FCC PART 15.247
TEST REPORT

For

Shanghai Huace Navigation Technology LTD.

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

FCC ID: SY4-B01008

Report Type:	**Product Type:**
Original Report	Data Collector

Test Engineer:	Chris Wang
Report Number:	RKS170217001-00B
Report Date:	2017-03-29
Reviewed By:	Oscar Ye RF Leader
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Shanghai Huace Navigation Technology LTD.
Tested Model	LT600
Series Model	LT600 WXYZ (WXYZ= 0-9, a-z)
Product Type	Data Collector
Dimension	235mm(L)×138 mm(W)×30 mm(H)
Power Supply	DC 3.8V from rechargeable battery or DC 5.0V form adapter

Adapter Information:
Model: EA1012AVRU-050
INPUT: 100-240Vac, 50/60Hz, 1.0A
OUTPUT: 5V, 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: 20170122001. (Assigned by the BACL. The EUT supplied by the applicant was received on 2017-01-22)*

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 Part 15B JBP, Part 15.247 DTS & Part 22H/27 TNB submissions with FCC ID: SY4-B01008.

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 and DA 00-705 March 30, 2000.

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
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The test site A 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

The system was configured for testing in an engineering mode which was controlled by the software.

EUT Exercise Software

The EUT tested in engineering mode.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

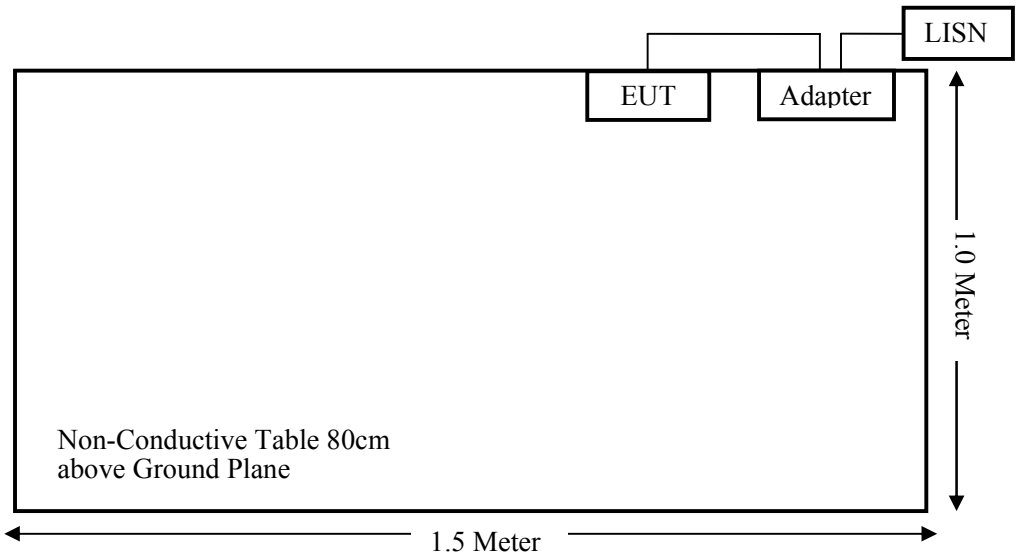
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

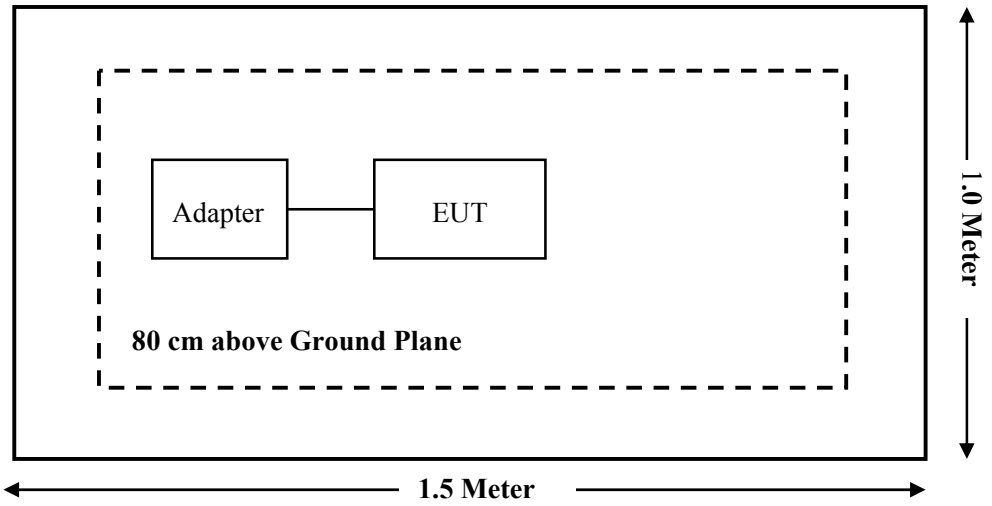
Cable Description	Shielding Type	Length (m)	From Port	To
USB Cable	Un-Shielding	0.8	EUT	Adapter

Block Diagram of Test Setup

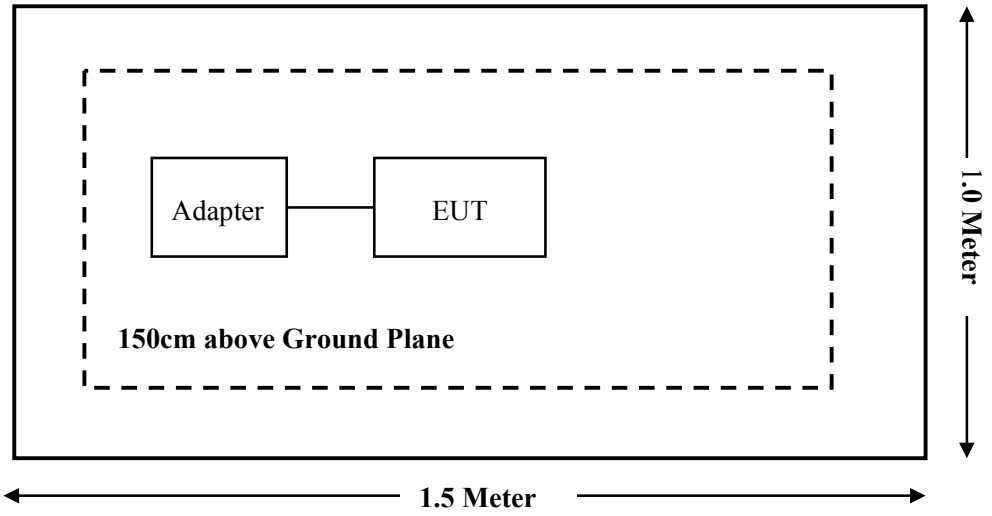
For Conducted Emissions:



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	2016-10-18	2019-10-17
Sonoma Instrunent	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	/	/	2017-02-14	2018-02-13
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	834115/007	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§2.1093and §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:
[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR

- f(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 Average power	Conducted Average power	Minimum test separation distance required for the exposure conditions
	(MHz)	(dBm)	(mW)	(mm)
BT	2402-2480	3.00	2.00	5.00

Note: Turn up power:

BDR: 2±1 dBm,
EDR: 0.5±1.5 dBm
which are declared by the manufacturer.

Result: [(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]
- [√ f(GHz)]= 2/5* √ 2.48= **0.63 <3.0**. So no SAR test is needed.

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 0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

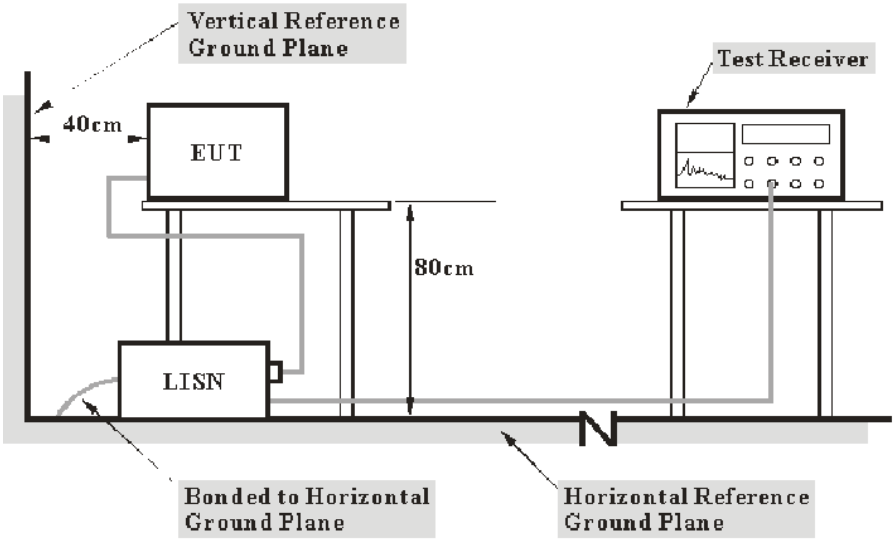
Result: Compliance.

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:

Correction Factor = LISN VDF + Cable Loss + 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:

Margin = Limit – Corrected Amplitude

Test Results Summary

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

Test Data

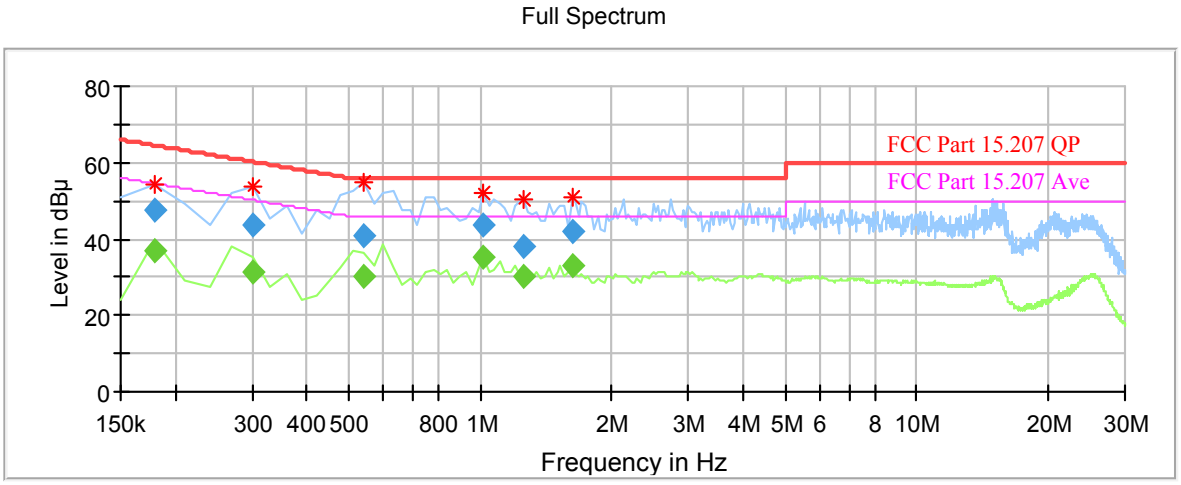
Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	56 %
ATM Pressure:	101.3 kPa

The testing was performed by Chris Wang on 2017-02-14.

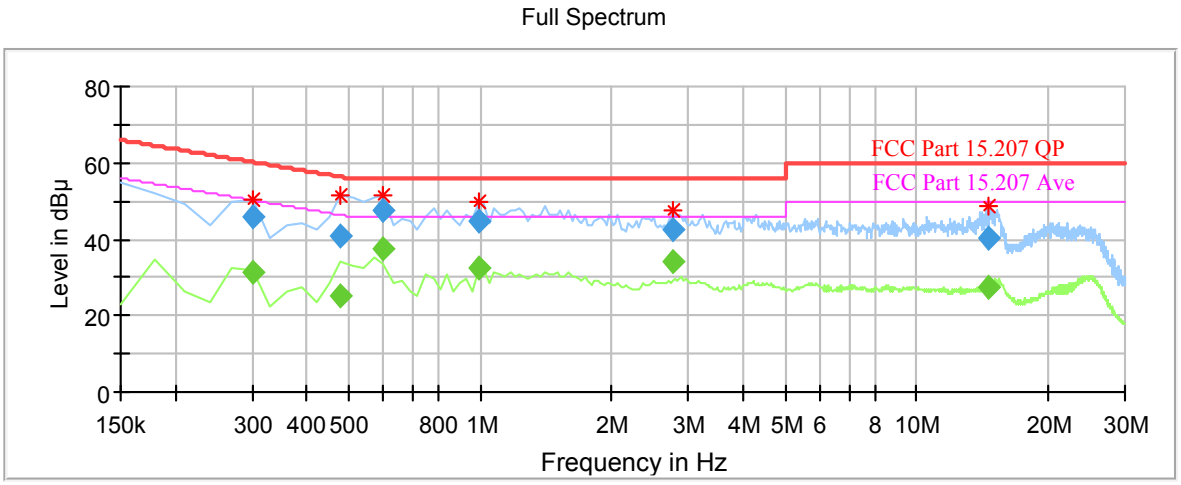
EUT operation mode: Transmitting in middle channel of GFSK(Worst case)

AC 120V/60 Hz, Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.180000	---	36.84	9.000	L1	10.0	17.65	54.49	Compliance
0.180000	47.65	---	9.000	L1	10.0	16.84	64.49	Compliance
0.300000	---	31.39	9.000	L1	10.0	18.85	50.24	Compliance
0.300000	43.53	---	9.000	L1	10.0	16.71	60.24	Compliance
0.540000	---	30.25	9.000	L1	10.1	15.75	46.00	Compliance
0.540000	40.74	---	9.000	L1	10.1	15.26	56.00	Compliance
1.020000	---	35.38	9.000	L1	9.9	10.62	46.00	Compliance
1.020000	43.60	---	9.000	L1	9.9	12.40	56.00	Compliance
1.260000	---	30.32	9.000	L1	9.9	15.68	46.00	Compliance
1.260000	38.14	---	9.000	L1	9.9	17.86	56.00	Compliance
1.620000	---	32.91	9.000	L1	9.9	13.09	46.00	Compliance
1.620000	42.11	---	9.000	L1	9.9	13.89	56.00	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.300000	---	31.12	9.000	N	10.1	19.12	50.24	Compliance
0.300000	46.08	---	9.000	N	10.1	14.16	60.24	Compliance
0.480000	---	25.25	9.000	N	10.1	21.09	46.34	Compliance
0.480000	40.80	---	9.000	N	10.1	15.54	56.34	Compliance
0.600000	---	37.27	9.000	N	10.0	8.73	46.00	Compliance
0.600000	47.50	---	9.000	N	10.0	8.50	56.00	Compliance
0.990000	---	32.57	9.000	N	9.9	13.43	46.00	Compliance
0.990000	44.57	---	9.000	N	9.9	11.43	56.00	Compliance
2.760000	---	34.11	9.000	N	9.9	11.89	46.00	Compliance
2.760000	42.48	---	9.000	N	9.9	13.52	56.00	Compliance
14.610000	---	27.33	9.000	N	10.0	22.67	50.00	Compliance
14.610000	40.55	---	9.000	N	10.0	19.45	60.00	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

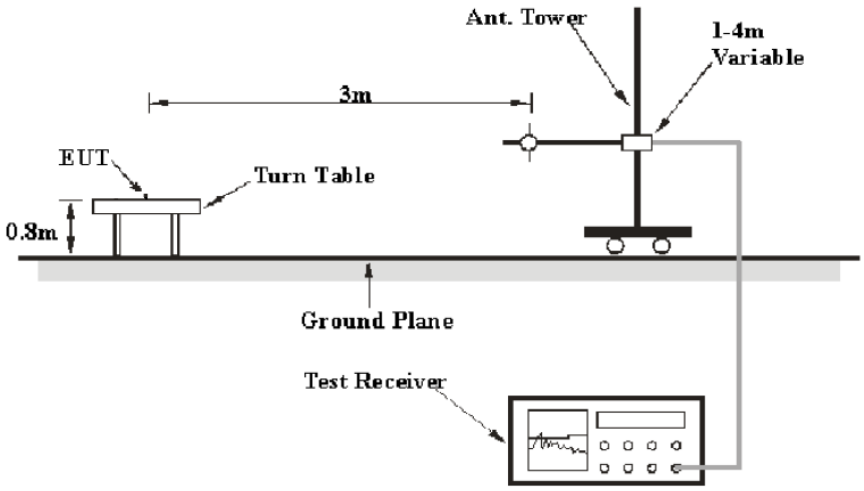
FCC §15.205; §15.209; §15.247(d)

Measurement Uncertainty

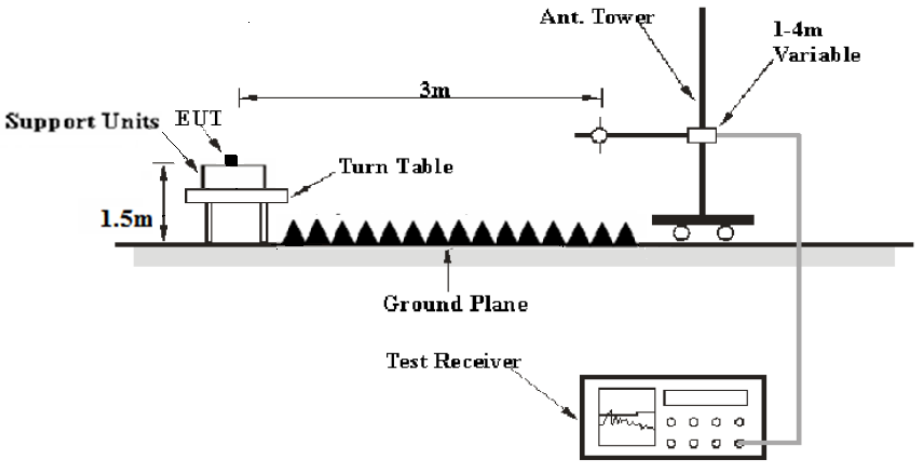
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency 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	RBW	Video B/W	Detector
1GHz – 25GHz	1MHz	3 MHz	PK
	1MHz	10 Hz	Ave.

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 and Average detection modes 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:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - 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:

Margin = Limit – 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:	22 ℃
Relative Humidity:	56 %
ATM Pressure:	101.3 kPa

The testing was performed by Chris Wang on 2017-02-14.

EUT operation mode: Transmitting

30MH -25 GHz: *(Scan with GFSK, π/4-DQPSK, 8-DPSK mode, the worst case is BDR Mode (GFSK))*

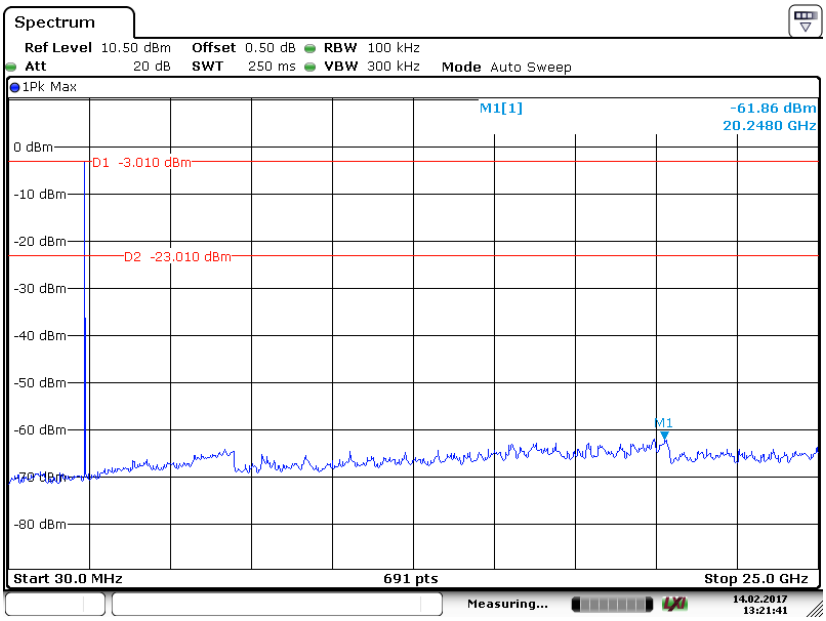
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2402 MHz)									
30.09	24.22	QP	222	199	V	0.6	24.82	40.00	15.18
43.26	26.57	QP	71	101	V	-5.2	21.37	40.00	18.63
2402.00	104.59	PK	224	227	V	-6.19	98.40	/	/
2402.00	86.11	Ave	249	227	V	-6.19	79.92	/	/
2402.00	97.42	PK	24	205	H	-6.19	91.23	/	/
2402.00	78.83	Ave	125	205	H	-6.19	72.64	/	/
2390.00	57.56	PK	166	243	V	-6.22	51.34	74.00	22.66
2390.00	43.69	Ave	215	243	V	-6.22	37.47	54.00	16.53
2400.00	70.56	PK	338	149	V	-6.19	64.37	74.00	9.63
2400.00	57.00	Ave	168	149	V	-6.19	50.81	54.00	3.19
1140.28	46.13	PK	276	149	V	-11.61	34.52	74.00	39.48
1140.28	32.42	Ave	128	149	V	-11.61	20.81	54.00	33.19
4804.00	43.42	PK	63	182	V	1.61	45.03	74.00	28.97
4804.00	29.39	Ave	159	182	V	1.61	31.00	54.00	23.00
7206.00	39.58	PK	36	118	H	7.55	47.13	74.00	26.87
7206.00	25.59	Ave	238	118	H	7.55	33.14	54.00	20.86

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (cm)	Polar (H/V)			Limit (dB μ V/m)	Margin (dB)
Middle Channel (2441 MHz)									
30.09	24.44	QP	157	132	V	0.6	25.04	40.00	14.96
43.26	27.95	QP	259	187	V	-5.2	22.75	40.00	17.25
2441.00	104.62	PK	175	241	V	-6.10	98.52	/	/
2441.00	85.74	Ave	159	167	V	-6.10	79.64	/	/
2441.00	98.86	PK	199	170	H	-6.10	92.76	/	/
2441.00	80.52	Ave	259	159	H	-6.10	74.42	/	/
1140.28	45.25	PK	231	172	V	-11.61	33.64	74.00	40.36
1140.28	32.42	Ave	158	183	V	-11.61	20.81	54.00	33.19
4773.55	42.61	PK	15	102	V	1.54	44.15	74.00	29.85
4773.55	30.02	Ave	25	159	V	1.54	31.56	54.00	22.44
4882.00	46.67	PK	60	170	V	1.79	48.46	74.00	25.54
4882.00	31.69	Ave	95	154	V	1.79	33.48	54.00	20.52
6961.92	42.76	PK	135	216	H	7.23	49.99	74.00	24.01
6961.92	29.39	Ave	257	217	H	7.23	36.62	54.00	17.38
7323.00	39.07	PK	30	120	H	7.67	46.74	74.00	27.26
7323.00	25.59	Ave	58	214	H	7.67	33.26	54.00	20.74
High Channel (2480MHz)									
30.09	24.19	QP	187	182	V	0.6	24.79	40.00	15.21
43.26	26.53	QP	329	105	V	-5.2	21.33	40.00	18.67
2480.00	104.65	PK	269	158	V	-6.01	98.64	/	/
2480.00	86.11	Ave	25	187	V	-6.01	80.10	/	/
2480.00	98.79	PK	248	205	H	-6.01	92.78	/	/
2480.00	80.34	Ave	157	168	H	-6.01	74.33	/	/
2483.50	61.66	PK	274	247	V	-6.01	55.65	74.00	18.35
2483.50	45.41	Ave	169	125	V	-6.01	39.40	54.00	14.60
1126.25	44.67	PK	305	205	V	-11.70	32.97	74.00	41.03
1126.25	31.94	Ave	311	139	V	-11.70	20.24	54.00	33.76
4960.00	43.73	PK	86	110	V	1.97	45.70	74.00	28.30
4960.00	30.32	Ave	90	201	V	1.97	32.29	54.00	21.71
6667.33	43.19	PK	117	220	V	6.39	49.58	74.00	24.42
6667.33	30.23	Ave	254	215	V	6.39	36.62	54.00	17.38
7440.00	38.84	PK	162	177	H	7.79	46.63	74.00	27.37
7440.00	25.92	Ave	198	208	H	7.79	33.71	54.00	20.29

Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Limit - Corrected. Amplitude

Spurious Emissions at Antenna Port*(For GFSK Mode)*:

Low Channel



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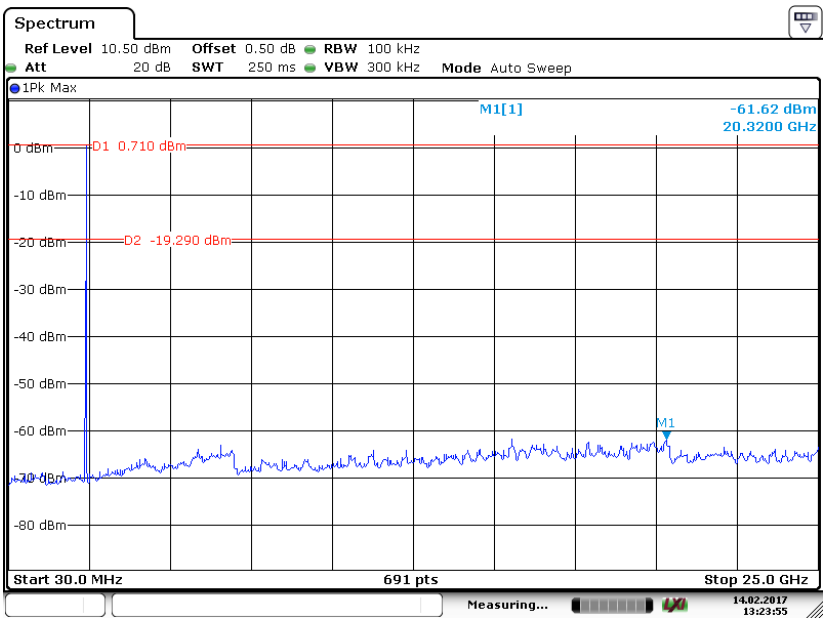
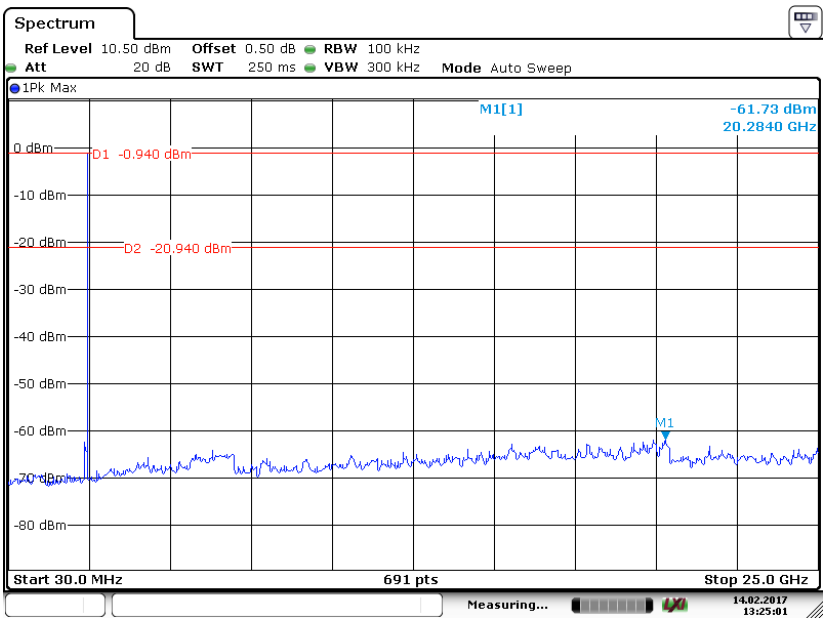
Middle Channel



Date: 14.FEB.2017 13:23:56

High Channel



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

Applicable Standard

Frequency hopping systems shall have hoping 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:	22 ℃
Relative Humidity:	56 %
ATM Pressure:	101.3 kPa

The testing was performed by Chris Wang on 2017-02-14.

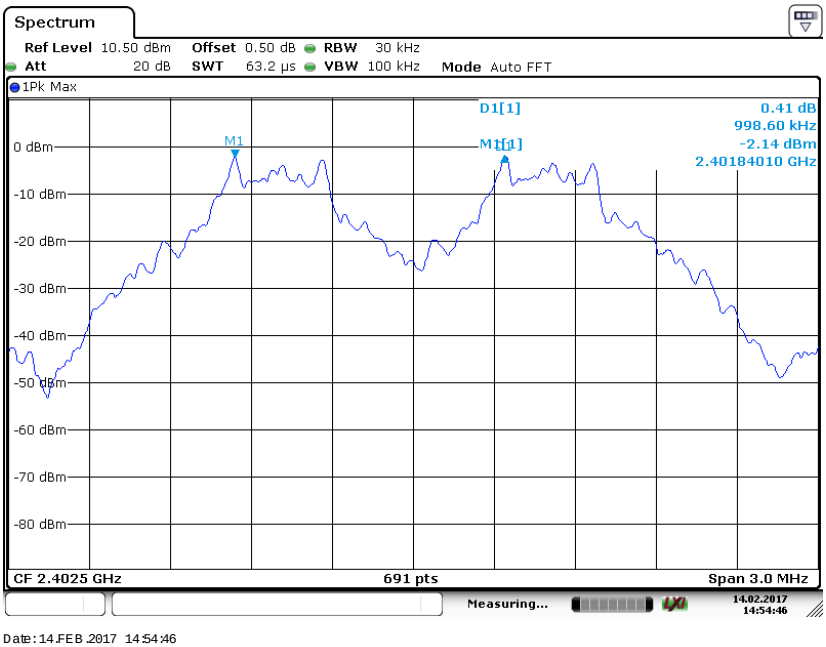
EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following tables and plots

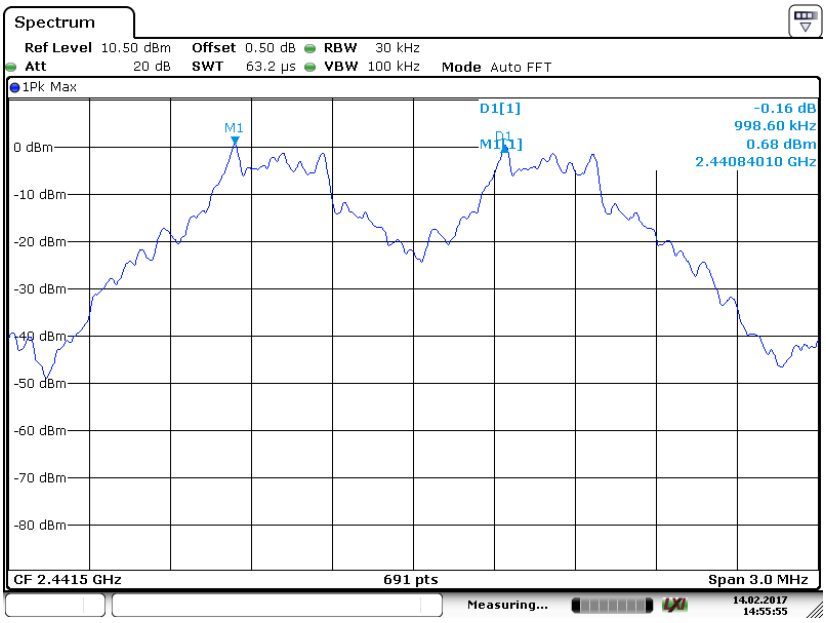
Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
BDR (GFSK)	Low	2402	0.9986	0.5383	Pass
	Adjacent	2403			
	Middle	2441	0.9986	0.5413	Pass
	Adjacent	2442			
	High	2480	0.9986	0.5383	Pass
	Adjacent	2479			
EDR (π/4-DQPSK)	Low	2402	1.0029	0.7525	Pass
	Adjacent	2403			
	Middle	2441	1.0029	0.7497	Pass
	Adjacent	2442			
	High	2480	1.0029	0.7497	Pass
	Adjacent	2479			
EDR (8-DPSK)	Low	2402	1.0072	0.7699	Pass
	Adjacent	2403			
	Middle	2441	1.0072	0.7757	Pass
	Adjacent	2442			
	High	2480	1.0072	0.7757	Pass
	Adjacent	2479			

Note: Limit = 2/3 * 20 dB bandwidth

BDR (GFSK): Low Channel

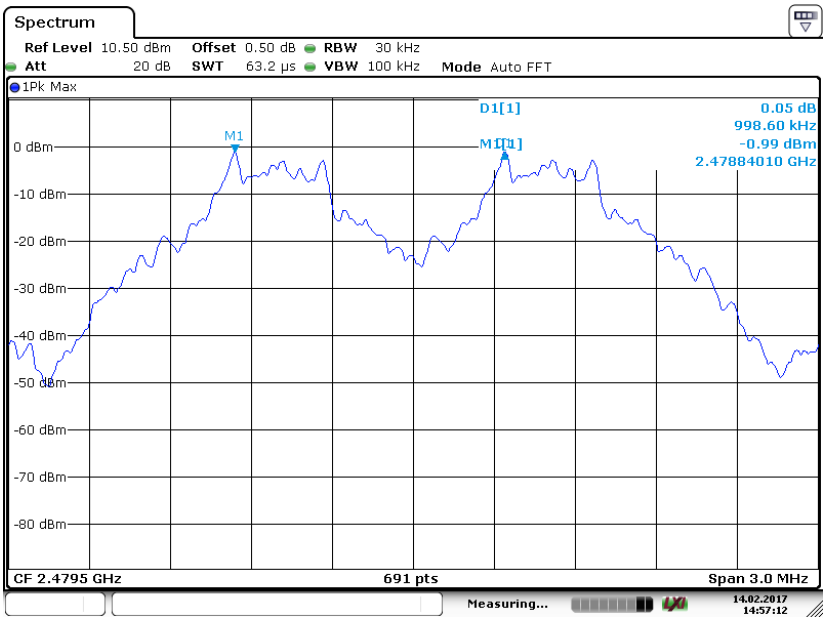


BDR (GFSK): Middle Channel



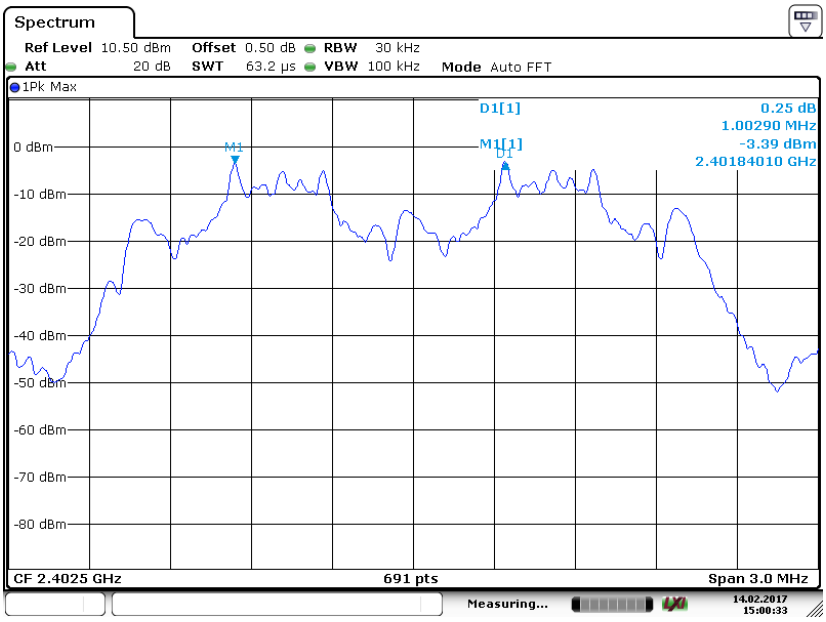
Date: 14.FEB.2017 14:55:55

BDR (GFSK): High Channel



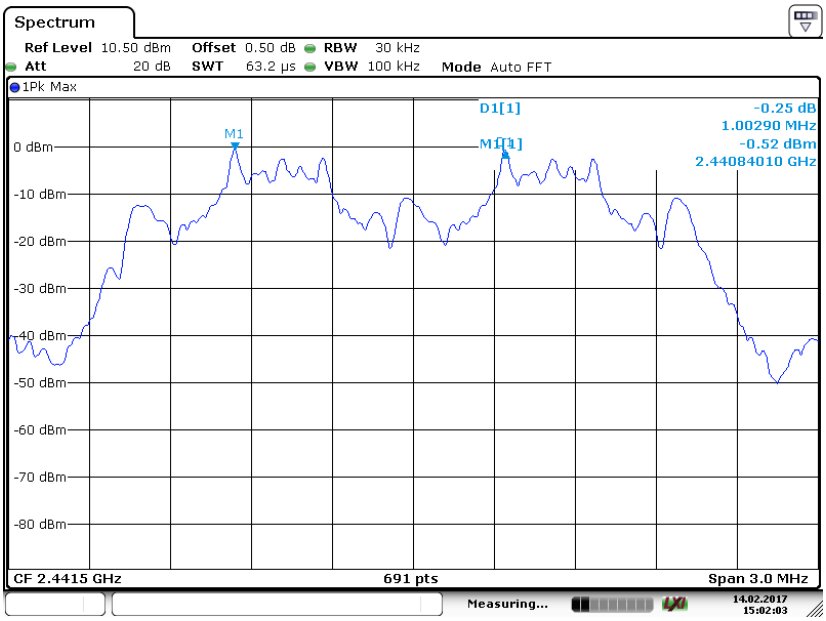
Date: 14.FEB.2017 14:57:13

EDR (π/4-DQPSK): Low Channel



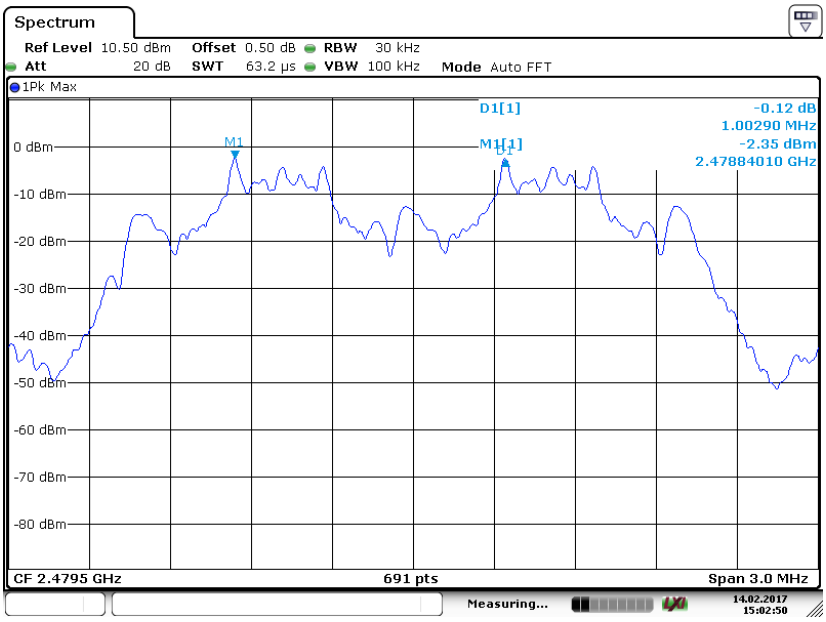
Date: 14.FEB.2017 15:00:33

EDR (π/4-DQPSK): Middle Channel



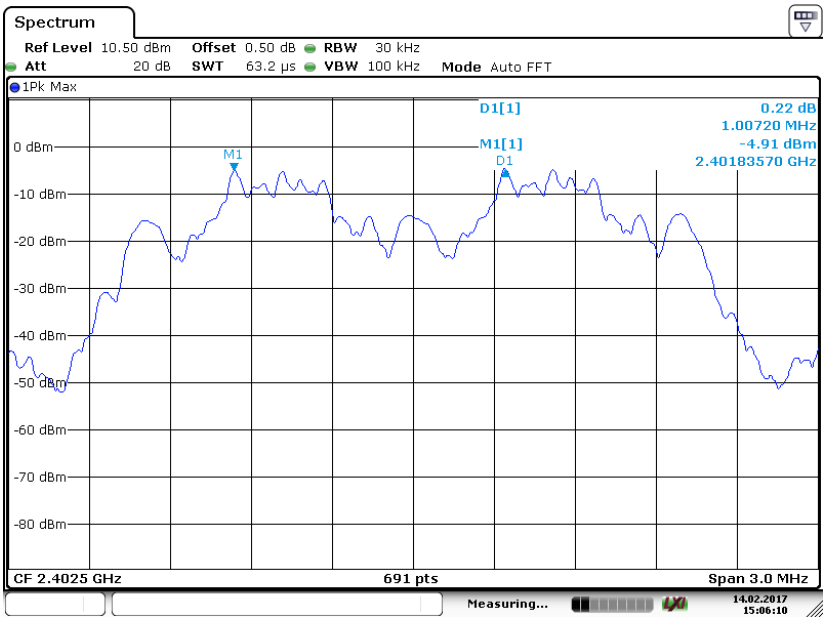
Date: 14.FEB.2017 15:02:04

EDR (π/4-DQPSK): High Channel



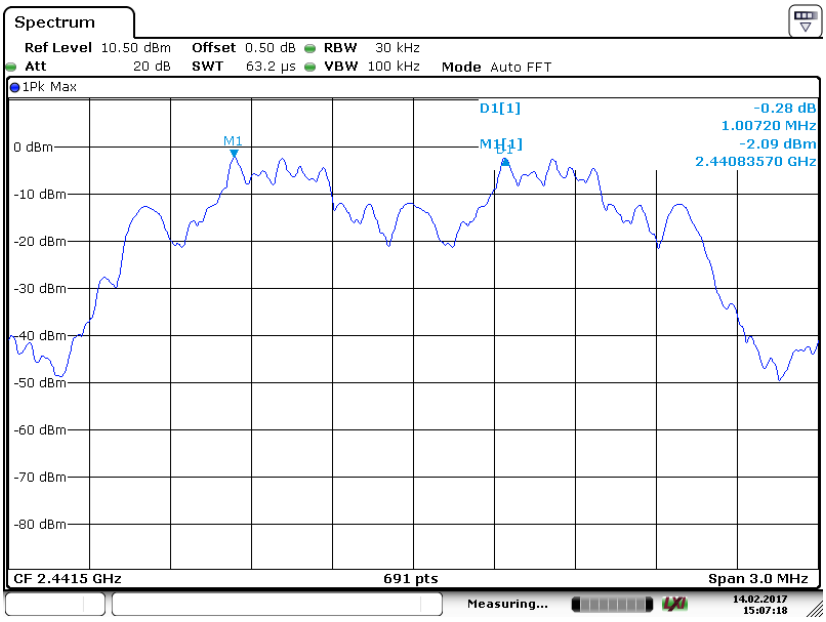
Date:14.FEB.2017 15:02:50

EDR (8-DPSK): Low Channel



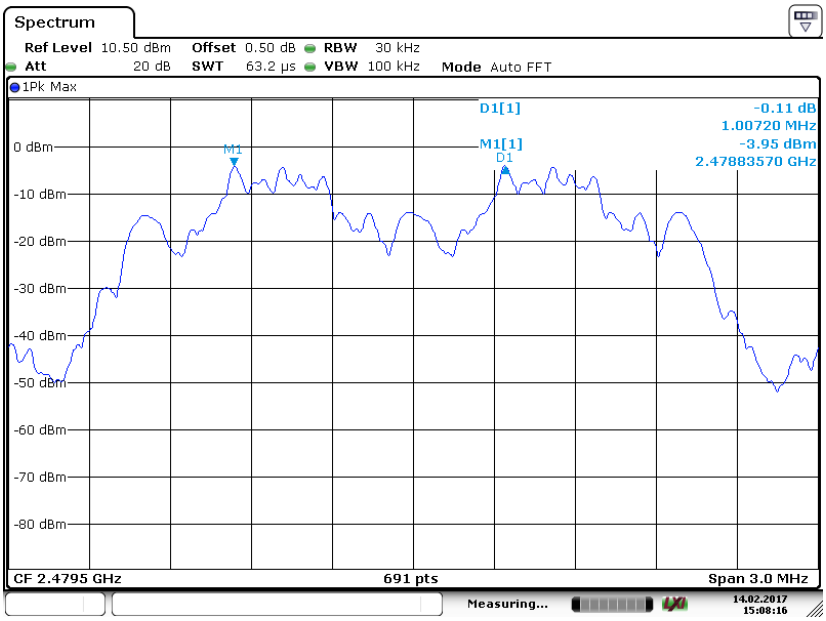
Date:14.FEB.2017 15:06:10

EDR (8-DPSK): Middle Channel



Date:14.FEB.2017 15:07:18

EDR (8-DPSK): High Channel



Date:14.FEB.2017 15:08:16

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:	22 ℃
Relative Humidity:	56 %
ATM Pressure:	101.3 kPa

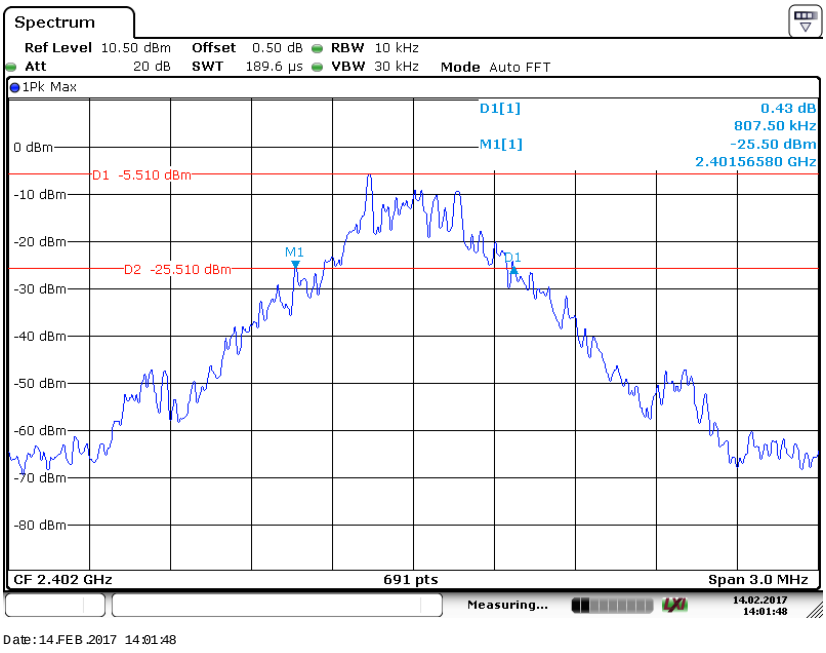
The testing was performed by Chris Wang on 2017-02-14.

EUT operation mode: Transmitting

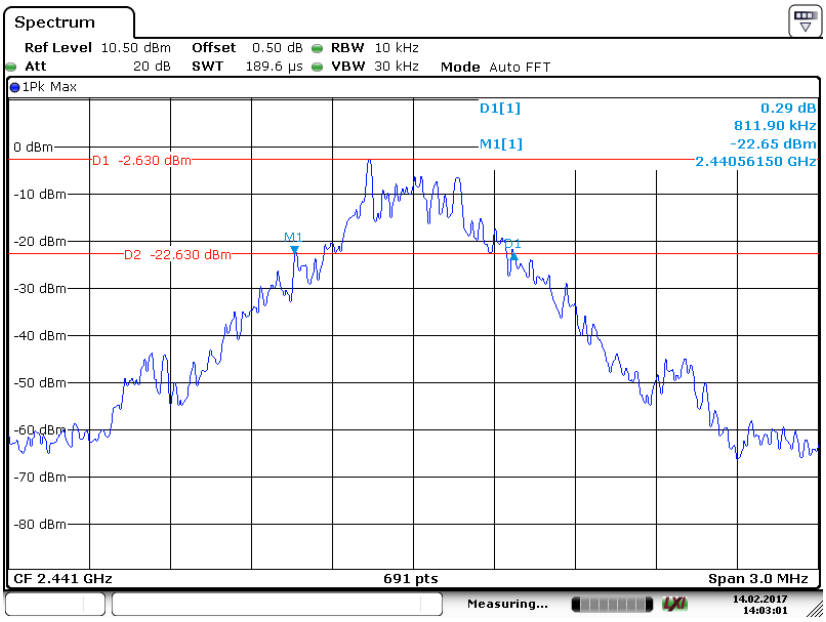
Test Result: Compliance. Please refer to following tables and plots

Mode	Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)
BDR (GFSK)	Low	2402	0.8075
	Middle	2441	0.8119
	High	2480	0.8075
EDR (π/4-DQPSK)	Low	2402	1.1288
	Middle	2441	1.1245
	High	2480	1.1245
EDR (8-DPSK)	Low	2402	1.1548
	Middle	2441	1.1635
	High	2480	1.1635

BDR (GFSK): Low Channel

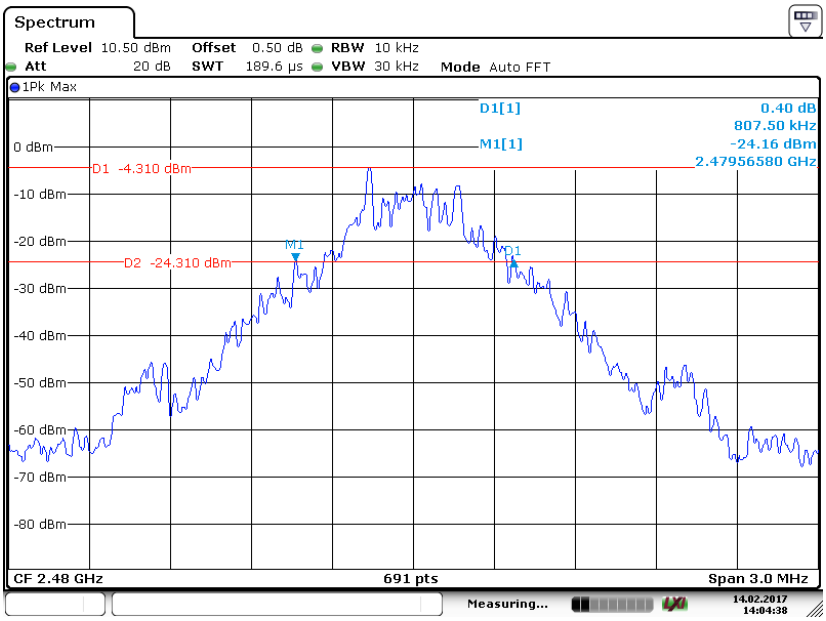


BDR (GFSK): Middle Channel



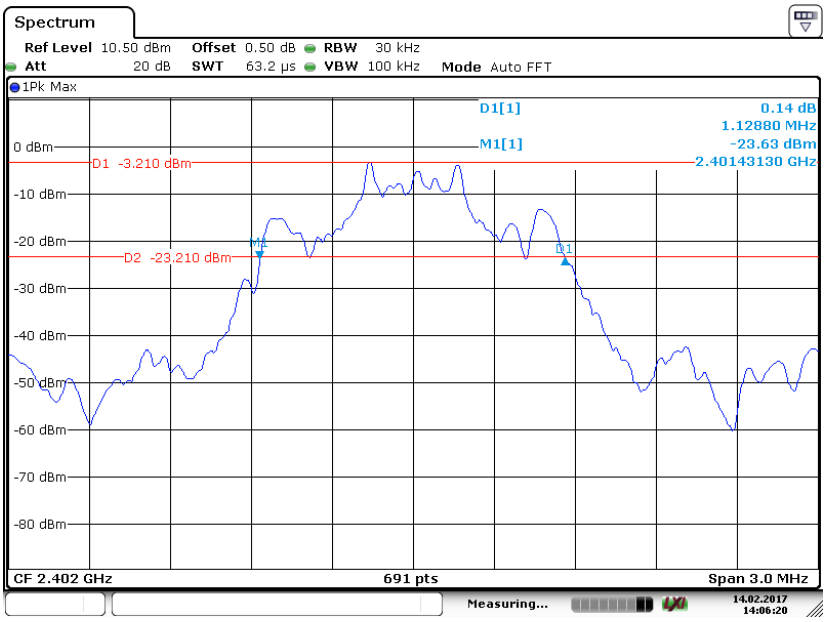
Date: 14.FEB.2017 14:03:01

BDR (GFSK): High Channel



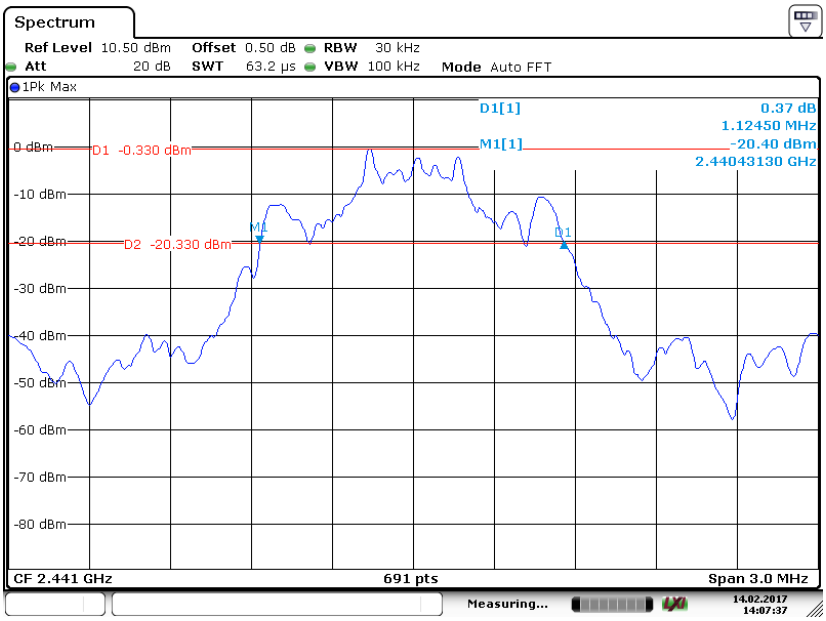
Date: 14.FEB.2017 14:04:38

EDR (π/4-DQPSK): Low Channel



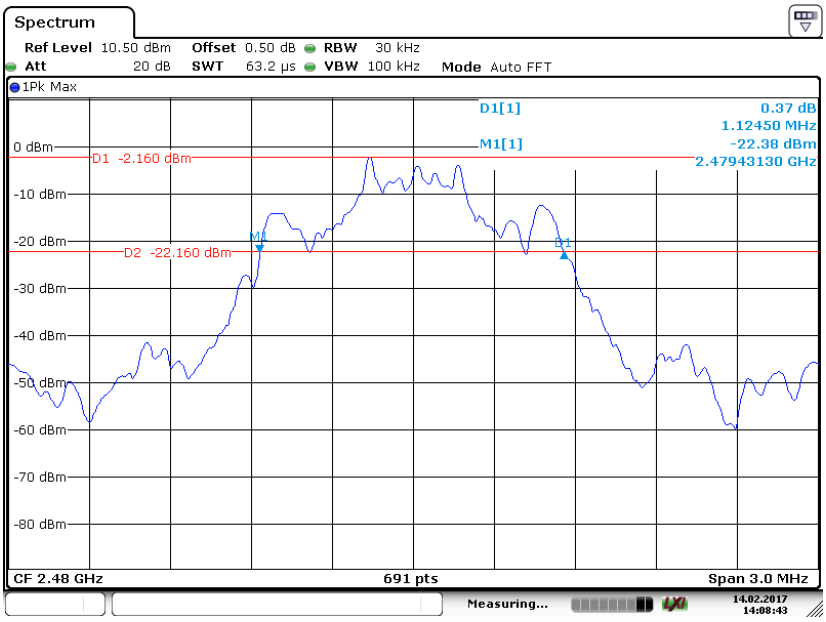
Date: 14.FEB.2017 14:06:20

EDR(π/4-DQPSK): Middle Channel



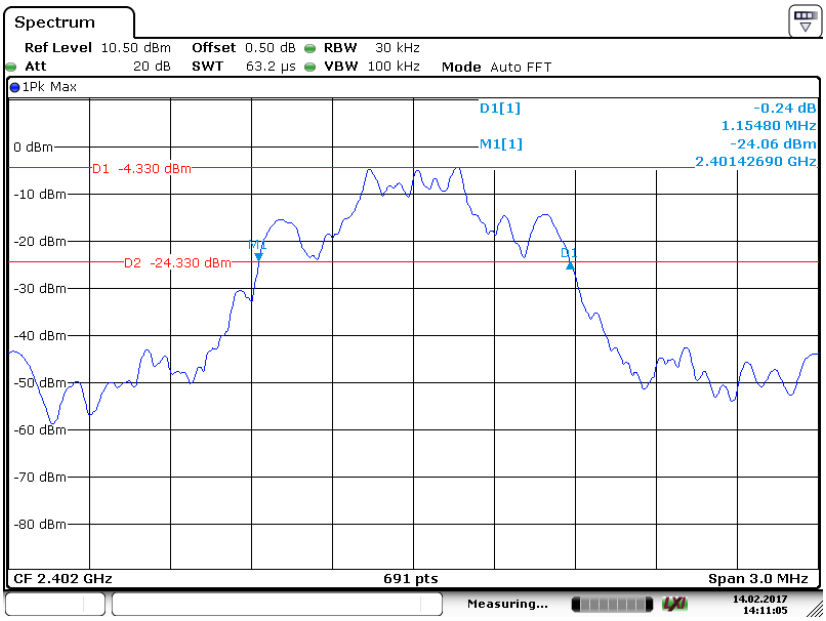
Date: 14.FEB.2017 14:07:37

EDR (π/4-DQPSK): High Channel



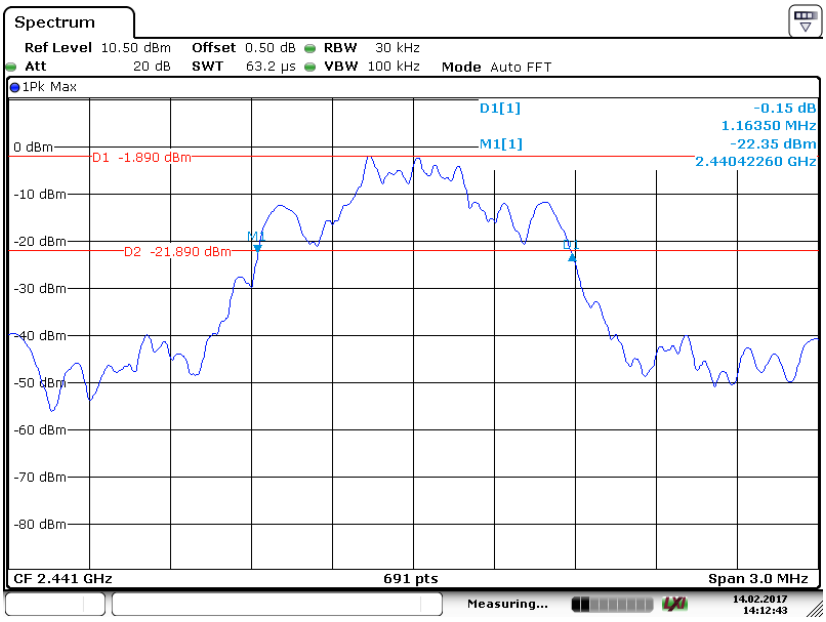
Date:14.FEB.2017 14:08:43

EDR (8-DPSK): Low Channel



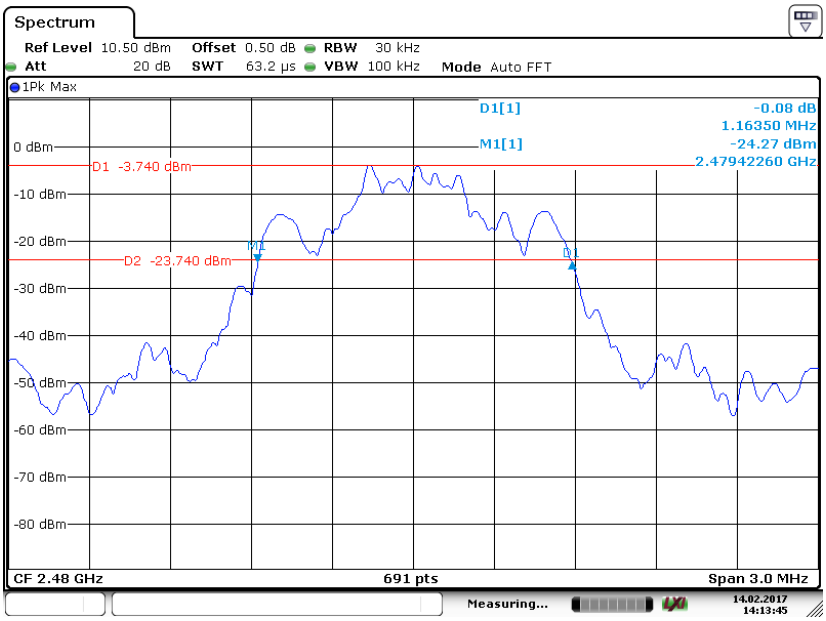
Date:14.FEB.2017 14:11:05

EDR (8-DPSK): Middle Channel



Date:14.FEB.2017 14:12:42

EDR (8-DPSK): High Channel



Date:14.FEB.2017 14:13:46

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:	22 ℃
Relative Humidity:	56 %
ATM Pressure:	101.3 kPa

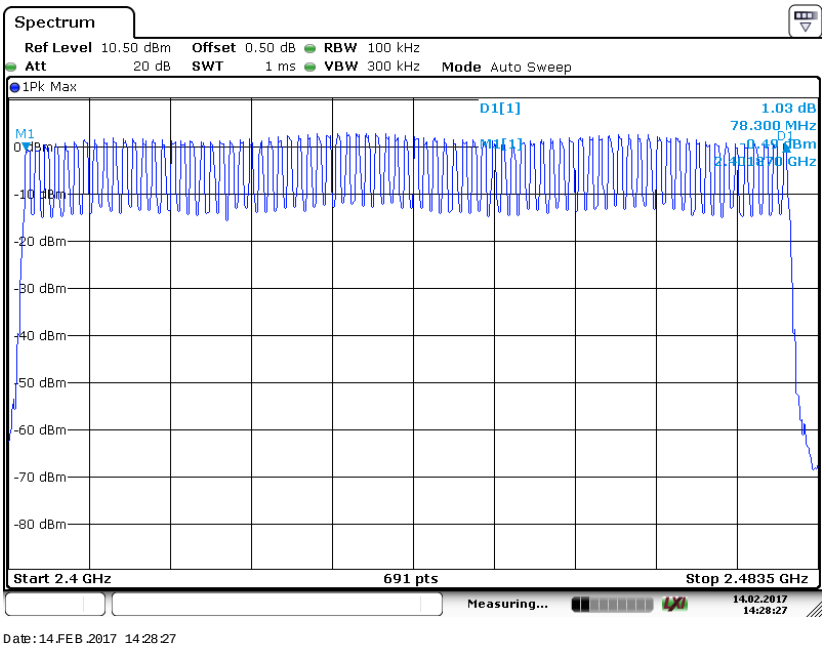
The testing was performed by Chris Wang on 2017-02-14.

EUT operation mode: Transmitting

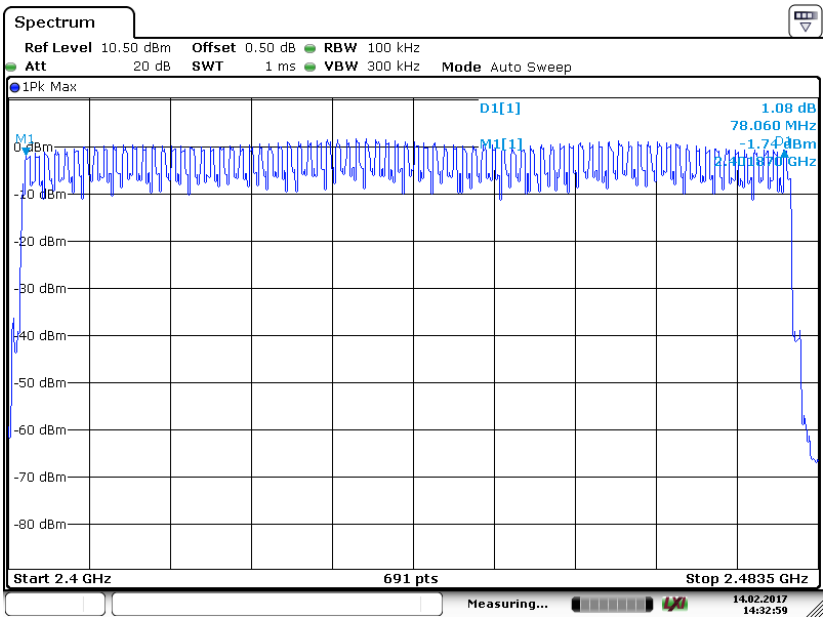
Test Result: Compliance. Please refer to following tables and plots

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

BDR (GFSK): Number of Hopping Channels

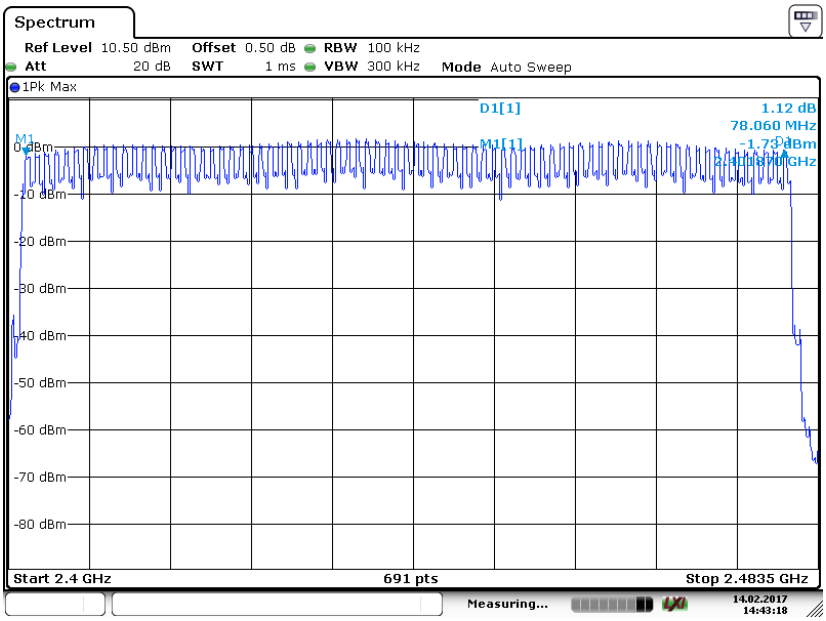


EDR (π/4-DQPSK): Number of Hopping Channels



Date:14.FEB.2017 14:33:00

EDR (8-DPSK): Number of Hopping Channels



Date:14.FEB.2017 14:43:19

FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL 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 was worked in channel hopping; Spectrum SPAN was set as 0. Sweep was set as 0.4 X channel no. (s), the quantity of pulse was get from single sweep. In addition, the time of single pulses was tested.

Test Data

Environmental Conditions

Temperature:	22 ℃
Relative Humidity:	56 %
ATM Pressure:	101.3 kPa

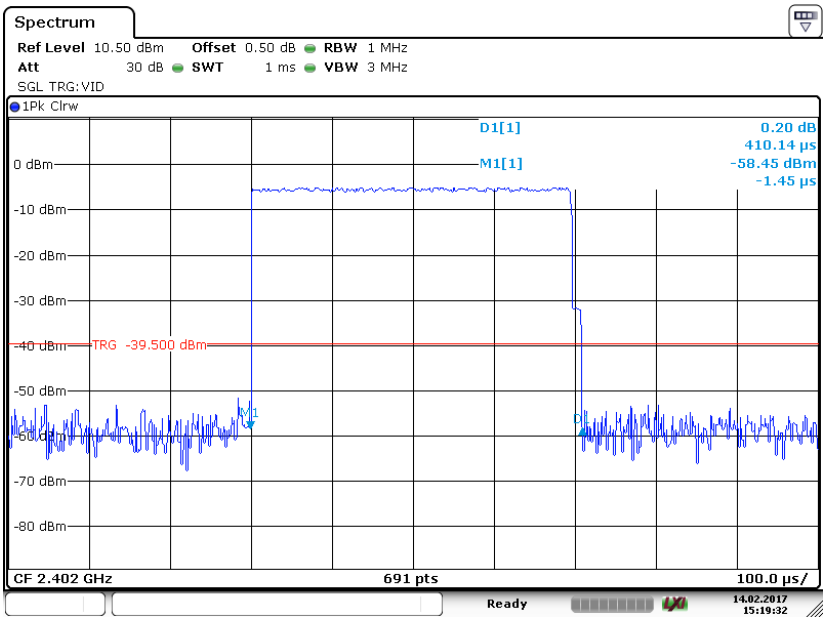
The testing was performed by Chris Wang on 2017-02-14.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following tables and plots

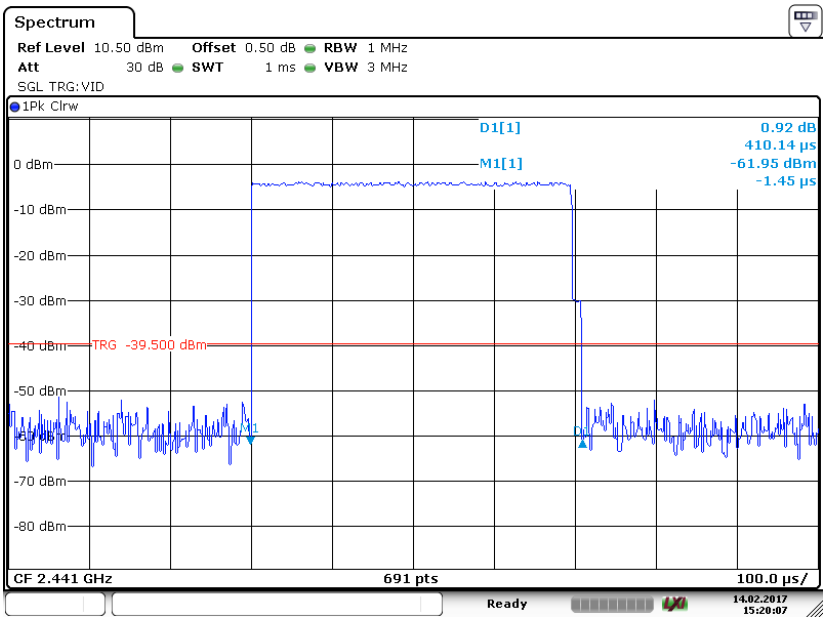
Mode		Channel	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Result
BDR (GFSK)	DH 1	Low	0.410	0.131	0.4	Pass
		Middle	0.410	0.131	0.4	Pass
		High	0.410	0.131	0.4	Pass
		Note: DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	DH 3	Low	1.687	0.270	0.4	Pass
		Middle	1.687	0.270	0.4	Pass
		High	1.687	0.270	0.4	Pass
		Note: DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	DH 5	Low	2.946	0.314	0.4	Pass
		Middle	2.946	0.314	0.4	Pass
		High	2.946	0.314	0.4	Pass
		Note: DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				
EDR (π/4-DQPSK)	2DH 1	Low	0.422	0.135	0.4	Pass
		Middle	0.422	0.135	0.4	Pass
		High	0.422	0.135	0.4	Pass
		Note: 2DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	2DH 3	Low	1.687	0.270	0.4	Pass
		Middle	1.687	0.270	0.4	Pass
		High	1.687	0.270	0.4	Pass
		Note: 2DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	2DH 5	Low	2.946	0.314	0.4	Pass
		Middle	2.946	0.314	0.4	Pass
		High	2.946	0.314	0.4	Pass
		Note: 2DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				
EDR (8-DPSK)	3DH 1	Low	0.422	0.135	0.4	Pass
		Middle	0.422	0.135	0.4	Pass
		High	0.422	0.135	0.4	Pass
		Note:3 DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	3DH 3	Low	1.687	0.270	0.4	Pass
		Middle	1.687	0.270	0.4	Pass
		High	1.687	0.270	0.4	Pass
		Note: 3DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	3DH 5	Low	2.946	0.314	0.4	Pass
		Middle	2.946	0.314	0.4	Pass
		High	2.946	0.314	0.4	Pass
		Note: 3DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				

BDR (GFSK): Pulse time, Low Channel, DH1



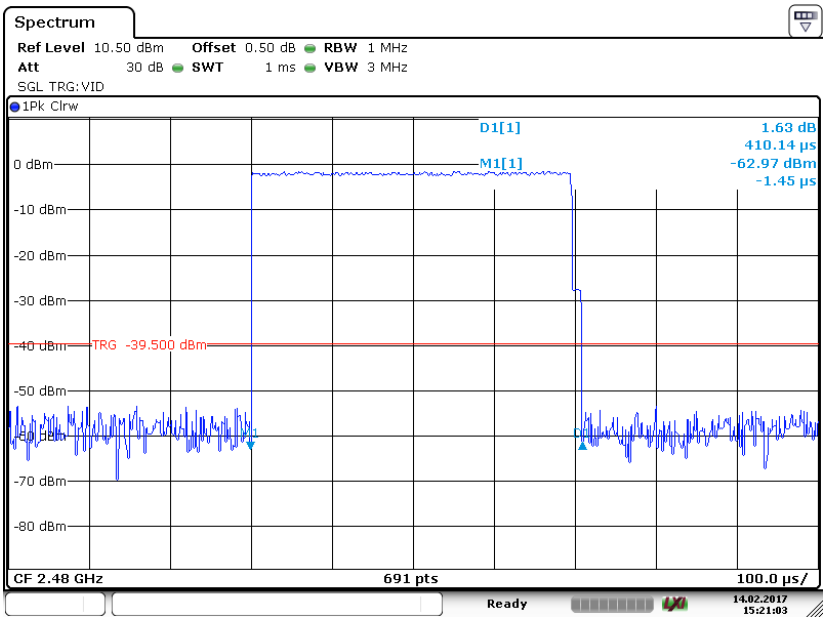
Date: 14.FEB.2017 15:19:32

Pulse time, Middle Channel, DH1



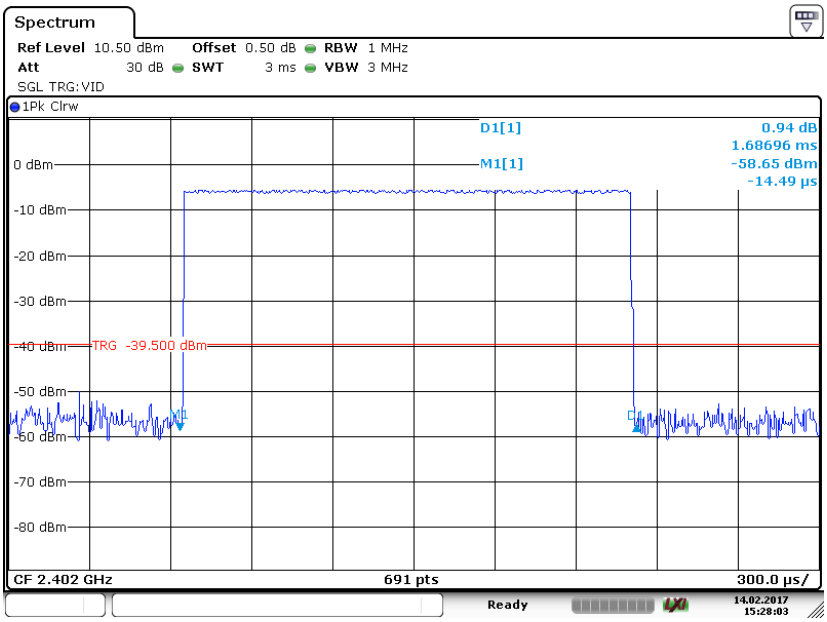
Date: 14.FEB.2017 15:20:07

Pulse time, High Channel, DH1



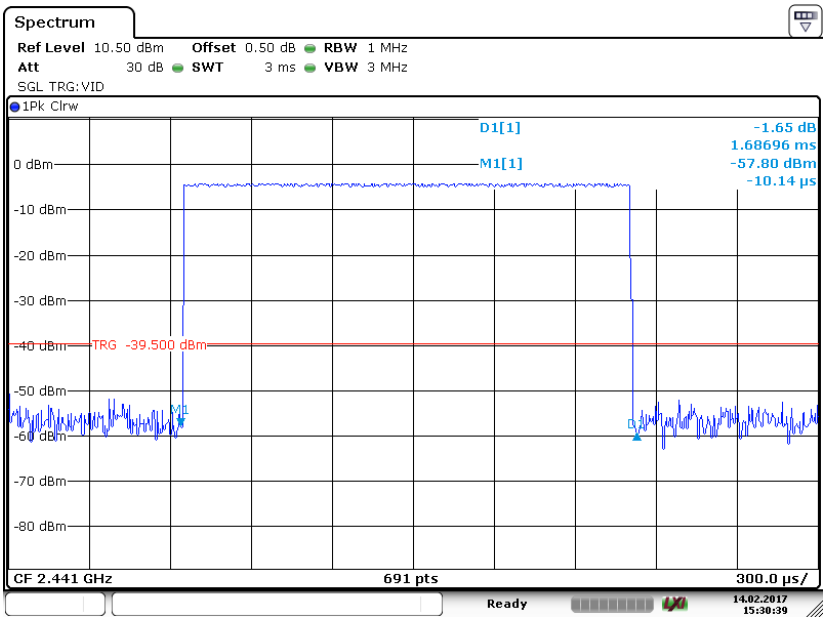
Date: 14.FEB.2017 15:21:03

Pulse time, Low Channel, DH3



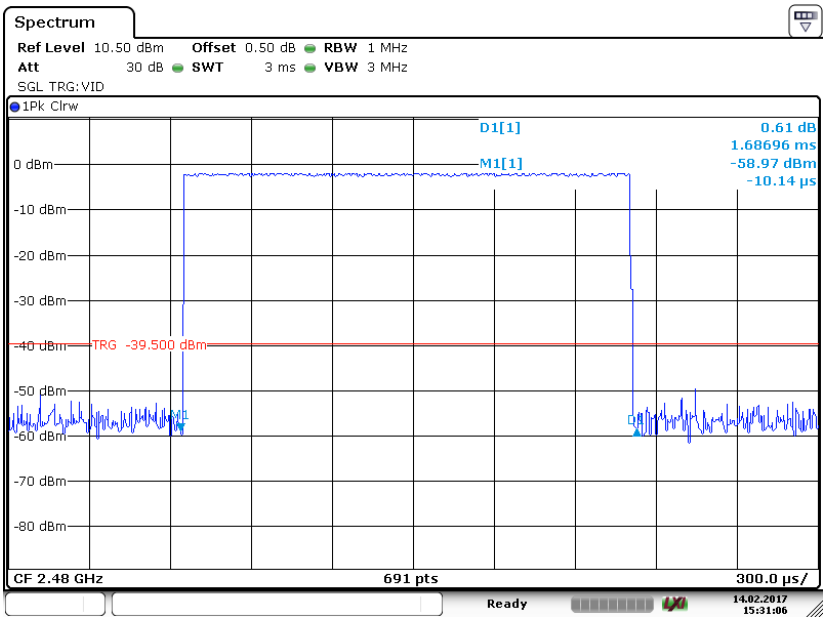
Date: 14.FEB.2017 15:28:03

Pulse time, Middle Channel, DH3



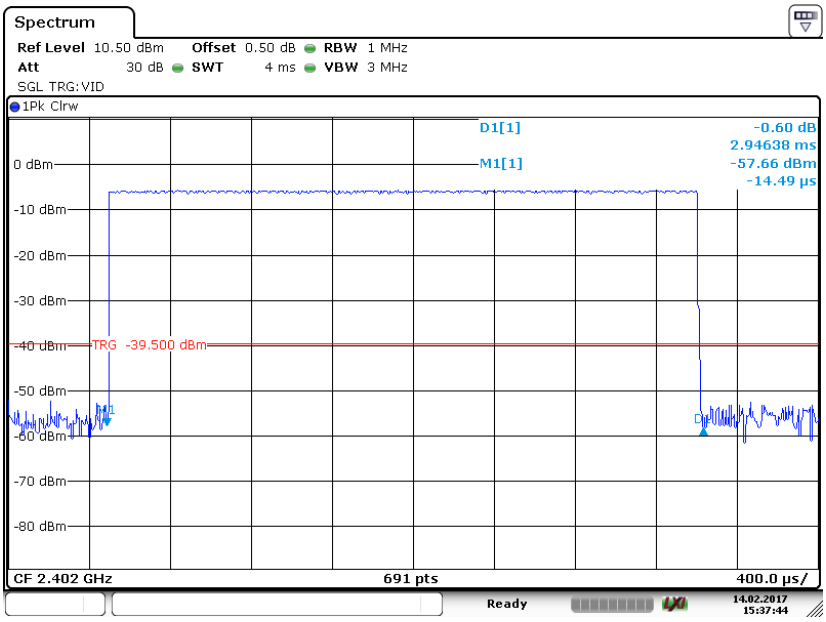
Date: 14.FEB.2017 15:30:40

Pulse time, High Channel, DH3



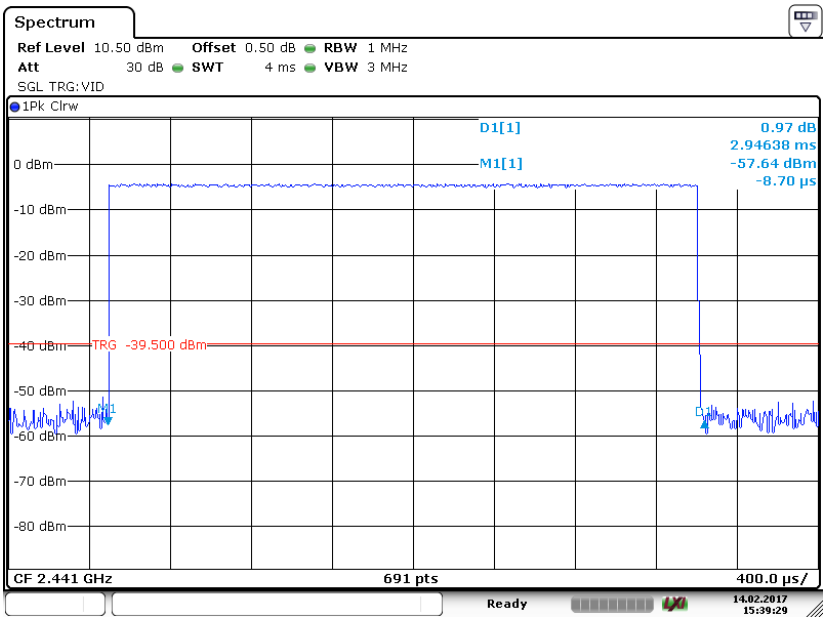
Date: 14.FEB.2017 15:31:06

Pulse time, Low Channel, DH5



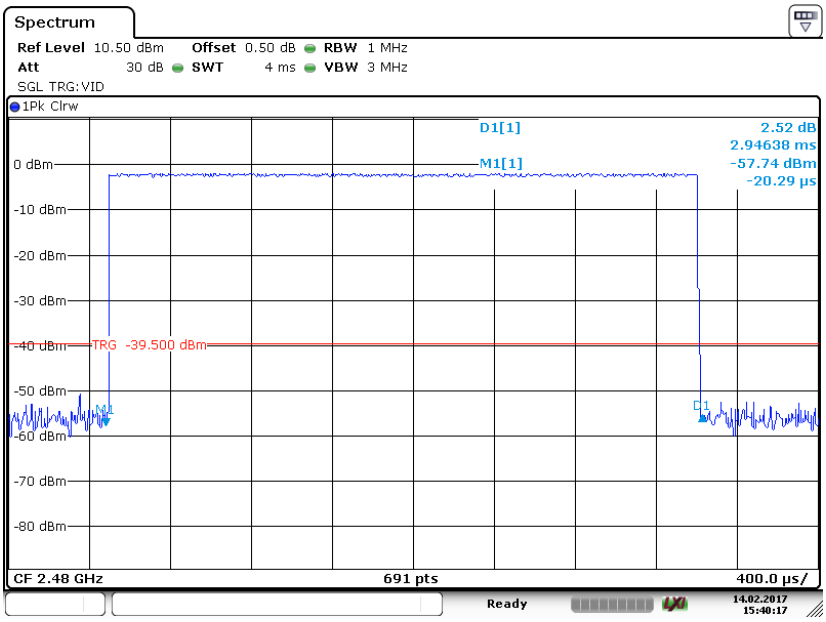
Date: 14.FEB.2017 15:37:44

Pulse time, Middle Channel, DH5



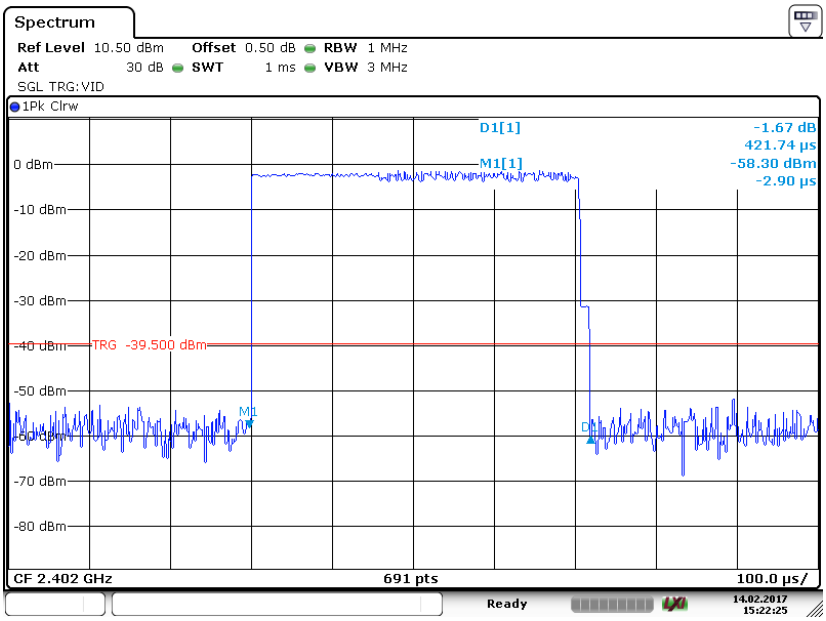
Date: 14.FEB.2017 15:39:29

Pulse time, High Channel, DH5



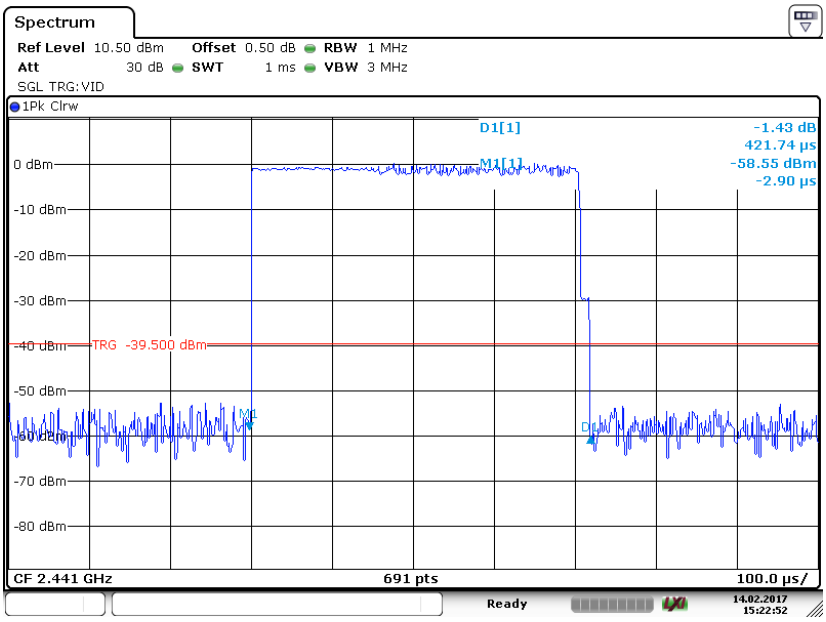
Date: 14.FEB.2017 15:40:18

EDR (π/4-DQPSK): Pulse time, Low Channel, 2DH1



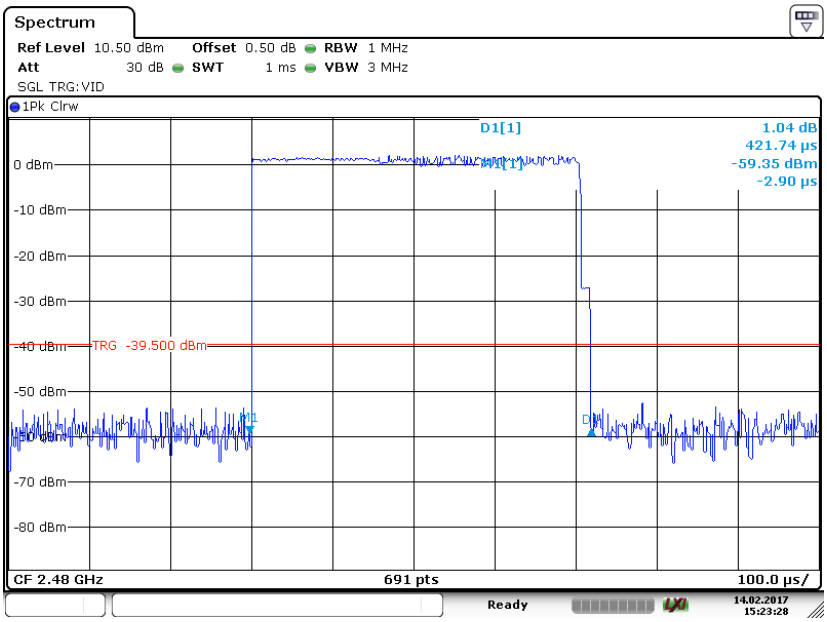
Date: 14.FEB.2017 15:22:26

Pulse time, Middle Channel, 2DH1



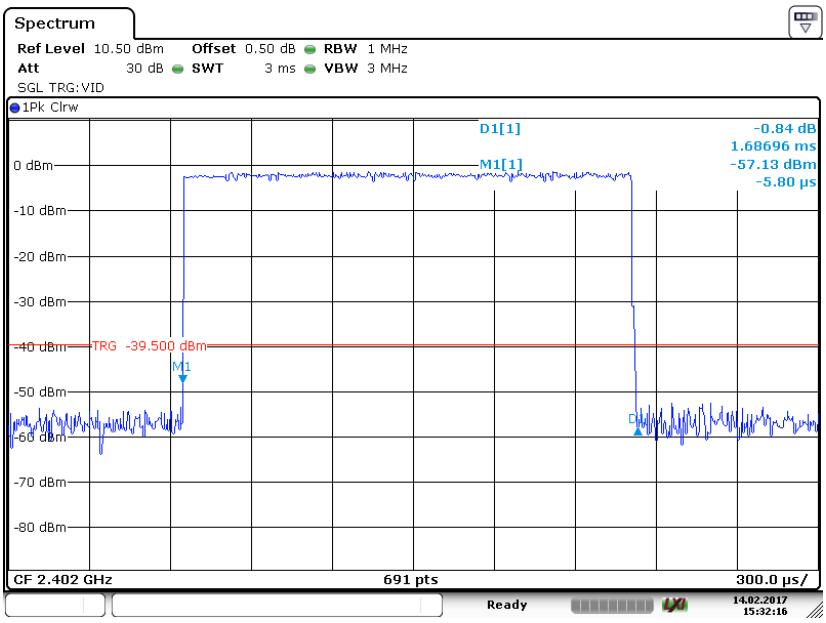
Date: 14.FEB.2017 15:22:52

Pulse time, High Channel, 2DH1



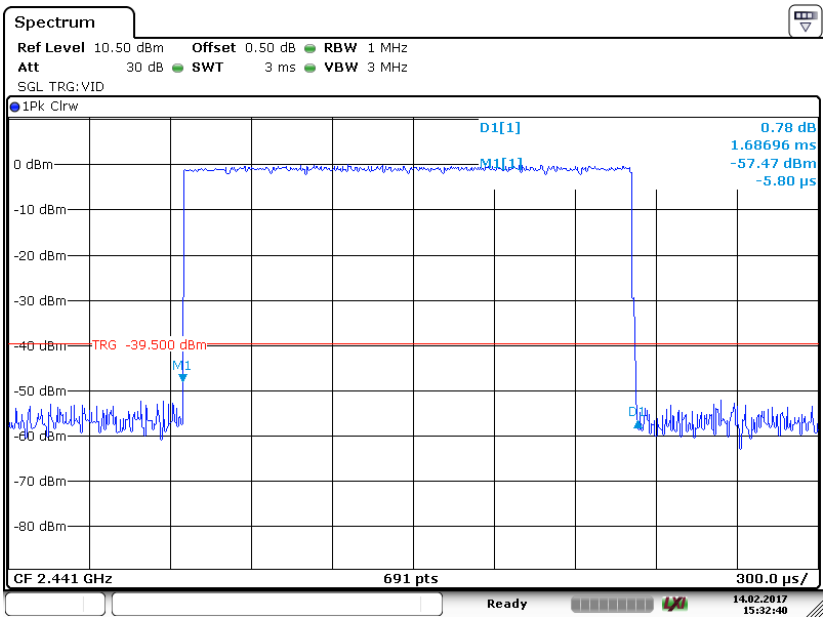
Date: 14.FEB.2017 15:23:28

Pulse time, Low Channel, 2DH3



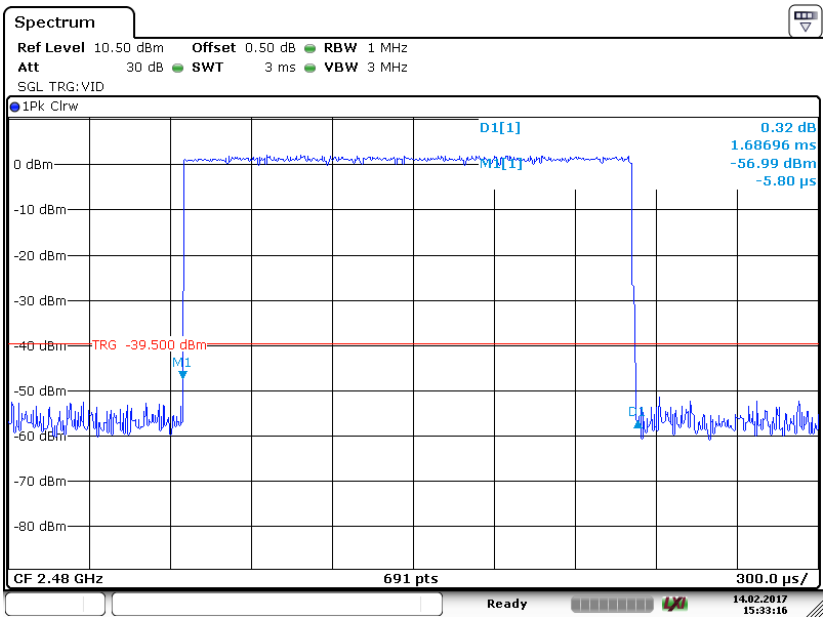
Date:14.FEB.2017 15:32:16

Pulse time, Middle Channel, 2DH3



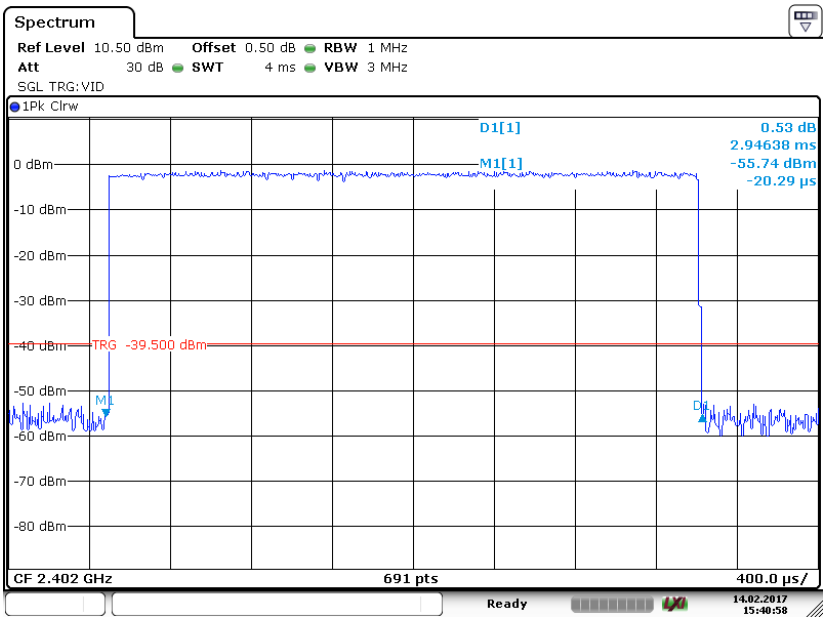
Date:14.FEB.2017 15:32:40

Pulse time, High Channel, 2DH3



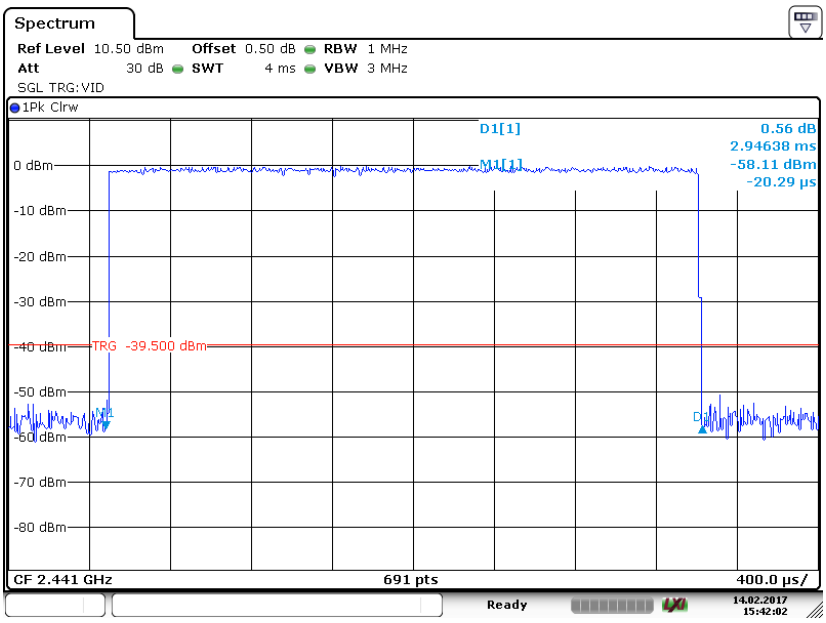
Date: 14.FEB.2017 15:33:17

Pulse time, Low Channel, 2DH5



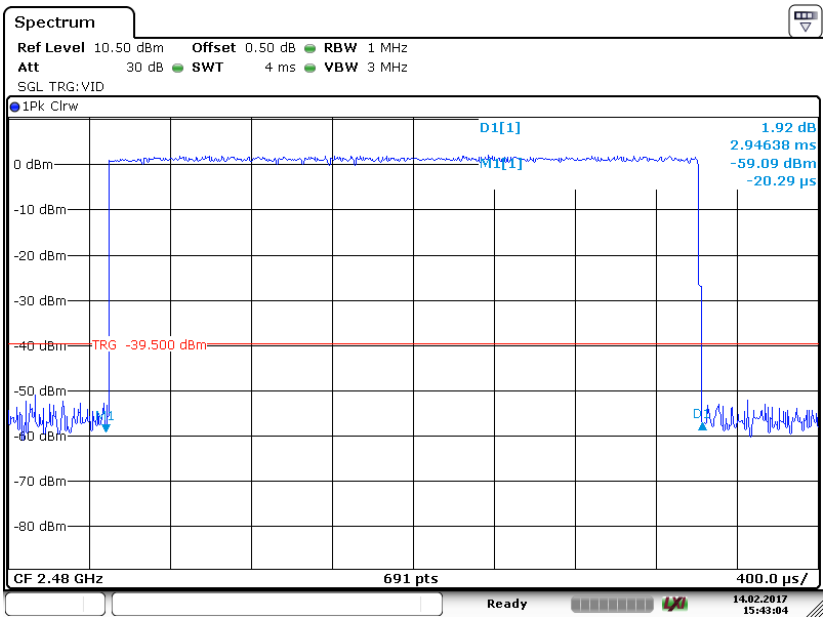
Date: 14.FEB.2017 15:40:58

Pulse time, Middle Channel, 2DH5



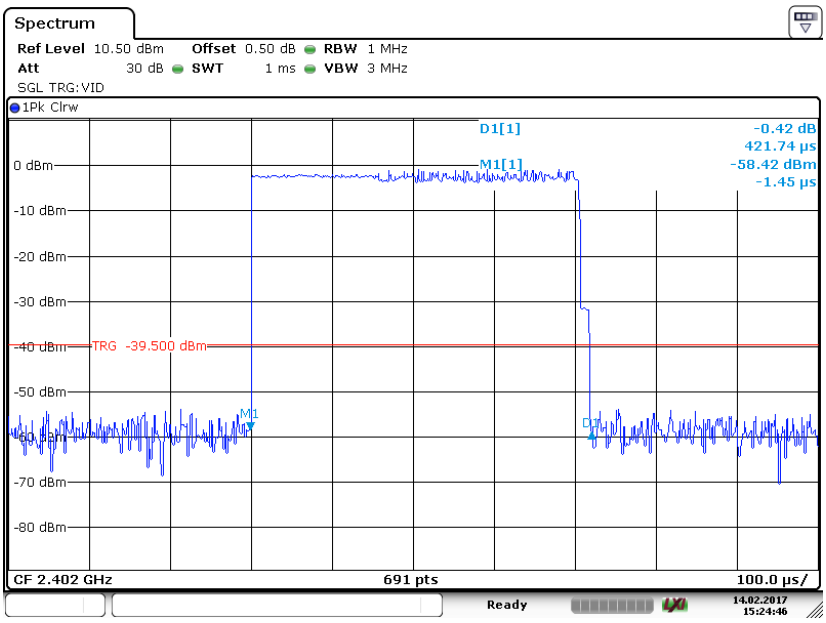
Date: 14.FEB.2017 15:42:02

Pulse time, High Channel, 2DH5



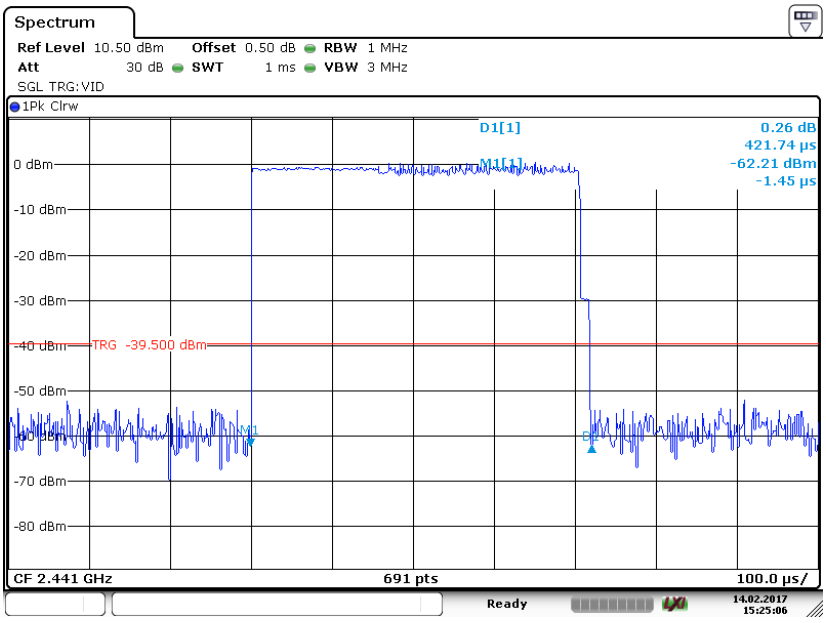
Date: 14.FEB.2017 15:43:04

EDR (8-DPSK): Pulse time, Low Channel, 3DH1



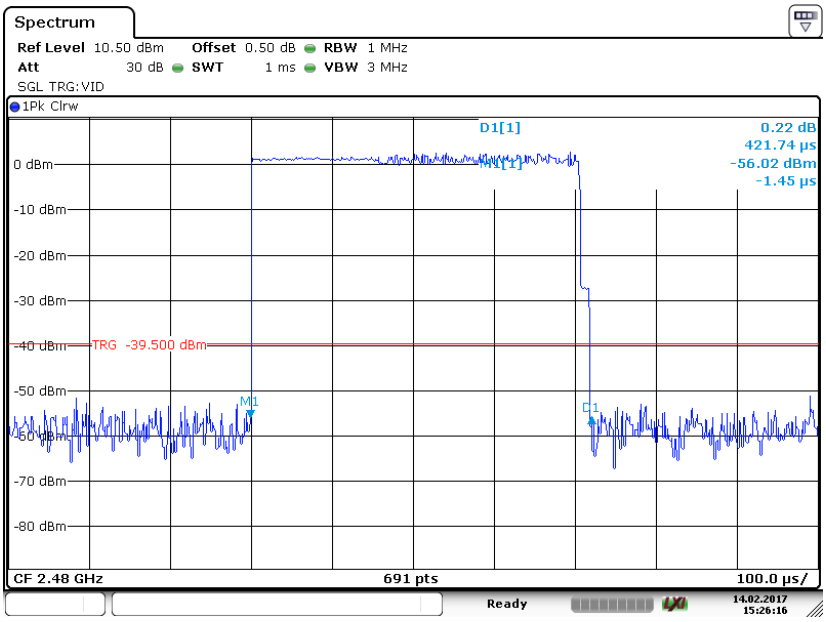
Date: 14.FEB.2017 15:24:47

Pulse time, Middle Channel, 3DH1



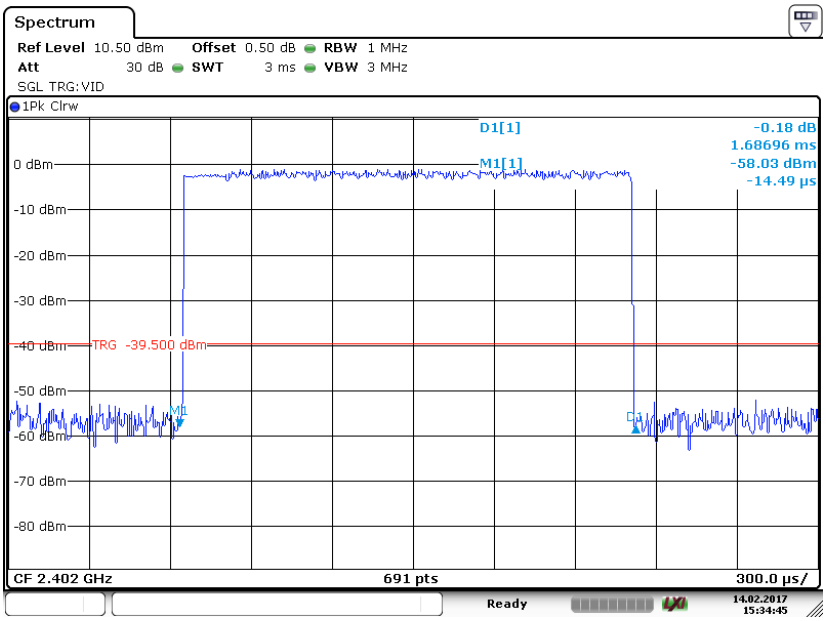
Date: 14.FEB.2017 15:25:06

Pulse time, High Channel, 3DH1



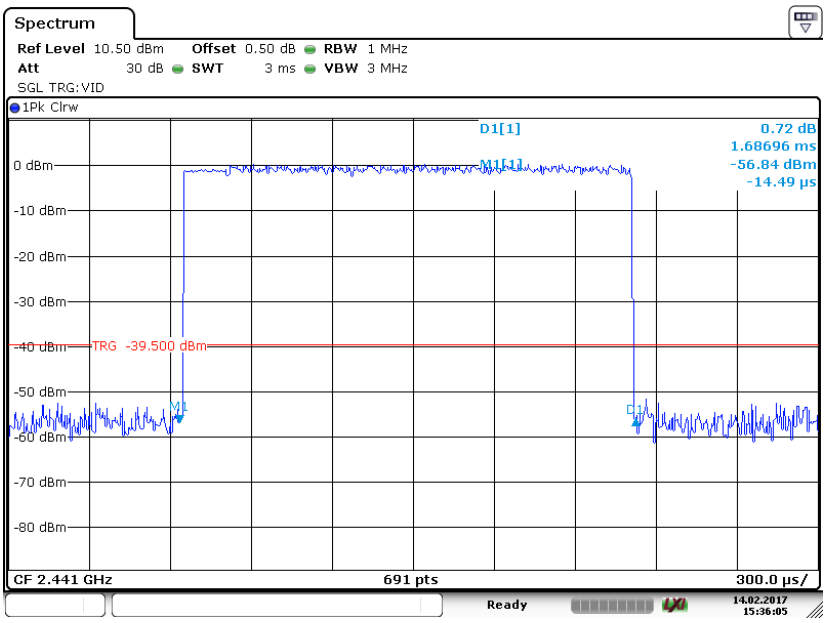
Date: 14.FEB.2017 15:26:16

Pulse time, Low Channel, 3DH3



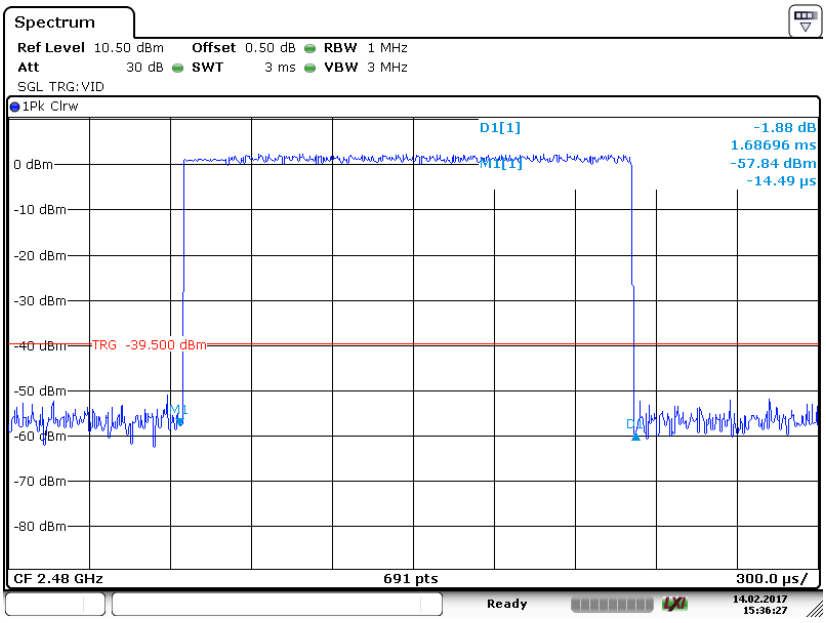
Date: 14.FEB.2017 15:34:45

Pulse time, Middle Channel, 3DH3



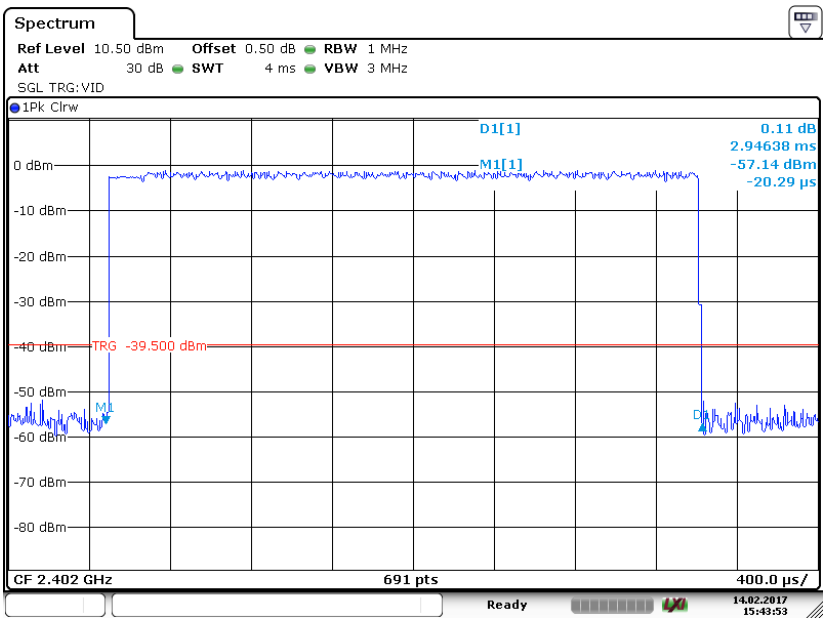
Date: 14.FEB.2017 15:36:05

Pulse time, High Channel, 3DH3



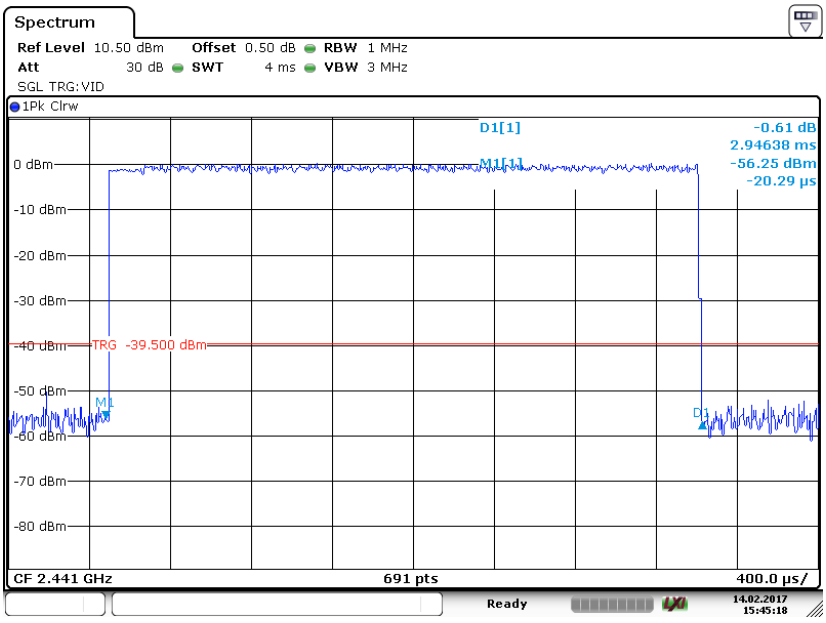
Date: 14.FEB.2017 15:36:27

Pulse time, Low Channel, 3DH5



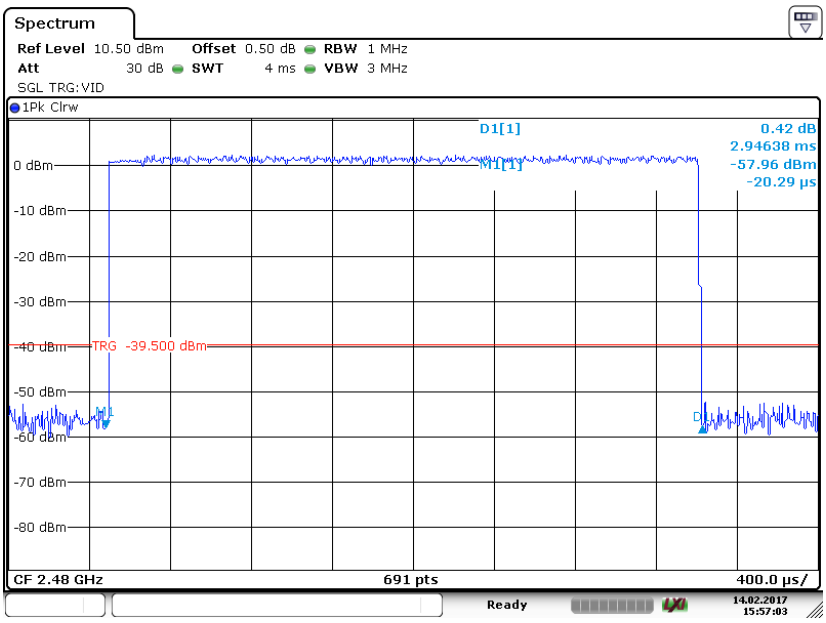
Date: 14.FEB.2017 15:43:54

Pulse time, Middle Channel, 3DH5



Date: 14.FEB.2017 15:45:19

Pulse time, High Channel, 3DH5



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:	22 ℃
Relative Humidity:	56 %
ATM Pressure:	101.3 kPa

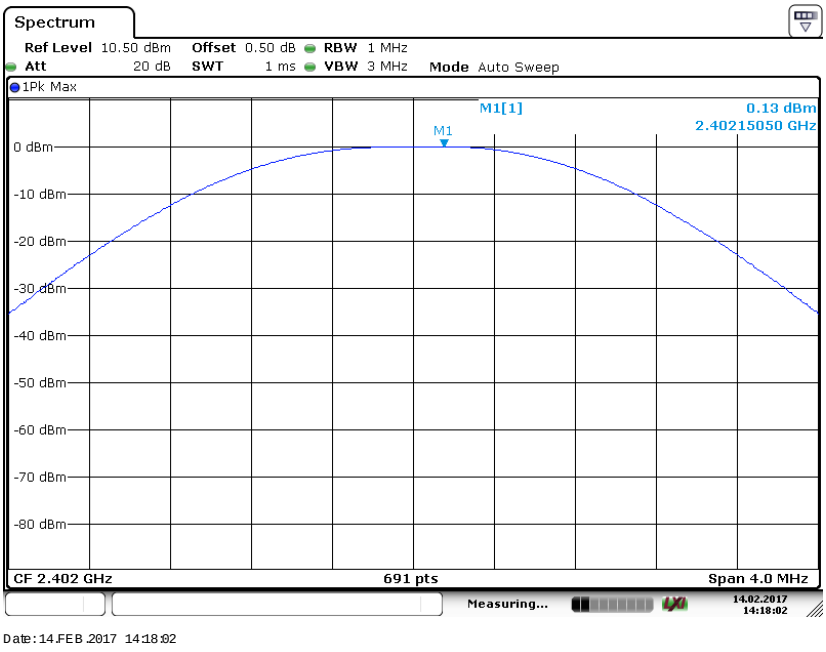
The testing was performed by Chris Wang on 2017-02-14.

EUT operation mode: Transmitting

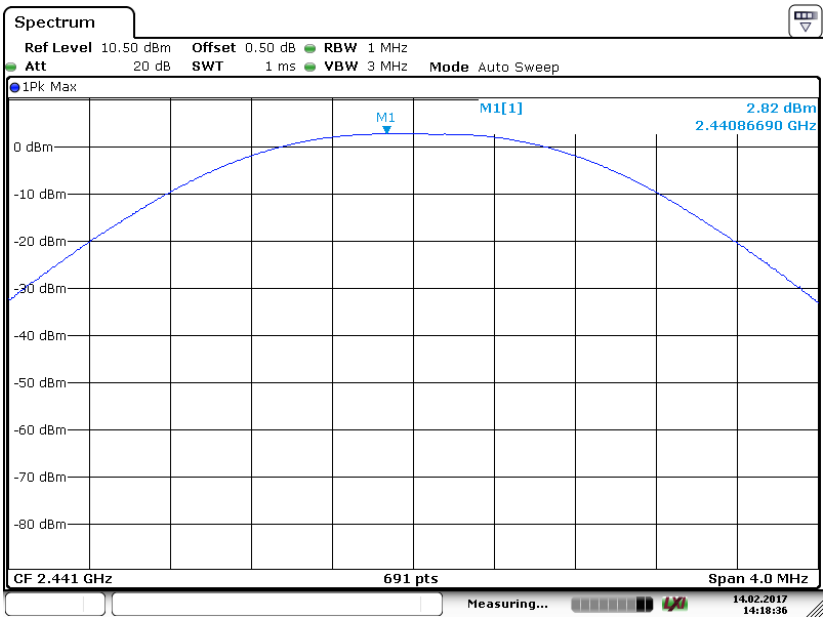
Test Result: Compliance. Please refer to following tables and plots

Mode	Channel	Frequency (MHz)	Output Power		Limit (mW)
			(dBm)	(mW)	
BDR (GFSK)	Low	2402	0.13	1.03	1000
	Middle	2441	2.82	1.91	1000
	High	2480	1.23	1.33	1000
EDR (π/4-DQPSK)	Low	2402	-0.86	0.82	1000
	Middle	2441	1.92	1.56	1000
	High	2480	0.18	1.04	1000
EDR (8-DPSK)	Low	2402	-0.87	0.82	1000
	Middle	2441	1.86	1.53	1000
	High	2480	0.11	1.03	1000

BDR (GFSK): Low Channel

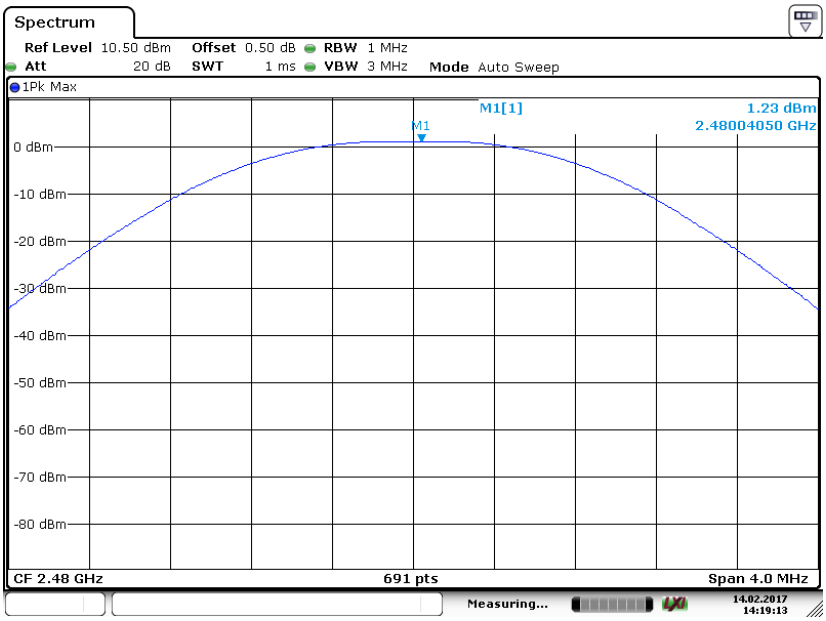


BDR (GFSK): Middle Channel



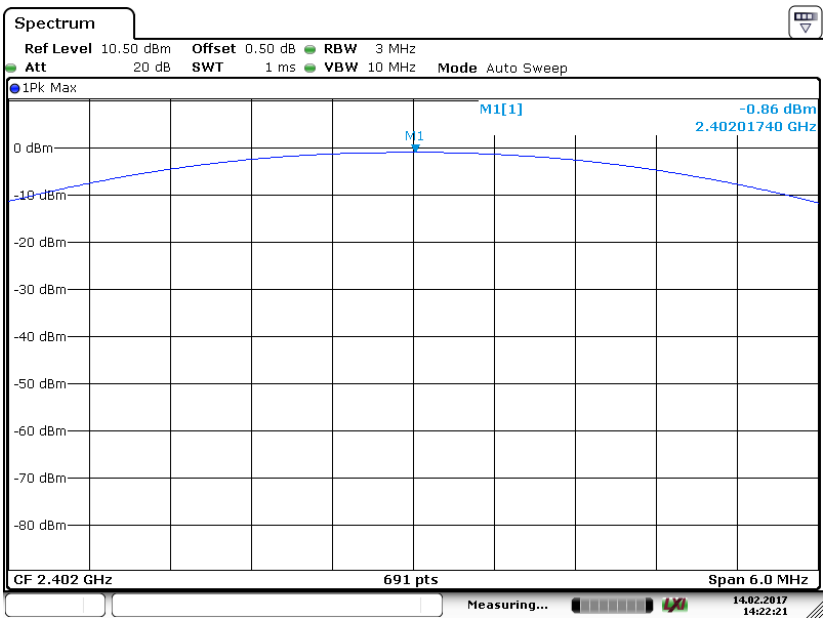
Date:14.FEB.2017 14:18:37

BDR (GFSK): High Channel



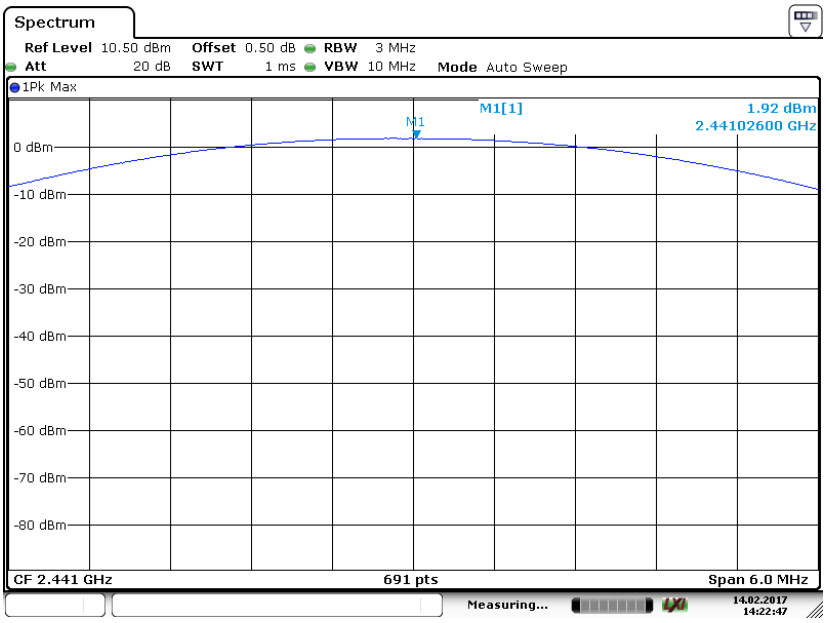
Date:14.FEB.2017 14:19:13

EDR(π/4-DQPSK): Low Channel



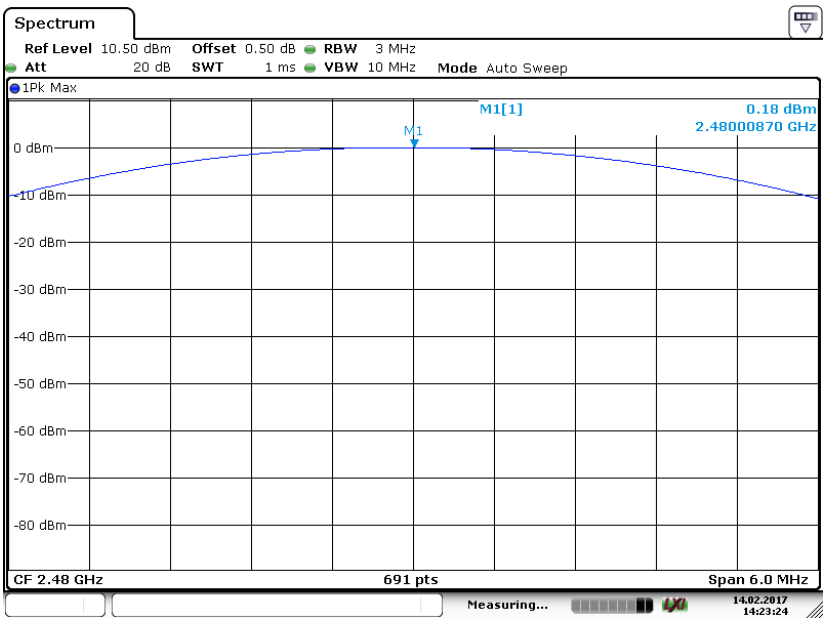
Date:14.FEB.2017 14:22:21

EDR(π/4-DQPSK): Middle Channel



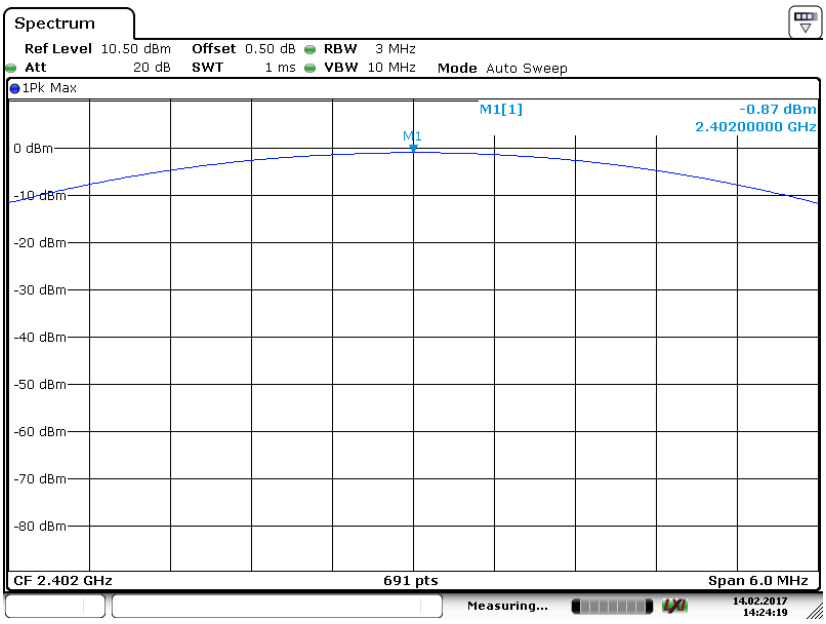
Date:14.FEB.2017 14:22:47

EDR(π/4-DQPSK): High Channel



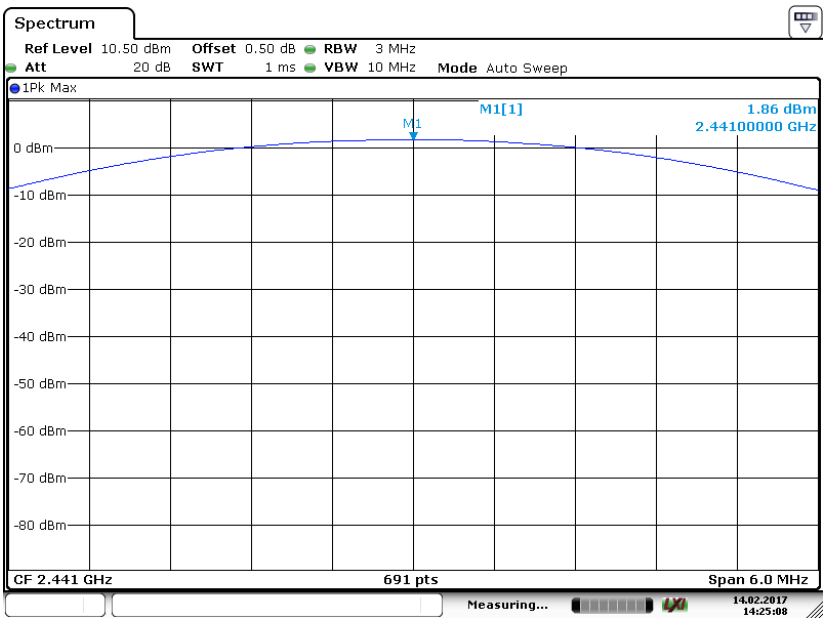
Date:14.FEB.2017 14:23:24

EDR(8-DPSK): Low Channel



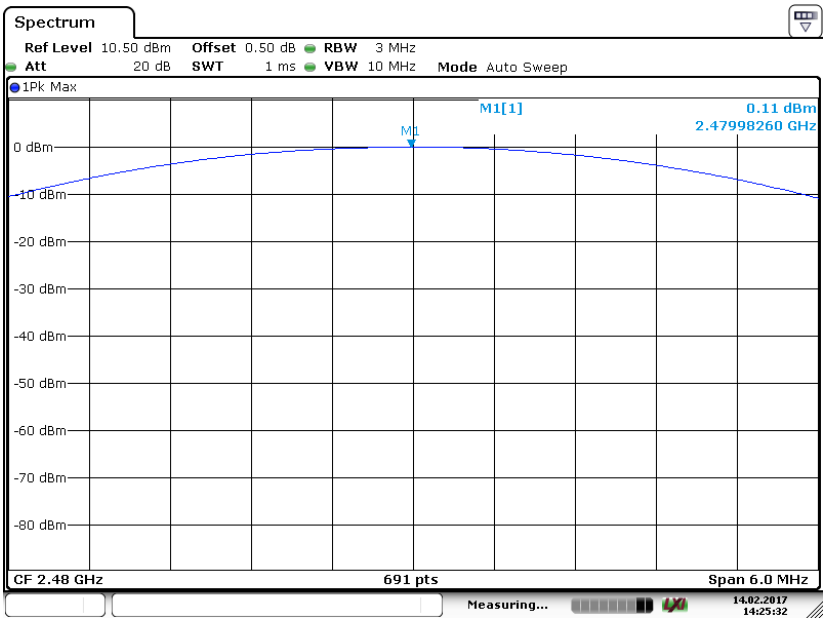
Date:14.FEB.2017 14:24:19

EDR(8-DPSK): Middle Channel



Date:14.FEB.2017 14:25:08

EDR(8-DPSK): High Channel



Date:14.FEB.2017 14:25:33

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

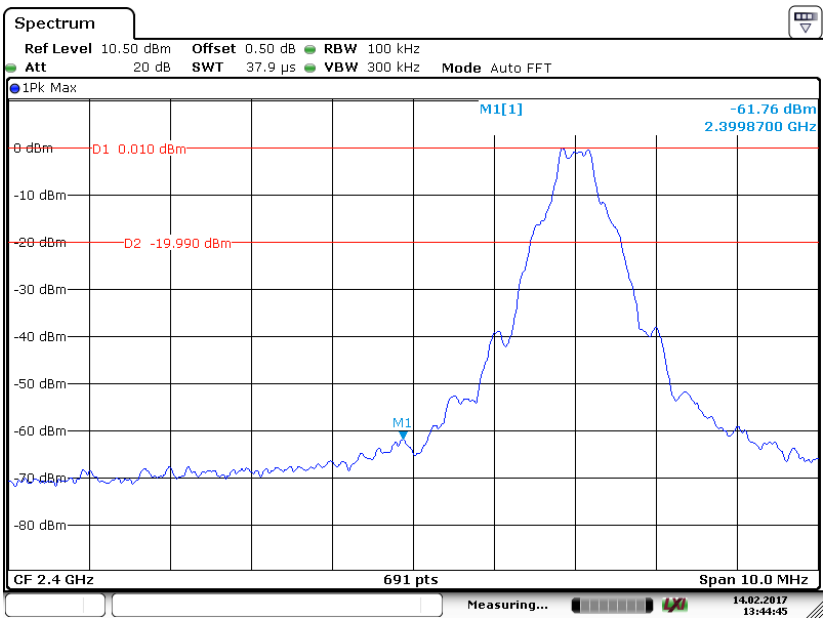
Temperature:	22 ℃
Relative Humidity:	56 %
ATM Pressure:	101.3 kPa

The testing was performed by Chris Wang on 2017-02-14.

EUT operation mode: Transmitting

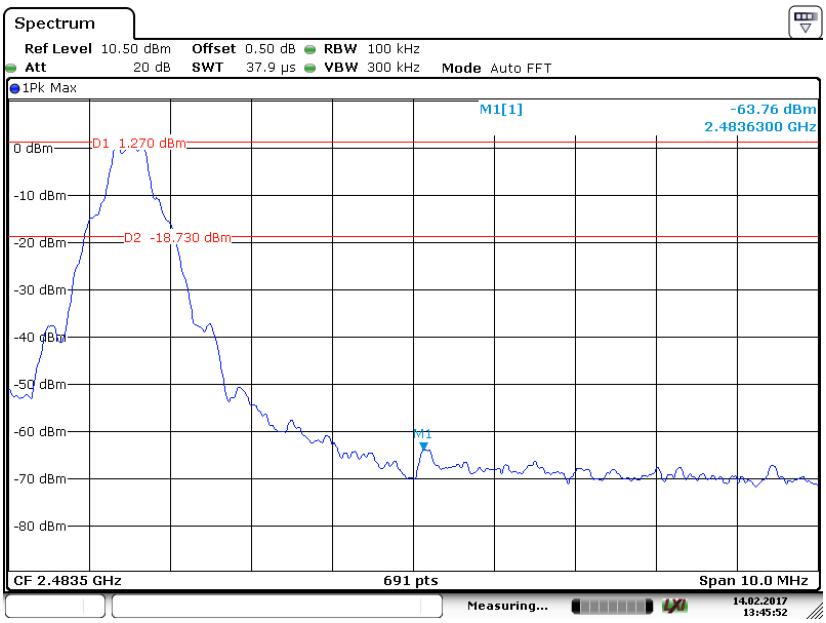
Test Result: Compliance. Please refer to following plots.

BDR (GFSK): Band Edge-Left Side



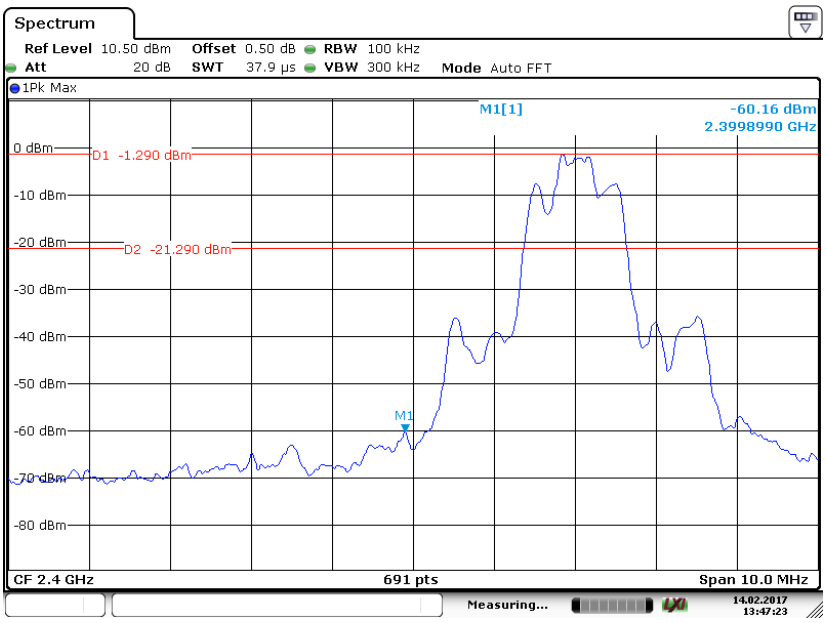
Date:14.FEB.2017 13:44:46

BDR (GFSK): Band Edge-Right Side



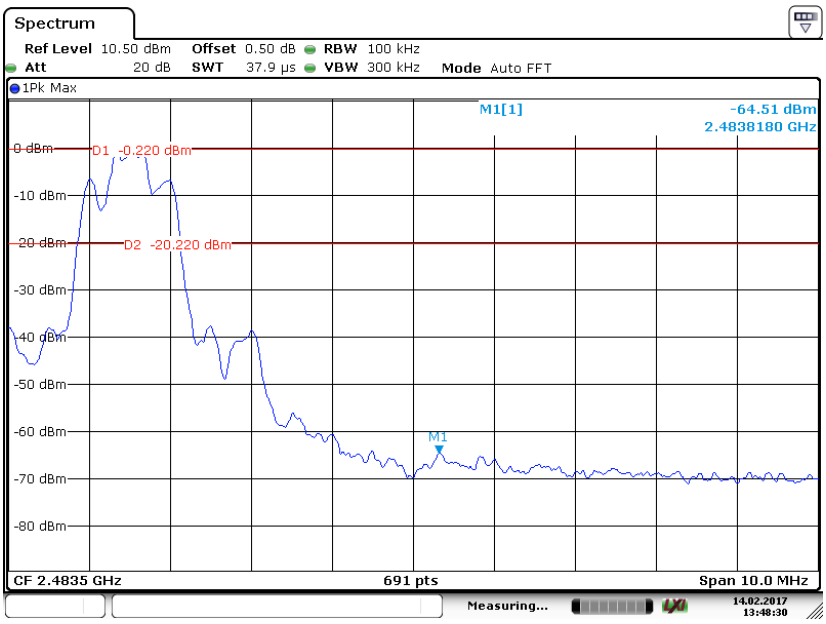
Date:14.FEB.2017 13:45:52

EDR (π/4-DQPSK): Band Edge-Left Side



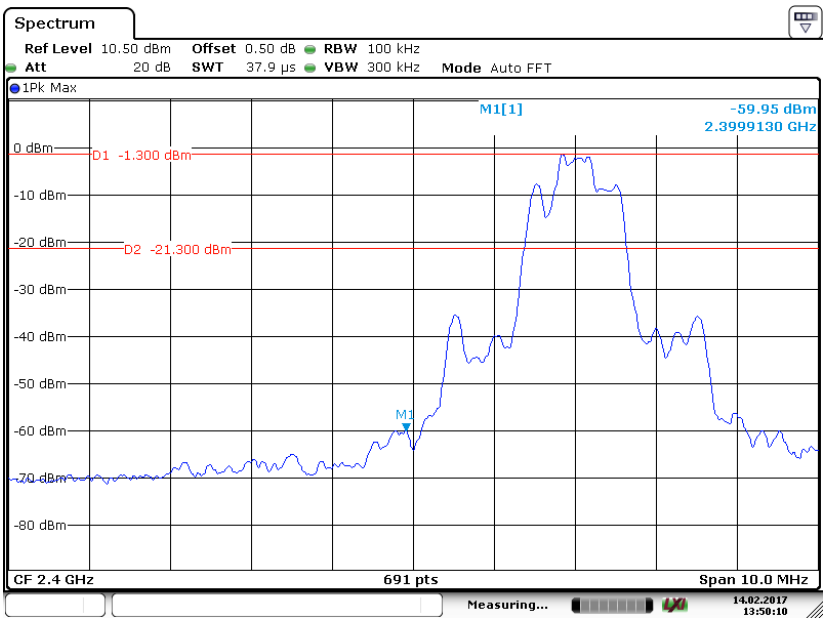
Date: 14.FEB.2017 13:47:23

EDR (π/4-DQPSK): Band Edge-Right Side



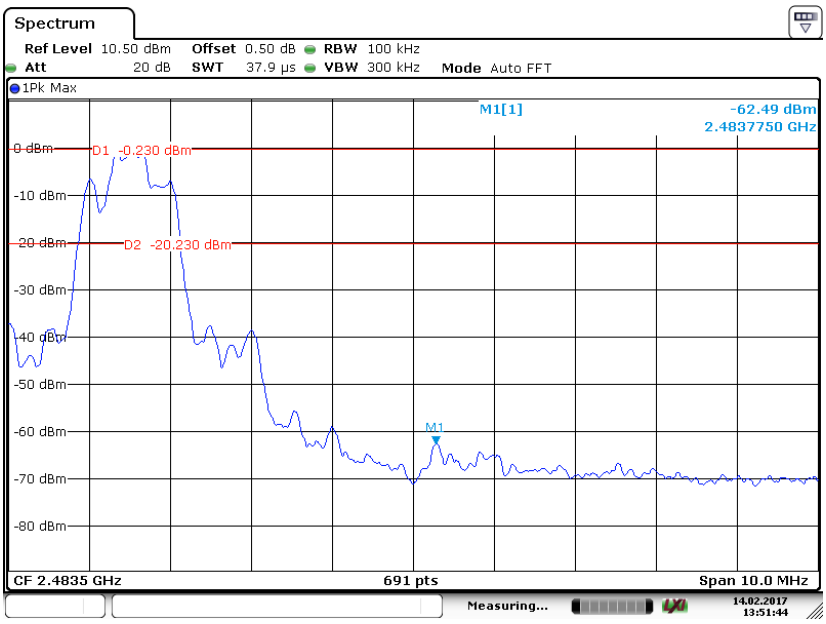
Date: 14.FEB.2017 13:48:29

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



Date:14.FEB.2017 13:50:10

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



Date:14.FEB.2017 13:51:44

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