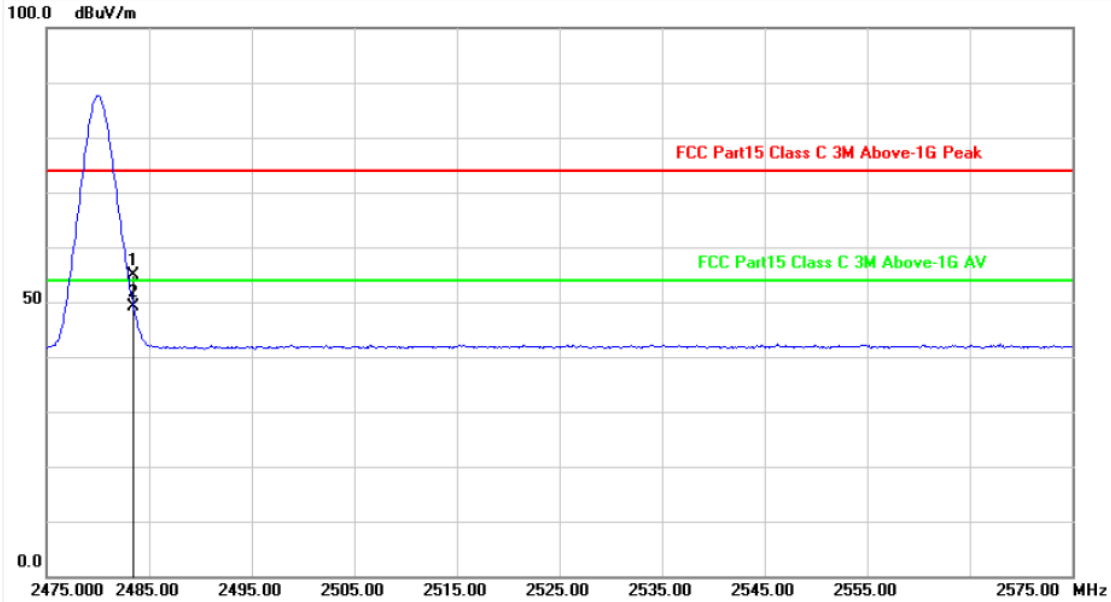
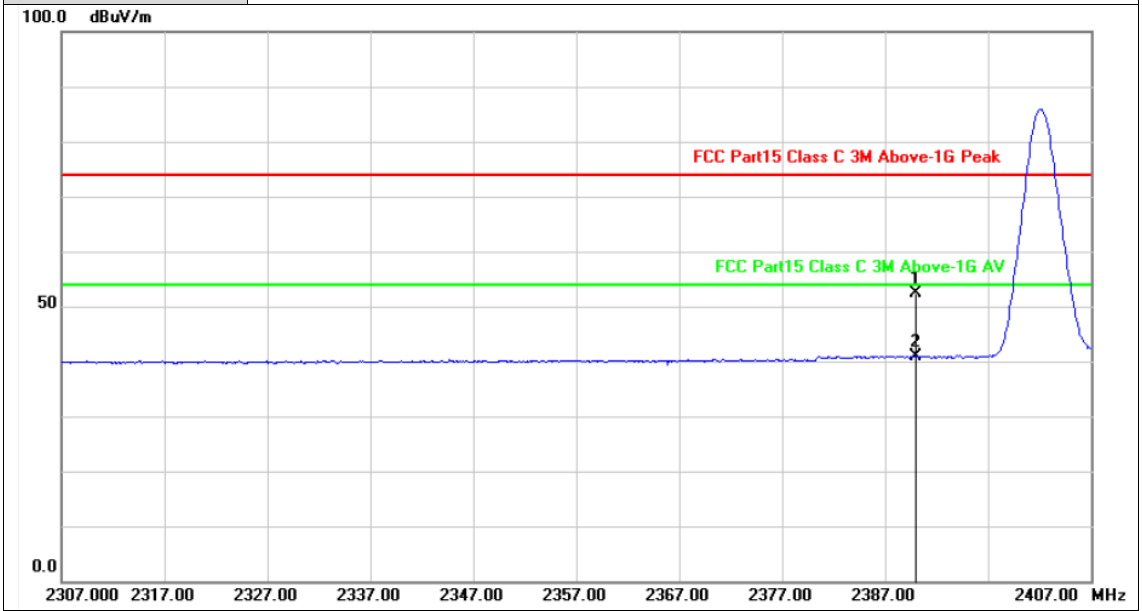
Ant. Pol.	Vertical
Test Mode:	π/4-DQPSK Mode 2480MHz



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	31.50	23.36	54.86	74.00	-19.14	peak
2	2483.500	31.50	17.55	49.05	54.00	-4.95	AVG

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

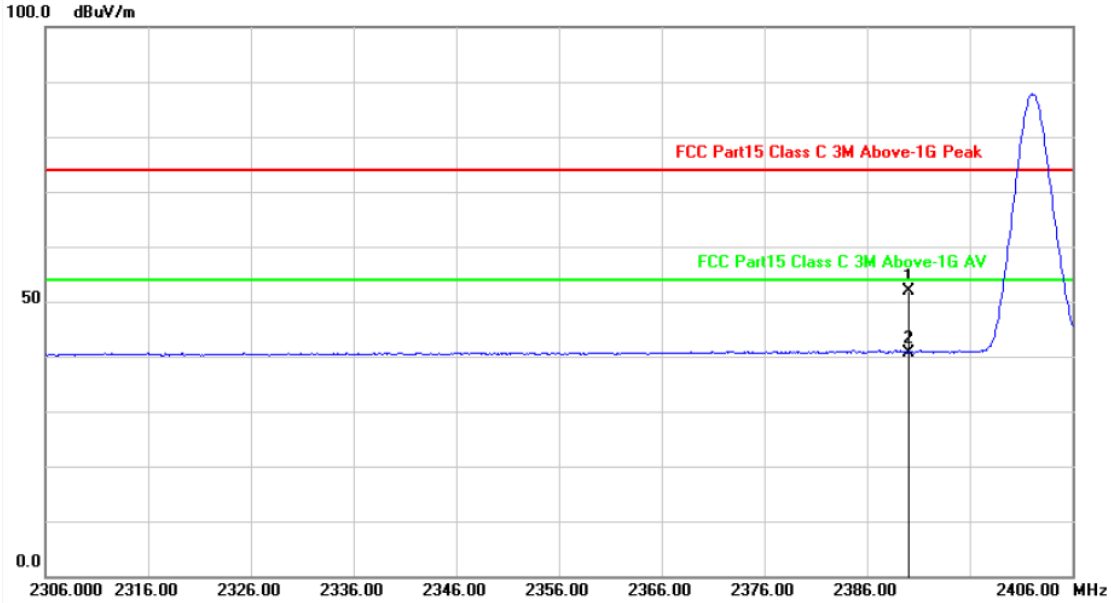
Ant. Pol.	Horizontal
Test Mode:	8-DPSK Mode 2402MHz



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	31.10	21.39	52.49	74.00	-21.51	peak
2	2390.000	31.10	9.78	40.88	54.00	-13.12	AVG

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

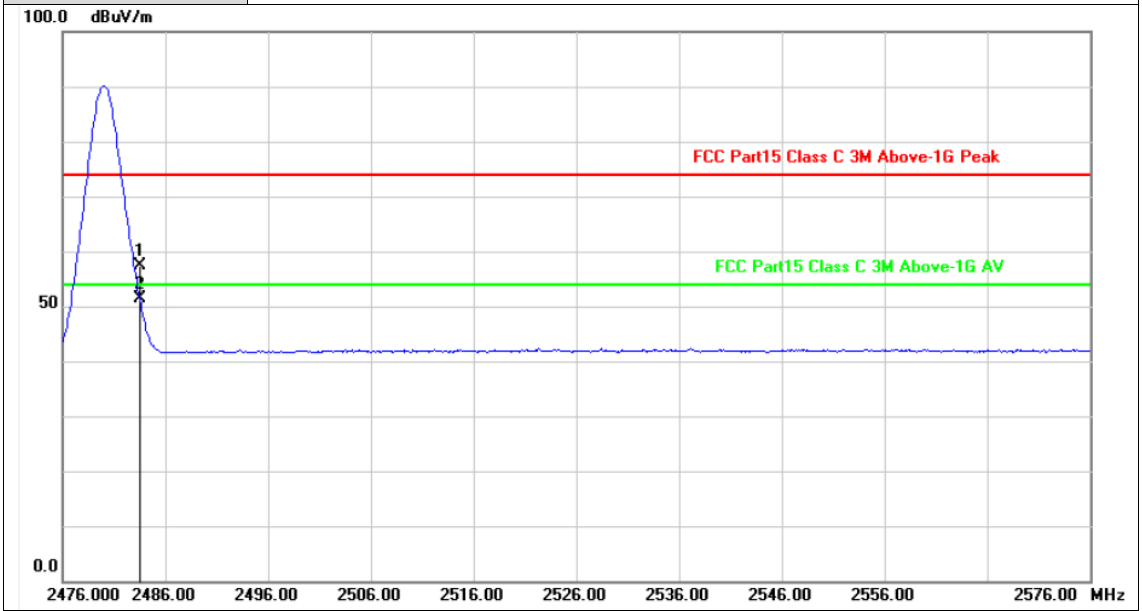
Ant. Pol.	Vertical
Test Mode:	8-DPSK Mode 2402MHz



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	31.10	20.77	51.87	74.00	-22.13	peak
2	2390.000	31.10	9.59	40.69	54.00	-13.31	AVG

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

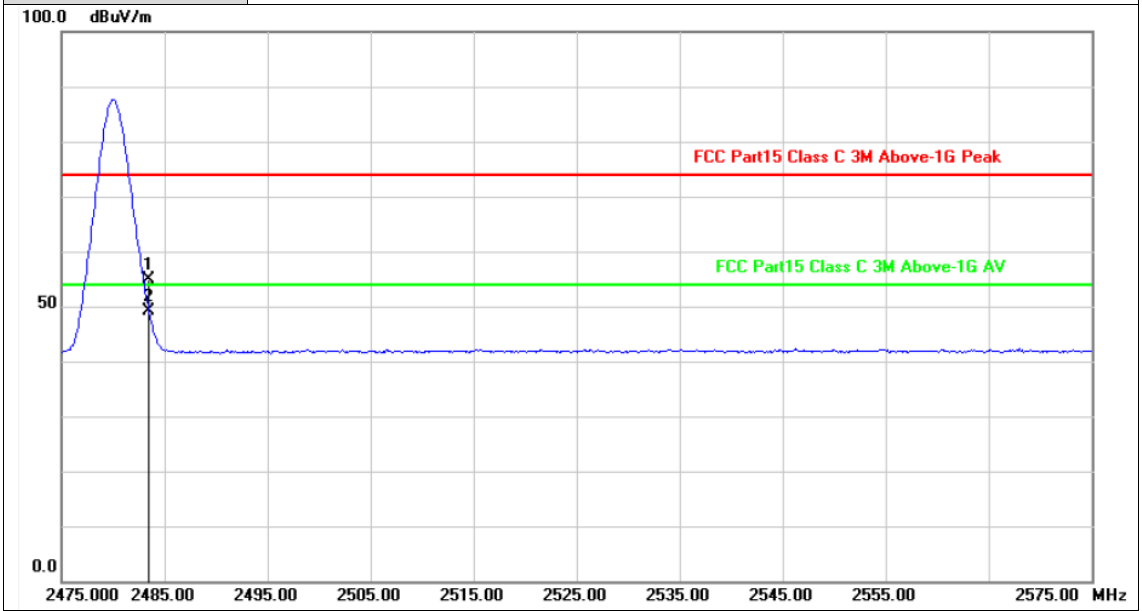
Ant. Pol.	Horizontal
Test Mode:	8-DPSK Mode 2480MHz



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	31.50	25.95	57.45	74.00	-16.55	peak
2	2483.500	31.50	19.85	51.35	54.00	-2.65	AVG

Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

Ant. Pol.	Vertical
Test Mode:	8-DPSK Mode 2480MHz



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	31.50	23.36	54.86	74.00	-19.14	peak
2	2483.500	31.50	17.55	49.05	54.00	-4.95	AVG

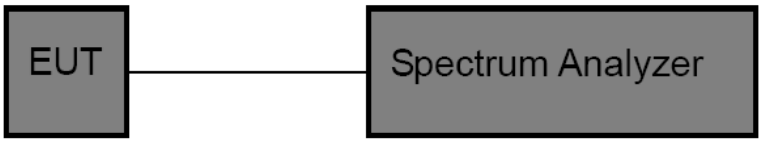
Remarks:
1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
2.Margin value = Level -Limit value

3.4. Band edge and Spurious Emissions (Conducted)

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

Test Configuration



Test Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   RBW = 100 kHz, VBW ≥ RBW, scan up through 10th harmonic.
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

Test Mode

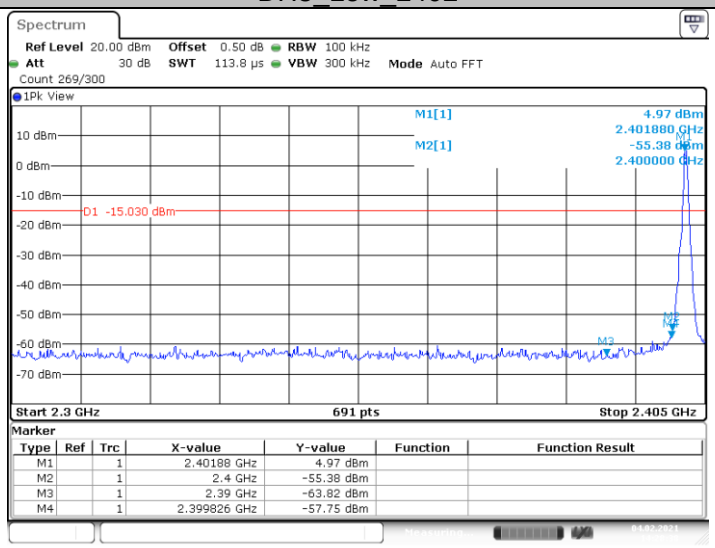
Please refer to the clause 2.4.

Test Results

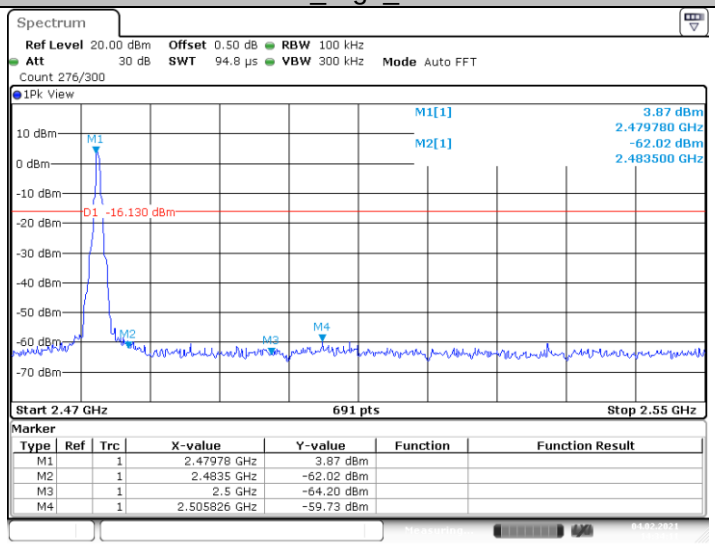
(1) Band edge Conducted Test

Test Mode	ChName	Channel	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
GFSK	Low	2402	4.97	-57.75	<=-15.03	PASS
	High	2480	3.87	-59.73	<=-16.13	PASS
	Low	Hop_2402	5.04	-58.06	-14.96	PASS
	High	Hop_2480	4.14	-57.42	-15.86	PASS
π/4-DQPSK	Low	2402	1.33	-59.73	<=-18.67	PASS
	High	2480	0.30	-60.38	<=-19.7	PASS
	Low	Hop_2402	1.33	-60.23	-18.67	PASS
	High	Hop_2480	0.61	-59.03	-19.39	PASS
8-DPSK	Low	2402	1.61	-58.31	<=-18.39	PASS
	High	2480	0.54	-60.58	<=-19.46	PASS
	Low	Hop_2402	1.63	-59.1	-18.37	PASS
	High	Hop_2480	0.88	-58.97	-19.12	PASS

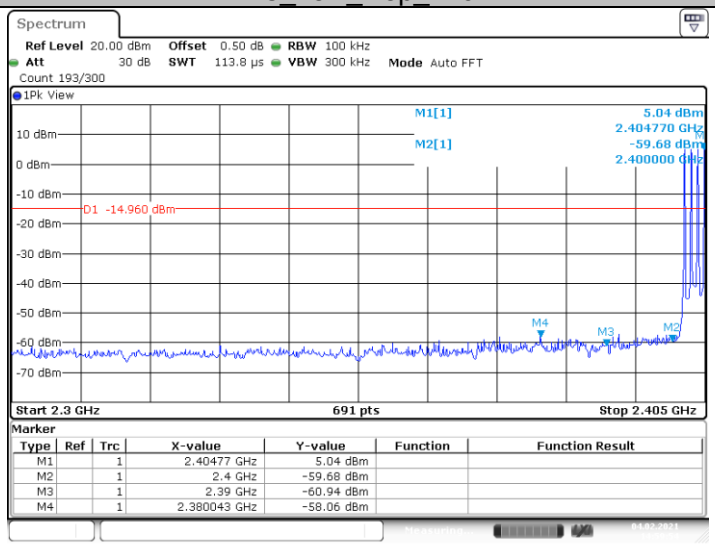
DH5_Low_2402



DH5_High_2480



DH5_Low_Hop_2402



DH5_High_Hop_2480

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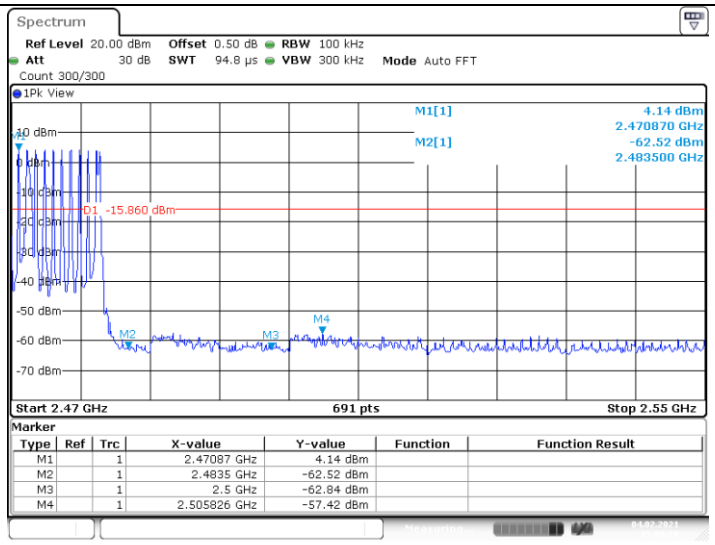
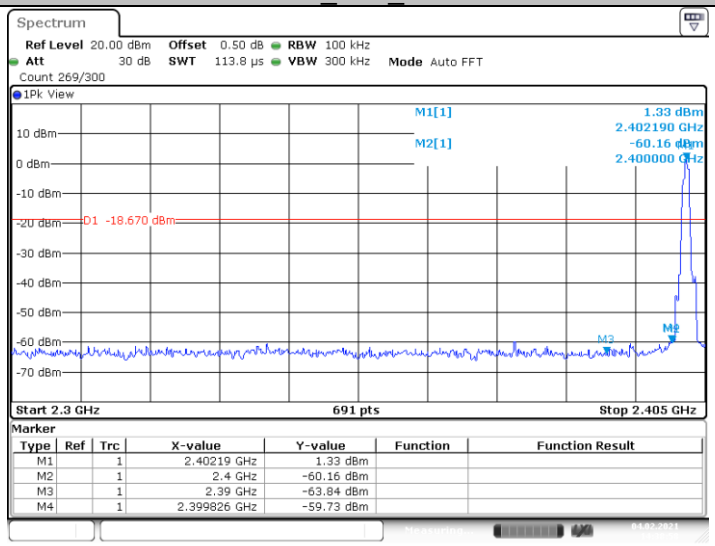
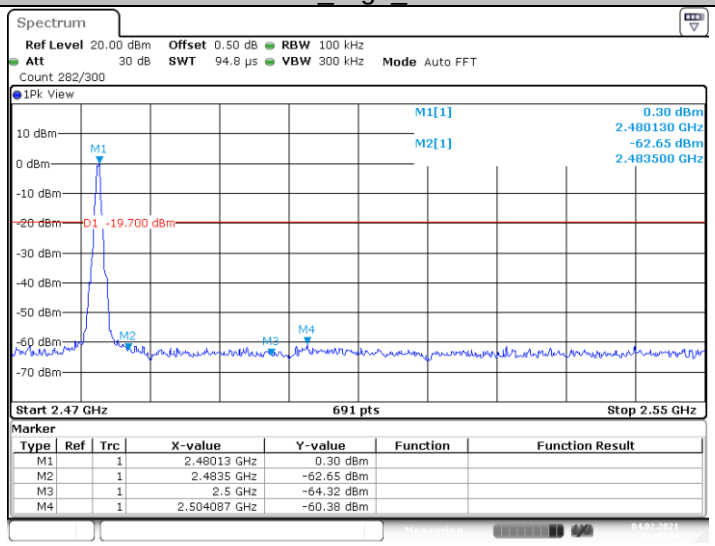


2DH5_Low_2402



2DH5_High_2480



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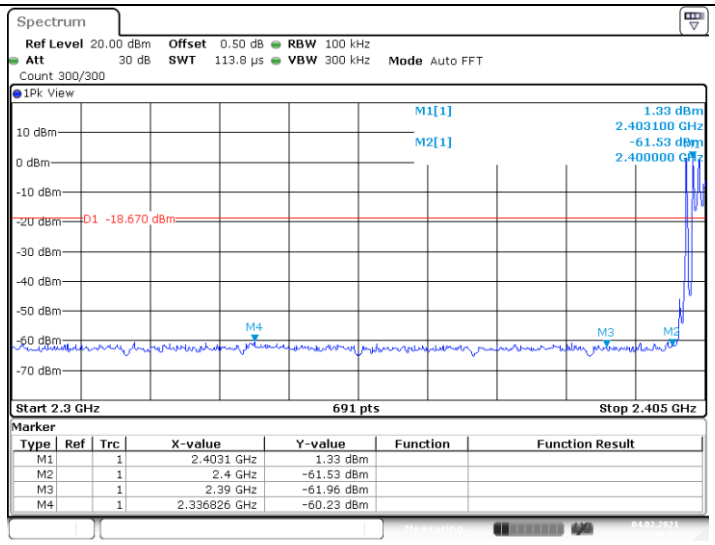
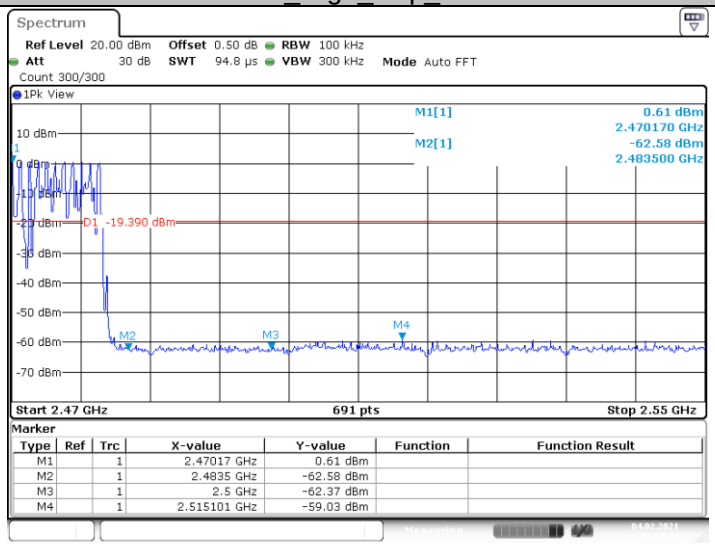
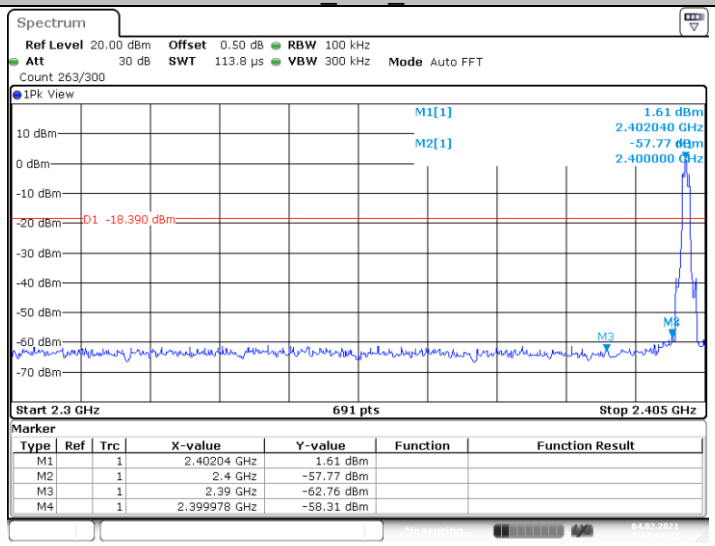


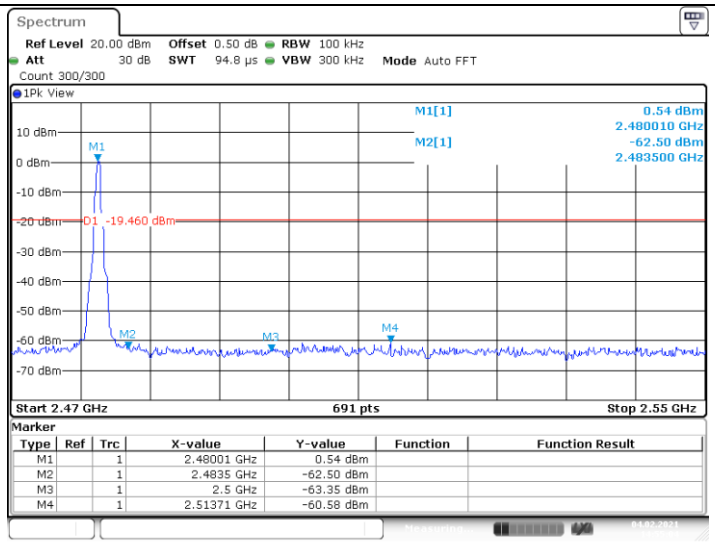
2DH5_High_Hop_2480



3DH5_Low_2402

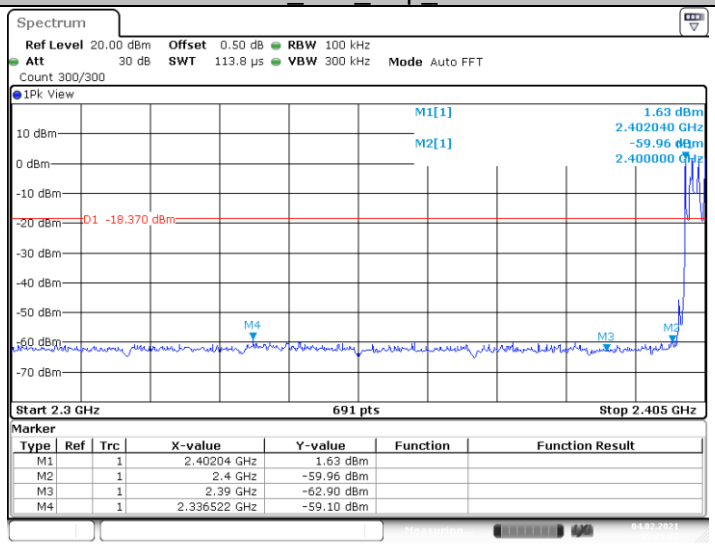


3DH5_High_2480



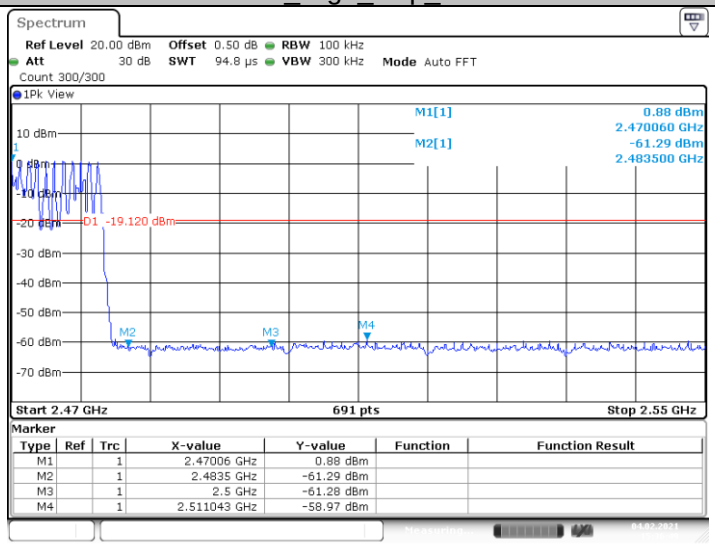
Date: 4.FEB.2021 14:55:04

3DH5_Low_Hop_2402



Date: 4.FEB.2021 15:23:26

3DH5_High_Hop_2480

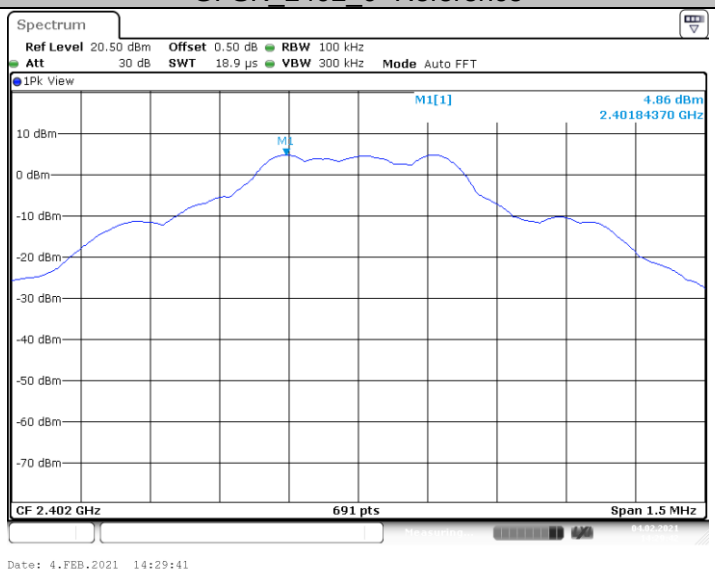


Date: 4.FEB.2021 15:36:49

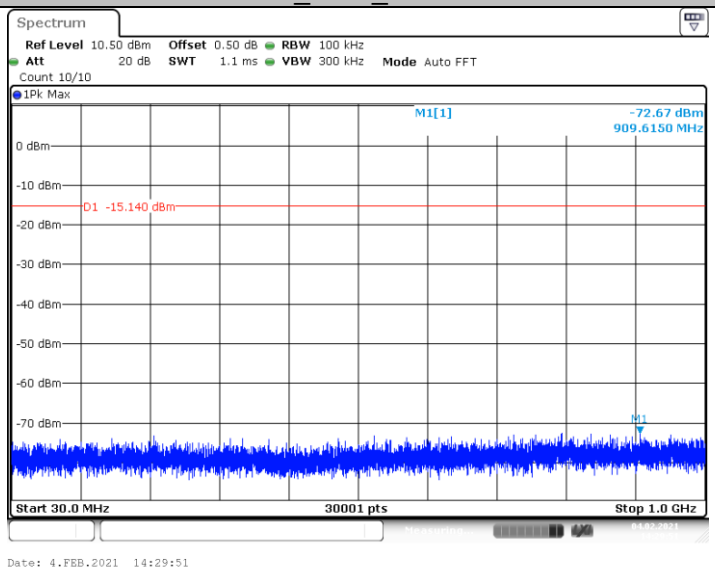
(2) Conducted Spurious Emissions Test

Test Mode	Channel	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
GFSK	2402	Reference	4.86	4.86	---	PASS
		30~1000	30~1000	-72.67	<=-15.14	PASS
		1000~26500	1000~26500	-48.14	<=-15.14	PASS
	2441	Reference	4.53	4.53	---	PASS
		30~1000	30~1000	-72.19	<=-15.47	PASS
		1000~26500	1000~26500	-48.89	<=-15.47	PASS
	2480	Reference	3.92	3.92	---	PASS
		30~1000	30~1000	-71.44	<=-16.08	PASS
		1000~26500	1000~26500	-48.49	<=-16.08	PASS
π/4-DQPSK	2402	Reference	1.22	1.22	---	PASS
		30~1000	30~1000	-72.55	<=-18.78	PASS
		1000~26500	1000~26500	-48.01	<=-18.78	PASS
	2441	Reference	0.72	0.72	---	PASS
		30~1000	30~1000	-72.53	<=-19.28	PASS
		1000~26500	1000~26500	-48.84	<=-19.28	PASS
	2480	Reference	0.33	0.33	---	PASS
		30~1000	30~1000	-71.73	<=-19.67	PASS
		1000~26500	1000~26500	-47.86	<=-19.67	PASS
8-DPSK	2402	Reference	1.49	1.49	---	PASS
		30~1000	30~1000	-72.86	<=-18.51	PASS
		1000~26500	1000~26500	-48.39	<=-18.51	PASS
	2441	Reference	0.96	0.96	---	PASS
		30~1000	30~1000	-71.95	<=-19.04	PASS
		1000~26500	1000~26500	-48.37	<=-19.04	PASS
	2480	Reference	0.57	0.57	---	PASS
		30~1000	30~1000	-72.57	<=-19.43	PASS
		1000~26500	1000~26500	-48.37	<=-19.43	PASS

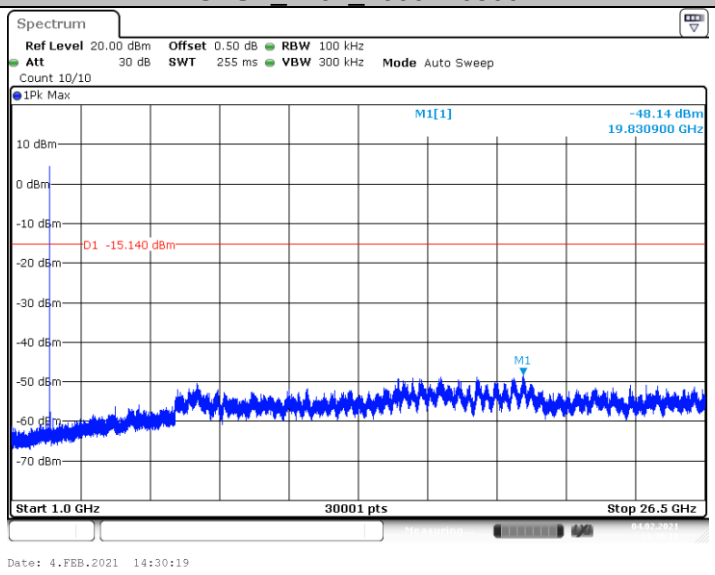
GFSK_2402_0~Reference



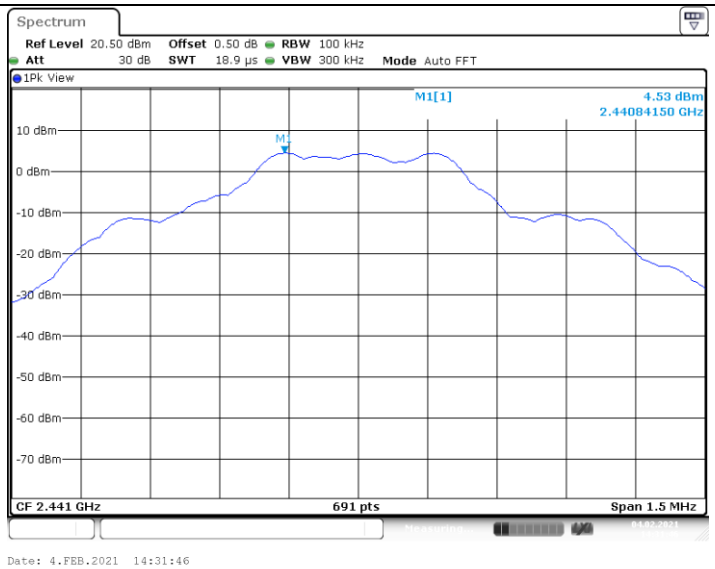
GFSK_2402_30~1000



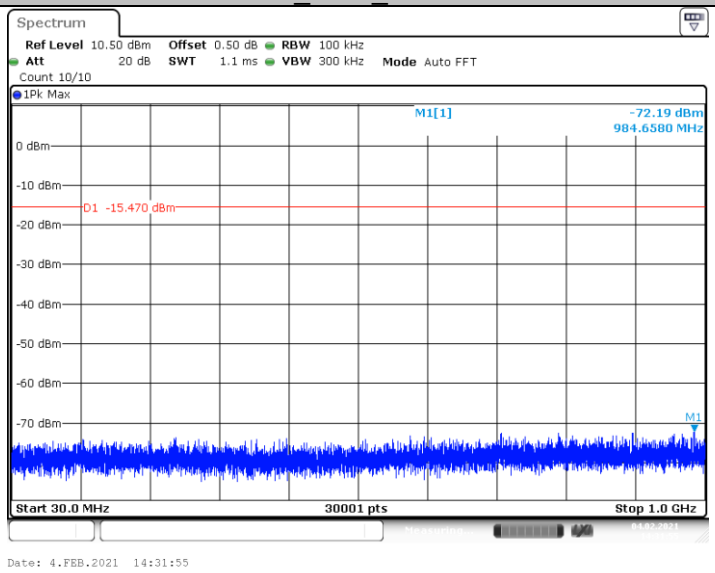
GFSK_2402_1000~26500



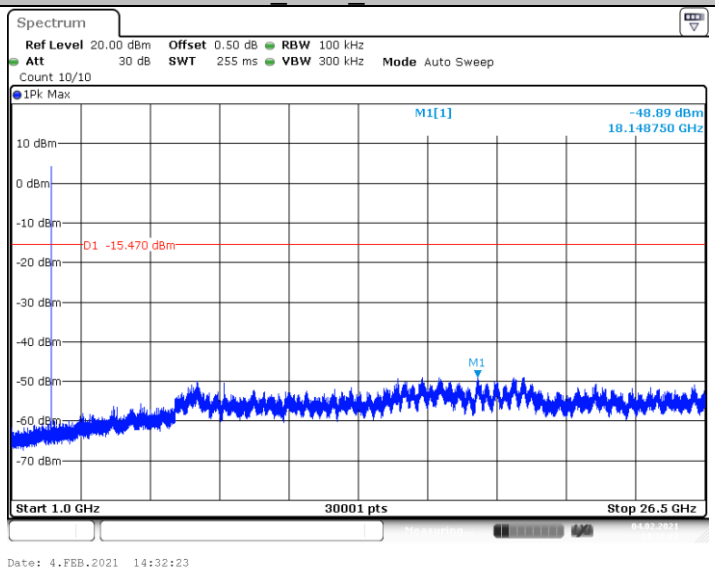
GFSK_2441_0~Reference



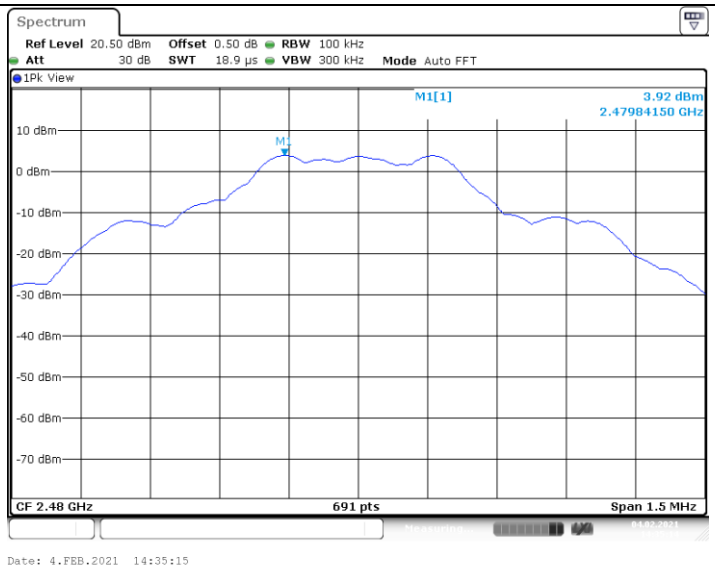
GFSK_2441_30~1000



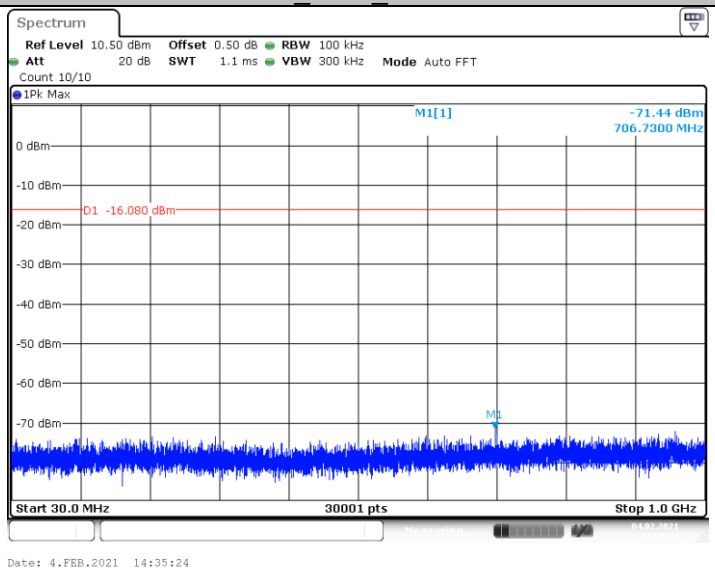
GFSK_2441_1000~26500



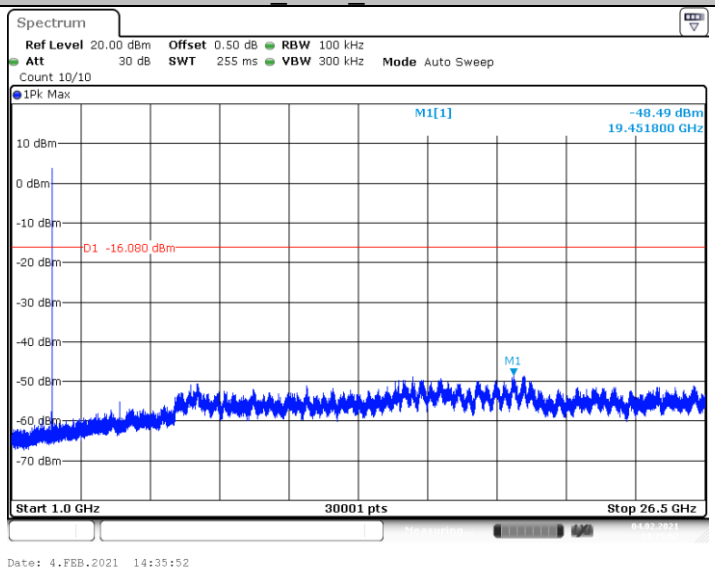
GFSK_2480_0~Reference



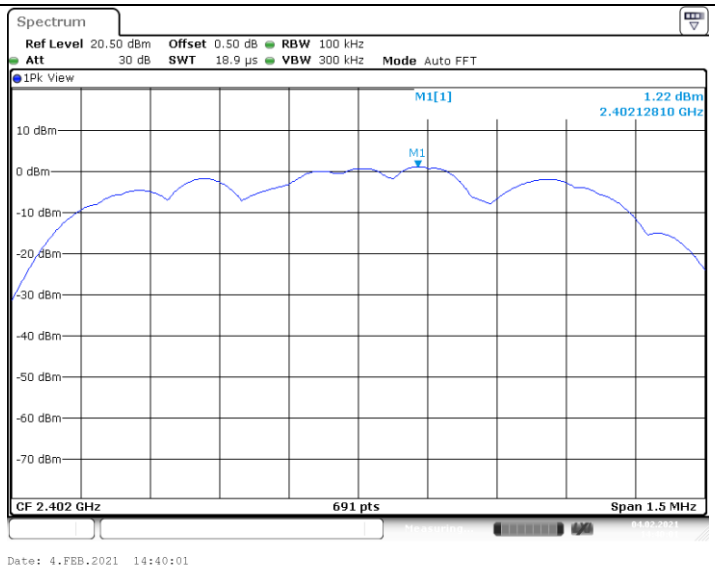
GFSK_2480_30~1000



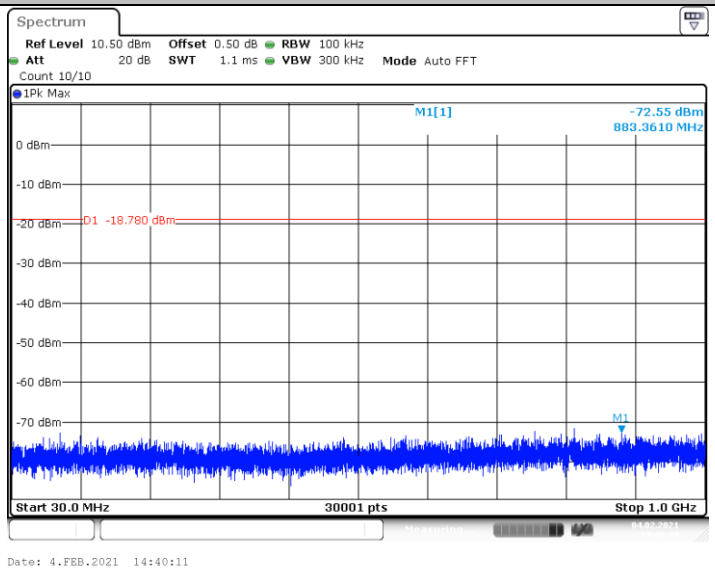
GFSK_2480_1000~26500



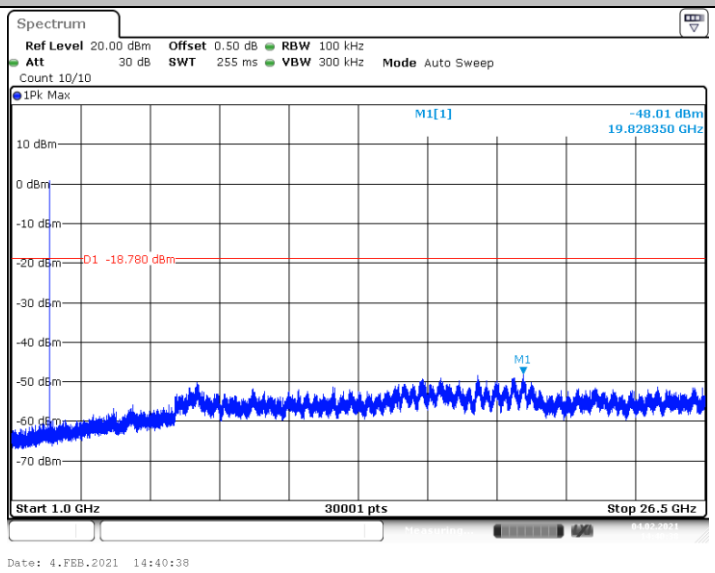
π/4-DQPSK_2402_0~Reference



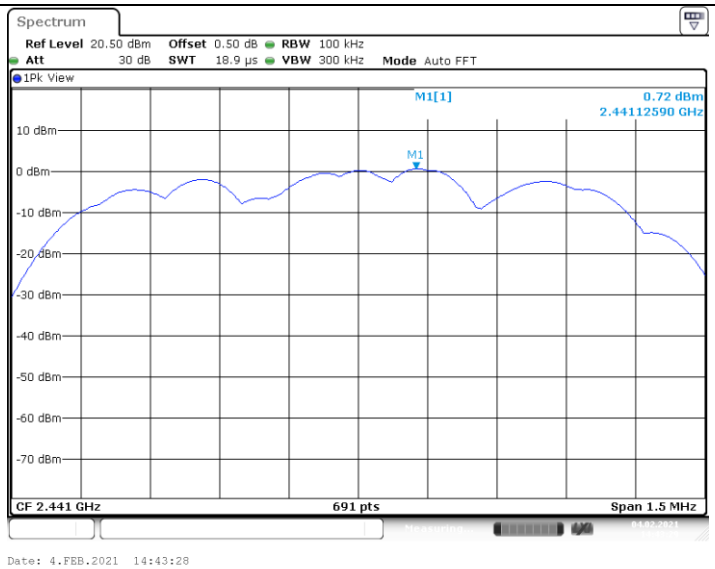
π/4-DQPSK_2402_30~1000



π/4-DQPSK_2402_1000~26500



π/4-DQPSK_2441_0~Reference



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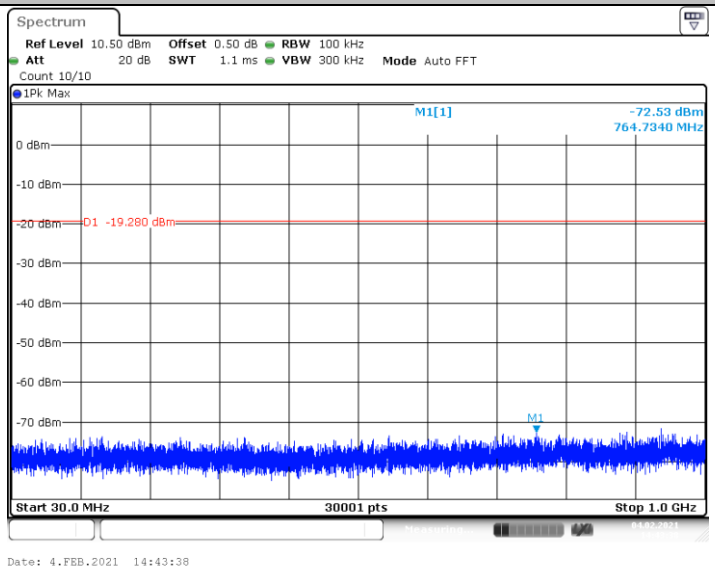
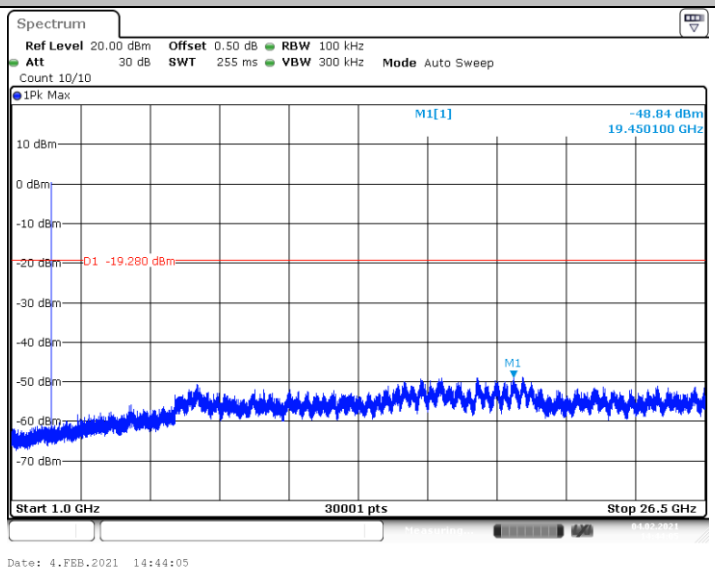
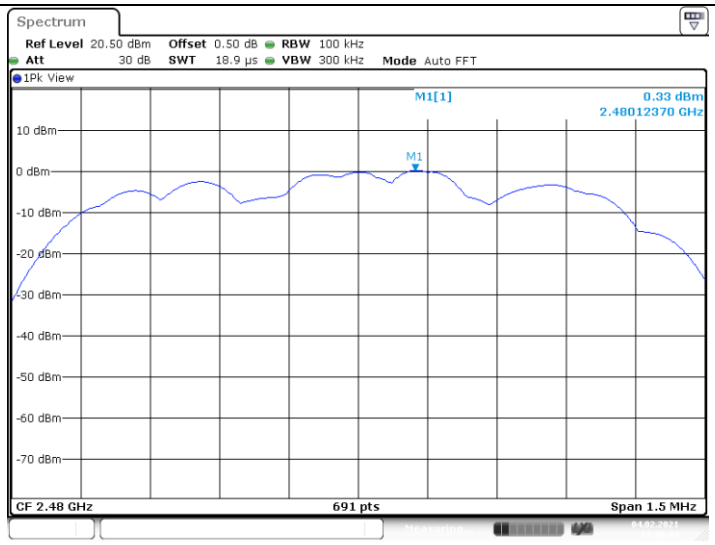


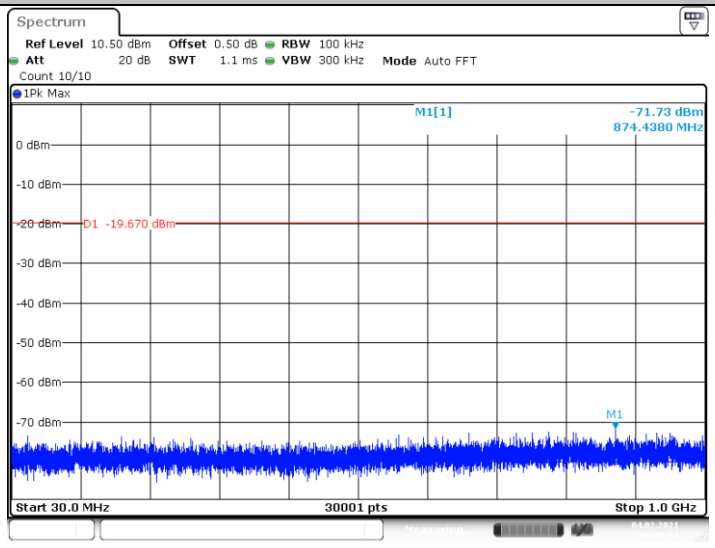
π/4-DQPSK_2441_1000~26500



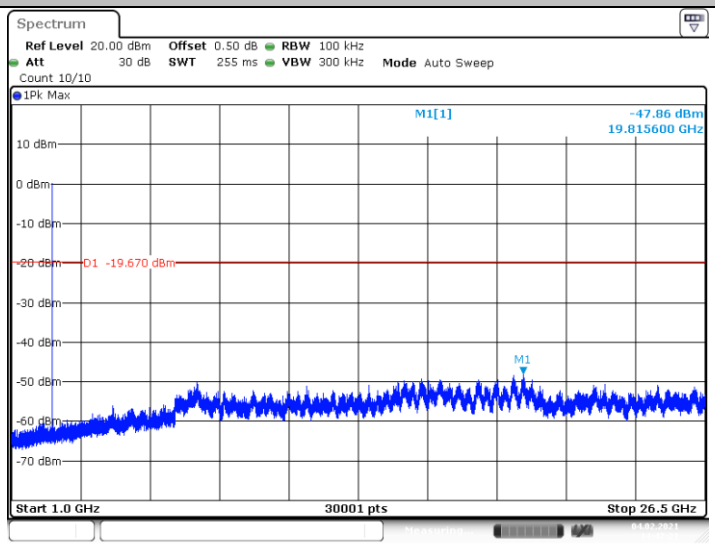
π/4-DQPSK_2480_0~Reference



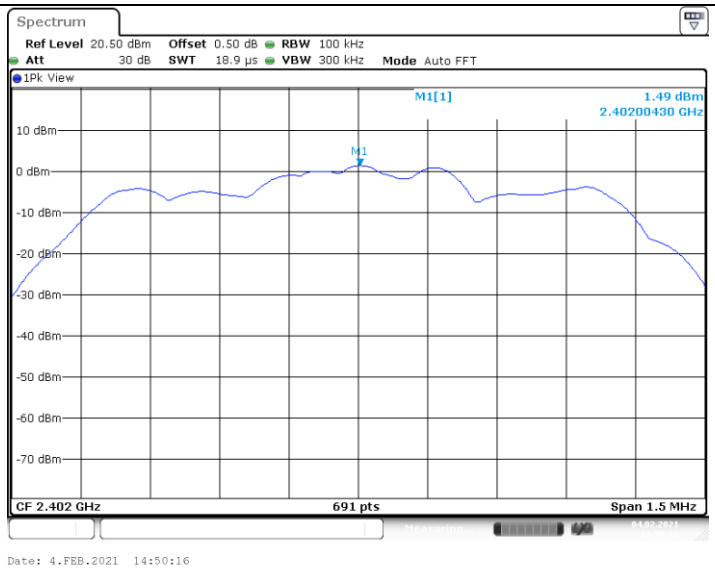
π/4-DQPSK_2480_30~1000



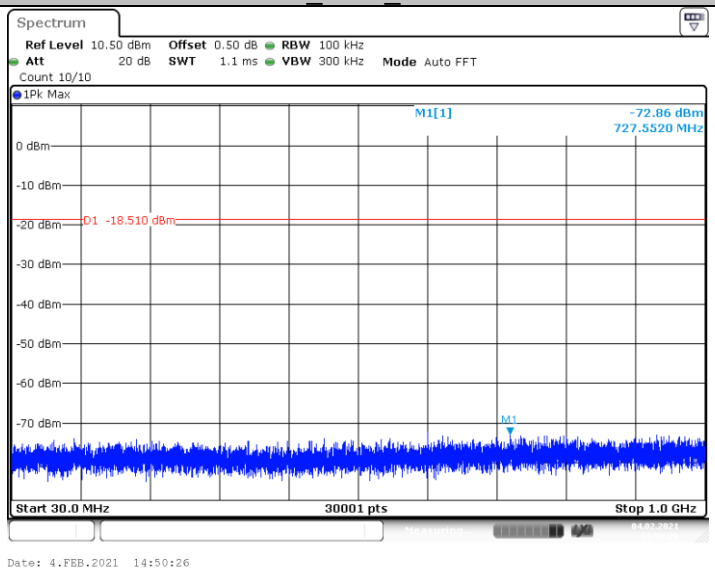
π/4-DQPSK_2480_1000~26500



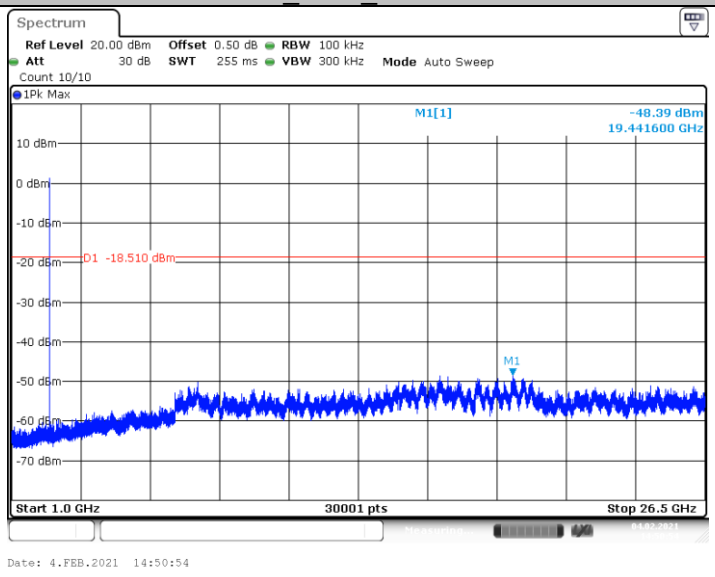
8-DPSK_2402_0~Reference



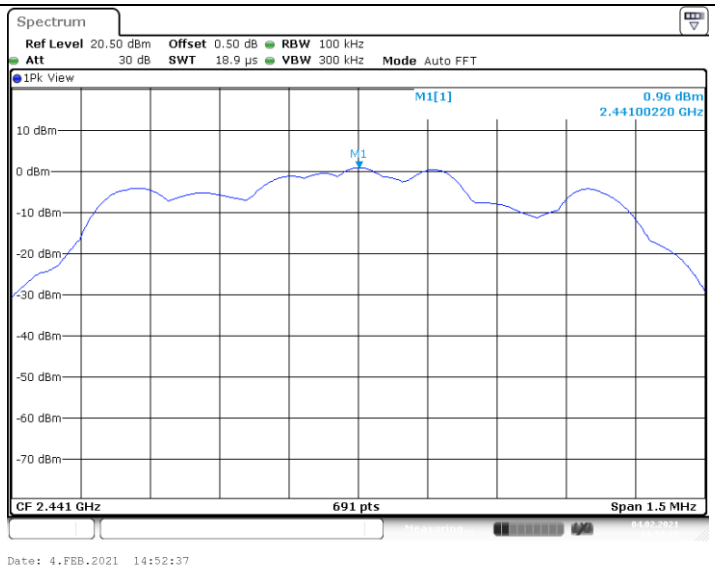
8-DPSK_2402_30~1000



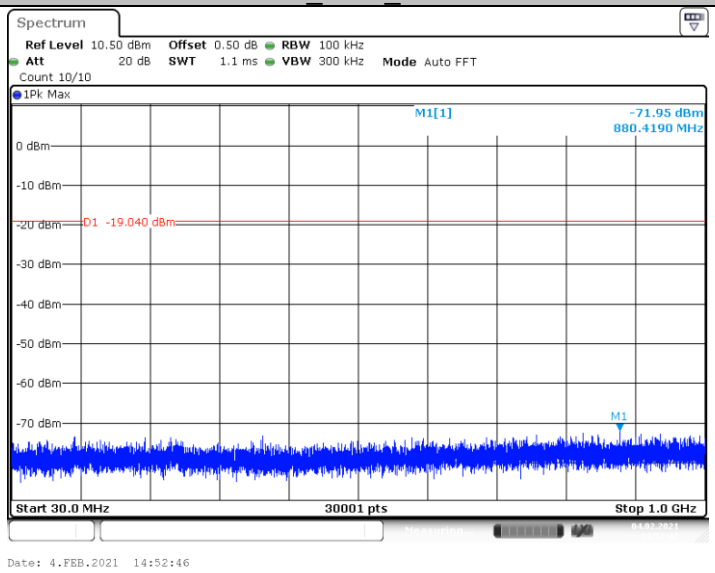
8-DPSK_2402_1000~26500



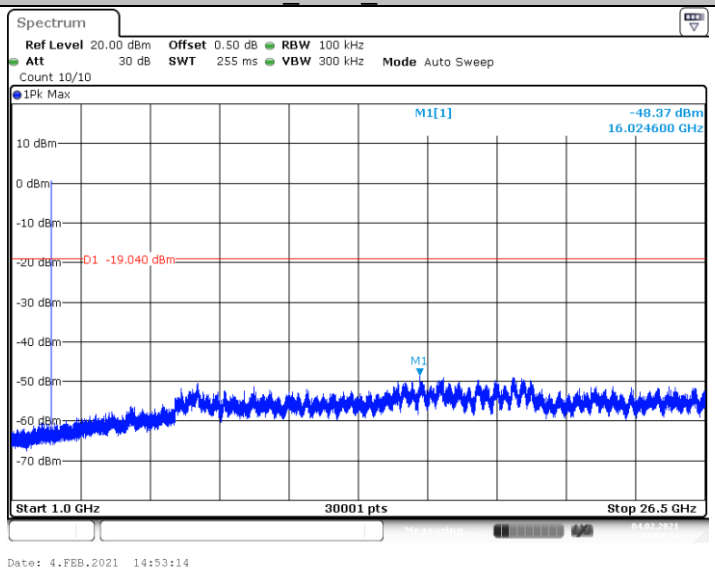
8-DPSK_2441_0~Reference



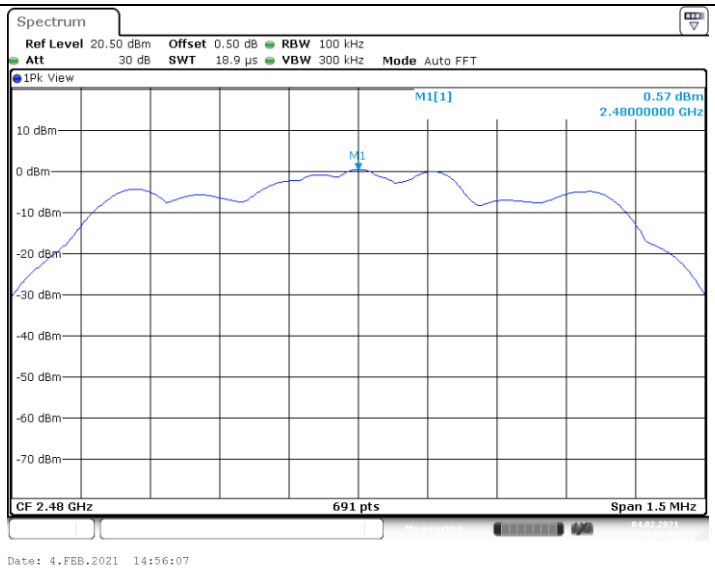
8-DPSK_2441_30~1000



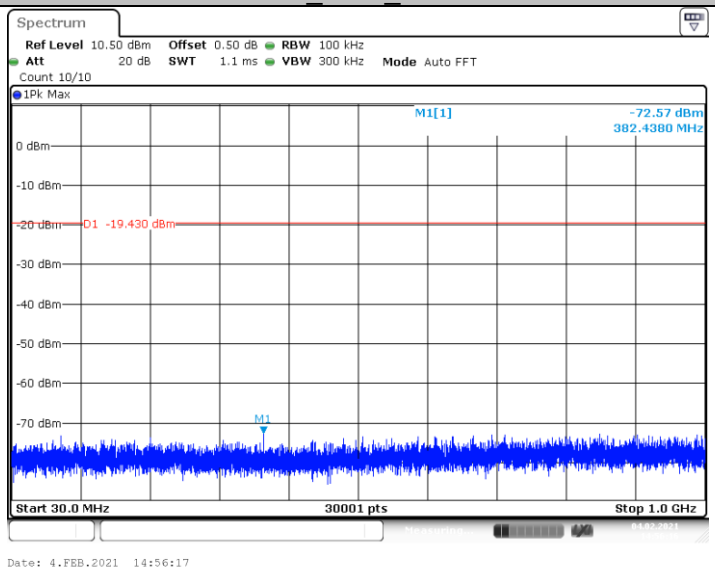
8-DPSK_2441_1000~26500



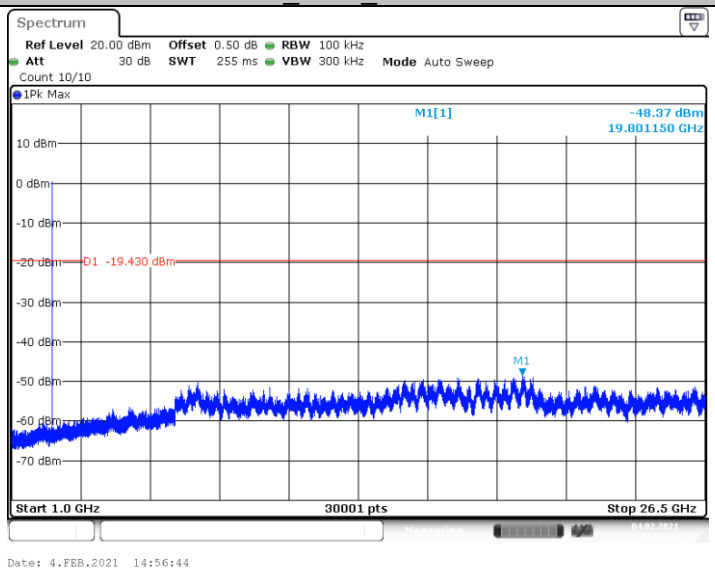
8-DPSK_2480_0~Reference



8-DPSK_2480_30~1000



8-DPSK_2480_1000~26500

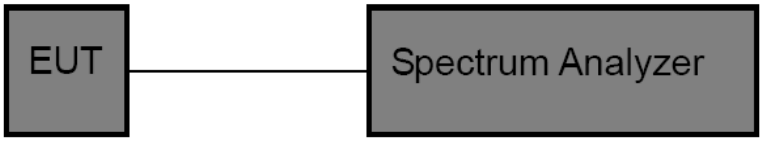


3.5. 20DB Bandwidth

Limit

N/A

Test Configuration



Test Procedure

5. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
6. OCB and 20dB Spectrum Setting:
   (1) Set RBW = 1% ~ 5% occupied bandwidth.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

Note: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

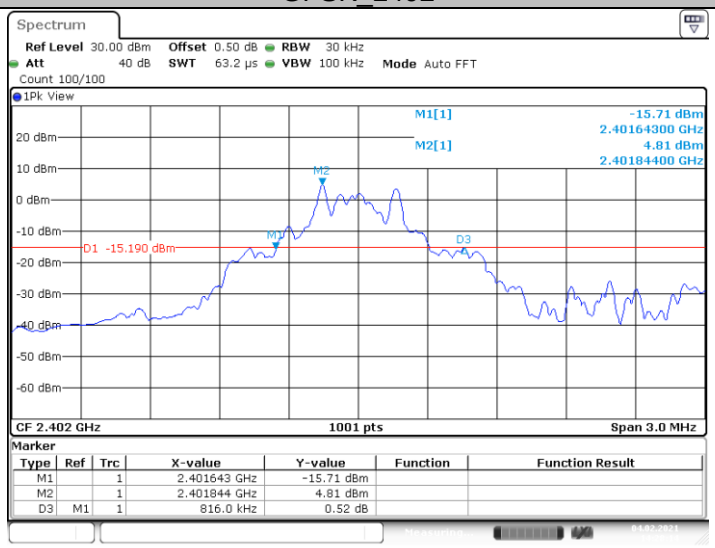
Test Mode

Please refer to the clause 2.4.

Test Results

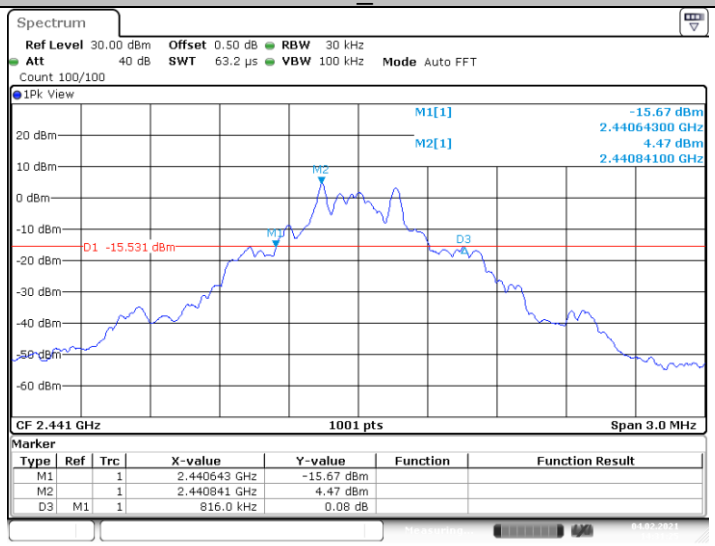
Test Mode	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	20dB Bandwidth *2/3 (kHz)	Verdict
GFSK	2402	0.816	2401.643	2402.459	544.00	PASS
	2441	0.816	2440.643	2441.459	544.00	PASS
	2480	0.819	2479.640	2480.459	546.00	PASS
π/4-DQPSK	2402	1.173	2401.415	2402.588	782.00	PASS
	2441	1.176	2440.412	2441.588	784.00	PASS
	2480	1.173	2479.409	2480.582	782.00	PASS
8-DPSK	2402	1.116	2401.442	2402.558	744.00	PASS
	2441	1.116	2440.439	2441.555	744.00	PASS
	2480	1.113	2479.439	2480.552	742.00	PASS

GFSK_2402



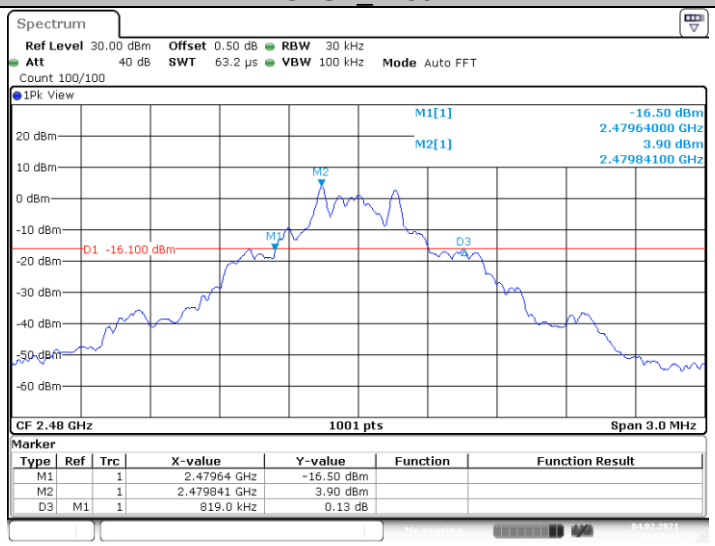
Date: 4.FEB.2021 14:28:13

GFSK_2441



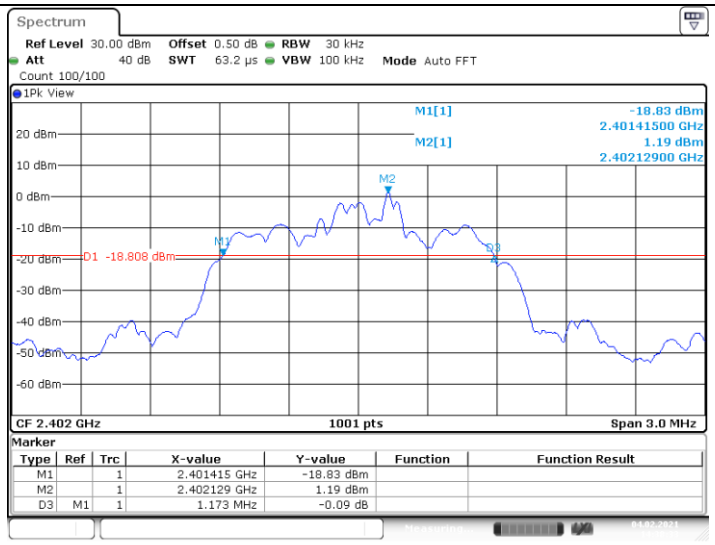
Date: 4.FEB.2021 14:31:25

GFSK_2480

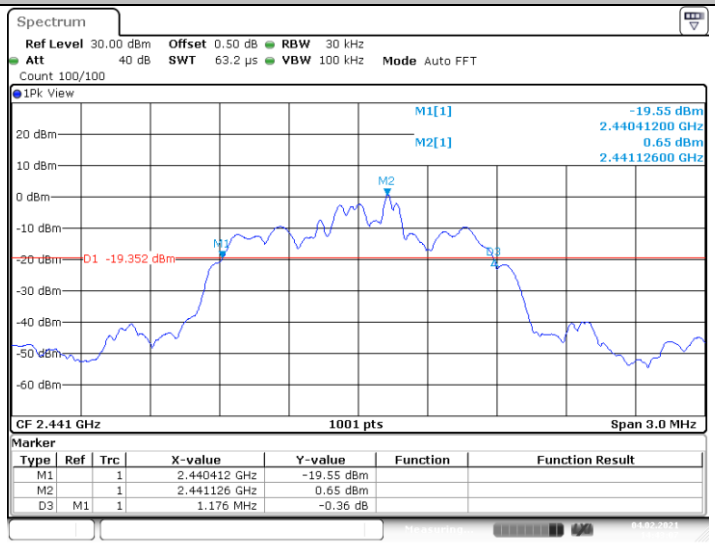


Date: 4.FEB.2021 14:33:46

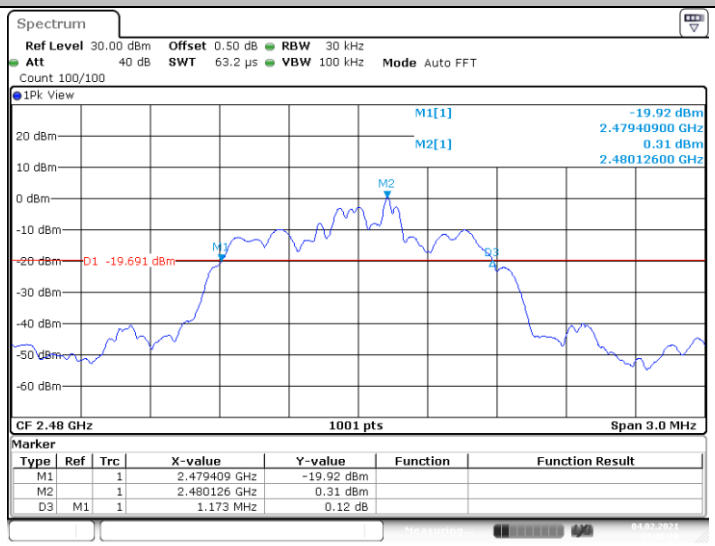
π/4-DQPSK_2402



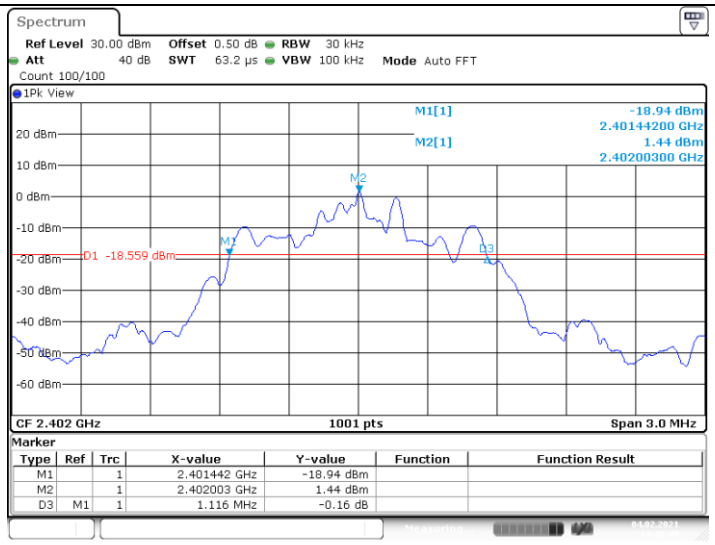
π/4-DQPSK_2441



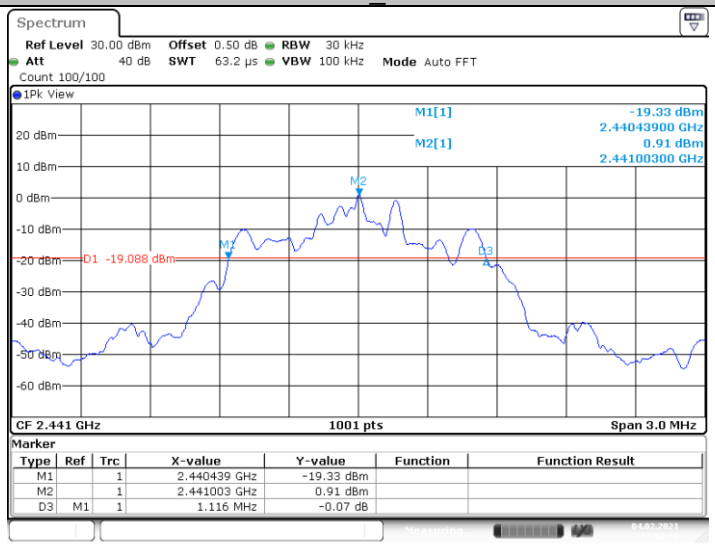
π/4-DQPSK_2480



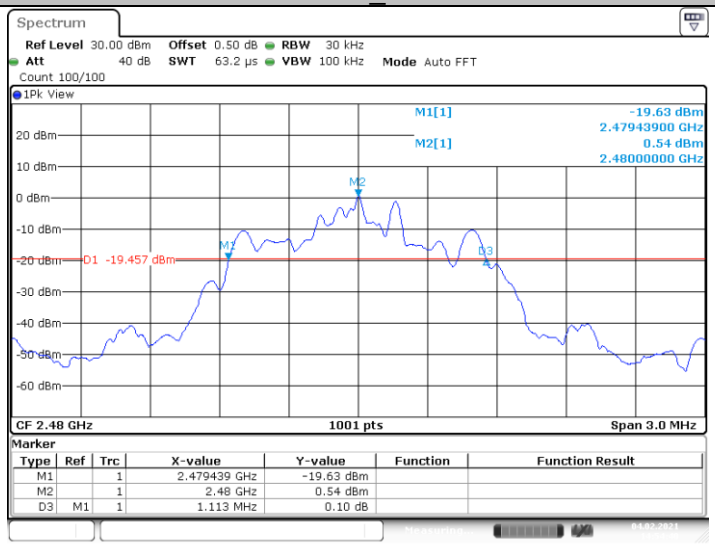
8-DPSK_2402



8-DPSK_2441



8-DPSK_2480



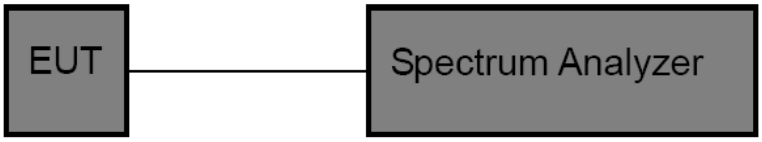
3.6. Channel Separation

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1)/ RSS-247 5.1 b :

Test Item	Limit	Frequency Range(MHz)
Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth Which is greater	2400~2483.5

Test Configuration



Test Procedure

7. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
8. Spectrum Setting:
   (1) Set RBW = 100 kHz.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

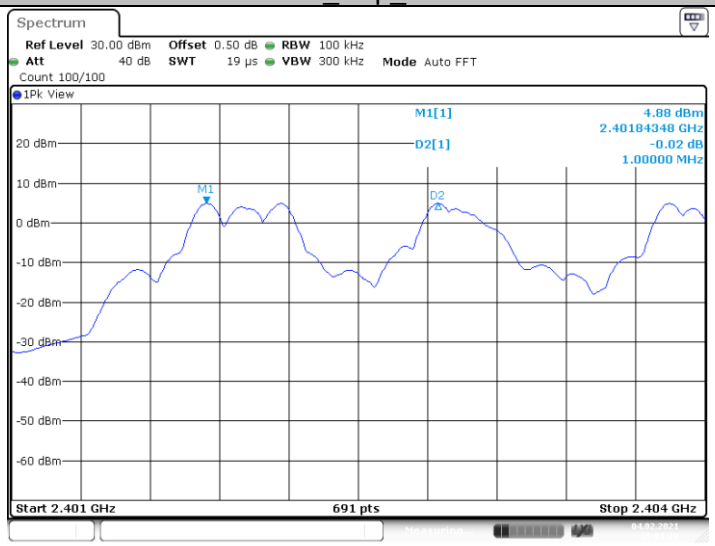
Test Mode

Please refer to the clause 2.4.

Test Results

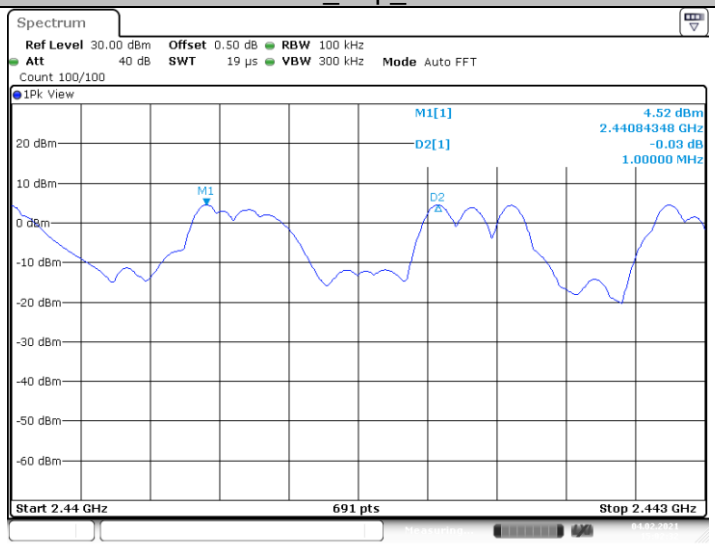
Test Mode	Channel	Result[MHz]	Limit[MHz]	Verdict
GFSK	Hop_2402	1.000	>544.00	PASS
	Hop_2441	1.000	>544.00	PASS
	Hop_2480	1.000	>546.00	PASS
π/4-DQPSK	Hop_2402	1.000	>782.00	PASS
	Hop_2441	1.004	>784.00	PASS
	Hop_2480	1.000	>782.00	PASS
8-DPSK	Hop_2402	1.004	>744.00	PASS
	Hop_2441	1.000	>744.00	PASS
	Hop_2480	1.000	>742.00	PASS

GFSK_Hop_2402



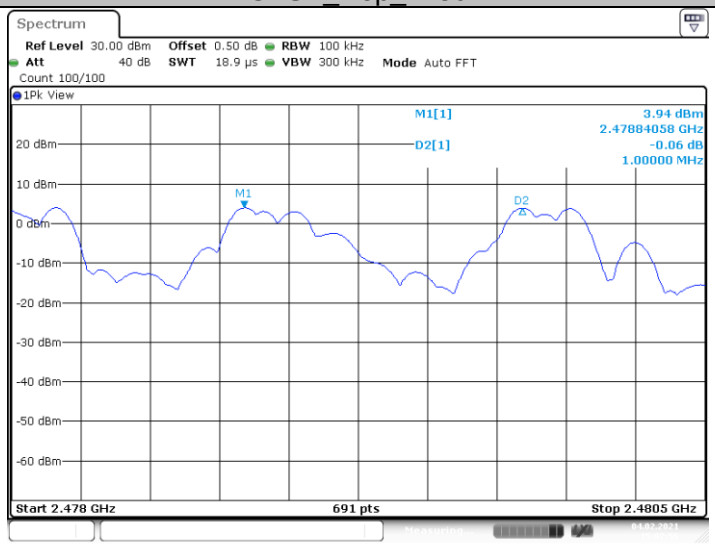
Date: 4.FEB.2021 15:01:10

GFSK_Hop_2441



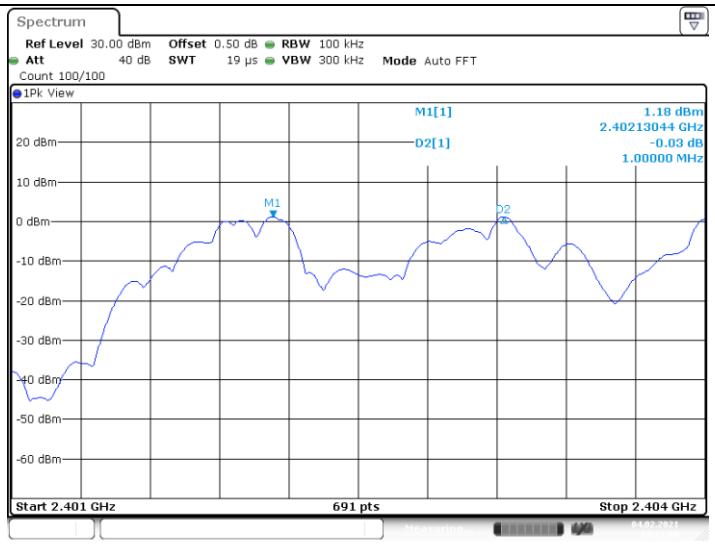
Date: 4.FEB.2021 15:02:31

GFSK_Hop_2480

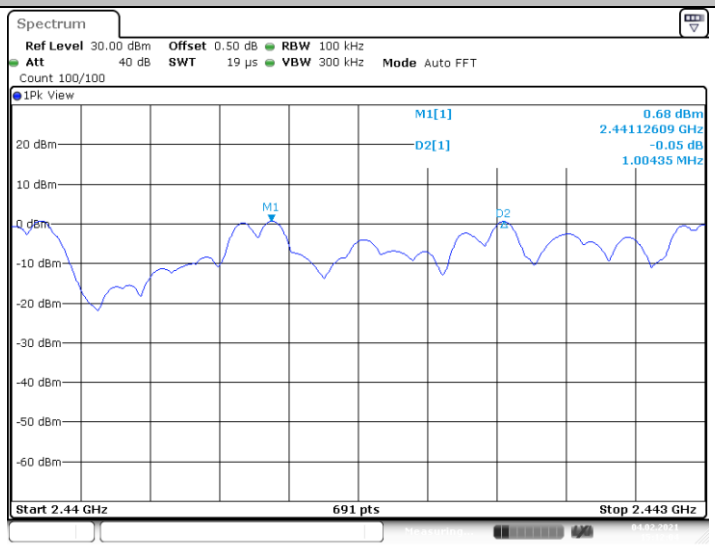


Date: 4.FEB.2021 15:02:56

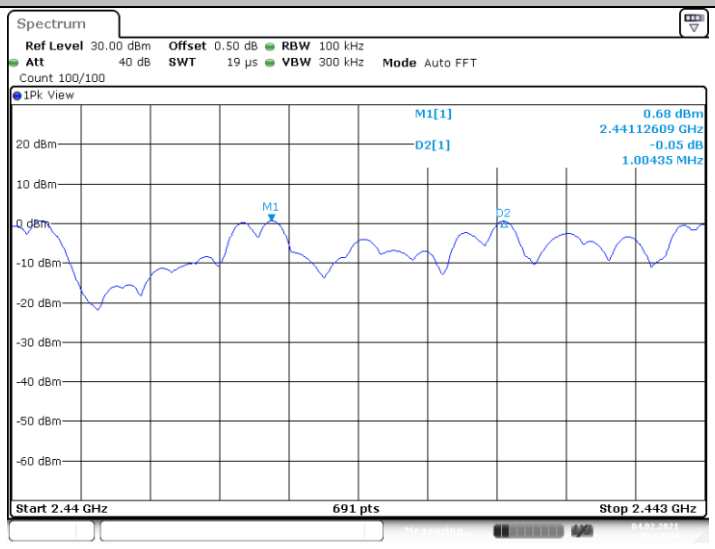
π/4-DQPSK_Hop_2402



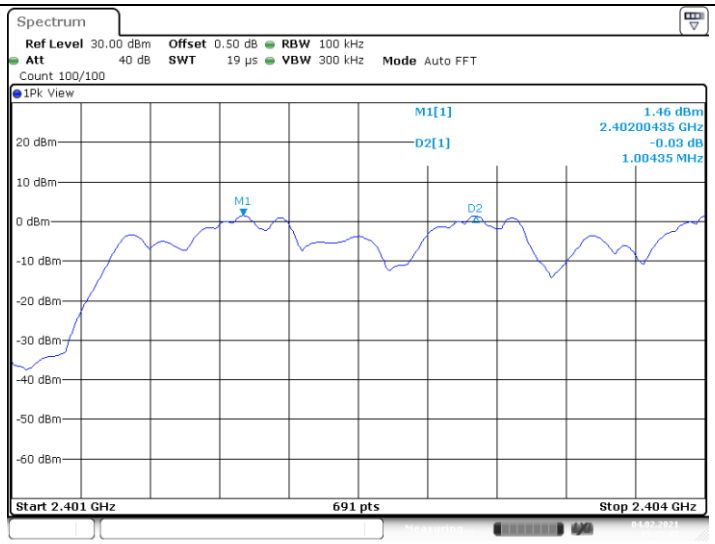
π/4-DQPSK_Hop_2441



π/4-DQPSK_Hop_2480

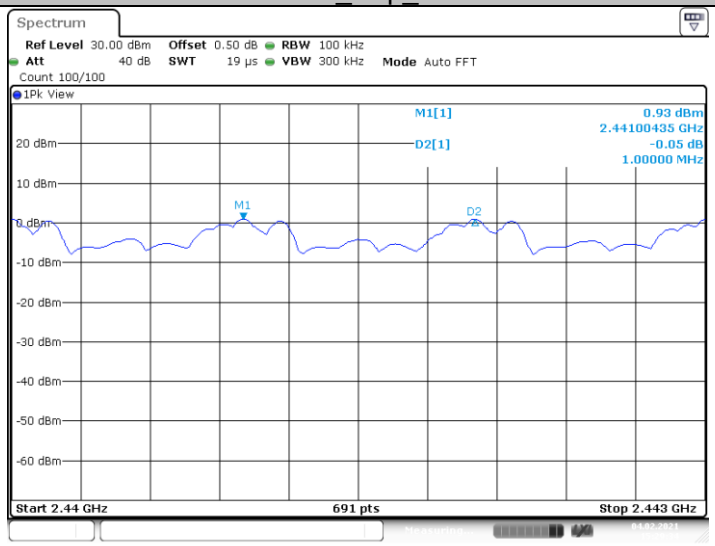


8-DPSK_Hop_2402



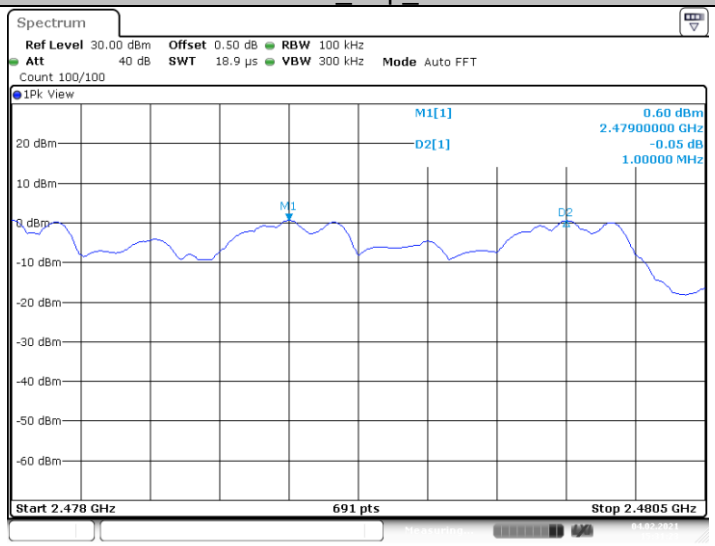
Date: 4.FEB.2021 15:25:47

8-DPSK_Hop_2441



Date: 4.FEB.2021 15:29:34

8-DPSK_Hop_2480



Date: 4.FEB.2021 15:31:23

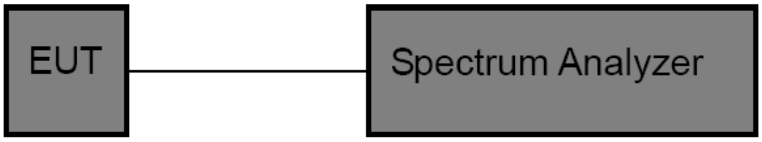
3.7. Number of Hopping Channel

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(iii)/ RSS-247 5.1 d:

Section	Test Item	Limit
15.247 (a)(iii)/ RSS-247 5.1 d:	Number of Hopping Channel	>15

Test Configuration



Test Procedure

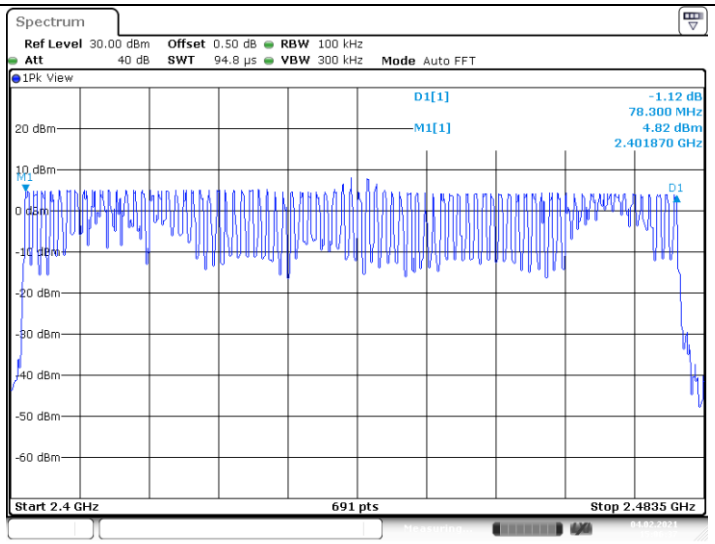
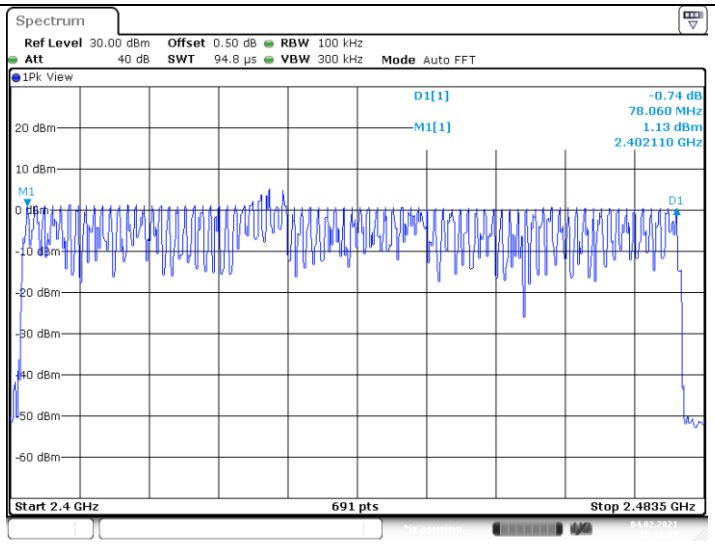
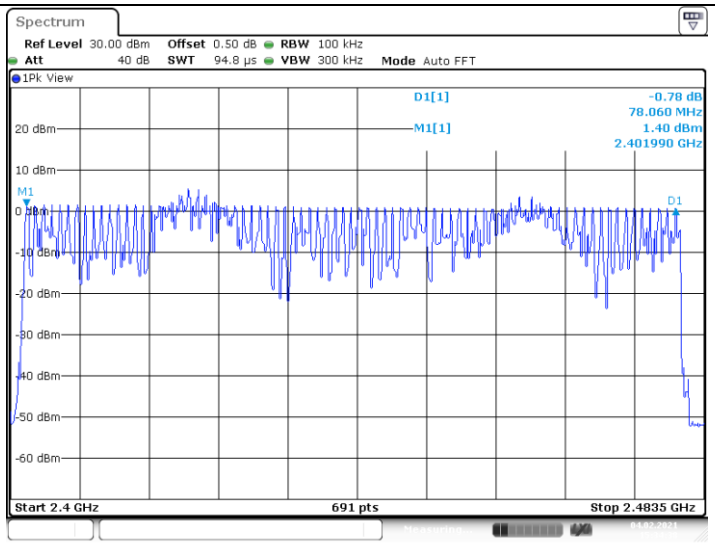
1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Peak Detector: RBW=100 kHz, VBW≥RBW, Sweep time= Auto.

Test Mode

Please refer to the clause 2.4.

Test Result

Modulation type	Channel number	Limit	Result
GFSK	79	≥15.00	Pass
π/4-DQPSK	79		
8DPSK	79		

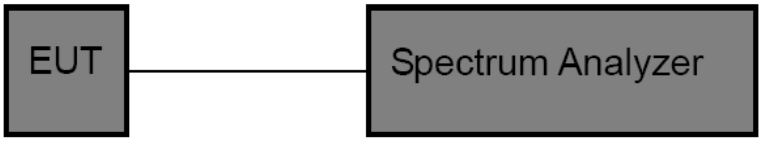
GFSK	 Date: 4.FEB.2021 15:06:37
π/4-DQPSK	 Date: 4.FEB.2021 15:18:04
8-DPSK	 Date: 4.FEB.2021 15:34:38

3.8. Dwell Time

Limit

Section	Test Item	Limit
15.247(a)(iii)/ RSS-247 5.1 d	Average Time of Occupancy	0.4 sec

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Spectrum Setting: RBW=1MHz, VBW≥RBW.
   (2) Use video trigger with the trigger level set to enable triggering only on full pulses.
   (3) Sweep Time is more than once pulse time.
   (4) Set the center frequency on any frequency would be measure and set the frequency span to zero.
   (5) Measure the maximum time duration of one single pulse.
   (6) Set the EUT for packet transmitting.

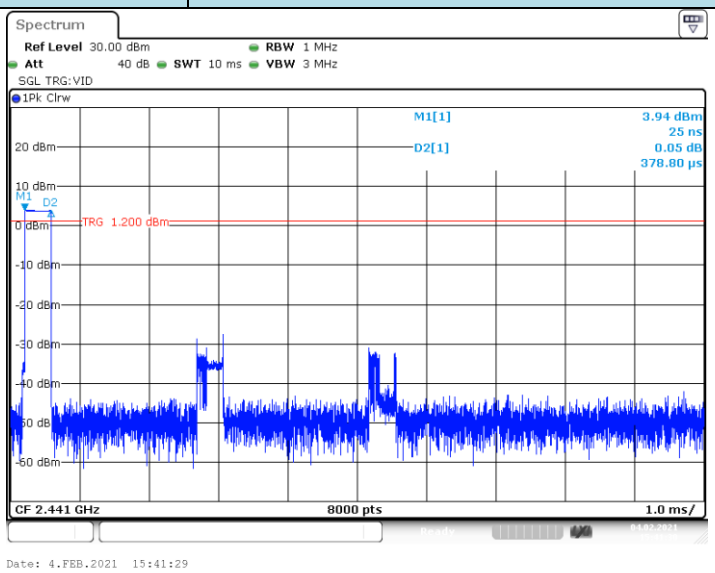
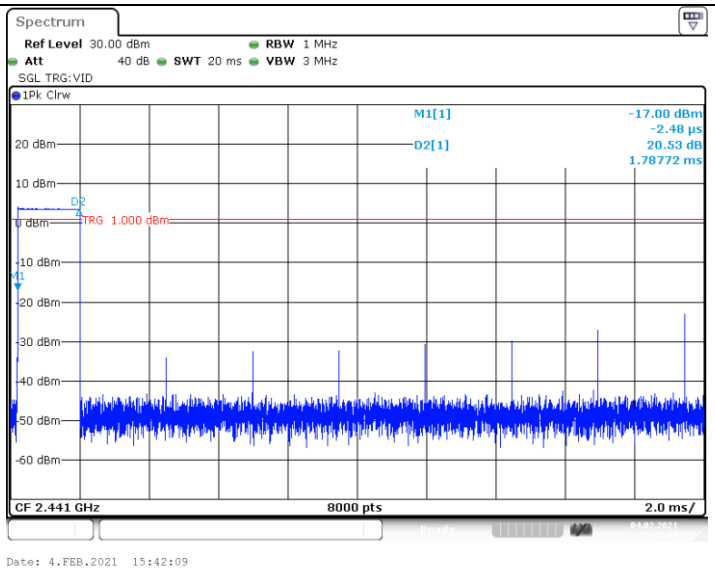
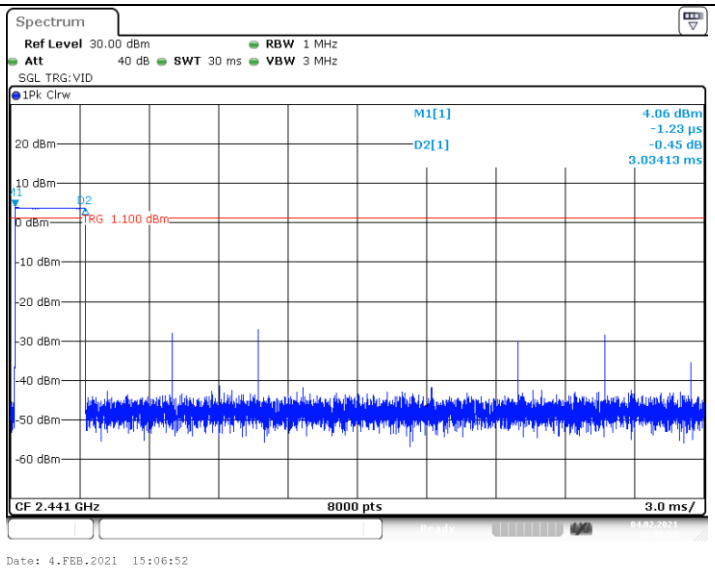
Test Mode

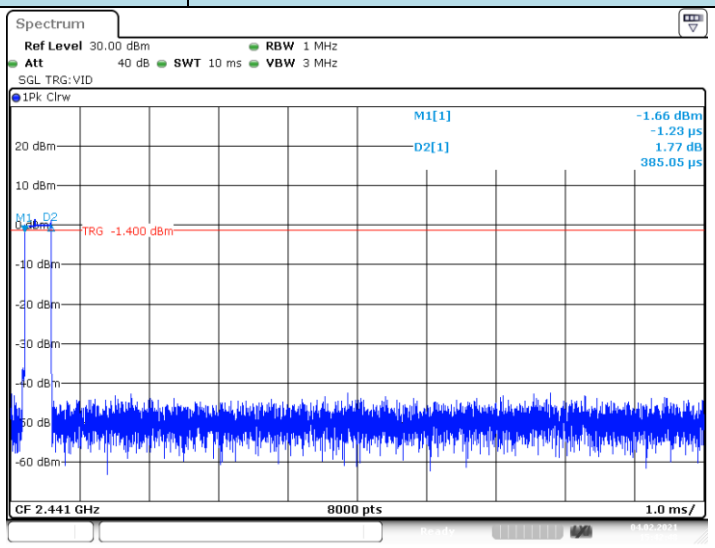
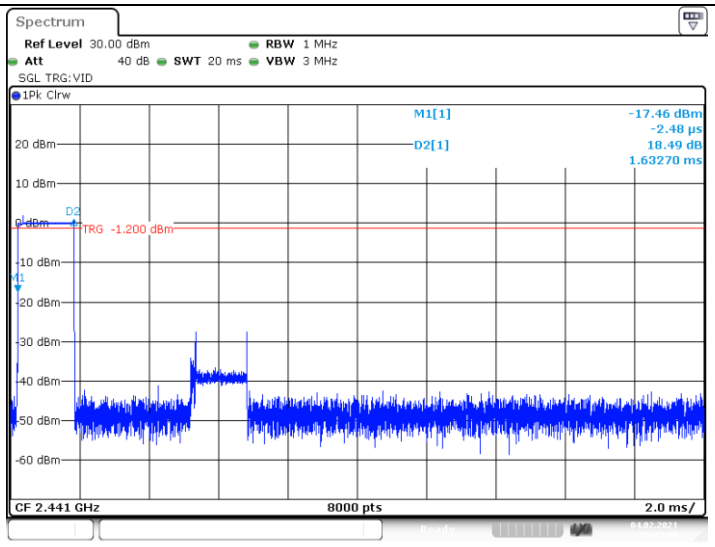
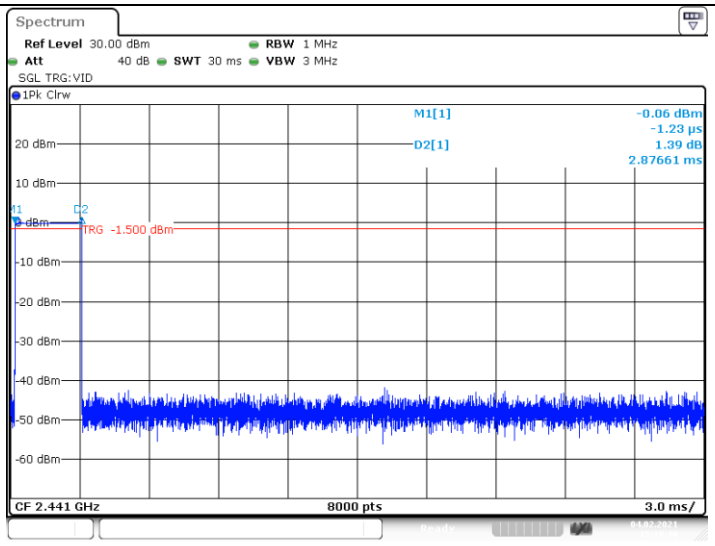
Please refer to the clause 2.4.

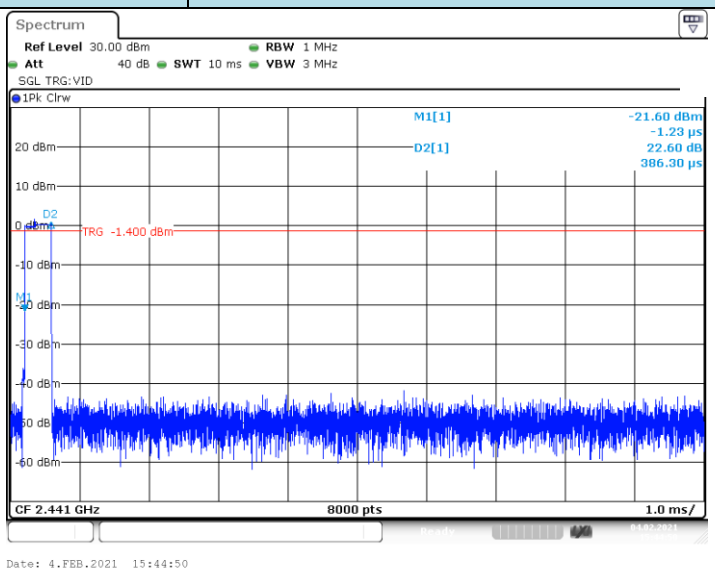
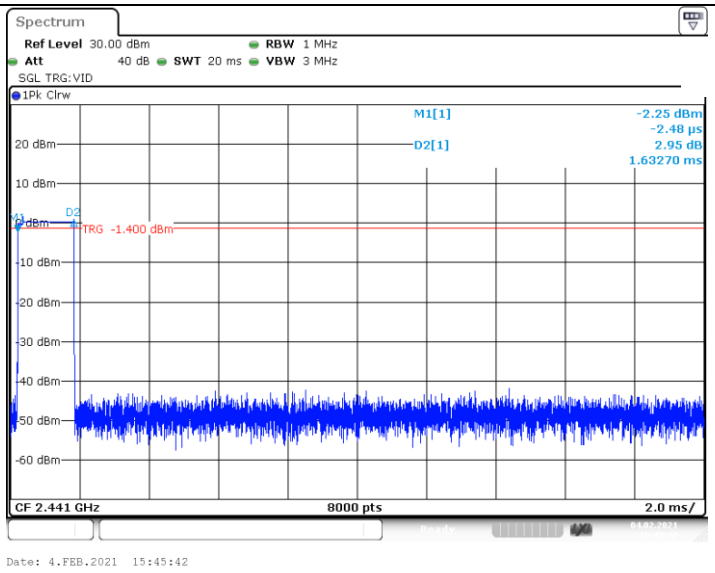
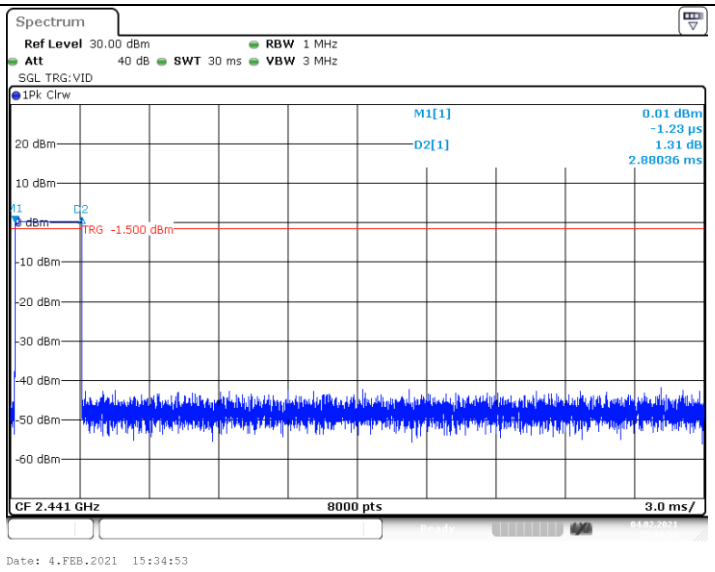
Test Result

Modulation type	Channel	Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (ms)	Limit (Second)	Result
GFSK	DH1	2441	0.38	121.60	31.60	≤ 0.40	Pass
	DH3	2441	1.79	286.40	31.60		
	DH5	2441	3.03	323.20	31.60		
π/4-DQPSK	2DH1	2441	0.39	124.80	31.60	≤ 0.40	Pass
	2DH3	2441	1.63	260.80	31.60		
	2DH5	2441	2.88	307.20	31.60		
8-DPSK	3DH1	2441	0.39	124.80	31.60	≤ 0.40	Pass
	3DH3	2441	1.63	260.80	31.60		
	3DH5	2441	2.88	307.20	31.60		

Note: 1DH1/2DH1/3DH1 Total of Dwell= Pulse Time(1600/2)*31.6/79*
1DH3/2DH3/3DH3 Total of Dwell= Pulse Time(1600/4)*31.6/79*
1DH5/2DH5/3DH5 Total of Dwell= Pulse Time(1600/6)*31.6/79*

Modulation Type:	GFSK
DH1	
DH3	
DH5	

Modulation Type:	π/4-DQPSK
2DH1	
2DH3	
2DH5	

Modulation Type:	8-DPSK
3DH1	
3DH3	
3DH5	

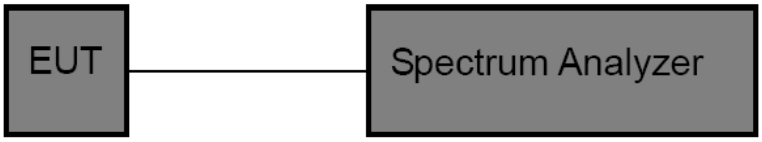
3.9. Peak Output Power

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(1) / RSS-247 5.4 b:

Test Item	Limit	Frequency Range(MHz)
Peak Output Power	Hopping Channels>75 Power<1W(30dBm) Other <125mW(21dBm)	2400~2483.5

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Set RBW> 20DB Bandwidth.
   (2) Set the video bandwidth (VBW) ≥ RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

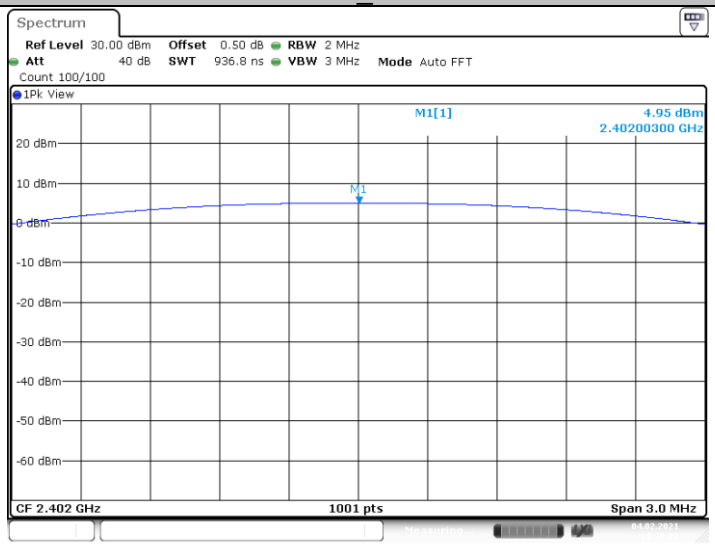
Test Mode

Please refer to the clause 2.4.

Test Result

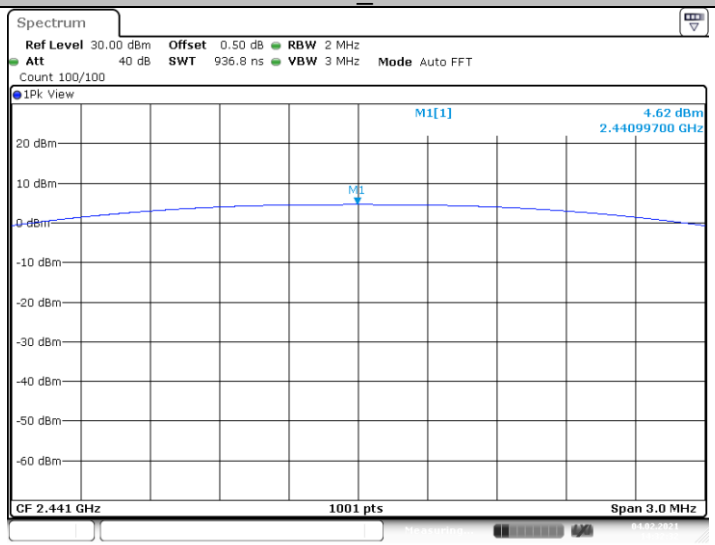
Test Mode	Channel	Result[dBm]	Limit[dBm]	Verdict
GFSK	2402	4.95	<=30	PASS
	2441	4.62	<=30	PASS
	2480	4.02	<=30	PASS
π/4-DQPSK	2402	2.79	<=30	PASS
	2441	2.40	<=30	PASS
	2480	2.04	<=30	PASS
8-DPSK	2402	3.15	<=30	PASS
	2441	1.70	<=30	PASS
	2480	1.41	<=30	PASS

GFSK_2402



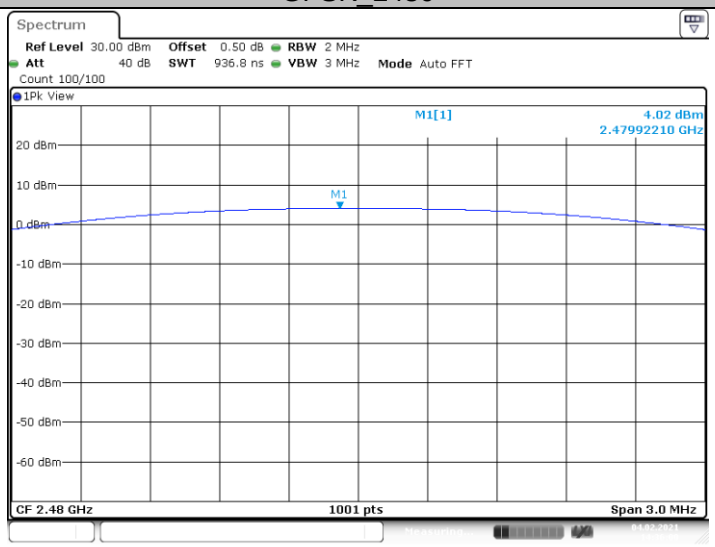
Date: 4.FEB.2021 14:30:27

GFSK_2441



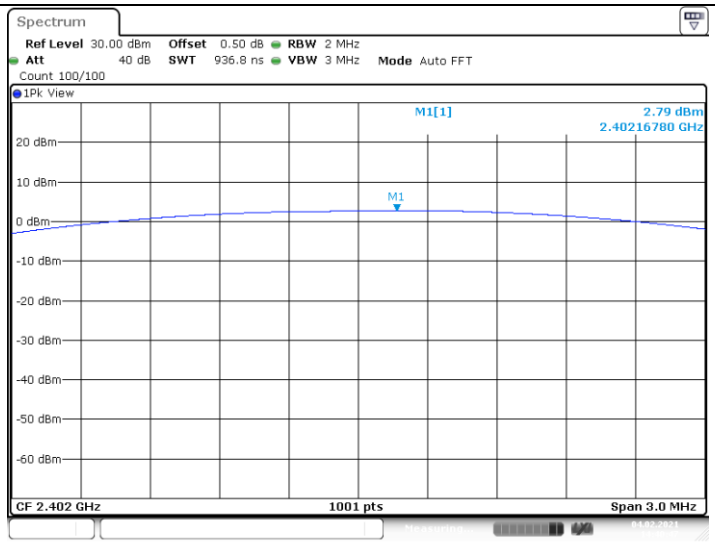
Date: 4.FEB.2021 14:32:32

GFSK_2480



Date: 4.FEB.2021 14:36:00

π/4-DQPSK_2402



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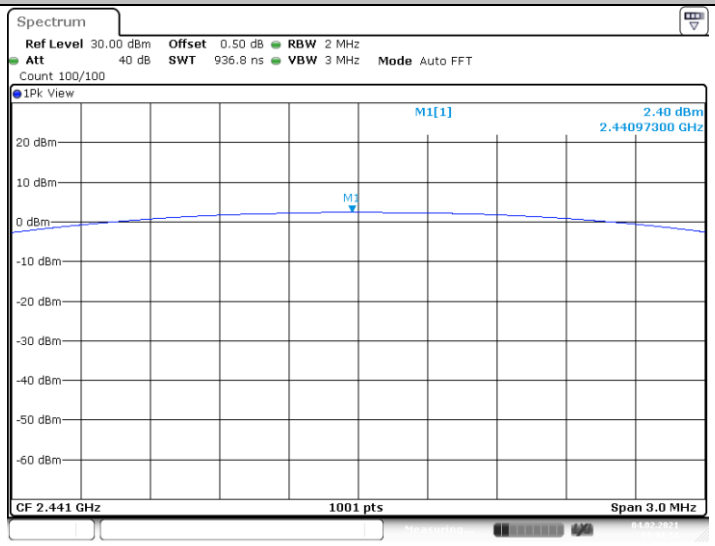
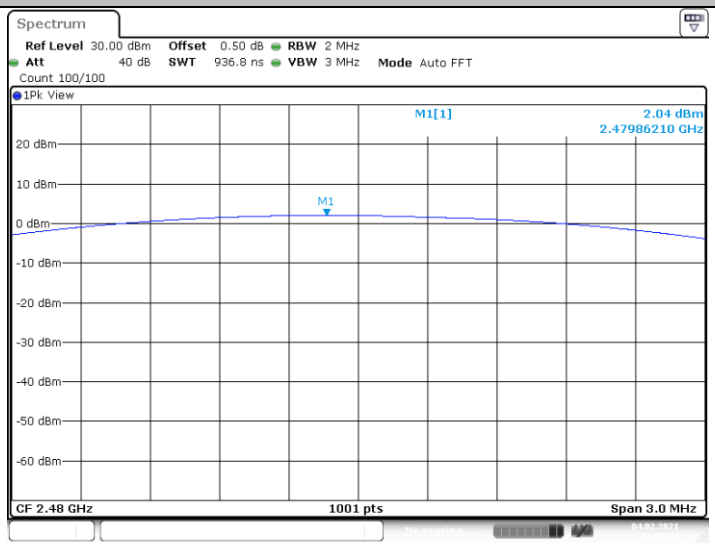
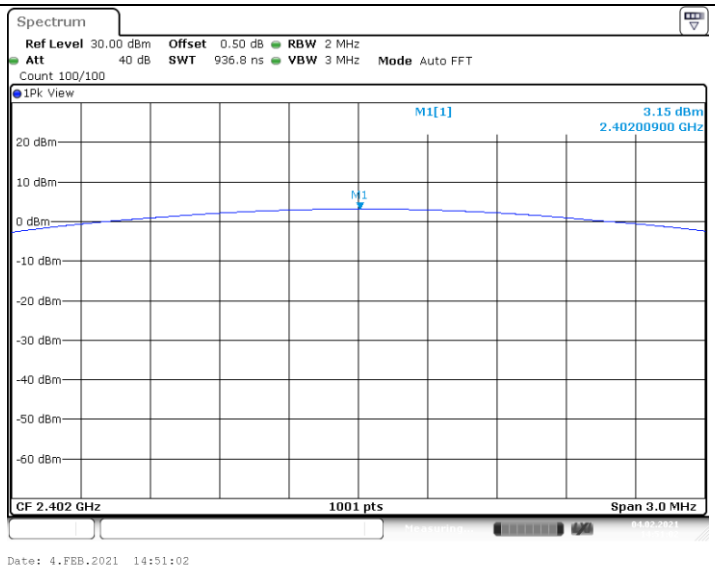


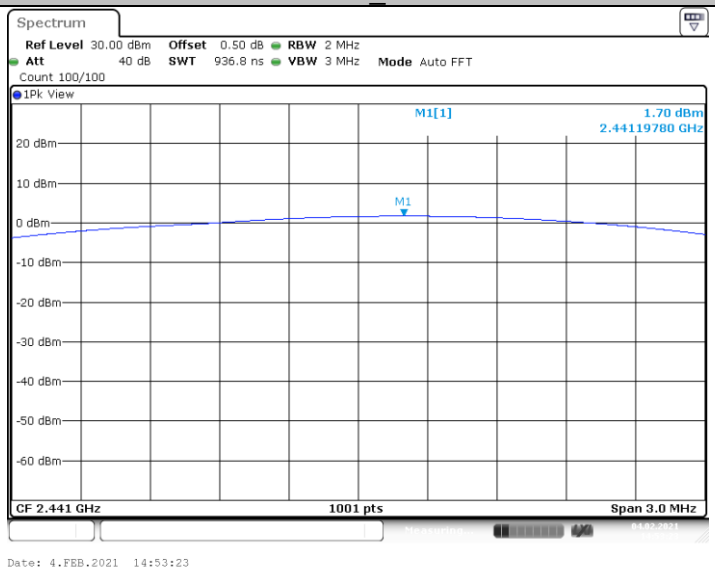
π/4-DQPSK_2480



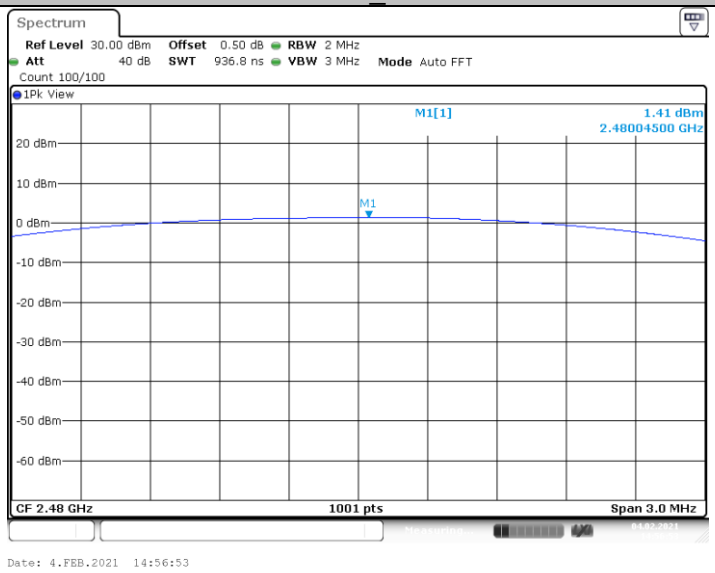
8-DPSK_2402



8-DPSK_2441



8-DPSK_2480

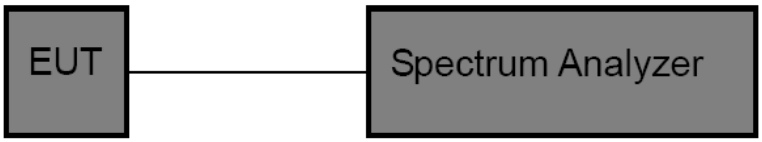


3.10. Duty Cycle

Limit

None, for report purposes only.

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 DTS Meas Guidance v05r02.
3. Spectrum Setting:

Set analyzer center frequency to test channel center frequency.
Set the span to 0Hz
Set the RBW to 10MHz
Set the VBW to 10MHz
Detector: Peak
Sweep time: Auto
Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

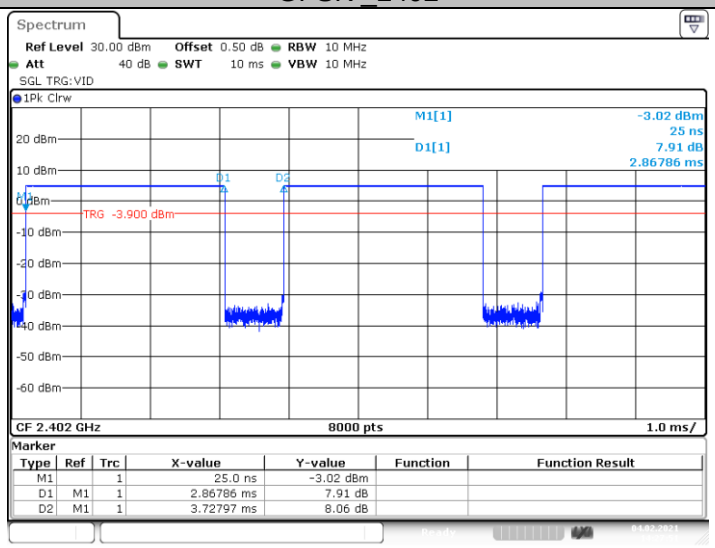
Test Mode

Please refer to the clause 2.4.

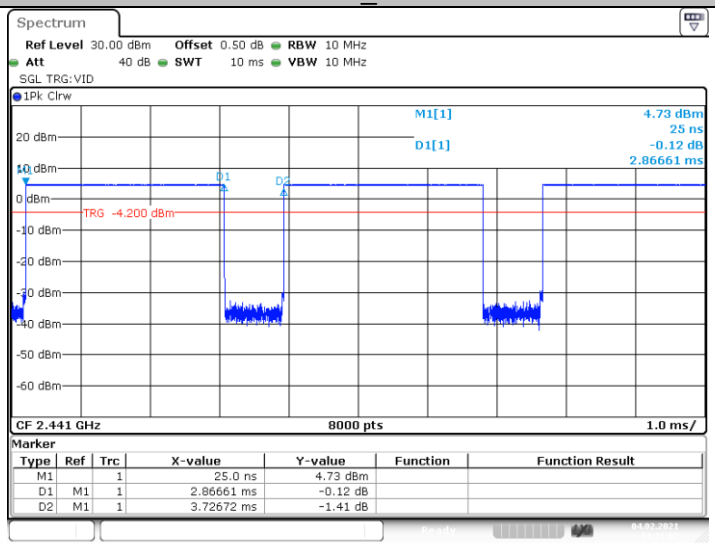
Test Result

Test Mode	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	1/T Minimum VBW (kHz)	Final setting For VBW (kHz)
GFSK	2402	2.868	3.728	76.93	0.35	1
	2441	2.867	3.727	76.92	0.35	1
	2480	2.868	3.727	76.95	0.35	1
π/4-DQPSK	2402	2.870	3.728	77.00	0.35	1
	2441	2.870	3.728	77.00	0.35	1
	2480	2.870	3.728	77.00	0.35	1
8-DPSK	2402	2.870	3.727	77.06	0.35	1
	2441	2.873	3.728	77.05	0.35	1
	2480	2.872	3.727	77.09	0.35	1

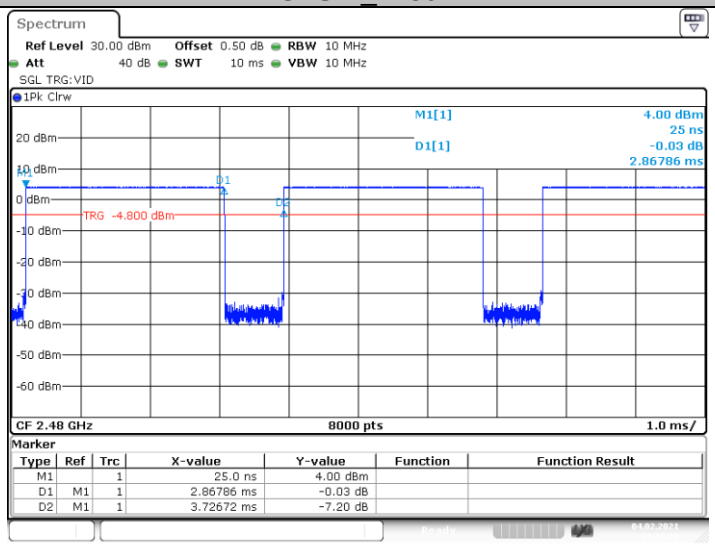
GFSK _2402



GFSK _2441



GFSK _2480



π/4-DQPSK_2402

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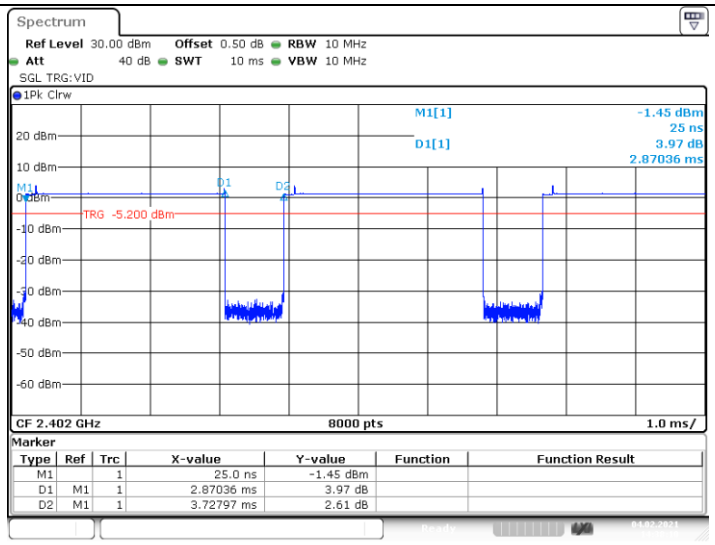
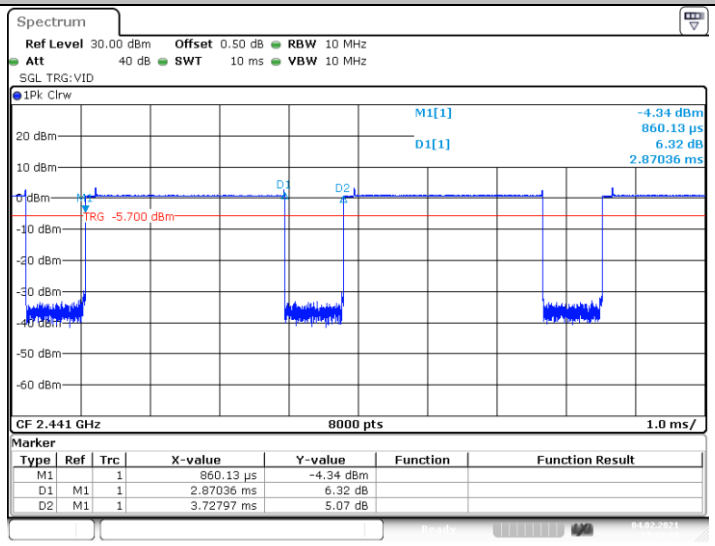


π/4-DQPSK_2441



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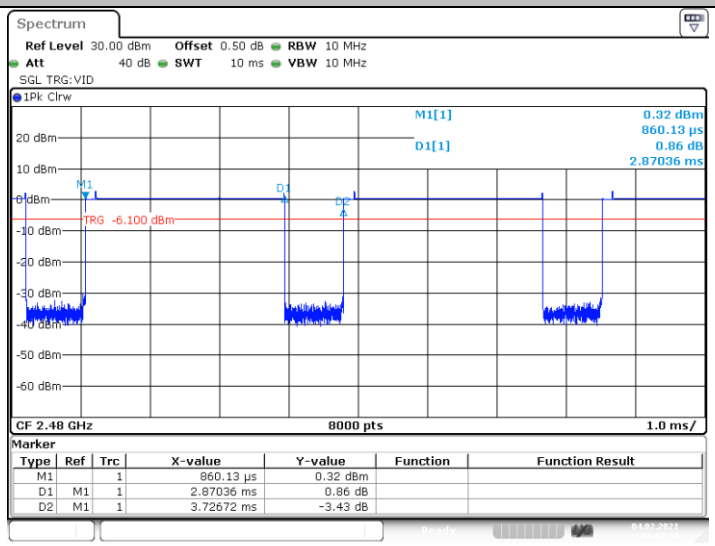
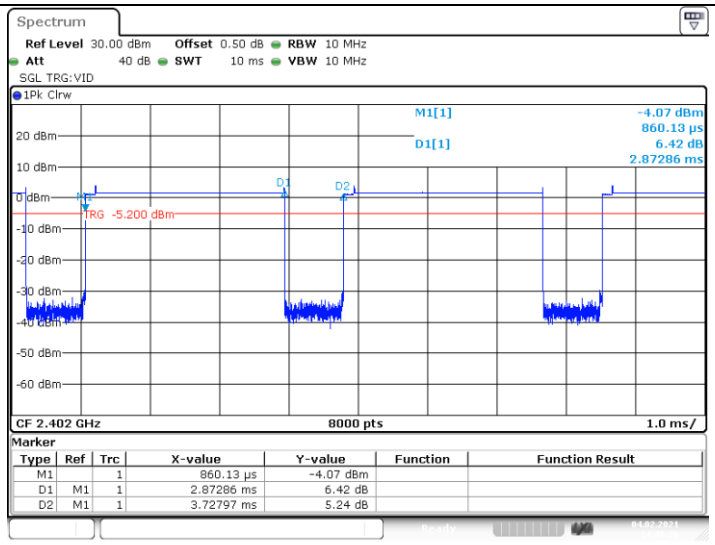


8-DPSK_2402



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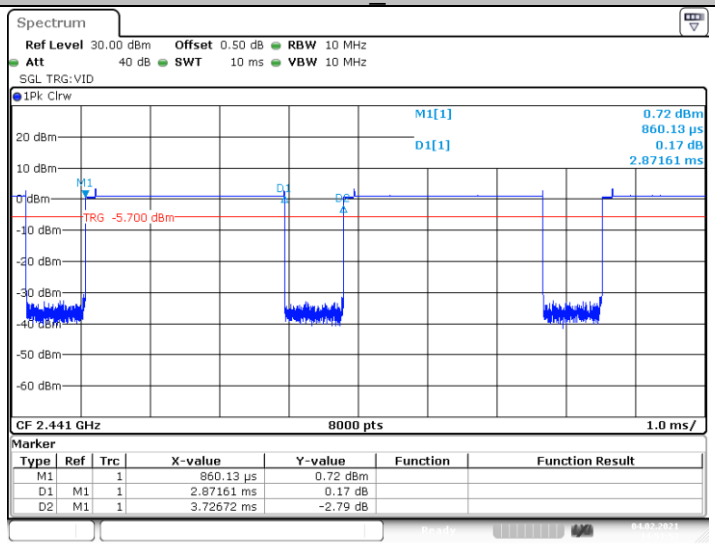
8-DPSK_2441



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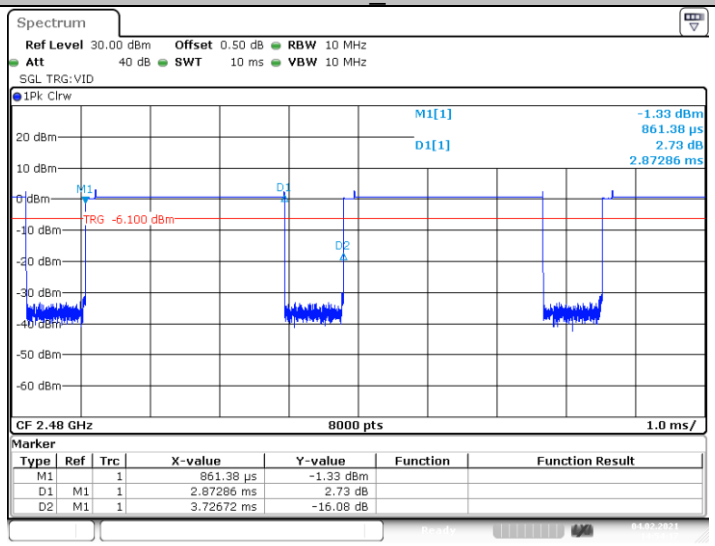
8-DPSK_2480



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3.11. Antenna Requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

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

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

Test Result

The test result is PASS, because the directional gain of the antenna less than 6dBi, please refer to the EUT internal photographs antenna photo.

**********THE END**********