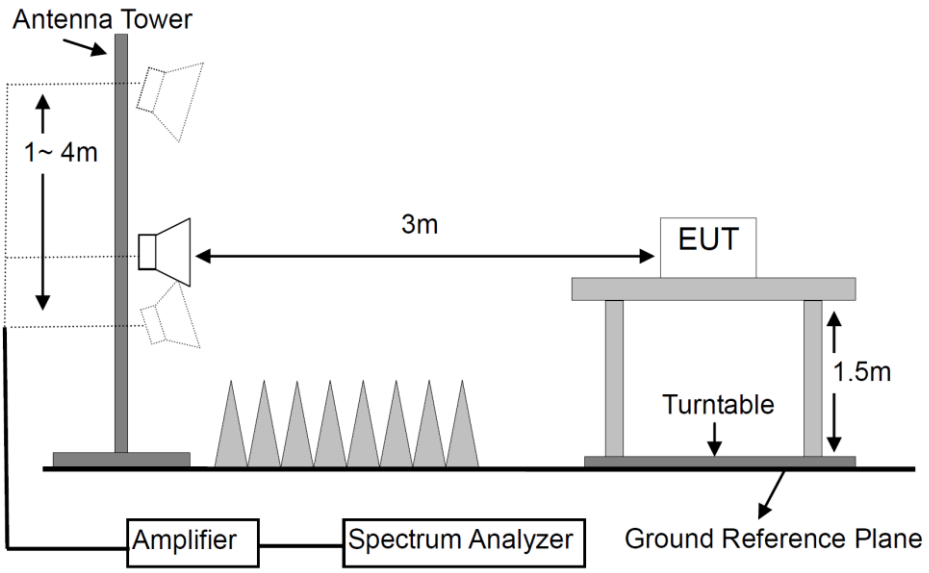


TEST PROCEDURES

a. Below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters semi- anechoic chamber room.

b. For the radiated emission test above 1GHz:

The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meters full anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

c. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to peak detect function and specified bandwidth with maximum hold mode.

f. A Quasi-peak measurement was then made for that frequency point for below 1GHz test. PK and AV for above 1GHz emission test.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Band (MHz)	Detector	Resolution Bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 1000	Peak	1 MHz	3 MHz
	Average	1 MHz	10 Hz

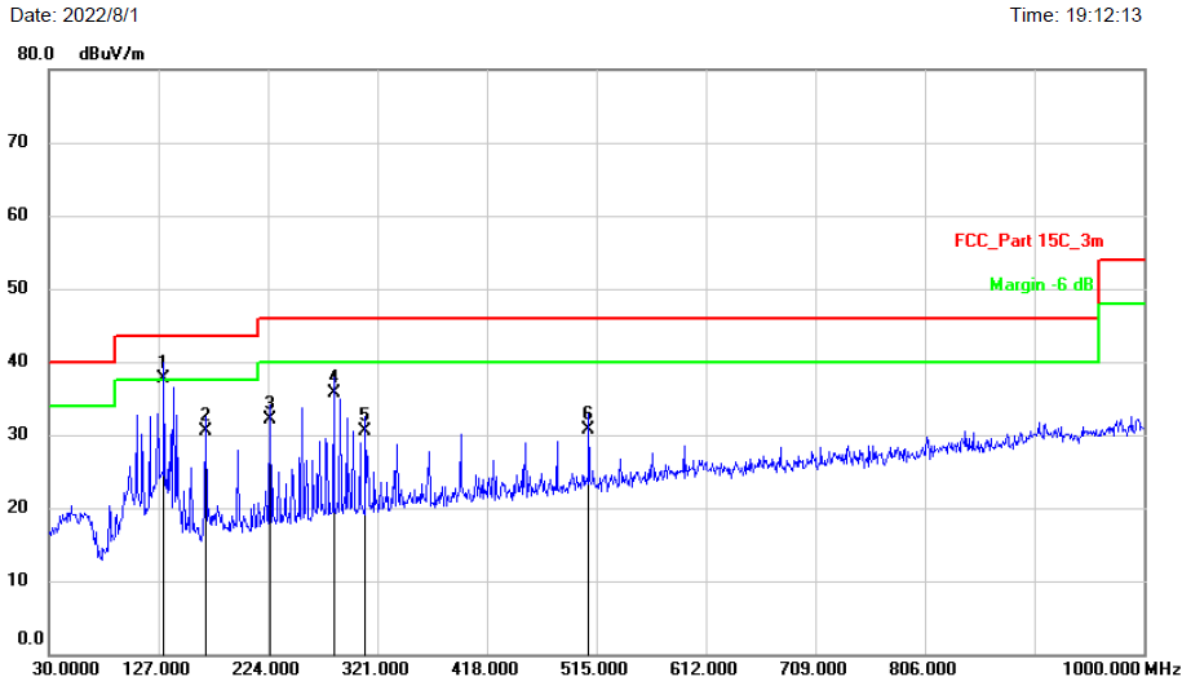
TEST RESULTS

PASS

Please refer to the following pages.

M/N: AARD100043854	Testing Voltage: AC 120V/60Hz
Polarization: Horizontal	Detector: QP
Test Mode: 1(the worst case)	Distance: 3m

Radiated Emission Measurement

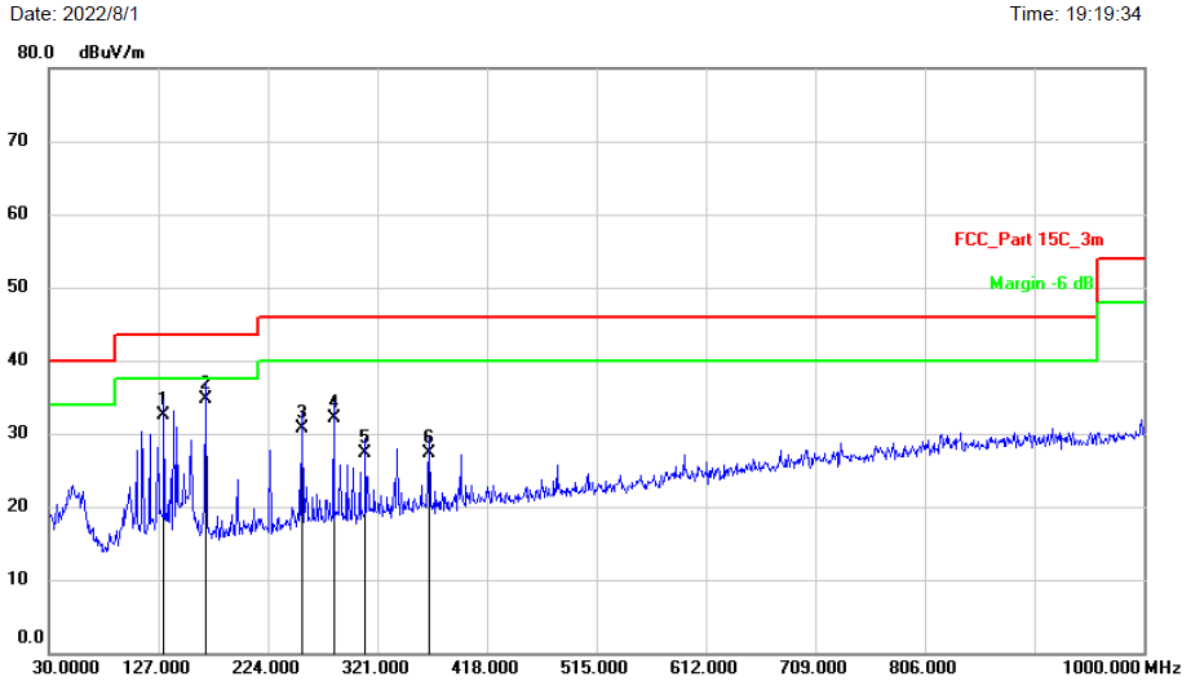


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	131.8500	48.41	-10.61	37.80	43.50	-5.70	QP	
2		168.7100	40.55	-10.05	30.50	43.50	-13.00	QP	
3		225.9400	39.34	-7.14	32.20	46.00	-13.80	QP	
4		282.2000	41.64	-5.84	35.80	46.00	-10.20	QP	
5		310.3299	35.74	-5.24	30.50	46.00	-15.50	QP	
6		508.2100	32.44	-1.64	30.80	46.00	-15.20	QP	

Note: Below 30MHz, the emissions are lower than 20dB below the allowable limit.

M/N: AARD100043854	Testing Voltage: AC 120V/60Hz
Polarization: Vertical	Detector: QP
Test Mode: 1(the worst case)	Distance: 3m

Radiated Emission Measurement



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		131.8500	43.81	-11.31	32.50	43.50	-11.00	QP	
2	*	168.7100	45.15	-10.35	34.80	43.50	-8.70	QP	
3		254.0700	38.08	-7.28	30.80	46.00	-15.20	QP	
4		282.2000	39.04	-6.84	32.20	46.00	-13.80	QP	
5		310.3299	33.54	-6.24	27.30	46.00	-18.70	QP	
6		366.5900	32.33	-4.93	27.40	46.00	-18.60	QP	

Note: Below 30MHz, the emissions are lower than 20dB below the allowable limit.

Modulation: 8DPSK(the worst case)				Test Result: PASS			Test frequency range: 1-25GHz			
Freq. (MHz)	Ant. Pol. (H/V)	Reading Level(dBuV)		Factor (dB/m)	Emission Level (dBuV/m)		Limit 3m (dBuV/m)		Margin (dB)	
		PK	AV		PK	AV	PK	AV	PK	AV
Operation Mode: TX Mode (Low)										
4804	V	45.84	31.26	6.30	52.14	37.56	74.00	54.00	-21.86	-16.44
7206	V	45.16	30.93	10.44	55.60	41.37	74.00	54.00	-18.40	-12.63

4804	H	46.02	31.18	6.30	52.32	37.48	74.00	54.00	-21.68	-16.52
7206	H	45.21	30.91	10.44	55.65	41.35	74.00	54.00	-18.35	-12.65

Operation Mode: TX Mode (Mid)										
4882	V	45.32	30.46	6.60	51.92	37.06	74.00	54.00	-22.08	-16.94
7323	V	45.78	30.63	10.55	56.33	41.18	74.00	54.00	-17.67	-12.82

4882	H	45.99	30.73	6.60	52.59	37.33	74.00	54.00	-21.41	-16.67
7323	H	45.93	30.51	10.55	56.48	41.06	74.00	54.00	-17.52	-12.94

Operation Mode: TX Mode (High)										
4960	V	44.31	30.73	6.89	51.20	37.62	74.00	54.00	-22.80	-16.38
7440	V	44.59	30.36	10.60	55.19	40.96	74.00	54.00	-18.81	-13.04

4960	H	44.95	30.80	6.89	51.84	37.69	74.00	54.00	-22.16	-16.31
7440	H	45.09	30.48	10.60	55.69	41.08	74.00	54.00	-18.31	-12.92

Spurious Emission in restricted band:										
2390.000	V	50.98	38.18	0.13	51.11	38.31	74.00	54.00	-22.89	-15.69
2390.000	H	53.13	38.41	0.13	53.26	38.54	74.00	54.00	-20.74	-15.46
2483.500	V	54.70	41.55	0.34	55.04	41.89	74.00	54.00	-18.96	-12.11
2483.500	H	56.13	42.46	0.34	56.47	42.80	74.00	54.00	-17.53	-11.20

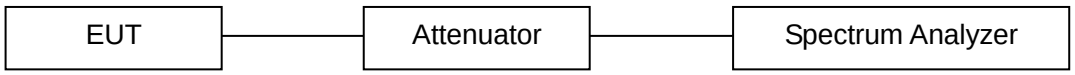
Remark: Data of measurement within this frequency range shown “---” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits.

13.3 Channel Separation test

LIMIT

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.

BLOCK DIAGRAM OF TEST SETUP



TEST PROCEDURES

a. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

b. Set to the maximum power setting and enable the EUT transmit continuously.

c. Enable the EUT hopping function.

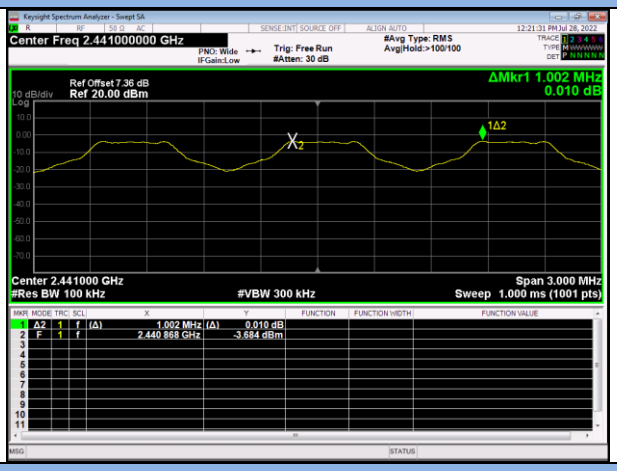
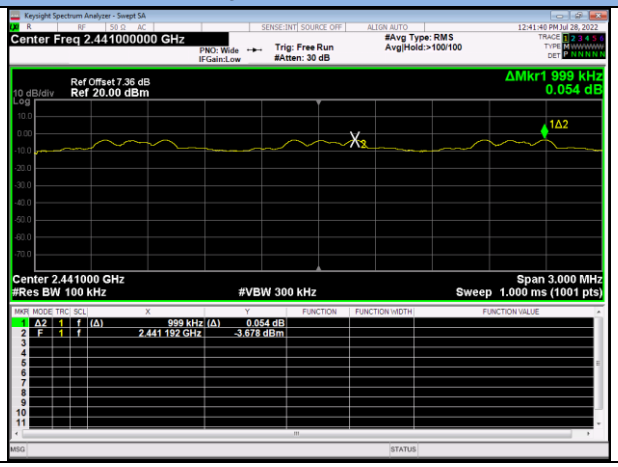
d. Set spectrum analyzer and perform testing according to ANSI C63.10-2013 clause 7.8.2.

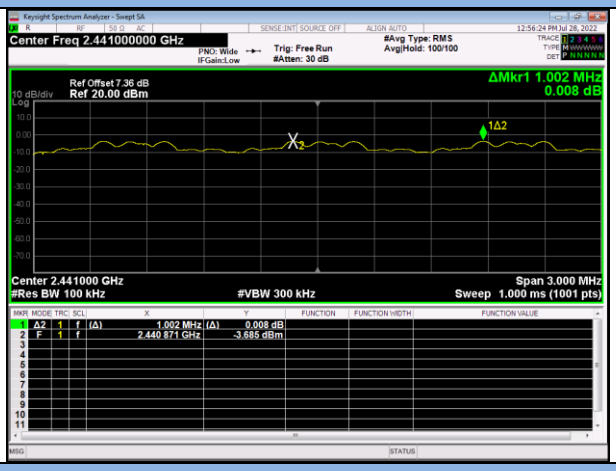
TEST RESULTS

PASS

Please refer to the following table.

Modulation	Channel	Frequency (MHz)	Hopping Separation Measurement (MHz)	Hopping Separation Limit (MHz)	Test Result
GFSK	Low	2402	1.002	>0.637	Pass
	Mid	2441	1.002	>0.637	Pass
	High	2480	1.005	>0.639	Pass
π/4-DQPSK	Low	2402	1.002	>0.856	Pass
	Mid	2441	0.999	>0.854	Pass
	High	2480	1.002	>0.869	Pass
8DPSK	Low	2402	0.996	>0.866	Pass
	Mid	2441	1.002	>0.866	Pass
	High	2480	0.999	>0.865	Pass

GFSK / Low Channel	GFSK / Mid Channel
	
GFSK / High Channel	**π/4-DQPSK / Low Channel**
	
π/4-DQPSK / Mid Channel	**π/4-DQPSK / High Channel**
	

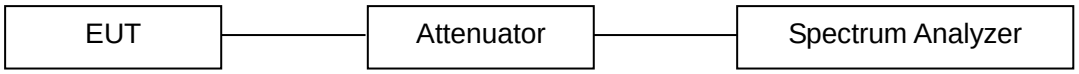
8DPSK / Low Channel	8DPSK / Mid Channel
	
8DPSK / High Channel	**---**
	Blank

13.4 20dB Bandwidth

LIMIT

N/A

BLOCK DIAGRAM OF TEST SETUP



TEST PROCEDURES

a. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

b. Set to the maximum power setting and enable the EUT transmit continuously.

c. Set spectrum analyzer and perform testing according to ANSI C63.10-2013 clause 6.9.2.

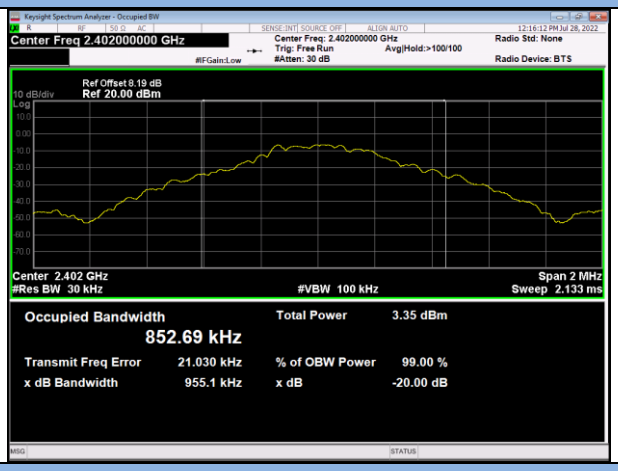
TEST RESULTS

PASS

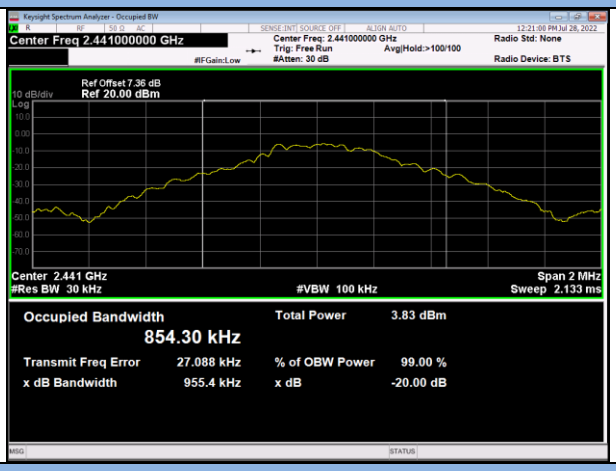
Please refer to the following table.

Modulation	Channel	Frequency (MHz)	20dB Measurement (MHz)	Limit (MHz)	Remark
GFSK	Low	2402	0.955	---	Reporting only
	Mid	2441	0.955	---	
	High	2480	0.958	---	
π/4-DQPSK	Low	2402	1.284	---	
	Mid	2441	1.282	---	
	High	2480	1.303	---	
8DPSK	Low	2402	1.299	---	
	Mid	2441	1.299	---	
	High	2480	1.298	---	

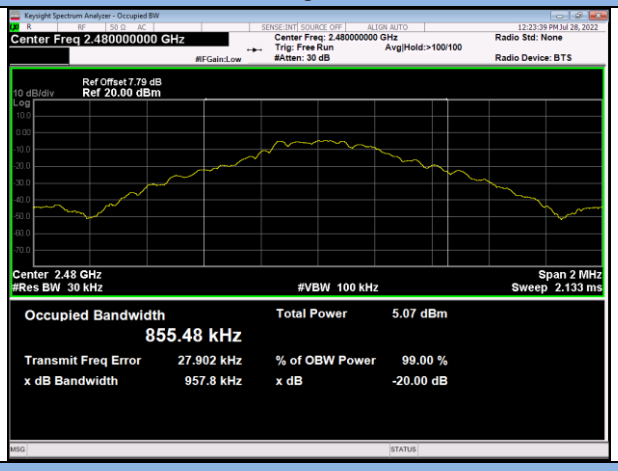
GFSK / Low Channel



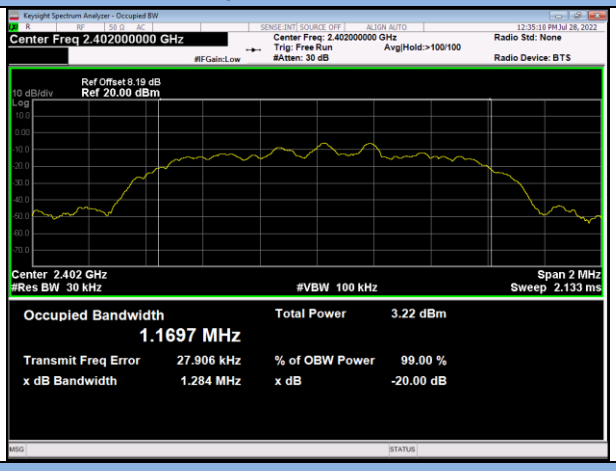
GFSK / Mid Channel



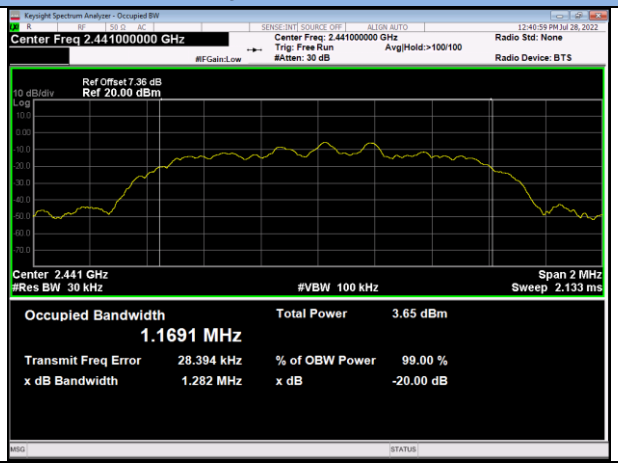
GFSK / High Channel



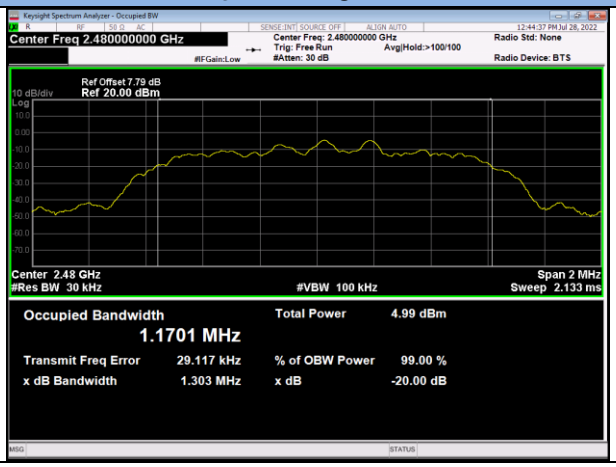
π/4-DQPSK / Low Channel

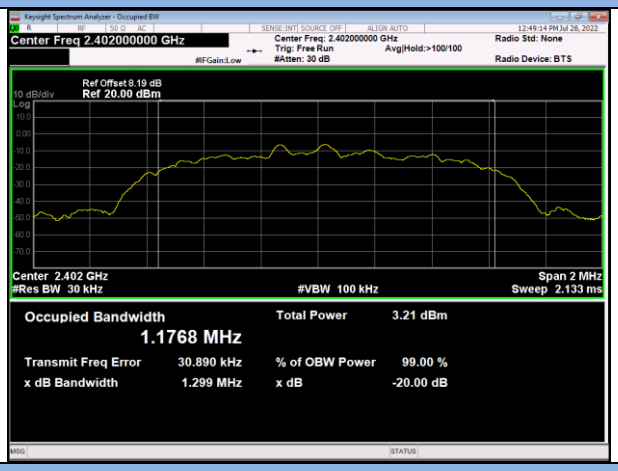
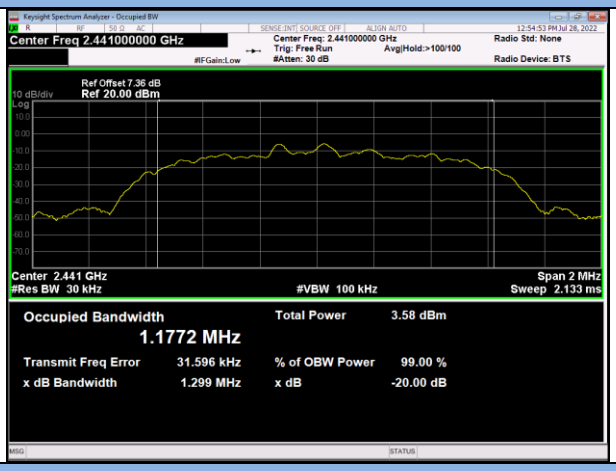
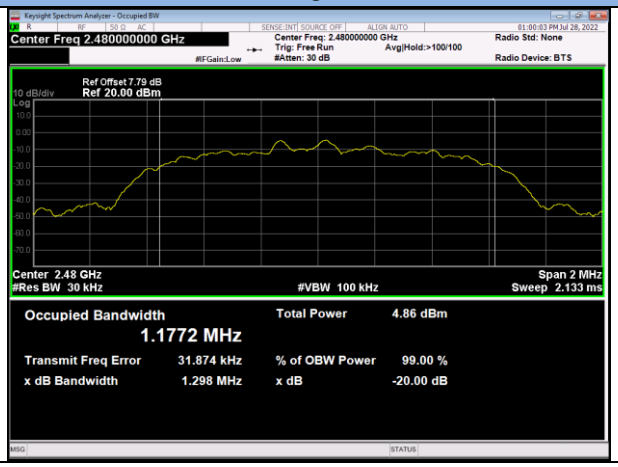


π/4-DQPSK / Mid Channel



π/4-DQPSK / High Channel



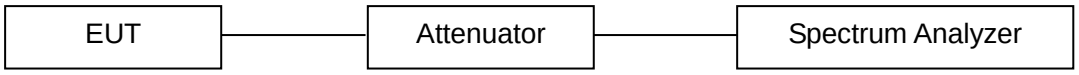
8DPSK / Low Channel	8DPSK / Mid Channel
	
8DPSK / High Channel	**---**
	Blank

13.5 Hopping Channel Number

LIMIT

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

BLOCK DIAGRAM OF TEST SETUP



TEST PROCEDURES

a. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

b. Set to the maximum power setting and enable the EUT transmit continuously.

c. Enable the EUT hopping function.

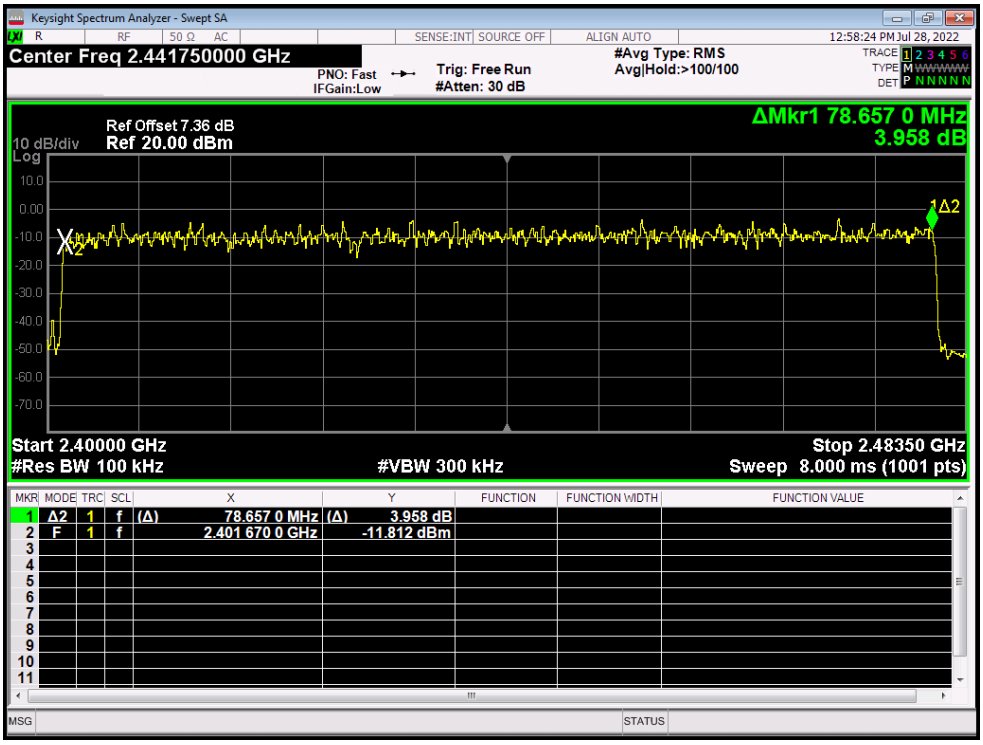
d. Set spectrum analyzer and perform testing according to ANSI C63.10-2013 clause 7.8.3.

TEST RESULTS

PASS

Please refer to the following table.

Modulation	Number of Hopping Channels Measurement	Limit	Test Result
GFSK	79	≥15	PASS
π/4-DQPSK	79	≥15	PASS
8DPSK	79	≥15	PASS
The worst case: 8DPSK			

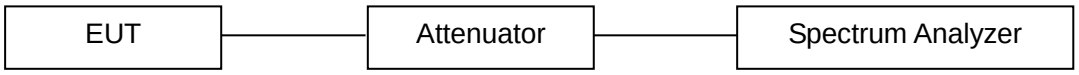


13.6 Time of Occupancy (Dwell Time)

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.

BLOCK DIAGRAM OF TEST SETUP



TEST PROCEDURES

a. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

b. Set to the maximum power setting and enable the EUT transmit continuously.

c. Enable the EUT hopping function.

d. Set spectrum analyzer and perform testing according to ANSI C63.10-2013 clause 7.8.4.

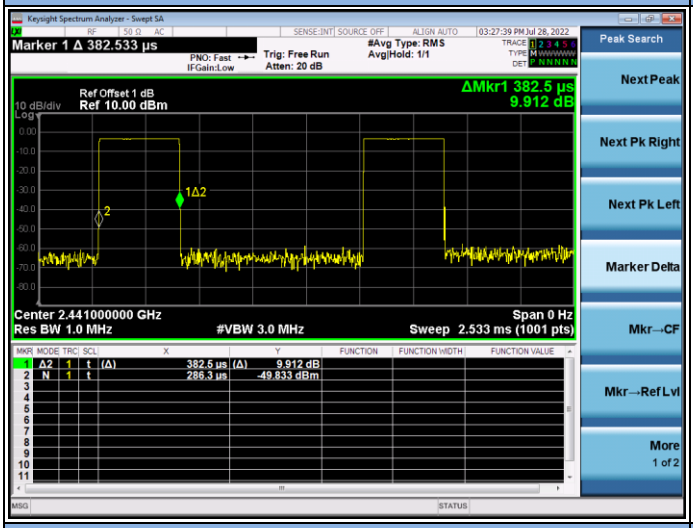
TEST RESULTS

PASS

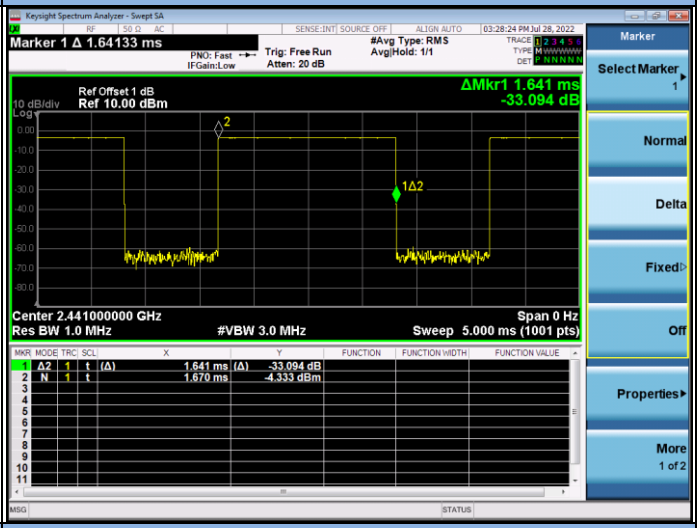
Please refer to the following table.

Modulation	Packet	Frequency (MHz)	Dwell Time Measurement (msec)	Limit (msec)	Test Result
GFSK	DH1	2441	0.383 (ms)*(1600/(2*79))*31.6= 122.56	400	Pass
	DH3	2441	1.641 (ms)*(1600/(4*79))*31.6= 262.56	400	Pass
	DH5	2441	2.889 (ms)*(1600/(6*79))*31.6= 308.16	400	Pass
π/4-DQPSK	2-DH1	2441	0.395 (ms)*(1600/(2*79))*31.6= 126.40	400	Pass
	2-DH3	2441	1.645 (ms)*(1600/(4*79))*31.6= 263.20	400	Pass
	2-DH5	2441	2.891 (ms)*(1600/(6*79))*31.6= 308.37	400	Pass
8DPSK	3-DH1	2441	0.395 (ms)*(1600/(2*79))*31.6= 126.40	400	Pass
	3-DH3	2441	1.648 (ms)*(1600/(4*79))*31.6= 263.68	400	Pass
	3-DH5	2441	2.893 (ms)*(1600/(6*79))*31.6= 308.59	400	Pass

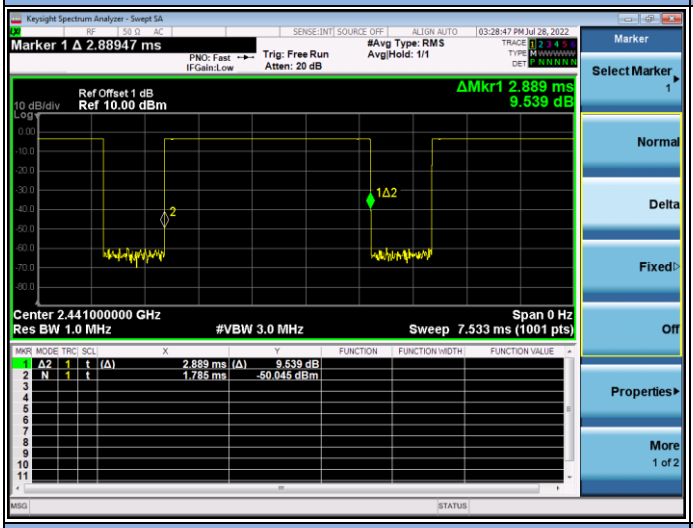
GFSK / DH1



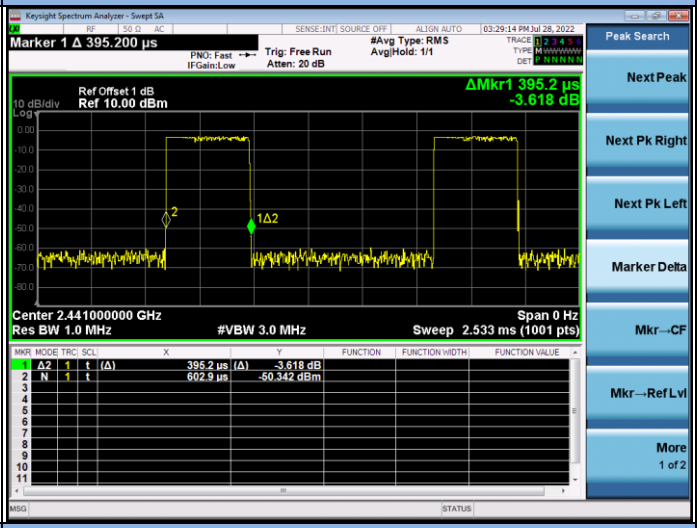
GFSK / DH3



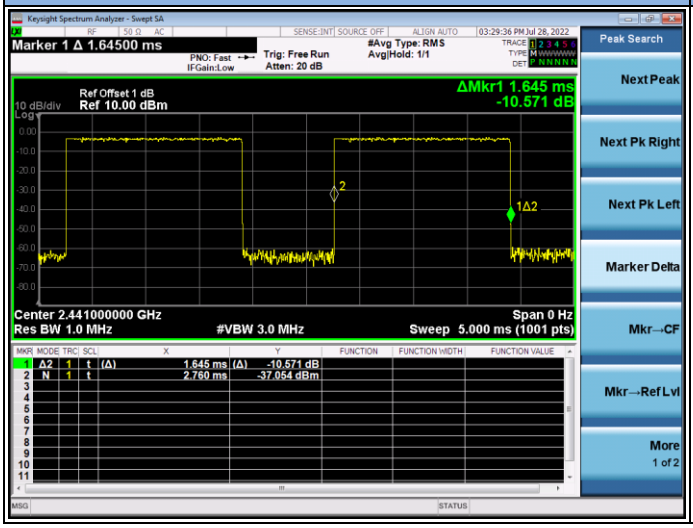
GFSK / DH5



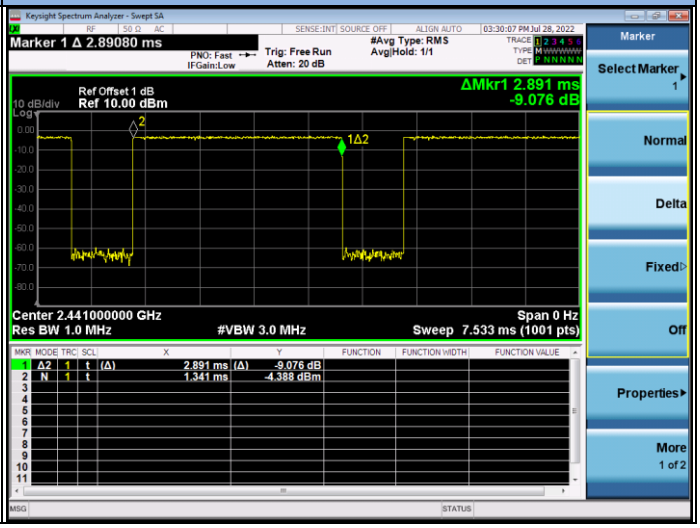
π/4-DQPSK / 2-DH1

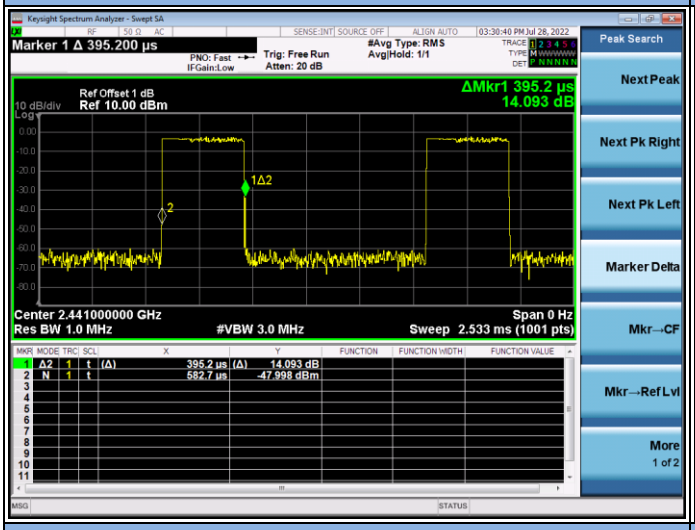
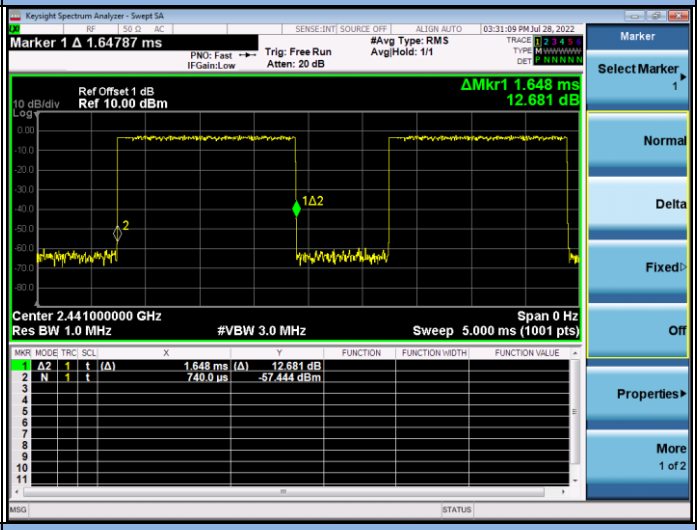
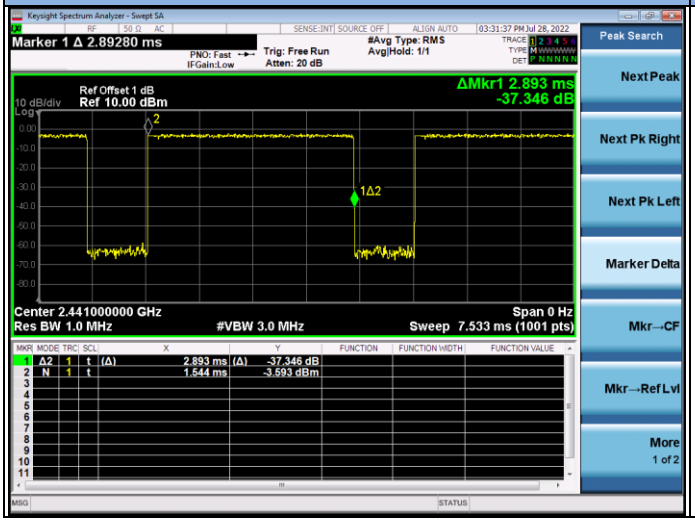


π/4-DQPSK / 2-DH3



π/4-DQPSK / 2-DH5



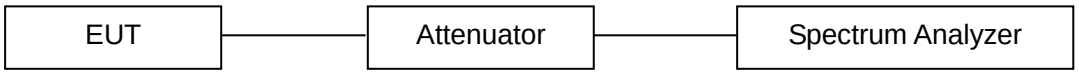
8DPSK / 3-DH1	8DPSK / 3-DH3
	
8DPSK / 3-DH5	**---**
	Blank

13.7 Maximum Peak Output Power

LIMIT

The maximum peak conducted output power of the intentional radiator shall not exceed the following: 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.

BLOCK DIAGRAM OF TEST SETUP



TEST PROCEDURES

a. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

b. Set to the maximum power setting and enable the EUT transmit continuously.

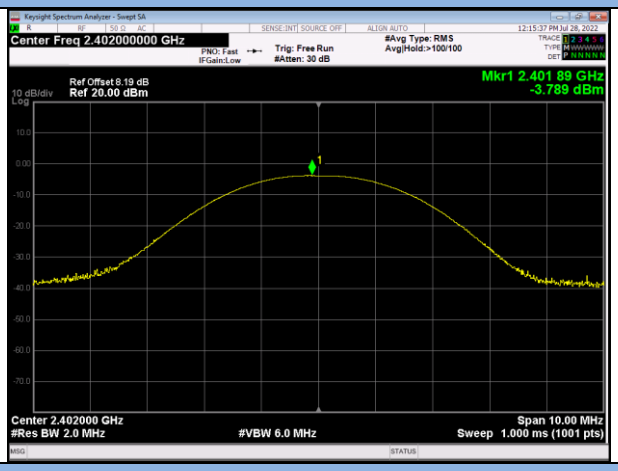
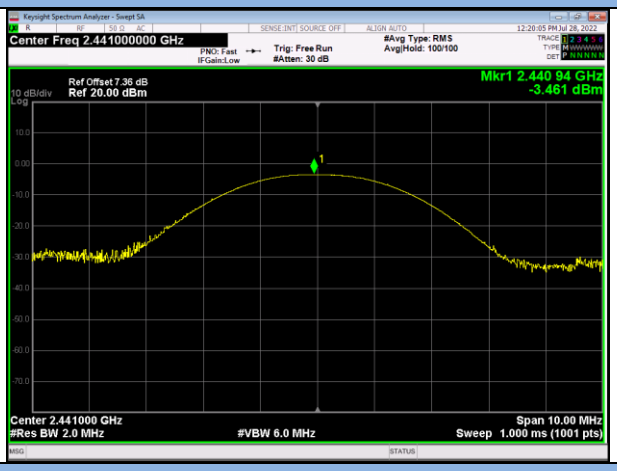
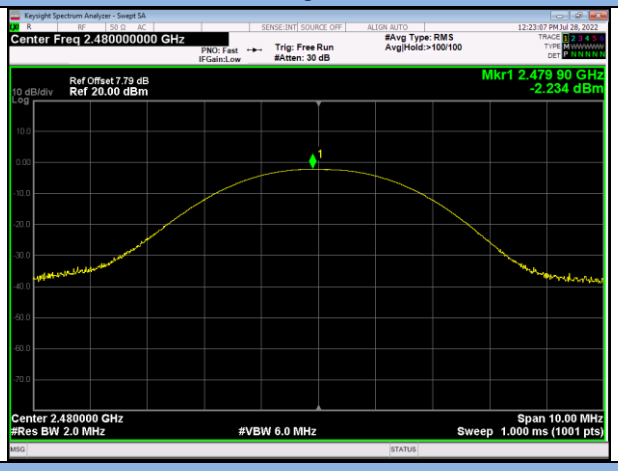
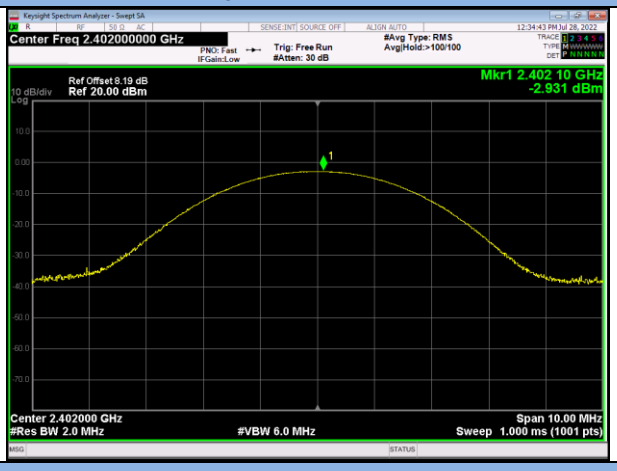
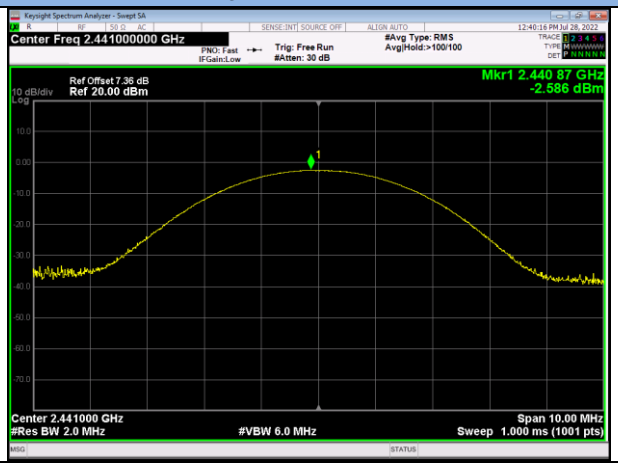
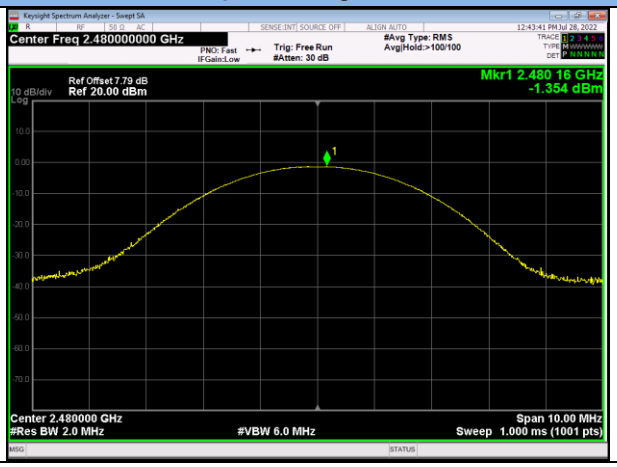
c. Set spectrum analyzer and perform testing according to ANSI C63.10-2013 clause 7.8.5.

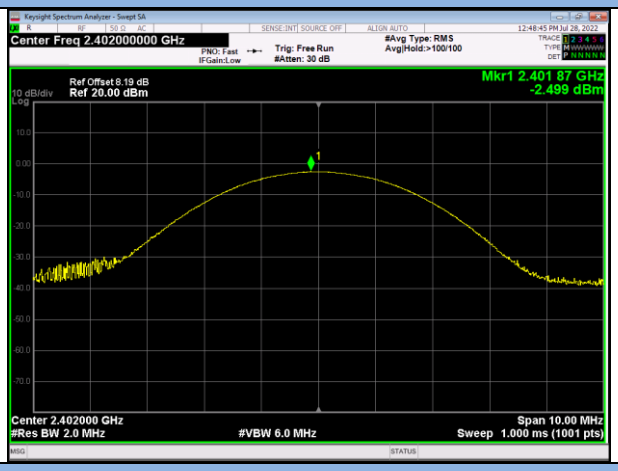
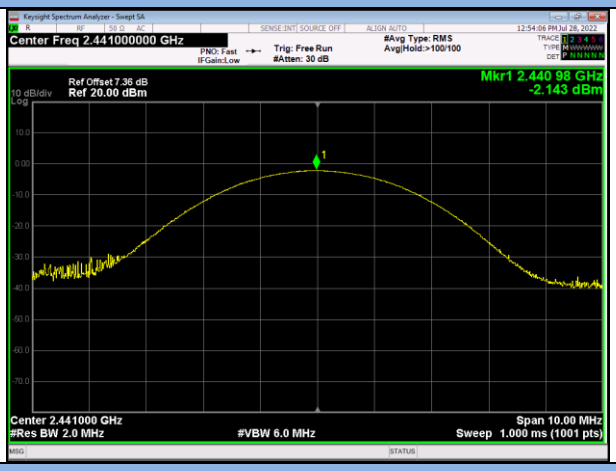
TEST RESULTS

PASS

Please refer to the following table.

Modulation	Frequency (MHz)	Peak Power output Measurement (dBm)	Peak Power output Measurement (mW)	Peak Power Limit (dBm)	Test Result
GFSK	2402.00	-3.789	0.42	21	Pass
	2441.00	-3.461	0.45	21	Pass
	2480.00	-2.234	0.60	21	Pass
π/4-DQPSK	2402.00	-2.931	0.51	21	Pass
	2441.00	-2.586	0.55	21	Pass
	2480.00	-1.354	0.73	21	Pass
8DPSK	2402.00	-2.499	0.56	21	Pass
	2441.00	-2.143	0.61	21	Pass
	2480.00	-0.897	0.81	21	Pass

GFSK / Low Channel	GFSK / Mid Channel
	
GFSK / High Channel	**π/4-DQPSK / Low Channel**
	
π/4-DQPSK / Mid Channel	**π/4-DQPSK / High Channel**
	

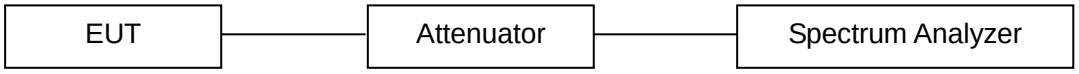
8DPSK / Low Channel	8DPSK / Mid Channel
	
8DPSK / High Channel	**---**
	Blank

13.8 Band Edge Conducted Spurious Emission Measurement

LIMIT

In any 100KHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

BLOCK DIAGRAM OF TEST SETUP



TEST PROCEDURES

a. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

b. Set to the maximum power setting and enable the EUT transmit continuously.

c. Set spectrum analyzer and perform testing according to ANSI C63.10-2013 clause 7.8.6 and 6.10.

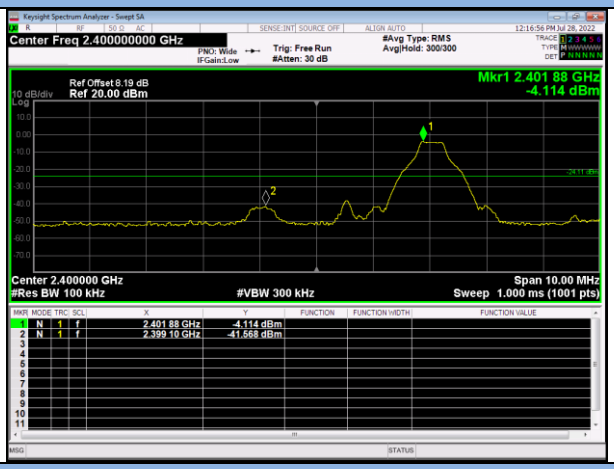
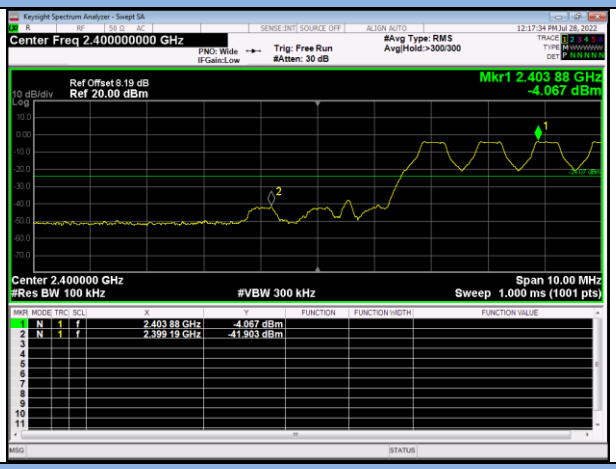
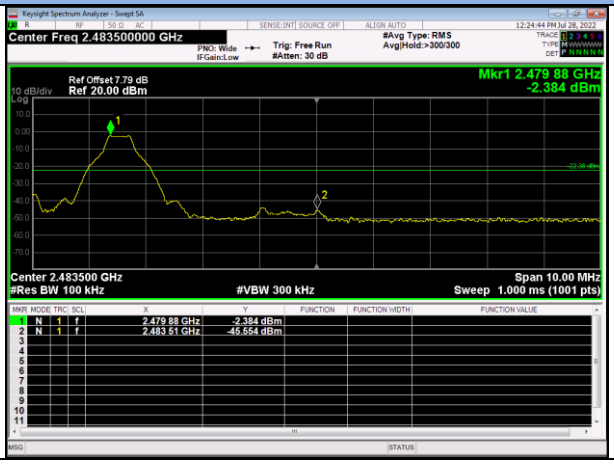
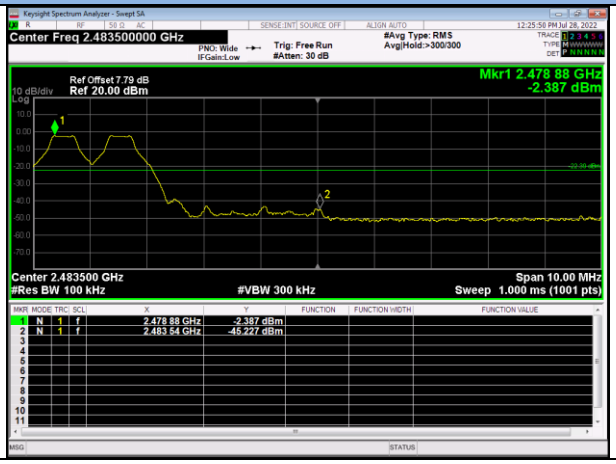
d. Enable hopping function of the EUT and then repeat steps above.

TEST RESULTS

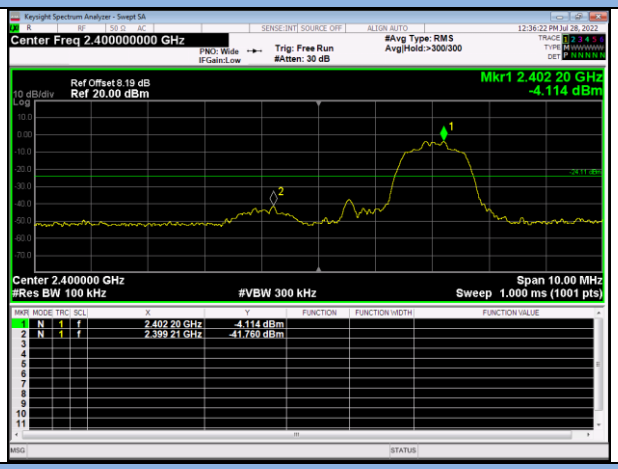
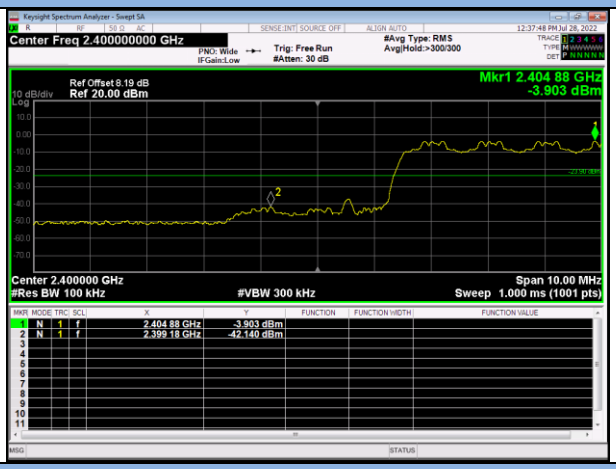
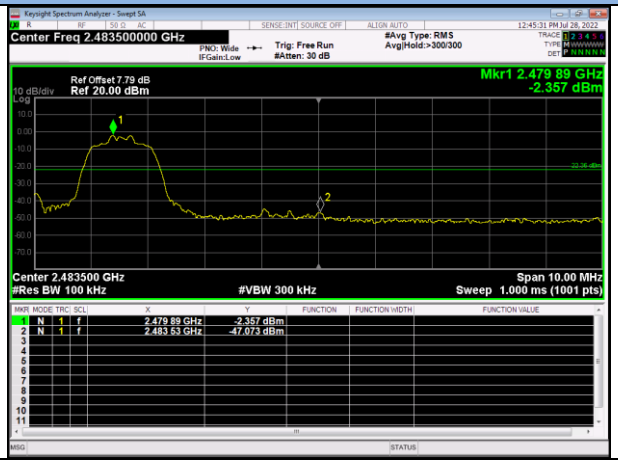
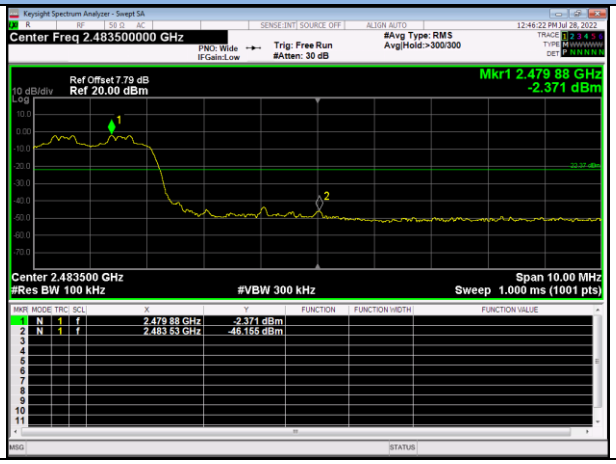
PASS

Please refer to the following test plots.

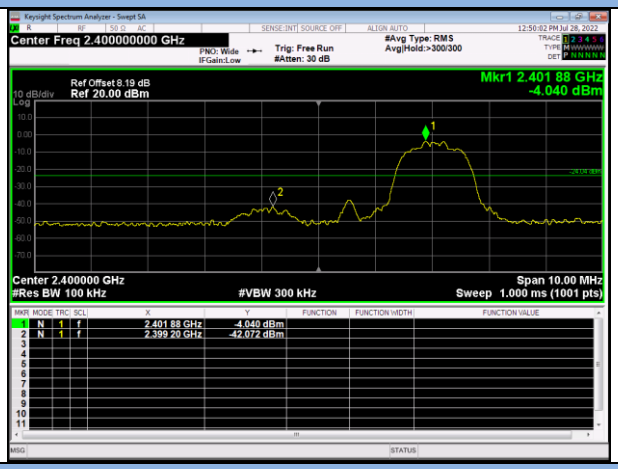
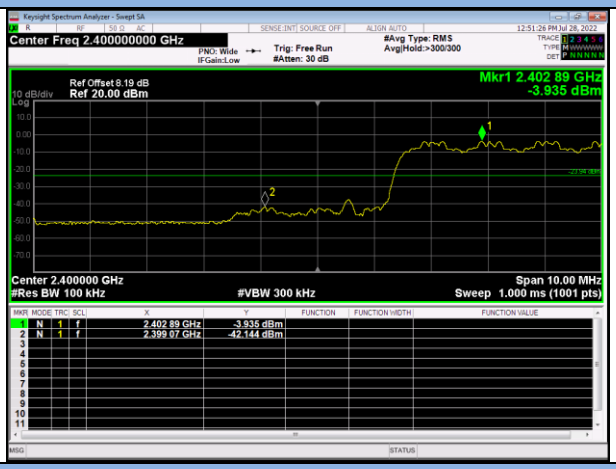
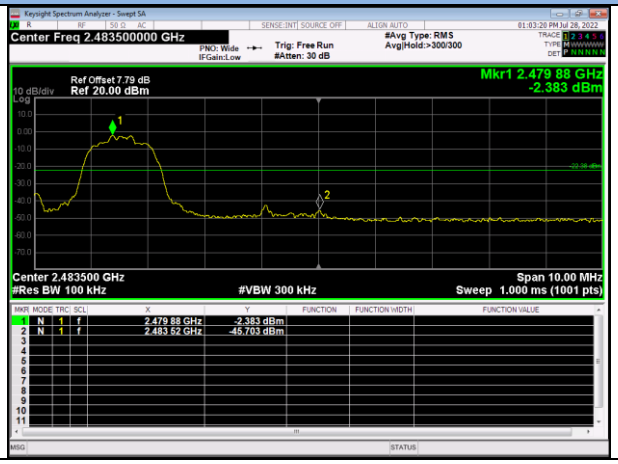
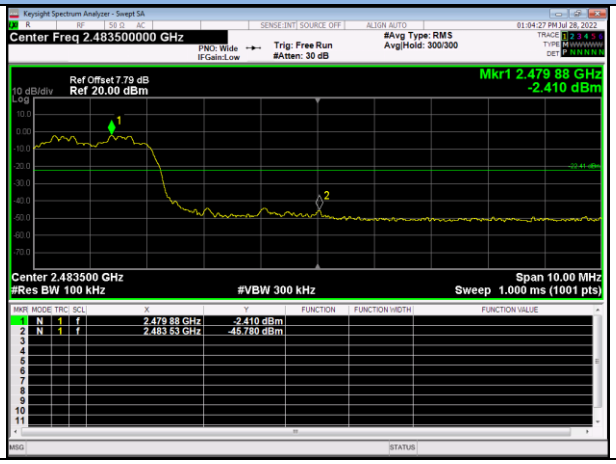
Band Edge

GFSK / Low / 2402	GFSK / Hopping
	
GFSK / High Channel / 2480	**GFSK / Hopping**
	

Band Edge

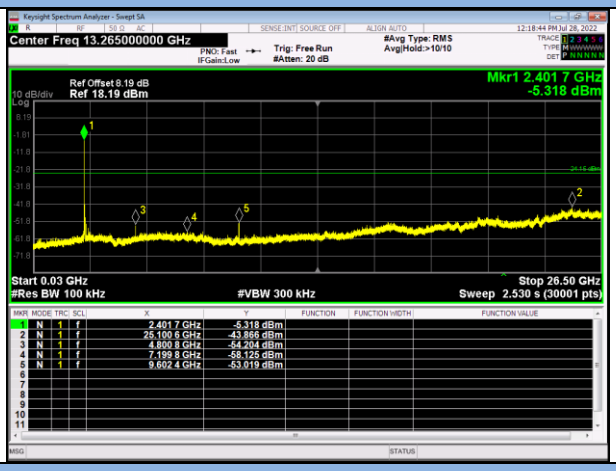
π/4-DQPSK / Low / 2402	π/4-DQPSK / Hopping
	
π/4-DQPSK / High / 2480	**π/4-DQPSK / Hopping**
	

Band Edge

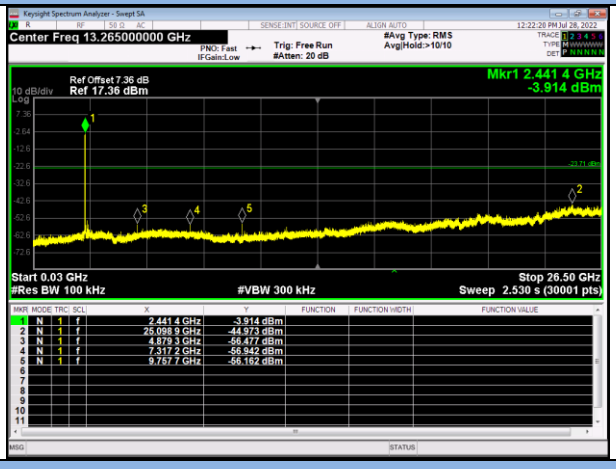
8DPSK / Low / 2402	8DPSK / Hopping
	
8DPSK / High / 2480	**8DPSK / Hopping**
	

Conducted Spurious Emission (the worst case)

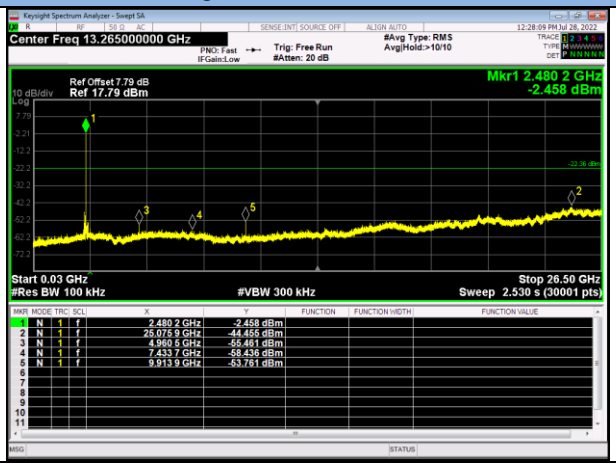
8DPSK / Low Channel / 30MHz~25GHz



8DPSK / Mid Channel / 30MHz~25GHz



8DPSK / High Channel / 30MHz~25GHz



13.9 Antenna Requirement

STANDARD APPLICABLE

According to of FCC part 15C section 15.203 and 15.247:

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.

ANTENNA CONNECTED CONSTRUCTION

The antenna is PCB antenna that no antenna other than furnished by the responsible party shall be used with the device, and the best case gain of the antenna is 0 dBi, Therefore, the antenna is considered to meet the requirement.

14. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schwarz	ESCI7	100837	Mar. 13, 2022	1 Year
2.	Antenna	Schwarzbeck	VULB9162	9162-010	Mar. 23, 2022	2 Year
3.	Spectrum Analyzer	Rohde & Schwarz	FSU26	200409/026	Mar. 13, 2022	1 Year
4.	Spectrum Analyzer	Keysight	N9020A	MY54200831	Mar. 13, 2022	1 Year
5.	Spectrum Analyzer	Rohde & Schwarz	FSV40	101094	Mar. 13, 2022	1 Year
6.	Horn Antenna	Schwarzbeck	BBHA9170	9170-172	Mar. 23, 2022	2 Year
7.	Power Sensor	DARE	RPR3006W	15I00041SNO 64	Mar. 13, 2022	1 Year
8.	Horn Antenna	COM-Power	AH-118	071078	Mar. 23, 2022	2 Year
9.	Pre-Amplifier	HP	HP 8449B	3008A00964	Mar. 13, 2022	1 Year
10.	Pre-Amplifier	HP	HP 8447D	1145A00203	Mar. 13, 2022	1 Year
11.	Loop Antenna	Schwarzbeck	FMZB 1513	1513-272	Mar. 23, 2022	2 Year
12.	Test Receiver	Rohde & Schwarz	ESCI	101152	Mar. 13, 2022	1 Year
13.	L.I.S.N	Rohde & Schwarz	ENV 216	101317	Mar. 13, 2022	1 Year
14.	RF Switching Unit	Compliance Direction Systems Inc.	RSU-M2	38311	Mar. 13, 2022	1 Year
15.	Temporary antenna connector	TESCOM	SS402	N/A	N/A	N/A
16.	Test Software	EZ	EZ_EMC, NTC-3A1.1	N/A	N/A	N/A

Note: For photographs of EUT and measurement, please refer to appendix in separate documents.

---End---