

Appendix

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1. Equipment List

Conducted Emission					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate
				(yyyy-mm-dd)	(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	2018/4/2	2019/4/1
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	2018/4/2	2019/4/1
RF conducted test					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate
				(yyyy-mm-dd)	(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

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
4	Conduct emission test	±3.12 dB(9KHz- 30MHz)

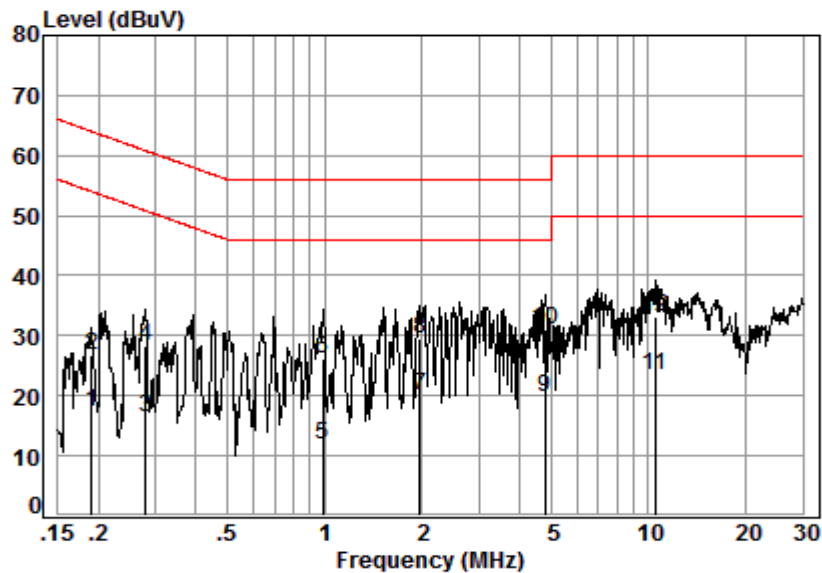
3. AC Power Line Conducted Emissions

Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

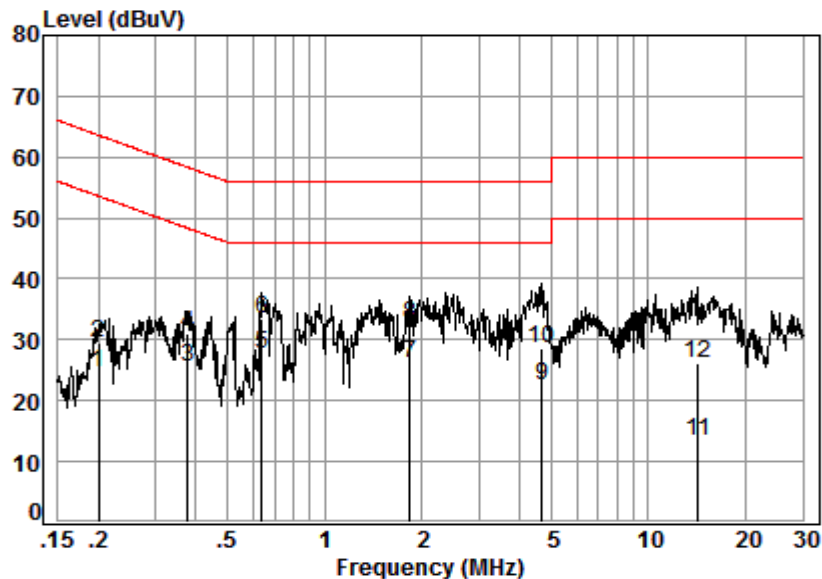
Live line:



Site : Shielding Room
 Condition: Line
 Job No. : 11311CR
 Test mode:

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.19	0.02	9.51	7.71	17.24	54.02	-36.78	Average
2	0.19	0.02	9.51	17.23	26.76	64.02	-37.26	QP
3	0.28	0.04	9.51	6.88	16.43	50.81	-34.38	Average
4	0.28	0.04	9.51	18.75	28.30	60.81	-32.51	QP
5	0.99	0.09	9.50	2.20	11.79	46.00	-34.21	Average
6	0.99	0.09	9.50	16.46	26.05	56.00	-29.95	QP
7	1.97	0.16	9.51	10.39	20.06	46.00	-25.94	Average
8	1.97	0.16	9.51	19.76	29.43	56.00	-26.57	QP
9	4.80	0.17	9.55	10.11	19.83	46.00	-26.17	Average
10	4.80	0.17	9.55	21.20	30.92	56.00	-25.08	QP
11	10.51	0.17	9.64	13.65	23.46	50.00	-26.54	Average
12	10.51	0.17	9.64	23.35	33.16	60.00	-26.84	QP

Neutral line:



Site : Shielding Room

Condition: Neutral

Job No. : 11311CR

Test mode:

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.20	0.02	9.57	15.11	24.70	53.62	-28.92	Average
2	0.20	0.02	9.57	19.97	29.56	63.62	-34.06	QP
3	0.38	0.05	9.59	15.86	25.50	48.34	-22.84	Average
4	0.38	0.05	9.59	21.32	30.96	58.34	-27.38	QP
5	0.64	0.07	9.62	17.84	27.53	46.00	-18.47	Average
6	0.64	0.07	9.62	23.81	33.50	56.00	-22.50	QP
7	1.84	0.15	9.64	16.42	26.21	46.00	-19.79	Average
8	1.84	0.15	9.64	22.80	32.59	56.00	-23.41	QP
9	4.70	0.17	9.68	12.79	22.64	46.00	-23.36	Average
10	4.70	0.17	9.68	18.78	28.63	56.00	-27.37	QP
11	14.21	0.20	9.91	3.36	13.47	50.00	-36.53	Average
12	14.21	0.20	9.91	16.13	26.24	60.00	-33.76	QP

Remarks:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level = Receiver Reading + LISN Factor + Cable Loss.

4. Conducted Peak Output Power

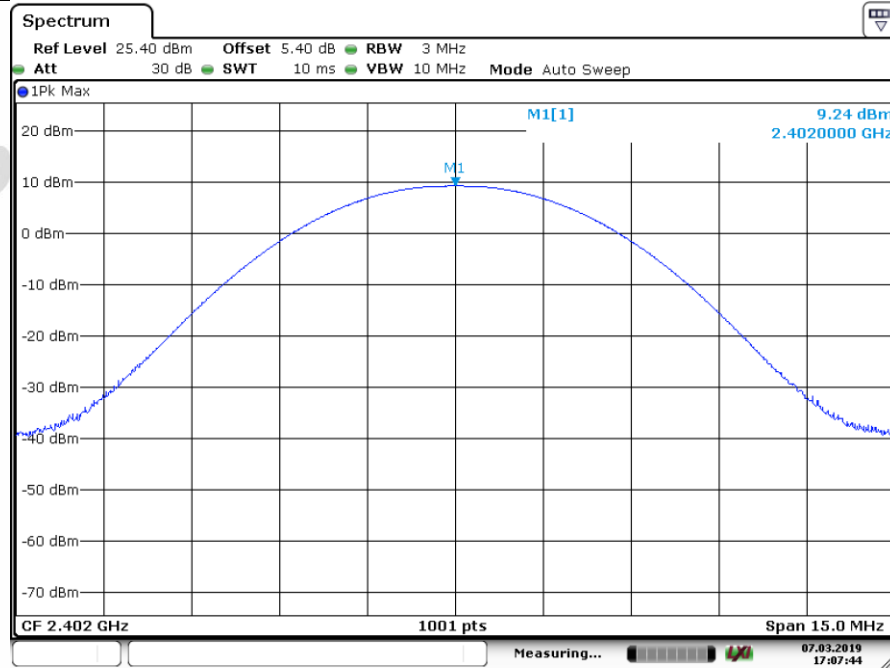
4.1. Test Results

Measurement Data of Peak power:

GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	9.24	20.97	Pass
Middle	9.70	20.97	Pass
Highest	8.09	20.97	Pass
$\pi/4$ DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	8.49	20.97	Pass
Middle	9.04	20.97	Pass
Highest	7.37	20.97	Pass
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	8.66	20.97	Pass
Middle	9.19	20.97	Pass
Highest	7.53	20.97	Pass

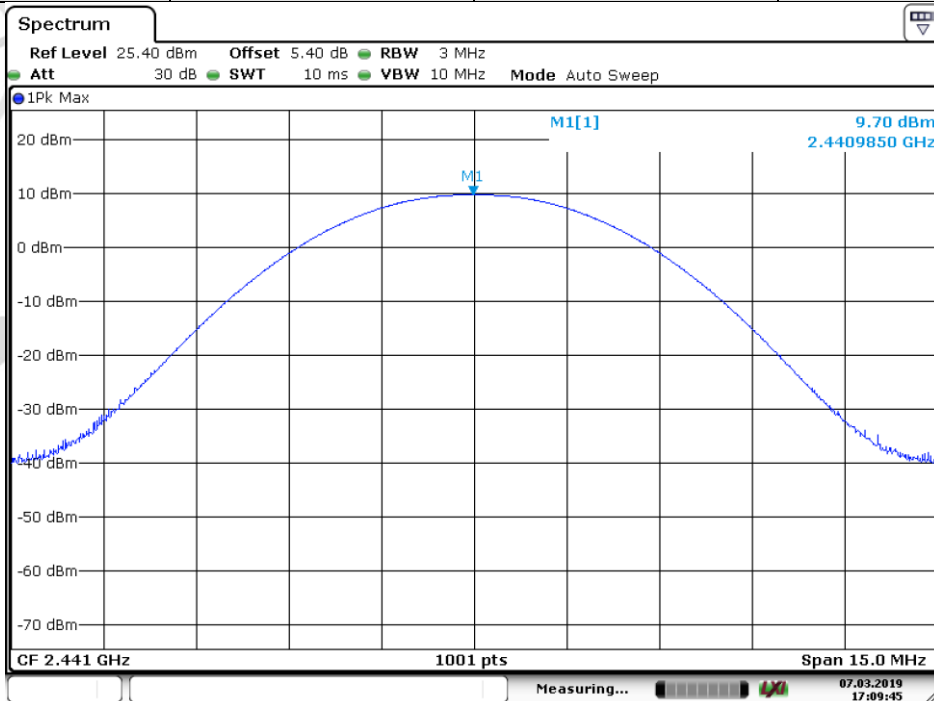
4.2. Test plots

Test mode:	GFSK	Test channel:	Lowest
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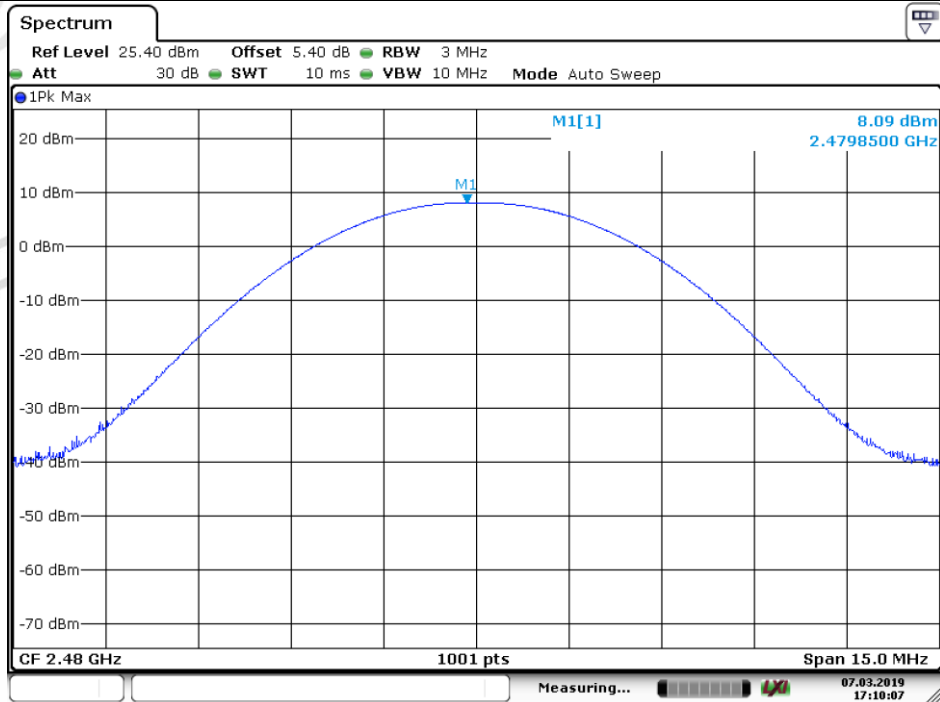
Date: 7.MAR.2019 17:07:45

Test mode:	GFSK	Test channel:	Middle
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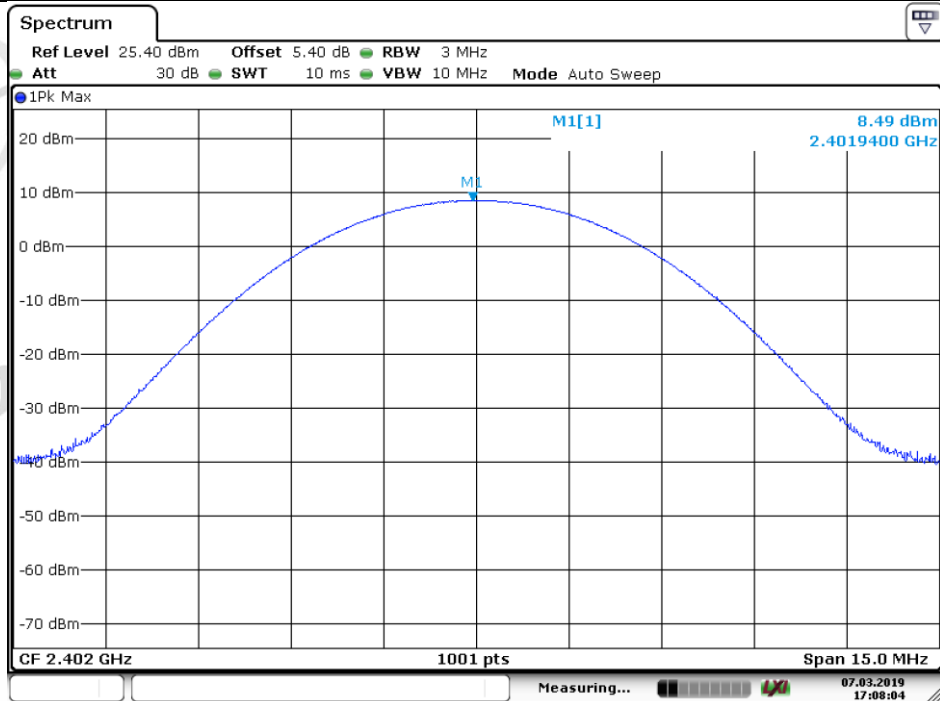
Date: 7.MAR.2019 17:09:46

Test mode:	GFSK	Test channel:	Highest
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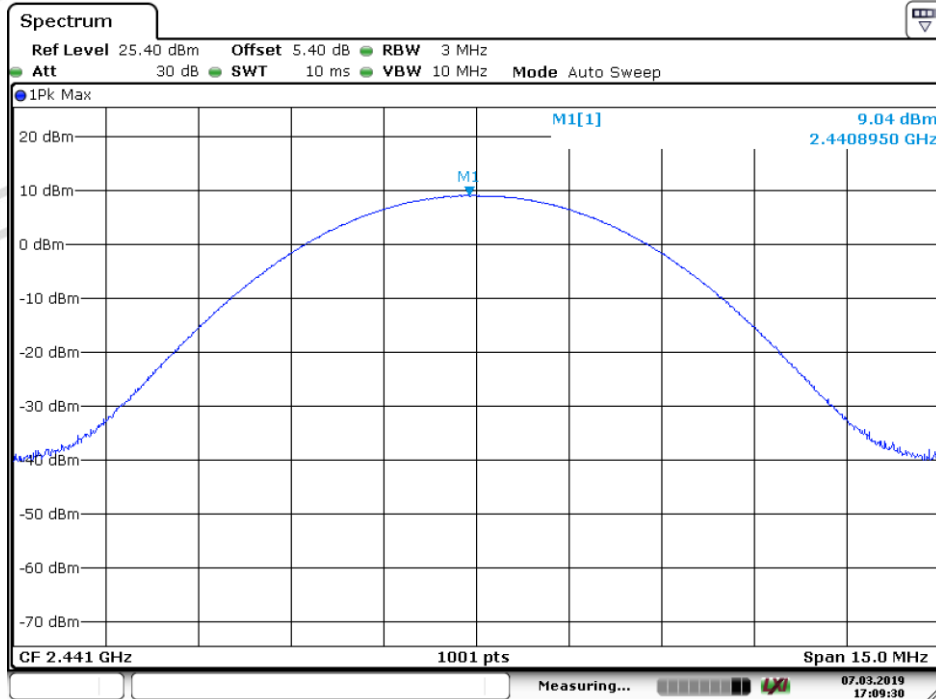
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Test mode:	$\pi/4$ DQPSK	Test channel:	Lowest
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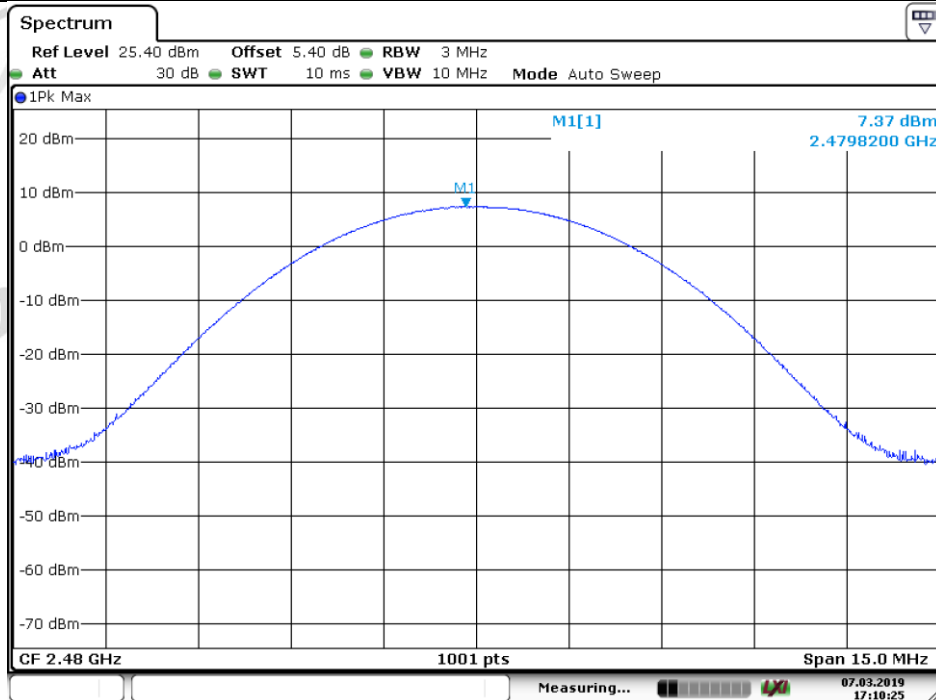
Date: 7.MAR.2019 17:08:04

Test mode:	$\pi/4$ DQPSK	Test channel:	Middle
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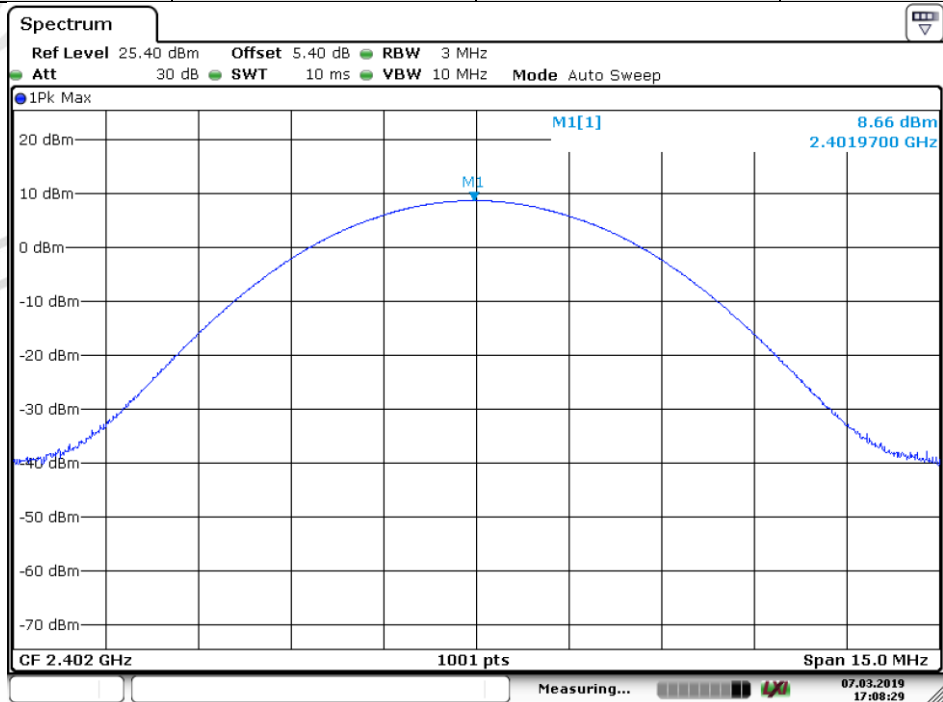
Date: 7.MAR.2019 17:09:30

Test mode:	$\pi/4$ DQPSK	Test channel:	Highest
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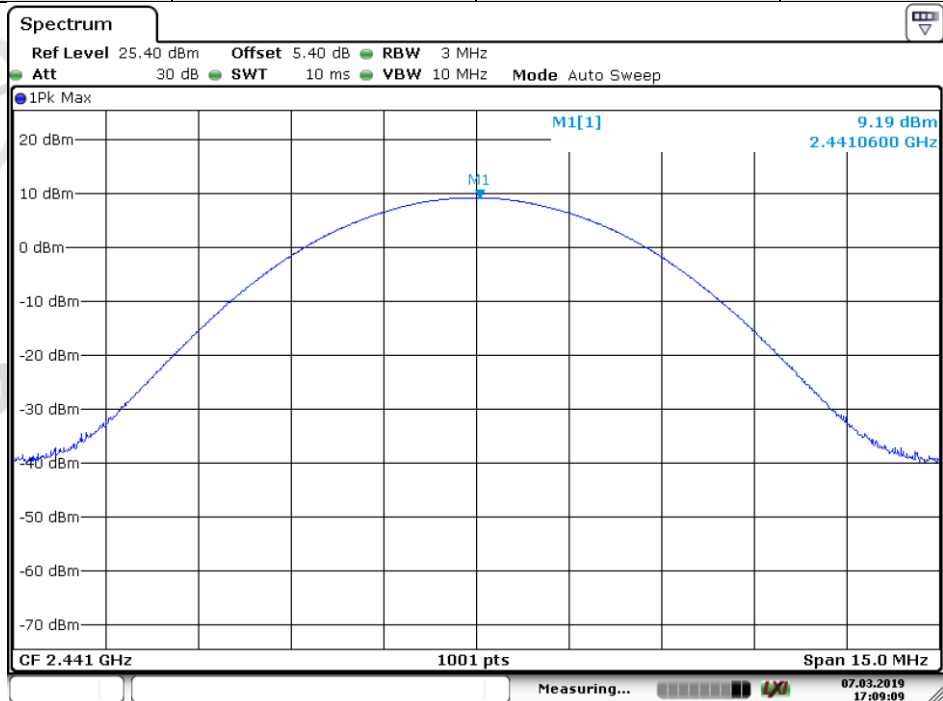
Date: 7.MAR.2019 17:10:26

Test mode:	8DPSK	Test channel:	Lowest
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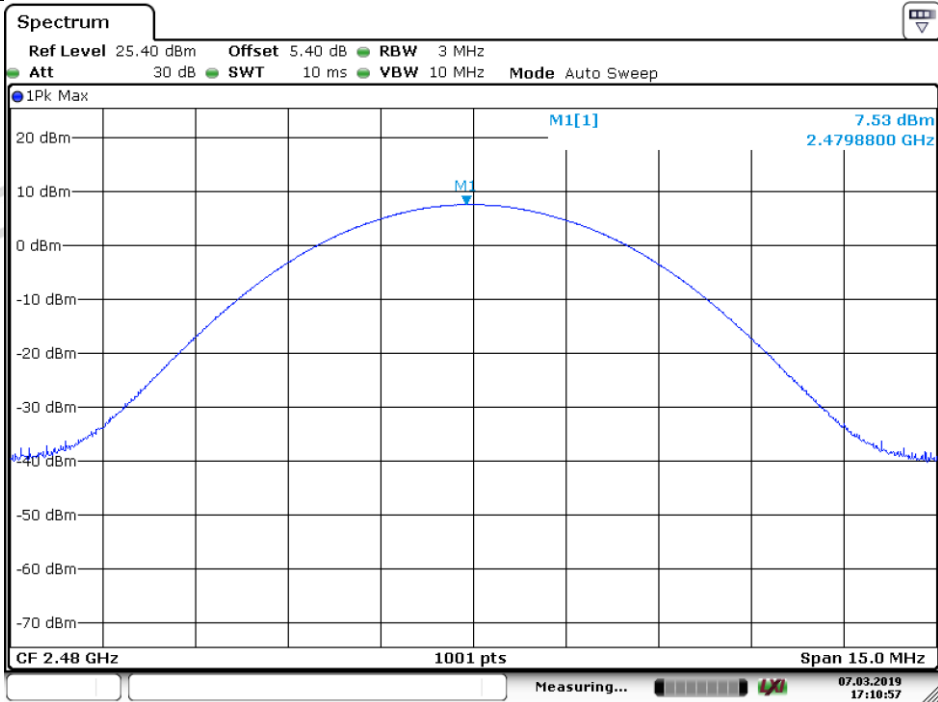
Date: 7.MAR.2019 17:08:30

Test mode:	8DPSK	Test channel:	Middle
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Date: 7.MAR.2019 17:09:09

Test mode:	8DPSK	Test channel:	Highest
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Date: 7.MAR.2019 17:10:57

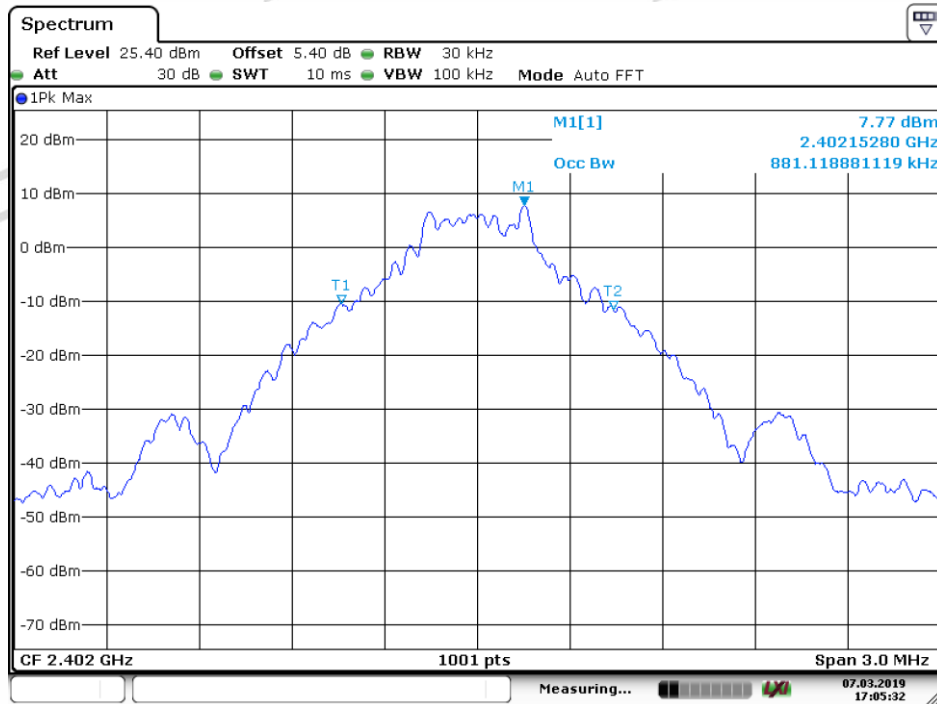
5. 20dB Emission Bandwidth & 99% Occupied Bandwidth

5.1. Test Results

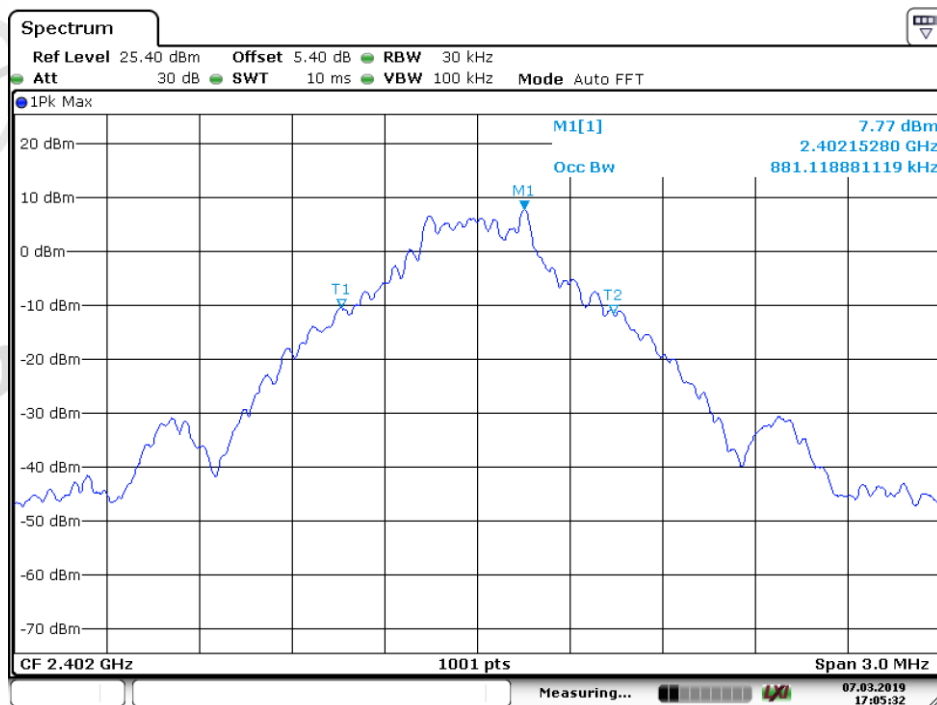
Mode	Test Channel	99% Occupied Bandwidth (KHz)	20dB Emission Bandwidth (KHz)	Result
GFSK	Lowest	881.1	965.0	Pass
	Middle	905.1	962.0	Pass
	Highest	881.1	941.1	Pass
$\pi/4$ DQPSK	Lowest	1171.8	1294.7	Pass
	Middle	1171.8	1279.7	Pass
	Highest	1168.8	1279.7	Pass
8DPSK	Lowest	1171.8	1294.7	Pass
	Middle	1162.8	1294.7	Pass
	Highest	1162.8	1294.7	Pass

5.2. Test plots

GFSK _Lowest Channel

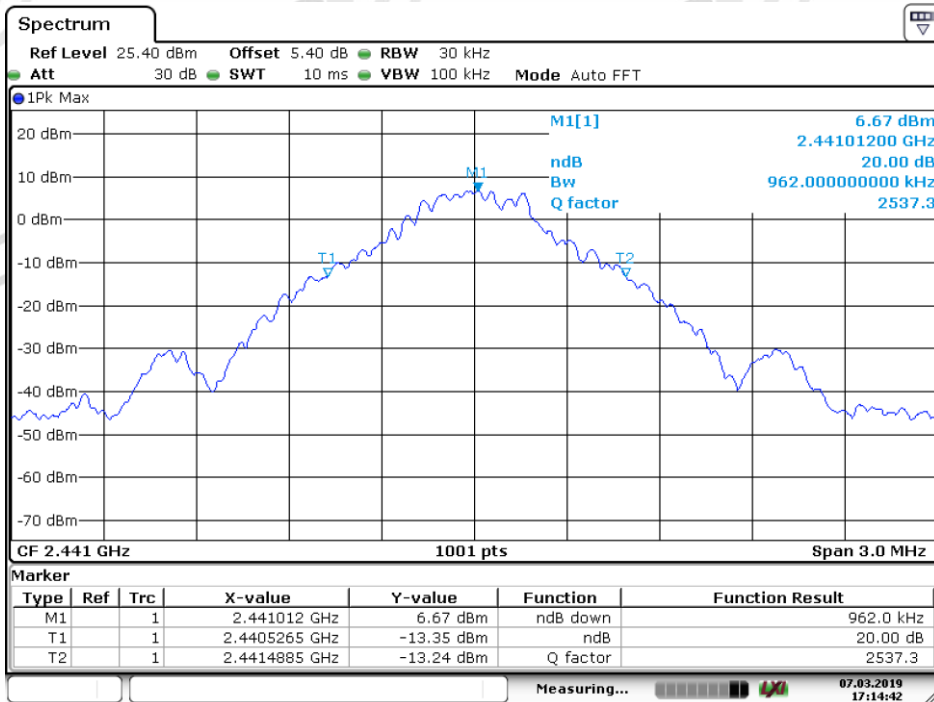


Date: 7.MAR.2019 17:05:33

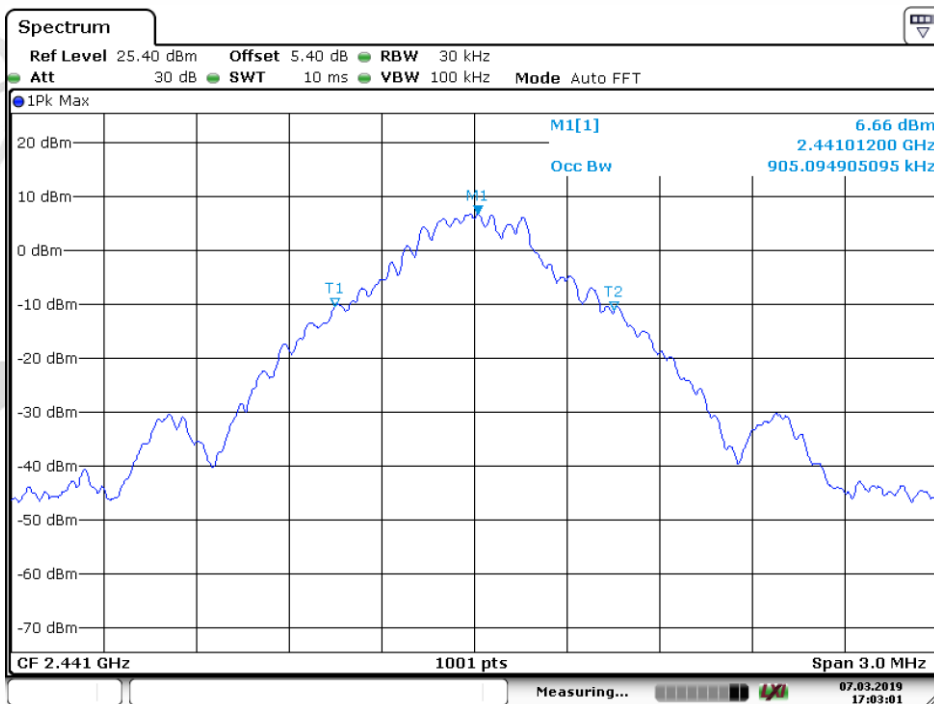


Date: 7.MAR.2019 17:05:33

GFSK_Middle Channel

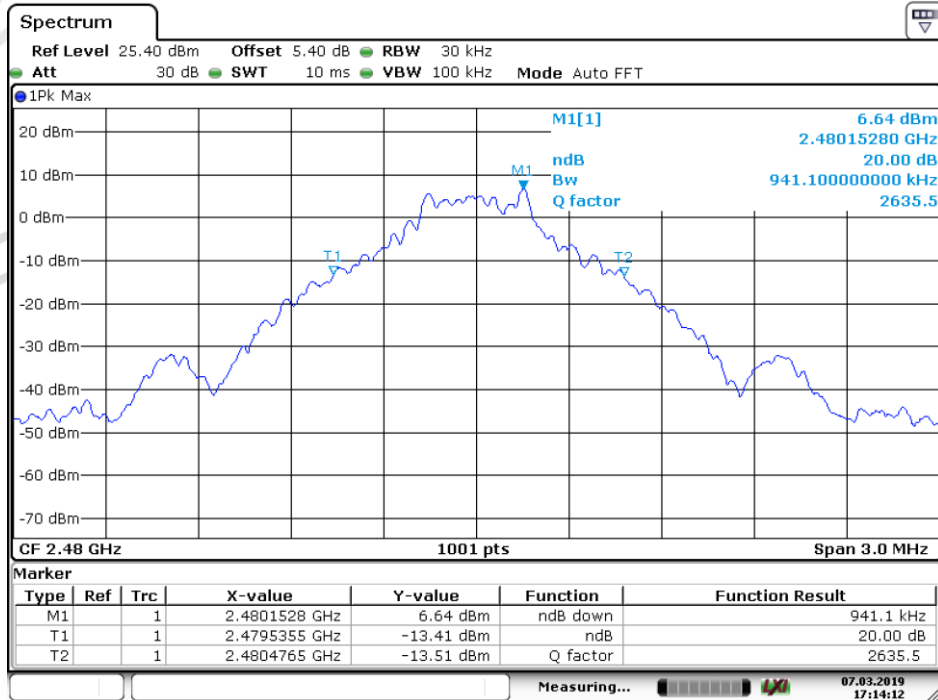


Date: 7.MAR.2019 17:14:42

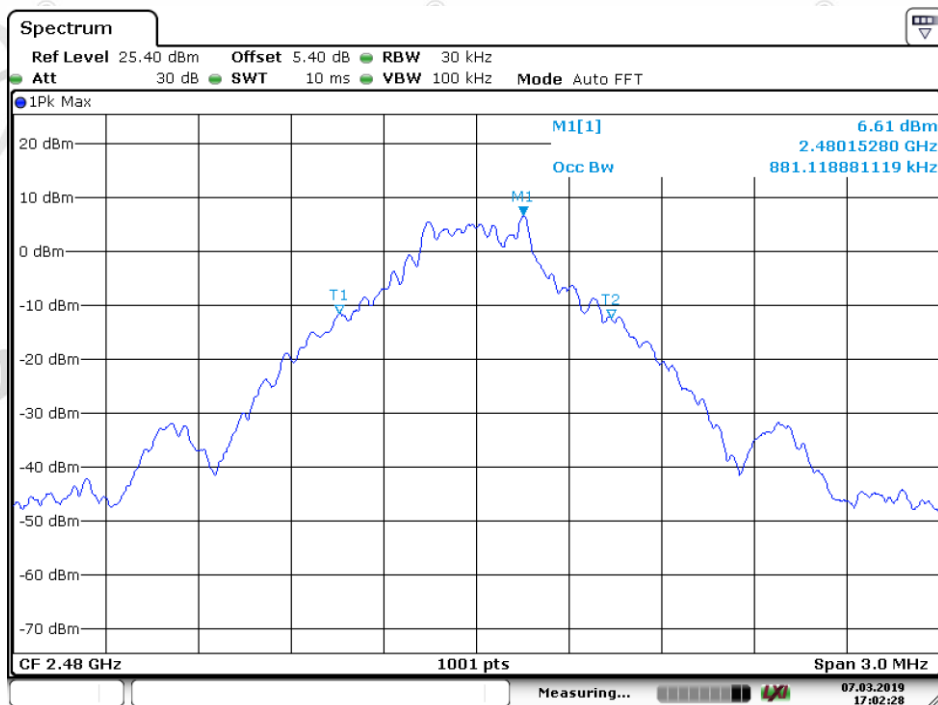


Date: 7.MAR.2019 17:03:01

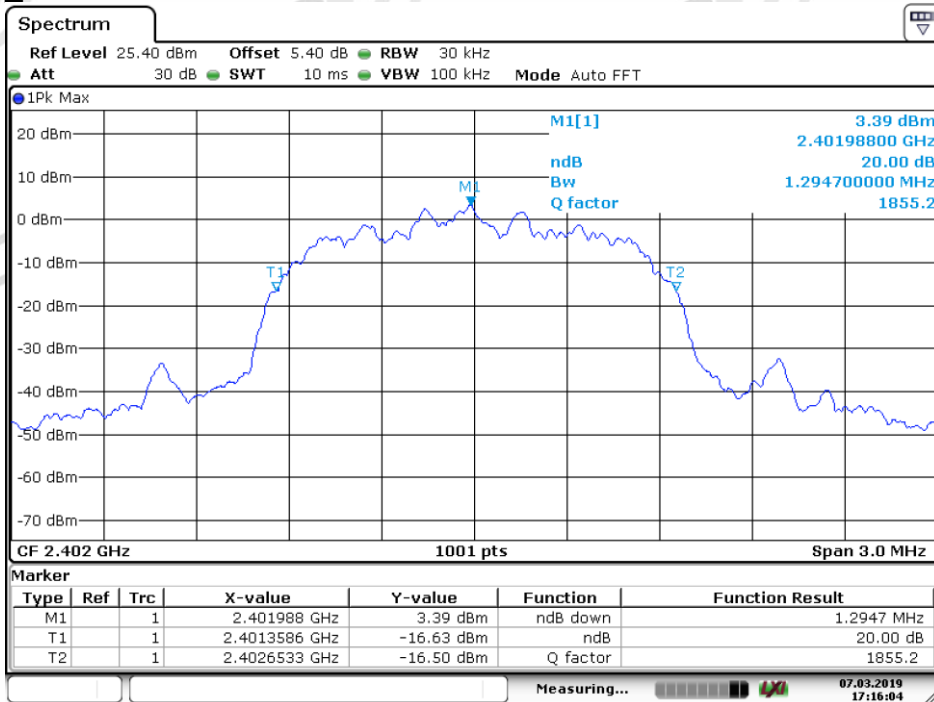
GFSK_Highest Channel



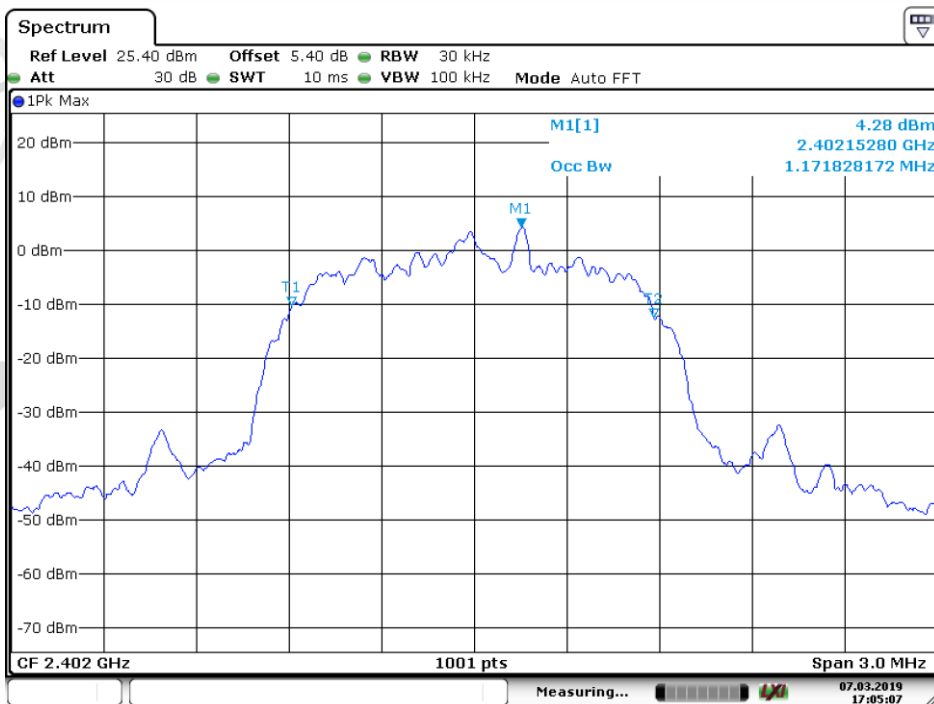
Date: 7.MAR.2019 17:14:12



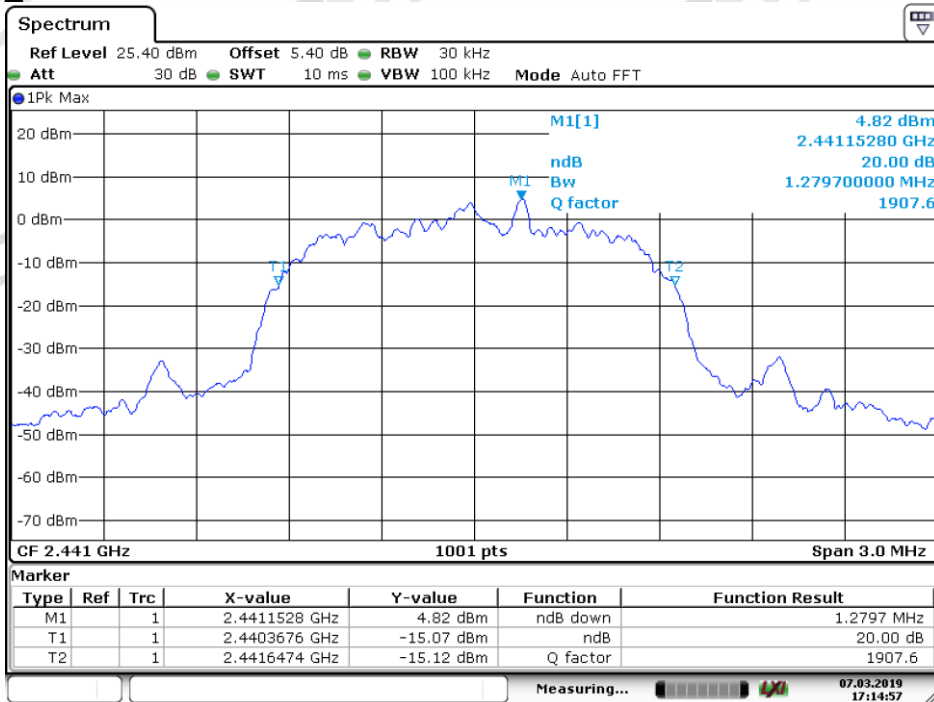
Date: 7.MAR.2019 17:02:28

$\pi/4$ DQPSK Lowest Channel

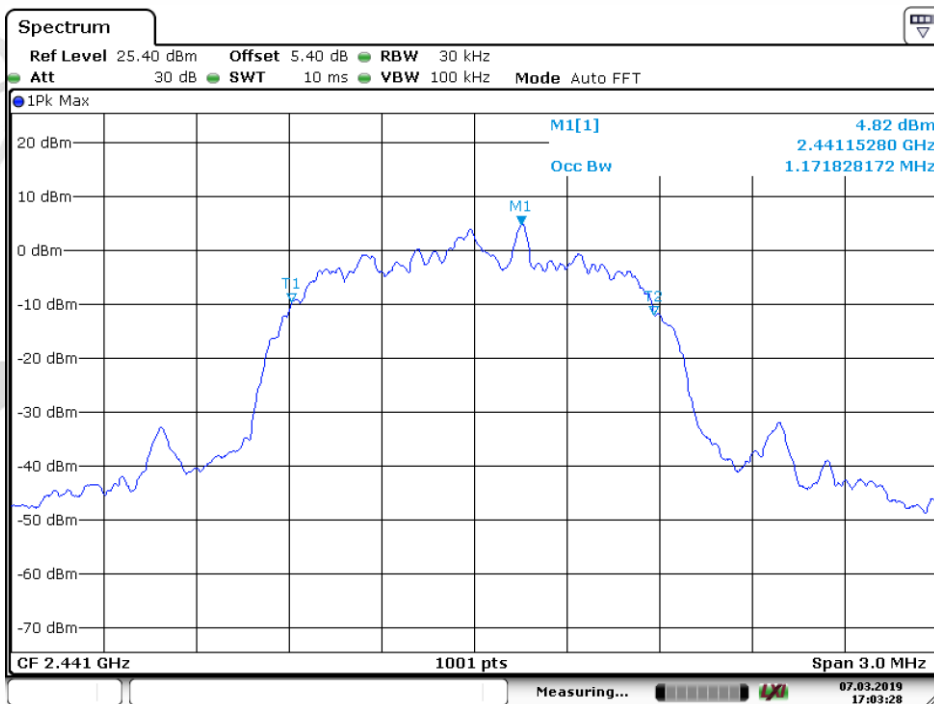
Date: 7.MAR.2019 17:16:04



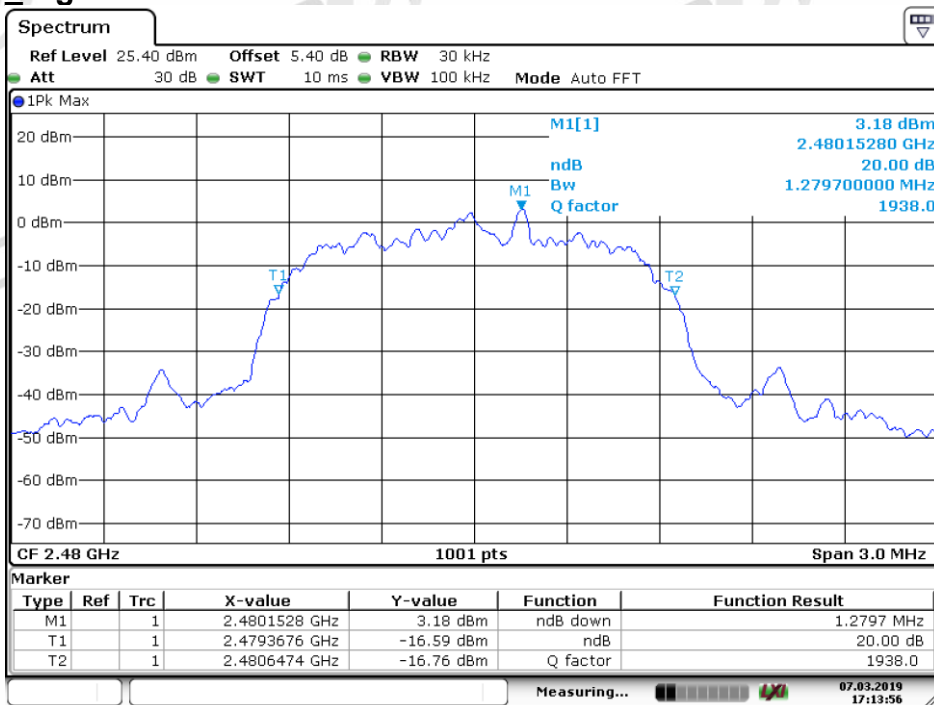
Date: 7.MAR.2019 17:05:07

$\pi/4$ DQPSK Middle Channel

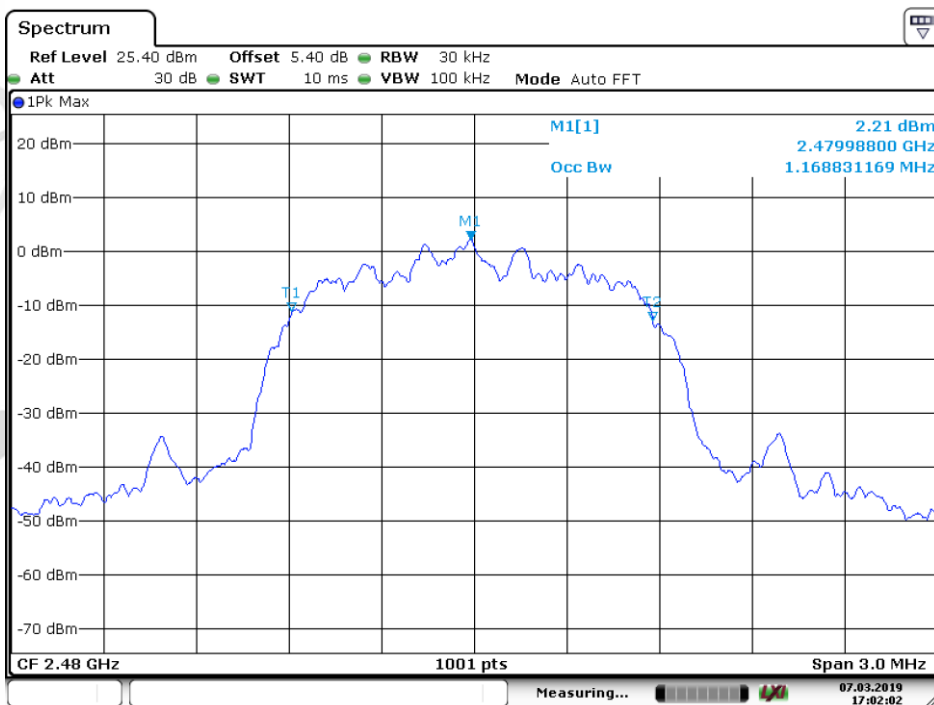
Date: 7.MAR.2019 17:14:57



Date: 7.MAR.2019 17:03:28

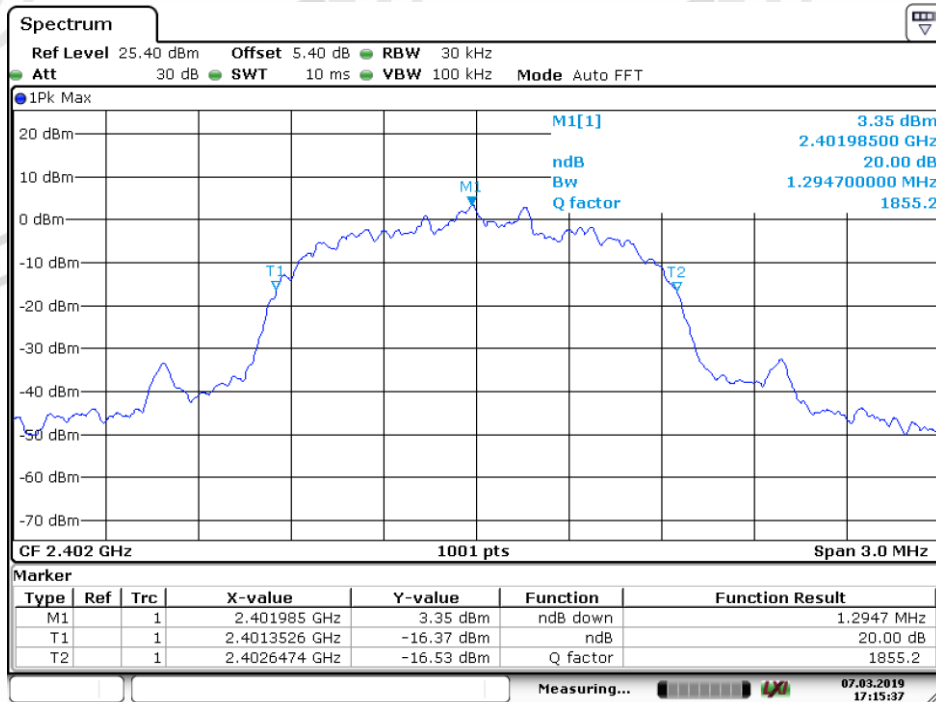
$\pi/4$ DQPSK_Highest Channel

Date: 7.MAR.2019 17:13:57

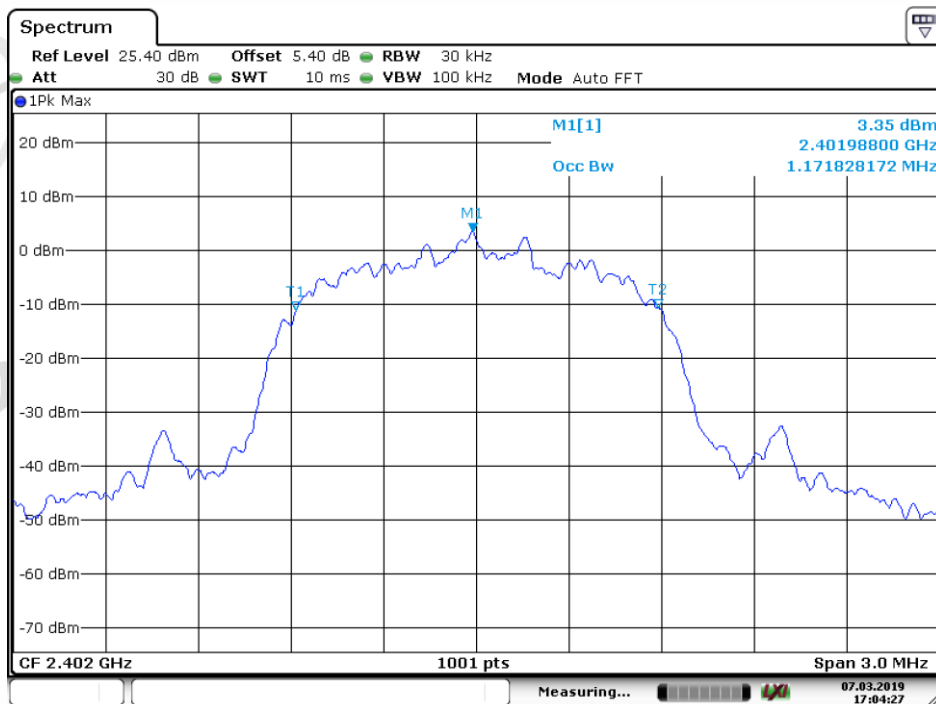


Date: 7.MAR.2019 17:02:03

8DPSK_Lowest Channel

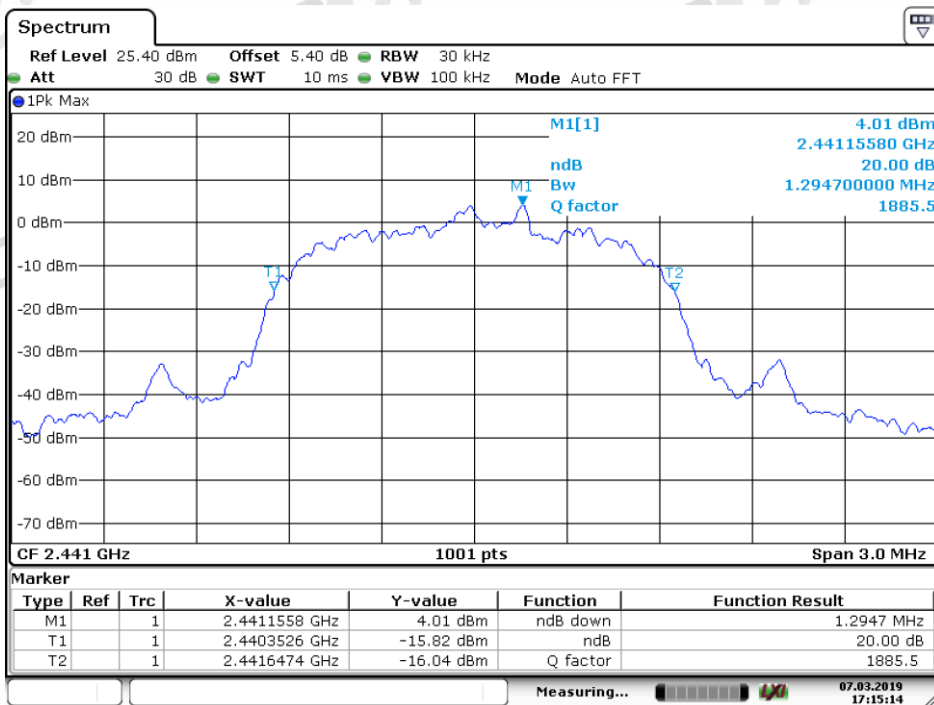


Date: 7.MAR.2019 17:15:37

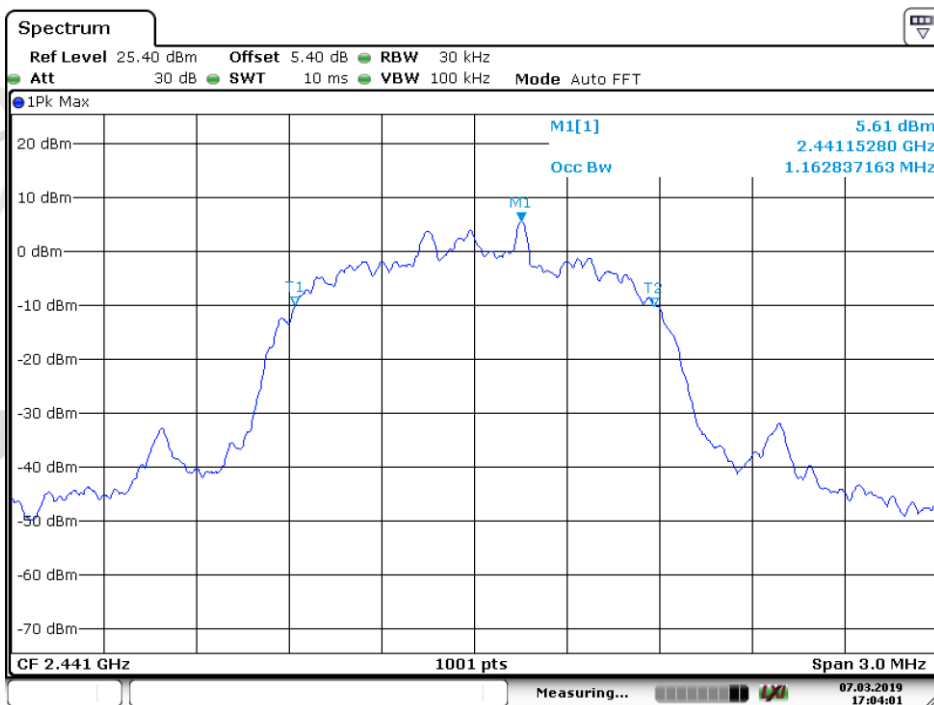


Date: 7.MAR.2019 17:04:27

8DPSK_Middle Channel

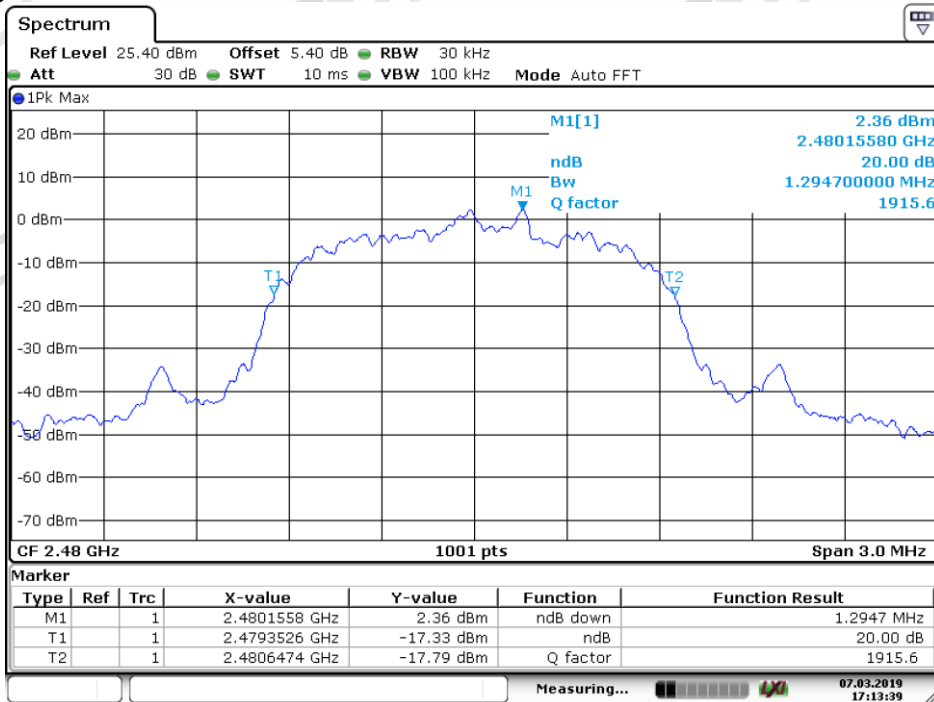


Date: 7.MAR.2019 17:15:15

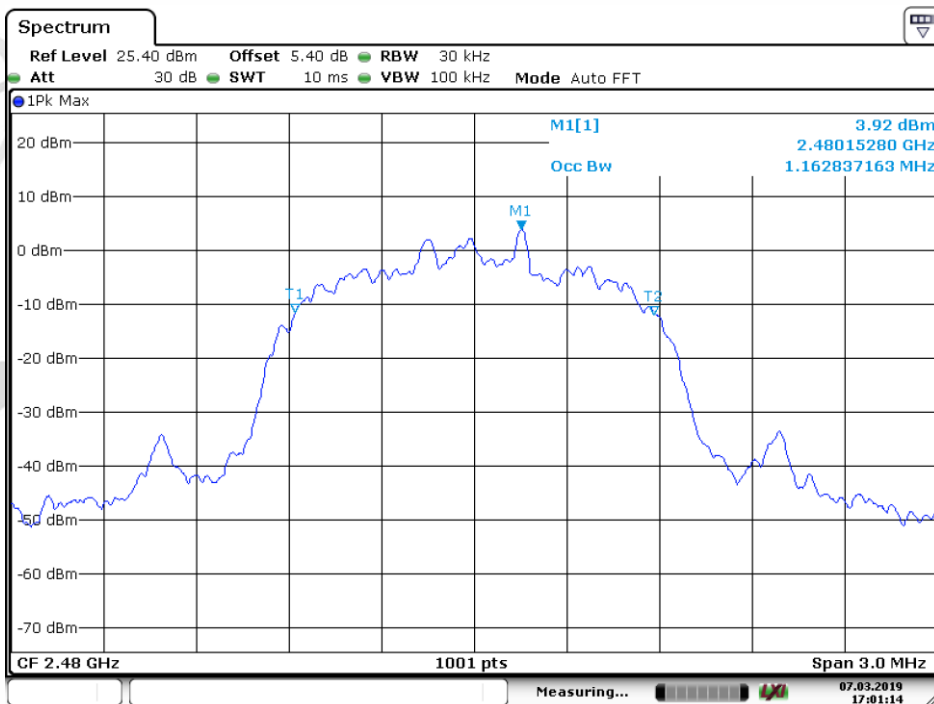


Date: 7.MAR.2019 17:04:01

8DPSK_Highest Channel



Date: 7.MAR.2019 17:13:40



Date: 7.MAR.2019 17:01:14

6. Carrier Frequencies Separation

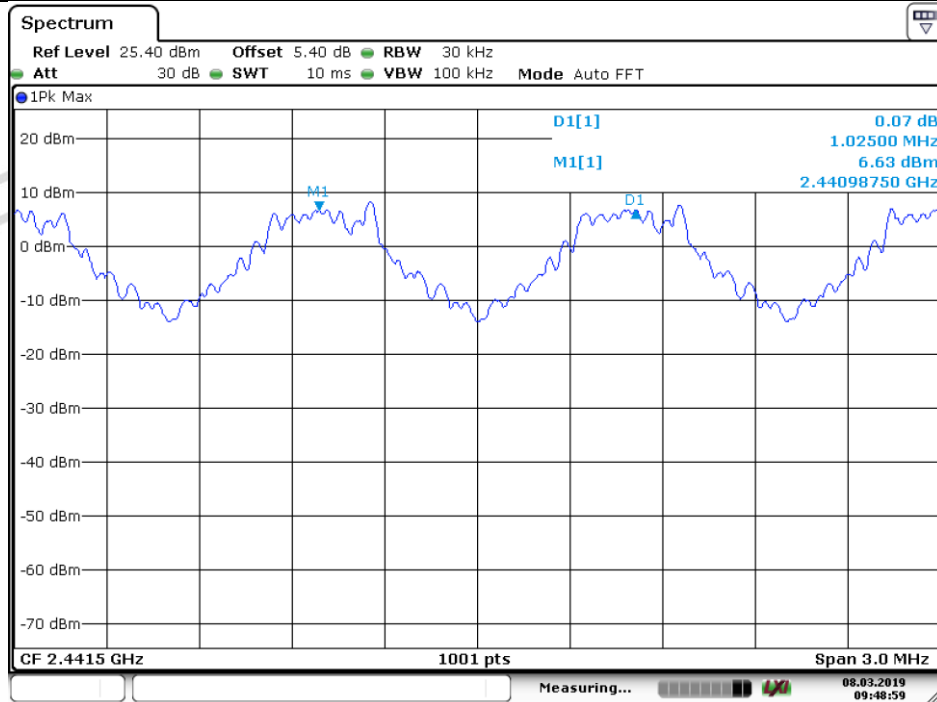
6.1. Test Results

GFSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	1025	643.3	Pass
$\pi/4$ DQPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	686	863.1	Pass
8DPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	998	863.1	Pass

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	965.0	643.3
$\pi/4$ DQPSK	1294.7	863.1
8DPSK	1294.7	863.1

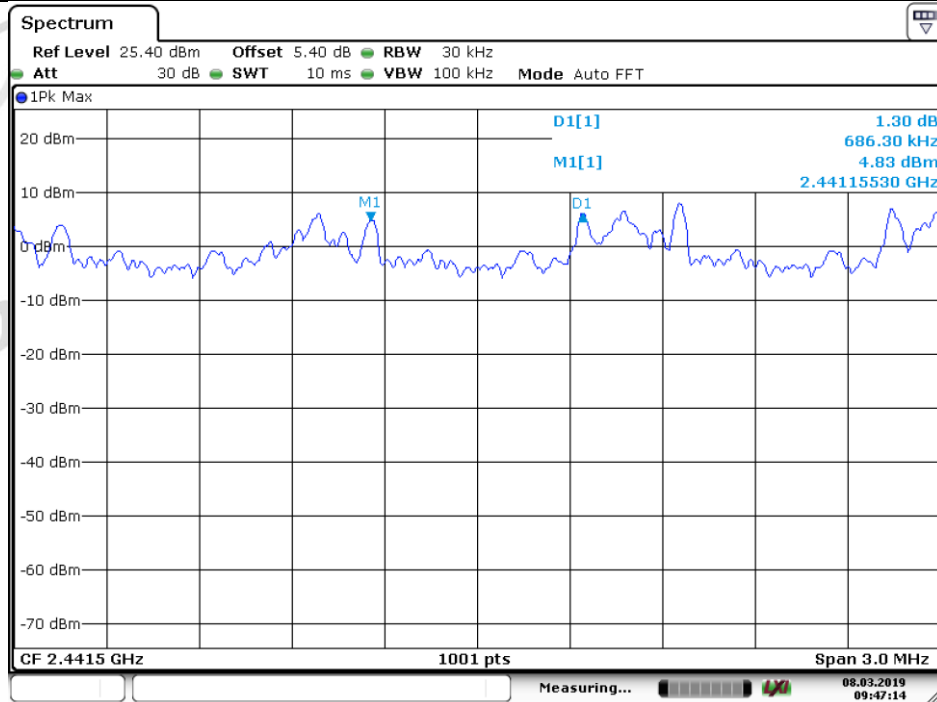
6.2. Test plots:

Test mode:	GFSK	Test channel:	Middle
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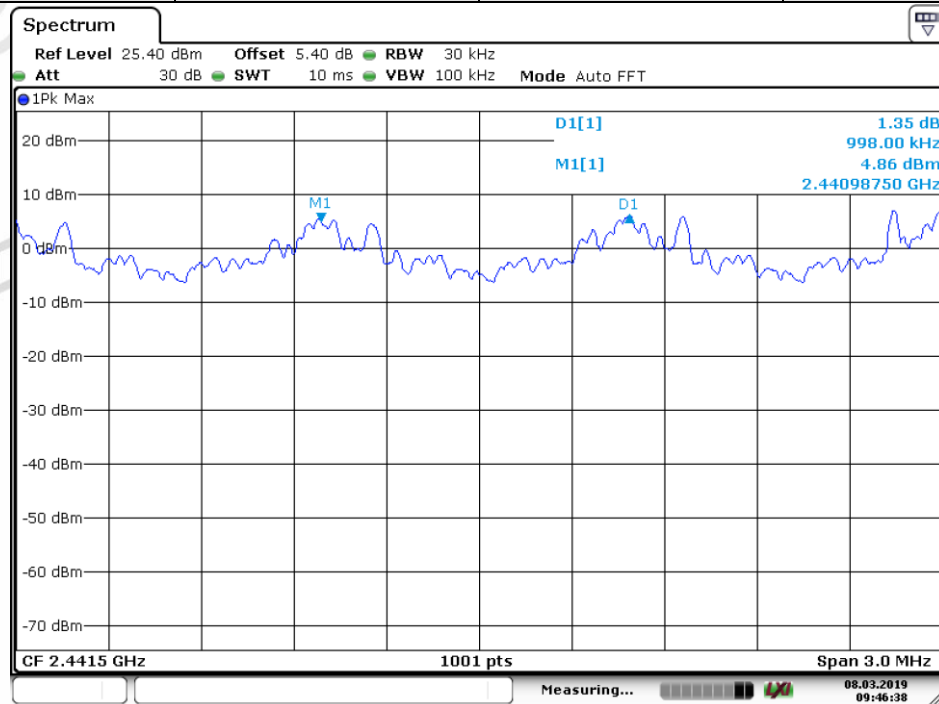
Date: 8.MAR.2019 09:49:00

Test mode:	$\pi/4$ DQPSK	Test channel:	Middle
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Date: 8.MAR.2019 09:47:14

Test mode:	8DPSK	Test channel:	Middle
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Date: 8.MAR.2019 09:46:38

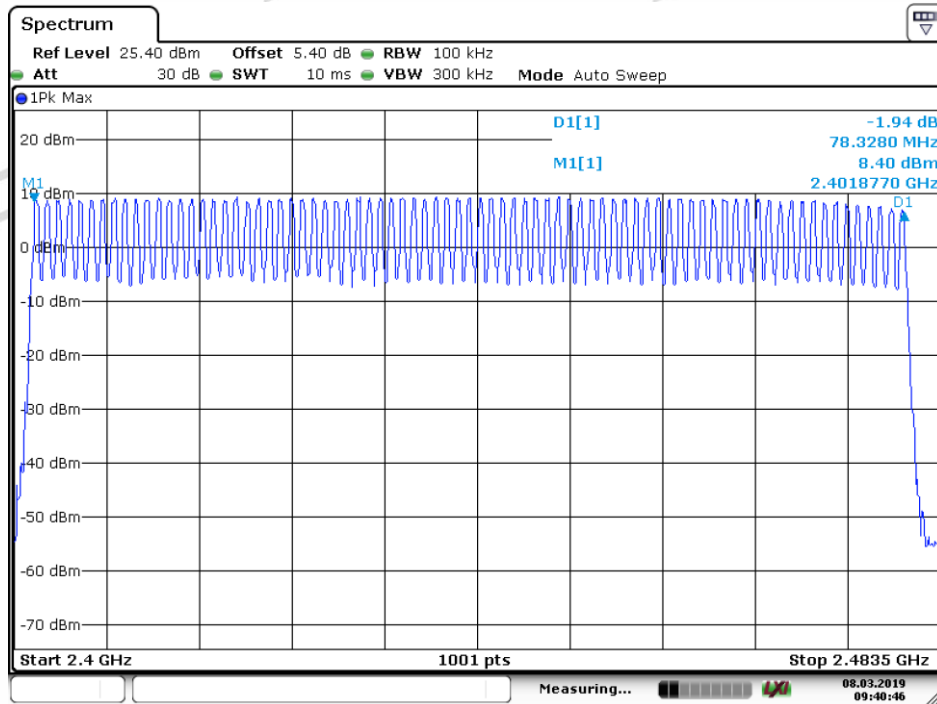
7. Hopping Channel Number

7.1. Test Results

Mode	Hopping channel numbers	Limit
GFSK	79	≥ 15
$\pi/4$ DQPSK	79	≥ 15
8DPSK	79	≥ 15

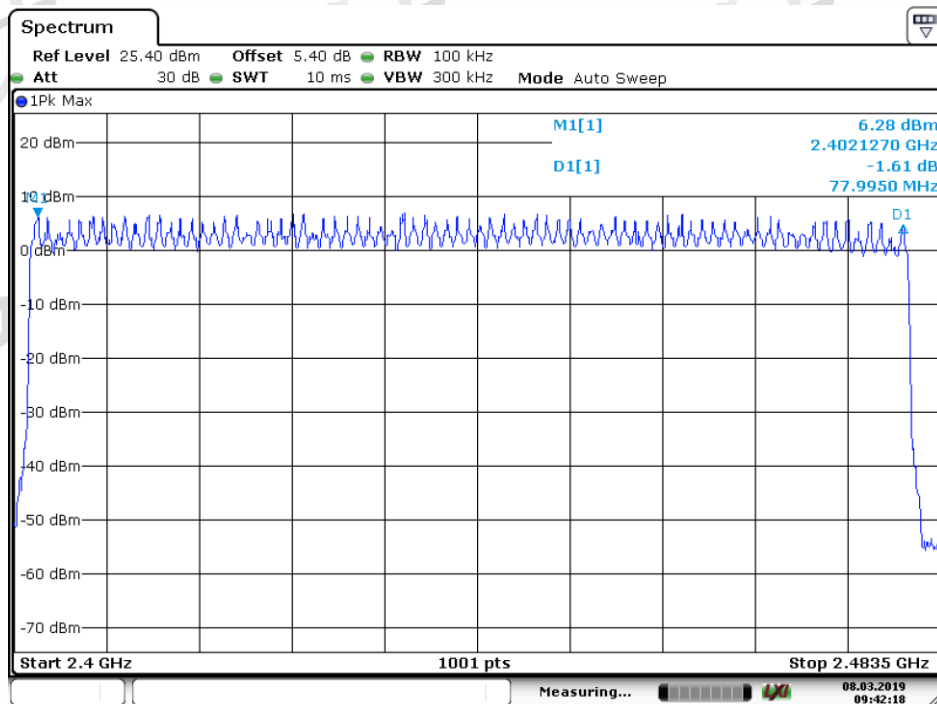
7.2. Test plots

GFSK



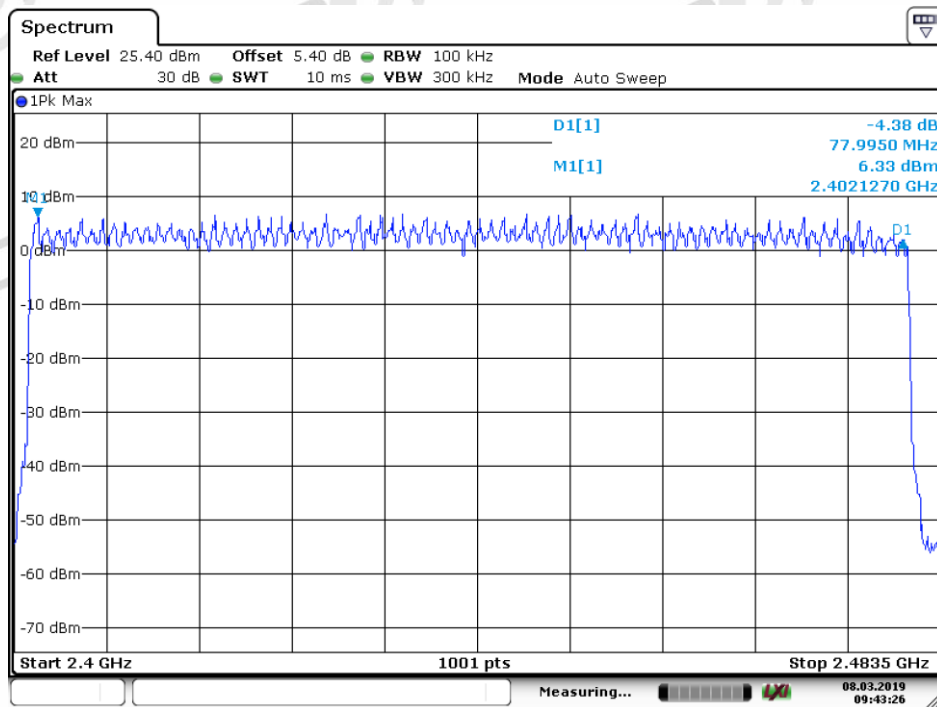
Date: 8.MAR.2019 09:40:46

$\pi/4$ DQPSK



Date: 8.MAR.2019 09:42:19

8DPSK



Date: 8.MAR.2019 09:43:26

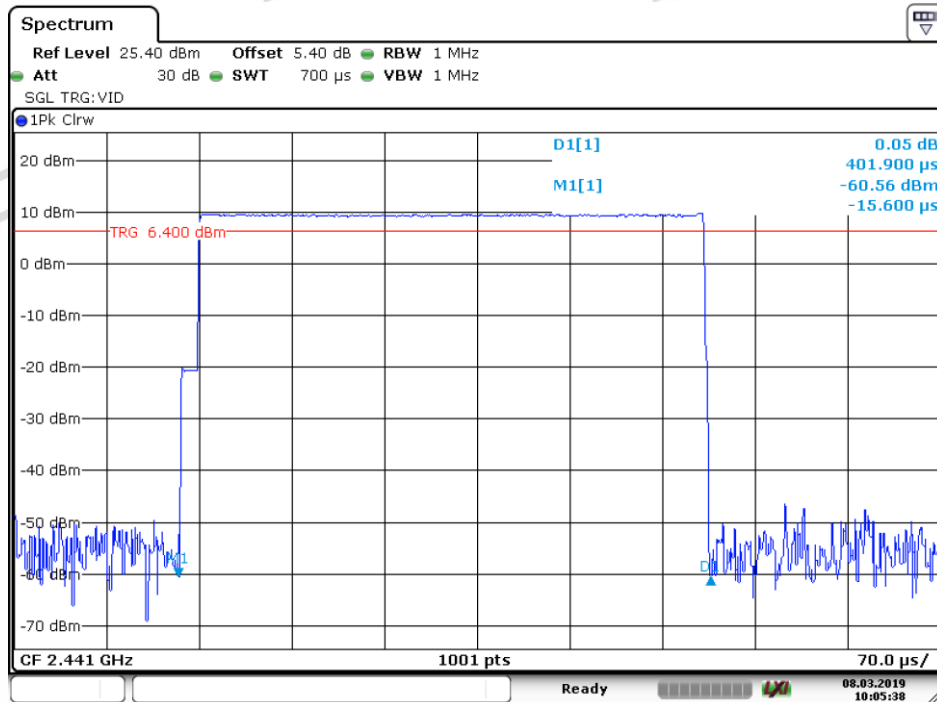
8. Dwell Time

8.1. Test Results

Operation Modes	On time (ms) on one channel
DH1	0.401
DH3	1.660
DH5	2.915
2-DH1	0.408
2-DH3	1.663
2-DH5	2.915
3-DH1	0.407
3-DH3	1.660
3-DH5	2.915

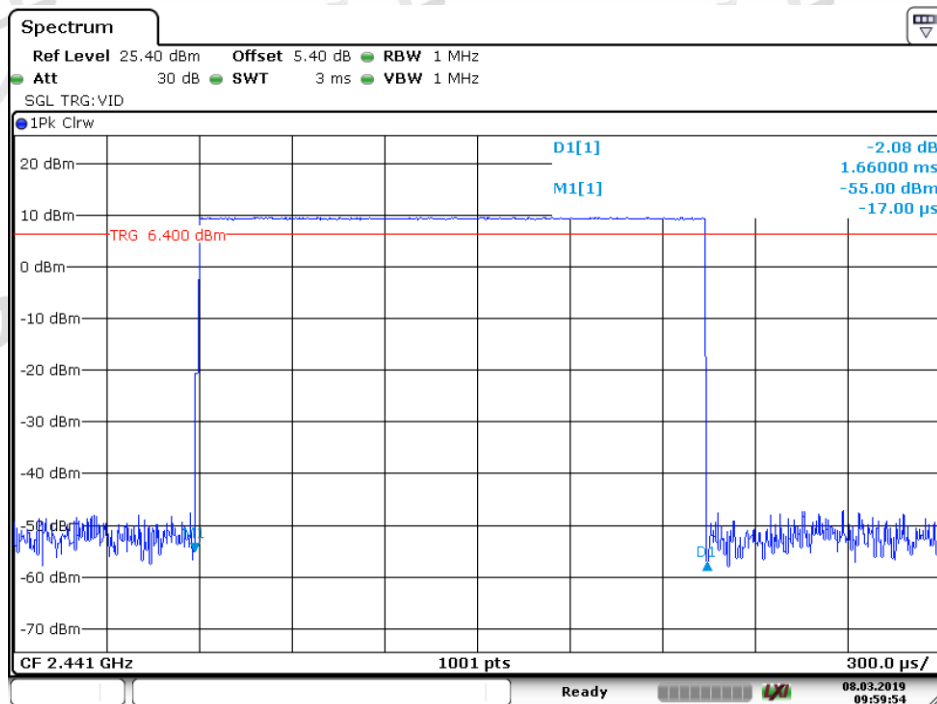
8.2. Test plots

DH1 _ Middle Channel



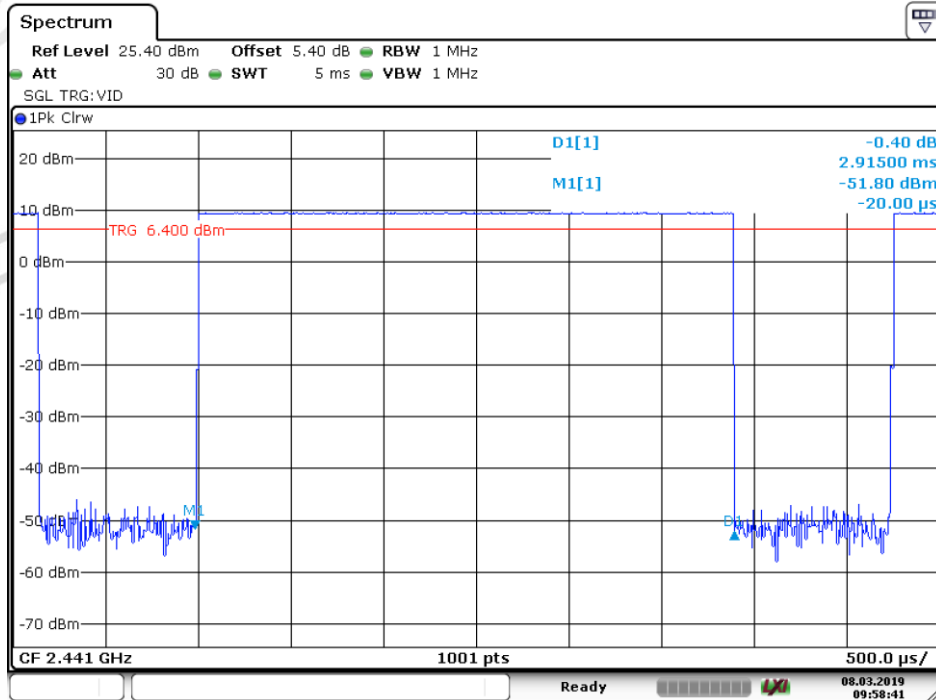
Date: 8.MAR.2019 10:05:38

DH3 _ Middle Channel



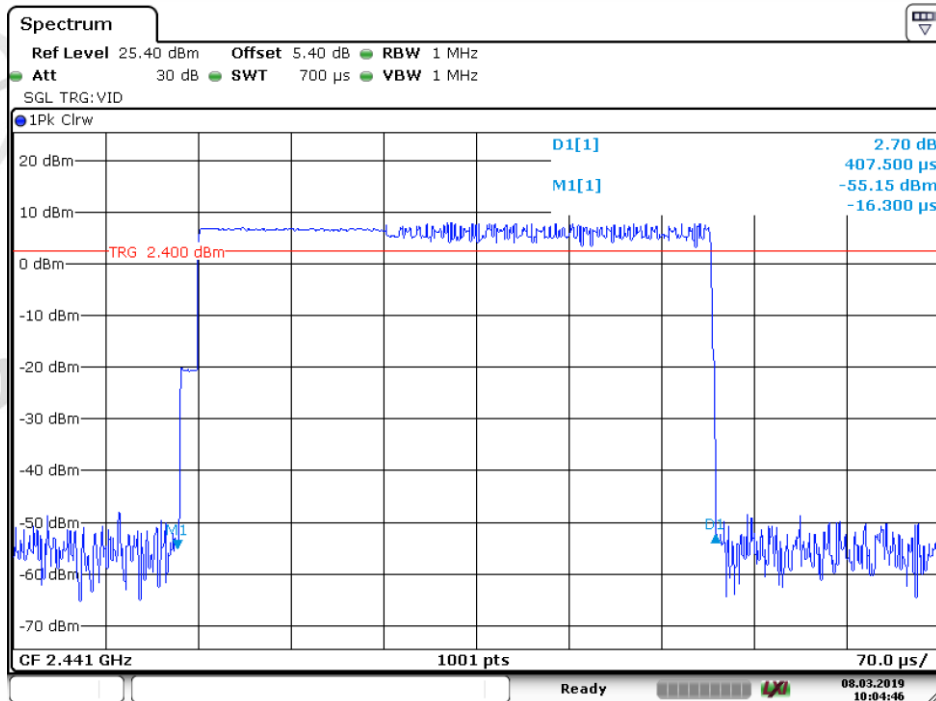
Date: 8.MAR.2019 09:59:54

DH5 _ Middle Channel



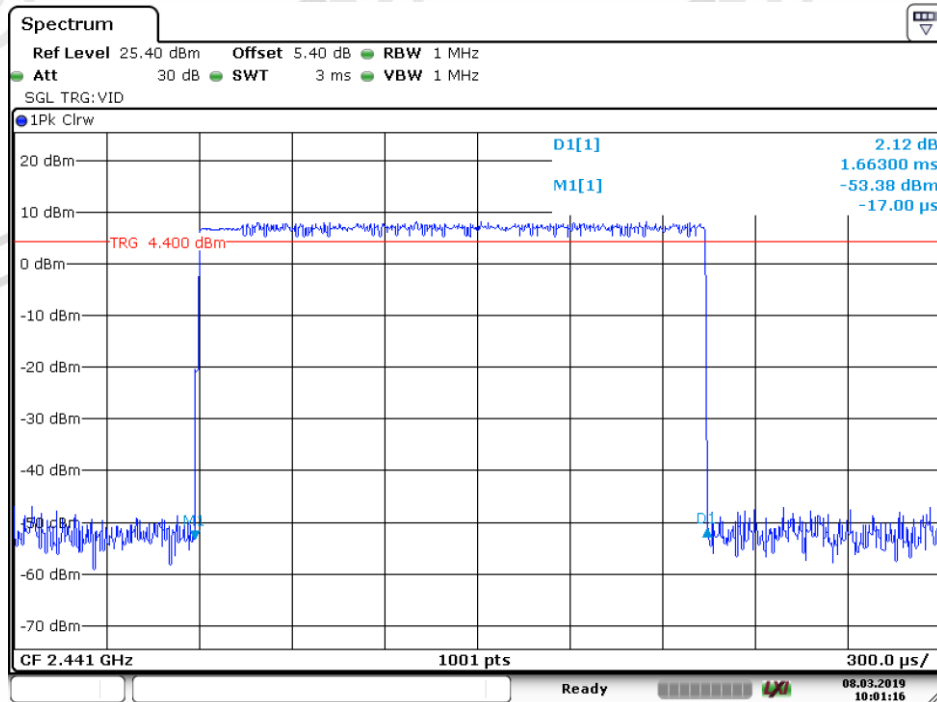
Date: 8.MAR.2019 09:58:41

2DH1 _ Middle Channel



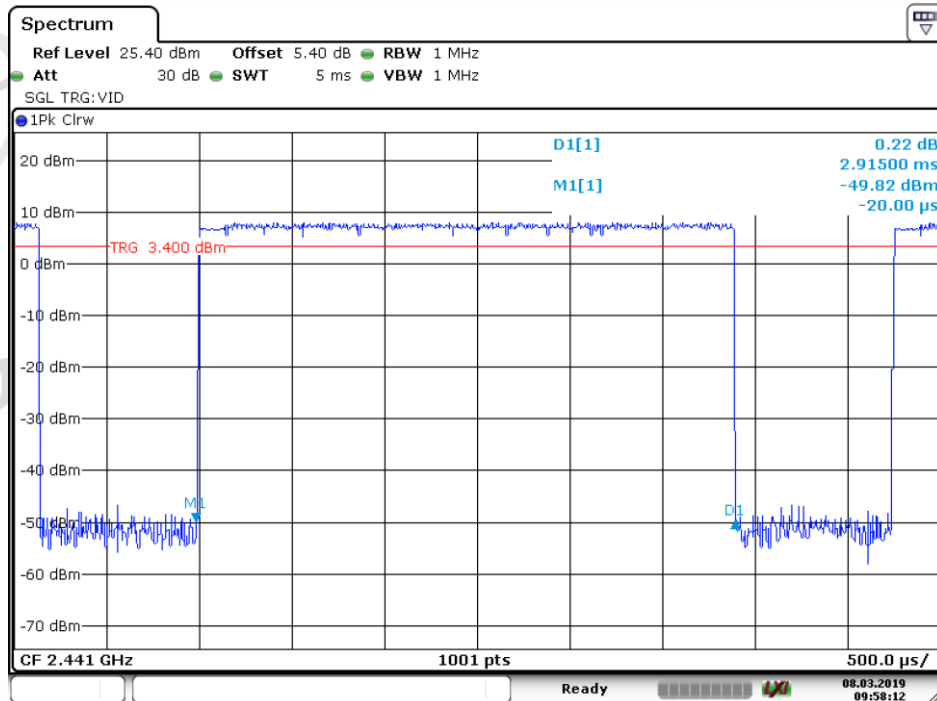
Date: 8.MAR.2019 10:04:47

2DH3 _ Middle Channel



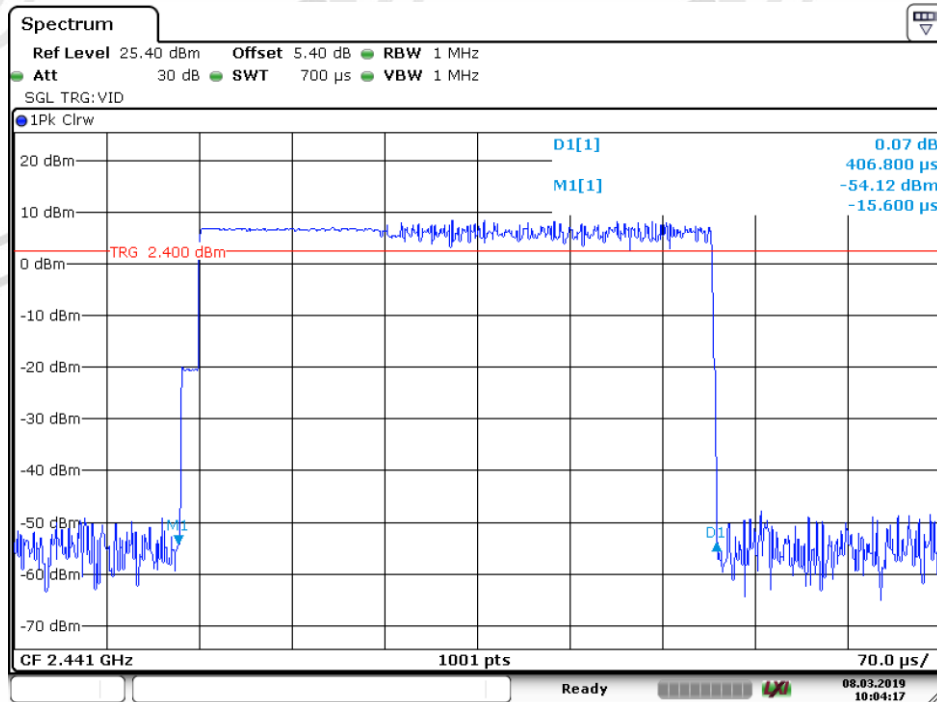
Date: 8.MAR.2019 10:01:17

2DH5 _ Middle Channel



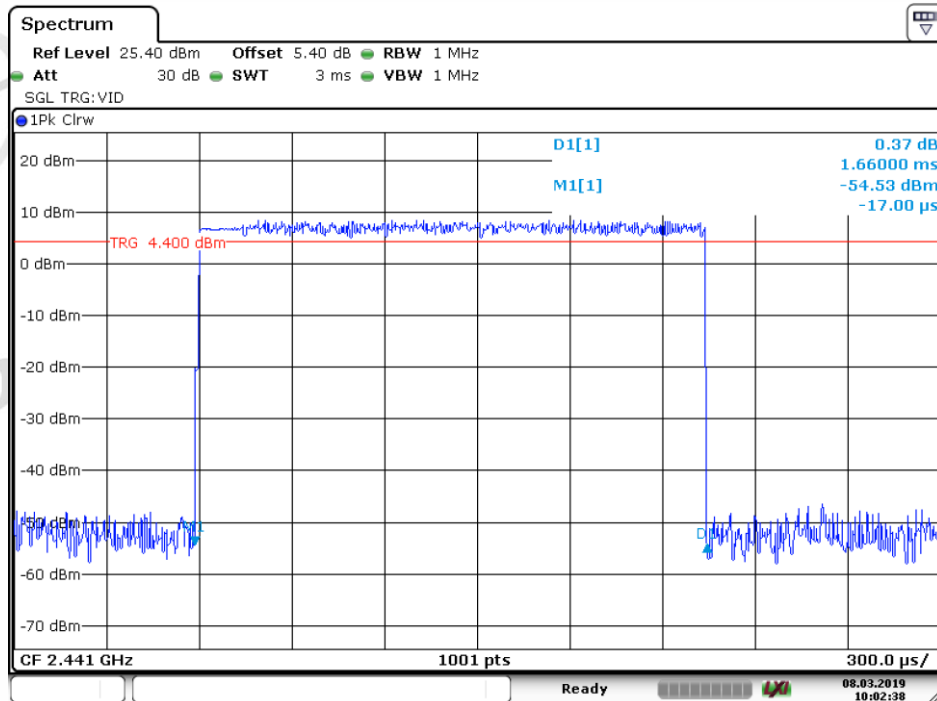
Date: 8.MAR.2019 09:58:12

3DH1 _ Middle Channel



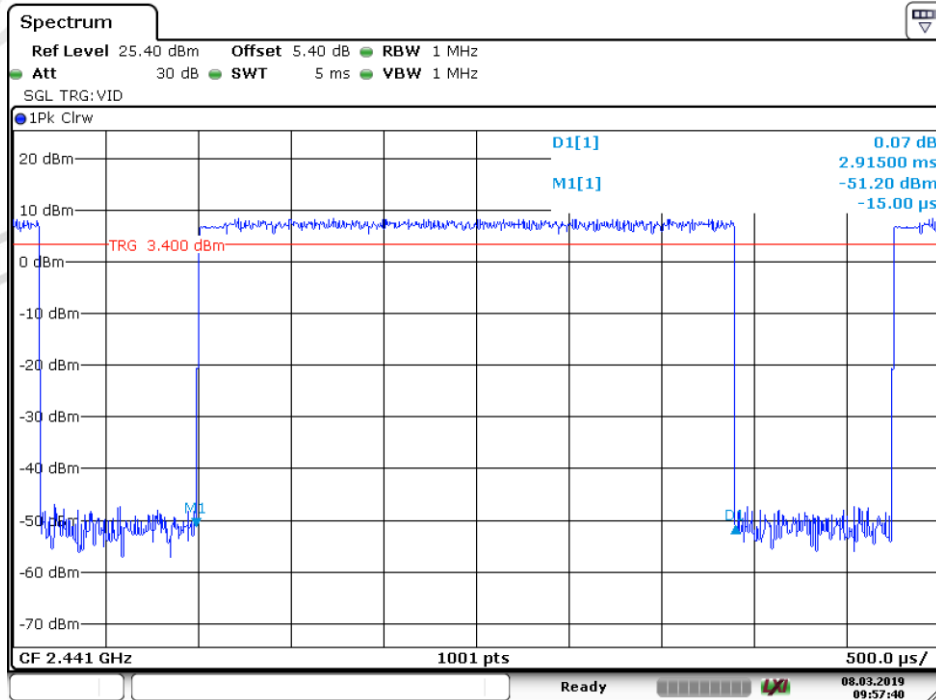
Date: 8.MAR.2019 10:04:17

3DH3 _ Middle Channel



Date: 8.MAR.2019 10:02:38

3DH5_Middle Channel

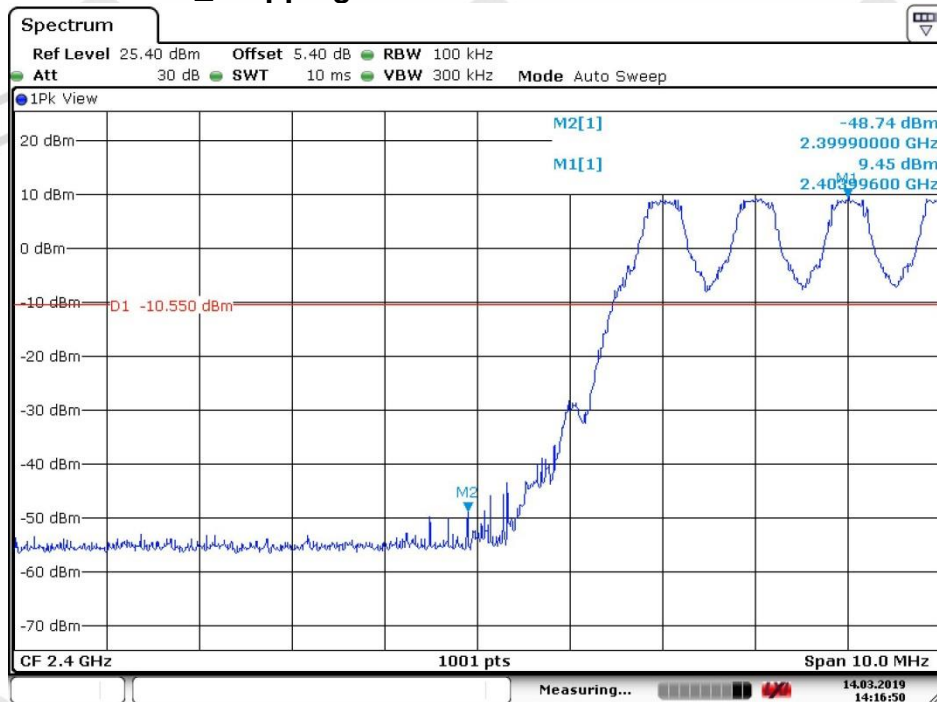


Date: 8. MAR. 2019 09:57:40

9. Band-edge for RF Conducted Emissions

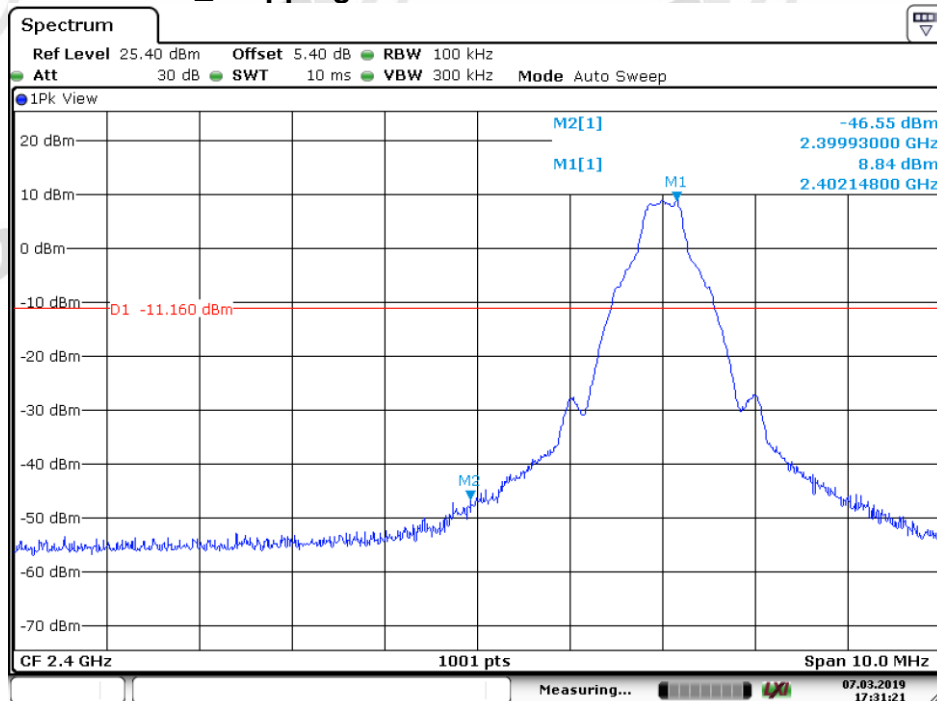
9.1. Test plots

GFSK _Lowest Channel_ Hopping ON



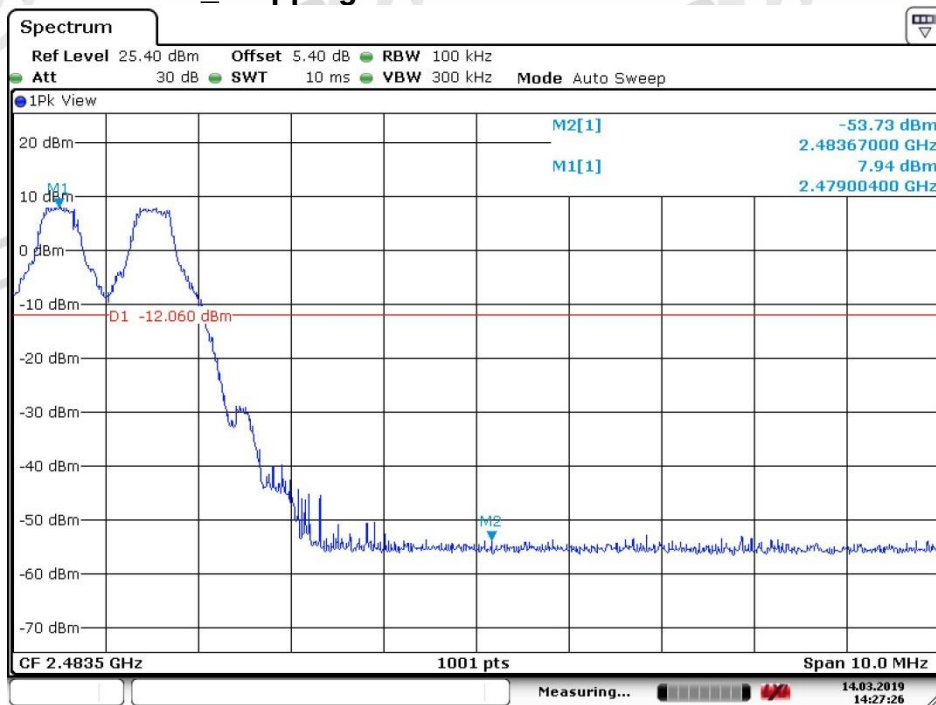
Date: 14.MAR.2019 14:16:50

GFSK _Lowest Channel_ Hopping OFF



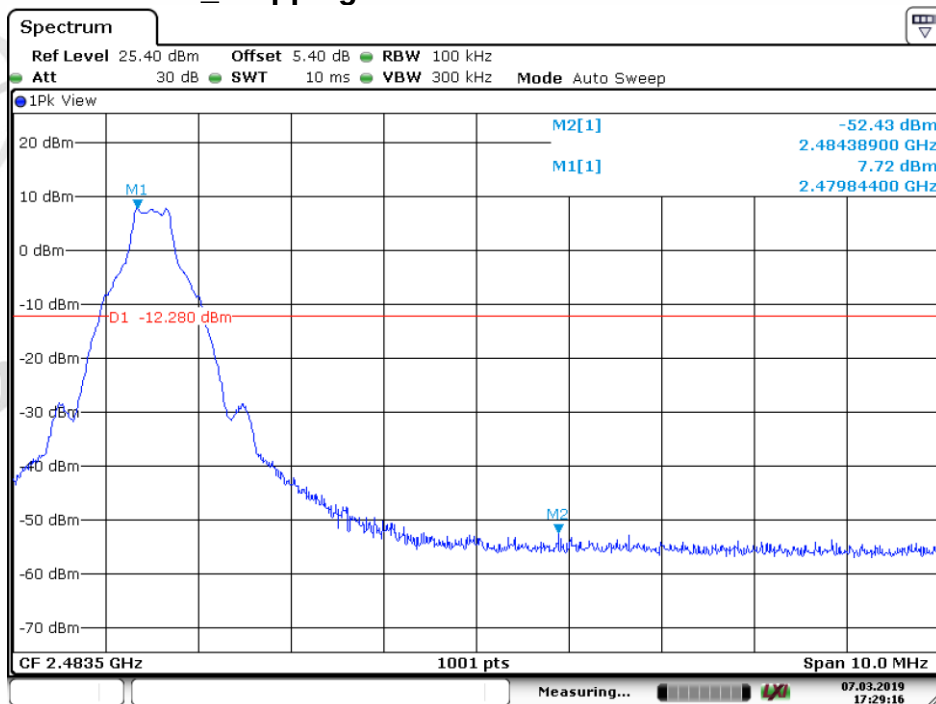
Date: 7.MAR.2019 17:31:21

GFSK_Highest Channel_Hopping ON

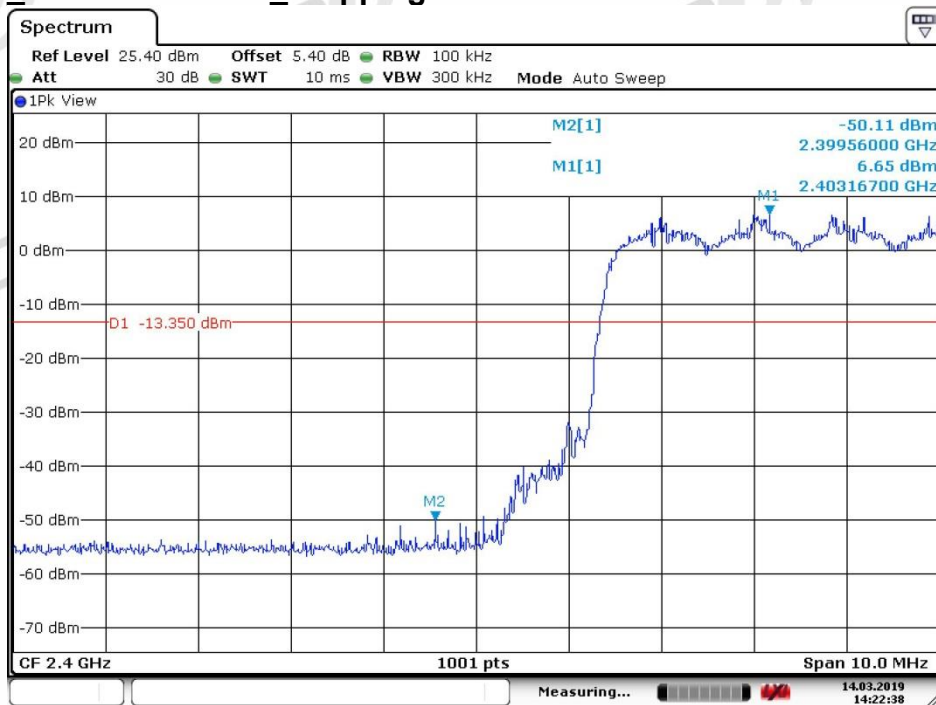


Date: 14.MAR.2019 14:27:26

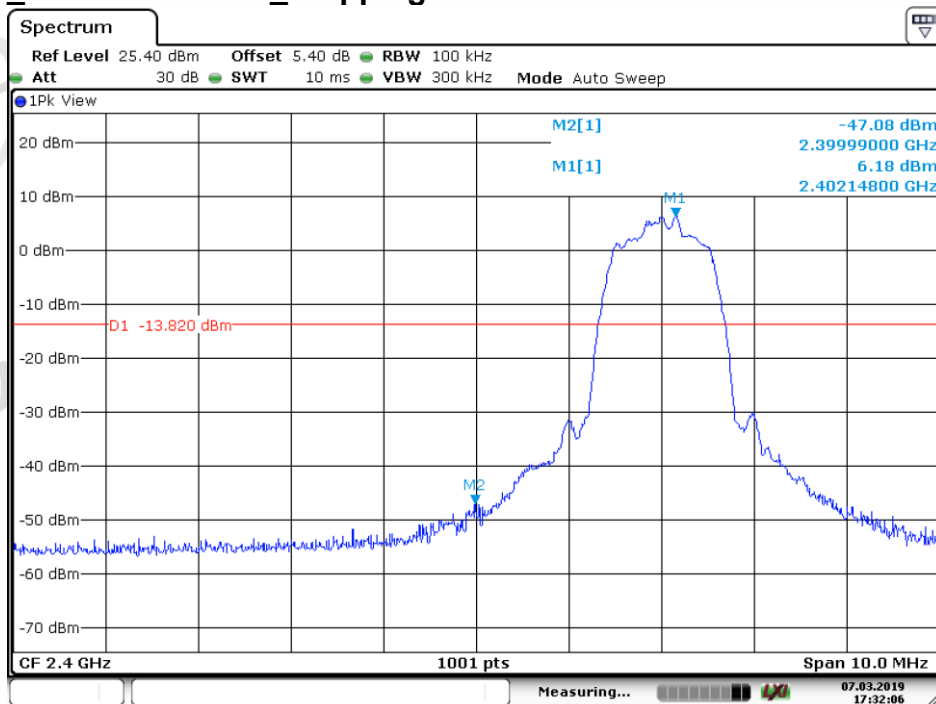
GFSK_Highest Channel_Hopping OFF



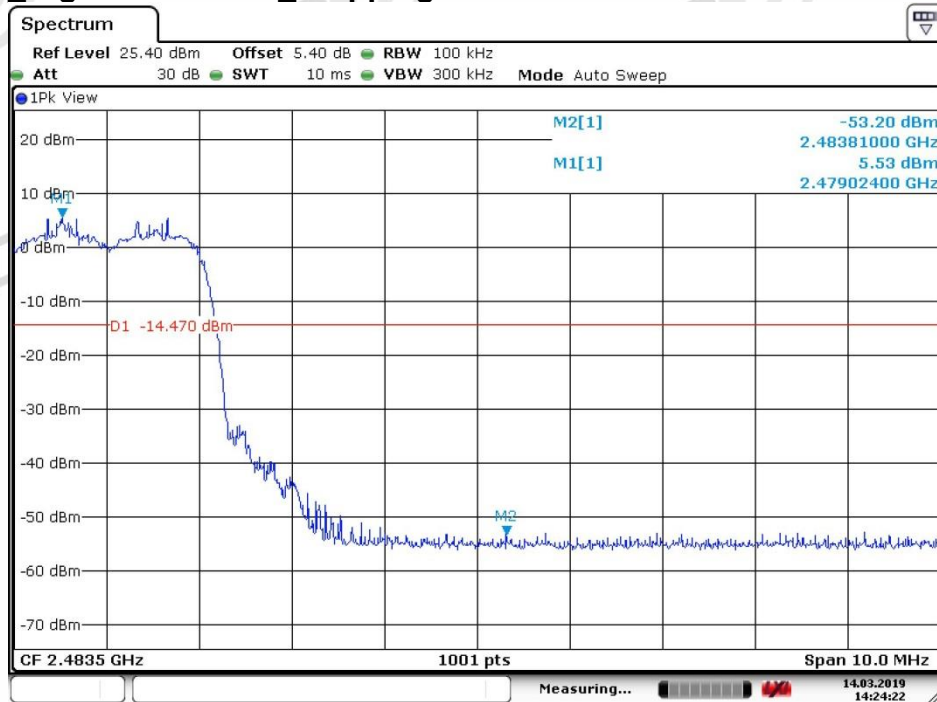
Date: 7.MAR.2019 17:29:17

$\pi/4$ DQPSK_Lowest Channel_ Hopping ON

Date: 14.MAR.2019 14:22:38

 $\pi/4$ DQPSK_Lowest Channel_ Hopping OFF

Date: 7.MAR.2019 17:32:06

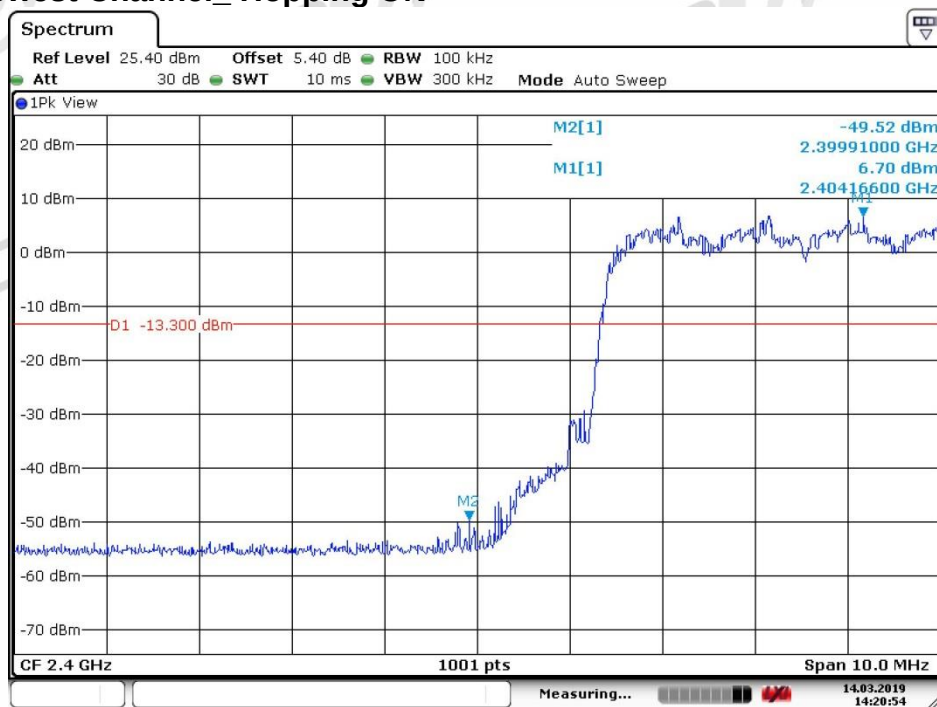
$\pi/4$ DQPSK_Highest Channel_ Hopping ON

Date: 14.MAR.2019 14:24:23

 $\pi/4$ DQPSK_Highest Channel_ Hopping OFF

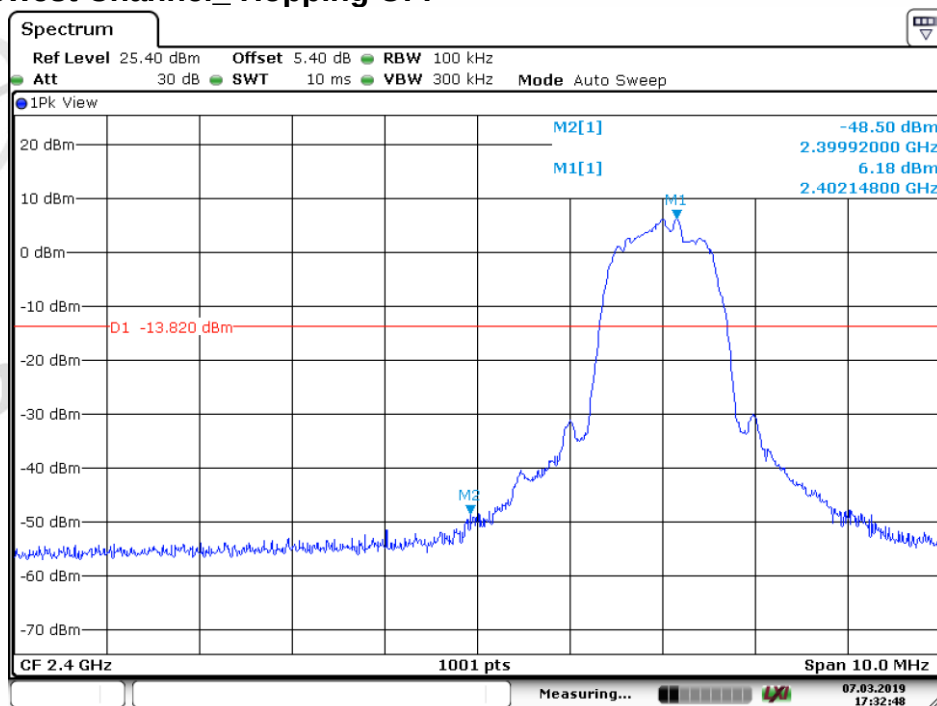
Date: 7.MAR.2019 17:28:24

8DPSK_Lowest Channel_ Hopping ON



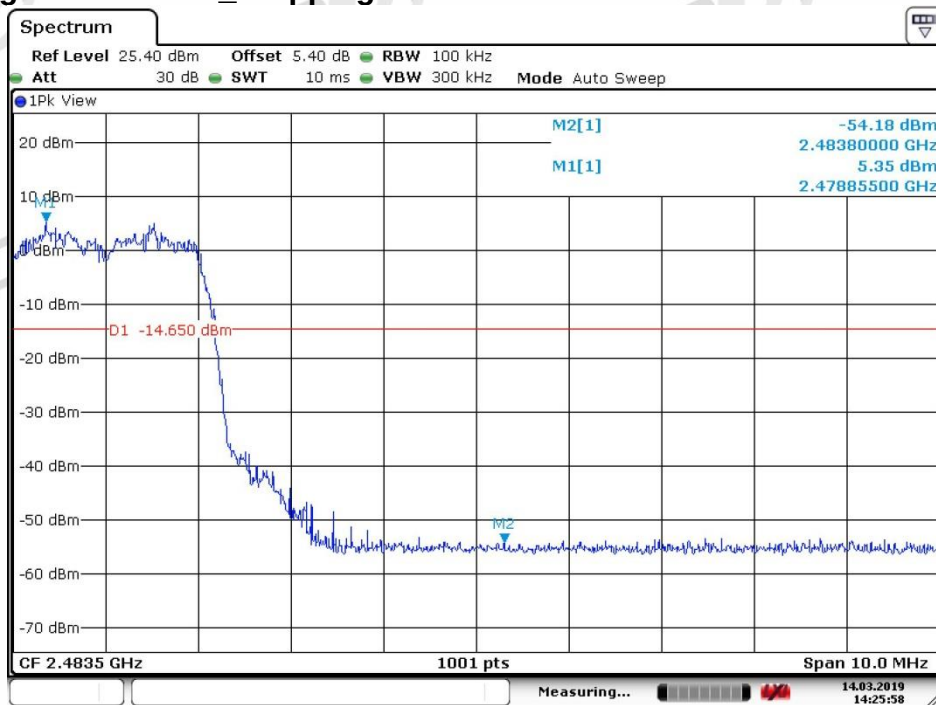
Date: 14.MAR.2019 14:20:55

8DPSK_Lowest Channel_ Hopping OFF



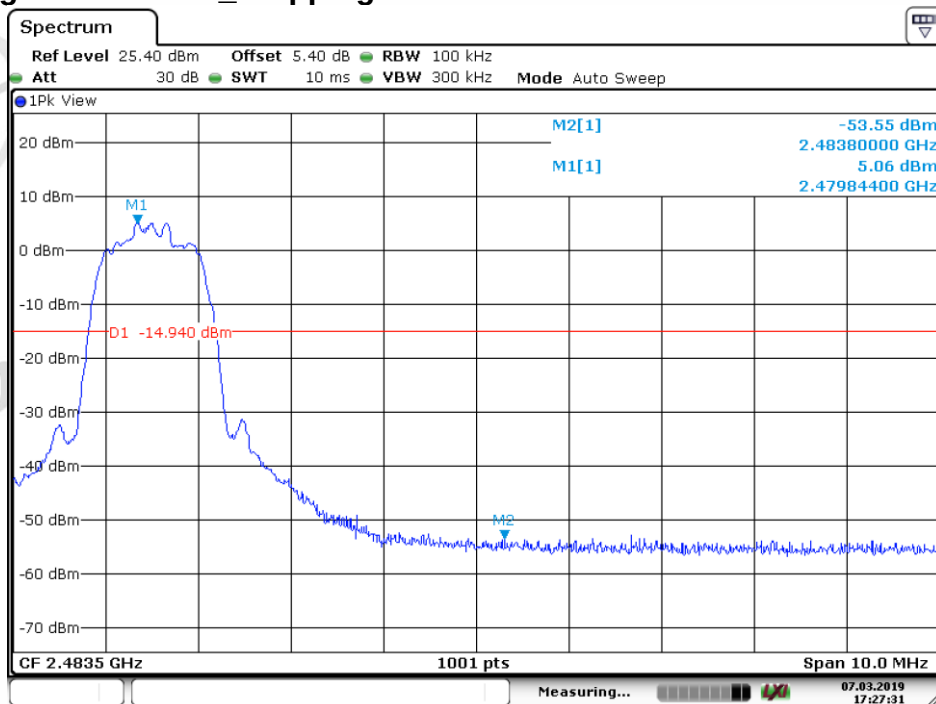
Date: 7.MAR.2019 17:32:48

8DPSK_Highest Channel_ Hopping ON



Date: 14.MAR.2019 14:25:59

8DPSK_Highest Channel_ Hopping OFF

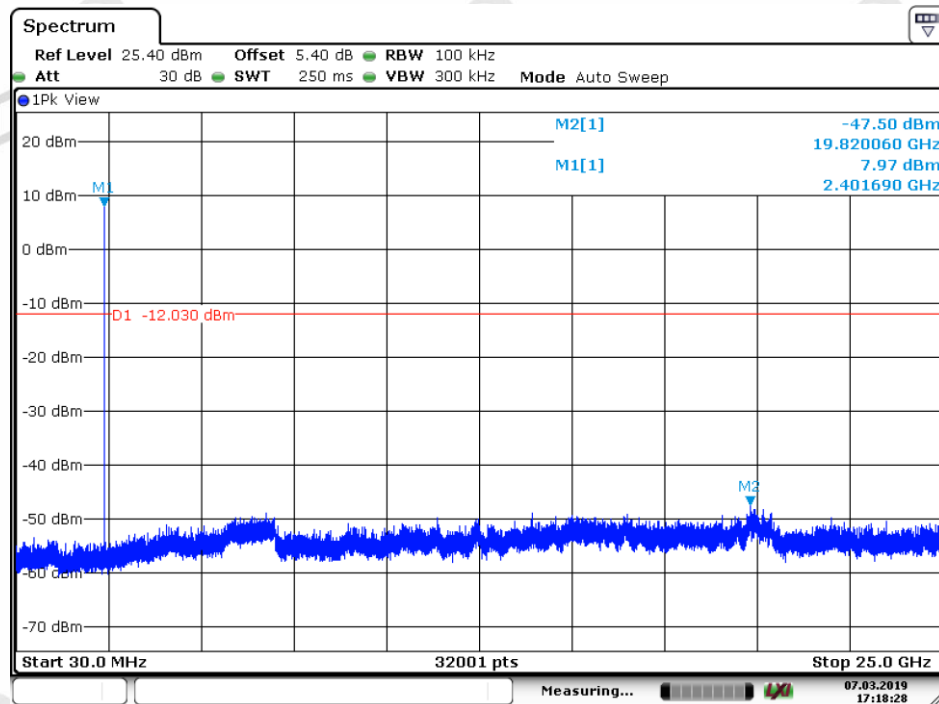


Date: 7.MAR.2019 17:27:31

10. Spurious RF Conducted Emissions

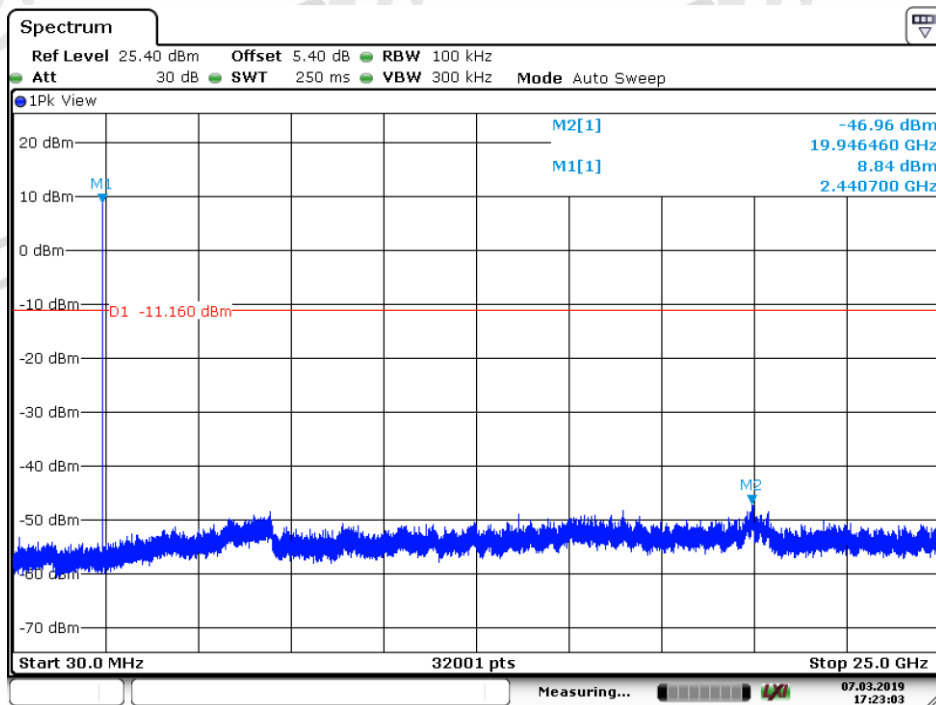
10.1. Test plots

GFSK _Lowest Channel



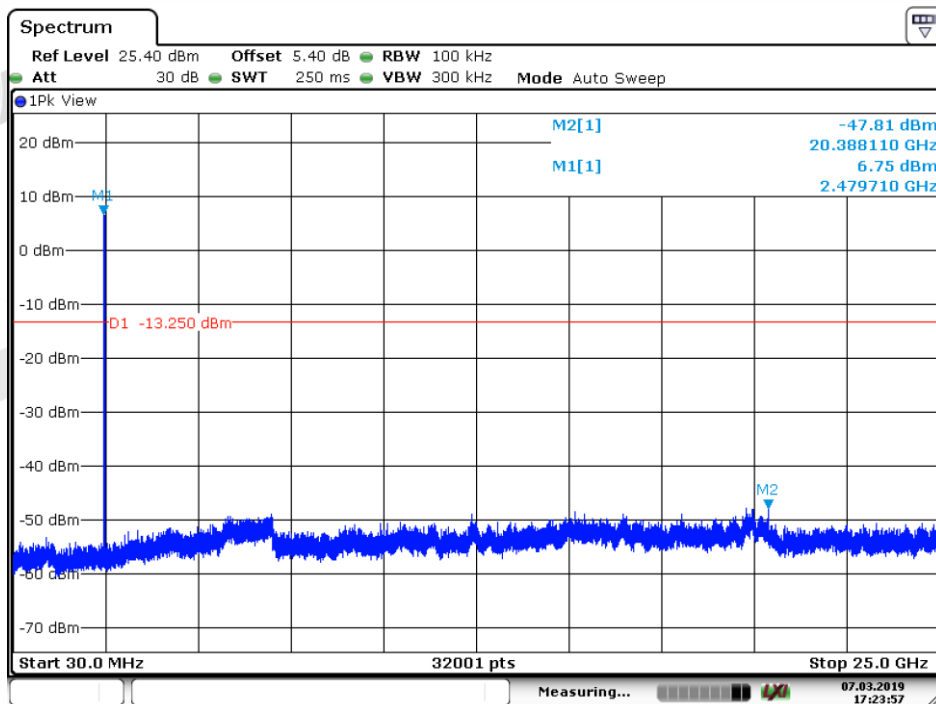
Date: 7.MAR.2019 17:18:29

GFSK_Middle Channel

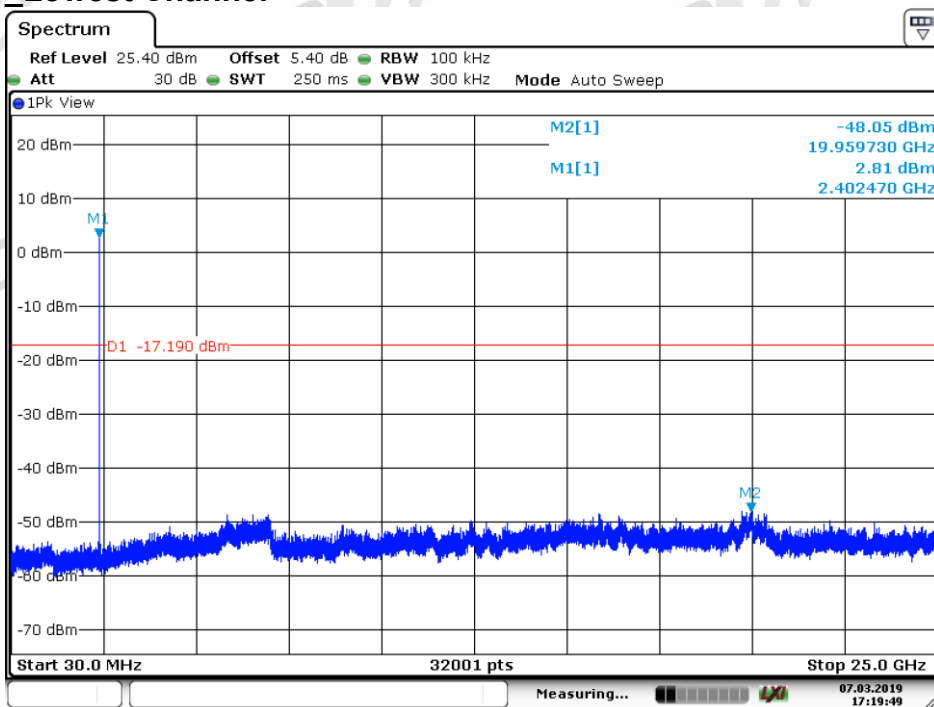


Date: 7.MAR.2019 17:23:03

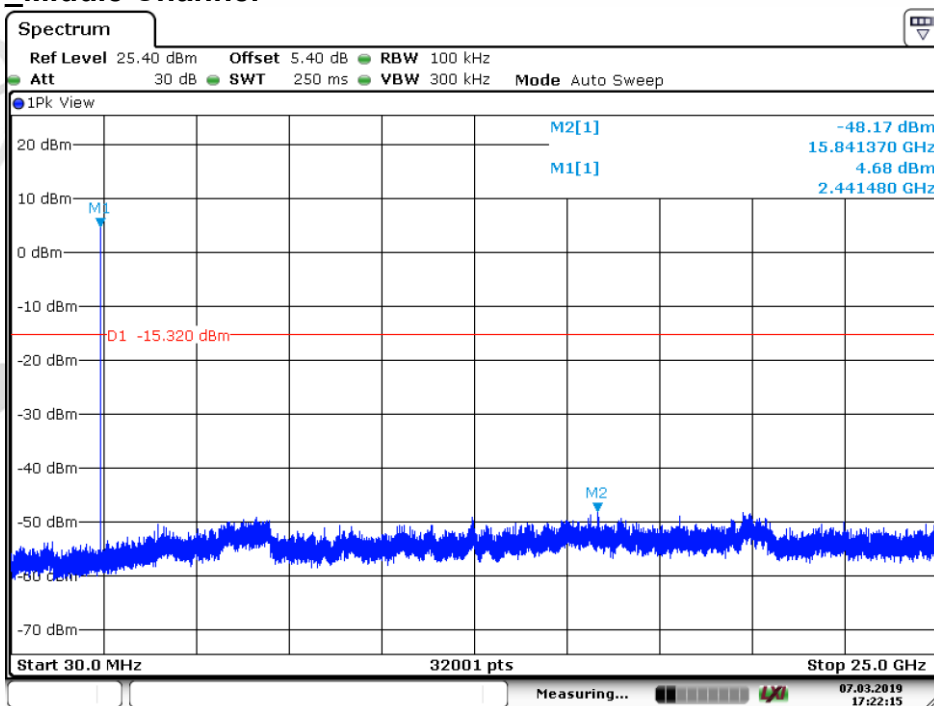
GFSK_Highest Channel



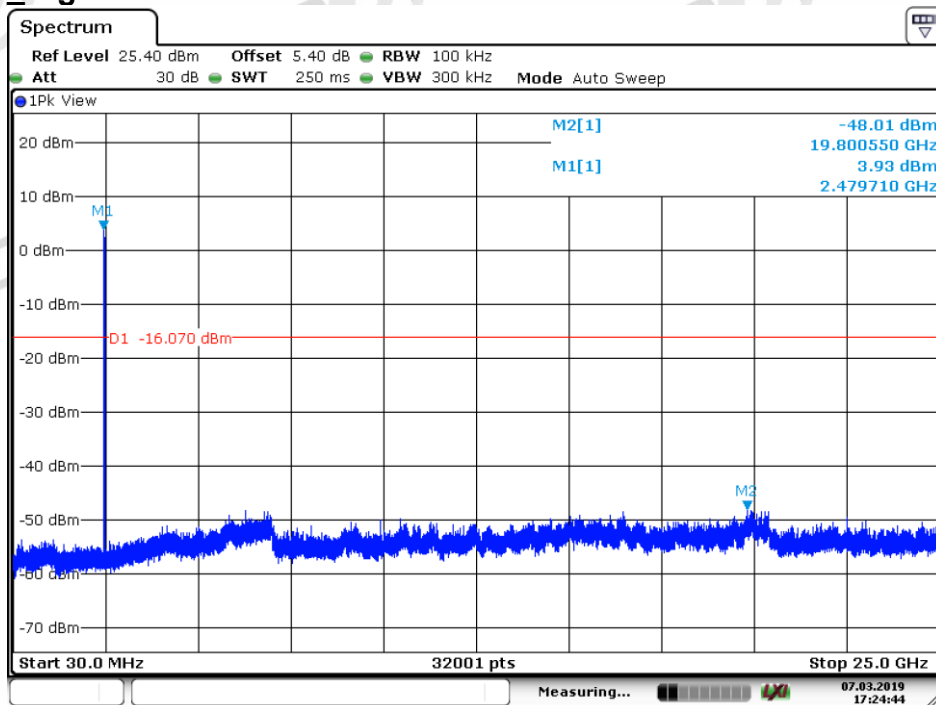
Date: 7.MAR.2019 17:23:57

$\pi/4$ DQPSK Lowest Channel

Date: 7.MAR.2019 17:19:50

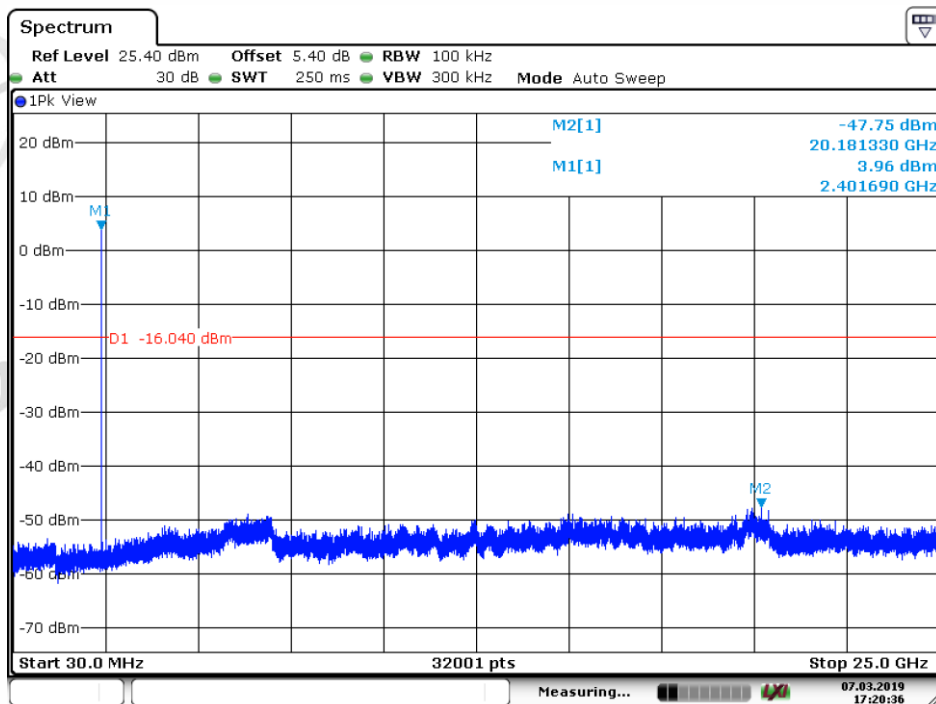
 $\pi/4$ DQPSK Middle Channel

Date: 7.MAR.2019 17:22:16

$\pi/4$ DQPSK_Highest Channel

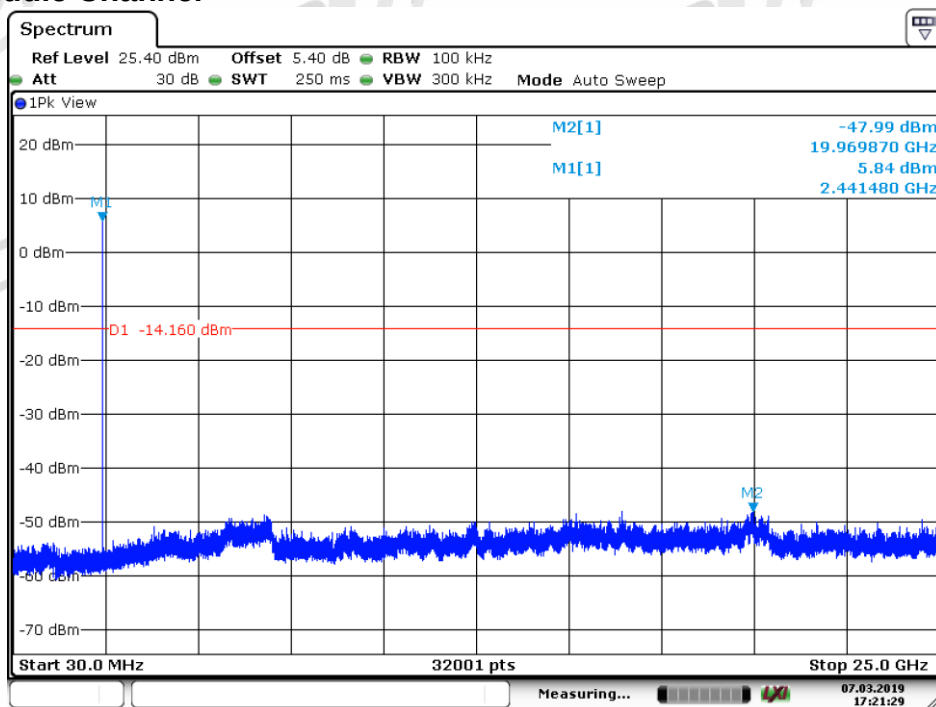
Date: 7.MAR.2019 17:24:45

8DPSK_Lowest Channel



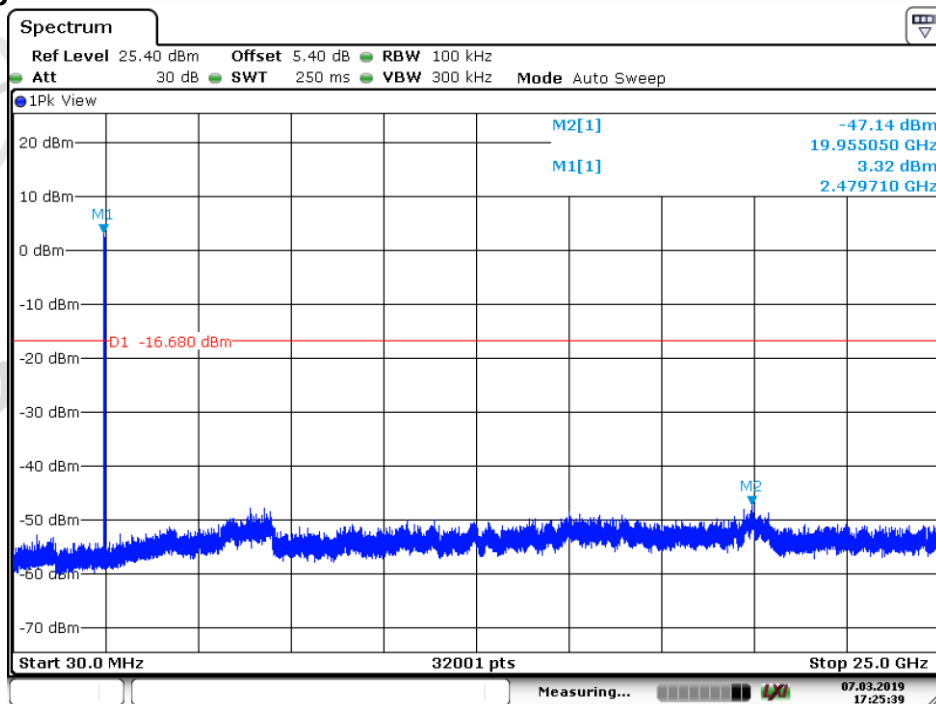
Date: 7.MAR.2019 17:20:36

8DPSK_Middle Channel



Date: 7.MAR.2019 17:21:28

8DPSK_Highest Channel



Date: 7.MAR.2019 17:25:39

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.

The End