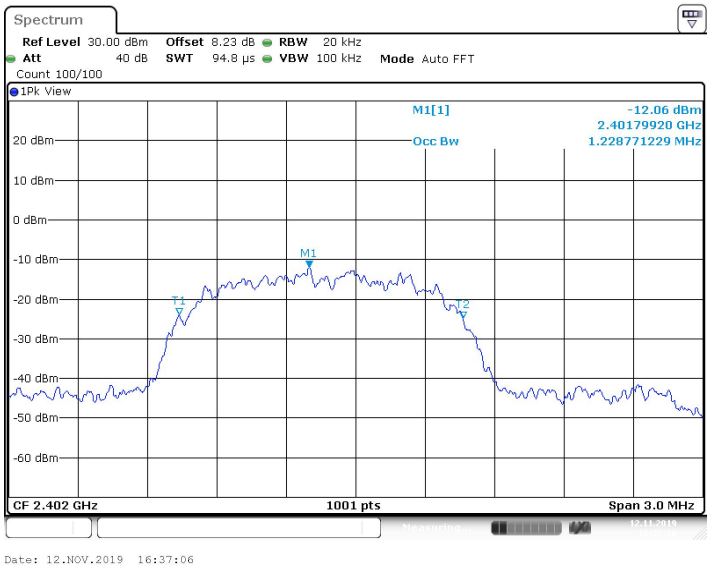
Test Mode:	8DPSK Mode			
Channel frequency (MHz)	99% OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	1.229	2401.236	2402.465	PASS
2441	1.217	2440.239	2441.456	PASS
2480	1.214	2479.239	2480.453	PASS

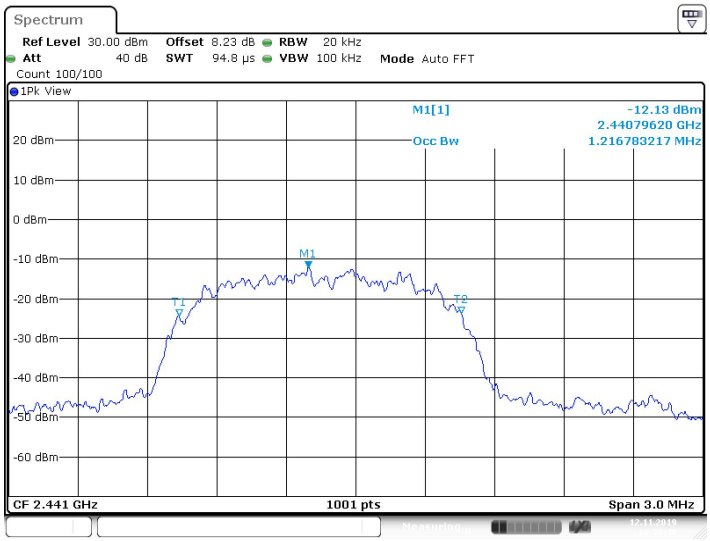
8DPSK Mode

2402 MHz



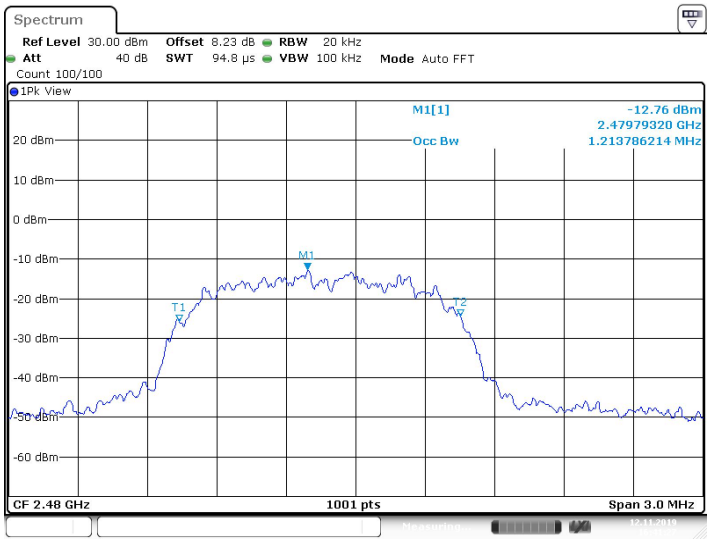
8DPSK Mode

2441 MHz



8DPSK Mode

2480 MHz



3.5. Carrier Frequencies Separation

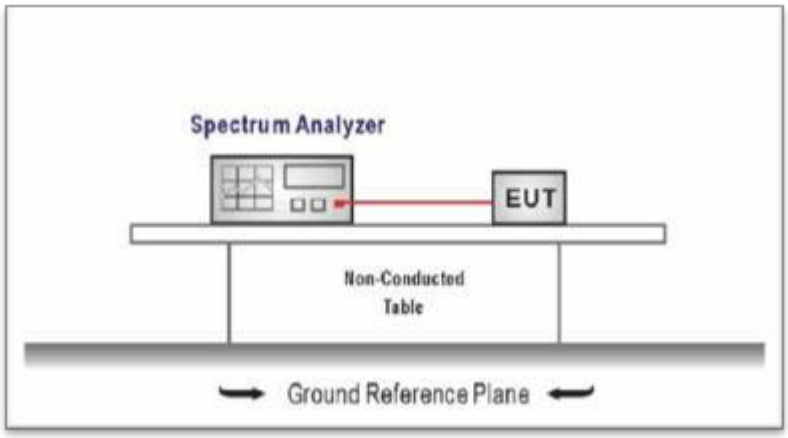
LIMIT

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

frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

Test 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

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 = 100 kHz.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

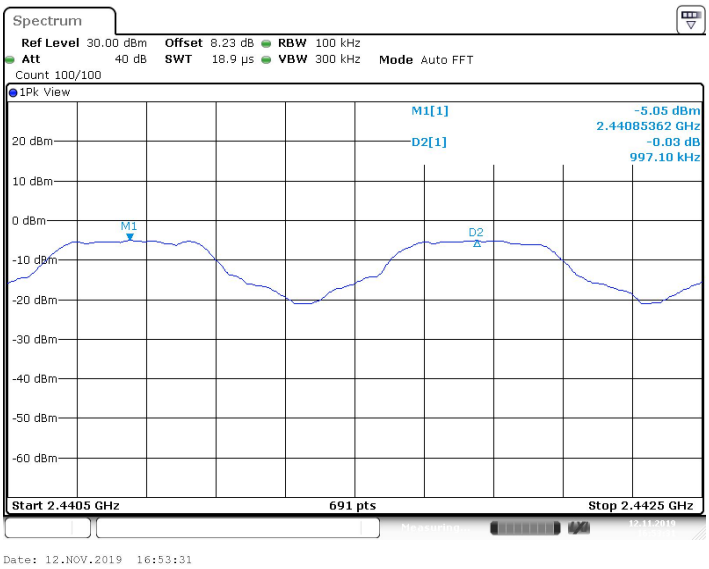
NOTE: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

Test Mode

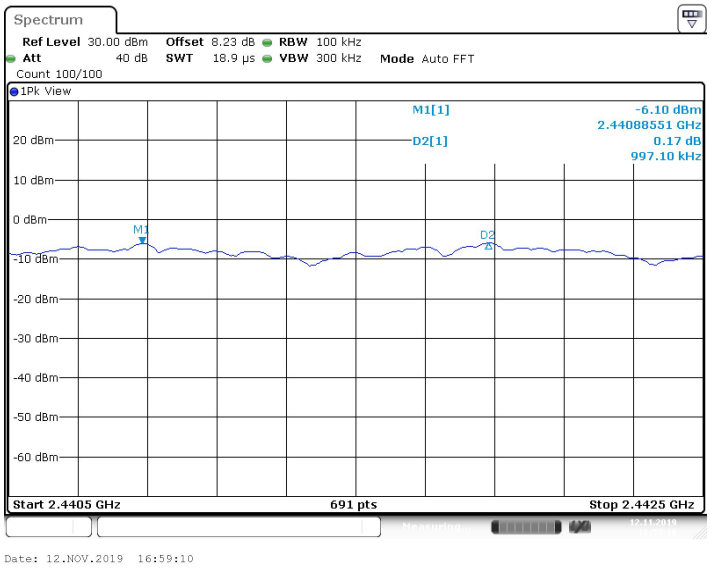
Please refer to the clause 2.3.

Test Results

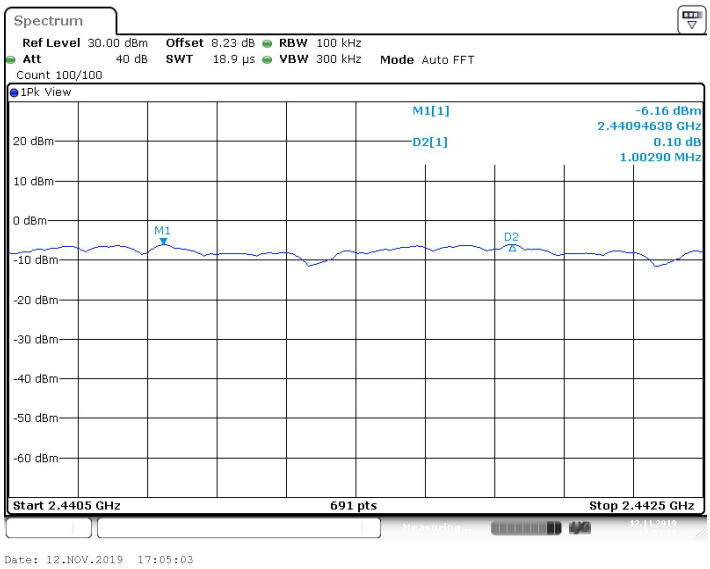
Test Mode:	GFSK Hopping Mode		
Test Mode	Result[MHz]	Limit[MHz]	Verdict
DH5	0.997	>=0.748	PASS
GFSK Hopping Mode			



Test Mode:	π/4DQPSK Hopping Mode		
Test Mode	Result[MHz]	Limit[MHz]	Verdict
2DH5	0.997	>=0.748	PASS
π/4DQPSK Hopping Mode			



Test Mode:	8DPSK Hopping Mode		
Test Mode	Result[MHz]	Limit[MHz]	Verdict
3DH5	1.003	>=0.748	PASS
8DPSK Hopping Mode			

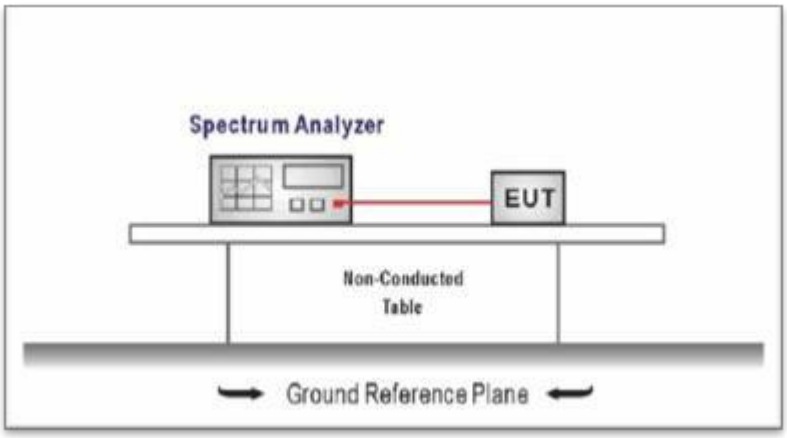


3.6. Number of Hopping Channel

Limit

Section	Test Item	Limit
15.247	Number of Hopping Channel	>15

Test Configuration



Test Procedure

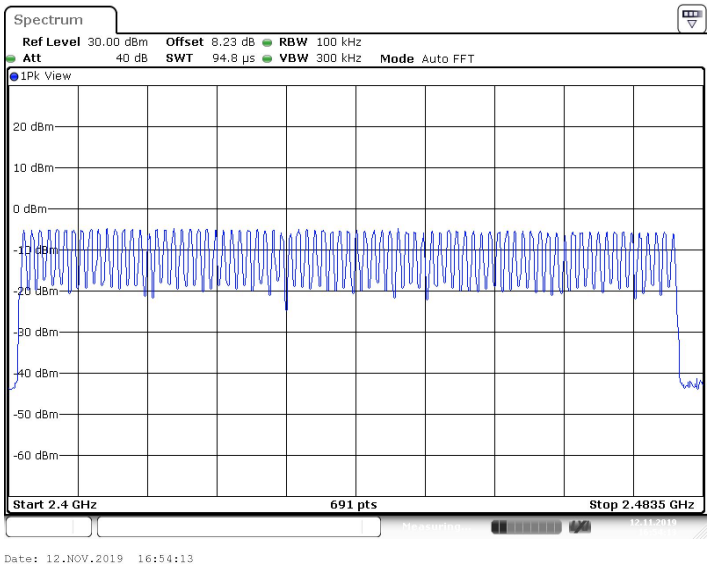
1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Peak Detector: RBW=100 kHz, VBW⩾RBW, Sweep time= Auto.

Test Mode

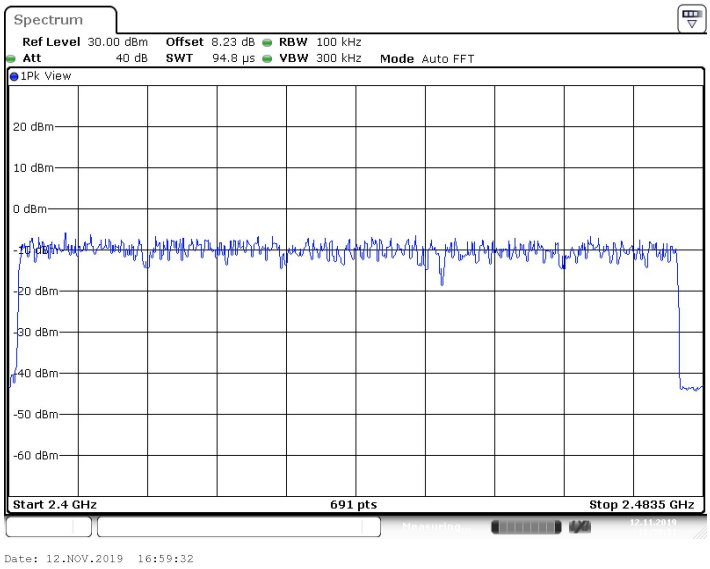
Please refer to the clause 2.3.

Test Result

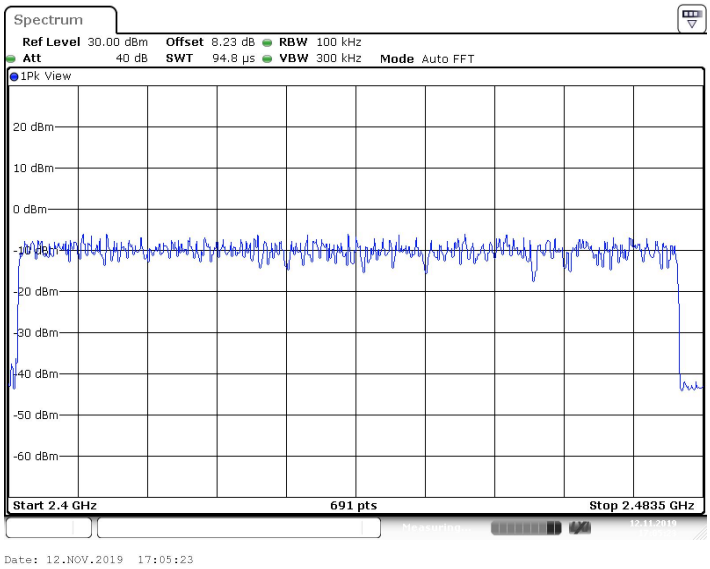
Test Mode:	GFSK Hopping Mode		
Frequency Range	**Test Mode**	**Quantity of Hopping Channel**	**Limit**
2402MHz~2483.5MHz	DH5	79	**>15**
GFSK Mode			



Test Mode:	π/4DQPSK Hopping Mode		
Frequency Range	**Test Mode**	**Quantity of Hopping Channel**	**Limit**
2402MHz~2483.5MHz	2DH5	79	**>15**
GFSK Mode			



Test Mode:	8DPSK Hopping Mode		
Frequency Range	**Test Mode**	**Quantity of Hopping Channel**	**Limit**
2402MHz~2483.5MHz	3DH5	79	**>15**
8DPSK Mode			

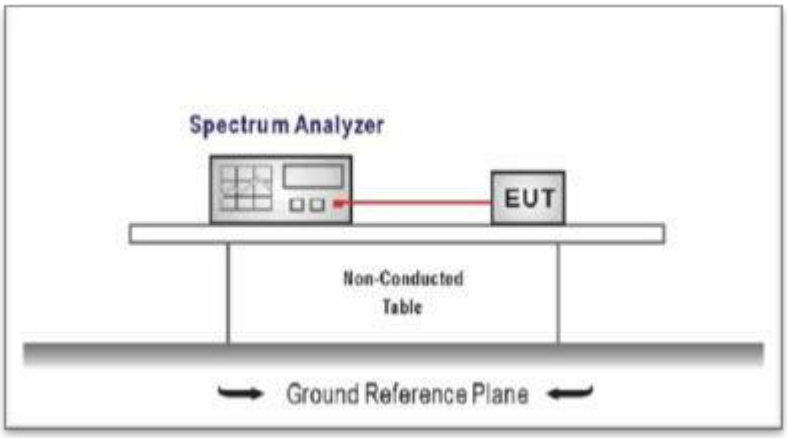


3.7. Dwell Time

Limit

Section	Test Item	Limit
15.247(a)(1)	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 2.3

Test Result

Note:

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

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

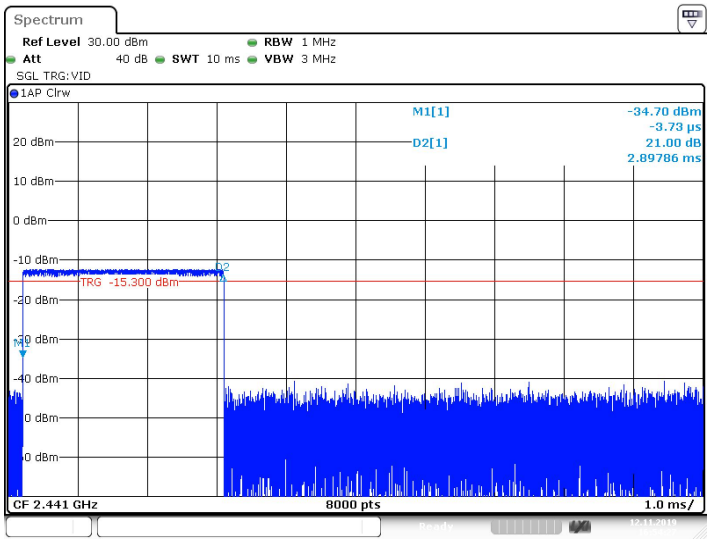
Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2DH3, 3DH3

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

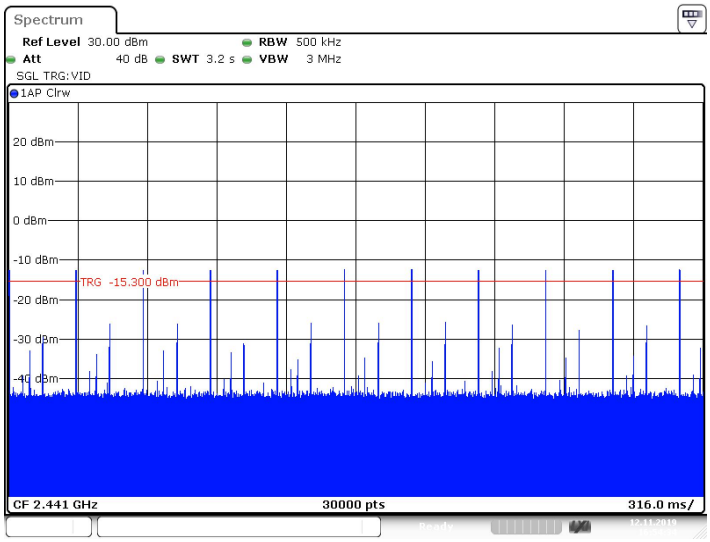
Test Mode:	GFSK Hopping Mode					
Test Mode	**Channel (MHz)**	**Pulse Time (ms)**	**Total of Dwell (ms)**	**Period Time (s)**	**Limit (ms)**	**Result**
1DH5	2441	2.90	309.33	31.60	**400**	**PASS**
1DH5 Total of Dwell= Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second						

GFSK Hopping Mode 1DH5

2441 MHz



Date: 12.NOV.2019 16:54:27



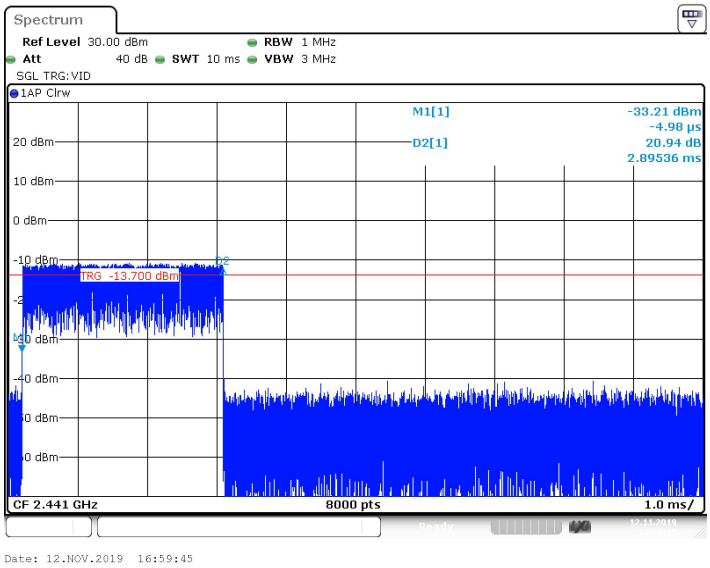
Date: 12.NOV.2019 16:54:34

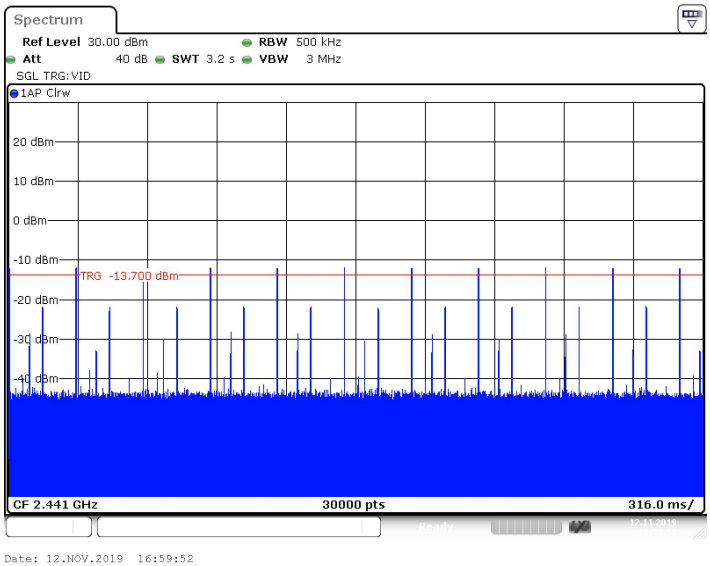
Test Mode:	π/4DQPSK Hopping Mode					
Test Mode	**Channel (MHz)**	**Pulse Time (ms)**	**Total of Dwell (ms)**	**Period Time (s)**	**Limit (ms)**	**Result**
2DH5	2441	2.90	309.33	31.60	**400**	**PASS**

2DH5 Total of Dwell= Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second

π/4DQPSK Hopping Mode 2DH5

2441 MHz

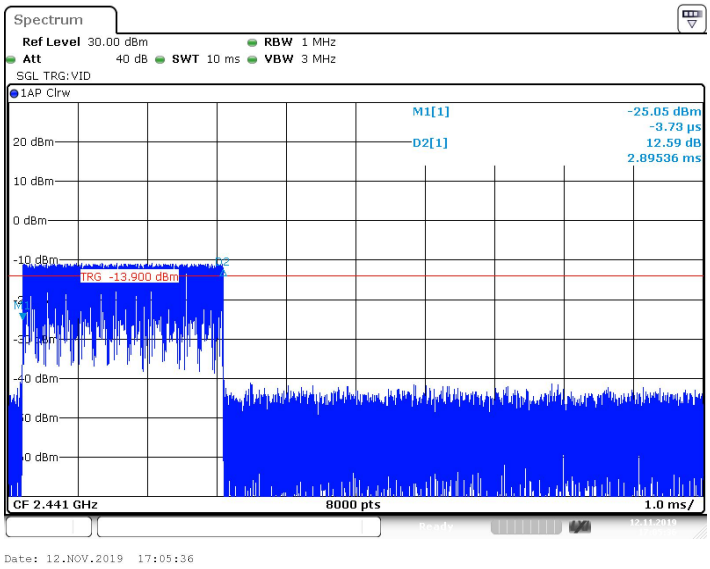


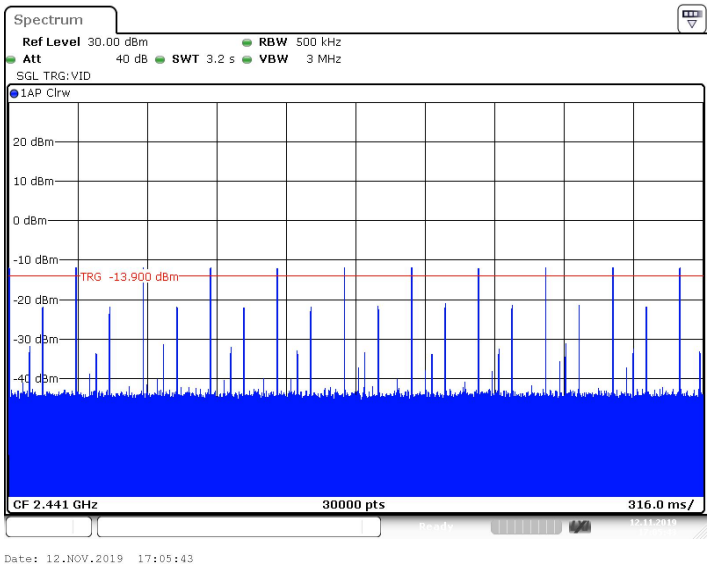


Test Mode:	8DPSK Hopping Mode					
Test Mode	**Channel (MHz)**	**Pulse Time (ms)**	**Total of Dwell (ms)**	**Period Time (s)**	**Limit (ms)**	**Result**
3DH5	2441	2.90	309.33	31.60	**400**	**PASS**
3DH5 Total of Dwell= Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second						

8DPSK Hopping Mode 3DH5

2441 MHz



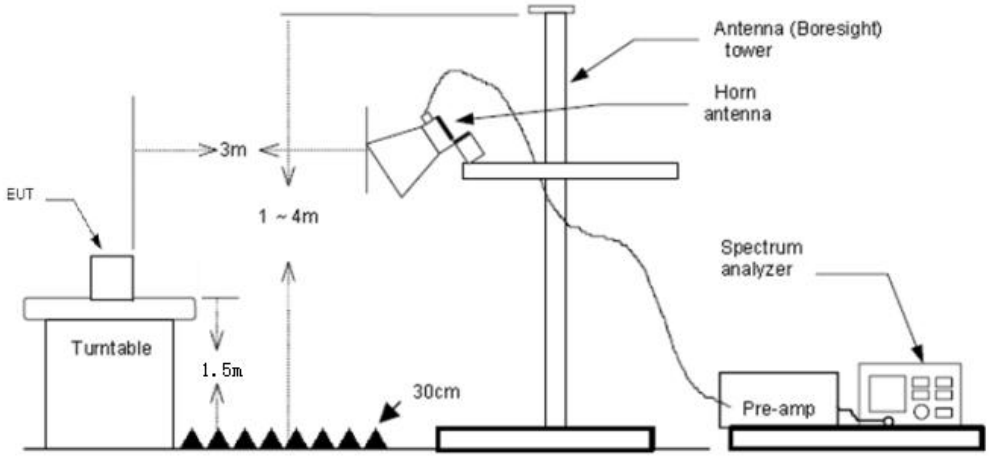


3.8. Band Edge Emissions(Radiated)

Limit

Restricted Frequency Band (MHz)	(dBuV/m)(at 3m)	
	Peak	Average
2310 ~2390	74	54
2483.5 ~2500	74	54
Note: All restriction bands have been tested, only the worst case is reported.		

Test Configuration



Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:
   RBW=1MHz, VBW=3MHz PEAK detector for Peak value.
   RBW=1MHz, VBW=10Hz with Average Detector for Average Value.

Test Mode

Please refer to the clause 2.3.

Test Results

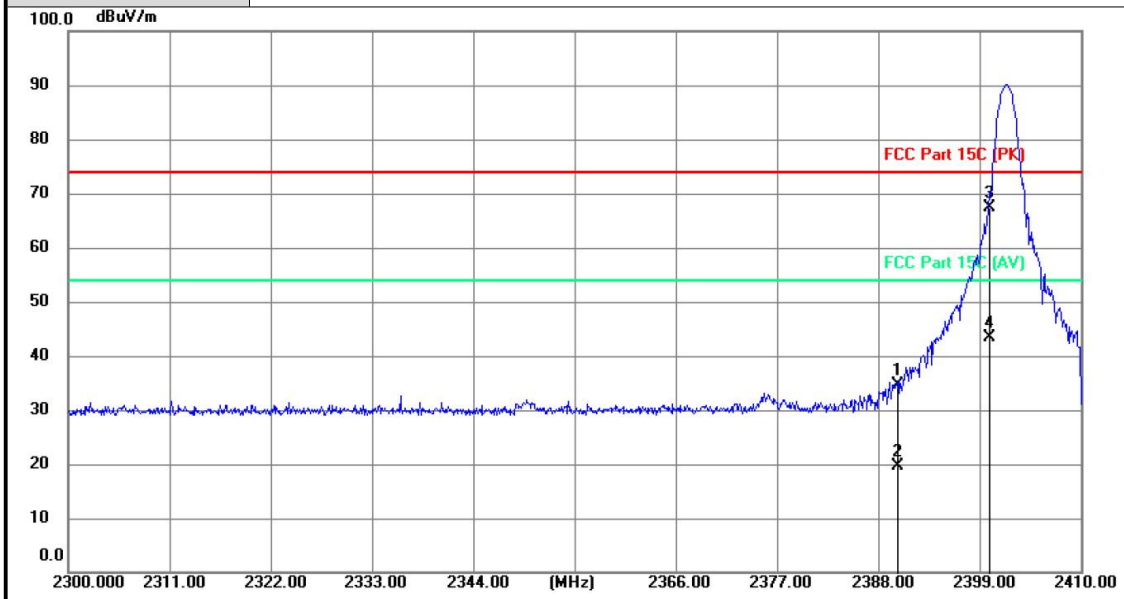
Note:

1.Measurement = Reading level + Correct Factor

Correct Factor=Antenna Factor + Cable Loss -Preamplifier Factor

2.Pre-scan GFSK, π/4QPSK and 8DPSK modulation, and found the GFSK modulation which it is worse case, so only show the test data for worse case.

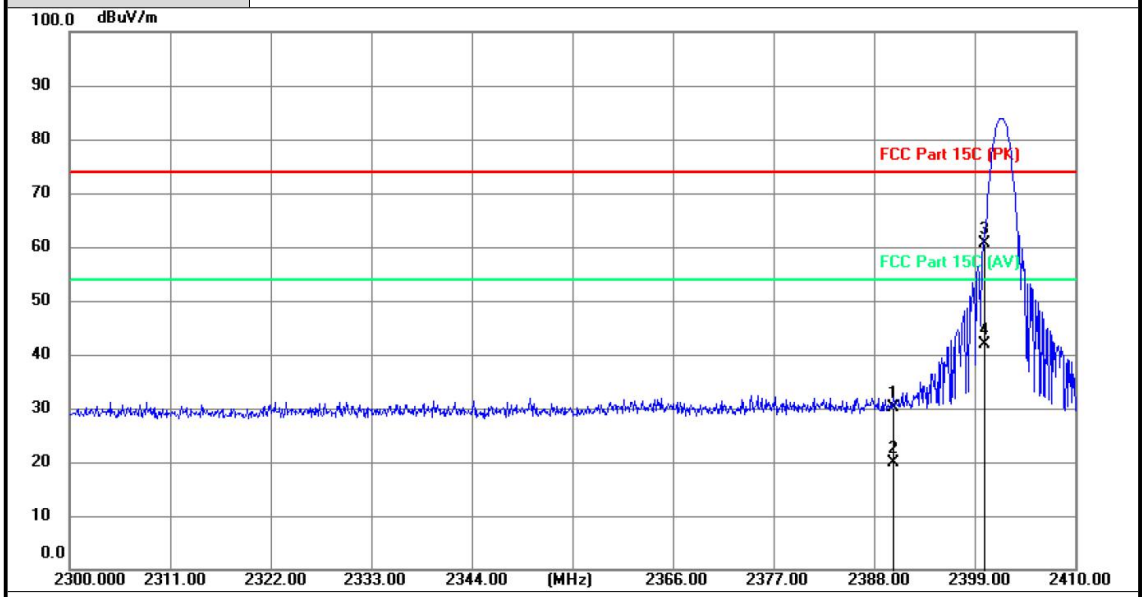
Ant. Pol.	Horizontal
Test Mode:	GFSK Mode 2402MHz



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Detector
1		2390.000	48.12	-13.49	34.63	74.00	-39.37	peak
2		2390.000	33.19	-13.49	19.70	54.00	-34.30	AVG
3	*	2400.000	80.79	-13.48	67.31	74.00	-6.69	peak
4		2400.000	56.98	-13.48	43.50	54.00	-10.50	AVG

Measurement = Reading level + Correct Factor

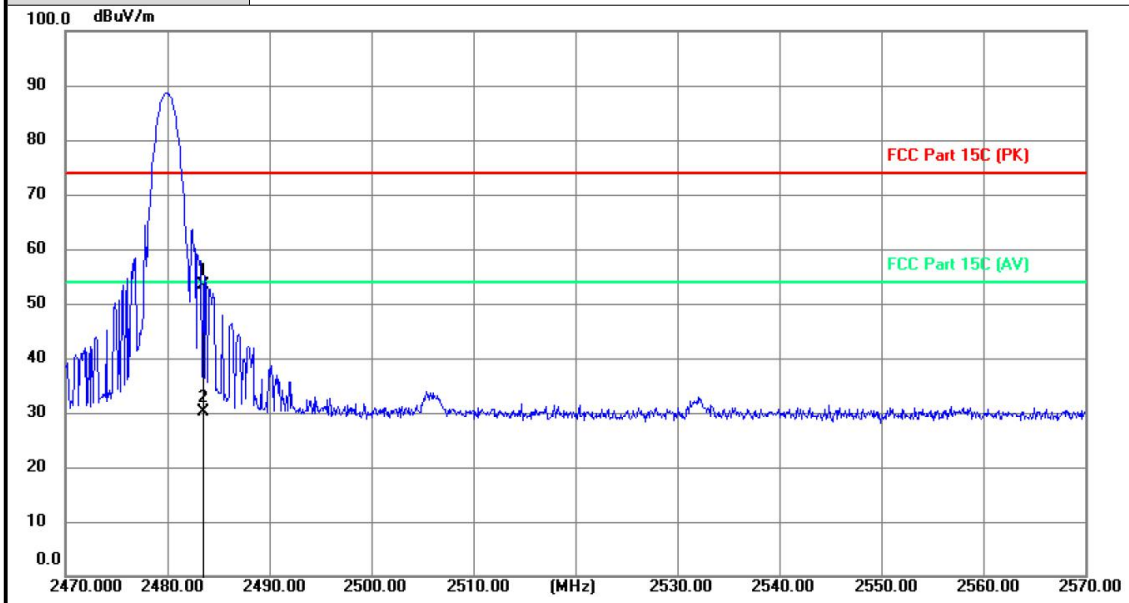
Ant. Pol.	Vertical
Test Mode:	GFSK Mode 2402 MHz



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Detector
1		2390.000	43.57	-13.49	30.08	74.00	-43.92	peak
2		2390.000	33.26	-13.49	19.77	54.00	-34.23	AVG
3		2400.000	74.12	-13.48	60.64	74.00	-13.36	peak
4	*	2400.000	55.29	-13.48	41.81	54.00	-12.19	AVG

Measurement = Reading level + Correct Factor

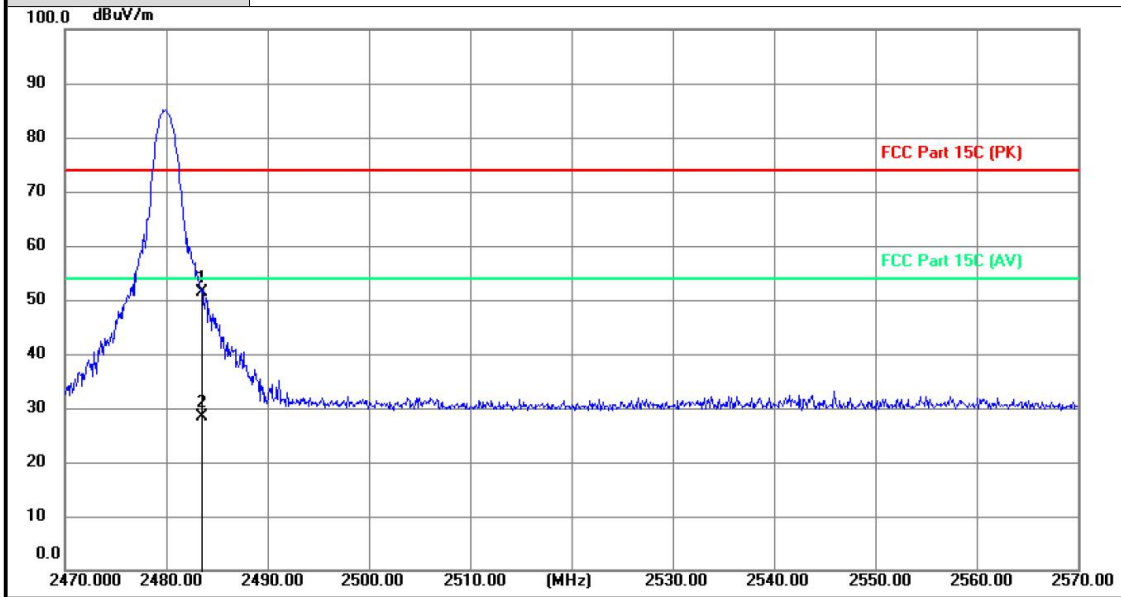
Ant. Pol.	Horizontal
Test Mode:	GFSK Mode 2480MHz



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Detector
1	*	2483.500	66.74	-13.35	53.39	74.00	-20.61	peak
2		2483.500	43.45	-13.35	30.10	54.00	-23.90	AVG

Measurement = Reading level + Correct Factor

Ant. Pol.	Vertical
Test Mode:	GFSK Mode 2480 MHz



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Detector
1	*	2483.500	64.62	-13.35	51.27	74.00	-22.73	peak
2		2483.500	41.81	-13.35	28.46	54.00	-25.54	AVG

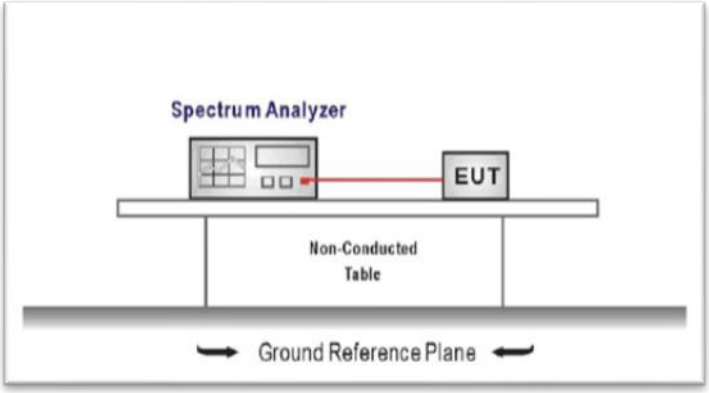
Measurement = Reading level + Correct Factor

3.9. Band Edge and Spurious Emission (conducted)

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section15.247 (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 pathloss 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
Sweep = auto, Detector function = peak, Trace = max hold

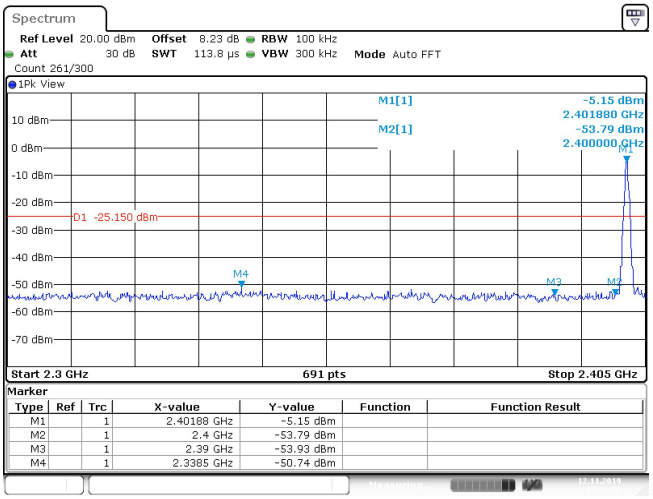
4.Measure and record the results in the test report.

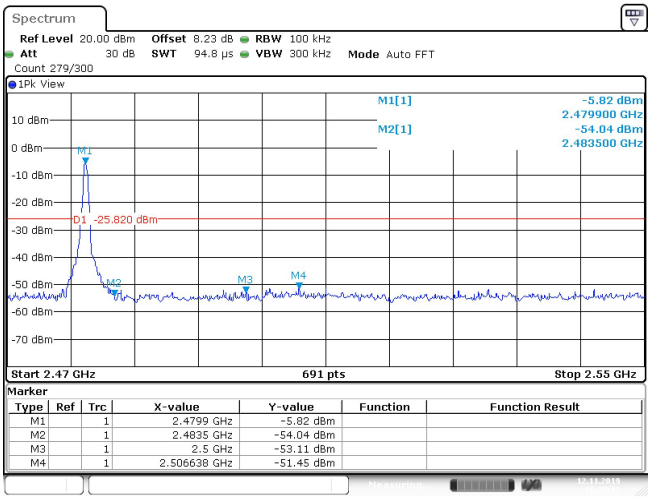
TEST MODE:

Please refer to the clause 2.3.

TEST RESULTS

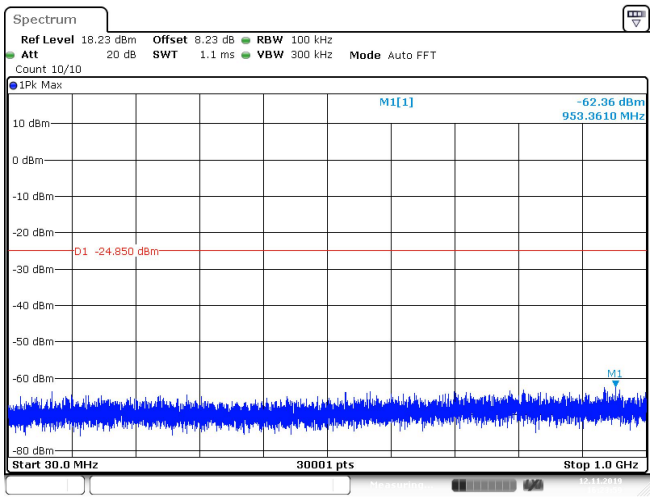
GFSK	
CH00-Bandedge	CH78-Bandedge





GFSK

CH00-SE



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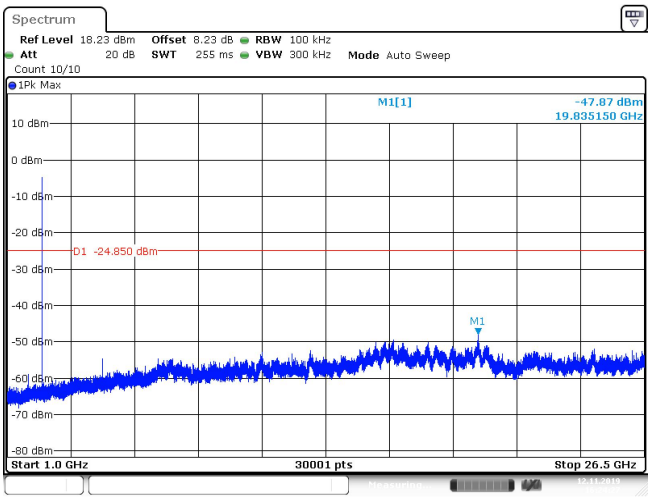
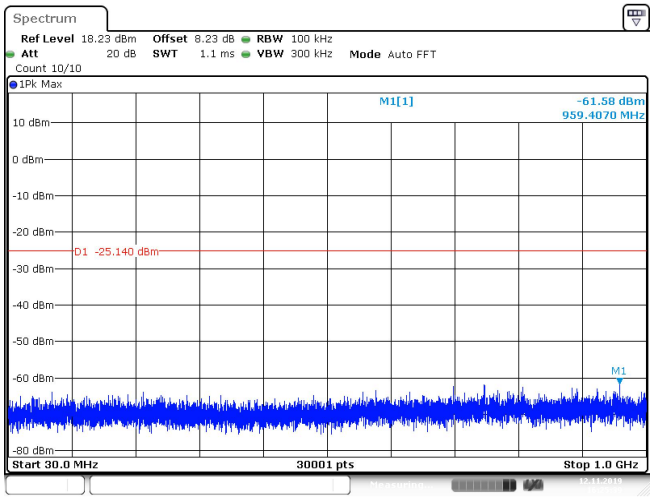
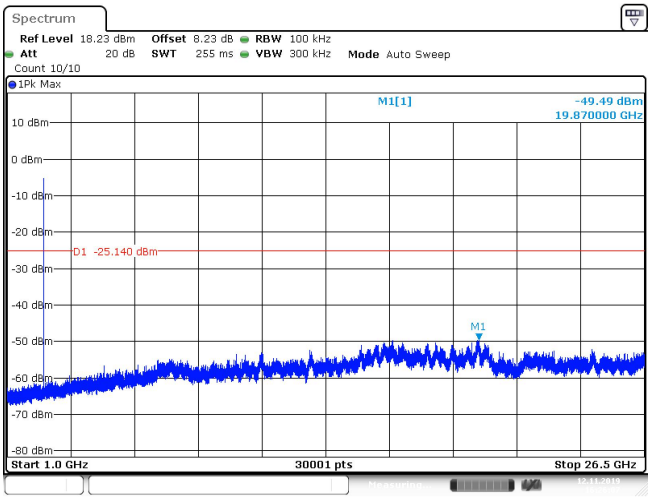


Date: 12.NOV.2019 16:24:27

CH39-SE

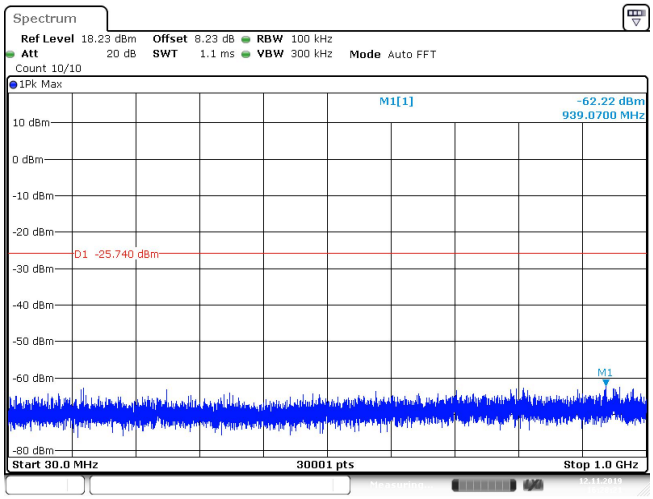


Date: 12.NOV.2019 16:25:39



Date: 12.NOV.2019 16:26:07

CH78-SE



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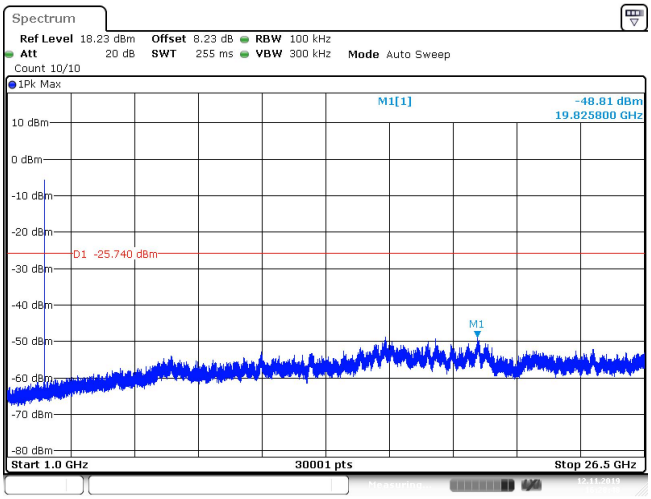

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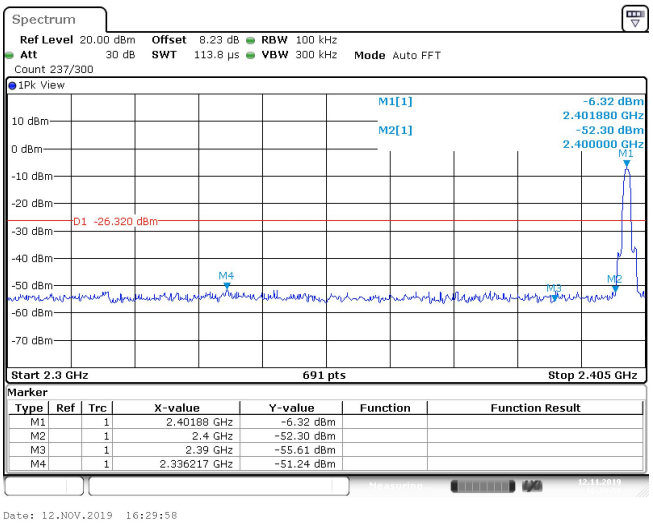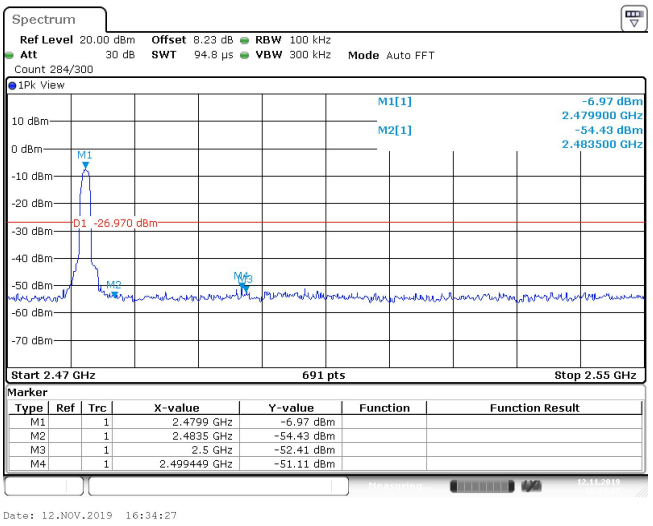
π/4DQPSK	
CH00-Bandedge	CH78-Bandedge