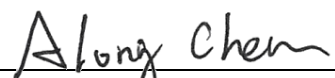


NCC Test Report

Equipment : Sleep
Model No. : WSM02
Brand Name : Withings
Applicant : Withings SA
Address : 2 rue Maurice Hartmann
92130 Issy-Les-Moulineaux
France
Standard : LP0002 Section 3.10.1 (2018-01-10)
Received Date : Oct. 24, 2017
Tested Date : Dec. 22 ~ Dec. 25, 2017
Dec. 27 ~ Dec. 30, 2019

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

Reviewed by:


Along Chen / Assistant Manager

Approved by:

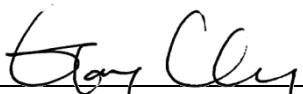

Gary Chang / Manager



Table of Contents

1	GENERAL DESCRIPTION	5
1.1	Information.....	5
1.2	Local Support Equipment List	8
1.3	Test Setup Chart	8
1.4	The Equipment List	9
1.5	Test Standards	11
1.6	Deviation from Test Standard and Measurement Procedure.....	11
1.7	Measurement Uncertainty	11
2	TEST CONFIGURATION	12
2.1	Testing Condition	12
2.2	The Worst Test Modes and Channel Details	13
3	TRANSMITTER TEST RESULTS.....	14
3.1	Conducted Emissions.....	14
3.2	Unwanted Emissions into Restricted Frequency Bands	19
3.3	Unwanted Emissions into Non-Restricted Frequency Bands	37
3.4	Conducted Output Power	42
3.5	Number of Hopping Frequency	44
3.6	20dB and Occupied Bandwidth	46
3.7	Channel Separation.....	48
3.8	Number of Dwell Time	50
4	RECEIVER TEST RESULTS	53
4.1	Conducted Emissions.....	53
4.2	Unwanted Emissions into Restricted Frequency Bands	58
5	TEST LABORATORY INFORMATION	66

Release Record

Report No.	Version	Description	Issued Date
TR792802-04AD	Rev. 01	Initial issue	Jun. 02, 2020

Summary of Test Results

NCC Rules	Test Items	Measured	Result
2.3	Conducted Emissions	[dBuV]: 0.476MHz 31.90 (Margin -14.51dB) - AV	Pass
3.10.1.5 2.8	Radiated Emissions	[dBuV/m at 3m]: 953.00MHz 37.33 (Margin -8.67dB) - PK	Pass
3.10.1.5	Band Edge	Meet the requirement of limit	Pass
3.10.1.2(1)(B)	Conducted Output Power	Power [dBm]: -3.07	Pass
3.10.1.6(1)(A)	Number of Hopping Channels	Meet the requirement of limit	Pass
3.10.1.6(1)(A)	Hopping Channel Separation	Meet the requirement of limit	Pass
3.10.1.6(1)(A)	Dwell Time	Meet the requirement of limit	Pass
3.10.1.4	Antenna Requirement	Meet the requirement of limit	Pass

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1 General Description

1.1 Information

Test results can be referred to ICC report no. FR792802AD & FR792802-03AD.

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information				
Frequency Range (MHz)	Bluetooth Mode	Ch. Frequency (MHz)	Channel Number	Data Rate
2400-2483.5	BR	2402-2480	0-78 [79]	1 Mbps
2400-2483.5	EDR	2402-2480	0-78 [79]	2 Mbps
2400-2483.5	EDR	2402-2480	0-78 [79]	3 Mbps
Note 1: RF output power specifies that Maximum Peak Conducted Output Power. Note 2: Bluetooth BR uses a GFSK. Note 3: Bluetooth EDR uses a combination of $\pi/4$ -DQPSK and 8DPSK.				

1.1.2 Antenna Details

Ant. No.	Brand	Model	Type	Connector	Gain (dBi)	Remarks
1	Broadcom	BCM9Fractal	PCB	N/A	2.8	---

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	5Vdc from AC adapter
-------------------	----------------------

1.1.4 Accessories

Accessories		
No.	Equipment	Description
1	AC adapter	Brand: ABP Model: SWA06B-050-1000U Power Rating: I/P: 100-240Vac, 50/60Hz, 0.3A O/P: 5Vdc, 1000mA
2	AC adapter	Brand: LONG.X.C Model: LXCP12X-050100DG Power Rating: I/P: 100-240Vac, 50/60Hz, 0.5A Max O/P: 5Vdc, 1.0A

1.1.5 Test Sample Information

MAC ID	1. 00:24:e4:6b:2d:c8 2. 00:24:e4:6b:31:56
--------	--

1.1.6 Channel List

Frequency band (MHz)				2400~2483.5			
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461	---	---

1.1.7 Test Tool and Duty Cycle

Test Tool	Tera Term, Version: 4.94
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1.1.8 Power Index of Test Tool

Modulation Mode	Test Frequency (MHz)		
	2402	2441	2480
GFSK/1Mbps	0x00	0x00	0x00
$\pi/4$ -DQPSK /2Mbps	0x00	0x00	0x00
8DPSK/3Mbps	0x00	0x00	0x00

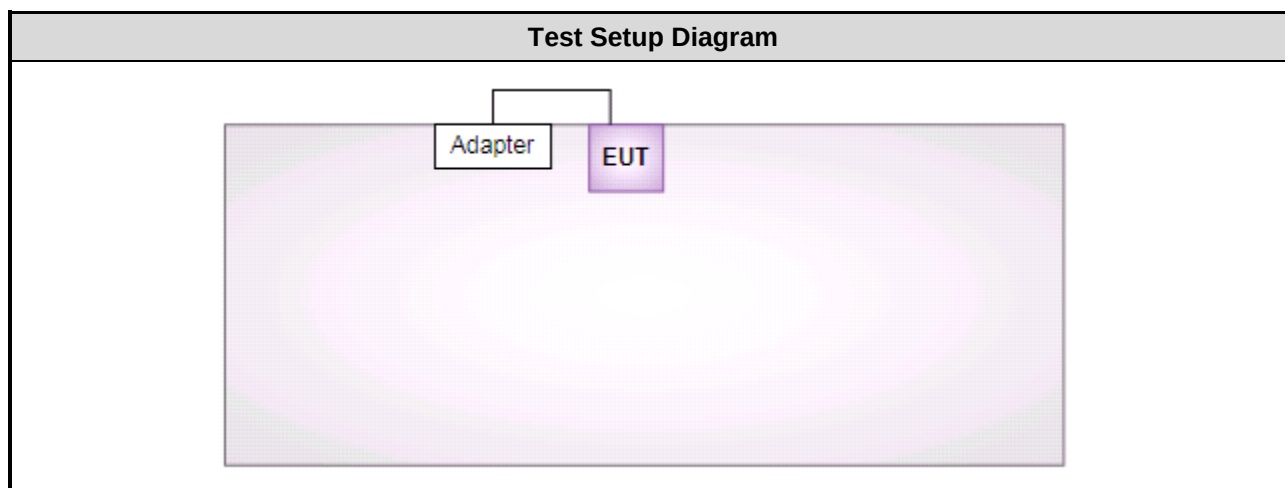
1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Notebook	DELL	Latitude E6440	DoC	實驗室提供(見備註 1)
2	USB 治具板	FTDI	FT232	---	申請者提供(見備註 2)

備註 1: 本案經申請者切結器材不提供隨貨配件，配件由實驗室提供併同檢驗。

備註 2: 本案經申請者切結器材不提供隨貨配件，配件由申請者提供併同檢驗。

1.3 Test Setup Chart



Note: The support notebook is disconnected from EUT and removed from test table after sending command to EUT by USB console cable to control EUT to transmit continuously.

1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Nov. 01, 2017				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Dec. 21, 2016	Dec. 20, 2017
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 08, 2016	Nov. 07, 2017
RF Cable-CON	EMC	EMCCFD300-BM-BM-6000	50821	Dec. 20, 2016	Dec. 19, 2017
Measurement Software	AUDIX	e3	6.120210k	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Dec. 30, 2019				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Jan. 08, 2019	Jan. 07, 2020
LISN	R&S	ENV216	101579	Mar. 08, 2019	Mar. 07, 2020
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 below 1GHz				
Test Site	966 chamber 1 / (03CH01-WS)				
Tested Date	Dec. 27, 2019				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101658	Dec. 12, 2019	Dec. 11, 2020
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 13, 2019	Nov. 12, 2020
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 12, 2019	Jul. 11, 2020
Preamplifier	EMC	EMC02325	980225	Jul. 09, 2019	Jul. 08, 2020
LF cable 1M	EMC	EMCCFD400-NM-N M-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.					

Test Item	Radiated Emission				
Test Site	966 chamber 3 / (03CH03-WS)				
Tested Date	Oct. 24 ~ Oct. 25, 2017				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101486	Nov. 15, 2016	Nov. 14, 2017
Receiver	Agilent	N9038A	MY53290044	Sep. 26, 2017	Sep. 25, 2018
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	Apr. 28, 2017	Apr. 27, 2018
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Feb. 09, 2017	Feb. 08, 2018
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170508	Dec. 29, 2016	Dec. 28, 2017
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 10, 2016	Nov. 09, 2017
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 09, 2016	Dec. 08, 2017
Preamplifier	EMC	EMC02325	980187	Sep. 04, 2017	Sep. 03, 2018
Preamplifier	Agilent	83017A	MY53270014	Aug. 21, 2017	Aug. 20, 2018
Preamplifier	EMC	EMC184045B	980192	Aug. 22, 2017	Aug. 21, 2018
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Feb. 04, 2017	Feb. 03, 2018
RF cable-8M	HUBER+SUHNER	SUCOFLEX104	MY22600/4	Feb. 04, 2017	Feb. 03, 2018
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Feb. 04, 2017	Feb. 03, 2018
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Feb. 04, 2017	Feb. 03, 2018
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Feb. 04, 2017	Feb. 03, 2018
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Feb. 04, 2017	Feb. 03, 2018
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	Dec. 22, 2017				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101063	Mar. 15, 2017	Mar. 14, 2018
Power Meter	Anritsu	ML2495A	1241002	Oct. 16, 2017	Oct. 15, 2018
Power Sensor	Anritsu	MA2411B	1207366	Oct. 16, 2017	Oct. 15, 2018
AC POWER SOURCE	G.W .	APS-9102	EL920581	Jun. 03, 2017	Jun. 02, 2018
Measurement Software	Sporton	Sporton_1	1.3.30	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

1.5 Test Standards

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

LP0002 Section 3.10.1 (2018-01-10)

ANSI C63.10-2013

1.6 Deviation from Test Standard and Measurement Procedure

None

1.7 Measurement Uncertainty

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

Measurement Uncertainty	
Parameters	Uncertainty
Bandwidth	± 34.134 Hz
Conducted power	± 0.808 dB
Power density	± 0.463 dB
Conducted emission	± 2.670 dB
AC conducted emission	± 2.92 dB
Radiated emission ≤ 1 GHz	± 3.41 dB
Radiated emission > 1 GHz	± 4.51 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
AC Conduction	CO01-WS	23°C / 59%	Akun Chung
Radiated Emissions below 1GHz	03CH01-WS	22°C / 68%	Akun Chung
Radiated Emissions above 1GHz	03CH03-WS	23-24°C / 64-66%	Aska Huang
RF Conducted	TH01-WS	21°C / 64%	Aska Huang

- FCC Designation No.: 03CH01-WS: TW2732
03CH03-WS: TW0009
- FCC site registration No.: 03CH01-WS: 181692
03CH03-WS: 207696
- ISED#: 10807A
- CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Data Rate (Mbps)	Mode	Test Configuration
Conducted Emissions	GFSK	2402	1Mbps	Tx	1, 2
Radiated Emissions $\leq$ 1GHz	GFSK	2402	1Mbps	Tx	1, 2
Radiated Emissions > 1GHz	GFSK 8DPSK	2402, 2441, 2480 2402, 2441, 2480	1Mbps 3Mbps	Tx	1
Conducted Output Power	GFSK π/4 QDPSK 8DPSK	2402, 2441, 2480 2402, 2441, 2480 2402, 2441, 2480	1Mbps 2Mbps 3Mbps	Tx	1
Number of Hopping Channels	GFSK 8DPSK	2402~2480 2402~2480	1Mbps 3Mbps	Tx	1
Hopping Channel Separation 20dB and Occupied bandwidth	GFSK 8DPSK	2402, 2441, 2480 2402, 2441, 2480	1Mbps 3Mbps	Tx	1
Dwell Time	GFSK 8DPSK	2402 2402	1Mbps 3Mbps	Tx	1
Conducted Emissions	GFSK	2402	1Mbps	Rx	1, 2
Radiated Emissions $\leq$ 1GHz	GFSK	2402	1Mbps	Rx	1, 2
Radiated Emissions > 1GHz	GFSK	2402	1Mbps	Rx	1
NOTE: 1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The Y-plane results were found as the worst case and were shown in this report. 2. Test Configurations are listed as follows: 1) Test Configuration 1: Adapter ABP 2) Test Configuration 2: Adapter LONG.X.C					

3 Transmitter Test Results

3.1 Conducted Emissions

3.1.1 Limit of Conducted Emissions

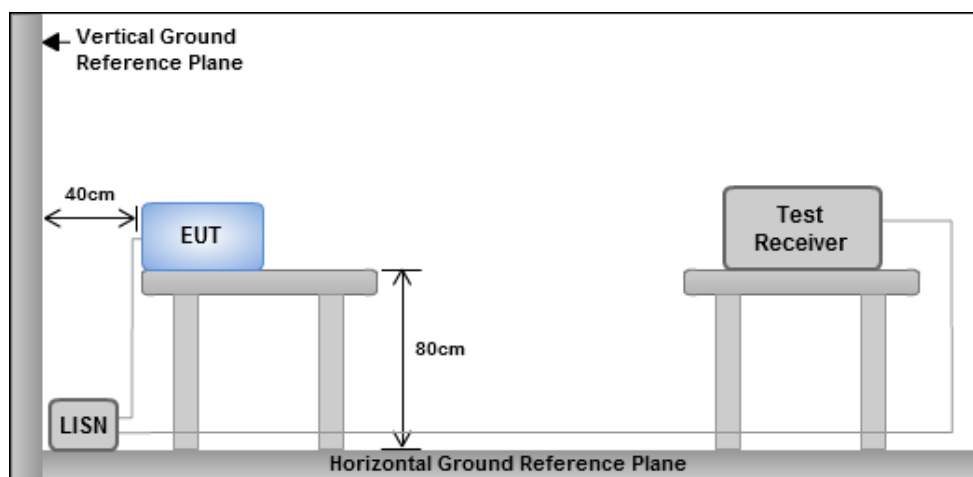
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

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

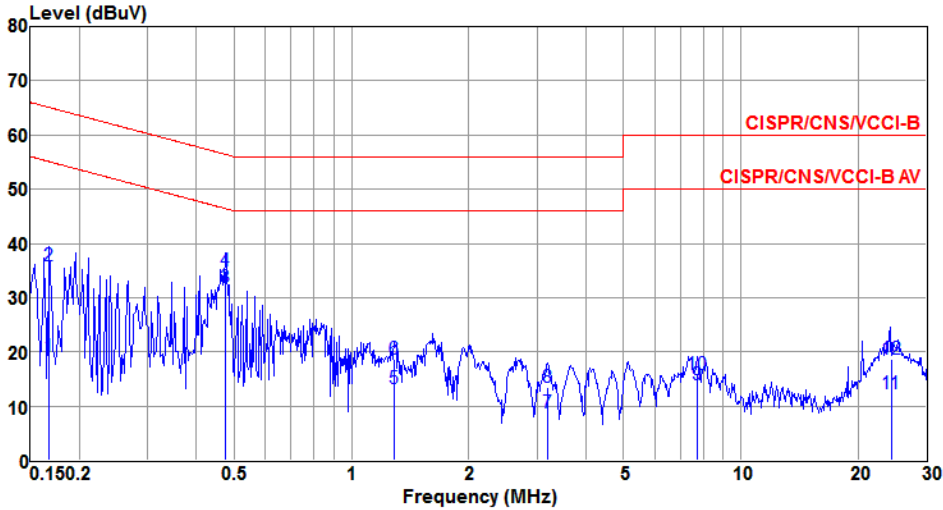


- Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

Test Configuration 1: Adapter ABP

3.1.4 Test Result of Conducted Emissions

Modulation Mode	GFSK	Test Freq. (MHz)	2402
Power Phase	Line		



	Freq	Level	Limit	Over	Read	LISN	cable	
	MHz	dBuV	Line	Limit	Level	factor	loss	Remark
			dBuV	dB	dBuV	dB	dB	
1	0.168	19.16	55.08	-35.92	18.86	0.28	0.02	Average
2	0.168	35.83	65.08	-29.25	35.53	0.28	0.02	QP
3	0.476	31.90	46.41	-14.51	31.53	0.35	0.02	Average
4	0.476	34.95	56.41	-21.46	34.58	0.35	0.02	QP
5	1.289	13.28	46.00	-32.72	12.82	0.40	0.06	Average
6	1.289	18.57	56.00	-37.43	18.11	0.40	0.06	QP
7	3.190	8.77	46.00	-37.23	8.13	0.46	0.18	Average
8	3.190	13.57	56.00	-42.43	12.93	0.46	0.18	QP
9	7.728	13.98	50.00	-36.02	13.15	0.54	0.29	Average
10	7.728	15.92	60.00	-44.08	15.09	0.54	0.29	QP
11	24.347	12.29	50.00	-37.71	10.95	0.96	0.38	Average
12	24.347	18.57	60.00	-41.43	17.23	0.96	0.38	QP

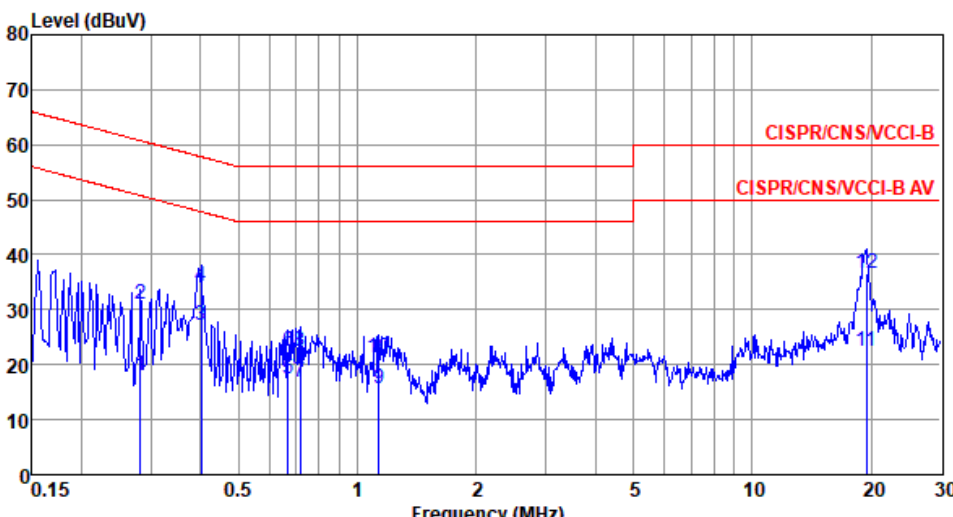
Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
 Note 2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

Modulation Mode	GFSK	Test Freq. (MHz)	2402																																																																																																																																							
Power Phase	Neutral																																																																																																																																									
Level (dBUV) <table><thead><tr><th></th><th>Freq</th><th>Level</th><th>Limit</th><th>Over</th><th>Read</th><th>LISN</th><th>cable</th><th></th></tr><tr><th></th><th>MHz</th><th>dBuV</th><th>Line</th><th>Limit</th><th>Level</th><th>factor</th><th>loss</th><th>Remark</th></tr><tr><th></th><th></th><th></th><th>dBuV</th><th>dB</th><th>dBuV</th><th>dB</th><th>dB</th><th></th></tr></thead><tbody><tr><td>1</td><td>0.159</td><td>23.56</td><td>55.52</td><td>-31.96</td><td>23.41</td><td>0.14</td><td>0.01</td><td>Average</td></tr><tr><td>2</td><td>0.159</td><td>41.02</td><td>65.52</td><td>-24.50</td><td>40.87</td><td>0.14</td><td>0.01</td><td>QP</td></tr><tr><td>3</td><td>0.476</td><td>24.40</td><td>46.41</td><td>-22.01</td><td>24.18</td><td>0.20</td><td>0.02</td><td>Average</td></tr><tr><td>4@</td><td>0.476</td><td>34.98</td><td>56.41</td><td>-21.43</td><td>34.76</td><td>0.20</td><td>0.02</td><td>QP</td></tr><tr><td>5</td><td>0.755</td><td>12.90</td><td>46.00</td><td>-33.10</td><td>12.63</td><td>0.24</td><td>0.03</td><td>Average</td></tr><tr><td>6</td><td>0.755</td><td>24.68</td><td>56.00</td><td>-31.32</td><td>24.41</td><td>0.24</td><td>0.03</td><td>QP</td></tr><tr><td>7</td><td>2.915</td><td>4.93</td><td>46.00</td><td>-41.07</td><td>4.43</td><td>0.33</td><td>0.17</td><td>Average</td></tr><tr><td>8</td><td>2.915</td><td>9.97</td><td>56.00</td><td>-46.03</td><td>9.47</td><td>0.33</td><td>0.17</td><td>QP</td></tr><tr><td>9</td><td>7.646</td><td>3.48</td><td>50.00</td><td>-46.52</td><td>2.76</td><td>0.43</td><td>0.29</td><td>Average</td></tr><tr><td>10</td><td>7.646</td><td>12.23</td><td>60.00</td><td>-47.77</td><td>11.51</td><td>0.43</td><td>0.29</td><td>QP</td></tr><tr><td>11</td><td>24.001</td><td>7.11</td><td>50.00</td><td>-42.89</td><td>5.90</td><td>0.83</td><td>0.38</td><td>Average</td></tr><tr><td>12</td><td>24.001</td><td>18.54</td><td>60.00</td><td>-41.46</td><td>17.33</td><td>0.83</td><td>0.38</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	0.159	23.56	55.52	-31.96	23.41	0.14	0.01	Average	2	0.159	41.02	65.52	-24.50	40.87	0.14	0.01	QP	3	0.476	24.40	46.41	-22.01	24.18	0.20	0.02	Average	4@	0.476	34.98	56.41	-21.43	34.76	0.20	0.02	QP	5	0.755	12.90	46.00	-33.10	12.63	0.24	0.03	Average	6	0.755	24.68	56.00	-31.32	24.41	0.24	0.03	QP	7	2.915	4.93	46.00	-41.07	4.43	0.33	0.17	Average	8	2.915	9.97	56.00	-46.03	9.47	0.33	0.17	QP	9	7.646	3.48	50.00	-46.52	2.76	0.43	0.29	Average	10	7.646	12.23	60.00	-47.77	11.51	0.43	0.29	QP	11	24.001	7.11	50.00	-42.89	5.90	0.83	0.38	Average	12	24.001	18.54	60.00	-41.46	17.33	0.83	0.38	QP
	Freq	Level	Limit	Over	Read	LISN	cable																																																																																																																																			
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4@	0.476	34.98	56.41	-21.43	34.76	0.20	0.02	QP																																																																																																																																		
5	0.755	12.90	46.00	-33.10	12.63	0.24	0.03	Average																																																																																																																																		
6	0.755	24.68	56.00	-31.32	24.41	0.24	0.03	QP																																																																																																																																		
7	2.915	4.93	46.00	-41.07	4.43	0.33	0.17	Average																																																																																																																																		
8	2.915	9.97	56.00	-46.03	9.47	0.33	0.17	QP																																																																																																																																		
9	7.646	3.48	50.00	-46.52	2.76	0.43	0.29	Average																																																																																																																																		
10	7.646	12.23	60.00	-47.77	11.51	0.43	0.29	QP																																																																																																																																		
11	24.001	7.11	50.00	-42.89	5.90	0.83	0.38	Average																																																																																																																																		
12	24.001	18.54	60.00	-41.46	17.33	0.83	0.38	QP																																																																																																																																		
Note 1: Level (dBUV) = Read Level (dBUV) + LISN Factor (dB) + Cable Loss (dB).																																																																																																																																										
2: Over Limit (dB) = Level (dBUV) – Limit Line (dBUV).																																																																																																																																										

Test Configuration 2: Adapter LONG.X.C

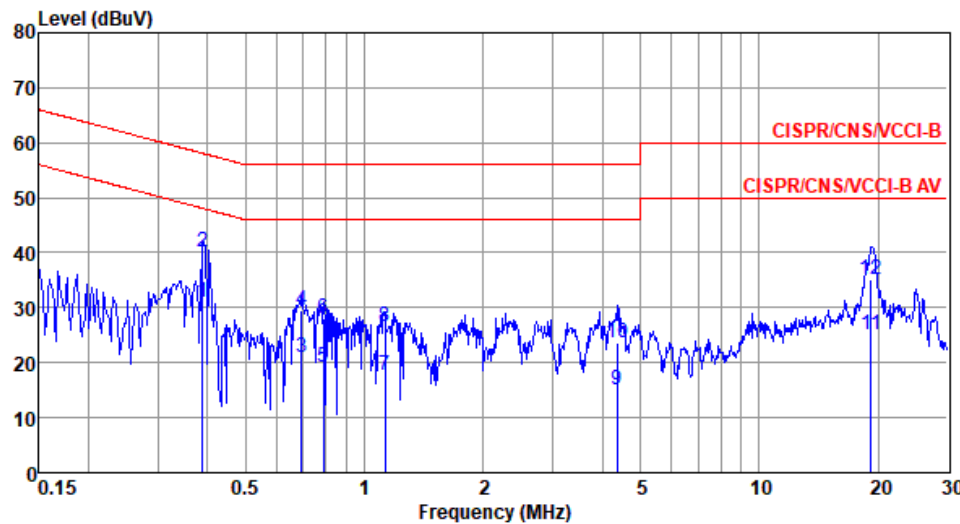
3.1.5 Test Result of Conducted Emissions

Modulation Mode	GFSK	Test Freq. (MHz)	2402
Power Phase	Line		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.282	18.09	50.76	-32.67	8.24	9.56	0.07	Average
2	0.282	31.00	60.76	-29.76	21.15	9.56	0.07	QP
3*	0.402	27.12	47.81	-20.69	17.22	9.57	0.08	Average
4	0.402	34.20	57.81	-23.61	24.30	9.57	0.08	QP
5	0.668	17.44	46.00	-28.56	7.46	9.59	0.10	Average
6	0.668	22.35	56.00	-33.65	12.37	9.59	0.10	QP
7	0.716	16.95	46.00	-29.05	6.96	9.59	0.11	Average
8	0.716	22.50	56.00	-33.50	12.51	9.59	0.11	QP
9	1.135	15.64	46.00	-30.36	5.59	9.60	0.13	Average
10	1.135	21.14	56.00	-34.86	11.09	9.60	0.13	QP
11	19.428	22.45	50.00	-27.55	11.54	9.66	0.65	Average
12	19.428	36.58	60.00	-23.42	25.67	9.66	0.65	QP

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

Modulation Mode	GFSK	Test Freq. (MHz)	2402																																																																																																																		
Power Phase	Neutral																																																																																																																				
Level (dBUV)  The graph displays the measured level in dBUV against frequency in MHz. Two red limit lines are shown: CISPR/CNS/VCCI-B (upper) and CISPR/CNS/VCCI-B AV (lower). The measured signal is a blue line with several peaks labeled 1 through 12. The x-axis ranges from 0.15 to 30 MHz, and the y-axis ranges from 0 to 80 dBUV. <table><thead><tr><th>Freq MHz</th><th>Level dBUV</th><th>Limit Line dBUV</th><th>Over Limit dB</th><th>Read Level dBUV</th><th>LISN factor dB</th><th>cable loss dB</th><th>Remark</th></tr></thead><tbody><tr><td>1*</td><td>31.01</td><td>48.08</td><td>-17.07</td><td>21.15</td><td>9.61</td><td>0.08</td><td>Average</td></tr><tr><td>2</td><td>40.19</td><td>58.08</td><td>-17.89</td><td>30.33</td><td>9.61</td><td>0.08</td><td>QP</td></tr><tr><td>3</td><td>0.694</td><td>20.84</td><td>46.00</td><td>-25.16</td><td>10.92</td><td>9.63</td><td>0.10</td><td>Average</td></tr><tr><td>4</td><td>0.694</td><td>29.61</td><td>56.00</td><td>-26.39</td><td>19.69</td><td>9.63</td><td>0.10</td><td>QP</td></tr><tr><td>5</td><td>0.788</td><td>19.26</td><td>46.00</td><td>-26.74</td><td>9.33</td><td>9.63</td><td>0.11</td><td>Average</td></tr><tr><td>6</td><td>0.788</td><td>28.19</td><td>56.00</td><td>-27.81</td><td>18.26</td><td>9.63</td><td>0.11</td><td>QP</td></tr><tr><td>7</td><td>1.129</td><td>17.58</td><td>46.00</td><td>-28.42</td><td>7.60</td><td>9.64</td><td>0.13</td><td>Average</td></tr><tr><td>8</td><td>1.129</td><td>26.54</td><td>56.00</td><td>-29.46</td><td>16.56</td><td>9.64</td><td>0.13</td><td>QP</td></tr><tr><td>9</td><td>4.361</td><td>15.18</td><td>46.00</td><td>-30.82</td><td>4.95</td><td>9.66</td><td>0.30</td><td>Average</td></tr><tr><td>10</td><td>4.361</td><td>23.55</td><td>56.00</td><td>-32.45</td><td>13.32</td><td>9.66</td><td>0.30</td><td>QP</td></tr><tr><td>11</td><td>19.224</td><td>25.15</td><td>50.00</td><td>-24.85</td><td>14.20</td><td>9.80</td><td>0.65</td><td>Average</td></tr><tr><td>12</td><td>19.224</td><td>35.01</td><td>60.00</td><td>-24.99</td><td>24.06</td><td>9.80</td><td>0.65</td><td>QP</td></tr></tbody></table> Note 1: Level (dBUV) = Read Level (dBUV) + LISN Factor (dB) + Cable Loss (dB). 2: Over Limit (dB) = Level (dBUV) – Limit Line (dBUV).				Freq MHz	Level dBUV	Limit Line dBUV	Over Limit dB	Read Level dBUV	LISN factor dB	cable loss dB	Remark	1*	31.01	48.08	-17.07	21.15	9.61	0.08	Average	2	40.19	58.08	-17.89	30.33	9.61	0.08	QP	3	0.694	20.84	46.00	-25.16	10.92	9.63	0.10	Average	4	0.694	29.61	56.00	-26.39	19.69	9.63	0.10	QP	5	0.788	19.26	46.00	-26.74	9.33	9.63	0.11	Average	6	0.788	28.19	56.00	-27.81	18.26	9.63	0.11	QP	7	1.129	17.58	46.00	-28.42	7.60	9.64	0.13	Average	8	1.129	26.54	56.00	-29.46	16.56	9.64	0.13	QP	9	4.361	15.18	46.00	-30.82	4.95	9.66	0.30	Average	10	4.361	23.55	56.00	-32.45	13.32	9.66	0.30	QP	11	19.224	25.15	50.00	-24.85	14.20	9.80	0.65	Average	12	19.224	35.01	60.00	-24.99	24.06	9.80	0.65	QP
Freq MHz	Level dBUV	Limit Line dBUV	Over Limit dB	Read Level dBUV	LISN factor dB	cable loss dB	Remark																																																																																																														
1*	31.01	48.08	-17.07	21.15	9.61	0.08	Average																																																																																																														
2	40.19	58.08	-17.89	30.33	9.61	0.08	QP																																																																																																														
3	0.694	20.84	46.00	-25.16	10.92	9.63	0.10	Average																																																																																																													
4	0.694	29.61	56.00	-26.39	19.69	9.63	0.10	QP																																																																																																													
5	0.788	19.26	46.00	-26.74	9.33	9.63	0.11	Average																																																																																																													
6	0.788	28.19	56.00	-27.81	18.26	9.63	0.11	QP																																																																																																													
7	1.129	17.58	46.00	-28.42	7.60	9.64	0.13	Average																																																																																																													
8	1.129	26.54	56.00	-29.46	16.56	9.64	0.13	QP																																																																																																													
9	4.361	15.18	46.00	-30.82	4.95	9.66	0.30	Average																																																																																																													
10	4.361	23.55	56.00	-32.45	13.32	9.66	0.30	QP																																																																																																													
11	19.224	25.15	50.00	-24.85	14.20	9.80	0.65	Average																																																																																																													
12	19.224	35.01	60.00	-24.99	24.06	9.80	0.65	QP																																																																																																													

3.2 Unwanted Emissions into Restricted Frequency Bands

3.2.1 Limit of Unwanted Emissions into Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:
Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

Note 2:
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

3.2.2 Test Procedures

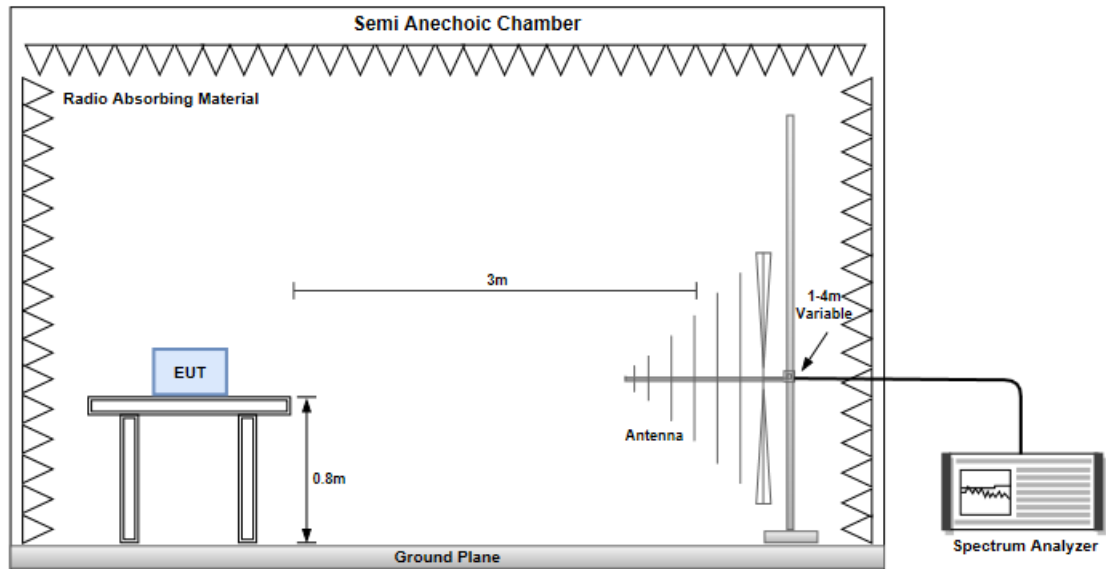
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

Note:

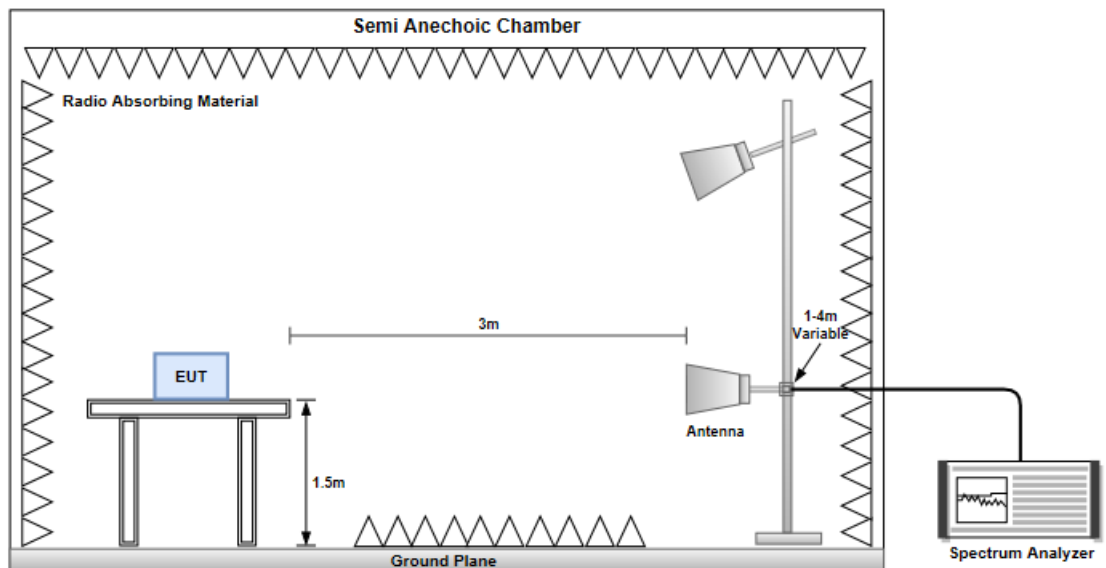
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. Radiated emission above 1GHz / Peak value
RBW=1MHz, VBW=3MHz and Peak detector
Radiated emission above 1GHz / Average value for harmonics
The average value is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula for DH5 packet type which has worst duty factor:
3.
$$20\log (\text{Duty cycle}) = 20\log \frac{1\text{s} / 1600 * 5}{100 \text{ ms}} = -30.1\text{dB}$$
4. Radiated emission above 1GHz / Average value for other emissions
RBW=1MHz, VBW=1/T and Peak detector

3.2.3 Test Setup

Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz

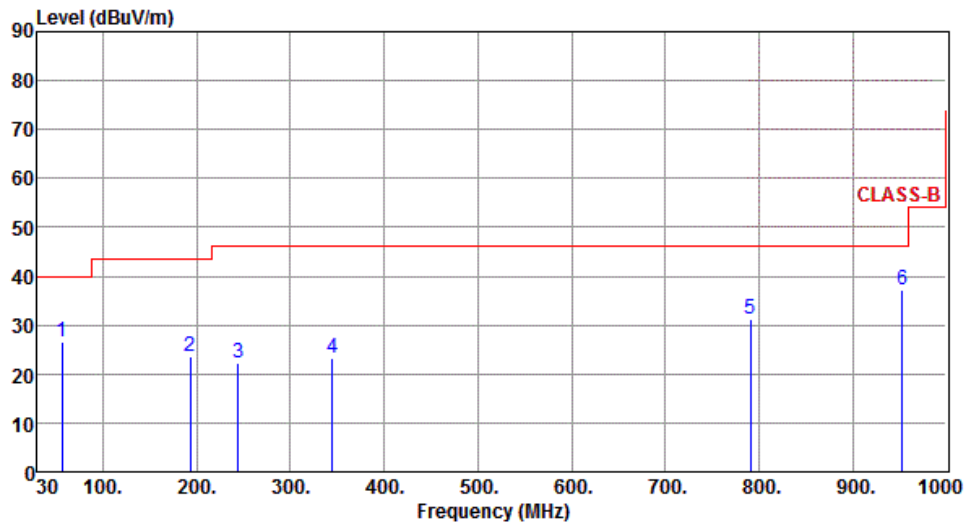


Test Configuration 1: Adapter ABP

3.2.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Horizontal		
Level (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	56.21	26.49	40.00	-13.51	34.85	-8.36	Peak	---	---
2	193.40	23.68	43.50	-19.82	34.22	-10.54	Peak	---	---
3	244.20	22.36	46.00	-23.64	31.57	-9.21	Peak	---	---
4	344.68	23.11	46.00	-22.89	29.62	-6.51	Peak	---	---
5	791.00	31.16	46.00	-14.84	28.65	2.51	Peak	---	---
6	953.00	37.33	46.00	-8.67	32.18	5.15	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.

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

Modulation	GFSK		Test Freq. (MHz)		2402	
Polarization	Horizontal					
Level (dBuV/m)						

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Vertical		
Level (dBUV/m)			

Modulation	GFSK	Test Freq. (MHz)	2441
Polarization	Horizontal		
Level (dBuV/m) </			

Modulation	GFSK	Test Freq. (MHz)	2441
Polarization	Vertical		
Level (dBuV/m)			

Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Horizontal		
Level (dBuV/m) <			

Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Vertical		
Level (dBUV/m)			

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

Modulation	8DPSK		Test Freq. (MHz)		2402				
Polarization	Horizontal								
Level (dBUV/m)									

Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Vertical		
Level (dBuV/m)			

Modulation	8DPSK	Test Freq. (MHz)	2441
Polarization	Horizontal		
Level (dBuV/m) <			

Modulation	8DPSK	Test Freq. (MHz)	2441
Polarization	Vertical		
Level (dBuV/m) <			

Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Horizontal		
Level (dBuV/m) </			

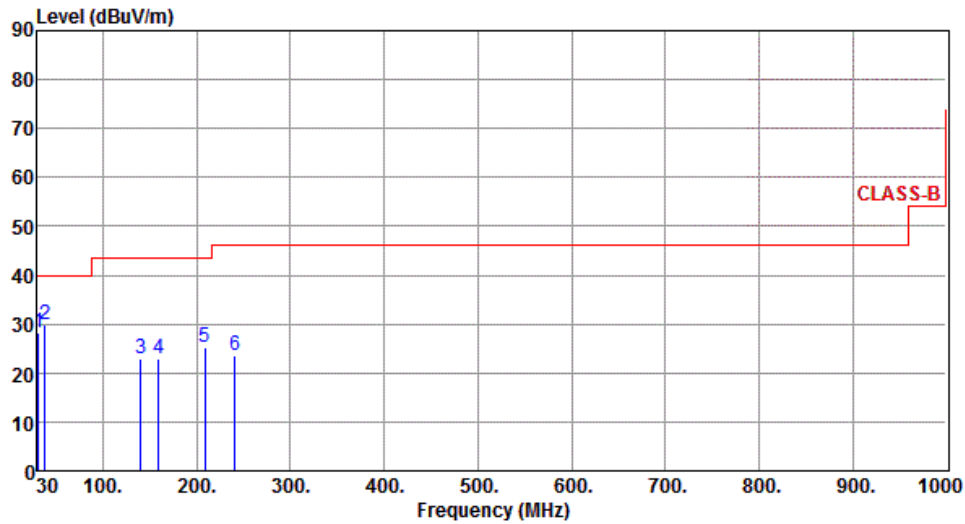
Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Vertical		
Level (dBUV/m)			

Test Configuration 2: Adapter LONG.X.C

3.2.7 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Horizontal		
Level (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	30.97	28.26	40.00	-11.74	37.86	-9.60	Peak	---	---
2	37.76	29.73	40.00	-10.27	38.62	-8.89	Peak	---	---
3	140.58	22.89	43.50	-20.61	31.75	-8.86	Peak	---	---
4	159.01	23.01	43.50	-20.49	31.33	-8.32	Peak	---	---
5	208.48	25.09	43.50	-18.41	37.16	-12.07	Peak	---	---
6	240.49	23.74	46.00	-22.26	33.91	-10.17	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.

3.3 Unwanted Emissions into Non-Restricted Frequency Bands

3.3.1 Limit of Unwanted Emissions into Non-Restricted Frequency Bands

The peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz.

3.3.2 Test Procedures

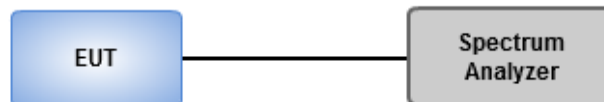
Reference Level Measurement

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

Unwanted Emissions Level Measurement

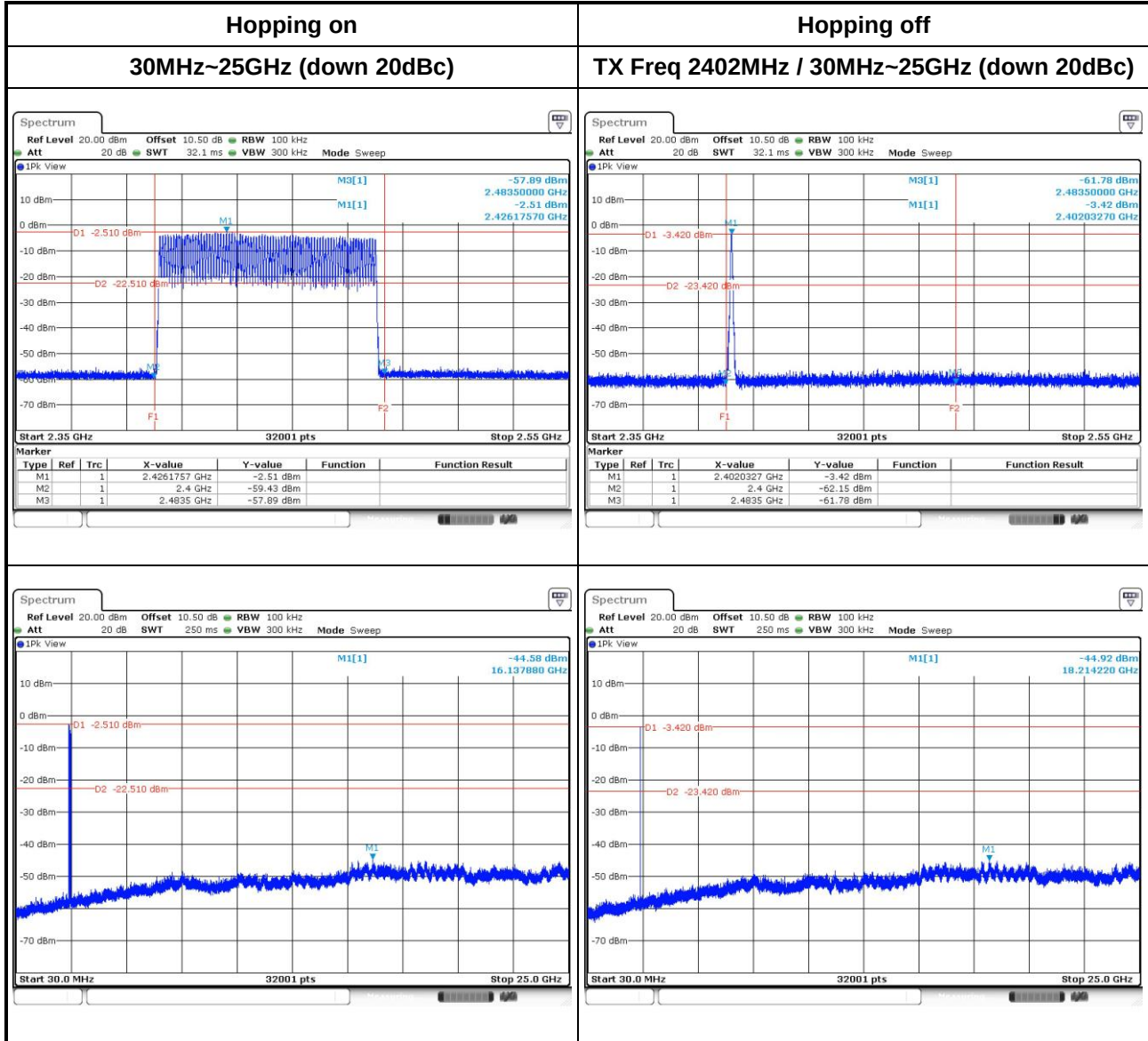
1. Set RBW = 100 kHz, VBW = 300 kHz, Detector = peak.
2. Trace Mode = max hold, Sweep = auto couple.
3. Allow the trace to stabilize.
4. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

3.3.3 Test Setup



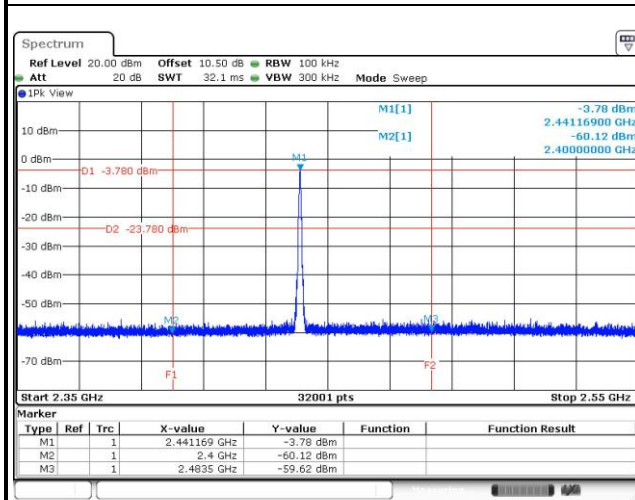
3.3.4 Unwanted Emissions into Non-Restricted Frequency Bands

GFSK



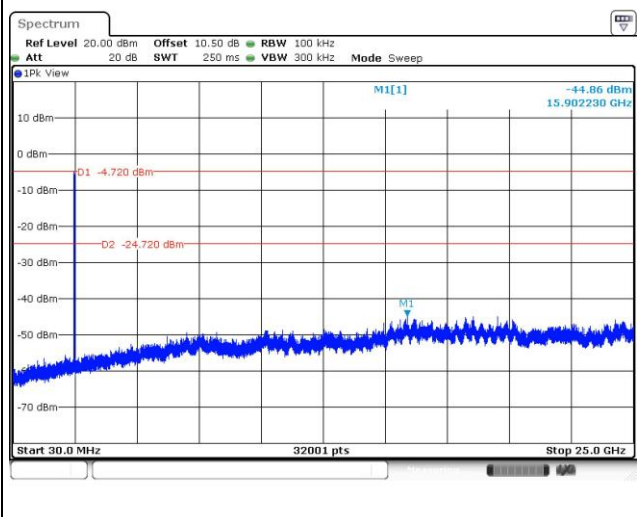
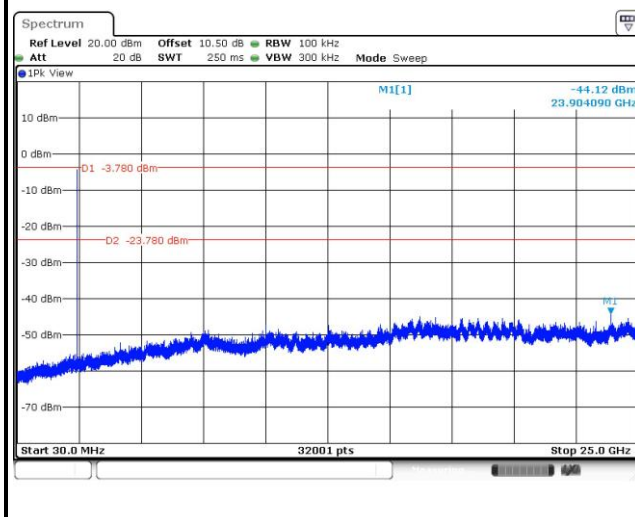
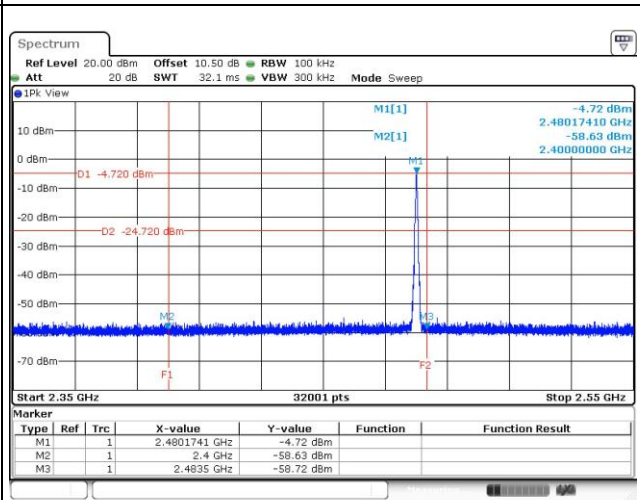
Hopping off

TX Freq 2441MHz / 30MHz~25GHz (down 20dBc)

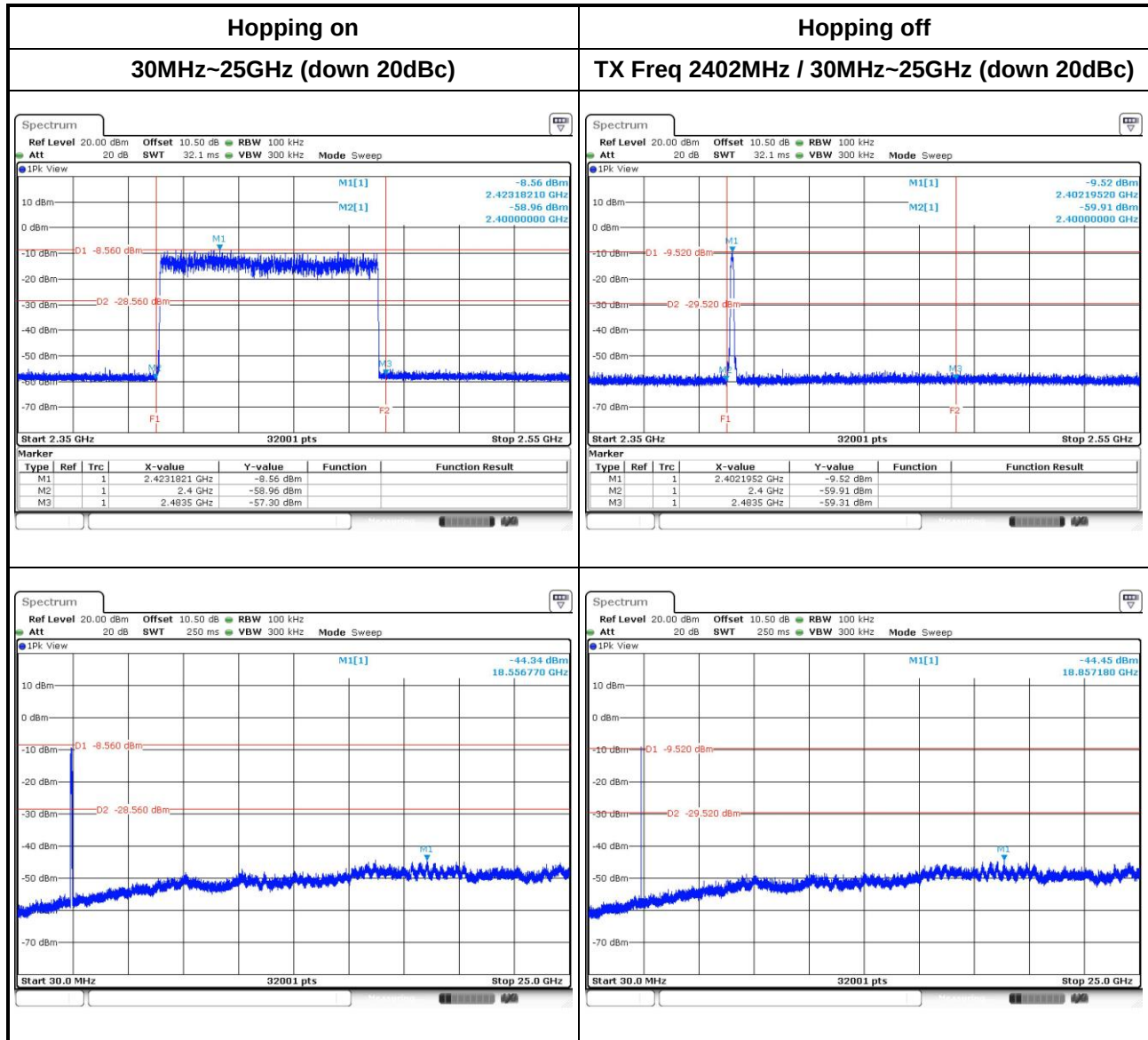


Hopping off

TX Freq 2480MHz / 30MHz~25GHz (down 20dBc)

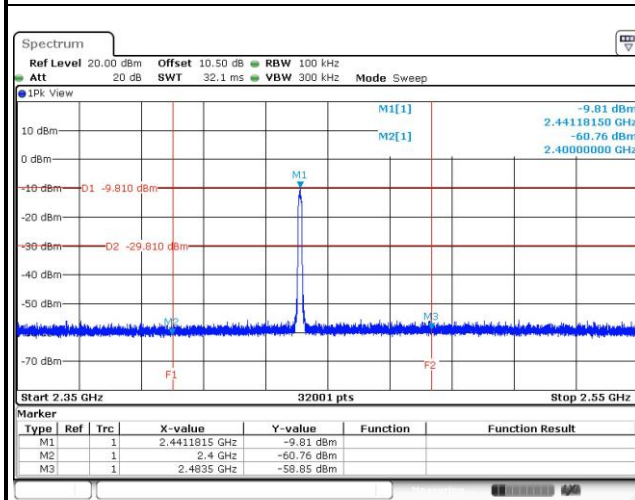


8DPSK



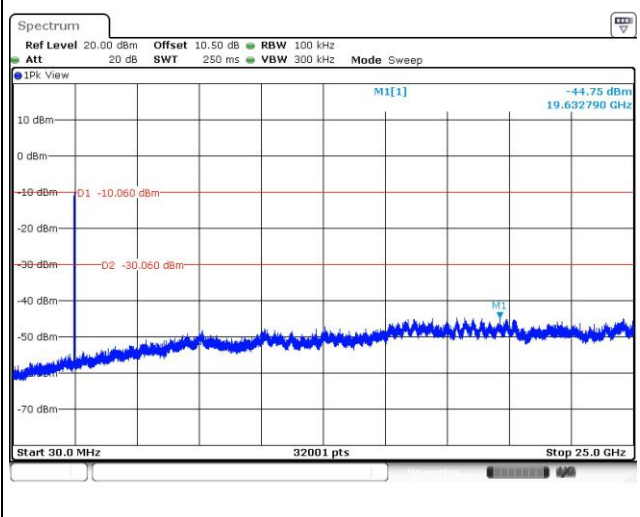
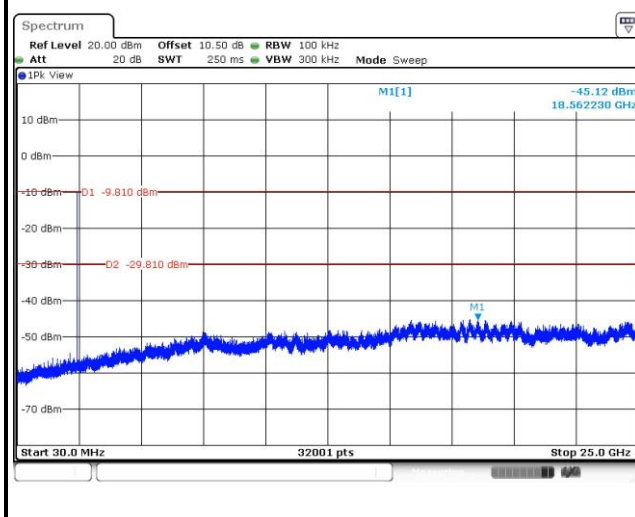
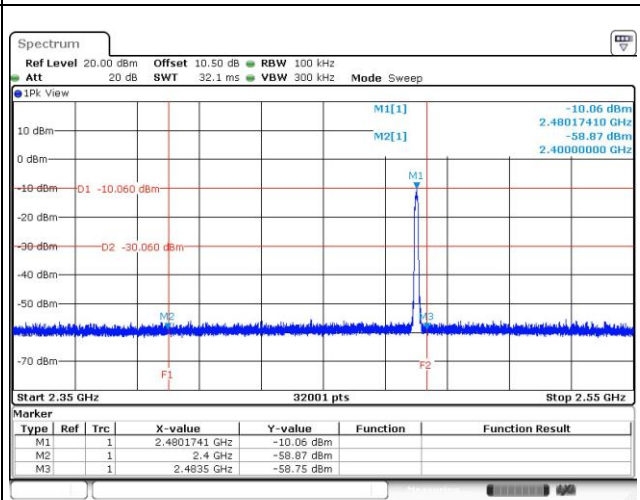
Hopping off

TX Freq 2441MHz / 30MHz~25GHz (down 20dBc)



Hopping off

TX Freq 2480MHz / 30MHz~25GHz (down 20dBc)



3.4 Conducted Output Power

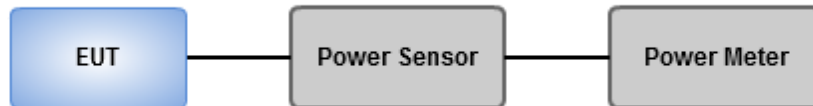
3.4.1 Limit of Conducted Output Power

- ☐ 1 Watt
For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band.
- ☒ 0.125 Watt
For all other frequency hopping systems in the 2400–2483.5 MHz band.
- ☐ 0.125 Watt
For Frequency hopping systems operating in the 2400–2483.5 MHz band have hopping channel carrier frequencies that are separated by two-thirds of the 20 dB bandwidth of the hopping channel.

3.4.2 Test Procedures

1. A wideband power meter is used for power measurement. Bandwidth of power sensor and meter is 50MHz
2. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power

3.4.3 Test Setup



3.4.4 Test Result of Conducted Output Power

Modulation Mode	Freq. (MHz)	Output Power (mW)	Output Power (dBm)	Limit (mW)
GFSK	2402	0.49	-3.07	125
GFSK	2441	0.43	-3.62	125
GFSK	2480	0.36	-4.47	125
π/4 DQPSK	2402	0.23	-6.44	125
π/4 DQPSK	2441	0.19	-7.16	125
π/4 DQPSK	2480	0.18	-7.37	125
8DPSK	2402	0.24	-6.18	125
8DPSK	2441	0.21	-6.84	125
8DPSK	2480	0.19	-7.12	125

Modulation Mode	Freq. (MHz)	AV Output Power (mW)	AV Output Power (dBm)
GFSK	2402	0.45	-3.47
GFSK	2441	0.39	-4.07
GFSK	2480	0.32	-5.01
π/4 DQPSK	2402	0.13	-9.03
π/4 DQPSK	2441	0.11	-9.77
π/4 DQPSK	2480	0.10	-9.99
8DPSK	2402	0.13	-9.02
8DPSK	2441	0.11	-9.76
8DPSK	2480	0.10	-9.98

Note: Average power is for reference only.

3.5 Number of Hopping Frequency

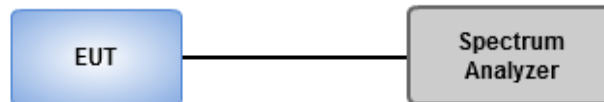
3.5.1 Limit of Number of Hopping Frequency

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

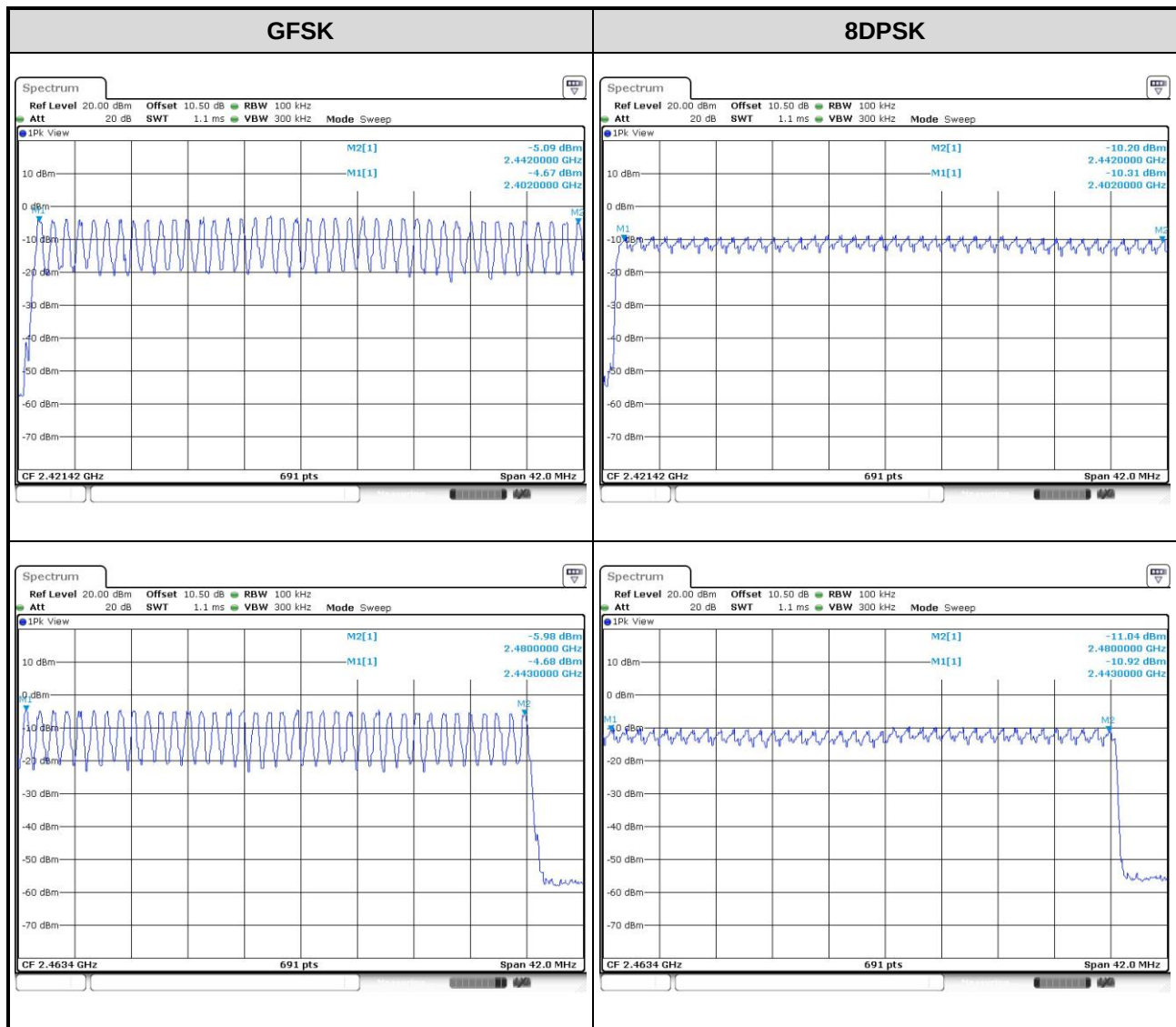
3.5.2 Test Procedures

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

3.5.3 Test Setup



3.5.4 Test Result of Number of Hopping Frequency



3.6 20dB and Occupied Bandwidth

3.6.1 Test Procedures

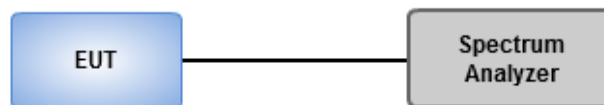
20dB Bandwidth

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

Occupied Bandwidth

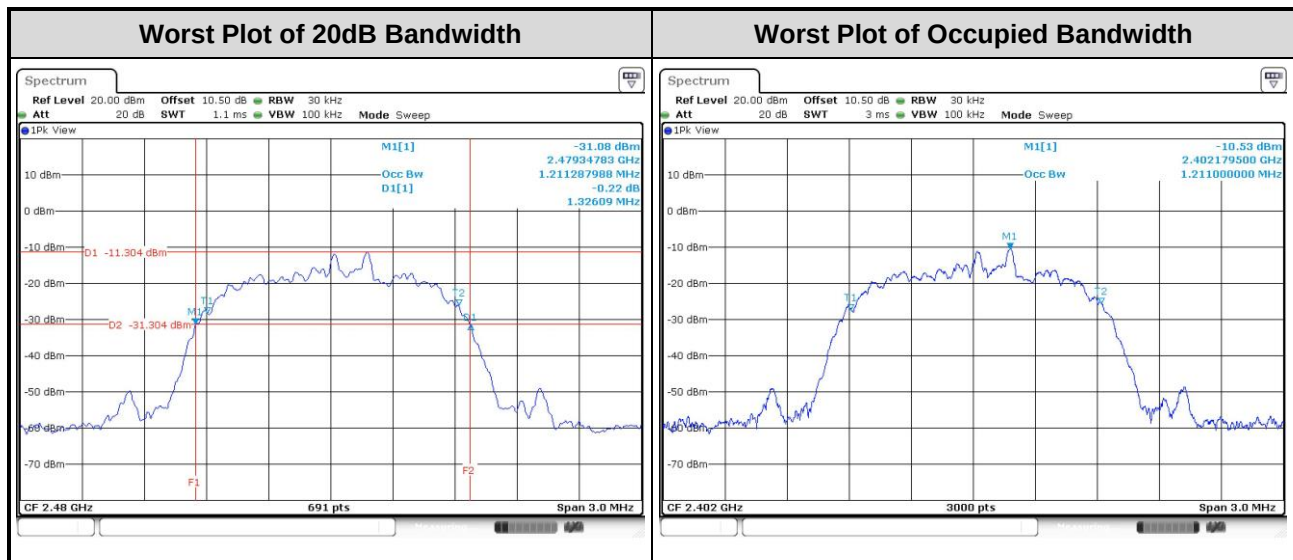
1. Set RBW=30kHz, VBW=100kHz, Sweep time = Auto, Detector=Sample, Trace max hold
2. Allow trace to stabilize
3. Use Occupied bandwidth function of spectrum analyzer to measuring 99% occupied bandwidth

3.6.2 Test Setup



3.6.3 Test result of 20dB and Occupied Bandwidth

Modulation Mode	Freq. (MHz)	20dB Bandwidth (MHz)	Occupied Bandwidth (MHz)
GFSK	2402	1.017	0.927
GFSK	2441	1.026	0.927
GFSK	2480	1.022	0.933
8DPSK	2402	1.326	1.211
8DPSK	2441	1.326	1.211
8DPSK	2480	1.326	1.210



3.7 Channel Separation

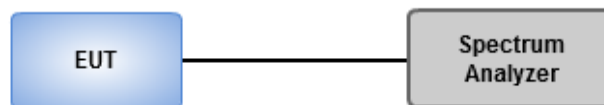
3.7.1 Limit of Channel Separation

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

3.7.2 Test Procedures

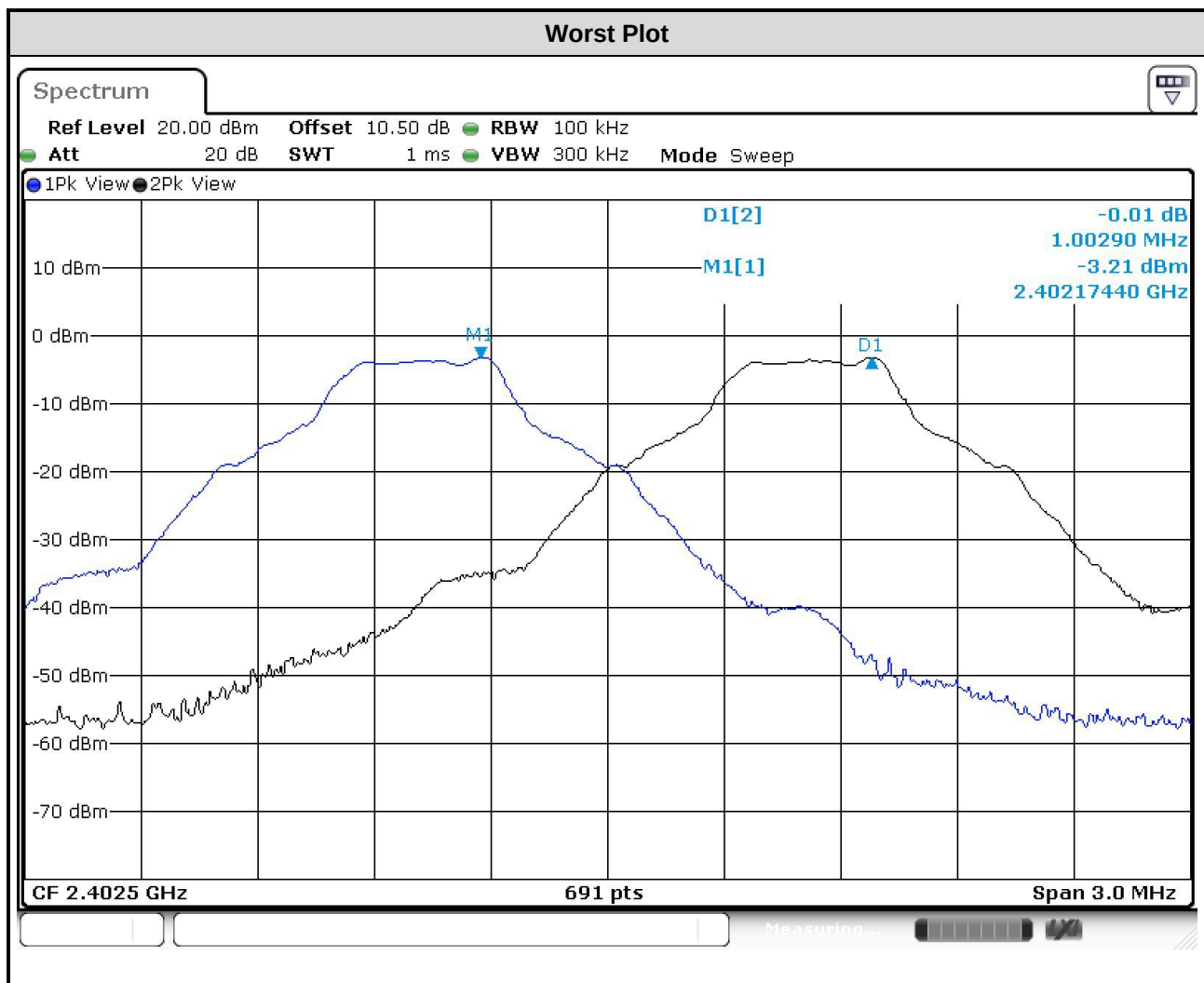
1. Set RBW=100kHz, VBW=300kHz, Sweep time = Auto, Detector=Peak Trace max hold
2. Allow trace to stabilize
3. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The EUT shall show compliance with the appropriate regulatory limit

3.7.3 Test Setup



3.7.4 Test result of Channel Separation

Modulation Mode	Freq. (MHz)	Channel Separation (MHz)	20dB Bandwidth (MHz)	Minimum Limit (MHz)
GFSK	2402	1.003	1.017	0.678
GFSK	2441	1.003	1.026	0.684
GFSK	2480	1.003	1.022	0.681
8DPSK	2402	1.003	1.326	0.884
8DPSK	2441	1.003	1.326	0.884
8DPSK	2480	1.003	1.326	0.884



3.8 Number of Dwell Time

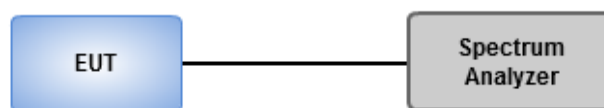
3.8.1 Limit of Dwell time

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

3.8.2 Test Procedures

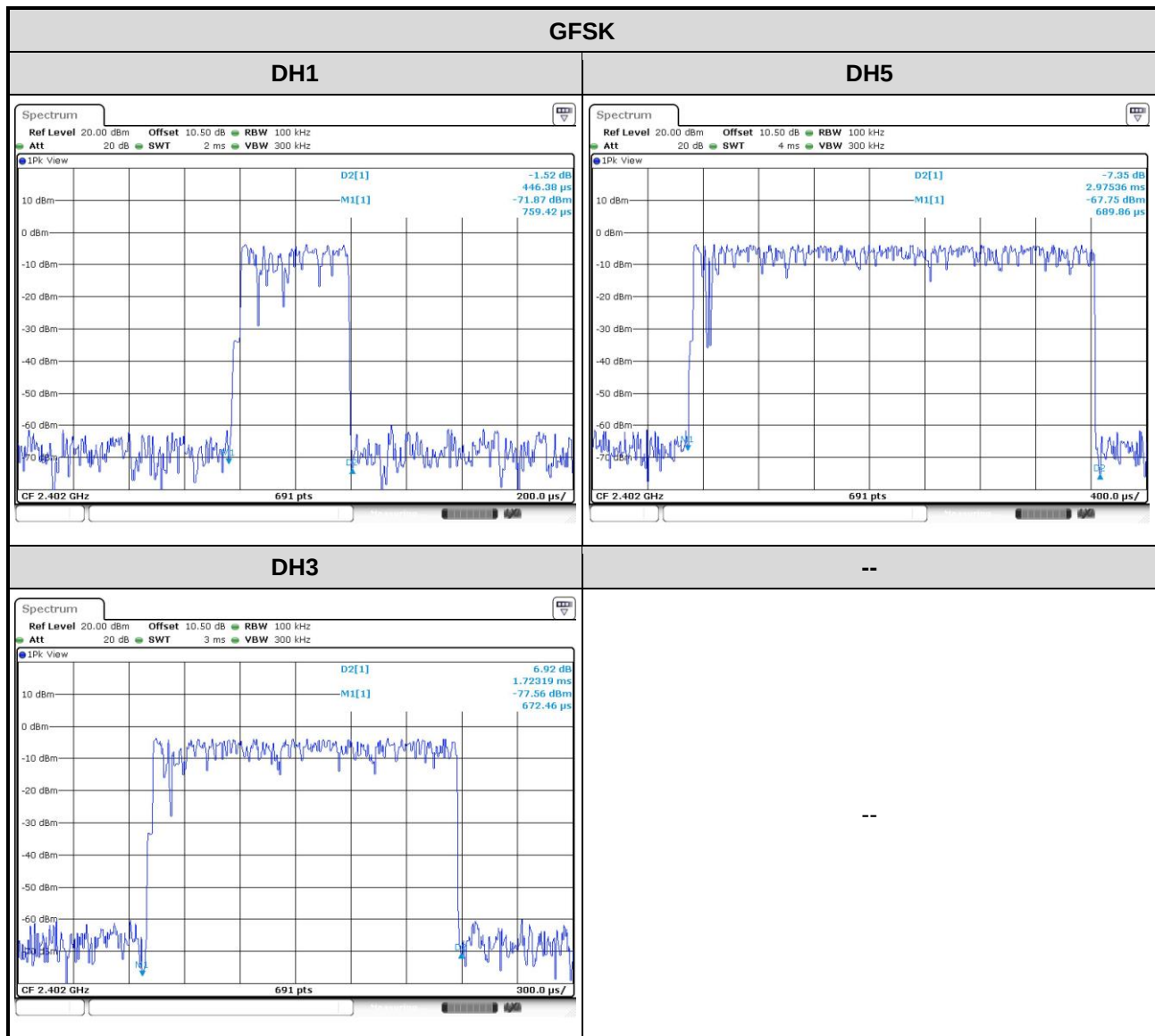
1. Set RBW=100kHz,VBW=300kHz,Sweep time = 500us(DH1),2ms(DH3),4ms(DH5), Detector=Peak, Span=0Hz,Trace max hold
2. Enable gating and trigger function of spectrum analyzer to measure burst on time.
3. The DH1 packet can cover a single time slot. A maximum length packet has duration of 1 time slots. The hopping rate is 1600 hops/second so the maximum dwell time is 1/1600 seconds, or 0.625ms. DH1 Packet permit maximum $1600 / 79 / 2 = 10.12$ hops per second in each channel (1 time slot TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times $10.12 \times 31.6 = 320$ within 31.6 seconds.
4. The DH3 packet can cover up to 3 time slots. A maximum length packet has duration of 3 time slots. The hopping rate is 1600 hops/second so the maximum dwell time is 3/1600 seconds, or 1.875ms. DH3 Packet permit maximum $1600 / 79 / 4 = 5.06$ hops per second in each channel (3 time slots TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times $5.06 \times 31.6 = 160$ within 31.6 seconds.
5. The DH5 packet can cover up to 5 time slots. Operate DH5 at maximum dwell time and maximum duty cycle. A maximum length packet has duration of 5 time slots. The hopping rate is 1600 hops/second so the maximum dwell time is 5/1600 seconds, or 3.125ms. DH5 Packet permit maximum $1600 / 79 / 6 = 3.37$ hops per second in each channel (5 time slots TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times $3.37 \times 31.6 = 106.6$ within 31.6 seconds

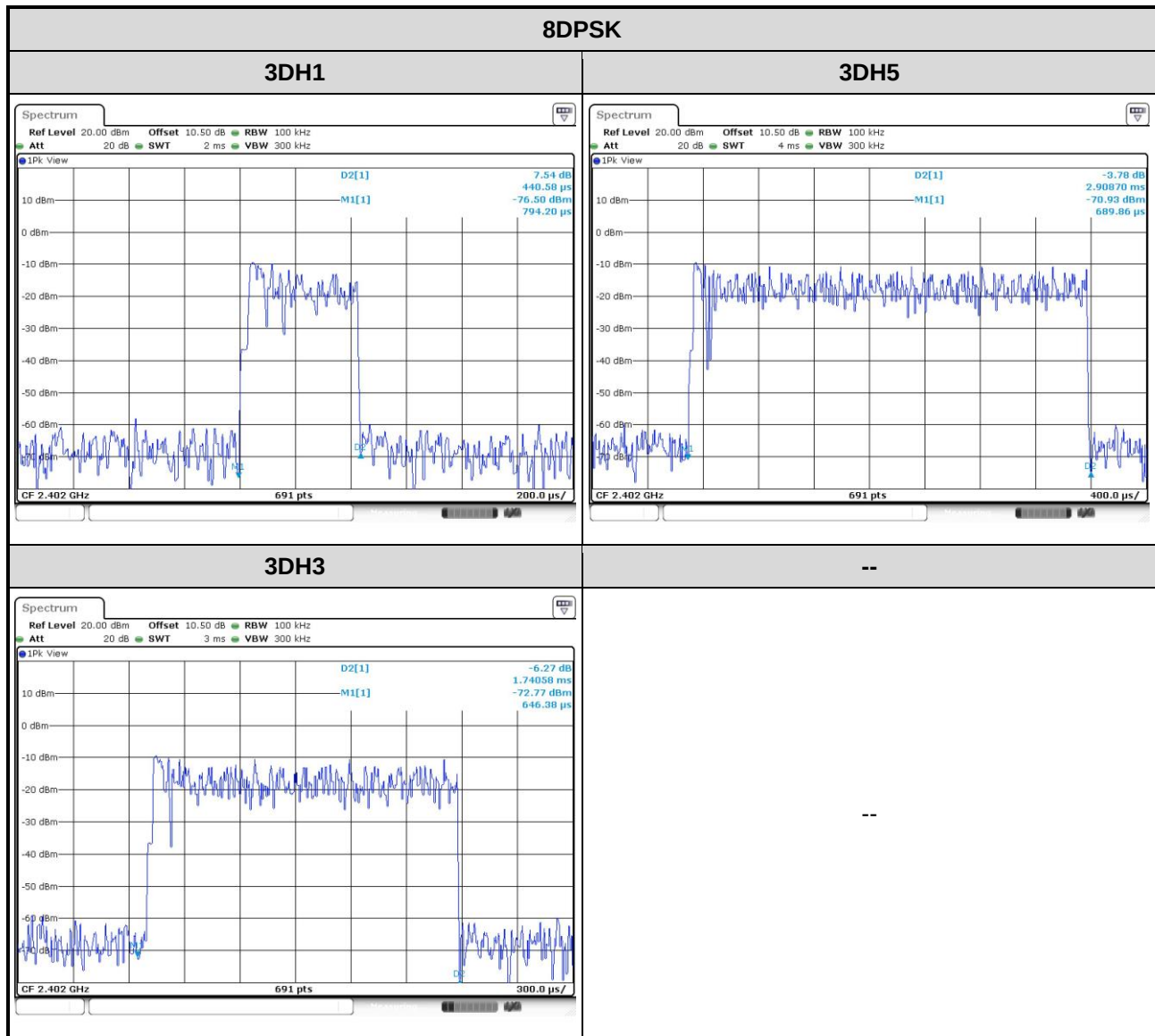
3.8.3 Test Setup



3.8.4 Test Result of Dwell Time

Modulation Mode	Freq. (MHz)	Length of Transmission Time (msec)	Number of Transmission in a 31.6 (79 Hopping*0.4)	Result (s)	Limit (s)
GFSK-DH1	2402	0.44638	320	0.143	0.4
GFSK-DH3	2402	1.72319	160	0.276	0.4
GFSK-DH5	2402	2.97536	106.6	0.317	0.4
8DPSK-DH1	2402	0.44058	320	0.141	0.4
8DPSK-DH3	2402	1.74058	160	0.278	0.4
8DPSK-DH5	2402	2.90870	106.6	0.310	0.4





4 Receiver Test Results

4.1 Conducted Emissions

4.1.1 Limit of Conducted Emissions

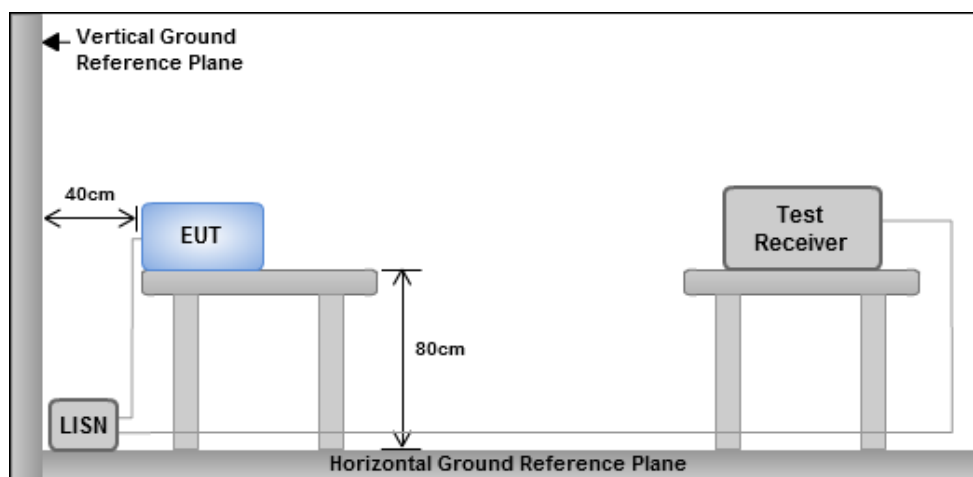
Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

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

4.1.2 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.

4.1.3 Test Setup

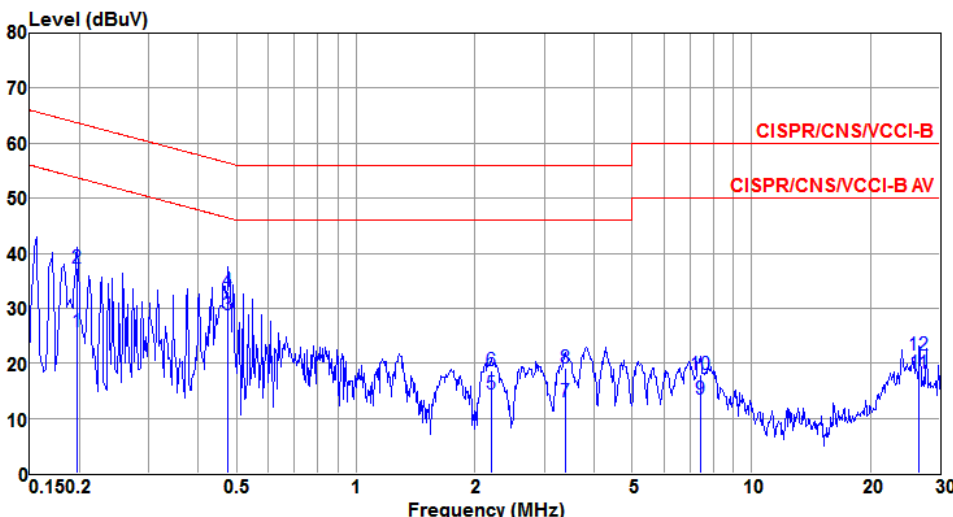


- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

Test Configuration 1: Adapter ABP

4.1.4 Test Result of Conducted Emissions

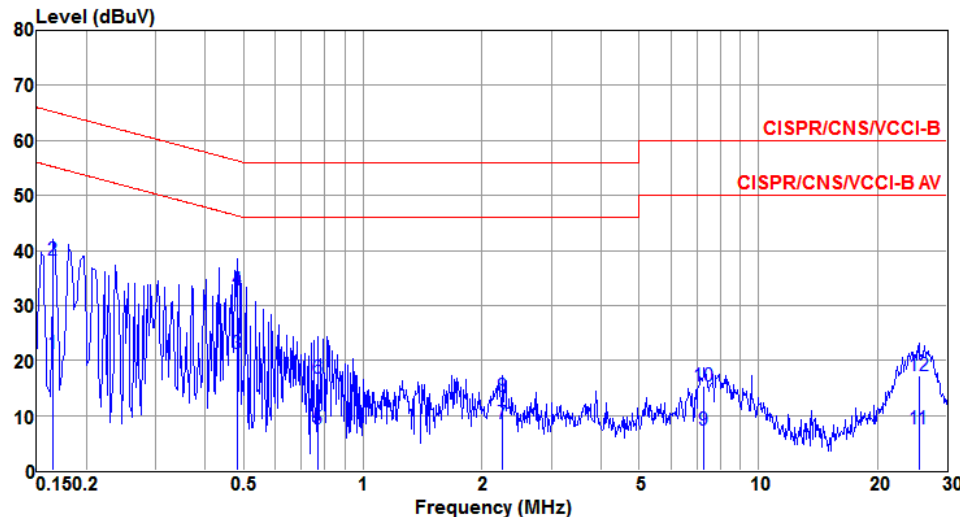
Modulation Mode	GFSK	Test Freq. (MHz)	2402
Power Phase	Line		



	Freq MHz	Level dBUV	Limit Line dBUV	Over Limit dB	Read Level dBUV	LISN factor dB	cable loss dB	Remark
1	0.198	25.62	53.71	-28.09	25.30	0.29	0.03	Average
2	0.198	37.30	63.71	-26.41	36.98	0.29	0.03	QP
3	0.476	28.87	46.41	-17.54	28.50	0.35	0.02	Average
4	0.476	32.99	56.41	-23.42	32.62	0.35	0.02	QP
5	2.201	14.45	46.00	-31.55	13.89	0.44	0.12	Average
6	2.201	18.61	56.00	-37.39	18.05	0.44	0.12	QP
7	3.381	13.01	46.00	-32.99	12.36	0.46	0.19	Average
8	3.381	19.23	56.00	-36.77	18.58	0.46	0.19	QP
9	7.446	13.42	50.00	-36.58	12.59	0.54	0.29	Average
10	7.446	17.92	60.00	-42.08	17.09	0.54	0.29	QP
11	26.558	18.30	50.00	-31.70	16.90	1.01	0.39	Average
12	26.558	21.42	60.00	-38.58	20.02	1.01	0.39	QP

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

Modulation Mode	GFSK	Test Freq. (MHz)	2402
Power Phase	Neutral		



Freq	Level	Limit	Over	Read	LISN	cable	Remark	
MHz	dBuV	dBuV	dB	dBuV	dB	dB		
1	0.165	21.27	55.21	-33.94	21.11	0.14	0.02	Average
2	0.165	38.33	65.21	-26.88	38.17	0.14	0.02	QP
3	0.481	21.13	46.32	-25.19	20.91	0.20	0.02	Average
4	0.481	32.88	56.32	-23.44	32.66	0.20	0.02	QP
5	0.767	7.63	46.00	-38.37	7.36	0.24	0.03	Average
6	0.767	16.79	56.00	-39.21	16.52	0.24	0.03	QP
7	2.261	8.56	46.00	-37.44	8.12	0.32	0.12	Average
8	2.261	13.56	56.00	-42.44	13.12	0.32	0.12	QP
9	7.290	7.22	50.00	-42.78	6.51	0.42	0.29	Average
10	7.290	15.31	60.00	-44.69	14.60	0.42	0.29	QP
11	25.456	7.48	50.00	-42.52	6.23	0.86	0.39	Average
12	25.456	17.34	60.00	-42.66	16.09	0.86	0.39	QP

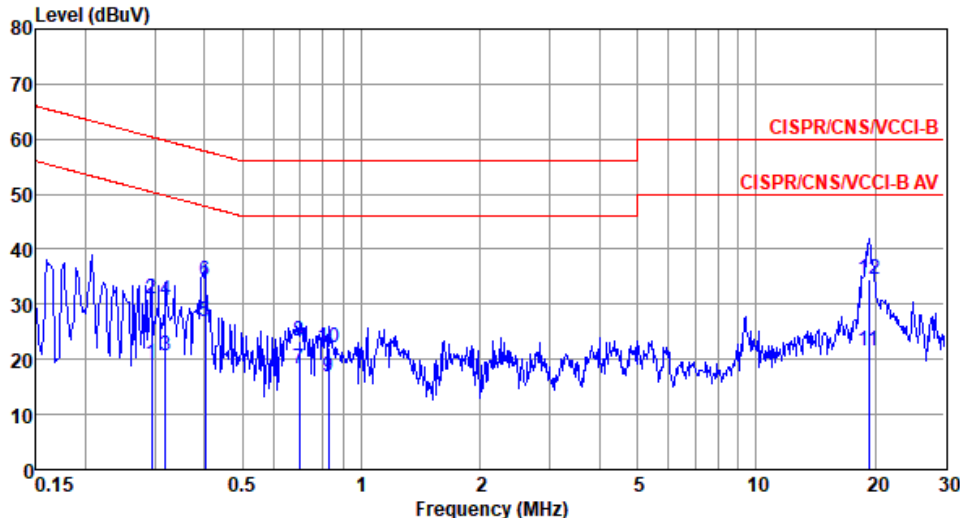
Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).

2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

Test Configuration 2: Adapter LONG.X.C

4.1.5 Test Result of Conducted Emissions

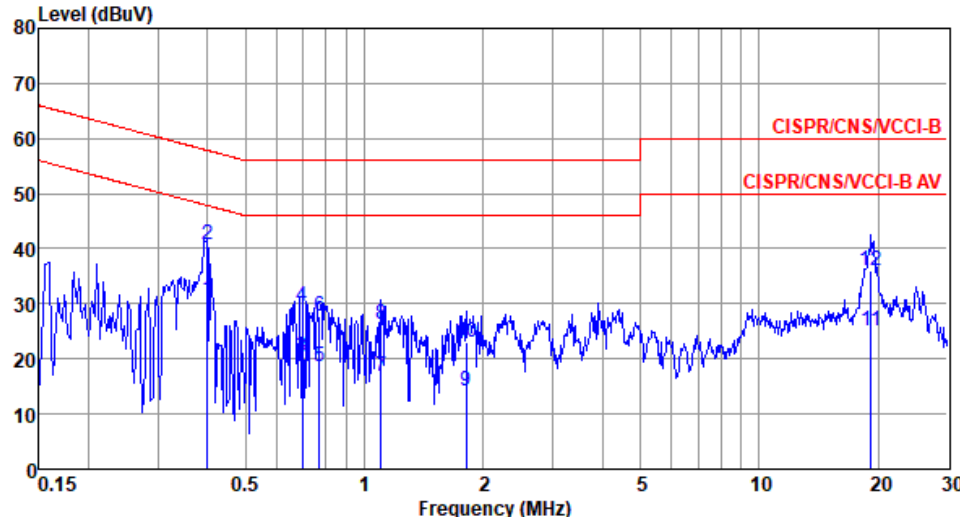
Modulation Mode	GFSK	Test Freq. (MHz)	2402
Power Phase	Line		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.294	19.14	50.41	-31.27	9.29	9.56	0.07	Average
2	0.294	31.02	60.41	-29.39	21.17	9.56	0.07	QP
3	0.318	20.72	49.75	-29.03	10.86	9.56	0.07	Average
4	0.318	30.73	59.75	-29.02	20.87	9.56	0.07	QP
5*	0.402	26.96	47.81	-20.85	17.06	9.57	0.08	Average
6	0.402	34.15	57.81	-23.66	24.25	9.57	0.08	QP
7	0.697	18.29	46.00	-27.71	8.31	9.59	0.10	Average
8	0.697	23.45	56.00	-32.55	13.47	9.59	0.10	QP
9	0.826	16.94	46.00	-29.06	6.93	9.59	0.11	Average
10	0.826	22.16	56.00	-33.84	12.15	9.59	0.11	QP
11	19.326	21.45	50.00	-28.55	10.55	9.66	0.65	Average
12	19.326	34.50	60.00	-25.50	23.60	9.66	0.65	QP

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

Modulation Mode	GFSK	Test Freq. (MHz)	2402
Power Phase	Neutral		



The graph displays the measured signal level in dBuV against frequency in MHz. The y-axis ranges from 0 to 80 dBuV, and the x-axis ranges from 0.15 to 30 MHz. Two red limit lines are shown: CISPR/CNS/VCCI-B (upper) and CISPR/CNS/VCCI-B AV (lower). The measured signal is shown as a blue line with several peaks. Peaks are labeled with numbers 1 through 12, corresponding to the data table below.

	Freq	Level	Limit	Over	Read	LISN	cable	Remark
	MHz	dBuV	Line	Limit	Level	factor	loss	
			dBuV	dB	dBuV	dB	dB	
1	0.400	30.56	47.86	-17.30	20.70	9.61	0.08	Average
2*	0.400	40.72	57.86	-17.14	30.86	9.61	0.08	QP
3	0.697	20.51	46.00	-25.49	10.59	9.63	0.10	Average
4	0.697	29.44	56.00	-26.56	19.52	9.63	0.10	QP
5	0.767	18.70	46.00	-27.30	8.77	9.63	0.11	Average
6	0.767	27.66	56.00	-28.34	17.73	9.63	0.11	QP
7	1.100	16.96	46.00	-29.04	6.98	9.64	0.13	Average
8	1.100	26.42	56.00	-29.58	16.44	9.64	0.13	QP
9	1.810	14.21	46.00	-31.79	4.14	9.65	0.17	Average
10	1.810	23.16	56.00	-32.84	13.09	9.65	0.17	QP
11	19.224	25.08	50.00	-24.92	14.13	9.80	0.65	Average
12	19.224	35.87	60.00	-24.13	24.92	9.80	0.65	QP

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

2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

4.2 Unwanted Emissions into Restricted Frequency Bands

4.2.1 Limit of Unwanted Emissions into Restricted Frequency Bands

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:
Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

Note 2:
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

4.2.2 Test Procedures

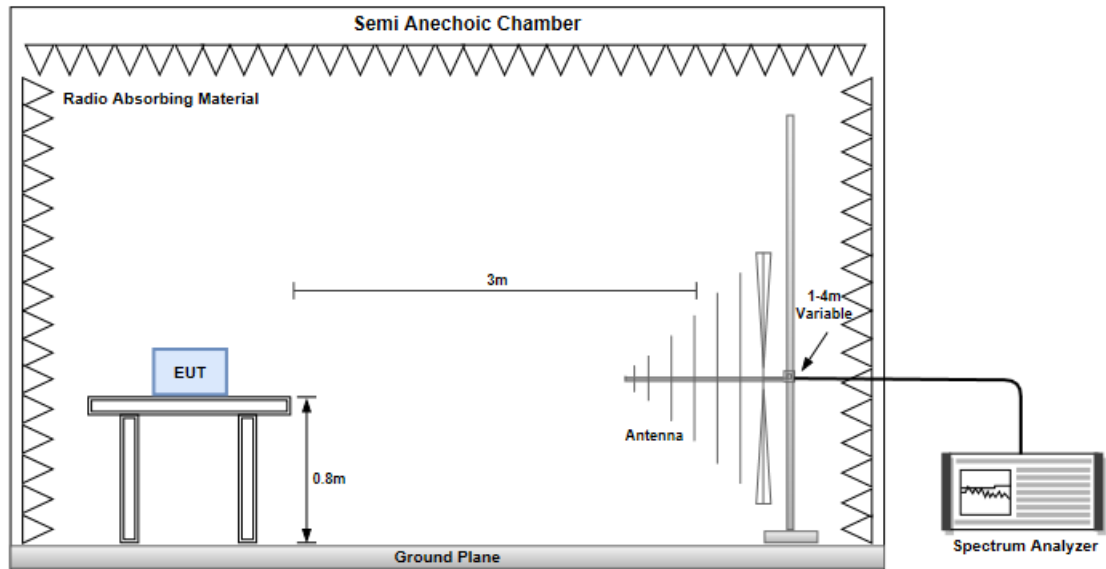
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission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

Note:

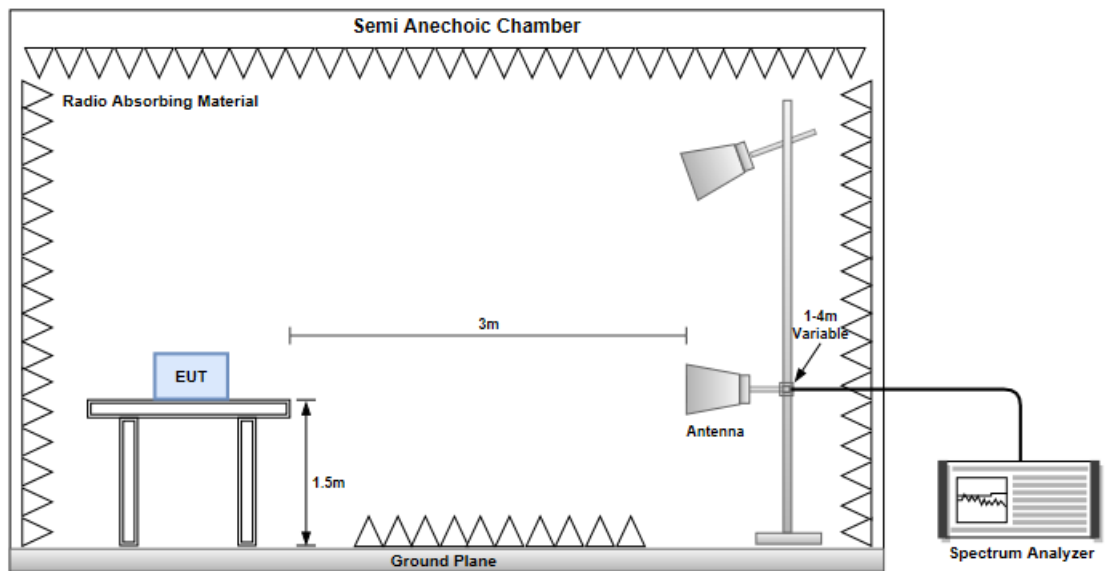
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=3MHz and RMS detector is for average measured value of radiated emission above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

4.2.3 Test Setup

Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz



Test Configuration 1: Adapter ABP

4.2.4 Receiver Radiated Unwanted Emissions

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Horizontal		
Level (dBuV/m)			

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Vertical		
Level (dBuV/m)			

4.2.5 Receiver Radiated Unwanted Emissions (Above 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Horizontal		
Level (dBuV/m)			

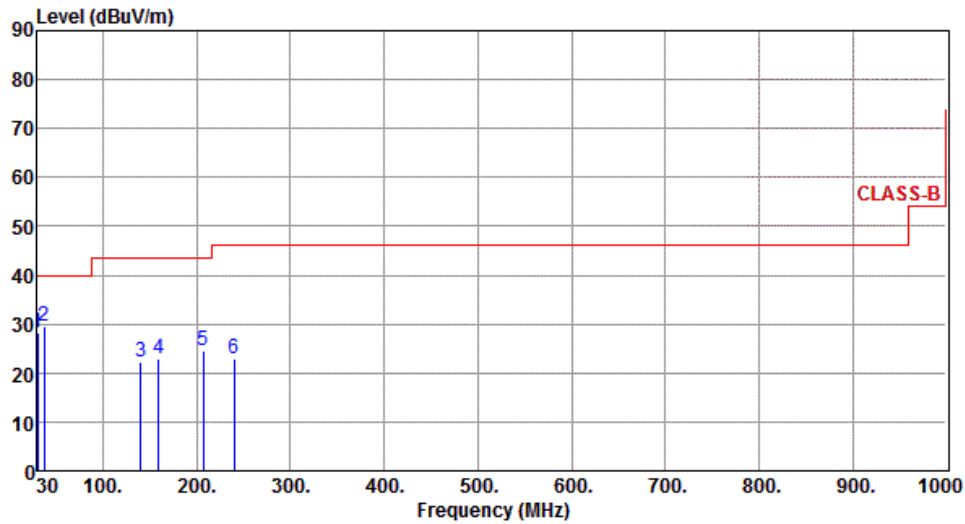
Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Vertical		
Level (dBuV/m) </			

Test Configuration 2: Adapter LONG.X.C

4.2.6 Receiver Radiated Unwanted Emissions

Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Horizontal		
 			

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	30.52	28.11	40.00	-11.89	37.76	-9.65	Peak	---	---
2	37.55	29.42	40.00	-10.58	38.35	-8.93	Peak	---	---
3	140.42	22.11	43.50	-21.39	30.97	-8.86	Peak	---	---
4	159.00	22.88	43.50	-20.62	31.20	-8.32	Peak	---	---
5	207.44	24.63	43.50	-18.87	36.70	-12.07	Peak	---	---
6	240.17	22.96	46.00	-23.04	33.14	-10.18	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.

5 Test laboratory information

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

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

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

Linkou

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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 District, Tao Yuan City
333, Taiwan, R.O.C.

Kwei Shan Site II

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd
St., Kwei Shan District, Tao Yuan
City 333, Taiwan, R.O.C.

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

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Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

==END==