

FCC C2PC Test Report

FCC ID : SQG-WB50NBT
Equipment : Wireless 802.11abgn + BT4.1 intelligent module
Model No. : WB50NBT
Brand Name : Laird Connectivity
Applicant : Laird Connectivity
Address : W66N220 Commerce Court, Cedarburg, Wisconsin 53012, USA
Standard : 47 CFR FCC Part 15.247
Received Date : Apr. 02, 2020
Tested Date : Jun. 01 ~ Jun. 04, 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.

Reviewed by:


Along Chen / Assistant Manager

Approved by:


Gary Chang / Manager



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Release Record

Report No.	Version	Description	Issued Date
FR631002-07AD	Rev. 01	Initial issue	Jun. 29, 2020

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	Conducted Emissions	[dBuV]: 0.350MHz 36.40 (Margin -12.56dB) - AV	Pass
15.247(d) 15.209	Radiated Emissions	[dBuV/m at 3m]: 263.77MHz 42.24 (Margin -3.76dB) - PK	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

This is a Class II Permissive Change report (C2PC).

This report is issued as a supplementary report to the original project no. FR631002AD. The modification is concerned with adding new antennas. Therefore, conducted emission and radiated emission tests were performed for this C2PC.

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 (New set of antennas were marked in boldface.)

Ant. No.	Model	Type	Connector	Operating Frequencies (MHz) / Antenna Gain (dBi)				
				2400~2483.5	5150~5250	5250~5350	5470~5725	5725~5850
1	Laird MAF94051	Dipole	RP-SMA	2.1	2.4	2.6	3.4	3.4
2	Laird NanoBlade-IP04	PCB Dipole	IPEX MHF	2	3.9	3.9	4	4
3	Laird MAF95310 Mini NanoBlade Flex	PCB Dipole	IPEX MHF	2.79	3.38			
4	Laird NanoBlue-IP04	PCB Dipole	IPEX MHF	2	---	---	---	---
5	Ethertronics WLAN_1000146	Isolated Magnetic Dipole	IPEX MHF	2.5	3.5			
6	Ethertronics 1004450	PCB Dipole	U.FI	1.3	2.69	2.69	2	1.9
7	Ethertronics 1004788	Dipole	U.FI	2.2	2.7			
8	Ethertronics 1004791	Dipole	U.FI	1.8	2.6			

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	3.3Vdc from host
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1.1.4 Accessories

N/A

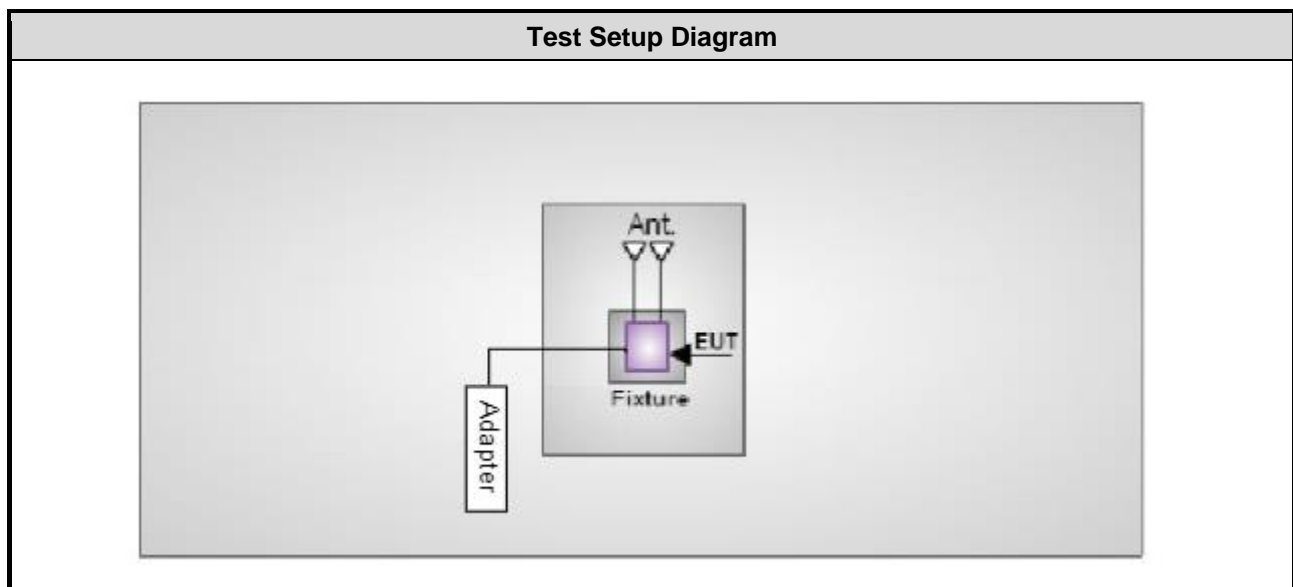
1.1.5 Channel List

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	---	---

1.2 Local Support Equipment List

Support Equipment List						
No.	Equipment	Brand	Model	S/N	FCC ID	Remarks
1	Notebook	DELL	Latitude E6430	9ZFB4X1	DoC	---
2	Fixture	---	---	---	---	Provided by applicant
3	Adapter	OEM	ADS0128-W 120100	---	---	Provided by applicant

1.3 Test Setup Chart



Note: The support notebook was disconnected from EUT and removed from test table when EUT is set to transmit continuously.

1.4 The Equipment List

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Tested Date	Jun. 04, 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 chamber 3 / (03CH03-WS)				
Tested Date	Jun. 01, 2020				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101499	Jan. 09, 2020	Jan. 08, 2021
Receiver	R&S	ESR3	101657	Feb. 14, 2020	Feb. 13, 2021
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	Apr. 29, 2020	Apr. 28, 2021
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Dec. 27, 2019	Dec. 26, 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	980187	Aug. 14, 2019	Aug. 13, 2020
Preamplifier	Agilent	83017A	MY53270014	Aug. 07, 2019	Aug. 06, 2020
Preamplifier	EMC	EMC184045B	980192	Aug. 01, 2019	Jul. 31, 2020
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Sep. 27, 2019	Sep. 26, 2020
RF cable-8M	EMC	EMC104-SM-SM-8000	181107	Sep. 27, 2019	Sep. 26, 2020
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Sep. 27, 2019	Sep. 26, 2020
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Sep. 27, 2019	Sep. 26, 2020
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Sep. 27, 2019	Sep. 26, 2020
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Sep. 27, 2019	Sep. 26, 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 15.247

ANSI C63.10-2013

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

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
AC conducted emission	± 2.92 dB
Radiated emission ≤ 1 GHz	± 3.96 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	25°C / 62%	Alex Tsai
Radiated Emissions	03CH03-WS	24°C / 64% 20°C / 64%	Brad Wu Aska Huang

- FCC Designation No.: TW0009
- FCC site registration No.: 207696
- ISSED#: 10807A
- CAB identifier: TW2732

2.2 Testing Facility

Test Laboratory	International Certification Corp.
Test Site	CO01-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.
Test Site	03CH03-WS
Address of Test Site	No. 14-1, Lane 19, 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 (Mbps)	Test Configuration
Conducted Emissions Radiated Emissions ≤ 1GHz	GFSK	2441	1Mbps	-
Radiated Emissions > 1GHz	GFSK 8DPSK	2402, 2441, 2480 2402, 2441, 2480	1Mbps 3Mbps	-

NOTE:

1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **Z-plane** results were found as the worst case and were shown in this report.
2. The antennas (1004788 & 1004791) are used for final testing for this module: (See item 1.1.2 for more details.)

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

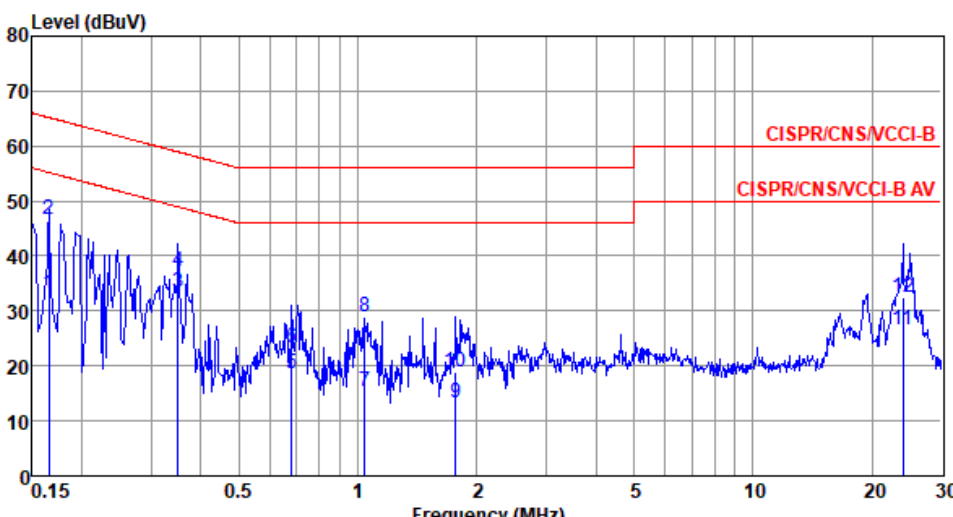
3.1.3 Test Setup



- 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

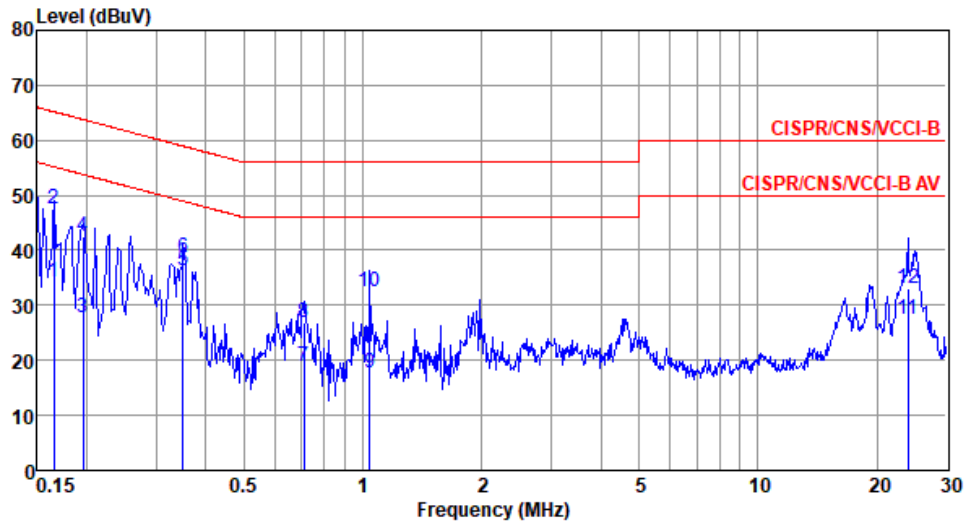
Modulation Mode	GFSK	Test Freq. (MHz)	2441
Power Phase	Line		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.165	33.13	55.21	-22.08	23.27	9.64	0.05	Average
2	0.165	46.53	65.21	-18.68	36.67	9.64	0.05	QP
3*	0.350	33.29	48.96	-15.67	23.34	9.63	0.08	Average
4	0.350	37.06	58.96	-21.90	27.11	9.63	0.08	QP
5	0.679	18.65	46.00	-27.35	8.63	9.63	0.10	Average
6	0.679	23.23	56.00	-32.77	13.21	9.63	0.10	QP
7	1.043	15.31	46.00	-30.69	5.24	9.63	0.12	Average
8	1.043	29.02	56.00	-26.98	18.95	9.63	0.12	QP
9	1.772	13.32	46.00	-32.68	3.17	9.64	0.17	Average
10	1.772	19.04	56.00	-36.96	8.89	9.64	0.17	QP
11	24.015	26.69	50.00	-23.31	15.64	9.67	0.70	Average
12	24.015	32.55	60.00	-27.45	21.50	9.67	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).

Modulation Mode	GFSK	Test Freq. (MHz)	2441
Power Phase	Neutral		



	Freq MHz	Level dBuV	Limit Line dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Remark
1	0.165	34.20	55.21	-21.01	24.36	9.66	0.05	Average
2	0.165	47.54	65.21	-17.67	37.70	9.66	0.05	QP
3	0.195	27.60	53.80	-26.20	17.74	9.65	0.06	Average
4	0.195	42.43	63.80	-21.37	32.57	9.65	0.06	QP
5*	0.350	36.40	48.96	-12.56	26.50	9.65	0.08	Average
6	0.350	38.53	58.96	-20.43	28.63	9.65	0.08	QP
7	0.708	18.84	46.00	-27.16	8.90	9.65	0.10	Average
8	0.708	26.92	56.00	-29.08	16.98	9.65	0.10	QP
9	1.043	17.75	46.00	-28.25	7.78	9.65	0.12	Average
10	1.043	32.61	56.00	-23.39	22.64	9.65	0.12	QP
11	24.015	27.37	50.00	-22.63	16.21	9.81	0.70	Average
12	24.015	33.07	60.00	-26.93	21.91	9.81	0.70	QP

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

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:

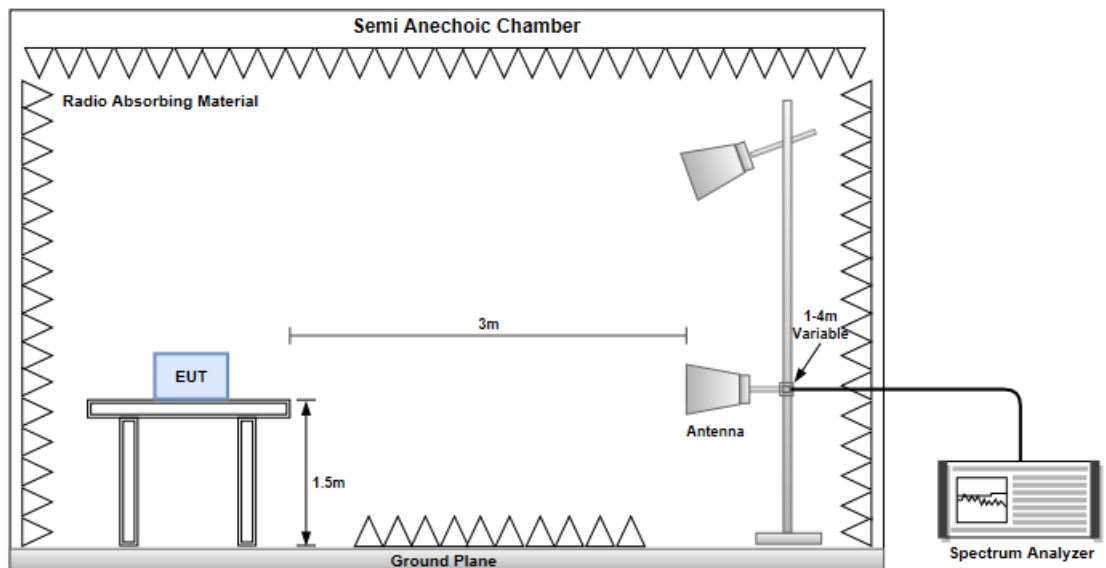
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. Radiated emission above 1GHz / Peak value
RBW=1MHz, VBW=3MHz and Peak detector
Radiated emission above 1GHz / Average value for harmonics and band edge emitted from 2480 MHz
The average value 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

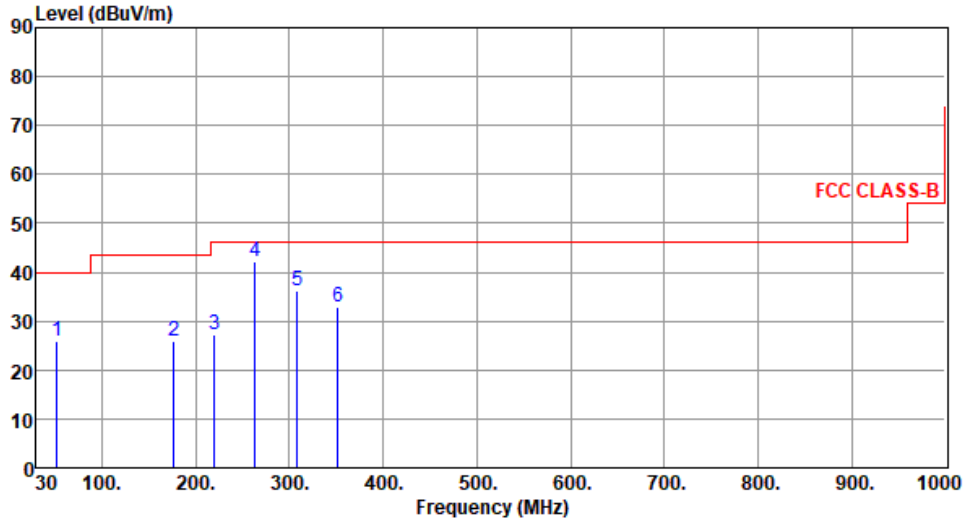


Radiated Emissions above 1 GHz



3.2.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2441
Polarization	Horizontal		



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

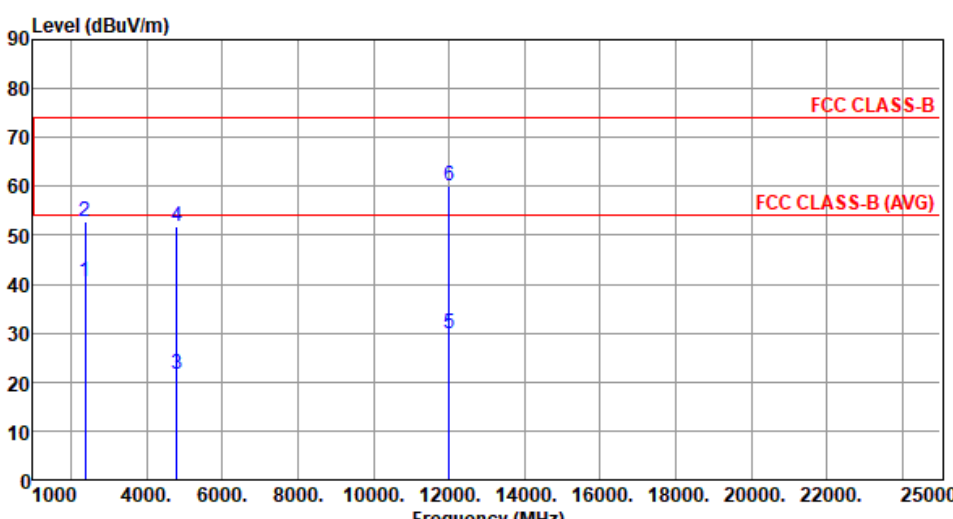
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	52.31	26.01	40.00	-13.99	34.94	-8.93	Peak	---	---
2	176.47	25.85	43.50	-17.65	35.81	-9.96	Peak	---	---
3	220.12	27.34	46.00	-18.66	39.73	-12.39	Peak	---	---
4	263.77	42.24	46.00	-3.76	51.98	-9.74	Peak	---	---
5	308.39	36.26	46.00	-9.74	44.48	-8.22	Peak	---	---
6	352.04	32.90	46.00	-13.10	40.10	-7.20	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
 *Factor includes antenna factor , cable loss and amplifier gain
 Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
 Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Modulation	GFSK		Test Freq. (MHz)		2441	
Polarization	Vertical					
<div><div><div>Level (dBuV/m)</div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div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3.2.5 Transmitter Radiated Unwanted Emissions (Above 1GHz) for GFSK

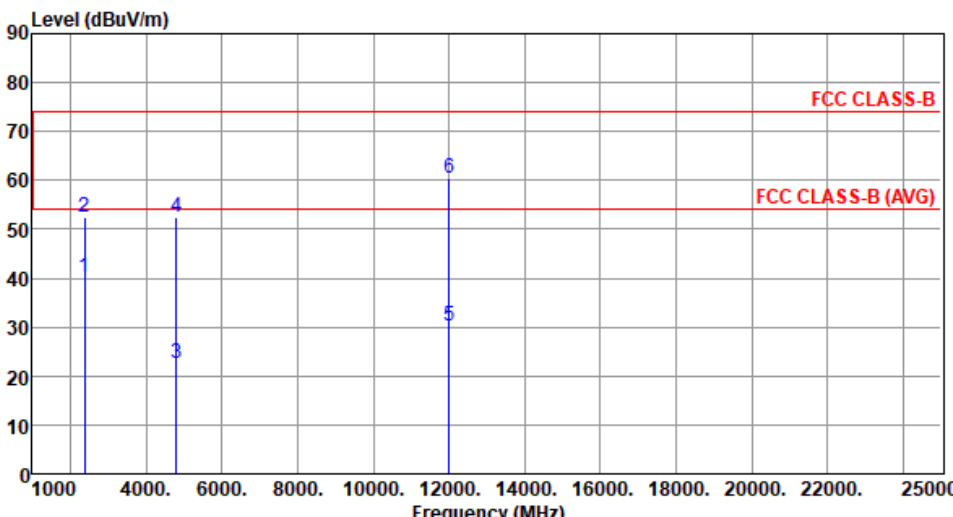
Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Horizontal		



	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	40.39	54.00	-13.61	40.15	0.24	Average	255	3
2	2390.00	52.76	74.00	-21.24	52.52	0.24	Peak	255	3
3	4804.00	21.66	54.00	-32.34	15.23	6.43	Average	150	195
4	4804.00	51.76	74.00	-22.24	45.33	6.43	Peak	150	195
5	12010.00	29.86	54.00	-24.14	13.80	16.06	Average	100	41
6	12010.00	59.96	74.00	-14.04	43.90	16.06	Peak	100	41

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).

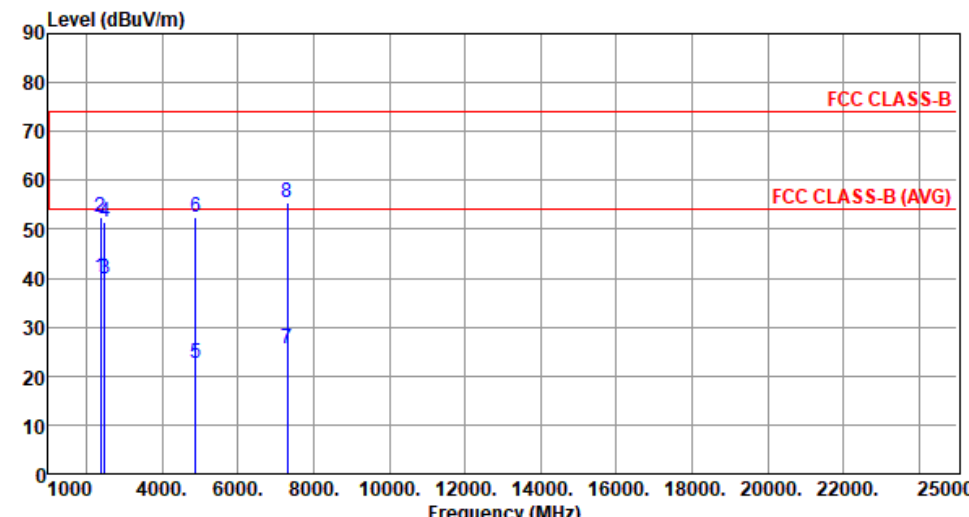
Modulation	GFSK	Test Freq. (MHz)	2402
Polarization	Vertical		



	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	40.04	54.00	-13.96	39.80	0.24	Average	102	28
2	2390.00	52.31	74.00	-21.69	52.07	0.24	Peak	102	28
3	4804.00	22.44	54.00	-31.56	16.01	6.43	Average	129	355
4	4804.00	52.54	74.00	-21.46	46.11	6.43	Peak	129	355
5	12010.00	30.19	54.00	-23.81	14.13	16.06	Average	100	24
6	12010.00	60.29	74.00	-13.71	44.23	16.06	Peak	100	24

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).

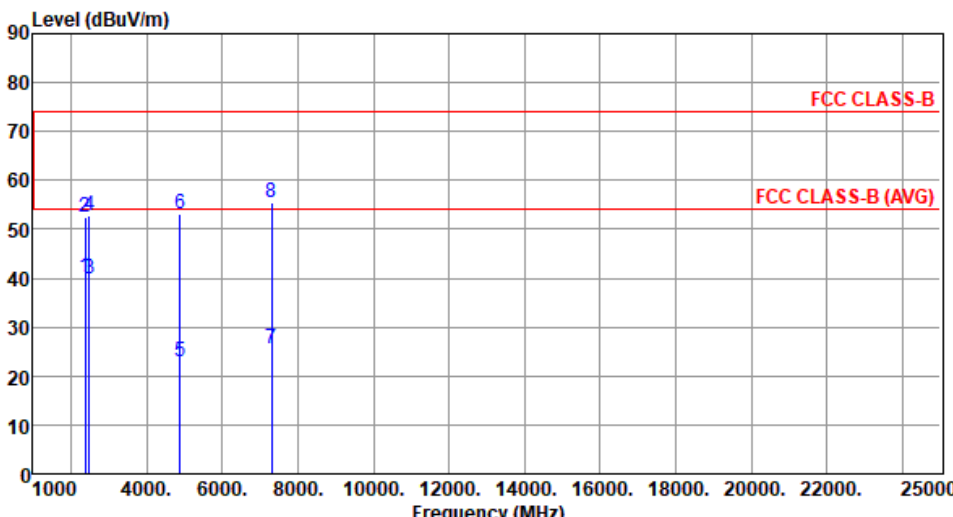
Modulation	GFSK	Test Freq. (MHz)	2441
Polarization	Horizontal		



	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	40.28	54.00	-13.72	40.04	0.24	Average	255	26
2	2390.00	52.36	74.00	-21.64	52.12	0.24	Peak	255	26
3	2483.50	39.88	54.00	-14.12	39.63	0.25	Average	255	26
4	2483.50	51.56	74.00	-22.44	51.31	0.25	Peak	255	26
5	4880.00	22.44	54.00	-31.56	15.98	6.46	Average	145	186
6	4880.00	52.54	74.00	-21.46	46.08	6.46	Peak	145	186
7	7320.00	25.48	54.00	-28.52	13.71	11.77	Average	100	35
8	7320.00	55.58	74.00	-18.42	43.81	11.77	Peak	100	35

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).

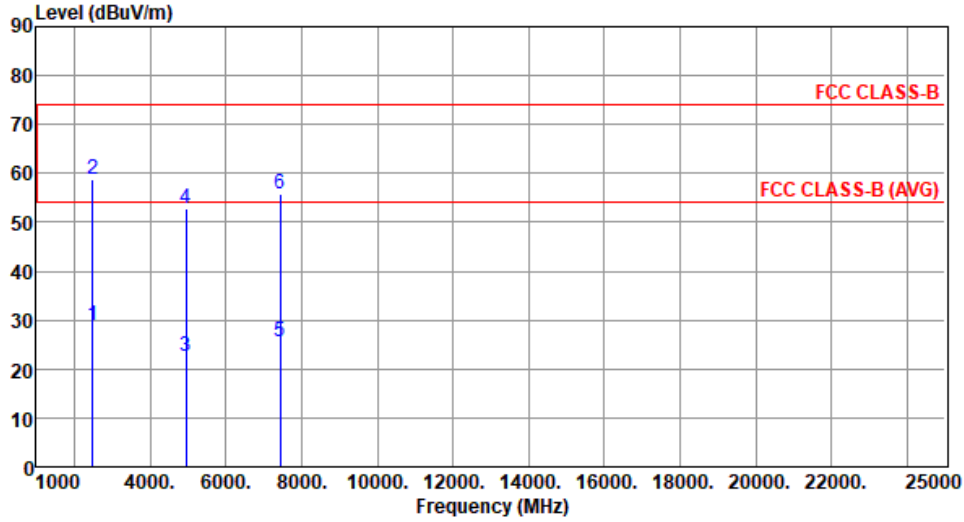
Modulation	GFSK	Test Freq. (MHz)	2441
Polarization	Vertical		



	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	40.18	54.00	-13.82	39.94	0.24	Average	103	34
2	2390.00	52.49	74.00	-21.51	52.25	0.24	Peak	103	34
3	2483.50	39.74	54.00	-14.26	39.49	0.25	Average	103	34
4	2483.50	52.64	74.00	-21.36	52.39	0.25	Peak	103	34
5	4880.00	22.88	54.00	-31.12	16.42	6.46	Average	115	342
6	4880.00	52.98	74.00	-21.02	46.52	6.46	Peak	115	342
7	7320.00	25.51	54.00	-28.49	13.74	11.77	Average	100	48
8	7320.00	55.61	74.00	-18.39	43.84	11.77	Peak	100	48

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).

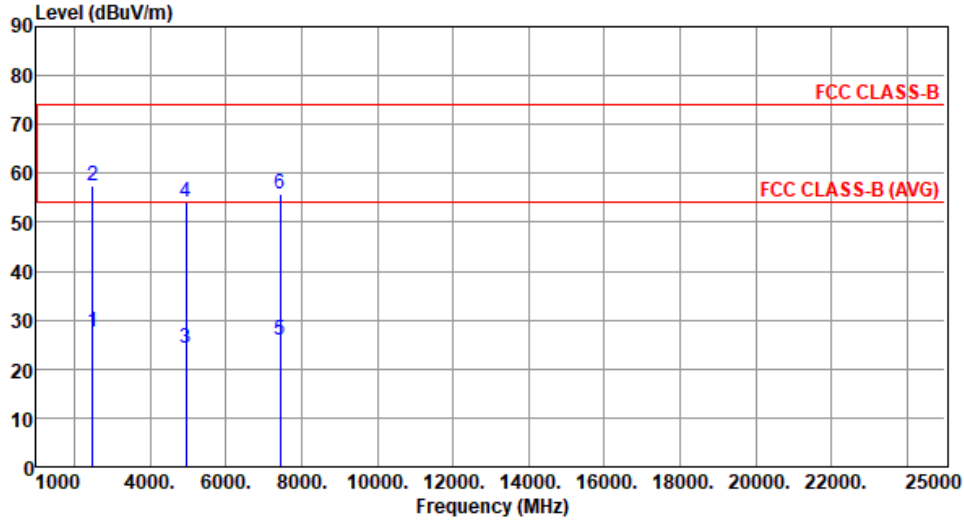
Modulation	GFSK	Test Freq. (MHz)	2480
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	28.82	54.00	-25.18	28.57	0.25	Average	243	3
2	2483.50	58.92	74.00	-15.08	58.67	0.25	Peak	243	3
3	4960.00	22.59	54.00	-31.41	15.91	6.68	Average	142	185
4	4960.00	52.69	74.00	-21.31	46.01	6.68	Peak	142	185
5	7440.00	25.66	54.00	-28.34	13.88	11.78	Average	100	24
6	7440.00	55.76	74.00	-18.24	43.98	11.78	Peak	100	24

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		

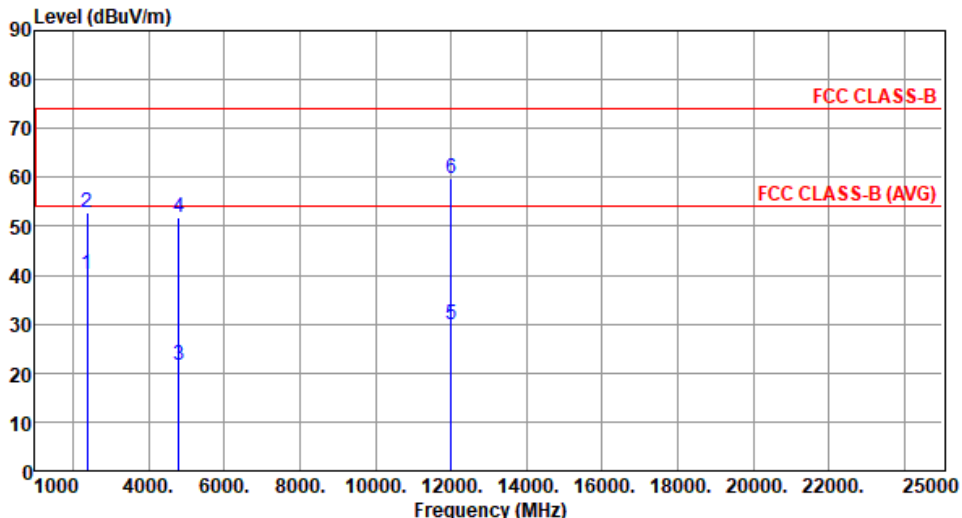


	Freq. MHz	Emission level dBUV/m	Limit dBUV/m	Margin dB	SA reading dBUV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	27.42	54.00	-26.58	27.17	0.25	Average	100	16
2	2483.50	57.52	74.00	-16.48	57.27	0.25	Peak	100	16
3	4960.00	24.19	54.00	-29.81	17.51	6.68	Average	125	348
4	4960.00	54.29	74.00	-19.71	47.61	6.68	Peak	125	348
5	7440.00	25.76	54.00	-28.24	13.98	11.78	Average	100	54
6	7440.00	55.86	74.00	-18.14	44.08	11.78	Peak	100	54

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

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

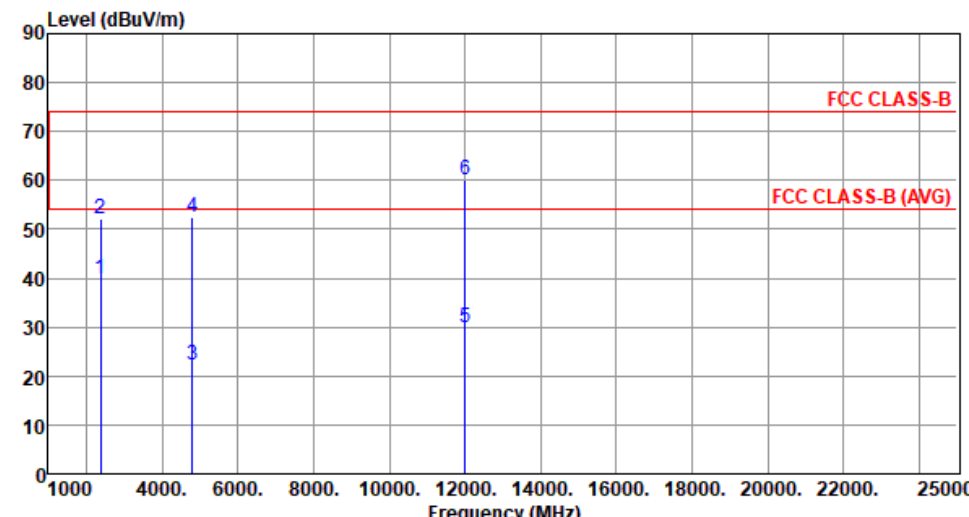
Modulation	8DPSK		Test Freq. (MHz)		2402	
Polarization	Horizontal					



	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	40.26	54.00	-13.74	40.02	0.24	Average	254	5
2	2390.00	52.68	74.00	-21.32	52.44	0.24	Peak	254	5
3	4804.00	21.66	54.00	-32.34	15.23	6.43	Average	144	185
4	4804.00	51.76	74.00	-22.24	45.33	6.43	Peak	144	185
5	12010.00	29.78	54.00	-24.22	13.72	16.06	Average	100	46
6	12010.00	59.88	74.00	-14.12	43.82	16.06	Peak	100	46

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).

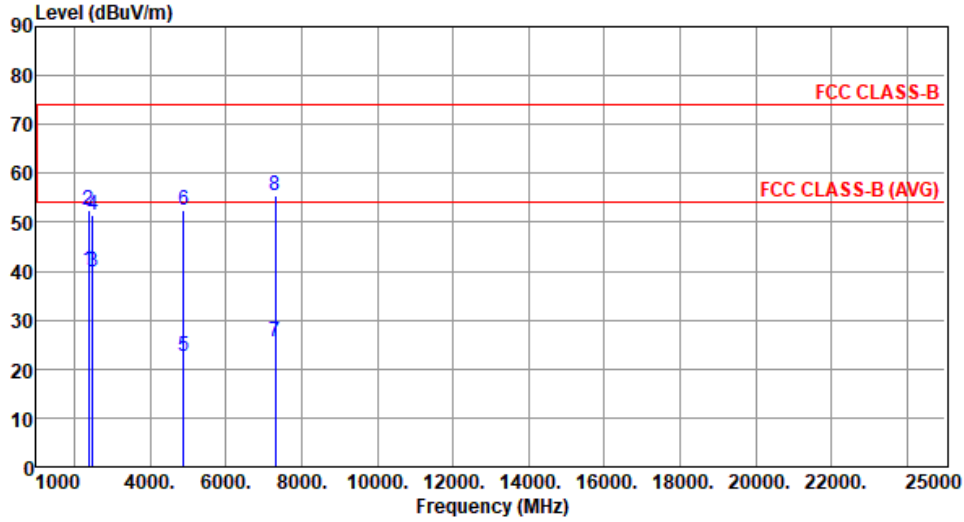
Modulation	8DPSK	Test Freq. (MHz)	2402
Polarization	Vertical		



	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	39.95	54.00	-14.05	39.71	0.24	Average	104	32
2	2390.00	52.24	74.00	-21.76	52.00	0.24	Peak	104	32
3	4804.00	22.36	54.00	-31.64	15.93	6.43	Average	129	355
4	4804.00	52.46	74.00	-21.54	46.03	6.43	Peak	129	355
5	12010.00	30.03	54.00	-23.97	13.97	16.06	Average	100	12
6	12010.00	60.13	74.00	-13.87	44.07	16.06	Peak	100	12

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).

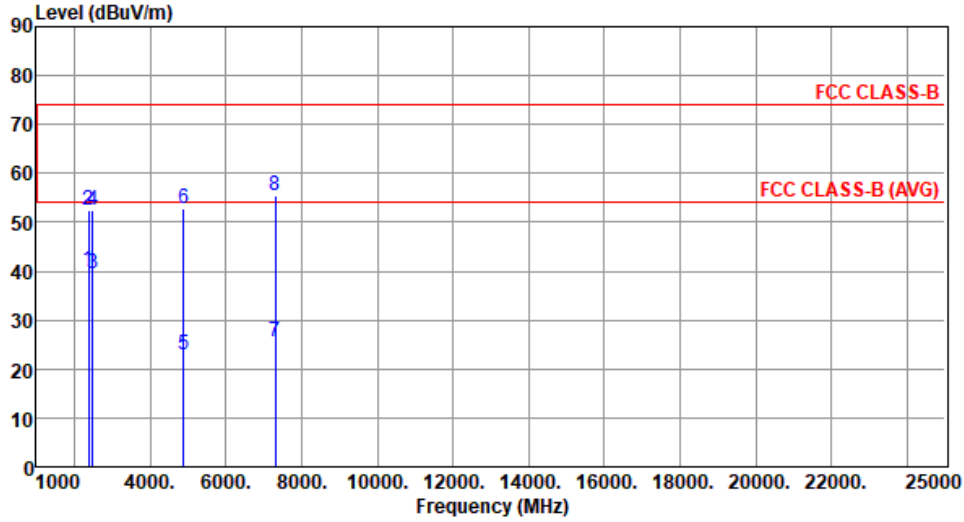
Modulation	8DPSK	Test Freq. (MHz)	2441
Polarization	Horizontal		



	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	40.11	54.00	-13.89	39.87	0.24	Average	254	26
2	2390.00	52.40	74.00	-21.60	52.16	0.24	Peak	254	26
3	2483.50	39.86	54.00	-14.14	39.61	0.25	Average	254	26
4	2483.50	51.59	74.00	-22.41	51.34	0.25	Peak	254	26
5	4880.00	22.44	54.00	-31.56	15.98	6.46	Average	141	196
6	4880.00	52.54	74.00	-21.46	46.08	6.46	Peak	141	196
7	7320.00	25.43	54.00	-28.57	13.66	11.77	Average	100	58
8	7320.00	55.53	74.00	-18.47	43.76	11.77	Peak	100	58

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

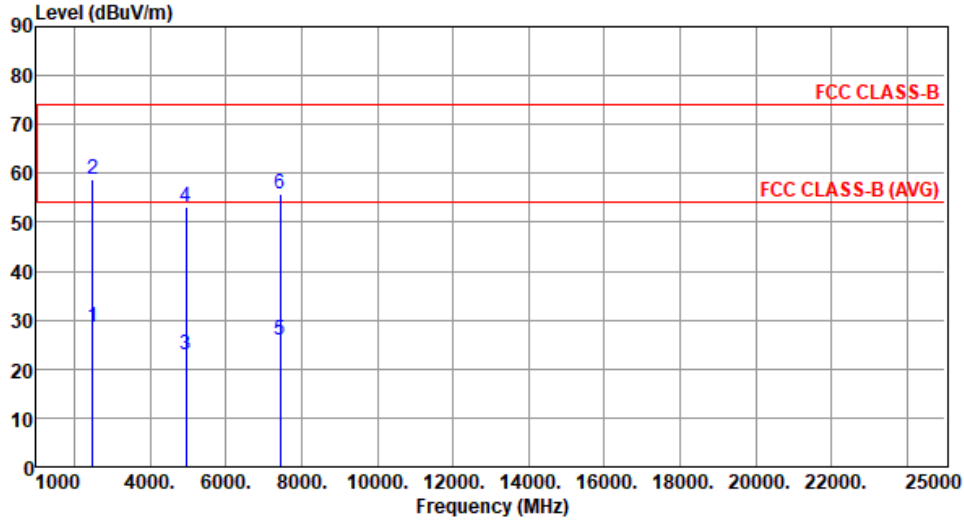
Modulation	8DPSK	Test Freq. (MHz)	2441
Polarization	Vertical		



	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	40.09	54.00	-13.91	39.85	0.24	Average	101	28
2	2390.00	52.36	74.00	-21.64	52.12	0.24	Peak	101	28
3	2483.50	39.68	54.00	-14.32	39.43	0.25	Average	101	28
4	2483.50	52.55	74.00	-21.45	52.30	0.25	Peak	101	28
5	4880.00	22.84	54.00	-31.16	16.38	6.46	Average	114	338
6	4880.00	52.94	74.00	-21.06	46.48	6.46	Peak	114	338
7	7320.00	25.49	54.00	-28.51	13.72	11.77	Average	100	66
8	7320.00	55.59	74.00	-18.41	43.82	11.77	Peak	100	66

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).

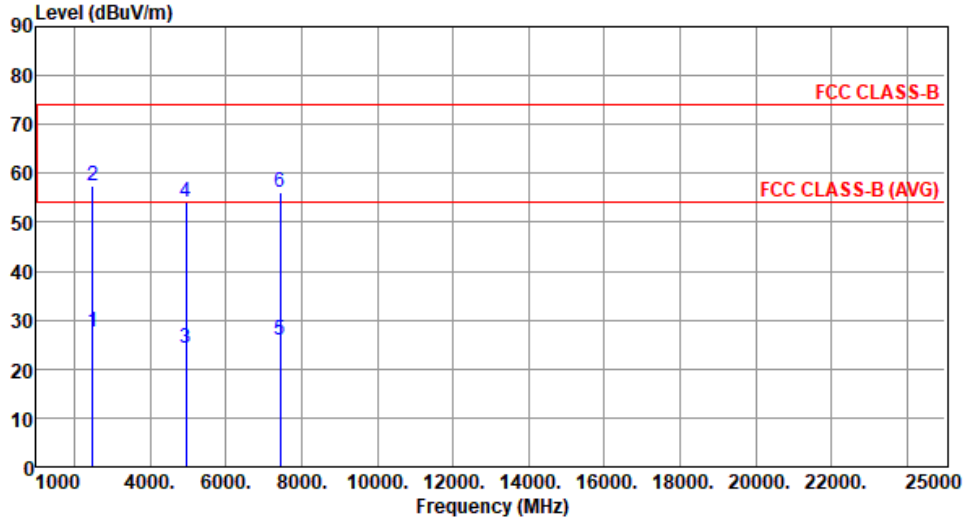
Modulation	8DPSK	Test Freq. (MHz)	2480
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	28.55	54.00	-25.45	28.30	0.25	Average	245	5
2	2483.50	58.65	74.00	-15.35	58.40	0.25	Peak	245	5
3	4960.00	23.05	54.00	-30.95	16.37	6.68	Average	140	188
4	4960.00	53.15	74.00	-20.85	46.47	6.68	Peak	140	188
5	7440.00	25.76	54.00	-28.24	13.98	11.78	Average	100	33
6	7440.00	55.86	74.00	-18.14	44.08	11.78	Peak	100	33

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	8DPSK	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	2483.50	27.48	54.00	-26.52	27.23	0.25	Average	100	21
2	2483.50	57.58	74.00	-16.42	57.33	0.25	Peak	100	21
3	4960.00	24.19	54.00	-29.81	17.51	6.68	Average	126	352
4	4960.00	54.29	74.00	-19.71	47.61	6.68	Peak	126	352
5	7440.00	25.90	54.00	-28.10	14.12	11.78	Average	100	44
6	7440.00	56.00	74.00	-18.00	44.22	11.78	Peak	100	44

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

3.2.7 Band edge Re-evaluation by DCCF for original configurations

Below configurations and peak values are from original report, report No.: FR631002AD.

This is to calculate average value by using DCCF method.

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:

$$20\log (\text{Duty cycle}) = 20\log \frac{1\text{s} / 1600 * 5}{100 \text{ ms}} = -30.1\text{dB}$$

Modulation: GFSK

Antenna Configuration	Frequency (MHz)	Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Pass / Fail
1 : MAF94051	2483.5	Horizontal	51.54(PK)	74	Pass
			21.44(AV)	54	Pass
		Vertical	53.96(PK)	74	Pass
			23.86(AV)	54	Pass
2: MAF95310 Mini NanoBlade Flex	2483.5	Horizontal	60.05(PK)	74	Pass
			29.95(AV)	54	Pass
		Vertical	55.93(PK)	74	Pass
			25.83(AV)	54	Pass
3 : WLAN_1000146	2483.5	Horizontal	55.49(PK)	74	Pass
			25.39(AV)	54	Pass
		Vertical	56.38(PK)	74	Pass
			26.28(AV)	54	Pass

Modulation: 8DPSK

Antenna Configuration	Frequency (MHz)	Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Pass / Fail
1 : MAF94051	2483.5	Horizontal	50.42(PK)	74	Pass
			20.32(AV)	54	Pass
		Vertical	52.84(PK)	74	Pass
			22.74(AV)	54	Pass
2: MAF95310 Mini NanoBlade Flex	2483.5	Horizontal	57.19(PK)	74	Pass
			27.09(AV)	54	Pass
		Vertical	54.20(PK)	74	Pass
			24.10(AV)	54	Pass
3 : WLAN_1000146	2483.5	Horizontal	54.75(PK)	74	Pass
			24.65(AV)	54	Pass
		Vertical	54.93(PK)	74	Pass
			24.83(AV)	54	Pass

4 Test laboratory information

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

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

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

Linkou

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No. 30-2, Ding Fwu Tsuen, Lin
Kou District, New Taipei City,
Taiwan, R.O.C.

Kwei Shan

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No. 3-1, Lane 6, Wen San 3rd St.,
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Kwei Shan Site II

Tel: 886-3-271-8640

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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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