



FCC PART 15C TEST REPORT No. I16N00808-BT

for

Silicon Application Corp.

Bluetooth GPS MODEL

Model Name: LINKIT2523HDK

With

Hardware Version: ELINK-T100-V2

Software Version: MT2523G_iot_sdk_dev_HDK_E2

FCC ID: 2AINMLINKIT2523HDK

Issued Date: Sep 5th, 2016

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

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REPORT HISTORY

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1. Test Laboratory

1.1. Testing Location

Location: CTTL(South Branch)

Address: TCL International E city No. 1001 Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong, China 518000

1.2. Testing Environment

Normal Temperature: 15-35°C

Extreme Temperature: -20/+60°C

Relative Humidity: 20-75%

1.3. Project data

Testing Start Date: 2016-07-20

Testing End Date: 2016-09-05

1.4. Signature

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2. Client Information

2.1. Applicant Information

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3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	Bluetooth GPS MODEL
Model Name	LINKIT2523HDK
Market Name	/
Frequency Band	2402MHz~2480MHz
Type of Modulation	GFSK/ π /4 DQPSK/8DPSK
Number of Channels	79
FCC ID	2AINMLINKIT2523HDK

*Note: Photographs of EUT are shown in ANNEX A of this test report.

3.2. Internal Identification of EUT

EUT ID*	IMEI	HW Version	SW Version	Receive Date
EUT1	MT2523G_01	ELINK-T100-V2	MT2523G_iot_sdk_dev_HDK_E2	2016-07-20

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE

AE ID*	Description	Type	SN
AE1	/	/	/

*AE ID: is used to identify the test sample in the lab internally.

4. Reference Documents

4.1. Documents supplied by applicant

EUT feature information is supplied by the applicant or manufacturer, which is the basis of testing.

4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part15	FCC CFR 47, Part 15, Subpart C: 15.205 Restricted bands of operation; 15.209 Radiated emission limits, general requirements; 15.247 Operation within the bands 902–928MHz, 2400–2483.5 MHz, and 5725–5850 MHz.	Nov,2015
ANSI C63.10	American National Standard for Testing Unlicensed Wireless Devices	Jun,2013

5. Test Results

5.1. Summary of Test Results

No	Test cases	Sub-clause of Part15C	Verdict
0	Antenna Requirement	15.203	P
1	Maximum Peak Output Power	15.247 (b)	P
2	Band Edges Compliance	15.247 (d)	P
3	Conducted Spurious Emission	15.247 (d)	P
4	Radiated Spurious Emission	15.247,15.205,15.209	P
5	Occupied 20dB bandwidth	15.247(a)	I
6	Time of Occupancy(Dwell Time)	15.247(a)	P
7	Number of Hopping Channel	15.247(a)	P
8	Carrier Frequency Separation	15.247(a)	P
9	AC Powerline Conducted Emission	15.107,15.207	P

See **ANNEX B** and **ANNEX C** for details.

5.2. Statements

CTTL has evaluated the test cases requested by the applicant/manufacturer as listed in section 5.1 of this report, for the EUT specified in section 3, according to the standards or reference documents listed in section 4.2

5.3. Terms used in the result table

Terms used in Verdict column

P	Pass
NA	Not Available
F	Fail

Abbreviations

AC	Alternating Current
AFH	Adaptive Frequency Hopping
BW	Band Width
E.I.R.P.	equivalent isotropical radiated power
ISM	Industrial, Scientific and Medical
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency
Tx	Transmitter

5.4. Laboratory Environment

Semi-anechoic chamber did not exceed following limits along the EMC testing

Temperature	Min. = 15 °C, Max. = 30 °C
Relative humidity	Min. = 35 %, Max. = 60 %
Shielding effectiveness	0.014MHz - 1MHz, >60dB; 1MHz - 1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4Ω
Normalised site attenuation (NSA)	< ±4dB, 3m/10m distance, from 30 to 1000 MHz
Uniformity of field strength	Between 0 and 6 dB, from 80 to 3000 MHz

Shielded room did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 30 °C
Relative humidity	Min. = 35 %, Max. = 60 %
Shielding effectiveness	0.014MHz - 1MHz, >60dB; 1MHz - 1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4 Ω

Fully-anechoic chamber did not exceed following limits along the EMC testing

Temperature	Min. = 15 °C, Max. = 30 °C
Relative humidity	Min. = 35 %, Max. = 60 %
Shielding effectiveness	0.014MHz - 1MHz, >60dB; 1MHz - 1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4Ω
Voltage Standing Wave Ratio (VSWR)	≤6dB, from 1 to 18 GHz, 3m distance

6. Test Facilities Utilized

Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Due date	Calibration Period
1	Vector Signal Analyzer	FSV40	100903	Rohde & Schwarz	2017-03-21	1 year
2	Bluetooth Tester	CBT32	100584	Rohde & Schwarz	2017-01-09	1 year

Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Due date	Calibration Period
1	Chamber	FACT5-2.0	4166	ETS-Lindgren	2018-05-13	3 years
2	Test Receiver	ESCI	100701	Rohde & Schwarz	2017-08-09	1 year
3	BiLog Antenna	VULB9163	9163 329	Schwarzbeck	2017-01-20	3 years
4	Horn Antenna	3117	00066577	ETS-Lindgren	2019-03-05	3 years
5	Spectrum Analyser	FSP40	100378	Rohde & Schwarz	2016-12-18	1 year
6	Bluetooth Tester	CBT32	100584	Rohde & Schwarz	2017-01-09	1 year
7	Loop Antenna	HLA6120	35779	TESEQ	2019-05-10	3 years
8	Test Receiver	ESCI	100702	Rohde & Schwarz	2017-06-26	1 year
9	LISN	ESH2-Z5	100196	Rohde & Schwarz	2017-01-12	1 year

Anechoic chamber

Fully anechoic chamber by ETS-Lindgren.

ANNEX A: MEASUREMENT RESULTS FOR RECEIVER

A.0 Antenna requirement

Measurement Limit:

Standard	Requirement
FCC CRF Part 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, § 15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Conclusion: The Directional gains of antenna used for transmitting is 0 dBi.

The RF transmitter uses an integrate antenna without connector.

A.1 Maximum Peak Output Power

Measurement Limit:

Standard	Limit (dBm)
FCC CRF Part 15.247(b)(1)	< 21

Measurement Results:

Mode	Test Result (dBm)					
	2402MHz (Ch0)		2441MHz (Ch39)		2480 MHz (Ch78)	
GFSK	Fig.1	2.63	Fig.2	2.12	Fig.3	0.24
$\pi/4$ DQPSK	Fig.4	1.78	Fig.5	1.25	Fig.6	-0.51
8DPSK	Fig.7	1.95	Fig.8	1.50	Fig.9	-0.42

Conclusion: Pass

A.2 Band Edges Compliance

Measurement Limit:

Standard	Limit (dBc)
FCC 47 CFR Part 15.247 (d)	> 20

Measurement Result:

Mode	Channel	Hopping	Test Results	Conclusion
GFSK	0	ON	Fig.10	P
	78	ON	Fig.11	P
$\pi/4$ DQPSK	0	ON	Fig.12	P
	78	ON	Fig.13	P
8DPSK	0	ON	Fig.14	P
	78	ON	Fig.15	P

Mode	Channel	Hopping	Test Results	Conclusion
GFSK	0	OFF	Fig.16	P
	78	OFF	Fig.17	P
$\pi/4$ DQPSK	0	OFF	Fig.18	P
	78	OFF	Fig.19	P
8DPSK	0	OFF	Fig.20	P
	78	OFF	Fig.21	P

See ANNEX C for test graphs.

Conclusion: Pass

A.3 Conducted Emission

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247 (d)	20dB below peak output power in 100 kHz bandwidth

Measurement Results:

MODE	Channel	Frequency Range	Test Results	Conclusion
GFSK	0	2.402 GHz	Fig.22	P
		30 MHz-3GHz	Fig.23	P
		3GHz-18GHz	Fig.24	P
	39	2.441 GHz	Fig.25	P
		30 MHz-3 GHz	Fig.26	P
		3GHz-18GHz	Fig.27	P
	78	2.480 GHz	Fig.28	P
		30 MHz-3GHz	Fig.29	P
		3GHz-18GHz	Fig.30	P
$\pi/4$ DQPSK	0	2.402 GHz	Fig.31	P
		30 MHz-3 GHz	Fig.32	P
		3GHz-18GHz	Fig.33	P
	39	2.441 GHz	Fig.34	P
		30 MHz-3GHz	Fig.35	P
		3GHz-18GHz	Fig.36	P
	78	2.480 GHz	Fig.37	P
		30 MHz-3GHz	Fig.38	P
		3GHz-18GHz	Fig.39	P
8DPSK	0	2.402 GHz	Fig.40	P
		30 MHz-3GHz	Fig.41	P
		3GHz-18GHz	Fig.42	P
	39	2.441 GHz	Fig.43	P
		30 MHz-3GHz	Fig.44	P
		3GHz-18GHz	Fig.45	P
	78	2.480 GHz	Fig.46	P
		30 MHz-3GHz	Fig.47	P
		3GHz-18GHz	Fig.48	P
/	All channel	18GHz-26GHz	Fig.49	P

See ANNEX C for test graphs.

Conclusion: Pass

A.4 Radiated Emission

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247, 15.205, 15.209	20dB below peak output power

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)).

Limit in restricted band:

Frequency of emission (MHz)	Field strength(µV/m)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Condition

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

Frequency of emission (MHz)	RBW/VBW	Sweep Time(s)
30-1000	120kHz/300kHz	5
1000-4000	1MHz/3MHz	15
4000-18000	1MHz/3MHz	40
18000-26500	1MHz/3MHz	20

Note: According to the performance evaluation, the radiated emission margin of EUT is over 20dB in the band from 9kHz to 30MHz. Therefore, the measurement starts from 30MHz to tenth harmonic.

The measurement results include the horizontal polarization and vertical polarization measurements.

Measurement Results:

Mode	Channel	Frequency Range	Test Results	Conclusion
GFSK	0	1 GHz ~18 GHz	Fig.50	P
	39	9 kHz ~30 MHz	Fig.51	P
		30 MHz ~1 GHz	Fig.52	P
		1 GHz ~18 GHz	Fig.53	P
	78	1 GHz ~18 GHz	Fig.54	P
	Power(CH0)	2.38 GHz ~ 2.45 GHz	Fig.55	P
	Power(CH78)	2.45 GHz ~ 2.5 GHz	Fig.56	P
$\pi/4$ DQPSK	0	1 GHz ~18 GHz	Fig.57	P
	39	9 kHz ~30 MHz	Fig.58	P
		30 MHz ~1 GHz	Fig.59	P
		1 GHz ~18 GHz	Fig.60	P
	78	1 GHz ~18 GHz	Fig.61	P
	Power(CH0)	2.38 GHz ~ 2.45 GHz	Fig.62	P
	Power(CH78)	2.45 GHz ~ 2.5 GHz	Fig.63	P
8DPSK	0	1 GHz ~18 GHz	Fig.64	P
	39	9 kHz ~30 MHz	Fig.65	P
		30 MHz ~1 GHz	Fig.66	P
		1 GHz ~18 GHz	Fig.67	P
	78	1 GHz ~18 GHz	Fig.68	P
	Power(CH0)	2.38 GHz ~ 2.45 GHz	Fig.69	P
	Power(CH78)	2.45 GHz ~ 2.5 GHz	Fig.70	P
/	All channels	18 GHz~ 26.5 GHz	Fig.71	P

GFSK CH0 (1-18GHz)

Frequency (MHz)	MaxPeak-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
14198.000000	55.4	H	11.3	18.6	74.0
14724.000000	56.3	H	11.9	17.7	74.0
15731.500000	58.3	V	12.7	15.7	74.0
16251.000000	58.7	V	13.2	15.3	74.0
16845.500000	59.3	H	13.9	14.7	74.0
17390.500000	59.0	H	14.0	15.0	74.0

Frequency (MHz)	Average-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
14176.000000	43.9	H	11.2	10.1	54.0
15155.500000	44.9	H	12.1	9.1	54.0
15677.000000	46.6	H	12.6	7.4	54.0
16232.000000	47.2	H	13.1	6.8	54.0
16785.000000	47.9	V	13.9	6.1	54.0
17352.500000	47.2	V	14.0	6.8	54.0

GFSK CH39 (1-18GHz)

Frequency (MHz)	MaxPeak-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
13623.000000	55.1	H	11.1	18.9	74.0
14475.500000	56.2	H	11.7	17.8	74.0
14826.500000	56.7	V	11.9	17.3	74.0
15700.000000	58.2	V	12.7	15.8	74.0
16340.500000	58.5	H	13.4	15.5	74.0
16771.000000	59.2	H	13.9	14.8	74.0

Frequency (MHz)	Average-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
13934.500000	43.4	V	10.8	10.6	54.0
14149.000000	43.8	H	11.2	10.2	54.0
15181.000000	44.8	V	12.2	9.2	54.0
15668.000000	46.6	V	12.6	7.4	54.0
16243.500000	47.0	V	13.2	7.0	54.0
16750.000000	47.7	H	13.9	6.3	54.0

GFSK CH78 (1-18GHz)

Frequency (MHz)	MaxPeak-ClearWrite (dBμV/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
13977.500000	56.0	H	10.8	18.0	74.0
15144.000000	57.5	H	12.1	16.5	74.0
15700.000000	58.3	H	12.7	15.7	74.0
16206.000000	58.6	V	13.1	15.4	74.0
16789.500000	60.1	V	13.9	13.9	74.0
17326.000000	58.8	V	14.0	15.2	74.0

Frequency (MHz)	Average-ClearWrite (dBμV/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
14521.000000	44.1	V	11.8	9.9	54.0
15179.500000	44.9	V	12.2	9.1	54.0
15689.000000	46.7	V	12.7	7.3	54.0
16213.000000	47.0	V	13.1	7.0	54.0
16738.000000	47.6	H	13.8	6.4	54.0
17303.500000	47.1	V	13.9	6.9	54.0

 $\pi/4$ DQPSK CH0 (1-18GHz)

Frequency (MHz)	MaxPeak-ClearWrite (dBμV/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
14531.000000	55.8	H	11.8	18.2	74.0
15184.000000	56.4	V	12.2	17.6	74.0
15808.500000	57.6	H	12.8	16.4	74.0
16198.500000	58.5	V	13.1	15.5	74.0
16728.500000	59.7	H	13.8	14.3	74.0
17964.500000	58.5	H	14.0	15.5	74.0

Frequency (MHz)	Average-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
14117.000000	43.7	V	11.1	10.3	54.0
15156.500000	44.8	H	12.1	9.2	54.0
15680.500000	46.3	H	12.6	7.7	54.0
16225.500000	46.8	H	13.1	7.2	54.0
16743.000000	47.4	H	13.9	6.6	54.0
17433.000000	46.8	H	14.0	7.2	54.0

 $\pi/4$ DQPSK CH39 (1-18GHz)

Frequency (MHz)	MaxPeak-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
14166.000000	55.5	V	11.2	18.5	74.0
14677.000000	56.8	V	12.0	17.2	74.0
15681.000000	58.4	H	12.6	15.6	74.0
16200.500000	58.5	H	13.1	15.5	74.0
16790.500000	59.0	V	13.9	15.0	74.0
17372.000000	59.2	H	14.0	14.8	74.0

Frequency (MHz)	Average-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
14157.000000	43.7	H	11.2	10.3	54.0
15178.500000	44.7	V	12.2	9.3	54.0
15686.000000	46.3	V	12.6	7.7	54.0
16208.500000	46.7	V	13.1	7.3	54.0
16781.000000	47.5	V	13.9	6.5	54.0
17354.000000	46.9	H	14.0	7.1	54.0

$\pi/4$ DQPSK CH78 (1-18GHz)

Frequency (MHz)	MaxPeak-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
14109.000000	55.3	V	11.1	18.7	74.0
14751.500000	55.8	H	11.9	18.2	74.0
15684.000000	58.0	H	12.6	16.0	74.0
16258.000000	59.4	H	13.2	14.6	74.0
16818.000000	58.7	H	13.9	15.3	74.0
17401.500000	58.8	H	14.0	15.2	74.0

Frequency (MHz)	Average-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
14167.000000	43.5	V	11.2	10.5	54.0
15185.500000	44.2	H	12.2	9.8	54.0
15678.000000	46.2	H	12.6	7.8	54.0
16223.500000	46.6	H	13.1	7.4	54.0
16760.500000	47.3	H	13.9	6.7	54.0
17351.000000	46.7	H	14.0	7.3	54.0

8DPSK CH0 (1-18GHz)

Frequency (MHz)	MaxPeak-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
14185.000000	55.9	H	11.2	18.1	74.0
15179.000000	56.3	V	12.2	17.7	74.0
15698.500000	57.5	V	12.7	16.5	74.0
16242.000000	58.2	H	13.2	15.8	74.0
16842.500000	58.5	V	13.9	15.5	74.0
17354.000000	58.7	V	14.0	15.3	74.0

Frequency (MHz)	Average-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
14144.500000	43.4	H	11.2	10.6	54.0
15168.500000	44.1	H	12.1	9.9	54.0
15681.000000	46.2	H	12.6	7.8	54.0
16206.000000	46.6	H	13.1	7.4	54.0
16792.000000	47.4	H	13.9	6.6	54.0
17394.000000	46.7	V	14.0	7.3	54.0

8DPSK CH39 (1-18GHz)

Frequency (MHz)	MaxPeak-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
14149.500000	55.5	V	11.2	18.5	74.0
14788.500000	56.1	V	11.9	17.9	74.0
15762.000000	58.2	H	12.8	15.8	74.0
16273.500000	59.2	H	13.2	14.8	74.0
16784.000000	58.9	H	13.9	15.1	74.0
17297.000000	58.6	V	13.9	15.4	74.0

Frequency (MHz)	Average-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
14529.000000	43.8	H	11.8	10.2	54.0
15168.500000	44.7	H	12.1	9.3	54.0
15721.500000	46.3	V	12.7	7.7	54.0
16231.500000	46.8	V	13.1	7.2	54.0
16783.000000	47.5	V	13.9	6.5	54.0
17354.000000	47.0	V	14.0	7.0	54.0

8DPSK CH78 (1-18GHz)

Frequency (MHz)	MaxPeak-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
14039.500000	55.8	H	10.9	18.2	74.0
15180.000000	56.7	V	12.2	17.3	74.0
15753.000000	58.0	V	12.8	16.0	74.0
16220.000000	59.0	H	13.1	15.0	74.0
16735.000000	59.1	V	13.8	14.9	74.0
17361.000000	59.1	H	14.0	14.9	74.0

Frequency (MHz)	Average-ClearWrite (dB μ V/m)	Polarization	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
14526.500000	43.9	V	11.8	10.1	54.0
15171.000000	44.8	V	12.1	9.2	54.0
15754.000000	46.3	V	12.8	7.7	54.0
16209.500000	46.7	V	13.1	7.3	54.0
16756.000000	47.4	H	13.9	6.6	54.0
17286.000000	46.8	V	13.9	7.2	54.0

See ANNEX C for test graphs.

Conclusion: Pass

A.5 Occupied 20dB Bandwidth

Measurement Limit:

Standard	Limit (kHz)
FCC 47 CFR Part 15.247 (a)	/

Measurement Result:

Mode	Channel	Occupied 20dB Bandwidth (MHz)		Conclusion
GFSK	0	Fig.72	1.122	/
	39	Fig.73	1.114	
	78	Fig.74	1.122	
$\pi/4$ DQPSK	0	Fig.75	1.346	/
	39	Fig.76	1.346	
	78	Fig.77	1.346	
8DPSK	0	Fig.78	1.360	/
	39	Fig.79	1.360	
	78	Fig.80	1.368	

See ANNEX C for test graphs.

Conclusion: PASS

A.6 Time of Occupancy (Dwell Time)

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247(a)	< 400 ms

Measurement Results:

Mode	Channel	Packet	Dwell Time(ms)		Conclusion
GFSK	39	DH5	Fig.81	201.9	P
			Fig.82		
$\pi/4$ DQPSK	39	2-DH5	Fig.83	187.6	P
			Fig.84		
8DPSK	39	3-DH5	Fig.85	149.9	P
			Fig.86		

Note: Time of Occupancy= Time of Occupancy(each)* Number of Transmissions

See ANNEX C for test graphs.

Conclusion: Pass

A.7 Number of Hopping Channels

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247(a)	At least 15 non-overlapping channels

Measurement Results:

Mode	Channel	Packet	Number of hopping channels	Test result	Conclusion
GFSK	39	DH5	Fig.87	Fig.88	79
$\pi/4$ DQPSK	39	2-DH5	Fig.89	Fig.90	79
8DPSK	39	3-DH5	Fig.91	Fig.92	79

See ANNEX C for test graphs.

Conclusion: Pass

A.8 Carrier Frequency Separation

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247(a)	By a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater

Measurement Results:

Mode	Channel	Packet	Separation of hopping channels	Test result (MHz)	Conclusion
GFSK	39	DH5	Fig.93	1.006	P
$\pi/4$ DQPSK	39	2-DH5	Fig.94	1.006	P
8DPSK	39	3-DH5	Fig.95	1.006	P

See ANNEX C for test graphs.

Conclusion: Pass

A.9 AC Power line Conducted Emission

Test Condition:

Voltage (V)	Frequency (Hz)
120	60

Measurement Result and limit:

BT (Quasi-peak Limit)-AE1

Frequency range (MHz)	Quasi-peak Limit (dB μ V)	Result (dB μ V)	Conclusion
		Traffic	
0.15 to 0.5	66 to 56		
0.5 to 5	56	Fig.96	P
5 to 30	60		

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

BT (Average Limit)-AE1

Frequency range (MHz)	Average-peak Limit (dB μ V)	Result (dB μ V)	Conclusion
		Traffic	
0.15 to 0.5	56 to 46		
0.5 to 5	46	Fig.96	P
5 to 30	50		

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

BT (Quasi-peak Limit)-AE1

Frequency range (MHz)	Quasi-peak Limit (dB μ V)	Result (dB μ V)	Conclusion
		Idle	
0.15 to 0.5	66 to 56		
0.5 to 5	56	Fig.97	P
5 to 30	60		

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

BT (Average Limit)-AE1

Frequency range (MHz)	Average-peak Limit (dB μ V)	Result (dB μ V)	Conclusion
		Idle	
0.15 to 0.5	56 to 46		
0.5 to 5	46	Fig.97	P
5 to 30	50		

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

Note: The measurement results include the L1 and N measurements.

See ANNEX C for test graphs.

Conclusion: Pass

ANNEX B: TEST FIGURE LIST

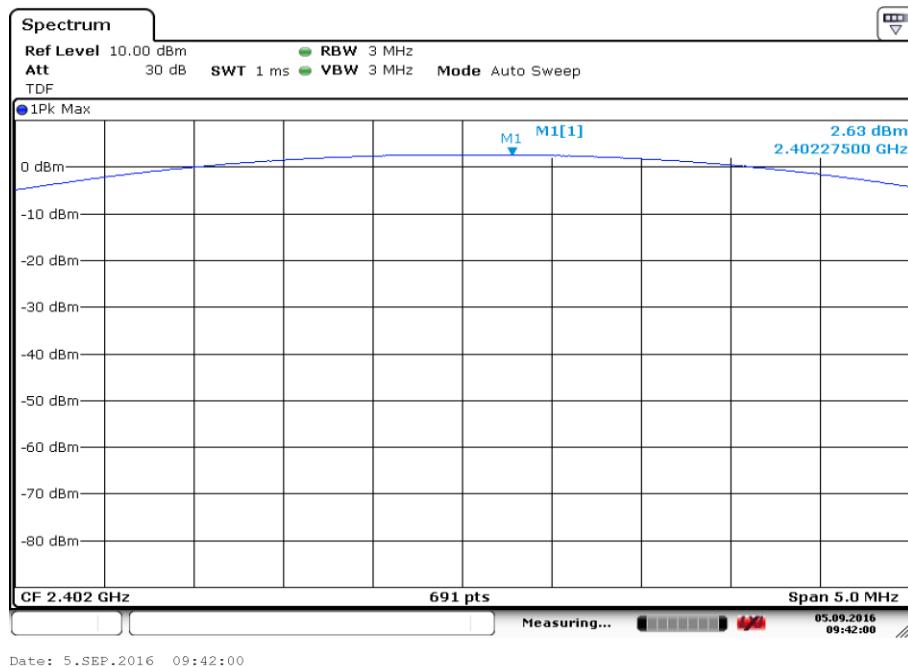


Fig. 1 Maximum Peak Output Power(GFSK, Ch 0)

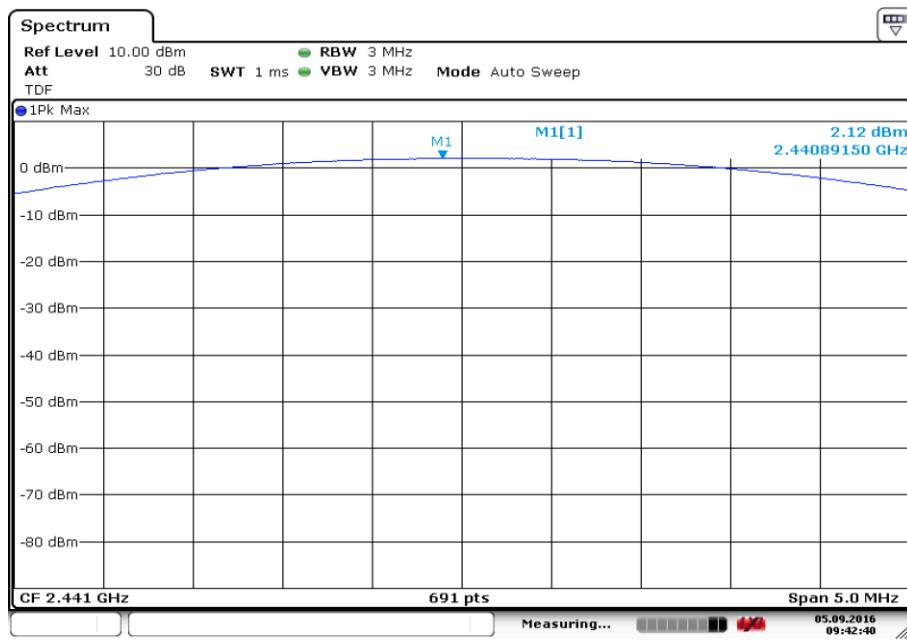


Fig. 2 Maximum Peak Output Power(GFSK, Ch 39)

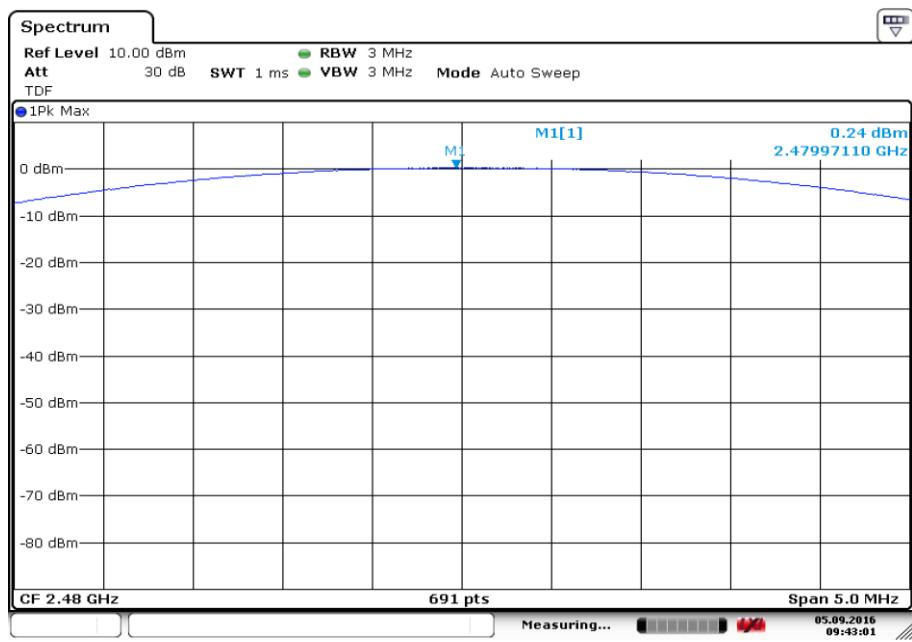


Fig. 3 Maximum Peak Output Power(GFSK, Ch 78)

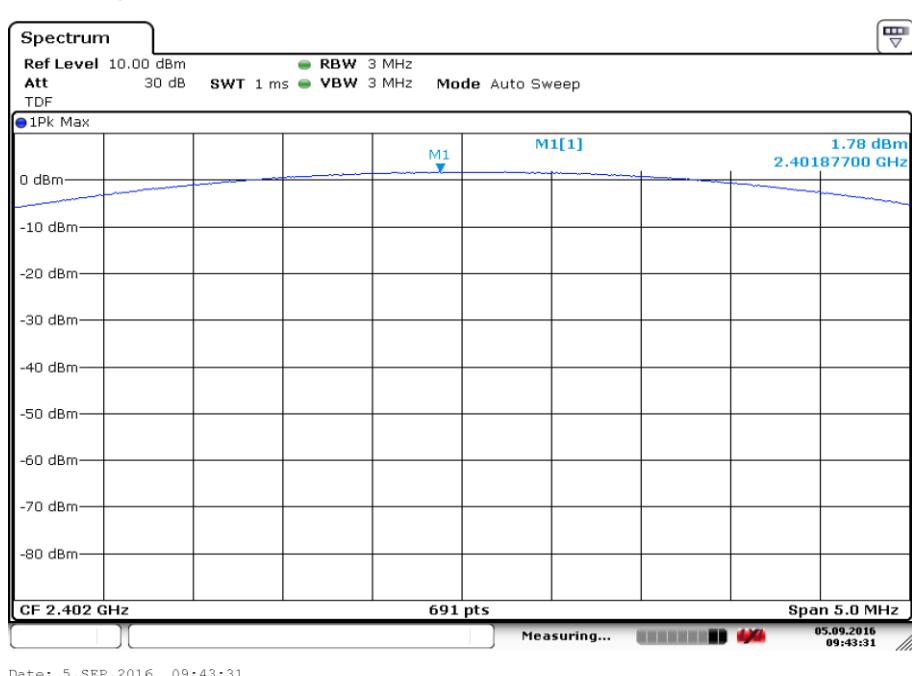


Fig. 4 Maximum Peak Output Power($\pi /4$ DQPSK, Ch 0)

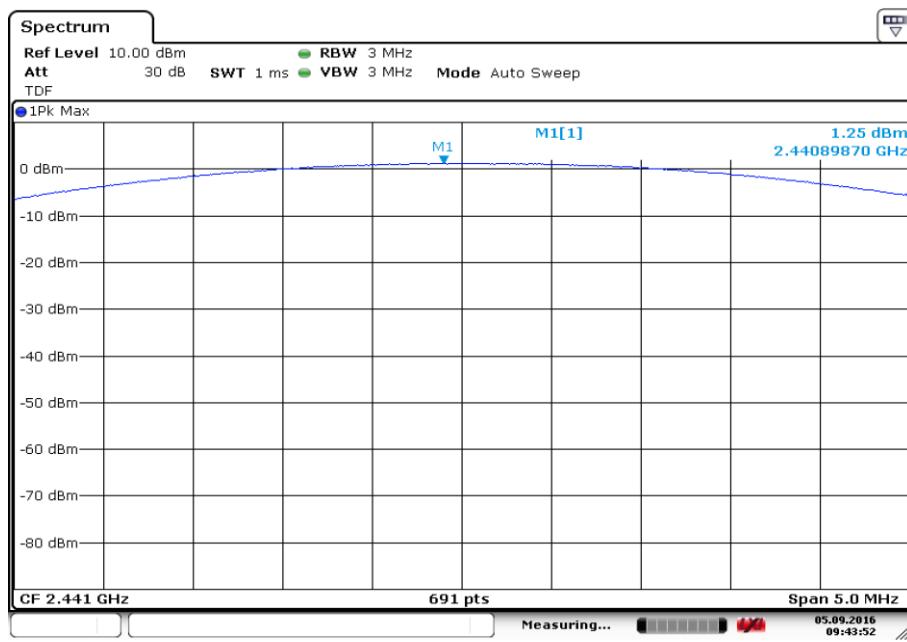


Fig. 5 Maximum Peak Output Power($\pi/4$ DQPSK, Ch 39)

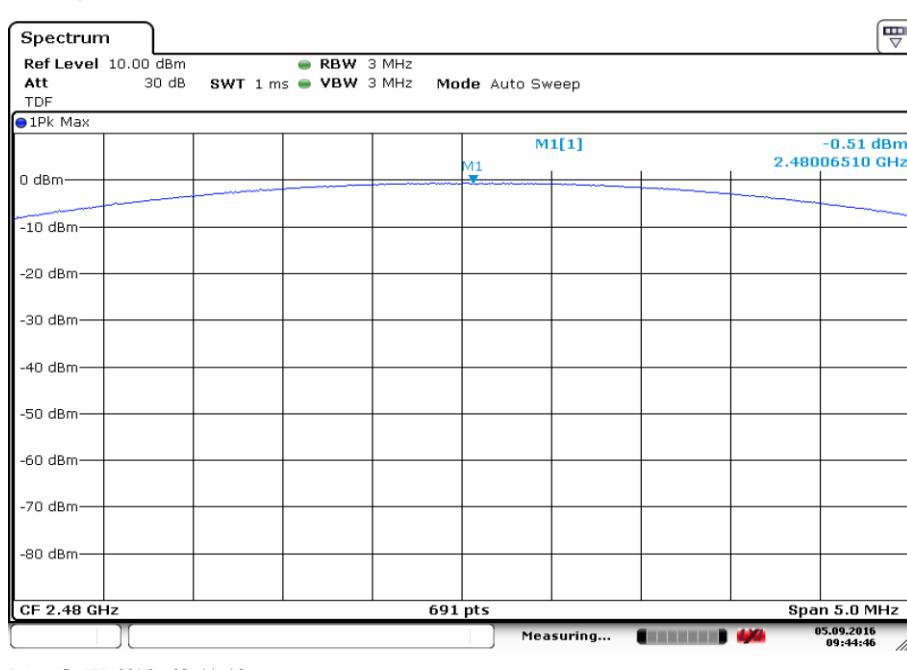


Fig. 6 Maximum Peak Output Power($\pi/4$ DQPSK, Ch 78)

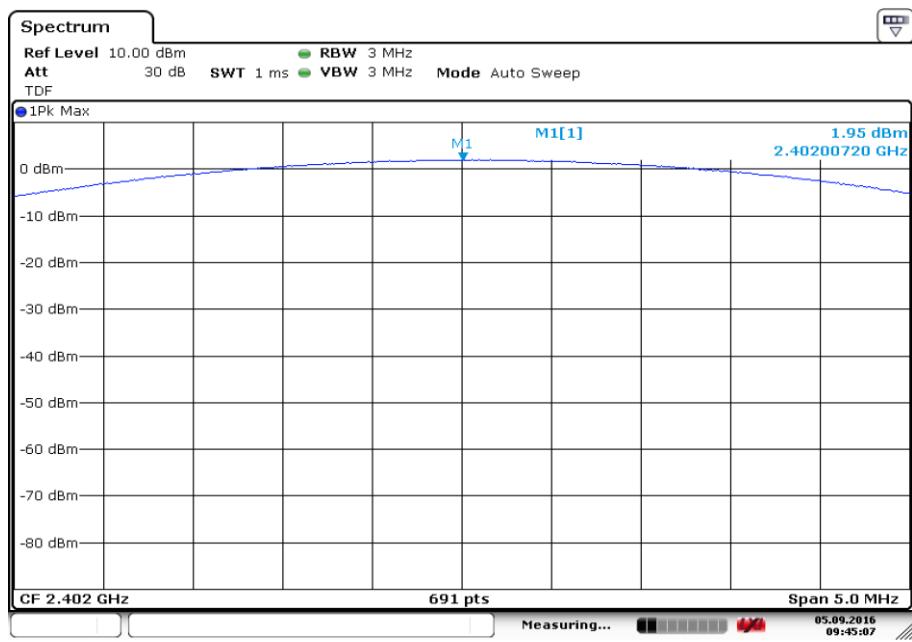


Fig. 7 Maximum Peak Output Power(8DPSK, Ch 0)

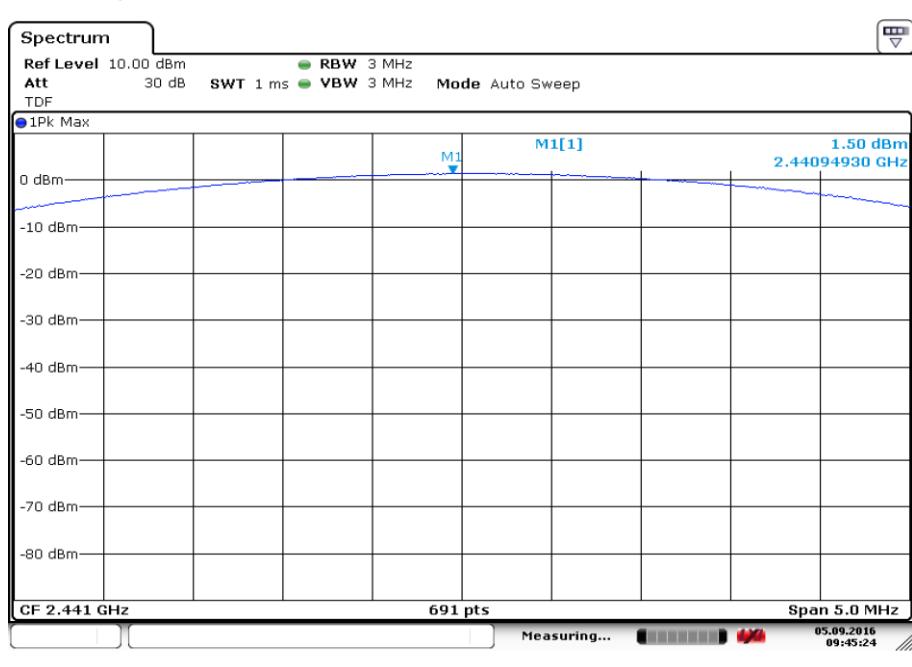


Fig. 8 Maximum Peak Output Power(8DPSK, Ch 39)

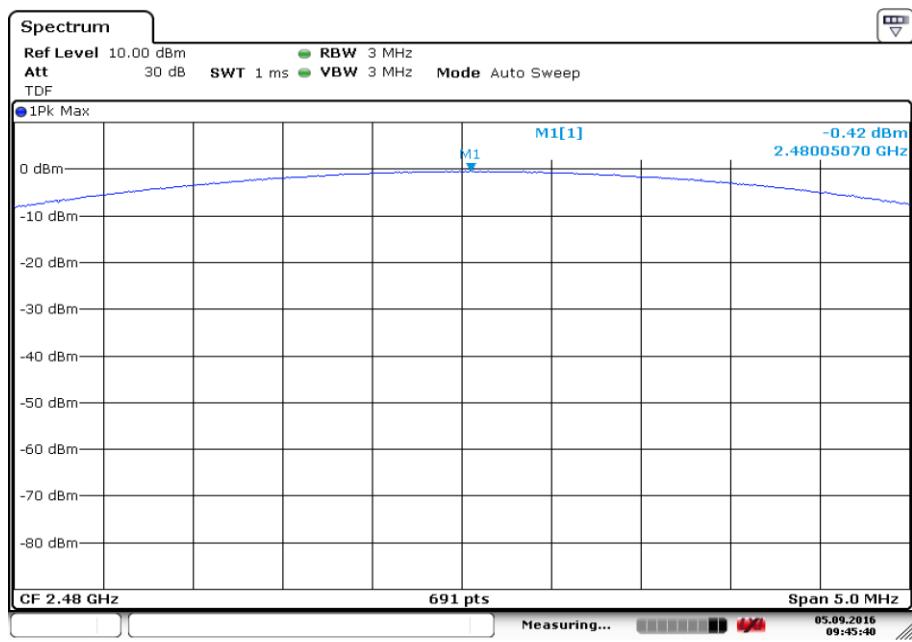


Fig. 9 Maximum Peak Output Power(8DPSK, Ch 78)

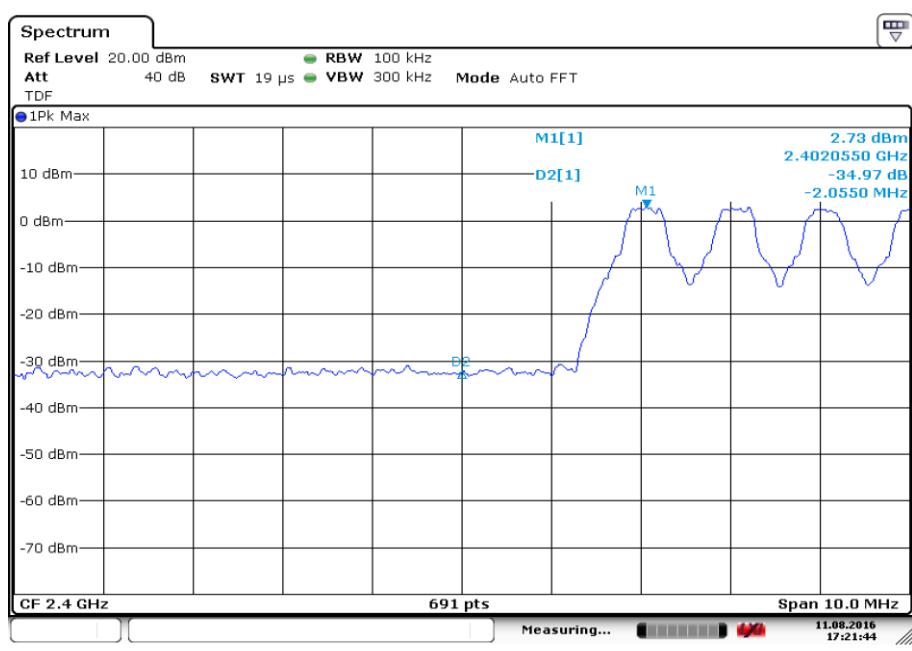


Fig. 10 Band Edges (GFSK, Ch 0, Hopping ON)

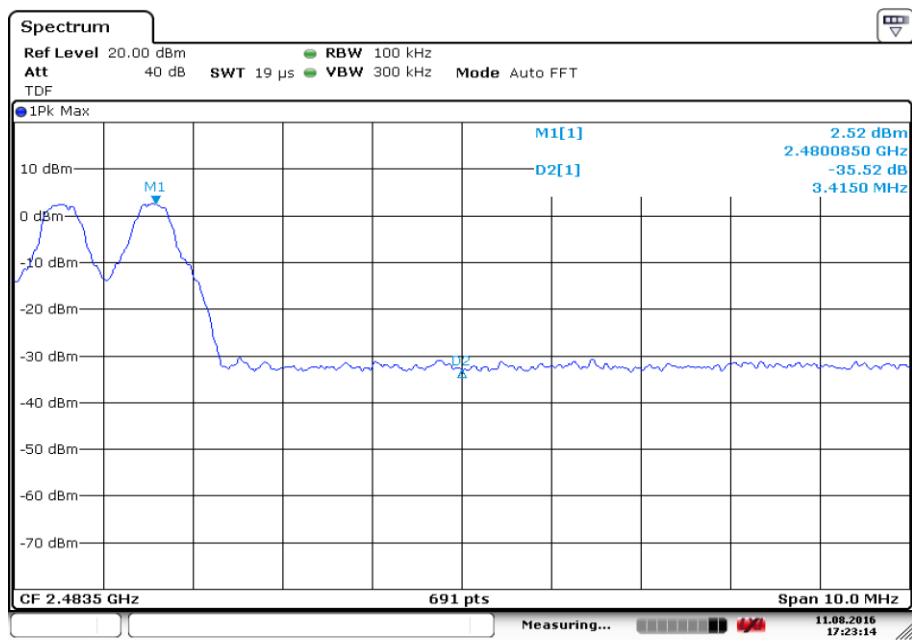


Fig. 11 Band Edges (GFSK, Ch 78, Hopping ON)

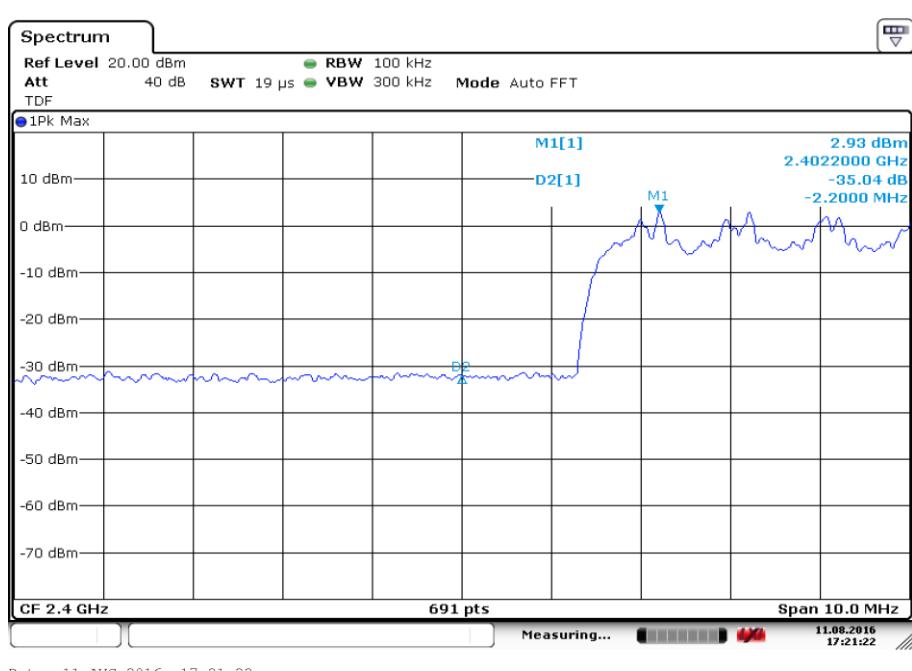
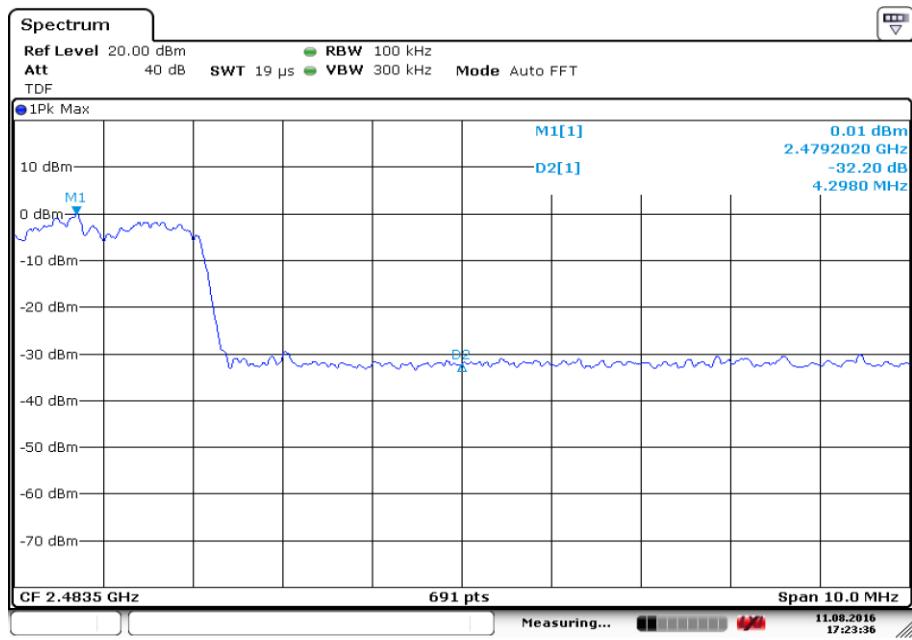
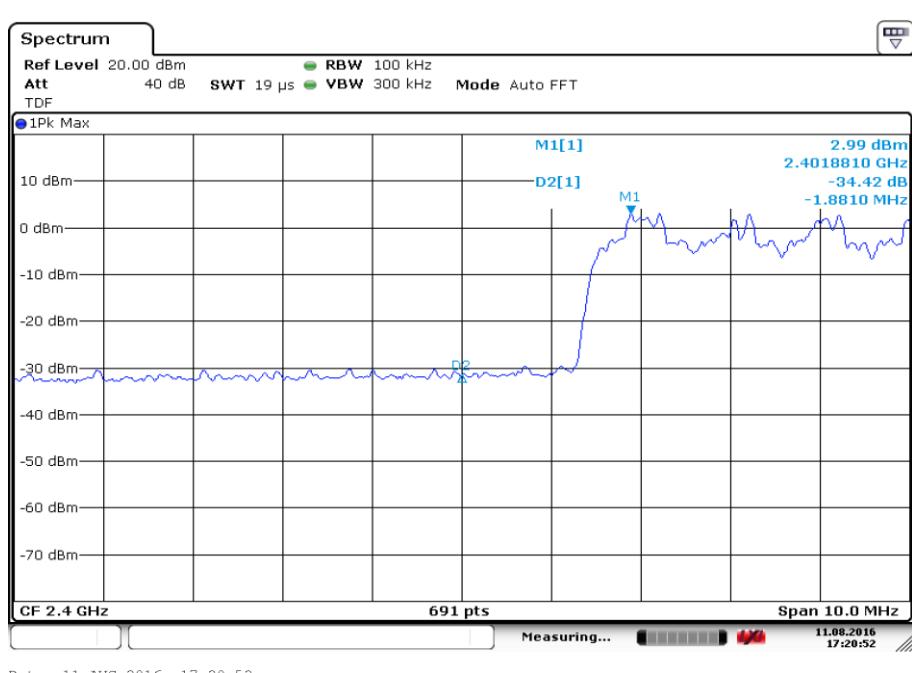
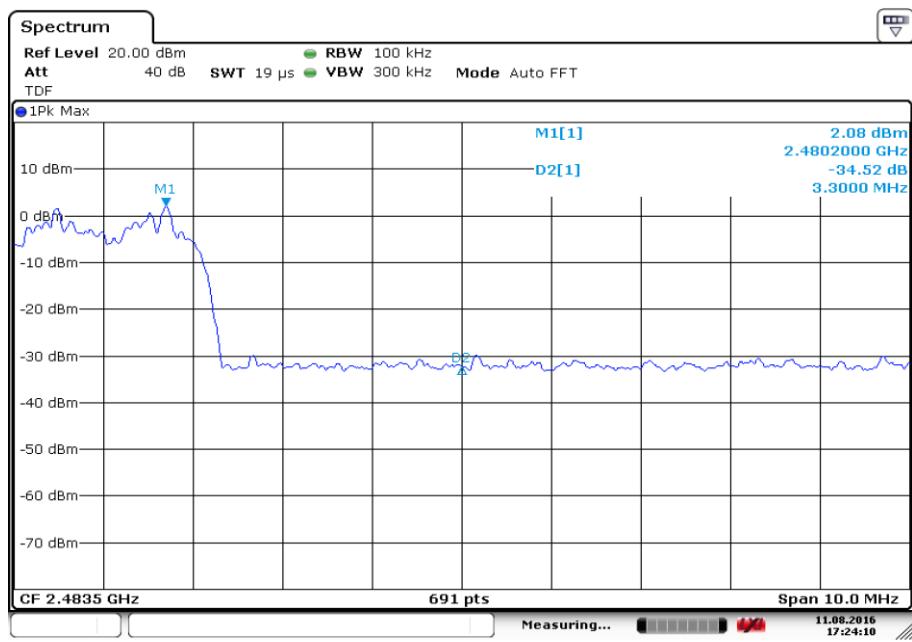
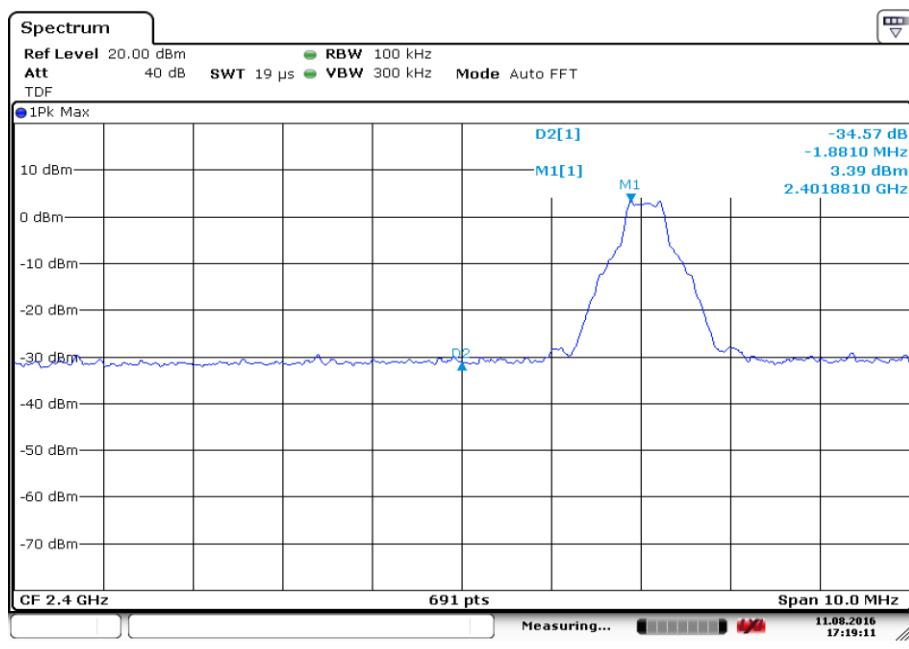


Fig. 12 Band Edges ($\pi/4$ DQPSK, Ch 0, Hopping ON)


Fig. 13 Band Edges ($\pi/4$ DQPSK, Ch 78, Hopping ON)

Fig. 14 Band Edges (8DPSK, Ch 0, Hopping ON)



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Fig. 15 Band Edges (8DPSK, Ch 78, Hopping ON)


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Fig. 16 Band Edges (GFSK, Ch 0, Hopping OFF)

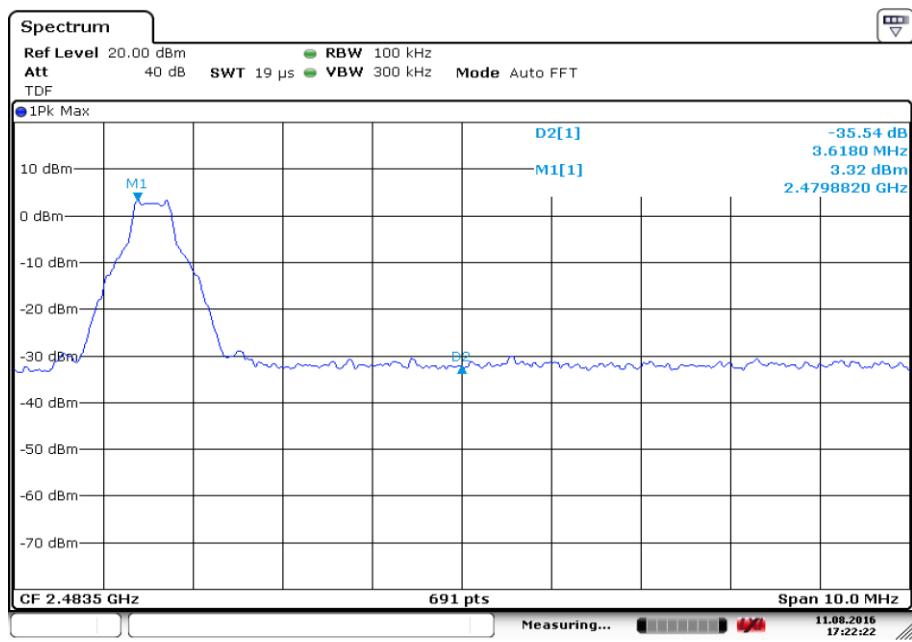


Fig. 17 Band Edges (GFSK, Ch 78, Hopping OFF)

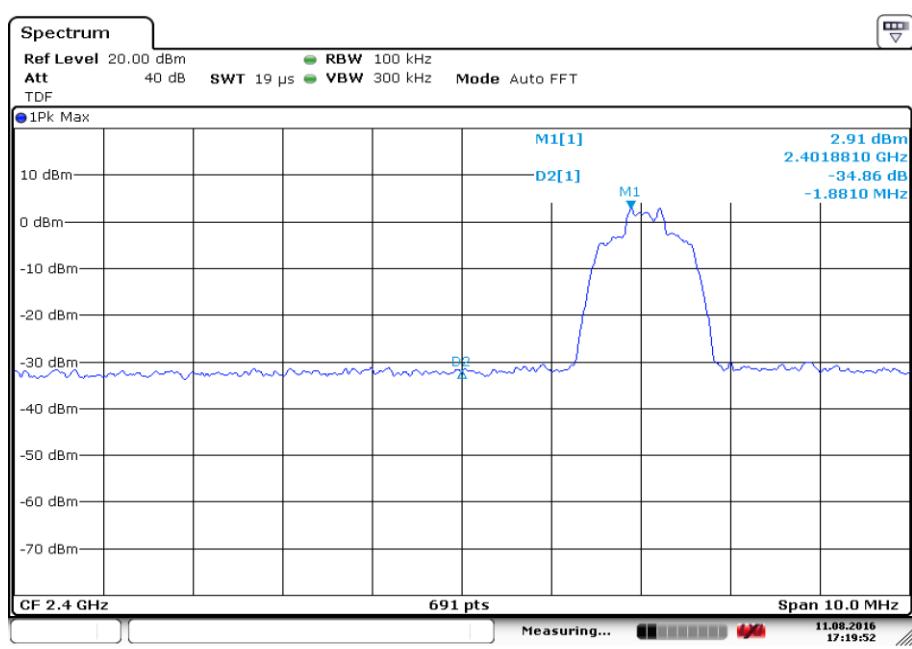


Fig. 18 Band Edges ($\pi/4$ DQPSK, Ch 0, Hopping OFF)

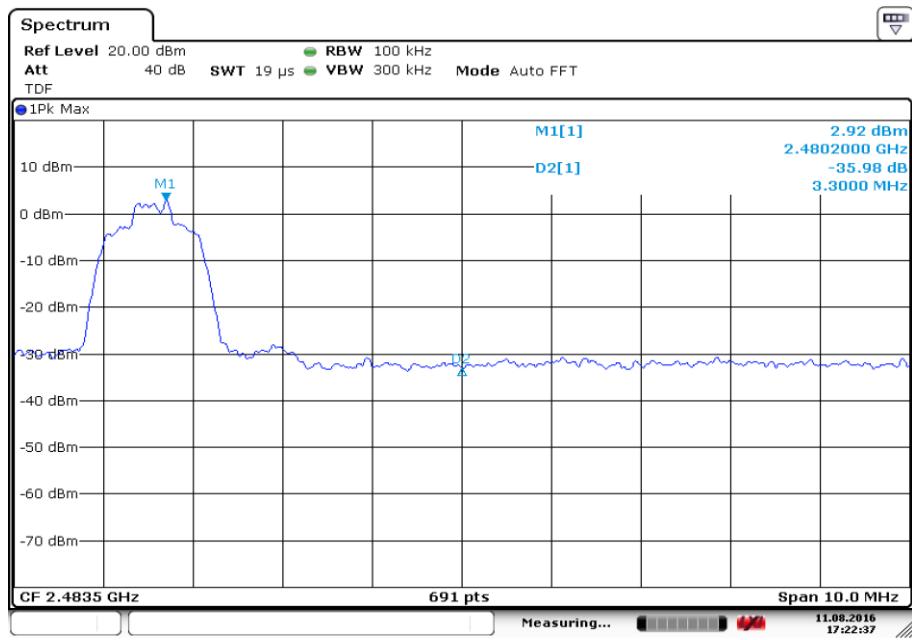


Fig. 19 Band Edges ($\pi/4$ DQPSK, Ch 78, Hopping OFF)

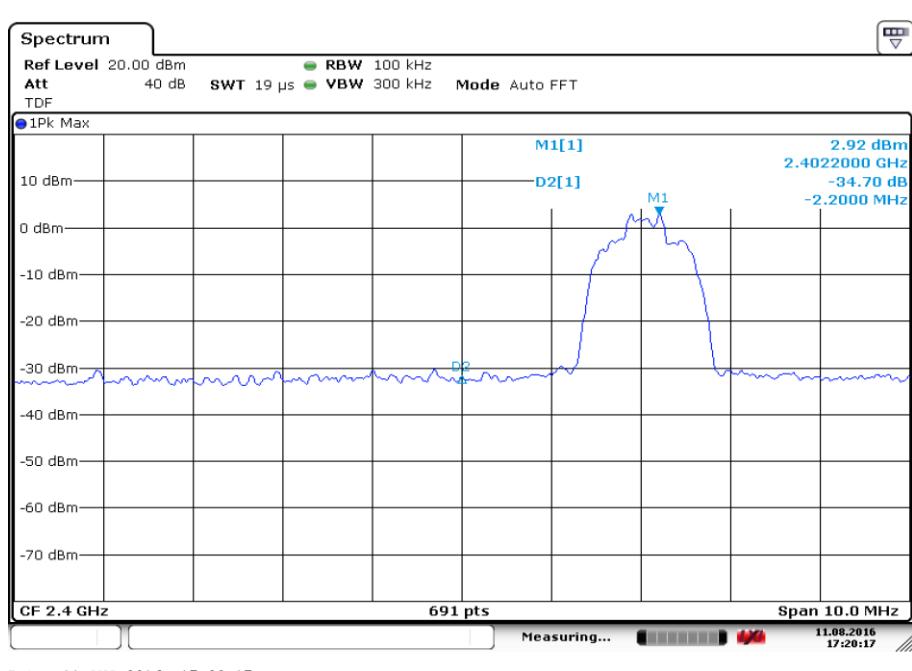


Fig. 20 Band Edges (8DPSK, Ch 0, Hopping OFF)

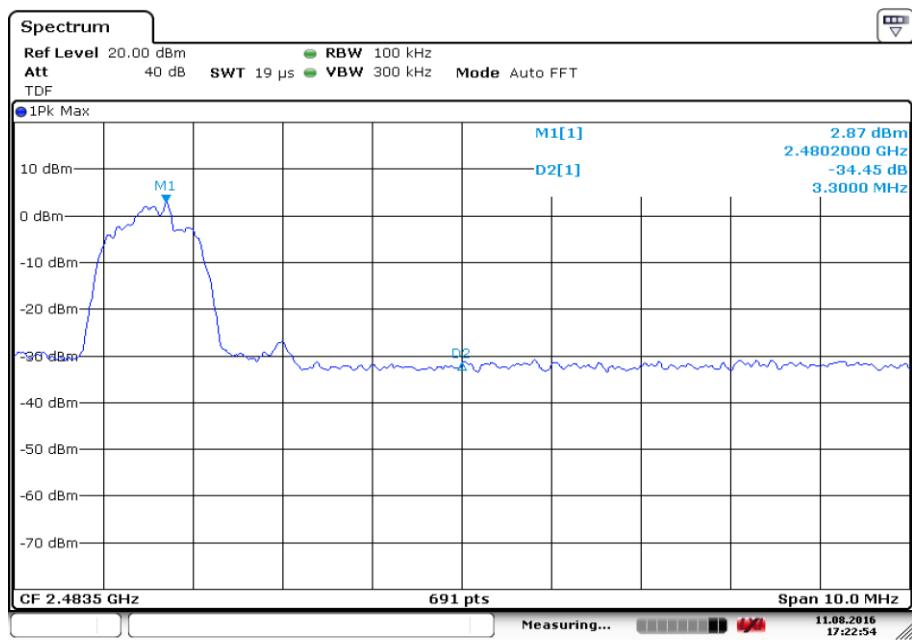


Fig. 21 Band Edges (8DPSK, Ch 78, Hopping OFF)

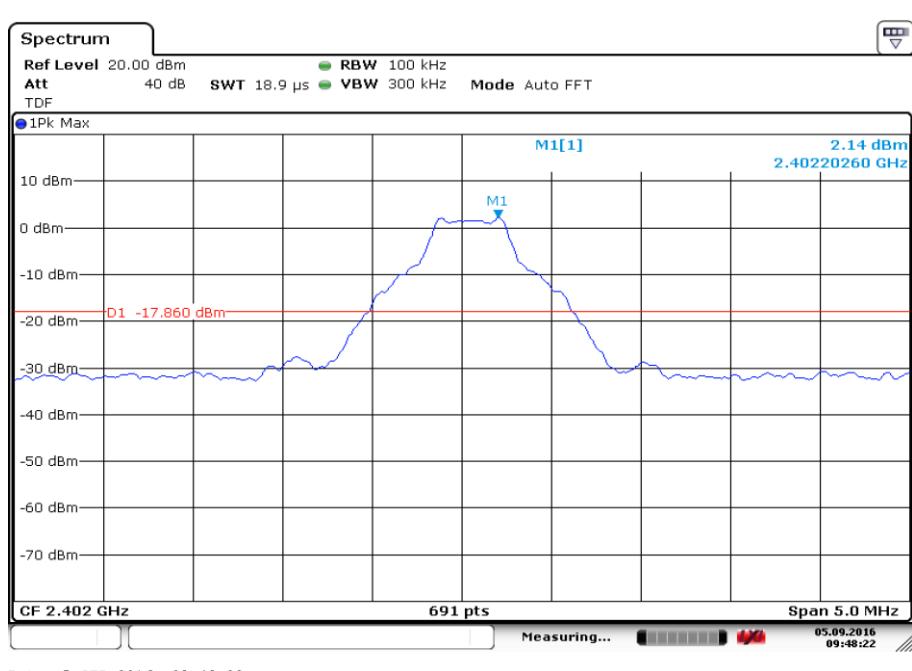


Fig. 22 Conducted Spurious Emission (GFSK, Ch0, 2.402GHz)

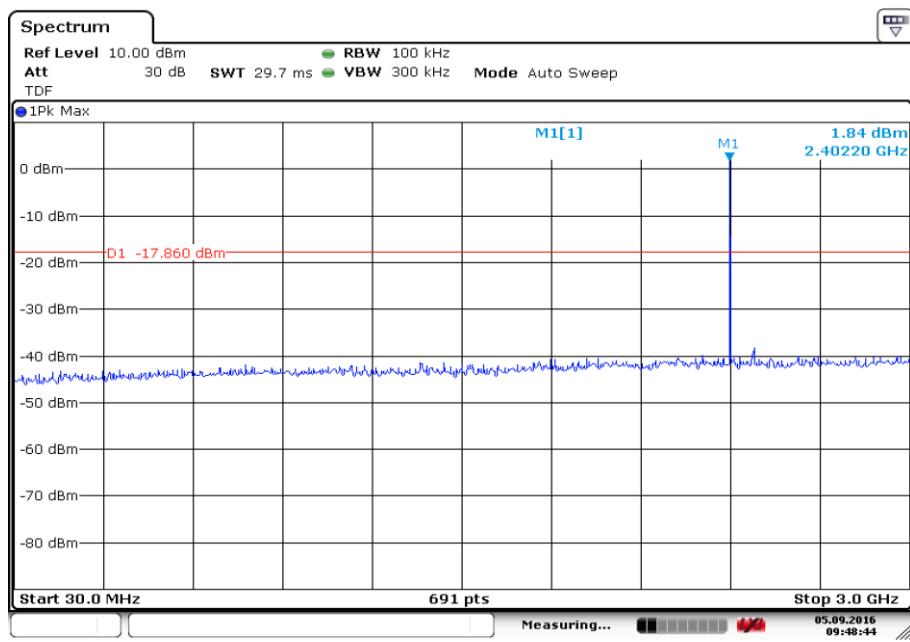


Fig. 23 Conducted Spurious Emission (GFSK, Ch0, 30 MHz-3 GHz)

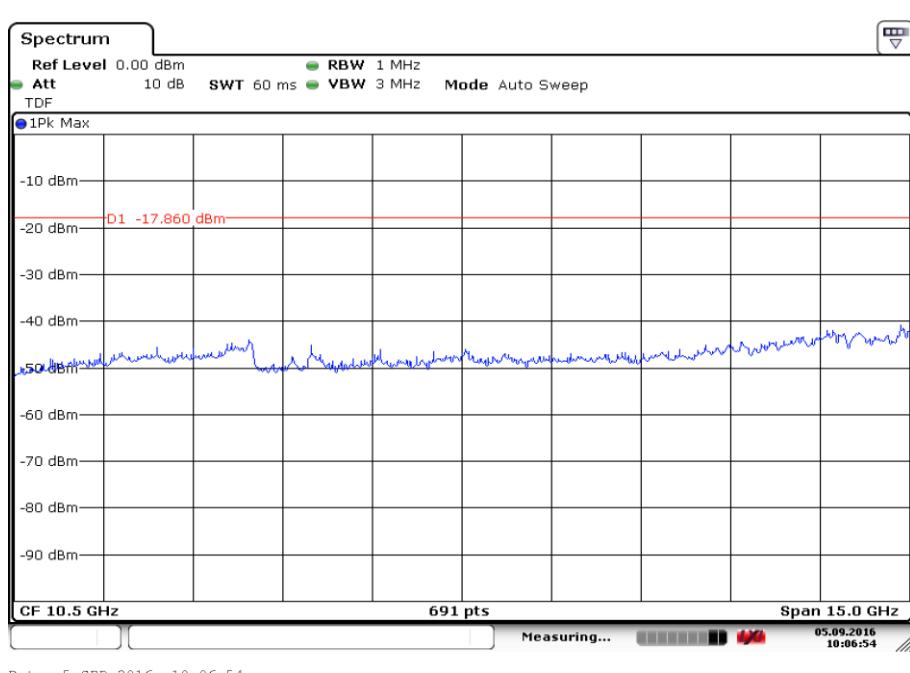


Fig. 24 Conducted Spurious Emission (GFSK, Ch0, 3GHz-18 GHz)

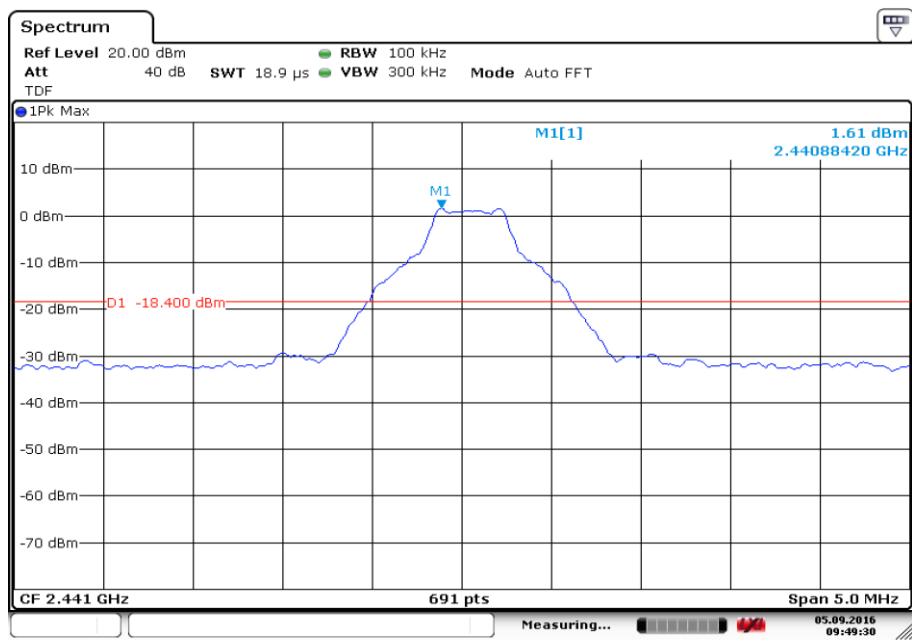


Fig. 25 Conducted Spurious Emission (GFSK, Ch39, 2.441GHz)

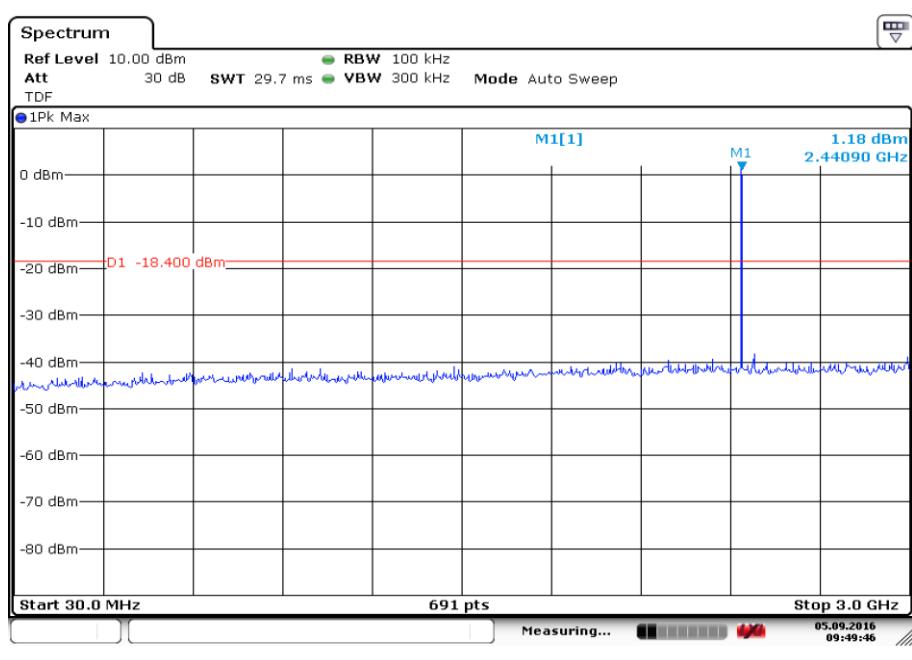


Fig. 26 Conducted Spurious Emission (GFSK, Ch39, 30 MHz-3 GHz)

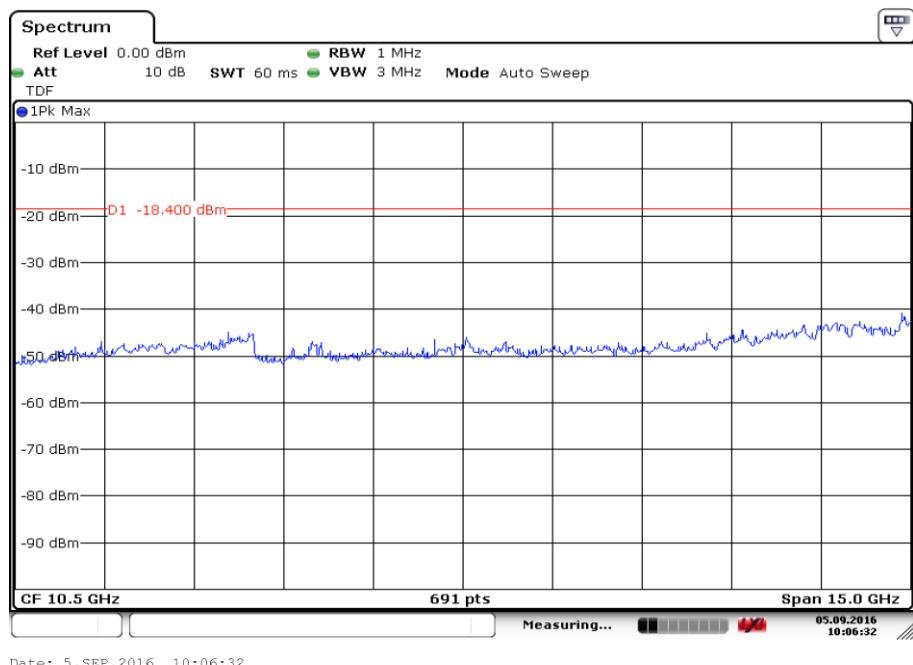


Fig. 27 Conducted Spurious Emission (GFSK, Ch39, 3GHz-18 GHz)

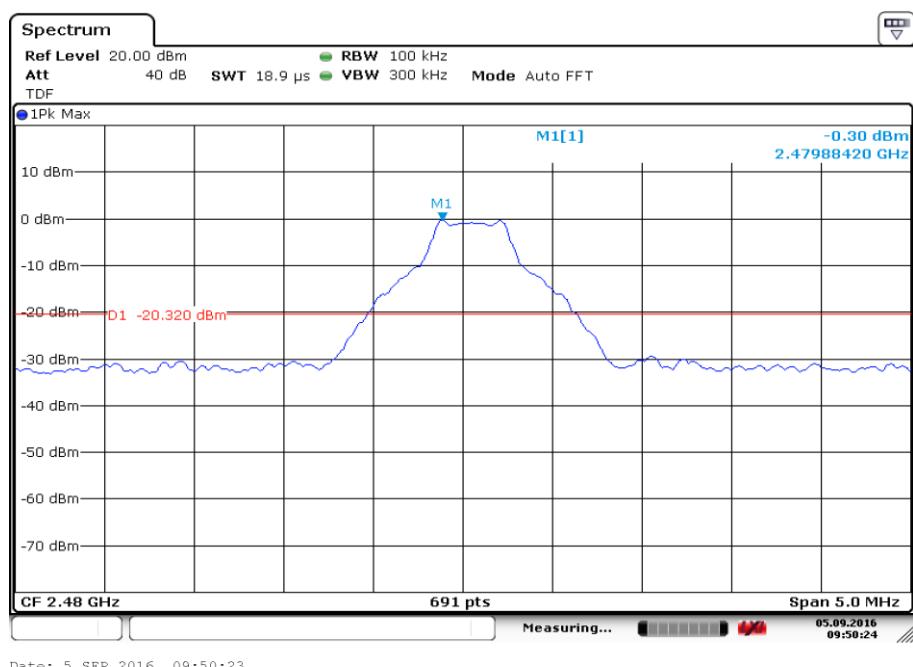


Fig. 28 Conducted Spurious Emission (GFSK, Ch78, 2.480GHz)

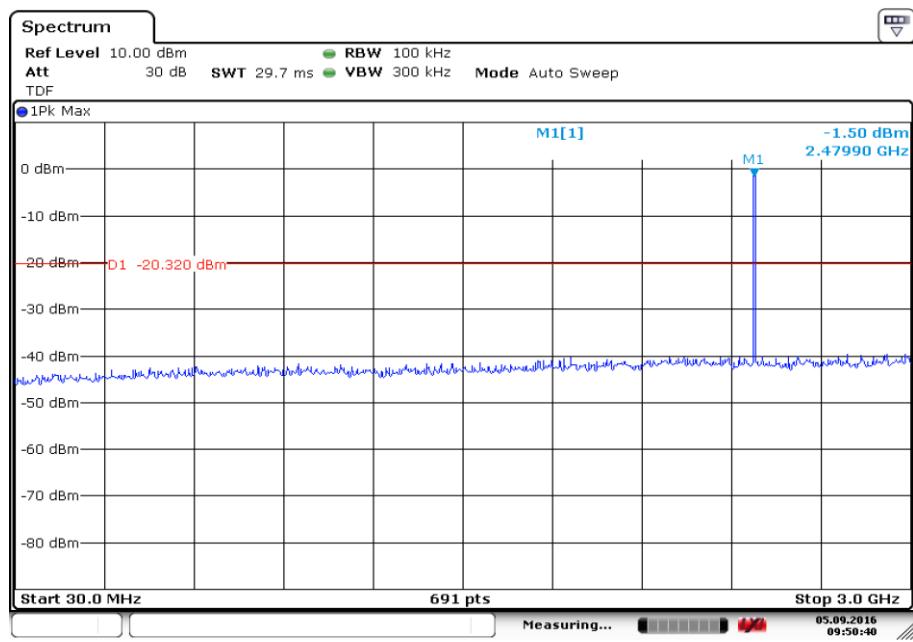


Fig. 29 Conducted Spurious Emission (GFSK, Ch78, 30 MHz-3 GHz)

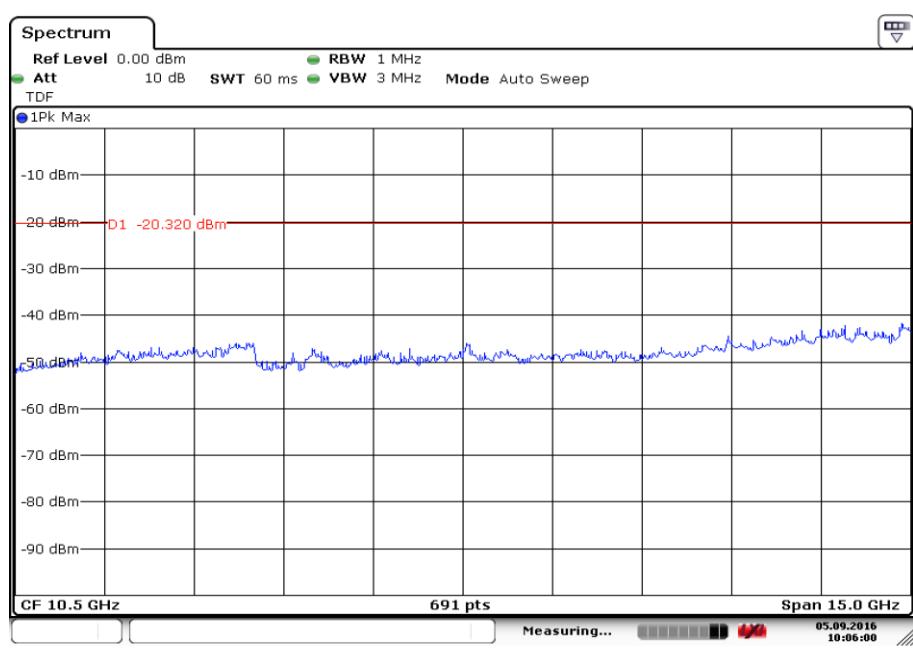


Fig. 30 Conducted Spurious Emission (GFSK, Ch78, 3GHz-18 GHz)

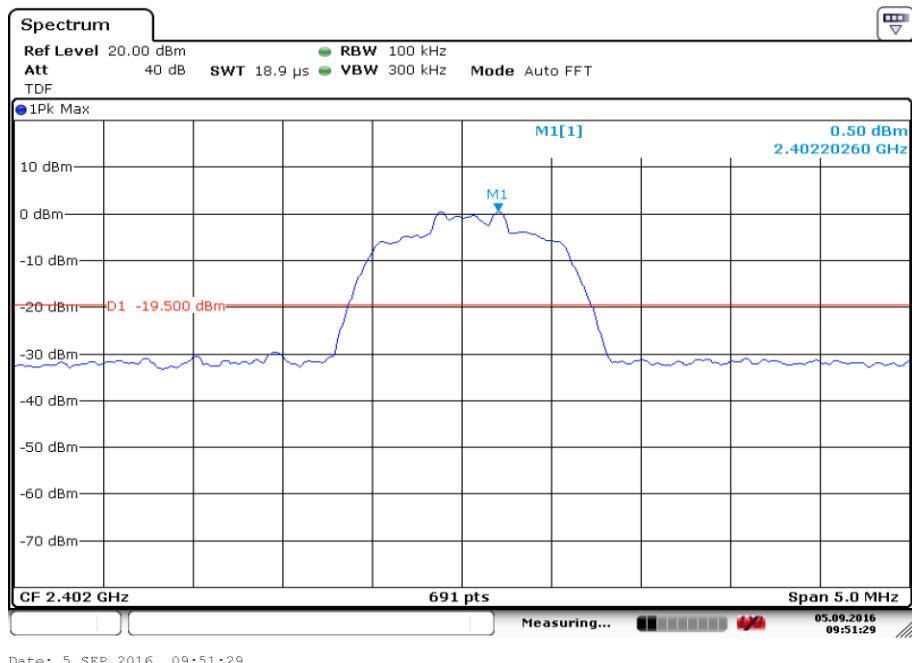


Fig. 31 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch0, 2.402GHz)

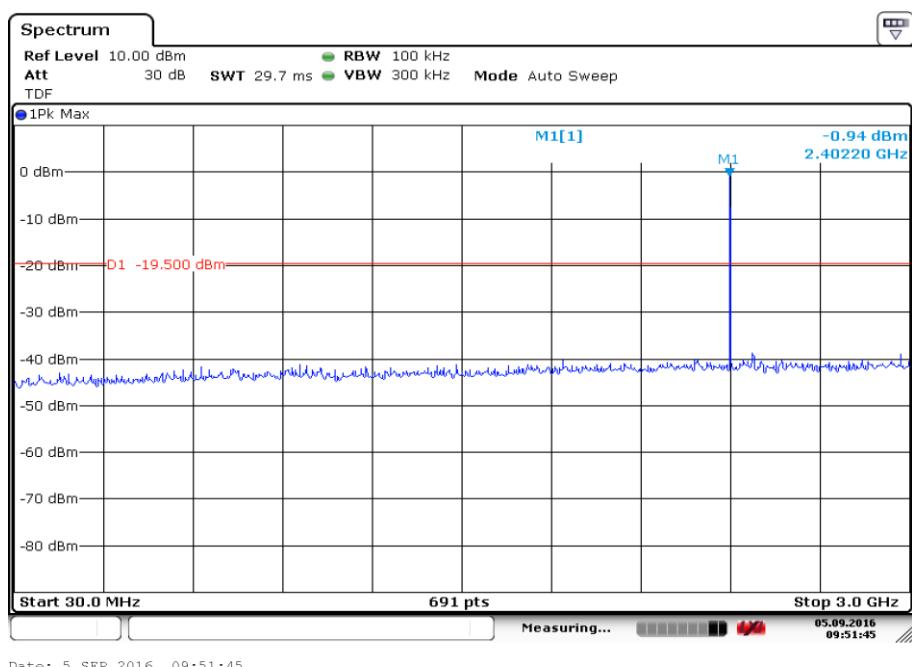


Fig. 32 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch0, 30 MHz-3 GHz)

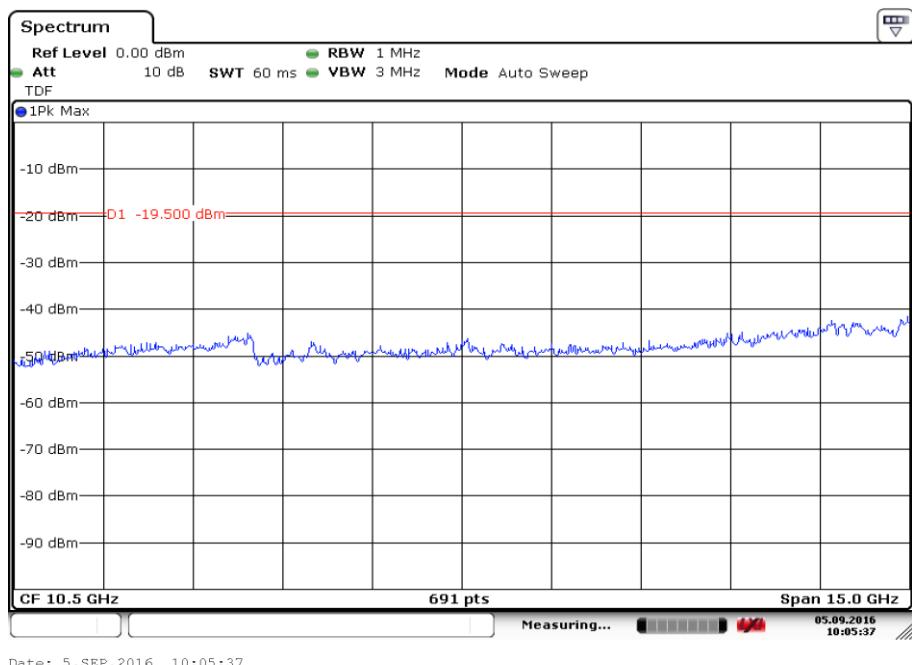


Fig. 33 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch0, 3GHz-18 GHz)

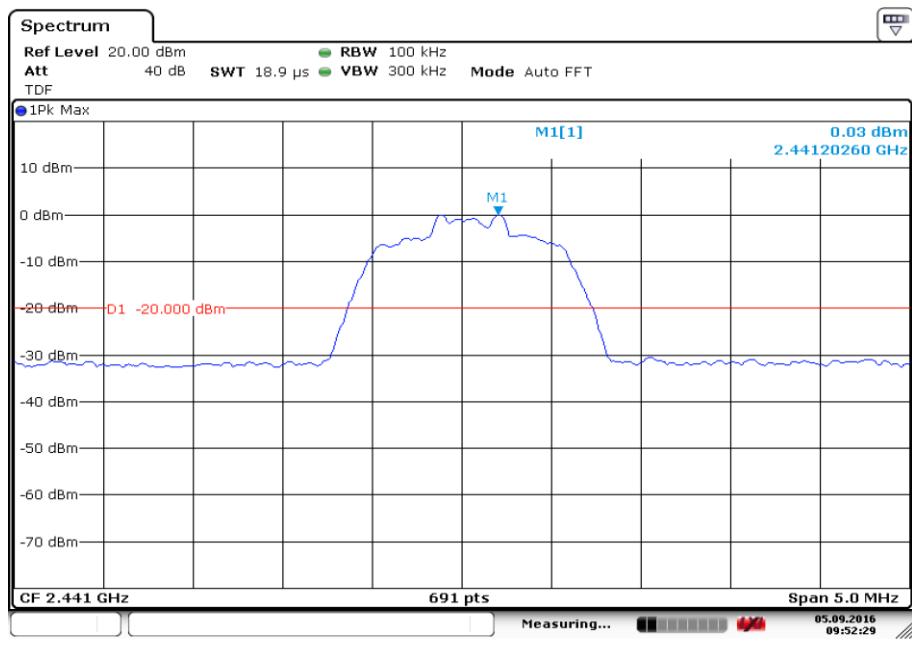


Fig. 34 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch39, 2.441GHz)

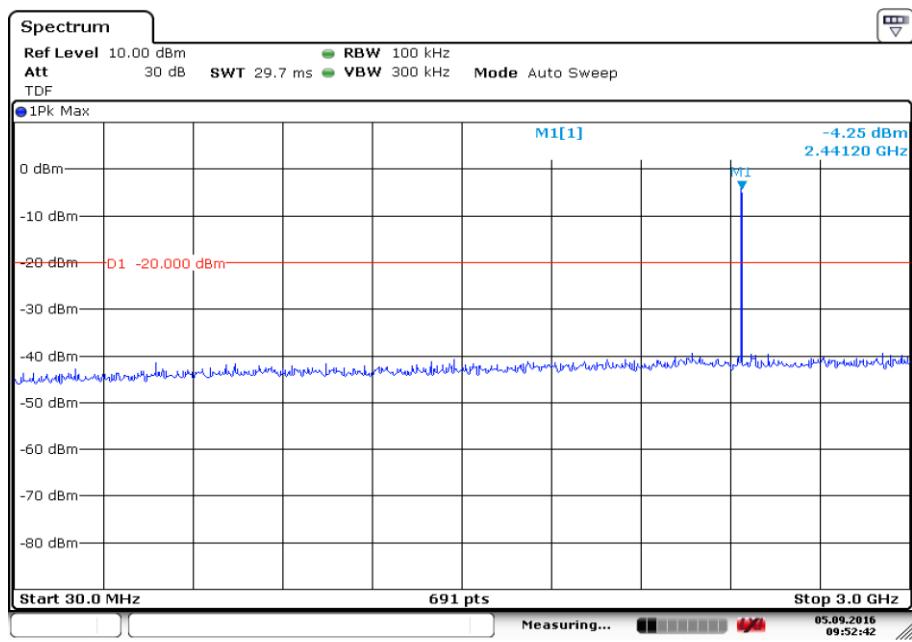


Fig. 35 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch39, 30 MHz-3 GHz)

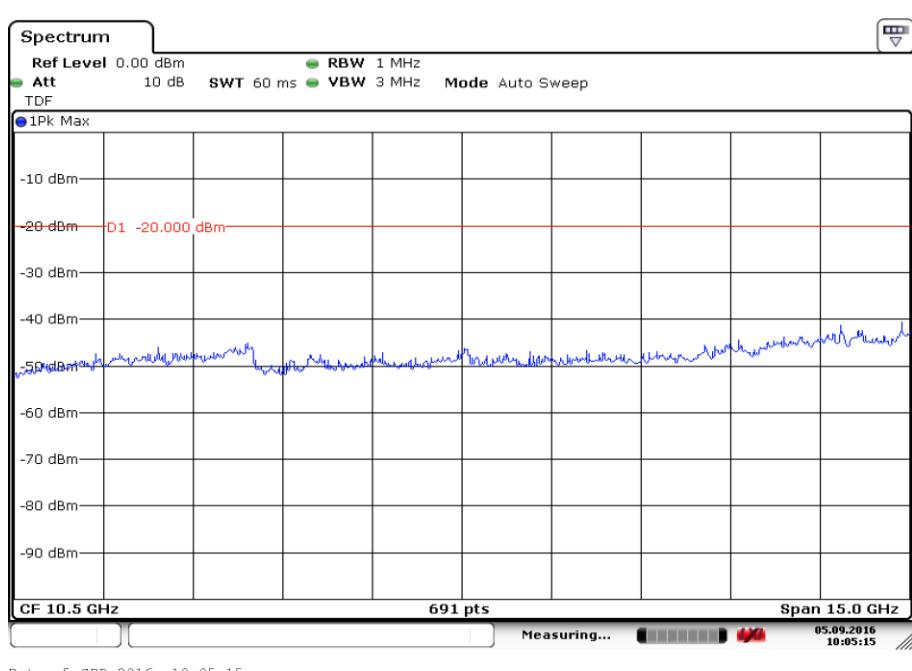


Fig. 36 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch39, 3GHz-18 GHz)

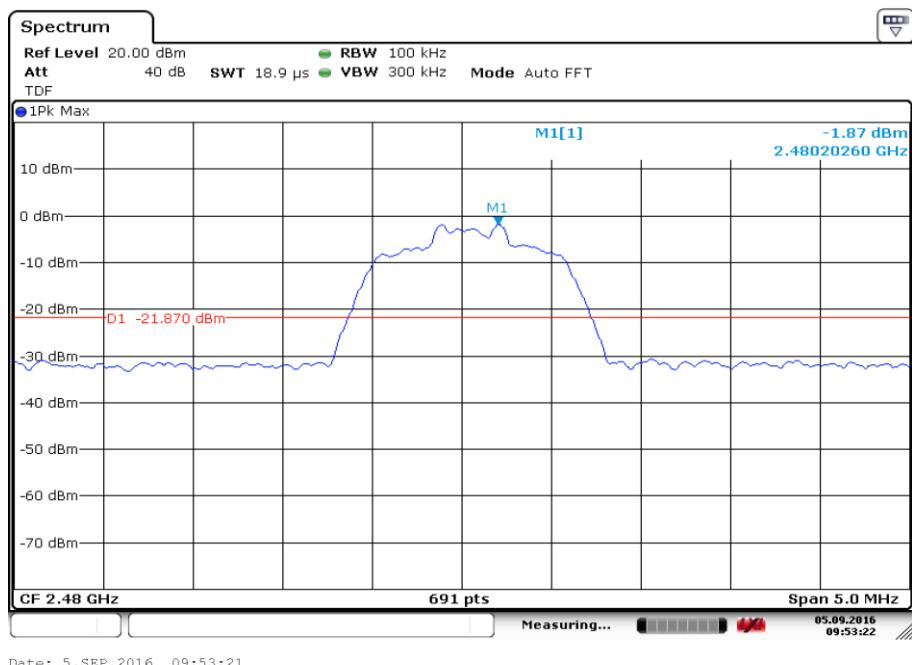


Fig. 37 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch78, 2.480GHz)

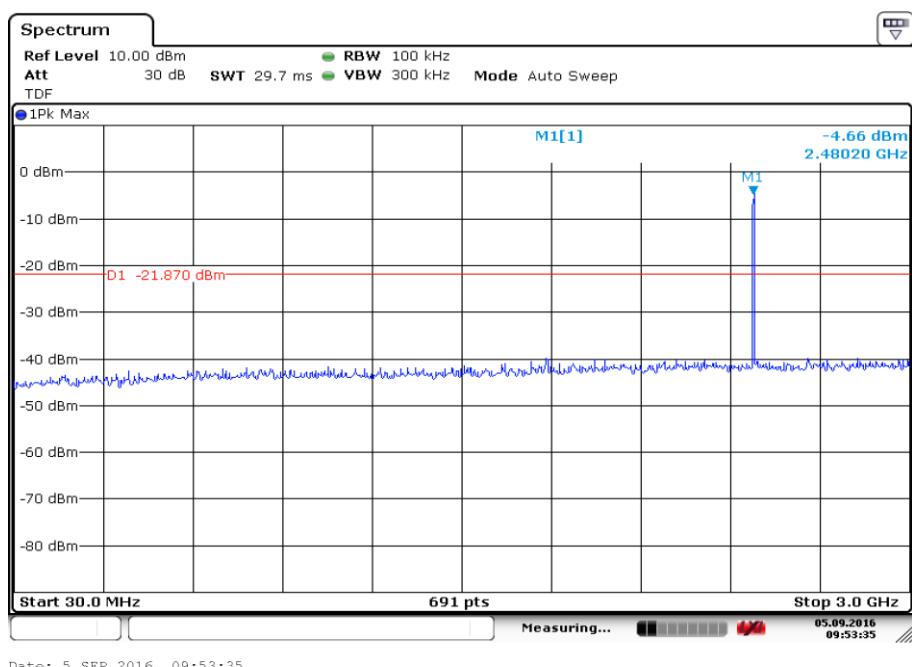


Fig. 38 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch78, 30 MHz-3 GHz)

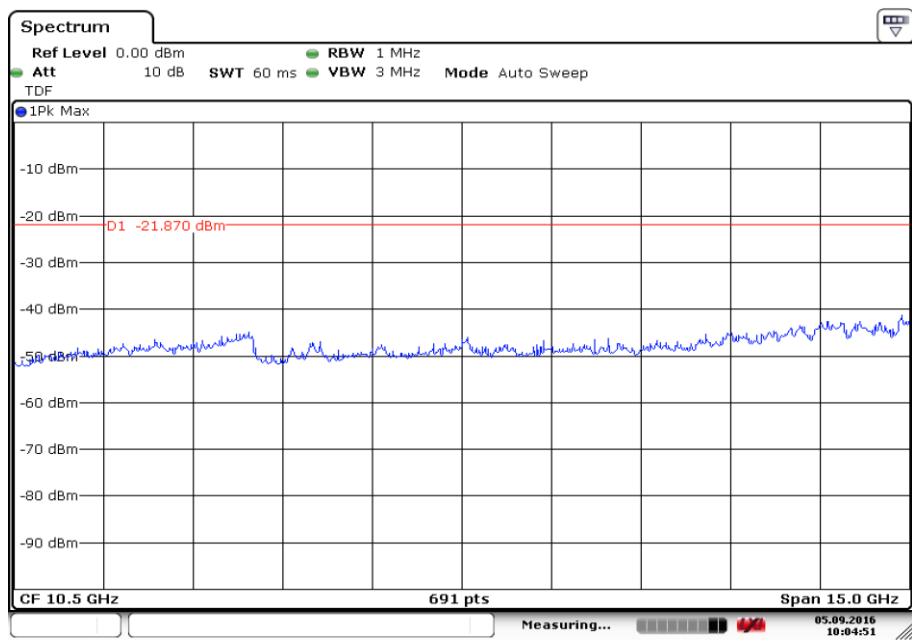


Fig. 39 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch78, 3GHz-18 GHz)

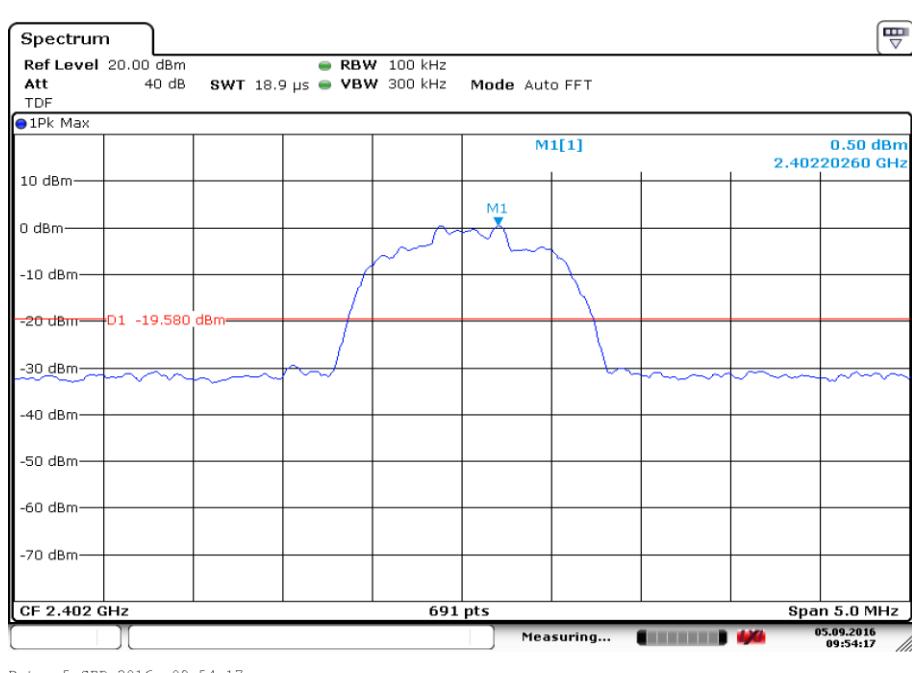


Fig. 40 Conducted Spurious Emission (8DPSK, Ch0, 2.402GHz)

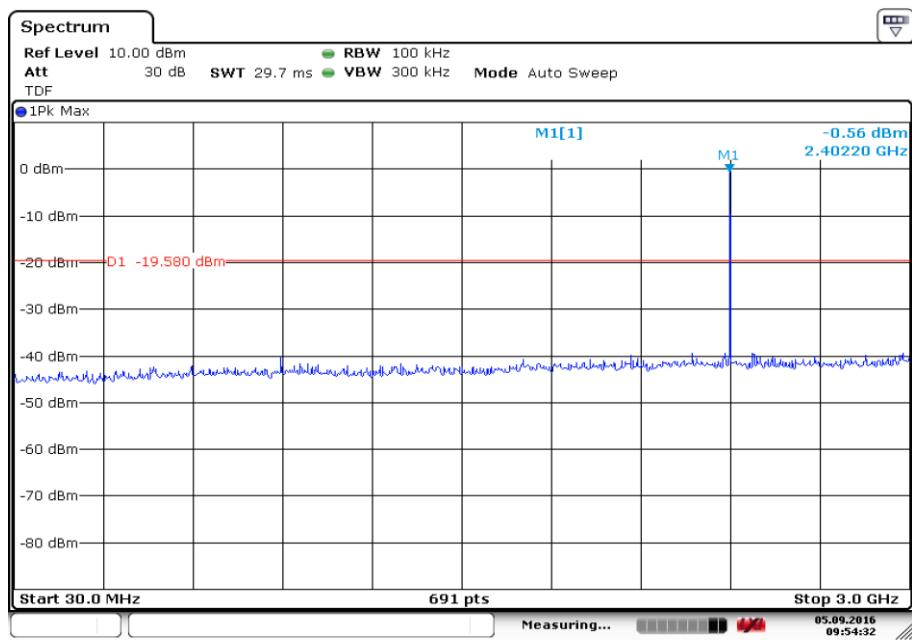


Fig. 41 Conducted Spurious Emission (8DPSK, Ch0, 30 MHz-3 GHz)

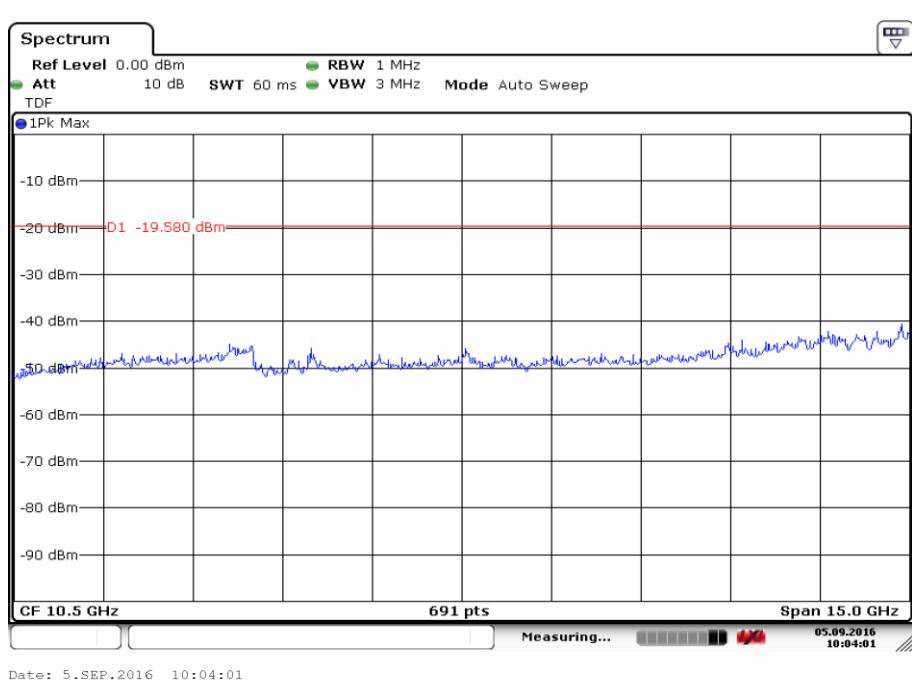


Fig. 42 Conducted Spurious Emission (8DPSK, Ch0, 3GHz-18 GHz)

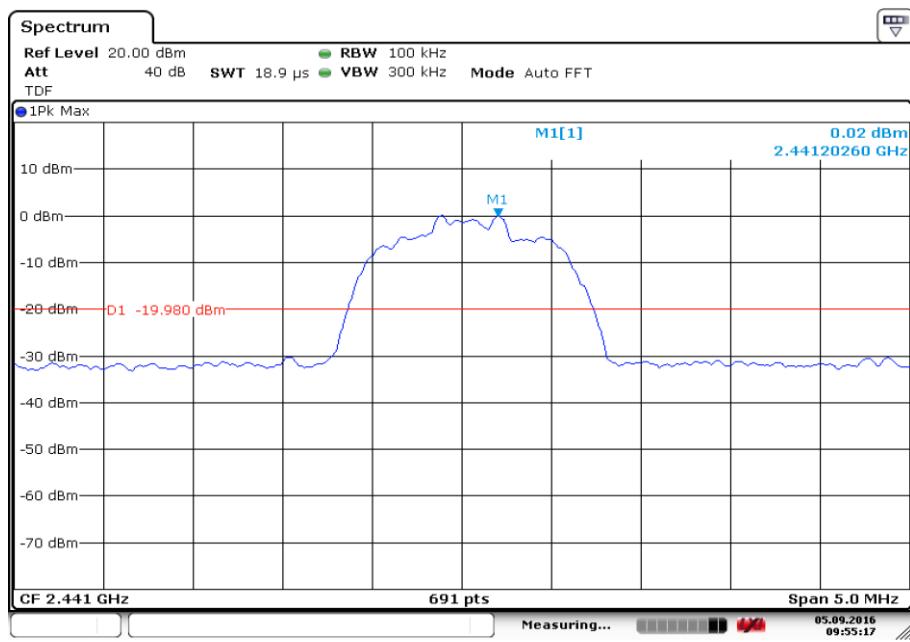


Fig. 43 Conducted Spurious Emission (8DPSK, Ch39, 2.441GHz)

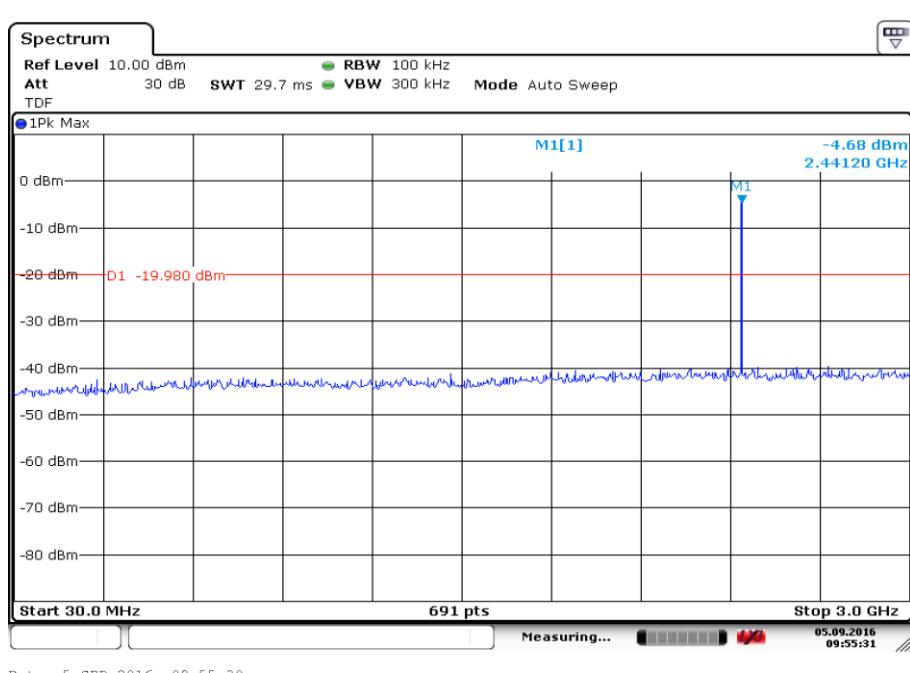


Fig. 44 Conducted Spurious Emission (8DPSK, Ch39, 30 MHz-3 GHz)

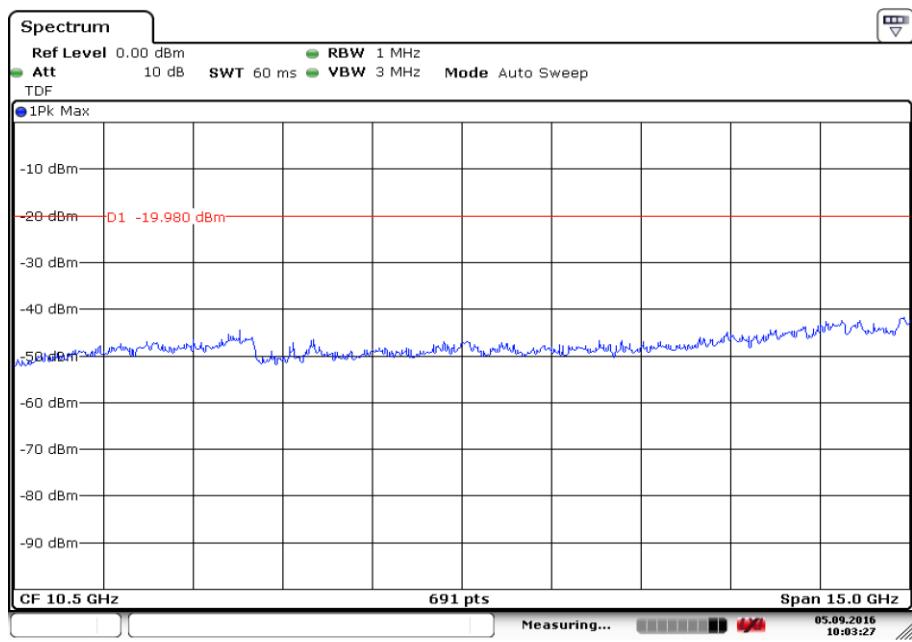


Fig. 45 Conducted Spurious Emission (8DPSK, Ch39, 3GHz-18 GHz)

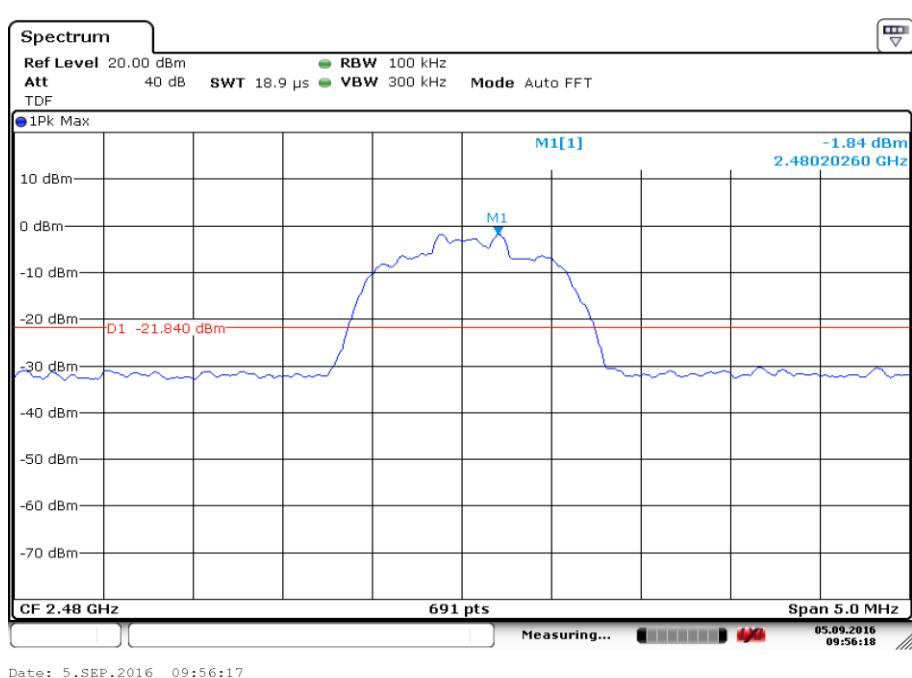


Fig. 46 Conducted Spurious Emission (8DPSK, Ch78, 2.480GHz)

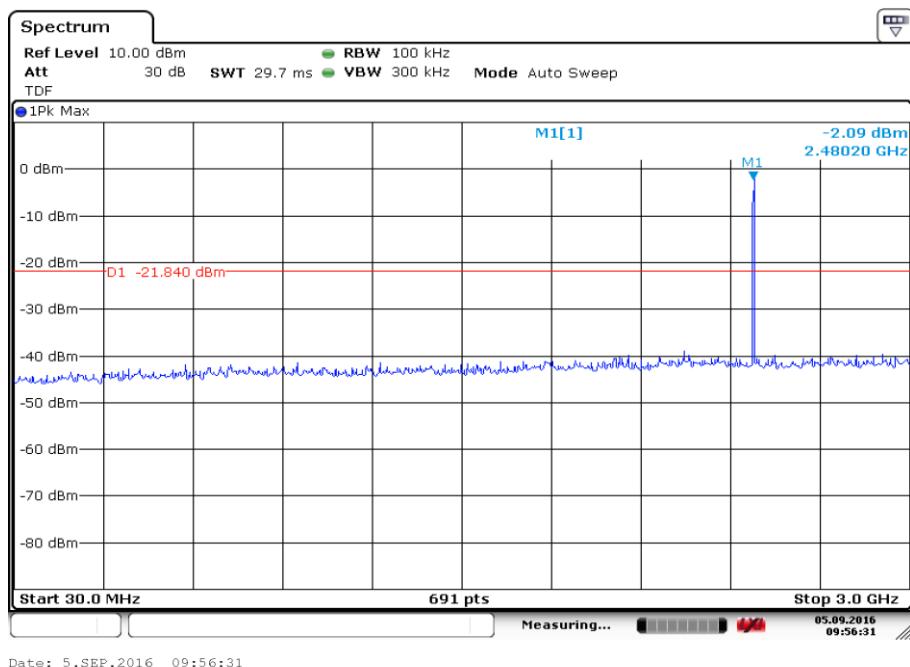


Fig. 47 Conducted Spurious Emission (8DPSK, Ch78, 30 MHz-3 GHz)

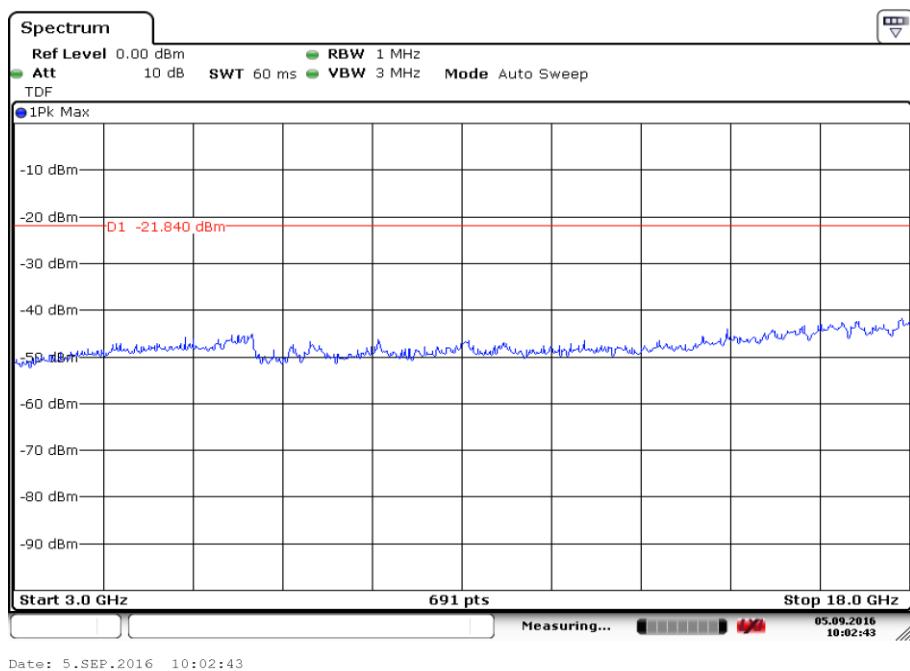


Fig. 48 Conducted Spurious Emission (8DPSK, Ch78, 3GHz-18 GHz)

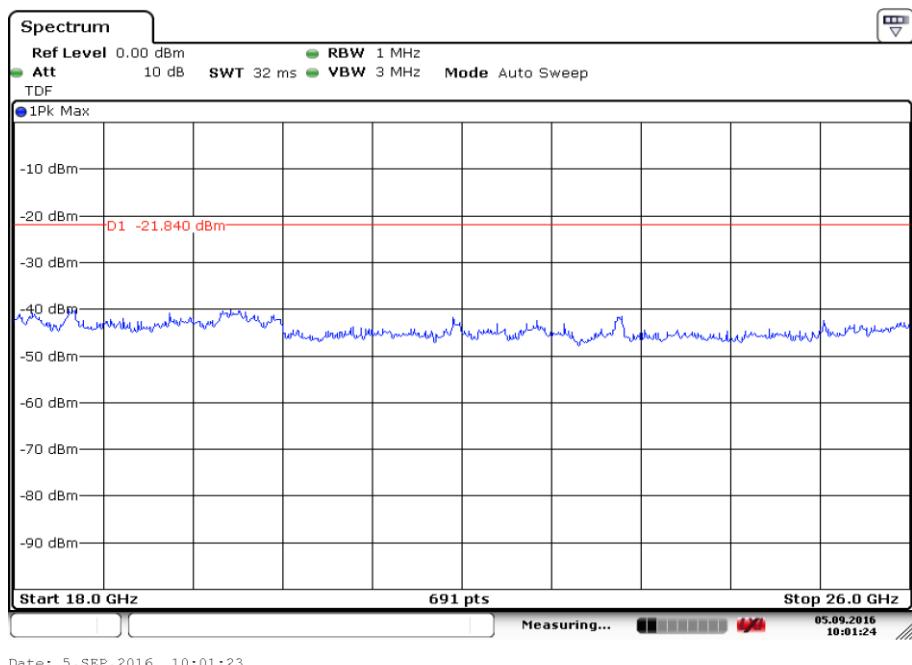


Fig. 49 Conducted Spurious Emission (All channel, 18 GHz-26 GHz)

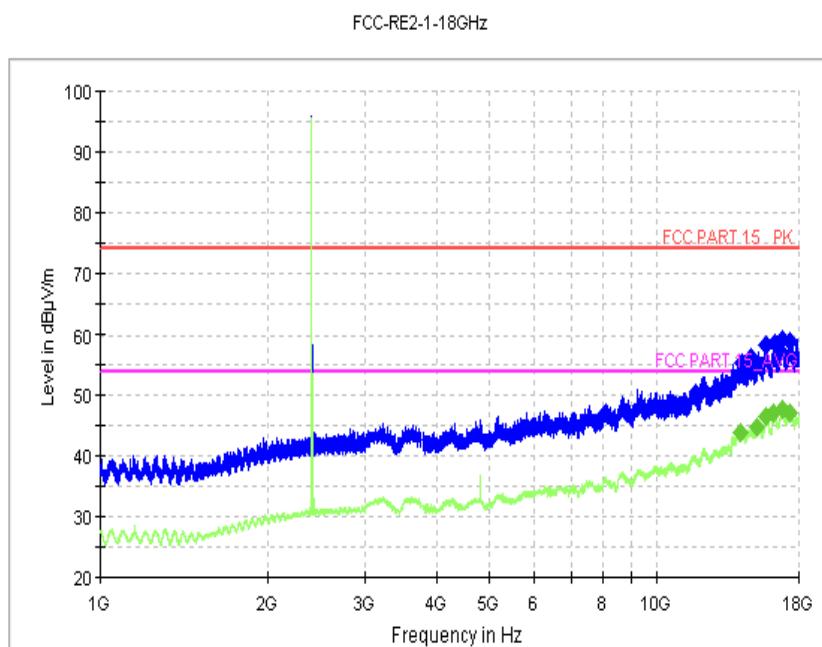


Fig. 50 Radiated Spurious Emission (GFSK, Ch0, 1 GHz ~18 GHz)

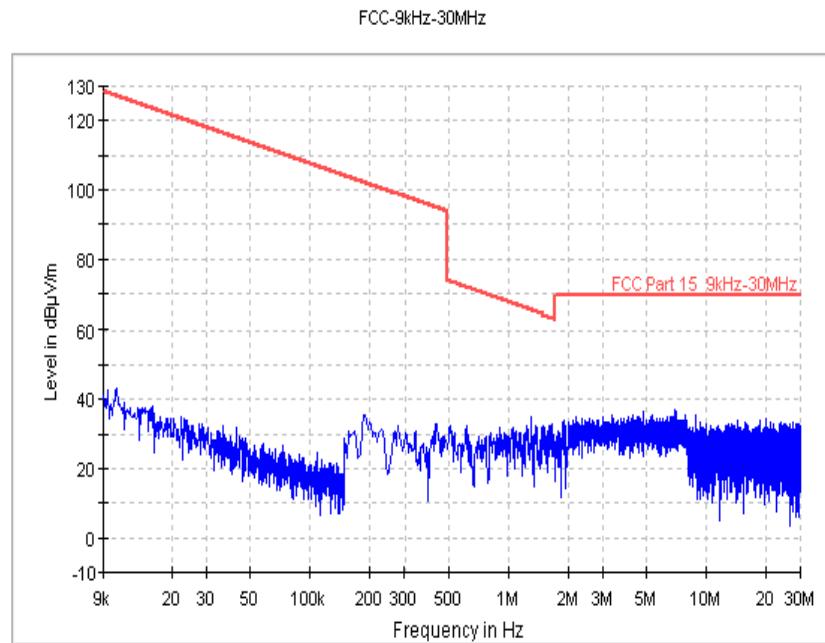


Fig. 51 Radiated Spurious Emission (GFSK, Ch39, 9 kHz ~30 MHz)

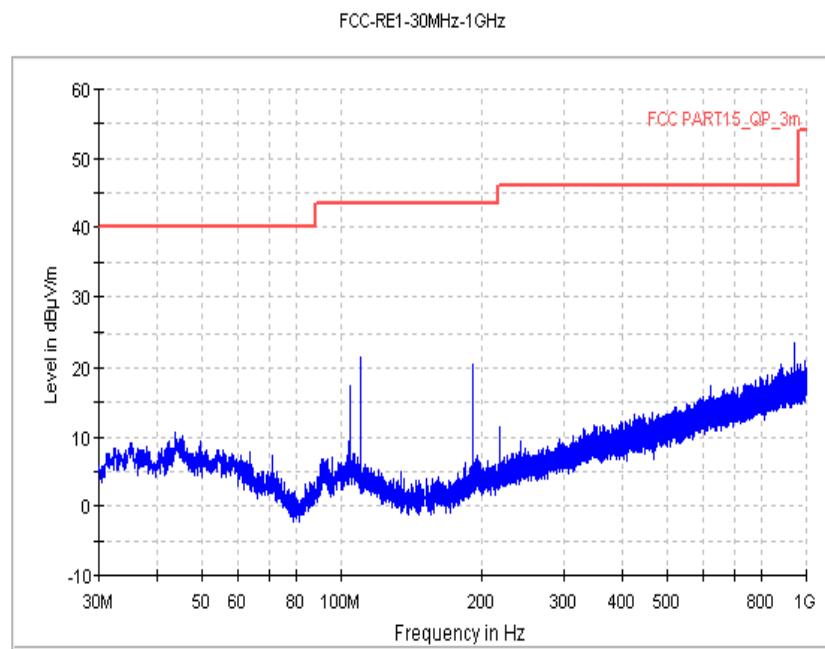


Fig. 52 Radiated Spurious Emission (GFSK, Ch39, 30 MHz ~1 GHz)

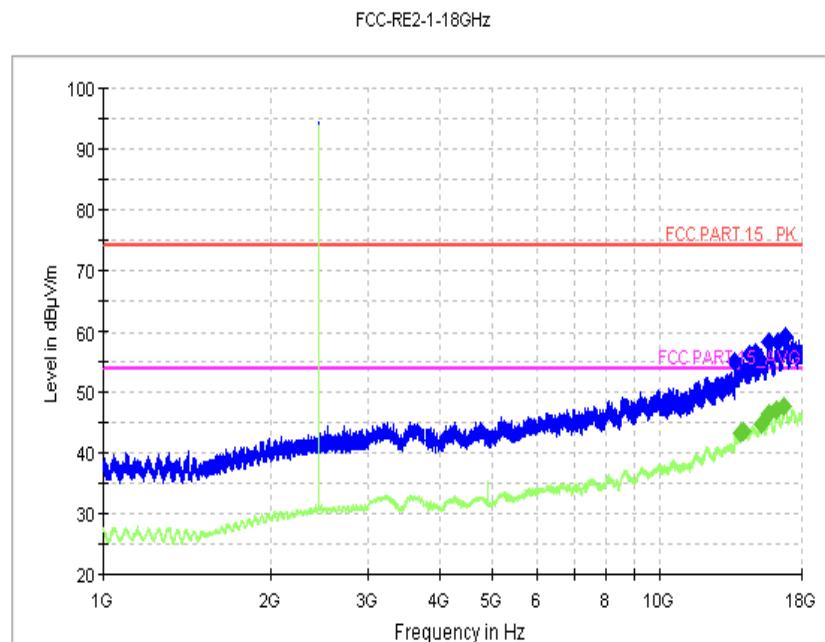


Fig. 53 Radiated Spurious Emission (GFSK, Ch39, 1 GHz ~18 GHz)

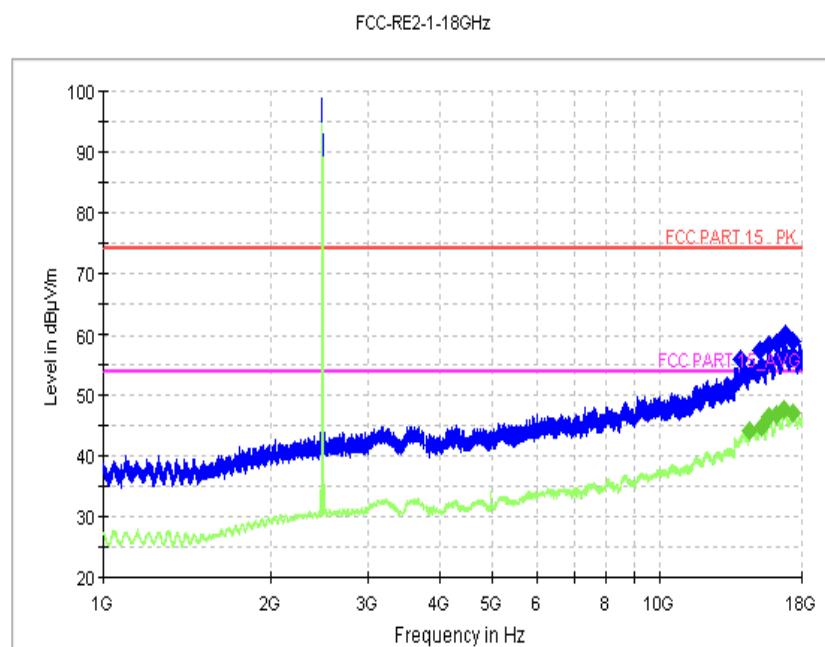


Fig. 54 Radiated Spurious Emission (GFSK, Ch78, 1 GHz ~18 GHz)

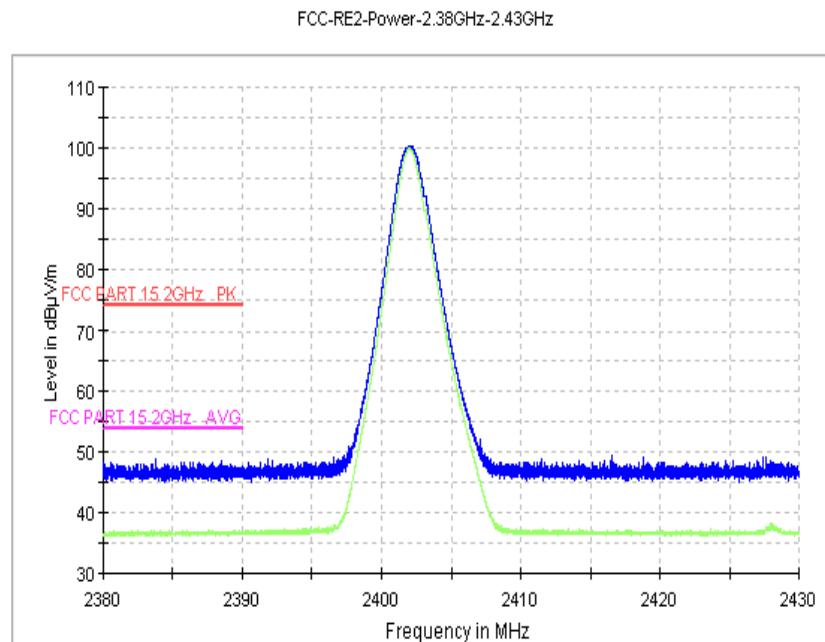


Fig. 55 Radiated Emission Power (GFSK, Ch0, 2380GHz~2450GHz)

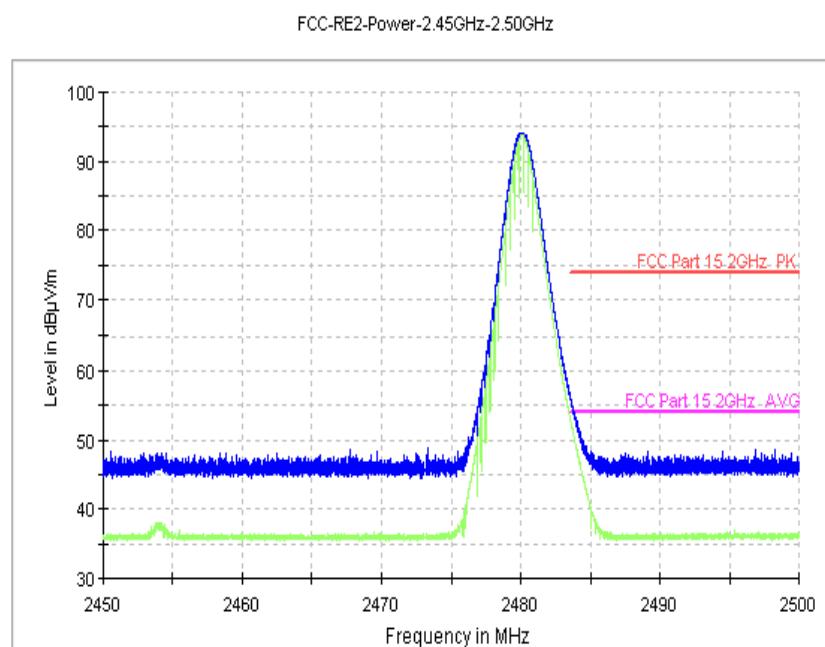


Fig. 56 Radiated Emission Power (GFSK, Ch78, 2450GHz~2500GHz)

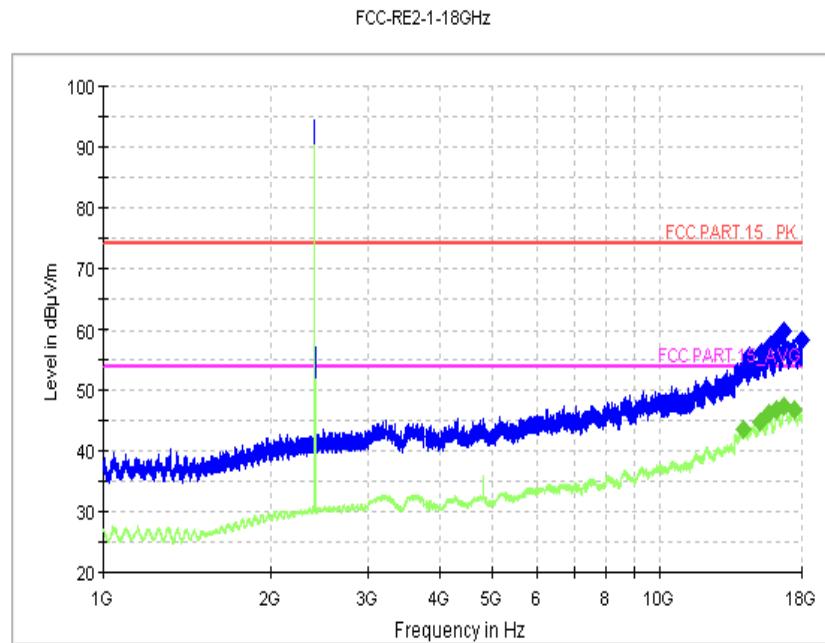


Fig. 57 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch0, 1 GHz ~18 GHz)

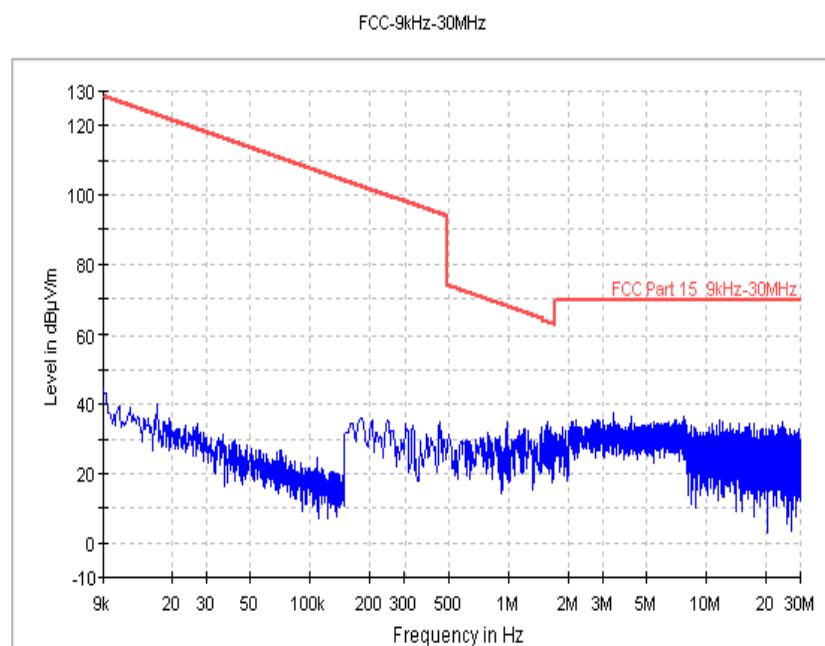


Fig. 58 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch39, 9 kHz ~30 MHz)

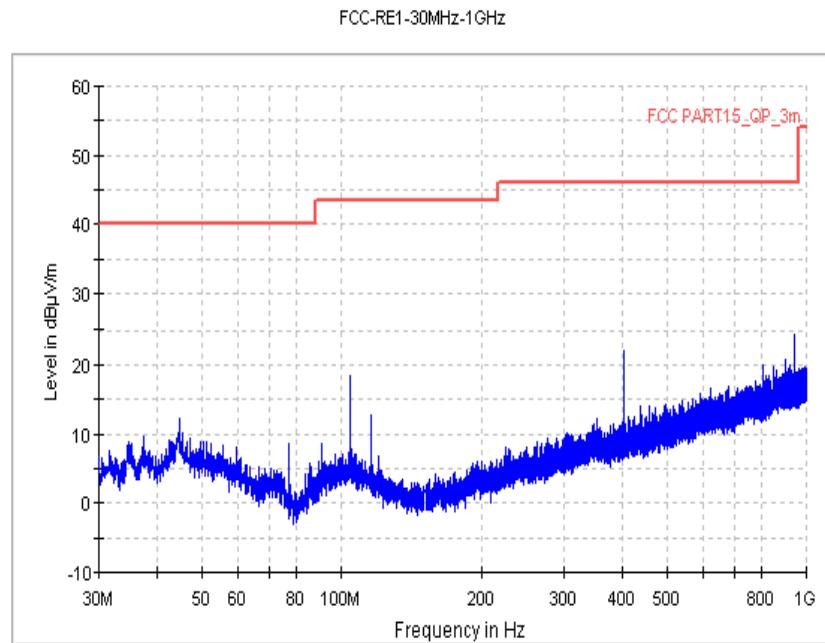


Fig. 59 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch39, 30 MHz ~1 GHz)

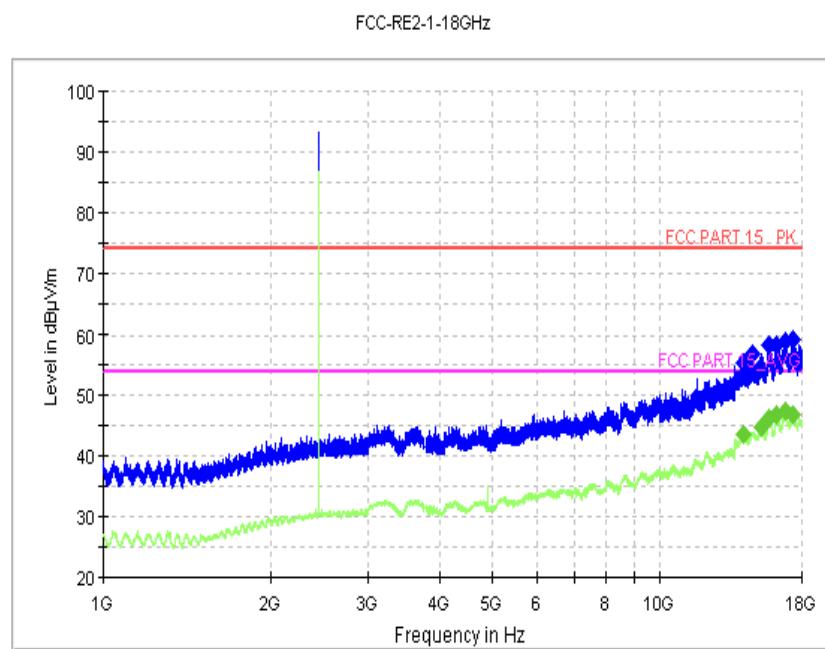


Fig. 60 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch39, 1 GHz ~18 GHz)

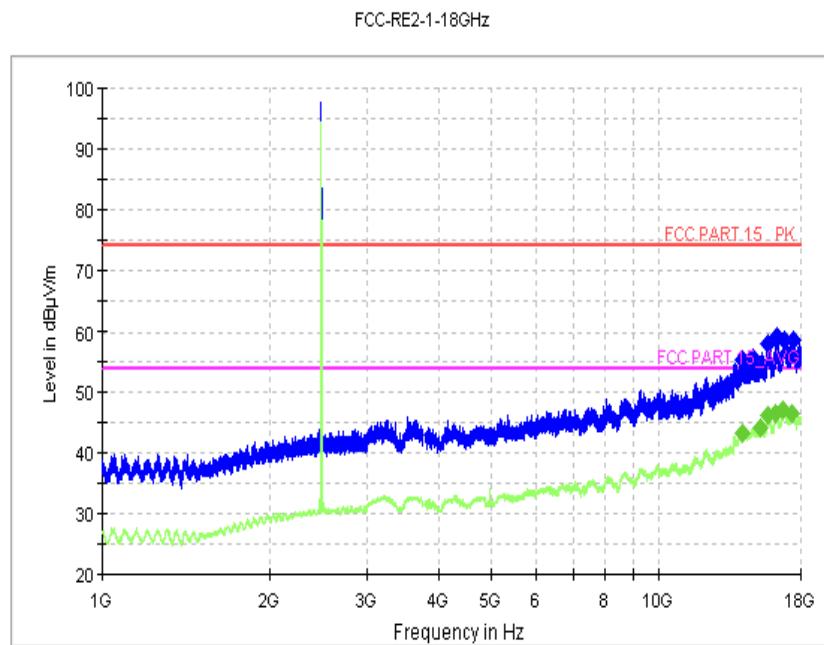


Fig. 61 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch78, 1 GHz ~18 GHz)

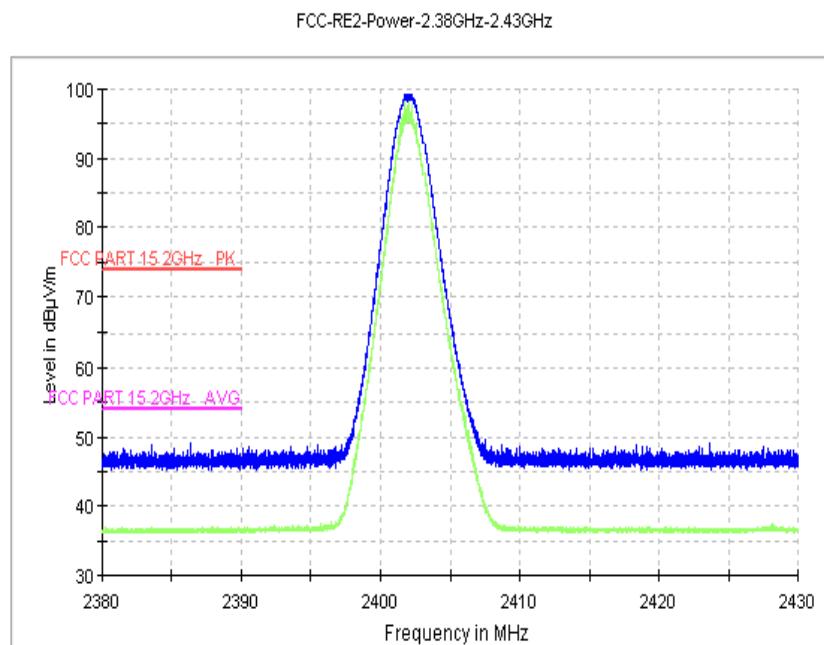


Fig. 62 Radiated Emission Power ($\pi/4$ DQPSK, Ch0, 2380GHz~2450GHz)

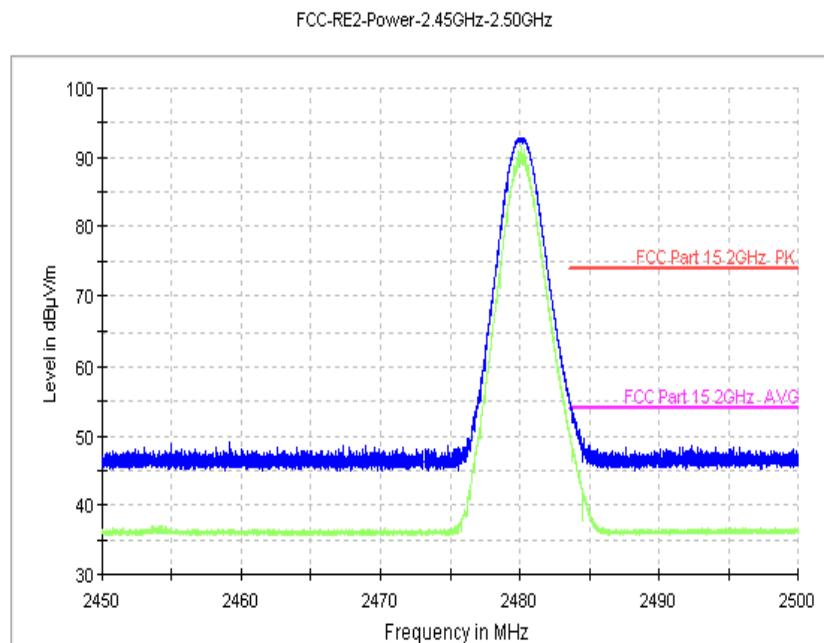


Fig. 63 Radiated Emission Power ($\pi/4$ DQPSK, Ch78, 2450GHz~2500GHz)

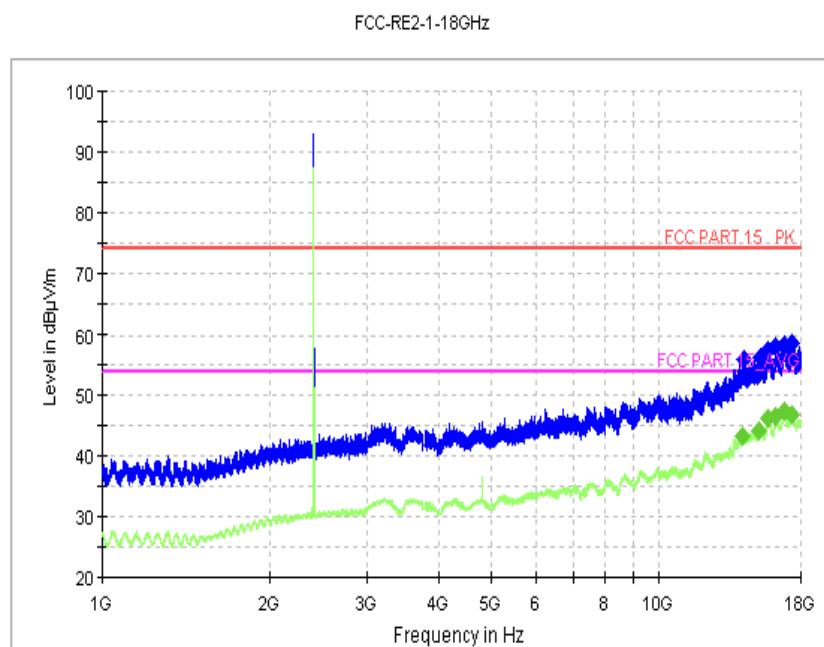


Fig. 64 Radiated Spurious Emission (8DPSK, Ch0, 1 GHz ~18 GHz)

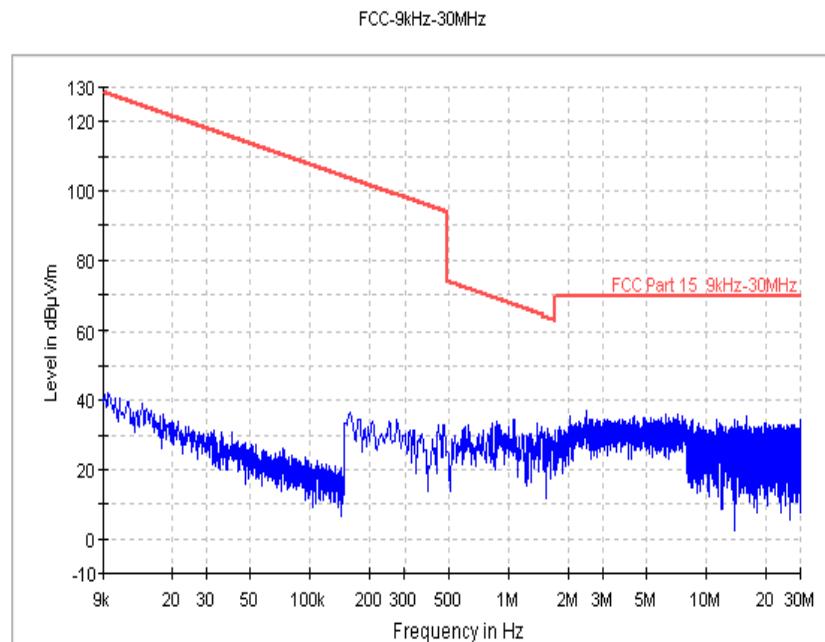


Fig. 65 Radiated Spurious Emission (8DPSK, Ch39, 9 kHz ~30 MHz)

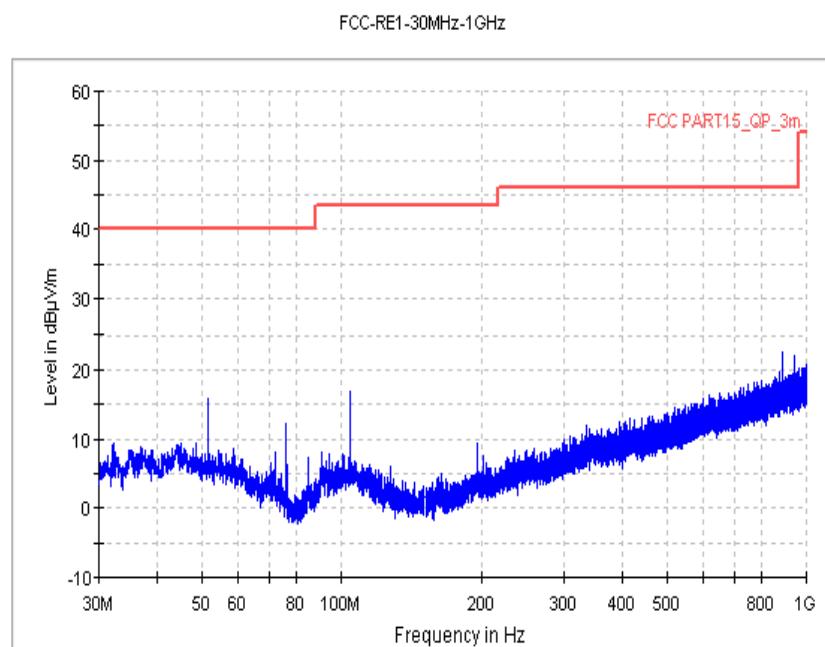


Fig. 66 Radiated Spurious Emission (8DPSK, Ch39, 30 MHz ~1 GHz)

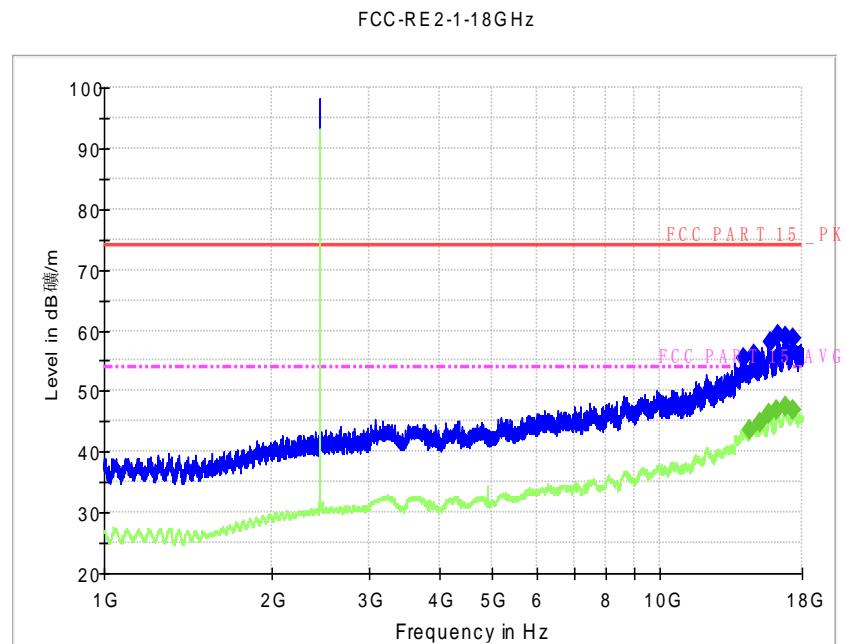


Fig. 67 Radiated Spurious Emission (8DPSK, Ch39, 1 GHz ~18 GHz)

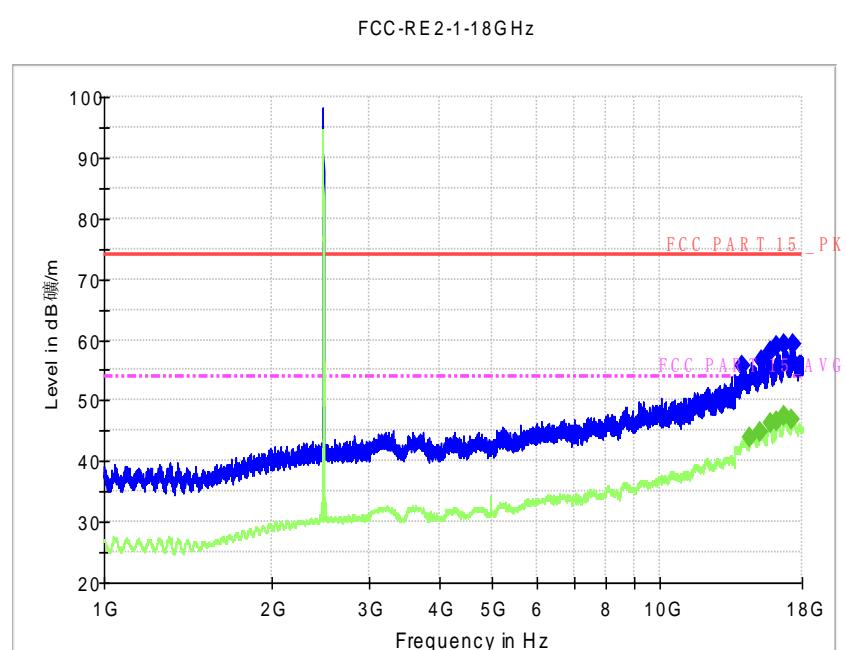
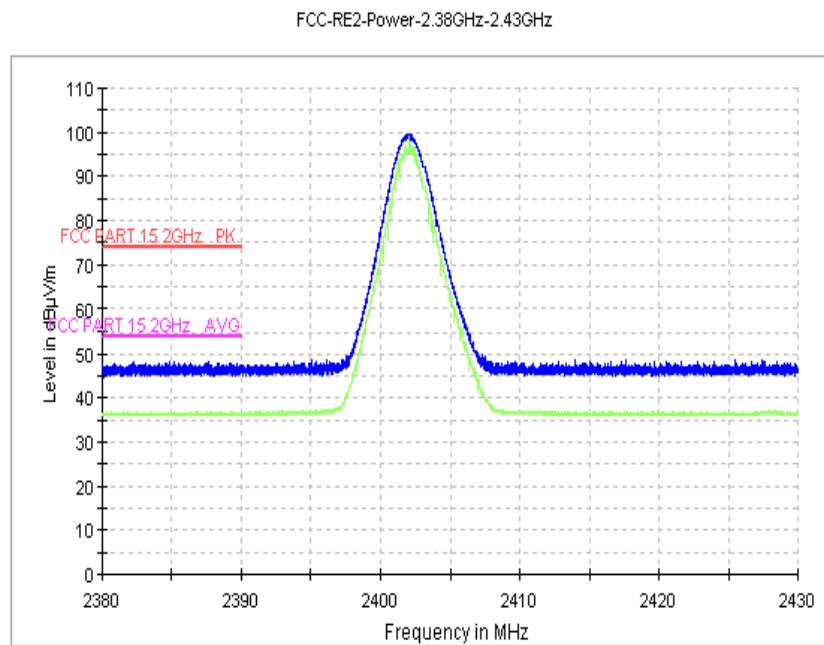
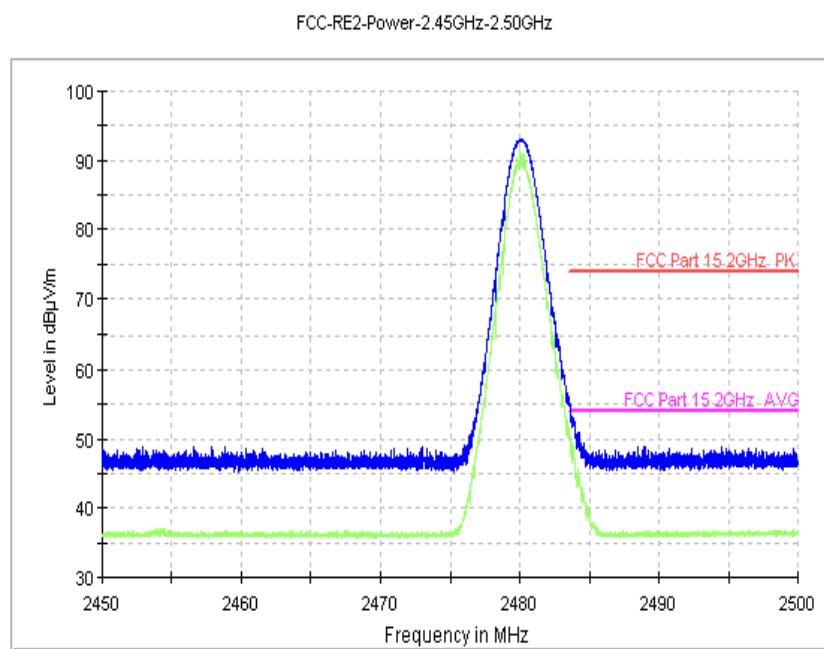


Fig. 68 Radiated Spurious Emission (8DPSK, Ch78, 1 GHz ~18 GHz)**Fig. 69 Radiated Emission Power (8DPSK, Ch0, 2380GHz~2450GHz)****Fig. 70 Radiated Emission Power (8DPSK, Ch78, 2450GHz~2500GHz)**

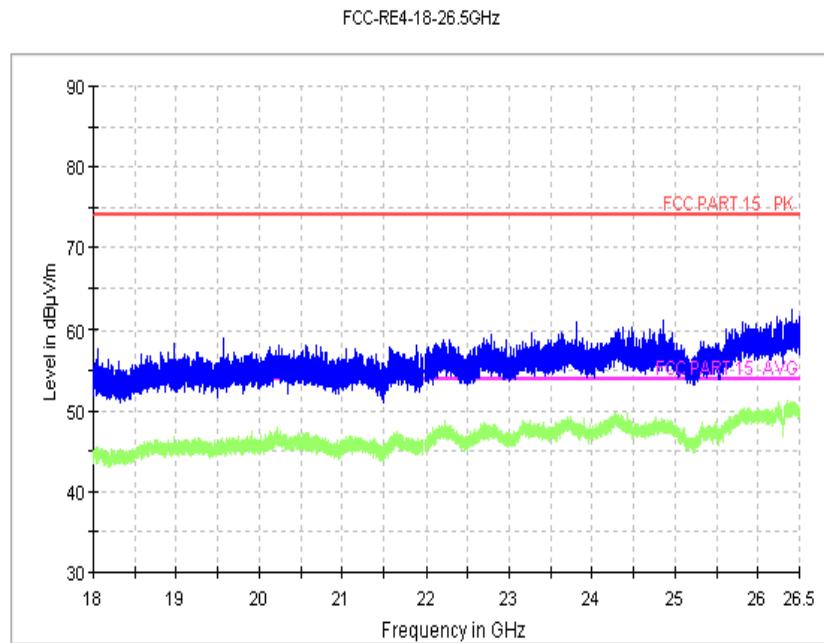


Fig. 71 Radiated Spurious Emission (All channel, 18 GHz ~26.5 GHz)

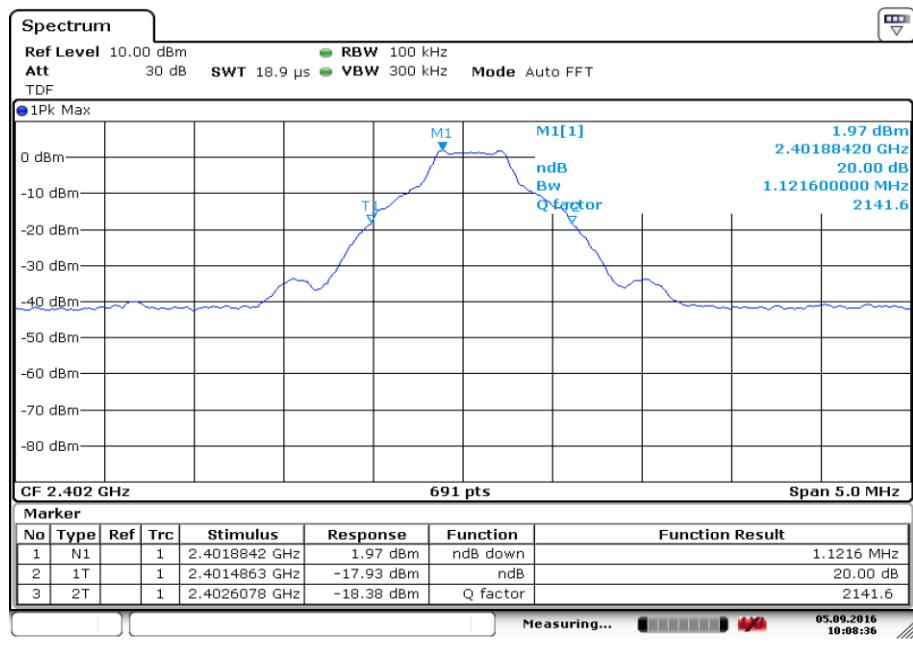
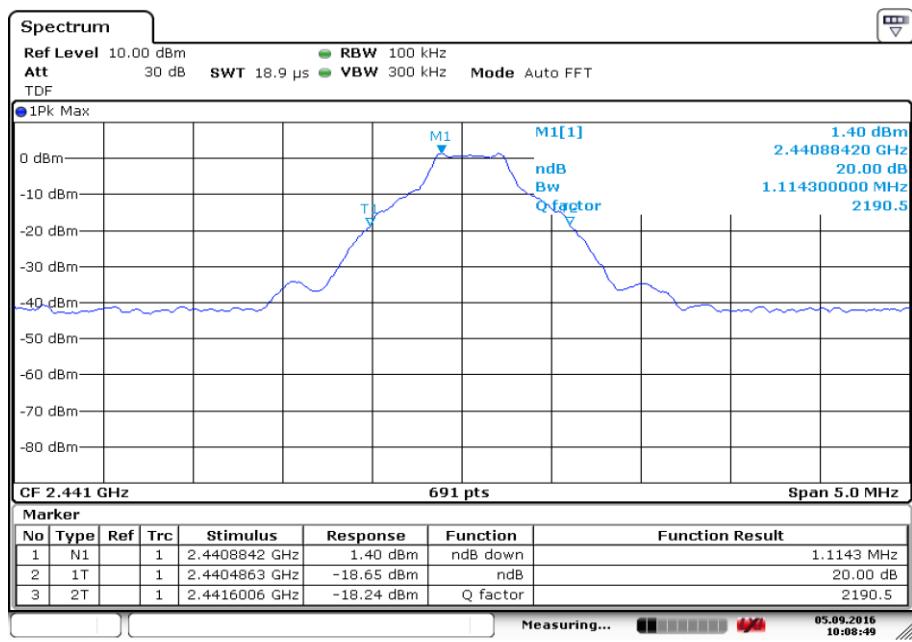
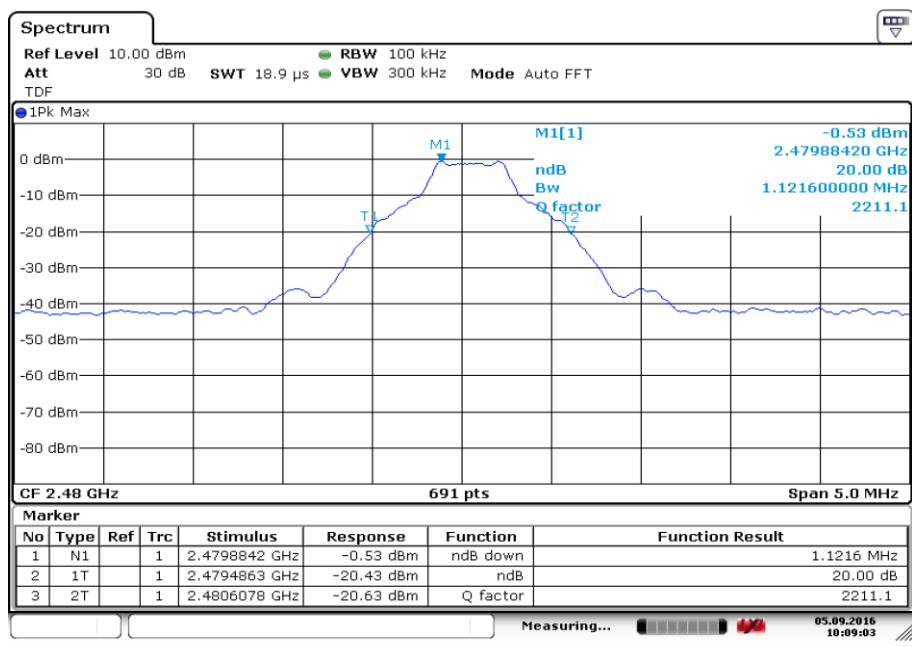


Fig. 72 Occupied 20dB Bandwidth (GFSK, Ch 0)

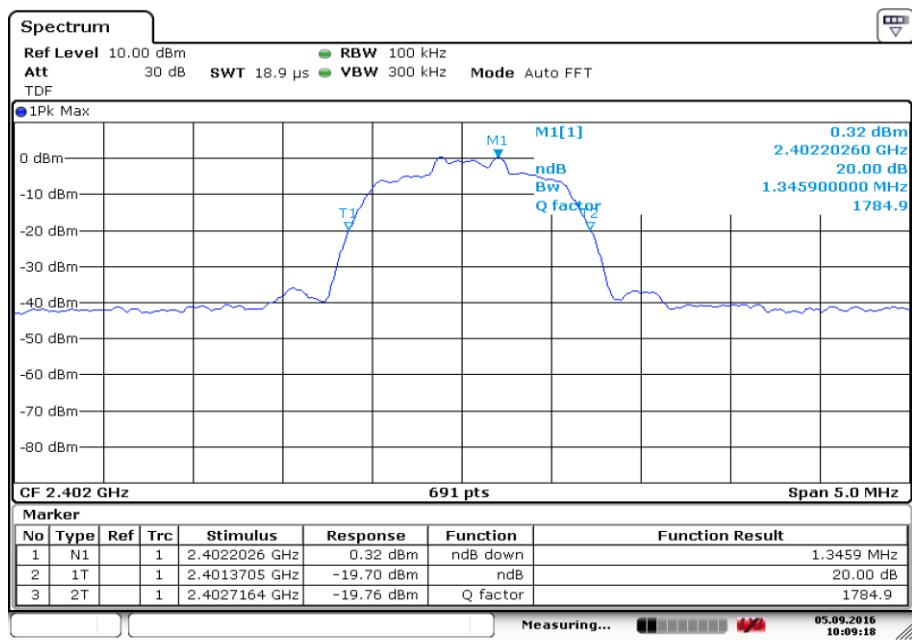
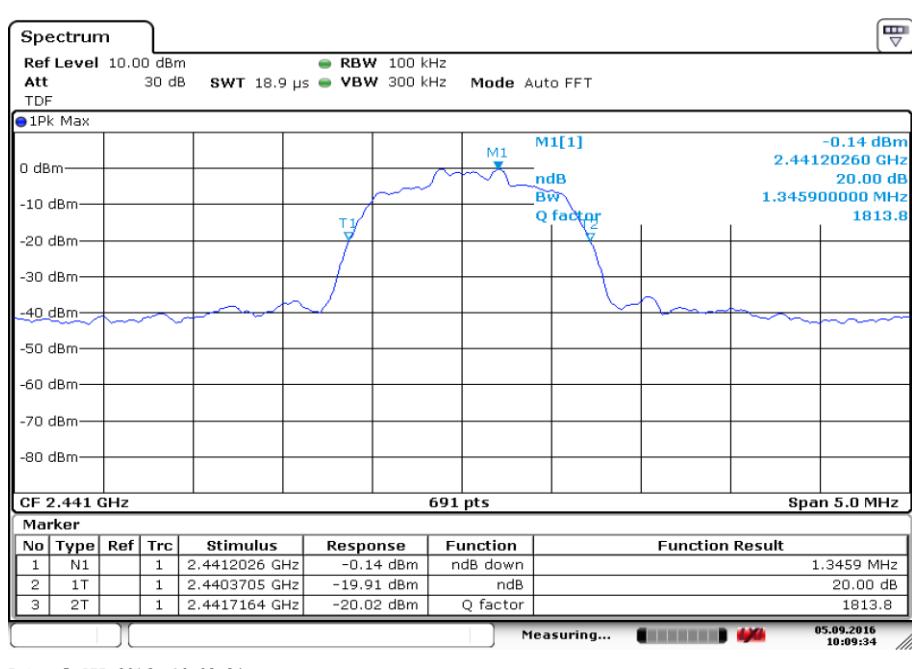


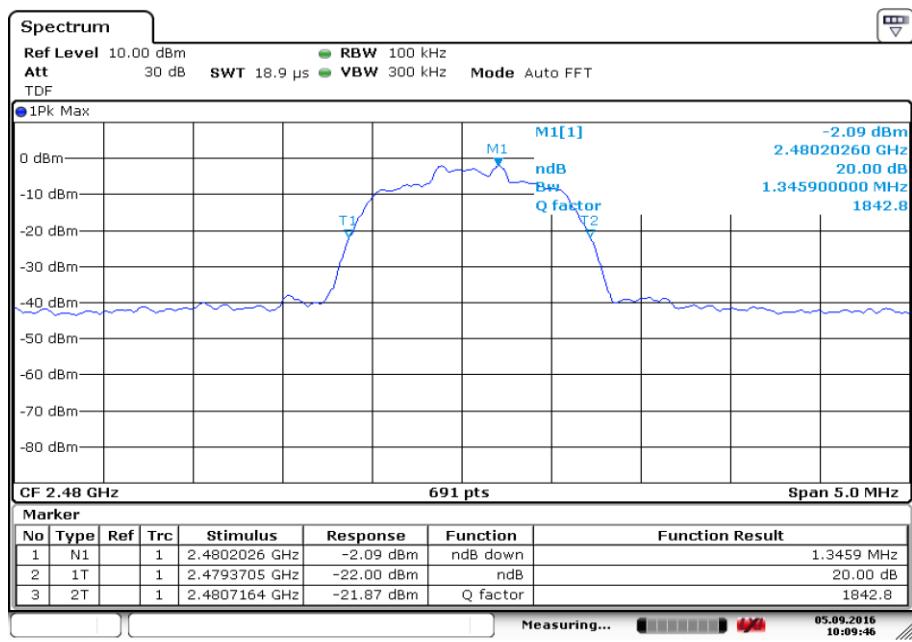
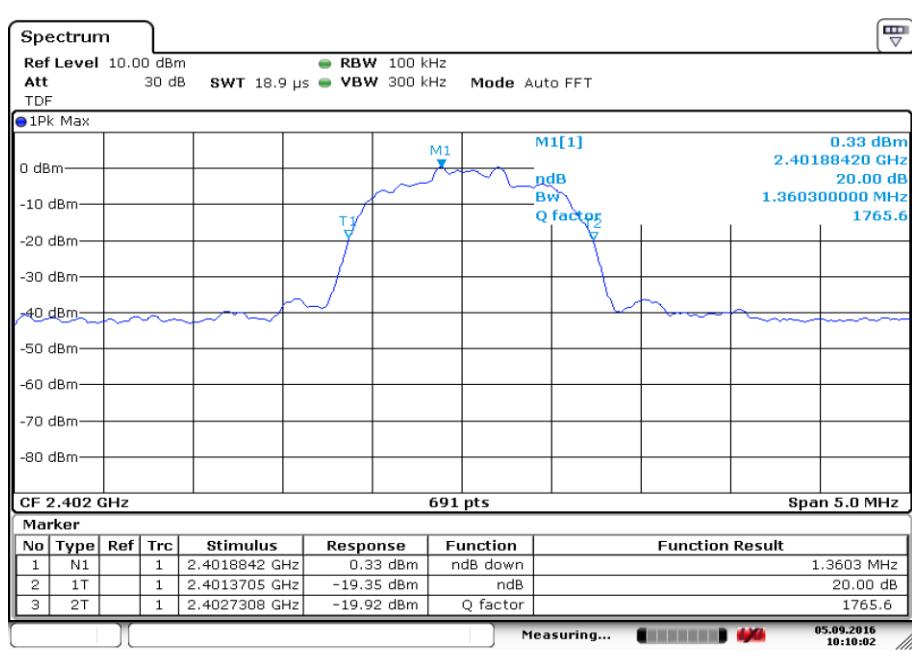
Date: 5.SEP.2016 10:08:49

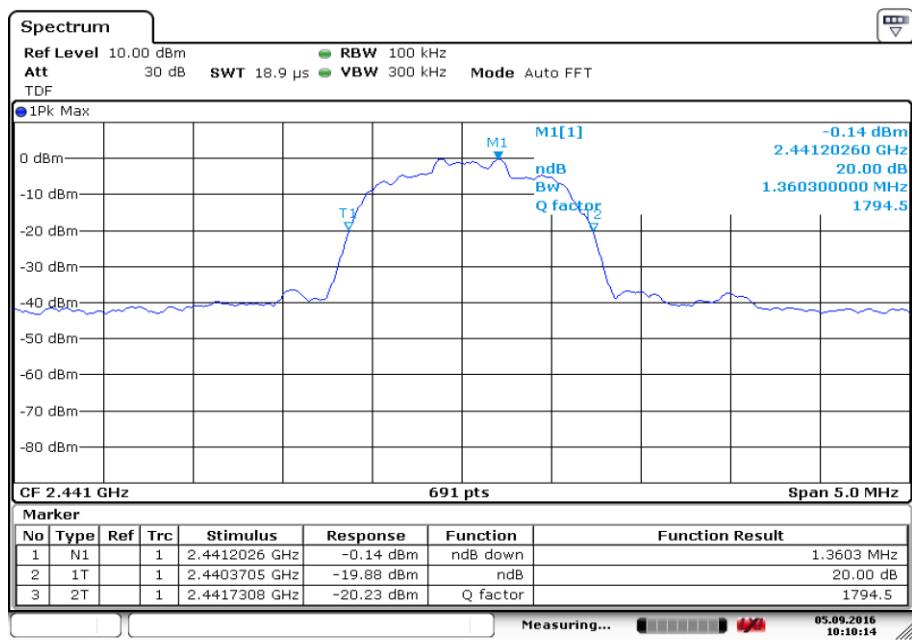
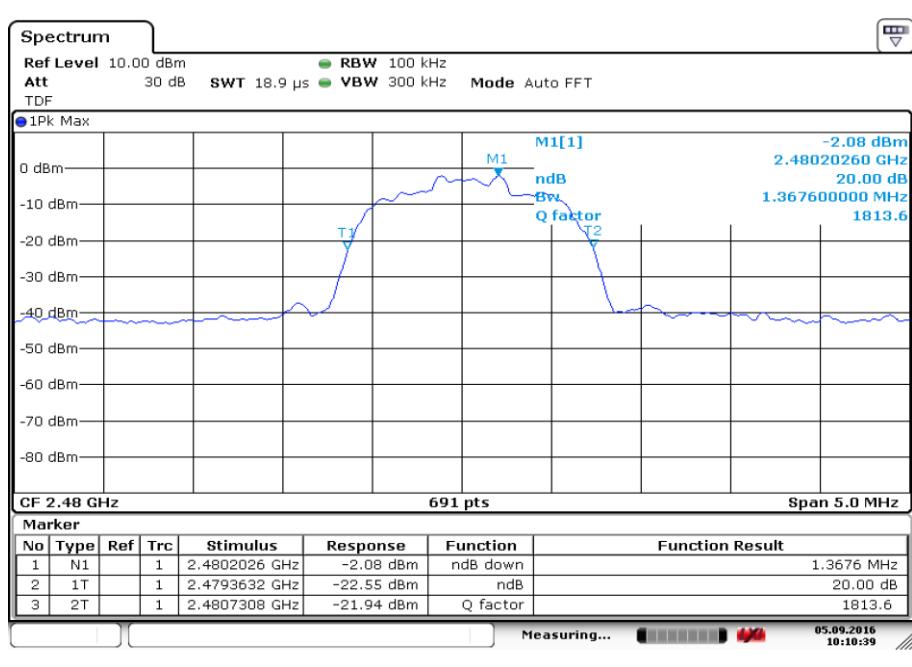
Fig. 73 Occupied 20dB Bandwidth (GFSK, Ch 39)


Date: 5.SEP.2016 10:09:03

Fig. 74 Occupied 20dB Bandwidth (GFSK, Ch 78)


Fig. 75 Occupied 20dB Bandwidth ($\pi/4$ DQPSK, Ch 0)

Fig. 76 Occupied 20dB Bandwidth ($\pi/4$ DQPSK, Ch 39)


Fig. 77 Occupied 20dB Bandwidth ($\pi/4$ DQPSK, Ch 78)

Fig. 78 Occupied 20dB Bandwidth (8DPSK, Ch 0)


Fig. 79 Occupied 20dB Bandwidth (8DPSK, Ch 39)

Fig. 80 Occupied 20dB Bandwidth (8DPSK, Ch 78)

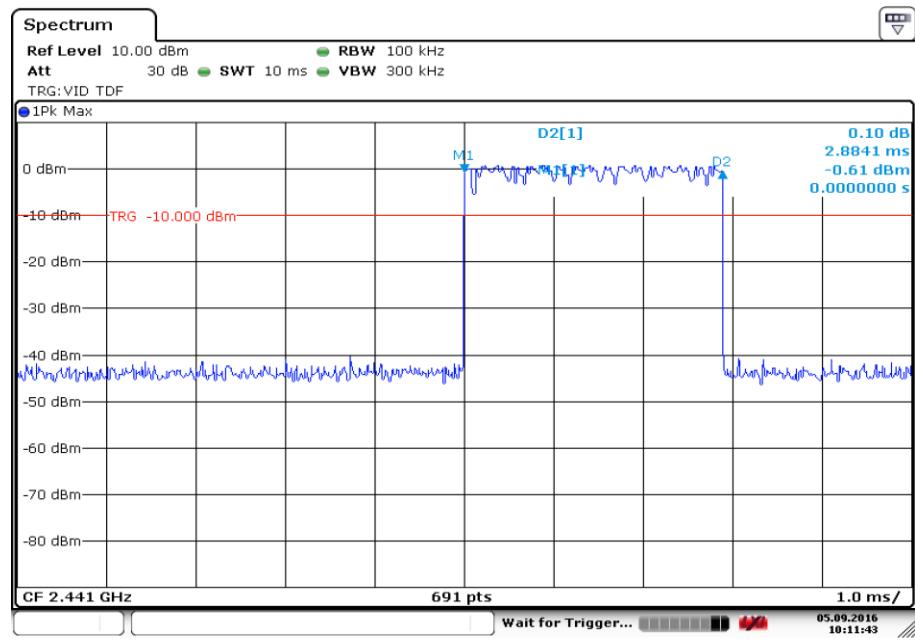


Fig. 81 Time of Occupancy(Dwell Time) (GFSK, Ch39)

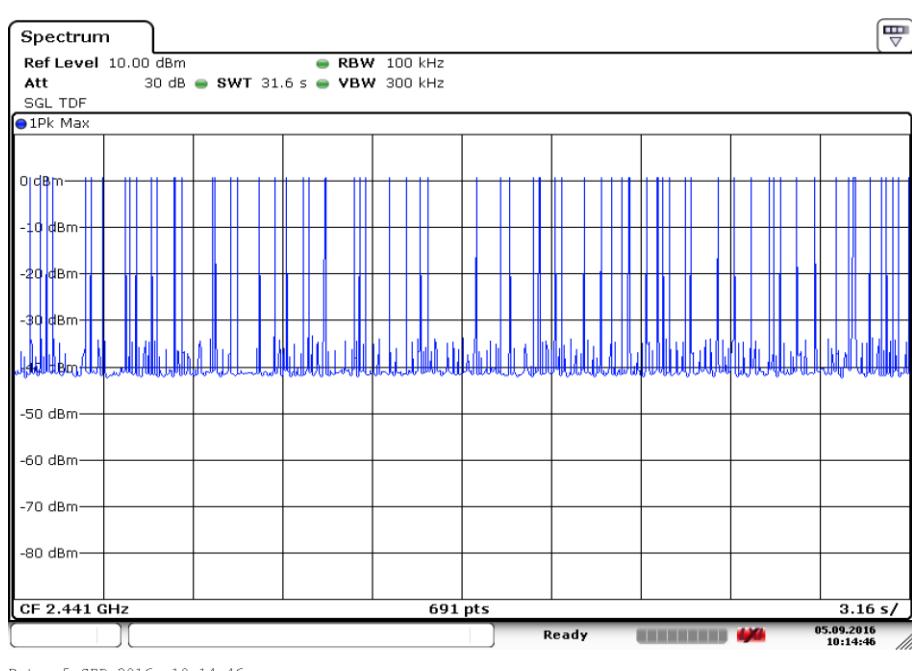


Fig. 82 Number of Transmissions (GFSK, Ch39)

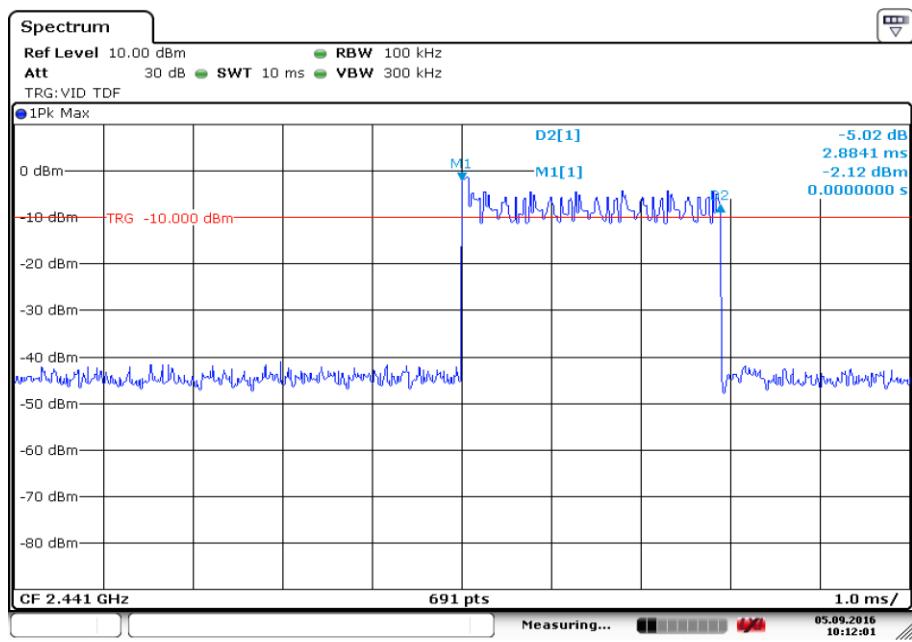


Fig. 83 Time of Occupancy(Dwell Time) ($\pi/4$ DQPSK, Ch39)

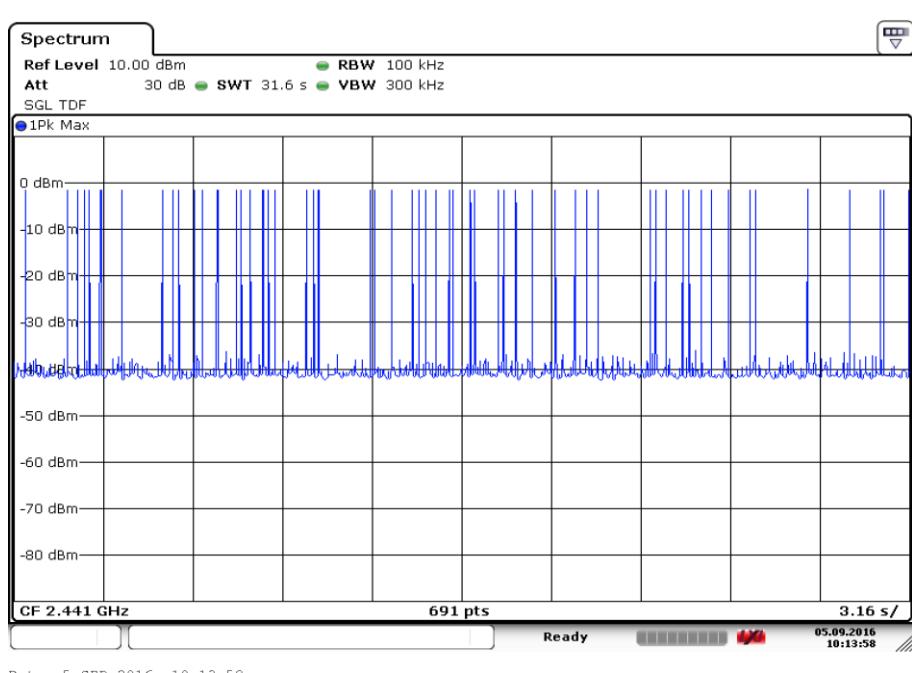
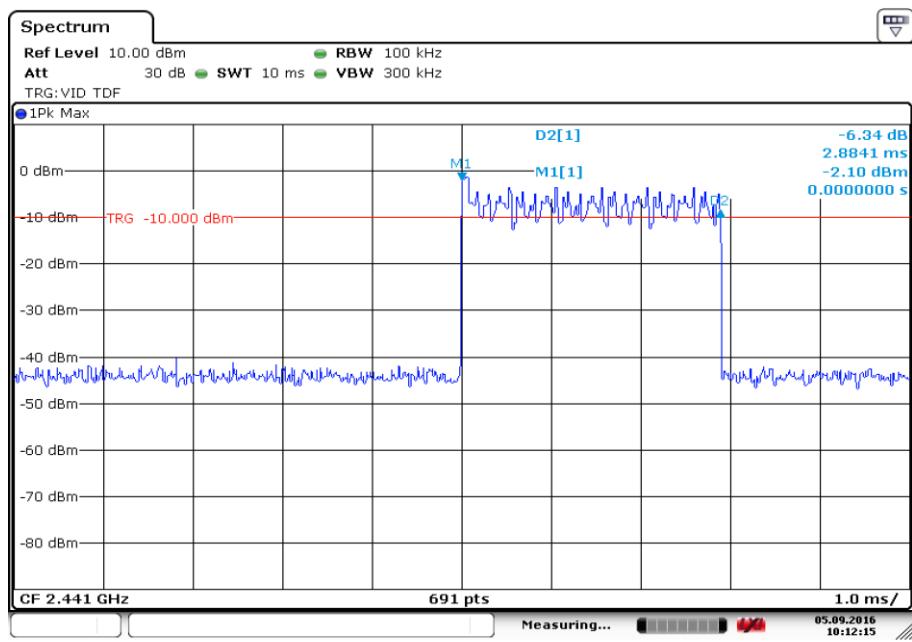
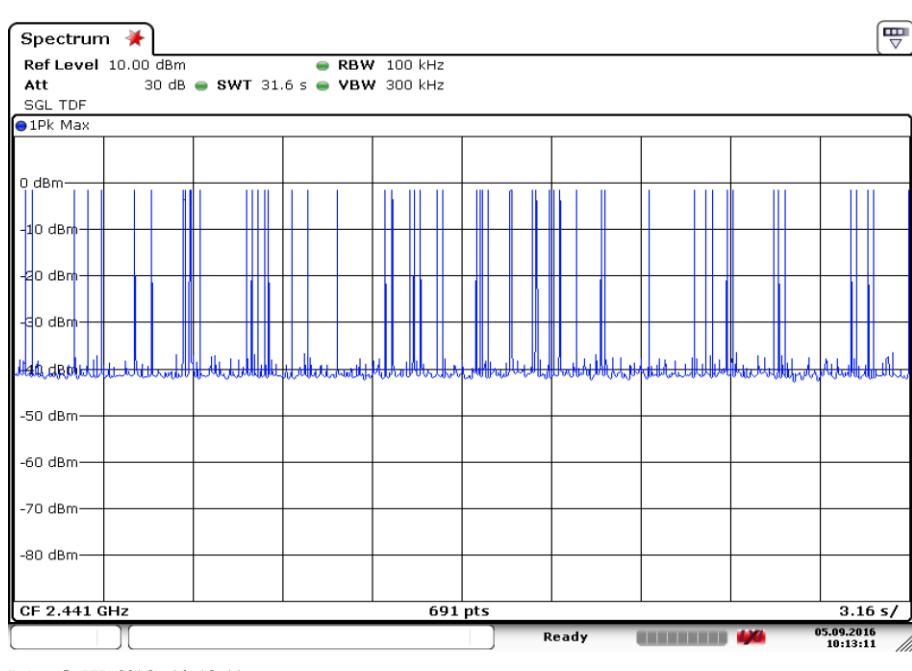


Fig. 84 Number of Transmissions ($\pi/4$ DQPSK, Ch39)


Fig. 85 Time of Occupancy(Dwell Time) (8DPSK, Ch39)

Fig. 86 Number of Transmissions (8DPSK, Ch39)

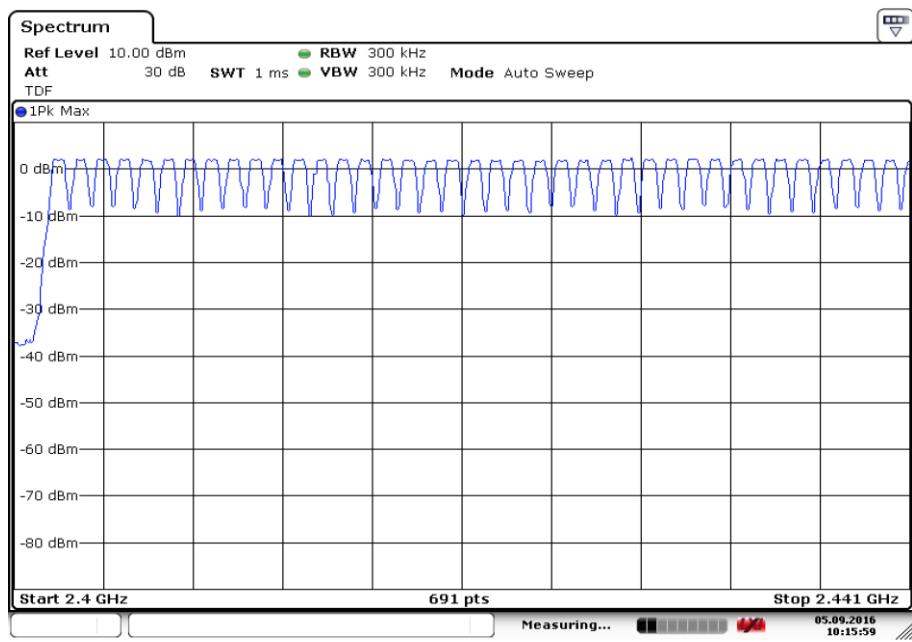


Fig. 87 Hopping channel ch0~39 (GFSK, Ch39)

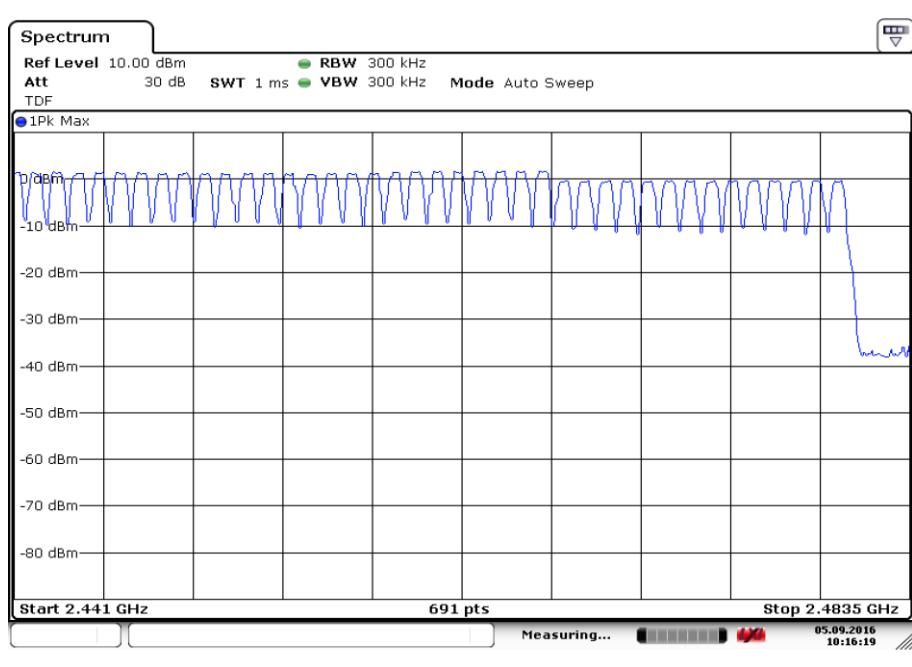


Fig. 88 Hopping channel ch39~78 (GFSK, Ch39)

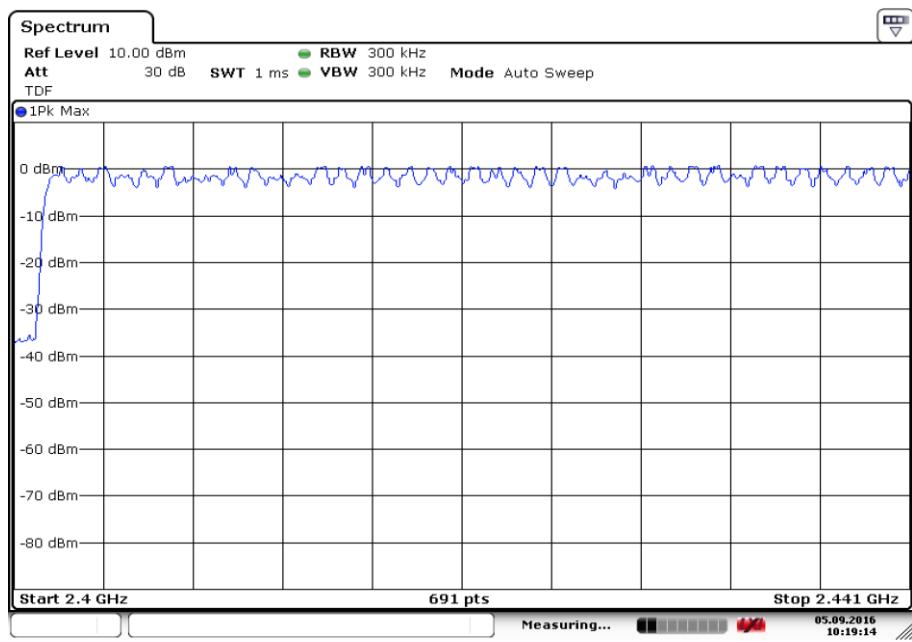


Fig. 89 Hopping channel ch0~39 ($\pi/4$ DQPSK, Ch39)

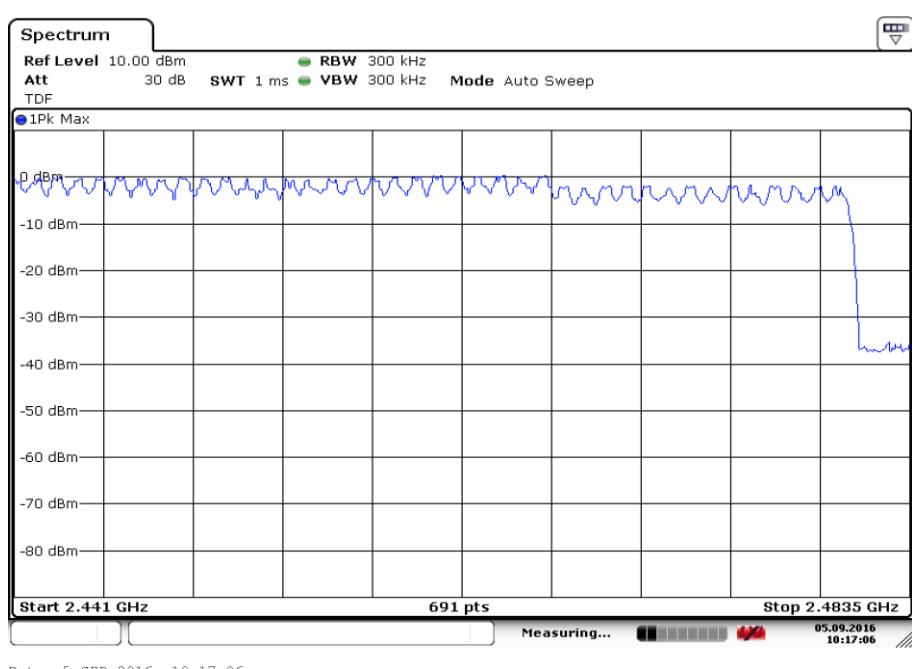


Fig. 90 Hopping channel ch39~78 ($\pi/4$ DQPSK, Ch39)

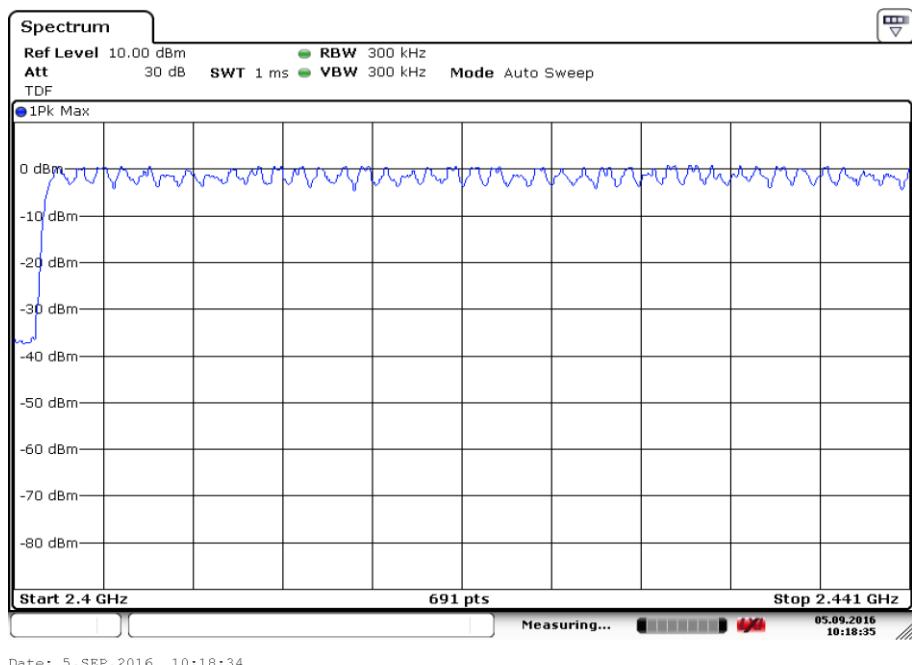


Fig. 91 Hopping channel ch0~39 (8DPSK, Ch39)

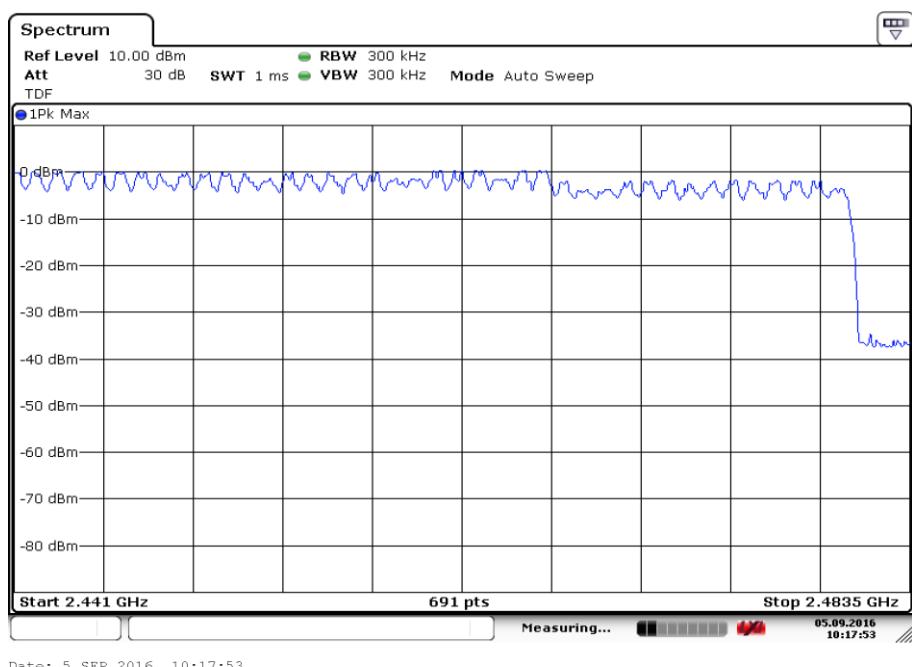


Fig. 92 Hopping channel ch39~78 (8DPSK, Ch39)

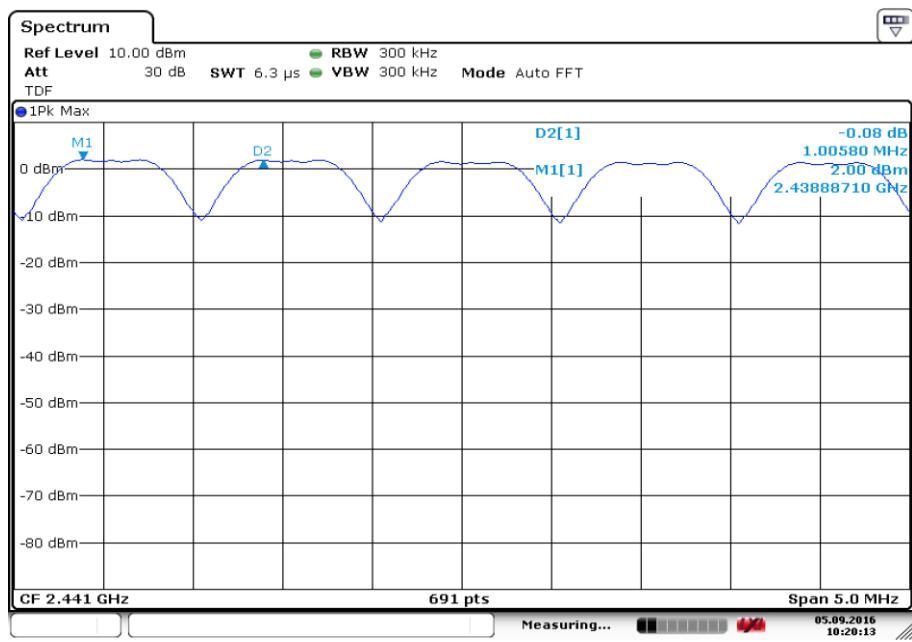


Fig. 93 Carrier Frequency Separation (GFSK, Ch39)

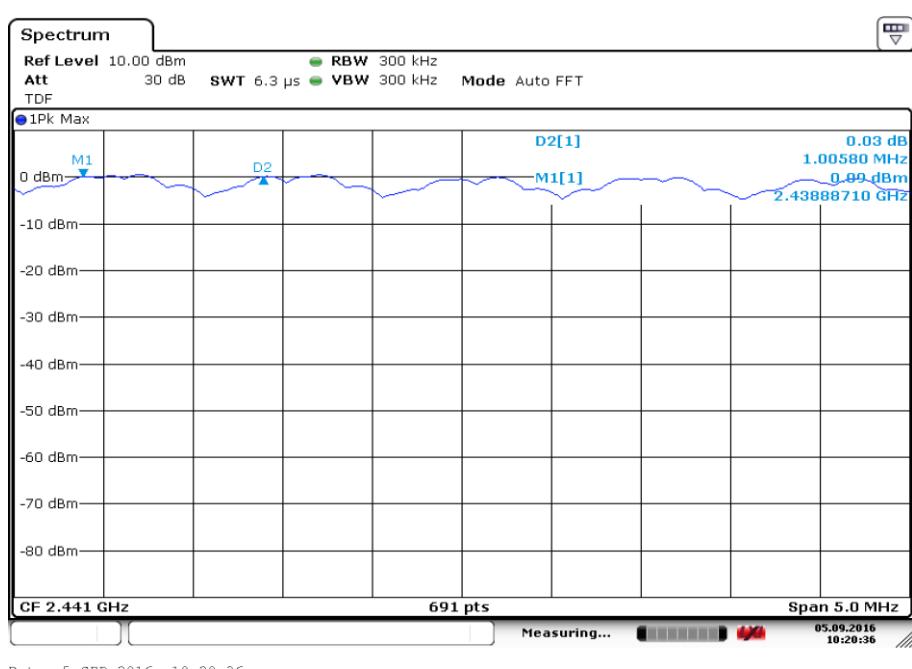


Fig. 94 Carrier Frequency Separation ($\pi/4$ DQPSK, Ch39)

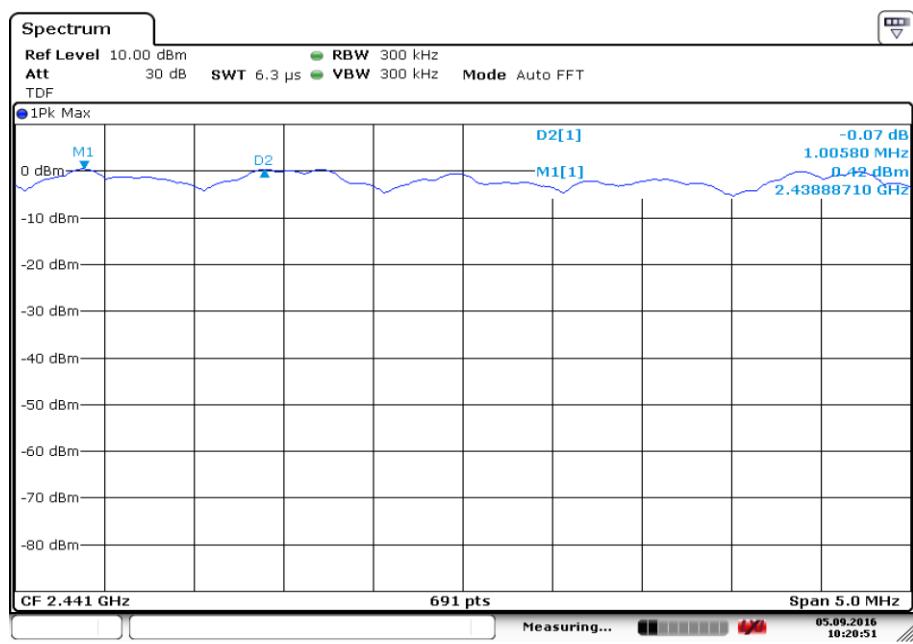


Fig. 95 Carrier Frequency Separation (8DPSK, Ch39)

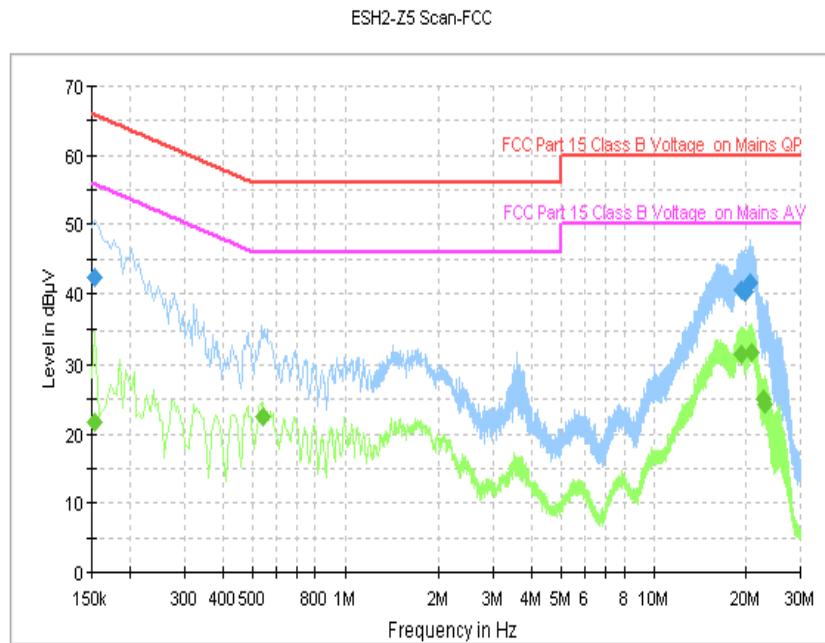


Fig. 96 AC Powerline Conducted Emission (Traffic, AE1)

MEASUREMENT RESULT: " QuasiPeak "

Frequency (MHz)	QuasiPeak (dB _u V)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dB _u V)
0.154000	42.4	GND	L1	9.7	23.4	65.8
19.322000	40.5	GND	L1	9.8	19.5	60.0
19.622000	40.2	GND	L1	9.8	19.8	60.0
19.690000	40.3	GND	L1	9.8	19.7	60.0
19.938000	40.4	GND	L1	9.8	19.6	60.0
20.594000	41.6	GND	L1	9.9	18.4	60.0

MEASUREMENT RESULT: " Average "

Frequency (MHz)	Average (dB _u V)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dB _u V)
0.154000	21.8	GND	L1	9.7	34.0	55.8
0.542000	22.5	GND	L1	9.8	23.5	46.0
19.178000	31.5	GND	L1	9.8	18.5	50.0
20.854000	31.8	GND	L1	9.9	18.2	50.0
22.654000	25.0	GND	N	10.0	25.0	50.0
23.074000	24.2	GND	N	10.0	25.8	50.0

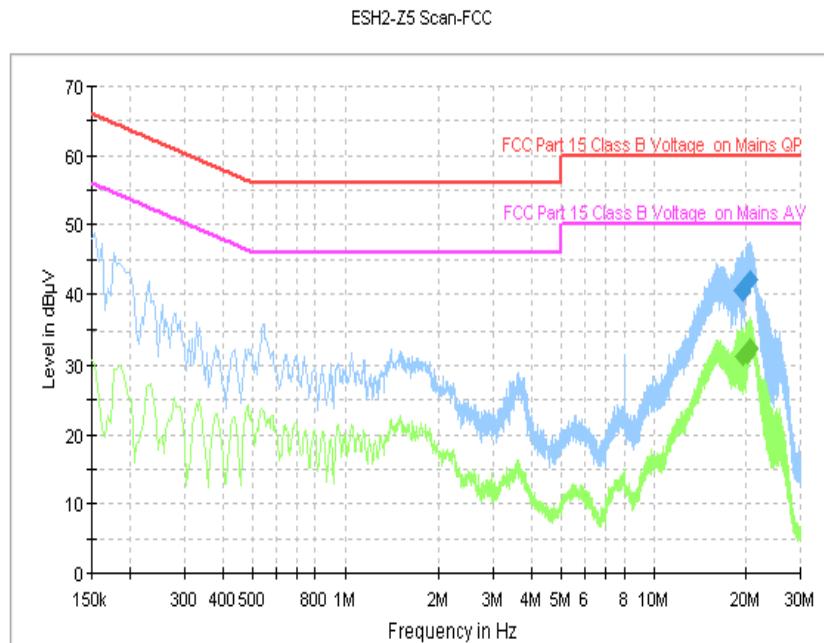


Fig. 97 AC Power line Conducted Emission (Idle, AE1)

MEASUREMENT RESULT: " QuasiPeak "

Frequency (MHz)	QuasiPeak (dB μ V)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
19.206000	40.5	GND	L1	9.8	19.5	60.0
19.318000	40.5	GND	L1	9.8	19.5	60.0
19.402000	40.6	GND	L1	9.8	19.4	60.0
19.482000	40.4	GND	L1	9.8	19.6	60.0
19.534000	40.2	GND	L1	9.8	19.8	60.0
20.554000	42.1	GND	L1	9.9	17.9	60.0

MEASUREMENT RESULT: " Average "

Frequency (MHz)	Average (dB μ V)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
19.442000	31.2	GND	L1	9.8	18.8	50.0
20.078000	31.5	GND	L1	9.8	18.5	50.0
20.162000	31.8	GND	L1	9.8	18.2	50.0
20.254000	32.2	GND	L1	9.9	17.8	50.0
20.506000	32.6	GND	L1	9.9	17.4	50.0
20.634000	32.4	GND	L1	9.9	17.6	50.0

ANNEX C: Persons involved in this testing

Test Name	Tester
Maximum Peak Output Power	Xu Ye, Tang Weisheng
Band Edges Compliance	Xu Ye, Tang Weisheng
Conducted Spurious Emission	Xu Ye, Tang Weisheng
Radiated Spurious Emission	Xu Ye, Tang Weisheng
Occupied 20dB bandwidth	Xu Ye, Tang Weisheng
Time of Occupancy(Dwell Time)	Xu Ye, Tang Weisheng
Number of Hopping Channel	Xu Ye, Tang Weisheng
Carrier Frequency Separation	Xu Ye, Tang Weisheng
AC Powerline Conducted Emission	Xu Ye, Tang Weisheng

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