

Appendix

Table of Contents

1	EQUIPMENT LIST	3
2	MEASUREMENT UNCERTAINTY (95% CONFIDENCE LEVELS, K=2)	3
3	AC POWER LINE CONDUCTED EMISSIONS	4
3.1	MEASUREMENT DATA	4
4	CONDUCTED PEAK OUTPUT POWER	6
4.1	TEST RESULTS	6
4.2	TEST PLOTS	7
5	20DB EMISSION BANDWIDTH & 99% OCCUPIED BANDWIDTH.....	12
5.1	TEST RESULTS	12
5.2	TEST PLOTS	13
6	CARRIER FREQUENCIES SEPARATION	22
6.1	TEST RESULTS	22
6.2	TEST PLOTS:	23
7	HOPPING CHANNEL NUMBER	25
7.1	TEST RESULTS	25
7.2	TEST PLOTS	26
8	DWELL TIME	28
8.1	TEST RESULTS	28
8.2	TEST PLOTS	29
9	BAND-EDGE FOR RF CONDUCTED EMISSIONS.....	34
9.1	TEST PLOTS	34
10	SPURIOUS RF CONDUCTED EMISSIONS	41
10.1	TEST PLOTS	41

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	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	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	$\pm 0.75\text{dB}$
2	RF power density, conducted	$\pm 2.84\text{dB}$
3	Spurious emissions, conducted	$\pm 0.75\text{dB}$
4	Conduct emission test	$\pm 3.12\text{ dB (9KHz- 30MHz)}$

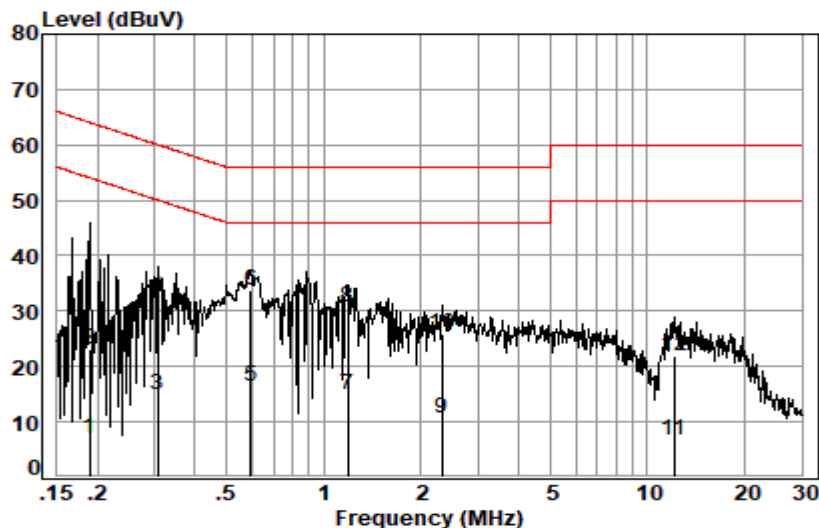
3 AC Power Line Conducted Emissions

3.1 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.

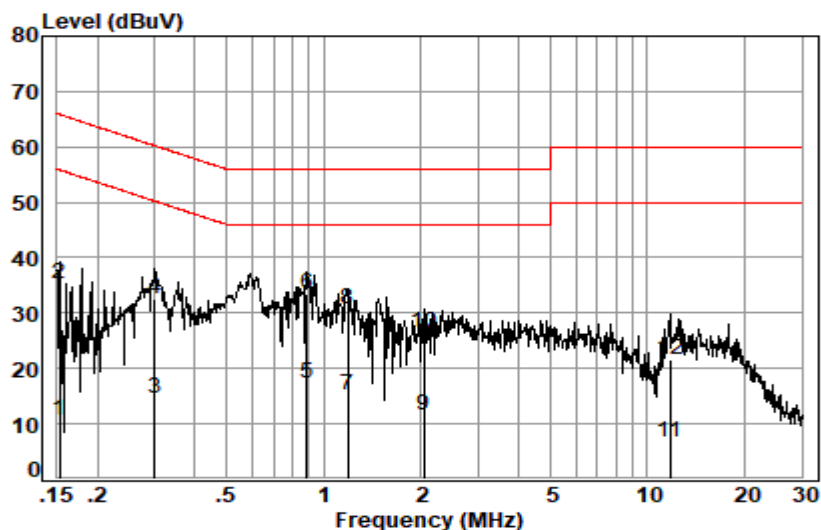
Live line:



Site : Shielding Room
 Condition: Line
 Job No. : 15593CR
 Test mode: b

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1894	0.02	9.66	-2.66	7.02	54.06	-47.04	Average
2	0.1894	0.02	9.66	13.56	23.24	64.06	-40.82	QP
3	0.3067	0.04	9.67	5.18	14.89	50.06	-35.17	Average
4	0.3067	0.04	9.67	22.88	32.59	60.06	-27.47	QP
5	0.5948	0.07	9.67	6.65	16.39	46.00	-29.61	Average
6	0.5948	0.07	9.67	23.98	33.72	56.00	-22.28	QP
7	1.1844	0.11	9.73	5.18	15.02	46.00	-30.98	Average
8	1.1844	0.11	9.73	20.95	30.79	56.00	-25.21	QP
9	2.3213	0.16	9.71	0.88	10.75	46.00	-35.25	Average
10	2.3213	0.16	9.71	16.01	25.88	56.00	-30.12	QP
11	12.0599	0.19	10.08	-3.46	6.81	50.00	-43.19	Average
12	12.0599	0.19	10.08	11.63	21.90	60.00	-38.10	QP

Neutral line:



Site : Shielding Room
 Condition: Neutral
 Job No. : 15593CR
 Test mode: b

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1532	0.01	9.63	1.15	10.79	55.82	-45.03	Average
2	0.1532	0.01	9.63	25.74	35.38	65.82	-30.44	QP
3	0.3003	0.04	9.64	4.78	14.46	50.24	-35.78	Average
4	0.3003	0.04	9.64	22.98	32.66	60.24	-27.58	QP
5	0.8897	0.08	9.71	7.55	17.34	46.00	-28.66	Average
6	0.8897	0.08	9.71	23.68	33.47	56.00	-22.53	QP
7	1.1844	0.11	9.70	5.43	15.24	46.00	-30.76	Average
8	1.1844	0.11	9.70	20.94	30.75	56.00	-25.25	QP
9	2.0441	0.16	9.69	1.74	11.59	46.00	-34.41	Average
10	2.0441	0.16	9.69	16.54	26.39	56.00	-29.61	QP
11	11.7446	0.19	10.05	-3.57	6.67	50.00	-43.33	Average
12	11.7446	0.19	10.05	11.39	21.63	60.00	-38.37	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

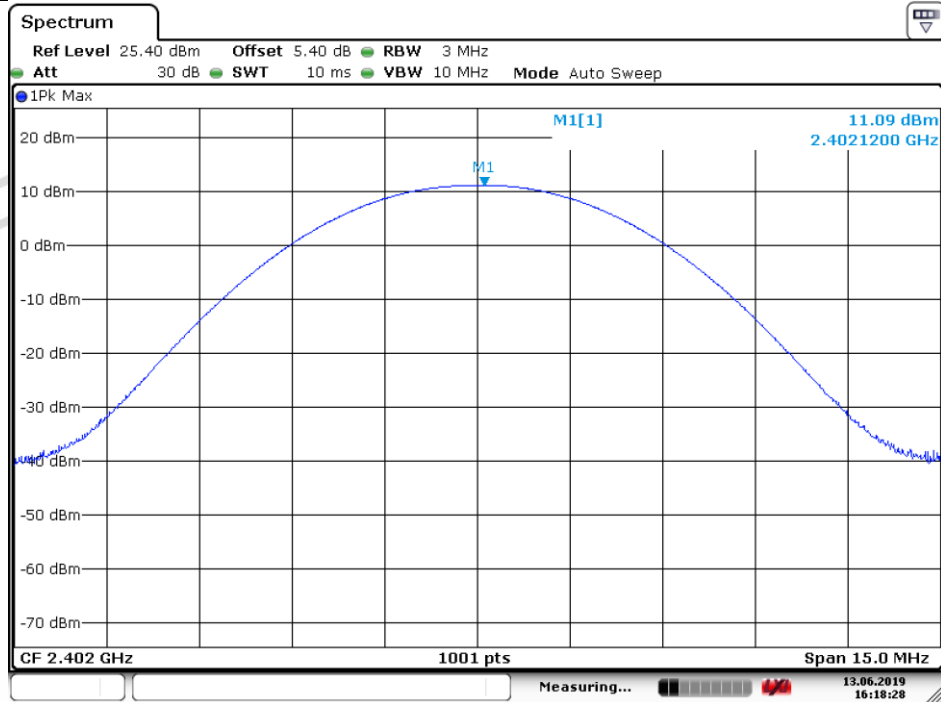
4.1 Test Results

Measurement Data of Peak power:

GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	11.09	20.97	Pass
Middle	11.56	20.97	Pass
Highest	9.74	20.97	Pass
$\pi/4$ DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	11.21	20.97	Pass
Middle	11.68	20.97	Pass
Highest	9.84	20.97	Pass
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	11.51	20.97	Pass
Middle	12.00	20.97	Pass
Highest	10.16	20.97	Pass

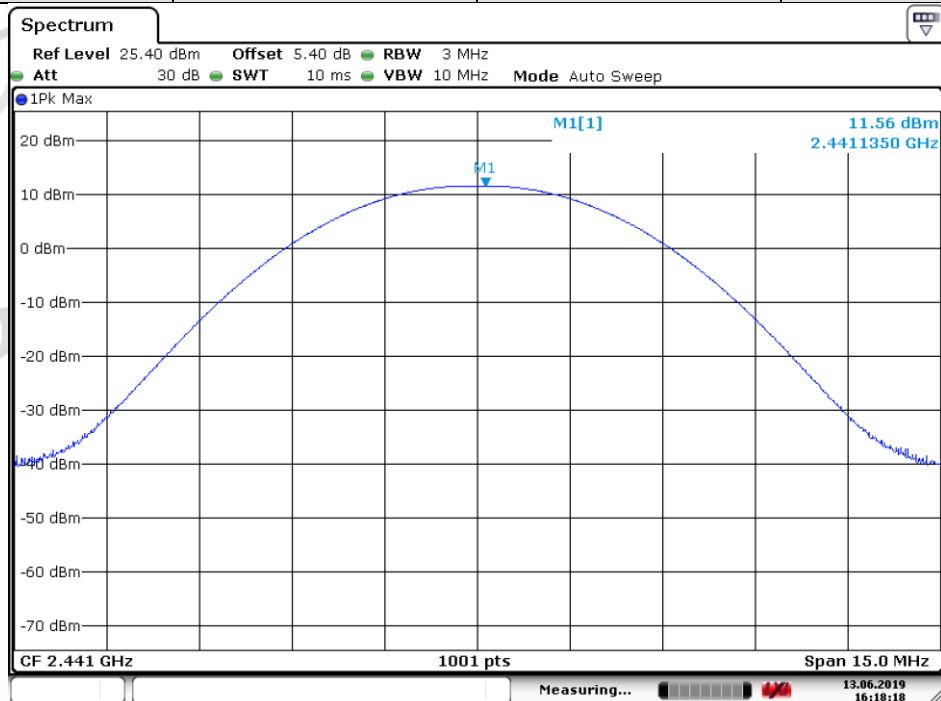
4.2 Test plots

Test mode:	GFSK	Test channel:	Lowest
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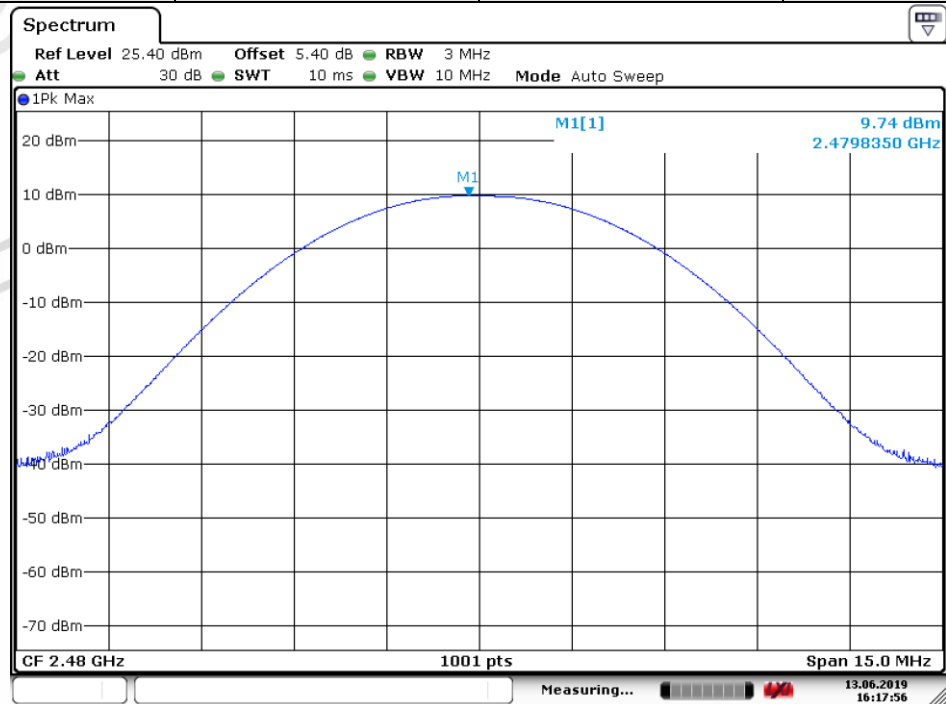
Date: 13.JUN.2019 16:18:29

Test mode:	GFSK	Test channel:	Middle
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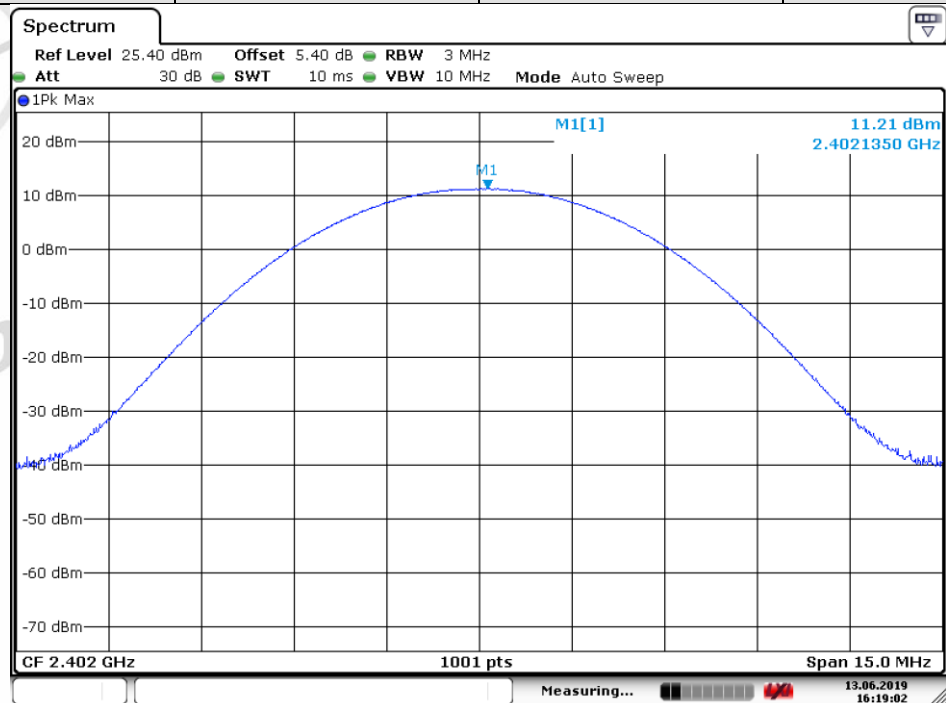
Date: 13.JUN.2019 16:18:18

Test mode:	GFSK	Test channel:	Highest
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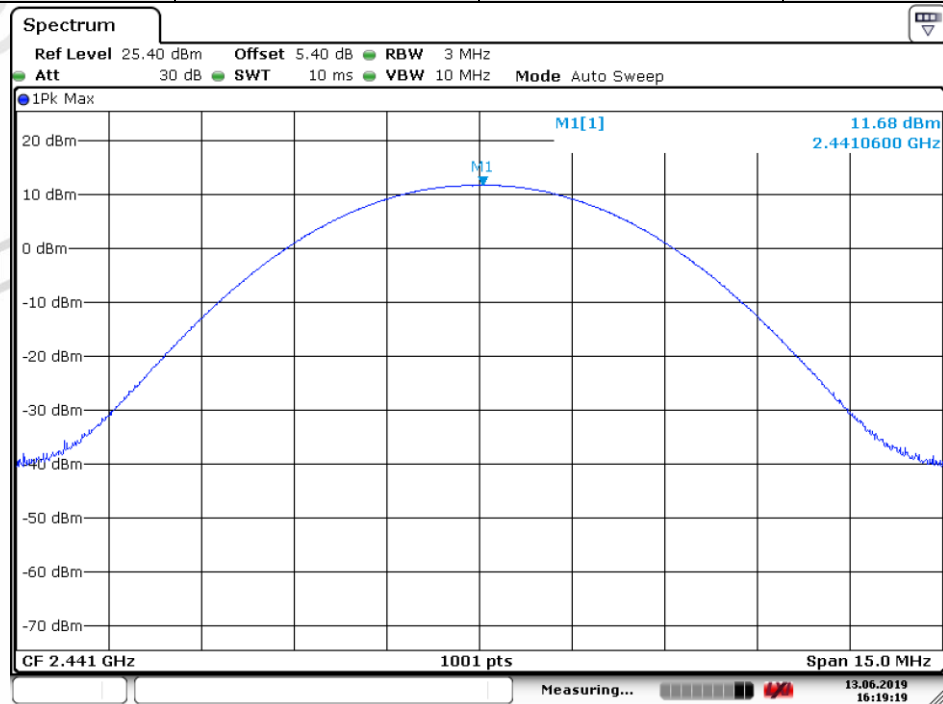
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Test mode:	$\pi/4$ DQPSK	Test channel:	Lowest
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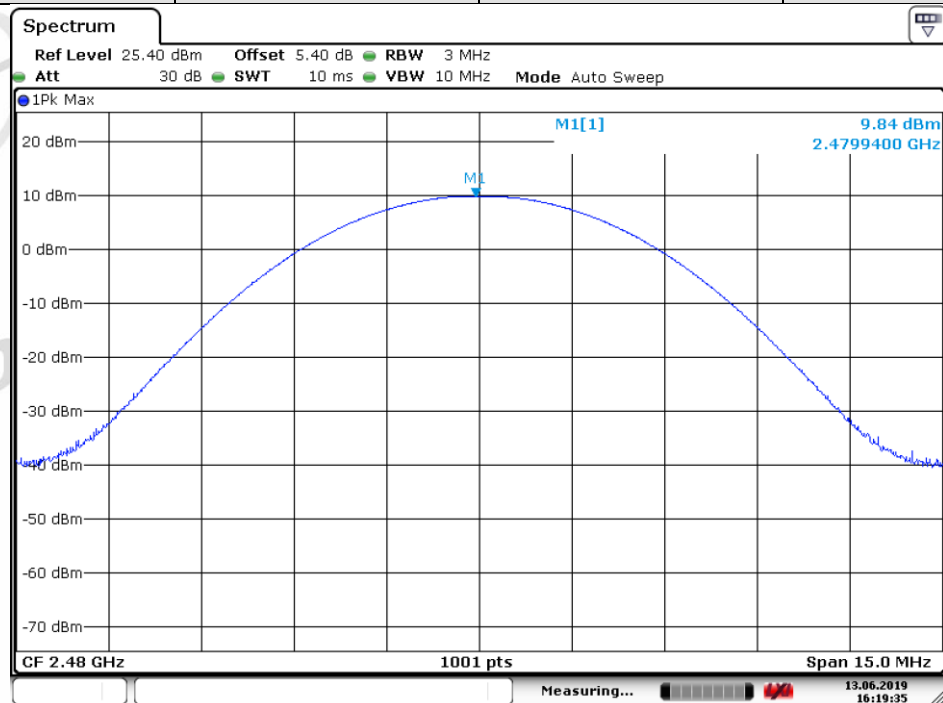
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Test mode:	$\pi/4$ DQPSK	Test channel:	Middle
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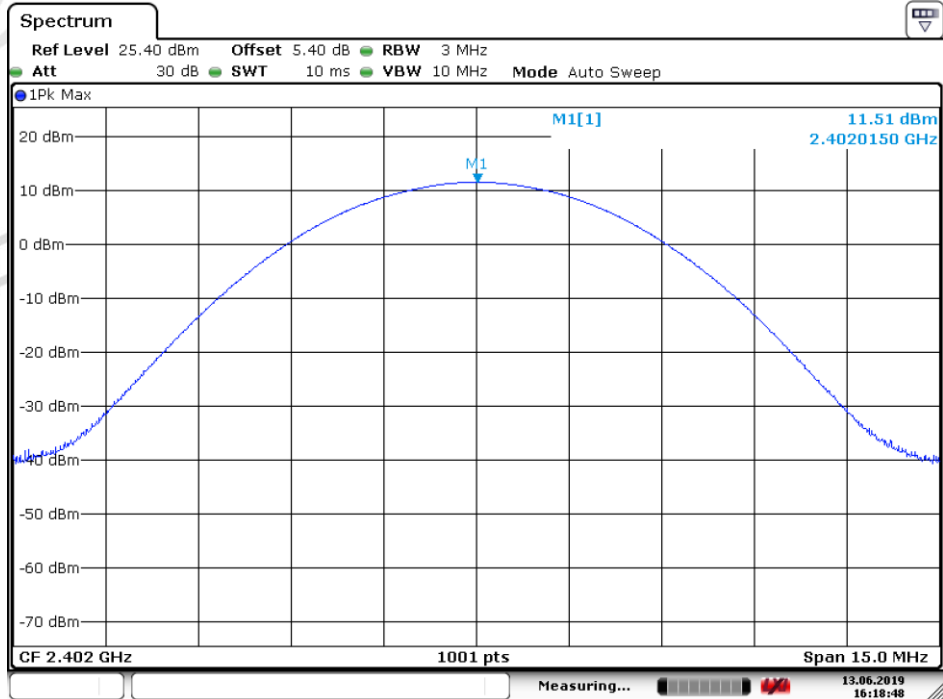
Date: 13.JUN.2019 16:19:19

Test mode:	$\pi/4$ DQPSK	Test channel:	Highest
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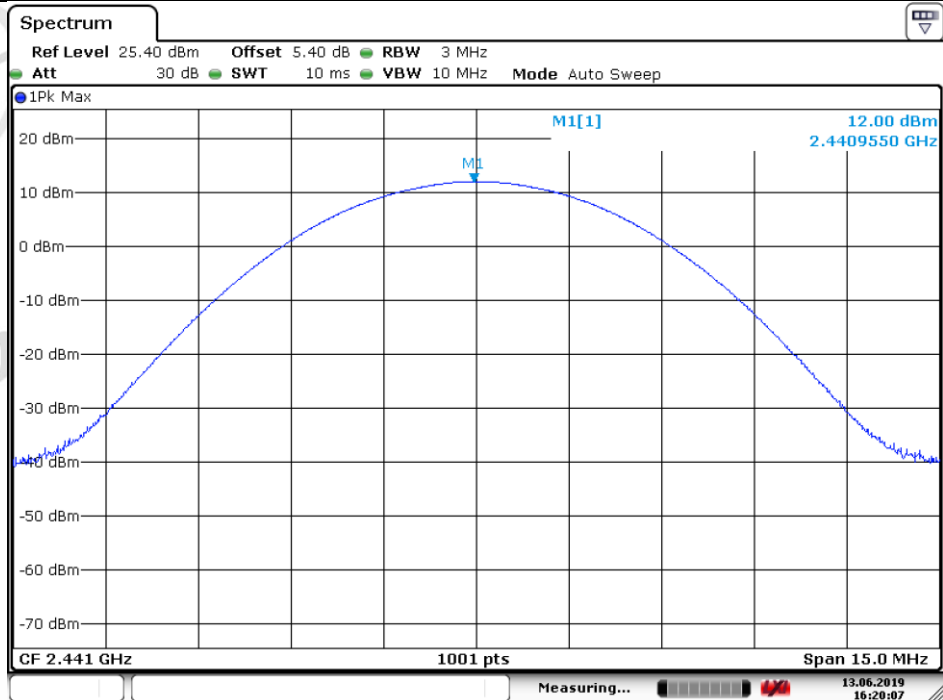
Date: 13.JUN.2019 16:19:35

Test mode:	8DPSK	Test channel:	Lowest
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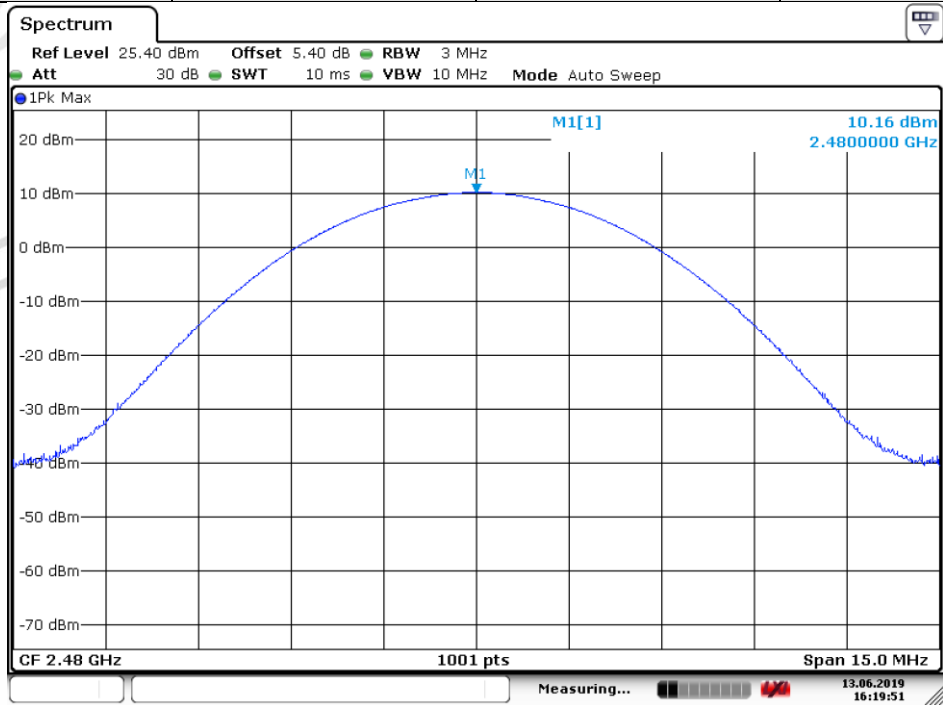
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Test mode:	8DPSK	Test channel:	Middle
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Date: 13.JUN.2019 16:20:08

Test mode:	8DPSK	Test channel:	Highest
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Date: 13.JUN.2019 16:19:52

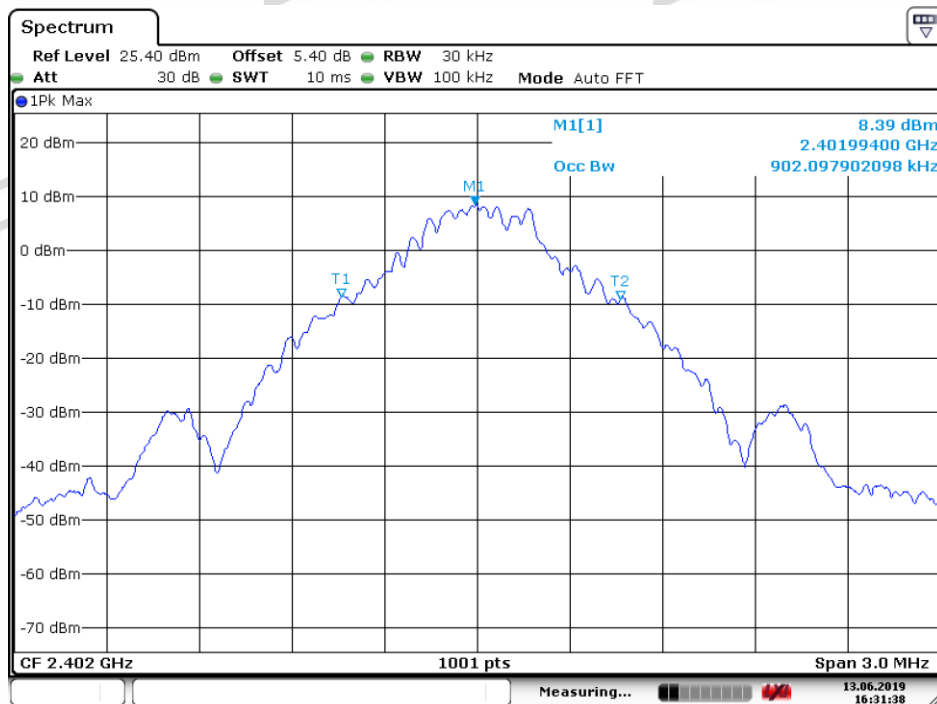
5 20dB Emission Bandwidth & 99% Occupied Bandwidth

5.1 Test Results

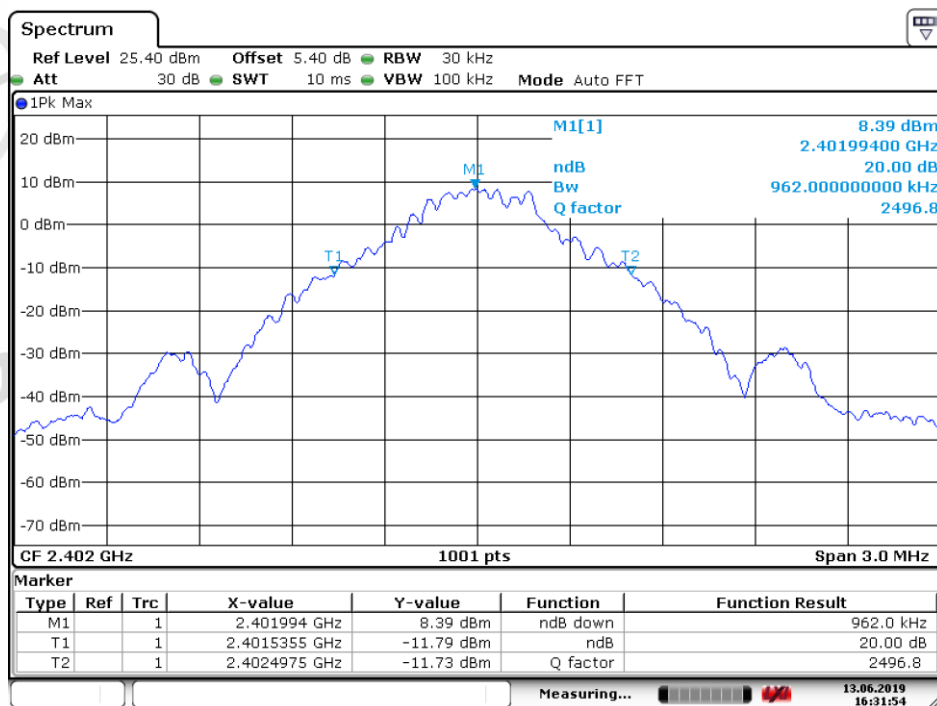
Mode	Test Channel	99% Occupied Bandwidth (KHz)	20dB Emission Bandwidth (KHz)	Result
GFSK	Lowest	902.1	962.0	Pass
	Middle	905.1	959.0	Pass
	Highest	905.1	977.0	Pass
$\pi/4$ DQPSK	Lowest	1168.8	1285.7	Pass
	Middle	1168.8	1288.7	Pass
	Highest	1168.8	1291.7	Pass
8DPSK	Lowest	1171.8	1294.7	Pass
	Middle	1174.8	1294.7	Pass
	Highest	1171.8	1294.7	Pass

5.2 Test plots

GFSK_Lowest Channel

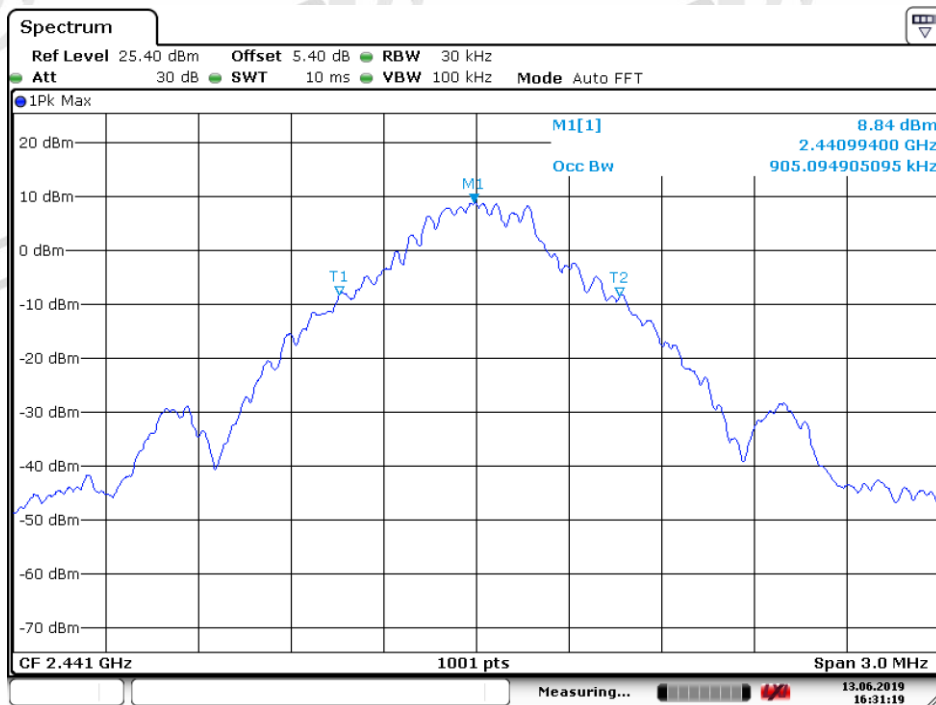


Date: 13 JUN.2019 16:31:39

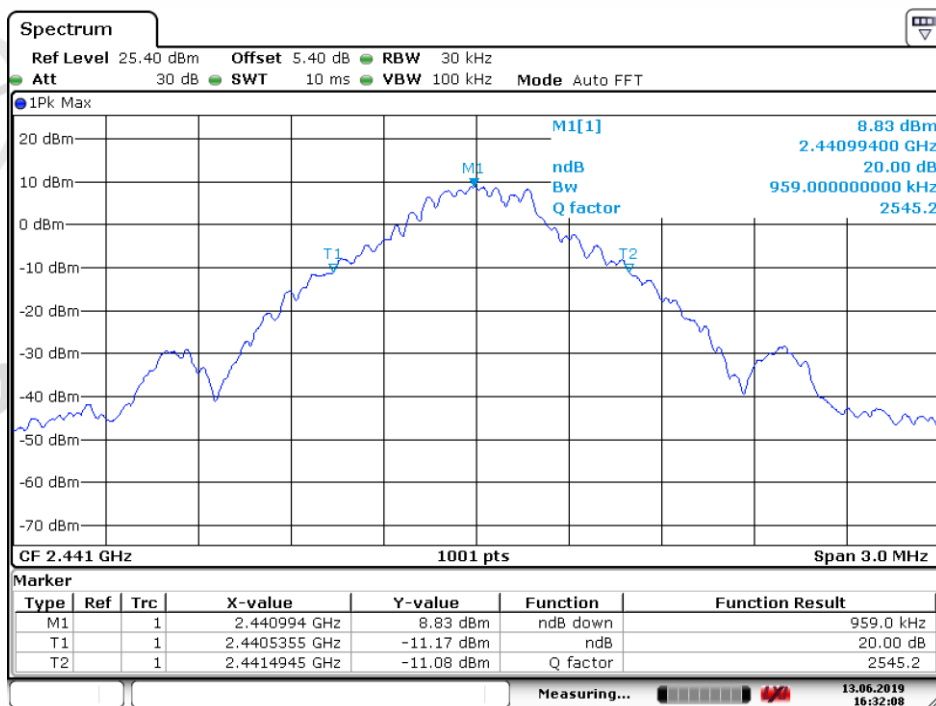


Date: 13 JUN.2019 16:31:55

GFSK_Middle Channel

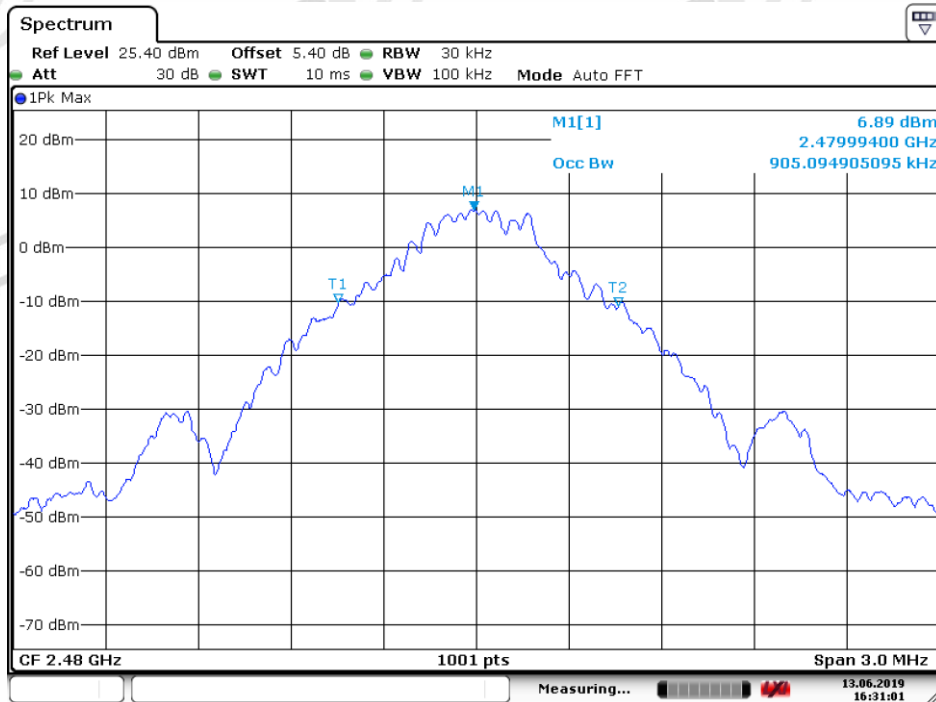


Date: 13. JUN.2019 16:31:19

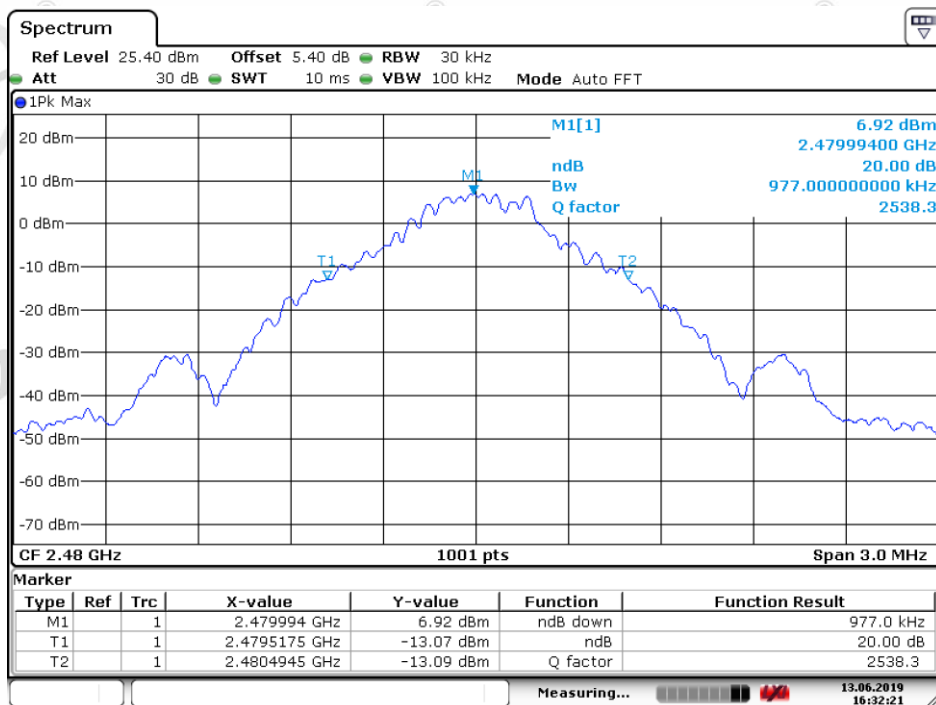


Date: 13. JUN.2019 16:32:09

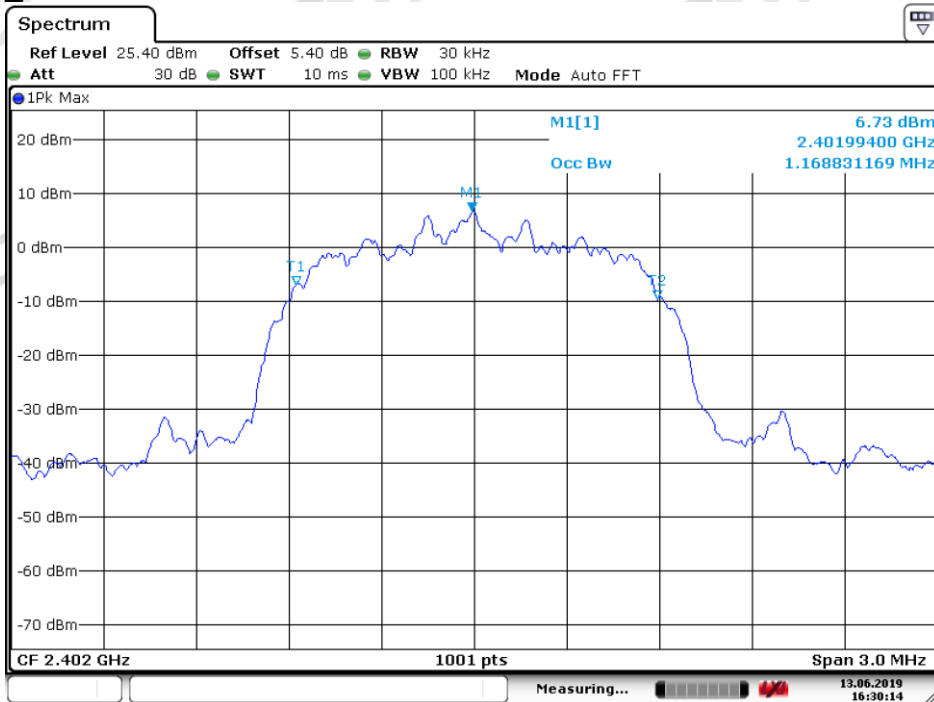
GFSK_Highest Channel



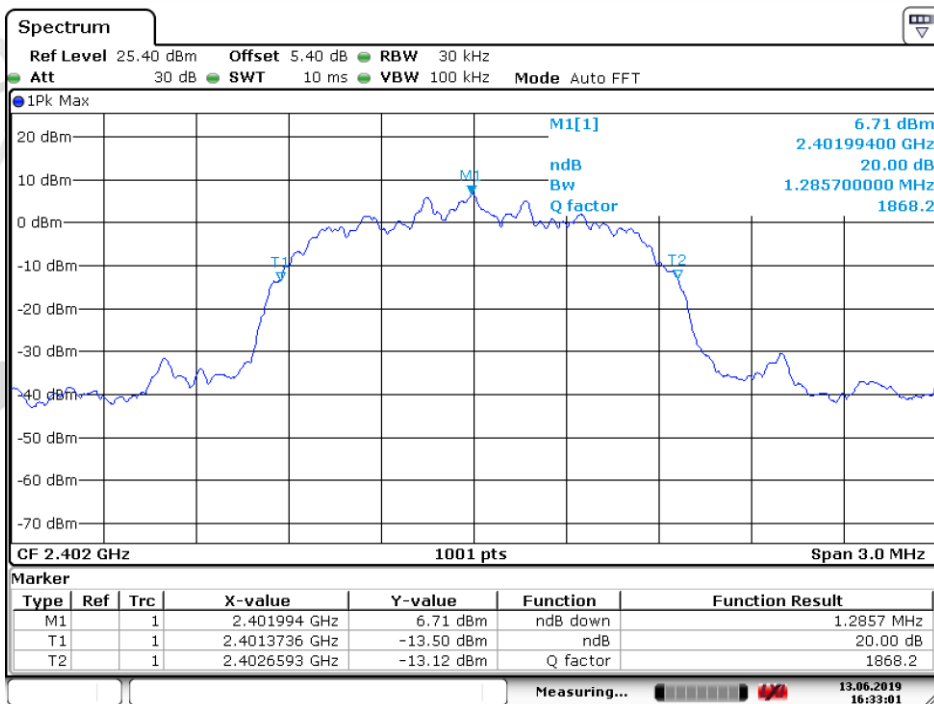
Date: 13. JUN.2019 16:31:02



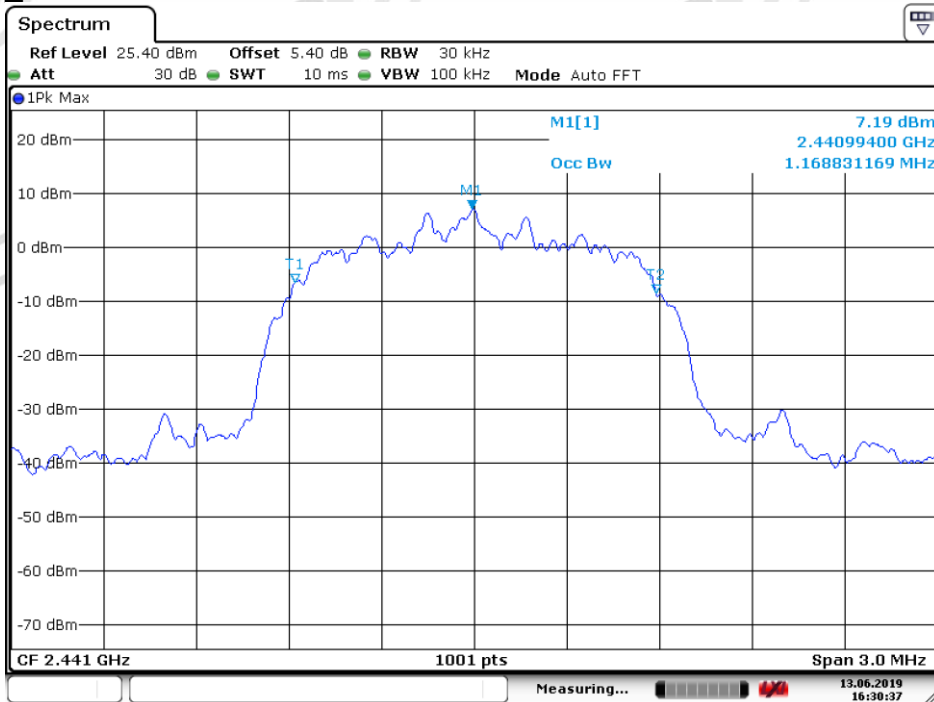
Date: 13. JUN.2019 16:32:22

$\pi/4$ DQPSK Lowest Channel

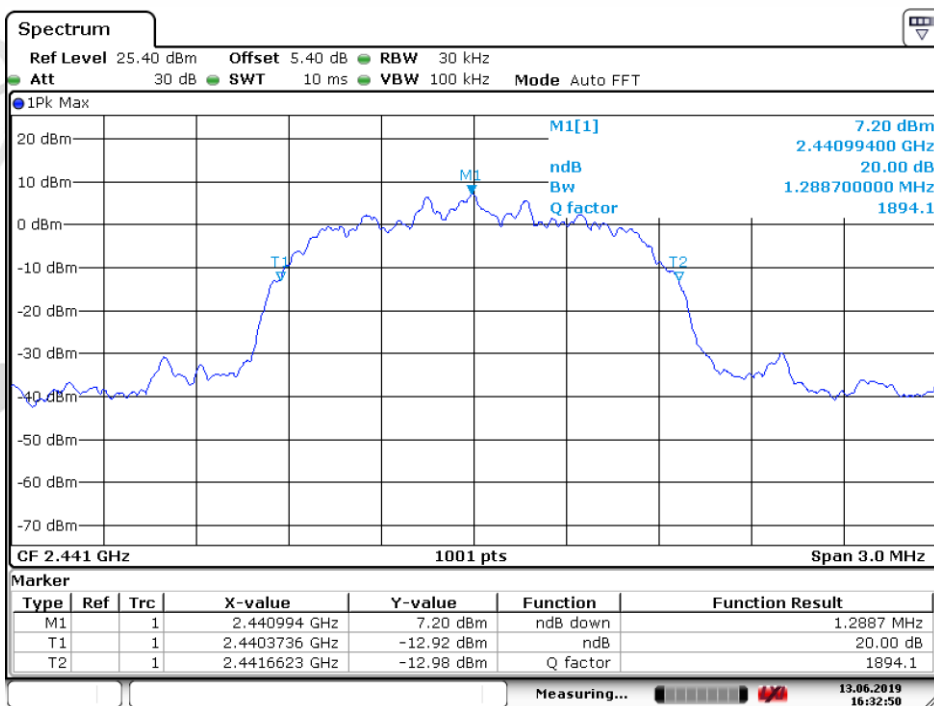
Date: 13. JUN.2019 16:30:14



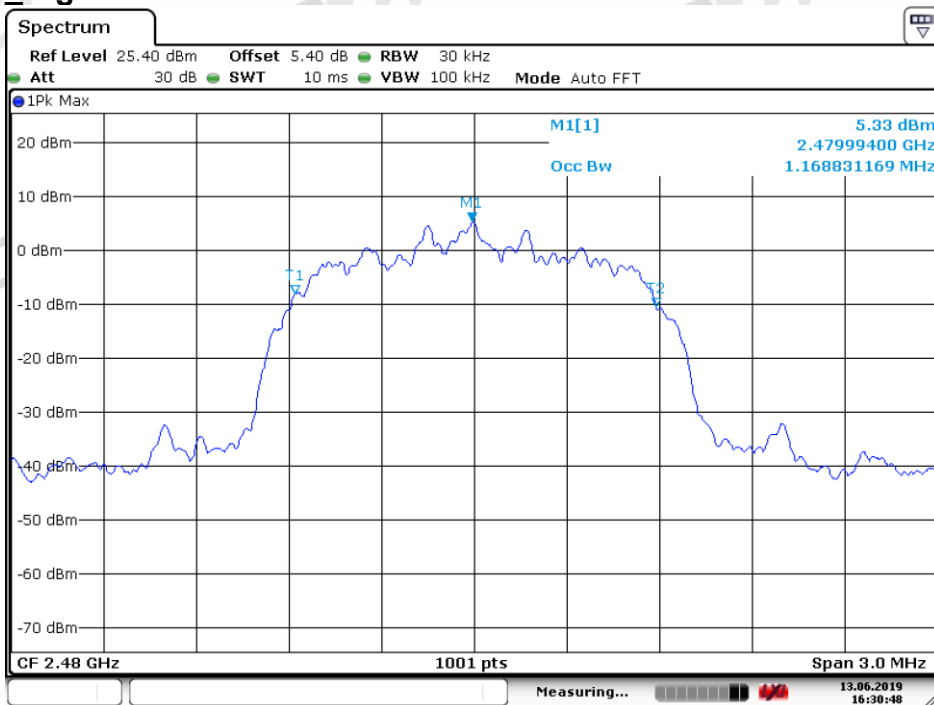
Date: 13. JUN.2019 16:33:01

$\pi/4$ DQPSK Middle Channel

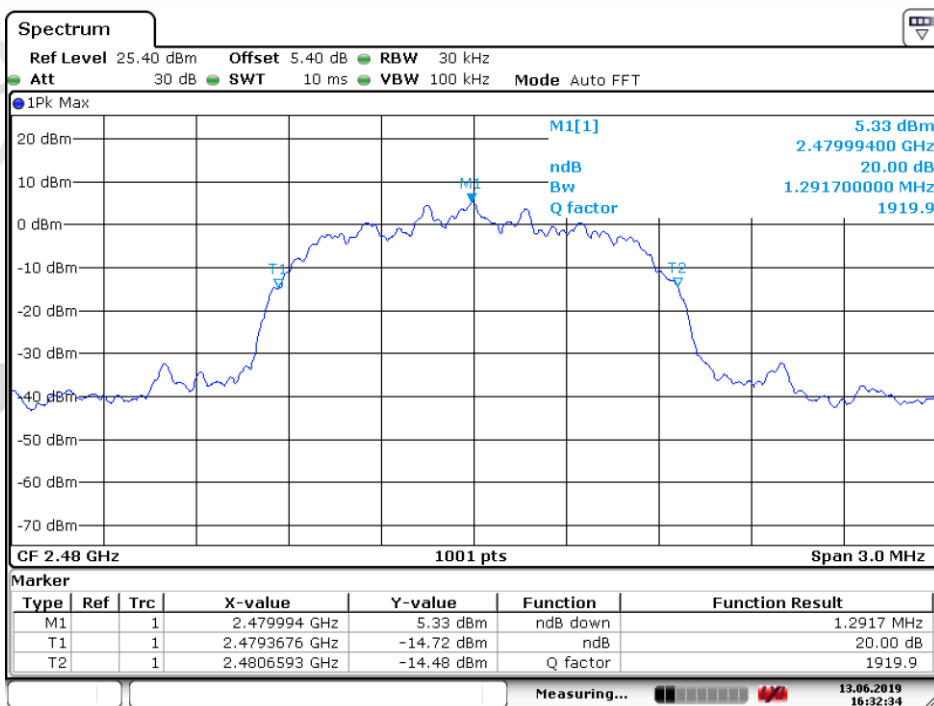
Date: 13. JUN.2019 16:30:37



Date: 13. JUN.2019 16:32:50

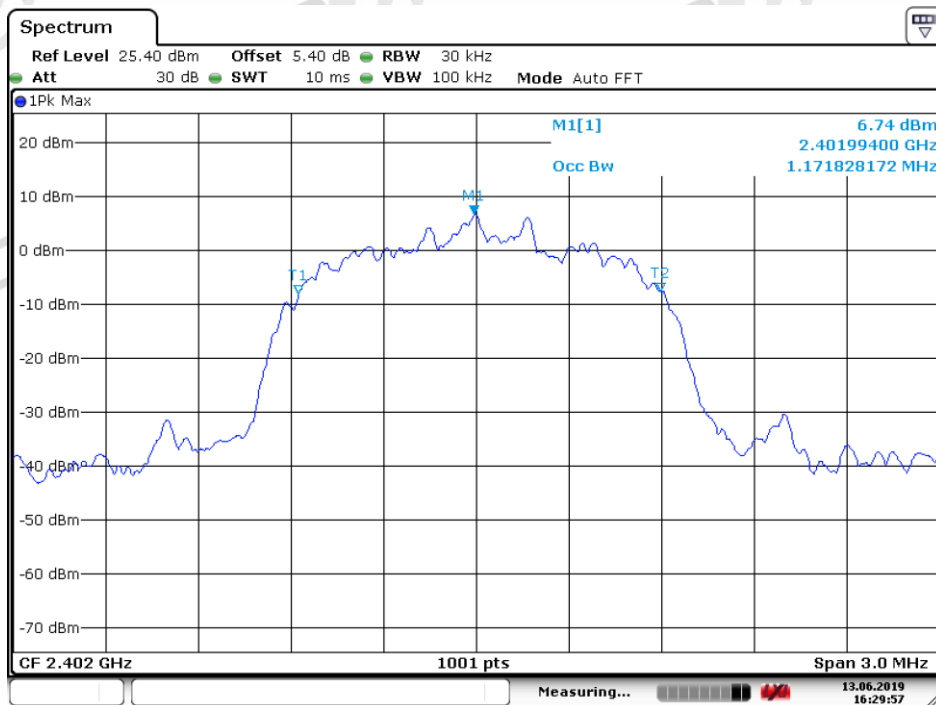
$\pi/4$ DQPSK Highest Channel

Date: 13. JUN.2019 16:30:49

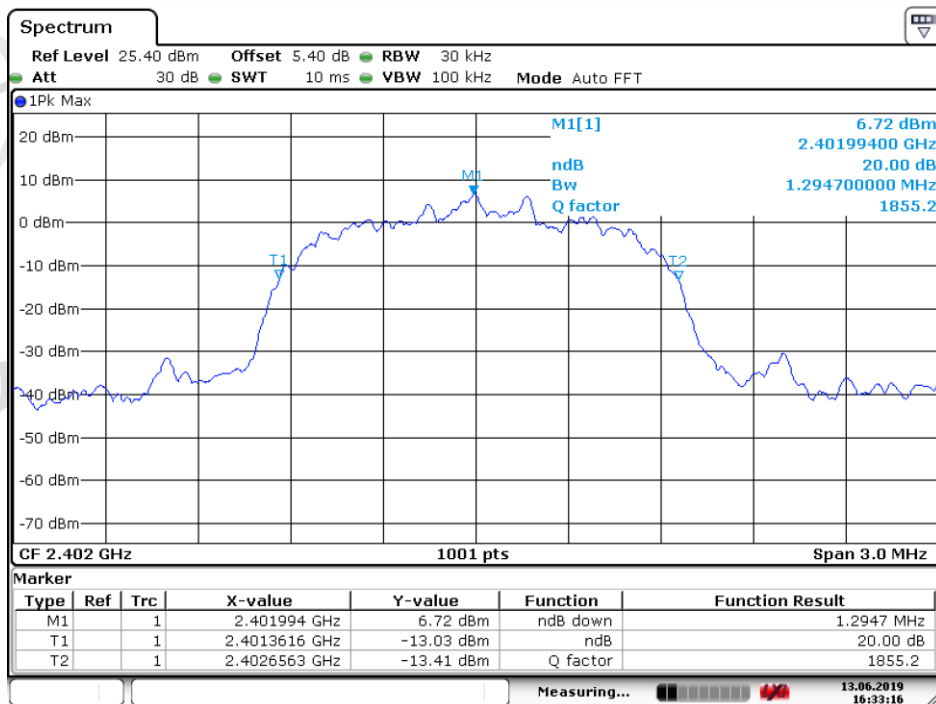


Date: 13. JUN.2019 16:32:34

8DPSK_Lowest Channel

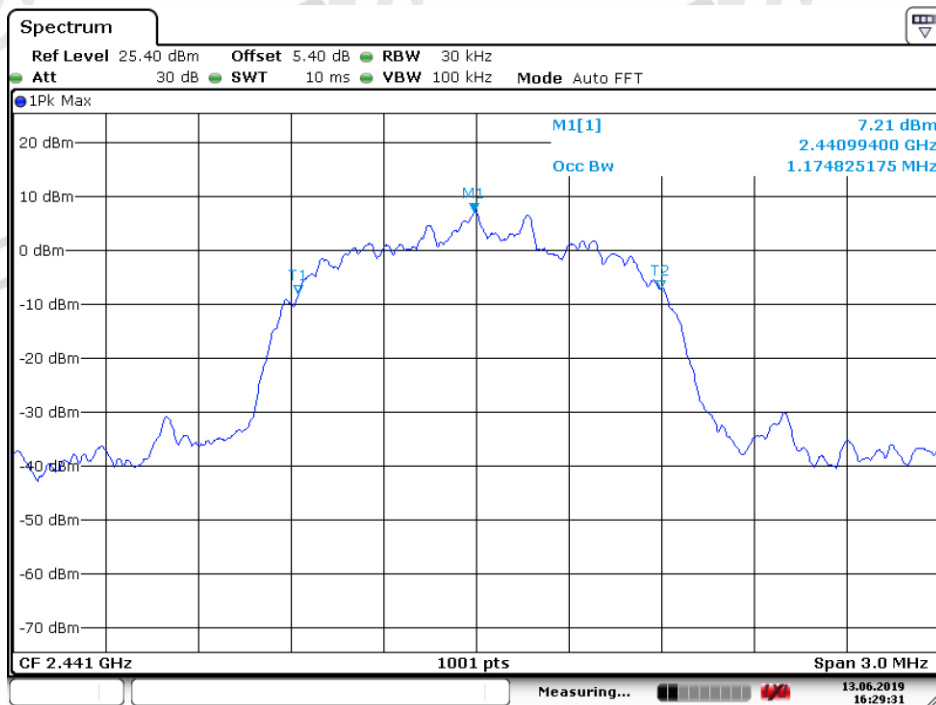


Date: 13. JUN.2019 16:29:58

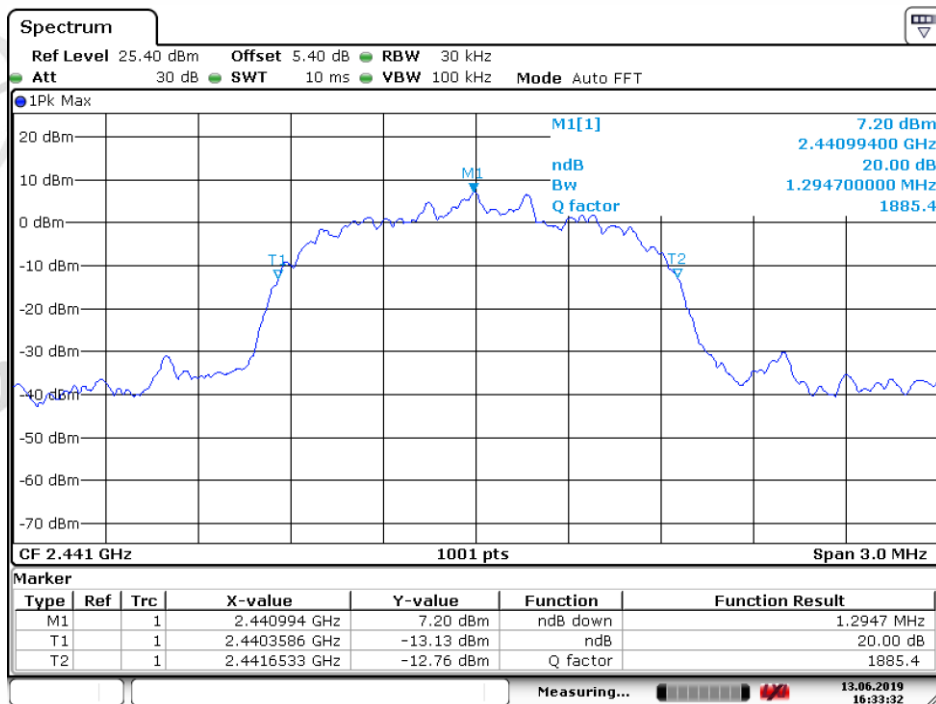


Date: 13. JUN.2019 16:33:16

8DPSK_Middle Channel

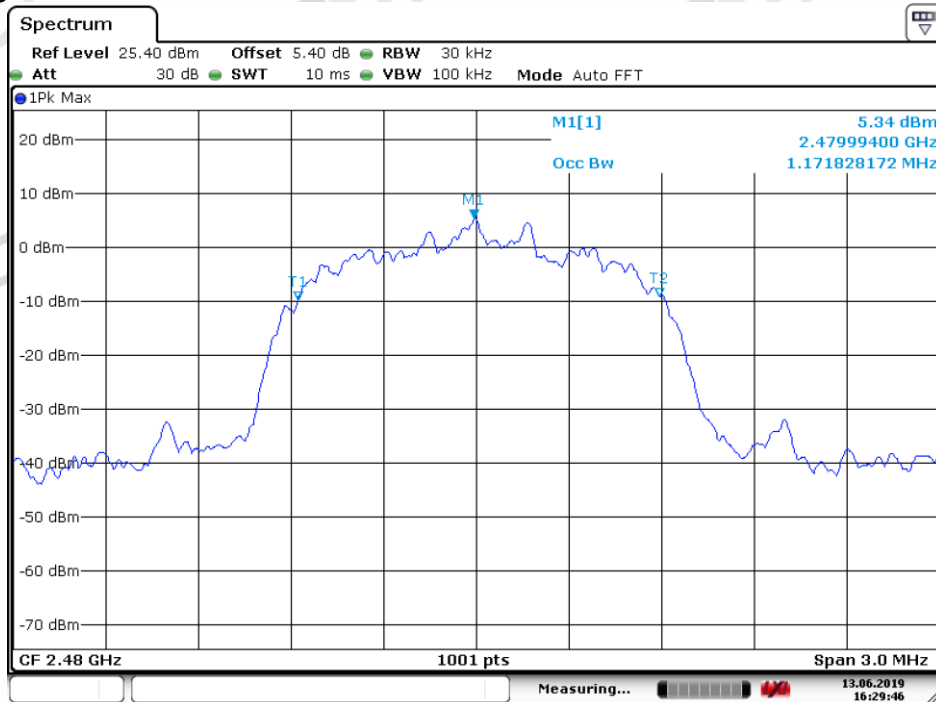


Date: 13. JUN.2019 16:29:32

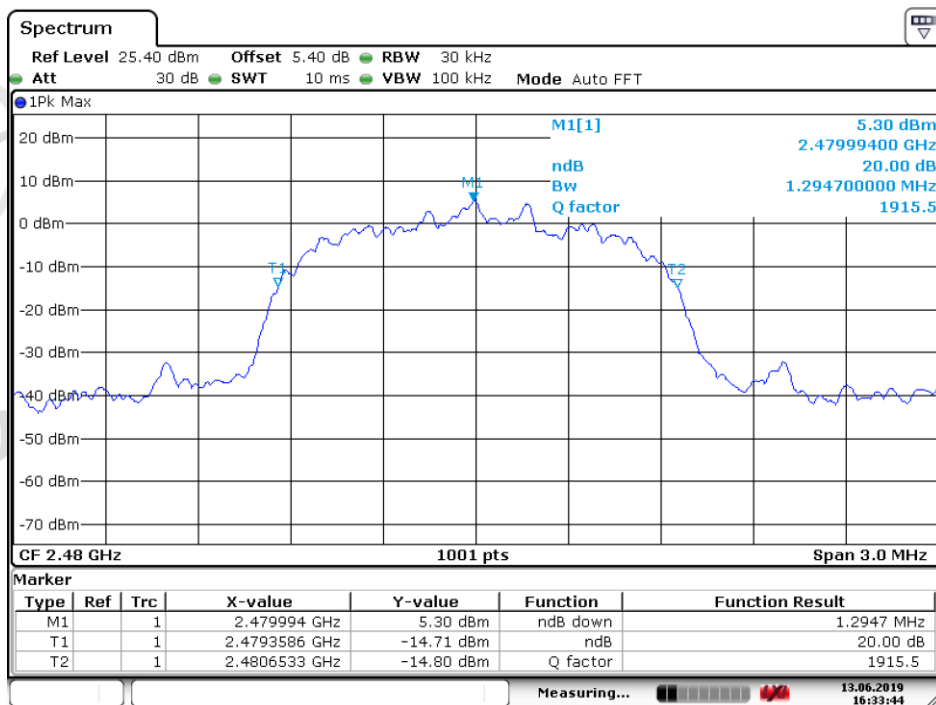


Date: 13. JUN.2019 16:33:33

8DPSK_Highest Channel



Date: 13. JUN.2019 16:29:46



Date: 13. JUN.2019 16:33:44

6 Carrier Frequencies Separation

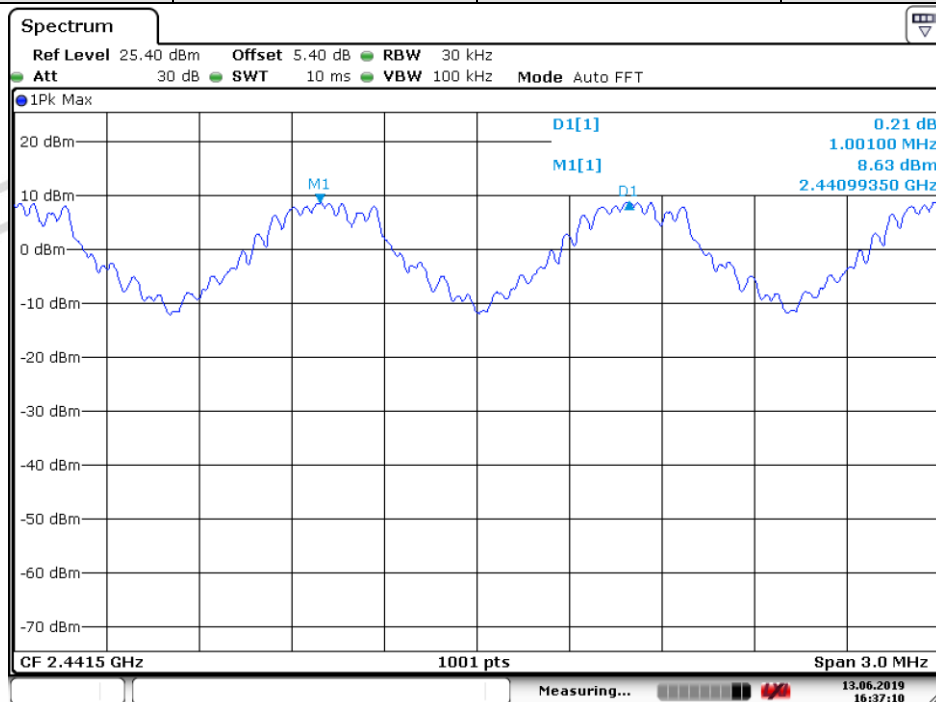
6.1 Test Results

GFSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	1001	651.3	Pass
$\pi/4$ DQPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	1001	861.1	Pass
8DPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	1001	863.1	Pass

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	977.0	651.3
$\pi/4$ DQPSK	1291.7	861.1
8DPSK	1294.7	863.1

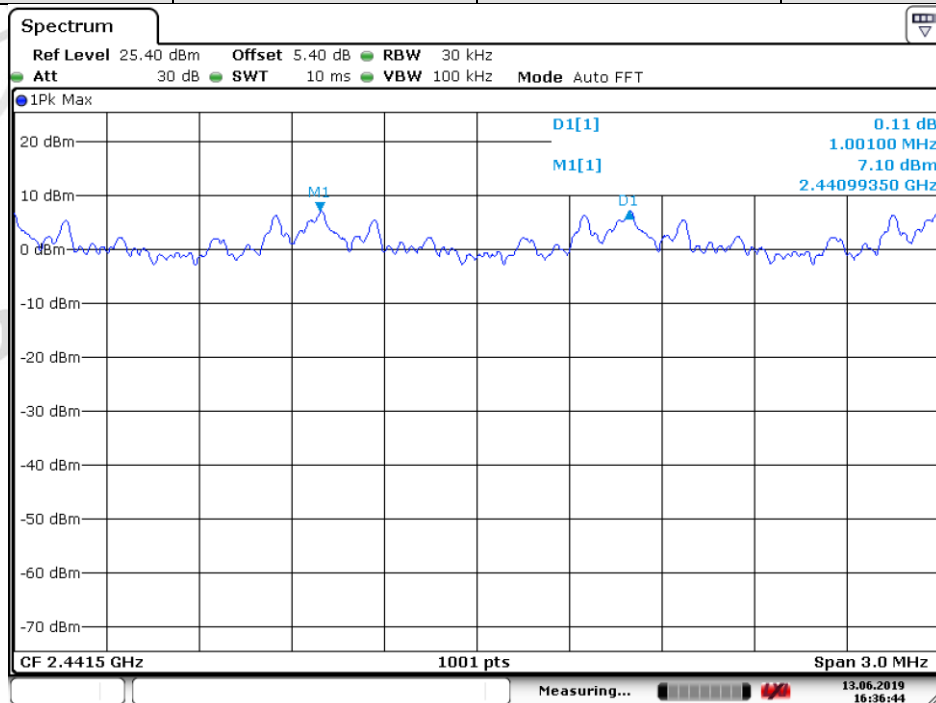
6.2 Test plots:

Test mode:	GFSK	Test channel:	Middle
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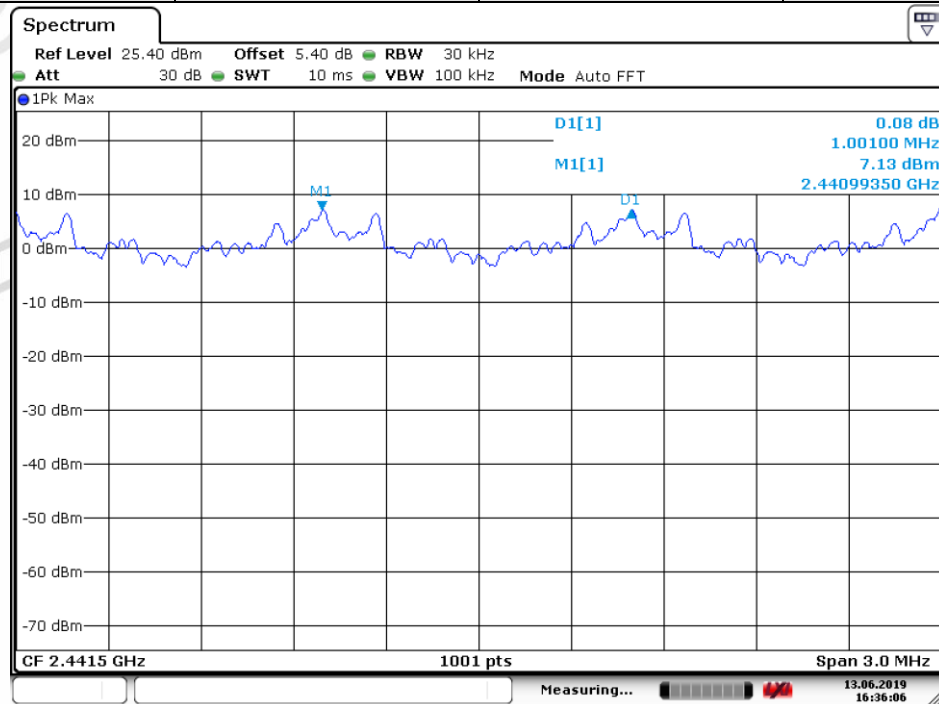
Date: 13.JUN.2019 16:37:11

Test mode:	$\pi/4$ DQPSK	Test channel:	Middle
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Date: 13.JUN.2019 16:36:44

Test mode:	8DPSK	Test channel:	Middle
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Date: 13 JUN.2019 16:36:06

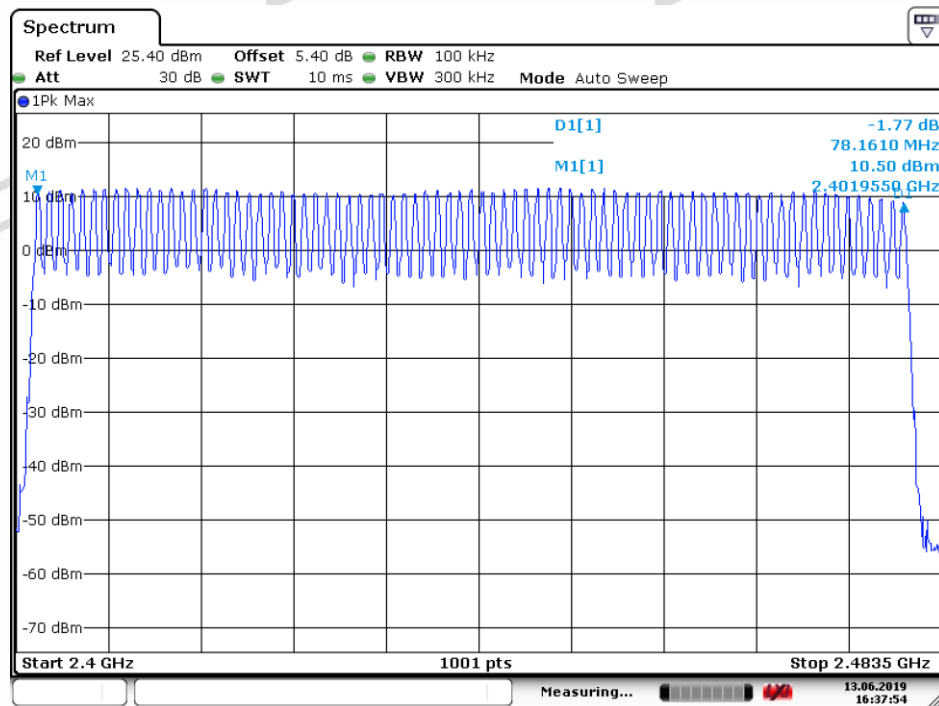
7 Hopping Channel Number

7.1 Test Results

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

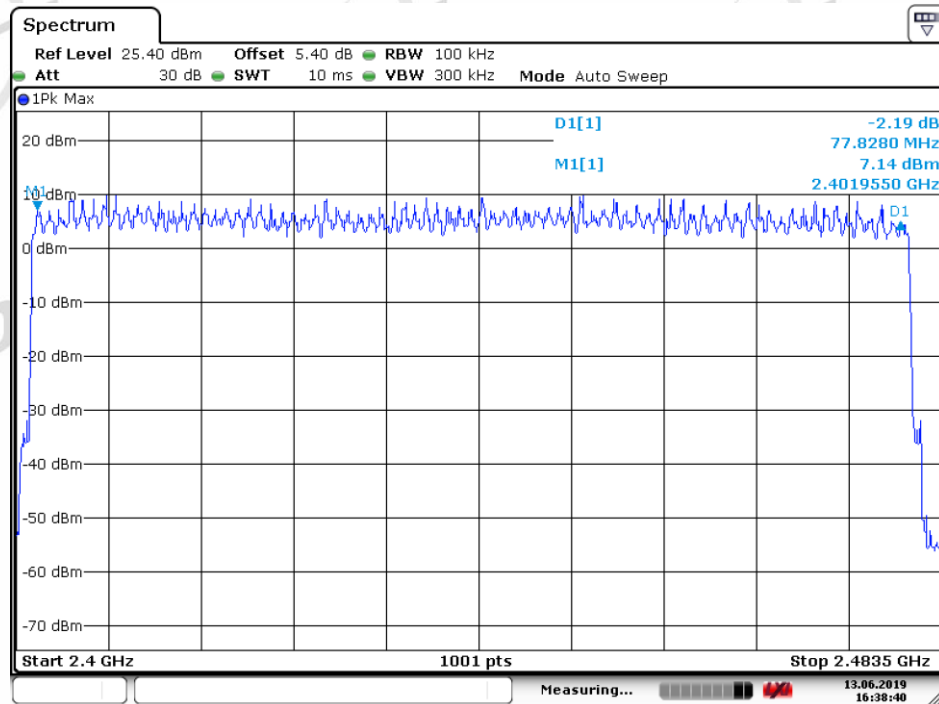
7.2 Test plots

GFSK



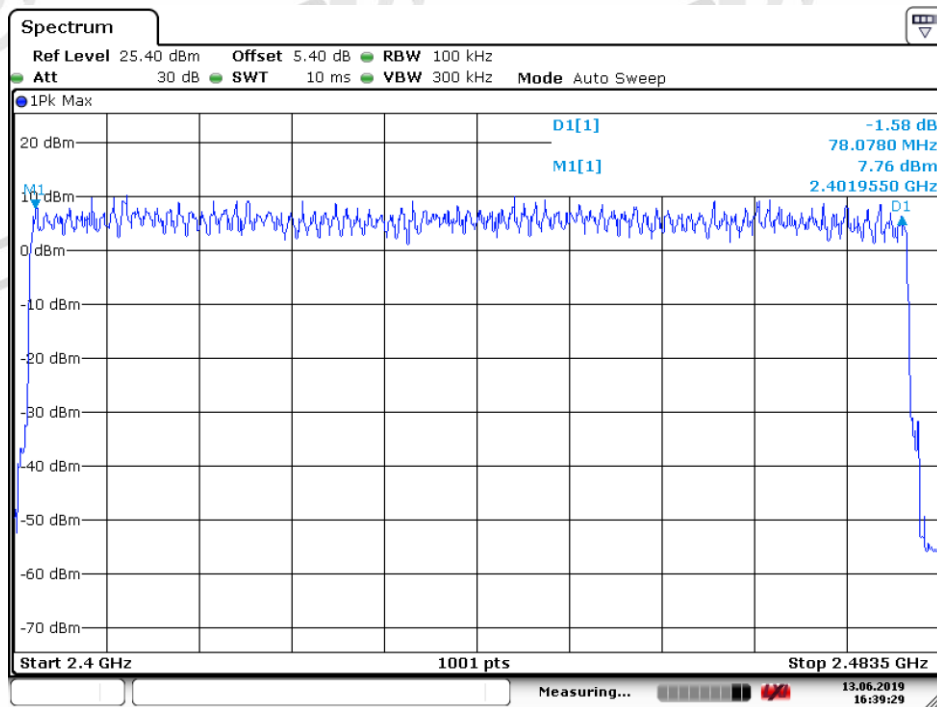
Date: 13 JUN.2019 16:37:55

$\pi/4$ DQPSK



Date: 13 JUN.2019 16:38:40

8DPSK



Date: 13 JUN.2019 16:39:29

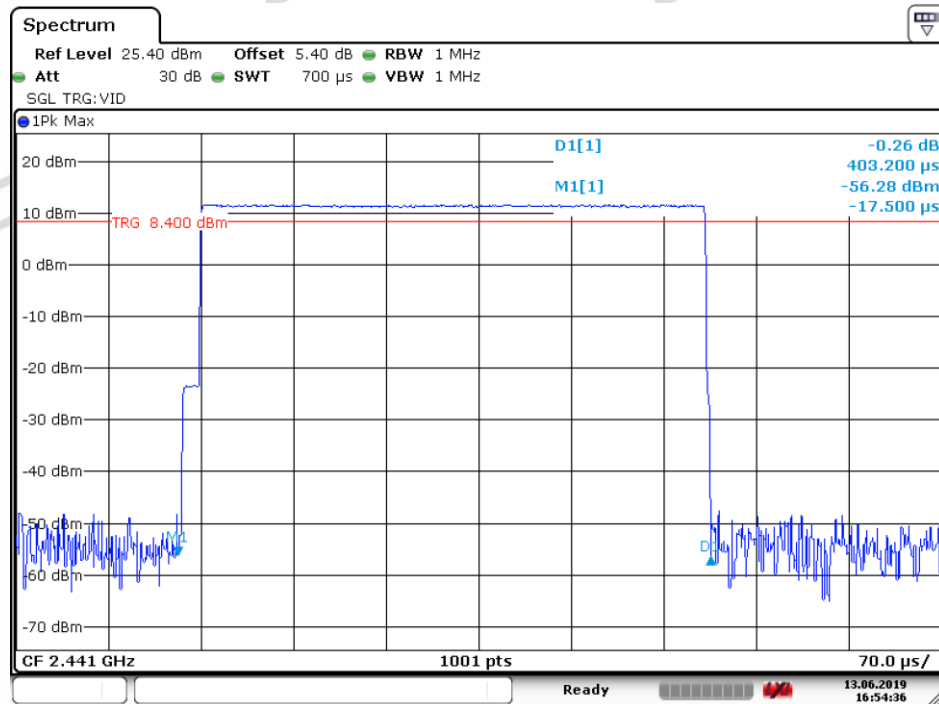
8 Dwell Time

8.1 Test Results

Operation Modes	On time (ms) on one channel
DH1	0.403
DH3	1.664
DH5	2.914
2-DH1	0.408
2-DH3	1.667
2-DH5	2.914
3-DH1	0.407
3-DH3	1.664
3-DH5	2.919

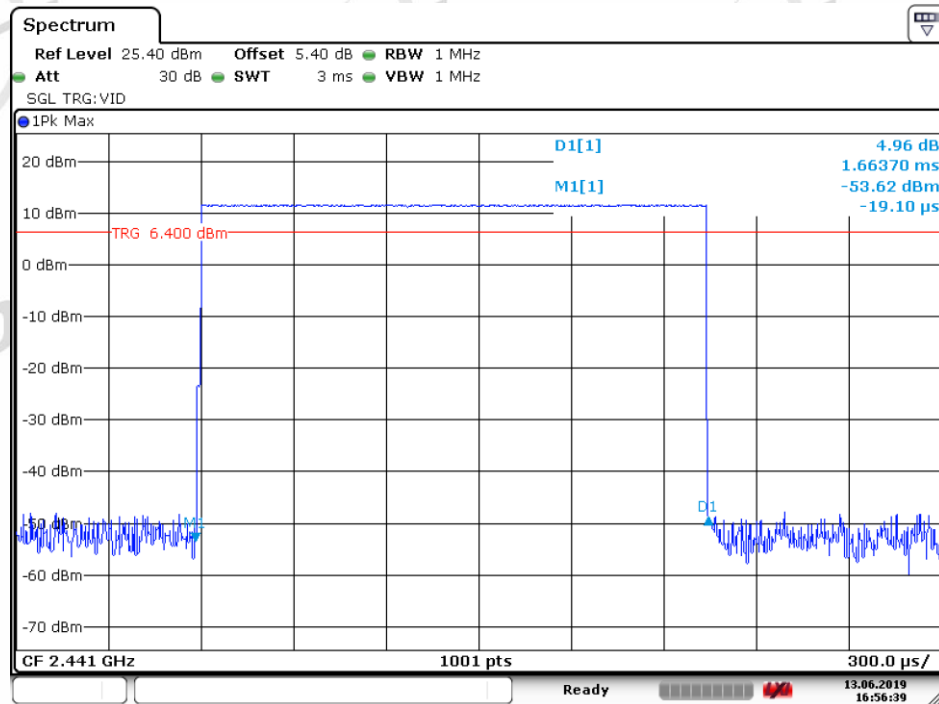
8.2 Test plots

DH1 _ Middle Channel



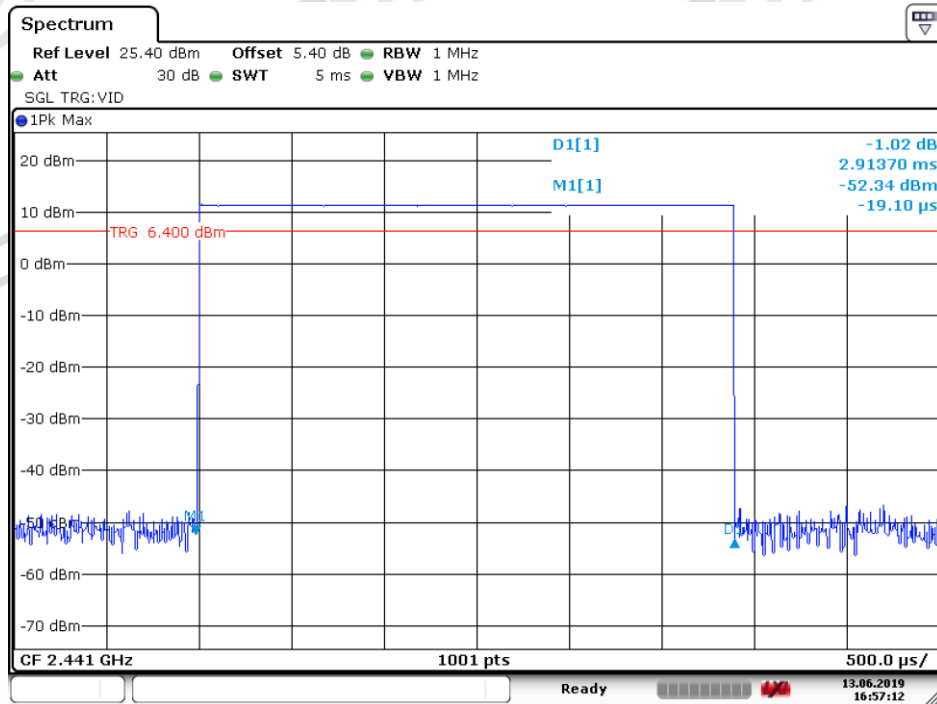
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DH3 _ Middle Channel



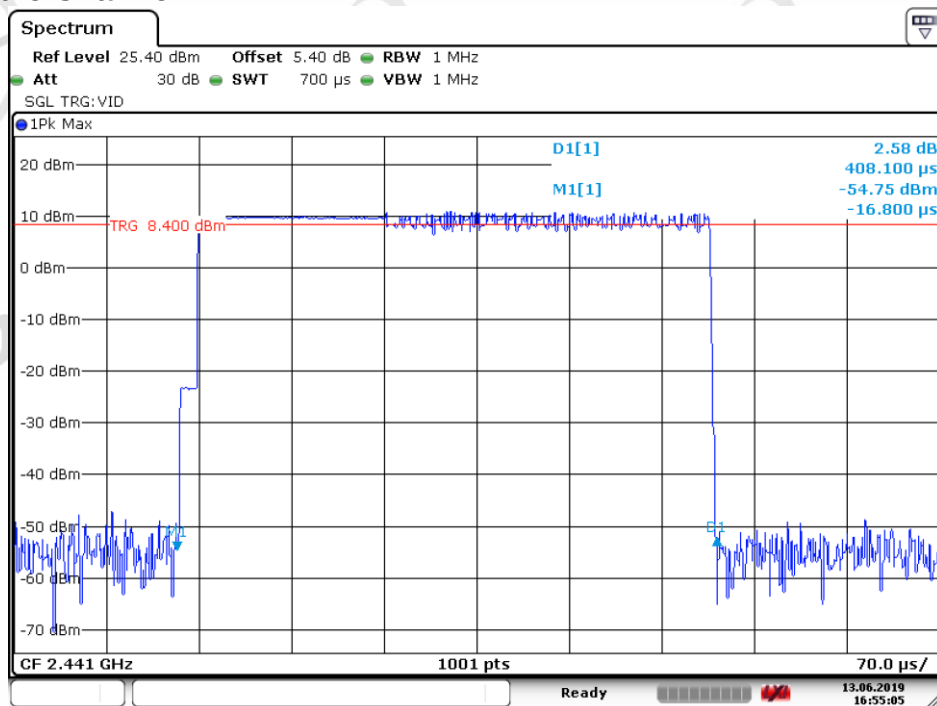
Date: 13 JUN.2019 16:56:39

DH5 _ Middle Channel



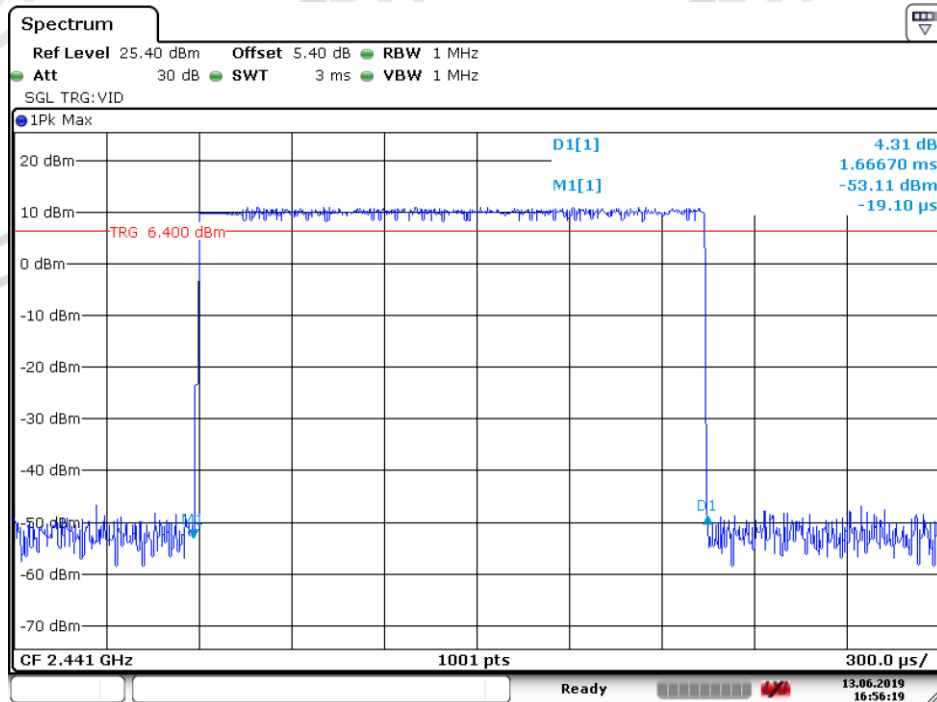
Date: 13. JUN.2019 16:57:12

2DH1 _ Middle Channel



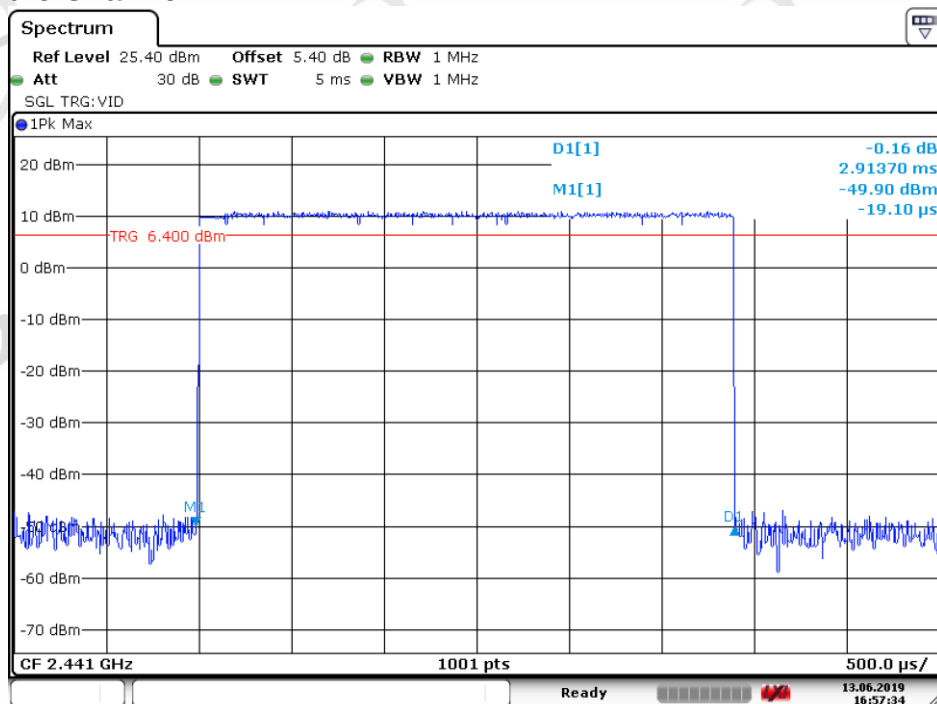
Date: 13. JUN.2019 16:55:05

2DH3 _ Middle Channel



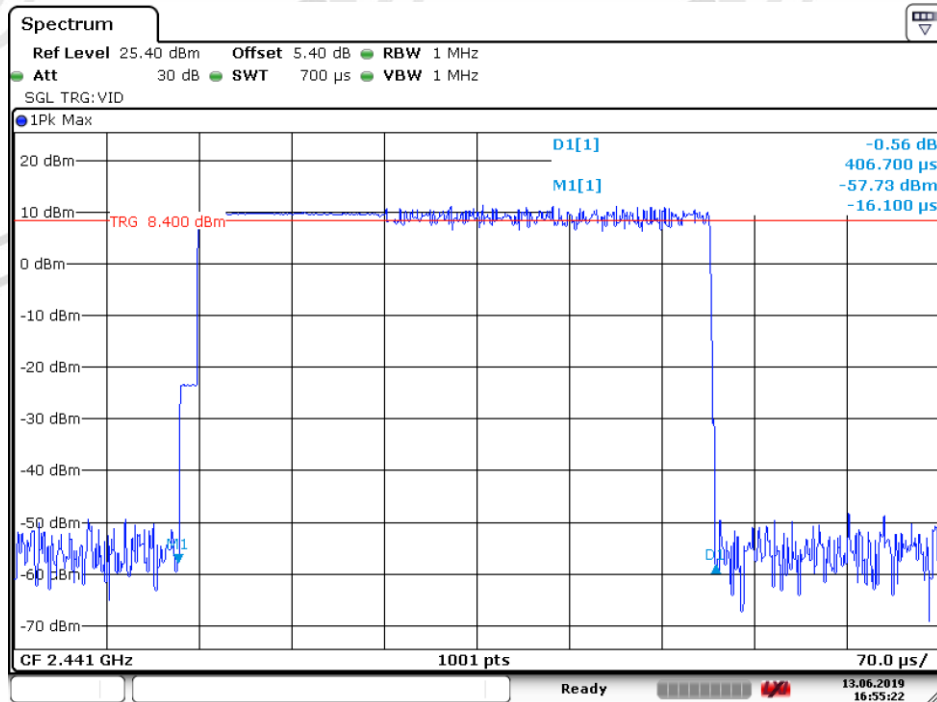
Date: 13. JUN.2019 16:56:19

2DH5 _ Middle Channel



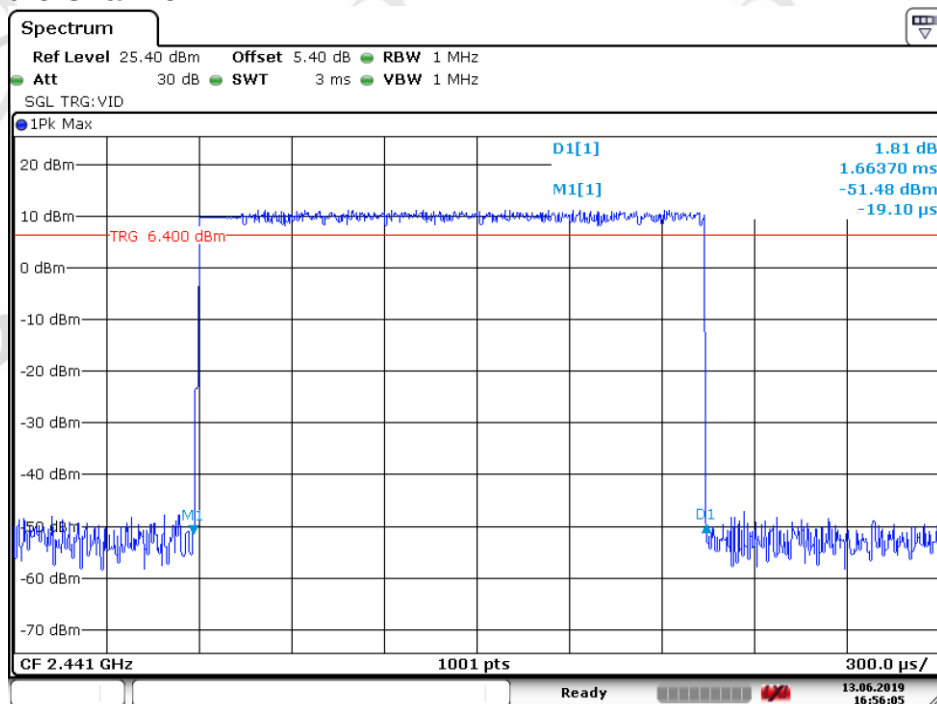
Date: 13. JUN.2019 16:57:34

3DH1 _ Middle Channel



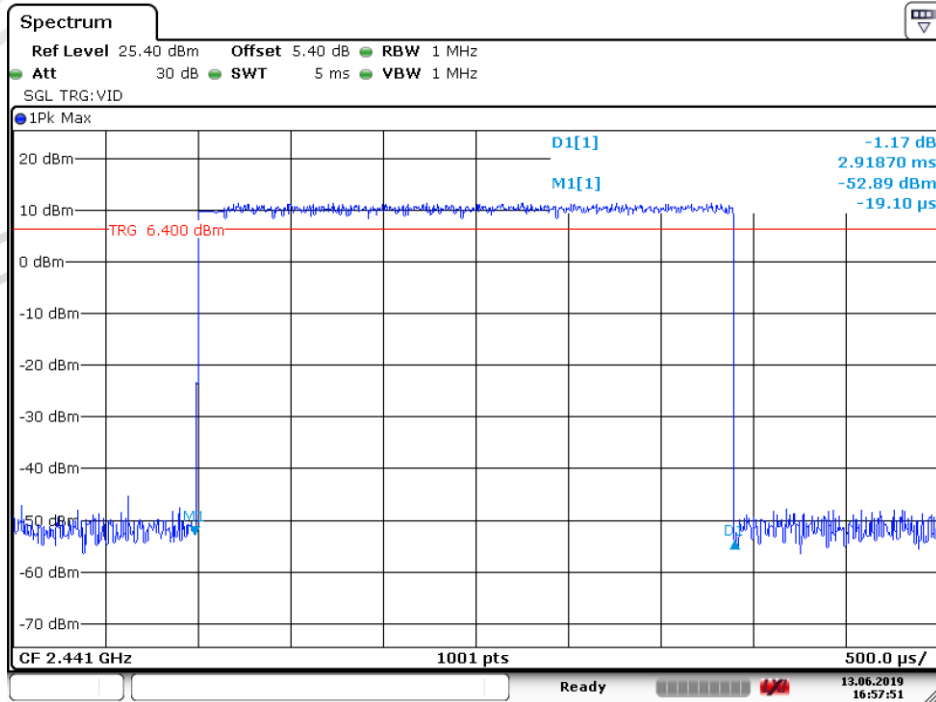
Date: 13. JUN.2019 16:55:21

3DH3 _ Middle Channel



Date: 13. JUN.2019 16:56:06

3DH5_Middle Channel

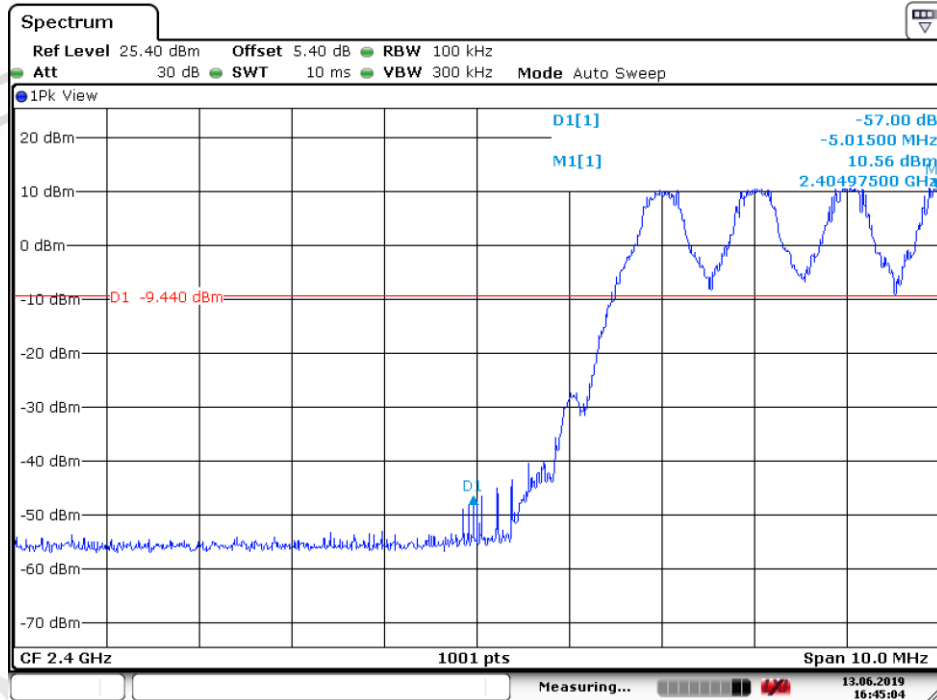


Date: 13 JUN.2019 16:57:51

9 Band-edge for RF Conducted Emissions

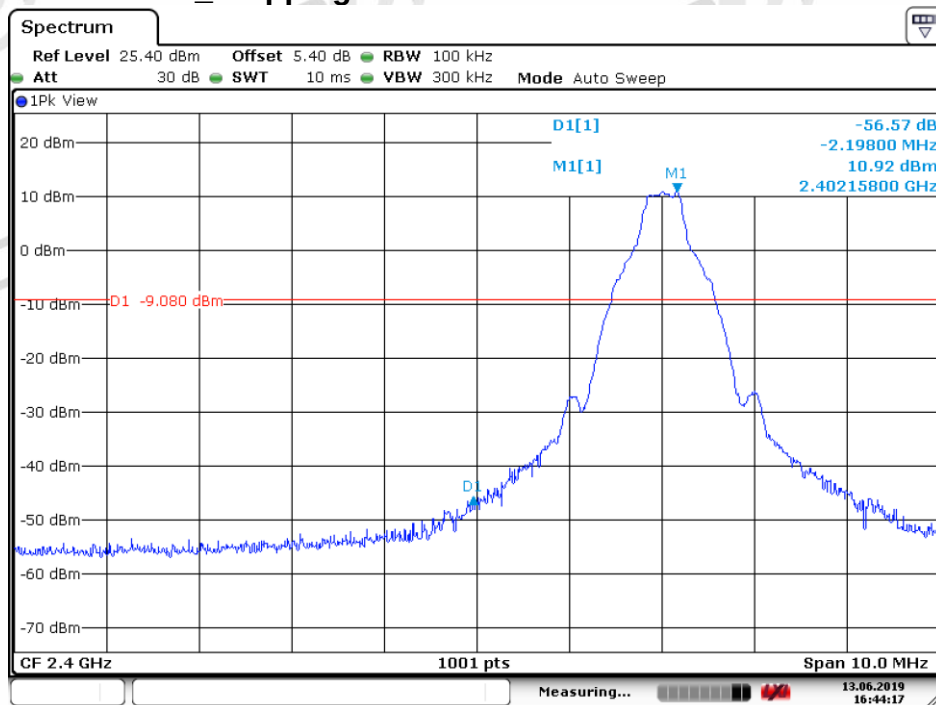
9.1 Test plots

GFSK _Lowest Channel_ Hopping ON

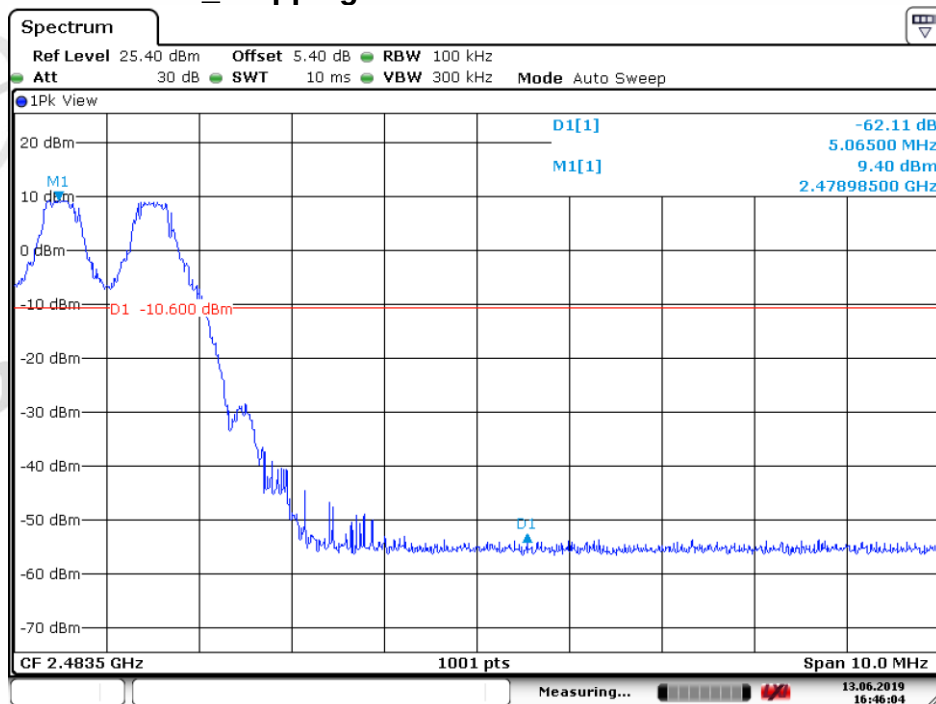


Date: 13 JUN.2019 16:45:04

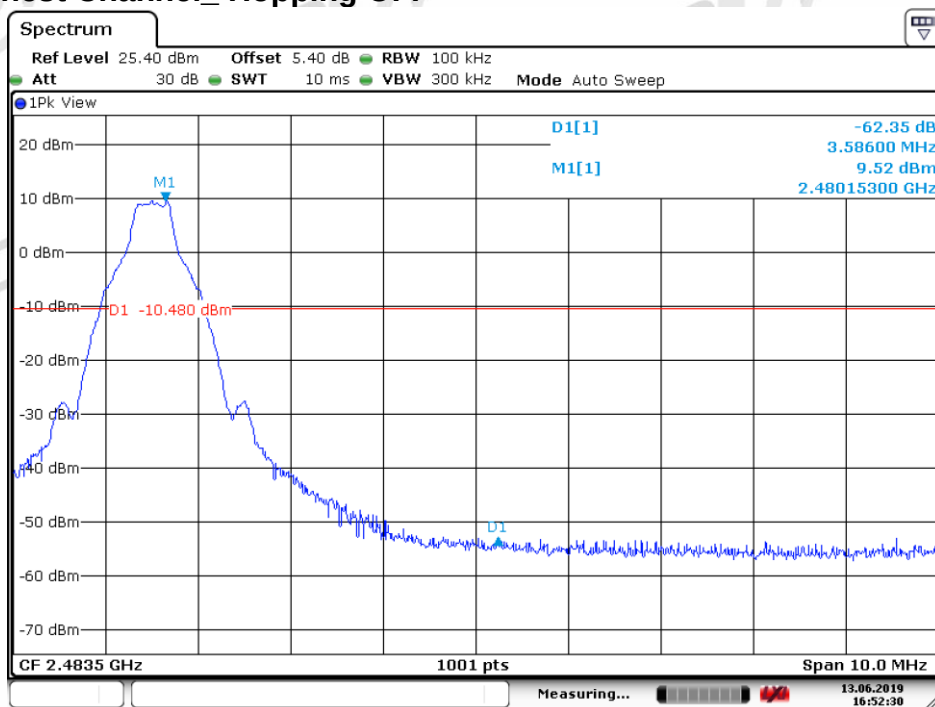
GFSK _Lowest Channel_ Hopping OFF



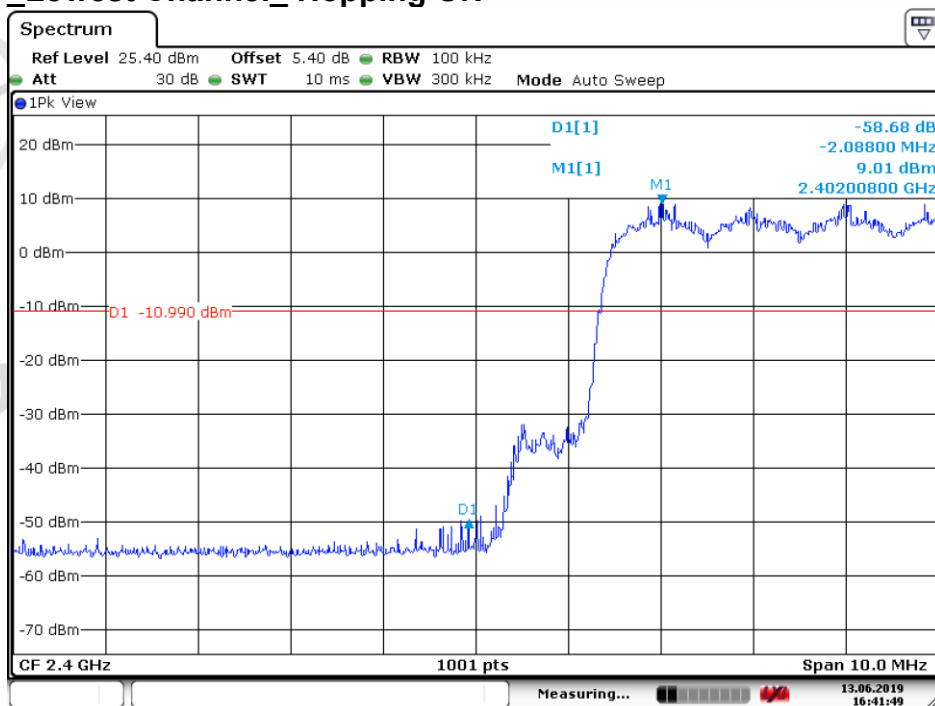
GFSK _Highest Channel_ Hopping ON



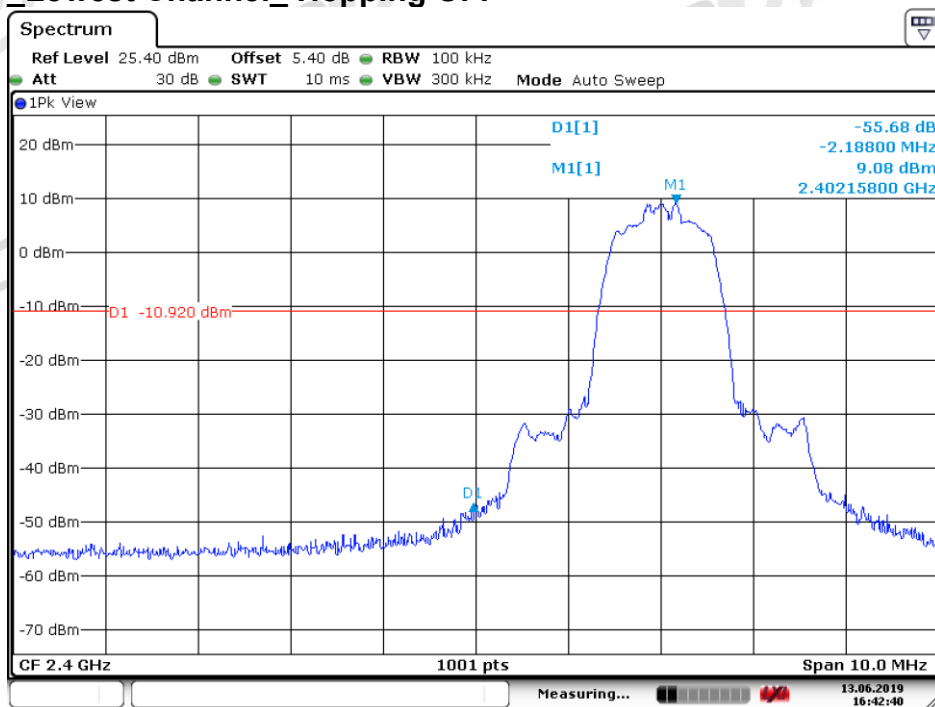
GFSK_Highest Channel_Hopping OFF



Date: 13. JUN.2019 16:52:31

 $\pi/4$ DQPSK_Lowest Channel_Hopping ON

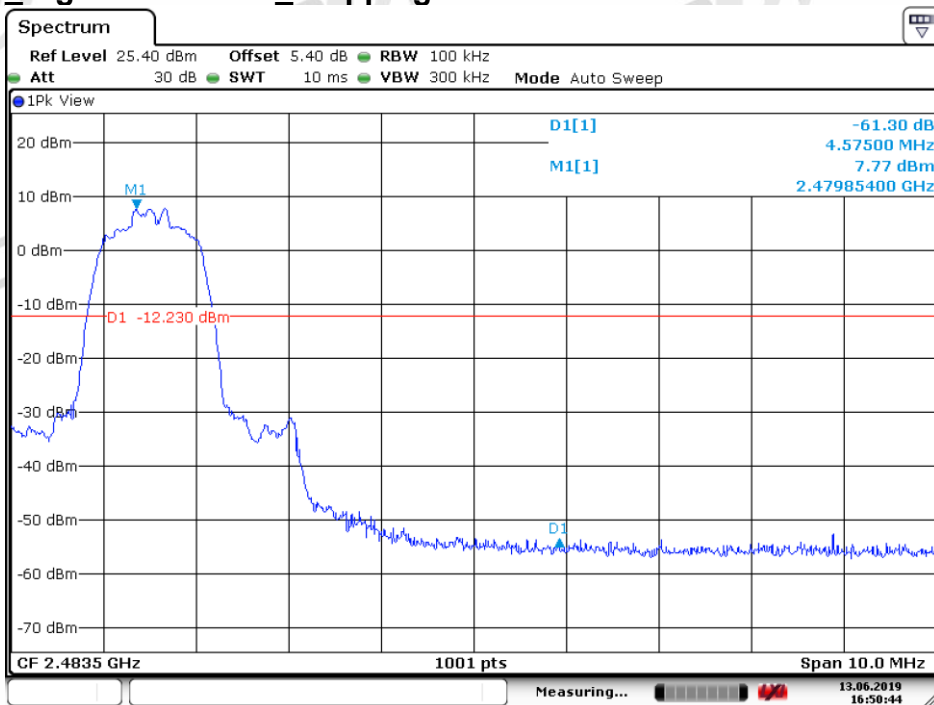
Date: 13. JUN.2019 16:41:50

$\pi/4$ DQPSK_Lowest Channel_ Hopping OFF

Date: 13. JUN.2019 16:42:40

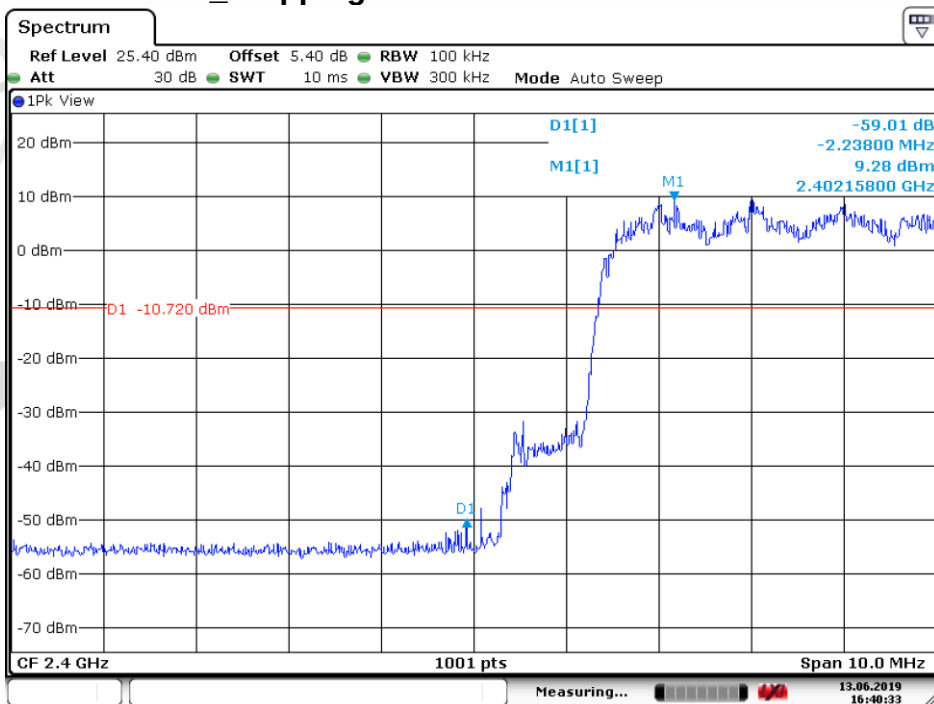
 $\pi/4$ DQPSK_Highest Channel_ Hopping ON

Date: 13. JUN.2019 16:47:05

$\pi/4$ DQPSK_Highest Channel_ Hopping OFF

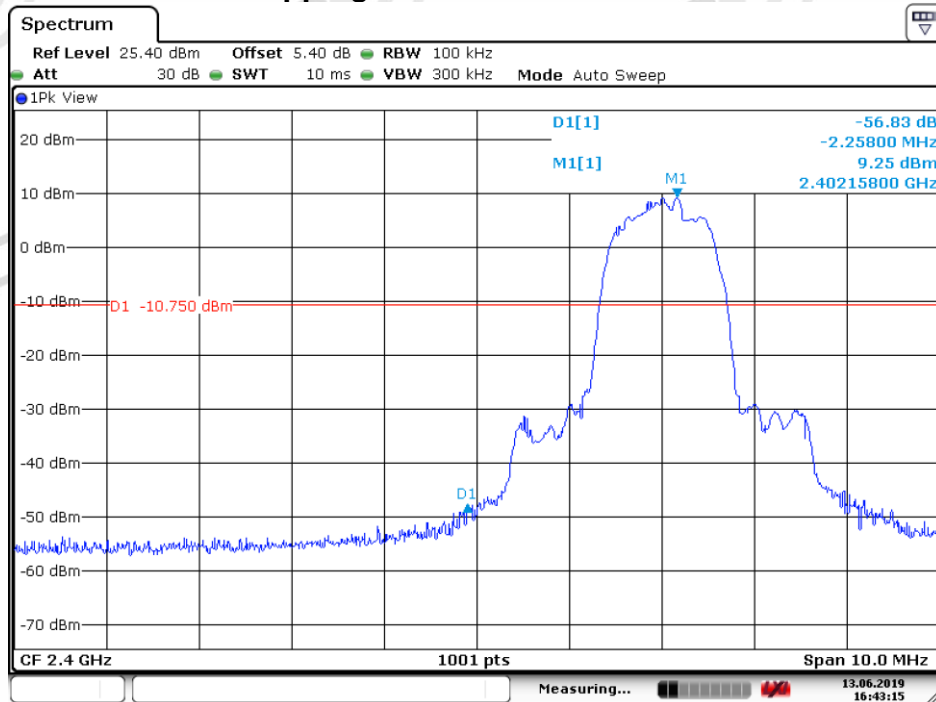
Date: 13. JUN.2019 16:50:44

8DPSK_Lowest Channel_ Hopping ON



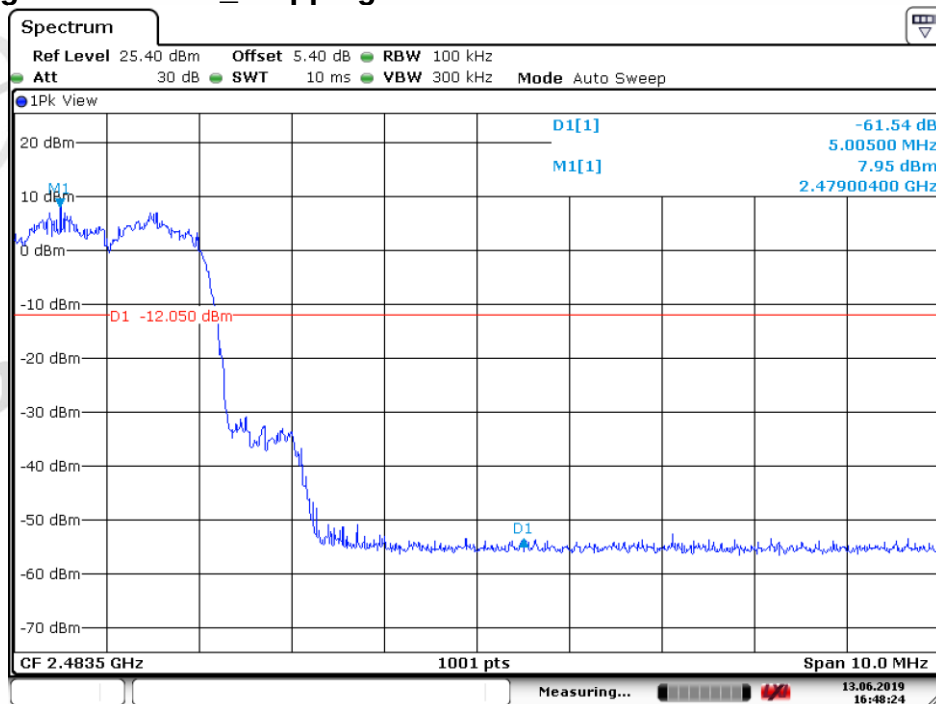
Date: 13. JUN.2019 16:40:34

8DPSK _Lowest Channel_ Hopping OFF



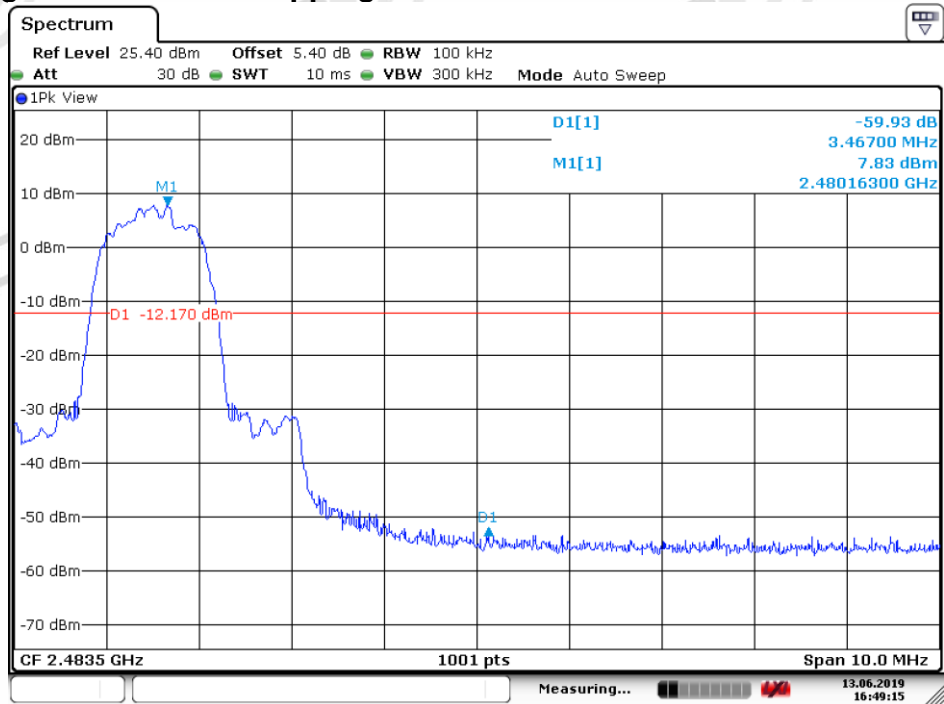
Date: 13. JUN.2019 16:43:16

8DPSK _Highest Channel_ Hopping ON



Date: 13. JUN.2019 16:48:24

8DPSK_Highest Channel_Hopping OFF

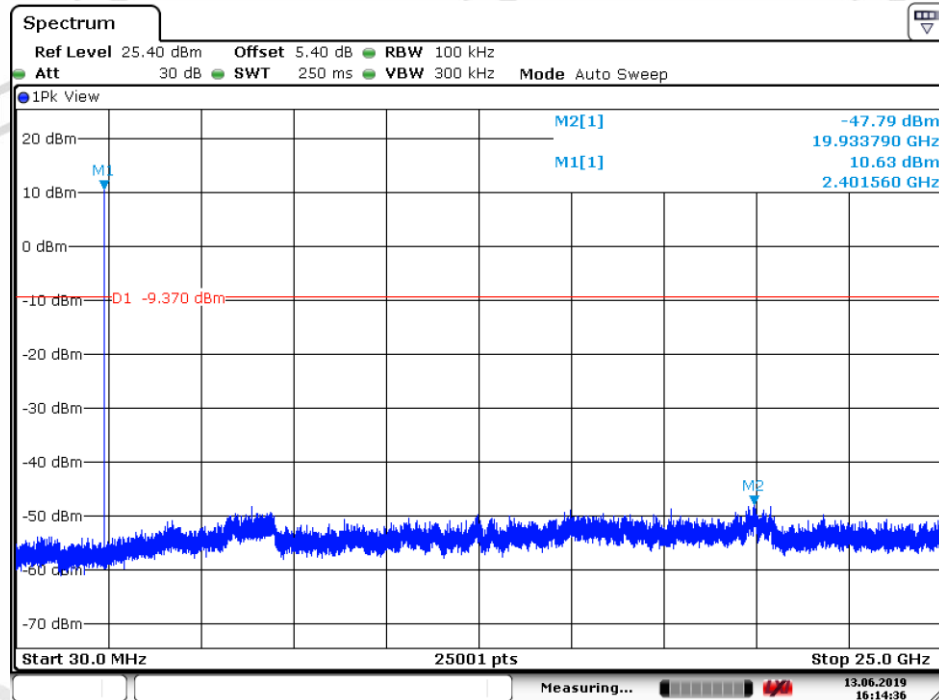


Date: 13. JUN.2019 16:49:16

10 Spurious RF Conducted Emissions

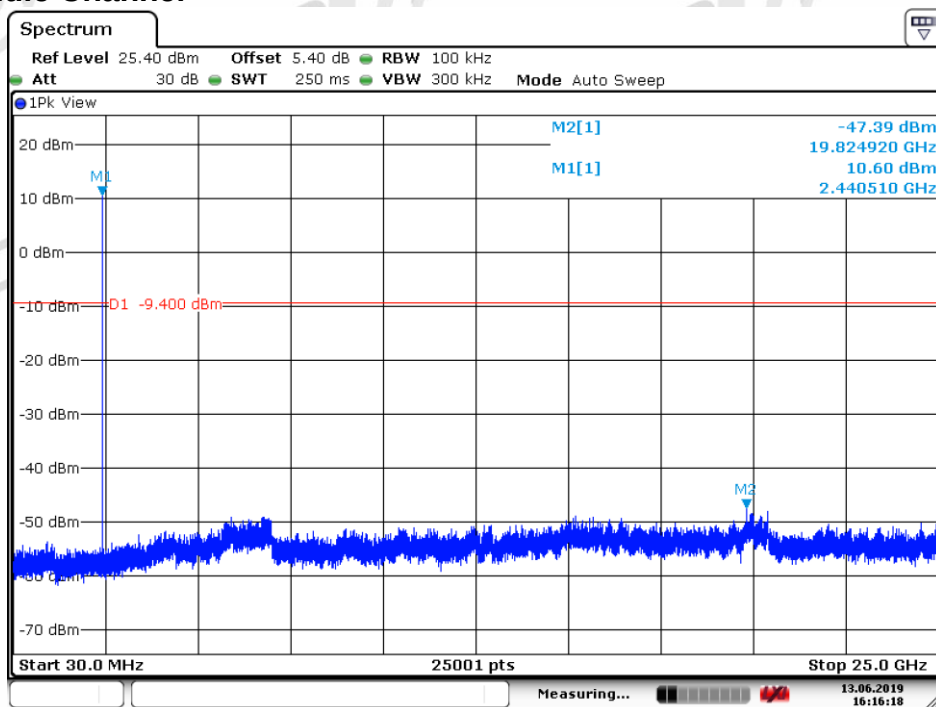
10.1 Test plots

GFSK _Lowest Channel



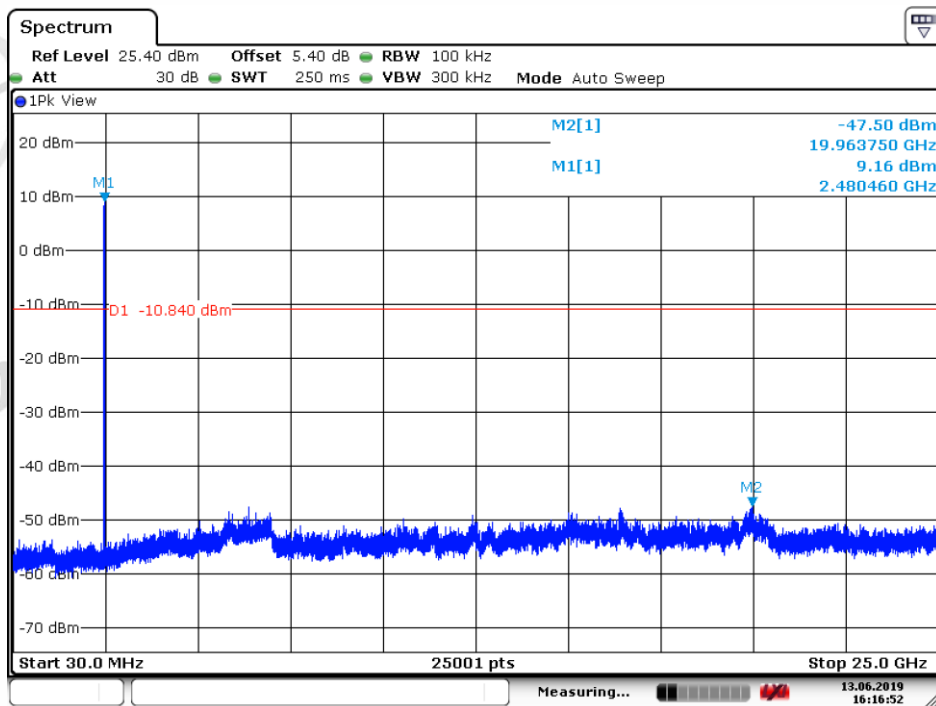
Date: 13 JUN 2019 16:14:37

GFSK_Middle Channel

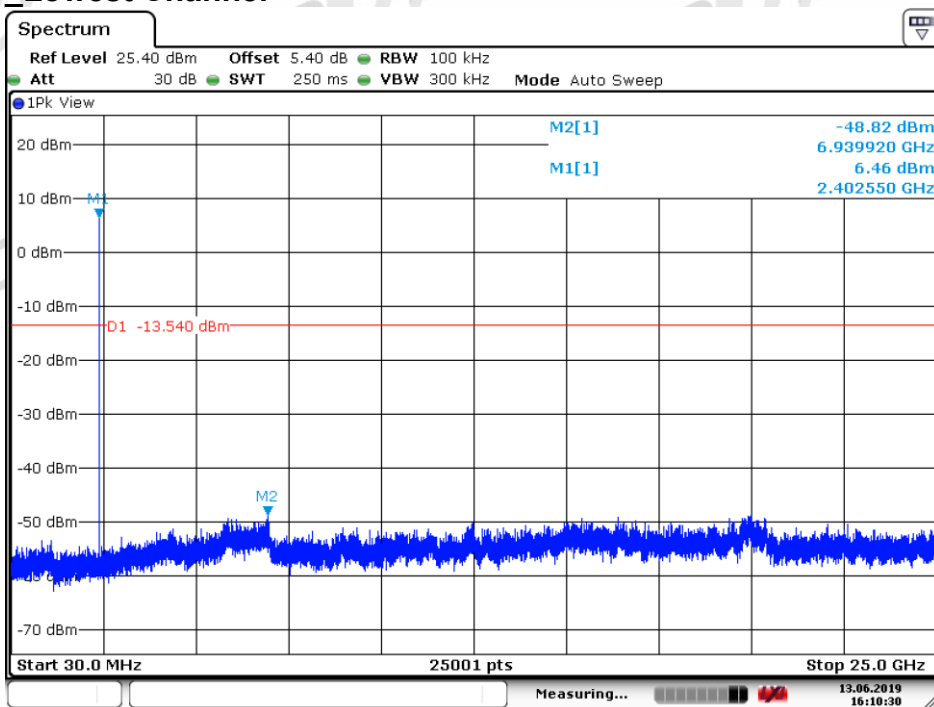


Date: 13. JUN.2019 16:16:19

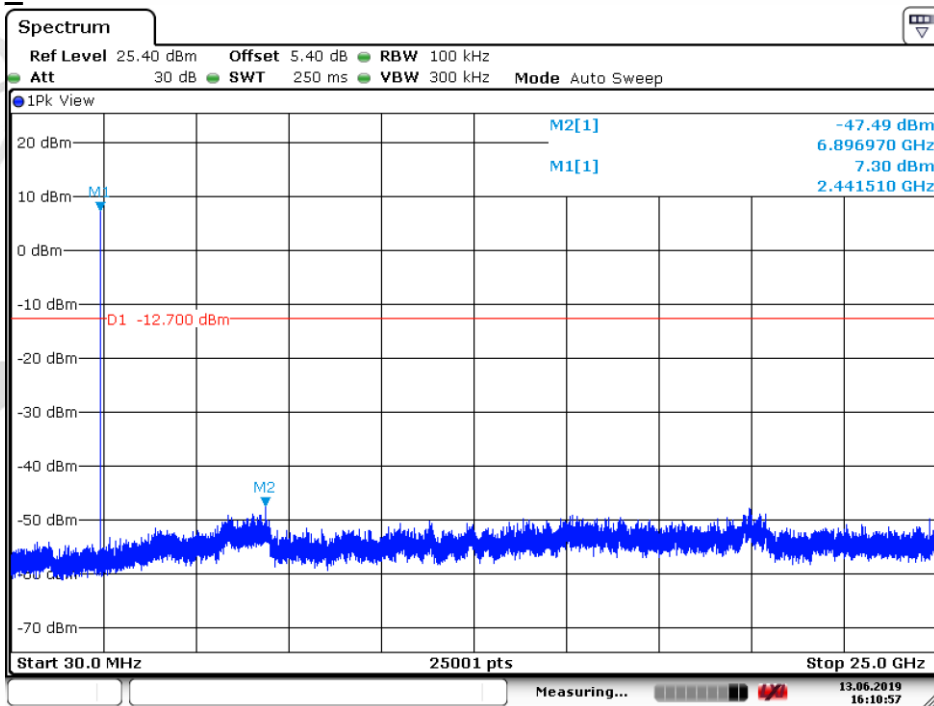
GFSK_Highest Channel



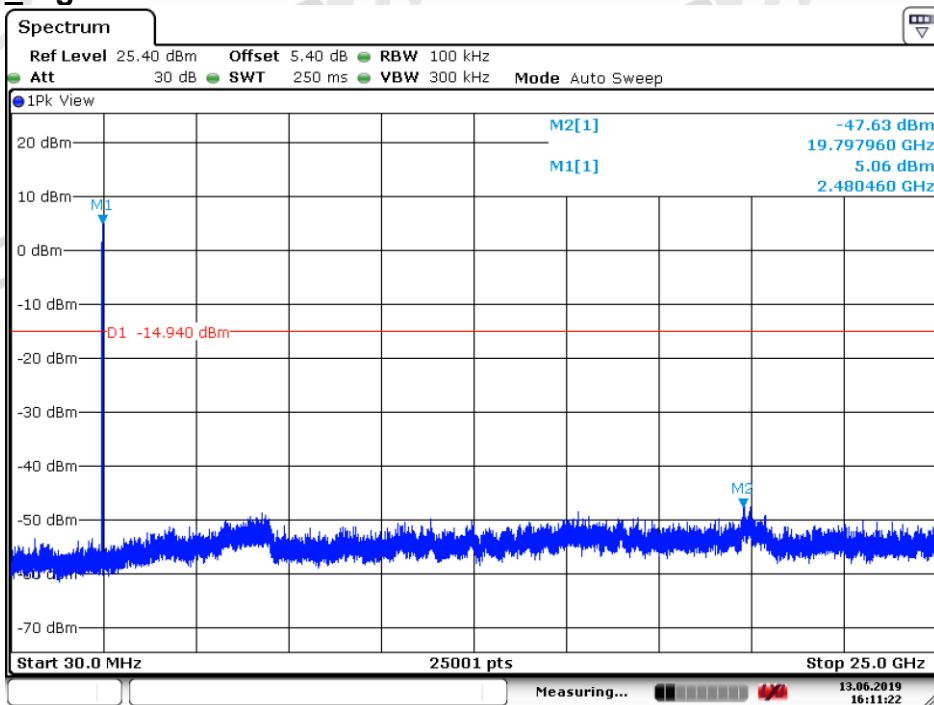
Date: 13. JUN.2019 16:16:52

$\pi/4$ DQPSK Lowest Channel

Date: 13. JUN.2019 16:10:30

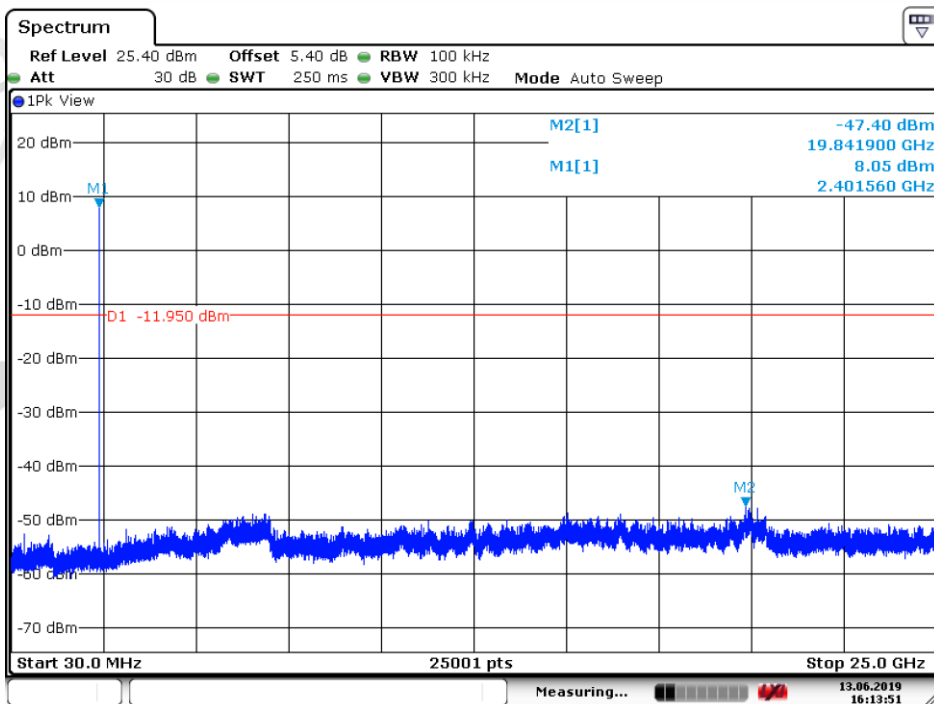
 $\pi/4$ DQPSK Middle Channel

Date: 13. JUN.2019 16:10:57

$\pi/4$ DQPSK_Highest Channel

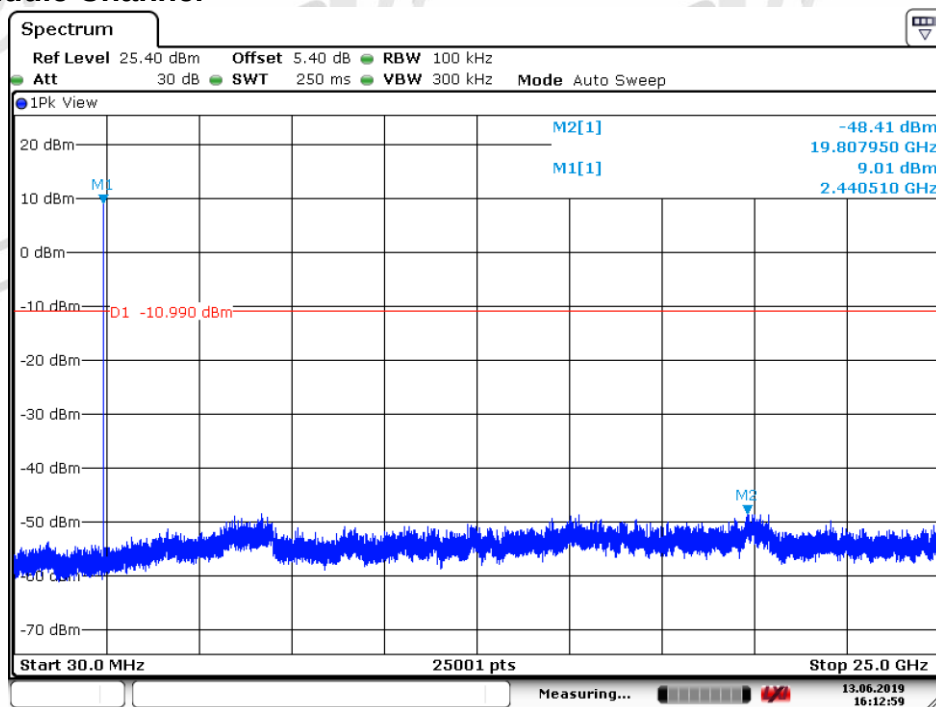
Date: 13. JUN.2019 16:11:23

8DPSK_Lowest Channel



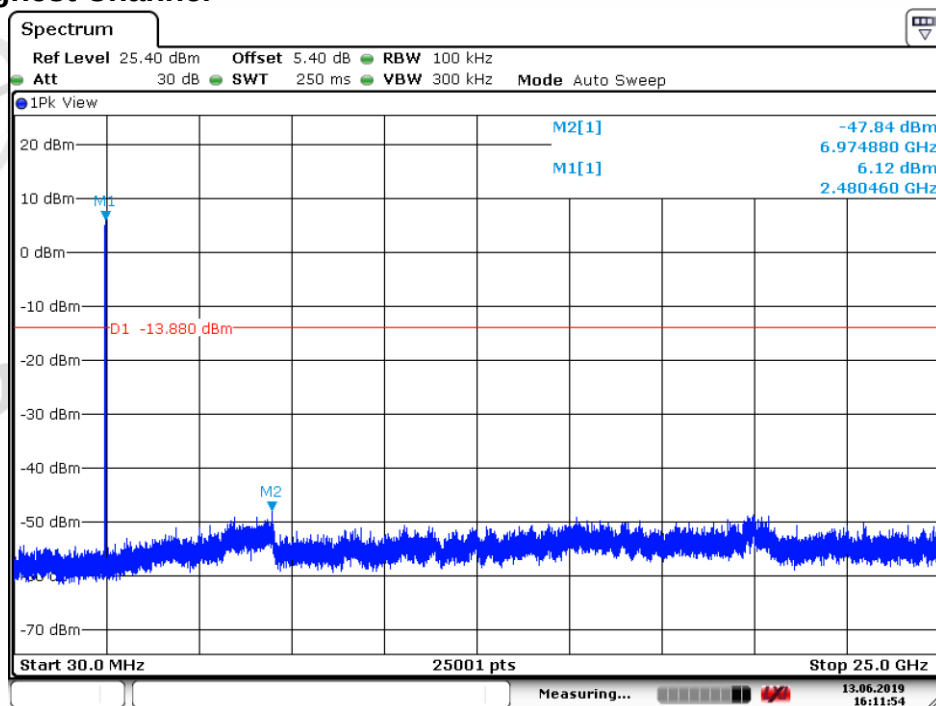
Date: 13. JUN.2019 16:13:51

8DPSK_Middle Channel



Date: 13.JUN.2019 16:12:59

8DPSK_Highest Channel



Date: 13.JUN.2019 16:11:55

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