TEST REPORT

Applicant:	Xiamen Paperang Technology Co.,Ltd.
Address of Applicant:	Room 3124,Xuanye Building,Pioneer Park,Xiamen Torch High-tech Zone,Fujian,China

Equipment Under Test (EUT)

Product Name:	Thermal Printer
Model No.:	C1S2, PAPERANG C1, C1C2, C1B2
Trade mark:	PAPERANG
FCC ID:	2APWO-C1S2
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of sample receipt:	23 Feb., 2022
Date of Test:	24 Feb., 2022~ 14 Mar., 2022
Date of report issued:	15 Mar., 2022
Test Result:	PASS *

* In the configuration tested, the EUT complied with the standards specified above.

1 Modified Information

Version No.	Date	Description
00	*15 Mar., 2022*	*Original*

Tested by: Raymon. Zheng **Date:** 15 Mar., 2022

Raymon Zheng/ Project Engineer

Reviewed by: **Date:** 15 Mar., 2022

Louis Ye/Manager

2 Contents

Page

3 Test Summary

Test Items	Section in CFR 47	Result
Antenna Requirement	15.203&15.247 (b)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(1)	Pass
20dB Occupied Bandwidth	15.247 (a)(1)	Pass
Carrier Frequencies Separation	15.247 (a)(1)	Pass
Hopping Channel Number	15.247 (a)(1)	Pass
Dwell Time	15.247 (a)(1)	Pass
Spurious Emission	15.205&15.209	Pass
Band Edge	15.247(d)	Pass

Remark:

1. *Pass: The EUT complies with the essential requirements in the standard.*
2. *N/A:Not Applicable.*
3. *The cable insertion loss used by "RF Output Power" and other conduction measurement items is 1dB (provided by the customer).*

Test Method:	*ANSI C63.10-2013* *KDB 558074 D01 15.247 Meas Guidance v05r02*

4 General Information

4.1 Client Information

Applicant:	Xiamen Paperang Technology Co.,Ltd.
Address:	Room 3124,Xuanye Building,Pioneer Park,Xiamen Torch High-tech Zone, Fujian,China
Manufacturer:	Xiamen Paperang Technology Co.,Ltd.
Address:	Room 3124,Xuanye Building,Pioneer Park,Xiamen Torch High-tech Zone, Fujian,China

4.2 General Description of E.U.T.

Product Name:	Thermal Printer
Model No.:	C1S2, PAPERANG C1, C1C2, C1B2
Operation Frequency:	2402MHz~2480MHz
Transfer rate:	1/2/3 Mbits/s
Number of channel:	79
Modulation type:	GFSK, π/4-DQPSK, 8DPSK
Modulation technology:	FHSS
Antenna Type:	PCB Antenna
Antenna gain:	0dBi
Power supply:	Battery
AC adapter:	N/A
Differences of series model:	Only the model name and appearance color are different between each model, others are the same, the difference does not affect the safety and electromagnetic compatibility performance of the product., so full tests were performed on the model C1S2.

Operation Frequency each of channel for GFSK, π/4-DQPSK, 8DPSK							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
2	2404MHz	22	2424MHz	42	2444MHz	62	2464MHz
3	2405MHz	23	2425MHz	43	2445MHz	63	2465MHz
4	2406MHz	24	2426MHz	44	2446MHz	64	2466MHz
5	2407MHz	25	2427MHz	45	2447MHz	65	2467MHz
…	…	…	…	…	…	…	…
15	2417MHz	35	2437MHz	55	2457MHz	75	2477MHz
16	2418MHz	36	2438MHz	56	2458MHz	76	2478MHz
17	2419MHz	37	2439MHz	57	2459MHz	77	2479MHz
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
19	2421MHz	39	2441MHz	59	2461MHz		
Remark: Channel 0, 39 &78 selected for GFSK, π/4-DQPSK and 8DPSK.							

4.3 Test environment and test mode

Operating Environment:	
Temperature:	22.5°C
Humidity:	55 % RH
Atmospheric Pressure:	1010 mbar
Test Modes:	
Non-hopping mode:	Keep the EUT in continuous transmitting mode with worst case data rate.
Hopping mode:	Keep the EUT in hopping mode.
Remark	GFSK (1 Mbps) is the worst case mode.
The sample was placed 0.8m (below 1GHz)/1.5m (above 1GHz) above the ground plane of 3m chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.	

4.4 Description of Support Units

The EUT has been tested as an independent unit.

4.5 Measurement Uncertainty

Parameters	Expanded Uncertainty
Radiated Emission (9kHz ~ 30MHz)	±2.5 dB (k=2)
Radiated Emission (30MHz ~ 1000MHz)	±4.1 dB (k=2)
Radiated Emission (1GHz ~ 18GHz)	±5.2 dB (k=2)

4.6 Additions to, deviations, or exclusions from the method

No

4.7 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

●**FCC - Designation No.: CN1279**

Jianyan Testing Group Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 892155.

●**ISED – CAB identifier.: CN0102**

Jianyan Testing Group Co., Ltd. has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements with ISED#:26114.

● **A2LA - Registration No.: 5568.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/5568-01.pdf

4.8 Laboratory Location

JianYan Testing Group Co.,Ltd.
Address: No.760, Fengling Road, Tong'an District, Xiamen, Fujian, China
Tel: +86-592-2273071, Fax:+86-592-2273700
Email: info-JYTee@lets.com, Website: http://www.lets.com/

4.9 Test Instruments list

Conducted Emission:					
Test Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
EMI Test Receiver	Rohde & Schwarz	ESR 3	102330	2021-07-29	2022-07-28
LISN	Rohde & Schwarz	ENV 216	102240	2021-07-29	2022-07-28
LISN	AFJ/Italy	LS16C\10	16012020470	2021-06-22	2022-06-21
EMI Test Software	Farad	EZ-EMC	Version: V.EMCE-3A1		

Radiated Emission:					
Test Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
EMI Test Receiver	Rohde & Schwarz	ESR 3	102329	2021-07-29	2022-07-28
Spectrum Analyzer	Rohde & Schwarz	FSV40-N	102175	2021-04-12	2022-04-11
BiConiLog Antenna	SCHWARZBECK	VULB 9163	1105	2021-12-05	2022-12-04
BiConiLog Antenna	SCHWARZBECK	VULB 9168	1066	2021-04-01	2022-03-31
Horn Antenna	SCHWARZBECK	BBHA 9120 D	911	2021-03-17	2022-03-16
Pre-amplifier	SCHWARZBECK	BBV9743	00009	2021-07-29	2022-07-28
Pre-amplifier	SCHWARZBECK	BBV9718C	00014	2021-04-01	2022-03-31
EMI Test Software	Farad	EZ-EMC	Version: V.EMCE-3A1		

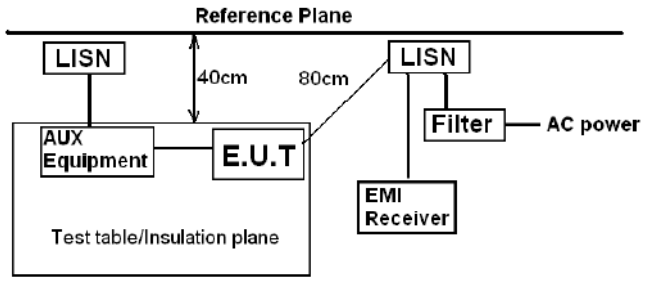
Conducted method For EN 300 328 Test System:					
Test Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
Signal Generator	Agilent	N5181	MY49060122	2021-04-12	2022-04-11
Signal Generator	Agilent	N5182A	MY51004823	2021-04-12	2022-04-11
Wideband Radio Communication Tester	R&S	CMW500	145852	2021-04-12	2022-04-11
Spectrum Analyzer	R&S	FSV40-N	102175	2021-04-12	2022-04-11
Test Software	MWRFTEST	MTS 8310	Version: 2.0.0.0		

5 Test results and measurement data

5.1 Antenna Requirement

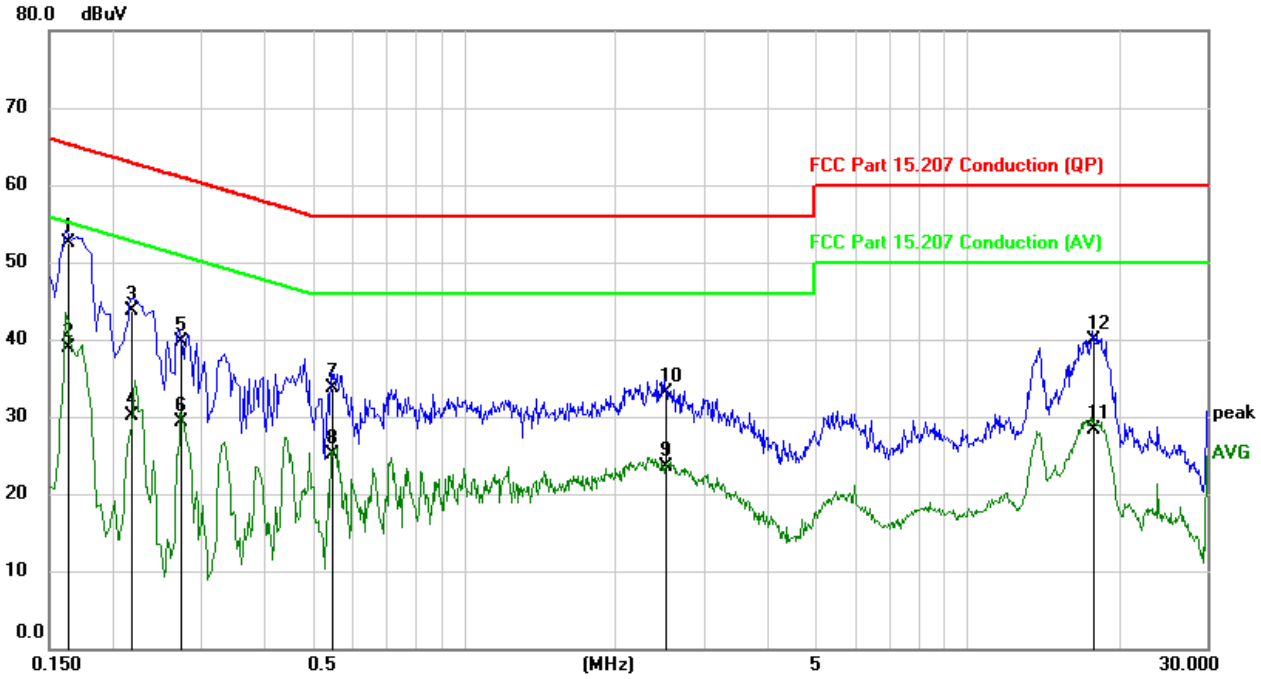
Standard requirement:	FCC Part15 C Section 15.203 &247(b)
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.247(b) (4) requirement: (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
E.U.T Antenna:	
The Bluetooth antenna is an Internal antenna which permanently attached, and the best case gain of the antenna is0dBi.	

5.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207		
Test Frequency Range:	150kHz to 30MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9kHz, VBW=30kHz, Sweep time=auto		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	* Decreases with the logarithm of the frequency.		
Test setup:	 *Remark:* *E.U.T: Equipment Under Test* *LISN: Line Impedence Stabilization Network* *Test table height=0.8m*		
Test procedure:	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network(L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10(latest version) on conducted measurement.		
Test Instruments:	Refer to section 4.9 for details		
Test mode:	Charging + BT Link.		
Test results:	Pass		

Measurement Data:

Product model:	C1S2	Test result:	pass
Test by:	Raymon Zheng	Test mode:	Mode 1
Test voltage:	120Vac, 60 Hz	Phase:	Line (N)
Environment:	Temp.: 22.3℃ Humi.: 46%		



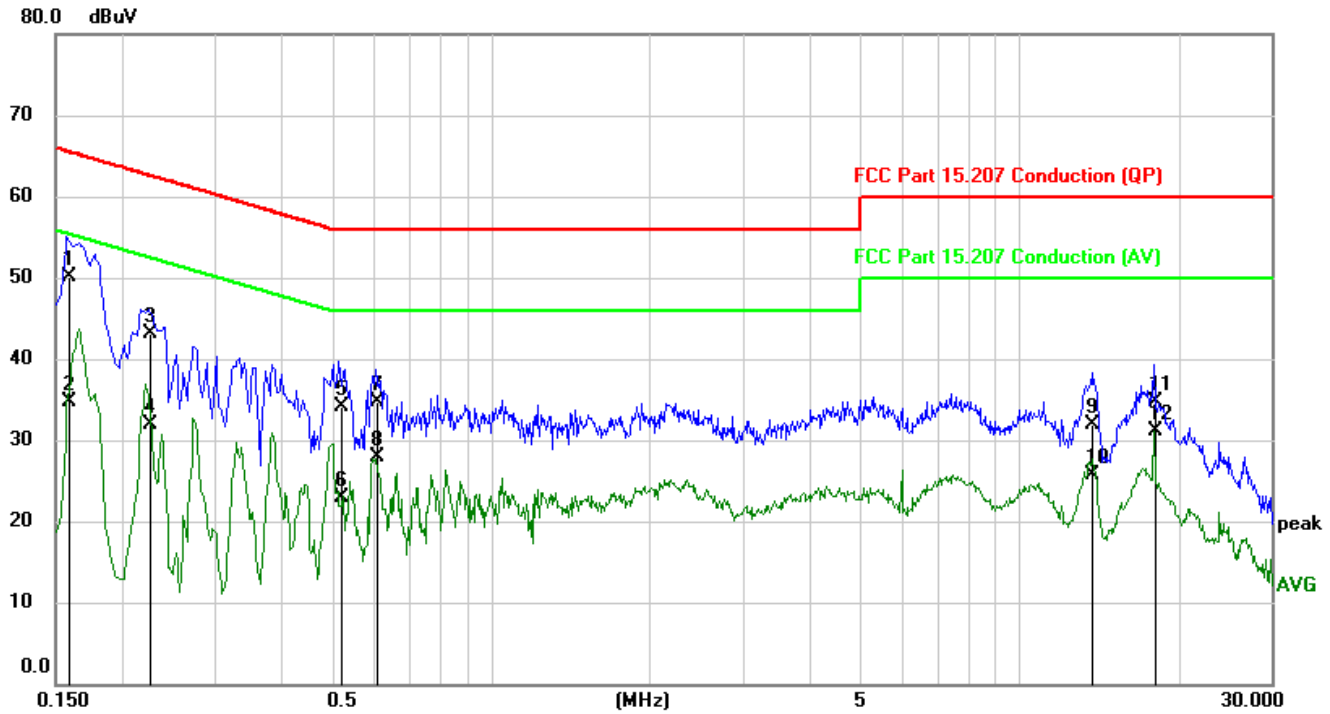
(Plot A:N Phase)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1626	42.79	9.64	52.43	65.33	-12.90	QP
2		0.1626	29.32	9.64	38.96	55.33	-16.37	AVG
3		0.2180	34.10	9.70	43.80	62.89	-19.09	QP
4		0.2180	20.50	9.70	30.20	52.89	-22.69	AVG
5		0.2740	29.94	9.72	39.66	61.00	-21.34	QP
6		0.2740	19.68	9.72	29.40	51.00	-21.60	AVG
7		0.5460	24.03	9.77	33.80	56.00	-22.20	QP
8		0.5460	15.43	9.77	25.20	46.00	-20.80	AVG
9		2.5059	13.74	9.86	23.60	56.00	-32.40	QP
10		2.5059	23.24	9.86	33.10	46.00	-12.90	AVG
11		17.8019	18.50	9.90	28.40	60.00	-31.60	QP
12	*	17.8019	30.00	9.90	39.90	50.00	-10.10	AVG

Notes:

1. *An initial pre-scan was performed on the line and neutral lines with peak detector.*
2. *Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.*
3. *Final Level =Receiver Read level + LISN Factor + Cable Loss.*

Product model:	C1S2	Test result:	pass
Test by:	Raymon Zheng	Test mode:	Mode 1
Test voltage:	120Vac, 60 Hz	Phase:	Line (L)
Environment:	Temp.: 22.3℃ Humi.: 46%		



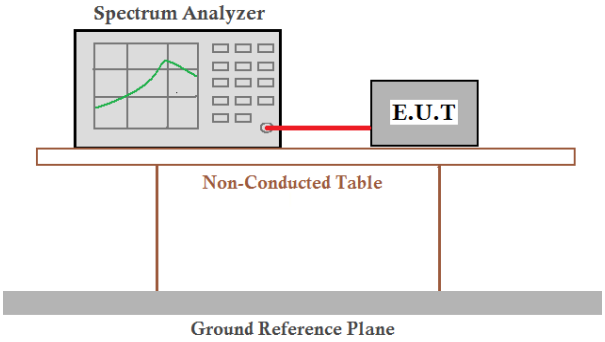
(Plot B:L Phase)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	*	0.1587	40.29	9.79	50.08	65.53	-15.45	QP
2		0.1587	25.01	9.79	34.80	55.53	-20.73	AVG
3		0.2265	33.42	9.75	43.17	62.58	-19.41	QP
4		0.2265	22.07	9.75	31.82	52.58	-20.76	AVG
5		0.5184	24.16	9.94	34.10	56.00	-21.90	QP
6		0.5184	12.95	9.94	22.89	46.00	-23.11	AVG
7		0.6060	24.80	9.87	34.67	56.00	-21.33	QP
8		0.6060	17.97	9.87	27.84	46.00	-18.16	AVG
9		13.7510	21.83	10.05	31.88	60.00	-28.12	QP
10		13.7510	15.63	10.05	25.68	50.00	-24.32	AVG
11		17.9994	24.55	10.06	34.61	60.00	-25.39	QP
12		17.9994	21.08	10.06	31.14	50.00	-18.86	AVG

Notes:

1. *An initial pre-scan was performed on the line and neutral lines with peak detector.*
2. *Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.*
3. *Final Level =Receiver Read level + LISN Factor + Cable Loss.*

Conducted Output Power

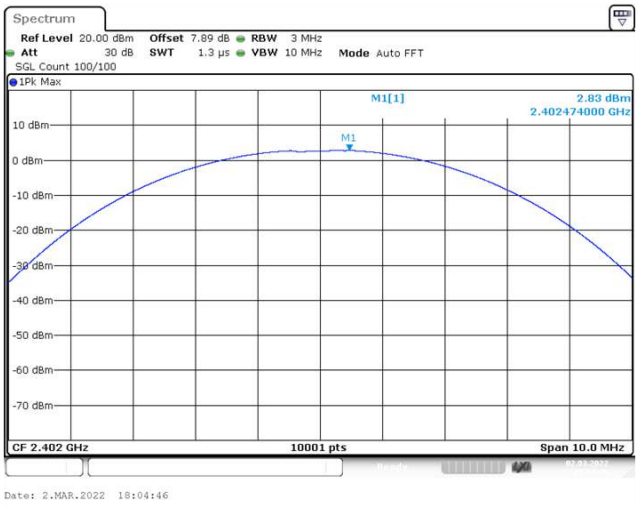
Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Receiver setup:	RBW=3MHz, VBW=10MHz, span=10MHz,Sweep time=auto couple. Detector=Peak ,Trace mode=max hold,Allow trace to fully stabilize.
Limit:	For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
Test setup:	
Test Instruments:	Refer to section 4.9 for details
Test mode:	Non-hopping mode
Test results:	Pass

Measurement Data:

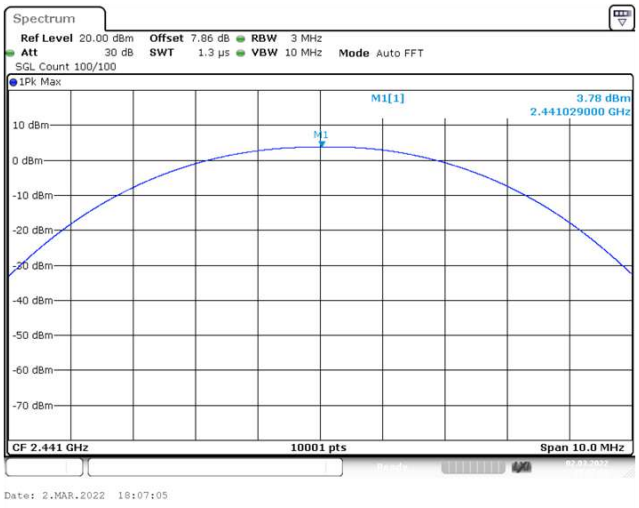
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
GFSK mode			
Lowest channel	2.830	21.00	Pass
Middle channel	3.785	21.00	Pass
Highest channel	5.971	21.00	Pass
π/4-DQPSK mode			
Lowest channel	2.774	21.00	Pass
Middle channel	3.691	21.00	Pass
Highest channel	5.359	21.00	Pass
8DPSK mode			
Lowest channel	2.745	21.00	Pass
Middle channel	3.562	21.00	Pass
Highest channel	5.804	21.00	Pass

Test plot as follows:

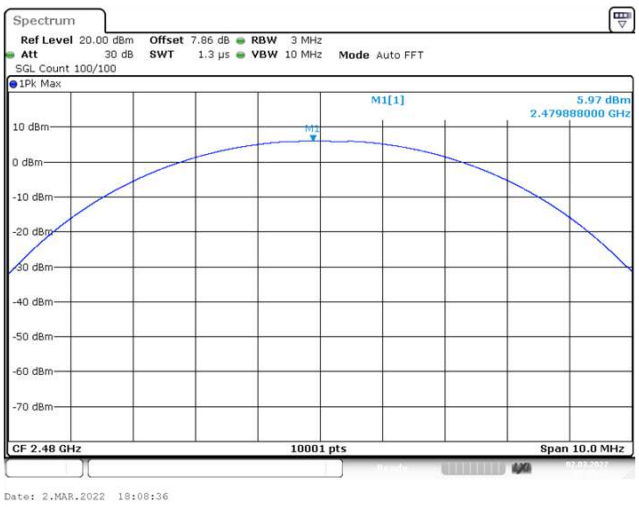
Modulation mode:GFSK



Lowest channel

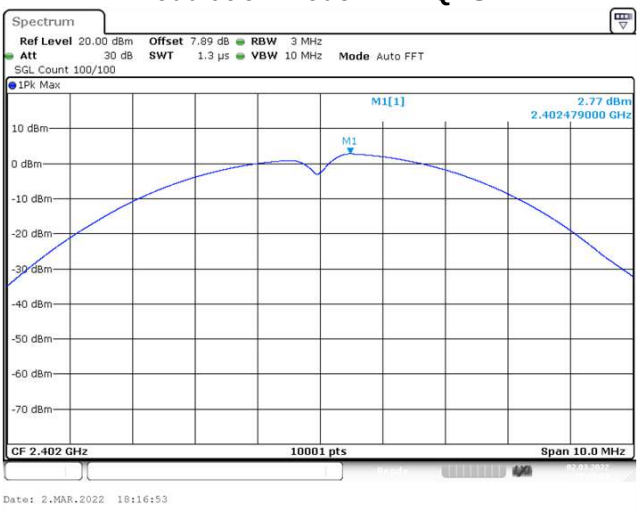


Middle channel

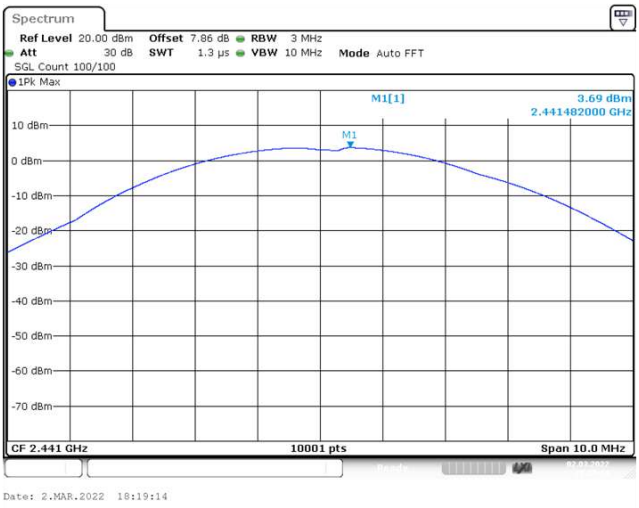


Highest channel

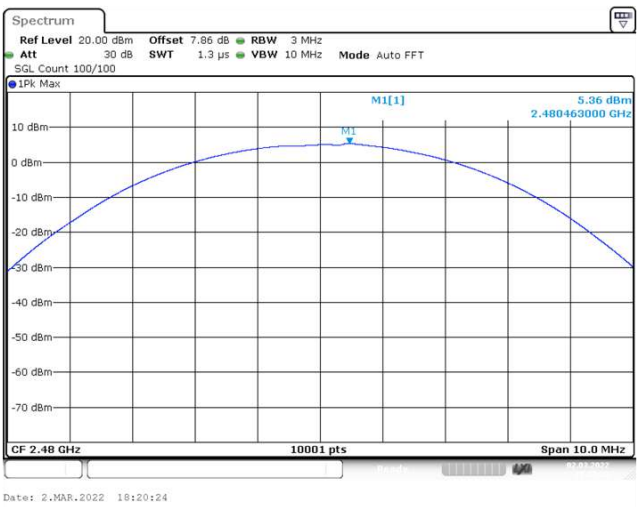
Modulation mode:π/4-DQPSK



Lowest channel

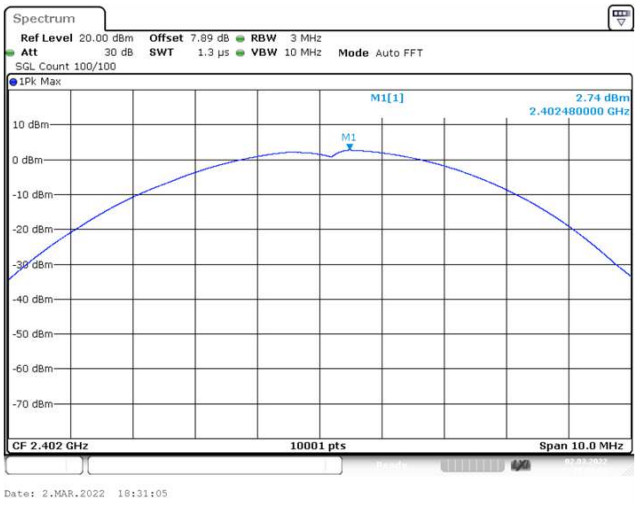


Middle channel

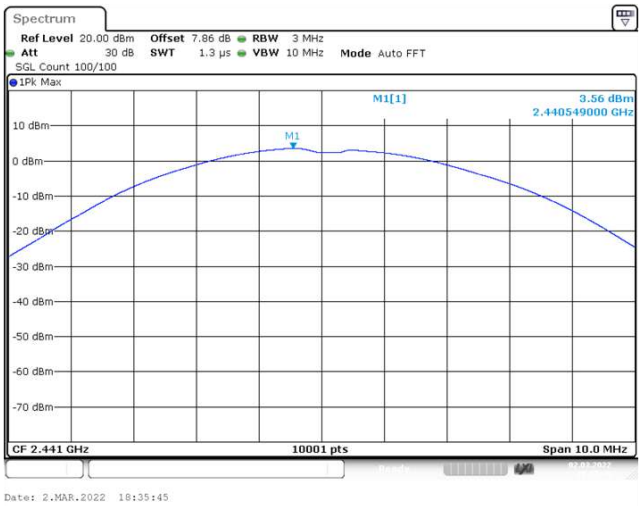


Highest channel

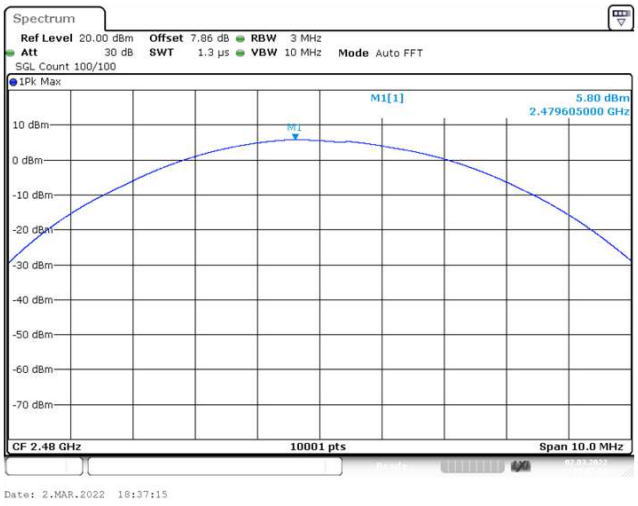
Modulation mode:8DPSK



Lowest channel



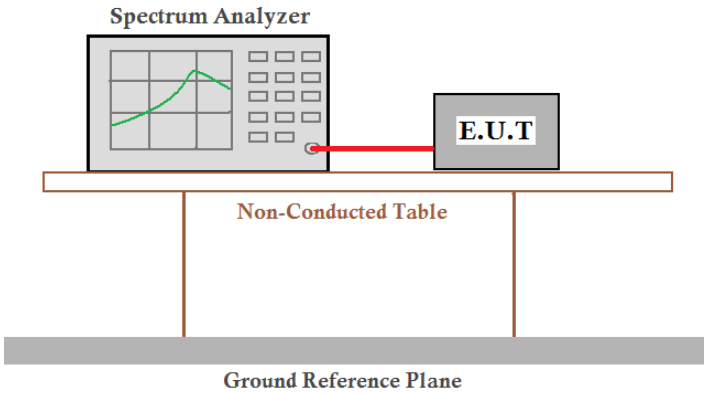
Middle channel



Highest channel

/

5.3 20dB Occupy Bandwidth

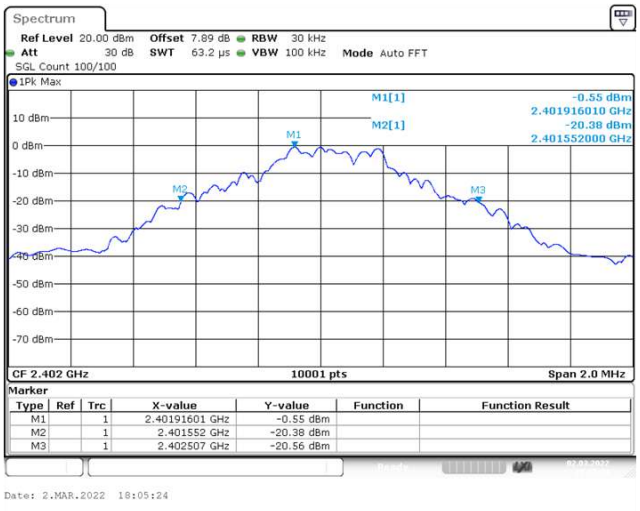
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Receiver setup:	RBW=30kHz, VBW=100kHz, detector=Peak
Limit:	N/A
Test setup:	
Test Instruments:	Refer to section 4.9 for details
Test mode:	Non-hopping mode
Test results:	Pass

Measurement Data:

Test channel	20dB Occupy Bandwidth (MHz)		
	GFSK	π/4-DQPSK	8DPSK
Lowest	0.955	1.358	1.311
Middle	0.944	1.385	1.388
Highest	0.884	1.261	1.272

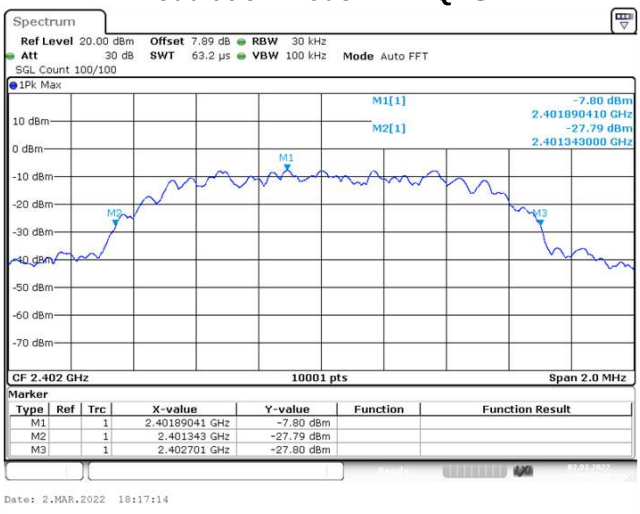
Test plot as follows:

Modulation mode:GFSK

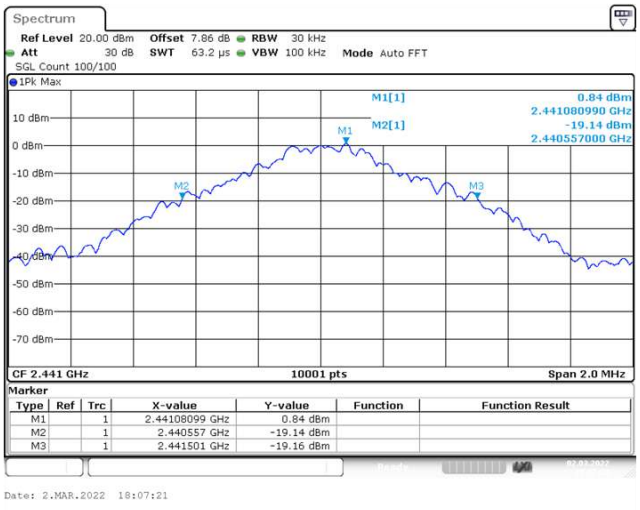


Lowest channel

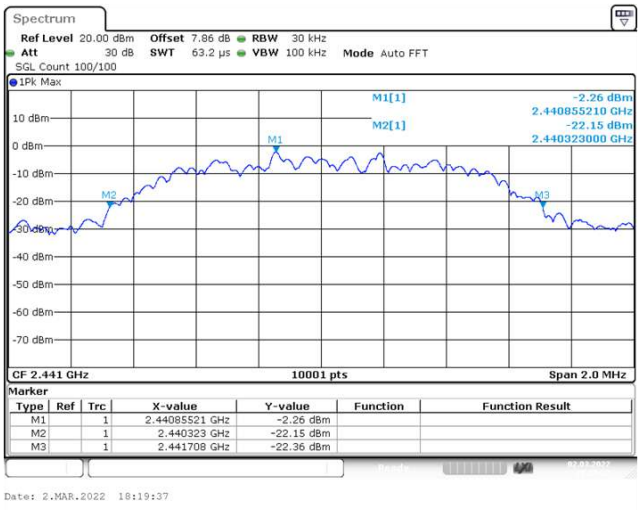
Modulation mode:π/4-DQPSK



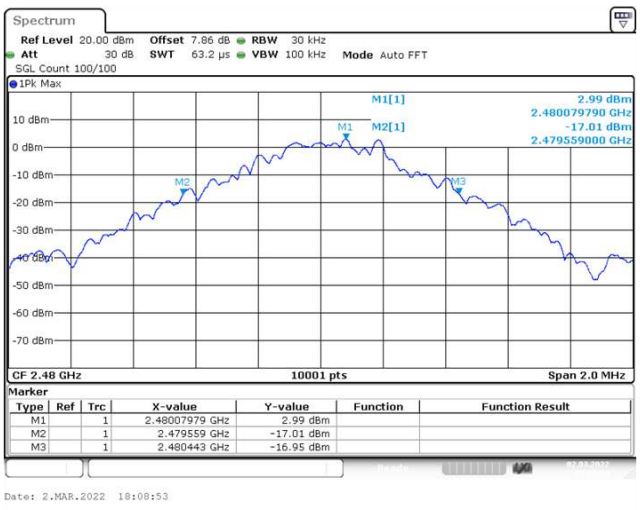
Lowest channel



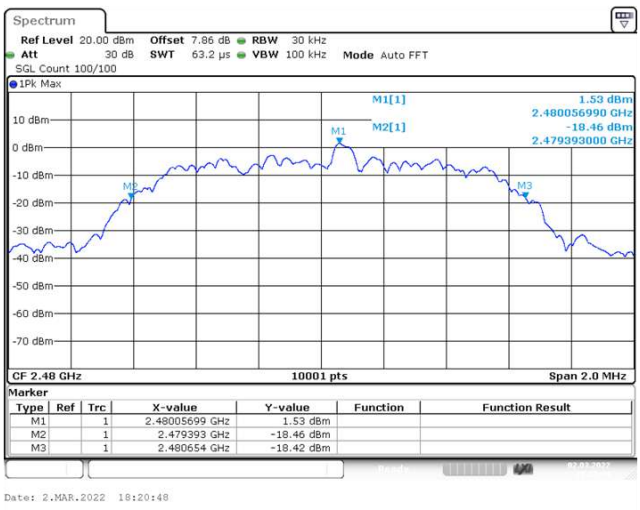
Middle channel



Middle channel

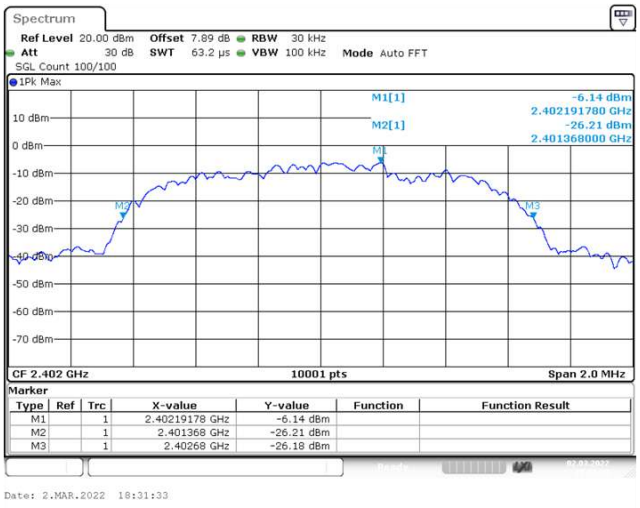


Highest channel

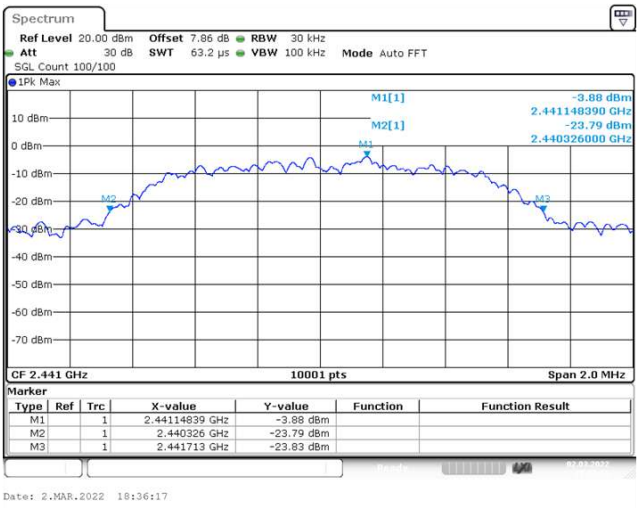


Highest channel

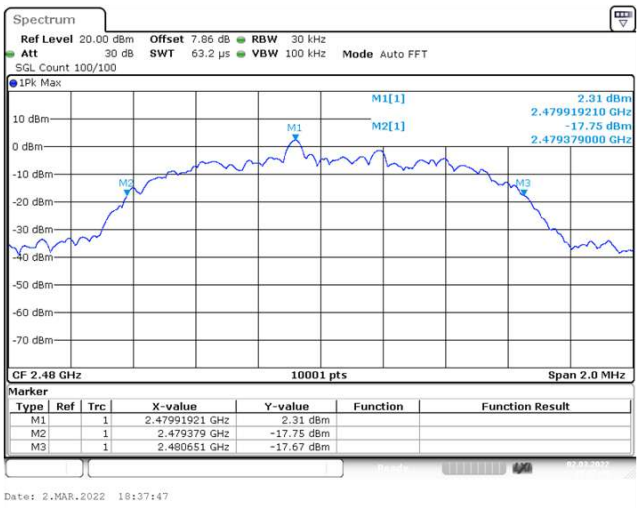
Modulation mode:8DPSK



Lowest channel

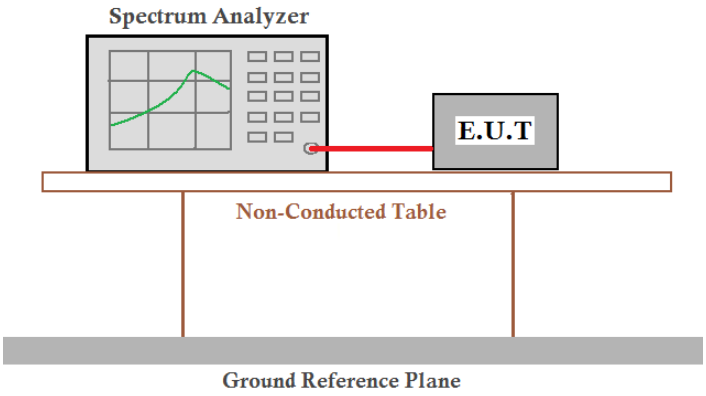


Middle channel



Highest channel

5.4 Carrier Frequencies Separation

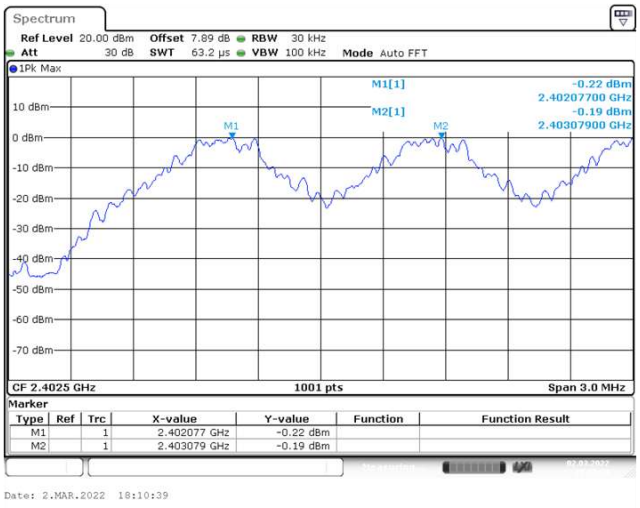
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Receiver setup:	RBW=100kHz, VBW=300kHz, detector=Peak
Limit:	0.025MHz or two-thirds of the 20dB bandwidth (whichever is greater)
Test setup:	
Test Instruments:	Refer to section 4.9 for details
Test mode:	Hopping mode
Test results:	Pass

Measurement Data:

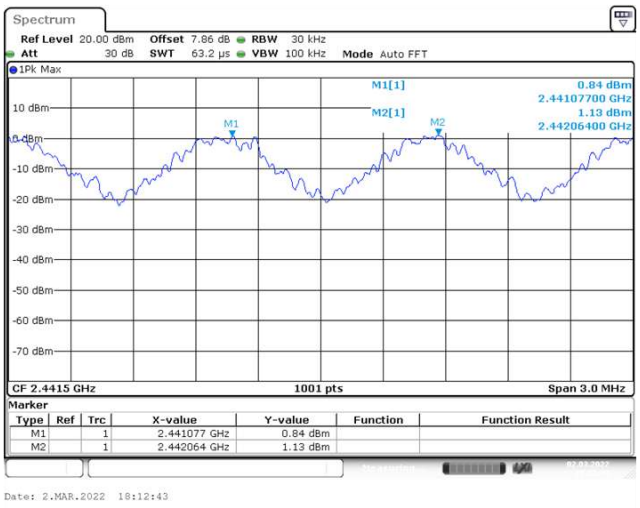
Measured Channel Numbers	Carrier Frequencies Separation (MHz)	20dB bandwidth (MHz)	Limit (MHz)	Result
GFSK				
0 and 1	1.002	0.955	0.637	Pass
39 and 40	0.987	0.944	0.629	Pass
77 and 78	1.017	0.884	0.589	Pass
π/4-DQPSK mode				
0 and 1	1.134	1.358	0.905	Pass
39 and 40	0.942	1.385	0.923	Pass
77 and 78	0.852	1.261	0.841	Pass
8DPSK mode				
0 and 1	1.002	1.311	0.874	Pass
39 and 40	1.152	1.388	0.925	Pass
77 and 78	0.852	1.272	0.848	Pass
Note 1:Min. Limit is equal to the two-thirds of the 20dB bandwidth				

Test plot as follows:

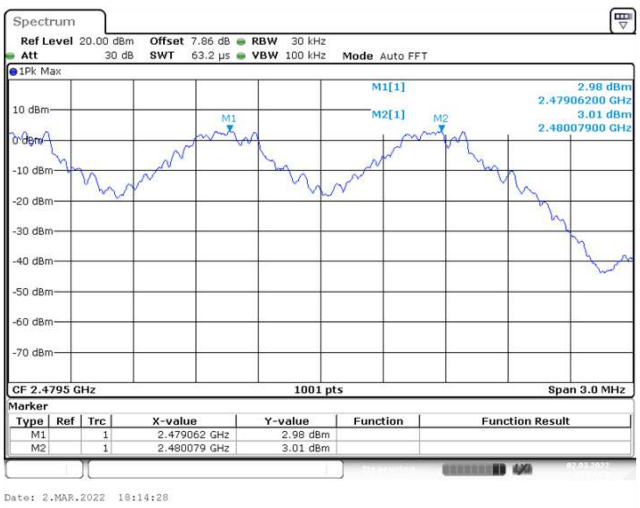
Modulation mode:GFSK



Lowest channel

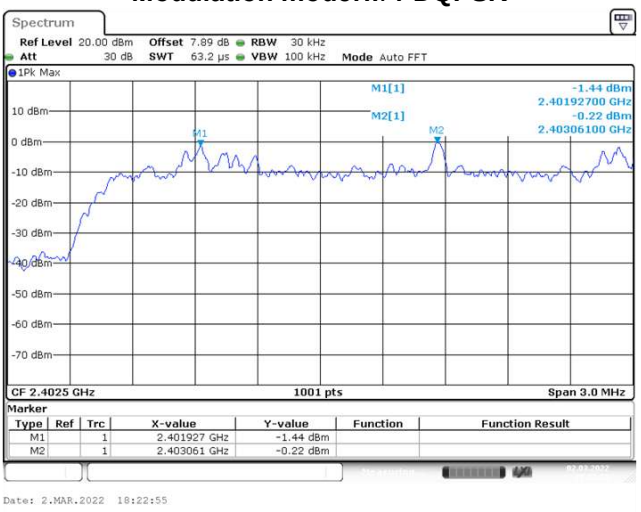


Middle channel

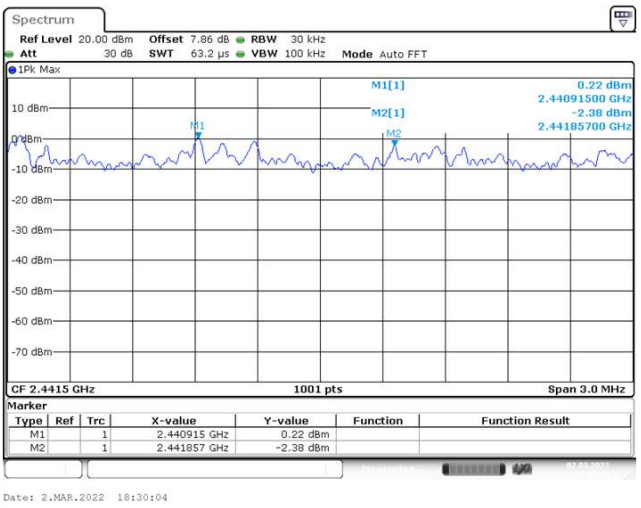


Highest channel

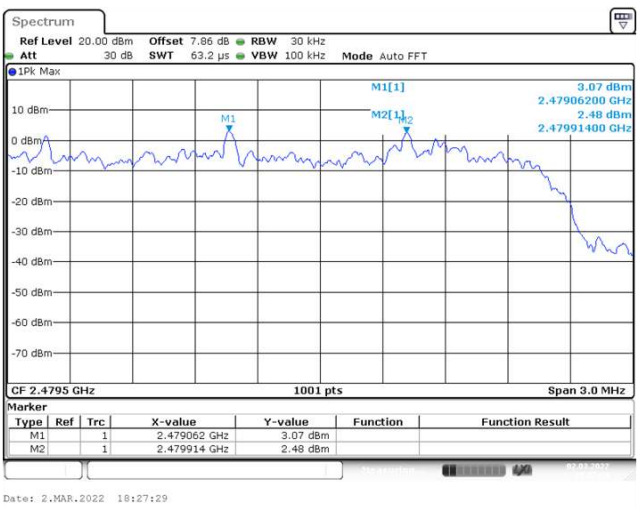
Modulation mode:π/4-DQPSK



Lowest channel

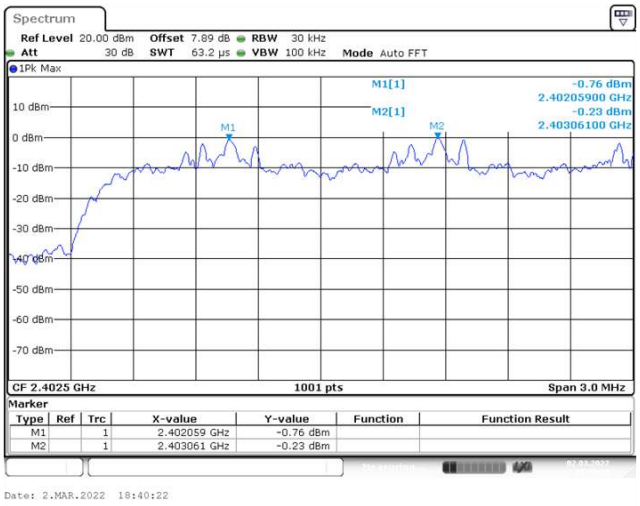


Middle channel

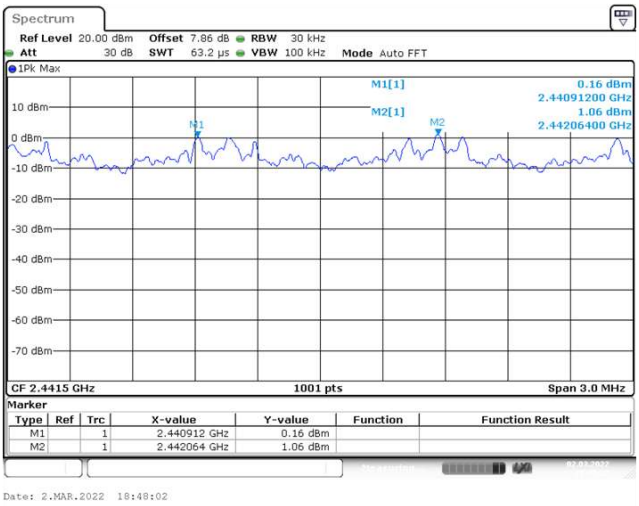


Highest channel

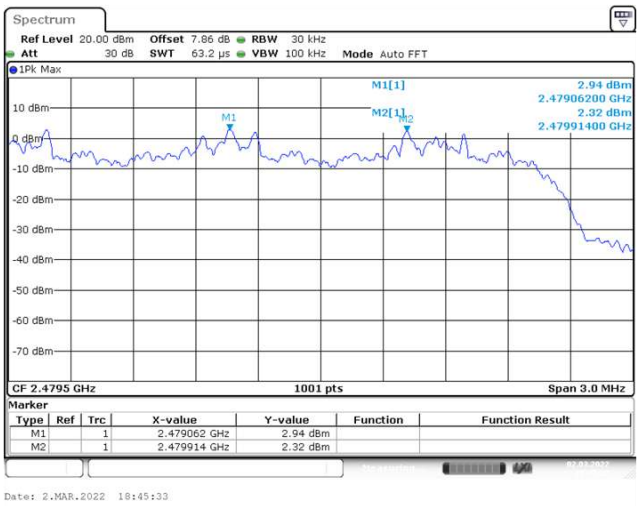
Modulation mode:8DPSK



Lowest channel

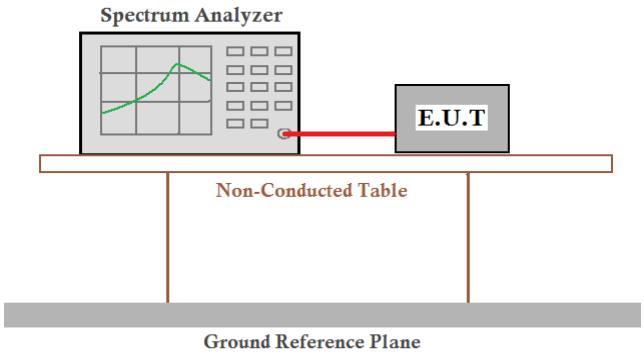


Middle channel



Highest channel

5.5 Hopping Channel Number

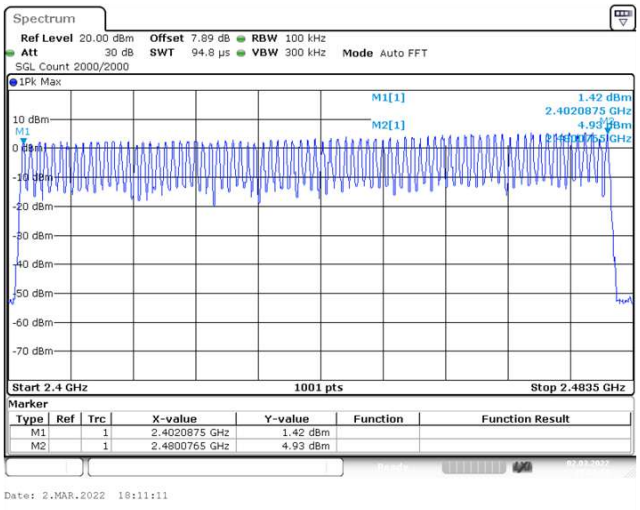
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz to 2483.5MHz, Detector=Peak
Limit:	15 channels
Test setup:	
Test Instruments:	Refer to section 4.9 for details
Test mode:	Hopping mode
Test results:	Pass

Measurement Data:

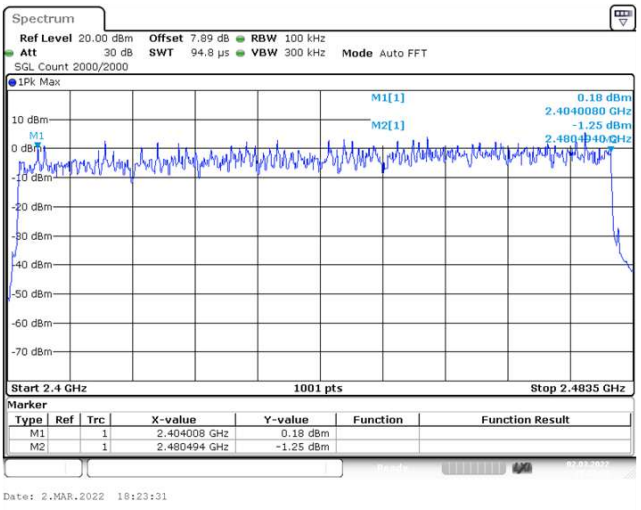
Mode	Hopping channel numbers	Limit	Result
GFSK, π/4-DQPSK, 8DPSK	79	15	Pass

Test plot as follows:

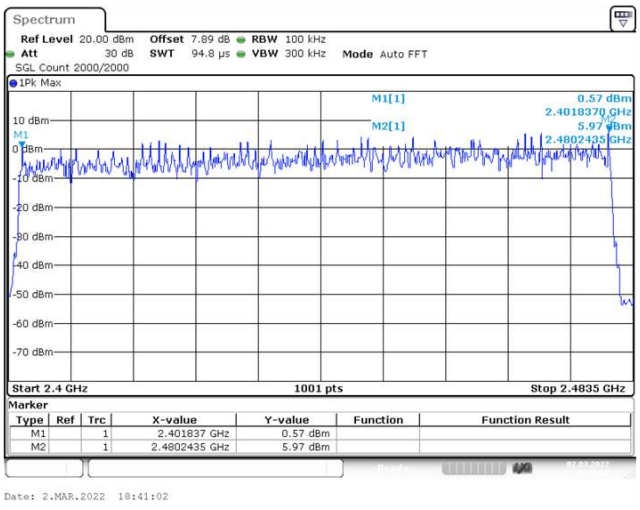
GFSK



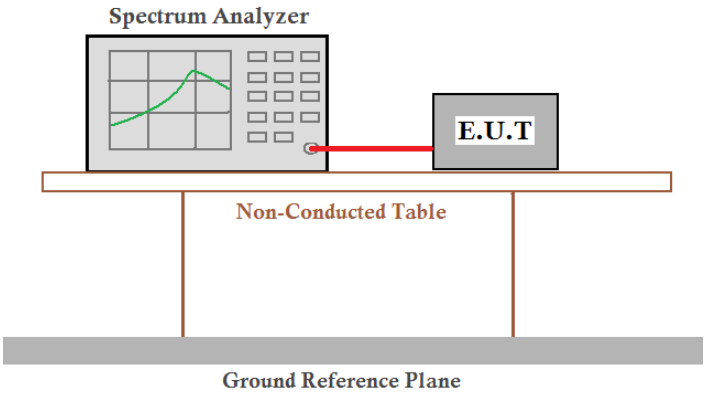
π/4-DQPSK



8DPSK



5.6 Dwell Time

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Receiver setup:	RBW=1MHz, VBW=3MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second
Test setup:	
Test Instruments:	Refer to section 4.9 for details
Test mode:	Hopping mode
Test results:	Pass

Measurement Data (Worse case):

For time of occupancy, all of mode were tested separately, we only recorded the worst test result(DH5/2 DH5/3DH5) in this report.

Mode	Packet	PulseWidth (ms)	Dwell time (ms)	Limit (second)	Result
GFSK	DH5	2.885	307.733	0.4	Pass
π/4-DQPSK	2DH5	2.891	308.373		
8DPSK	3DH5	2.892	308.480		

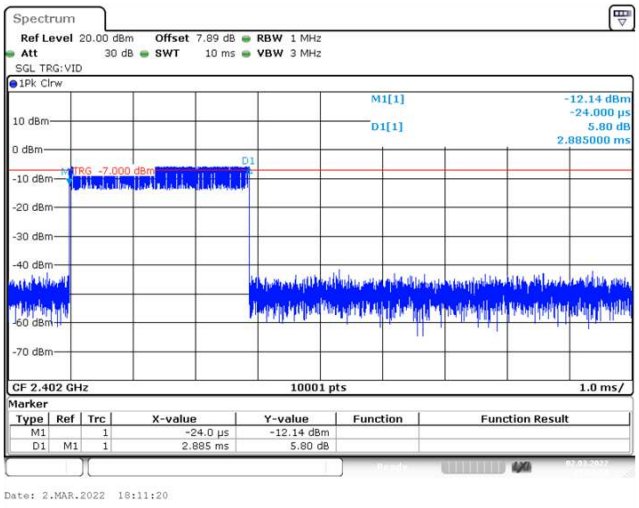
Note:

The test period= 0.4 Second/Channel x 79 Channel = 31.6 s

CalculationFormula: Dwell time = Ton time per hop * Hopping numbers * Period

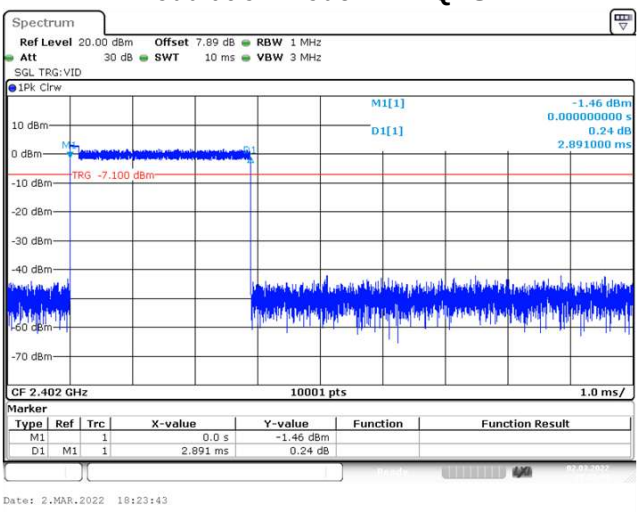
Test plot as follows:

Modulation mode:GFSK



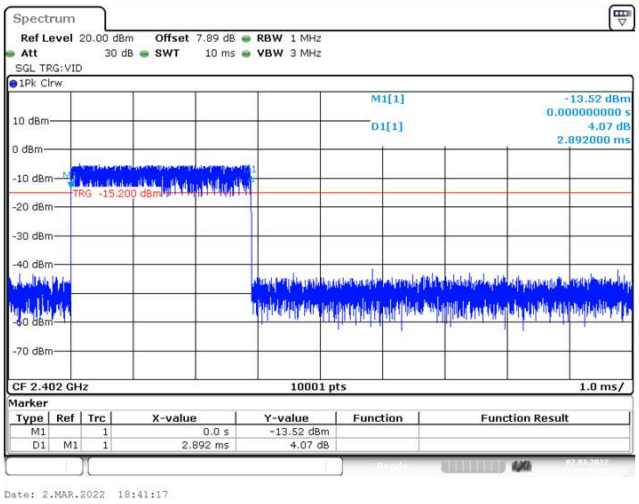
DH5

Modulation mode:π/4-DQPSK



2-DH5

Modulation mode:8DPSK



3-DH5

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5.7 Pseudorandom Frequency Hopping Sequence

Test Requirement:	FCC Part15 C Section 15.247 (a)(1) requirement:

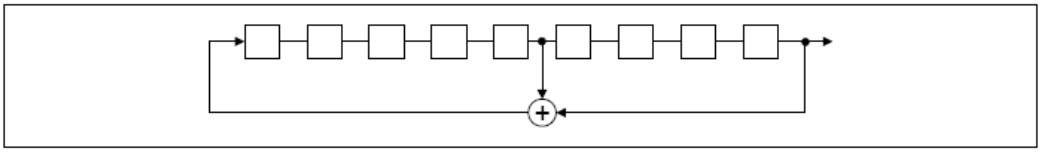
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively. 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, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence

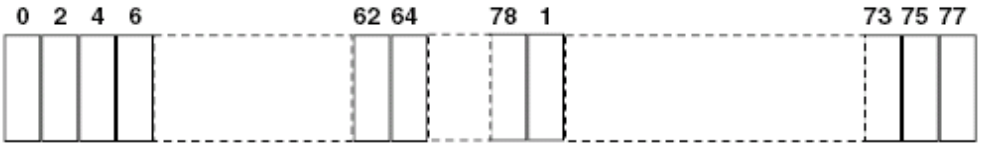
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

• Number of shift register stages: 9
• Length of pseudo-random sequence: 2^9 -1 = 511 bits
• Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:

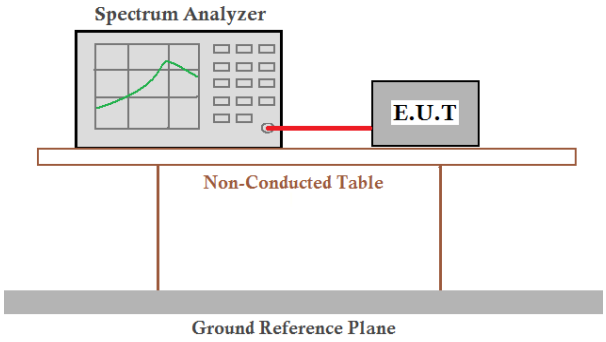


Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

5.8 Band Edge

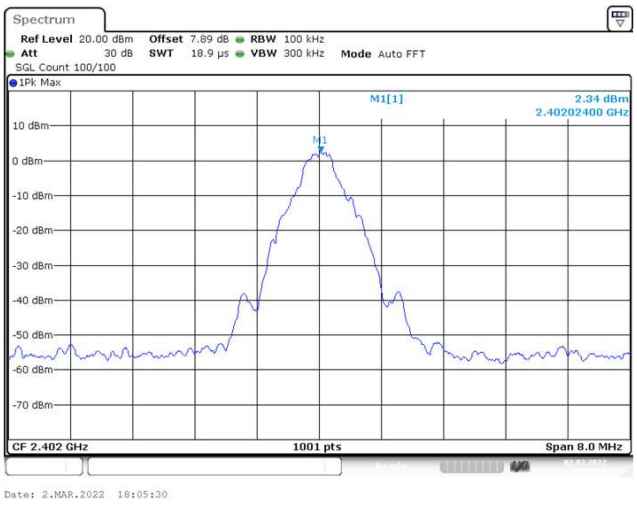
5.8.1 Conducted Emission Method

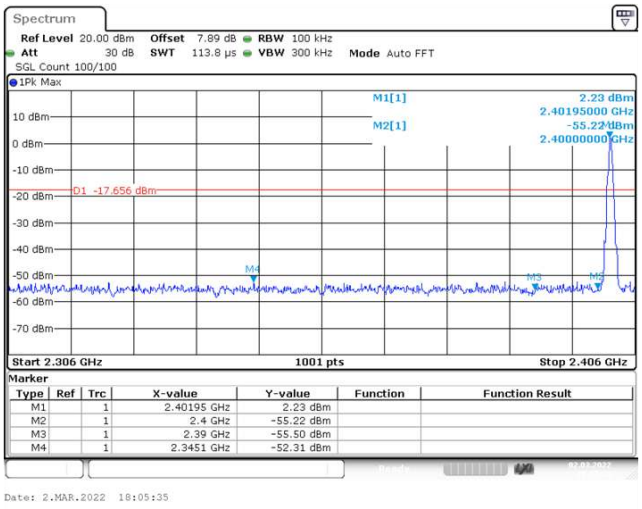
Test Requirement:	FCC Part15 C Section 15.247 (d)
Receiver setup:	RBW=100kHz, VBW=300kHz, Detector=Peak
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	
Test Instruments:	Refer to section 4.9 for details
Test mode:	Non-hopping mode and hopping mode
Test results:	Pass

Test plot as follows:

GFSK

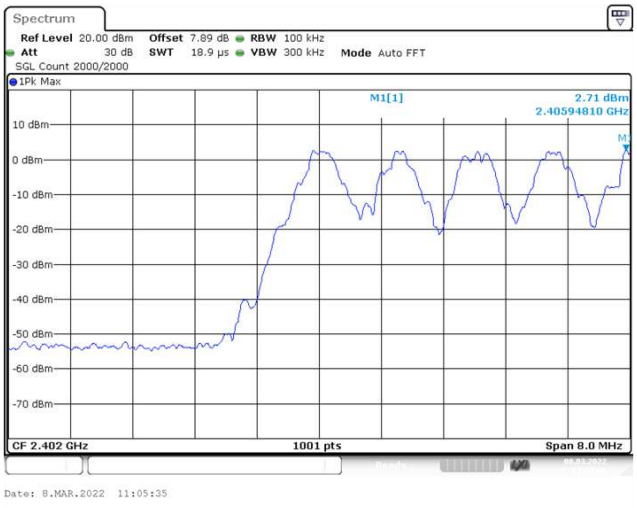
Lowest Channel

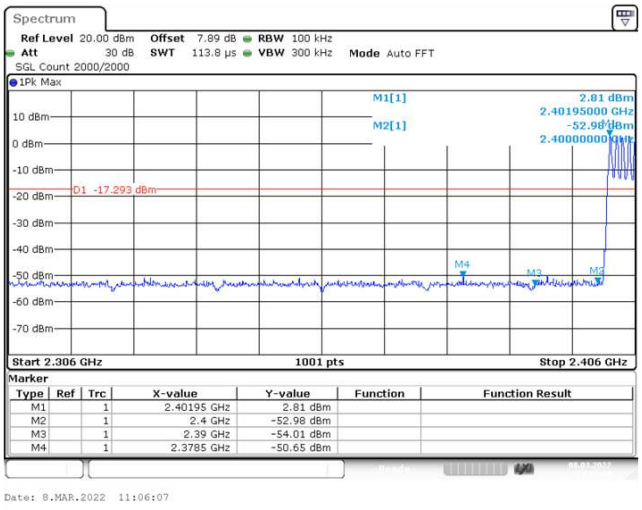




No-hopping mode

Lowest Channel

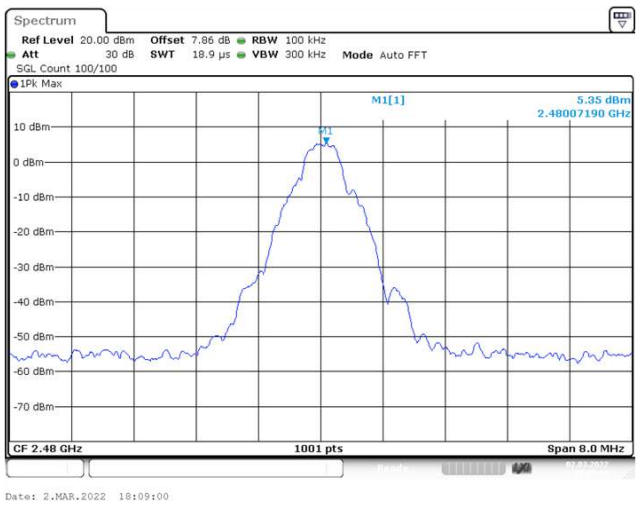


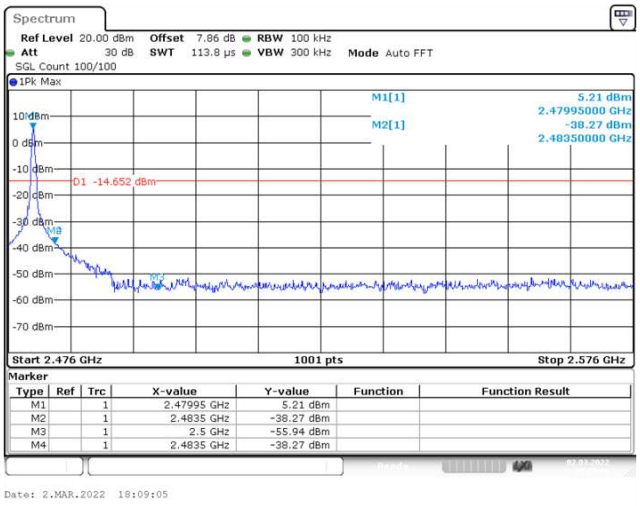


Hopping mode

GFSK

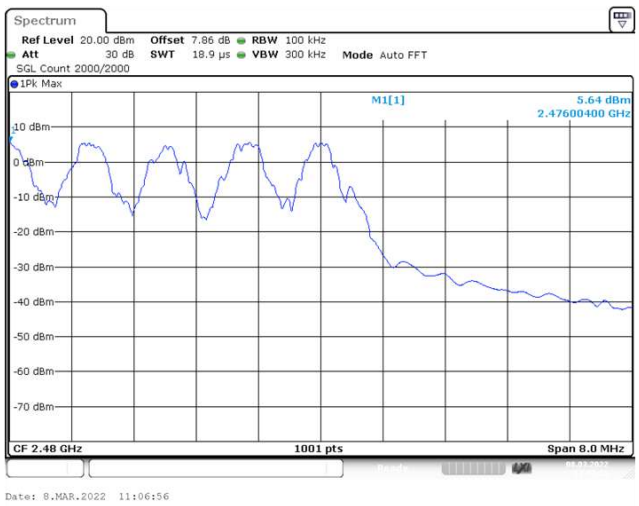
Highest Channel

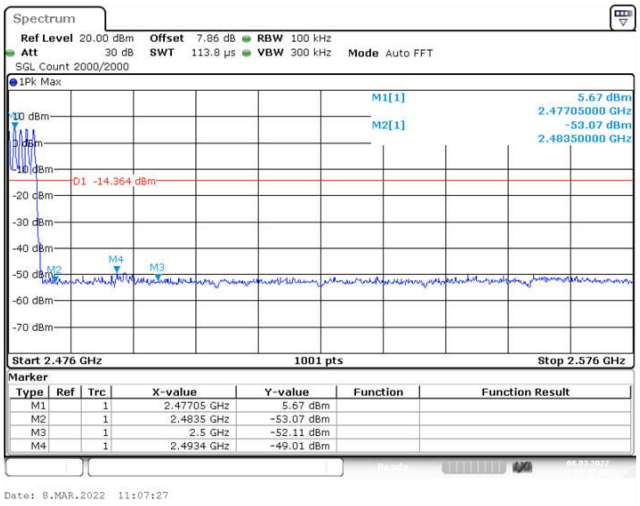




No-hopping mode

Highest Channel

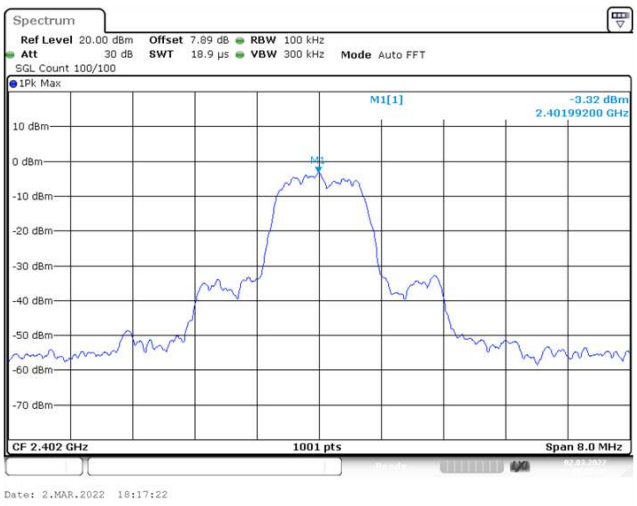


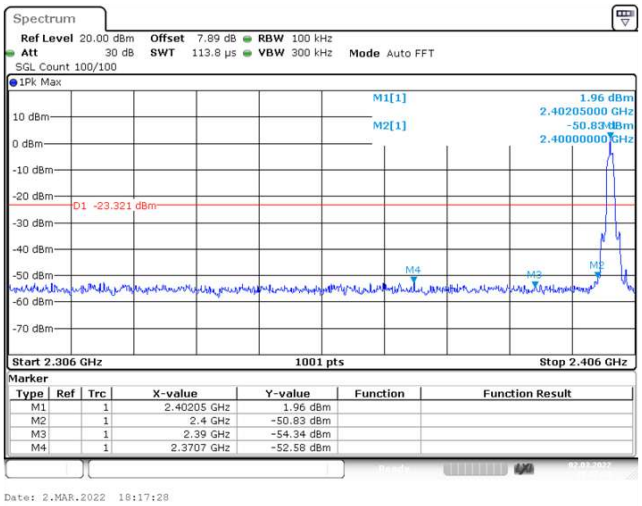


Hopping mode

π/4-DQPSK

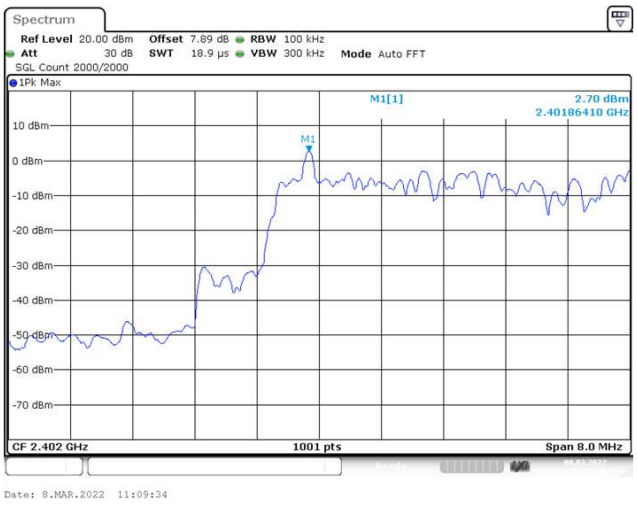
Lowest Channel

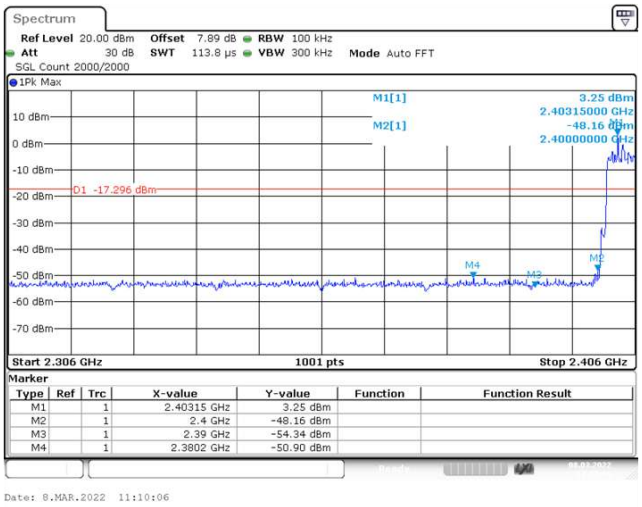




No-hopping mode

Lowest Channel

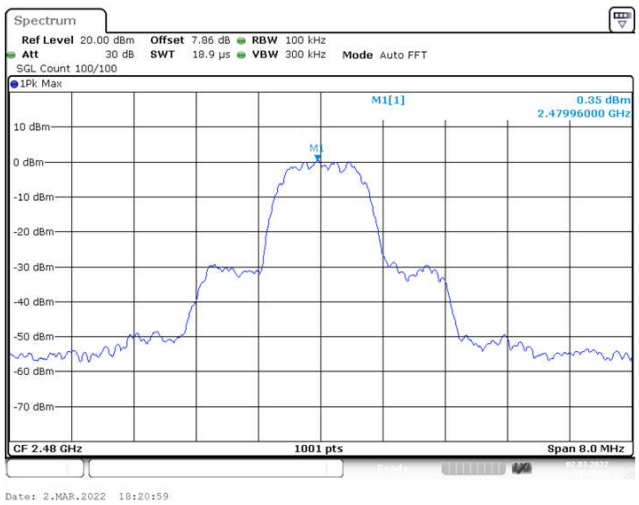


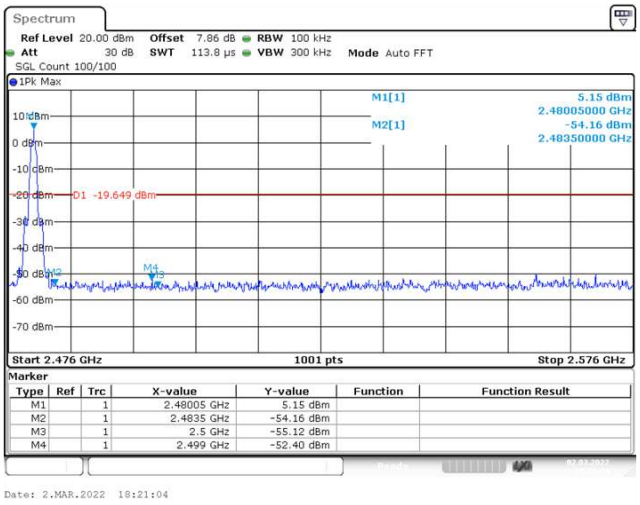


Hopping mode

π/4-DQPSK

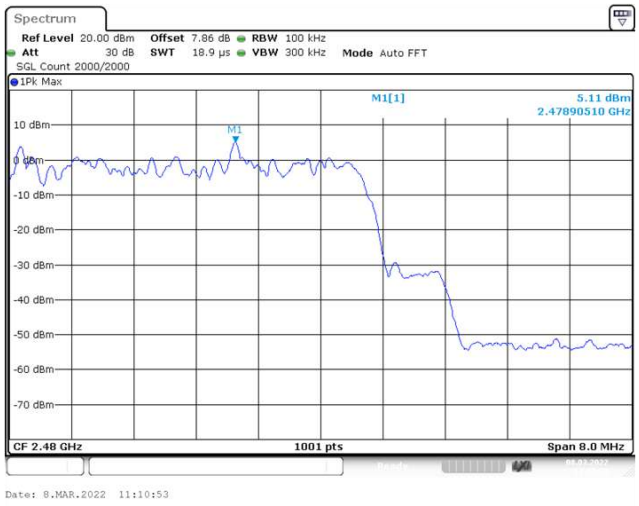
Highest Channel

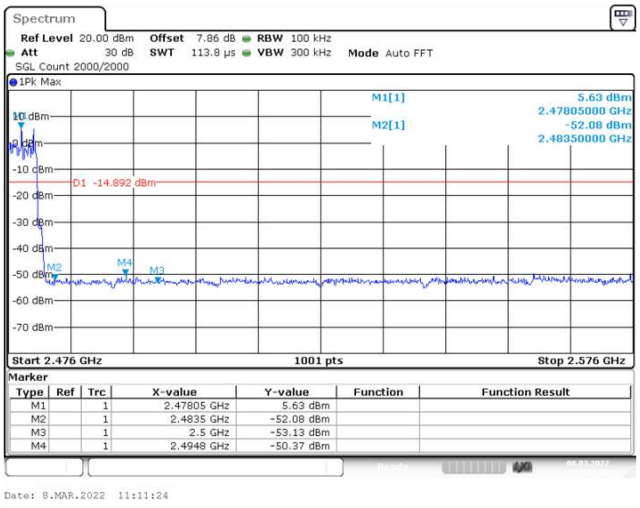




No-hopping mode

Highest Channel

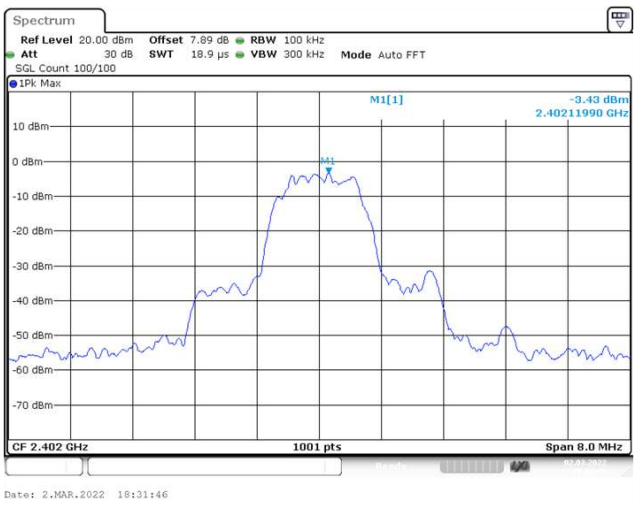


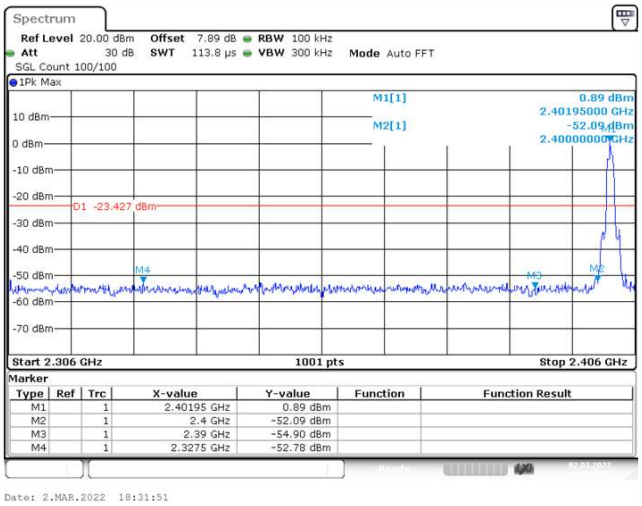


Hopping mode

8DPSK

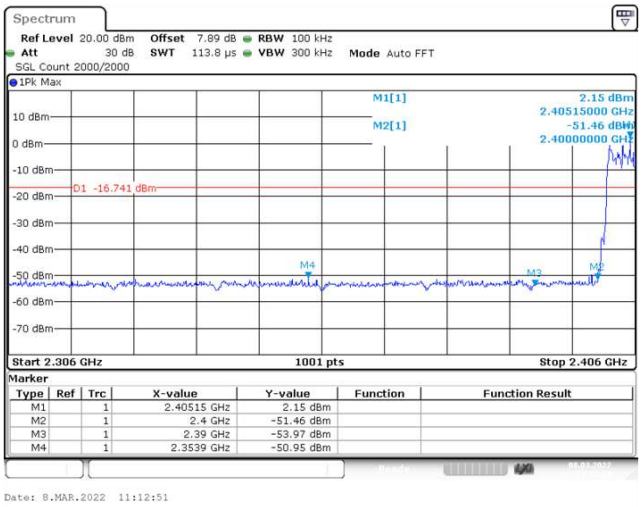
Lowest Channel





No-hopping mode

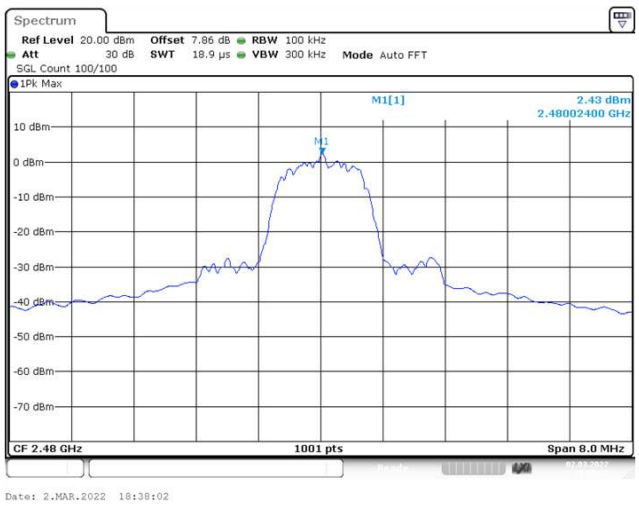
Lowest Channel

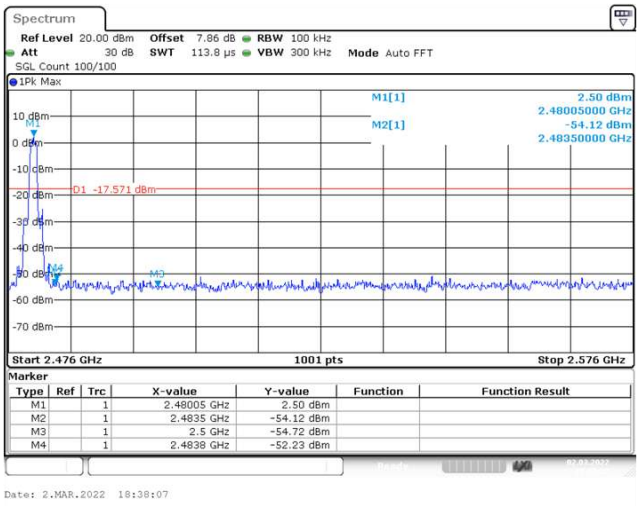


Hopping mode

8DPSK

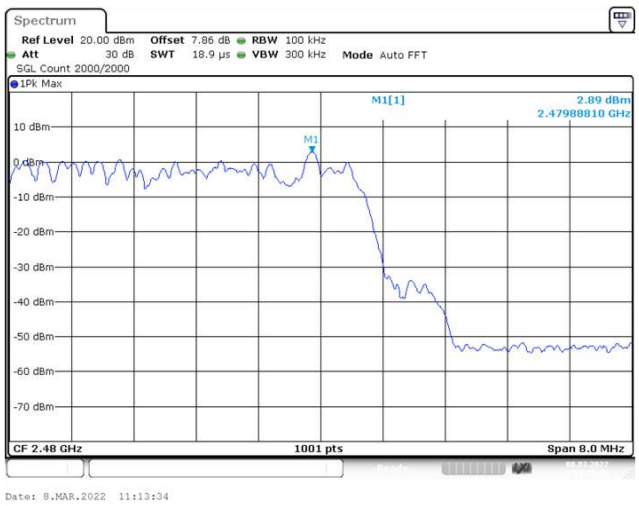
Highest Channel

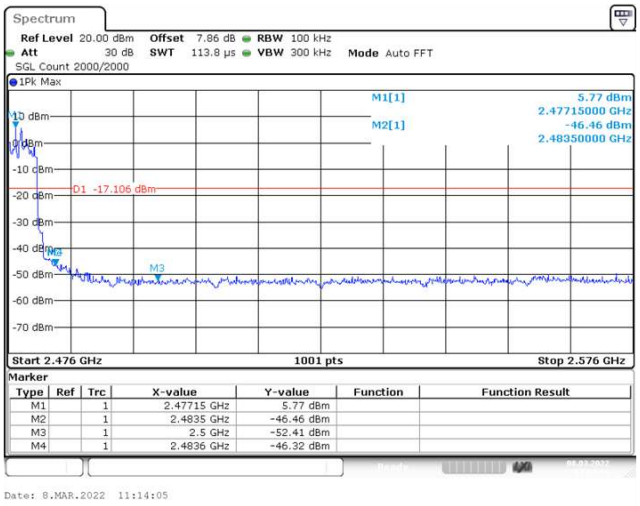




No-hopping mode

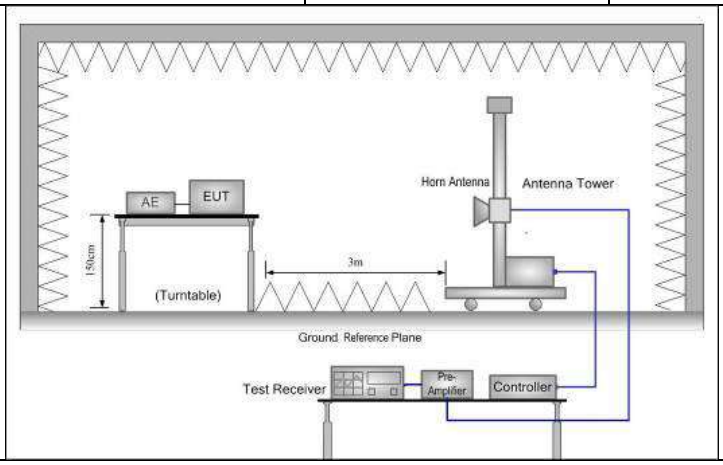
Highest Channel





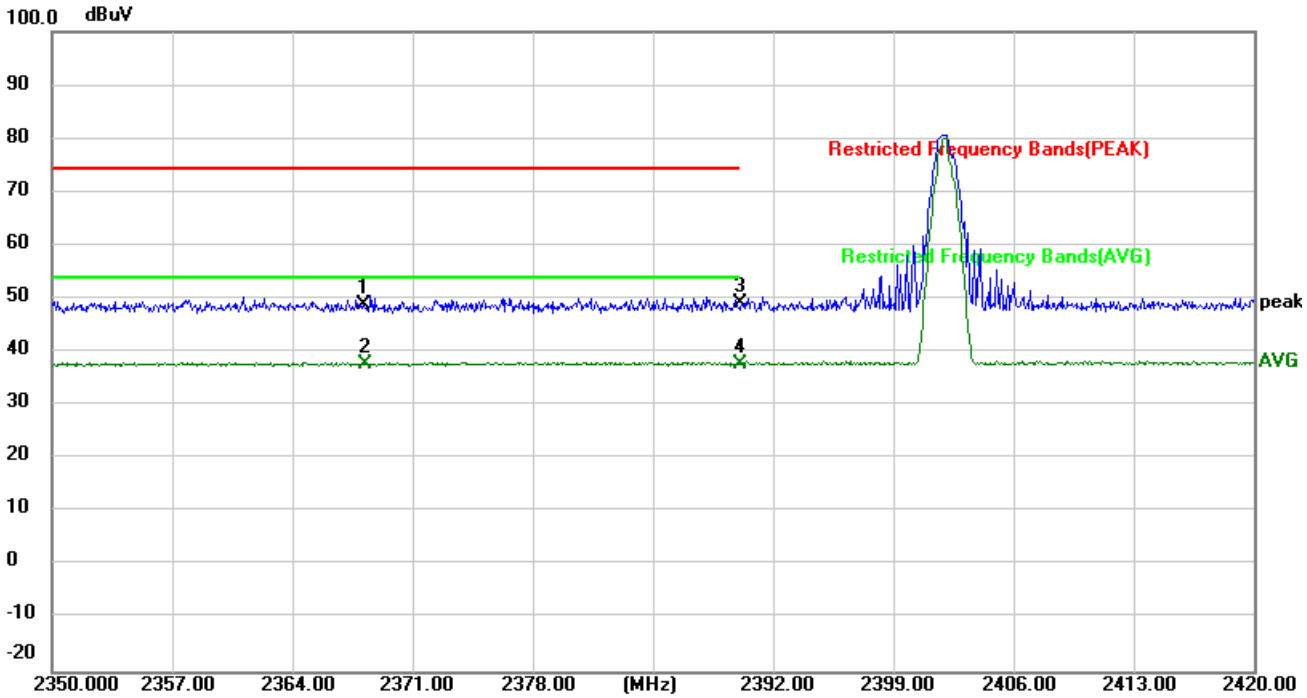
Hopping mode

5.8.2 Radiated Emission Method

<table>
<tr><td>Test Requirement:</td><td colspan="5">FCC Part15 C Section 15.209 and 15.205</td></tr>
<tr><td>Test Frequency Range:</td><td colspan="5">2380 MHz to 2410 MHz and 2465 MHz to 2520 MHz</td></tr>
<tr><td>Test Distance:</td><td colspan="5">3m</td></tr>
<tr><td rowspan="3">Receiver setup:</td><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>RMS</td><td>1MHz</td><td>3MHz</td><td>Average Value</td></tr>
<tr><td rowspan="3">Limit:</td><td colspan="2">Frequency</td><td colspan="2">Limit (dBuV/m @3m)</td><td>Remark</td></tr>
<tr><td colspan="2" rowspan="2">Above 1GHz</td><td colspan="2">54.00</td><td>Average Value</td></tr>
<tr><td colspan="2">74.00</td><td>Peak Value</td></tr>
<tr><td>Test setup:</td><td colspan="5"> 
</td></tr>
<tr><td>Test Procedure:</td><td colspan="5">1. The EUT was placed on the top of a rotating table 1.5meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</td></tr>
<tr><td>Test Instruments:</td><td colspan="5">Refer to section 4.9 for details</td></tr>
<tr><td>Test mode:</td><td colspan="5">Non-hopping mode</td></tr>
<tr><td>Test results:</td><td colspan="5">Pass</td></tr>
</table>

GFSK Mode:

Product Name:	Thermal Printer	Product Model:	C1S2
Test By:	Raymon Zheng	Test mode:	DH5Tx mode
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	DC5V	Environment:	Temp:23.6℃ Humi.: 48%

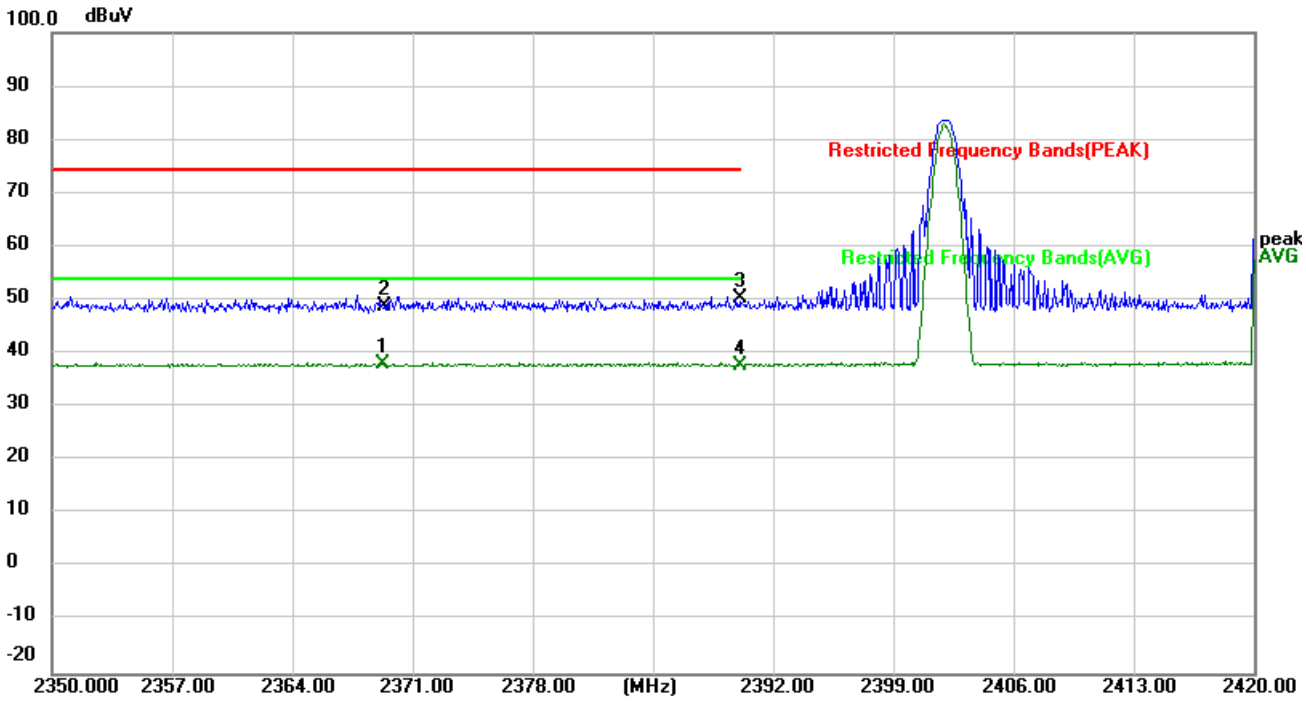


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		2368.130	55.46	-6.68	48.78	74.00	25.22	peak
2	*	2368.270	44.58	-6.68	37.90	54.00	16.10	AVG
3		2390.000	55.78	-6.67	49.11	74.00	24.89	peak
4		2390.000	44.29	-6.67	37.62	54.00	16.38	AVG

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Thermal Printer	Product Model:	C1S2
Test By:	Raymon Zheng	Test mode:	DH5Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	DC5V	Environment:	Temp.: 23.6℃ Humi: 48%

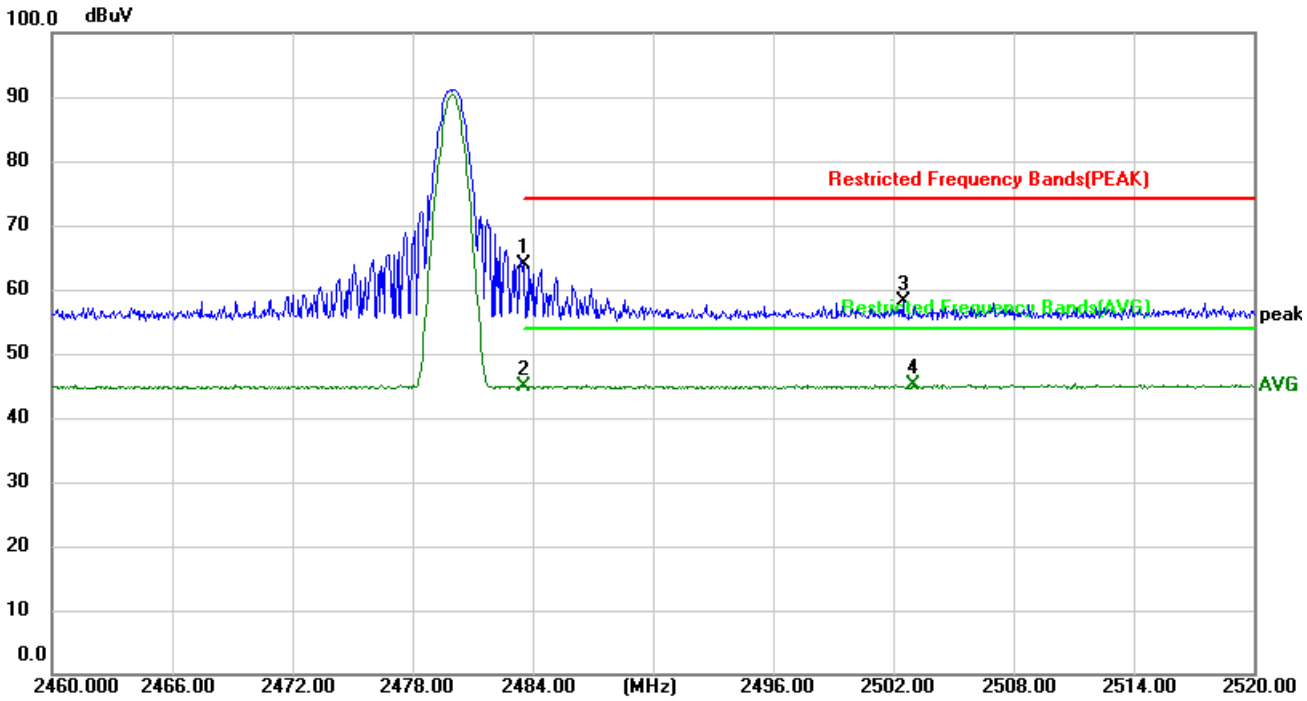


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	*	2369.250	44.76	-6.67	38.09	54.00	15.91	AVG
2		2369.390	55.44	-6.67	48.77	74.00	25.23	peak
3		2390.000	57.13	-6.67	50.46	74.00	23.54	peak
4		2390.000	44.48	-6.67	37.81	54.00	16.19	AVG

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Thermal Printer	Product Model:	C1S2
Test By:	Raymon Zheng	Test mode:	DH5 Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	DC5V	Environment:	Temp: 23.6℃ Humi: 48%

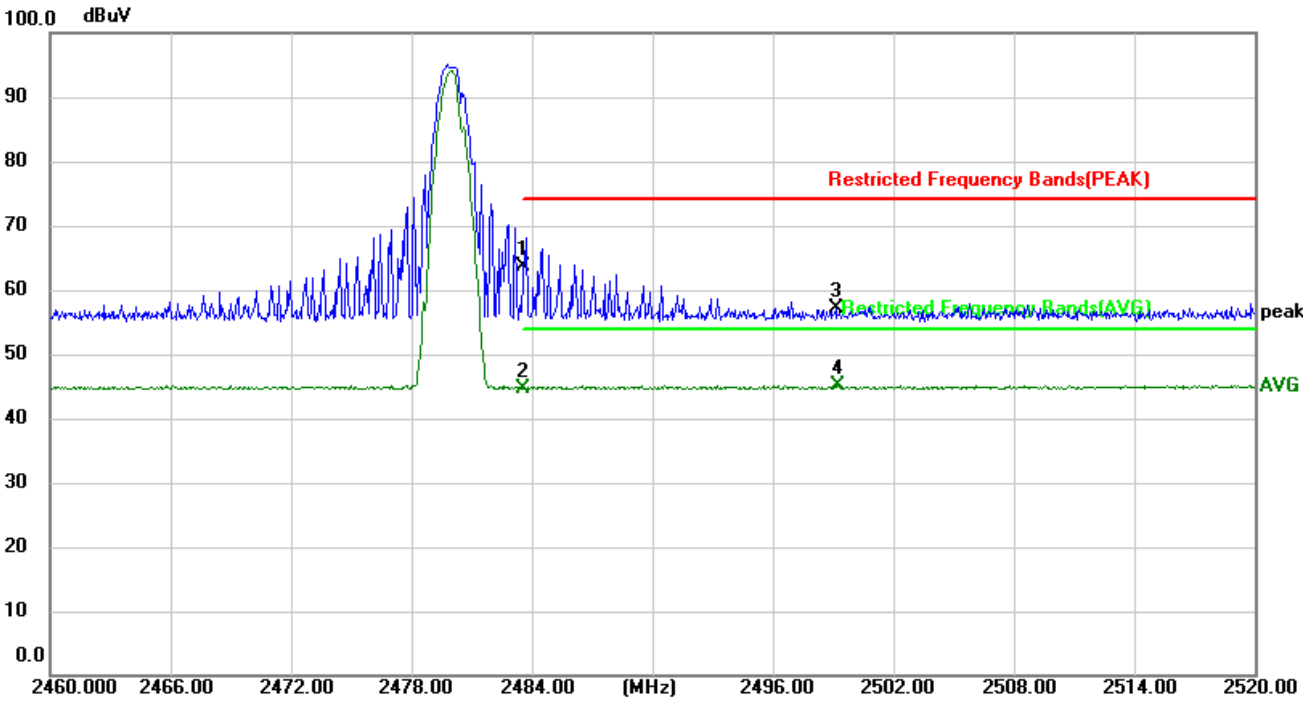


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		2483.500	64.15	-0.36	63.79	74.00	10.21	peak
2		2483.500	45.23	-0.36	44.87	54.00	9.13	AVG
3		2502.480	58.47	-0.37	58.10	74.00	15.90	peak
4	*	2502.960	45.47	-0.37	45.10	54.00	8.90	AVG

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Thermal Printer	Product Model:	C1S2
Test By:	Raymon Zheng	Test mode:	DH5 Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC5V	Environment:	Temp:23.6℃ Humi: 48%



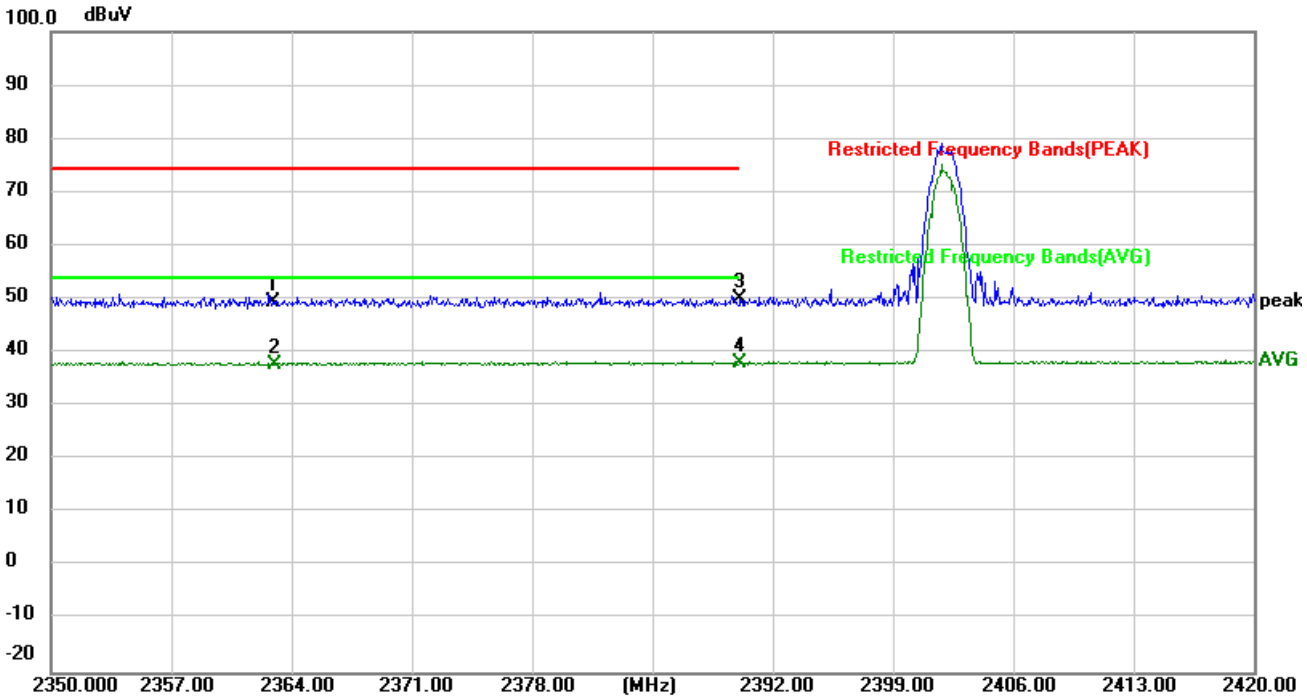
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		2483.500	63.99	-0.36	63.63	74.00	10.37	peak
2		2483.500	45.10	-0.36	44.74	54.00	9.26	AVG
3		2499.120	57.41	-0.37	57.04	74.00	16.96	peak
4	*	2499.240	45.52	-0.37	45.15	54.00	8.85	AVG

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

π/4-DQPSK mode

Product Name:	Thermal Printer	Product Model:	C1S2
Test By:	Raymon Zheng	Test mode:	2DH5 Tx mode
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	DC5V	Environment:	Temp:23.6℃ Humi: 48%

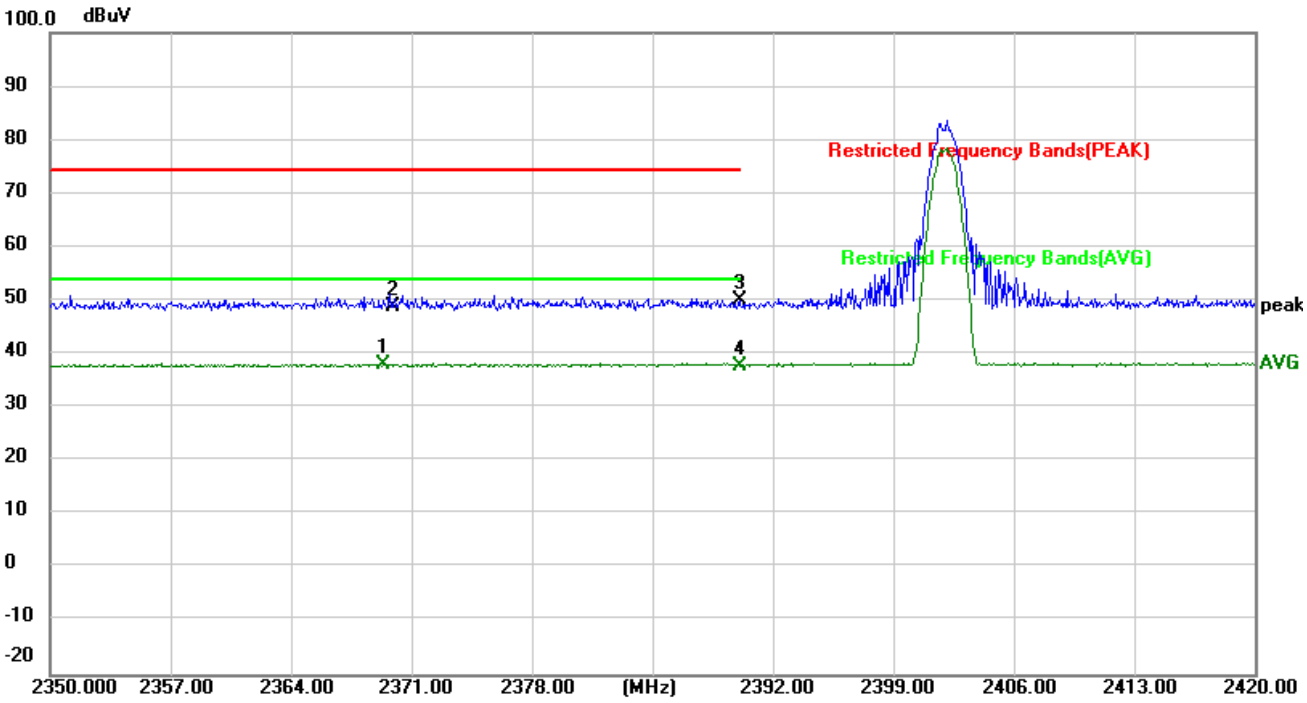


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		2362.950	56.19	-6.68	49.51	74.00	24.49	peak
2		2363.020	44.43	-6.68	37.75	54.00	16.25	AVG
3		2390.000	56.58	-6.67	49.91	74.00	24.09	peak
4	*	2390.000	44.62	-6.67	37.95	54.00	16.05	AVG

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Thermal Printer	Product Model:	C1S2
Test By:	Raymon Zheng	Test mode:	2DH5 Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	DC5V	Environment:	Temp:23.6℃ Humi: 48%

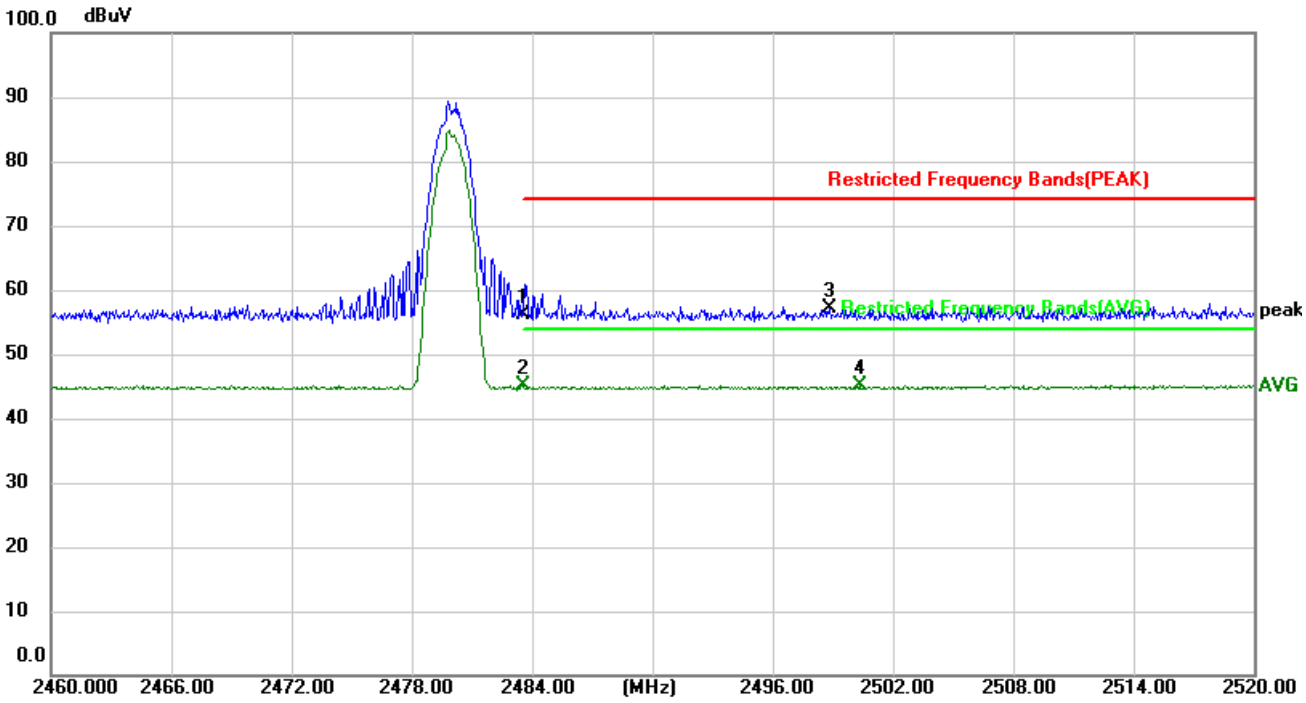


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	*	2369.390	44.59	-6.67	37.92	54.00	16.08	AVG
2		2369.950	55.56	-6.67	48.89	74.00	25.11	peak
3		2390.000	56.63	-6.67	49.96	74.00	24.04	peak
4		2390.000	44.52	-6.67	37.85	54.00	16.15	AVG

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Thermal Printer	Product Model:	C1S2
Test By:	Raymon Zheng	Test mode:	2DH5 Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	DC5V	Environment:	Temp:23.6℃ Humi: 48%

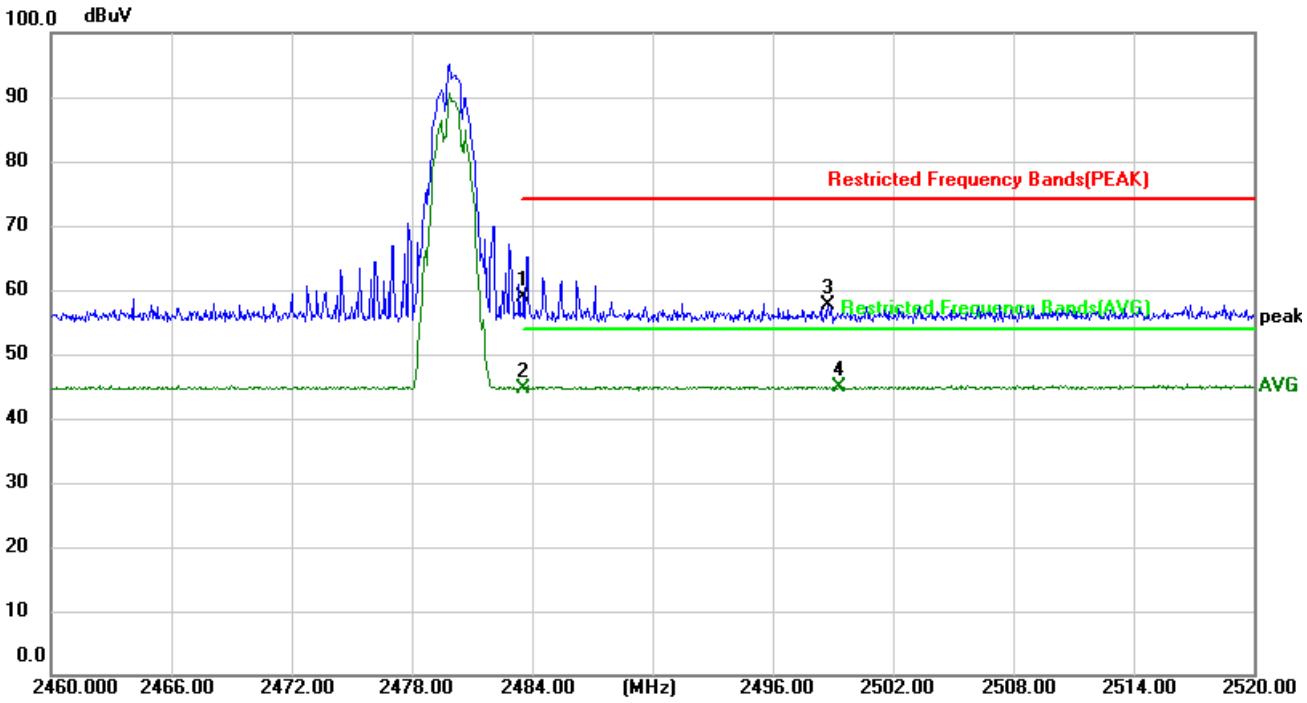


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		2483.500	56.58	-0.36	56.22	74.00	17.78	peak
2	*	2483.500	45.42	-0.36	45.06	54.00	8.94	AVG
3		2498.820	57.59	-0.37	57.22	74.00	16.78	peak
4		2500.320	45.41	-0.37	45.04	54.00	8.96	AVG

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Thermal Printer	Product Model:	C1S2
Test By:	Raymon Zheng	Test mode:	2DH5 Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC5V	Environment:	Temp:23.6℃ Humi: 48%



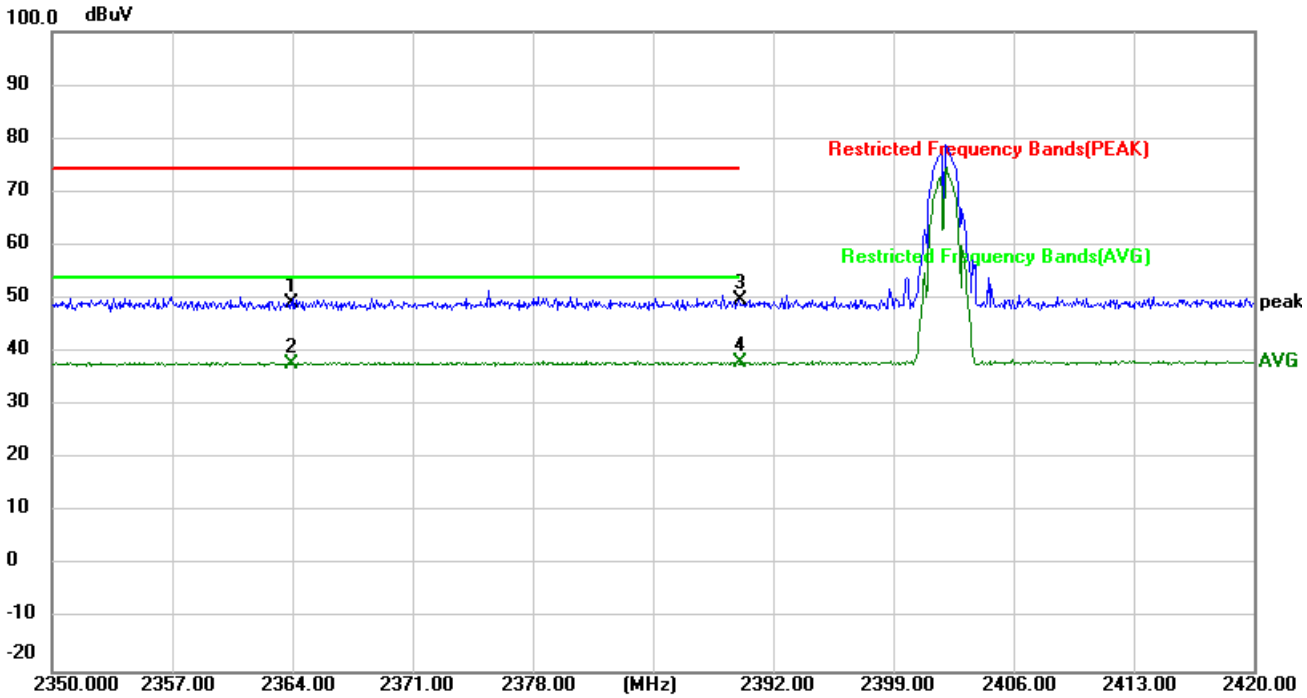
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		2483.500	59.28	-0.36	58.92	74.00	15.08	peak
2		2483.500	45.03	-0.36	44.67	54.00	9.33	AVG
3		2498.760	57.97	-0.37	57.60	74.00	16.40	peak
4	*	2499.300	45.35	-0.37	44.98	54.00	9.02	AVG

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

8DPSK mode

Product Name:	Thermal Printer	**Product Model:**	C1S2
Test By:	Raymon Zheng	**Test mode:**	3DH5 Tx mode
Test Channel:	Lowest channel	**Polarization:**	Vertical
Test Voltage:	DC5V	**Environment:**	Temp:23.6℃ Humi: 48%

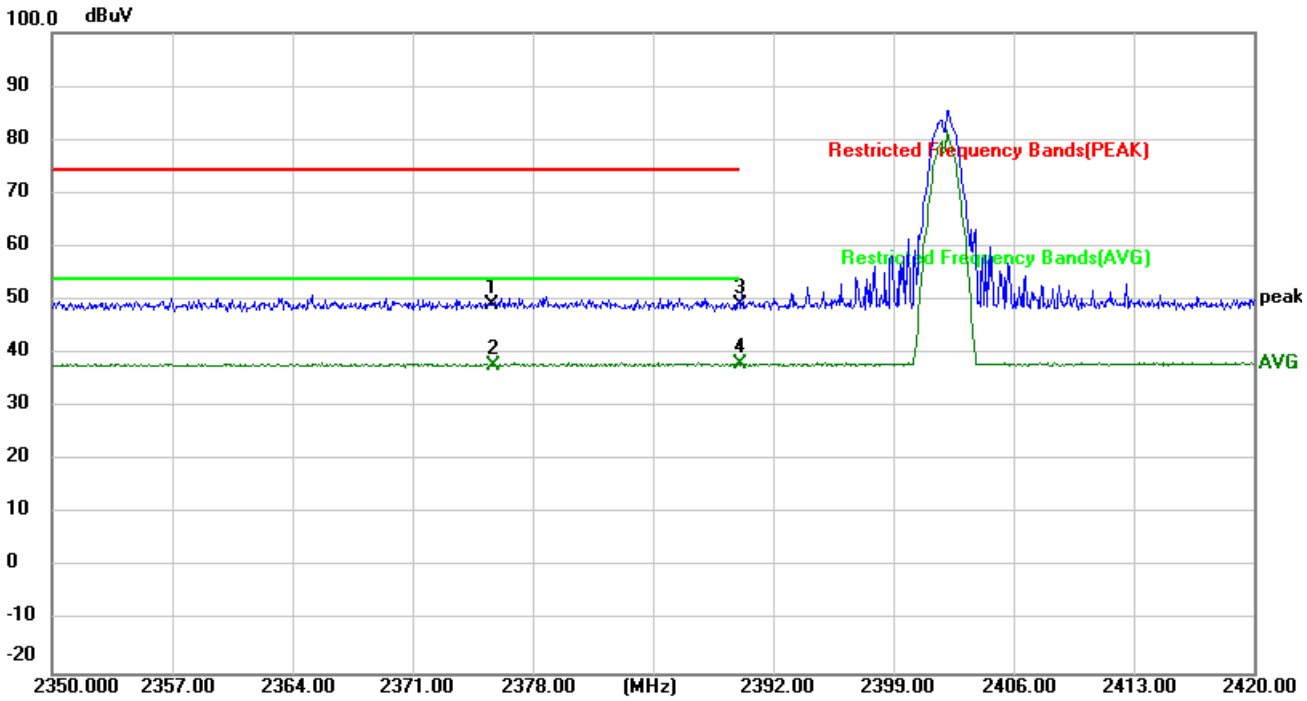


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		2363.930	55.98	-6.68	49.30	74.00	24.70	peak
2		2363.930	44.45	-6.68	37.77	54.00	16.23	AVG
3		2390.000	56.53	-6.67	49.86	74.00	24.14	peak
4	*	2390.000	44.61	-6.67	37.94	54.00	16.06	AVG

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Thermal Printer	Product Model:	C1S2
Test By:	Raymon Zheng	Test mode:	3DH5 Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	DC5V	Environment:	Temp:23.6℃ Humi: 48%

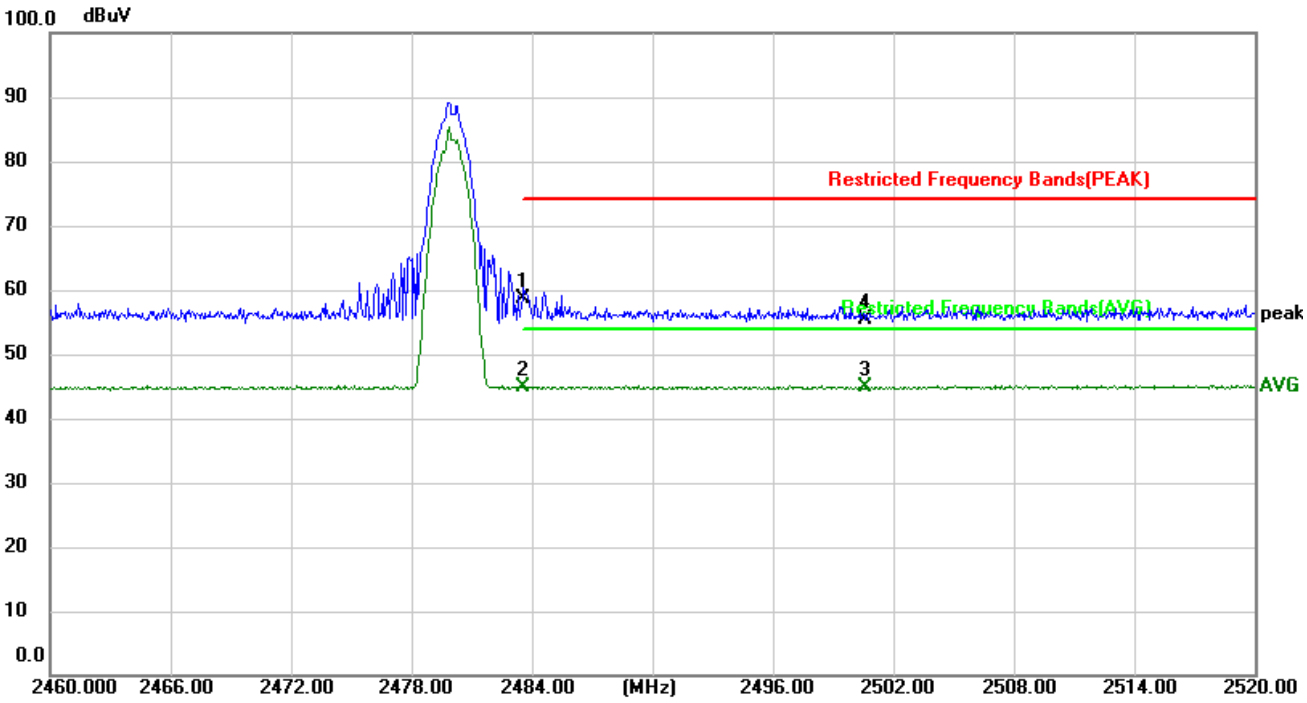


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		2375.620	55.70	-6.68	49.02	74.00	24.98	peak
2		2375.690	44.49	-6.68	37.81	54.00	16.19	AVG
3		2390.000	55.86	-6.67	49.19	74.00	24.81	peak
4	*	2390.000	44.75	-6.67	38.08	54.00	15.92	AVG

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Thermal Printer	Product Model:	C1S2
Test By:	Raymon Zheng	Test mode:	3DH5 Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	DC5V	Environment:	Temp:23.6℃ Humi: 48%

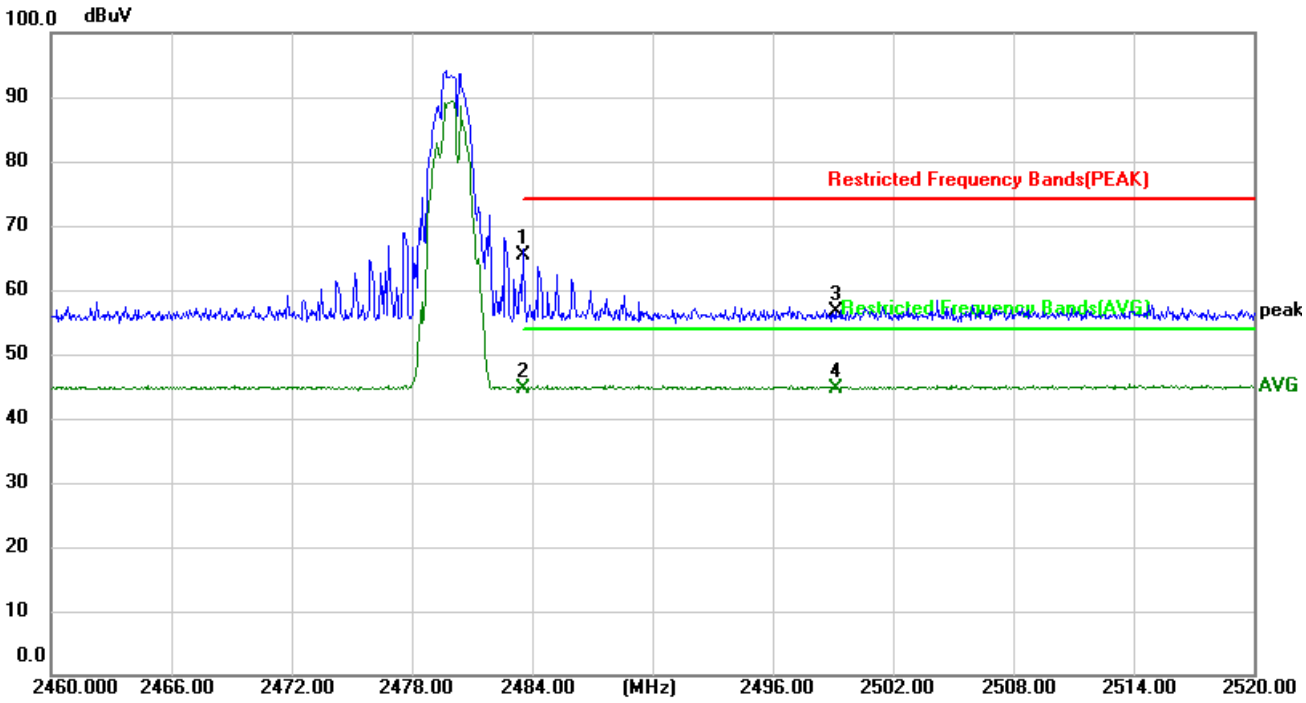


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		2483.500	59.04	-0.36	58.68	74.00	15.32	peak
2	*	2483.500	45.28	-0.36	44.92	54.00	9.08	AVG
3		2500.560	45.17	-0.37	44.80	54.00	9.20	AVG
4		2500.620	55.69	-0.37	55.32	74.00	18.68	peak

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Thermal Printer	Product Model:	C1S2
Test By:	Raymon Zheng	Test mode:	3DH5 Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC5V	Environment:	Temp:23.6℃ Humi: 48%



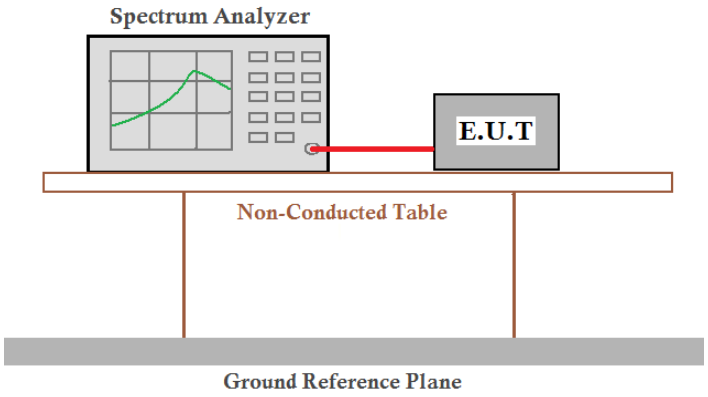
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	*	2483.500	65.63	-0.36	65.27	74.00	8.73	peak
2		2483.500	45.05	-0.36	44.69	54.00	9.31	AVG
3		2499.120	56.88	-0.37	56.51	74.00	17.49	peak
4		2499.120	44.98	-0.37	44.61	54.00	9.39	AVG

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

5.9 Spurious Emission

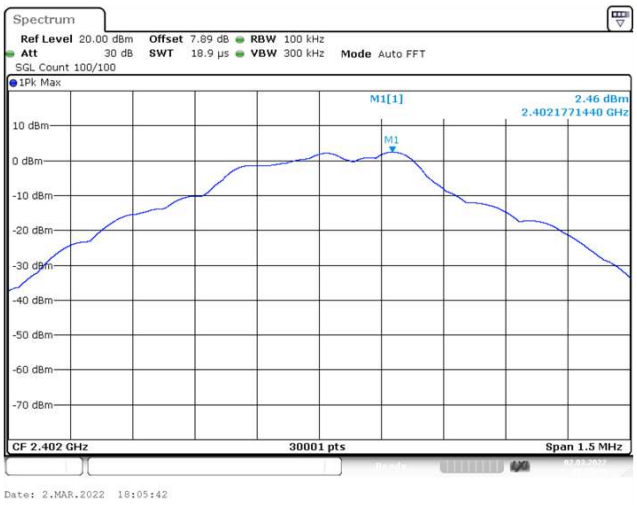
5.9.1 Conducted Emission Method

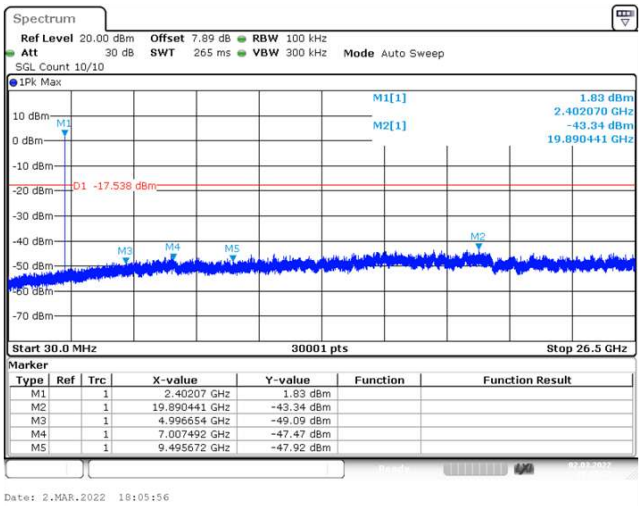
Test Requirement:	FCC Part15 C Section 15.247 (d)
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	
Test Instruments:	Refer to section 4.9 for details
Test mode:	Non-hopping mode
Test results:	Pass

Test plot as follows:

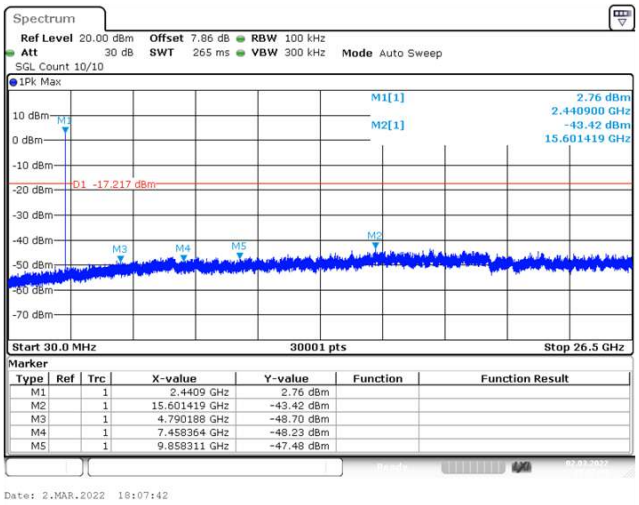
GFSK

Lowest Channel

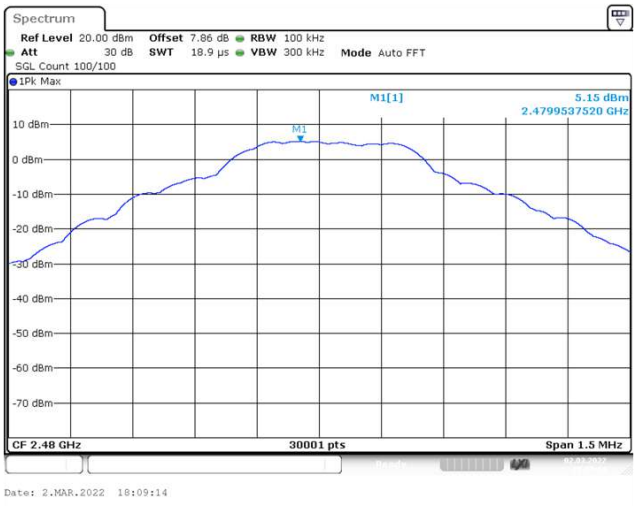


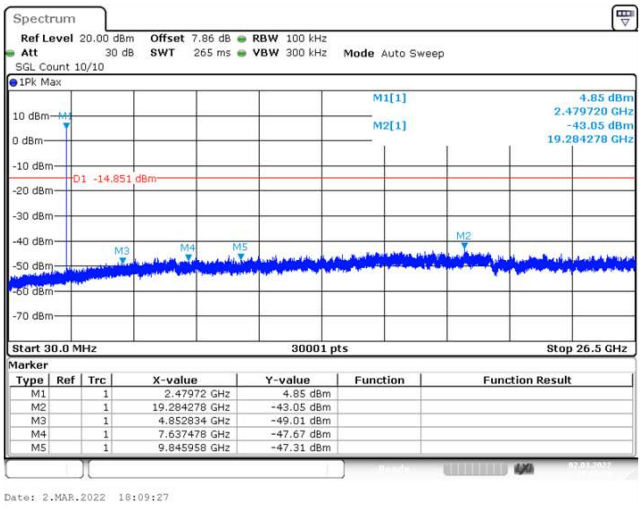


Middle channel



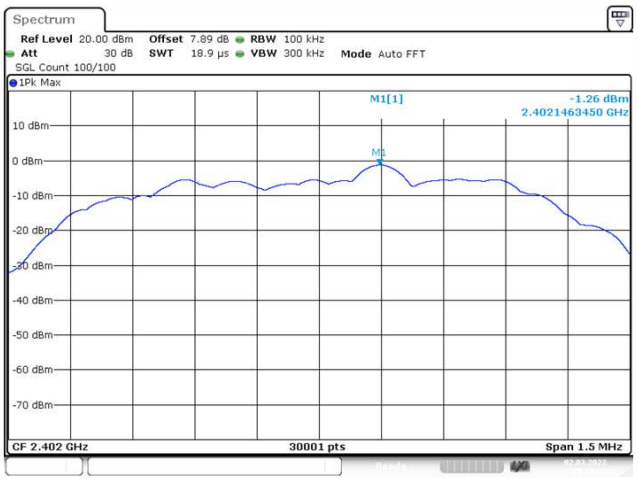
Highest Channel

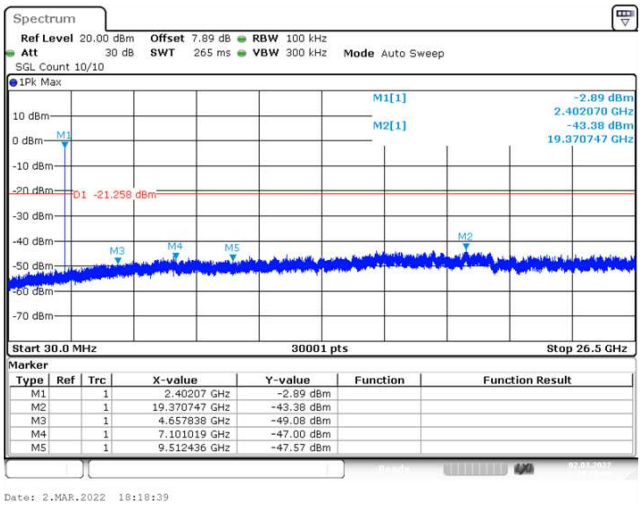




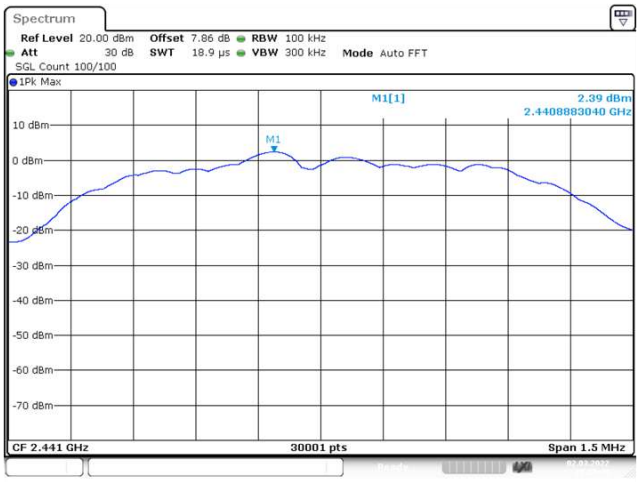
π/4-DQPSK

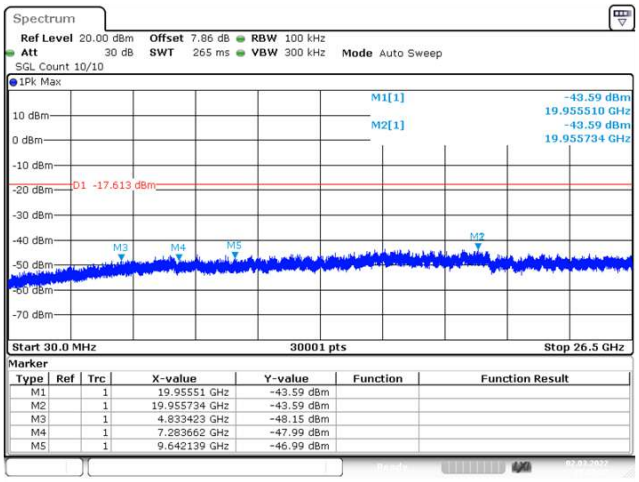
Lowest Channel



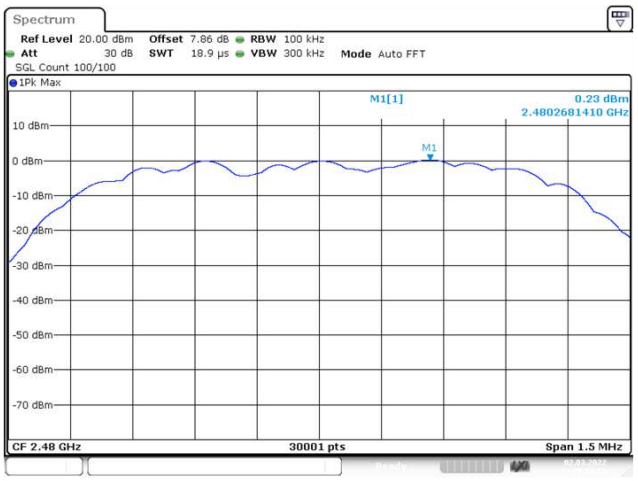


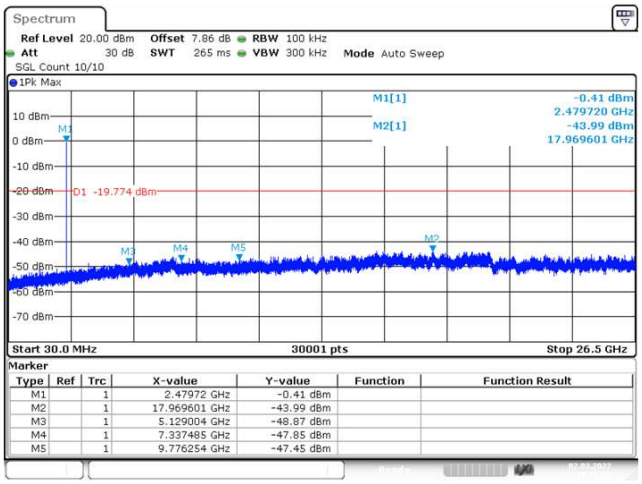
Middle channel





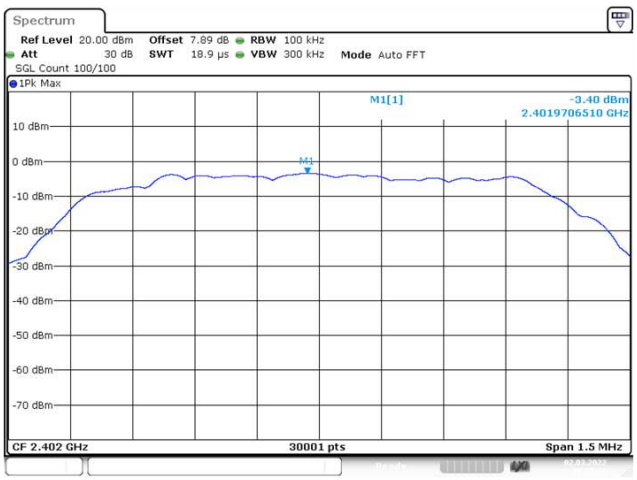
Highest Channel

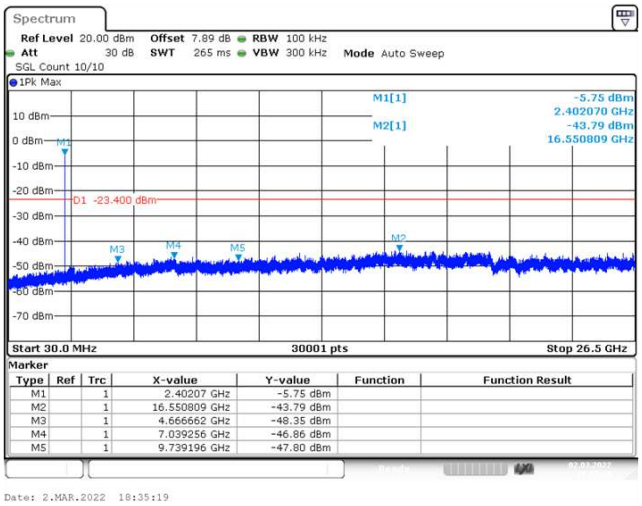




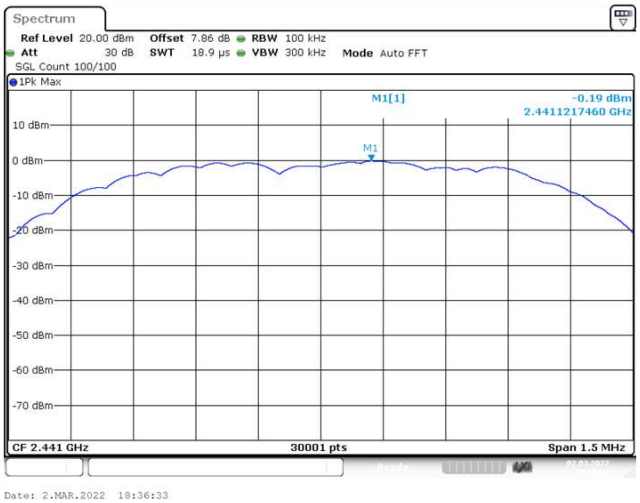
8DPSK

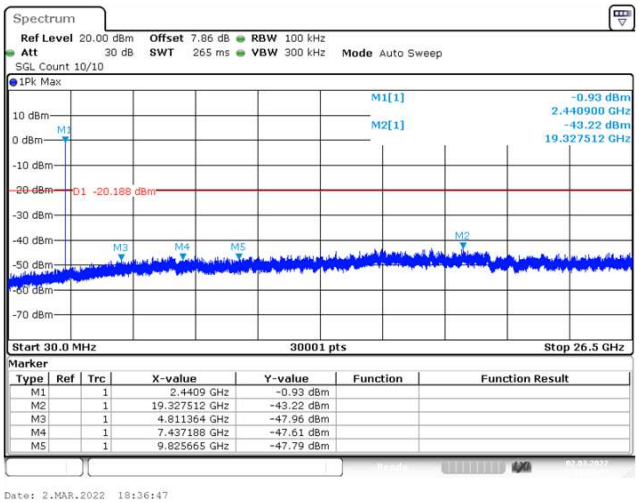
Lowest Channel



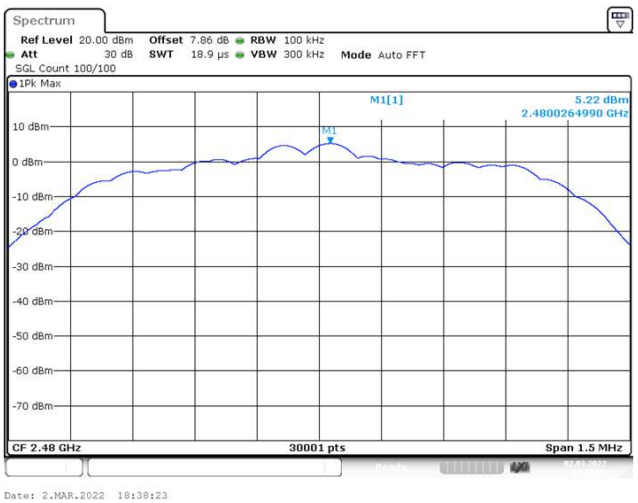


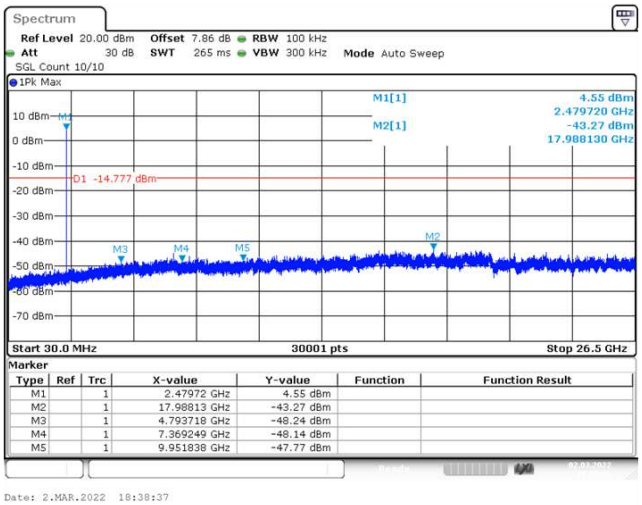
Middle channel





Highest Channel





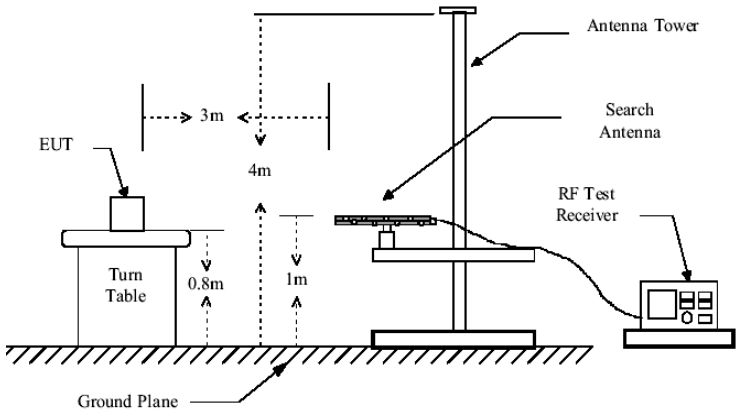
5.9.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209				
Test Frequency Range:	9kHz to 25GHz				
TestDistance:	3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value

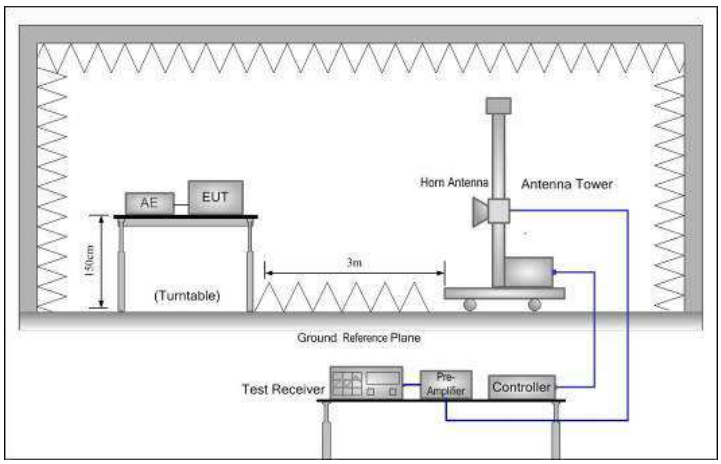
Limit:	Frequency	Limit (dBuV/m @3m)	Remark
	30MHz-88MHz	40.0	Quasi-peak Value
	88MHz-216MHz	43.5	Quasi-peak Value
	216MHz-960MHz	46.0	Quasi-peak Value
	960MHz-1GHz	54.0	Quasi-peak Value
	Above 1GHz	54.0	Average Value
		74.0	Peak Value

Test setup:

Below 1GHz



Above 1GHz



Test Procedure:

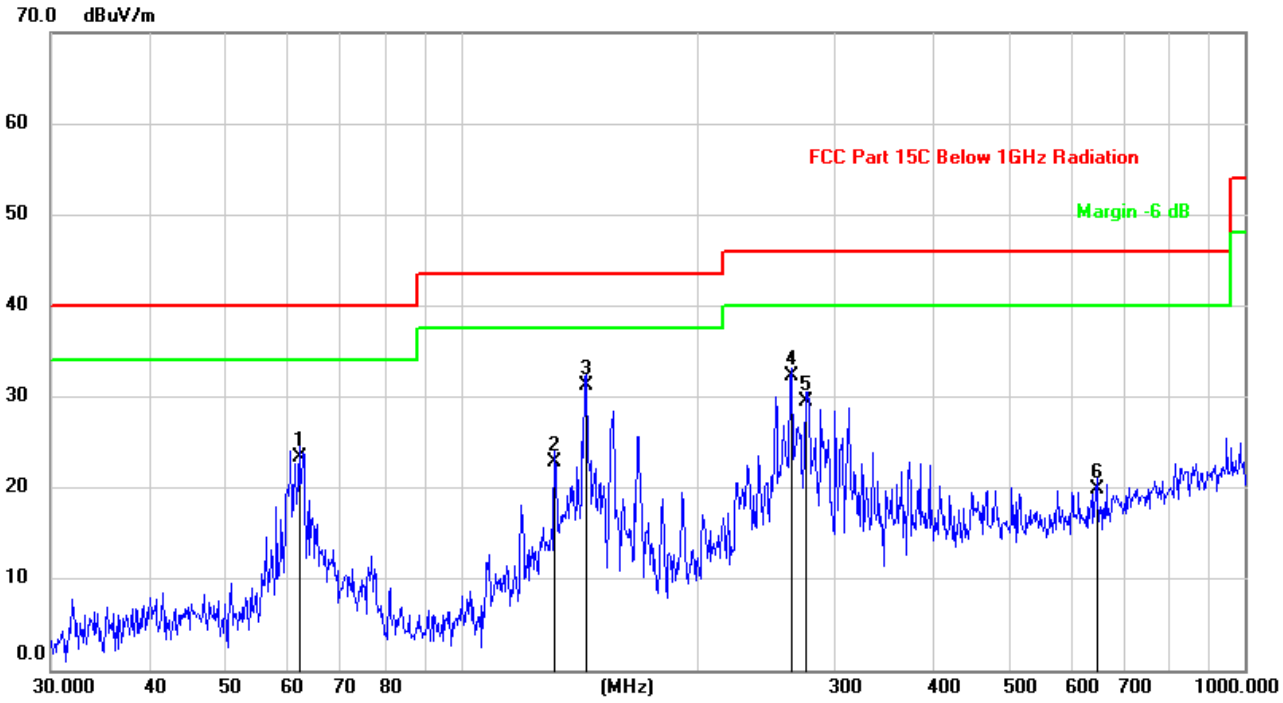
1. The EUT was placed on the top of a rotating table 0.8m(below 1GHz)/1.5m(above 1GHz) above the groundat a 3 meter chamber.The table was rotated 360 degrees todetermine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, whichwas mounted on the top of a variable-height antenna

	tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and thenthe antenna was tuned to heights from 1 meter to 4 meters and the rotatablewas turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and SpecifiedBandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Test Instruments:	Refer to section 4.9 for details
Test mode:	Non-hopping mode
Test results:	Pass
Remark:	1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case. 2. 9 kHz to 30 MHz is noise floor, so only shows the data of above 30MHz in this report.

Measurement Data(worst case):

Below 1GHz:

Product Name:	Thermal Printer	**Product Model:**	C1S2
Test By:	Raymon Zheng	**Test mode:**	BT Tx mode
Test Frequency:	30 MHz ~ 1 GHz	**Polarization:**	Vertical
Test Voltage:	DC5V	**Environment:**	Temp: 23.6℃ Humi: 48%

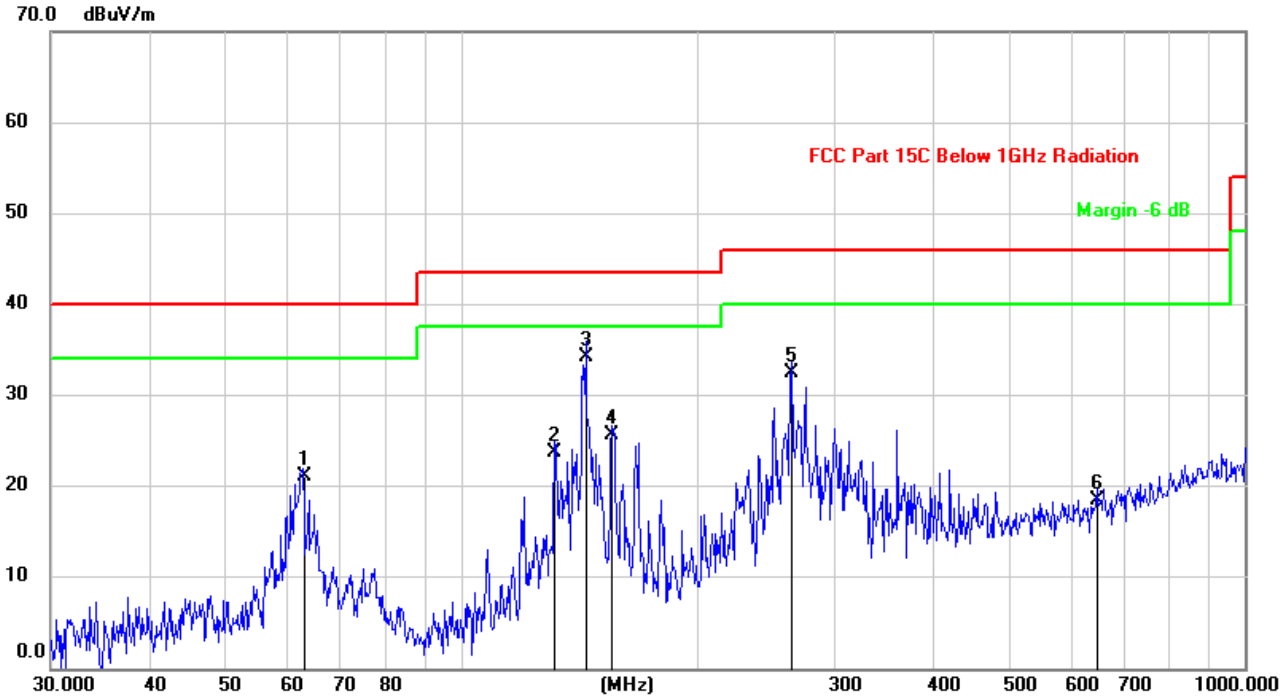


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		62.2128	39.83	-16.43	23.40	40.00	-16.60	QP
2		131.7576	40.64	-17.74	22.90	43.50	-20.60	QP
3	*	144.3348	49.06	-17.83	31.23	43.50	-12.27	QP
4		264.7457	44.48	-12.22	32.26	46.00	-13.74	QP
5		275.1570	41.45	-11.89	29.56	46.00	-16.44	QP
6		647.3854	23.57	-3.67	19.90	46.00	-26.10	QP

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Product Name:	Thermal Printer	Product Model:	C1S2
Test By:	Raymon Zheng	Test mode:	BT Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	DC5V	Environment:	Temp: 23.6℃ Humi: 48%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		62.8708	37.53	-16.50	21.03	40.00	-18.97	QP
2		131.7577	41.54	-17.74	23.80	43.50	-19.70	QP
3	*	144.3348	52.03	-17.83	34.20	43.50	-9.30	QP
4		155.9101	43.01	-17.41	25.60	43.50	-17.90	QP
5		264.7457	44.72	-12.22	32.50	46.00	-13.50	QP
6		647.3856	22.07	-3.67	18.40	46.00	-27.60	QP

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

Above 1GHz:

Test channel: Lowest channel						
Detector: PeakValue						
Frequency (MHz)	Read Level (dBuV)	Correct Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	37.01	7.54	44.55	74.00	-29.48	Vertical
4804.00	43.26	7.54	50.80	74.00	-23.20	Horizontal
Detector: AverageValue						
Frequency (MHz)	Read Level (dBuV)	Correct Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	23.60	7.54	31.14	54.00	-22.86	Vertical
4804.00	27.97	7.54	35.51	54.00	-18.49	Horizontal
Test channel: Middle channel						
Detector: PeakValue						
Frequency (MHz)	Read Level (dBuV)	Correct Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4882.00	41.72	7.79	49.51	74.00	-24.49	Vertical
4882.00	41.64	7.79	49.43	74.00	-24.57	Horizontal
Detector: AverageValue						
Frequency (MHz)	Read Level (dBuV)	Correct Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4884.00	28.06	7.79	35.85	54.00	-18.15	Vertical
4884.00	26.94	7.79	34.73	54.00	-19.27	Horizontal
Test channel: Highest channel						
Detector: PeakValue						
Frequency (MHz)	Read Level (dBuV)	Correct Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	39.74	8.06	47.80	74.00	-26.20	Vertical
4960.00	44.11	8.06	52.17	74.00	-21.83	Horizontal
Detector: AverageValue						
Frequency (MHz)	Read Level (dBuV)	Correct Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	26.42	8.06	34.48	54.00	-19.52	Vertical
4960.00	26.98	8.06	35.04	54.00	-18.96	Horizontal
Remark: *1. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.* *2. The emission levels of other frequencies are very lower than the limit and not show in test report.*						

------End of report------