Appendix

Bluetooth

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1 Equipment List

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	2019/4/1	2020/3/31
Measurement Software	AUDIX	e3 V5.4.1221d	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2019/6/12	2020/6/11
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	2019/6/12	2020/6/11
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)

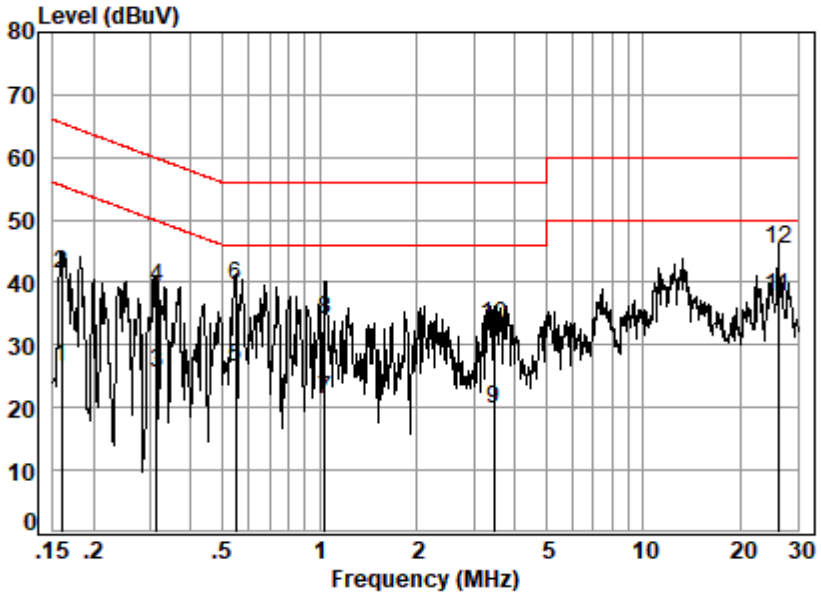
3 AC Power Line Conducted Emissions

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.

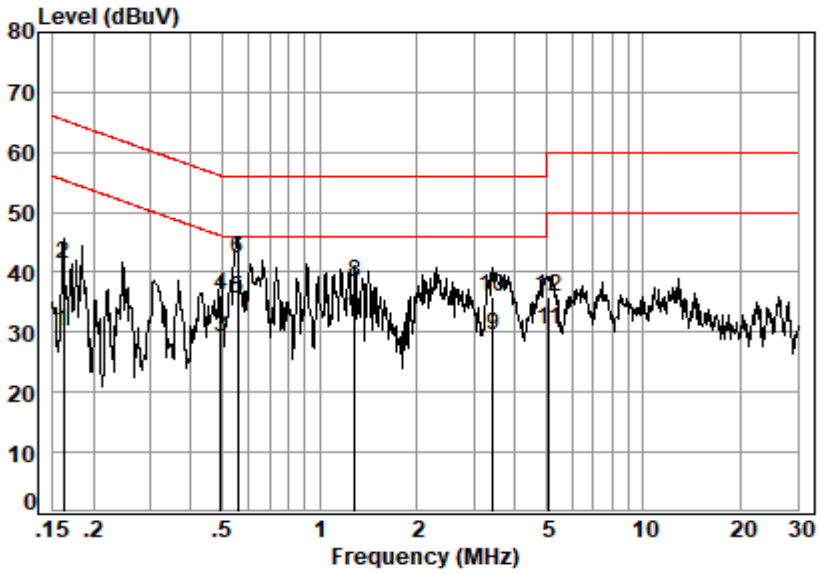
Live line:



Site : Shielding Room
Condition: Line
Job No. : 16957CR
Test mode: b

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1590	0.01	9.66	16.79	26.46	55.52	-29.06	Average
2	0.1590	0.01	9.66	31.75	41.42	65.52	-24.10	QP
3	0.3133	0.04	9.67	15.69	25.40	49.88	-24.48	Average
4	0.3133	0.04	9.67	29.54	39.25	59.88	-20.63	QP
5	0.5493	0.06	9.67	16.85	26.58	46.00	-19.42	Average
6	0.5493	0.06	9.67	29.75	39.48	56.00	-16.52	QP
7	1.0375	0.09	9.74	11.42	21.25	46.00	-24.75	Average
8	1.0375	0.09	9.74	24.19	34.02	56.00	-21.98	QP
9	3.4538	0.16	9.71	9.83	19.70	46.00	-26.30	Average
10	3.4538	0.16	9.71	23.40	33.27	56.00	-22.73	QP
11	26.0012	0.26	10.29	27.19	37.74	50.00	-12.26	Average
12	26.0012	0.26	10.29	34.71	45.26	60.00	-14.74	QP

Neutral line:



Site : Shielding Room
Condition: Neutral
Job No. : 16957CR
Test mode: b

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1615	0.01	9.64	20.61	30.26	55.38	-25.12	Average
2	0.1615	0.01	9.64	31.86	41.51	65.38	-23.87	QP
3	0.4941	0.06	9.64	19.50	29.20	46.10	-16.90	Average
4	0.4941	0.06	9.64	26.53	36.23	56.10	-19.87	QP
5	0.5581	0.07	9.64	26.03	35.74	46.00	-10.26	Average
6	0.5581	0.07	9.64	32.43	42.14	56.00	-13.86	QP
7	1.2824	0.11	9.70	22.01	31.82	46.00	-14.18	Average
8	1.2824	0.11	9.70	28.66	38.47	56.00	-17.53	QP
9	3.4356	0.16	9.68	19.62	29.46	46.00	-16.54	Average
10	3.4356	0.16	9.68	26.04	35.88	56.00	-20.12	QP
11	5.1118	0.17	9.71	20.59	30.47	50.00	-19.53	Average
12	5.1118	0.17	9.71	26.09	35.97	60.00	-24.03	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

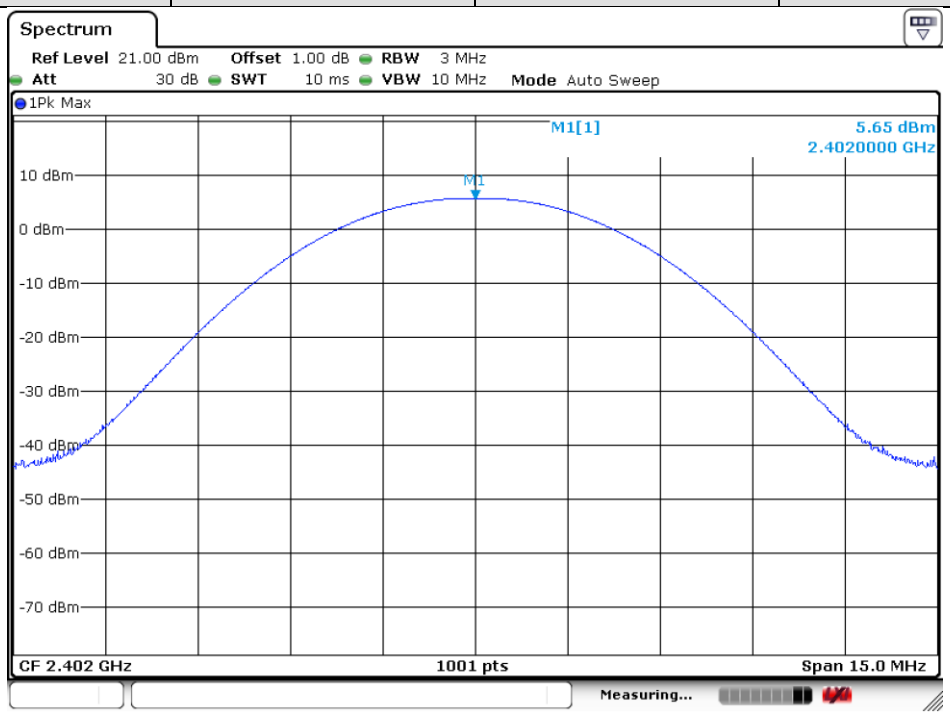
4.1 Test Results

Measurement Data of Peak power:

GFSK mode			
Test channel	**Peak Output Power (dBm)**	**Limit (dBm)**	**Result**
Lowest	5.65	20.97	Pass
Middle	5.03	20.97	Pass
Highest	5.05	20.97	Pass
π/4DQPSK mode			
Test channel	**Peak Output Power (dBm)**	**Limit (dBm)**	**Result**
Lowest	5.97	20.97	Pass
Middle	5.39	20.97	Pass
Highest	5.39	20.97	Pass
8DPSK mode			
Test channel	**Peak Output Power (dBm)**	**Limit (dBm)**	**Result**
Lowest	6.01	20.97	Pass
Middle	5.24	20.97	Pass
Highest	5.20	20.97	Pass

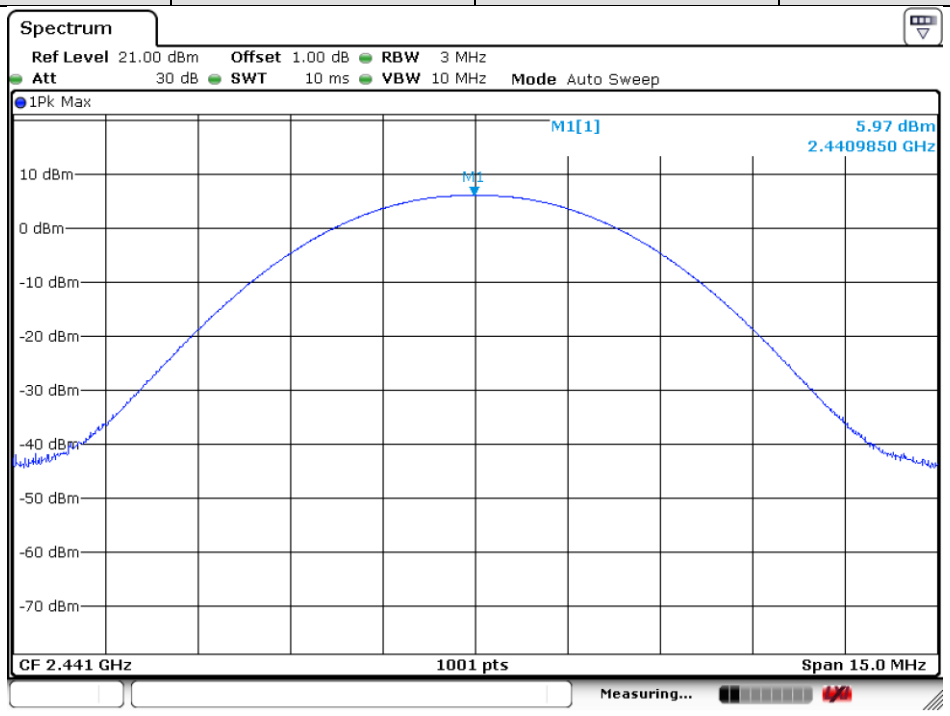
4.2 Test plots

Test mode:	GFSK	Test channel:	Lowest



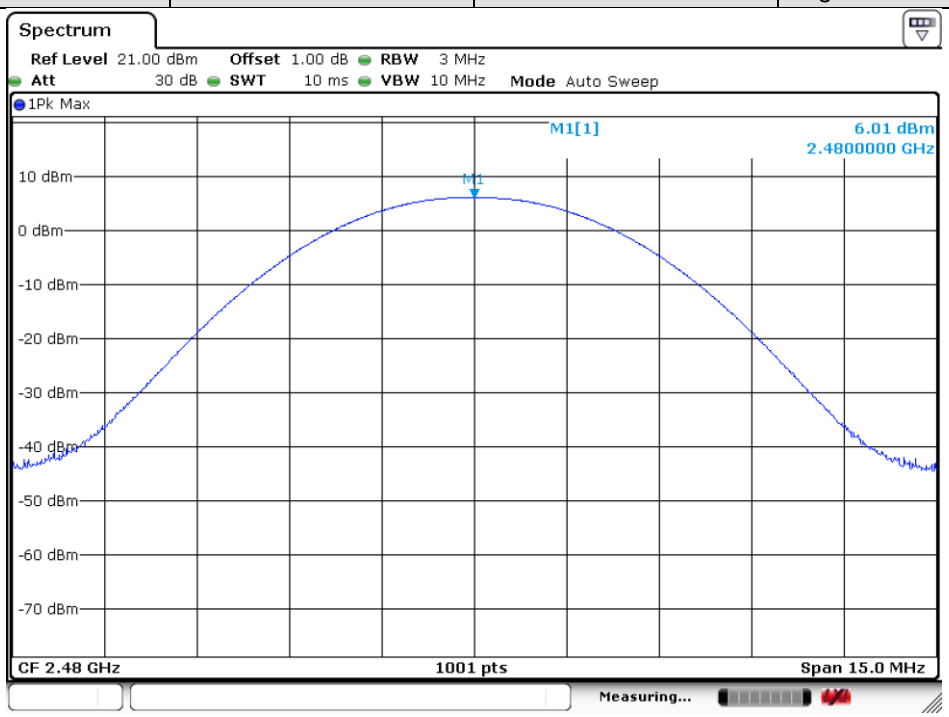
Date: 6.AUG.2019 01:57:39

Test mode:	GFSK	Test channel:	Middle



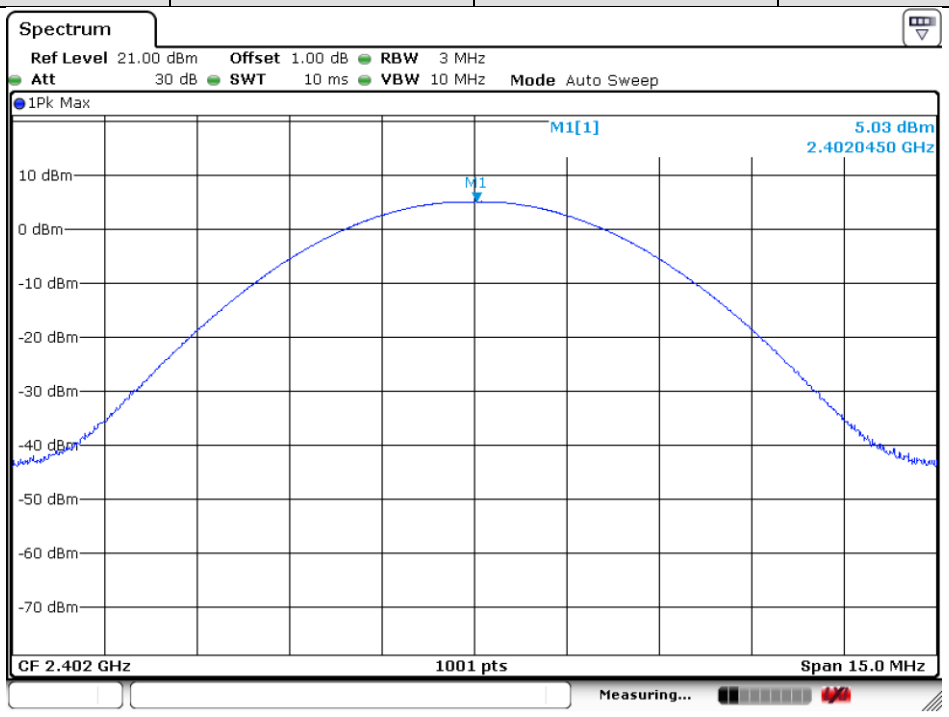
Date: 6.AUG.2019 01:58:08

Test mode:	GFSK	Test channel:	Highest



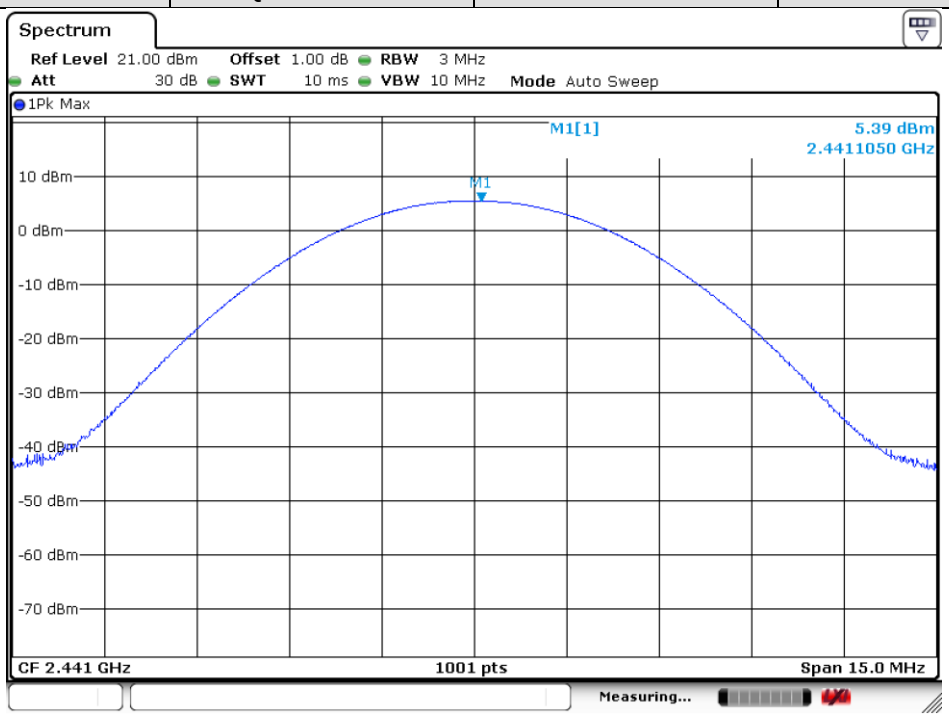
Date: 6.AUG.2019 01:58:27

Test mode:	π/4DQPSK	Test channel:	Lowest



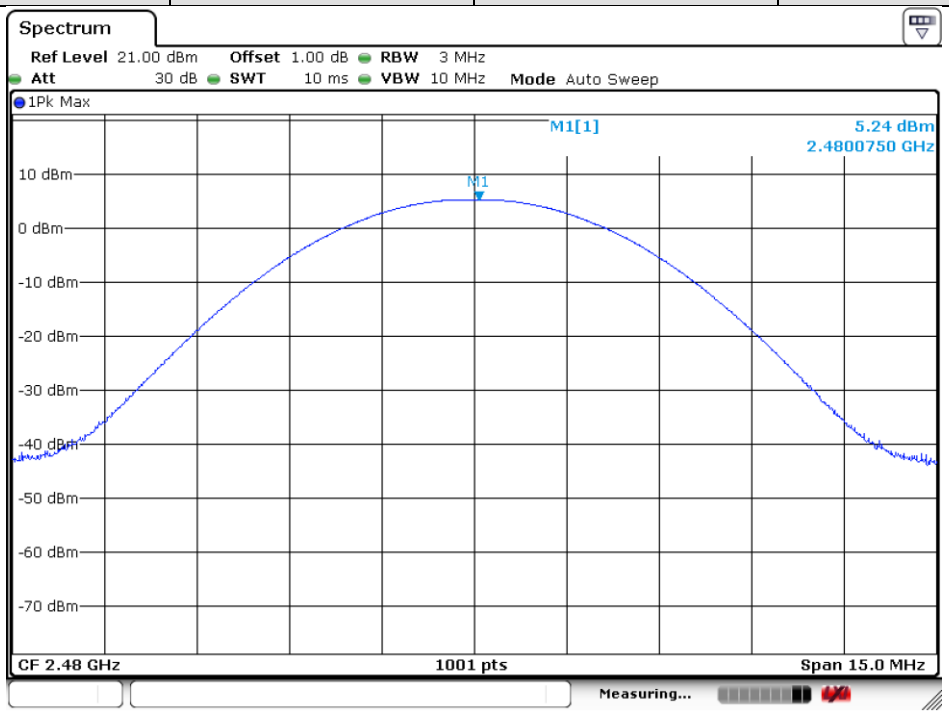
Date: 6.AUG.2019 01:55:51

Test mode:	π/4DQPSK	Test channel:	Middle



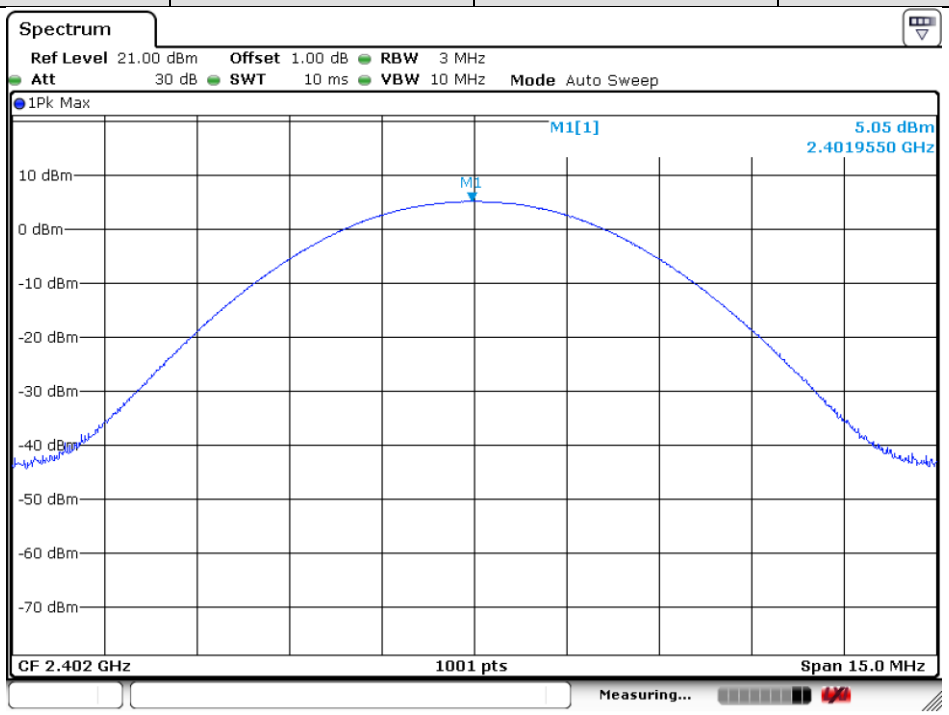
Date: 6.AUG.2019 01:56:18

Test mode:	π/4DQPSK	Test channel:	Highest



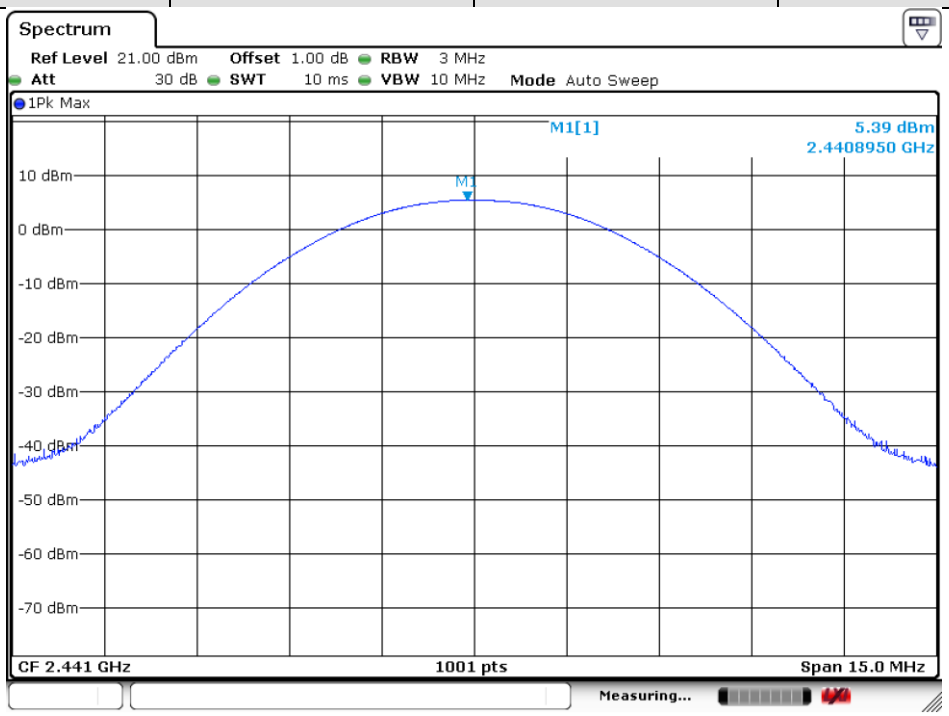
Date: 6.AUG.2019 01:56:55

Test mode:	8DPSK	Test channel:	Lowest



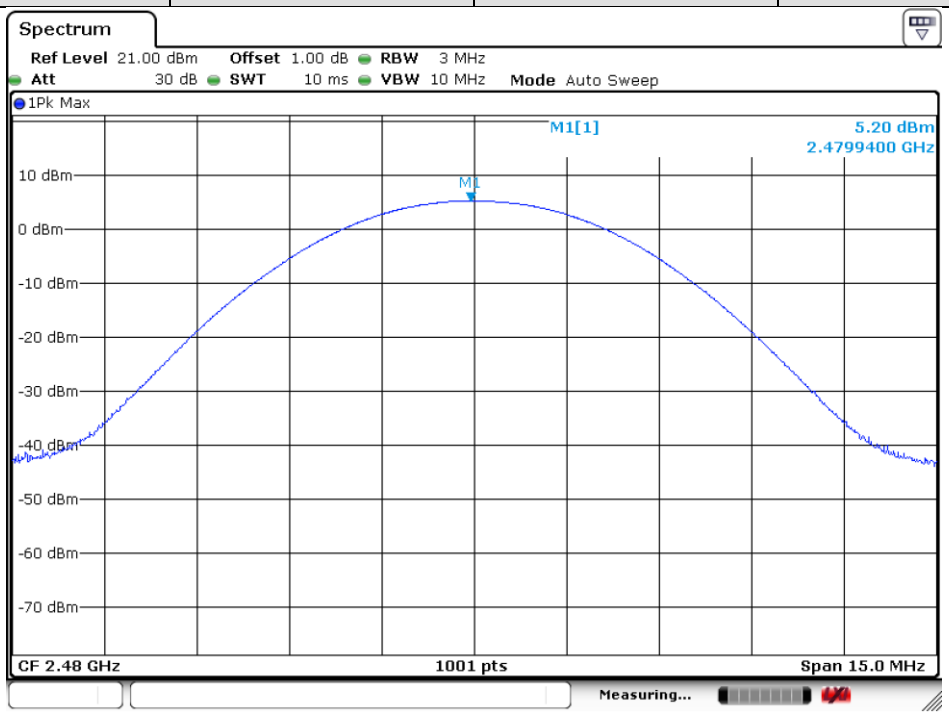
Date: 6.AUG.2019 01:55:13

Test mode:	8DPSK	Test channel:	Middle



Date: 6.AUG.2019 01:54:58

Test mode:	8DPSK	Test channel:	Highest



Date: 6.AUG.2019 01:53:56

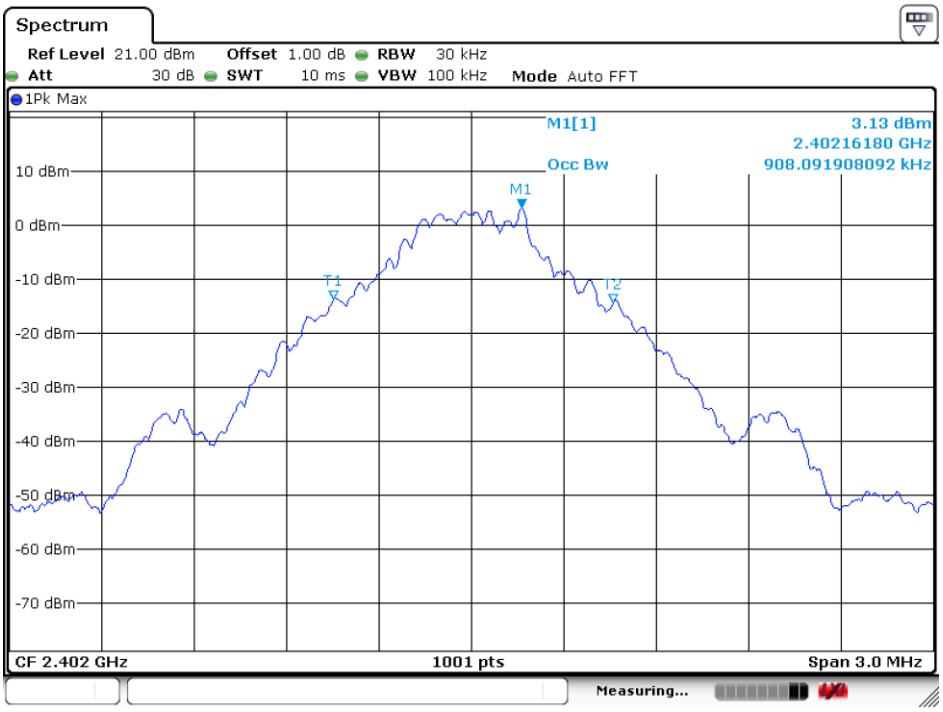
5 20dB Emission Bandwidth & 99% Occupied Bandwidth

5.1 Test Results

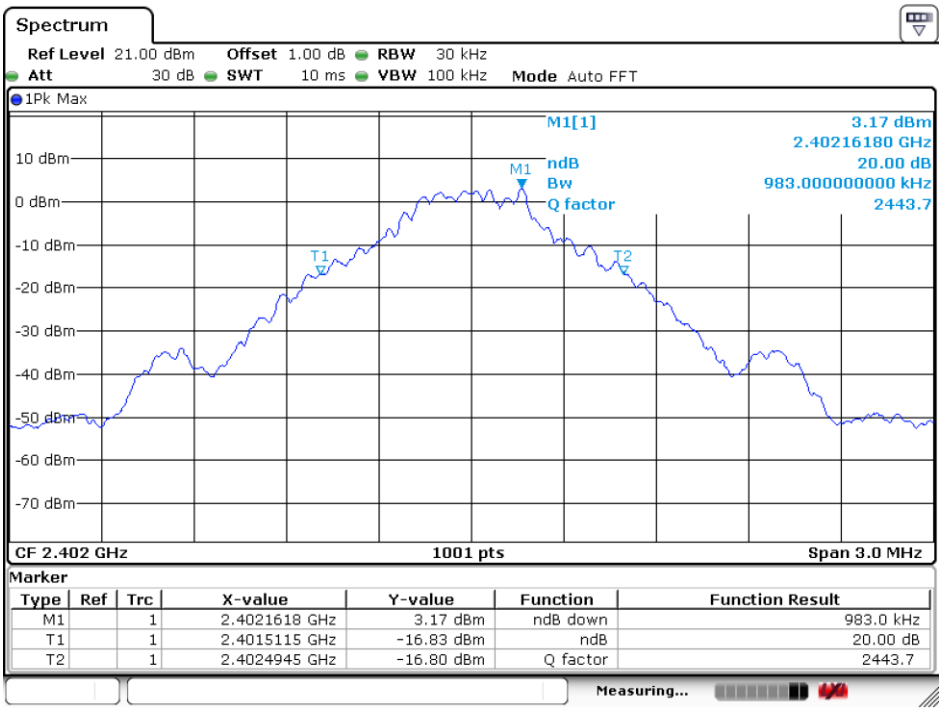
Mode	Test Channel	99% Occupied Bandwidth (KHz)	20dB Emission Bandwidth (KHz)	Result
GFSK	Lowest	908.1	983.0	Pass
	Middle	908.1	980.0	Pass
	Highest	911.1	992.0	Pass
π/4DQPSK	Lowest	1180.8	1297.7	Pass
	Middle	1183.8	1300.7	Pass
	Highest	1168.8	1282.7	Pass
8DPSK	Lowest	1180.8	1282.7	Pass
	Middle	1189.8	1285.7	Pass
	Highest	1174.8	1279.7	Pass

5.2 Test plots

GFSK _Lowest Channel



Date: 6.AUG.2019 01:59:57

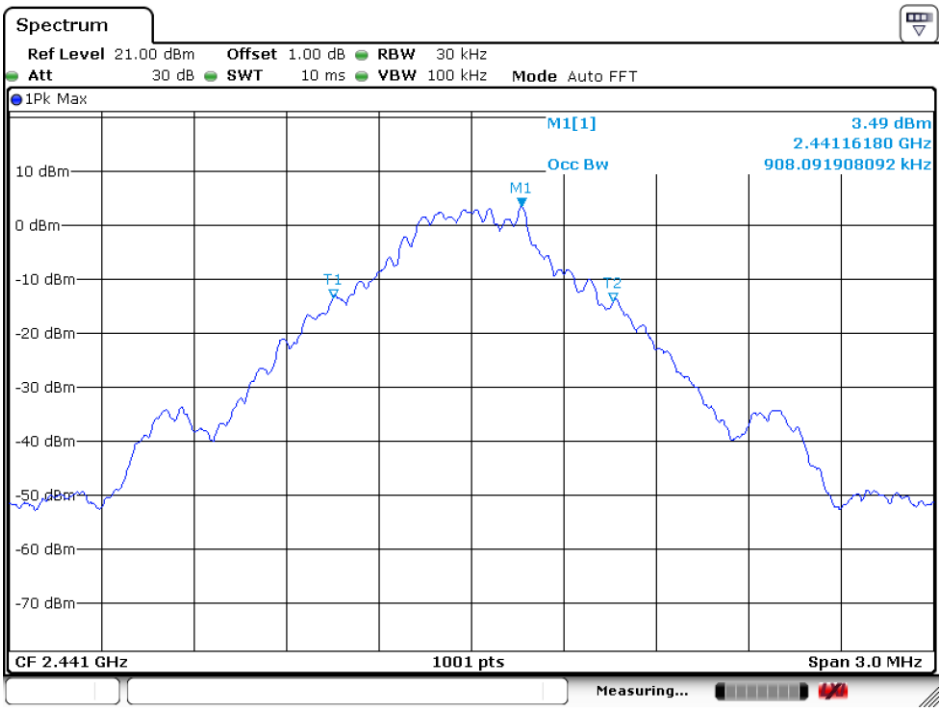


Marker

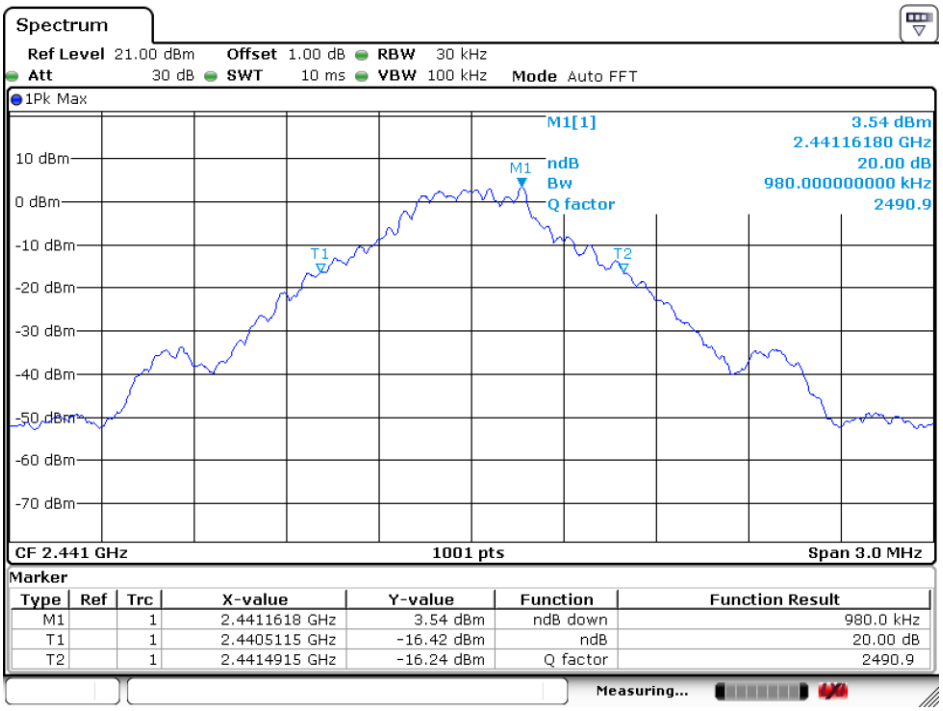
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4021618 GHz	3.17 dBm	ndB down	983.0 kHz
T1		1	2.4015115 GHz	-16.83 dBm	ndB	20.00 dB
T2		1	2.4024945 GHz	-16.80 dBm	Q factor	2443.7

Date: 6.AUG.2019 02:06:31

GFSK _Middle Channel

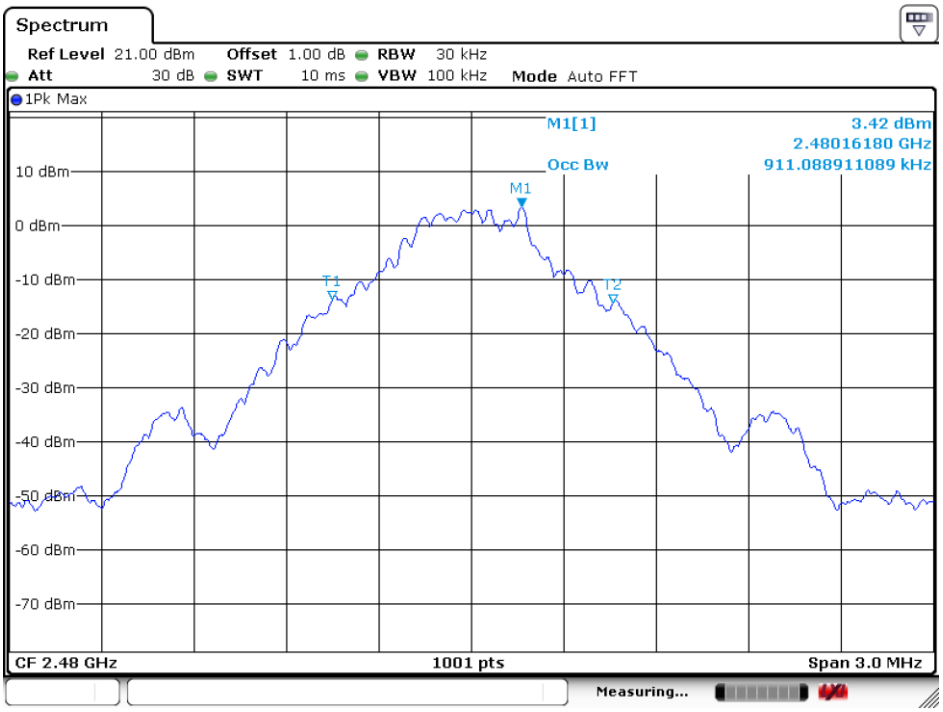


Date: 6.AUG.2019 01:59:33

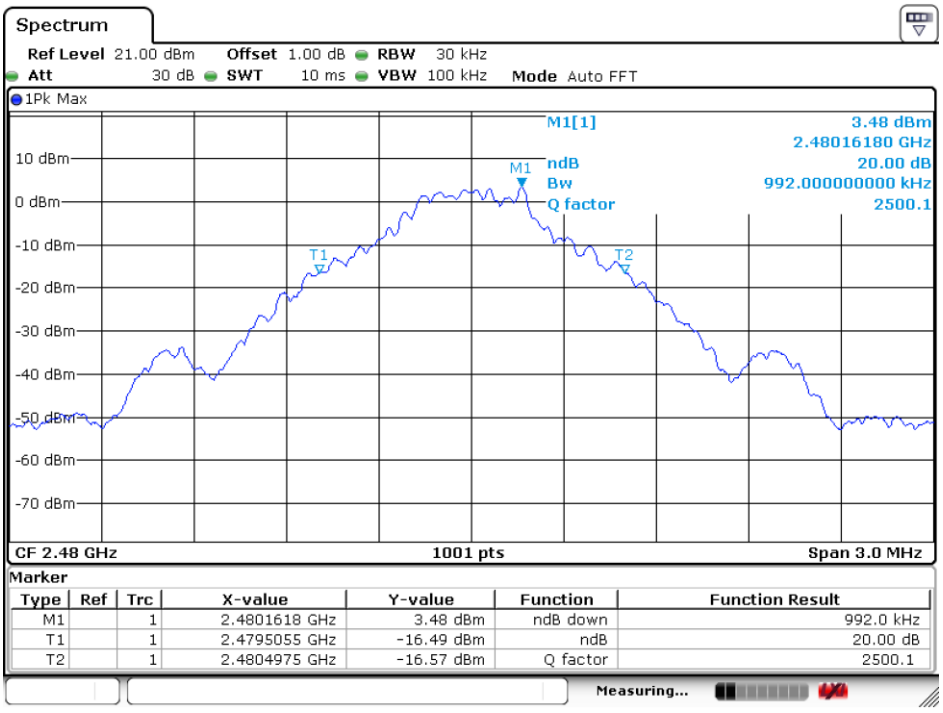


Date: 6.AUG.2019 02:06:50

GFSK _Highest Channel

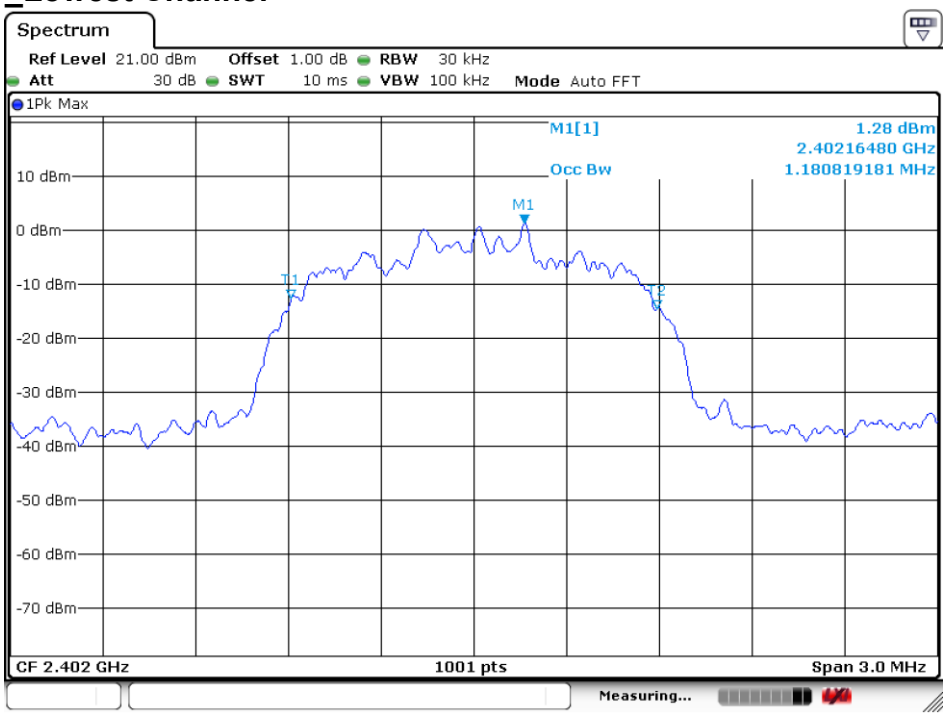


Date: 6.AUG.2019 01:58:58



Date: 6.AUG.2019 02:07:04

π/4DQPSK _Lowest Channel



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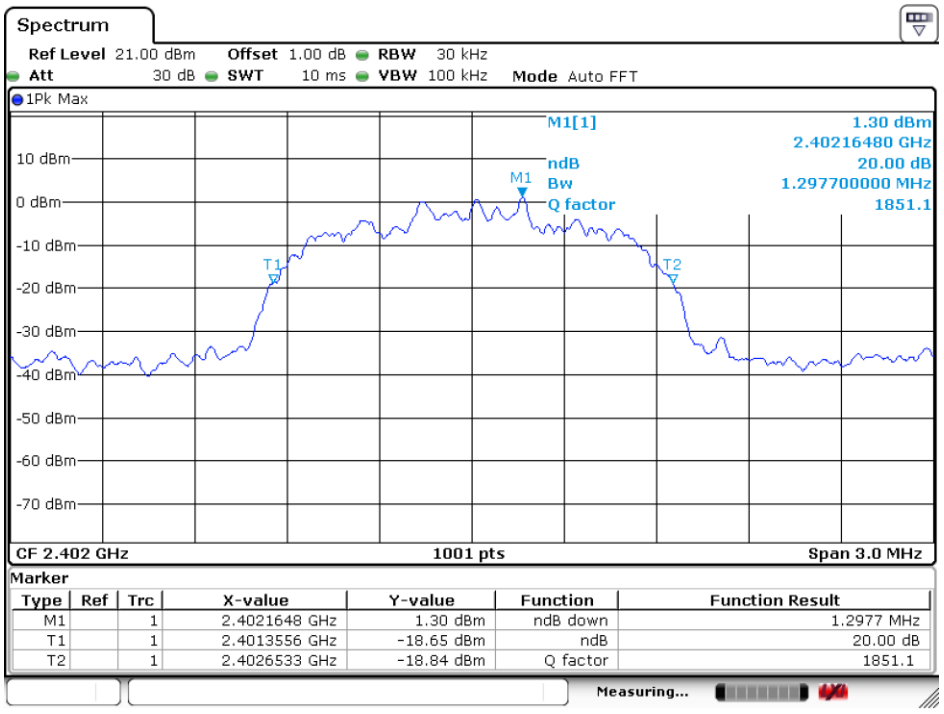

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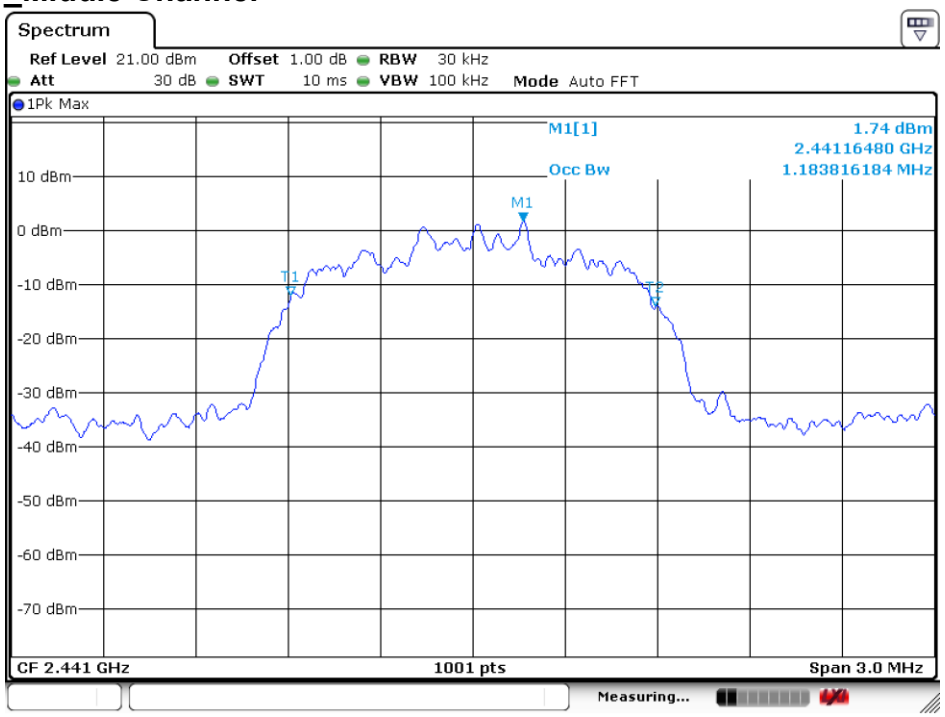
π/4DQPSK _Middle Channel



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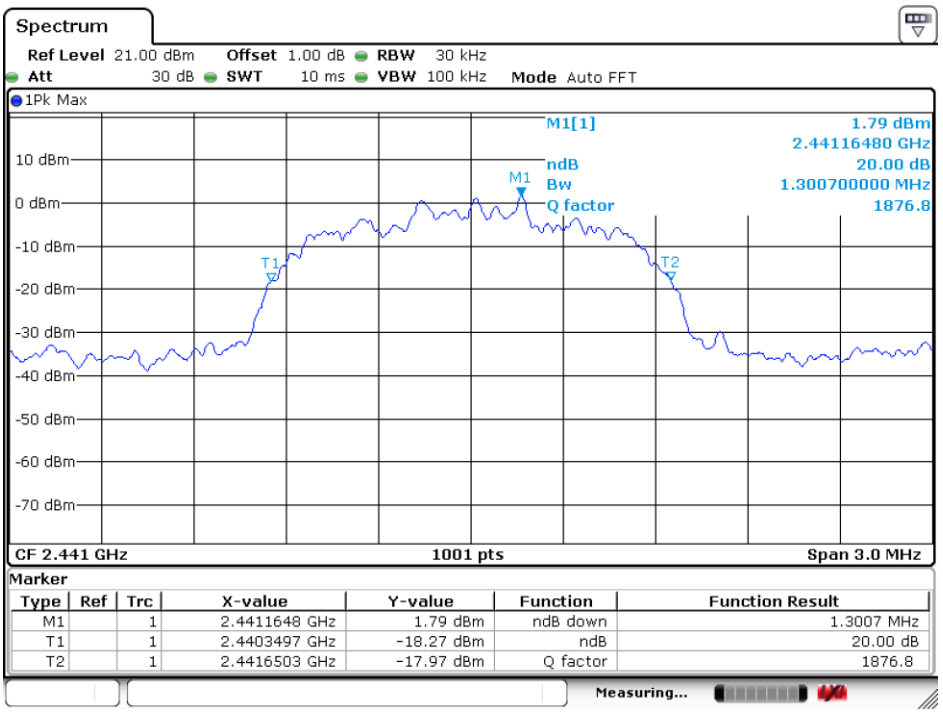
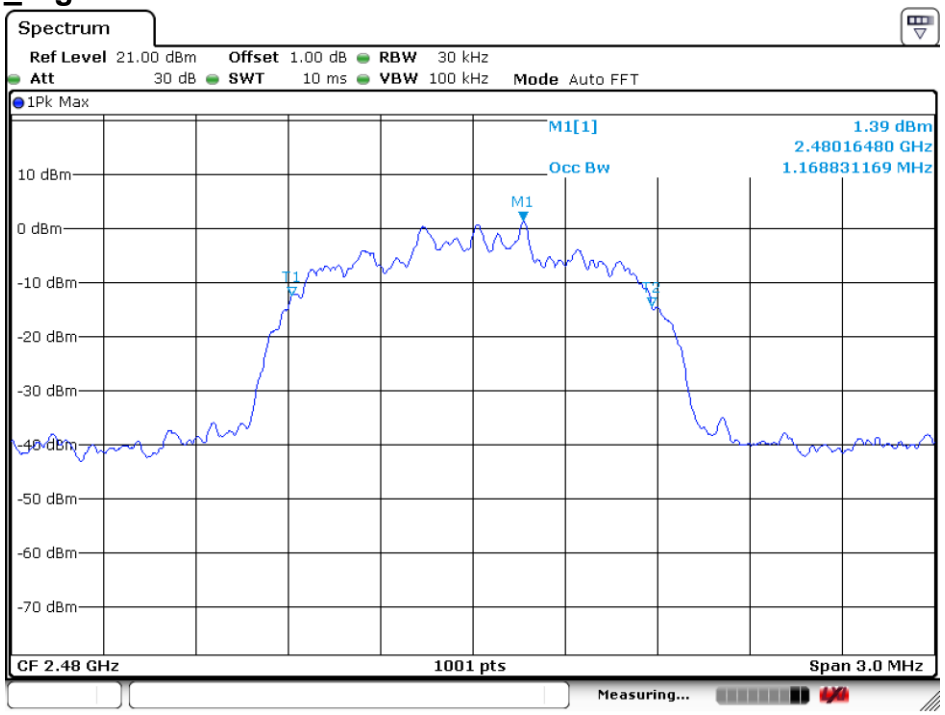


Date: 6.AUG.2019 02:05:24

π/4DQPSK _Highest Channel



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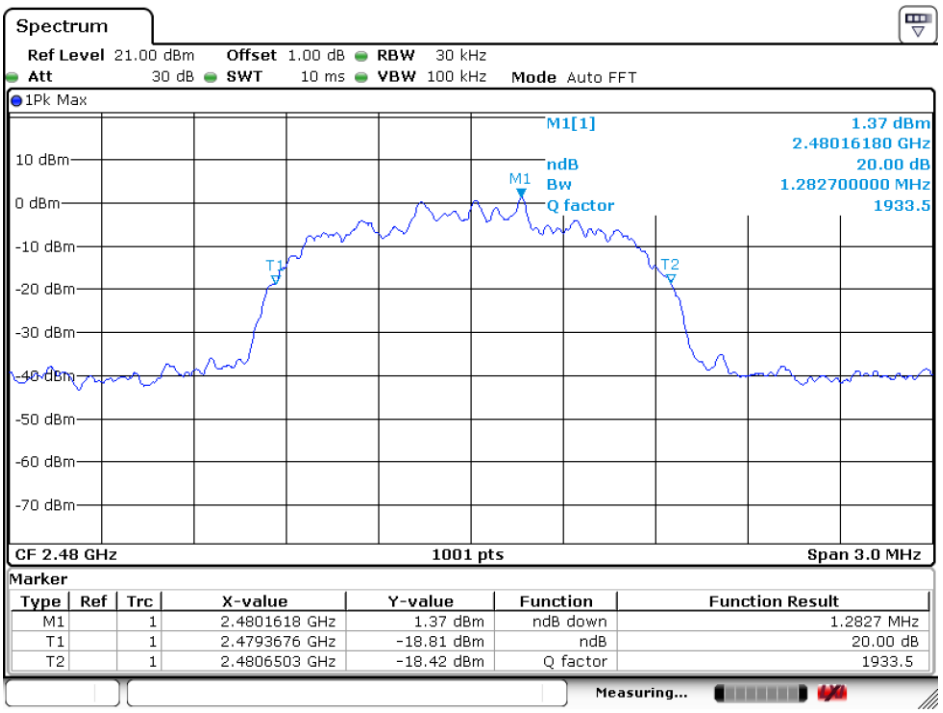
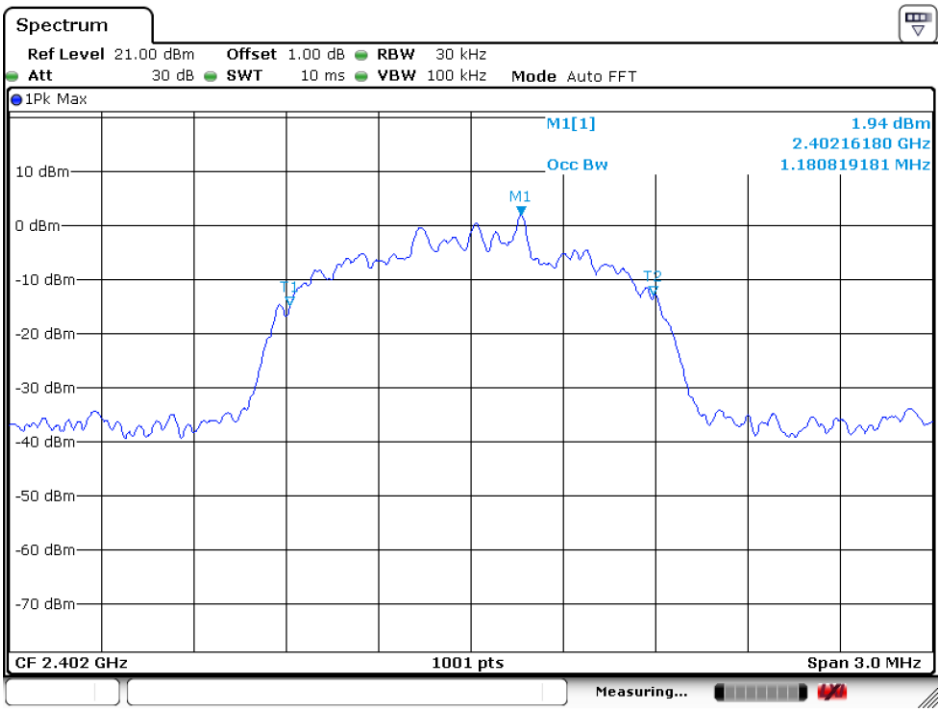


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4801618 GHz	1.37 dBm	ndB down	1.2827 MHz
T1		1	2.4793676 GHz	-18.81 dBm	ndB	20.00 dB
T2		1	2.4806503 GHz	-18.42 dBm	Q factor	1933.5

Date: 6.AUG.2019 02:05:02

8DPSK_Lowest Channel



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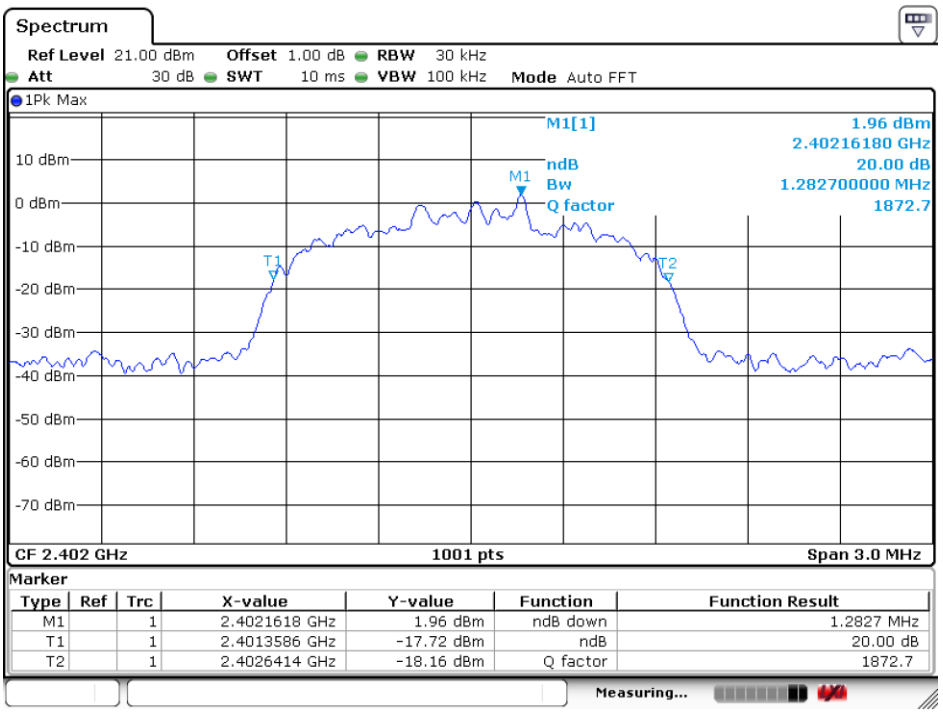

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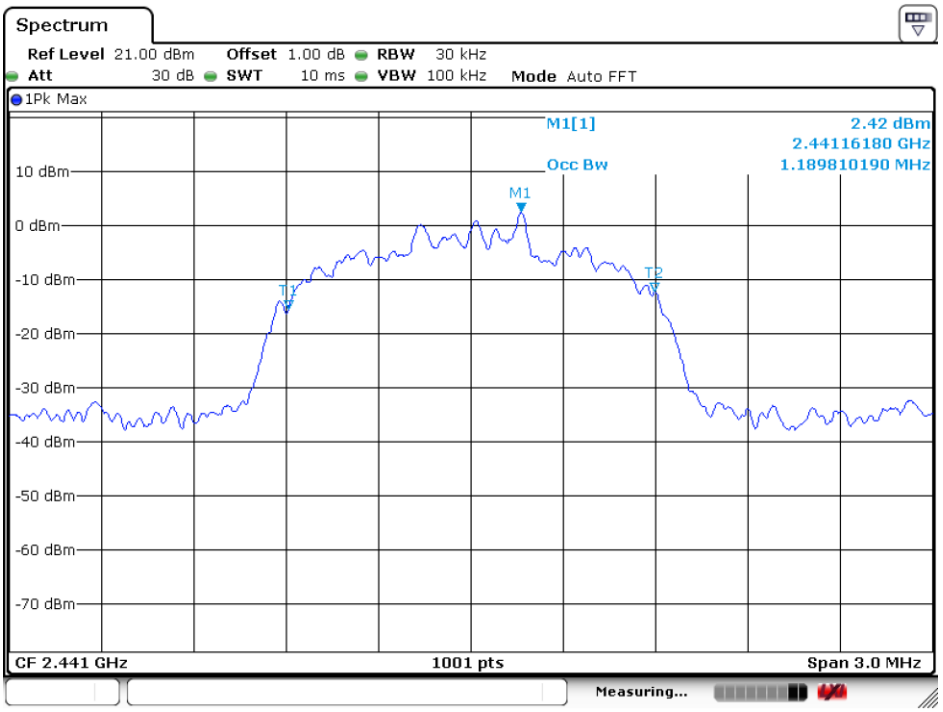
8DPSK _Middle Channel



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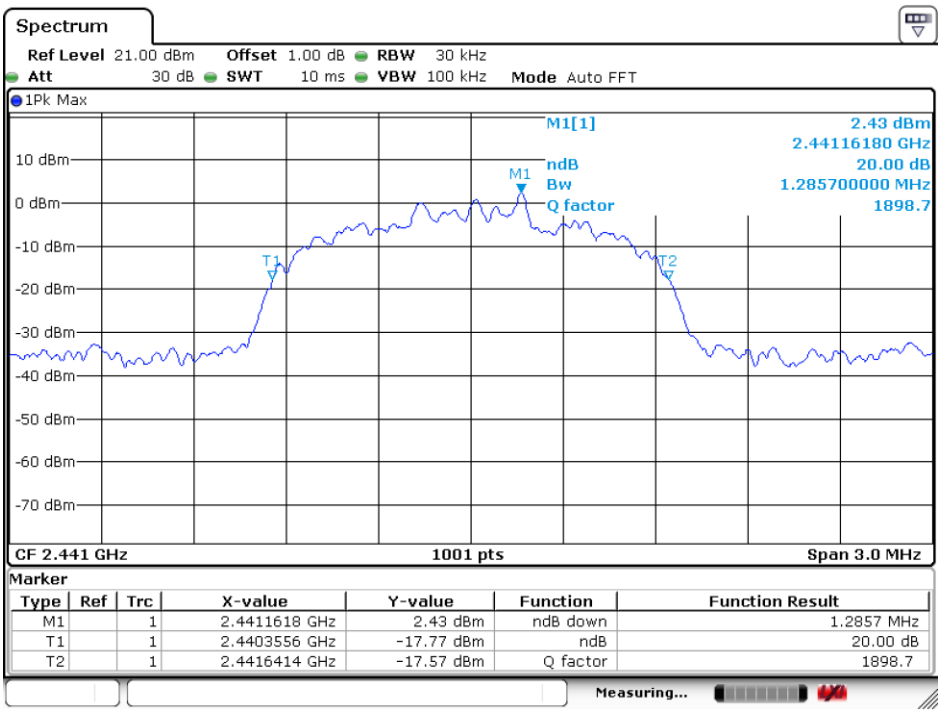
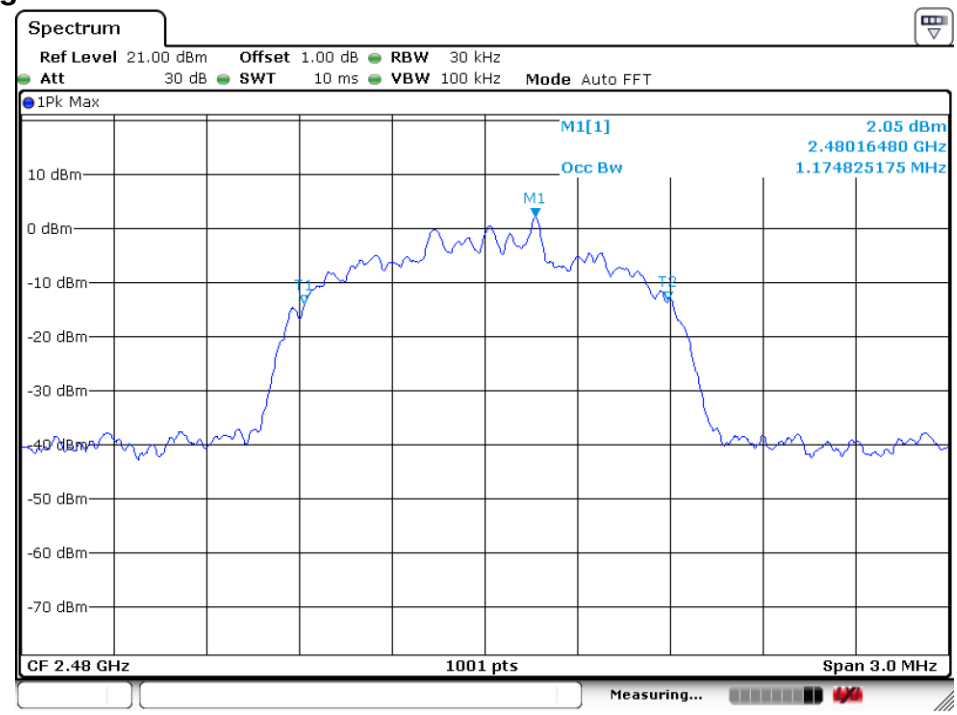
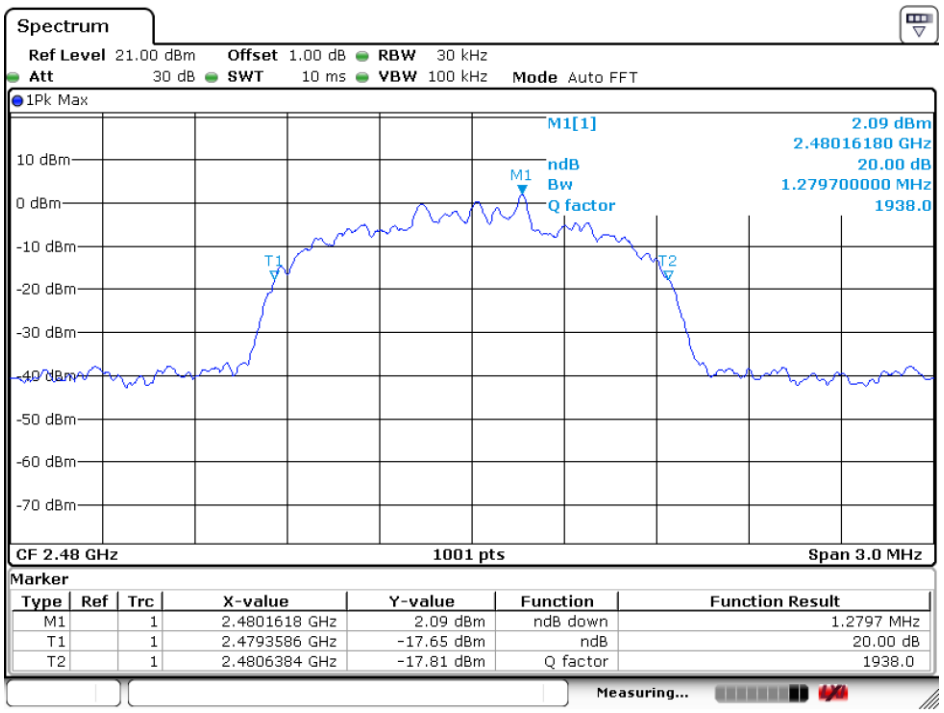


Date: 6.AUG.2019 02:04:12

8DPSK_Highest Channel



Date: 6.AUG.2019 02:01:22



Date: 6.AUG.2019 02:04:38

6 Carrier Frequencies Separation

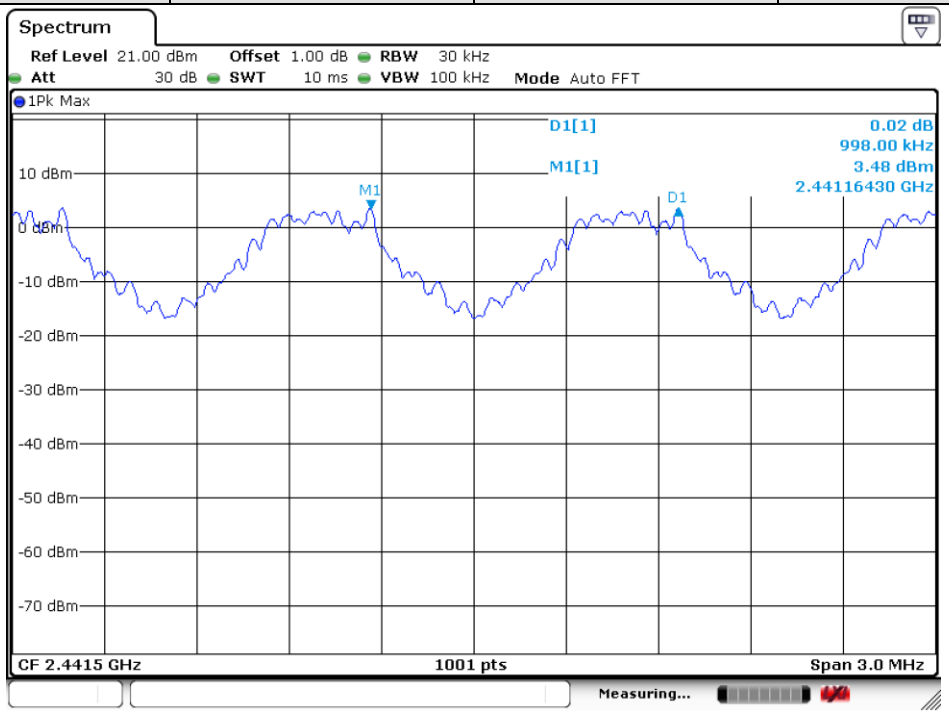
6.1 Test Results

GFSK mode			
Test channel	**Carrier Frequencies Separation (kHz)**	**Limit (kHz)**	**Result**
Middle	998	661.3	Pass
π/4DQPSK mode			
Test channel	**Carrier Frequencies Separation (kHz)**	**Limit (kHz)**	**Result**
Middle	1001	867.1	Pass
8DPSK mode			
Test channel	**Carrier Frequencies Separation (kHz)**	**Limit (kHz)**	**Result**
Middle	998	857.1	Pass

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	992.0	661.3
π/4DQPSK	1300.7	867.1
8DPSK	1285.7	857.1

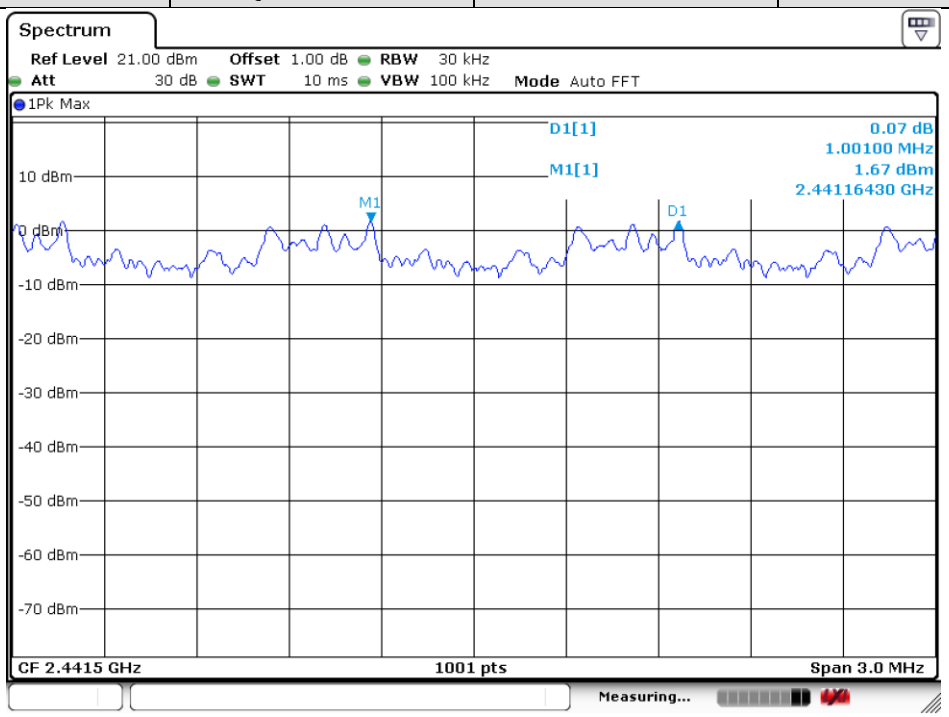
6.2 Test plots:

Test mode:	GFSK	Test channel:	Middle



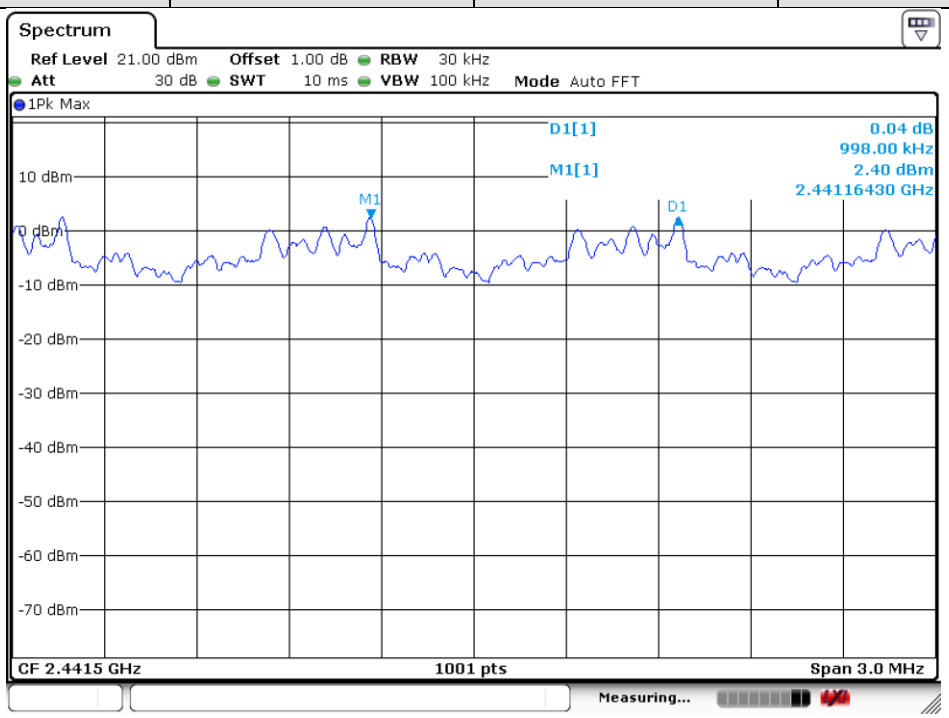
Date: 6.AUG.2019 02:08:24

Test mode:	π/4DQPSK	Test channel:	Middle



Date: 6.AUG.2019 02:08:55

Test mode:	8DPSK	Test channel:	Middle



Date: 6.AUG.2019 02:09:32

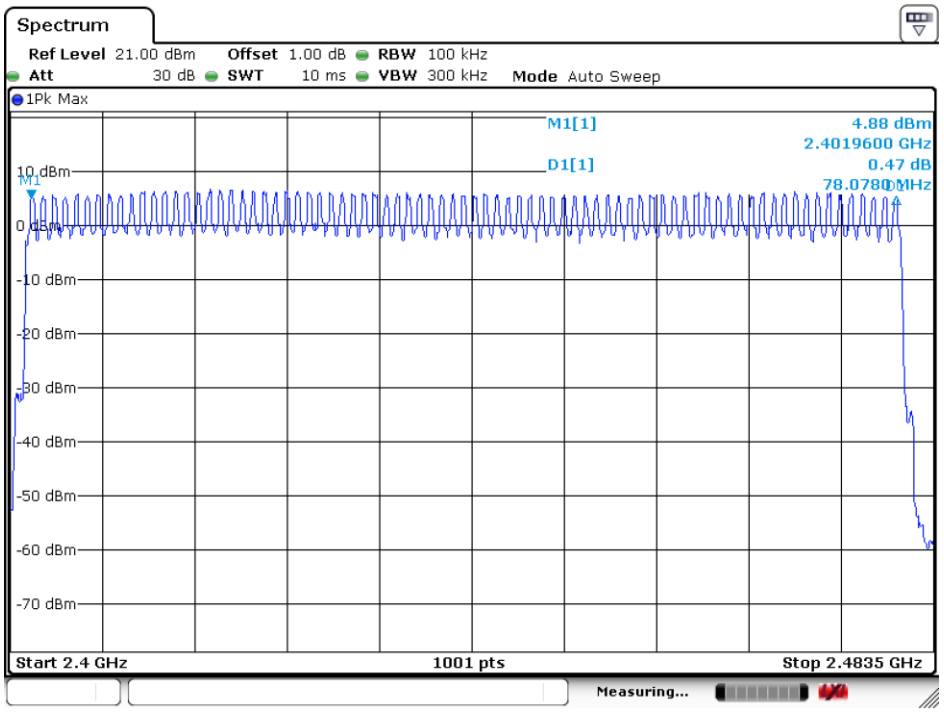
7 Hopping Channel Number

7.1 Test Results

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

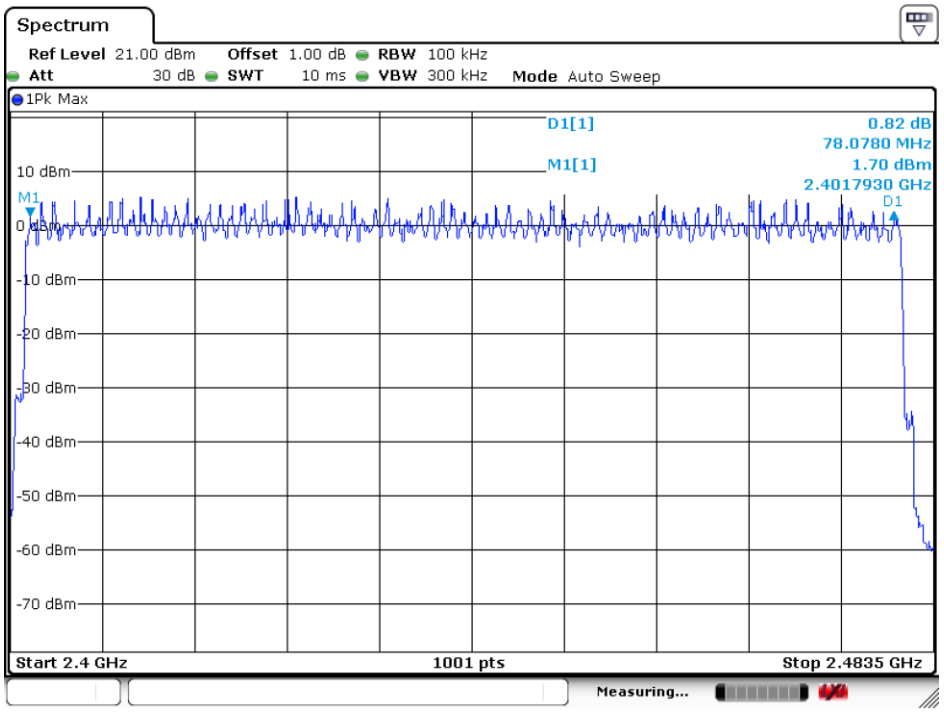
7.2 Test plots

GFSK



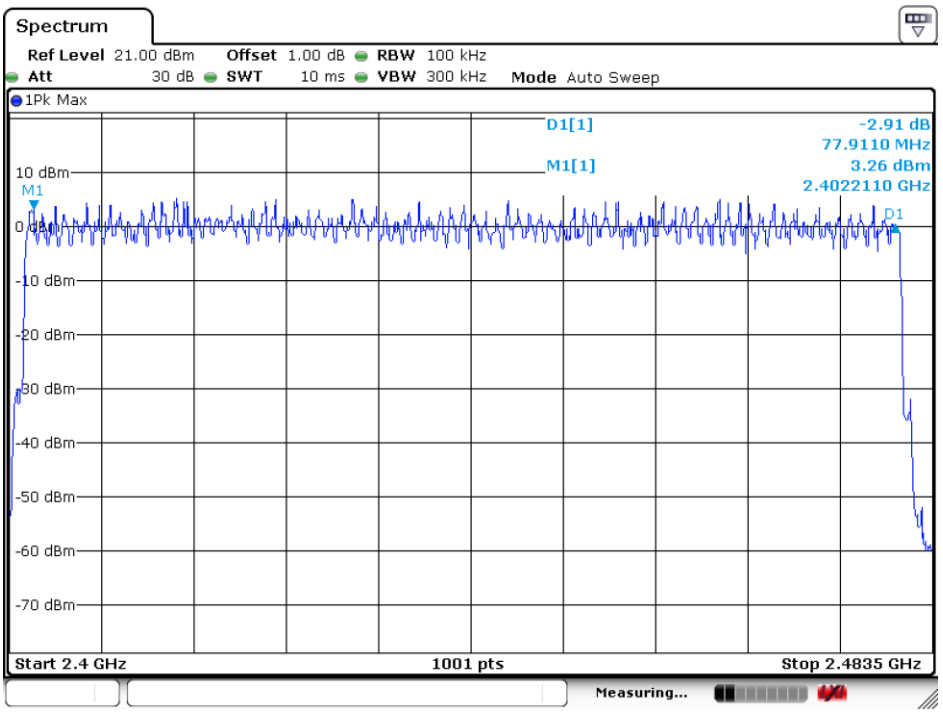
Date: 6.AUG.2019 02:12:28

π/4DQPSK



Date: 6.AUG.2019 02:11:21

8DPSK



Date: 6.AUG.2019 02:10:23

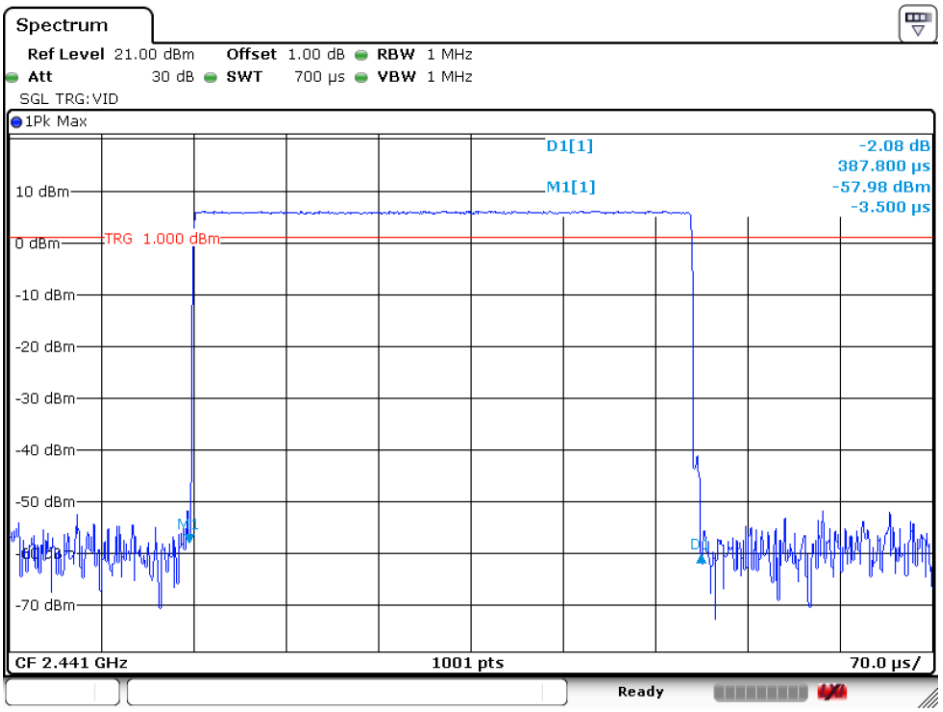
8 Dwell Time

8.1 Test Results

Operation Modes	On time (ms) on one channel
DH1	0.388
DH3	1.651
DH5	2.906
2-DH1	0.394
2-DH3	1.651
2-DH5	2.901
3-DH1	0.394
3-DH3	1.651
3-DH5	2.911

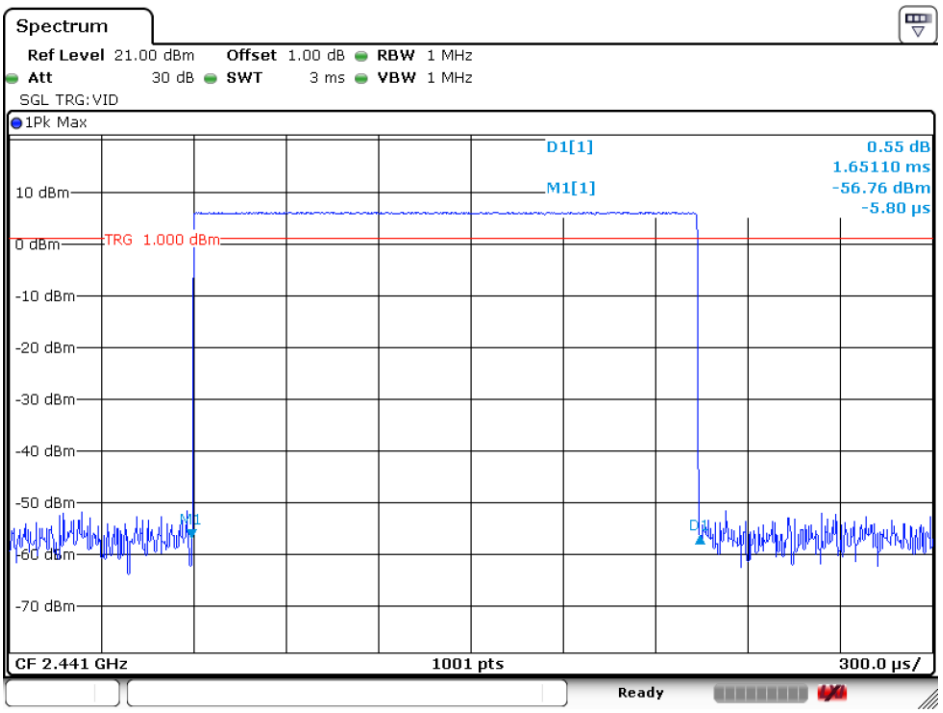
8.2 Test plots

DH1 _Middle Channel



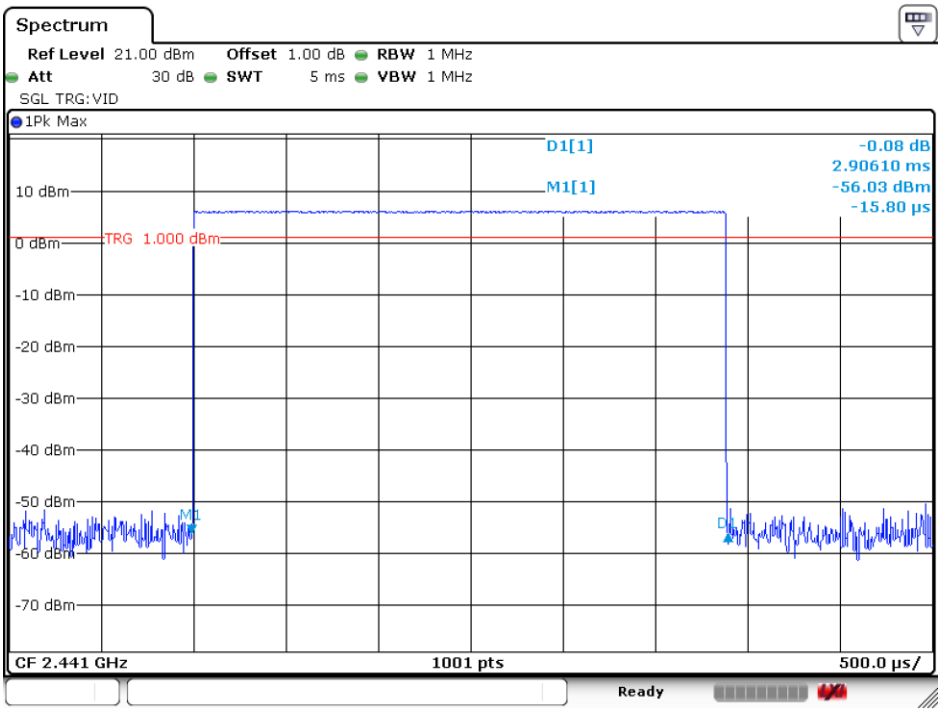
Date: 6.AUG.2019 03:39:35

DH3 _ Middle Channel



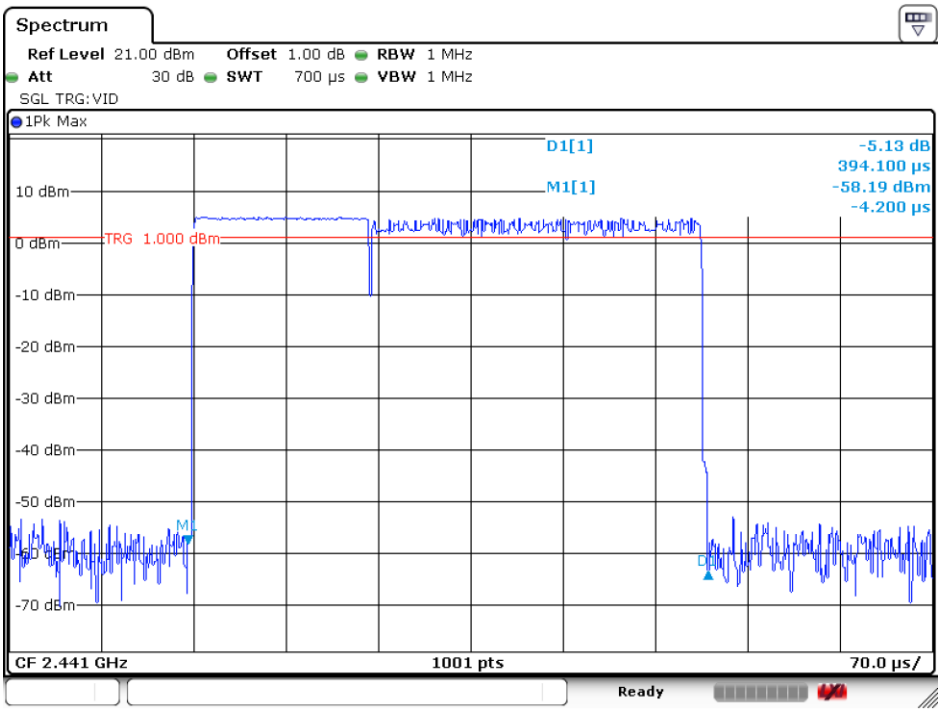
Date: 6.AUG.2019 03:42:53

DH5 _ Middle Channel



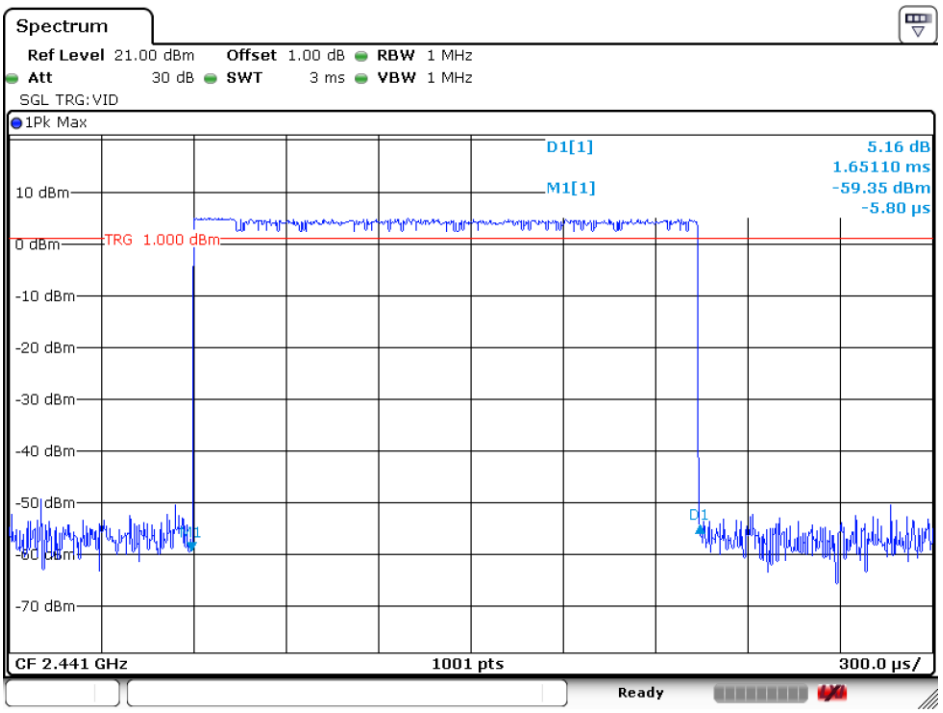
Date: 6.AUG.2019 03:44:31

2DH1 _Middle Channel



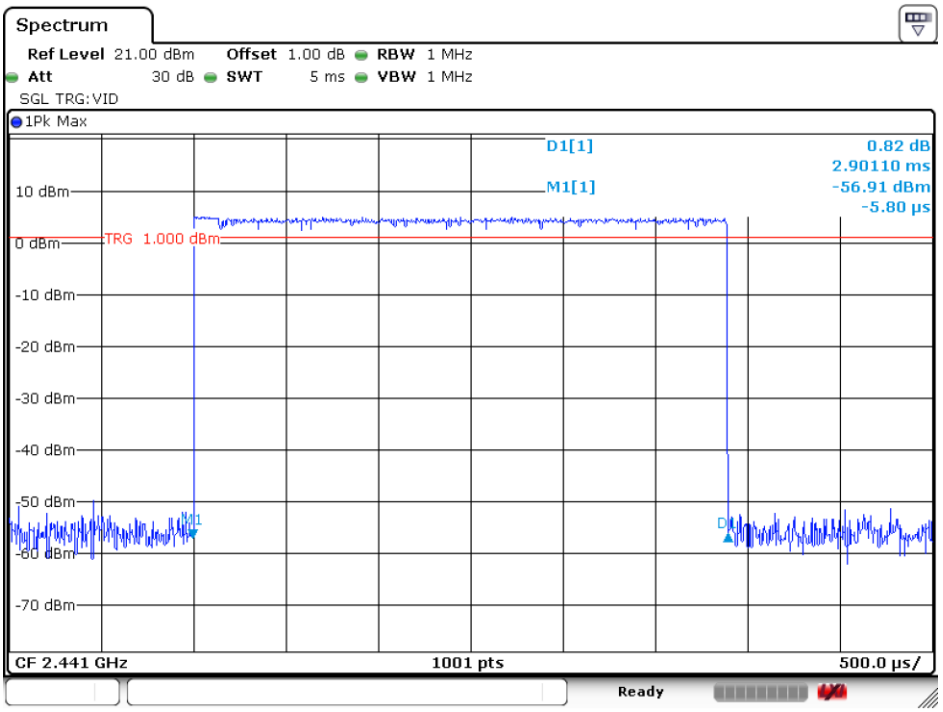
Date: 6.AUG.2019 03:41:45

2DH3 _ Middle Channel



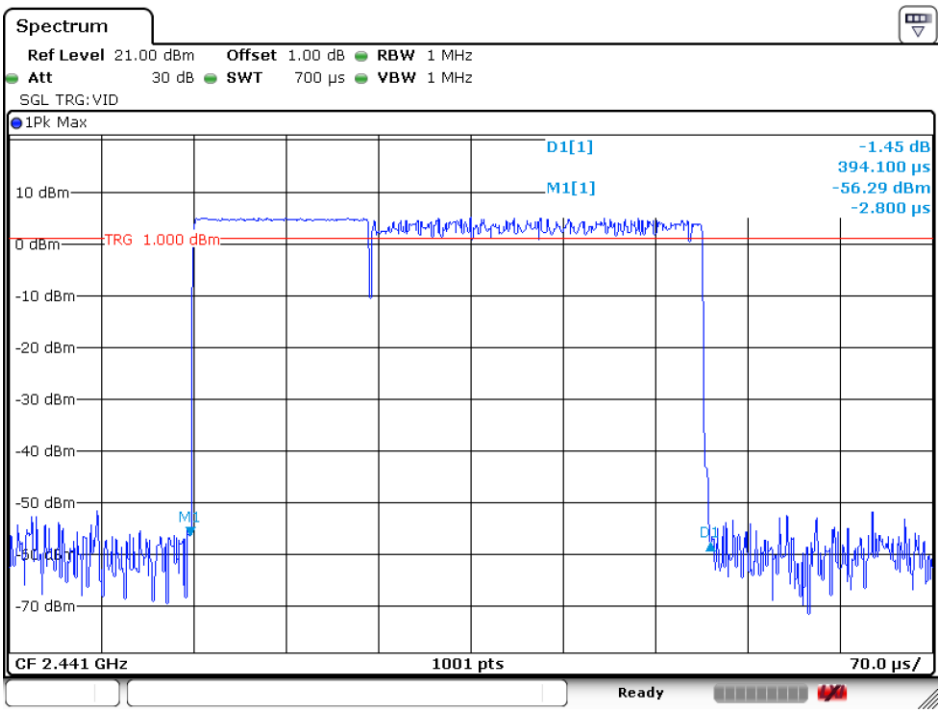
Date: 6.AUG.2019 03:43:27

2DH5 _ Middle Channel



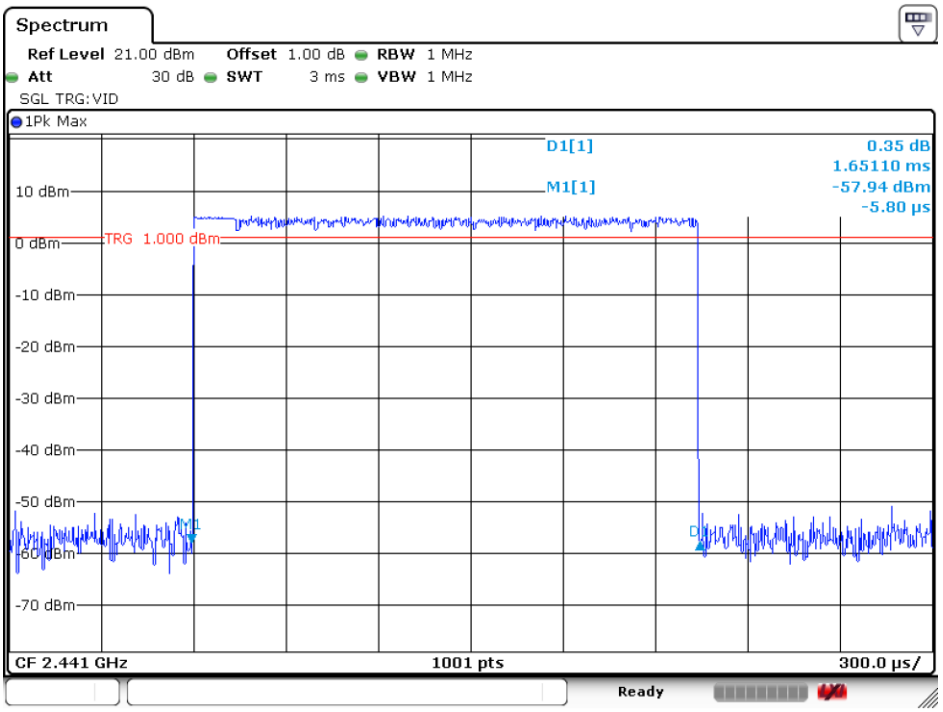
Date: 6.AUG.2019 03:44:56

3DH1 _Middle Channel



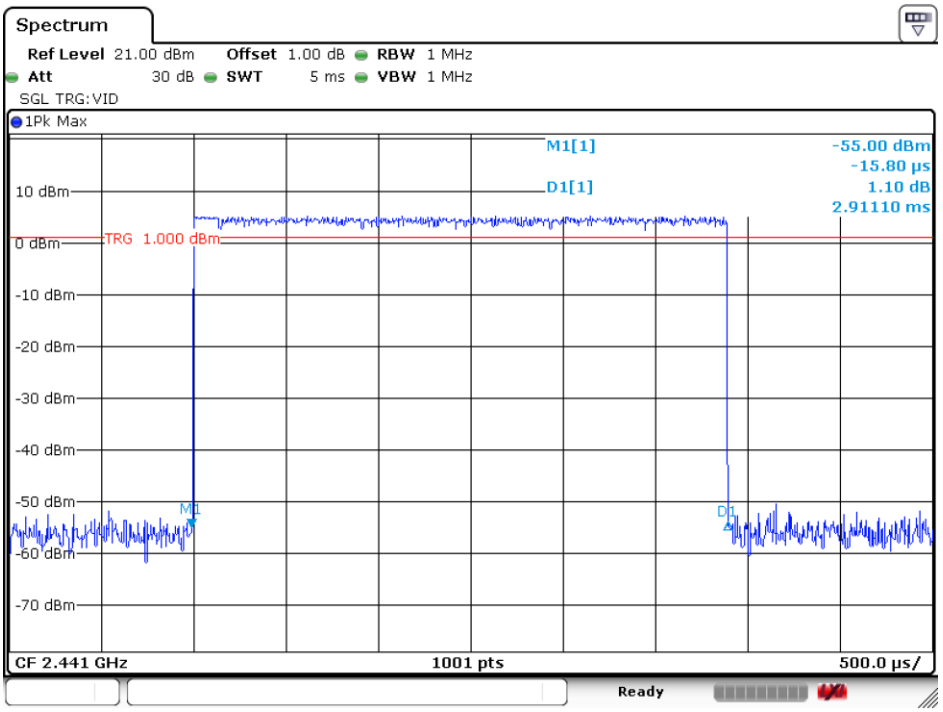
Date: 6.AUG.2019 03:42:11

3DH3 _ Middle Channel



Date: 6.AUG.2019 03:43:50

3DH5 _ Middle Channel

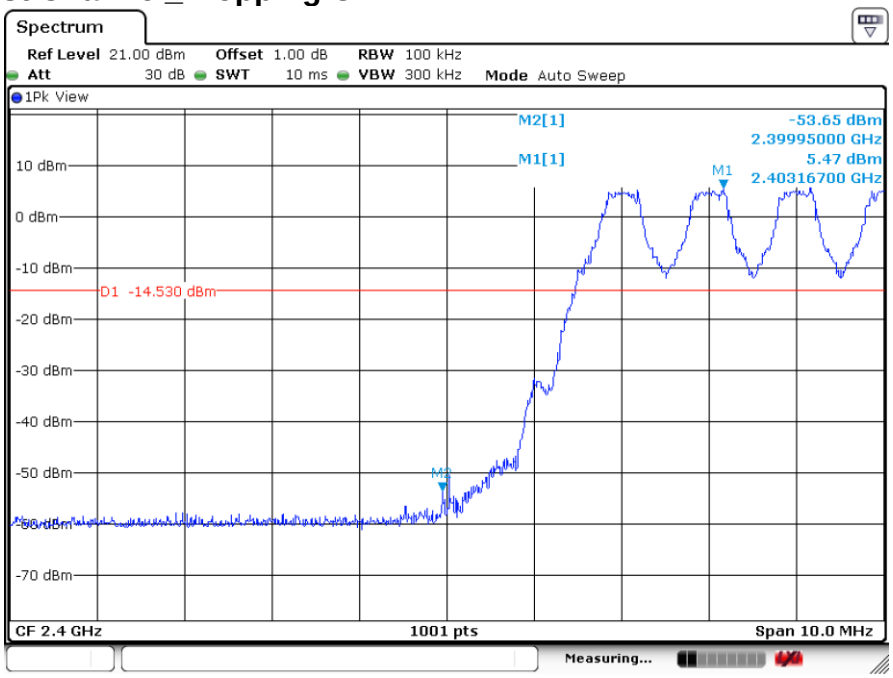


Date: 6.AUG.2019 03:45:20

9 Band-edge for RF Conducted Emissions

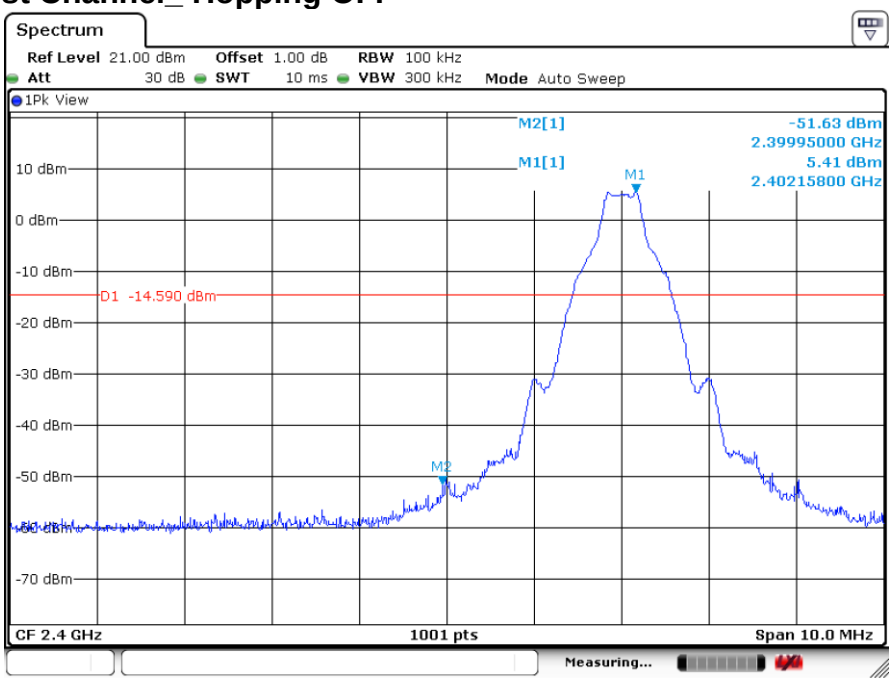
9.1 Test plots

GFSK _Lowest Channel_ Hopping ON



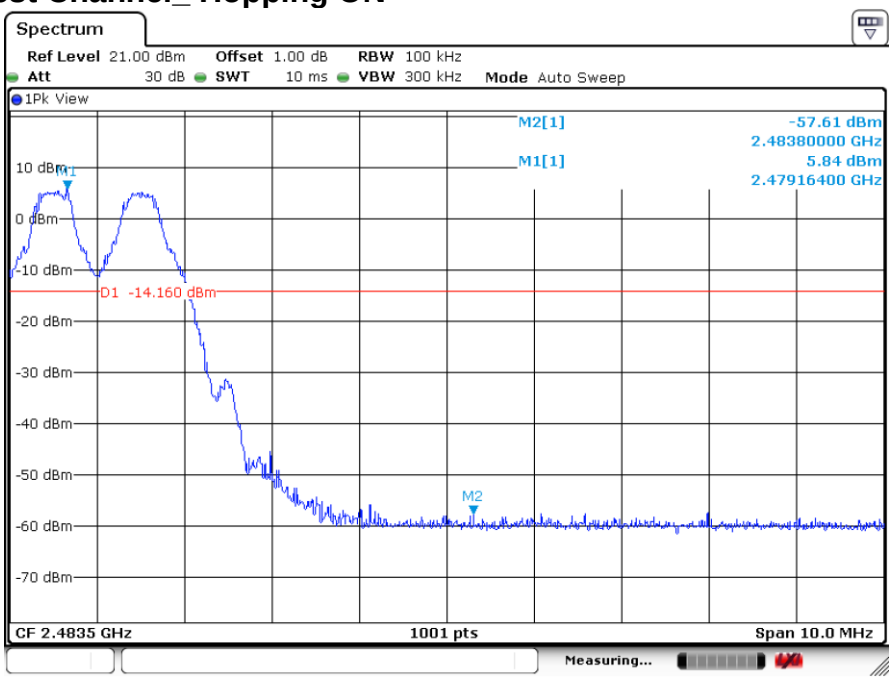
Date: 6.AUG.2019 03:05:36

GFSK _Lowest Channel_ Hopping OFF



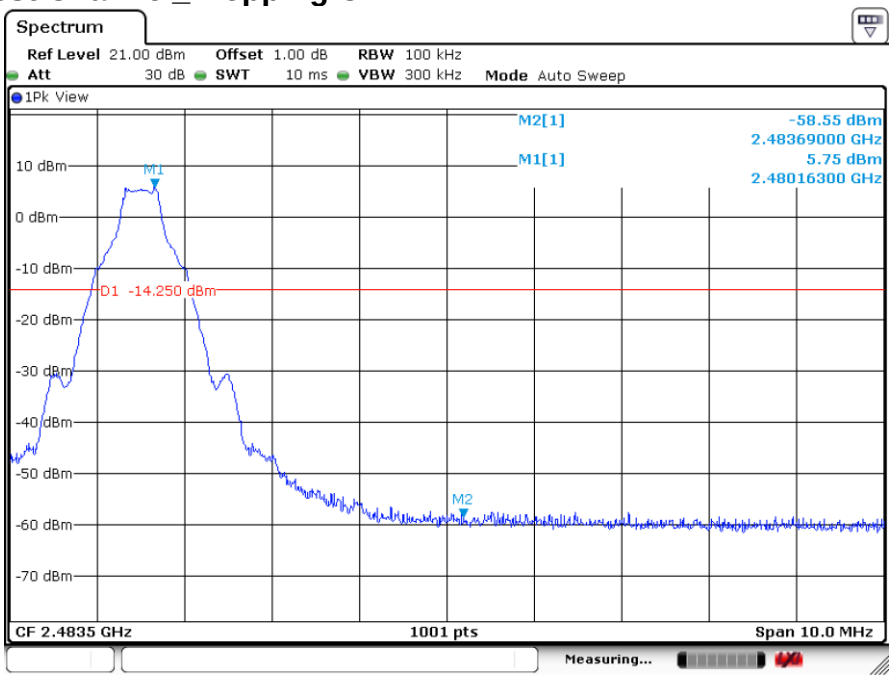
Date: 6.AUG.2019 03:07:15

GFSK _Highest Channel_ Hopping ON



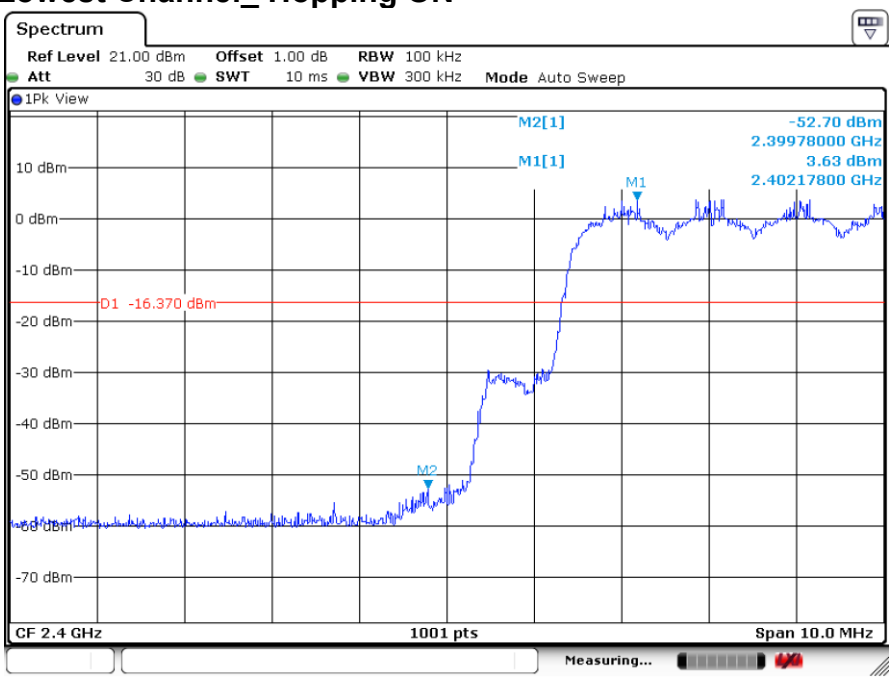
Date: 6.AUG.2019 03:20:25

GFSK _Highest Channel_ Hopping OFF



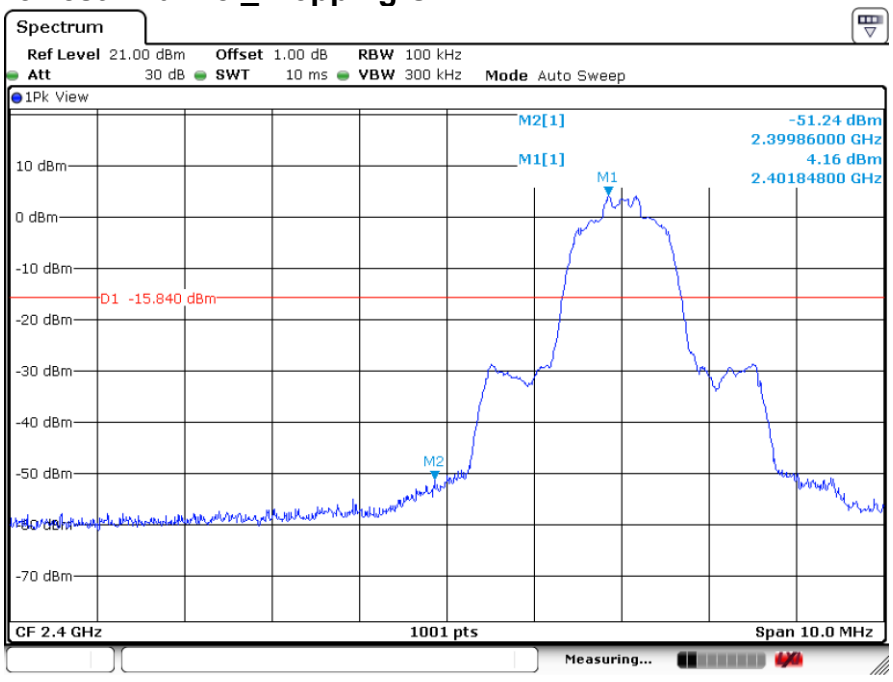
Date: 6.AUG.2019 03:19:34

π/4DQPSK _Lowest Channel_ Hopping ON



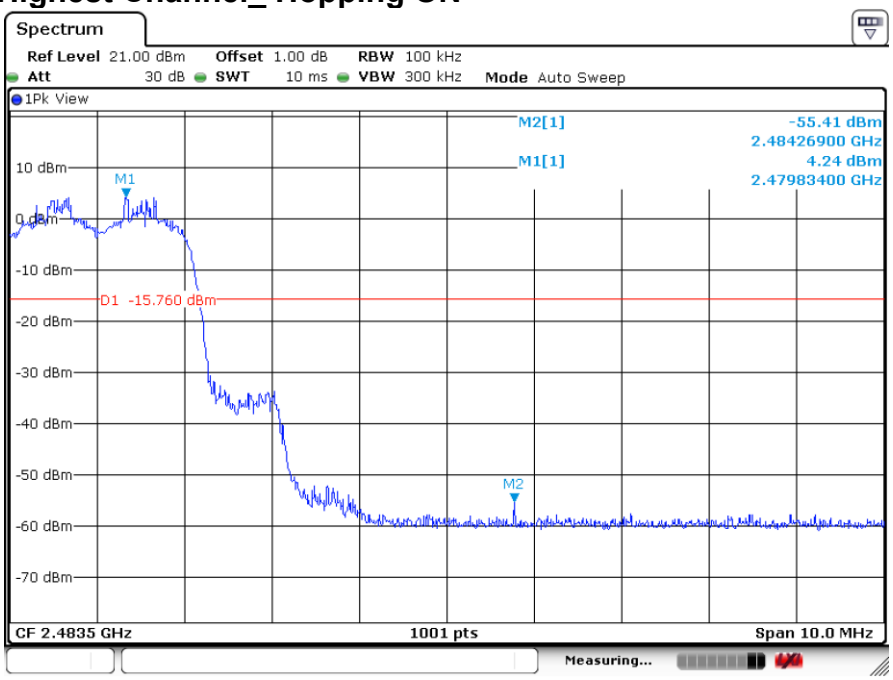
Date: 6.AUG.2019 03:09:41

π/4DQPSK _Lowest Channel_ Hopping OFF



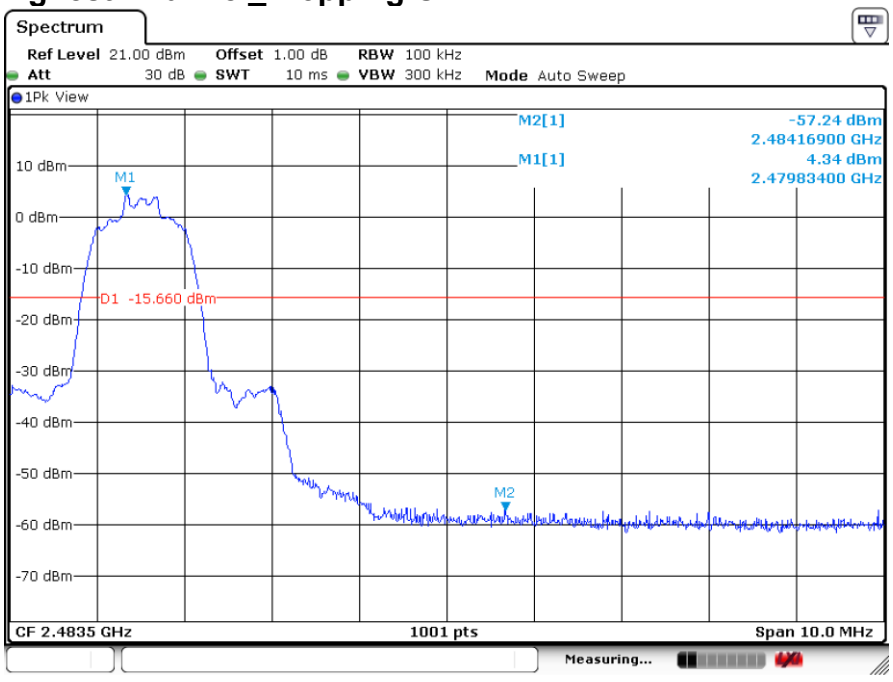
Date: 6.AUG.2019 03:08:17

π/4DQPSK _Highest Channel_ Hopping ON



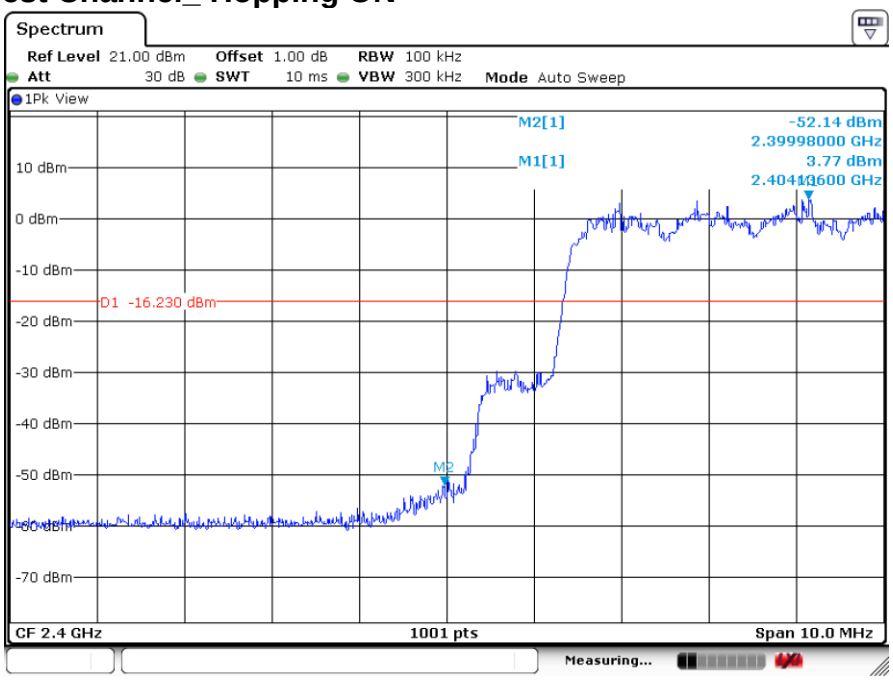
Date: 6.AUG.2019 03:16:08

π/4DQPSK _Highest Channel_ Hopping OFF



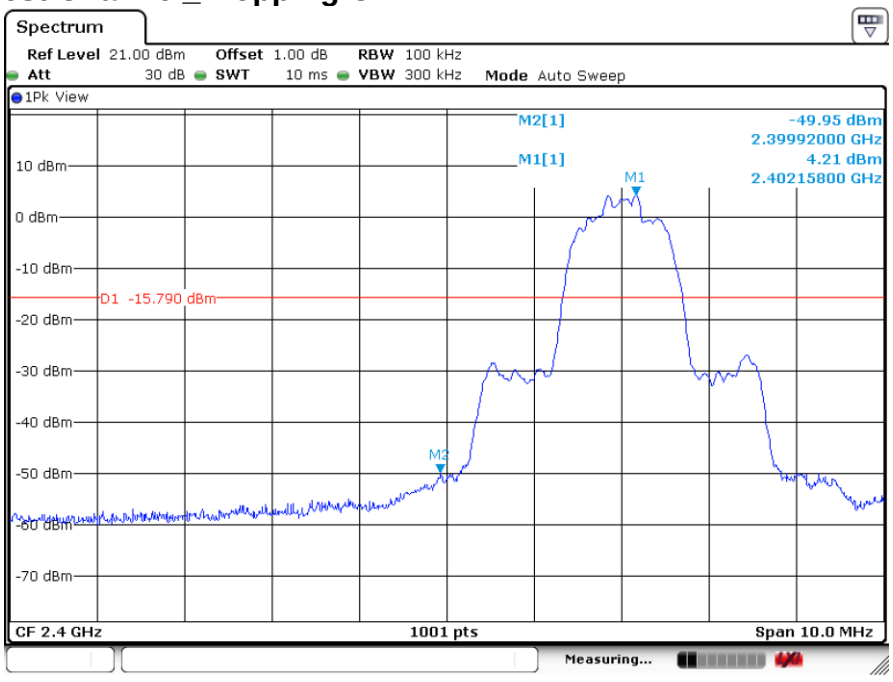
Date: 6.AUG.2019 03:17:00

8DPSK _Lowest Channel_ Hopping ON



Date: 6.AUG.2019 03:11:10

8DPSK _Lowest Channel_ Hopping OFF

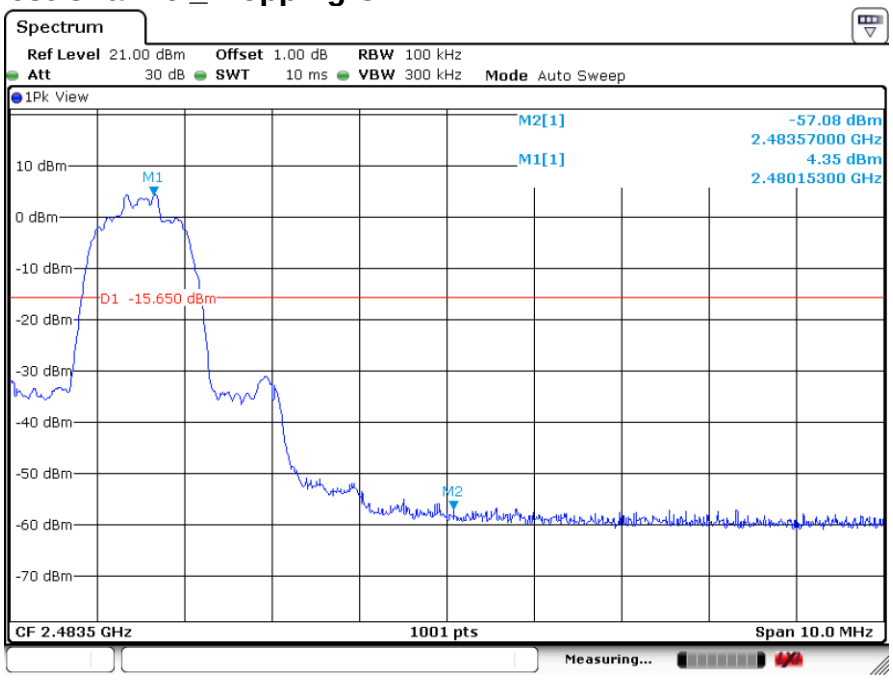


Date: 6.AUG.2019 03:12:36

8DPSK _Highest Channel_ Hopping ON

Date: 6.AUG.2019 03:14:42

8DPSK _Highest Channel_ Hopping OFF

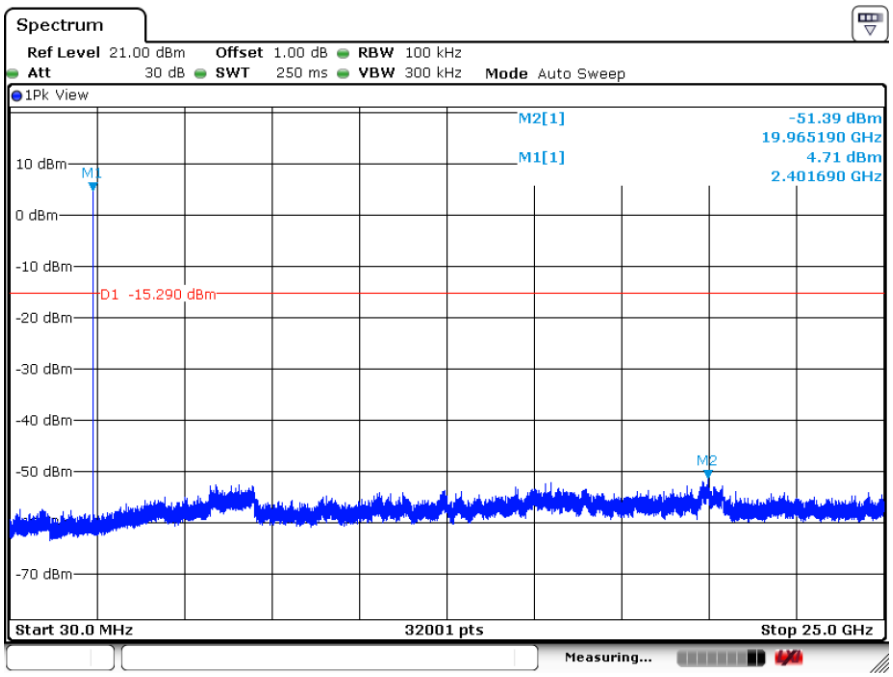


Date: 6.AUG.2019 03:13:29

10 Spurious RF Conducted Emissions

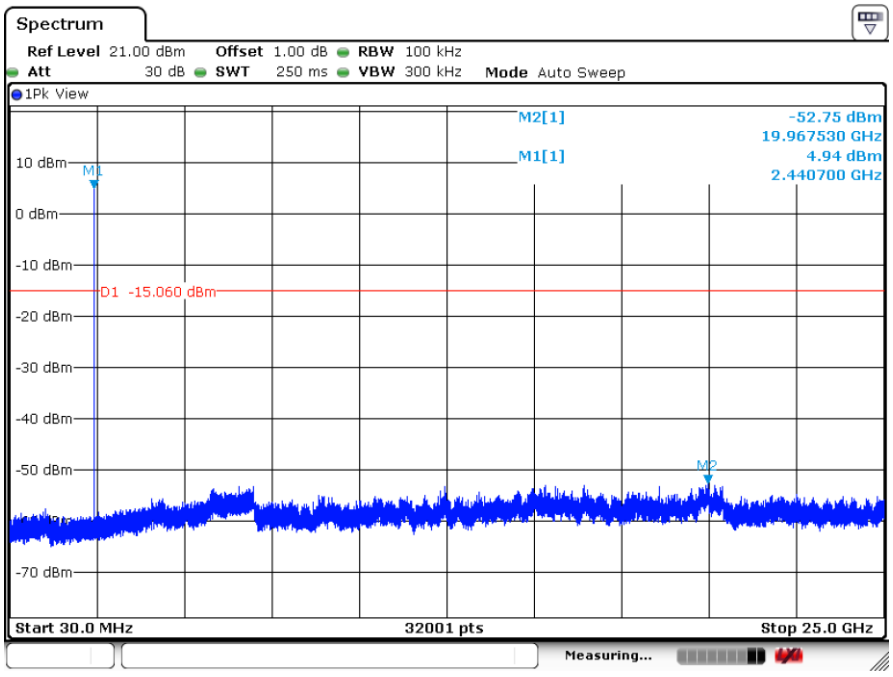
10.1 Test plots

GFSK _Lowest Channel



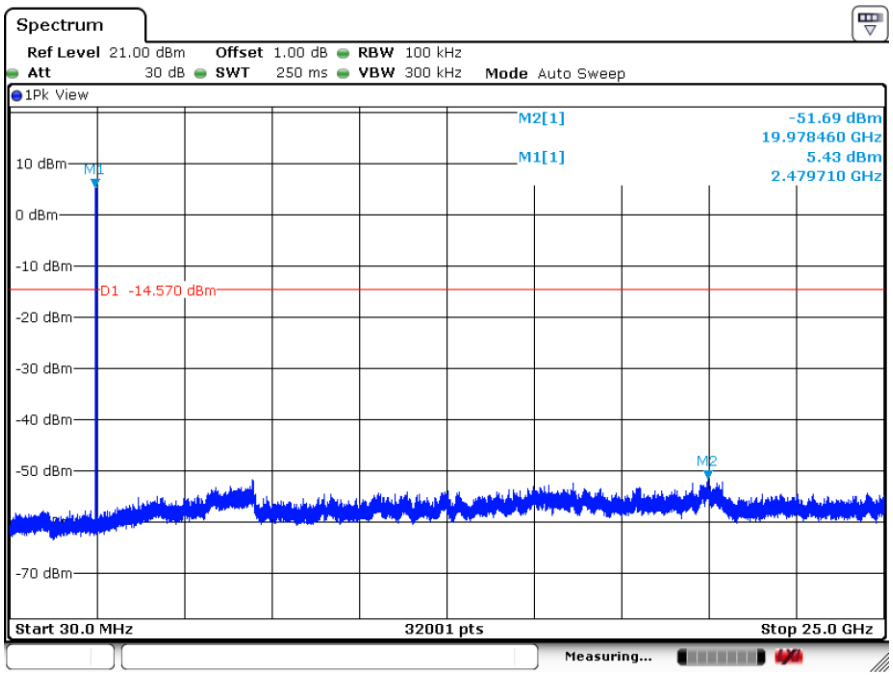
Date: 6.AUG.2019 03:25:59

GFSK _Middle Channel



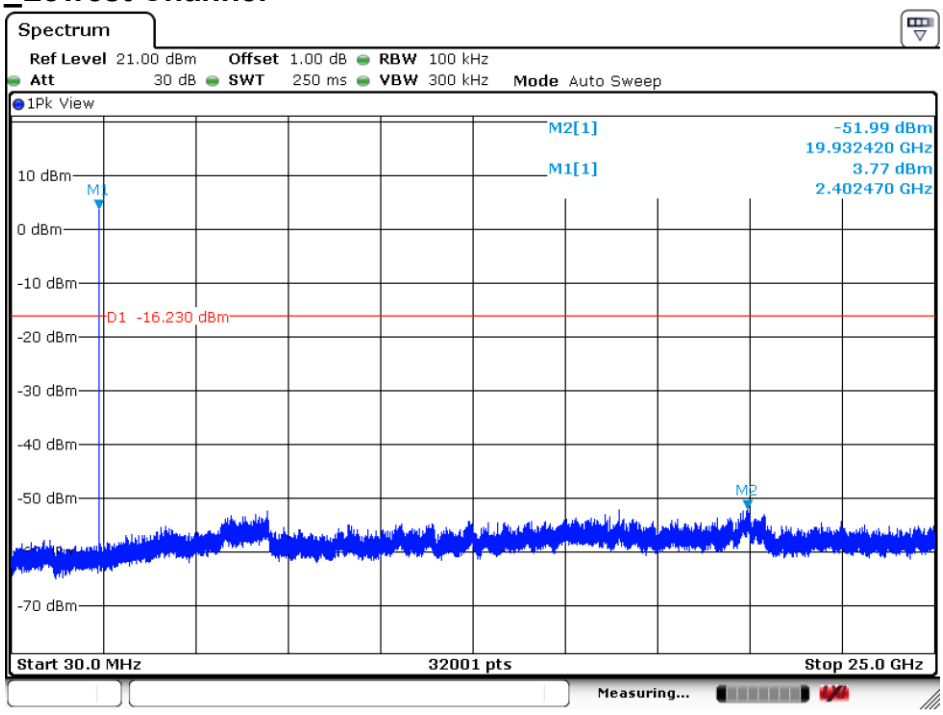
Date: 6.AUG.2019 03:24:34

GFSK _Highest Channel



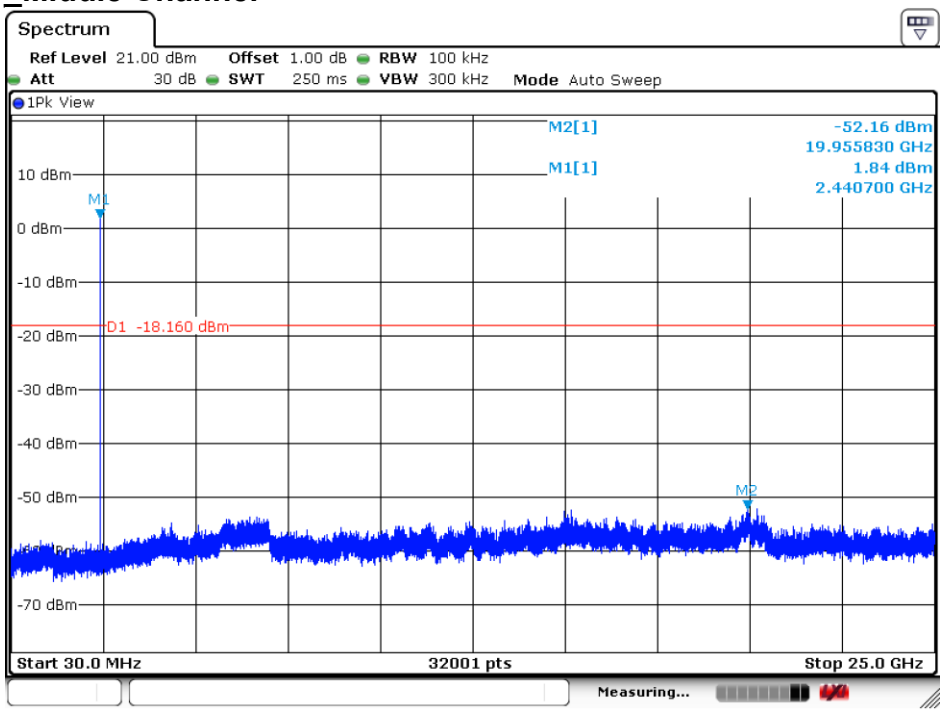
Date: 6.AUG.2019 03:23:48

π/4DQPSK _Lowest Channel



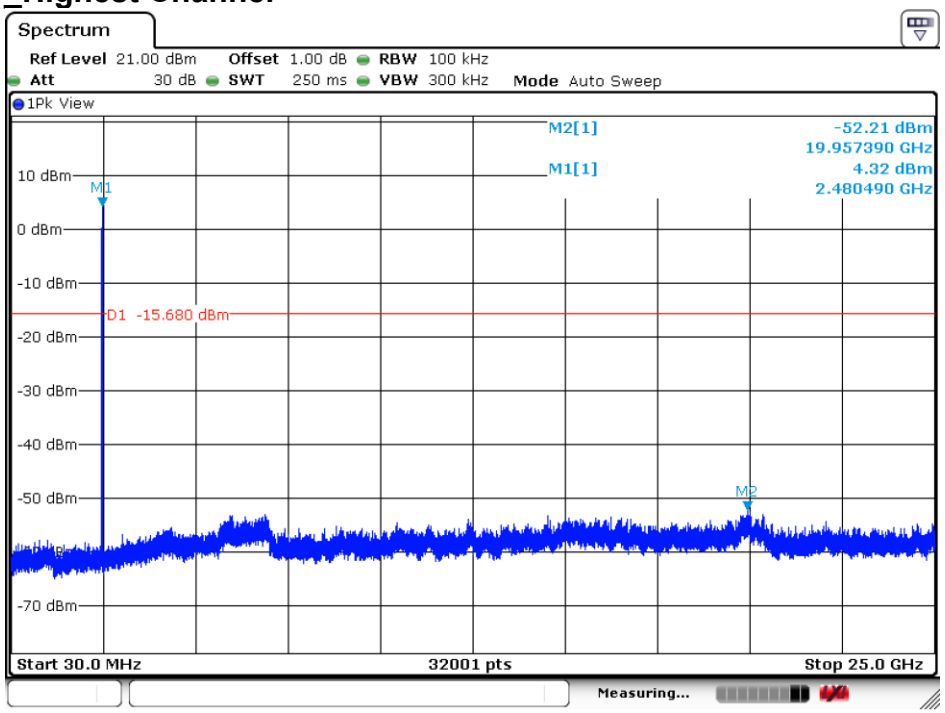
Date: 6.AUG.2019 03:29:31

π/4DQPSK _Middle Channel



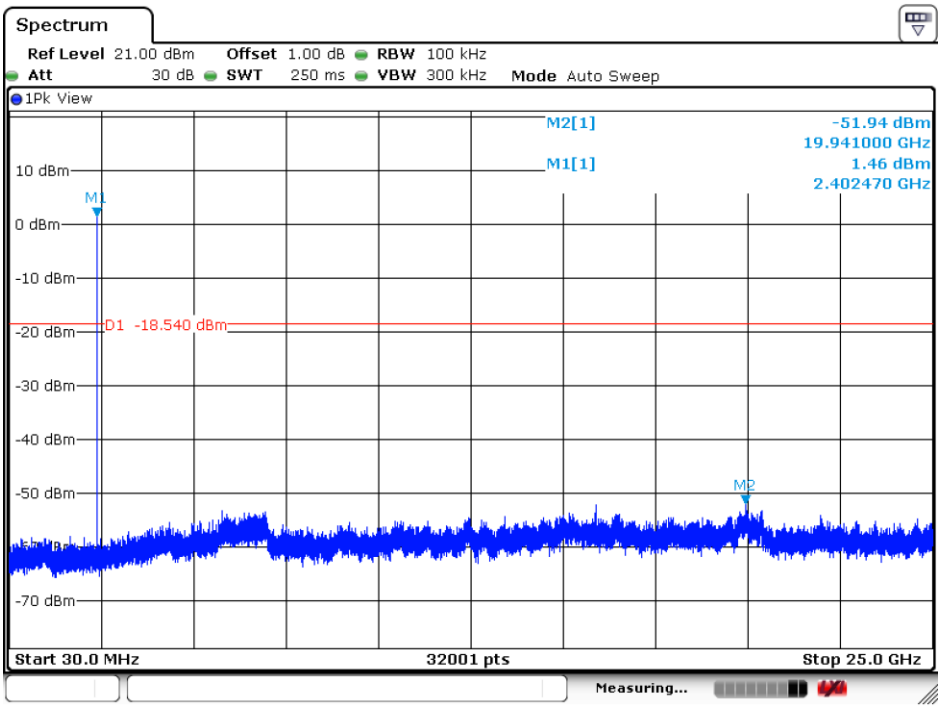
Date: 6.AUG.2019 03:30:35

π/4DQPSK _Highest Channel



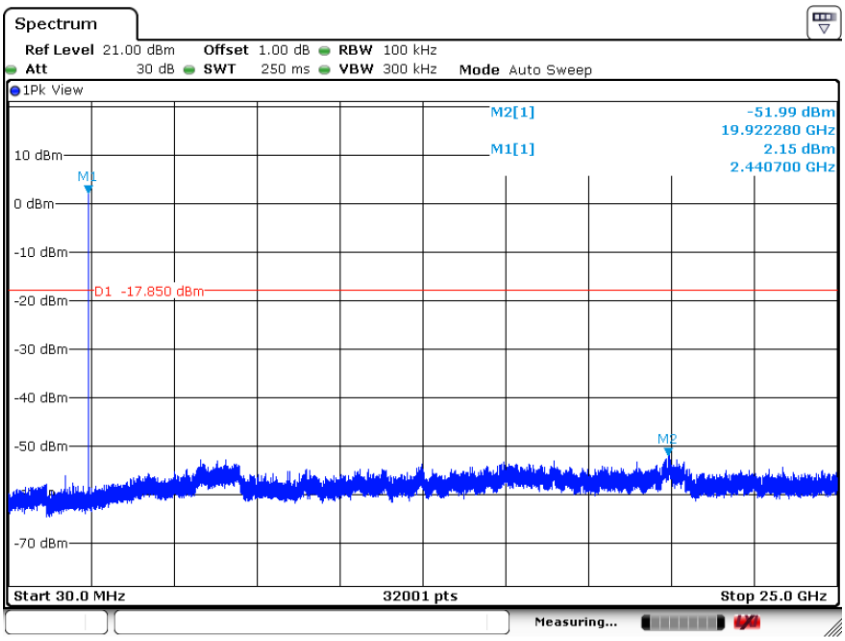
Date: 6.AUG.2019 03:31:14

8DPSK_Lowest Channel



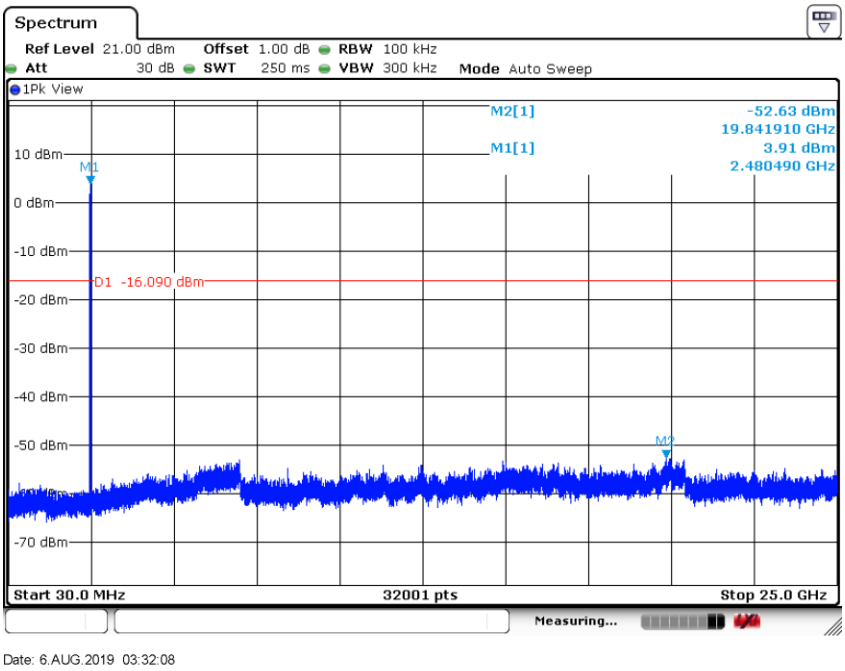
Date: 6.AUG.2019 03:37:48

8DPSK _Middle Channel



Date: 6.AUG.2019 03:34:49

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.

The End