

NCC Test Report

Equipment : 真無線骨傳導藍牙耳機
BLUETOOTH WIRELESS BONE CONDUCTION
EARPHONE

Model No. : PEACE TW-1

Brand Name : earsopen

Applicant : 群光電子股份有限公司

Address : 台北市三重區光復路二段 69 號

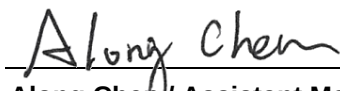
Standard : LP0002 Section 4.10.1 (2020-07-01)

Received Date : May 20, 2020

Tested Date : Jun. 04 ~ Jun. 22, 2020

We, International Certification Corp., 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
TR052002	Rev. 01	Initial issue	Nov. 09, 2020

Summary of Test Results

NCC Rules	Test Items	Measured	Result
3.3	Conducted Emissions	[dBuV]: 0.383MHz 28.53 (Margin -19.68dB) - AV	Pass
4.10.1.5 3.6	Radiated Emissions	[dBuV/m at 3m]: 9757.00MHz 51.02 (Margin -2.98dB) - AV	Pass
4.10.1.5	Band Edge	Meet the requirement of limit	Pass
4.10.1.2(1)(B)	Conducted Output Power	Power [dBm]: 5.55	Pass
4.10.1.6(1)(A)	Number of Hopping Channels	Meet the requirement of limit	Pass
4.10.1.6(1)(A)	Hopping Channel Separation	Meet the requirement of limit	Pass
4.10.1.6(1)(A)	Dwell Time	Meet the requirement of limit	Pass
4.10.1.4	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

The EUT has two appearances for marketing purpose. The difference is only at outer appearance's color (black and white).

1.1.1 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	2402-2480	0-78 [79]	1 Mbps
2400-2483.5	EDR	2402-2480	0-78 [79]	2 Mbps
2400-2483.5	EDR	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.

1.1.2 Antenna Details

Ant. No.	Brand	Model	Type	Connector	Gain (dBi)
1	SINAWELL	BT01B (SN0374)	Monopole	N/A	-1.95

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	5Vdc from adapter 3.7Vdc from battery
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1.1.4 Accessories

No.	Equipment	Description
1	Rechargeable lithium-ion battery	廠牌: Guangdong Anqiao New Energy Technology Co. Ltd. 型號: 501225/110mAh/3.7V 額定電源: DC 3.7V, 110mAh, 0.407Wh
2	lithium-ion battery	廠牌: DongGuan Hugnen Technology (HGT) Co.,LTD 型號: 802525P-430mAh 額定電源: DC 3.7V, 430mAh, 1.59Wh
3	Type C USB cable	廠牌: Dongguan City Kuling Electronic co.,Ltd. 型號: KL-0065 線長: 0.7m, shielded without core
4	充電盒	廠牌: earsopen 型號: PEACE TW-1 額定輸入電源: 5Vdc, 0.5A 額定輸出電源: 5Vdc, 0.22A

1.1.5 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	---	---

1.1.6 Test Tool and Duty Cycle

Test Tool	Airoha Tool Kit, V2.3.4	
Duty Cycle and Duty Factor	Duty Cycle (%)	Duty Factor (dB)
DH5	78.46%	1.05
3DH5	78.46%	1.05

1.1.7 Power Index of Test Tool

Modulation Mode	Test Frequency (MHz)		
	2402	2441	2480
GFSK/1Mbps	54(default)	54(default)	54(default)
$\pi/4$ -DQPSK /2Mbps	54(default)	54(default)	54(default)
8DPSK/3Mbps	54(default)	54(default)	54(default)

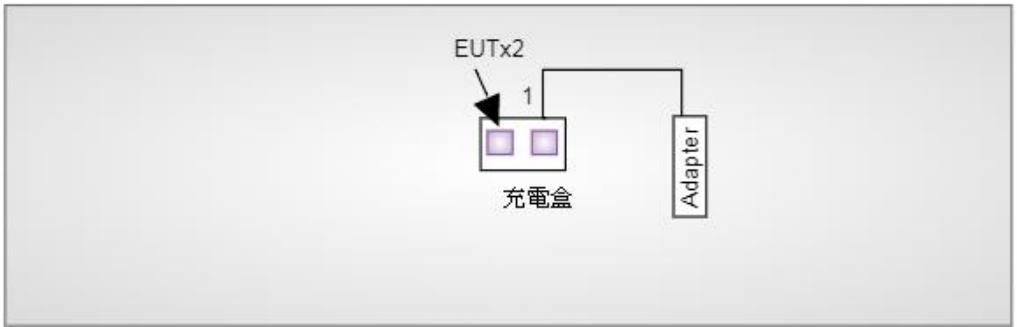
1.2 Local Support Equipment List

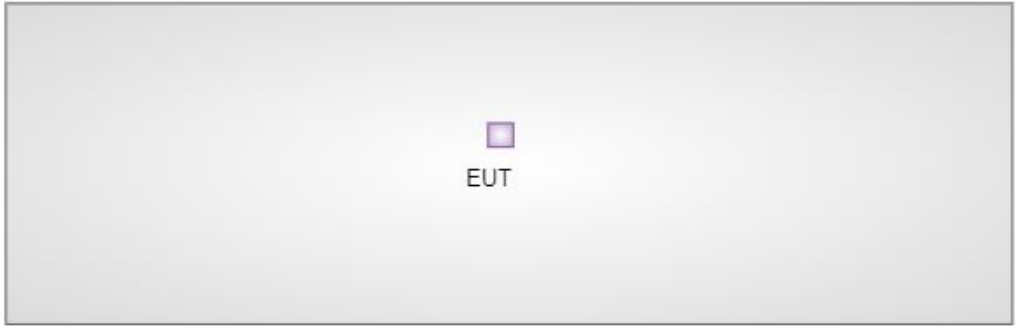
Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Signal cable / Length (m)
1	Notebook	DELL	Latitude E5470	DoC	實驗室提供(見備註 1)
2	Adapter	Samsung	ETA-U90JWs	---	實驗室提供(見備註 1)
3	Fixture	earsopen	SU-1532	---	申請者提供(見備註 2)

備註 1: 本案經申請者切結器材不提供隨貨配件，配件由實驗室提供併同檢驗。

備註 2: 本案經申請者切結器材不提供隨貨配件，配件由申請者提供併同檢驗。

1.3 Test Setup Chart

Test Setup Diagram (Charging mode)	
	
No.	Signal cable / Length (m)
1	Type C USB cable, 0.7m shielded.

Test Setup Diagram (Battery mode)	
	

Note: The support notebook & fixture are disconnected from EUT and removed from test table when EUT is set to transmit continuously.

1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Jun. 23, 2020				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101658	Dec. 12, 2019	Dec. 11, 2020
LISN	R&S	ENV216	101579	Mar. 12, 2020	Mar. 11, 2021
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 22, 2019	Oct. 21, 2020
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 chamber 3 / (03CH03-WS)				
Tested Date	Jun. 04 ~ Jun. 12, 2020				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101499	Jan. 09, 2020	Jan. 08, 2021
Receiver	R&S	ESR3	101657	Feb. 14, 2020	Feb. 13, 2021
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	Apr. 29, 2020	Apr. 28, 2021
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Dec. 27, 2019	Dec. 26, 2020
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2019	Nov. 14, 2020
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 13, 2019	Nov. 12, 2020
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 07, 2019	Oct. 06, 2020
Preamplifier	EMC	EMC02325	980187	Aug. 14, 2019	Aug. 13, 2020
Preamplifier	Agilent	83017A	MY53270014	Aug. 07, 2019	Aug. 06, 2020
Preamplifier	EMC	EMC184045B	980192	Aug. 01, 2019	Jul. 31, 2020
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Sep. 27, 2019	Sep. 26, 2020
RF cable-8M	EMC	EMC104-SM-SM-8000	181107	Sep. 27, 2019	Sep. 26, 2020
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Sep. 27, 2019	Sep. 26, 2020
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Sep. 27, 2019	Sep. 26, 2020
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Sep. 27, 2019	Sep. 26, 2020
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Sep. 27, 2019	Sep. 26, 2020
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	Jun. 22, 2020				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101063	Apr. 30, 2020	Apr. 29, 2021
Power Meter	Anritsu	ML2495A	1241002	Oct. 23, 2019	Oct. 22, 2020
Power Sensor	Anritsu	MA2411B	1207366	Oct. 23, 2019	Oct. 22, 2020
DC POWER SOURCE	GW INSTEK	GPC-6030D	GES855395	Oct. 29, 2019	Oct. 28, 2020
AC POWER SOURCE	APC	AFC-500W	F312060012	Dec. 02, 2019	Dec. 01, 2020
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.5 Test Standards

LP0002 Section 4.10.1 (2020-07-01)
ANSI C63.10-2013
ANSI C63.4-2014

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 ≤ 1GHz	±3.96 dB
Radiated emission > 1GHz	±4.51 dB

2 Test Configuration

2.1 Testing Facility

Test Laboratory	International Certification Corp.
Test Site	CO01-WS, TH01-WS
Address of Test Site	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.
Test Site	03CH03-WS
Address of Test Site	No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

- FCC Designation No.: TW0009
- FCC site registration No.: 207696
- ISSED#: 10807A
- CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Data Rate	Mode	Test configurations
AC Power Line Conducted Emissions	Charge mode	---	---	---	1
Radiated Emissions ≤ 1GHz	Charge mode	---	---	---	1
Radiated Emissions ≤ 1GHz	8DPSK	2402	3Mbps	Tx	1
Radiated Emissions > 1GHz	GFSK 8DPSK	2402, 2441, 2480 2402, 2441, 2480	1Mbps 3Mbps	Tx	2
Conducted Output Power	GFSK 11 /4 DQPSK 8DPSK	2402, 2441, 2480 2402, 2441, 2480 2402, 2441, 2480	1Mbps 2Mbps 3Mbps	Tx	2
Number of Hopping Channels	GFSK 11 /4 DQPSK 8DPSK	2402 ~ 2480 2402 ~ 2480 2402 ~ 2480	1Mbps 2Mbps 3Mbps	Tx	2
Hopping Channel Separation	GFSK 11 /4 DQPSK 8DPSK	2402, 2441, 2480 2402, 2441, 2480 2402, 2441, 2480	1Mbps 2Mbps 3Mbps	Tx	2
Dwell Time	GFSK 11 /4 DQPSK 8DPSK	2402 2402 2402	1Mbps 2Mbps 3Mbps	Tx	2
Radiated Emissions	8DPSK	2402	3Mbps	Rx	2

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) The EUT had been tested by following test configurations.
 - 1) Configuration 1: Charging mode
 - 2) Configuration 2: Battery mode

3 Transmitter Test Results

3.1 Conducted Emissions

3.1.1 Limit of Conducted Emissions

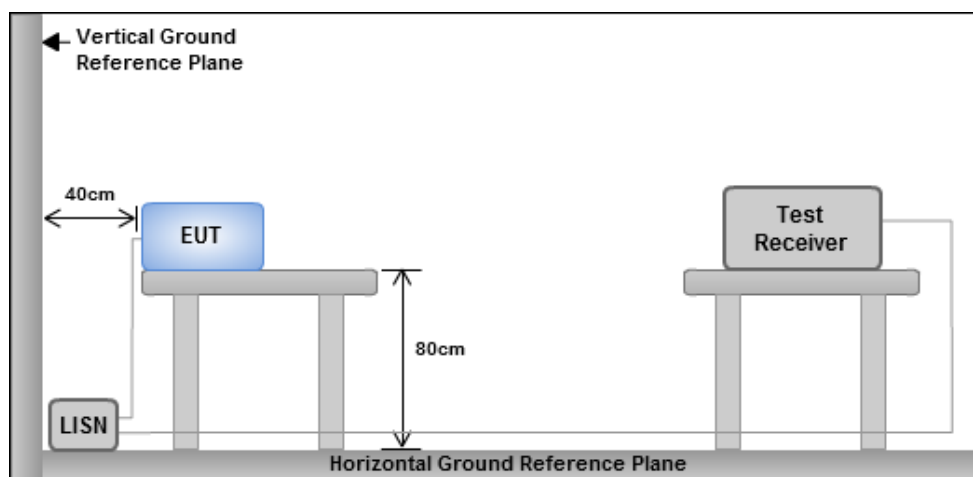
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

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



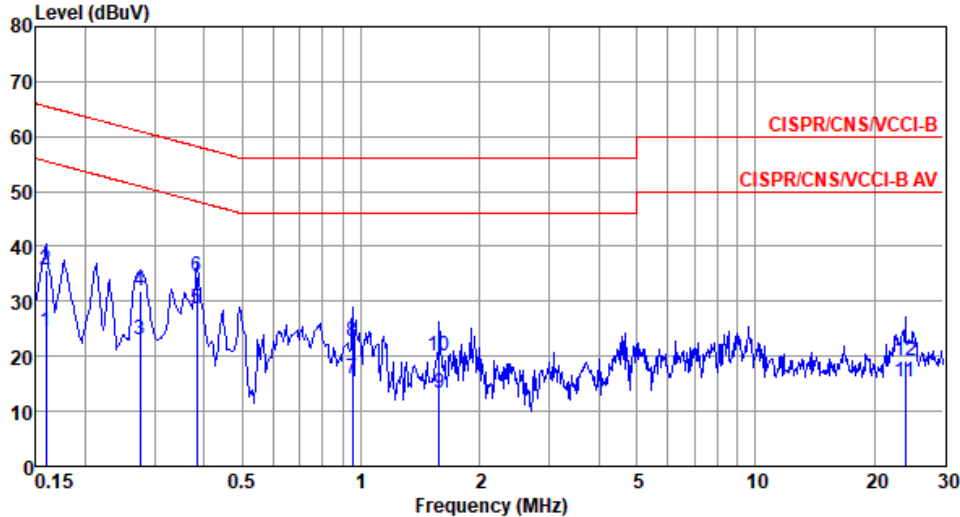
- Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.1.4 Test Result of Conducted Emissions

Modulation Mode	Charging mode																																																																																																																					
Power Phase	Line																																																																																																																					
Test by : Alex Temperature: 22°C Humidity: 61%																																																																																																																						
Level (dBUV) <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>LISN factor dB</th><th>cable loss dB</th><th>Remark</th></tr></thead><tbody><tr><td>1</td><td>0.195</td><td>20.61</td><td>53.80</td><td>-33.19</td><td>10.73</td><td>9.63</td><td>0.06</td><td>Average</td></tr><tr><td>2</td><td>0.195</td><td>34.19</td><td>63.80</td><td>-29.61</td><td>24.31</td><td>9.63</td><td>0.06</td><td>QP</td></tr><tr><td>3*</td><td>0.365</td><td>23.88</td><td>48.61</td><td>-24.73</td><td>13.93</td><td>9.63</td><td>0.08</td><td>Average</td></tr><tr><td>4</td><td>0.365</td><td>31.90</td><td>58.61</td><td>-26.71</td><td>21.95</td><td>9.63</td><td>0.08</td><td>QP</td></tr><tr><td>5</td><td>0.779</td><td>18.98</td><td>46.00</td><td>-27.02</td><td>8.94</td><td>9.63</td><td>0.11</td><td>Average</td></tr><tr><td>6</td><td>0.779</td><td>28.02</td><td>56.00</td><td>-27.98</td><td>17.98</td><td>9.63</td><td>0.11</td><td>QP</td></tr><tr><td>7</td><td>1.049</td><td>17.70</td><td>46.00</td><td>-28.30</td><td>7.63</td><td>9.63</td><td>0.12</td><td>Average</td></tr><tr><td>8</td><td>1.049</td><td>25.68</td><td>56.00</td><td>-30.32</td><td>15.61</td><td>9.63</td><td>0.12</td><td>QP</td></tr><tr><td>9</td><td>1.577</td><td>14.44</td><td>46.00</td><td>-31.56</td><td>4.31</td><td>9.64</td><td>0.16</td><td>Average</td></tr><tr><td>10</td><td>1.577</td><td>21.91</td><td>56.00</td><td>-34.09</td><td>11.78</td><td>9.64</td><td>0.16</td><td>QP</td></tr><tr><td>11</td><td>24.015</td><td>15.30</td><td>50.00</td><td>-34.70</td><td>4.25</td><td>9.67</td><td>0.70</td><td>Average</td></tr><tr><td>12</td><td>24.015</td><td>19.51</td><td>60.00</td><td>-40.49</td><td>8.46</td><td>9.67</td><td>0.70</td><td>QP</td></tr></tbody></table>			Freq MHz	Level dBUV	Limit Line dBUV	Over Limit dB	Read Level dBUV	LISN factor dB	cable loss dB	Remark	1	0.195	20.61	53.80	-33.19	10.73	9.63	0.06	Average	2	0.195	34.19	63.80	-29.61	24.31	9.63	0.06	QP	3*	0.365	23.88	48.61	-24.73	13.93	9.63	0.08	Average	4	0.365	31.90	58.61	-26.71	21.95	9.63	0.08	QP	5	0.779	18.98	46.00	-27.02	8.94	9.63	0.11	Average	6	0.779	28.02	56.00	-27.98	17.98	9.63	0.11	QP	7	1.049	17.70	46.00	-28.30	7.63	9.63	0.12	Average	8	1.049	25.68	56.00	-30.32	15.61	9.63	0.12	QP	9	1.577	14.44	46.00	-31.56	4.31	9.64	0.16	Average	10	1.577	21.91	56.00	-34.09	11.78	9.64	0.16	QP	11	24.015	15.30	50.00	-34.70	4.25	9.67	0.70	Average	12	24.015	19.51	60.00	-40.49	8.46	9.67	0.70	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).																																																																																																																						

Modulation Mode	Charging mode
Power Phase	Neutral

Test by : Alex Temperature: 22°C Humidity: 61%



The graph displays the measured level in dBuV across a frequency range from 0.15 MHz to 30 MHz. Two red lines represent the CISPR/CNS/VCCI-B and CISPR/CNS/VCCI-B AV limits. The blue line shows the measured signal, with several peaks labeled 1 through 12. The measured signal is generally below the limits, with a notable peak at 0.383 MHz (labeled 5*) that is close to the CISPR/CNS/VCCI-B limit.

	Freq MHz	Level dBuV	Limit dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.159	24.36	55.52	-31.16	14.52	9.66	0.05	Average
2	0.159	35.66	65.52	-29.86	25.82	9.66	0.05	QP
3	0.276	23.00	50.94	-27.94	13.12	9.65	0.07	Average
4	0.276	31.78	60.94	-29.16	21.90	9.65	0.07	QP
5*	0.383	28.53	48.21	-19.68	18.63	9.65	0.08	Average
6	0.383	34.60	58.21	-23.61	24.70	9.65	0.08	QP
7	0.953	16.04	46.00	-29.96	6.07	9.65	0.12	Average
8	0.953	22.74	56.00	-33.26	12.77	9.65	0.12	QP
9	1.577	13.40	46.00	-32.60	3.34	9.66	0.16	Average
10	1.577	20.18	56.00	-35.82	10.12	9.66	0.16	QP
11	24.015	15.21	50.00	-34.79	4.05	9.81	0.70	Average
12	24.015	19.07	60.00	-40.93	7.91	9.81	0.70	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
 Note 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:
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.

3.2.2 Test Procedures

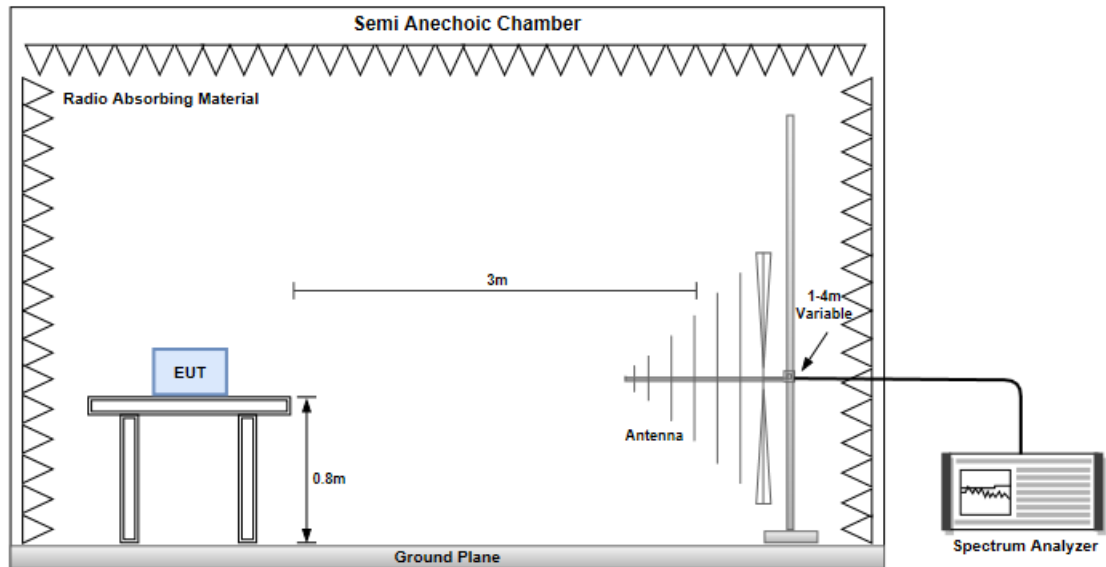
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission 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:

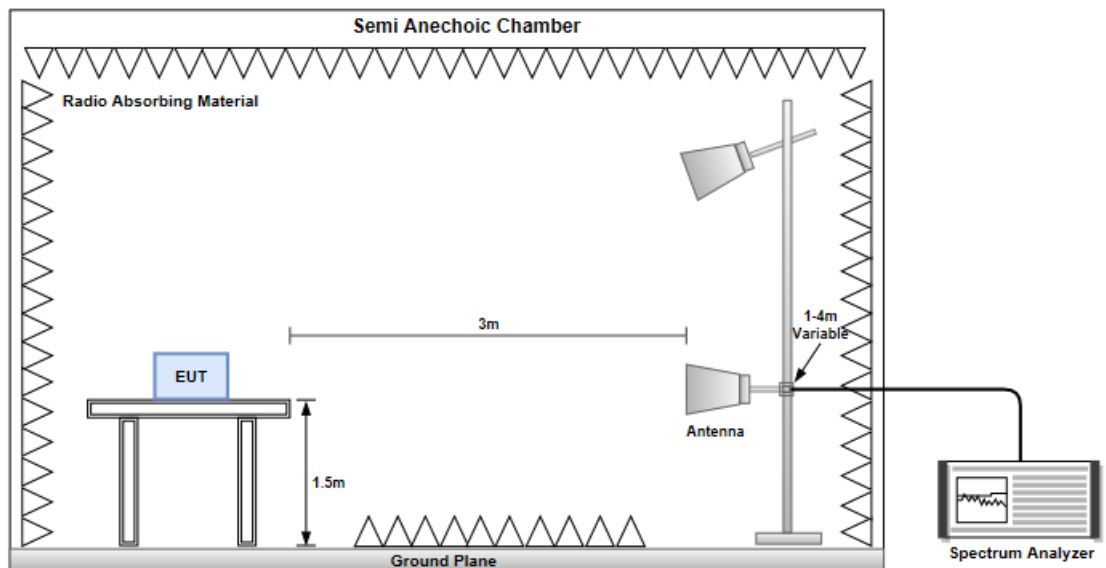
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. Radiated emission above 1GHz / Peak value
RBW=1MHz, VBW=3MHz and Peak detector
Radiated emission above 1GHz / Average value for harmonics
The average value is: Average = Peak value + 20log(Duty 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

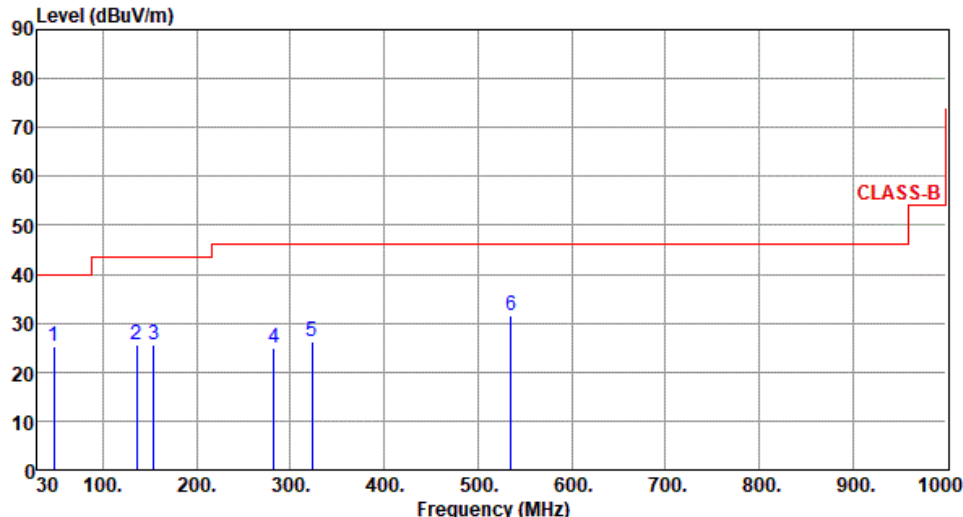
Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz

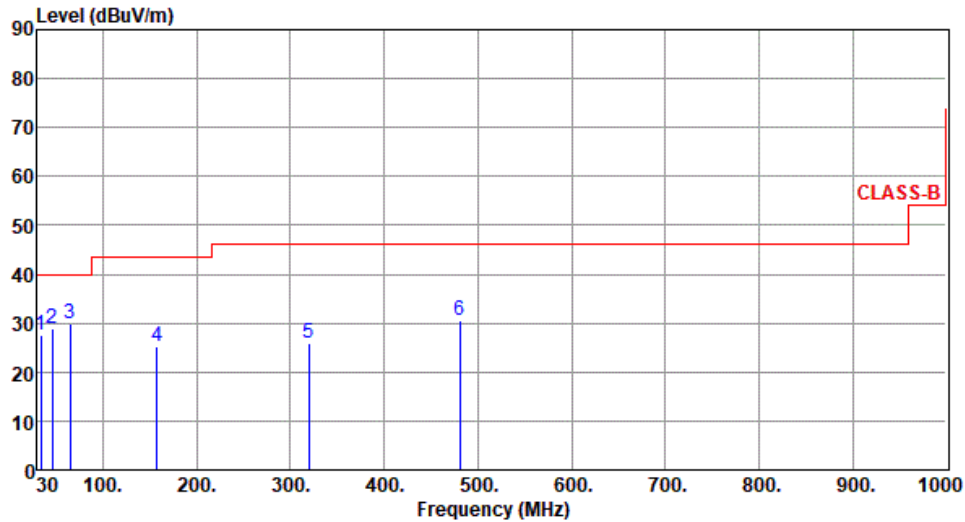


3.2.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	Charging mode	Test Freq. (MHz)	---																																																																						
Polarization	Horizontal	Test Configuration	1																																																																						
Test By :Roger Lu Temperature(°C):24 Humidity(%):64																																																																									
Level (dBuV/m)  <table><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</th><th>Remark</th><th>ANT High cm</th><th>Turn Table deg</th></tr><tr><td>1</td><td>47.46</td><td>25.13</td><td>40.00</td><td>-14.87</td><td>34.03</td><td>-8.90</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>2</td><td>135.73</td><td>25.47</td><td>43.50</td><td>-18.03</td><td>35.08</td><td>-9.61</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>3</td><td>154.16</td><td>25.54</td><td>43.50</td><td>-17.96</td><td>34.47</td><td>-8.93</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>4</td><td>282.20</td><td>24.94</td><td>46.00</td><td>-21.06</td><td>33.86</td><td>-8.92</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>5</td><td>322.94</td><td>26.34</td><td>46.00</td><td>-19.66</td><td>34.02</td><td>-7.68</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>6</td><td>535.37</td><td>31.55</td><td>46.00</td><td>-14.45</td><td>33.98</td><td>-2.43</td><td>Peak</td><td>---</td><td>---</td></tr></table>					Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg	1	47.46	25.13	40.00	-14.87	34.03	-8.90	Peak	---	---	2	135.73	25.47	43.50	-18.03	35.08	-9.61	Peak	---	---	3	154.16	25.54	43.50	-17.96	34.47	-8.93	Peak	---	---	4	282.20	24.94	46.00	-21.06	33.86	-8.92	Peak	---	---	5	322.94	26.34	46.00	-19.66	34.02	-7.68	Peak	---	---	6	535.37	31.55	46.00	-14.45	33.98	-2.43	Peak	---	---
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg																																																																
1	47.46	25.13	40.00	-14.87	34.03	-8.90	Peak	---	---																																																																
2	135.73	25.47	43.50	-18.03	35.08	-9.61	Peak	---	---																																																																
3	154.16	25.54	43.50	-17.96	34.47	-8.93	Peak	---	---																																																																
4	282.20	24.94	46.00	-21.06	33.86	-8.92	Peak	---	---																																																																
5	322.94	26.34	46.00	-19.66	34.02	-7.68	Peak	---	---																																																																
6	535.37	31.55	46.00	-14.45	33.98	-2.43	Peak	---	---																																																																
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *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.																																																																									

Modulation	Charging mode	Test Freq. (MHz)	---
Polarization	Vertical	Test Configuration	1

Test By :Roger Lu Temperature(°C):24 Humidity(%):64



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	33.88	27.64	40.00	-12.36	37.64	-10.00	Peak	---	---
2	45.52	28.85	40.00	-11.15	37.61	-8.76	Peak	---	---
3	64.92	29.99	40.00	-10.01	39.97	-9.98	Peak	---	---
4	158.04	25.26	43.50	-18.24	34.28	-9.02	Peak	---	---
5	320.03	25.99	46.00	-20.01	33.81	-7.82	Peak	---	---
6	481.05	30.50	46.00	-15.50	33.92	-3.42	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

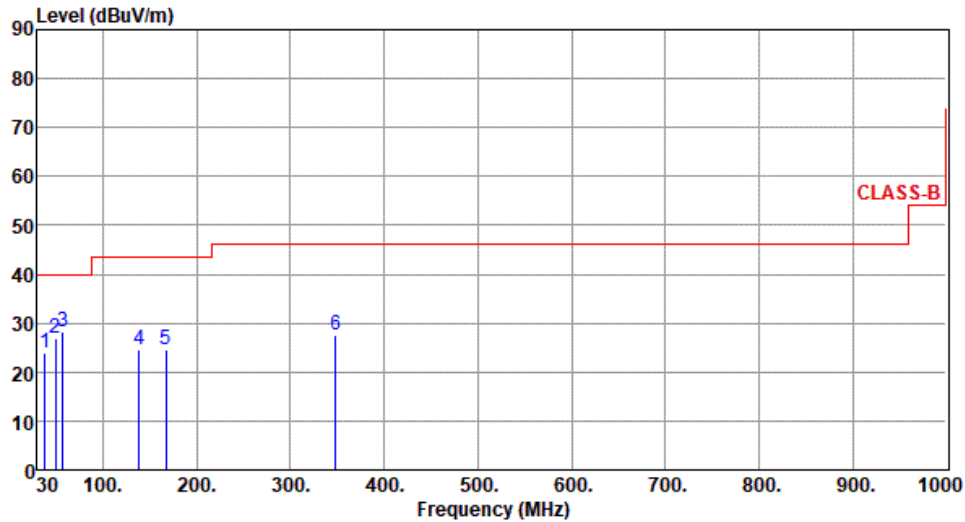
*Factor includes antenna factor , cable loss and amplifier gain

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.

Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Horizontal	Test Configuration	2

Test By :Roger Lu Temperature(°C):23 Humidity(%):62



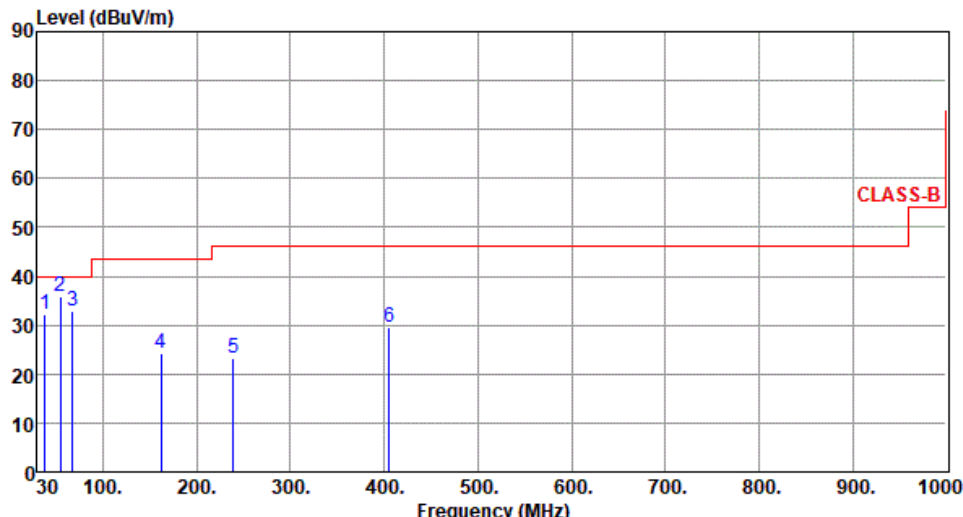
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	37.76	23.97	40.00	-16.03	33.22	-9.25	Peak	---	---
2	49.40	26.91	40.00	-13.09	35.73	-8.82	Peak	---	---
3	57.16	28.10	40.00	-11.90	37.16	-9.06	Peak	---	---
4	138.64	24.66	43.50	-18.84	34.13	-9.47	Peak	---	---
5	166.77	24.55	43.50	-18.95	33.73	-9.18	Peak	---	---
6	348.16	27.65	46.00	-18.35	34.91	-7.26	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*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.

Modulation	8DPSK	Test Freq. (MHz)	2402																																																																						
Polarization	Vertical	Test Configuration	2																																																																						
Test By :Roger Lu Temperature(°C):23 Humidity(%):62																																																																									
Level (dBuV/m)  <table><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</th><th>Remark</th><th>ANT High cm</th><th>Turn Table deg</th></tr><tr><td>1</td><td>37.76</td><td>32.12</td><td>40.00</td><td>-7.88</td><td>41.37</td><td>-9.25</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>2</td><td>54.35</td><td>35.81</td><td>40.00</td><td>-4.19</td><td>44.81</td><td>-9.00</td><td>QP</td><td>100</td><td>276</td></tr><tr><td>3</td><td>67.83</td><td>32.87</td><td>40.00</td><td>-7.13</td><td>43.34</td><td>-10.47</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>4</td><td>161.92</td><td>24.17</td><td>43.50</td><td>-19.33</td><td>33.19</td><td>-9.02</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>5</td><td>239.52</td><td>23.28</td><td>46.00</td><td>-22.72</td><td>33.92</td><td>-10.64</td><td>Peak</td><td>---</td><td>---</td></tr><tr><td>6</td><td>405.39</td><td>29.66</td><td>46.00</td><td>-16.34</td><td>35.26</td><td>-5.60</td><td>Peak</td><td>---</td><td>---</td></tr></table>					Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg	1	37.76	32.12	40.00	-7.88	41.37	-9.25	Peak	---	---	2	54.35	35.81	40.00	-4.19	44.81	-9.00	QP	100	276	3	67.83	32.87	40.00	-7.13	43.34	-10.47	Peak	---	---	4	161.92	24.17	43.50	-19.33	33.19	-9.02	Peak	---	---	5	239.52	23.28	46.00	-22.72	33.92	-10.64	Peak	---	---	6	405.39	29.66	46.00	-16.34	35.26	-5.60	Peak	---	---
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg																																																																
1	37.76	32.12	40.00	-7.88	41.37	-9.25	Peak	---	---																																																																
2	54.35	35.81	40.00	-4.19	44.81	-9.00	QP	100	276																																																																
3	67.83	32.87	40.00	-7.13	43.34	-10.47	Peak	---	---																																																																
4	161.92	24.17	43.50	-19.33	33.19	-9.02	Peak	---	---																																																																
5	239.52	23.28	46.00	-22.72	33.92	-10.64	Peak	---	---																																																																
6	405.39	29.66	46.00	-16.34	35.26	-5.60	Peak	---	---																																																																
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *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.																																																																									

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

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Horizontal	Test Configuration	2
Test By :Roger Lu Temperature(°C):25 Humidity(%):65			
Level (dBuV/m) <			

Modulation	GFSK	Test Freq. (MHz)	2402																																																																						
Polarization	Vertical	Test Configuration	2																																																																						
Test By :Roger Lu Temperature(°C):25 Humidity(%):65																																																																									
Level (dBuV/m) 1 2 3 4 5 6 74.00 54.00 CLASS-B CLASS-B (AVG) 90 80 70 60 50 40 30 20 10 0 1000. 4000. 6000. 8000. 10000. 12000. 14000. 16000. 18000. 20000. 22000. 25000 Frequency (MHz) <table><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</th><th>Remark</th><th>ANT High cm</th><th>Turn Table deg</th></tr><tr><td>1</td><td>2390.00</td><td>40.39</td><td>54.00</td><td>-13.61</td><td>40.15</td><td>0.24</td><td>Average</td><td>155</td><td>183</td></tr><tr><td>2</td><td>2390.00</td><td>53.91</td><td>74.00</td><td>-20.09</td><td>53.67</td><td>0.24</td><td>Peak</td><td>155</td><td>183</td></tr><tr><td>3</td><td>4804.00</td><td>23.82</td><td>54.00</td><td>-30.18</td><td>17.39</td><td>6.43</td><td>Average</td><td>243</td><td>18</td></tr><tr><td>4</td><td>4804.00</td><td>53.92</td><td>74.00</td><td>-20.08</td><td>47.49</td><td>6.43</td><td>Peak</td><td>243</td><td>18</td></tr><tr><td>5</td><td>12010.00</td><td>29.07</td><td>54.00</td><td>-24.93</td><td>13.01</td><td>16.06</td><td>Average</td><td>100</td><td>60</td></tr><tr><td>6</td><td>12010.00</td><td>59.17</td><td>74.00</td><td>-14.83</td><td>43.11</td><td>16.06</td><td>Peak</td><td>100</td><td>60</td></tr></table>					Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg	1	2390.00	40.39	54.00	-13.61	40.15	0.24	Average	155	183	2	2390.00	53.91	74.00	-20.09	53.67	0.24	Peak	155	183	3	4804.00	23.82	54.00	-30.18	17.39	6.43	Average	243	18	4	4804.00	53.92	74.00	-20.08	47.49	6.43	Peak	243	18	5	12010.00	29.07	54.00	-24.93	13.01	16.06	Average	100	60	6	12010.00	59.17	74.00	-14.83	43.11	16.06	Peak	100	60
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg																																																																
1	2390.00	40.39	54.00	-13.61	40.15	0.24	Average	155	183																																																																
2	2390.00	53.91	74.00	-20.09	53.67	0.24	Peak	155	183																																																																
3	4804.00	23.82	54.00	-30.18	17.39	6.43	Average	243	18																																																																
4	4804.00	53.92	74.00	-20.08	47.49	6.43	Peak	243	18																																																																
5	12010.00	29.07	54.00	-24.93	13.01	16.06	Average	100	60																																																																
6	12010.00	59.17	74.00	-14.83	43.11	16.06	Peak	100	60																																																																
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).																																																																									

Modulation	GFSK	Test Freq. (MHz)	2441
Polarization	Horizontal	Test Configuration	2
Test By :Roger Lu Temperature(°C):25 Humidity(%):65			
Level (dBuV/m) </			

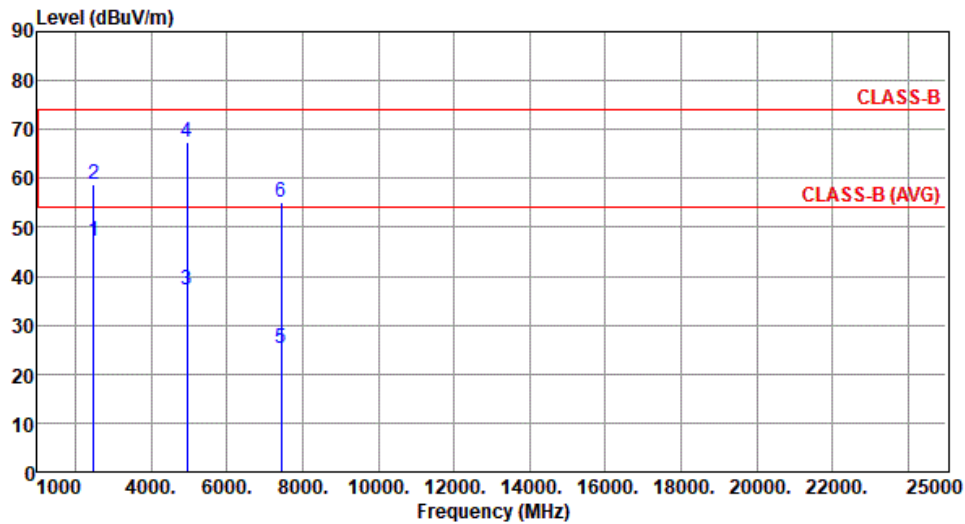
Modulation	GFSK	Test Freq. (MHz)	2441
Polarization	Vertical	Test Configuration	2
Test By :Roger Lu Temperature(°C):25 Humidity(%):65			
Level (dBuV/m) </			

Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Horizontal	Test Configuration	2

Test By :Roger Lu

Temperature(°C):25

Humidity(%):65



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	47.17	54.00	-6.83	46.92	0.25	Average	115	135
2	2483.50	58.66	74.00	-15.34	58.41	0.25	Peak	115	135
3	4960.00	37.19	54.00	-16.81	30.51	6.68	Average	100	95
4	4960.00	67.29	74.00	-6.71	60.61	6.68	Peak	100	95
5	7440.00	25.18	54.00	-28.82	13.40	11.78	Average	175	245
6	7440.00	55.28	74.00	-18.72	43.50	11.78	Peak	175	245

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Vertical	Test Configuration	2
Test By :Roger Lu Temperature(°C):25 Humidity(%):65			
Level (dBuV/m) <			

3.2.6 Transmitter Radiated Unwanted Emissions (Above 1GHz) for 8DPSK

Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Horizontal	Test Configuration	2
Test By :Roger Lu Temperature(°C):25 Humidity(%):65			
Level (dBuV/m)			

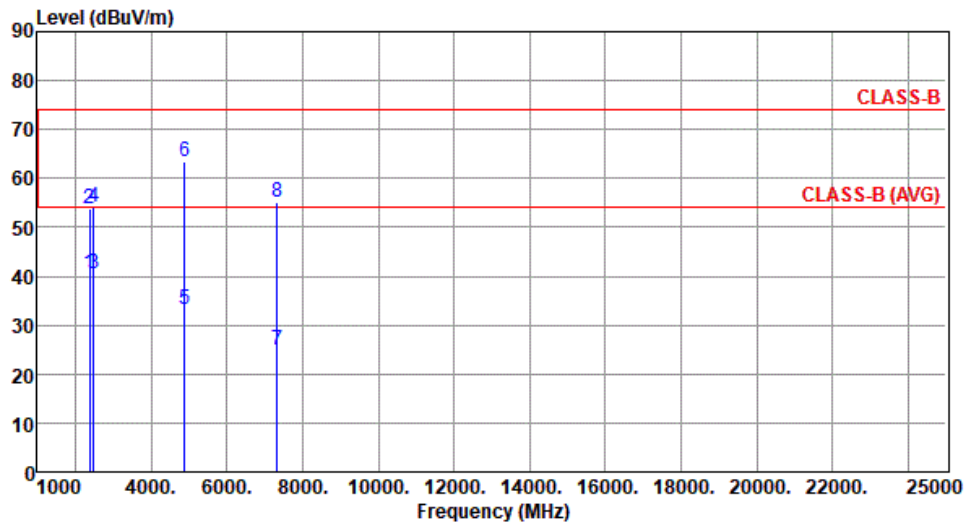
Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Vertical	Test Configuration	2
Test By :Roger Lu Temperature(°C):25 Humidity(%):65			
Level (dBuV/m) </			

Modulation	8DPSK	Test Freq. (MHz)	2441
Polarization	Horizontal	Test Configuration	2

Test By :Roger Lu

Temperature(°C):25

Humidity(%):65



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	40.50	54.00	-13.50	40.26	0.24	Average	147	133
2	2390.00	53.93	74.00	-20.07	53.69	0.24	Peak	147	133
3	2483.50	40.47	54.00	-13.53	40.22	0.25	Average	147	133
4	2483.50	54.12	74.00	-19.88	53.87	0.25	Peak	147	133
5	4882.00	33.22	54.00	-20.78	26.77	6.45	Average	100	105
6	4882.00	63.32	74.00	-10.68	56.87	6.45	Peak	100	105
7	7323.00	24.99	54.00	-29.01	13.21	11.78	Average	100	20
8	7323.00	55.09	74.00	-18.91	43.31	11.78	Peak	100	20

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	8DPSK	Test Freq. (MHz)	2441
Polarization	Vertical	Test Configuration	2
Test By :Roger Lu Temperature(°C):25 Humidity(%):65			
Level (dBuV/m) </			

Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Horizontal	Test Configuration	2
Test By :Roger Lu Temperature(°C):25 Humidity(%):65			
Level (dBUV/m) </			

Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Vertical	Test Configuration	2
Test By :Roger Lu Temperature(°C):25 Humidity(%):65			
Level (dBuV/m)			

3.3 Unwanted Emissions into Non-Restricted Frequency Bands

3.3.1 Limit of Unwanted Emissions into Non-Restricted Frequency Bands

The peak output power 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.

3.3.2 Test Procedures

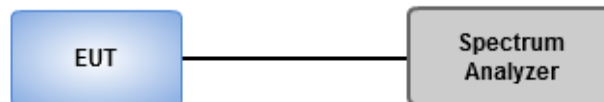
Reference Level Measurement

1. Set the RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Set Sweep time = auto couple, Trace mode = max hold.
3. Allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

Unwanted Emissions Level Measurement

1. Set RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Trace Mode = max hold, Sweep = auto couple.
3. Allow the trace to stabilize.
4. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

3.3.3 Test Setup



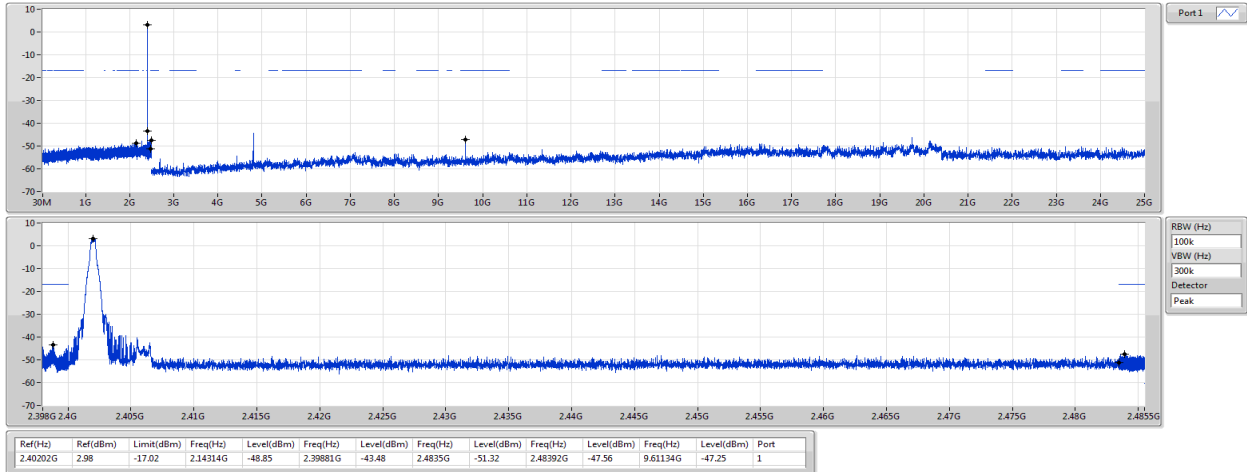
3.3.4 Unwanted Emissions into Non-Restricted Frequency Bands

Ambient Condition	24°C / 67%	Tested By	Aska Huang
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BT-BR(1Mbps)

CSEndB-FS

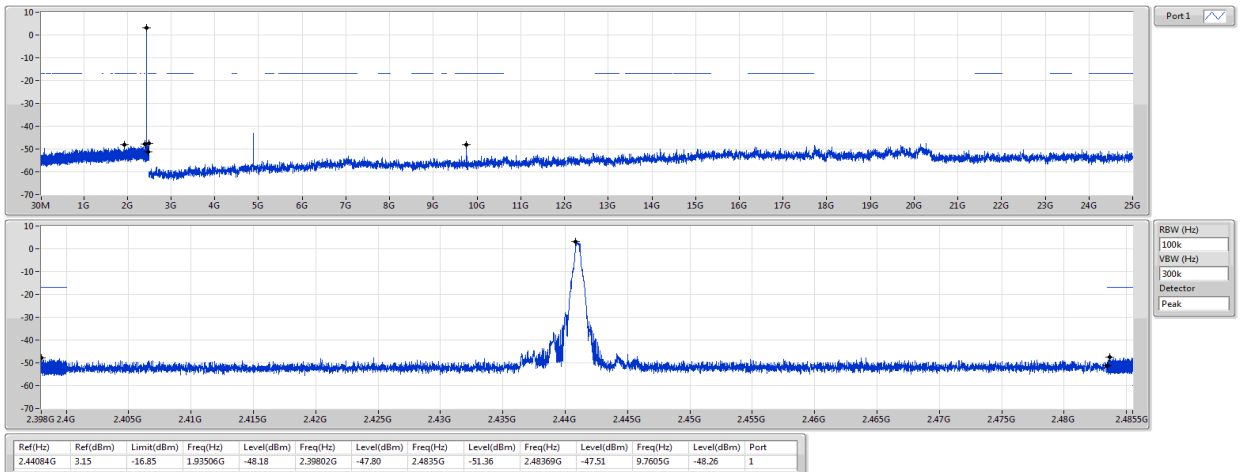
2402MHz



BT-BR(1Mbps)

CSEndB-FS

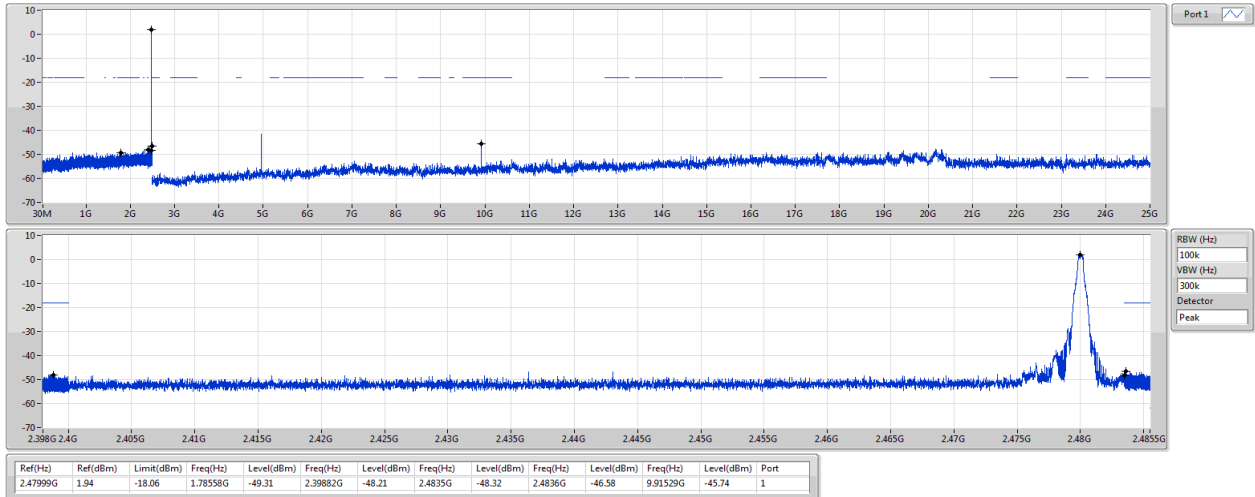
2441MHz



BT-BR(1Mbps)

2480MHz

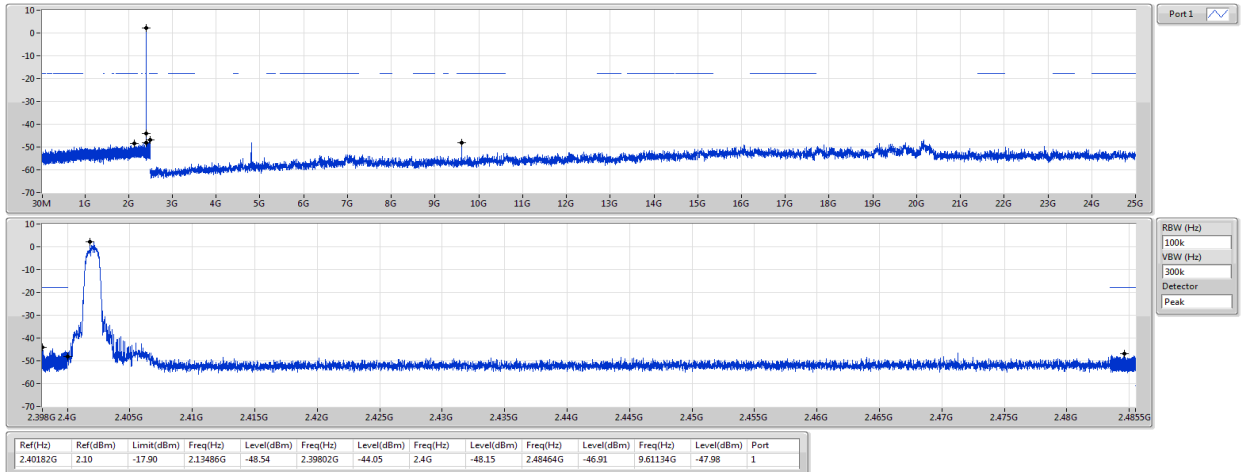
CSENdB-FS



BT-EDR(2Mbps)

2402MHz

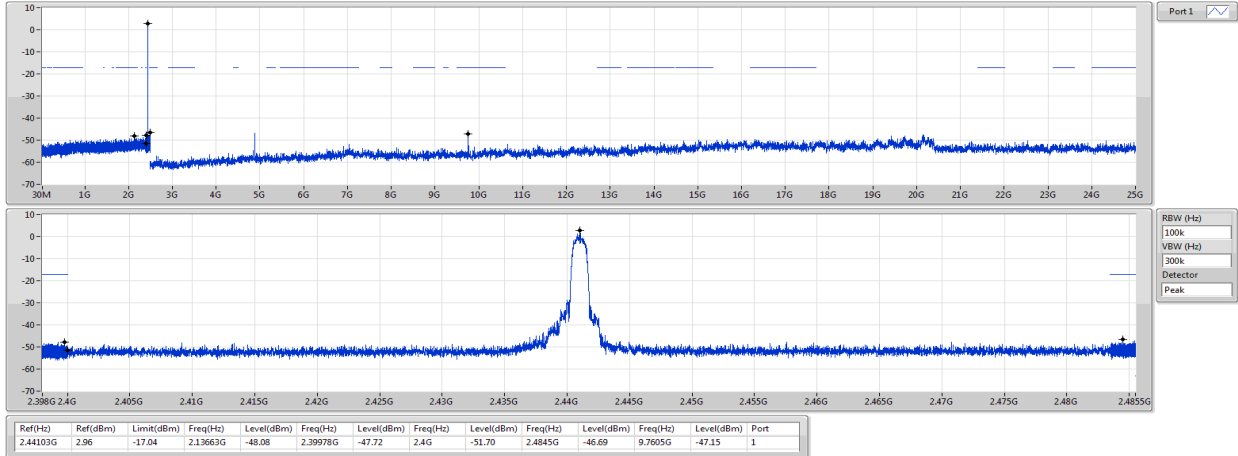
CSENdB-FS



BT-EDR(2Mbps)

CSEndB-FS

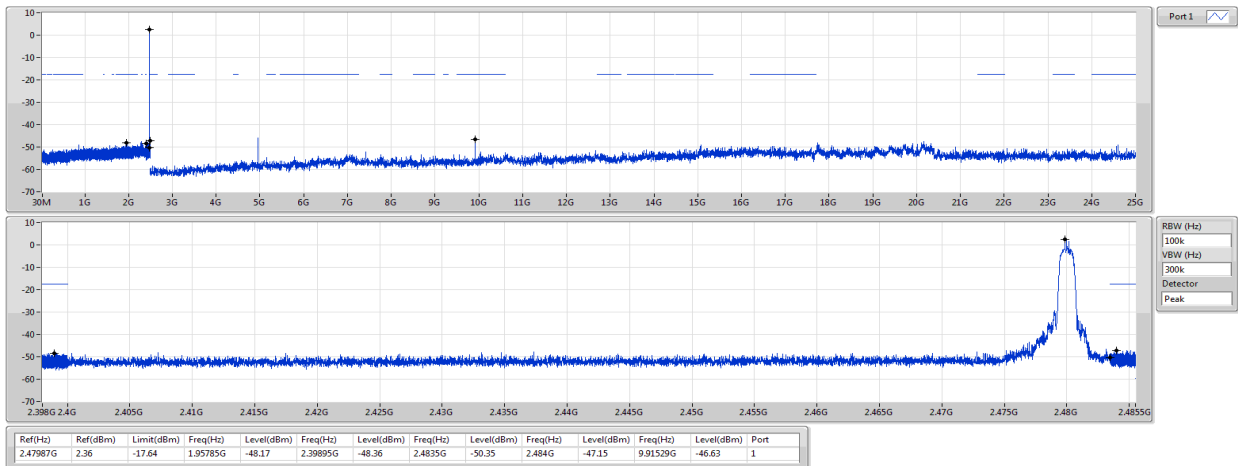
2441MHz



BT-EDR(2Mbps)

CSEndB-FS

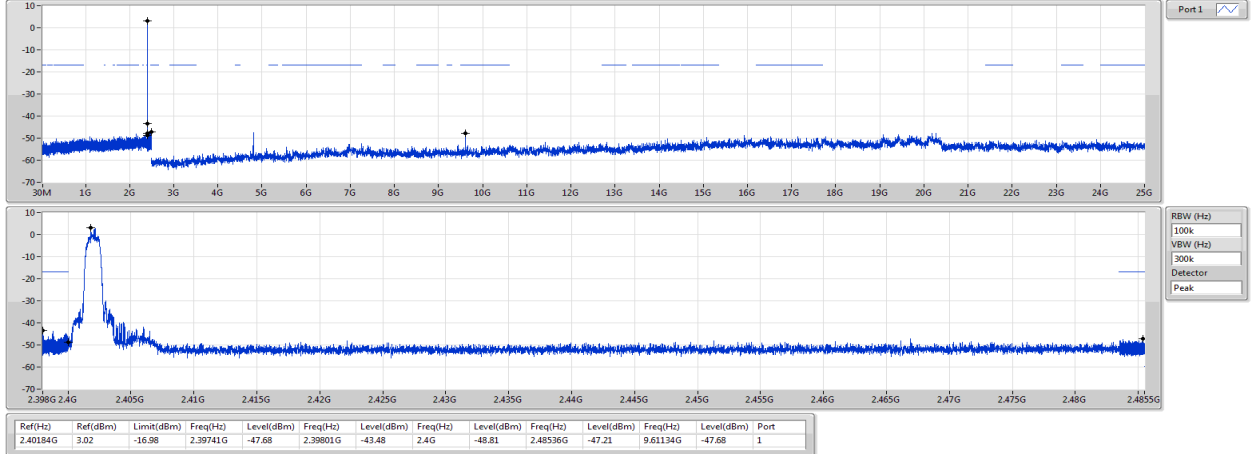
2480MHz



BT-EDR(3Mbps)

CSEndB-FS

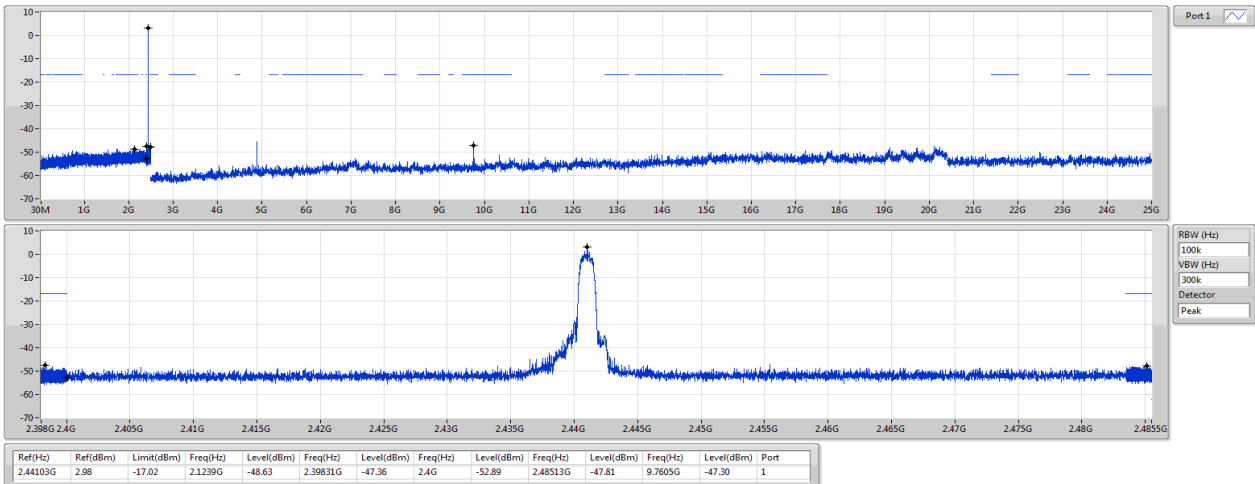
2402MHz



BT-EDR(3Mbps)

CSEndB-FS

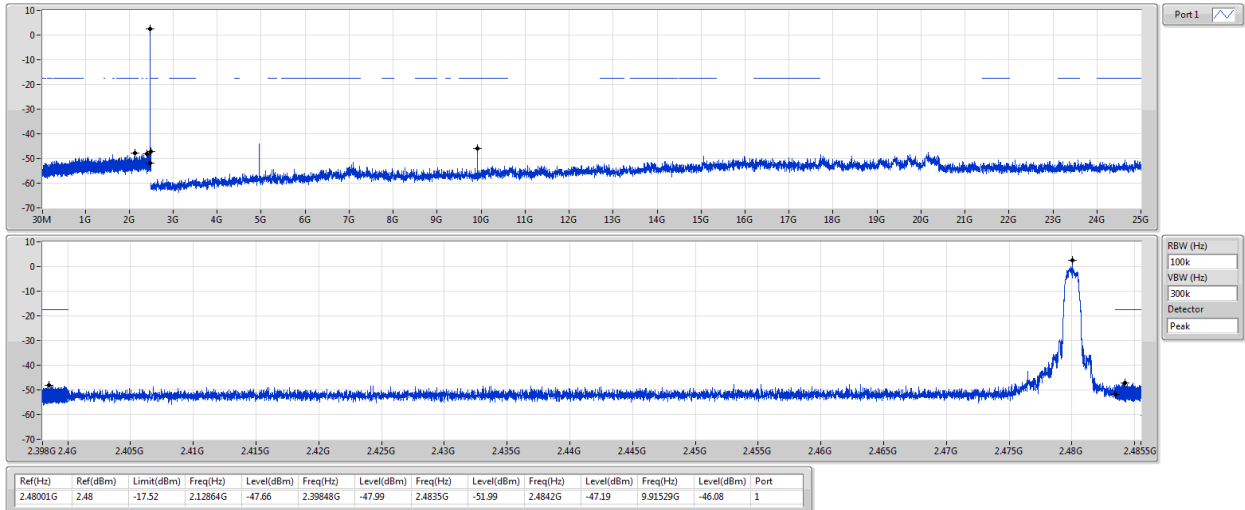
2441MHz



BT-EDR(3Mbps)

CSEndB-FS

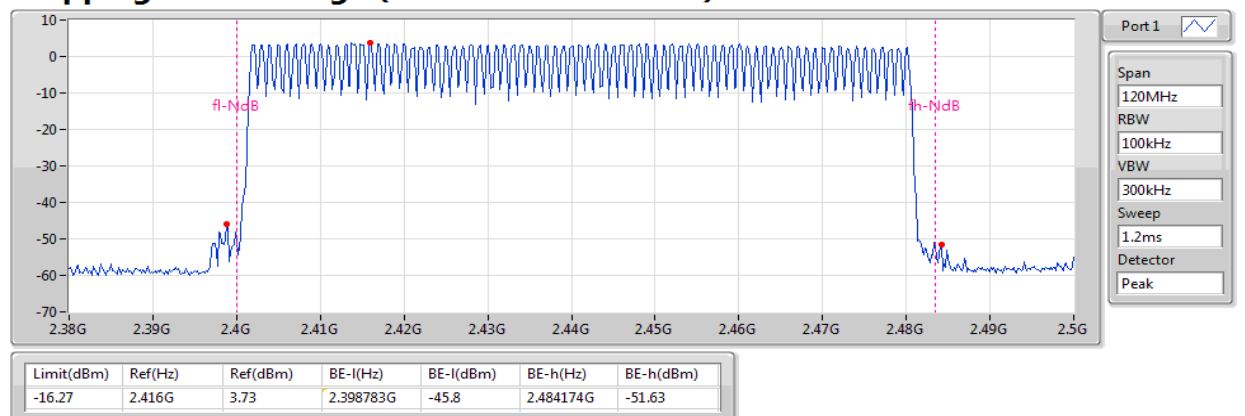
2480MHz



BT-BR(1Mbps)

2441MHz

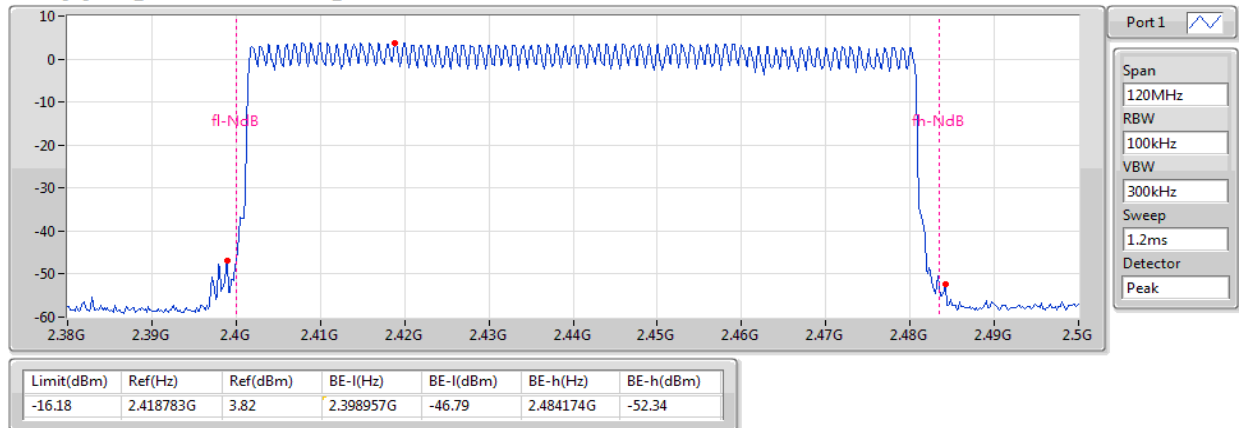
Hopping Ch Bandedge (Non-restricted Band)



BT-EDR(2Mbps)

2441MHz

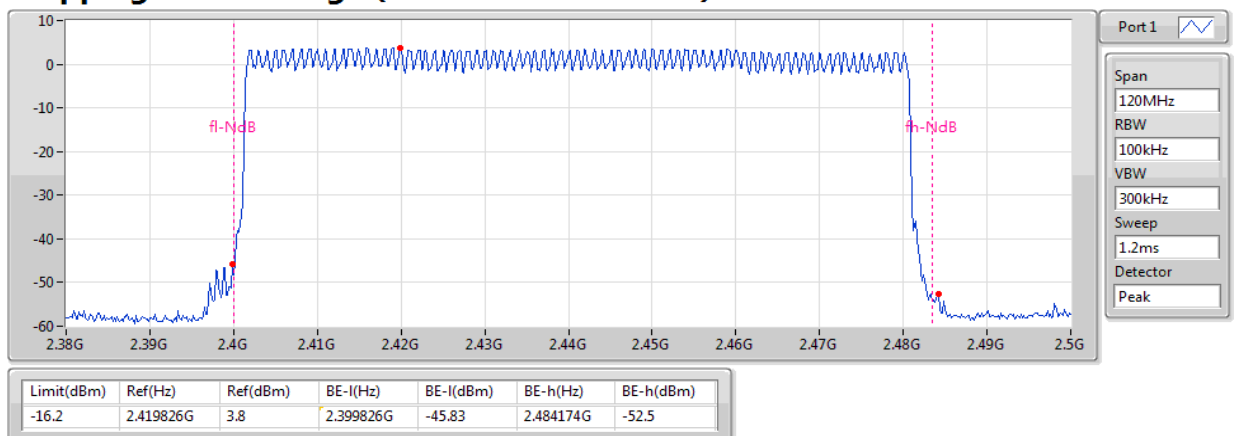
Hopping Ch Bandedge (Non-restricted Band)



BT-EDR(3Mbps)

2441MHz

Hopping Ch Bandedge (Non-restricted Band)



3.4 Conducted Output Power

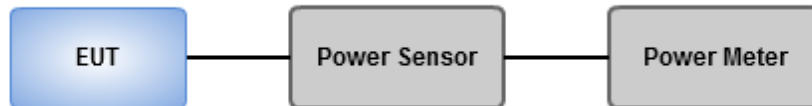
3.4.1 Limit of Conducted Output Power

- ☐ 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.

3.4.2 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

3.4.3 Test Setup



3.4.4 Test Result of Conducted Output Power

Ambient Condition	24°C / 67%	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)	4.11	0.00258
BT-EDR(2Mbps)	5.19	0.00330
BT-EDR(3Mbps)	5.55	0.00359

Result

Mode	Result	Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-BR(1Mbps)	-	-	-	-
2402MHz	Pass	-1.95	4.11	21.00
2441MHz	Pass	-1.95	3.98	21.00
2480MHz	Pass	-1.95	3.22	21.00
BT-EDR(2Mbps)	-	-	-	-
2402MHz	Pass	-1.95	5.19	21.00
2441MHz	Pass	-1.95	5.09	21.00
2480MHz	Pass	-1.95	4.40	21.00
BT-EDR(3Mbps)	-	-	-	-
2402MHz	Pass	-1.95	5.55	21.00
2441MHz	Pass	-1.95	5.29	21.00
2480MHz	Pass	-1.95	4.69	21.00

Summary of Conducted (Average) Output Power

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT-BR(1Mbps)	3.76	0.00238
BT-EDR(2Mbps)	2.58	0.00181
BT-EDR(3Mbps)	2.63	0.00183

Result

Mode	Result	Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT-BR(1Mbps)	-	-	-	-
2402MHz	Pass	-1.95	3.76	-
2441MHz	Pass	-1.95	3.61	-
2480MHz	Pass	-1.95	2.88	-
BT-EDR(2Mbps)	-	-	-	-
2402MHz	Pass	-1.95	2.58	-
2441MHz	Pass	-1.95	2.43	-
2480MHz	Pass	-1.95	1.70	-
BT-EDR(3Mbps)	-	-	-	-
2402MHz	Pass	-1.95	2.63	-
2441MHz	Pass	-1.95	2.45	-
2480MHz	Pass	-1.95	1.71	-

Note: Average power is for reference only.

3.5 Number of Hopping Frequency

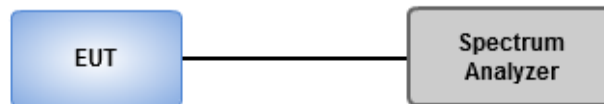
3.5.1 Limit of Number of Hopping Frequency

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

3.5.2 Test Procedures

1. Set RBW = 100kHz, VBW = 300kHz, Sweep time = Auto, Detector = Peak Trace max hold.
2. Allow trace to stabilize.

3.5.3 Test Setup



3.5.4 Test Result of Number of Hopping Frequency

Ambient Condition	24°C / 67%	Tested By	Aska Huang
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Summary

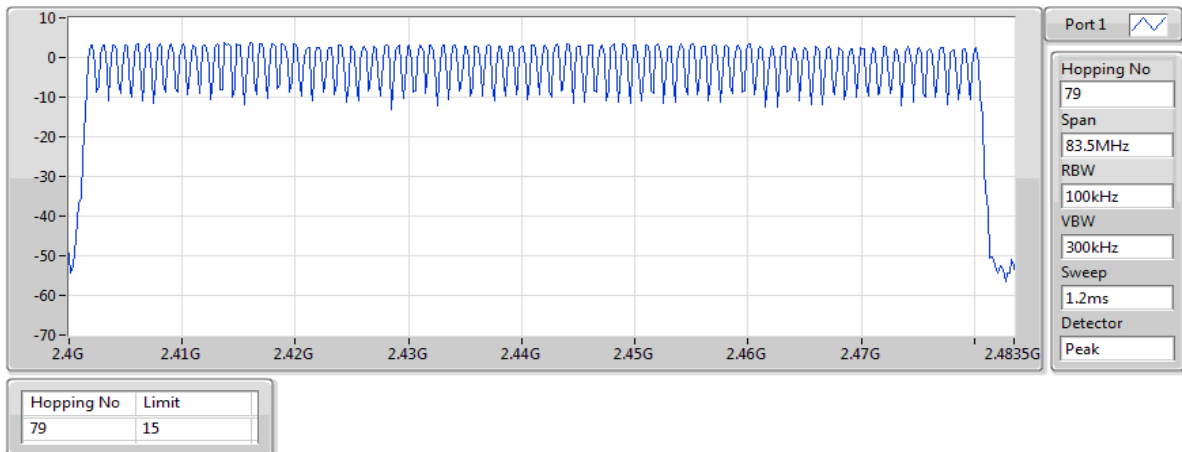
Mode	Max-Hop No
2.4-2.4835GHz	-
BT-BR(1Mbps)	79
BT-EDR(2Mbps)	79
BT-EDR(3Mbps)	79

Result

Mode	Result	Hopping No	Limit
BT-BR(1Mbps)	-	-	-
2441MHz	Pass	79	15
BT-EDR(2Mbps)	-	-	-
2441MHz	Pass	79	15
BT-EDR(3Mbps)	-	-	-
2441MHz	Pass	79	15

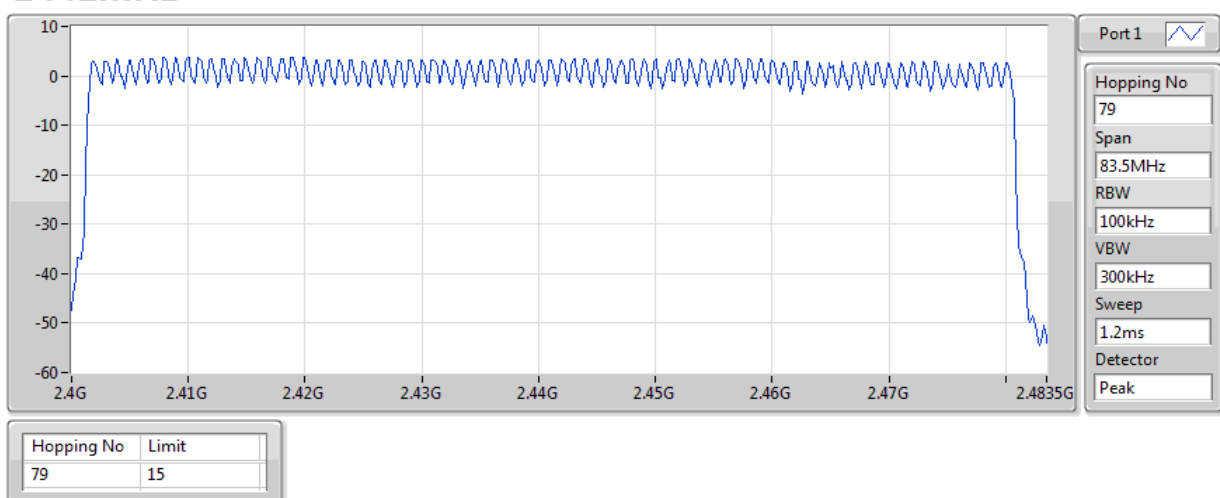
BT-BR(1Mbps)
2441MHz

Hopping Ch



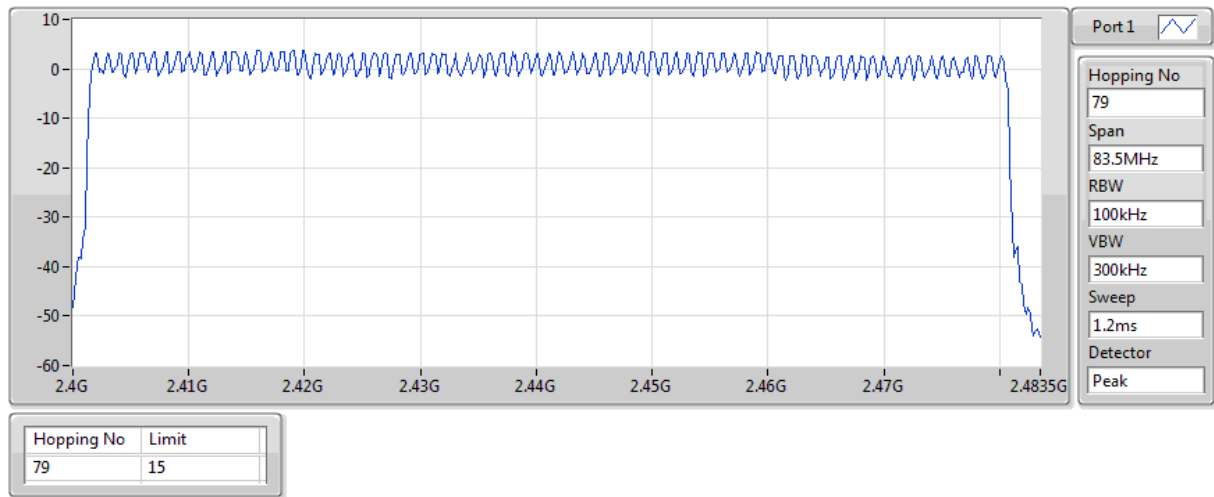
BT-EDR(2Mbps)
2441MHz

Hopping Ch



BT-EDR(3Mbps)
2441MHz

Hopping Ch



3.6 20dB and Occupied Bandwidth

3.6.1 Test Procedures

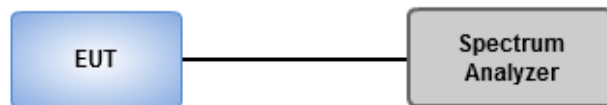
20 dB Bandwidth

1. Set RBW=10kHz VBW= 30kHz for BT BR mode, RBW=20kHz, VBW=100kHz for other modes, Sweep time = Auto, Detector=Peak , Trace max hold
2. Allow trace to stabilize
3. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

1. Set RBW=10kHz VBW= 30kHz for BT BR mode, RBW=20kHz, VBW=100kHz for other modes, Sweep time = Auto, Detector=Sample , Trace max hold
2. Allow trace to stabilize
3. Use Occupied bandwidth function of spectrum analyzer to measuring 99% occupied bandwidth

3.6.2 Test Setup



3.6.3 Test result of 20dB and Occupied Bandwidth

Ambient Condition	24°C / 67%	Tested By	Aska Huang
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Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
BT-BR(1Mbps)	938.406k	871.201k	871KF1D	851.449k	865.412k
BT-EDR(2Mbps)	1.232M	1.178M	1M18G1D	1.203M	1.169M
BT-EDR(3Mbps)	1.236M	1.195M	1M20G1D	1.236M	1.178M

Max-N dB = Maximum 20dB down bandwidth; **Max-OBW** = Maximum 99% occupied bandwidth;

Min-N dB = Minimum 20dB down bandwidth; **Min-OBW** = Minimum 99% occupied bandwidth;

Result

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
BT-BR(1Mbps)	-	-	-	-
2402MHz	Pass	Inf	938.406k	871.201k
2441MHz	Pass	Inf	851.449k	871.201k
2480MHz	Pass	Inf	938.406k	865.412k
BT-EDR(2Mbps)	-	-	-	-
2402MHz	Pass	Inf	1.203M	1.178M
2441MHz	Pass	Inf	1.232M	1.169M
2480MHz	Pass	Inf	1.21M	1.169M
BT-EDR(3Mbps)	-	-	-	-
2402MHz	Pass	Inf	1.236M	1.178M
2441MHz	Pass	Inf	1.236M	1.195M
2480MHz	Pass	Inf	1.236M	1.187M

Port X-N dB = Port X 20dB down bandwidth; **Port X-OBW** = Port X 99% occupied bandwidth;

BT-BR(1Mbps)

2402MHz



20dB(Hz)	Fl-20dB(Hz)	Fh-20dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
938.406k	2.401551G	2.402489G	871.201k	2.401577G	2.402449G	Inf	1

EBW-FS



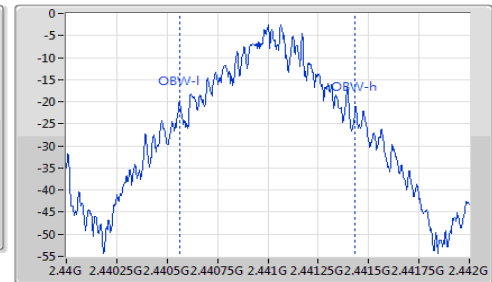
BT-BR(1Mbps)

2441MHz



20dB(Hz)	Fl-20dB(Hz)	Fh-20dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
851.449k	2.440558G	2.441409G	871.201k	2.440563G	2.441434G	Inf	1

EBW-FS



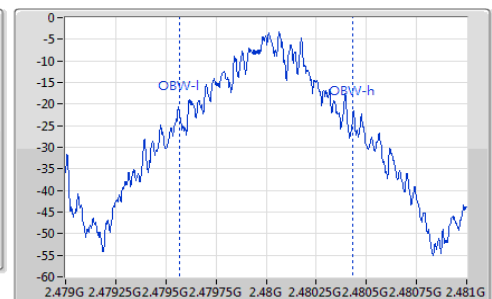
BT-BR(1Mbps)

2480MHz



20dB(Hz)	Fl-20dB(Hz)	Fh-20dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
938.406k	2.479551G	2.480489G	865.412k	2.479566G	2.480431G	Inf	1

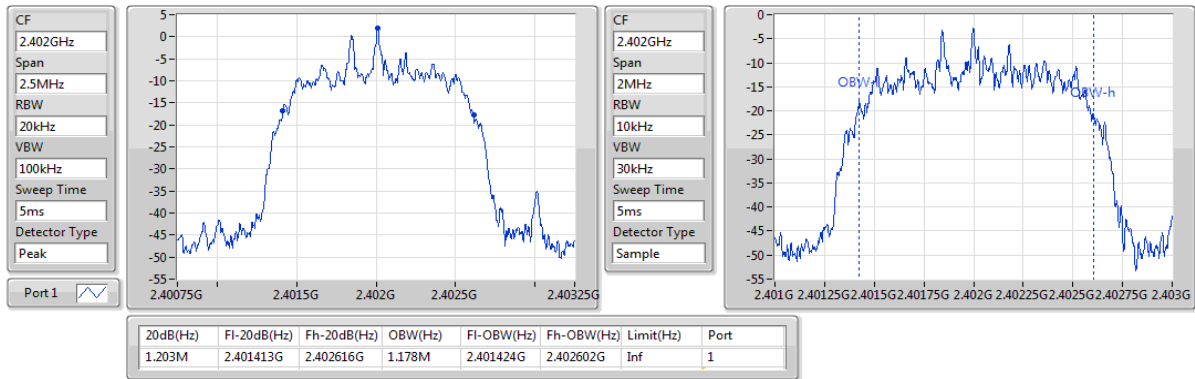
EBW-FS



BT-EDR(2Mbps)

EBW-FS

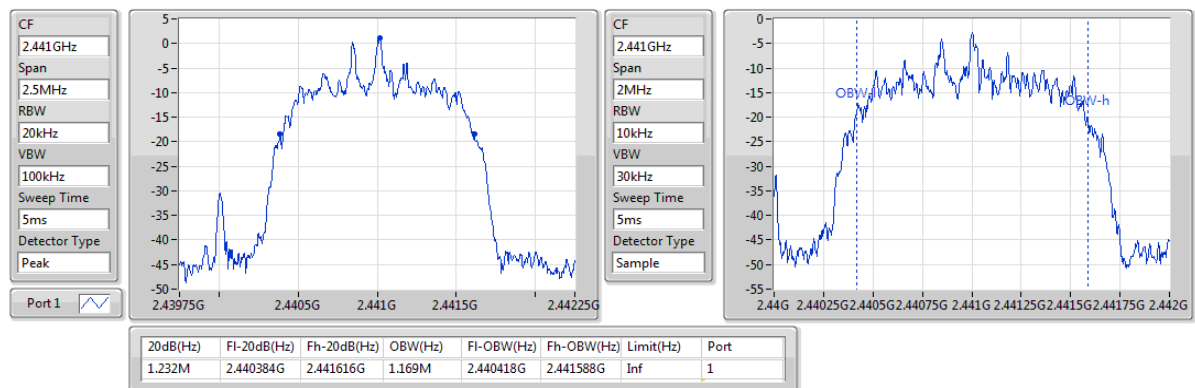
2402MHz



BT-EDR(2Mbps)

EBW-FS

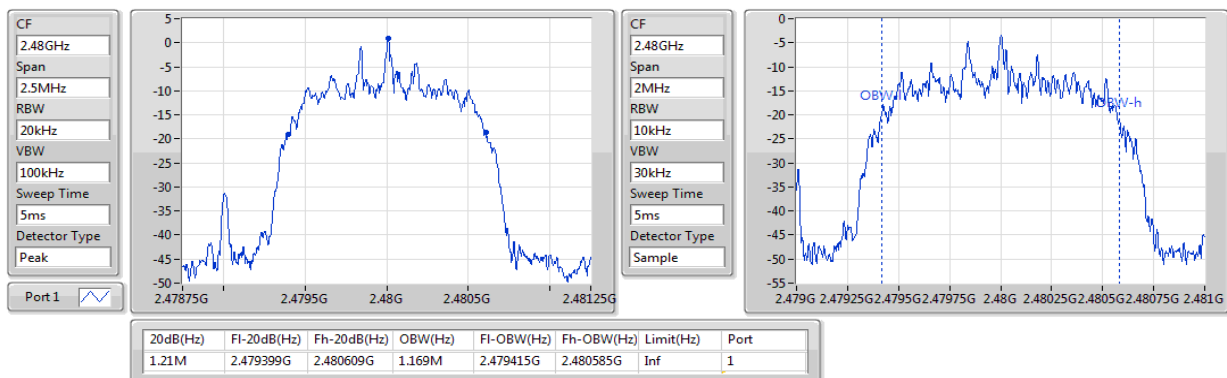
2441MHz



BT-EDR(2Mbps)

EBW-FS

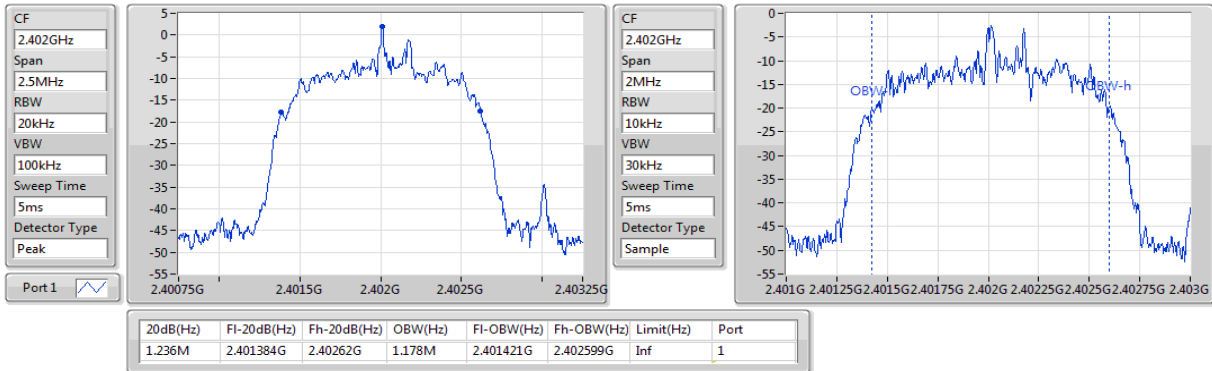
2480MHz



BT-EDR(3Mbps)

EBW-FS

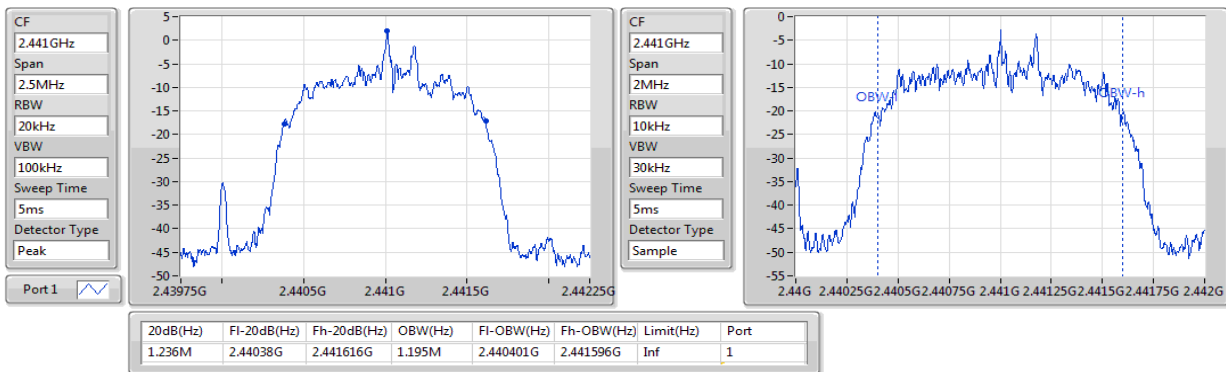
2402MHz



BT-EDR(3Mbps)

EBW-FS

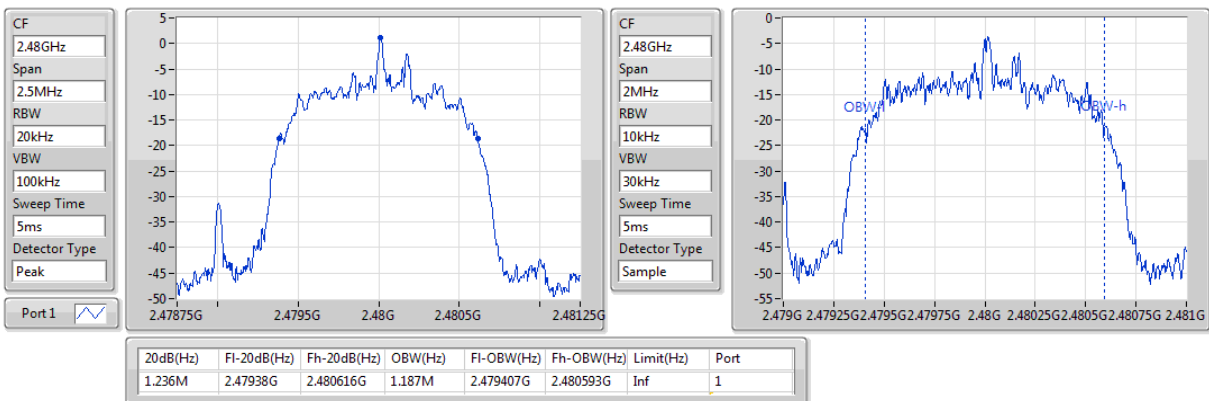
2441MHz



BT-EDR(3Mbps)

EBW-FS

2480MHz



3.7 Channel Separation

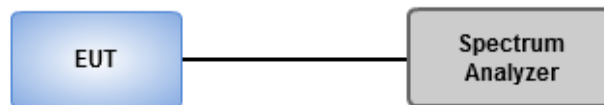
3.7.1 Limit of Channel Separation

- ☐ Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.
- ☒ Frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

3.7.2 Test Procedures

1. Set RBW=30kHz, VBW=100kHz, Sweep time = Auto, Detector=Peak Trace max hold
2. Allow trace to stabilize
3. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The EUT shall show compliance with the appropriate regulatory limit

3.7.3 Test Setup



3.7.4 Test result of Channel Separation

Ambient Condition	24°C / 67%	Tested By	Aska Huang
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Summary

Mode	Max-Space (Hz)	Min-Space (Hz)
2.4-2.4835GHz	-	-
BT-BR(1Mbps)	1.004348M	1M
BT-EDR(2Mbps)	1.004348M	1M
BT-EDR(3Mbps)	1.004348M	1M

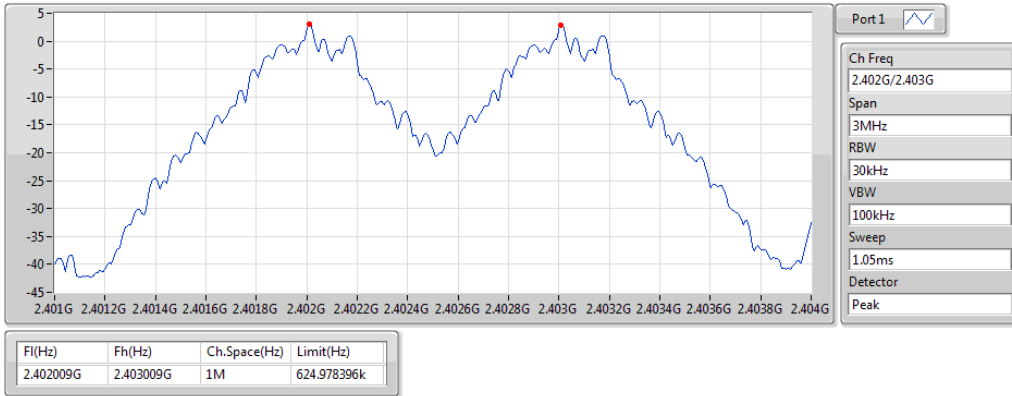
Result

Mode	Result	Fl (Hz)	Fh (Hz)	Ch.Space (Hz)	Limit (Hz)
BT-BR(1Mbps)	-	-	-	-	-
2402MHz	Pass	2.402009G	2.403009G	1M	624.978396k
2441MHz	Pass	2.441009G	2.442013G	1.004348M	567.065034k
2480MHz	Pass	2.479013G	2.480013G	1M	624.978396k
BT-EDR(2Mbps)	-	-	-	-	-
2402MHz	Pass	2.402009G	2.403013G	1.004348M	801.198k
2441MHz	Pass	2.441009G	2.442013G	1.004348M	820.512k
2480MHz	Pass	2.479013G	2.480013G	1M	805.86k
BT-EDR(3Mbps)	-	-	-	-	-
2402MHz	Pass	2.402009G	2.403013G	1.004348M	823.176k
2441MHz	Pass	2.441009G	2.442013G	1.004348M	823.176k
2480MHz	Pass	2.479013G	2.480013G	1M	823.176k

BT-BR(1Mbps)

Channel Separation

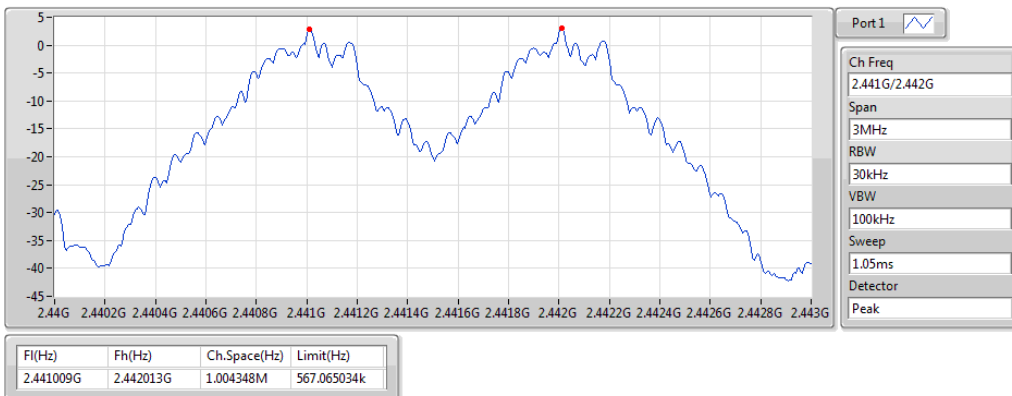
2.402G/2.403GHz



BT-BR(1Mbps)

Channel Separation

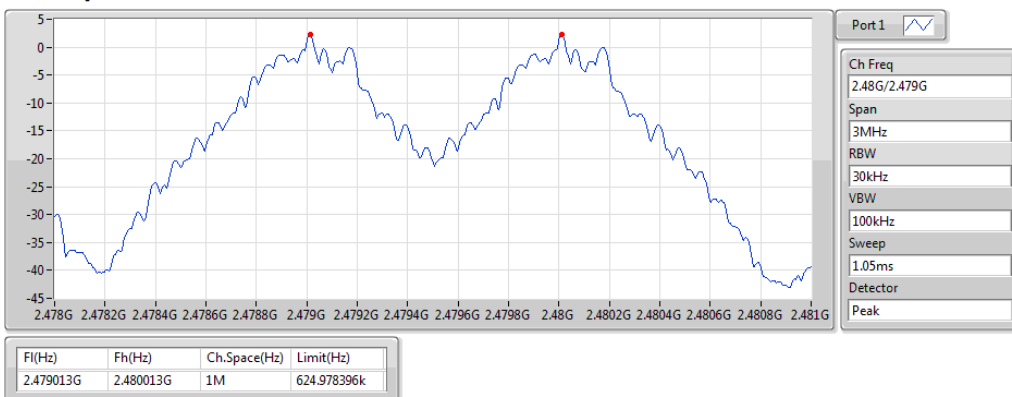
2.441G/2.442GHz



BT-BR(1Mbps)

Channel Separation

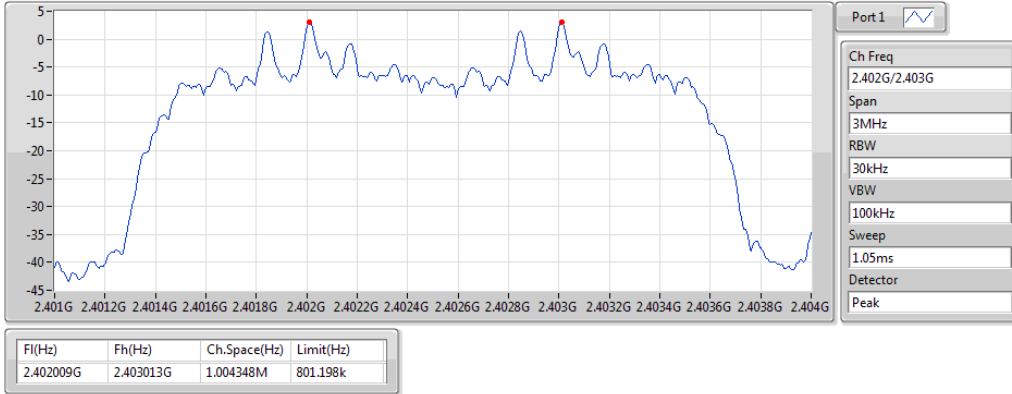
2.48G/2.479GHz



BT-EDR(2Mbps)

Channel Separation

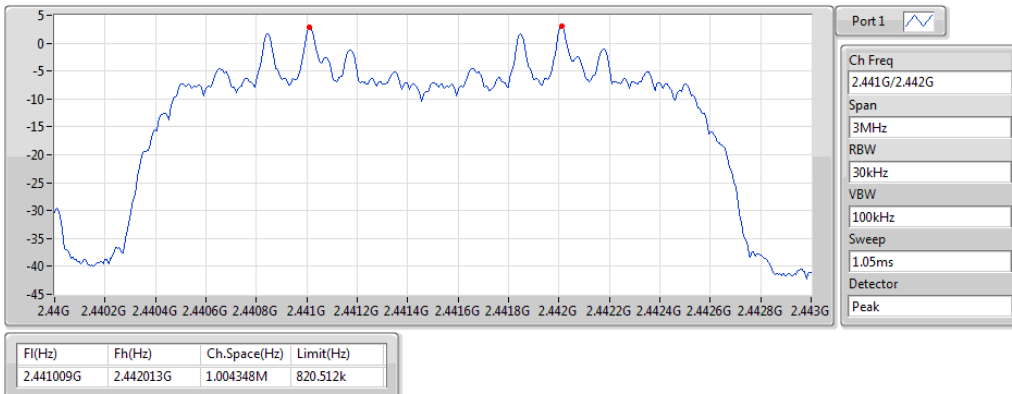
2.402G/2.403GHz



BT-EDR(2Mbps)

Channel Separation

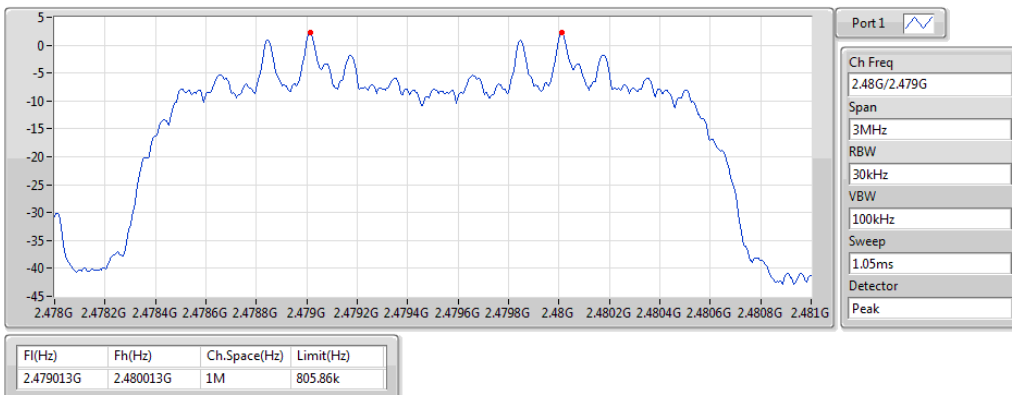
2.441G/2.442GHz



BT-EDR(2Mbps)

Channel Separation

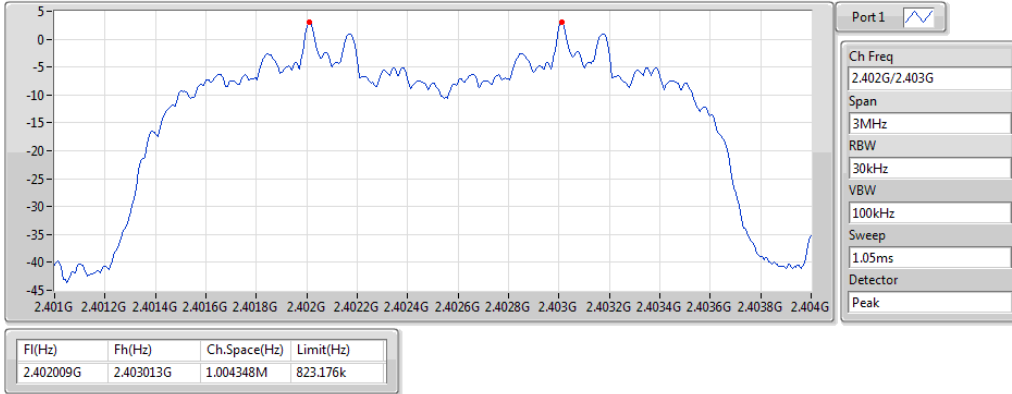
2.48G/2.479GHz



BT-EDR(3Mbps)

Channel Separation

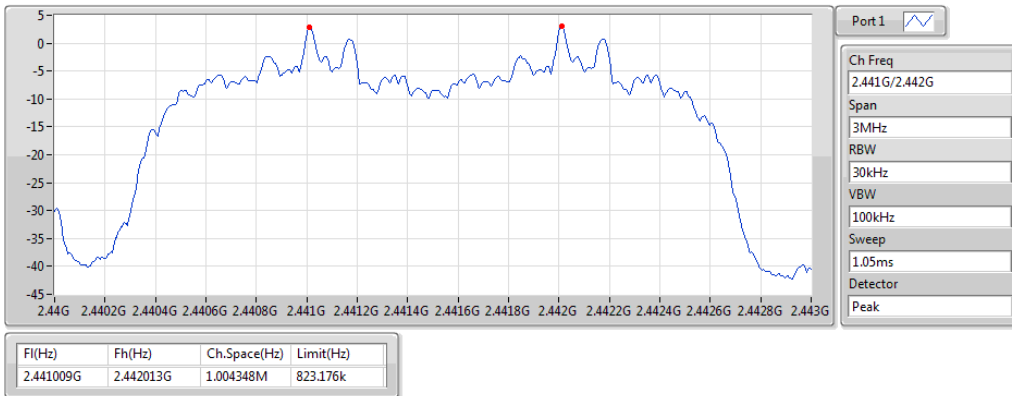
2.402G/2.403GHz



BT-EDR(3Mbps)

Channel Separation

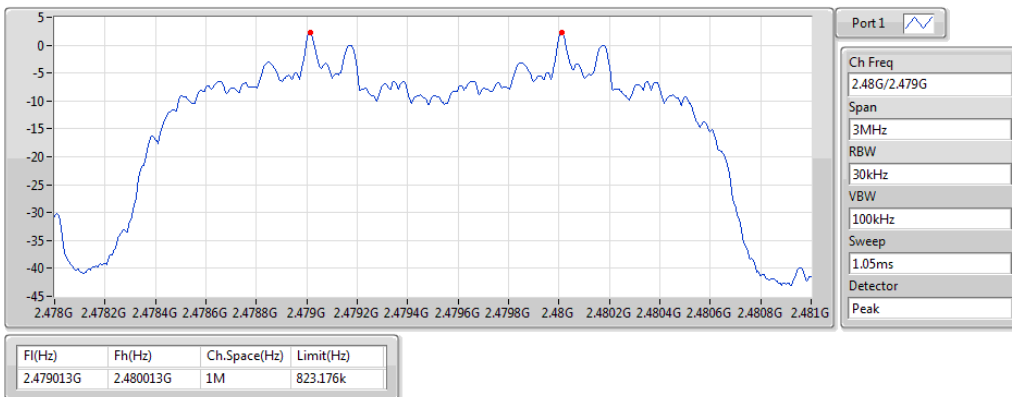
2.441G/2.442GHz



BT-EDR(3Mbps)

Channel Separation

2.48G/2.479GHz



3.8 Number of Dwell Time

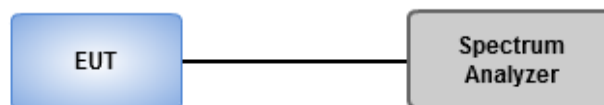
3.8.1 Limit of Dwell time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

3.8.2 Test Procedures

1. Set RBW=300 kHz, VBW=1 MHz, Sweep time=5 ms, Detector=Peak, Span=0 Hz, Trace max hold.
2. Enable gating and trigger function of spectrum analyzer to measure burst on time.
3. Set RBW=300 kHz, VBW=1 MHz, Sweep time=5 s / 2 s, Detector=Peak, Span=0 Hz, Trace max hold.
4. Enable gating and trigger function of spectrum analyzer to measure burst on number of transmission.
5. Set RBW=300 kHz, VBW=1 MHz, Sweep time=31.6 s / 8 s, Detector=Peak, Span=0 Hz, Trace max hold.
6. Enable gating and trigger function of spectrum analyzer to measure burst on number of transmission of entire time cycle.

3.8.3 Test Setup



3.8.4 Test Result of Dwell Time

Ambient Condition	24°C / 67%	Tested By	Aska Huang
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Result/ Non AFH mode

Mode	Result	Period (s)	Dwell (s)	Limit (s)	Tx On (ms)	Number of transmission in a 5 s
BT-BR(1Mbps)	-	-	-	-	-	-
2402MHz_DH5	PASS	31.6	0.31257	0.4	2.90925	17
BT-EDR(2Mbps)	-	-	-	-	-	-
2402MHz_DH5	PASS	31.6	0.31308	0.4	2.91400	17
BT-EDR(3Mbps)	-	-	-	-	-	-
2402MHz_DH5	PASS	31.6	0.31327	0.4	2.91575	17

Note 1: Dwell time = Number of transmission in a 5 second x Tx On Time x 6.32

Note 2: DH5 was the worst mode.

Result/ AFH mode

Mode	Result	Period (s)	Dwell (s)	Limit (s)	Tx On (ms)	Number of transmission in a 2 s
BT-BR-AFH(1Mbps)	-	-	-	-	-	-
2402MHz_DH5	PASS	8	0.31420	0.4	2.90925	27
BT-EDR-AFH(2Mbps)	-	-	-	-	-	-
2402MHz_DH5	PASS	8	0.31469	0.4	2.91375	27
BT-EDR-AFH(3Mbps)	-	-	-	-	-	-
2402MHz_DH5	PASS	8	0.30329	0.4	2.91625	26

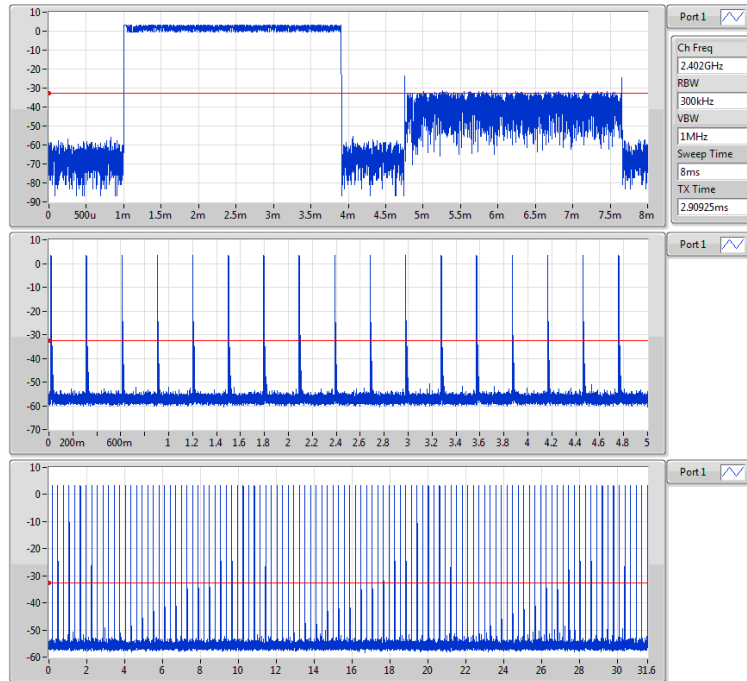
Note 1: Dwell time = Number of transmission in a 2 second x Tx On Time x 4

Note 2: DH5 was the worst mode.

BT-BR(1Mbps)

2402MHz

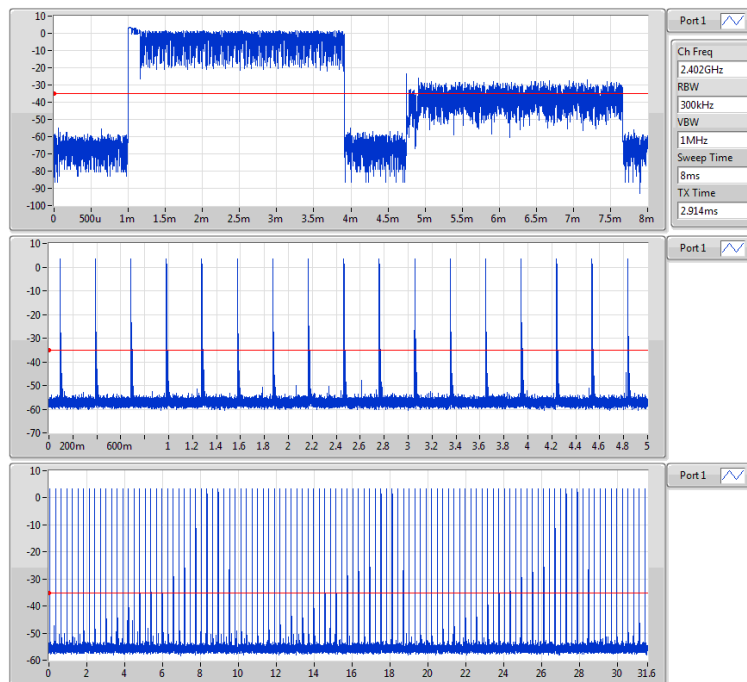
Dwell



BT-EDR(2Mbps)

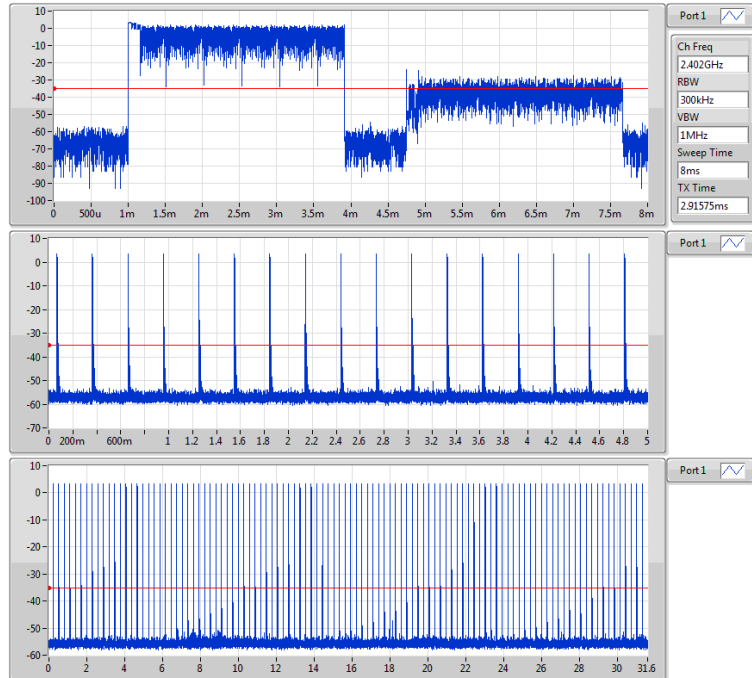
2402MHz

Dwell



BT-EDR(3Mbps)

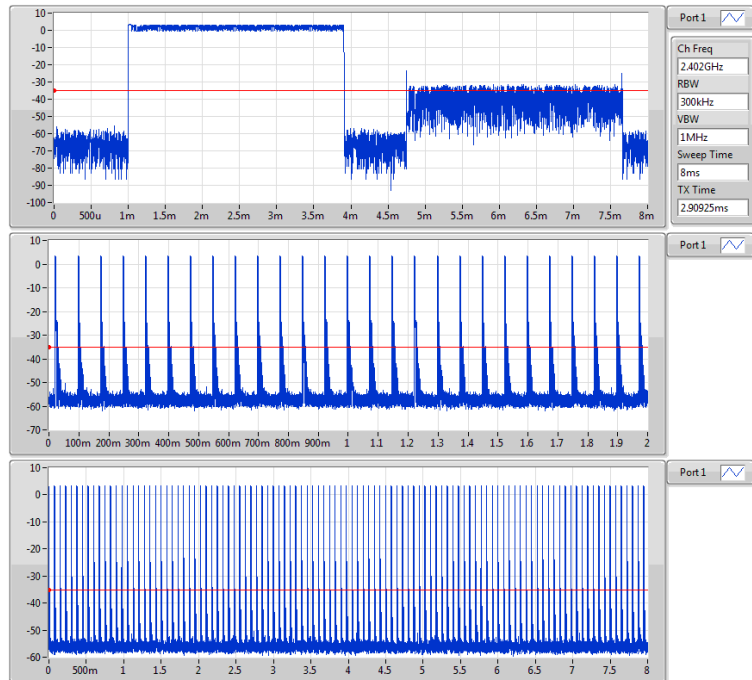
2402MHz



Dwell

BT-BR-AFH(1Mbps)

2402MHz

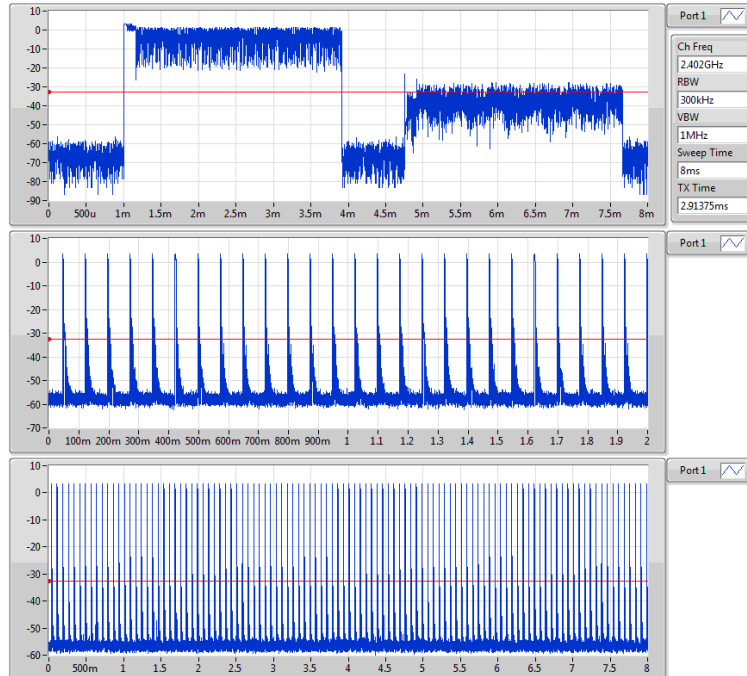


Dwell

BT-EDR-AFH(2Mbps)

Dwell

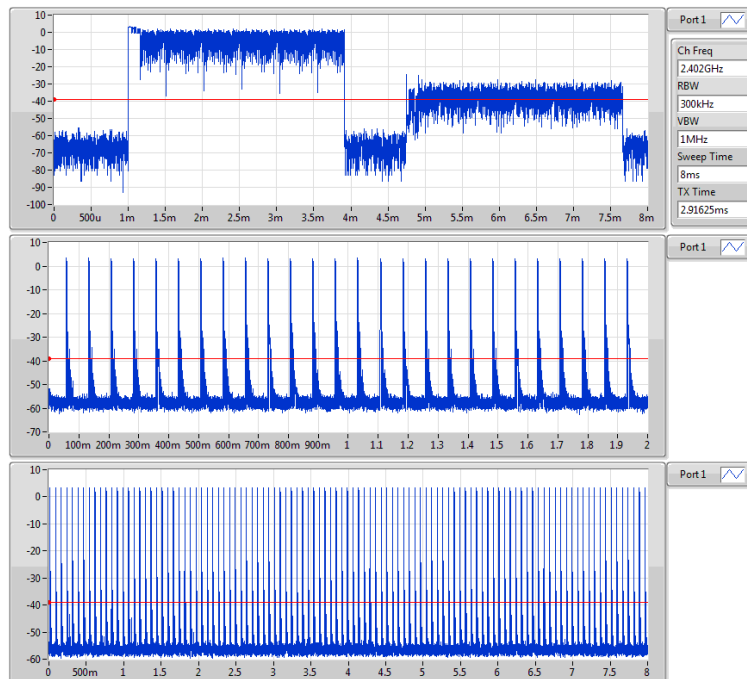
2402MHz



BT-EDR-AFH(3Mbps)

Dwell

2402MHz



4 Receiver Test Results

4.1 Unwanted Emissions into Restricted Frequency Bands

4.1.1 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:
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.

4.1.2 Test Procedures

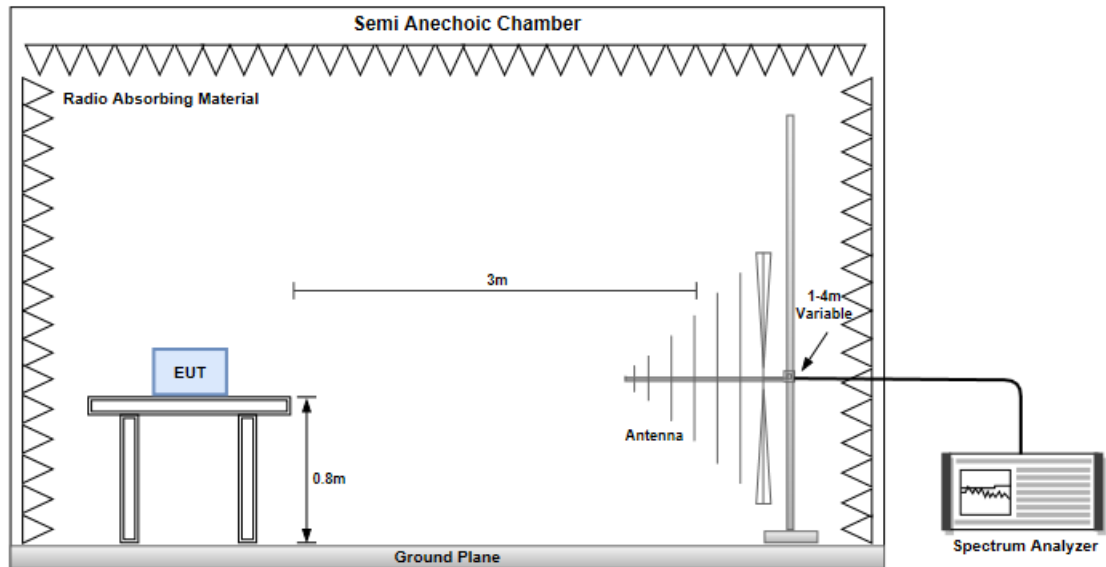
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at a height of 0.8 m test table above the ground plane.
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:

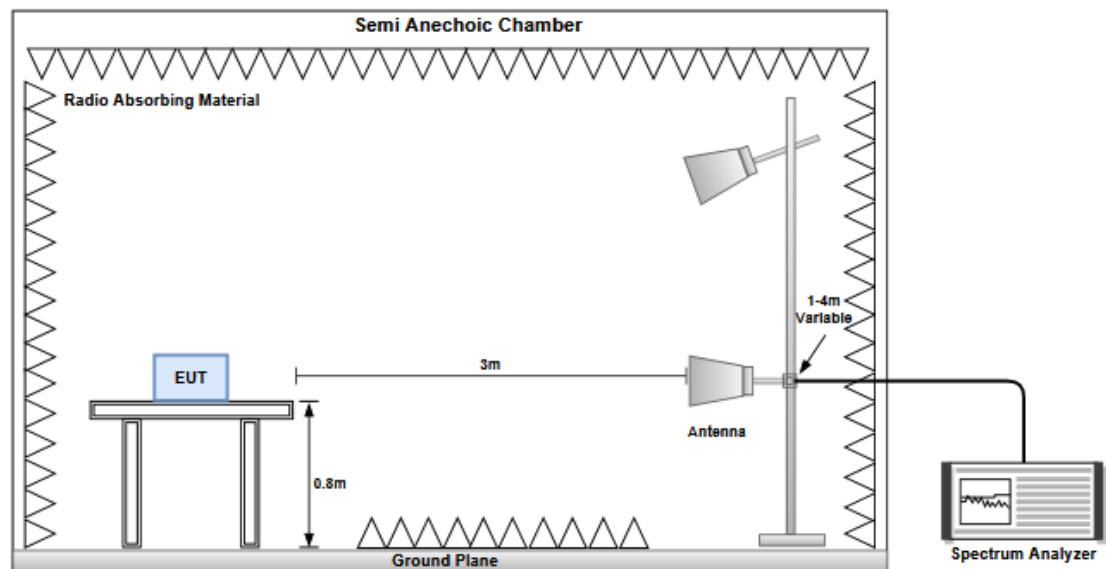
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.

4.1.3 Test Setup

Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz



4.1.4 Receiver Radiated Unwanted Emissions

Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Horizontal	Test Configuration	2
Test By :Roger Lu Temperature(°C):23 Humidity(%):62			
Level (dBUV/m)			

Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Vertical	Test Configuration	2
Test By :Roger Lu Temperature(°C):23 Humidity(%):62			
Level (dBuV/m)			

4.1.5 Receiver Radiated Unwanted Emissions (Above 1GHz)

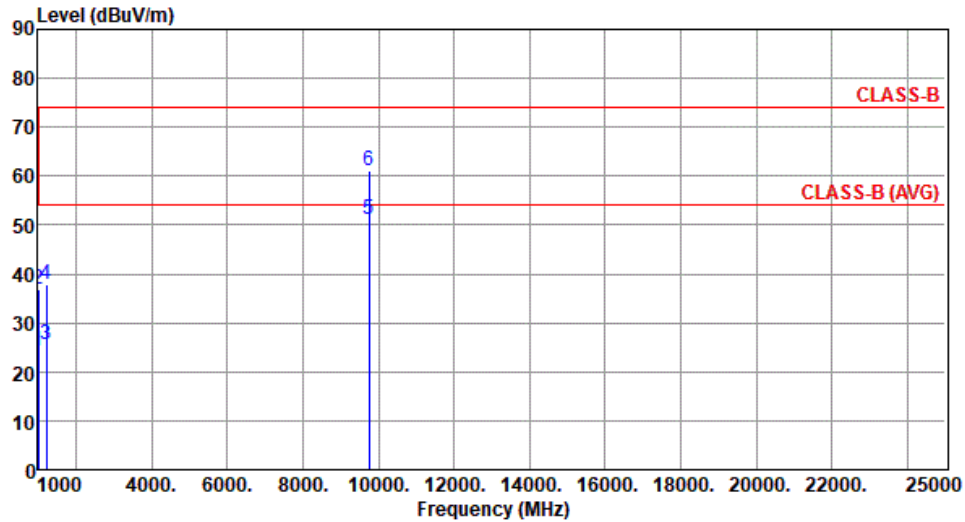
Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Horizontal	Test Configuration	2
Test By :Roger Lu Temperature(°C):25 Humidity(%):65			
Level (dBuV/m)			

Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Vertical	Test Configuration	2

Test By :Roger Lu

Temperature(°C):25

Humidity(%):65



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1008.00	24.18	54.00	-29.82	31.22	-7.04	Average	100	45
2	1008.00	37.02	74.00	-36.98	44.06	-7.04	Peak	100	45
3	1223.00	25.64	54.00	-28.36	30.78	-5.14	Average	100	60
4	1223.00	37.96	74.00	-36.04	43.10	-5.14	Peak	100	60
5	9757.00	51.02	54.00	-2.98	34.98	16.04	Average	100	119
6	9757.00	61.09	74.00	-12.91	45.05	16.04	Peak	100	119

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

5 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 Corp (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>.

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Kwei Shan Site II

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd
St., Kwei Shan District, 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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==END==