

FCC PART 15.247 TEST REPORT

For

Shanghai Huace Navigation Technology LTD.

Building C,599 Gaojing Road,Qingpu District,Shanghai,China

FCC ID: SY4-B01007

Report Type: Original Report	Product Type: Data Collector
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Shanghai Huace Navigation Technology LTD.
Tested Model	LT40
Series Model	LT40 WXYZ(WXYZ=0-9, a-z)
Product Type	Data Collector
Dimension	164.8 mm(L)×86.0 mm(W)×19.3 mm(H)
Power Supply	DC 3.8V from rechargeable battery and DC 5.0V form adapter

Adapter Information:

Model: EA1012AVRU-050

Input: AC100-240 V 50/60Hz 1.0A

Output: 5.0V, 2.4A

* Note: The difference between tested model and series model was explained in the declaration letter.

*All measurement and test data in this report was gathered from production sample serial number: 20170424005.
(Assigned by the BACL. The EUT supplied by the applicant was received on 2017-04-24)

Objective

This test report is prepared on behalf of Shanghai Huace Navigation Technology LTD. in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

FCC Part15.247 DTS, Part 22H/24E/27 PCE & Part 15B JBP submissions with FCC ID: SY4-B01007.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
	18GHz~40GHz	4.88dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road,Kunshan,Jiangsu province,China.

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For Bluetooth, 79 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	40	2442
1	2403	...	...
2	2404	...	...
...	...	...	...
...	...	77	2479
39	2441	78	2480

EUT was tested with Channel 0, 39 and 78.

EUT Exercise Software

EUT was tested in the engineering mode.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

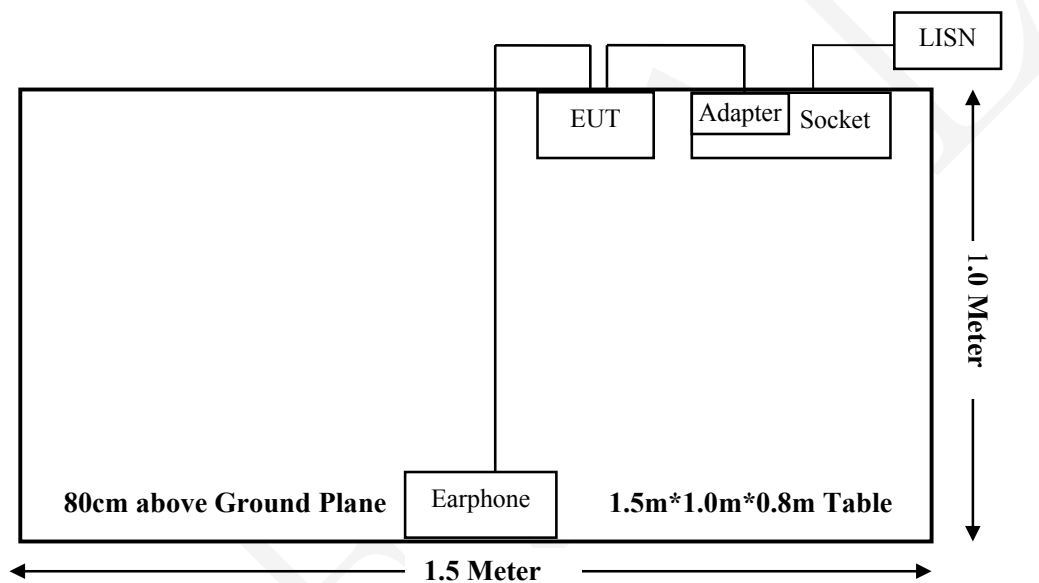
Manufacturer	Description	Model	Serial Number
Huace	Earphone	/	/

External I/O Cable

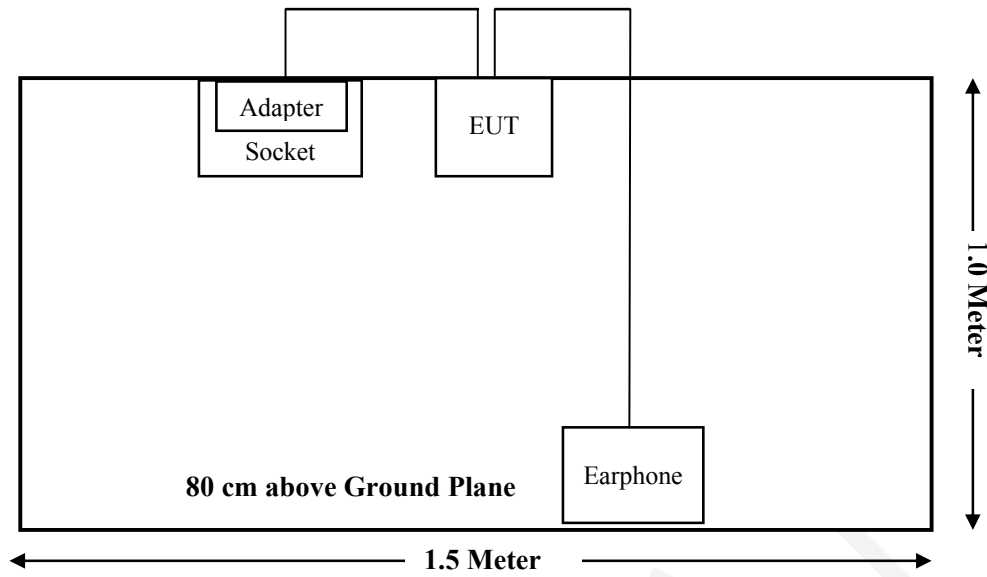
Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup

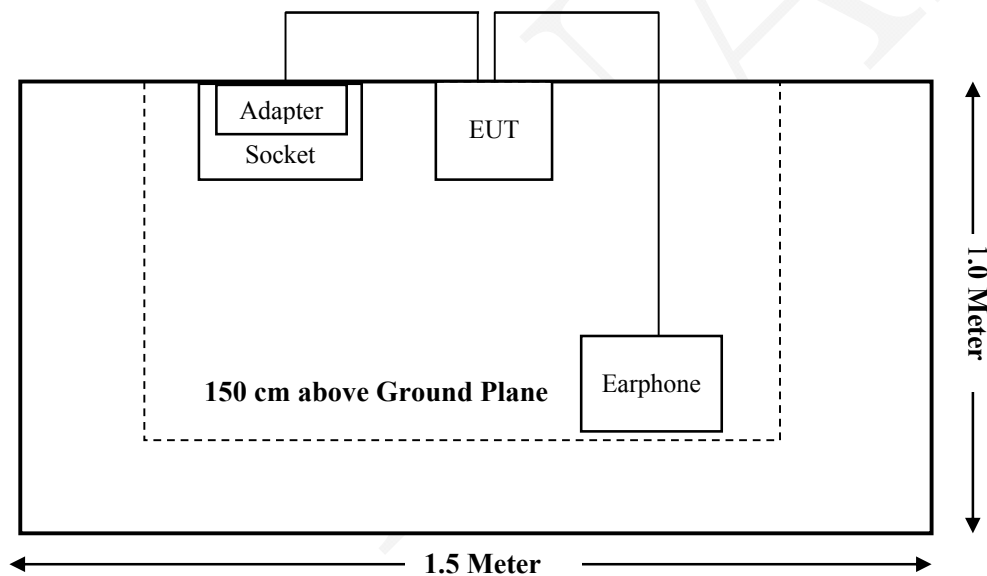
For Conducted Emissions:



For Radiated Emissions (Below 1GHz):



For Radiated Emissions (Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i),§1.1310& §2.1093	RF EXPOSURE	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209 & §15.247(d)	Radiated Emissions	Compliance
§15.247(a)(1)	20 dB Emission Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(1)	Peak Output Power Measurement	Compliance
§15.247(d)	Band edges	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-24
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-25	2017-11-24
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
ETS	Horn Antenna	3115	6229	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-12-12	2019-12-12
Sonoma Instrument	Pre-amplifier	330	171377	2016-12-12	2017-12-11
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-12-12	2017-12-11
Heatsink Required	Amplifier	QLW-18405536-J0	15964001009	2016-12-12	2017-12-11
R&S	Auto test Software	EMC32	100361	/	/
Haojintech	Coaxial Cable	Cable-1	001	2016-12-12	2017-12-11
Haojintech	Coaxial Cable	Cable-2	002	2016-12-12	2017-12-11
Haojintech	Coaxial Cable	Cable-3	003	2016-12-12	2017-12-11
MICRO-COAX	Coaxial Cable	Cable-4	004	2016-12-12	2017-12-11
MICRO-COAX	Coaxial Cable	Cable-5	005	2016-12-12	2017-12-11
RF Conducted Test					
Rohde & Schwarz	FSV40 Signal Analyzer	FSV40	101116	2016-07-04	2017-07-03
Huace	RF Cable	N/A	N/A	2017-05-13	2018-05-12
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-24
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2016-10-10	2017-10-09
ROHDE&SCHWARZ	LISN	ENV216	3560655016	2016-11-25	2017-11-24
Rohde & Schwarz	CE Test software	EMC 32	100357	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2016-09-08	2017-09-07

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.247 (i), §1.1310& §2.1093 –RF EXPOSURE

Applicable Standard

According to §2.1093 and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06:

For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

Measurement Result

Mode	Frequency Range	Conducted peak power	Conducted peak power	Minimum test separation distance required for the exposure conditions
	(MHz)	(dBm)	(mW)	(mm)
BT	2402-2480	2.30	1.70	5.00

Note: For above output power is declared by the manufacturer.

Result: $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})]$

- $[\sqrt{f(\text{GHz})}] = 1.70/5 \cdot \sqrt{2.48} = 0.54 < 3.0$

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 15.203, 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 shall be considered sufficient to comply with the provisions of this Section. 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.

Antenna Connector Construction

The EUT has a FPCB antenna arrangement for Bluetooth, which the antenna gain is 2.5 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

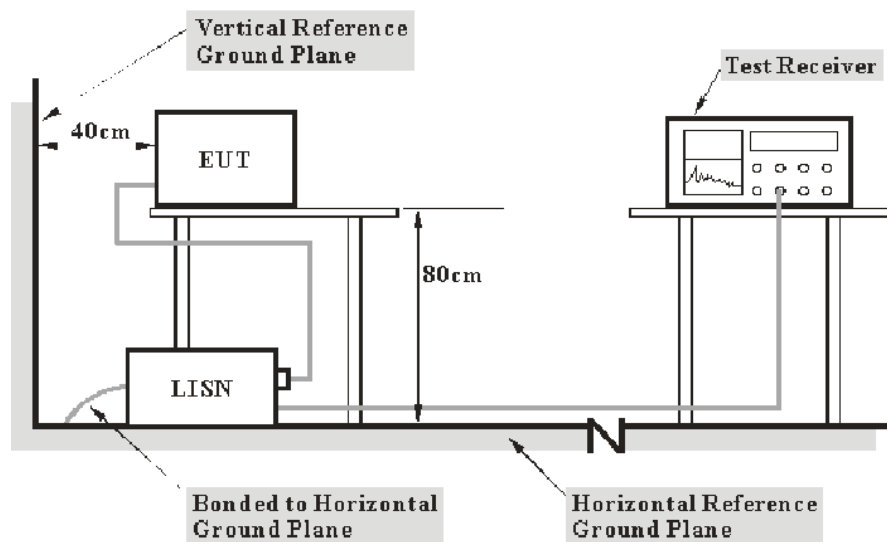
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

EUT Setup



Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data

Environmental Conditions

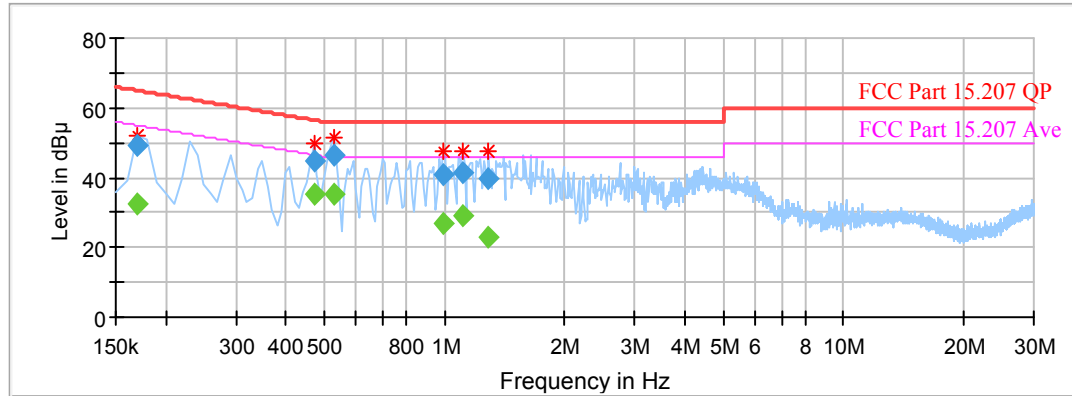
Temperature:	20.2 °C
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

The testing was performed by Ada Yu on 2017-05-16.

EUT operation mode: Transmitting in middle channel of GFSK (Worst case)

AC 120V/60 Hz, Line

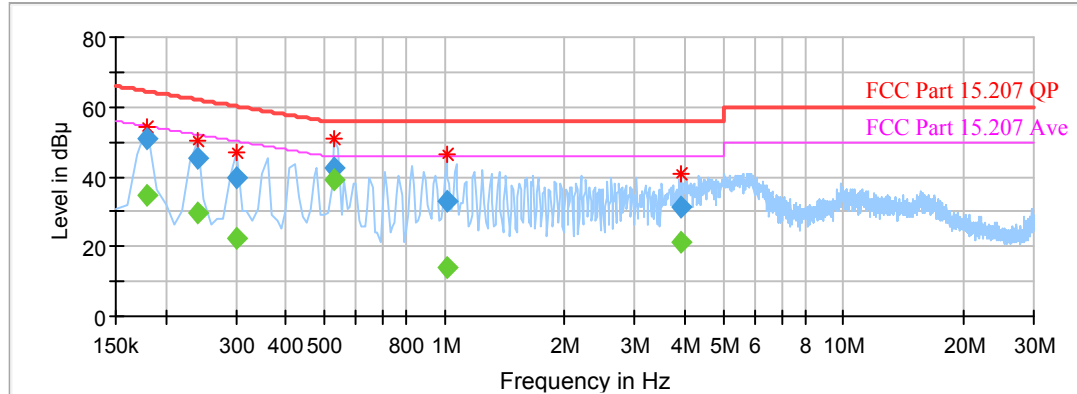
Full Spectrum



Frequency (MHz)	QuasiPeak (dBμV)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.170000	---	32.46	9.000	L1	10.0	22.50	54.96	Compliance
0.170000	49.10	---	9.000	L1	10.0	15.86	64.96	Compliance
0.470000	---	35.39	9.000	L1	10.1	11.12	46.51	Compliance
0.470000	44.65	---	9.000	L1	10.1	11.86	56.51	Compliance
0.530000	---	35.09	9.000	L1	10.1	10.91	46.00	Compliance
0.530000	46.50	---	9.000	L1	10.1	9.50	56.00	Compliance
0.990000	---	26.67	9.000	L1	9.9	19.33	46.00	Compliance
0.990000	40.77	---	9.000	L1	9.9	15.23	56.00	Compliance
1.110000	---	28.92	9.000	L1	9.9	17.08	46.00	Compliance
1.110000	41.51	---	9.000	L1	9.9	14.49	56.00	Compliance
1.290000	---	22.90	9.000	L1	9.9	23.10	46.00	Compliance
1.290000	39.91	---	9.000	L1	9.9	16.09	56.00	Compliance

AC 120V/60 Hz, Neutral

Full Spectrum



Frequency (MHz)	QuasiPeak (dBμV)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.180000	---	34.73	9.000	N	10.1	19.76	54.49	Compliance
0.180000	50.87	---	9.000	N	10.1	13.62	64.49	Compliance
0.240000	---	29.81	9.000	N	10.1	22.29	52.10	Compliance
0.240000	45.04	---	9.000	N	10.1	17.06	62.10	Compliance
0.300000	---	22.13	9.000	N	10.1	28.11	50.24	Compliance
0.300000	39.96	---	9.000	N	10.1	20.28	60.24	Compliance
0.530000	---	38.99	9.000	N	10.1	7.01	46.00	Compliance
0.530000	42.79	---	9.000	N	10.1	13.21	56.00	Compliance
1.010000	---	14.24	9.000	N	9.9	31.76	46.00	Compliance
1.010000	33.25	---	9.000	N	9.9	22.75	56.00	Compliance
3.930000	---	21.42	9.000	N	9.9	24.58	46.00	Compliance
3.930000	31.24	---	9.000	N	9.9	24.76	56.00	Compliance

Note:

- 1) Corr.=LISN VDF (Voltage Division Factor) + Cable Loss
- 2) Corrected Amplitude = Reading + Corr.
- 3) Margin = Limit –Corrected Amplitude

FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS

Applicable Standard

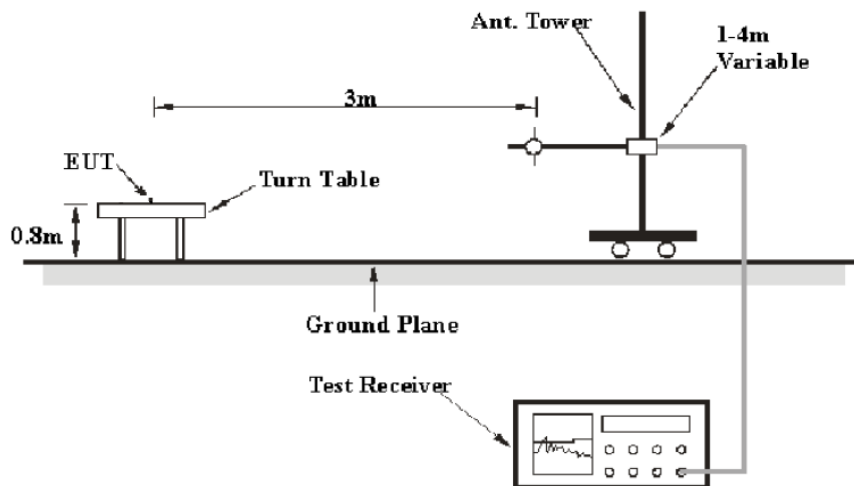
FCC §15.205; §15.209; §15.247(d)

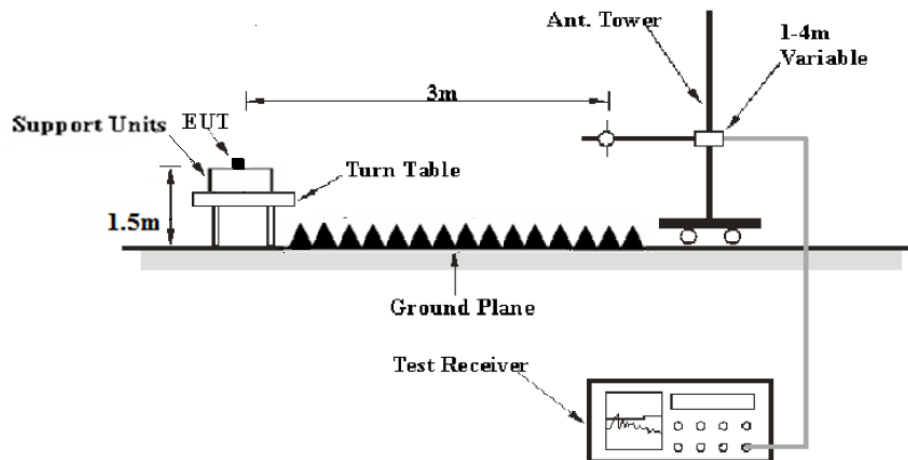
Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

EUT Setup

Below 1 GHz:



Above 1GHz:

The radiated emission tests were performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209 and FCC 15.247 limits.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP

Frequency Range	Item	RBW	Video B/W	Detector
1GHz – 25GHz	PK Value	1MHz	3 MHz	PK
	AV Value	1MHz	10 Hz	PK

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All final data was recorded in Quasi-peak detection mode for frequency range of 30 MHz -1 GHz and peak detection mode for frequencies above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Test Data

Environmental Conditions

Temperature:	20.2 °C
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

The testing was performed by Ada Yu on 2017-05-21.

EUT operation mode: Transmitting

30MH -25 GHz: (Scan with GFSK, $\pi/4$ -DQPSK, 8-DPSK mode, the worst case is GFSK mode)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	PK/QP/Ave		Height (cm)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2402 MHz)									
70.51	33.21	QP	326	114	V	-5.20	28.01	40	11.99
2402.00	97.23	PK	312	240	V	-6.19	91.04	/	/
2402.00	93.07	Ave	312	240	V	-6.19	86.88	/	/
2402.00	96.11	PK	304	165	H	-6.19	89.92	/	/
2402.00	92.97	Ave	304	165	H	-6.19	86.78	/	/
2390.00	44.28	PK	103	120	V	-6.22	38.06	74	35.94
2390.00	39.17	Ave	103	120	V	-6.22	32.95	54	21.05
2400.00	46.17	PK	158	132	V	-6.19	39.98	74	34.02
2400.00	41.23	Ave	158	132	V	-6.19	35.04	54	18.96
1268.00	44.35	PK	257	204	H	-10.85	33.50	74	40.50
1268.00	39.21	Ave	257	204	H	-10.85	28.36	54	25.64
4804.00	45.36	PK	132	117	V	1.61	46.97	74	27.03
4804.00	39.79	Ave	132	117	V	1.61	41.40	54	12.60
7206.00	41.23	PK	145	247	V	7.55	48.78	74	25.22
7206.00	29.33	Ave	145	247	V	7.55	36.88	54	17.12

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	PK/QP/Ave		Height (cm)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Middle Channel (2441 MHz)									
70.51	33.19	QP	351	174	V	-5.20	27.99	40	12.01
2441.00	100.28	PK	221	183	V	-6.17	94.11	/	/
2441.00	96.34	Ave	221	183	V	-6.17	90.17	/	/
2441.00	98.64	PK	9	152	H	-6.17	92.47	/	/
2441.00	94.86	Ave	9	152	H	-6.17	88.69	/	/
1334.00	44.26	PK	273	227	H	-10.45	33.81	74	40.19
1334.00	39.31	Ave	273	227	H	-10.45	28.86	54	25.14
3684.00	43.59	PK	100	137	H	-1.34	42.25	74	31.75
3684.00	38.19	Ave	100	137	H	-1.34	36.85	54	17.15
4882.00	47.16	PK	20	170	V	1.79	48.95	74	25.05
4882.00	41.57	Ave	20	170	V	1.79	43.36	54	10.64
6663.00	44.28	PK	135	117	H	6.38	50.66	74	23.34
6663.00	40.21	Ave	135	117	H	6.38	46.59	54	7.41
7323.00	42.13	PK	25	201	V	7.67	49.80	74	24.20
7323.00	30.28	Ave	25	201	V	7.67	37.95	54	16.05
High Channel (2480MHz)									
70.51	33.35	QP	79	106	V	-5.20	28.15	40	11.85
2480.00	96.05	PK	89	184	V	-6.01	90.04	/	/
2480.00	92.17	Ave	89	184	V	-6.01	86.16	/	/
2480.00	95.36	PK	160	129	H	-6.01	89.35	/	/
2480.00	91.23	Ave	160	129	H	-6.01	85.22	/	/
2483.50	45.13	PK	309	217	V	-6.01	39.12	74	34.88
2483.50	41.54	Ave	309	217	V	-6.01	35.53	54	18.47
2689.00	44.17	PK	131	170	H	-4.94	39.23	74	34.77
2689.00	41.03	Ave	131	170	H	-4.94	36.09	54	17.91
4960.00	45.22	PK	78	183	V	1.97	47.19	74	26.81
4960.00	41.36	Ave	78	183	V	1.97	43.33	54	10.67
6348.00	44.36	PK	167	103	H	5.35	49.71	74	24.29
6348.00	40.21	Ave	167	103	H	5.35	45.56	54	8.44
7440.00	40.46	PK	36	144	V	7.79	48.25	74	25.75
7440.00	27.33	Ave	36	144	V	7.79	35.12	54	18.88

Note:

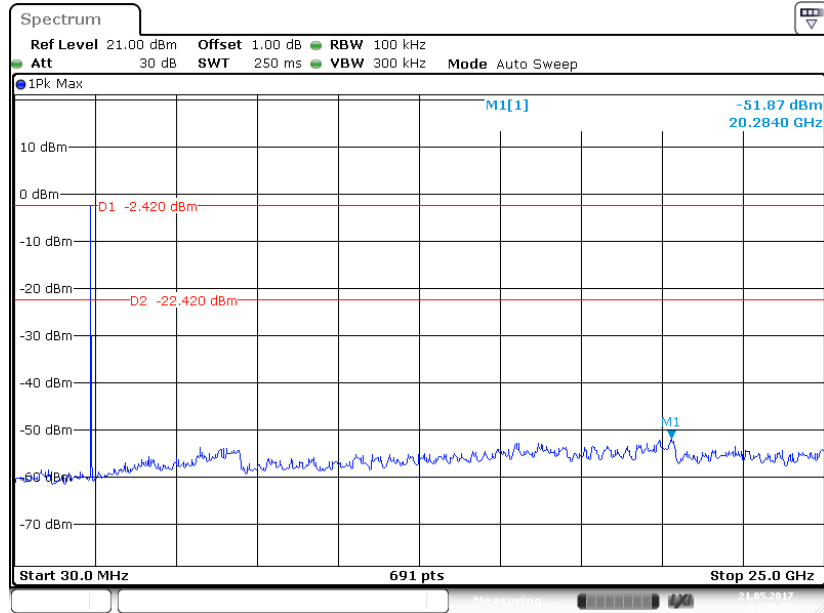
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Corrected Amplitude = Corrected Factor + Reading

Margin = Limit - Corrected. Amplitude

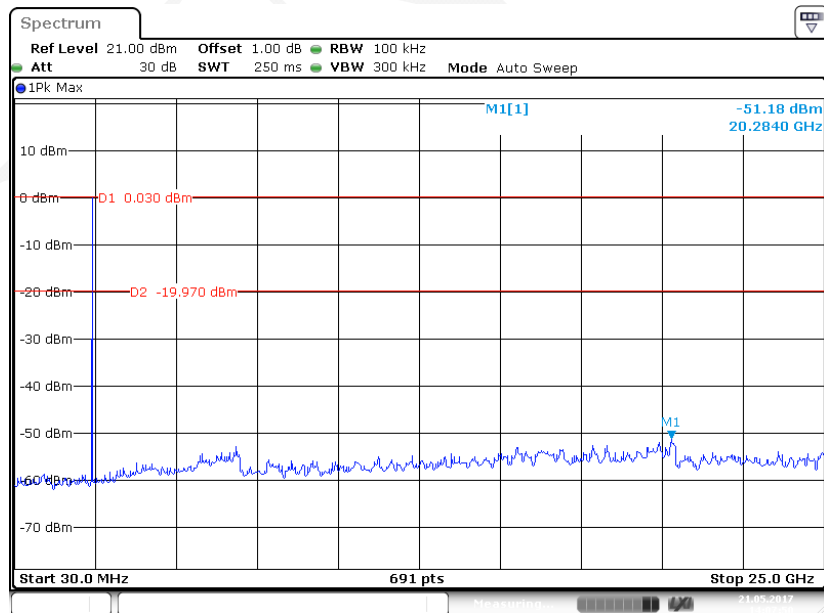
Spurious Emissions at Antenna Port:

Low Channel



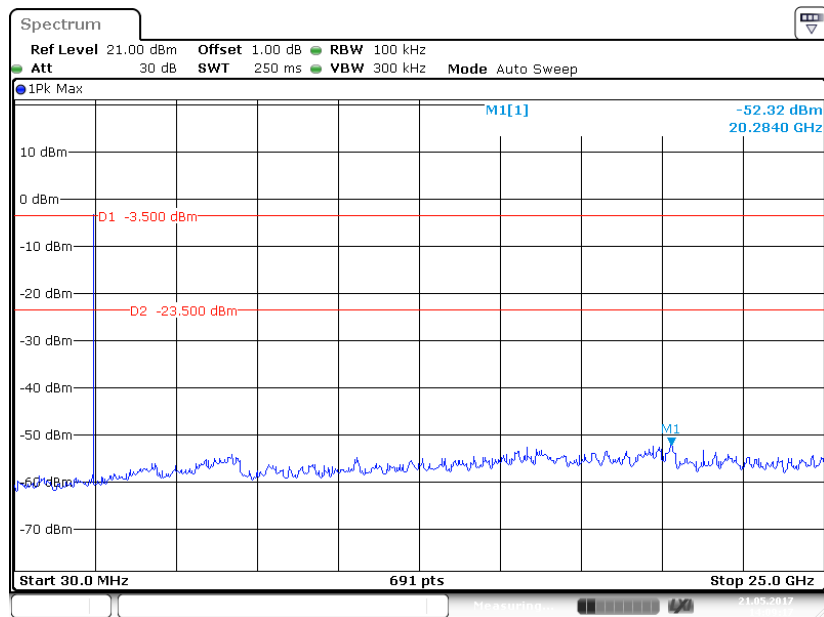
Date: 21 MAY 2017 14:06:58

Middle Channel



Date: 21 MAY 2017 14:07:50

High Channel



FCC §15.247(a) (1)-CHANNEL SEPARATION TEST

Applicable Standard

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW.

Test Procedure

1. Set the EUT in transmitting mode, maxhold the channel.
2. Set the adjacent channel of the EUT and maxhold another trace.
3. Measure the channel separation.

Test Data

Environmental Conditions

Temperature:	20.3 °C
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

The testing was performed by Ada Yu on 2017-05-16 to 2017-05-21.

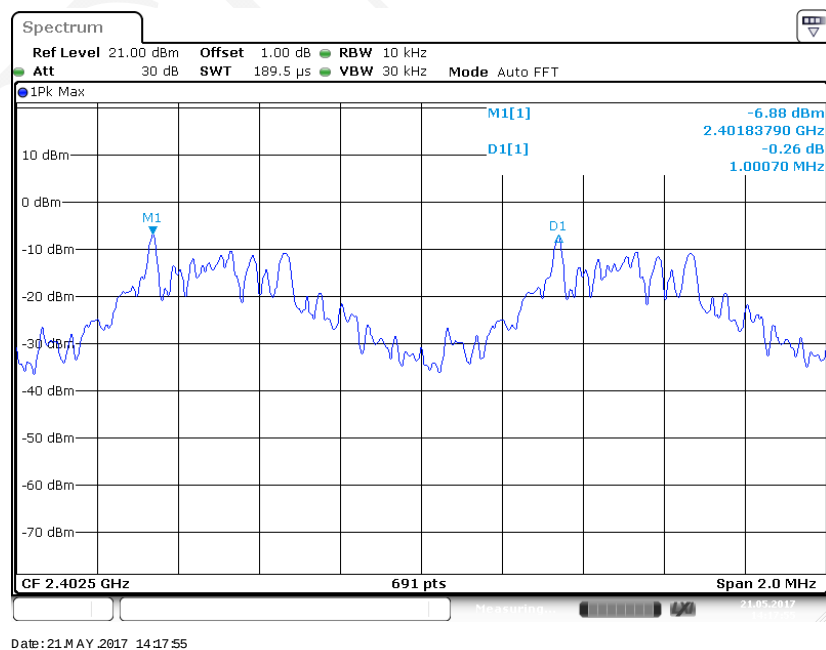
EUT operation mode: Transmitting

Test Result: Compliance.

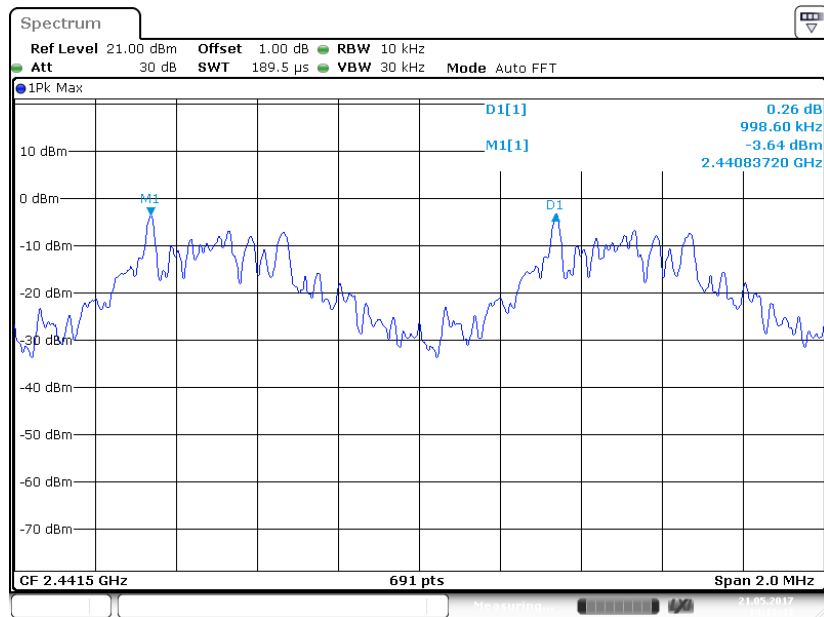
Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
BDR (GFSK)	Low	2402	1.001	0.540
	Adjacent	2403		
	Middle	2441	0.999	0.540
	Adjacent	2442		
	High	2480	1.001	0.540
	Adjacent	2479		
EDR ($\pi/4$-DQPSK)	Low	2402	0.995	0.833
	Adjacent	2403		
	Middle	2441	1.003	0.838
	Adjacent	2442		
	High	2480	0.995	0.833
	Adjacent	2479		
EDR (8-DPSK)	Low	2402	1.003	0.843
	Adjacent	2403		
	Middle	2441	1.003	0.843
	Adjacent	2442		
	High	2480	0.995	0.843
	Adjacent	2479		

Note: Limit = $2/3 \times 20$ dB bandwidth

BDR (GFSK): Low Channel

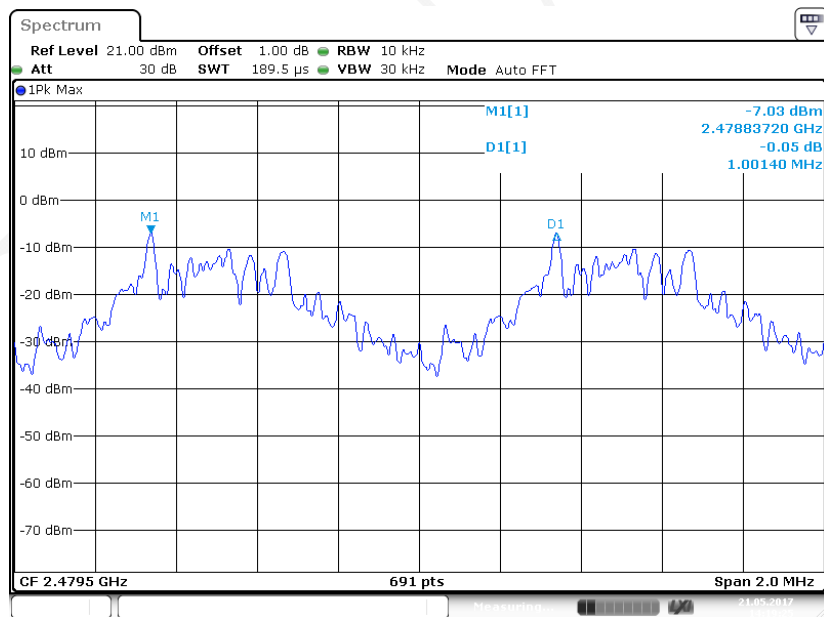


BDR (GFSK): Middle Channel



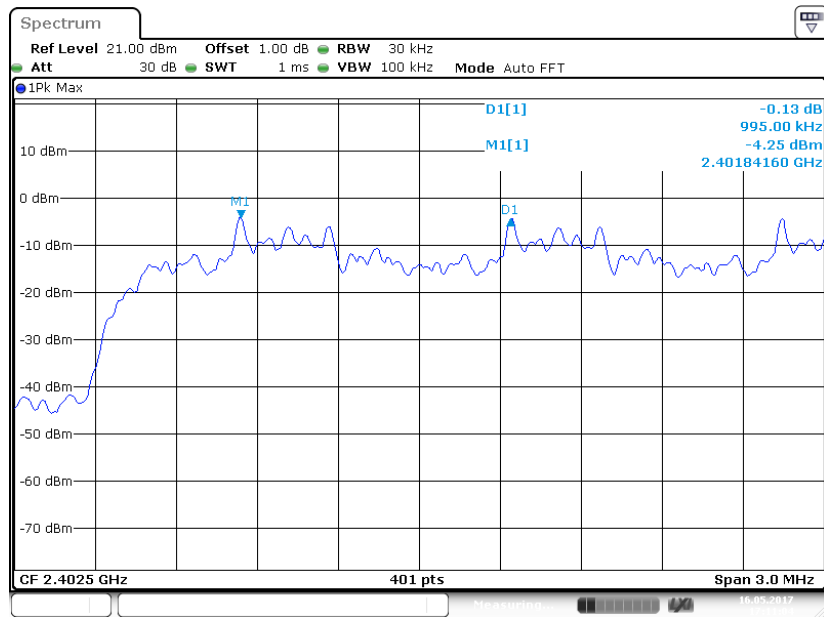
Date: 21 MAY 2017 14:18:44

BDR (GFSK): High Channel

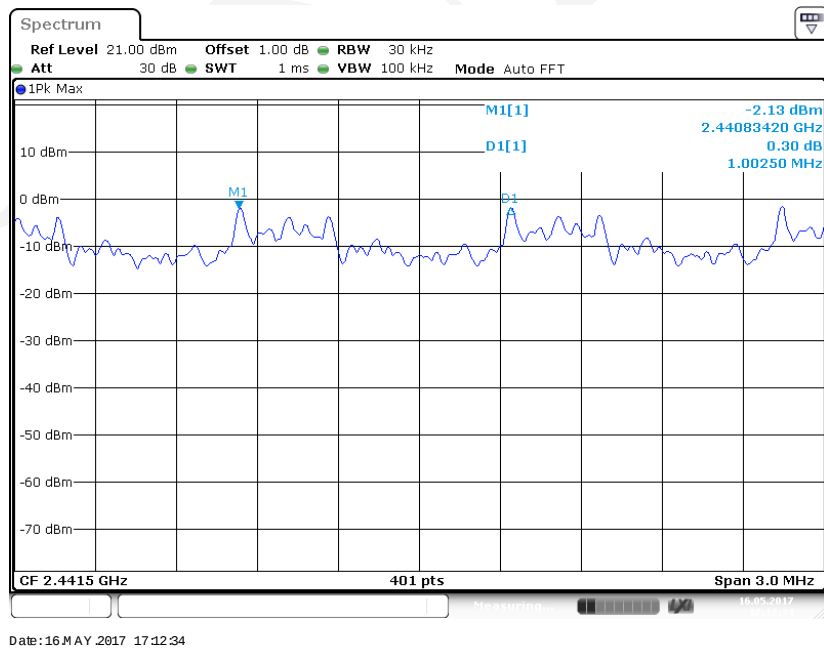


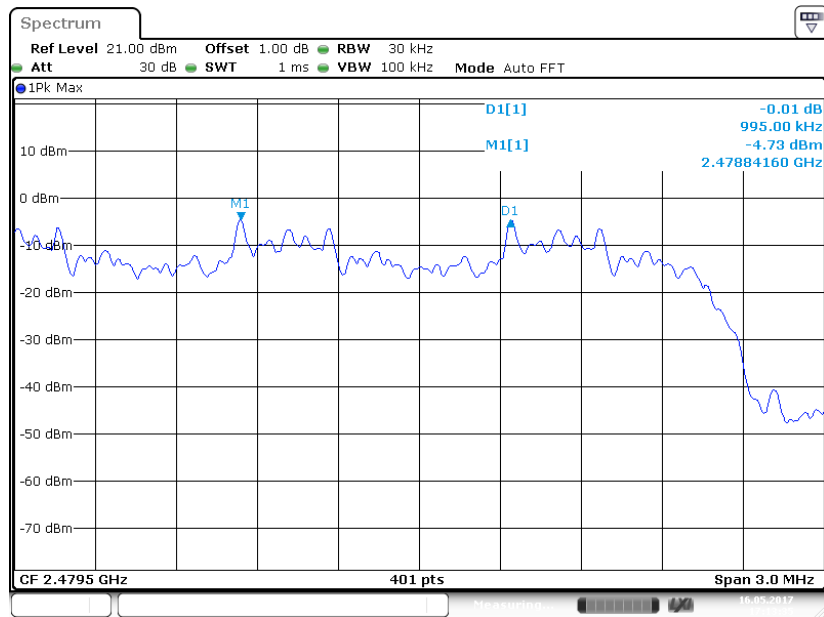
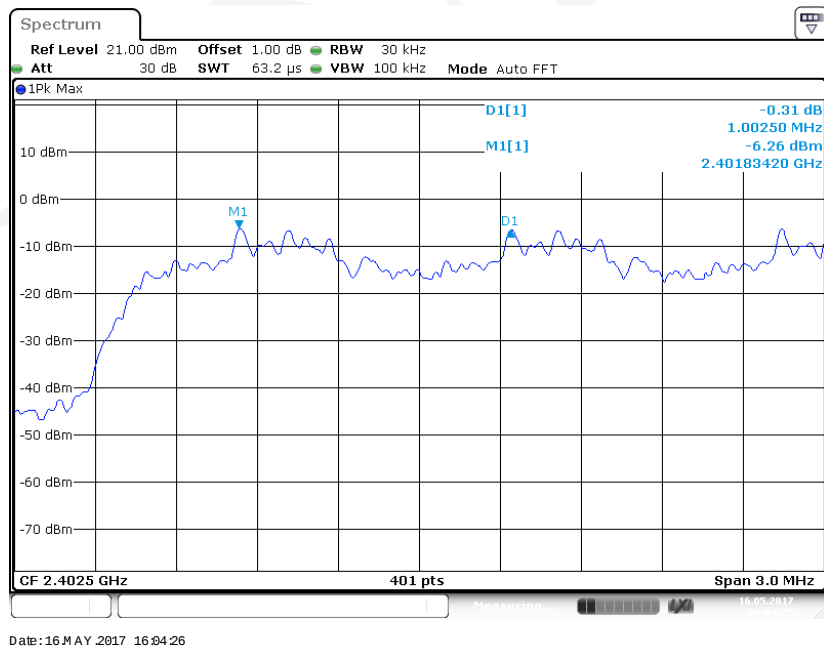
Date: 21 MAY 2017 14:19:25

EDR ($\pi/4$ -DQPSK): Low Channel

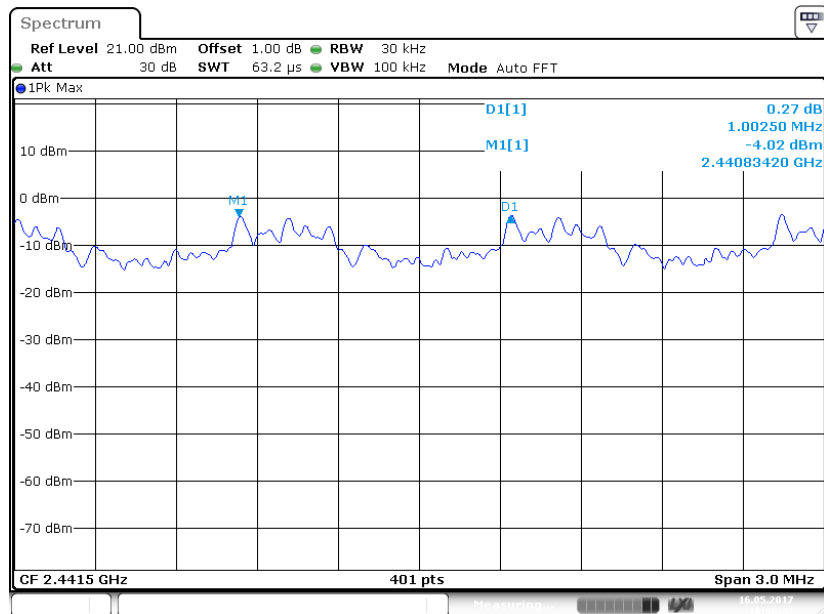


EDR ($\pi/4$ -DQPSK): Middle Channel



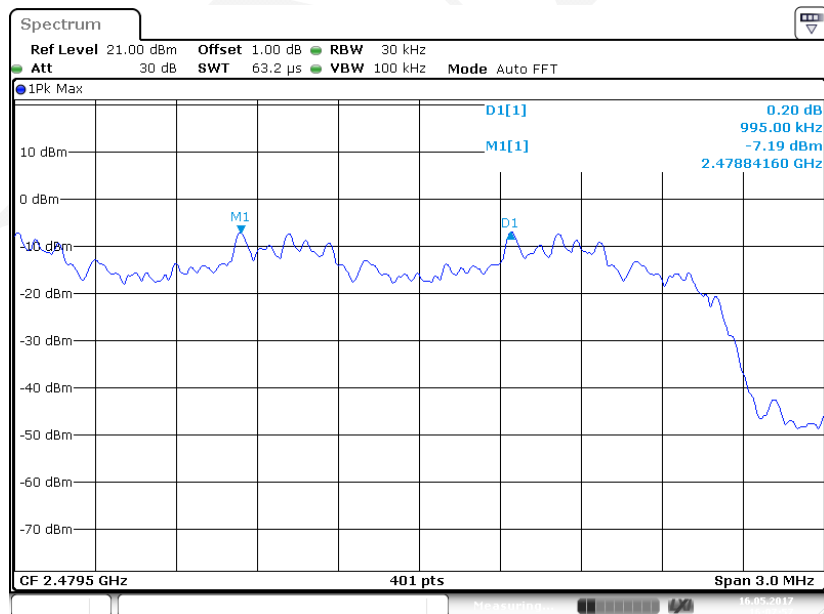
EDR ($\pi/4$ -DQPSK): High Channel**EDR (8-DPSK): Low Channel**

EDR (8-DPSK): Middle Channel



Date: 16 MAY 2017 16:06:42

EDR (8-DPSK): High Channel



Date: 16 MAY 2017 16:07:58

FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH**Applicable Standard**

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Data**Environmental Conditions**

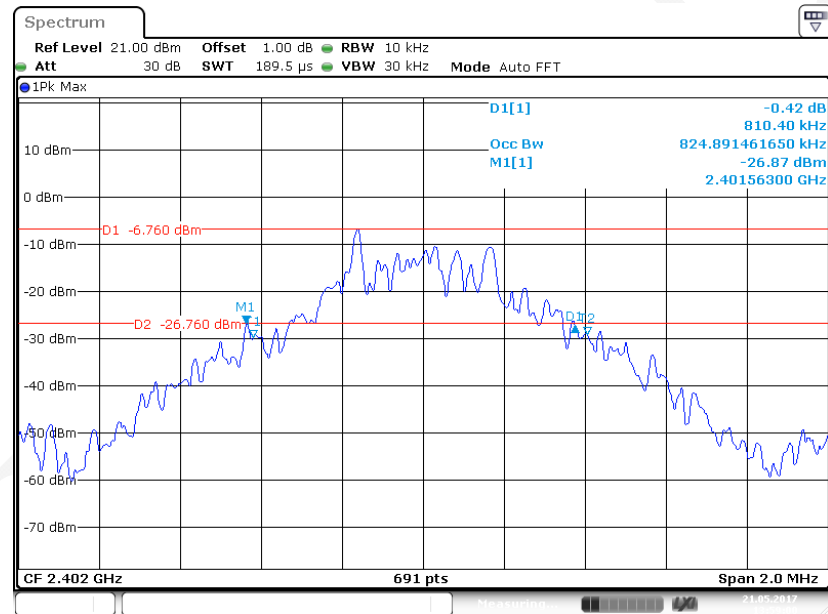
Temperature:	20.3 °C
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

The testing was performed by Ada Yu on 2017-05-16 to 2017-05-21.

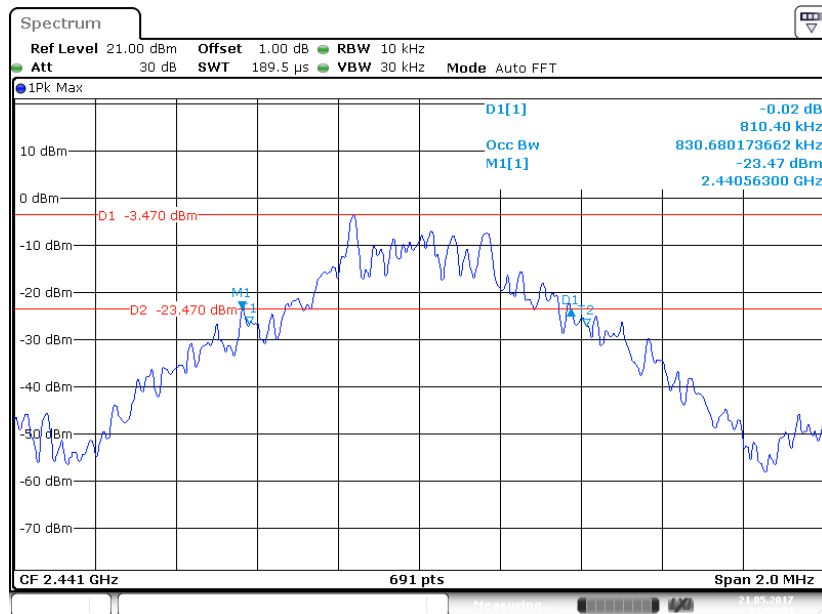
EUT operation mode: Transmitting

Test Result: Compliance.

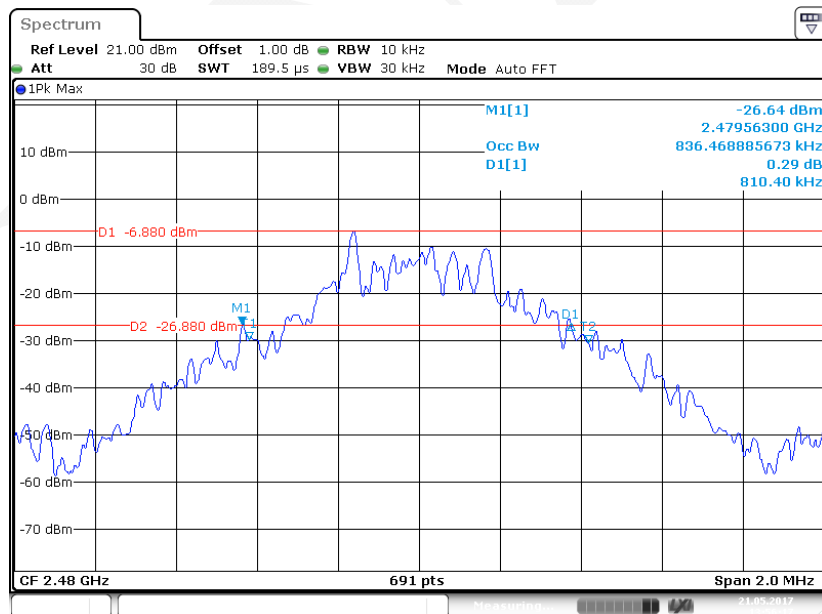
Mode	Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)
BDR (GFSK)	Low	2402	0.810
	Middle	2441	0.810
	High	2480	0.810
EDR ($\pi/4$-DQPSK)	Low	2402	1.249
	Middle	2441	1.257
	High	2480	1.249
EDR (8-DPSK)	Low	2402	1.264
	Middle	2441	1.264
	High	2480	1.264

BDR (GFSK): Low Channel

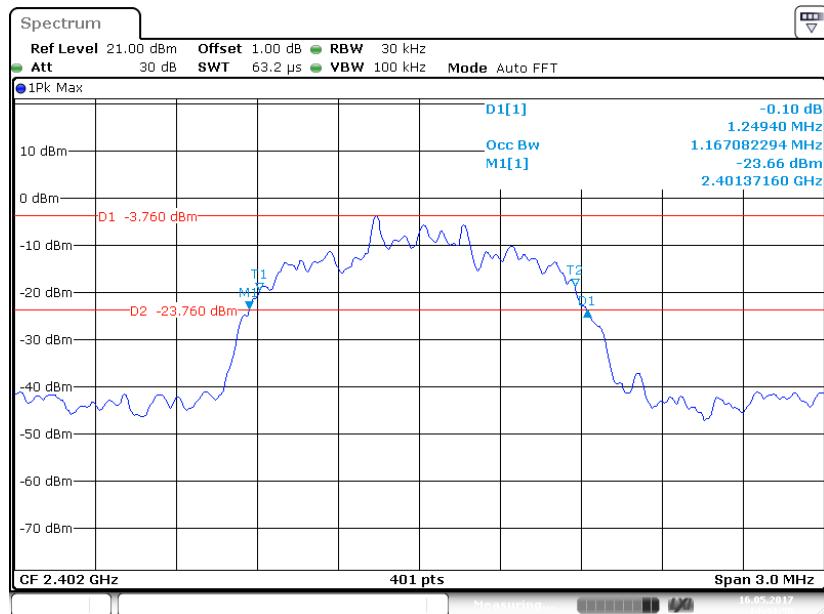
Date: 21 MAY 2017 13:59:00

BDR (GFSK): Middle Channel

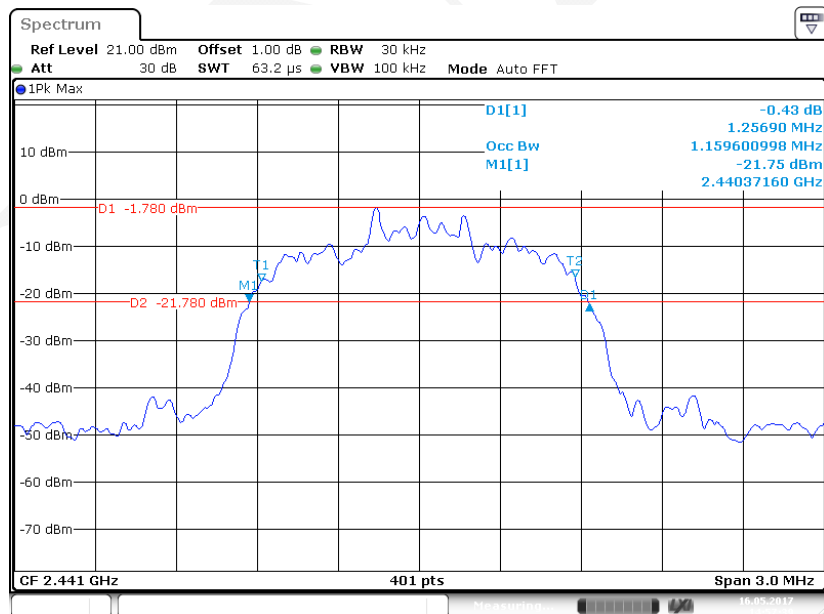
Date: 21 MAY 2017 13:57:44

BDR (GFSK): High Channel

Date: 21 MAY 2017 13:56:17

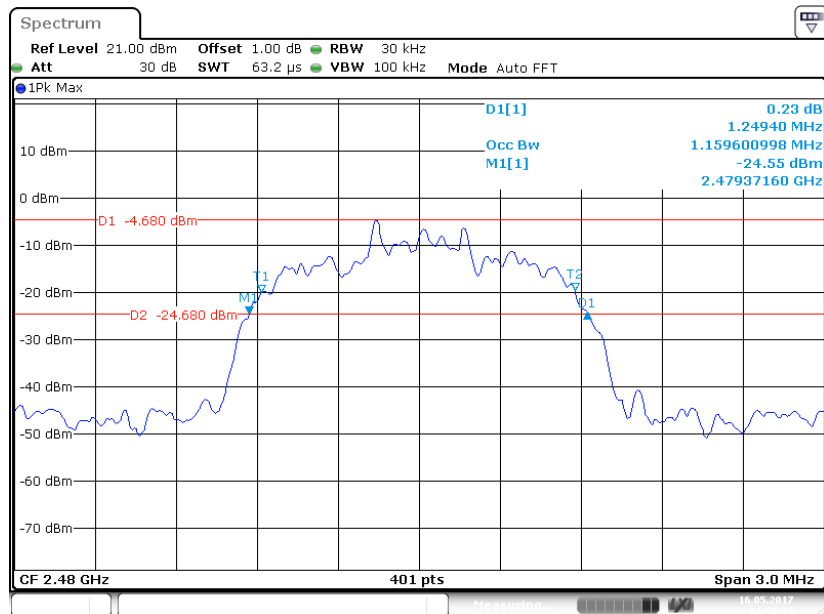
EDR ($\pi/4$ -DQPSK): Low Channel

Date: 16 MAY 2017 14:44:55

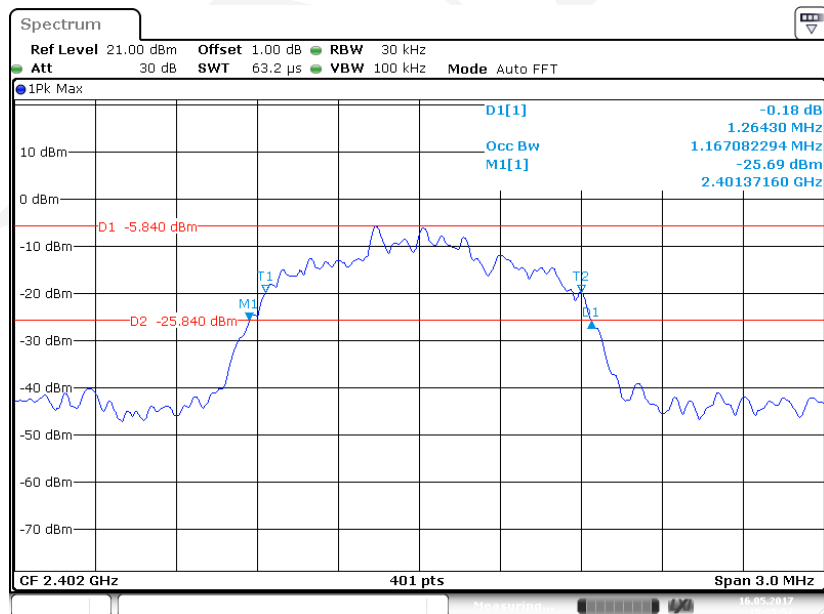
EDR($\pi/4$ -DQPSK): Middle Channel

Date: 16 MAY 2017 14:57:39

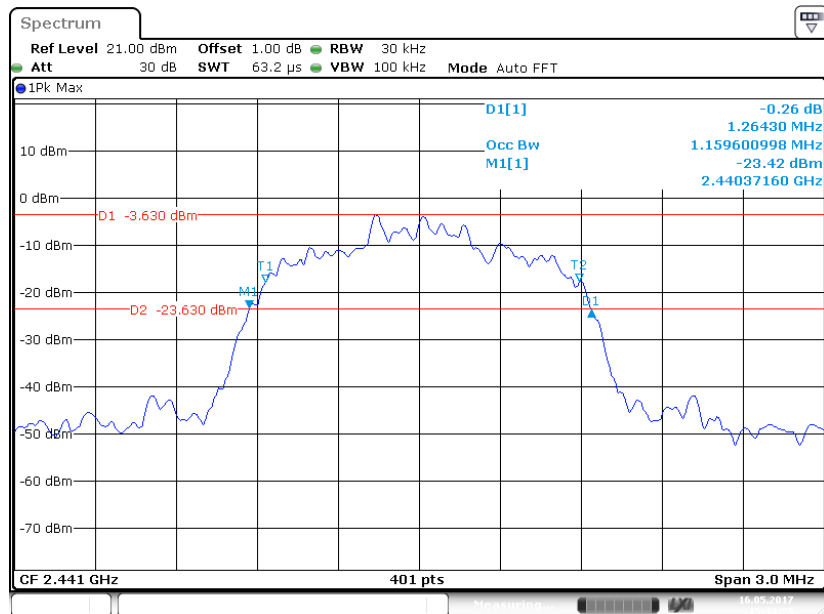
EDR ($\pi/4$ -DQPSK): High Channel



EDR (8-DPSK): Low Channel

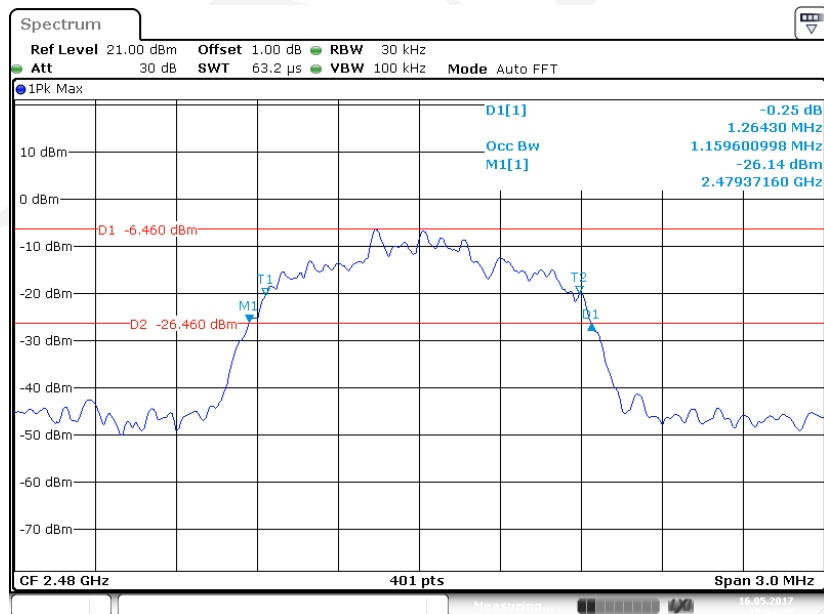


EDR (8-DPSK): Middle Channel



Date: 16 MAY 2017 15:39:25

EDR (8-DPSK): High Channel



Date: 16 MAY 2017 15:53:26

FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST**Applicable Standard**

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the max-hold function record the quantity of the channel.

Test Data**Environmental Conditions**

Temperature:	20.1 °C
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

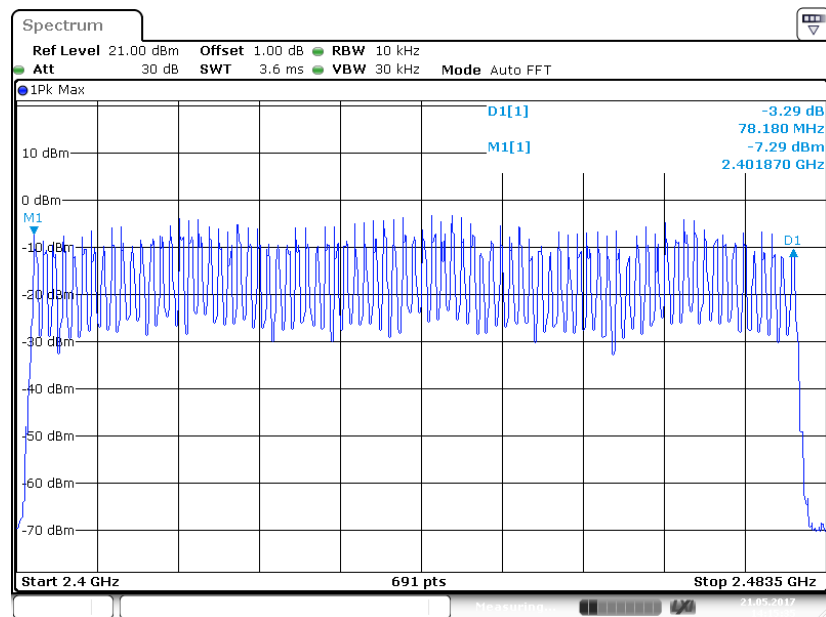
The testing was performed by Ada Yu on 2017-05-16 to 2017-05-21.

EUT operation mode: Transmitting

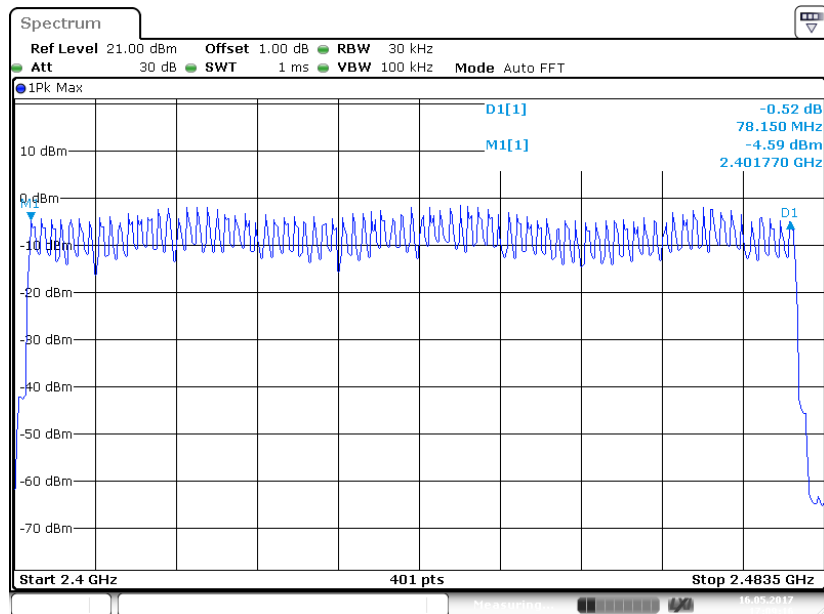
Test Result: Compliance.

Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
BDR (GFSK)	2400-2483.5	79	≥ 15
EDR ($\pi/4$ -DQPSK)	2400-2483.5	79	≥ 15
EDR (8-DPSK)	2400-2483.5	79	≥ 15

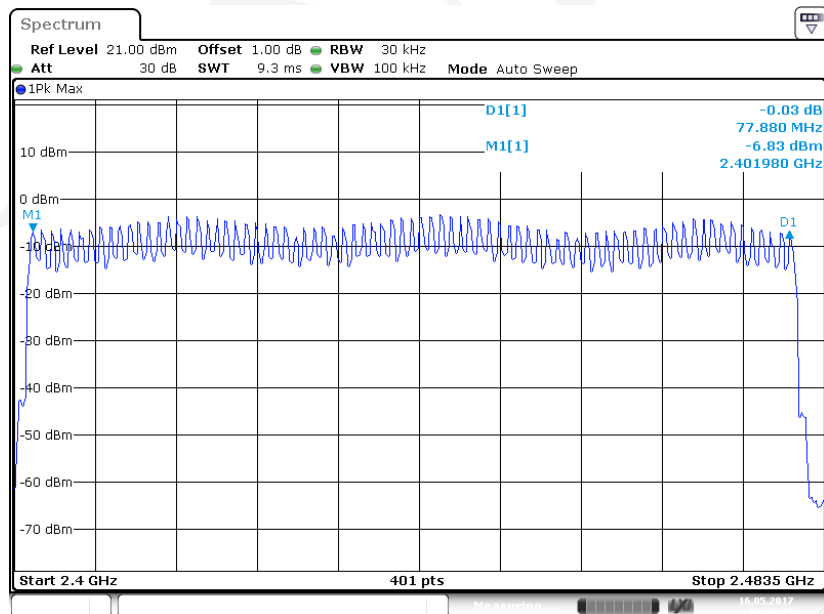
BDR (GFSK): Number of Hopping Channels



Date: 21 MAY 2017 14:15:36

EDR ($\pi/4$ -DQPSK): Number of Hopping Channels

Date: 16 MAY 2017 17:59:17

EDR (8-DPSK): Number of Hopping Channels

Date: 16 MAY 2017 15:58:16

FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWEELL TIME)**Applicable Standard**

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: Zero span, centered on a hopping channel.
2. RBW shall be $\leq$ channel spacing and where possible RBW should be set $\gg 1 / T$, where T is the expected dwell time per channel.
3. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
4. Detector function: Peak.
5. Trace: Max hold.

The quantity of pulse was get from single sweep. In addition, the time of single pulses was tested.

Test Data**Environmental Conditions**

Temperature:	20.1 °C
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

The testing was performed by Ada Yu on 2017-05-16 to 2017-05-21.

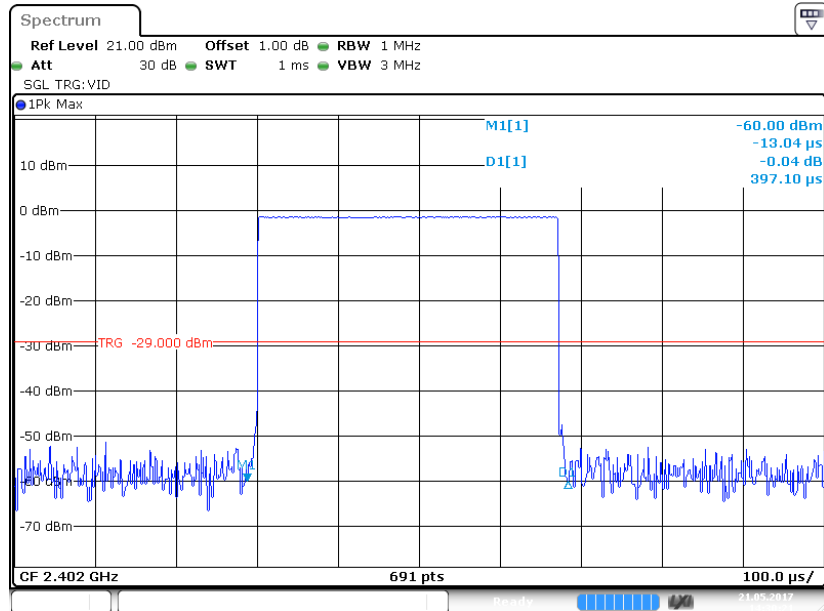
EUT operation mode: Transmitting

Test Result: Compliance.

Mode		Channel	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Result
BDR (GFSK)	DH 1	Low	0.397	0.127	0.4	Pass
		Middle	0.390	0.125	0.4	Pass
		High	0.391	0.125	0.4	Pass
		Note: DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	DH 3	Low	1.649	0.264	0.4	Pass
		Middle	1.663	0.266	0.4	Pass
		High	1.652	0.264	0.4	Pass
		Note: DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	DH 5	Low	2.907	0.310	0.4	Pass
		Middle	2.924	0.312	0.4	Pass
		High	2.930	0.313	0.4	Pass
		Note: DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				
EDR ($\pi/4$ -DQPSK)	2DH 1	Low	0.404	0.129	0.4	Pass
		Middle	0.396	0.127	0.4	Pass
		High	0.396	0.127	0.4	Pass
		Note: 2DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	2DH 3	Low	1.698	0.272	0.4	Pass
		Middle	1.666	0.267	0.4	Pass
		High	1.666	0.267	0.4	Pass
		Note: 2DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	2DH 5	Low	2.920	0.311	0.4	Pass
		Middle	2.950	0.315	0.4	Pass
		High	2.940	0.314	0.4	Pass
		Note: 2DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				
EDR (8-DPSK)	3DH 1	Low	0.403	0.129	0.4	Pass
		Middle	0.408	0.131	0.4	Pass
		High	0.408	0.131	0.4	Pass
		Note: 3 DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	3DH 3	Low	1.684	0.269	0.4	Pass
		Middle	1.671	0.267	0.4	Pass
		High	1.665	0.266	0.4	Pass
		Note: 3DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	3DH 5	Low	2.910	0.310	0.4	Pass
		Middle	2.960	0.316	0.4	Pass
		High	2.920	0.311	0.4	Pass
		Note: 3DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				

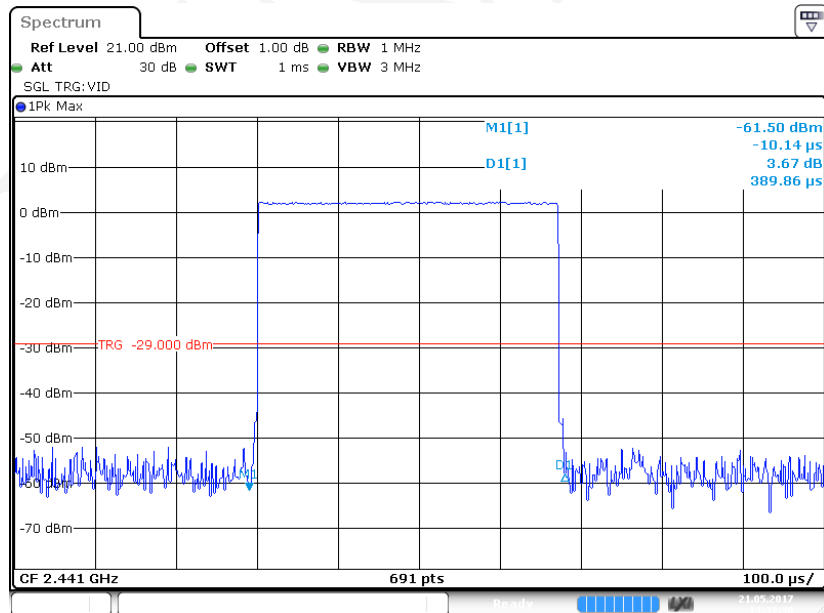
BDR (GFSK):

Pulse time, Low Channel, DH1



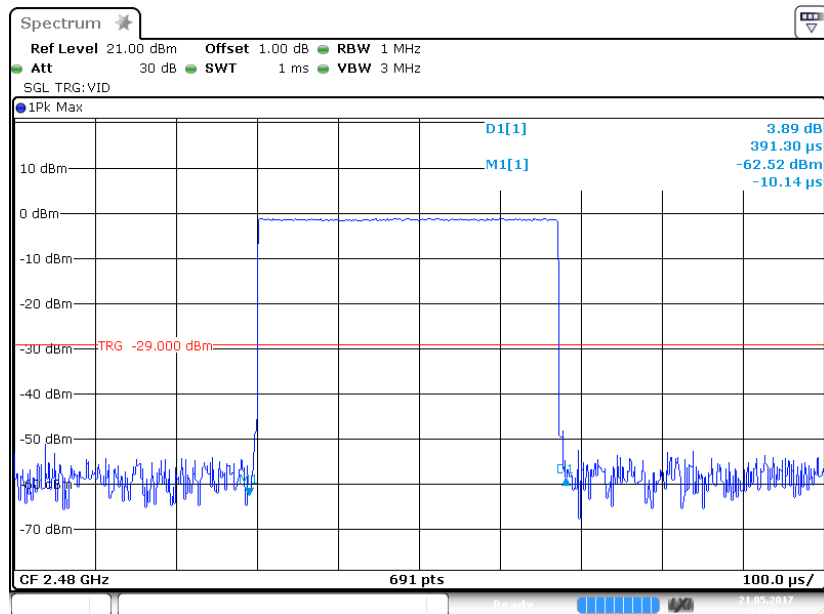
Date: 21 MAY 2017 14:30:20

Pulse time, Middle Channel, DH1



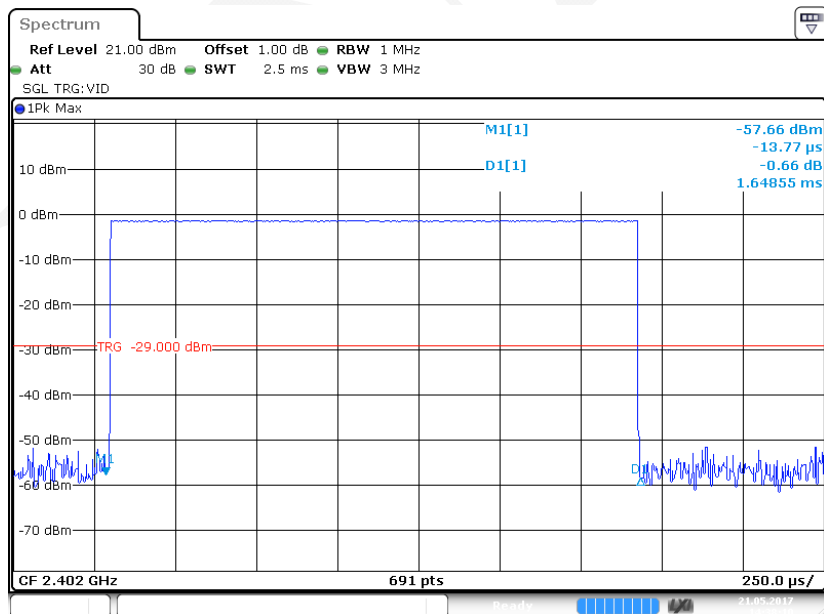
Date: 21 MAY 2017 14:31:46

Pulse time, High Channel, DH1

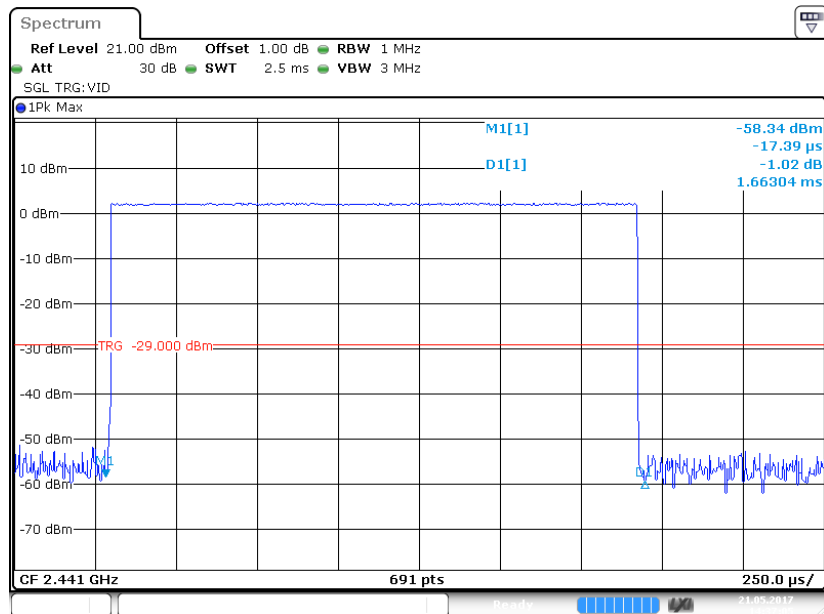


Date: 21 MAY 2017 14:34:36

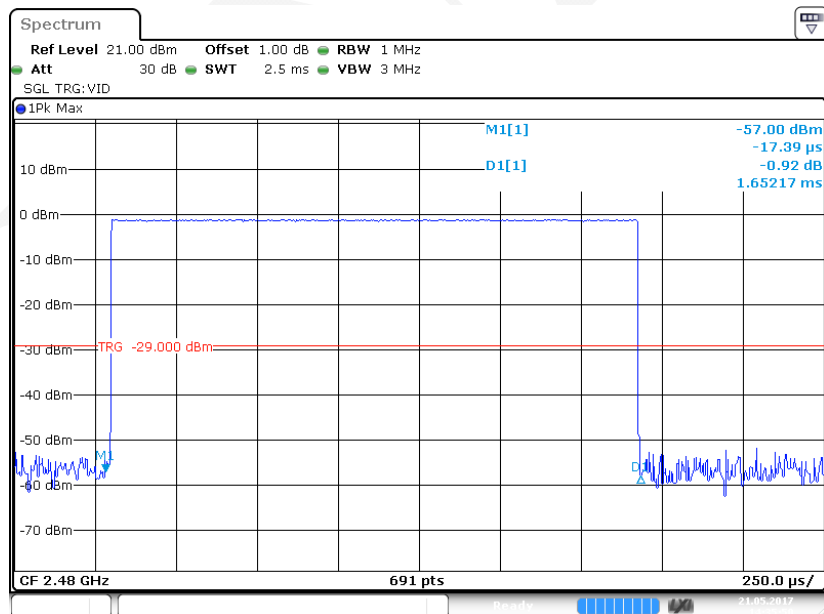
Pulse time, Low Channel, DH3



Date: 21 MAY 2017 14:38:10

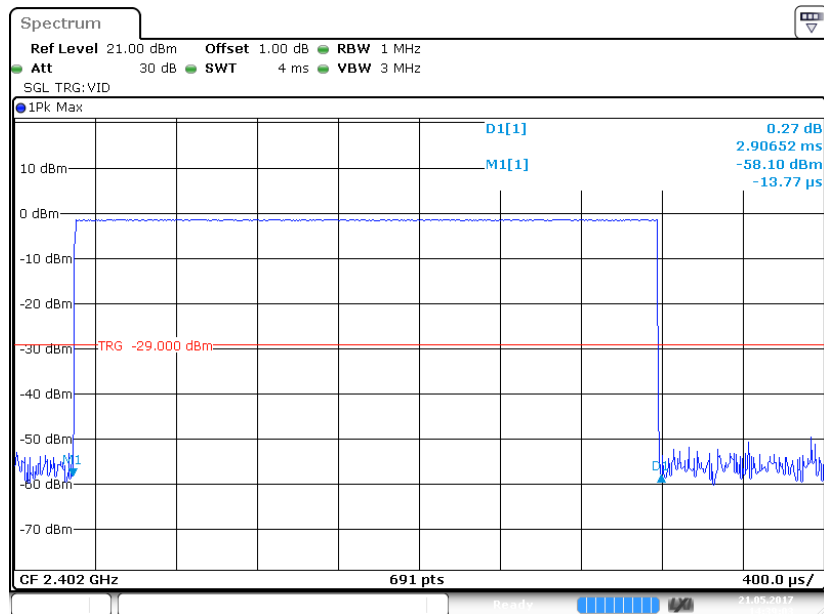
Pulse time, Middle Channel, DH3

Date: 21 MAY 2017 14:37:05

Pulse time, High Channel, DH3

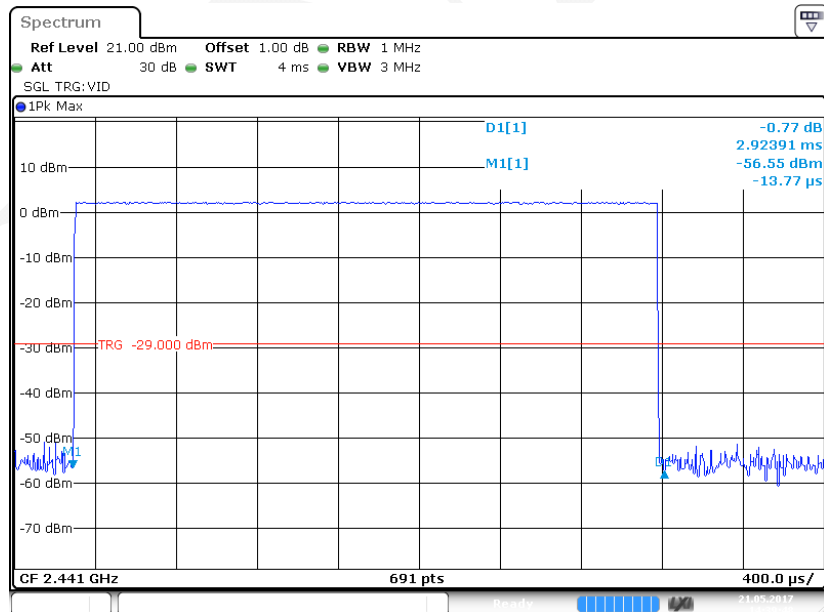
Date: 21 MAY 2017 14:35:50

Pulse time, Low Channel, DH5



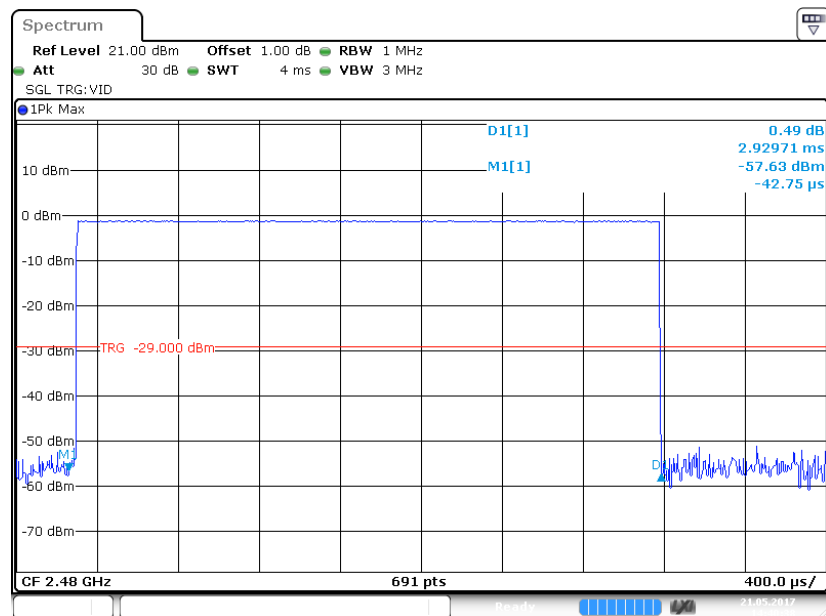
Date: 21 MAY 2017 14:39:33

Pulse time, Middle Channel, DH5



Date: 21 MAY 2017 14:39:49

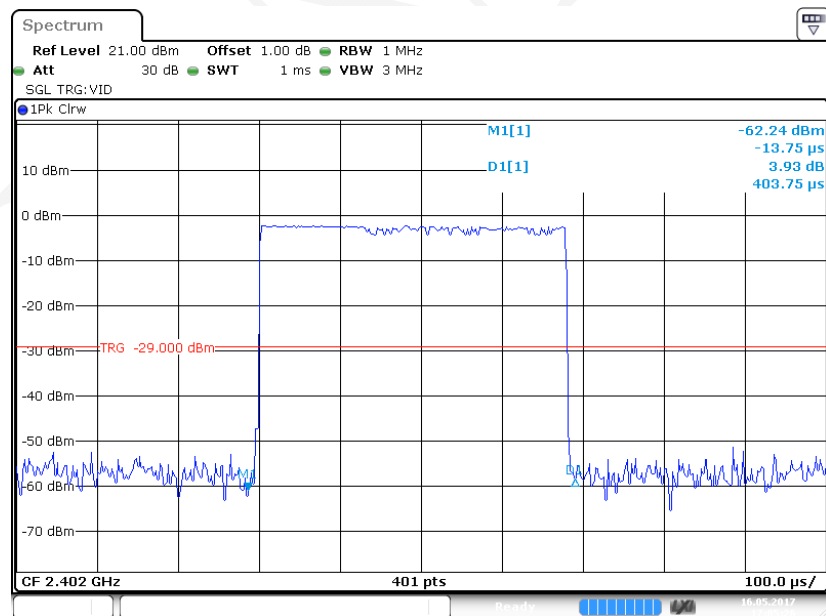
Pulse time, High Channel, DH5



Date: 21 MAY 2017 14:40:39

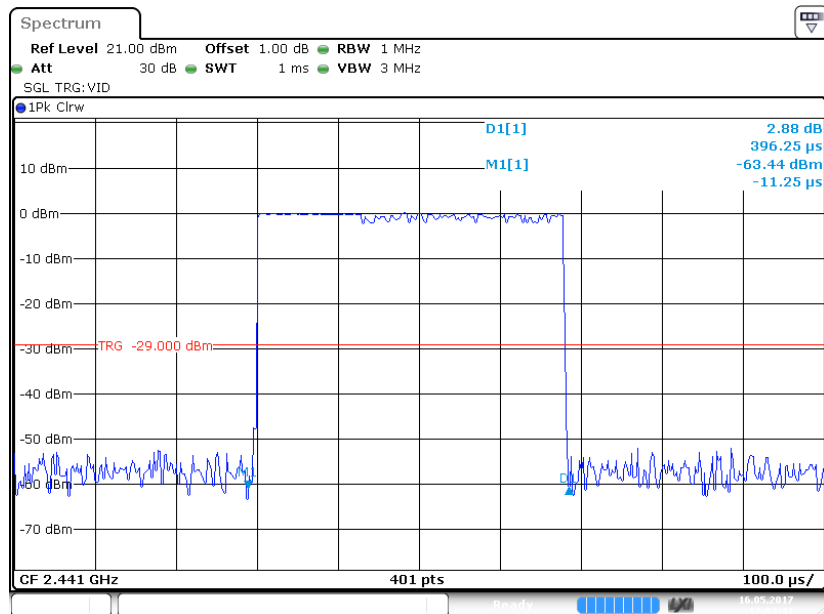
EDR ($\pi/4$ -DQPSK):

Pulse time, Low Channel, 2DH1



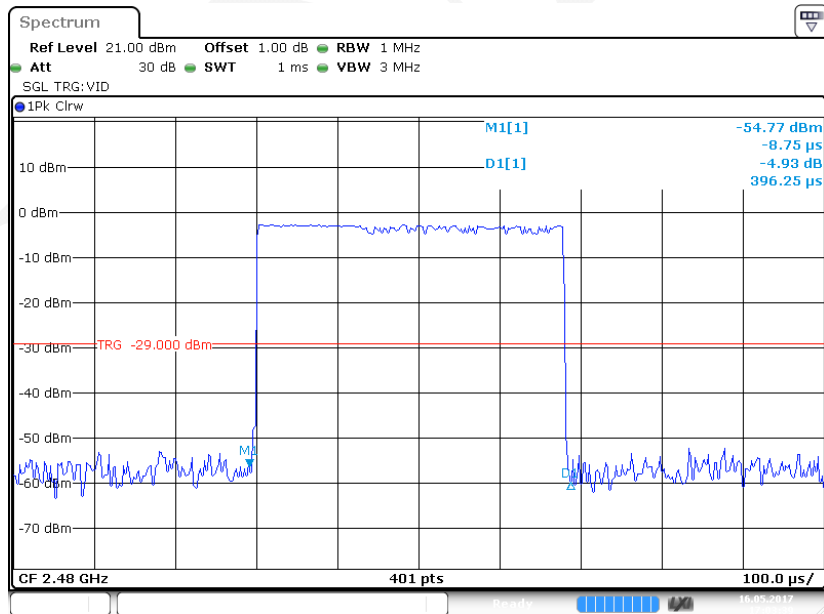
Date: 16 MAY 2017 17:05:26

Pulse time, Middle Channel, 2DH1



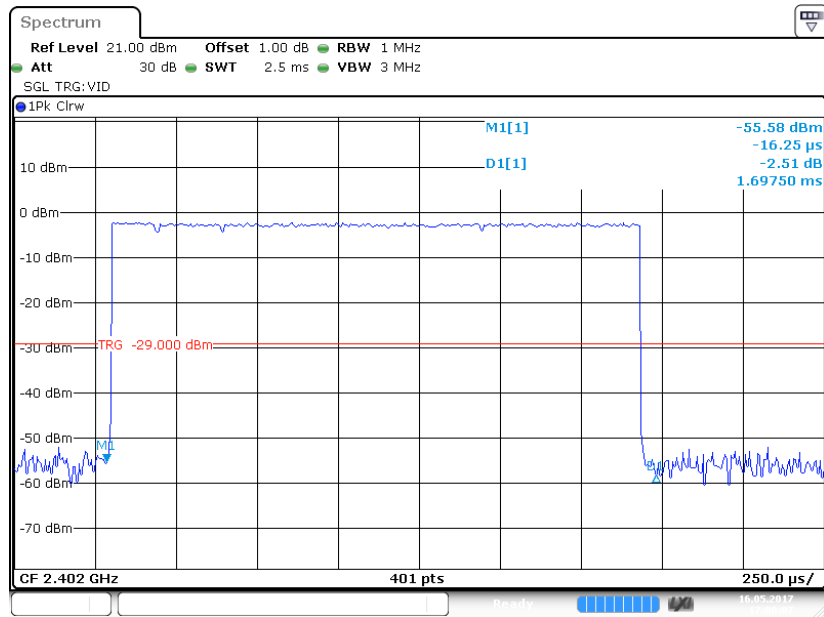
Date: 16 MAY 2017 17:04:41

Pulse time, High Channel, 2DH1

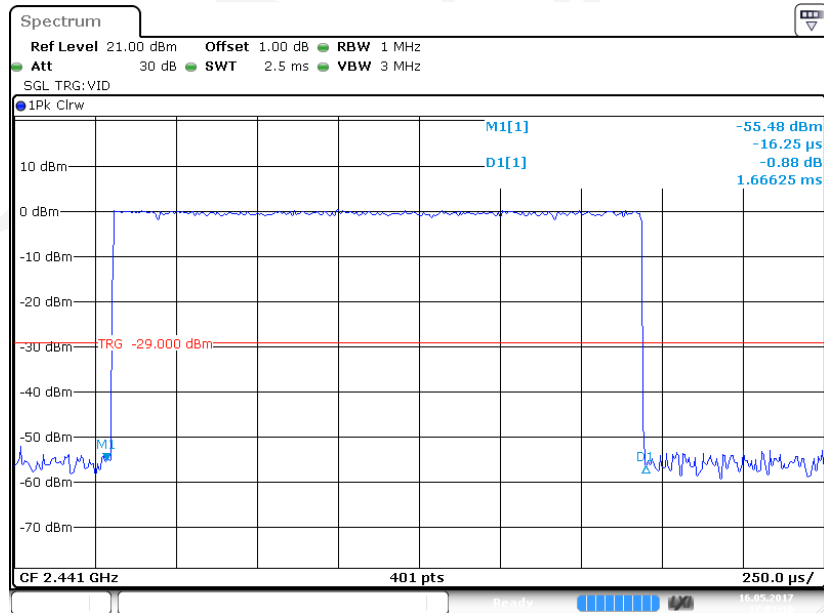


Date: 16 MAY 2017 17:03:39

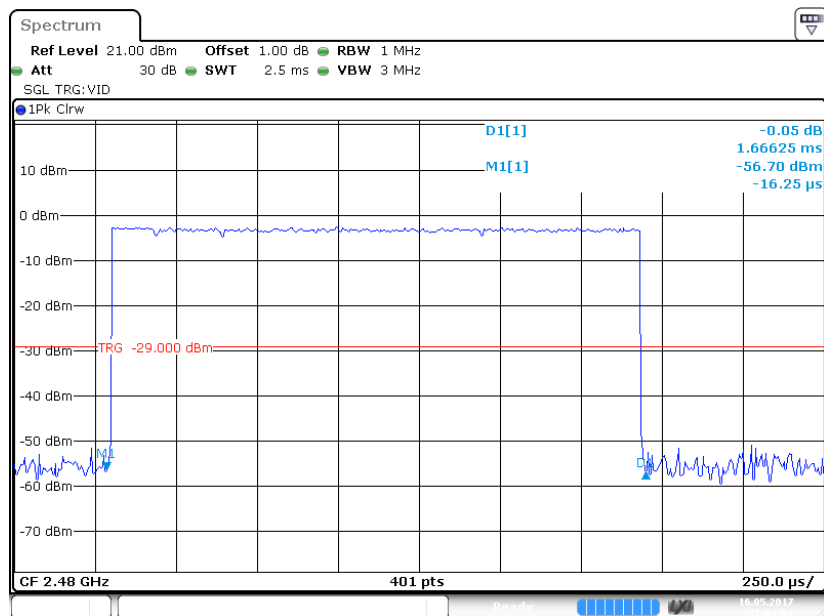
Pulse time, Low Channel, 2DH3



Pulse time, Middle Channel, 2DH3

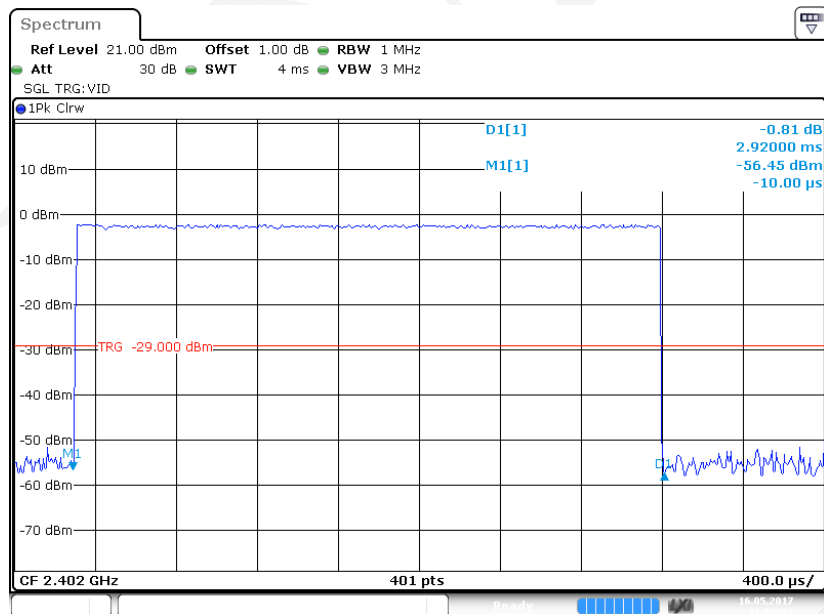


Pulse time, High Channel, 2DH3



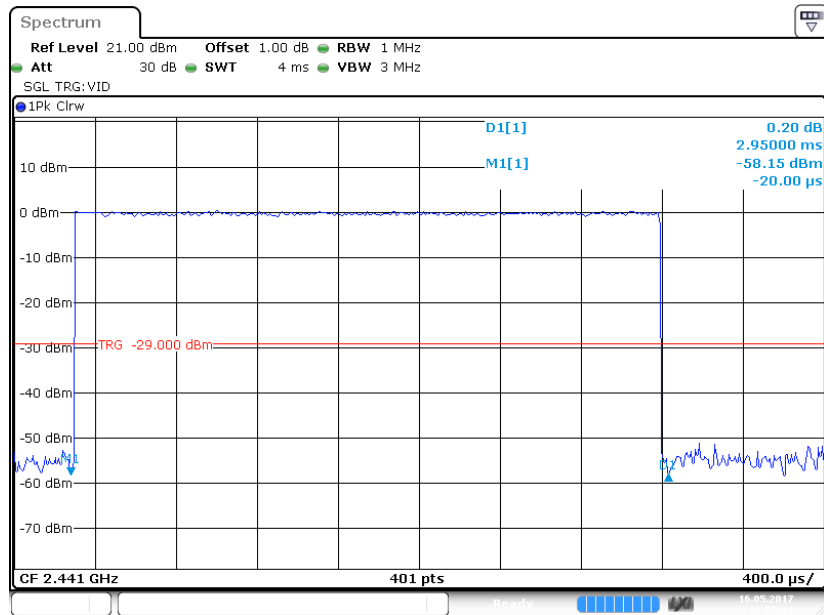
Date: 16 MAY 2017 17:01:51

Pulse time, Low Channel, 2DH5

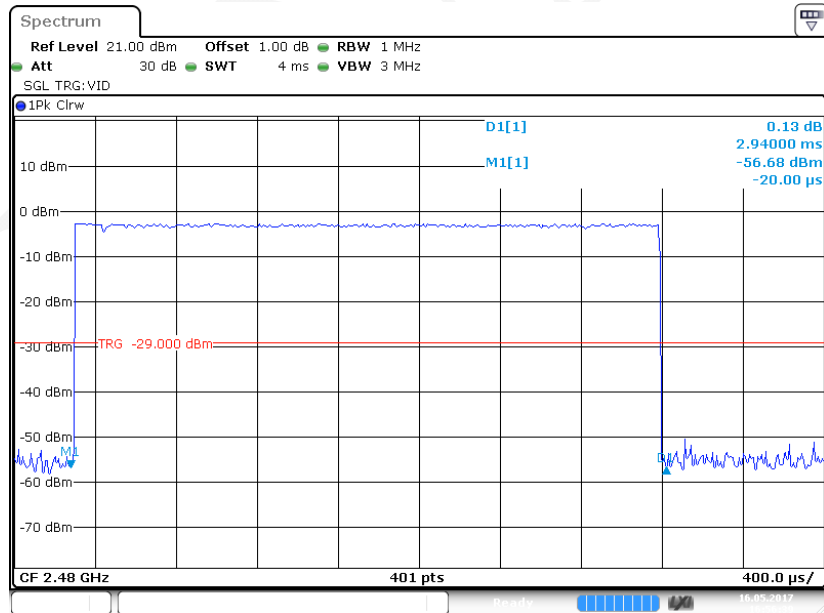


Date: 16 MAY 2017 16:58:39

Pulse time, Middle Channel, 2DH5

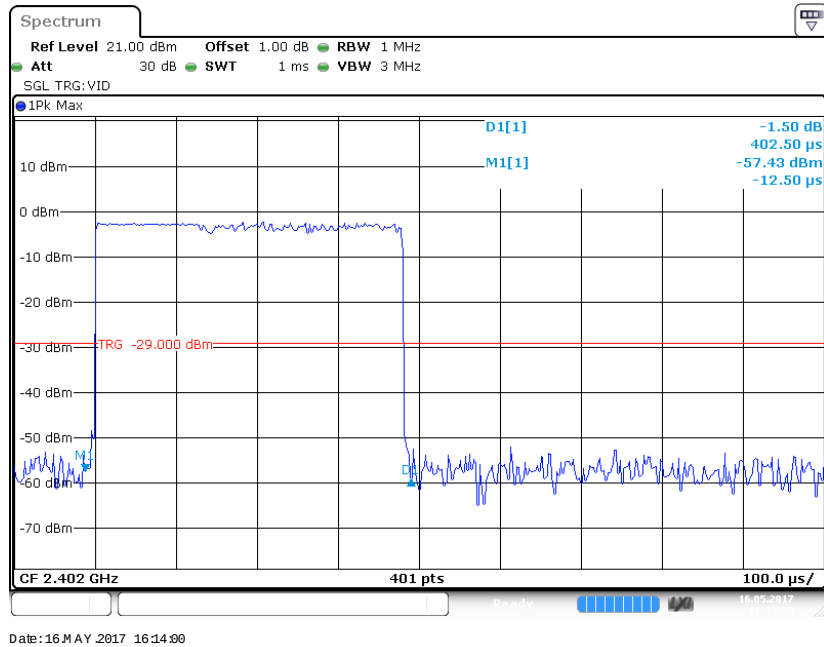


Pulse time, High Channel, 2DH5

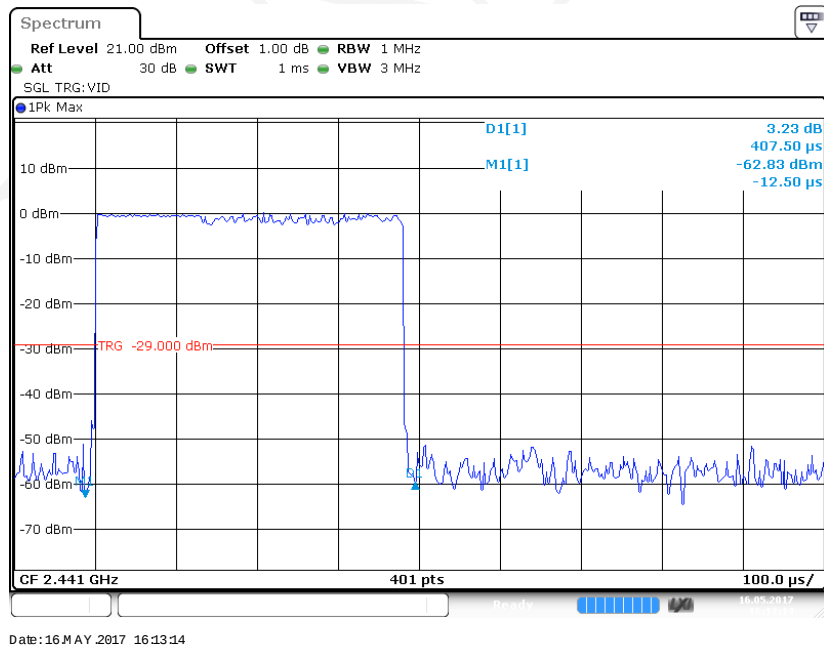


EDR (8-DPSK):

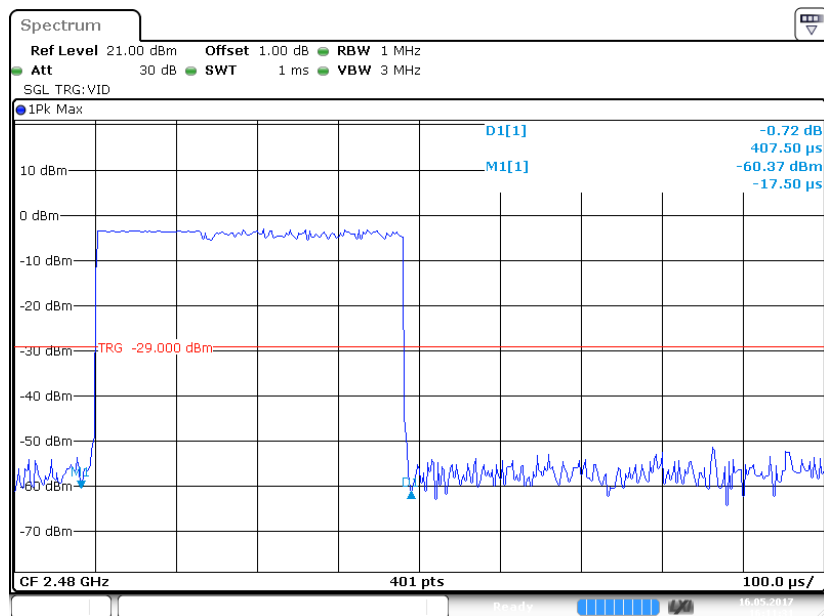
Pulse time, Low Channel, 3DH1



Pulse time, Middle Channel, 3DH1

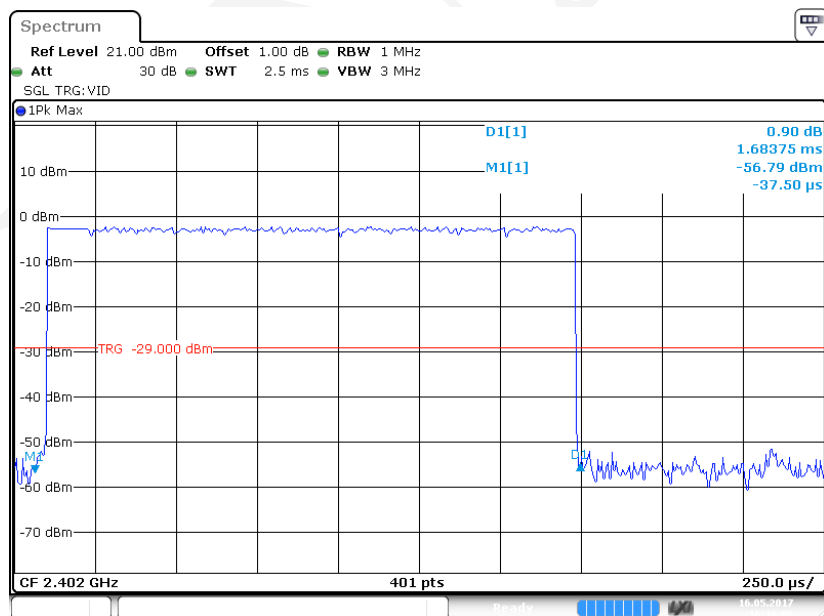


Pulse time, High Channel, 3DH1



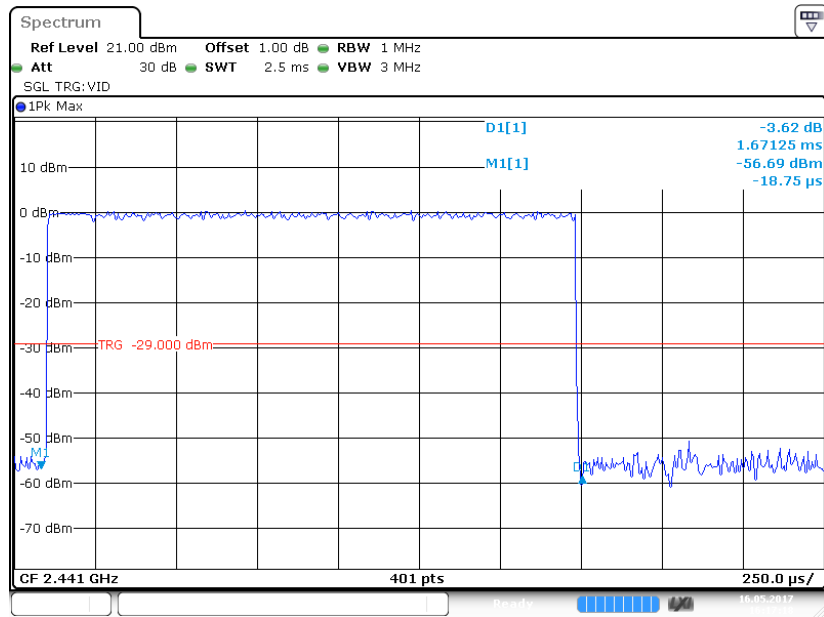
Date: 16 MAY 2017 16:11:31

Pulse time, Low Channel, 3DH3

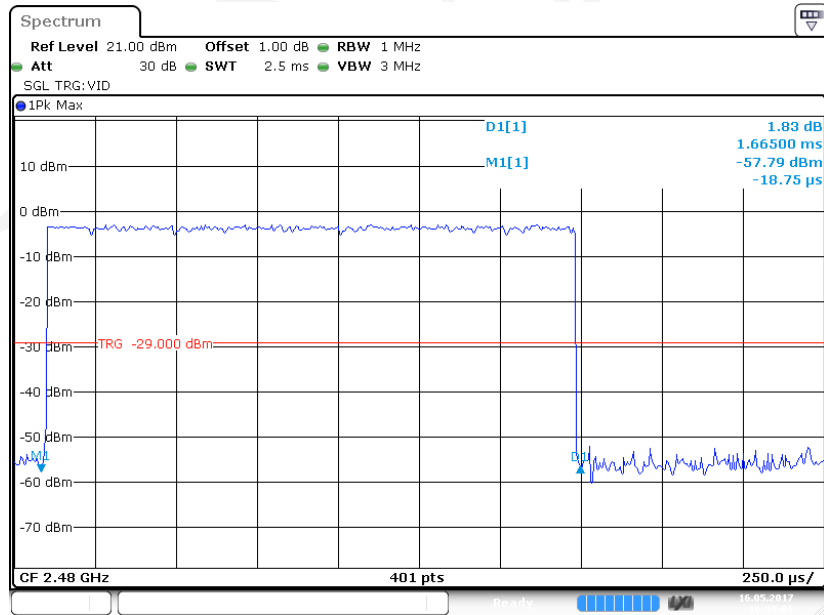


Date: 16 MAY 2017 16:16:36

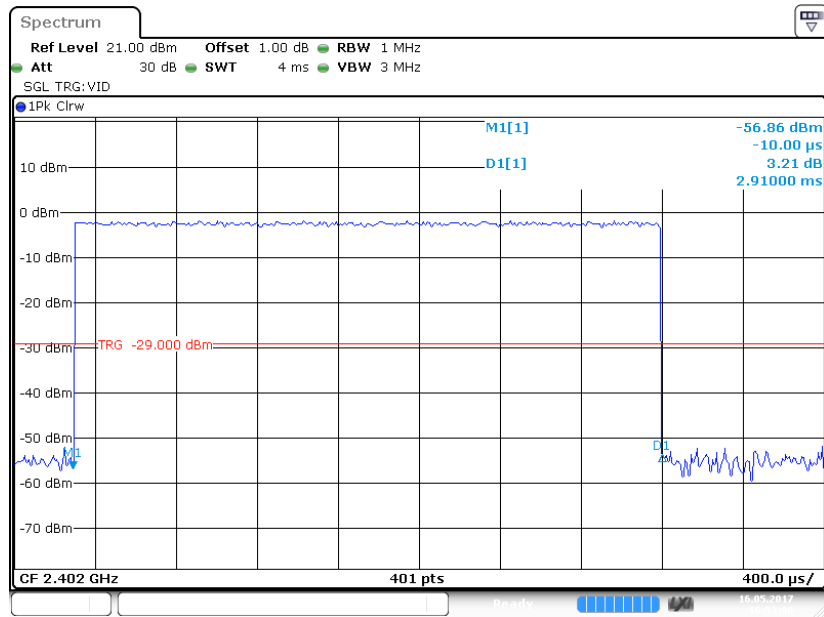
Pulse time, Middle Channel, 3DH3



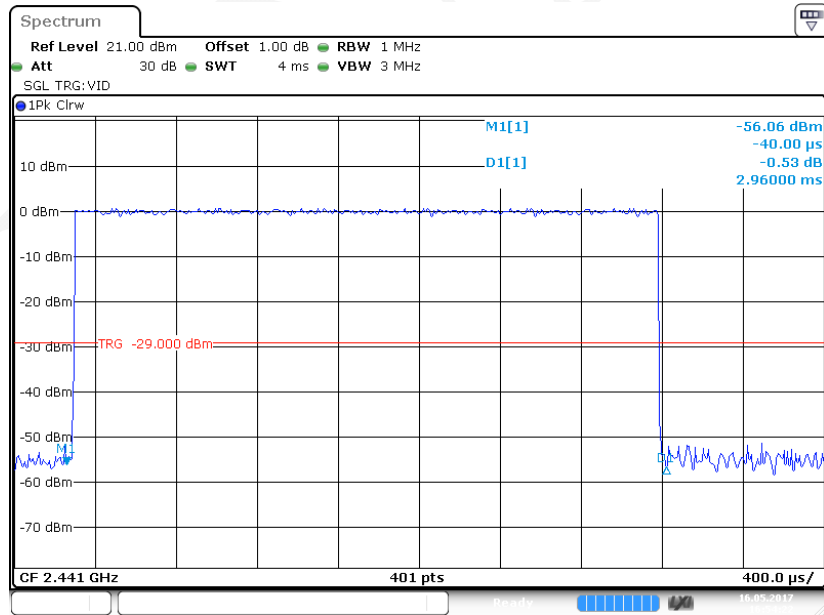
Pulse time, High Channel, 3DH3



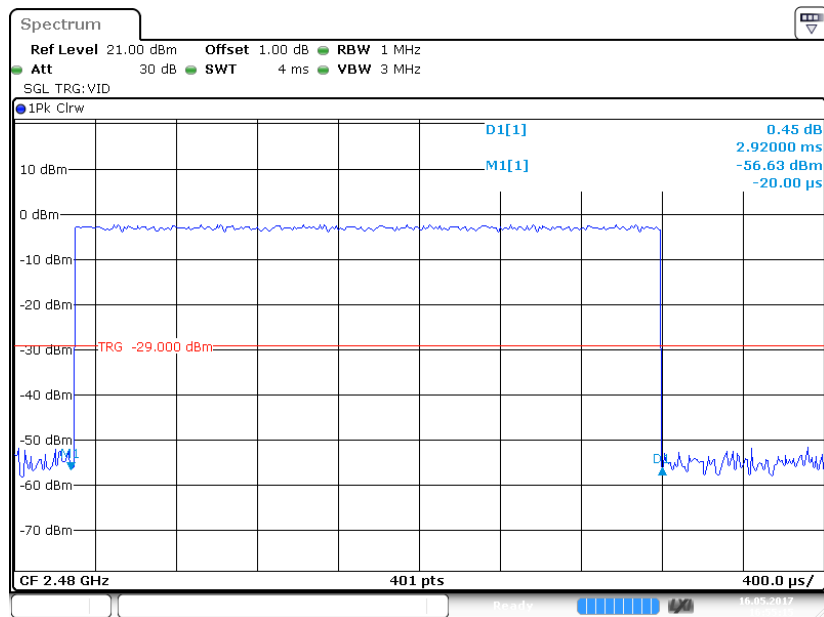
Pulse time, Low Channel, 3DH5



Pulse time, Middle Channel, 3DH5



Pulse time, High Channel, 3DH5



Date: 16 MAY 2017 16:55:15

FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.

Test Data

Environmental Conditions

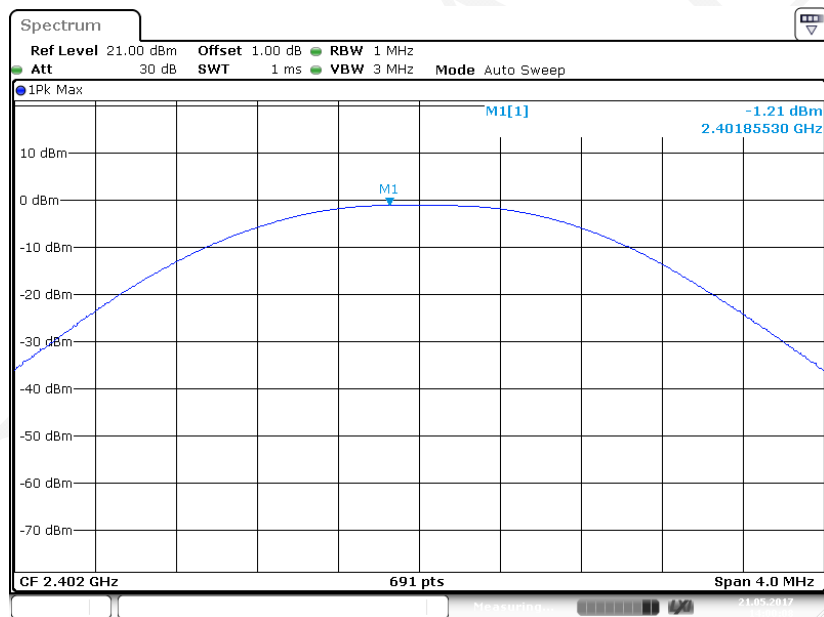
Temperature:	20.2 °C
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

The testing was performed by Ada Yu on 2017-05-16 to 2017-05-21.

EUT operation mode: Transmitting

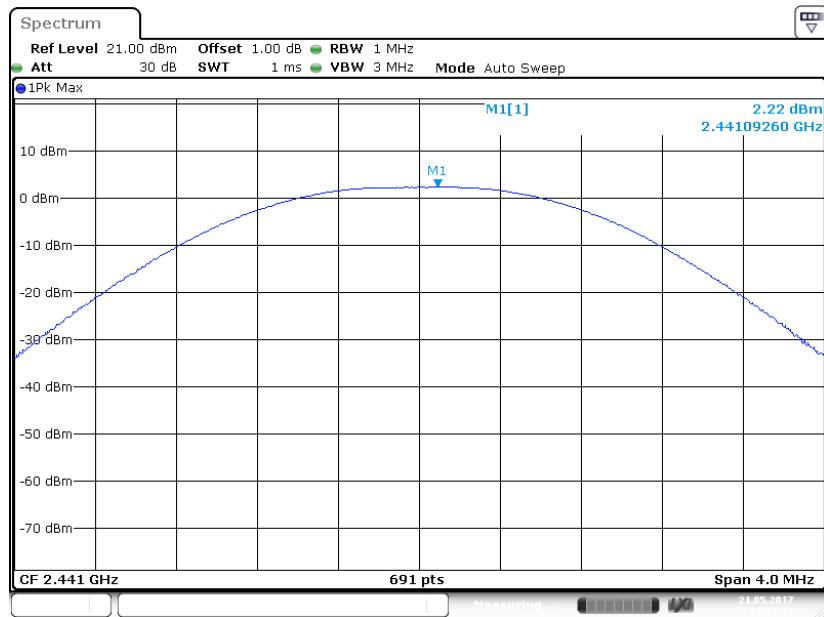
Test Result: Compliance.

Mode	Channel	Frequency (MHz)	Output Power		Limit (mW)
			(dBm)	(mW)	
BDR (GFSK)	Low	2402	-1.21	0.76	1000
	Middle	2441	2.22	1.67	1000
	High	2480	-1.17	0.76	1000
EDR ($\pi/4$-DQPSK)	Low	2402	1.66	1.47	125
	Middle	2441	0.89	1.23	125
	High	2480	-1.75	0.67	125
EDR (8-DPSK)	Low	2402	-1.52	0.70	125
	Middle	2441	1.00	1.26	125
	High	2480	-2.07	0.62	125

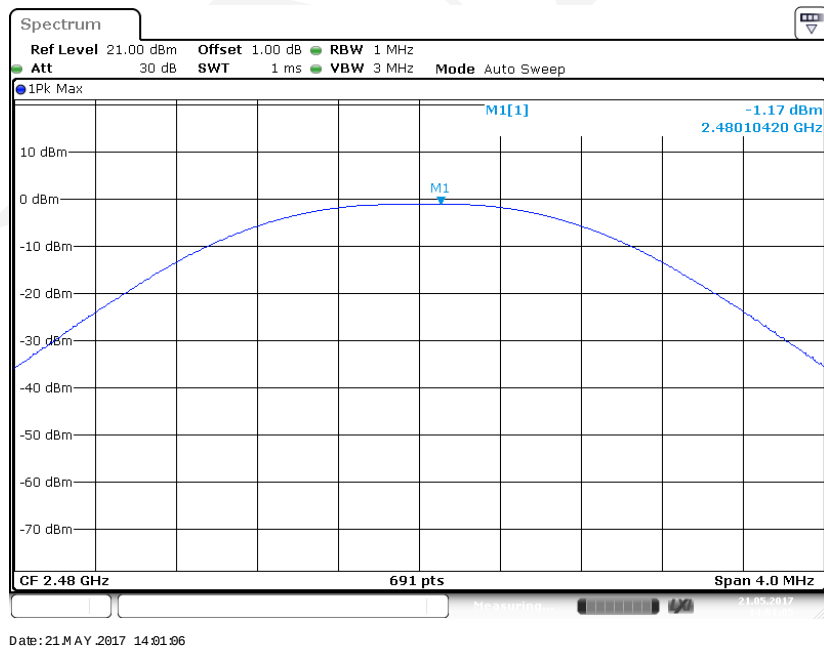
BDR (GFSK): Low Channel

Date: 21.MAY.2017 14:00:08

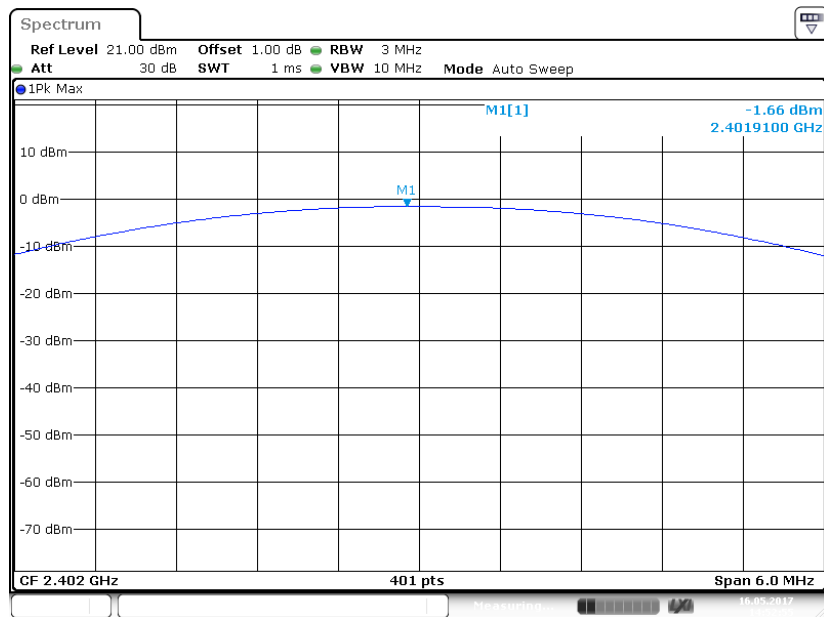
BDR (GFSK): Middle Channel



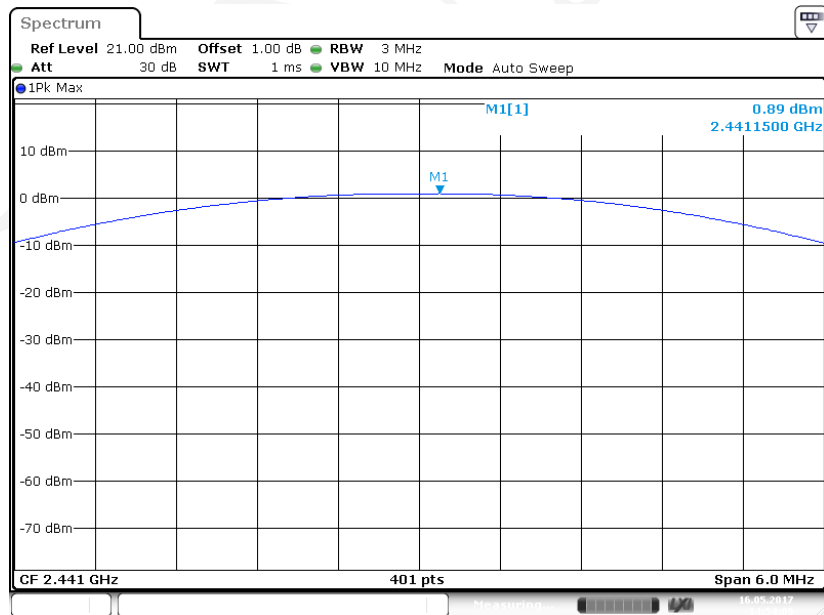
BDR (GFSK): High Channel



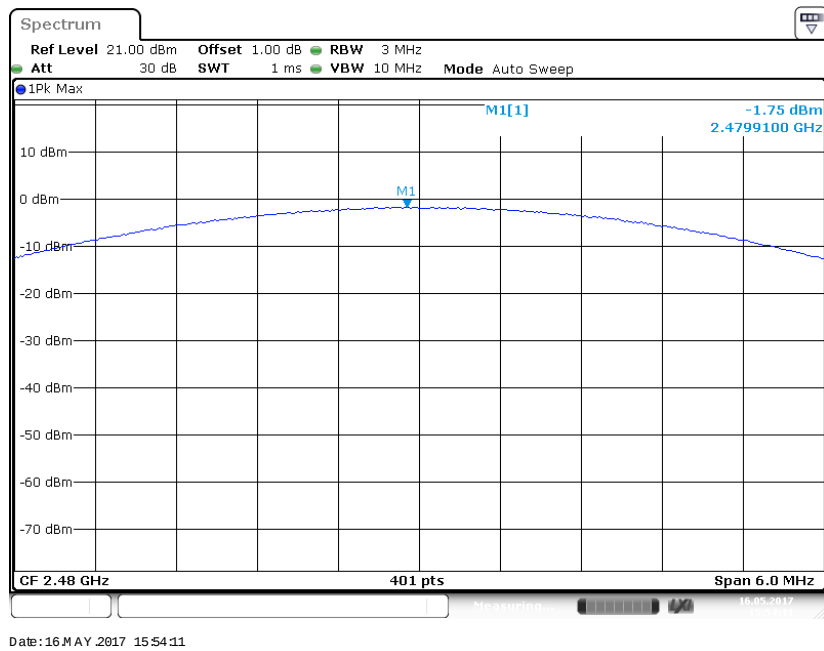
EDR($\pi/4$ -DQPSK): Low Channel



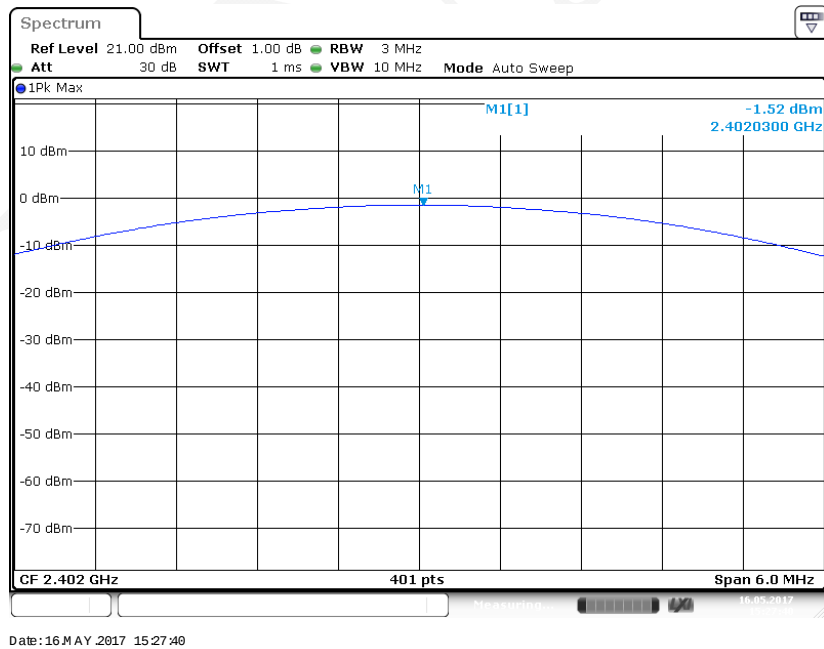
EDR($\pi/4$ -DQPSK): Middle Channel



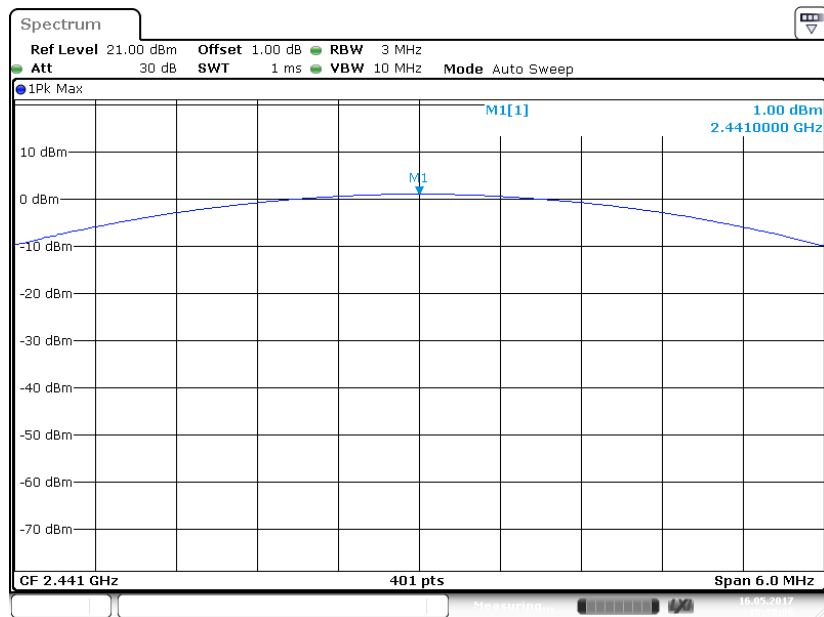
EDR($\pi/4$ -DQPSK): High Channel



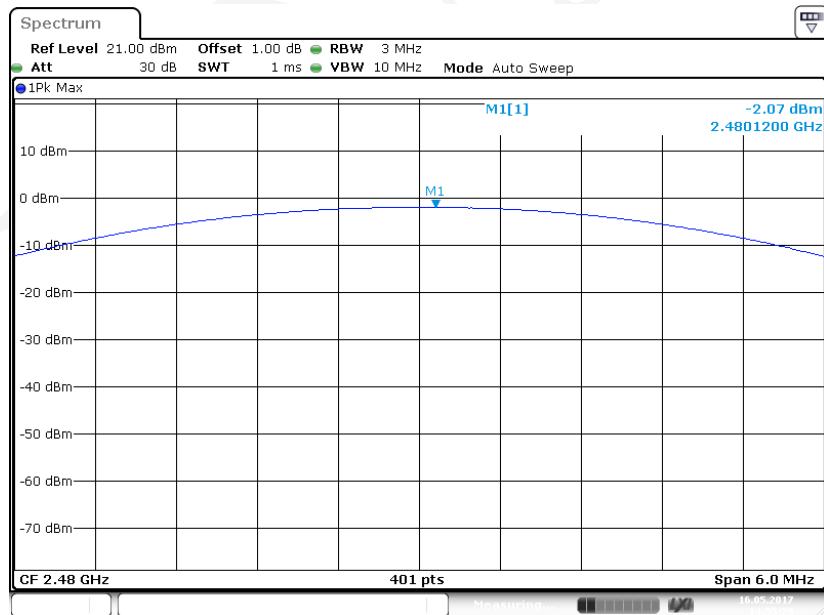
EDR(8-DPSK): Low Channel



EDR(8-DPSK): Middle Channel



EDR(8-DPSK): High Channel



FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Data

Environmental Conditions

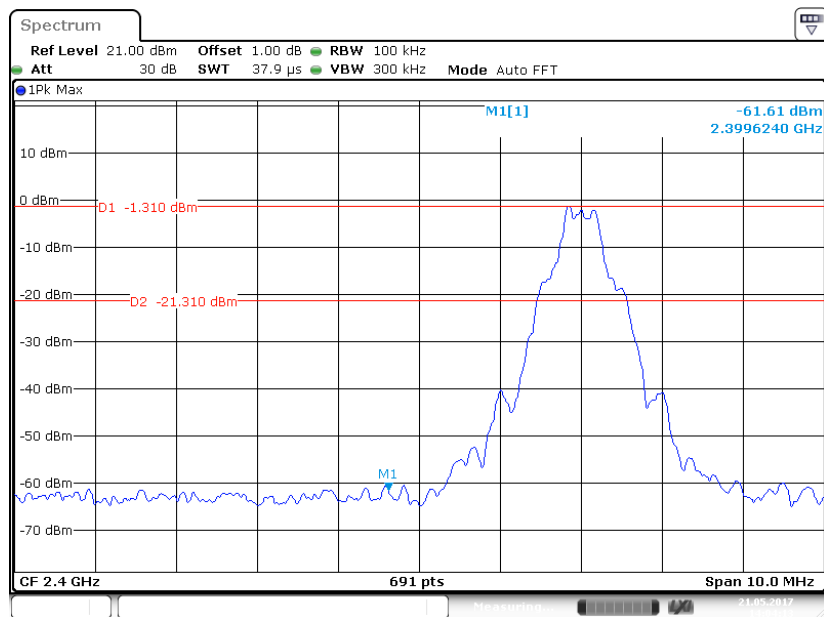
Temperature:	20.2 °C
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

The testing was performed by Ada Yu on 2017-05-21 to 2017-06-19.

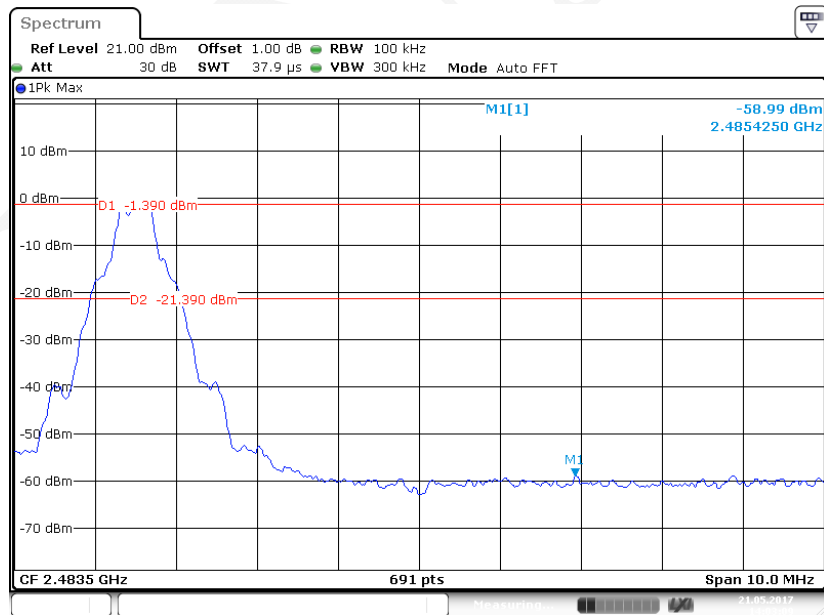
EUT operation mode: Transmitting

Test Result: Compliance.

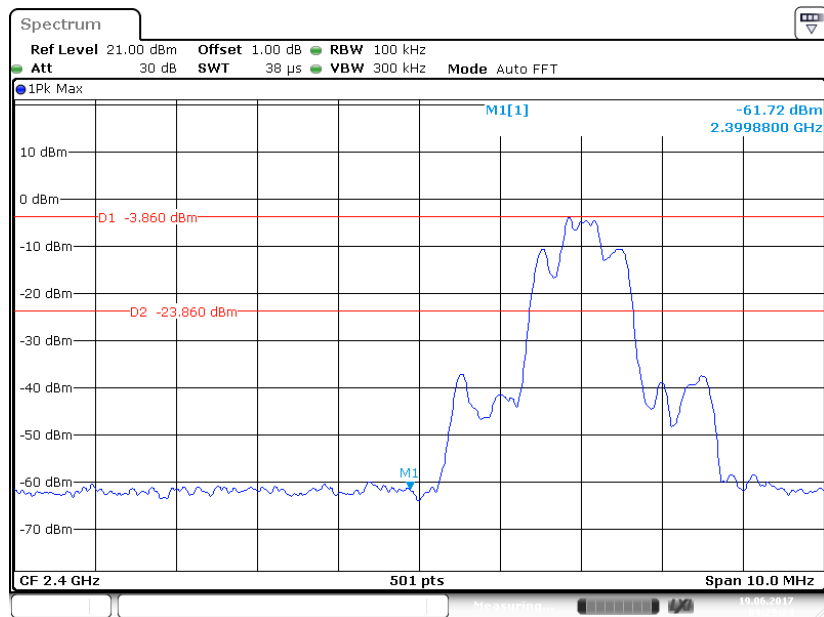
BDR (GFSK): Band Edge-Left Side



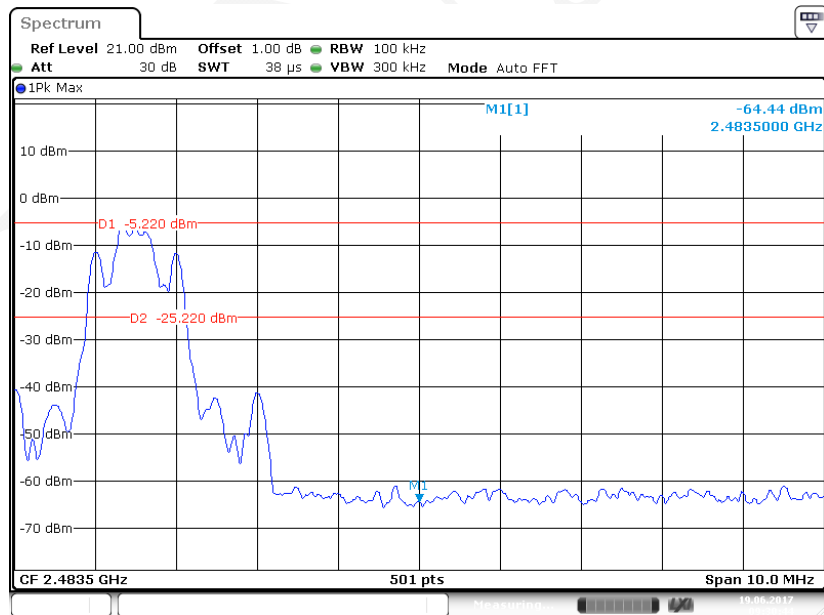
BDR (GFSK): Band Edge-Right Side



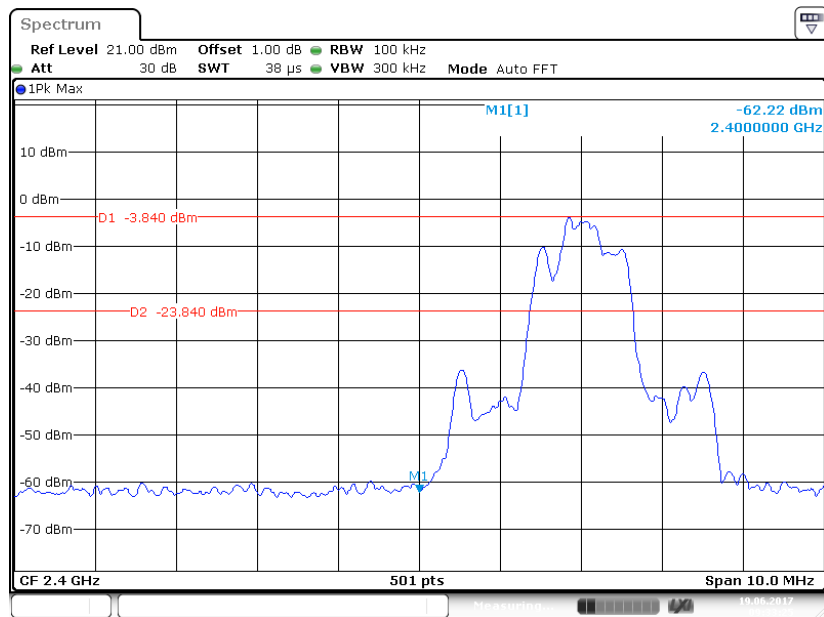
EDR ($\pi/4$ -DQPSK): Band Edge-Left Side



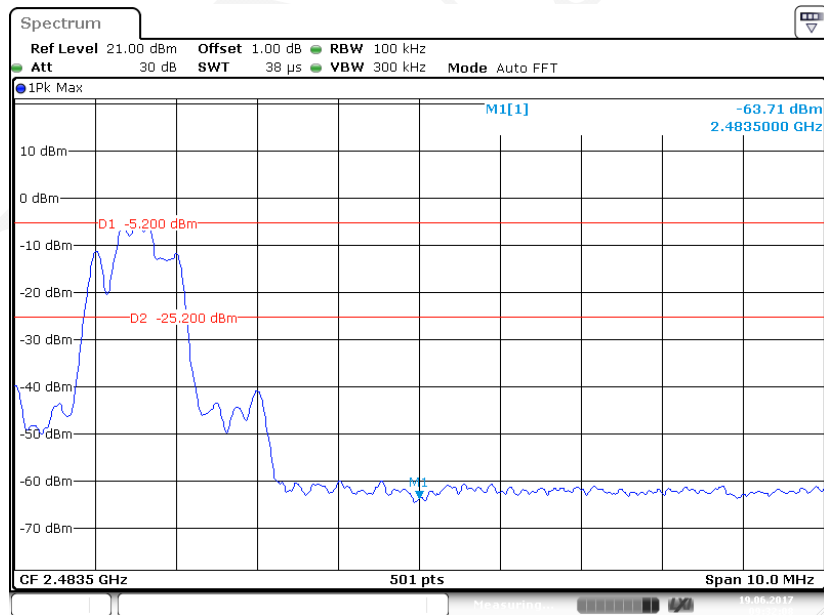
EDR ($\pi/4$ -DQPSK): Band Edge-Right Side

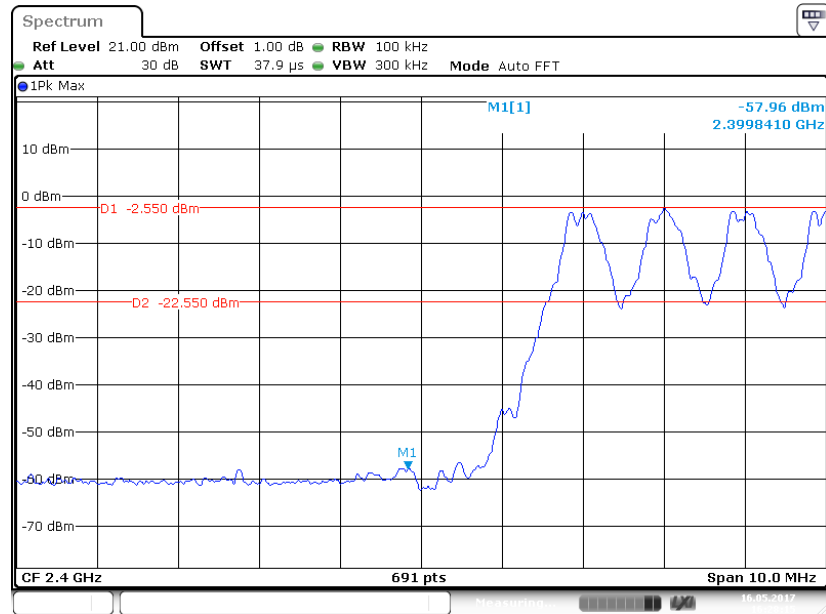


EDR (8-DPSK): Band Edge-Left Side

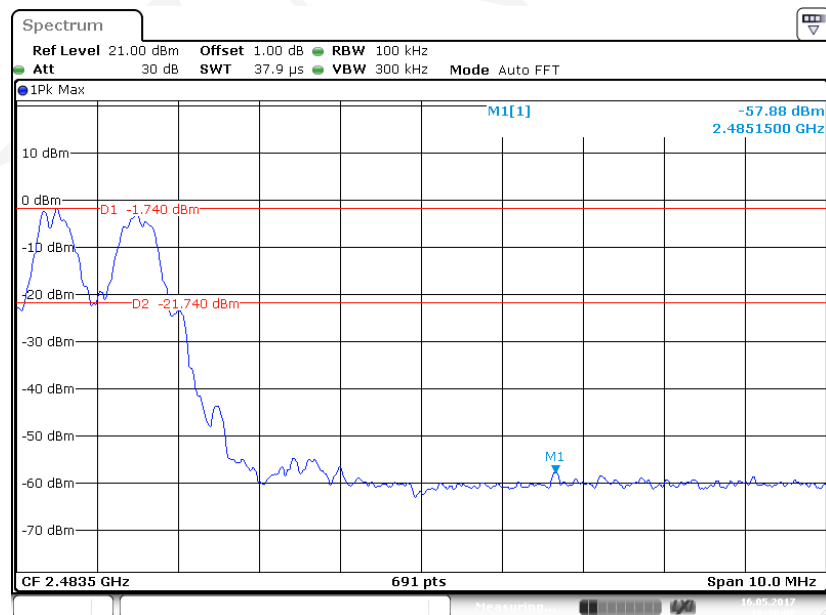


BDR (8-DPSK): Band Edge-Right Side

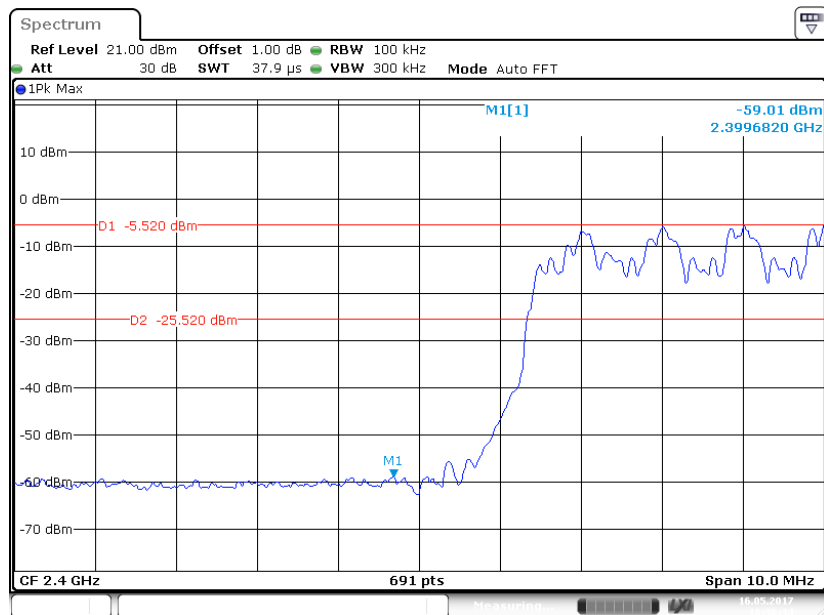
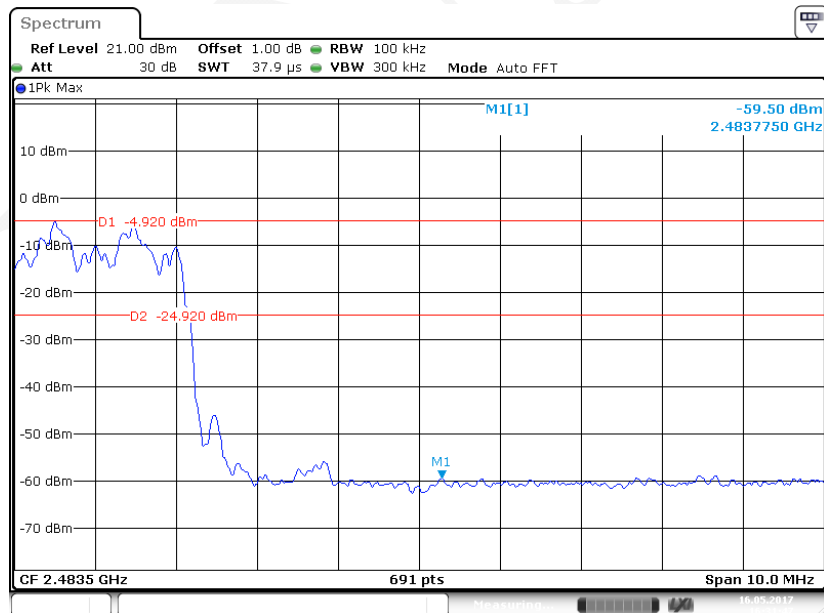


Band Edge-Hopping**BDR (GFSK): Left Side**

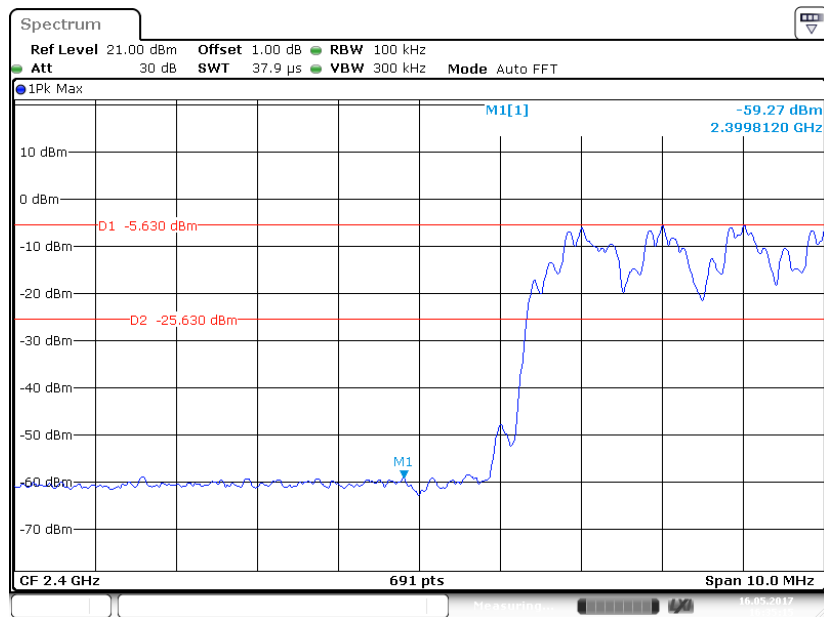
Date: 16 MAY 2017 16:28:15

BDR (GFSK): Right Side

Date: 16 MAY 2017 16:30:08

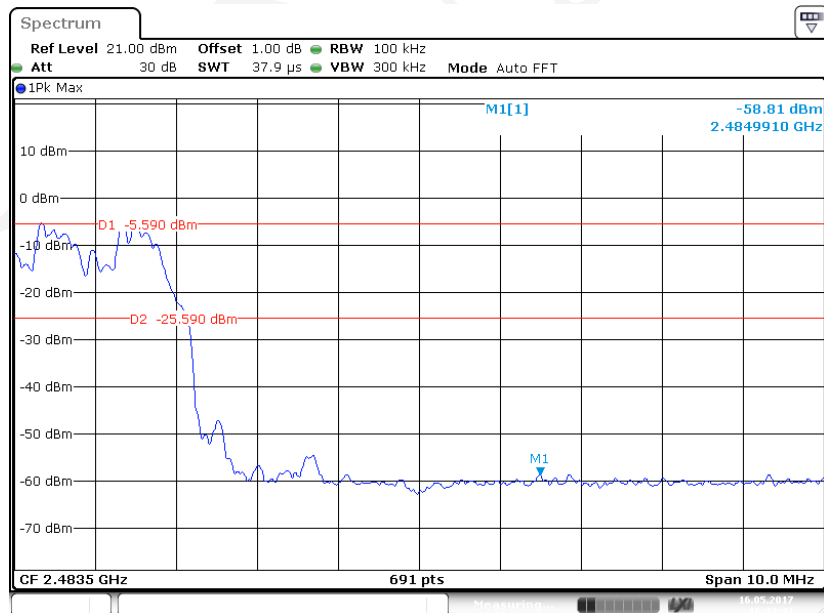
EDR ($\pi/4$ -DQPSK): Left SideEDR ($\pi/4$ -DQPSK): Right Side

EDR (8-DPSK): Left Side



Date: 16 MAY 2017 16:35:15

BDR (8-DPSK): Right Side



Date: 16 MAY 2017 16:33:41

***** END OF REPORT *****