

# FCC Test Report

**FCC ID** : JVPCR20C  
**Equipment** : ScreenBar Halo  
**Model No.** : CR20\_C  
**Brand Name** : BenQ  
**Qisda Ref. No** : AL-27599  
**Applicant** : BenQ Corporation  
**Address** : 16 Jihu Road, Neihu, Taipei 114, Taiwan  
**Standard** : 47 CFR FCC Part 15.249  
**Received Date** : Feb. 04, 2021  
**Tested Date** : Mar. 05 ~ Mar. 08, 2021

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

Reviewed by:

  
\_\_\_\_\_  
Along Chen / Assistant Manager

Approved by:

  
\_\_\_\_\_  
Gary Chang / Manager



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## Release Record

Report No.	Version	Description	Issued Date
FR120403	Rev. 01	Initial issue	Mar. 30, 2021

## Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	AC Power Line Conducted Emissions	[dBuV]: 0.763MHz 32.60 (Margin -13.40dB) - AV	Pass
15.249(a)	Field Strength of Fundamental	Meet the requirement of limit	Pass
15.249(a)(d)	Field Strength of Harmonics and Emissions Radiated outside of the Specified Frequency Bands	Meet the requirement of limit	Pass
15.215(c)	20dB bandwidth	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)	Modulation	Ch. Freq. (MHz)	Channel Number	Data Rate
2400-2483.5	GFSK	2405-2475	0-2 [3]	125kbps

### 1.1.2 Antenna Details

Ant. No.	Brand	Model	Type	Connector	Gain (dBi)
1	Qisda	CR20	Monopole	No	2.04

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

<b>Power Supply Type</b>	From USB port, DC 5V
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### 1.1.4 Channel List

Channel	Frequency (MHz)
0	2405
1	2446
2	2475

### 1.1.5 Test Tool and Duty Cycle

<b>Test Tool</b>	Hardware control	
<b>Duty Cycle and Duty Factor</b>	<b>Duty Cycle (%)</b>	<b>Duty Factor (dB)</b>
	41.40%	3.83

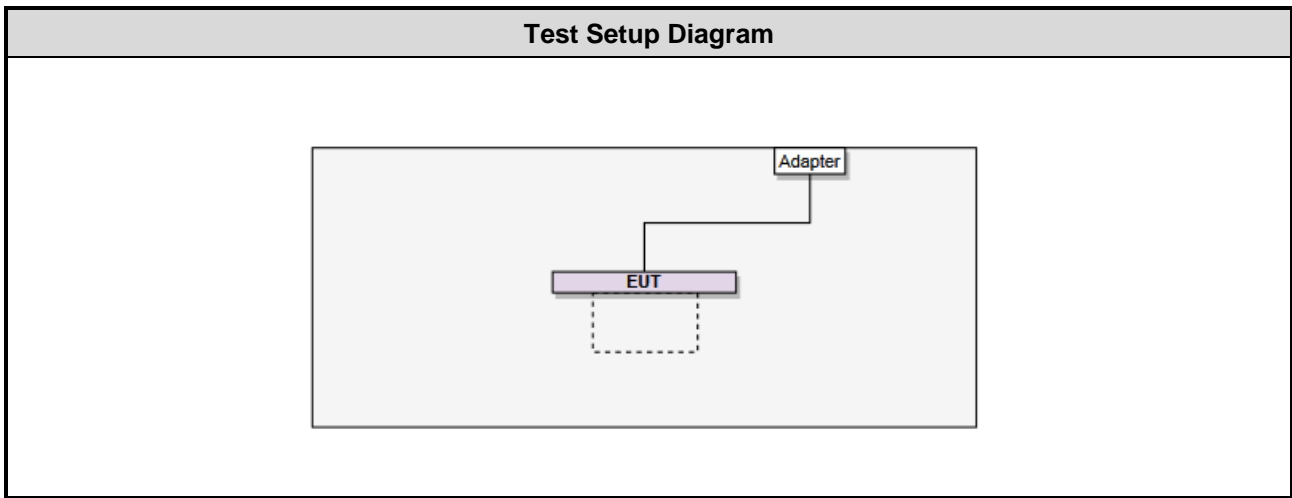
### 1.1.6 Power Index of Test Tool

Power Index			
Modulation Mode	Test Frequency (MHz)		
	2405	2446	2475
GFSK	Default	Default	Default

## 1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Adapter	Samsung	ETA-U90JWS	DoC	---

## 1.3 Test Setup Chart



## 1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
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. 12, 2020	Mar. 11, 2021
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 21, 2020	Oct. 20, 2021
Measurement Software	AUDIX	e3	6.120210k	NA	NA

Note: Calibration Interval of instruments listed above is one year.

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101498	Dec. 04, 2020	Dec. 03, 2021
Receiver	R&S	ESR3	101658	Feb. 08, 2021	Feb. 07, 2022
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 10, 2020	Jul. 09, 2021
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 11, 2020	Dec. 10, 2021
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 06, 2020	Nov. 05, 2021
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 17, 2020	Nov. 16, 2021
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 06, 2020	Oct. 05, 2021
Preamplifier	EMC	EMC02325	980225	Jul. 03, 2020	Jul. 02, 2021
Preamplifier	Agilent	83017A	MY39501308	Sep. 26, 2020	Sep. 25, 2021
Preamplifier	EMC	EMC184045B	980192	Jul. 21, 2020	Jul. 20, 2021
RF Cable	EMC	EMCCFD400-SM-SM-80 00	181106	Oct. 06, 2020	Oct. 05, 2021
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 06, 2020	Oct. 05, 2021
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Oct. 06, 2020	Oct. 05, 2021
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	160502	Oct. 06, 2020	Oct. 05, 2021
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 06, 2020	Oct. 05, 2021
LF cable 11M	EMC	EMCCFD400-NW-N W-11000	200801	Oct. 06, 2020	Oct. 05, 2021
Measurement Software	AUDIX	e3	6.120210g	NA	NA

Note: Calibration Interval of instruments listed above is one year.

## 1.5 Test Standards

47 CFR FCC Part 15.249

ANSI C63.10-2013

## 1.6 Deviation from Test Standard and Measurement Procedure

None

## 1.7 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
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

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

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

### 2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Data Rate	Test Configuration
AC Power Line Conducted Emissions	GFSK	2446	125kbps	--
Field Strength of Fundamental	GFSK	2405 / 2446 / 2475	125kbps	--
Radiated Emissions ≤ 1GHz	GFSK	2446	125kbps	--
Radiated Emissions > 1GHz	GFSK	2405 / 2446 / 2475	125kbps	--
20dB bandwidth	GFSK	2405 / 2446 / 2475	125kbps	--

## 3 Transmitter Test Results

### 3.1 Conducted Emissions

#### 3.1.1 Limit of Conducted Emissions

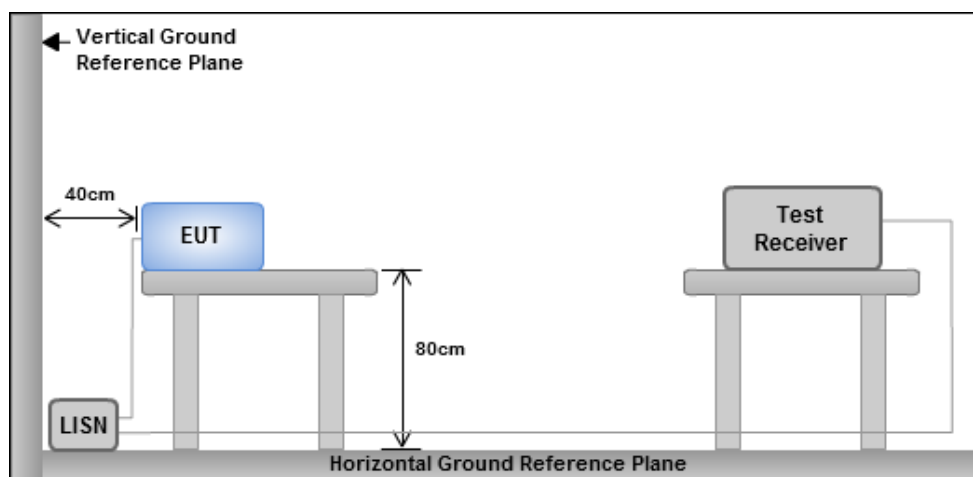
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

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

#### 3.1.2 Test Procedures

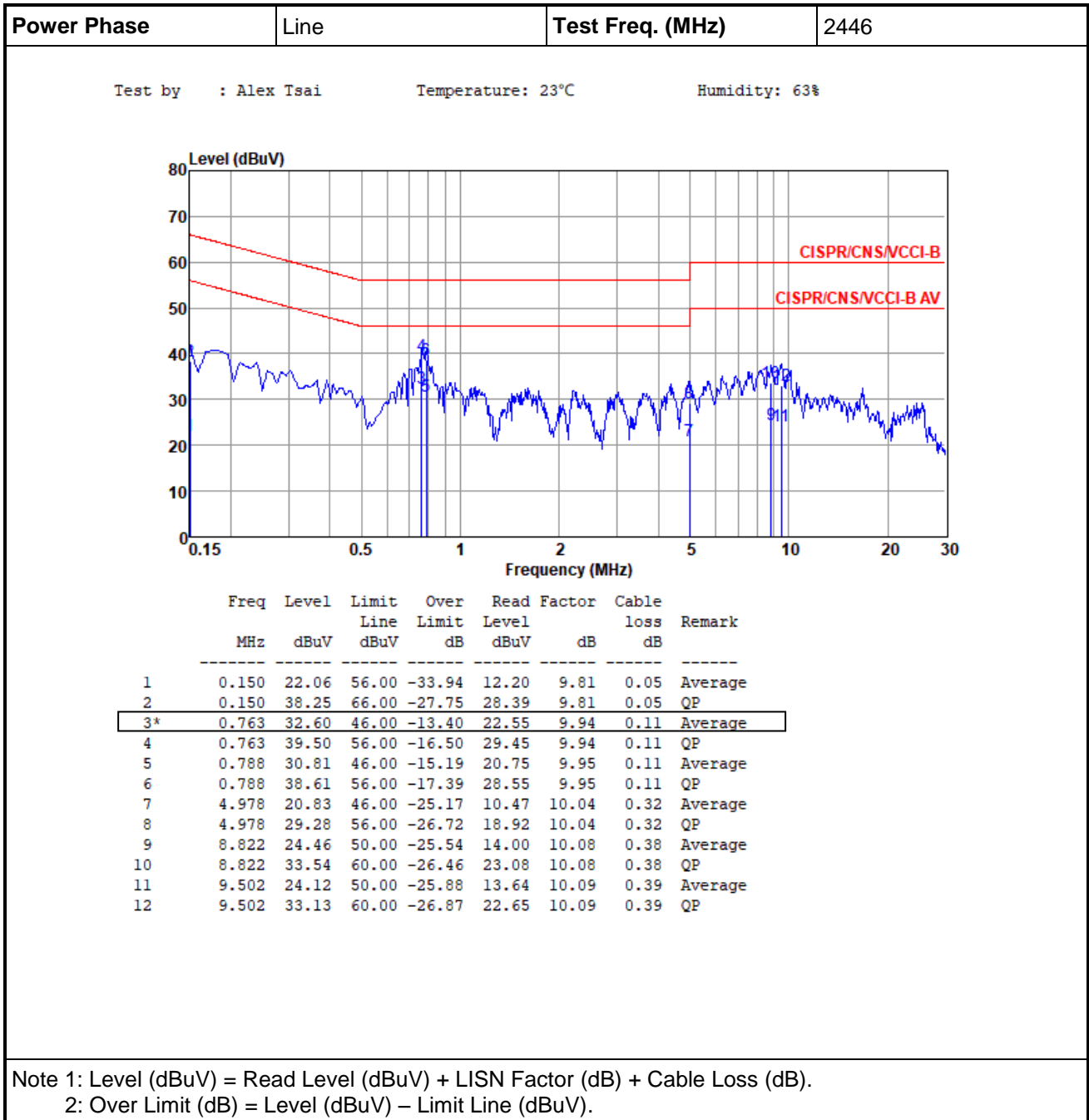
1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels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

#### 3.1.3 Test Setup



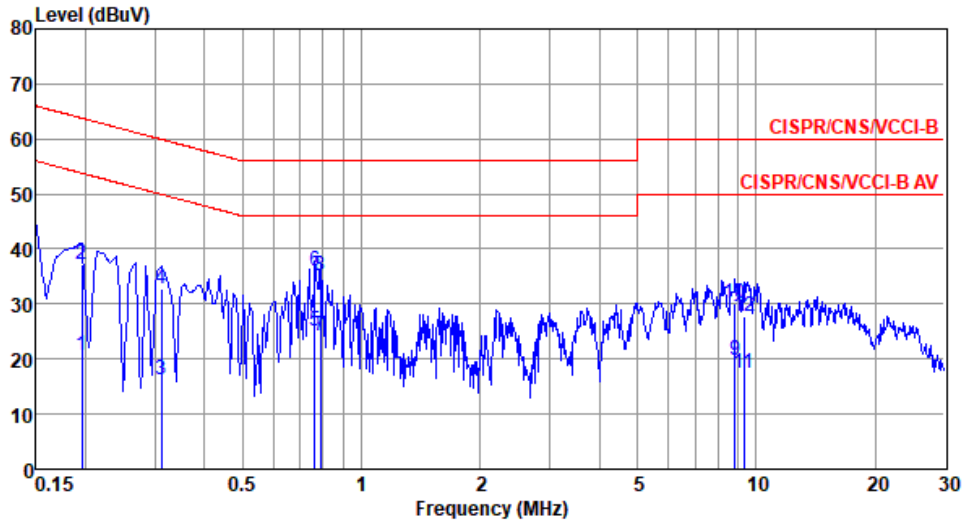
- Note: 1. Support units were connected to second LISN.  
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

### 3.1.4 Test Result of Conducted Emissions



<b>Power Phase</b>	Neutral	<b>Test Freq. (MHz)</b>	2446
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Test by : Alex Tsai      Temperature: 23°C      Humidity: 63%



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	Factor dB	Cable loss dB	Remark
1	0.195	20.53	53.80	-33.27	10.67	9.80	0.06	Average
2	0.195	37.21	63.80	-26.59	27.35	9.80	0.06	QP
3	0.312	16.15	49.93	-33.78	6.26	9.82	0.07	Average
4	0.312	32.86	59.93	-27.07	22.97	9.82	0.07	QP
5	0.763	25.15	46.00	-20.85	15.20	9.84	0.11	Average
6*	0.763	36.01	56.00	-19.99	26.06	9.84	0.11	QP
7	0.788	24.21	46.00	-21.79	14.26	9.84	0.11	Average
8	0.788	35.06	56.00	-20.94	25.11	9.84	0.11	QP
9	8.822	19.82	50.00	-30.18	9.40	10.04	0.38	Average
10	8.822	30.07	60.00	-29.93	19.65	10.04	0.38	QP
11	9.302	17.38	50.00	-32.62	6.94	10.05	0.39	Average
12	9.302	27.80	60.00	-32.20	17.36	10.05	0.39	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 Radiated Emission

This section includes field strength of fundamental, field strength of harmonics and emissions radiated outside of the operating frequency bands.

### 3.2.1 Limit of field strength of fundamental and field strength of harmonics

Fundamental Frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
2400–2483.5 MHz	50	500

### 3.2.2 Limit of Unwanted Emissions

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in below table, whichever is the lesser attenuation.

Radiated emission limits			
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.

### 3.2.3 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. Radiated emission below 1GHz  
120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission
2. Radiated emission above 1GHz / Peak value except fundamental  
RBW=1MHz, VBW=3MHz and Peak detector
3. Radiated emission above 1GHz / Average value for field strength of fundamental and harmonics  
The average value is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:

$$20\log(\text{Duty cycle}) = 20\log \frac{0.62174 \times 7\text{ms}}{100 \text{ms}} = -27.23\text{dB}$$

Please see page 24 for plotted duty

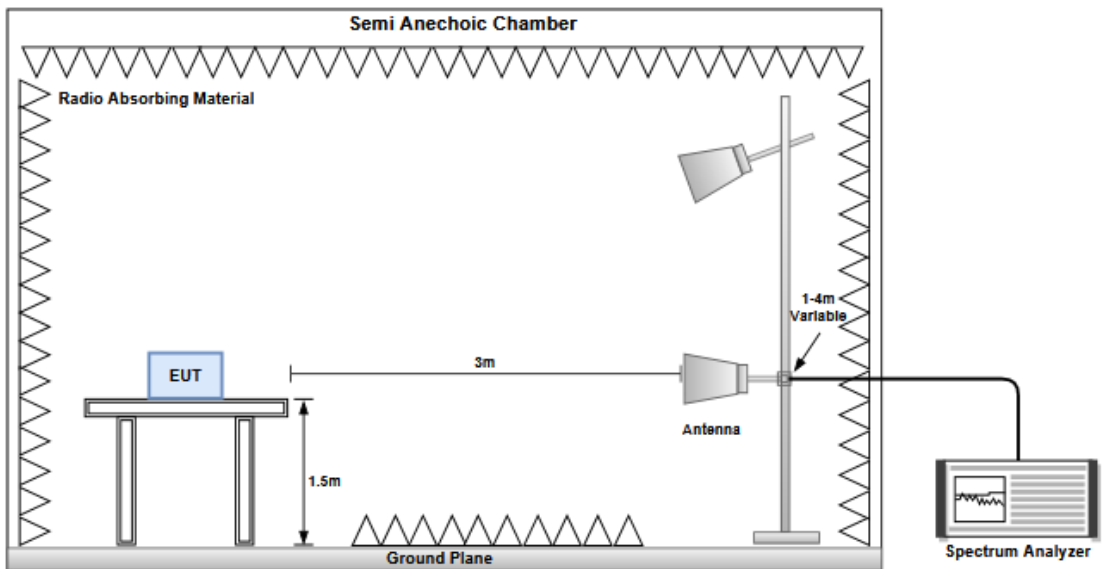
4. Radiated emission above 1GHz / Average value for other emissions  
RBW=1MHz, VBW=10Hz and Peak detector
5. Radiated emission Peak value for fundamental  
RBW=3MHz, VBW=10MHz and Peak detector

### 3.2.4 Test Setup

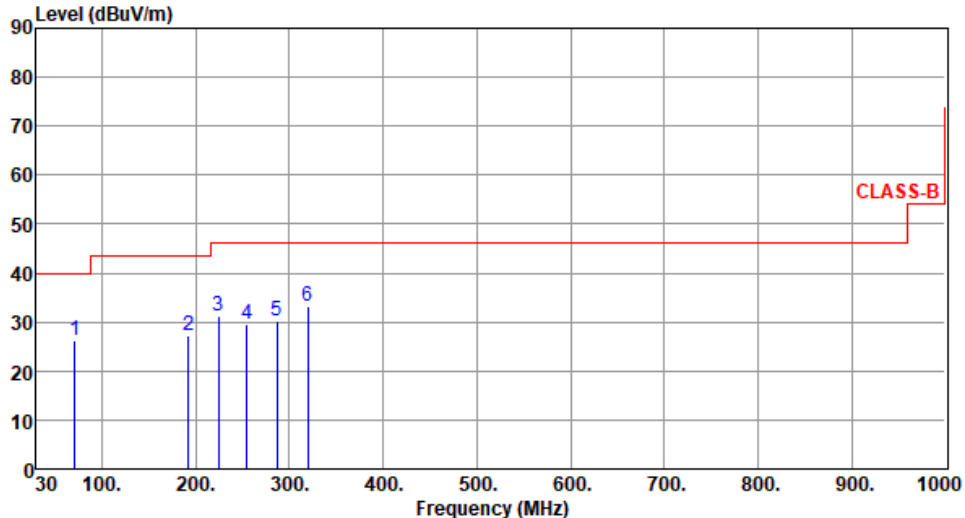
#### Radiated Emissions below 1 GHz



#### Radiated Emissions above 1 GHz



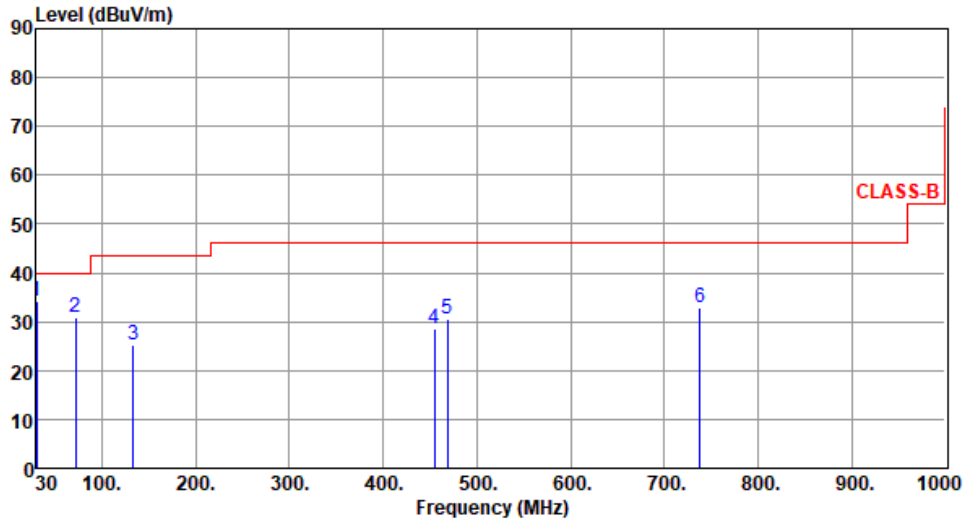
### 3.2.5 Transmitter Radiated Unwanted Emissions (Below 1GHz)

<b>Modulation</b>	GFSK	<b>Test Freq. (MHz)</b>	2446																																																																
<b>Polarization</b>	Horizontal																																																																		
Test By : Akun Chung      Temperature(°C):23      Humidity(%):67																																																																			
 <p>The graph plots Level (dBuV/m) on the y-axis (0 to 90) against Frequency (MHz) on the x-axis (30 to 1000). A red line represents the CLASS-B limit, which is constant at 40 dBuV/m from 30 MHz to 100 MHz, then steps up to 45 dBuV/m from 100 MHz to 900 MHz, and finally steps up to 70 dBuV/m from 900 MHz to 1000 MHz. Six blue vertical lines represent emission peaks, labeled 1 through 6, with their respective frequencies and levels indicated in the table below.</p>																																																																			
	<table border="1"> <thead> <tr> <th>Freq. MHz</th> <th>Emission level dBuV/m</th> <th>Limit dBuV/m</th> <th>Margin dB</th> <th>SA reading dBuV</th> <th>Factor dB/m</th> <th>Remark</th> <th>ANT High cm</th> <th>Turn Table deg</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>70.74</td> <td>26.24</td> <td>40.00</td> <td>-13.76</td> <td>37.26</td> <td>-11.02</td> <td>Peak</td> <td>---</td> </tr> <tr> <td>2</td> <td>191.99</td> <td>27.19</td> <td>43.50</td> <td>-16.31</td> <td>38.84</td> <td>-11.65</td> <td>Peak</td> <td>---</td> </tr> <tr> <td>3</td> <td>224.00</td> <td>31.05</td> <td>46.00</td> <td>-14.95</td> <td>43.04</td> <td>-11.99</td> <td>Peak</td> <td>---</td> </tr> <tr> <td>4</td> <td>255.04</td> <td>29.44</td> <td>46.00</td> <td>-16.56</td> <td>39.36</td> <td>-9.92</td> <td>Peak</td> <td>---</td> </tr> <tr> <td>5</td> <td>287.05</td> <td>30.39</td> <td>46.00</td> <td>-15.61</td> <td>38.88</td> <td>-8.49</td> <td>Peak</td> <td>---</td> </tr> <tr> <td>6</td> <td>320.03</td> <td>33.31</td> <td>46.00</td> <td>-12.69</td> <td>40.73</td> <td>-7.42</td> <td>Peak</td> <td>---</td> </tr> </tbody> </table>	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	70.74	26.24	40.00	-13.76	37.26	-11.02	Peak	---	2	191.99	27.19	43.50	-16.31	38.84	-11.65	Peak	---	3	224.00	31.05	46.00	-14.95	43.04	-11.99	Peak	---	4	255.04	29.44	46.00	-16.56	39.36	-9.92	Peak	---	5	287.05	30.39	46.00	-15.61	38.88	-8.49	Peak	---	6	320.03	33.31	46.00	-12.69	40.73	-7.42	Peak	---			
Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg																																																											
1	70.74	26.24	40.00	-13.76	37.26	-11.02	Peak	---																																																											
2	191.99	27.19	43.50	-16.31	38.84	-11.65	Peak	---																																																											
3	224.00	31.05	46.00	-14.95	43.04	-11.99	Peak	---																																																											
4	255.04	29.44	46.00	-16.56	39.36	-9.92	Peak	---																																																											
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6	320.03	33.31	46.00	-12.69	40.73	-7.42	Peak	---																																																											
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB/m) *Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m). Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.																																																																			



<b>Modulation</b>	GFSK	<b>Test Freq. (MHz)</b>	2446
<b>Polarization</b>	Vertical		

Test By : Akun Chung      Temperature(°C): 23      Humidity(%): 67



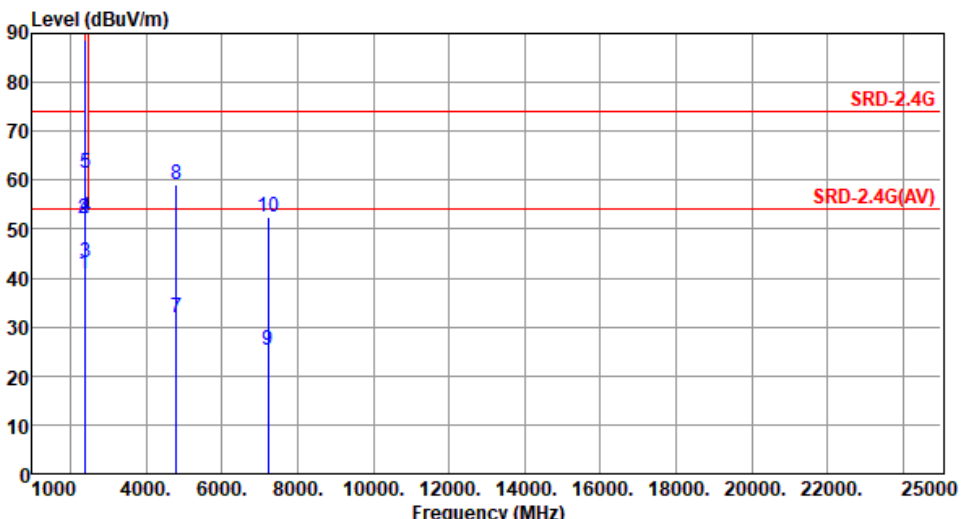
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	30.00	34.14	40.00	-5.86	43.62	-9.48	Peak	---	---
2	71.71	30.95	40.00	-9.05	42.06	-11.11	Peak	---	---
3	133.79	25.12	43.50	-18.38	34.72	-9.60	Peak	---	---
4	454.86	28.43	46.00	-17.57	32.55	-4.12	Peak	---	---
5	468.44	30.64	46.00	-15.36	34.53	-3.89	Peak	---	---
6	738.10	32.75	46.00	-13.25	31.42	1.33	Peak	---	---

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

\*Factor includes antenna factor , cable loss and amplifier gain

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

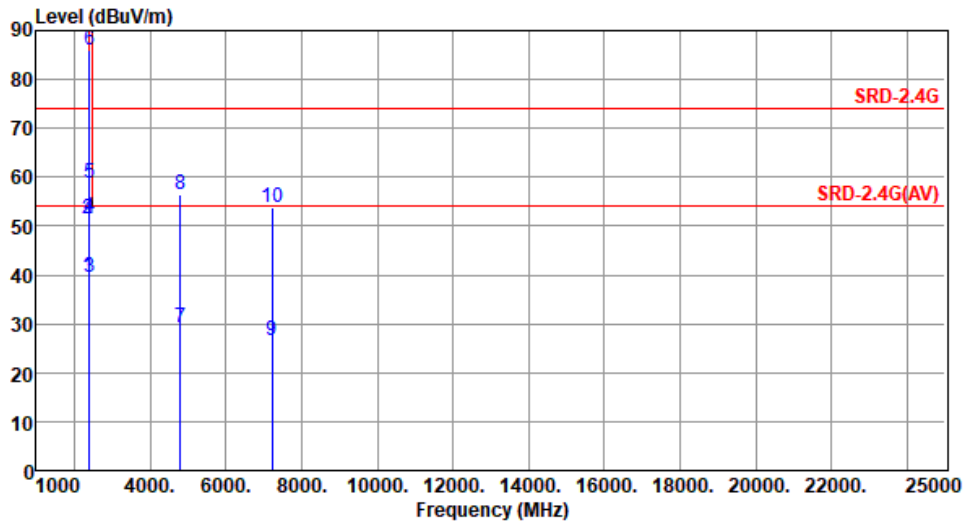
### 3.2.6 Transmitter Radiated Unwanted Emissions (Above 1GHz)

<b>Modulation</b>	GFSK	<b>Test Freq. (MHz)</b>	2405						
<b>Polarization</b>	Horizontal								
Test By : Akun Chung      Temperature(°C):23      Humidity(%):67									
 <p>The graph plots Level (dBuV/m) on the y-axis (0 to 90) against Frequency (MHz) on the x-axis (1000 to 25000). Two horizontal red lines represent limits: SRD-2.4G at approximately 75 dBuV/m and SRD-2.4G(AV) at approximately 55 dBuV/m. Ten vertical blue lines represent emission points, labeled 1 through 10, with their respective levels and factors indicated in the table below.</p>									
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		cm	deg
1	2390.00	41.01	54.00	-12.99	43.80	-2.79	Average	169	250
2	2390.00	52.19	74.00	-21.81	54.98	-2.79	Peak	169	250
3	2400.00	43.06	54.00	-10.94	45.85	-2.79	Average	169	250
4	2400.00	52.43	74.00	-21.57	55.22	-2.79	Peak	169	250
5	2405.00	61.56	94.00	-32.44	64.35	-2.79	Average	169	250
6	2405.00	88.79	114.00	-25.21	91.58	-2.79	Peak	169	250
7	4810.00	31.92	54.00	-22.08	28.43	3.49	Average	100	211
8	4810.00	59.15	74.00	-14.85	55.66	3.49	Peak	100	211
9	7215.00	25.38	54.00	-28.62	16.43	8.95	Average	200	185
10	7215.00	52.61	74.00	-21.39	43.66	8.95	Peak	200	185

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

<b>Modulation</b>	GFSK	<b>Test Freq. (MHz)</b>	2405
<b>Polarization</b>	Vertical		

Test By : Akun Chung      Temperature(°C): 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	39.60	54.00	-14.40	42.39	-2.79	Average	100	162
2	2390.00	51.57	74.00	-22.43	54.36	-2.79	Peak	100	162
3	2400.00	39.60	54.00	-14.40	42.39	-2.79	Average	100	162
4	2400.00	51.73	74.00	-22.27	54.52	-2.79	Peak	100	162
5	2405.00	58.79	94.00	-35.21	61.58	-2.79	Average	100	162
6	2405.00	86.02	114.00	-27.98	88.81	-2.79	Peak	100	162
7	4810.00	29.11	54.00	-24.89	25.62	3.49	Average	100	181
8	4810.00	56.34	74.00	-17.66	52.85	3.49	Peak	100	181
9	7215.00	26.60	54.00	-27.40	17.65	8.95	Average	291	161
10	7215.00	53.83	74.00	-20.17	44.88	8.95	Peak	291	161

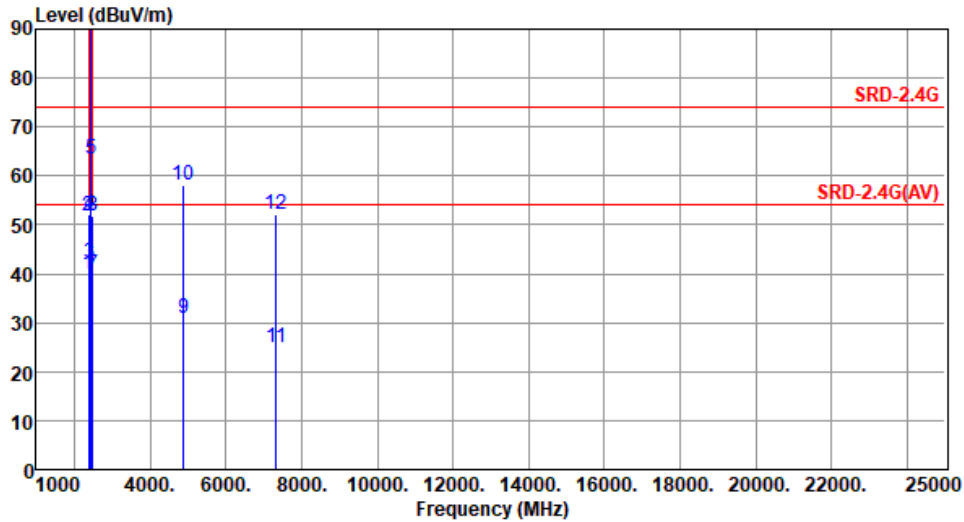
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain

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

<b>Modulation</b>	GFSK	<b>Test Freq. (MHz)</b>	2446
<b>Polarization</b>	Horizontal		

Test By : Akun Chung      Temperature(°C): 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	39.86	54.00	-14.14	42.65	-2.79	Average	167	251
2	2390.00	51.90	74.00	-22.10	54.69	-2.79	Peak	167	251
3	2400.00	42.08	54.00	-11.92	44.87	-2.79	Average	167	251
4	2400.00	52.19	74.00	-21.81	54.98	-2.79	Peak	167	251
5	2446.00	63.28	94.00	-30.72	66.00	-2.72	Average	167	251
6	2446.00	90.51	114.00	-23.49	93.23	-2.72	Peak	167	251
7	2483.50	39.92	54.00	-14.08	42.66	-2.74	Average	167	251
8	2483.50	51.95	74.00	-22.05	54.69	-2.74	Peak	167	251
9	4892.00	30.94	54.00	-23.06	27.47	3.47	Average	100	203
10	4892.00	58.17	74.00	-15.83	54.70	3.47	Peak	100	203
11	7338.00	24.79	54.00	-29.21	15.74	9.05	Average	204	186
12	7338.00	52.02	74.00	-21.98	42.97	9.05	Peak	204	186

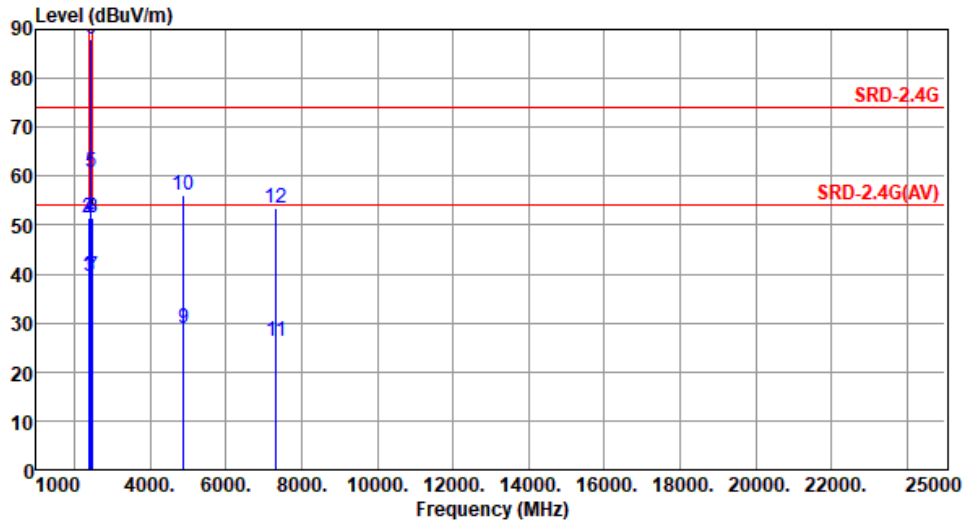
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain

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

<b>Modulation</b>	GFSK	<b>Test Freq. (MHz)</b>	2446
<b>Polarization</b>	Vertical		

Test By : Akun Chung      Temperature(°C): 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	39.46	54.00	-14.54	42.25	-2.79	Average	100	159
2	2390.00	51.49	74.00	-22.51	54.28	-2.79	Peak	100	159
3	2400.00	39.51	54.00	-14.49	42.30	-2.79	Average	100	159
4	2400.00	51.57	74.00	-22.43	54.36	-2.79	Peak	100	159
5	2446.00	60.61	94.00	-33.39	63.33	-2.72	Average	100	159
6	2446.00	87.84	114.00	-26.16	90.56	-2.72	Peak	100	159
7	2483.50	39.55	54.00	-14.45	42.29	-2.74	Average	100	159
8	2483.50	51.59	74.00	-22.41	54.33	-2.74	Peak	100	159
9	4892.00	28.94	54.00	-25.06	25.47	3.47	Average	100	178
10	4892.00	56.17	74.00	-17.83	52.70	3.47	Peak	100	178
11	7338.00	26.28	54.00	-27.72	17.23	9.05	Average	294	158
12	7338.00	53.51	74.00	-20.49	44.46	9.05	Peak	294	158

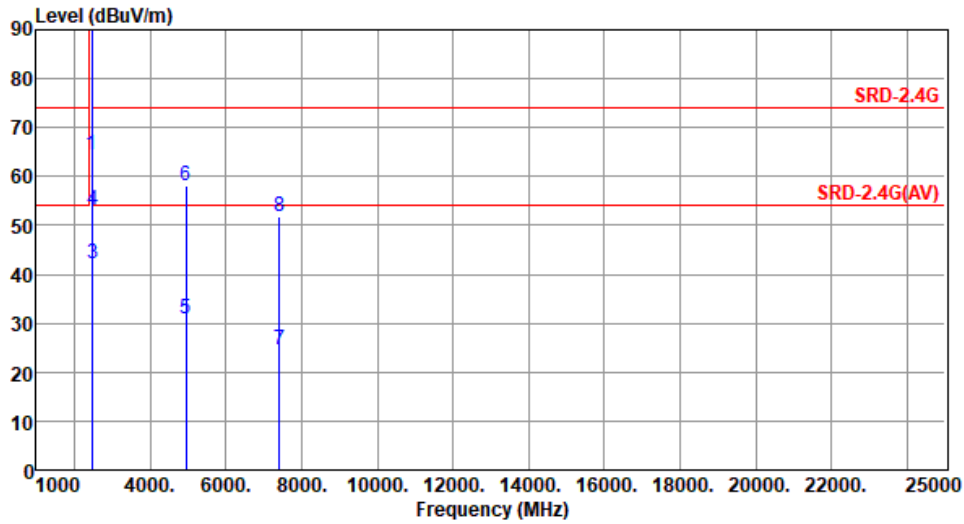
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB/m)

\*Factor includes antenna factor , cable loss and amplifier gain

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

<b>Modulation</b>	GFSK	<b>Test Freq. (MHz)</b>	2475
<b>Polarization</b>	Horizontal		

Test By : Akun Chung      Temperature(°C): 23      Humidity(%): 67



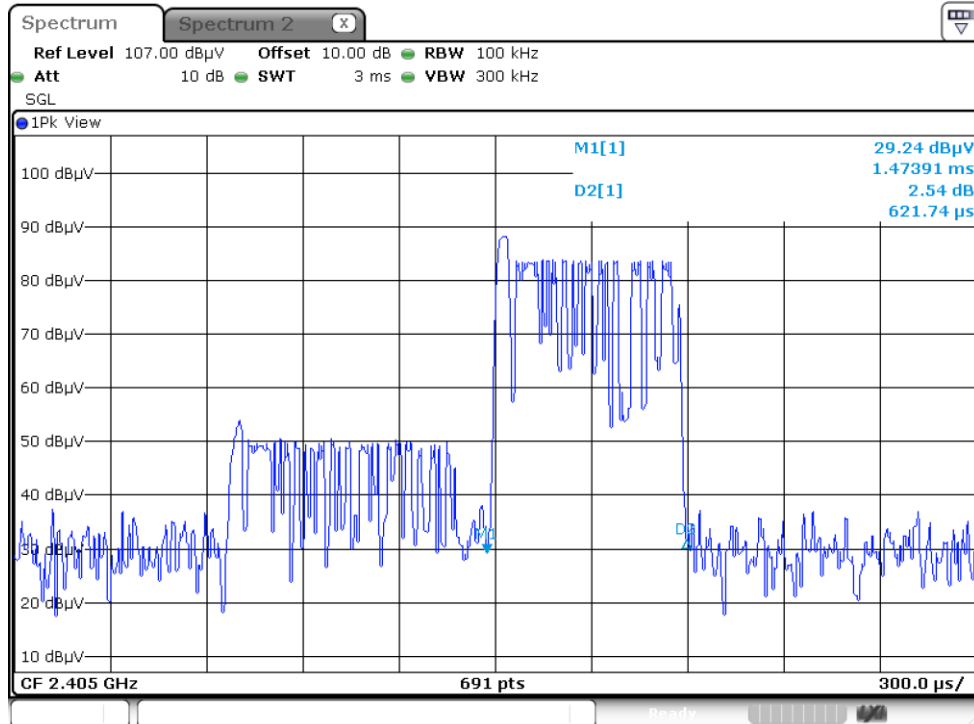
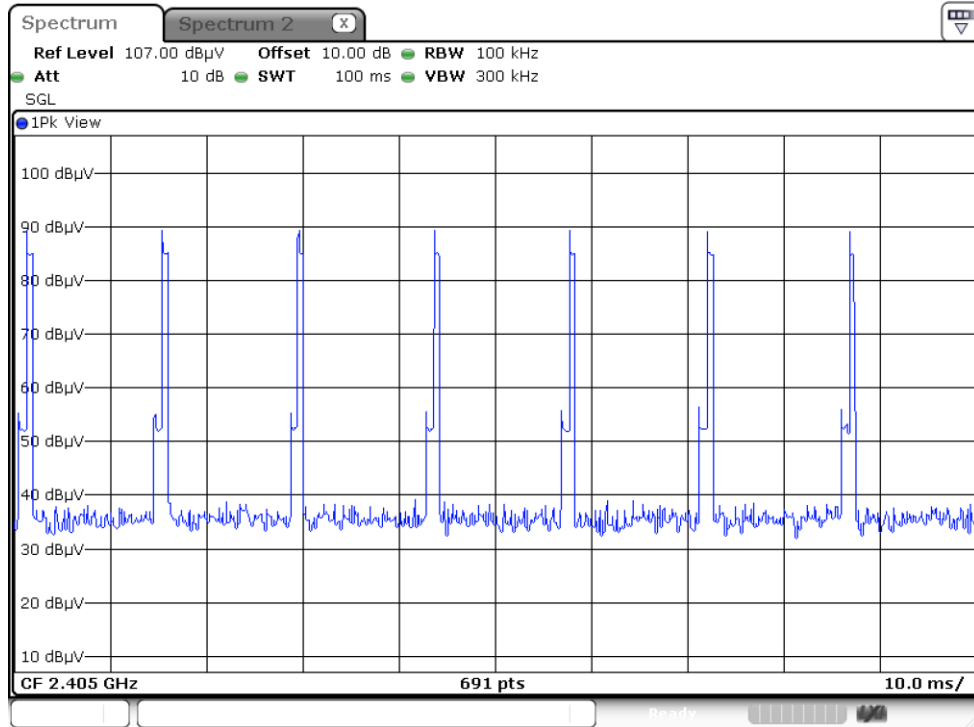
	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	2475.00	64.37	94.00	-29.63	67.11	-2.74	Average	162	252
2	2475.00	91.60	114.00	-22.40	94.34	-2.74	Peak	162	252
3	2483.50	42.14	54.00	-11.86	44.88	-2.74	Average	162	252
4	2483.50	53.24	74.00	-20.76	55.98	-2.74	Peak	162	252
5	4950.00	31.01	54.00	-22.99	27.39	3.62	Average	100	211
6	4950.00	58.24	74.00	-15.76	54.62	3.62	Peak	100	211
7	7425.00	24.59	54.00	-29.41	15.63	8.96	Average	206	184
8	7425.00	51.82	74.00	-22.18	42.86	8.96	Peak	206	184

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

\*Factor includes antenna factor, cable loss and amplifier gain

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

<b>Modulation</b>	GFSK	<b>Test Freq. (MHz)</b>	2475						
<b>Polarization</b>	Vertical								
Test By	:Akun Chung	Temperature(°C)	:23	Humidity(%)	:67				
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		cm	deg
1	2475.00	61.37	94.00	-32.63	64.11	-2.74	Average	100	163
2	2475.00	88.60	114.00	-25.40	91.34	-2.74	Peak	100	163
3	2483.50	39.86	54.00	-14.14	42.60	-2.74	Average	100	163
4	2483.50	51.71	74.00	-22.29	54.45	-2.74	Peak	100	163
5	4950.00	29.01	54.00	-24.99	25.39	3.62	Average	100	180
6	4950.00	56.24	74.00	-17.76	52.62	3.62	Peak	100	180
7	7425.00	26.06	54.00	-27.94	17.10	8.96	Average	291	153
8	7425.00	53.29	74.00	-20.71	44.33	8.96	Peak	291	153
<p>Note 1: Emission Level (dBUV/m) = SA Reading (dBUV/m) + Factor* (dB/m)            *Factor includes antenna factor , cable loss and amplifier gain            Note 2: Margin (dB) = Emission level (dBUV/m) – Limit (dBUV/m).</p>									



$$20\log(\text{Duty cycle}) = 20\log \frac{0.62174 \times 7 \text{ ms}}{100 \text{ ms}} = -27.23\text{dB}$$

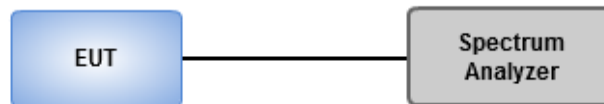


### 3.3 20dB and Occupied Bandwidth

#### 3.3.1 Test Procedures

1. Set resolution bandwidth (RBW) = 20 kHz, Video bandwidth = 100 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 20dB relative to the maximum level measured in the fundamental emission.
5. Use the occupied measurement function of spectrum analyzer to measure 99% occupied bandwidth.

#### 3.3.2 Test Setup

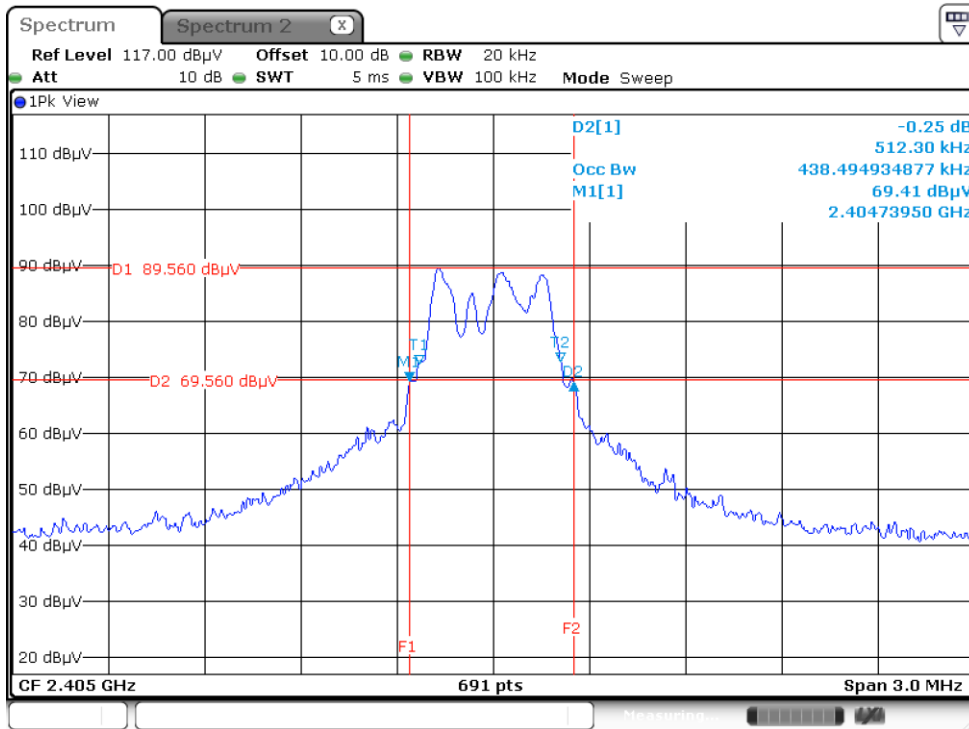


#### 3.3.3 20dB and Occupied Bandwidth

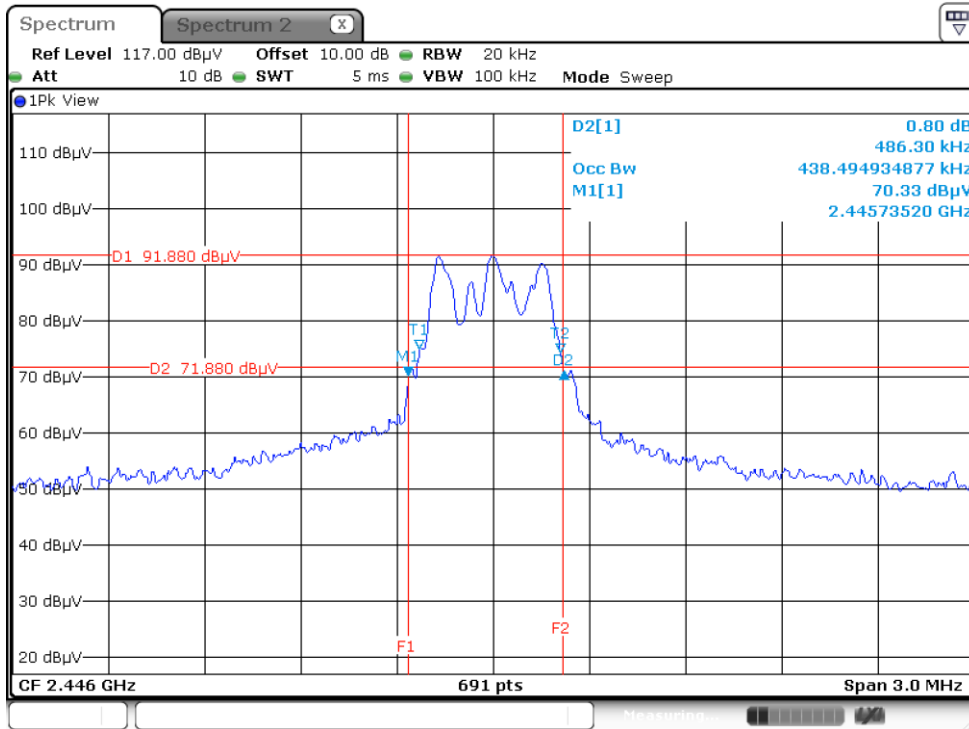
<b>Ambient Condition</b>	23°C / 67%	<b>Tested By</b>	Akun Chung
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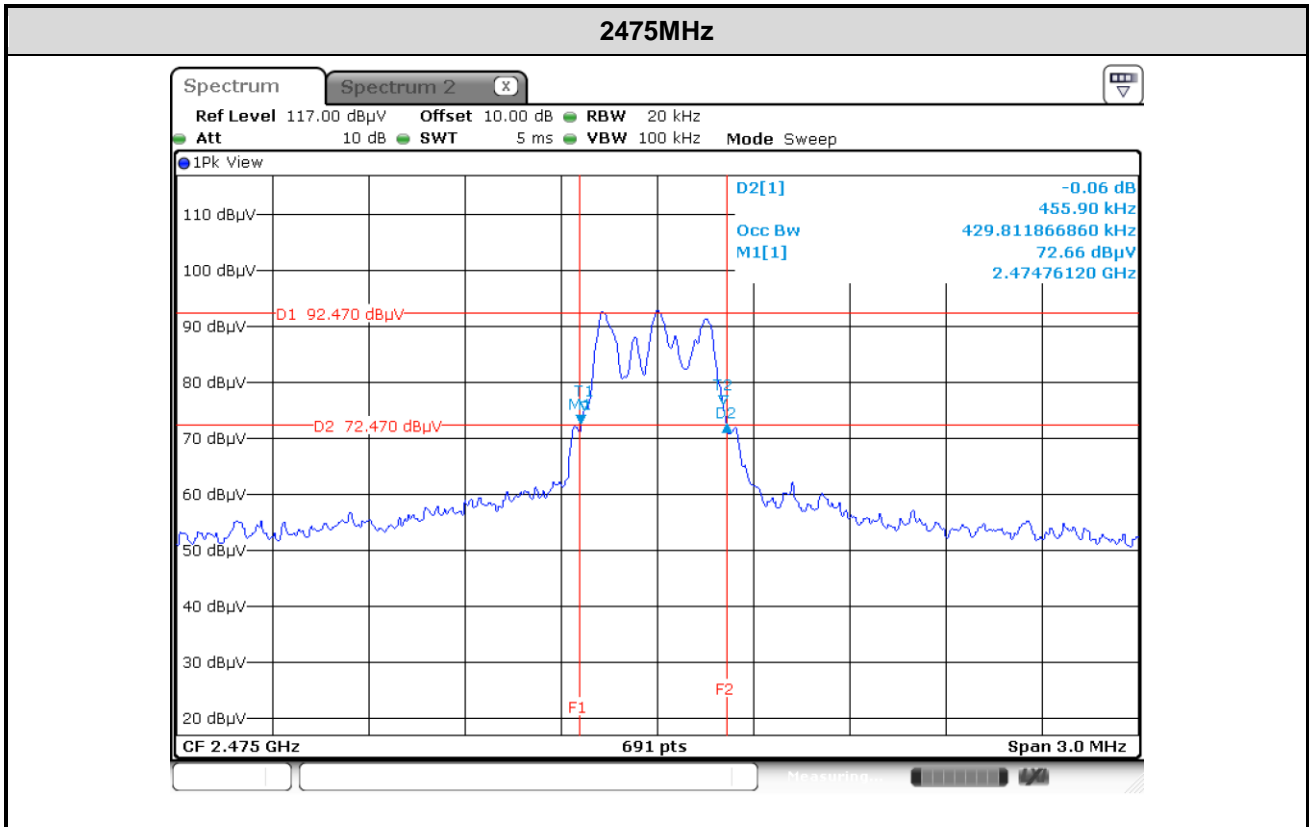
Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied BW (MHz)
2405	0.512	0.438
2446	0.486	0.438
2475	0.456	0.430

### 2405MHz



### 2446MHz





## 4 Test laboratory information

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

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

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

### **Linkou**

Tel: 886-2-2601-1640

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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.)

### **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: 886-3-318-0155

Email: ICC\_Service@icertifi.com.tw

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