



TEST REPORT

No. I22N00716-BT

for

HMD Global Oy

Smart Phone

Model Name: TA-1413

with

Hardware Version: V01

Software Version: 00WW_0_017

FCC ID: 2AJOTTA-1413

Issued Date: 2022-04-25

Designation Number: CN1210

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 SAICT.

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CONTENTS

CONTENTS	2
1. SUMMARY OF TEST REPORT.....	3
1.1. TEST ITEMS.....	3
1.2. TEST STANDARDS	3
1.3. TEST RESULT	3
1.4. TESTING LOCATION	3
1.5. PROJECT DATA	3
1.6. SIGNATURE	3
2. CLIENT INFORMATION.....	4
2.1. APPLICANT INFORMATION	4
2.2. MANUFACTURER INFORMATION	4
3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE)	5
3.1. ABOUT EUT	5
3.2. INTERNAL IDENTIFICATION OF EUT USED DURING THE TEST	5
3.3. INTERNAL IDENTIFICATION OF AE USED DURING THE TEST	5
3.4. GENERAL DESCRIPTION.....	5
4. REFERENCE DOCUMENTS.....	6
4.1. DOCUMENTS SUPPLIED BY APPLICANT	6
4.2. REFERENCE DOCUMENTS FOR TESTING.....	6
5. TEST RESULTS	7
5.1. TESTING ENVIRONMENT.....	7
5.2. TEST RESULTS	7
5.3. STATEMENTS.....	7
6. TEST EQUIPMENTS UTILIZED	8
7. LABORATORY ENVIRONMENT.....	9
8. MEASUREMENT UNCERTAINTY	10
ANNEX A: DETAILED TEST RESULTS.....	11
TEST CONFIGURATION.....	11
A.0 ANTENNA REQUIREMENT	13
A.1 MAXIMUM PEAK OUTPUT POWER	14
A.2 BAND EDGES COMPLIANCE	15
A.3 CONDUCTED EMISSION.....	22
A.4 RADIATED EMISSION.....	27
A.5 20dB BANDWIDTH.....	39
A.6 TIME OF OCCUPANCY (DWELL TIME)	44
A.7 NUMBER OF HOPPING CHANNELS.....	46
A.8 CARRIER FREQUENCY SEPARATION	48
A.9 AC POWER LINE CONDUCTED EMISSION	50



1. Summary of Test Report

1.1. Test Items

Description	Smart Phone
Model Name	TA-1413
Applicant's name	HMD Global Oy
Manufacturer's Name	HMD Global Oy

1.2. Test Standards

FCC Part15-2019; ANSI C63.10-2013

1.3. Test Result

Pass

Please refer to "5.2.Test Results"

1.4. Testing Location

Address: Building G, Shenzhen International Innovation Center, No.1006 Shennan Road,
Futian District, Shenzhen, Guangdong, P. R. China

1.5. Project data

Testing Start Date:	2022-04-02
Testing End Date:	2022-04-21

1.6. Signature

Lin Kanfeng
(Prepared this test report)

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2. Client Information

2.1. Applicant Information

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2.2. Manufacturer Information

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

3.1. About EUT

Description	Smart Phone
Model Name	TA-1413
Frequency Band	2400MHz~2483.5MHz
Type of Modulation	GFSK/ π /4 DQPSK/8DPSK
Number of Channels	79
Antenna Type	Dedicated antenna
Supply Voltage	DC 3.8V
Power source	Battery
FCC ID	2AJOTTA-1413
Condition of EUT as received	No abnormality in appearance

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of Shenzhen Academy of Information and Communications Technology.

3.2. Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version	Receive Date
UT10aa	355400570002744	V01	00WW_0_017	2022-04-02
UT08aa	355400570003247	V01	00WW_0_017	2022-04-02

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

UT10aa is used for conduction test, UT08aa is used for radiation test and AC Power line Conducted Emission test.

3.3. Internal Identification of AE used during the test

AE ID*	Description	Model	Manufacturer
AE1	Battery	GH6581	Shenzhen Aerospace Electronic CO.,Ltd.
AE2	Charger	AD-010U	Shenzhen Baijunda Electronics Co. LTD

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

3.4. General Description

The Equipment under Test (EUT) is a Smart Phone with dedicated antenna.

Manual and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the client.



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 Part 15	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	2019
ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	2013

5. Test Results

5.1. Testing Environment

Normal Temperature: 15~35°C

Relative Humidity: 20~75%

5.2. Test Results

No	Test cases	Sub-clause of Part 15C	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 Power line Conducted Emission	15.107,15.207	P

See **ANNEX A** for details.

5.3. Statements

SAICT has evaluated the test cases requested by the applicant/manufacture as listed in section 5.2 of this report, for the EUT specified in section 3, according to the standards or reference documents listed in section 4.2.

Disclaimer:

A. After confirmation with the customer, the sample information provided by the customer may affect the validity of the measurement results in this report, and the impact and consequences arising therefrom shall be borne by the customer.

B. The samples in this report are provided by the customer, and the test results are only applicable to the samples received.

6. Test Equipments Utilized

Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Due date	Calibration Period
1	Vector Signal Analyzer	FSV40	100903	Rohde & Schwarz	2022-12-29	1 year
2	Power Sensor	U2021XA	MY55430013	Keysight	2022-12-29	1 year
3	Data Acquisition	U2531A	TW55443507	Keysight	/	/
4	Bluetooth Tester	CBT32	100584	Rohde & Schwarz	2022-12-29	1 year
5	Test Receiver	ESCI	100701	Rohde & Schwarz	2022-08-08	1 year
6	LISN	ENV216	102067	Rohde & Schwarz	2022-07-15	1 year

Radiated test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Due date	Calibration Period
1	Loop Antenna	HLA6120	35779	TESEQ	2022-04-25	3 years
2	BiLog Antenna	3142E	00224831	ETS-Lindgren	2024-05-27	3 years
3	Horn Antenna	3117	00066577	ETS-Lindgren	2025-03-15	3 years
4	Horn Antenna	QSH-SL-18-26-S-20	17013	Q-par	2023-01-06	3 years
5	Horn Antenna	QSH-SL-8-26-40-K-20	17014	Q-par	2023-01-06	3 years
6	Test Receiver	ESR7	101676	Rohde & Schwarz	2022-11-24	1 year
7	Spectrum Analyser	FSV40	101192	Rohde & Schwarz	2023-01-12	1 year
8	Chamber	FACT3-2.0	1285	ETS-Lindgren	2023-05-29	2 years

Test software

No.	Equipment	Manufacturer	Version
1	TechMgr Software	CAICT	2.1.1
2	EMC32	Rohde & Schwarz	10.50.40

EUT is engineering software provided by the customer to control the transmitting signal.
The EUT was programmed to be in continuously transmitting mode.

Anechoic chamber

Fully anechoic chamber by ETS-Lindgren

7. Laboratory Environment

Semi-anechoic chamber

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	> 2M Ω
Ground system resistance	< 4 Ω
Normalised site attenuation (NSA)	< $\pm$ 4 dB, 3 m distance, from 30 to 1000 MHz

Shielded room

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-1000MHz>90 dB
Electrical insulation	> 2M Ω
Ground system resistance	< 4 Ω

Fully-anechoic chamber

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	> 2M Ω
Ground system resistance	< 4 Ω
Voltage Standing Wave Ratio (VSWR)	$\leq$ 6 dB, from 1 to 18 GHz, 3 m distance
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz

8. Measurement Uncertainty

Test Name	Uncertainty ($k=2$)	
1. RF Output Power - Conducted	1.32dB	
2. Time of Occupancy - Conducted	0.58ms	
3. Occupied channel bandwidth - Conducted	66Hz	
4 Transmitter Spurious Emission - Conducted	$30\text{MHz} \leq f < 1\text{GHz}$	1.41dB
	$1\text{GHz} \leq f < 7\text{GHz}$	1.92dB
	$7\text{GHz} \leq f < 13\text{GHz}$	2.31dB
	$13\text{GHz} \leq f \leq 26\text{GHz}$	2.61dB
5. Transmitter Spurious Emission - Radiated	$9\text{kHz} \leq f < 30\text{MHz}$	1.79dB
	$30\text{MHz} \leq f < 1\text{GHz}$	4.86dB
	$1\text{GHz} \leq f < 18\text{GHz}$	4.50dB
	$18\text{GHz} \leq f \leq 40\text{GHz}$	2.90dB
6. AC Power line Conducted Emission	$150\text{kHz} \leq f \leq 30\text{MHz}$	3.00dB

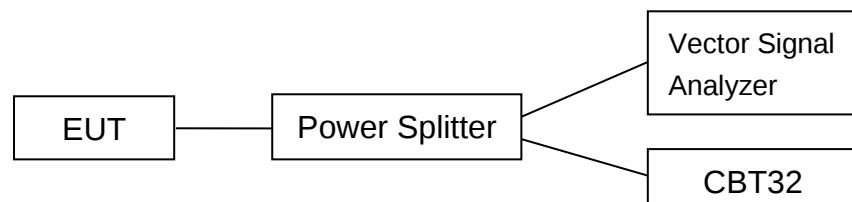
ANNEX A: Detailed Test Results

Test Configuration

The measurement is made according to ANSI C63.10.

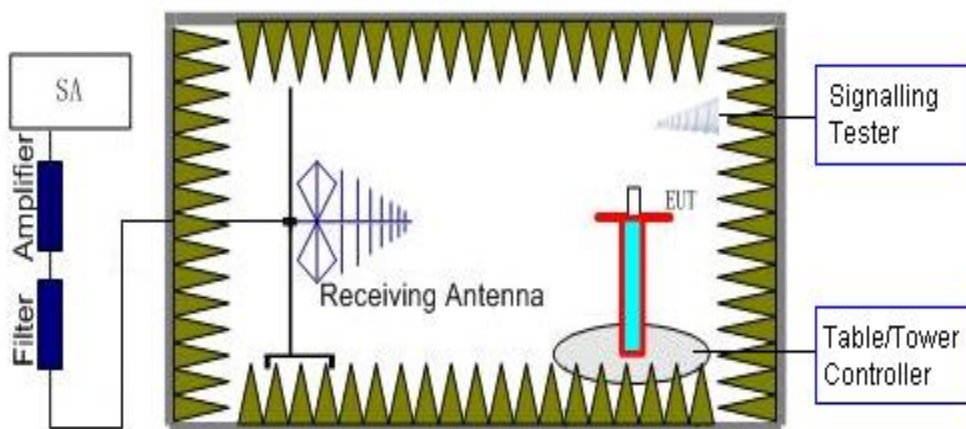
1) Conducted Measurements

1. Connect the EUT to the test system correctly.
2. Set the EUT to the required work mode.
3. Set the EUT to the required channel.
4. Set the EUT hopping mode (hopping on or hopping off).
5. Set the spectrum analyzer to start measurement.
6. Record the values.



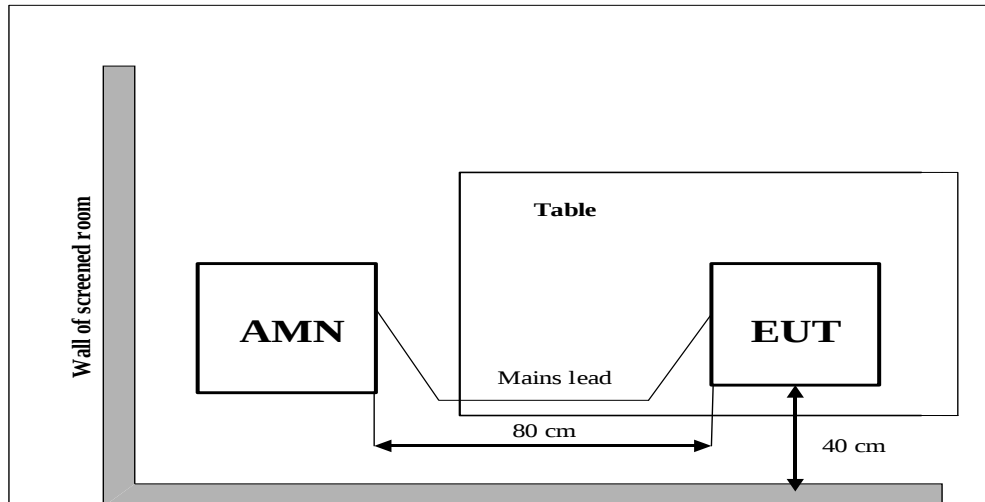
2) Radiated Measurements

Test setup: EUT was placed on a 1.5 meter high non-conductive table at a 3 meter test distance from the receive antenna. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT and adjusting the receiving antenna polarization.



3) AC Power line Conducted Emission Measurement

The EUT is working as Bluetooth terminal. A communication link of Bluetooth is set up with a System Simulator (SS). The EUT is commanded to operate at maximum transmitting power.



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 1.2 dBi.

The RF transmitter uses an integrate antenna without connector.



A.1 Maximum Peak Output Power

Method of Measurement: See ANSI C63.10-clause 7.8.5.

A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

Measurement Limit:

Standard	Limit (dBm)
FCC CRF Part 15.247(b)	< 30

Measurement Results:

Mode	RF output power (dBm)		
	2402MHz (Ch0)	2441MHz (Ch39)	2480MHz (Ch78)
GFSK	7.37	8.44	7.54
$\pi/4$ DQPSK	8.99	9.91	8.96
8DPSK	9.23	10.23	9.24

Conclusion: Pass

A.2 Band Edges Compliance

Measurement Limit:

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

Measurement Result:

Mode	Channel	Hopping	Test Results	Conclusion
GFSK	0	OFF	Fig.1	P
	78	OFF	Fig.2	P
	0	ON	Fig.3	P
	78	ON	Fig.4	P
$\pi/4$ DQPSK	0	OFF	Fig.5	P
	78	OFF	Fig.6	P
	0	ON	Fig.7	P
	78	ON	Fig.8	P
8DPSK	0	OFF	Fig.9	P
	78	OFF	Fig.10	P
	0	ON	Fig.11	P
	78	ON	Fig.12	P

See below for test graphs.

Conclusion: Pass

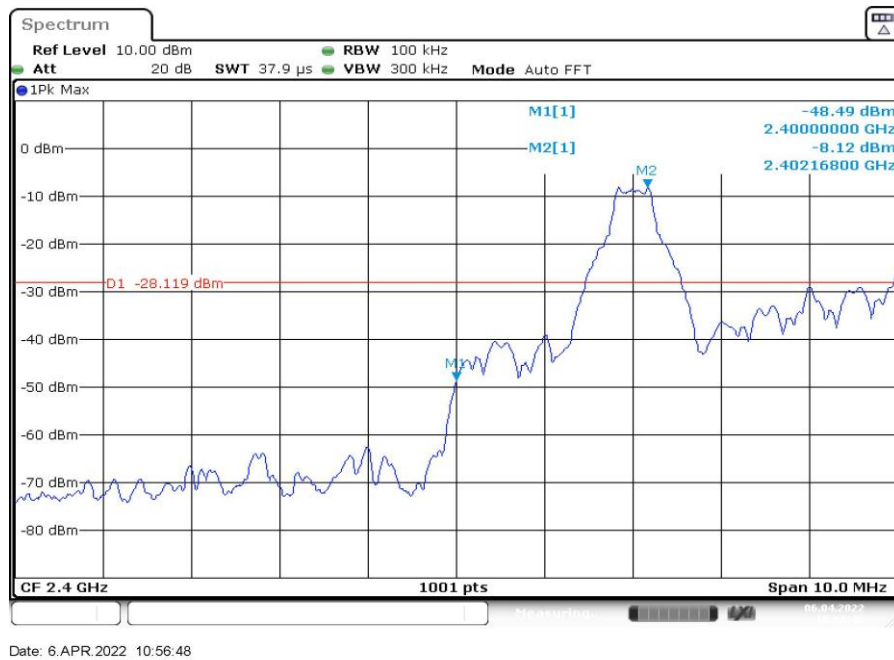


Fig. 1 Band Edges (GFSK, Ch 0, Hopping OFF)

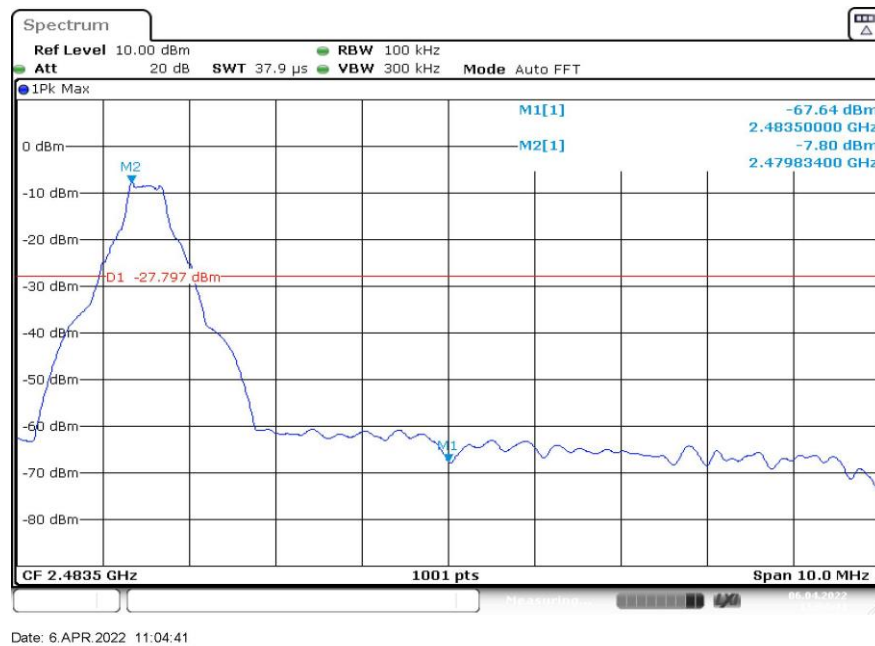


Fig. 2 Band Edges (GFSK, Ch 78, Hopping OFF)

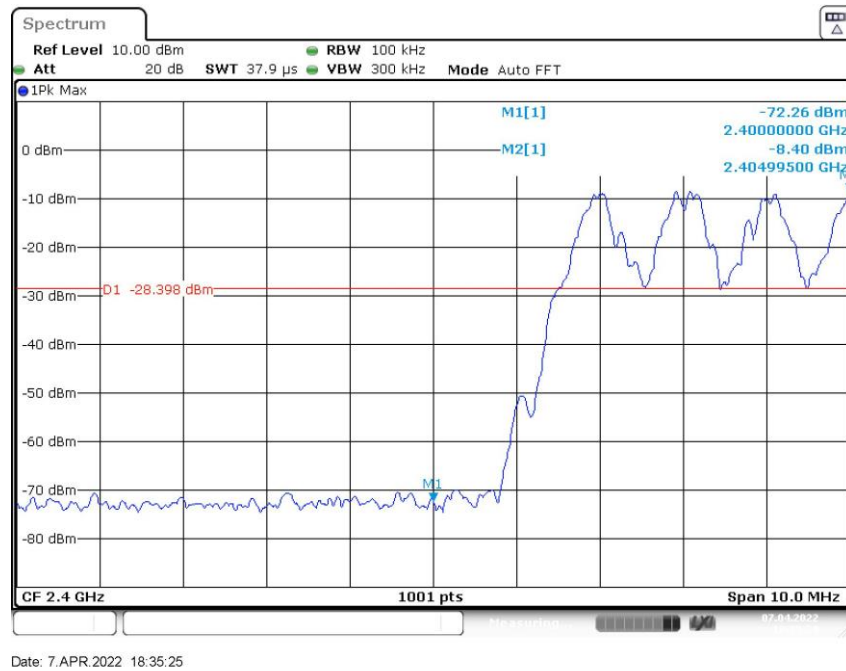


Fig. 3 Band Edges (GFSK, Ch 0, Hopping)

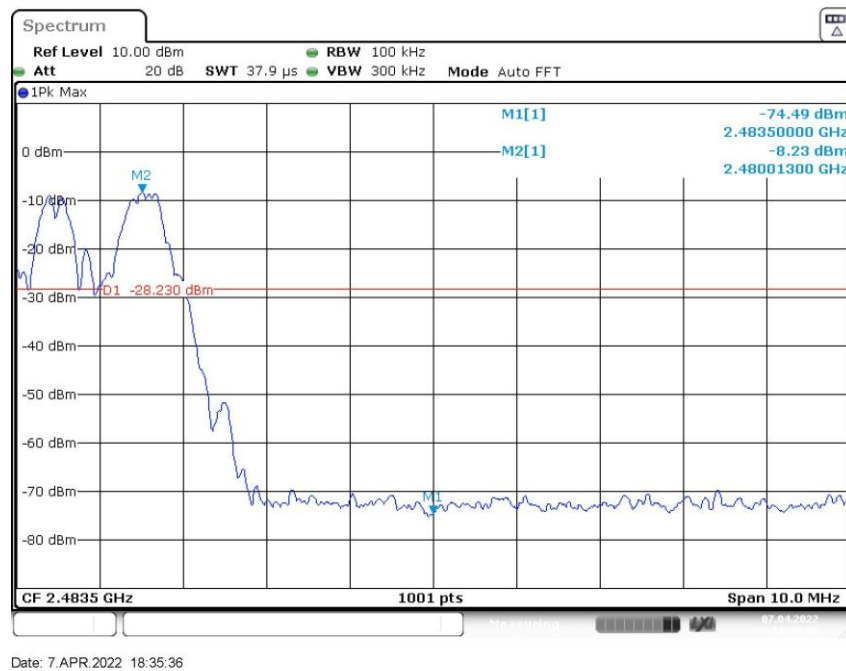


Fig. 4 Band Edges (GFSK, Ch 78, Hopping)

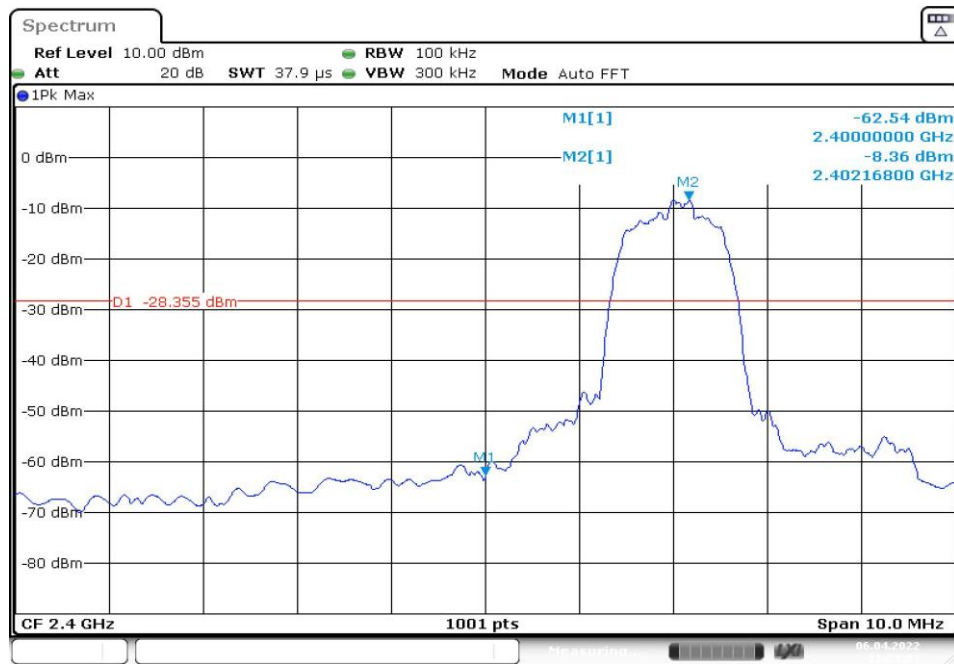


Fig. 5 Band Edges ($\pi/4$ DQPSK, Ch 0, Hopping OFF)

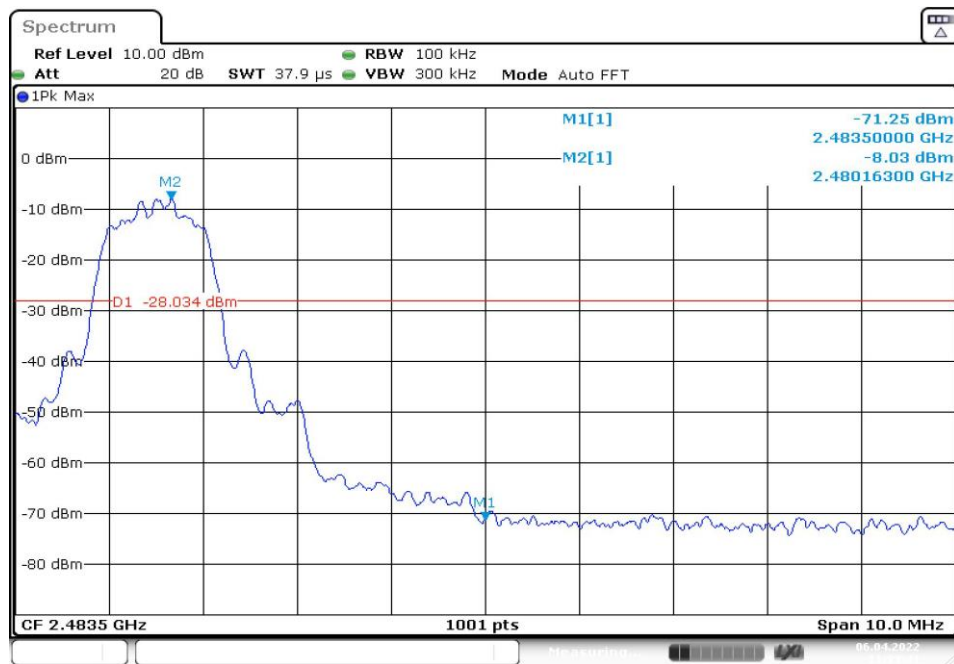


Fig. 6 Band Edges ($\pi/4$ DQPSK, Ch 78, Hopping OFF)

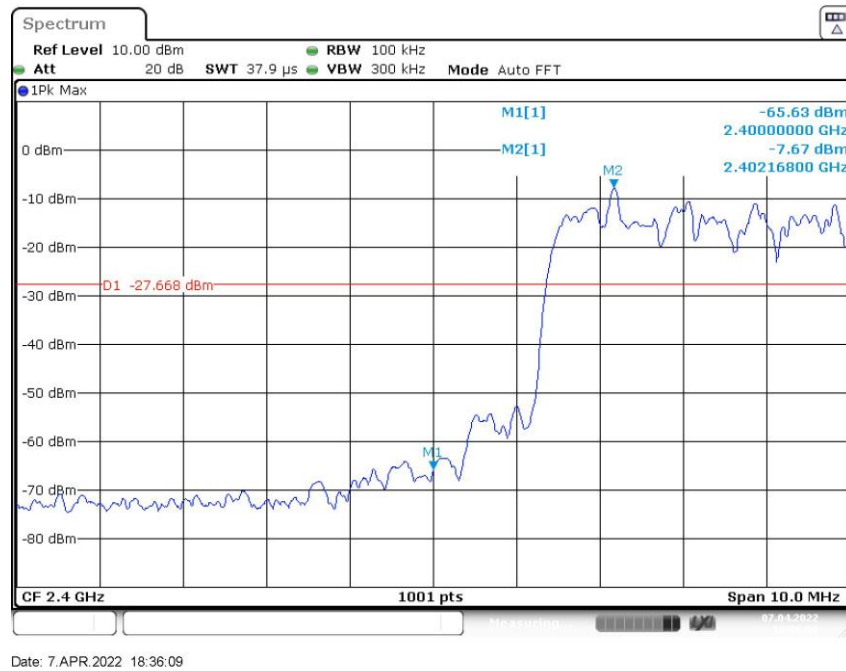


Fig. 7 Band Edges ($\pi/4$ DQPSK, Ch 0, Hopping)

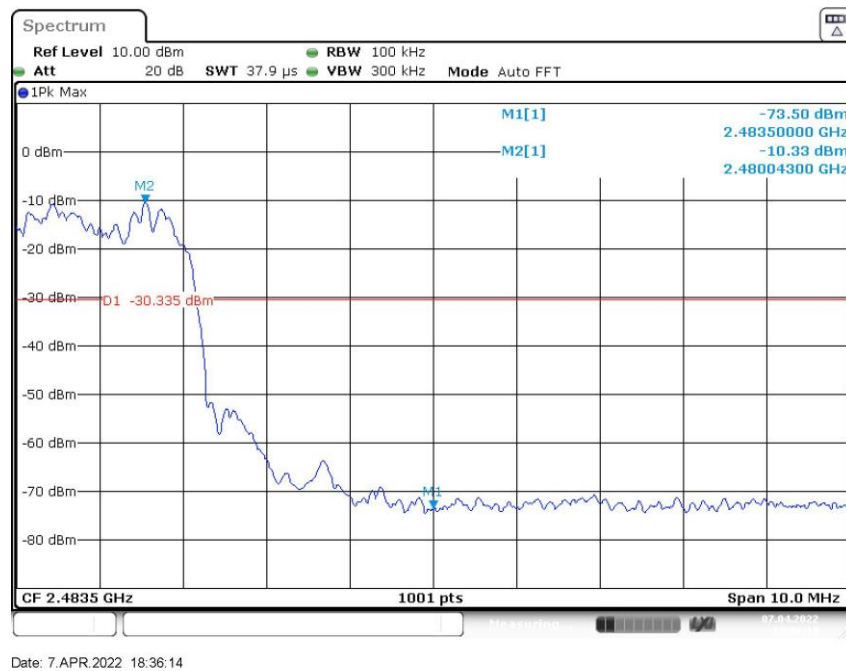
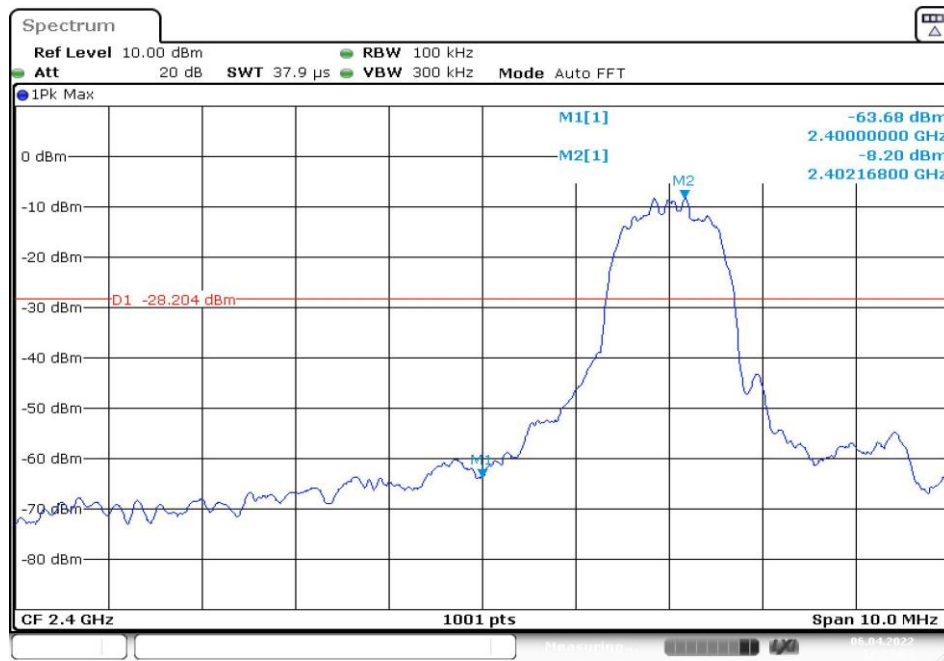
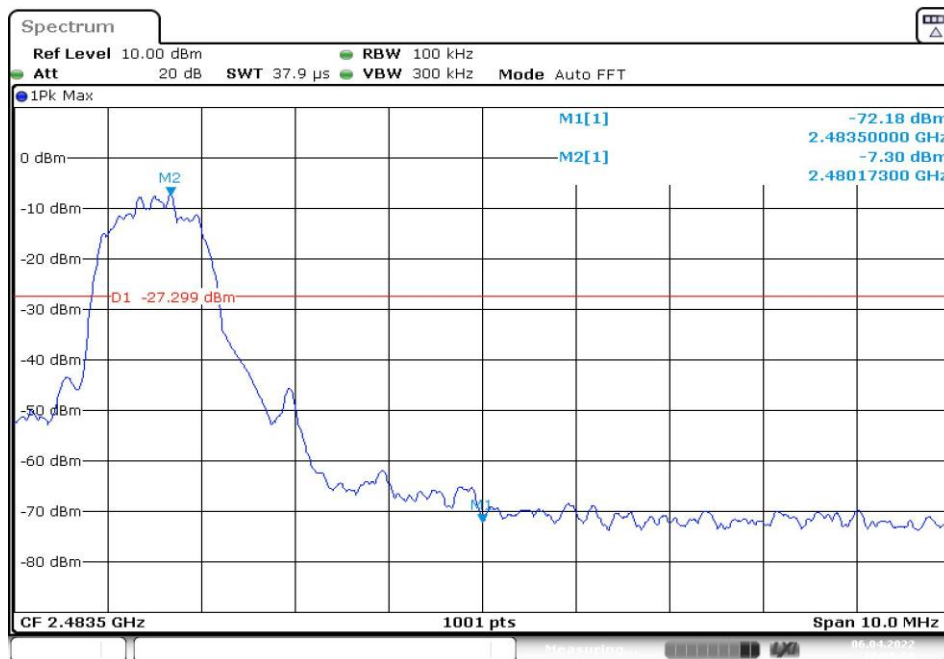


Fig. 8 Band Edges ($\pi/4$ DQPSK, Ch 78, Hopping)



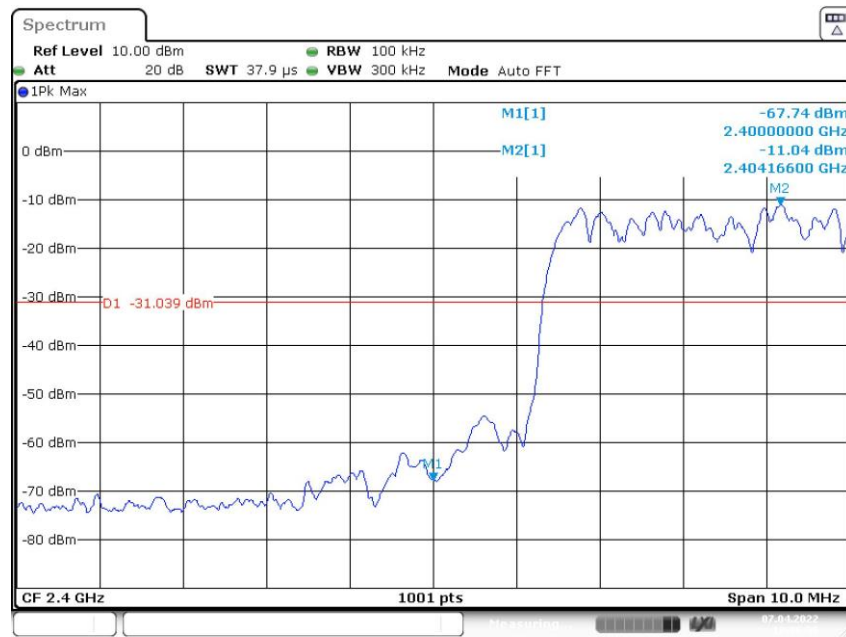
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Fig. 9 Band Edges (8DPSK, Ch 0, Hopping OFF)



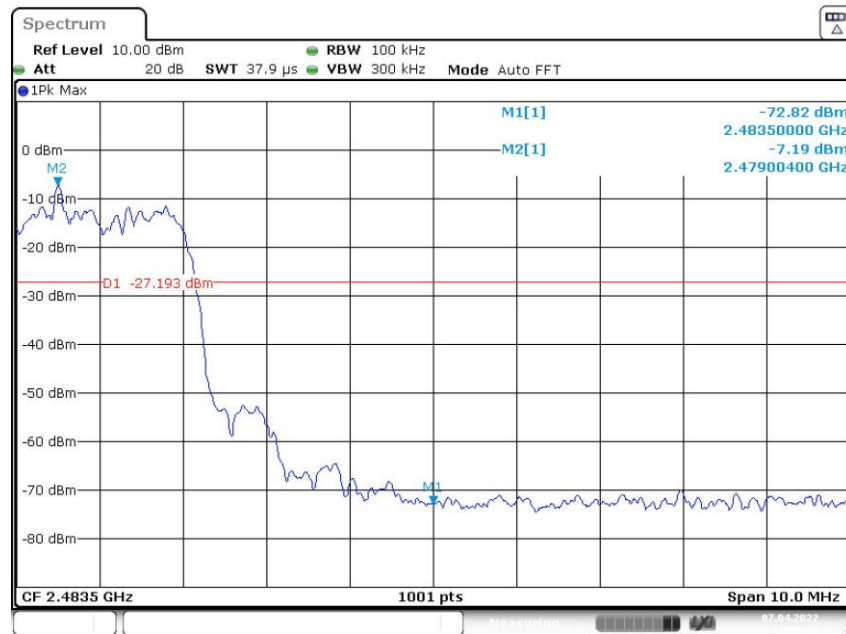
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Fig. 10 Band Edges (8DPSK, Ch 78, Hopping OFF)



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Fig. 11 Band Edges (8DPSK, Ch 0, Hopping)



Date: 7.APR.2022 18:36:41

Fig. 12 Band Edges (8DPSK, Ch 78, Hopping)

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	30MHz-25GHz	Fig.13	P
	39	30MHz-25GHz	Fig.14	P
	78	30MHz-25GHz	Fig.15	P
$\pi/4$ DQPSK	0	30MHz-25GHz	Fig.16	P
	39	30MHz-25GHz	Fig.17	P
	78	30MHz-25GHz	Fig.18	P
8DPSK	0	30MHz-25GHz	Fig.19	P
	39	30MHz-25GHz	Fig.20	P
	78	30MHz-25GHz	Fig.21	P

See below for test graphs.

Conclusion: Pass

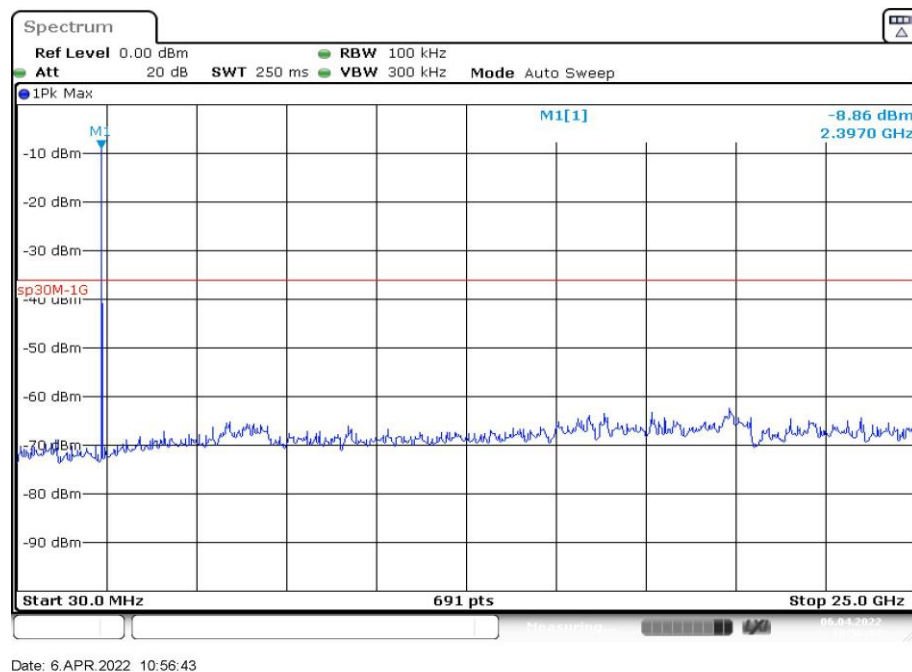
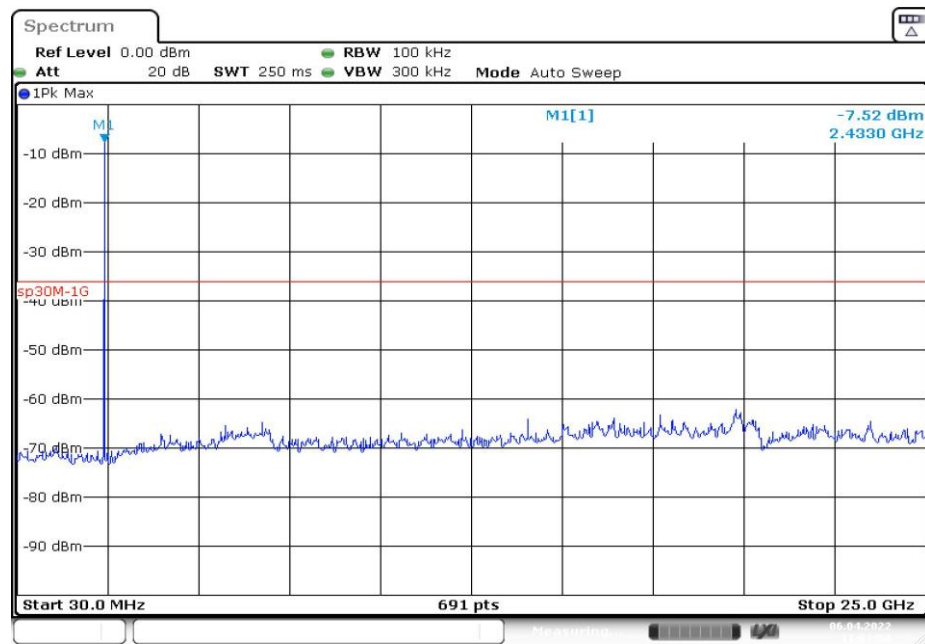
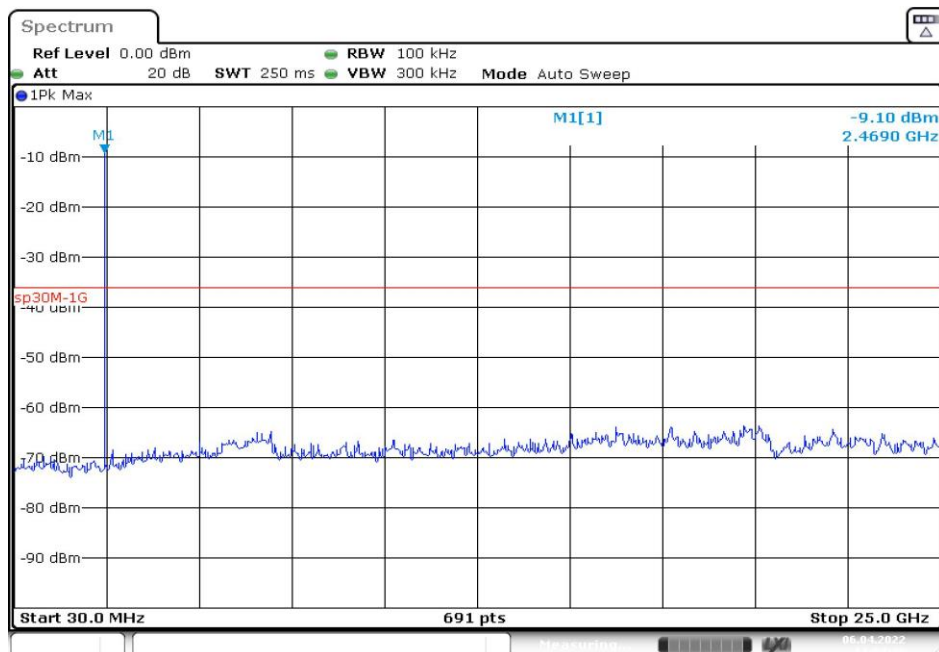


Fig. 13 Conducted Spurious Emission (GFSK, Ch0, 30 MHz-26.5GHz)



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Fig. 14 Conducted Spurious Emission (GFSK, Ch39, 30 MHz-26.5GHz)



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Fig. 15 Conducted Spurious Emission (GFSK, Ch78, 30 MHz-26.5GHz)

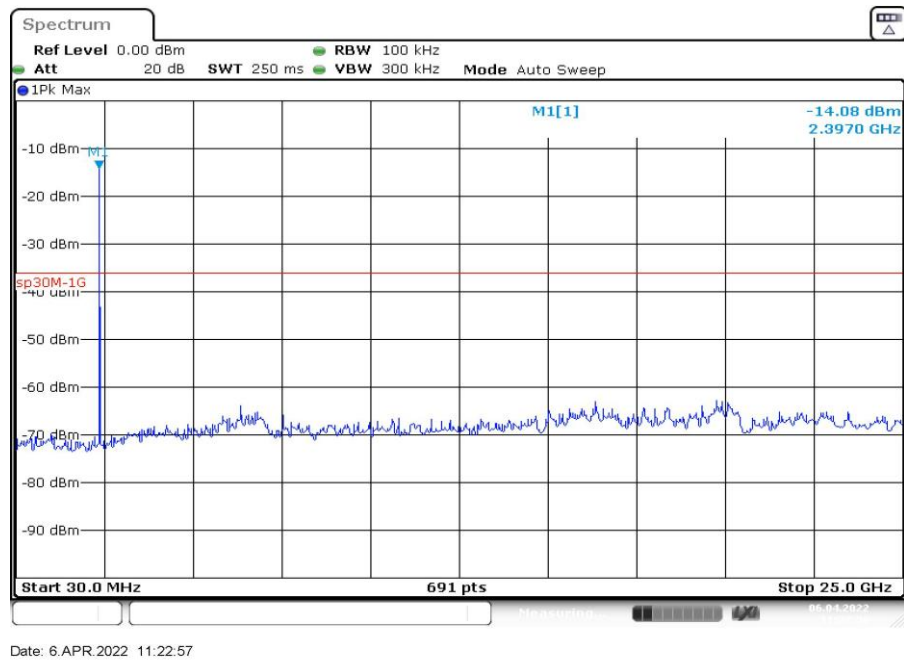


Fig. 16 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch0, 30 MHz-26.5GHz)

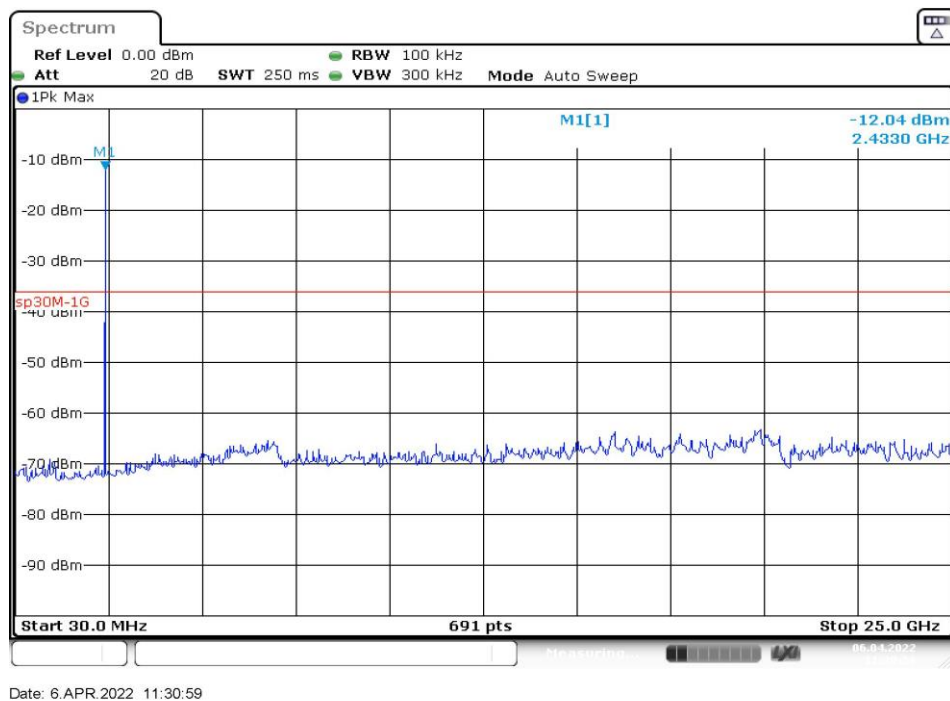
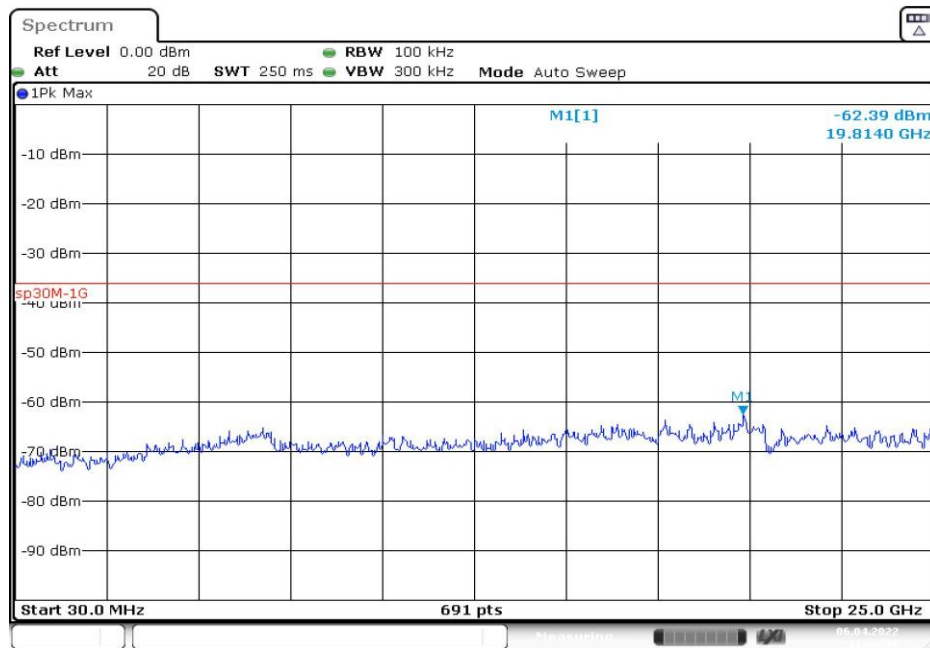
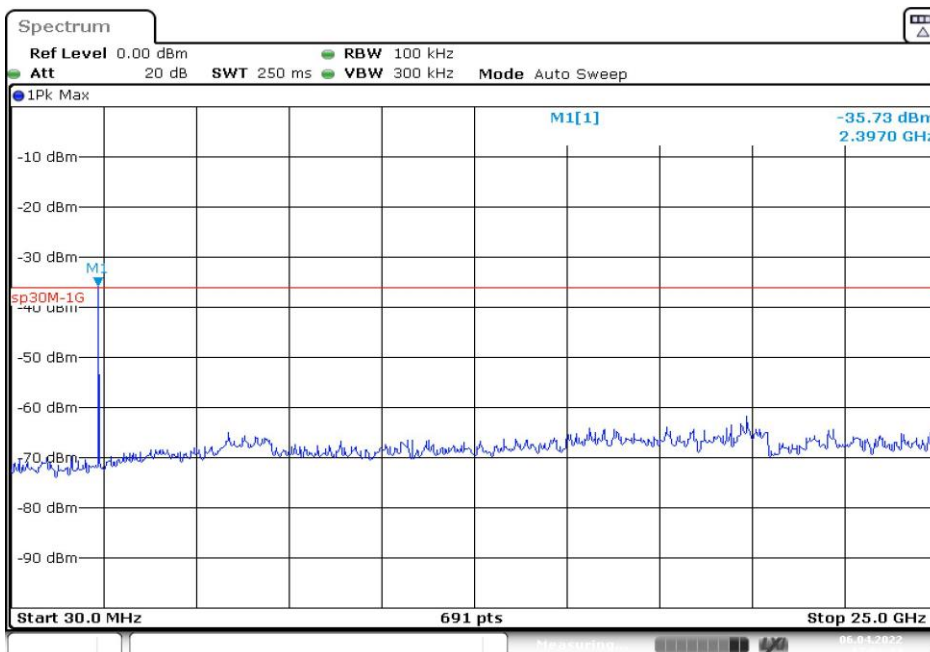


Fig. 17 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch39, 30 MHz-26.5GHz)



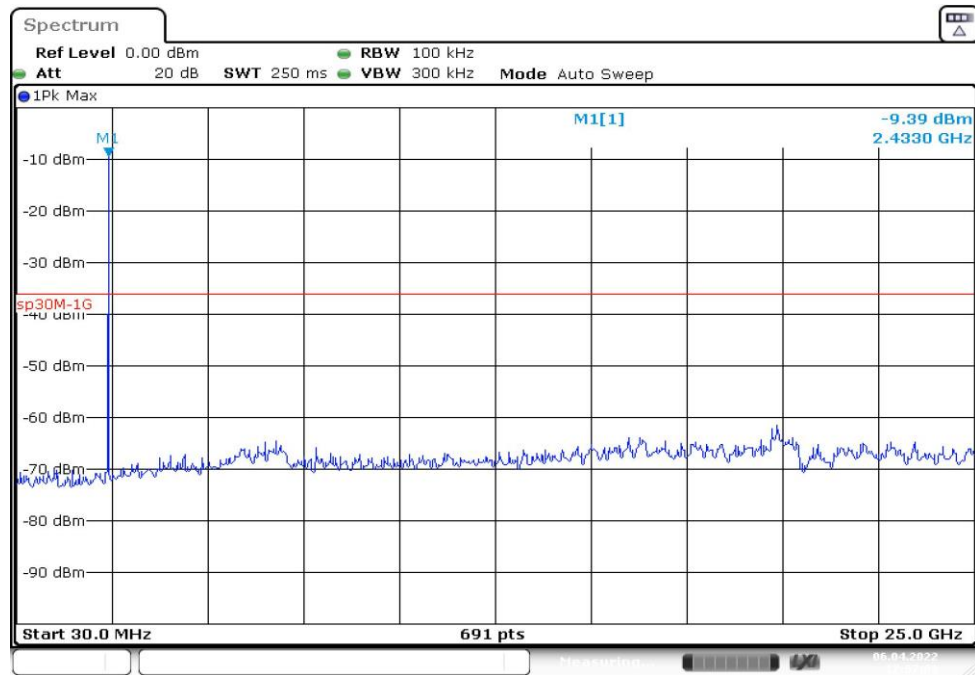
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Fig. 18 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch78, 30 MHz-26.5GHz)



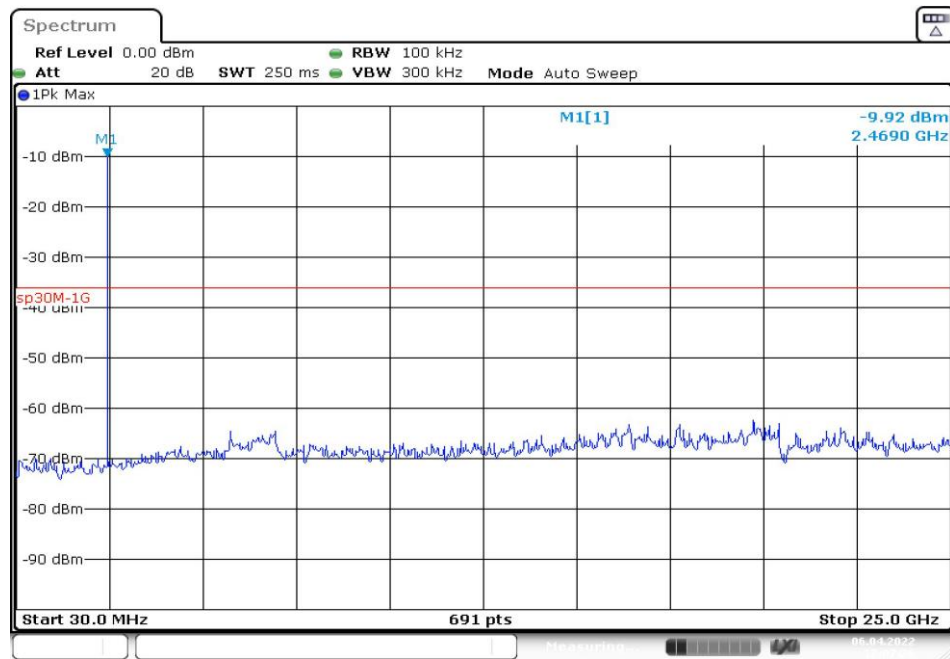
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Fig. 19 Conducted Spurious Emission (8DPSK, Ch0, 30 MHz-26.5GHz)



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Fig. 20 Conducted Spurious Emission (8DPSK, Ch39, 30 MHz-26.5GHz)



Date: 6.APR.2022 17:07:26

Fig. 21 Conducted Spurious Emission (8DPSK, Ch78, 30 MHz-26.5GHz)

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($\mu\text{V/m}$)	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.22	P
	39	1 GHz ~18 GHz	Fig.23	P
	78	1 GHz ~18 GHz	Fig.24	P
	Restricted Band(CH0)	2.38 GHz ~ 2.45 GHz	Fig.25	P
	Restricted Band (CH78)	2.45 GHz ~ 2.5 GHz	Fig.26	P
$\pi/4$ DQPSK	0	1 GHz ~18 GHz	Fig.27	P
	39	1 GHz ~18 GHz	Fig.28	P
	78	1 GHz ~18 GHz	Fig.29	P
	Restricted Band (CH0)	2.38 GHz ~ 2.45 GHz	Fig.30	P
	Restricted Band (CH78)	2.45 GHz ~ 2.5 GHz	Fig.31	P
8DPSK	0	1 GHz ~18 GHz	Fig.32	P
	39	1 GHz ~18 GHz	Fig.33	P
	78	1 GHz ~18 GHz	Fig.34	P
	Restricted Band (CH0)	2.38 GHz ~ 2.45 GHz	Fig.35	P
	Restricted Band (CH78)	2.45 GHz ~ 2.5 GHz	Fig.36	P
/	All channels	9 kHz ~30 MHz	Fig.37	P
		30 MHz ~1 GHz	Fig.38	P
		18 GHz ~26.5 GHz	Fig.39	P

Worst Case Result
GFSK CH0 (1-18GHz)

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Pol	Corr. (dB/m)
4803.500000	44.44	74.00	29.56	V	-0.3
10692.500000	46.68	74.00	27.32	H	6.0
12720.000000	48.17	74.00	25.83	H	8.8
15295.500000	49.27	74.00	24.73	H	12.2
16266.000000	51.01	74.00	22.99	V	14.7
17895.500000	51.87	74.00	22.13	H	16.6

Frequency (MHz)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Pol	Corr. (dB/m)
4804.000000	39.25	54.00	14.75	V	-0.3
10766.000000	34.23	54.00	19.77	V	6.4
12672.500000	36.61	54.00	17.39	V	9.0
14502.500000	37.26	54.00	16.74	H	11.7
16923.500000	39.88	54.00	14.12	V	16.0
17949.000000	40.65	54.00	13.35	V	17.2

GFSK CH39 (1-18GHz)

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
4881.500000	44.09	74.00	29.91	V	-0.1
9872.000000	45.28	74.00	28.72	H	5.2
13124.500000	48.19	74.00	25.81	H	9.8
14861.500000	49.56	74.00	24.44	V	11.6
16518.000000	52.44	74.00	21.56	V	15.3
17992.000000	52.35	74.00	21.65	H	16.9

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
4882.000000	36.10	54.00	17.90	V	-0.1
9858.500000	33.73	54.00	20.27	H	5.3
12671.500000	36.33	54.00	17.67	H	9.0
14510.500000	37.37	54.00	16.63	V	11.7
16913.500000	39.99	54.00	14.01	H	16.0
17907.500000	40.71	54.00	13.29	V	17.3

GFSK CH78 (1-18GHz)

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
4960.000000	47.22	74.00	26.78	V	-0.1
9873.000000	45.19	74.00	28.81	H	5.2
11443.000000	47.42	74.00	26.58	V	6.7
14521.500000	49.77	74.00	24.23	H	11.7
16500.000000	51.03	74.00	22.97	H	15.2
17948.000000	52.62	74.00	21.38	H	17.2

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
4960.000000	42.74	54.00	11.26	V	-0.1
9877.000000	33.69	54.00	20.31	H	5.3
11433.500000	34.85	54.00	19.15	V	6.8
14453.000000	37.41	54.00	16.59	H	11.6
16879.500000	39.90	54.00	14.10	V	16.0
17949.000000	40.67	54.00	13.33	V	17.2

Note:

A "reference path loss" is established and the A_{Rpl} is the attenuation of "reference path loss", and Antenna Factor, the gain of the preamplifier, the cable loss. P_{Mea} is the field strength recorded from the instrument. The measurement results are obtained as described below:

Result= P_{Mea} +Cable Loss +Antenna Factor-Gain of the preamplifier.

See below for test graphs.

Conclusion: Pass

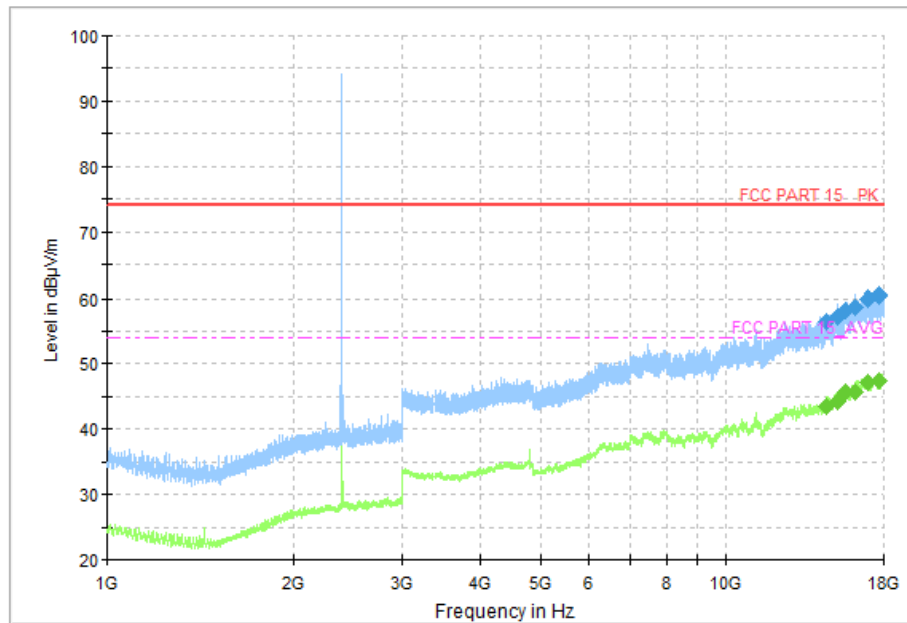


Fig. 22 Radiated Spurious Emission (GFSK, Ch0, 1 GHz ~18 GHz)

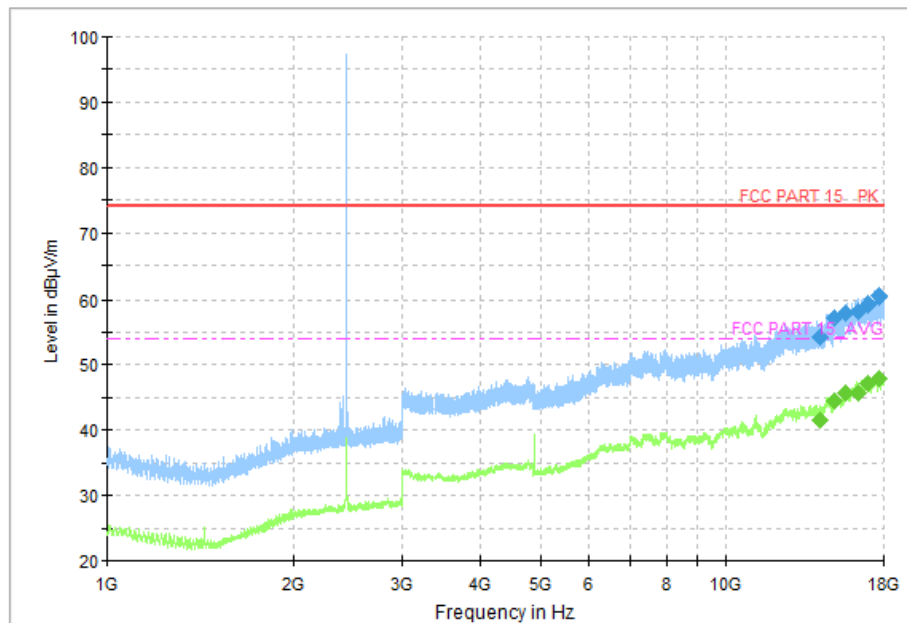


Fig. 23 Radiated Spurious Emission (GFSK, Ch39, 1 GHz ~18 GHz)

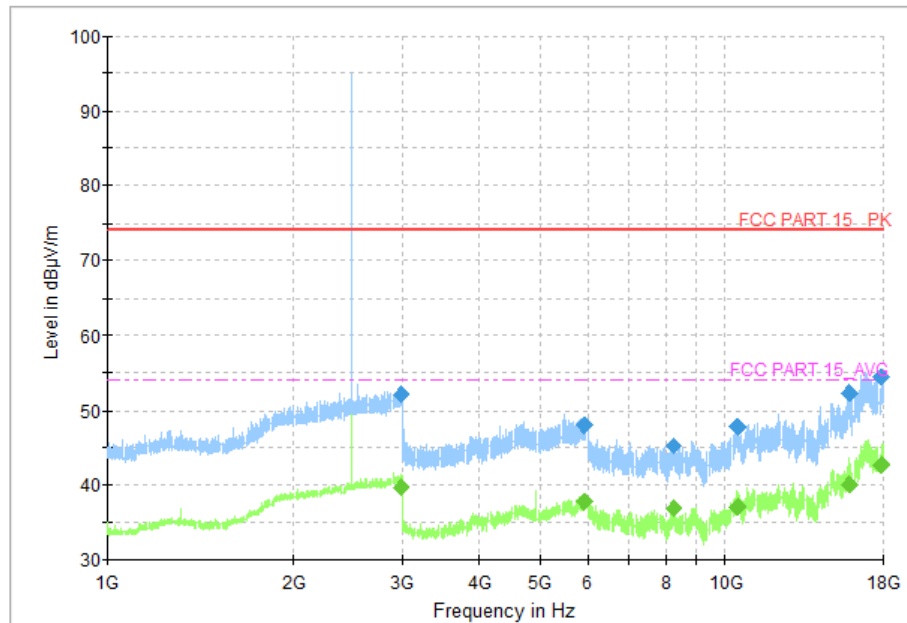


Fig. 24 Radiated Spurious Emission (GFSK, Ch78, 1 GHz ~18 GHz)

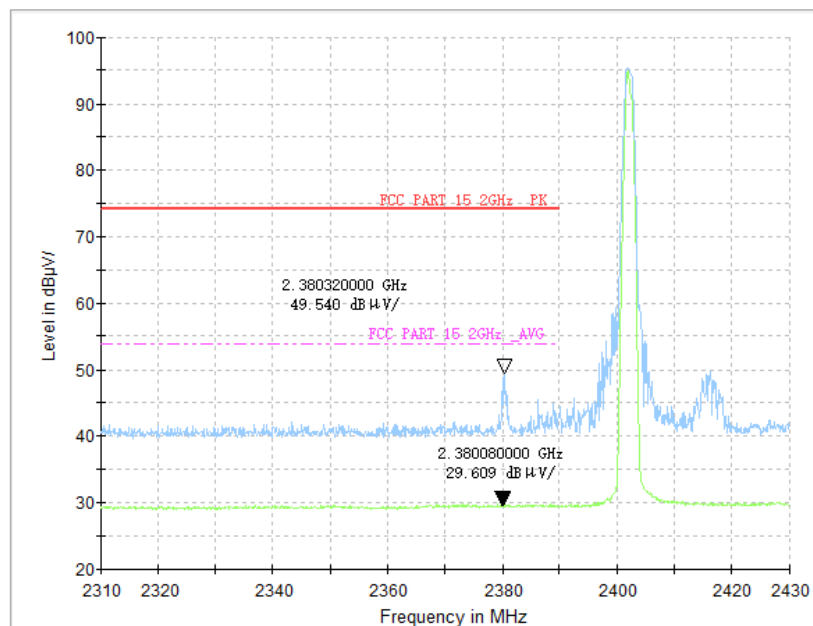


Fig. 25 Radiated Band Edges (GFSK, Ch0, 2380GHz~2450GHz)

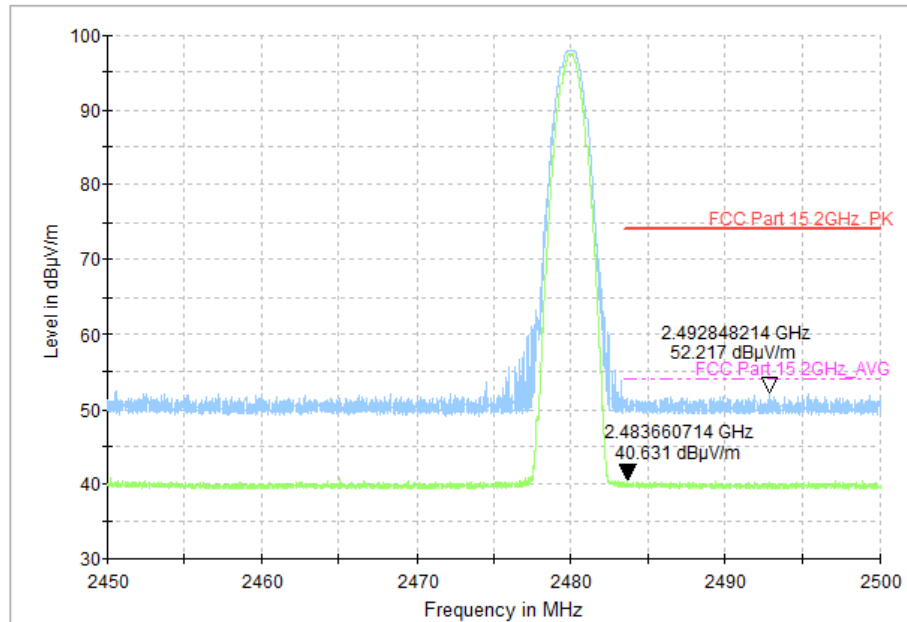


Fig. 26 Radiated Band Edges (GFSK, Ch78, 2450GHz~2500GHz)

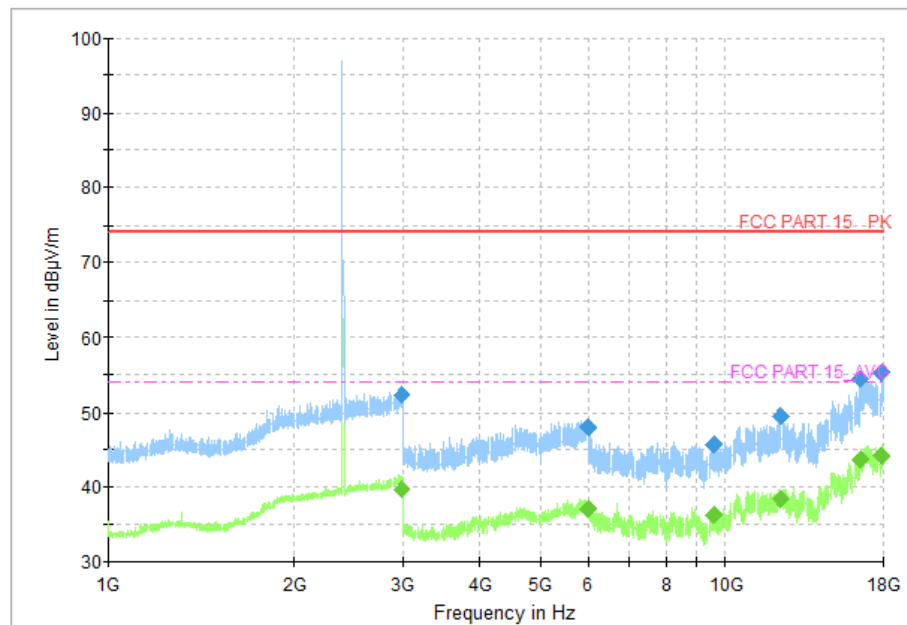


Fig. 27 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch0, 1 GHz ~18 GHz)

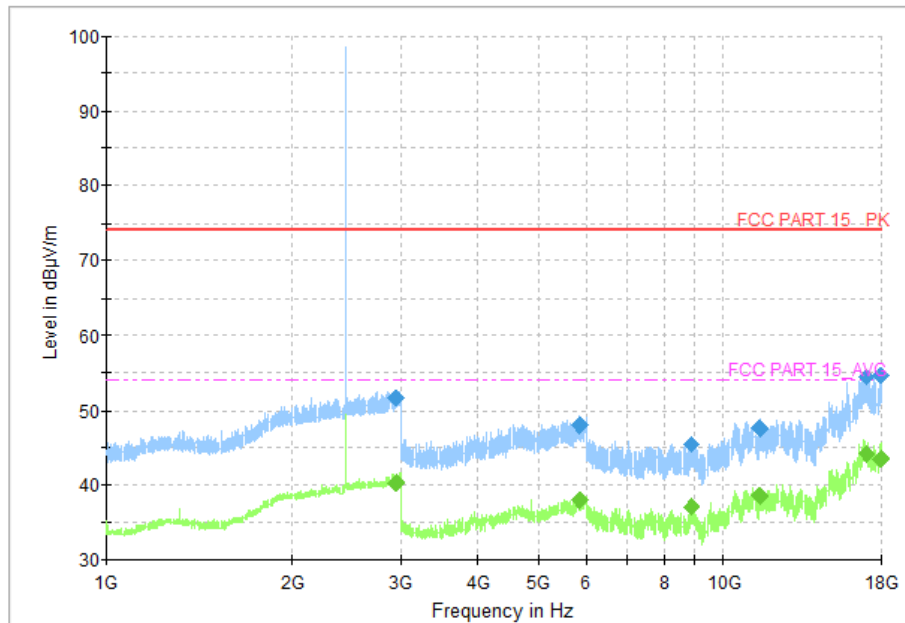


Fig. 28 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch39, 1 GHz ~18 GHz)

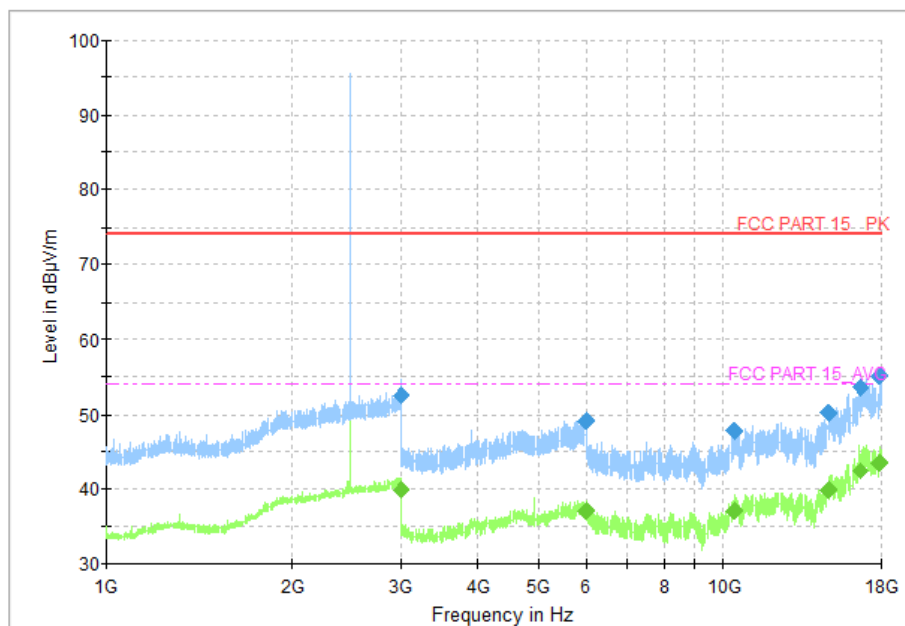


Fig. 29 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch78, 1 GHz ~18 GHz)

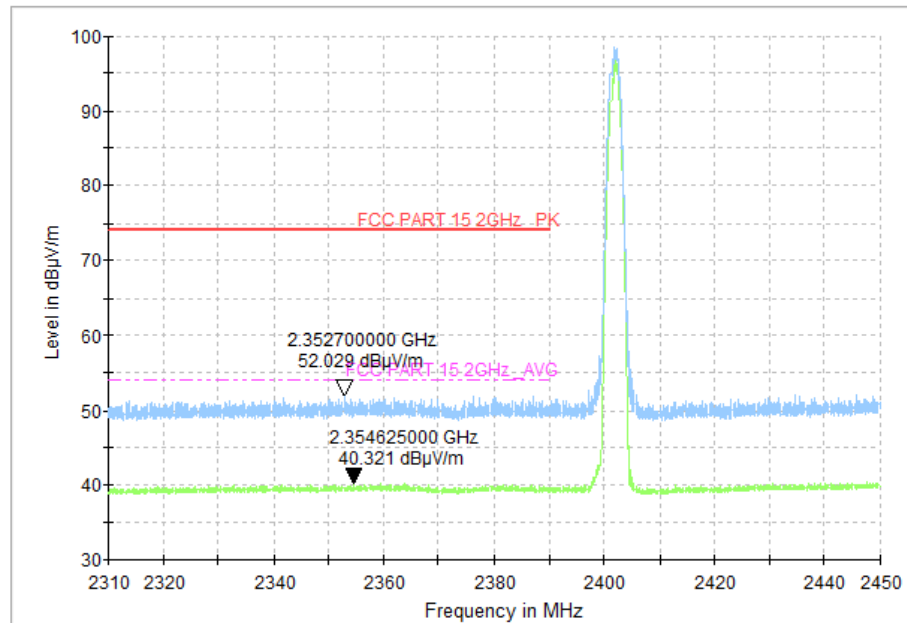


Fig. 30 Radiated Band Edges ($\pi/4$ DQPSK, Ch0, 2380GHz~2450GHz)

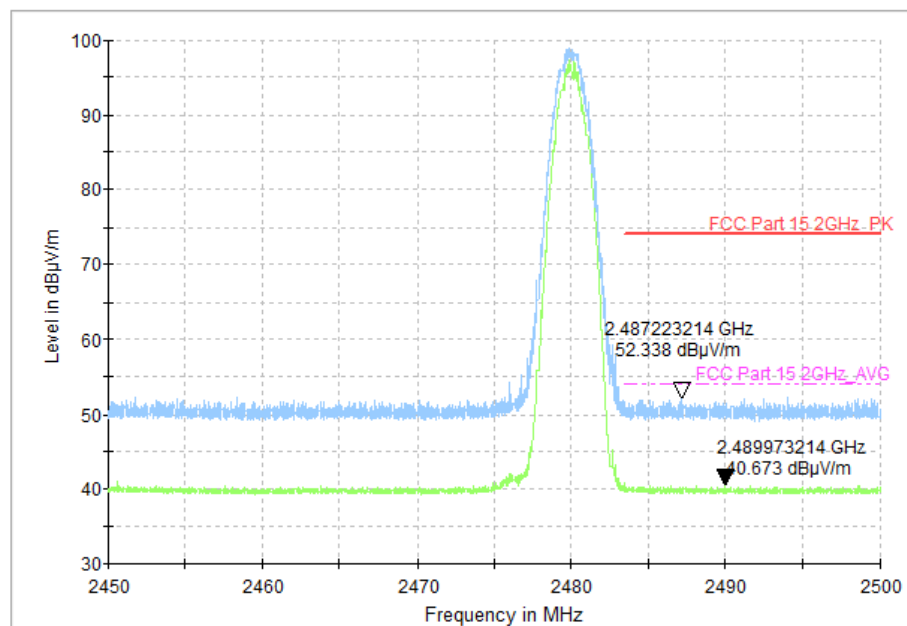


Fig. 31 Radiated Band Edges ($\pi/4$ DQPSK, Ch78, 2450GHz~2500GHz)

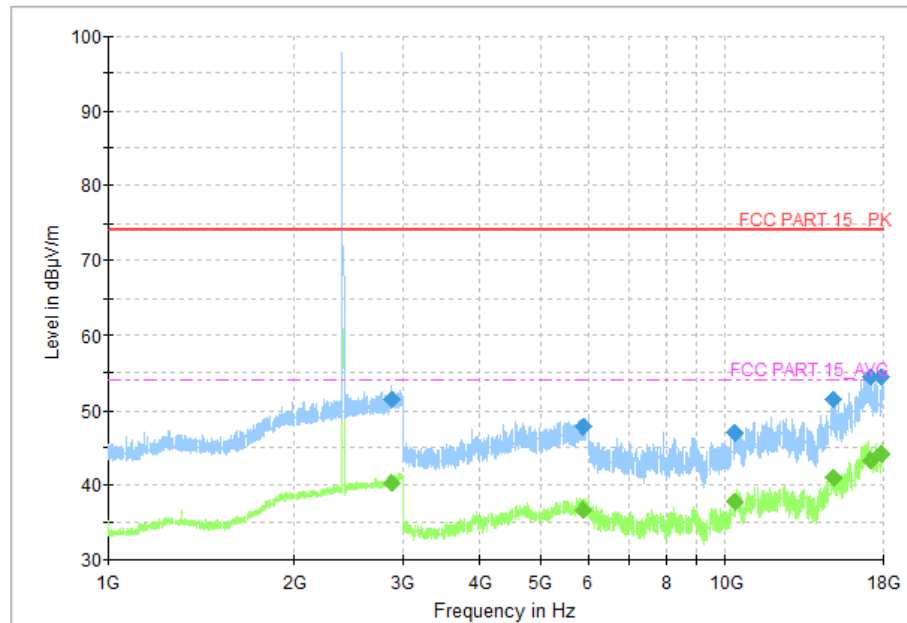


Fig. 32 Radiated Spurious Emission (8DPSK, Ch0, 1 GHz ~18 GHz)

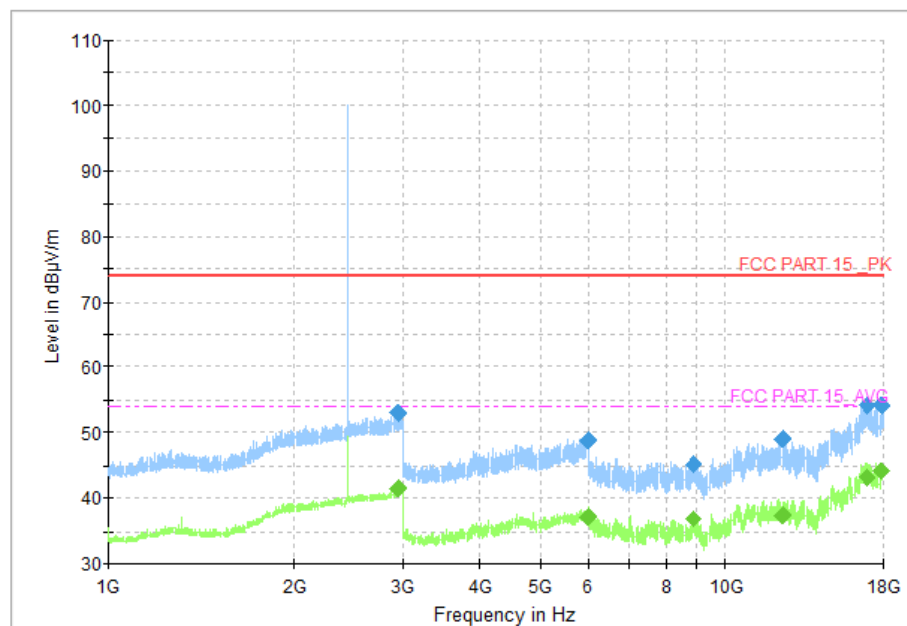


Fig. 33 Radiated Spurious Emission (8DPSK, Ch39, 1 GHz ~18 GHz)

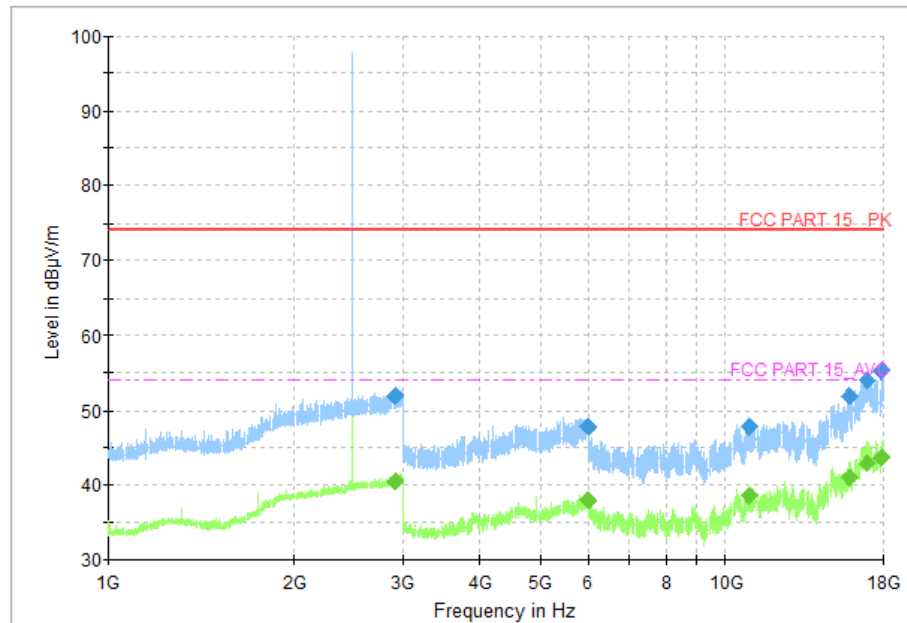


Fig. 34 Radiated Spurious Emission (8DPSK, Ch78, 1 GHz ~18 GHz)

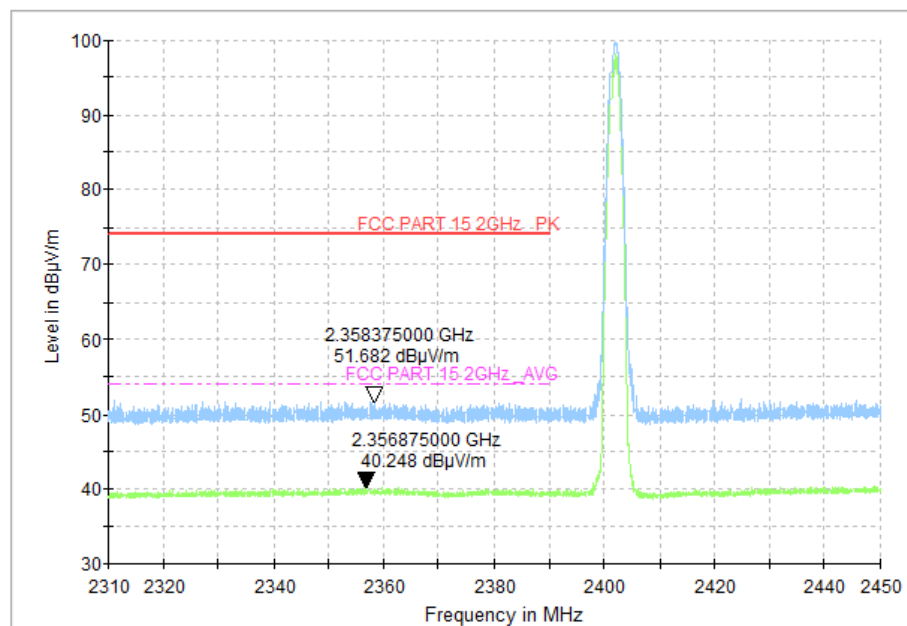


Fig. 35 Radiated Band Edges (8DPSK, Ch0, 2380GHz~2450GHz)

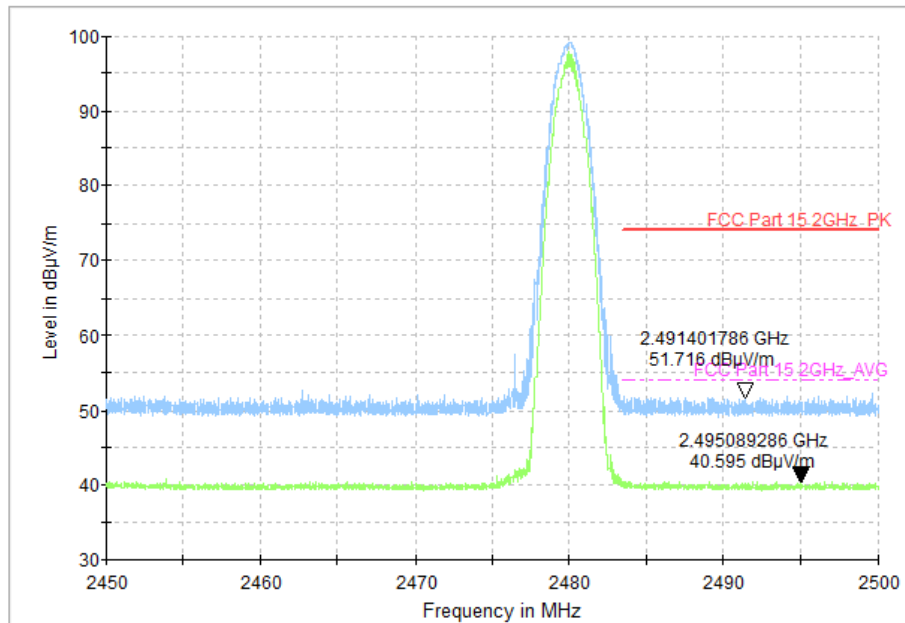


Fig. 36 Radiated Band Edges (8DPSK, Ch78, 2450GHz~2500GHz)

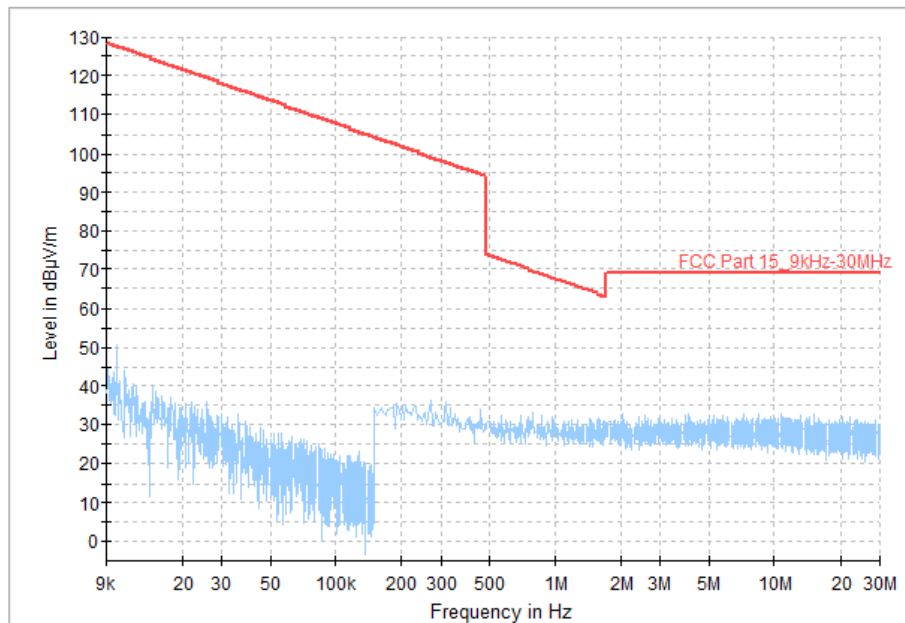


Fig. 37 Radiated Spurious Emission (All Channels, 9 kHz ~30 MHz)

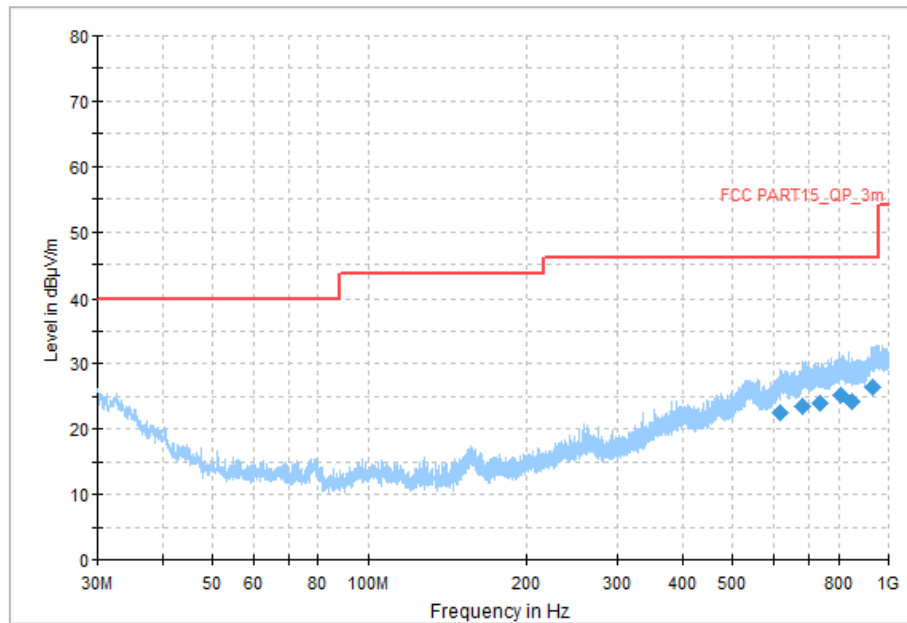


Fig. 38 Radiated Spurious Emission (All Channels, 30 MHz ~1 GHz)

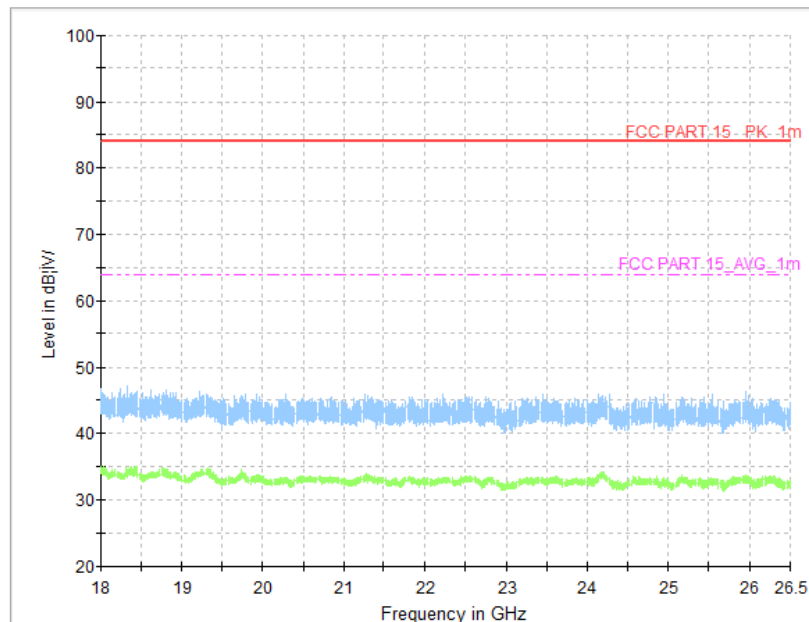


Fig. 39 Radiated Spurious Emission (All Channels, 18 GHz ~26.5 GHz)

A.5 20dB Bandwidth

Measurement Limit:

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

Measurement Result:

Mode	Channel	20dB Bandwidth (MHz)		conclusion
GFSK	0	Fig.40	0.84	/
	39	Fig.41	0.84	
	78	Fig.42	0.84	
$\pi/4$ DQPSK	0	Fig.43	1.29	/
	39	Fig.44	1.29	
	78	Fig.45	1.29	
8DPSK	0	Fig.46	1.30	/
	39	Fig.47	1.30	
	78	Fig.48	1.30	

See below for test graphs.

Conclusion: PASS

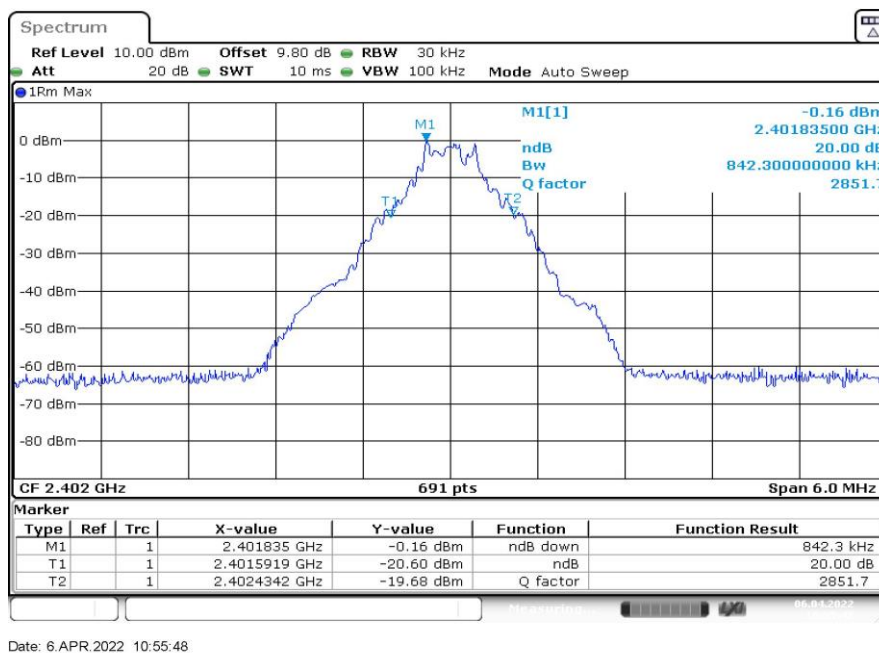
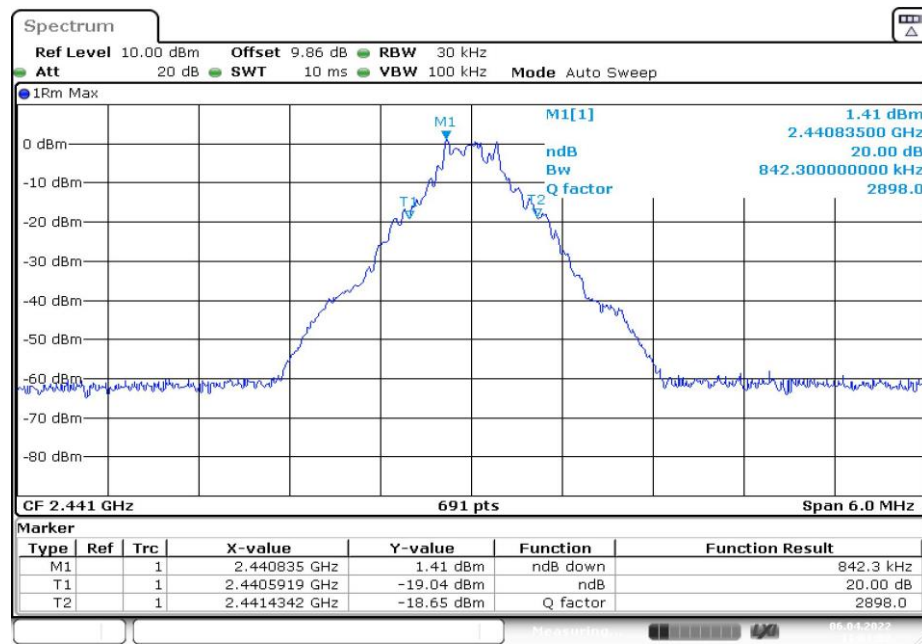
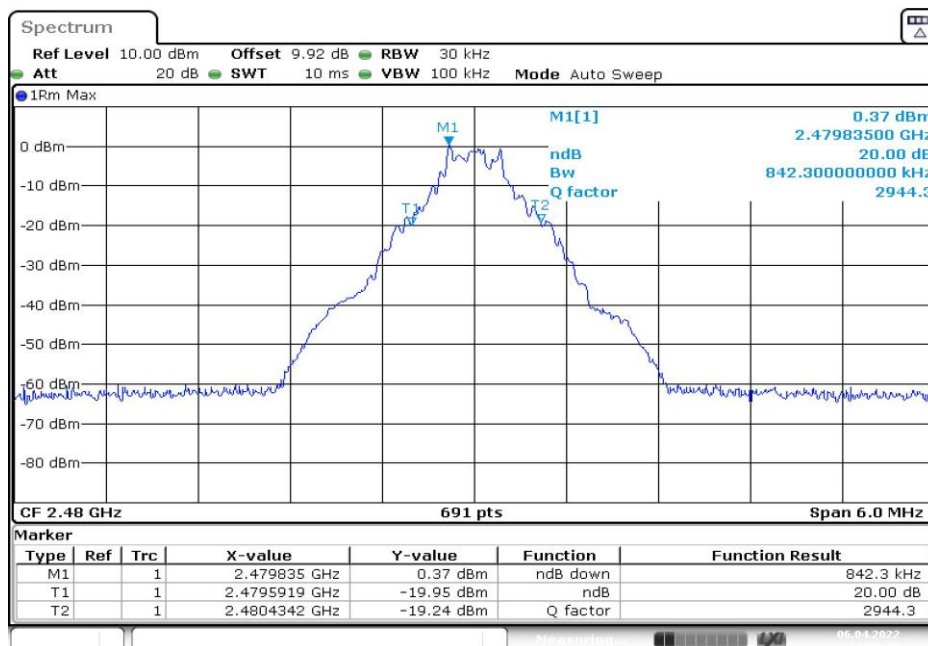


Fig. 40 20dB Bandwidth (GFSK, Ch 0)



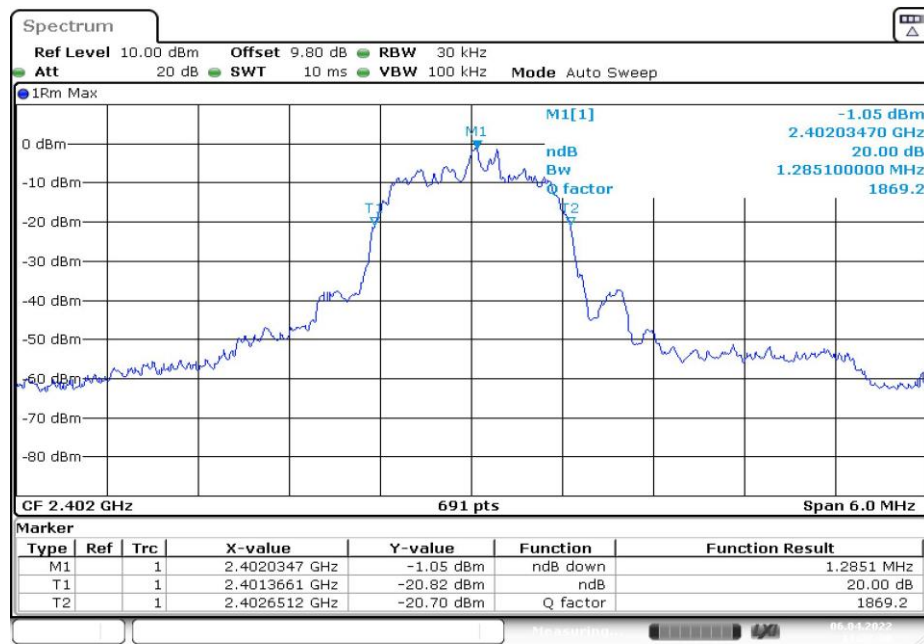
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Fig. 41 20dB Bandwidth (GFSK, Ch 39)



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Fig. 42 20dB Bandwidth (GFSK, Ch 78)



Date: 6.APR.2022 11:22:01

Fig. 43 20dB Bandwidth ($\pi/4$ DQPSK, Ch 0)



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Fig. 44 20dB Bandwidth ($\pi/4$ DQPSK, Ch 39)

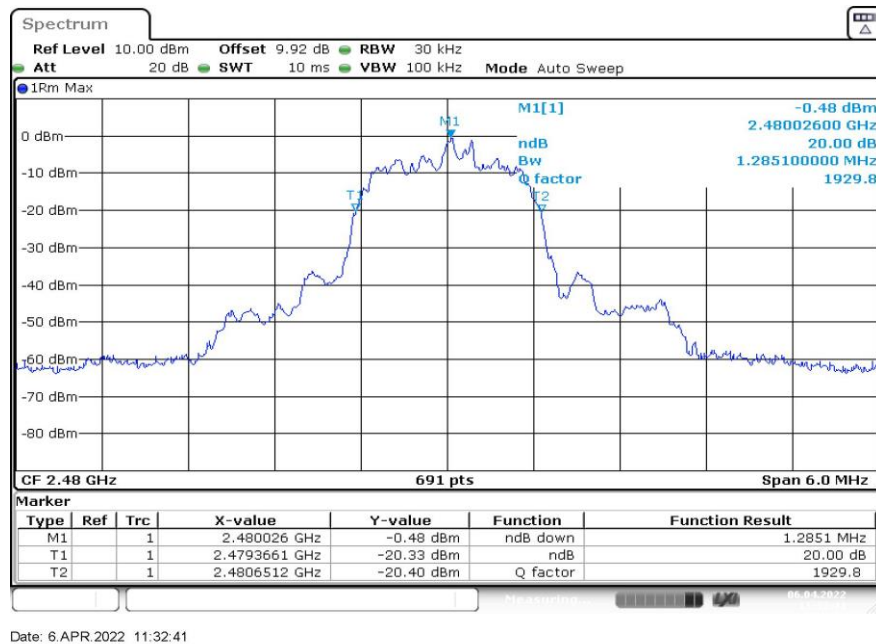


Fig. 45 20dB Bandwidth ($\pi/4$ DQPSK, Ch 78)

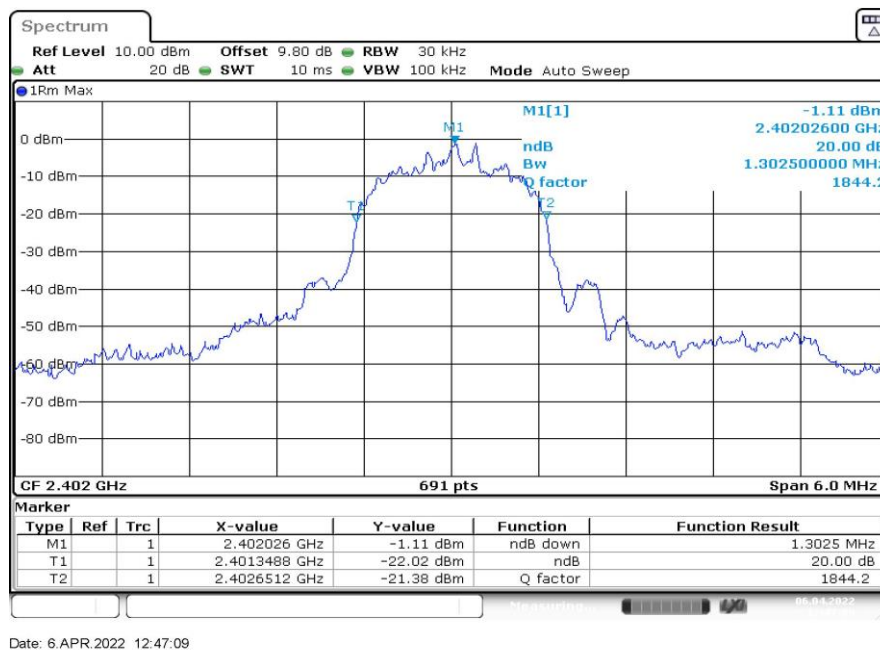


Fig. 46 20dB Bandwidth (8DPSK, Ch 0)

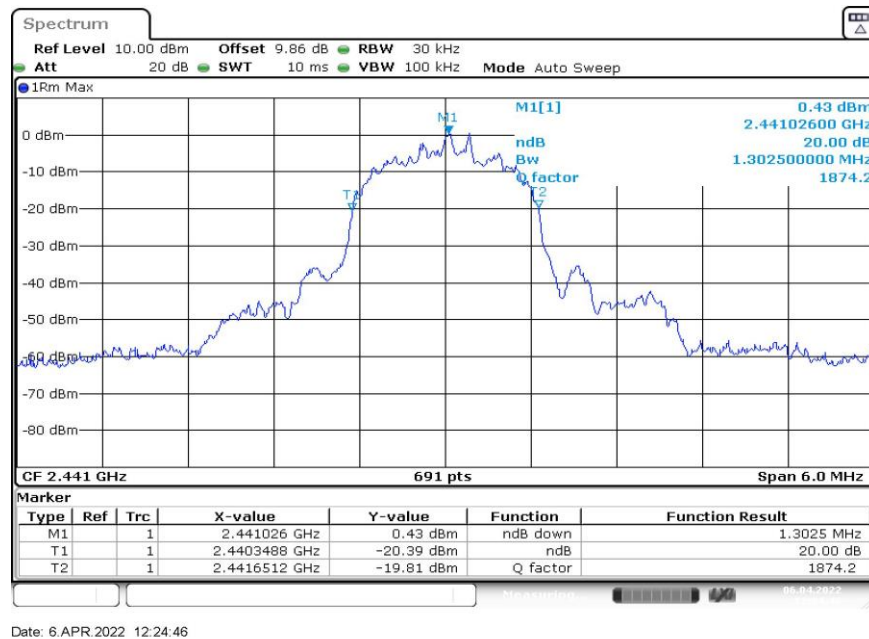


Fig. 47 20dB Bandwidth (8DPSK, Ch 39)

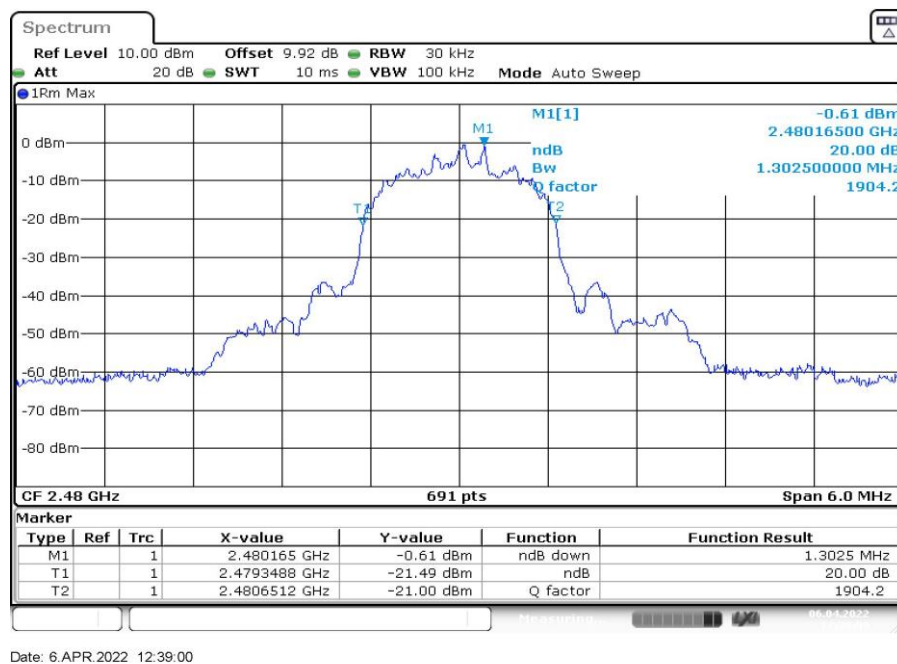


Fig. 48 20dB Bandwidth (8DPSK, Ch 78)

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.49	306.10	P
$\pi/4$ DQPSK	39	2-DH5	Fig.50	305.10	P
8DPSK	39	3-DH5	Fig.51	305.10	P

See below for test graphs.

Conclusion: Pass

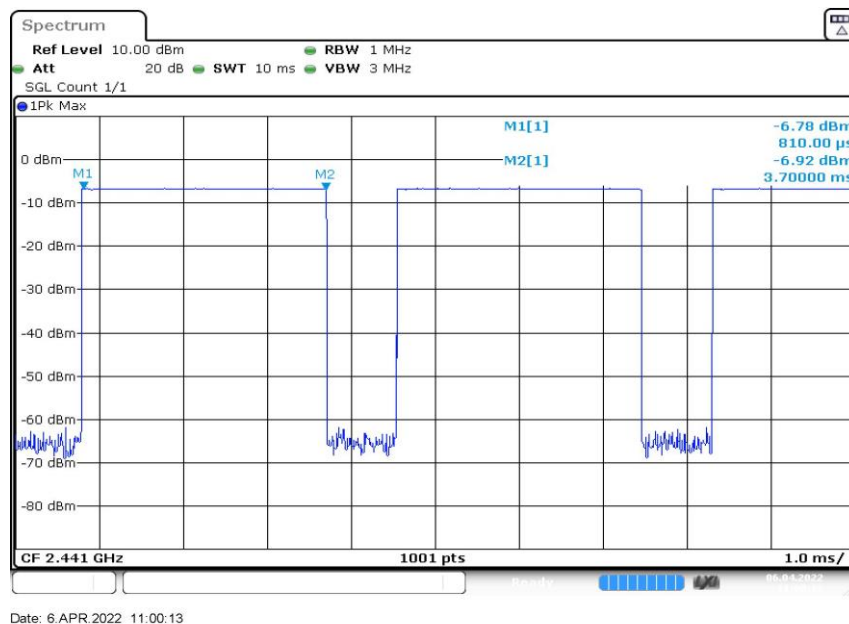


Fig. 49 Time of Occupancy (Dwell Time) (GFSK, Ch39)

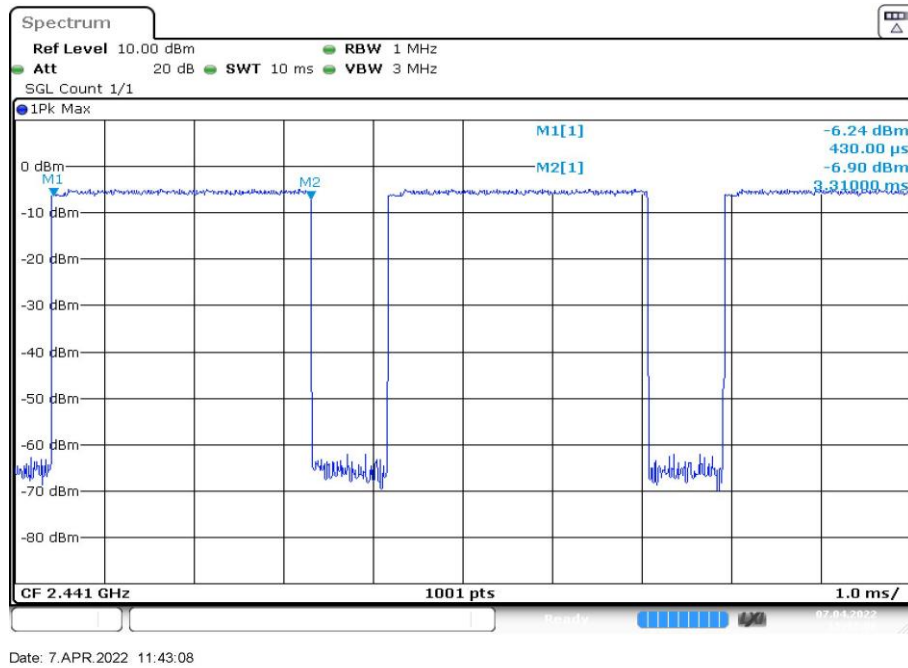


Fig. 50 Time of Occupancy (Dwell Time) ($\pi/4$ DQPSK, Ch39)

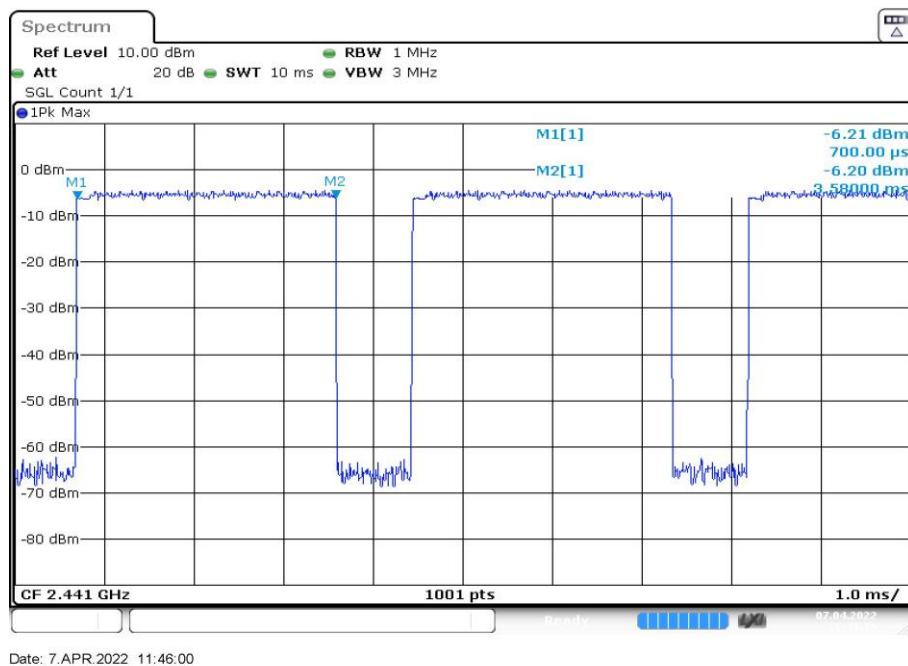


Fig. 51 Time of Occupancy (Dwell Time) (8DPSK, Ch39)

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	Packet	Number of hopping	Test result	Conclusion
GFSK	DH5	Fig.52	79	P
$\pi/4$ DQPSK	2-DH5	Fig.53	79	P
8DPSK	3-DH5	Fig.54	79	P

See below for test graphs.

Conclusion: Pass

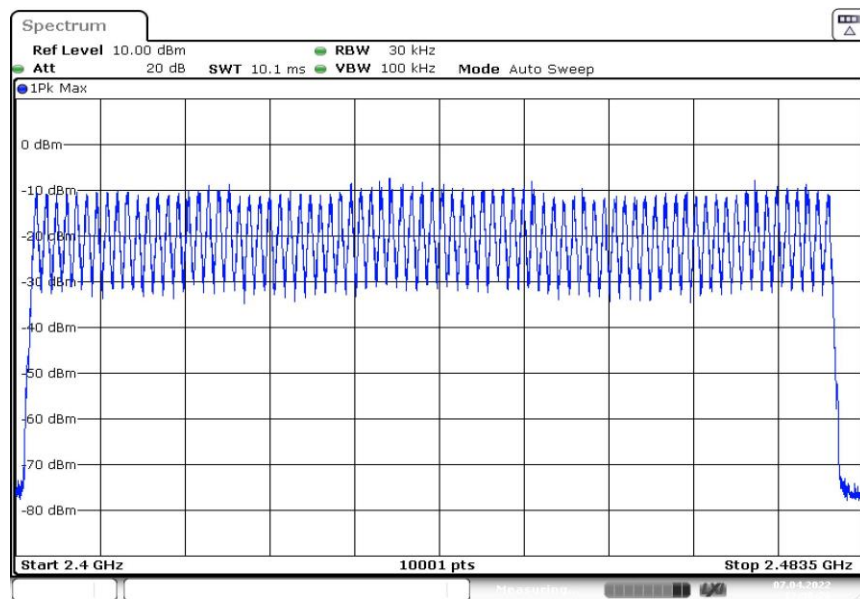


Fig. 52 Hopping channel ch0~39 (GFSK, Ch39)

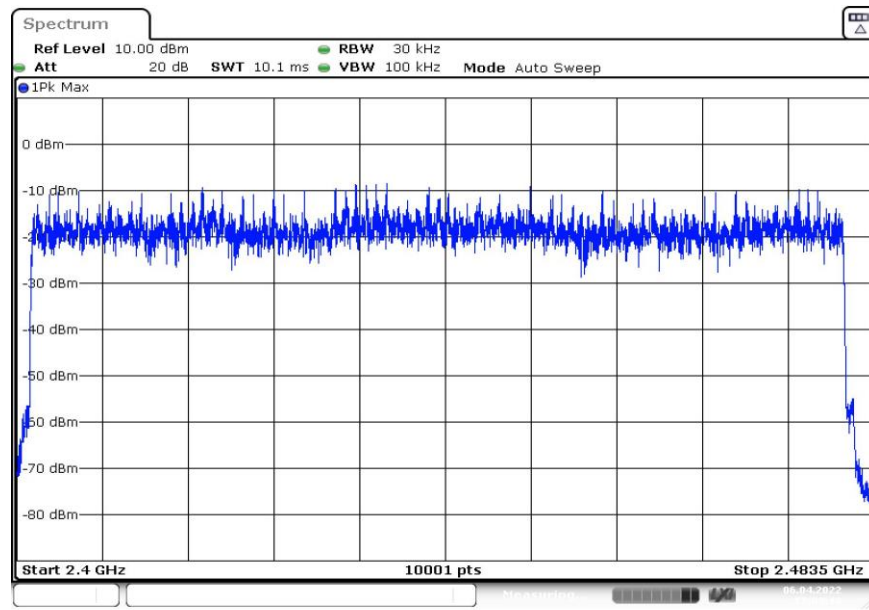


Fig. 53 Hopping channel ch0~78 ($\pi/4$ DQPSK, Ch39)

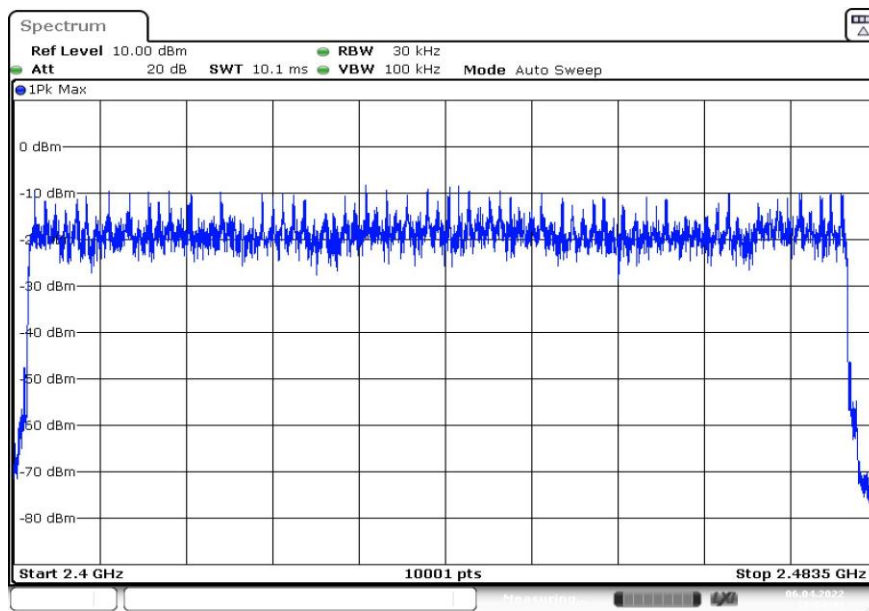


Fig. 54 Hopping channel ch0~78 (8DPSK, Ch39)

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.55	1.00	P
$\pi/4$ DQPSK	39	2-DH5	Fig.56	1.00	P
8DPSK	39	3-DH5	Fig.57	1.00	P

See below for test graphs.

Conclusion: Pass

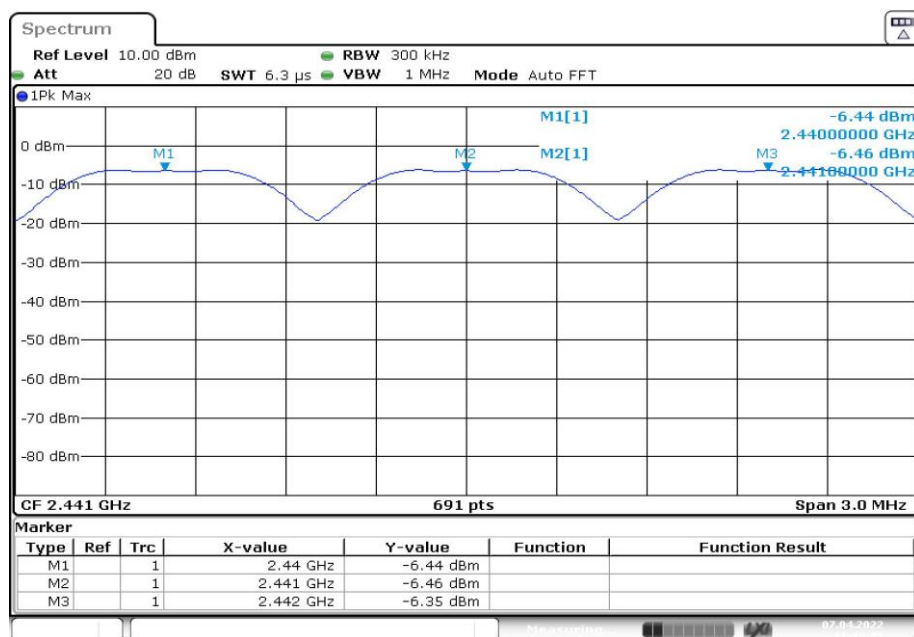
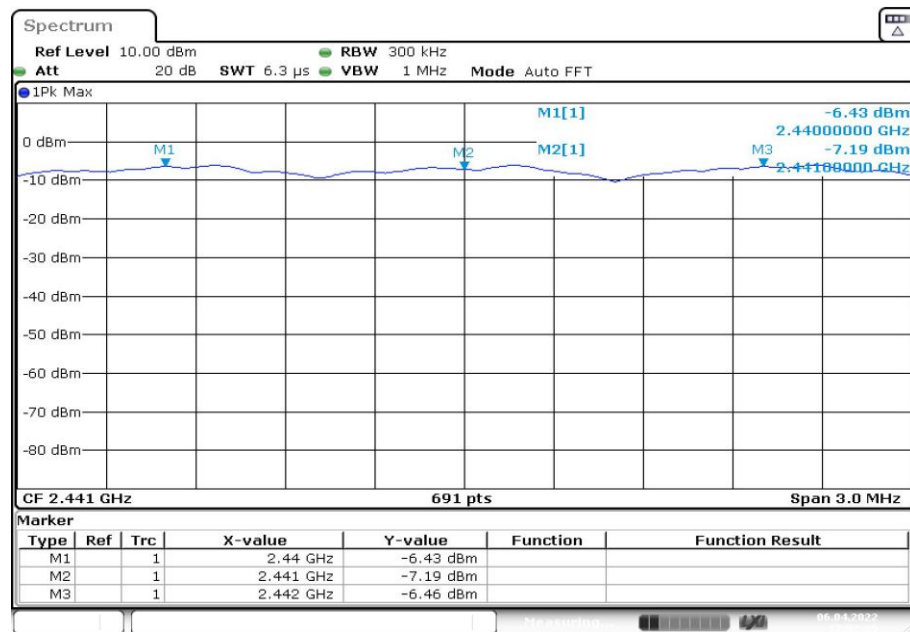
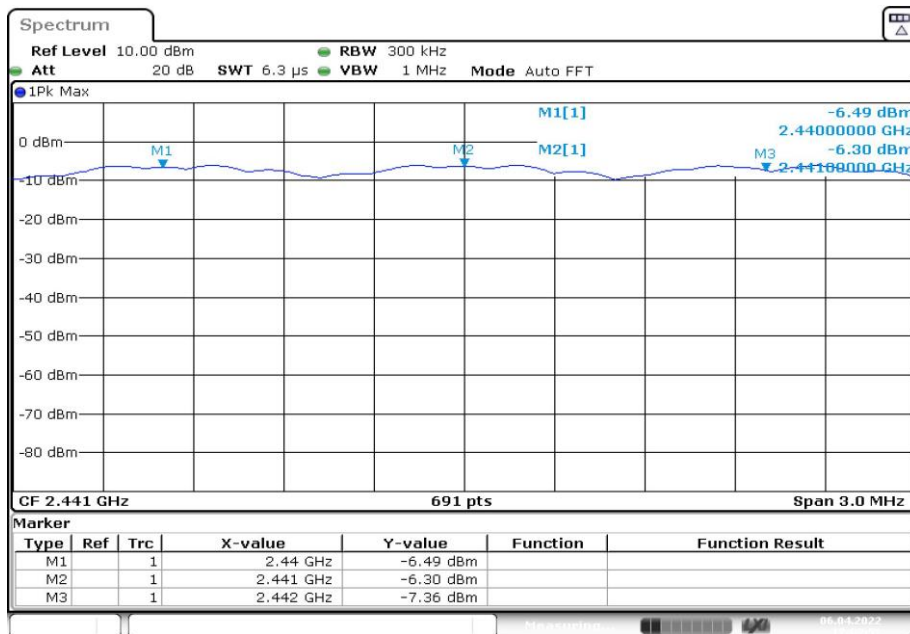


Fig. 55 Carrier Frequency Separation (GFSK, Ch39)



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Fig. 56 Carrier Frequency Separation ($\pi/4$ DQPSK, Ch39)



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Fig. 57 Carrier Frequency Separation (8DPSK, Ch39)

A.9 AC Power line Conducted Emission

Test Condition:

Voltage (V)	Frequency (Hz)
120	60

Measurement Result and limit:

BT-AE1,AE2

Frequency range (MHz)	Quasi-peak Limit (dB μ V)	Average-peak Limit (dB μ V)	Result (dB μ V)		Conclusion
			Traffic	Idle	
0.15 to 0.5	66 to 56	56 to 46	Fig.58	Fig.59	P
0.5 to 5	56	46			
5 to 30	60	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 below for test graphs.

Conclusion: Pass

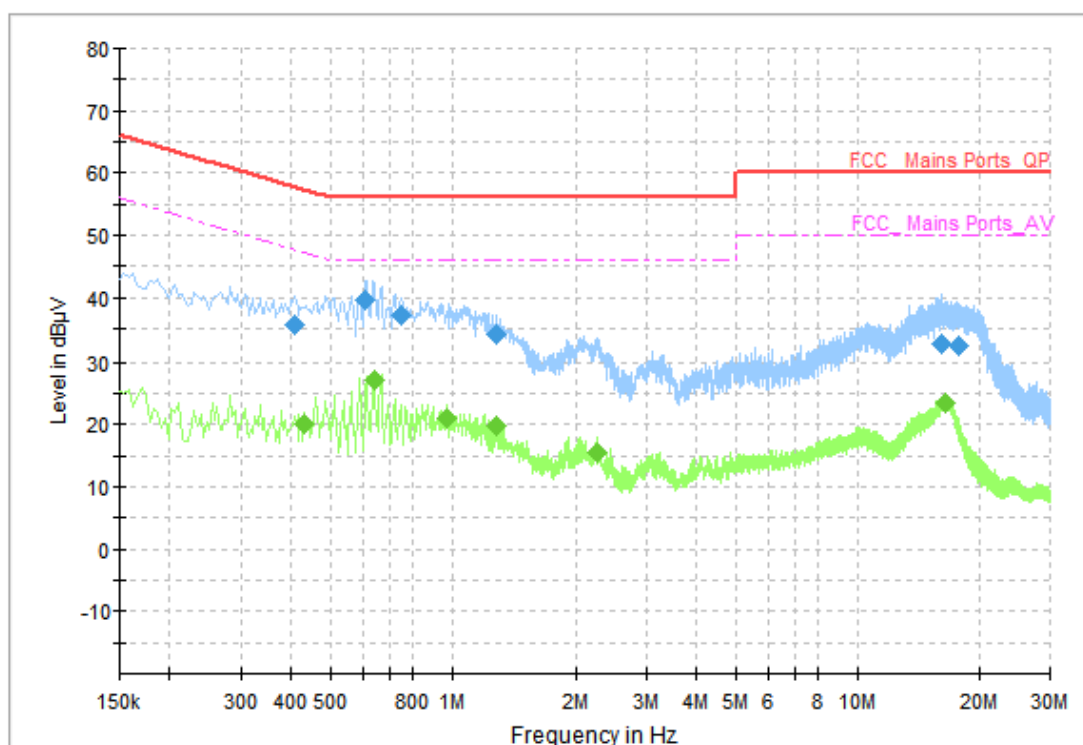


Fig. 58 AC Power line Conducted Emission (Traffic)

Measurement Results: Quasi Peak

Frequency (MHz)	Quasi Peak (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
0.406000	35.69	57.73	22.04	L1	ON	10
0.610000	39.55	56.00	16.45	L1	ON	10
0.746000	37.12	56.00	18.88	N	ON	10
1.286000	34.24	56.00	21.76	N	ON	10
16.130000	32.67	60.00	27.33	N	ON	11
17.810000	32.44	60.00	27.56	N	ON	10

Measurement Results: Average

Frequency (MHz)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
0.430000	19.97	47.25	27.28	L1	ON	10
0.642000	27.20	46.00	18.80	N	ON	10
0.970000	21.03	46.00	24.97	N	ON	10
1.286000	19.73	46.00	26.27	N	ON	10
2.258000	15.60	46.00	30.40	N	ON	10
16.438000	23.34	50.00	26.66	N	ON	11

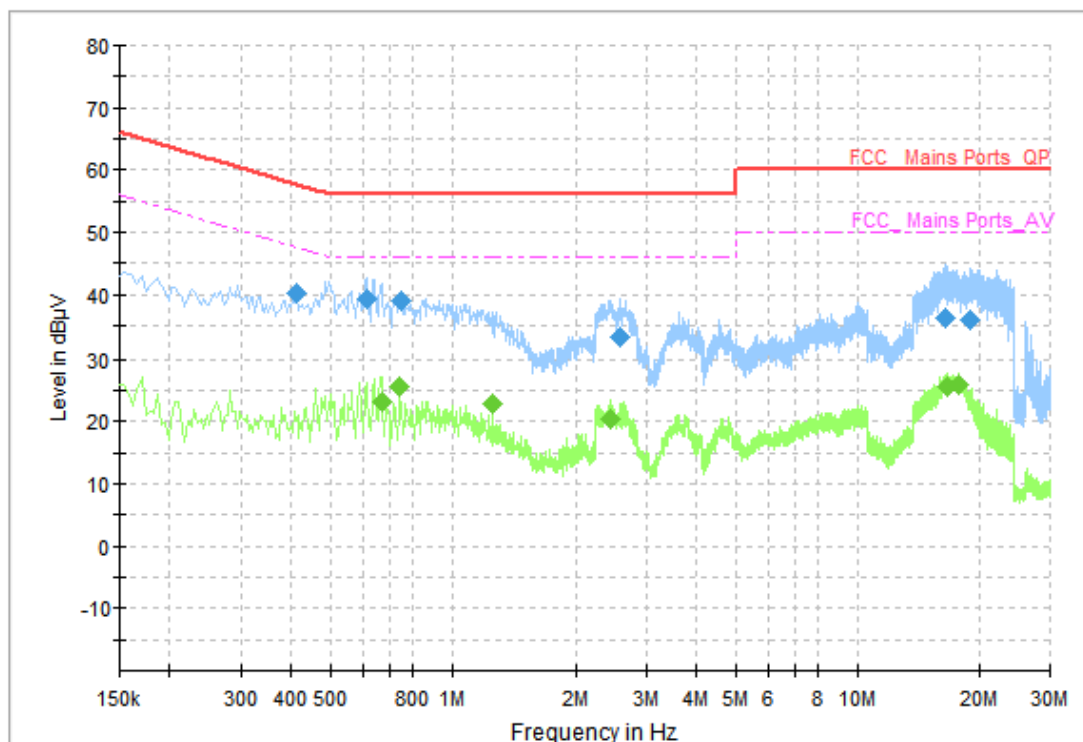


Fig. 59 AC Power line Conducted Emission (Idle)

Measurement Results: Quasi Peak

Frequency (MHz)	Quasi Peak (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
0.410000	40.34	57.65	17.31	L1	ON	10
0.614000	39.47	56.00	16.53	L1	ON	10
0.746000	39.08	56.00	16.92	N	ON	10
2.578000	33.21	56.00	22.79	N	ON	10
16.526000	36.12	60.00	23.88	N	ON	11
18.974000	36.03	60.00	23.97	L1	ON	10

Measurement Results: Average

Frequency (MHz)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Line	Filter	Corr. (dB)
0.670000	23.19	46.00	22.81	L1	ON	10
0.742000	25.42	46.00	20.58	N	ON	10
1.254000	22.70	46.00	23.30	N	ON	10
2.454000	20.48	46.00	25.52	N	ON	10
16.706000	25.54	50.00	24.46	N	ON	11
17.898000	26.00	50.00	24.00	N	ON	10

END OF REPORT