FCC Test Report

Report No.:	RWAQ202400241A
Applicant:	Shenzhen Neutop Optoelectronics Co., Ltd
Address:	502, BLDG 4, Pingshan minQi Technology Park, No. 65 Lishan Road, Pingshan Community,Taoyuan Street, Nanshan District, Shenzhen,Guangdong, China
Product Name:	Projector
Product Model:	D001
Multiple Models:	EAZZE D1, D002, D003,D004,D005
Trade Mark:	N/A
FCC ID:	2BEGB-YX02
Standards:	FCC CFR Title 47 Part 15C (§15.247)
Test Date:	2024-03-19 to 2024-04-10
Test Result:	Complied
Report Date:	2024-04-15

Reviewed by:	Abel Chen	**Approved by:**	Jacob Kong
	Project Engineer		Manager

Prepared by:

World Alliance Testing & Certification (Shenzhen) Co., Ltd

No. 1002, East Block, Laobing Building, Xingye Road 3012, Xixiang street, Bao'an District, Shenzhen, Guangdong, People's Republic of China

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Announcement

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3. This sample tested is in compliance with the limits of the above regulation.

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5. The information marked "#" is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report. Customer model name, addresses, names, trademarks etc. are included.

Revision History

Version No.	Issued Date	Description
00	*2024-04-15*	*Original*

Contents

1 General Information

1.1 Client Information

Applicant:	Shenzhen Neutop Optoelectronics Co., Ltd
Address:	502, BLDG 4, Pingshan minQi Technology Park, No. 65 Lishan Road, Pingshan Community,Taoyuan Street, Nanshan District, Shenzhen,Guangdong, China
Manufacturer:	Shenzhen Neutop Optoelectronics Co., Ltd
Address:	502, BLDG 4, Pingshan minQi Technology Park, No. 65 Lishan Road, Pingshan Community,Taoyuan Street, Nanshan District, Shenzhen,Guangdong, China

1.2 Product Description of EUT

The EUT is Projector that contains BT, 2.4G and 5G WLAN radios; this report covers the full testing of the BT radio.

Sample Serial Number	6S-1 for CE Test, 6S-2 for RE test, 6S-3 for RF test conducted test (assigned by WATC)
Sample Received Date	2024-03-19
Sample Status	Good Condition
Frequency Range	2402MHz - 2480MHz
Maximum Conducted Peak Output Power	7.05dBm
Modulation Technology	GFSK, π/4 DQPSK, 8DPSK
Spatial Streams	SISO (1TX, 1RX)
Antenna Gain#	2.47dBi
Power Supply	DC 21V from adapter
Operating temperature#	0 deg.C to +35 deg.C
Adapter 1 Information	Model: JDA2102850WUS Input: AC100-240V, 50/60Hz, 1.25A Output: DC 21V/2.85A,
Adapter 2 Information	Model: Z72A210285US00 Input: AC100-240V, 50/60Hz, 1.5A Output: DC 21V/2.85A,
Modification	Sample No Modification by the test lab

1.3 Antenna information

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.

Device Antenna information:	
The BT antenna is an internal antenna which cannot replace by end-user, please see product internal photos for details.	

1.4 Related Submittal(s)/Grant(s)

FCC Part 15, Subpart C, Equipment Class: DTS, FCC ID: 2BEGB-YX02

FCC Part 15, Subpart E, Equipment Class: NII, FCC ID: 2BEGB-YX02

1.5 Measurement Uncertainty

Parameter		Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
AC Power Lines Conducted Emissions		±3.14dB
Emissions, Radiated	Below 30MHz	±2.78dB
	Below 1GHz	±4.84dB
	Above 1GHz	±5.44dB
Emissions, Conducted		1.75dB
Conducted Power		0.74dB
Frequency Error		150Hz
Bandwidth		0.34%
Power Spectral Density		0.74dB

Note: *The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.*

1.6 Laboratory Location

World Alliance Testing & Certification (Shenzhen) Co., Ltd

No. 1002, East Block, Laobing Building, Xingye Road 3012, Xixiang street, Bao'an District, Shenzhen, Guangdong, People's Republic of China

Tel: +86-755-29691511, Email: qa@watc.com.cn

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 463912, the FCC Designation No. : CN5040.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0160.

1.7 Test Methodology

FCC CFR 47 Part 2

FCC CFR 47 Part 15

KDB 558074 D01 DTS Meas Guidance v05r02

ANSI C63.10-2013

2 Description of Measurement

2.1 Test Configuration

Operating channels:					
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	39	2441	76	2478
1	2403	40	2442	77	2479
…	…	…	…	78	2480
38	2440	…	…	/	/
According to ANSI C63.10-2013 chapter 5.6.1 Table 11 requirement, select lowest channel, middle channel, and highest channel in the frequency range in which device operates for testing. The detailed frequency points are as follows:					
Lowest channel		Middle channel		Highest channel	
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	39	2441	78	2480

Test Mode:				
Transmitting mode:	Keep the EUT in continuous transmitting with modulation			
Exercise software#:	SecureCRT_x86_7.1.1.264			
Mode	**Data rate**	**Power Level Setting#**		
		Low Channel	**Middle Channel**	**High Channel**
GFSK	1Mbps	04	04	04
π/4 DQPSK	2Mbps	04	04	04
8DPSK	3Mbps	04	04	04
The exercise software and the maximum power setting that provided by manufacturer.				

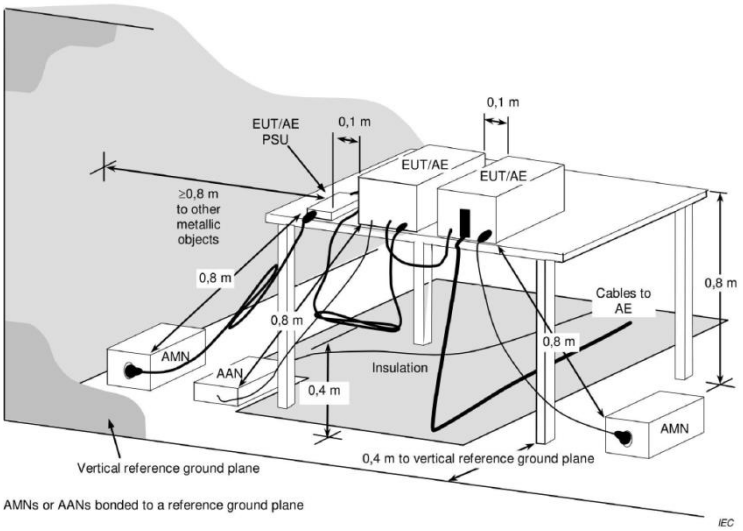
Worst-Case Configuration:
For AC power line conducted emission and radiated emission 9kHz-1GHz and above 18GHz were performed with the EUT transmits at the channel with highest output power as worst-case scenario.

2.2 Test Auxiliary Equipment

Manufacturer	Description	Model	Serial Number
aigo	USB flash disk*2	unknown	unknown
unknown	Earphone	unknown	unknown
TMALL	magicbox	unknown	unknown
unknown	HDMI cable	unknown	unknown
unknown	Audio cable	unknown	unknown
DELL	laptop	unknown	unknown

2.3 Test Setup

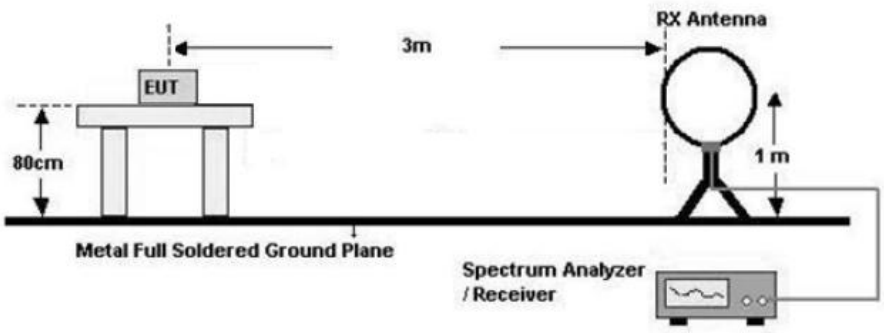
1) Conducted emission measurement:



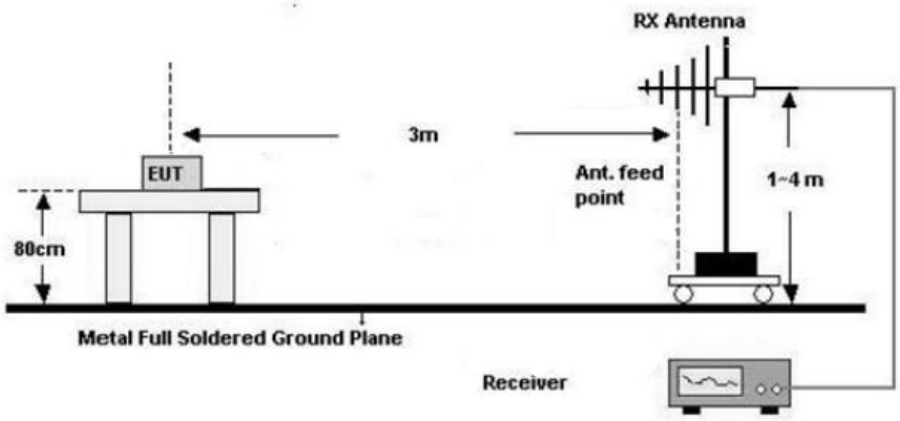
Note: The 0.8 m distance specified between EUT/AE/PSU and AMN/AAN, is applicable only to the EUT being measured. If the device is AE then it shall be >0.8 m.

2) Radiated emission measurement:

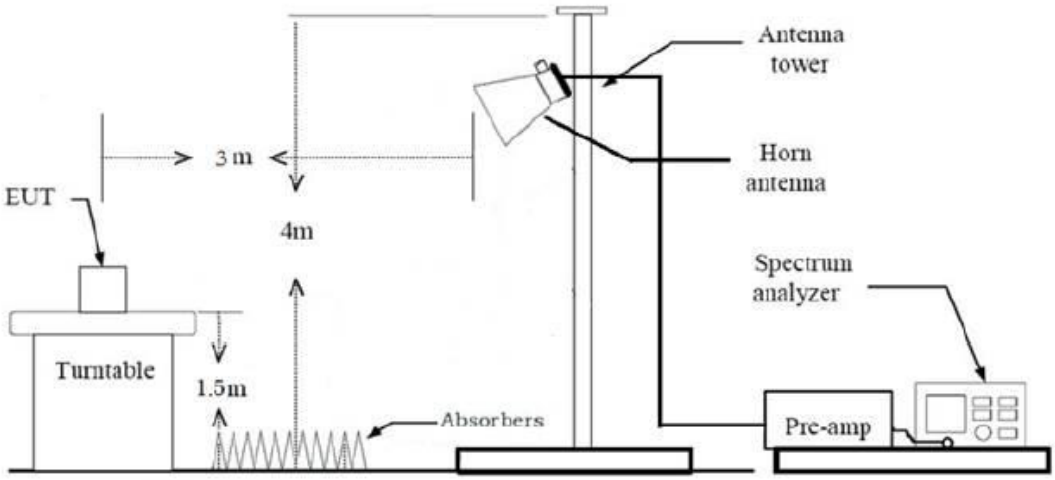
Below 30MHz (3m SAC)



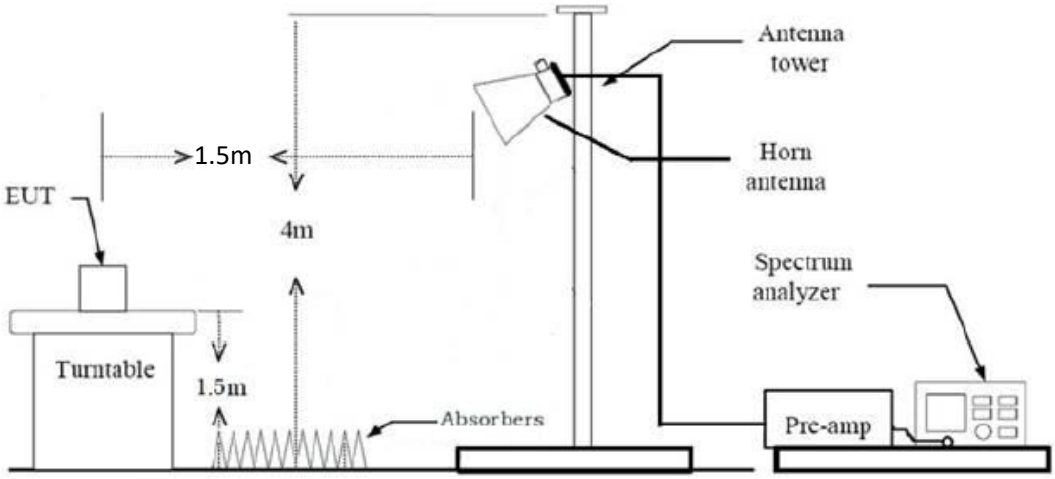
30MHz-1GHz (3m SAC)



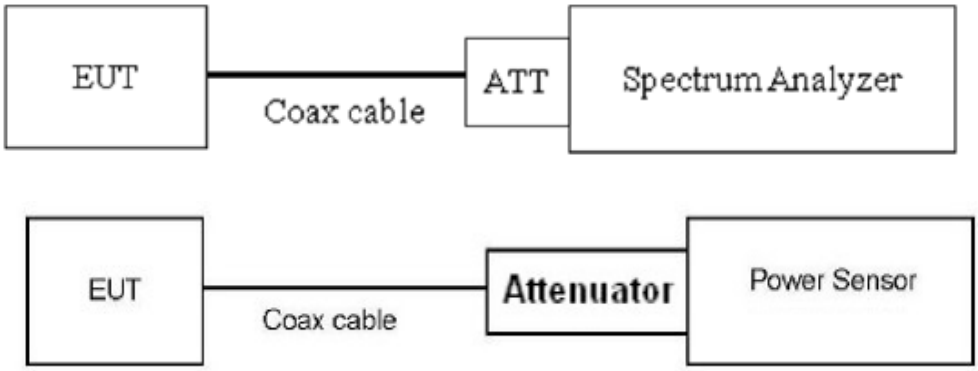
1GHz-18GHz(3m FAC)



Above 18GHz (3m FAC)



3) RF Conducted Test



or

2.4 Test Procedure

Conducted emission:

1. The E.U.T is placed on a non-conducting table 40cm from the vertical ground plane and 80cm above the horizontal ground plane (Please refer to the block diagram of the test setup and photographs).
2. 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 on conducted measurement.
3. Line conducted data is recorded for both Line and Neutral

Radiated Emission Procedure:

a) For below 30MHz

1. All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz- 30 MHz) to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40*Log (test distance / specification distance).
2. Loop antenna use, investigation was done on the three antenna orientations (parallel, perpendicular, gound-parallel)

b) For 30MHz-1GHz:

1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m.
2. EUT works in each mode of operation that needs to be tested. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.

c) For above 1GHz:

1. The EUT was placed on the tabletop of a rotating table 1.5 m the ground at a 3 m fully anechoic room. The measurement distance from the EUT to the receiving antenna is 3 m (1-18GHz) and 1.5 m (above 18GHz).
2. EUT works in each mode of operation that needs to be tested，and having the EUT continuously working. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.
3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.
4. Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

RF Conducted Test:

1. The antenna port of EUT was connected to the RF port of the test equipment (Power Meter or

Spectrum analyzer) through Attenuator and RF cable.

2. The cable assembly insertion loss of 6.5dB (including 6.0 dB Attenuator and 0.5dB cable) was entered as an offset in the test equipment. Note: Actual cable loss was unavailable at the time of testing, therefore a loss of 0.5dB was assumed as worst case. This was later verified to be true by laboratory. (if the RF cable provided by client, the cable loss declared by client)
3. The EUT is keeping in continuous transmission mode and tested in all modulation modes.

2.5 Measurement Method

Description of Test	Measurement Method
AC Line Conducted Emissions	ANSI C63.10-2013 Section 6.2
Maximum Conducted Output Power	ANSI C63.10-2013 Section 7.8.5
20 dB Emission Bandwidth	ANSI C63.10-2013 Section 6.9.2
99% Occupied Bandwidth	ANSI C63.10-2013 Section 6.9.3
Channel separation	ANSI C63.10-2013 Section 7.8.2
Number of hopping Frequency	ANSI C63.10-2013 Section 7.8.3
Time of occupancy (dwell time)	ANSI C63.10-2013 Section 7.8.4
100kHz Bandwidth of Frequency Band Edge	ANSI C63.10-2013 Section 7.8.7.2&6.10
Radiated emission	ANSI C63.10-2013 Section 7.8&6.3&6.4&6.5&6.6

2.6 Measurement Equipment

Manufacturer	Description	Model	Management No.	Calibration Date	Calibration Due Date
AC Line Conducted Emission Test					
ROHDE& SCHWARZ	EMI TEST RECEIVER	ESR	101817	2023/7/3	2024/7/2
R&S	LISN	ENV216	101748	2023/8/1	2024/7/31
N/A	Coaxial Cable	NO.12	N/A	2023/7/3	2024/7/2
Farad	Test Software	EZ-EMC	Ver. EMEC-3A1	/	/
Radiated Emission Test					
R&S	EMI test receiver	ESR3	102758	2023/7/3	2024/7/2
ROHDE&	SPECTRUM	FSV40-N	101608	2023/7/3	2024/7/2

SCHWARZ	ANALYZER				
SONOMA INSTRUMENT	Low frequency amplifier	310	186014	2023/7/12	2024/7/11
COM-POWER	preamplifier	PAM-118A	18040152	2023/8/21	2024/8/20
COM-POWER	Amplifier	PAM-840A	461306	2023/8/8	2024/8/7
BACL	Loop Antenna	1313-1A	4010611	2024/2/7	2027/2/6
SCHWARZBECK	Log - periodic wideband antenna	VULB 9163	9163-872	2023/7/7	2024/7/6
Astro Antenna Ltd	Horn antenna	AHA-118S	3015	2023/7/6	2024/7/5
Ducommun technologies	Horn Antenna	ARH-4223-02	1007726-03	2023/7/10	2024/7/9
Oulitong	Band Reject Filter	OBSF-2400-248 3.5-50N	OE02103119	2023/9/15	2024/9/14
N/A	Coaxial Cable	N/A	NO.9	2023/8/8	2024/8/7
N/A	Coaxial Cable	N/A	NO.10	2023/8/8	2024/8/7
N/A	Coaxial Cable	N/A	NO.11	2023/8/8	2024/8/7
Audix	Test Software	E3	191218 V9	/	/
RF Conducted Test					
ROHDE& SCHWARZ	SPECTRUM ANALYZER	FSU-26	200680/026	2023/7/12	2024/7/11
narda	6dB attenuator	603-06-1	N/A	2023/7/26	2024/7/25

Note: All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or International standards.

3 Test Results

3.1 Test Summary

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.247 (a)(1)	20dB Emission Bandwidth	Compliance
-	99% Occupied Bandwidth	Report only
§15.247 (a)(1)	Channel separation	Compliance
§15.247 (a)(1)(iii)	Number of hopping Frequency	Compliance
§15.247 (a)(1)(iii)	Time of occupancy (dwell time)	Compliance
§15.247(b)(1)	Maximum Conducted Output Power	Compliance
§15.247(d)	100kHz Bandwidth of Frequency Band Edge	Compliance
§15.205, §15.209, §15.247(d)	Radiated emission	Compliance

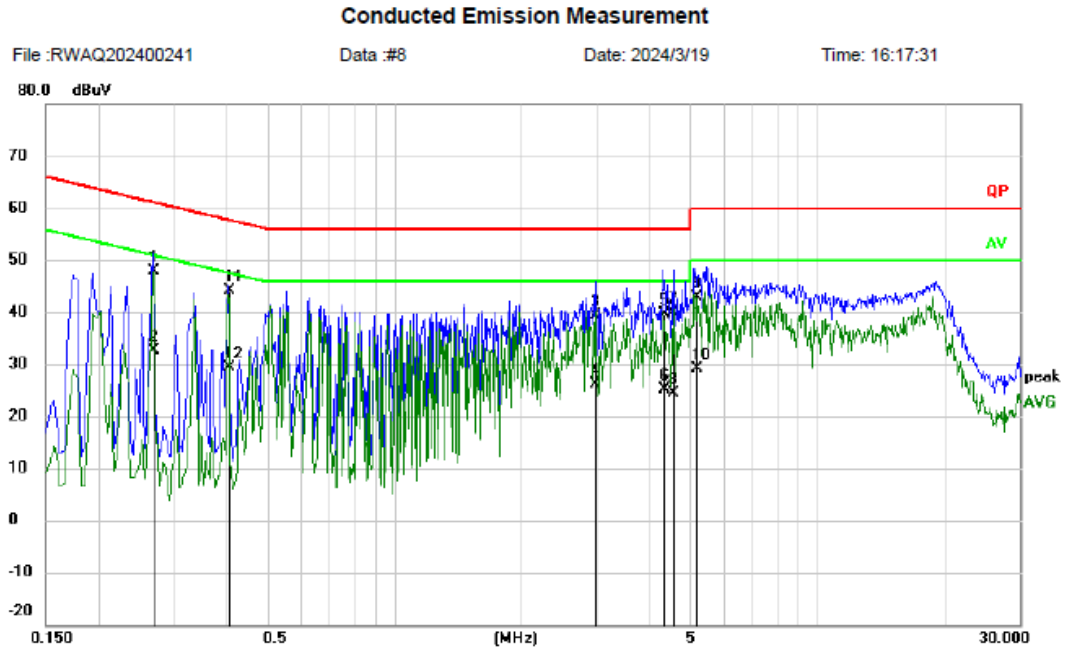
3.2 Limit

Test items	Limit
AC Line Conducted Emissions	See details §15.207 (a)
Conducted Output Power	For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.
Channel separation	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. 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.
Number of hopping Frequency	Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.
Time of occupancy (dwell time)	The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.
Spurious Emissions, 100kHz Bandwidth of Frequency Band Edge	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

3.3 AC Line Conducted Emissions Test Data

Test Date:	2024-03-19	Test By:	Lirou Li
Environment condition:	Temperature: 25.6°C; Relative Humidity:51%; ATM Pressure: 101.1kPa		

Adapter1



Limit: QP
Mode:transmitting
Note: 8DPSK Low channel

Phase: L1
Power: AC 120V/60Hz

Temperature: 25.6
Humidity: 51 %
Air Pressure: 1011 hpa

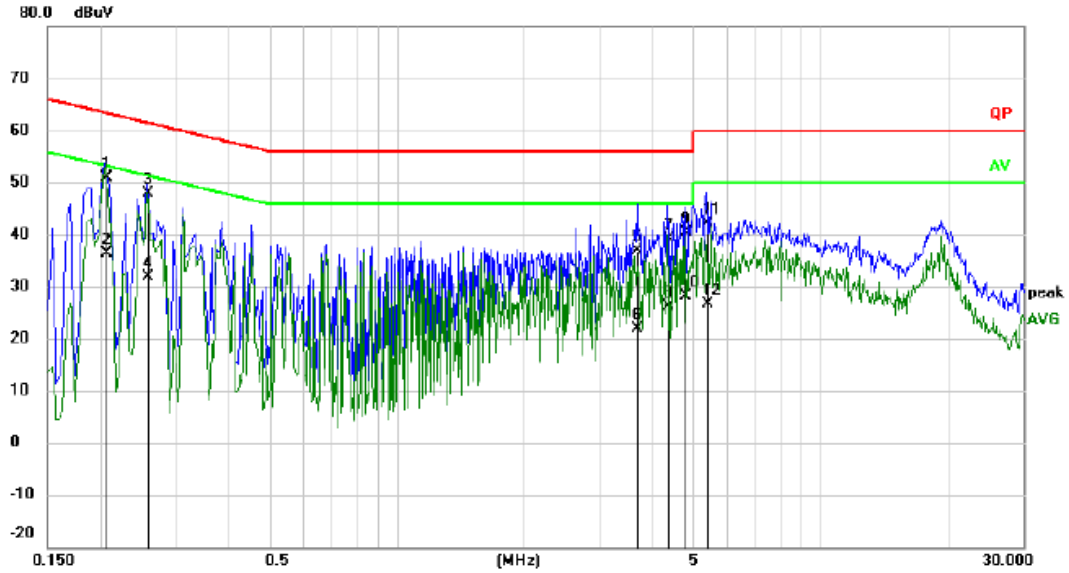
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over Limit		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.2700	37.27	10.68	47.95	61.12	-13.17	QP	
2		0.2700	21.84	10.68	32.52	51.12	-18.60	AVG	
3		2.9860	28.53	10.80	39.33	56.00	-16.67	QP	
4		2.9860	15.43	10.80	26.23	46.00	-19.77	AVG	
5		4.3220	28.40	11.12	39.52	56.00	-16.48	QP	
6		4.3220	14.07	11.12	25.19	46.00	-20.81	AVG	
7		4.5540	28.81	11.13	39.94	56.00	-16.06	QP	
8		4.5540	13.28	11.13	24.41	46.00	-21.59	AVG	
9		5.1660	31.67	11.14	42.81	60.00	-17.19	QP	
10		5.1660	17.88	11.14	29.02	50.00	-20.98	AVG	
11		0.4060	33.29	10.79	44.08	57.73	-13.65	QP	
12		0.4060	18.50	10.79	29.29	47.73	-18.44	AVG	

*:Maximum data x:Over limit !:over margin

Engineer Signature: Lirou

Conducted Emission Measurement

File :RWAQ202400241 Data :#7 Date: 2024/3/19 Time: 16:15:21



Limit: QP Phase: N Temperature: 25.6

Mode:transmitting Power: AC 120V/60Hz Humidity: 51 %

Note: 8DPSK Low channel Air Pressure: 1011 hpa

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over Limit		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.2060	40.41	10.42	50.83	63.37	-12.54	QP	
2		0.2060	25.95	10.42	36.37	53.37	-17.00	AVG	
3		0.2580	37.28	10.49	47.77	61.50	-13.73	QP	
4		0.2580	21.29	10.49	31.78	51.50	-19.72	AVG	
5		3.6860	26.43	10.46	36.89	56.00	-19.11	QP	
6		3.6860	11.42	10.46	21.88	46.00	-24.12	AVG	
7		4.3500	28.69	10.45	39.14	56.00	-16.86	QP	
8		4.3500	15.80	10.45	26.25	46.00	-19.75	AVG	
9		4.7819	29.88	10.51	40.39	56.00	-15.61	QP	
10		4.7819	17.53	10.51	28.04	46.00	-17.96	AVG	
11		5.3620	31.47	10.58	42.05	60.00	-17.95	QP	
12		5.3620	15.97	10.58	26.55	50.00	-23.45	AVG	

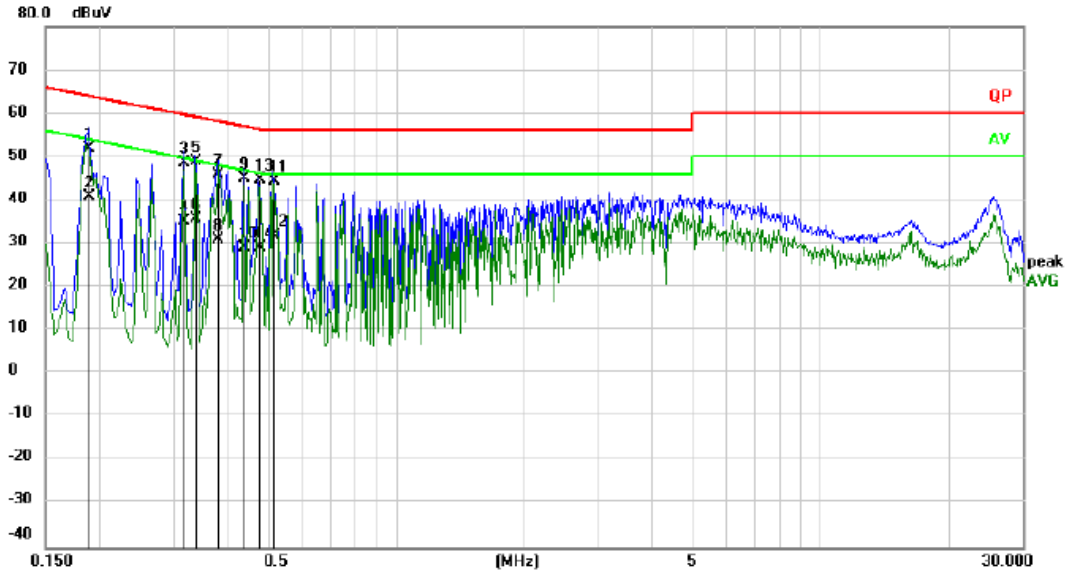
*:Maximum data x:Over limit !:over margin Engineer Signature: Lirou

Test Date:	2024-04-09	Test By:	Lirou Li
Environment condition:	Temperature: 23.1°C; Relative Humidity:56%; ATM Pressure: 101.4kPa		

Adapter 2

Conducted Emission Measurement

File :RWAQ202400241 Data :#4 Date: 2024/4/9 Time: 17:21:31



Limit: QP Phase: L1 Temperature: 23.1

Mode:transmitting Power: AC 120V/60Hz Humidity: 56 %

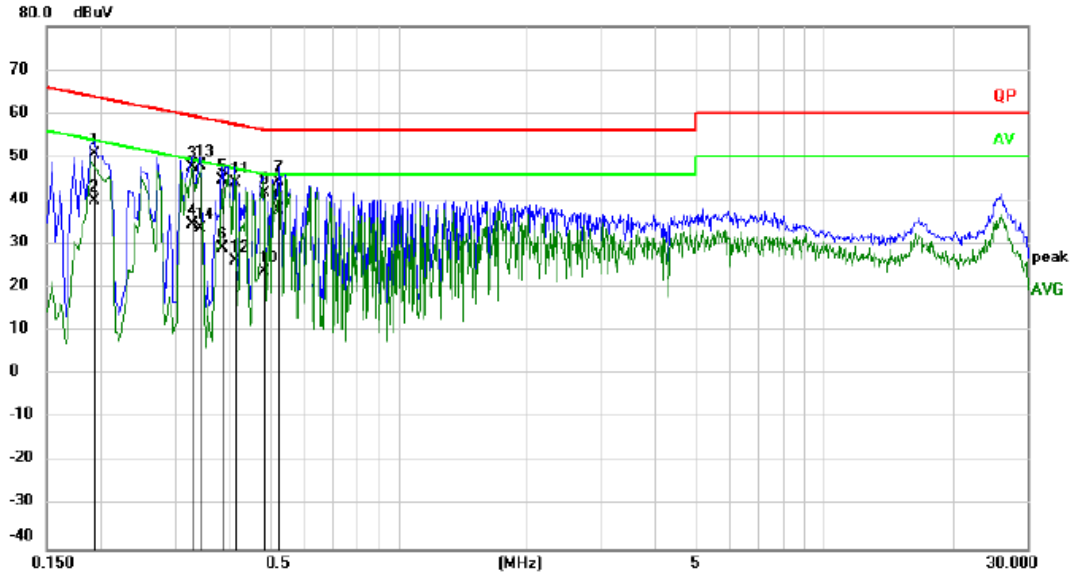
Note: 8DPSK Low channel Air Pressure: 1014 hpa

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over Limit		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1900	41.45	10.65	52.10	64.04	-11.94	QP	
2		0.1900	30.19	10.65	40.84	54.04	-13.20	AVG	
3		0.3180	37.92	10.72	48.64	59.76	-11.12	QP	
4		0.3180	24.53	10.72	35.25	49.76	-14.51	AVG	
5	*	0.3379	38.17	10.73	48.90	59.25	-10.35	QP	
6		0.3379	24.95	10.73	35.68	49.25	-13.57	AVG	
7		0.3820	35.33	10.77	46.10	58.24	-12.14	QP	
8		0.3820	20.11	10.77	30.88	48.24	-17.36	AVG	
9		0.4380	34.12	10.79	44.91	57.10	-12.19	QP	
10		0.4380	18.22	10.79	29.01	47.10	-18.09	AVG	
11		0.5180	33.51	10.82	44.33	56.00	-11.67	QP	
12		0.5180	21.10	10.82	31.92	46.00	-14.08	AVG	
13		0.4780	33.98	10.81	44.79	56.37	-11.58	QP	
14		0.4780	18.40	10.81	29.21	46.37	-17.16	AVG	

*:Maximum data x:Over limit !:over margin Engineer Signature: Lirou

Conducted Emission Measurement

File :RWAQ202400241 Data :#3 Date: 2024/4/9 Time: 17:10:45



Limit: QP Phase: N Temperature: 23.1

Mode:transmitting Power: AC 120V/60Hz Humidity: 56 %

Note: 8DPSK Low channel Air Pressure: 1014 hpa

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over Limit		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1940	40.41	10.43	50.84	63.86	-13.02	QP	
2		0.1940	29.42	10.43	39.85	53.86	-14.01	AVG	
3		0.3300	37.07	10.57	47.64	59.45	-11.81	QP	
4		0.3300	23.97	10.57	34.54	49.45	-14.91	AVG	
5		0.3860	34.26	10.64	44.90	58.15	-13.25	QP	
6		0.3860	18.65	10.64	29.29	48.15	-18.86	AVG	
7		0.5260	33.91	10.69	44.60	56.00	-11.40	QP	
8	*	0.5260	27.14	10.69	37.83	46.00	-8.17	AVG	
9		0.4860	30.96	10.71	41.67	56.24	-14.57	QP	
10		0.4860	13.08	10.71	23.79	46.24	-22.45	AVG	
11		0.4140	33.62	10.65	44.27	57.57	-13.30	QP	
12		0.4140	15.63	10.65	26.28	47.57	-21.29	AVG	
13		0.3420	37.36	10.58	47.94	59.15	-11.21	QP	
14		0.3420	23.19	10.58	33.77	49.15	-15.38	AVG	

*:Maximum data x:Over limit !:over margin Engineer Signature: Lirou

Remark:

Measurement (dBuV)= Reading Level (dBuV) + Correct Factor(dB)

Correct Factor(dB)= LISN Voltage Division Factor (dB)+ Cable loss(dB)

Over Limit = Measurement – Limit

3.4 Radiated emission Test Data

9 kHz-30MHz:

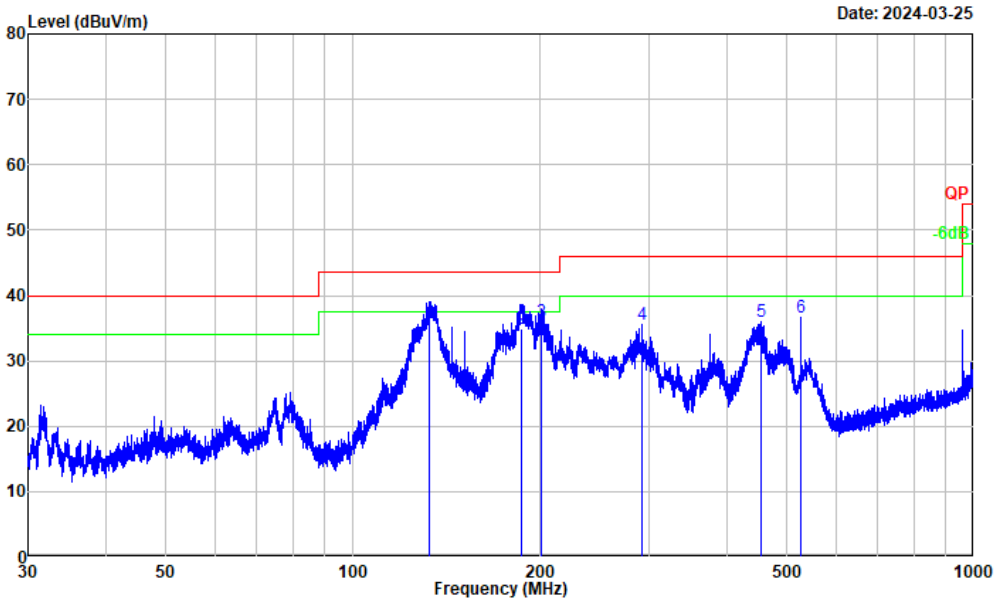
Test Date:	2024-03-25	**Test By:**	Luke Li
Environment condition:	Temperature: 23.8°C; Relative Humidity:69%; ATM Pressure: 100.8kPa		

For radiated emissions below 30MHz, there were no emissions found within 20dB of limit.

30MHz-1GHz:

Test Date:	2024-03-25	Test By:	Luke Li
Environment condition:	Temperature: 23.8°C; Relative Humidity:69%; ATM Pressure: 100.8kPa		

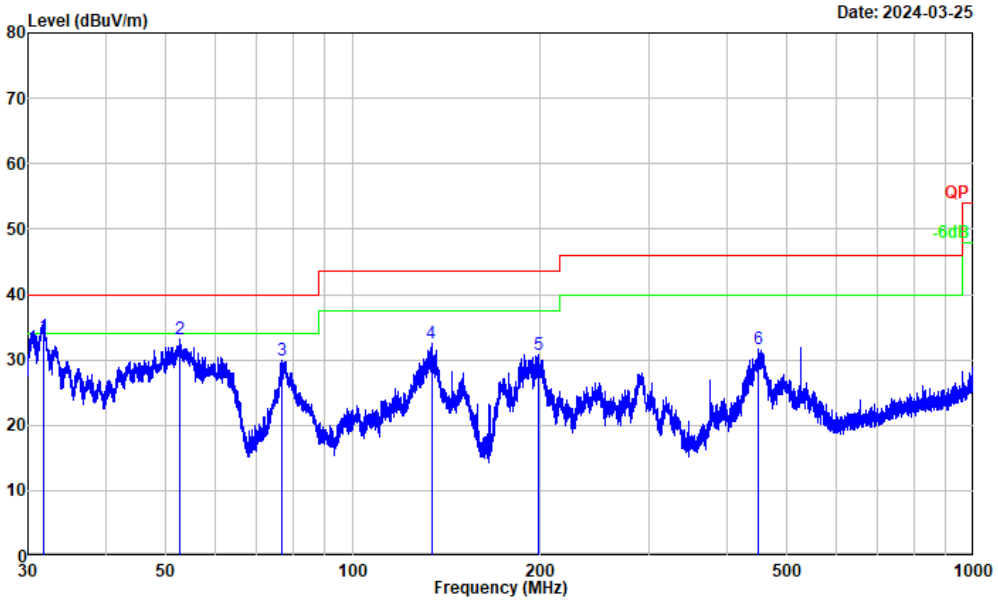
Adapter 1



Project No. : RWAQ202400241
Test Mode : Transmitting
Test Voltage : AC 120V/60Hz
Environment : 23.8℃/69%R.H./100.8kPa
Tested by : Luke Li
Polarization : horizontal
Remark : 8DPSK Low Channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	132.943	54.30	-18.28	36.02	43.50	-7.48	QP
2	186.975	50.90	-15.94	34.96	43.50	-8.54	QP
3	201.353	50.80	-14.82	35.98	43.50	-7.52	QP
4	291.757	48.26	-12.80	35.46	46.00	-10.54	Peak
5	454.664	45.81	-9.88	35.93	46.00	-10.07	Peak
6	526.585	45.12	-8.53	36.59	46.00	-9.41	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain



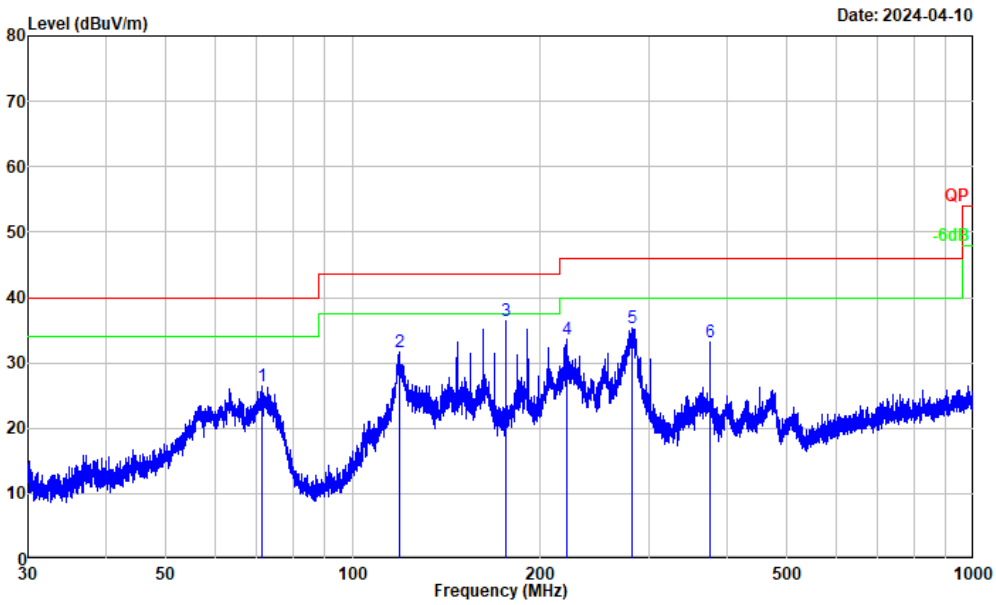
Project No. : RWAQ202400241
Test Mode : Transmitting
Test Voltage : AC 120V/60Hz
Environment : 23.8℃/69%R.H./100.8kPa
Tested by : Luke Li
Polarization : vertical
Remark : 8DPSK Low Channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	31.815	49.40	-15.73	33.67	40.00	-6.33	QP
2	52.671	45.88	-12.81	33.07	40.00	-6.93	Peak
3	76.958	48.67	-18.85	29.82	40.00	-10.18	Peak
4	133.878	50.70	-18.28	32.42	43.50	-11.08	Peak
5	198.896	45.66	-14.82	30.84	43.50	-12.66	Peak
6	449.314	41.62	-9.88	31.74	46.00	-14.26	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain

Test Date:	2024-04-10	Test By:	Luke Li
Environment condition:	Temperature: 22.2°C; Relative Humidity:64%; ATM Pressure: 101.2kPa		

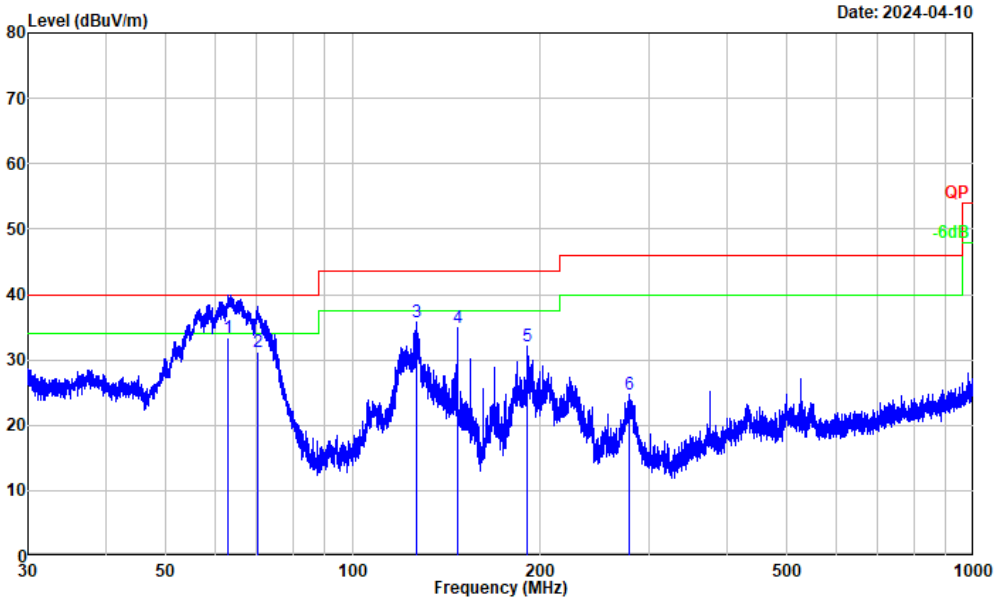
Adapter 2



Project No. : RWAQ202400241
Test Mode : Transmitting
Test Voltage : AC 120V/60Hz
Environment : 22.2℃/64%R.H./101.2kPa
Tested by : Luke Li
Polarization : horizontal
Remark : 8DPSK Low Channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	71.526	44.05	-17.57	26.48	40.00	-13.52	Peak
2	118.934	48.15	-16.43	31.72	43.50	-11.78	Peak
3	176.617	53.34	-16.91	36.43	43.50	-7.07	Peak
4	220.769	48.26	-14.64	33.62	46.00	-12.38	Peak
5	282.074	48.28	-12.99	35.29	46.00	-10.71	Peak
6	376.222	43.94	-10.77	33.17	46.00	-12.83	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain



Project No. : RWAQ202400241
Test Mode : Transmitting
Test Voltage : AC 120V/60Hz
Environment : 22.2℃/64%R.H./101.2kPa
Tested by : Luke Li
Polarization : vertical
Remark : 8DPSK Low Channel

--No.	Frequency (MHz)	Reading (dBµV)	Factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Over Limit (dB)	Detector
1	62.987	48.11	-14.64	33.47	40.00	-6.53	QP
2	70.159	48.30	-17.02	31.28	40.00	-8.72	QP
3	126.518	53.53	-17.76	35.77	43.50	-7.73	Peak
4	147.239	53.35	-18.44	34.91	43.50	-8.59	Peak
5	191.370	47.52	-15.49	32.03	43.50	-11.47	Peak
6	278.755	37.80	-13.05	24.75	46.00	-21.25	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain

Remark:

Result = Reading + Factor

Factor = Antenna factor + Cable loss – Amplifier gain

Over Limit = Result – Limit

Above 1GHz:

Test Date:	2024-03-26	Test By:	Bard Huang
Environment condition:	Temperature: 23.8°C; Relative Humidity:69%; ATM Pressure: 100.8kPa		

Frequency (MHz)	Reading level (dBμV)	Polar	Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Remark
GFSK							
Low Channel							
2389.982	37.28	horizontal	8.25	45.53	54.00	-8.47	Average
2389.982	48.70	horizontal	8.25	56.95	74.00	-17.05	Peak
2390.000	37.77	vertical	8.25	46.02	54.00	-7.98	Average
2390.000	49.78	vertical	8.25	58.03	74.00	-15.97	Peak
4804.000	48.38	horizontal	0.21	48.59	74.00	-25.41	Peak
4804.000	48.56	vertical	0.21	48.77	74.00	-25.23	Peak
Middle Channel							
4882.000	48.48	horizontal	0.45	48.93	74.00	-25.07	Peak
4882.000	47.80	vertical	0.45	48.25	74.00	-25.75	Peak
High Channel							
2483.500	36.97	horizontal	8.25	45.22	54.00	-8.78	Average
2483.500	48.45	horizontal	8.25	56.70	74.00	-17.30	Peak
2483.500	37.48	vertical	8.25	45.73	54.00	-8.27	Average
2483.500	48.55	vertical	8.25	56.80	74.00	-17.20	Peak
4960.000	48.36	horizontal	0.93	49.29	74.00	-24.71	Peak
4960.000	48.39	vertical	0.93	49.32	74.00	-24.68	Peak
π/4 DQPSK							
Low Channel							
2390.000	37.13	horizontal	8.25	45.38	54.00	-8.62	Average
2390.000	48.73	horizontal	8.25	56.98	74.00	-17.02	Peak
2390.000	37.26	vertical	8.25	45.51	54.00	-8.49	Average
2390.000	48.30	vertical	8.25	56.55	74.00	-17.45	Peak
4804.000	48.29	horizontal	0.21	48.50	74.00	-25.50	Peak
4804.000	48.46	vertical	0.21	48.67	74.00	-25.33	Peak
Middle Channel							
4882.000	48.29	horizontal	0.45	48.74	74.00	-25.26	Peak
4882.000	48.59	vertical	0.45	49.04	74.00	-24.96	Peak
High Channel							
2483.500	37.26	horizontal	8.25	45.51	54.00	-8.49	Average

2483.500	49.82	horizontal	8.25	58.07	74.00	-15.93	Peak
2483.500	37.25	vertical	8.25	45.50	54.00	-8.50	Average
2483.500	49.42	vertical	8.25	57.67	74.00	-16.33	Peak
4960.000	47.83	horizontal	0.93	48.76	74.00	-25.24	Peak
4960.000	47.14	vertical	0.93	48.07	74.00	-25.93	Peak
8DPSK							
Low Channel							
2390.000	37.00	horizontal	8.25	45.25	54.00	-8.75	Average
2390.000	49.22	horizontal	8.25	57.47	74.00	-16.53	Peak
2390.000	37.37	vertical	8.25	45.62	54.00	-8.38	Average
2390.000	49.73	vertical	8.25	57.98	74.00	-16.02	Peak
4804.000	48.24	horizontal	0.21	48.45	74.00	-25.55	Peak
4804.000	48.52	vertical	0.21	48.73	74.00	-25.27	Peak
Middle Channel							
4882.000	48.21	horizontal	0.45	48.66	74.00	-25.34	Peak
4882.000	48.26	vertical	0.45	48.71	74.00	-25.29	Peak
High Channel							
2483.504	37.12	horizontal	8.25	45.37	54.00	-8.63	Average
2483.504	48.62	horizontal	8.25	56.87	74.00	-17.13	Peak
2483.500	37.39	vertical	8.25	45.64	54.00	-8.36	Average
2483.500	49.39	vertical	8.25	57.64	74.00	-16.36	Peak
4960.000	47.64	horizontal	0.93	48.57	74.00	-25.43	Peak
4960.000	48.19	vertical	0.93	49.12	74.00	-24.88	Peak

Remark:

Corrected Amplitude= Reading level + corrected Factor

Corrected Factor = Antenna factor + Cable loss – Amplifier gain

Margin = Corrected Amplitude – Limit

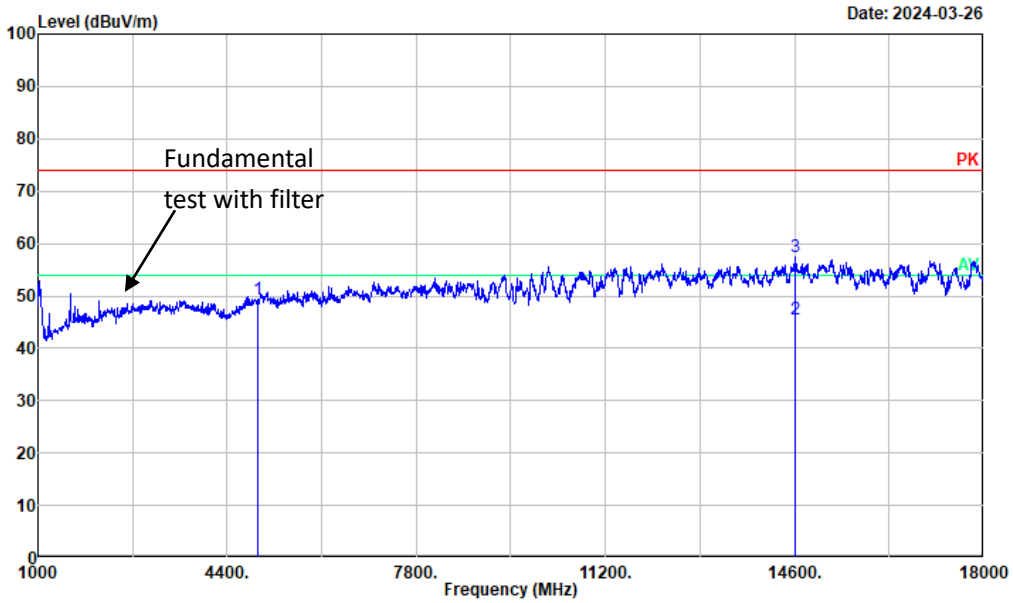
For the test result of Peak below the Peak limit more than 20dB, which can compliance with the average limit, just the Peak level was recorded.

The emission levels of other frequencies that were lower than the limit 20dB, not show in test report.

For emissions in 18GHz-25GHz range, all emissions were investigated and in the noise floor level.

Test plot for example as below:

Mode:	DH5	Channel:	2480MHz

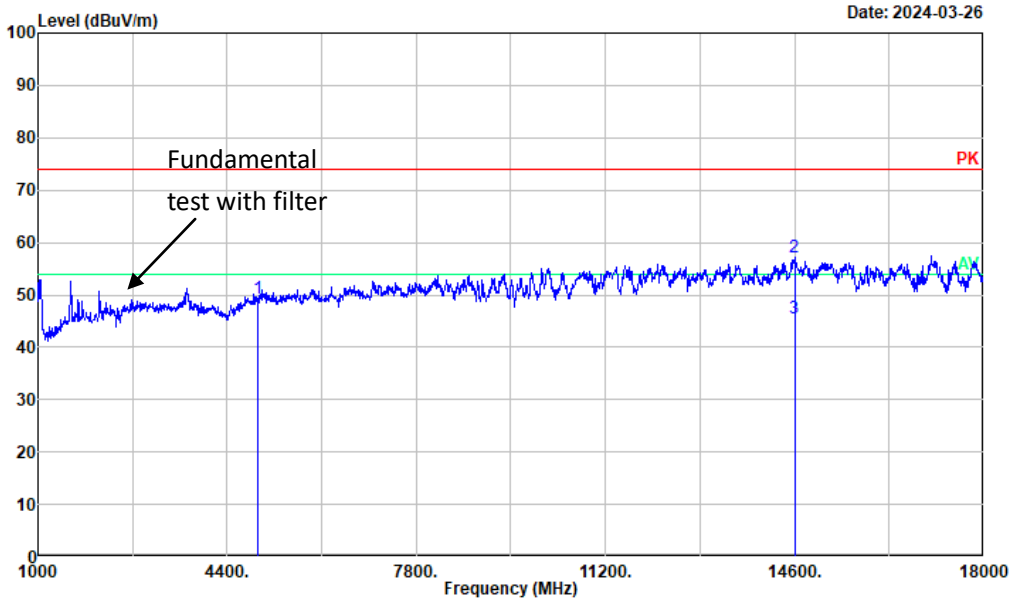


Project No. : RWAQ202400241
Test Mode : Transmitting
Test Voltage : AC 120V/60Hz
Environment : 23.8℃/69%R.H./100.8kPa
Tested by : Bard Huang
Polarization : horizontal
Remark : DH5 high channel

--No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)	Detector
1	4960.000	48.36	0.93	49.29	74.00	-24.71	Peak
2	14606.800	36.06	9.42	45.48	54.00	-8.52	Average
3	14606.800	48.06	9.42	57.48	74.00	-16.52	Peak

Remarks: Factor = Antenna factor + Cable loss - Preamp gain

Mode:	DH5	Channel:	2480MHz



Project No. : RWAQ202400241
Test Mode : Transmitting
Test Voltage : AC 120V/60Hz
Environment : 23.8℃/69%R.H./100.8kPa
Tested by : Bard Huang
Polarization : vertical
Remark : DH5 high channel

--No.	Frequency (MHz)	Reading (dBμV)	Factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)	Detector
1	4960.000	48.39	0.93	49.32	74.00	-24.68	Peak
2	14598.300	47.66	9.45	57.11	74.00	-16.89	Peak
3	14598.300	36.20	9.45	45.65	54.00	-8.35	Average

Remarks: Factor = Antenna factor + Cable loss - Preamp gain

3.5 RF Conducted Test Data

Test Date:	2024-03-27	Test By:	Ryan Zhang
Environment condition:	Temperature: 25.6°C; Relative Humidity:54%; ATM Pressure: 101.4kPa		

3.5.1 20 dB Emission Bandwidth and 99% Occupied Bandwidth

Test Mode	Channel	20dB BW [MHz]	99% OBW[MHz]
GFSK	2402	0.804	0.752
	2441	0.804	0.756
	2480	0.804	0.752
π/4 DQPSK	2402	1.304	1.176
	2441	1.324	1.180
	2480	1.308	1.176
8DPSK	2402	1.292	1.184
	2441	1.288	1.184
	2480	1.296	1.184

3.5.2 Maximum Conducted Peak Output Power

Test Mode	Channel[MHz]	Result[dBm]	Limit[dBm]	Verdict
GFSK	2402	4.21	21	Pass
	2441	4.28	21	Pass
	2480	4.06	21	Pass
π/4 DQPSK	2402	6.67	21	Pass
	2441	6.47	21	Pass
	2480	6.34	21	Pass
8DPSK	2402	7.05	21	Pass
	2441	7.01	21	Pass
	2480	6.87	21	Pass

3.5.3 Channel separation

Test Mode	Channel[MHz]	Result[MHz]	Limit[MHz]	Verdict
GFSK	2402	1.008	0.536	Pass
	2441	1.002	0.536	Pass
	2480	1.008	0.536	Pass
π/4 DQPSK	2402	1.002	0.869	Pass
	2441	0.996	0.883	Pass
	2480	1.002	0.872	Pass
8DPSK	2402	1.002	0.861	Pass
	2441	1.002	0.859	Pass
	2480	0.996	0.864	Pass

Note： Limit≤2/3*20dB BW

3.5.4 Number of hopping Frequency

Test Mode	**Frequency Range [MHz]**	**Number of hopping Frequency**	**Limit**	Verdict
GFSK	2400-2483.5	79	≥15	Pass
π/4 DQPSK	2400-2483.5	79	≥15	Pass
8DPSK	2400-2483.5	79	≥15	Pass

3.5.5 Time of occupancy (dwell time)

Test Mode	Packet Type	Channel[MHz]	Pulse Time [ms]	Result[s]	Limit[s]	Verdict
GFSK	DH1	2441	0.398	0.127	0.400	Pass
	DH3	2441	1.668	0.267	0.400	Pass
	DH5	2441	2.933	0.313	0.400	Pass
π/4 DQPSK	2DH1	2441	0.403	0.129	0.400	Pass
	2DH3	2441	1.678	0.268	0.400	Pass
	2DH5	2441	2.957	0.315	0.400	Pass
8DPSK	3DH1	2441	0.406	0.130	0.400	Pass
	3DH3	2441	1.675	0.268	0.400	Pass
	3DH5	2441	2.933	0.313	0.400	Pass

Note:

DH1: Dwell time=Pulse time (ms) *(1600/2/79)*31.6s

DH3: Dwell time=Pulse time (ms) *(1600/4/79)*31.6s

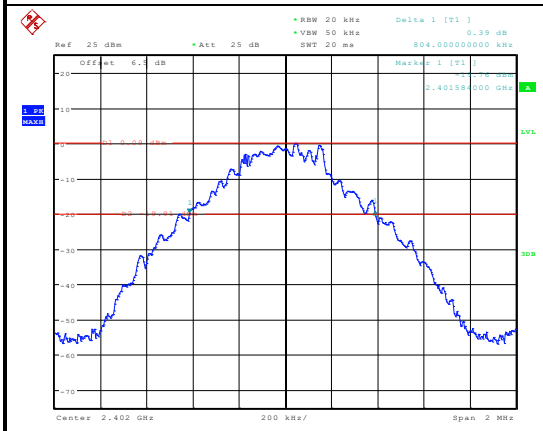
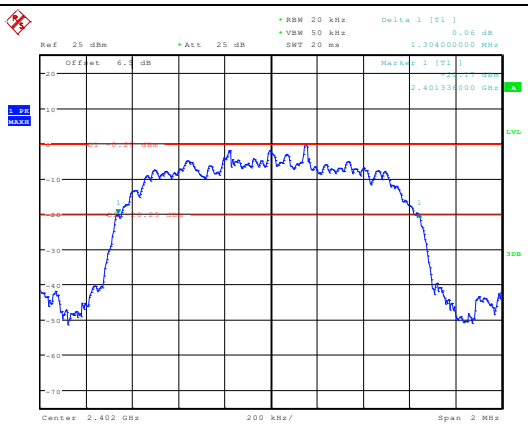
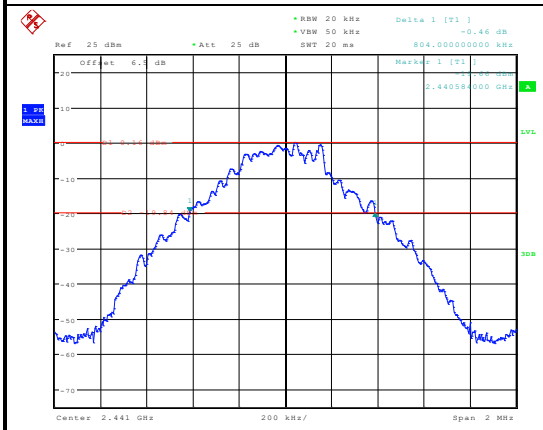
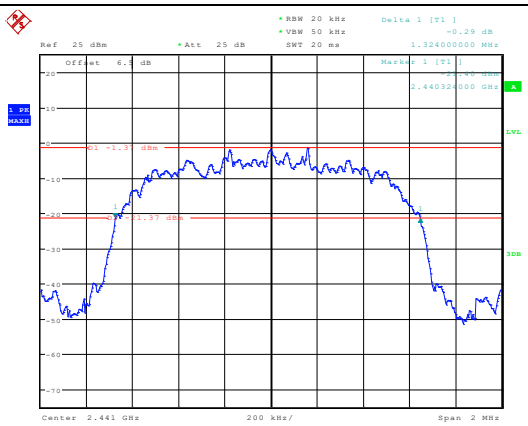
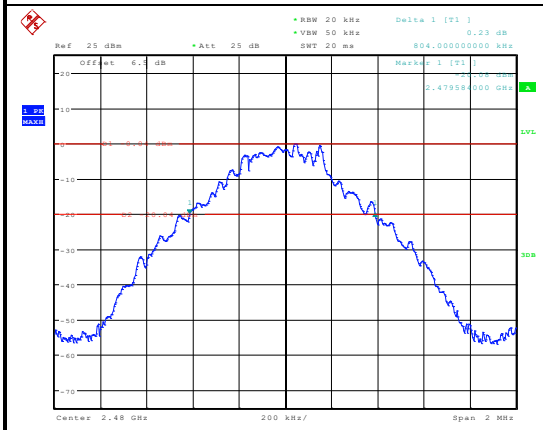
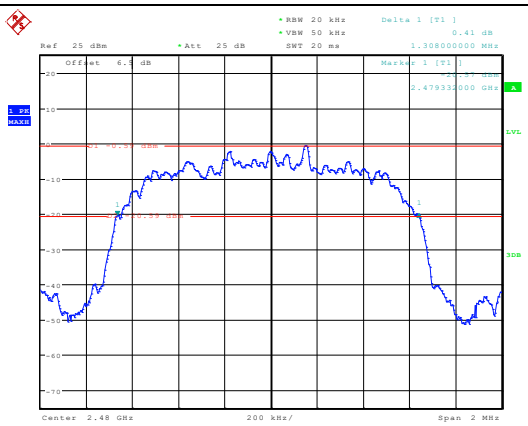
DH5: Dwell time=Pulse time (ms) *(1600/6/79)*31.6s

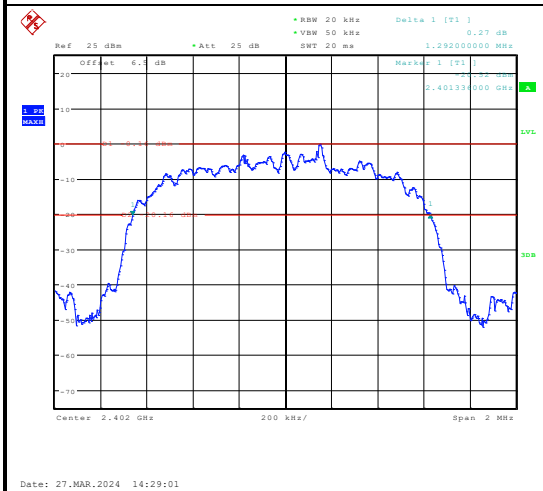
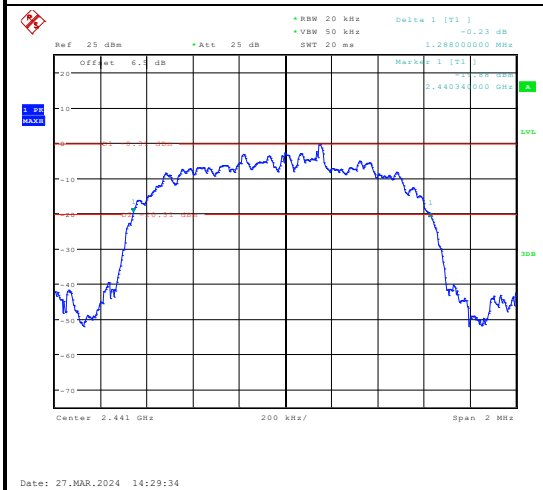
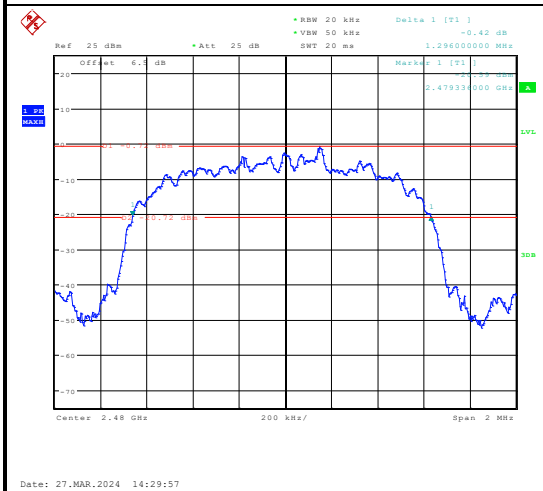
3.5.6 100 kHz Bandwidth of Frequency Band Edge

Test Mode	Channel	Result	Limit	Verdict
GFSK	2402	Refer test plot	Refer test plot	Pass
	2480	Refer test plot	Refer test plot	Pass
π/4 DQPSK	2402	Refer test plot	Refer test plot	Pass
	2480	Refer test plot	Refer test plot	Pass
8DPSK	2402	Refer test plot	Refer test plot	Pass
	2480	Refer test plot	Refer test plot	Pass

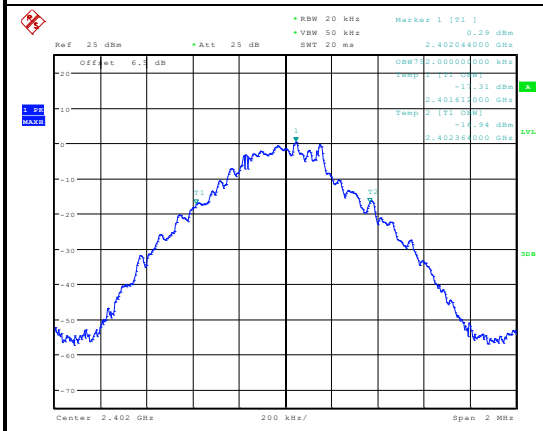
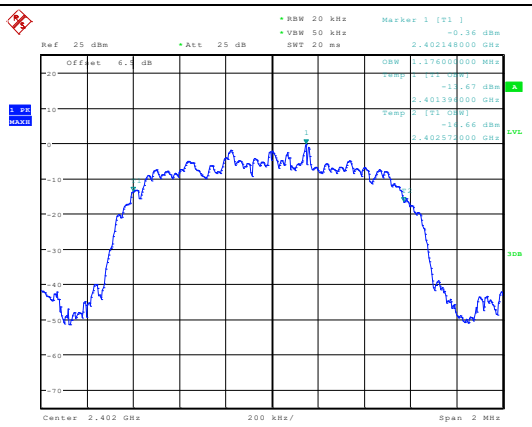
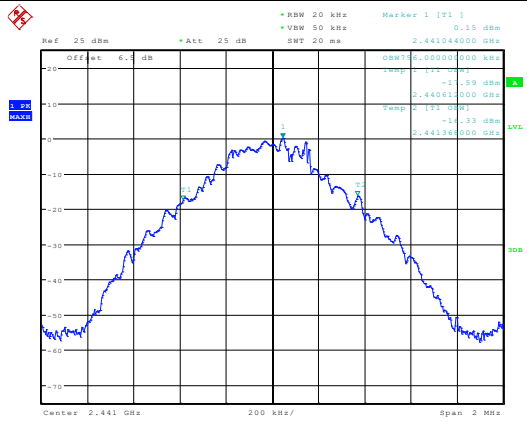
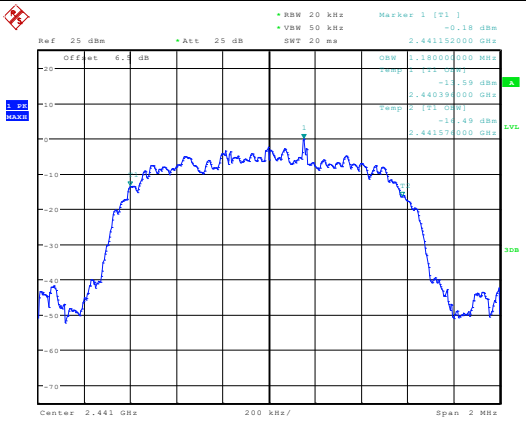
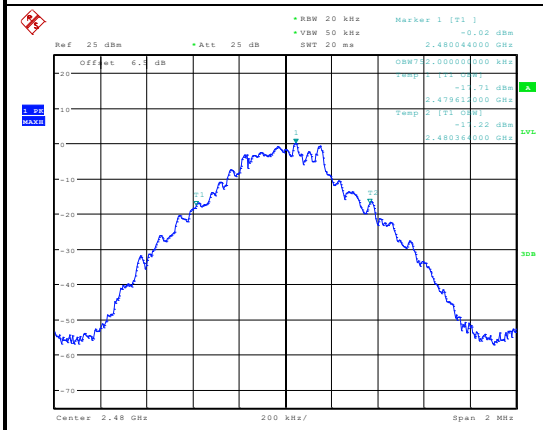
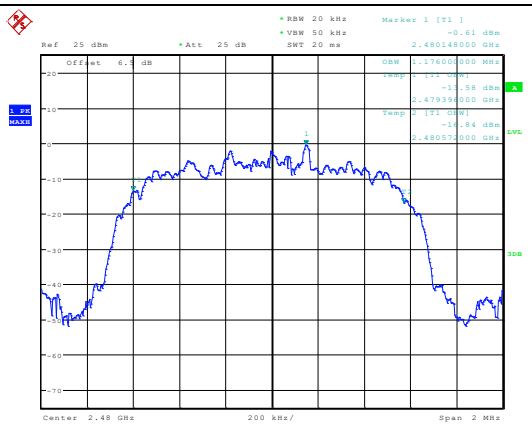
Test Plots:

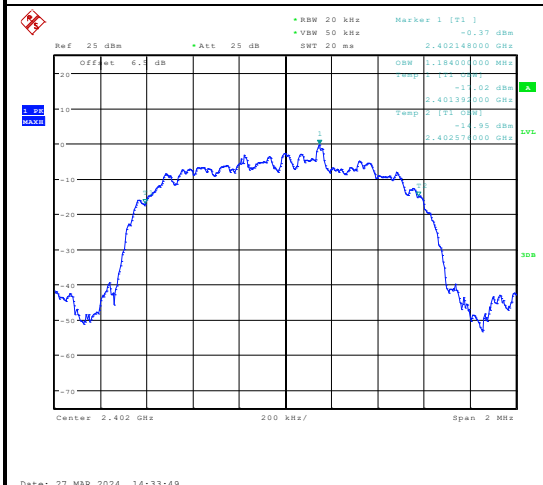
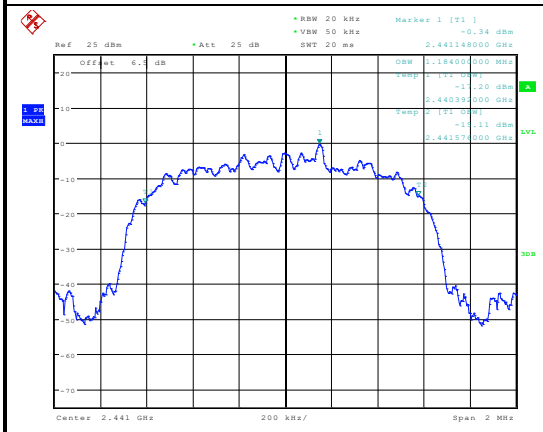
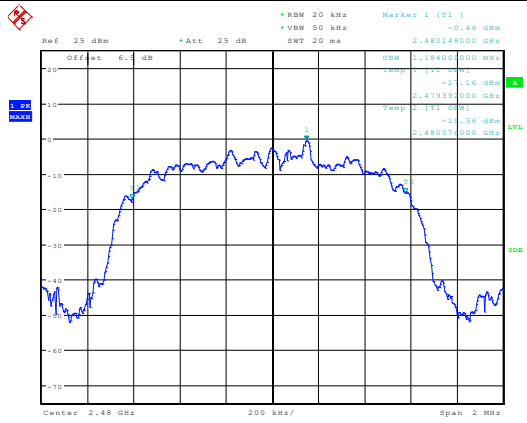
20 dB Emission Bandwidth:

GFSK	π /4 DQPSK
Lowest channel	Lowest channel
	
Middle channel	Middle channel
	
High channel	High channel
	

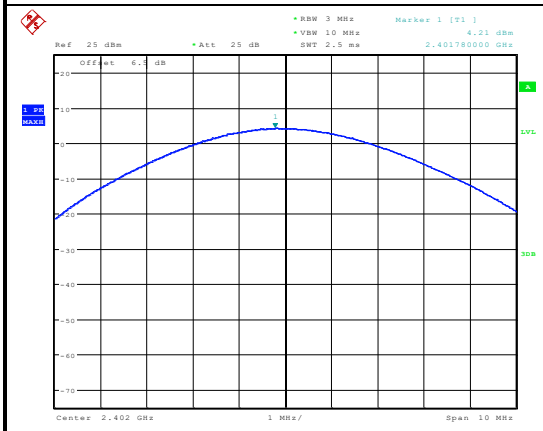
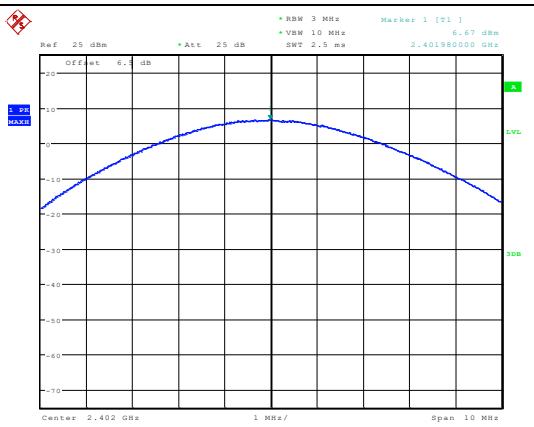
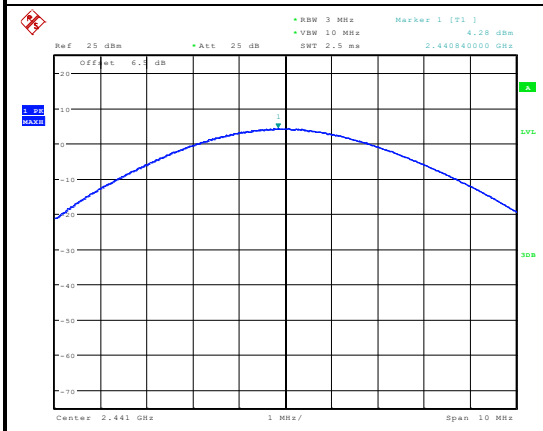
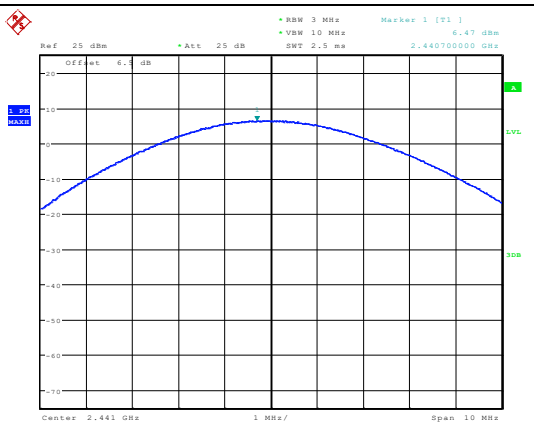
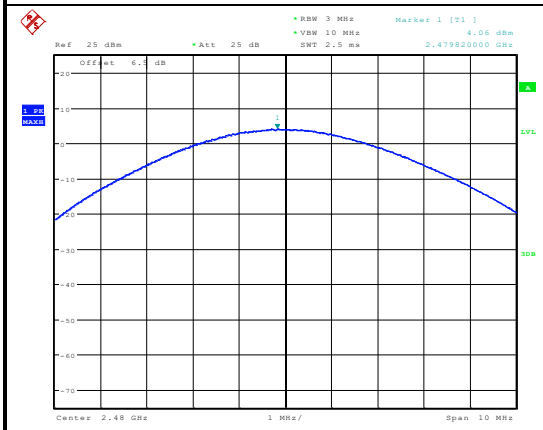
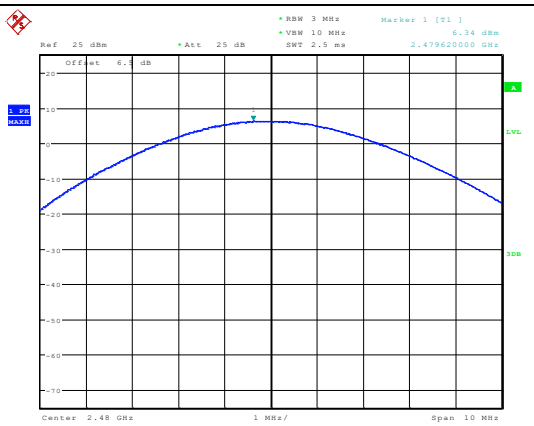
8DPSK	/
Lowest channel	/
	/
Middle channel	/
	/
High channel	/
	/

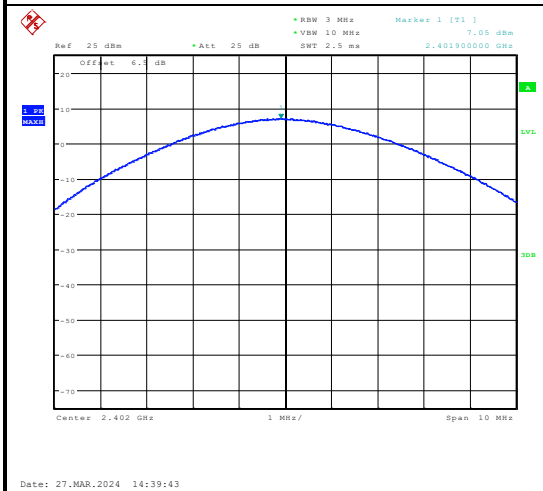
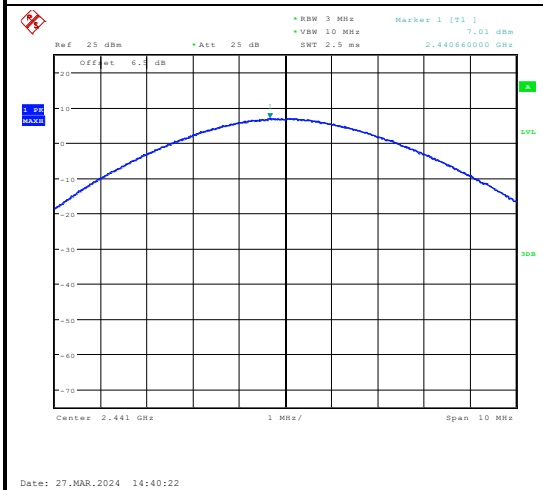
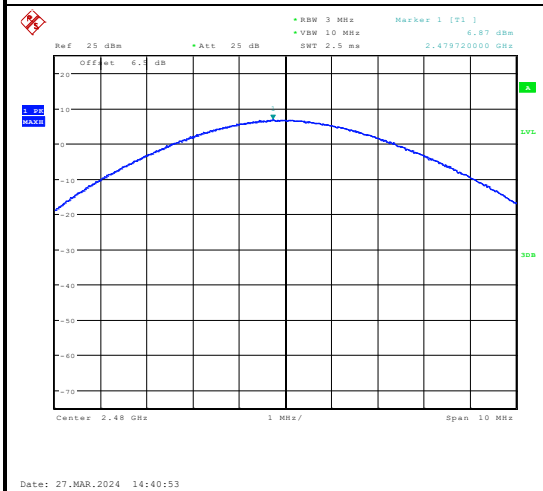
99% Occupied Bandwidth:

GFSK	π /4 DQPSK
Lowest channel	Lowest channel
	
Middle channel	Middle channel
	
High channel	High channel
	

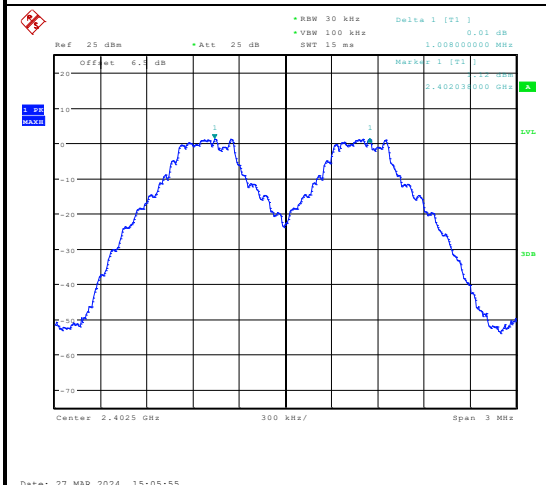
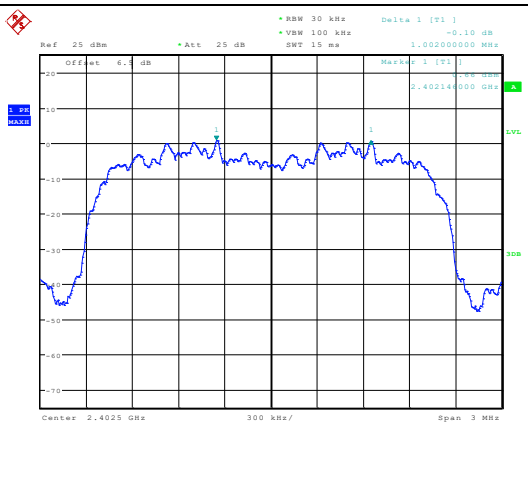
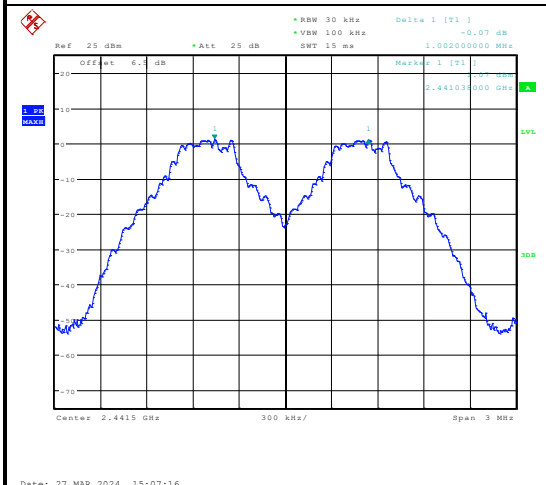
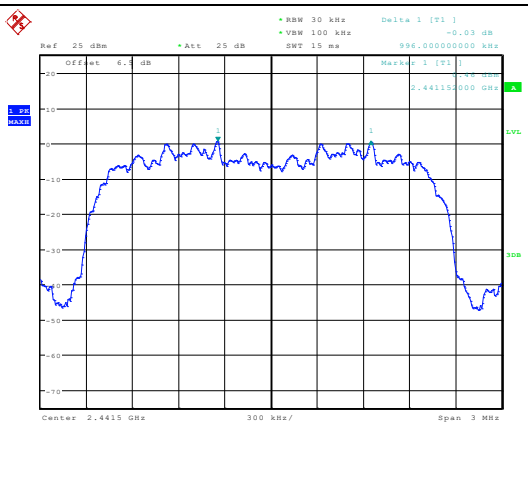
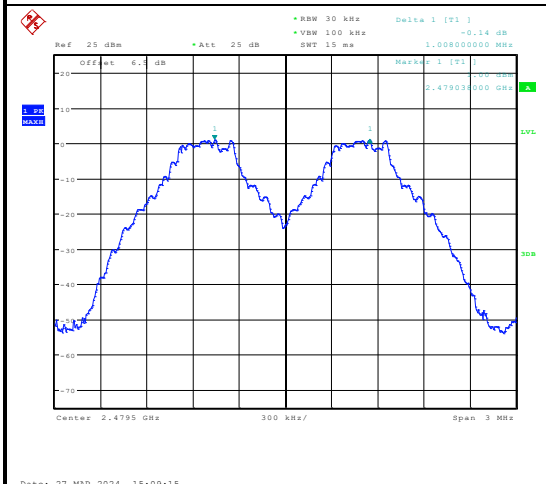
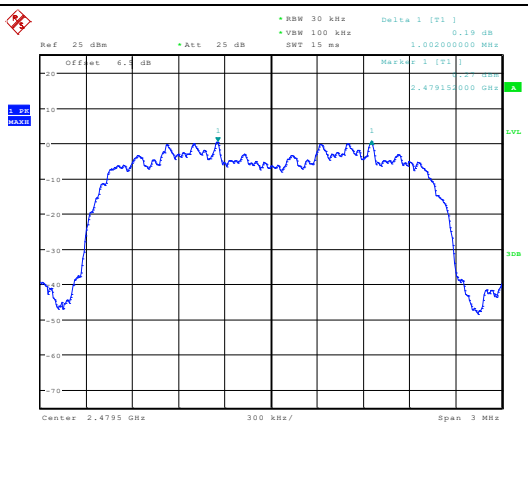
8DPSK	/
Lowest channel	/
	/
Middle channel	/
	/
High channel	/
	/

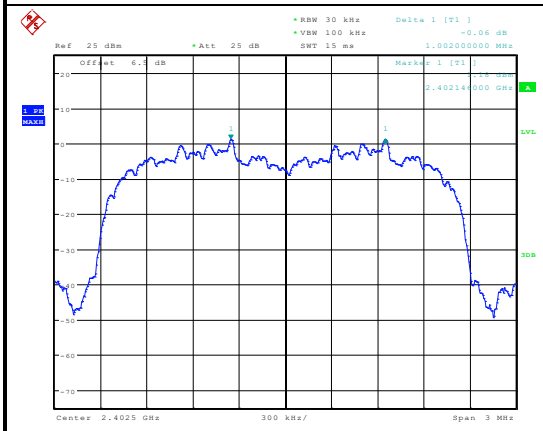
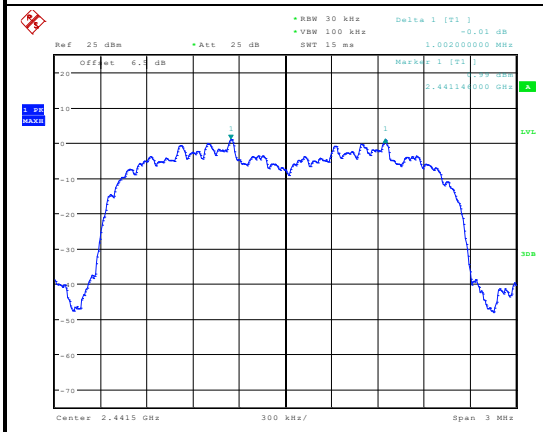
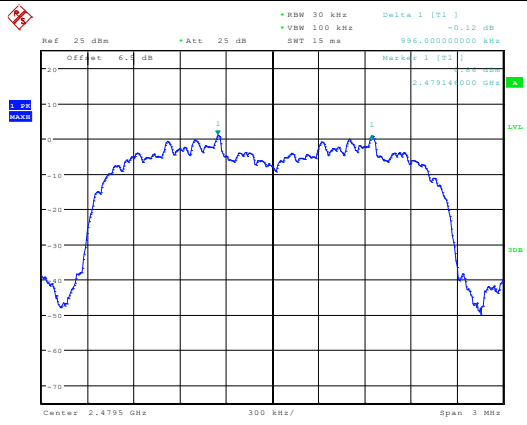
Maximum Conducted Peak Output Power:

GFSK	π /4 DQPSK
Lowest channel	Lowest channel
	
Middle channel	Middle channel
	
High channel	High channel
	

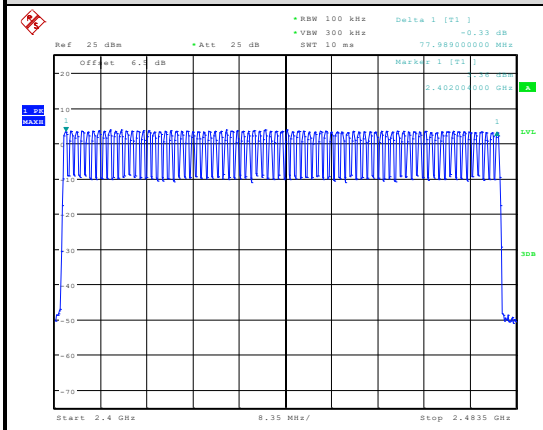
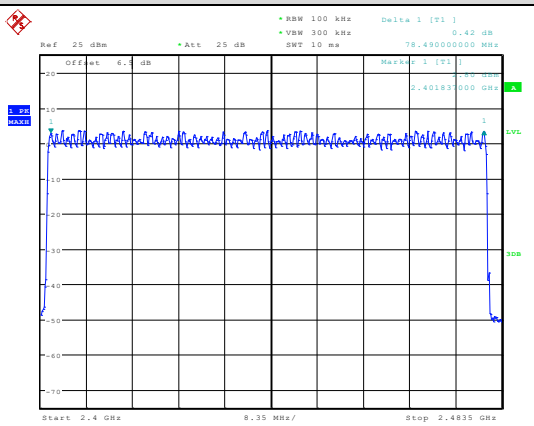
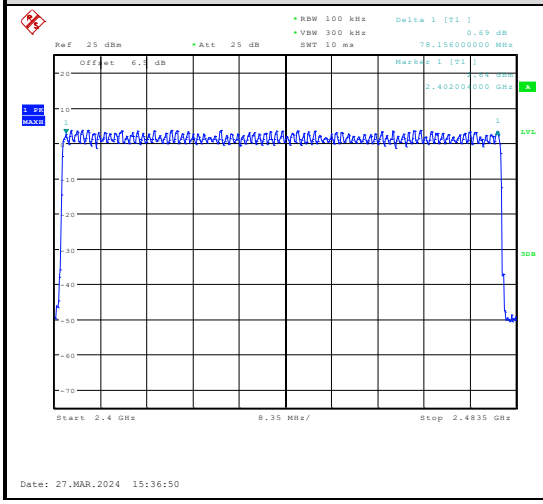
8DPSK	/
Lowest channel	/
	/
Middle channel	/
	/
High channel	/
	/

Channel separation:

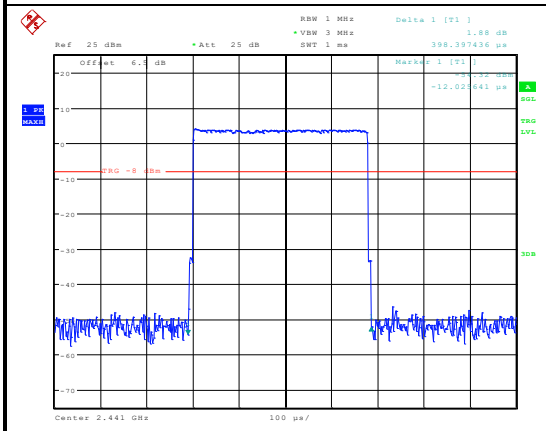
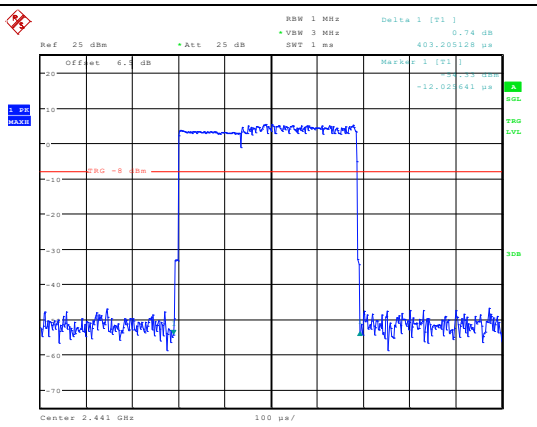
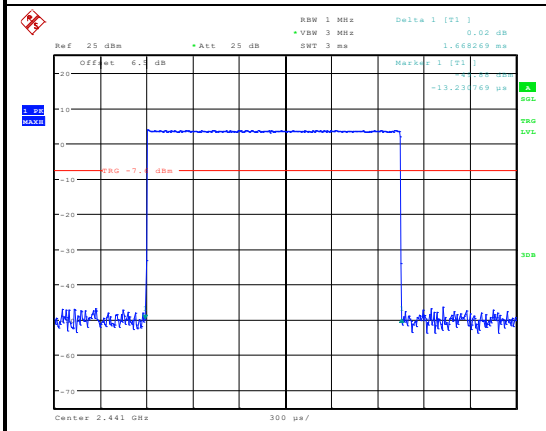
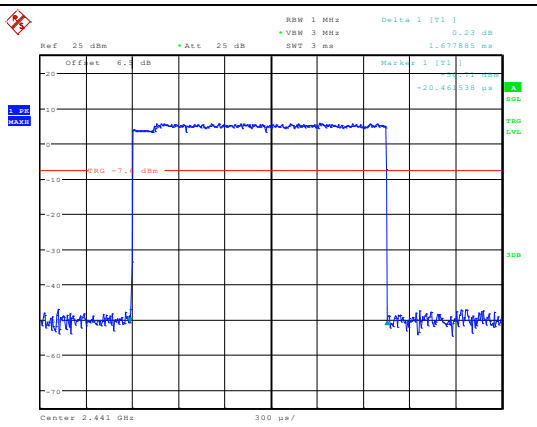
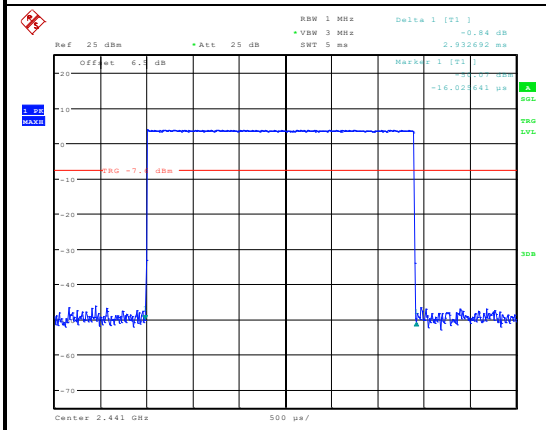
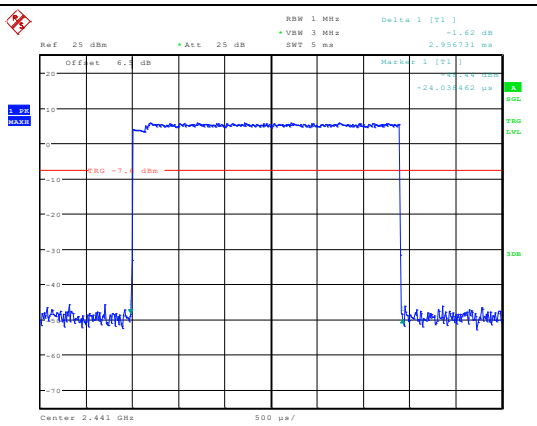
GFSK	π /4 DQPSK
Lowest channel	Lowest channel
	
Middle channel	Middle channel
	
High channel	High channel
	

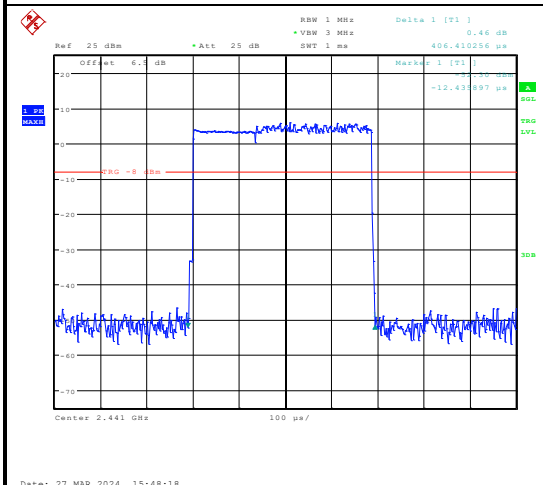
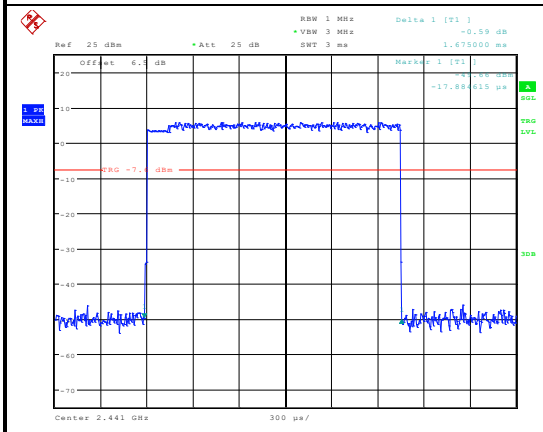
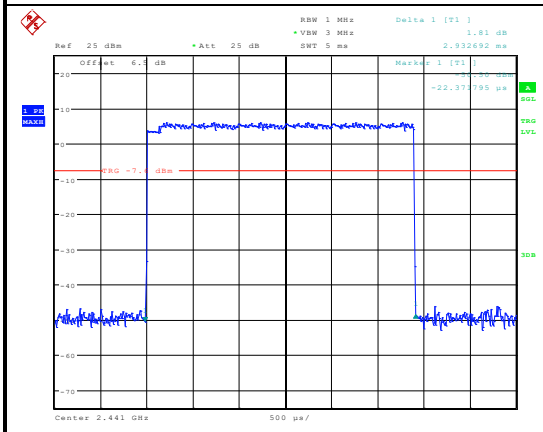
8DPSK	/
Lowest channel	/
	/
Middle channel	/
	/
High channel	/
	/

Number of hopping Frequency

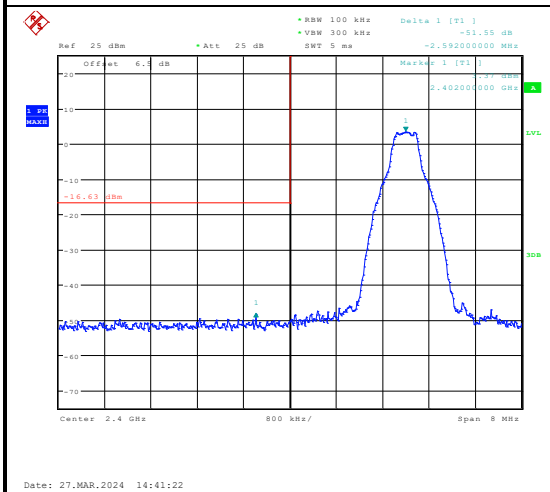
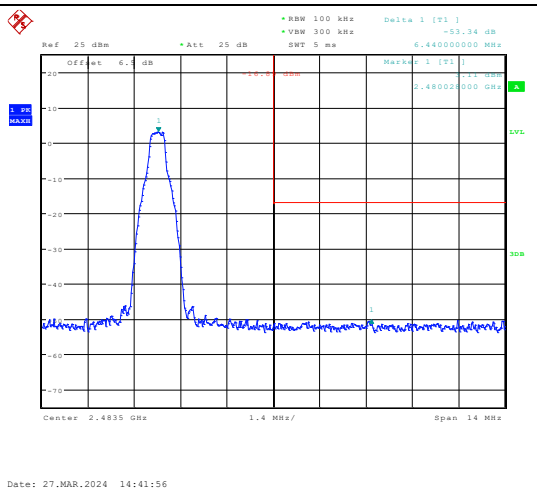
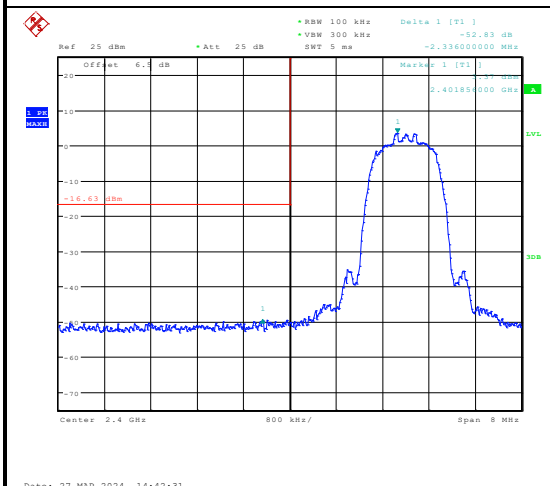
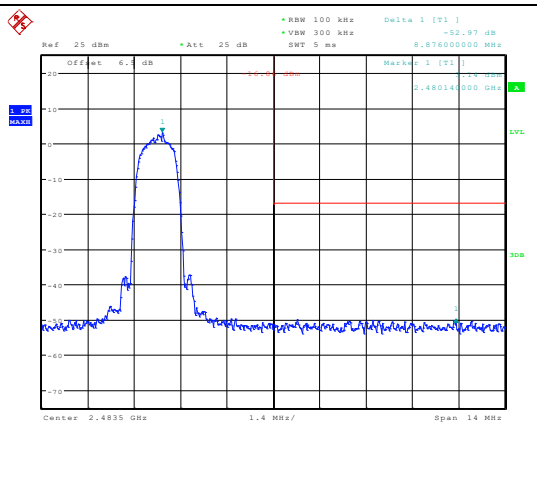
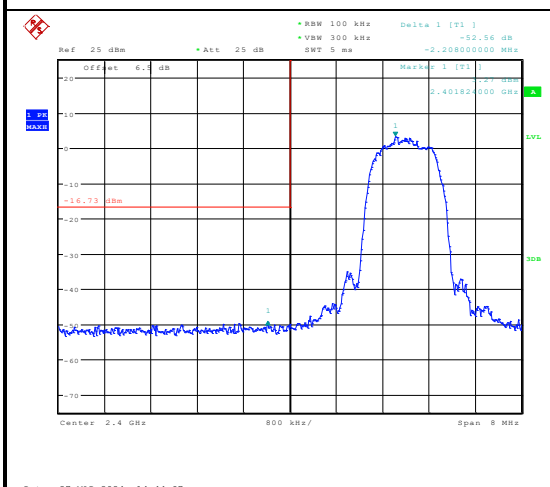
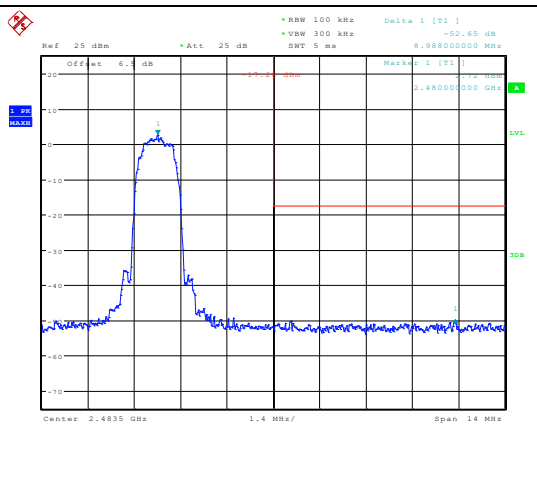
GFSK	π /4 DQPSK
	
8DPSK	**/**
	/

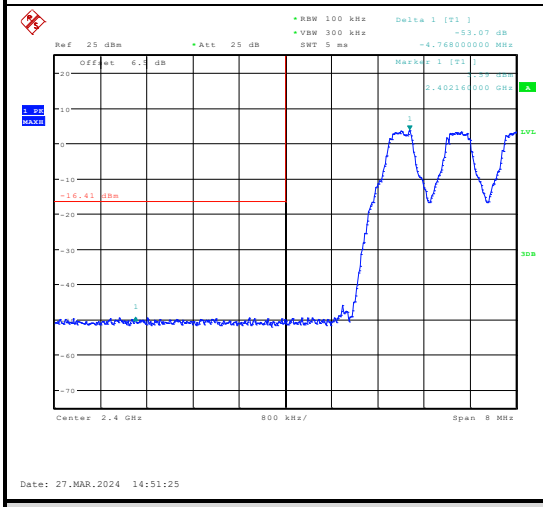
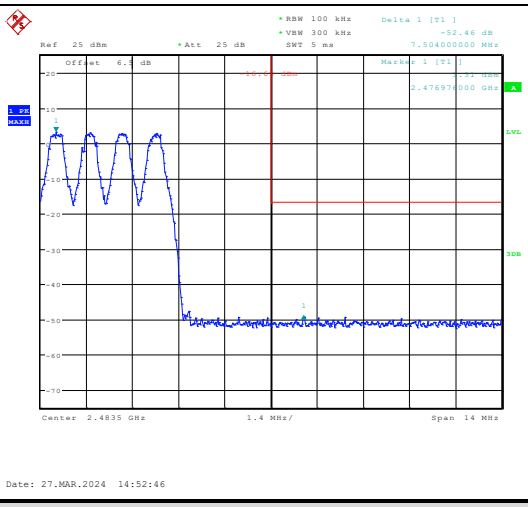
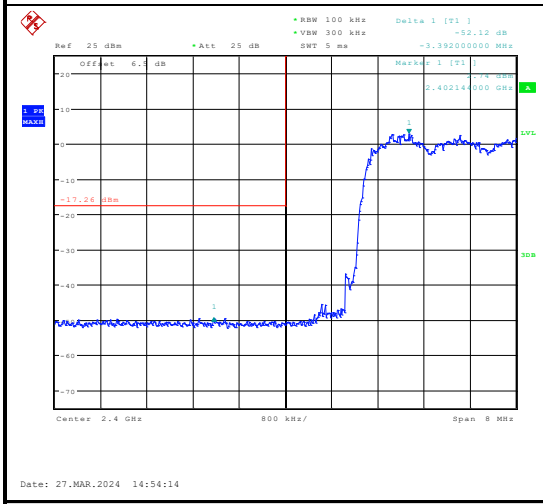
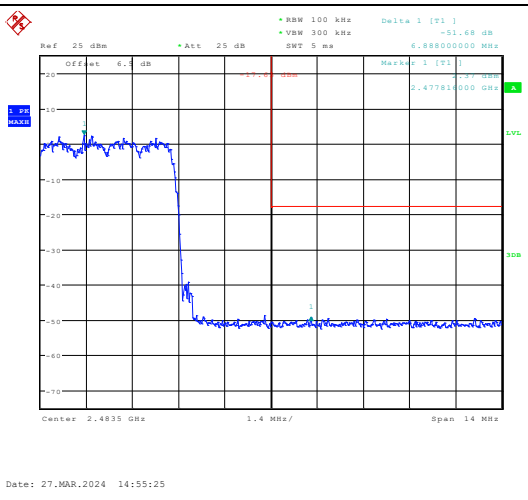
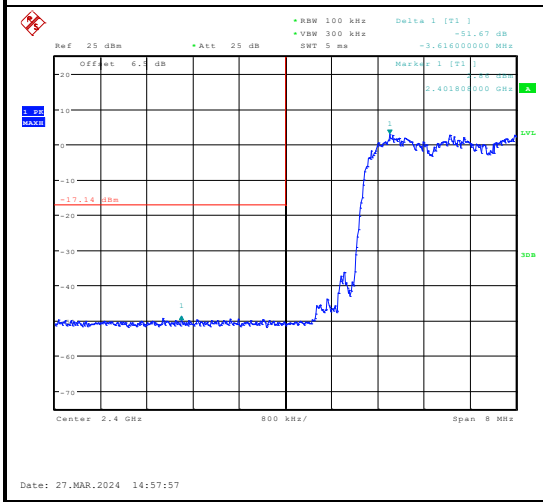
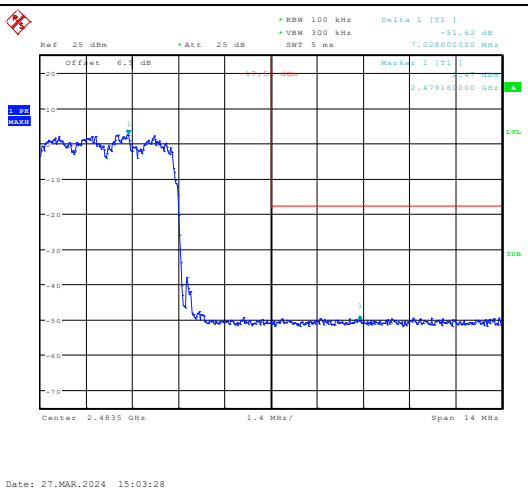
Time of occupancy (dwell time)

GFSK	π /4 DQPSK
Lowest channel	Lowest channel
	
Middle channel	Middle channel
	
High channel	High channel
	

8DPSK	/
Lowest channel	/
	/
Middle channel	/
	/
High channel	/
	/

100kHz Bandwidth of Frequency Band Edge:

Hopping disabled	
GFSK	
Lowest channel	High channel
	
π /4 DQPSK	
Lowest channel	High channel
	
8DPSK	
Lowest channel	High channel
	

Hopping enabled	
GFSK	
Lowest channel	High channel
	
Date: 27.MAR.2024 14:51:25	Date: 27.MAR.2024 14:52:46
π /4 DQPSK	
Lowest channel	High channel
	
Date: 27.MAR.2024 14:54:14	Date: 27.MAR.2024 14:55:25
8DPSK	
Lowest channel	High channel
	
Date: 27.MAR.2024 14:57:57	Date: 27.MAR.2024 15:03:28

4 Test Setup Photo

Please refer to the attachment RWAQ202400241Test Setup photo.

5 E.U.T Photo

Please refer to the attachment RWAQ202400241 External photo and RWAQ202400241 Internal photo.

---End of Report---