FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No..... :	**MAX25120208P02-R01**
FCC ID..... :	**2BTWA-VK-01**
Compiled by (position+printed name+signature).. :	Engineer/ Cindy Zheng Cindy zheng
Supervised by (position+printed name+signature).. :	Manager/Haley Wen Haley wen
Approved by (position+printed name+signature).. :	RF Manager/ Vivian Jiang Vivian Jiang
Date of issue.....:	January 9, 2026
Testing Laboratory Name.....:	**MAXLAB Testing Co.,Ltd.**
Address..... :	1/F, Building B, Xinshidai GR Park,Shiyan Street, Bao'an District, Shenzhen,Guangdong, 518052, People's Republic of China
Applicant's name.....:	**Shenzhen Youyi Creative Culture Co..Ltd**
Address..... :	No. 301, Lane 11, Longjing Second District, Sanlian Community, Jihua Street, Longgang District, Shenzhen
Test specification..... :	
Standard.....:	**FCC Part 15.247:** **ANSI C63.10-2020** **KDB558074 D01 V05r02: April 2, 2019**

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Test item description.....:	**Custom volume knob**
Trade Mark.....:	ANTICATER
Manufacturer.....:	Shenzhen Youyi Creative Culture Co..Ltd
Model/Type reference..... :	VK-01
Listed Models ..... :	VK-02
Modulation ..... :	GFSK, π/4DQPSK, 8-DPSK
Frequency.....	From 2402MHz to 2480MHz
Rating.....:	DC 3.7V From Battery or DC 5V by USB port
Result.....:	**PASS**

TEST REPORT

Equipment under Test	:	**Custom volume knob**
Model /Type	:	VK-01
Listed Models	:	VK-02
Model Declaration	:	All the models are electrical identical including the same software parameter and hardware design, same mechanical structure and design, the only difference is the model named different.
Applicant	:	**Shenzhen Youyi Creative Culture Co..Ltd**
Address	:	No. 301, Lane 11, Longjing Second District, Sanlian Community, Jihua Street, Longgang District, Shenzhen
Manufacturer	:	**Shenzhen Youyi Creative Culture Co..Ltd**
Address	:	No. 301, Lane 11, Longjing Second District, Sanlian Community, Jihua Street, Longgang District, Shenzhen

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
ANSI C63.10-2020:AmericanNationalStandardforTestingUnlicensedWirelessDevices

KDB558074 D01 V05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	December 30, 2025
Testing commenced on	:	December 30, 2025
Testing concluded on	:	January 9, 2026

2.2 Product Description

Product Name:	Custom volume knob
Model/Type reference:	VK-01,VK-02
Power supply:	DC 3.7V From Battery or DC 5V by USB port
Adapter information (Auxiliary test supplied by testing Lab）	Model: EP-TA20CBC Input:AC 100-240V 50/60Hz Output:DC 5V 2A Firmware Version: EPTA5.14.2 Manufacture: Huizhou Dongyang Yienbi Electronics Co., Ltd
Hardware version:	/
Software version:	/
Testing sample ID：	MAX25120208P01-R01-1# (Engineer sample) MAX25120208P01-R01-2# (Normal sample)
Bluetooth :	
Supported Type:	Bluetooth BR/EDR
Modulation:	GFSK, π/4DQPSK, 8-DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	PCB Antenna
Antenna gain:	1.3 dBi

2.3 Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V/ 50 Hz	○	120V/60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

DC 3.7V from battery or DC 5.0V from USB Port

2.4 Short description of the Equipment under Test (EUT)

This is a Custom volume knob.
For more details, refer to the user's manual of the EUT.

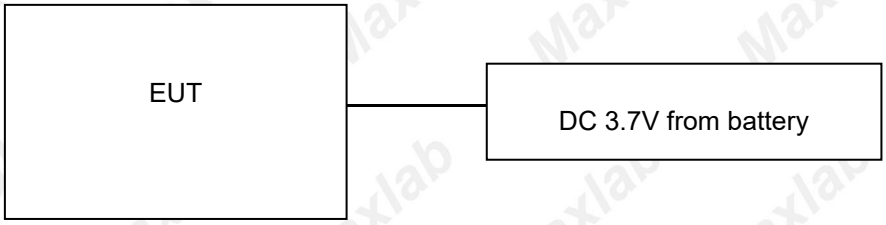
2.5 EUT operation mode

The Applicant provides communication tools software(Engineer mode) to control the EUT for staying in continuoustransmitting (Duty Cycle more than 98%) and receiving mode for testing .There are79 channels provided to the EUT and Channel 00/39/78 were selected to test.

Operation Frequency:

Channel	Frequency (MHz)
00	2402
01	2403
⋮	⋮
38	2440
39	2441
40	2442
⋮	⋮
77	2479
78	2480

2.6 Block Diagram of Test Setup



2.7 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for the device filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.8 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Address of the test laboratory

MAXLAB Testing Co.,Ltd.
1/F, Building B, Xinshidai GR Park,Shiyan Street, Bao'an District, Shenzhen,Guangdong, 518052, People's Republic of China

3.2 Test Facility

FCC-Registration No.: 562200 Designation Number: CN1338
MAX Testing Co.,Ltd. has been listed on the US Federal Communications Commissionlist of test facilities recognized to perform electromagnetic emissions measurements.

Industry Canada Registration Number. Is: 11093A CAB identifier: CN0019
The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing.

A2LA-Lab Cert. No.: 4707.01
MAX Testing 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.

3.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:
Radiated Emission:

Temperature:	24 ° C
Humidity:	45 %
Atmospheric pressure:	950-1050mbar

AC Power Conducted Emission:

Temperature:	25 ° C
Humidity:	46 %
Atmospheric pressure:	950-1050mbar

Conducted testing:

Temperature:	25 ° C
Humidity:	44 %
Atmospheric pressure:	950-1050mbar

3.4 Summary of measurement results

Test Specification clause	Test case	Test Mode	Test Channel	Recorded In Report		Test result
§15.247(a)(1)	Carrier Frequency separation	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Middle	Compliant
§15.247(a)(1)	Number of Hopping channels	GFSK Π/4DQPSK 8DPSK	☒ Full	GFSK	☒ Full	Compliant
§15.247(a)(1)	Time of Occupancy (dwell time)	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Middle	Compliant
§15.247(a)(1)	Spectrumbandwidth of aFHSS system20dB bandwidth	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	Compliant
§15.247(b)(1)	Maximum output peak power	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	Compliant
§15.247(d)	Band edgecompliance conducted	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Highest	Compliant
§15.205	Band edgecompliance radiated	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Highest	Compliant
§15.247(d)	TX spuriousemissions conducted	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	Compliant
§15.247(d)	TX spuriousemissions radiated	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	Compliant
§15.209(a)	TX spurious Emissions radiated Below 1GHz	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Middle	Compliant
§15.107(a) §15.207	Conducted Emissions 9KHz-30 MHz	Charging	/	Charging	/	Compliant

Remark:
1. The measurement uncertainty is not included in the test result.
2. We tested all test mode and recorded worst case in report.

3.5 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01"Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibilityand Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the MAXLAB Testing Co.,Ltd.quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.
Hereafter the best measurement capability for MAXLAB Testing Co.,Ltd.:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	9KHz~30MHz	3.82 dB	(1)
Radiated Emission	30~1000MHz	4.06 dB	(1)
Radiated Emission	1~18GHz	5.14 dB	(1)
Radiated Emission	18-40GHz	5.38 dB	(1)
Conducted Disturbance	0.15~30MHz	2.14 dB	(1)
Transmitter power conducted	1~40GHz	0.57 dB	(1)
Conducted spurious emission	1~40GHz	1.60 dB	(1)
OBW	1~40GHz	25 Hz	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.6 Equipments Used during the Test

Conducted Emission					
Test Equipment	**Manufacturer**	**Model**	**Serial No.**	**Date of Cal.**	**Due Date**
Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	MAX252	2025-10-27	2026-10-26
EMI Test Receiver	R&S	ESCI 7	MAX552	2025-10-27	2026-10-26
Coaxial Switch	ANRITSU CORP	MP59B	MAX225	2025-10-27	2026-10-26
ENV216 2-L-V-NETZNACHB.DE	ROHDE&SCHWARZ	ENV216	MAX226	2025-10-27	2026-10-26
Coaxial Cable	MAX	N/A	MAX227	N/A	N/A
EMI Test Software	AUDIX	E3	N/A	N/A	N/A
Thermo meter	KTJ	TA328	MAX233	2025-10-27	2026-10-26
Absorbing clamp	Elektronik-Feinmechanik	MDS21	MAX229	2025-10-27	2026-10-26
LISN	R&S	ENV216	308	2025-10-27	2026-10-26
LISN	R&S	ENV216	314	2025-10-27	2026-10-26

Radiation Test equipment					
Test Equipment	**Manufacturer**	**Model**	**Serial No.**	**Date of Cal.**	**Due Date**
3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	MAX250	2025-10-27	2026-10-26
Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	MAX251	N/A	N/A
EMI Test Receiver	Rohde & Schwarz	ESU26	MAX203	2025-10-27	2026-10-26
BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	MAX214	2025-10-27	2026-10-26
Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	MAX208	2025-10-27	2026-10-26
Horn Antenna	ETS-LINDGREN	3160	MAX217	2025-10-27	2026-10-26
EMI Test Software	AUDIX	E3	N/A	N/A	N/A
Coaxial Cable	MAX	N/A	MAX213	2025-10-27	2026-10-26
Coaxial Cable	MAX	N/A	MAX211	2025-10-27	2026-10-26
Coaxial cable	MAX	N/A	MAX210	2025-10-27	2026-10-26
Coaxial Cable	MAX	N/A	MAX212	2025-10-27	2026-10-26
Amplifier(100kHz-3GHz)	HP	8347A	MAX204	2025-10-27	2026-10-26
Amplifier(2GHz-20GHz)	HP	84722A	MAX206	2025-10-27	2026-10-26
Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	MAX218	2025-10-27	2026-10-26
Band filter	Amindeon	82346	MAX219	2025-10-27	2026-10-26
Power Meter	Anritsu	ML2495A	MAX540	2025-10-27	2026-10-26
Power Sensor	Anritsu	MA2411B	MAX541	2025-10-27	2026-10-26

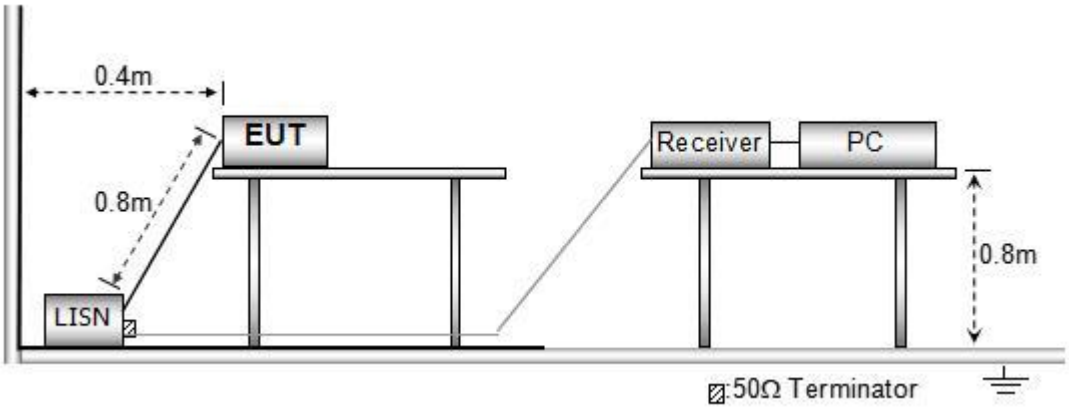
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	MAX575	2025-10-27	2026-10-26
Splitter	Agilent	11636B	MAX237	2025-10-27	2026-10-26
Loop Antenna	ZHINAN	ZN30900A	MAX534	2025-10-27	2026-10-26
Breitband hornantenne	SCHWARZBECK	BBHA 9170	MAX579	2025-10-27	2026-10-26
Amplifier	TDK	PA-02-02	MAX574	2025-10-27	2026-10-26
Amplifier	TDK	PA-02-03	MAX576	2025-10-27	2026-10-26
PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	MAX578	2025-10-27	2026-10-26

RF Conducted Test:					
Test Equipment	**Manufacturer**	**Model**	**Serial No.**	**Date of Cal.**	**Due Date**
MXA Signal Analyzer	Agilent	N9020A	MAX566	2025-10-27	2026-10-26
EMI Test Receiver	R&S	ESCI 7	MAX552	2025-10-27	2026-10-26
Spectrum Analyzer	Agilent	E4440A	MAX533	2025-10-27	2026-10-26
MXG vector Signal Generator	Agilent	N5182A	MAX567	2025-10-27	2026-10-26
ESG Analog Signal Generator	Agilent	E4428C	MAX568	2025-10-27	2026-10-26
USB RF Power Sensor	DARE	RPR3006W	MAX569	2025-10-27	2026-10-26
RF Switch Box	Shongyi	RFSW3003328	MAX571	2025-10-27	2026-10-26
Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	MAX572	2025-10-27	2026-10-26

4 TEST CONDITIONS AND RESULTS

4.1 AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2020
2 Support equipment, if needed, was placed as per ANSI C63.10-2020 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2020 The EUT received power from adapter, the adapter received AC120V/60Hzand AC 240V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5 All support equipments received AC power from a second LISN, if any.
6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT.The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8 During the above scans, the emissions were maximized by cable manipulation.

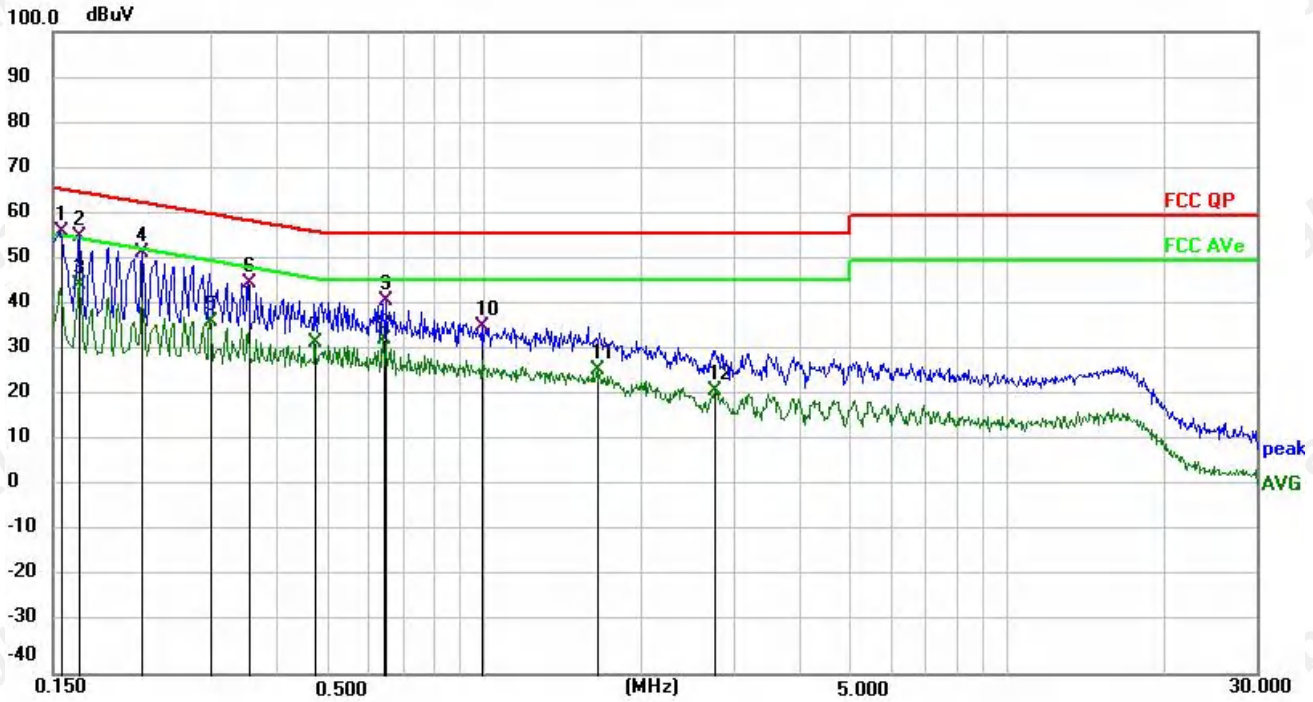
AC Power Conducted Emission Limit

For intentional device,according to § 15.207(a) AC Power Conducted Emission Limits isas following：

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 RESULTS

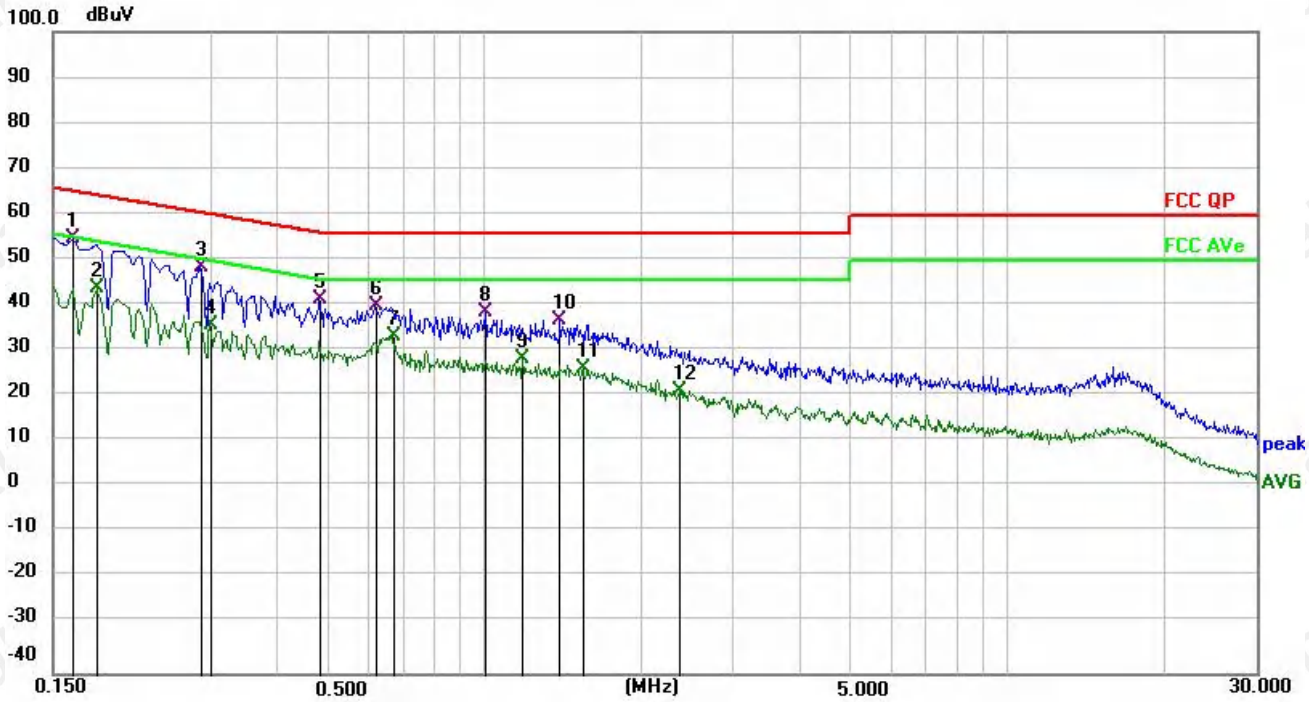
Power supply:	DC 5V from Adapter AC 120V/60Hz	Polarization	L



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.1545	39.65	16.61	56.26	65.75	-9.49	QP	P	
2	0.1680	38.74	16.71	55.45	65.06	-9.61	QP	P	
3	0.1680	28.09	16.71	44.80	55.06	-10.26	AVG	P	
4	0.2220	35.05	16.72	51.77	62.74	-10.97	QP	P	
5	0.2985	20.15	16.71	36.86	50.28	-13.42	AVG	P	
6	0.3525	28.46	16.70	45.16	58.90	-13.74	QP	P	
7	0.4740	15.63	16.69	32.32	46.44	-14.12	AVG	P	
8	0.6405	16.28	16.66	32.94	46.00	-13.06	AVG	P	
9	0.6495	24.72	16.66	41.38	56.00	-14.62	QP	P	
10	0.9915	19.17	16.62	35.79	56.00	-20.21	QP	P	
11	1.6485	9.69	16.54	26.23	46.00	-19.77	AVG	P	
12	2.7690	5.47	16.37	21.84	46.00	-24.16	AVG	P	

Note:1).Level (dBμV)= Reading (dBμV)+ Factor (dB)
2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)
3). Margin(dB) = Level (dBμV) - Limit (dBμV)

Power supply:	DC 5V from Adapter AC 120V/60Hz	Polarization	N



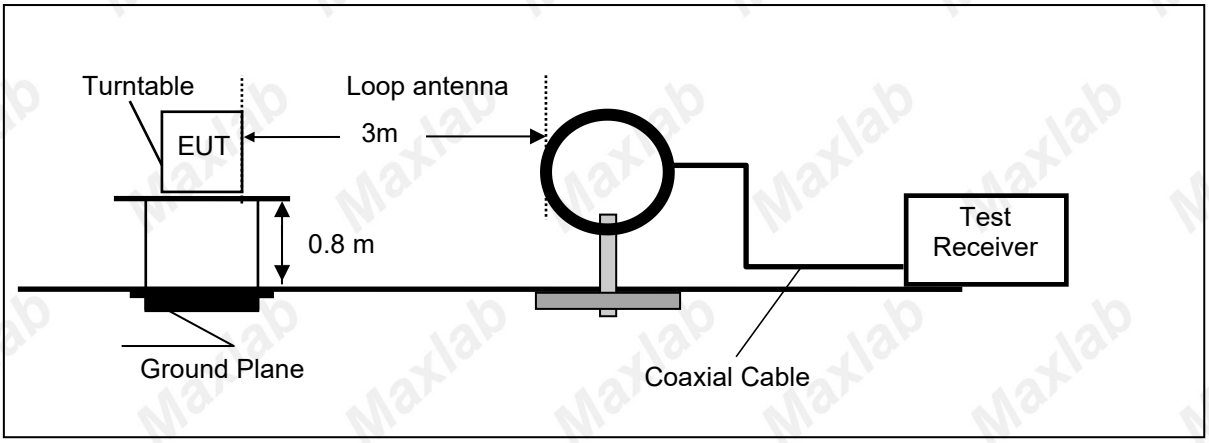
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1 *	0.1635	37.54	17.53	55.07	65.28	-10.21	QP	P	
2	0.1815	26.60	17.53	44.13	54.42	-10.29	AVG	P	
3	0.2850	31.13	17.52	48.65	60.67	-12.02	QP	P	
4	0.2985	18.44	17.52	35.96	50.28	-14.32	AVG	P	
5	0.4830	24.08	17.52	41.60	56.29	-14.69	QP	P	
6	0.6180	22.70	17.51	40.21	56.00	-15.79	QP	P	
7	0.6675	16.14	17.51	33.65	46.00	-12.35	AVG	P	
8	1.0095	21.55	17.50	39.05	56.00	-16.95	QP	P	
9	1.1895	11.20	17.50	28.70	46.00	-17.30	AVG	P	
10	1.4010	19.54	17.49	37.03	56.00	-18.97	QP	P	
11	1.5494	9.34	17.49	26.83	46.00	-19.17	AVG	P	
12	2.3639	4.49	17.46	21.95	46.00	-24.05	AVG	P	

Note:1).Level (dBμV)= Reading (dBμV)+ Factor (dB)
2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)
3). Margin(dB) = Level (dBμV) - Limit (dBμV)

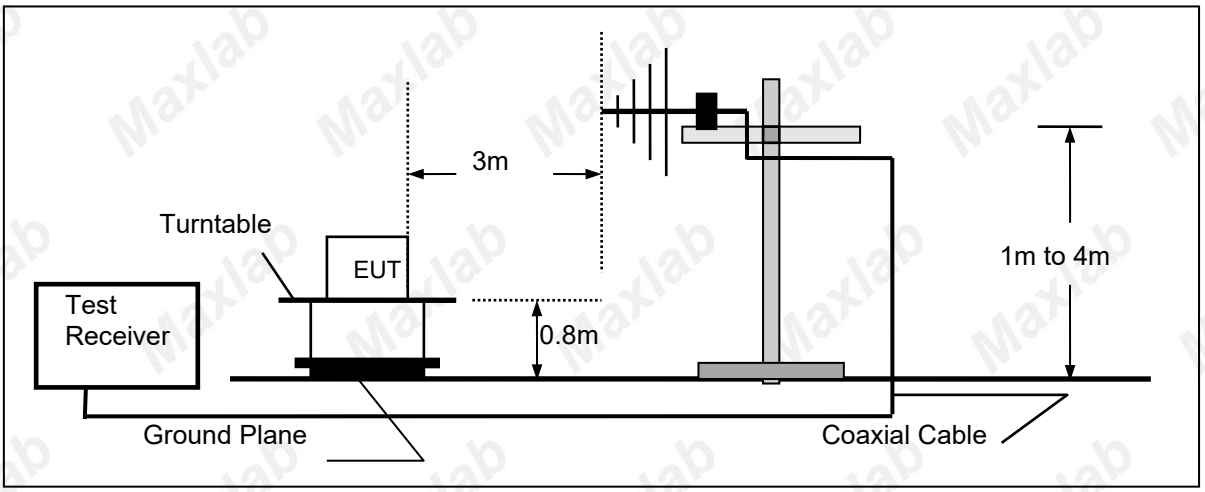
4.2 Radiated Emission

TEST CONFIGURATION

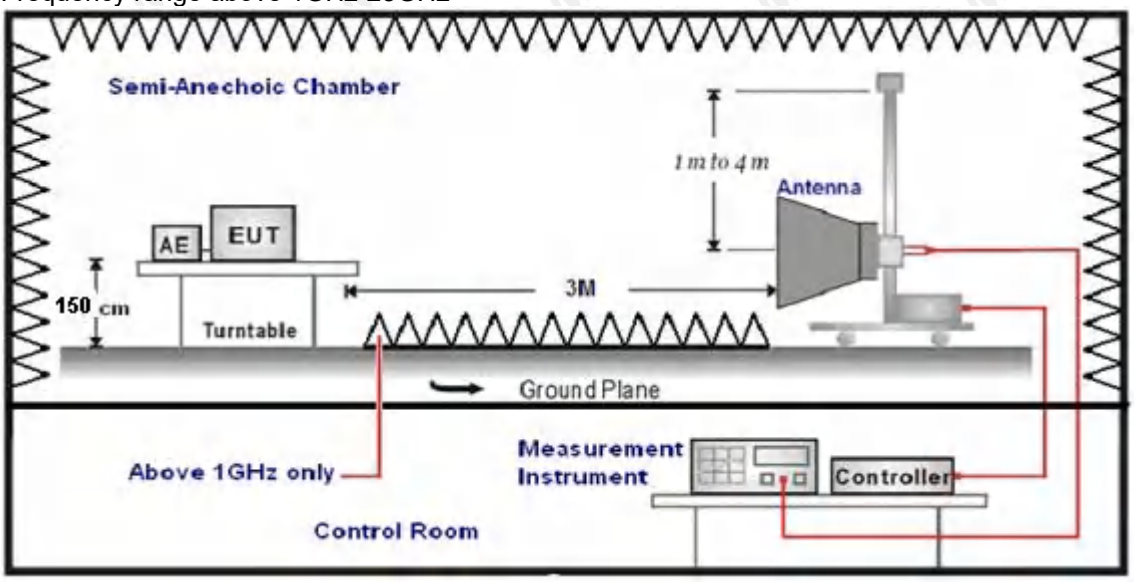
Frequency range 9KHz–30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz–1GHz;the EUT was placed on a turn table which is 1.5m above ground plane when testing frequency range 1GHz–25GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. Radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL- AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency(MHz)	Distance(Meters)	Radiated(dBμV/m)	Radiated(μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200

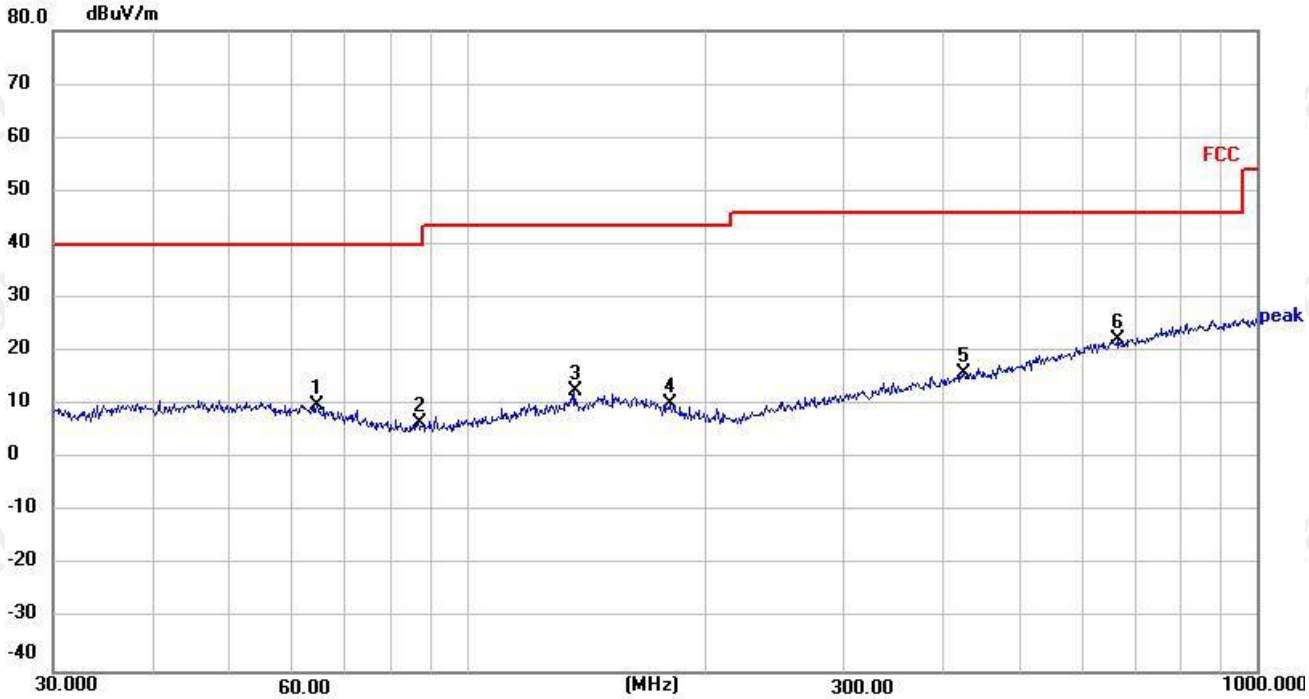
Above 960	3	54.0	500

TEST RESULTS

Remark:
1. This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
2. We measured Radiated Emission at GFSK, π*/4 DQPSK and 8-DPSK* mode from 9 KHz to 25GHz and recorded worst case at GFSK DH5 mode.
3. For below 1GHz testing recorded worst at GFSK DH5 middle channel.
4. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

For 30MHz-1GHz

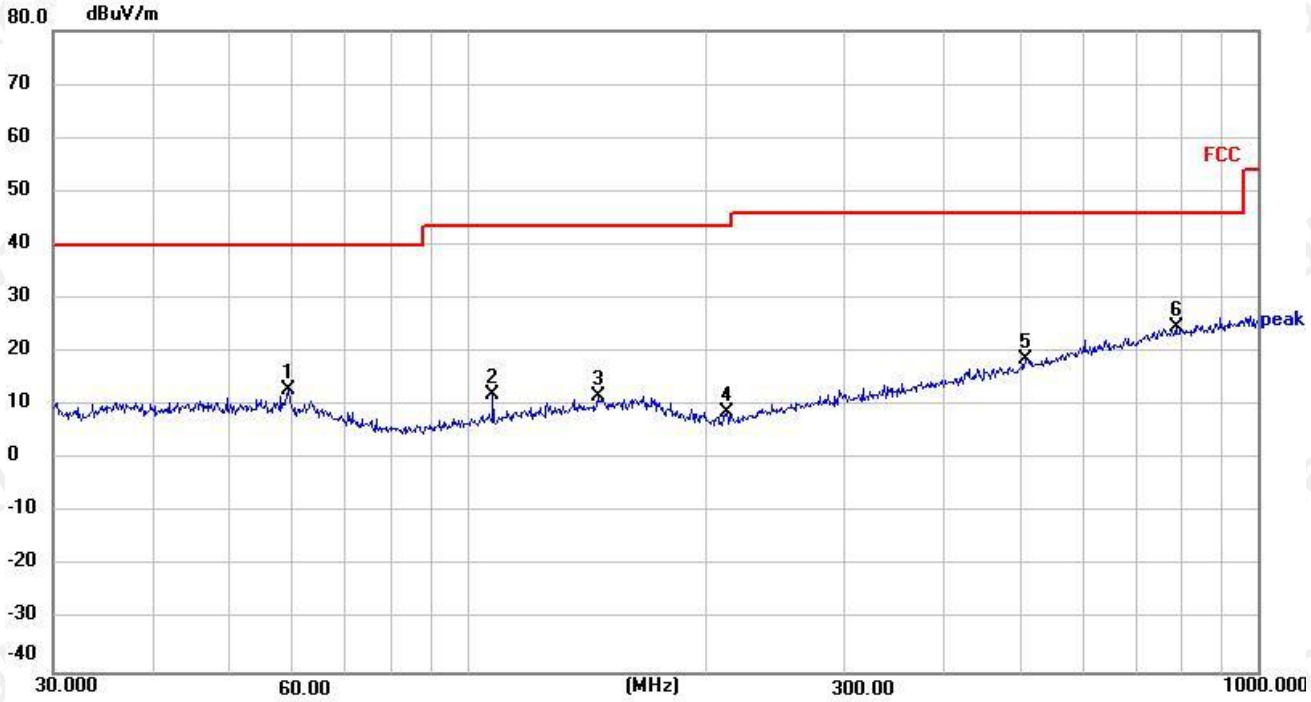
Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	64.6594	27.79	-17.80	9.99	40.00	-30.01	peak	100	0	P	
2	86.8068	27.43	-20.64	6.79	40.00	-33.21	peak	100	0	P	
3	136.9392	29.65	-16.91	12.74	43.50	-30.76	peak	100	0	P	
4	180.6488	27.83	-17.72	10.11	43.50	-33.39	peak	100	0	P	
5	426.5210	28.30	-12.33	15.97	46.00	-30.03	peak	100	0	P	
6 *	665.8035	29.24	-6.88	22.36	46.00	-23.64	peak	100	0	P	

Note:1).Level (dBμV/m)=Reading (dBμV/m)+ Factor (dB/m)
2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)
3). Margin(dB) = Level(dBμV/m) - Limit(dBμV/m)

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	59.4405	30.02	-17.01	13.01	40.00	-26.99	peak	100	360	P	
2	107.8877	31.06	-19.15	11.91	43.50	-31.59	peak	100	360	P	
3	146.3735	28.06	-16.23	11.83	43.50	-31.67	peak	100	360	P	
4	213.0151	28.06	-19.34	8.72	43.50	-34.78	peak	100	360	P	
5	508.2582	29.18	-10.46	18.72	46.00	-27.28	peak	100	360	P	
6 *	787.8513	29.34	-4.77	24.57	46.00	-21.43	peak	100	360	P	

Note:1).Level (dBμV/m)=Reading (dBμV/m)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Level(dBμV/m) - Limit(dBμV/m)

Note:GFSK, π/4 DQPSK and 8-DPSKall have been tested, only worse case GFSK is reported.

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	56.09	PK	74	17.91	60.45	32.40	5.11	41.87	-4.36
4804.00	46.00	AV	54	8.00	50.36	32.40	5.11	41.87	-4.36
7206.00	55.18	PK	74	18.82	55.81	36.58	6.43	43.64	-0.63
7206.00	45.10	AV	54	8.90	45.73	36.58	6.43	43.64	-0.63

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	56.33	PK	74	17.67	60.69	32.40	5.11	41.87	-4.36
4804.00	46.40	AV	54	7.60	50.76	32.40	5.11	41.87	-4.36
7206.00	54.80	PK	74	19.20	55.43	36.58	6.43	43.64	-0.63
7206.00	44.98	AV	54	9.02	45.61	36.58	6.43	43.64	-0.63

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	56.90	PK	74	17.10	60.85	32.56	5.34	41.85	-3.95
4882.00	46.69	AV	54	7.31	50.64	32.56	5.34	41.85	-3.95
7323.00	55.10	PK	74	18.90	55.46	36.54	6.81	43.71	-0.36
7323.00	44.90	AV	54	9.10	45.26	36.54	6.81	43.71	-0.36

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	56.90	PK	74	17.10	60.85	32.56	5.34	41.85	-3.95
4882.00	46.70	AV	54	7.30	50.65	32.56	5.34	41.85	-3.95
7323.00	54.88	PK	74	19.12	55.24	36.54	6.81	43.71	-0.36
7323.00	44.90	AV	54	9.10	45.26	36.54	6.81	43.71	-0.36

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	57.10	PK	74	16.90	60.56	32.73	5.64	41.83	-3.46
4960.00	46.88	AV	54	7.12	50.34	32.73	5.64	41.83	-3.46
7440.00	55.69	PK	74	18.31	55.75	36.50	7.23	43.79	-0.06
7440.00	45.57	AV	54	8.43	45.63	36.50	7.23	43.79	-0.06

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	57.06	PK	74	16.94	60.52	32.73	5.64	41.83	-3.46
4960.00	46.89	AV	54	7.11	50.35	32.73	5.64	41.83	-3.46
7440.00	55.09	PK	74	18.91	55.15	36.50	7.23	43.79	-0.06
7440.00	45.30	AV	54	8.70	45.36	36.50	7.23	43.79	-0.06

REMARKS:
1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)- Pre-amplifier
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

Results of Band Edges Test (Radiated)

Note:GFSK, Pi/4 DQPSK and 8-DPSKall have been tested, only worse case GFSK is reported.

GFSK

TestFrequency(MHz):			**Lowest channel**		**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)
2310.00	50.32	PK	74	23.68	60.74	27.42	4.31	42.15	-10.42
2310.00	40.04	AV	54	13.96	50.46	27.42	4.31	42.15	-10.42
2390.00	47.86	PK	74	26.14	58.15	27.55	4.35	42.19	-10.29
2390.00	37.97	AV	54	16.03	48.26	27.55	4.35	42.19	-10.29
2400.00	45.46	PK	74	28.54	55.65	27.70	4.39	42.28	-10.19
2400.00	35.05	AV	54	18.95	45.24	27.70	4.39	42.28	-10.19

TestFrequency(MHz):			**Lowest channel**		**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)
2310.00	48.34	PK	74	25.66	58.76	27.42	4.31	42.15	-10.42
2310.00	38.20	AV	54	15.80	48.62	27.42	4.31	42.15	-10.42
2390.00	45.36	PK	74	28.64	55.65	27.55	4.35	42.19	-10.29
2390.00	36.56	AV	54	17.44	46.85	27.55	4.35	42.19	-10.29
2400.00	43.22	PK	74	30.78	53.41	27.70	4.39	42.28	-10.19
2400.00	33.07	AV	54	20.93	43.26	27.70	4.39	42.28	-10.19

TestFrequency(MHz):			**Highest channel**		**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)
2483.50	45.02	PK	74	28.98	55.65	27.55	4.38	42.56	-10.63
2483.50	34.52	AV	54	19.48	45.15	27.55	4.38	42.56	-10.63
2500.00	42.68	PK	74	31.32	53.41	27.69	4.46	42.88	-10.73
2500.00	32.92	AV	54	21.08	43.65	27.69	4.46	42.88	-10.73

TestFrequency(MHz):			**Highest channel**		**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	41.83	PK	74	32.17	52.46	27.55	4.38	42.56	-10.63
2483.50	31.99	AV	54	22.01	42.62	27.55	4.38	42.56	-10.63
2500.00	39.61	PK	74	34.39	50.34	27.69	4.46	42.88	-10.73
2500.00	30.22	AV	54	23.78	40.95	27.69	4.46	42.88	-10.73

REMARKS:
1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)- Pre-amplifier
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

4.3 Maximum Peak Output Power

Limit

The Maximum Peak Output Power Measurement is 30dBm(for GFSK)/20.97dBm(for EDR)

Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW = 3MHz.Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

Test Configuration

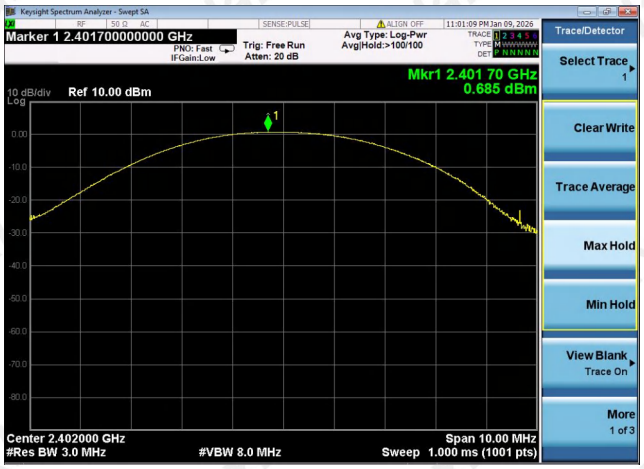
Test Results

Type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	00	0.685	30.00	Pass
	39	0.672		
	78	0.371		
π/4DQPSK	00	2.516	20.97	Pass
	39	2.651		
	78	2.281		
8-DPSK	00	2.542	20.97	Pass
	39	2.569		
	78	2.263		

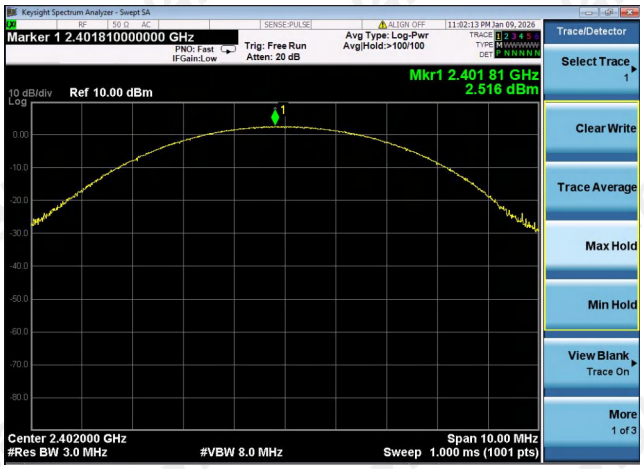
Note: 1.The test results including the cable lose.

Test plots

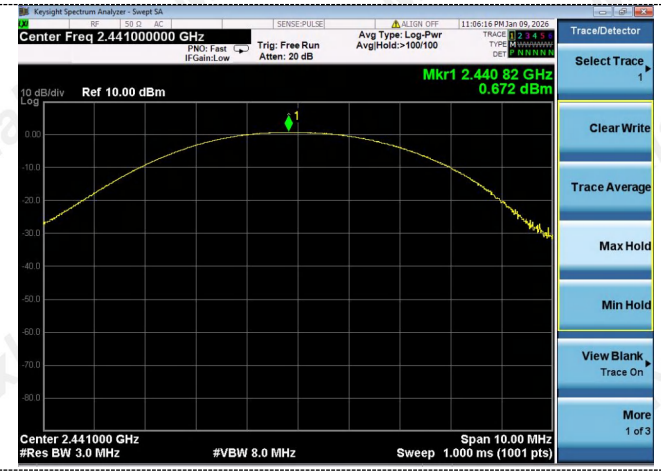
GFSK(CH00)



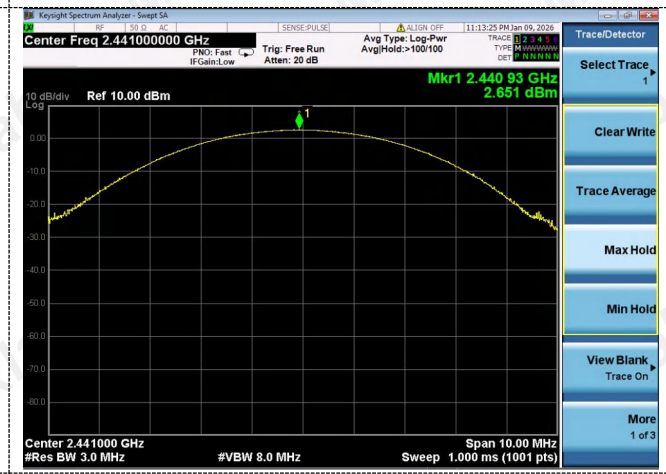
π/4DQPSK (CH00)



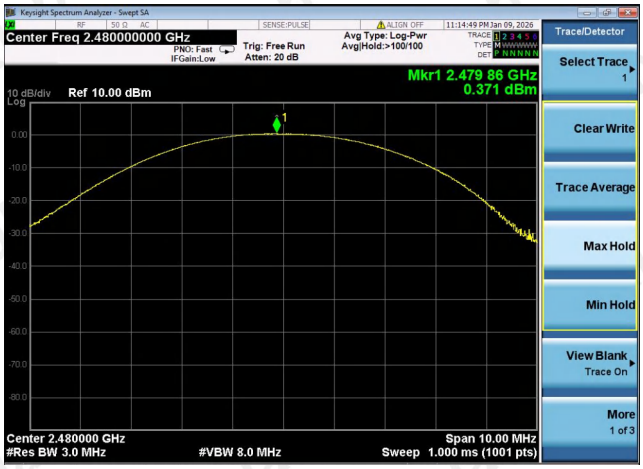
GFSK(CH39)



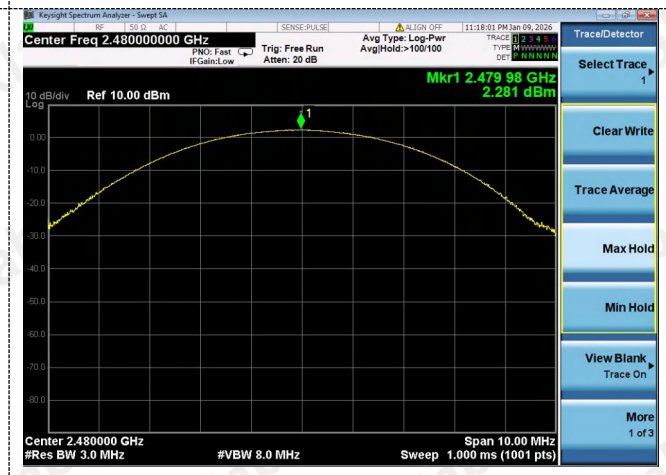
π/4DQPSK (CH39)



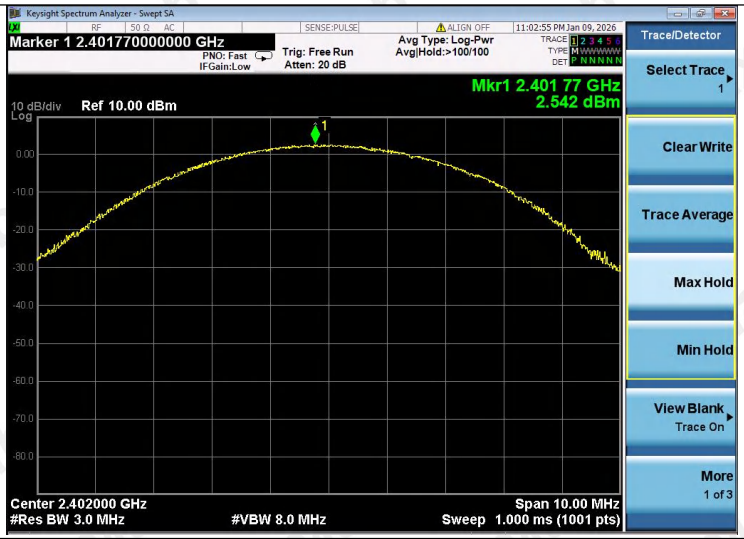
GFSK(CH78)



π/4DQPSK (CH78)



8-DPSK(CH00)



8-DPSK(CH39)

8-DPSK(CH78)

4.4 20dB Bandwidth

Limit

For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwidth.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 91 KHz VBW.

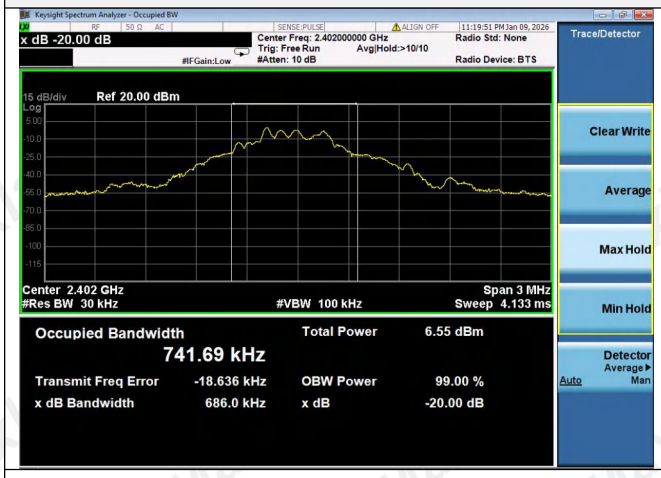
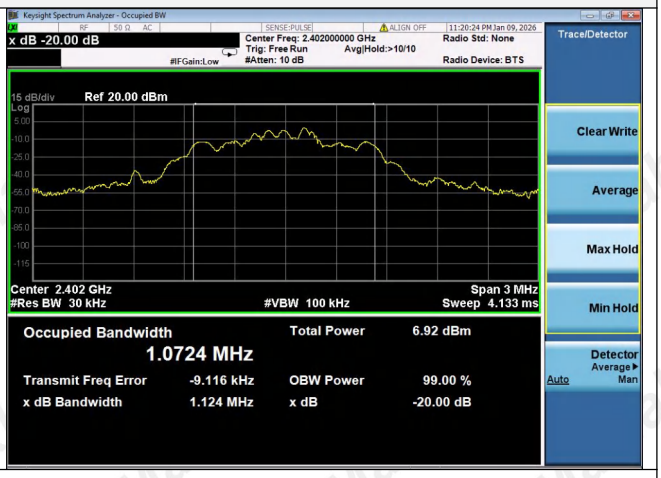
The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

Test Configuration

Test Results

Modulation	Channel	20dB bandwidth (MHz)	Result
GFSK	CH00	0.686	Pass
	CH39	0.672	
	CH78	0.687	
π/4DQPSK	CH00	1.124	
	CH39	1.122	
	CH78	1.119	
8-DPSK	CH00	1.129	
	CH39	1.120	
	CH78	1.126	

Test graphs:

GFSK Modulation	π/4DQPSK Modulation
	
CH00	CH00
CH39	CH39
CH78	CH78

8-DPSKModulation

CH00

CH39

CH78

4.5 Frequency Separation

LIMIT

According to 15.247(a)(1),frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 300 KHz RBW and 1MHz VBW.

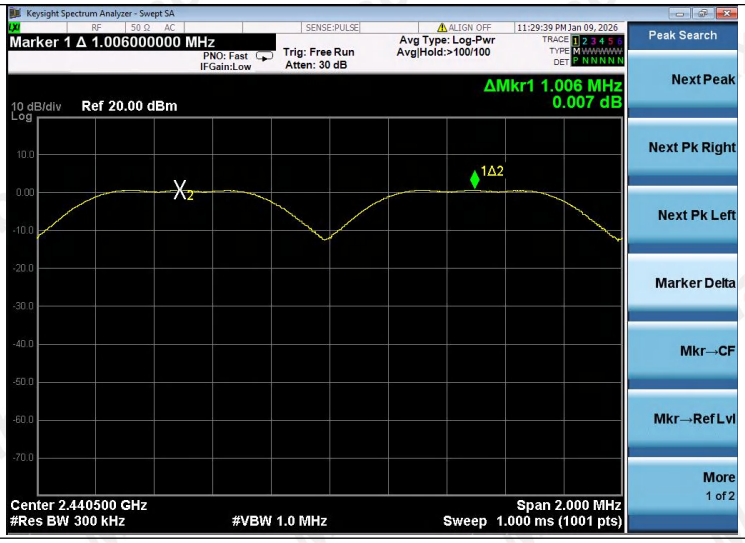
TEST CONFIGURATION

TEST RESULTS

Modulation	Channel	Channel Separation (MHz)	Limit(MHz)	Result
GFSK	CH38	1.006	0.687	Pass
	CH39			
π/4DQPSK	CH38	1.002	0.749	Pass
	CH39			
8-DPSK	CH38	1.004	0.753	Pass
	CH39			

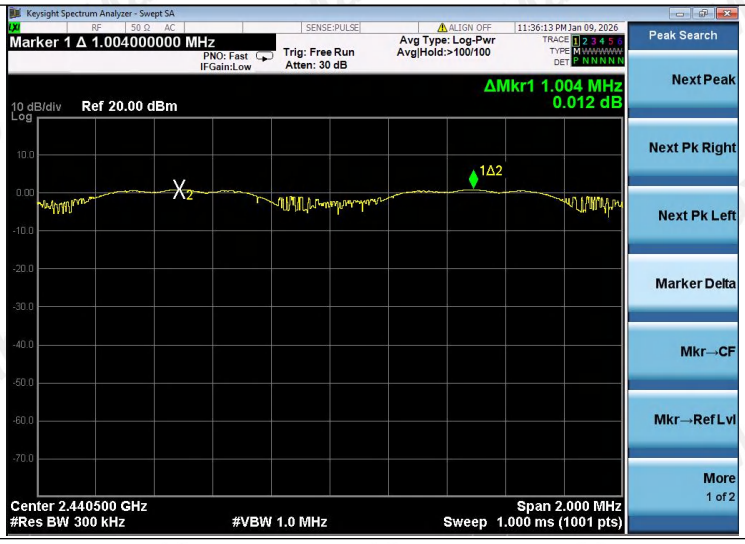
Note:We have tested all mode at high, middle and low channel, andrecorded worst case at middle

Test Graphs



GFSK

π/4DQPSK



8-DPSK

4.6 Number of hopping frequency

Limit

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

Test Procedure

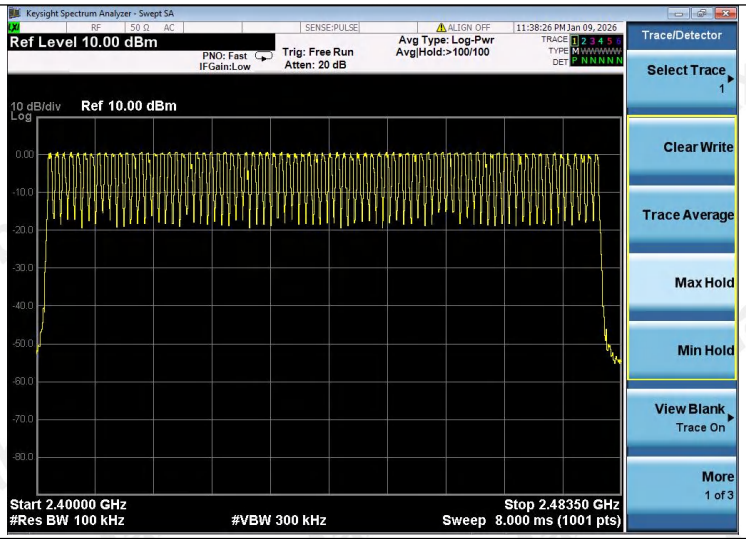
The transmitter output was connected to the spectrum analyzer through an attenuator. Set spectrum analyzer start 2400MHz to 2483.5MHz with 100 KHz RBW and 300 KHz VBW.

Test Configuration

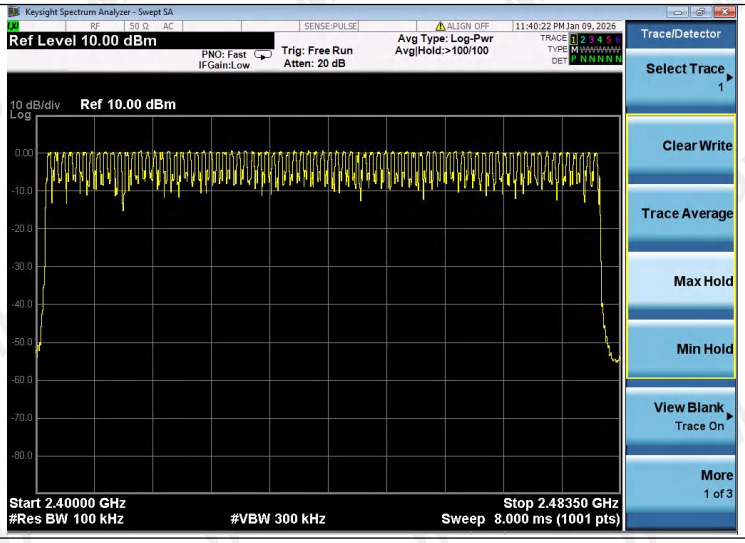
Test Results

Modulation	Number of Hopping Channel	Limit	Result
GFSK	79	≥15	Pass
π/4DQPSK	79		
8-DPSK	79		

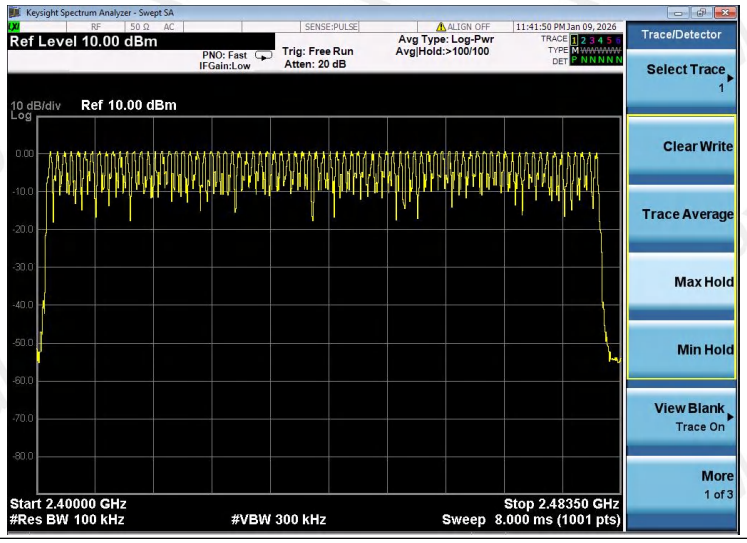
Test plot as follows:



GFSK Modulation



π/4DQPSK Modulation



8-DPSK Modulation

4.7 Time ofOccupancy (Dwell Time)

Limit

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.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with 1MHz RBW and 3MHz VBW, Span 0Hz.

Test Configuration

Test Results

Modulation	Packet	Burst time (ms)	Dwell time (s)	Limit (s)	Result
GFSK	DH1	0.395	0.126	0.40	Pass
	DH3	1.650	0.264		
	DH5	2.895	0.309		
π/4DQPSK	2-DH1	0.395	0.126	0.40	Pass
	2-DH3	1.655	0.265		
	2-DH5	2.905	0.310		
8-DPSK	3-DH1	0.400	0.128	0.40	Pass
	3-DH3	1.655	0.265		
	3-DH5	2.910	0.310		

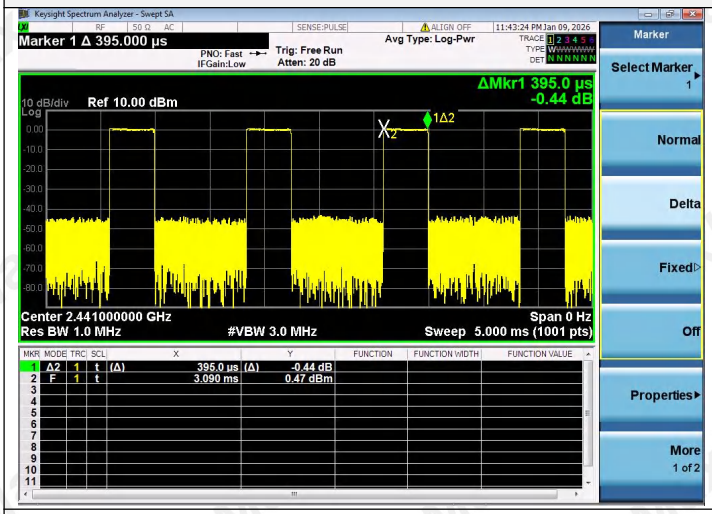
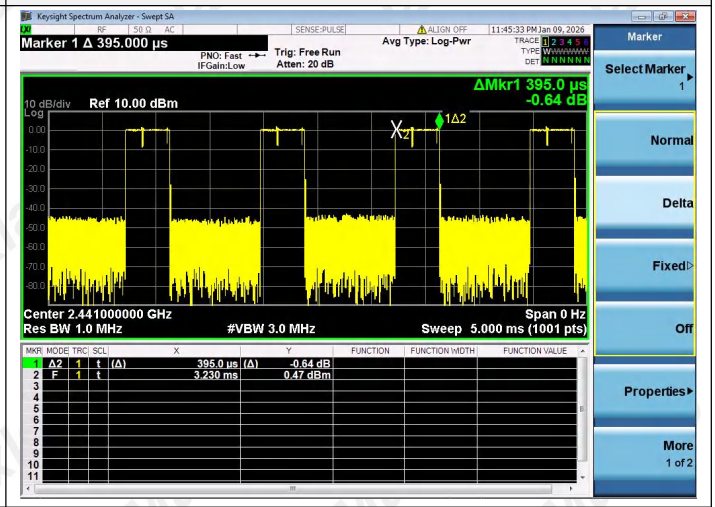
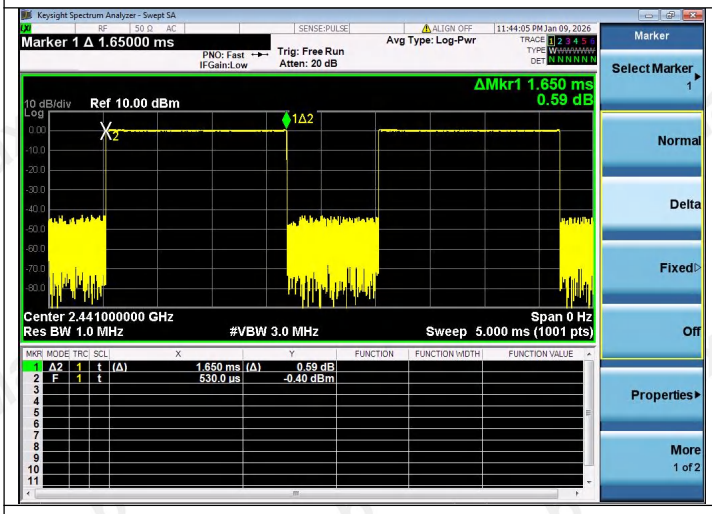
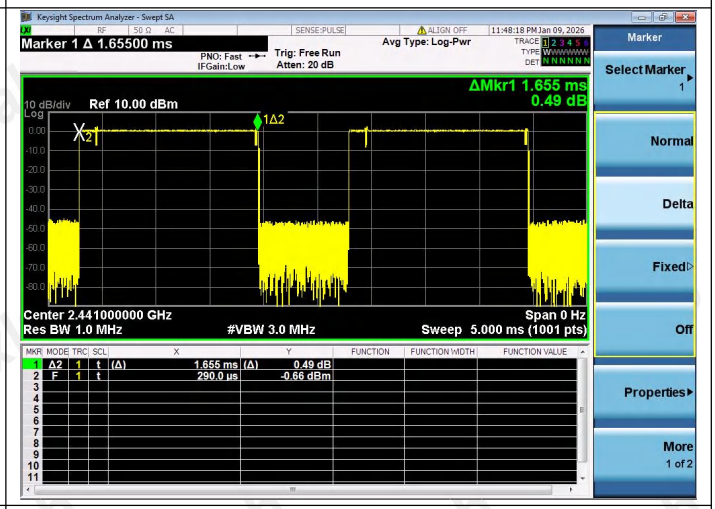
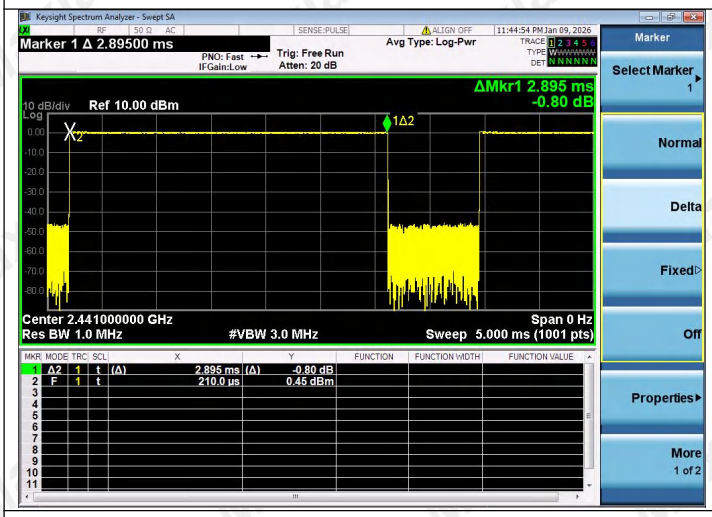
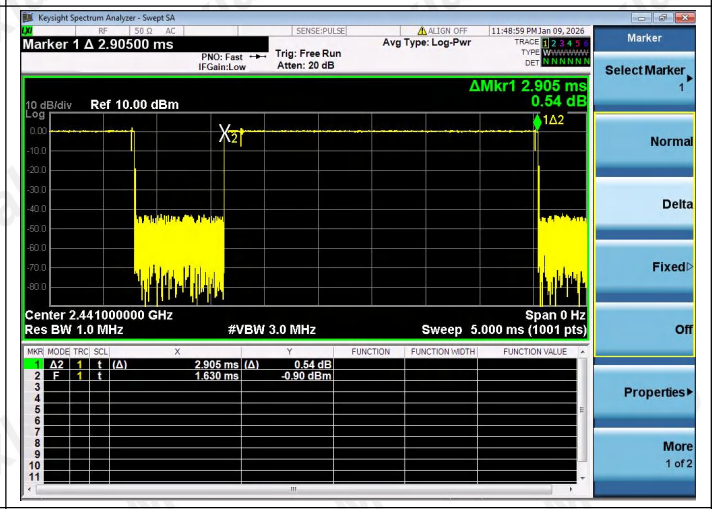
Note:We have tested all mode at high,middle and low channel,and recoreded worst case at middle channel.

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

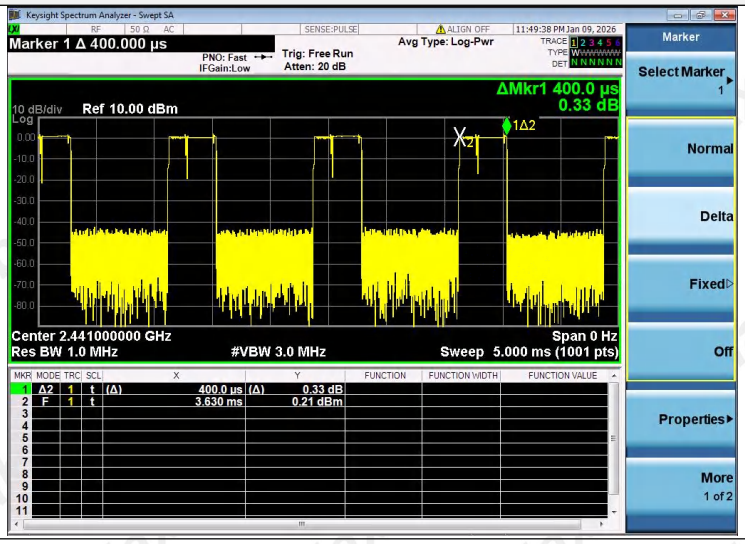
Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2-DH3, 3-DH2

Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second for DH5, 2-DH5, 3-DH3

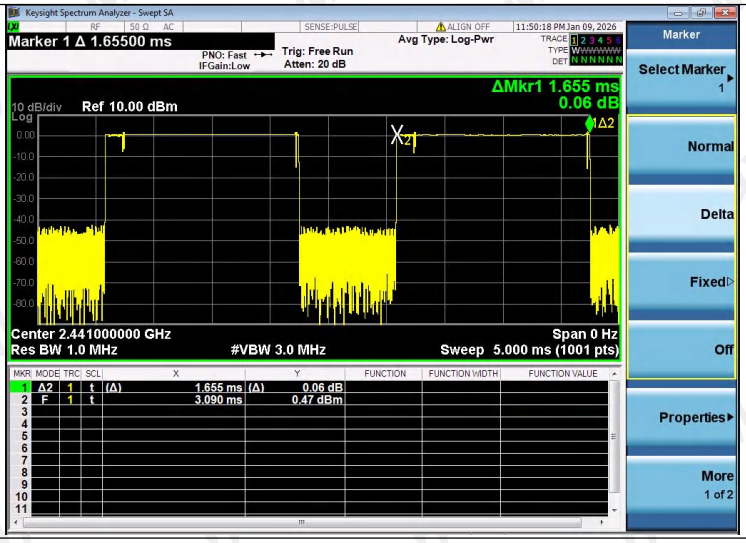
Test plot as follows:

GFSK Modulation	π/4DQPSK Modulation
	
DH1 burst time	2-DH1 burst time
	
DH3 burst time	2-DH3 burst time
	
DH5 burst time	2-DH5 burst time

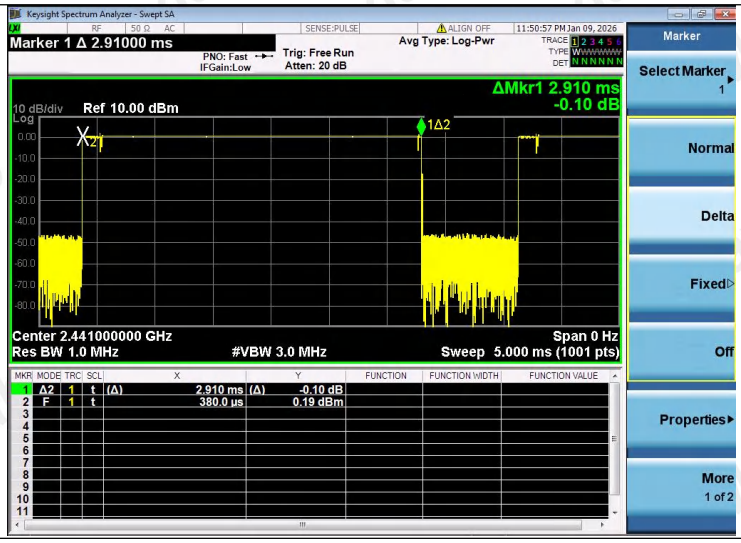
8-DPSK Modulation



3-DH1 burst time



3-DH3 burst time



3-DH5 burst time

4.8 Out-of-band Emissions

Limit

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 desiredpower, based on either an RF con-ducted or a radiated measurement, pro-vided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter com-plies 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.

Test Procedure

Connect the transmitter output to spectrumanalyzer using a low loss RF cable, and set the spectrumanalyzer to RBW=100 kHz, VBW= 300 kHz, peak detector , and max hold. Measurements utilizing these setting are made of the in-band reference level, bandedge and out-of-band emissions.

Test Configuration

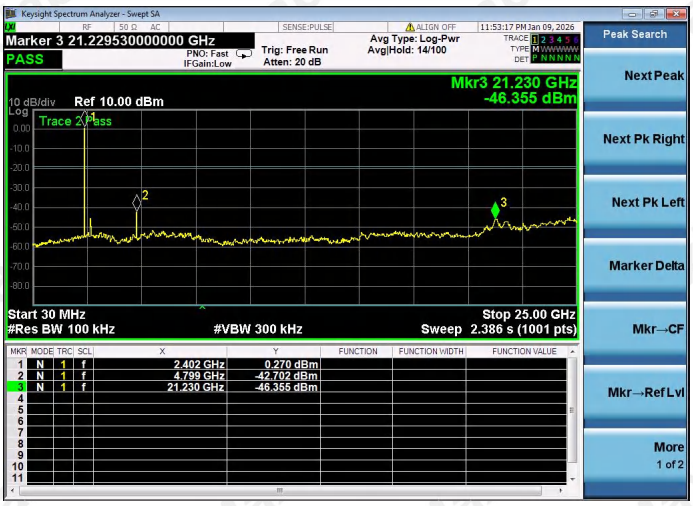
Test Results

Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandage measurement data.
We measured all conditions (DH1, DH3, DH5) and recorded worst case at DH5

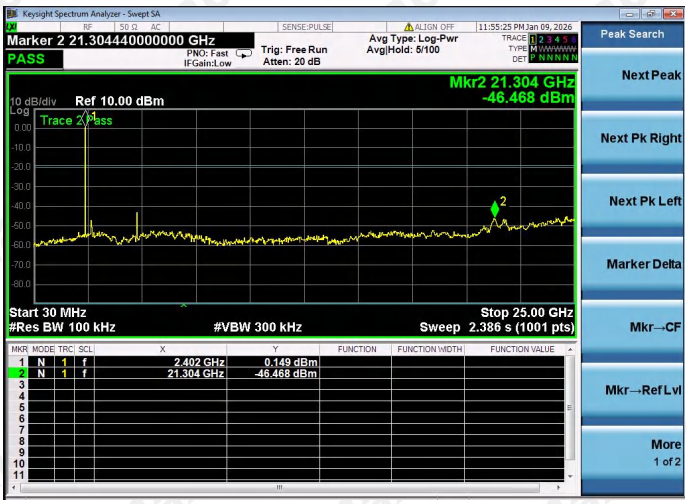
Test plot as follows:

30MHz-25G

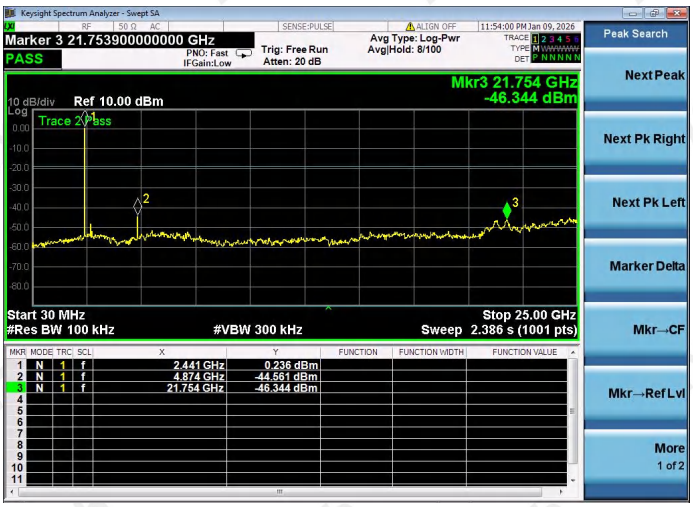
GFSK(CH00)



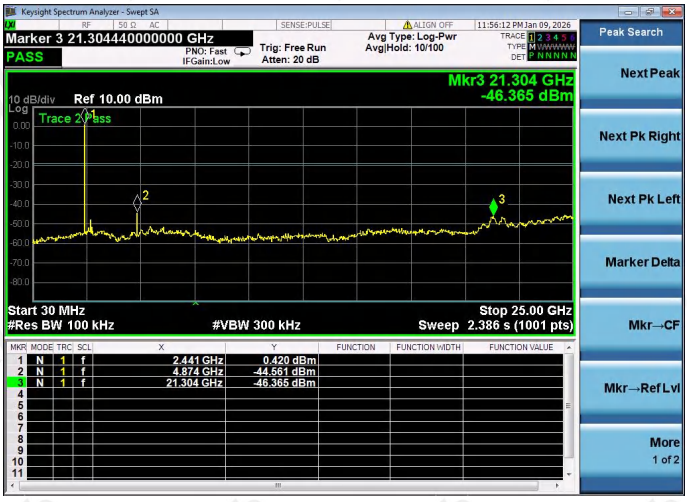
π/4DQPSK (CH00)



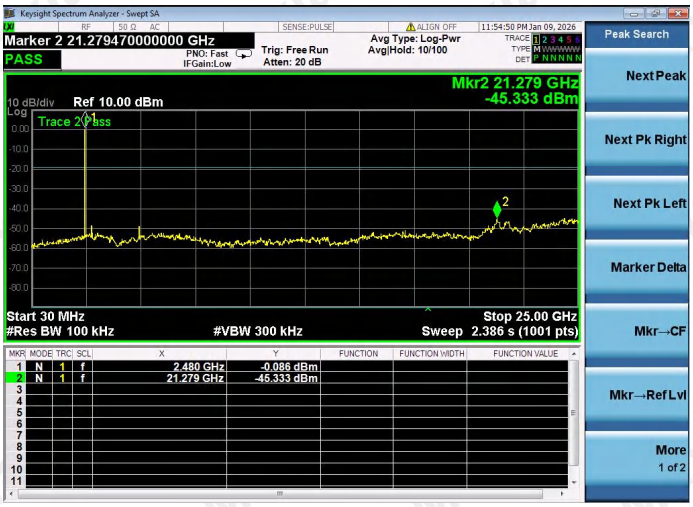
GFSK(CH39)



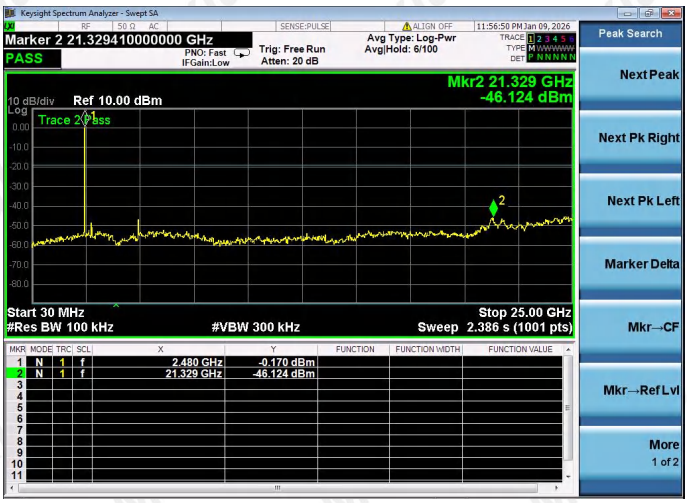
π/4DQPSK (CH39)



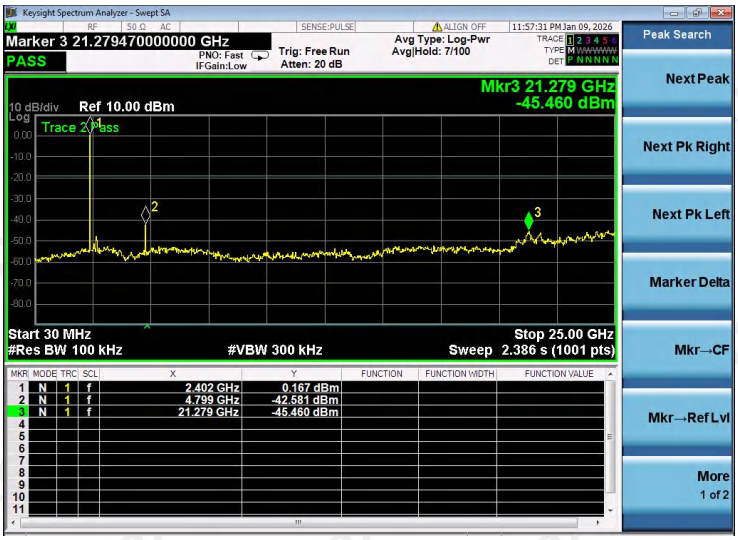
GFSK(CH78)



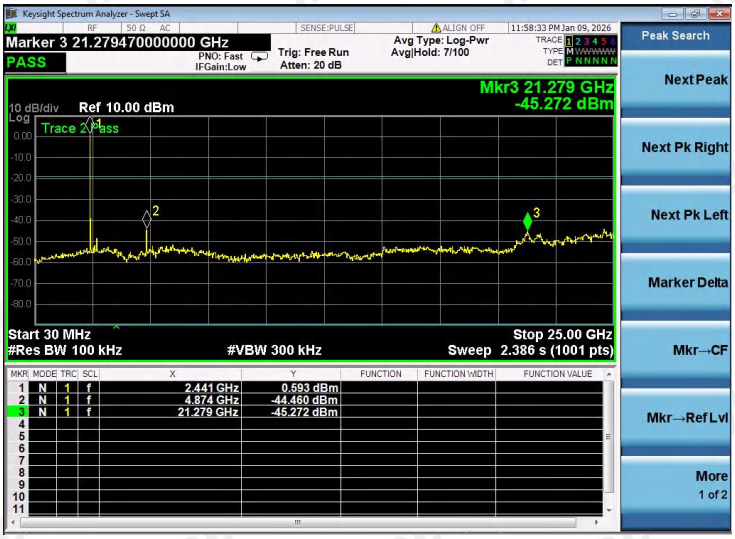
π/4DQPSK (CH78)



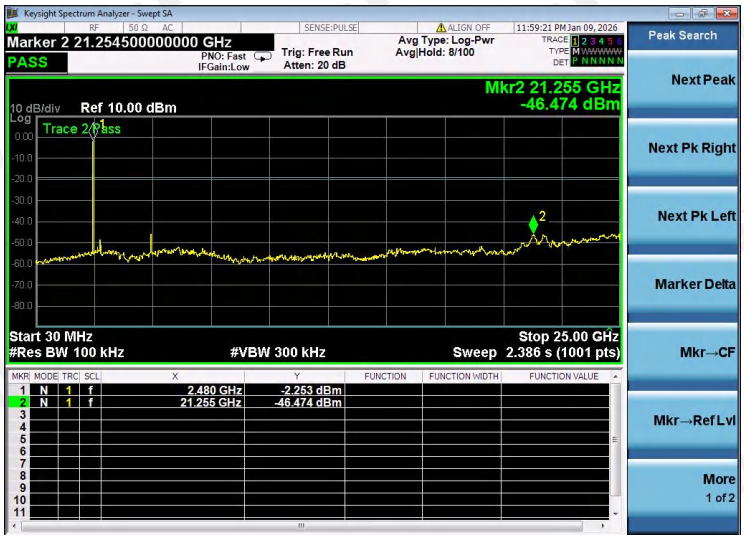
8-DPSK(CH00)



8-DPSK(CH39)

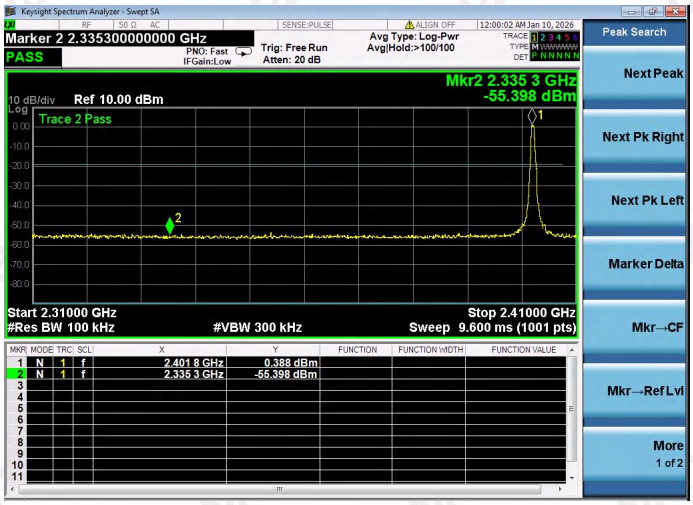


8-DPSK(CH78)

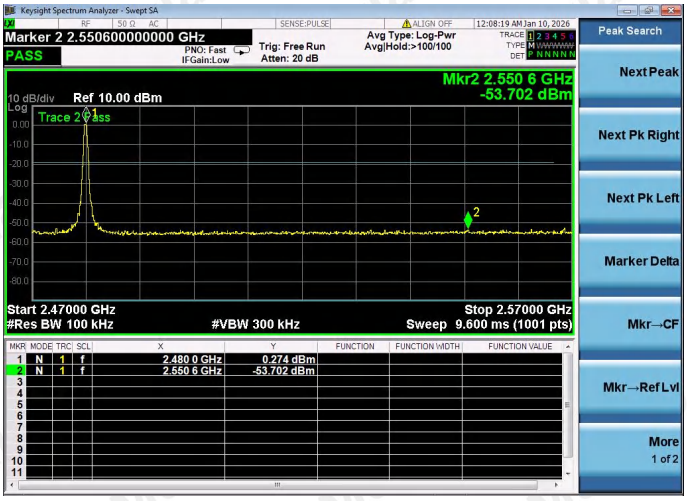


Band-edge Measurements for RF Conducted Emissions:

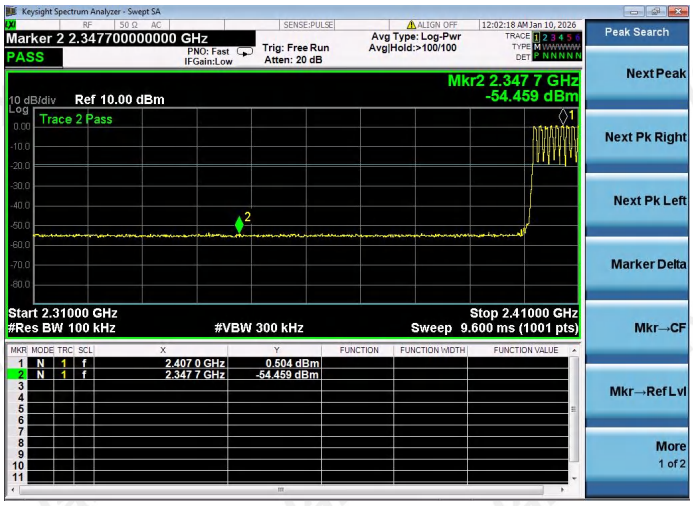
GFSK



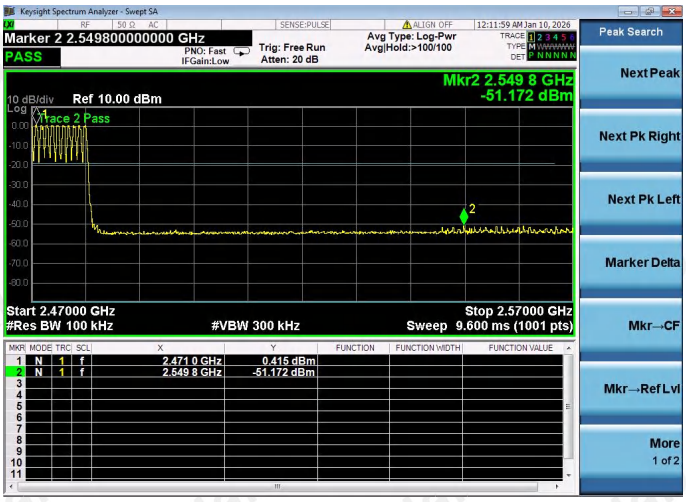
Left Band edge hoping off



RightBand edge hoping off

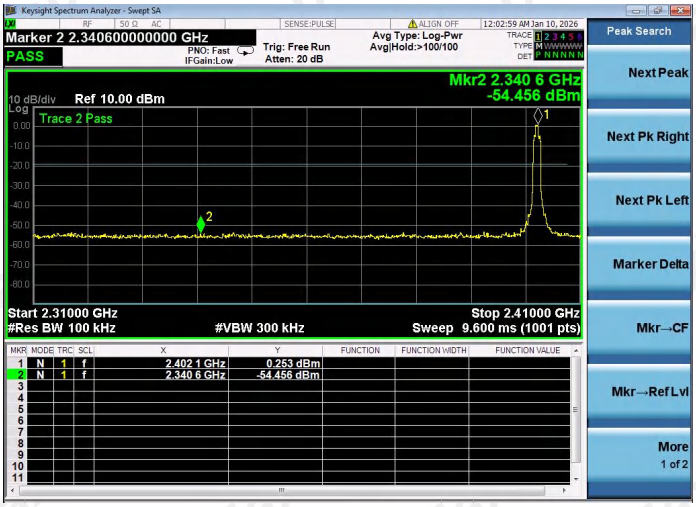


Left Band edge hoping on

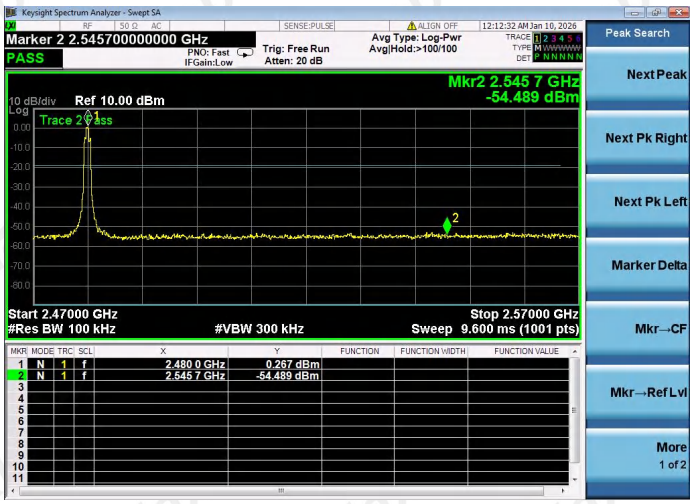


RightBand edge hoping on

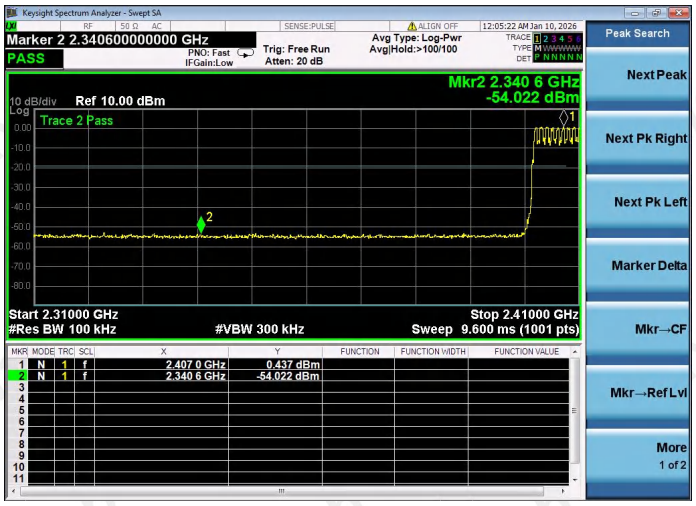
π/4DQPSK



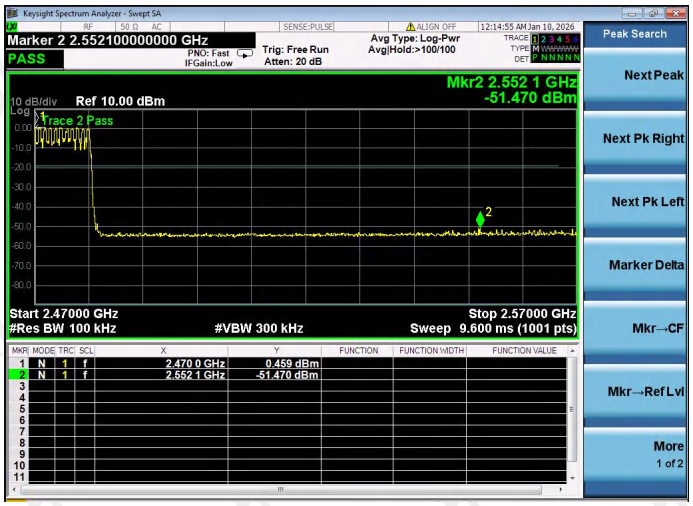
Left Band edge hoping off



RightBand edge hoping off

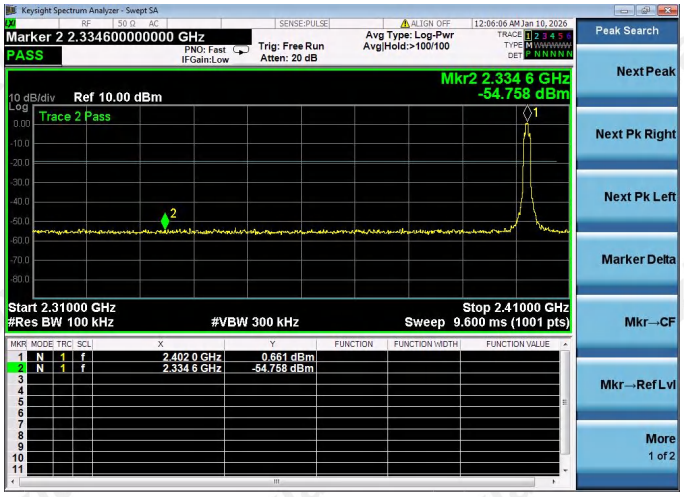


Left Band edge hoping on

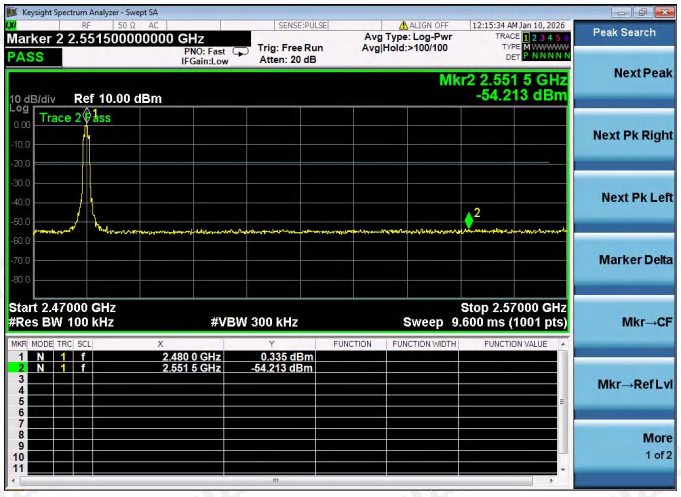


RightBand edge hoping on

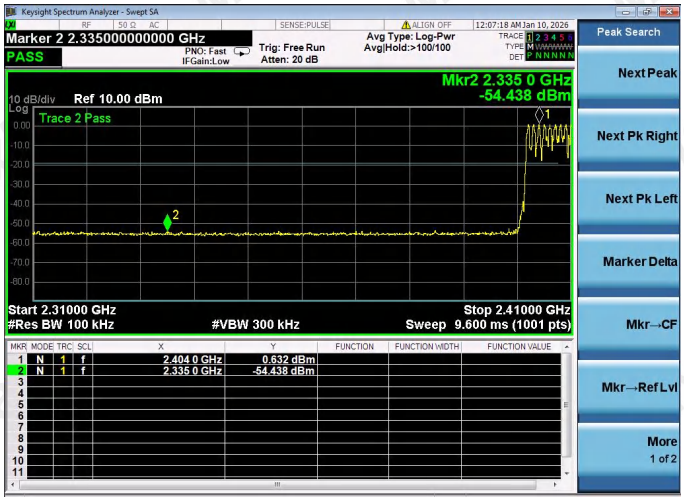
8-DPSK



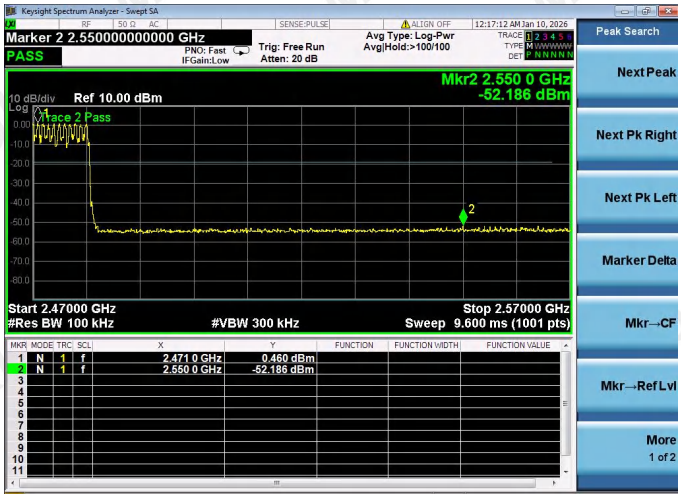
Left Band edge hoping off



RightBand edge hoping off



Left Band edge hoping on



RightBand edge hoping on

4.9 Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

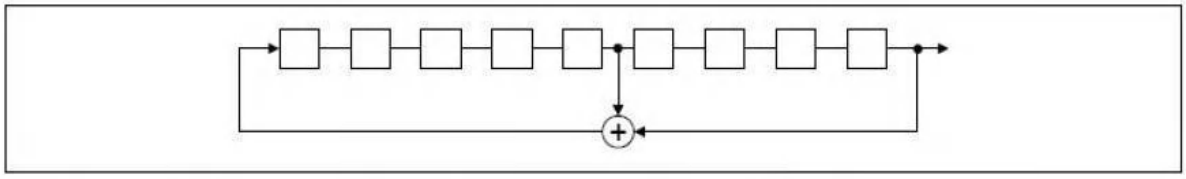
For 47 CFR Part 15C section 15.247 (a) (1) requirement:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence Requirement

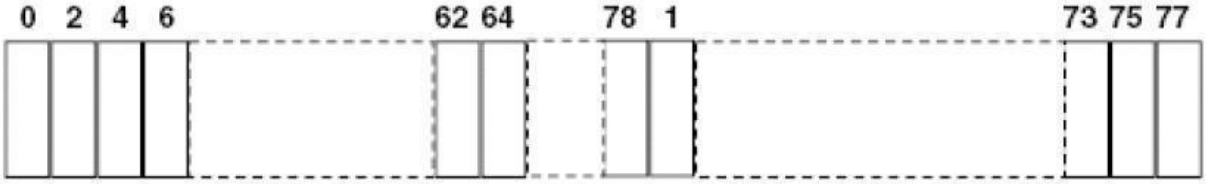
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the firststage. The sequence begins with the first one of 9 consecutive ones, forexample: the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros:8(non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.

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

4.10 Antenna Requirement

Standard Applicable

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.
And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance

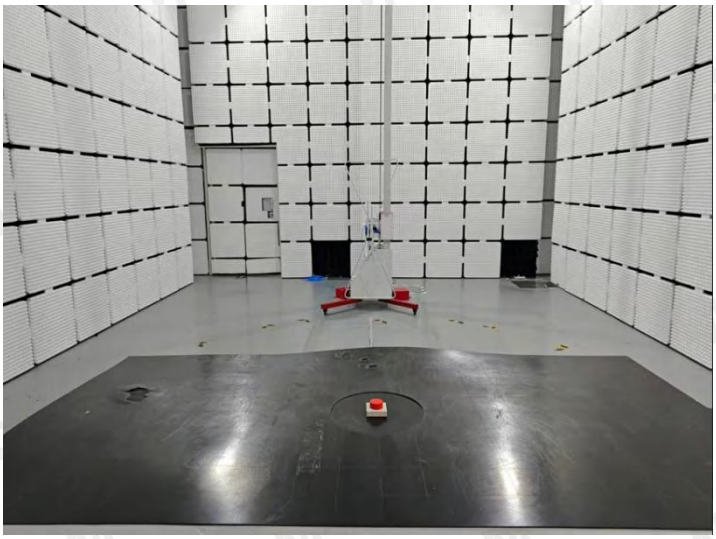
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

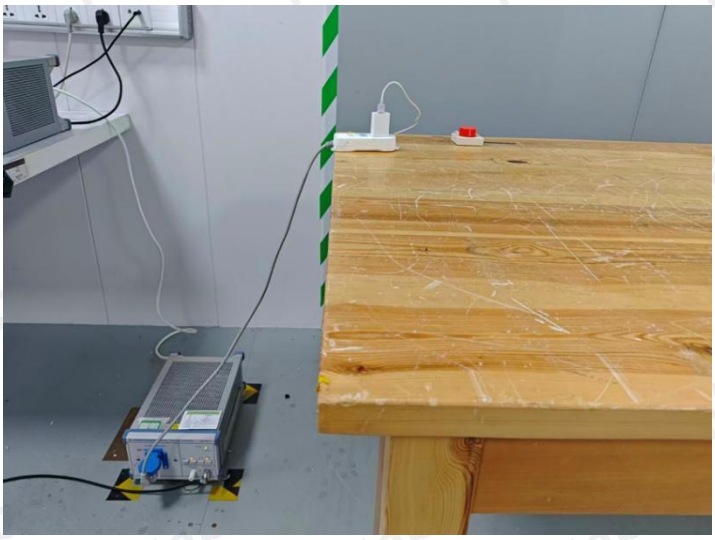
Antenna Connected Construction

The maximum gain of antenna was 1.3 dBi.

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

5 Test Setup Photos of the EUT





6 Photos of the EUT

Reference to the report ANNEX A of external photos and ANNEX B of internal photos.

**********End of Report**********