

# ISED C2PC Test Report

**IC** : 3147A-SU60SOMC  
**Equipment** : 802.11ac Professional Wi-Fi + BT5.0 Module  
**Model No.** : SU60-SOMC (453-00003)  
SU60-SOMC-2G (453-00004)  
(please refer to section 1.1.1 for more details.)  
**Brand Name** : Laird Connectivity  
**Applicant** : Laird Connectivity, LLC  
**Address** : W66N220 Commerce Court Cedarburg WI  
53012 United States Of America (Excluding  
The States Of Alaska)  
**Manufacturer** : Laird Connectivity, LLC  
**Address** : W66N220 Commerce Court, Cedarburg,  
Wisconsin 53012, USA  
**Standard** : RSS-247 Issue 2 February 2017  
**Received Date** : Aug. 26, 2021  
**Tested Date** : Aug. 31 ~ Sep. 02, 2021

We, International Certification Corporation, would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:

  
Along Chen / Assistant Manager

Approved by:

  
Gary Chang / Manager



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## Release Record

Report No.	Version	Description	Issued Date
CR841101-05AE	Rev. 01	Initial issue	Oct. 05, 2021

## Summary of Test Results

IC Rules	Test Items	Measured	Result
RSS-Gen Section 8.8	AC Power Line Conducted Emissions	[dBuV]: 0.402MHz 35.05 (Margin -12.76dB) - AV	Pass
RSS-247 Section 5.5 RSS-Gen Section 8.9	Radiated Emissions	[dBuV/m at 3m]: 46.49MHz 30.85 (Margin -9.15dB) - PK	Pass
RSS-247 Section 5.4 (d)	Maximum Output Power	Power [dBm]: 8.50	Pass
N/A	Antenna Requirement	Meet the requirement of limit	Pass

### Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

### Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

# 1 General Description

## 1.1 Information

This is a Class II Permissive Change report (C2PC).

This report is issued as a supplementary report to the original project no. CR841101AE. The modification is concerned with following:

- ✧ Revised brand name, Applicant and address.
- ✧ Changed U1 to RT5170A for lower suspend mode current.
- ✧ Added C87 for solve the co-location issue with LTE.

Therefore, related test items had been performed and presented in the following sections.

### 1.1.1 Product Details

The following models are provided to this EUT.

Brand Name	Model Name	Product Name	Description
Laird Connectivity	SU60-SOMC (453-00003)	802.11ac Professional Wi-Fi + BT5.0 Module	2G/1G MCP
	SU60-SOMC-2G (453-00004)		4G/2G MCP
★ The above models, both options were assessed and <b>SU60-SOMC-2G (453-00004)</b> was found to be worst case and was selected for the final testing.			

### 1.1.2 Specification of the Equipment under Test (EUT)

RF General Information				
Frequency Range (MHz)	Bluetooth Mode	Ch. Freq. (MHz)	Channel Number	Data Rate
2400-2483.5	V4.2 LE	2402-2480	0-39 [40]	1 Mbps
Note 1: Bluetooth LE (Low energy) uses GFSK modulation.				

### 1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	3.3Vdc from host
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### 1.1.4 Test Sample Information

Serial Number of Test Sample	Radiated Emission: 453-00003 AC Power Line Conducted Emission: 453-00003 Antenna Port Conducted: 453-00003
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### 1.1.5 Accessories

Brand	Model	Type	Connector	Gain (dBi)
LSR	001-0009	Dipole	IPEX U.FL	2
Laird	NanoBlade-IP04	PCB Dipole	IPEX U.FL	2
Laird	MAF95310 Mini NanoBlade Flex	PCB Dipole	IPEX U.FL	2.79
LSR	FlexPIFA 001-0016	PIFA	IPEX U.FL	2.5
Ethertronics	WLAN_1000146	Magnetic Dipole	IPEX U.FL	2.5
Laird	MIMO FlexPIFA Antenna	PIFA	IPEX U.FL	2
LSR	001-0009 (with filter)	Dipole	IPEX U.FL	2

### 1.1.6 Accessories

Accessories		
No.	Equipment	Description
1	AC Adapter	Brand Name: I.T.E POWER SUPPLY Model Name: MU12AY120100-A1 Power Rating: I/P: 100-240Vac, 50/60Hz, 0.3A O/P: 12Vdc, 1A Power Line: 1.48m non-shielded cable w/o core

### 1.1.7 Channel List

Frequency band (MHz)				2400~2483.5			
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
37	2402	9	2422	18	2442	28	2462
0	2404	10	2424	19	2444	29	2464
1	2406	38	2426	20	2446	30	2466
2	2408	11	2428	21	2448	31	2468
3	2410	12	2430	22	2450	32	2470
4	2412	13	2432	23	2452	33	2472
5	2414	14	2434	24	2454	34	2474
6	2416	15	2436	25	2456	35	2476
7	2418	16	2438	26	2458	36	2478
8	2420	17	2440	27	2460	39	2480

### 1.1.8 Test Tool and Duty Cycle

Test tool	Putty, Version:0.60.0.0
Duty cycle of test signal (%)	64.35%
Duty Factor (dB)	1.91

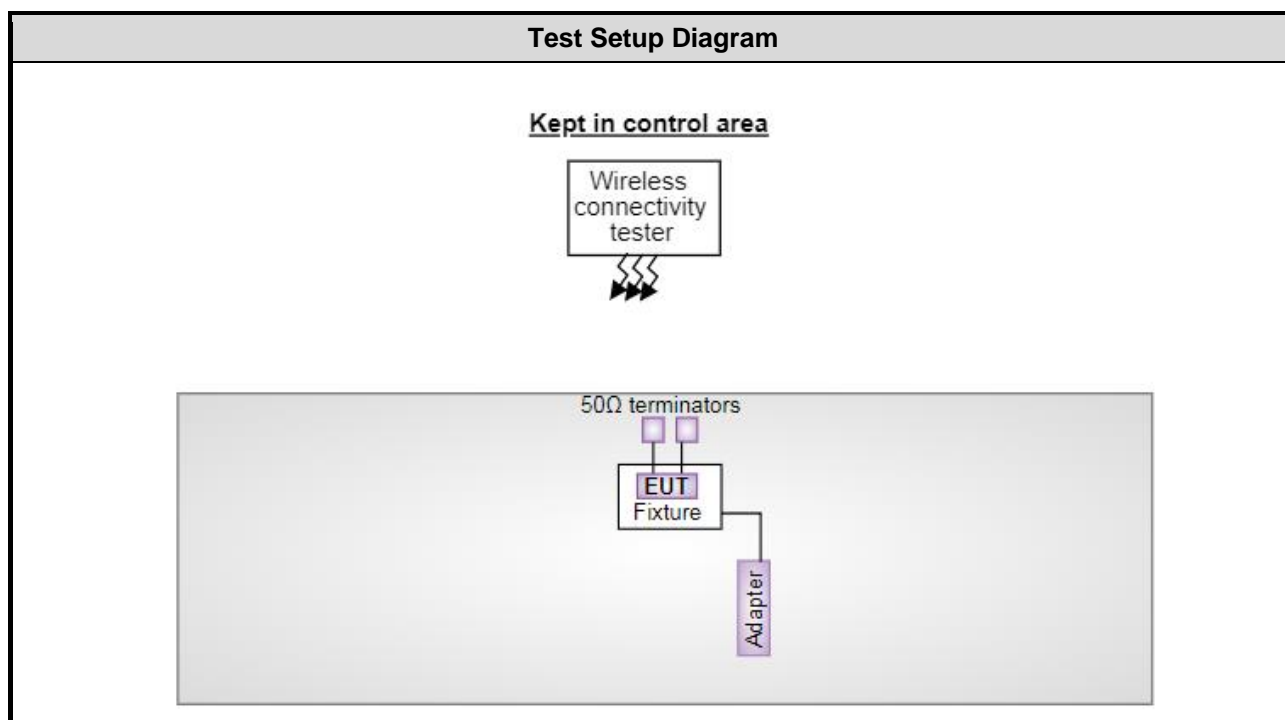
### 1.1.9 Power Index of Test Tool

Modulation Mode	Test Frequency (MHz)		
	2402	2440	2480
BT LE-1Mbps	default	default	default

## 1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Wireless connectivity tester	R&S	CMW270	DoC	---

## 1.3 Test Setup Chart



## 1.4 Test Equipment List and Calibration Data

<b>Test Item</b>	Conducted Emission				
<b>Test Site</b>	Conduction room 1 / (CO01-WS)				
<b>Tested Date</b>	Sep. 02, 2021				
<b>Instrument</b>	<b>Brand</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Calibration Date</b>	<b>Calibration Until</b>
Receiver	R&S	ESR3	101658	Feb. 08, 2021	Feb. 07, 2022
LISN	R&S	ENV216	101579	Mar. 17, 2021	Mar. 16, 2022
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 21, 2020	Oct. 20, 2021
Measurement Software	AUDIX	e3	6.120210k	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

<b>Test Item</b>	Radiated Emission				
<b>Test Site</b>	966 chamber1 / (03CH01-WS)				
<b>Tested Date</b>	Aug. 31, 2021				
<b>Instrument</b>	<b>Brand</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Calibration Date</b>	<b>Calibration Until</b>
Receiver	R&S	ESR3	101657	Mar. 12, 2021	Mar. 11, 2022
Spectrum Analyzer	R&S	FSV40	101498	Dec. 04, 2020	Dec. 03, 2021
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 17, 2020	Nov. 16, 2021
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jun. 30, 2021	Jun. 29, 2022
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 11, 2020	Dec. 10, 2021
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170508	Dec. 31, 2020	Dec. 30, 2021
Preamplifier	EMC	EMC02325	980225	Jun. 29, 2021	Jun. 28, 2022
Preamplifier	Agilent	83017A	MY39501308	Sep. 26, 2020	Sep. 25, 2021
Preamplifier	EMC	EMC184045B	980192	Jul. 14, 2021	Jul. 13, 2022
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 06, 2020	Oct. 05, 2021
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 06, 2020	Oct. 05, 2021
LF cable 11M	EMC	EMCCFD400-NW-N W-11000	200801	Oct. 06, 2020	Oct. 05, 2021
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	160502	Oct. 06, 2020	Oct. 05, 2021
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 06, 2020	Oct. 05, 2021
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Oct. 06, 2020	Oct. 05, 2021
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					



<b>Test Item</b>	RF Conducted				
<b>Test Site</b>	(TH01-WS)				
<b>Tested Date</b>	Aug. 31, 2021				
<b>Instrument</b>	<b>Brand</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Calibration Date</b>	<b>Calibration Until</b>
Spectrum Analyzer	R&S	FSV40	101063	Apr. 19, 2021	Apr. 18, 2022
Power Meter	Anritsu	ML2495A	1241002	Nov. 04, 2020	Nov. 03, 2021
Power Sensor	Anritsu	MA2411B	1207366	Nov. 04, 2020	Nov. 03, 2021
Measurement Software	Sporton-	SENSE-15247_FS	V5.10.7.11	NA	NA
Wireless connectivity tester	R&S	CMW270	100856	Nov. 02, 2020	Nov. 01, 2021
Note: Calibration Interval of instruments listed above is one year.					

## 1.5 Test Standards

RSS-247 Issue 2 February 2017

RSS-Gen Issue 5 February 2021 Amendment 2

ANSI C63.10-2013

## 1.6 Reference Guidance

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

## 1.7 Deviation from Test Standard and Measurement Procedure

None

## 1.8 Measurement Uncertainty

The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor ( $k=2$ )).

Measurement Uncertainty	
Parameters	Uncertainty
Bandwidth	$\pm 34.130$ Hz
Conducted power	$\pm 0.808$ dB
Power density	$\pm 0.583$ dB
Conducted emission	$\pm 2.715$ dB
AC conducted emission	$\pm 2.92$ dB
Radiated emission $\leq 1$ GHz	$\pm 3.41$ dB
Radiated emission $> 1$ GHz	$\pm 4.59$ dB

## 2 Test Configuration

### 2.1 Testing Facility

<b>Test Laboratory</b>	International Certification Corporation
<b>Test Site</b>	CO01-WS, 03CH01-WS, TH01-WS
<b>Address of Test Site</b>	No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.)

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- ISED#: 10807A
- CAB identifier: TW2732

### 2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Data Rate	Test Configuration
AC Power Line Conducted Emissions Radiated Emissions $\leq$ 1GHz Radiated Emissions $>$ 1GHz	BT LE	2402	1Mbps	---
Band edge	BT LE	2480	1Mbps	---
Maximum Output Power	BT LE	2402, 2440, 2480	1Mbps	---

**NOTE:**

1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **X-plane** results were found as the worst case and were shown in this report.
2. 50Ω terminator is connected to antenna port of EUT for radiated emission measurement.

### 3 Transmitter Test Results

#### 3.1 Conducted Emissions

##### 3.1.1 Limit of Conducted Emissions

Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: \* Decreases with the logarithm of the frequency.

##### 3.1.2 Test Procedures

1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50  $\Omega$  LISN port.
3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
4. This measurement was performed with AC 120V/60Hz

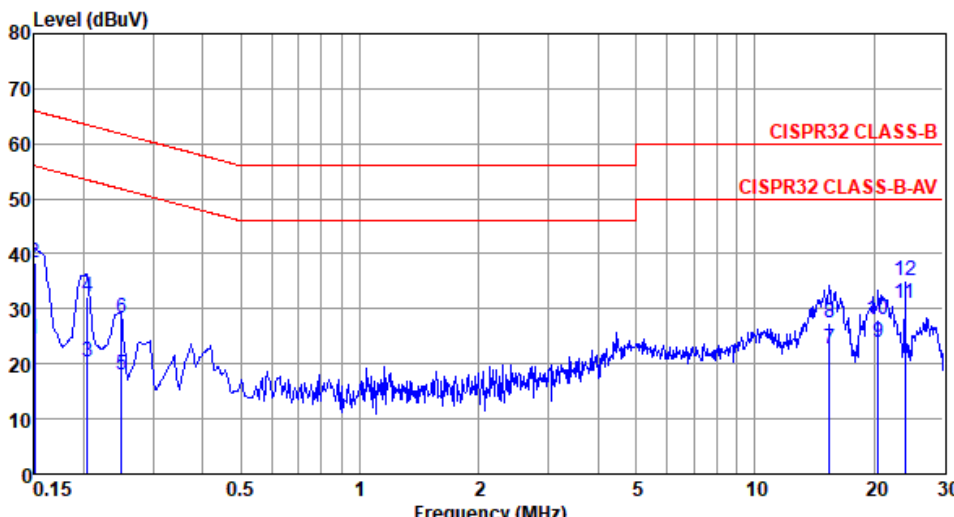
##### 3.1.3 Test Setup



- Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

### 3.1.4 Test Result of Conducted Emissions

Modulation Mode	BT-LE(1Mbps)	Test Freq. (MHz)	2402																																																																																																																					
Power Phase	Line																																																																																																																							
Test by : Joe Liao      Temperature: 22°C      Humidity: 64%																																																																																																																								
<div><div><div>Level (dBUV)</div><div></div><div>Frequency (MHz)</div></div><table><thead><tr><th></th><th>Freq MHz</th><th>Level dBUV</th><th>Limit Line dBUV</th><th>Over Limit dB</th><th>Read Level dBUV</th><th>Factor dB</th><th>Cable loss dB</th><th>Remark</th></tr></thead><tbody><tr><td>1</td><td>0.150</td><td>27.72</td><td>56.00</td><td>-28.28</td><td>17.84</td><td>9.83</td><td>0.05</td><td>Average</td></tr><tr><td>2</td><td>0.150</td><td>41.81</td><td>66.00</td><td>-24.19</td><td>31.93</td><td>9.83</td><td>0.05</td><td>QP</td></tr><tr><td>3</td><td>0.168</td><td>29.51</td><td>55.08</td><td>-25.57</td><td>19.63</td><td>9.83</td><td>0.05</td><td>Average</td></tr><tr><td>4</td><td>0.168</td><td>43.31</td><td>65.08</td><td>-21.77</td><td>33.43</td><td>9.83</td><td>0.05</td><td>QP</td></tr><tr><td>5*</td><td>0.402</td><td>35.05</td><td>47.81</td><td>-12.76</td><td>25.08</td><td>9.89</td><td>0.08</td><td>Average</td></tr><tr><td>6</td><td>0.402</td><td>39.44</td><td>57.81</td><td>-18.37</td><td>29.47</td><td>9.89</td><td>0.08</td><td>QP</td></tr><tr><td>7</td><td>15.470</td><td>24.22</td><td>50.00</td><td>-25.78</td><td>13.41</td><td>10.20</td><td>0.61</td><td>Average</td></tr><tr><td>8</td><td>15.470</td><td>29.36</td><td>60.00</td><td>-30.64</td><td>18.55</td><td>10.20</td><td>0.61</td><td>QP</td></tr><tr><td>9</td><td>19.845</td><td>24.55</td><td>50.00</td><td>-25.45</td><td>13.62</td><td>10.26</td><td>0.67</td><td>Average</td></tr><tr><td>10</td><td>19.845</td><td>29.31</td><td>60.00</td><td>-30.69</td><td>18.38</td><td>10.26</td><td>0.67</td><td>QP</td></tr><tr><td>11</td><td>24.000</td><td>35.28</td><td>50.00</td><td>-14.72</td><td>24.22</td><td>10.37</td><td>0.69</td><td>Average</td></tr><tr><td>12</td><td>24.000</td><td>39.27</td><td>60.00</td><td>-20.73</td><td>28.21</td><td>10.37</td><td>0.69</td><td>QP</td></tr></tbody></table></div>					Freq MHz	Level dBUV	Limit Line dBUV	Over Limit dB	Read Level dBUV	Factor dB	Cable loss dB	Remark	1	0.150	27.72	56.00	-28.28	17.84	9.83	0.05	Average	2	0.150	41.81	66.00	-24.19	31.93	9.83	0.05	QP	3	0.168	29.51	55.08	-25.57	19.63	9.83	0.05	Average	4	0.168	43.31	65.08	-21.77	33.43	9.83	0.05	QP	5*	0.402	35.05	47.81	-12.76	25.08	9.89	0.08	Average	6	0.402	39.44	57.81	-18.37	29.47	9.89	0.08	QP	7	15.470	24.22	50.00	-25.78	13.41	10.20	0.61	Average	8	15.470	29.36	60.00	-30.64	18.55	10.20	0.61	QP	9	19.845	24.55	50.00	-25.45	13.62	10.26	0.67	Average	10	19.845	29.31	60.00	-30.69	18.38	10.26	0.67	QP	11	24.000	35.28	50.00	-14.72	24.22	10.37	0.69	Average	12	24.000	39.27	60.00	-20.73	28.21	10.37	0.69	QP
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Note 1: Level (dBUV) = Read Level (dBUV) + LISN Factor (dB) + Cable Loss (dB). 2: Over Limit (dB) = Level (dBUV) – Limit Line (dBUV).																																																																																																																								

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Test by : Joe Liao      Temperature: 22°C      Humidity: 64%																																																																																																																								
<div><div><div>Level (dBuV)</div><div></div><div>Frequency (MHz)</div></div><table><thead><tr><th></th><th>Freq MHz</th><th>Level dBuV</th><th>Limit Line dBuV</th><th>Over Limit dB</th><th>Read Level dBuV</th><th>Factor dB</th><th>Cable loss dB</th><th>Remark</th></tr></thead><tbody><tr><td>1</td><td>0.150</td><td>24.54</td><td>56.00</td><td>-31.46</td><td>14.67</td><td>9.82</td><td>0.05</td><td>Average</td></tr><tr><td>2</td><td>0.150</td><td>38.49</td><td>66.00</td><td>-27.51</td><td>28.62</td><td>9.82</td><td>0.05</td><td>QP</td></tr><tr><td>3</td><td>0.204</td><td>20.28</td><td>53.45</td><td>-33.17</td><td>10.39</td><td>9.83</td><td>0.06</td><td>Average</td></tr><tr><td>4</td><td>0.204</td><td>32.10</td><td>63.45</td><td>-31.35</td><td>22.21</td><td>9.83</td><td>0.06</td><td>QP</td></tr><tr><td>5</td><td>0.249</td><td>17.90</td><td>51.78</td><td>-33.88</td><td>7.99</td><td>9.84</td><td>0.07</td><td>Average</td></tr><tr><td>6</td><td>0.249</td><td>28.40</td><td>61.78</td><td>-33.38</td><td>18.49</td><td>9.84</td><td>0.07</td><td>QP</td></tr><tr><td>7</td><td>15.470</td><td>22.68</td><td>50.00</td><td>-27.32</td><td>11.83</td><td>10.24</td><td>0.61</td><td>Average</td></tr><tr><td>8</td><td>15.470</td><td>27.36</td><td>60.00</td><td>-32.64</td><td>16.51</td><td>10.24</td><td>0.61</td><td>QP</td></tr><tr><td>9</td><td>20.486</td><td>23.85</td><td>50.00</td><td>-26.15</td><td>12.84</td><td>10.34</td><td>0.67</td><td>Average</td></tr><tr><td>10</td><td>20.486</td><td>28.06</td><td>60.00</td><td>-31.94</td><td>17.05</td><td>10.34</td><td>0.67</td><td>QP</td></tr><tr><td>11*</td><td>24.000</td><td>31.12</td><td>50.00</td><td>-18.88</td><td>19.99</td><td>10.44</td><td>0.69</td><td>Average</td></tr><tr><td>12</td><td>24.000</td><td>35.14</td><td>60.00</td><td>-24.86</td><td>24.01</td><td>10.44</td><td>0.69</td><td>QP</td></tr></tbody></table></div>					Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Remark	1	0.150	24.54	56.00	-31.46	14.67	9.82	0.05	Average	2	0.150	38.49	66.00	-27.51	28.62	9.82	0.05	QP	3	0.204	20.28	53.45	-33.17	10.39	9.83	0.06	Average	4	0.204	32.10	63.45	-31.35	22.21	9.83	0.06	QP	5	0.249	17.90	51.78	-33.88	7.99	9.84	0.07	Average	6	0.249	28.40	61.78	-33.38	18.49	9.84	0.07	QP	7	15.470	22.68	50.00	-27.32	11.83	10.24	0.61	Average	8	15.470	27.36	60.00	-32.64	16.51	10.24	0.61	QP	9	20.486	23.85	50.00	-26.15	12.84	10.34	0.67	Average	10	20.486	28.06	60.00	-31.94	17.05	10.34	0.67	QP	11*	24.000	31.12	50.00	-18.88	19.99	10.44	0.69	Average	12	24.000	35.14	60.00	-24.86	24.01	10.44	0.69	QP
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Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB). 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).																																																																																																																								

## 3.2 RF Output Power

### 3.2.1 Limit of RF Output Power

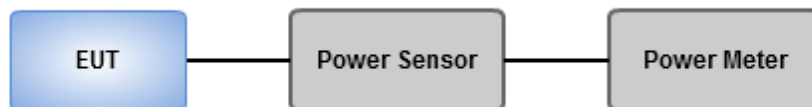
Conducted power shall not exceed 1Watt.

Antenna gain  $\leq 6\text{dBi}$ , no any corresponding reduction is in output power limit.

### 3.2.2 Test Procedures

A broadband RF power meter is used for output power measurement. The video bandwidth of power meter is greater than DTS bandwidth of EUT. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power.

### 3.2.3 Test Setup



### 3.2.4 Test Result of Maximum Output Power

Ambient Condition	24°C / 66%	Tested By	Aska Huang
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#### Summary of Peak Conducted Output Power

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	8.50	0.00708

#### Result

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	2.79	8.50	30.00
2440MHz	Pass	2.79	8.15	30.00
2480MHz	Pass	2.79	7.70	30.00

#### Summary of Conducted (Average) Output Power

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-LE(1Mbps)	8.45	0.00700

#### Result

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-LE(1Mbps)	-	-	-	-
2402MHz	Pass	2.79	8.45	-
2440MHz	Pass	2.79	8.10	-
2480MHz	Pass	2.79	7.68	-

Note: Average power is for reference only.

### 3.3 Emissions in Restricted Frequency Bands

#### 3.3.1 Limit of Emissions in Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

**Note 1:**  
Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

**Note 2:**  
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

#### 3.3.2 Test Procedures

1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

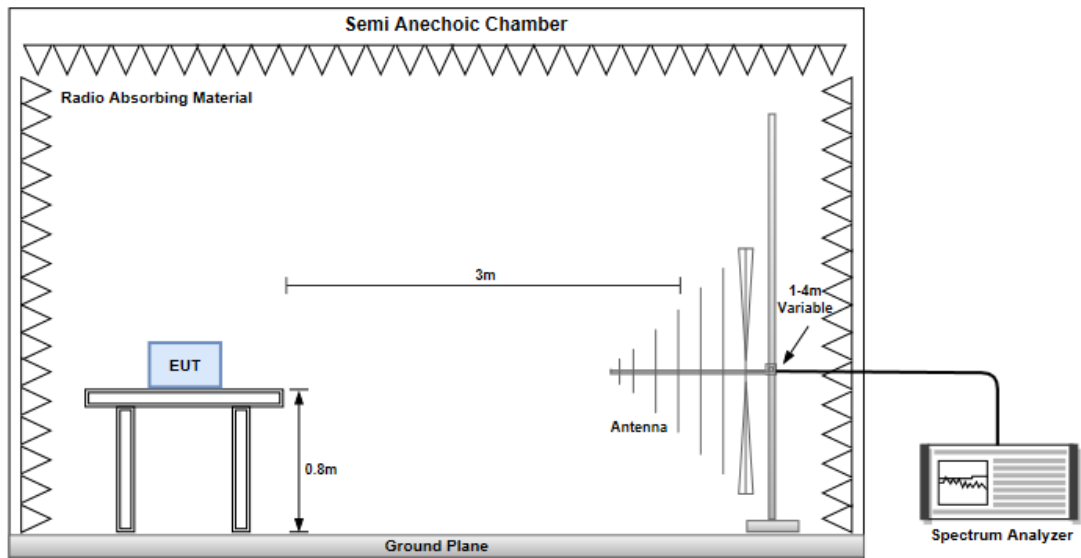
Note:

1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

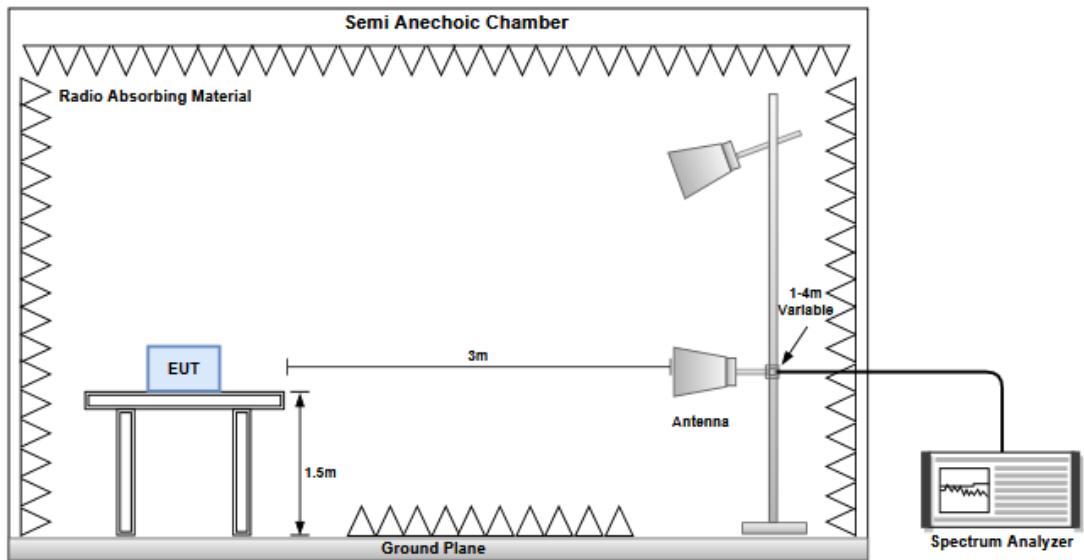


### 3.3.3 Test Setup

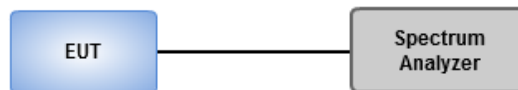
#### Radiated Emissions below 1 GHz



#### Radiated Emissions above 1 GHz



#### Transmitter Conducted Unwanted Emissions (30MHz~40GHz)

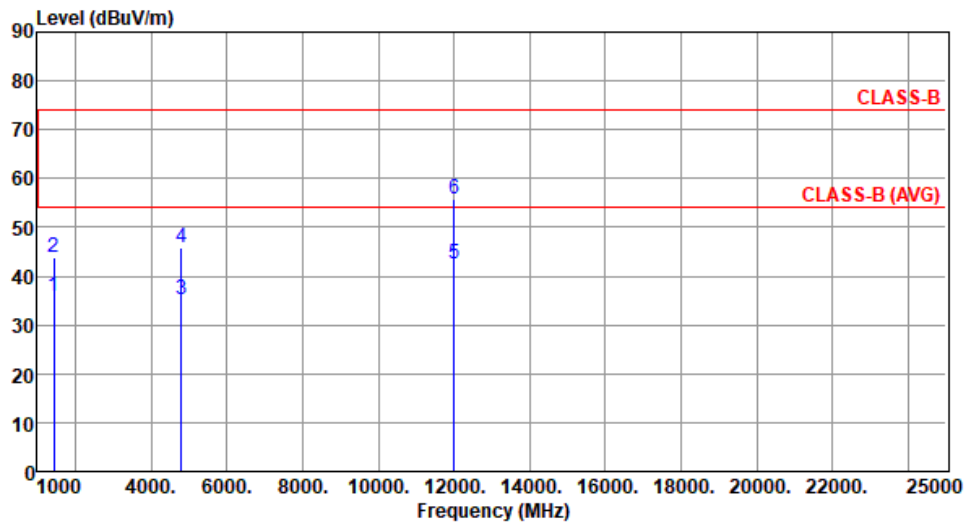


### 3.3.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	BT LE-1Mbps	Test Freq. (MHz)	2402
Polarization	Horizontal		
Test By :Roger Lu      Temperature(°C):25      Humidity(%):66			
<div><div><div>Level (dBuV/m)</div><div><div><div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div>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Modulation	BT LE-1Mbps	Test Freq. (MHz)	2402
Polarization	Vertical		
Test By :Roger Lu      Temperature(°C):25      Humidity(%):66			
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### 3.3.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation	BT LE-1Mbps	Test Freq. (MHz)	2402						
Polarization	Horizontal								
Test By :Roger Lu      Temperature(°C):25      Humidity(%):66									
<div><div>Level (dBuV/m)</div><div></div><div>Frequency (MHz)</div></div>									
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	1440.00	35.86	54.00	-18.14	41.78	-5.92	Average	100	258
2	1440.00	43.85	74.00	-30.15	49.77	-5.92	Peak	100	258
3	4804.00	35.28	54.00	-18.72	31.78	3.50	Average	100	345
4	4804.00	45.79	74.00	-28.21	42.29	3.50	Peak	100	345
5	12010.00	42.55	54.00	-11.45	28.28	14.27	Average	100	30
6	12010.00	55.72	74.00	-18.28	41.45	14.27	Peak	100	30

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor\* (dB/m)  
\*Factor includes antenna factor , cable loss and amplifier gain  
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	BT LE-1Mbps	Test Freq. (MHz)	2402
Polarization	Vertical		
Test By :Roger Lu      Temperature(°C):25      Humidity(%):66			
<div><div><div>Level (dBUV/m)</div><div><div><div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div>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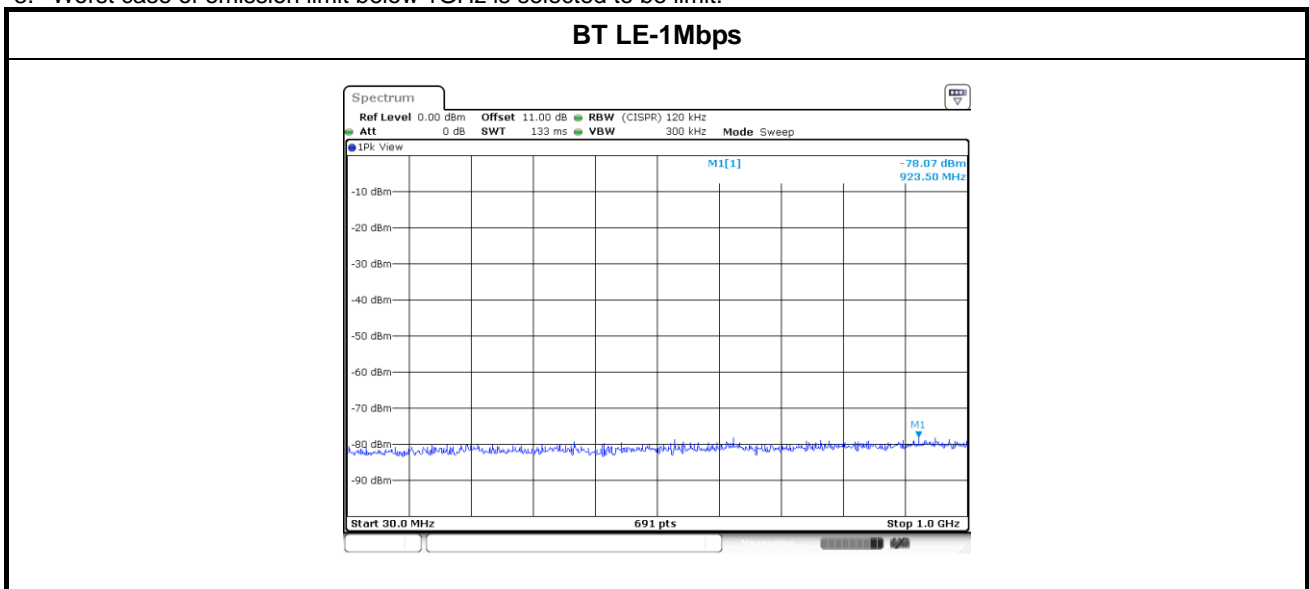
### 3.3.6 Transmitter Conducted Unwanted Emissions (Below 1 GHz)

<b>Ambient Condition</b>	24°C / 66%	<b>Tested By</b>	Aska Huang
--------------------------	------------	------------------	------------

Modulation Mode		BT LE-1Mbps		Frequency	2402MHz	
Range (MHz)	Max Value (dBm)	DG (dBi)	GRF (dB)	EIRP (dBm)	Min E-Field Limit (dBm)	E-Field Margin (dB)
30~1000	-78.07	2.79	4.70	-70.58	-55.20	-15.38

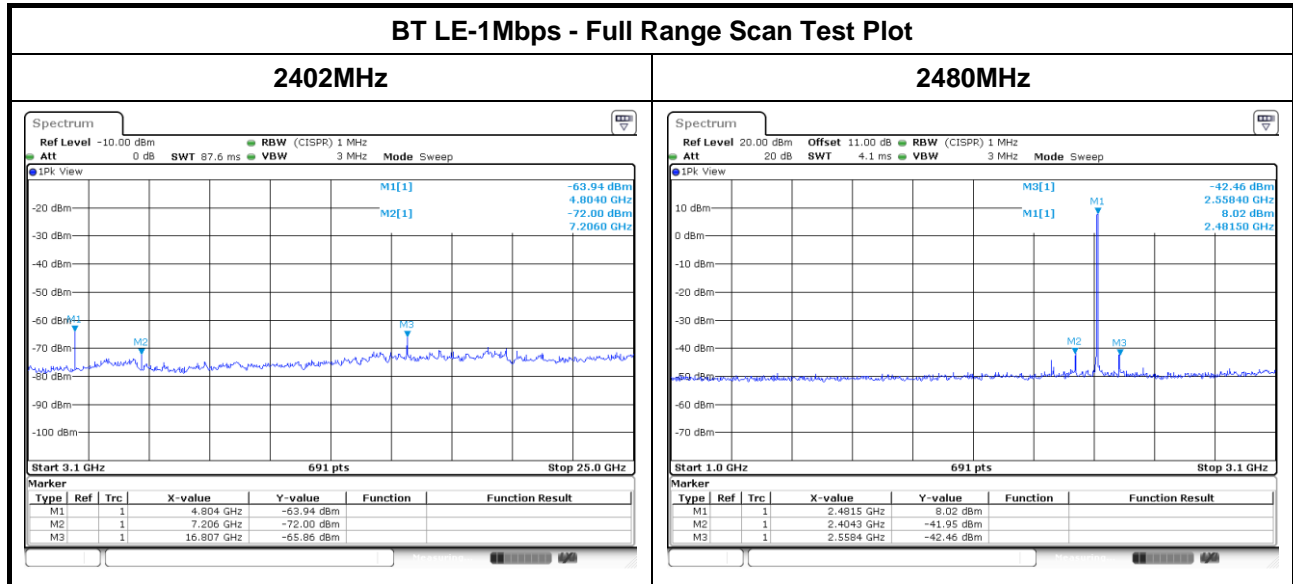
Note:

1. GRF = Ground Reflection Factor.
2. DG = Directional Gain.
3. Worst case of emission limit below 1GHz is selected to be limit.



### 3.3.7 Transmitter Conducted Unwanted Emissions (Above 1GHz)

Ambient Condition	24°C / 66%	Tested By	Aska Huang
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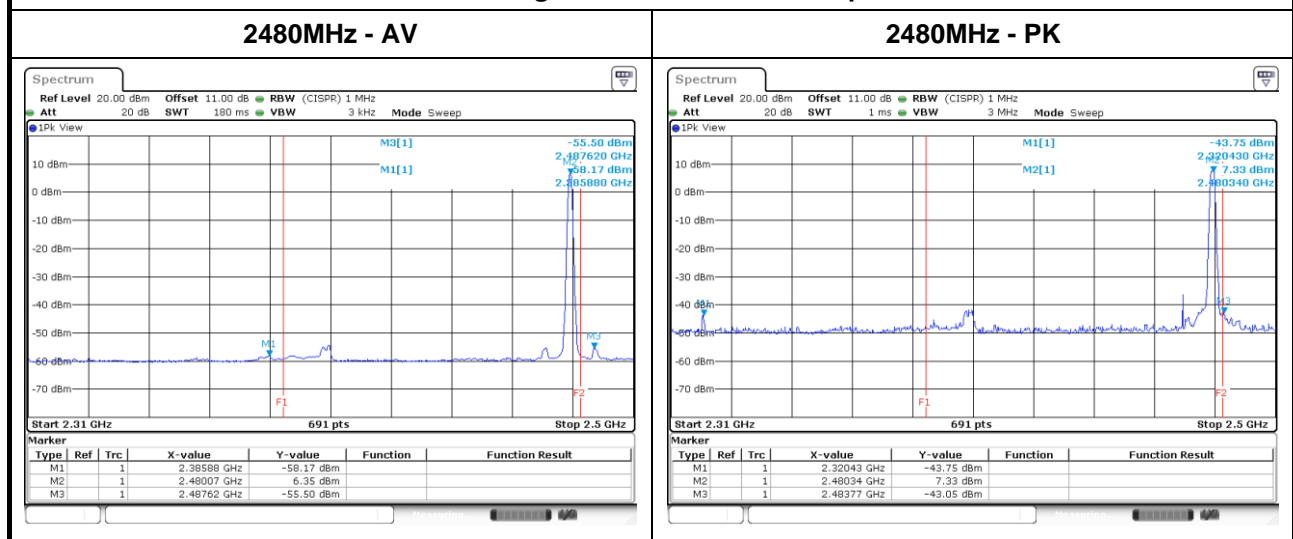


### Transmitter Conducted Unwanted Emissions Results in Band Edge

Modulation Mode		BT LE-1Mbps					
Test ch. Freq. (MHz)	Range (MHz)	Max Value (dBm)	DG (dBi)	EIRP (dBm)	E-Field Limit (dBm)	E-Field Margin (dB)	Remark
2480	2310~2390	-43.75	2.79	-40.96	-21.20	-19.76	PK
	2310~2390	-58.17	2.79	-55.38	-41.20	-14.18	AV
	2483.5~2500	-43.05	2.79	-40.26	-21.20	-19.06	PK
	2483.5~2500	-55.50	2.79	-52.71	-21.20	-31.51	AV

Note: DG = Directional Gain.

### Band Edge Test Plot - BT LE-1Mbps

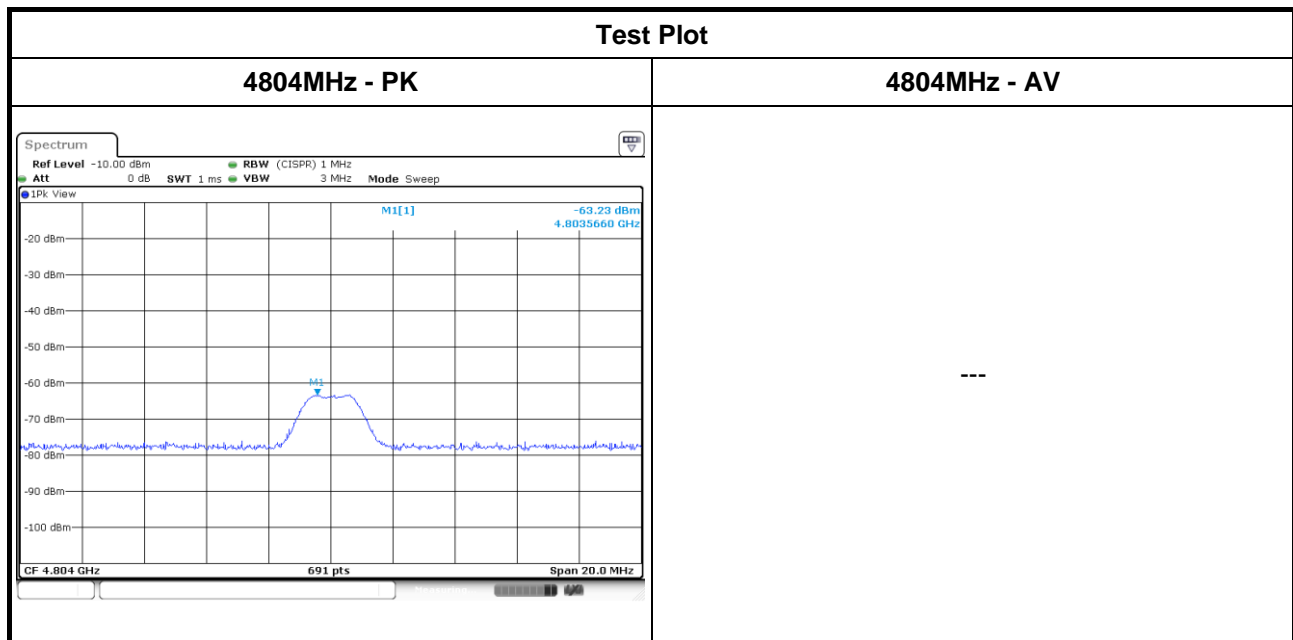




Transmitter Conducted Unwanted Emissions Results in Restricted Frequency Band						
Modulation Mode		BT LE-1Mbps		Frequency	2402MHz	
Freq. (MHz)	Remark	Max Value (dBm)	DG (dBi)	EIRP (dBm)	E-Field Limit (dBuV/m)	E-Field Margin (dB)
4804.00	PK	-63.23	2.79	-60.44	-21.20	-39.24
4804.00	AV	-	2.79	-	-41.20	-

Note:

1. If the PK margin greater than 20 dB, there is no need to get AVG reading.
2. DG = Directional Gain.



## 4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corporation (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <http://www.icertifi.com.tw>.

### **Linkou**

Tel: 886-2-2601-1640

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### **Kwei Shan**

Tel: 886-3-271-8666

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City 33381, Taiwan (R.O.C.)  
No.2-1, Lane 6, Wen San 3rd  
St., Kwei Shan Dist., Tao Yuan  
City 33381, Taiwan (R.O.C.)

### **Kwei Shan Site II**

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St., Kwei Shan Dist., Tao Yuan  
City 333, Taiwan (R.O.C.)

If you have any suggestion, please feel free to contact us as below information.

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Fax: 886-3-318-0155

Email: ICC\_Service@icertifi.com.tw

==END==