

FCC Test Report

FCC ID : IPH-03958
Equipment : Smart Watch
Model No. : A03958
Brand Name : GARMIN
Applicant : Garmin International, Inc.
Address : 1200 E. 151st Street Olathe, KS 66062 United States
Standard : 47 CFR FCC Part 15.249
Received Date : Apr. 30, 2020
Tested Date : May 29 ~ Jun 09, 2020

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

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

Reviewed by:



Along Chen / Assistant Manager

Approved by:



Gary Chang / Manager



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Release Record

Report No.	Version	Description	Issued Date
FR051401AF	Rev. 01	Initial issue	Jul. 01, 2020

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	AC Power Line Conducted Emissions	[dBuV]: 0.763MHz 25.51 (Margin -20.49dB) - 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
2402-2480	GFSK	2402-2480	1-79 [79]	1 Mbps

1.1.2 Antenna Details

Ant. No.	Type	Connector	Gain (dBi)
1	Slot	No	-2.13

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	5Vdc from host 3.87Vdc from battery
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1.1.4 Accessories

No.	Equipment	Description
1	Battery	Brand: GARMIN Model: 361-00136-10 Rating: 3.87Vdc, 195mAh
2	USB cable	Brand: GARMIN Model: 320-01069-10 Power line: 0.52m shielded without core

1.1.5 Channel List

Frequency band (MHz)				2400~2483.5			
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2402	21	2422	41	2442	61	2462
2	2403	22	2423	42	2443	62	2463
3	2404	23	2424	43	2444	63	2464
4	2405	24	2425	44	2445	64	2465
5	2406	25	2426	45	2446	65	2466
6	2407	26	2427	46	2447	66	2467
7	2408	27	2428	47	2448	67	2468
8	2409	28	2429	48	2449	68	2469
9	2410	29	2430	49	2450	69	2470
10	2411	30	2431	50	2451	70	2471
11	2412	31	2432	51	2452	71	2472
12	2413	32	2433	52	2453	72	2473
13	2414	33	2434	53	2454	73	2474
14	2415	34	2435	54	2455	74	2475
15	2416	35	2436	55	2456	75	2476
16	2417	36	2437	56	2457	76	2477
17	2418	37	2438	57	2458	77	2478
18	2419	38	2439	58	2459	78	2479
19	2420	39	2440	59	2460	79	2480
20	2421	40	2441	60	2461	---	---

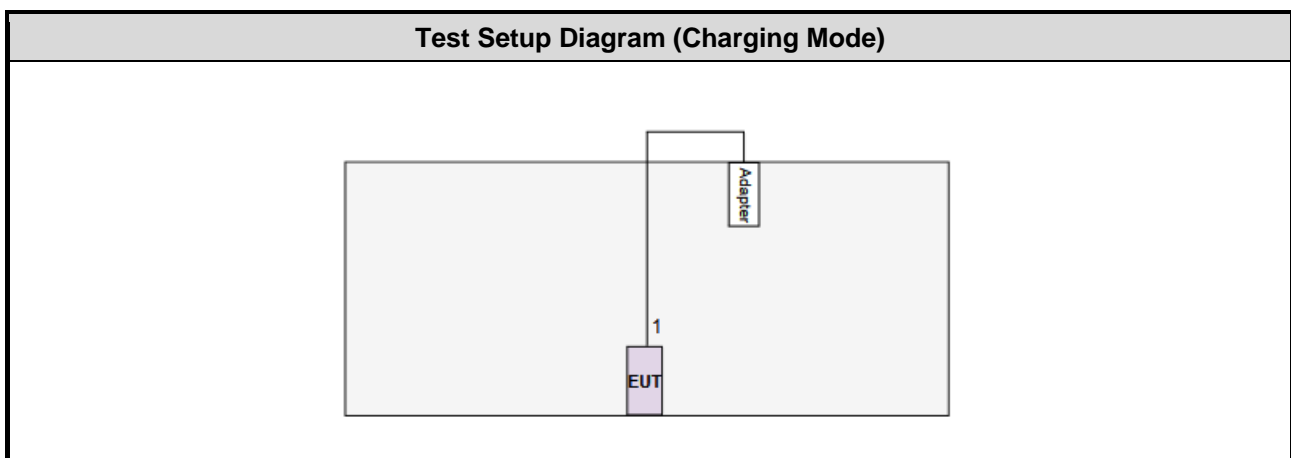
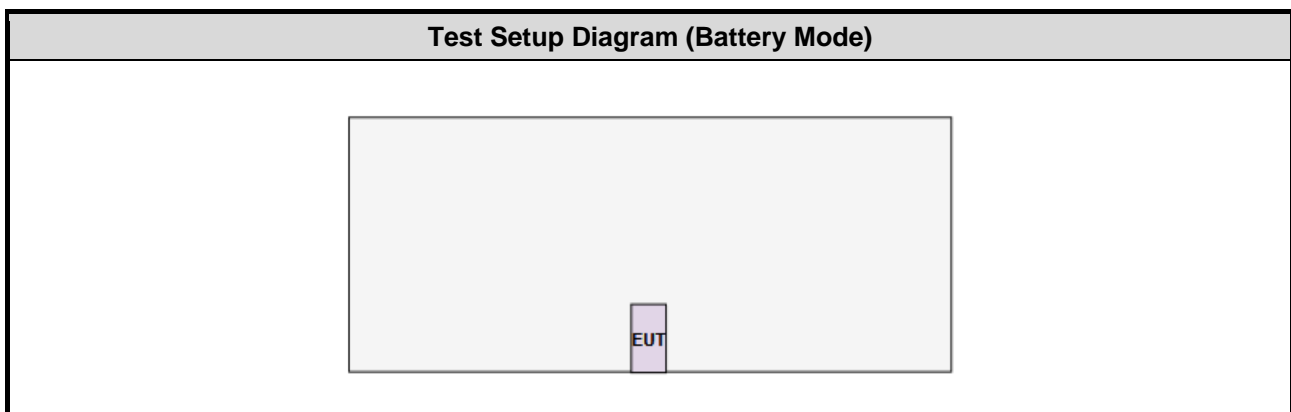
1.1.6 Test Tool and Duty Cycle

Test Tool	Hardware control, V6.03	
Duty Cycle and Duty Factor	Duty Cycle (%)	Duty Factor (dB)
	100	0

1.2 Local Support Equipment List

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

1.3 Test Setup Chart



No.	Signal cable / Length (m)
1	USB, 0.52m shielded.

1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Jun. 09, 2020				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101658	Dec. 12, 2019	Dec. 11, 2020
LISN	R&S	ENV216	101579	Mar. 12, 2020	Mar. 11, 2021
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 22, 2019	Oct. 21, 2020
Measurement Software	AUDIX	e3	6.120210k	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Tested Date	May 29 ~ Jun. 01, 2020				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101498	Dec. 17, 2019	Dec. 16, 2020
Receiver	R&S	ESR3	101657	Feb. 14, 2020	Feb. 13, 2021
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 12, 2019	Jul. 11, 2020
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 12, 2019	Dec. 11, 2020
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2019	Nov. 14, 2020
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 13, 2019	Nov. 12, 2020
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 07, 2019	Oct. 06, 2020
Preamplifier	EMC	EMC02325	980225	Jul. 09, 2019	Jul. 08, 2020
Preamplifier	Agilent	83017A	MY39501308	Oct. 08, 2019	Oct. 07, 2020
Preamplifier	EMC	EMC184045B	980192	Aug. 01, 2019	Jul. 31, 2020
RF Cable	EMC	EMC104-SM-SM-8000	181106	Oct. 07, 2019	Oct. 06, 2020
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 07, 2019	Oct. 06, 2020
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Oct. 07, 2019	Oct. 06, 2020
LF cable 1M	EMC	EMCCFD400-NM-NM-1000	160502	Oct. 07, 2019	Oct. 06, 2020
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 07, 2019	Oct. 06, 2020
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Oct. 07, 2019	Oct. 06, 2020
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 ≤ 1 GHz	± 3.41 dB
Radiated emission > 1 GHz	± 4.59 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	21°C / 56%	Alex Tsai
Radiated Emissions	03CH01-WS	24°C / 65-68%	Brad Wu Akun Chung

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

2.2 Testing Facility

Test Laboratory	International Certification Corp.
Test Site	CO01-WS, 03CH01-WS
Address of Test Site	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

2.3 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Data Rate	Test Configuration
AC Power Line Conducted Emissions	Charging	---	---	1
Field Strength of Fundamental	GFSK	2402, 2441, 2480	1 Mbps	2
Radiated Emissions ≤ 1GHz	GFSK	2402	1 Mbps	2
	Charging	---	---	1
Radiated Emissions > 1GHz	GFSK	2402, 2441, 2480	1 Mbps	2
20dB bandwidth	GFSK	2402, 2441, 2480	1 Mbps	2

NOTE:

1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **Z-plane** result was found as the worst case and was shown in this report.
2. The test configurations are listed as follows:
 Test Configuration 1: Charging mode
 Test Configuration 2: Battery mode

3 Transmitter Test Results

3.1 Conducted Emissions

3.1.1 Limit of Conducted Emissions

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

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

3.1.2 Test Procedures

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

3.1.3 Test Setup

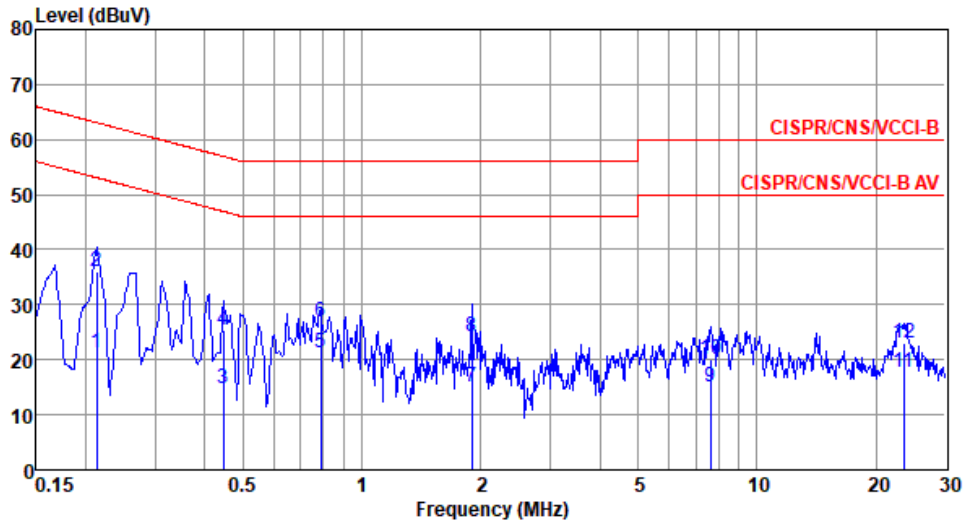


- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.1.4 Test Result of Conducted Emissions

Modulation Mode	Charging	Test Freq. (MHz)	---																																																																																																																																							
Power Phase	Line																																																																																																																																									
<table border="1"> <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>0.150</td> <td>23.76</td> <td>56.00</td> <td>-32.24</td> <td>13.91</td> <td>9.64</td> <td>0.05</td> <td>Average</td> </tr> <tr> <td>2</td> <td>0.150</td> <td>39.00</td> <td>66.00</td> <td>-27.00</td> <td>29.15</td> <td>9.64</td> <td>0.05</td> <td>QP</td> </tr> <tr> <td>3</td> <td>0.267</td> <td>20.03</td> <td>51.20</td> <td>-31.17</td> <td>10.12</td> <td>9.63</td> <td>0.07</td> <td>Average</td> </tr> <tr> <td>4</td> <td>0.267</td> <td>34.03</td> <td>61.20</td> <td>-27.17</td> <td>24.12</td> <td>9.63</td> <td>0.07</td> <td>QP</td> </tr> <tr> <td>5*</td> <td>0.763</td> <td>25.51</td> <td>46.00</td> <td>-20.49</td> <td>15.47</td> <td>9.63</td> <td>0.11</td> <td>Average</td> </tr> <tr> <td>6</td> <td>0.763</td> <td>32.57</td> <td>56.00</td> <td>-23.43</td> <td>22.53</td> <td>9.63</td> <td>0.11</td> <td>QP</td> </tr> <tr> <td>7</td> <td>1.053</td> <td>21.75</td> <td>46.00</td> <td>-24.25</td> <td>11.68</td> <td>9.63</td> <td>0.12</td> <td>Average</td> </tr> <tr> <td>8</td> <td>1.053</td> <td>33.20</td> <td>56.00</td> <td>-22.80</td> <td>23.13</td> <td>9.63</td> <td>0.12</td> <td>QP</td> </tr> <tr> <td>9</td> <td>1.898</td> <td>16.40</td> <td>46.00</td> <td>-29.60</td> <td>6.24</td> <td>9.64</td> <td>0.18</td> <td>Average</td> </tr> <tr> <td>10</td> <td>1.898</td> <td>25.94</td> <td>56.00</td> <td>-30.06</td> <td>15.78</td> <td>9.64</td> <td>0.18</td> <td>QP</td> </tr> <tr> <td>11</td> <td>23.018</td> <td>20.44</td> <td>50.00</td> <td>-29.56</td> <td>9.39</td> <td>9.69</td> <td>0.69</td> <td>Average</td> </tr> <tr> <td>12</td> <td>23.018</td> <td>25.16</td> <td>60.00</td> <td>-34.84</td> <td>14.11</td> <td>9.69</td> <td>0.69</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	0.150	23.76	56.00	-32.24	13.91	9.64	0.05	Average	2	0.150	39.00	66.00	-27.00	29.15	9.64	0.05	QP	3	0.267	20.03	51.20	-31.17	10.12	9.63	0.07	Average	4	0.267	34.03	61.20	-27.17	24.12	9.63	0.07	QP	5*	0.763	25.51	46.00	-20.49	15.47	9.63	0.11	Average	6	0.763	32.57	56.00	-23.43	22.53	9.63	0.11	QP	7	1.053	21.75	46.00	-24.25	11.68	9.63	0.12	Average	8	1.053	33.20	56.00	-22.80	23.13	9.63	0.12	QP	9	1.898	16.40	46.00	-29.60	6.24	9.64	0.18	Average	10	1.898	25.94	56.00	-30.06	15.78	9.64	0.18	QP	11	23.018	20.44	50.00	-29.56	9.39	9.69	0.69	Average	12	23.018	25.16	60.00	-34.84	14.11	9.69	0.69	QP
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<p>Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB). Note 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).</p>																																																																																																																																										

Modulation Mode	Charging	Test Freq. (MHz)	---
Power Phase	Neutral		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.213	21.30	53.10	-31.80	11.44	9.65	0.06	Average
2	0.213	35.94	63.10	-27.16	26.08	9.65	0.06	QP
3	0.447	14.89	46.93	-32.04	4.99	9.65	0.08	Average
4	0.447	25.49	56.93	-31.44	15.59	9.65	0.08	QP
5*	0.788	21.18	46.00	-24.82	11.23	9.65	0.11	Average
6	0.788	26.73	56.00	-29.27	16.78	9.65	0.11	QP
7	1.898	14.98	46.00	-31.02	4.88	9.66	0.18	Average
8	1.898	24.14	56.00	-31.86	14.04	9.66	0.18	QP
9	7.646	14.96	50.00	-35.04	4.58	9.71	0.36	Average
10	7.646	19.97	60.00	-40.03	9.59	9.71	0.36	QP
11	23.511	17.60	50.00	-32.40	6.46	9.81	0.70	Average
12	23.511	22.99	60.00	-37.01	11.85	9.81	0.70	QP

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

3.2 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:

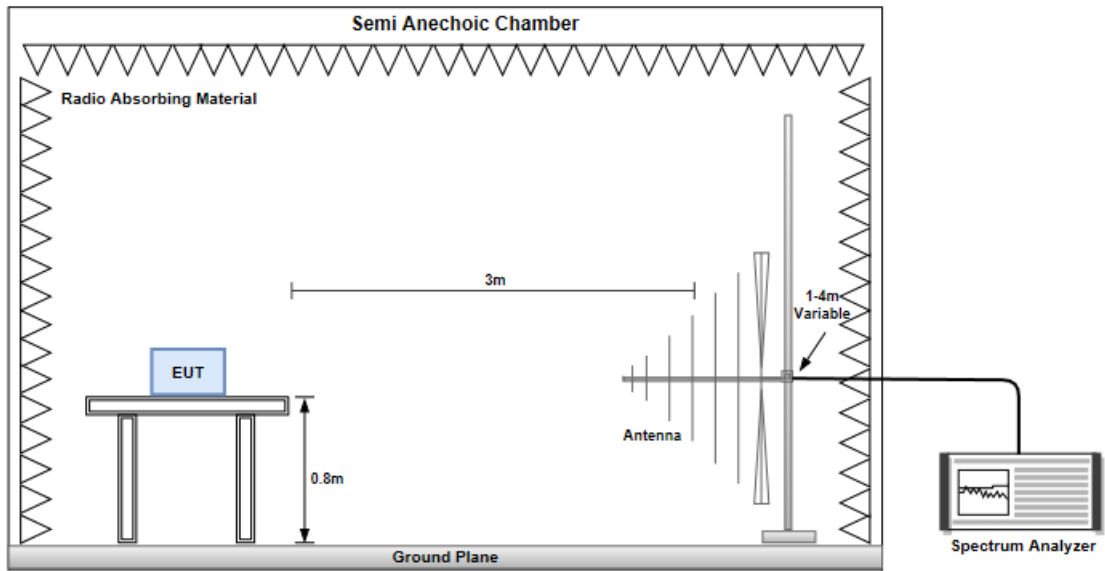
$$20\log(\text{Duty cycle}) = 20\log \frac{0.31884 \times 1\text{ms}}{100 \text{ms}} = -49.93\text{dB}$$

Please see page 27 for plotted duty

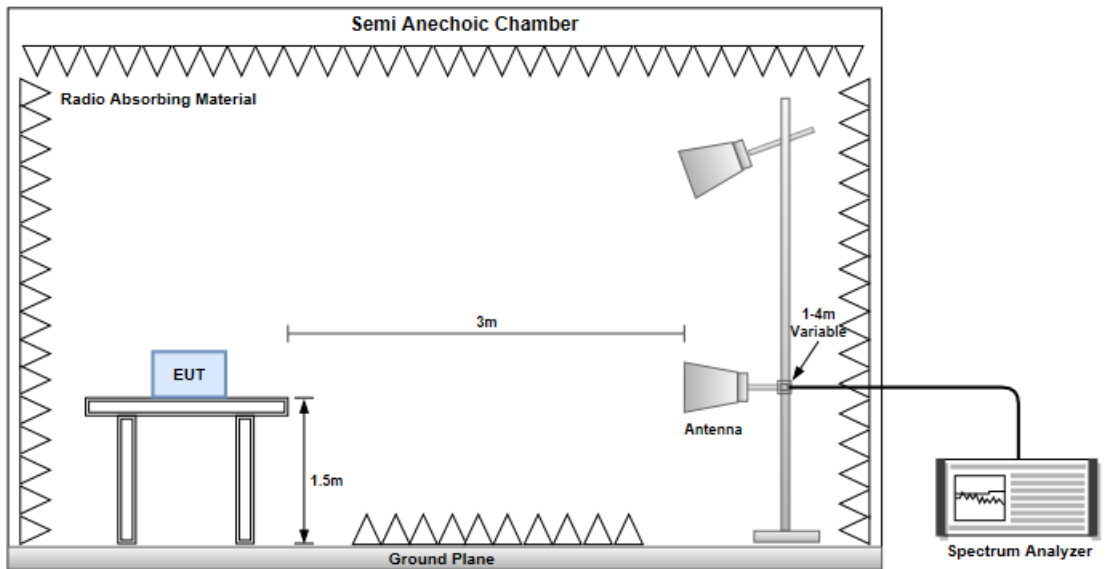
4. Radiated emission above 1GHz / Average value for other emissions
RBW=1MHz, VBW=10Hz and Peak detector
5. Radiated emission Peak value for fundamental
RBW=1MHz, VBW=3MHz and Peak detector

3.2.4 Test Setup

Radiated Emissions below 1 GHz

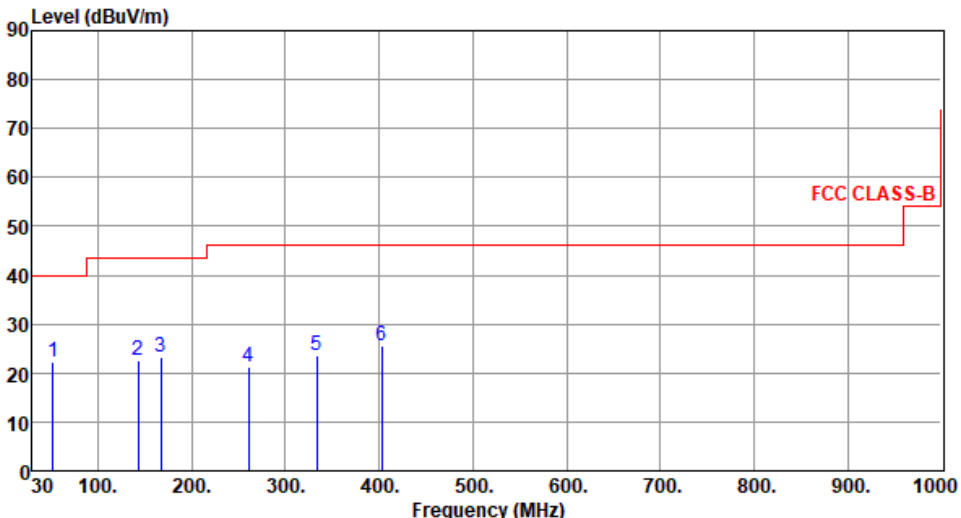


Radiated Emissions above 1 GHz

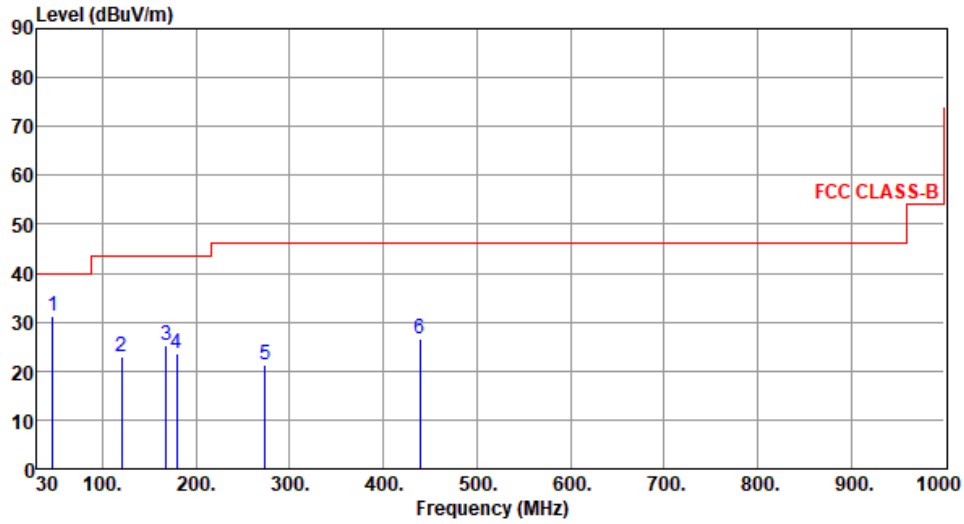


Test Configuration 1: Charging mode

3.2.5 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation Mode	Charging	Test Freq. (MHz)	---						
Polarization	Horizontal								
									
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High cm	Turn Table deg
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB			
1	52.31	22.12	40.00	-17.88	30.58	-8.46	Peak	---	---
2	142.52	22.48	43.50	-21.02	31.18	-8.70	Peak	---	---
3	166.77	23.20	43.50	-20.30	31.90	-8.70	Peak	---	---
4	260.86	21.20	46.00	-24.80	30.77	-9.57	Peak	---	---
5	333.61	23.71	46.00	-22.29	30.85	-7.14	Peak	---	---
6	402.48	25.42	46.00	-20.58	30.92	-5.50	Peak	---	---
<p>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.</p>									

Modulation Mode	Charging	Test Freq. (MHz)	---
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	46.49	31.27	40.00	-8.73	39.63	-8.36	Peak	---	---
2	120.21	22.93	43.50	-20.57	33.52	-10.59	Peak	---	---
3	167.74	25.18	43.50	-18.32	33.88	-8.70	Peak	---	---
4	179.38	23.47	43.50	-20.03	33.28	-9.81	Peak	---	---
5	273.47	21.27	46.00	-24.73	30.14	-8.87	Peak	---	---
6	439.34	26.56	46.00	-19.44	30.90	-4.34	Peak	---	---

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

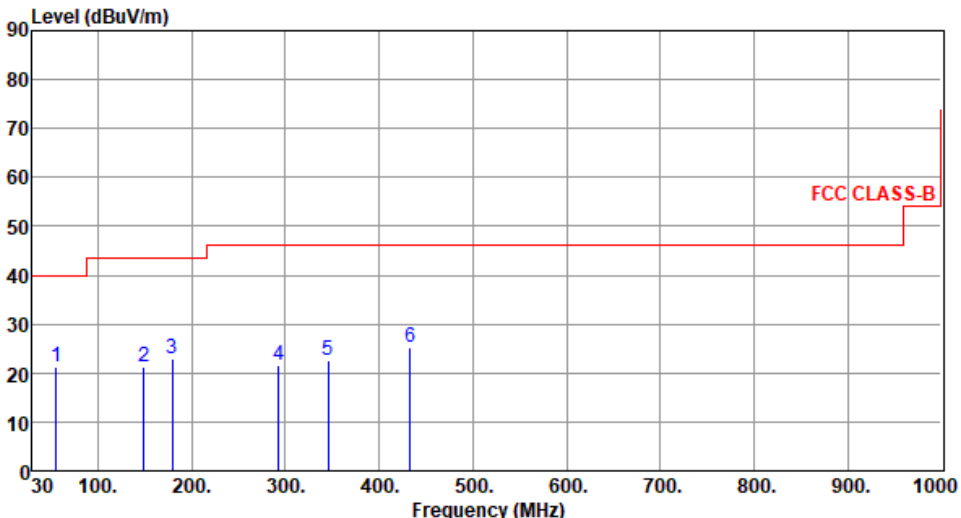
*Factor includes antenna factor , cable loss and amplifier gain

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.

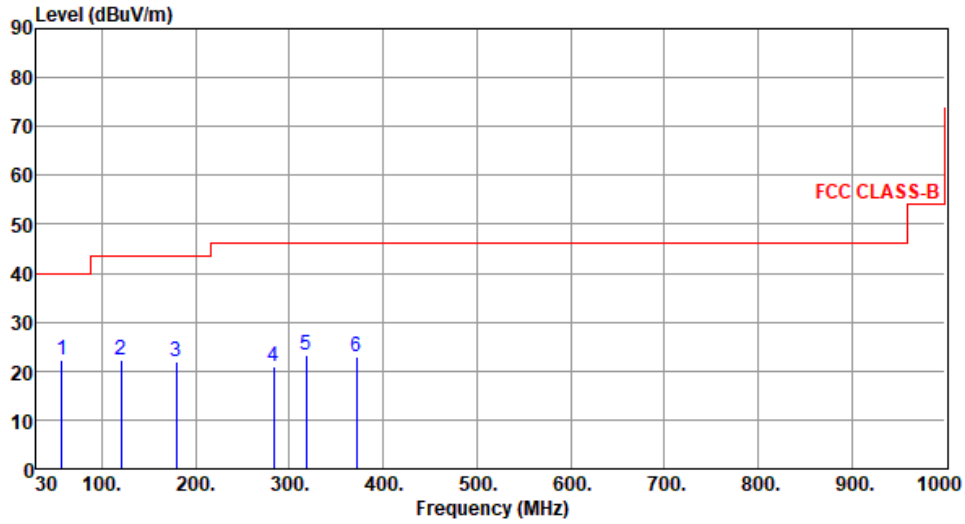
Test Configuration 2: Battery mode

3.2.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2402						
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	55.22	21.19	40.00	-18.81	29.86	-8.67	Peak	---	---
2	149.31	21.18	43.50	-22.32	29.65	-8.47	Peak	---	---
3	179.38	22.91	43.50	-20.59	32.72	-9.81	Peak	---	---
4	292.87	21.57	46.00	-24.43	29.83	-8.26	Peak	---	---
5	345.25	22.65	46.00	-23.35	29.73	-7.08	Peak	---	---
6	433.52	25.23	46.00	-20.77	29.74	-4.51	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	GFSK	Test Freq. (MHz)	2402
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	57.16	22.18	40.00	-17.82	30.91	-8.73	Peak	---	---
2	120.21	22.18	43.50	-21.32	32.77	-10.59	Peak	---	---
3	179.38	21.81	43.50	-21.69	31.62	-9.81	Peak	---	---
4	283.17	20.78	46.00	-25.22	29.30	-8.52	Peak	---	---
5	318.09	23.11	46.00	-22.89	30.56	-7.45	Peak	---	---
6	371.44	23.06	46.00	-22.94	29.21	-6.15	Peak	---	---

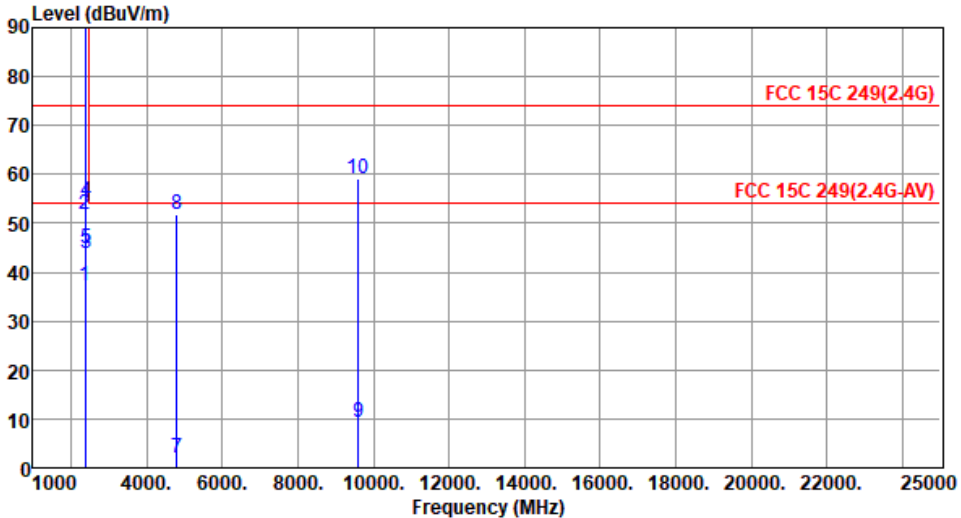
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

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

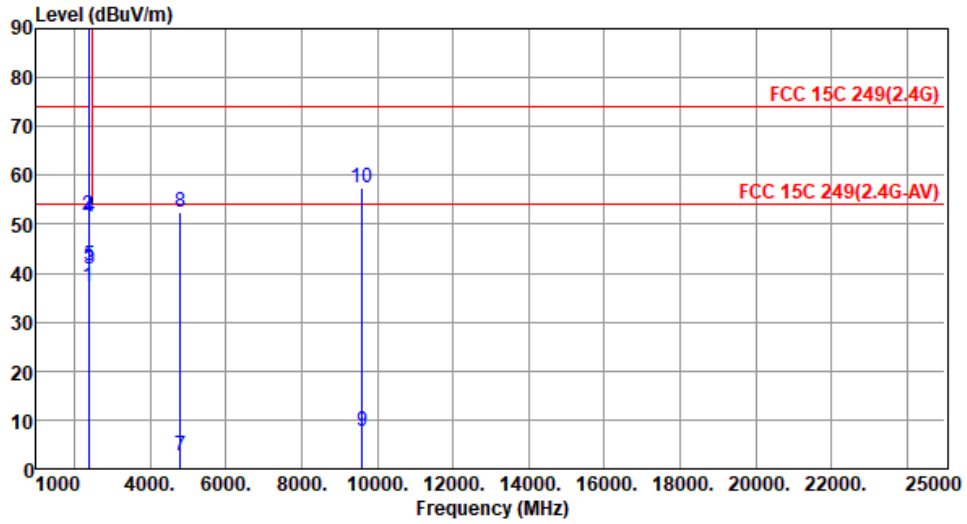
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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

Modulation	GFSK	Test Freq. (MHz)	2402						
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	2390.00	37.23	54.00	-16.77	40.03	-2.80	Average	189	185
2	2390.00	51.84	74.00	-22.16	54.64	-2.80	Peak	189	185
3	2400.00	43.78	54.00	-10.22	46.62	-2.84	Average	189	185
4	2400.00	54.31	74.00	-19.69	57.15	-2.84	Peak	189	185
5	2402.00	44.80	94.00	-49.20	47.65	-2.85	Average	189	185
6	2402.00	94.73	114.00	-19.27	97.58	-2.85	Peak	189	185
7	4804.00	1.98	54.00	-52.02	-1.55	3.53	Average	142	143
8	4804.00	51.91	74.00	-22.09	48.38	3.53	Peak	142	143
9	9608.00	9.30	54.00	-44.70	-4.07	13.37	Average	144	118
10	9608.00	59.23	74.00	-14.77	45.86	13.37	Peak	144	118

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

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Vertical		



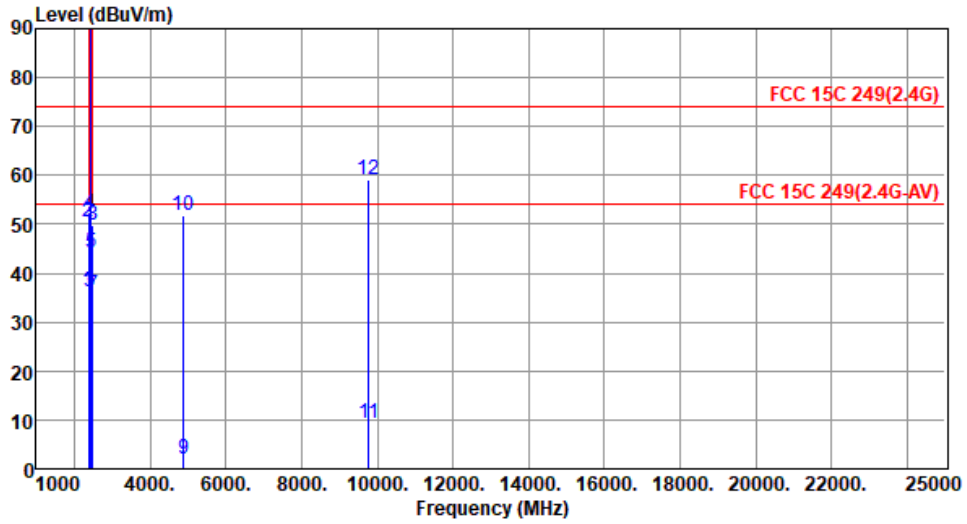
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	37.21	54.00	-16.79	40.01	-2.80	Average	209	185
2	2390.00	51.75	74.00	-22.25	54.55	-2.80	Peak	209	185
3	2400.00	40.85	54.00	-13.15	43.69	-2.84	Average	209	185
4	2400.00	51.46	74.00	-22.54	54.30	-2.84	Peak	209	185
5	2402.00	41.65	94.00	-52.35	44.50	-2.85	Average	209	185
6	2402.00	91.58	114.00	-22.42	94.43	-2.85	Peak	209	185
7	4804.00	2.60	54.00	-51.40	-0.93	3.53	Average	101	116
8	4804.00	52.53	74.00	-21.47	49.00	3.53	Peak	101	116
9	9608.00	7.56	54.00	-46.44	-5.81	13.37	Average	136	168
10	9608.00	57.49	74.00	-16.51	44.12	13.37	Peak	136	168

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

*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	GFSK	Test Freq. (MHz)	2440
Polarization	Horizontal		



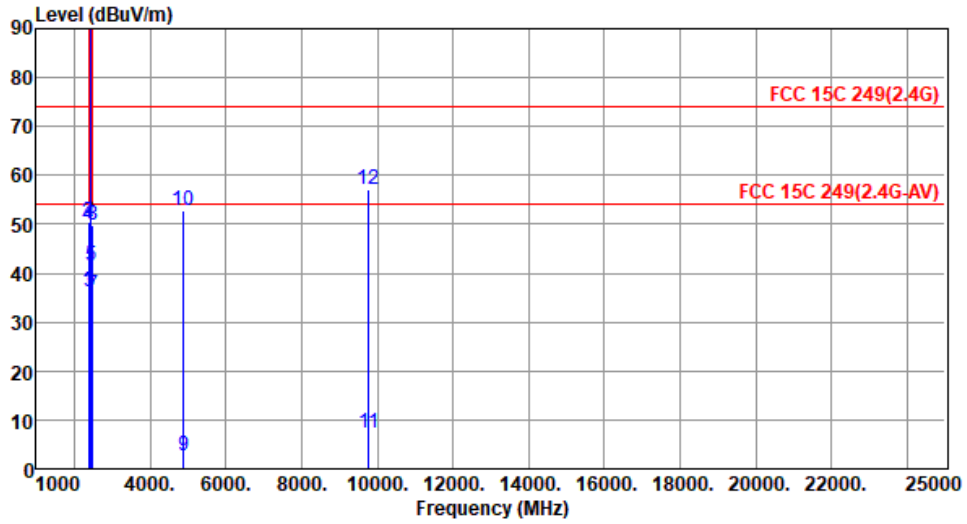
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	36.13	54.00	-17.87	38.93	-2.80	Average	183	180
2	2390.00	50.44	74.00	-23.56	53.24	-2.80	Peak	183	180
3	2400.00	36.18	54.00	-17.82	39.02	-2.84	Average	183	180
4	2400.00	52.15	74.00	-21.85	54.99	-2.84	Peak	183	180
5	2441.00	44.28	94.00	-49.72	47.32	-3.04	Average	183	180
6	2441.00	94.21	114.00	-19.79	97.25	-3.04	Peak	183	180
7	2483.50	35.60	54.00	-18.40	38.63	-3.03	Average	183	180
8	2483.50	49.95	74.00	-24.05	52.98	-3.03	Peak	183	180
9	4882.00	1.90	54.00	-52.10	-1.73	3.63	Average	145	144
10	4882.00	51.83	74.00	-22.17	48.20	3.63	Peak	145	144
11	9764.00	9.25	54.00	-44.75	-4.49	13.74	Average	141	116
12	9764.00	59.18	74.00	-14.82	45.44	13.74	Peak	141	116

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

*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	GFSK	Test Freq. (MHz)	2440
Polarization	Vertical		



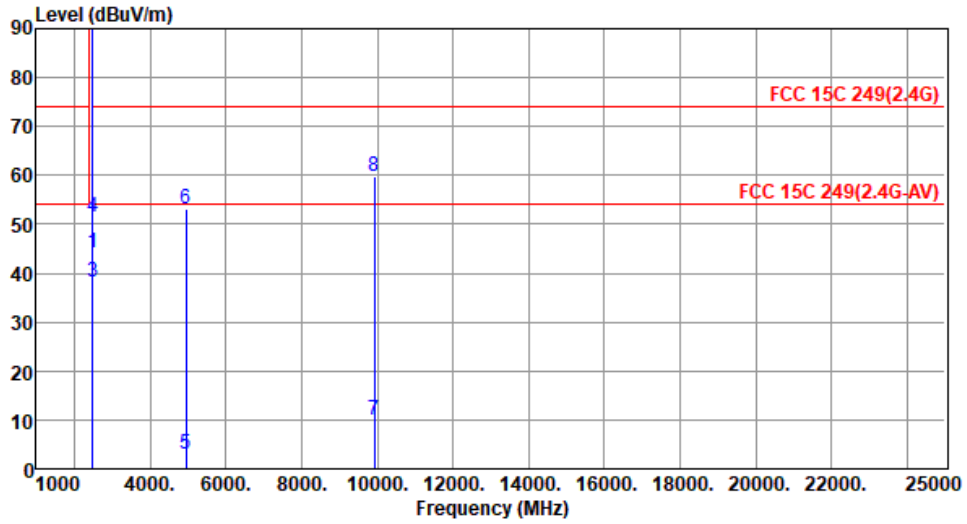
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	36.08	54.00	-17.92	38.88	-2.80	Average	206	184
2	2390.00	50.35	74.00	-23.65	53.15	-2.80	Peak	206	184
3	2400.00	36.10	54.00	-17.90	38.94	-2.84	Average	206	184
4	2400.00	50.46	74.00	-23.54	53.30	-2.84	Peak	206	184
5	2441.00	41.45	94.00	-52.55	44.49	-3.04	Average	206	184
6	2441.00	91.38	114.00	-22.62	94.42	-3.04	Peak	206	184
7	2483.50	35.55	54.00	-18.45	38.58	-3.03	Average	206	184
8	2483.50	49.87	74.00	-24.13	52.90	-3.03	Peak	206	184
9	4882.00	2.72	54.00	-51.28	-0.91	3.63	Average	105	113
10	4882.00	52.65	74.00	-21.35	49.02	3.63	Peak	105	113
11	9764.00	7.35	54.00	-46.65	-6.39	13.74	Average	133	169
12	9764.00	57.28	74.00	-16.72	43.54	13.74	Peak	133	169

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

*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Horizontal		



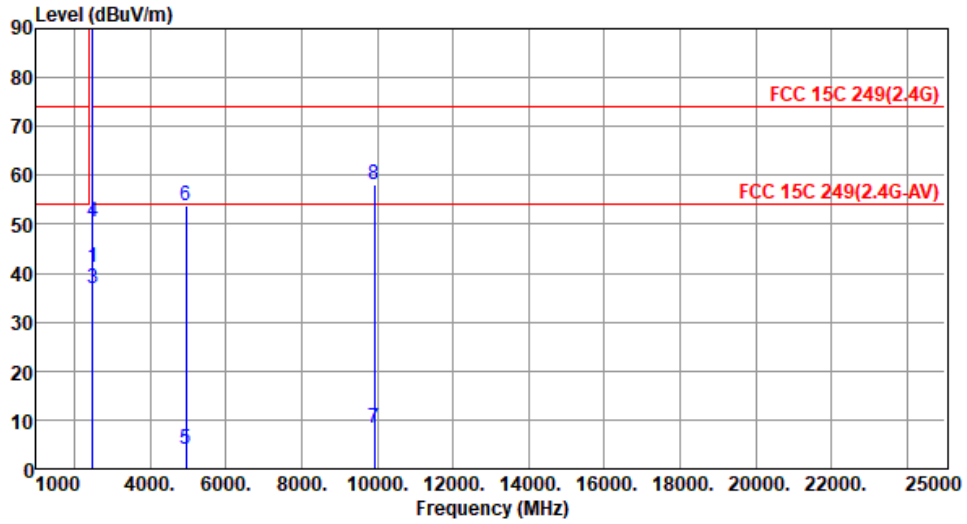
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2480.00	44.10	94.00	-49.90	47.13	-3.03	Average	165	208
2	2480.00	94.03	114.00	-19.97	97.06	-3.03	Peak	165	208
3	2483.50	38.33	54.00	-15.67	41.36	-3.03	Average	165	208
4	2483.50	51.63	74.00	-22.37	54.66	-3.03	Peak	165	208
5	4960.00	3.08	54.00	-50.92	-0.75	3.83	Average	165	144
6	4960.00	53.01	74.00	-20.99	49.18	3.83	Peak	165	144
7	9920.00	9.82	54.00	-44.18	-4.09	13.91	Average	114	116
8	9920.00	59.75	74.00	-14.25	45.84	13.91	Peak	114	116

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

*Factor includes antenna factor , cable loss and amplifier gain

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

Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Vertical		

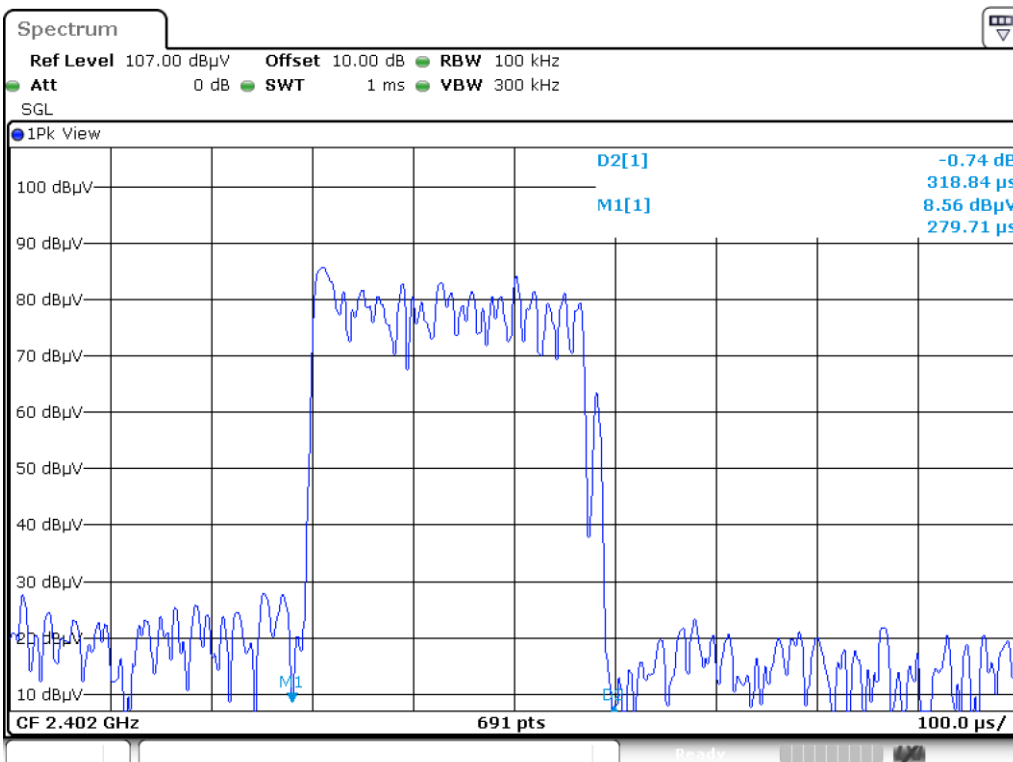
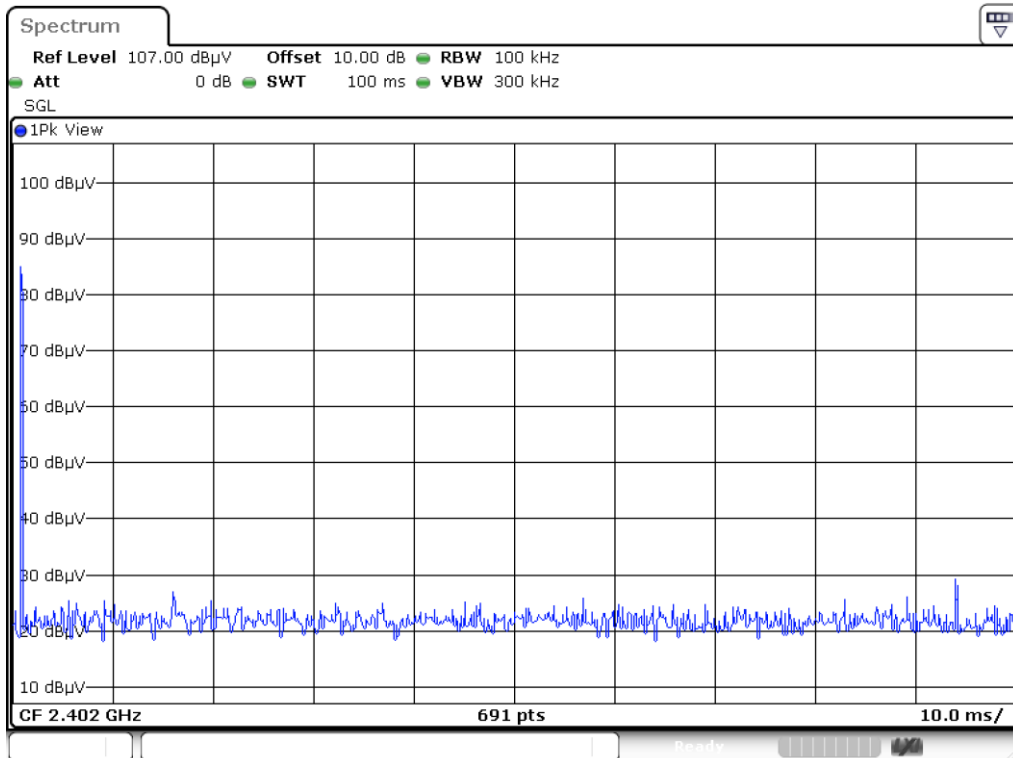


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2480.00	41.12	94.00	-52.88	44.15	-3.03	Average	212	188
2	2480.00	91.05	114.00	-22.95	94.08	-3.03	Peak	212	188
3	2483.50	36.86	54.00	-17.14	39.89	-3.03	Average	212	188
4	2483.50	50.56	74.00	-23.44	53.59	-3.03	Peak	212	188
5	4960.00	3.98	54.00	-50.02	0.15	3.83	Average	117	102
6	4960.00	53.91	74.00	-20.09	50.08	3.83	Peak	117	102
7	9920.00	8.22	54.00	-45.78	-5.69	13.91	Average	150	174
8	9920.00	58.15	74.00	-15.85	44.24	13.91	Peak	150	174

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).



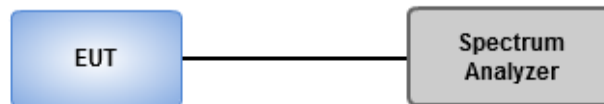
$$20\log(\text{Duty cycle}) = 20\log \frac{0.31884 \times 1 \text{ ms}}{100 \text{ ms}} = -49.93\text{dB}$$

3.3 20dB and Occupied Bandwidth

3.3.1 Test Procedures

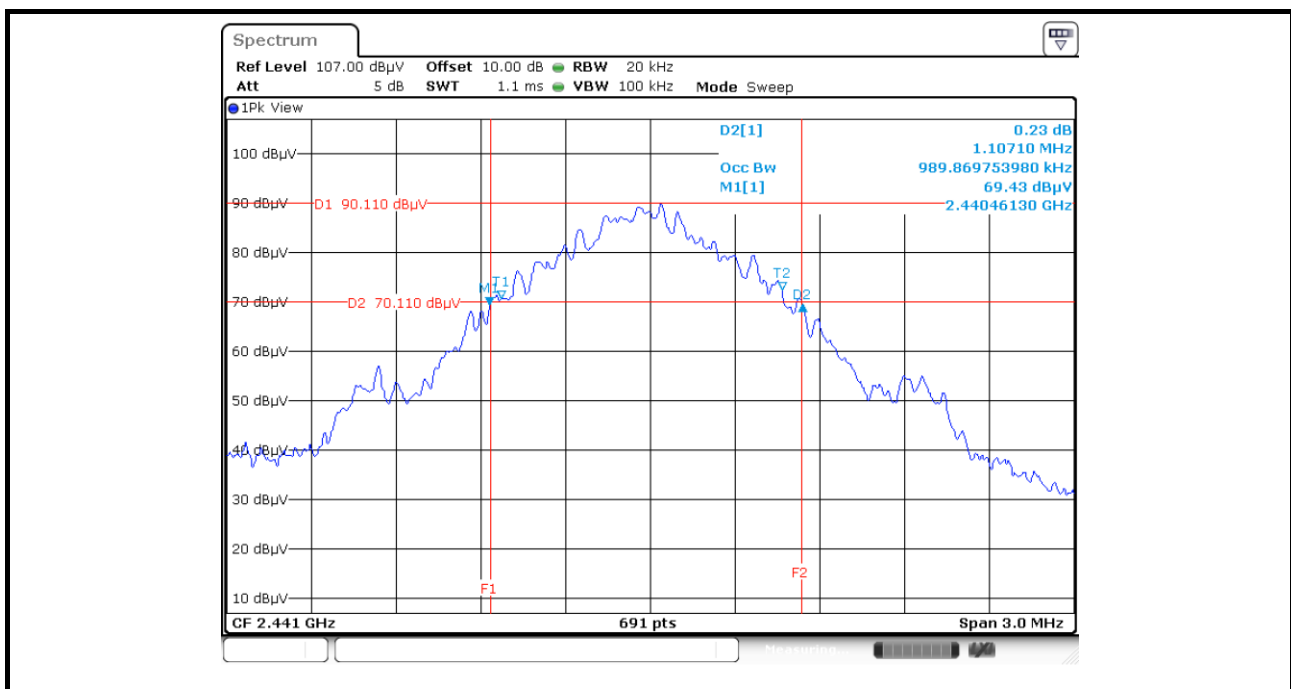
1. Set resolution bandwidth (RBW) = 20 kHz, Video bandwidth = 100 kHz.
2. Detector = Peak(20 dB bandwidth) / Sample(Occupied bandwidth), Trace mode = max hold
3. Sweep = auto couple, Allow the trace to stabilize.
4. Measure the maximum width of the emission that is constrained by the frequencies associated 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

Freq. (MHz)	20dB Bandwidth (MHz)	Occupied Bandwidth (MHz)
2402	1.016	0.933
2441	1.107	0.990
2480	0.960	0.925



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>.

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Kwei Shan Site II

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St., Kwei Shan District, Tao Yuan
City 333, Taiwan, R.O.C.

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

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Email: ICC_Service@icertifi.com.tw

==END==