Shenzhen HTT Technology Co., Ltd.

Report No.: HTT202308014F02

TEST Report

Applicant:	Shenzhen Speediance Living Technology Co., Ltd.
Address of Applicant:	8A-F, Konka R&D Building, No.28, South 12th Road, Science and Technology Park, Nanshan District, Shenzhen, guangdongprovince, China
Manufacturer :	Sodan Technology (Huizhou) Co. Ltd.
Address of Manufacturer :	Ganpi Village, Zhenlong Town, Huiyang District, Huizhou City

Equipment Under Test (EUT)

Product Name:	GYM PAL
Model No.:	PAL220A1100C12
Series model:	N/A
Trade Mark:	N/A
FCC ID:	2A4WP-PAL
IC:	28295-PAL
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247 RSS-247 Issue 2 February 2017 RSS-Gen Issue 5
Date of sample receipt:	Jul.28,2023
Date of Test:	Jul.28,2023~Aug.03,2023
Date of report issued:	Aug.03,2023
Test Result :	PASS *

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

1. Version

Version No.	Date	Description
00	*Aug.03,2023*	*Original*

Tested/ Prepared By	Heber He	***Date:***	***Aug.03,2023***
	Project Engineer		
Check By:	Bruce Zhu	***Date:***	***Aug.03,2023***
	Reviewer		
Approved By :	Kevin Yang	***Date:***	***Aug.03,2023***
	Authorized Signature		

2. Contents

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3. Test Summary

Test Item	Section in CFR 47 15.247/RSS 247	Result
Antenna Requirement	15.203/15.247 (c) RSS-Gen Issue 5	Pass
AC Power Line Conducted Emission	15.207 RSS-Gen 8.8	Pass
Conducted Peak Output Power	15.247 (b)(1) RSS 247 5.4 (2)	Pass
20dB Bandwidth& 99% Bandwidth	15.247 (a)(1) RSS 247 5.1 (1) RSS-Gen 4.6	Pass
Carrier Frequencies Separation	15.247 (a)(1) RSS 247 5.1 (2)	Pass
Hopping Channel Number	15.247 (a)(1)(iii) RSS 247 5.1 (4)	Pass
Dwell Time	15.247 (a)(1)(iii) RSS 247 5.1 (4)	Pass
Radiated Emission	15.205/15.209 RSS-Gen 8.9	Pass
Band Edge	15.247(d) RSS-Gen 8.10	Pass
Spurious RF Conducted Emission	15.247(d) RSS 247 5.5	Pass

Remarks:

1. *Pass: The EUT complies with the essential requirements in the standard.*
2. *Test according to ANSI C63.10:2013*

Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	3.45 dB	(1)
Radiated Emission	1~6GHz	3.54 dB	(1)
Radiated Emission	6~40GHz	5.38 dB	(1)
Conducted Disturbance	0.15~30MHz	2.66 dB	(1)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.			

4. General Information

4.1. General Description of EUT

Product Name:	GYM PAL
Model No.:	PAL220A1100C12
HVIN:	PAL220A1100C12
Test sample(s) ID:	HTT202308014-1(Engineer sample) HTT202308014-2(Normal sample)
Operation Frequency:	2402MHz~2480MHz
Channel numbers:	79
Channel separation:	1MHz
Modulation type:	GFSK, π/4-DQPSK, 8-DPSK
Antenna Type:	PCB Antenna
Antenna gain:	3.42 dBi
Power Supply:	AC 120V
Hardware version:	V001
Software version:	V007-V008-V006

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

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2402MHz
The middle channel	2441MHz
The Highest channel	2480MHz

4.2. Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode.
Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.	

4.3. Description of Support Units

None.

4.4. Deviation from Standards

None.

4.5. Abnormalities from Standard Conditions

None.

4.6. Test Facility

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

FCC-Registration No.: 779513 Designation Number: CN1319
Shenzhen HTT Technology Co.,Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

ISED#: 27952 CAB identifier: CN0128
Shenzhen HTT Technology Co.,Ltd. has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

A2LA-Lab Cert. No.: 6435.01
Shenzhen HTT Technology Co.,Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

4.7. Test Location

All tests were performed at:

Shenzhen HTT Technology Co.,Ltd.
1F, Building B, Huafeng International Robotics Industrial Park, Hangcheng Road,Nanchang Community, Xixiang Street, Bao'an District, Shenzhen, Guangdong, China
Tel: 0755-23595200
Fax: 0755-23595201

4.8. Additional Instructions

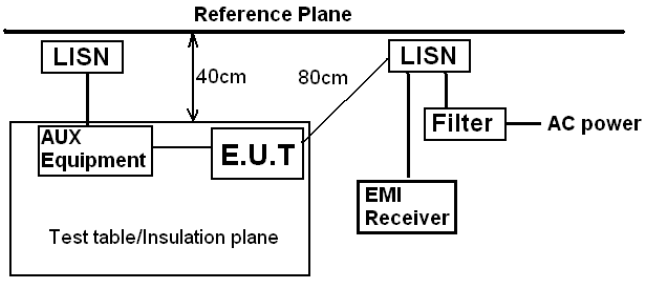
Test Software	Special AT test command provided by manufacturer to Keep the EUT in continuously transmitting mode and hopping mode
Power level setup	Default

5. Test Instruments list

Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	Shenzhen C.R.T technology co., LTD	9*6*6	HTT-E028	Aug. 10 2021	Aug. 09 2024
2	Control Room	Shenzhen C.R.T technology co., LTD	4.8*3.5*3.0	HTT-E030	Aug. 10 2021	Aug. 09 2024
3	EMI Test Receiver	Rohde&Schwar	ESCI7	HTT-E022	Apr. 26 2023	Apr. 25 2024
4	Spectrum Analyzer	Rohde&Schwar	FSP	HTT-E037	Apr. 26 2023	Apr. 25 2024
5	Coaxial Cable	ZDecl	ZT26-NJ-NJ-0.6M	HTT-E018	Apr. 26 2023	Apr. 25 2024
6	Coaxial Cable	ZDecl	ZT26-NJ-SMAJ-2M	HTT-E019	Apr. 26 2023	Apr. 25 2024
7	Coaxial Cable	ZDecl	ZT26-NJ-SMAJ-0.6M	HTT-E020	Apr. 26 2023	Apr. 25 2024
8	Coaxial Cable	ZDecl	ZT26-NJ-SMAJ-8.5M	HTT-E021	Apr. 26 2023	Apr. 25 2024
9	Composite logarithmic antenna	Schwarzbeck	VULB 9168	HTT-E017	May. 21 2023	May. 20 2024
10	Horn Antenna	Schwarzbeck	BBHA9120D	HTT-E016	May. 20 2023	May. 19 2024
11	Loop Antenna	Zhinan	ZN30900C	HTT-E039	Apr. 26 2023	Apr. 25 2024
12	Horn Antenna	Beijing Hangwei Dayang	OBH100400	HTT-E040	Apr. 26 2023	Apr. 25 2024
13	low frequency Amplifier	Sonoma Instrument	310	HTT-E015	Apr. 26 2023	Apr. 25 2024
14	high-frequency Amplifier	HP	8449B	HTT-E014	Apr. 26 2023	Apr. 25 2024
15	Variable frequency power supply	Shenzhen Anbiao Instrument Co., Ltd	ANB-10VA	HTT-082	Apr. 26 2023	Apr. 25 2024
16	EMI Test Receiver	Rohde & Schwarz	ESCS30	HTT-E004	Apr. 26 2023	Apr. 25 2024
17	Artificial Mains	Rohde & Schwarz	ESH3-Z5	HTT-E006	May. 23 2023	May. 22 2024
18	Artificial Mains	Rohde & Schwarz	ENV-216	HTT-E038	May. 23 2023	May. 22 2024
19	Cable Line	Robinson	Z302S-NJ-BNCJ-1.5M	HTT-E001	Apr. 26 2023	Apr. 25 2024
20	Attenuator	Robinson	6810.17A	HTT-E007	Apr. 26 2023	Apr. 25 2024
21	Variable frequency power supply	Shenzhen Yanghong Electric Co., Ltd	YF-650（5KVA）	HTT-E032	Apr. 26 2023	Apr. 25 2024
22	Control Room	Shenzhen C.R.T technology co., LTD	8*4*3.5	HTT-E029	Aug. 10 2021	Aug. 09 2024
23	DC power supply	Agilent	E3632A	HTT-E023	Apr. 26 2023	Apr. 25 2024
24	EMI Test Receiver	Agilent	N9020A	HTT-E024	Apr. 26 2023	Apr. 25 2024
25	Analog signal generator	Agilent	N5181A	HTT-E025	Apr. 26 2023	Apr. 25 2024
26	Vector signal generator	Agilent	N5182A	HTT-E026	Apr. 26 2023	Apr. 25 2024
27	Power sensor	Keysight	U2021XA	HTT-E027	Apr. 26 2023	Apr. 25 2024
28	Temperature and humidity meter	Shenzhen Anbiao Instrument Co., Ltd	TH10R	HTT-074	Apr. 28 2023	Apr. 27 2024
29	Radiated Emission Test Software	Farad	EZ-EMC	N/A	N/A	N/A
30	Conducted Emission Test Software	Farad	EZ-EMC	N/A	N/A	N/A
31	RF Test Software	panshanrf	TST	N/A	N/A	N/A

6. Test results and Measurement Data

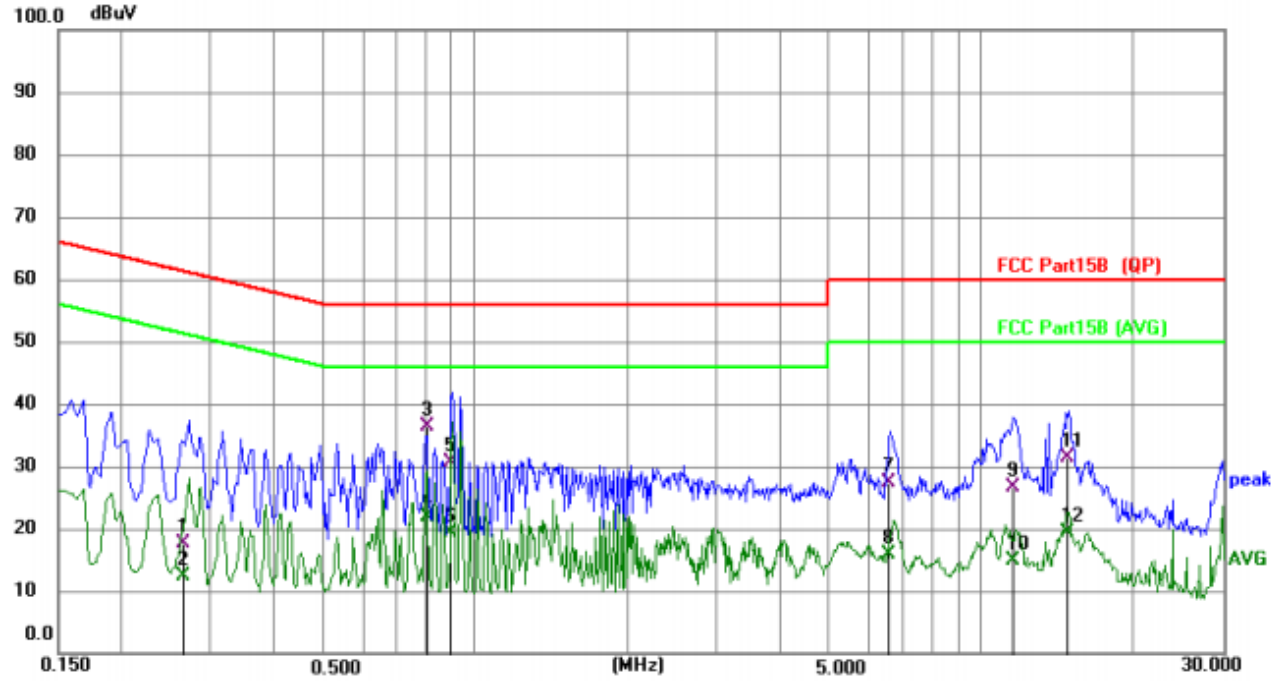
6.1. Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207/RSS-Gen 8.8
Test Method:	ANSI C63.10:2013
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 C63.10:2013 on conducted measurement.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test environment:	Temp.: 25 °C / Humid.: 52% / Press.: 1012mbar
Test voltage:	AC 120V, 60Hz
Test results:	Pass

Remark: Both high and low voltages have been tested to show only the worst low voltage test data.

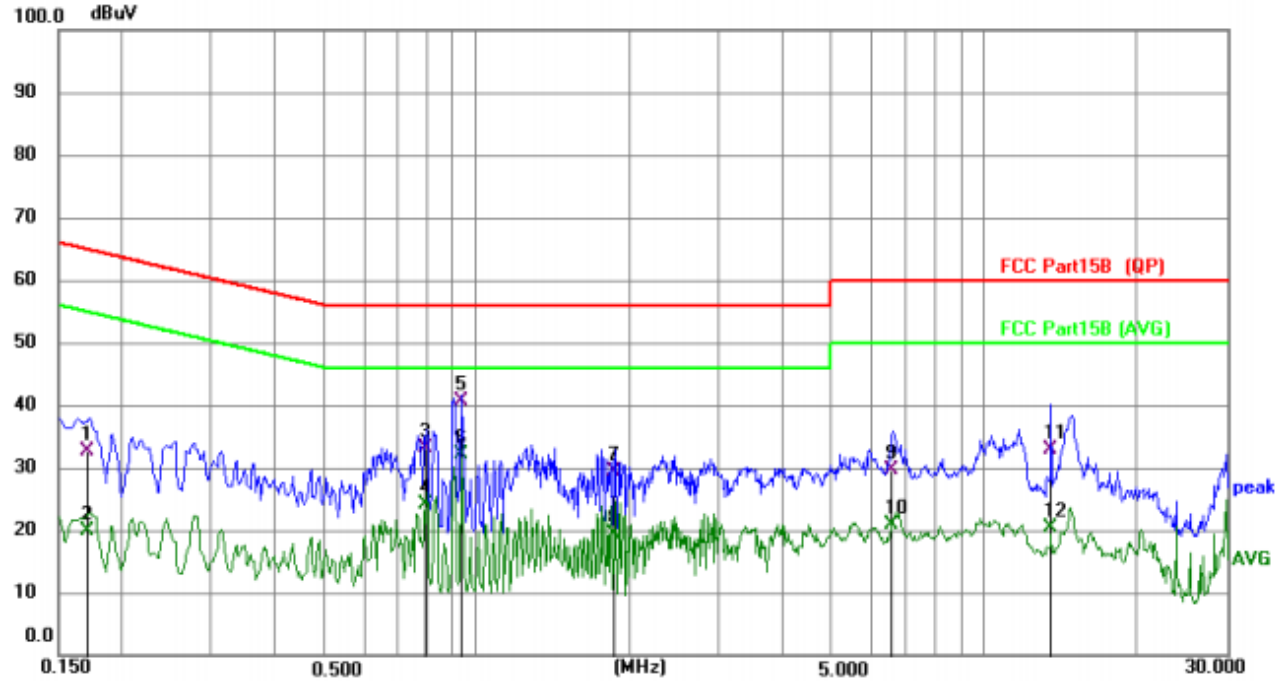
Measurement data:

Line:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1		0.2652	7.42	10.23	17.65	61.27	-43.62	QP
2		0.2652	2.13	10.23	12.36	51.27	-38.91	AVG
3	*	0.8051	26.09	10.37	36.46	56.00	-19.54	QP
4		0.8051	11.39	10.37	21.76	46.00	-24.24	AVG
5		0.9003	20.22	10.38	30.60	56.00	-25.40	QP
6		0.9003	9.12	10.38	19.50	46.00	-26.50	AVG
7		6.5963	16.75	10.62	27.37	60.00	-32.63	QP
8		6.5963	5.29	10.62	15.91	50.00	-34.09	AVG
9		11.5487	15.69	10.82	26.51	60.00	-33.49	QP
10		11.5487	3.95	10.82	14.77	50.00	-35.23	AVG
11		14.8599	20.23	11.05	31.28	60.00	-28.72	QP
12		14.8599	8.35	11.05	19.40	50.00	-30.60	AVG

Neutral:

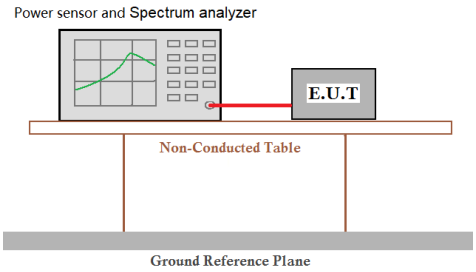


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1		0.1714	22.50	10.18	32.68	64.89	-32.21	QP
2		0.1714	9.58	10.18	19.76	54.89	-35.13	AVG
3		0.7941	22.87	10.37	33.24	56.00	-22.76	QP
4		0.7941	13.82	10.37	24.19	46.00	-21.81	AVG
5		0.9359	30.25	10.33	40.58	56.00	-15.42	QP
6	*	0.9359	21.68	10.33	32.01	46.00	-13.99	AVG
7		1.8686	18.88	10.39	29.27	56.00	-26.73	QP
8		1.8686	8.96	10.39	19.35	46.00	-26.65	AVG
9		6.5960	18.94	10.66	29.60	60.00	-30.40	QP
10		6.5960	10.23	10.66	20.89	50.00	-29.11	AVG
11		13.5525	21.79	11.08	32.87	60.00	-27.13	QP
12		13.5525	9.37	11.08	20.45	50.00	-29.55	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 Los

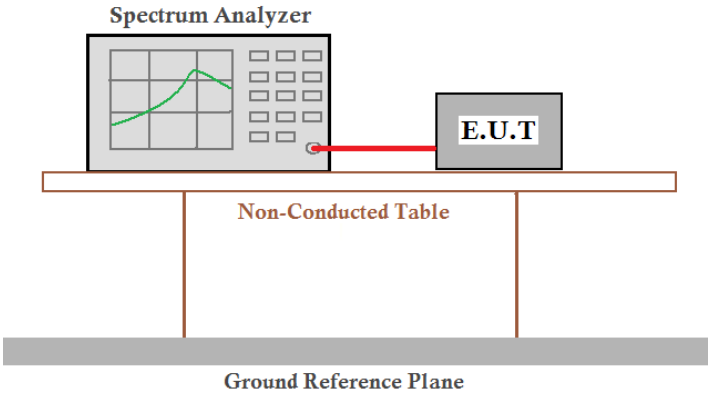
6.2. Conducted Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(1)/ RSS 247 5.4 (2)					
Test Method:	ANSI C63.10:2013					
Limit:	30dBm(for GFSK),20.97dBm(for EDR)					
Test setup:						
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar

Measurement Data

Mode	Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
GFSK	Lowest	3.61	30.00	Pass
	Middle	3.79		
	Highest	5.50		
π/4-DQPSK	Lowest	5.53	20.97	Pass
	Middle	6.30		
	Highest	7.60		
8-DPSK	Lowest	6.13	20.97	Pass
	Middle	6.90		
	Highest	8.14		

6.3. 20dB Emission Bandwidth and 99% Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)/ RSS 247 5.1 (1)RSS-Gen 4.6					
Test Method:	ANSI C63.10:2013					
Limit:	N/A					
Test setup:						
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar

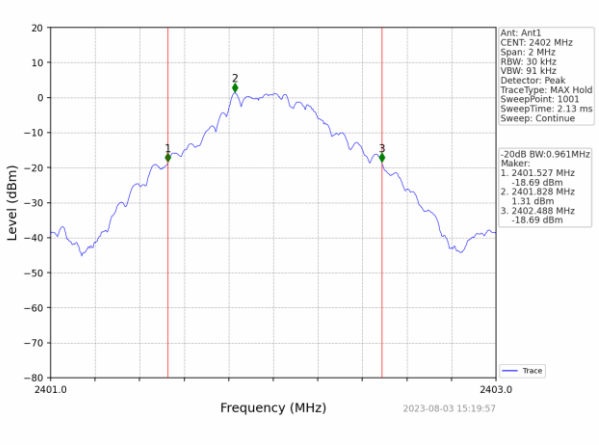
Measurement Data

Mode	Test channel	20dB Bandwidth (MHz)	99% bandwidth (MHz)	Result
GFSK	Lowest	0.961	0.867	Pass
	Middle	0.959	0.867	
	Highest	0.961	0.866	
π/4-DQPSK	Lowest	1.285	1.158	Pass
	Middle	1.286	1.158	
	Highest	1.285	1.160	
8-DPSK	Lowest	1.304	1.167	Pass
	Middle	1.304	1.167	
	Highest	1.304	1.168	

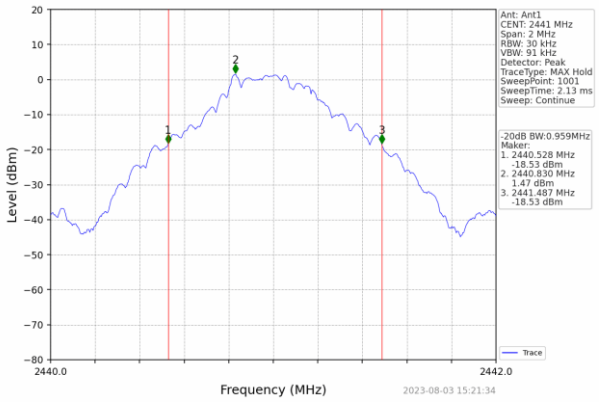
Test plot as follows:

20dB Bandwidth

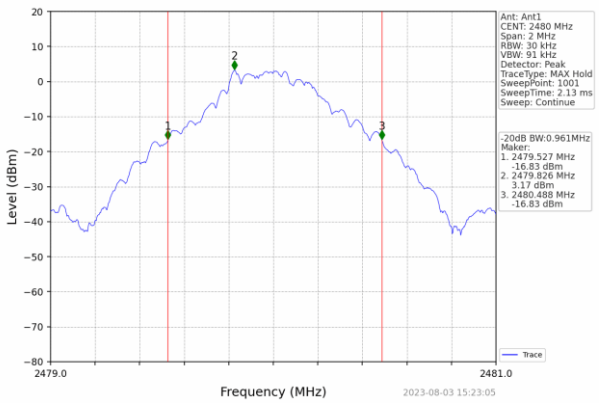
Test mode:	GFSK mode



Lowest channel

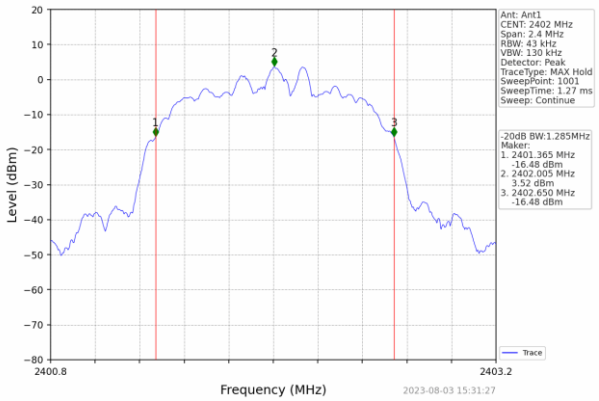


Middle channel

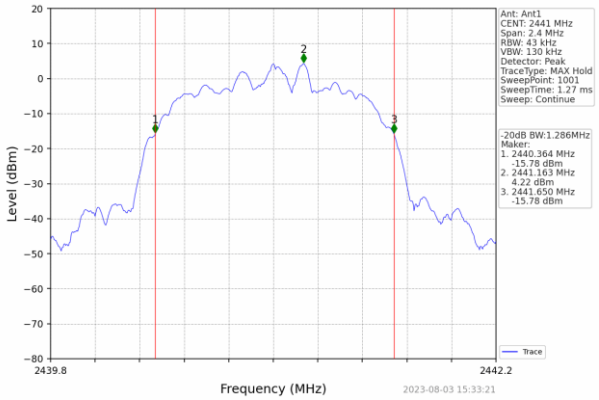


Highest channel

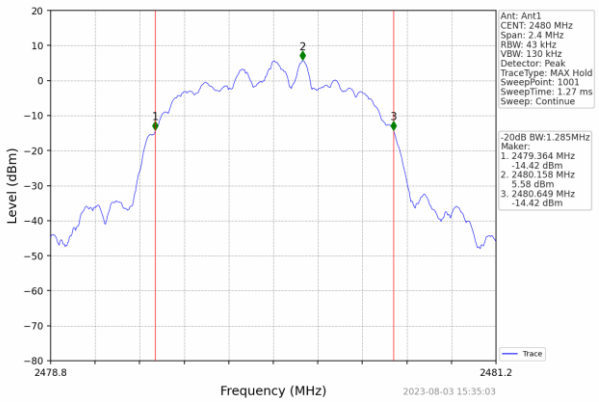
Test mode:	π/4-DQPSK mode



Lowest channel

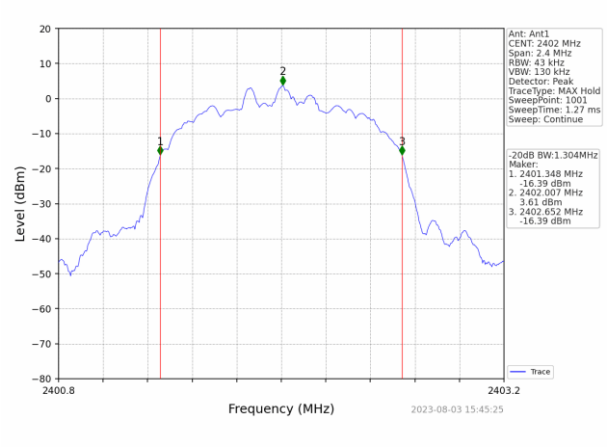


Middle channel

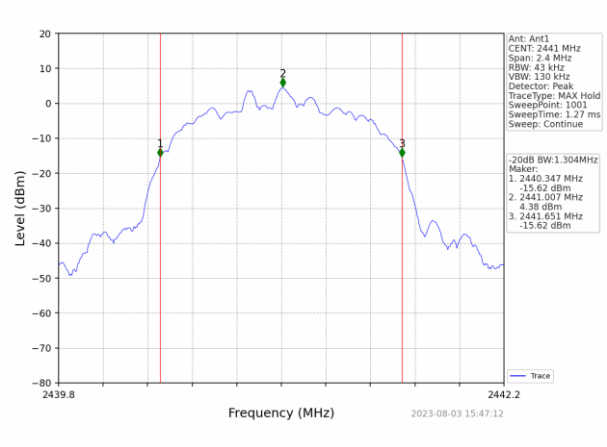


Highest channel

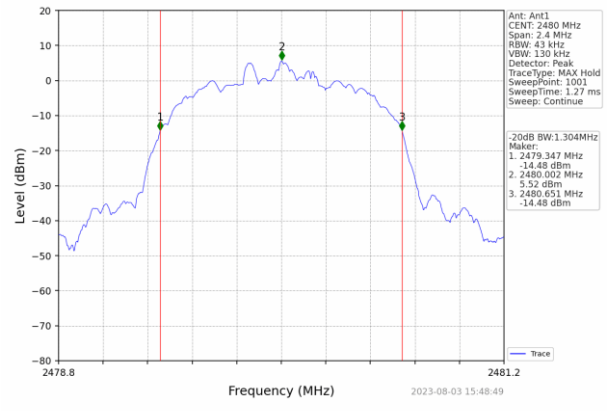
Test mode:	8-DPSK mode



Lowest channel



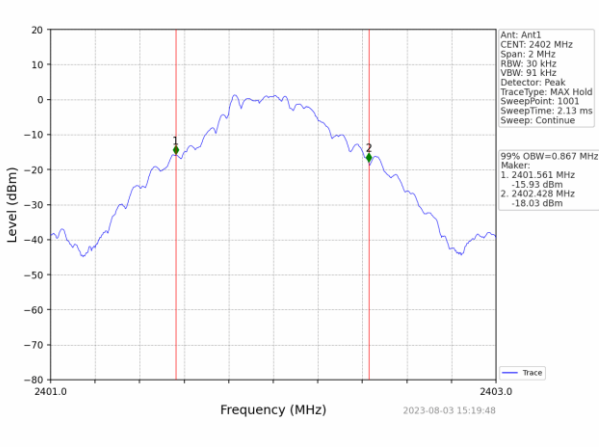
Middle channel



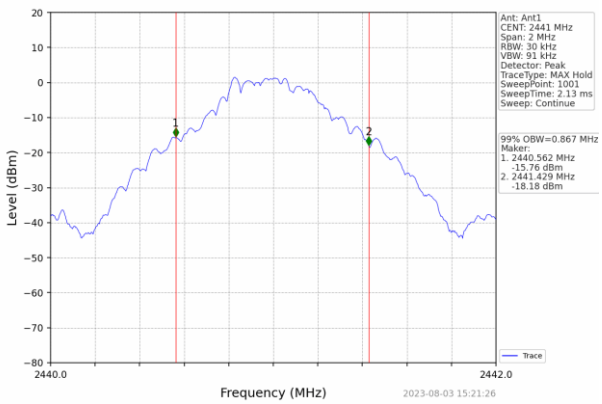
Highest channel

99% bandwidth

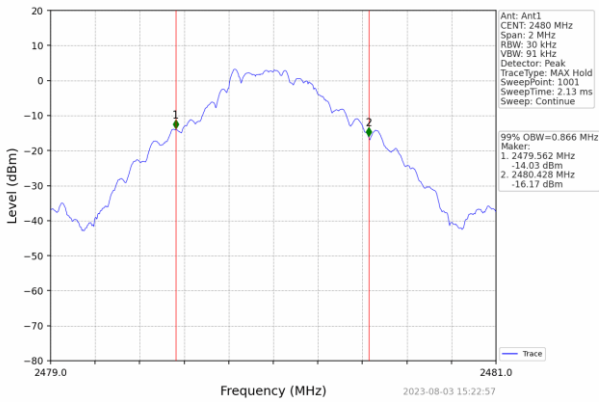
Test mode:	GFSK mode



Lowest channel

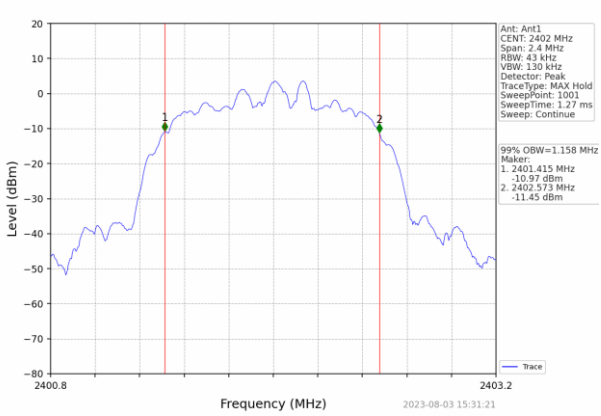


Middle channel

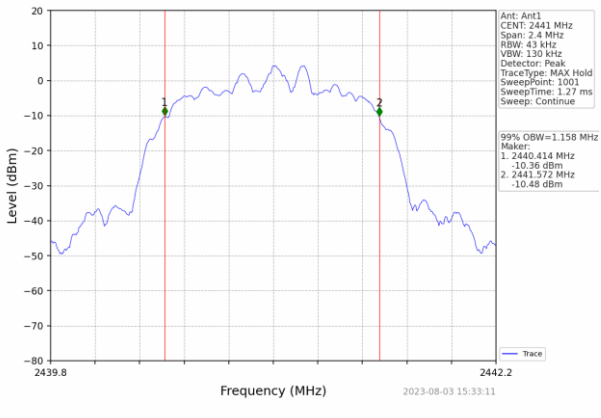


Highest channel

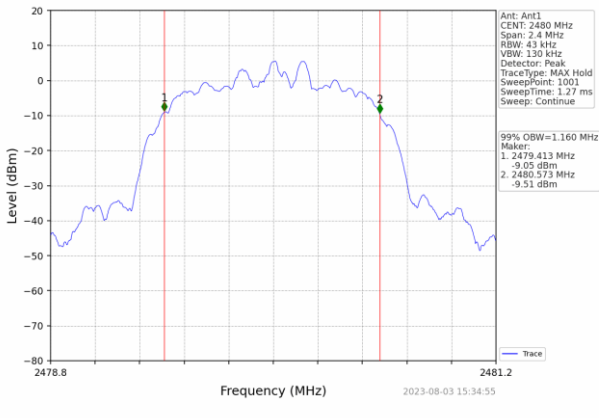
Test mode:	π/4-DQPSK mode



Lowest channel

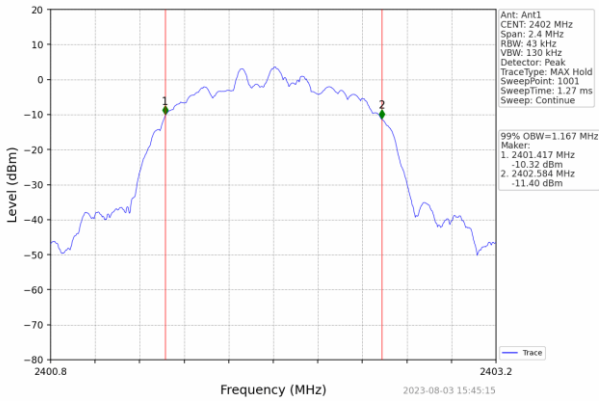


Middle channel

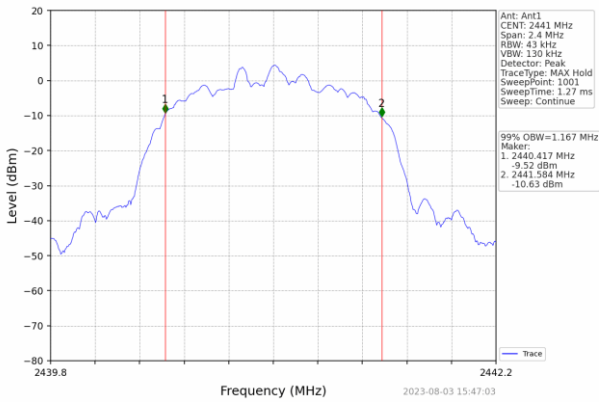


Highest channel

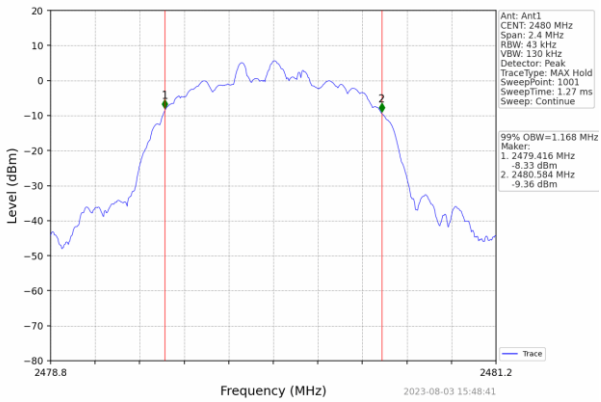
Test mode:	8-DPSK mode



Lowest channel

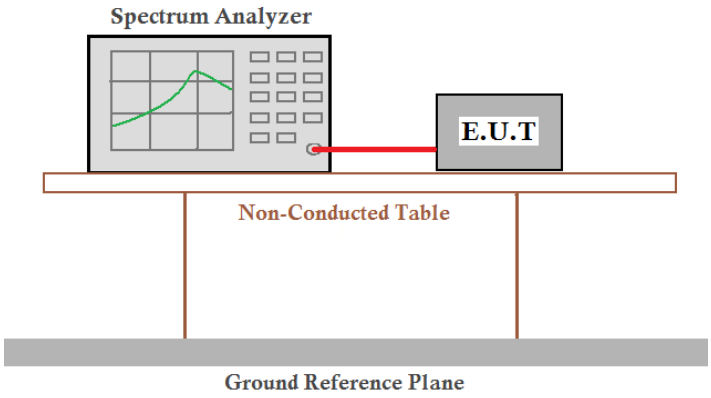


Middle channel



Highest channel

6.4. Frequencies Separation

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)/ RSS 247 5.1 (2)					
Test Method:	ANSI C63.10:2013					
Receiver setup:	RBW=100KHz, VBW=300KHz, detector=Peak					
Limit:	GFSK: 20dB bandwidth π/4-DQPSK : 0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)					
Test setup:						
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar

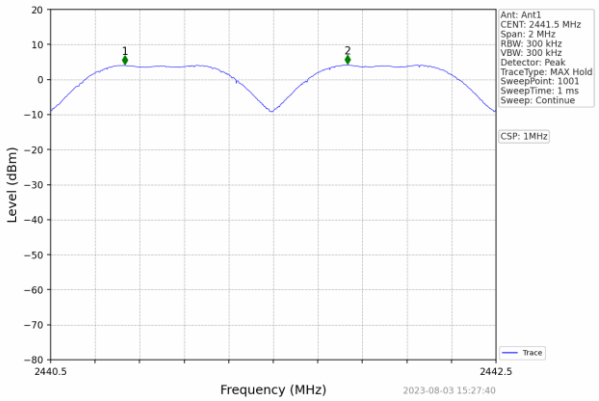
Measurement Data

Mode	Test channel	Frequencies Separation (MHz)	Limit (kHz)	Result
GFSK	Middle	1.000	25KHz or 2/3*20dB bandwidth	Pass
π/4-DQPSK	Middle	1.001	25KHz or 2/3*20dB bandwidth	Pass
8-DPSK	Middle	0.989	25KHz or 2/3*20dB bandwidth	Pass

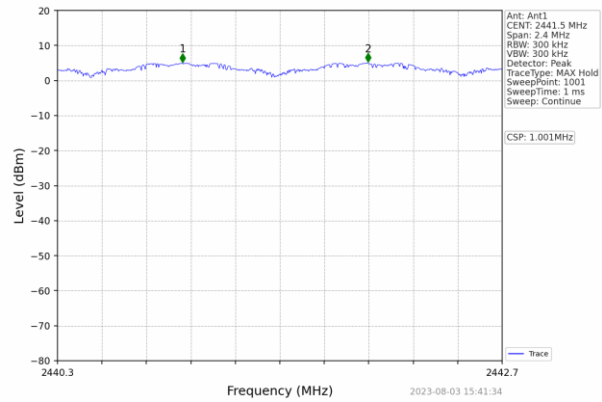
Remark: We have tested all mode at high, middle and low channel, and recorded worst case at middle

Test plot as follows:

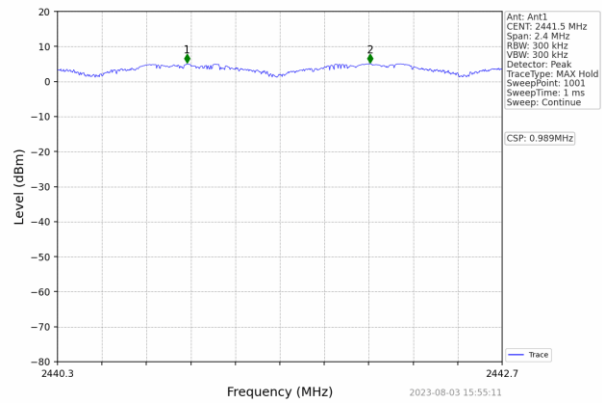
Modulation mode:	GFSK



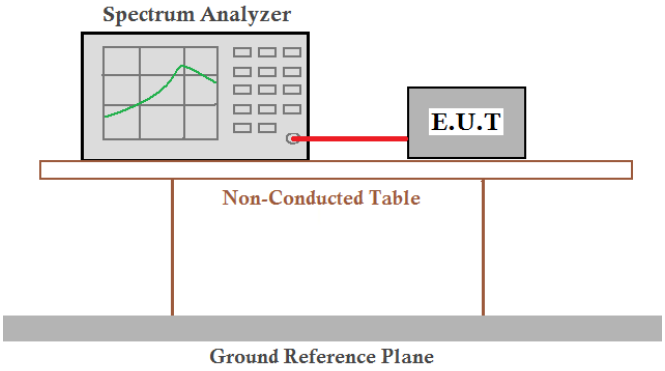
Test mode:	π/4-DQPSK



Test mode:	8-DPSK



6.5. Hopping Channel Number

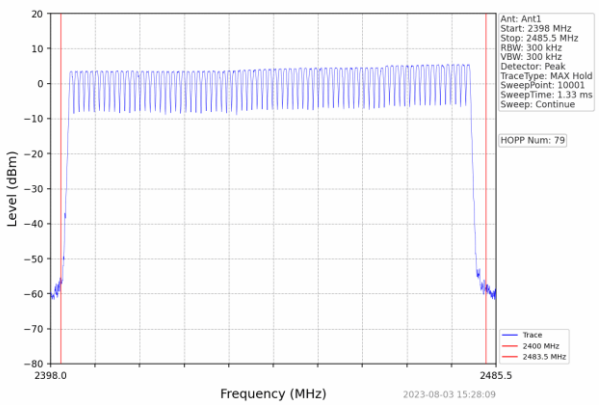
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)/ RSS 247 5.1 (4)					
Test Method:	ANSI C63.10:2013					
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak					
Limit:	15 channels					
Test setup:						
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar

Measurement Data:

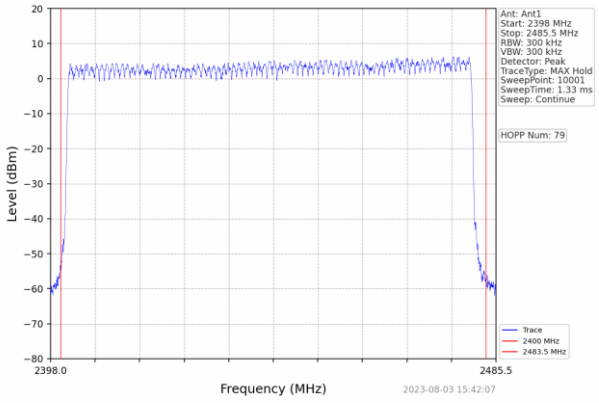
Mode	Hopping channel numbers	Limit	Result
GFSK	79	≥15	Pass
π/4-DQPSK	79		Pass
8-DPSK	79		Pass

Test plot as follows:

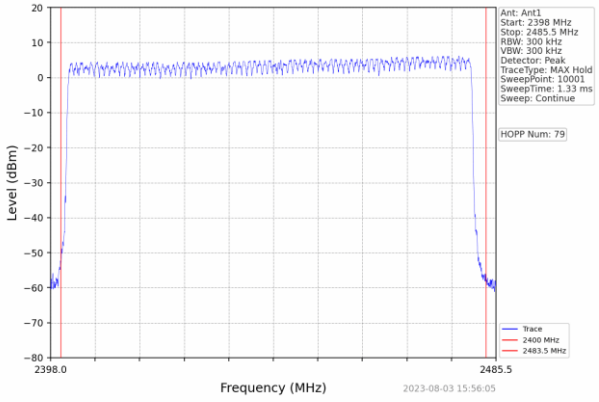
Test mode:	GFSK



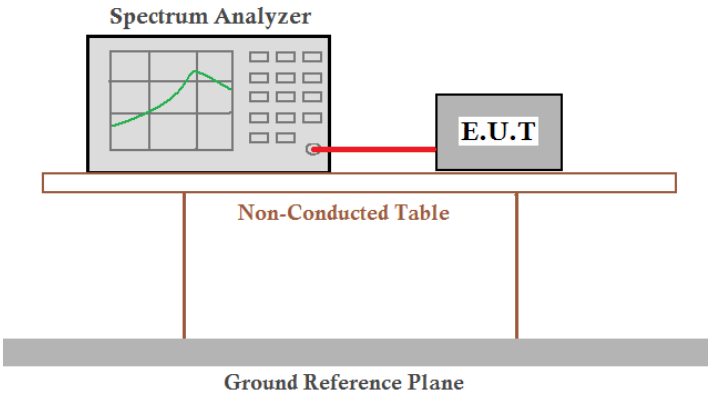
Test mode:	π/4-DQPSK



Test mode:	8-DPSK



6.6. Dwell Time

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)/ RSS 247 5.1 (4)					
Test Method:	ANSI C63.10:2013					
Receiver setup:	RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak					
Limit:	0.4 Second					
Test setup:						
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar

Measurement Data

Modulation	Packet	Burst time (ms)	Dwell time (ms)	Limit (ms)	Result
GFSK	DH1	0.388	124.160	400	Pass
	DH3	1.642	252.868		
	DH5	2.900	287.100		
π/4DQPSK	2-DH1	0.396	126.720	400	Pass
	2-DH3	1.658	252.016		
	2-DH5	2.906	290.600		
8DPSK	3-DH1	0.396	126.720	400	Pass
	3-DH3	1.656	278.208		
	3-DH5	2.908	302.432		

Note:We have tested all mode at high,middle and low channel,and recoreded worst case at middle channel.

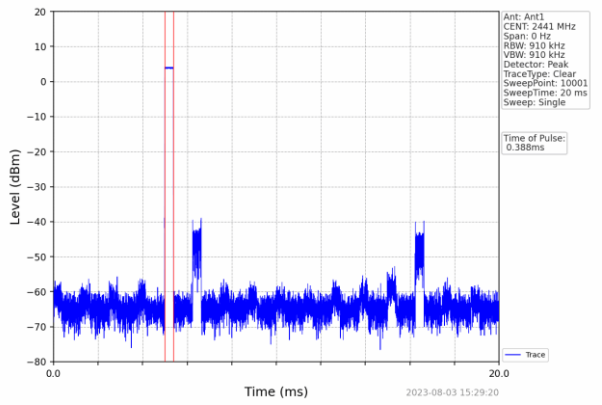
Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second for DH1, 2-DH1, 3-DH1

Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2-DH3, 3-DH3

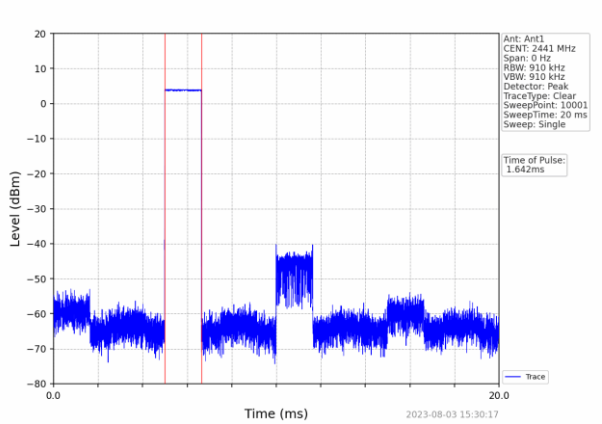
Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second for DH5, 2-DH5, 3-DH5

Test plot as follows:

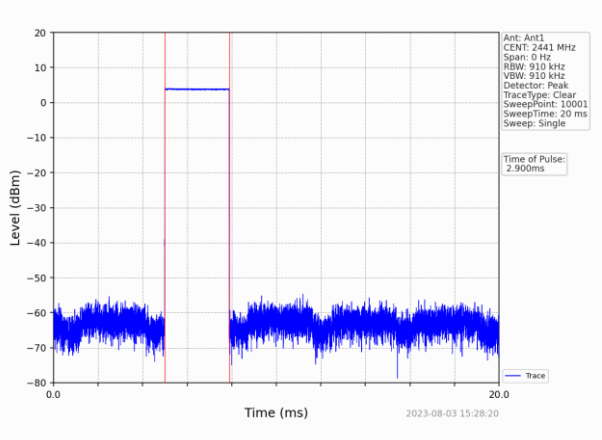
GFSK mode



DH1

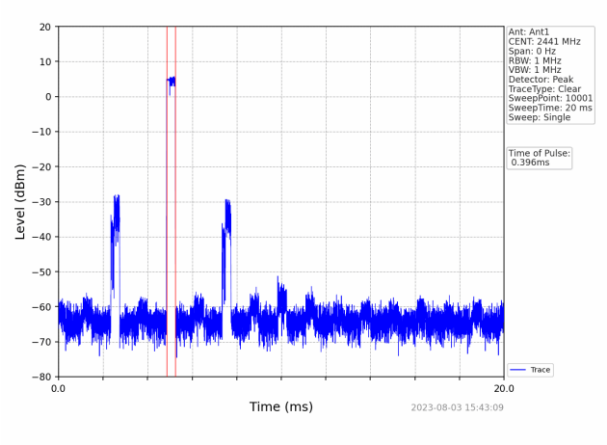


DH3

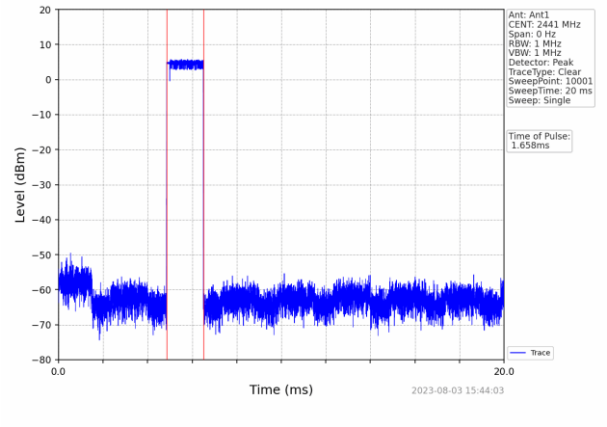


DH5

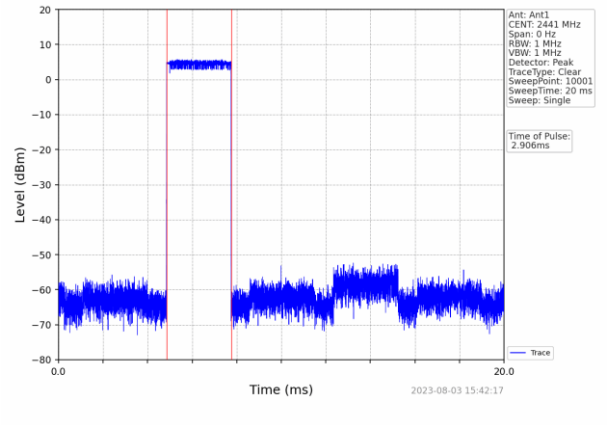
π/4-DQPSK mode



2DH1

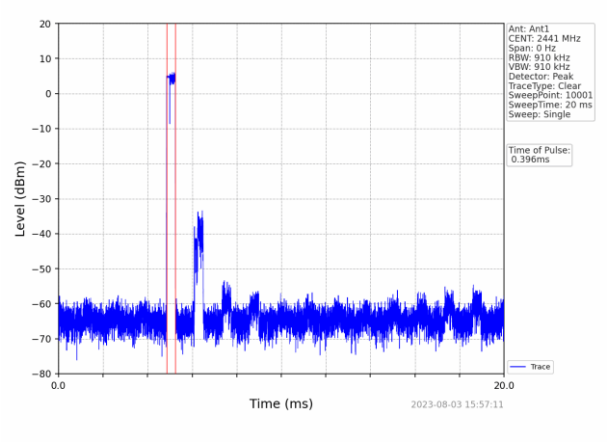


2DH3

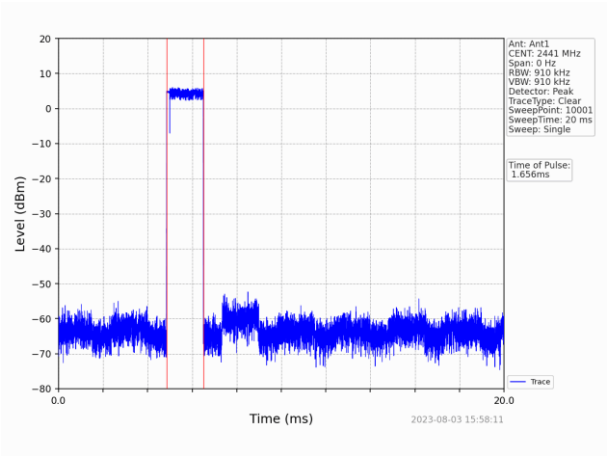


2DH5

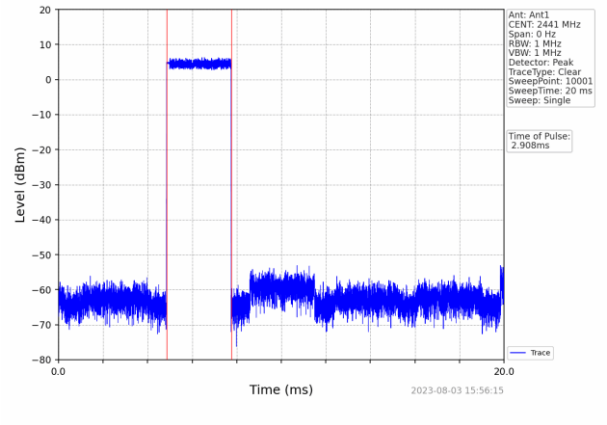
8-DPSK mode



3DH1



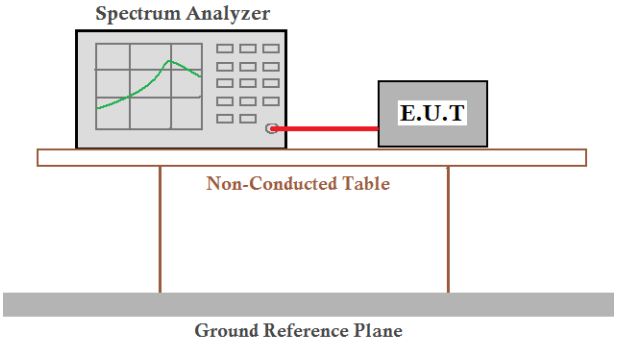
3DH3



3DH5

6.7. Band Edge

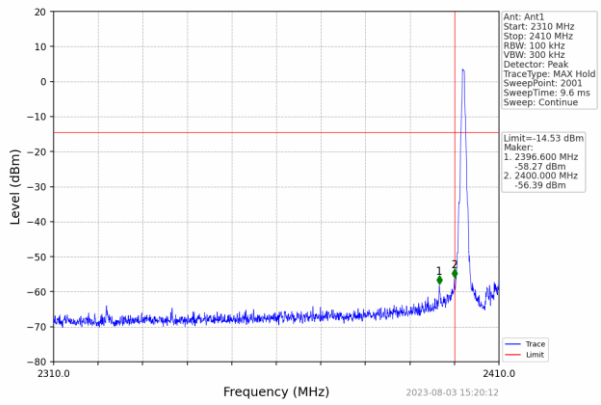
6.7.1. Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)/ RSS-Gen 8.10					
Test Method:	ANSI C63.10:2013					
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 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar

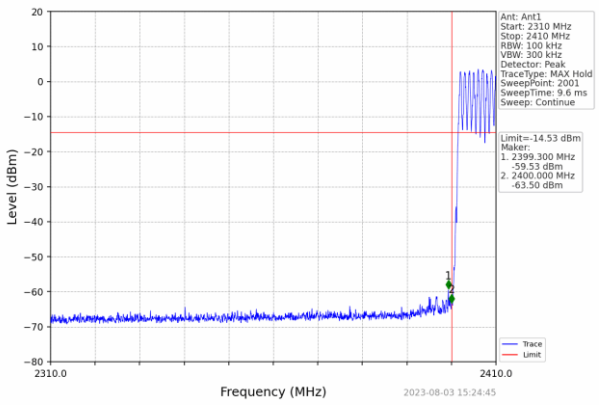
Test plot as follows:

GFSK Mode:

Test channel	Lowest channel

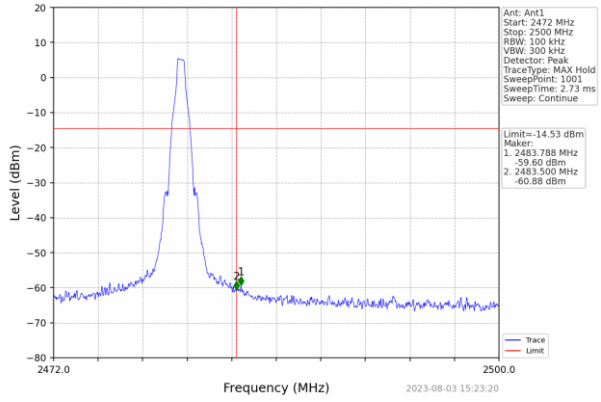


No-hopping mode

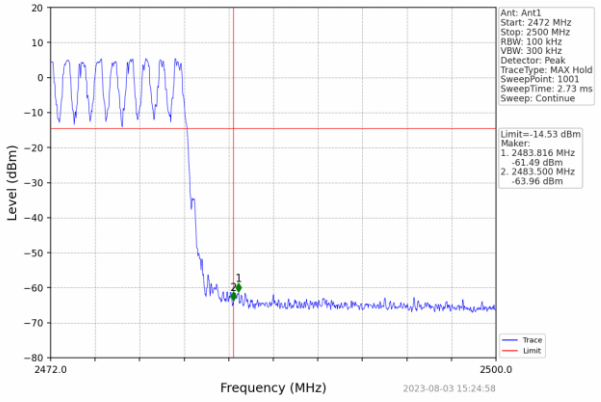


Hopping mode

Test channel:	Highest channel



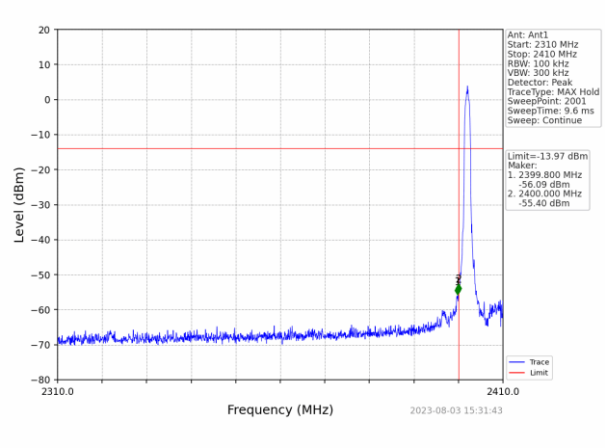
No-hopping mode



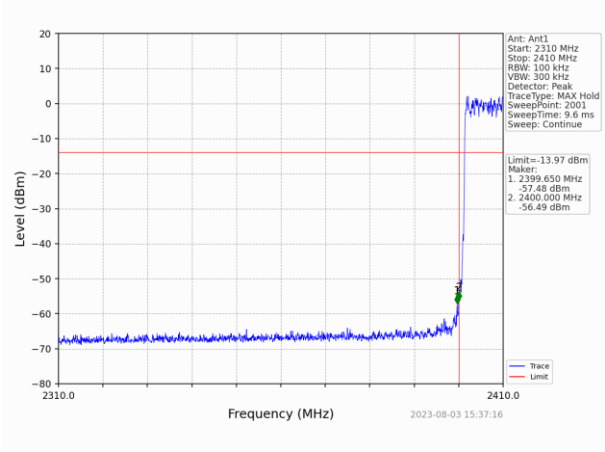
Hopping mode

π/4-DQPSK Mode:

Test channel	Lowest channel

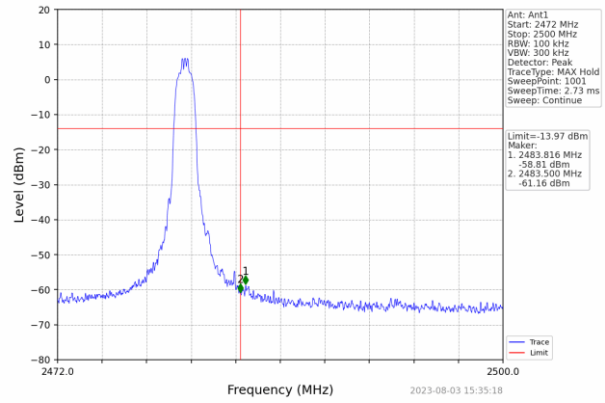


No-hopping mode

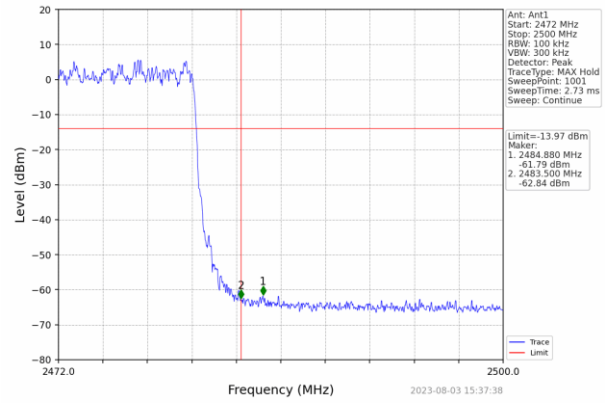


Hopping mode

Test channel:	Highest channel

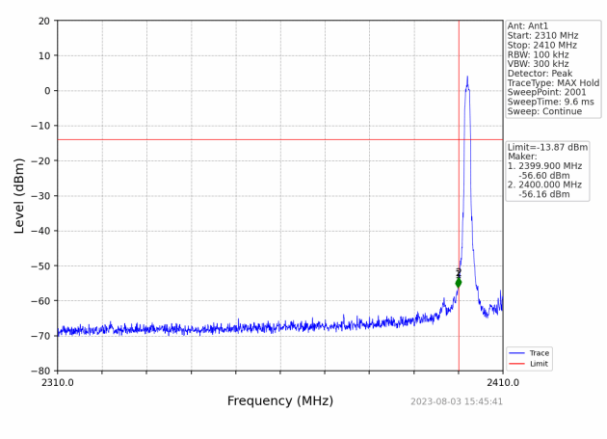
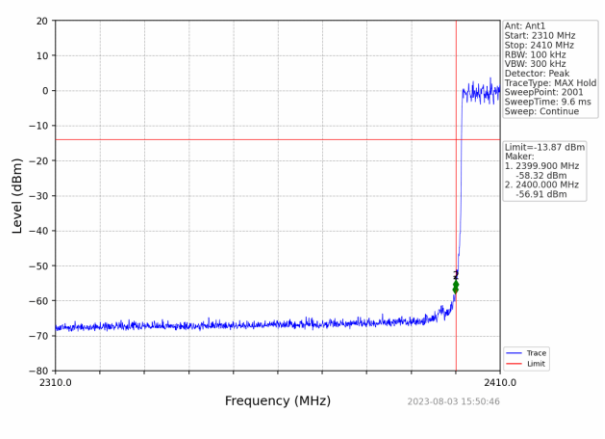


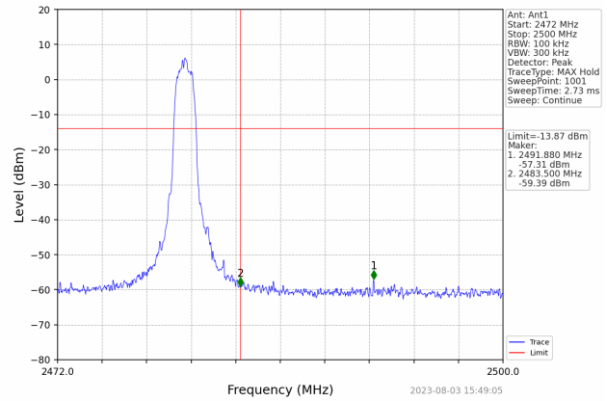
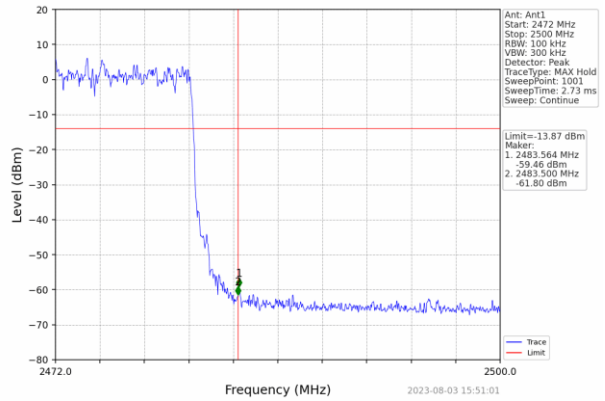
No-hopping mode



Hopping mode

8-DPSK Mode:

Test channel	Lowest channel
	
No-hopping mode	Hopping mode

Test channel:	Highest channel
	
No-hopping mode	Hopping mode

6.7.2. Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205/RSS-Gen 8.9
Test Method:	ANSI C63.10:2013
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.
Test site:	Measurement Distance: 3m

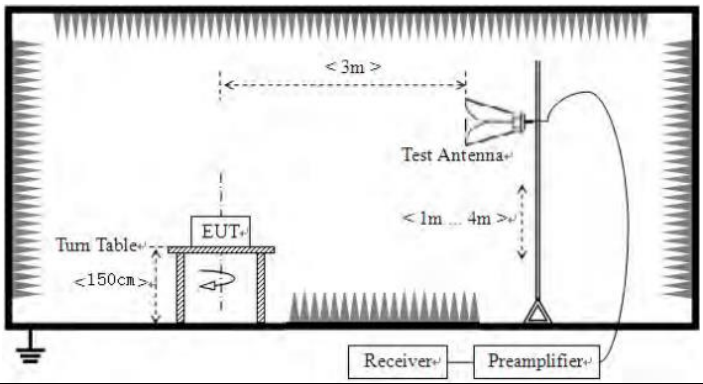
Receiver setup:

Frequency	Detector	RBW	VBW	Remark
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	Peak	1MHz	10Hz	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 1.5 meters 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 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar

Measurement Data

Remark: GFSK, Pi/4 DQPSK,8-DPSK all have been tested, only worse case GFSK is reported.

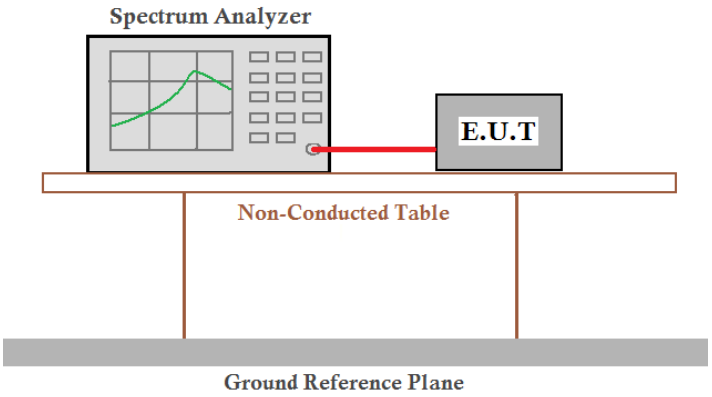
Operation Mode: GFSK TX Low channel(2402MHz)

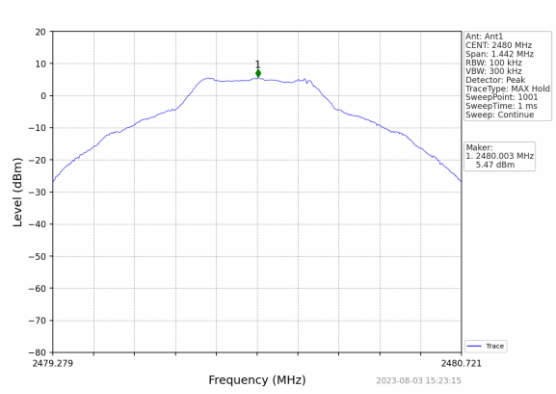
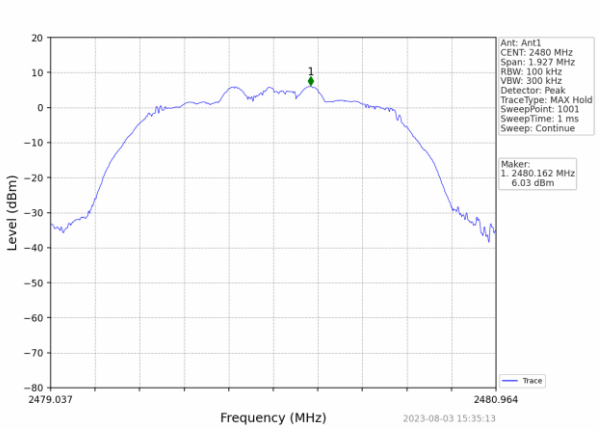
GFSK

Frequency(MHz):			**2402**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	59.40	PK	74	14.60	60.79	27.2	4.31	32.9	-1.39
2390.00	44.64	AV	54	9.36	46.03	27.2	4.31	32.9	-1.39
Frequency(MHz):			**2402**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2390.00	59.50	PK	74	14.50	60.89	27.2	4.31	32.9	-1.39
2390.00	45.33	AV	54	8.67	46.72	27.2	4.31	32.9	-1.39
Frequency(MHz):			**2480**		**P olarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	56.77	PK	74	17.23	57.70	27.4	4.47	32.8	-0.93
2483.50	44.43	AV	54	9.57	45.36	27.4	4.47	32.8	-0.93
Frequency(MHz):			**2480**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
2483.50	55.72	PK	74	18.28	56.65	27.4	4.47	32.8	-0.93
2483.50	43.31	AV	54	10.69	44.24	27.4	4.47	32.8	-0.93

6.8. Spurious Emission

6.8.1. Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)/ RSS 247 5.5					
Test Method:	ANSI C63.10:2013					
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 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test results:	Pass					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar

Reference

GFSK

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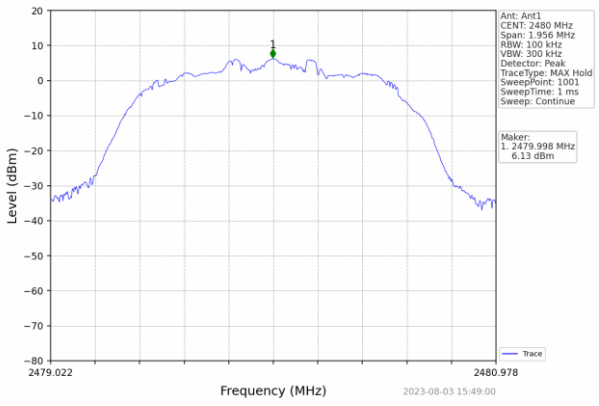
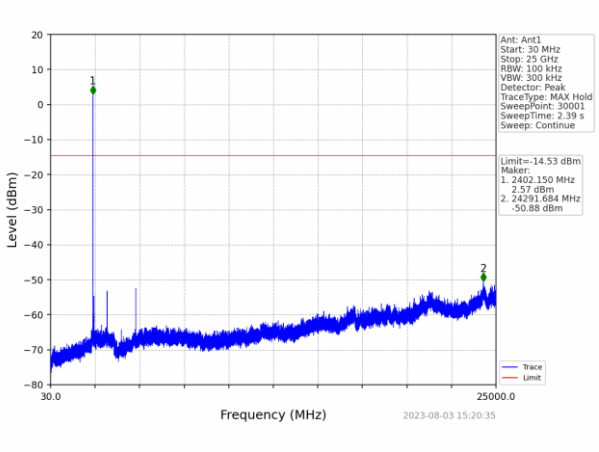

8-DPSK

GFSK

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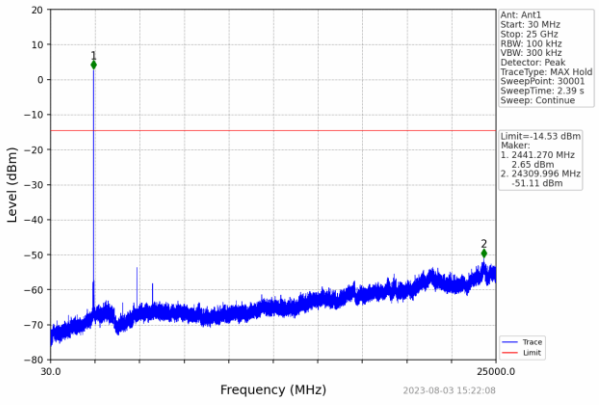
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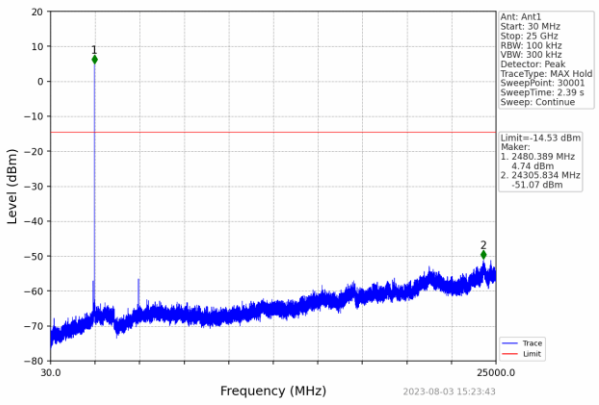
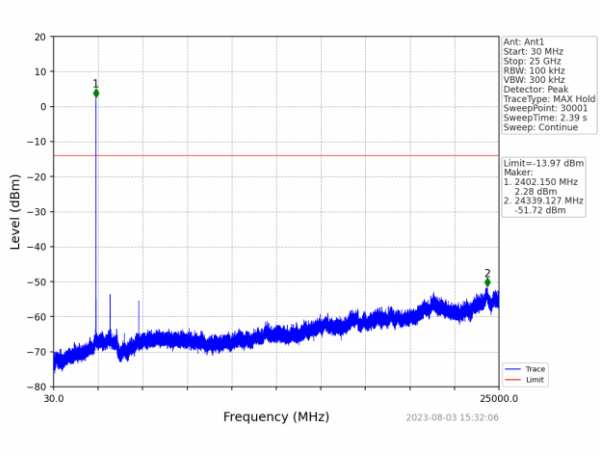

CH78

π/4DQPSK

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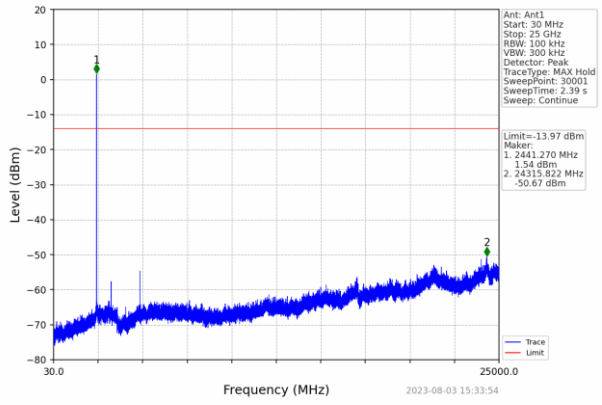
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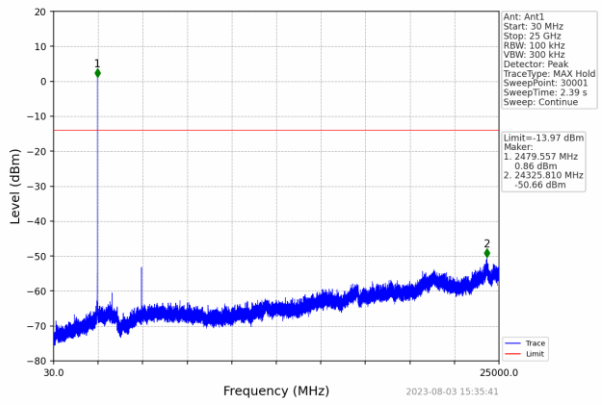
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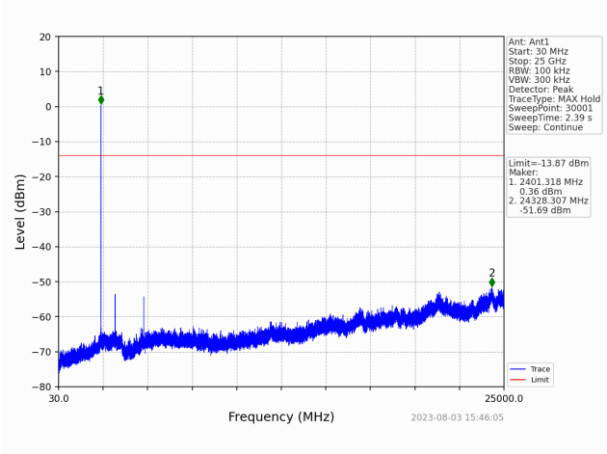
8-DPSK

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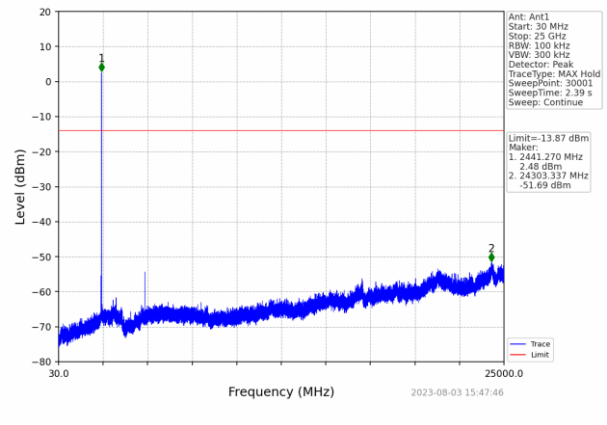
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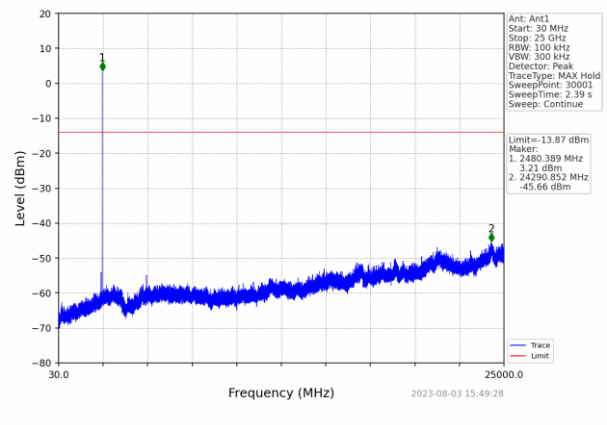

CH78

6.8.2. Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 /RSS-Gen 8.9
Test Method:	ANSI C63.10:2013
Test Frequency Range:	9kHz to 25GHz
Test site:	Measurement Distance: 3m

Receiver setup:

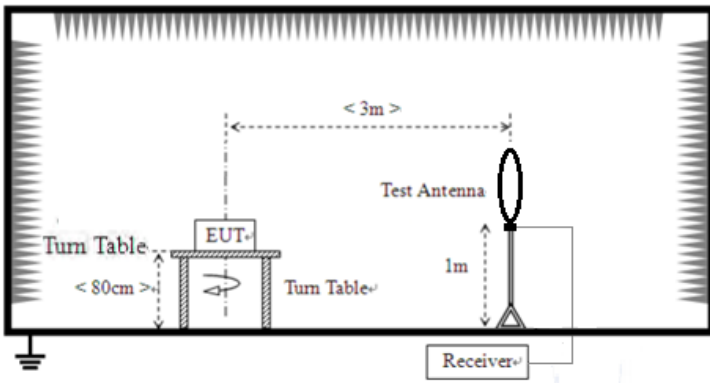
Frequency	Detector	RBW	VBW	Value
9KHz-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak
150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

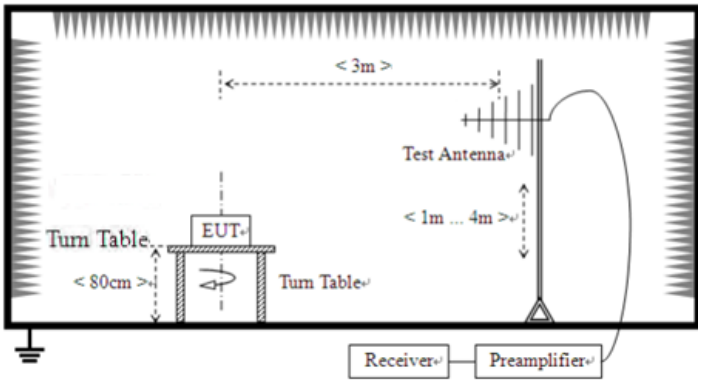
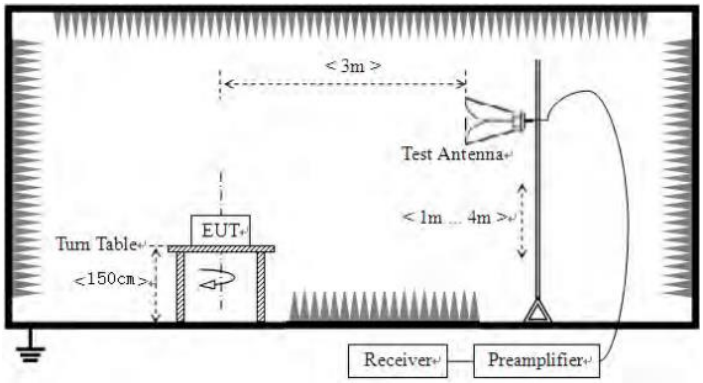
Limit:

Frequency	Limit (uV/m)	Value	Measurement Distance
0.009MHz-0.490MHz	2400/F(KHz)	QP	300m
0.490MHz-1.705MHz	24000/F(KHz)	QP	30m
1.705MHz-30MHz	30	QP	30m
30MHz-88MHz	100	QP	3m
88MHz-216MHz	150	QP	
216MHz-960MHz	200	QP	
960MHz-1GHz	500	QP	
Above 1GHz	500	Average	
	5000	Peak	

Test setup:

For radiated emissions from 9kHz to 30MHz



	For radiated emissions from 30MHz to1GHz  For radiated emissions above 1GHz 
Test Procedure:	1. The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) 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 6.0 for details
Test mode:	Refer to section 5.2 for details

Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar
Test voltage:	AC 120V, 60Hz					
Test results:	Pass					

Measurement data:

Remarks:

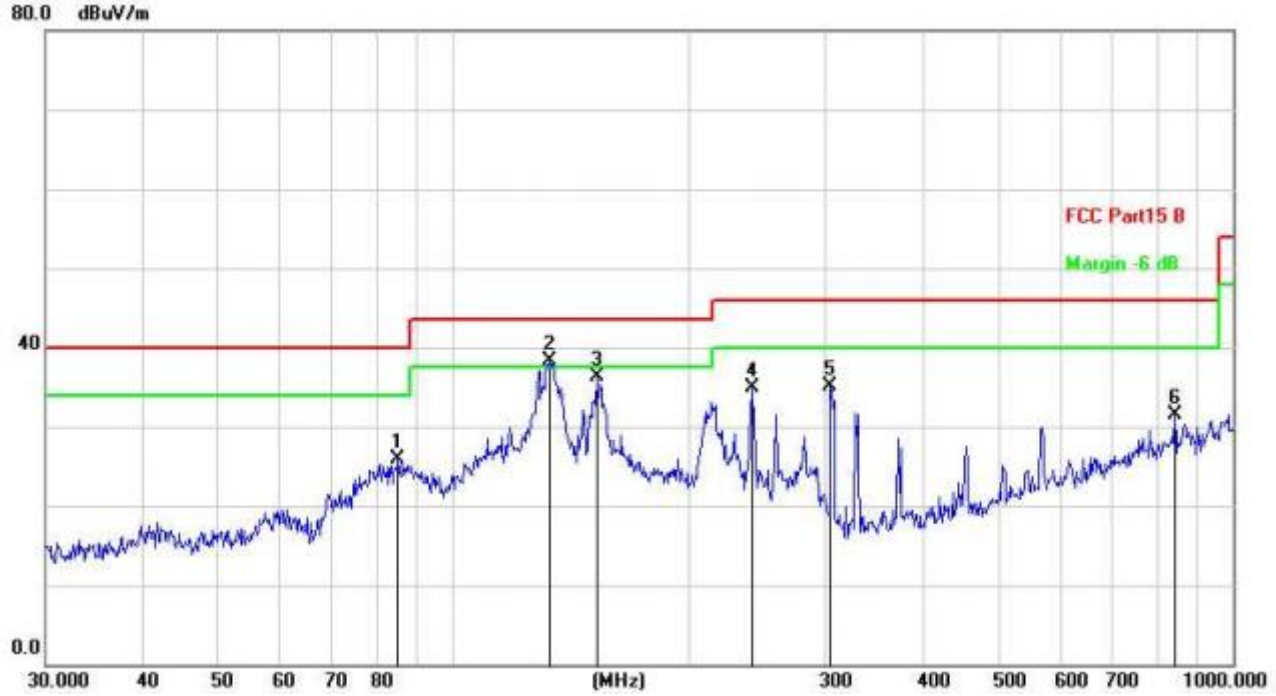
1. *During the test, pre-scan the GFSK, π/4-DQPSK, 8-DPSK modulation, and found the GFSK modulation which it is worse case.*
2. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

■ **9kHz~30MHz**

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

For 30MHz-1GHz

Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dB/m	dB	Detector
1		84.9993	41.31	-15.45	25.86	40.00	-14.14	QP
2	*	133.1511	50.63	-12.32	38.31	43.50	-5.19	QP
3		152.6640	46.85	-10.57	36.28	43.50	-7.22	QP
4		241.6762	46.69	-11.86	34.83	46.00	-11.17	QP
5		304.6099	45.46	-10.42	35.04	46.00	-10.96	QP
6		842.1295	30.39	1.03	31.42	46.00	-14.58	QP

Final Level =Receiver Read level + Correct Factor

Vertical

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dB/m	dB	Detector
1		66.7325	45.19	-12.77	32.42	40.00	-7.58	QP
2	*	132.2204	51.02	-12.39	38.63	43.50	-4.87	QP
3	!	152.6639	48.18	-10.57	37.61	43.50	-5.89	QP
4		219.0751	51.18	-13.30	37.88	46.00	-8.12	QP
5		401.8385	37.78	-7.98	29.80	46.00	-16.20	QP
6		975.7527	27.92	3.58	31.50	54.00	-22.50	QP

Final Level =Receiver Read level + Correct Factor

For 1GHz to 25GHz

Remark: For test above 1GHz GFSK,Pi/4 DQPSK and 8-DPSK were test at Low, Middle, and High channel; only the worst result of GFSK was reported as below:

GFSK (above 1GHz)

Frequency(MHz):			**2402**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	59.36	PK	74	14.64	53.66	31	6.5	31.8	5.7
4804.00	43.03	AV	54	10.97	37.33	31	6.5	31.8	5.7
7206.00	54.01	PK	74	19.99	41.36	36	8.15	31.5	12.65
7206.00	44.19	AV	54	9.81	31.54	36	8.15	31.5	12.65

Frequency(MHz):			**2402**		**Polarity:**		**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4804.00	58.04	PK	74	15.96	52.34	31	6.5	31.8	5.7
4804.00	42.80	AV	54	11.20	37.10	31	6.5	31.8	5.7
7206.00	53.91	PK	74	20.09	41.26	36	8.15	31.5	12.65
7206.00	43.11	AV	54	10.89	30.46	36	8.15	31.5	12.65

Frequency(MHz):			**2441**		**Polarity:**		**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4882.00	59.71	PK	74	14.29	53.55	31.2	6.61	31.65	6.16
4882.00	43.12	AV	54	10.88	36.96	31.2	6.61	31.65	6.16
7323.00	53.03	PK	74	20.97	40.08	36.2	8.23	31.48	12.95

7323.00	44.02	AV	54	9.98	31.07	36.2	8.23	31.48	12.95

Frequency(MHz):			2441		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4882.00	62.06	PK	74	11.94	55.90	31.2	6.61	31.65	6.16
4882.00	43.40	AV	54	10.60	37.24	31.2	6.61	31.65	6.16
7323.00	54.30	PK	74	19.70	41.35	36.2	8.23	31.48	12.95
7323.00	43.33	AV	54	10.67	30.38	36.2	8.23	31.48	12.95

Frequency(MHz):			2480		Polarity:		HORIZONTAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	61.68	PK	74	12.32	55.02	31.4	6.76	31.5	6.66
4960.00	41.27	AV	54	12.73	34.61	31.4	6.76	31.5	6.66
7440.00	54.56	PK	74	19.44	41.26	36.4	8.35	31.45	13.3
7440.00	45.60	AV	54	8.40	32.30	36.4	8.35	31.45	13.3

Frequency(MHz):			2480		Polarity:		VERTICAL		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
4960.00	62.59	PK	74	11.41	55.93	31.4	6.76	31.5	6.66
4960.00	43.34	AV	54	10.66	36.68	31.4	6.76	31.5	6.66
7440.00	53.50	PK	74	20.50	40.20	36.4	8.35	31.45	13.3
7440.00	44.64	AV	54	9.36	31.34	36.4	8.35	31.45	13.3

Remark：
(1) Data of measurement within this frequency range shown “--- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
(2) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed.

6.9. Antenna Requirement

Standard Applicable

For intentional device, according to RSS-Gen 6.8:

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

For intentional device, according to FCC 47 CFR Section 15.203:

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

FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1) (I):

(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

Test Result:

The maximum gain of antenna was 3.42 dBi.

Remark:The antenna gain is provided by the customer , if the data provided by the customer is not accurate, Shenzhen HTT Technology Co.,Ltd. does not assume any responsibility.

7. Test Setup Photo

Reference to the **appendix I** for details.

8. EUT Constructional Details

Reference to the **appendix II** for details.

------End------