FCC Test Report

FCC ID	:	**P27-IG502L**
Equipment	:	**Monitor Gateway**
Model No.	:	**IG-502L**
Brand Name	:	**OxTech, LLC**
Applicant	:	**Sercomm Corporation**
Address	:	**8F, No. 3-1, YuanQu St., NanKang, Taipei 115, Taiwan, R.O.C.**
Standard	:	**47 CFR FCC Part 15.247**
Received Date	:	**Dec. 21, 2021**
Tested Date	:	**Jan. 08 ~ Jan. 24, 2022**

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 shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by: **Approved by:**

Along Chen / Assistant Manager **Gary Chang / Manager**

Table of Contents

Release Record

Report No.	Version	Description	Issued Date
FR1D2104	Rev. 01	Initial issue	Feb. 17, 2022

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.419MHz 35.50 (Margin -11.96dB) - AV	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 2483.50MHz 52.76 (Margin -1.24dB) - AV	Pass
15.247(b)(3)	Maximum Output Power	Max Power [dBm]: 12.66	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 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

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-OQPSK modulation.				

1.1.2 Antenna Details

Ant. No.	Type	Connector	Gain (dBi)	Remarks
1	PIFA	UFL	5.1	---

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: Leader Model: MU18D1120150-A1 Power Rating: I/P: 100-240Vac, 50/60Hz, 0.6A O/P:12Vdc, 1.5A Power Line: 1.45m non-shielded without core
2	AC Adapter	Brand: Sercomm Model: PU18W120ULB15-DPX-00 Power Rating: I/P: 100-240Vac, 50/60Hz, 0.7A O/P:12Vdc, 1.5A, 18.0W
3	RJ45	1.45m non-shielded without 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: V0.060	
Duty Cycle and Duty Factor	Duty Cycle (%)	Duty Factor (dB)
	100	0

1.1.7 Power Index of Test Tool

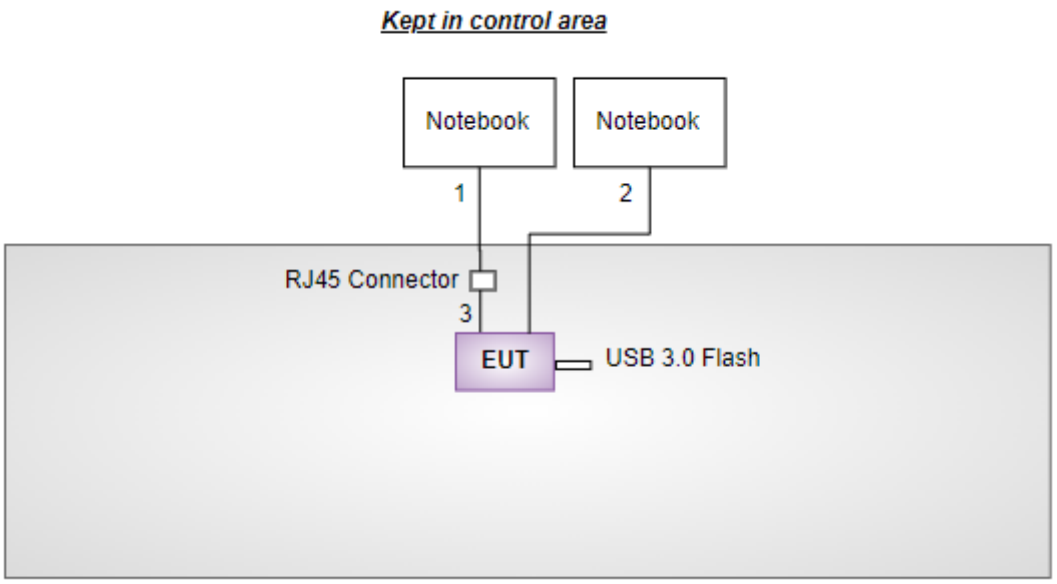
Modulation Mode	Test Frequency (MHz)	Power Index
OQPSK	2405	13
OQPSK	2440	13
OQPSK	2475	13
OQPSK	2480	12

1.2 Local Support Equipment List

Support Equipment List					
No.	**Equipment**	**Brand**	**Model**	**FCC ID**	**Remarks**
1	Notebook	DELL	Latitude E5470	DoC	---
2	Notebook	DELL	Latitude E5470	DoC	---
3	USB 3.0 Flash	Transcend	JetFlash 700	---	---

1.3 Test Setup Chart

Test Setup Diagram



No.	Signal cable / Length (m)
1-2	RJ45, 10m non-shielded.
3	RJ45, 1.45m non-shielded.

1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Jan. 24, 2022				
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
LISN (Support Unit)	SCHWARZBECK MESS-ELEKTRONIK	NSLK 8127	8127477	Feb .25, 2021	Feb .24, 2022
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 19, 2021	Oct. 18, 2022
50 ohm terminal (Support Unit)	NA	50	04	May 25, 2021	May 24, 2022
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	Jan. 08, 2022				
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	101063	Apr. 19, 2021	Apr. 18, 2022
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 08, 2021	Nov. 07, 2022
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. 03, 2021	Dec. 02, 2022
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 04, 2021	Nov. 03, 2022
Preamplifier	EMC	EMC02325	980225	Jun. 29, 2021	Jun. 28, 2022
Preamplifier	Agilent	83017A	MY39501308	Sep. 28, 2021	Sep. 27, 2022
Preamplifier	EMC	EMC184045B	980192	Jul. 14, 2021	Jul. 13, 2022
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 05, 2021	Oct. 04, 2022
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 05, 2021	Oct. 04, 2022
LF cable 11M	EMC	EMCCFD400-NW-NW-11000	200801	Oct. 05, 2021	Oct. 04, 2022
LF cable 1M	EMC	EMCCFD400-NM-NM-1000	160502	Oct. 05, 2021	Oct. 04, 2022
RF Cable	EMC	EMC104-35M-35M-8000	210920	Oct. 05, 2021	Oct. 04, 2022
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 05, 2021	Oct. 04, 2022
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	Jan. 22, 2022				
Instrument	**Brand**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	R&S	FSV40	101498	Nov. 29, 2021	Nov. 28, 2022
Power Meter	Anritsu	ML2495A	1241002	Nov. 07, 2021	Nov. 06, 2022
Power Sensor	Anritsu	MA2411B	1207366	Nov. 07, 2021	Nov. 06, 2022
Measurement Software	Sporton	SENSE-15247_FS	V5.10.7.11	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.5 Test Standards

47 CFR FCC Part 15.247
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 ≤ 1GHz	±3.41 dB
Radiated emission > 1GHz	±4.59 dB

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
- ISED#: 10807A
- CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

Test item	Modulation Mode	Test Frequency (MHz)	Data Rate	Test Configuration
Conducted Emissions	OQPSK	2475	250kbps	2
Radiated Emissions ≤1GHz	OQPSK	2475	250kbps	1
Radiated Emissions >1GHz Maximum Output Power 6dB bandwidth Power spectral density	OQPSK	2405 / 2440 / 2475 / 2480	250kbps	1

NOTE:

1. Two adapters (Leader and Sercomm) had been covered during the pretest, and found that **Sercomm adapter** was the worst case of AC Power line conducted emission test item and **Leader adapter** was the worst case of Radiated Spurious emission test item.
2. Test configurations are as below
   Configuration 1: Leader adapter for Radiated emission and antenna port conducted test
   Configuration 2: Sercomm adapter for AC Power Line Conducted Emissions

3 Transmitter Test Results

3.1 Conducted Emissions

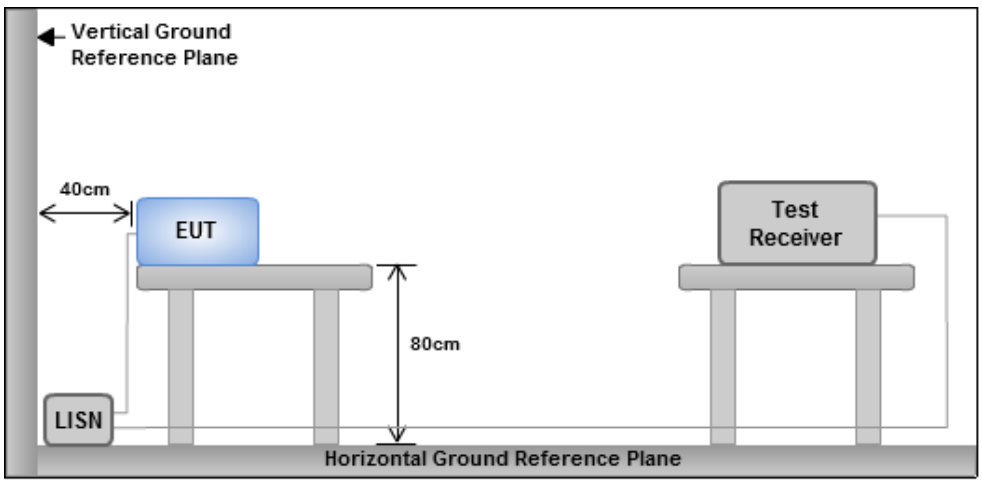
3.1.1 Limit of Conducted Emissions

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



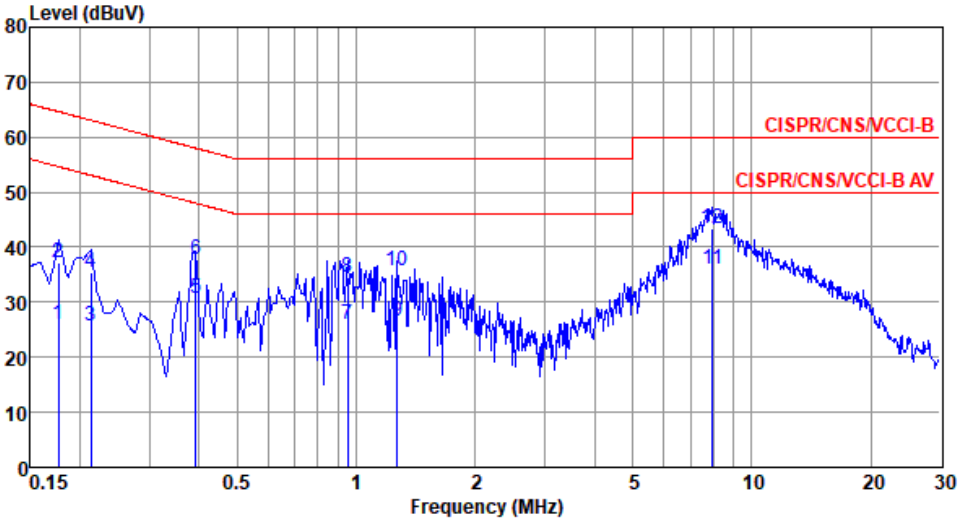
Note: 1. Support units were connected to second LISN.

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	OQPSK	Test Freq. (MHz)	2475
Power Phase	Line		

Test by : Joe Liao Temperature: 16°C Humidity: 60%

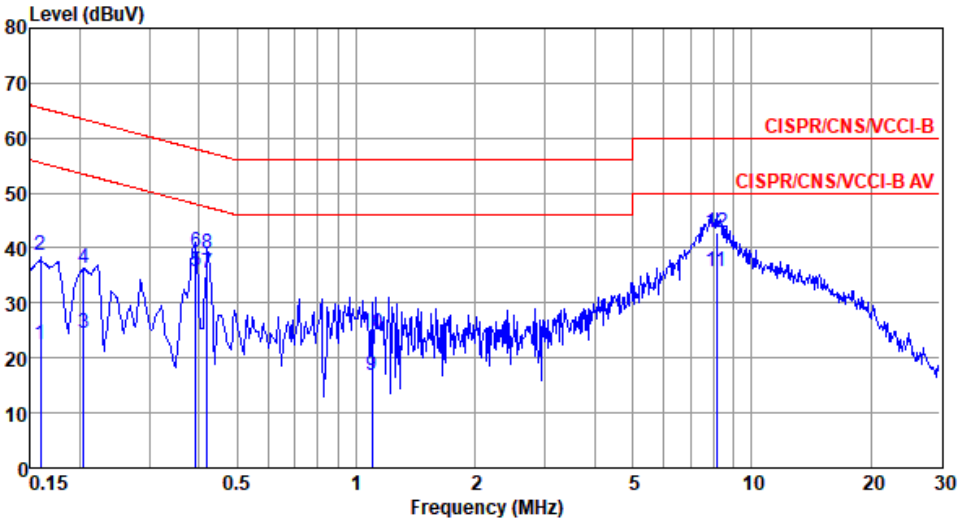


	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Cable loss	Aux	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	
1	0.177	26.09	54.64	-28.55	16.15	9.65	0.08	0.21	Average
2	0.177	37.16	64.64	-27.48	27.22	9.65	0.08	0.21	QP
3	0.213	25.64	53.10	-27.46	15.68	9.65	0.08	0.23	Average
4	0.213	35.42	63.10	-27.68	25.46	9.65	0.08	0.23	QP
5	0.393	30.68	47.99	-17.31	20.60	9.64	0.08	0.36	Average
6	0.393	37.76	57.99	-20.23	27.68	9.64	0.08	0.36	QP
7	0.953	26.10	46.00	-19.90	15.92	9.65	0.16	0.37	Average
8	0.953	34.67	56.00	-21.33	24.49	9.65	0.16	0.37	QP
9	1.269	26.47	46.00	-19.53	16.27	9.65	0.17	0.38	Average
10	1.269	35.60	56.00	-20.40	25.40	9.65	0.17	0.38	QP
11*	7.977	36.04	50.00	-13.96	25.51	9.70	0.39	0.44	Average
12	7.977	43.48	60.00	-16.52	32.95	9.70	0.39	0.44	QP

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

Modulation	OQPSK	Test Freq. (MHz)	2475
Power Phase	Neutral		

Test by : Joe Liao Temperature: 16°C Humidity: 60%



	Freq	Level	Limit Line	Over Limit	Read Level	Factor	Cable loss	Aux	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	
1	0.159	22.36	55.52	-33.16	12.43	9.69	0.08	0.16	Average
2	0.159	38.71	65.52	-26.81	28.78	9.69	0.08	0.16	QP
3	0.204	24.65	53.45	-28.80	14.71	9.68	0.08	0.18	Average
4	0.204	36.36	63.45	-27.09	26.42	9.68	0.08	0.18	QP
5	0.393	35.64	47.99	-12.35	25.70	9.67	0.08	0.19	Average
6	0.393	39.24	57.99	-18.75	29.30	9.67	0.08	0.19	QP
7*	0.419	35.50	47.46	-11.96	25.56	9.67	0.08	0.19	Average
8	0.419	38.88	57.46	-18.58	28.94	9.67	0.08	0.19	QP
9	1.094	16.92	46.00	-29.08	6.79	9.68	0.17	0.28	Average
10	1.094	24.63	56.00	-31.37	14.50	9.68	0.17	0.28	QP
11	8.148	35.79	50.00	-14.21	25.29	9.75	0.39	0.36	Average
12	8.148	42.93	60.00	-17.07	32.43	9.75	0.39	0.36	QP

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

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

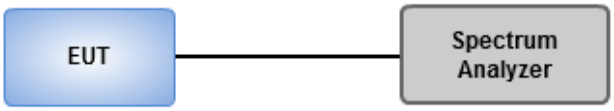
6dB Bandwidth

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

Ambient Condition	22°C / 67%	Tested By	Brad Wu

Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
Zigbee	1.83M	2.243M	2M24G1D	1.667M	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;

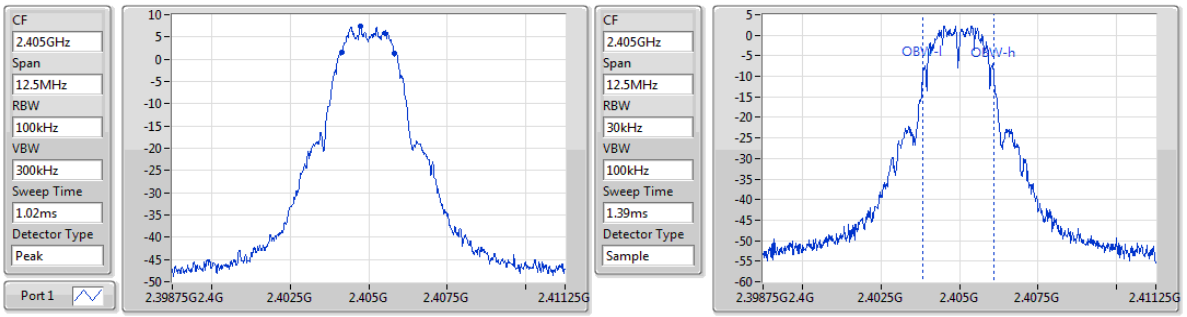
Result

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
Zigbee	-	-	-	-
2405MHz	Pass	500k	1.667M	2.243M
2445MHz	Pass	500k	1.667M	2.243M
2475MHz	Pass	500k	1.83M	2.243M
2480MHz	Pass	500k	1.703M	2.243M

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

Zigbee **EBW**

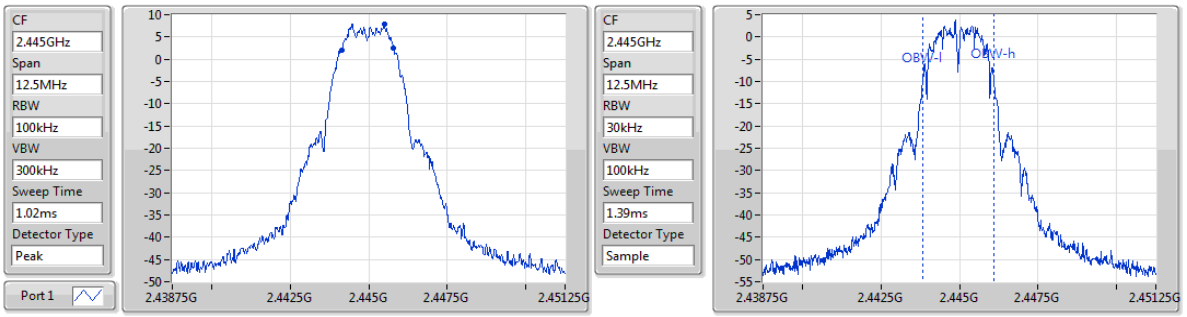
2405MHz



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.667M	2.404149G	2.405815G	2.243M	2.403842G	2.406085G	500k	1

Zigbee **EBW**

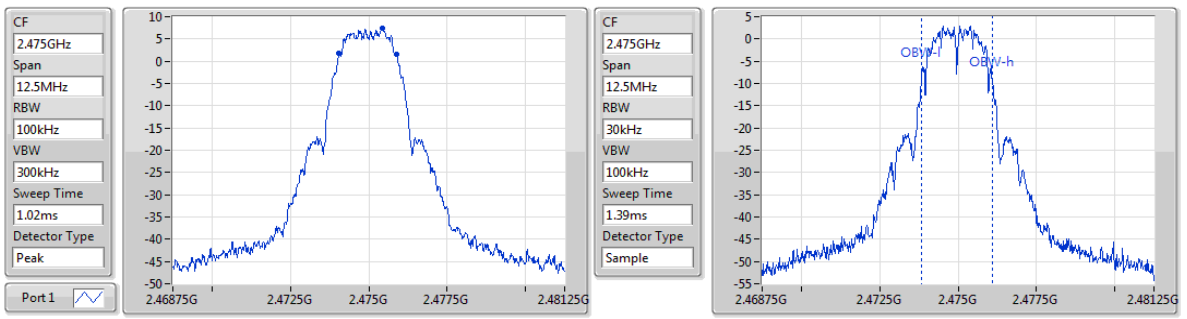
2445MHz



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.667M	2.44413G	2.445797G	2.243M	2.443842G	2.446085G	500k	1

Zigbee **EBW**

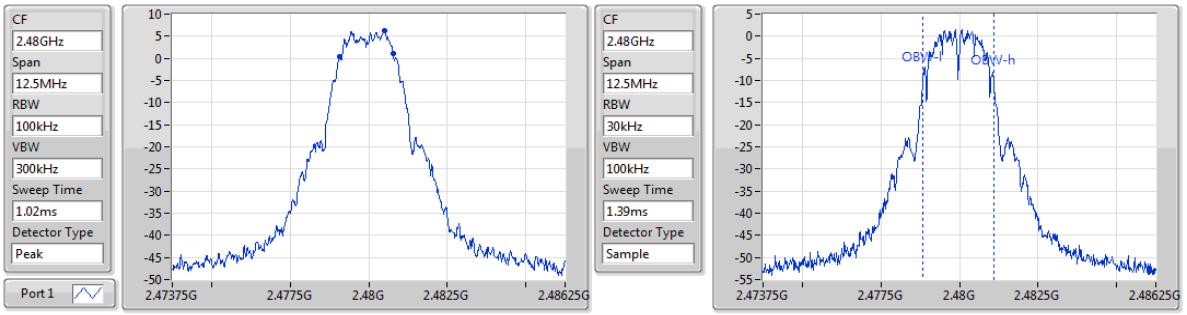
2475MHz



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.83M	2.474058G	2.475888G	2.243M	2.473842G	2.476085G	500k	1

Zigbee **EBW**

2480MHz



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.703M	2.479076G	2.480779G	2.243M	2.478842G	2.481085G	500k	1

3.3 RF Output Power

3.3.1 Limit of RF Output Power

Conducted power shall not exceed 1Watt.

Antenna gain <= 6dBi, 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

Ambient Condition	22°C / 67%	Tested By	Brad Wu

Summary of Peak Conducted Output Power

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
Zigbee	12.66	0.01845

Result

Mode	Result	Antenna Gain (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)
Zigbee	-	-	-	-	-
2405MHz	Pass	5.10	12.27	12.27	30.00
2445MHz	Pass	5.10	12.51	12.51	30.00
2475MHz	Pass	5.10	12.66	12.66	30.00
2480MHz	Pass	5.10	11.19	11.19	30.00

Summary of Conducted (Average) Output Power

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
Zigbee	12.62	0.01828

Result

Mode	Result	Antenna Gain (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)
Zigbee	-	-	-	-	-
2405MHz	Pass	5.10	12.22	12.22	-
2445MHz	Pass	5.10	12.47	12.47	-
2475MHz	Pass	5.10	12.62	12.62	-
2480MHz	Pass	5.10	11.13	11.13	-

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

Peak PSD

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.

Average PSD, duty cycle ≥ 98%

1. Set the RBW = 30 kHz, VBW = 100 kHz.
2. Detector = RMS, Sweep time = auto couple.
3. Sweep time = auto couple.
4. Employ trace averaging (RMS) mode over a minimum of 100 traces.
5. Use the peak marker function to determine the maximum amplitude level.

Average PSD, duty cycle < 98%

1 Set the RBW = 30 kHz, VBW = 100 kHz. Detector = RMS.

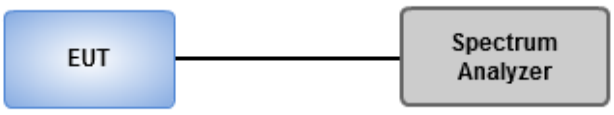
2 Set the sweep time to: ≥ 10 (number of measurement points in sweep) x (total on/off period of the transmitted signal).

3 Perform the measurement over a single sweep.

4 Use the peak marker function to determine the maximum amplitude level.

5 Add 10 log (1/x), where x is the duty cycle.

3.4.3 Test Setup



3.4.4 Test Result of Power Spectral Density

Ambient Condition	22°C / 67%	Tested By	Brad Wu

Summary

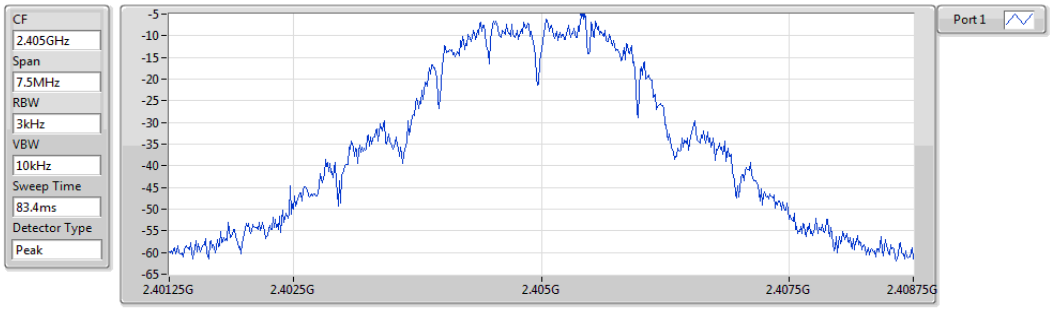
Mode	PD (dBm/3kHz)
2.4-2.4835GHz	-
Zigbee	-3.79

Result

Mode	Result	Antenna Gain (dBi)	Port 1 (dBm)	Power Density (dBm/3kHz)	Power Density Limit (dBm/3kHz)
Zigbee	-	-	-	-	-
2405MHz	Pass	5.10	-5.09	-5.09	8.00
2445MHz	Pass	5.10	-5.24	-5.24	8.00
2475MHz	Pass	5.10	-3.79	-3.79	8.00
2480MHz	Pass	5.10	-5.30	-5.30	8.00

Zigbee **PSD**

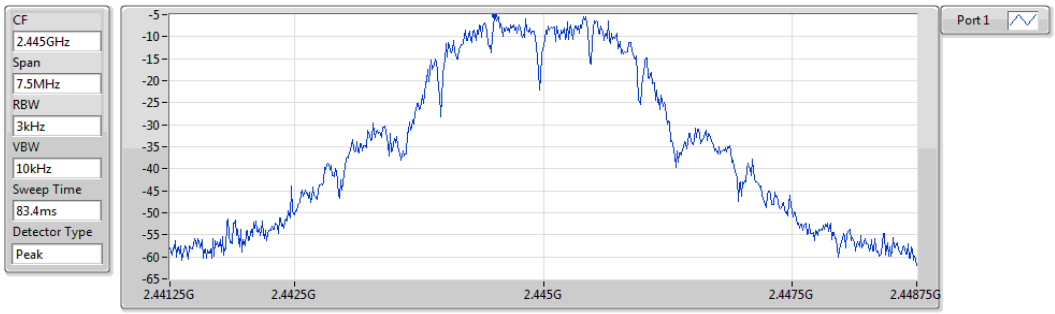
2405MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-5.09	-5.09	-5.09

Zigbee **PSD**

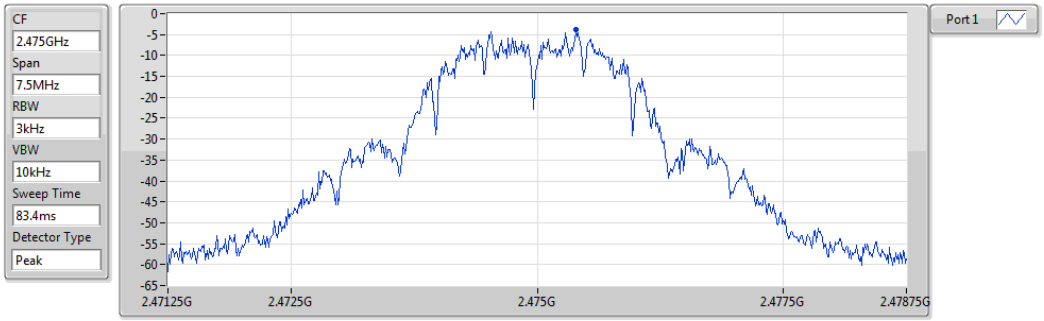
2445MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-5.24	-5.24	-5.24

Zigbee **PSD**

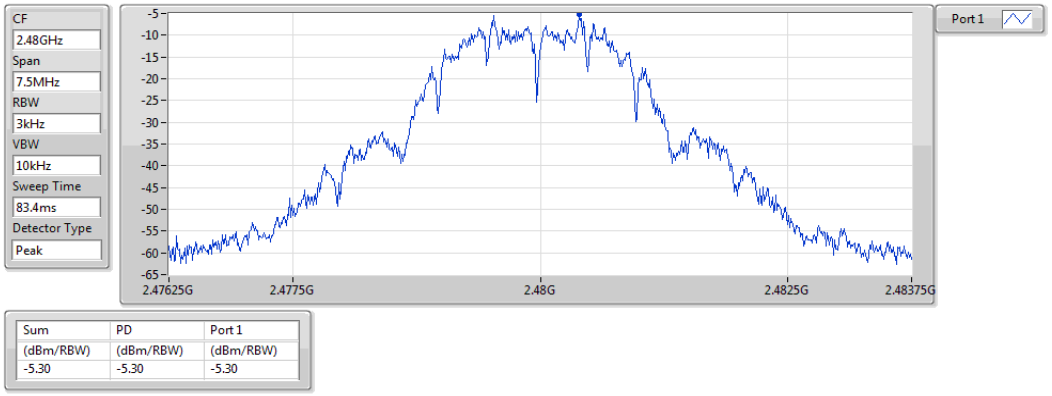
2475MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-3.79	-3.79	-3.79

Zigbee **PSD**

2480MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-5.30	-5.30	-5.30

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:
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.

3.5.2 Test Procedures

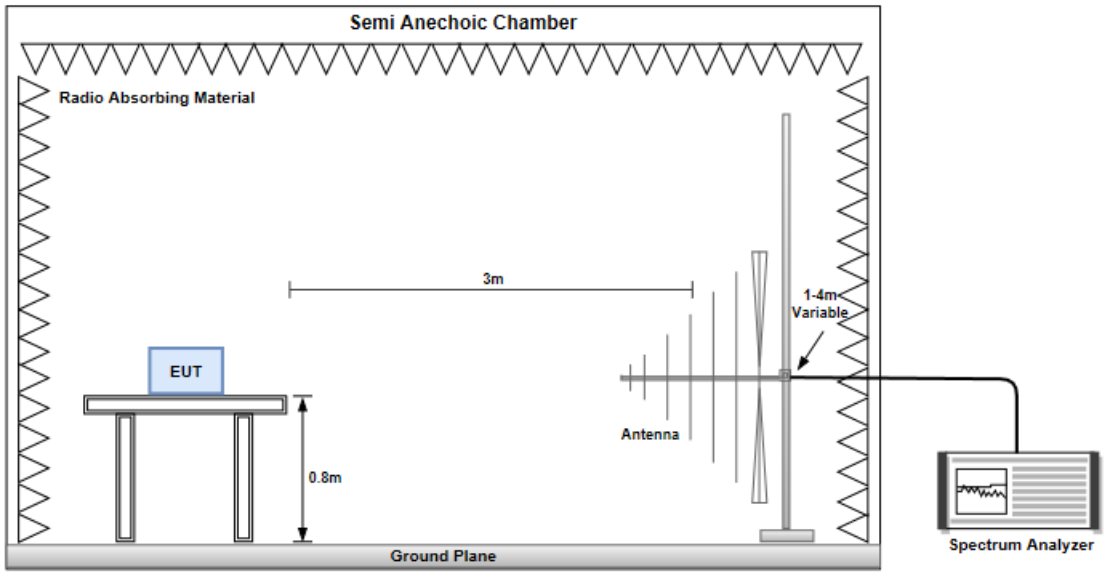
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

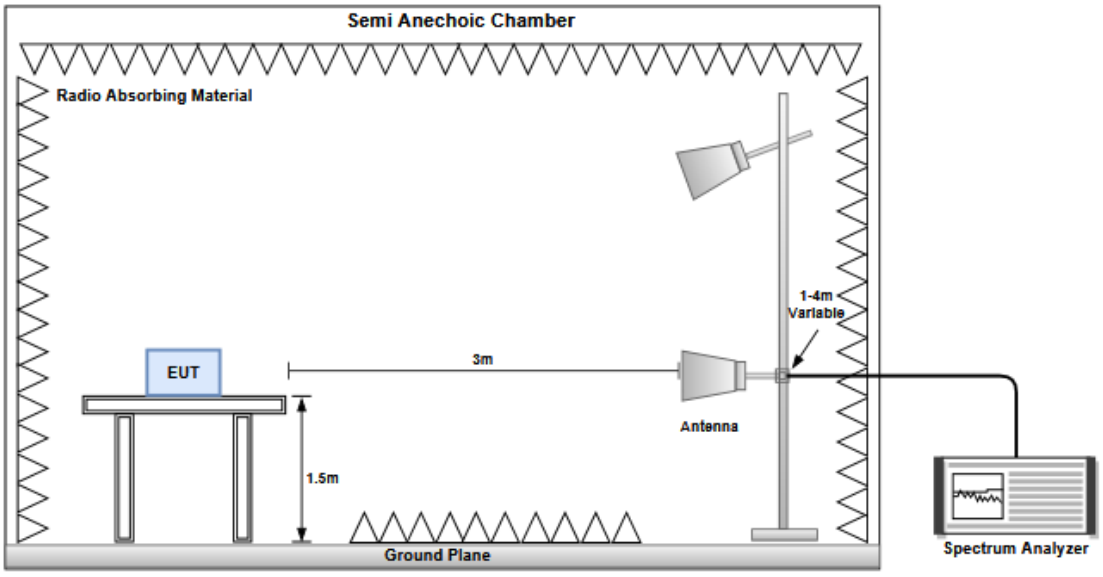
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above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

3.5.3 Test Setup

Radiated Emissions below 1 GHz



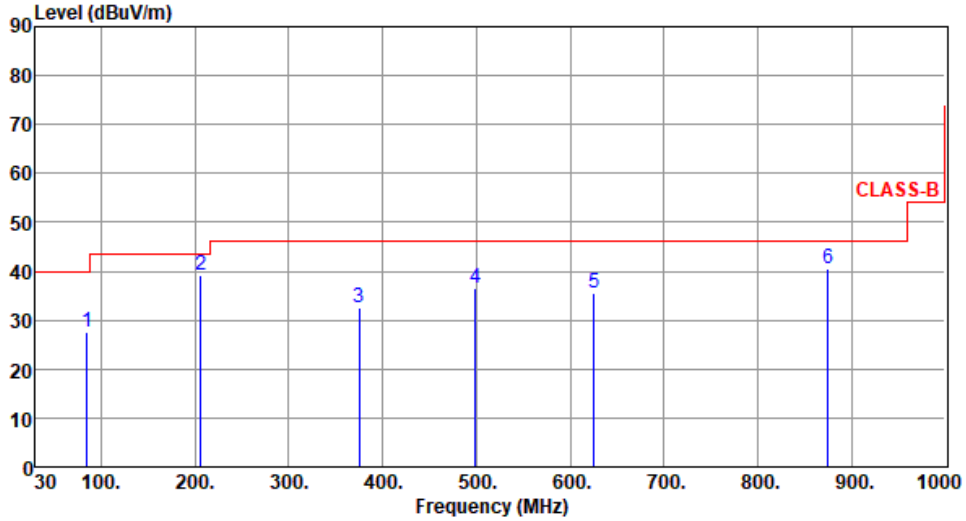
Radiated Emissions above 1 GHz



3.5.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	OQPSK	Test Freq. (MHz)	2475
Polarization	Horizontal		

Test By :Roger Lu Temperature(℃):23 Humidity(%):67

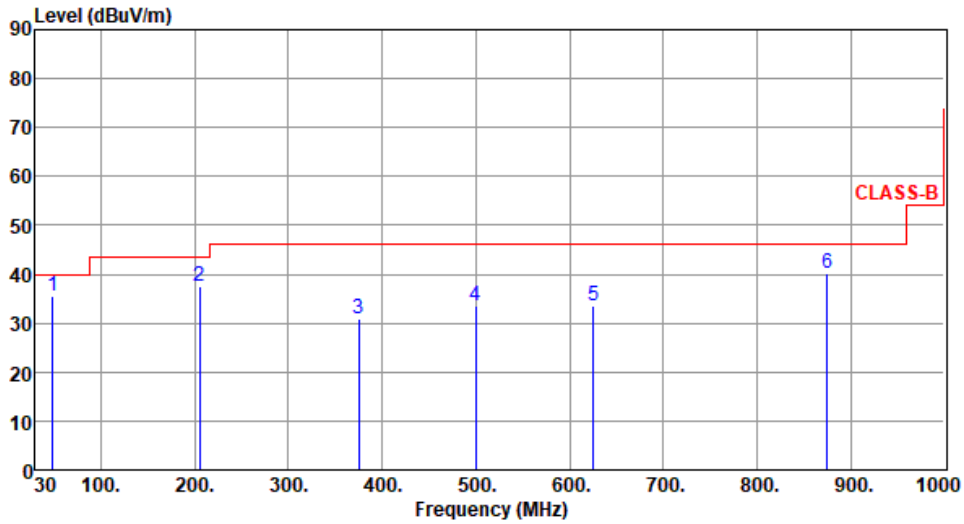


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	85.15	27.45	40.00	-12.55	41.89	-14.44	Peak	---	---
2	206.59	39.15	43.50	-4.35	51.11	-11.96	Peak	---	---
3	375.31	32.55	46.00	-13.45	38.87	-6.32	Peak	---	---
4	499.03	36.68	46.00	-9.32	39.99	-3.31	Peak	---	---
5	625.10	35.40	46.00	-10.60	35.85	-0.45	Peak	---	---
6	875.15	40.64	46.00	-5.36	37.49	3.15	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	OQPSK	Test Freq. (MHz)	2475
Polarization	Vertical		

Test By :Roger Lu Temperature(℃):23 Humidity(%):67



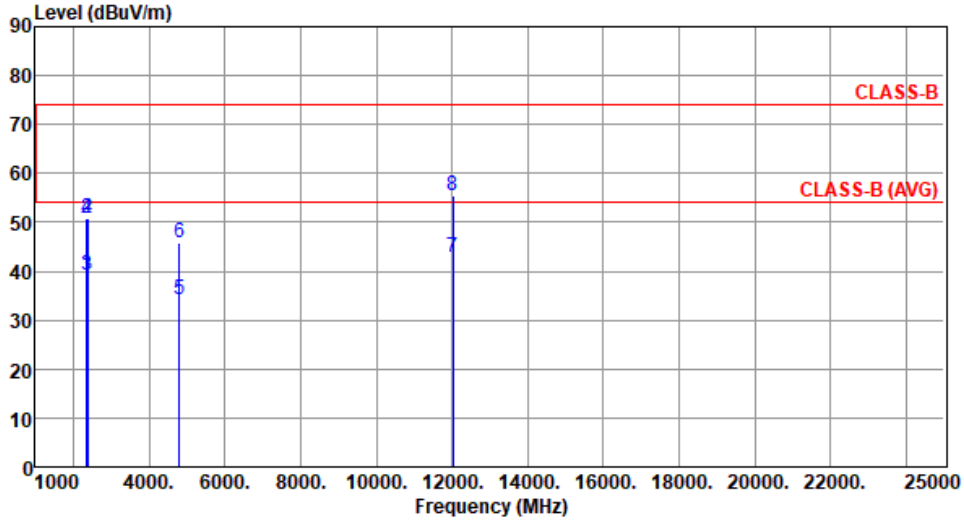
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	48.22	35.49	40.00	-4.51	44.08	-8.59	QP	100	162
2	205.59	37.64	43.50	-5.86	49.61	-11.97	Peak	---	---
3	375.15	31.03	46.00	-14.97	37.36	-6.33	Peak	---	---
4	499.58	33.67	46.00	-12.33	36.97	-3.30	Peak	---	---
5	625.58	33.56	46.00	-12.44	34.01	-0.45	Peak	---	---
6	875.12	40.29	46.00	-5.71	37.14	3.15	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	OQPSK	Test Freq. (MHz)	2405
Polarization	Horizontal		

Test By :Roger Lu Temperature(℃):23 Humidity(%):67

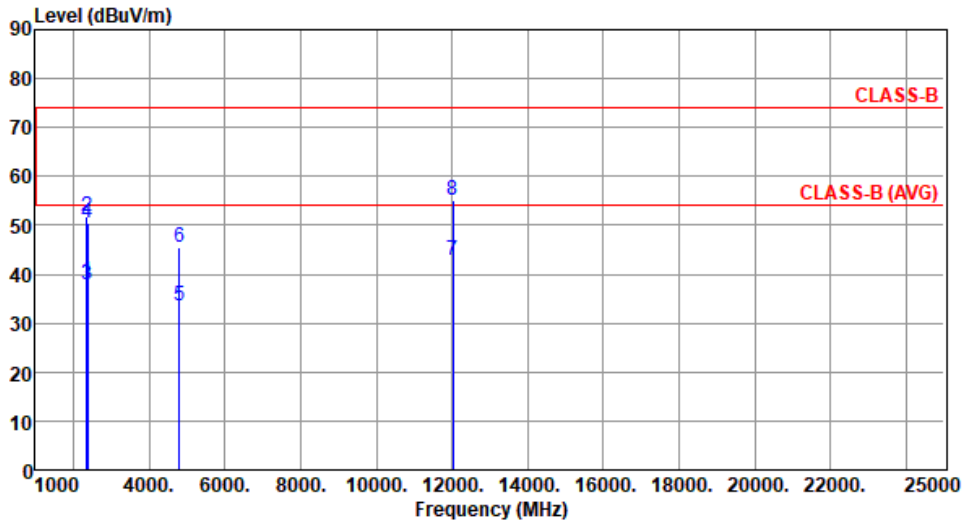


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	2367.00	39.33	54.00	-14.67	42.02	-2.69	Average	124	17
2	2367.00	50.92	74.00	-23.08	53.61	-2.69	Peak	124	17
3	2390.00	39.09	54.00	-14.91	41.84	-2.75	Average	124	17
4	2390.00	50.81	74.00	-23.19	53.56	-2.75	Peak	124	17
5	4810.00	34.23	54.00	-19.77	30.10	4.13	Average	100	144
6	4810.00	45.96	74.00	-28.04	41.83	4.13	Peak	100	144
7	12025.00	42.92	54.00	-11.08	29.25	13.67	Average	100	60
8	12025.00	55.32	74.00	-18.68	41.65	13.67	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	OQPSK	Test Freq. (MHz)	2405
Polarization	Vertical		

Test By :Roger Lu Temperature(℃):23 Humidity(%):67

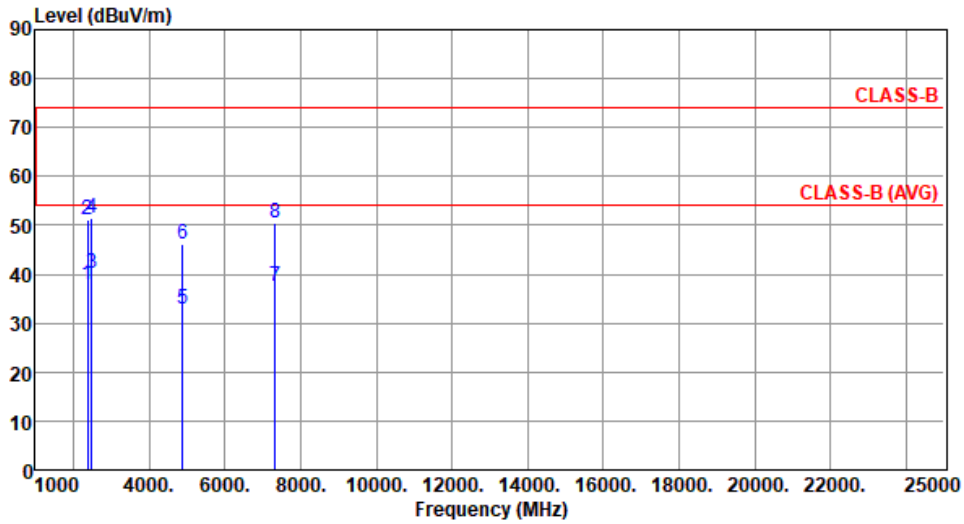


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	2367.00	38.57	54.00	-15.43	41.26	-2.69	Average	100	158
2	2367.00	51.90	74.00	-22.10	54.59	-2.69	Peak	100	158
3	2390.00	37.92	54.00	-16.08	40.67	-2.75	Average	100	158
4	2390.00	50.54	74.00	-23.46	53.29	-2.75	Peak	100	158
5	4810.00	33.39	54.00	-20.61	29.26	4.13	Average	100	5
6	4810.00	45.39	74.00	-28.61	41.26	4.13	Peak	100	5
7	12025.00	42.82	54.00	-11.18	29.15	13.67	Average	100	40
8	12025.00	55.13	74.00	-18.87	41.46	13.67	Peak	100	40

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	OQPSK	Test Freq. (MHz)	2440
Polarization	Horizontal		

Test By :Roger Lu Temperature(℃):23 Humidity(%):67

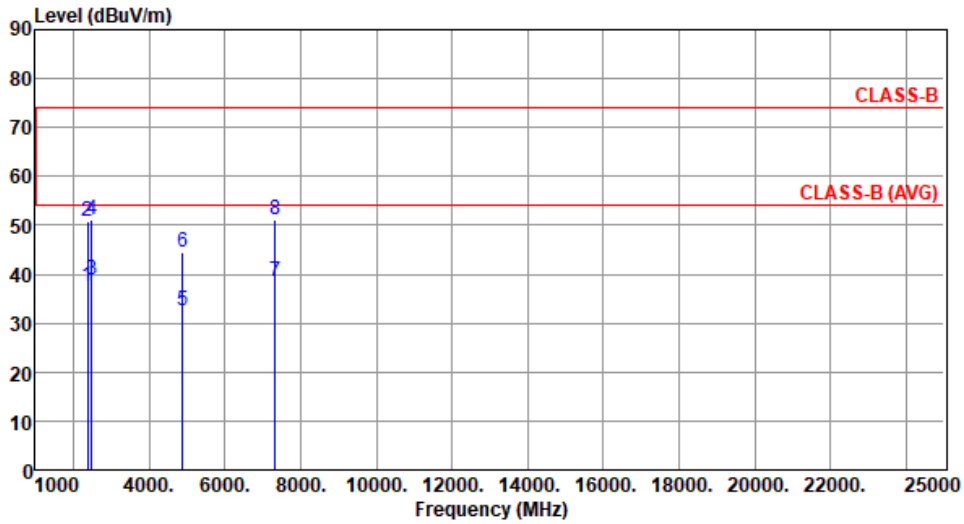


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	2390.00	37.81	54.00	-16.19	40.56	-2.75	Average	113	21
2	2390.00	51.14	74.00	-22.86	53.89	-2.75	Peak	113	21
3	2483.50	40.26	54.00	-13.74	42.96	-2.70	Average	113	21
4	2483.50	51.56	74.00	-22.44	54.26	-2.70	Peak	113	21
5	4890.00	32.93	54.00	-21.07	28.82	4.11	Average	100	141
6	4890.00	46.08	74.00	-27.92	41.97	4.11	Peak	100	141
7	7335.00	37.47	54.00	-16.53	28.19	9.28	Average	100	60
8	7335.00	50.39	74.00	-23.61	41.11	9.28	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	OQPSK	Test Freq. (MHz)	2440
Polarization	Vertical		

Test By :Roger Lu Temperature(℃):23 Humidity(%):67

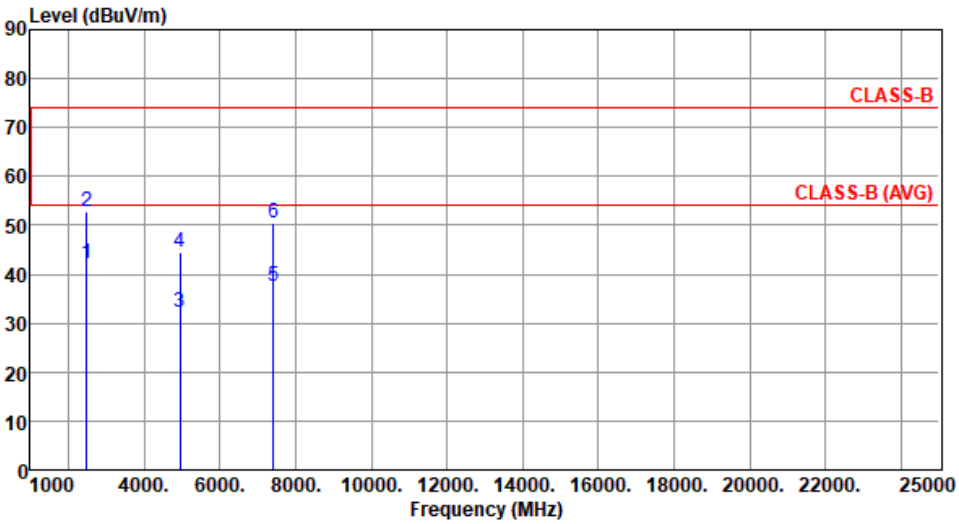


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	2390.00	37.50	54.00	-16.50	40.25	-2.75	Average	100	161
2	2390.00	50.81	74.00	-23.19	53.56	-2.75	Peak	100	161
3	2483.50	38.86	54.00	-15.14	41.56	-2.70	Average	100	161
4	2483.50	51.08	74.00	-22.92	53.78	-2.70	Peak	100	161
5	4890.00	32.51	54.00	-21.49	28.40	4.11	Average	100	1
6	4890.00	44.47	74.00	-29.53	40.36	4.11	Peak	100	1
7	7335.00	38.38	54.00	-15.62	29.10	9.28	Average	100	250
8	7335.00	51.09	74.00	-22.91	41.81	9.28	Peak	100	250

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	OQPSK	**Test Freq. (MHz)**	2475
Polarization	Horizontal		

Test By :Roger Lu Temperature(℃):23 Humidity(%):67

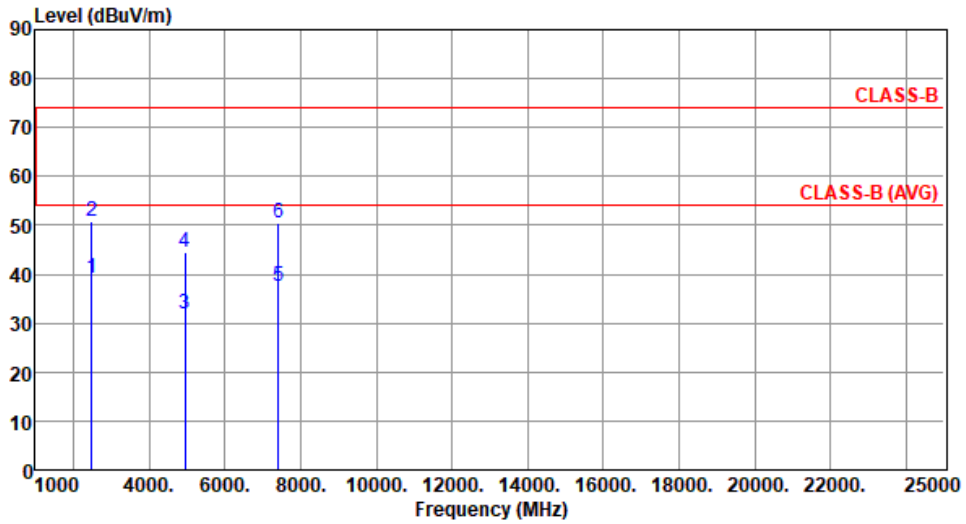


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	2483.50	42.18	54.00	-11.82	44.88	-2.70	Average	140	23
2	2483.50	52.92	74.00	-21.08	55.62	-2.70	Peak	140	23
3	4950.00	32.15	54.00	-21.85	28.12	4.03	Average	100	146
4	4950.00	44.62	74.00	-29.38	40.59	4.03	Peak	100	146
5	7425.00	37.59	54.00	-16.41	28.27	9.32	Average	100	50
6	7425.00	50.59	74.00	-23.41	41.27	9.32	Peak	100	50

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	OQPSK	Test Freq. (MHz)	2475
Polarization	Vertical		

Test By :Roger Lu Temperature(℃):23 Humidity(%):67

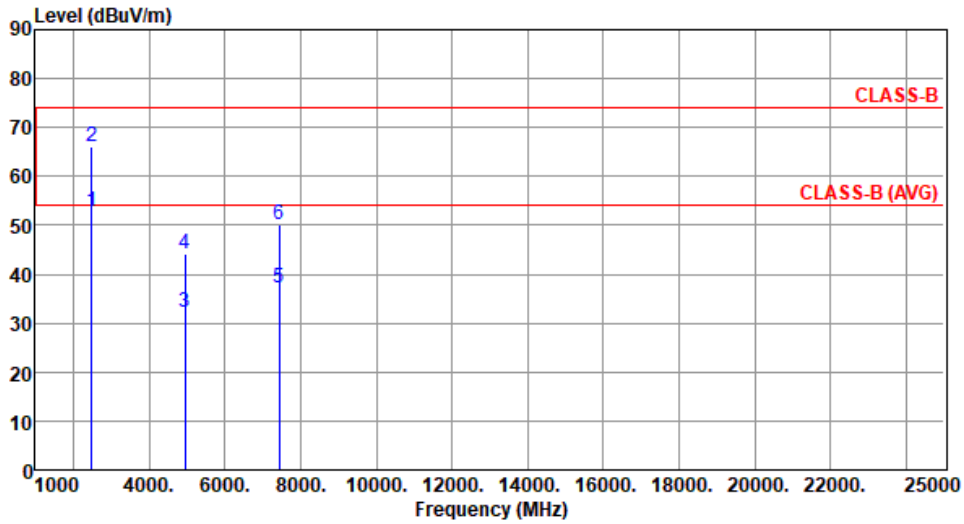


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	2483.50	39.08	54.00	-14.92	41.78	-2.70	Average	100	157
2	2483.50	50.92	74.00	-23.08	53.62	-2.70	Peak	100	157
3	4950.00	32.05	54.00	-21.95	28.02	4.03	Average	100	10
4	4950.00	44.49	74.00	-29.51	40.46	4.03	Peak	100	10
5	7425.00	37.48	54.00	-16.52	28.16	9.32	Average	100	40
6	7425.00	50.46	74.00	-23.54	41.14	9.32	Peak	100	40

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	OQPSK	**Test Freq. (MHz)**	2480
Polarization	Horizontal		

Test By :Roger Lu Temperature(℃):23 Humidity(%):67

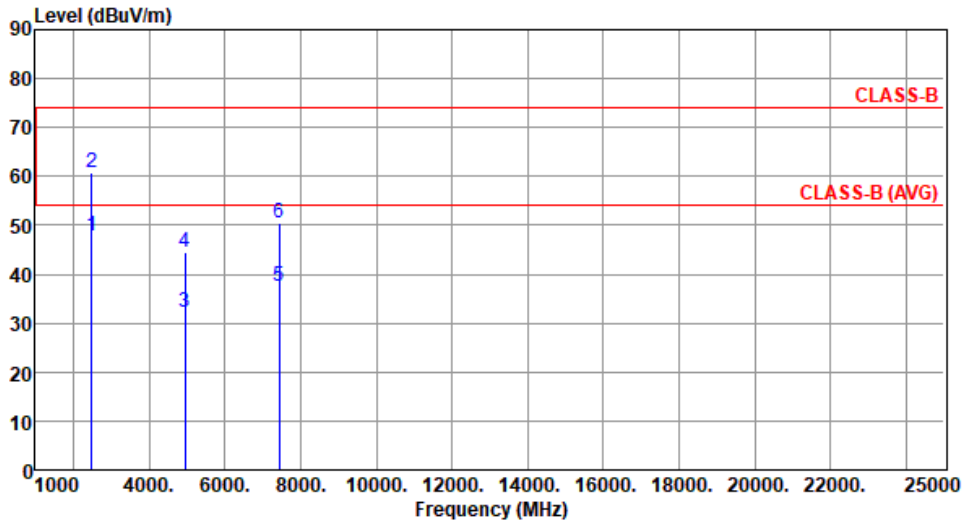


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	2483.50	52.76	54.00	-1.24	55.46	-2.70	Average	116	20
2	2483.50	65.99	74.00	-8.01	68.69	-2.70	Peak	116	20
3	4960.00	32.07	54.00	-21.93	28.04	4.03	Average	100	138
4	4960.00	44.29	74.00	-29.71	40.26	4.03	Peak	100	138
5	7440.00	37.28	54.00	-16.72	27.91	9.37	Average	100	58
6	7440.00	50.29	74.00	-23.71	40.92	9.37	Peak	100	58

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	OQPSK	Test Freq. (MHz)	2480
Polarization	Vertical		

Test By :Roger Lu Temperature(℃):23 Humidity(%):67



	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	2483.50	47.68	54.00	-6.32	50.38	-2.70	Average	100	155
2	2483.50	60.88	74.00	-13.12	63.58	-2.70	Peak	100	155
3	4960.00	32.14	54.00	-21.86	28.11	4.03	Average	100	15
4	4960.00	44.35	74.00	-29.65	40.32	4.03	Peak	100	15
5	7440.00	37.55	54.00	-16.45	28.18	9.37	Average	100	43
6	7440.00	50.44	74.00	-23.56	41.07	9.37	Peak	100	43

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).

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

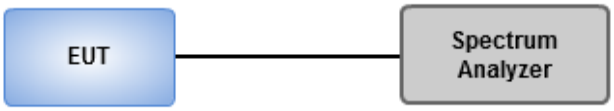
Reference level measurement

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

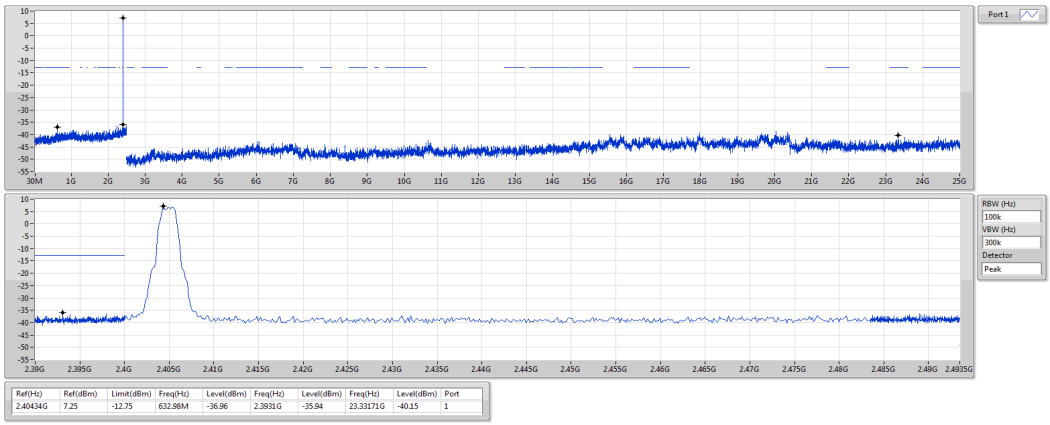


3.6.4 Unwanted Emissions into Non-Restricted Frequency Bands

Ambient Condition	22°C / 67%	Tested By	Brad Wu

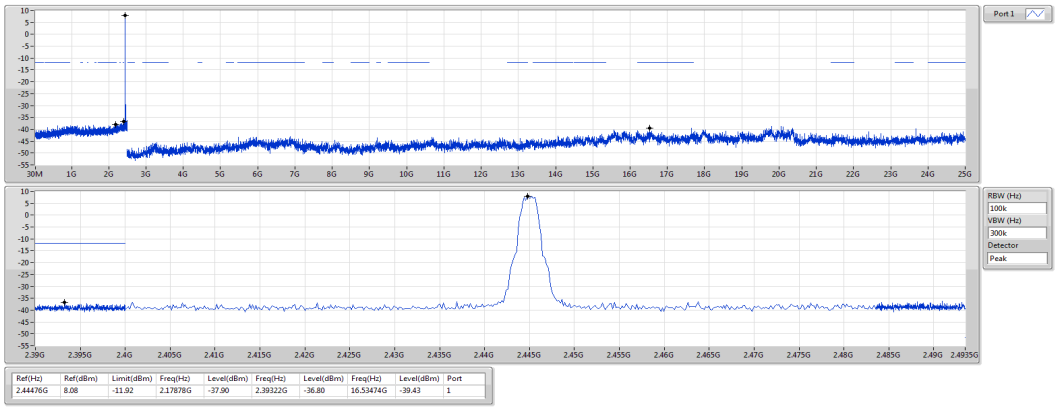
Zigbee **CSE NdB**

2405MHz



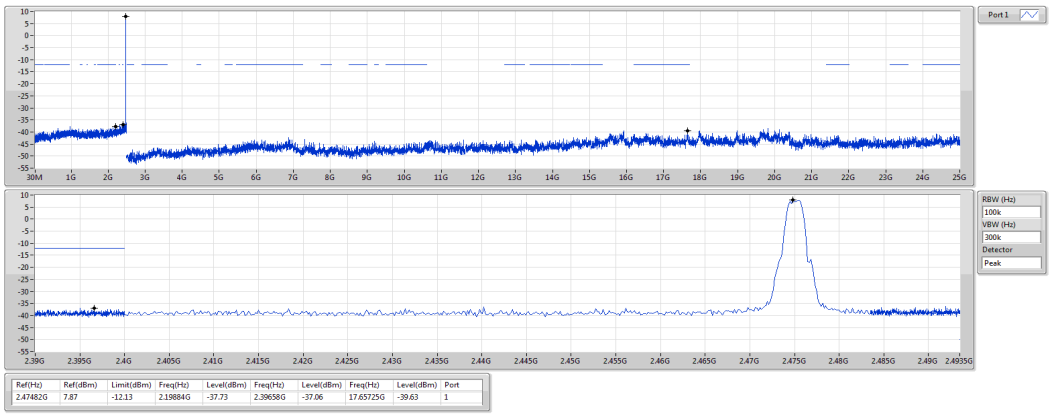
Zigbee **CSE NdB**

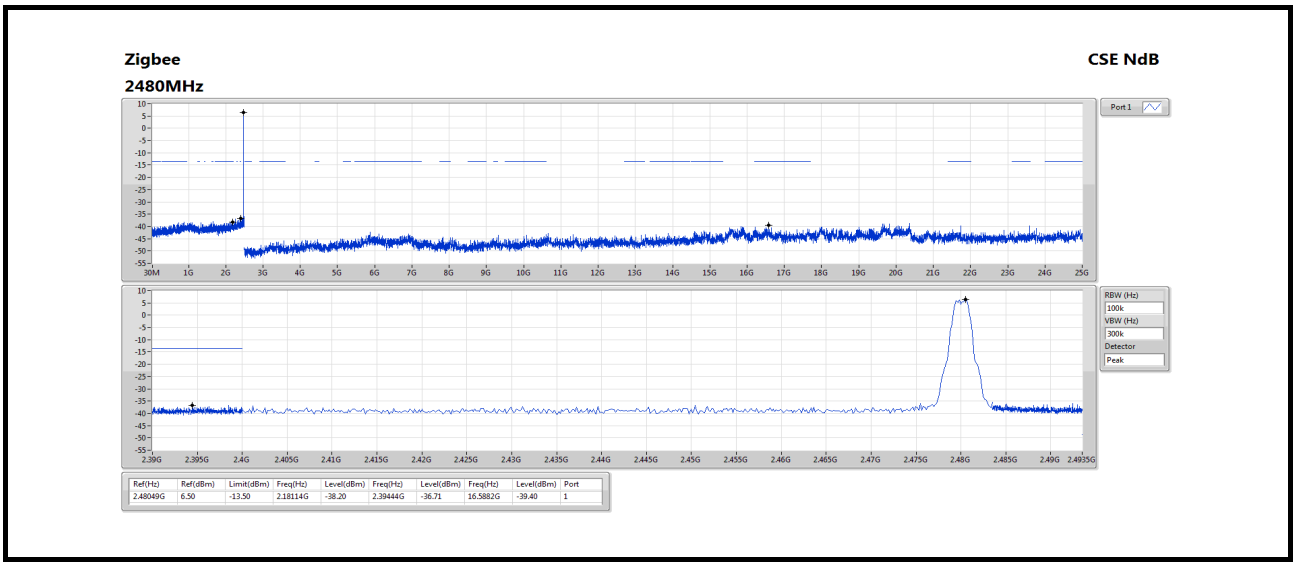
2445MHz



Zigbee **CSE NdB**

2475MHz




Zigbee
CSE NdB
2480MHz
Port 1
RBW (Hz)
100k
VBW (Hz)
300k
Detector
Peak
Ref(Hz) Ref(dBm) Limit(dBm) Freq(Hz) Level(dBm) Freq(Hz) Level(dBm) Freq(Hz) Level(dBm) Port
2.48049G 6.50 -13.50 2.18114G -38.20 2.39444G -36.71 16.5882G -39.40 1

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

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