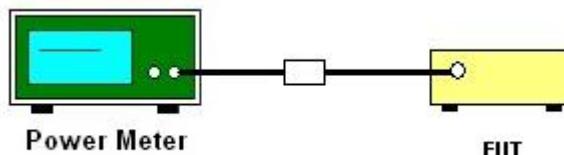
3.2.2 Measuring Instruments

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 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.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~25°C	
Test Engineer :	Luffy Lin	Relative Humidity :	51~55%	
Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	-0.41	30.00	Pass
19	2440	-0.33	30.00	Pass
39	2480	-0.45	30.00	Pass

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

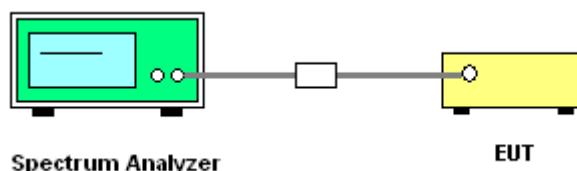
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03
2. The RF output of EUT was connected to the spectrum analyzer 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. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~25°C
Test Engineer :	Luffy Lin	Relative Humidity :	51~55%

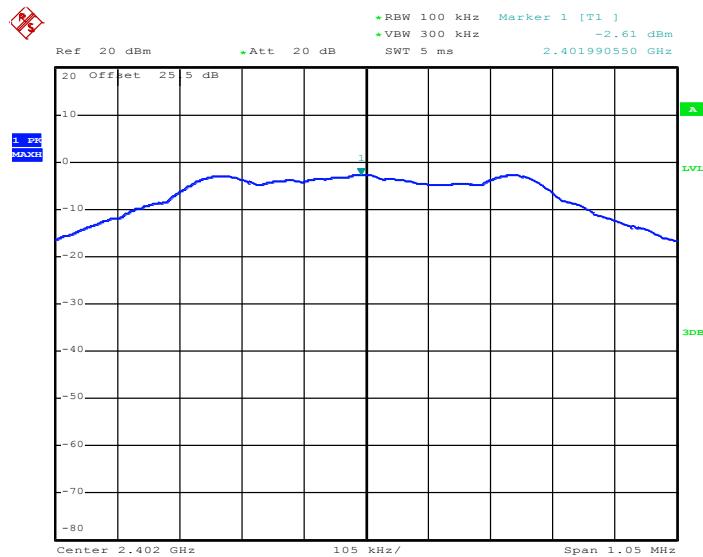
Channel	Frequency (MHz)	Power Density		Max. Limits (dBm/3kHz)	Pass/Fail
		PSD/100kHz (dBm)	PSD/3kHz (dBm)		
00	2402	-2.610	-17.220	8	Pass
19	2440	-2.270	-16.890	8	Pass
39	2480	-2.440	-17.000	8	Pass

Note:

1. Measured power density (dBm) has offset with cable loss.
2. The Measured power density (dBm)/ 100kHz is reference level and used as 20dBc down for Conducted Band Edges and Conducted Spurious Emission limit line.

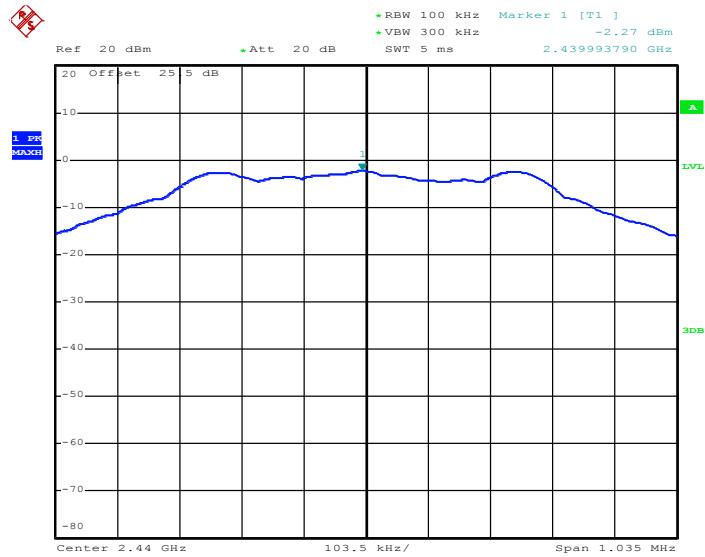
3.3.6 Test Result of Power Spectral Density Plots (100kHz)

PSD 100kHz Plot on Channel 00



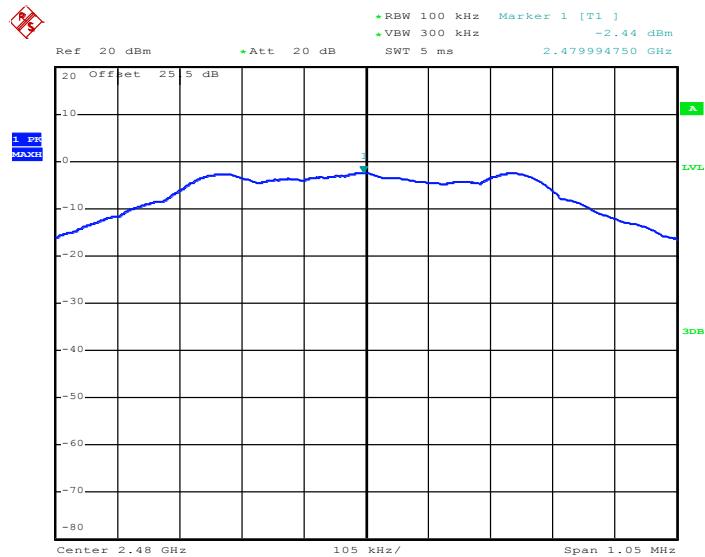
Date: 9.MAY.2015 10:45:30

PSD 100kHz Plot on Channel 19



Date: 9.MAY.2015 10:51:19

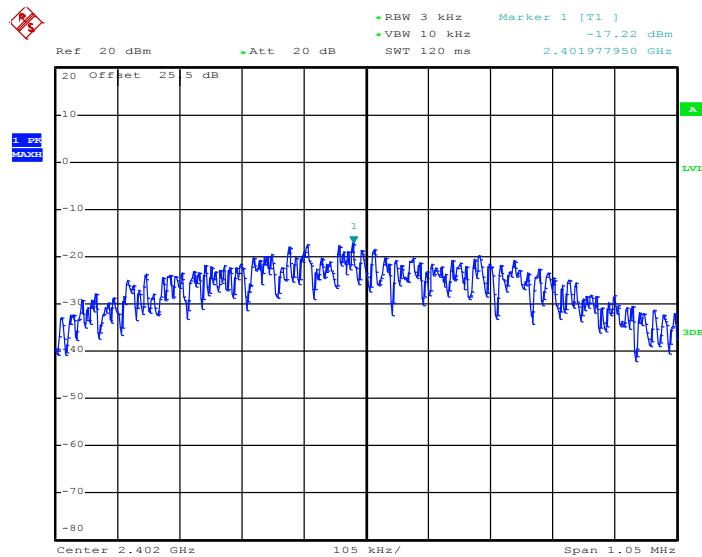
PSD 100kHz Plot on Channel 39



Date: 9.MAY.2015 10:56:45

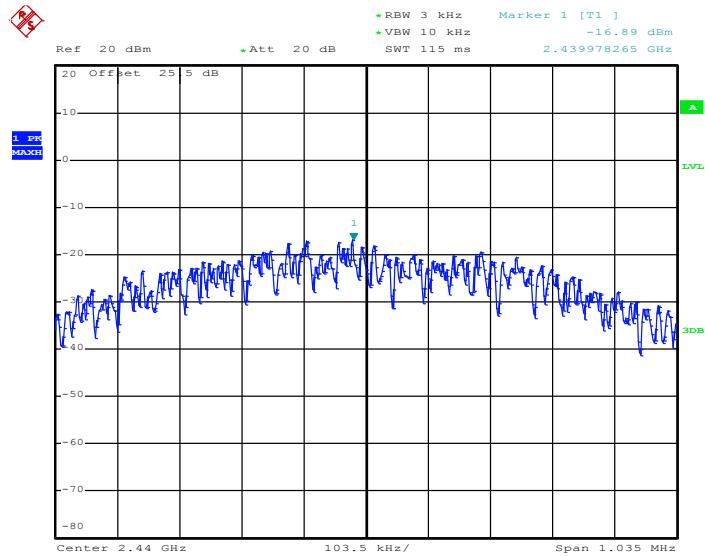
3.3.7 Test Result of Power Spectral Density Plots (3kHz)

PSD 3kHz Plot on Channel 00



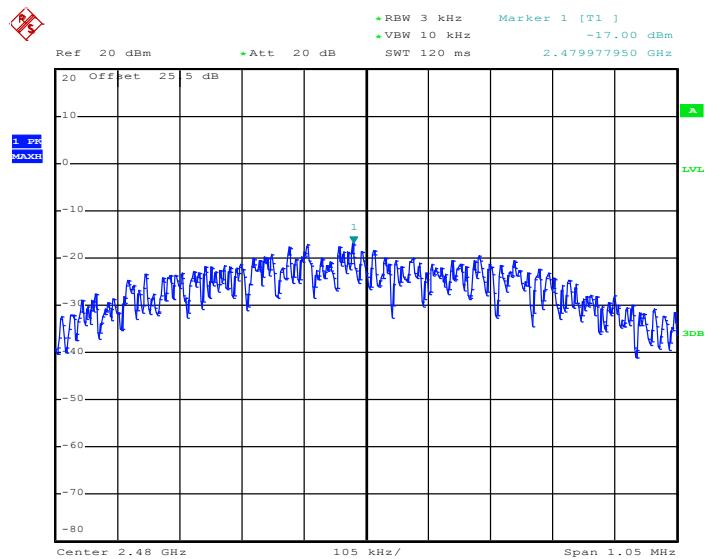
Date: 9.MAY.2015 10:45:00

PSD 3kHz Plot on Channel 19



Date: 9.MAY.2015 10:50:56

PSD 3kHz Plot on Channel 39



Date: 9.MAY.2015 10:56:22

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3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

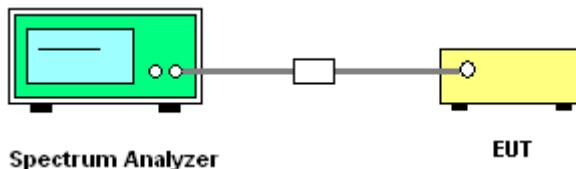
3.4.2 Measuring Instruments

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

3.4.3 Test Procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r03.
2. The RF output of EUT was connected to the spectrum analyzer 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. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

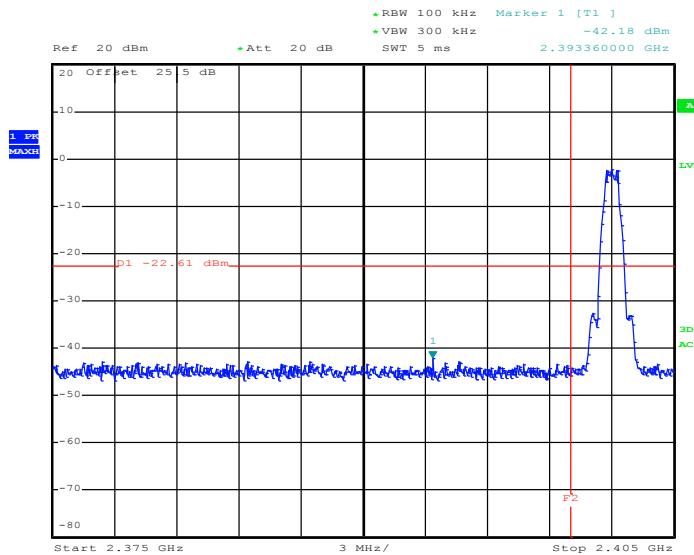
3.4.4 Test Setup



3.4.5 Test Result of Conducted Band Edges

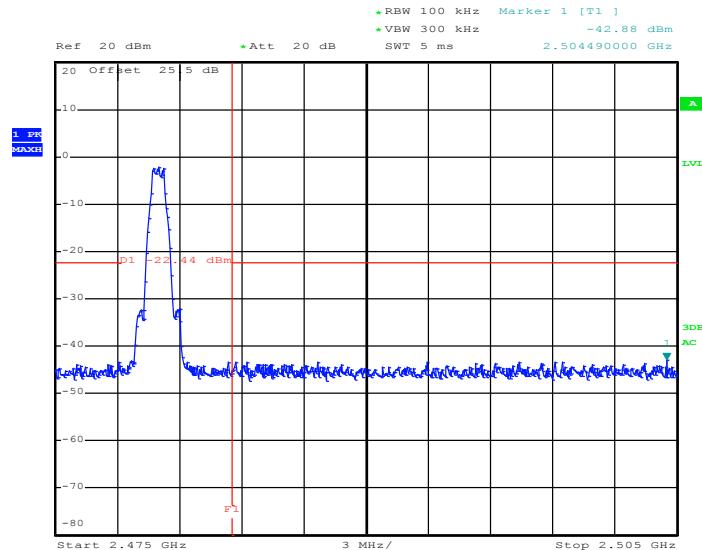
Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~25°C
Test Channel :	00 and 39	Relative Humidity :	51~55%
		Test Engineer :	Luffy Lin

Low Band Edge Plot on Channel 00



Date: 12.MAY.2015 19:59:37

High Band Edge Plot on Channel 39



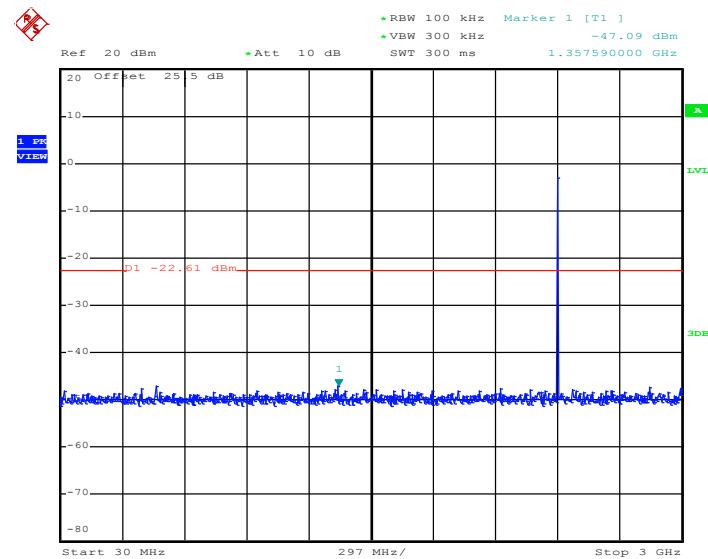
Date: 12.MAY.2015 20:01:05

3.4.6 Test Result of Conducted Spurious Emission

Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~25°C
Test Channel :	00	Relative Humidity :	51~55%
		Test Engineer :	Luffy Lin

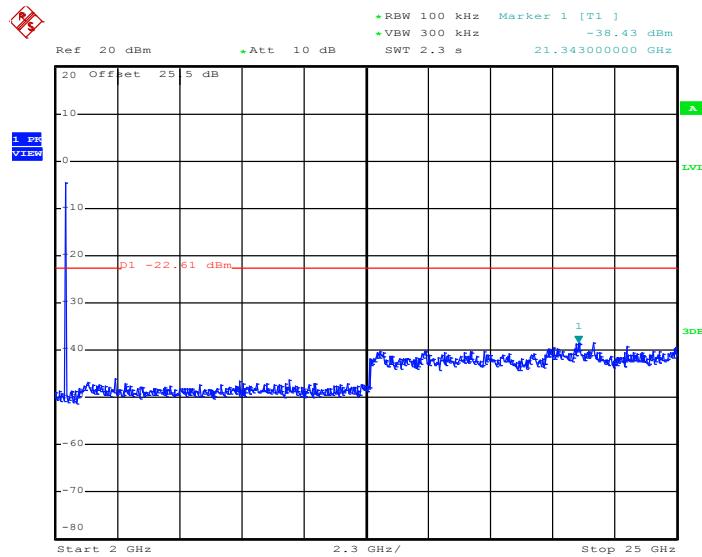
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 00



Date: 9.MAY.2015 10:46:30

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 00

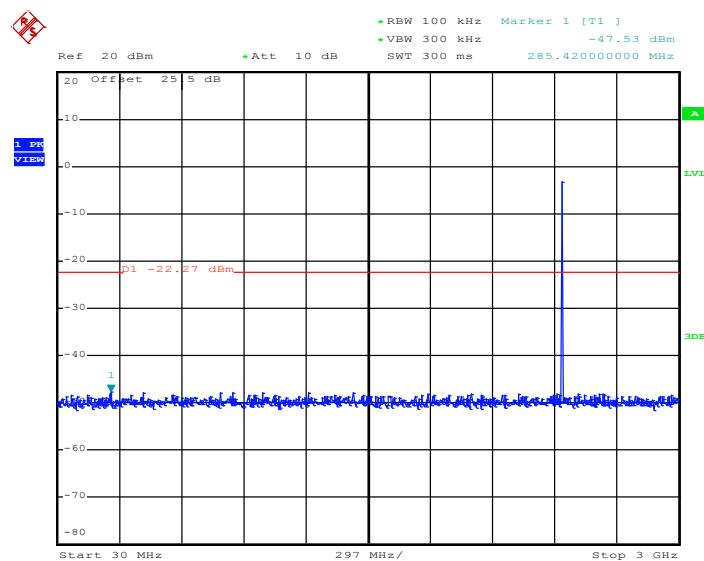


Date: 9.MAY.2015 10:46:48

Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~25°C
Test Channel :	19	Relative Humidity :	51~55%
		Test Engineer :	Luffy Lin

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 19



Date: 9.MAY.2015 10:51:43

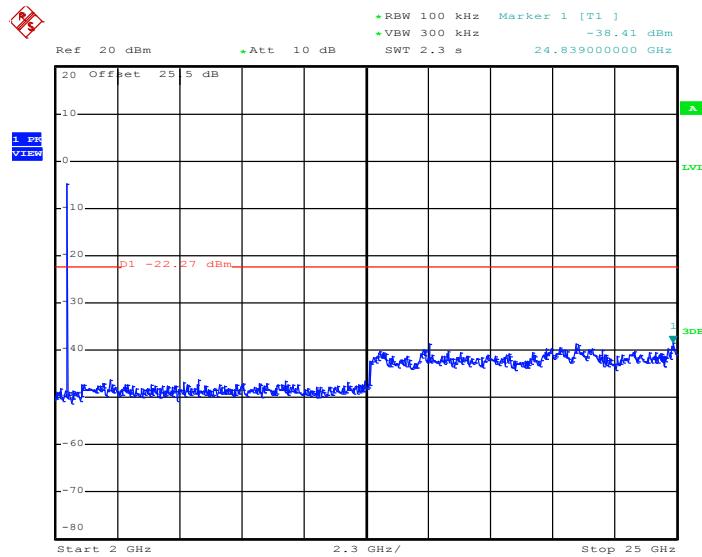
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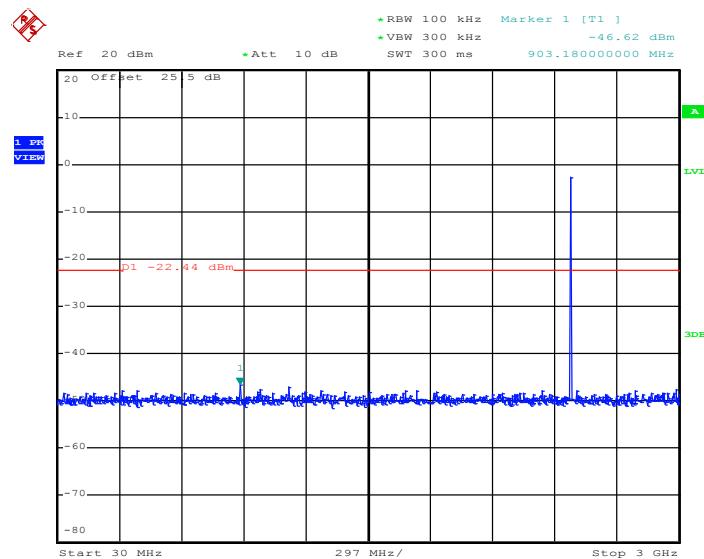
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19



Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~25°C
Test Channel :	39	Relative Humidity :	51~55%
		Test Engineer :	Luffy Lin

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 39



Date: 9.MAY.2015 11:00:50

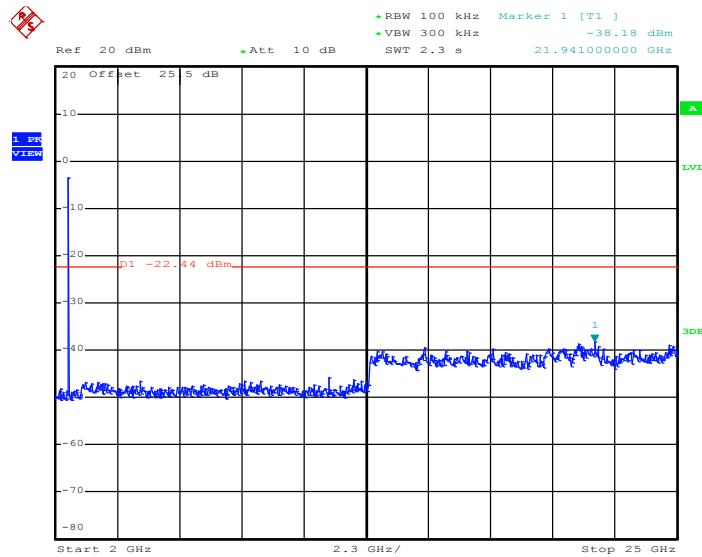
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Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39



Date: 9.MAY.2015 11:01:08

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 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

3.5.2 Measuring Instruments

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

3.5.3 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 \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement.

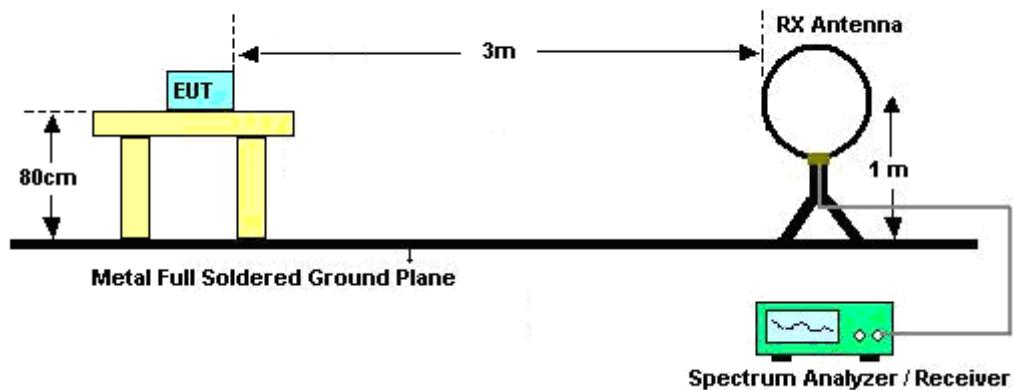
For average measurement:

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

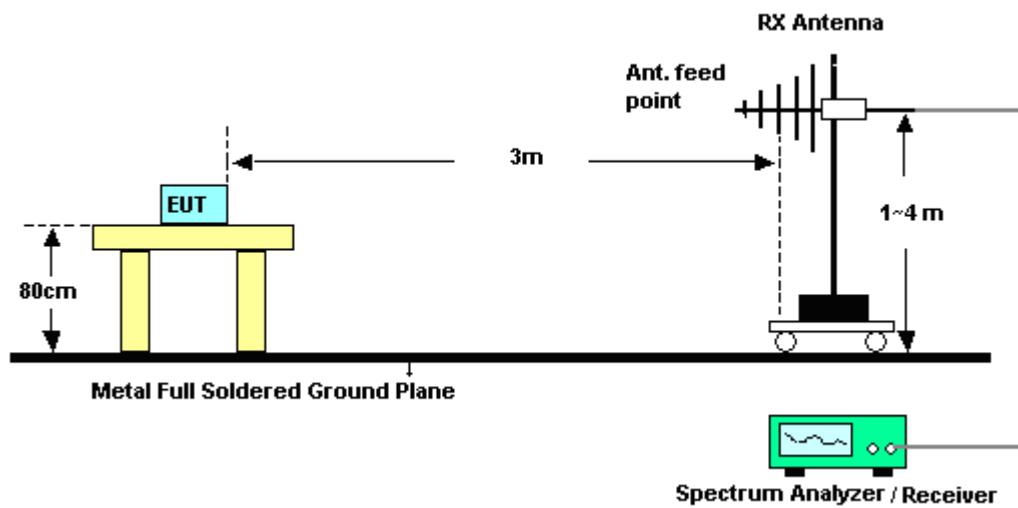
Band	Duty Cycle(%)	T(μs)	1/T(kHz)	VBW Setting
Bluetooth 4.0 - LE	60.51	380	2.63	3kHz

3.5.4 Test Setup

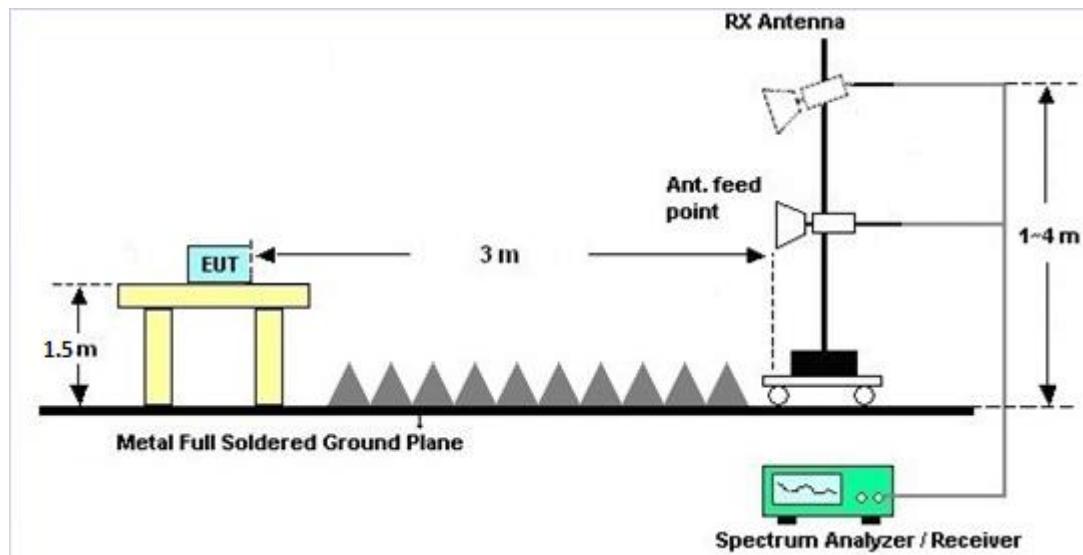
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



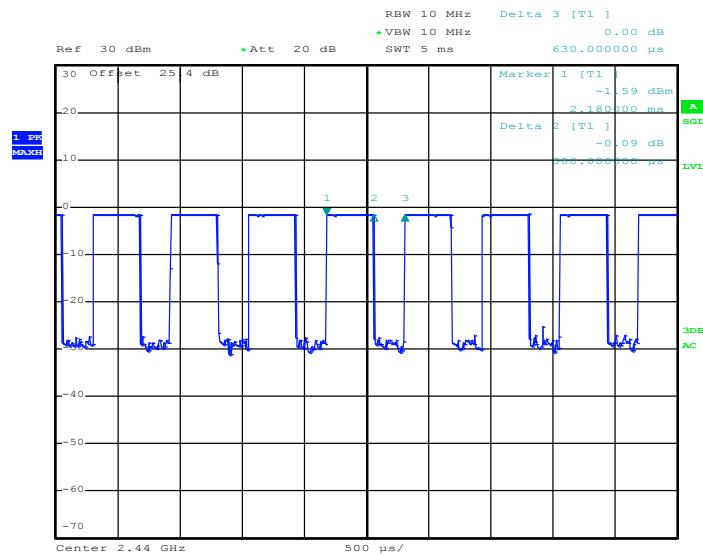
3.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

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.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

3.5.7 Duty Cycle



Date: 7.MAY.2015 21:09:13

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

Please refer to Appendix A.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

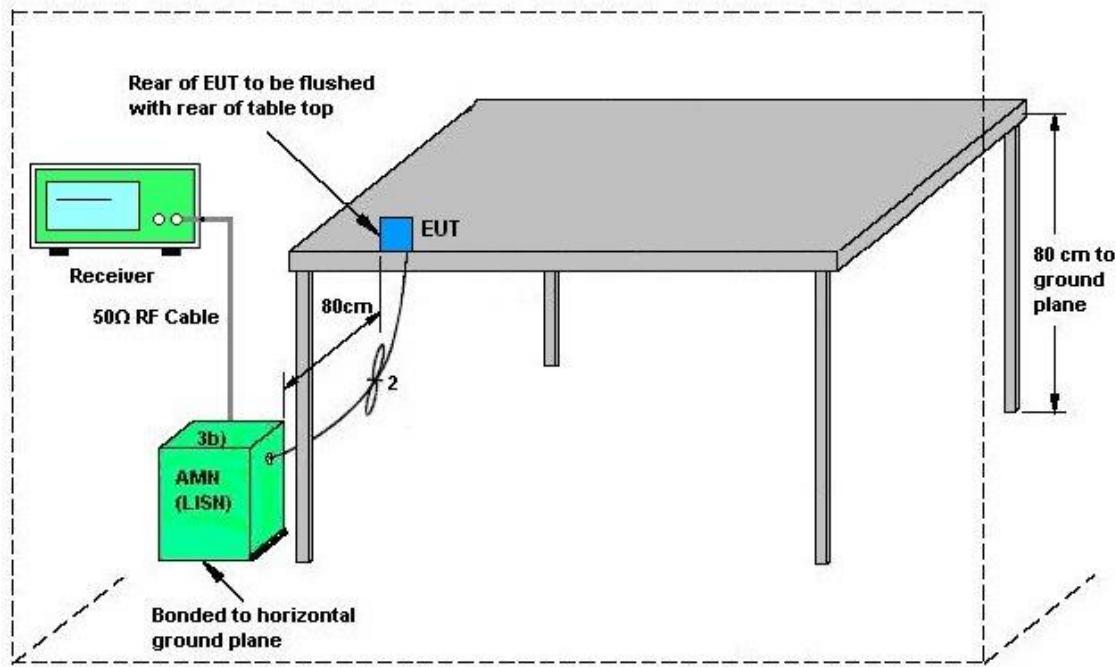
3.6.2 Measuring Instruments

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

3.6.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.6.4 Test Setup



AMN = Artificial mains network (LISN)

AE = Associated equipment

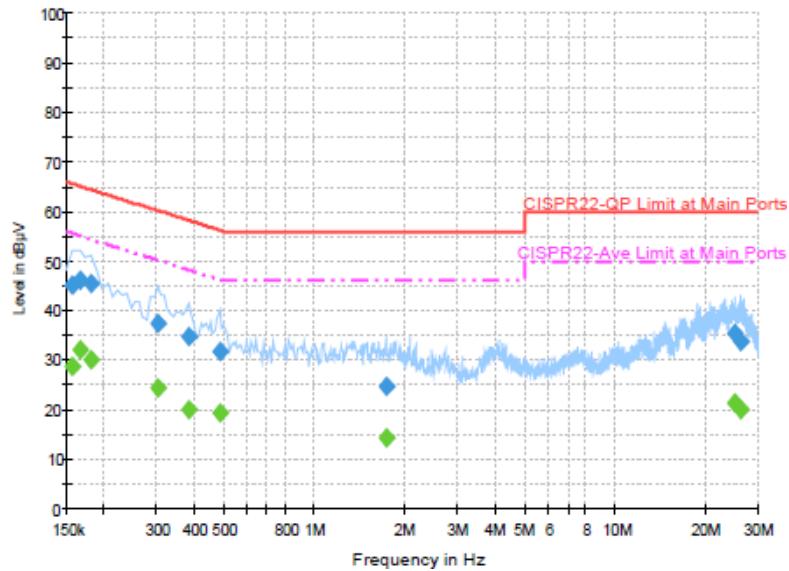
EUT = Equipment under test

ISH = Impedance stabilization network

3.6.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	23~25°C																																																								
Test Engineer :	Eric Jeng	Relative Humidity :	56~60%																																																								
Test Voltage :	120Vac / 60Hz	Phase :	Line																																																								
Function Type :	WLAN (2.4GHz) Link + Bluetooth Link + H-Pattern + Earphone + Micro SD Card + USB Cable(Charging from Adapter)																																																										
Final Result : Quasi-Peak <table border="1"> <thead> <tr> <th>Frequency (MHz)</th> <th>Quasi-Peak (dBμV)</th> <th>Filter</th> <th>Line</th> <th>Corr. (dB)</th> <th>Margin (dB)</th> <th>Limit (dBμV)</th> </tr> </thead> <tbody> <tr><td>0.150000</td><td>42.0</td><td>Off</td><td>L1</td><td>19.5</td><td>24.0</td><td>66.0</td></tr> <tr><td>0.174000</td><td>46.3</td><td>Off</td><td>L1</td><td>19.5</td><td>18.5</td><td>64.8</td></tr> <tr><td>0.294000</td><td>36.3</td><td>Off</td><td>L1</td><td>19.5</td><td>24.1</td><td>60.4</td></tr> <tr><td>0.318000</td><td>36.6</td><td>Off</td><td>L1</td><td>19.5</td><td>23.2</td><td>59.8</td></tr> <tr><td>0.382000</td><td>35.2</td><td>Off</td><td>L1</td><td>19.5</td><td>23.0</td><td>58.2</td></tr> <tr><td>0.494000</td><td>33.0</td><td>Off</td><td>L1</td><td>19.4</td><td>23.1</td><td>56.1</td></tr> <tr><td>3.862000</td><td>25.7</td><td>Off</td><td>L1</td><td>19.7</td><td>30.3</td><td>56.0</td></tr> </tbody> </table>				Frequency (MHz)	Quasi-Peak (dB μ V)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	0.150000	42.0	Off	L1	19.5	24.0	66.0	0.174000	46.3	Off	L1	19.5	18.5	64.8	0.294000	36.3	Off	L1	19.5	24.1	60.4	0.318000	36.6	Off	L1	19.5	23.2	59.8	0.382000	35.2	Off	L1	19.5	23.0	58.2	0.494000	33.0	Off	L1	19.4	23.1	56.1	3.862000	25.7	Off	L1	19.7	30.3	56.0
Frequency (MHz)	Quasi-Peak (dB μ V)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)																																																					
0.150000	42.0	Off	L1	19.5	24.0	66.0																																																					
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3.862000	25.7	Off	L1	19.7	30.3	56.0																																																					
Final Result : Average <table border="1"> <thead> <tr> <th>Frequency (MHz)</th> <th>Average (dBμV)</th> <th>Filter</th> <th>Line</th> <th>Corr. (dB)</th> <th>Margin (dB)</th> <th>Limit (dBμV)</th> </tr> </thead> <tbody> <tr><td>0.150000</td><td>27.9</td><td>Off</td><td>L1</td><td>19.5</td><td>28.1</td><td>56.0</td></tr> <tr><td>0.174000</td><td>32.3</td><td>Off</td><td>L1</td><td>19.5</td><td>22.5</td><td>54.8</td></tr> <tr><td>0.294000</td><td>25.5</td><td>Off</td><td>L1</td><td>19.5</td><td>24.9</td><td>50.4</td></tr> <tr><td>0.318000</td><td>25.9</td><td>Off</td><td>L1</td><td>19.5</td><td>23.9</td><td>49.8</td></tr> <tr><td>0.382000</td><td>25.5</td><td>Off</td><td>L1</td><td>19.5</td><td>22.7</td><td>48.2</td></tr> <tr><td>0.494000</td><td>23.2</td><td>Off</td><td>L1</td><td>19.4</td><td>22.9</td><td>46.1</td></tr> <tr><td>3.862000</td><td>15.5</td><td>Off</td><td>L1</td><td>19.7</td><td>30.5</td><td>46.0</td></tr> </tbody> </table>				Frequency (MHz)	Average (dB μ V)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	0.150000	27.9	Off	L1	19.5	28.1	56.0	0.174000	32.3	Off	L1	19.5	22.5	54.8	0.294000	25.5	Off	L1	19.5	24.9	50.4	0.318000	25.9	Off	L1	19.5	23.9	49.8	0.382000	25.5	Off	L1	19.5	22.7	48.2	0.494000	23.2	Off	L1	19.4	22.9	46.1	3.862000	15.5	Off	L1	19.7	30.5	46.0
Frequency (MHz)	Average (dB μ V)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)																																																					
0.150000	27.9	Off	L1	19.5	28.1	56.0																																																					
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0.318000	25.9	Off	L1	19.5	23.9	49.8																																																					
0.382000	25.5	Off	L1	19.5	22.7	48.2																																																					
0.494000	23.2	Off	L1	19.4	22.9	46.1																																																					
3.862000	15.5	Off	L1	19.7	30.5	46.0																																																					

Test Mode :	Mode 1	Temperature :	23~25°C
Test Engineer :	Eric Jeng	Relative Humidity :	56~60%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	WLAN (2.4GHz) Link + Bluetooth Link + H-Pattern + Earphone + Micro SD Card + USB Cable(Charging from Adapter)		



Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dB μ V)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.158000	45.3	Off	N	19.5	20.3	65.6
0.166000	46.3	Off	N	19.4	18.9	65.2
0.182000	45.6	Off	N	19.5	18.8	64.4
0.302000	37.4	Off	N	19.5	22.8	60.2
0.382000	34.8	Off	N	19.5	23.4	58.2
0.486000	31.6	Off	N	19.5	24.6	56.2
1.734000	24.9	Off	N	19.6	31.1	56.0
25.230000	35.5	Off	N	20.1	24.5	60.0
26.310000	33.8	Off	N	20.2	26.2	60.0

Final Result : Average

Frequency (MHz)	Average (dB μ V)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.158000	28.9	Off	N	19.5	26.7	55.6
0.166000	32.2	Off	N	19.4	23.0	55.2
0.182000	30.0	Off	N	19.5	24.4	54.4
0.302000	24.4	Off	N	19.5	25.8	50.2
0.382000	20.0	Off	N	19.5	28.2	48.2
0.486000	19.4	Off	N	19.5	26.8	46.2
1.734000	14.4	Off	N	19.6	31.6	46.0
25.230000	21.5	Off	N	20.1	28.5	50.0
26.310000	20.1	Off	N	20.2	29.9	50.0

3.7 Antenna Requirements

3.7.1 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.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 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	May 09, 2015~May 12, 2015	Jan. 13, 2016	Conducted (TH02-HY)
Power Sensor	Agilent	E9327A	US40441548	300MHz~40GHz	Jan. 14, 2015	May 09, 2015~May 12, 2015	Jan. 13, 2016	Conducted (TH02-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100057	9kHz-40GHz	Oct. 17, 2014	May 09, 2015~May 12, 2015	Oct. 16, 2015	Conducted (TH02-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jul. 28, 2014	Jun. 16, 2015	Jul. 27, 2015	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 03, 2014	Jun. 16, 2015	Nov. 02, 2015	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Nov. 24, 2014	Jun. 16, 2015	Nov. 23, 2015	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D	35414	30MHz~1GHz	Oct. 24, 2014	Jun. 16, 2015	Oct. 23, 2015	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 03, 2014	Jun. 16, 2015	Oct. 02, 2015	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 20, 2014	Jun. 16, 2015	Nov. 19, 2015	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Sep. 24, 2014	Jun. 16, 2015	Sep. 23, 2015	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Jun. 16, 2015	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0-360 degree	N/A	Jun. 16, 2015	N/A	Radiation (03CH11-HY)
Preamplifier	MITEQ	JS44-180040 00-33-8P	1840917	18GHz ~ 40GHz	Jun. 02, 2015	Jun. 16, 2015	Jun. 01, 2016	Radiation (03CH11-HY)
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100356	9kHz – 2.75GHz	Dec. 01, 2014	Jun. 15, 2015	Nov. 30, 2015	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Dec. 02, 2014	Jun. 15, 2015	Dec. 01, 2015	Conduction (CO05-HY)
AC Power Source()	ChainTek	APC-1000W	N/A	N/A	N/A	Jun. 15, 2015	N/A	Conduction (CO05-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	2.26
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	4.90
--	-------------

Appendix A. Radiated Spurious Emission

Test Engineer :	Derreck Chen and Jesse Wang	Temperature :	23~25°C
		Relative Humidity :	46~48%

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency (MHz)	Level (dB μ V/m)	Over Limit (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	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		2361.57	50.89	-23.11	74	51.85	27.14	5.95	34.05	288	309	P	H
		2383.71	41.8	-12.2	54	42.64	27.19	6.01	34.04	288	309	A	H
	*	2402	94.27	-	-	95.07	27.23	6.01	34.04	288	309	P	H
	*	2402	93.73	-	-	94.53	27.23	6.01	34.04	288	309	A	H
													H
													H
		2366.43	50.43	-23.57	74	51.32	27.14	6.01	34.04	108	287	P	V
		2361.84	41.55	-12.45	54	42.51	27.14	5.95	34.05	108	287	A	V
	*	2402	93.39	-	-	94.19	27.23	6.01	34.04	108	287	P	V
	*	2402	92.88	-	-	93.68	27.23	6.01	34.04	108	287	A	V
													V
													V
BLE CH 19 2440MHz		2357.79	51.52	-22.48	74	52.48	27.14	5.95	34.05	349	313	P	H
		2373.27	41.82	-12.18	54	42.66	27.19	6.01	34.04	349	313	A	H
	*	2439.746	95.27	-	-	95.89	27.37	6.04	34.03	349	313	P	H
	*	2439.997	94.7	-	-	95.32	27.37	6.04	34.03	349	313	A	H
		2485.04	51.08	-22.92	74	51.54	27.46	6.09	34.01	349	313	P	H
		2485.24	42.27	-11.73	54	42.73	27.46	6.09	34.01	349	313	A	H
		2348.97	51.11	-22.89	74	52.11	27.1	5.95	34.05	114	276	P	V
		2375.61	41.7	-12.3	54	42.54	27.19	6.01	34.04	114	276	A	V
	*	2440.247	94.63	-	-	95.25	27.37	6.04	34.03	114	276	P	V
	*	2440.08	94.07	-	-	94.69	27.37	6.04	34.03	114	276	A	V
		2498	51.92	-22.08	74	52.33	27.5	6.09	34	114	276	P	V
		2490.76	42.21	-11.79	54	42.63	27.5	6.09	34.01	114	276	A	V

BLE CH 39 2480MHz	*	2480	96.23	-	-	96.71	27.46	6.07	34.01	379	296	P	H	
	*	2480	94.69	-	-	95.17	27.46	6.07	34.01	379	296	A	H	
		2494.52	51.85	-22.15	74	52.26	27.5	6.09	34	379	296	P	H	
		2497.4	42.47	-11.53	54	42.88	27.5	6.09	34	379	296	A	H	
													H	
													H	
	*	2480	94.02	-	-	94.5	27.46	6.07	34.01	101	272	P	V	
	*	2480.076	93.48	-	-	93.96	27.46	6.07	34.01	101	272	A	V	
		2490.64	51.29	-22.71	74	51.71	27.5	6.09	34.01	101	272	P	V	
		2488.32	42.38	-11.62	54	42.8	27.5	6.09	34.01	101	272	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	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
		(MHz)	(dB μ V/m)	Limit (dB)	Line (dB μ V/m)	Level (dB μ V)	Factor (dB/m)	Loss (dB)	Factor (dB)	Pos (cm)	Pos (deg)	Avg. (P/A)	(H/V)
BLE CH 00 2402MHz		4804	44.56	-29.44	74	38.16	31.3	8.65	33.55	100	0	P	H
													H
													H
													H
		4804	45.2	-28.8	74	38.8	31.3	8.65	33.55	100	0	P	V
													V
													V
													V
BLE CH 19 2440MHz		4880	44.67	-29.33	74	38.11	31.41	8.69	33.54	100	0	P	H
		7320	50.74	-23.26	74	38.49	36.32	10.39	34.46	100	0	P	H
													H
		4880	46.1	-27.9	74	39.54	31.41	8.69	33.54	100	0	P	V
		7320	49.55	-24.45	74	37.3	36.32	10.39	34.46	100	0	P	V
													V
													V
													V
BLE CH 39 2480MHz		4960	45.21	-28.79	74	38.42	31.54	8.79	33.54	100	0	P	H
		7440	49.22	-24.78	74	36.63	36.59	10.52	34.52	100	0	P	H
													H
		4960	45.58	-28.42	74	38.79	31.54	8.79	33.54	100	0	P	V
		7440	49.42	-24.58	74	36.83	36.59	10.52	34.52	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 (MHz)	Level (dB μ V/m)	Over Limit (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
2.4GHz BLE LF		52.95	6.93	-33.07	40	31.02	6.67	1.04	31.8	-	-	P	H
		165.54	13.88	-29.62	43.5	34.95	9.07	1.64	31.78	-	-	P	H
		282.18	13.85	-32.15	46	31.13	12.54	1.94	31.76	-	-	P	H
		341.3	12.58	-33.42	46	28.34	13.85	2.17	31.78	-	-	P	H
		640.9	18.6	-27.4	46	28.58	19.1	2.96	32.04	-	-	P	H
		856.5	20.67	-25.33	46	28.74	20.14	3.44	31.65	185	25	P	H
													H
													H
													H
													H
													H
													H
													H
													H
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	Peak or Average
H/V	Horizontal or Vertical

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

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dB μ V/m)	Over Limit (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak (P/A)	Avg. (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

$$1. \text{ Level(dB}\mu\text{V/m)} =$$

$$= \text{Antenna Factor(dB/m)} + \text{Cable Loss(dB)} + \text{Read Level(dB}\mu\text{V)} - \text{Preamp Factor(dB)}$$

$$2. \text{ Over Limit(dB)} = \text{Level(dB}\mu\text{V/m)} - \text{Limit Line(dB}\mu\text{V/m)}$$

For Peak Limit @ 2390MHz:

$$1. \text{ Level(dB}\mu\text{V/m)}$$

$$= \text{Antenna Factor(dB/m)} + \text{Cable Loss(dB)} + \text{Read Level(dB}\mu\text{V)} - \text{Preamp Factor(dB)}$$

$$= 32.22(\text{dB/m}) + 4.58(\text{dB}) + 54.51(\text{dB}\mu\text{V}) - 35.86 (\text{dB})$$

$$= 55.45 (\text{dB}\mu\text{V/m})$$

$$2. \text{ Over Limit(dB)}$$

$$= \text{Level(dB}\mu\text{V/m)} - \text{Limit Line(dB}\mu\text{V/m)}$$

$$= 55.45(\text{dB}\mu\text{V/m}) - 74(\text{dB}\mu\text{V/m})$$

$$= -18.55(\text{dB})$$

For Average Limit @ 2390MHz:

$$1. \text{ Level(dB}\mu\text{V/m)}$$

$$= \text{Antenna Factor(dB/m)} + \text{Cable Loss(dB)} + \text{Read Level(dB}\mu\text{V)} - \text{Preamp Factor(dB)}$$

$$= 32.22(\text{dB/m}) + 4.58(\text{dB}) + 42.6(\text{dB}\mu\text{V}) - 35.86 (\text{dB})$$

$$= 43.54 (\text{dB}\mu\text{V/m})$$

$$2. \text{ Over Limit(dB)}$$

$$= \text{Level(dB}\mu\text{V/m)} - \text{Limit Line(dB}\mu\text{V/m)}$$

$$= 43.54(\text{dB}\mu\text{V/m}) - 54(\text{dB}\mu\text{V/m})$$

$$= -10.46(\text{dB})$$

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