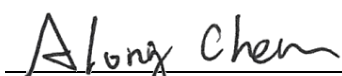


FCC Test Report

FCC ID : 2ARU9NEPHUBL001
Equipment : Neptune IoT Hub Lite
Model No. : HM-HUB-120
Brand Name : HOMA
Applicant : HOMA Technologies JSC
Address : Building 5, 13th Street, QTSC Tan Chanh Hiep
Ward, District 12, Ho Chi Minh city, 729226,
Vietnam.
Standard : 47 CFR FCC Part 15.247
Received Date : Nov. 09, 2018
Tested Date : Nov. 23 ~ Nov. 28, 2018

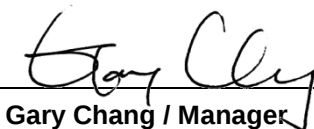
We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval 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
FR8N0901ZB	Rev. 01	Initial issue	Feb. 15, 2019

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.171MHz 44.27 (Margin -20.63dB) - QP	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 2483.50MHz 52.99 (Margin -1.01dB) - AV	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 19.44	Pass
15.247(a)(2)	6dB Bandwidth	Meet the requirement of limit	Pass
15.247(e)	Power Spectral Density	Meet the requirement of limit	Pass
15.203	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 values of gain for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of the gain.

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information				
Frequency Range (MHz)	Mode	Ch. Frequency (MHz)	Channel Number	Data Rate
2400~2483.5	ZigBee	2405~2480	11-26 [16]	250kbps
Note 1: ZigBee uses DSSS-O-QPSK modulation.				

1.1.2 Antenna Details

Ant. No.	Type	Connector	Gain (dBi)	Remarks
1	PIFA	UFL	2.62	---

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	12Vdc from adapter
-------------------	--------------------

1.1.4 Accessories

Accessories		
No.	Equipment	Description
1	AC Adapter	Brand: APD Model: WA-36A12R Power Rating: I/P: 100-240Vac, 50/60Hz, 0.9A Max O/P: 12Vdc, 3.0A Power Line: DC 1.8m non-shielded w/o core

1.1.5 Channel List

Channel No.	Frequency (MHz)
11	2405
12	2410
13	2415
14	2420
15	2425
16	2430
17	2435
18	2440
19	2445
20	2450
21	2455
22	2460
23	2465
24	2470
25	2475
26	2480

1.1.6 Test Tool and Duty Cycle

Test Tool	PUTTY, Version:V0.60	
Duty Cycle and Duty Factor	Duty Cycle (%)	Duty Factor (dB)
	100	0

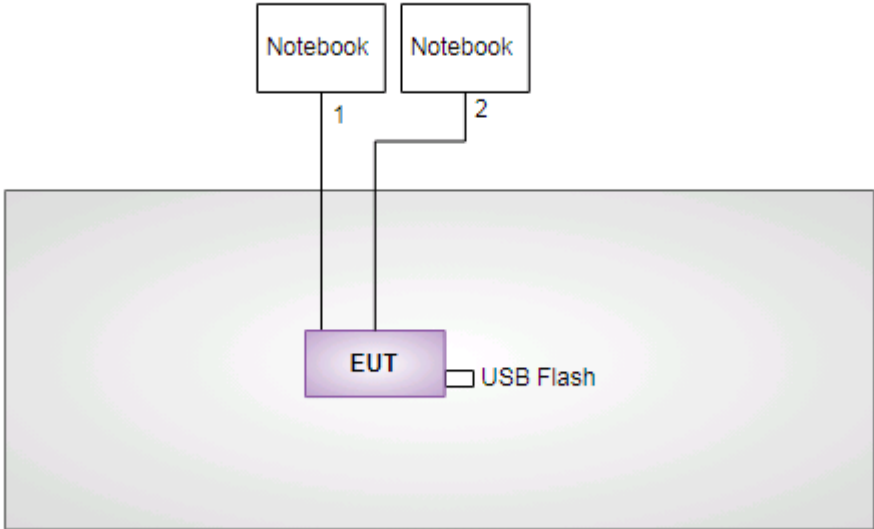
1.1.7 Power Index of Test Tool

Modulation Mode	Test Frequency (MHz)	Power Index
O-QPSK	2405	0x14
O-QPSK	2440	0x14
O-QPSK	2475	0x14
O-QPSK	2480	0x0d

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Notebook	DELL	Latitude E5470	3J5JVF2	---
2	Notebook	DELL	Latitude E6430	9ZFB4X1	---
3	USB Flash	Kingston	DTSE9	NXPAB	---

1.3 Test Setup Chart

Test Setup Diagram	
	
No.	Signal cable / Length (m)
1	RJ45, 10m non-shielded.
2	RJ45, 10m non-shielded.

1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Jan. 05, 2018	Jan. 04, 2019
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 05, 2018	Nov. 04, 2019
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 23, 2018	Oct. 23, 2019
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 1 / (03CH01-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101498	Dec. 04, 2017	Dec. 03, 2018
Receiver	R&S	ESR3	101657	Jan. 05, 2018	Jan. 04, 2019
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 18, 2018	Jul. 17, 2019
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 20, 2017	Dec. 19, 2018
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2018	Nov. 14, 2019
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 09, 2018	Nov. 08, 2019
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 08, 2018	Oct. 07, 2019
Preamplifier	EMC	EMC02325	980225	Jul. 20, 2018	Jul. 19, 2019
Preamplifier	Agilent	83017A	MY39501308	Oct. 04, 2018	Oct. 03, 2019
Preamplifier	EMC	EMC184045B	980192	Aug. 09, 2018	Aug. 08, 2019
RF Cable	EMC	EMC104-SM-SM-8000	181106	Oct. 08, 2018	Oct. 07, 2019
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 08, 2018	Oct. 07, 2019
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Oct. 08, 2018	Oct. 07, 2019
LF cable 1M	EMC	EMCCFD400-NM-NM-1000	160502	Oct. 08, 2018	Oct. 07, 2019
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 08, 2018	Oct. 07, 2019
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Oct. 08, 2018	Oct. 07, 2019
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)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101063	Apr. 16, 2018	Apr. 15, 2019
Power Meter	Anritsu	ML2495A	1241002	Oct. 09, 2018	Oct. 08, 2019
Power Sensor	Anritsu	MA2411B	1207366	Oct. 09, 2018	Oct. 08, 2019
AC POWER SOURCE	APC	AFC-500W	F312060012	Dec. 01, 2017	Nov. 30, 2018
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.247

ANSI C63.10-2013

FCC KDB 558074 D01 15.247 Meas Guidance v05

1.6 Deviation from Test Standard and Measurement Procedure

None

1.7 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Measurement Uncertainty	
Parameters	Uncertainty
Bandwidth	±34.139 Hz
Conducted power	±0.808 dB
Power density	±0.557 dB
Conducted emission	±2.680 dB
AC conducted emission	±2.90 dB
Radiated emission ≤ 1GHz	±3.41 dB
Radiated emission > 1GHz	±4.59 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	24°C / 57%	Alex Tsai
Radiated Emissions	03CH01-WS	24°C / 62-66%	Aska Huang Akun Chung
RF Conducted	TH01-WS	22°C / 64%	Aska Huang

- FCC Designation No.: TW2732
- FCC site registration No.: 181692
- IC site registration No.: 10807A-1

2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (MHz)	Data Rate	Test Configuration
Conducted Emissions	O-QPSK	2405	250kbps	---
Radiated Emissions ≤1GHz	O-QPSK	2405	250kbps	---
Radiated Emissions >1GHz Maximum Output Power 6dB bandwidth Power spectral density	O-QPSK	2405 / 2440 / 2475 / 2480	250kbps	---

NOTE:

1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **Z-plane** results were found as the worst case and were shown in this report.

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.

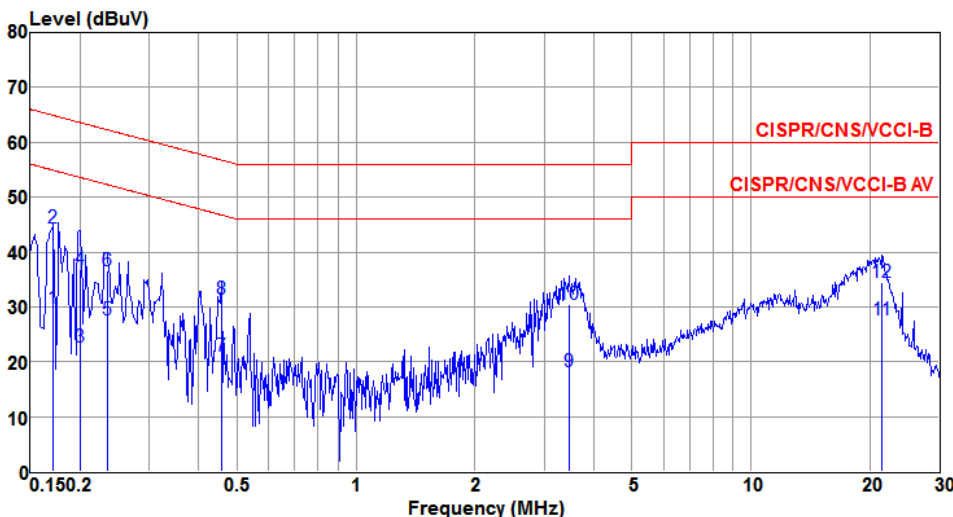
3.1.3 Test Setup



- 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

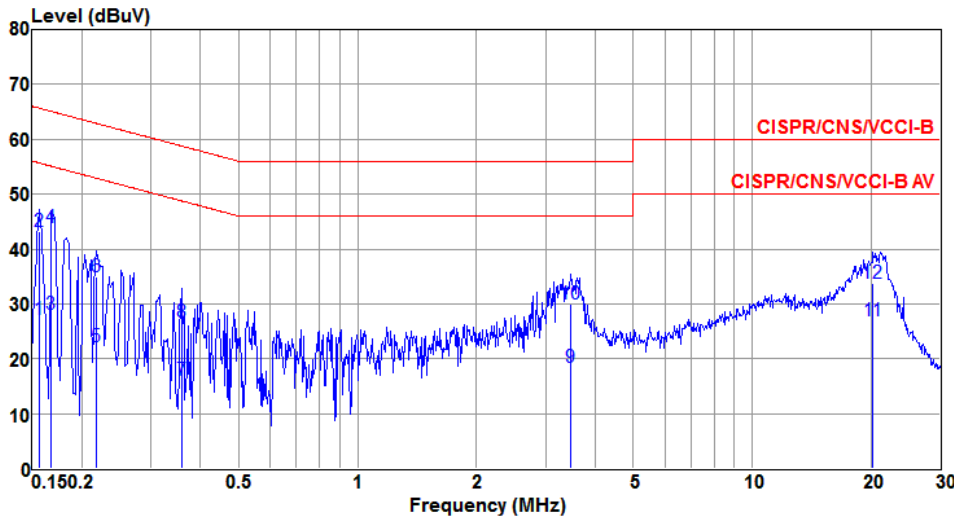
3.1.4 Test Result of Conducted Emissions

Modulation	O-QPSK	Test Freq. (MHz)	2405
Power Phase	Line		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.171	29.64	54.90	-25.26	29.45	0.07	0.02	Average
2*	0.171	44.27	64.90	-20.63	44.08	0.07	0.02	QP
3	0.201	22.61	53.58	-30.97	22.41	0.06	0.03	Average
4	0.201	36.71	63.58	-26.87	36.51	0.06	0.03	QP
5	0.234	27.52	52.30	-24.78	27.31	0.06	0.03	Average
6	0.234	36.49	62.30	-25.81	36.28	0.06	0.03	QP
7	0.456	20.95	46.76	-25.81	20.71	0.06	0.02	Average
8	0.456	31.31	56.76	-25.45	31.07	0.06	0.02	QP
9	3.472	18.26	46.00	-27.74	17.70	0.11	0.19	Average
10	3.472	30.49	56.00	-25.51	29.93	0.11	0.19	QP
11	21.486	27.64	50.00	-22.36	26.53	0.25	0.36	Average
12	21.486	34.42	60.00	-25.58	33.31	0.25	0.36	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

Modulation	O-QPSK	Test Freq. (MHz)	2405																																																																																																																																							
Power Phase	Neutral																																																																																																																																									
Level (dBuV)  Frequency (MHz) <table><thead><tr><th></th><th>Freq</th><th>Level</th><th>Limit</th><th>Over</th><th>Read</th><th>LISN</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>factor</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>dB</th><th>dB</th><th></th></tr></thead><tbody><tr><td>1</td><td>0.156</td><td>27.21</td><td>65.69</td><td>-38.48</td><td>26.95</td><td>0.05</td><td>0.01</td><td>Average</td></tr><tr><td>2</td><td>0.156</td><td>43.12</td><td>65.69</td><td>-22.57</td><td>42.86</td><td>0.05</td><td>0.01</td><td>QP</td></tr><tr><td>3</td><td>0.168</td><td>28.09</td><td>65.08</td><td>-36.99</td><td>27.82</td><td>0.05</td><td>0.02</td><td>Average</td></tr><tr><td>4*</td><td>0.168</td><td>43.93</td><td>65.08</td><td>-21.15</td><td>43.66</td><td>0.05</td><td>0.02</td><td>QP</td></tr><tr><td>5</td><td>0.219</td><td>22.15</td><td>62.88</td><td>-40.73</td><td>21.86</td><td>0.04</td><td>0.03</td><td>Average</td></tr><tr><td>6</td><td>0.219</td><td>35.01</td><td>62.88</td><td>-27.87</td><td>34.72</td><td>0.04</td><td>0.03</td><td>QP</td></tr><tr><td>7</td><td>0.358</td><td>16.17</td><td>58.78</td><td>-42.61</td><td>15.85</td><td>0.05</td><td>0.02</td><td>Average</td></tr><tr><td>8</td><td>0.358</td><td>26.58</td><td>58.78</td><td>-32.20</td><td>26.26</td><td>0.05</td><td>0.02</td><td>QP</td></tr><tr><td>9</td><td>3.472</td><td>18.45</td><td>56.00</td><td>-37.55</td><td>17.83</td><td>0.09</td><td>0.19</td><td>Average</td></tr><tr><td>10</td><td>3.472</td><td>29.90</td><td>56.00</td><td>-26.10</td><td>29.28</td><td>0.09</td><td>0.19</td><td>QP</td></tr><tr><td>11</td><td>20.270</td><td>26.95</td><td>60.00</td><td>-33.05</td><td>25.75</td><td>0.26</td><td>0.34</td><td>Average</td></tr><tr><td>12</td><td>20.270</td><td>33.75</td><td>60.00</td><td>-26.25</td><td>32.55</td><td>0.26</td><td>0.34</td><td>QP</td></tr></tbody></table>					Freq	Level	Limit	Over	Read	LISN	cable			MHz	dBuV	Line	Limit	Level	factor	loss	Remark				dBuV	dB	dBuV	dB	dB		1	0.156	27.21	65.69	-38.48	26.95	0.05	0.01	Average	2	0.156	43.12	65.69	-22.57	42.86	0.05	0.01	QP	3	0.168	28.09	65.08	-36.99	27.82	0.05	0.02	Average	4*	0.168	43.93	65.08	-21.15	43.66	0.05	0.02	QP	5	0.219	22.15	62.88	-40.73	21.86	0.04	0.03	Average	6	0.219	35.01	62.88	-27.87	34.72	0.04	0.03	QP	7	0.358	16.17	58.78	-42.61	15.85	0.05	0.02	Average	8	0.358	26.58	58.78	-32.20	26.26	0.05	0.02	QP	9	3.472	18.45	56.00	-37.55	17.83	0.09	0.19	Average	10	3.472	29.90	56.00	-26.10	29.28	0.09	0.19	QP	11	20.270	26.95	60.00	-33.05	25.75	0.26	0.34	Average	12	20.270	33.75	60.00	-26.25	32.55	0.26	0.34	QP
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3.2 6dB and Occupied Bandwidth

3.2.1 Limit of 6dB Bandwidth

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

3.2.2 Test Procedures

6dB Bandwidth

1. Set resolution bandwidth (RBW) = 100 kHz, Video bandwidth = 300 kHz.
2. Detector = Peak, Trace mode = max hold.
3. Sweep = auto couple, Allow the trace to stabilize.
4. 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 6dB relative to the maximum level measured in the fundamental emission.

Occupied Bandwidth

1. Set resolution bandwidth (RBW) = 1% ~ 5 % of OBW, Video bandwidth = 3 x RBW
2. Detector = Sample, Trace mode = max hold.
3. Sweep = auto couple, Allow the trace to stabilize.
4. Use the OBW measurement function of spectrum analyzer to measure the occupied bandwidth.

3.2.3 Test Setup



3.2.4 Test Result of 6dB and Occupied Bandwidth

Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
Zigbee	1.757M	2.243M	2M24G1D	1.63M	2.243M

Max-N dB = Maximum 6dB down bandwidth; **Max-OBW** = Maximum 99% occupied bandwidth;

Min-N dB = Minimum 6dB down bandwidth; **Min-OBW** = Minimum 99% occupied bandwidth;

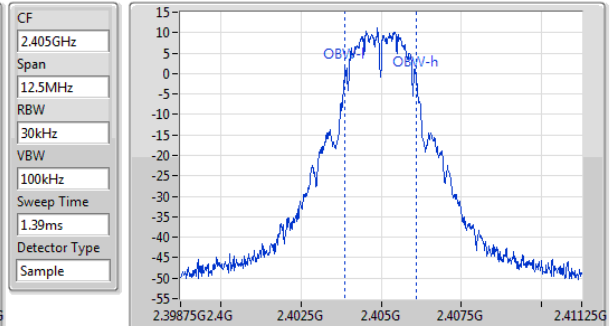
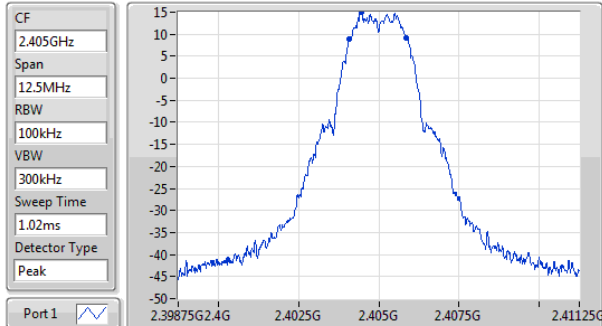
Result

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
Zigbee	-	-	-	-
2405MHz	Pass	500k	1.757M	2.243M
2440MHz	Pass	500k	1.649M	2.243M
2475MHz	Pass	500k	1.667M	2.243M
2480MHz	Pass	500k	1.63M	2.243M

Port X-N dB = Port X 6dB down bandwidth; **Port X-OBW** = Port X 99% occupied bandwidth;

Zigbee

2405MHz

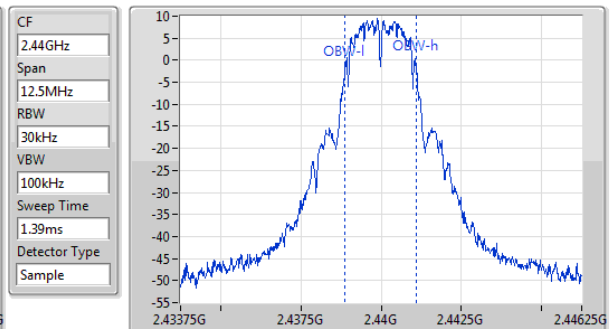
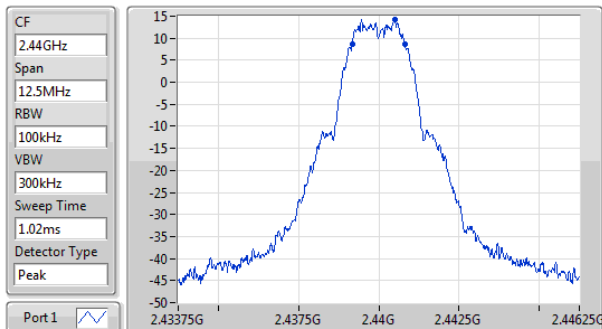


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.757M	2.404094G	2.405851G	2.243M	2.40386G	2.406103G	500k	1

EBW

Zigbee

2440MHz

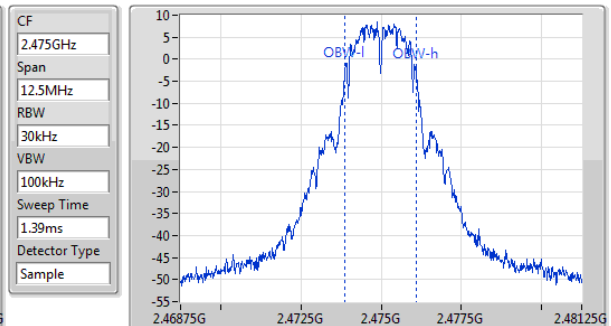
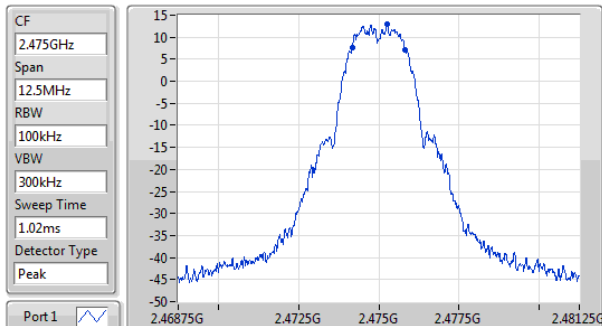


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.649M	2.439167G	2.440815G	2.243M	2.43886G	2.441103G	500k	1

EBW

Zigbee

2475MHz

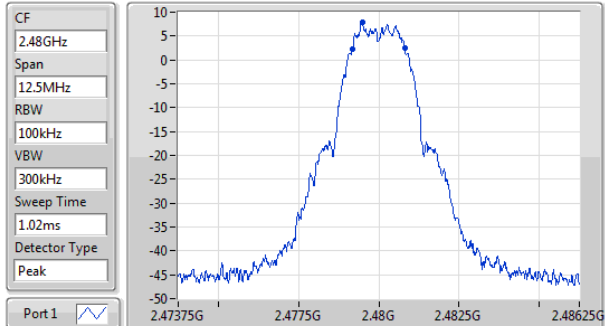


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.667M	2.474167G	2.475833G	2.243M	2.47386G	2.476103G	500k	1

EBW

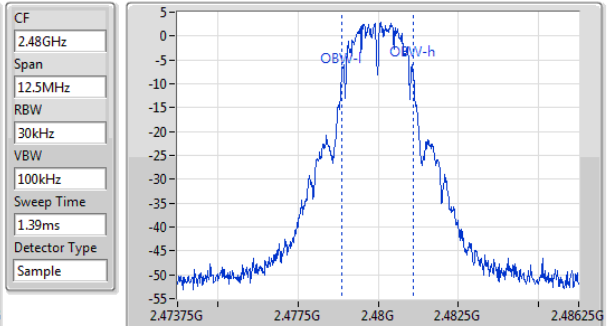
Zigbee

2480MHz



6dB(Hz)	Fl-6dB(Hz)	Ph-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Ph-OBW(Hz)	Limit(Hz)	Port
1.63M	2.479185G	2.480815G	2.243M	2.47886G	2.481103G	500k	1

EBW



3.3 RF Output Power

3.3.1 Limit of RF Output Power

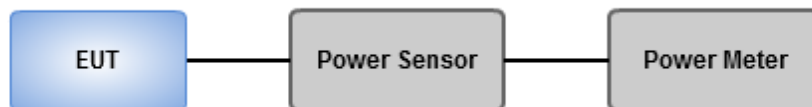
Conducted power shall not exceed 1Watt.

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

3.3.2 Test Procedures

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

3.3.3 Test Setup



3.3.4 Test Result of Maximum Output Power

Summary of Peak conducted Output Power

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
Zigbee	19.44	0.08790

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)
Zigbee	-	-	-	-	-
2405MHz	Pass	2.62	19.44	19.44	30.00
2440MHz	Pass	2.62	19.32	19.32	30.00
2475MHz	Pass	2.62	19.17	19.17	30.00
2480MHz	Pass	2.62	11.75	11.75	30.00

DG = Directional Gain; Port X = Port X output power

Summary of Conducted (Average) Output Power

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
Zigbee	19.42	0.08750

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)
Zigbee	-	-	-	-	-
2405MHz	Pass	2.62	19.42	19.42	-
2440MHz	Pass	2.62	19.31	19.31	-
2475MHz	Pass	2.62	19.16	19.16	-
2480MHz	Pass	2.62	11.71	11.71	-

DG = Directional Gain; Port X = Port X output power

Note : Conducted average output power is for reference only

3.4 Power Spectral Density

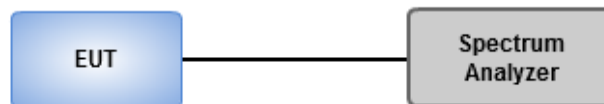
3.4.1 Limit of Power Spectral Density

Power spectral density shall not be greater than 8 dBm in any 3 kHz band.

3.4.2 Test Procedures

1. Set the RBW = 3 kHz, VBW = 10 kHz.
2. Detector = Peak, Sweep time = auto couple.
3. Trace mode = max hold, allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

3.4.3 Test Setup



3.4.4 Test Result of Power Spectral Density

Summary

Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
Zigbee	3.35

RBW=3kHz.

Result

Mode	Result	DG (dBi)	Port 1 (dBm/RBW)	PD (dBm/RBW)	PD Limit (dBm/RBW)
Zigbee	-	-	-	-	-
2405MHz	Pass	2.62	3.35	3.35	8.00
2440MHz	Pass	2.62	2.90	2.90	8.00
2475MHz	Pass	2.62	1.90	1.90	8.00
2480MHz	Pass	2.62	-4.16	-4.16	8.00

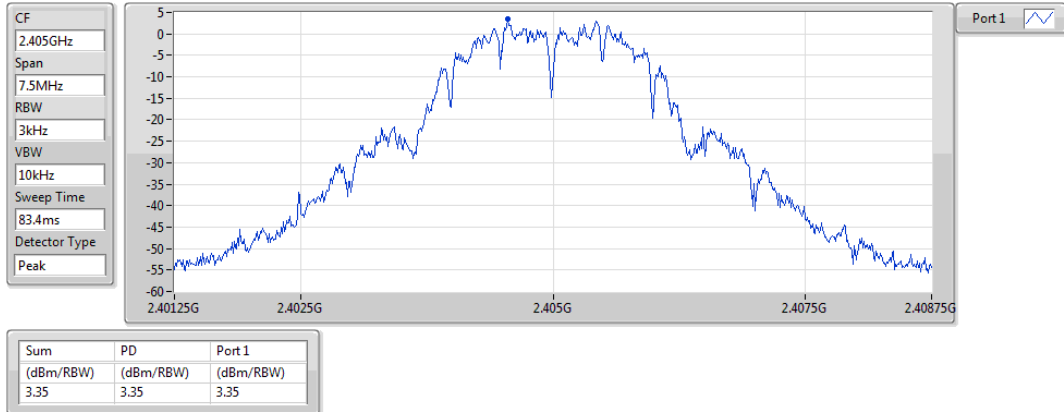
DG = Directional Gain;

PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; **Port X** = Port X power density;

Zigbee

PSD

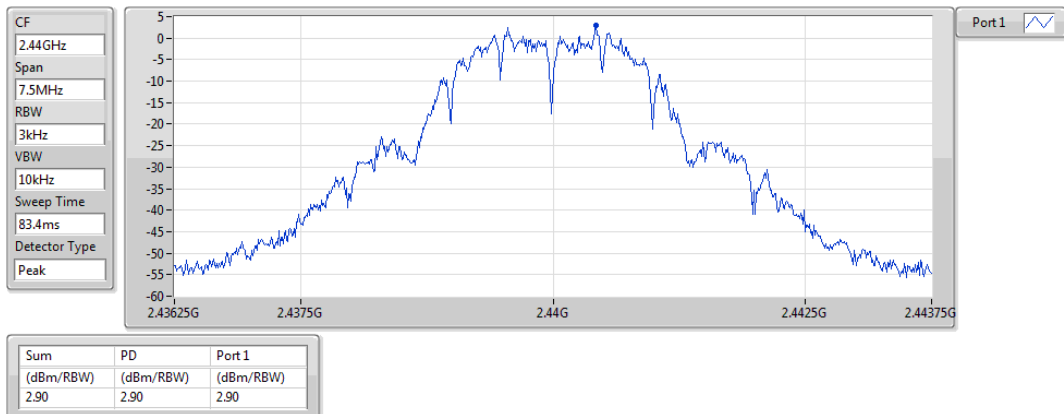
2405MHz



Zigbee

PSD

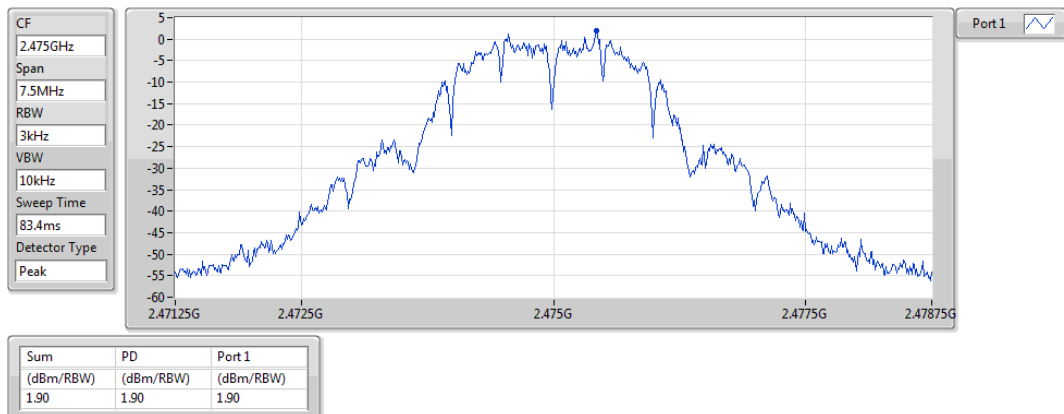
2440MHz



Zigbee

PSD

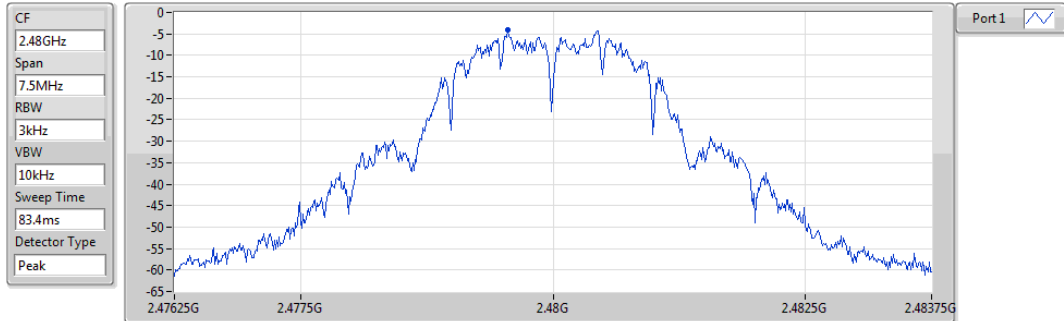
2475MHz



Zigbee

PSD

2480MHz



Sum	PD	Port 1
(dBm/Hz)	(dBm/Hz)	(dBm/Hz)
-4.16	-4.16	-4.16

3.5 Unwanted Emissions into Restricted Frequency Bands

3.5.1 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.

3.5.2 Test Procedures

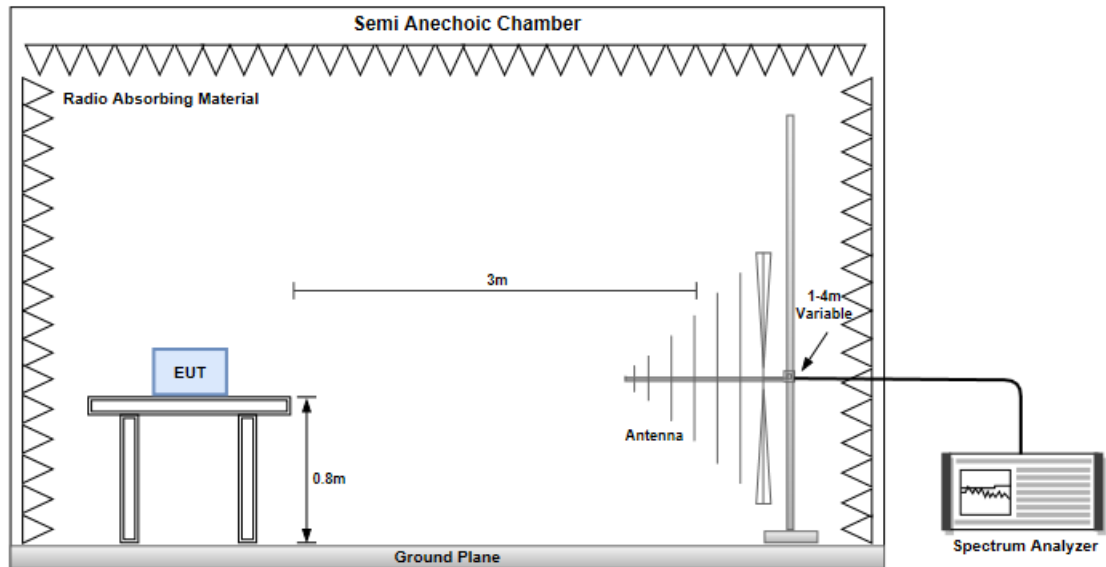
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

Note:

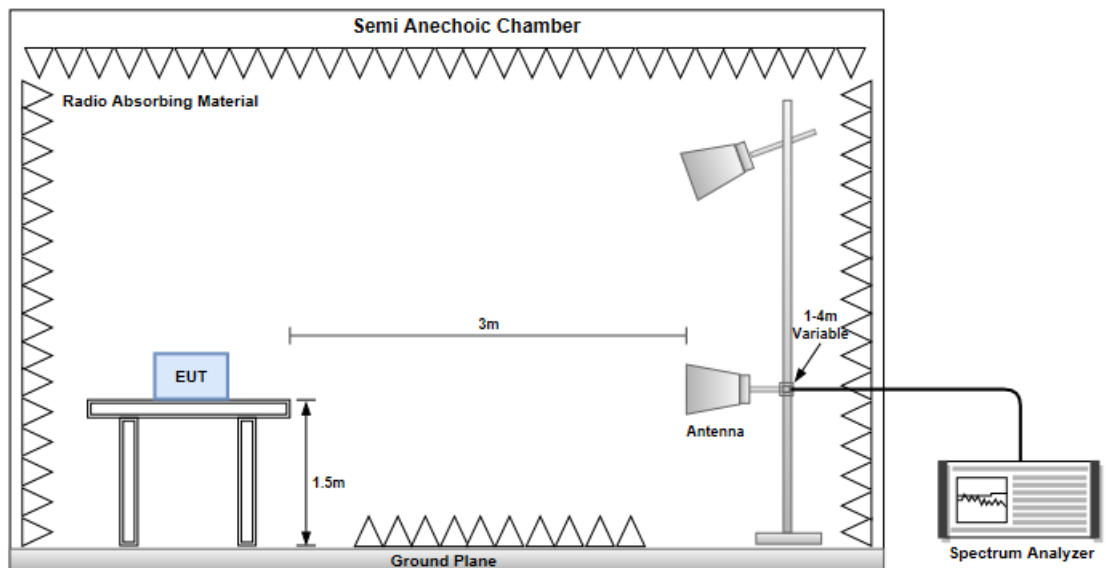
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.5.3 Test Setup

Radiated Emissions below 1 GHz

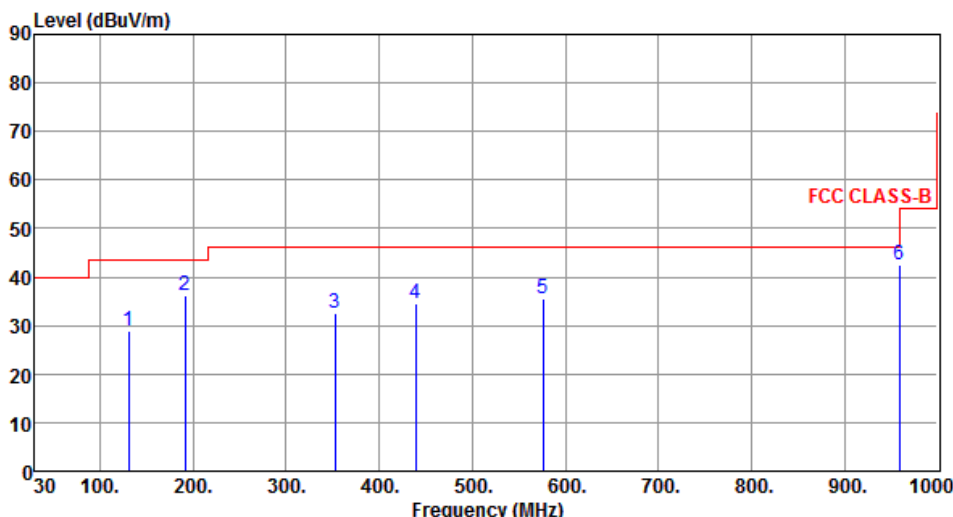


Radiated Emissions above 1 GHz



3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	O-QPSK	Test Freq. (MHz)	2405
Polarization	Horizontal		

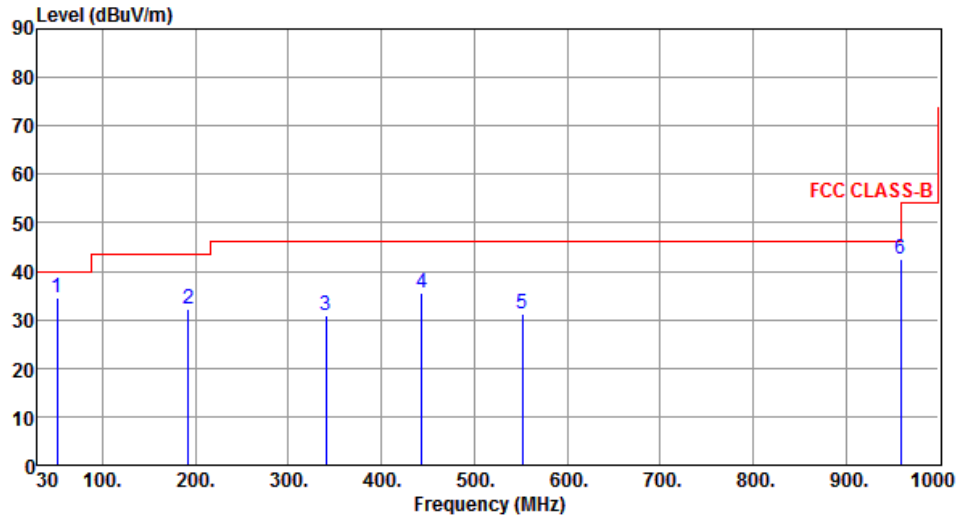


The graph displays the radiated unwanted emissions for FCC CLASS-B. The y-axis represents the Level in dBuV/m, ranging from 0 to 90. The x-axis represents the Frequency in MHz, ranging from 30 to 1000. A red line indicates the FCC CLASS-B limit, which is 40 dBuV/m from 30 MHz to 100 MHz, 45 dBuV/m from 100 MHz to 1000 MHz, and 55 dBuV/m above 1000 MHz. Six measured peaks are labeled with blue numbers 1 through 6, corresponding to the data in the table below.

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	130.88	29.00	43.50	-14.50	38.52	-9.52	Peak	---	---
2	191.85	36.12	43.50	-7.38	46.70	-10.58	Peak	---	---
3	352.31	32.45	46.00	-13.55	39.04	-6.59	Peak	---	---
4	439.52	34.68	46.00	-11.32	39.10	-4.42	Peak	---	---
5	575.68	35.63	46.00	-10.37	37.14	-1.51	Peak	---	---
6	959.26	42.43	46.00	-3.57	38.23	4.20	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	O-QPSK	Test Freq. (MHz)	2405
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	51.55	34.51	40.00	-5.49	42.45	-7.94	Peak	---	---
2	192.28	32.23	43.50	-11.27	42.84	-10.61	Peak	---	---
3	340.25	30.72	46.00	-15.28	37.59	-6.87	Peak	---	---
4	443.51	35.61	46.00	-10.39	39.94	-4.33	Peak	---	---
5	551.42	31.28	46.00	-14.72	33.22	-1.94	Peak	---	---
6	959.26	42.45	46.00	-3.55	38.25	4.20	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.

3.5.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

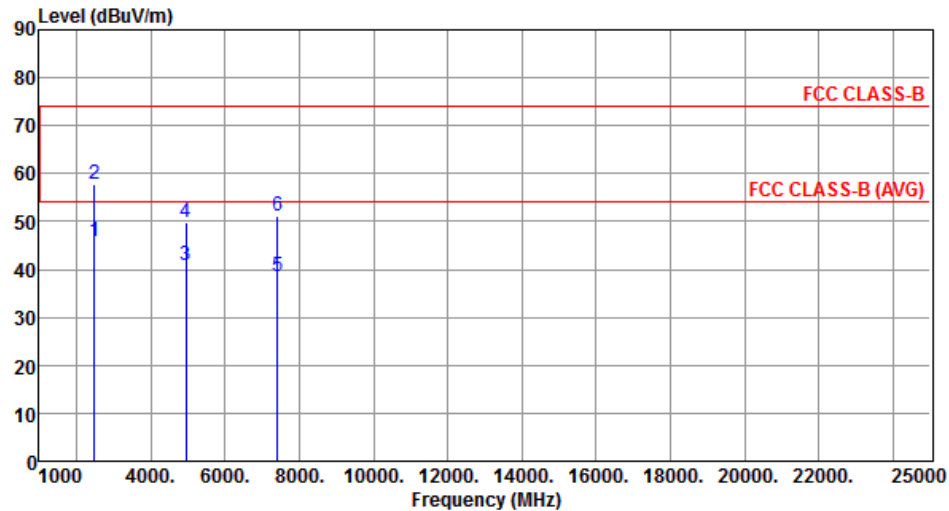
Modulation	O-QPSK	Test Freq. (MHz)	2405
Polarization	Horizontal		
Level (dBuV/m)			

Modulation	O-QPSK	Test Freq. (MHz)	2405
Polarization	Vertical		
Level (dBUV/m)			

Modulation	O-QPSK	Test Freq. (MHz)	2440
Polarization	Horizontal		
Level (dBUV/m) </			

Modulation	O-QPSK	Test Freq. (MHz)	2440
Polarization	Vertical		
Level (dBUV/m) </			

Modulation	O-QPSK	Test Freq. (MHz)	2475
Polarization	Horizontal		



	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	45.70	54.00	-8.30	48.66	-2.96	Average	135	45
2	2483.50	57.82	74.00	-16.18	60.78	-2.96	Peak	135	45
3	4950.00	40.87	54.00	-13.13	36.54	4.33	Average	100	48
4	4950.00	49.91	74.00	-24.09	45.58	4.33	Peak	100	48
5	7425.00	38.66	54.00	-15.34	29.84	8.82	Average	120	32
6	7425.00	51.06	74.00	-22.94	42.24	8.82	Peak	120	32

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	O-QPSK	Test Freq. (MHz)	2475
Polarization	Vertical		
Level (dBuV/m)			

Modulation	O-QPSK	Test Freq. (MHz)	2480
Polarization	Horizontal		
Level (dBUV/m) </			

Modulation	O-QPSK	Test Freq. (MHz)	2480
Polarization	Vertical		
Level (dBuV/m)			

3.6 Emissions in Non-Restricted Frequency Bands

3.6.1 Emissions in Non-Restricted Frequency Bands Limit

Peak power 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.

3.6.2 Test Procedures

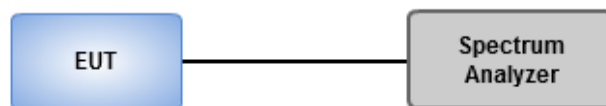
Reference level measurement

1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Use the peak marker function to determine the maximum PSD level

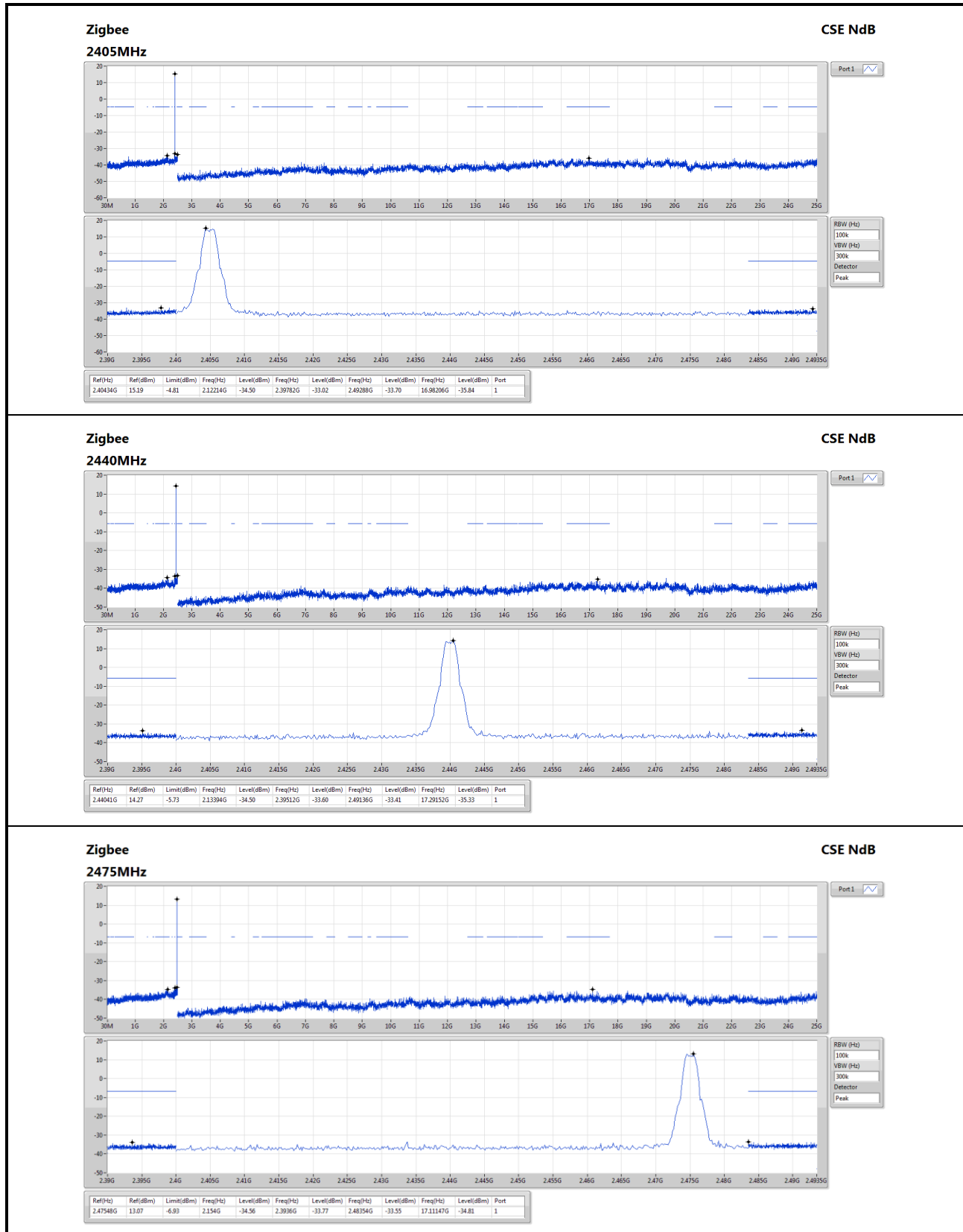
Emission level measurement

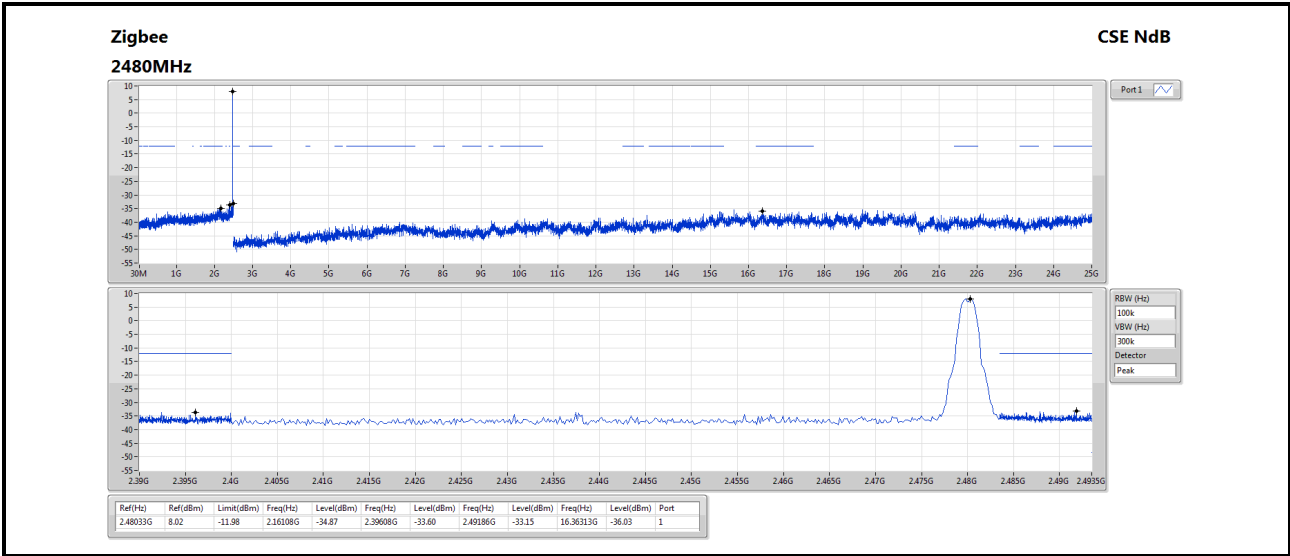
1. Set RBW=100kHz, VBW = 300kHz , Detector = Peak, Sweep time = Auto
2. Trace = max hold , Allow Trace to fully stabilize
3. Scan Frequency range is up to 25GHz
4. Use the peak marker function to determine the maximum amplitude level

3.6.3 Test Setup



3.6.4 Unwanted Emissions into Non-Restricted Frequency Bands





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 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>.

Linkou

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

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