

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
CR841101-05AD	Rev. 01	Initial issue	Oct. 05, 2021

Summary of Test Results

IC Rules	Test Items	Measured	Result
RSS-Gen Section 8.8	Conducted Emissions	[dBuV]: 0.402MHz 34.98 (Margin -12.83dB) - AV	Pass
RSS-247 Section 5.5 RSS-Gen Section 8.9	Radiated Emissions	[dBuV/m at 3m]: 45.52MHz 33.94 (Margin -6.06dB) - PK	Pass
RSS-247 Section 5.1(b) RSS-247 Section 5.4(b)	Conducted Output Power	Power [dBm]: 10.73	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. CR841101AD. 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 SU60-SOMC-2G (453-00004) 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. Frequency (MHz)	Channel Number	Data Rate
2400-2483.5	BR V4.2	2402-2480	0-78 [79]	1 Mbps
2400-2483.5	EDR V4.2	2402-2480	0-78 [79]	2 Mbps
2400-2483.5	EDR V4.2	2402-2480	0-78 [79]	3 Mbps
Note 1: RF output power specifies that Maximum Peak Conducted Output Power.				
Note 2: Bluetooth BR uses a GFSK.				
Note 3: Bluetooth EDR uses a combination of $\pi/4$ -DQPSK and 8DPSK.				

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: 453-00004 AC Power Line Conducted Emission: 453-00004 Antenna Port Conducted: 453-00004
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1.1.5 Antenna Details

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)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461	---	---

1.1.8 Test Tool and Duty Cycle

Test Tool	Simulator, Brand: R&S / Model: CMW270		
Duty Cycle and Duty Factor	Mode	Duty cycle (%)	Duty factor (dB)
	GFSK	47.34%	3.25
	$\pi/4$ -DQPSK	47.34%	3.25
	8DPSK	47.34%	3.25

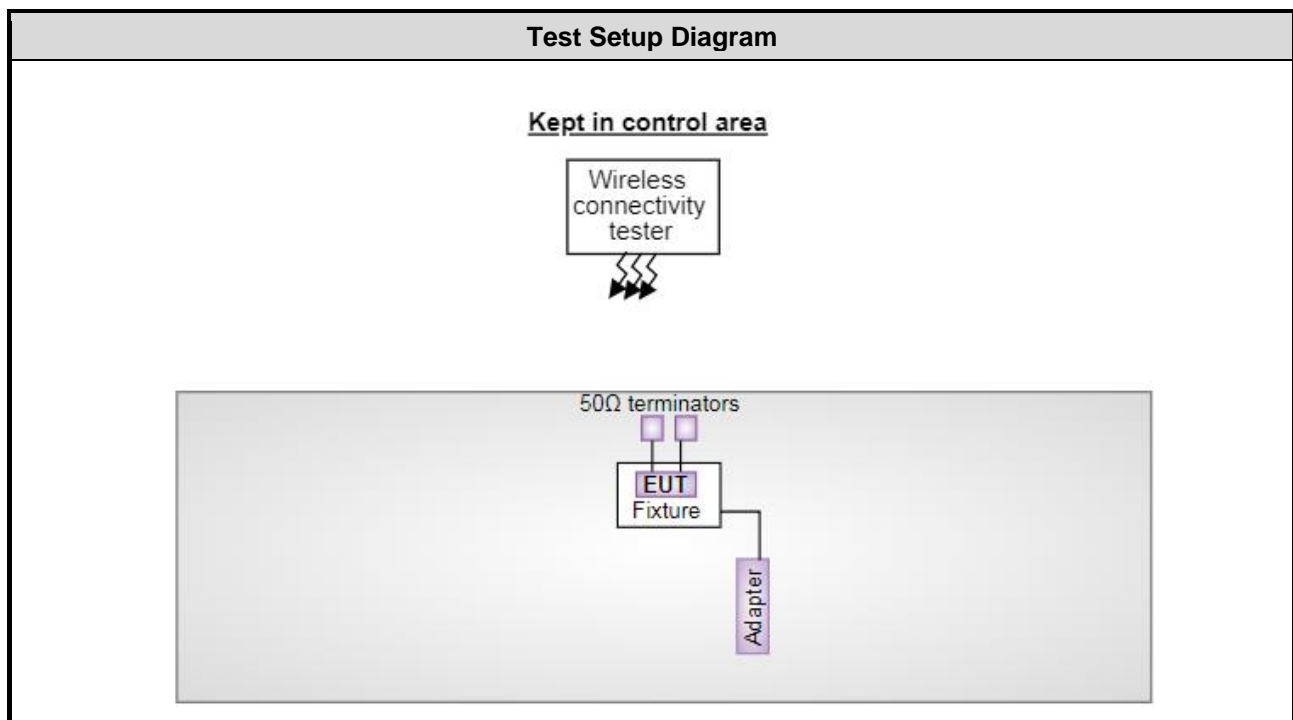
1.1.9 Power Index of Test Tool

Modulation Mode	Test Frequency (MHz)		
	2402	2441	2480
GFSK/1Mbps	default	default	default
$\pi/4$ -DQPSK /2Mbps	default	default	default
8DPSK/3Mbps	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 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Sep. 02, 2021				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
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.					

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Tested Date	Aug. 31, 2021				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
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.					

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Tested Date	Aug. 31, 2021				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
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	± 34.130 Hz
Conducted power	± 0.808 dB
Power density	± 0.583 dB
Conducted emission	± 2.715 dB
AC conducted emission	± 2.92 dB
Radiated emission ≤ 1 GHz	± 3.41 dB
Radiated emission > 1 GHz	± 4.59 dB
Time	$\pm 0.1\%$

2 Test Configuration

2.1 Testing Facility

Test Laboratory	International Certification Corporation
Test Site	CO01-WS, 03CH01-WS, TH01-WS
Address of Test Site	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
- ISSED#: 10807A
- CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Data Rate (Mbps)	Test Configuration
Conducted Emissions Radiated Emissions ≤ 1GHz Radiated Emissions > 1GHz	GFSK	2402	1Mbps	---
Band edge	GFSK	2441	1Mbps	---
Conducted Output Power	GFSK	2402, 2441, 2480	1Mbps	---
	π/4 DQPSK	2402, 2441, 2480	2Mbps	
	8DPSK	2402, 2441, 2480	3Mbps	

NOTE:

- 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.
- 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 Ω 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

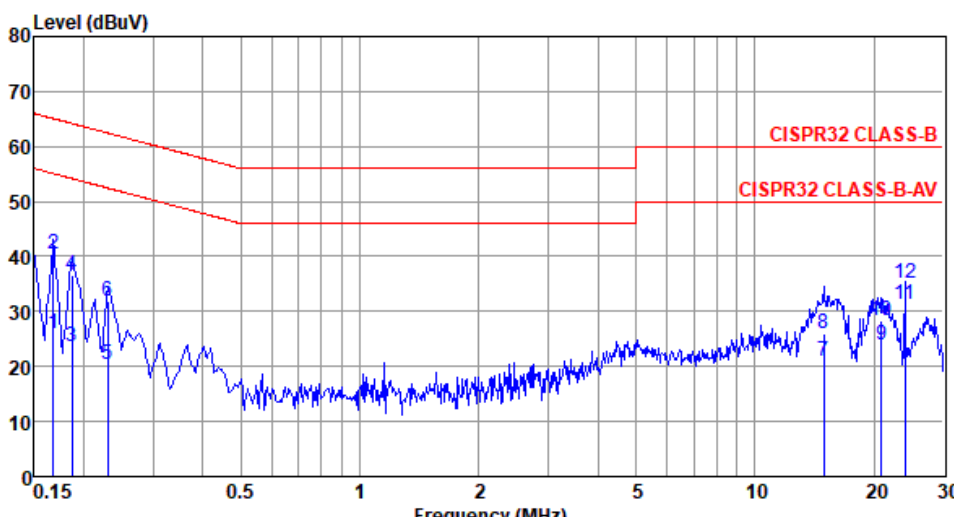
3.1.3 Test Setup



- 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	GFSK	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><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>27.63</td><td>56.00</td><td>-28.37</td><td>17.75</td><td>9.83</td><td>0.05</td><td>Average</td></tr><tr><td>2</td><td>0.150</td><td>41.74</td><td>66.00</td><td>-24.26</td><td>31.86</td><td>9.83</td><td>0.05</td><td>QP</td></tr><tr><td>3</td><td>0.168</td><td>29.53</td><td>55.08</td><td>-25.55</td><td>19.65</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>34.98</td><td>47.81</td><td>-12.83</td><td>25.01</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>15.970</td><td>24.39</td><td>50.00</td><td>-25.61</td><td>13.56</td><td>10.21</td><td>0.62</td><td>Average</td></tr><tr><td>8</td><td>15.970</td><td>29.88</td><td>60.00</td><td>-30.12</td><td>19.05</td><td>10.21</td><td>0.62</td><td>QP</td></tr><tr><td>9</td><td>20.377</td><td>22.02</td><td>50.00</td><td>-27.98</td><td>11.08</td><td>10.27</td><td>0.67</td><td>Average</td></tr><tr><td>10</td><td>20.377</td><td>27.92</td><td>60.00</td><td>-32.08</td><td>16.98</td><td>10.27</td><td>0.67</td><td>QP</td></tr><tr><td>11</td><td>24.000</td><td>35.48</td><td>50.00</td><td>-14.52</td><td>24.42</td><td>10.37</td><td>0.69</td><td>Average</td></tr><tr><td>12</td><td>24.000</td><td>39.66</td><td>60.00</td><td>-20.34</td><td>28.60</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	27.63	56.00	-28.37	17.75	9.83	0.05	Average	2	0.150	41.74	66.00	-24.26	31.86	9.83	0.05	QP	3	0.168	29.53	55.08	-25.55	19.65	9.83	0.05	Average	4	0.168	43.31	65.08	-21.77	33.43	9.83	0.05	QP	5*	0.402	34.98	47.81	-12.83	25.01	9.89	0.08	Average	6	0.402	39.44	57.81	-18.37	29.47	9.89	0.08	QP	7	15.970	24.39	50.00	-25.61	13.56	10.21	0.62	Average	8	15.970	29.88	60.00	-30.12	19.05	10.21	0.62	QP	9	20.377	22.02	50.00	-27.98	11.08	10.27	0.67	Average	10	20.377	27.92	60.00	-32.08	16.98	10.27	0.67	QP	11	24.000	35.48	50.00	-14.52	24.42	10.37	0.69	Average	12	24.000	39.66	60.00	-20.34	28.60	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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<div><div><div>Level (dBUV)</div><div></div><div><table><tr><th></th><th>Freq</th><th>Level</th><th>Limit</th><th>Over</th><th>Read</th><th>Factor</th><th>Cable</th><th></th></tr><tr><th></th><th>MHz</th><th>dBuV</th><th>Line</th><th>Limit</th><th>Level</th><th>dB</th><th>loss</th><th>Remark</th></tr><tr><th></th><th></th><th></th><th>dBuV</th><th>dB</th><th>dBuV</th><th></th><th>dB</th><th></th></tr><tr><td>1</td><td>0.168</td><td>26.03</td><td>55.08</td><td>-29.05</td><td>16.16</td><td>9.82</td><td>0.05</td><td>Average</td></tr><tr><td>2</td><td>0.168</td><td>40.51</td><td>65.08</td><td>-24.57</td><td>30.64</td><td>9.82</td><td>0.05</td><td>QP</td></tr><tr><td>3</td><td>0.186</td><td>23.59</td><td>54.20</td><td>-30.61</td><td>13.70</td><td>9.83</td><td>0.06</td><td>Average</td></tr><tr><td>4</td><td>0.186</td><td>36.75</td><td>64.20</td><td>-27.45</td><td>26.86</td><td>9.83</td><td>0.06</td><td>QP</td></tr><tr><td>5</td><td>0.230</td><td>20.31</td><td>52.44</td><td>-32.13</td><td>10.42</td><td>9.83</td><td>0.06</td><td>Average</td></tr><tr><td>6</td><td>0.230</td><td>32.02</td><td>62.44</td><td>-30.42</td><td>22.13</td><td>9.83</td><td>0.06</td><td>QP</td></tr><tr><td>7</td><td>14.907</td><td>20.86</td><td>50.00</td><td>-29.14</td><td>10.04</td><td>10.22</td><td>0.60</td><td>Average</td></tr><tr><td>8</td><td>14.907</td><td>25.94</td><td>60.00</td><td>-34.06</td><td>15.12</td><td>10.22</td><td>0.60</td><td>QP</td></tr><tr><td>9</td><td>20.924</td><td>23.82</td><td>50.00</td><td>-26.18</td><td>12.79</td><td>10.35</td><td>0.68</td><td>Average</td></tr><tr><td>10</td><td>20.924</td><td>28.47</td><td>60.00</td><td>-31.53</td><td>17.44</td><td>10.35</td><td>0.68</td><td>QP</td></tr><tr><td>11*</td><td>24.000</td><td>31.43</td><td>50.00</td><td>-18.57</td><td>20.30</td><td>10.44</td><td>0.69</td><td>Average</td></tr><tr><td>12</td><td>24.000</td><td>35.10</td><td>60.00</td><td>-24.90</td><td>23.97</td><td>10.44</td><td>0.69</td><td>QP</td></tr></table></div></div></div>					Freq	Level	Limit	Over	Read	Factor	Cable			MHz	dBuV	Line	Limit	Level	dB	loss	Remark				dBuV	dB	dBuV		dB		1	0.168	26.03	55.08	-29.05	16.16	9.82	0.05	Average	2	0.168	40.51	65.08	-24.57	30.64	9.82	0.05	QP	3	0.186	23.59	54.20	-30.61	13.70	9.83	0.06	Average	4	0.186	36.75	64.20	-27.45	26.86	9.83	0.06	QP	5	0.230	20.31	52.44	-32.13	10.42	9.83	0.06	Average	6	0.230	32.02	62.44	-30.42	22.13	9.83	0.06	QP	7	14.907	20.86	50.00	-29.14	10.04	10.22	0.60	Average	8	14.907	25.94	60.00	-34.06	15.12	10.22	0.60	QP	9	20.924	23.82	50.00	-26.18	12.79	10.35	0.68	Average	10	20.924	28.47	60.00	-31.53	17.44	10.35	0.68	QP	11*	24.000	31.43	50.00	-18.57	20.30	10.44	0.69	Average	12	24.000	35.10	60.00	-24.90	23.97	10.44	0.69	QP
	Freq	Level	Limit	Over	Read	Factor	Cable																																																																																																																																			
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1	0.168	26.03	55.08	-29.05	16.16	9.82	0.05	Average																																																																																																																																		
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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 Unwanted Emissions into Restricted Frequency Bands

3.2.1 Limit of Unwanted Emissions into 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:
Quasi-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.

3.2.2 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. Radiated emission above 1GHz / Peak value
RBW=1MHz, VBW=3MHz and Peak detector

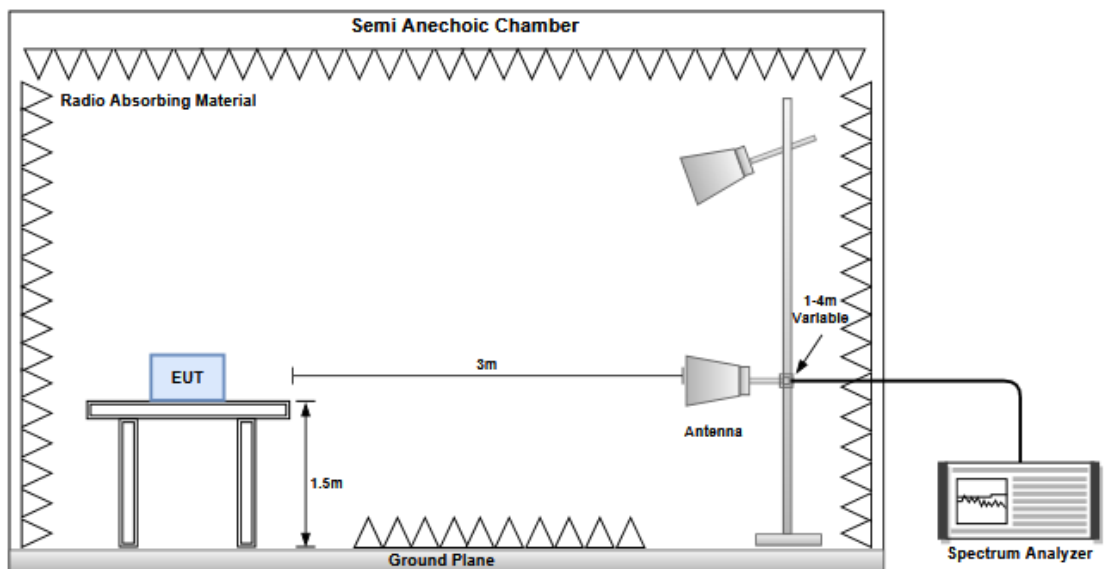
Radiated emission above 1GHz / Average value for harmonics
The average value is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula for DH5 packet type which has worst duty factor:
3.
$$20\log (\text{Duty cycle}) = 20\log \frac{1\text{s} / 1600 * 5}{100 \text{ ms}} = -30.1\text{dB}$$
4. Radiated emission above 1GHz / Average value for other emissions
RBW=1MHz, VBW=1/T and Peak detector

3.2.3 Test Setup

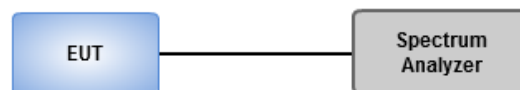
Radiated Emissions below 1 GHz



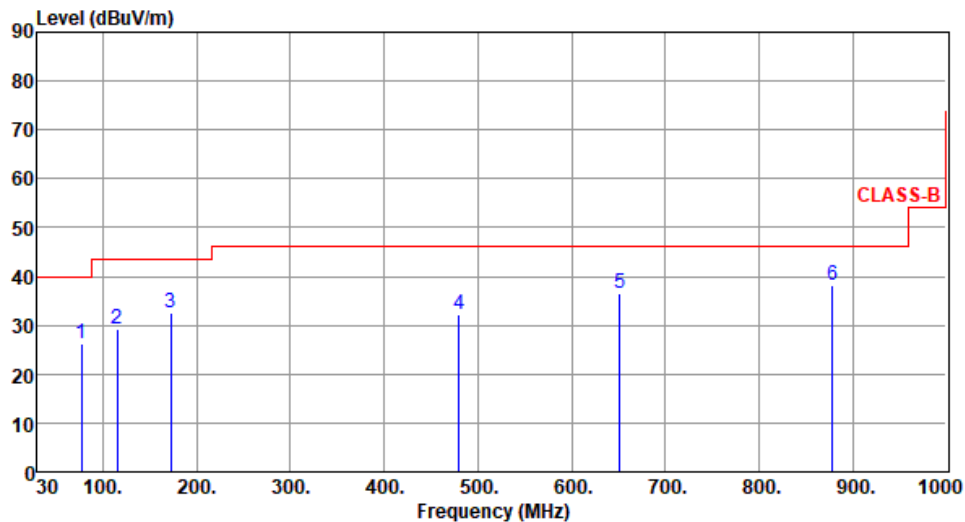
Radiated Emissions above 1 GHz



Transmitter Conducted Unwanted Emissions (30MHz~40GHz)



3.2.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	GFSK	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><table><thead><tr><th></th><th>Freq. MHz</th><th>Emission level dBuV/m</th><th>Limit dBuV/m</th><th>Margin dB</th><th>SA reading dBuV</th><th>Factor dB/m</th><th>Remark</th><th>ANT High cm</th><th>Turn Table deg</th></tr></thead><tbody><tr><td>1</td><td>77.53</td><td>26.16</td><td>40.00</td><td>-13.84</td><td>38.98</td><td>-12.82</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>2</td><td>115.36</td><td>29.34</td><td>43.50</td><td>-14.16</td><td>40.53</td><td>-11.19</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>3</td><td>172.59</td><td>32.39</td><td>43.50</td><td>-11.11</td><td>41.72</td><td>-9.33</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>4</td><td>480.08</td><td>32.32</td><td>46.00</td><td>-13.68</td><td>36.13</td><td>-3.81</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>5</td><td>651.77</td><td>36.46</td><td>46.00</td><td>-9.54</td><td>36.90</td><td>-0.44</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>6</td><td>878.75</td><td>38.08</td><td>46.00</td><td>-7.92</td><td>35.04</td><td>3.04</td><td>Peak</td><td>---</td><td>---</td></tr></tbody></table></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	77.53	26.16	40.00	-13.84	38.98	-12.82	Peak	---	---	2	115.36	29.34	43.50	-14.16	40.53	-11.19	Peak	---	---	3	172.59	32.39	43.50	-11.11	41.72	-9.33	Peak	---	---	4	480.08	32.32	46.00	-13.68	36.13	-3.81	Peak	---	---	5	651.77	36.46	46.00	-9.54	36.90	-0.44	Peak	---	---	6	878.75	38.08	46.00	-7.92	35.04	3.04	Peak	---	---
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg																																																																
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<div>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). Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.</div>																																																																									

Modulation	GFSK	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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3.2.5 Transmitter Radiated Unwanted Emissions (Above 1GHz) for GFSK

Modulation	GFSK		Test Freq. (MHz)		2402	
Polarization	Horizontal					
Test By :Roger Lu Temperature(°C):25 Humidity(%):66						
<div><div>Level 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Modulation	GFSK	Test Freq. (MHz)	2402
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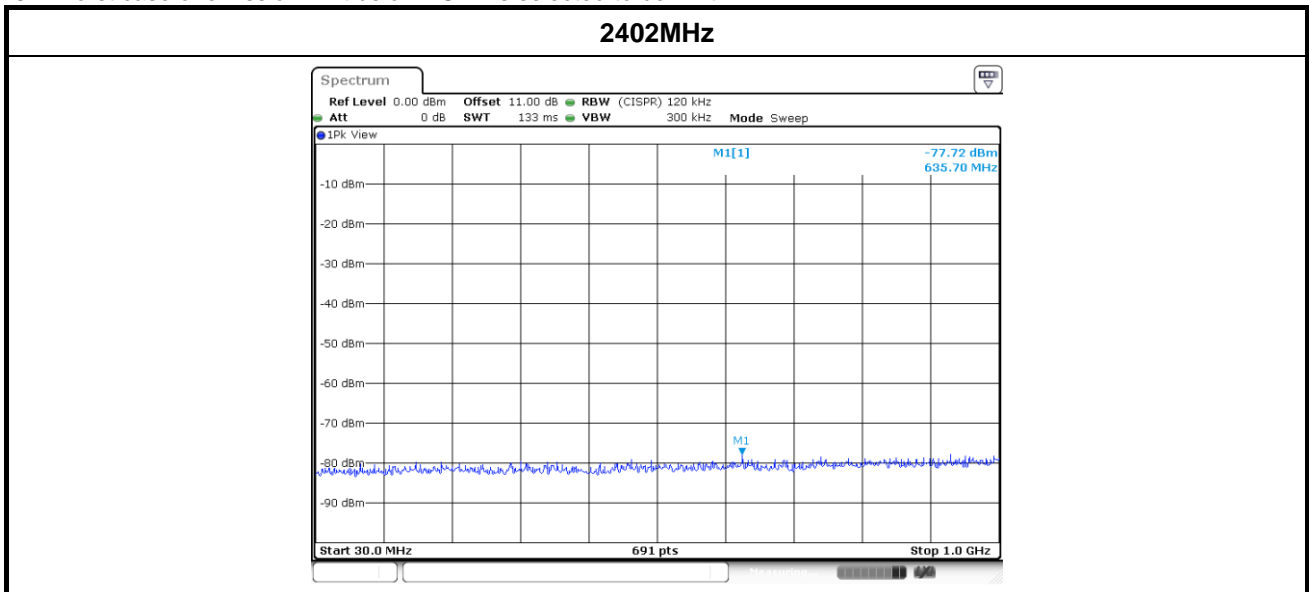
3.2.6 Transmitter Conducted Unwanted Emissions (Below 1 GHz)

Ambient Condition	24°C / 66%	Tested By	Aska Huang
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Modulation Mode		GFSK		Frequency	2402MHz	
Range (MHz)	Max Value (dBm)	DG (dBi)	GRF (dB)	EIRP (dBm)	Min E-Field Limit (dBm)	E-Field Margin (dB)
30~1000	-77.72	2.79	4.70	-70.23	-55.20	-15.03

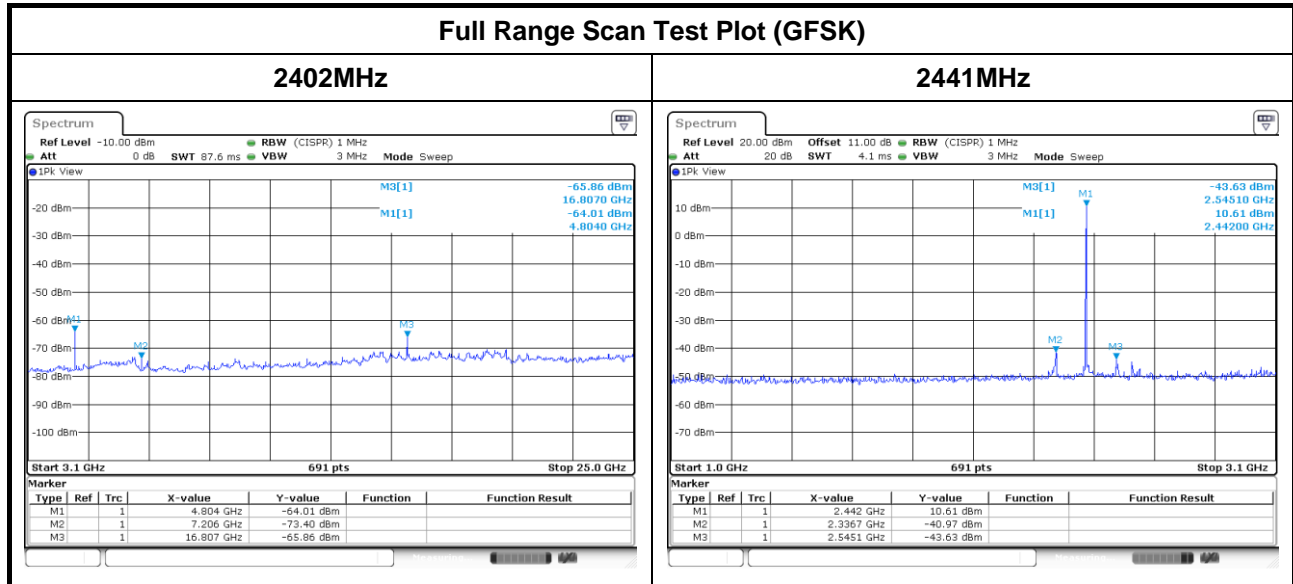
Note:

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



3.2.7 Transmitter Conducted Unwanted Emissions (Above 1GHz)

Ambient Condition	24°C / 66%	Tested By	Aska Huang
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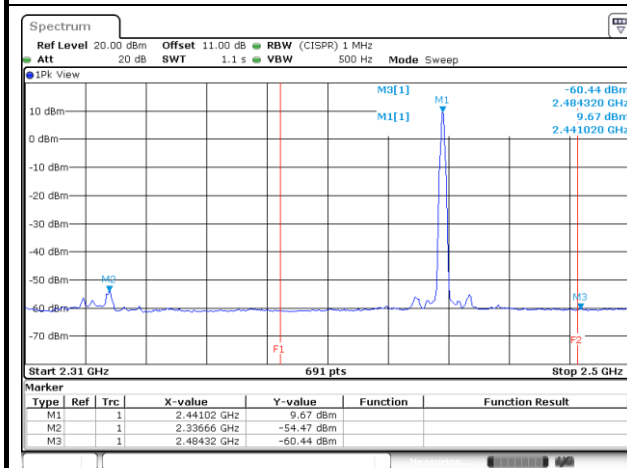
Transmitter Conducted Unwanted Emissions Results in Band Edge

Modulation Mode		GFSK					
Test ch. Freq. (MHz)	Range (MHz)	Max Value (dBm)	DG (dBi)	EIRP (dBm)	E-Field Limit (dBm)	E-Field Margin (dB)	Remark
2441	2310~2390	-41.17	2.79	-38.38	-21.20	-17.18	PK
	2310~2390	-54.47	2.79	-51.68	-41.20	-10.48	AV
	2483.5~2500	-47.28	2.79	-44.49	-21.20	-23.29	PK
	2483.5~2500	-60.44	2.79	-57.65	-41.20	-16.45	AV

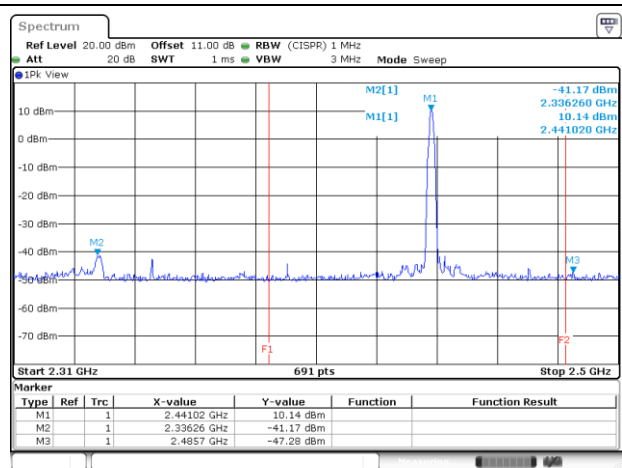
Note: DG = Directional Gain.

Band Edge Test Plot

2441MHz - AV



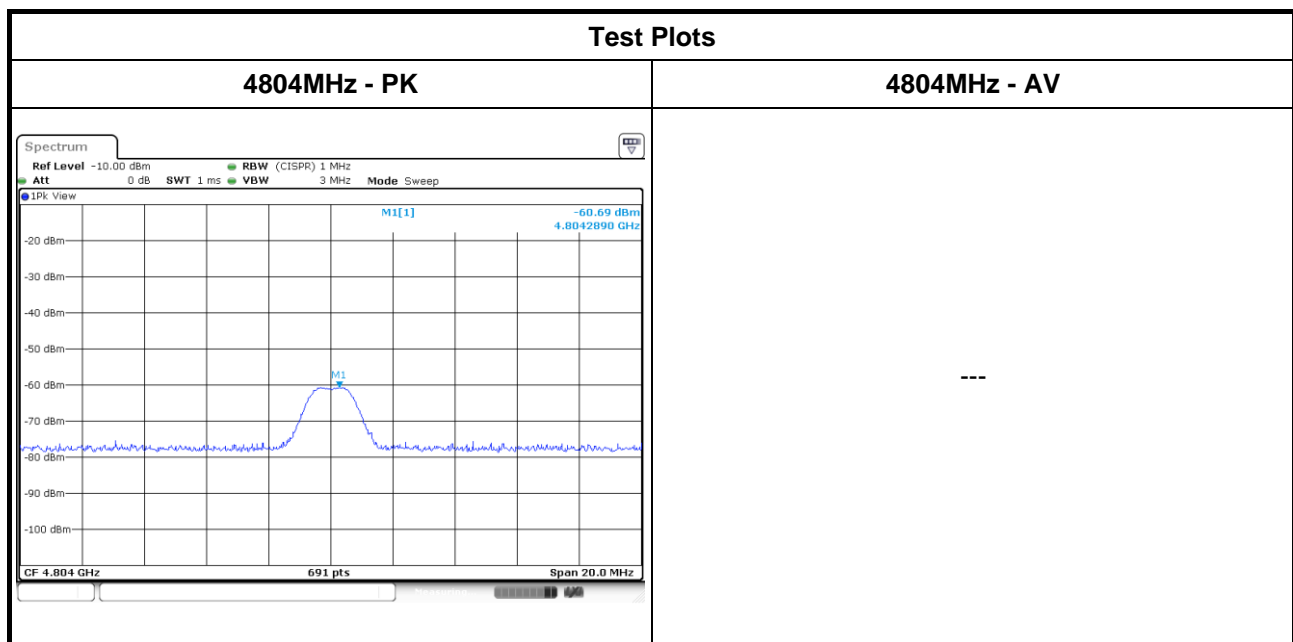
2441MHz - PK



Transmitter Conducted Unwanted Emissions Results in Restricted Frequency Band						
Modulation Mode		GFSK		Frequency	2402MHz	
Freq. (MHz)	Remark	Max Value (dBm)	DG (dBi)	EIRP (dBm)	E-Field Limit (dBuV/m)	E-Field Margin (dB)
4804.00	PK	-60.69	2.79	-57.90	-21.20	-36.70
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.



3.3 Conducted Output Power

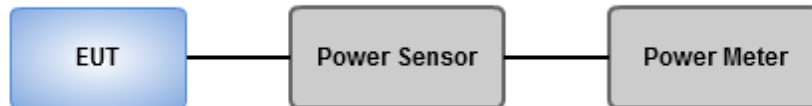
3.3.1 Limit of Conducted Output Power

- ☐ 1 Watt
For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band.
- ☒ 0.125 Watt
For all other frequency hopping systems in the 2400–2483.5 MHz band.
- ☐ 0.125 Watt
For Frequency hopping systems operating in the 2400–2483.5 MHz band have hopping channel carrier frequencies that are separated by two-thirds of the 20 dB bandwidth of the hopping channel.

3.3.2 Test Procedures

1. A wideband power meter is used for power measurement. Bandwidth of power sensor and meter is 50MHz
2. 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

3.3.3 Test Setup



3.3.4 Test Result of Conducted 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-BR(1Mbps)	10.73	0.01183
BT-EDR(2Mbps)	10.02	0.01005
BT-EDR(3Mbps)	10.29	0.01069

Result

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-BR(1Mbps)	-	-	-	-
2402MHz	Pass	2.79	10.73	21.00
2441MHz	Pass	2.79	10.19	21.00
2480MHz	Pass	2.79	9.67	21.00
BT-EDR(2Mbps)	-	-	-	-
2402MHz	Pass	2.79	10.02	21.00
2441MHz	Pass	2.79	9.51	21.00
2480MHz	Pass	2.79	8.95	21.00
BT-EDR(3Mbps)	-	-	-	-
2402MHz	Pass	2.79	10.29	21.00
2441MHz	Pass	2.79	9.76	21.00
2480MHz	Pass	2.79	9.21	21.00

Summary of Conducted (Average) Output Power

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-BR(1Mbps)	10.67	0.01167
BT-EDR(2Mbps)	7.56	0.00570
BT-EDR(3Mbps)	7.57	0.00571

Result

Mode	Result	Antenna Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-BR(1Mbps)	-	-	-	-
2402MHz	Pass	2.79	10.67	-
2441MHz	Pass	2.79	10.14	-
2480MHz	Pass	2.79	9.61	-
BT-EDR(2Mbps)	-	-	-	-
2402MHz	Pass	2.79	7.56	-
2441MHz	Pass	2.79	7.00	-
2480MHz	Pass	2.79	6.46	-
BT-EDR(3Mbps)	-	-	-	-
2402MHz	Pass	2.79	7.57	-
2441MHz	Pass	2.79	7.01	-
2480MHz	Pass	2.79	6.47	-

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

No.30-2, Ding Fwu Tsuen, Lin Kou
District, New Taipei City, Taiwan
(R.O.C.)

Kwei Shan

Tel: 886-3-271-8666

No.3-1, Lane 6, Wen San 3rd
St., Kwei Shan Dist., Tao Yuan
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

Tel: 886-3-271-8640

No.14-1, Lane 19, Wen San 3rd
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.

Tel: 886-3-271-8666

Fax: 886-3-318-0345

Email: ICC_Service@icertifi.com.tw

==END==