TEST REPORT

No.B23N00972-BT

for

Robert Bosch GmbH

Virtual Cockpit Unit

Model Name: VCUNH1

with

Hardware Version: C3

Software Version: SQBR4-20

FCC ID: 2AUXS-VCUNH1

Issued Date: 2023-09-14

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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REPORT HISTORY

Report Number	Revision	Description	Issue Date
B23N00972-BT	Rev.0	1st edition	2023-09-14

Note: the latest revision of the test report supersedes all previous versions.

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1. Summary of Test Report

1.1. Test Items

Description	Virtual Cockpit Unit
Model Name	VCUNH1
Applicant's name	Robert Bosch GmbH
Manufacturer's Name	Robert Bosch GmbH

1.2. Test Standards

FCC Part15-2021; 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 518000

1.5. Project data

Testing Start Date:	2023-07-05
Testing End Date:	2023-08-09

1.6. Signature

Lin Zechuang
(Prepared this test report)

An Ran
(Reviewed this test report)

Zhang Bojun
(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name:	Robert Bosch GmbH
Address:	Robert-Bosch-Str. 200, 31139 Hildesheim, Germany
Contact Person	Dirk Zamow
E-Mail	Dirk.Zamow@de.bosch.com
Telephone:	+49 5121 49-2608
Fax:	/

2.2. Manufacturer Information

Company Name:	Robert Bosch GmbH
Address:	Robert-Bosch-Str. 200, 31139 Hildesheim, Germany
Contact Person	Dirk Zamow
E-Mail	Dirk.Zamow@de.bosch.com
Telephone:	+49 5121 49-2608
Fax:	/

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

3.1. About EUT

Description	Virtual Cockpit Unit
Model Name	VCUNH1
Frequency Band	ISM 2400MHz~2483.5MHz
Equipment type	Bluetooth® BR/EDR
Type of Modulation	GFSK/π/4 DQPSK/8DPSK
Number of Channels	79
Antenna Type	Integrated antenna
Antenna Gain	5.2dBi(Ant0)
Power Supply	13.5V DC by External Power Supply
FCC ID	2AUXS-VCUNH1
Condition of EUT as received	No abnormality in appearance

Note1: The device is connected with two antennas (RF0 and RF1).
Internal antenna(RF0) has no antenna connector. External antenna(RF1) uses a unique Single High-Speed FAKRA Mini 1 pin - Rosenberger connector. The internal antenna RF0 is shared with Wifi via Time Division Multiplexing. The antennas are used with the following frequencies.

- RF0(Ant0) is for internal antenna which supports BT and Wifi (2.4GHz and 5GHz).
- RF1(Ant1) is for external antenna which supports only Wifi (2.4GHz and 5GHz).

Note2: 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*	SN or IMEI	HW Version	SW Version	Date of Receipt
UT02aa	9000002	C3	SQBR4-20	2023-06-28
UT03aa	9000004	C3	SQBR4-20	2023-06-28

*EUT ID: is used to identify the test sample in the lab internally.
UT02aa is used for conduction test, UT03aa is used for radiation test.

3.1. Internal Identification of AE used during the test

AE No.	Description	AE ID*
AE1	DC power supply	Aa01a
AE2	Data Cable	Ca01a
AE3	Power Cable	Ba01a
AE4	OptoUSB-2.0 Transceiver	Ha01a

AE1

Model	PCR1000LA
Manufacturer	KIKUSUI

AE2

Model	J6 HSAL-II

Manufacturer	MOLEX

AE3

Model	J2 56 way STAK50H SYSTEM
Manufacturer	/

AE4

Model	OptoUSB-2.0
Manufacturer	Messtechnik

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

3.3. General Description

The Equipment under Test (EUT) is a model of Virtual Cockpit Unit with integrated 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	2021
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℃

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)	**/**
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**

See **ANNEX A** for details.

5.3. Statements

SAICT has evaluated the test cases requested by the applicant/manufacturer 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 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	RF Control Unit	JS0806-2	21C8060398	Tonscend	2023-05-08	1 year
5	Wireless Connective Tester	CMW270	100540	Rohde & Schwarz	2023-03-13	1 year
6	Shielding Room	S81	CT000986-1344	ETS-Lindgren	2021-09-13	5 years

Radiated test system

9K-30MHz, 30MHz-1GHz, 18GHz-26.5GHz:

No.	Equipment	Model	Serial Number	Manufacturer	Calibration date	Calibration Period
1	Test Receiver	ESR7	101676	Rohde & Schwarz	2022-11-24	1 year
2	Spectrum Analyzer	FSV40	101192	Rohde & Schwarz	2023-01-12	1 year
3	BiLog Antenna	3142E	0224831	ETS-Lindgren	2021-05-28	3years
4	Horn Antenna	3117	00066577	ETS-Lindgren	2022-04-18	3 years
5	Horn Antenna	QSH-SL-18-26 -S-20	17013	Q-par	2023-02-02	3 years
6	Horn Antenna	QSH-SL-18-40 -K-SG	15979	Q-par	2021-01-30	3 years
7	Anechoic Chamber	FACT3-2.0	1285	ETS-Lindgren	2023-05-29	2 years
8	Loop Antenna	HLA6120	35779	TESEQ	2022-05-13	3 years

1GHz-18GHz:

No.	Equipment	Model	Serial Number	Manufacturer	Calibration date	Calibration Period
1	Test Receiver	FSV40-N	101655	Rohde & Schwarz	2023-05-03	1 year
2	BiLog Antenna	VULB 9163	9163-330	Schwarzbeck	2021-03-23	3 year
3	Horn Antenna	3117	00227733	ETS-lindgren	2023-03-16	3 years
4	Anechoic Chamberr	SAC3-1.2	TJ2359-Q1922	ETS-Lindgren	2022-09-05	2 years
5	Filter	HPF_3G18G-SMA	SKET	/	/	/
6	Filter	HPF_6.3G21G-SMA	SKET	/	/	/

Test software

No.	Equipment	Manufacturer	Version
1	JS1120-3	Tonscend	3.3
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.

7. Laboratory Environment

Shielded room

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	> 2MΩ
Ground system resistance	< 4 Ω

Anechoic chamber (FACT3-2.0)

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	> 2MΩ
Ground system resistance	< 4 Ω
Normalised site attenuation (NSA)	<±4 dB, 3 m distance, from 30 to 1000 MHz
Voltage Standing Wave Ratio (VSWR)	≤ 6 dB, from 1 to 18 GHz, 3m distance
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz

Anechoic chamber (SAC3-1.2)

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	> 2MΩ
Ground system resistance	< 4 Ω
Voltage Standing Wave Ratio (VSWR)	≤ 6 dB, from 1 to 18 GHz, 3m distance
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz

8. Measurement Uncertainty

Test Name	Uncertainty (*k*=2)	
1. Maximum Peak Output Power	1.32dB	
2. Band Edges Compliance	1.92dB	
3. Transmitter Spurious Emission - Conducted	30MHz≤f<1GHz	1.41dB
	1GHz≤f<7GHz	1.92dB
	7GHz≤f<13GHz	2.31dB
	13GHz≤f≤26GHz	2.61dB
4.. Transmitter Spurious Emission - Radiated	9kHz≤f<30MHz	1.70dB
	30MHz≤f<1GHz	4.80dB
	1GHz≤f<18GHz	4.88dB
	18GHz≤f≤40GHz	2.36dB
5. 20dB Bandwidth	4.56kHz	
6. Time of Occupancy (Dwell Time) & Number of Hopping Channels	0.58ms	
7. Carrier Frequency Separation	4.56kHz	

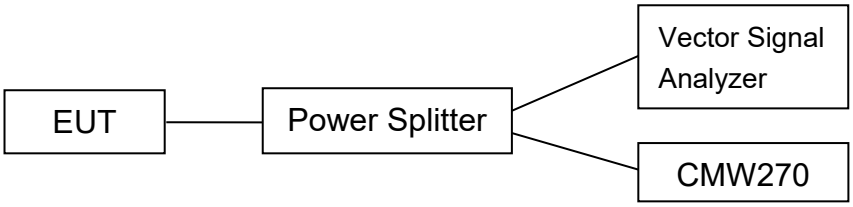
ANNEX A: Detailed Test Results

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.

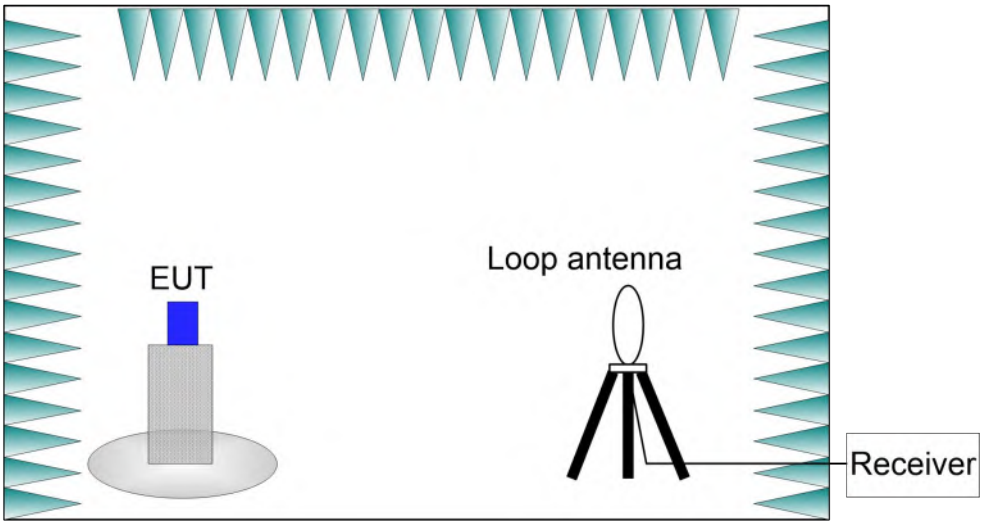


2) Radiated Measurements

Test setup:

9kHz-30MHz:

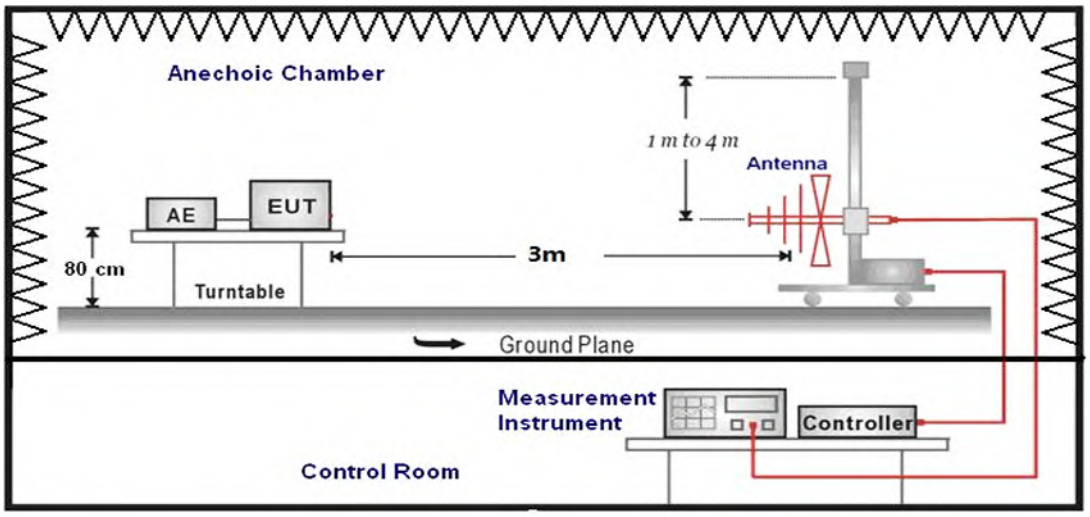
The EUT are measured in a anechoic chamber. The EUT is placed on a non-conductive stand of 80cm high, the External antenna of EUT and EUT are placed 50cm apart center to center on the same plane, and at a measurement distance of 3m from the receiving antenna. The center of the receiving loop antenna is 1.0 meter above the ground. The test setup refers to figure below. During the tests, Detected emissions were maximized at each frequency by rotating the EUT and adjusting the receiver antenna polarization.



30MHz-1GHz:

The EUT are measured in a anechoic chamber. The EUT is placed on a non-conductive stand of 80cm high, the external antenna of EUT and EUT are placed 50cm apart center to center on the same plane, and at a measurement distance of 3m from the receiving antenna. The center of the receiving antenna is 1.0 meter to 4.0 meter above the ground. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT and adjusting the receiver antenna polarization.

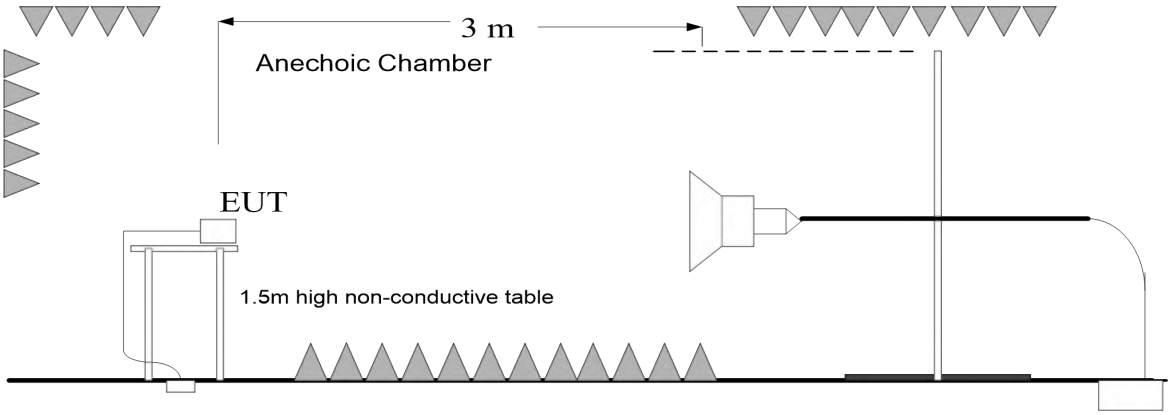
30MHz-1GHz:



1GHz-40GHz：

The EUT are measured in a anechoic chamber. The EUT is placed on a non-conductive stand of 1.5 meter high, the External antenna of EUT and EUT are placed 50cm apart center to center on the same plane, and at a measurement distance of 3m from the receiving antenna. The center of the receiving loop antenna is 1.5 meter above the ground. The test setup refers to figure below. During the tests, Detected emissions were maximized at each frequency by rotating the EUT and adjusting the receiver antenna polarization.

1GHz-40GHz:



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 5.2dBi.
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.

Measurement Limit:

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

Measurement Results:

Mode	Frequency (MHz)	RF output power (dBm)		Conclusion
GFSK	2402(CH0)	Fig.1	2.55	**P**
	2441(CH39)	Fig.2	2.42	**P**
	2480(CH78)	Fig.3	2.06	**P**
π/4 DQPSK	2402(CH0)	Fig.4	4.03	**P**
	2441(CH39)	Fig.5	4.01	**P**
	2480(CH78)	Fig.6	3.72	**P**
8DPSK	2402(CH0)	Fig.7	4.57	**P**
	2441(CH39)	Fig.8	4.43	**P**
	2480(CH78)	Fig.9	4.12	**P**

See below for test graphs.

Conclusion: Pass

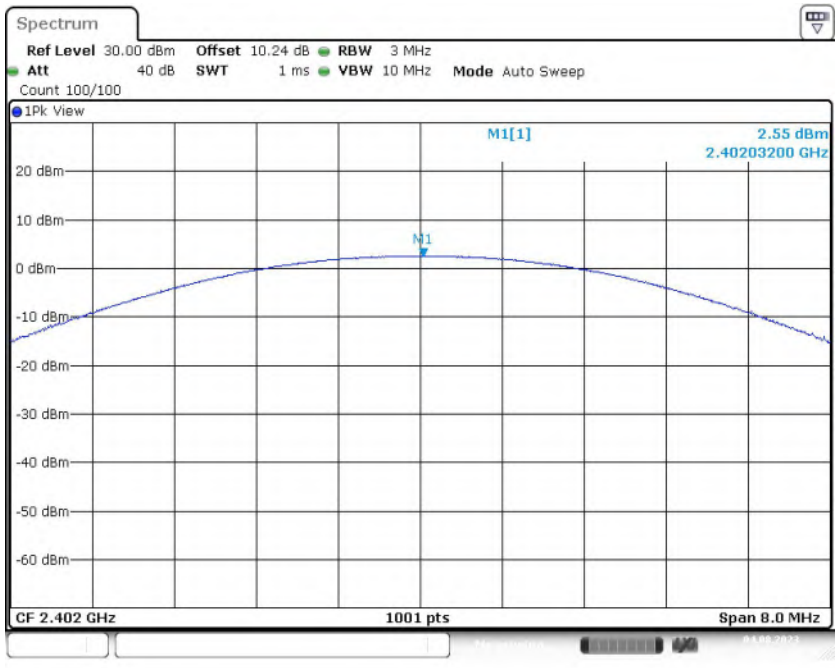


Fig. 1 Maximum Peak Output Power (GFSK, CH0)

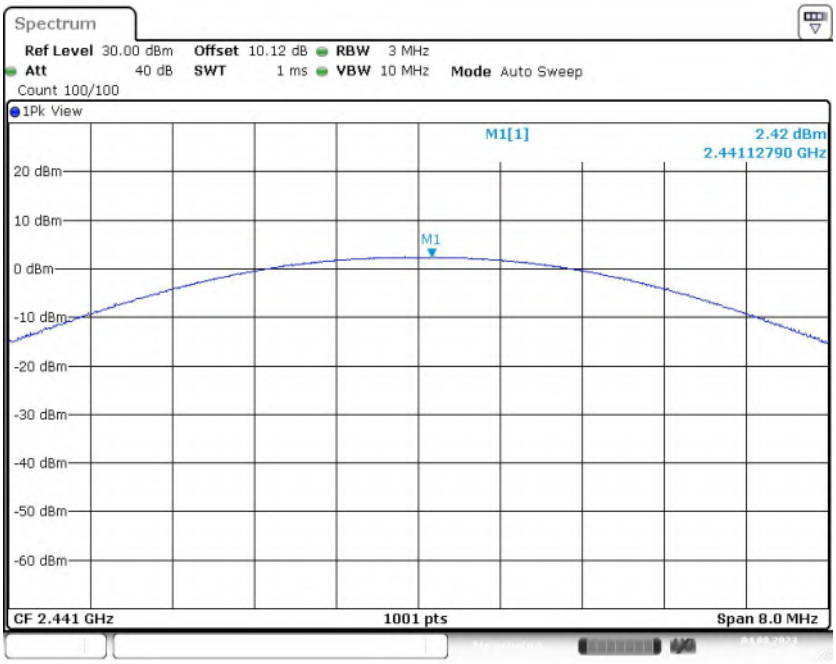


Fig. 2 Maximum Peak Output Power (GFSK, CH39)

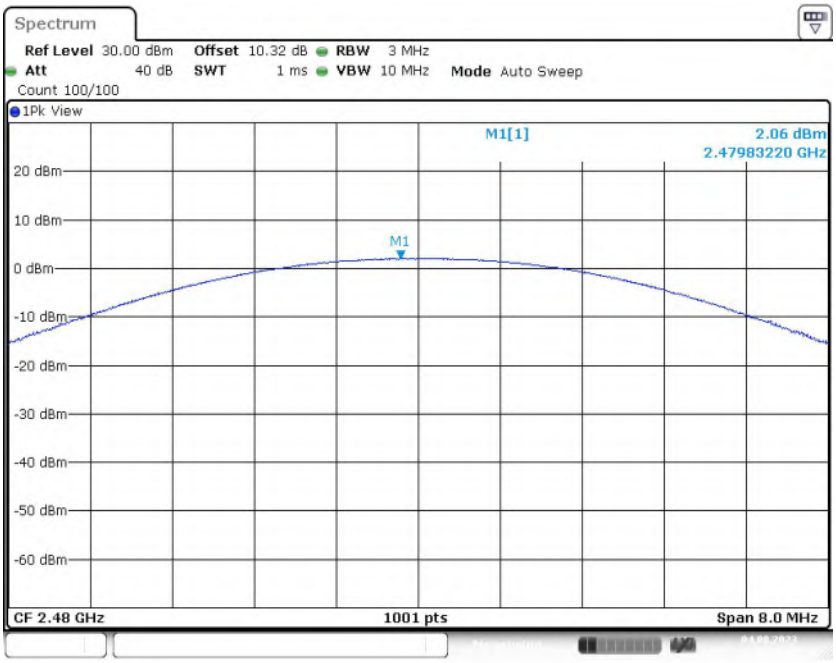


Fig. 3 Maximum Peak Output Power (GFSK, CH78)

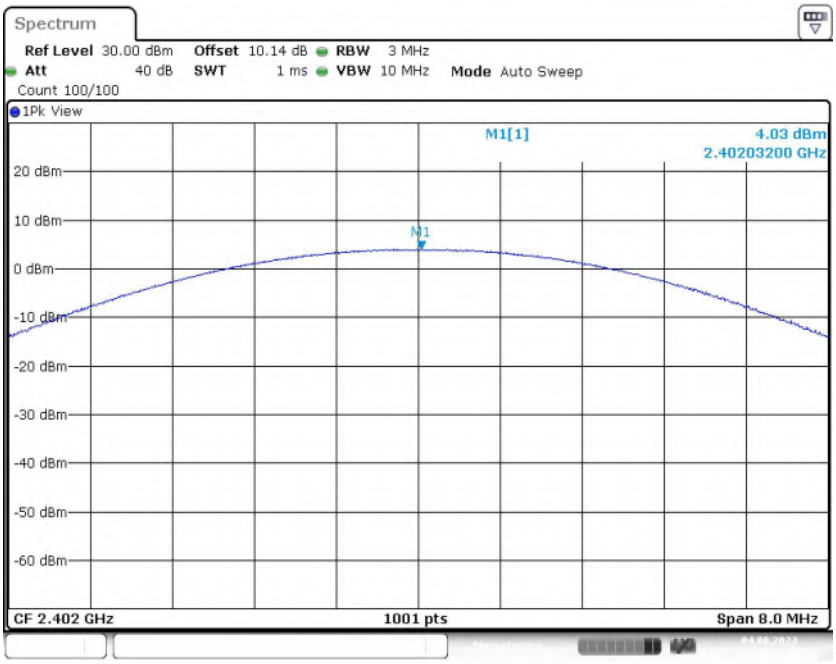


Fig. 4 Maximum Peak Output Power (π/4 DQPSK, CH0)

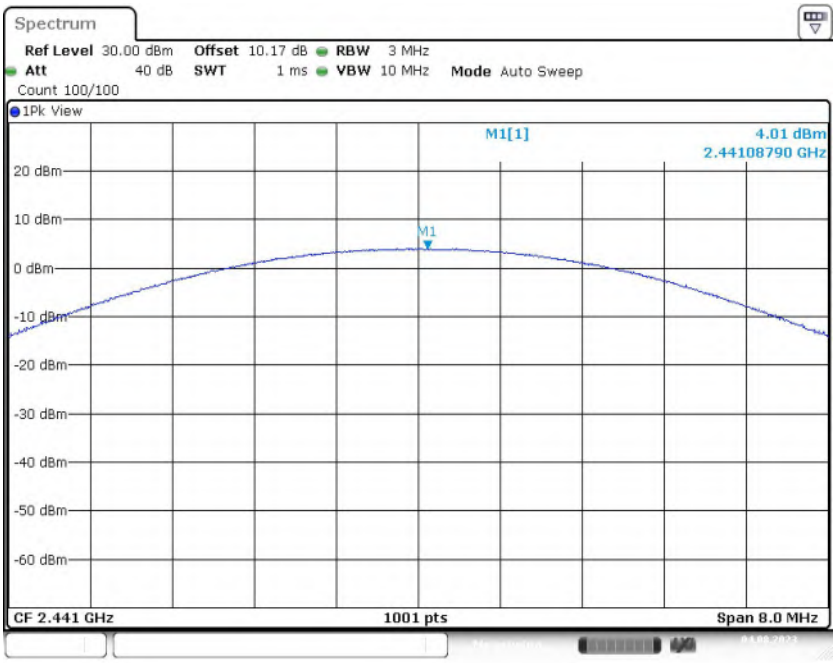


Fig. 5 Maximum Peak Output Power (π/4 DQPSK, CH39)

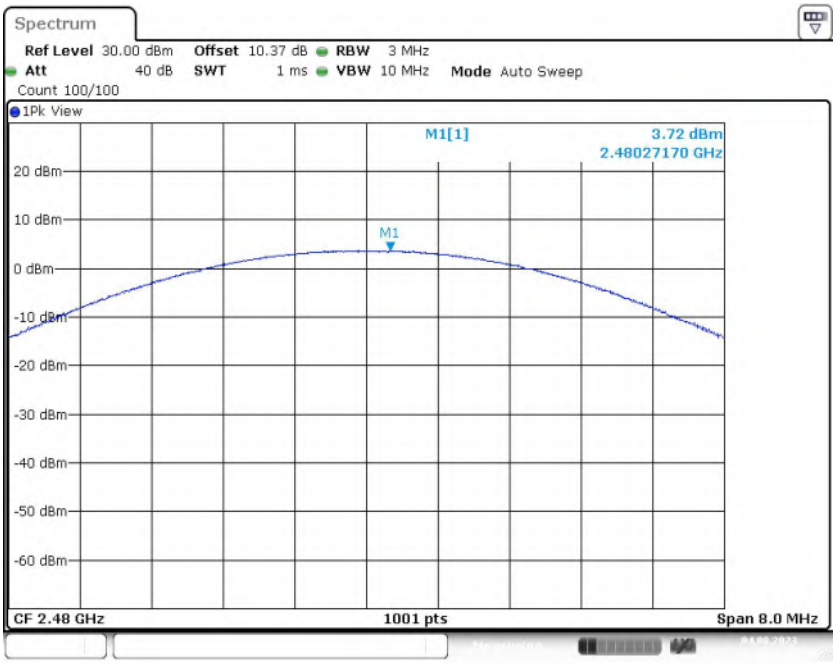


Fig. 6 Maximum Peak Output Power (π/4 DQPSK, CH78)

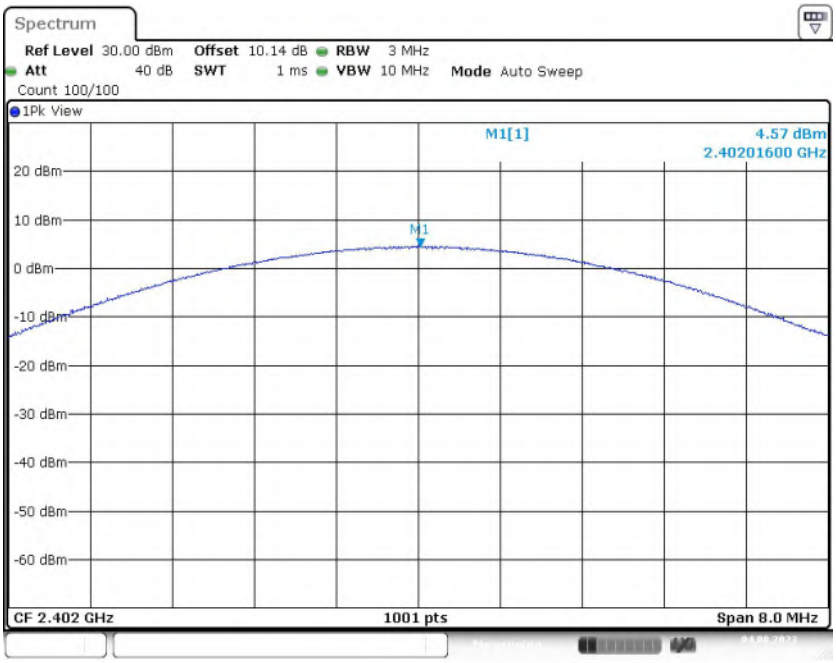


Fig. 7 Maximum Peak Output Power (8DPSK, CH0)

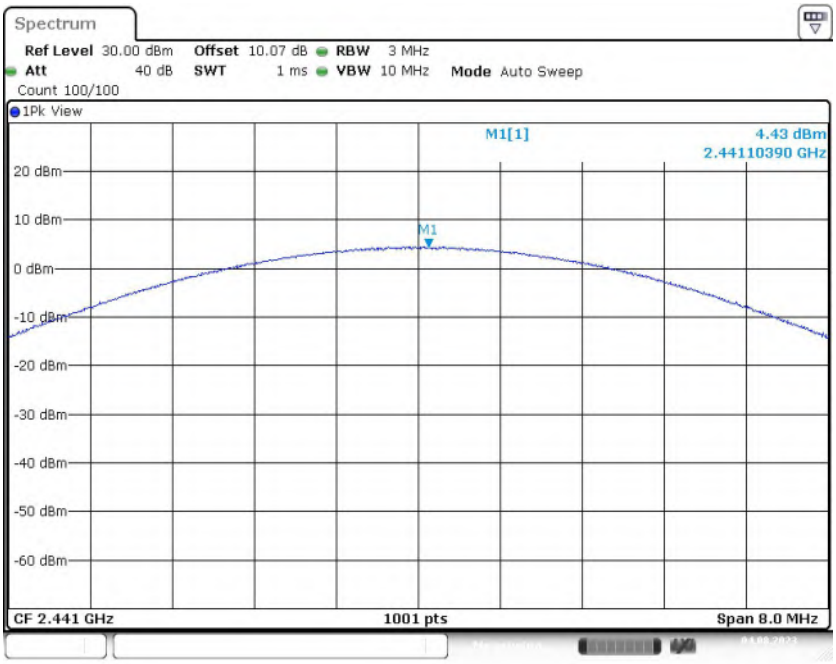


Fig. 8 Maximum Peak Output Power (8DPSK, CH39)

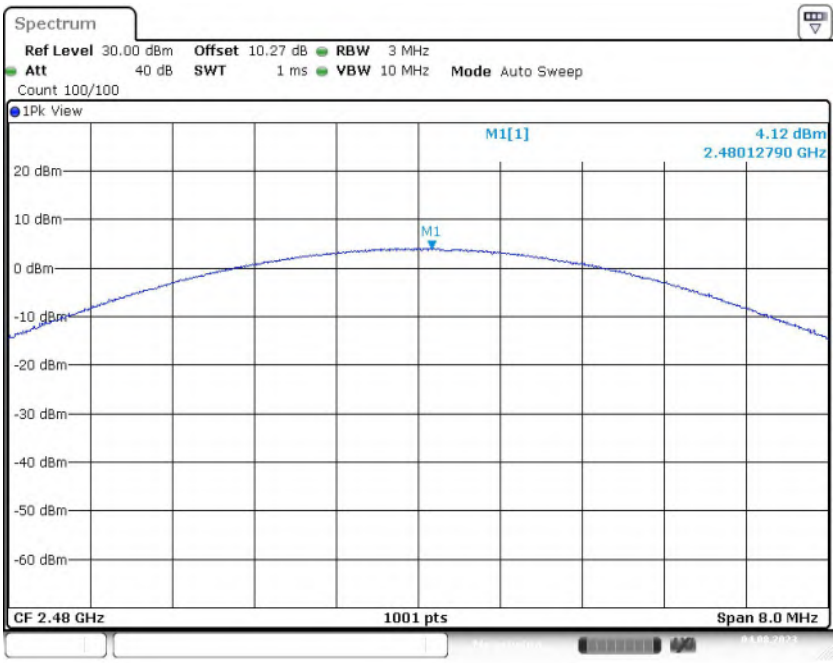


Fig. 9 Maximum Peak Output Power (8DPSK, CH78)

A.2 Band Edges Compliance

Method of Measurement: See ANSI C63.10-clause 7.8.6.

Measurement Limit:

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

Measurement Result:

Mode	Frequency (MHz)	Hopping	Test Results (dBc)		Conclusion
GFSK	2402(CH0)	OFF	Fig.10	46.85	**P**
	2480(CH78)	OFF	Fig.11	45.59	**P**
	2402(CH0)	ON	Fig.12	45.56	**P**
	2480(CH78)	ON	Fig.13	44.57	**P**
π/4 DQPSK	2402(CH0)	OFF	Fig.14	47.16	**P**
	2480(CH78)	OFF	Fig.15	47.42	**P**
	2402(CH0)	ON	Fig.16	45.69	**P**
	2480(CH78)	ON	Fig.17	45.95	**P**
8DPSK	2402(CH0)	OFF	Fig.18	46.54	**P**
	2480(CH78)	OFF	Fig.19	46.79	**P**
	2402(CH0)	ON	Fig.20	46.09	**P**
	2480(CH78)	ON	Fig.21	45.58	**P**

See below for test graphs.

Conclusion: Pass

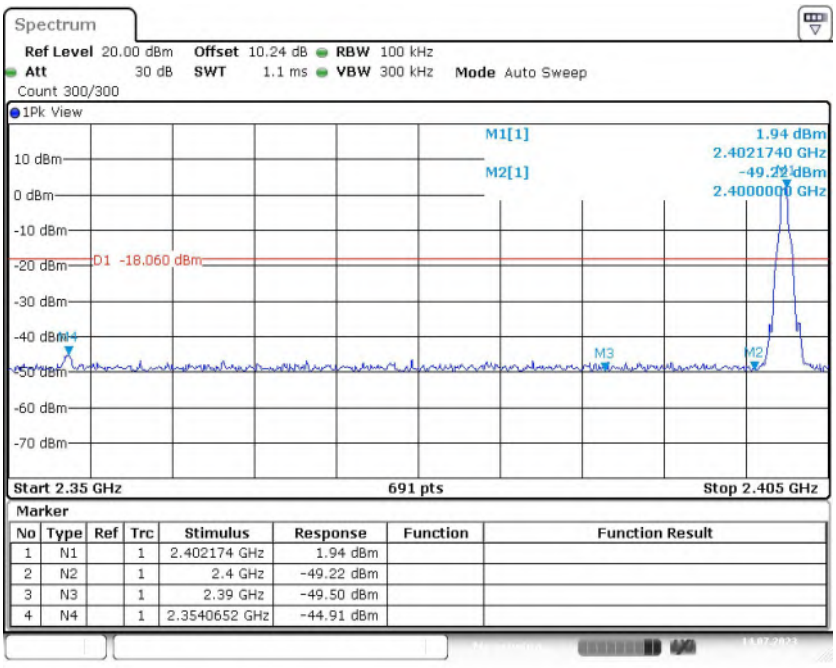


Fig. 10 Band Edges (GFSK, CH0, Hopping OFF)

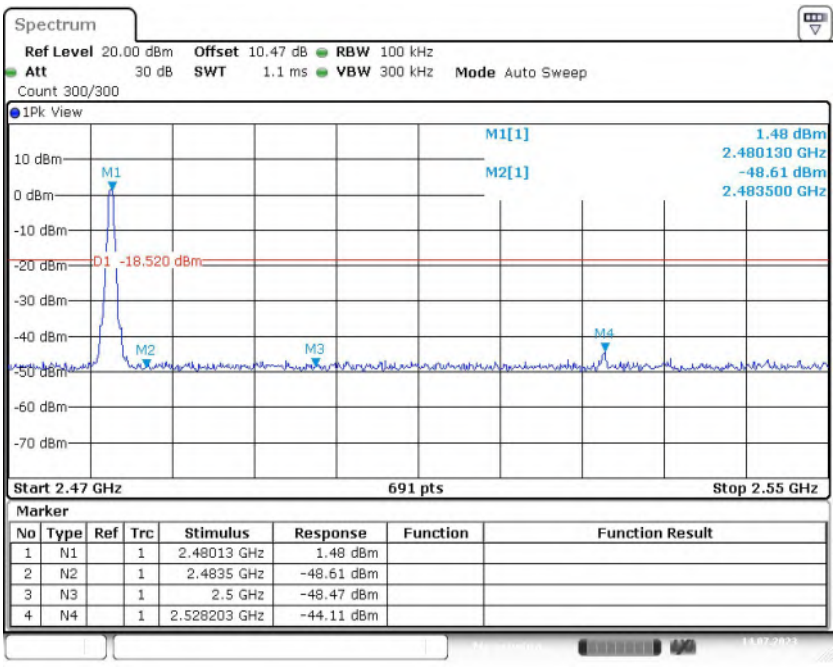


Fig. 11 Band Edges (GFSK, CH78, Hopping OFF)

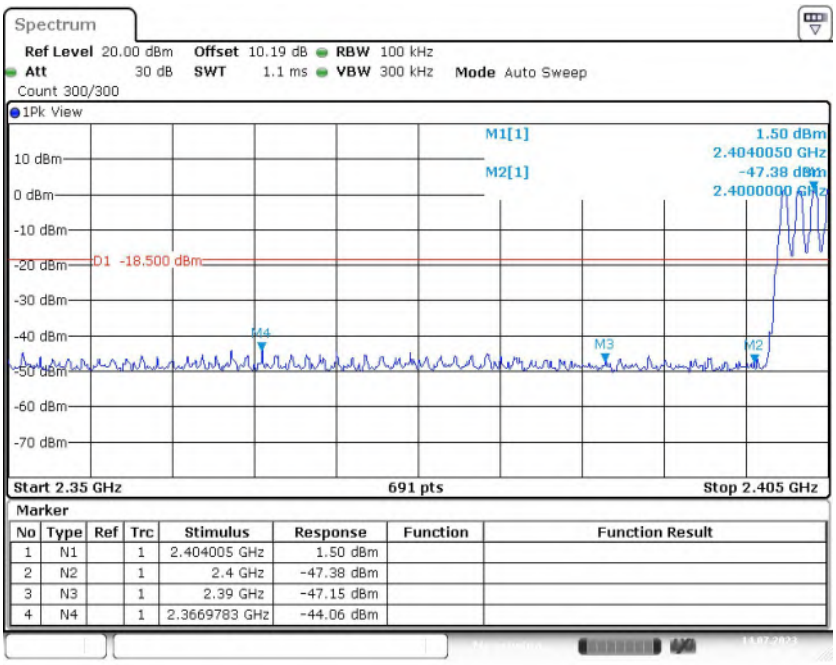


Fig. 12 Band Edges (GFSK, CH0, Hopping ON)

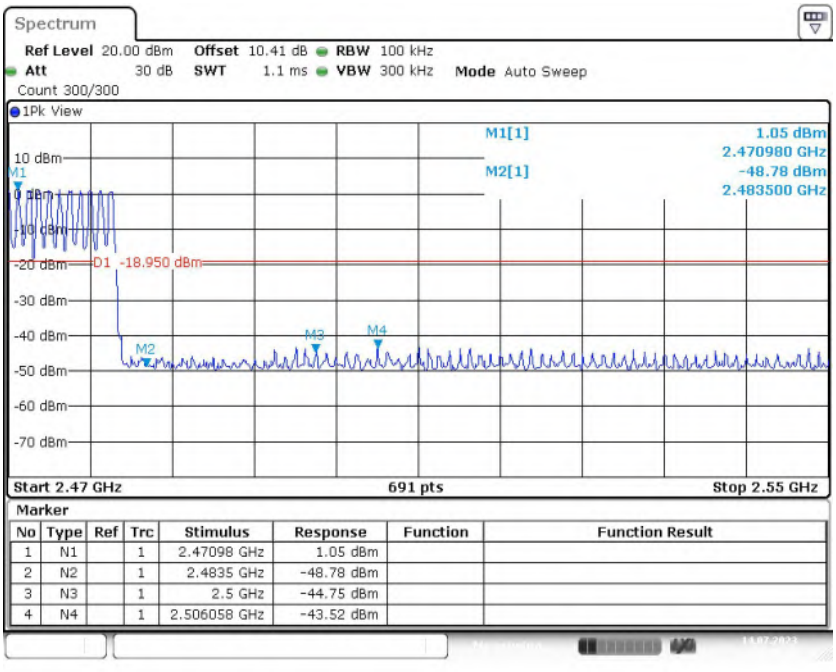


Fig. 13 Band Edges (GFSK, CH78, Hopping ON)

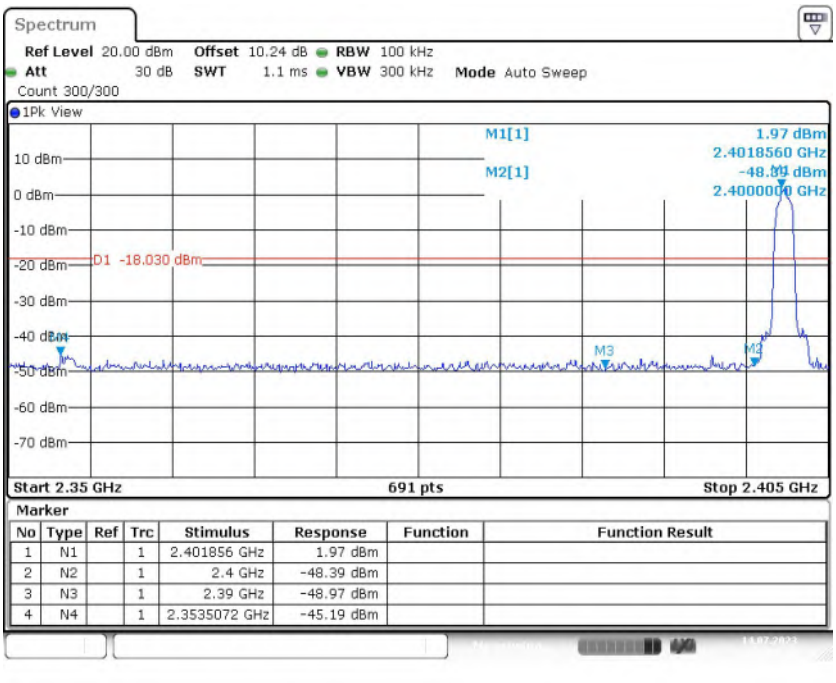


Fig. 14 Band Edges (π/4 DQPSK, CH0, Hopping OFF)

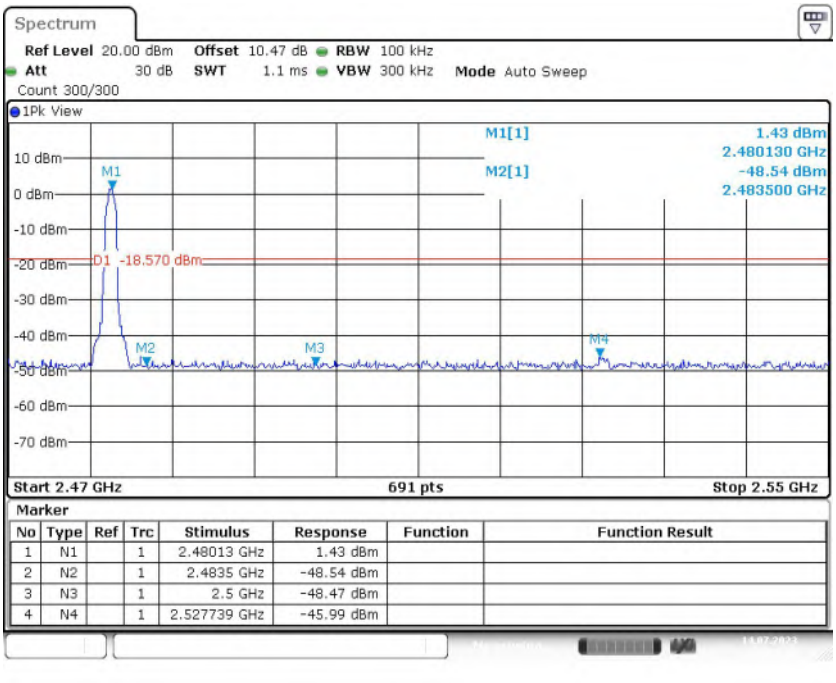


Fig. 15 Band Edges (π/4 DQPSK, CH78, Hopping OFF)

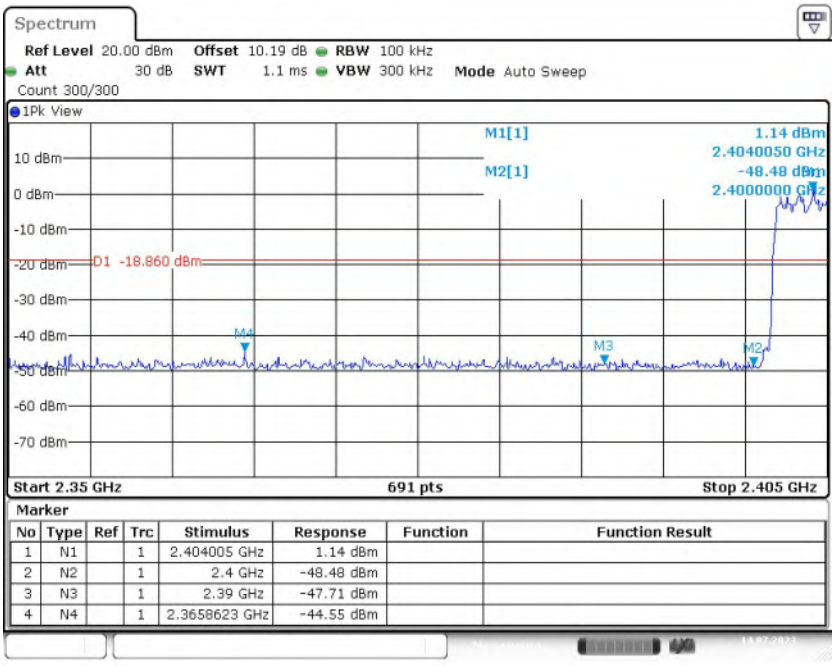


Fig. 16 Band Edges (π/4 DQPSK, CH0, Hopping ON)

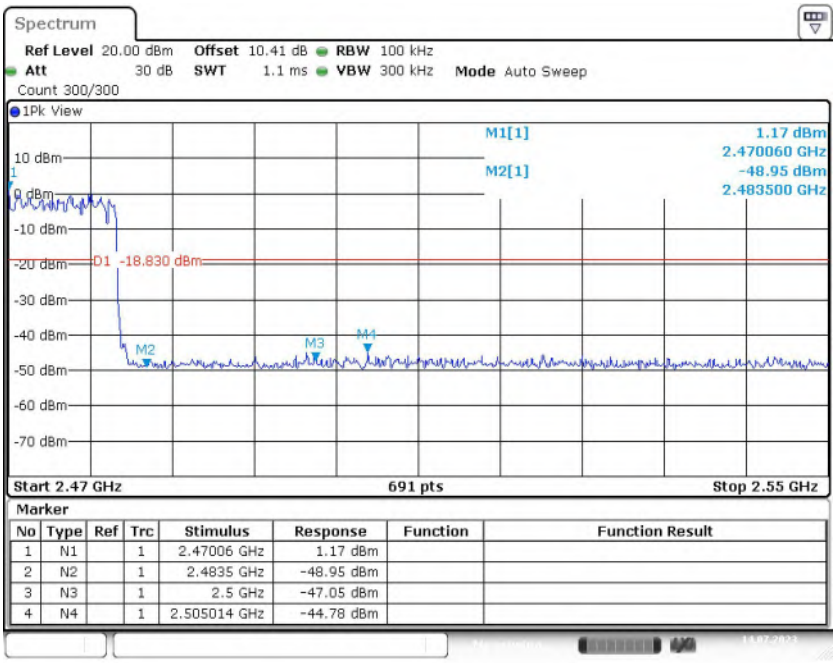


Fig. 17 Band Edges (π/4 DQPSK, CH78, Hopping ON)

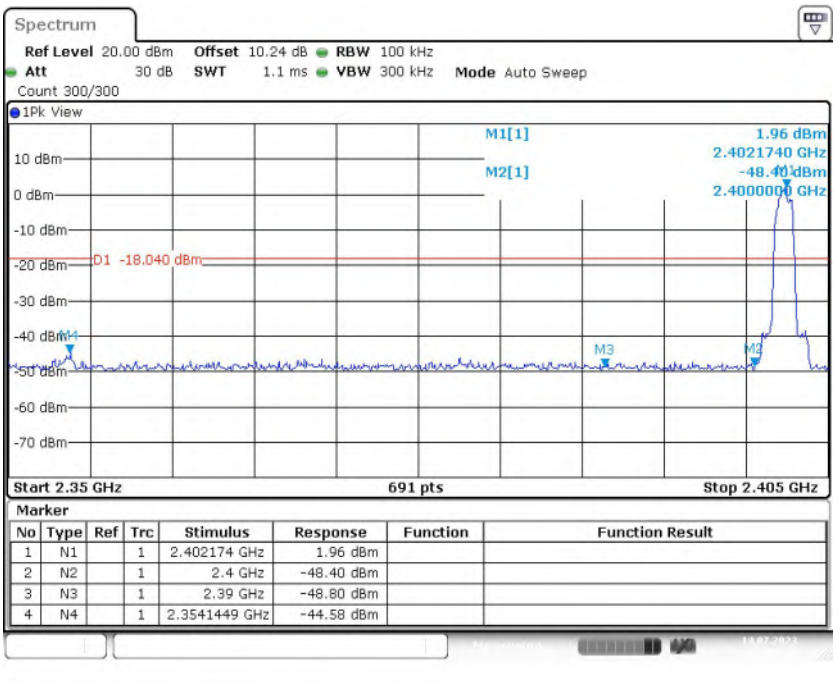


Fig. 18 Band Edges (8DPSK, CH0, Hopping OFF)

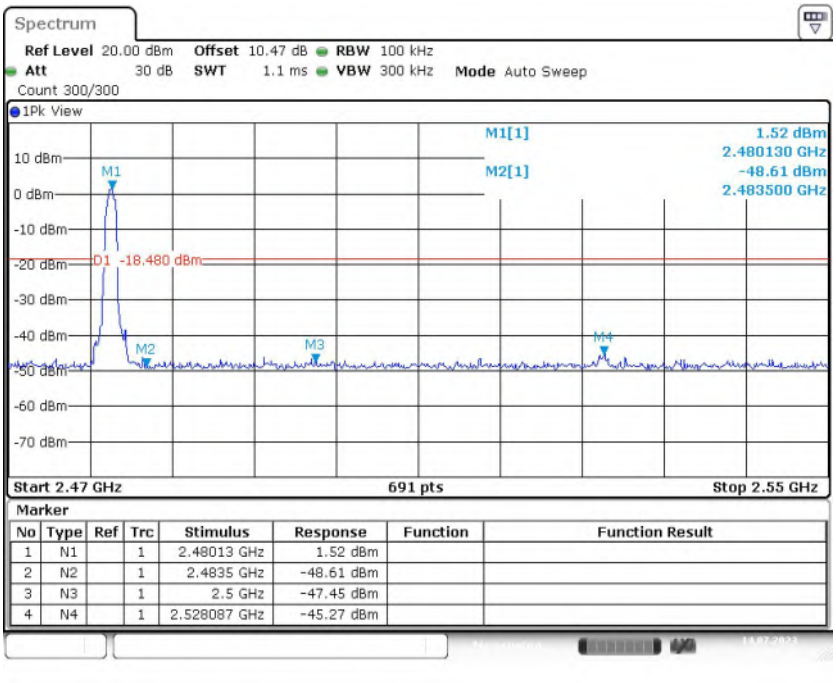


Fig. 19 Band Edges (8DPSK, CH78, Hopping OFF)

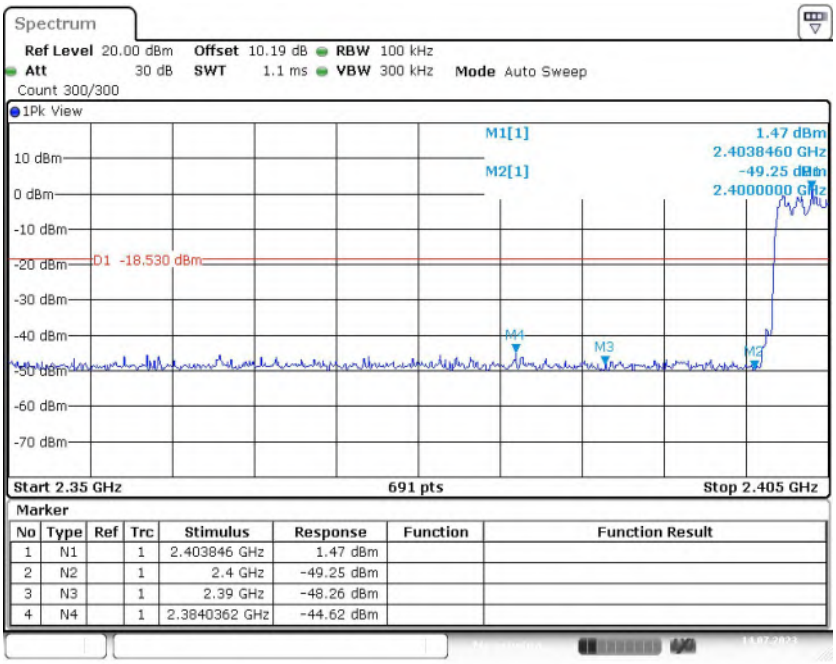


Fig. 20 Band Edges (8DPSK, CH0, Hopping ON)

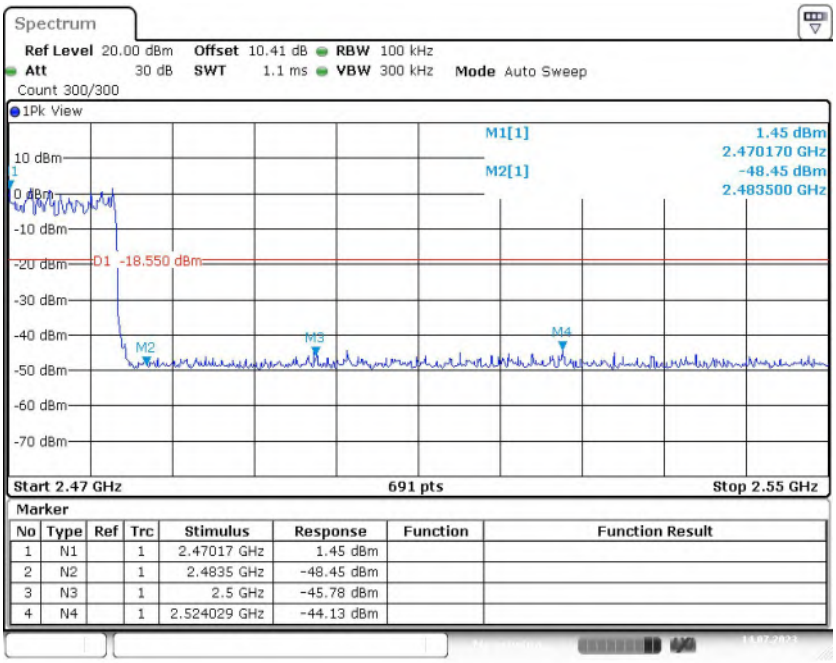


Fig. 21 Band Edges (8DPSK, CH78, Hopping ON)

A.3 Conducted Emission

Method of Measurement: See ANSI C63.10-clause 7.8.8.

Measurement Limit:

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

Measurement Results:

Mode	Frequency (MHz)	Frequency Range	Test Results	Conclusion
GFSK	2402(CH0)	1GHz-26.5GHz	Fig.22	**P**
	2441(CH39)	1GHz-26.5GHz	Fig.23	**P**
	2480(CH78)	1GHz-26.5GHz	Fig.24	**P**
π/4 DQPSK	2402(CH0)	1GHz-26.5GHz	Fig.25	**P**
	2441(CH39)	1GHz-26.5GHz	Fig.26	**P**
	2480(CH78)	1GHz-26.5GHz	Fig.27	**P**
8DPSK	2402(CH0)	1GHz-26.5GHz	Fig.28	**P**
	2441(CH39)	1GHz-26.5GHz	Fig.29	**P**
	2480(CH78)	1GHz-26.5GHz	Fig.30	**P**
/	All channels	30MHz -1GHz	Fig.31	**P**

See below for test graphs.

Conclusion: Pass

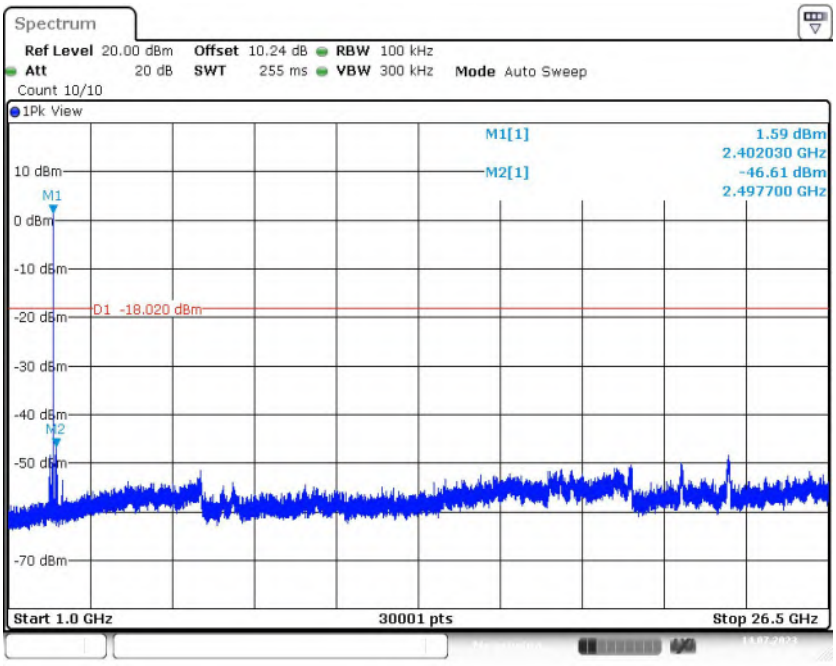


Fig. 22 Conducted Spurious Emission (GFSK, CH0, 1GHz-26.5GHz)

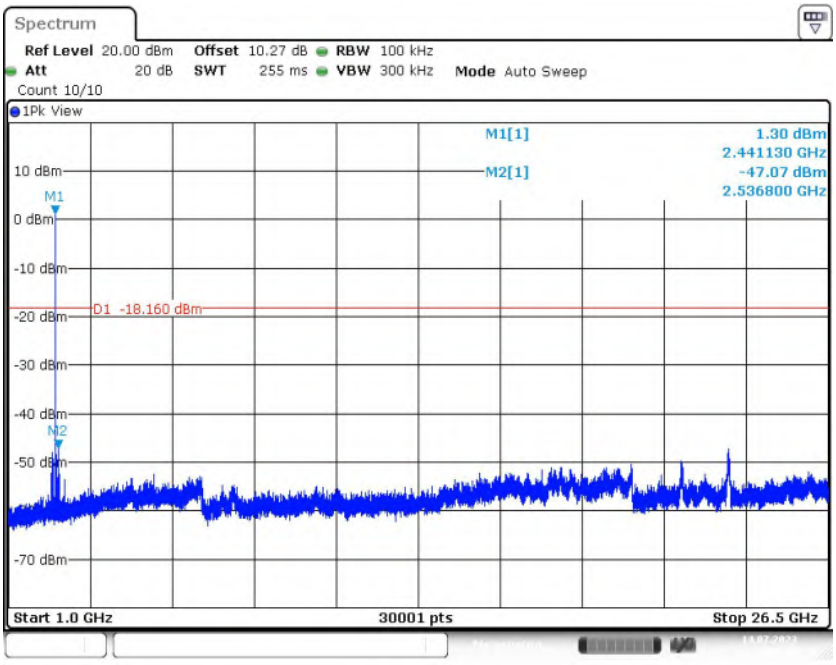


Fig. 23 Conducted Spurious Emission (GFSK, CH39, 1GHz-26.5GHz)

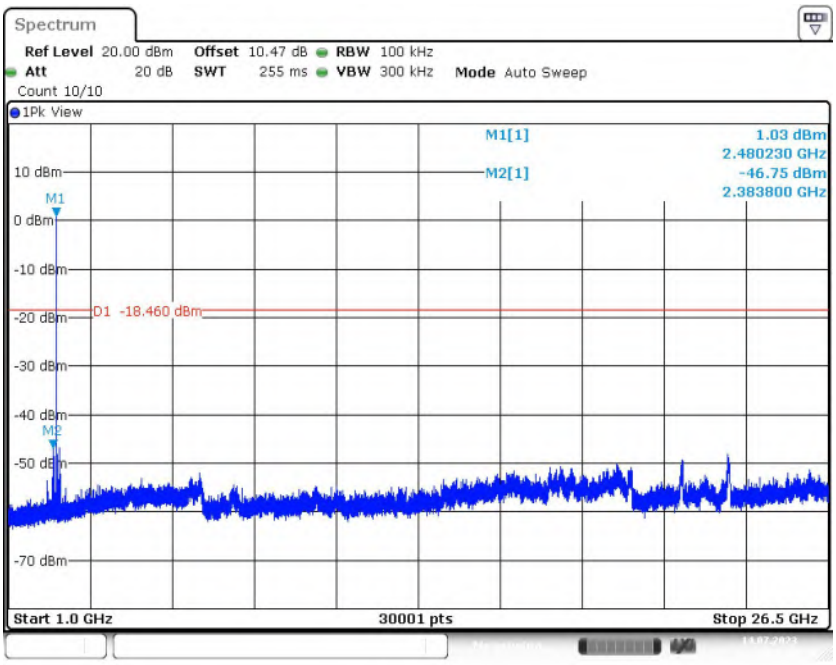


Fig. 24 Conducted Spurious Emission (GFSK, CH78, 1GHz-26.5GHz)

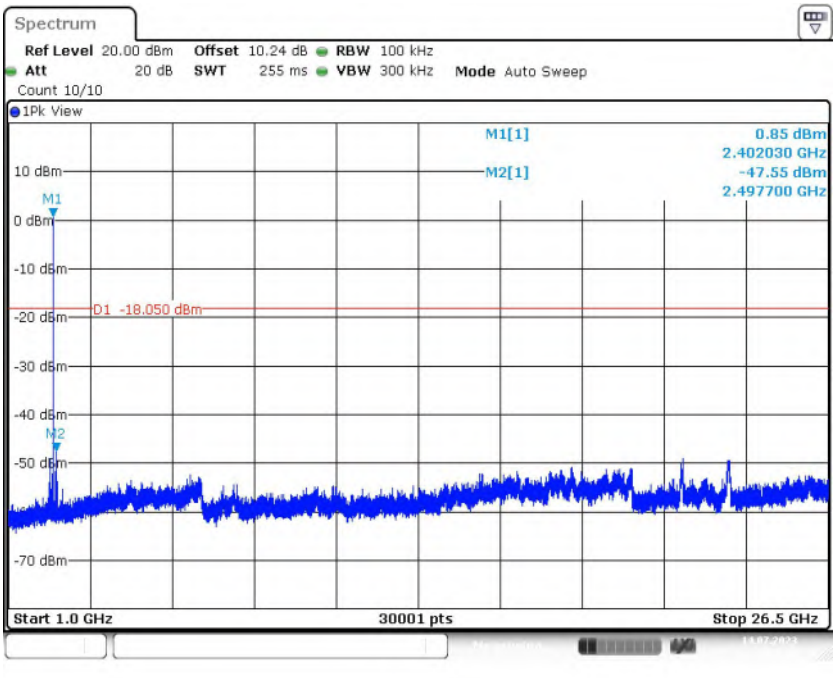


Fig. 25 Conducted Spurious Emission (π/4 DQPSK, CH0, 1GHz-26.5GHz)

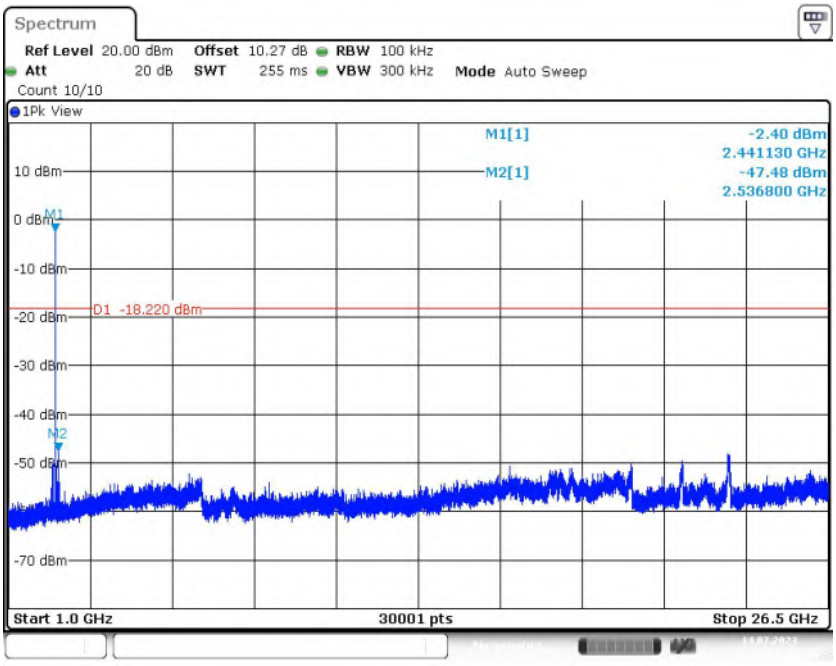


Fig. 26 Conducted Spurious Emission (π/4 DQPSK, CH39, 1GHz-26.5GHz)

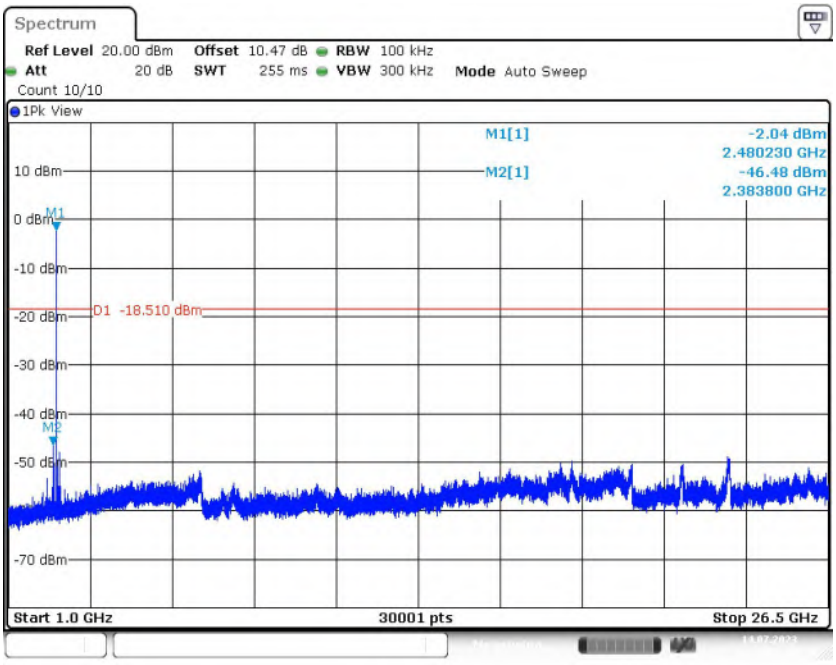


Fig. 27 Conducted Spurious Emission (π/4 DQPSK, CH78, 1GHz-26.5GHz)

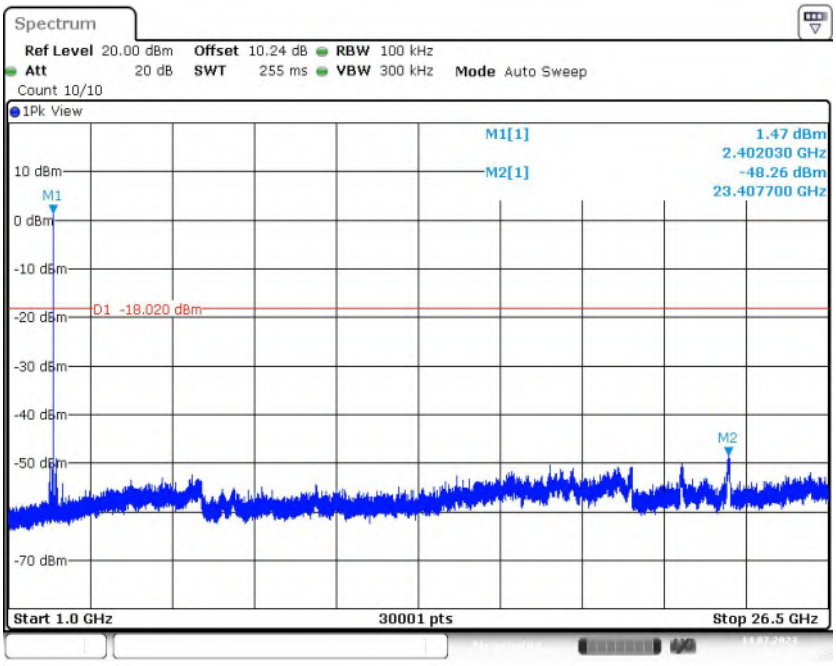


Fig. 28 Conducted Spurious Emission (8DPSK, CH0, 1GHz-26.5GHz)

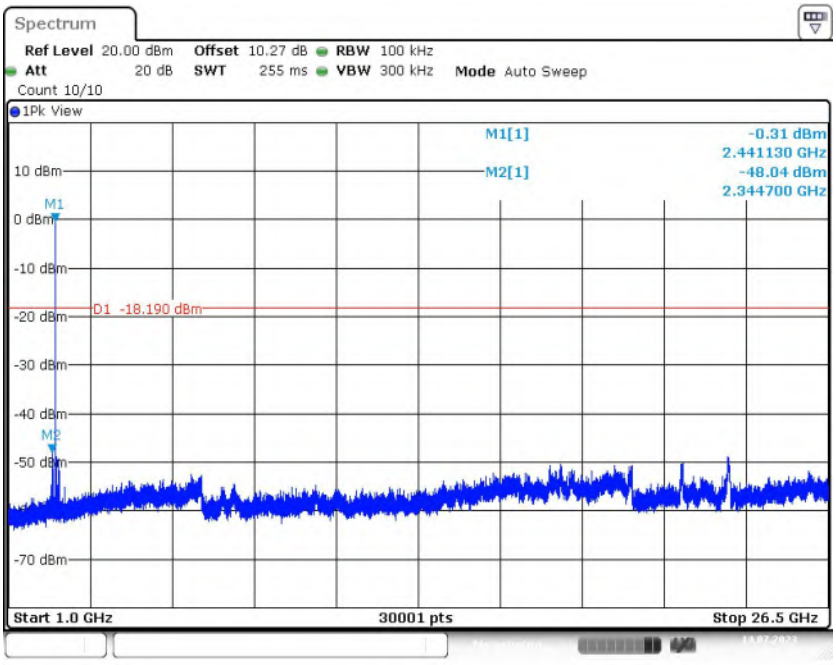


Fig. 29 Conducted Spurious Emission (8DPSK, CH39, 1GHz-26.5GHz)

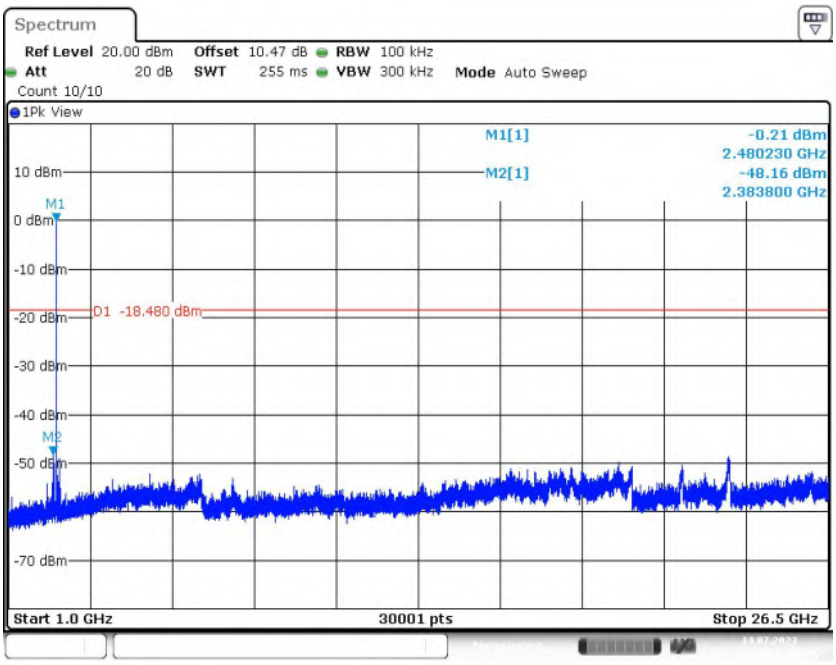


Fig. 30 Conducted Spurious Emission (8DPSK, CH78, 1GHz-26.5GHz)

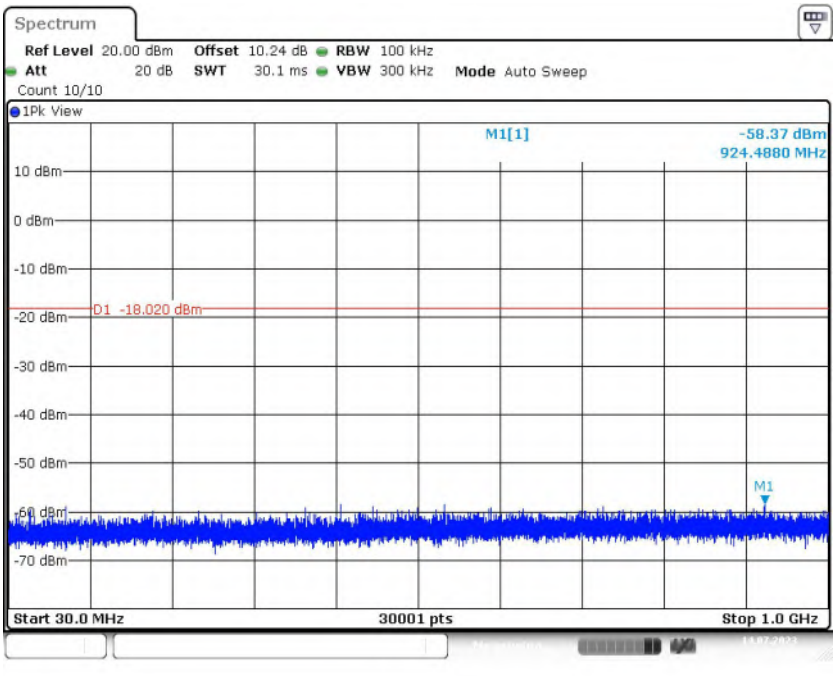


Fig. 31 Conducted Spurious Emission (All Channels, 30MHz -1GHz)

A.4 Radiated Emission

Method of Measurement: See ANSI C63.10-clause 6.3&6.4&6.5&6.6.

Measurement Limit:

Standard	Limit (dBm)
FCC 47 CFR Part 15.247, 15.205, 15.209	20dBm 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. For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases were recorded in this report.

Measurement Results:

Mode	Frequency (MHz)	Frequency Range	Test Results	Conclusion
GFSK	2402(CH0)	1 GHz ~18 GHz	Fig.32	**P**
	2441(CH39)	1 GHz ~18 GHz	Fig.33	**P**
	2480(CH78)	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**
π/4 DQPSK	2402(CH0)	1 GHz ~18 GHz	Fig.37	**P**
	2441(CH39)	1 GHz ~18 GHz	Fig.38	**P**
	2480(CH78)	1 GHz ~18 GHz	Fig.39	**P**
	Restricted Band (CH0)	2.38 GHz ~ 2.45 GHz	Fig.40	**P**
	Restricted Band (CH78)	2.45 GHz ~ 2.5 GHz	Fig.41	**P**
8DPSK	2402(CH0)	1 GHz ~18 GHz	Fig.42	**P**
	2441(CH39)	1 GHz ~18 GHz	Fig.43	**P**
	2480(CH78)	1 GHz ~18 GHz	Fig.44	**P**
	Restricted Band (CH0)	2.38 GHz ~ 2.45 GHz	Fig.45	**P**
	Restricted Band (CH78)	2.45 GHz ~ 2.5 GHz	Fig.46	**P**
/	All channels	9 kHz ~30 MHz	Fig.47	**P**
		30 MHz ~1 GHz	Fig.48	**P**
		18 GHz ~26.5 GHz	Fig.49	**P**

Worst Case Result

GFSK CH0 (1-18GHz)

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
4998.000000	52.89	74.00	21.11	H	3.5
7917.857143	49.99	74.00	24.01	H	6.0
9956.142857	52.71	74.00	21.29	H	8.1
12423.000000	48.58	74.00	25.42	V	11.4
15831.857143	50.99	74.00	23.01	V	14.0
16958.571429	52.79	74.00	21.21	V	18.2

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
4998.000000	36.54	54.00	17.46	H	3.5
7917.857143	39.35	54.00	14.65	H	6.0
9956.142857	35.81	54.00	18.19	H	8.1
12423.000000	37.83	54.00	16.17	V	11.4
15831.857143	38.89	54.00	15.11	V	14.0
16958.571429	42.06	54.00	11.94	V	18.2

π/4 DQPSK CH0 (1-18GHz)

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
4982.700000	52.53	74.00	21.47	H	4.6
7055.571429	46.95	74.00	27.05	H	6.2
9967.714286	48.73	74.00	23.27	H	9.3
11882.142857	49.93	74.00	24.07	V	12.9
14867.142857	51.04	74.00	22.96	V	14.7
16611.857143	55.88	74.00	18.12	V	19.3

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
4982.700000	38.06	54.00	15.94	H	4.6
7055.571429	37.62	54.00	16.38	H	6.2
9967.714286	35.72	54.00	18.28	H	9.3
11882.142857	37.14	54.00	16.86	V	12.9
14867.142857	39.01	54.00	14.99	V	14.7
16611.857143	43.61	54.00	10.39	V	19.3

8DPSK CH0 (1-18GHz)

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
4986.900000	55.68	74.00	18.32	H	4.6
6520.714286	55.30	74.00	18.70	H	6.6
7615.714286	54.31	74.00	19.69	V	6.4
9973.285714	54.72	74.00	19.28	H	9.3
15374.142857	51.48	74.00	22.52	V	14.3
17913.428571	56.80	74.00	17.20	V	21.4

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	Corr. (dB/m)
4986.900000	38.82	54.00	15.18	H	4.6
6520.714286	42.64	54.00	11.36	H	6.6
7615.714286	42.12	54.00	11.88	V	6.4
9973.285714	36.98	54.00	17.02	H	9.3
15374.142857	39.68	54.00	14.32	V	14.3
17913.428571	45.08	54.00	8.92	V	21.4

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

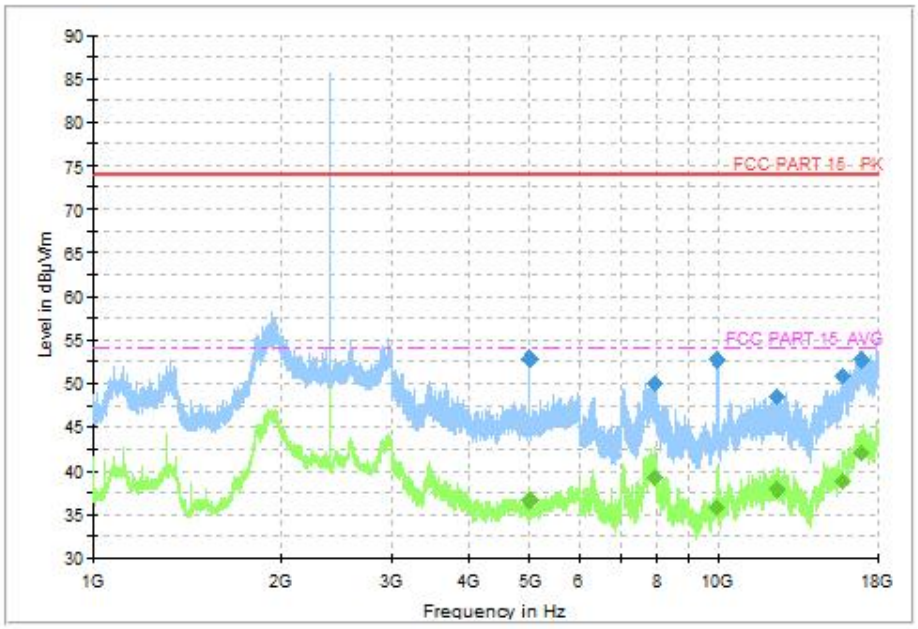


Fig. 32 Radiated Spurious Emission (GFSK, CH0, 1GHz ~18GHz)

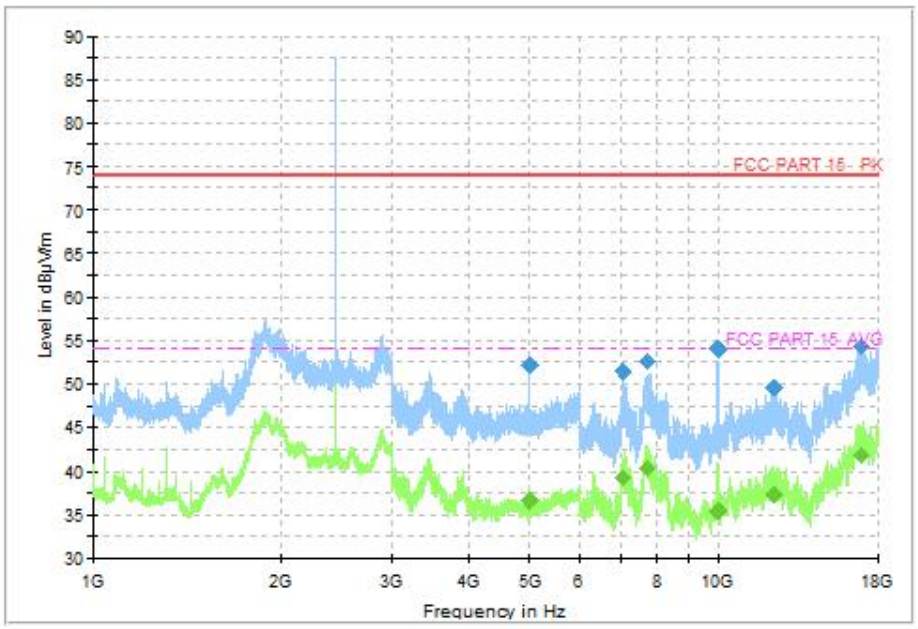


Fig. 33 Radiated Spurious Emission (GFSK, CH39, 1GHz ~18GHz)

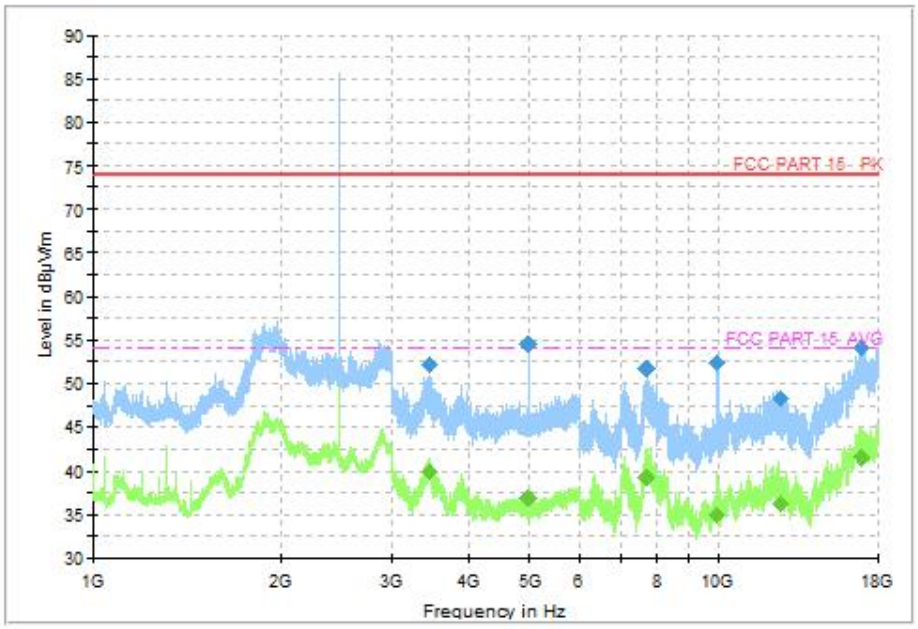


Fig. 34 Radiated Spurious Emission (GFSK, CH78, 1GHz ~18GHz)

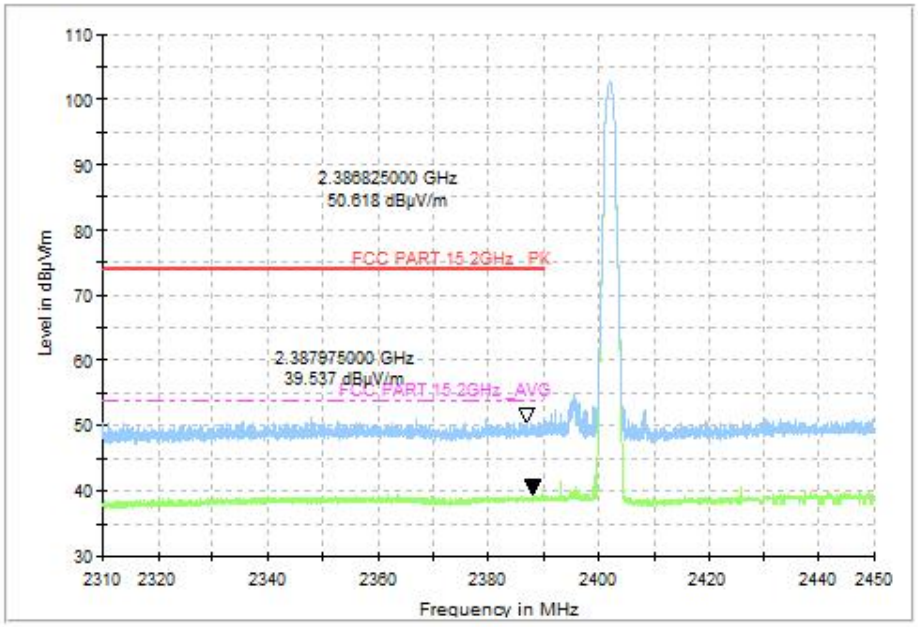


Fig. 35 Radiated Band Edges (GFSK, CH0, 2.38GHz~2.45GHz)

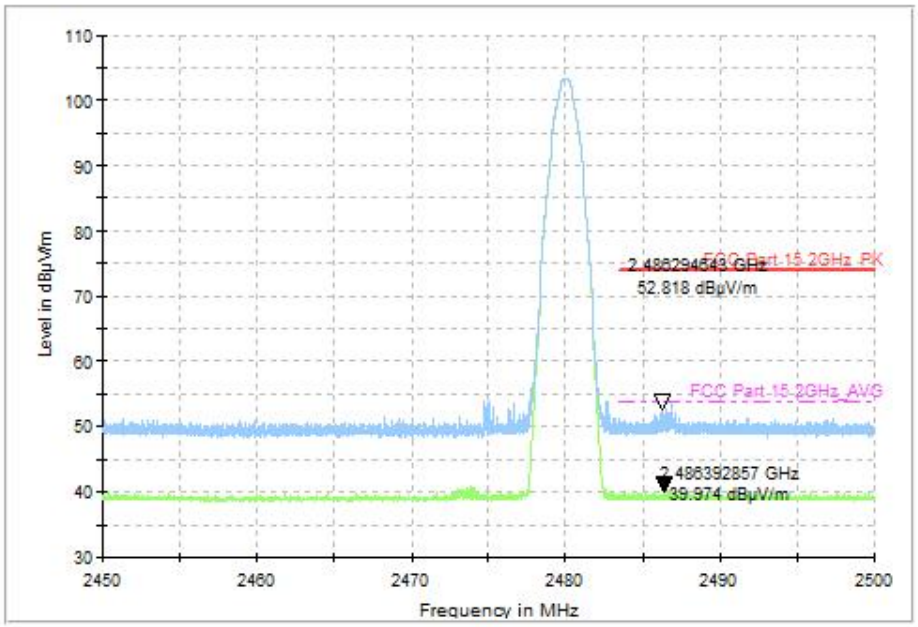


Fig. 36 Radiated Band Edges (GFSK, CH78, 2.45GHz~2.50GHz)

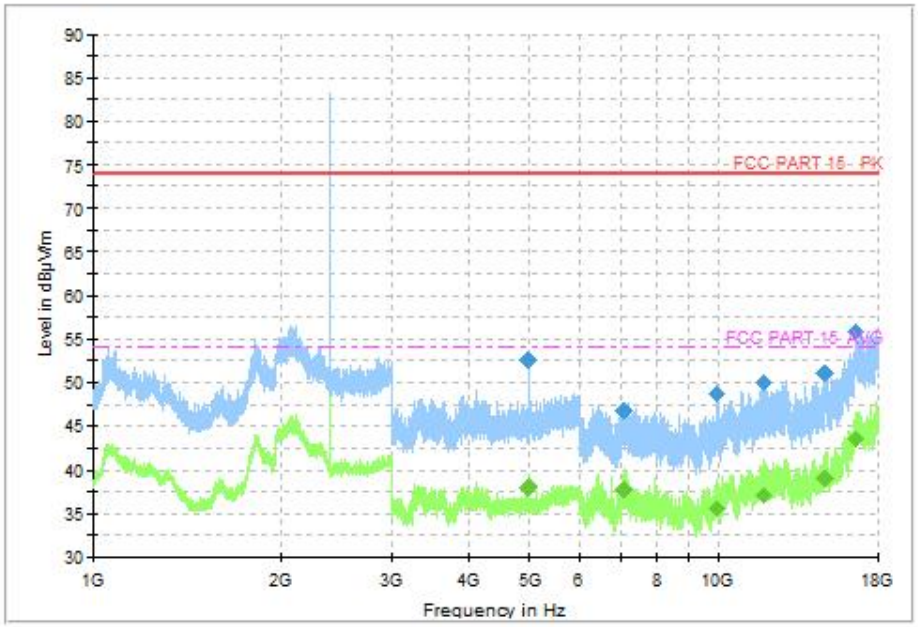


Fig. 37 Radiated Spurious Emission (π/4 DQPSK, CH0, 1GHz ~18GHz)

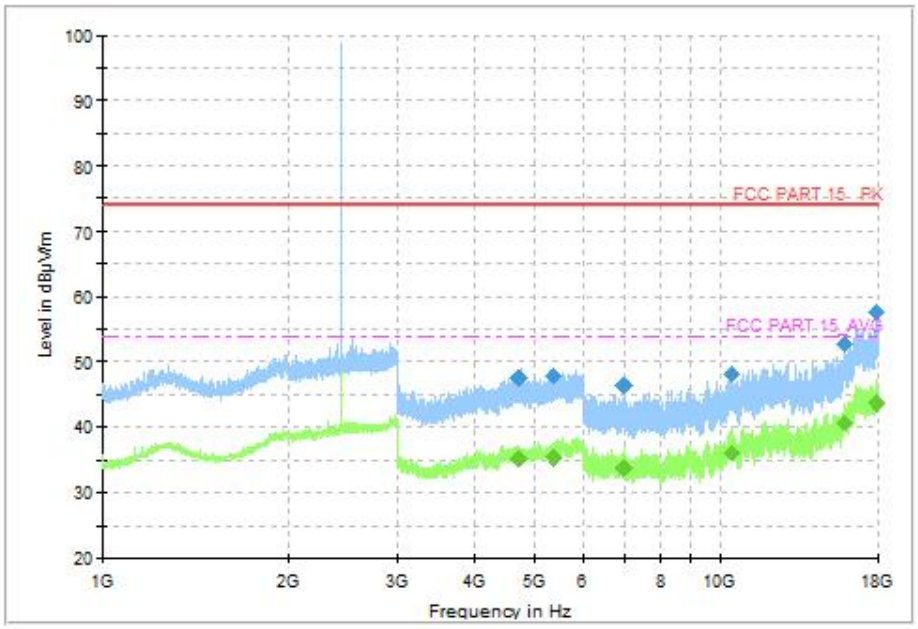


Fig. 38 Radiated Spurious Emission (π/4 DQPSK, CH39, 1GHz ~18GHz)

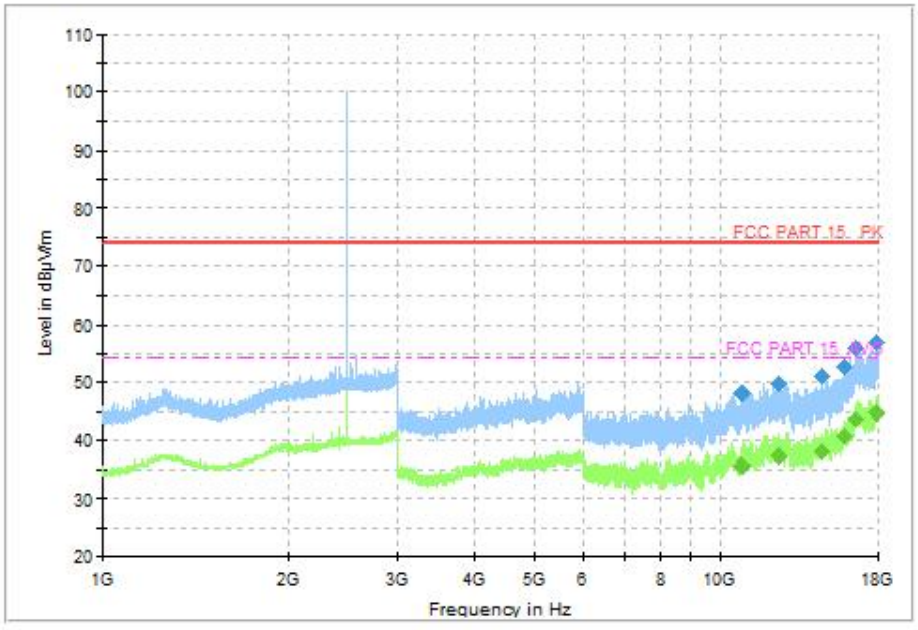


Fig. 39 Radiated Spurious Emission (π/4 DQPSK, CH78, 1GHz ~18GHz)

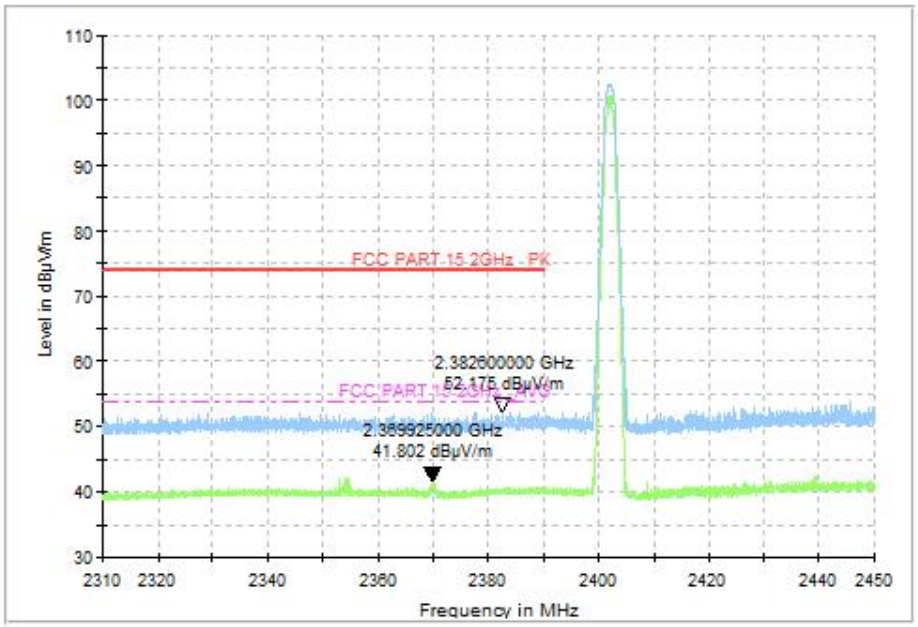


Fig. 40 Radiated Band Edges (π/4 DQPSK, CH0, 2.38GHz~2.45GHz)

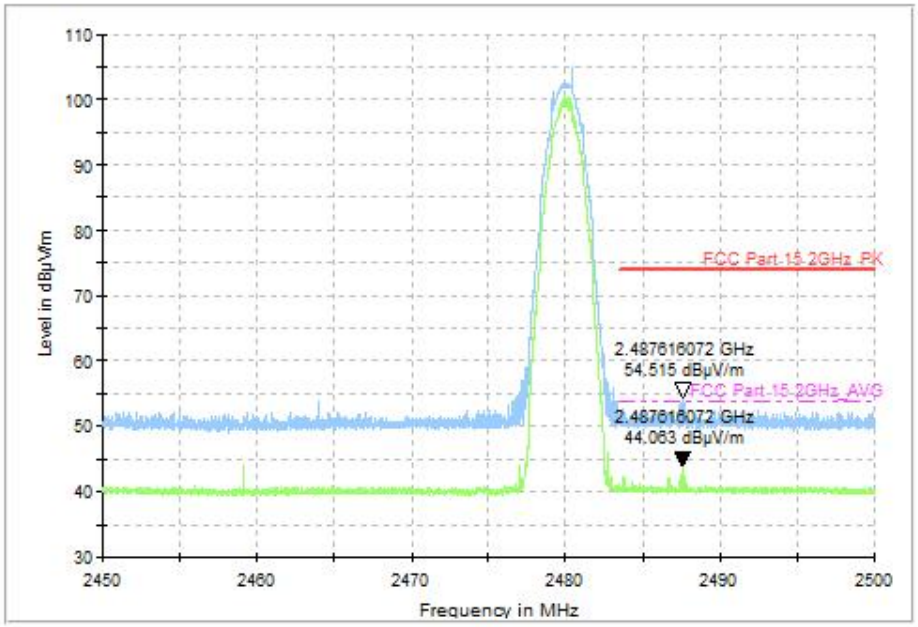


Fig. 41 Radiated Band Edges (π/4 DQPSK, CH78, 2.45GHz~2.50GHz)

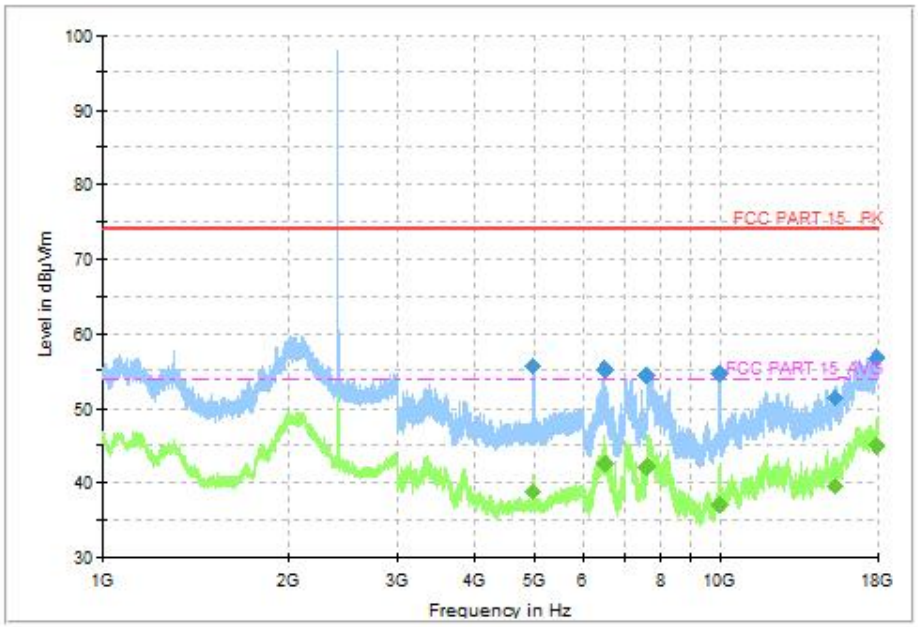


Fig. 42 Radiated Spurious Emission (8DPSK, CH0, 1GHz ~18GHz)

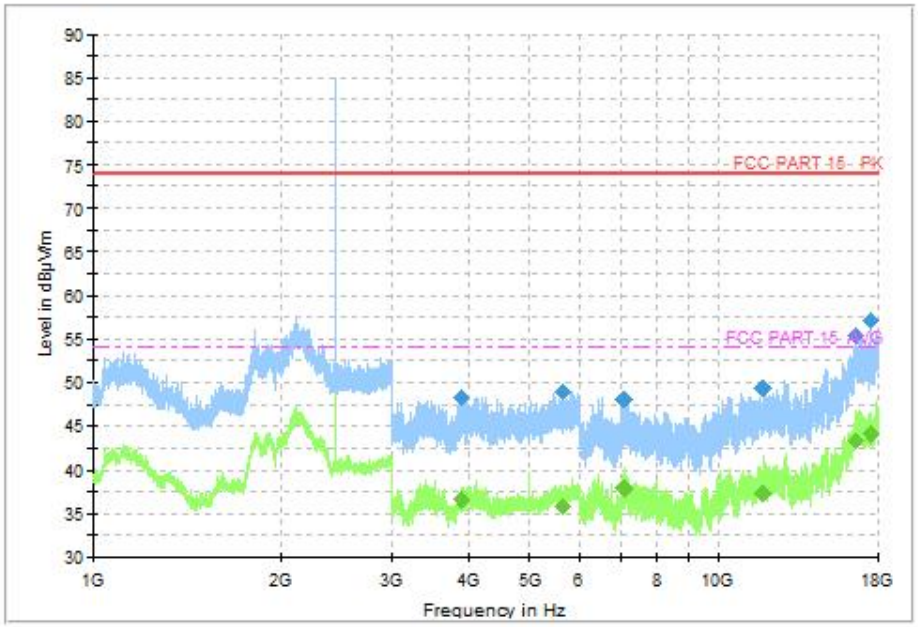


Fig. 43 Radiated Spurious Emission (8DPSK, CH39, 1GHz ~18GHz)

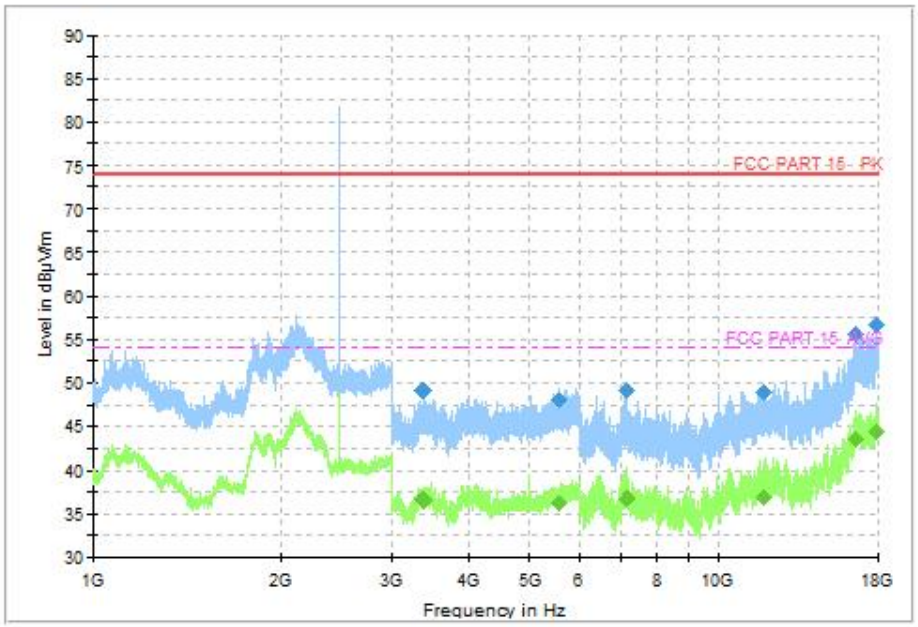


Fig. 44 Radiated Spurious Emission (8DPSK, CH78, 1GHz ~18GHz)

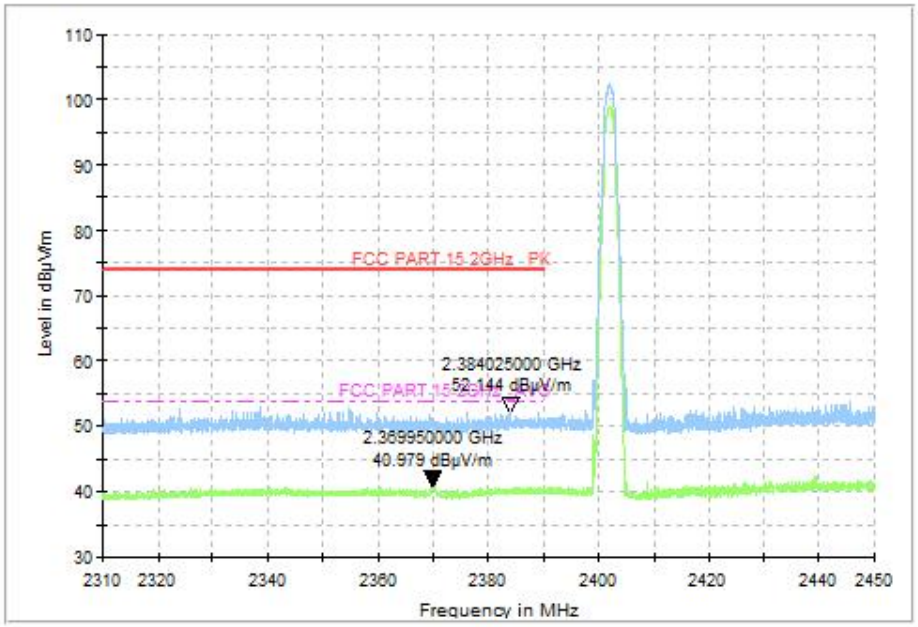


Fig. 45 Radiated Band Edges (8DPSK, CH0, 2.38GHz~2.45GHz)

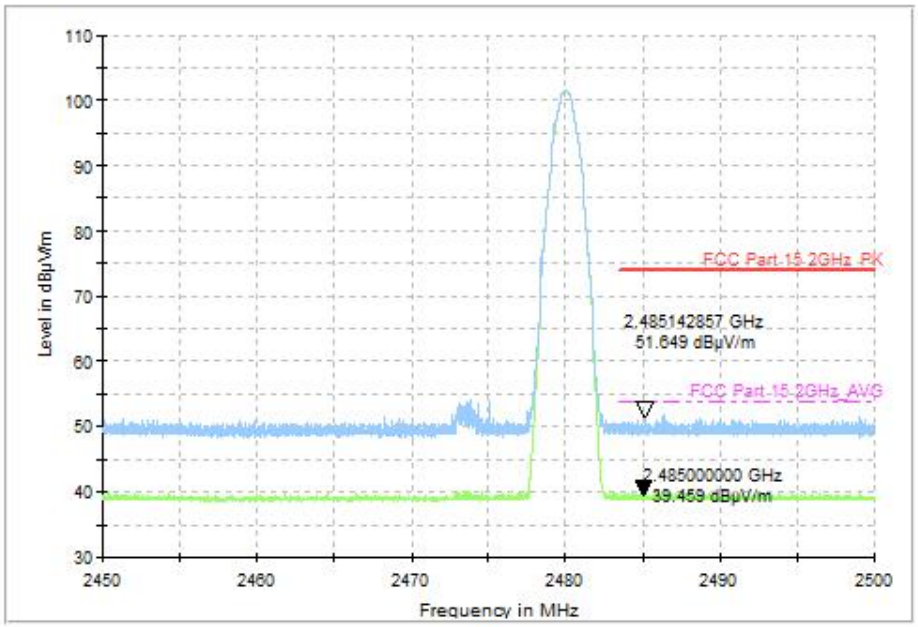


Fig. 46 Radiated Band Edges (8DPSK, CH78, 2.45GHz~2.50GHz)

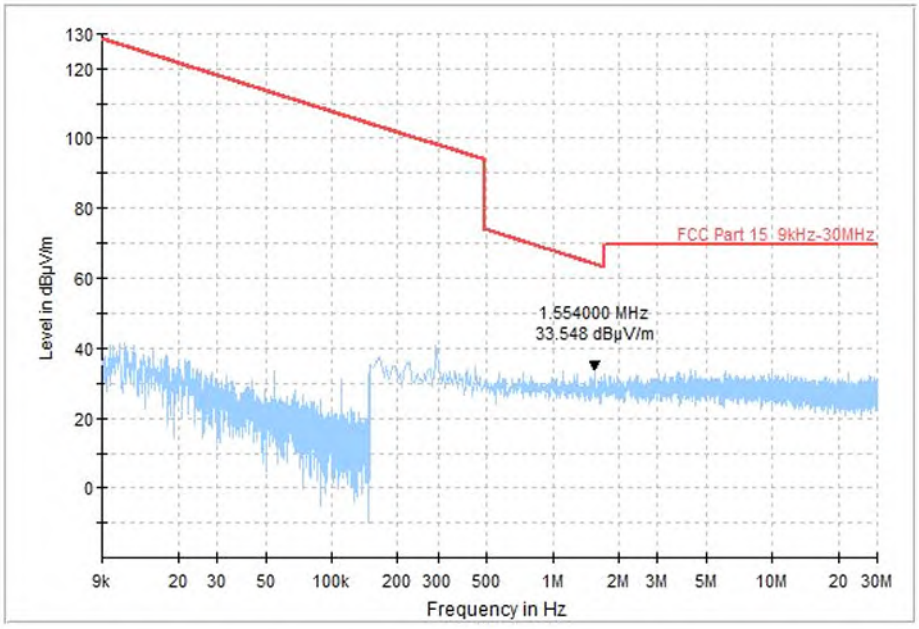


Fig. 47 Radiated Spurious Emission (All Channels, 9kHz ~30MHz)

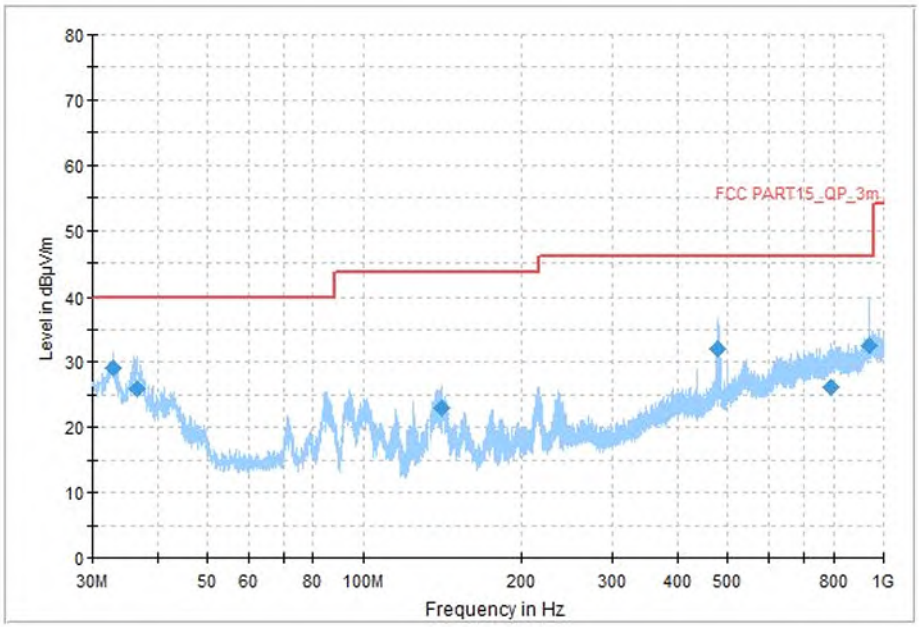


Fig. 48 Radiated Spurious Emission (All Channels, 30MHz ~1GHz)

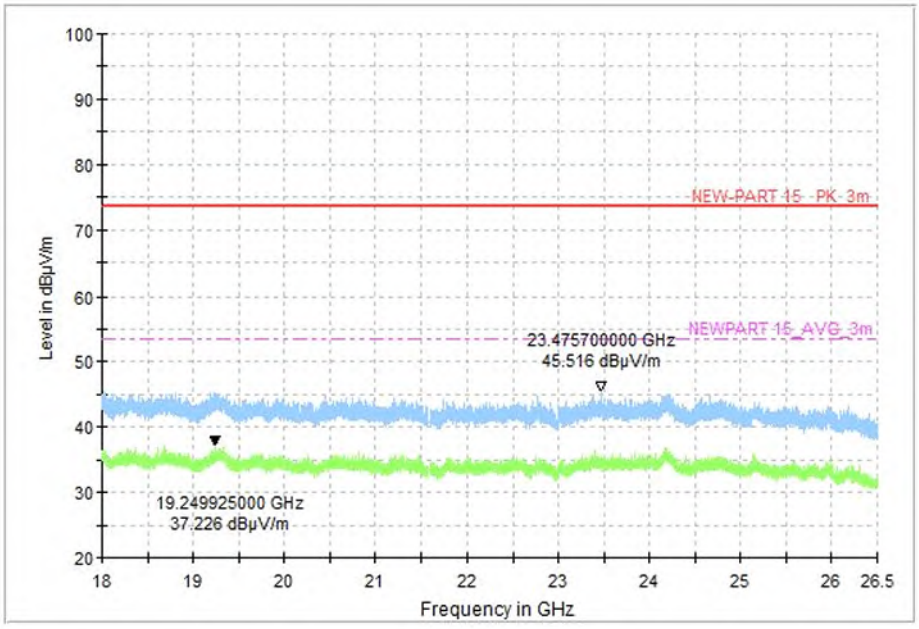


Fig. 49 Radiated Spurious Emission (All Channels, 18GHz ~26.5GHz)

A.5 20dB Bandwidth

Method of Measurement: See ANSI C63.10-clause 7.8.7.

Measurement Limit:

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

Measurement Result:

Mode	Frequency (MHz)	20dB Bandwidth (MHz)		Conclusion
GFSK	2402(CH0)	Fig.50	0.92	/
	2441(CH39)	Fig.51	0.91	
	2480(CH78)	Fig.52	0.92	
π/4 DQPSK	2402(CH0)	Fig.53	1.29	/
	2441(CH39)	Fig.54	1.28	
	2480(CH78)	Fig.55	1.29	
8DPSK	2402(CH0)	Fig.56	1.26	/
	2441(CH39)	Fig.57	1.26	
	2480(CH78)	Fig.58	1.26	

See below for test graphs.

Conclusion: PASS

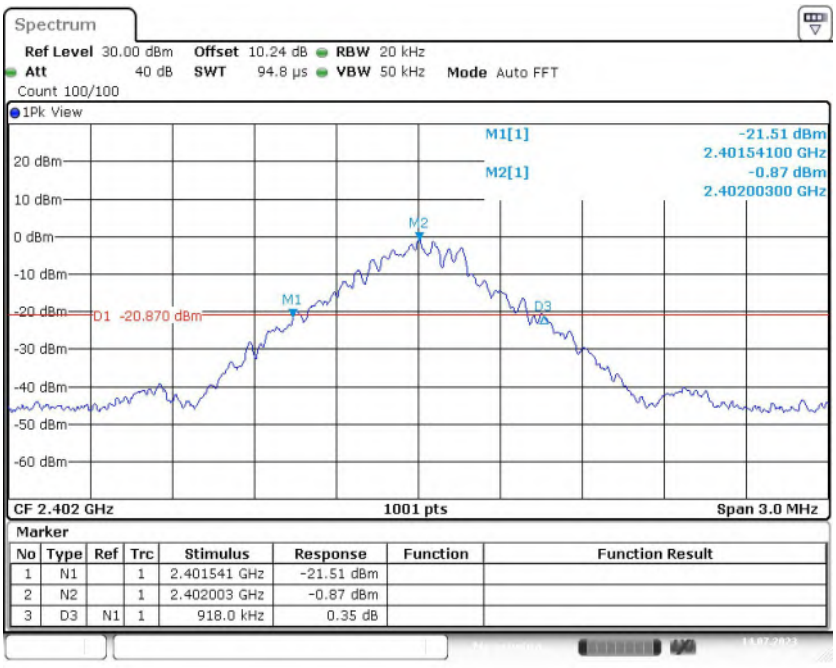


Fig. 50 20dB Bandwidth (GFSK, CH0)

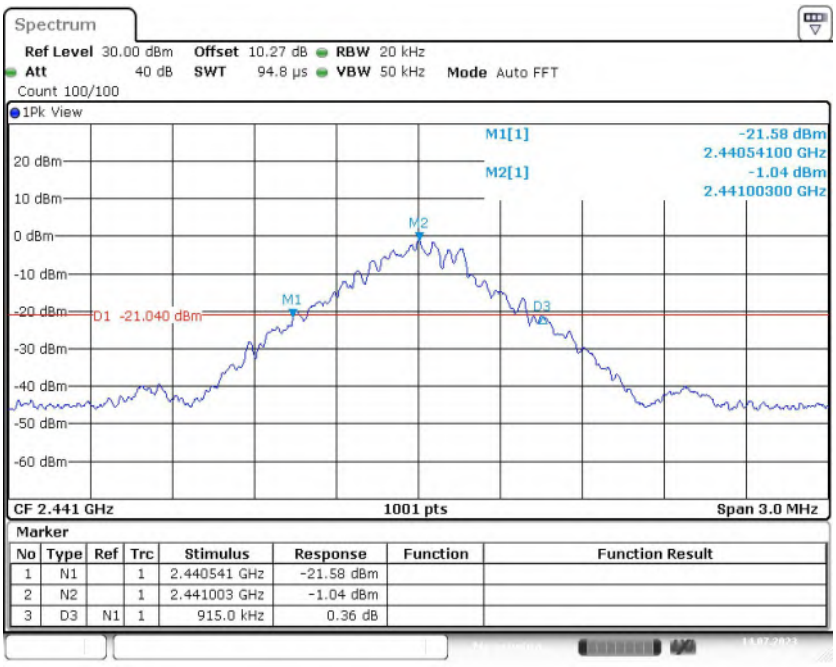


Fig. 51 20dB Bandwidth (GFSK, CH39)

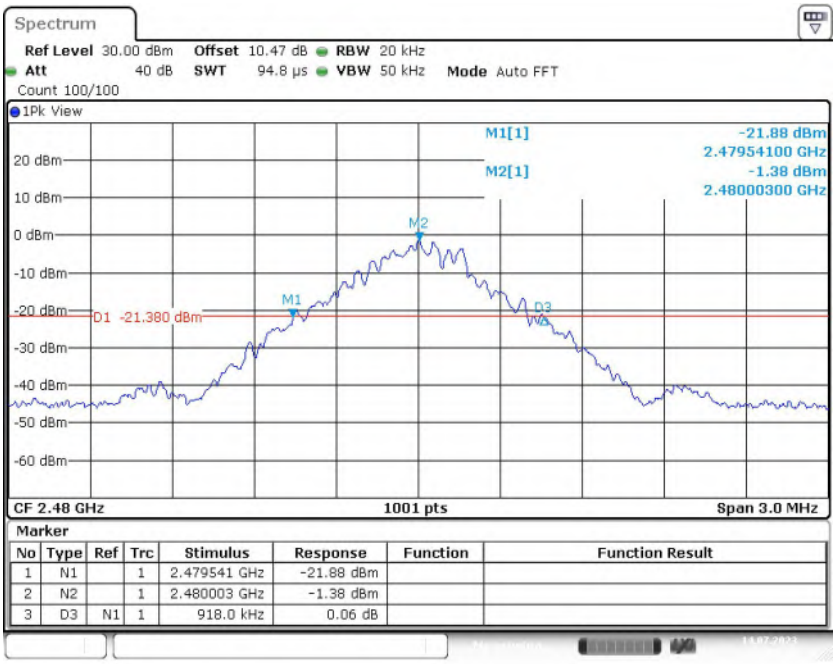


Fig. 52 20dB Bandwidth (GFSK, CH78)

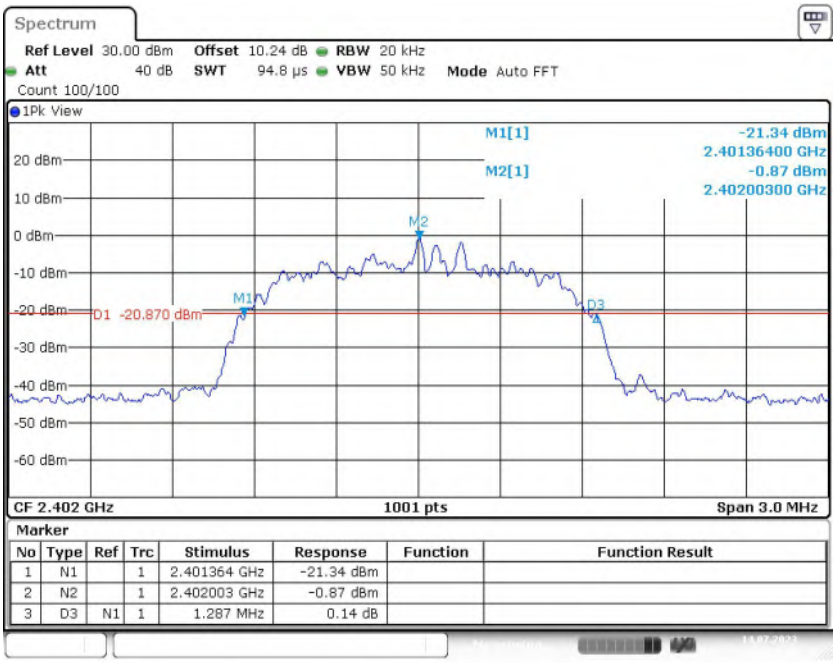


Fig. 53 20dB Bandwidth (π/4 DQPSK, CH0)

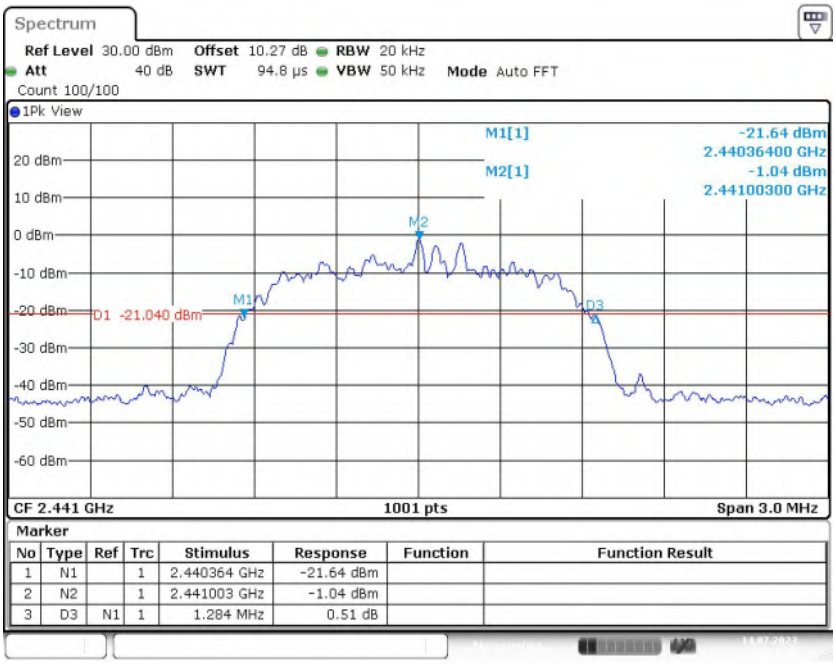


Fig. 54 20dB Bandwidth (π/4 DQPSK, CH39)

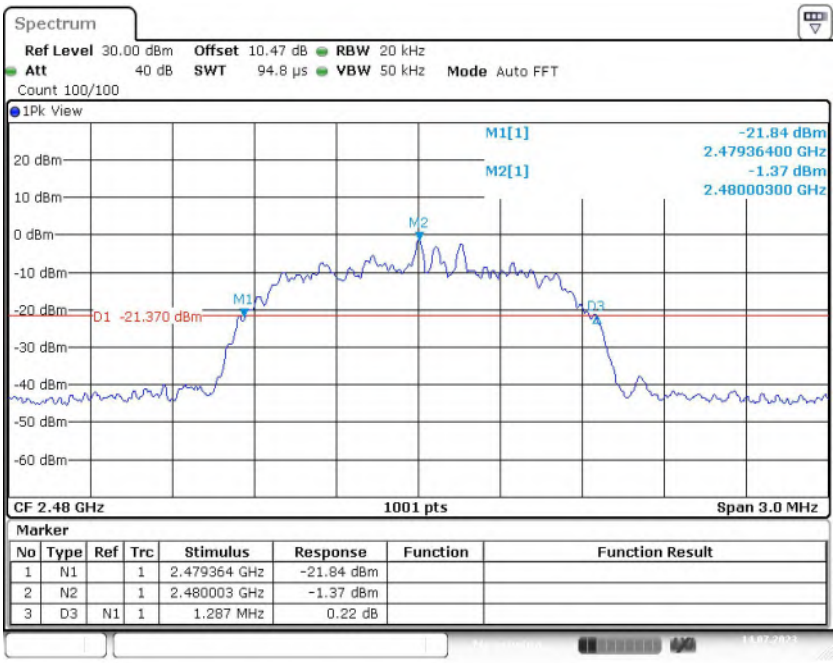


Fig. 55 20dB Bandwidth (π/4 DQPSK, CH78)

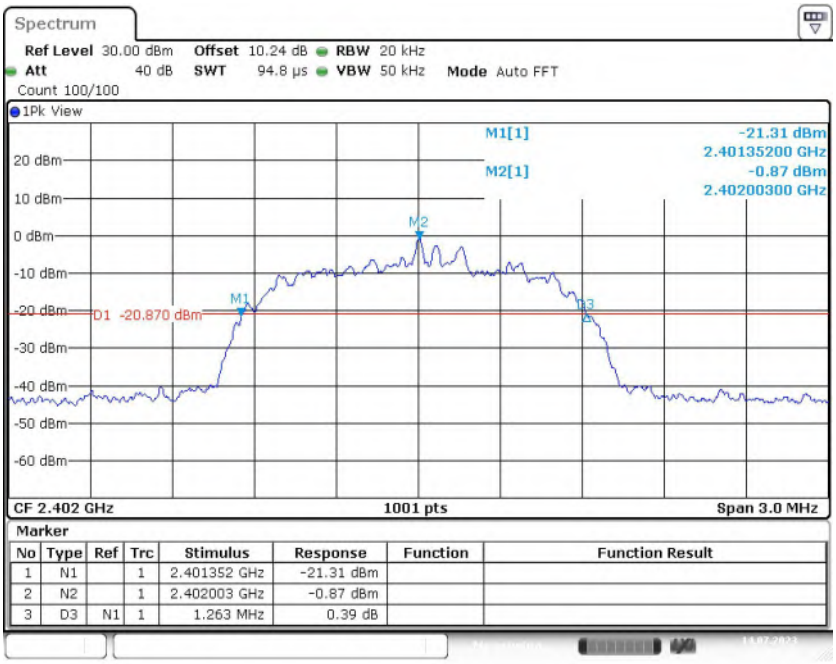


Fig. 56 20dB Bandwidth (8DPSK, CH0)

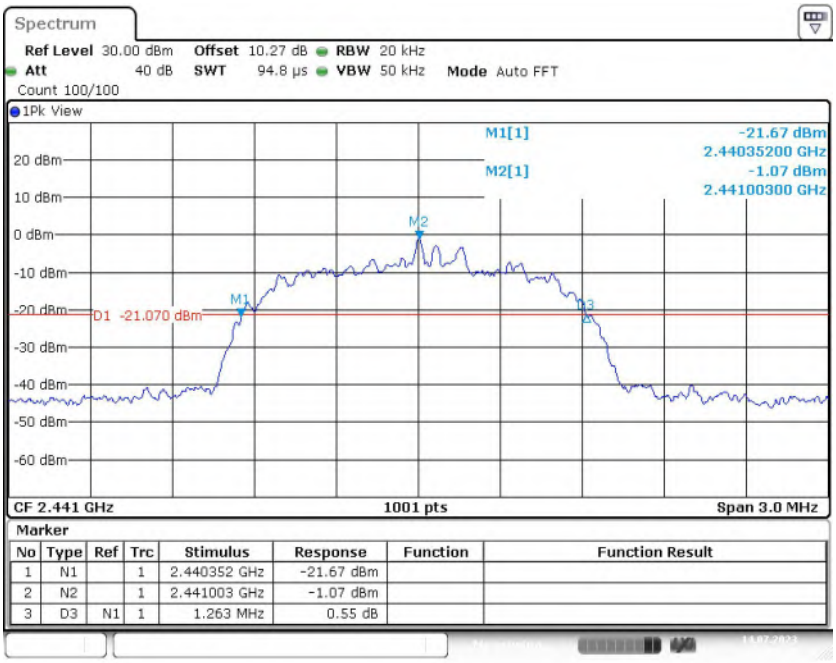


Fig. 57 20dB Bandwidth (8DPSK, CH39)

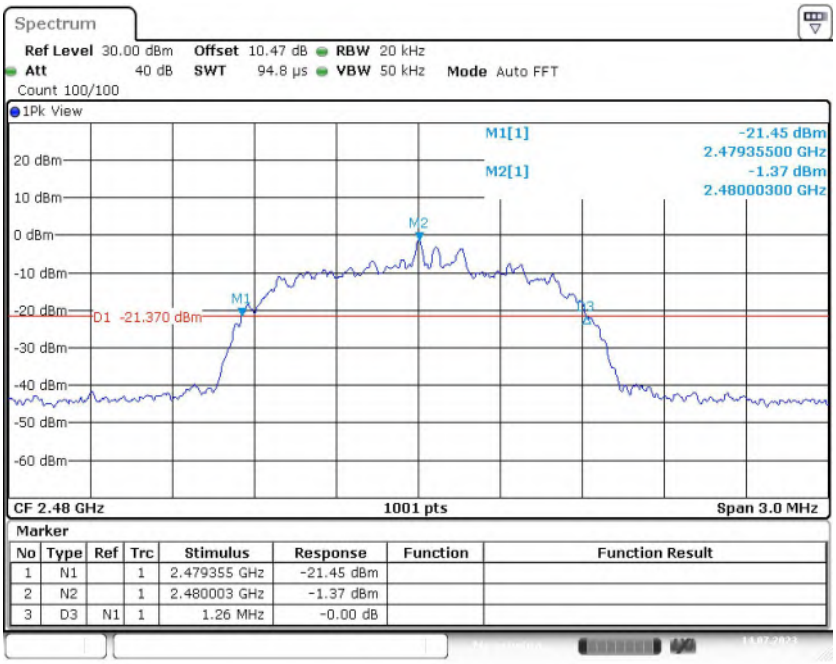


Fig. 58 20dB Bandwidth (8DPSK, CH78)

A.6 Time of Occupancy (Dwell Time)

Method of Measurement: See ANSI C63.10-clause 7.8.4.

Measurement Limit:

Standard	Limit (s)
FCC 47 CFR Part 15.247(a)	< 0.4

Measurement Results:

Mode	Frequency (MHz)	Packet	Burst Width (ms)		Total Hops (Num)		Result (s)	Conclusion
GFSK	2441(CH39)	DH5	Fig.59	2.86	Fig.60	110	0.32	**P**
π/4 DQPSK	2441(CH39)	2-DH5	Fig.61	2.90	Fig.62	110	0.32	**P**
8DPSK	2441(CH39)	3-DH5	Fig.63	2.87	Fig.64	120	0.35	**P**

See below for test graphs.

Conclusion: Pass

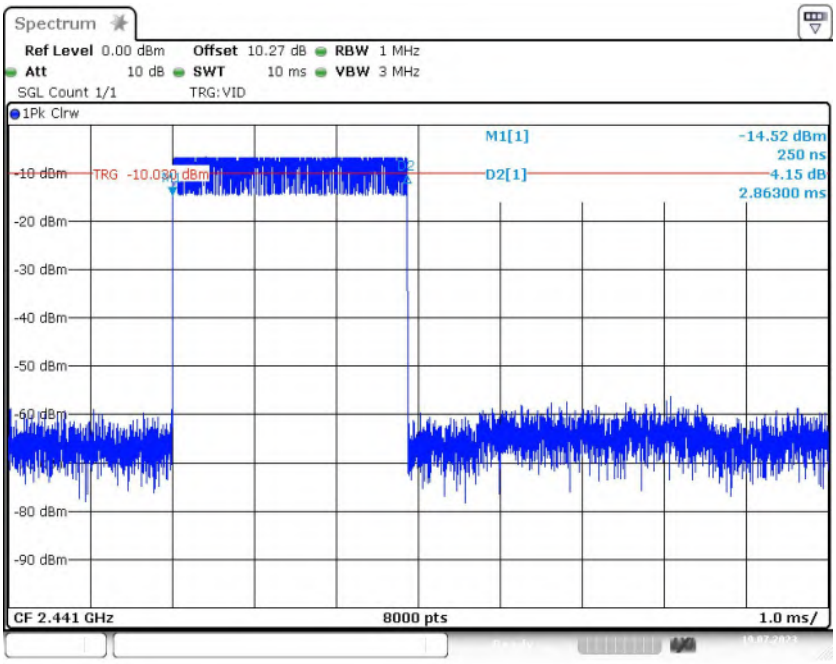


Fig. 59 BurstWidth (Dwell Time) (GFSK, CH39)

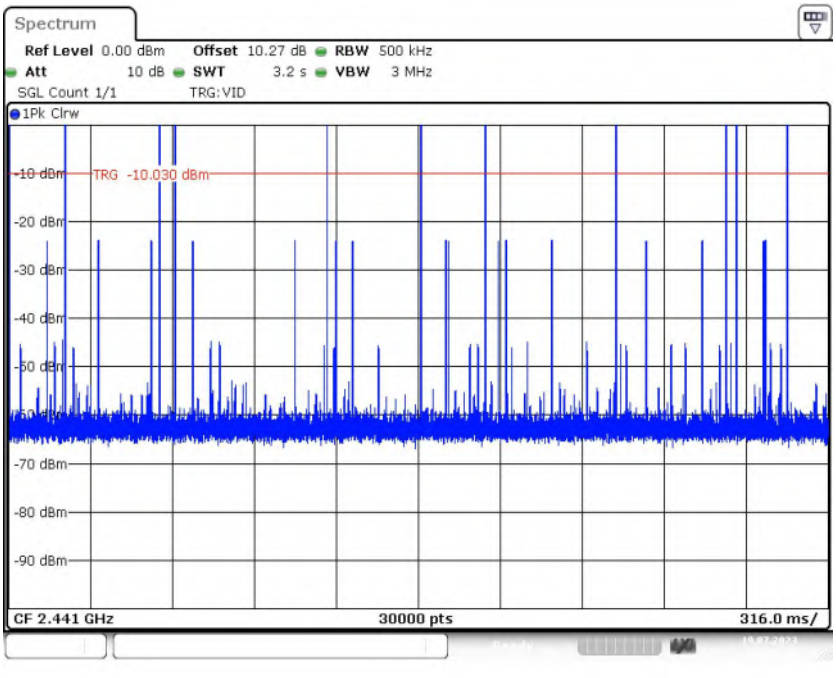


Fig. 60 Number of Burst in Observation Period (Dwell Time) (GFSK, CH39)

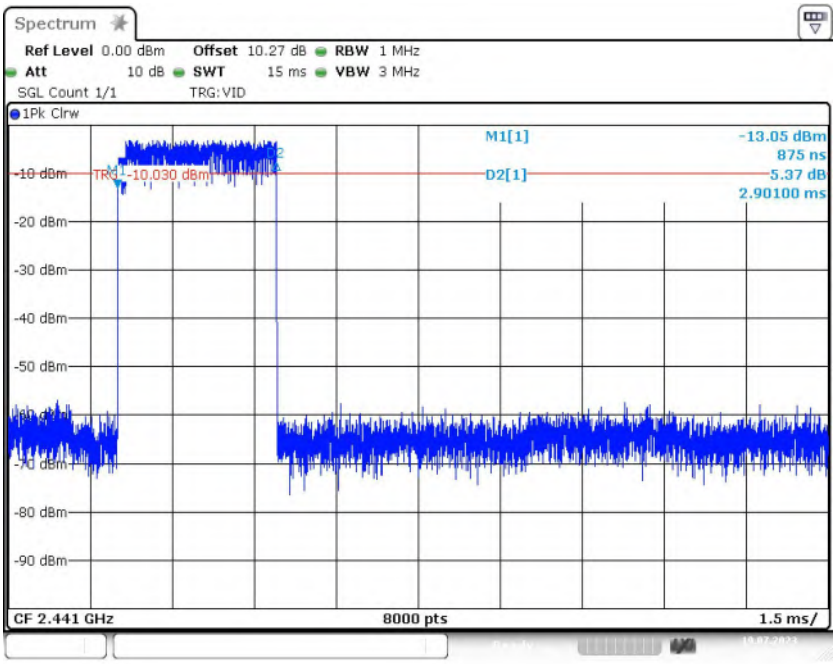


Fig. 61 BurstWidth (Dwell Time) (π/4 DQPSK, CH39)

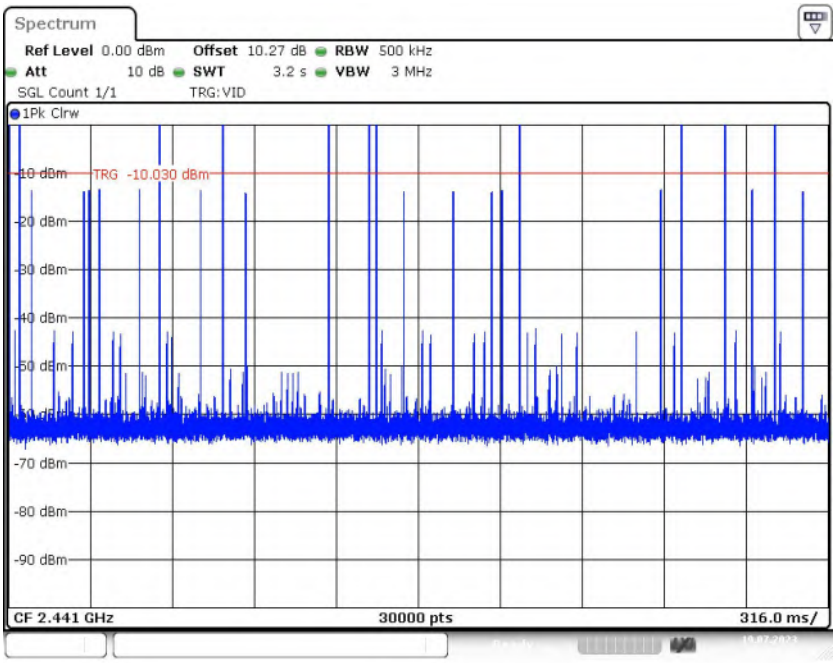


Fig. 62 Number of Burst in Observation Period (Dwell Time) (π/4 DQPSK, CH39)

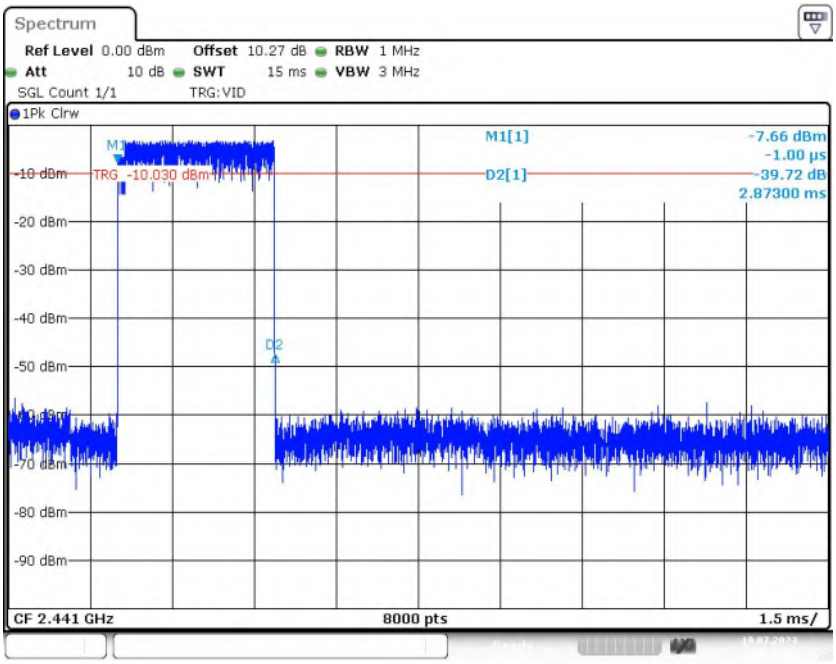


Fig. 63 BurstWidth (Dwell Time) (8DPSK, CH39)

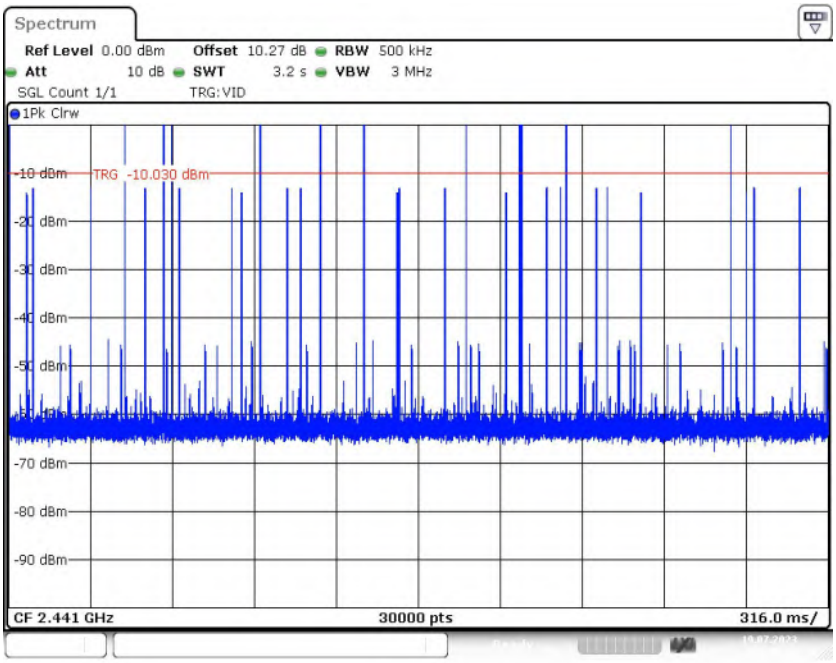


Fig. 64 Number of Burst in Observation Period (Dwell Time) (8DPSK, CH39)

A.7 Number of Hopping Channels

Method of Measurement: See ANSI C63.10-clause 7.8.3.

Measurement Limit:

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

Measurement Results:

Mode	Packet	Number of Hopping Channels	Test results (Num)	Conclusion
GFSK	DH5	Fig.65	79	**P**
π/4 DQPSK	2-DH5	Fig.66	79	**P**
8DPSK	3-DH5	Fig.67	79	**P**

See below for test graphs.

Conclusion: Pass

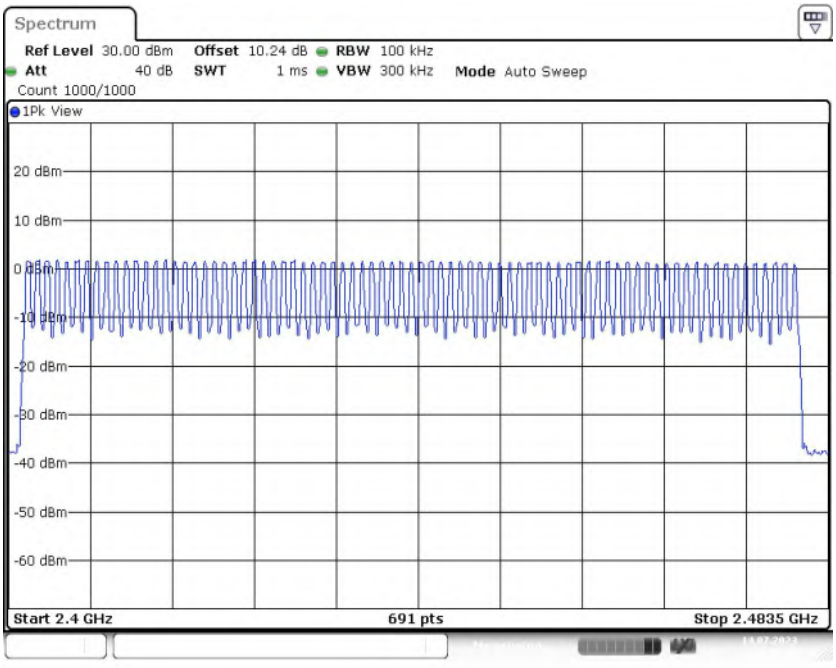
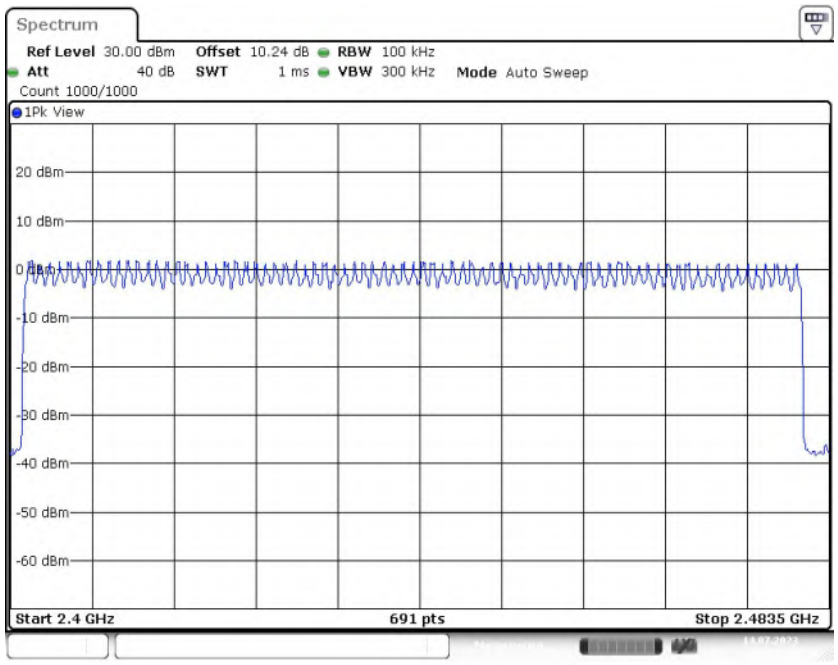


Fig. 65 Number of Hopping Channels (GFSK, Hopping)



8

Fig. 66 Number of Hopping Channels (π/4 DQPSK, Hopping)

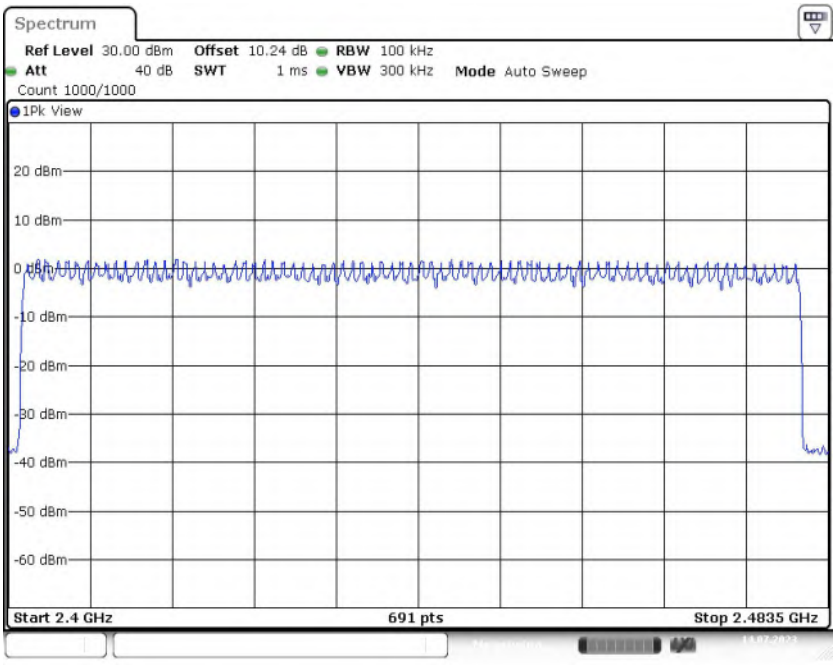


Fig. 67 Number of Hopping Channels (8DPSK, Hopping)

A.8 Carrier Frequency Separation

Method of Measurement: See ANSI C63.10-clause 7.8.2.

Measurement Limit:

Standard	Limit (kHz)
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	Frequency (MHz)	Packet	Separation of hopping channels	Test result (kHz)	Conclusion
GFSK	2441(CH39)	DH5	Fig.68	1006.00	**P**
π/4 DQPSK	2441(CH39)	2-DH5	Fig.69	1000.00	**P**
8DPSK	2441(CH39)	3-DH5	Fig.70	1003.00	**P**

See below for test graphs.

Conclusion: Pass

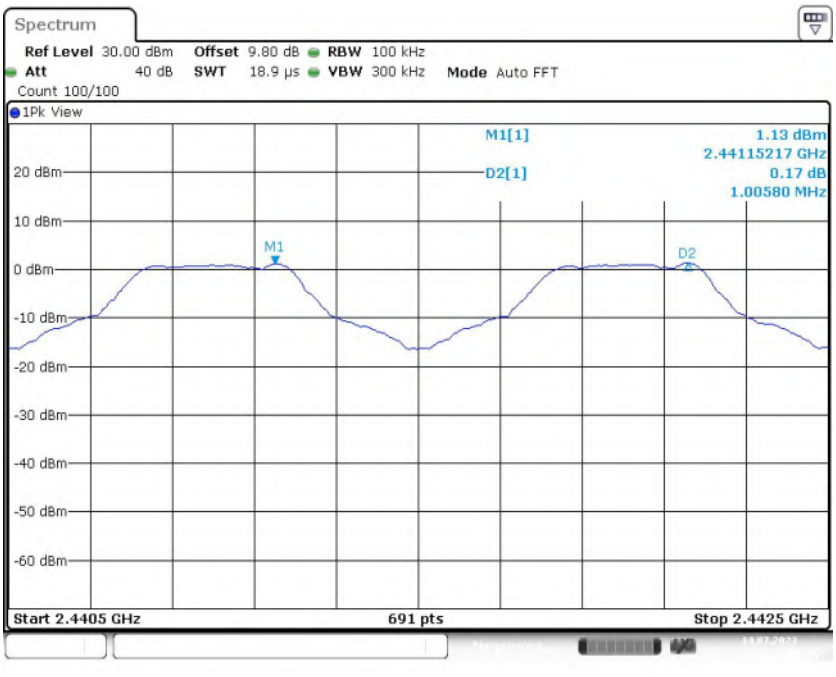


Fig. 68 Carrier Frequency Separation (GFSK, CH39)

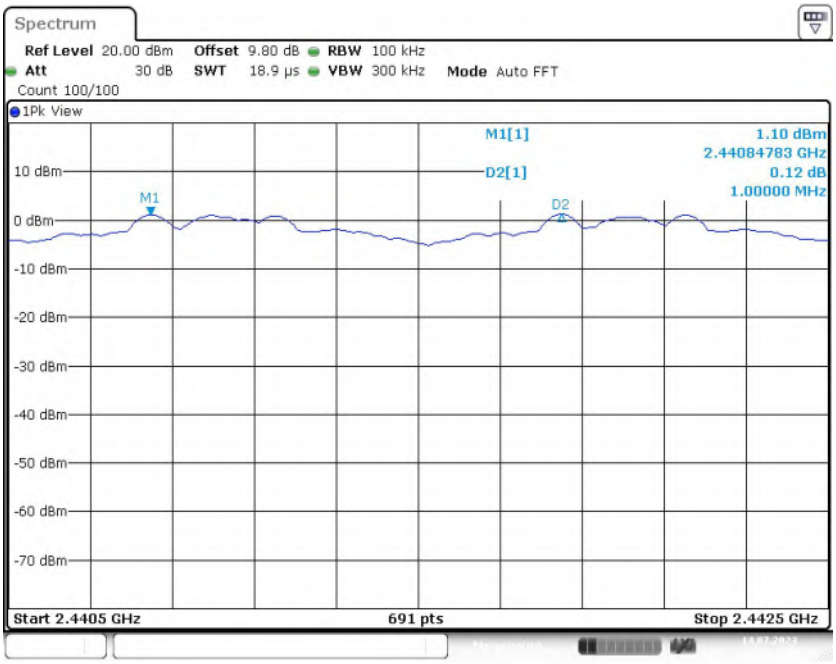


Fig. 69 Carrier Frequency Separation (π/4 DQPSK, CH39)

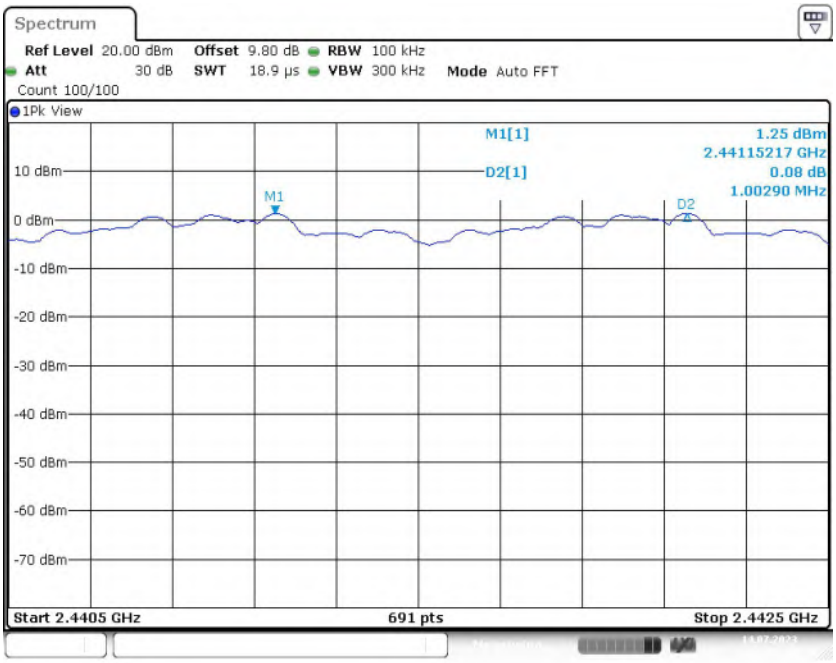


Fig. 70 Carrier Frequency Separation (8DPSK, CH39)

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