Appendix

Main Test Instruments

Conducted Emission					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Duedate (yyyy-mm-dd)
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2017/5/10	2020/5/9
LISN	Rohde & Schwarz	ENV216	SEM007-01	2018/9/2	2019/9/2
LISN	ETS-LINDGREN	Feb-16	SEM007-02	2019/3/2	2020/3/1
Measurement Software	AUDIX	e3 V5.4.1221d	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2018/7/12	2019/7/11
2 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T2-02	EMC0122	2019/2/11	2020/2/10
EMI Test Receiver	Rohde & Schwarz	ESCI	SEM004-02	2019/3/2	2020/3/1

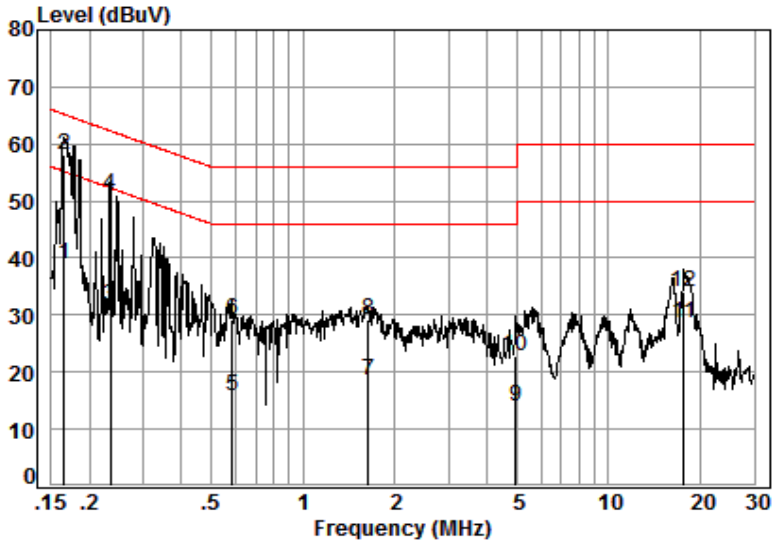
RF conducted test					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Duedate (yyyy-mm-dd)
DC Power Supply	Agilent Technologies Inc	66311B	W009-09	2018/9/15	2019/9/15
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2019/1/13	2020/1/12
Coaxial Cable	SGS	N/A	SEM031-01	2018/7/13	2019/7/12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2018/9/2	2019/9/2
Temperature Chamber	GIANT FORCE	ICT-150-40-CP-AR	W027-03	2018/11/27	2019/11/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2018/9/2	2019/9/2

Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	±0.75dB
2	RF power density, conducted	±2.84dB
3	Spurious emissions, conducted	±0.75dB
5	Conduct emission test	±3.12 dB (9KHz- 30MHz)

AC Power Line Conducted Emissions

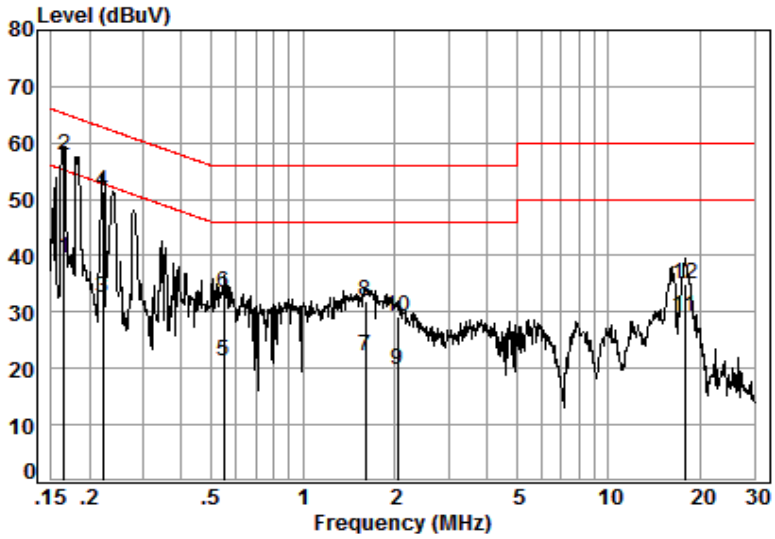
Live line:



Site : Shielding Room
Condition: Line
Job No. : 11305CR
Test mode: a

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.17	0.01	9.66	29.13	38.80	55.21	-16.41	Average
2	0.17	0.01	9.66	48.43	58.10	65.21	-7.11	QP
3	0.23	0.03	9.67	22.09	31.79	52.30	-20.51	Average
4	0.23	0.03	9.67	41.27	50.97	62.30	-11.33	QP
5	0.59	0.07	9.67	6.12	15.86	46.00	-30.14	Average
6	0.59	0.07	9.67	19.42	29.16	56.00	-26.84	QP
7	1.64	0.14	9.73	8.74	18.61	46.00	-27.39	Average
8	1.64	0.14	9.73	19.25	29.12	56.00	-26.88	QP
9	4.95	0.17	9.74	4.14	14.05	46.00	-31.95	Average
10	4.95	0.17	9.74	12.88	22.79	56.00	-33.21	QP
11	17.66	0.23	10.19	18.13	28.55	50.00	-21.45	Average
12	17.66	0.23	10.19	23.65	34.07	60.00	-25.93	QP

Neutral line:



Site : Shielding Room
Condition: Neutral
Job No. : 11305CR
Test mode: a

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.17	0.01	9.64	29.97	39.62	55.21	-15.59	Average
2	0.17	0.01	9.64	48.26	57.91	65.21	-7.30	QP
3	0.22	0.03	9.64	22.88	32.55	52.79	-20.24	Average
4	0.22	0.03	9.64	41.89	51.56	62.79	-11.23	QP
5	0.55	0.06	9.64	11.66	21.36	46.00	-24.64	Average
6	0.55	0.06	9.64	23.84	33.54	56.00	-22.46	QP
7	1.60	0.14	9.70	12.38	22.22	46.00	-23.78	Average
8	1.60	0.14	9.70	22.25	32.09	56.00	-23.91	QP
9	2.03	0.16	9.69	10.04	19.89	46.00	-26.11	Average
10	2.03	0.16	9.69	19.50	29.35	56.00	-26.65	QP
11	17.75	0.23	10.22	18.78	29.23	50.00	-20.77	Average
12	17.75	0.23	10.22	24.41	34.86	60.00	-25.14	QP

Conducted Peak Output Power

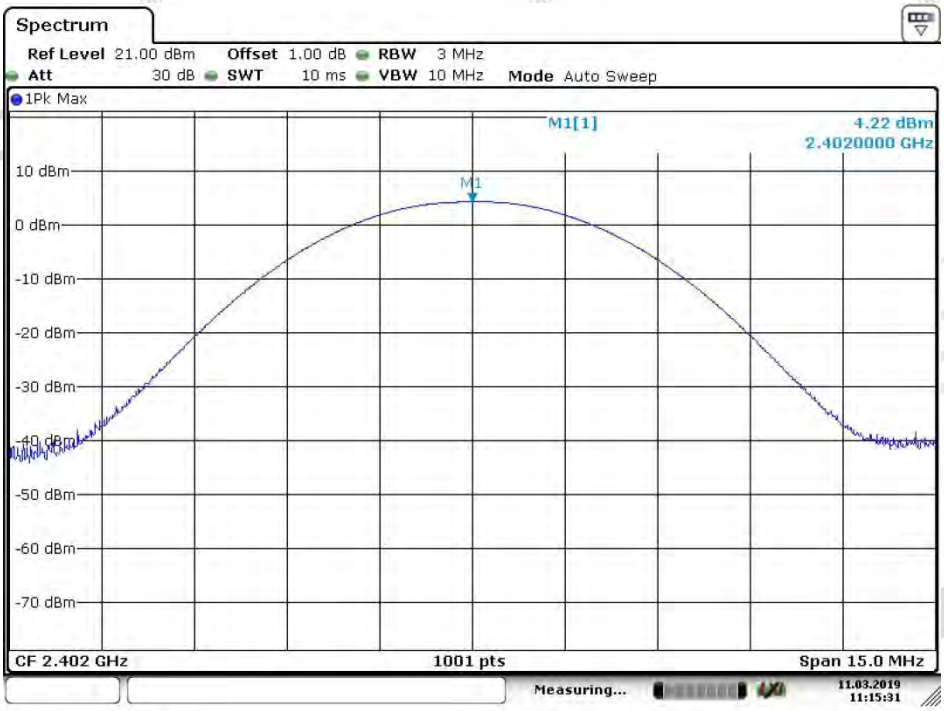
Test Results

Measurement Data of Peak power:

GFSK mode			
Test channel	**Peak Output Power (dBm)**	**Limit (dBm)**	**Result**
Lowest	4.22	20.97	Pass
Middle	4.89	20.97	Pass
Highest	3.81	20.97	Pass
π/4DQPSK mode			
Test channel	**Peak Output Power (dBm)**	**Limit (dBm)**	**Result**
Lowest	5.24	20.97	Pass
Middle	5.88	20.97	Pass
Highest	4.83	20.97	Pass
8DPSK mode			
Test channel	**Peak Output Power (dBm)**	**Limit (dBm)**	**Result**
Lowest	5.61	20.97	Pass
Middle	6.28	20.97	Pass
Highest	5.21	20.97	Pass

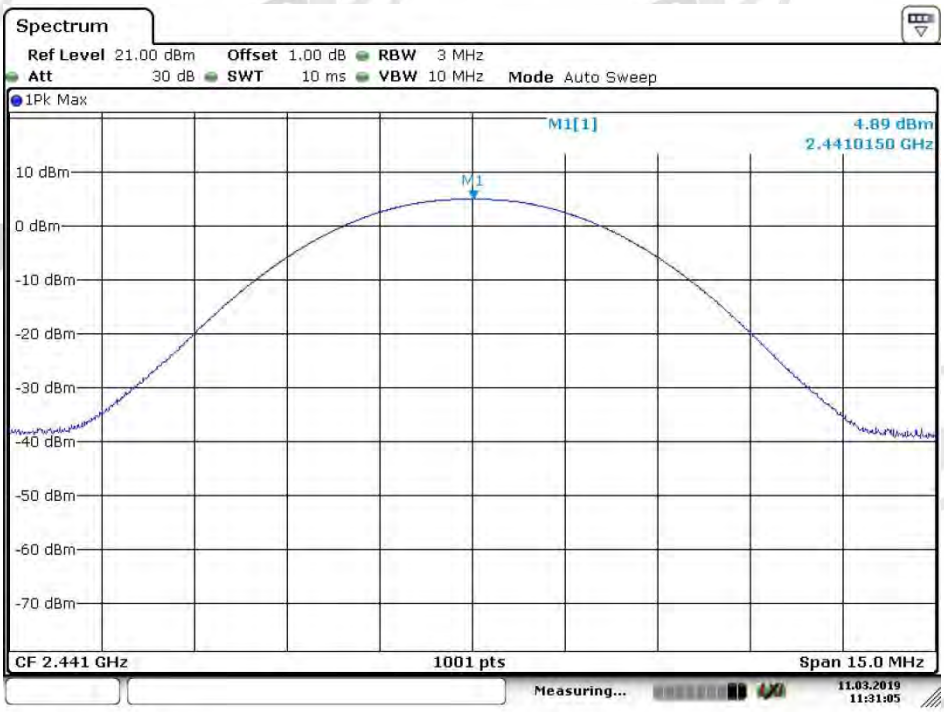
Test plots

Test mode:	GFSK	Test channel:	Lowest



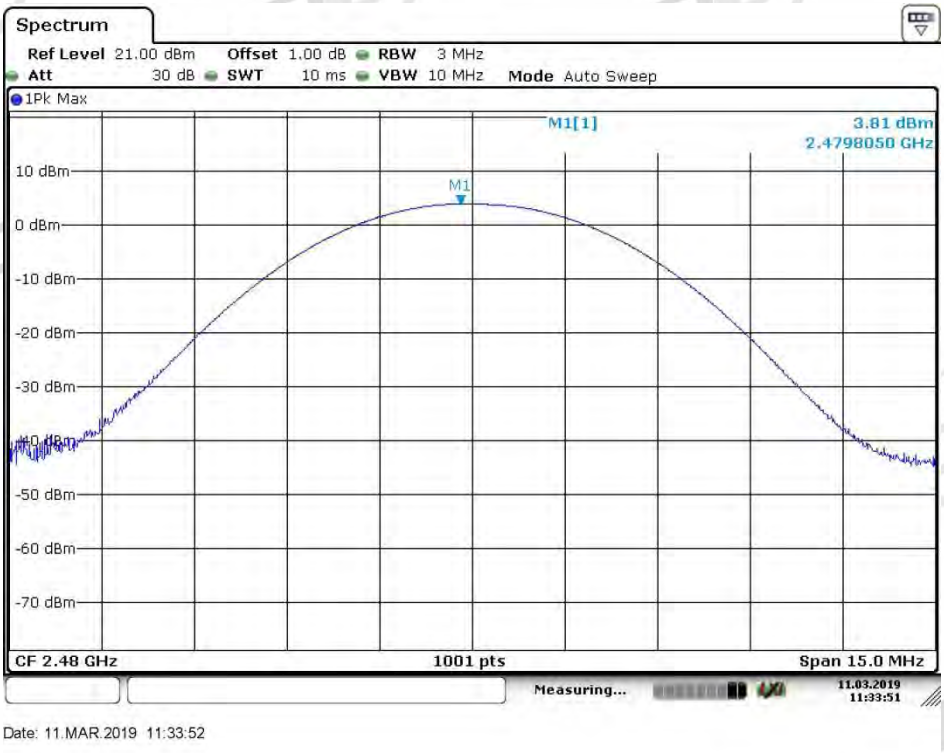
Date: 11.MAR.2019 11:15:32

Test mode:	GFSK	Test channel:	Middle



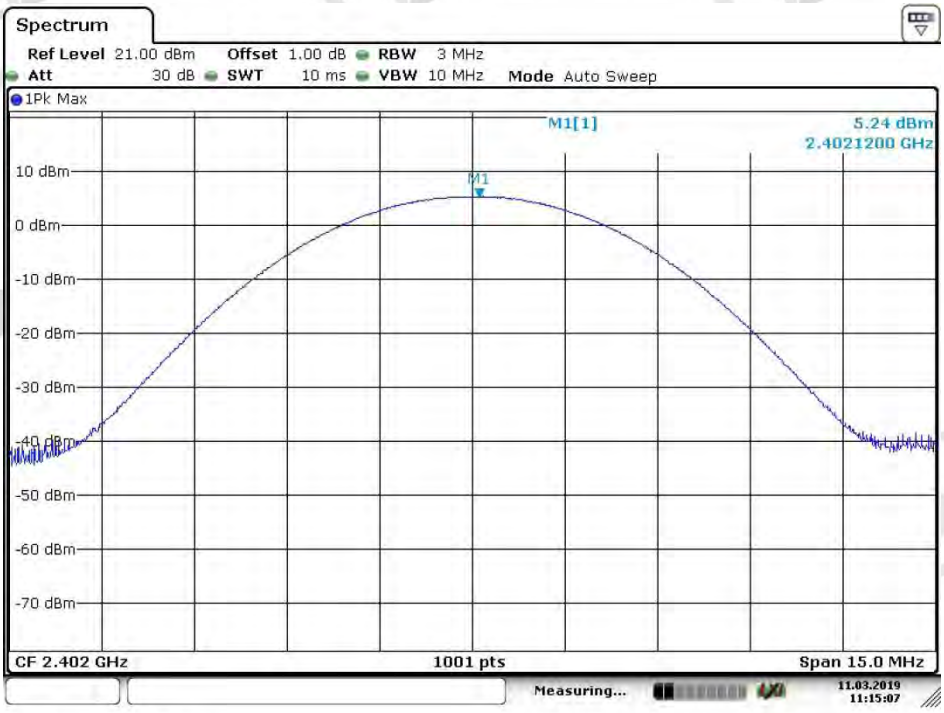
Date: 11.MAR.2019 11:31:05

Test mode:	GFSK	Test channel:	Highest



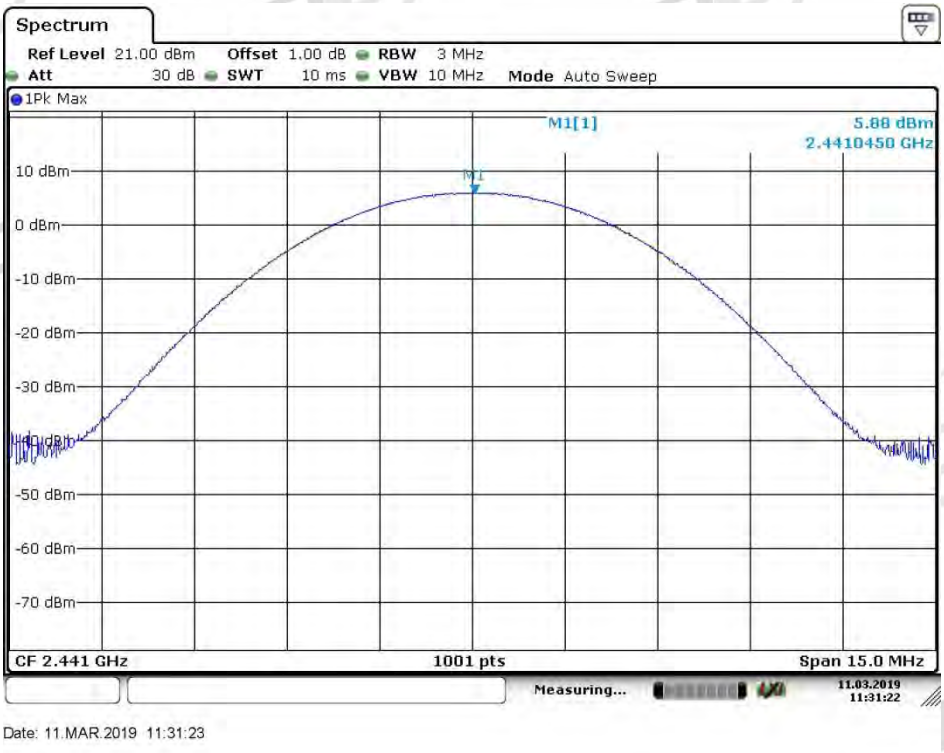
Date: 11.MAR.2019 11:33:52

Test mode:	π/4DQPSK	Test channel:	Lowest

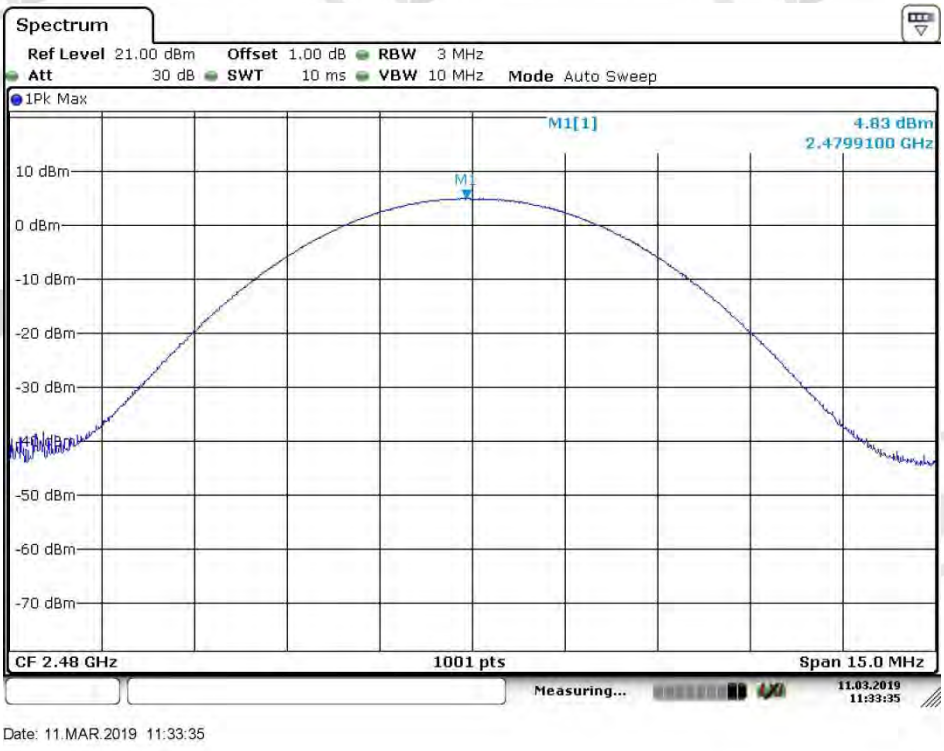


Date: 11.MAR.2019 11:15:07

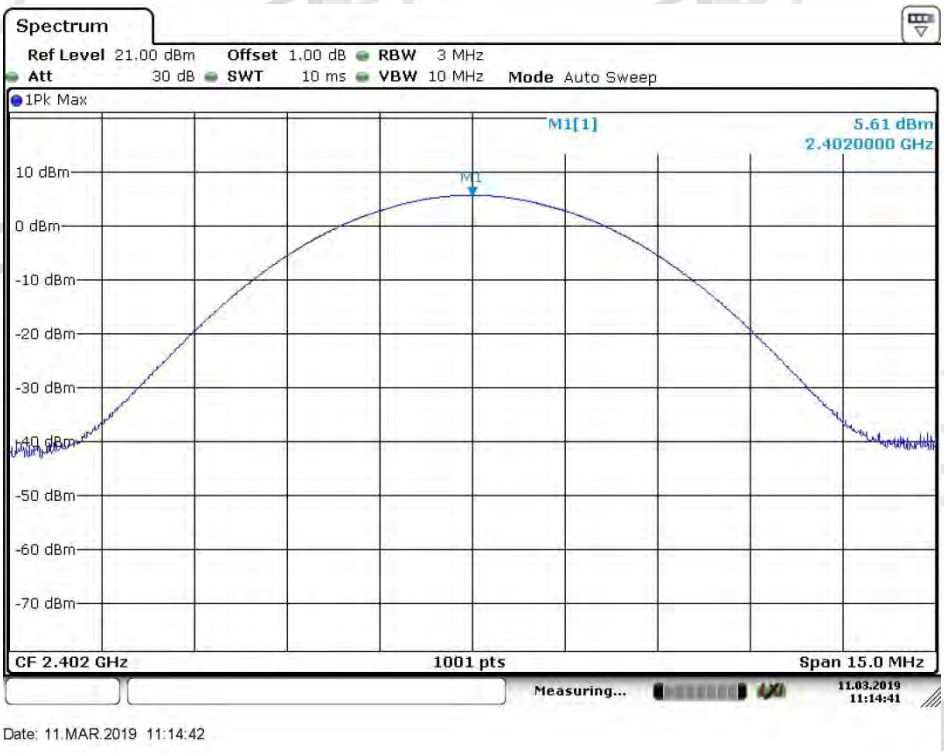
Test mode:	π/4DQPSK	Test channel:	Middle



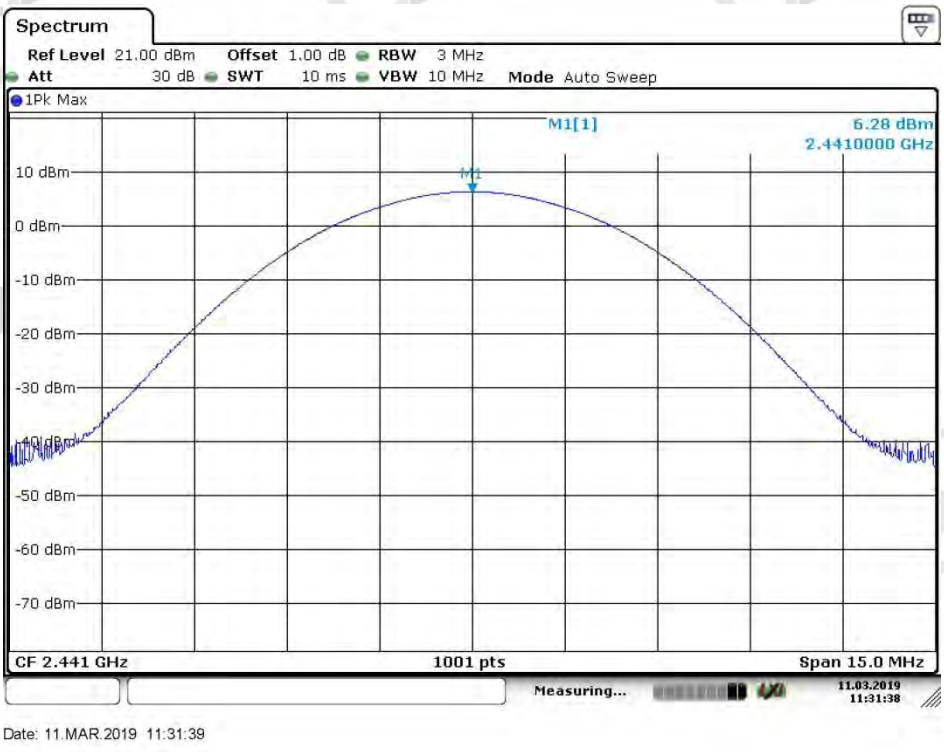
Test mode:	π/4DQPSK	Test channel:	Highest



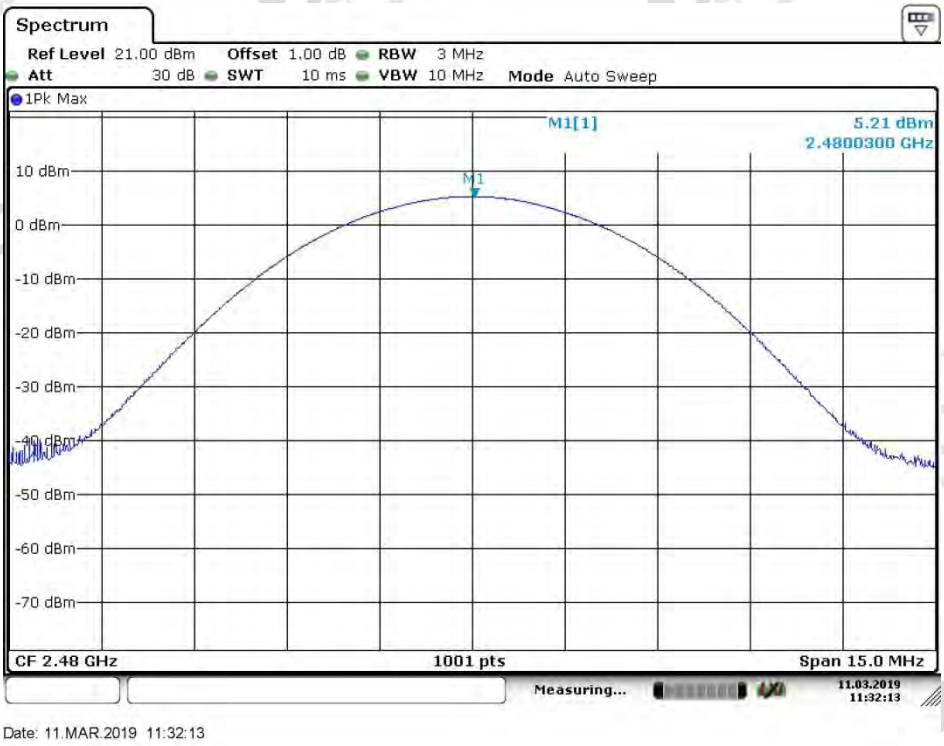
Test mode:	8DPSK	Test channel:	Lowest



Test mode:	8DPSK	Test channel:	Middle



Test mode:	8DPSK	Test channel:	Highest



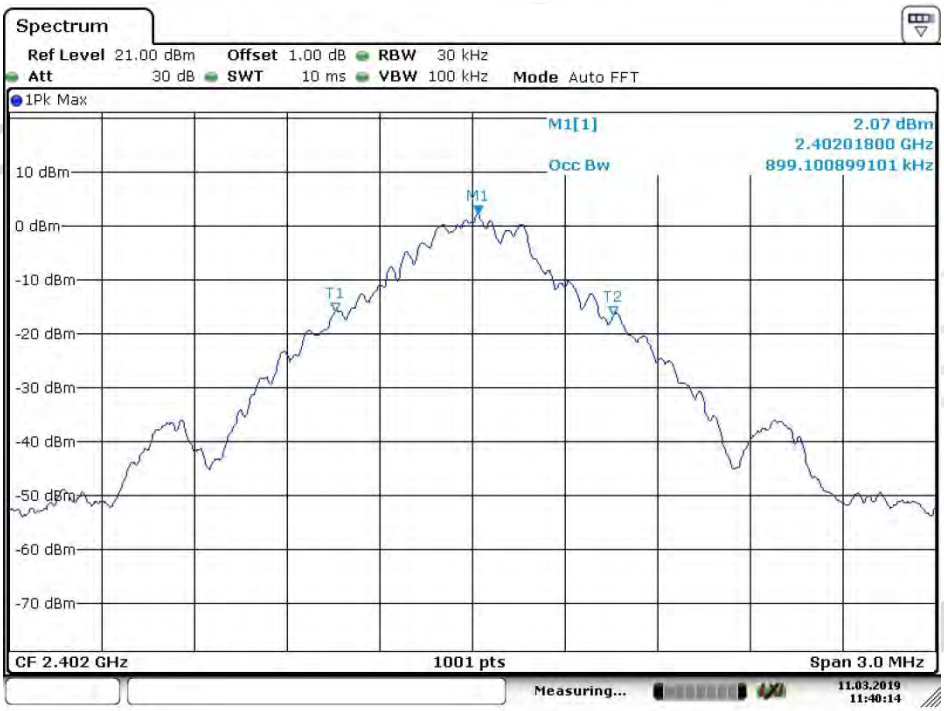
20dB Emission Bandwidth & 99% Occupied Bandwidth

Test Results

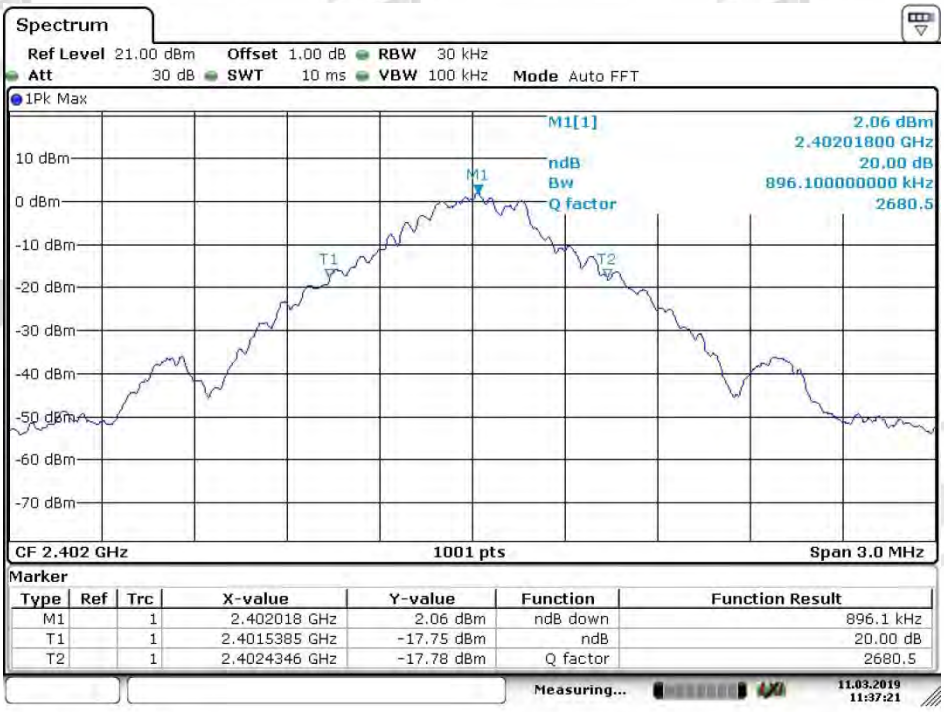
Mode	Test Channel	99% Occupied Bandwidth (KHz)	20dB Emission Bandwidth (KHz)	Result
GFSK	Lowest	899.1	896.1	Pass
	Middle	896.1	899.1	Pass
	Highest	896.1	899.1	Pass
π/4DQPSK	Lowest	1171.8	1276.7	Pass
	Middle	1171.8	1279.7	Pass
	Highest	1168.8	1276.7	Pass
8DPSK	Lowest	1171.8	1279.7	Pass
	Middle	1171.8	1279.7	Pass
	Highest	1171.8	1276.7	Pass

Test plots

GFSK _Lowest Channel



Date: 11.MAR.2019 11:40:14

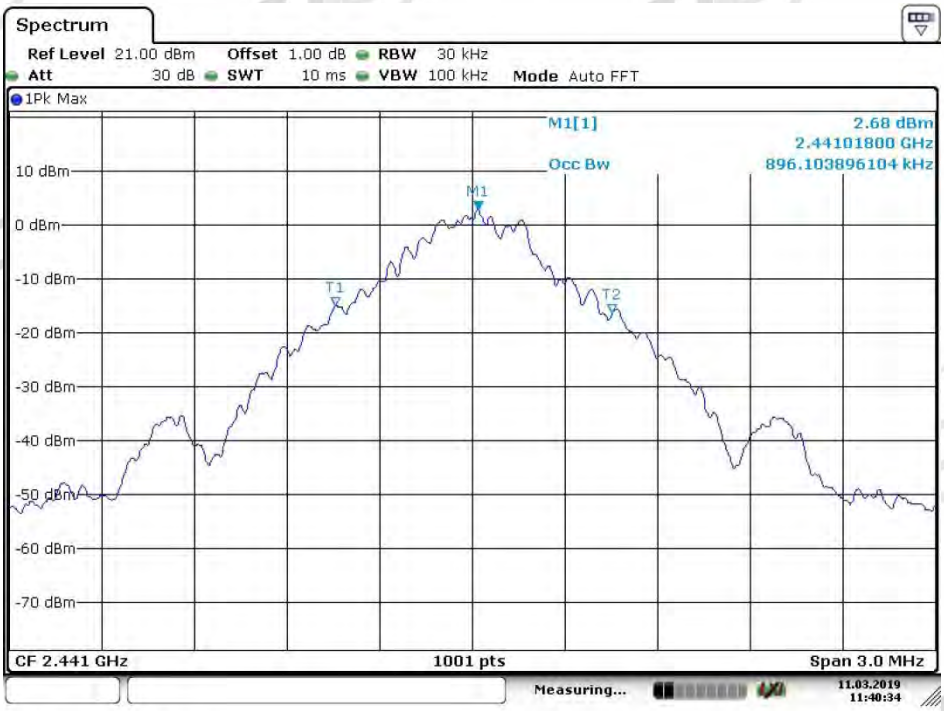


Marker

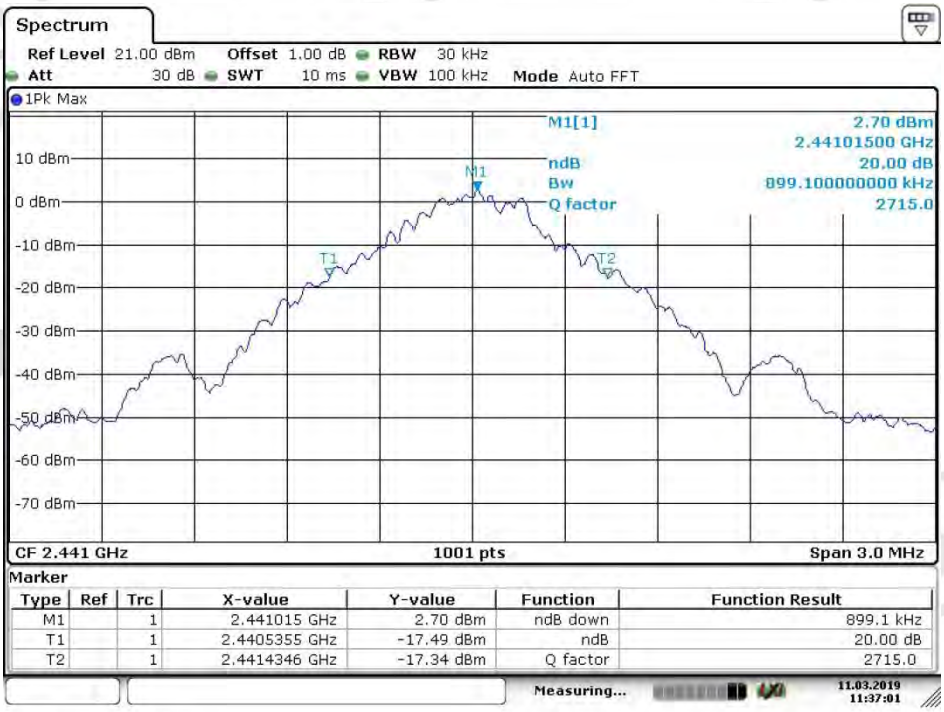
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.402018 GHz	2.06 dBm	ndB down	896.1 kHz
T1		1	2.4015385 GHz	-17.75 dBm	ndB	20.00 dB
T2		1	2.4024346 GHz	-17.78 dBm	Q factor	2680.5

Date: 11.MAR.2019 11:37:21

GFSK _Middle Channel



Date: 11.MAR.2019 11:40:34

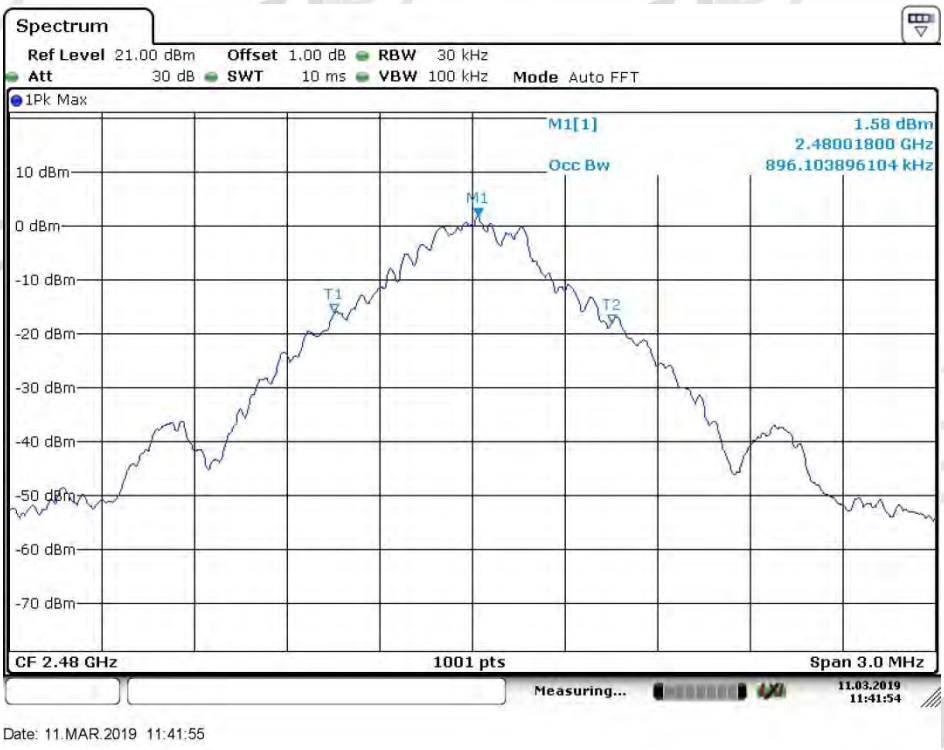


Marker

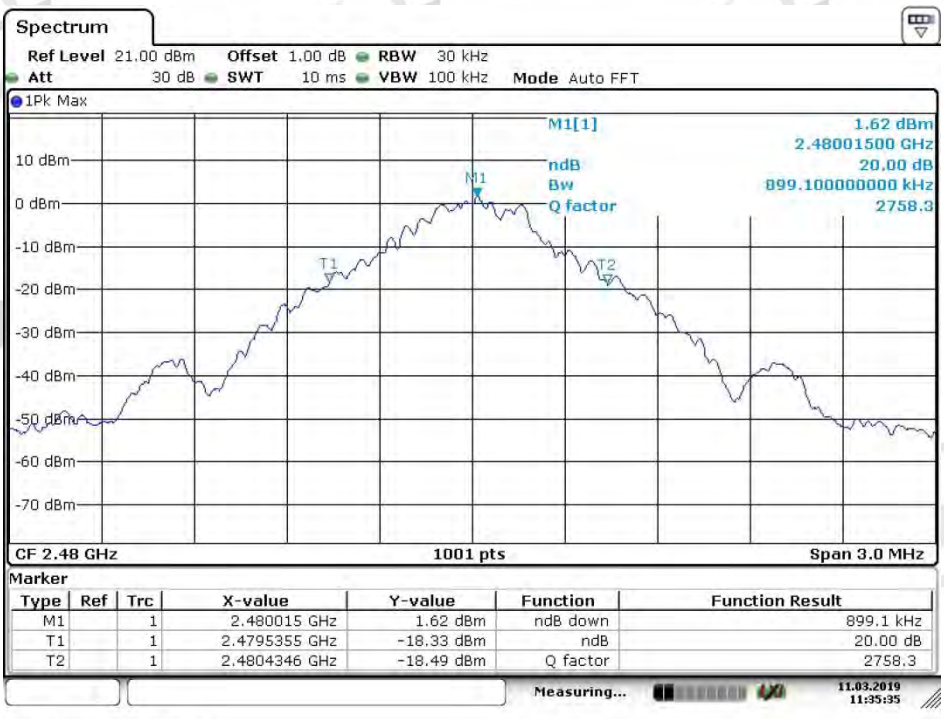
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.441015 GHz	2.70 dBm	ndB down	899.1 kHz
T1		1	2.4405355 GHz	-17.49 dBm	ndB	20.00 dB
T2		1	2.4414346 GHz	-17.34 dBm	Q factor	2715.0

Date: 11.MAR.2019 11:37:02

GFSK _Highest Channel



Date: 11.MAR.2019 11:41:55

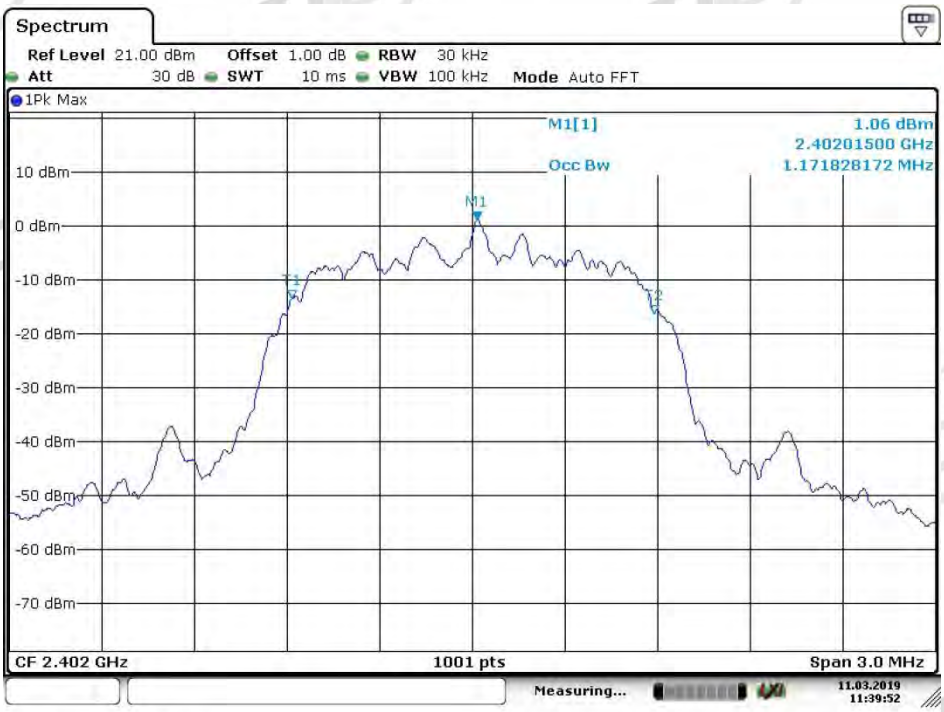


Marker

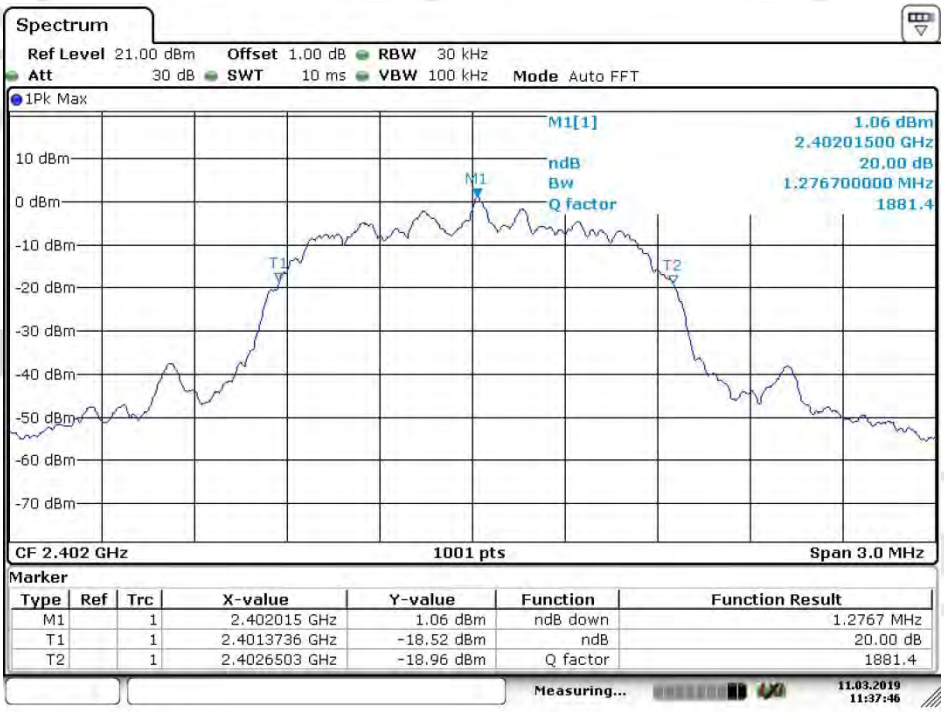
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.480015 GHz	1.62 dBm	ndB down	899.1 kHz
T1		1	2.4795355 GHz	-18.33 dBm	ndB	20.00 dB
T2		1	2.4804346 GHz	-18.49 dBm	Q factor	2758.3

Date: 11.MAR.2019 11:35:35

π/4DQPSK _Lowest Channel



Date: 11.MAR.2019 11:39:53

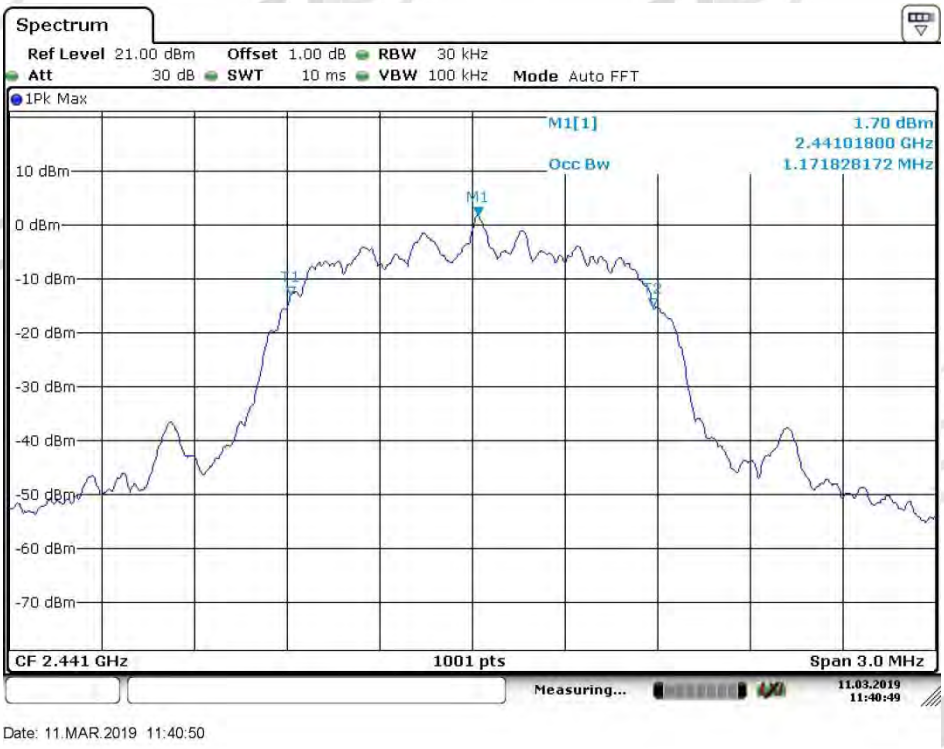


Marker

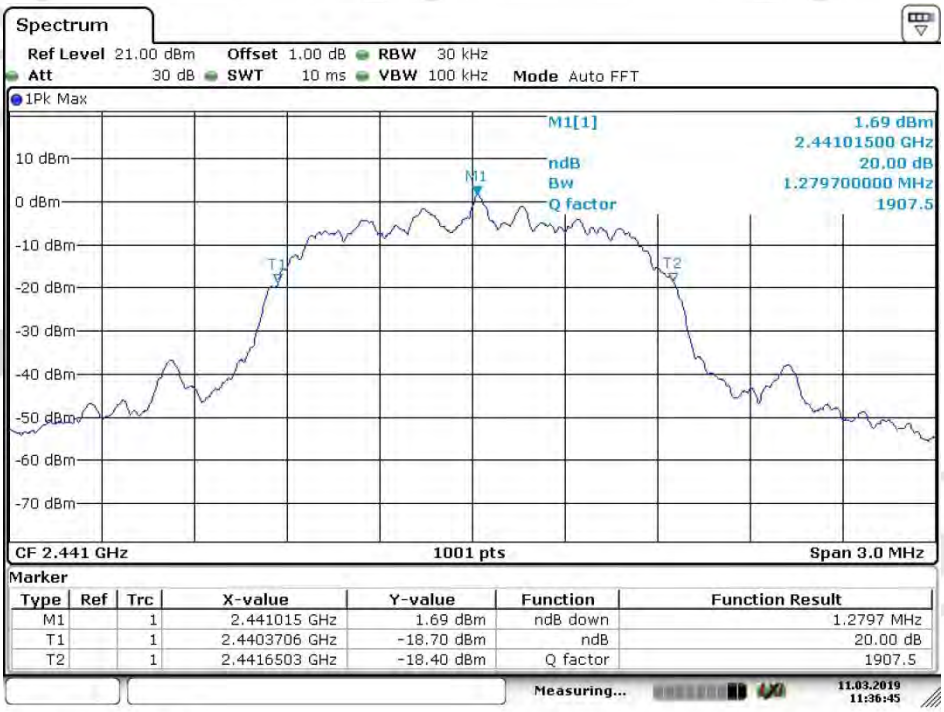
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.402015 GHz	1.06 dBm	ndB down	1.2767 MHz
T1		1	2.4013736 GHz	-18.52 dBm	ndB	20.00 dB
T2		1	2.4026503 GHz	-18.96 dBm	Q factor	1881.4

Date: 11.MAR.2019 11:37:46

π/4DQPSK _Middle Channel



Date: 11.MAR.2019 11:40:50

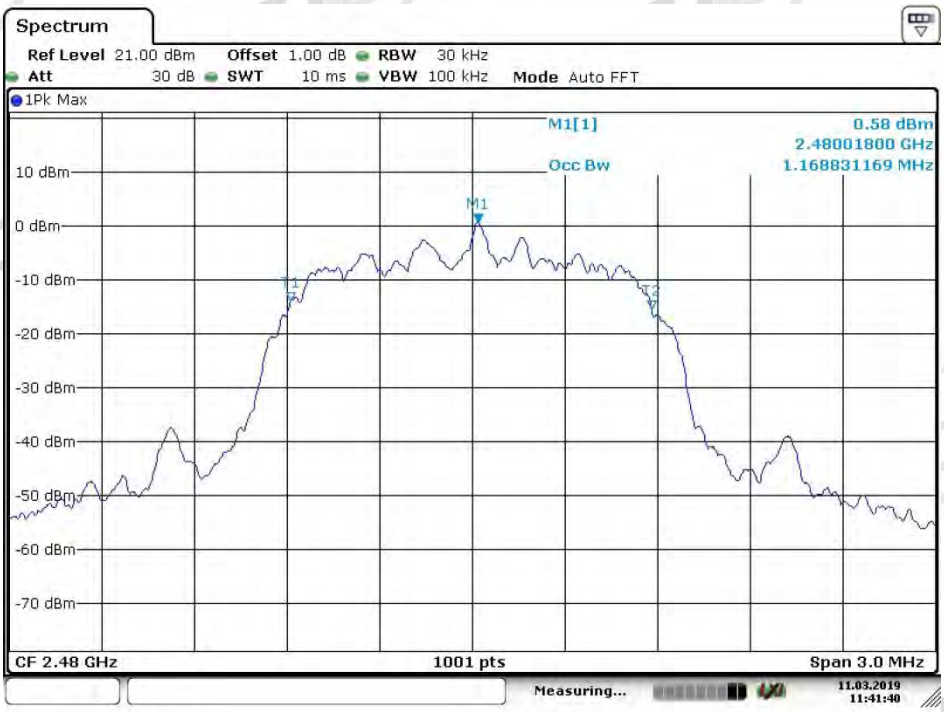


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.441015 GHz	1.69 dBm	ndB down	1.2797 MHz
T1		1	2.4403706 GHz	-18.70 dBm	ndB	20.00 dB
T2		1	2.4416503 GHz	-18.40 dBm	Q factor	1907.5

Date: 11.MAR.2019 11:36:45

π/4DQPSK _Highest Channel



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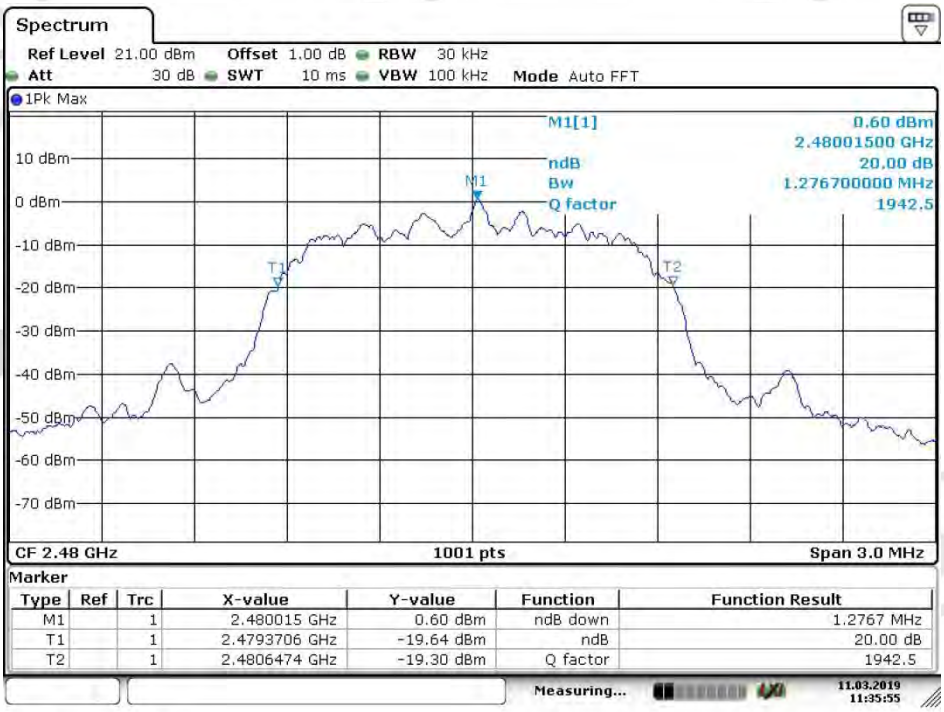


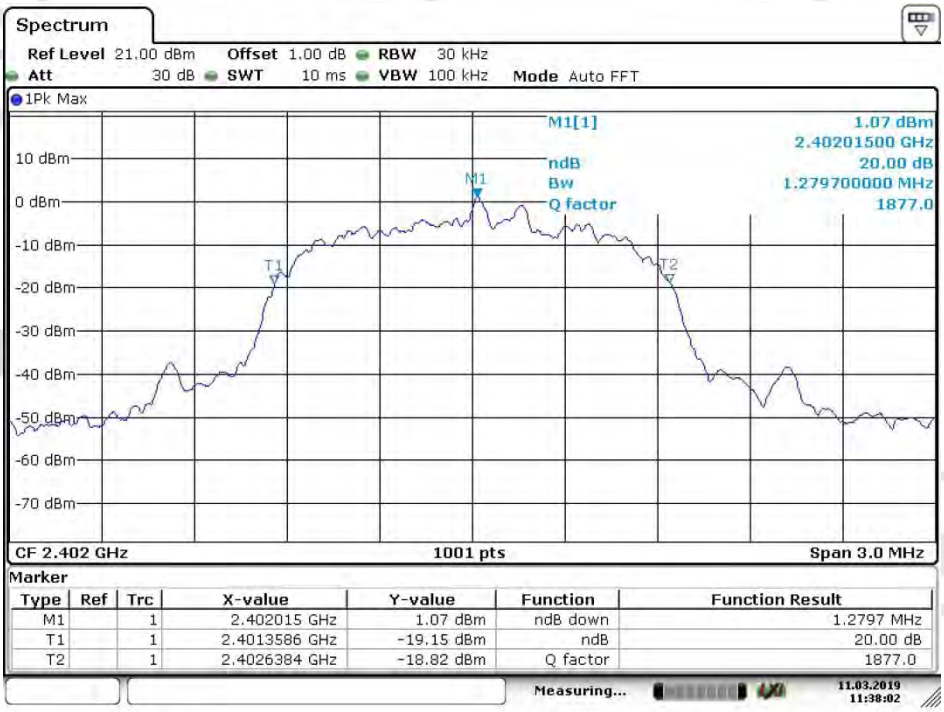
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.480015 GHz	0.60 dBm	ndB down	1.2767 MHz
T1		1	2.4793706 GHz	-19.64 dBm	ndB	20.00 dB
T2		1	2.4806474 GHz	-19.30 dBm	Q factor	1942.5

Date: 11.MAR.2019 11:35:56

8DPSK_Lowest Channel

Date: 11.MAR.2019 11:39:34

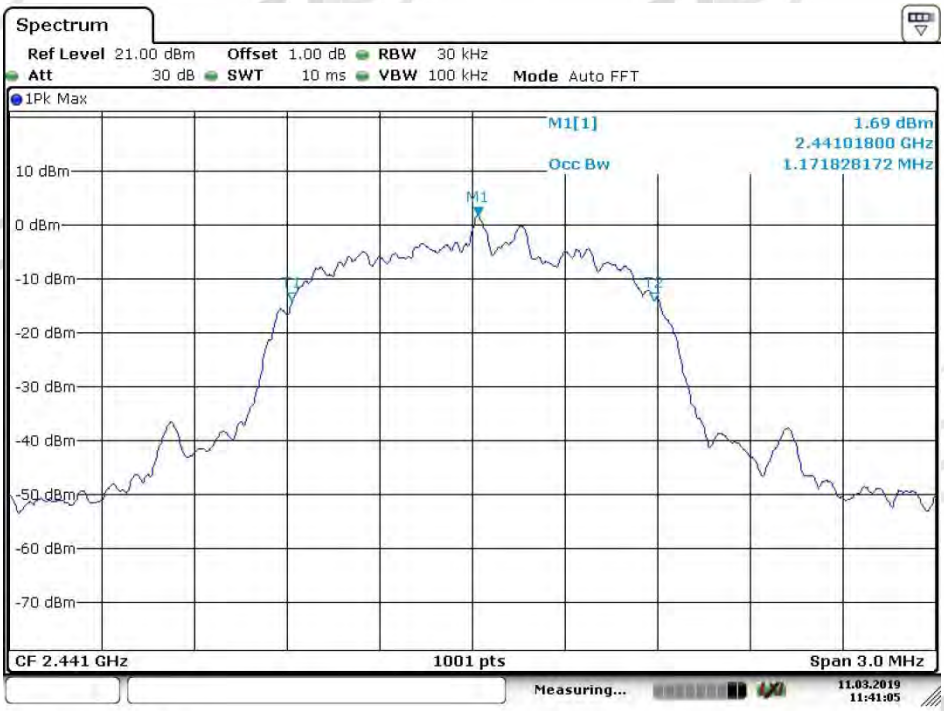


Marker

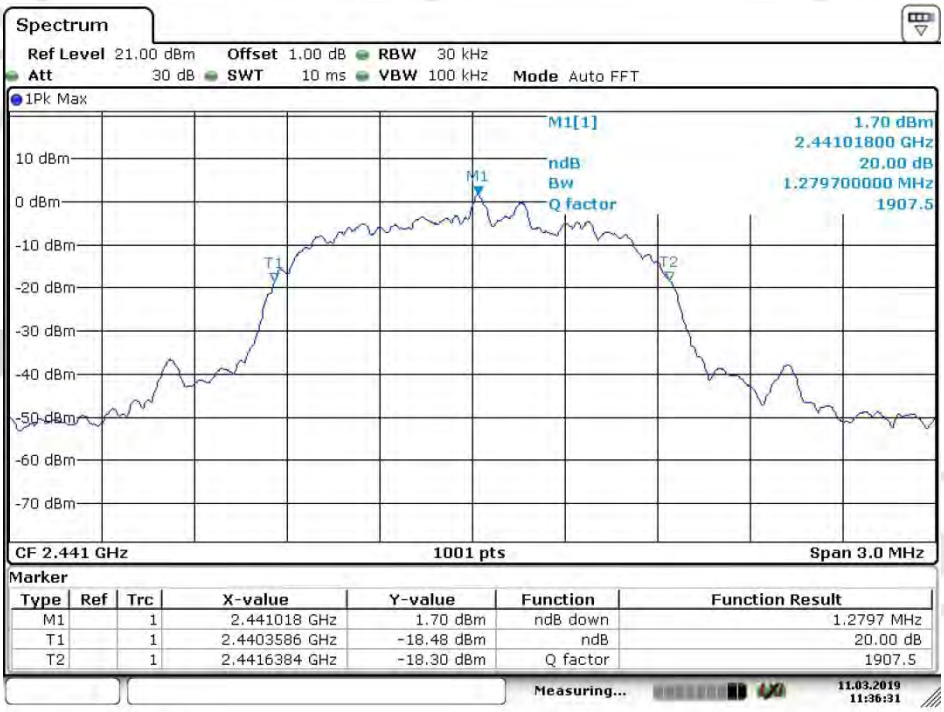
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.402015 GHz	1.07 dBm	ndB down	1.2797 MHz
T1		1	2.4013586 GHz	-19.15 dBm	ndB	20.00 dB
T2		1	2.4026384 GHz	-18.82 dBm	Q factor	1877.0

Date: 11.MAR.2019 11:38:02

8DPSK _Middle Channel



Date: 11.MAR.2019 11:41:06



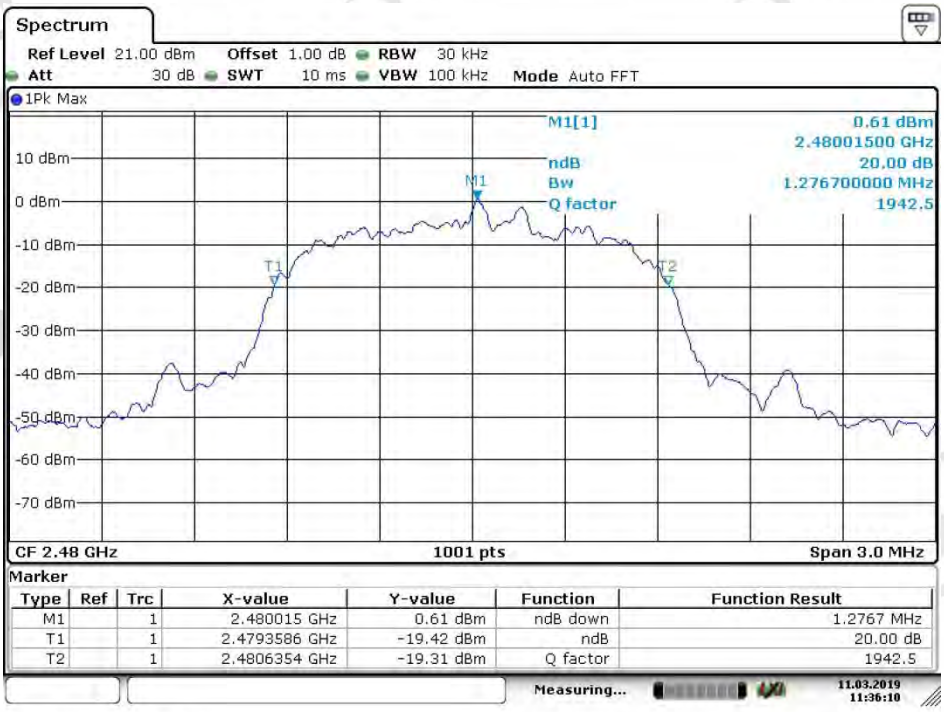
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.441018 GHz	1.70 dBm	ndB down	1.2797 MHz
T1		1	2.4403586 GHz	-18.48 dBm	ndB	20.00 dB
T2		1	2.4416384 GHz	-18.30 dBm	Q factor	1907.5

Date: 11.MAR.2019 11:36:31

8DPSK_Highest Channel

Date: 11.MAR.2019 11:41:26



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.480015 GHz	0.61 dBm	ndB down	1.2767 MHz
T1		1	2.4793586 GHz	-19.42 dBm	ndB	20.00 dB
T2		1	2.4806354 GHz	-19.31 dBm	Q factor	1942.5

Date: 11.MAR.2019 11:36:10

Carrier Frequencies Separation

Test Results

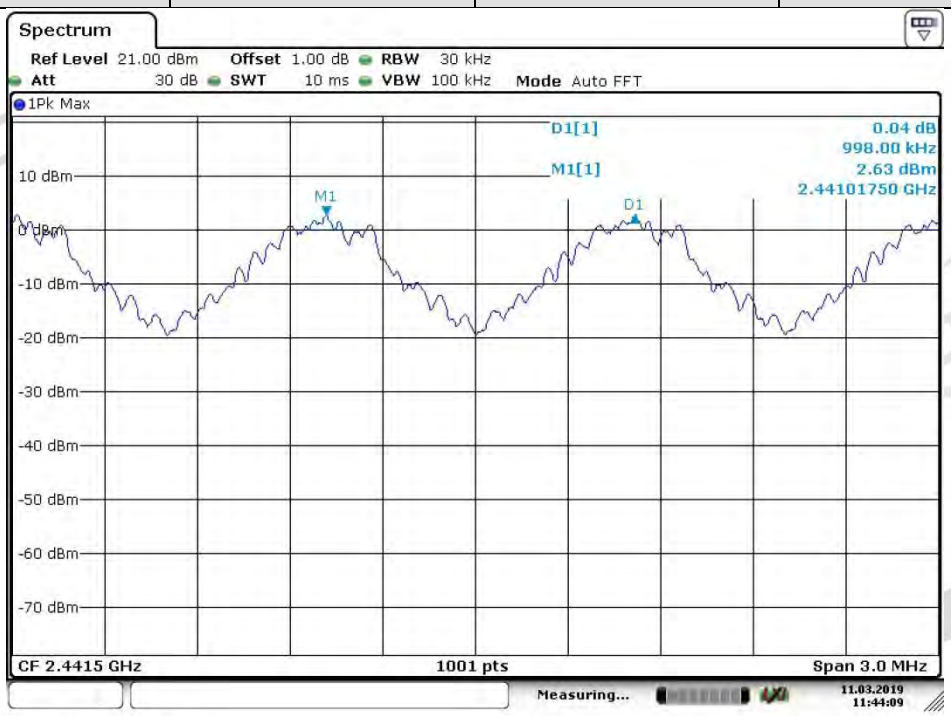
GFSK mode			
Test channel	**Carrier Frequencies Separation (kHz)**	**Limit (kHz)**	**Result**
Middle	998	599.4	Pass
π/4DQPSK mode			
Test channel	**Carrier Frequencies Separation (kHz)**	**Limit (kHz)**	**Result**
Middle	1001	835.1	Pass
8DPSK mode			
Test channel	**Carrier Frequencies Separation (kHz)**	**Limit (kHz)**	**Result**
Middle	1001	841.1	Pass

Remark: According to section 6.4,

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	899.1	599.4
π/4DQPSK	1279.7	853.1
8DPSK	1279.7	853.1

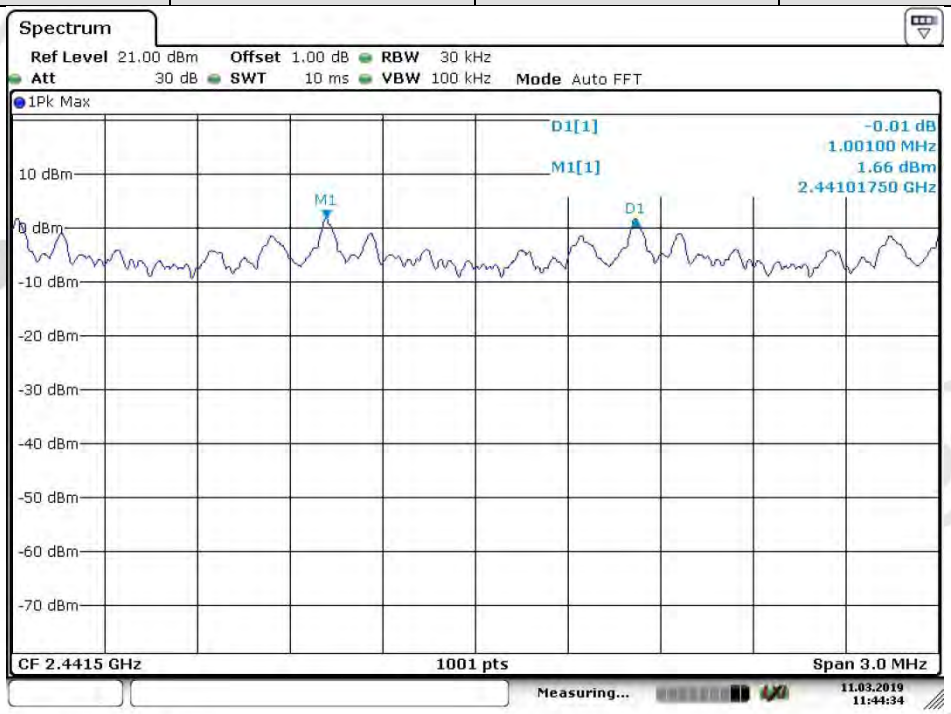
Test plots:

Test mode:	GFSK	Test channel:	Middle



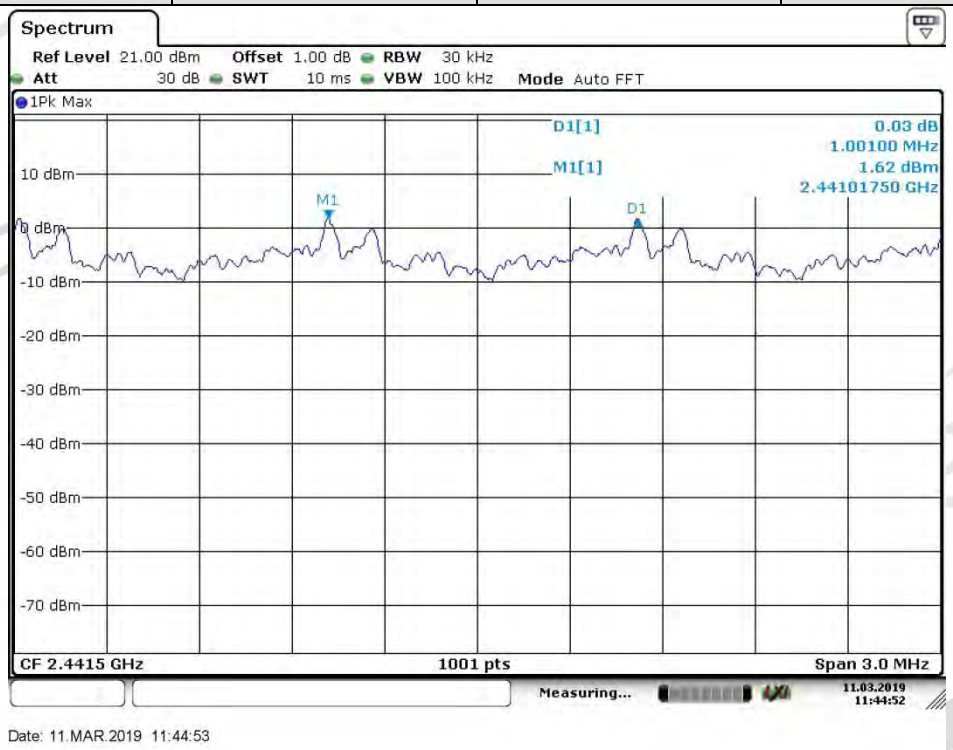
Date: 11.MAR.2019 11:44:09

Test mode:	π/4DQPSK	Test channel:	Middle



Date: 11.MAR.2019 11:44:35

Test mode:	8DPSK	Test channel:	Middle



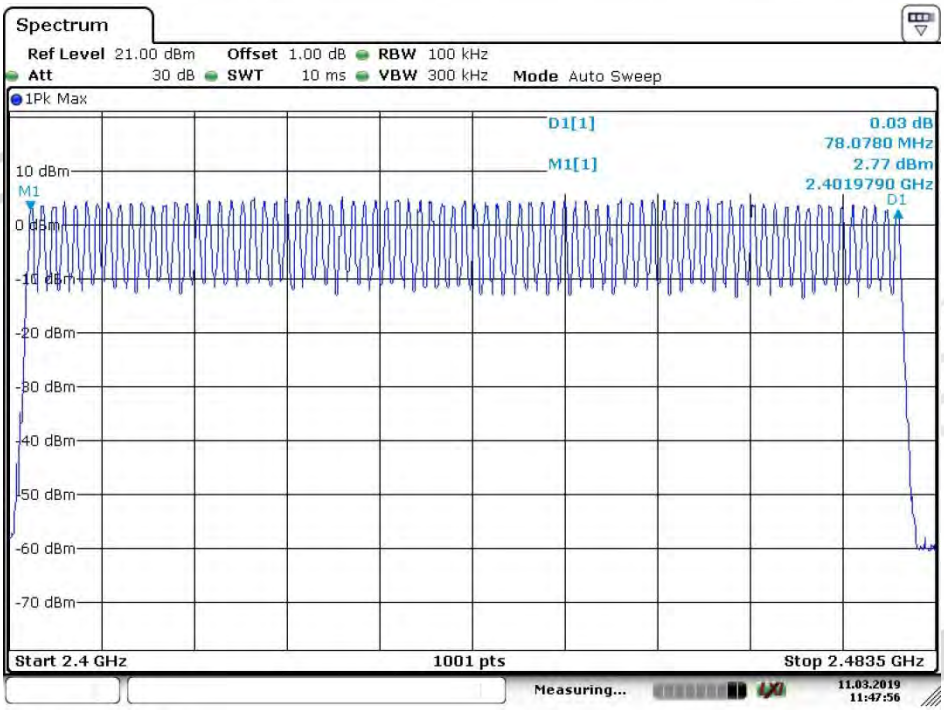
Hopping Channel Number

Test Results

Mode	Hopping channel numbers	Limit
GFSK	79	≥15
π/4DQPSK	79	≥15
8DPSK	79	≥15

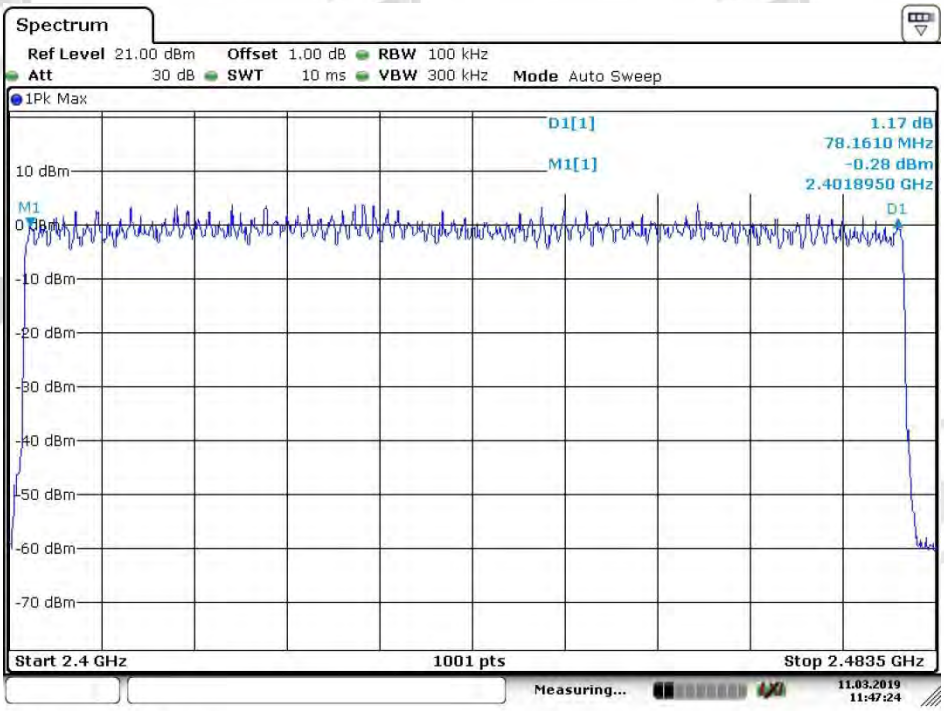
Test plots

GFSK



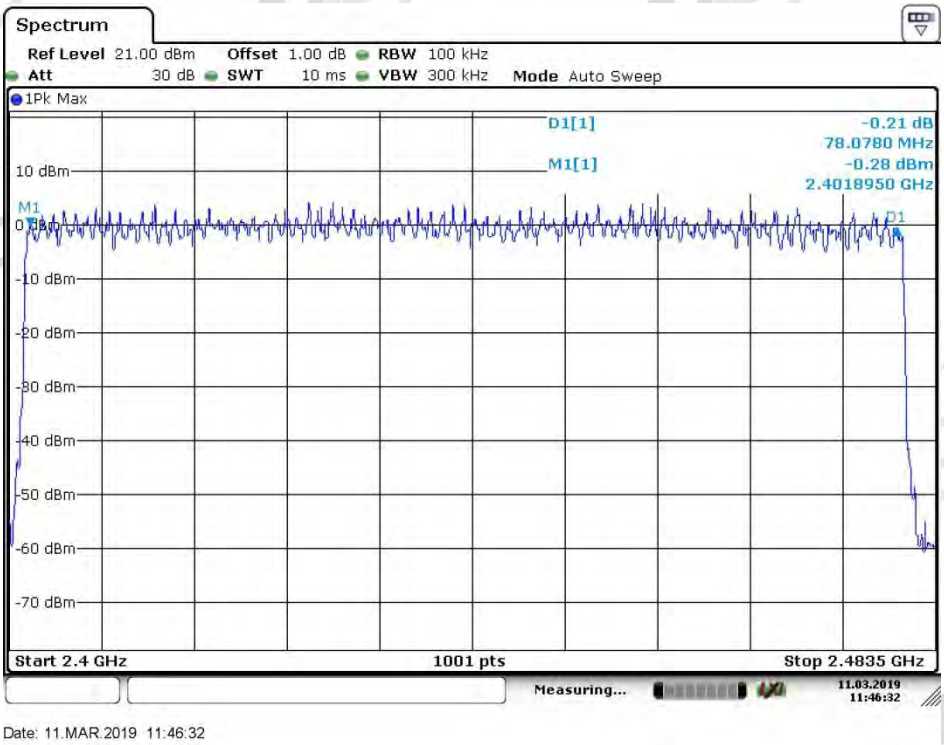
Date: 11.MAR.2019 11:47:57

π/4DQPSK



Date: 11.MAR.2019 11:47:24

8DPSK


Spectrum
Ref Level 21.00 dBm Offset 1.00 dB RBW 100 kHz
Att 30 dB SWT 10 ms VBW 300 kHz Mode Auto Sweep
1Pk Max
D1[1] -0.21 dB
78.0780 MHz
M1[1] -0.28 dBm
2.4018950 GHz
10 dBm
M1
D1
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
Start 2.4 GHz
1001 pts
Stop 2.4835 GHz
Measuring...
11.03.2019
11:46:32
Date: 11.MAR.2019 11:46:32

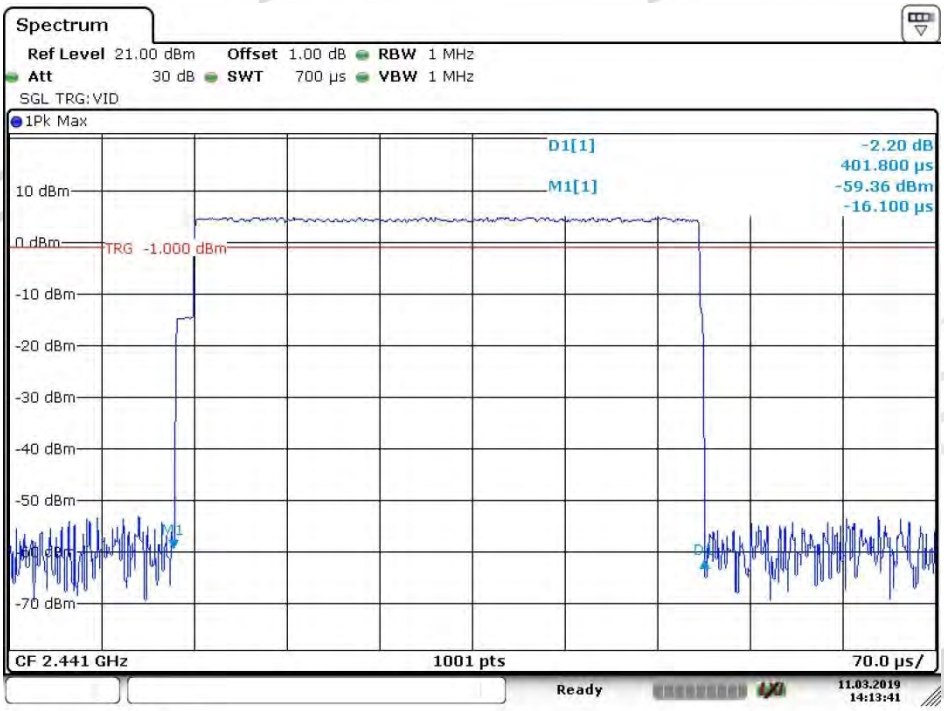
Dwell Time

Test Results

Operation Modes	On time（ms）on one channel
DH1	0.401
DH3	1.663
DH5	2.911
2-DH1	0.407
2-DH3	1.666
2-DH5	2.920
3-DH1	0.409
3-DH3	1.666
3-DH5	2.916

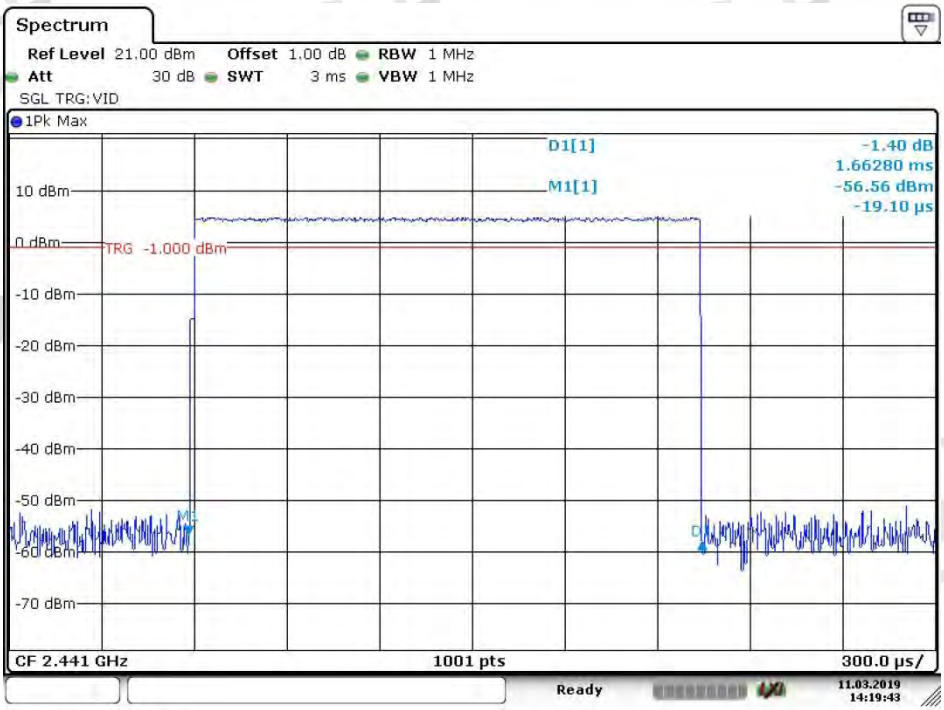
Test plots

DH1 _Middle Channel



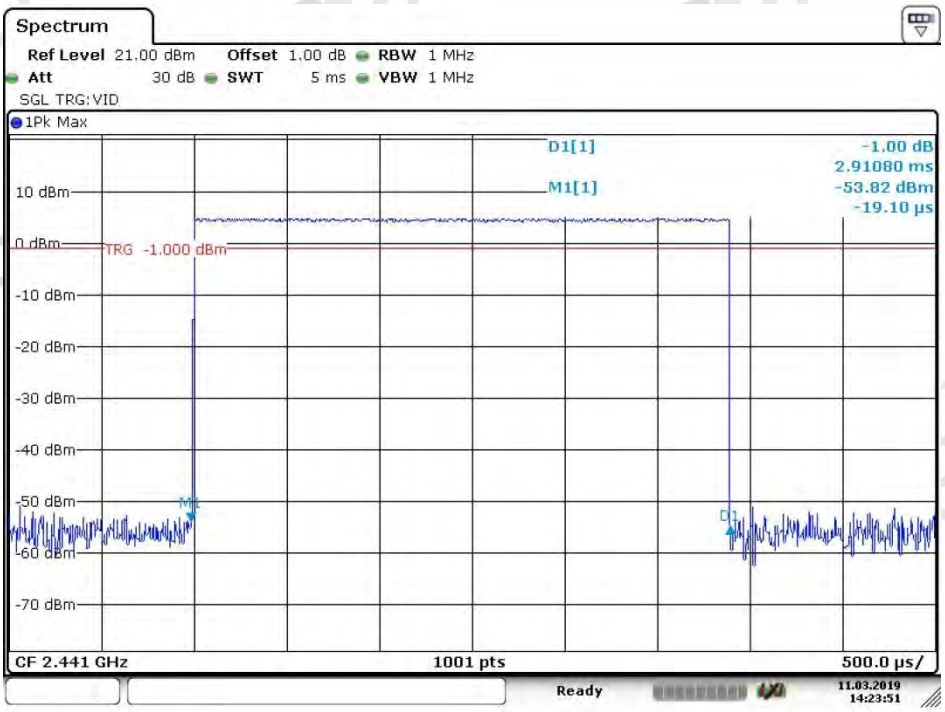
Date: 11.MAR.2019 14:13:41

DH3 _ Middle Channel



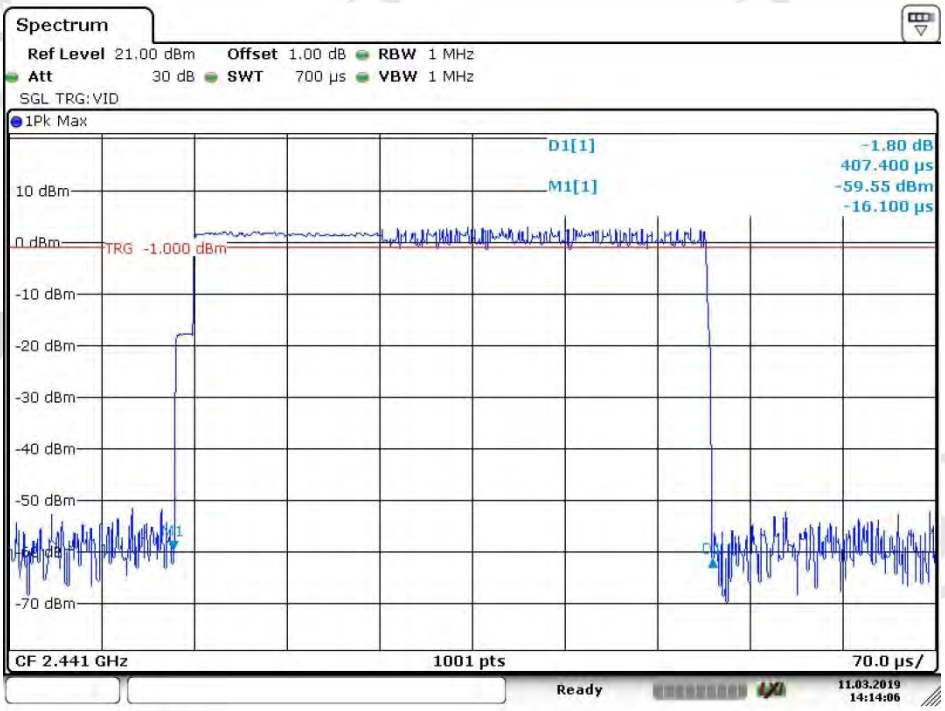
Date: 11.MAR.2019 14:19:43

DH5 _ Middle Channel



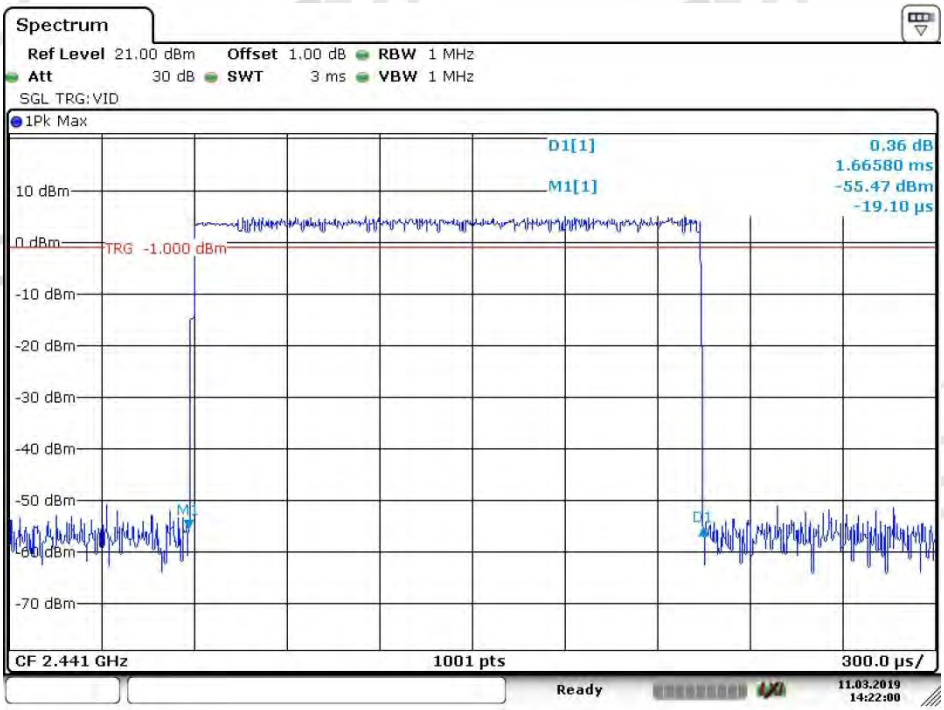
Date: 11.MAR.2019 14:23:52

2DH1 _Middle Channel



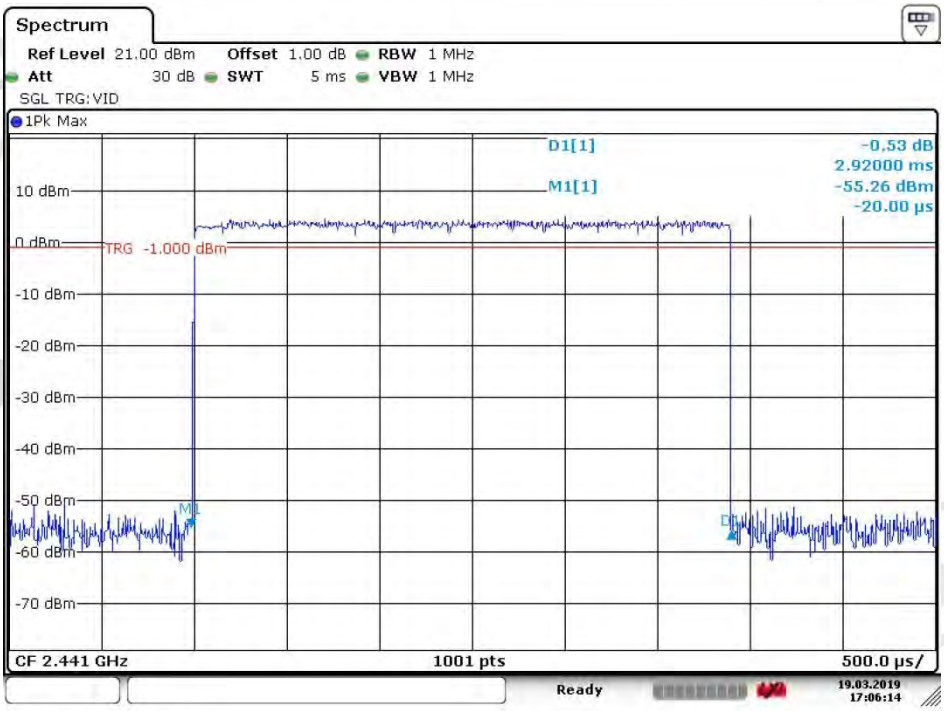
Date: 11.MAR.2019 14:14:07

2DH3 _ Middle Channel



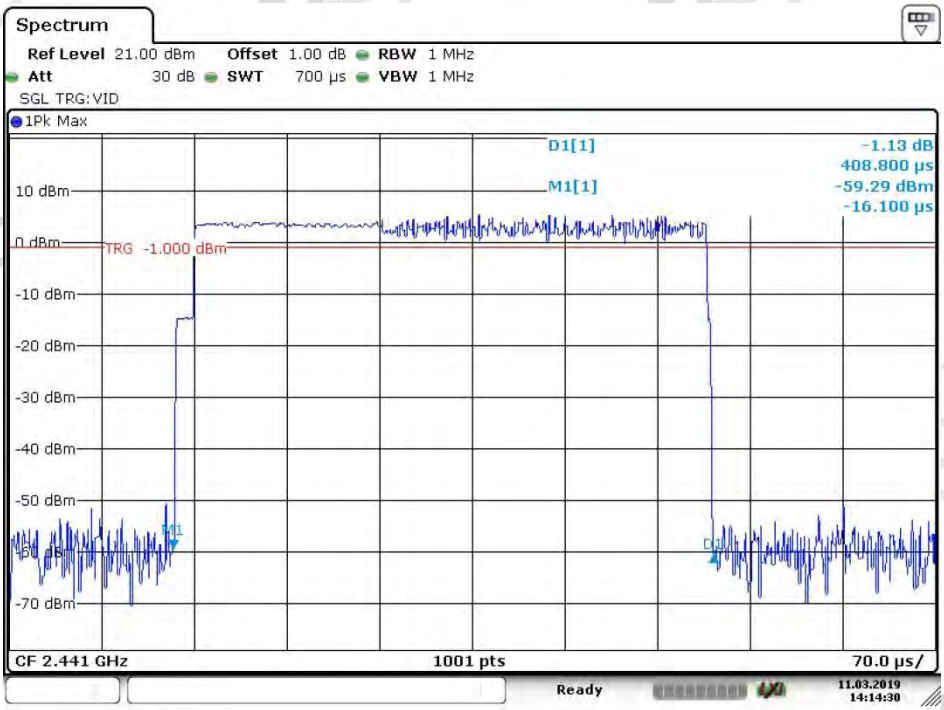
Date: 11.MAR.2019 14:22:00

2DH5 _ Middle Channel



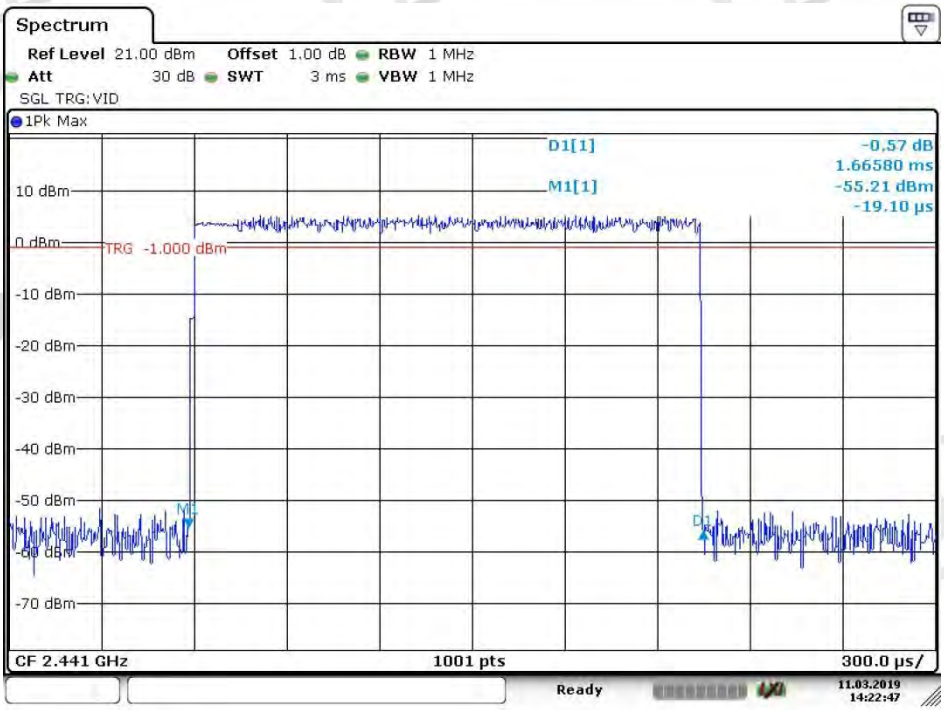
Date: 19.MAR.2019 17:06:15

3DH1 _Middle Channel



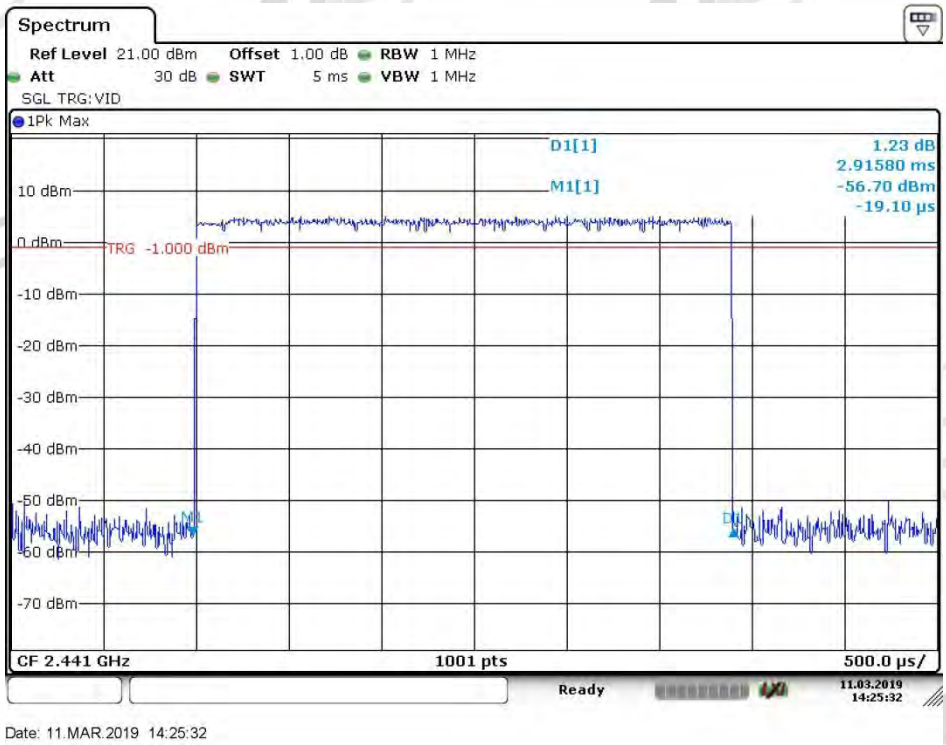
Date: 11.MAR.2019 14:14:31

3DH3 _ Middle Channel



Date: 11.MAR.2019 14:22:46

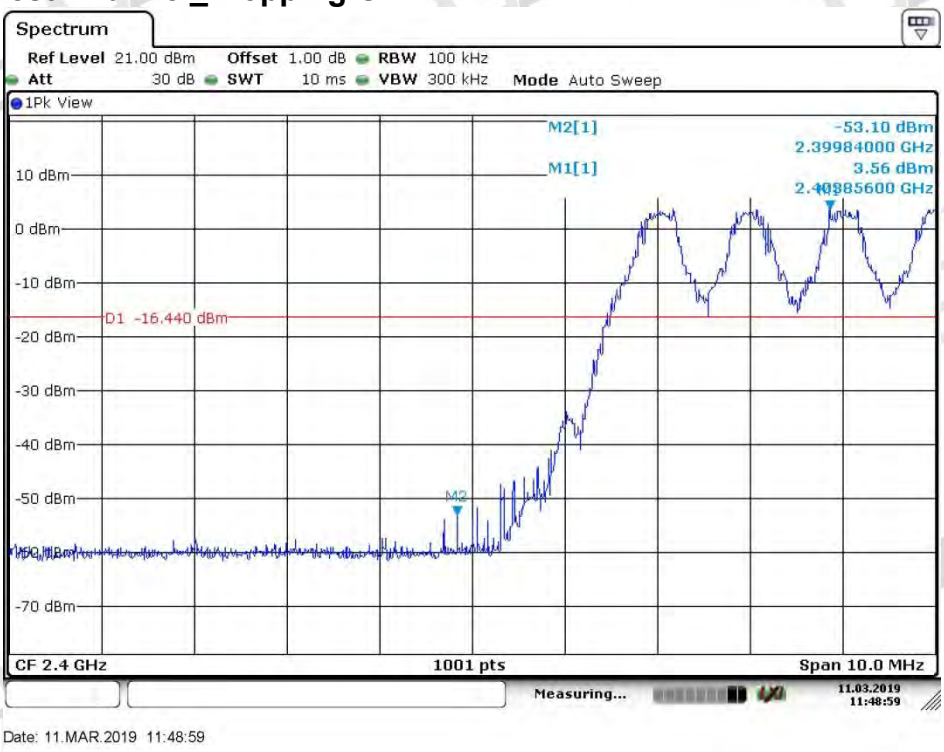
3DH5 _ Middle Channel



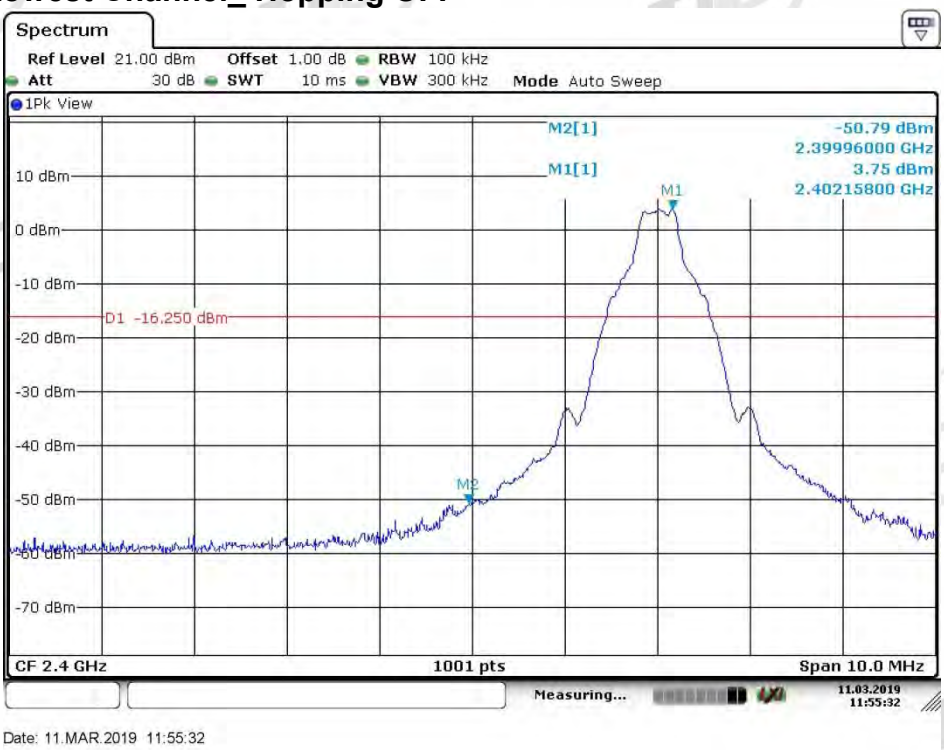
Band-edge for RF Conducted Emissions

Test plots

GFSK _Lowest Channel_ Hopping ON

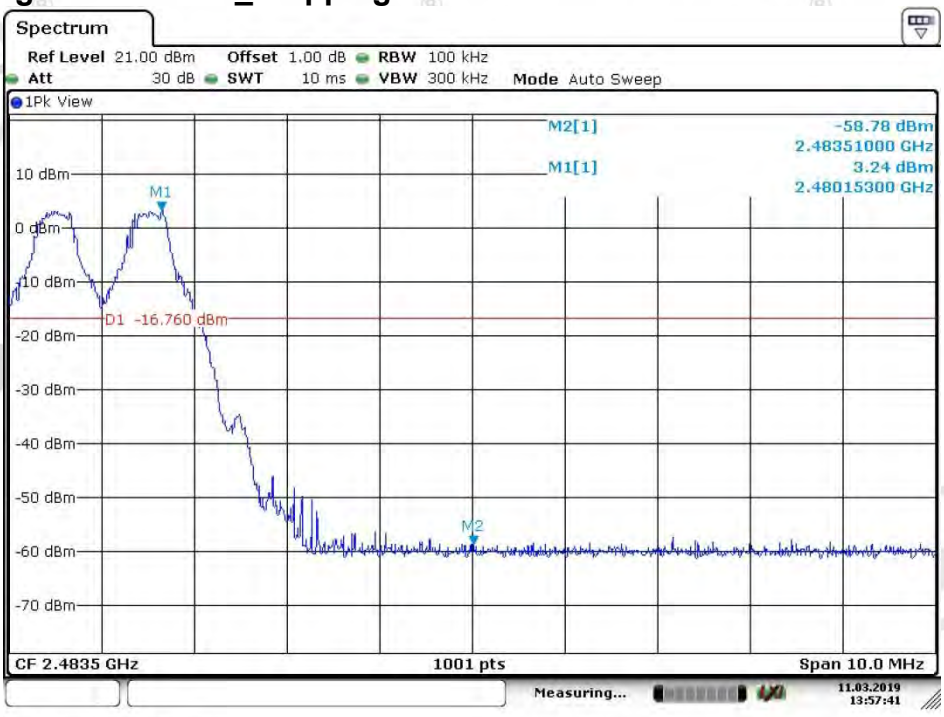


GFSK _Lowest Channel_ Hopping OFF



Date: 11.MAR.2019 11:55:32

GFSK _Highest Channel_ Hopping ON

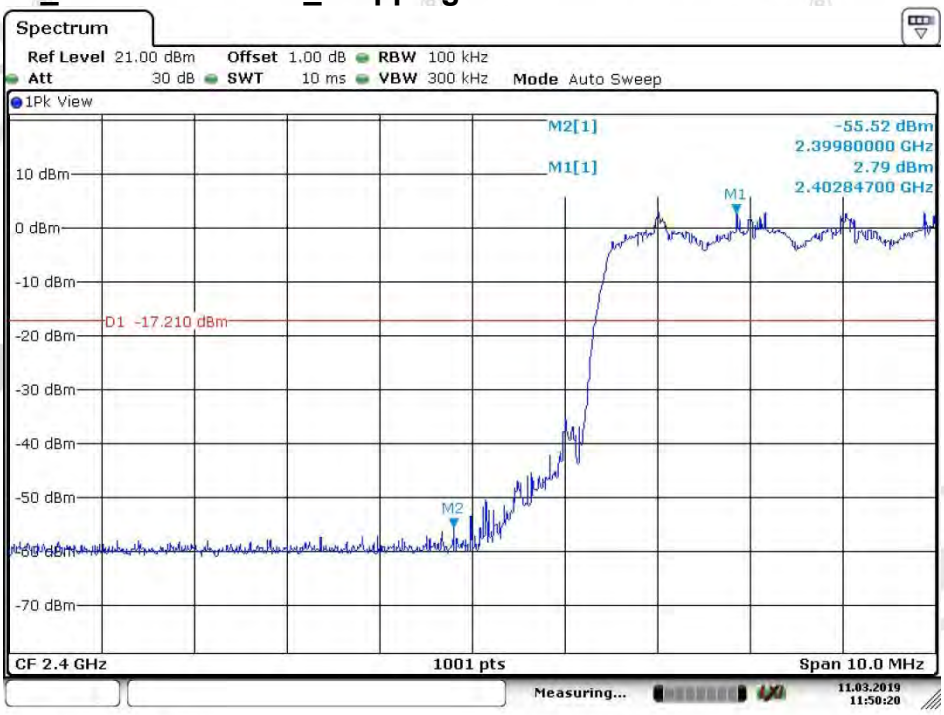


Date: 11.MAR.2019 13:57:41

GFSK _Highest Channel_ Hopping OFF

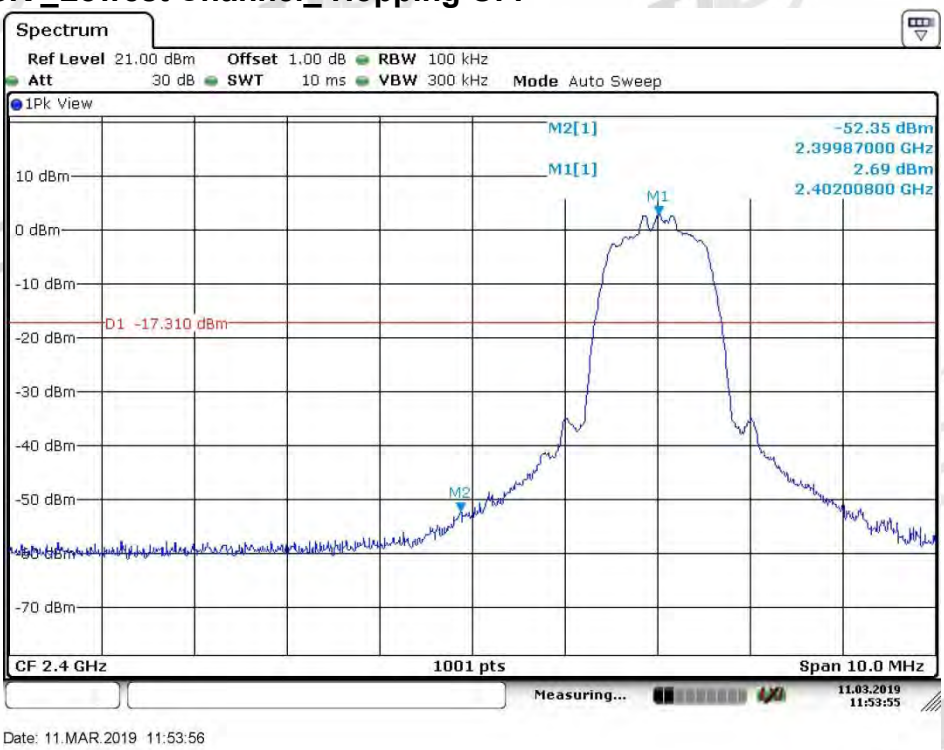
Date: 11.MAR.2019 13:42:37

π/4DQPSK _Lowest Channel_ Hopping ON



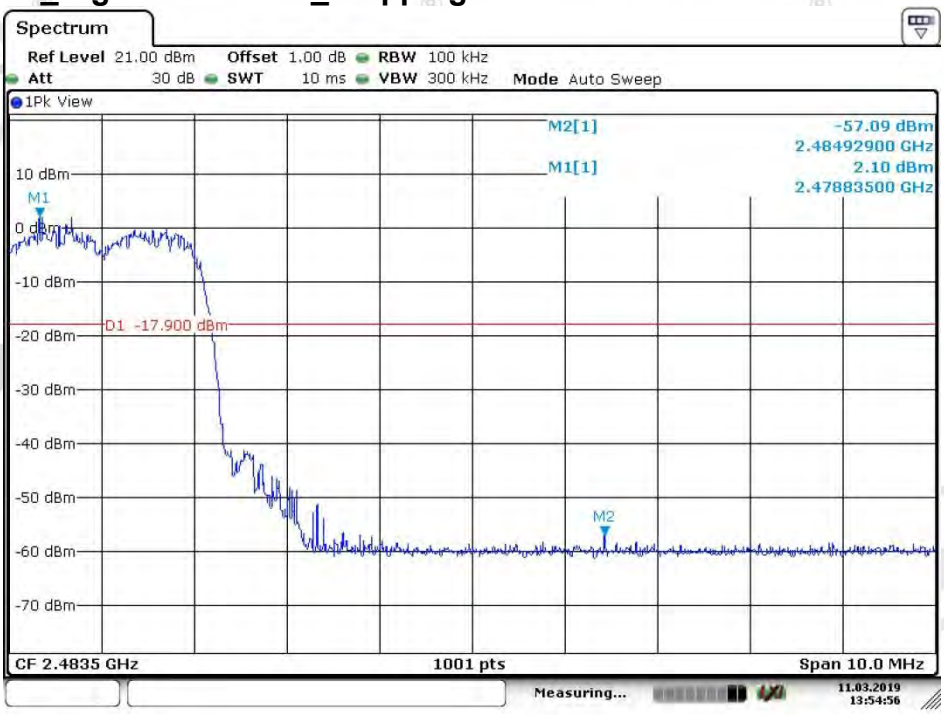
Date: 11.MAR.2019 11:50:20

π/4DQPSK _Lowest Channel_ Hopping OFF



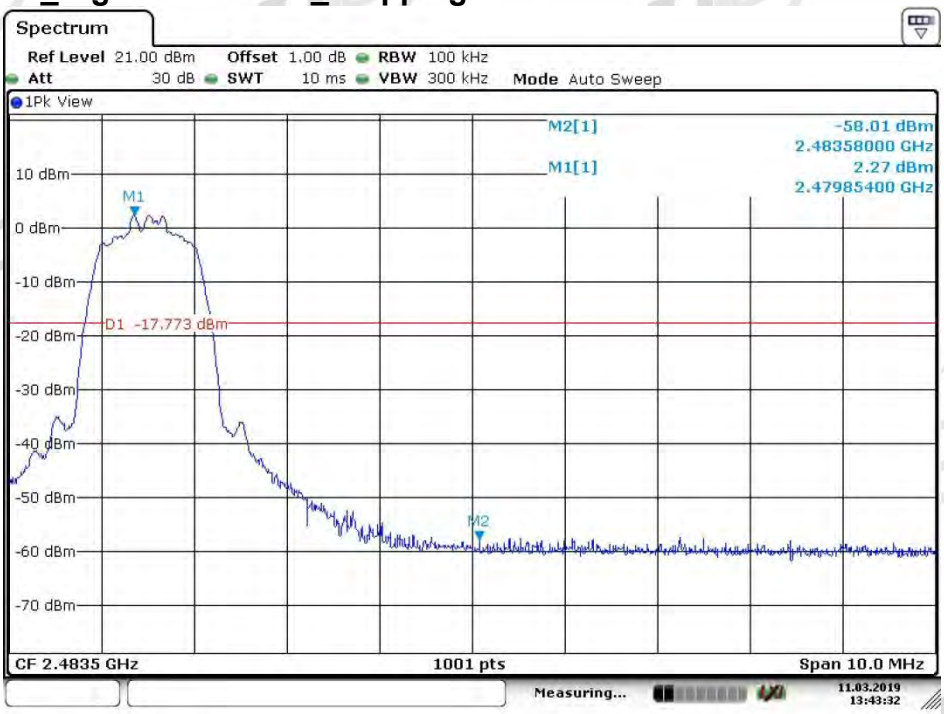
Date: 11.MAR.2019 11:53:56

π/4DQPSK _Highest Channel_ Hopping ON



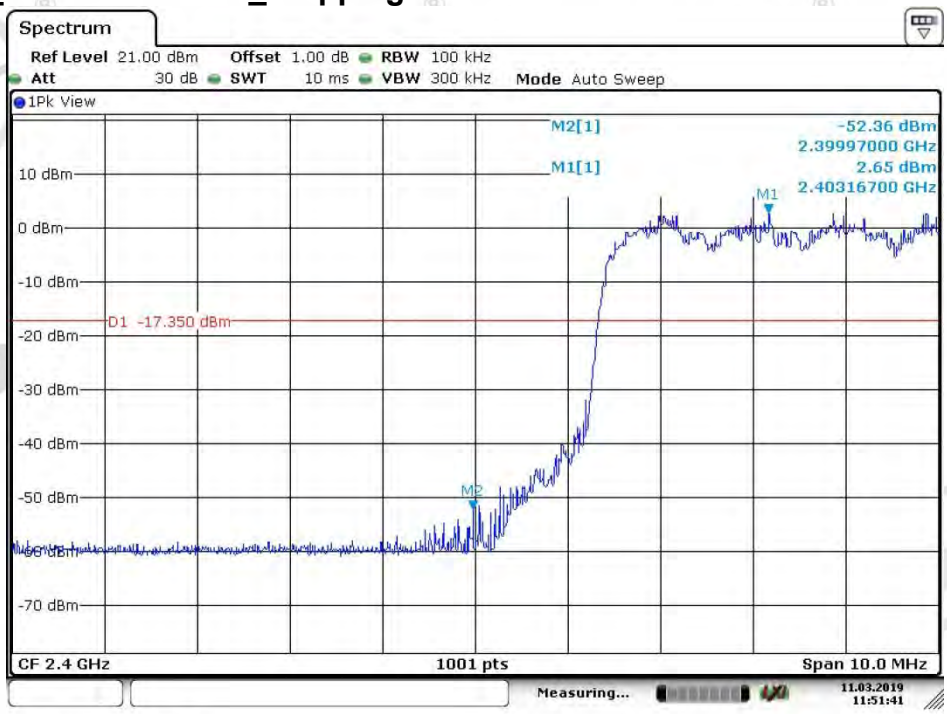
Date: 11.MAR.2019 13:54:57

π/4DQPSK _Highest Channel_ Hopping OFF



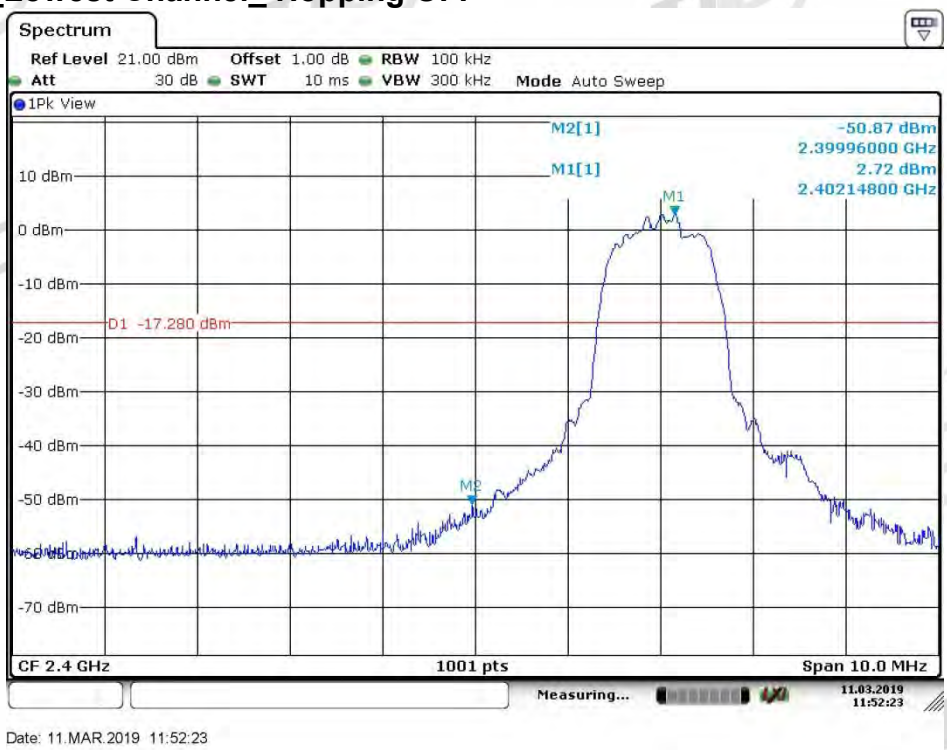
Date: 11.MAR.2019 13:43:33

8DPSK _Lowest Channel_ Hopping ON



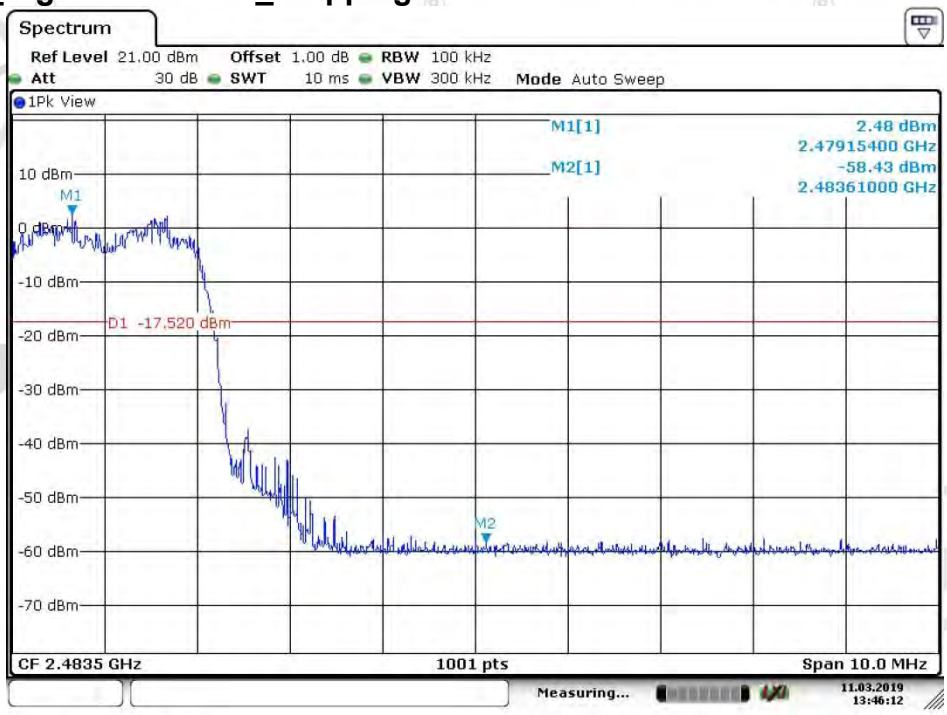
Date: 11.MAR.2019 11:51:42

8DPSK _Lowest Channel_ Hopping OFF



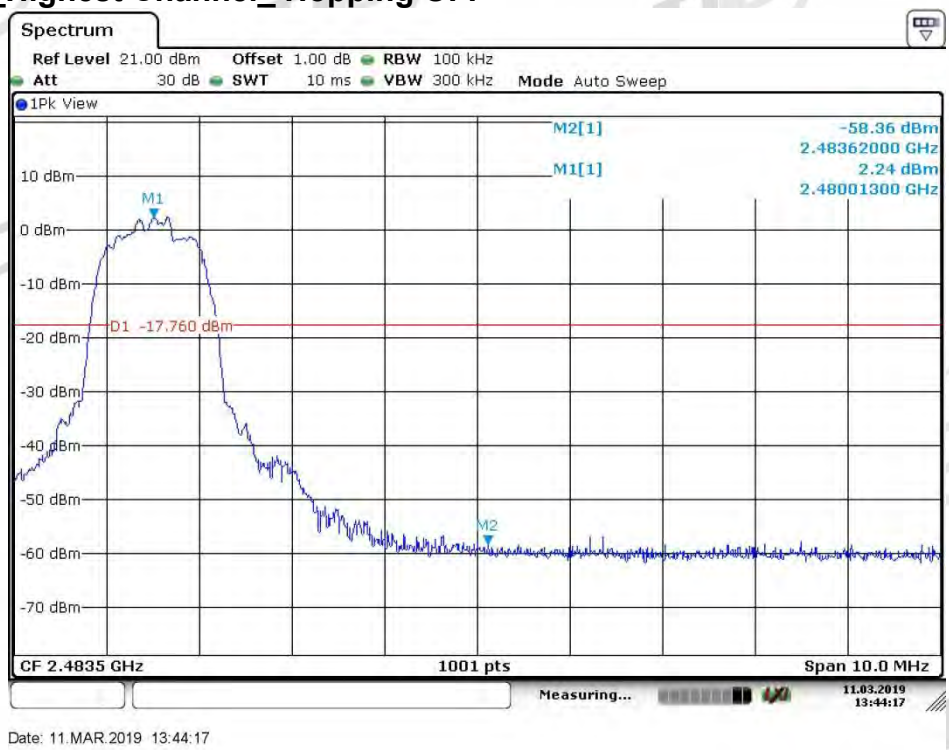
Date: 11.MAR.2019 11:52:23

8DPSK _Highest Channel_ Hopping ON



Date: 11.MAR.2019 13:46:12

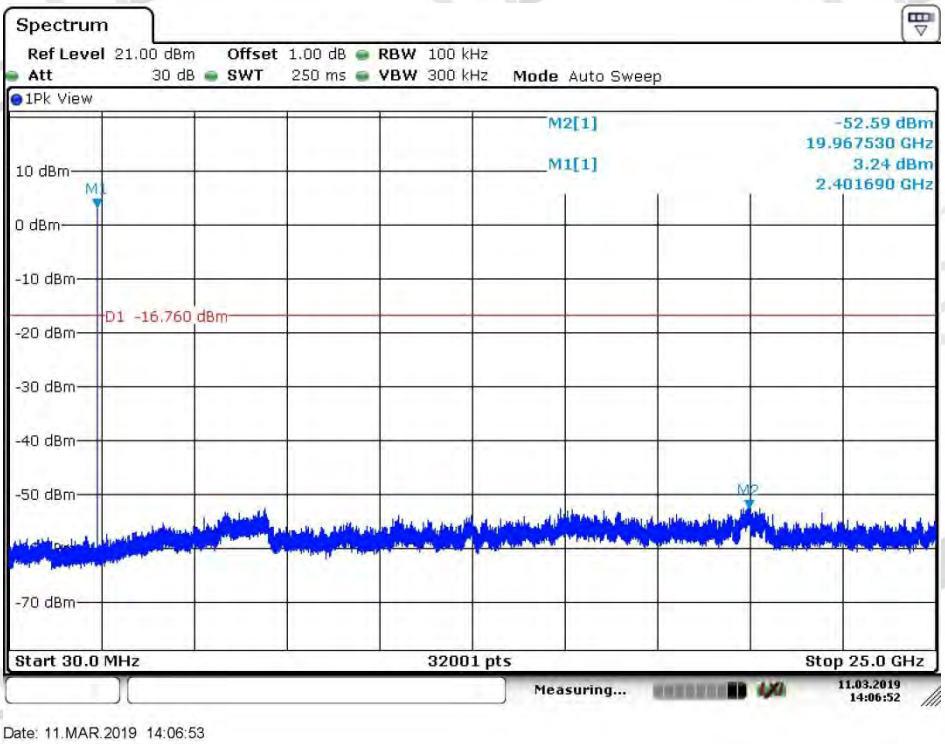
8DPSK _Highest Channel_ Hopping OFF



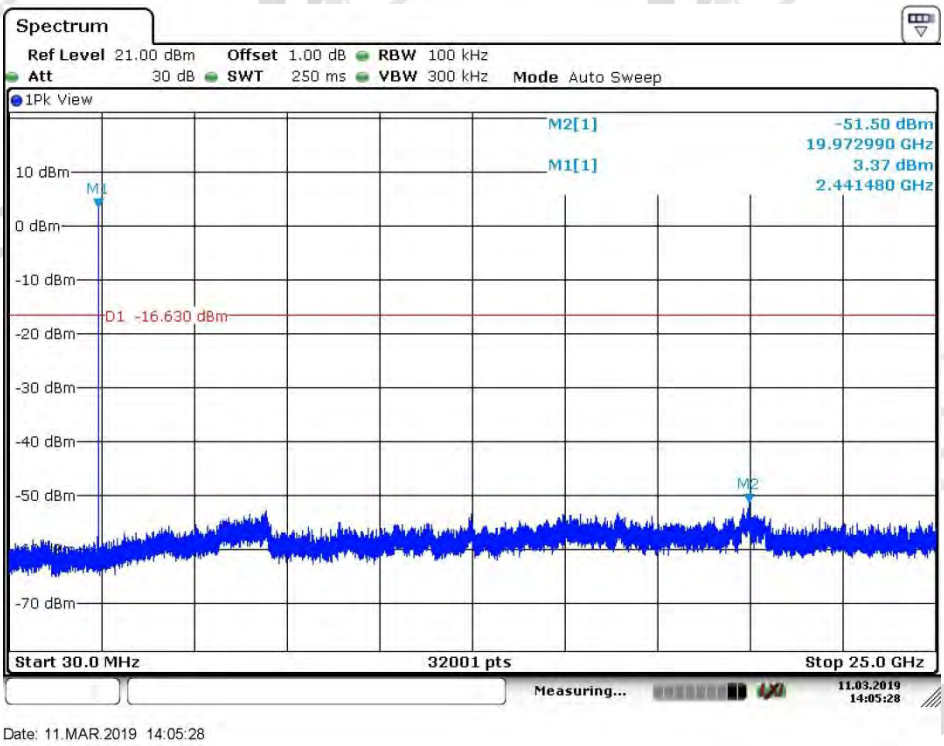
Spurious RF Conducted Emissions

Test plots

GFSK _Lowest Channel

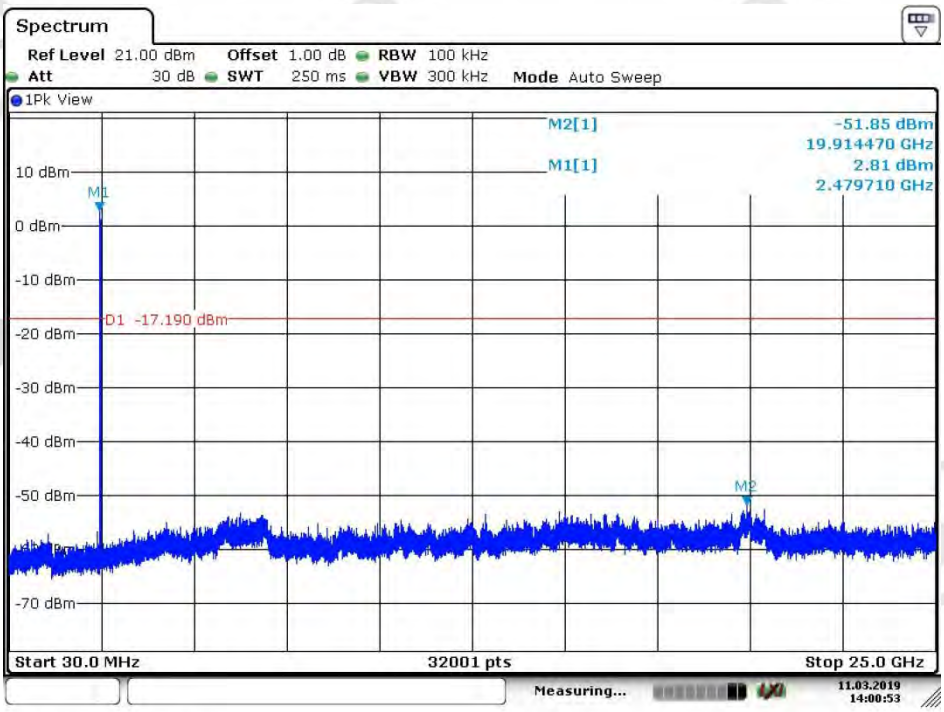


GFSK _Middle Channel



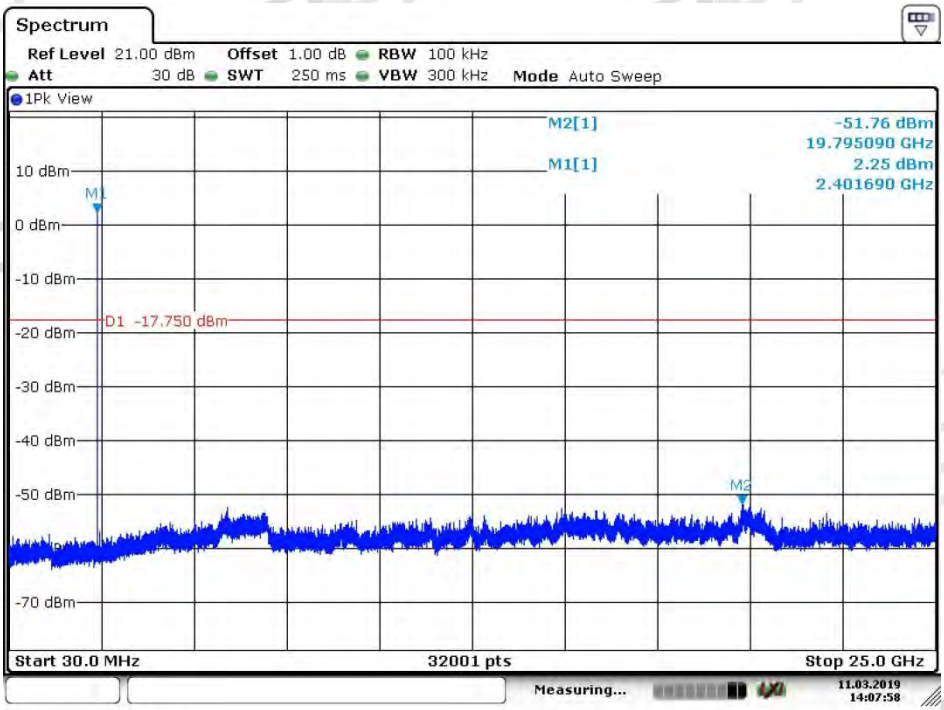
Date: 11.MAR.2019 14:05:28

GFSK _Highest Channel



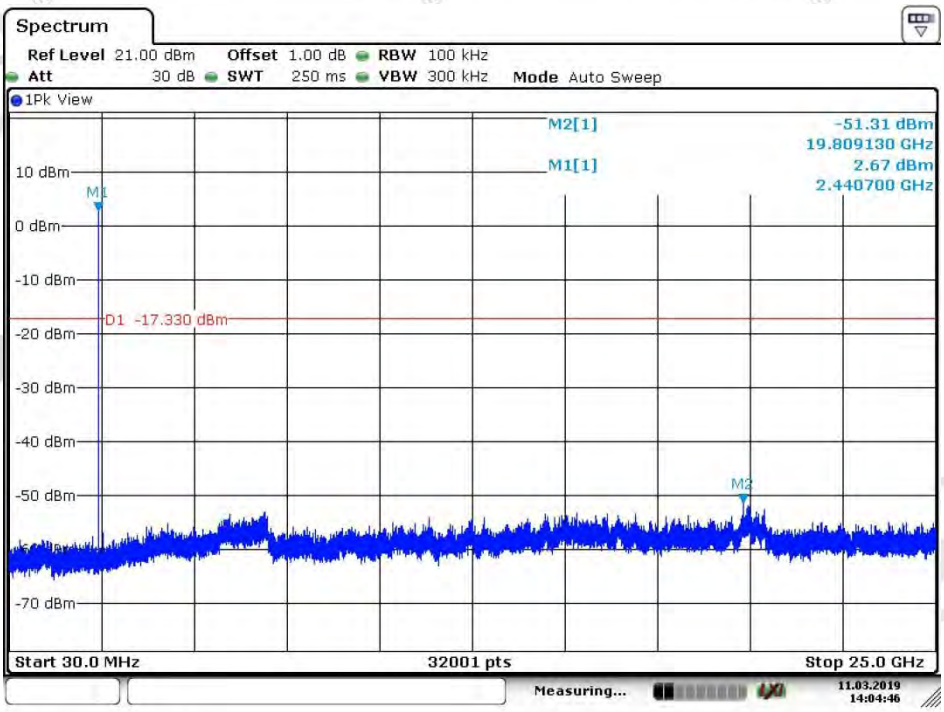
Date: 11.MAR.2019 14:00:53

π/4DQPSK _Lowest Channel



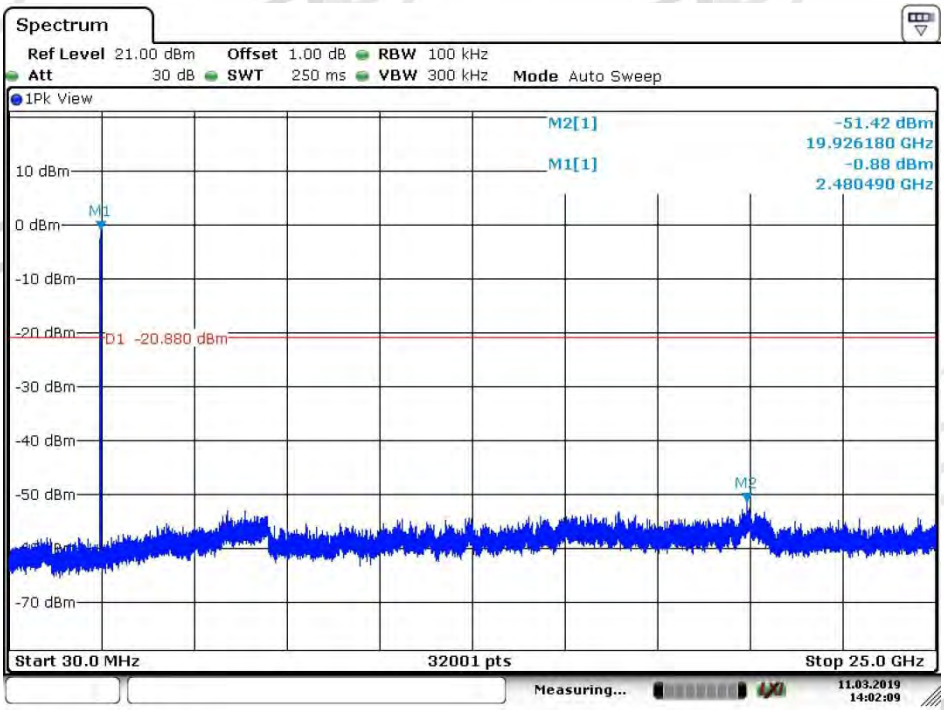
Date: 11.MAR.2019 14:07:59

π/4DQPSK _Middle Channel



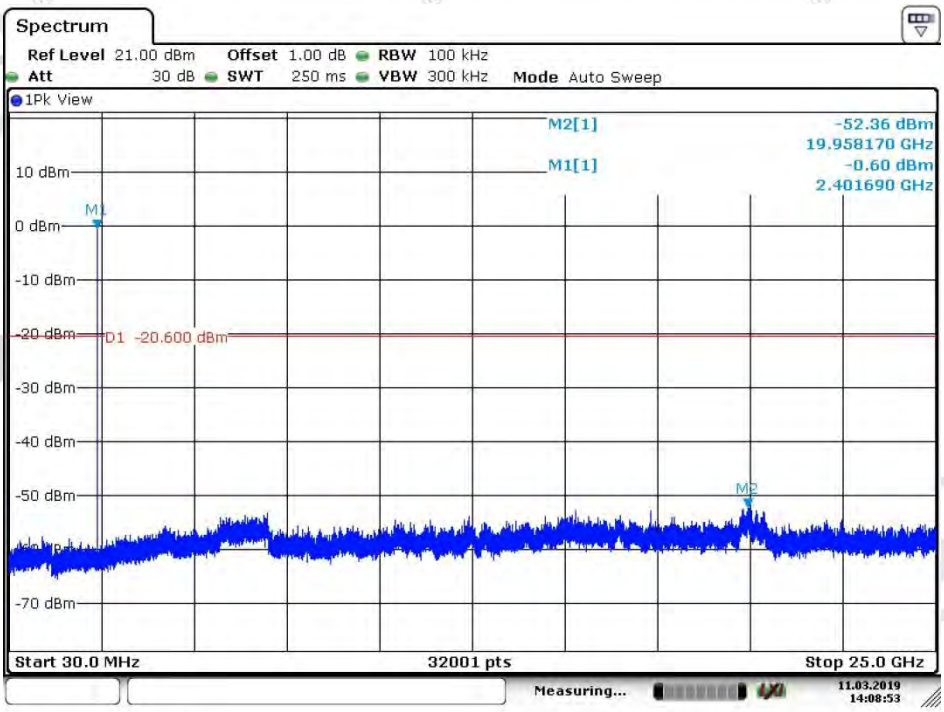
Date: 11.MAR.2019 14:04:47

π/4DQPSK _Highest Channel



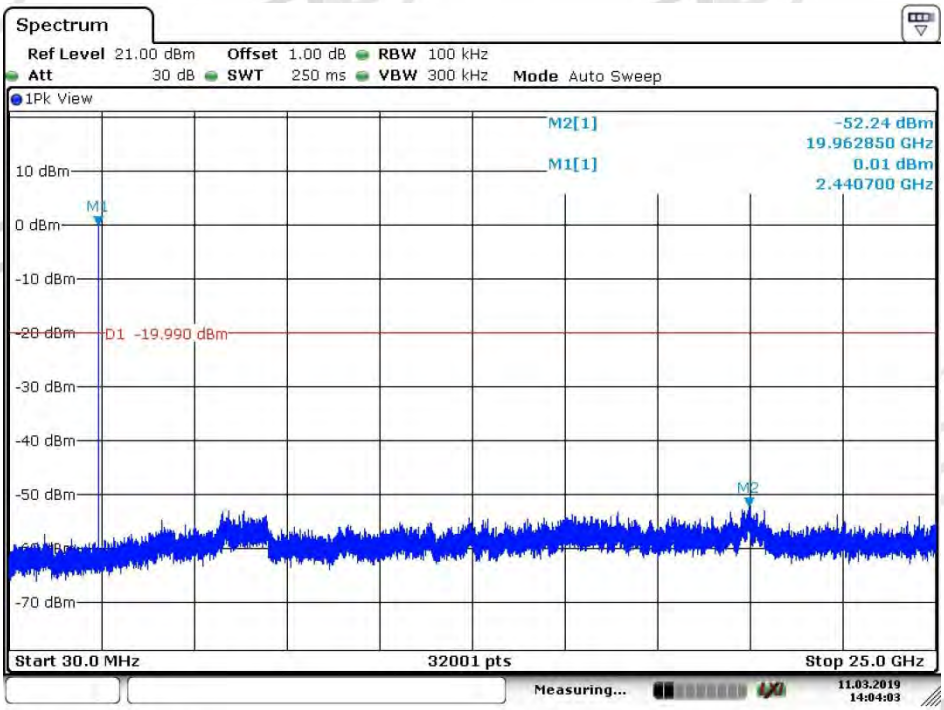
Date: 11.MAR.2019 14:02:10

8DPSK_Lowest Channel



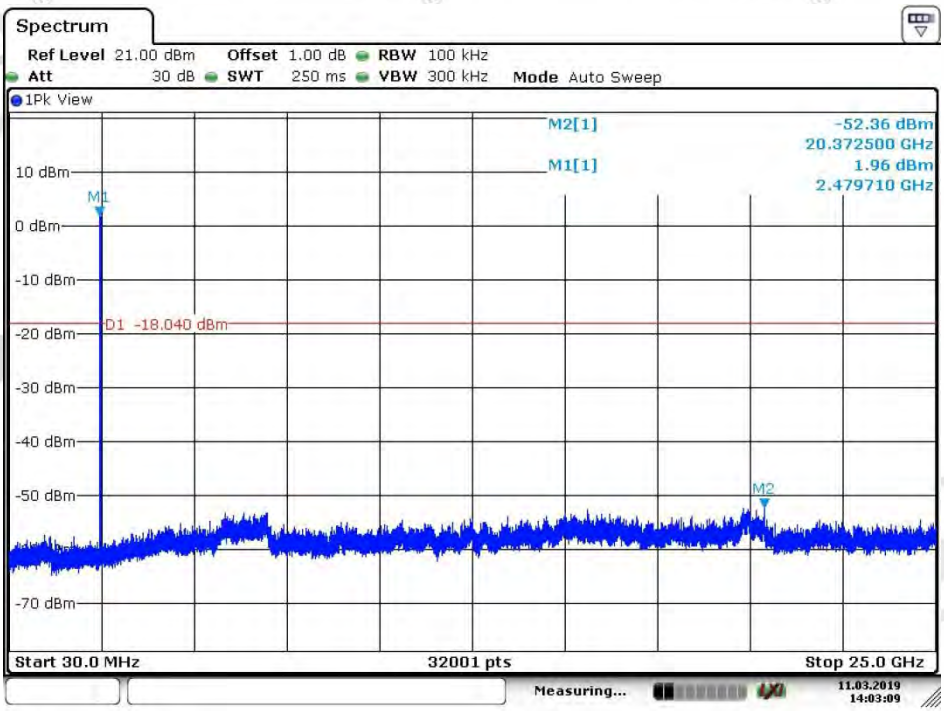
Date: 11.MAR.2019 14:08:53

8DPSK _Middle Channel



Date: 11.MAR.2019 14:04:03

8DPSK_Highest Channel



Date: 11.MAR.2019 14:03:10

Remark:

Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz was very low, and the above harmonics were the highest point could be found when testing, The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.