

Appendix

Main Test Instruments

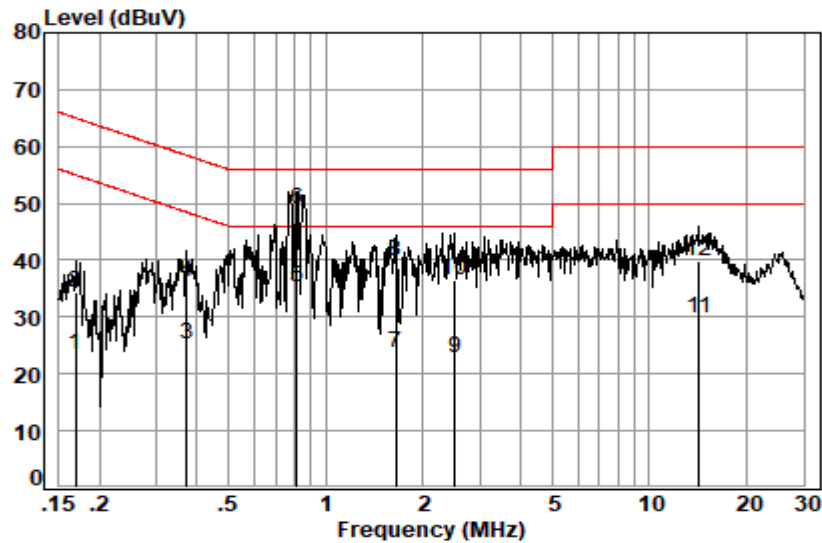
Conducted Emission					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal.Duedate
				(yyyy-mm-dd)	(yyyy-mm-dd)
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2017/5/10	2020/5/9
LISN	Rohde & Schwarz	ENV216	SEM007-01	2018/9/2	2019/9/2
LISN	ETS-LINDGREN	Feb-16	SEM007-02	2019/3/2	2020/3/1
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

Measurement Uncertainty

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)
5	Temperature test	±1°C
6	Humidity test	±3%
7	DC and low frequency voltages	±0.5%

AC Power Line Conducted Emissions

Live line:



Site : Shielding Room

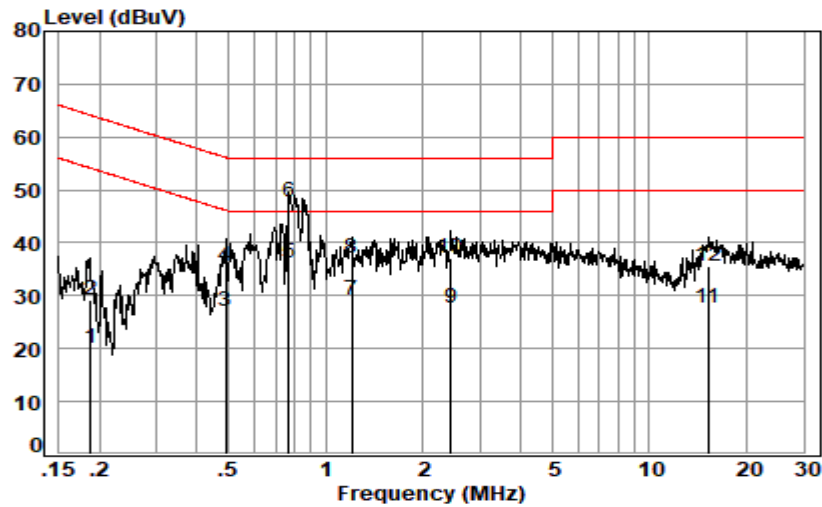
Condition: Line

Job No. : 16053CR

Test mode: a

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1685	0.01	9.66	13.90	23.57	55.03	-31.46	Average
2	0.1685	0.01	9.66	24.73	34.40	65.03	-30.63	QP
3	0.3712	0.05	9.67	15.58	25.30	48.47	-23.17	Average
4	0.3712	0.05	9.67	26.56	36.28	58.47	-22.19	QP
5	0.8131	0.08	9.74	25.55	35.37	46.00	-10.63	Average
6	0.8131	0.08	9.74	39.09	48.91	56.00	-7.09	QP
7	1.6450	0.14	9.73	13.86	23.73	46.00	-22.27	Average
8	1.6450	0.14	9.73	29.92	39.79	56.00	-16.21	QP
9	2.5133	0.16	9.71	12.99	22.86	46.00	-23.14	Average
10	2.5133	0.16	9.71	26.52	36.39	56.00	-19.61	QP
11	14.2127	0.20	10.28	19.23	29.71	50.00	-20.29	Average
12	14.2127	0.20	10.28	29.34	39.82	60.00	-20.18	QP

Neutral line:



Site : Shielding Room
 Condition: Neutral
 Job No. : 16053CR
 Test mode: a

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1874	0.02	9.64	10.42	20.08	54.15	-34.07	Average
2	0.1874	0.02	9.64	19.53	29.19	64.15	-34.96	QP
3	0.4915	0.06	9.64	17.46	27.16	46.14	-18.98	Average
4	0.4915	0.06	9.64	25.82	35.52	56.14	-20.62	QP
5	0.7711	0.08	9.69	26.49	36.26	46.00	-9.74	Average
6	0.7711	0.08	9.69	38.05	47.82	56.00	-8.18	QP
7	1.2034	0.11	9.70	19.47	29.28	46.00	-16.72	Average
8	1.2034	0.11	9.70	27.26	37.07	56.00	-18.93	QP
9	2.4346	0.16	9.68	17.83	27.67	46.00	-18.33	Average
10	2.4346	0.16	9.68	27.21	37.05	56.00	-18.95	QP
11	15.2261	0.21	10.37	17.20	27.78	50.00	-22.22	Average
12	15.2261	0.21	10.37	25.01	35.59	60.00	-24.41	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.

Conducted Peak Output Power

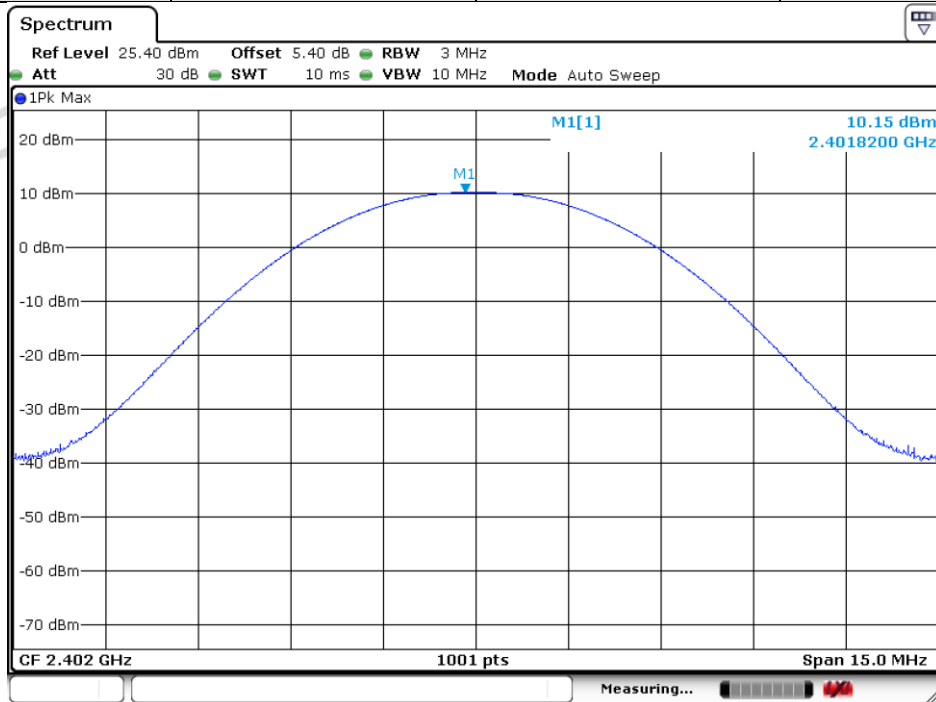
Test Results

Measurement Data of Peak power:

GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	10.15	20.97	Pass
Middle	10.33	20.97	Pass
Highest	9.17	20.97	Pass
$\pi/4$ DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	9.81	20.97	Pass
Middle	9.76	20.97	Pass
Highest	8.73	20.97	Pass
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	9.97	20.97	Pass
Middle	10.01	20.97	Pass
Highest	8.93	20.97	Pass

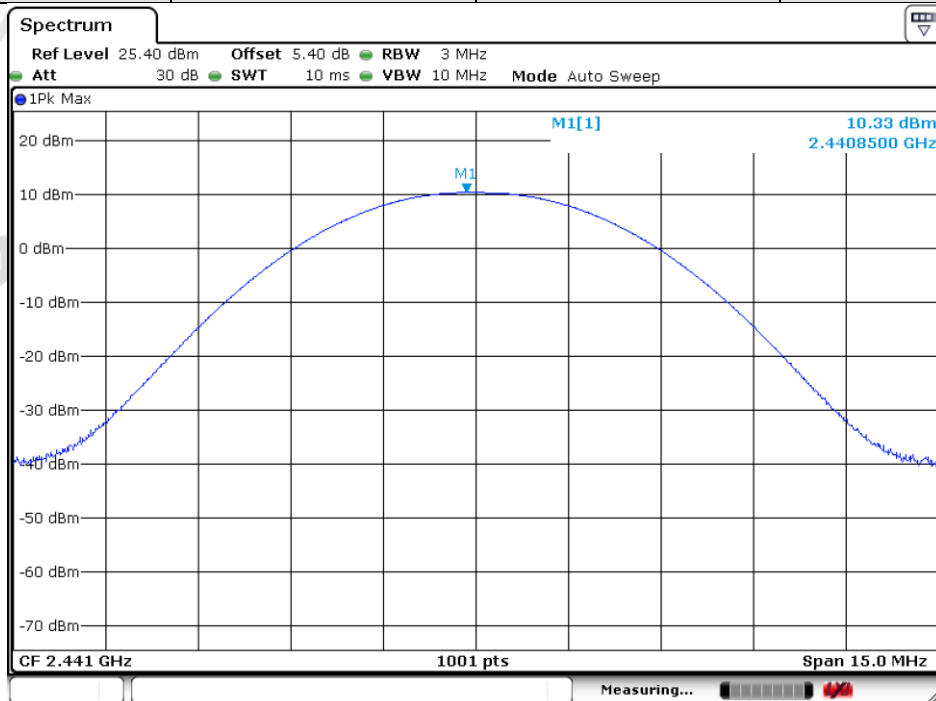
Test plots

Test mode:	GFSK	Test channel:	Lowest
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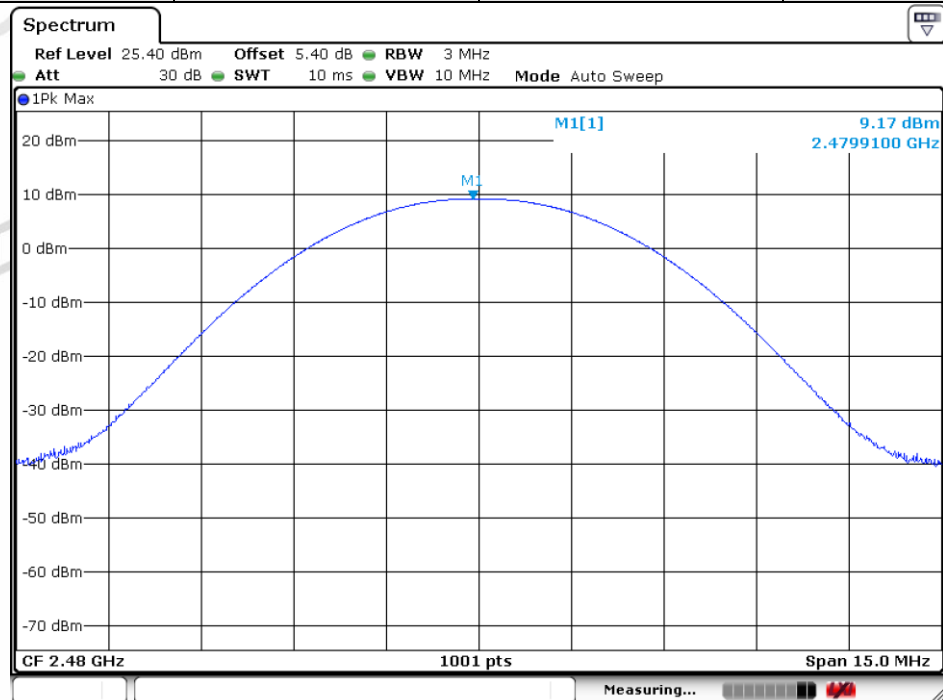
Date: 12.JUL.2019 21:48:34

Test mode:	GFSK	Test channel:	Middle
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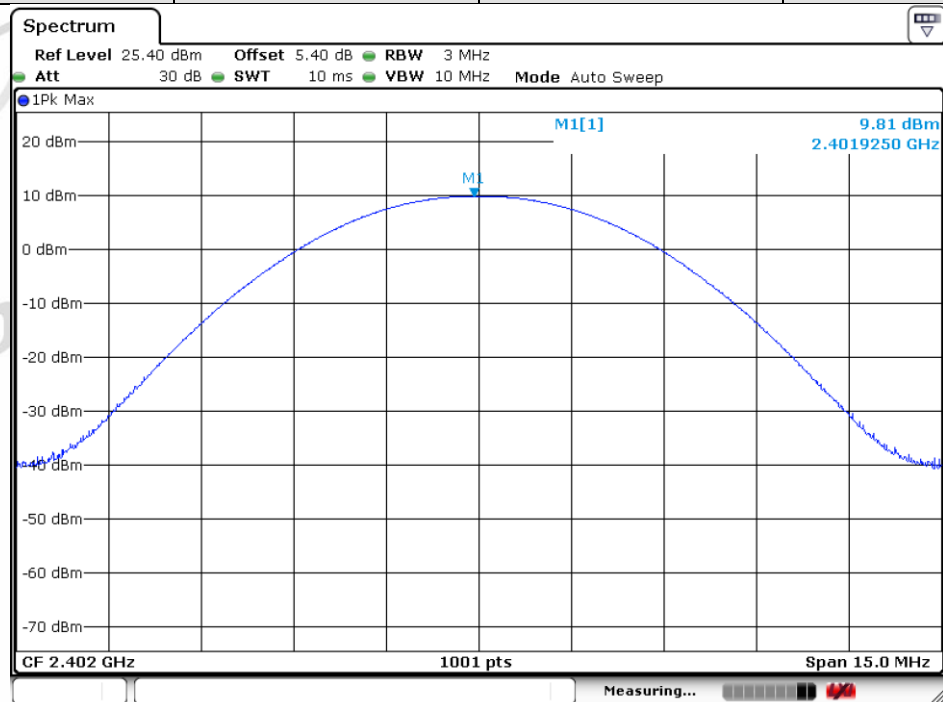
Date: 12.JUL.2019 21:49:08

Test mode:	GFSK	Test channel:	Highest
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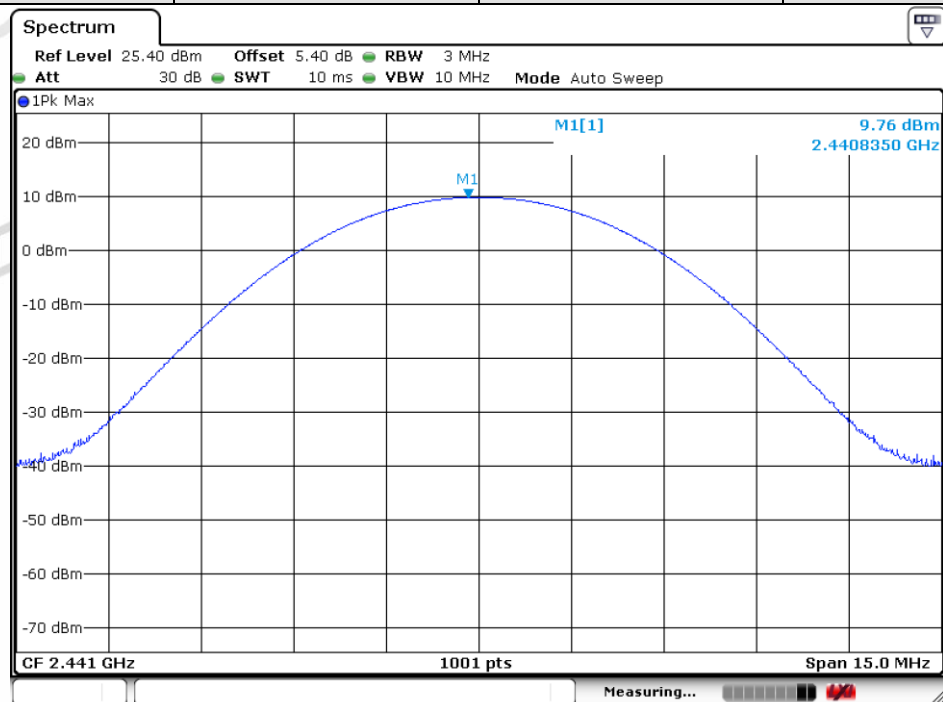
Date: 12 JUL 2019 21:49:28

Test mode:	$\pi/4$ DQPSK	Test channel:	Lowest
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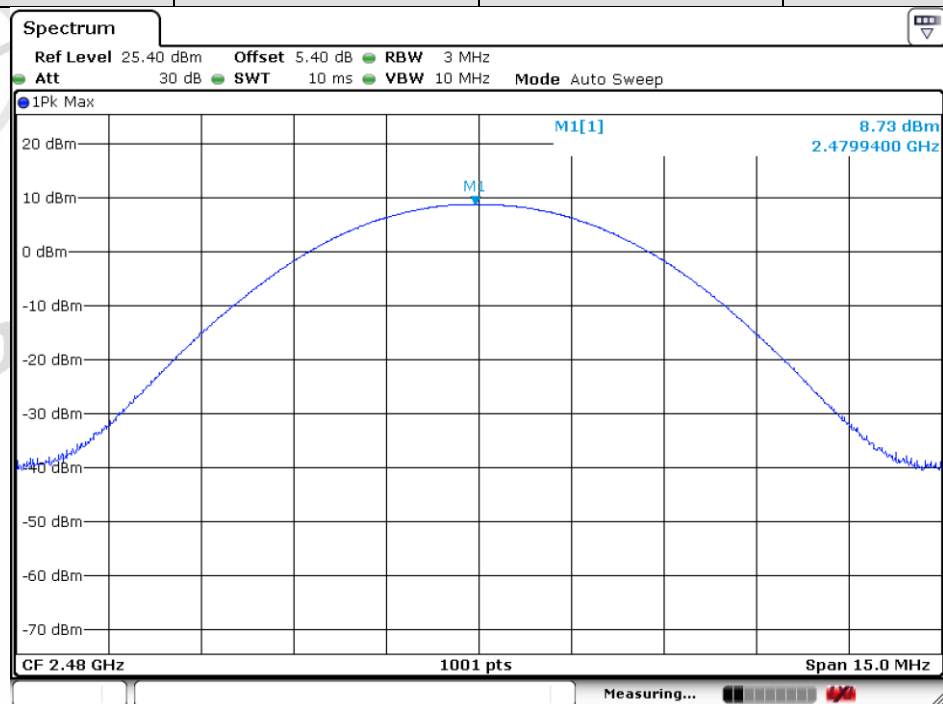
Date: 12 JUL 2019 21:52:20

Test mode:	$\pi/4$ DQPSK	Test channel:	Middle
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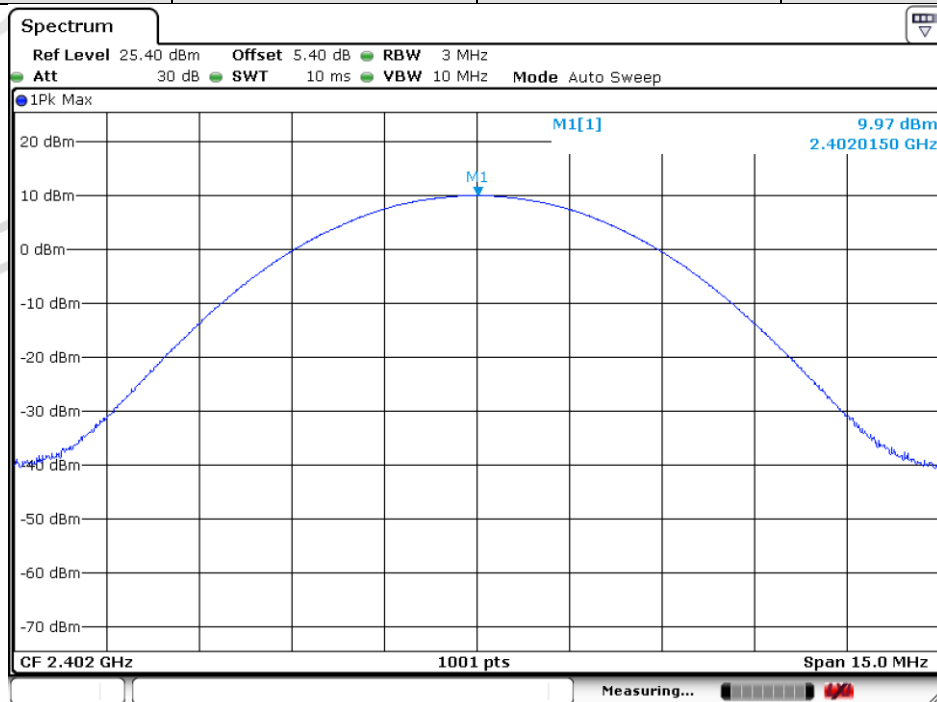
Date: 12.JUL.2019 21:52:03

Test mode:	$\pi/4$ DQPSK	Test channel:	Highest
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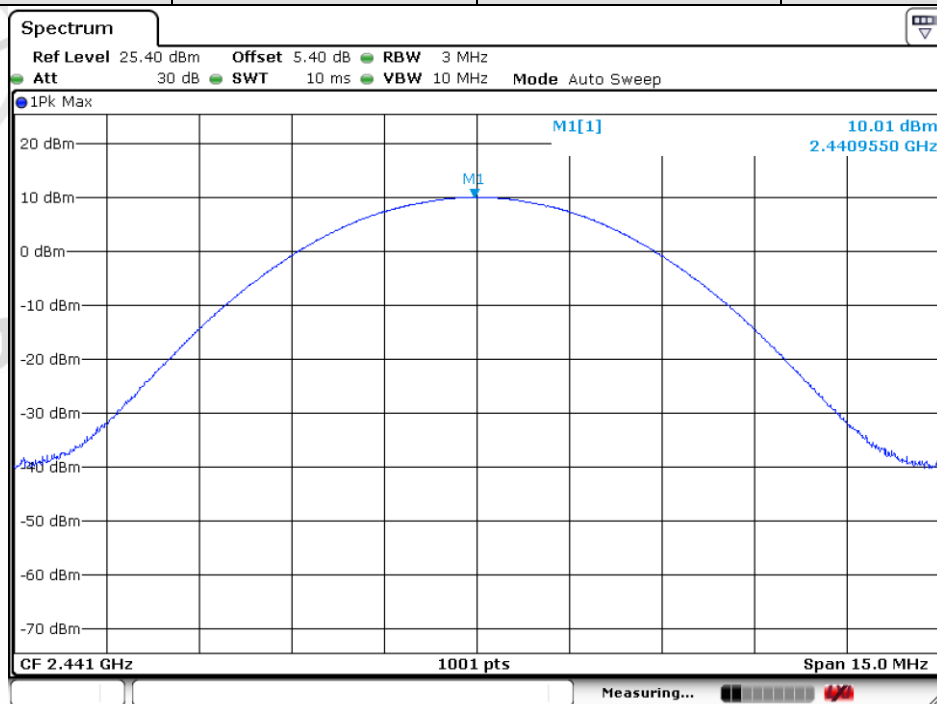
Date: 12.JUL.2019 21:51:38

Test mode:	8DPSK	Test channel:	Lowest
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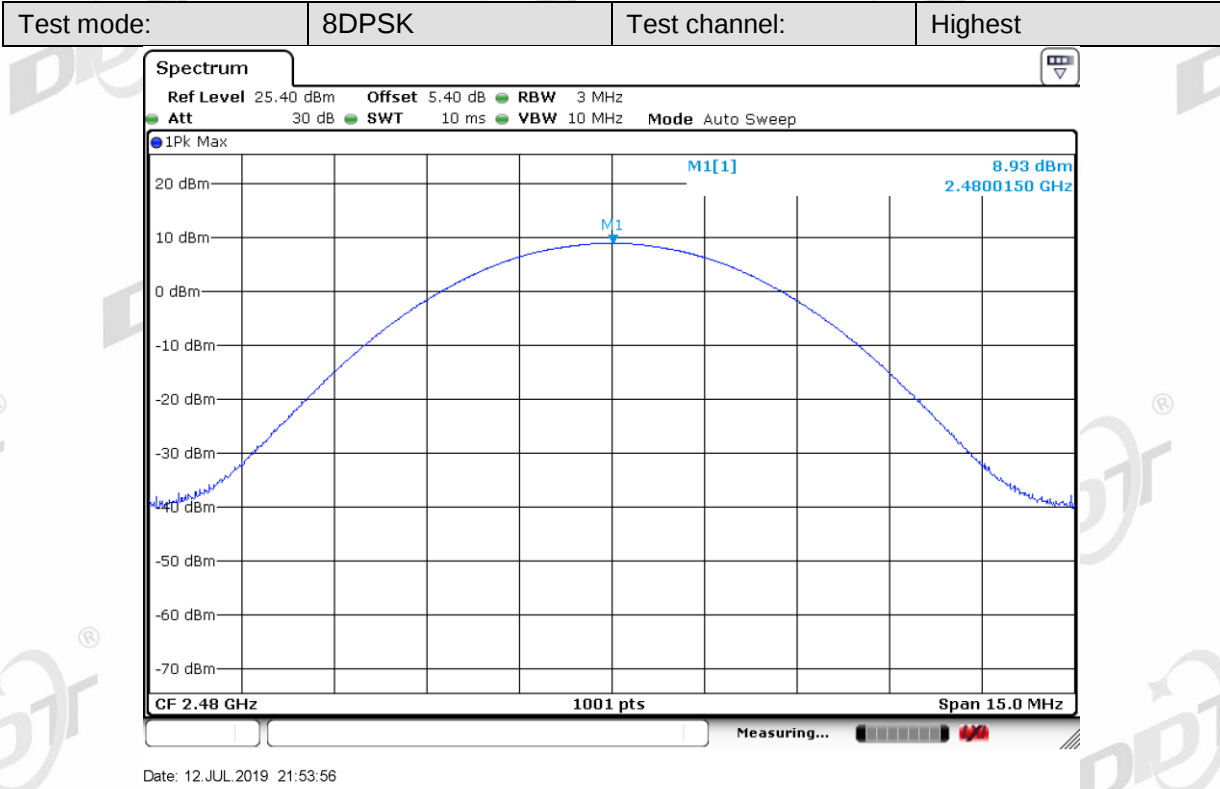


Date: 12 JUL 2019 21:52:47

Test mode:	8DPSK	Test channel:	Middle
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Date: 12 JUL 2019 21:53:12



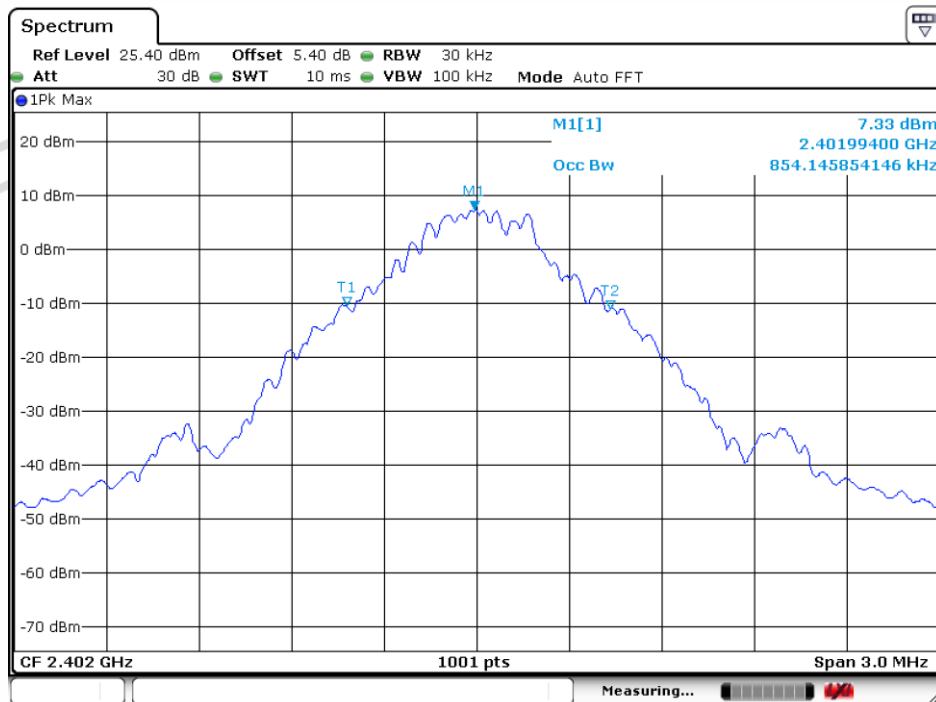
20dB Emission Bandwidth & 99% Occupied Bandwidth

Test Results

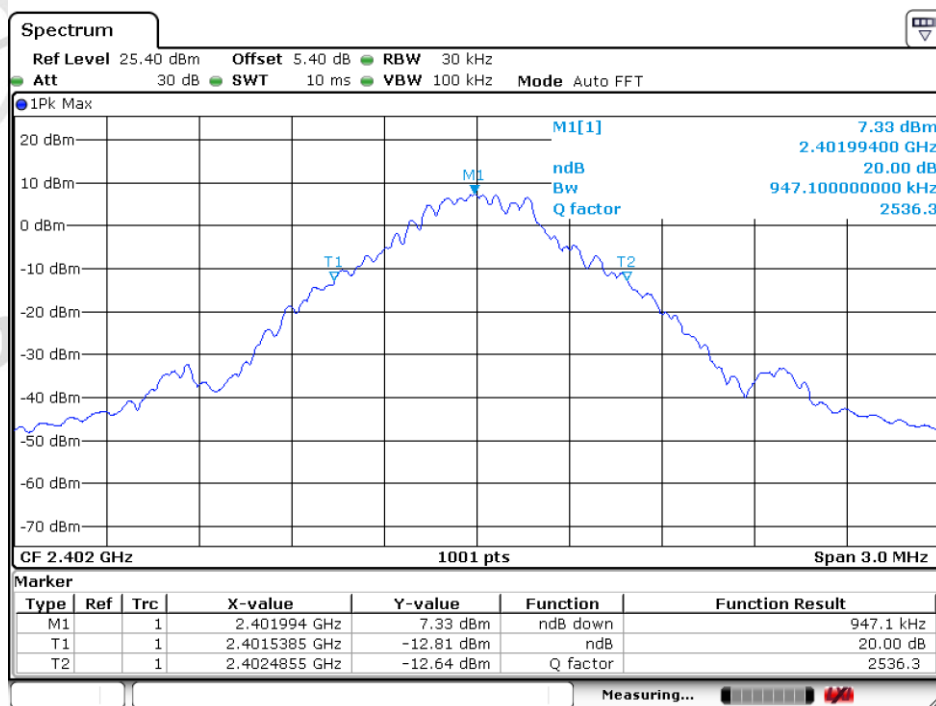
Mode	Test Channel	99% Occupied Bandwidth (KHz)	20dB Emission Bandwidth (KHz)	Result
GFSK	Lowest	854.1	947.1	Pass
	Middle	854.1	947.1	Pass
	Highest	851.1	947.1	Pass
$\pi/4$ DQPSK	Lowest	1186.8	1309.7	Pass
	Middle	1174.8	1294.7	Pass
	Highest	1180.8	1243.8	Pass
8DPSK	Lowest	1192.8	1300.7	Pass
	Middle	1178.2	1294.7	Pass
	Highest	1186.8	1261.7	Pass

Test plots

GFSK_Lowest Channel

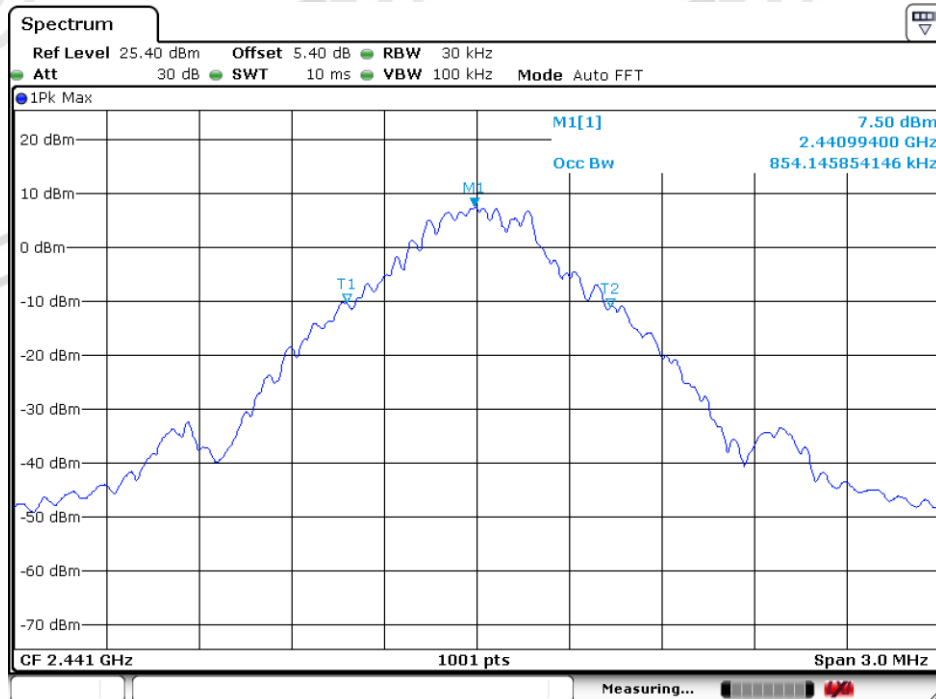


Date: 12 JUL 2019 21:58:35

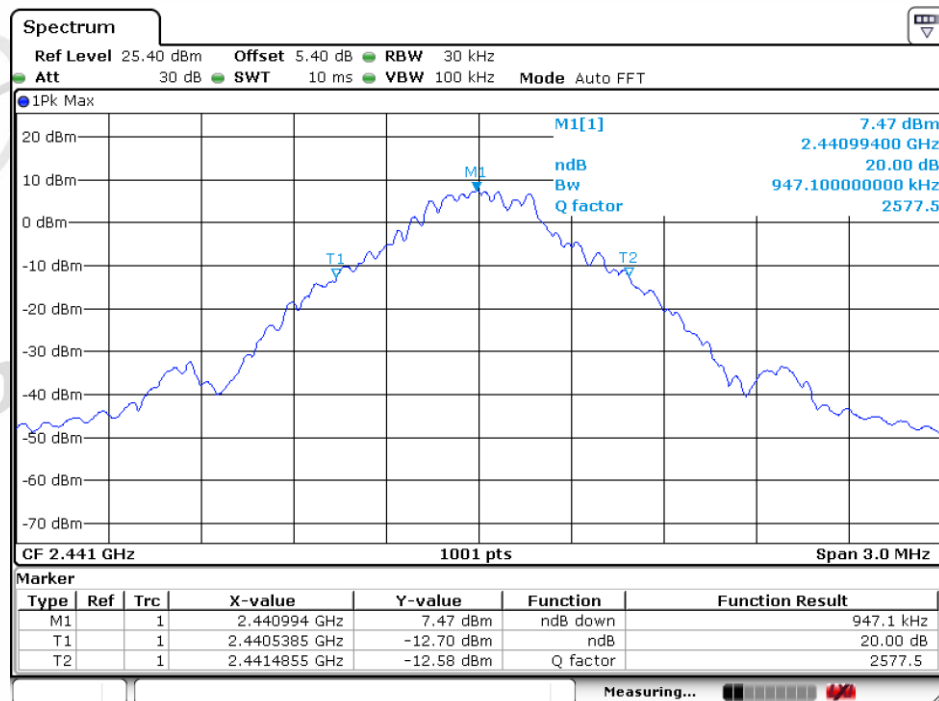


Date: 12 JUL 2019 22:17:42

GFSK_Middle Channel

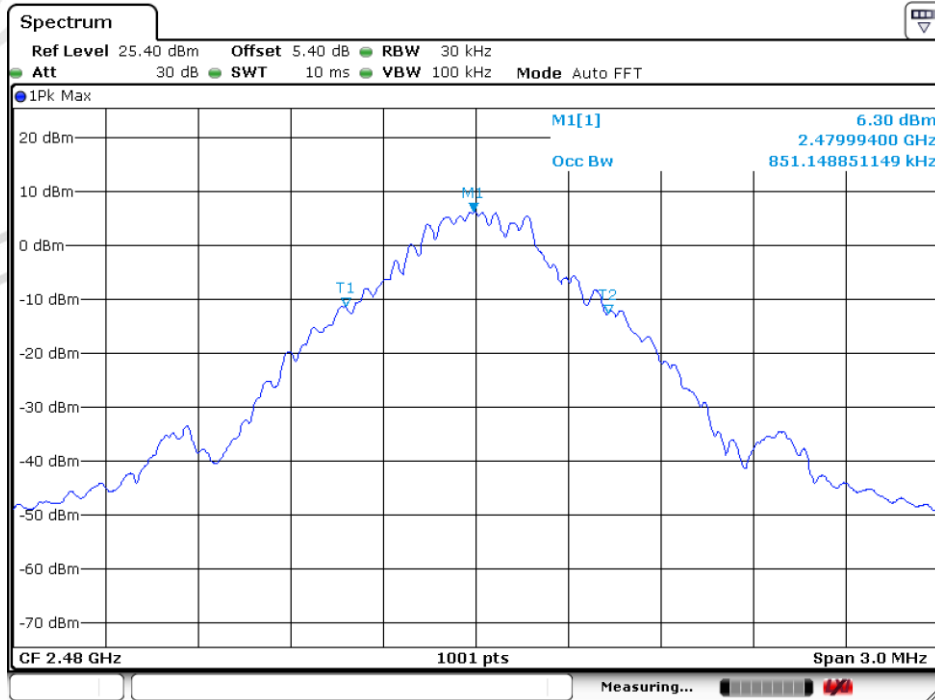


Date: 12 JUL 2019 21:58:11

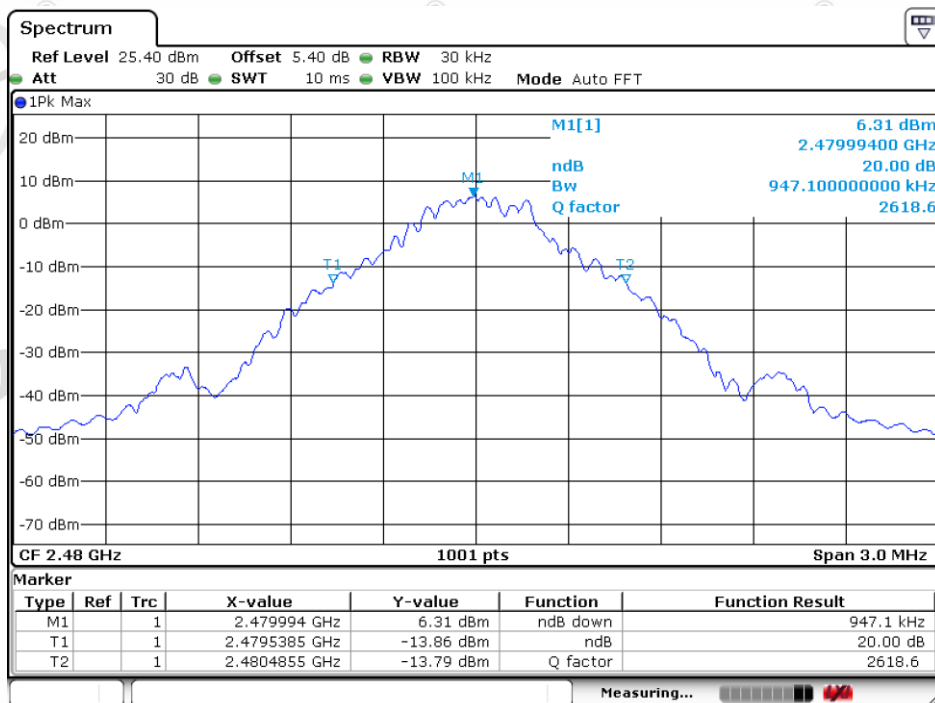


Date: 12 JUL 2019 22:18:15

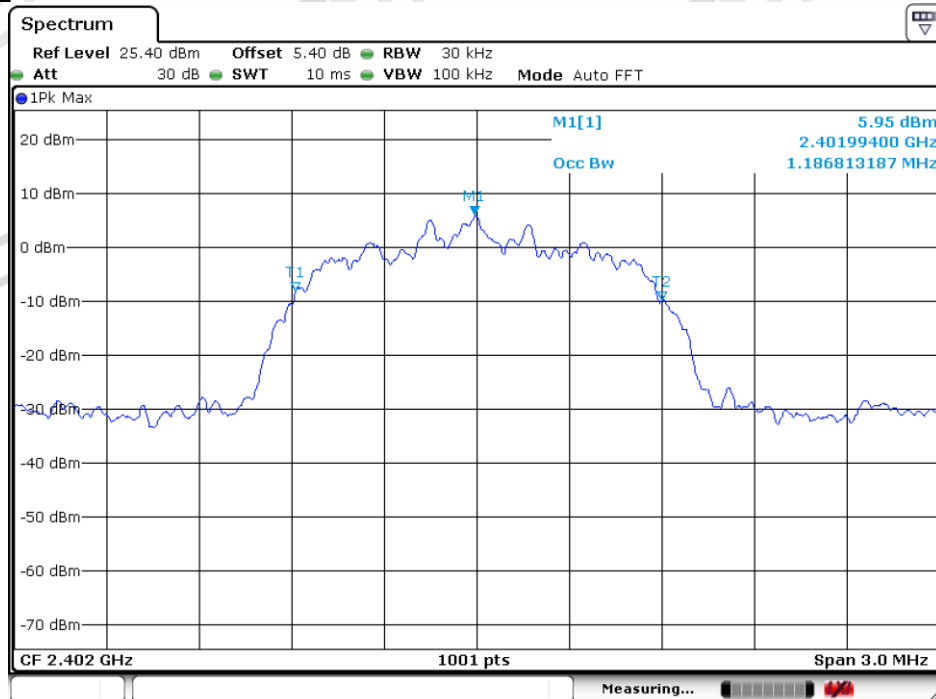
GFSK_Highest Channel



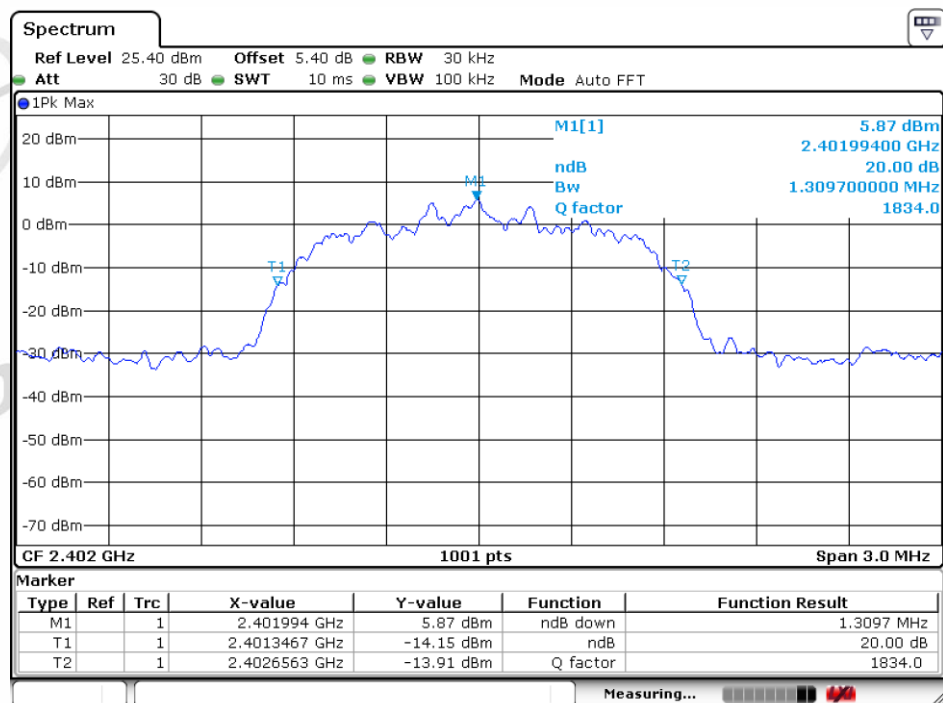
Date: 12 JUL 2019 21:57:52



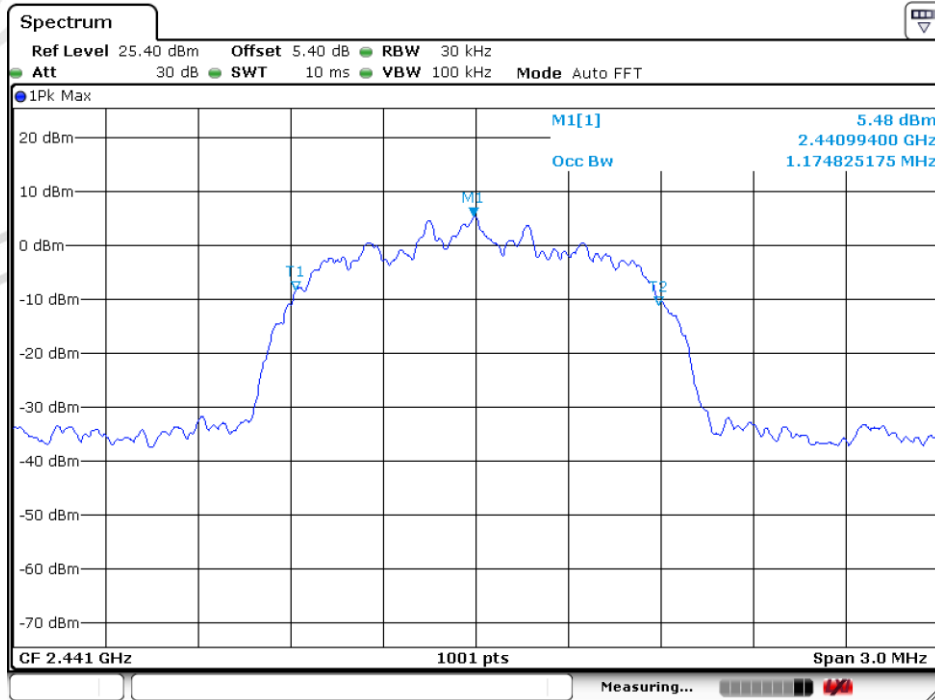
Date: 12 JUL 2019 22:18:30

$\pi/4$ DQPSK Lowest Channel

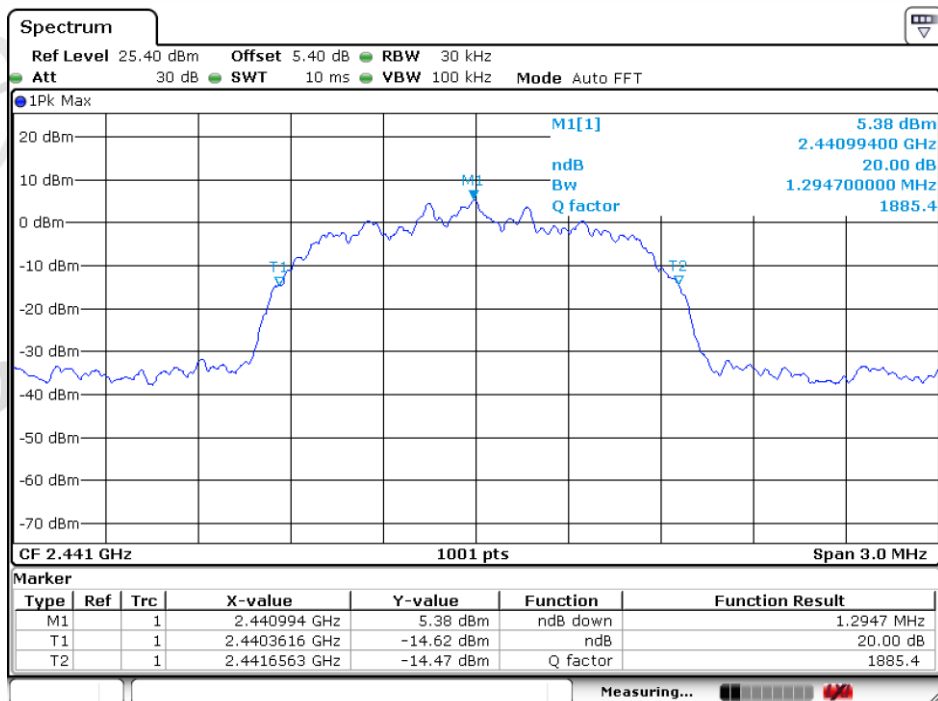
Date: 12 JUL 2019 21:56:40



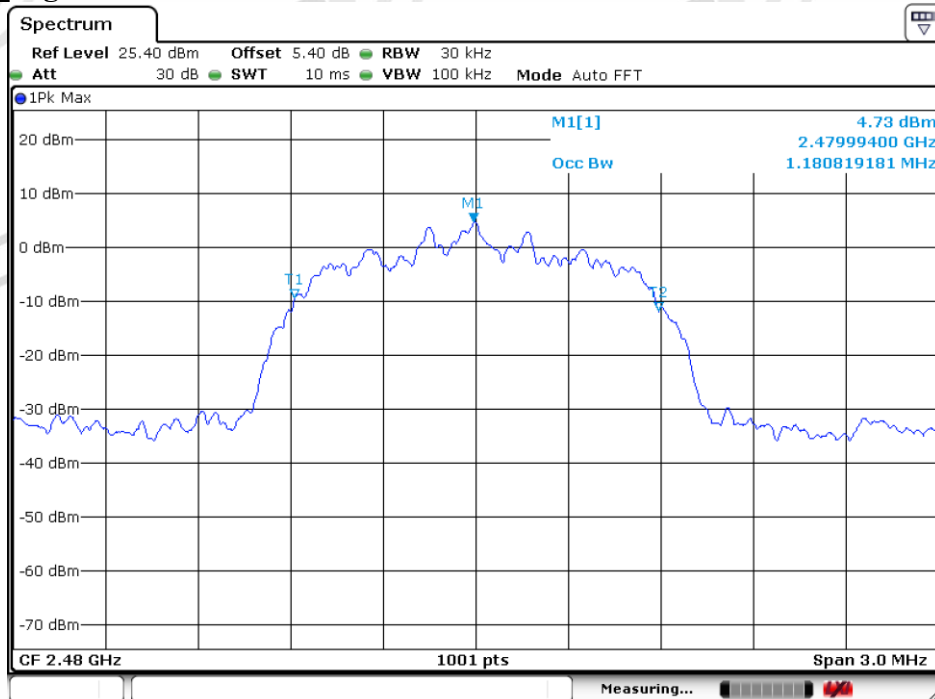
Date: 12 JUL 2019 22:21:52

$\pi/4$ DQPSK Middle Channel

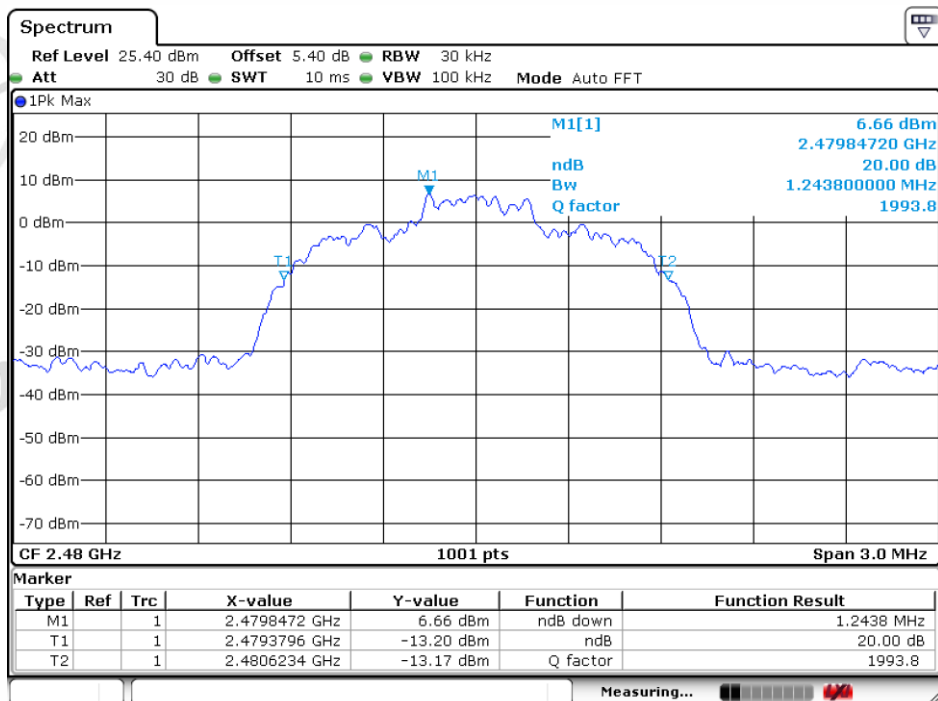
Date: 12 JUL 2019 21:57:13



Date: 12 JUL 2019 22:21:27

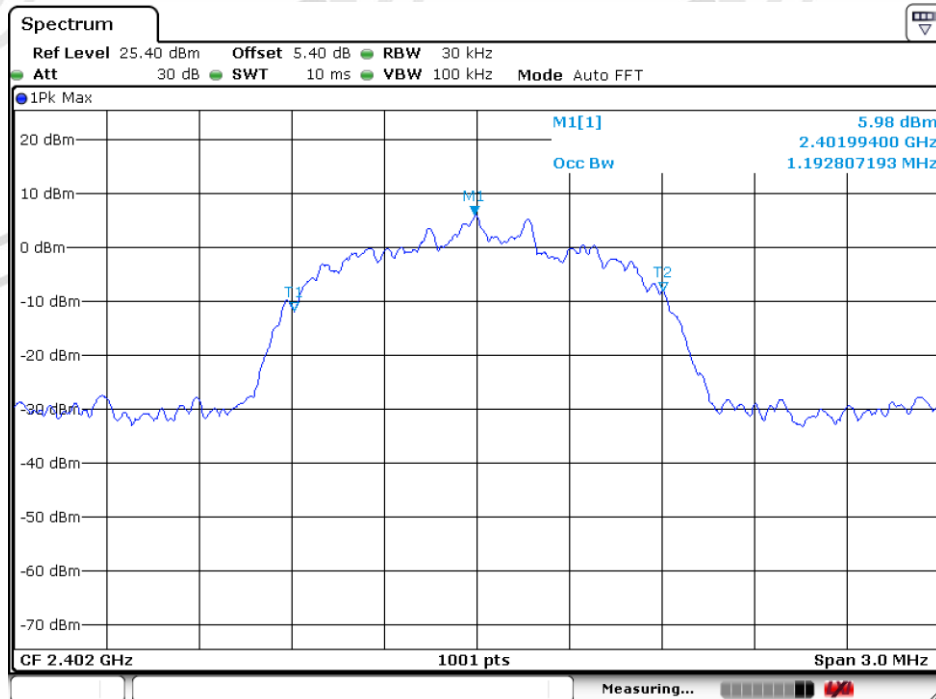
$\pi/4$ DQPSK_Highest Channel

Date: 12.JUL.2019 21:57:27

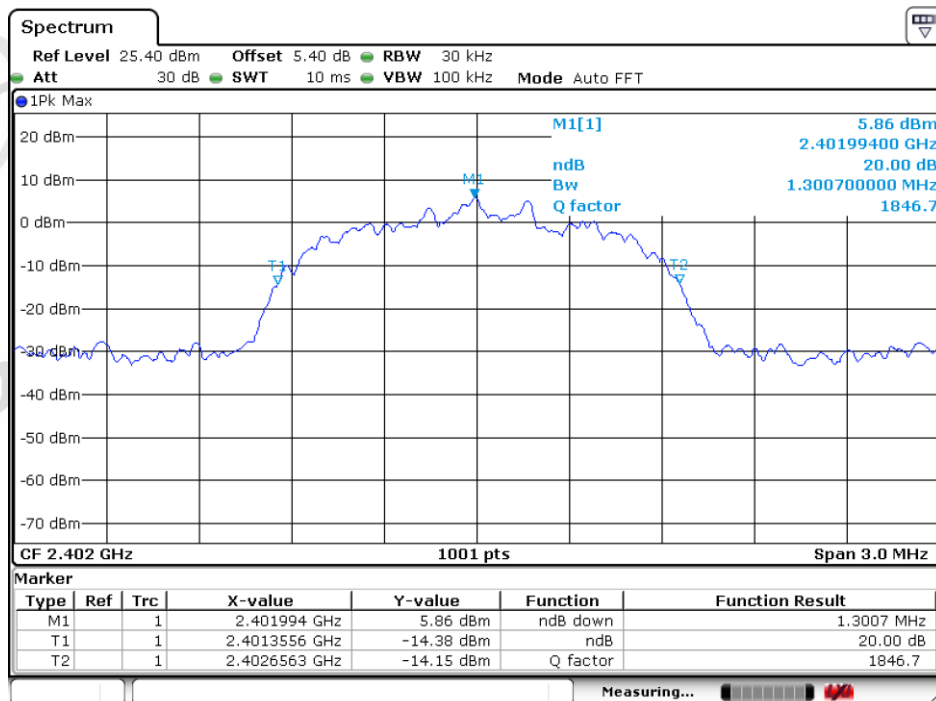


Date: 12.JUL.2019 22:20:26

8DPSK_Lowest Channel

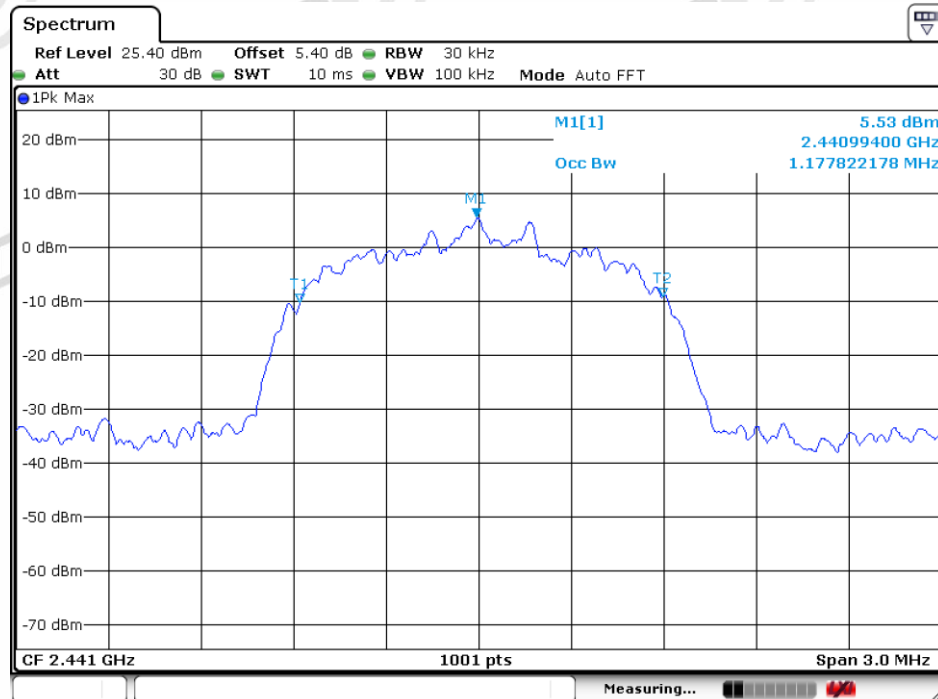


Date: 12 JUL 2019 21:54:59

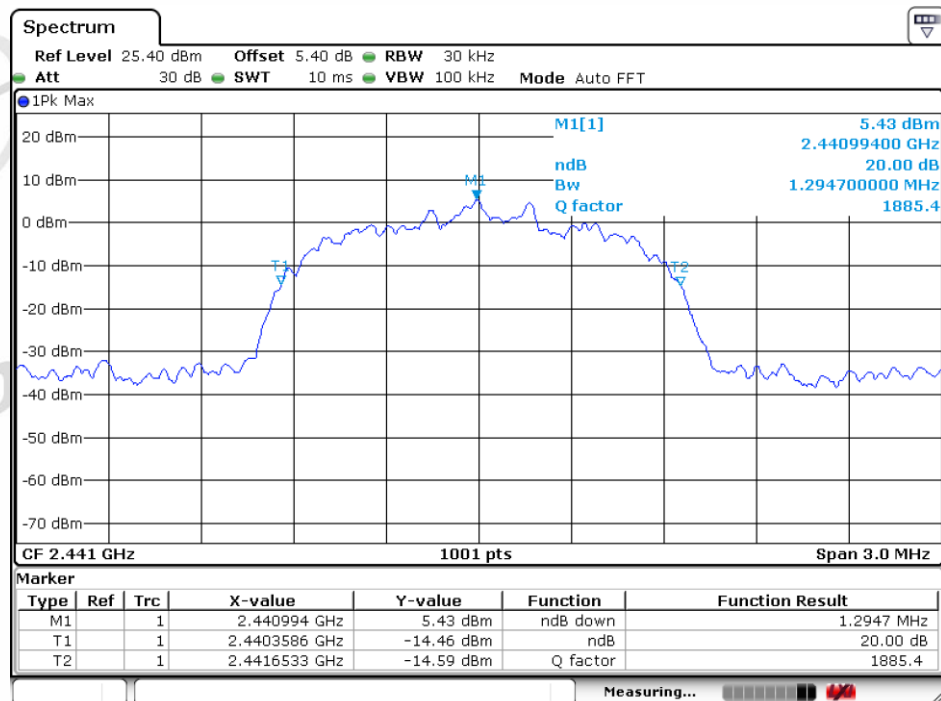


Date: 12 JUL 2019 22:22:10

8DPSK_Middle Channel

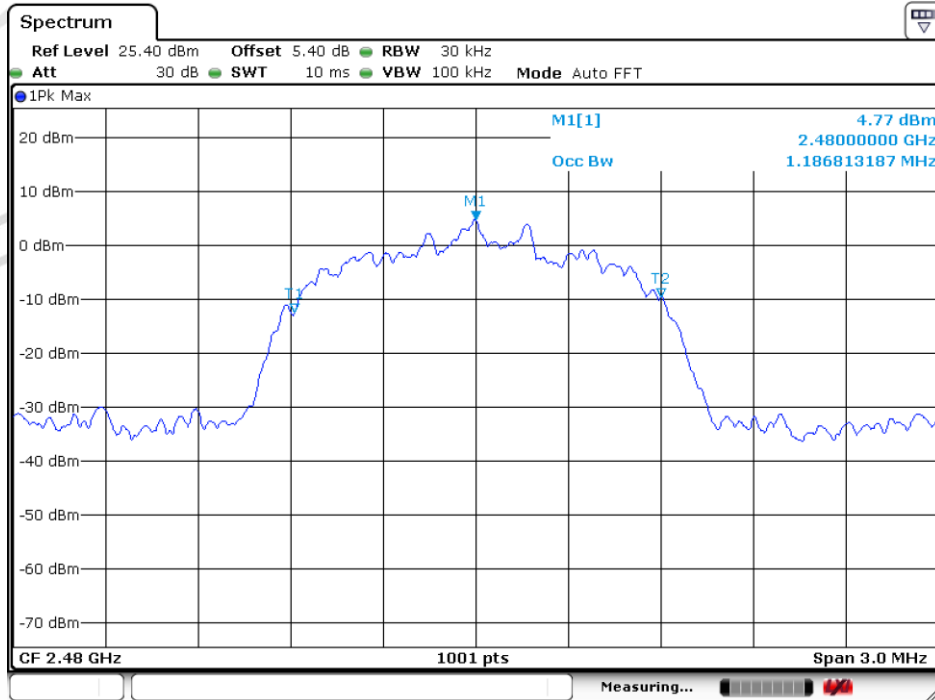


Date: 12 JUL 2019 21:54:46

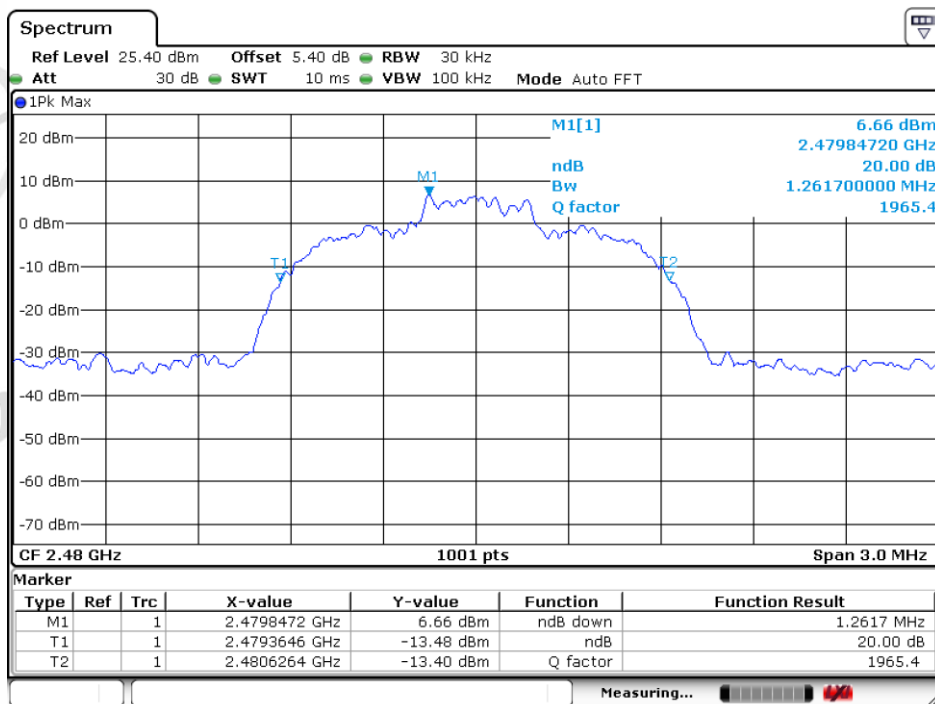


Date: 12 JUL 2019 22:21:12

8DPSK_Highest Channel



Date: 12 JUL 2019 21:54:17



Date: 12 JUL 2019 22:20:43

Carrier Frequencies Separation

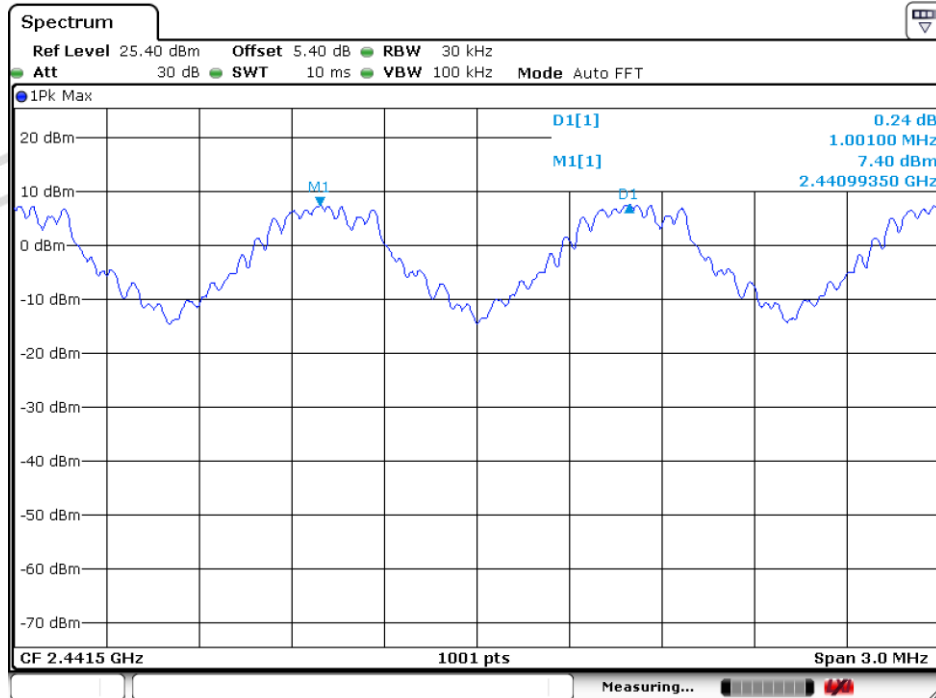
Test Results

GFSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	1001	631.4	Pass
$\pi/4$ DQPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	1001	873.1	Pass
8DPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	1001	867.1	Pass

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	947.1	631.4
$\pi/4$ DQPSK	1309.7	873.1
8DPSK	1300.7	867.1

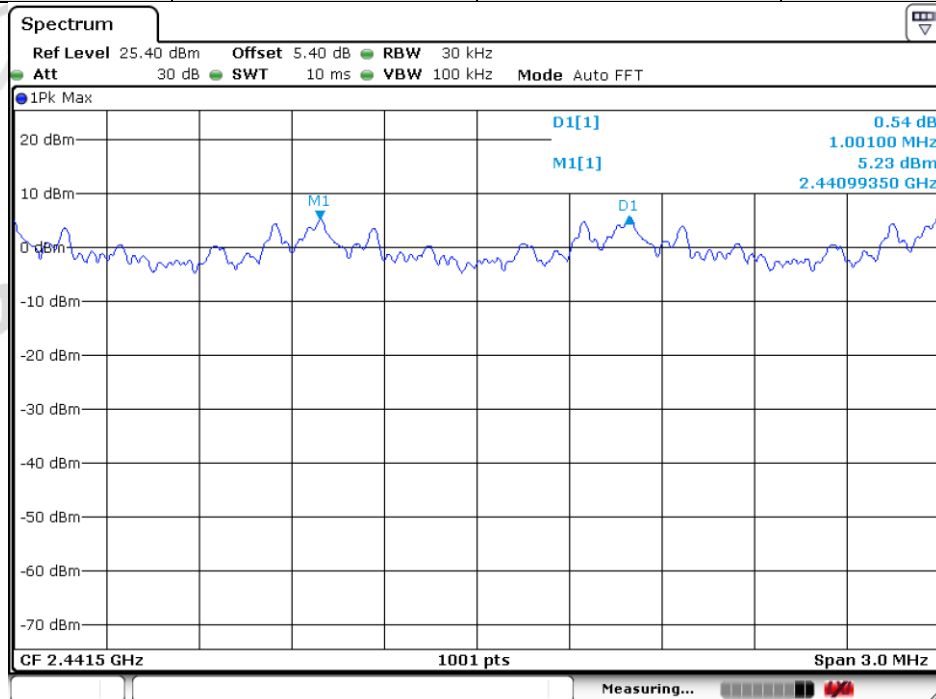
Test plots:

Test mode:	GFSK	Test channel:	Middle
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Date: 12.JUL.2019 22:28:26

Test mode:	$\pi/4$ DQPSK	Test channel:	Middle
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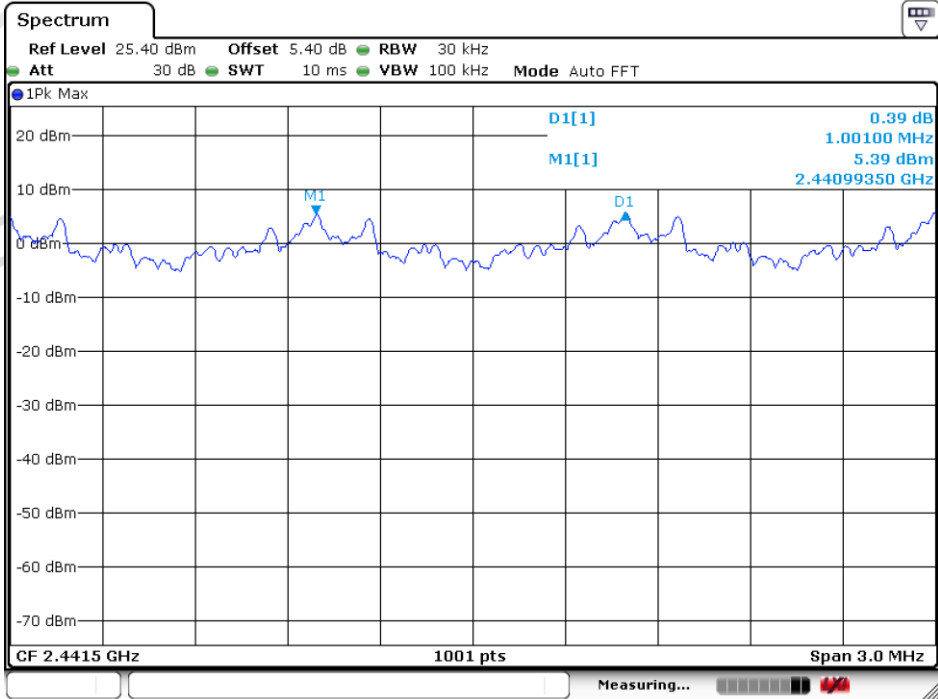
Date: 12.JUL.2019 22:25:15

Test mode:

8DPSK

Test channel:

Middle



Date: 12.JUL.2019 22:24:38

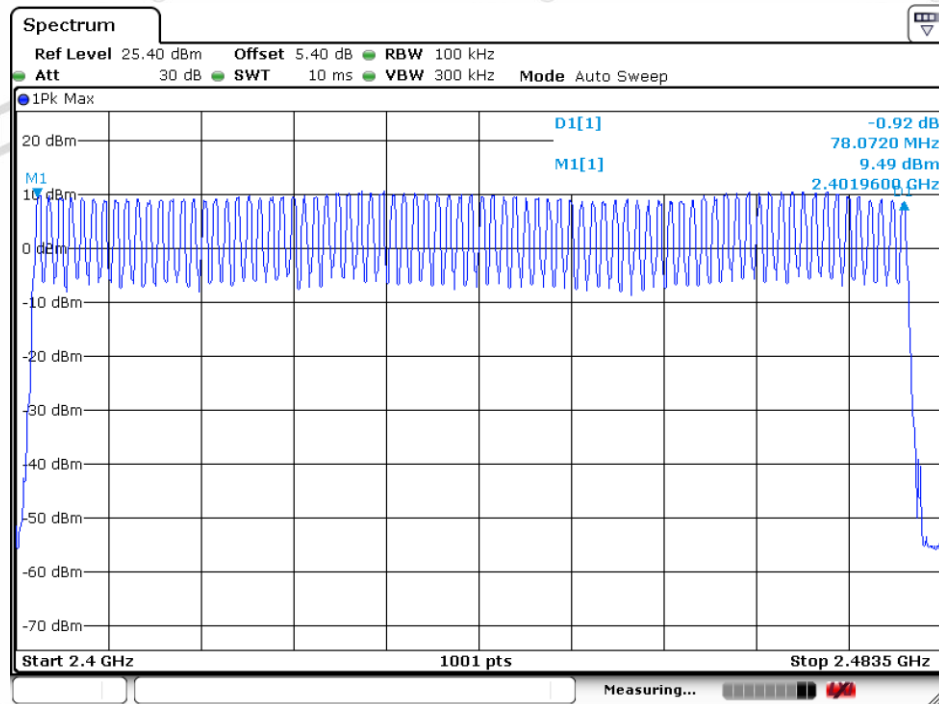
Hopping Channel Number

Test Results

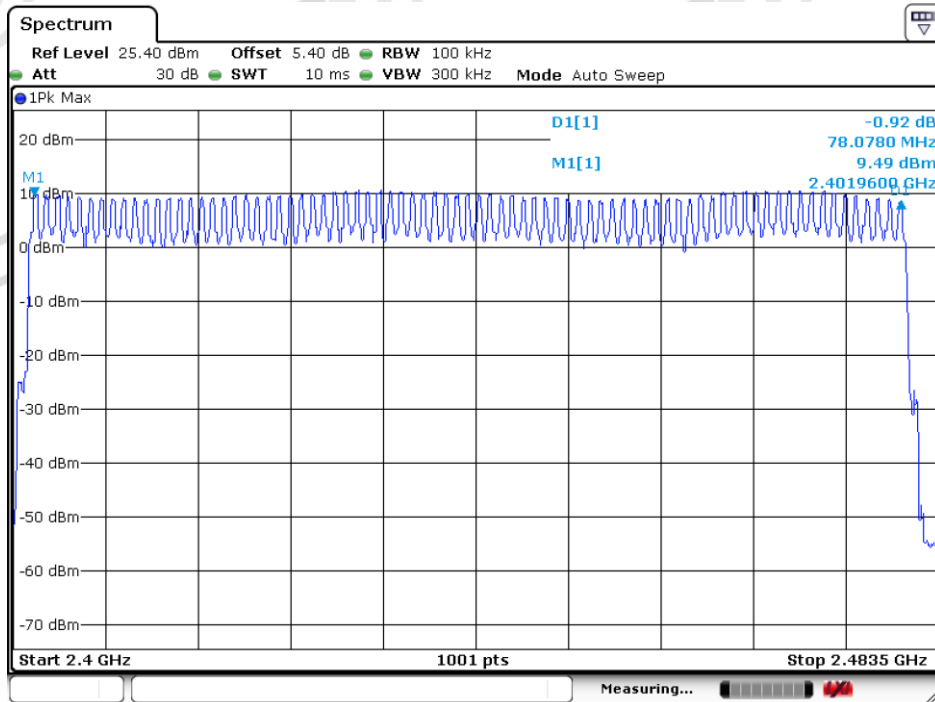
Mode	Hopping channel numbers	Limit
GFSK	79	≥ 15
$\pi/4$ DQPSK	79	≥ 15
8DPSK	79	≥ 15

Test plots

GFSK

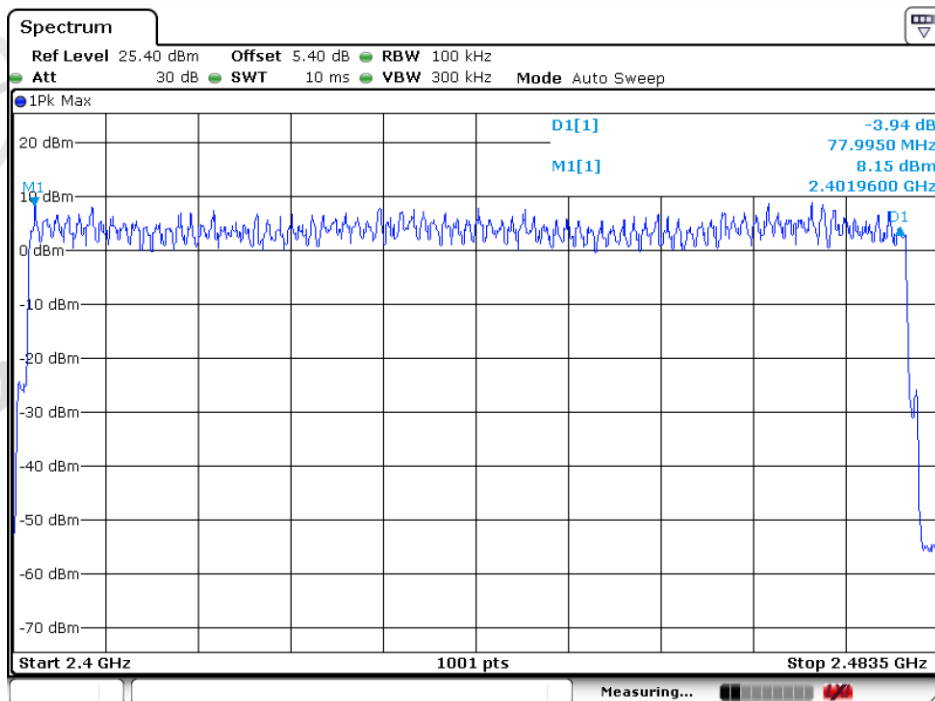


Date: 12.JUL.2019 22:31:10

$\pi/4$ DQPSK

Date: 12 JUL 2019 22:32:07

8DPSK



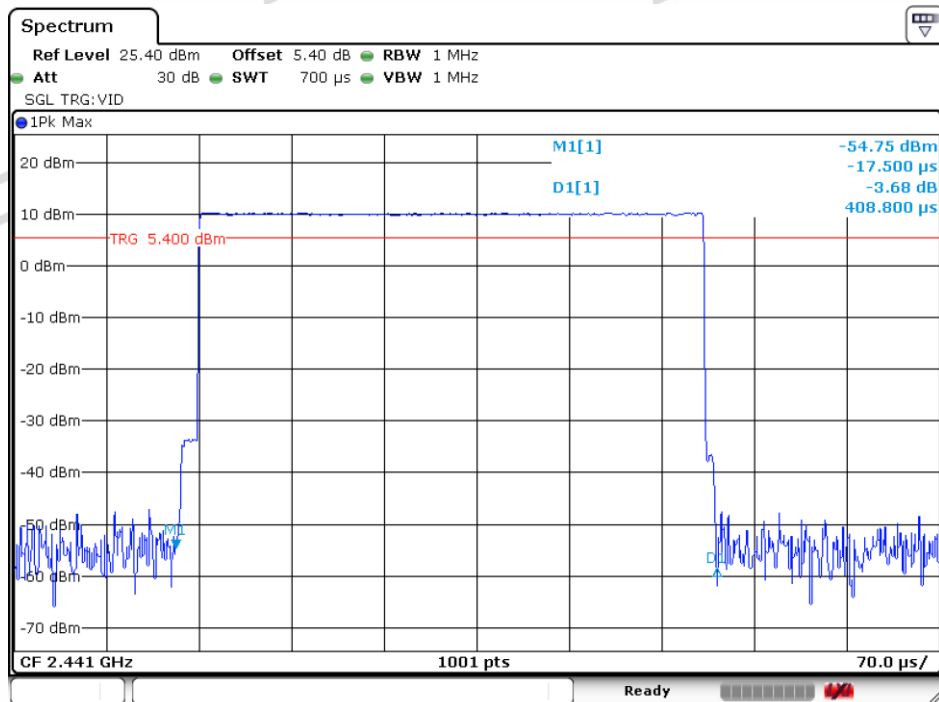
Date: 12 JUL 2019 22:33:03

Dwell Time**Test Results**

Operation Modes	On time (ms) on one channel
DH1	0.409
DH3	1.671
DH5	2.916
2-DH1	0.413
2-DH3	1.674
2-DH5	2.921
3-DH1	0.414
3-DH3	1.668
3-DH5	2.926

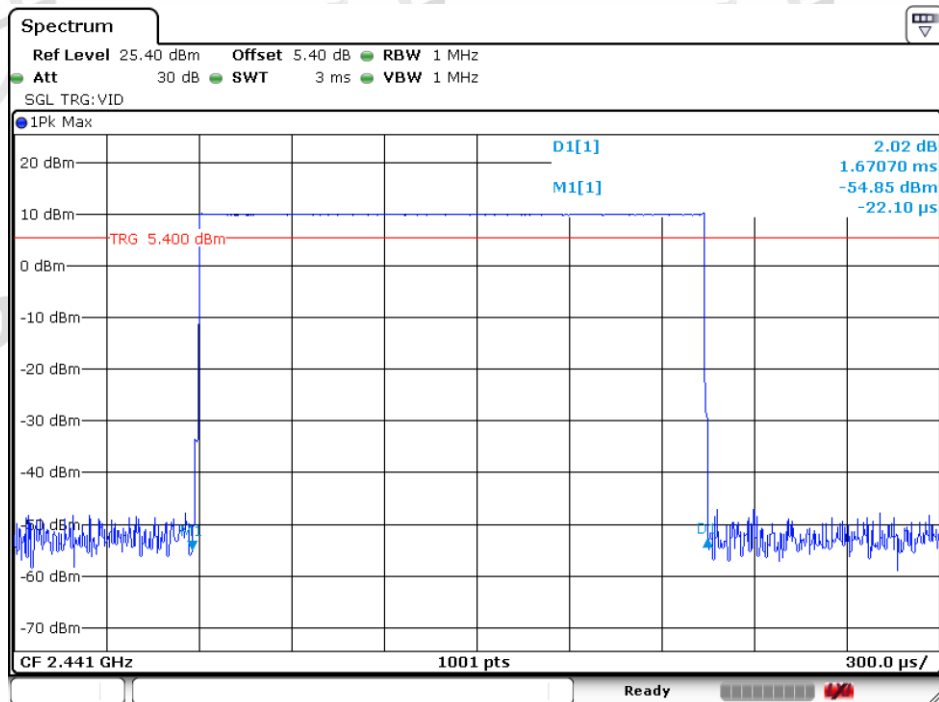
Test plots

DH1 _ Middle Channel



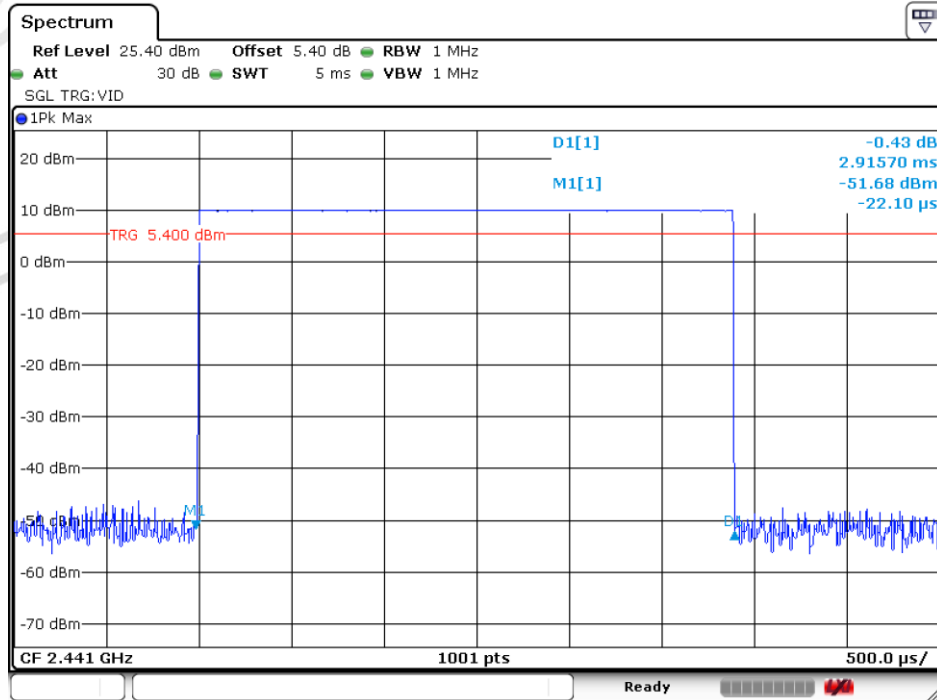
Date: 13 JUL 2019 01:20:46

DH3 _ Middle Channel



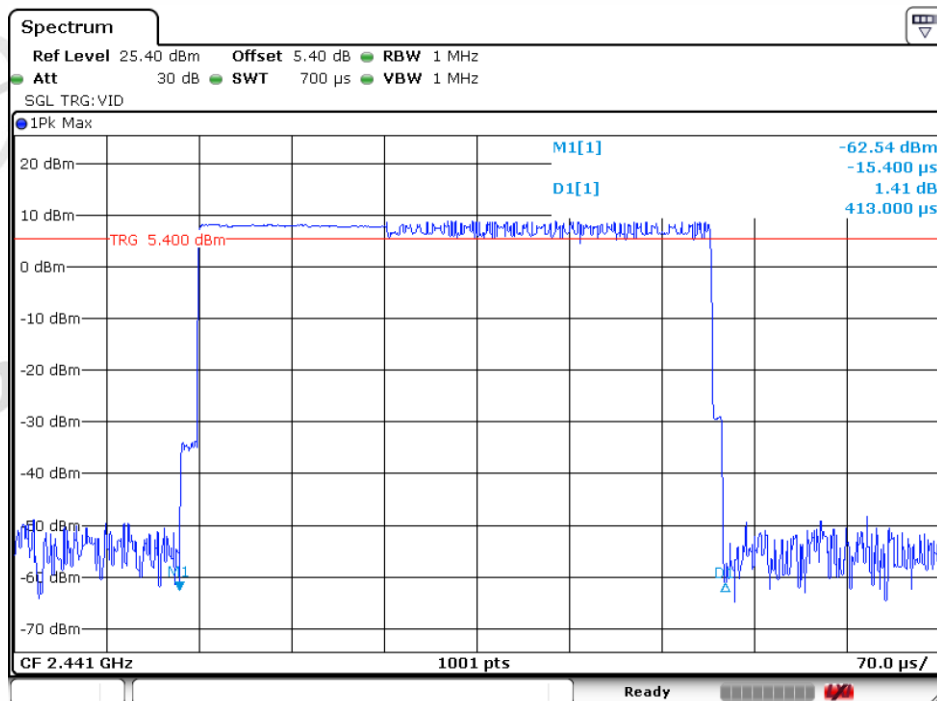
Date: 13 JUL 2019 01:23:48

DH5 _ Middle Channel



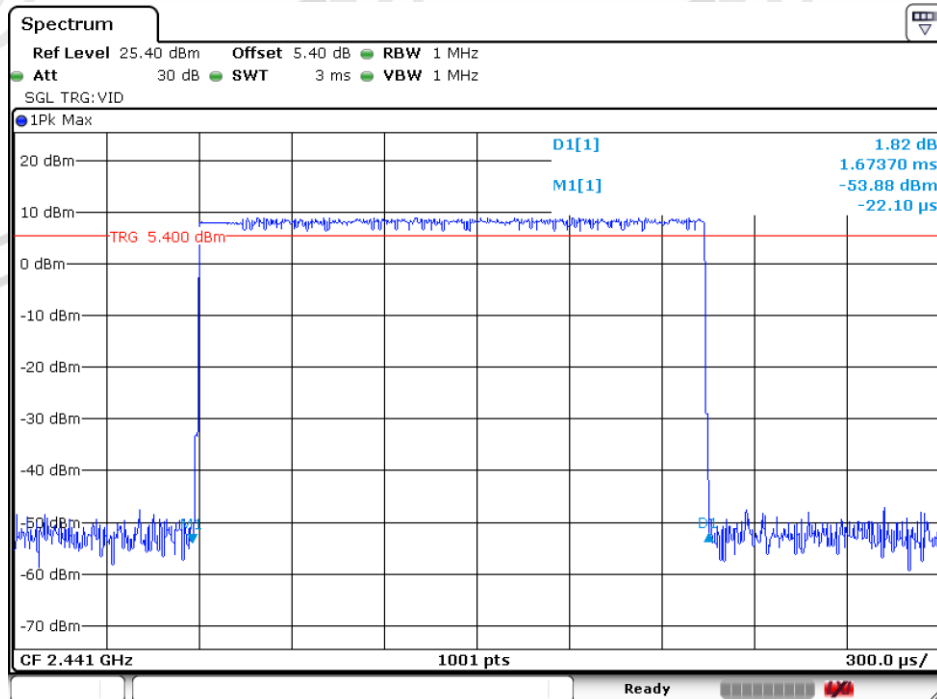
Date: 13.JUL.2019 01:24:21

2DH1 _ Middle Channel



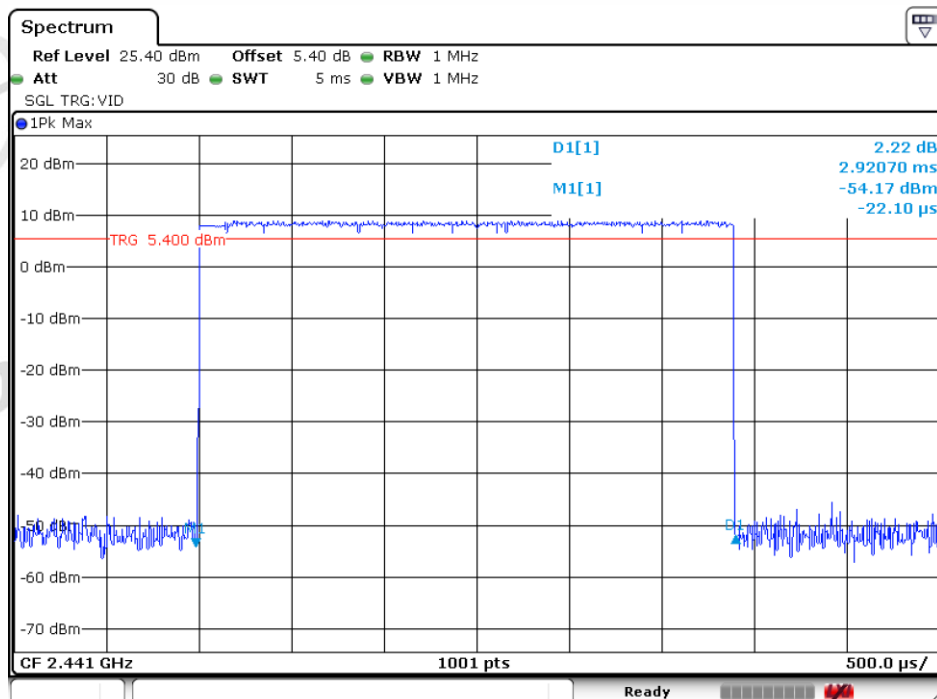
Date: 13.JUL.2019 01:21:17

2DH3 _ Middle Channel



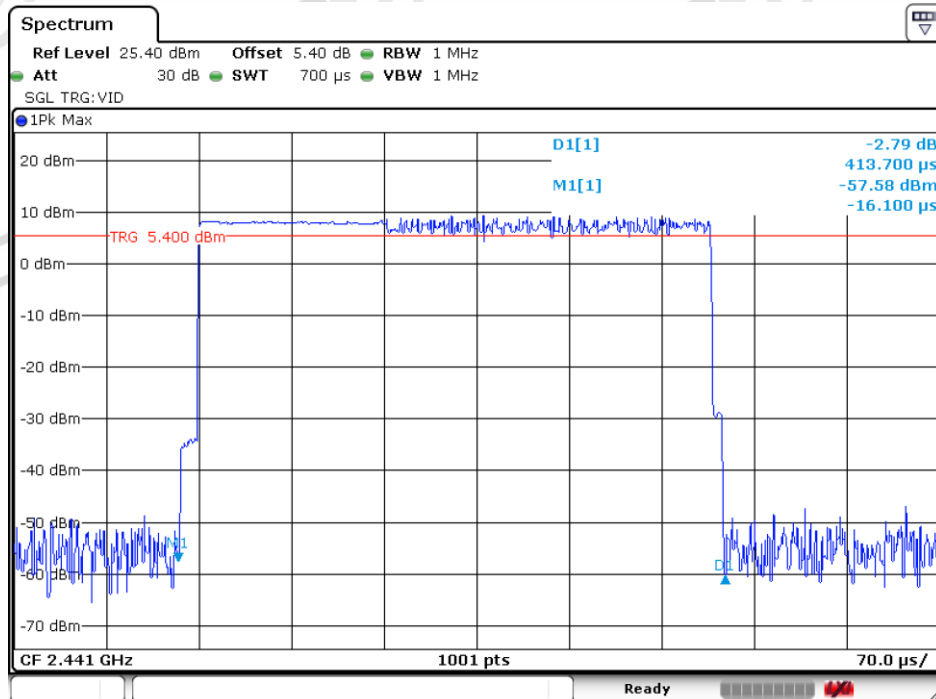
Date: 13 JUL 2019 01:22:23

2DH5 _ Middle Channel



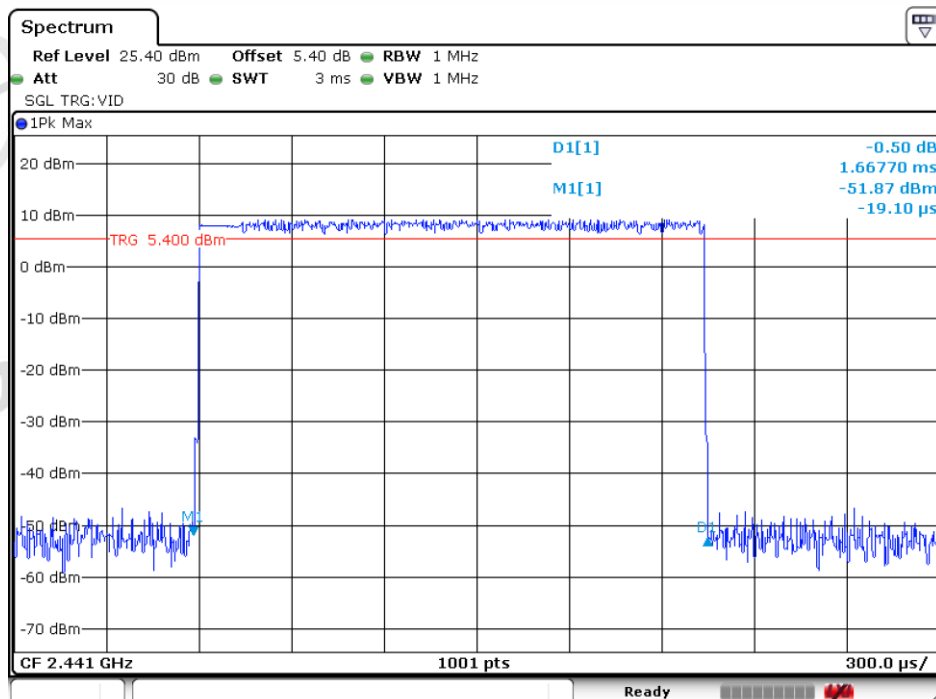
Date: 13 JUL 2019 01:24:47

3DH1 _ Middle Channel



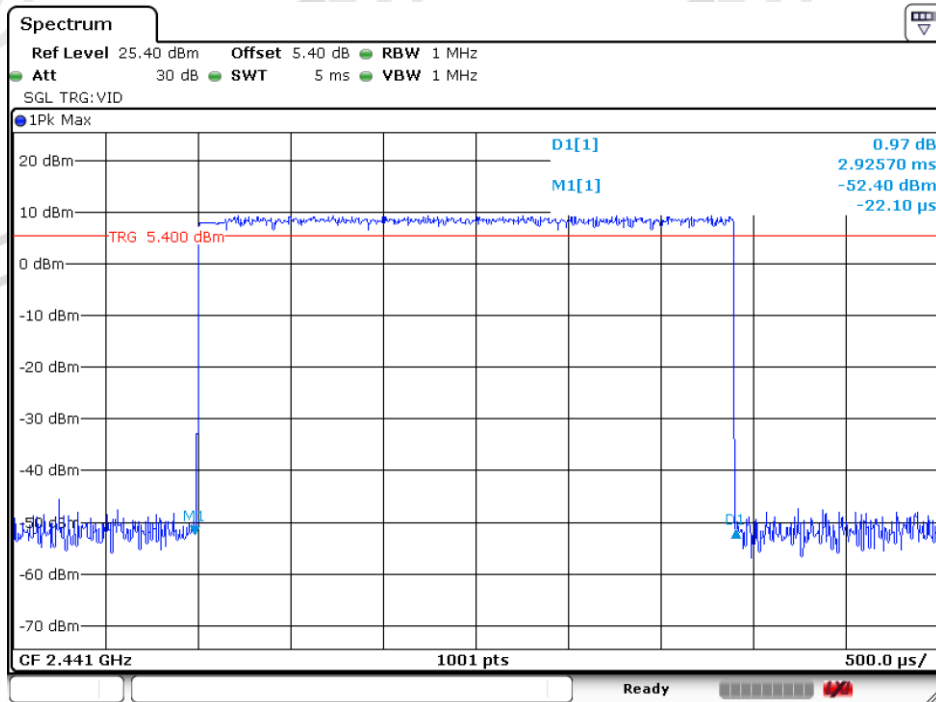
Date: 13 JUL 2019 01:21:34

3DH3 _ Middle Channel



Date: 13 JUL 2019 01:22:07

3DH5 Middle Channel

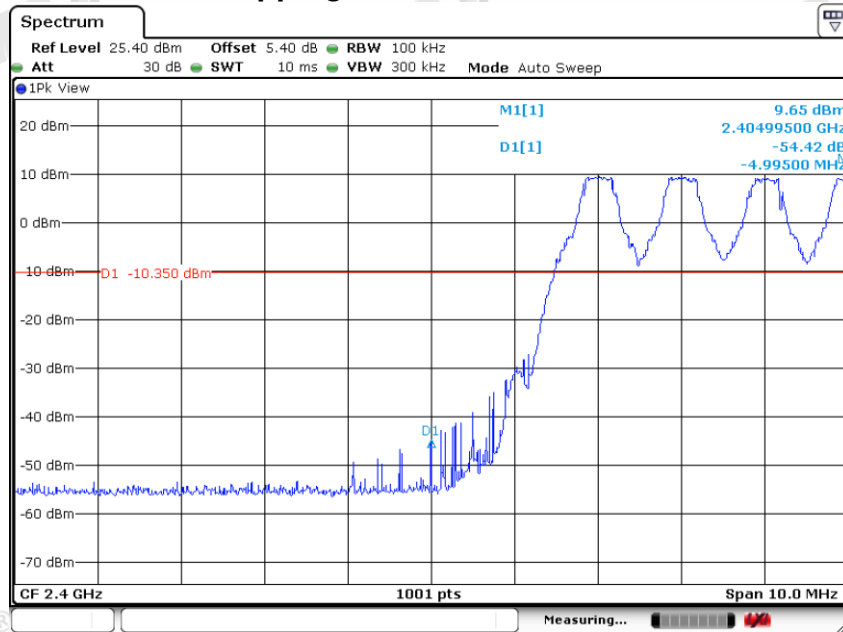


Date: 13 JUL 2019 01:25:03

Band-edge for RF Conducted Emissions

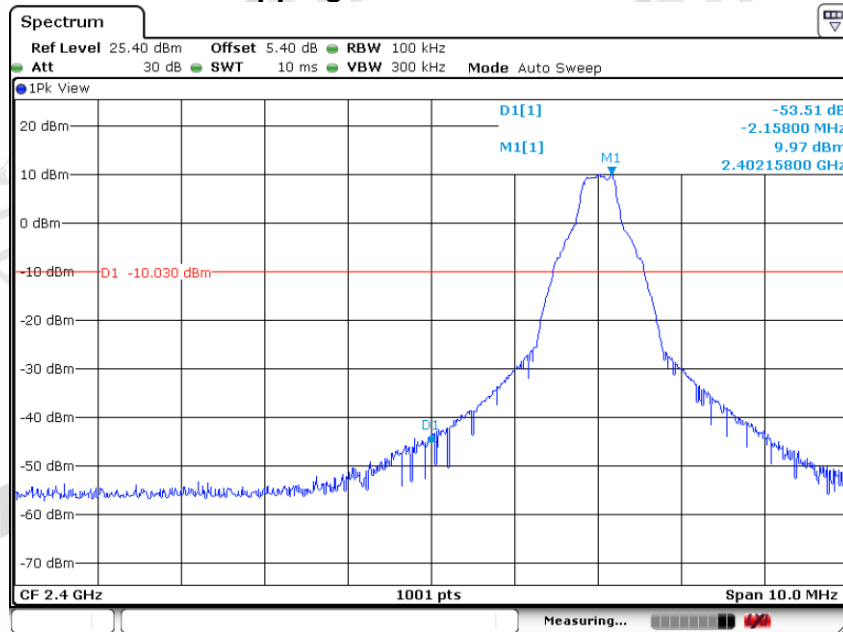
Test plots

GFSK _Lowest Channel_ Hopping ON



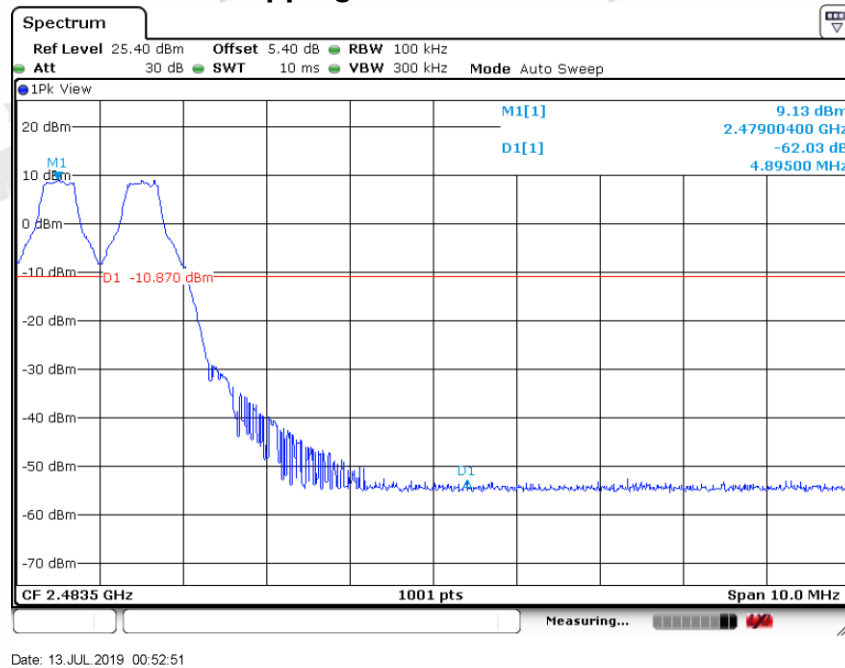
Date: 13 JUL 2019 00:31:20

GFSK _Lowest Channel_ Hopping OFF

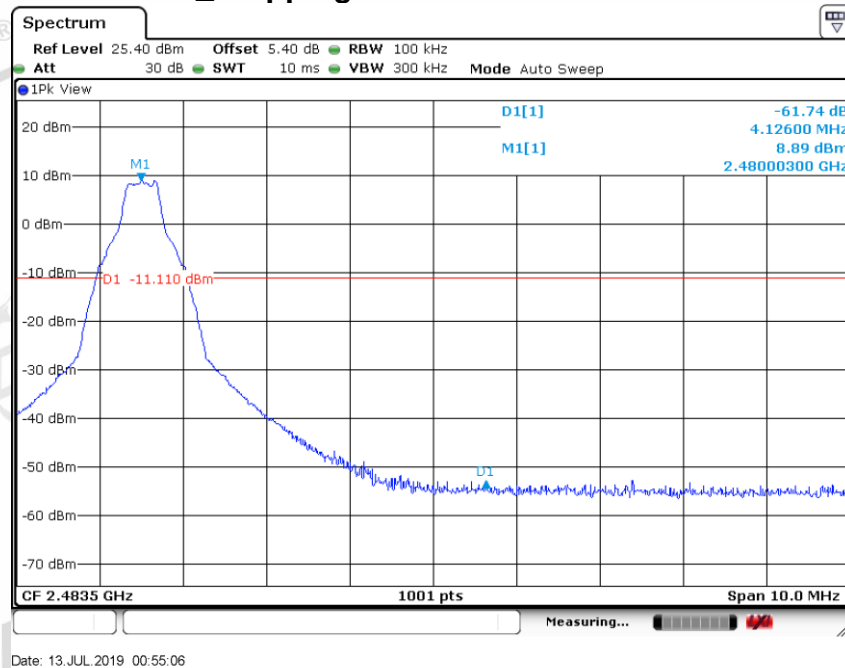


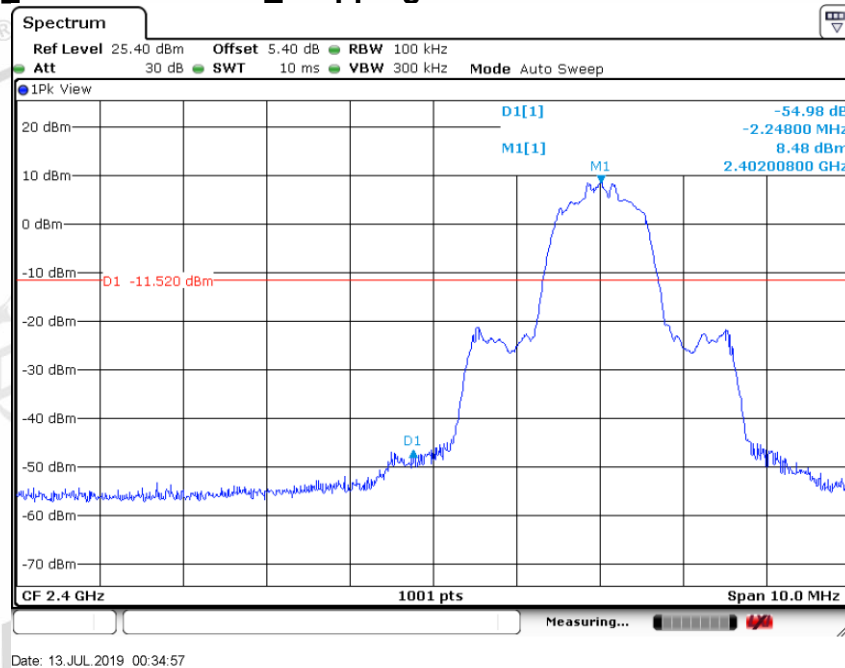
Date: 13 JUL 2019 00:28:41

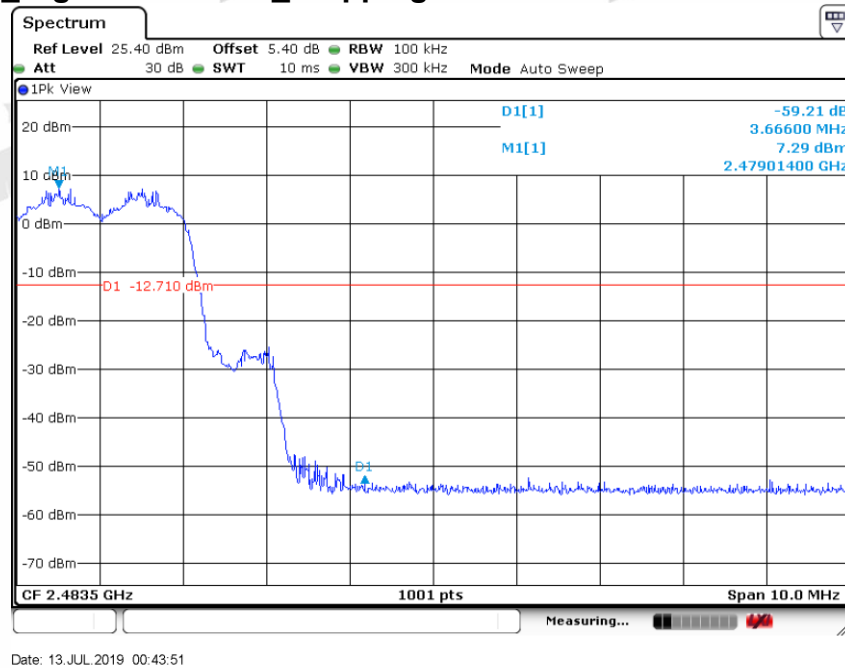
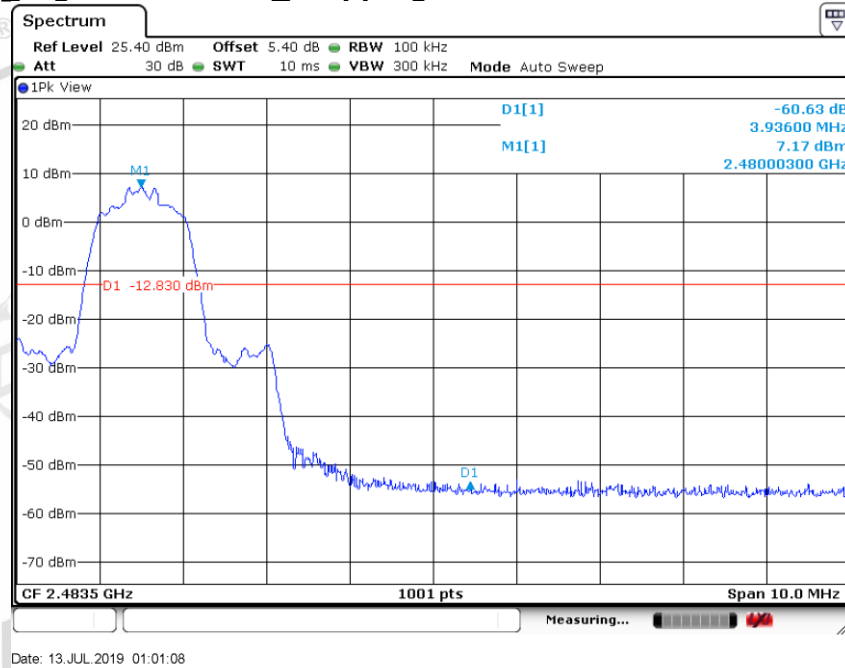
GFSK _Highest Channel_ Hopping ON



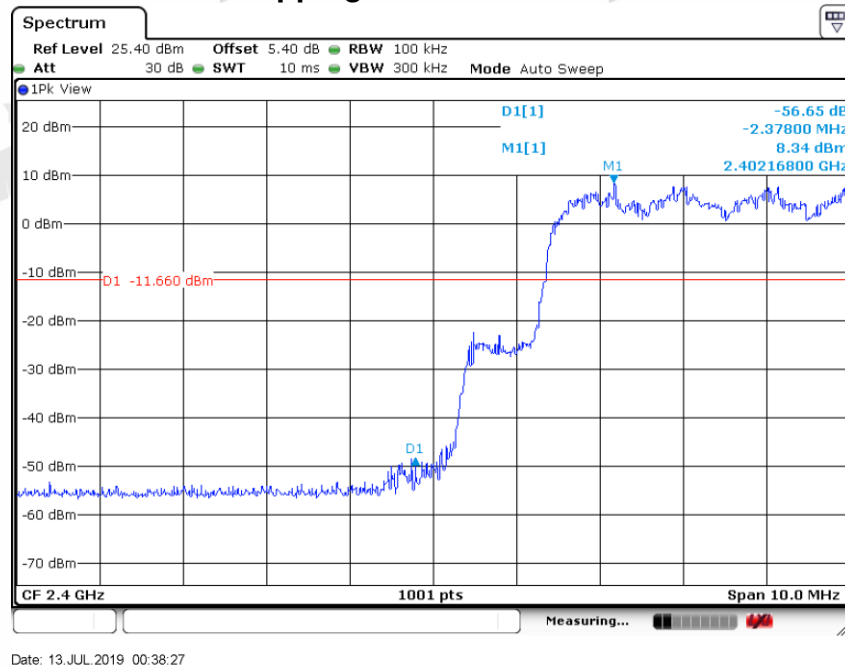
GFSK _Highest Channel_ Hopping OFF



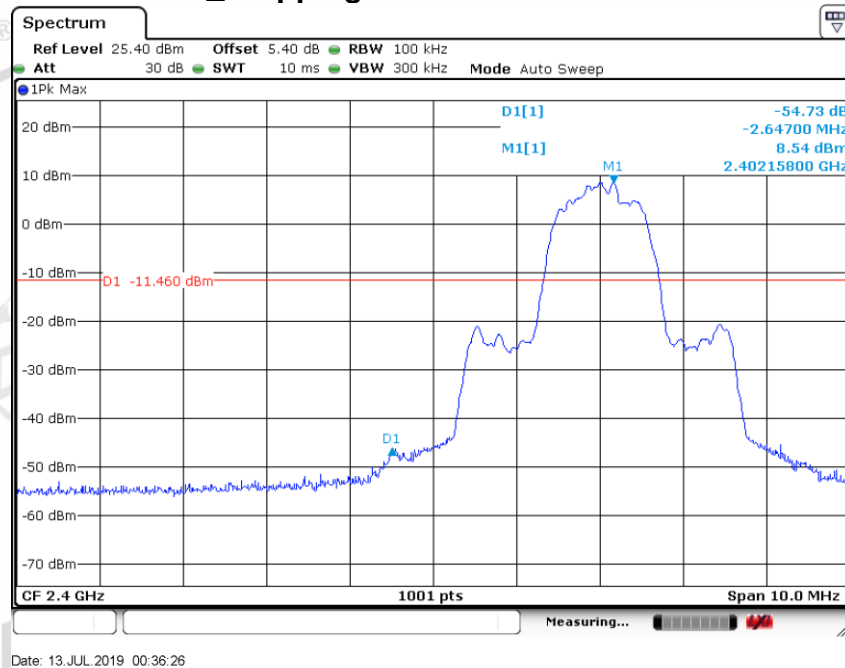
$\pi/4$ DQPSK _Lowest Channel_ Hopping ON $\pi/4$ DQPSK _Lowest Channel_ Hopping OFF

$\pi/4$ DQPSK_Highest Channel_Hopping ON $\pi/4$ DQPSK_Highest Channel_Hopping OFF

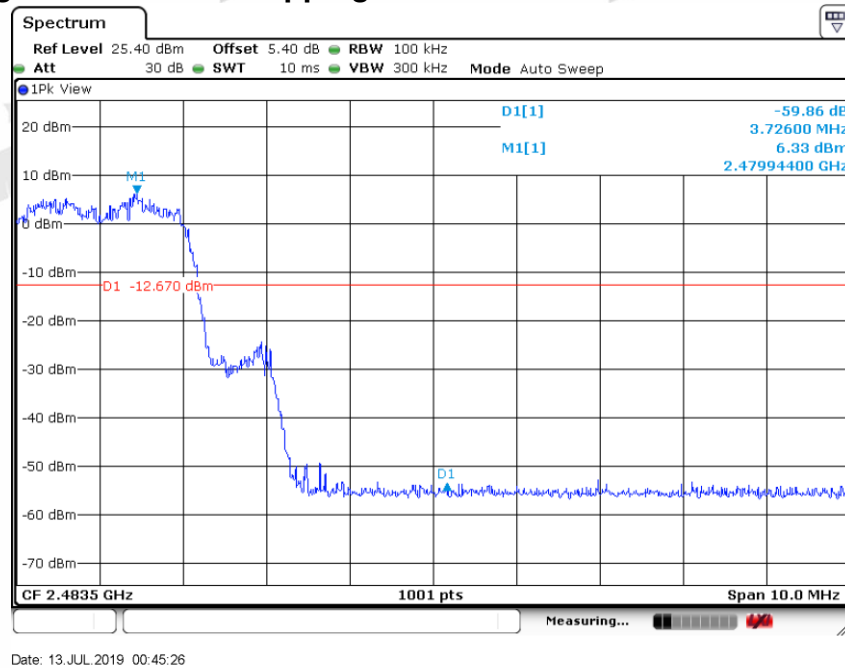
8DPSK _Lowest Channel_ Hopping ON



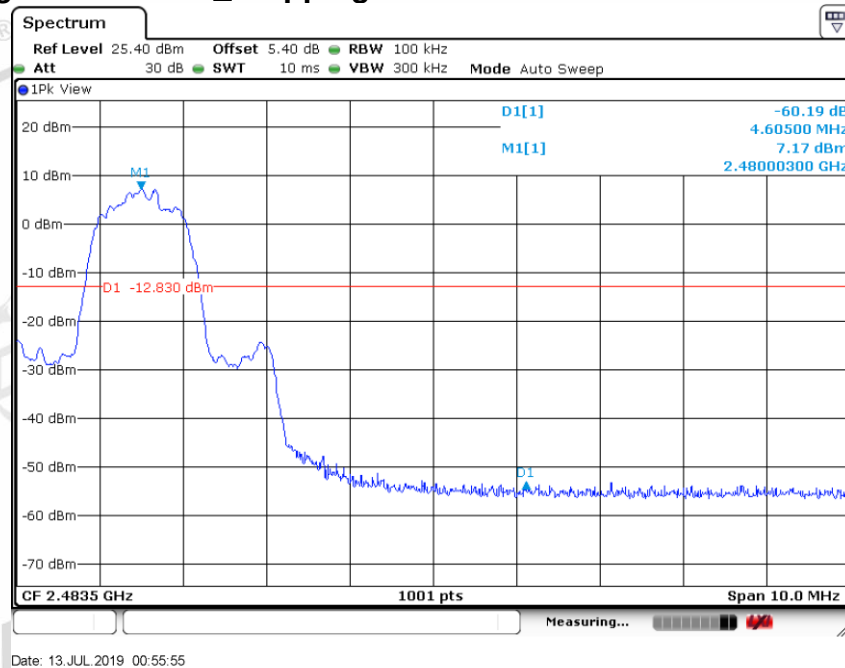
8DPSK _Lowest Channel_ Hopping OFF



8DPSK_Highest Channel_Hopping ON



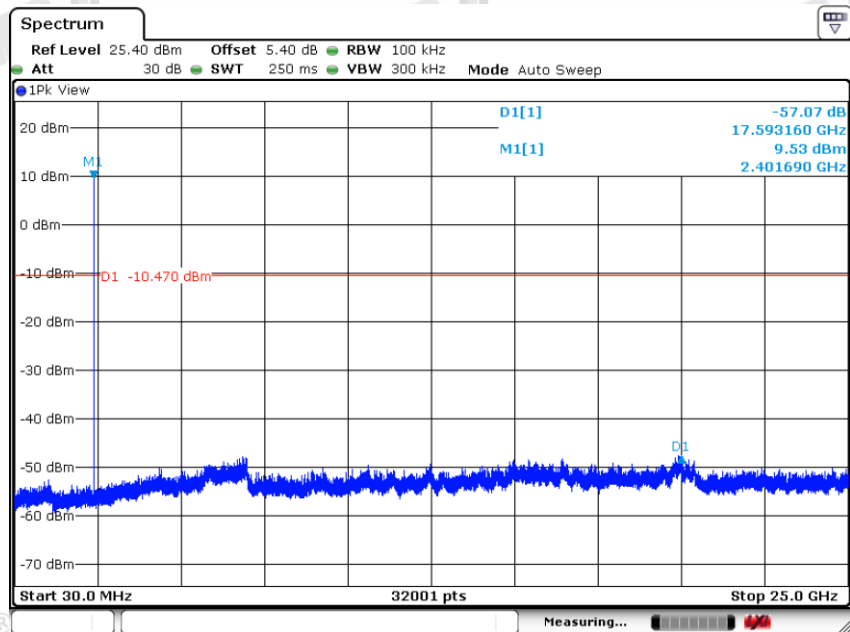
8DPSK_Highest Channel_Hopping OFF



Spurious RF Conducted Emissions

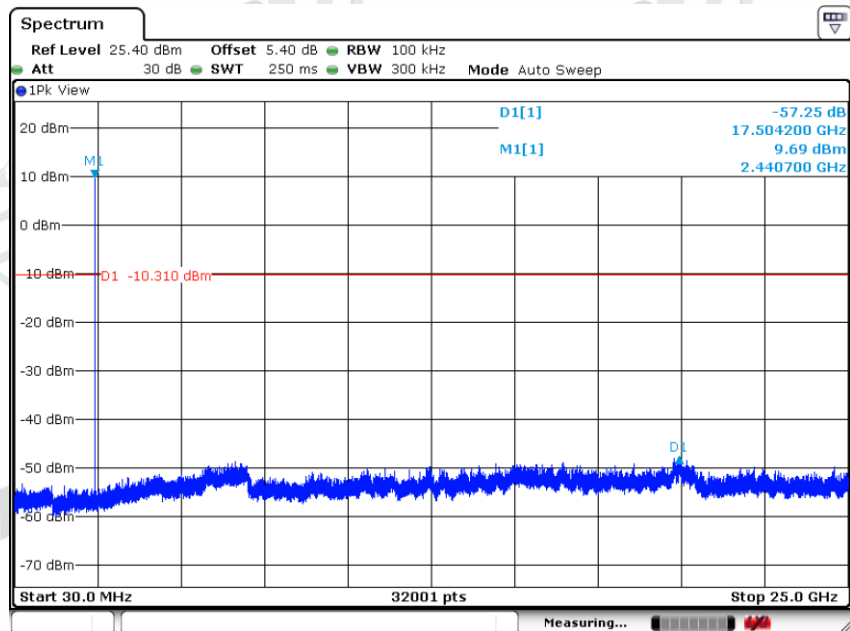
Test plots

GFSK _Lowest Channel



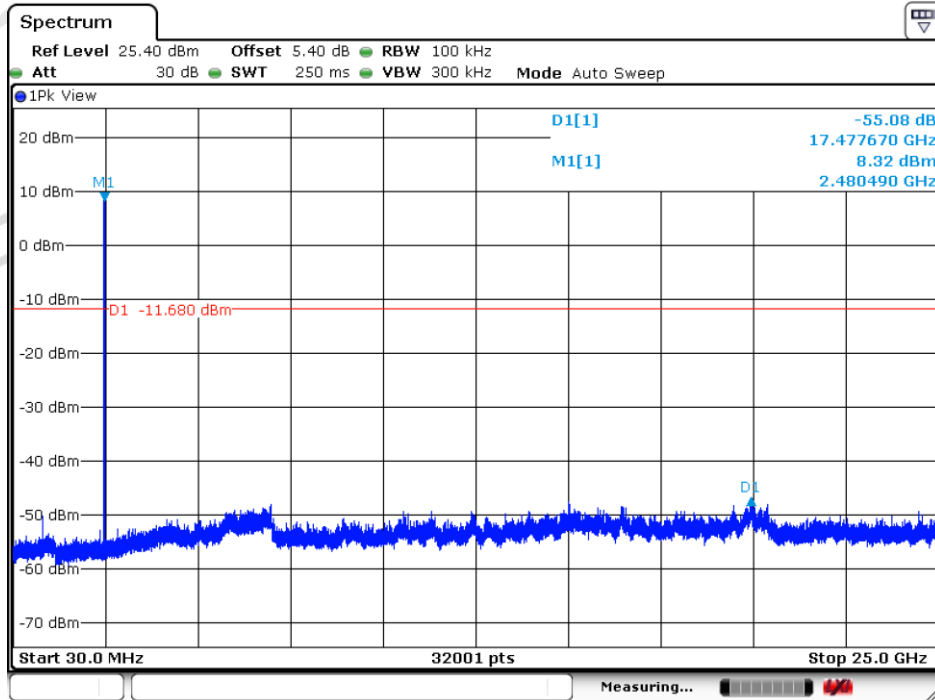
Date: 13 JUL 2019 01:19:20

GFSK _Middle Channel

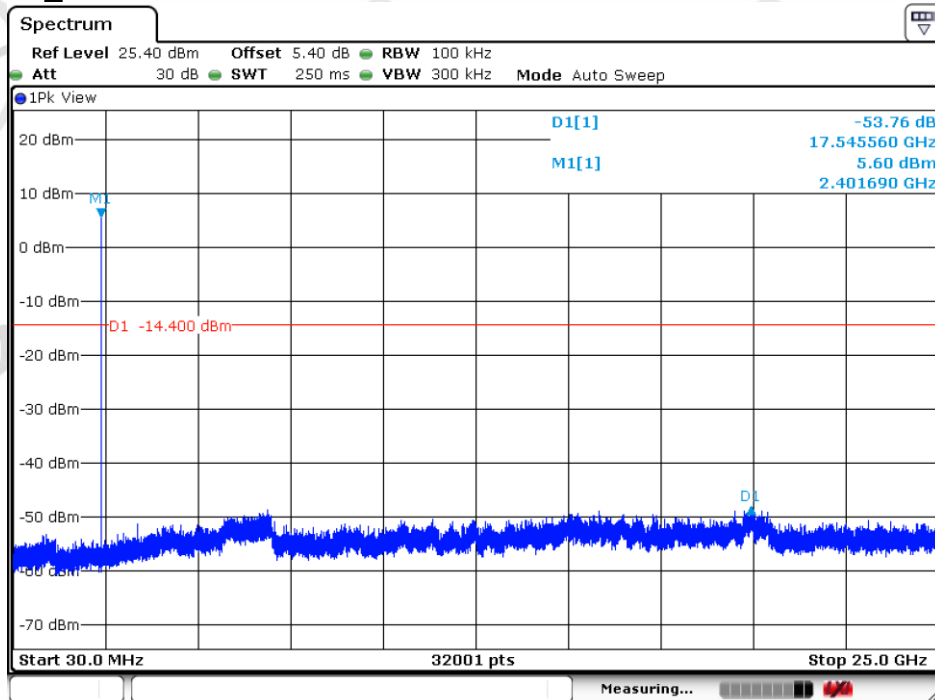


Date: 13 JUL 2019 01:18:03

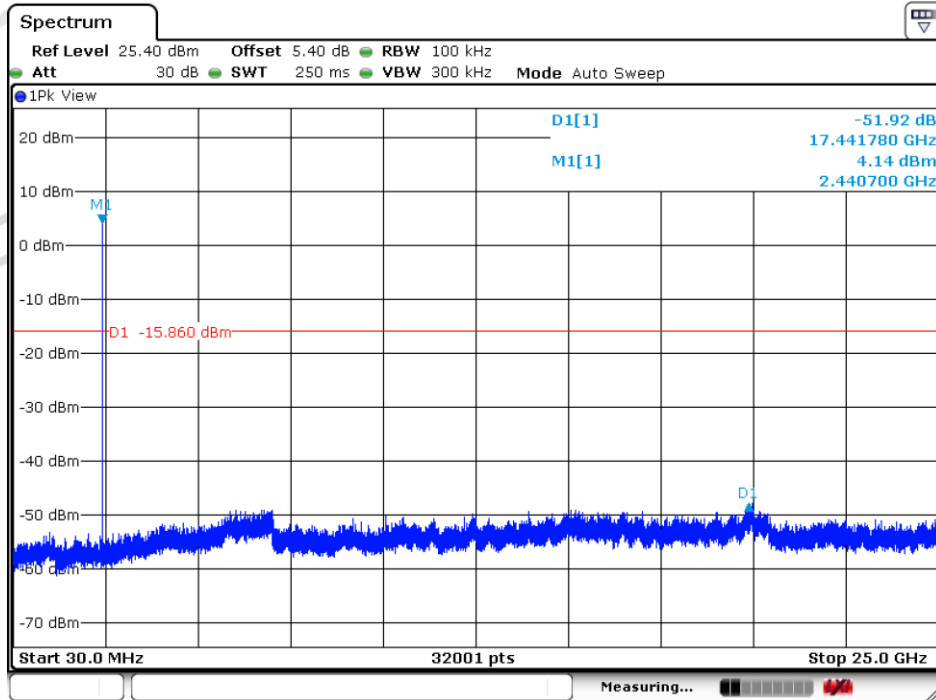
GFSK_Highest Channel



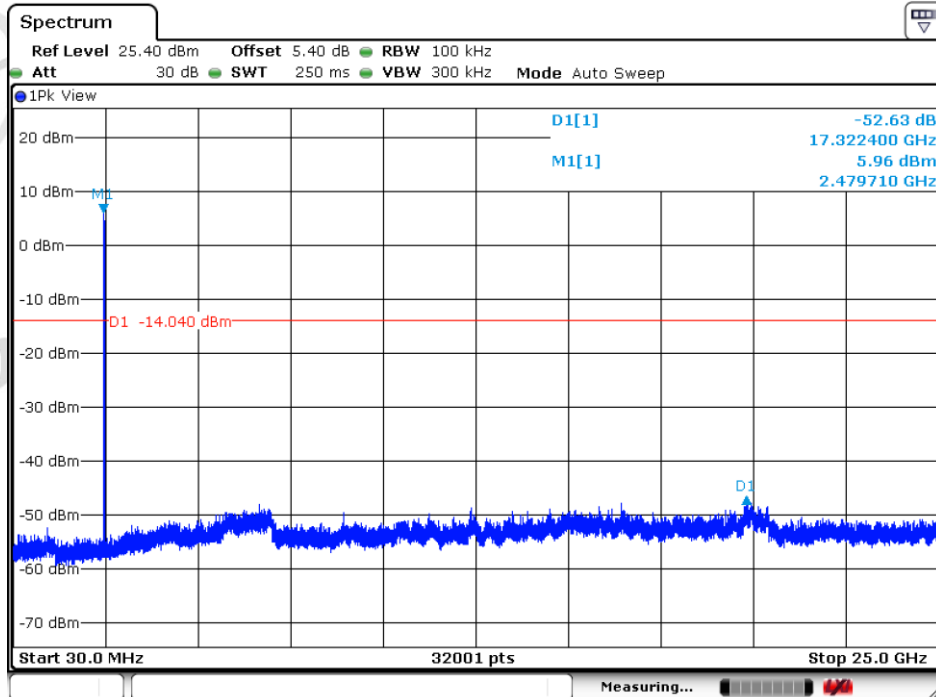
Date: 13 JUL 2019 01:17:09

 $\pi/4$ DQPSK_Lowest Channel

Date: 13 JUL 2019 01:05:25

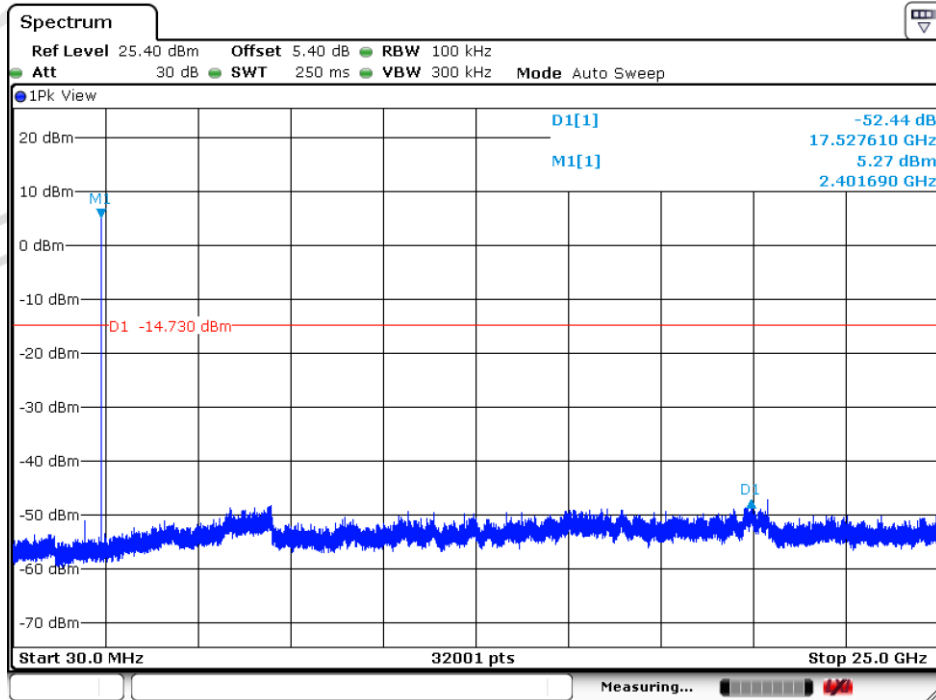
$\pi/4$ DQPSK_Middle Channel

Date: 13 JUL 2019 01:03:28

 $\pi/4$ DQPSK_Highest Channel

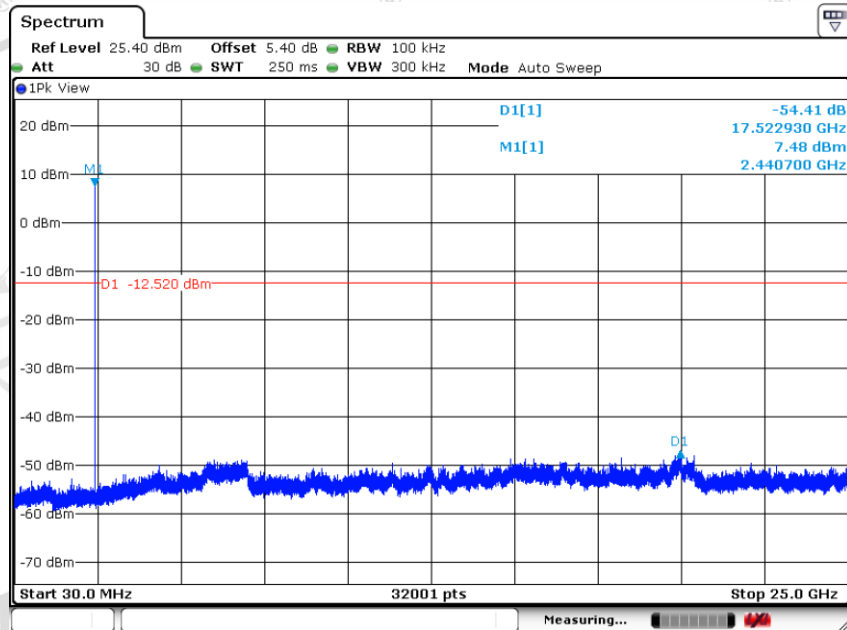
Date: 13 JUL 2019 01:02:44

8DPSK_Lowest Channel



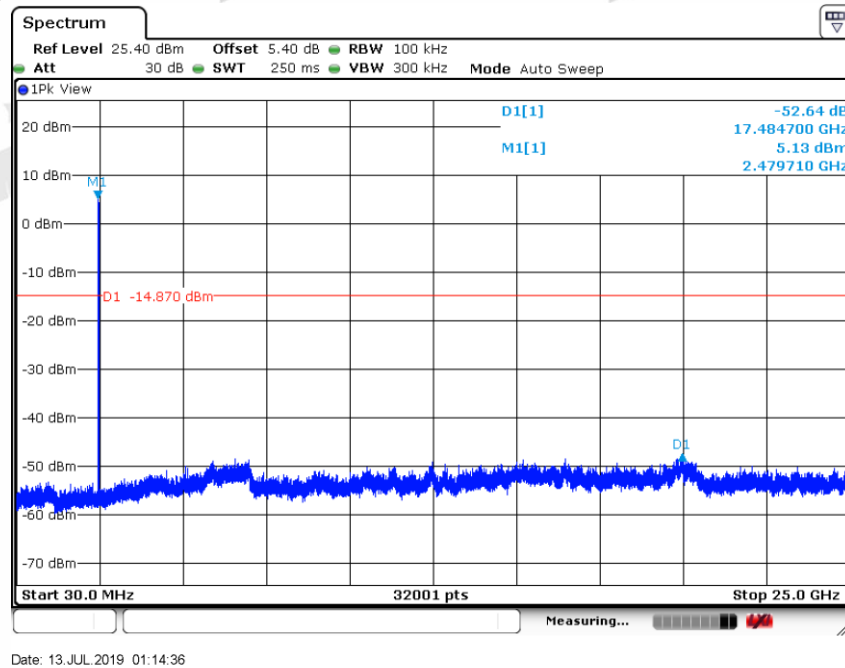
Date: 13 JUL 2019 01:12:25

8DPSK_Middle Channel



Date: 13 JUL 2019 01:13:39

8DPSK_Highest Channel



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.