

Note: (1) All Readings are Peak Value and AV.

(2) Emission Level= Reading Level + Factor

(3) Factor= Antenna Gain + Cable Loss – Amplifier Gain

(4) 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, therefore, than 20 dB below the limit do no reported.

(5) Measurement uncertainty: ± 3.7 dB.

(6) Horn antenna used for the emission over 1000MHz.

6. CHANNEL SEPARATION
6.1 Measurement Procedure

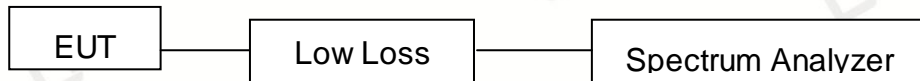
Minimum Hopping Channel Carrier Frequency Separation, FCC Rule 15.247(a)(1):

Connect EUT antenna terminal to the spectrum analyzer with a low loss cable, and using the Marker and Max-Hold function to record the separation of two adjacent channels.

6.2 Limit

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.

6.3 Test SET-UP (Block Diagram of Configuration)



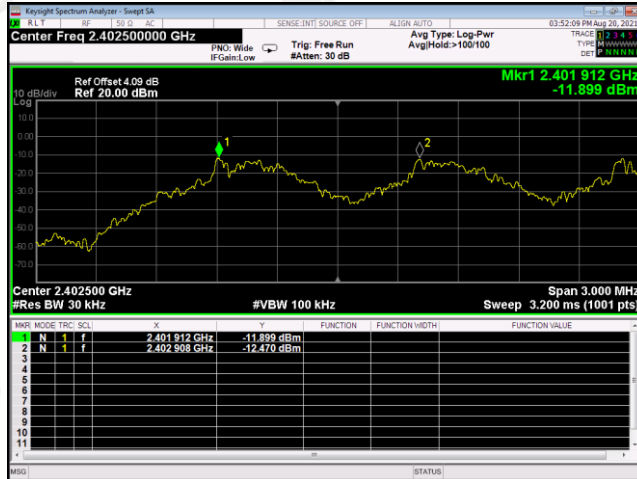
6.4 Measurement Results

Refer to attached data chart.

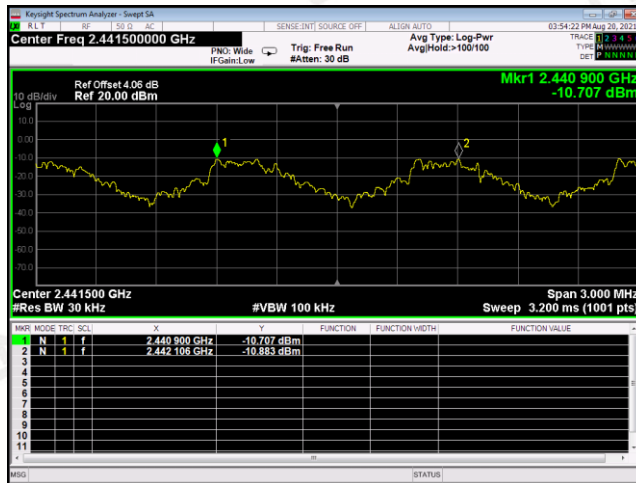
RBW:	30kHz	Temperature:	24 °C
VBW:	100kHz	Humidity:	52 %
Spectrum Detector:	PK	Test By:	Bob
Packet:	DH1, 2DH1, 3DH1(Worst case)	Test Date:	August 20, 2021
Test Result:	PASS		

Channel	Test Frequency (MHz)	Separation Read Value (MHz)	Separation Limit 2/3 20dB Bandwidth (kHz)
GFSK			
Lowest	2402	0.996	>578.0
Middle	2441	1.206	>596.0
Highest	2480	1.008	>588.7
$\pi/4$-DQPSK			
Lowest	2402	1.197	>866.0
Middle	2441	1.287	>832.7
Highest	2480	1.011	>855.3
8DPSK			
Lowest	2402	0.999	>805.3
Middle	2441	0.993	>804.7
Highest	2480	1.002	>805.3

GFSK Lowest Channel



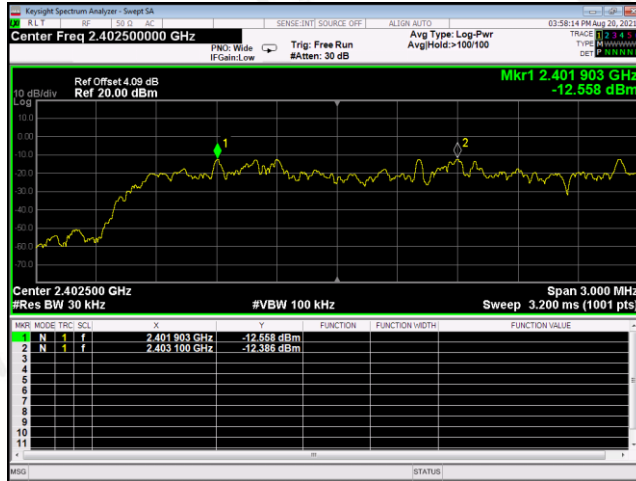
GFSK Middle Channel



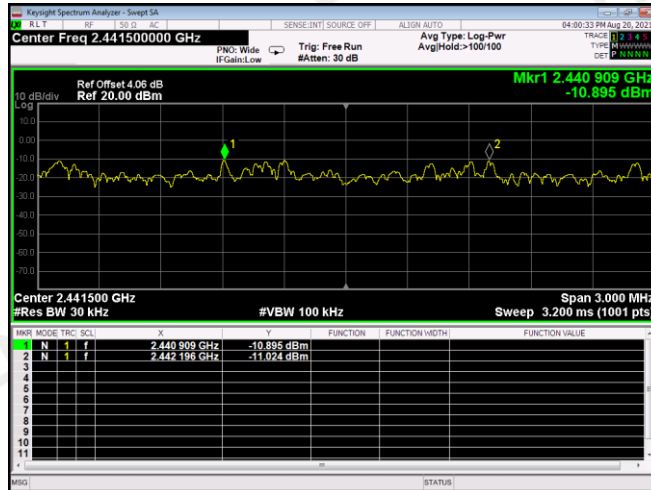
GFSK Highest Channel



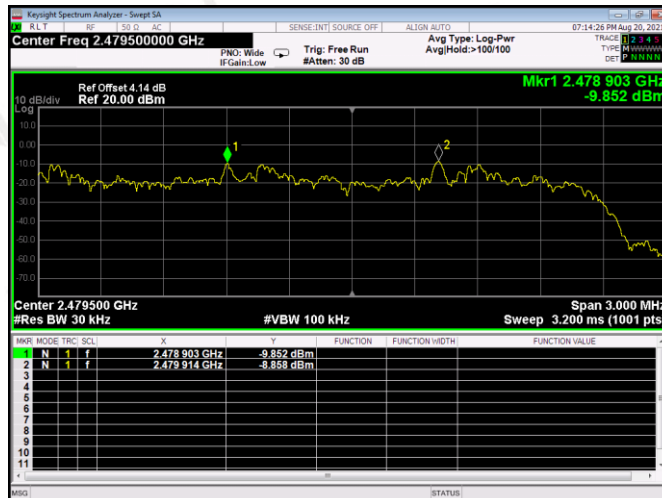
$\pi/4$ -DQPSK Lowest Channel



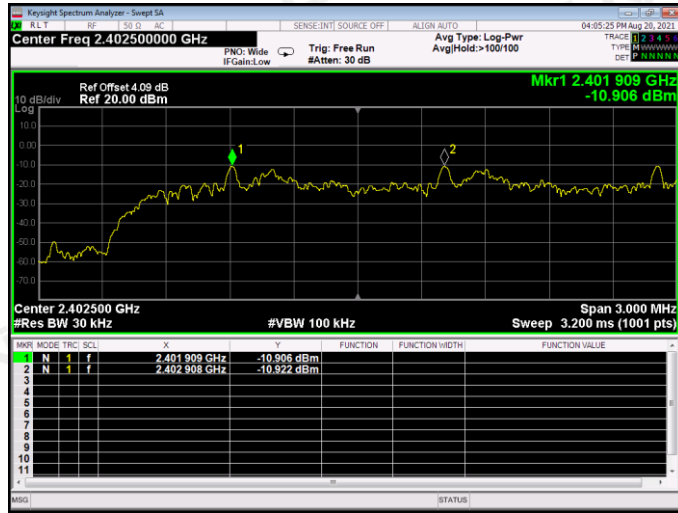
$\pi/4$ -DQPSK Middle Channel



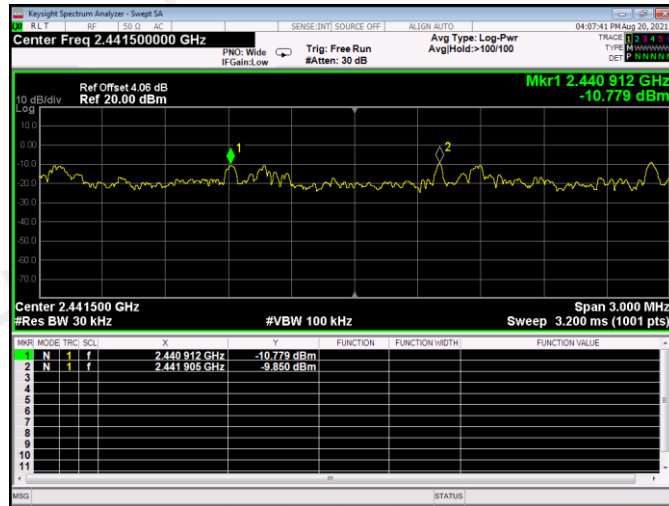
$\pi/4$ -DQPSK Highest Channel



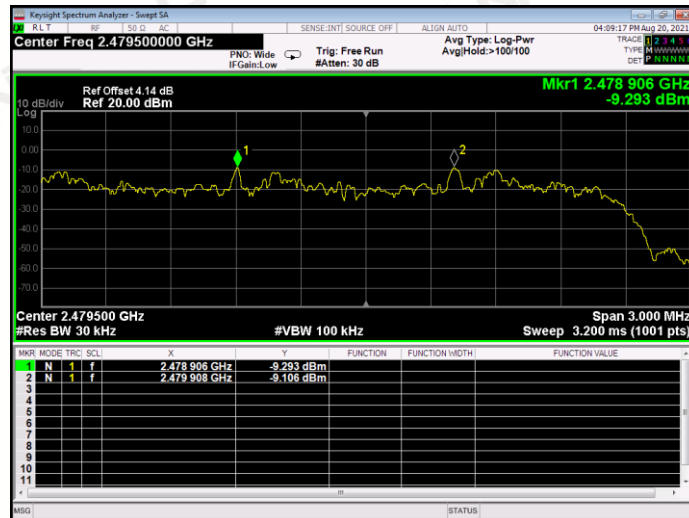
8DPSK Lowest Channel



8DPSK Middle Channel



8DPSK Highest Channel



7. 20B BANDWIDTH

7.1 Measurement Procedure

Maximum 20dB RF Bandwidth, FCC Rule 15.247(a)(1):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW was chosen so that the display was a result of the hopping channel modulation. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. Use the spectrum 20dB down delta function to measure the bandwidth.

7.2 Test SET-UP (Block Diagram of Configuration)



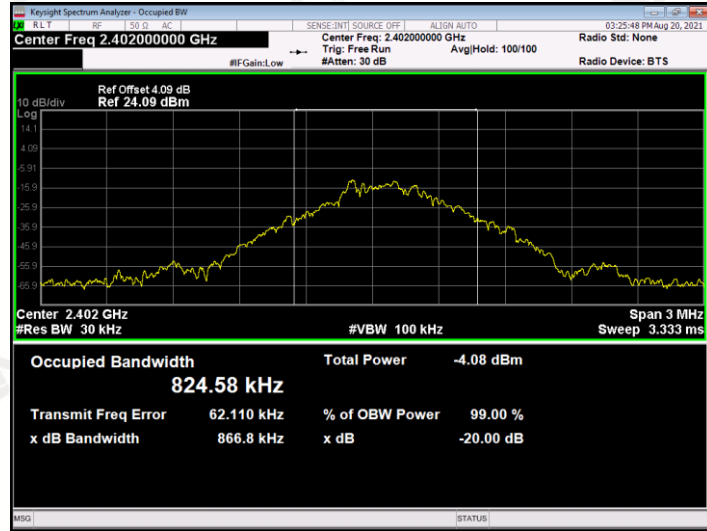
7.3 Measurement Results

Refer to attached data chart.

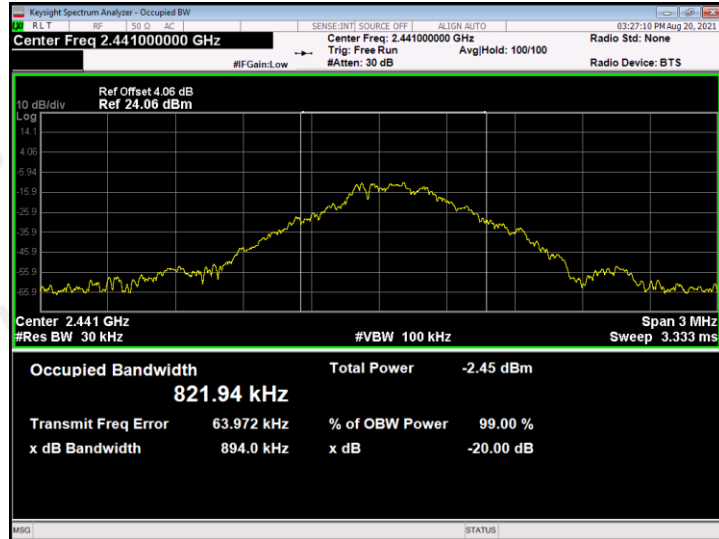
RBW:	30kHz	Temperature:	24 °C
VBW:	100kHz	Humidity:	52 %
Spectrum Detector:	PK	Test By:	Bob
Packet:	DH1, 2DH1, 3DH1(Worst case)	Test Date:	September 1, 2021
Test Result:	PASS		

Channel	Test Frequency (MHz)	20dB BANDWIDTH(MHz)
GFSK		
Lowest	2402	0.867
Middle	2441	0.894
Highest	2480	0.883
$\pi/4$-DQPSK		
Lowest	2402	1.299
Middle	2441	1.249
Highest	2480	1.283
8DPSK		
Lowest	2402	1.208
Middle	2441	1.207
Highest	2480	1.208

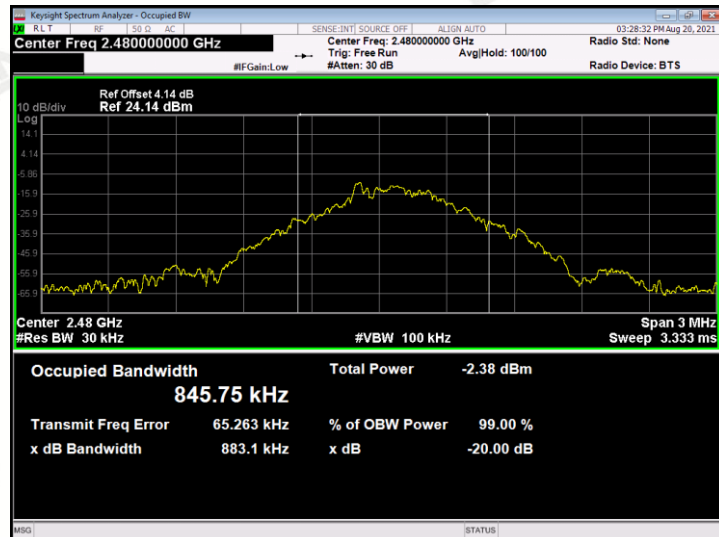
GFSK Lowest Channel



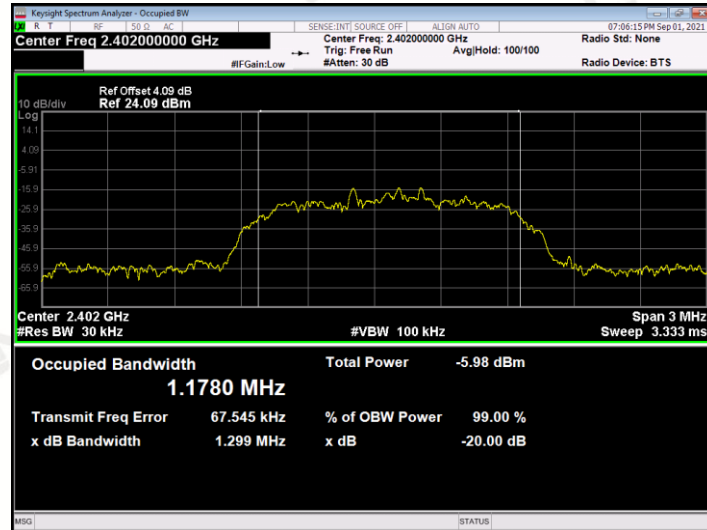
GFSK Middle Channel



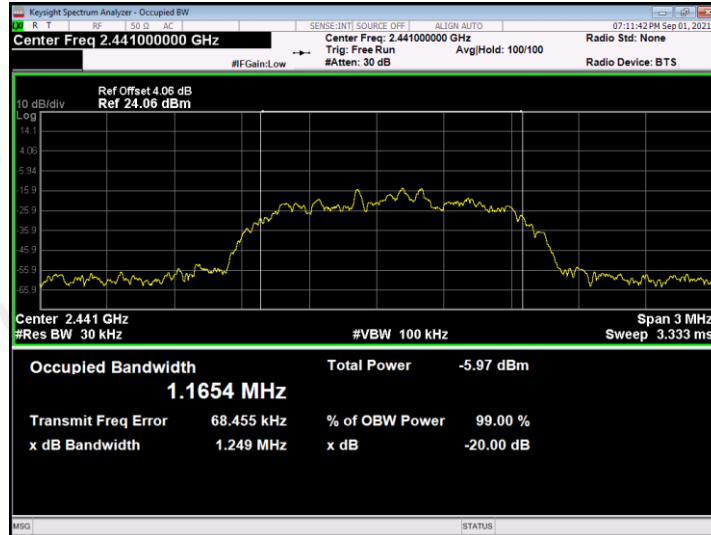
GFSK Highest Channel



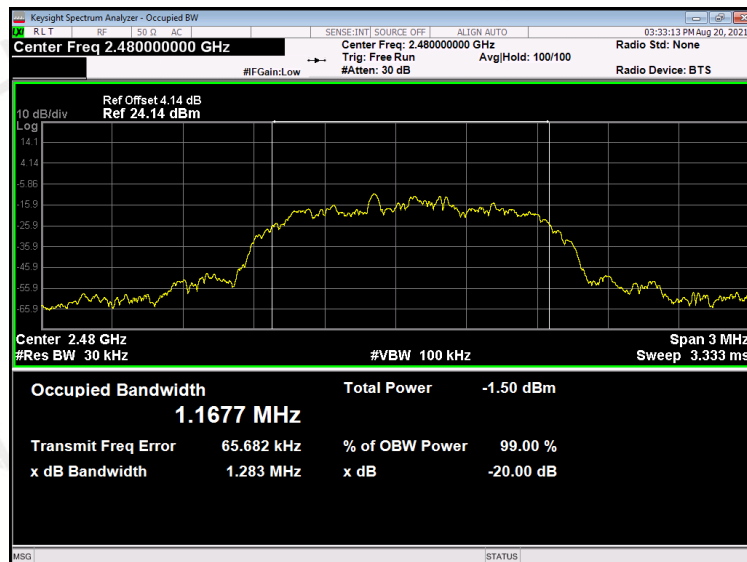
$\pi/4$ -DQPSK Lowest Channel



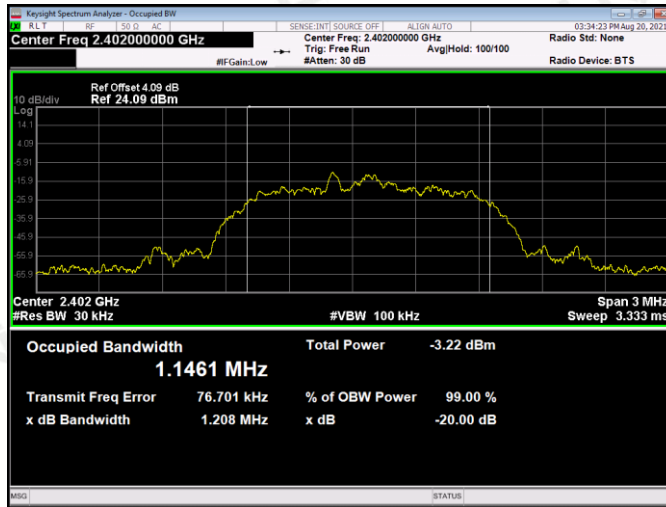
$\pi/4$ -DQPSK Middle Channel



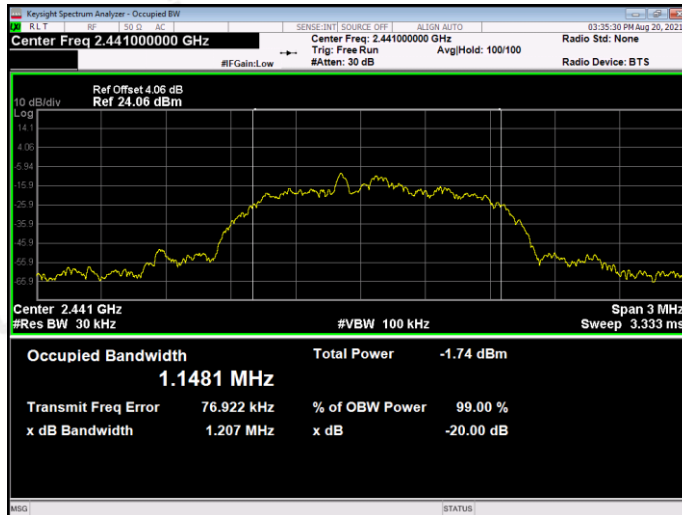
$\pi/4$ -DQPSK Highest Channel



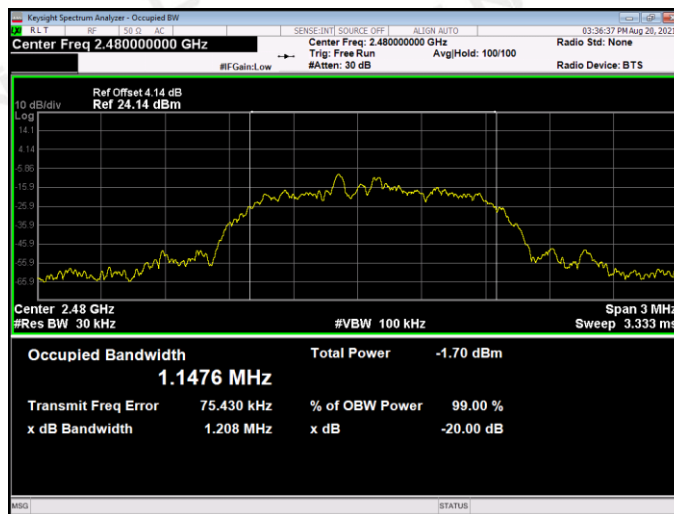
8DPSK Lowest Channel



8DPSK Middle Channel



DPSK Highest Channel



8. HOPPING CHANNEL NUMBER

8.1 Measurement Procedure

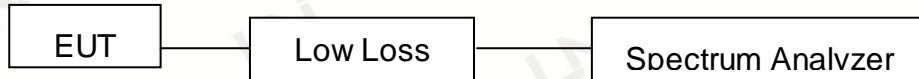
Minimum Number of Hopping Frequencies, FCC Rule 15.247(a)(1)(iii):

Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, and the spectrum analyzer set to MAX HOLD readings were taken for 3-5 minutes. The channel peaks so recorded were added together, and the total number compared to the minimum number of channels required in the regulation.

8.2 Limit

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

8.3 Test SET-UP (Block Diagram of Configuration)

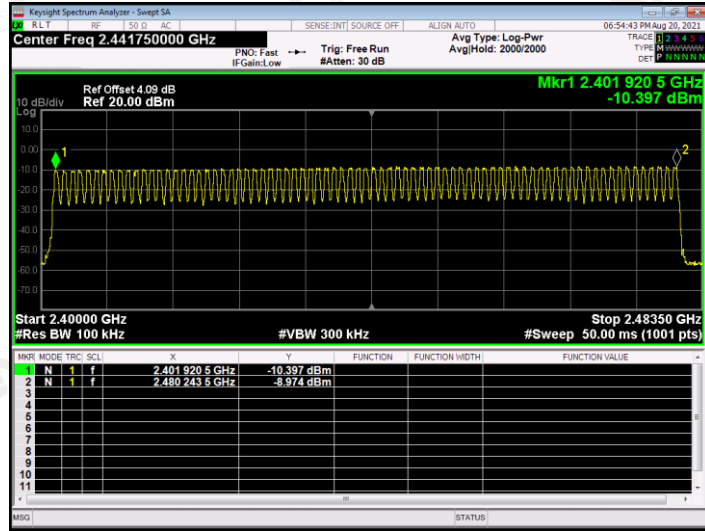


8.4 Measurement Results

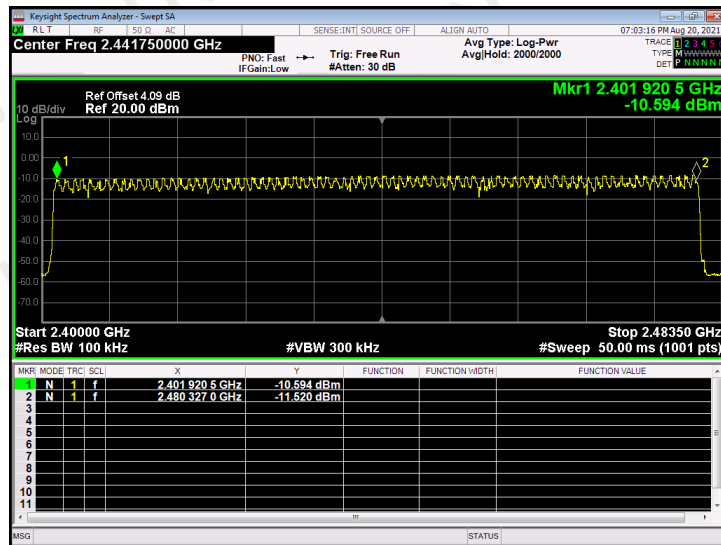
RBW:	100kHz	Temperature:	24 °C
VBW:	300kHz	Humidity:	52 %
Spectrum Detector:	PK	Test By:	Bob
Packet:	DH1, 2DH1, 3DH1(Worst case)	Test Date:	August 20, 2021
Test Result:	PASS		

Hopping Channel Frequency Range	Number of Hopping Channels	Limit
2400-2483.5	79	≥15

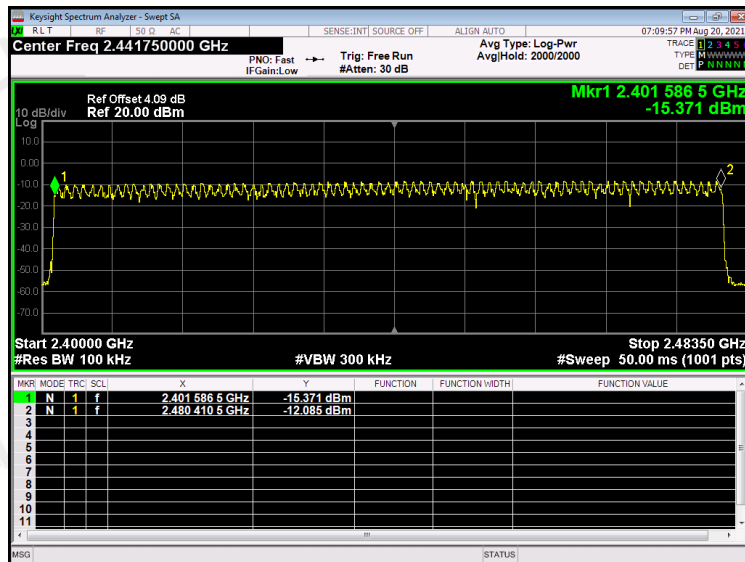
GFSK



$\pi/4$ -DQPSK



8DPSK



9. TIME OF OCCUPANCY (DWEELL TIME)

9.1 Measurement Procedure

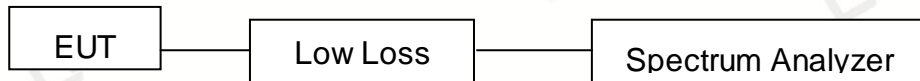
Average Channel Occupancy Time, FCC Ref:15.247(a)(1)(iii):

Connect EUT antenna terminal to the spectrum analyzer with a low loss cable. The spectrum analyzer center frequency was set to one of the known hopping channels. The Sweep was set to 10 ms, the SPAN was set to Zero SPAN. The time duration of the transmissions so captured was measured with the Marker Delta function

9.2 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.

9.3 Test SET-UP (Block Diagram of Configuration)



9.4 Measurement Results

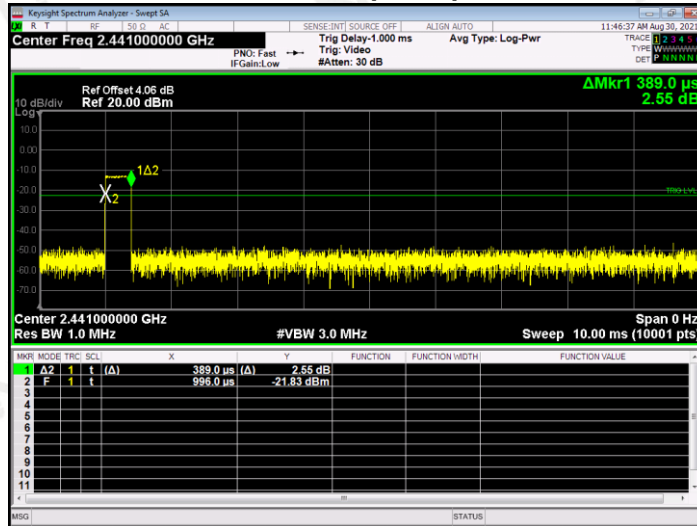
Refer to attached data chart.

The maximum number of hopping channels in 31.6s (0.4s/Channel x 79 Channel)

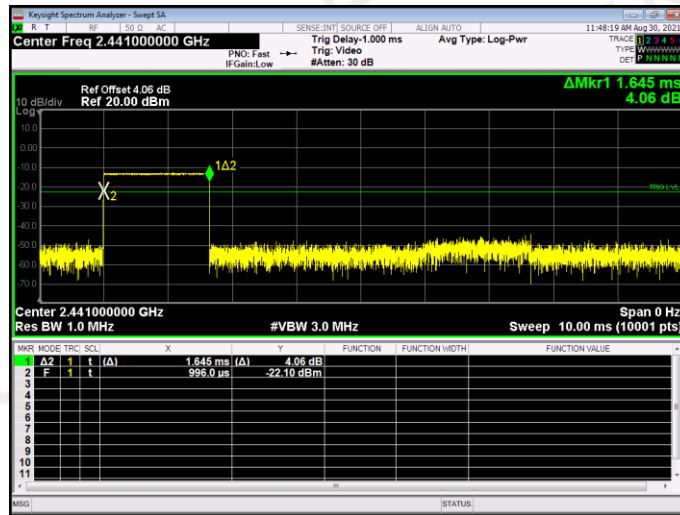
RBW:	1MHz	Temperature:	24 °C
VBW:	3MHz	Humidity:	52 %
Spectrum Detector:	PK	Test By:	Bob
Test Result:	PASS	Test Date:	August 20, 2021

Packet	Frequency (MHz)	Result (msec)			Limit (msec)
GFSK					
DH1	2441	0.389	$(ms) * (1600 / (2 * 79)) * 31.6 =$	124.48	400
DH3	2441	1.645	$(ms) * (1600 / (4 * 79)) * 31.6 =$	263.2	400
DH5	2441	2.893	$(ms) * (1600 / (6 * 79)) * 31.6 =$	308.587	400
$\pi/4$-DQPSK					
2-DH1	2441	0.398	$(ms) * (1600 / (2 * 79)) * 31.6 =$	127.36	400
2-DH3	2441	1.646	$(ms) * (1600 / (4 * 79)) * 31.6 =$	263.36	400
2-DH5	2441	2.894	$(ms) * (1600 / (6 * 79)) * 31.6 =$	308.693	400
8DPSK					
3-DH1	2441	0.4	$(ms) * (1600 / (2 * 79)) * 31.6 =$	128	400
3-DH3	2441	1.649	$(ms) * (1600 / (4 * 79)) * 31.6 =$	263.84	400
3-DH5	2441	2.901	$(ms) * (1600 / (6 * 79)) * 31.6 =$	309.44	400

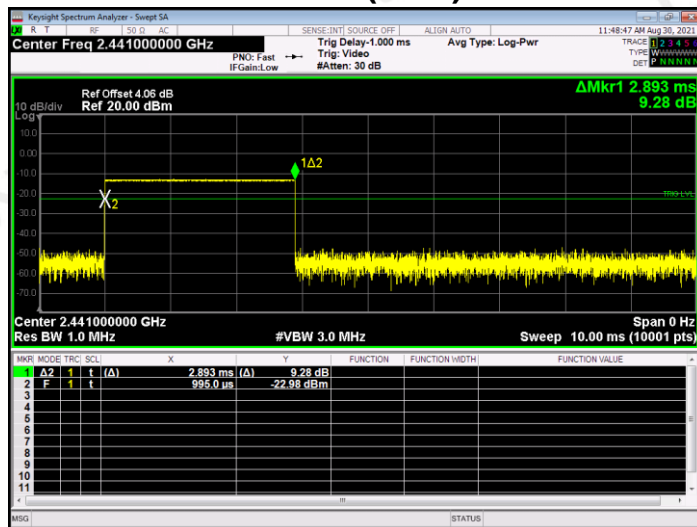
GFSK (DH1)



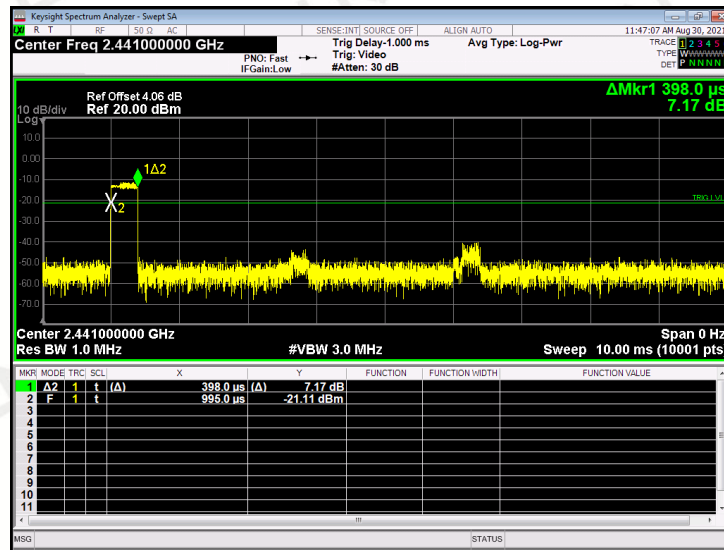
GFSK (DH3)



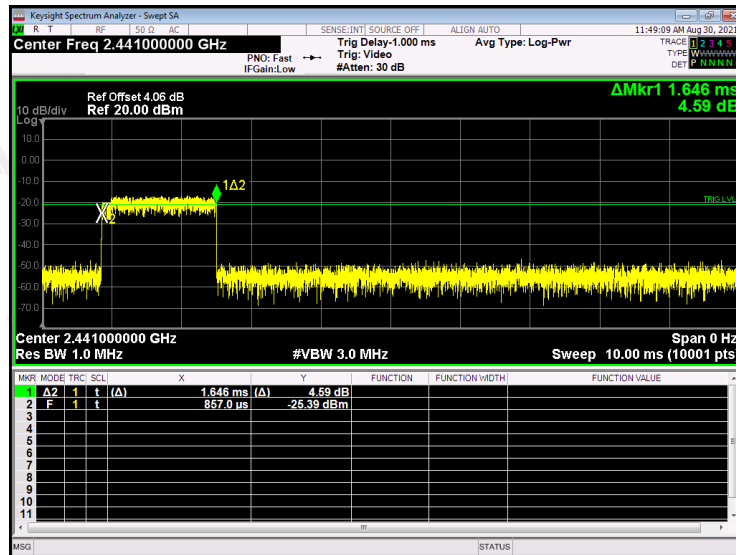
GFSK (DH5)



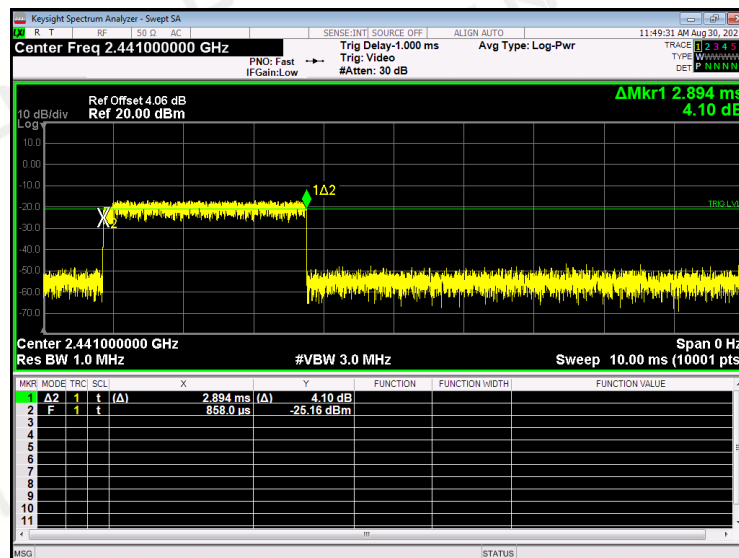
$\pi/4$ -DQPSK (2-DH1)



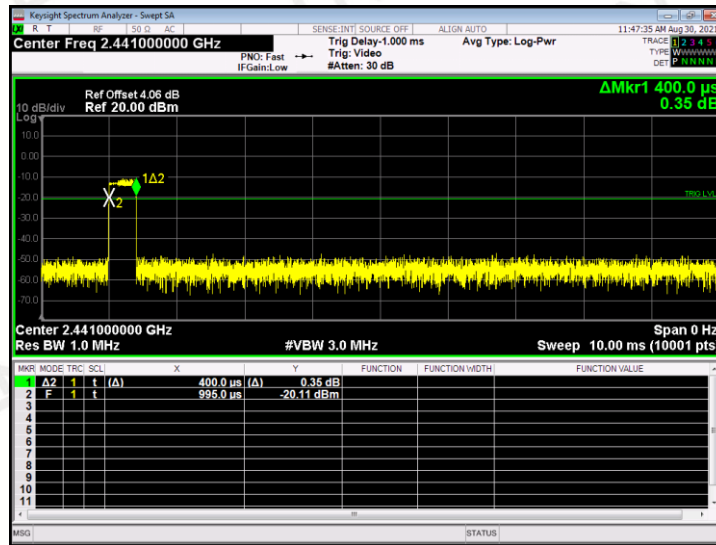
$\pi/4$ -DQPSK (2-DH3)



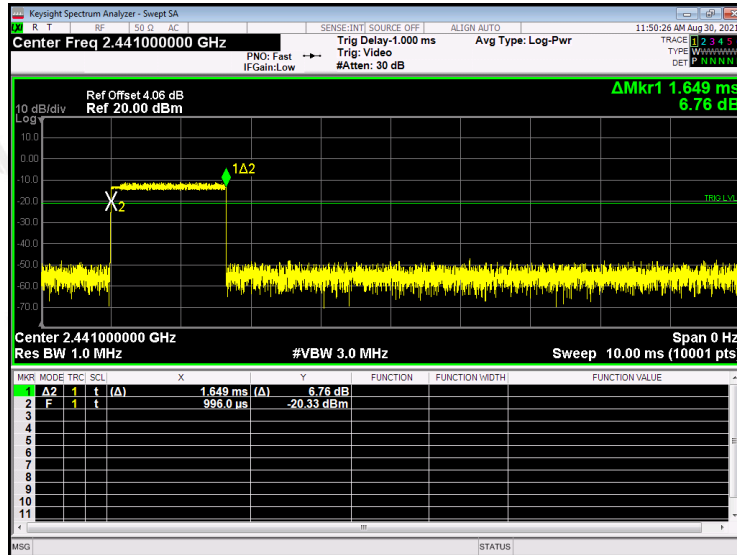
$\pi/4$ -DQPSK (2-DH5)



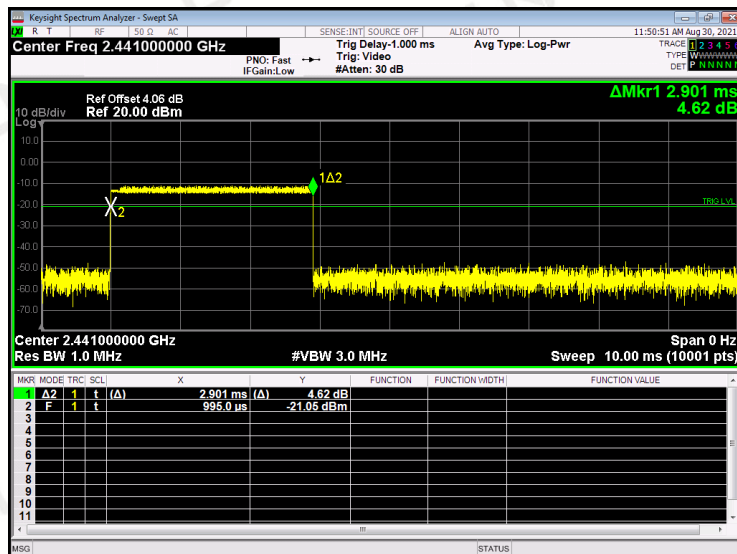
8DPSK (3-DH1)



8DPSK (3-DH3)



PSK (3-DH5)



10. MAXIMUM PEAK OUTPUT POWER

10.1 Measurement Procedure

Maximum Conducted Output Power at Antenna Terminals, FCC Rules 15.247(b)(1):

Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum. The analyzer was set for RBW > 20dB bandwidth and power was read directly in dBm. Cable loss was considered during this measurement.

10.2 Limit

For all other frequency hopping systems in the 2400-2483.5MHz band: 0.125 watts .

10.3 Test SET-UP (Block Diagram of Configuration)

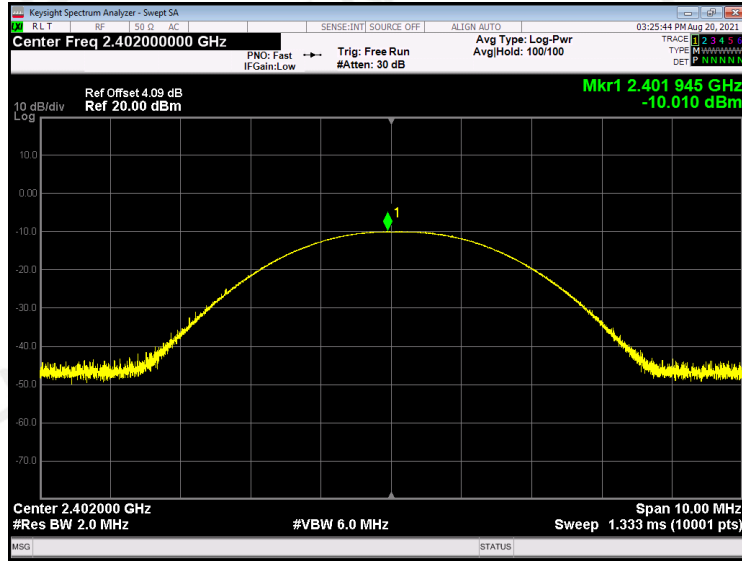


10.4 Measurement Results

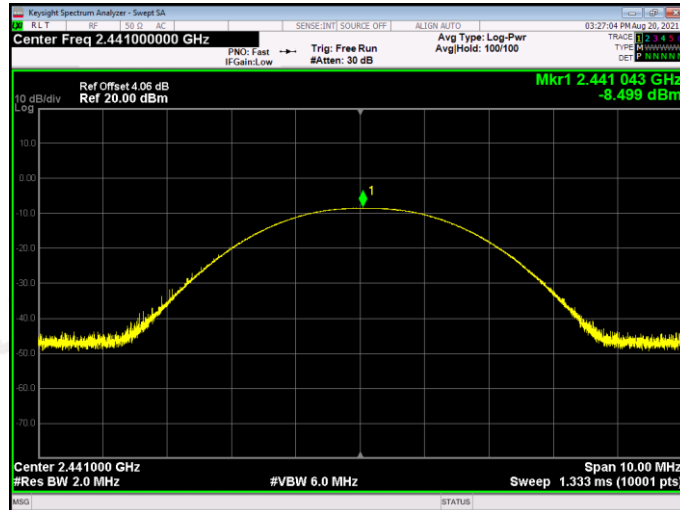
RBW:	2MHz	Temperature:	24 °C
VBW:	6MHz	Humidity:	52 %
Spectrum Detector:	PK	Test By:	Bob
Packet:	DH1, 2DH1, 3DH1(Worst case)	Test Date:	August 20, 2021

Channel Frequency (MHz)	Peak Power output (dBm)	Peak Power output (W)	Peak Power Limit (dBm/W)	Results
GFSK				
2402.00	-10.01	0.0000977	21 / 0.125	PASS
2441.00	-8.499	0.000141	21 / 0.125	PASS
2480.00	-8.039	0.000157	21 / 0.125	PASS
$\pi/4$ -DQPSK				
2402.00	-9.771	0.000105	21 / 0.125	PASS
2441.00	-8.492	0.000142	21 / 0.125	PASS
2480.00	-8.039	0.000157	21 / 0.125	PASS
8DPSK				
2402.00	-7.333	0.000185	21 / 0.125	PASS
2441.00	-5.797	0.000263	21 / 0.125	PASS
2480.00	-5.339	0.000292	21 / 0.125	PASS

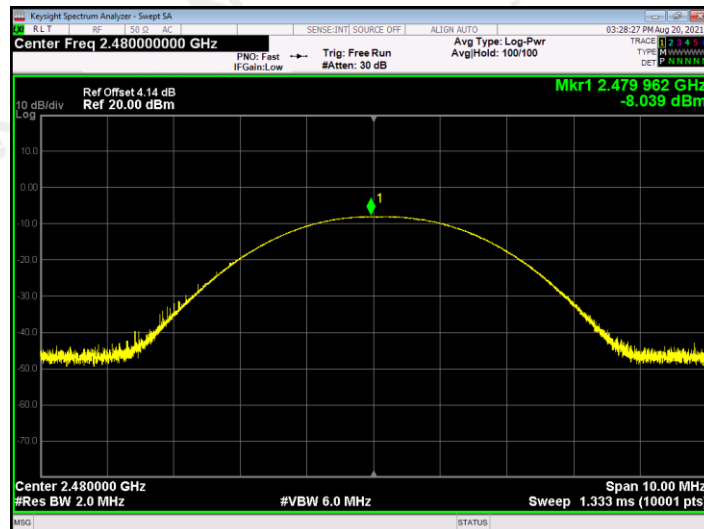
GFSK Lowest Channel



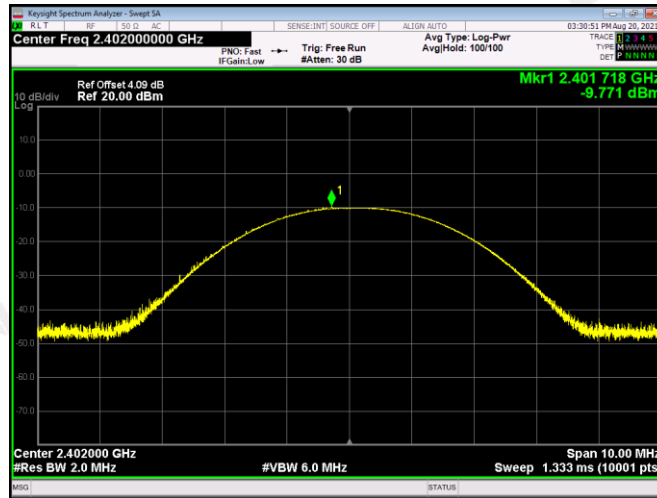
GFSK Middle Channel



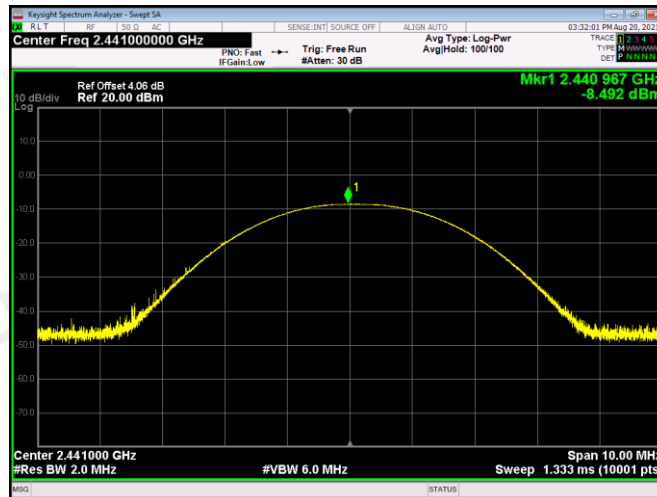
GFSK Highest Channel



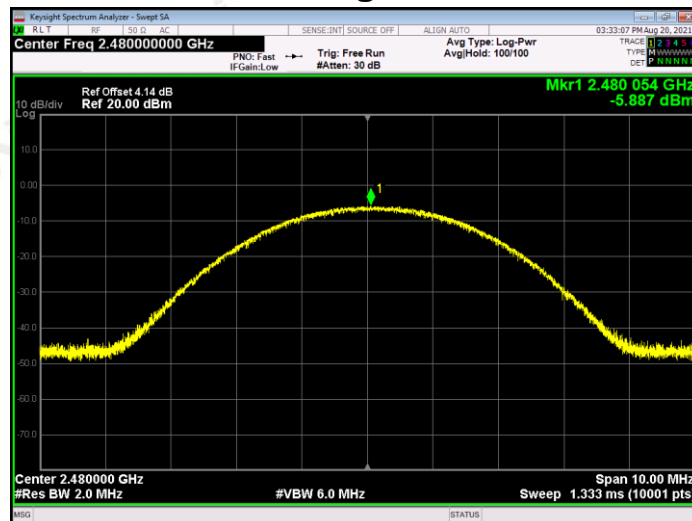
$\pi/4$ -DQPSK Lowest Channel



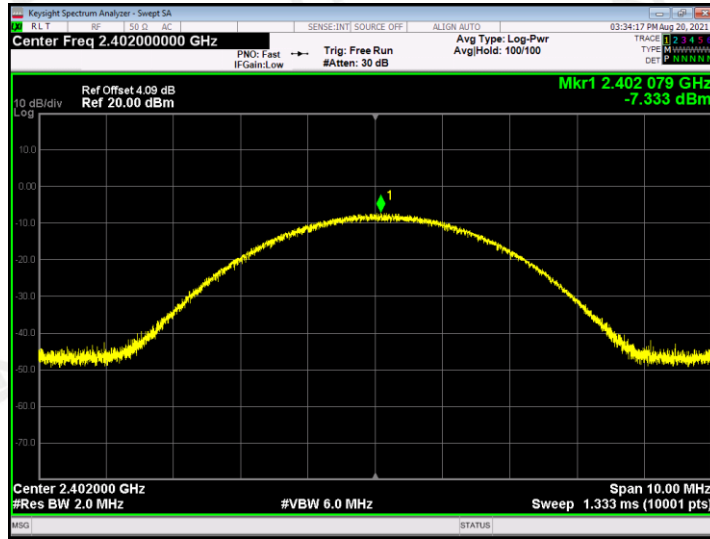
$\pi/4$ -DQPSK Middle Channel



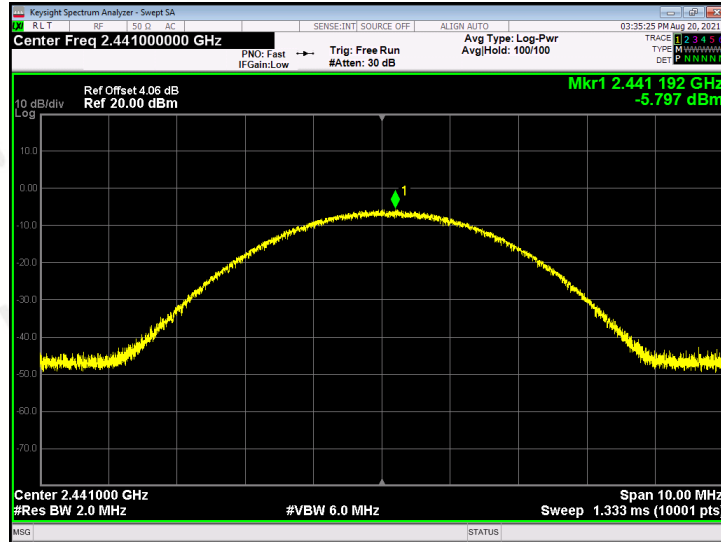
$\pi/4$ -DQPSK Highest Channel



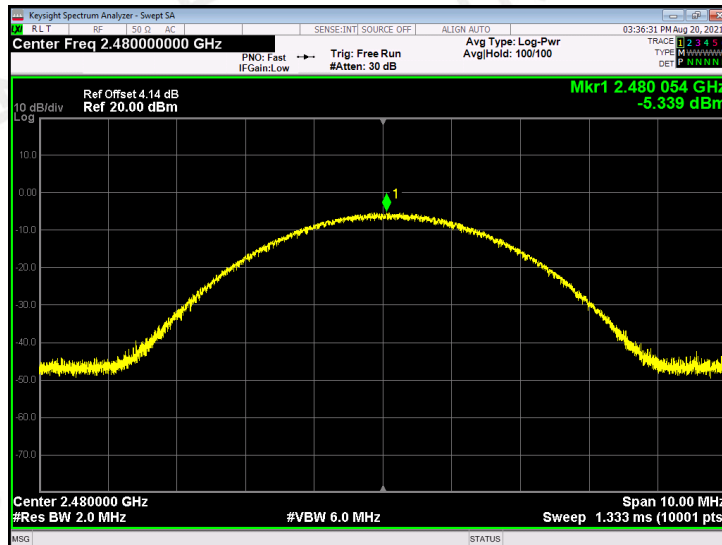
8DPSK Lowest Channel



8DPSK Middle Channel



8DPSK Highest Channel



11. BAND EDGE

11.1 Measurement Procedure

Out of Band Emissions, FCC Rule 15.247(d):

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

- 1.The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz.
- 2.The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.

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

The transmitter output is connected to spectrum analyzer. The resolution bandwidth is set to 100KHz, and the video bandwidth set to 300kHz.

11.2 Limit

15.247(d) In any 100KHz 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 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.

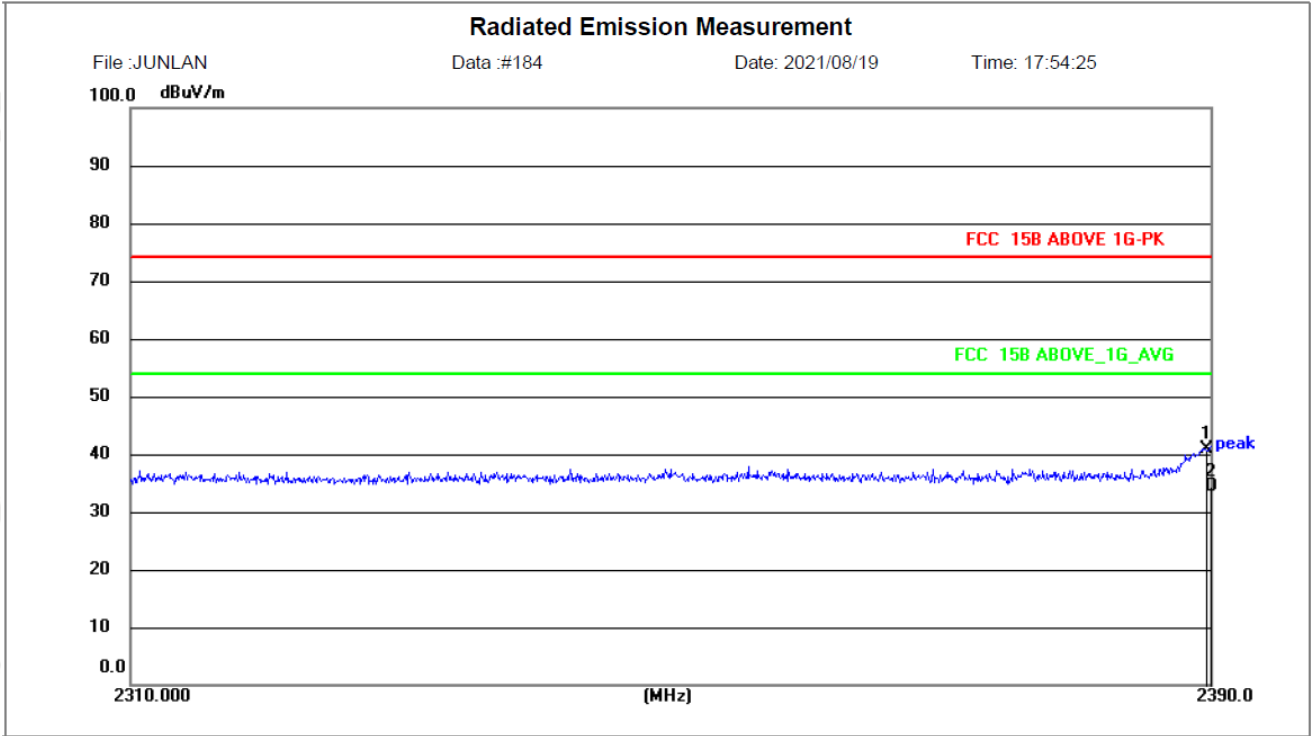
11.3 Measurement Results

Please see below test table and plots.

Note: All modes of operation were investigated and the worst case (8DPSK Mode) emissions are reported.

For Radiated restricted band:

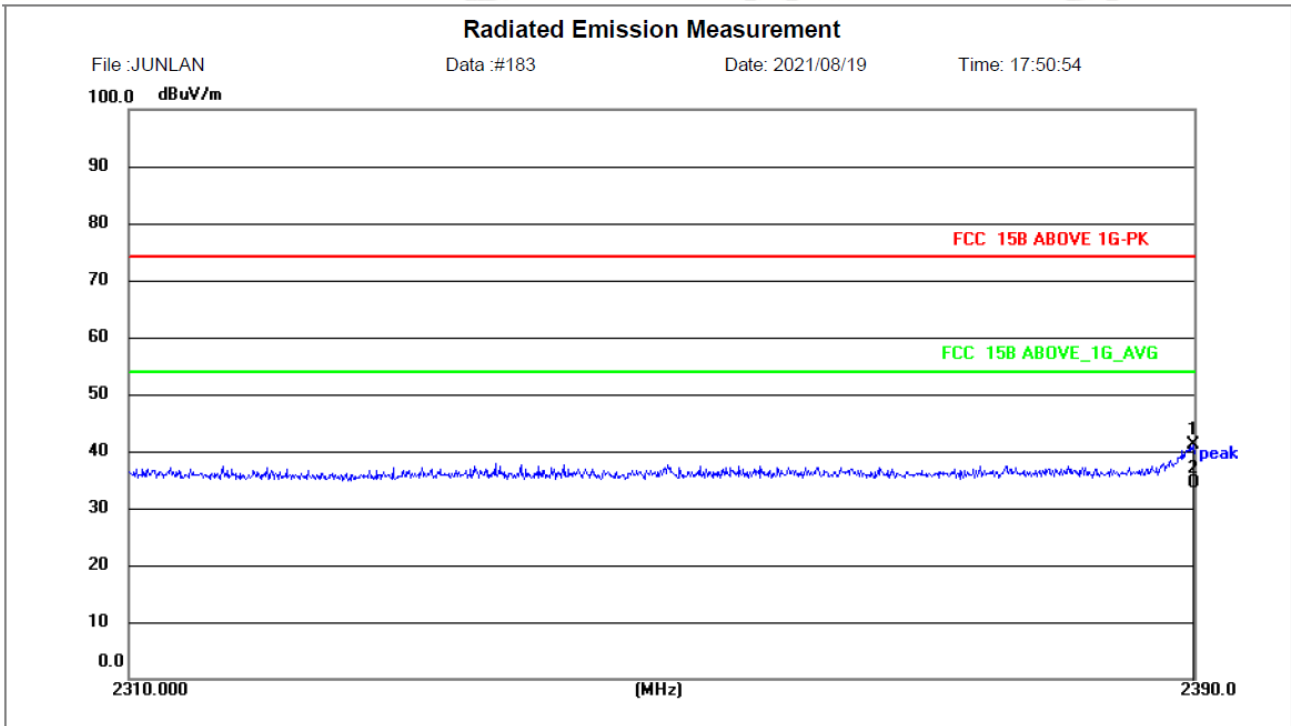
E.U.T:	Bluetooth Portable USB Suitcase Turntable	Polarization:	Horizontal
Model No.:	STT104BT-BLACK_ING	Temperature:	26 °C
Test Mode:	TX 2402MHz (8DPSK)	Humidity:	54 %
Test Distance:	3m	Test By:	Bob
Test Results:	PASS	Test Voltage	AC 120V/60Hz



Site 966 Chamber	Polarization: Horizontal	Temperature: 26(C)
Limit: FCC 15B ABOVE 1G-PK	Power: AC120V/60Hz	Humidity: 54 %
EUT:	Distance: 3m	
M/N: STT104BT-BLACK_ING		
Mode: BT 2402MHz		
Note: Manuf: JUNLAN ELECTRONIC LTD		
Adapter: JY005050100BD-UL		

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	2389.627	37.08	3.90	40.98	74.00	33.02	peak	131	159	P	
2 *	2390.000	30.59	3.90	34.49	54.00	19.51	AVG	149	165	P	

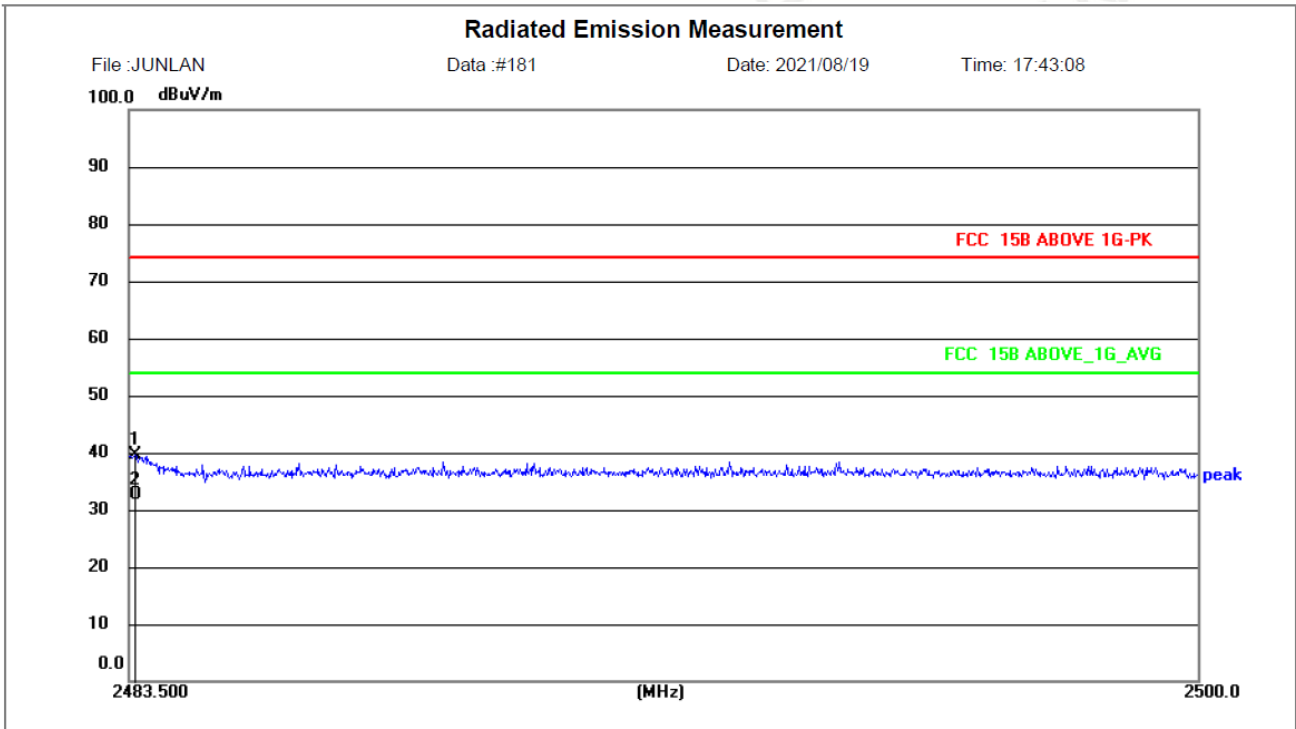
E.U.T:	Bluetooth Portable USB Suitcase Turntable	Polarization:	Vertical
Model No.:	STT104BT-BLACK_ING	Temperature:	26 °C
Test Mode:	TX 2402MHz (8DPSK)	Humidity:	54 %
Test Distance:	3m	Test By:	Bob
Test Results:	PASS	Test Voltage	AC 120V/60Hz



Site 966 Chamber	Polarization: Vertical	Temperature: 26(C)
Limit: FCC 15B ABOVE 1G-PK	Power: AC120V/60Hz	Humidity: 54 %
EUT:	Distance: 3m	
M/N: STT104BT-BLACK_ING		
Mode: BT 2402MHz		
Note: Manuf:JUNLAN ELECTRONIC LTD		
Adapter:JY005050100BD-UL		

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	2389.973	37.16	3.90	41.06	74.00	32.94	peak	149	152	P	
2 *	2389.973	30.54	3.90	34.44	54.00	19.56	AVG	153	138	P	

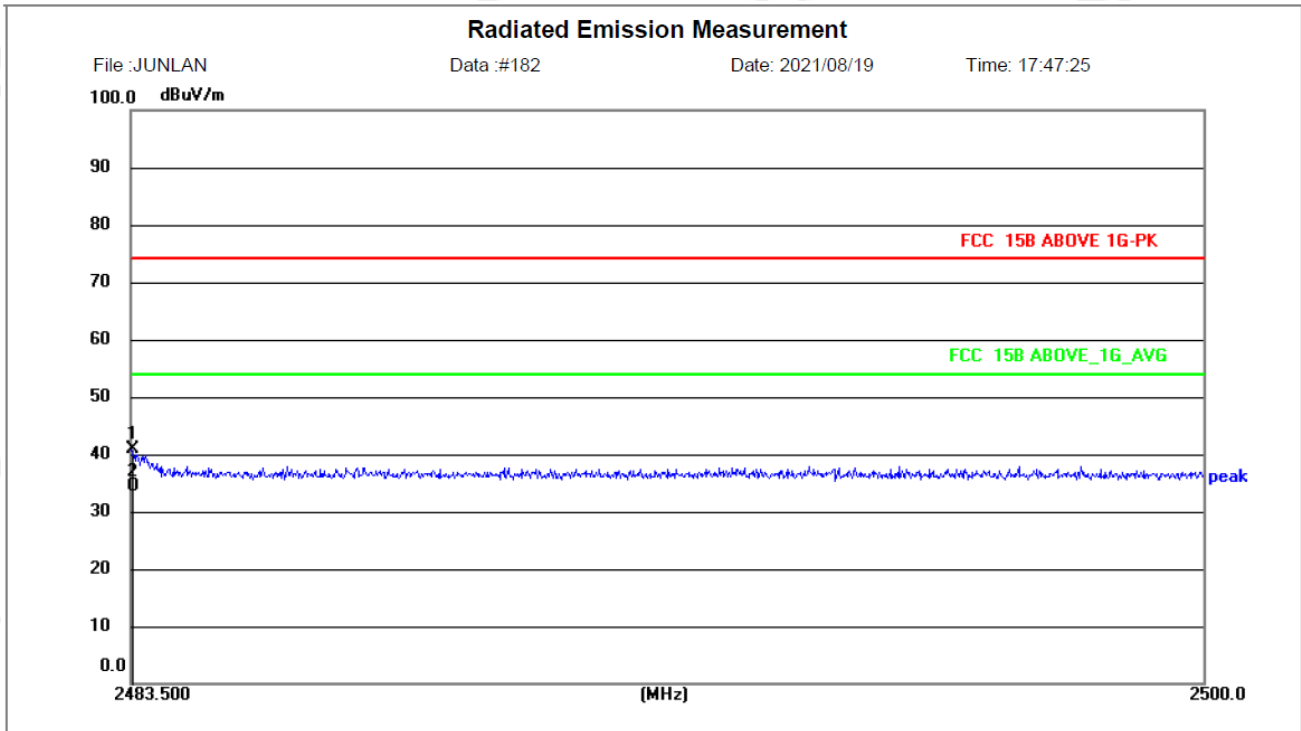
E.U.T:	Bluetooth Portable USB Suitcase Turntable	Polarization:	Horizontal
Model No.:	STT104BT-BLACK_ING	Temperature:	26 °C
Test Mode:	TX 2480MHz (8DPSK)	Humidity:	54 %
Test Distance:	3m	Test By:	Bob
Test Results:	PASS	Test Voltage	AC 120V/60Hz



Site 966 Chamber	Polarization: Horizontal	Temperature: 26(C)
Limit: FCC 15B ABOVE 1G-PK	Power: AC120V/60Hz	Humidity: 54 %
EUT:	Distance: 3m	
M/N: STT104BT-BLACK_ING		
Mode: BT 2480MHz		
Note: Manuf:JUNLAN ELECTRONIC LTD		
Adapter:JY005050100BD-UL		

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	2483.610	35.46	4.28	39.74	74.00	34.26	peak	138	56	P	
2 *	2483.610	28.34	4.28	32.62	54.00	21.38	AVG	129	102	P	

E.U.T:	Bluetooth Portable USB Suitcase Turntable	Polarization:	Vertical
Model No.:	STT104BT-BLACK_ING	Temperature:	26 °C
Test Mode:	TX 2480MHz (8DPSK)	Humidity:	54 %
Test Distance:	3m	Test By:	Bob
Test Results:	PASS	Test Voltage	AC 120V/60Hz



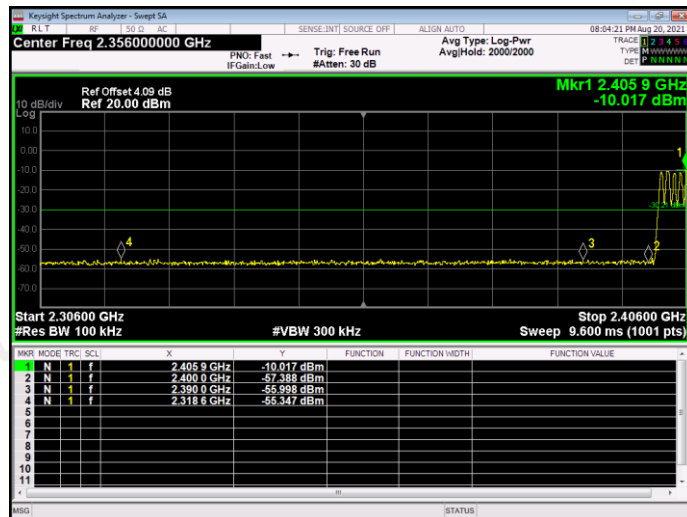
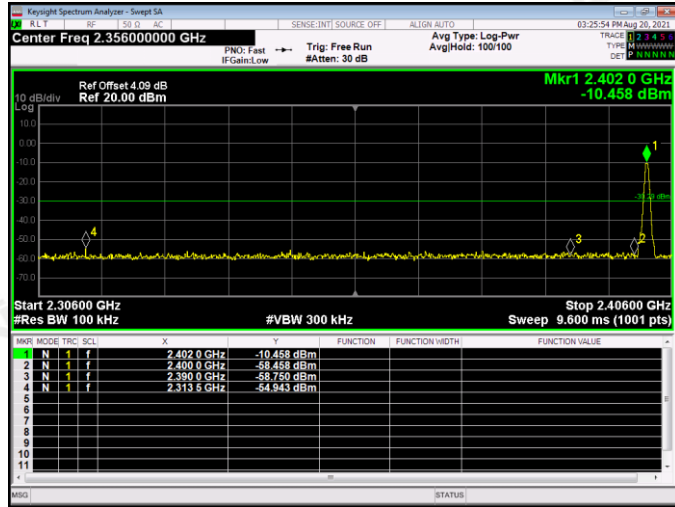
Site 966 Chamber	Polarization: Vertical	Temperature: 26(C)
Limit: FCC 15B ABOVE 1G-PK	Power: AC120V/60Hz	Humidity: 54 %
EUT:	Distance: 3m	
M/N: STT104BT-BLACK_ING		
Mode: BT 2480MHz		
Note: Manuf:JUNLAN ELECTRONIC LTD		
Adapter:JY005050100BD-UL		

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	2483.517	36.62	4.28	40.90	74.00	33.10	peak	158	236	P	
2 *	2483.517	30.10	4.28	34.38	54.00	19.62	AVG	143	152	P	

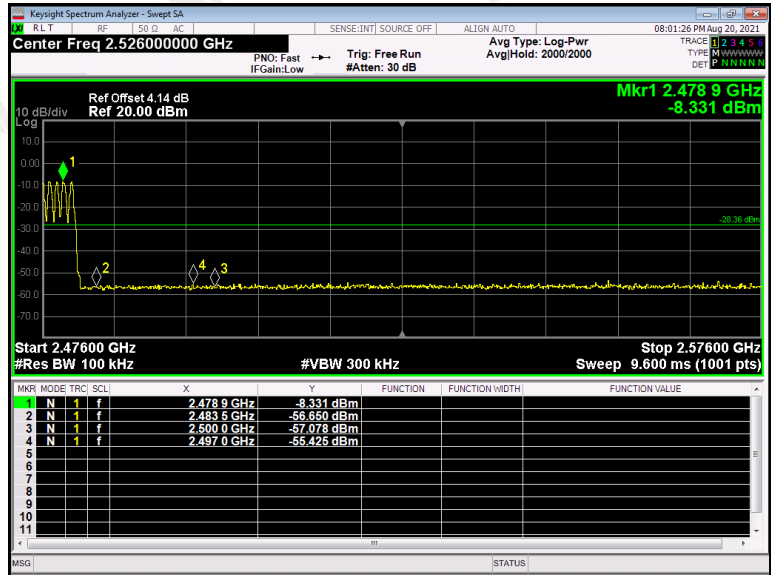
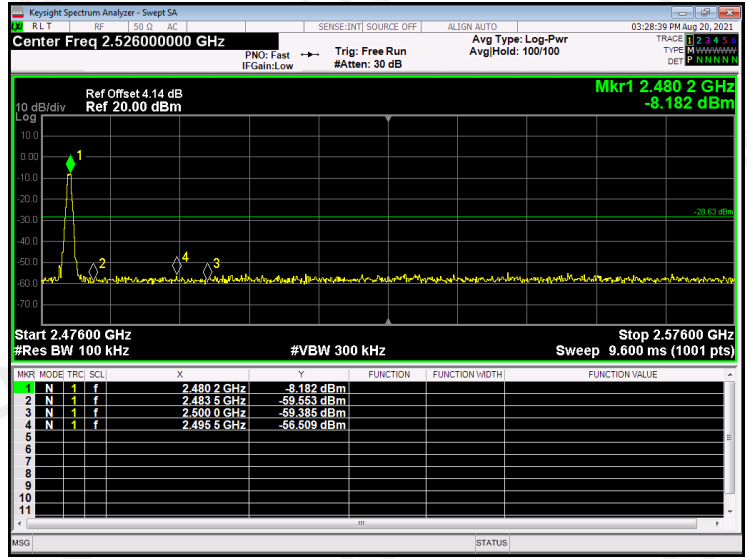
- Note:**
- (1) Result= Reading + Factor
 - (2) Factor= Antenna Gain + Cable Loss – Amplifier Gain
 - (3) Horn antenna used for the emission over 1000MHz.

For RF Conducted restricted band:

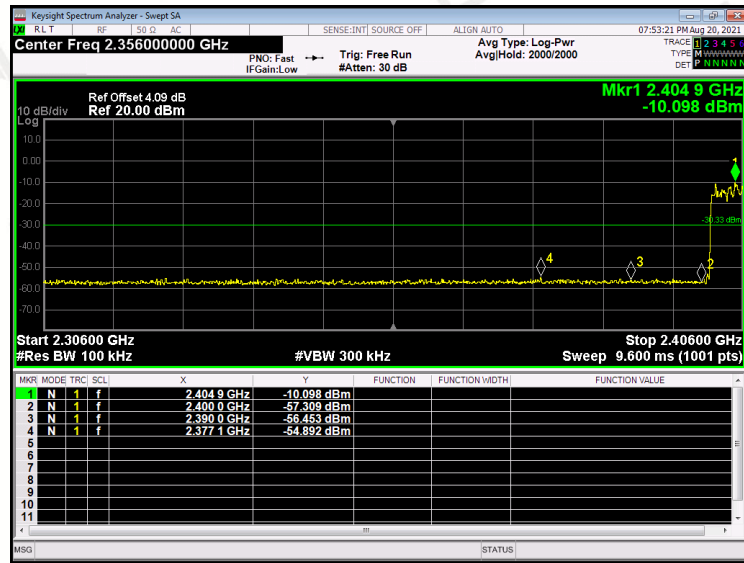
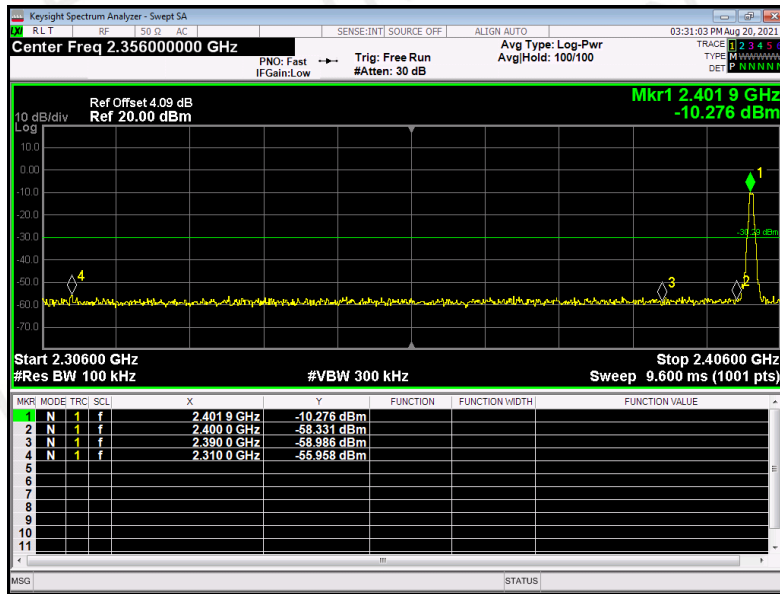
GFSK Lowest Channel



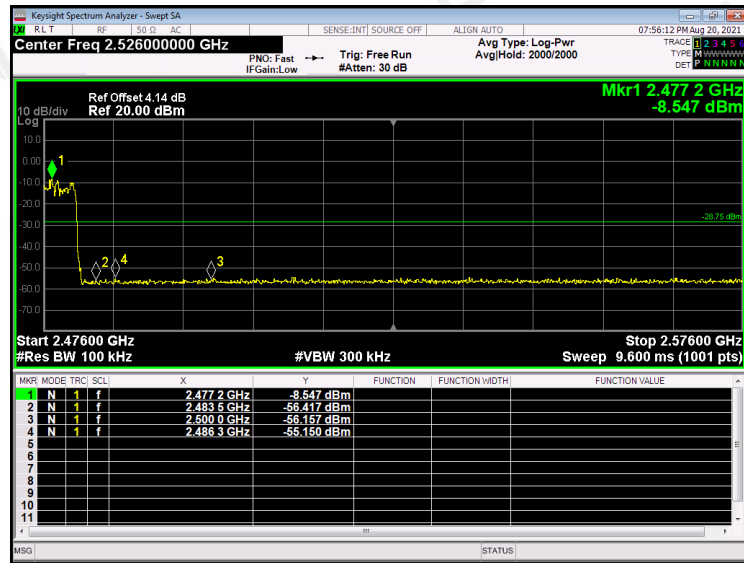
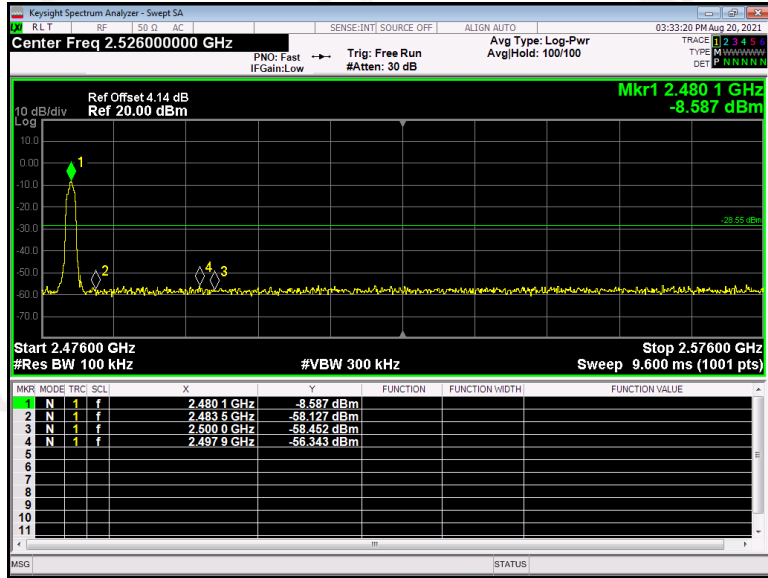
GFSK Highest Channel



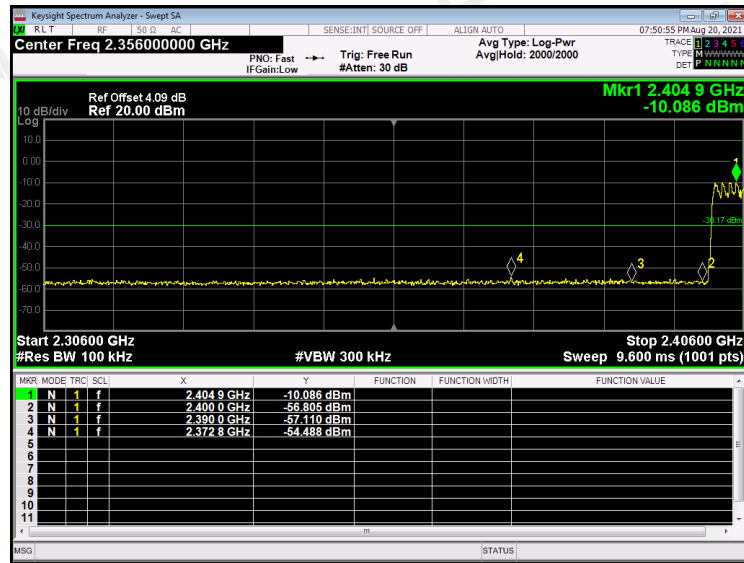
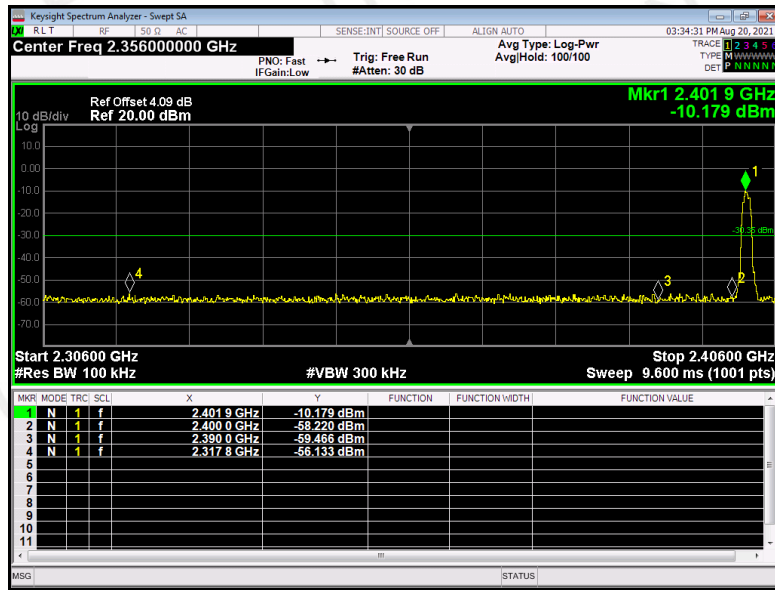
$\pi/4$ -DQPSK Lowest Channel



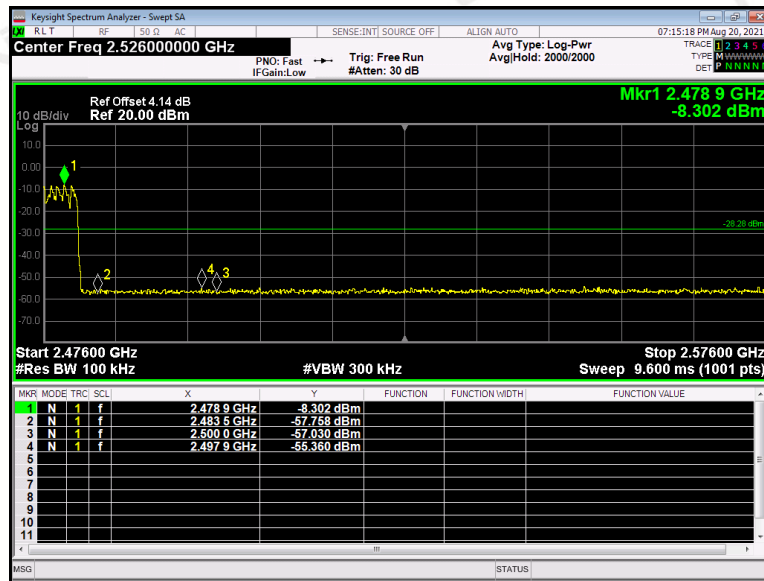
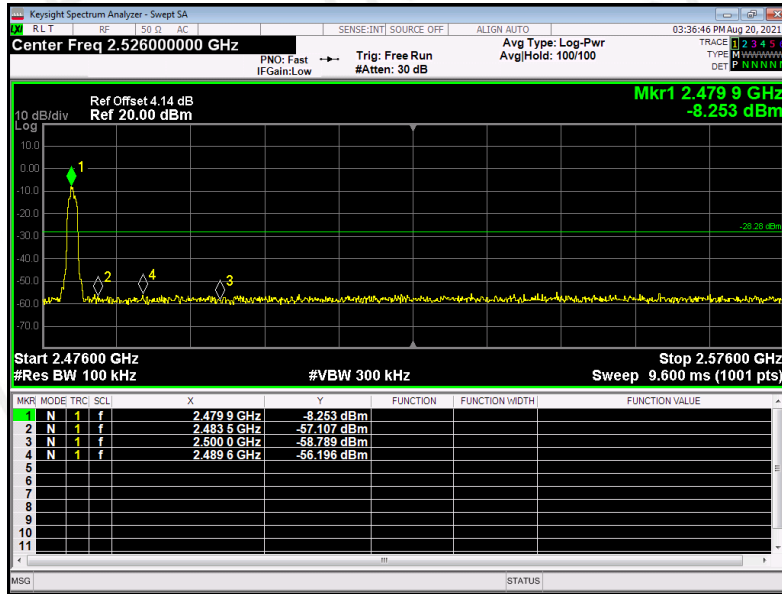
$\pi/4$ -DQPSK Highest Channel



8DPSK Lowest Channel



8DPSK Highest Channel



12. ANTENNA APPLICATION

12.1 Antenna requirement

According to of FCC part 15C section 15.203 and 15.204:

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

12.2 Measurement Results

The EUT antenna is PCB antenna. It comply with the standard requirement.

13. CONDUCTED SPURIOUS EMISSIONS

13.1 Measurement Procedure

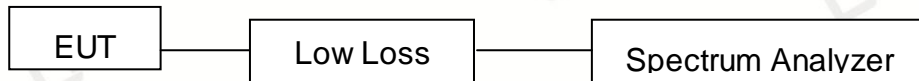
Out of Band Conducted Spurious Emissions, FCC Rule 15.247(d):

The transmitter output is connected to spectrum analyzer. All spurious emission and up to the tenth harmonic was measured and they were found to be at least 20dB below the highest level of the desired power in the passband.

13.2 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.

13.3 Test SET-UP (Block Diagram of Configuration)



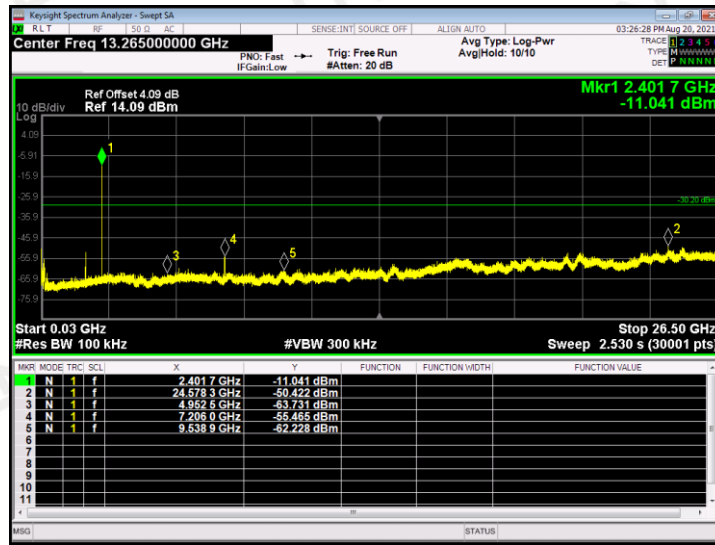
13.4 Measurement Results

Pass

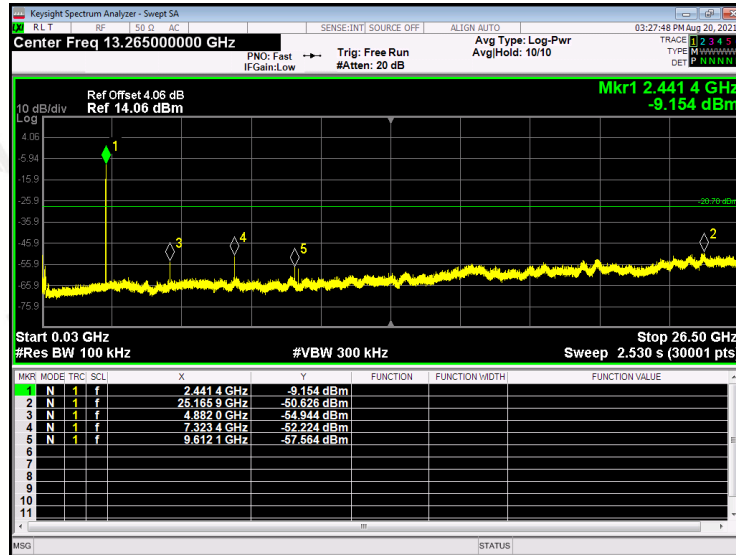
Please refer to following plots.



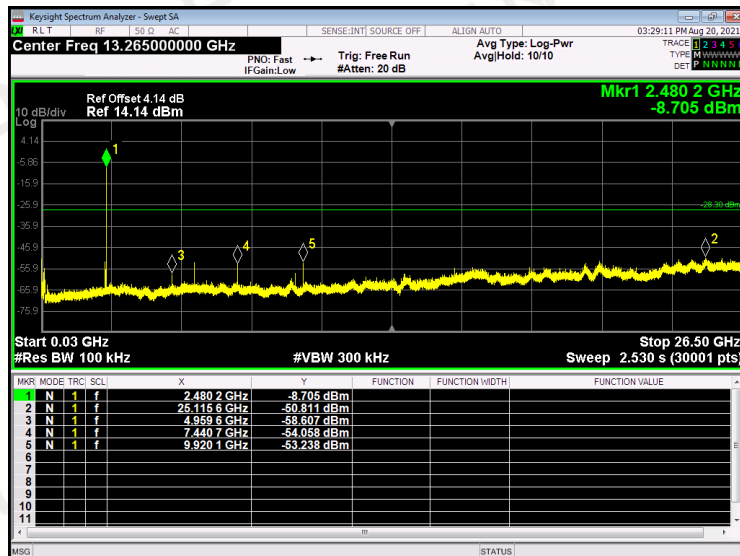
GFSK Lowest Channel



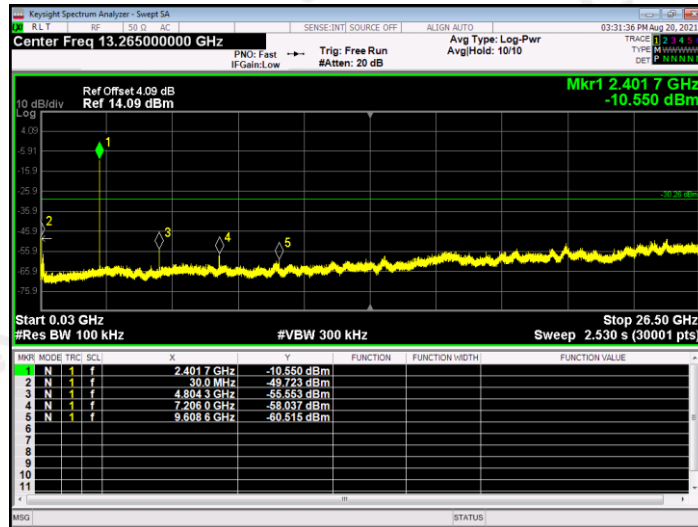
GFSK Middle Channel



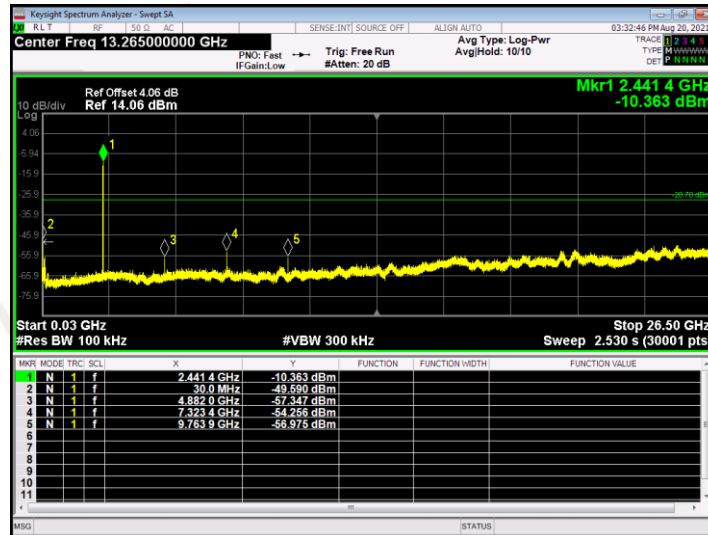
GFSK Highest Channel



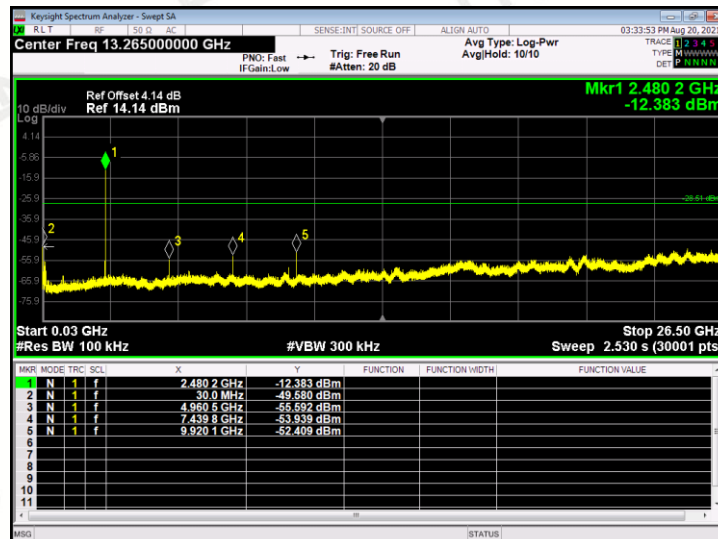
$\pi/4$ -DQPSK Lowest Channel



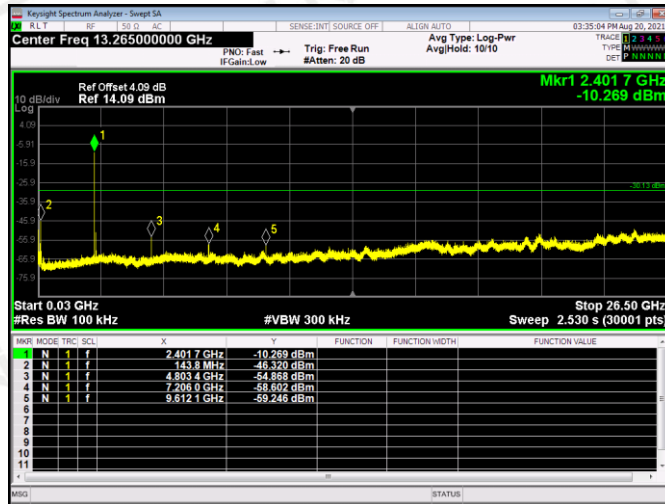
$\pi/4$ -DQPSK Middle Channel



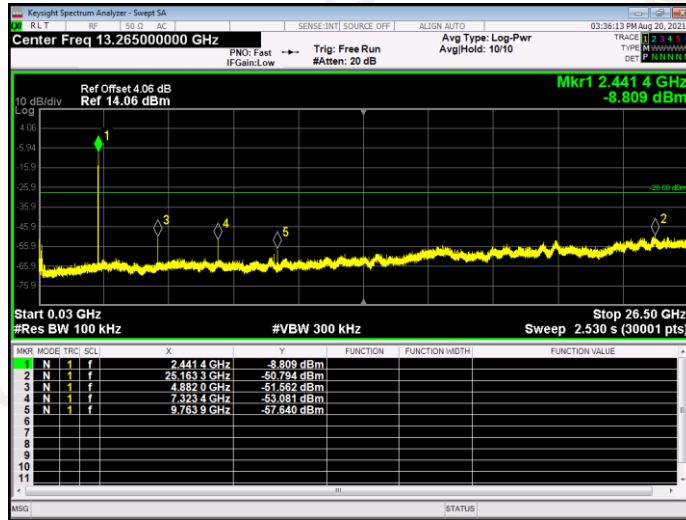
$\pi/4$ -DQPSK Highest Channel



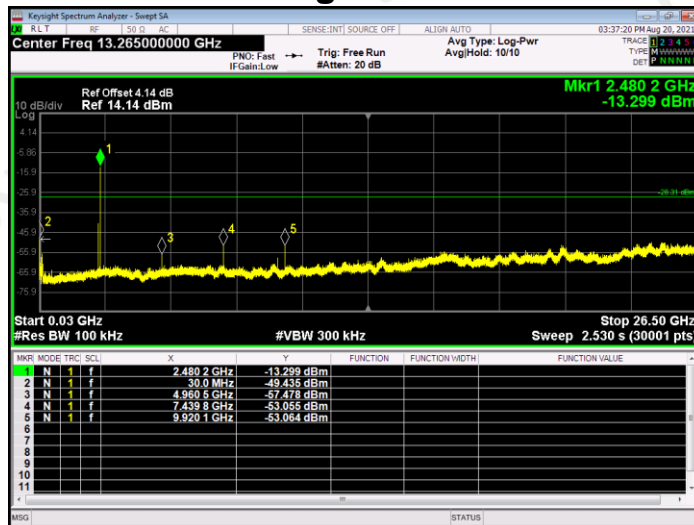
8DPSK Lowest Channel



8DPSK Middle Channel



8DPSK Highest Channel



14. TEST EQUIPMENT LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated Dates	Cal. Interval
1	Conducted Emission Test Software	EZ-EMC	Ver.CCS-3A1-CE	N/A	N/A	N/A
2	AMN	Schwarzbeck	NNLK8121	8121370	2020.10.13	1 Year
3	AMN	ETS	3810/2	00020199	2020.10.13	1 Year
4	AAN	TESEQ	T8-Cat6	38888	2020.10.13	1 Year
5	Pulse Limiter	CYBRTEK	EM5010	E115010056	2021.05.19	1 Year
6	EMI Test Receiver	Rohde&Schwarz	ESCI	101210	2020.10.13	1 Year
1	Radiated Emission Test Software	EZ-EMC	Ver.CCS-03A1	N/A	N/A	N/A
2	Horn Antenna	Sunol	DRH-118	A101415	2020.10.19	1 Year
3	Broadband Hybrid Antenna	Sunol	JB1	A090215	2021.03.02	1 Year
4	PREAMP	HP	8449B	3008A00160	2020.10.13	1 Year
5	PREAMP	HP	8447D	2944A07999	2021.05.19	1 Year
6	EMI TEST RECEIVER	Rohde&Schwarz	ESR3	101891	2020.10.13	1 Year
7	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	2020.10.13	1 Year
8	Signal Generator	Agilent	E4421B	MY4335105	2020.11.12	1 Year
9	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2020.10.13	1 Year
10	MXA Signal Analyzer	Keysight	N9020A	MY51110104	2020.10.13	1 Year
11	RF Power sensor	DARE	RPR3006W	15I00041SNO88	2021.05.19	1 Year
12	RF Power sensor	DARE	RPR3006W	15I00041SNO89	2021.05.19	1 Year
13	RF power divider	Anritsu	K241B	992289	2020.10.13	1 Year
14	Wideband radio communication tester	Rohde&Schwarz	CMW500	154987	2020.10.13	1 Year
15	Active Loop Antenna	Com-Power	AL-130R	10160009	2021.05.19	1 Year
16	Broadband Hybrid Antennas	Schwarzbeck	VULB9163	VULB9163#958	2021.05.19	1 Year
17	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1680	2021.05.19	1 Year
18	Horn Antenna	A-INFOMW	LB-180400-KF	J211060660	2020.11.05	1 Year
19	Microwave Broadband Preamplifier	Schwarzbeck	BBV 9721	100472	2020.10.13	1 Year
20	Signal Generator	Agilent	N5183A	MY47420153	2020.10.13	1 Year
21	Spectrum Analyzer	Rohde&Schwarz	FSP 40	100501	2020.10.13	1 Year
22	Power Meter	KEYSIGHT	N1911A	MY50520168	2020.10.13	1 Year
23	Frequency Meter	VICTOR	VC2000	997406086	2020.10.13	1 Year
24	DC Power Source	HYELEC	HY5020E	055161818	2020.10.13	1 Year

APPENDIX-PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

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