

FCC TEST REPORT

Application No.: ZR/2020/30010
Applicant: Xiaomi Communications Co., Ltd.
Address of Applicant: #019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
Manufacturer: Xiaomi Communications Co., Ltd.
Address of Manufacturer: #019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
EUT Description: Mobile Phone
Model No.: M2004J11G
Trade Mark: POCO
FCC ID: 2AFZZJ11G
Standards: 47 CFR FCC Part 2, Subpart J
 47 CFR Part 15, Subpart C
Test Method: ANSI C63.10 (2013)
 KDB558074 D01 15.247 Meas Guidance v05r02
Date of Receipt: 2020/3/12
Date of Test: 2020/3/13 to 2020/4/27
Date of Issue: 2021/5/1

Test Result:	PASS *
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* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Derek Yang
Wireless Laboratory Manager



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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
00		2020/4/27		Original
01		2021/5/1	Eason Wang	1. Add test site Information 2. Modify data conversion error of antenna height 3. Update equipment list

*This report supersedes our previous report ZR/2020/3001004, issued on 2020/4/27, which is hereby deemed null and void.

Authorized for issue by:		
Prepared By	<i>Eason Wang</i>	(Eason Wang) /Engineer
Checked By	<i>David Chen</i>	(David Chen) /Reviewer



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2 Test Summary

Test Item	Test Requirement	Test method	Test Result	Result	Test Lab*
AC Power Line Conducted Emission	15.207	ANSI C63.10 (2013)	Clause 4.3	PASS	B
Conducted Peak Output Power	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.4	PASS	A
20dB Emission Bandwidth & 99% Occupied Bandwidth	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.5	PASS	A
Carrier Frequencies Separation	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.6	PASS	A
Hopping Channel Number	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.7	PASS	A
Dwell Time	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.8	PASS	A
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10 (2013)	Clause 4.9	PASS	A
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10 (2013)	Clause 4.10	PASS	A
Radiated Spurious emissions	15.247(d); 15.205/15.209	ANSI C63.10 (2013)	Clause 4.11	PASS	B
Restricted bands around fundamental frequency (Radiated Emission)	15.247(d); 15.205/15.209	ANSI C63.10 (2013)	Clause 4.12	PASS	B

Remark: All test were performed by Lab A and B.

Parts of test items above were subcontracted to Lab B.

Lab A SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

Lab B SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD.



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3 General Information

3.1 Client Information

Applicant:	Xiaomi Communications Co., Ltd.
Address of Applicant:	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
Manufacturer:	Xiaomi Communications Co., Ltd.
Address of Manufacturer:	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

3.2 Test Location

Lab A:

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
Post code:	518057
Test engineer:	Adam Liang, Dee Zheng, Mike Hu

Lab B:

Company:	SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD.
Address:	1/F, Unit D, Building 1, Kanghong Orange Technology Park, No.137, Keyuan 3rd Road, Fengdong New City, Xi'an, Shaanxi China
Post code:	710086
Test engineer:	Ben Huang, Leah Chen



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3.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

Lab A:

• **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• **Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

Lab B:

• **A2LA (Certificate No. 4854.01)**

SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.

• **FCC –Designation Number: CN1271.**



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3.4 General Description of EUT

EUT Description:	Mobile Phone
Model No.:	M2004J11G
Trade Mark:	POCO
Hardware Version:	P1
Software Version:	MIUI11
Operation Frequency:	2400MHz~2483.5MHz fc = 2402 MHz + N * 1 MHz, where: -fc = "Operating Frequency" in MHz, -N = "Channel Number" with the range from 0 to 78.
Bluetooth Version:	Bluetooth V3.0 +EDR
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Number of Channel:	79
Hopping Channel Type:	Adaptive Frequency Hopping systems
Sample Type:	<input checked="" type="checkbox"/> Portable Device, <input type="checkbox"/> Module
Antenna Type:	<input type="checkbox"/> External, <input checked="" type="checkbox"/> Integrated
Antenna Gain:	-1.43dBi
Power Supply	<input type="checkbox"/> AC/DC Adapter; <input checked="" type="checkbox"/> Battery <input type="checkbox"/> PoE;; <input type="checkbox"/> Other:

Operation Frequency each of channel

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
2	2404MHz	22	2424MHz	42	2444MHz	62	2464MHz
3	2405MHz	23	2425MHz	43	2445MHz	63	2465MHz
4	2406MHz	24	2426MHz	44	2446MHz	64	2466MHz
5	2407MHz	25	2427MHz	45	2447MHz	65	2467MHz
6	2408MHz	26	2428MHz	46	2448MHz	66	2468MHz
7	2409MHz	27	2429MHz	47	2449MHz	67	2469MHz
8	2410MHz	28	2430MHz	48	2450MHz	68	2470MHz
9	2411MHz	29	2431MHz	49	2451MHz	69	2471MHz
10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
11	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
12	2414MHz	32	2434MHz	52	2454MHz	72	2474MHz
13	2415MHz	33	2435MHz	53	2455MHz	73	2475MHz
14	2416MHz	34	2436MHz	54	2456MHz	74	2476MHz
15	2417MHz	35	2437MHz	55	2457MHz	75	2477MHz
16	2418MHz	36	2438MHz	56	2458MHz	76	2478MHz
17	2419MHz	37	2439MHz	57	2459MHz	77	2479MHz
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz



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 中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

19	2421MHz	39	2441MHz	59	2461MHz	
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Remark:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle

frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest channel	2402MHz
The Middle channel	2441MHz
The Highest channel	2480MHz

3.5 Test Environment

Operating Environment	
Temperature:	24.0 °C
Humidity:	55 % RH
Atmospheric Pressure:	101.30 KPa

3.6 Description of Support Units

The EUT has been tested independent unit.



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4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
<p>15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p>	
<p>The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -1.43dBi.</p>	



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4.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

4.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

4.2.2 Conclusion

Standard Requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1):

According to Technical Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.

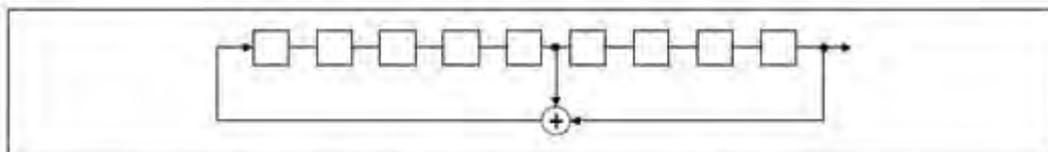
> Number of shift register stages: 9

> Length of pseudo-random sequence: $2^9 - 1 = 511$ bits

> Longest sequence of zeros: 8 (non-inverted signal)

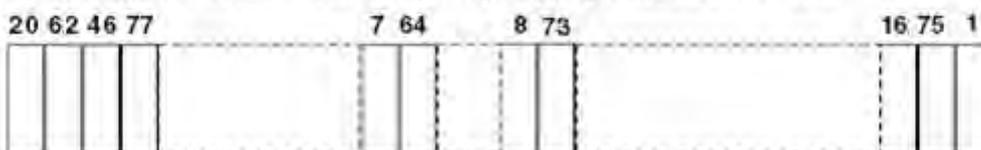
Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.



According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g):

According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the RF system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h):

According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels. The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.



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4.3 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	150kHz to 30MHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	* Decreases with the logarithm of the frequency.		
Test Procedure:	<p>1) The mains terminal disturbance voltage test was conducted in a shielded room.</p> <p>2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.</p> <p>3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,</p> <p>4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.</p> <p>5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.</p>		



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<p>Test Setup:</p>	
<p>Exploratory Test Mode:</p>	<p>Non-hopping transmitting mode with all kind of modulation and all kind of data type at the lowest, middle, high channel. Charge + Transmitting mode.</p>
<p>Final Test Mode:</p>	<p>Through Pre-scan, find the DH5 of data type and GFSK modulation at the lowest channel is the worst case. Charge + Transmitting mode Only the worst case is recorded in the report.</p>
<p>Instruments Used:</p>	<p>Refer to section 5.10 for details</p>
<p>Test Results:</p>	<p>Pass</p>

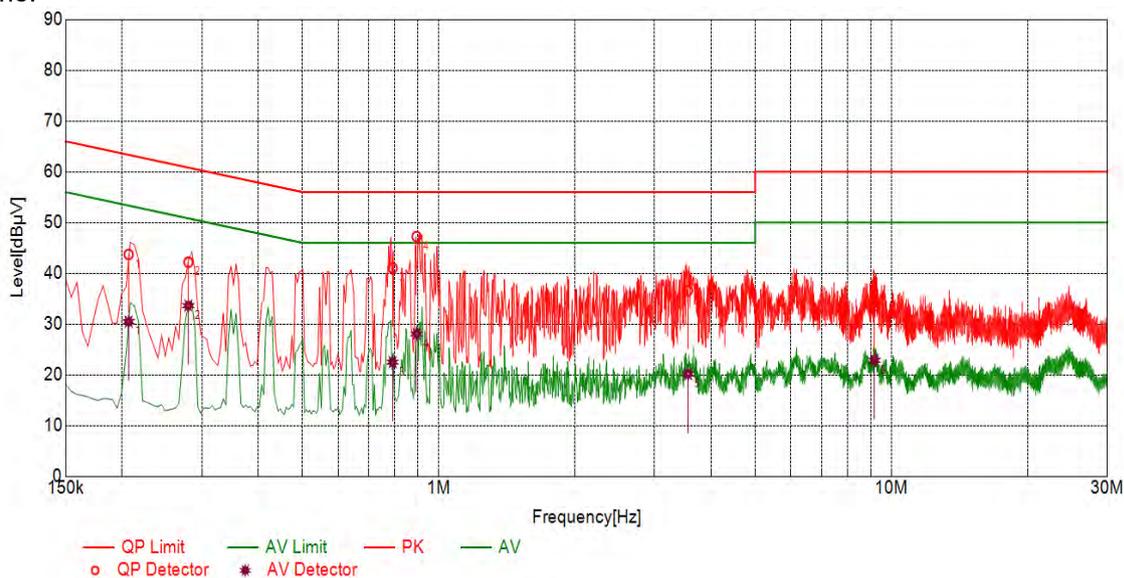


Measurement Data

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:



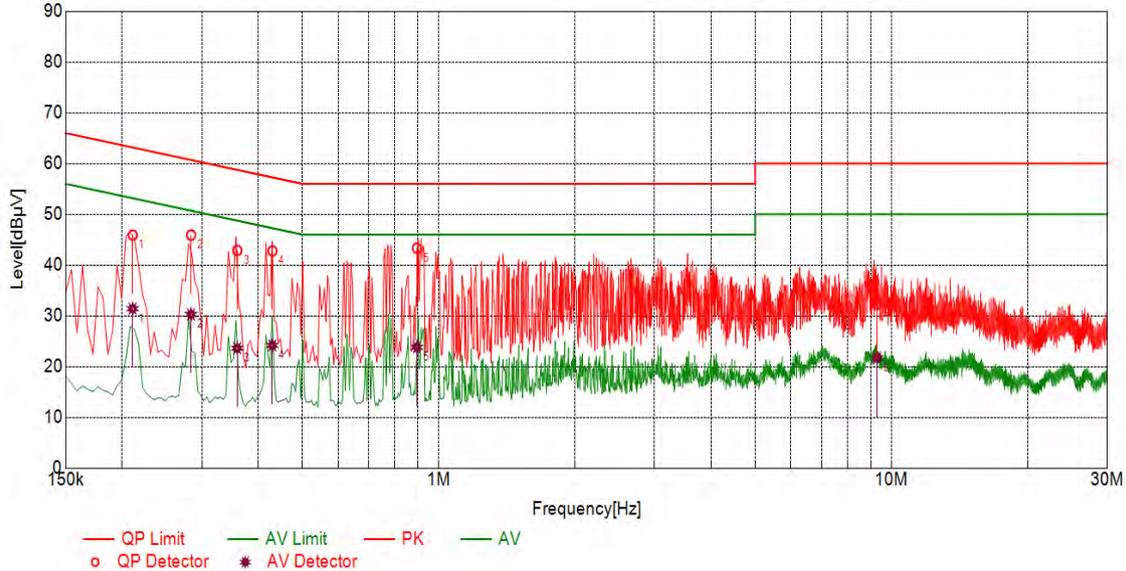
Test Graph

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type
1	0.2067	10.10	43.71	63.34	19.63	30.46	53.34	22.88	L
2	0.2801	10.10	42.18	60.81	18.63	33.62	50.81	17.19	L
3	0.7917	10.10	41.03	56.00	14.97	22.50	46.00	23.50	L
4	0.8939	10.10	47.24	56.00	8.76	28.08	46.00	17.92	L
5	3.5554	10.10	36.60	56.00	19.40	20.15	46.00	25.85	L
6	9.1795	10.10	33.60	60.00	26.40	22.85	50.00	27.15	L



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Neutral line:



Test Graph

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type
1	0.2110	10.10	45.90	63.17	17.27	31.40	53.17	21.77	N
2	0.2840	10.10	45.90	60.70	14.80	30.26	50.70	20.44	N
3	0.3592	10.10	42.88	58.75	15.87	23.61	48.75	25.14	N
4	0.4295	10.10	42.78	57.26	14.48	24.18	47.26	23.08	N
5	0.8954	10.10	43.33	56.00	12.67	23.78	46.00	22.22	N
6	9.2968	10.10	32.41	60.00	27.59	21.72	50.00	28.28	N



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Remarks:

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



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4.4 Conducted Peak Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013 Section 7.8.5
Test Setup:	
Limit:	(20.97dBm) 125mW
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type.
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass



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4.4.1 Test Results

Measurement Data of Average power:

ANT1		
GFSK mode		
Test channel	Average Output Power (dBm)	Result
Lowest	13.68	Report purpose only
Middle	13.83	Report purpose only
Highest	13.63	Report purpose only
$\pi/4$ DQPSK mode		
Test channel	Average Output Power (dBm)	Result
Lowest	11.39	Report purpose only
Middle	11.42	Report purpose only
Highest	10.94	Report purpose only
8DPSK mode		
Test channel	Average Output Power (dBm)	Result
Lowest	11.37	Report purpose only
Middle	11.41	Report purpose only
Highest	10.94	Report purpose only

ANT2		
GFSK mode		
Test channel	Average Output Power (dBm)	Result
Lowest	14.3	Report purpose only
Middle	14.35	Report purpose only
Highest	14.15	Report purpose only
$\pi/4$ DQPSK mode		
Test channel	Average Output Power (dBm)	Result
Lowest	12.12	Report purpose only
Middle	12.16	Report purpose only
Highest	11.81	Report purpose only
8DPSK mode		
Test channel	Average Output Power (dBm)	Result
Lowest	12.02	Report purpose only
Middle	12.08	Report purpose only
Highest	11.85	Report purpose only



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Measurement Data of Peak power:

ANT1			
GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	15.93	20.97	Pass
Middle	16.39	20.97	Pass
Highest	15.73	20.97	Pass
$\pi/4$ DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	15.44	20.97	Pass
Middle	15.81	20.97	Pass
Highest	15.28	20.97	Pass
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	15.90	20.97	Pass
Middle	16.34	20.97	Pass
Highest	15.67	20.97	Pass

ANT2			
GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	15.75	20.97	Pass
Middle	15.76	20.97	Pass
Highest	15.87	20.97	Pass
$\pi/4$ DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	15.51	20.97	Pass
Middle	15.19	20.97	Pass
Highest	15.57	20.97	Pass
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	15.55	20.97	Pass
Middle	15.53	20.97	Pass
Highest	14.85	20.97	Pass



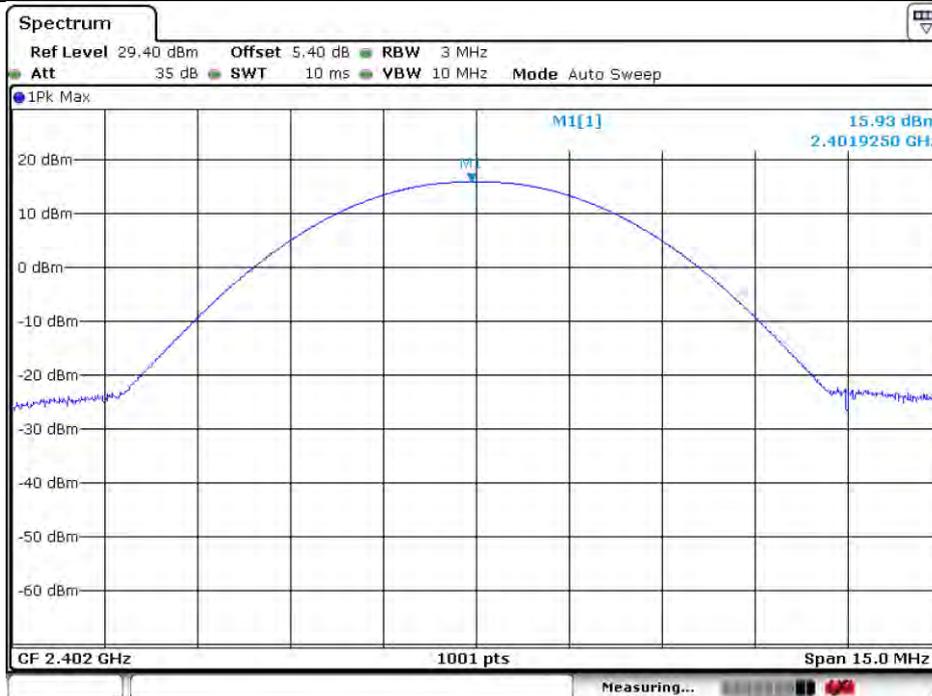
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4.4.2 Test plots

Test for ANT1:

Test mode:	GFSK	Test channel:	Lowest
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Date: 30.MAR.2020 09:19:36

Test mode:	GFSK	Test channel:	Middle
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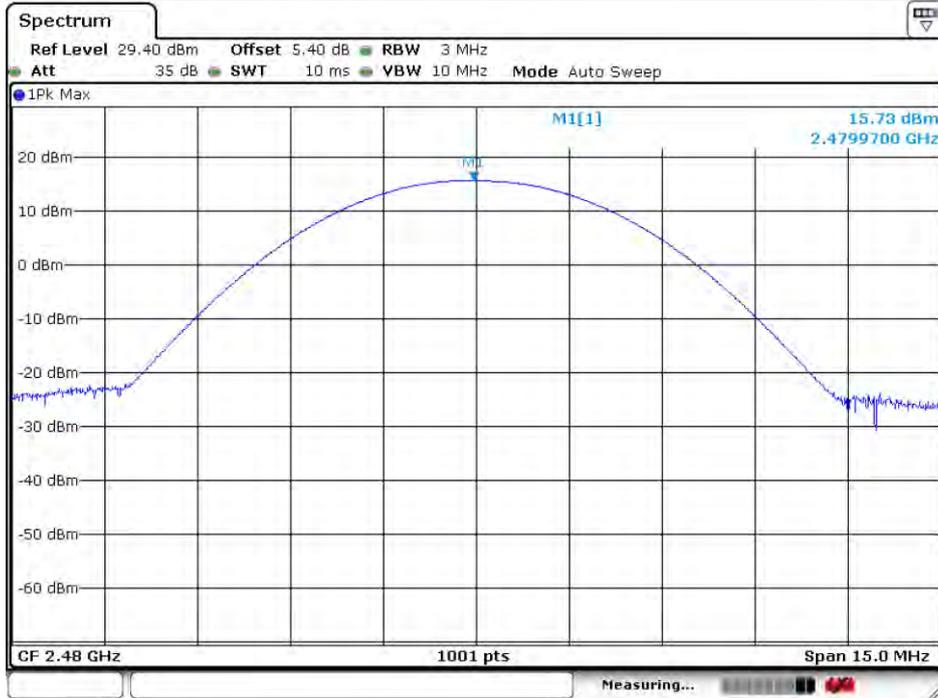
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Date: 30.MAR.2020 09:20:26

Test mode:	GFSK	Test channel:	Highest
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Date: 30.MAR.2020 09:20:50

Test mode:	$\pi/4$ DQPSK	Test channel:	Lowest
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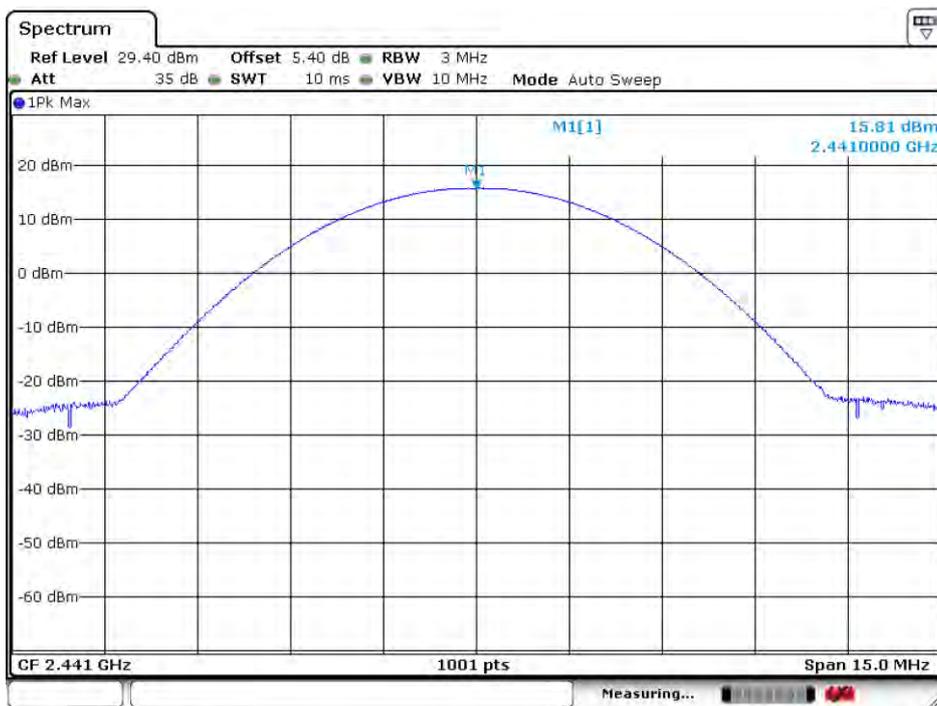


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Date: 30.MAR.2020 09:26:01

Test mode:	$\pi/4$ DQPSK	Test channel:	Middle
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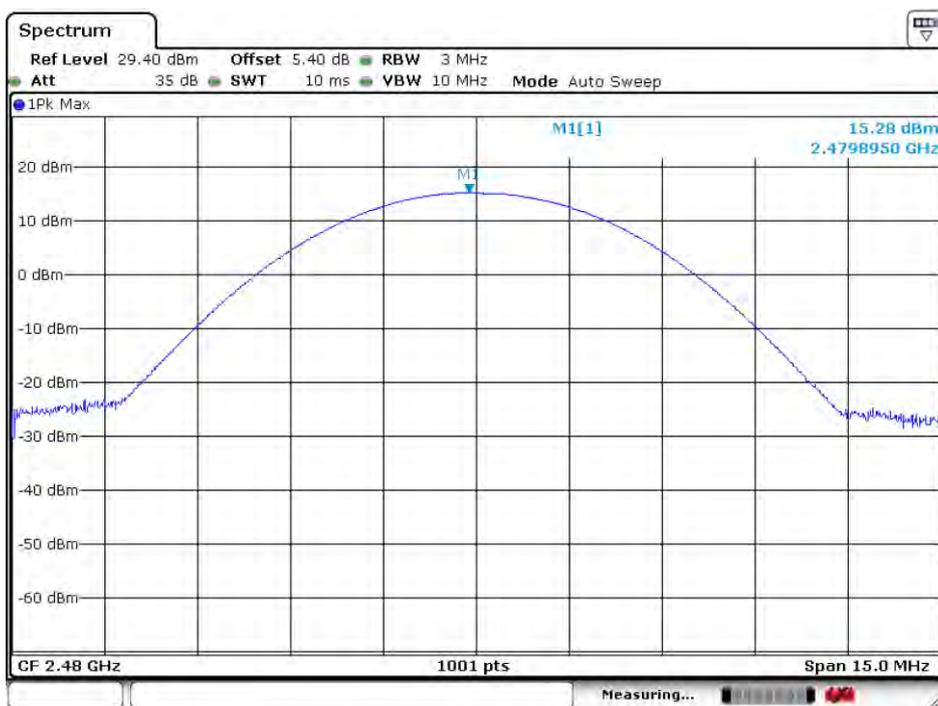


Date: 30.MAR.2020 09:25:30

Test mode:	$\pi/4$ DQPSK	Test channel:	Highest
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Date: 30.MAR.2020 09:26:25



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Test mode:	8DPSK	Test channel:	Lowest
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Date: 30.MAR.2020 09:22:03

Test mode:	8DPSK	Test channel:	Middle
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Date: 30.MAR.2020 09:24:10



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Test mode:	8DPSK	Test channel:	Highest
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Date: 30.MAR.2020 09:21:25

Test for ANT2:

Test mode:	GFSK	Test channel:	Lowest
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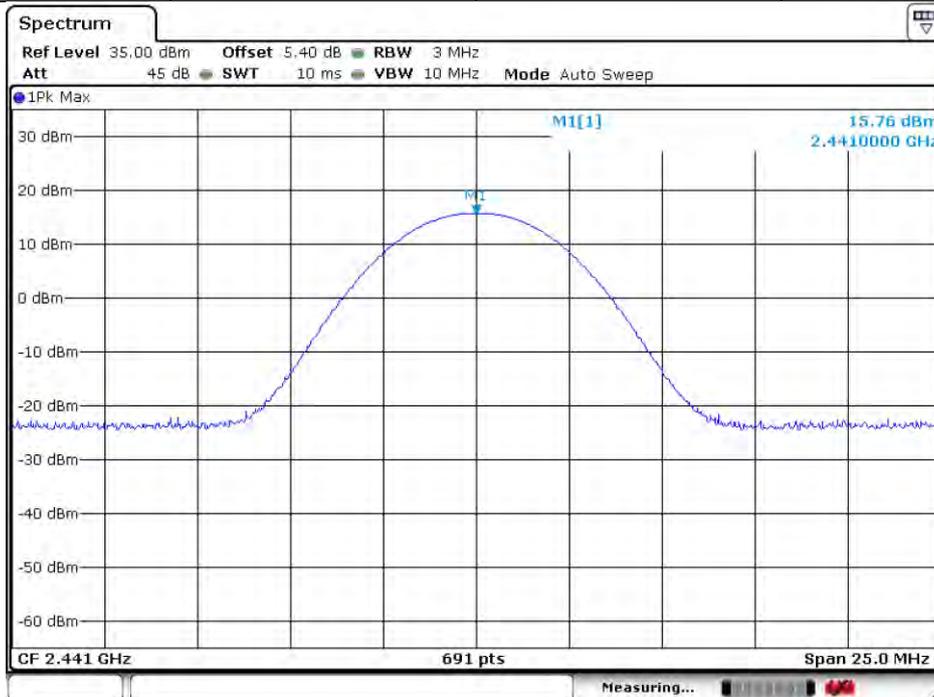


Date: 17.APR.2020 09:35:38



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Test mode:	GFSK	Test channel:	Middle
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Date: 17.APR.2020 09:36:08

Test mode:	GFSK	Test channel:	Highest
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Date: 17.APR.2020 09:36:26



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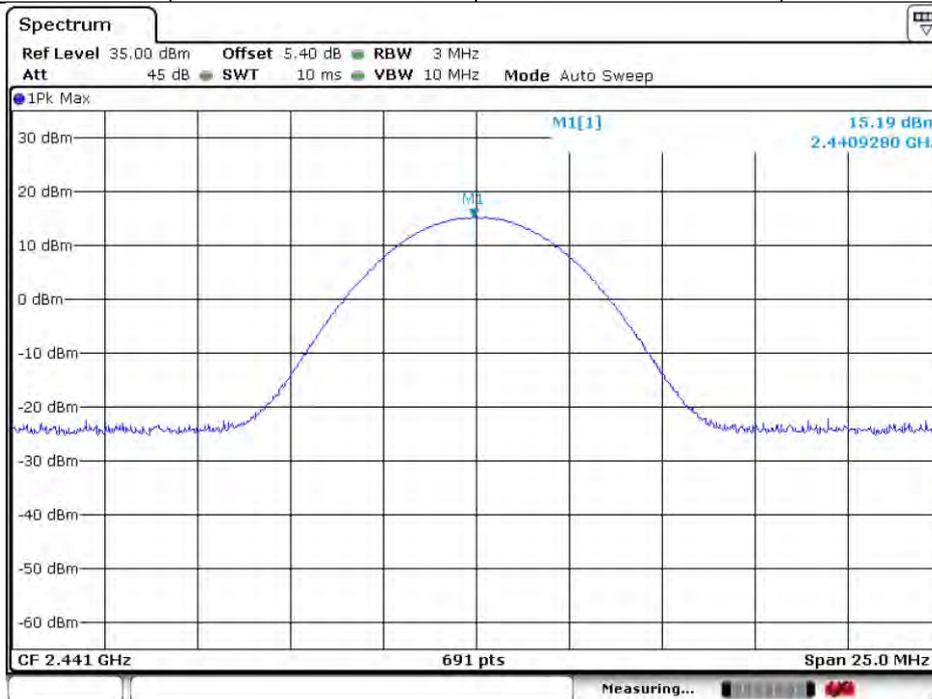
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Test mode:	$\pi/4$ DQPSK	Test channel:	Lowest
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Date: 17.APR.2020 09:37:20

Test mode:	$\pi/4$ DQPSK	Test channel:	Middle
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Date: 17.APR.2020 09:37:34

Test mode:	$\pi/4$ DQPSK	Test channel:	Highest
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中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

Test mode:	8DPSK	Test channel:	Lowest
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Date: 17.APR.2020 09:38:33

Test mode:	8DPSK	Test channel:	Middle
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Date: 17.APR.2020 09:37:49



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Test mode:	8DPSK	Test channel:	Highest
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4.5 20dB Emission Bandwidth & 99% Occupied Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013 Section 7.8.7
Test Setup:	
Limit:	NA
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type.
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass



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4.5.1 Test Results

Mode	Test Channel	99% Occupied Bandwidth (KHz)	20dB Emission Bandwidth (KHz)	Result
GFSK _ANT1	Lowest	821.1	938.1	Pass
	Middle	833.2	908.1	Pass
	Highest	833.2	911.1	Pass
π/4DQPSK _ANT1	Lowest	1171.8	1321.7	Pass
	Middle	1171.8	1321.7	Pass
	Highest	1168.8	1321.7	Pass
8DPSK _ANT1	Lowest	1174.8	1306.7	Pass
	Middle	1174.8	1303.7	Pass
	Highest	1177.8	1303.7	Pass
GFSK _ANT2	Lowest	833.6	903.0	Pass
	Middle	816.2	942.1	Pass
	Highest	820.5	946.5	Pass
π/4DQPSK _ANT2	Lowest	1133.1	1293.8	Pass
	Middle	1141.8	1237.3	Pass
	Highest	1167.8	1315.5	Pass
8DPSK _ANT2	Lowest	1176.6	1298.1	Pass
	Middle	1141.8	1215.6	Pass
	Highest	1146.2	1298.1	Pass

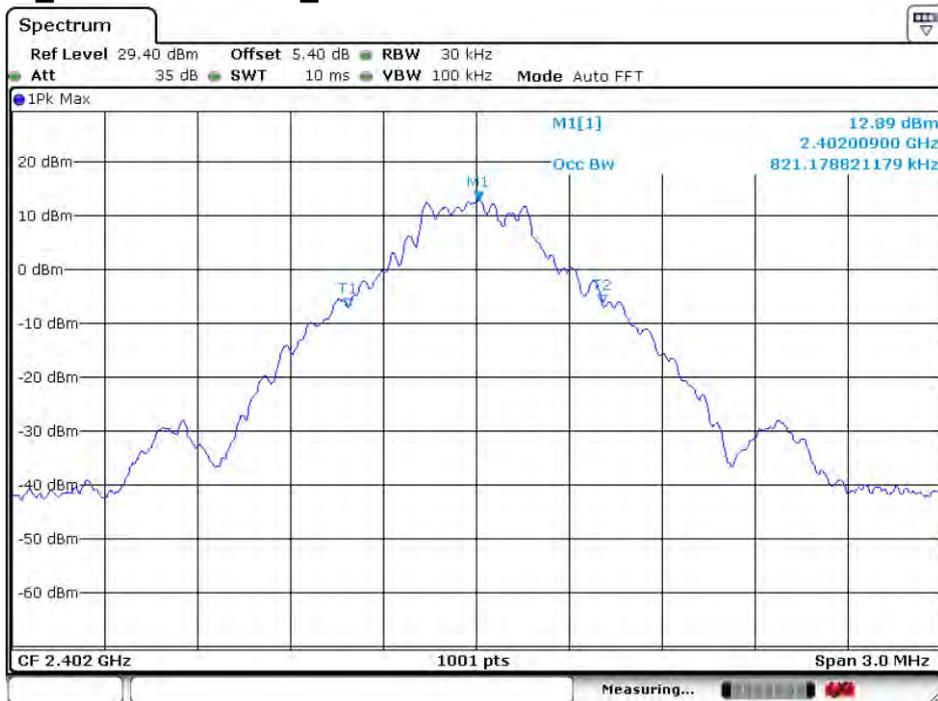


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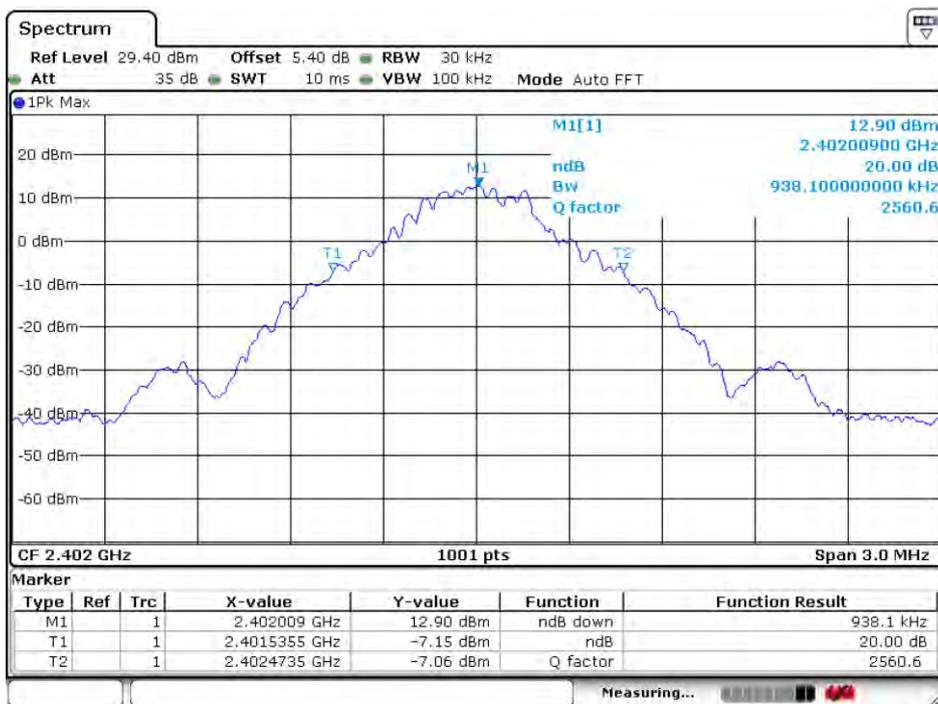
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4.5.2 Test plots

4.5.2.1 GFSK_Lowest Channel_ANT1



Date: 30.MAR.2020 09:29:51

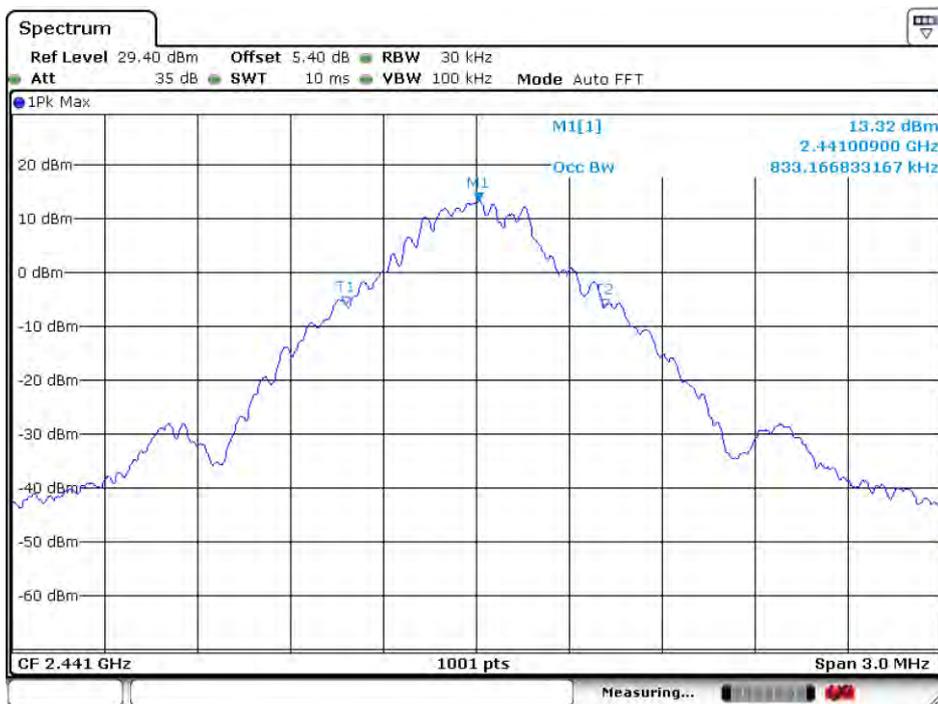


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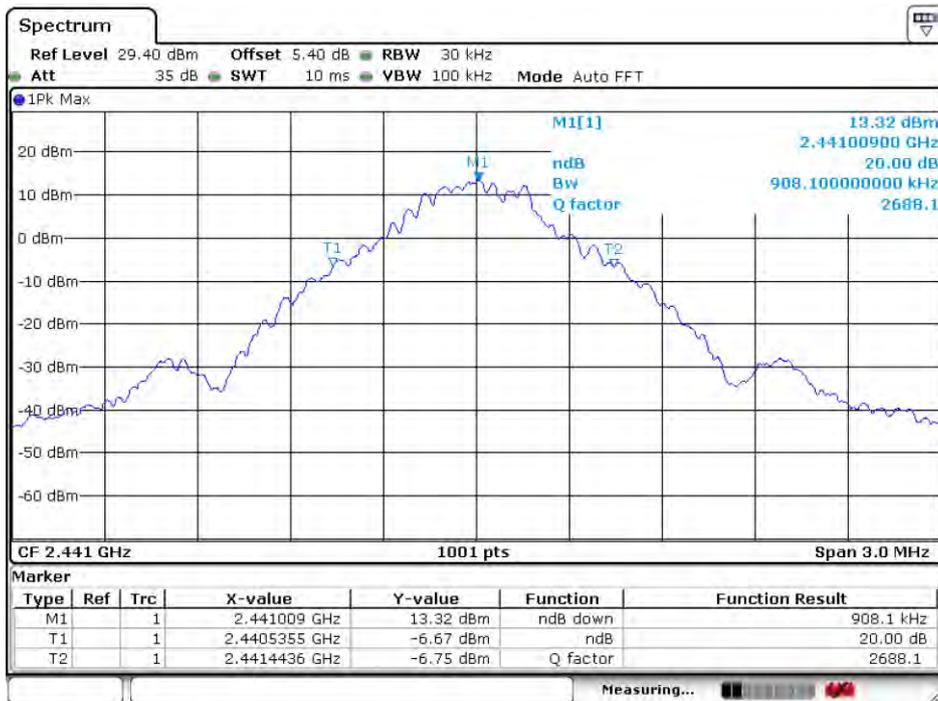


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4.5.2.2 GFSK_Middle Channel_ANT1



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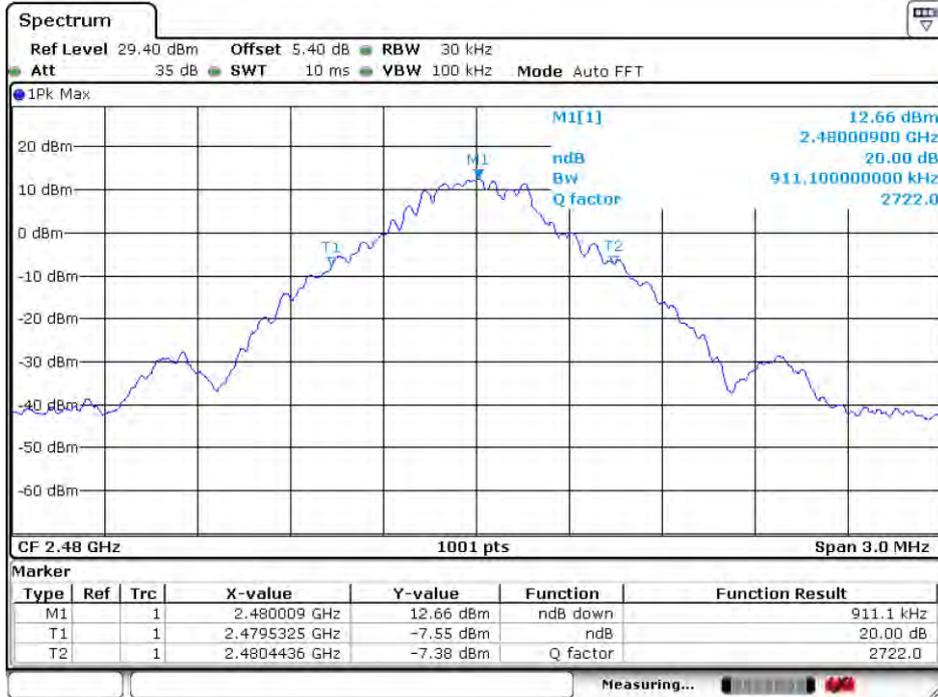


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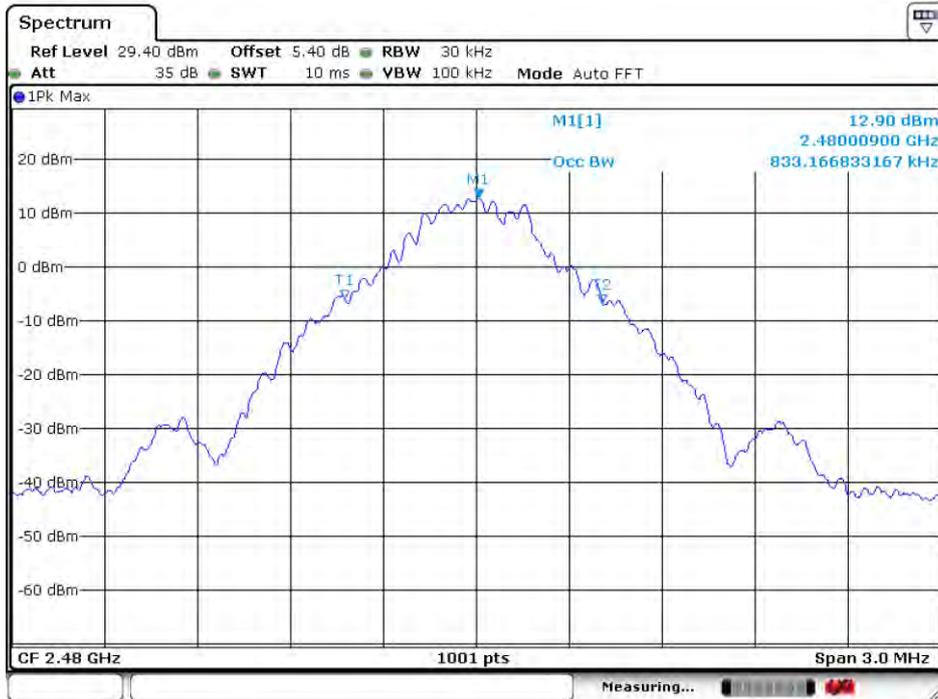


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4.5.2.3 GFSK_Highest Channel_ANT1



Date: 30.MAR.2020 09:31:09



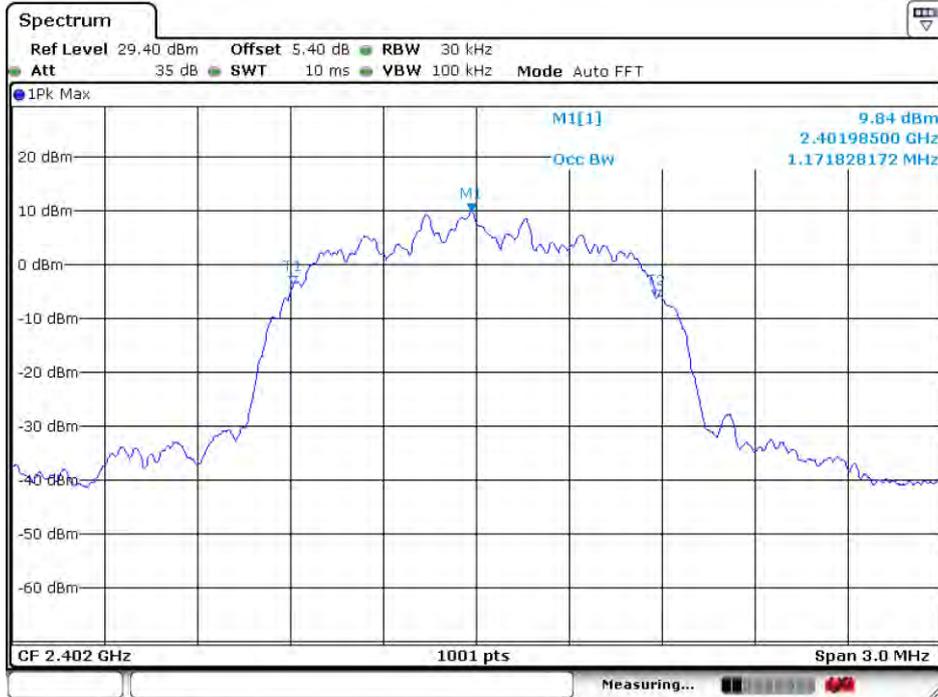
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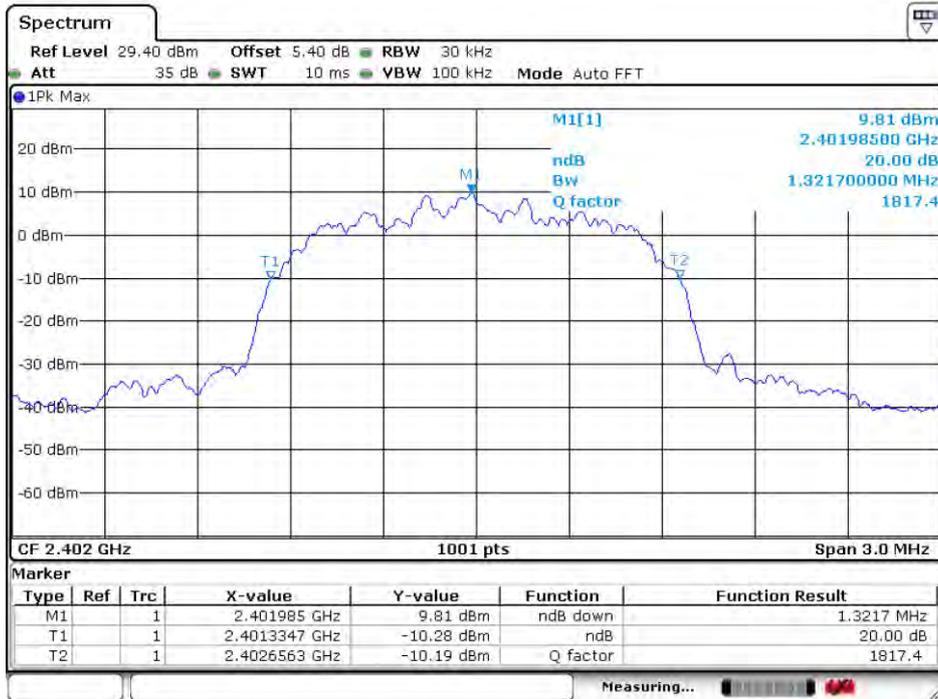
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4.5.2.4 $\pi/4$ DQPSK_Lowest Channel_ANT1



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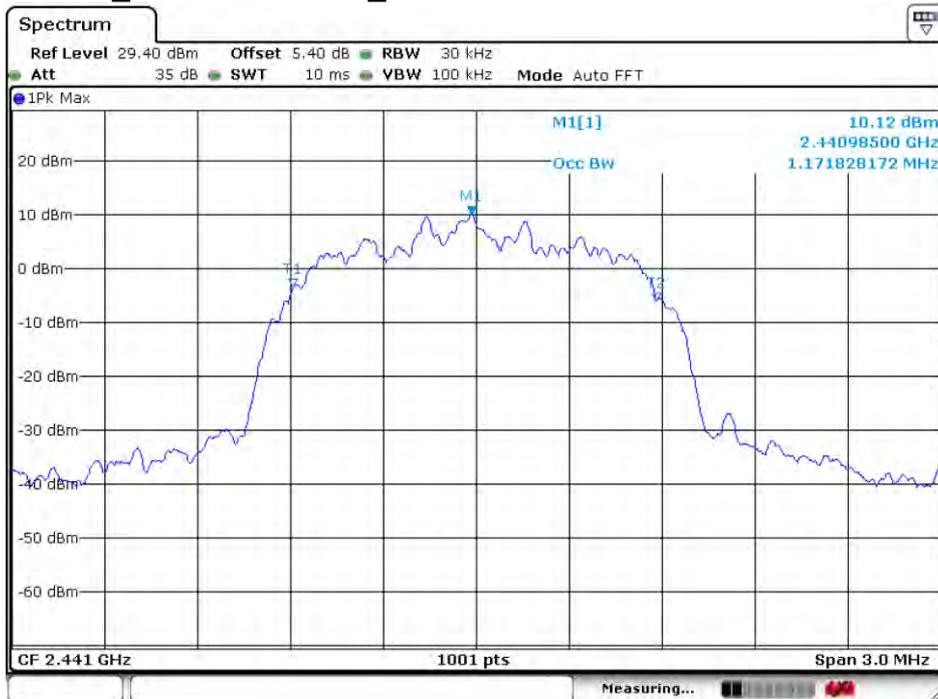


Date: 30.MAR.2020 09:28:04

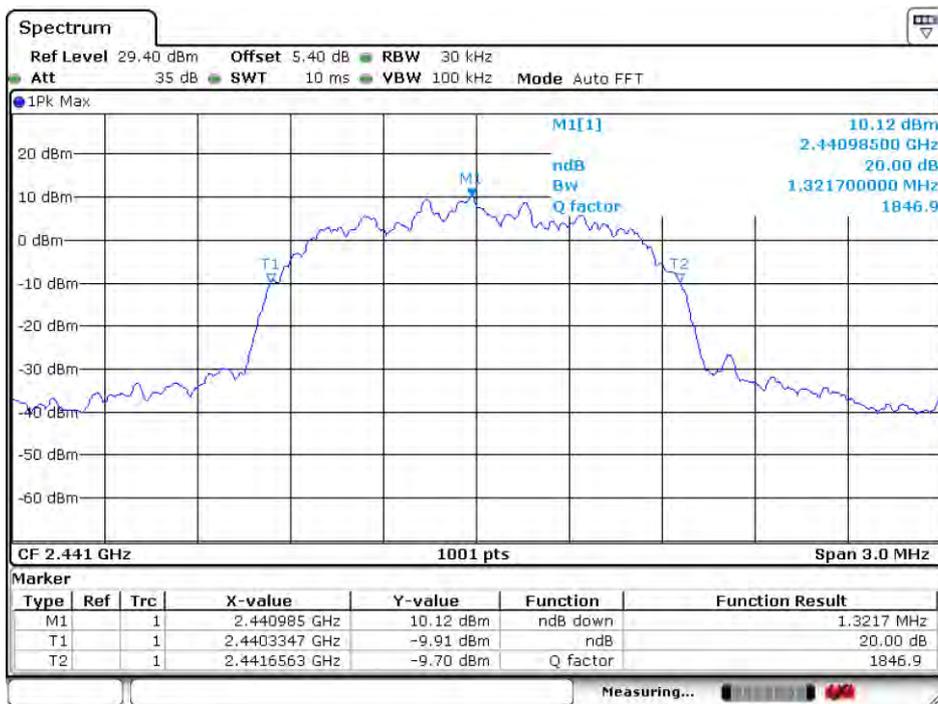


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4.5.2.5 $\pi/4$ DQPSK_Middle Channel_ANT1



Date: 30.MAR.2020 09:27:30



Date: 30.MAR.2020 09:27:13



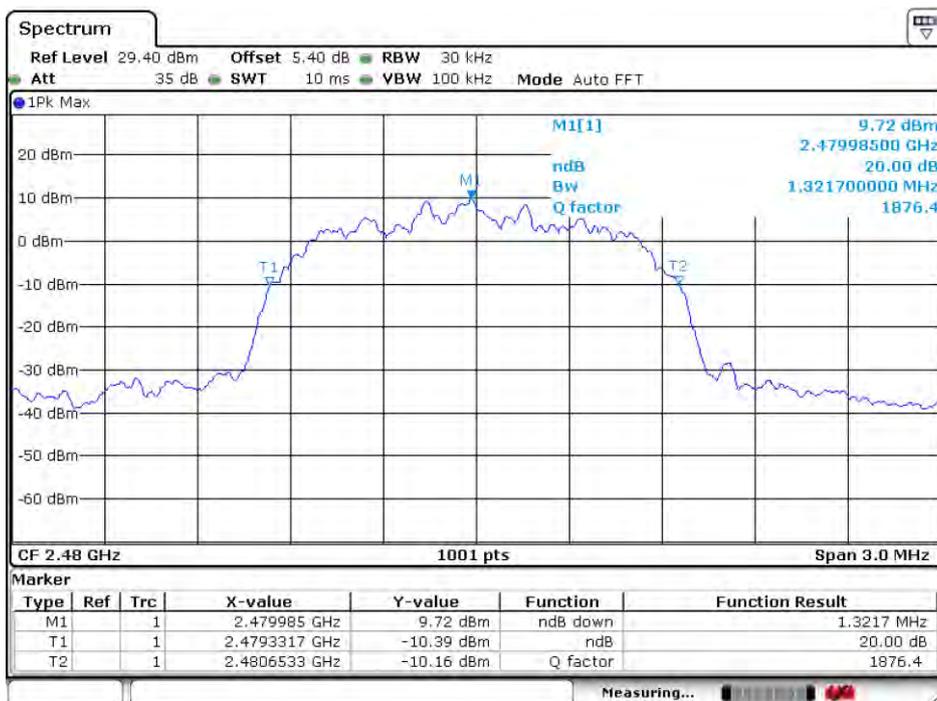
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4.5.2.6 $\pi/4$ DQPSK_Highest Channel_ANT1



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4.5.2.7 8DPSK_Lowest Channel_ANT1



Date: 30.MAR.2020 09:28:33

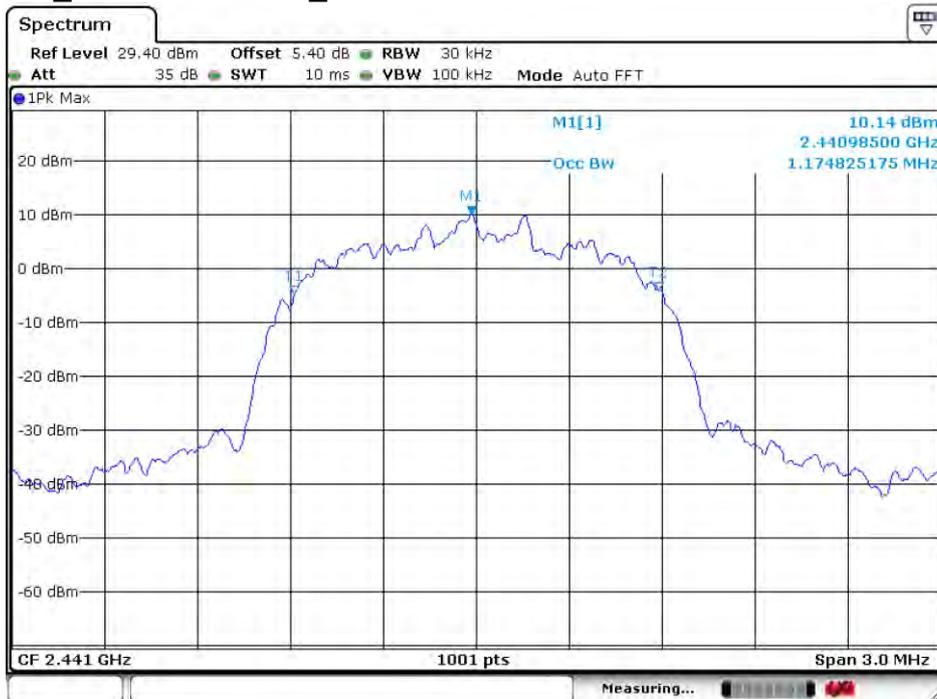


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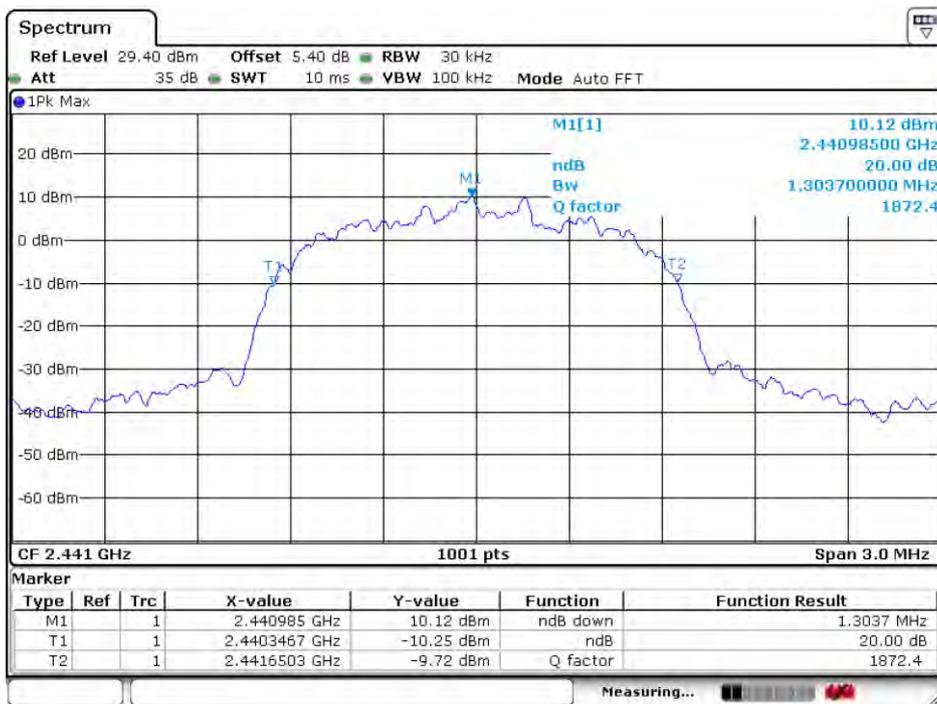


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4.5.2.8 8DPSK_Middle Channel_ANT1



Date: 30.MAR.2020 09:28:51



Date: 30.MAR.2020 09:29:00

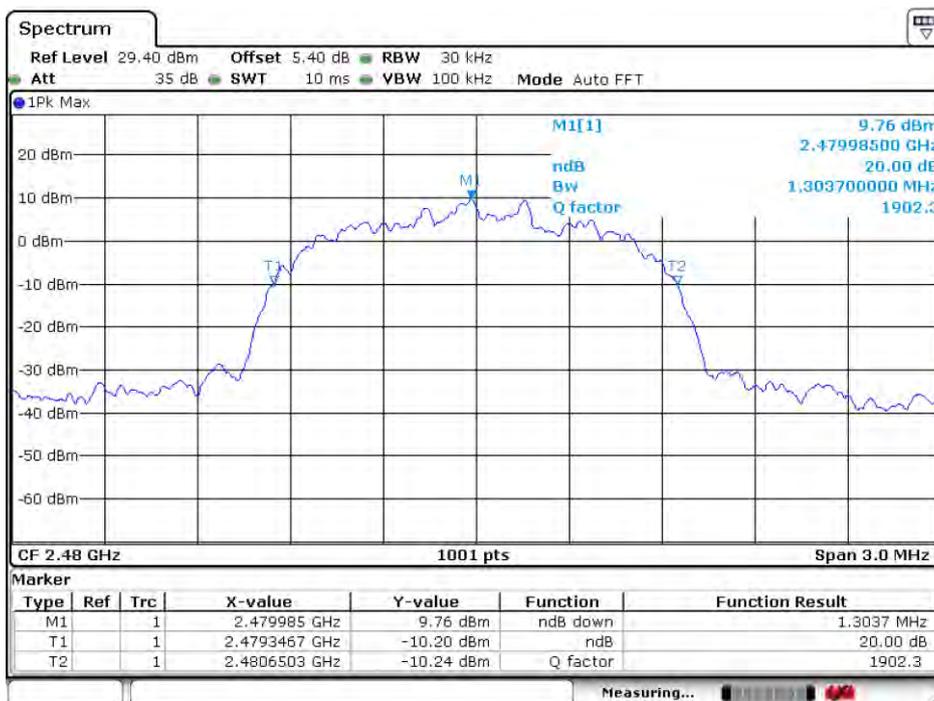


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4.5.2.9 8DPSK_Highest Channel_ANT1



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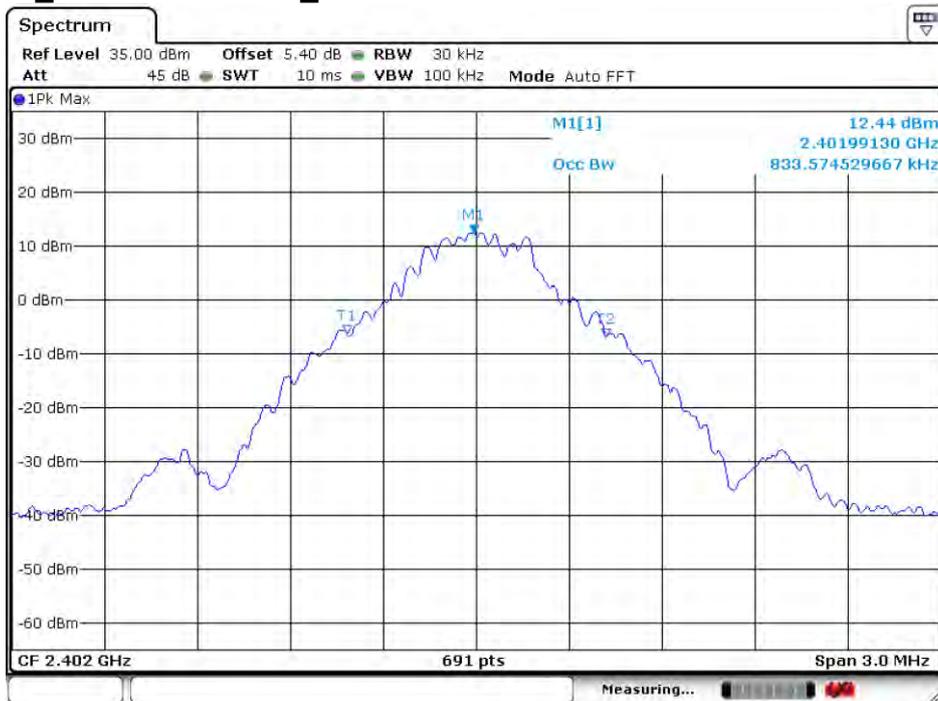
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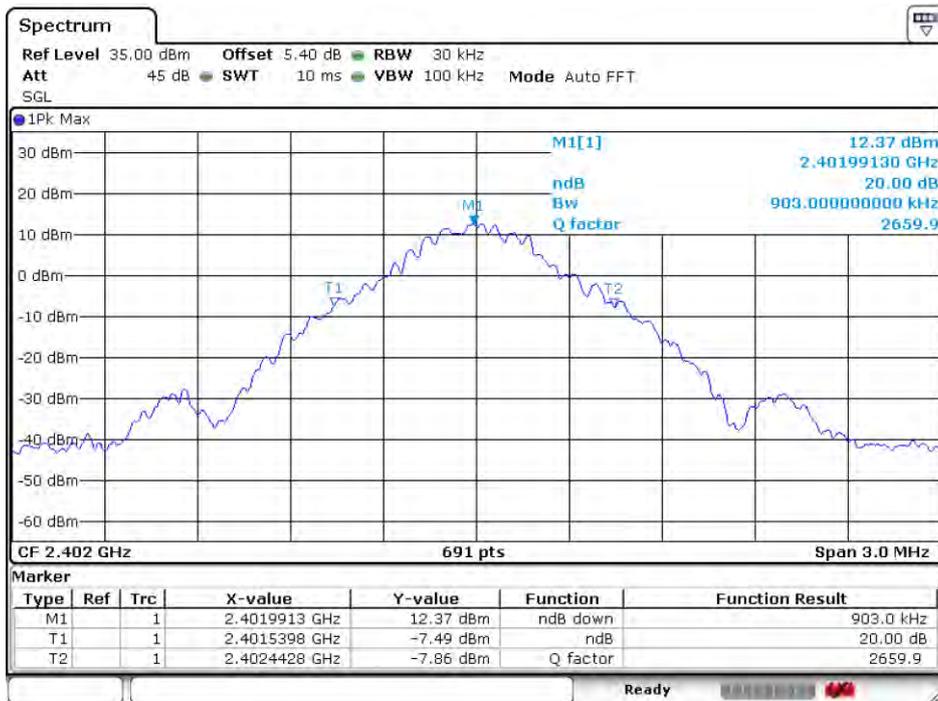
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4.5.3 Test plots

4.5.3.1 GFSK_Lowest Channel_ANT2



Date: 17.APR.2020 09:58:27



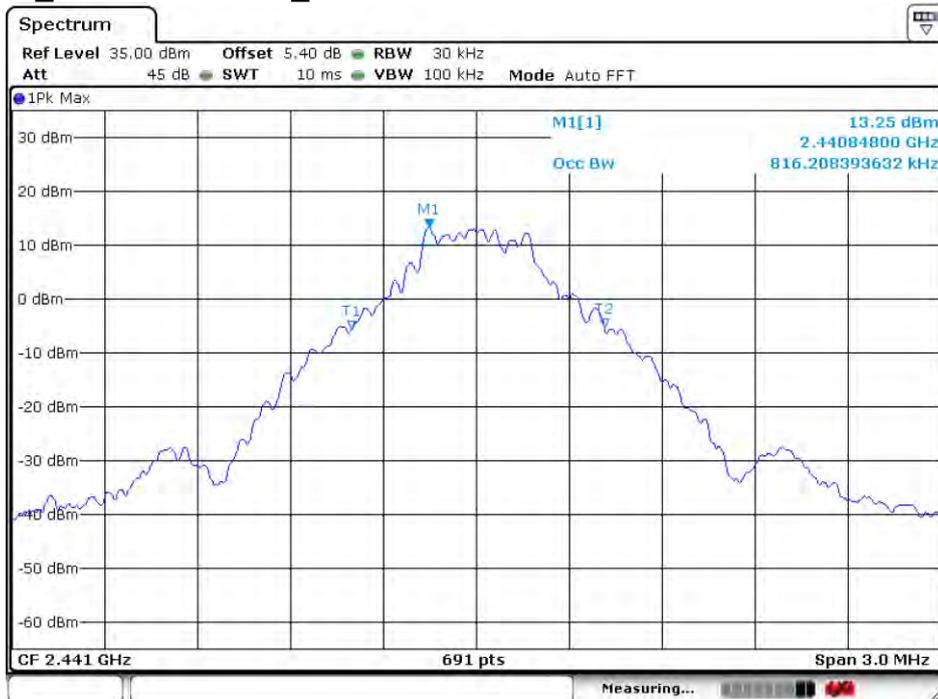
Date: 17.APR.2020 09:58:41



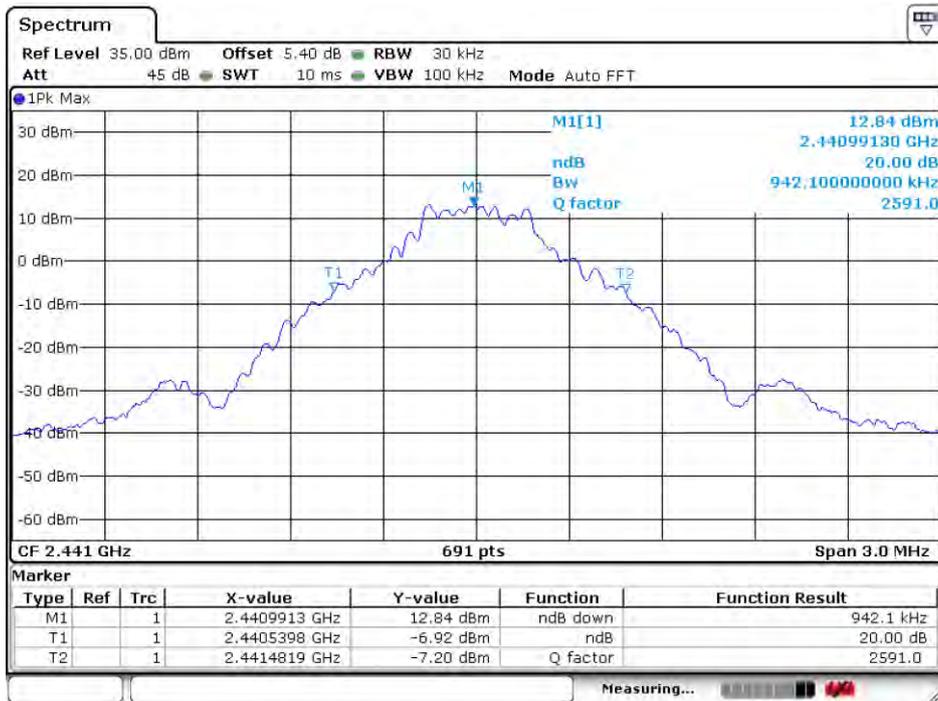
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4.5.3.2 GFSK_Middle Channel_ANT2



Date: 17.APR.2020 10:00:22



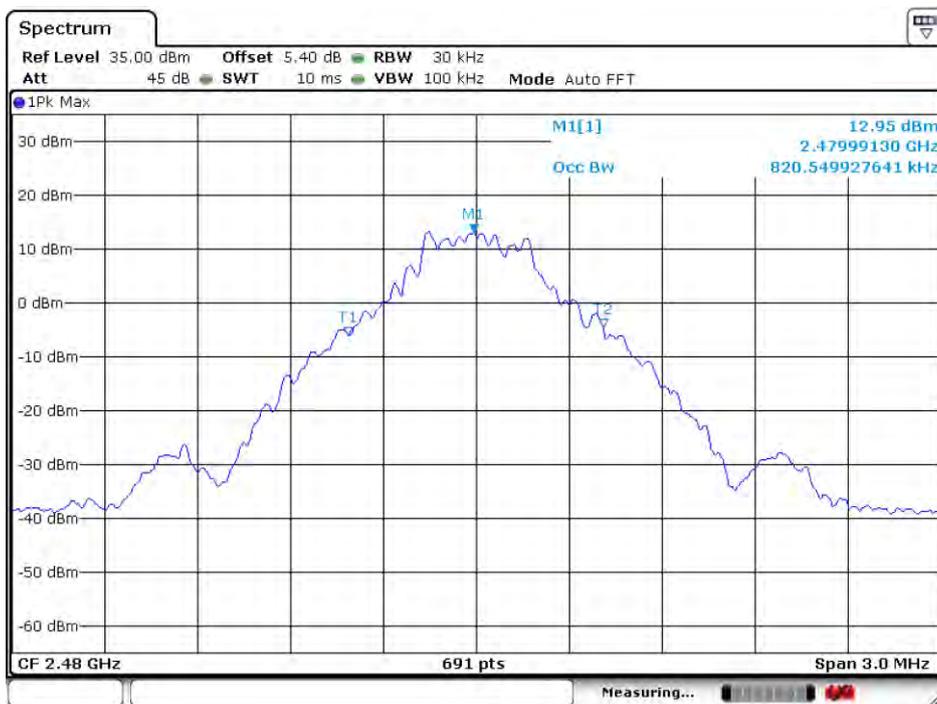
Date: 17.APR.2020 10:00:04



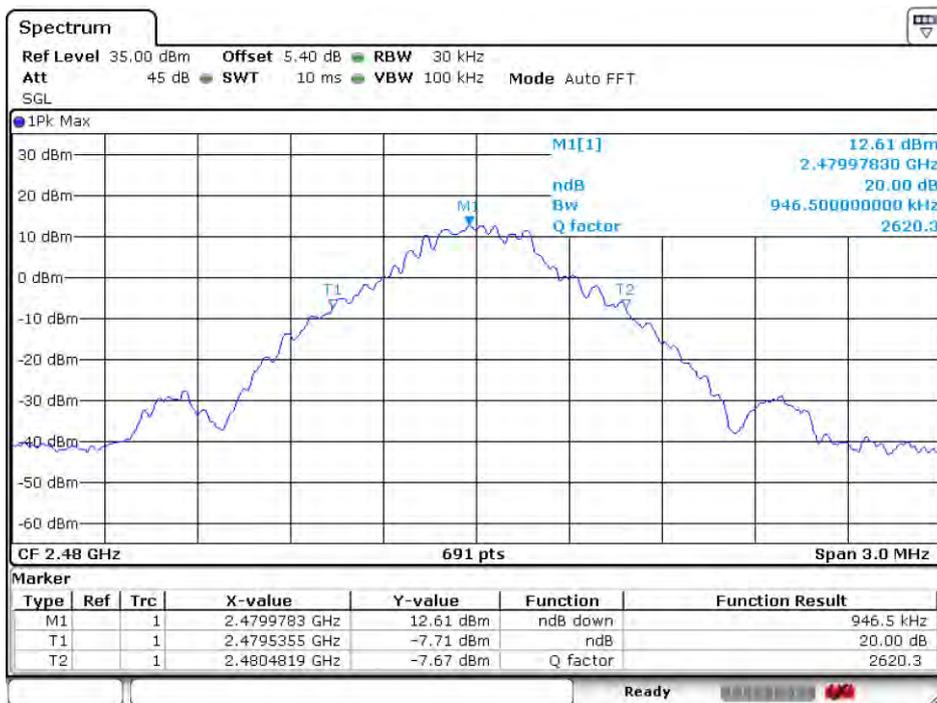
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4.5.3.3 GFSK_Highest Channel_ANT2



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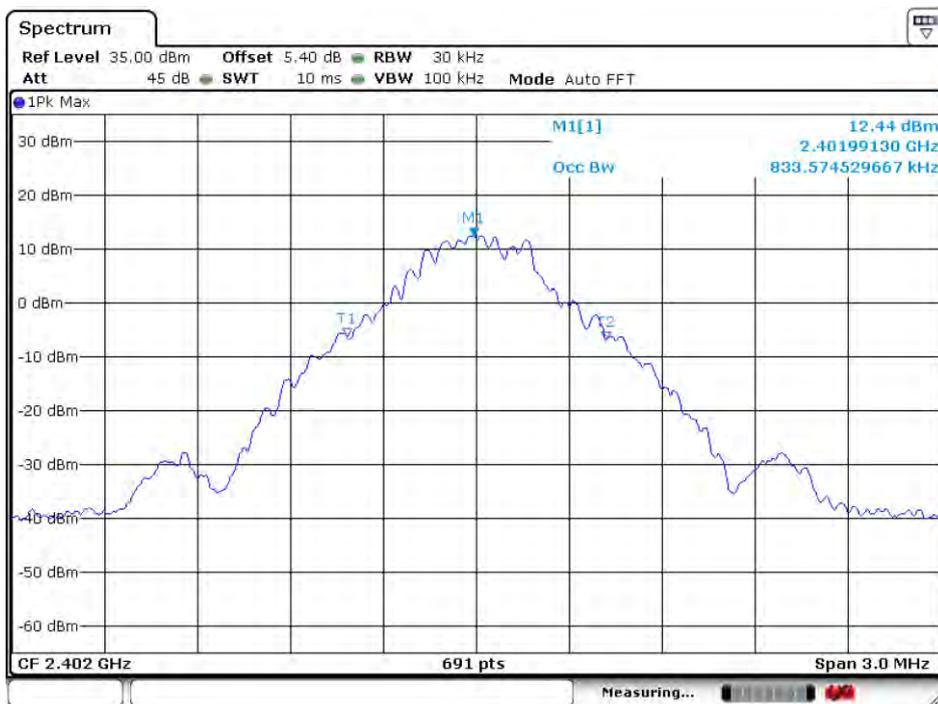


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4.5.3.4 $\pi/4$ DQPSK _Lowest Channel_ ANT2



Date: 17.APR.2020 09:58:27



Date: 17.APR.2020 09:56:39



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4.5.3.5 $\pi/4$ DQPSK_Middle Channel_ANT2



Date: 17.APR.2020 09:50:51

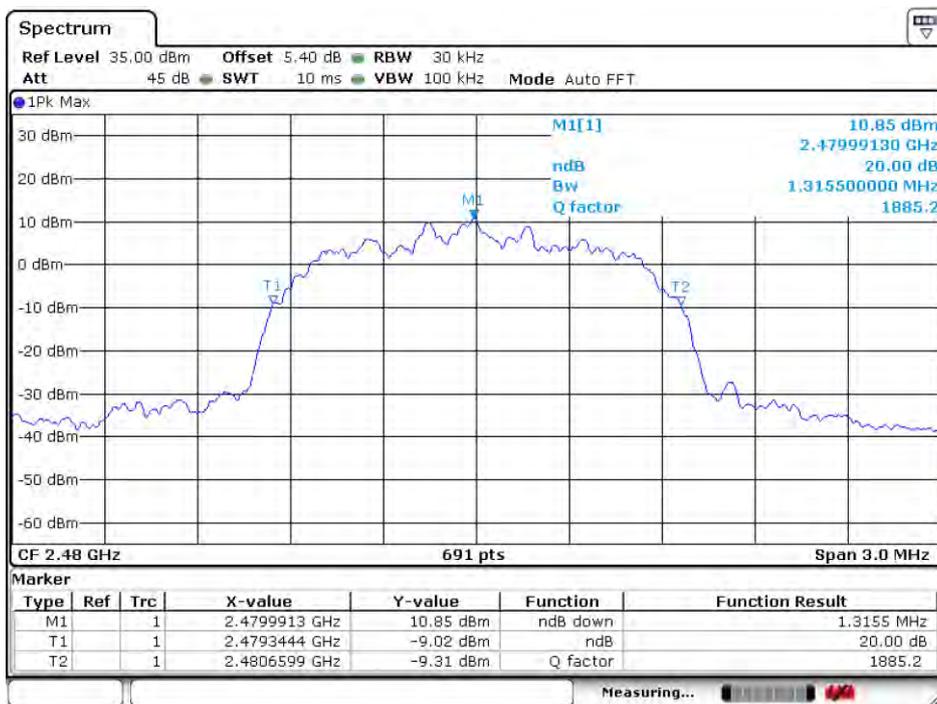


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4.5.3.6 $\pi/4$ DQPSK_Highest Channel_ANT2



Date: 17.APR.2020 09:49:53



Date: 17.APR.2020 09:50:06

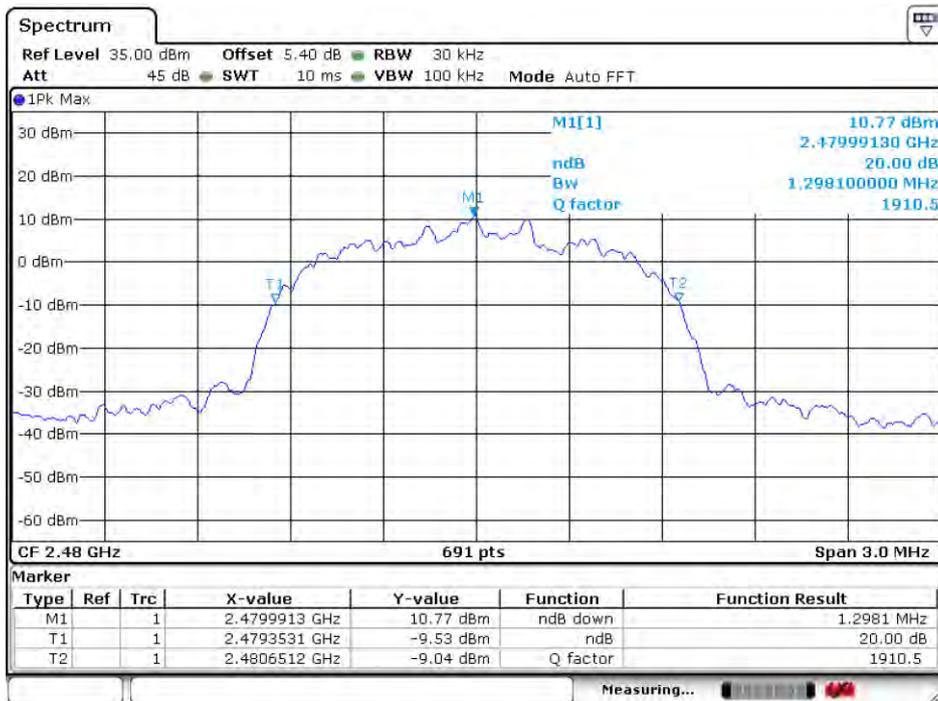


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4.5.3.7 8DPSK_Lowest Channel_ANT2



Date: 17.APR.2020 09:42:29



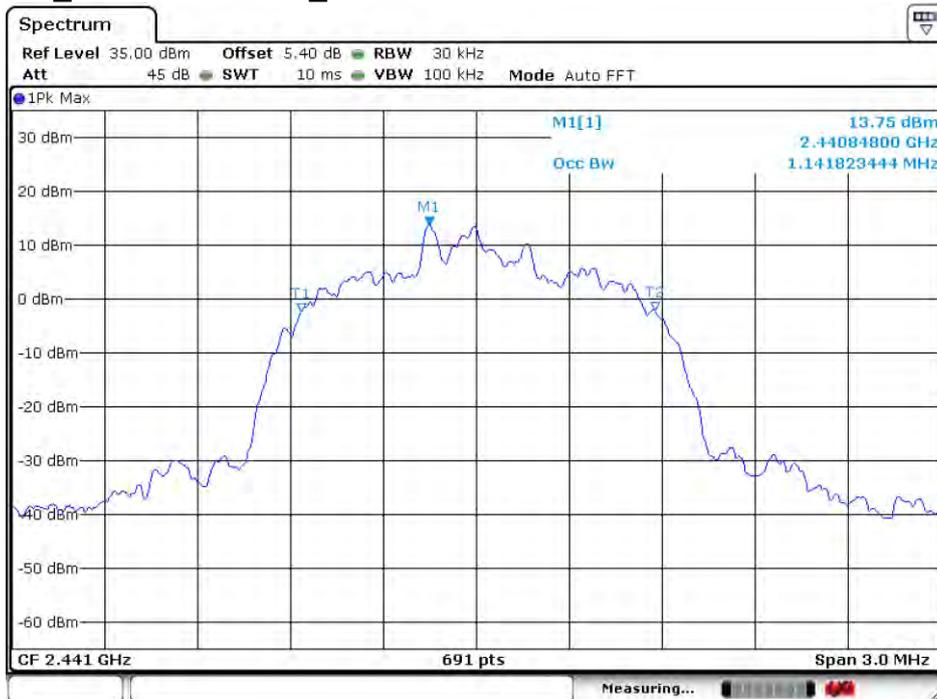
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4.5.3.8 8DPSK_Middle Channel_ANT2



Date: 17.APR.2020 09:48:34



Date: 17.APR.2020 09:48:24



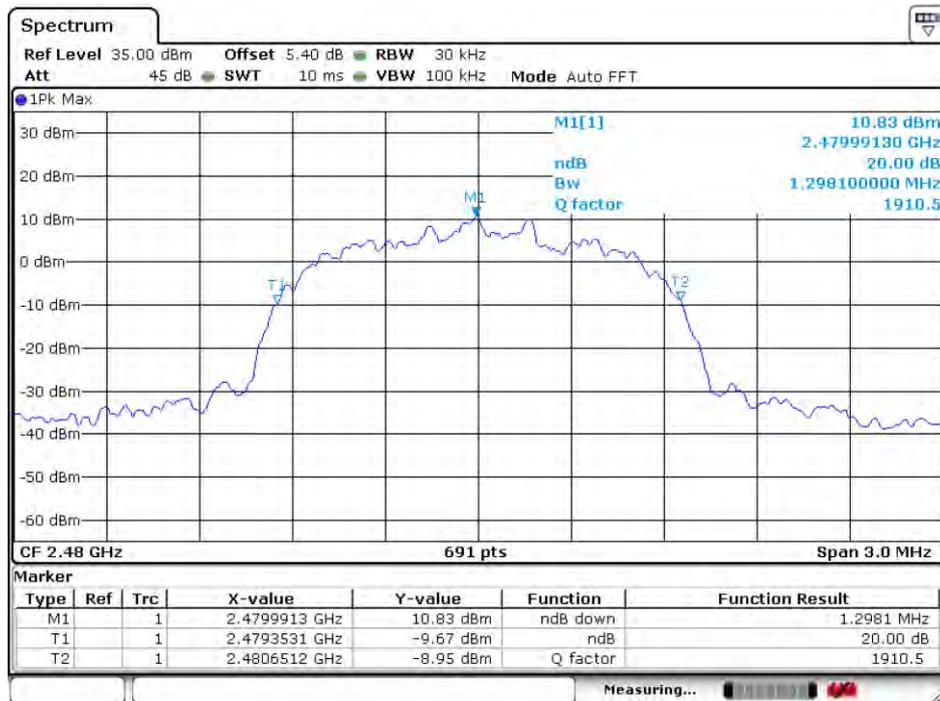
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4.5.3.9 8DPSK_Highest Channel_ANT2



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Date: 17.APR.2020 09:49:38



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4.6 Carrier Frequencies Separation

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013 Section 7.8.2
Test Setup:	
Limit:	2/3 of the 20dB bandwidth
	Remark: the transmission power is less than 0.125W.
Exploratory Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type.
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass



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4.6.1 Test Results

The results for ANT1:

GFSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	998	625.4	Pass
π/4DQPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	998	881.1	Pass
8DPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	998	871.1	Pass

Remark: According to section 6.4,

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	938.1	625.4
π/4DQPSK	1321.7	881.1
8DPSK	1306.7	871.1



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The results for ANT2:

GFSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	1002	631	Pass
π/4DQPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	1146.2	877	Pass
8DPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Middle	1150.5	865.4	Pass

Remark: According to section 6.4,

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	946.5	631
π/4DQPSK	1315.5	877
8DPSK	1298.1	865.4

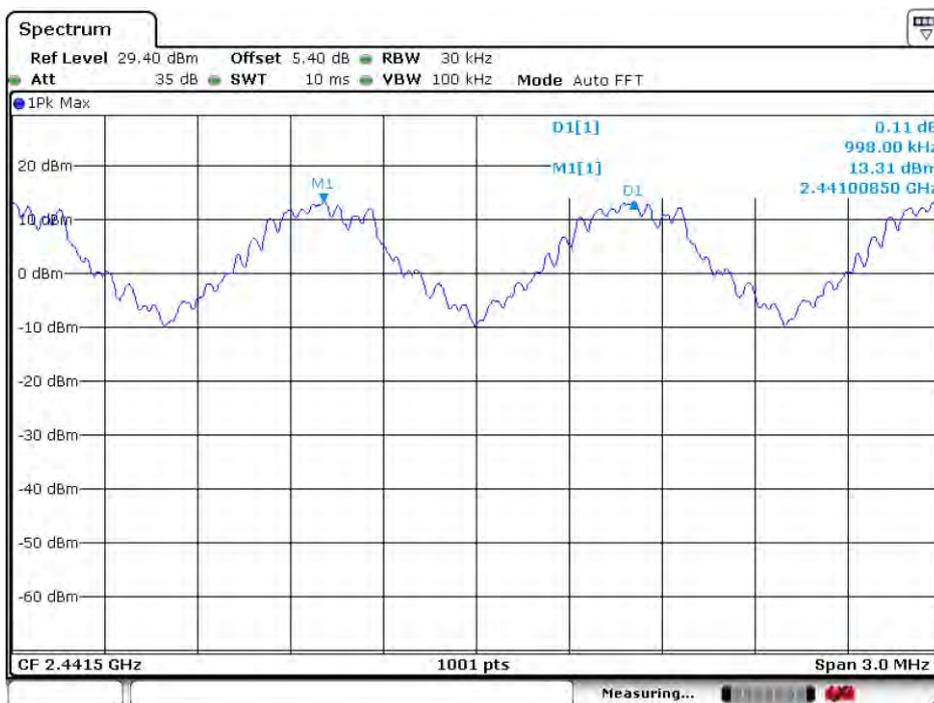


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4.6.2 Test plots:

Test mode:	GFSK_ANT1	Test channel:	Middle
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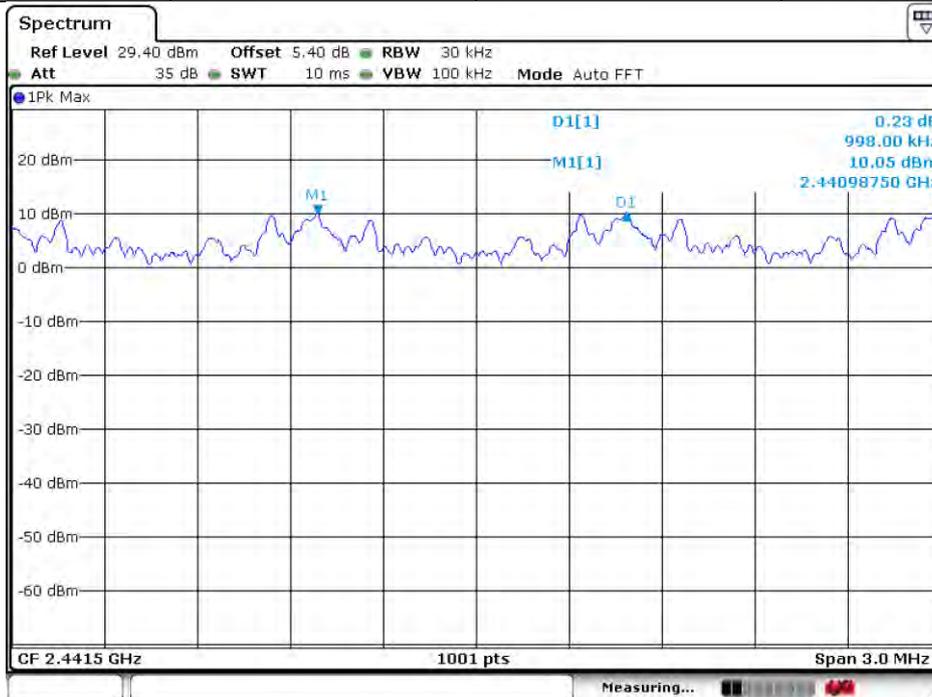
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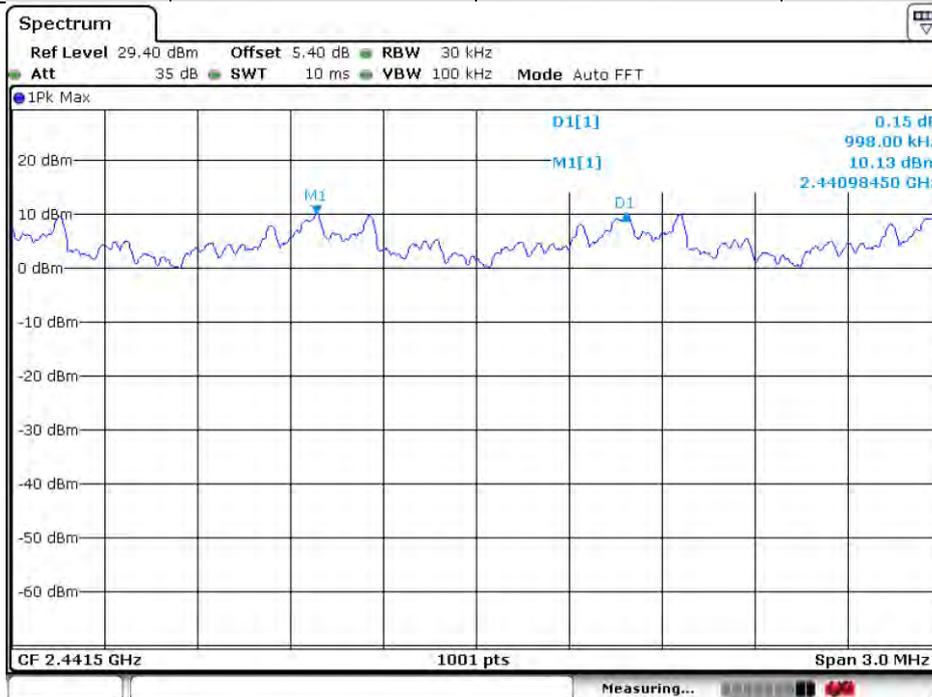
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Test mode:	$\pi/4$ DQPSK_ANT1	Test channel:	Middle
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Date: 30.MAR.2020 09:34:44

Test mode:	8DPSK_ANT1	Test channel:	Middle
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Date: 30.MAR.2020 09:34:05

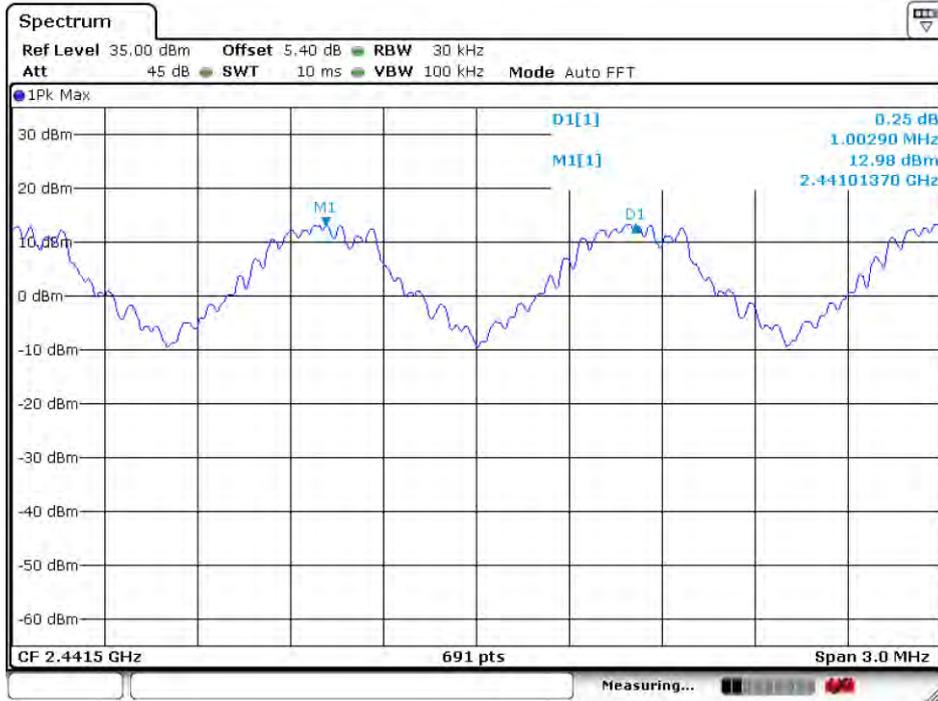


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Test mode:	GFSK_ANT2	Test channel:	Middle
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Date: 17.APR.2020 10:21:58

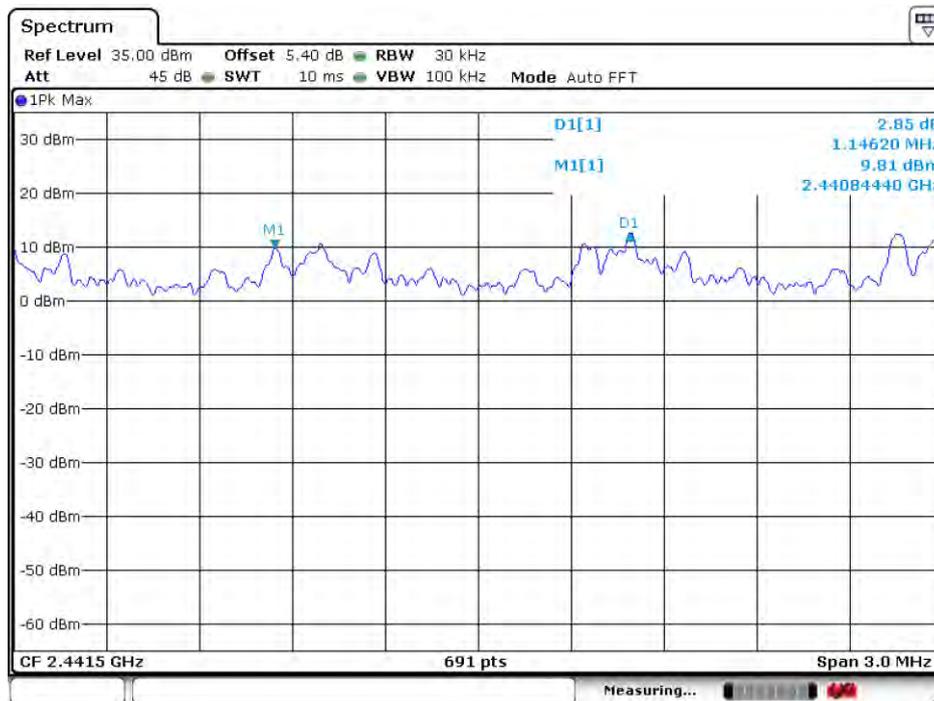


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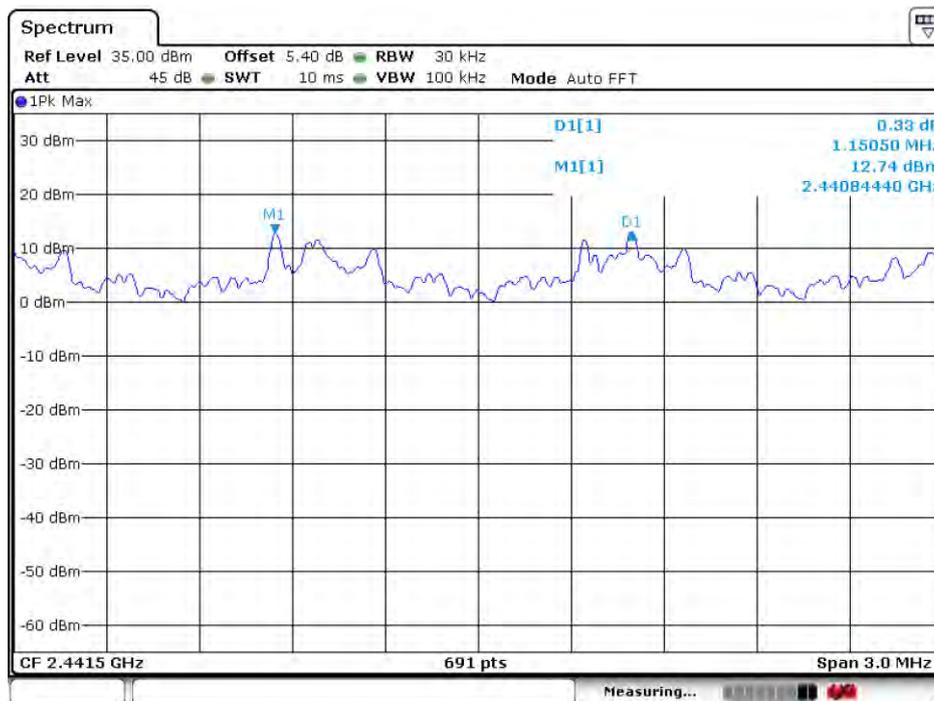
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Test mode:	$\pi/4$ DQPSK_ANT2	Test channel:	Middle
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Date: 17.APR.2020 10:21:17

Test mode:	8DPSK_ANT2	Test channel:	Middle
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Date: 17.APR.2020 10:19:58



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4.7 Hopping Channel Number

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013 Section 7.8.3
Test Setup:	
Limit:	At least 15 channels
Test Mode:	Hopping transmitting with all kind of modulation
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

4.7.1 Test Results

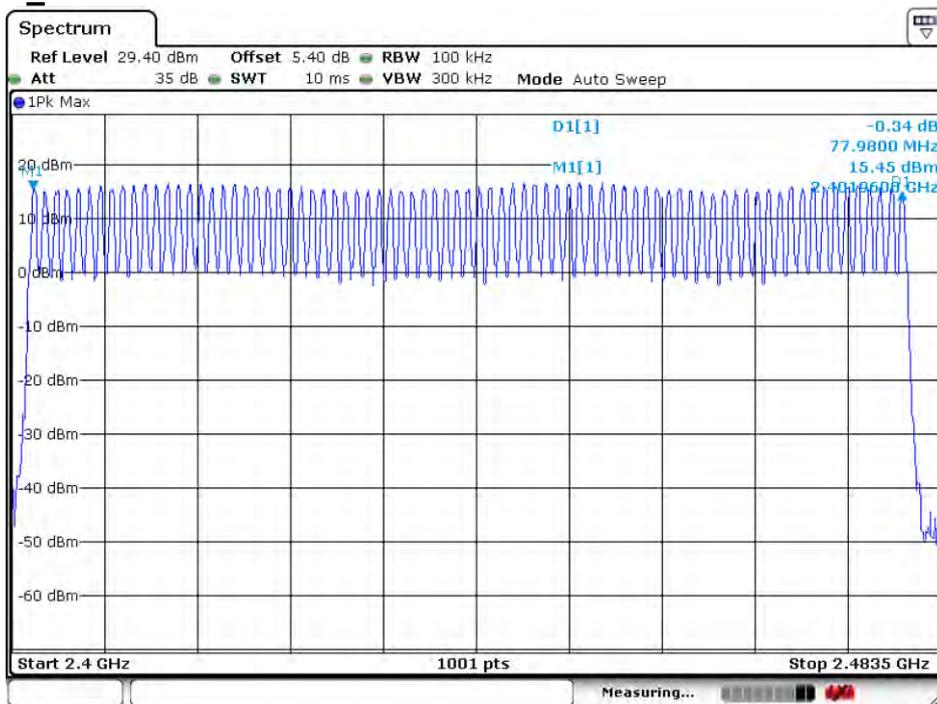
Mode	Hopping channel numbers	Limit
GFSK_ANT1	79	≥15
π/4DQPSK_ANT1	79	≥15
8DPSK_ANT1	79	≥15
GFSK_ANT2	79	≥15
π/4DQPSK_ANT2	79	≥15
8DPSK_ANT2	79	≥15



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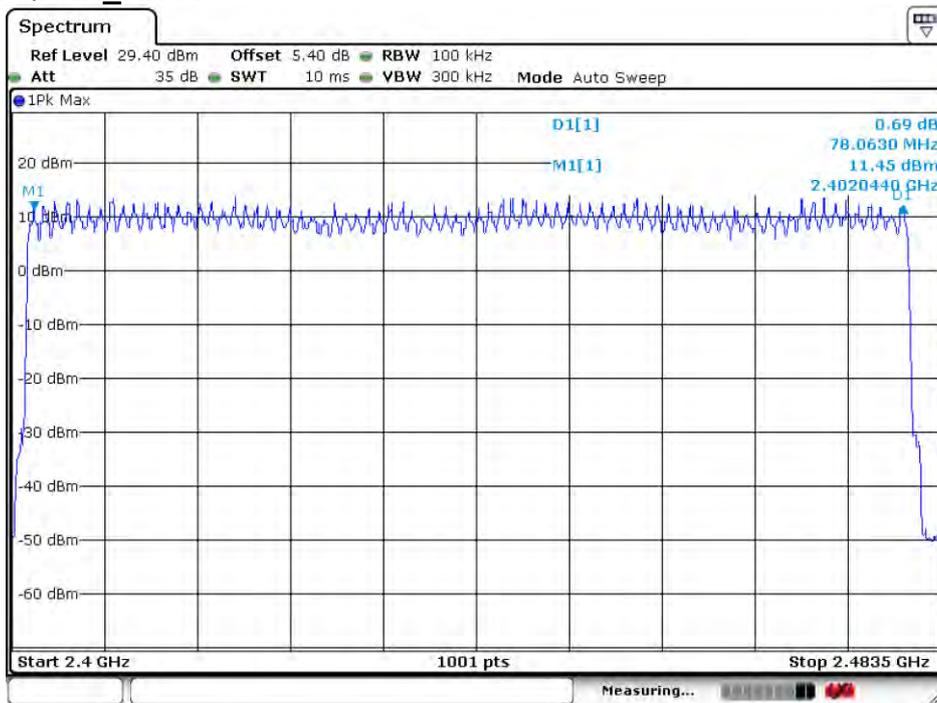
4.7.2 Test plots

4.7.2.1 GFSK_ANT1



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4.7.2.2 $\pi/4$ QPSK_ANT1



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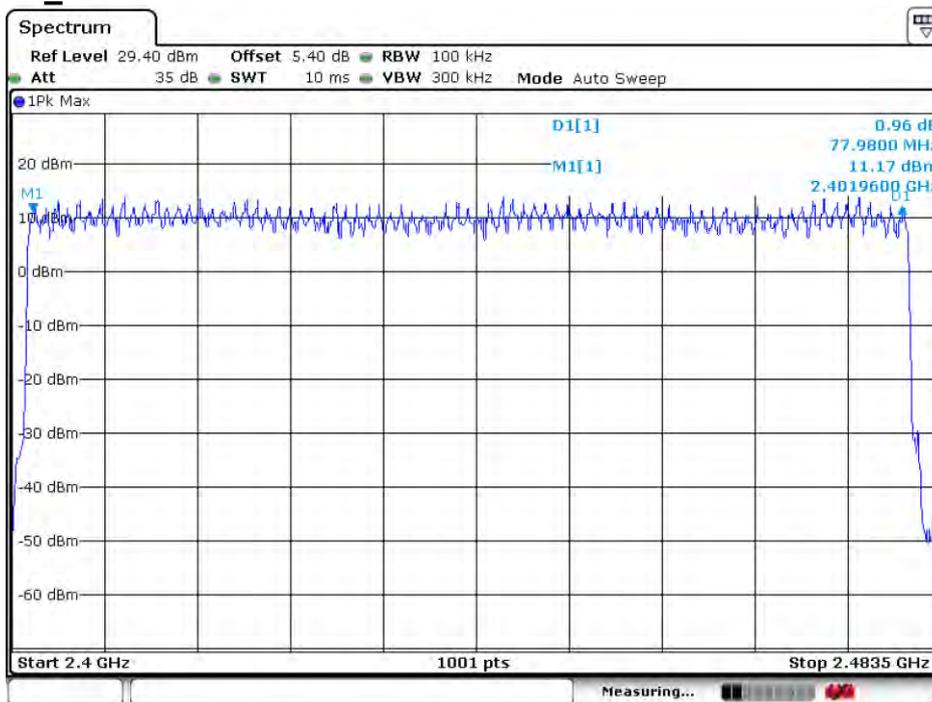


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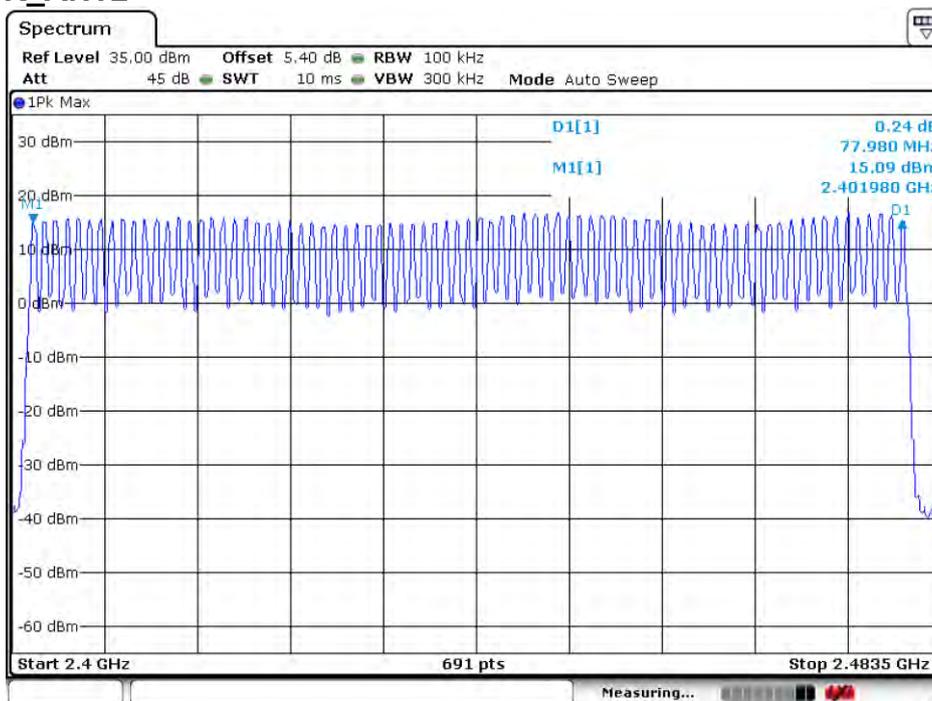
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4.7.2.3 8DPSK_ANT1



4.7.2.4 GFSK_ANT2



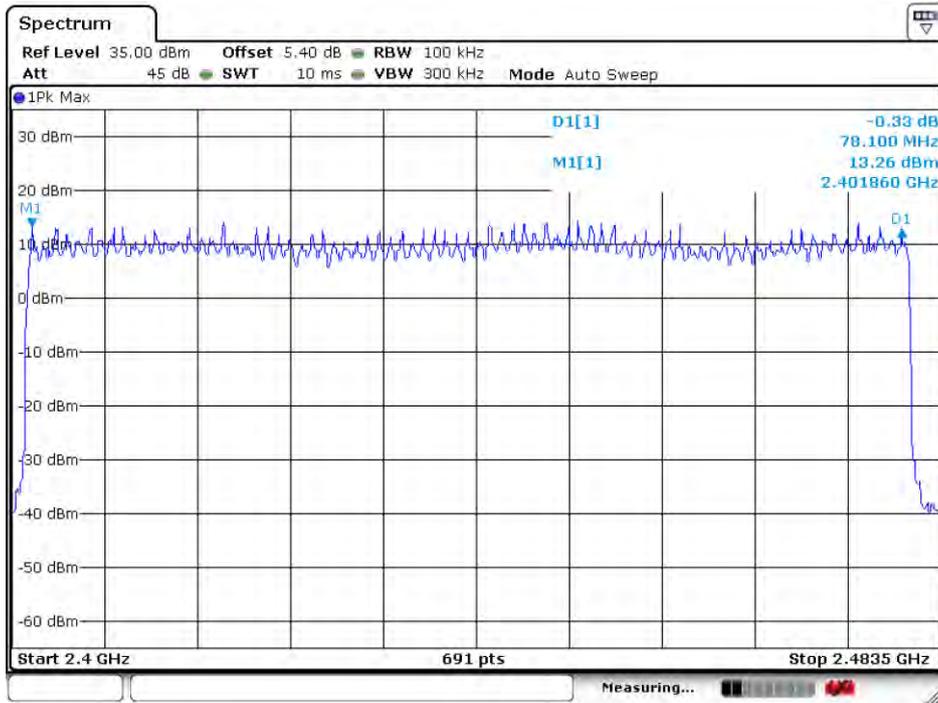
4.7.2.5 $\pi/4$ DQPSK_ANT2



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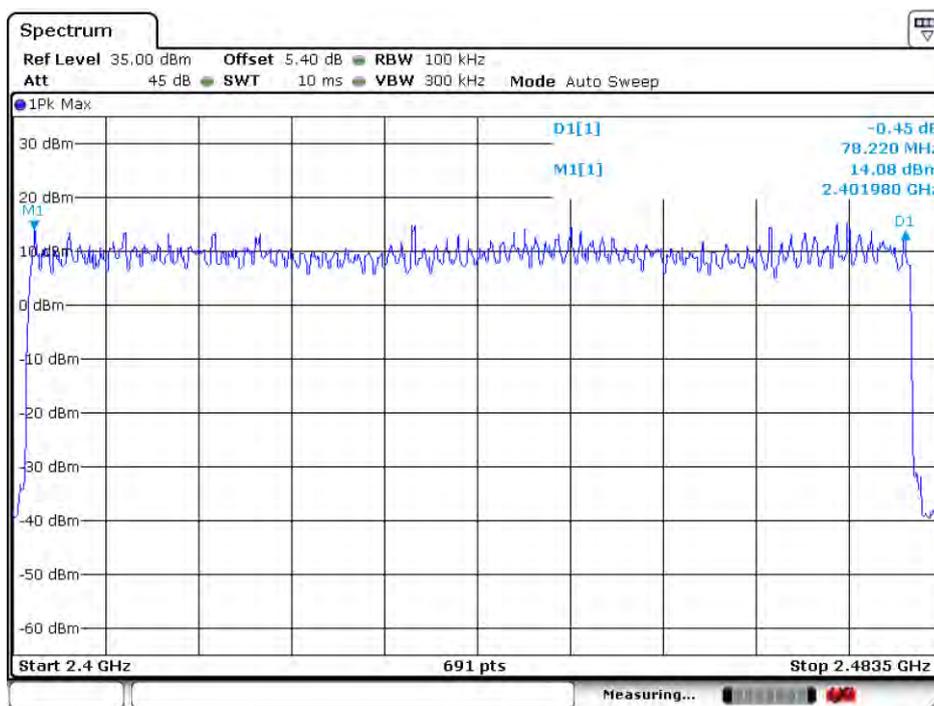
4.7.2.6 8DPSK_ANT2



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4.8 Dwell Time

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013 Section 7.8.4
Test Setup:	
Instruments Used:	Refer to section 5.10 for details
Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type.
Limit:	0.4 Second
Test Results:	Pass



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4.8.1 Test Results

Operation Modes	On time (ms) on one channel
DH1_ANT1	0.392
DH3_ANT1	1.655
DH5_ANT1	2.905
2-DH1_ANT1	0.398
2-DH3_ANT1	1.657
2-DH5_ANT1	2.905
3-DH1_ANT1	0.399
3-DH3_ANT1	1.654
3-DH5_ANT1	2.905
DH1_ANT2	0.386
DH3_ANT2	1.650
DH5_ANT2	2.906
2-DH1_ANT2	0.391
2-DH3_ANT2	1.652
2-DH5_ANT2	2.906
3-DH1_ANT2	0.392
3-DH3_ANT2	1.646
3-DH5_ANT2	2.906

Bluetooth Time of Occupancy Calculation

Typically, Bluetooth 1x/EDR mode has a channel hopping rate of 1600 hops/s, since 1x/EDR modes use 5 transmit and 1 receive slot, for a total of 6 slots, the Bluetooth transmitter is actually hopping at a rate of $1600/6=266.67$ hops/slot

$400ms \times 79$ Channel = 31.6 s (Time of Occupancy Limit)

Worst case BT has 266.67 hops/second (for 1x/EDR modes with 3-DH5 operation)

266.67 hops/second/ 79 channels= 3.38 hops/second (# of hops/second on one channel)

3.38 hops/second/channel* 31.6 seconds= 106.67 hops (#hops over a 31.6 second period)

106.67 hops * 2.906 ms/channel = 309.98 ms(worst case dwell time for one channel in 1x/EDR modes)

With AFH, the number of channels is reduced to a minimum of 20 channels and the channel hopping rate is reduced by 50% to 800hops/s, AFH mode also uses 6 slots so the Bluetooth transmitter hops at a rate of $800/6=133.3$ hops/s/slot

$400ms \times 20$ Channel = 8 s (Time of Occupancy Limit)

Worst case BT has 133.3 hops/second/slot (for AFH mode with 3-DH5 operation)

133.3 hops/second/ 20 channels= 6.67 hops/second (#hops/second on one channel)

6.67 hops/second * 8 seconds= 53.34 hops (#hops over a 8 seconds period)

53.34 hops x 2.906 ms/channel= 155.01 ms(worst case dwell time for one channel in AFH mode)

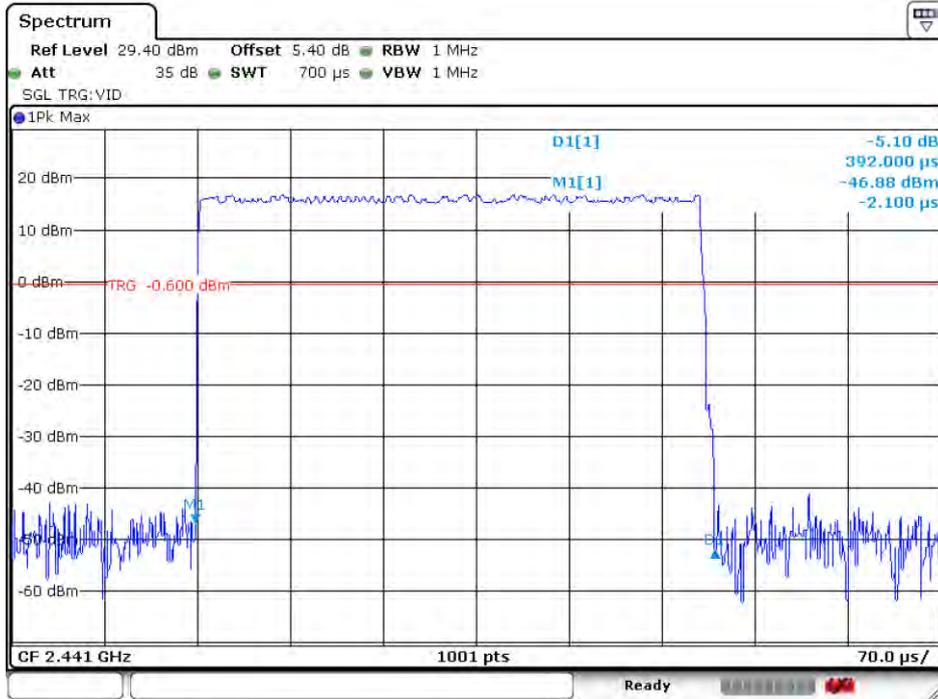


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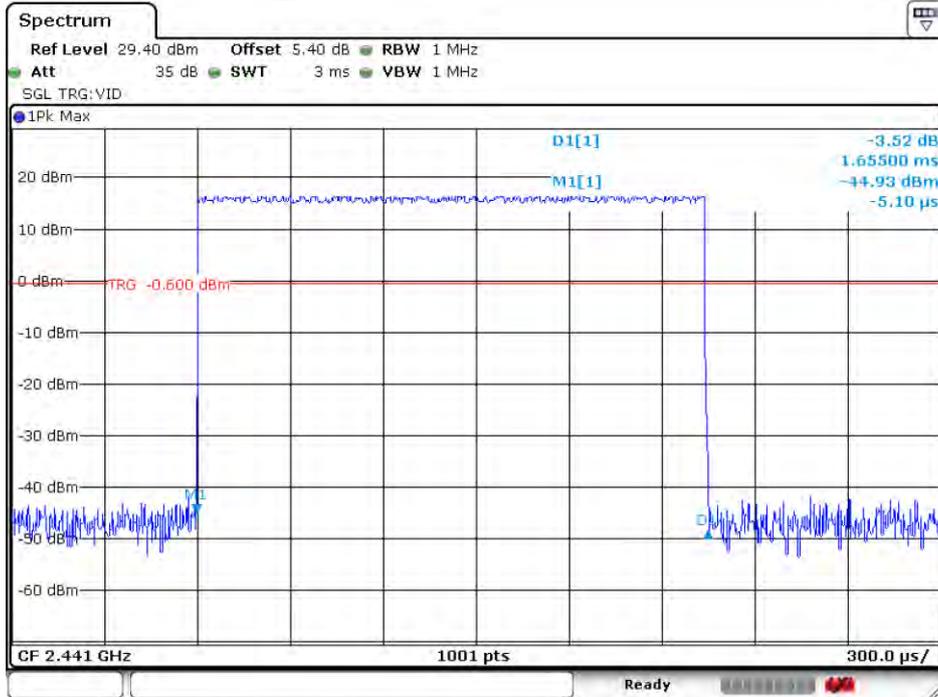
4.8.2 Test plots

4.8.2.1 DH1_Middle Channel_ANT1



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4.8.2.2 DH3_Middle Channel_ANT1

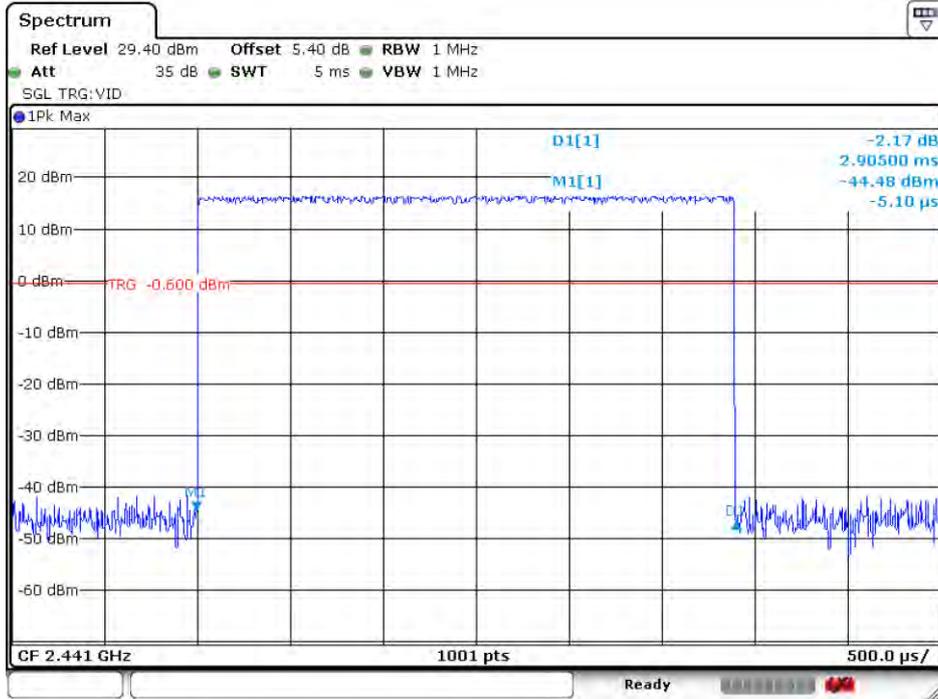


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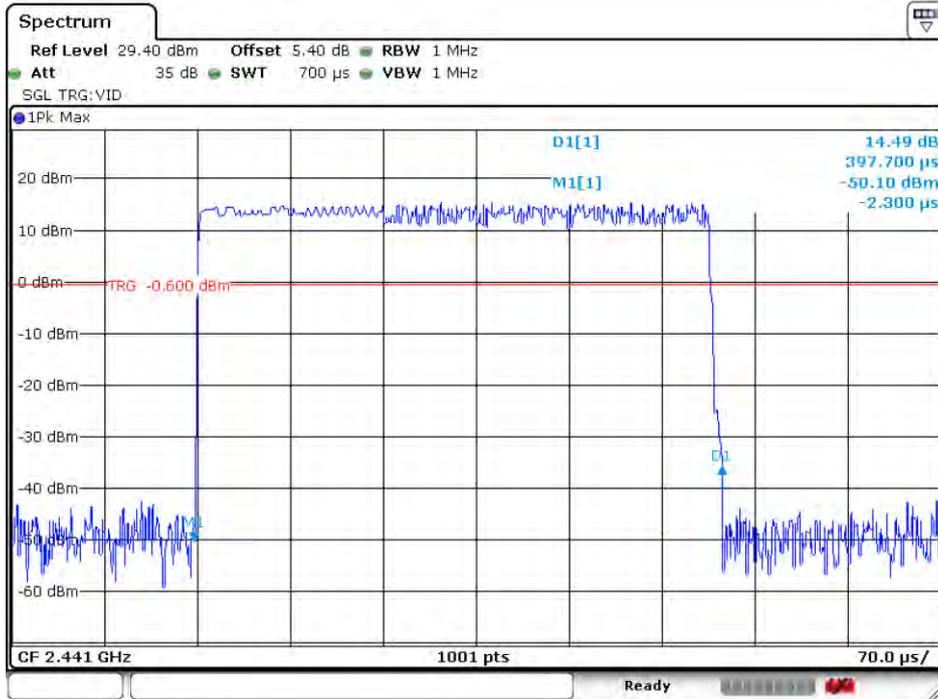
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4.8.2.3 DH5 _ Middle Channel_ANT1



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4.8.2.4 2DH1 _ Middle Channel_ANT1

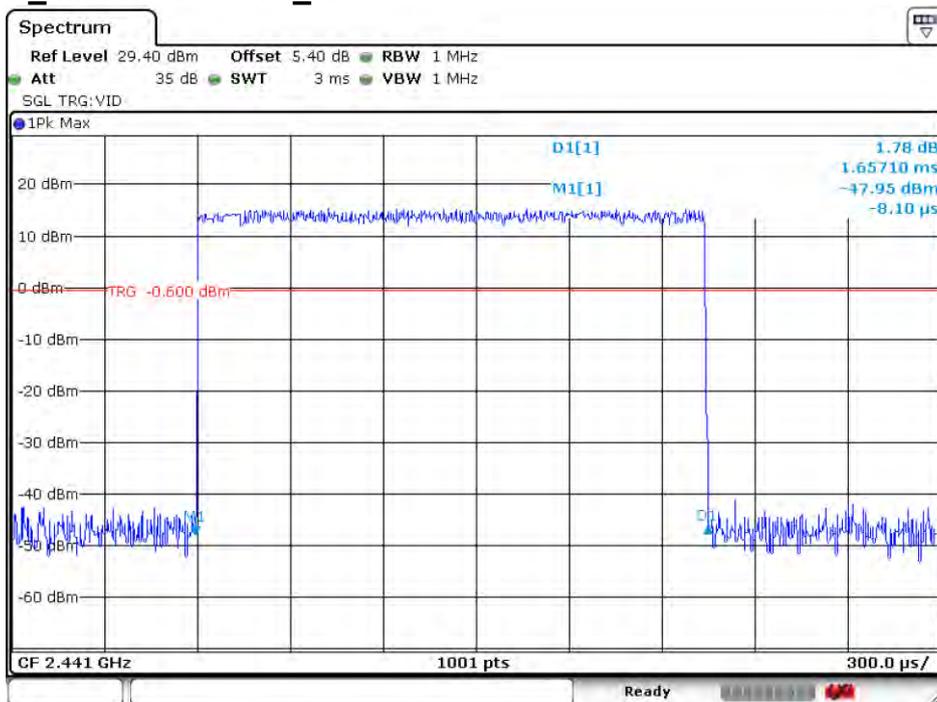


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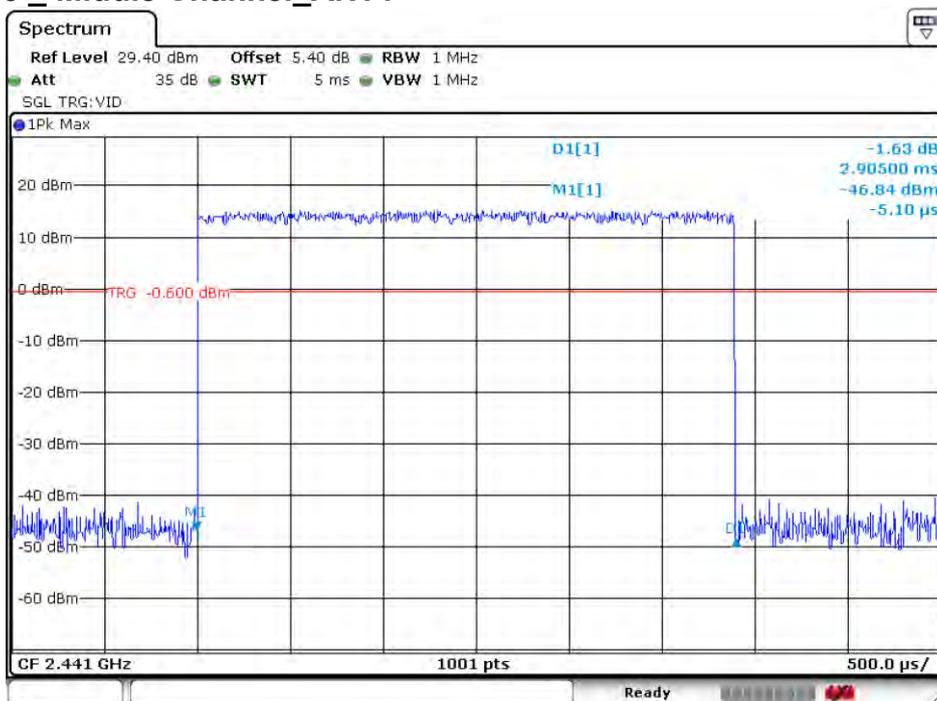
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4.8.2.5 2DH3 _ Middle Channel_ANT1



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4.8.2.6 2DH5 _ Middle Channel_ANT1

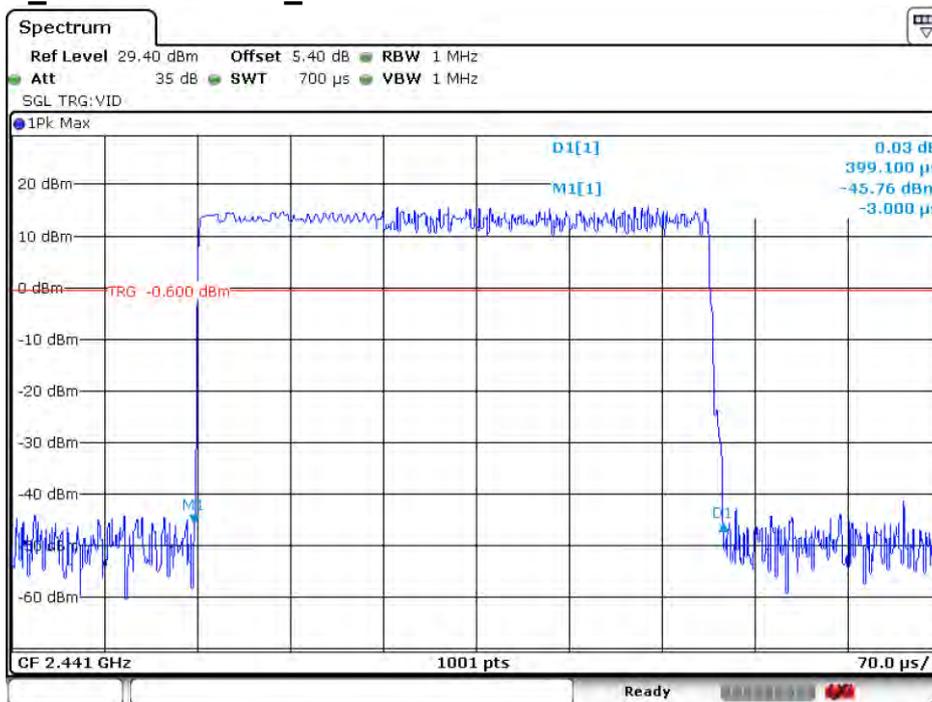


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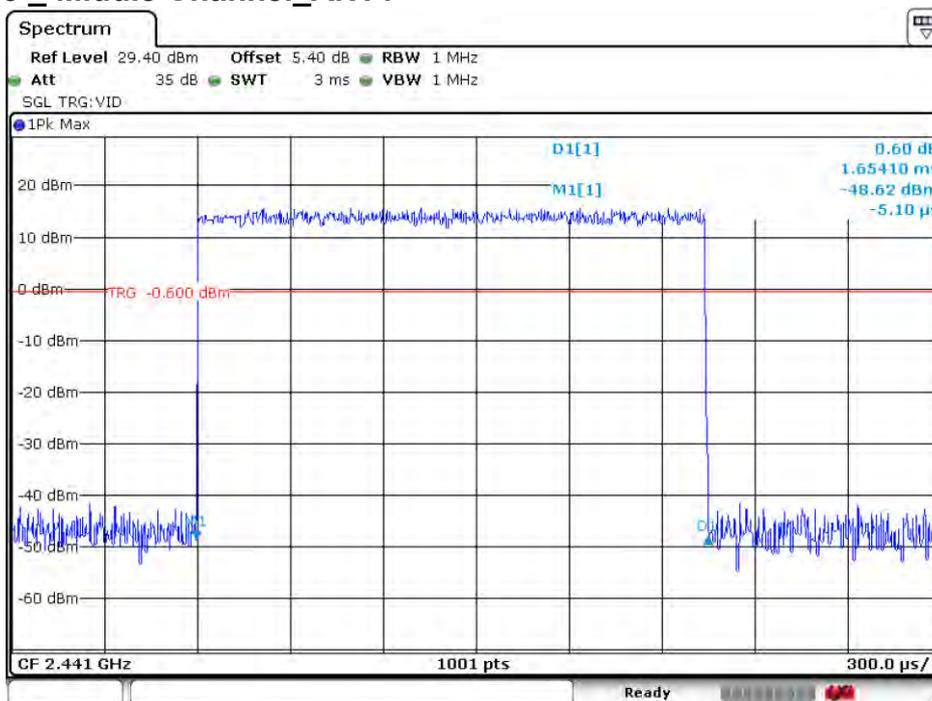
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4.8.2.7 3DH1_Middle Channel_ANT1



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4.8.2.8 3DH3_Middle Channel_ANT1

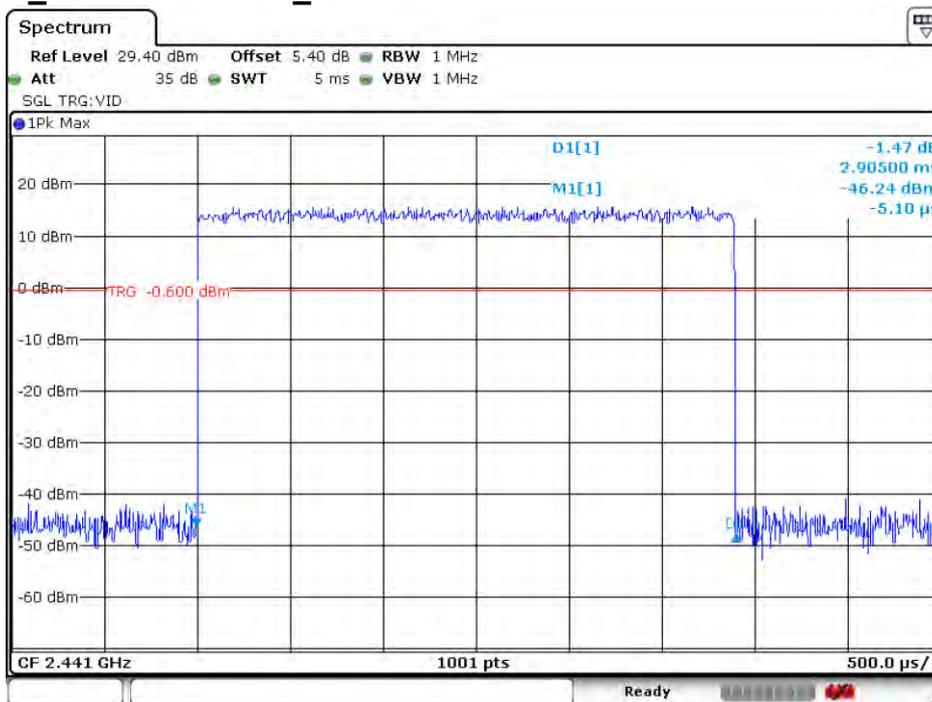


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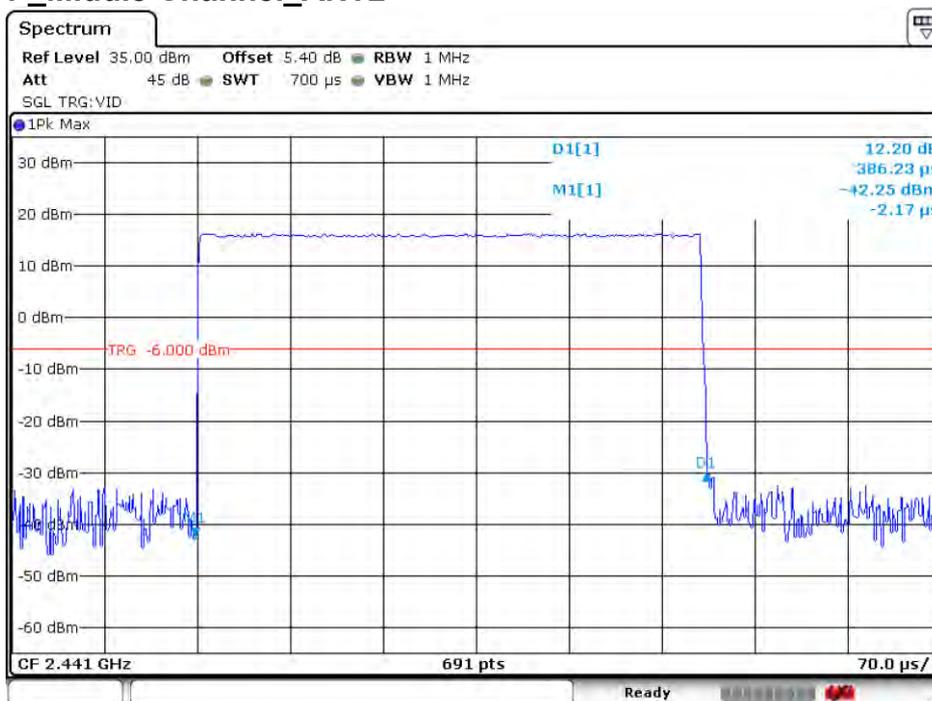
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4.8.2.9 3DH5 _ Middle Channel_ANT1



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4.8.2.10 DH1 _ Middle Channel_ANT2

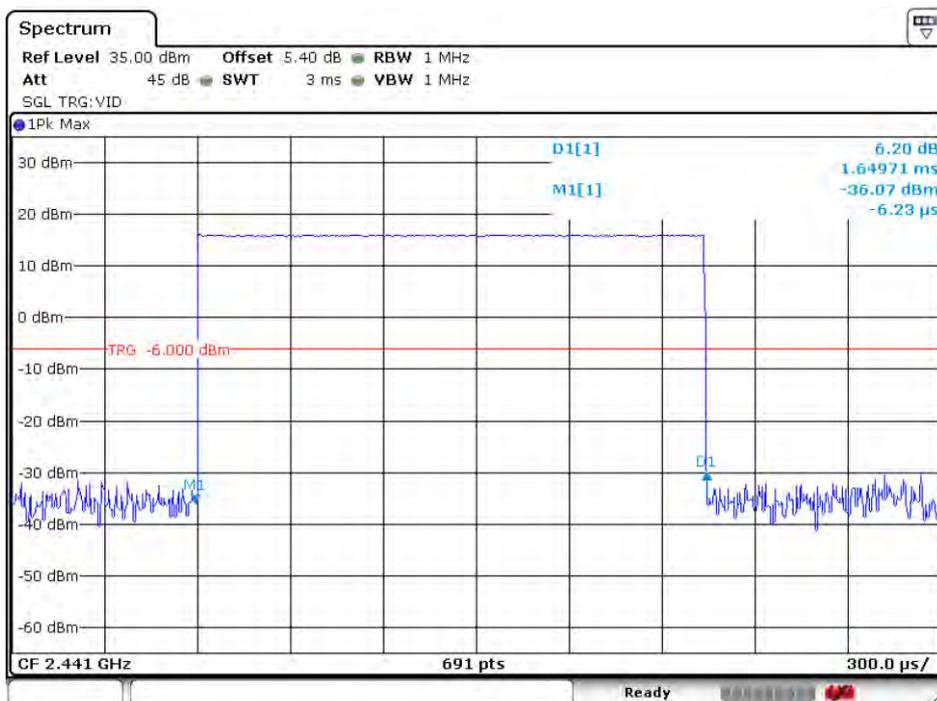


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4.8.2.11 DH3 _ Middle Channel_ANT2

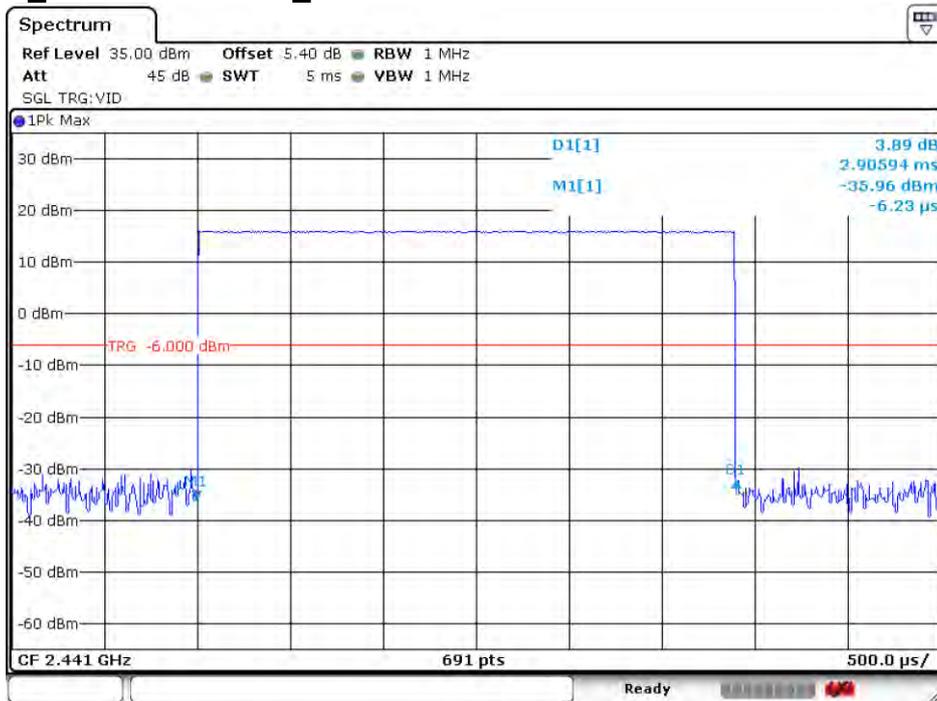


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4.8.2.12 DH5_Middle Channel_ANT2

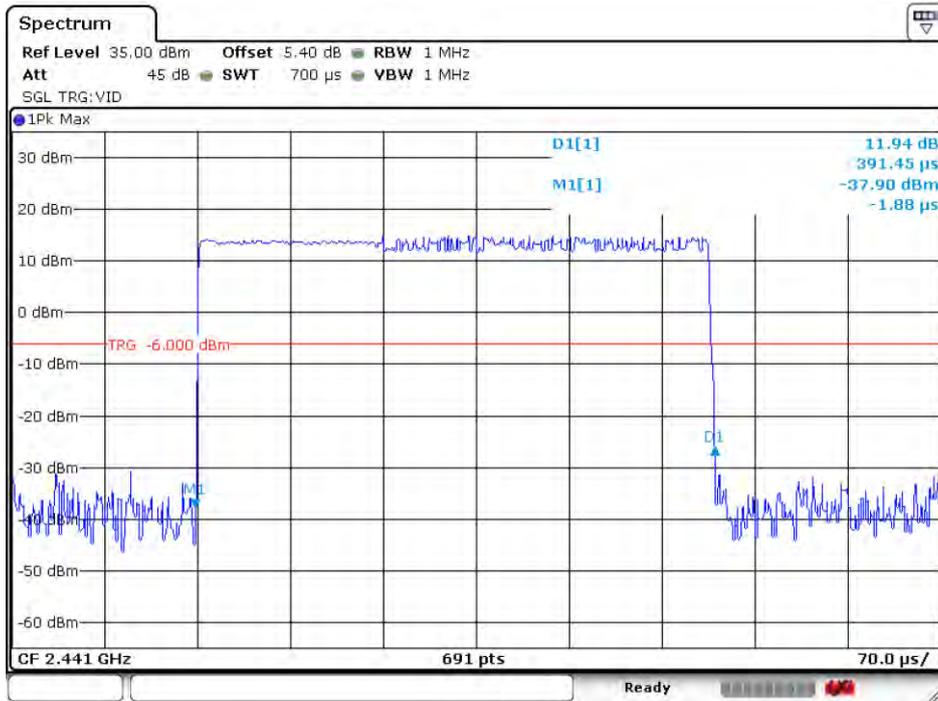


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4.8.2.13 2DH1_Middle Channel_ANT2



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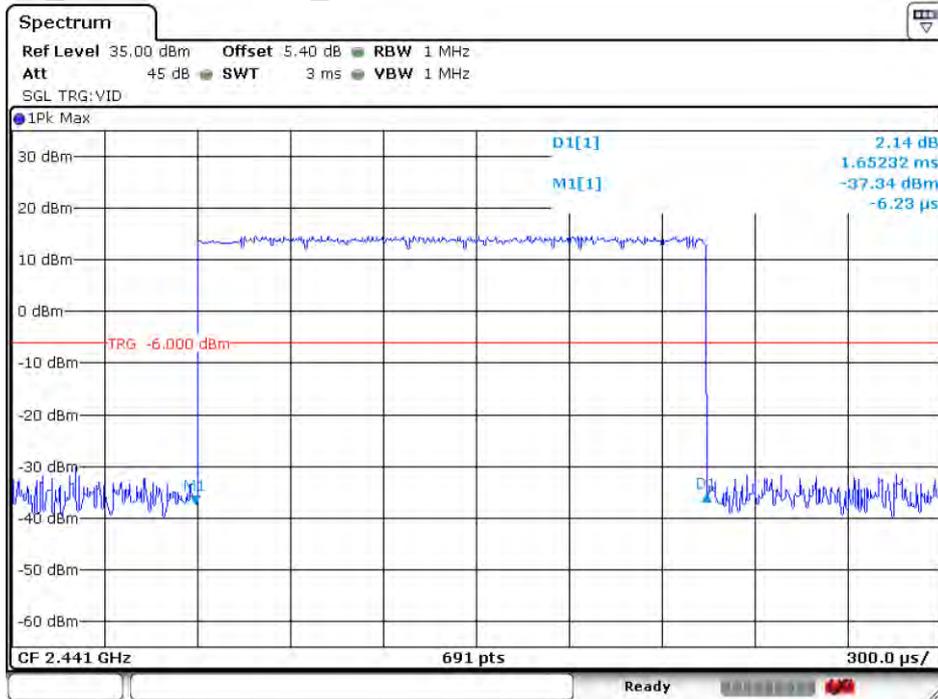


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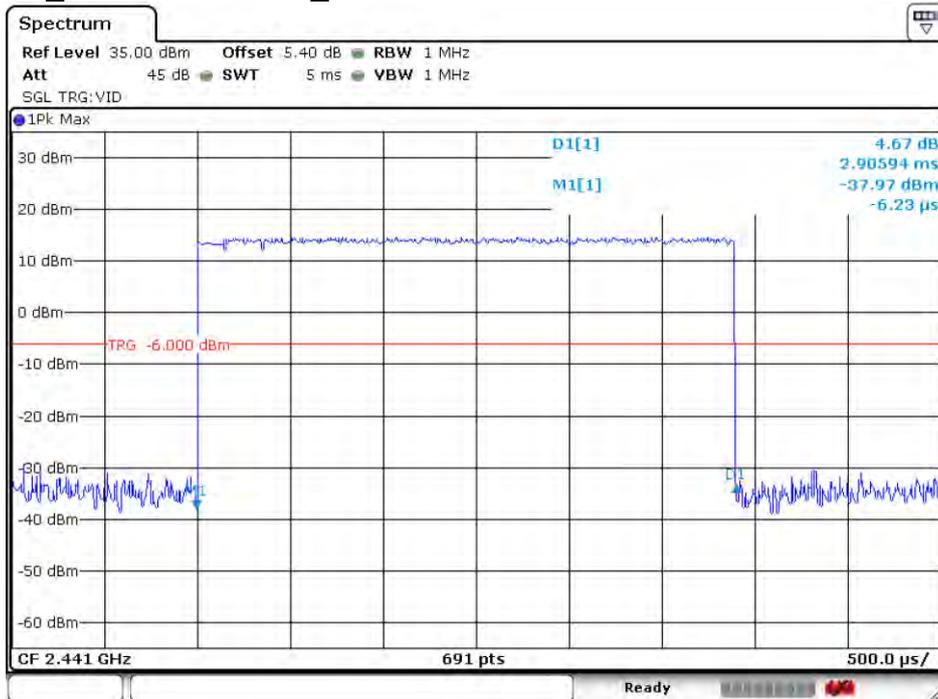
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4.8.2.14 2DH3 _ Middle Channel_ANT2



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4.8.2.15 2DH5 _ Middle Channel_ANT2

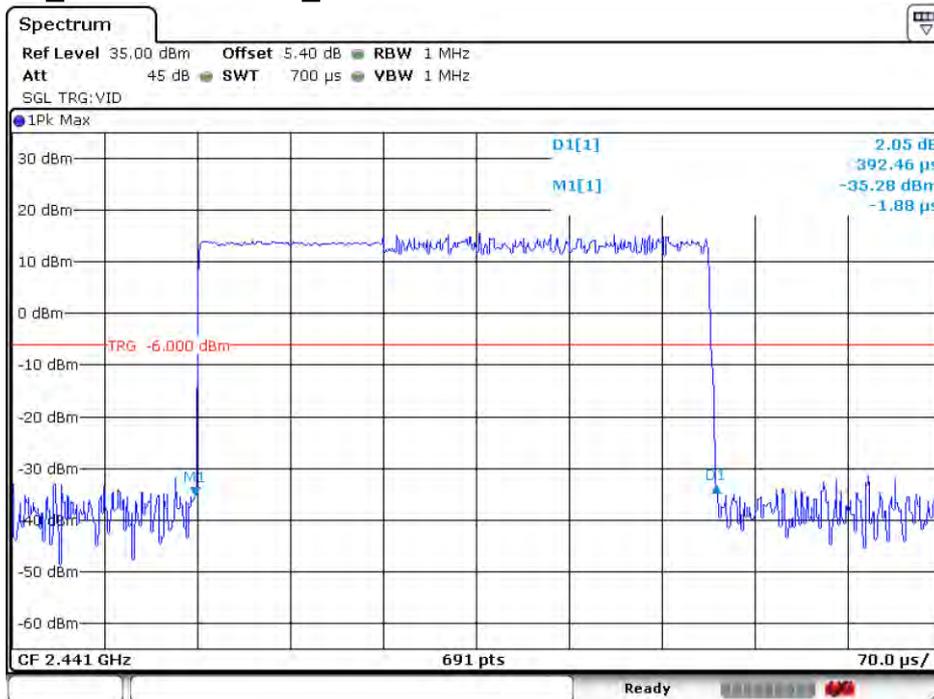


Date: 17.APR.2020 10:32:16



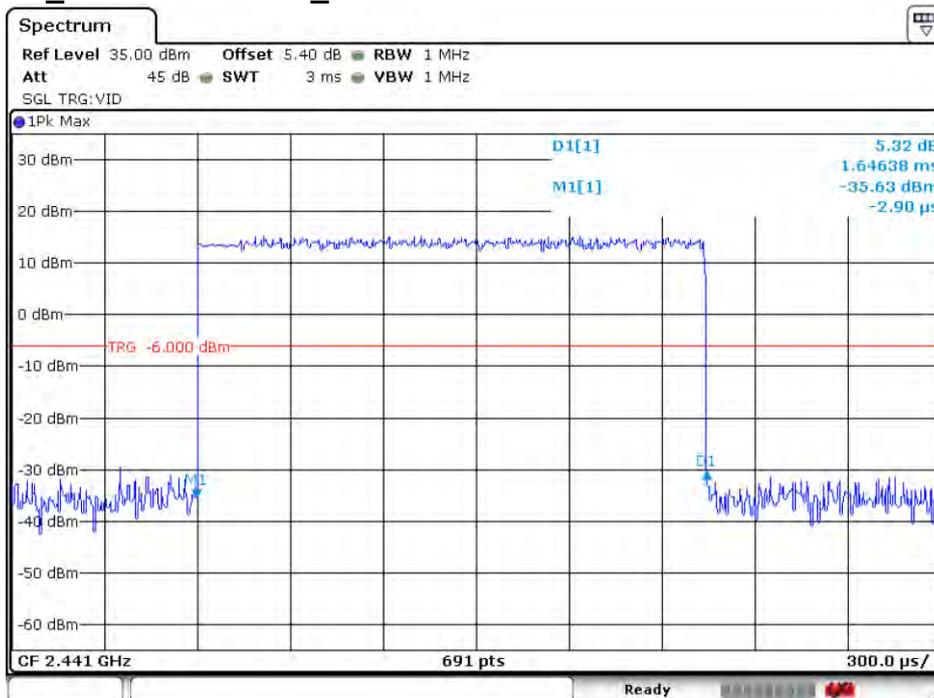
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4.8.2.16 3DH1_Middle Channel_ANT2



Date: 17.APR.2020 10:29:43

4.8.2.17 3DH3_Middle Channel_ANT2

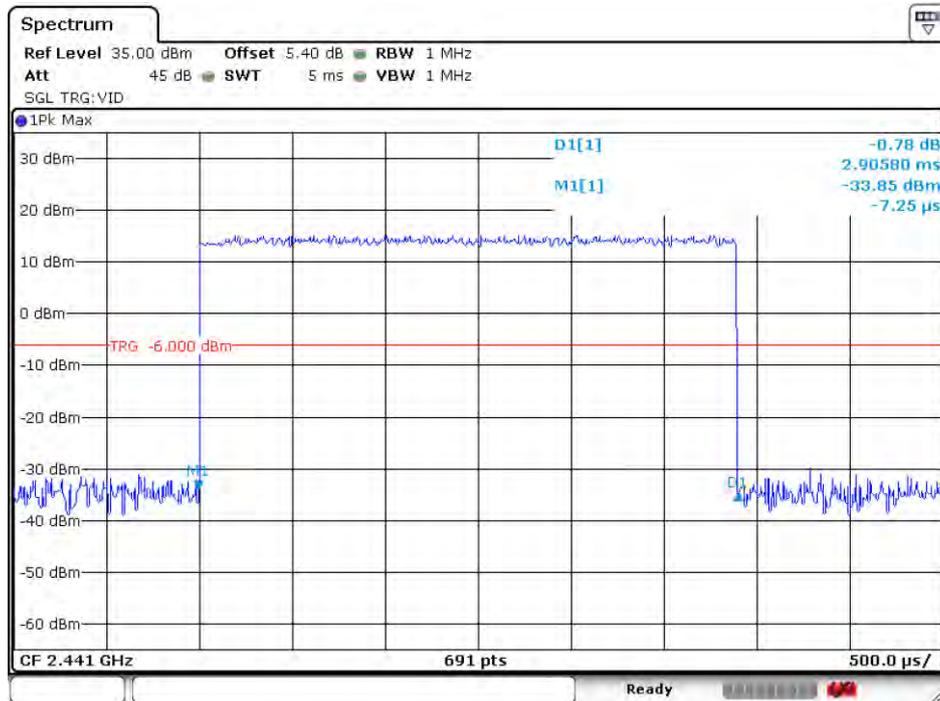


Date: 17.APR.2020 10:28:56



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4.8.2.18 3DH5 _ Middle Channel_ANT2



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4.9 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 Section 7.8.6
Test Setup:	
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Exploratory Test Mode:	Hopping and Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass

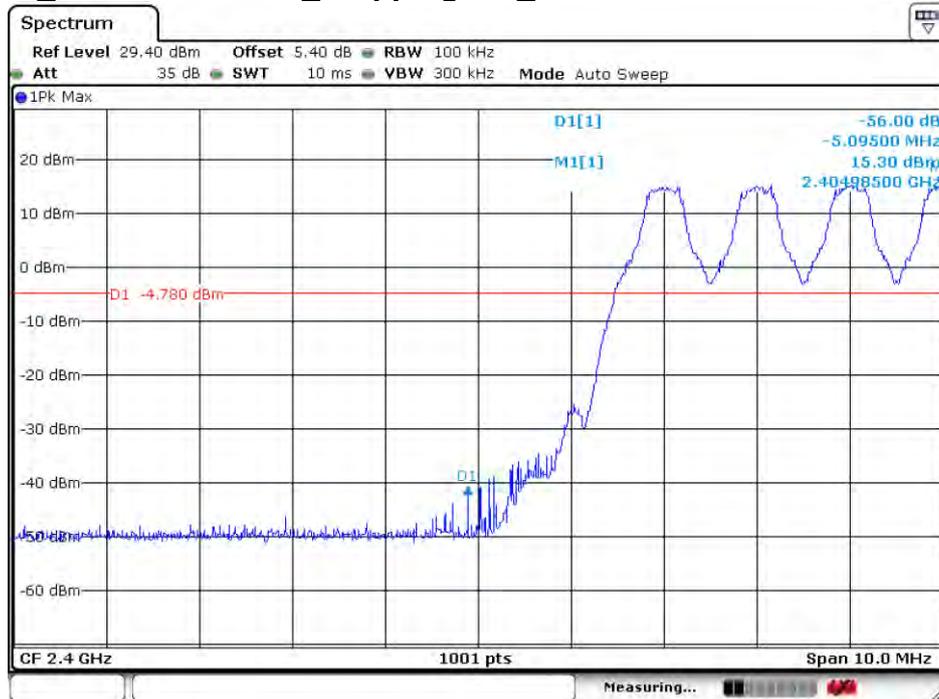


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4.9.1 Test plots

4.9.1.1 GFSK_Lowest Channel_Hopping ON_ANT1



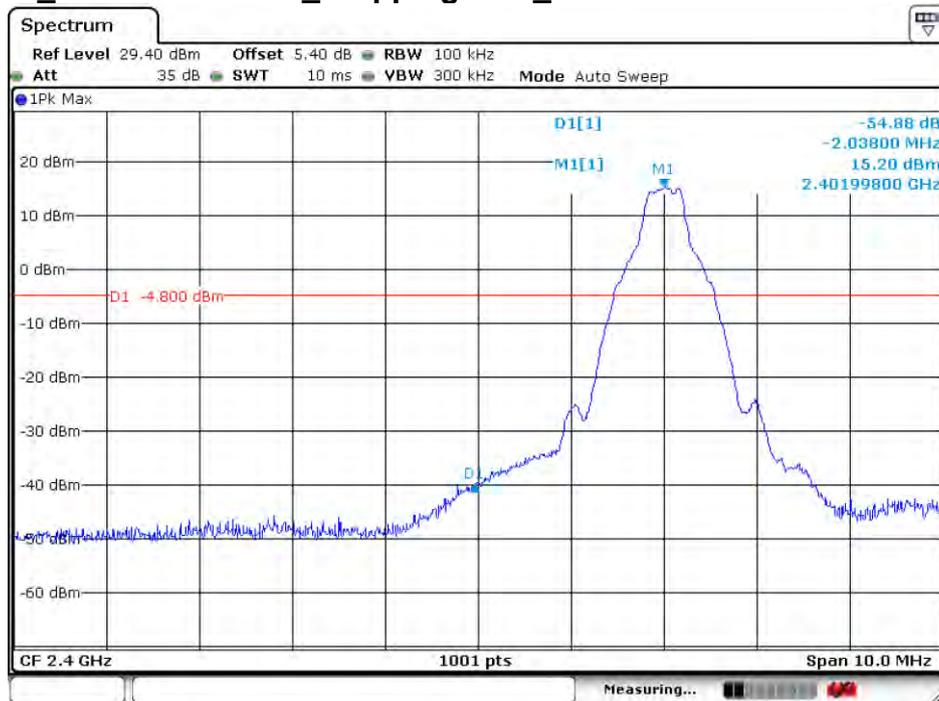
Date: 30.MAR.2020 09:56:20



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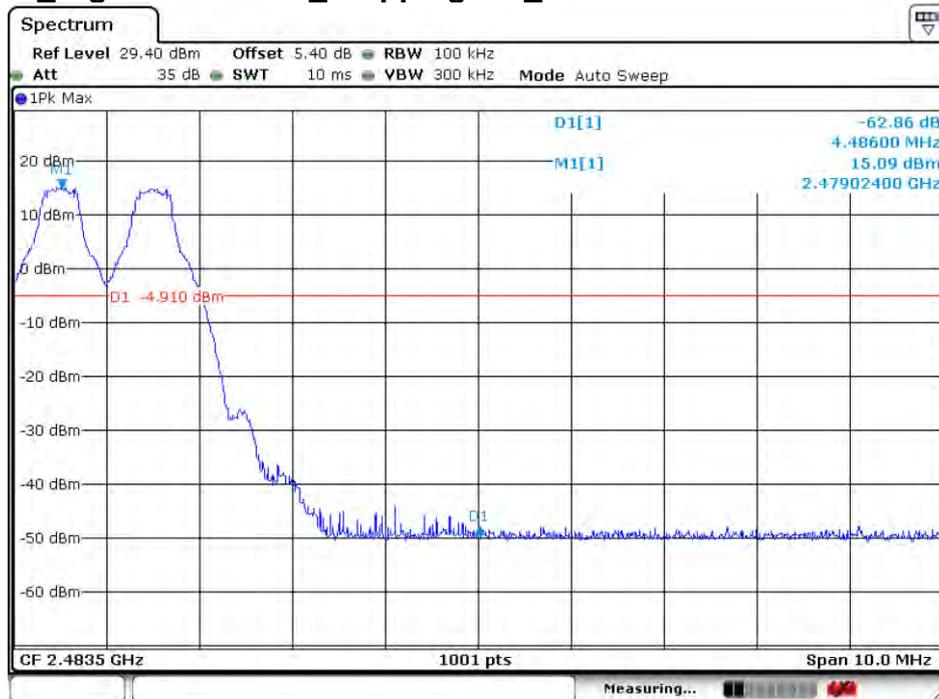
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4.9.1.2 GFSK_Lowest Channel_Hopping OFF_ANT1



Date: 30.MAR.2020 09:59:39

4.9.1.3 GFSK_Highest Channel_Hopping ON_ANT1



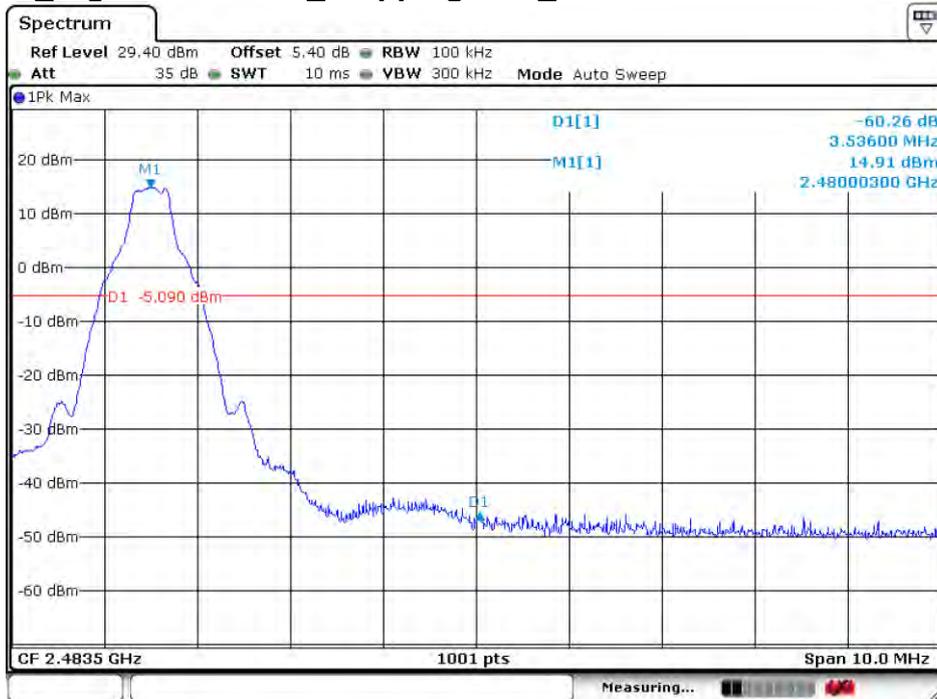
Date: 30.MAR.2020 09:57:50



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4.9.1.4 GFSK_Highest Channel_Hopping OFF_ANT1



Date: 30.MAR.2020 09:58:57

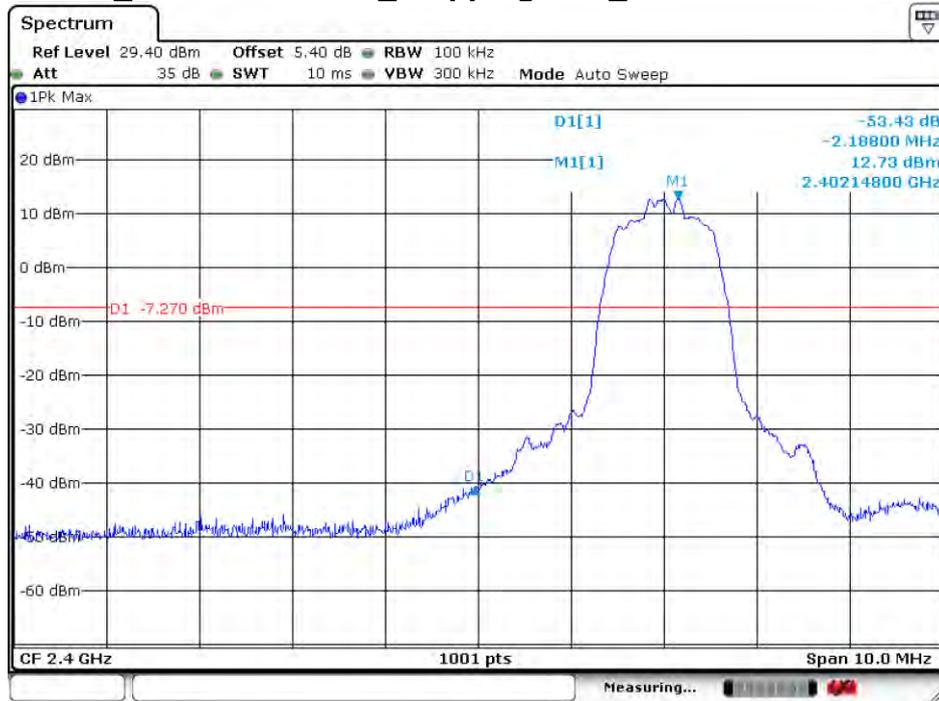
4.9.1.5 $\pi/4$ DQPSK_Lowest Channel_Hopping ON_ANT1



Date: 28.APR.2020 13:01:30

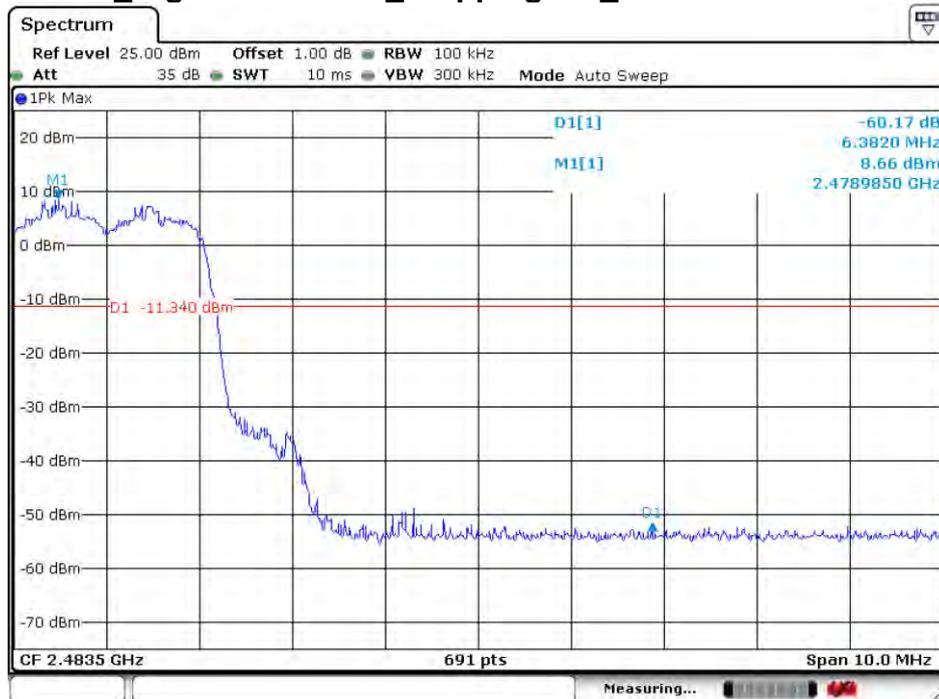


4.9.1.6 $\pi/4$ DQPSK _Lowest Channel_ Hopping OFF_ANT1



Date: 30.MAR.2020 09:50:20

4.9.1.7 $\pi/4$ DQPSK _Highest Channel_ Hopping ON_ANT1



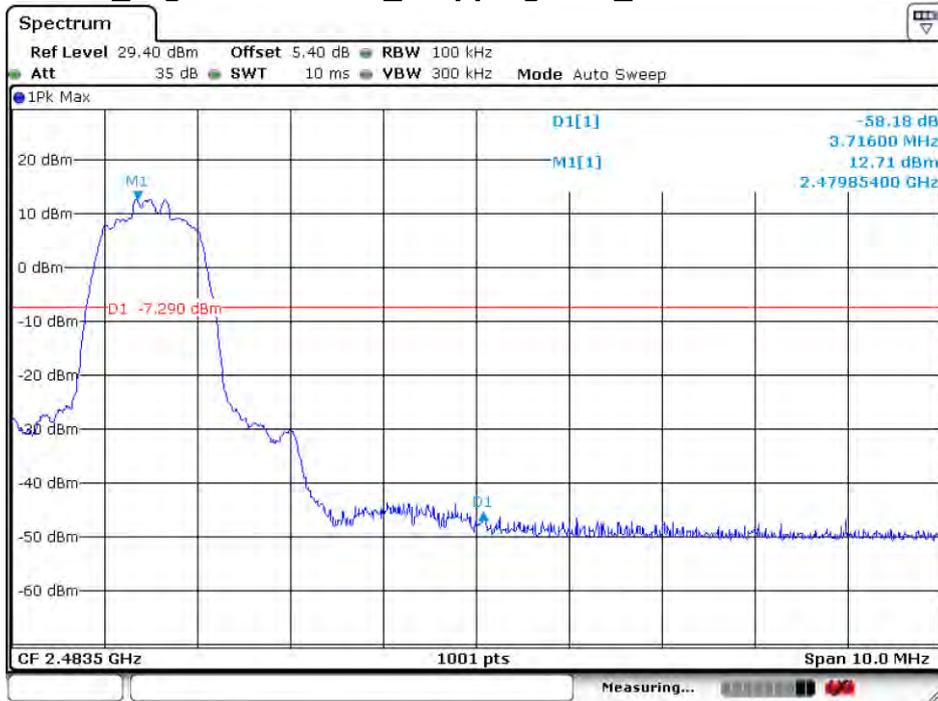
Date: 30.MAR.2020 08:36:41



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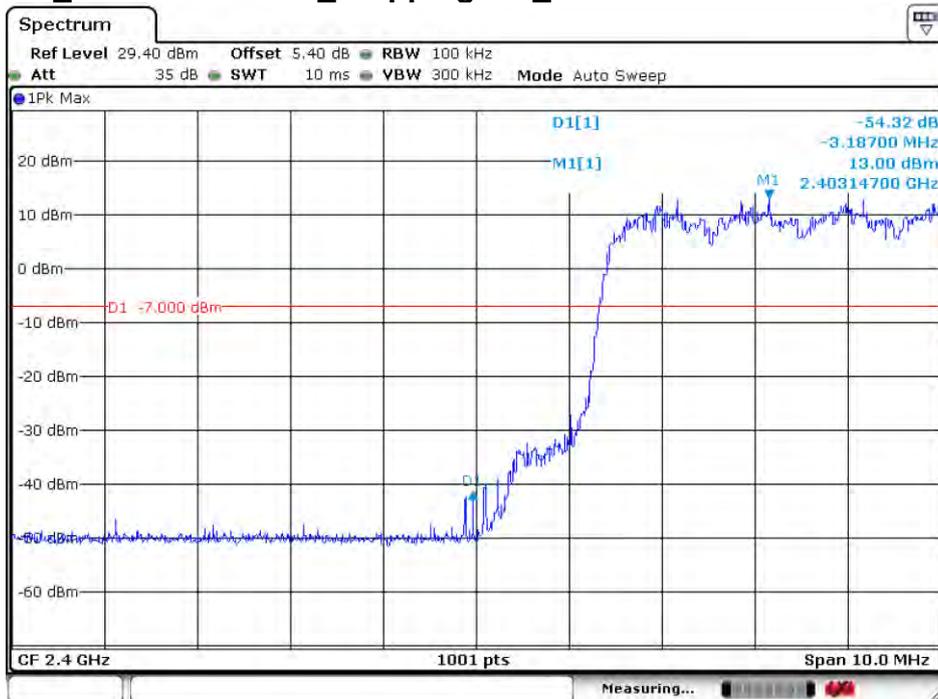
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4.9.1.8 $\pi/4$ DQPSK_Highest Channel_Hopping OFF_ANT1



Date: 30.MAR.2020 09:49:22

4.9.1.9 8DPSK_Lowest Channel_Hopping ON_ANT1

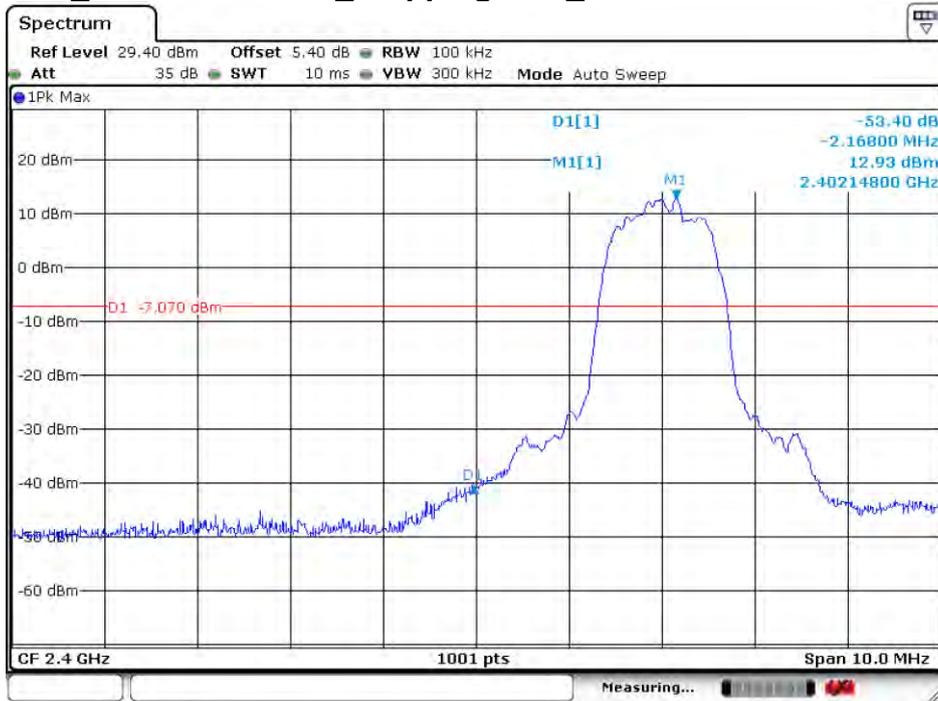


Date: 30.MAR.2020 09:54:11



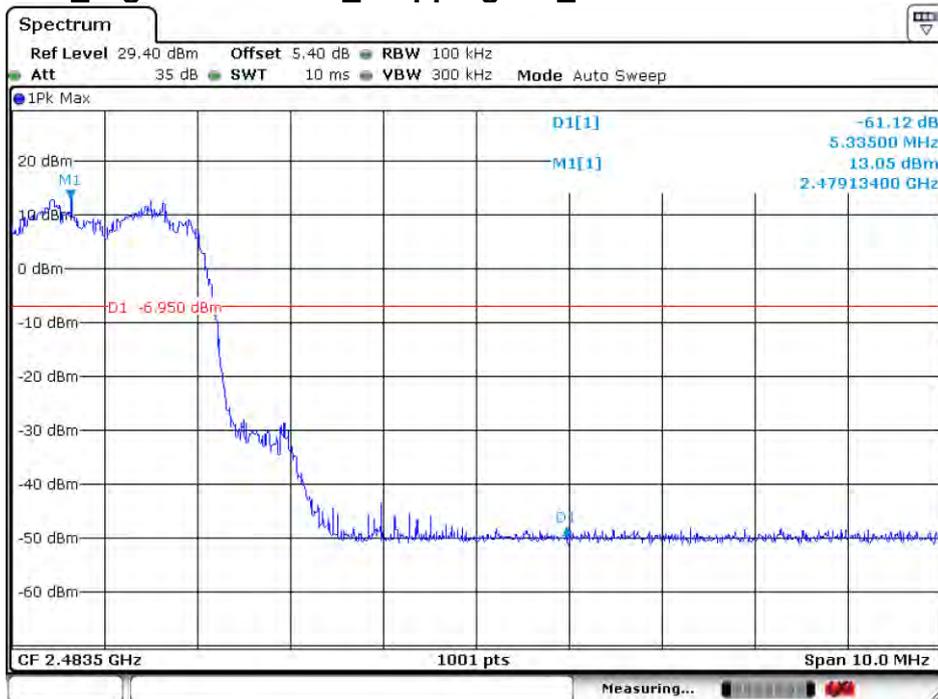
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4.9.1.10 8DPSK_Lowest Channel_Hopping OFF_ANT1



Date: 30.MAR.2020 09:51:32

4.9.1.11 8DPSK_Highest Channel_Hopping ON_ANT1

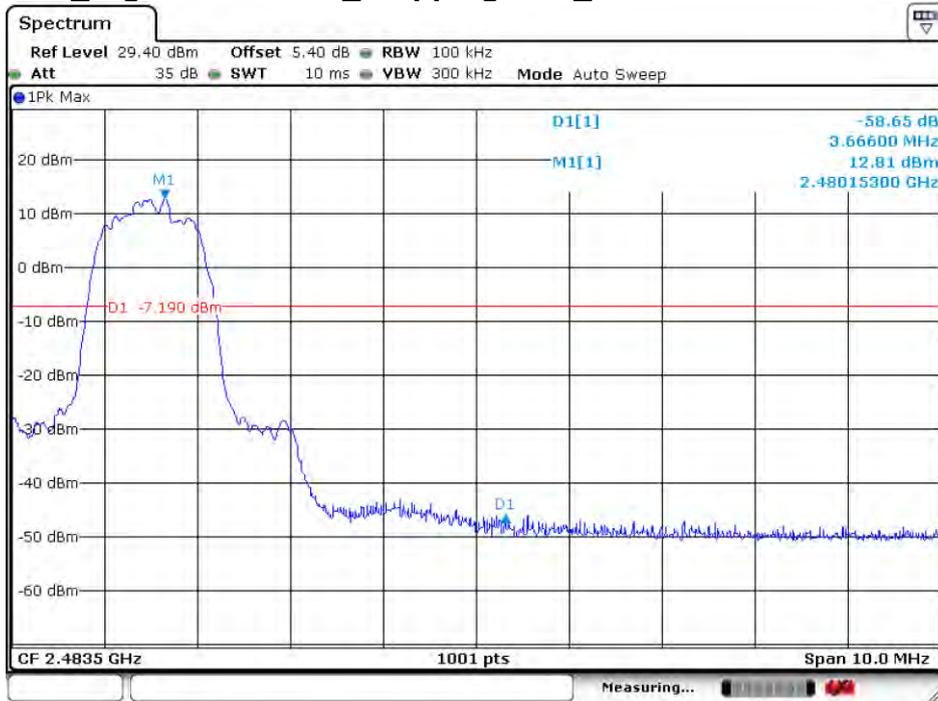


Date: 30.MAR.2020 09:53:07



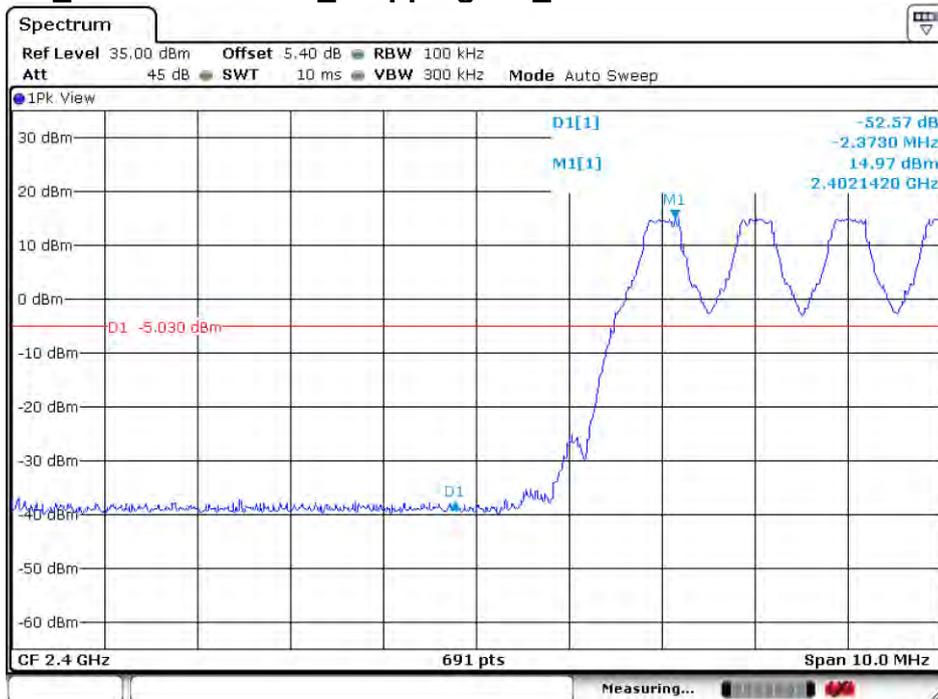
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4.9.1.12 8DPSK_Highest Channel_Hopping OFF_ANT1



Date: 30.MAR.2020 09:52:19

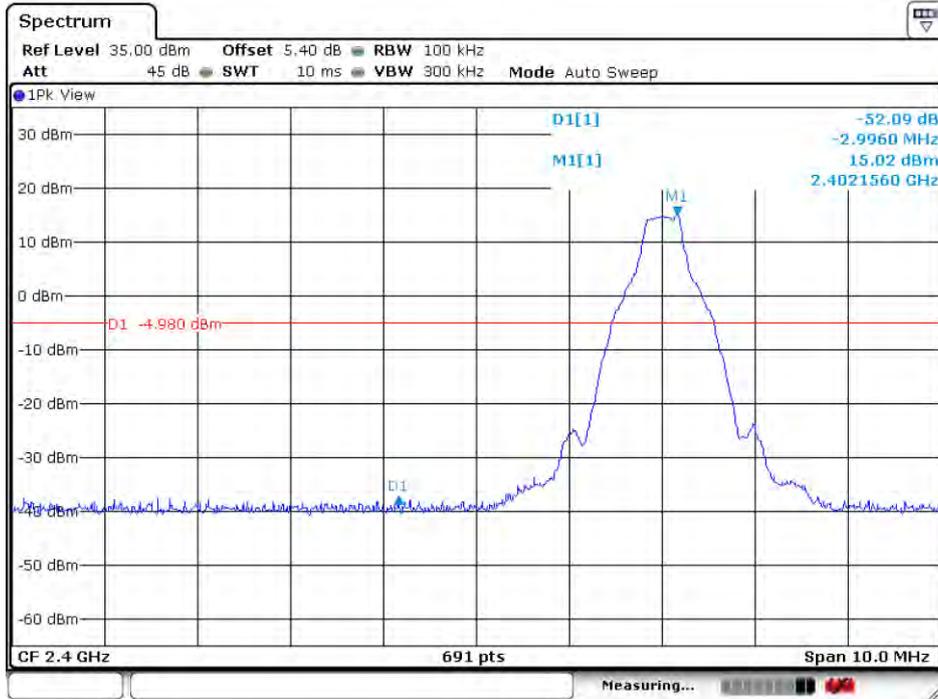
4.9.1.13 GFSK_Lowest Channel_Hopping ON_ANT2



Date: 17.APR.2020 10:06:43

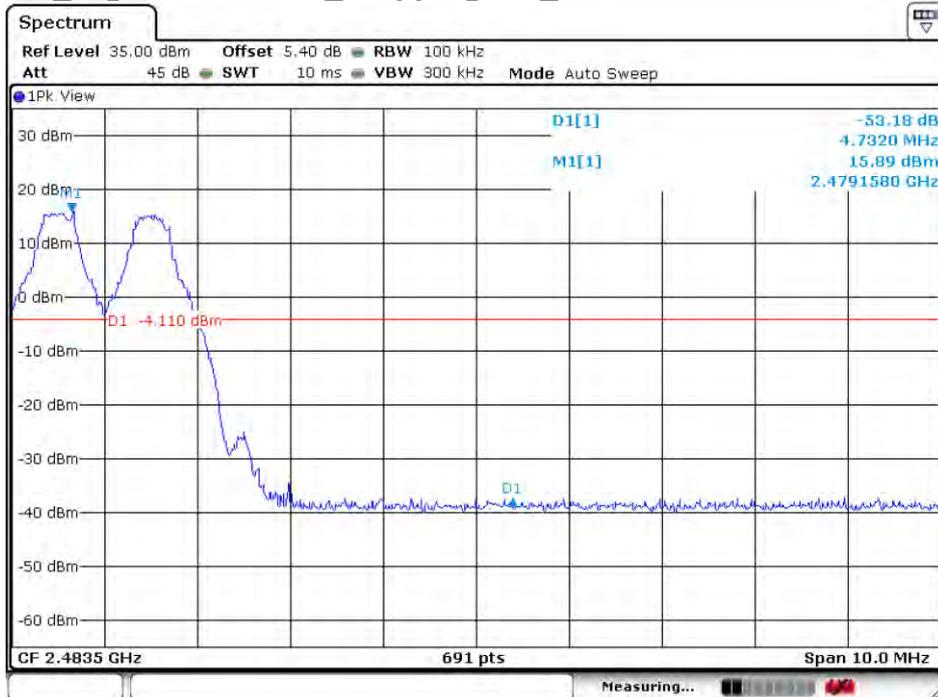


4.9.1.14 GFSK_Lowest Channel_Hopping OFF_ANT2



Date: 17.APR.2020 10:05:14

4.9.1.15 GFSK_Highest Channel_Hopping ON_ANT2

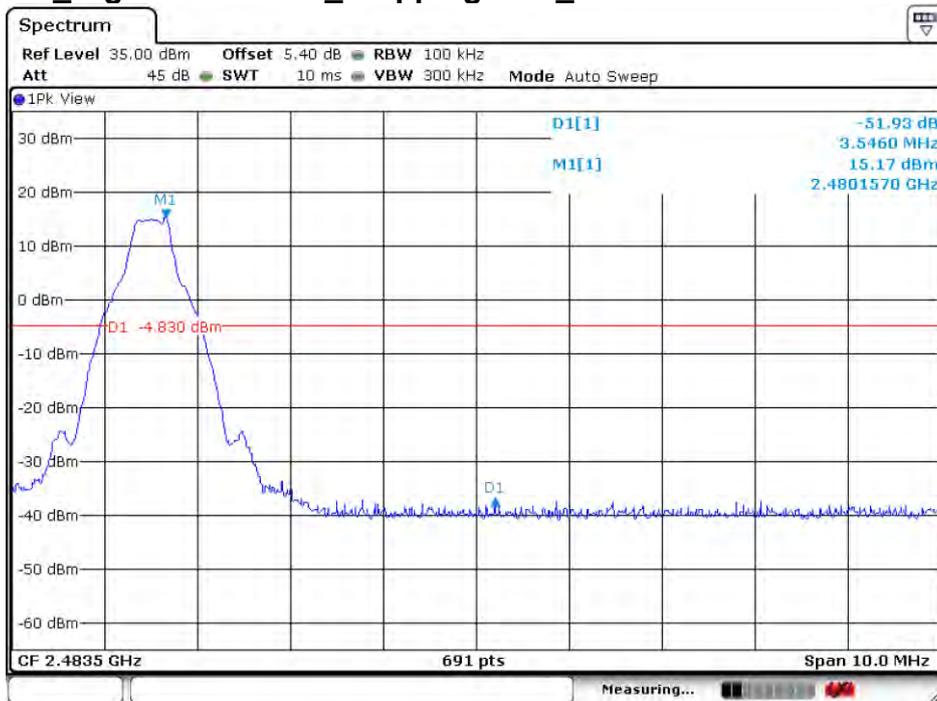


Date: 17.APR.2020 10:08:16



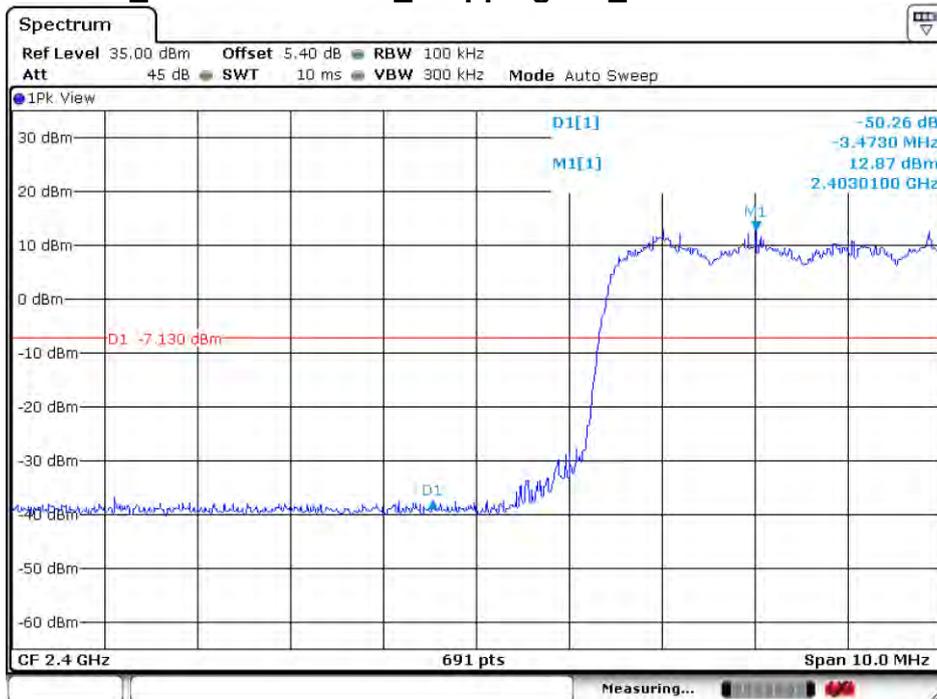
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4.9.1.16 GFSK_Highest Channel_Hopping OFF_ANT2



Date: 17.APR.2020 10:04:19

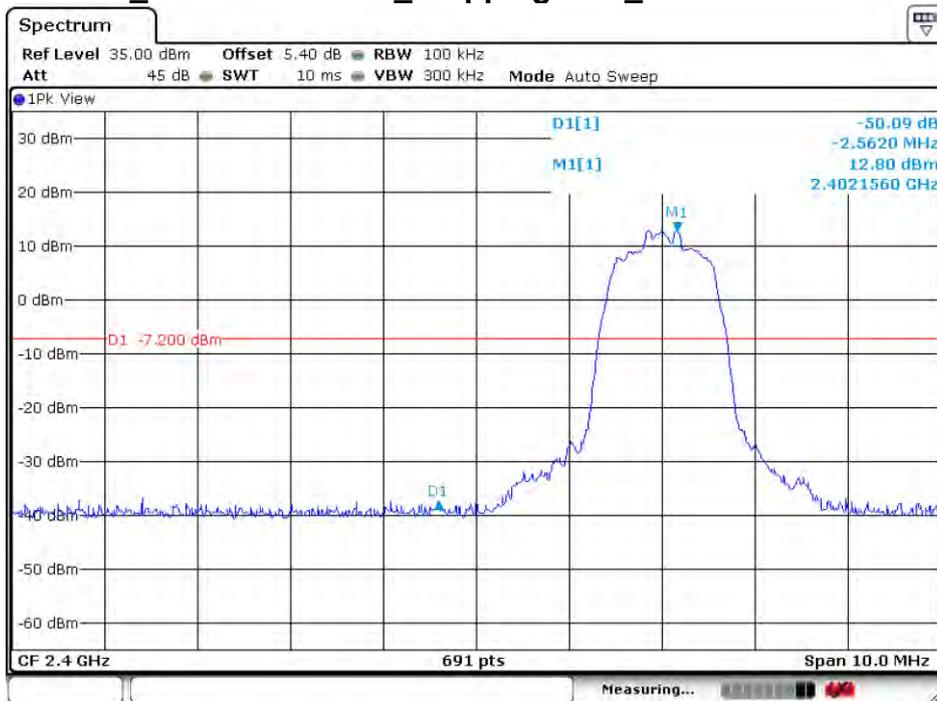
4.9.1.17 $\pi/4$ DQPSK_Lowest Channel_Hopping ON_ANT2



Date: 17.APR.2020 10:10:23

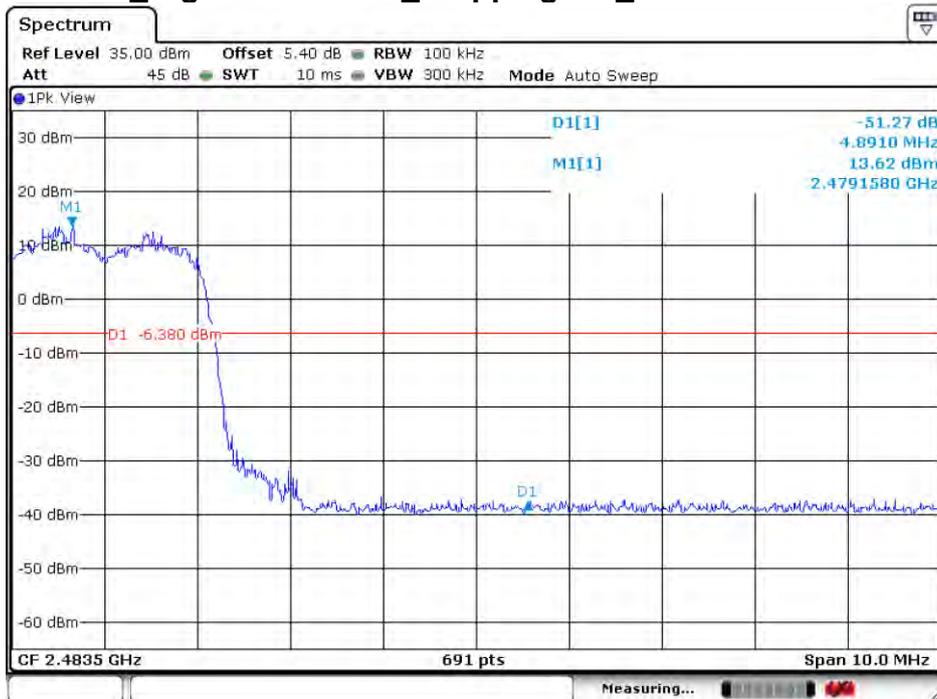


4.9.1.18 $\pi/4$ DQPSK _Lowest Channel_ Hopping OFF_ANT2



Date: 17.APR.2020 10:10:51

4.9.1.19 $\pi/4$ DQPSK _Highest Channel_ Hopping ON_ANT2

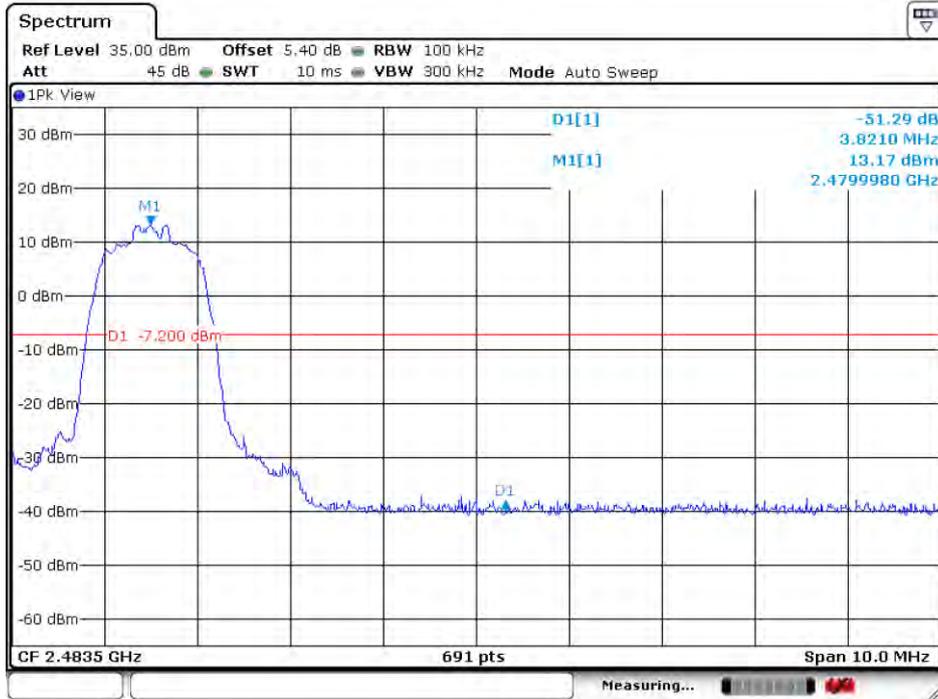


Date: 17.APR.2020 10:09:20



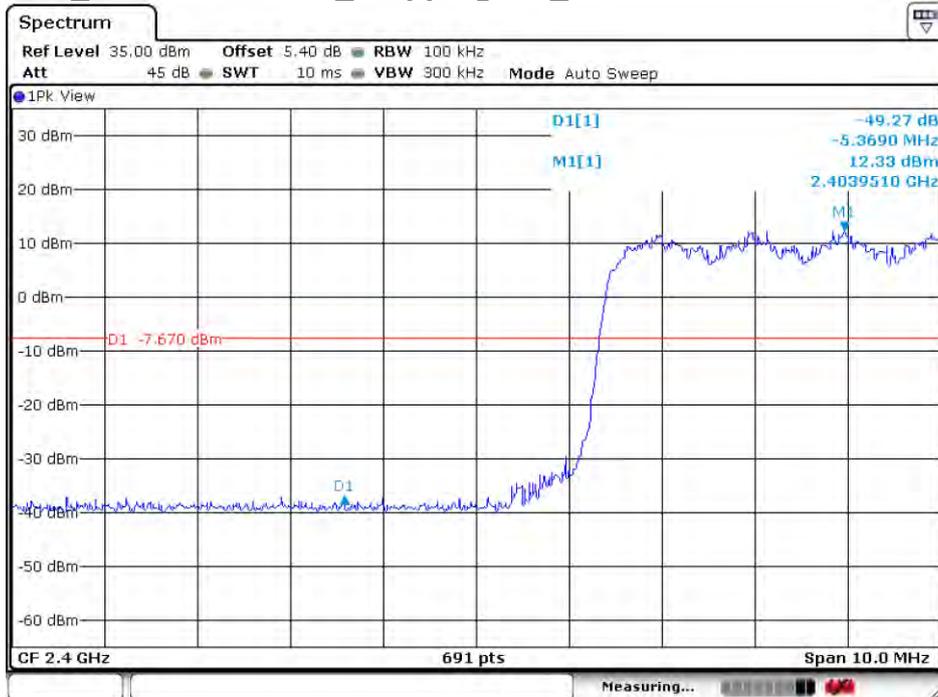
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4.9.1.20 $\pi/4$ DQPSK_Highest Channel_Hopping OFF_ANT2



Date: 17.APR.2020 10:11:43

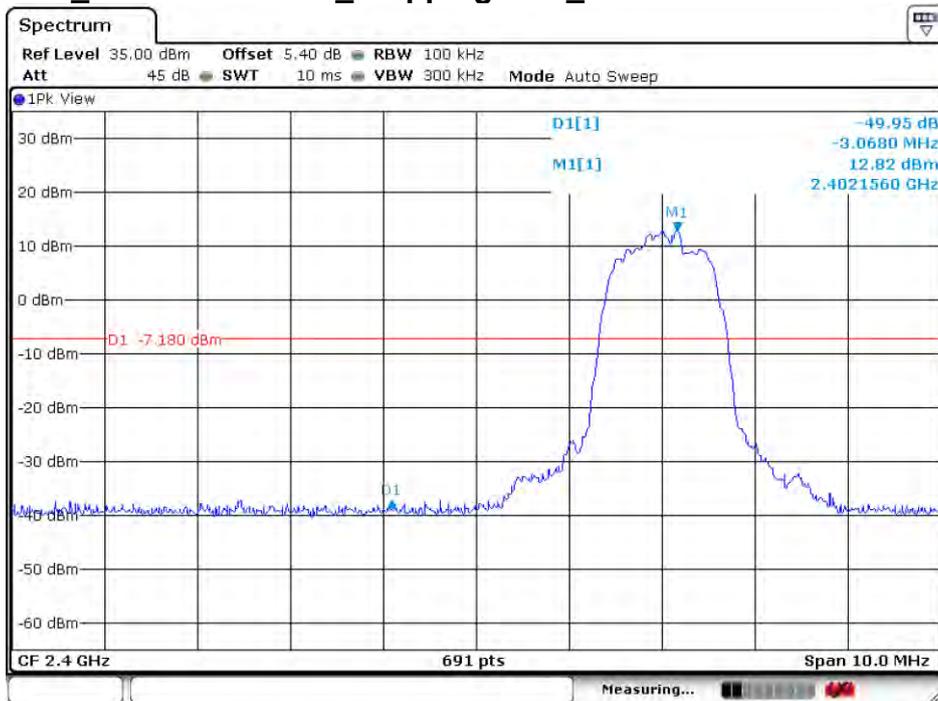
4.9.1.21 8DPSK_Lowest Channel_Hopping ON_ANT2



Date: 17.APR.2020 10:15:46

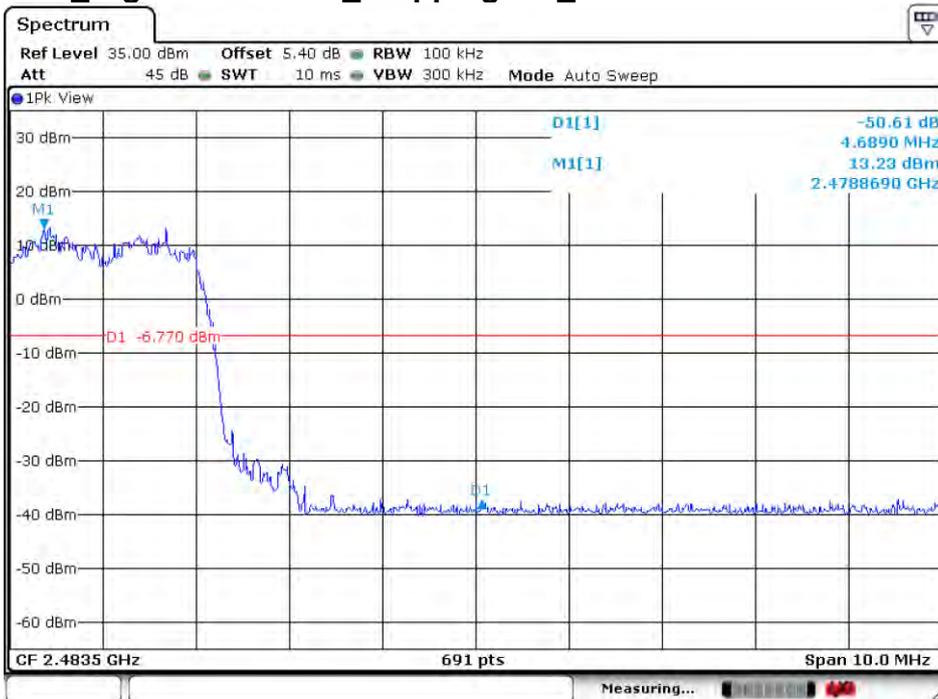


4.9.1.22 8DPSK_Lowest Channel_Hopping OFF_ANT2



Date: 17.APR.2020 10:13:47

4.9.1.23 8DPSK_Highest Channel_Hopping ON_ANT2



Date: 17.APR.2020 10:17:32



4.9.1.24 8DPSK _Highest Channel_ Hopping OFF_ANT2



Date: 17.APR.2020 10:12:45



4.10 Spurious RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 Section 7.8.8
Test Setup:	
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Instruments Used:	Refer to section 5.10 for details
Test Results:	Pass



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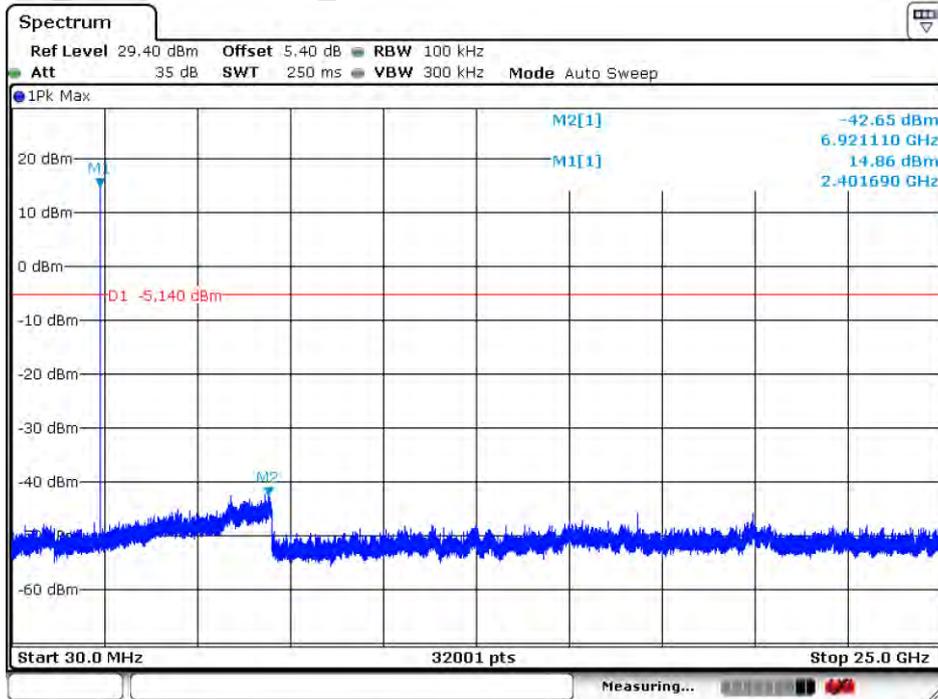
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4.10.1 Test plots

4.10.1.1 GFSK_Lowest Channel_ANT1



Date: 30.MAR.2020 10:00:35

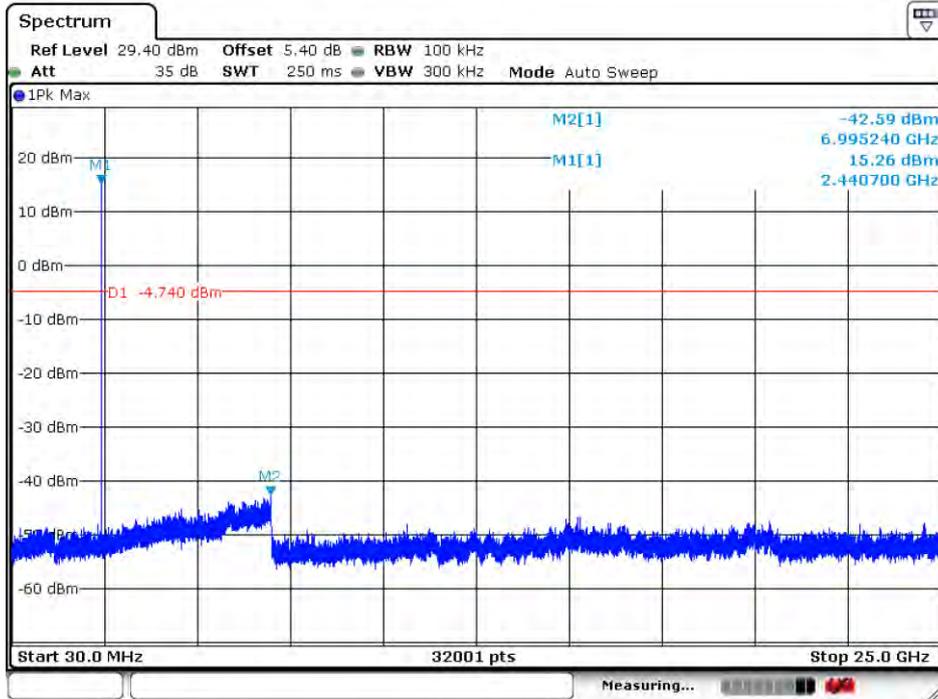


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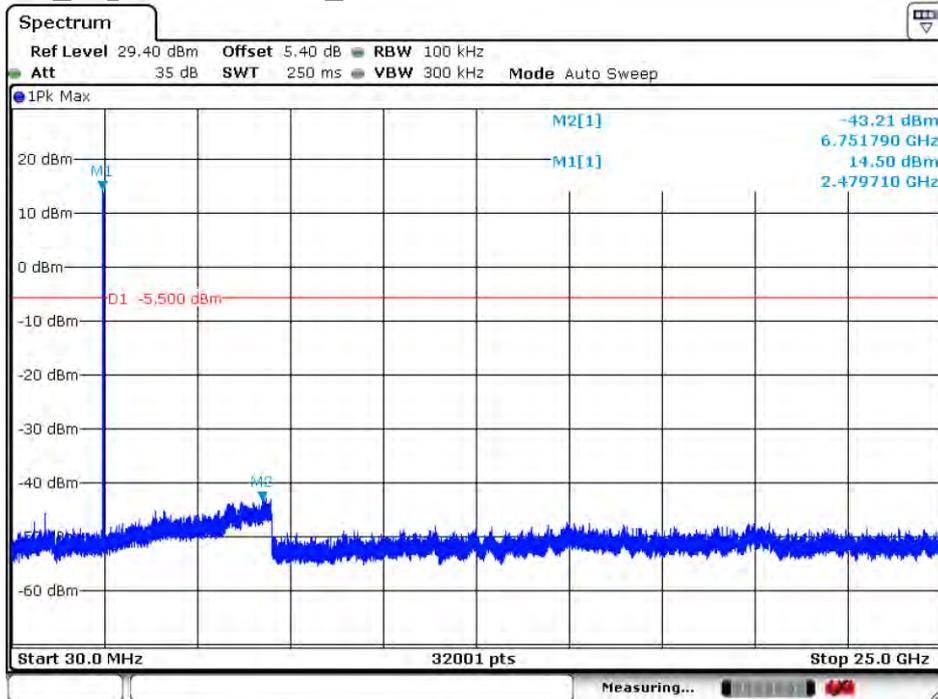
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4.10.1.2 GFSK_Middle Channel_ANT1



Date: 30.MAR.2020 10:01:05

4.10.1.3 GFSK_Highest Channel_ANT1



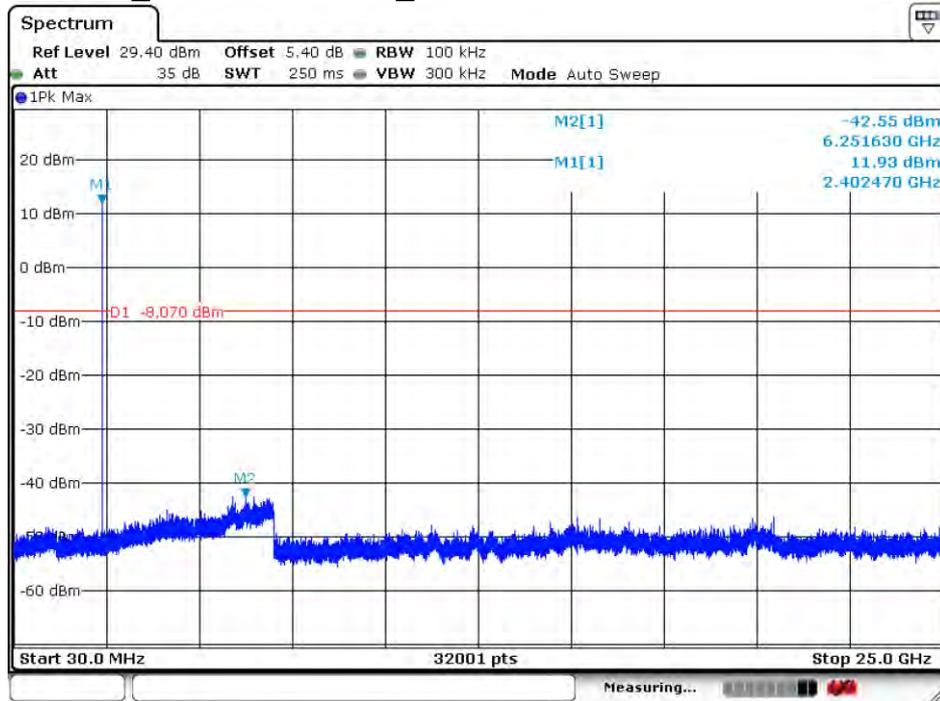
Date: 30.MAR.2020 10:01:45



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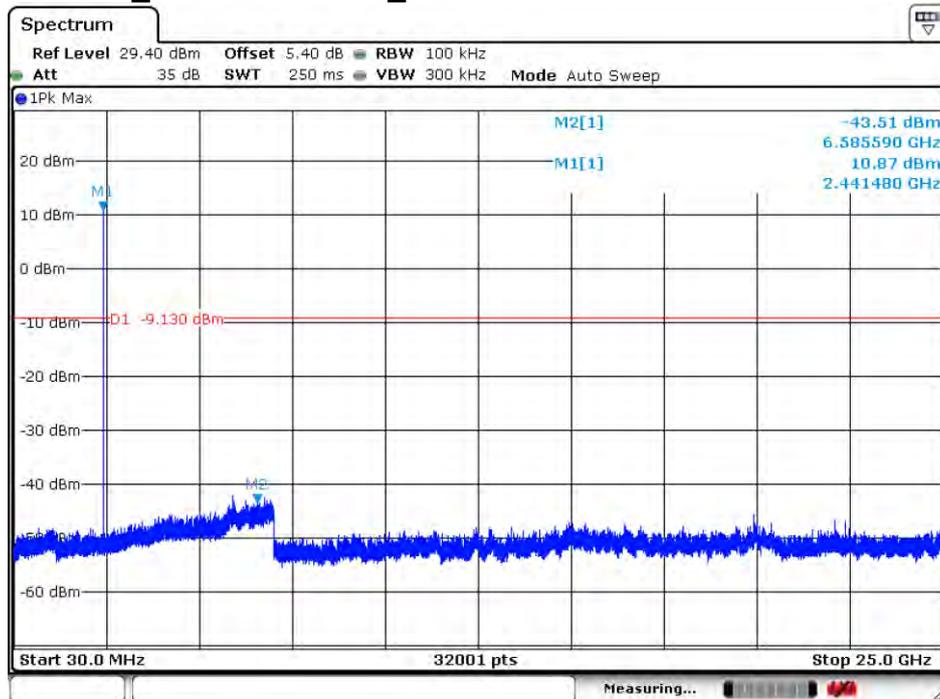
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4.10.1.4 $\pi/4$ DQPSK_Lowest Channel_ANT1



Date: 30.MAR.2020 10:06:30

4.10.1.5 $\pi/4$ DQPSK_Middle Channel_ANT1



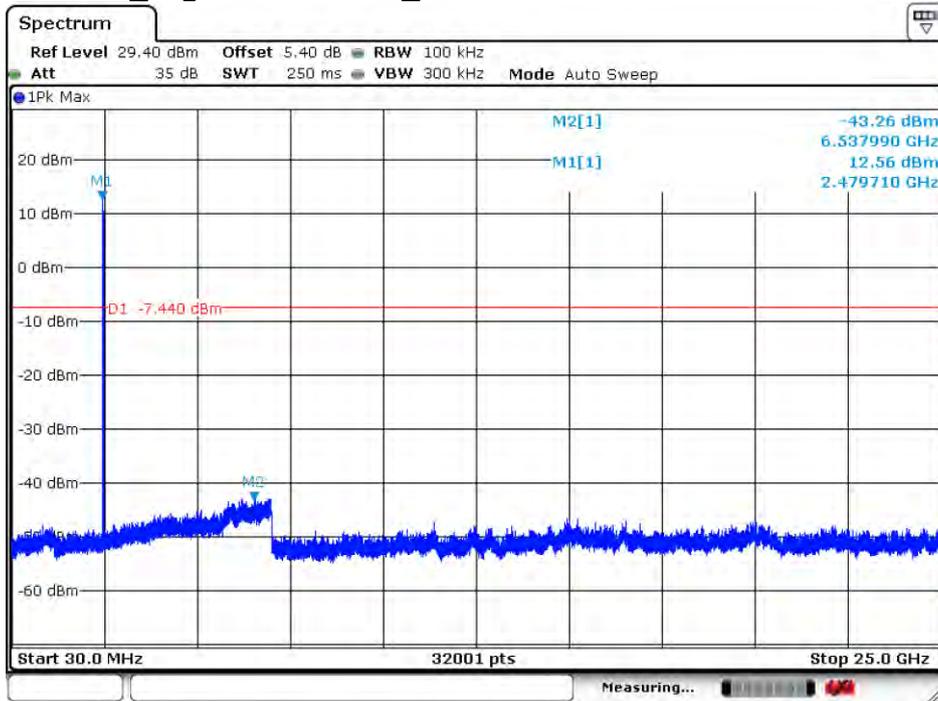
Date: 30.MAR.2020 10:07:18



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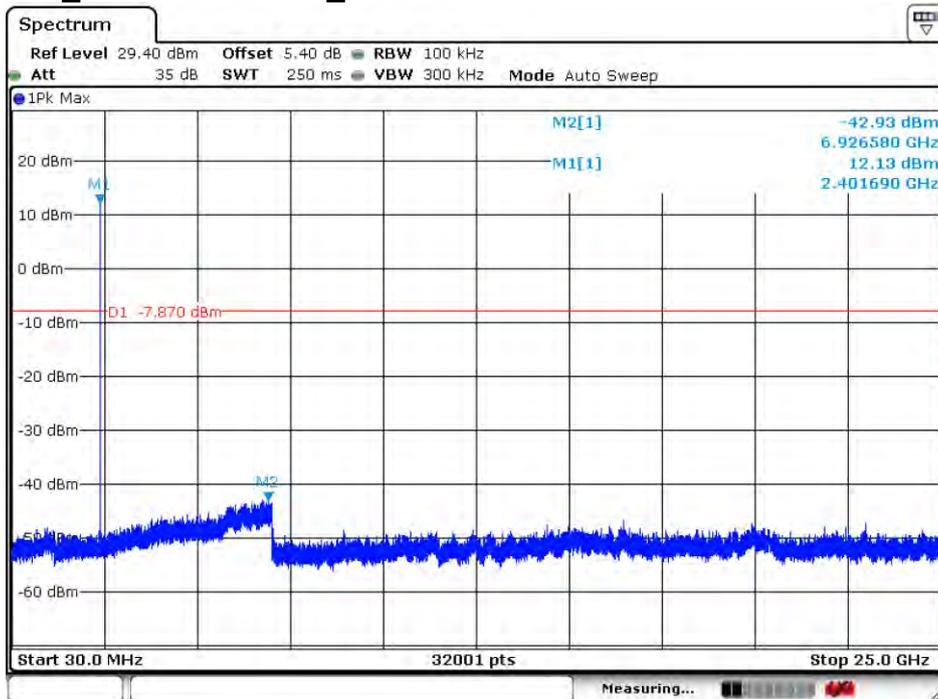
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4.10.1.6 $\pi/4$ DQPSK_Highest Channel_ANT1



Date: 30.MAR.2020 10:05:48

4.10.1.7 8DPSK_Lowest Channel_ANT1



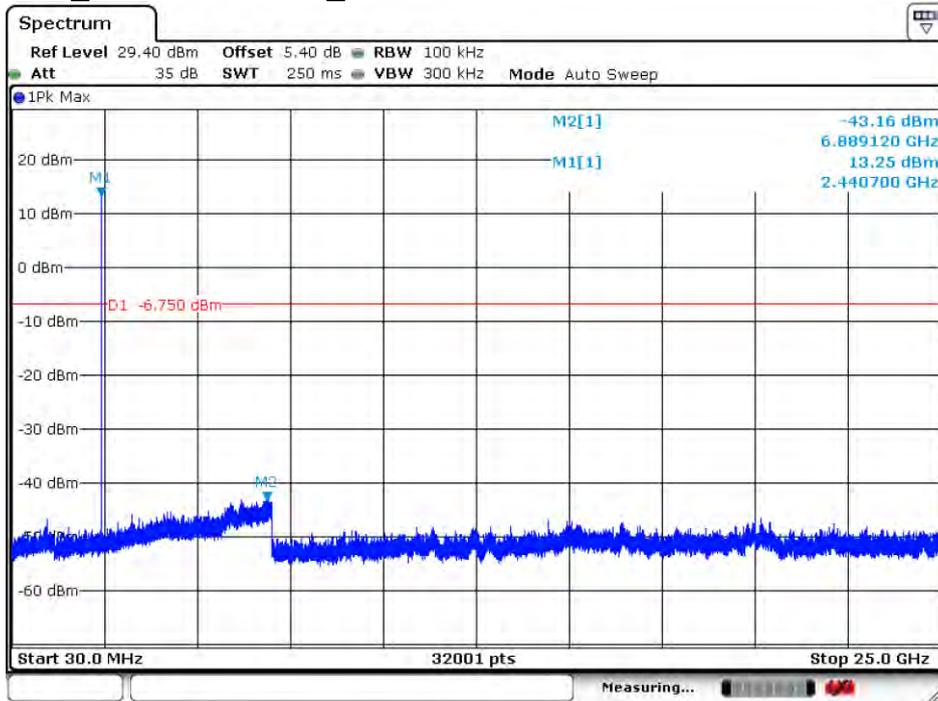
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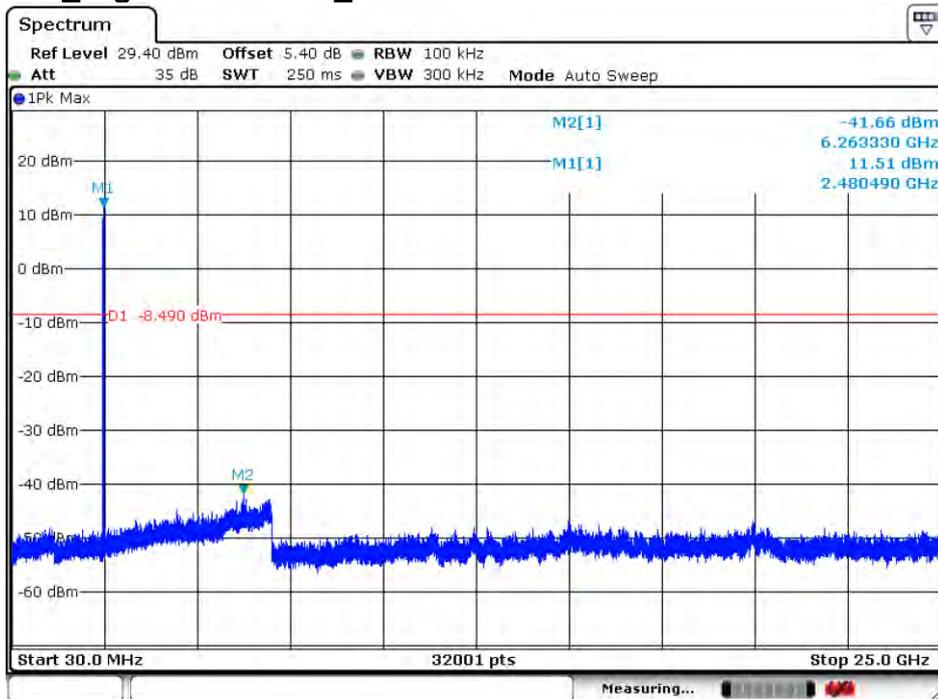
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4.10.1.8 8DPSK_Middle Channel_ANT1



Date: 30.MAR.2020 10:03:58

4.10.1.9 8DPSK_Highest Channel_ANT1



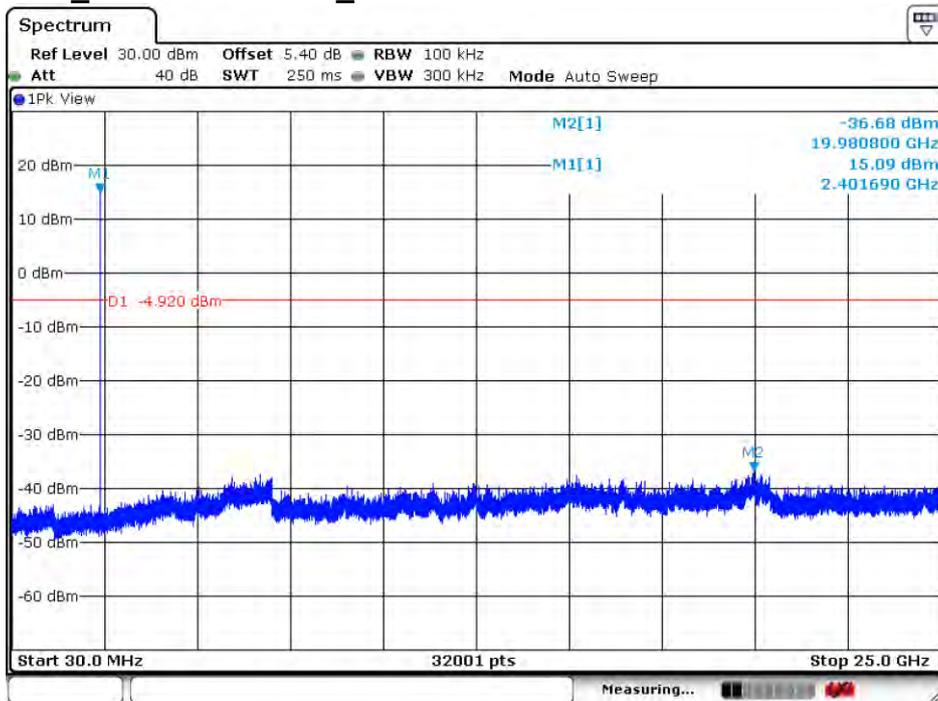
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4.10.1.10 GFSK_Lowest Channel_ANT2



Date: 17.APR.2020 10:44:43



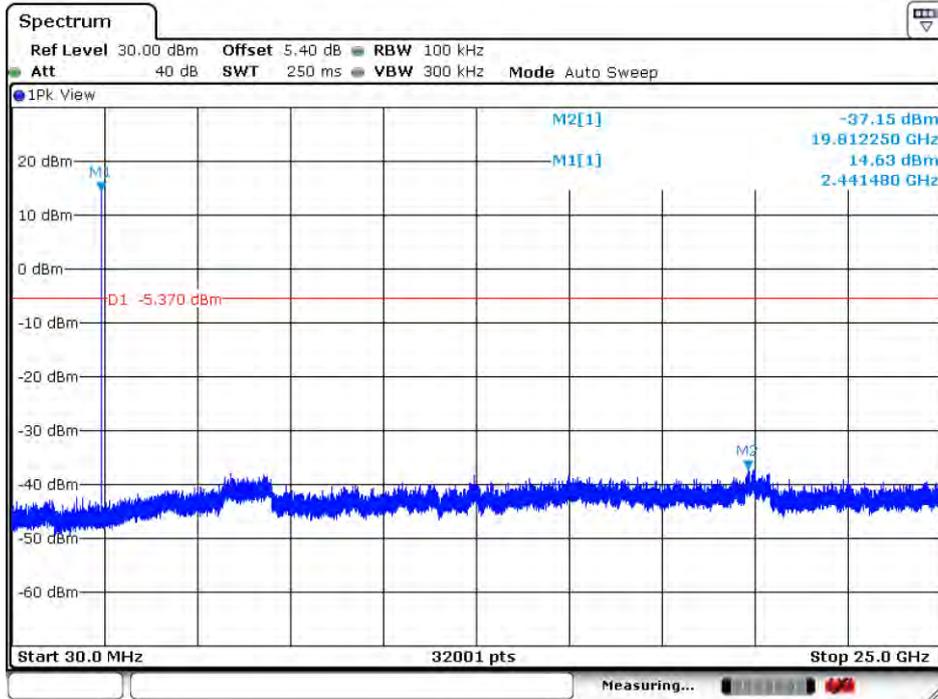
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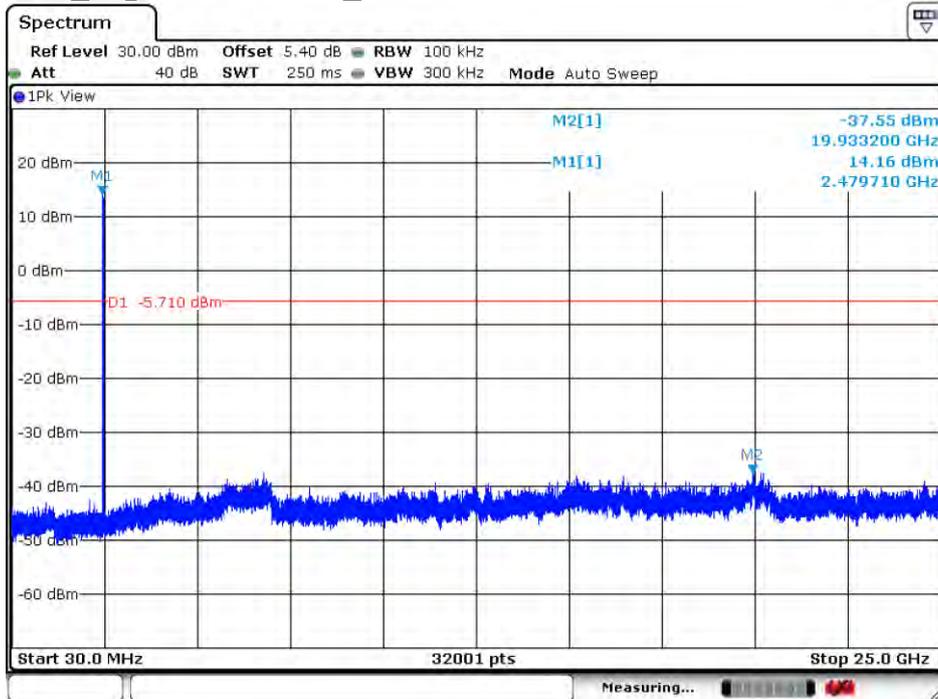
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4.10.1.11 GFSK_Middle Channel_ANT2



Date: 17.APR.2020 10:46:36

4.10.1.12 GFSK_Highest Channel_ANT2

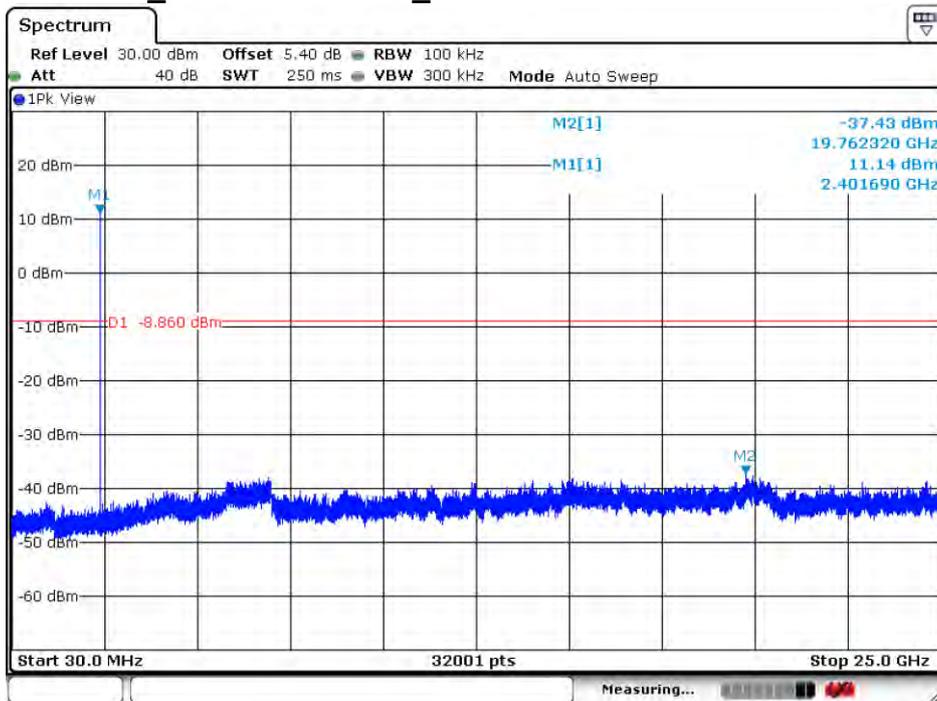


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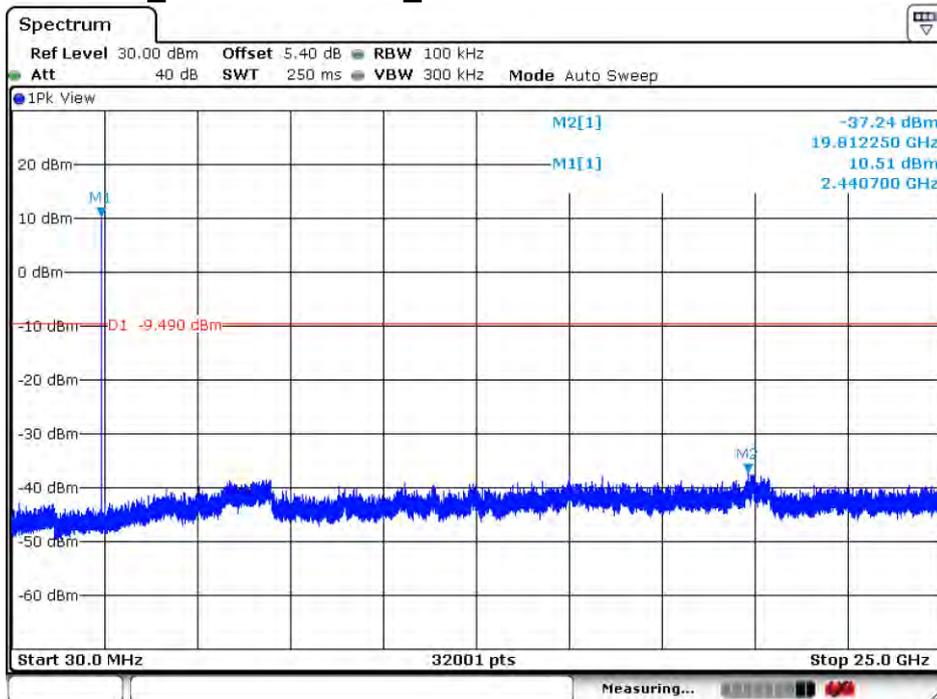


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4.10.1.13 $\pi/4$ DQPSK_Lowest Channel_ANT2

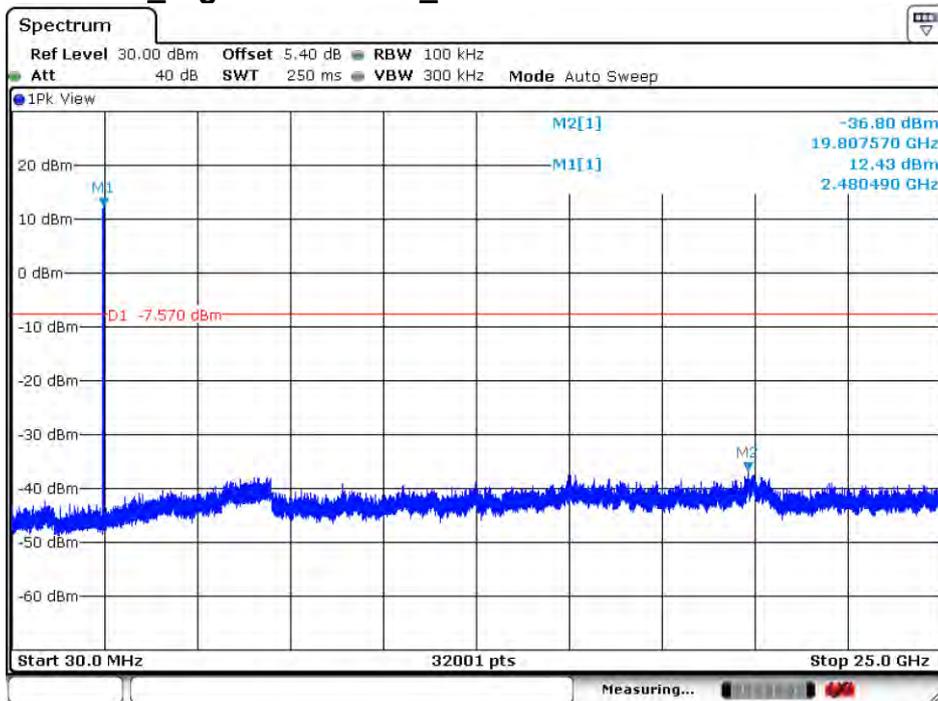


4.10.1.14 $\pi/4$ DQPSK_Middle Channel_ANT2

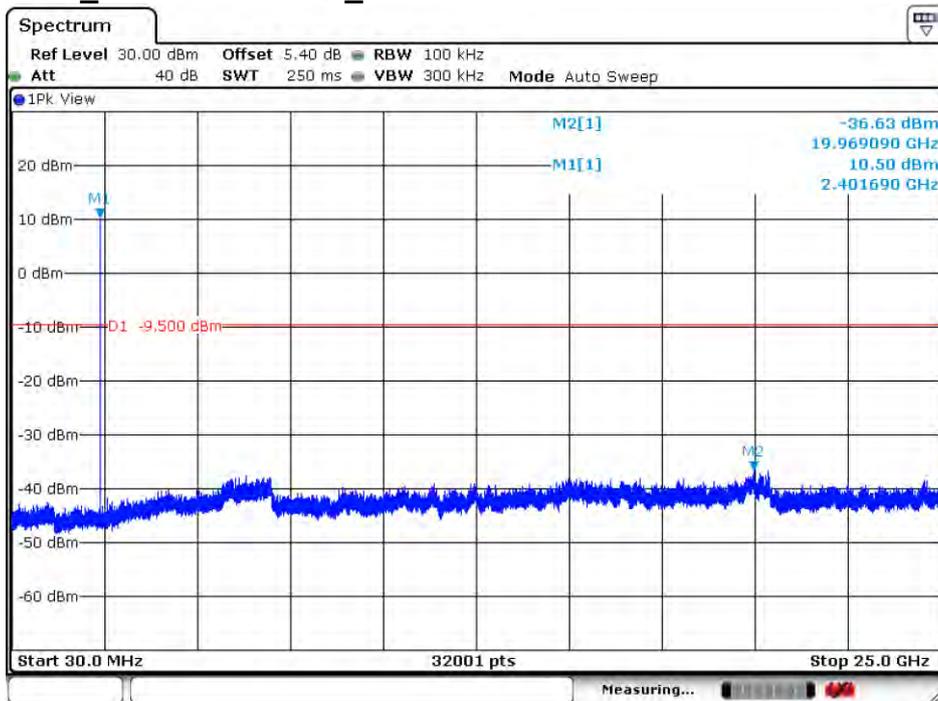


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4.10.1.15 $\pi/4$ DQPSK_Highest Channel_ANT2



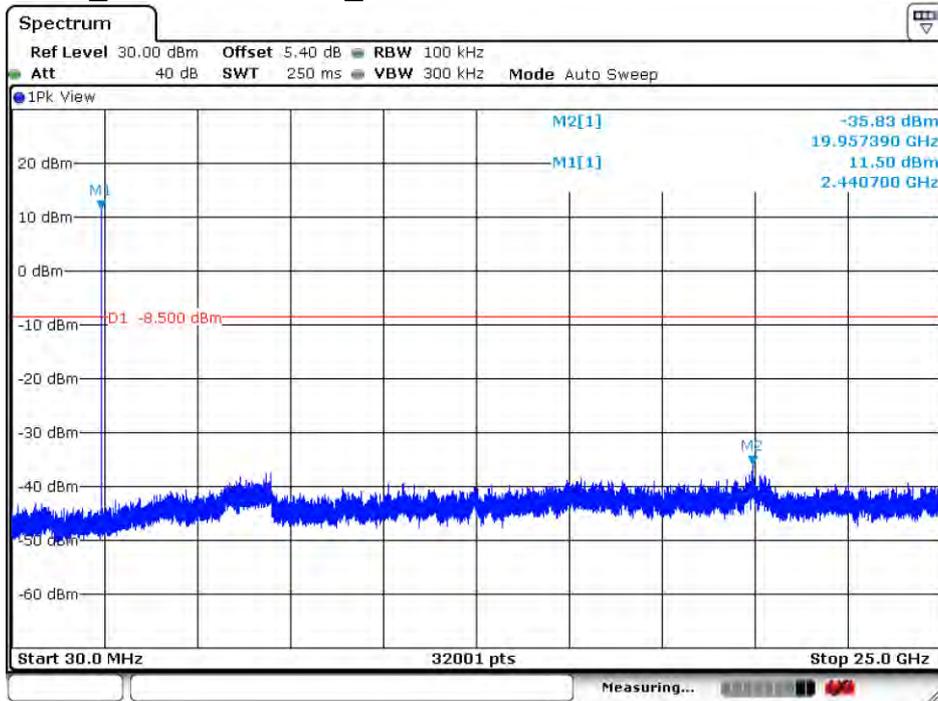
4.10.1.16 8DPSK_Lowest Channel_ANT2



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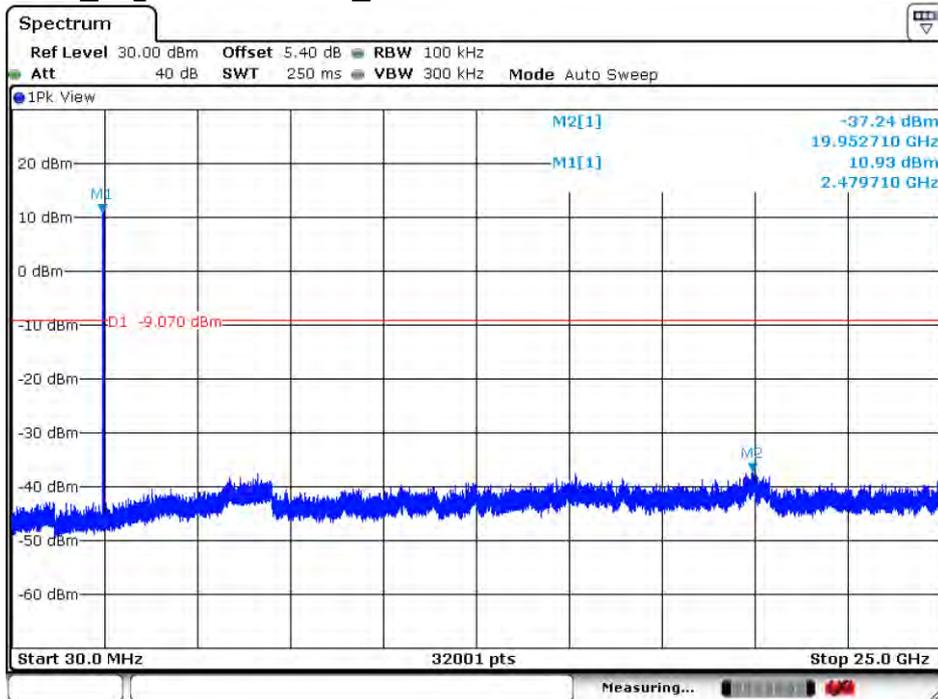
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4.10.1.17 8DPSK_Middle Channel_ANT2



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4.10.1.18 8DPSK_Highest Channel_ANT2



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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.



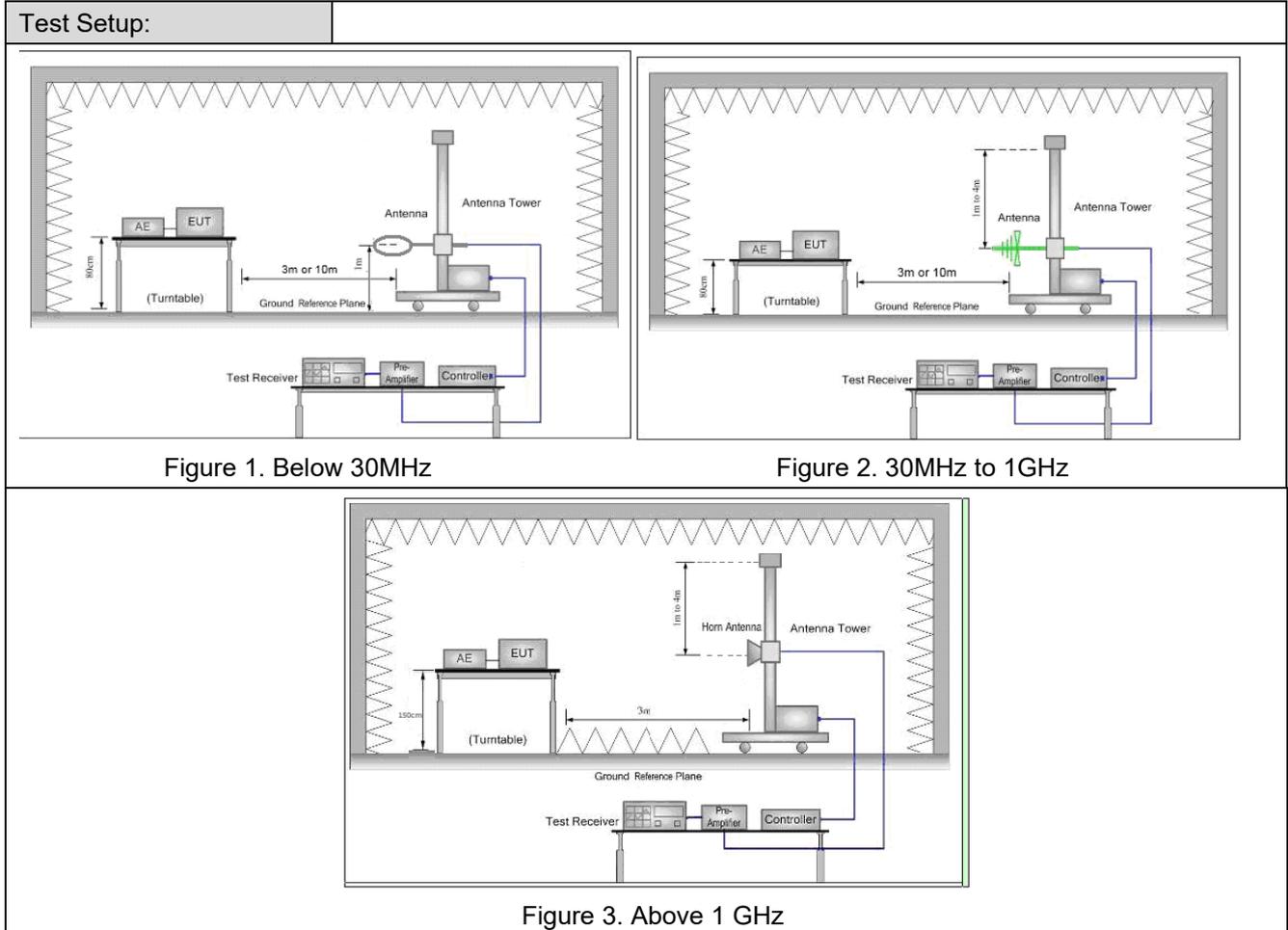
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4.11 Radiated Spurious Emission

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10: 2013				
Test Site:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
Peak		1MHz	10Hz	Average	
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
Remark: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.					





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