TEST REPORT

Applicant:	Beijing Changba Technology Co., Ltd.
Address of Applicant:	Room 260, 3C, 5th floor, No.9 Wangjing Street, Chaoyang District, Beijing, China
Equipment Under Test (EUT)	
Product Name:	CALF Speaker Microphone
Model No.:	C12
Trade mark:	CALF
FCC ID:	2AWERC12
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of sample receipt:	08 Apr., 2022
Date of Test:	17 Apr., 2022~ 20 Apr., 2022
Date of report issued:	19 May 2022
Test Result:	PASS *

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

1 Modified Information

Version No.	Date	Description
00	*19 May 2022*	*Original*

Tested by: Leo Zhang ***Date:*** 19 May 2022

Leo Zhang/ Engineer

Reviewed by: ***Date:*** 19 May 2022

Louis Ye/ Manager

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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 0.5dB (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:	Beijing Changba Technology Co., Ltd.
Address:	Room 260, 3C, 5th floor, No.9 Wangjing Street, Chaoyang District, Beijing, China
Manufacturer:	Same as Applicant
Address:	Same as Applicant

4.2 General Description of E.U.T.

Product Name:	CALF Speaker Microphone
Model No.:	C12
Operation Frequency:	2402MHz~2480MHz
Hardware Version	V1
Software Version	V1
Transfer rate:	1/2 Mbits/s
Number of channel:	79
Modulation type:	GFSK, π/4-DQPSK
Modulation technology:	FHSS
Antenna Type:	PCB Antenna
Antenna gain:	2dBi
Power supply:	Battery
AC adapter:	N/A

Operation Frequency each of channel for GFSK, π/4-DQPSK							
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 and π/4-DQPSK							

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)	±5.6 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 method:					
Test Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
EMI Test Receiver	R&S	ESR 3	102330	2021-07-29	2022-07-28
EMI Test Receiver	R&S	ESR 7	102259	2022-03-01	2023-02-28
Spectrum Analyzer	R&S	FSV40-N	102175	2022-03-01	2023-02-28
BiConiLog Antenna	SCHWARZBECK	VULB 9163	1105	2021-12-05	2022-12-04
BiConiLog Antenna	SCHWARZBECK	VULB 9168	1066	2022-03-05	2023-03-04
Horn Antenna	SCHWARZBECK	BBHA 9120 D	911	2022-03-05	2023-03-04
Pre-amplifier	SCHWARZBECK	BBV9743	00009	2021-07-29	2022-07-28
Pre-amplifier	SCHWARZBECK	BBV9744	162	N/A	N/A
Pre-amplifier	SCHWARZBECK	BBV9718C	00014	2022-03-01	2023-02-28
EMI Test Software	Farad	EZ-EMC	Version: V.EMCE-3A1		

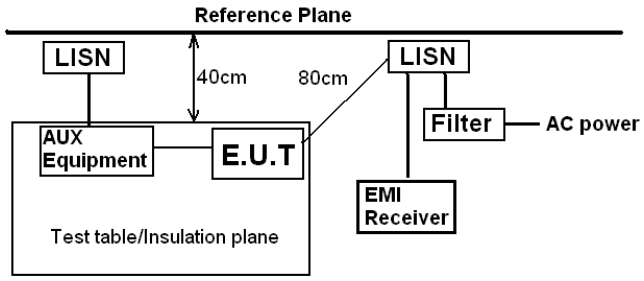
Conducted method:					
Test Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
SpectureAnalyzer	R&S	FSV40-N	102175	2022-03-01	2023-02-28
Test Software	MWRFTEST	MTS 8310	Version: 2.0.0.0		

5 Test results and measurement data

5.1 Antenna Requirement

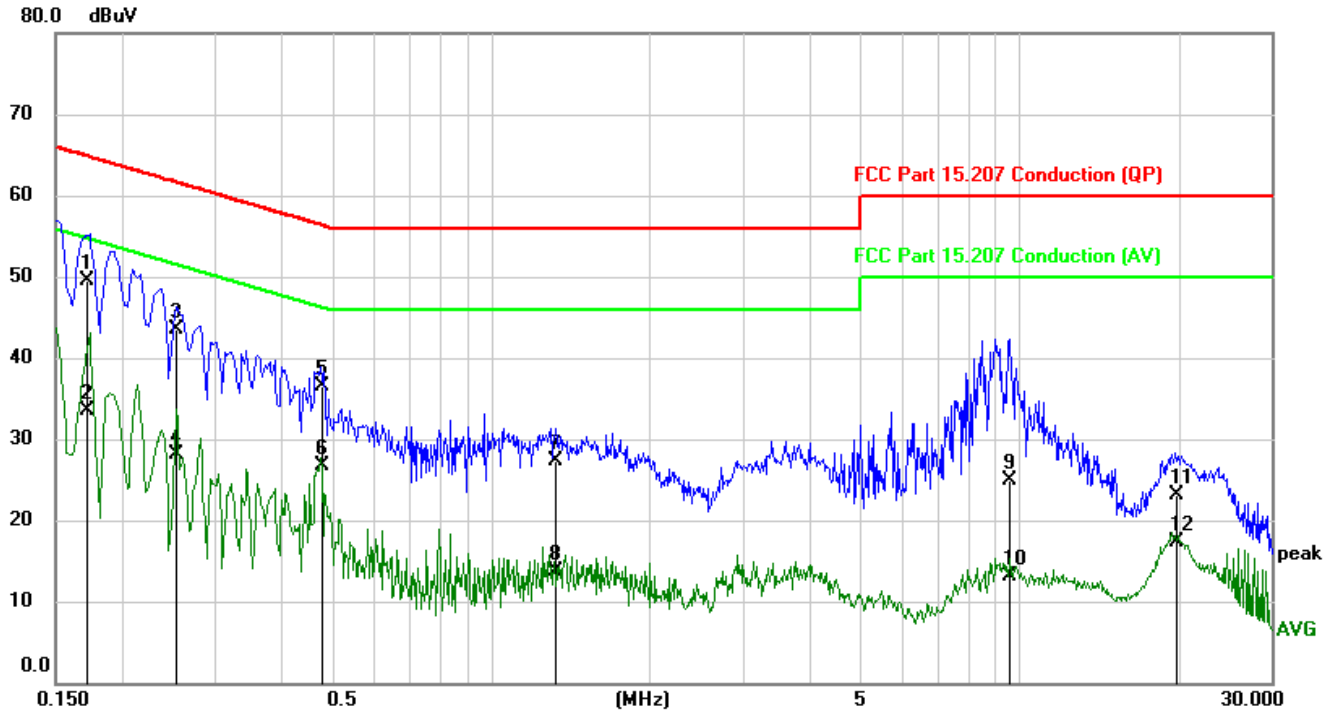
Standard requirement:	FCC Part15 C Section 15.203 &247(b)
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique 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 is 2dBi.	

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:	C12	**Test result:**	pass
Test by:	Leo Zhang	**Test mode:**	Charging + BT Link.
Test voltage:	120Vac, 60 Hz	**Phase:**	Line (N)
Environment:	Temp.: 22.9℃ Humi.: 49%		



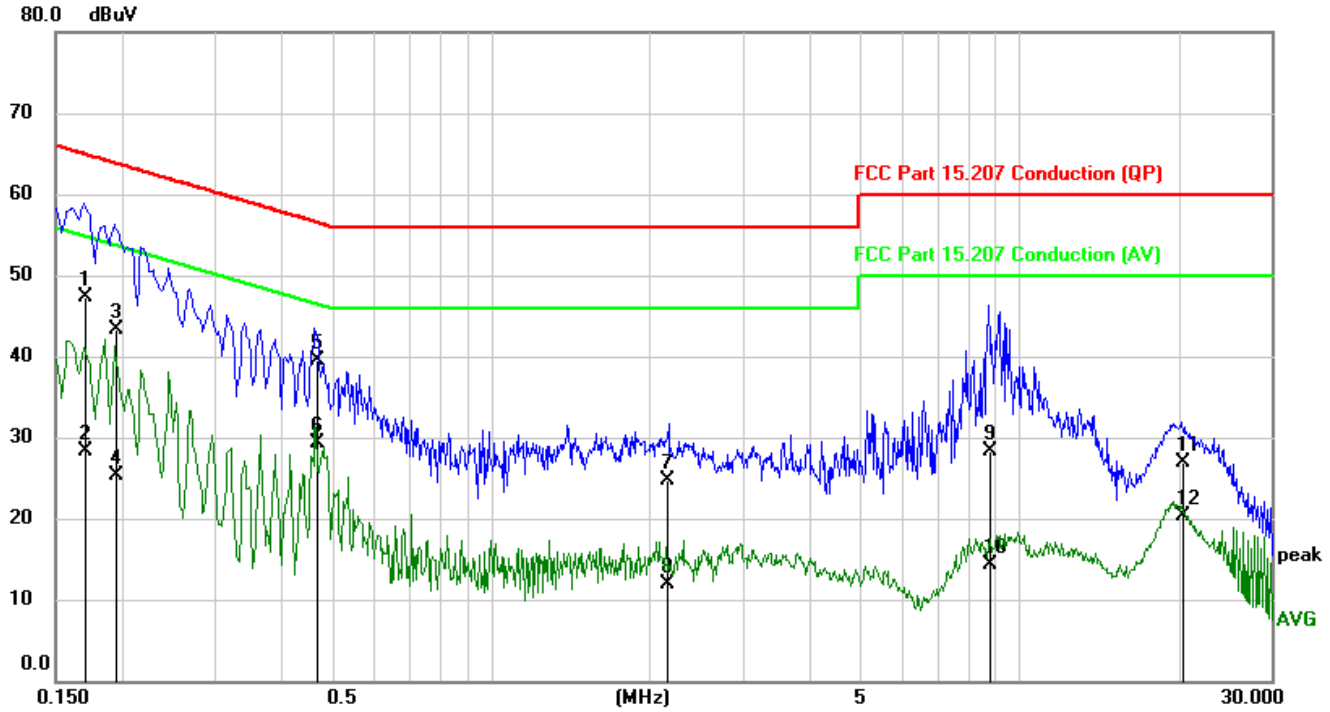
(Plot A:N Phase)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	*	0.1720	39.95	9.65	49.60	64.86	-15.26	QP
2		0.1720	23.87	9.65	33.52	54.86	-21.34	AVG
3		0.2525	33.81	9.71	43.52	61.67	-18.15	QP
4		0.2525	18.40	9.71	28.11	51.67	-23.56	AVG
5		0.4772	26.71	9.78	36.49	56.39	-19.90	QP
6		0.4772	16.90	9.78	26.68	46.39	-19.71	AVG
7		1.3195	17.55	9.69	27.24	56.00	-28.76	QP
8		1.3195	3.92	9.69	13.61	46.00	-32.39	AVG
9		9.5492	14.90	10.06	24.96	60.00	-35.04	QP
10		9.5492	3.08	10.06	13.14	50.00	-36.86	AVG
11		19.7623	13.33	9.81	23.14	60.00	-36.86	QP
12		19.7623	7.57	9.81	17.38	50.00	-32.62	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:	C12	Test result:	pass
Test by:	Leo Zhang	Test mode:	Charging + BT Link.
Test voltage:	120Vac, 60 Hz	Phase:	Line (L)
Environment:	Temp.: 22.9℃ Humi.: 49%		



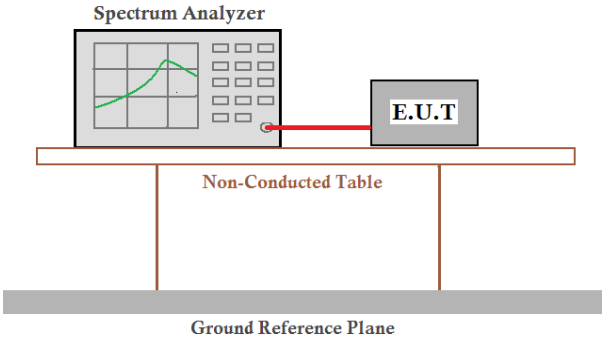
(Plot B:L Phase)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1702	37.42	9.79	47.21	64.95	-17.74	QP
2		0.1702	18.60	9.79	28.39	54.95	-26.56	AVG
3		0.1947	33.45	9.80	43.25	63.83	-20.58	QP
4		0.1947	15.57	9.80	25.37	53.83	-28.46	AVG
5	*	0.4668	29.63	9.91	39.54	56.57	-17.03	QP
6		0.4668	19.35	9.91	29.26	46.57	-17.31	AVG
7		2.1505	14.89	9.86	24.75	56.00	-31.25	QP
8		2.1505	2.08	9.86	11.94	46.00	-34.06	AVG
9		8.7487	18.18	10.05	28.23	60.00	-31.77	QP
10		8.7487	4.16	10.05	14.21	50.00	-35.79	AVG
11		20.3461	16.87	10.08	26.95	60.00	-33.05	QP
12		20.3461	10.19	10.08	20.27	50.00	-29.73	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.*

5.3 Conducted Output Power

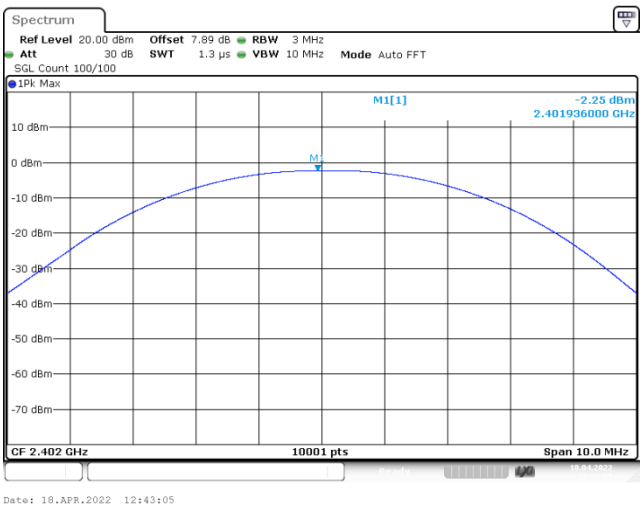
Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Receiver setup:	RBW=3MHz, VBW=10MHz, span=10MHz,Sweep time=auto couple. Detector=Peak ,Trace mode=max hold,Allow trace to fully stabilize.
Limit:	For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping 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:

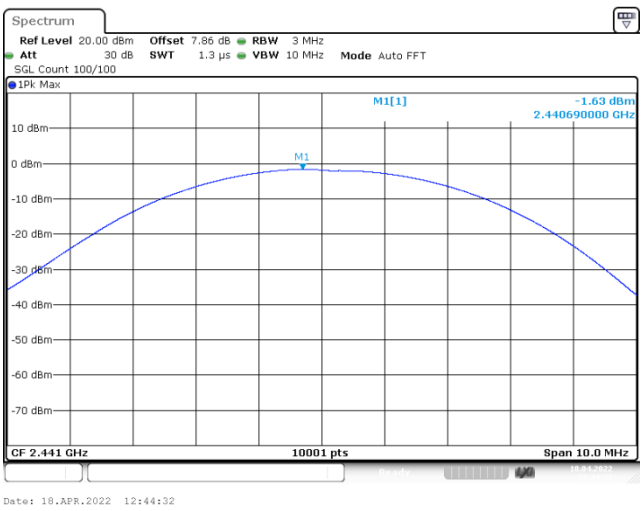
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
GFSK mode			
Lowest channel	-2.246	21.00	Pass
Middle channel	-1.627	21.00	Pass
Highest channel	-1.259	21.00	Pass
π/4-DQPSK mode			
Lowest channel	-0.625	21.00	Pass
Middle channel	-0.563	21.00	Pass
Highest channel	0.229	21.00	Pass

Test plot as follows:

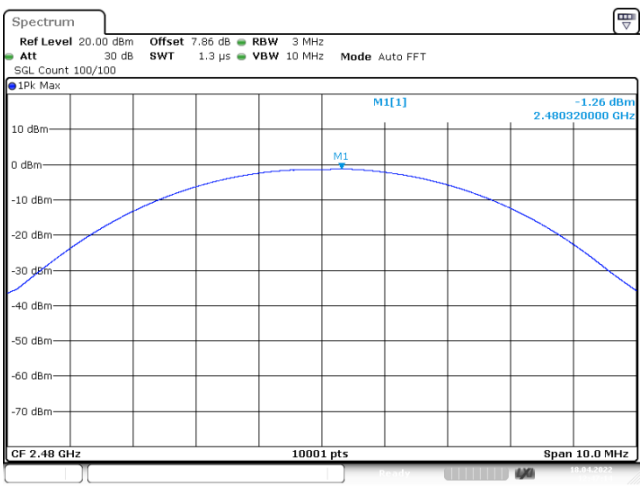
Modulation mode:GFSK



Lowest channel

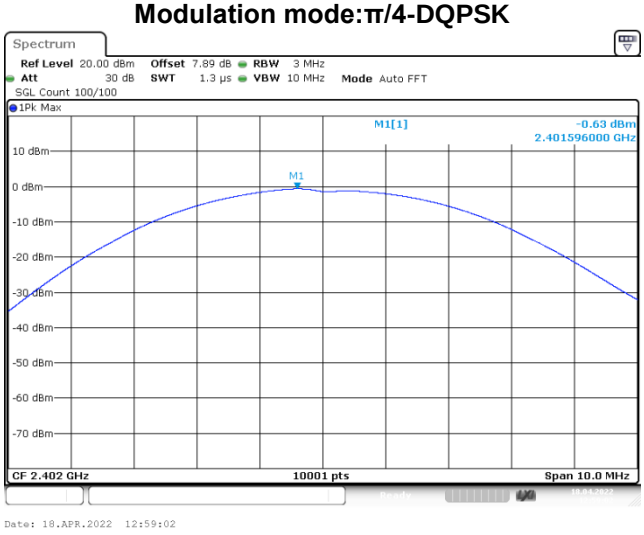


Middle channel

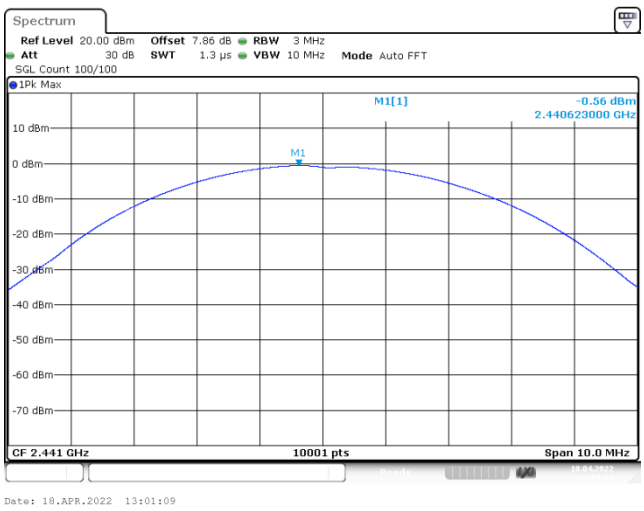


Highest channel

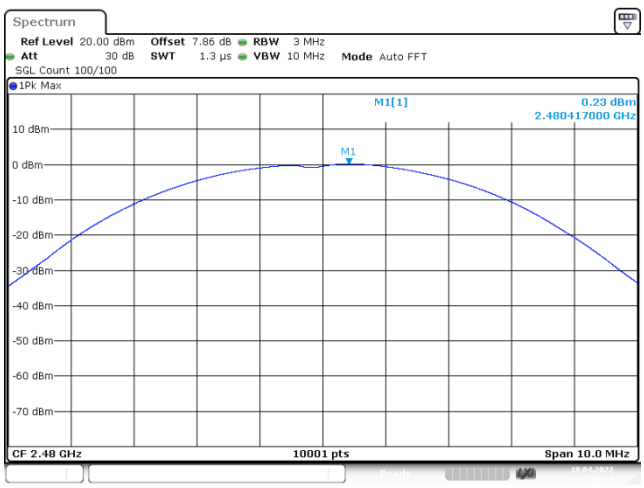
Modulation mode:π/4-DQPSK



Lowest channel

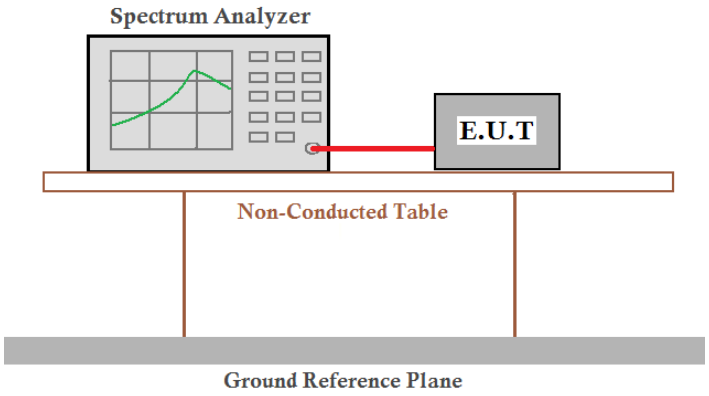


Middle channel



Highest channel

5.4 20dB Occupy Bandwidth

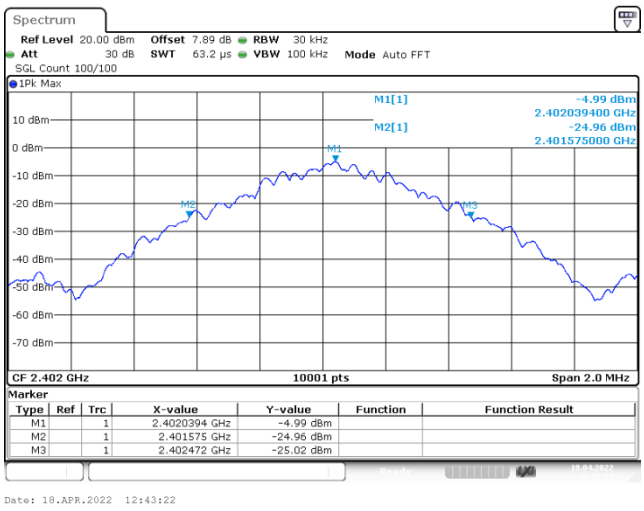
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Receiver setup:	RBW=30kHz, VBW=100kHz, detector=Peak
Limit:	N/A
Test setup:	
Test Instruments:	Refer to section 4.9 for details
Test mode:	Non-hopping mode
Test results:	Pass

Measurement Data:

Test channel	20dB Occupy Bandwidth (MHz)	
	GFSK	π/4-DQPSK
Lowest	0.897	1.352
Middle	0.948	1.327
Highest	0.939	1.329

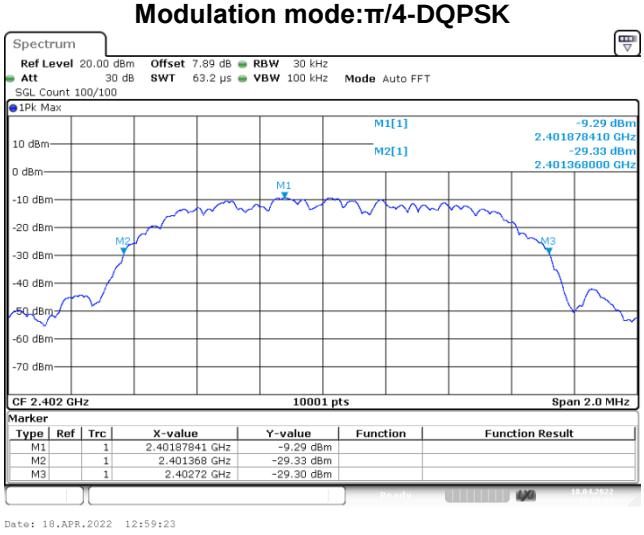
Test plot as follows:

Modulation mode:GFSK

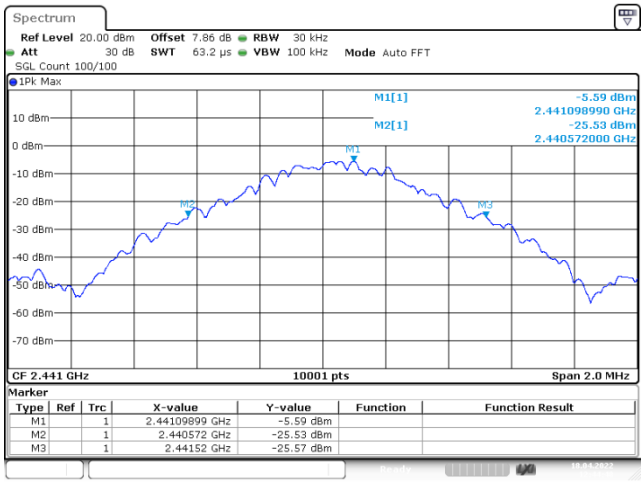


Lowest channel

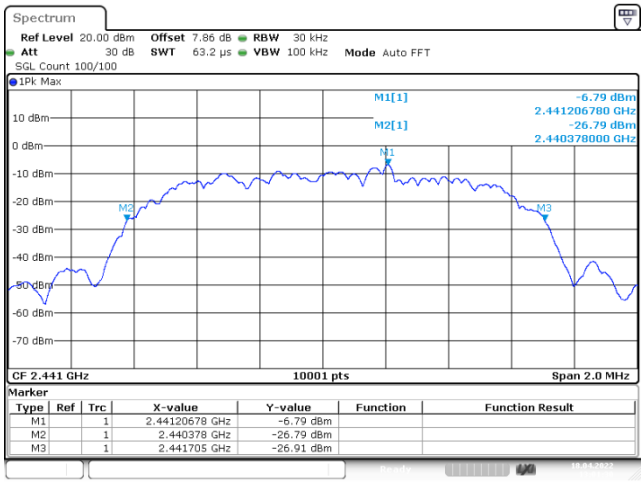
Modulation mode:π/4-DQPSK



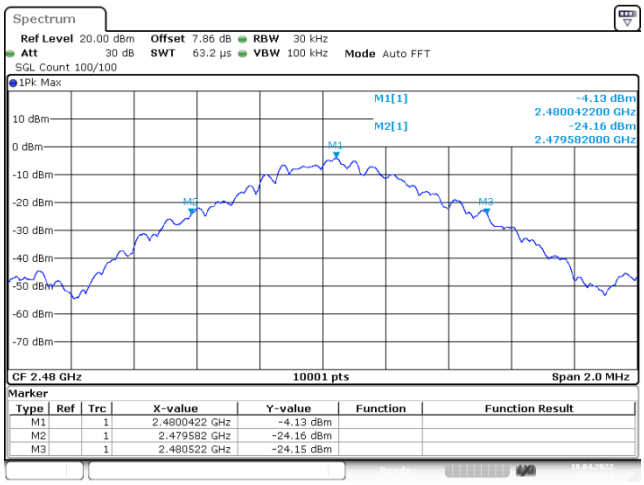
Lowest channel



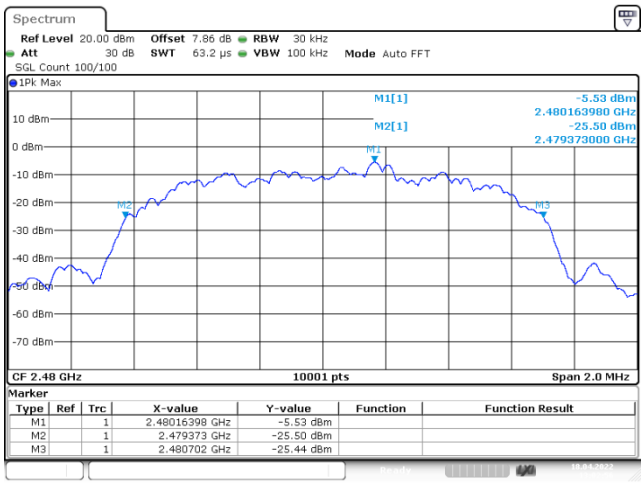
Middle channel



Middle channel

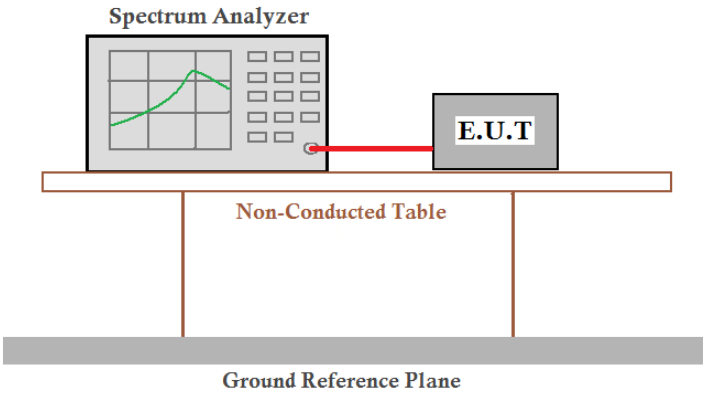


Highest channel



Highest channel

5.5 Carrier Frequencies Separation

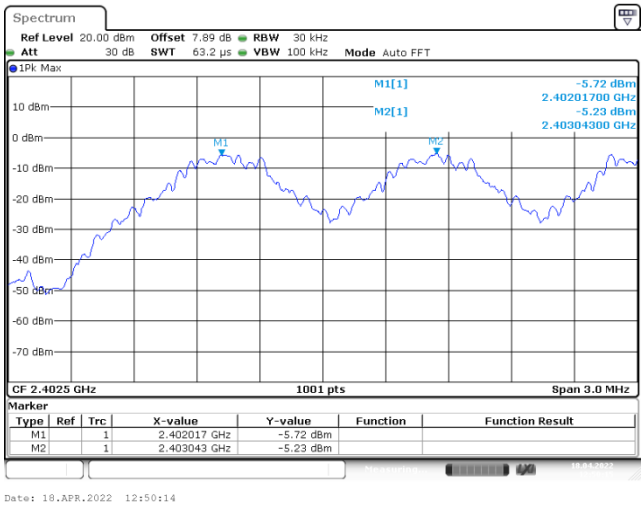
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Receiver setup:	RBW=100kHz, VBW=300kHz, detector=Peak
Limit:	0.025MHz or two-thirds of the 20dB bandwidth (whichever is greater)
Test setup:	
Test Instruments:	Refer to section 4.9 for details
Test mode:	Hopping mode
Test results:	Pass

Measurement Data:

Measured Channel Numbers	Carrier Frequencies Separation (MHz)	20dB bandwidth (MHz)	Limit (MHz)	Result
GFSK				
0 and 1	1.026	0.897	0.598	Pass
39 and 40	1.002	0.948	0.632	Pass
77 and 78	0.996	0.939	0.626	Pass
π/4-DQPSK mode				
0 and 1	1.002	1.352	0.901	Pass
39 and 40	0.999	1.327	0.885	Pass
77 and 78	0.996	1.329	0.886	Pass
Note 1:Min. Limit is equal to the two-thirds of the 20dB bandwidth				

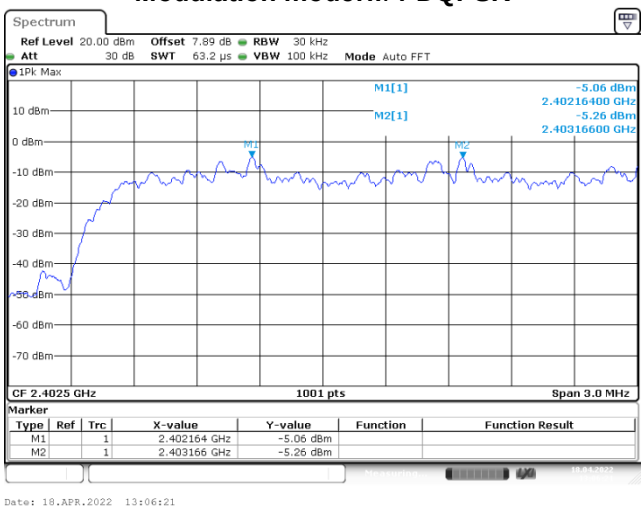
Test plot as follows:

Modulation mode:GFSK

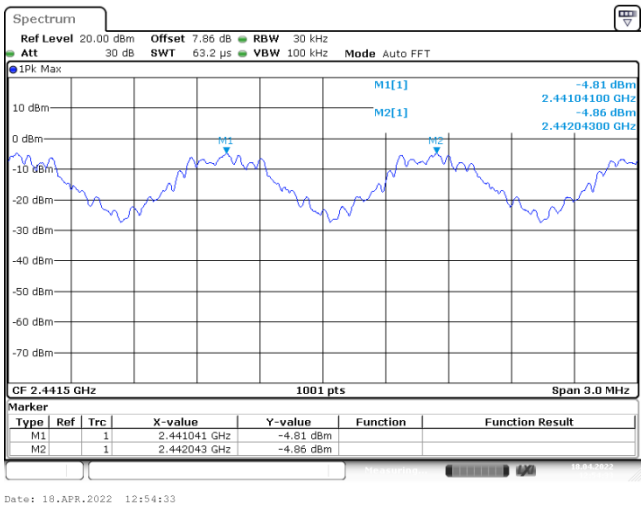


Lowest channel

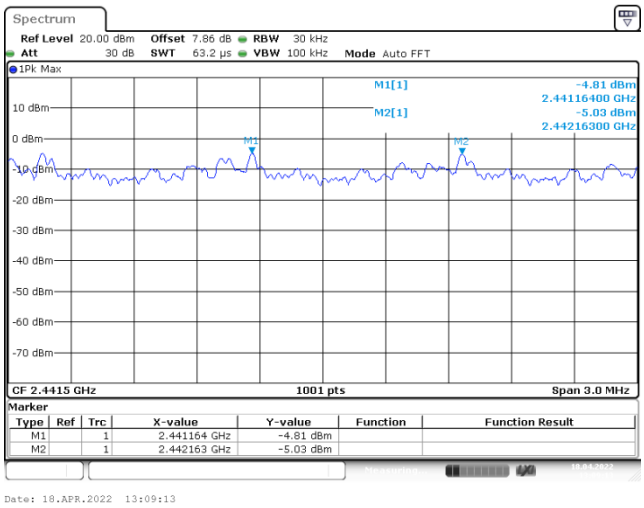
Modulation mode:π/4-DQPSK



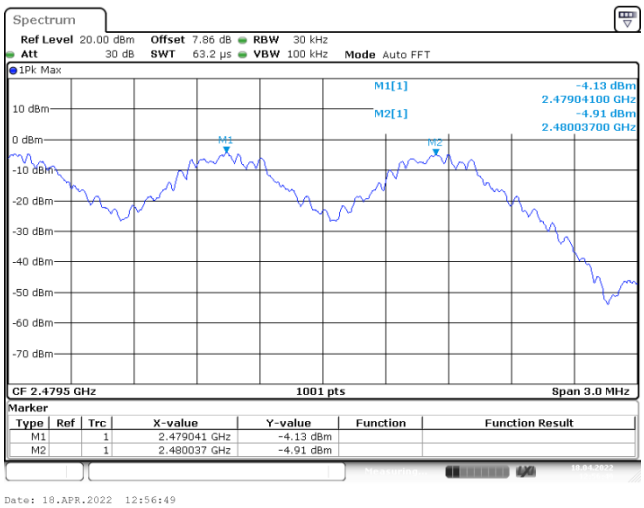
Lowest channel



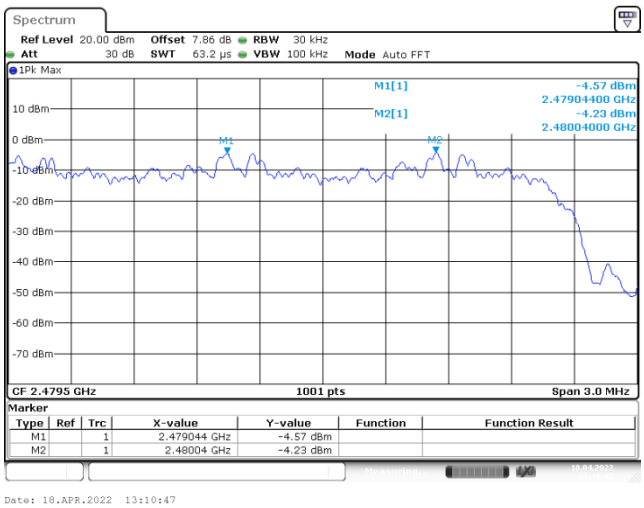
Middle channel



Middle channel

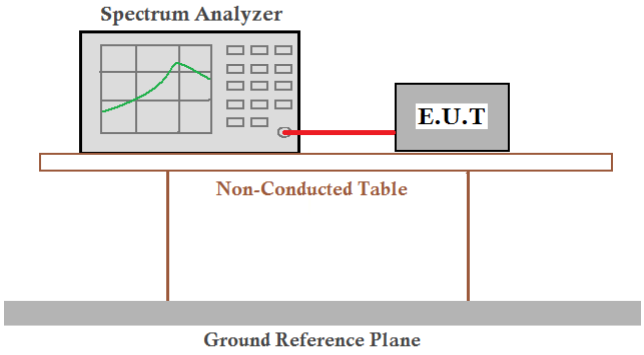


Highest channel



Highest channel

5.6 Hopping Channel Number

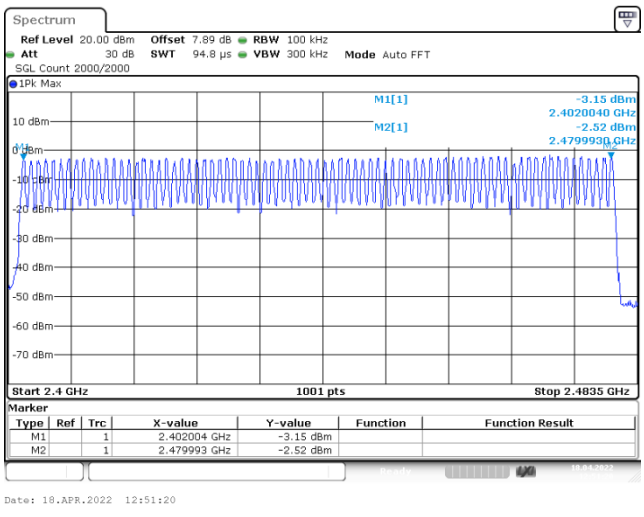
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz to 2483.5MHz, Detector=Peak
Limit:	15 channels
Test setup:	
Test Instruments:	Refer to section 4.9 for details
Test mode:	Hopping mode
Test results:	Pass

Measurement Data:

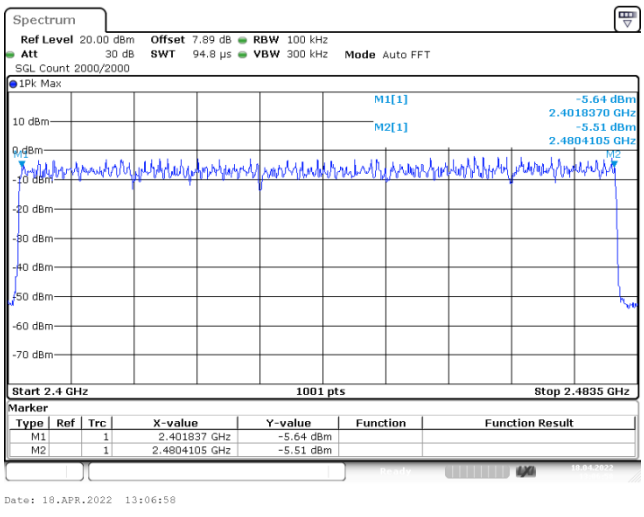
Mode	Hopping channel numbers	Limit	Result
GFSK, π/4-DQPSK	79	15	Pass

Test plot as follows:

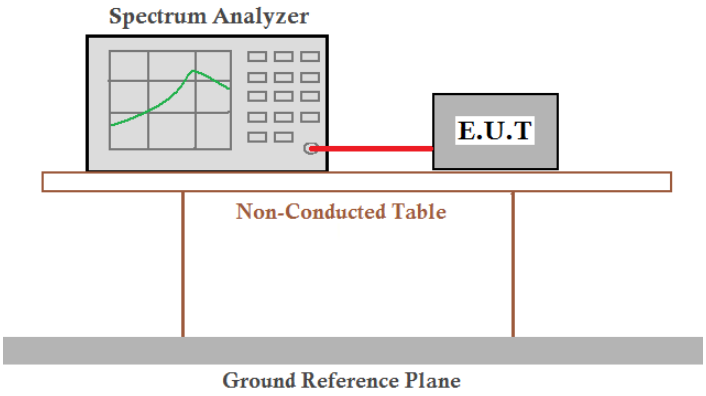
GFSK



π/4-DQPSK



5.7 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) in this report.

Mode	Packet	PulseWidth (ms)	Dwell time (ms)	Limit (second)	Result
GFSK	DH5	2.905	309.867	0.4	Pass
π/4-DQPSK	2DH5	2.909	310.293		

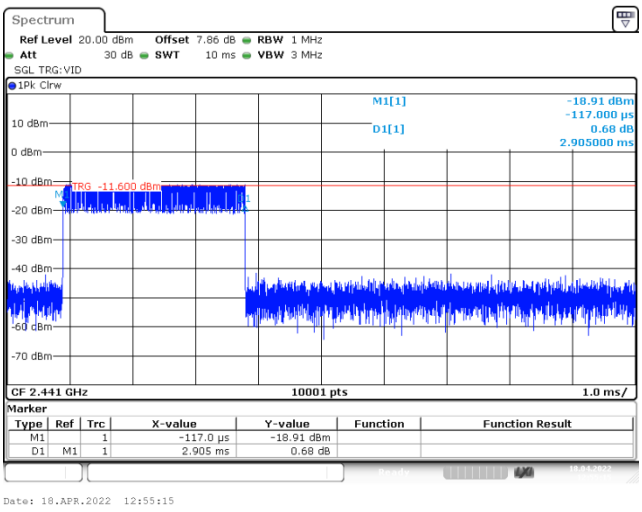
Note:

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

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

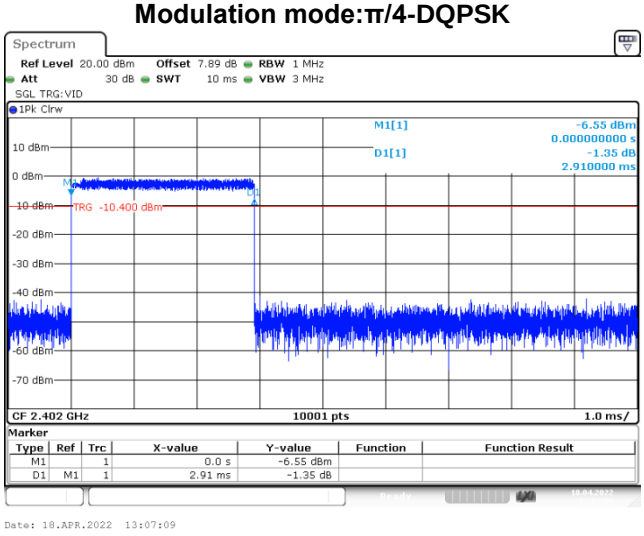
Test plot as follows:

Modulation mode:GFSK



DH5

Modulation mode:π/4-DQPSK



2-DH5

5.8 Pseudorandom Frequency Hopping Sequence

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

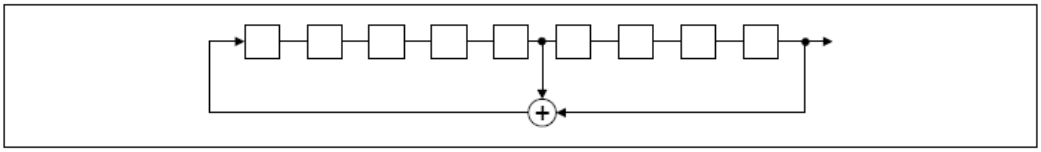
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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

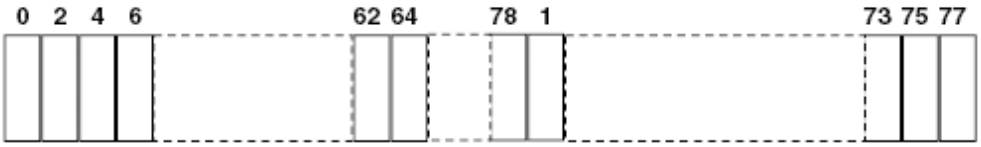
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized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

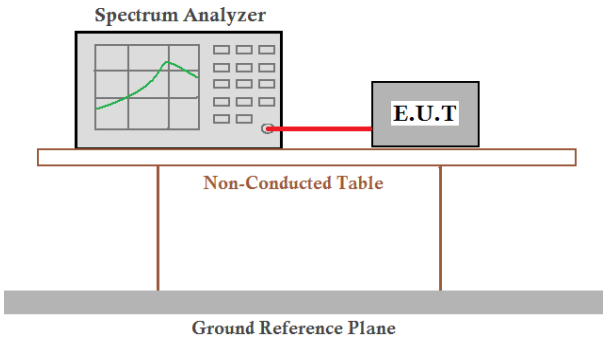


Each frequency used equally on the average by each transmitter.

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.

5.9 Band Edge

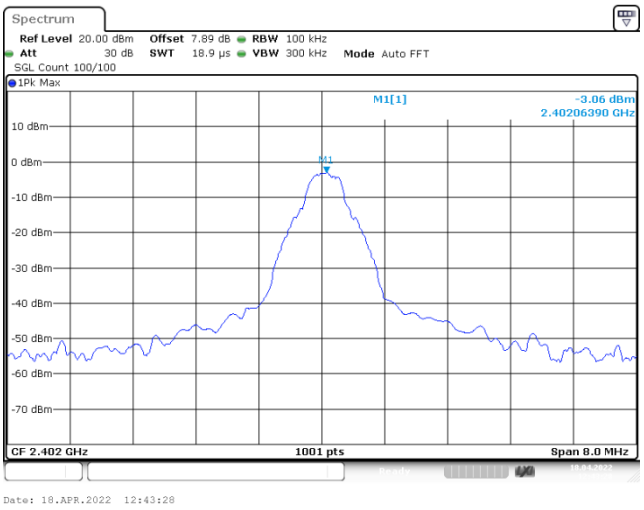
5.9.1 Conducted Emission Method

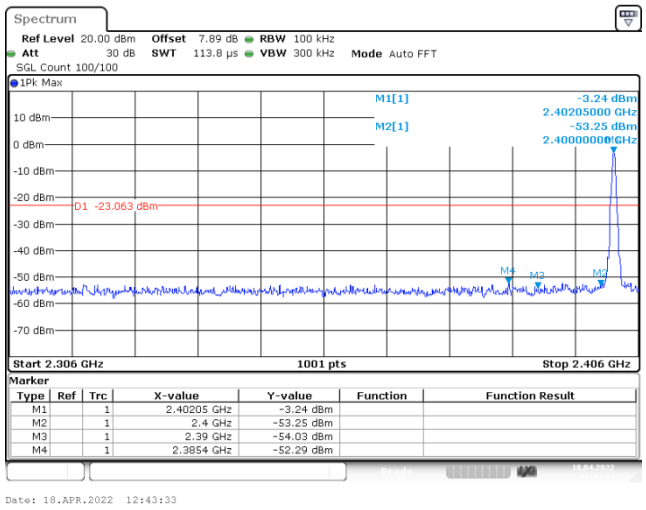
Test Requirement:	FCC Part15 C Section 15.247 (d)
Receiver setup:	RBW=100kHz, VBW=300kHz, Detector=Peak
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall 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

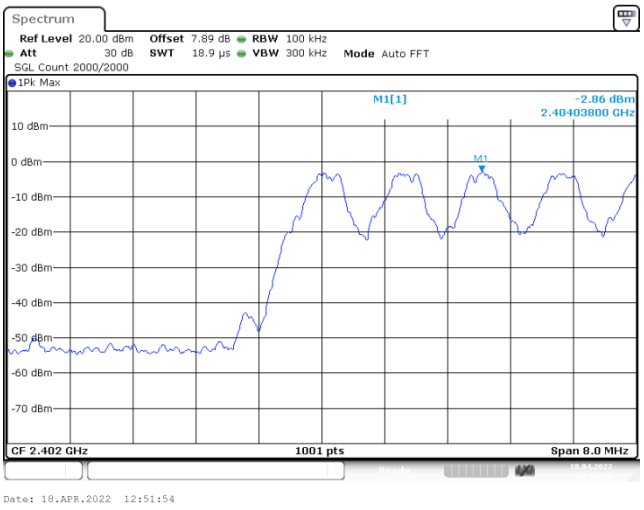
Lowest Channel

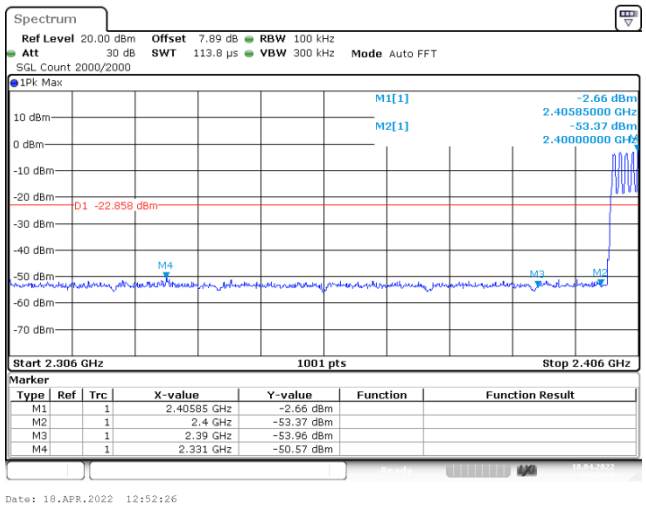




No-hopping mode

Lowest Channel

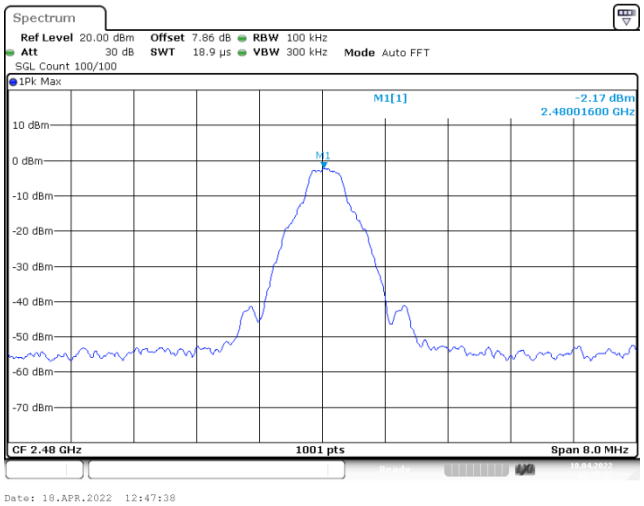


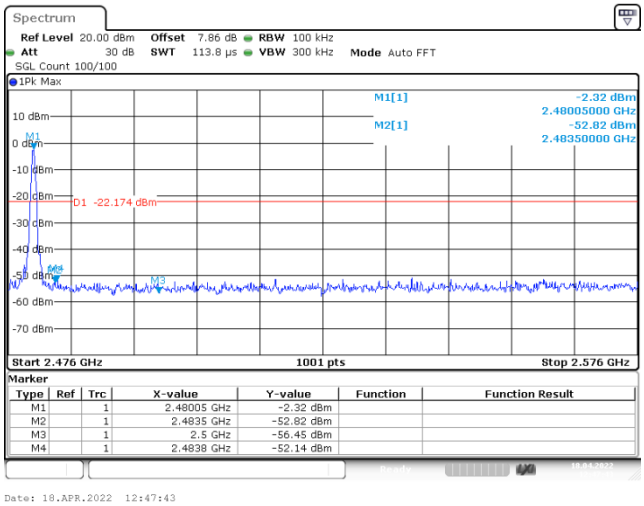


Hopping mode

GFSK

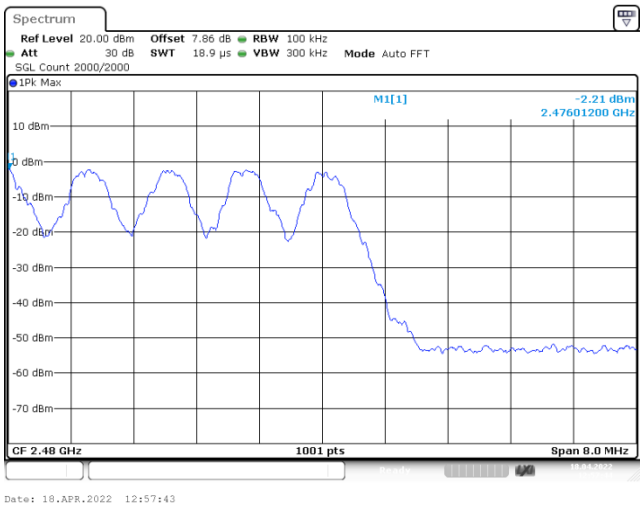
Highest Channel

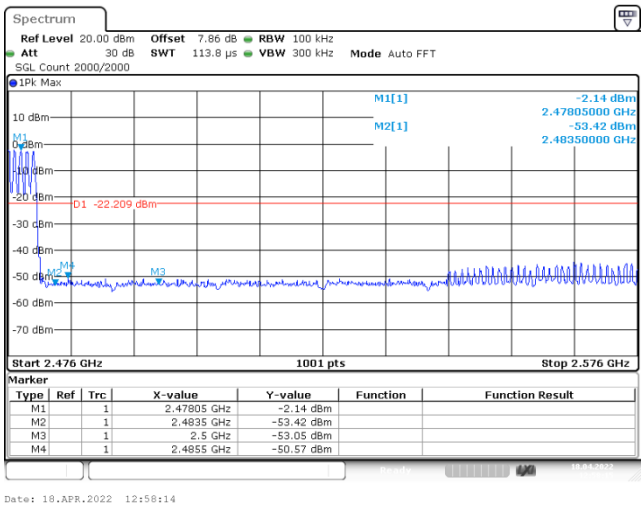




No-hopping mode

Highest Channel

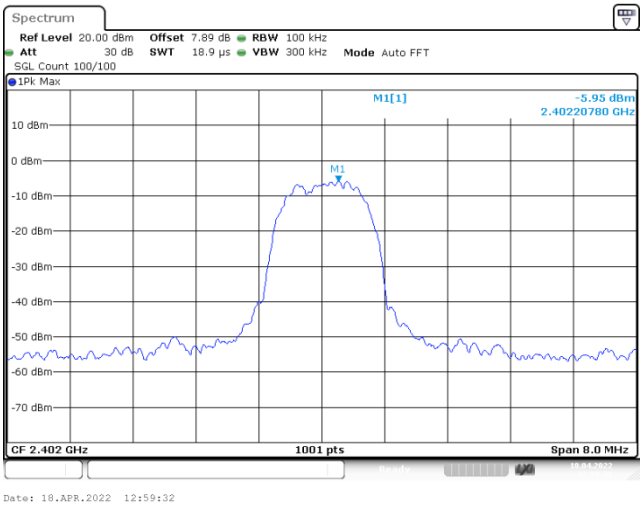


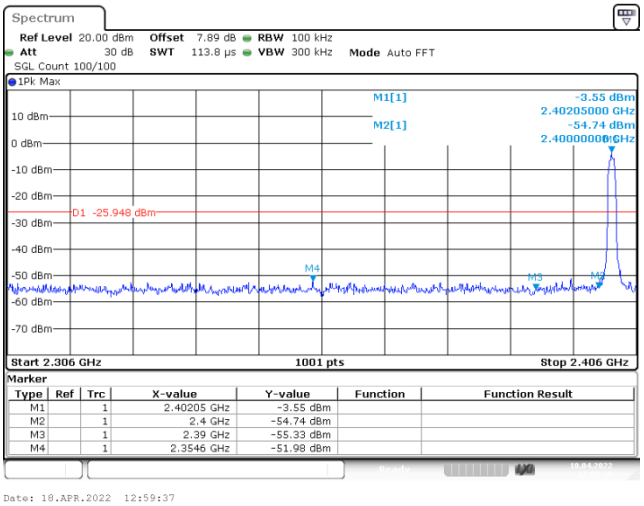


Hopping mode

π/4-DQPSK

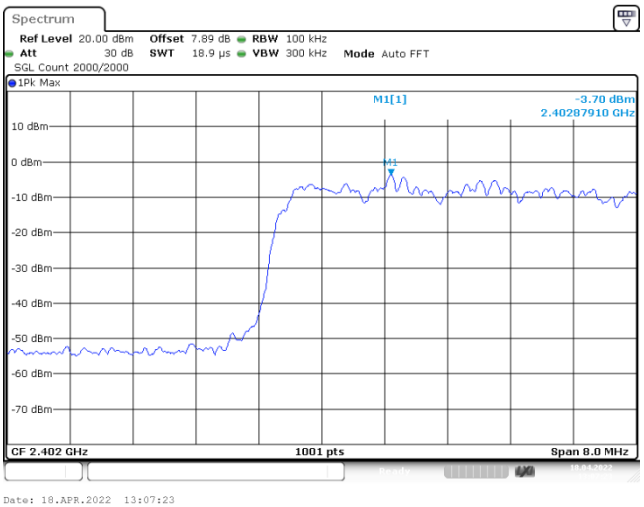
Lowest Channel

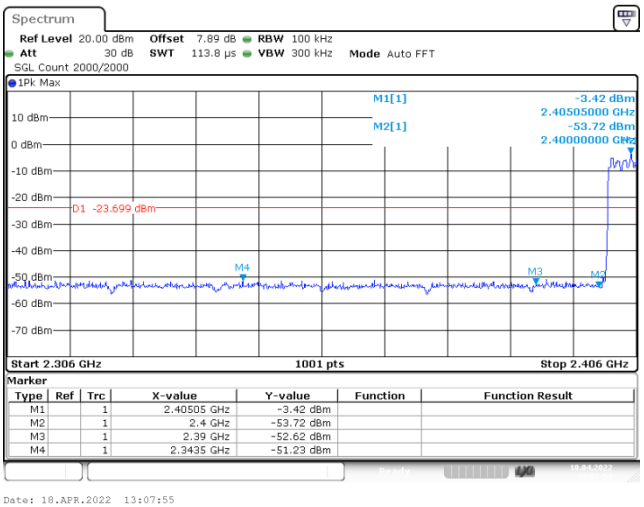




No-hopping mode

Lowest Channel

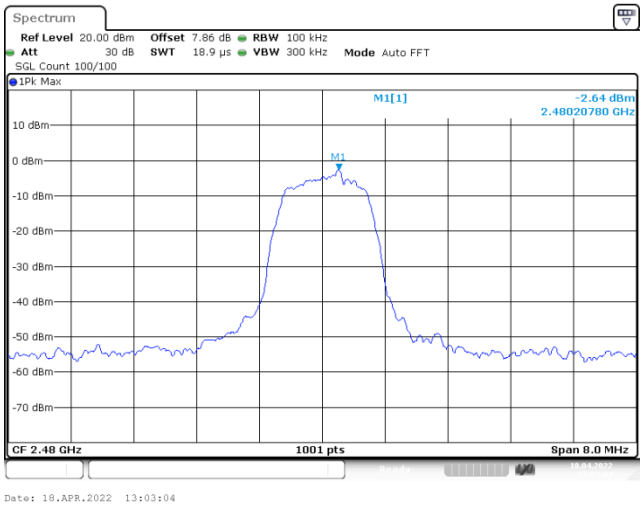


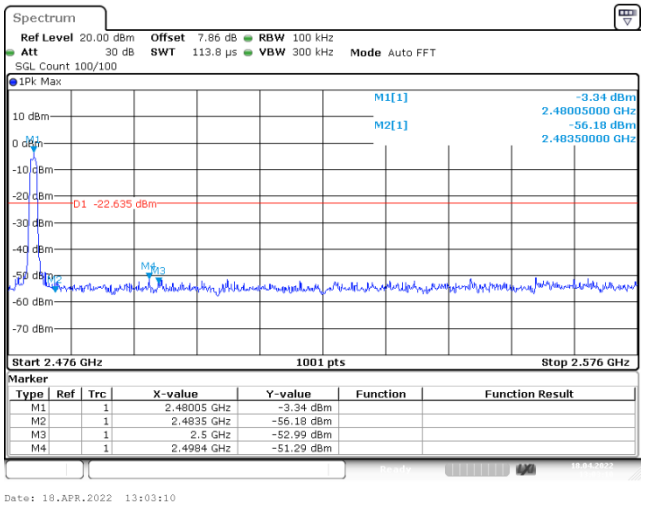


Hopping mode

π/4-DQPSK

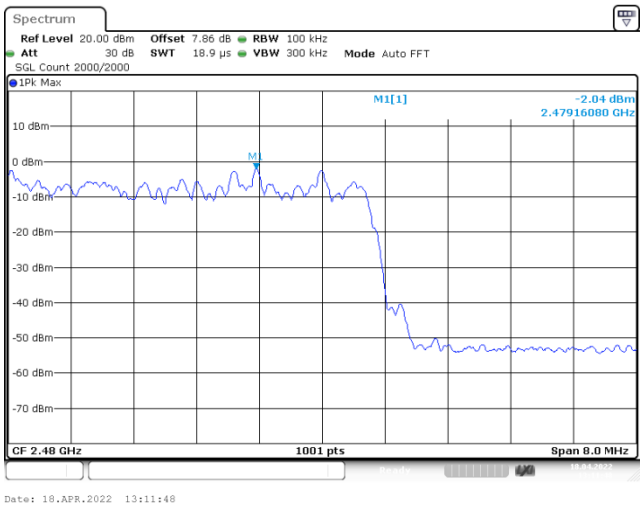
Highest Channel

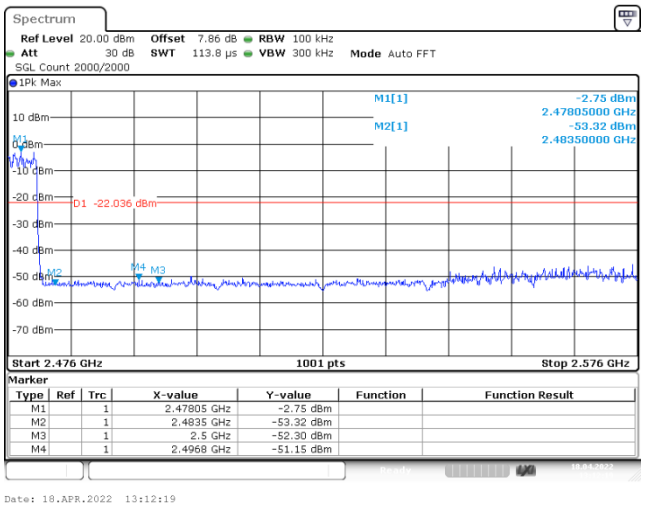




No-hopping mode

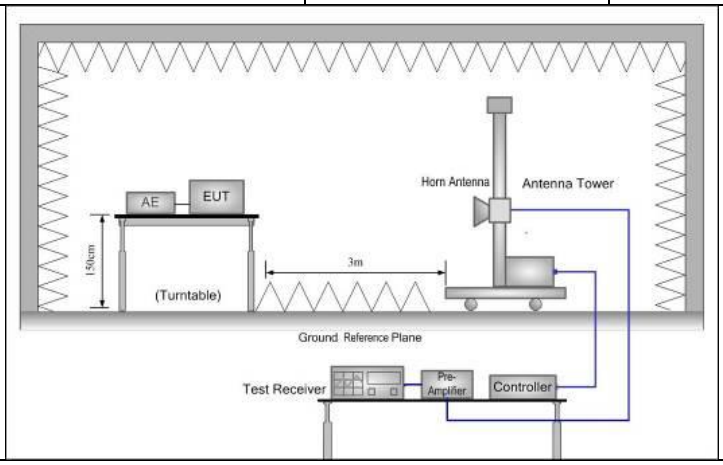
Highest Channel





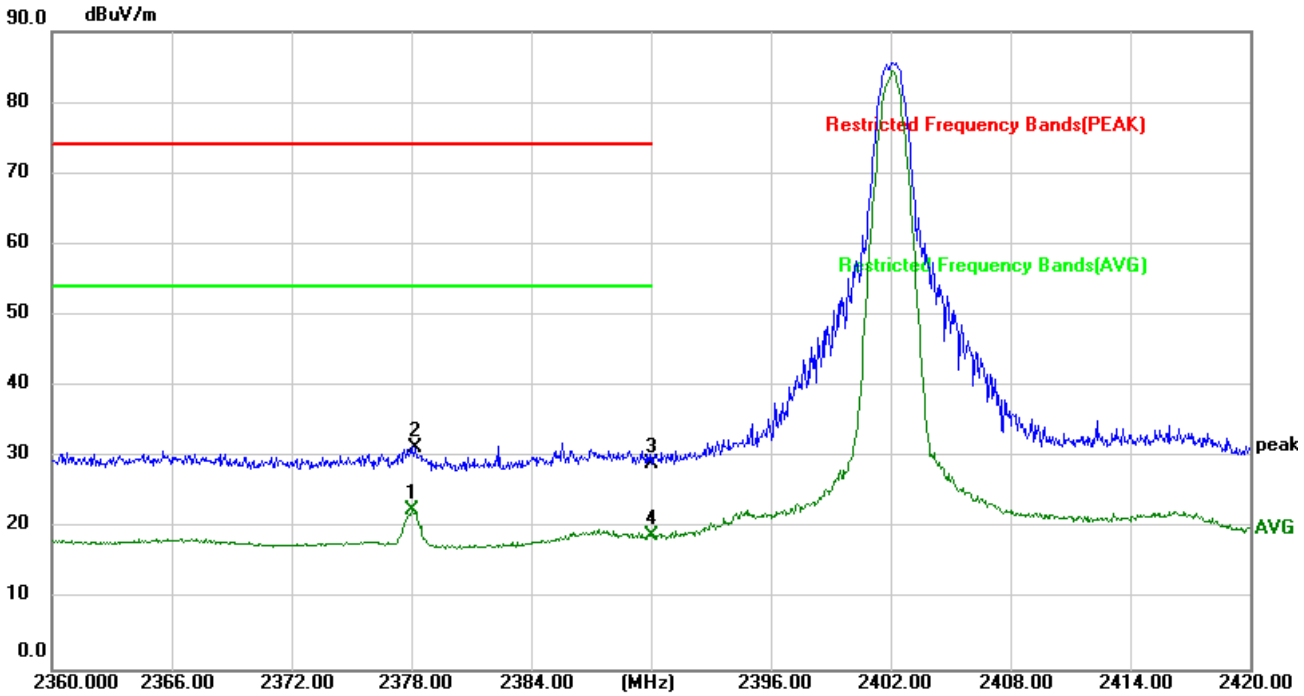
Hopping mode

5.9.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Frequency Range:	2380 MHz to 2410 MHz and 2465 MHz to 2520 MHz				
Test Distance:	3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value
Limit:	Frequency		Limit (dBuV/m @3m)		Remark
	Above 1GHz		54.00		Average Value
			74.00		Peak Value
Test setup:					
Test Procedure:	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.				
Test Instruments:	Refer to section 4.9 for details				
Test mode:	Non-hopping mode				
Test results:	Pass				

GFSK Mode:

Product Name:	CALF Speaker Microphone	**Product Model:**	C12
Test By:	Leo Zhang	**Test mode:**	DH5 Tx mode
Test Channel:	Lowest channel	**Polarization:**	Vertical
Test Voltage:	DC5V	**Environment:**	Temp:24.5℃ Humi.: 47%

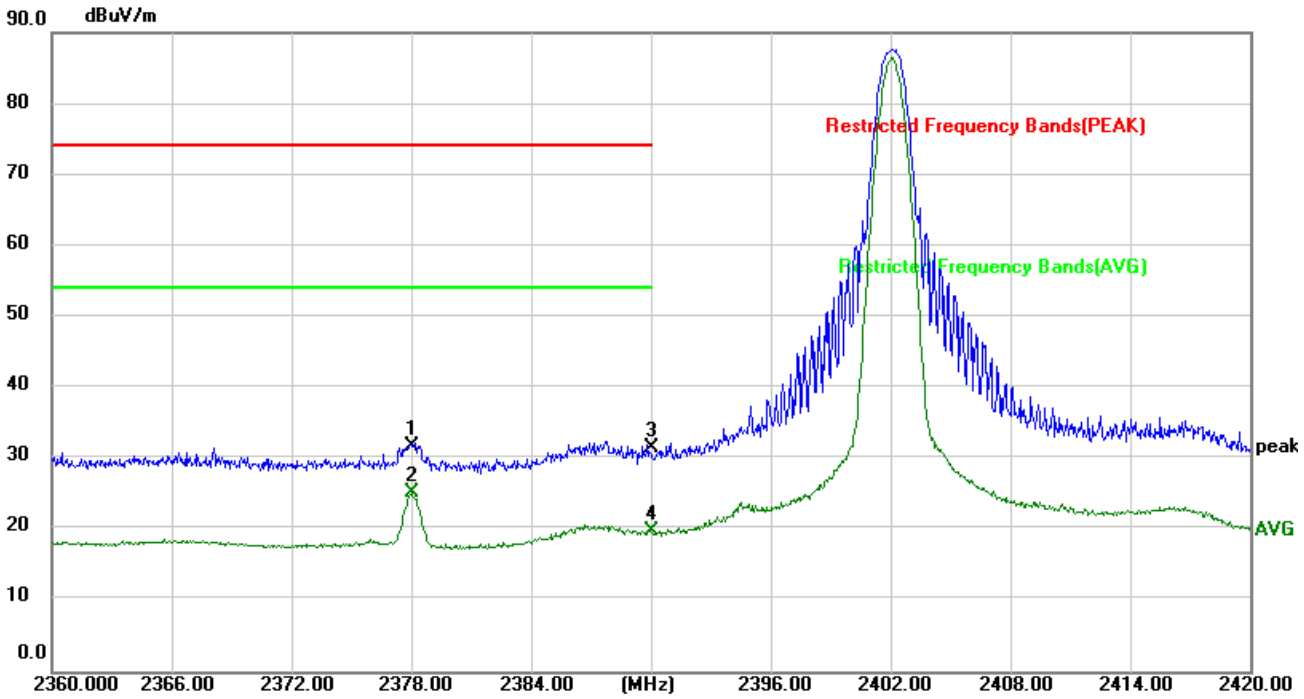


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	*	2378.000	22.74	-0.22	22.52	54.00	31.48	AVG
2		2378.180	31.63	-0.22	31.41	74.00	42.59	peak
3		2390.000	29.36	-0.25	29.11	74.00	44.89	peak
4		2390.000	19.16	-0.25	18.91	54.00	35.09	AVG

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:	CALF Speaker Microphone	Product Model:	C12
Test By:	Leo Zhang	Test mode:	DH5 Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	DC5V	Environment:	Temp.: 24.5℃ Humi: 47%

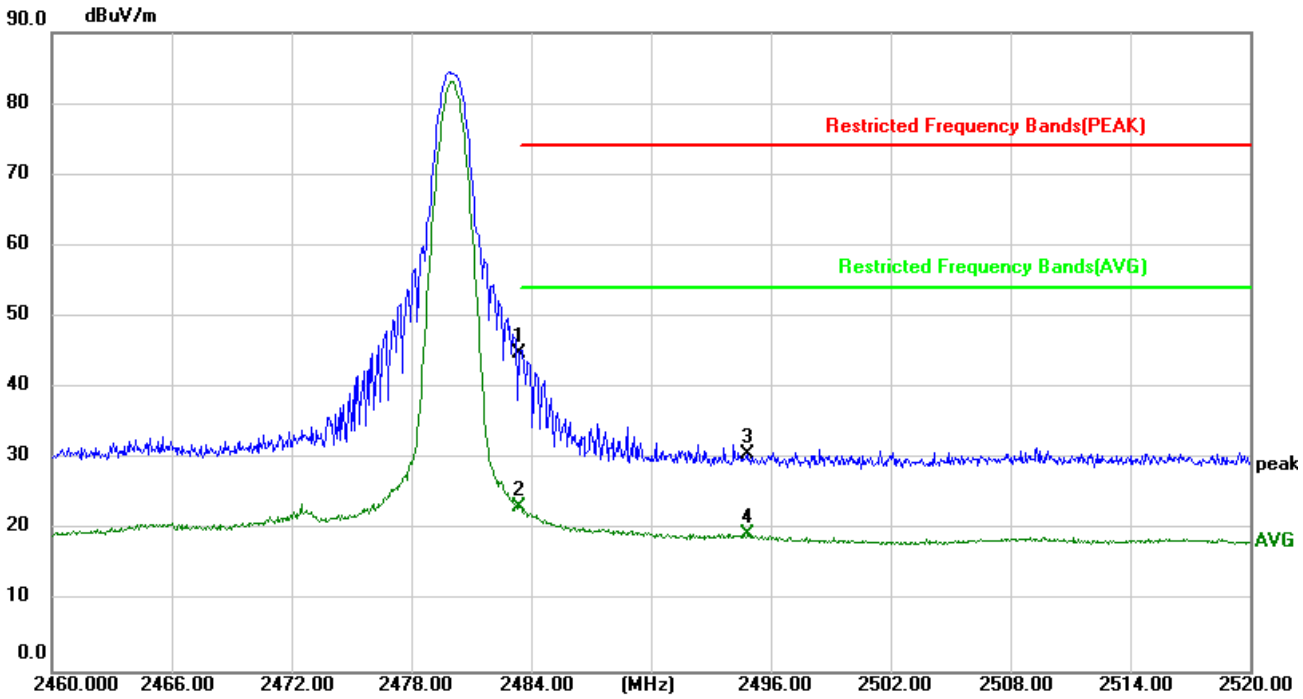


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2378.000	31.96	-0.22	31.74	74.00	42.26	peak
2	*	2378.000	25.64	-0.22	25.42	54.00	28.58	AVG
3		2390.000	31.76	-0.25	31.51	74.00	42.49	peak
4		2390.000	20.25	-0.25	20.00	54.00	34.00	AVG

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:	CALF Speaker Microphone	Product Model:	C12
Test By:	Leo Zhang	Test mode:	DH5 Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	DC5V	Environment:	Temp: 24.5℃ Humi: 47%

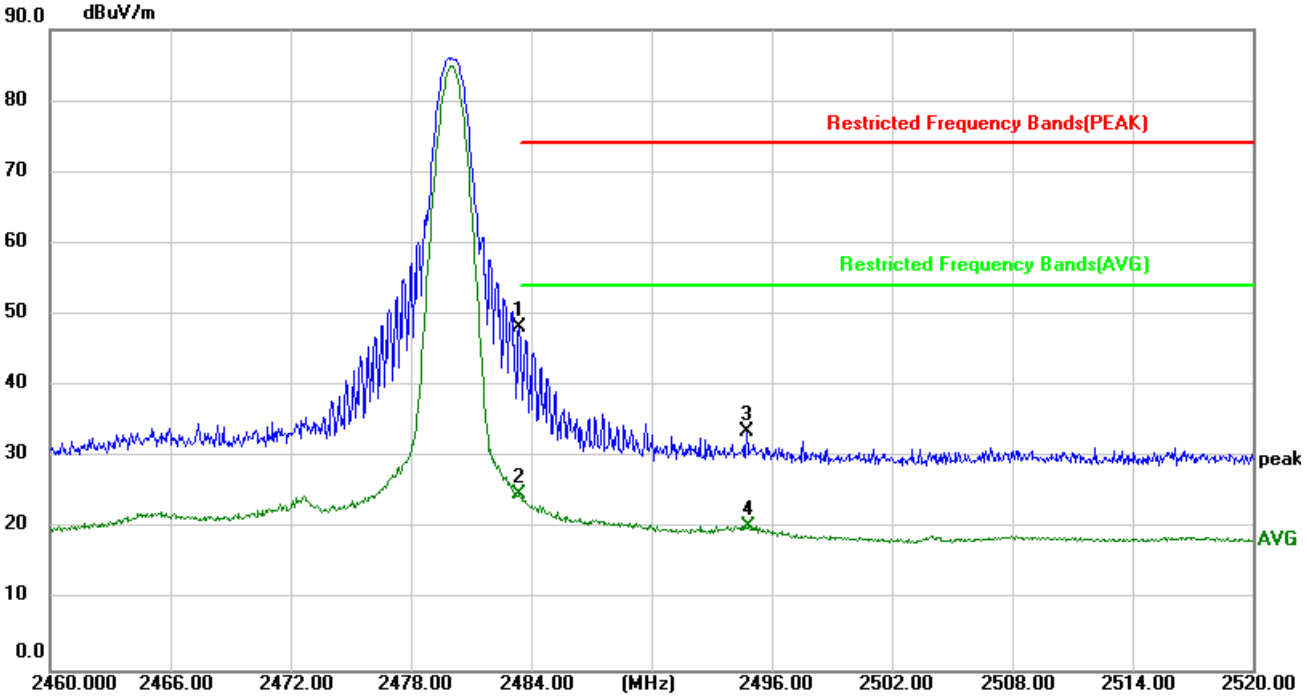


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	45.36	-0.36	45.00	74.00	29.00	peak
2		2483.500	23.55	-0.36	23.19	54.00	30.81	AVG
3		2494.800	31.09	-0.37	30.72	74.00	43.28	peak
4	*	2494.860	19.84	-0.37	19.47	54.00	34.53	AVG

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:	CALF Speaker Microphone	Product Model:	C12
Test By:	Leo Zhang	Test mode:	DH5 Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC5V	Environment:	Temp:24.5℃ Humi: 47%



Note:

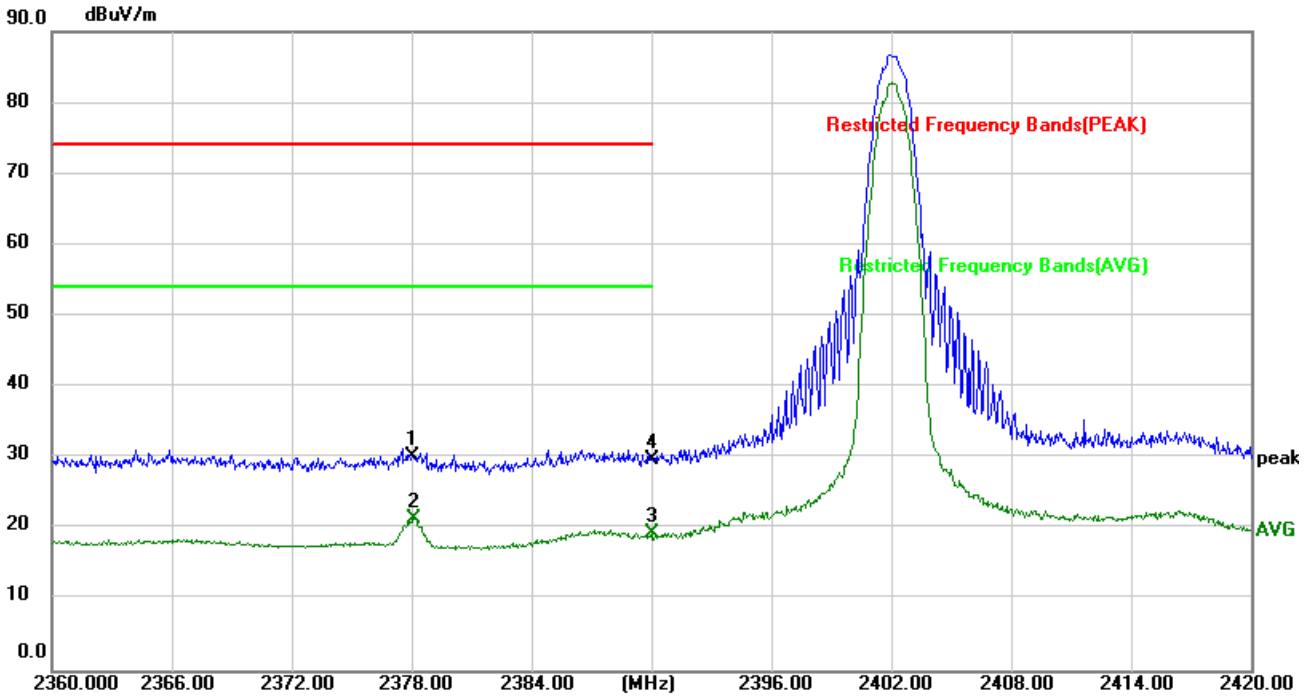
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	48.53	-0.36	48.17	74.00	25.83	peak
2		2483.500	25.15	-0.36	24.79	54.00	29.21	AVG
3		2494.740	33.94	-0.37	33.57	74.00	40.43	peak
4	*	2494.800	20.75	-0.37	20.38	54.00	33.62	AVG

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:	CALF Speaker Microphone	**Product Model:**	C12
Test By:	Leo Zhang	**Test mode:**	2DH5 Tx mode
Test Channel:	Lowest channel	**Polarization:**	Vertical
Test Voltage:	DC5V	**Environment:**	Temp:24.5℃ Humi: 47%

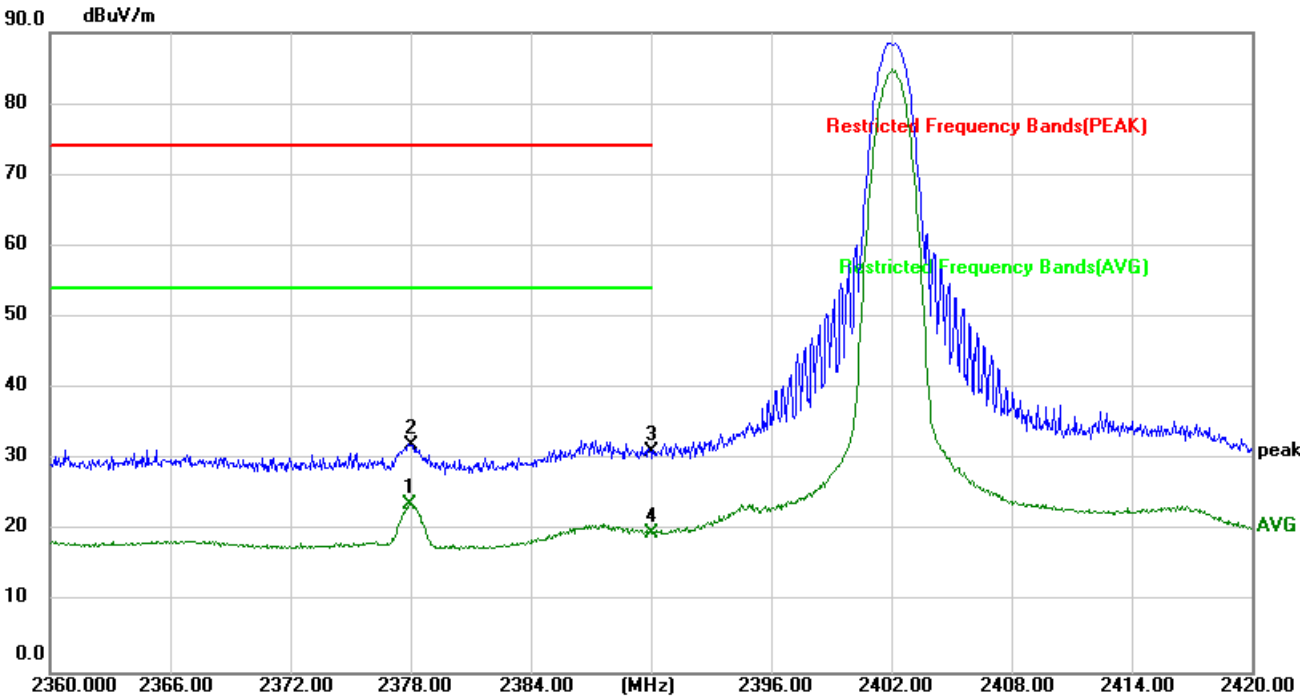


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2378.000	30.50	-0.22	30.28	74.00	43.72	peak
2	*	2378.120	21.69	-0.22	21.47	54.00	32.53	AVG
3		2390.000	19.68	-0.25	19.43	54.00	34.57	AVG
4		2390.000	30.09	-0.25	29.84	74.00	44.16	peak

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:	CALF Speaker Microphone	Product Model:	C12
Test By:	Leo Zhang	Test mode:	2DH5 Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	DC5V	Environment:	Temp:24.5℃ Humi: 47%

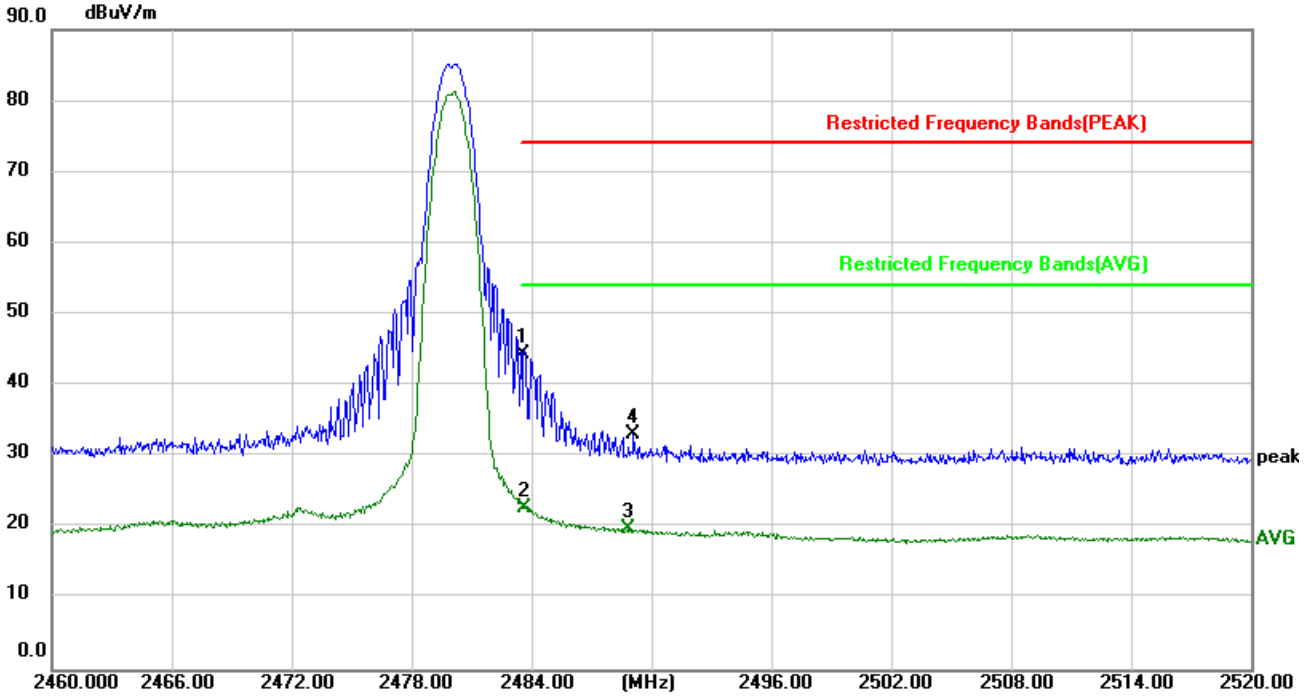


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	*	2377.940	23.98	-0.22	23.76	54.00	30.24	AVG
2		2378.000	32.28	-0.22	32.06	74.00	41.94	peak
3		2390.000	31.34	-0.25	31.09	74.00	42.91	peak
4		2390.000	19.95	-0.25	19.70	54.00	34.30	AVG

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:	CALF Speaker Microphone	Product Model:	C12
Test By:	Leo Zhang	Test mode:	2DH5 Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	DC5V	Environment:	Temp:24.5℃ Humi: 47%

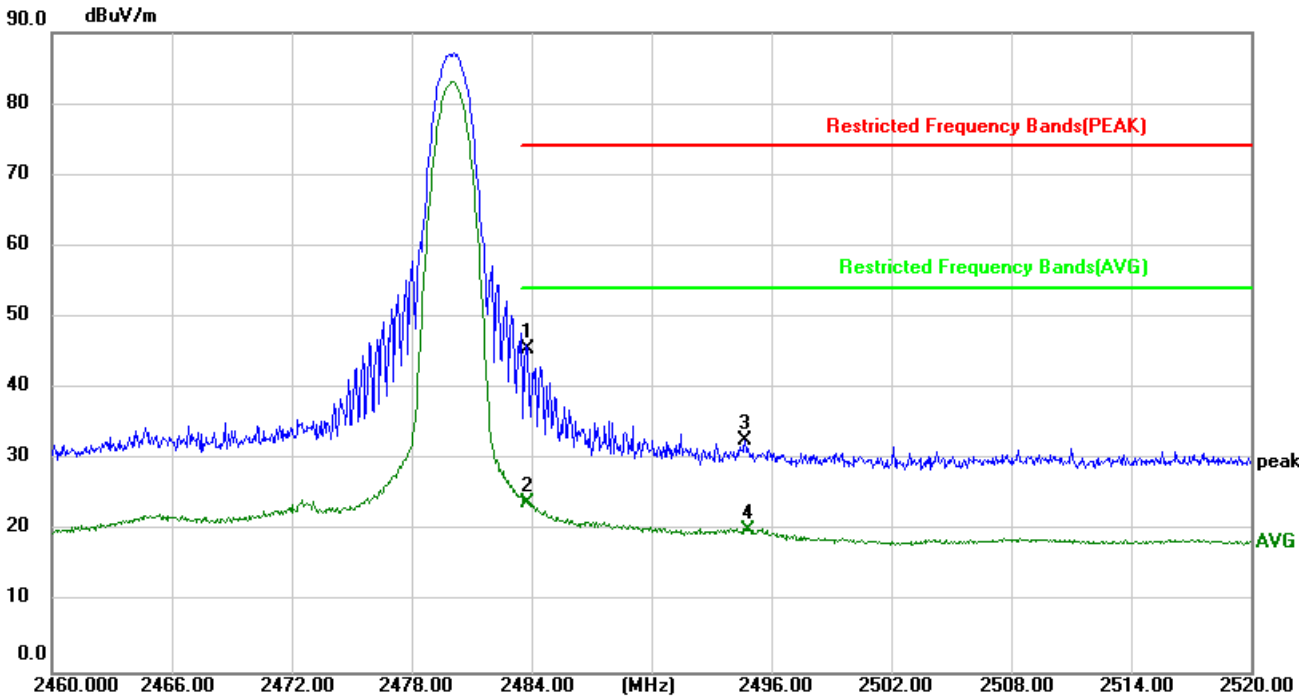


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	*	2483.580	44.91	-0.36	44.55	74.00	29.45	peak
2		2483.640	23.13	-0.36	22.77	54.00	31.23	AVG
3		2488.860	20.22	-0.36	19.86	54.00	34.14	AVG
4		2489.100	33.66	-0.36	33.30	74.00	40.70	peak

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:	CALF Speaker Microphone	Product Model:	C12
Test By:	Leo Zhang	Test mode:	2DH5 Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC5V	Environment:	Temp:24.5℃ Humi: 47%



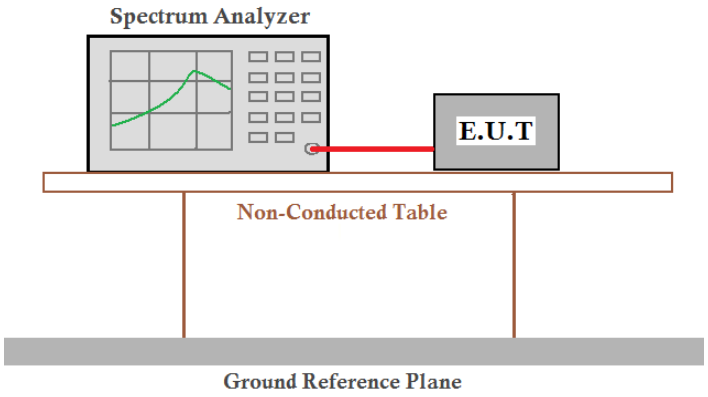
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	*	2483.760	45.93	-0.36	45.57	74.00	28.43	peak
2		2483.820	24.24	-0.36	23.88	54.00	30.12	AVG
3		2494.680	33.12	-0.37	32.75	74.00	41.25	peak
4		2494.860	20.62	-0.37	20.25	54.00	33.75	AVG

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.*

5.10 Spurious Emission

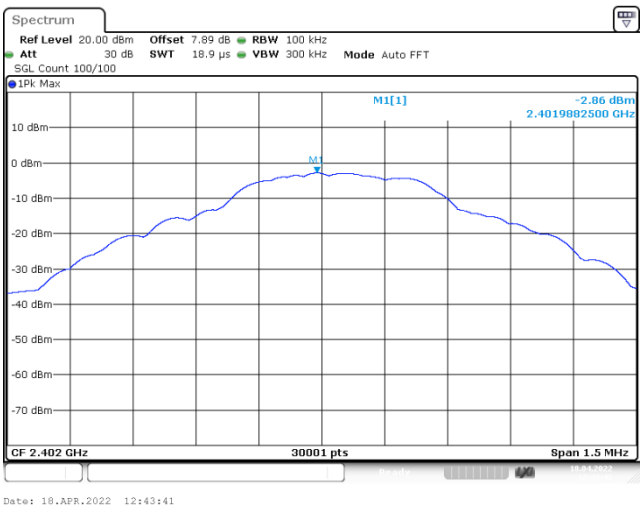
5.10.1 Conducted Emission Method

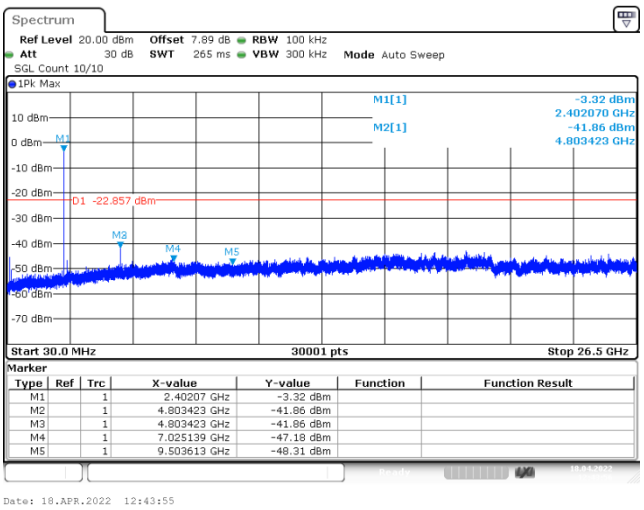
Test Requirement:	FCC Part15 C Section 15.247 (d)
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth 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:

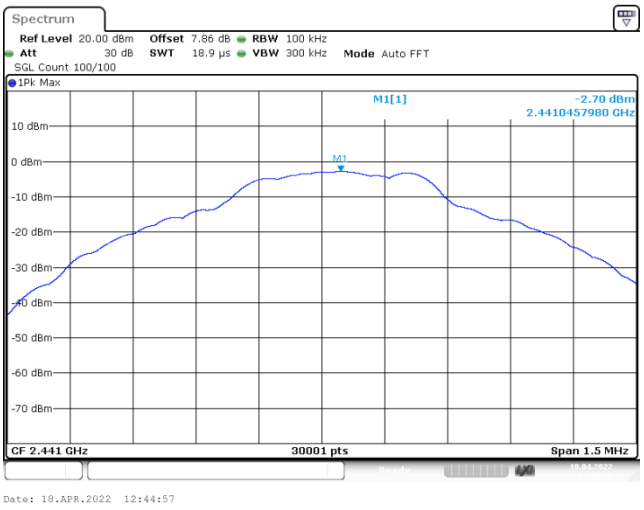
GFSK

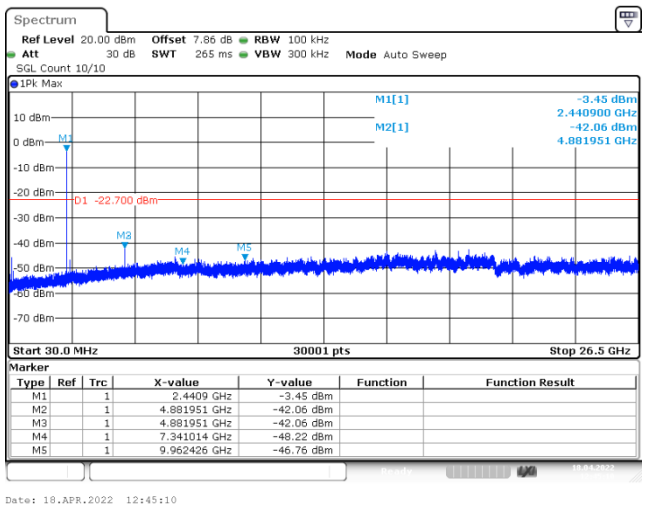
Lowest Channel



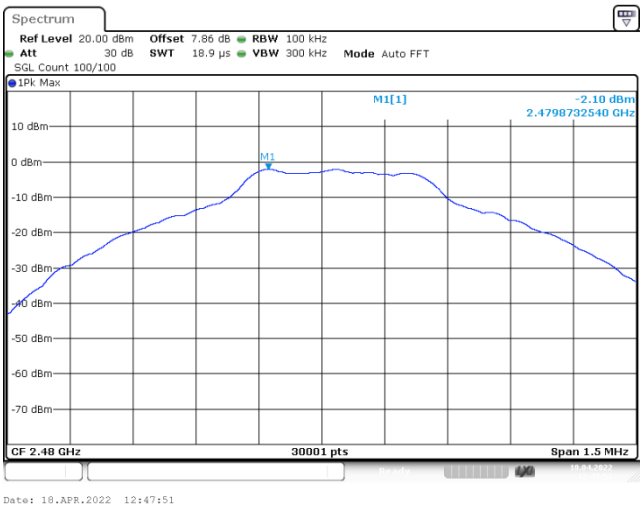


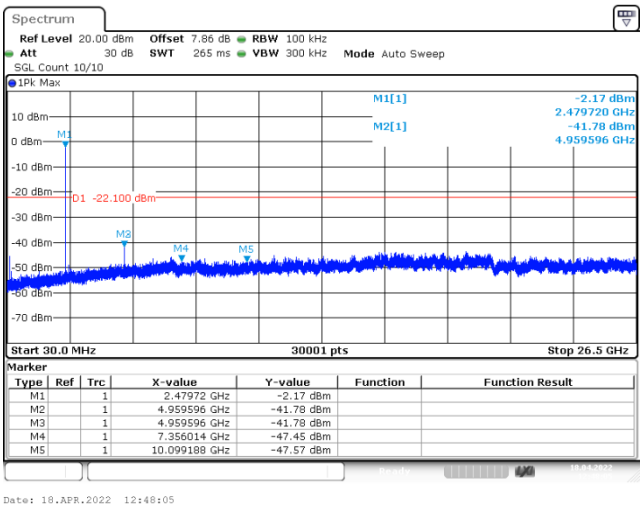
Middle channel





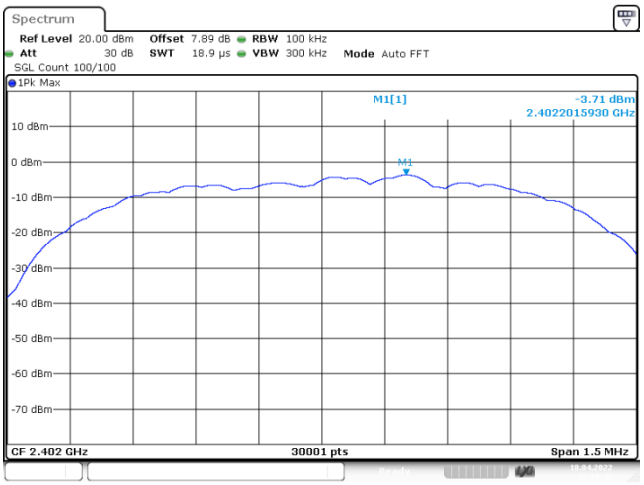
Highest Channel



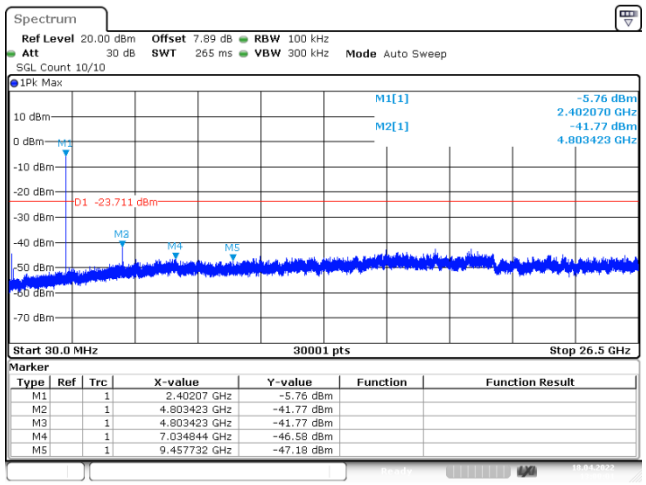


π/4-DQPSK

Lowest Channel

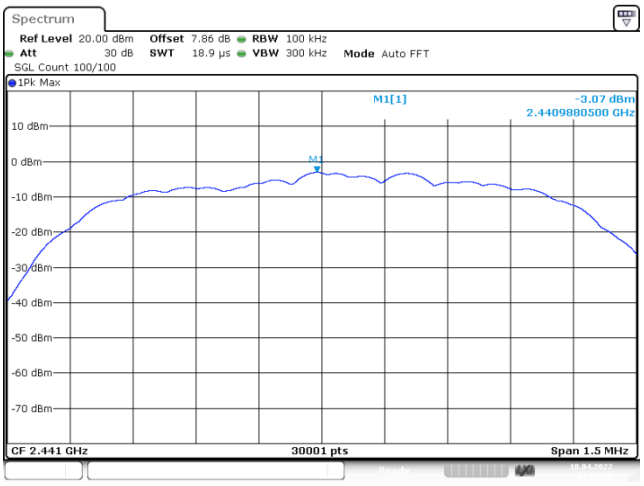


Date: 18.APR.2022 12:59:47

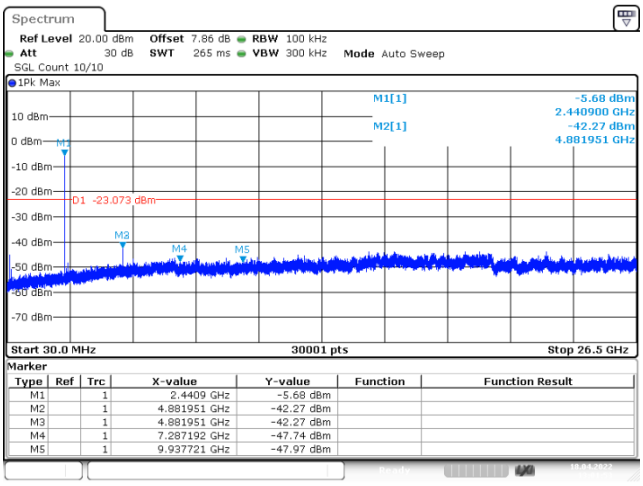


Date: 18.APR.2022 13:00:01

Middle channel

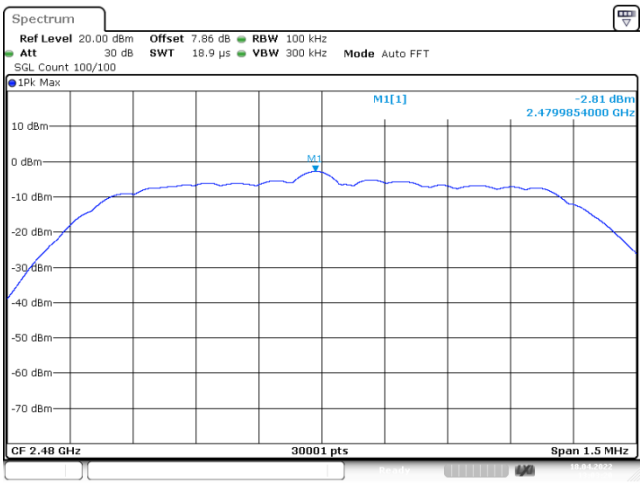


Date: 18.APR.2022 13:01:40

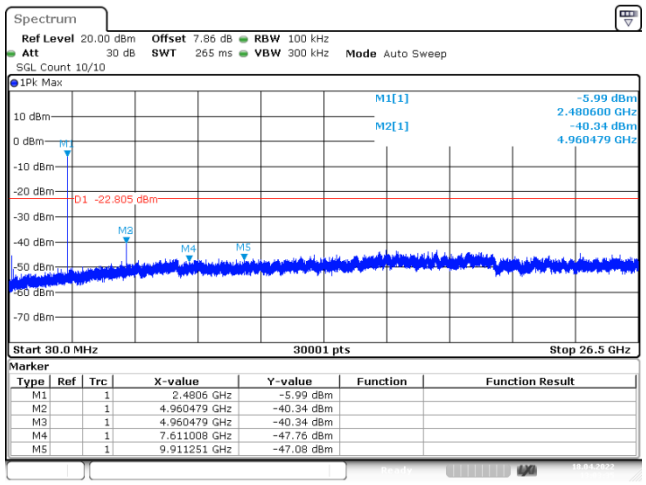


Date: 18.APR.2022 13:01:53

Highest Channel



Date: 18.APR.2022 13:03:20



Date: 18.APR.2022 13:03:34

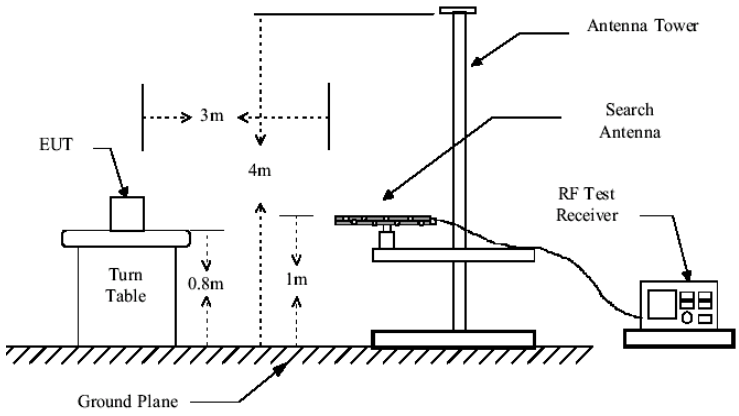
5.10.2 Radiated Emission Method

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

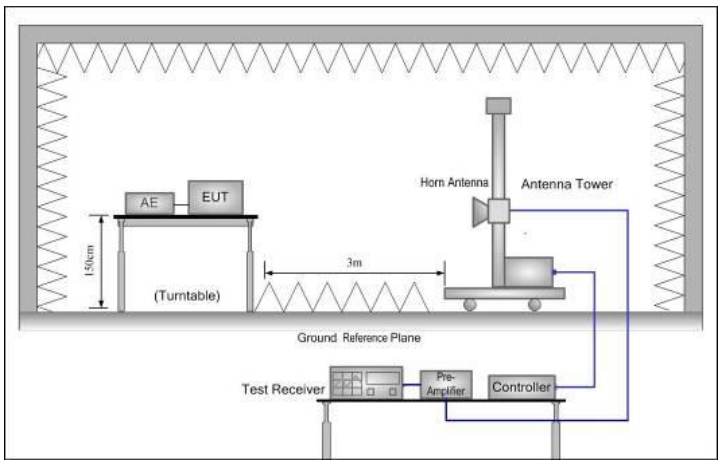
Limit:	Frequency	Limit (dBuV/m @3m)	Remark
	30MHz-88MHz	40.0	Quasi-peak Value
	88MHz-216MHz	43.5	Quasi-peak Value
	216MHz-960MHz	46.0	Quasi-peak Value
	960MHz-1GHz	54.0	Quasi-peak Value
	Above 1GHz	54.0	Average Value
		74.0	Peak Value

Test setup:

Below 1GHz



Above 1GHz



Test Procedure:

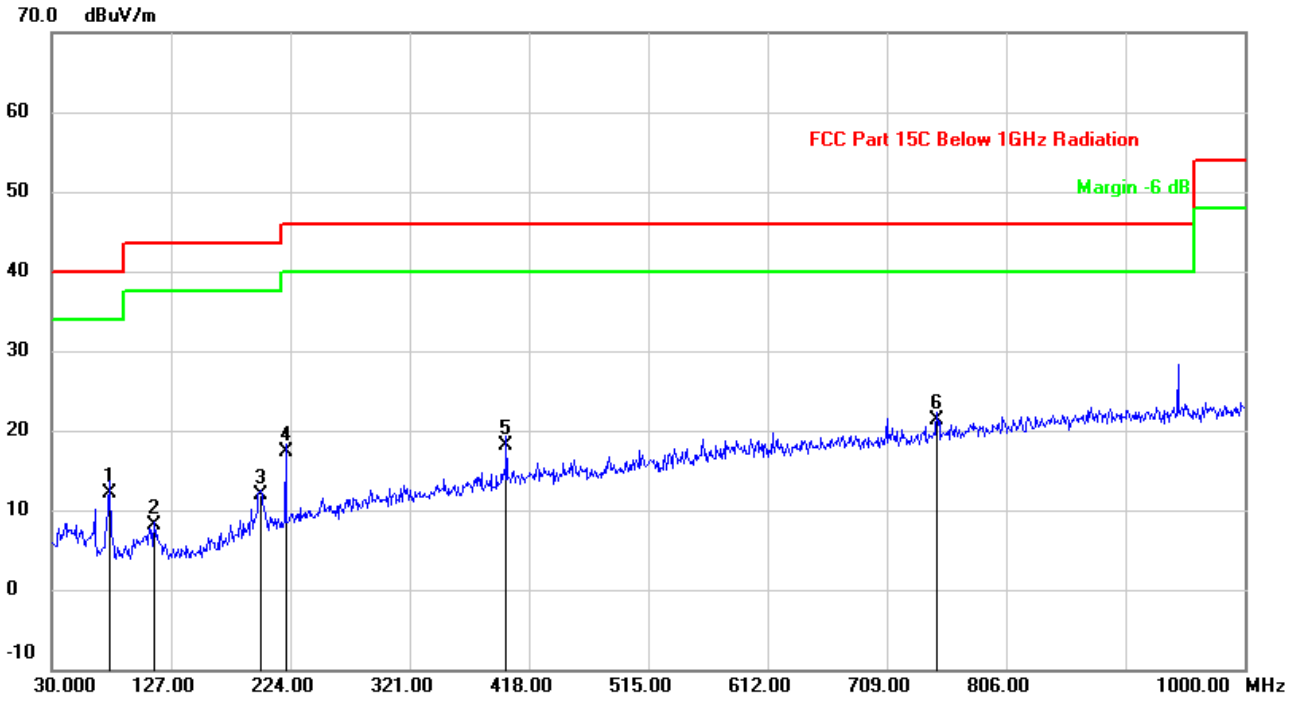
1. The EUT was placed on the top of a rotating table 0.8m(below 1GHz)/1.5m(above 1GHz) above the groundat a 3 meter chamber.The table was rotated 360 degrees todetermine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, whichwas mounted on 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:	CALF Speaker Microphone	Product Model:	C12
Test By:	Leo Zhang	Test mode:	BT Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Vertical
Test Voltage:	DC5V	Environment:	Temp: 23.5℃ Humi: 46%

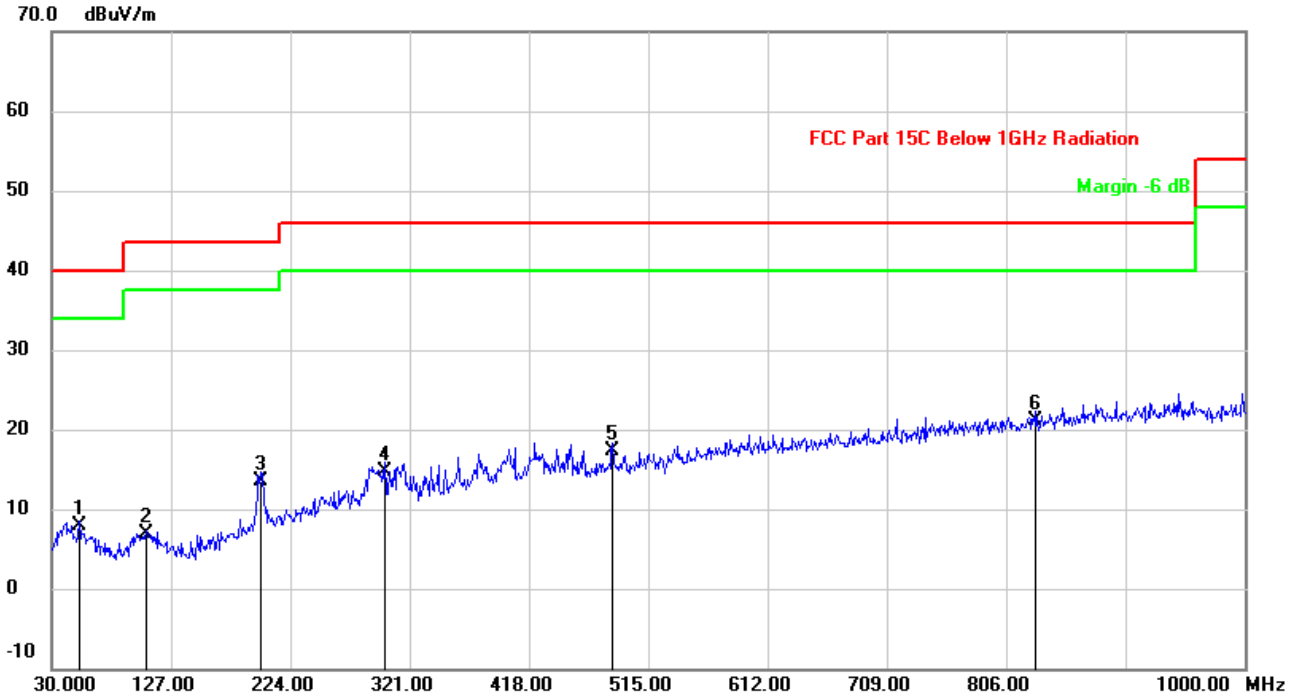


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		76.5600	29.86	-17.71	12.15	40.00	-27.85	QP
2		113.4200	24.15	-16.09	8.06	43.50	-35.44	QP
3		199.7500	26.18	-14.33	11.85	43.50	-31.65	QP
4		220.1200	30.92	-13.66	17.26	46.00	-28.74	QP
5		399.5700	26.73	-8.53	18.20	46.00	-27.80	QP
6	*	749.7400	23.38	-2.09	21.29	46.00	-24.71	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:	CALF Speaker Microphone	Product Model:	C12
Test By:	Leo Zhang	Test mode:	BT Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	DC5V	Environment:	Temp: 23.5℃ Humi: 46%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		52.3100	23.11	-15.29	7.82	40.00	-32.18	QP
2		106.6300	22.61	-15.79	6.82	43.50	-36.68	QP
3		199.7500	27.79	-14.33	13.46	43.50	-30.04	QP
4		300.6300	25.85	-11.10	14.75	46.00	-31.25	QP
5		485.9000	24.13	-6.87	17.26	46.00	-28.74	QP
6	*	830.2500	21.83	-0.65	21.18	46.00	-24.82	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(worst case):

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	35.92	7.66	43.58	74.00	-30.42	Vertical
4804.00	41.55	7.66	49.21	74.00	-24.79	Horizontal
Detector: AverageValue						
Frequency (MHz)	Read Level (dBuV)	Correct Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	22.42	7.66	30.16	54.00	-23.92	Vertical
4804.00	24.90	7.66	32.56	54.00	-21.44	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	43.13	7.86	50.99	74.00	-23.01	Vertical
4882.00	42.81	7.86	50.67	74.00	-19.94	Horizontal
Detector: AverageValue						
Frequency (MHz)	Read Level (dBuV)	Correct Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4884.00	26.65	7.86	34.51	54.00	-19.49	Vertical
4884.00	26.20	7.86	34.06	54.00	-19.94	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	40.33	8.32	48.65	74.00	-25.35	Vertical
4960.00	37.83	8.32	46.15	74.00	-27.85	Horizontal
Detector: AverageValue						
Frequency (MHz)	Read Level (dBuV)	Correct Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	24.66	8.32	32.98	54.00	-21.02	Vertical
4960.00	23.04	8.32	31.36	54.00	-22.64	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------