

TEST REPORT

For Bluetooth-EDR

Report No. : CHTEW23070052 Report Verification: 
Project No..... : SHT2306085601EW
FCC ID..... : 2AN9S-ABX00022
Applicant's name : Arduino S.r.l.
Address..... : Via Andrea Appiani, 25, 20900 MONZA (Italy)
Product Name : Arduino MKR Vidor 4000
Trade Mark : Arduino
Model No. : ABX00022
Listed Model(s) : -
Standard : FCC CFR Title 47 Part 15 Subpart C § 15.247
Date of receipt of test sample..... : Jun.29, 2023
Date of testing..... : Jun.29, 2023- Jul.17, 2023
Date of issue..... : Jul.18, 2023
Result..... : PASS

Compiled by
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Contents

<u>1.</u>	<u>TEST STANDARDS AND REPORT VERSION</u>	<u>3</u>
1.1.	Test Standards	3
1.2.	Report version	3
<u>2.</u>	<u>TEST DESCRIPTION</u>	<u>4</u>
<u>3.</u>	<u>SUMMARY</u>	<u>5</u>
3.1.	Client Information	5
3.2.	Product Description	5
3.3.	Radio Specification Description	5
3.4.	Testing Laboratory Information	6
<u>4.</u>	<u>TEST CONFIGURATION</u>	<u>7</u>
4.1.	Test frequency list	7
4.2.	Descriptions of Test mode	7
4.3.	Test mode	7
4.4.	Test sample information	8
4.5.	Support unit used in test configuration and system	8
4.6.	Testing environmental condition	8
4.7.	Statement of the measurement uncertainty	9
4.8.	Equipment Used during the Test	10
<u>5.</u>	<u>TEST CONDITIONS AND RESULTS</u>	<u>11</u>
5.1.	Antenna Requirement	11
5.2.	AC Conducted Emission	12
5.3.	Peak Output Power	14
5.4.	20 dB Bandwidth	15
5.5.	99% Occupied Bandwidth	16
5.6.	Carrier Frequencies Separation	17
5.7.	Hopping Channel Number	18
5.8.	Dwell Time	19
5.9.	Duty Cycle Correction Factor (DCCF)	20
5.10.	Pseudorandom Frequency Hopping Sequence	21
5.11.	Conducted Band edge and Spurious Emission	22
5.12.	Radiated Band edge Emission	24
5.13.	Radiated Spurious Emission	26
<u>6.</u>	<u>TEST SETUP PHOTOS</u>	<u>31</u>
<u>7.</u>	<u>EXTERNAL AND INTERNAL PHOTOS</u>	<u>33</u>
7.1.	External Photos	33
7.2.	Internal Photos	35
<u>8.</u>	<u>APPENDIX REPORT</u>	<u>35</u>

1. TEST STANDARDS AND REPORT VERSION

1.1. Test Standards

The tests were performed according to following standards:

- [FCC CFR Title 47 Part 15 Subpart C § 15.247](#): Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz
- [ANSI C63.10:2020](#): American National Standard for Testing Unlicensed Wireless Devices
- [KDB 558074 D01 15.247 Meas Guidance v05r02](#): Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of The FCC Rules

1.2. Report version

Revision No.	Date of issue	Description
N/A	2023-07-18	Original

2. TEST DESCRIPTION

Report clause	Test Items	Standard Requirement	Result	Test Engineer
5.1	Antenna Requirement	15.203/15.247 (c)	PASS	kongyongshu
5.2	AC Conducted Emission	15.207	PASS	Chuanfeng Li
5.3	Peak Output Power	15.247 (b)(1)	PASS	kongyongshu
5.4	20 dB Bandwidth	15.247 (a)(1)	PASS	kongyongshu
5.5	99% Occupied Bandwidth	-	PASS ^{*1}	kongyongshu
5.6	Carrier Frequency Separation	15.247 (a)(1)	PASS	kongyongshu
5.7	Hopping Channel Number	15.247 (a)(1)	PASS	kongyongshu
5.8	Dwell Time	15.247 (a)(1)	PASS	kongyongshu
5.9	Duty Cycle Correction Factor	-	PASS ^{*1}	kongyongshu
5.10	Pseudorandom Frequency Hopping Sequence	15.247(b)(4)	PASS	kongyongshu
5.11	Conducted Band Edge and Spurious Emission	15.247(d)/15.205	PASS	kongyongshu
5.12	Radiated Band Edge Emission	15.205/15.209	PASS	Yi fan Wang
5.13	Radiated Spurious Emission	15.247(d)/15.205/15.209	PASS	Quanhai Deng

Note:

- The measurement uncertainty is not included in the test result.
- ^{*1}: No requirement on standard, only report these test data.

3. SUMMARY

3.1. Client Information

Applicant:	Arduino S.r.l.
Address:	Via Andrea Appiani, 25, 20900 MONZA (Italy)
Manufacturer:	Arduino S.r.l.
Address:	Via Andrea Appiani, 25, 20900 MONZA (Italy)

3.2. Product Description

Main unit information:	
Product Name:	Arduino MKR Vidor 4000
Trade Mark:	Arduino
Model No.:	ABX00022
Listed Model(s):	-
Power supply:	DC 5V
Hardware version:	1.0
Software version:	1.8.13

3.3. Radio Specification Description

Bluetooth version:	V5.0
Support function:	EDR
Modulation:	GFSK, $\pi/4$ DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	PIFA Antenna
Antenna gain:	-3.2dBi

3.4. Testing Laboratory Information

Laboratory Name	Shenzhen Huatongwei International Inspection Co., Ltd.	
Laboratory Location	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China	
Contact information:	Phone: 86-755-26715499 E-mail: cs@szhtw.com.cn http://www.szhtw.com.cn	
Qualifications	Type	Accreditation Number
	FCC	762235

4. TEST CONFIGURATION

4.1. Test frequency list

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channels which were tested. The Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the below blue front.

Channel	Frequency (MHz)
00	2402
01	2403
⋮	⋮
39	2441
⋮	⋮
77	2479
78	2480

4.2. Descriptions of Test mode

Preliminary tests were performed in different data rates and recorded the RF output power in the clause 5.3

Note:

- 1) The manufacturer declare that the maximum power value of the product is set as a default value in the enter test mode software.
- 2) All the test data for each data rate were verified, found 8DPSK Modulation which is worse case mode

4.3. Test mode

For RF test items:			
The engineering test program was provided and enabled to make EUT continuous transmitting.			
Test Item	Modulation / Data Rate		
	GFSK 1Mbps	$\pi/4$ DQPSK 2Mbps	8DPSK 3Mbps
Conducted test item	✓	✓	✓
Radiated test item	-	-	✓
Remark:			
– For radiated test item, the worst mode data rate 3Mbps was reported only, because this data rate has the highest RF output power at preliminary tests.			
– The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.			

4.4. Test sample information

Test item	HTW sample no.
RF Conducted test items	Refer to the description in the appendix report
RF Radiated test items	YPHT23060856002-02
EMI test items	YPHT23060856002

Note:

RF Conducted test items: Peak Output Power, 20 dB Bandwidth, 99% Occupied Bandwidth, Carrier Frequency Separation, Hopping Channel Number, Dwell Time, Duty Cycle Correction Factor, Pseudorandom Frequency Hopping Sequence, Conducted Band Edge and Spurious Emission

RF Radiated test items: Radiated Band Edge Emission, Radiated Spurious Emission

EMI test items: AC Conducted Emission

4.5. Support unit used in test configuration and system

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The following peripheral devices and interface cables were connected during the measurement:

Whether support unit is used?			
✓ Yes			
Item	Equipment	Trade Name	Model No.
1	Laptop	DELL	Vostro 14-3459
2			

4.6. Testing environmental condition

Type	Requirement	Actual
Temperature:	15~35°C	25°C
Relative Humidity:	25~75%	50%
Air Pressure:	860~1060mbar	1000mbar

4.7. Statement of the measurement uncertainty

No.	Test Items	Measurement Uncertainty
1	AC Conducted Emission	3.21dB
2	Peak Output Power	1.07
3	Power Spectral Density	1.07
4	6dB Bandwidth	0.002%
5	99% Occupied Bandwidth	0.002%
6	Duty cycle	-
7	Conducted Band Edge and Spurious Emission	1.68dB
8	Radiated Band Edge Emission	4.54dB for 30MHz-1GHz 5.10dB for above 1GHz
9	Radiated Spurious Emission	4.54dB for 30MHz-1GHz 5.10dB for above 1GHz

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4.8. Equipment Used during the Test

● Conducted test item							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Signal and spectrum Analyzer	R&S	HTWE0242	FSV40	100048	2022/08/25	2023/08/24
●	Signal & Spectrum Analyzer	R&S	HTWE0262	FSW26	103440	2022/08/25	2023/08/24
●	Vector signal generator	R&S	HTWE0244	SMBV100A	260790	2023/05/23	2024/05/22
●	Test software	Tonscend	N/A	JS1120	N/A	N/A	N/A

● Radiated emission- Below 1GHz							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0127	SAC-3m-02	C11121	2018/09/30	2023/09/29
●	EMI Test Receiver	R&S	HTWE0099	ESCI	100900	2022/08/30	2023/08/29
●	Loop Antenna	R&S	HTWE0546	HFH2-Z2E	101073	2021/05/25	2024/05/24
●	Ultra-Broadband Antenna	SCHWARZBECK	HTWE0547	VULB9163	945	2022/05/23	2025/05/22
●	Pre-Amplifier	SCHWARZBECK	HTWE0295	BBV 9742	N/A	2022/11/04	2023/11/03
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-01	N/A	N/A	2023/02/24	2024/02/23
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-02	SUCOFLEX104	501184/4	2023/02/24	2024/02/23
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

● Radiated emission- Above 1GHz							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0122	SAC-3m-01	C11121	2018/09/27	2023/09/26
●	Spectrum Analyzer	R&S	HTWE0098	FSP40	100597	2022/08/25	2023/08/24
●	Horn Antenna	ETS	HTWE0548	3117	240120	2022/05/20	2025/05/19
●	Horn Antenna	STEATITE	HTWE0549	QMS-00880	25661	2022/05/20	2025/05/19
●	Pre-amplifier	CD	HTWE0071	PAP-0102	12004	2022/11/04	2023/11/03
●	Broadband Pre-amplifier	SCHWARZBECK	HTWE0201	BBV 9718	9718-248	2023/02/27	2024/02/26
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-01	6m 18GHz S Serisa	N/A	2023/02/24	2024/02/23
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-02	6m 3GHz RG Serisa	N/A	2023/02/24	2024/02/23
●	RF Connection Cable	HUBER+SUHNER	HTWE0119-05	6m 3GHz RG Serisa	N/A	2023/02/24	2024/02/23
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-04	6m 3GHz RG Serisa	N/A	2023/02/24	2024/02/23
●	Test Software	Audix	N/A	E3	N/A	N/A	N/A

5. TEST CONDITIONS AND RESULTS

5.1. Antenna Requirement

REQUIREMENT

FCC CFR Title 47 Part 15 Subpart C Section 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, 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.

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

The antenna type is a PIFA antenna, Refer to the below antenna photo.



5.2. AC Conducted Emission

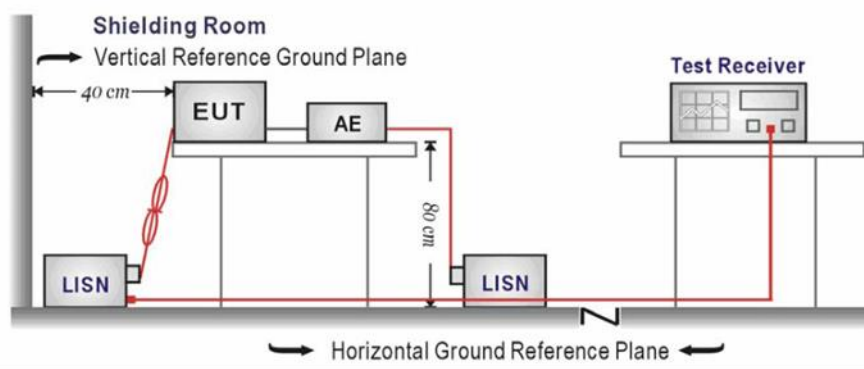
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup according to ANSI C63.10 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

TEST MODE

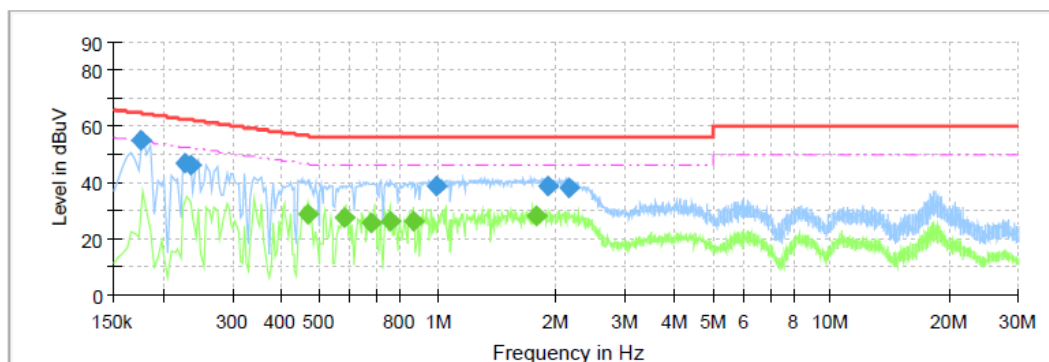
Refer to the clause 4.3

TEST RESULT

☒ Passed ☐ Not Applicable

Test Line:

L

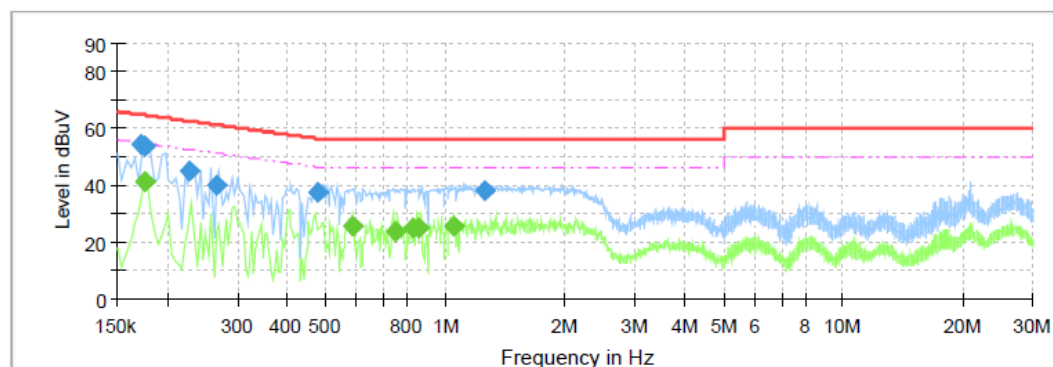


Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Corr. (dB)
0.175500	54.92	---	64.70	9.77	L1	10.0
0.227500	46.66	---	62.54	15.88	L1	10.0
0.235500	46.16	---	62.25	16.09	L1	10.0
0.467500	---	28.91	46.56	17.65	L1	10.0
0.579500	---	27.59	46.00	18.41	L1	10.0
0.679500	---	25.65	46.00	20.35	L1	10.0
0.759500	---	26.21	46.00	19.79	L1	10.0
0.871500	---	26.16	46.00	19.84	L1	10.0
0.987500	38.68	---	56.00	17.32	L1	10.0
1.772500	---	28.05	46.00	17.95	L1	10.0
1.911500	38.92	---	56.00	17.08	L1	10.0
2.159500	38.07	---	56.00	17.93	L1	10.0

Test Line:

N



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Corr. (dB)
0.171500	54.13	---	64.89	10.76	N	10.0
0.175500	53.50	---	64.70	11.20	N	10.0
0.175500	---	41.41	54.70	13.28	N	10.0
0.227500	44.70	---	62.54	17.84	N	10.0
0.267500	40.08	---	61.20	21.12	N	10.0
0.479500	37.65	---	56.35	18.70	N	10.0
0.587500	---	25.81	46.00	20.19	N	10.0
0.747500	---	23.66	46.00	22.34	N	10.0
0.827500	---	24.93	46.00	21.07	N	10.0
0.859500	---	25.11	46.00	20.89	N	10.0
1.051500	---	25.46	46.00	20.54	N	10.0
1.259500	37.88	---	56.00	18.12	N	10.0

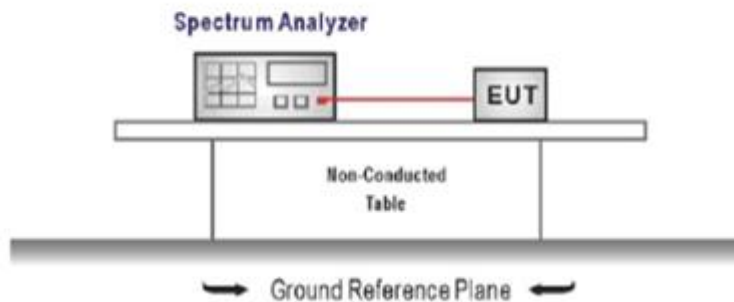
5.3. Peak Output Power

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(1):

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt.
For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the pathloss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW $\geq$ the 20 dB bandwidth of the emission being measured, VBW $\geq$ RBW
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE

Refer to the clause 4.3

TEST RESULT

☒ Passed ☐ Not Applicable

TEST DATA

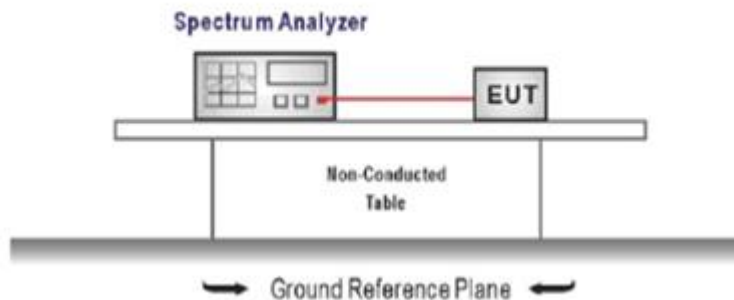
Refer to the appendix report

5.4. 20 dB Bandwidth

LIMIT

N/A

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW $\geq$ 1% of the 20 dB bandwidth, VBW $\geq$ RBW
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE

Refer to the clause 4.3

TEST RESULT

☒ Passed ☐ Not Applicable

TEST DATA

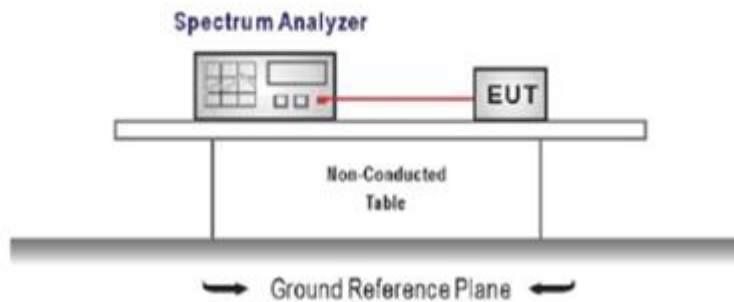
Refer to the appendix report

5.5. 99% Occupied Bandwidth

LIMIT

N/A

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).
Center Frequency = channel center frequency
Span $\geq 1.5 \times \text{OBW}$
RBW = 1%~5%OBW
VBW $\geq 3 \times \text{RBW}$
Sweep time = auto couple
Detector = Peak
Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.

TEST MODE

Refer to the clause 4.3

TEST RESULT

☒ Passed ☐ Not Applicable

TEST DATA

Refer to the appendix report

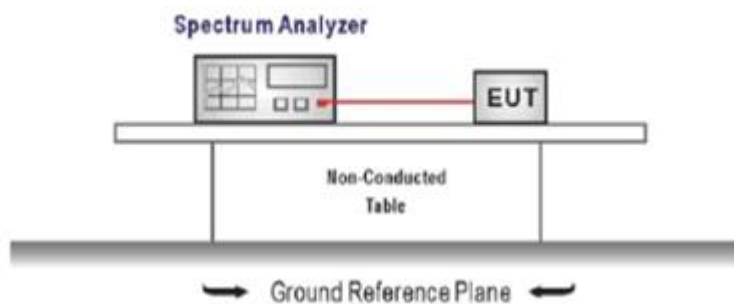
5.6. Carrier Frequencies Separation

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):

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

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels
RBW $\geq$ 1% of the span, VBW $\geq$ RBW
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE

Refer to the clause 4.3

TEST RESULTS

☒ Passed ☐ Not Applicable

TEST DATA

Refer to the appendix report

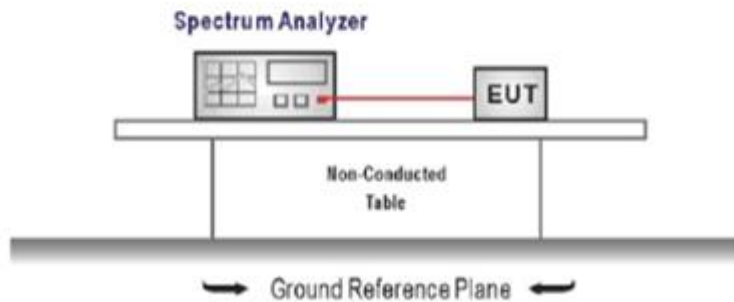
5.7. Hopping Channel Number

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least **15** channels.

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
Span = the frequency band of operation
RBW $\geq$ 1% of the span, VBW $\geq$ RBW
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE

Refer to the clause 4.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

TEST DATA

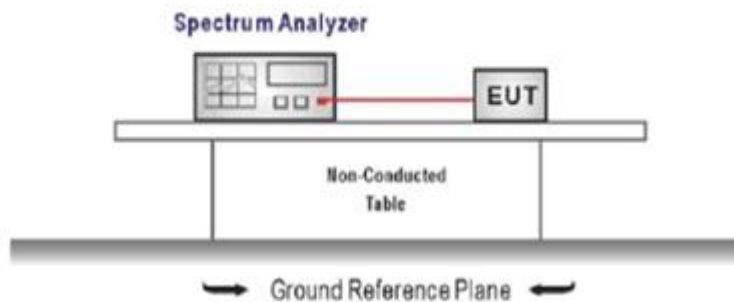
Refer to the appendix report

5.8. Dwell Time

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1): The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
Span = zero span, centered on a hopping channel, RBW= 1 MHz, VBW $\geq$ RBW
Sweep = as necessary to capture the entire dwell time per hopping channel,
Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE

Refer to the clause 4.3

TEST RESULTS

☒ Passed ☐ Not Applicable

TEST DATA

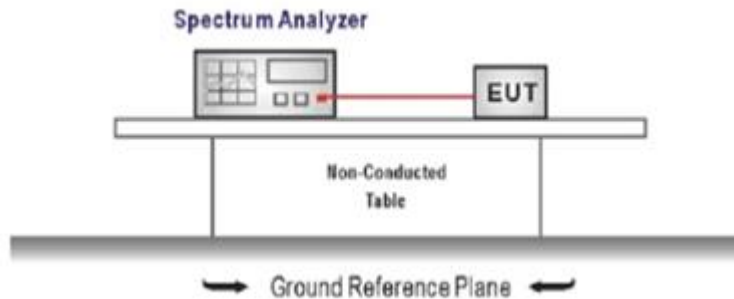
Refer to the appendix report

5.9. Duty Cycle Correction Factor (DCCF)

LIMIT

N/A

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
Span = zero span, centered on a hopping channel, RBW= 1 MHz, VBW $\geq$ RBW
Sweep = as necessary to capture the entire dwell time per hopping channel,
Detector function = peak, Trigger mode
4. Measure and record the duty cycle data

TEST MODE

Refer to the clause 4.3

TEST DATA

Refer to the appendix report

5.10. Pseudorandom Frequency Hopping Sequence

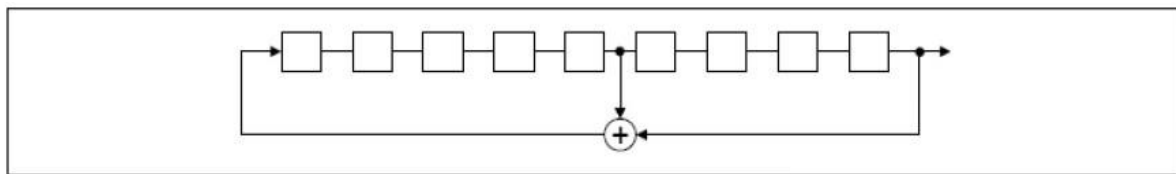
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo-randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

TEST RESULTS

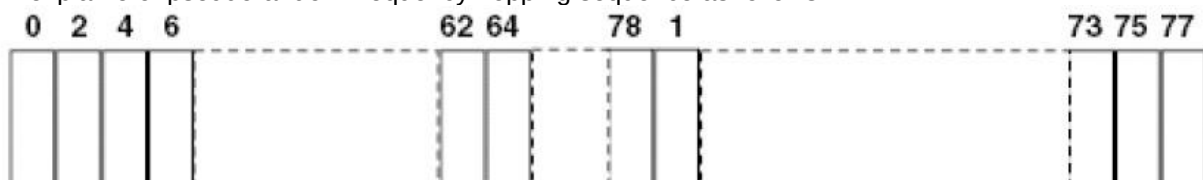
The pseudorandom frequency hopping sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: $2^9 - 1 = 511$ bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of pseudorandom frequency hopping sequence as follows:



Each frequency used equally on the average by each transmitter.

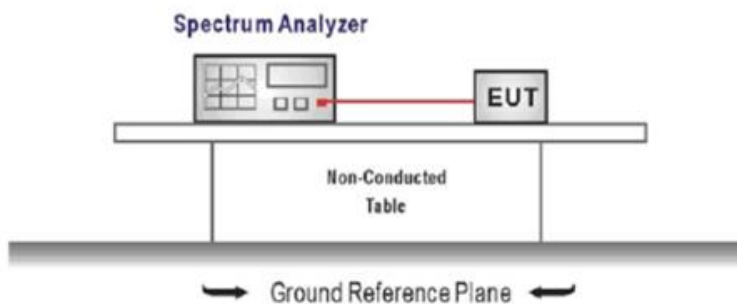
The system receiver has input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

5.11. Conducted Band edge and Spurious Emission

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Emission level measurement
Set the center frequency and span to encompass frequency range to be measured
RBW = 100 kHz, VBW $\geq 3 \times$ RBW
Detector = peak, Sweep time = auto couple, Trace mode = max hold
Allow trace to fully stabilize
Use the peak marker function to determine the maximum amplitude level.
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.
4. Ensure that the amplitude of all unwanted emission outside of the authorized frequency band excluding restricted frequency bands) are attenuated by at least the minimum requirements specified (at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz). Report the three highest emission relative to the limit.

TEST MODE

Refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

TEST DATA

Refer to the appendix report

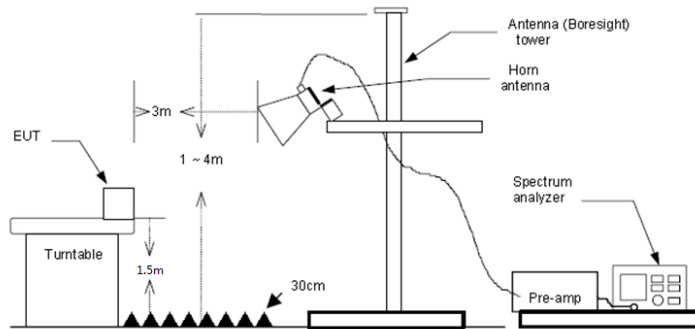
5.12. Radiated Band edge Emission

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, Radiated Emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the Radiated Emissions limits specified in §15.209(a) (see §15.205(c)).

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10 .
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10 on radiated measurement.
5. Use the following spectrum analyzer settings:
 - a) Span shall wide enough to fully capture the emission being measured
 - b) Set RBW=100kHz for <1GHz, VBW=3*RBW, Sweep time=auto, Detector=peak, Trace=max hold
 - c) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurementFor average measurement: use duty cycle correction factor method (DCCF)
Averager level = Peak level + DCCF

TEST MODE

Refer to the clause 4.3

TEST RESULT

☒ Passed ☐ Not Applicable

Note:

- 1) Level= Reading + Factor; Factor =Antenna Factor+ Cable Loss- Preamp Factor
- 2) Over Limit = Level- Limit
- 3) Average measurement was not performed if peak level is lower than average limit(54 dBuV/m).

Test channel:		CH00		Polarity			Horizontal		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	2310.00	48.65	27.86	4.01	37.56	42.96	74.00	-31.04	Peak
2	2390.03	56.45	27.54	4.31	37.45	50.85	74.00	-23.15	Peak

Test channel:		CH00		Polarity			Vertical		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	2310.00	47.32	27.86	4.01	37.56	41.63	74.00	-32.37	Peak
2	2390.03	55.26	27.54	4.31	37.45	49.66	74.00	-24.34	Peak

Test channel:		CH78		Polarity			Horizontal		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	2483.50	56.09	27.33	4.18	37.26	50.34	74.00	-23.66	Peak
2	2489.07	60.16	27.32	4.18	37.26	54.40	74.00	-19.60	Peak
3	2500.00	48.93	27.30	4.19	37.26	43.16	74.00	-30.84	Peak
Test channel:		CH78		Polarity			Horizontal		
Frequency (MHz)	Read Level (dBuV/m)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Test value	
2489.07	29.58	27.32	4.18	37.26	23.82	54.00	-30.18	Average	

Test channel:		CH78		Polarity			Vertical		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	2483.50	57.17	27.33	4.18	37.26	51.42	74.00	-22.58	Peak
2	2488.97	59.61	27.32	4.18	37.26	53.85	74.00	-20.15	Peak
3	2500.00	49.15	27.30	4.19	37.26	43.38	74.00	-30.62	Peak
Test channel:		CH78		Polarity			Horizontal		
Frequency (MHz)	Read Level (dBuV/m)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Test value	
2483.50	26.60	27.33	4.18	37.26	20.85	54.00	-33.15	Average	
2488.97	29.03	27.32	4.18	37.26	23.27	54.00	-30.73	Average	

5.13. Radiated Spurious Emission

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

Frequency	Limit (dBuV/m)	Value
0.009 MHz ~0.49 MHz	2400/F(kHz) @300m	Quasi-peak
0.49 MHz ~ 1.705 MHz	24000/F(kHz) @30m	Quasi-peak
1.705 MHz ~30 MHz	30 @30m	Quasi-peak

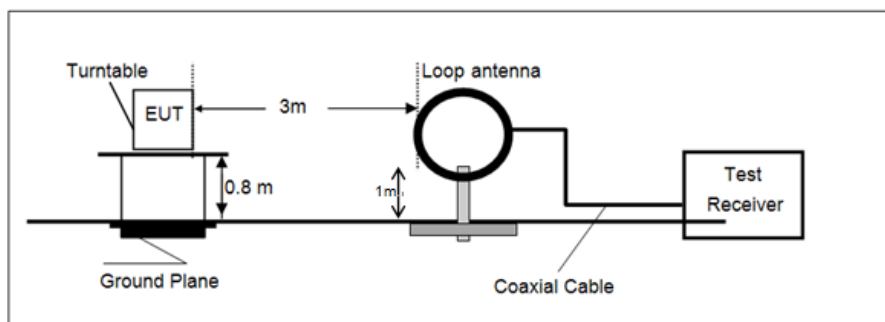
Note: Limit dBuV/m @3m = Limit dBuV/m @300m + 40*log(300/3)= Limit dBuV/m @300m +80,

Limit dBuV/m @3m = Limit dBuV/m @30m +40*log(30/3)= Limit dBuV/m @30m + 40.

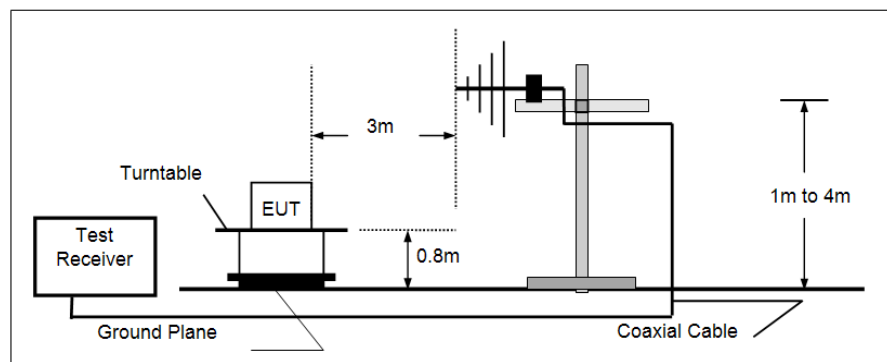
Frequency	Limit (dBuV/m @3m)	Value
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz~1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

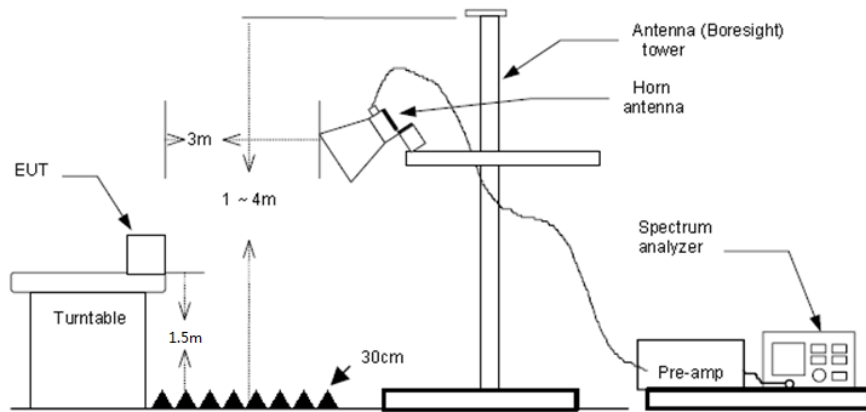
- 9 kHz ~ 30 MHz



- 30 MHz ~ 1 GHz



- Above 1 GHz



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10.
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
 - a) Span shall wide enough to fully capture the emission being measured;
 - b) Below 1 GHz:

RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;

If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
 - c) Set RBW=1MHz, VBW=3MHz for >1GHz, Sweep time=auto, Detector=peak, Trace=max hold for Peak measurement

For average measurement: use duty cycle correction factor method (DCCF)

Averager level = Peak level + DCCF

TEST MODE

Refer to the clause 4.3

TEST RESULT

☒ **Passed** ☐ **Not Applicable**

Note:

- 1) Level= Reading + Factor/Transd; Factor/Transd =Antenna Factor+ Cable Loss- Preamp Factor
- 2) Over Limit = Level– Limit
- 3) Average measurement was not performed if peak level is lower than average limit(54 dBuV/m) for above 1GHz.

For 9 kHz ~ 30 MHz

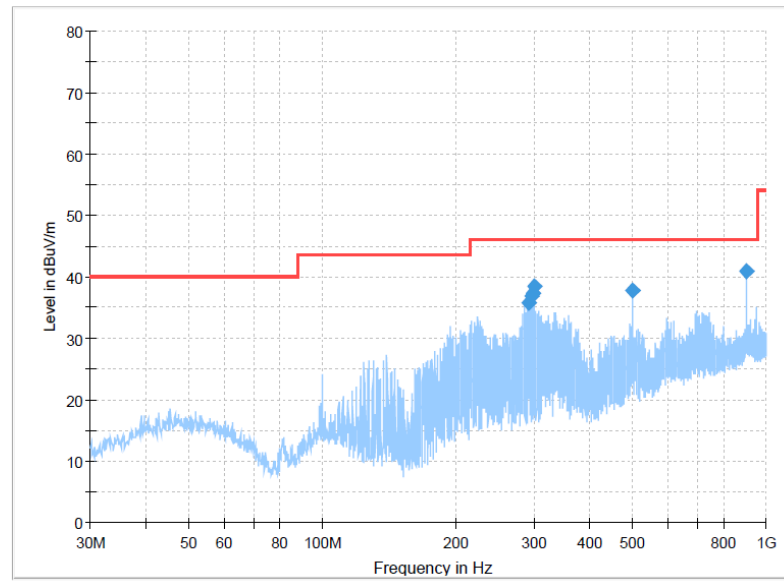
The EUT was pre-scanned this frequency band, found the radiated level 20dB lower than the limit, so don't show data on this report.

For 30 MHz ~ 1000 MHz

Have pre-scan all test channel, found CH39 which it was worst case, so only show the worst case's data on this report.

Polarization:

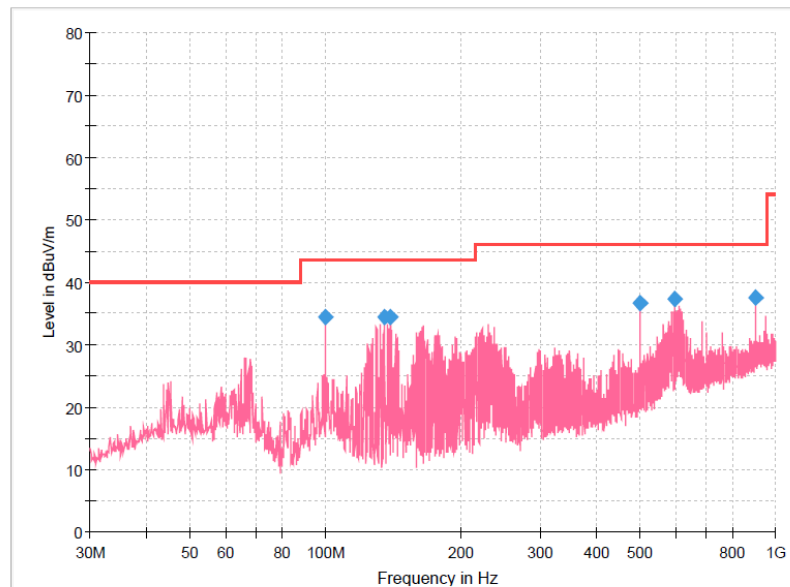
Horizontal

**Final Result**

Frequency (MHz)	MaxPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
292.142500	35.73	46.00	10.27	100.0	H	140.0	-7.6
294.810000	36.93	46.00	9.07	100.0	H	140.0	-7.5
297.477500	37.23	46.00	8.77	100.0	H	140.0	-7.5
300.023750	38.45	46.00	7.55	100.0	H	140.0	-7.4
500.086250	37.83	46.00	8.17	100.0	H	218.0	-2.0
900.332500	40.96	46.00	5.04	100.0	H	218.0	6.7

Polarization:

Vertical

**Final Result**

Frequency (MHz)	MaxPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
99.961250	34.31	43.50	9.19	100.0	V	299.0	-10.7
135.608750	34.46	43.50	9.04	100.0	V	98.0	-14.3
139.731250	34.40	43.50	9.10	100.0	V	161.0	-14.3
500.207500	36.73	46.00	9.27	100.0	V	146.0	-2.0
594.782500	37.39	46.00	8.61	100.0	V	200.0	0.9
899.968750	37.47	46.00	8.53	100.0	V	200.0	6.6

For 1 GHz ~ 25 GHz

Test channel		CH00			Polarity			Horizontal		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Aux dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	3200.50	44.35	28.90	4.84	36.98	0.00	41.11	74.00	-32.89	Peak
2	4797.27	37.70	31.29	5.99	35.32	0.00	39.66	74.00	-34.34	Peak
3	8002.06	34.99	37.00	8.00	33.31	0.00	46.68	74.00	-27.32	Peak
4	11545.04	33.69	40.41	10.39	36.37	0.00	48.12	74.00	-25.88	Peak

Test channel		CH39			Polarity			Horizontal		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Aux dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	3993.90	39.77	29.79	5.62	36.37	0.00	38.81	74.00	-35.19	Peak
2	5762.24	43.69	31.92	6.66	34.86	0.00	47.41	74.00	-26.59	Peak
3	8063.40	34.17	37.00	8.19	33.32	0.00	46.04	74.00	-27.96	Peak
4	10999.95	35.45	40.50	10.00	36.67	0.00	49.28	74.00	-24.72	Peak

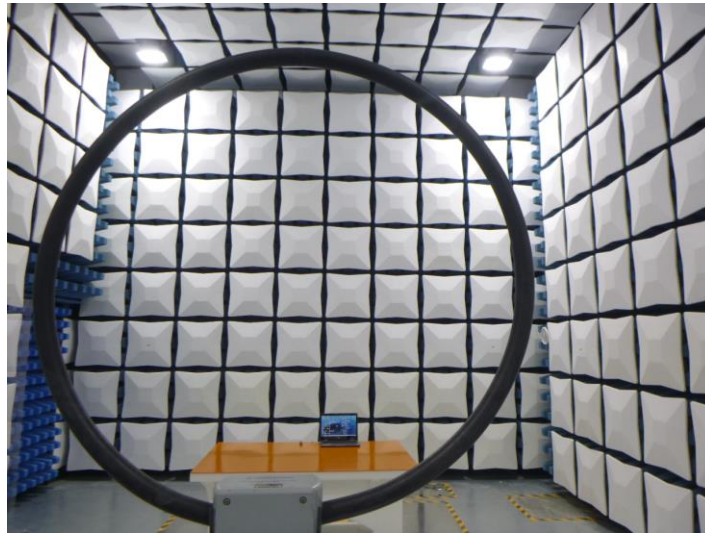
Test channel		CH39			Polarity			Vertical		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Aux dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	4149.35	38.43	29.90	5.76	36.25	0.00	37.84	74.00	-36.16	Peak
2	5762.24	43.47	31.92	6.66	34.86	0.00	47.19	74.00	-26.81	Peak
3	8063.40	34.59	37.00	8.19	33.32	0.00	46.46	74.00	-27.54	Peak
4	11574.46	32.82	40.35	10.41	36.38	0.00	47.20	74.00	-26.80	Peak

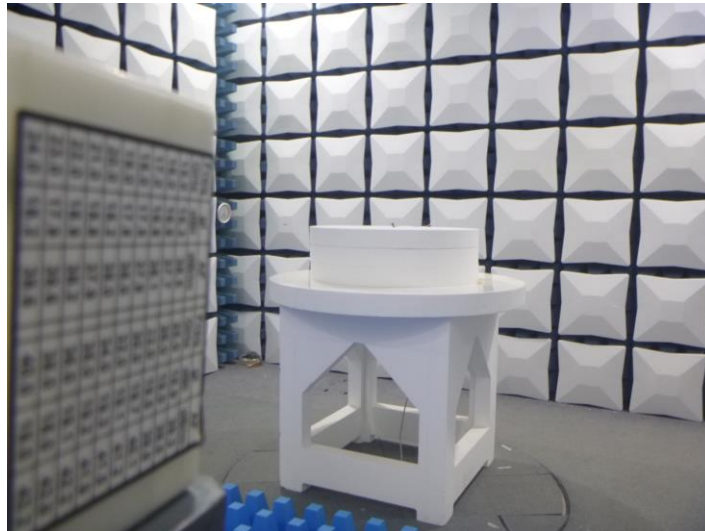
Test channel		CH78			Polarity			Horizontal		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Aux dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	4223.95	37.86	29.95	5.79	36.07	0.00	37.53	74.00	-36.47	Peak
2	6956.63	33.51	34.93	7.35	34.09	0.00	41.70	74.00	-32.30	Peak
3	9275.16	33.68	39.15	9.24	36.22	0.00	45.85	74.00	-28.15	Peak
4	10888.51	32.83	40.48	9.95	36.76	0.00	46.50	74.00	-27.50	Peak

Test channel		CH78			Polarity			Vertical		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Aux dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	3308.19	46.57	28.30	4.85	36.84	0.00	42.88	74.00	-31.12	Peak
2	5762.24	43.79	31.92	6.66	34.86	0.00	47.51	74.00	-26.49	Peak
3	8063.40	34.69	37.00	8.19	33.32	0.00	46.56	74.00	-27.44	Peak
4	10999.95	35.37	40.50	10.00	36.67	0.00	49.20	74.00	-24.80	Peak

6. TEST SETUP PHOTOS

Radiated Emission



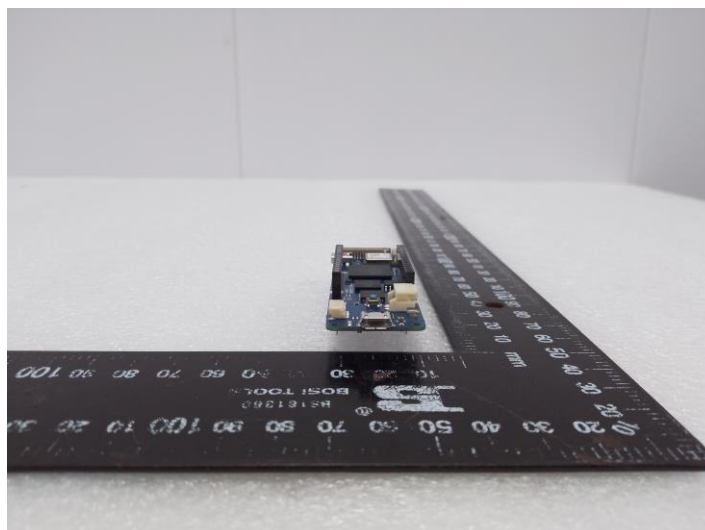
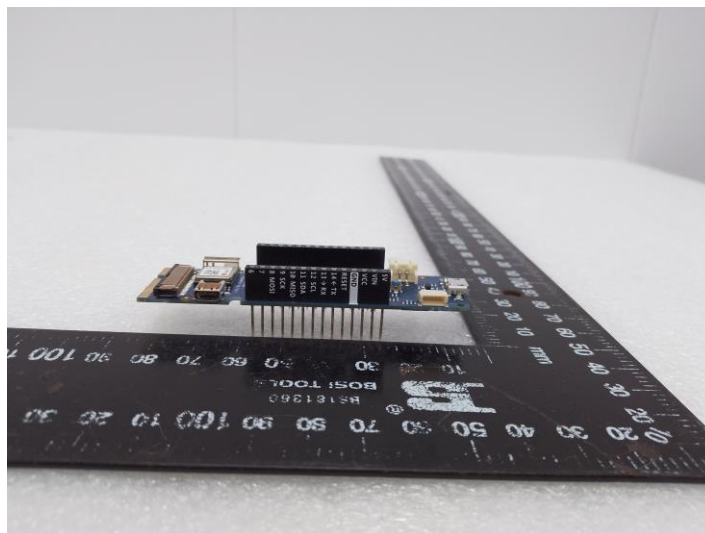
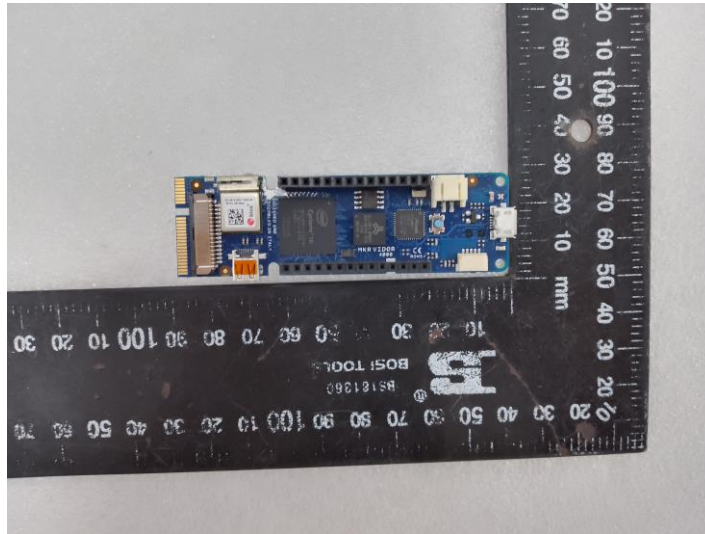


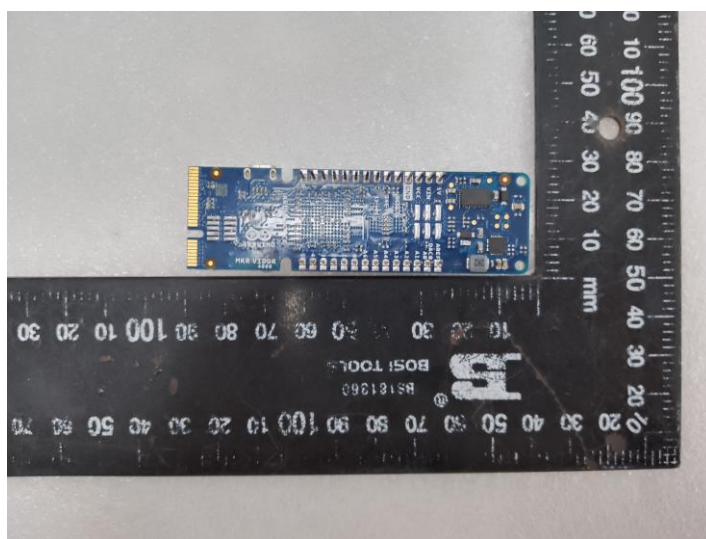
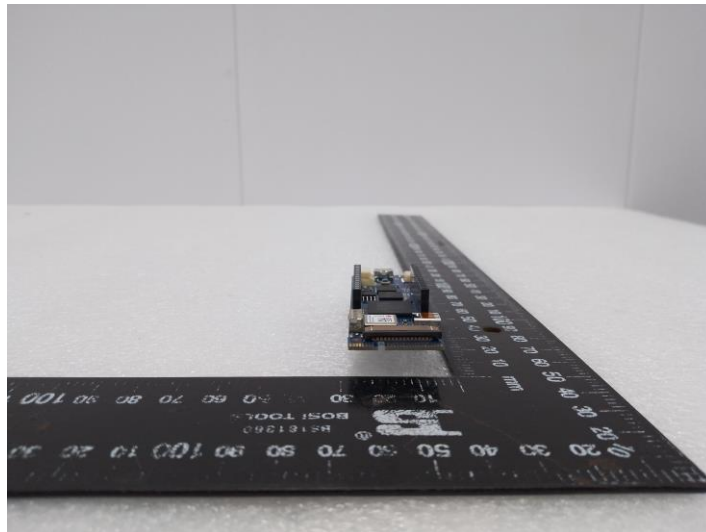
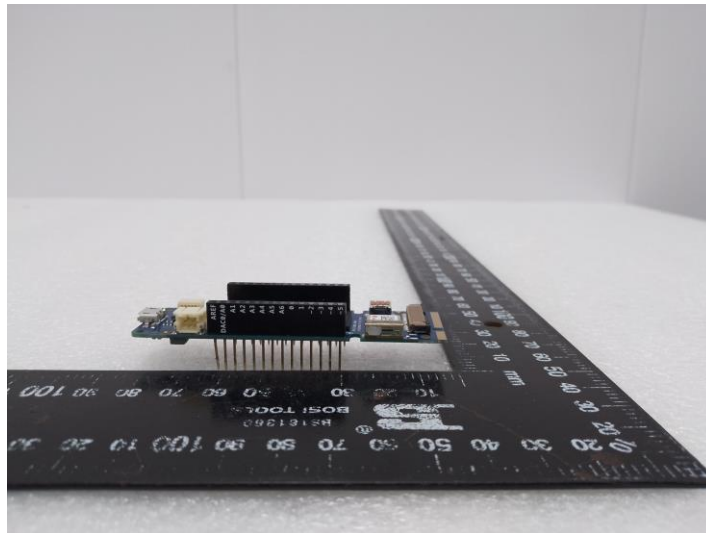
AC Conducted Emission



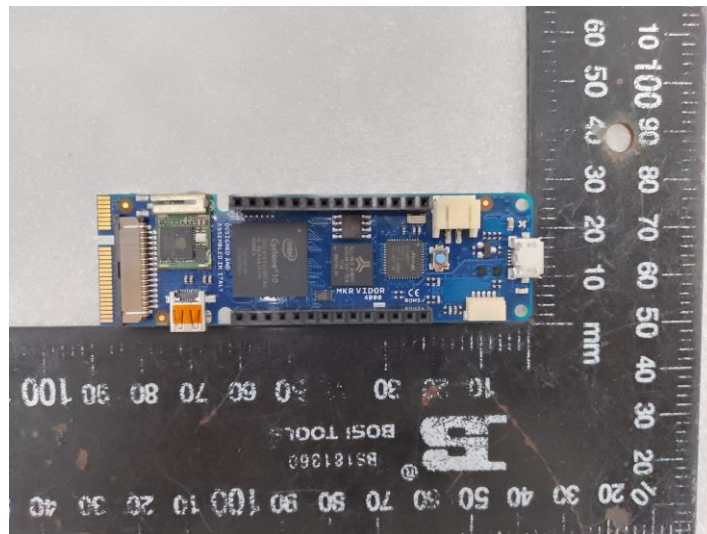
7. EXTERNAL AND INTERNAL PHOTOS

7.1. External Photos





7.2. Internal Photos



8. APPENDIX REPORT

APPENDIX REPORT

Project No.	SHT2306085601EW	Radio Specification	Bluetooth EDR
Test sample No.	YPHT23060856002-01	Model No.	ABX00022
Start test date	2023/07/10	Finish date	2023/07/10
Temperature	24.1℃	Humidity	46%
Test Engineer	kongyongshu	Auditor	Xiaodong Zhao

Appendix clause	Test item	Result
A	Peak Output Power	PASS
B	20 dB Bandwidth	PASS
C	99% Occupied Bandwidth	PASS
D	Carrier Frequencies Separation	PASS
E	Hopping Channel Number	PASS
F	Dwell Time	PASS
G	Duty Cycle Correction Factor (DCCF)	PASS
H	Band edge and Spurious Emissions(coducted)	PASS

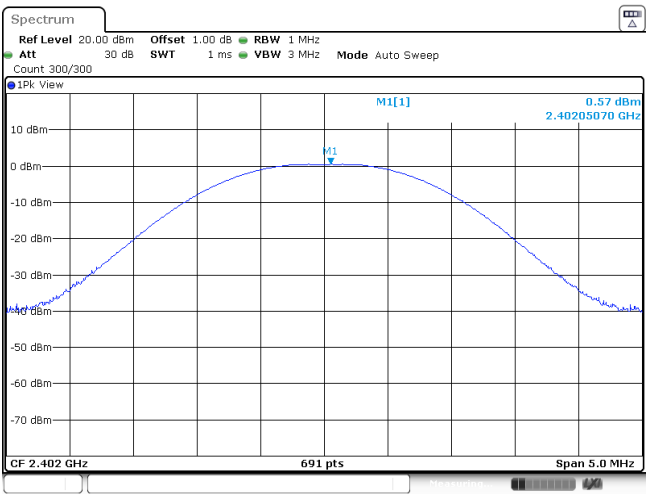
Appendix A: Peak Output Power

Modulation type	Channel	Peak Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
GFSK	00	0.57	0.52	≤ 30.00	Pass
	39	1.14	1.09		
	78	0.43	0.38		
$\pi/4$ DQPSK	00	3.13	2.72	≤ 21.00	Pass
	39	4.01	3.76		
	78	3.43	2.86		
8DPSK	00	3.91	3.41	≤ 21.00	Pass
	39	4.42	3.92		
	78	3.89	3.41		

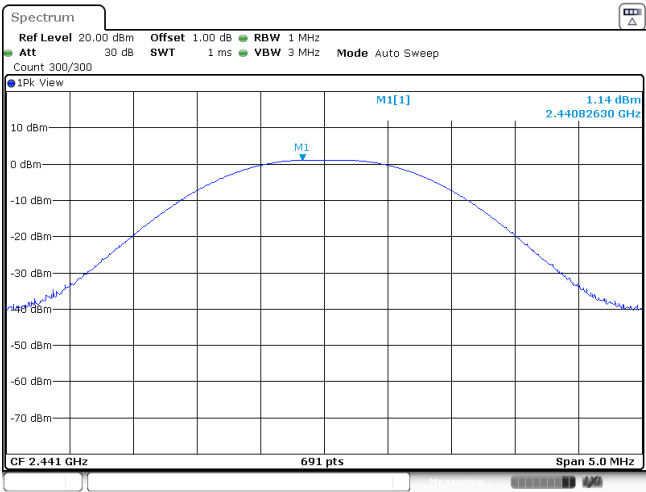
Modulation Type:

GFSK

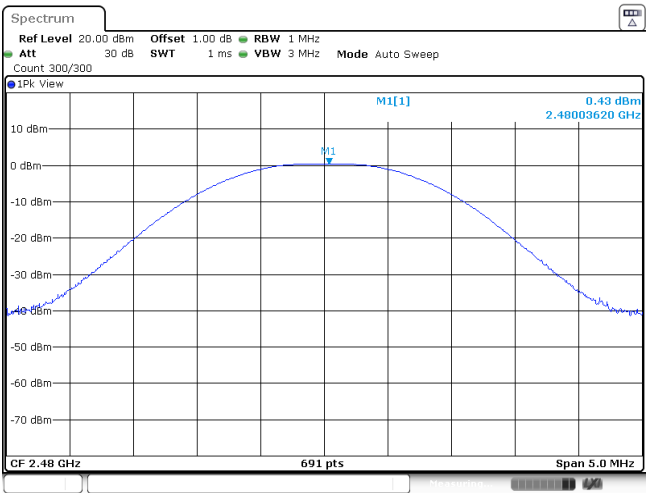
CH00



CH39



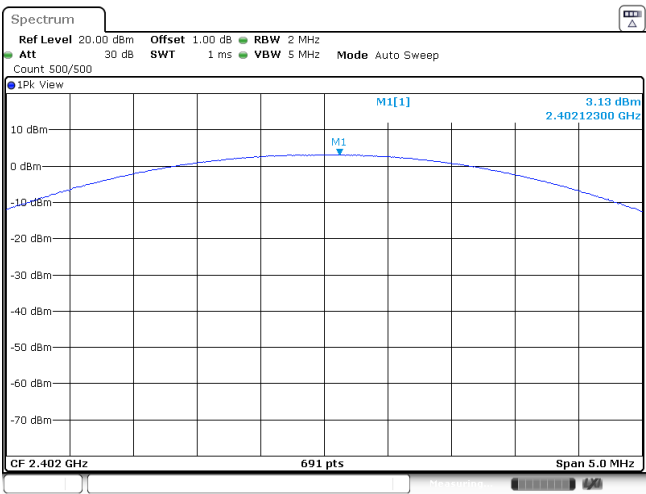
CH78



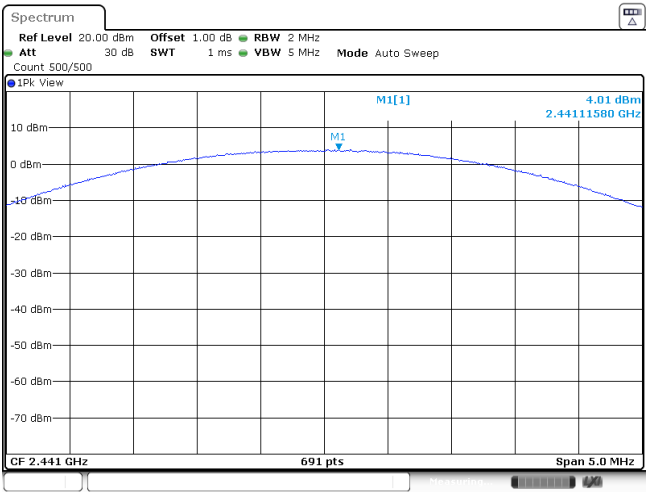
Modulation Type:

$\pi/4$ DQPSK

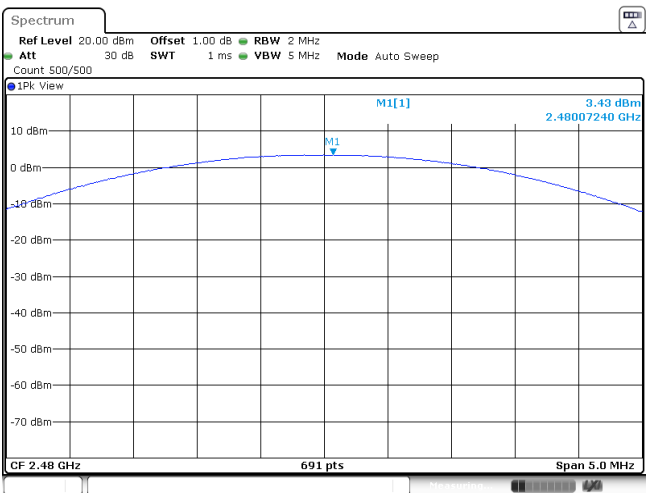
CH00



CH39



CH78



Appendix report page: 5 of 41

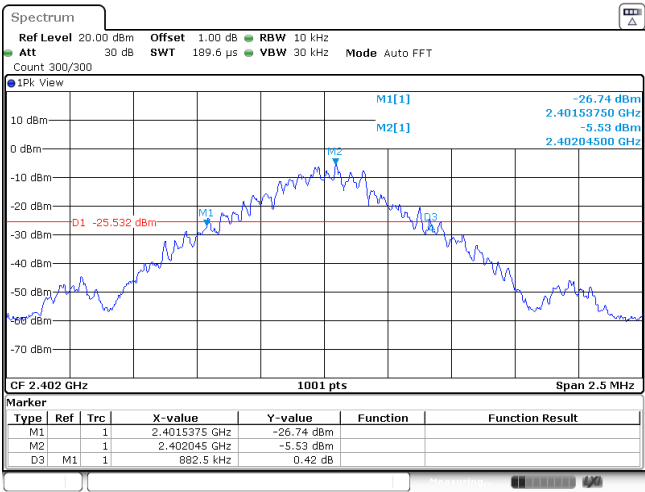
Appendix B : 20 dB Bandwidth

Modulation type	Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
GFSK	00	882.50	-	Pass
	39	882.50		
	78	882.50		
$\pi/4$ DQPSK	00	1325.00	-	Pass
	39	1327.50		
	78	1327.50		
8DPSK	00	1310.00	-	Pass
	39	1310.00		
	78	1310.00		

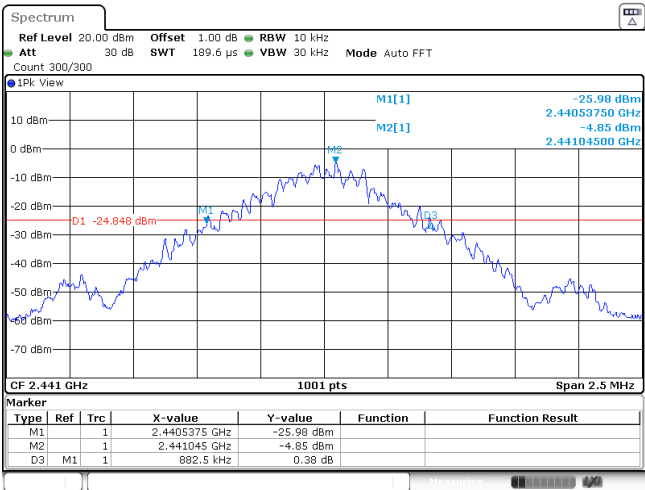
Modulation Type:

GFSK

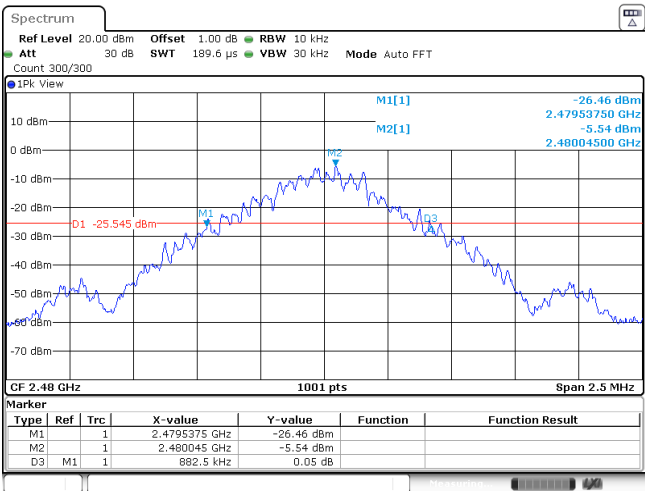
CH00



CH39



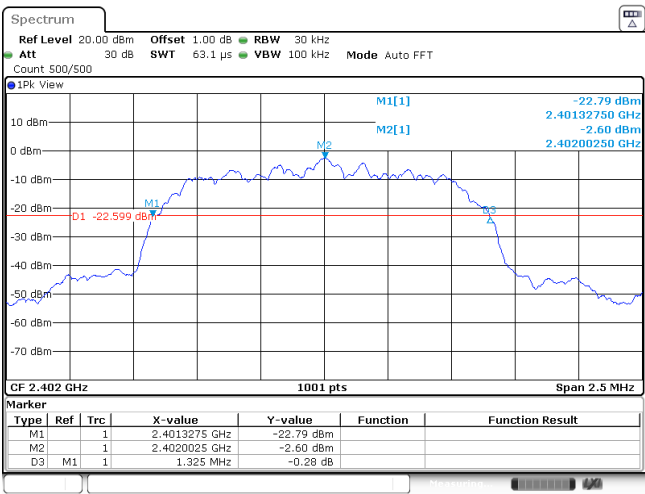
CH78



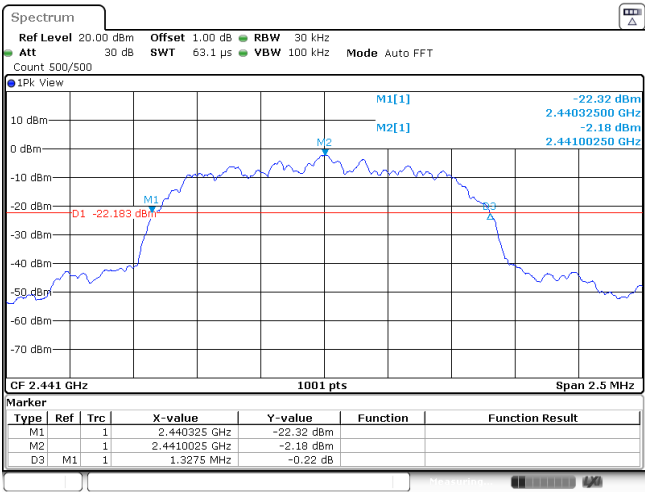
Modulation Type:

π /4DQPSK

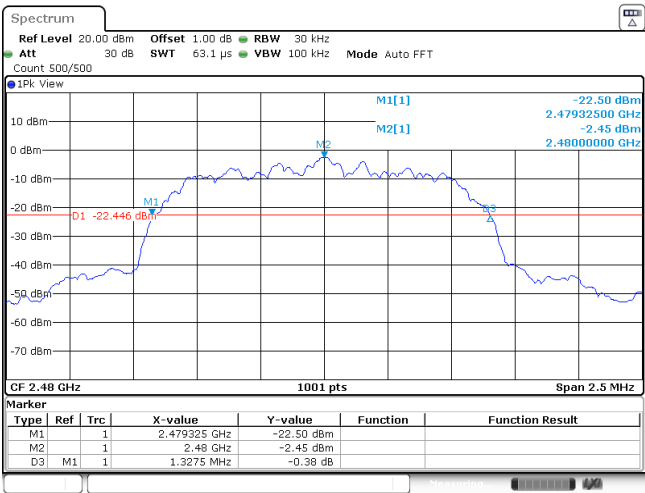
CH00



CH39



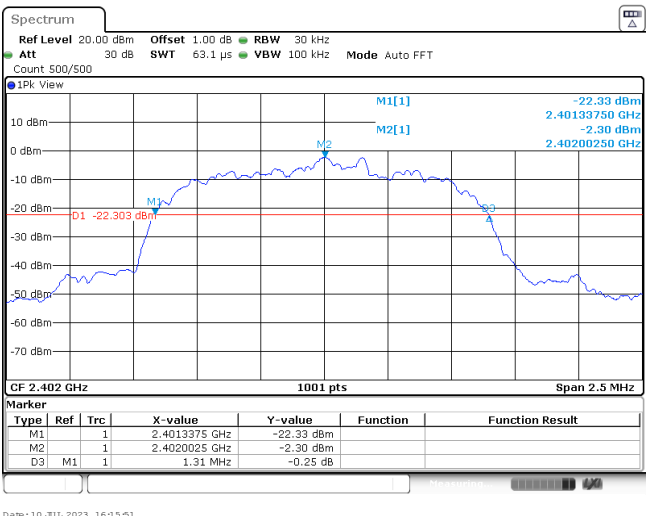
CH78



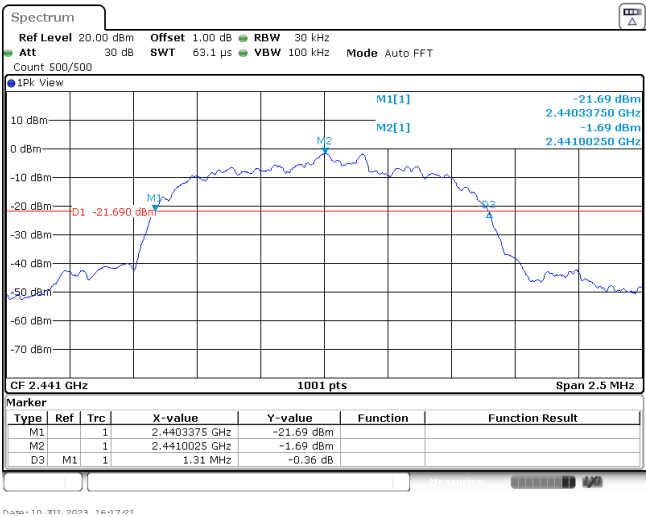
Modulation Type:

8DPSK

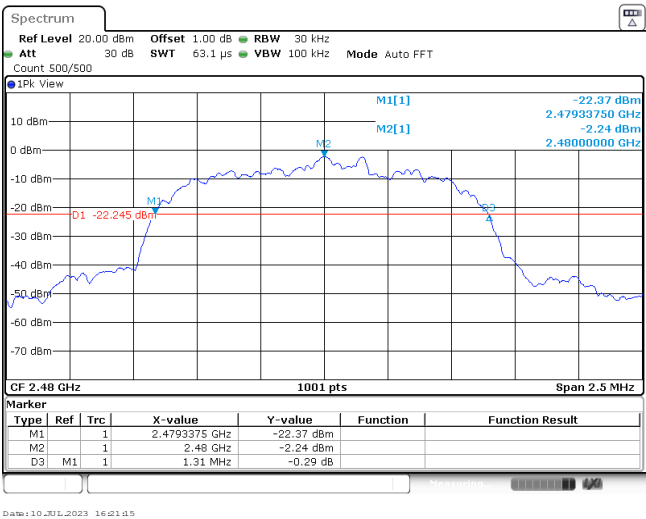
CH00



CH39



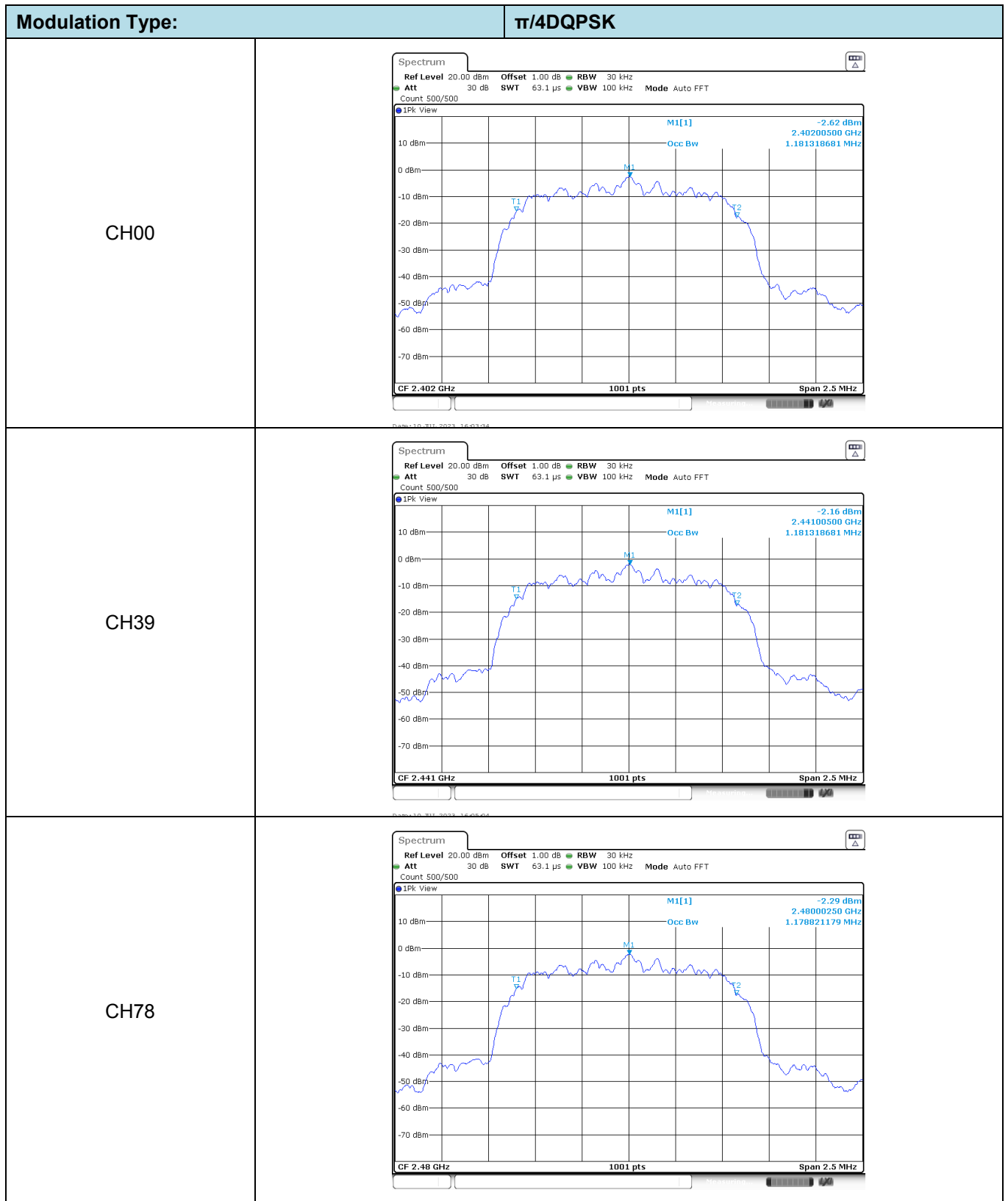
CH78

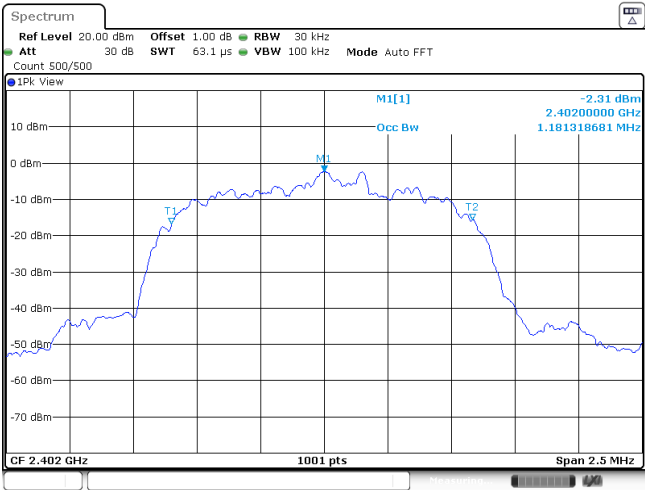
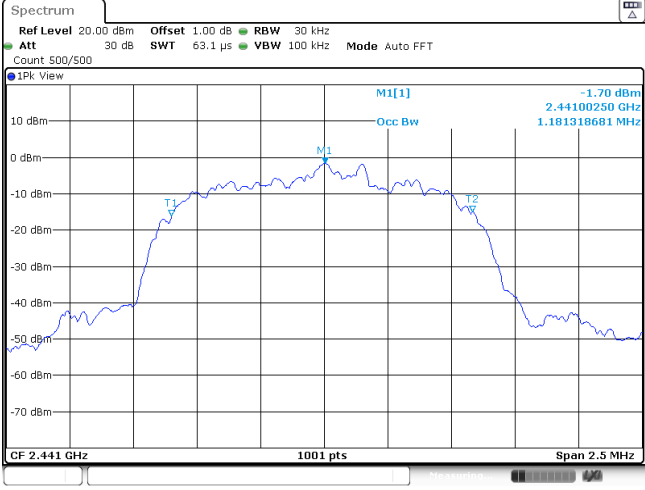
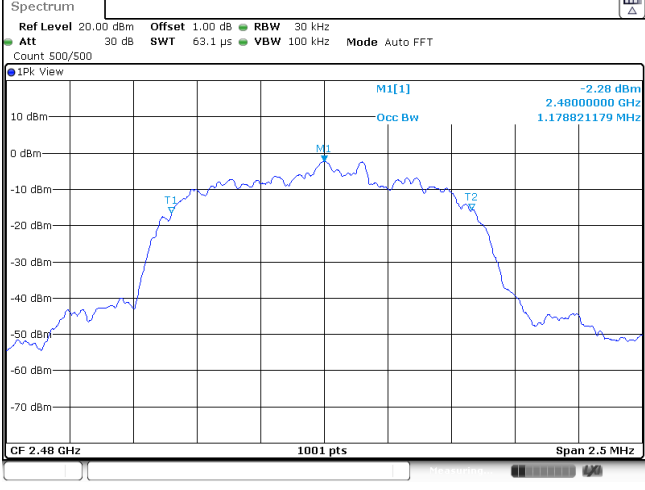


Appendix C: 99% Occupied Bandwidth

Modulation type	Channel	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
GFSK	00	0.84	-	Pass
	39	0.84		
	78	0.84		
$\pi/4$ DQPSK	00	1.18	-	Pass
	39	1.18		
	78	1.18		
8DPSK	00	1.18	-	Pass
	39	1.18		
	78	1.18		

Appendix report page: 11 of 41



Modulation Type: 8DPSK	
CH00	 Spectrum plot for CH00. The plot shows a signal centered at 2.402 GHz. The peak level is -2.31 dBm. The plot includes frequency markers T1, M1, and T2, and a span of 2.5 MHz.
CH39	 Spectrum plot for CH39. The plot shows a signal centered at 2.441 GHz. The peak level is -1.70 dBm. The plot includes frequency markers T1, M1, and T2, and a span of 2.5 MHz.
CH78	 Spectrum plot for CH78. The plot shows a signal centered at 2.48 GHz. The peak level is -2.28 dBm. The plot includes frequency markers T1, M1, and T2, and a span of 2.5 MHz.

Appendix D: Carrier Frequencies Separation

Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (kHz) *	Result
GFSK	39	1.00	≥882.50	Pass
π/4DQPSK	39	1.00	≥885.00	Pass
8DPSK	39	1.00	≥873.33	Pass

Note:

*: GFSK limit = The maximum 20 dB Bandwidth for GFSK modulation on the appendix B.

π/4DQPSK limit = 2/3 * The maximum 20 dB Bandwidth for π/4DQPSK modulation on the appendix B.

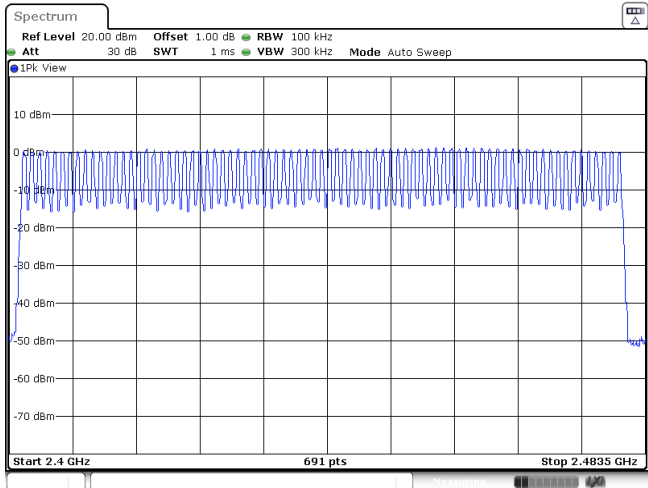
8DPSK limit = 2/3 * The maximum 20 dB Bandwidth for 8DPSK modulation on the appendix B

GFSK	Spectrum Ref Level 20.00 dBm Att 30 dB Offset 1.00 dB RBW 30 kHz SWT 63.2 μs VBW 100 kHz Mode Auto FFT Count 100/100 1Pk View M1 M1[1] D1 D1[1] -1.55 dBm 2.44096522 GHz -0.24 dB 1.00801 MHz 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm Start 2.44 GHz 691 pts Stop 2.443 GHz Date: 10.01.2023 15:38:51
π /4DQPSK	Spectrum Ref Level 20.00 dBm Att 30 dB Offset 1.00 dB RBW 30 kHz SWT 63.2 μs VBW 100 kHz Mode Auto FFT Count 100/100 1Pk View M1 M1[1] D1 D1[1] -2.54 dBm 2.44100435 GHz 0.04 dB 1.00000 MHz 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm Start 2.44 GHz 691 pts Stop 2.443 GHz Date: 10.01.2023 15:40:22
8DPSK	Spectrum Ref Level 20.00 dBm Att 30 dB Offset 1.00 dB RBW 30 kHz SWT 63.2 μs VBW 100 kHz Mode Auto FFT Count 100/100 1Pk View M1 M1[1] D1 D1[1] -2.02 dBm 2.44100000 GHz -0.02 dB 1.00435 MHz 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm Start 2.44 GHz 691 pts Stop 2.443 GHz Date: 10.01.2023 15:41:47

Appendix E: Hopping Channel Number

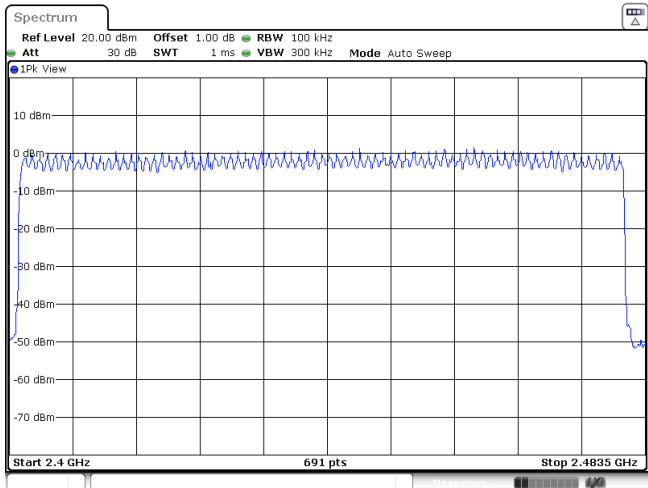
Modulation type	Channel number	Limit	Result
GFSK	79	≥15.00	Pass
π/4DQPSK	79		
8DPSK	79		

GFSK



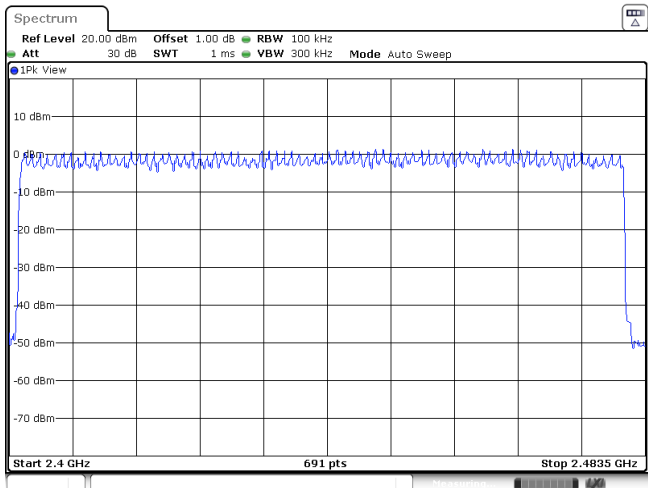
Date: 10 JUL 2023 15:42:23

$\pi/4$ DQPSK



Date: 10 JUL 2023 15:44:41

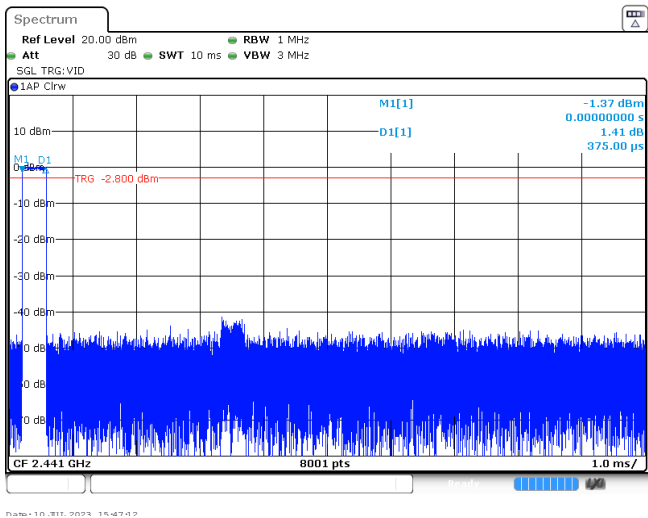
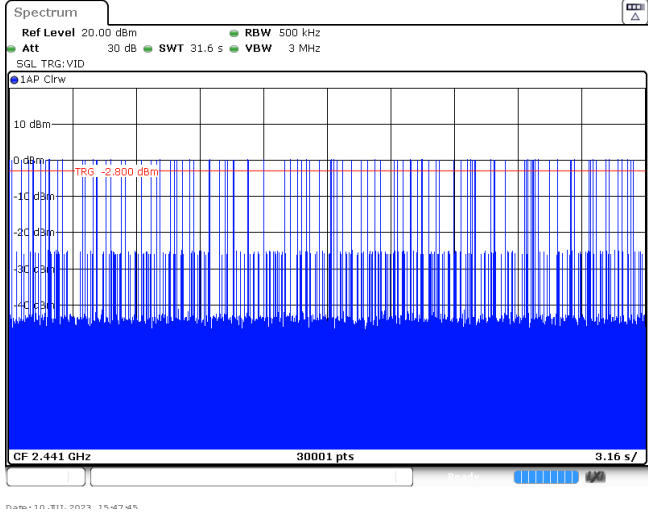
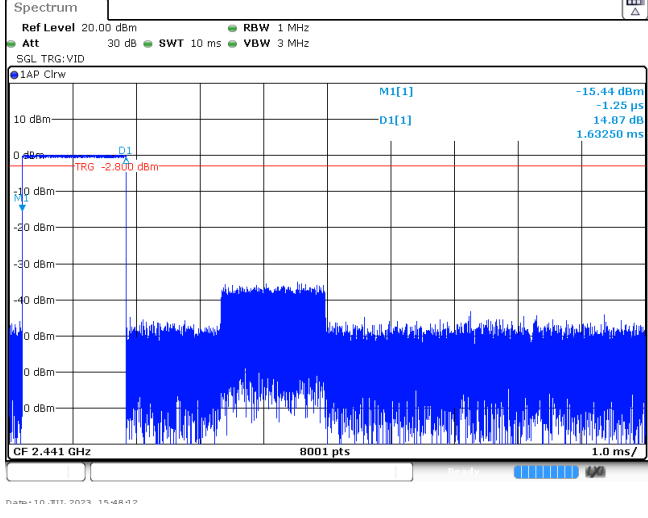
8DPSK

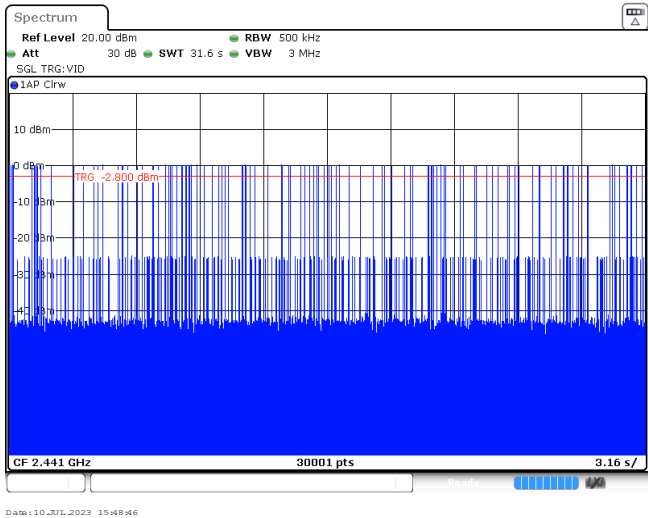
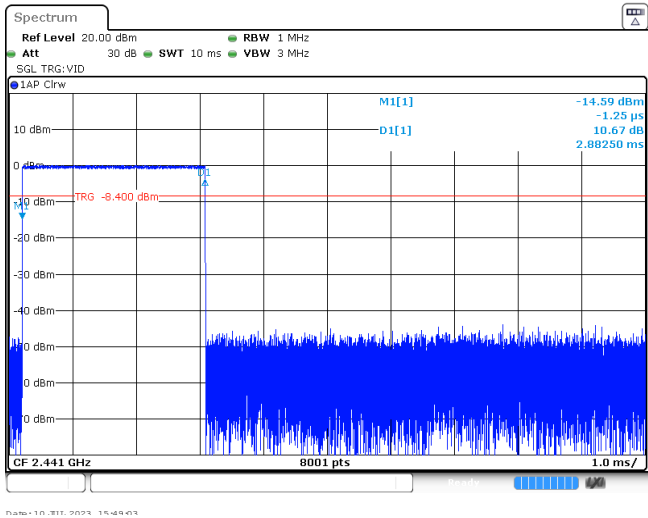
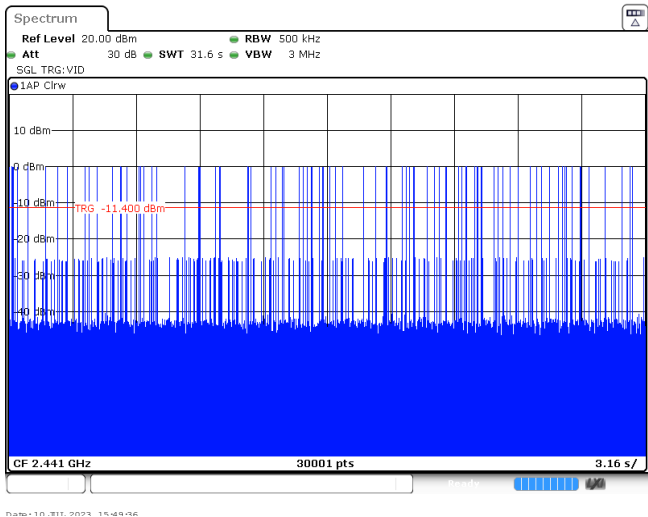


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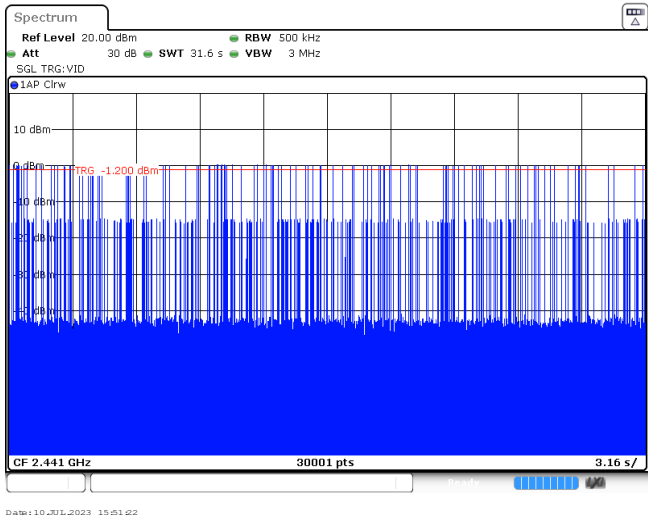
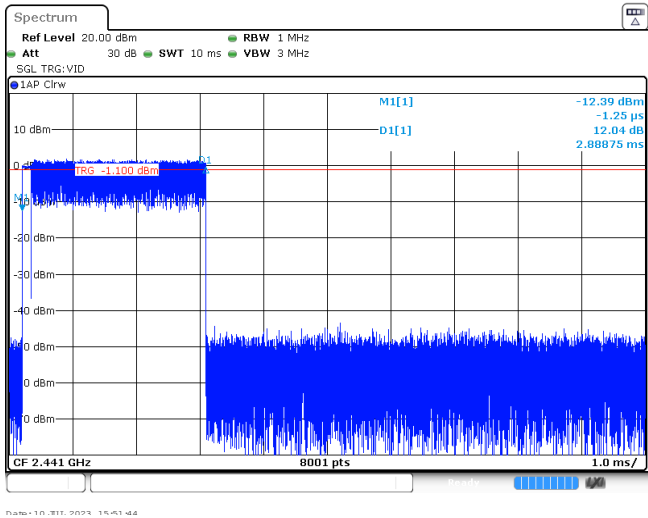
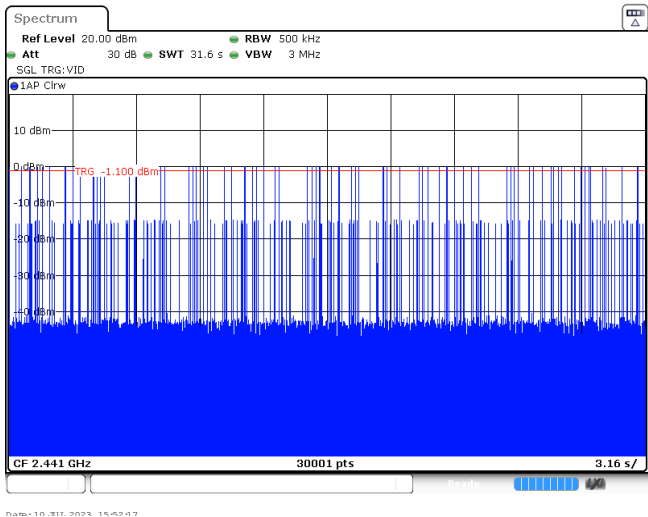
Appendix F: Dwell Time

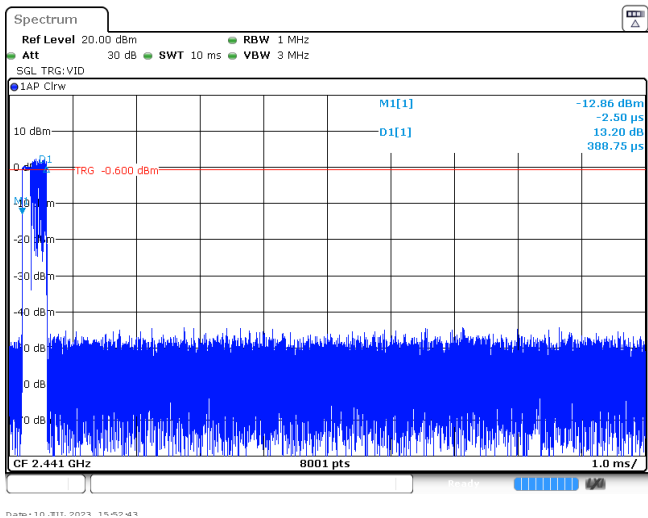
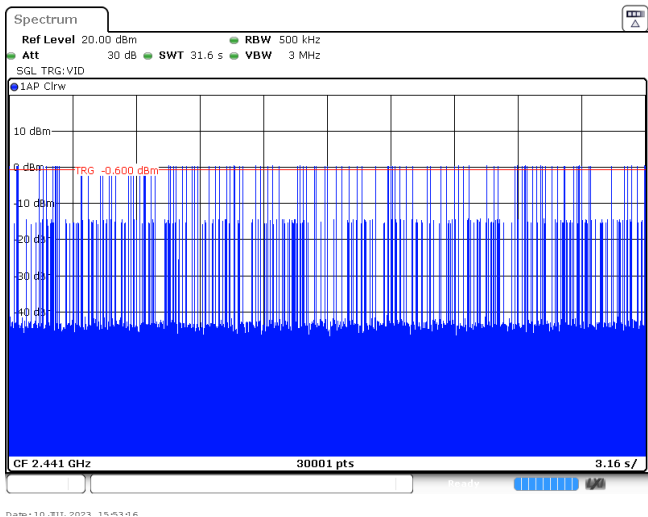
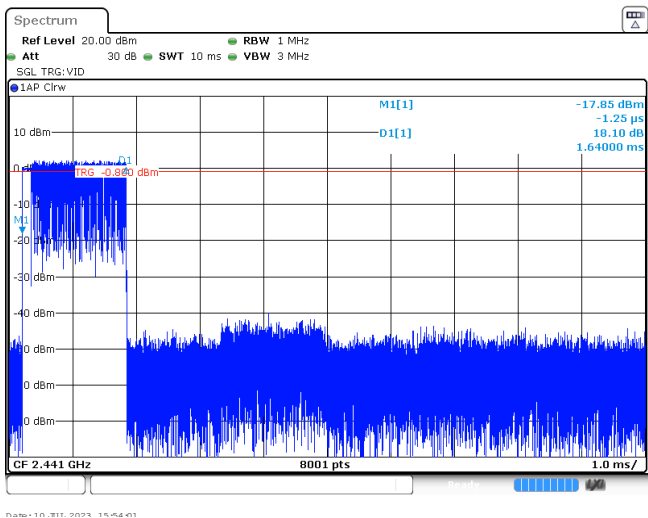
Modulation type	Packet	Burst Width [ms]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.38	107	0.04	≤ 0.40	Pass
	DH3	1.63	119	0.19		
	DH5	2.88	82	0.24		
$\pi/4$ DQPSK	2DH1	0.39	139	0.05	≤ 0.40	Pass
	2DH3	1.64	118	0.19		
	2DH5	2.89	78	0.23		
8DPSK	3DH1	0.39	113	0.04	≤ 0.40	Pass
	3DH3	1.64	116	0.19		
	3DH5	2.89	76	0.22		

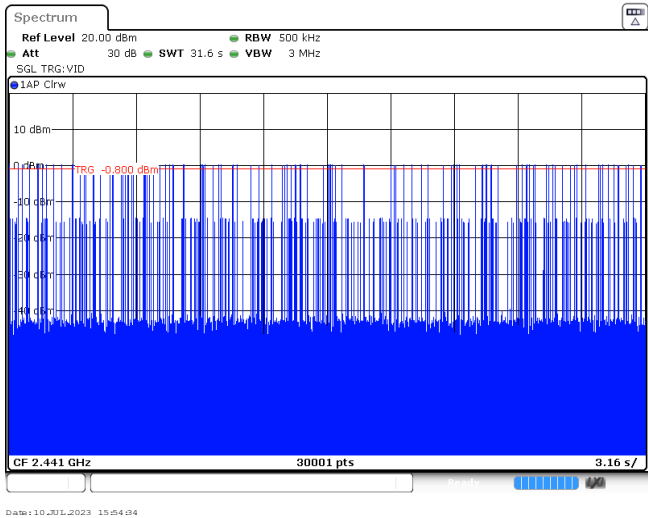
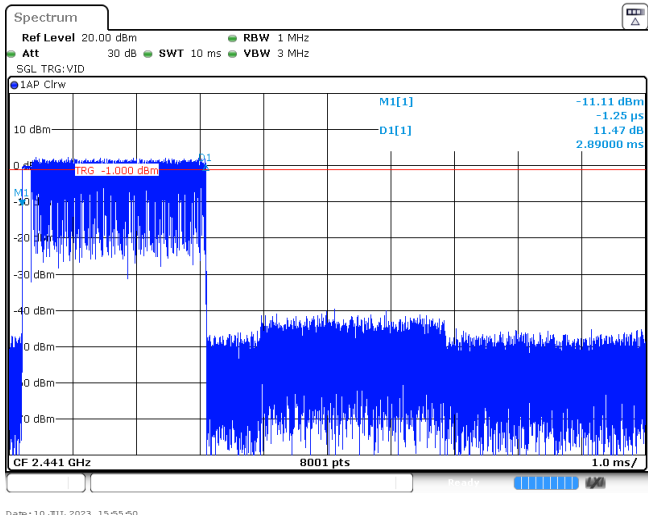
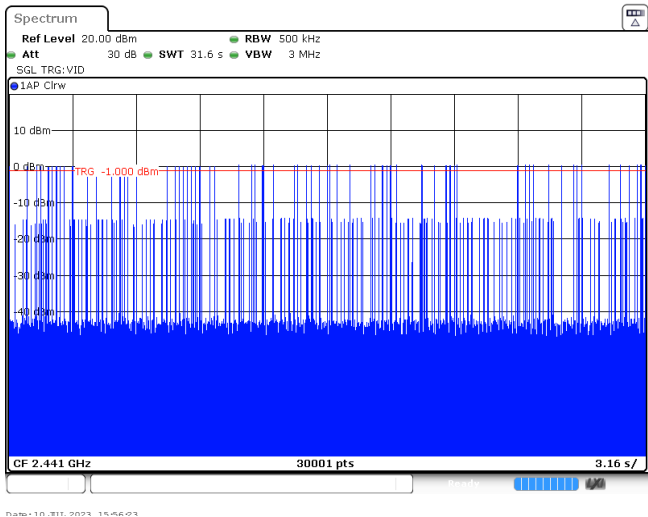
Modulation Type: GFSK	
DH1 Burst width	
DH1 Burst number	
DH3 Burst width	

DH3 Burst number	
DH5 Burst width	
DH5 Burst number	

Modulation Type: $\pi/4$ DQPSK	
2DH1 Burst width	
2DH1 Burst number	
2DH3 Burst width	

2DH3 Burst number	
2DH5 Burst width	
2DH5 Burst number	

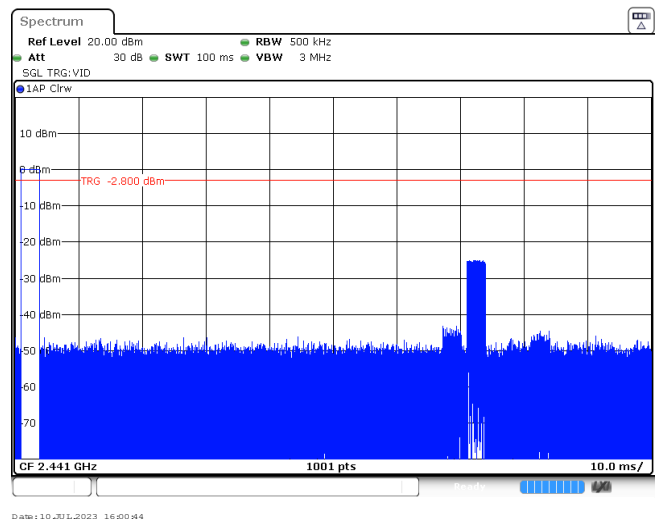
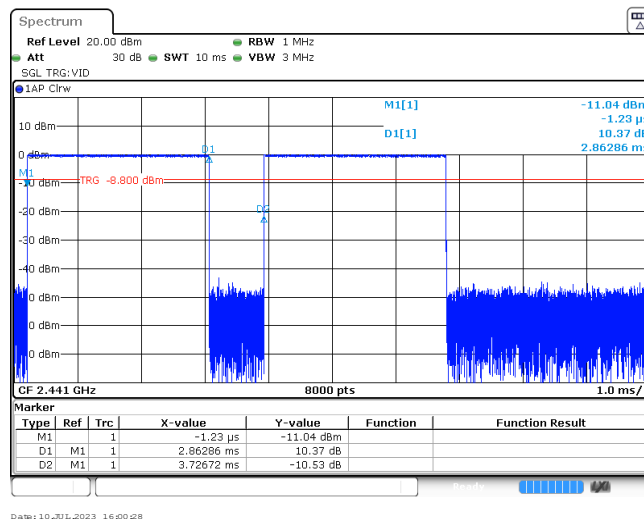
Modulation Type: 8DPSK	
3DH1 Burst width	
3DH1 Burst number	
3DH3 Burst width	

3DH3 Burst number	 Spectrum Ref Level 20.00 dBm Att 30 dB RBW 500 kHz SWT 31.6 s VBW 3 MHz SGL TRG:VID 1AP Clrw 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm CF 2.441 GHz 30001 pts 3.16 s/ Date: 10 JUL 2023 15:54:04
3DH5 Burst width	 Spectrum Ref Level 20.00 dBm Att 30 dB RBW 1 MHz SWT 10 ms VBW 3 MHz SGL TRG:VID 1AP Clrw 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm CF 2.441 GHz 8001 pts 1.0 ms/ Date: 10 JUL 2023 15:55:50
3DH5 Burst number	 Spectrum Ref Level 20.00 dBm Att 30 dB RBW 500 kHz SWT 31.6 s VBW 3 MHz SGL TRG:VID 1AP Clrw 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm CF 2.441 GHz 30001 pts 3.16 s/ Date: 10 JUL 2023 15:56:03

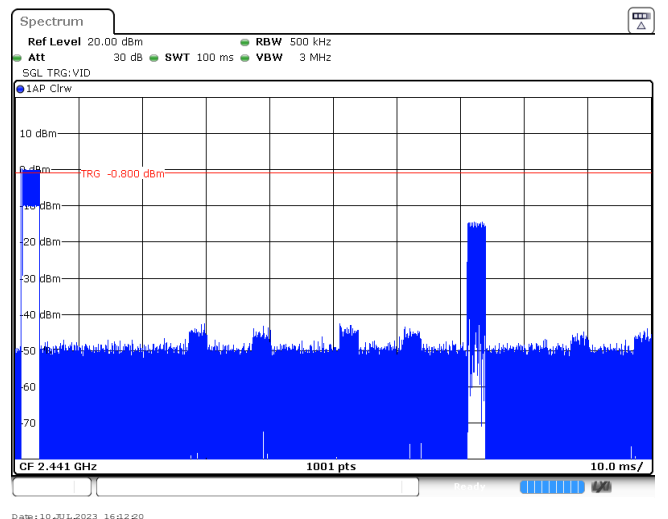
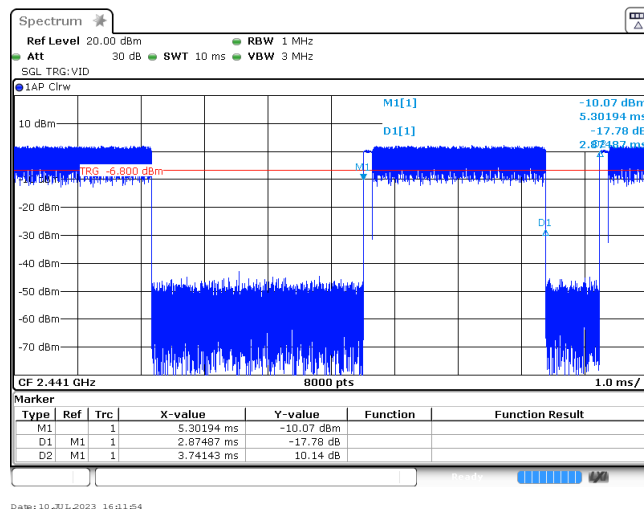
Appendix G: Duty Cycle Correction Factor (DCCF)

DCCF Calculate Formula					
$DCCF = 20 * \text{Log}(\text{duty cycle}) = 20 * \text{Log}(T_{\text{on time}} / T_{\text{period}})$					
Modulation type	Test Frequency (MHz)	$T_{\text{on time}}$ for single burst [ms]	T_{period} [ms]	Burst Quantity	DCCF [dB]
GFSK	2441	2.86	100	1	-30.87
$\pi/4$ DQPSK	2441	2.87	100	2	-24.82
8DPSK	2441	2.87	100	1	-30.84

GFSK

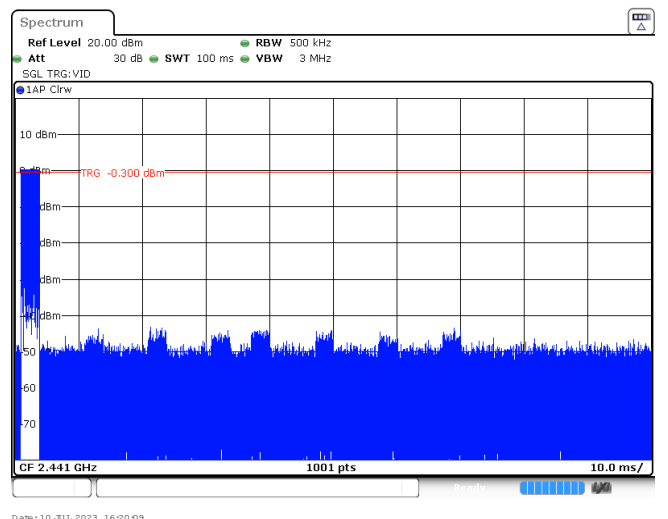
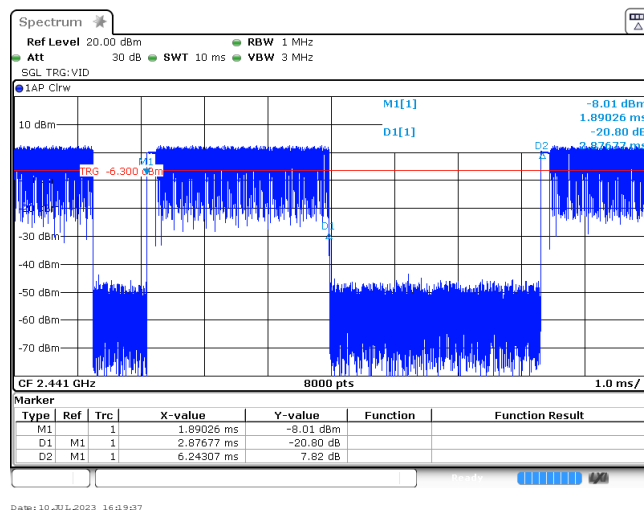
T_{on} time for single burst

Burst Quantity

 $\pi/4$ DQPSKT_{on} time for single burst

Burst Quantity

8DPSK

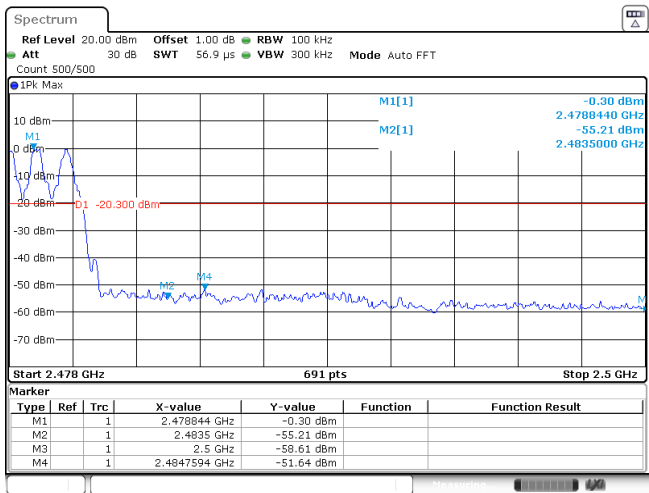
T_{on} time for single burst

Burst Quantity

Appendix H: Band edge and Spurious Emissions (conducted)

Test Item:	Band edge	Modulation type:	GFSK
CH00 No hopping mode	Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 1.1 ms VBW 300 kHz Mode Auto Sweep Count 300/300 1Pk Max </		

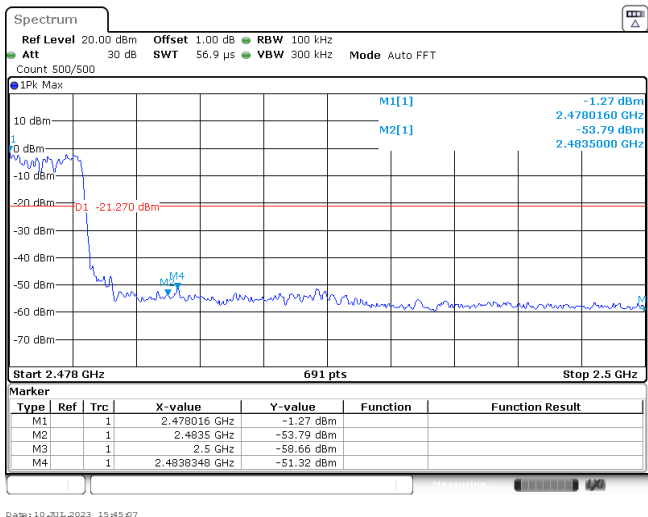
CH78
Hopping mode



Date: 10 JUL 2023 15:42:49

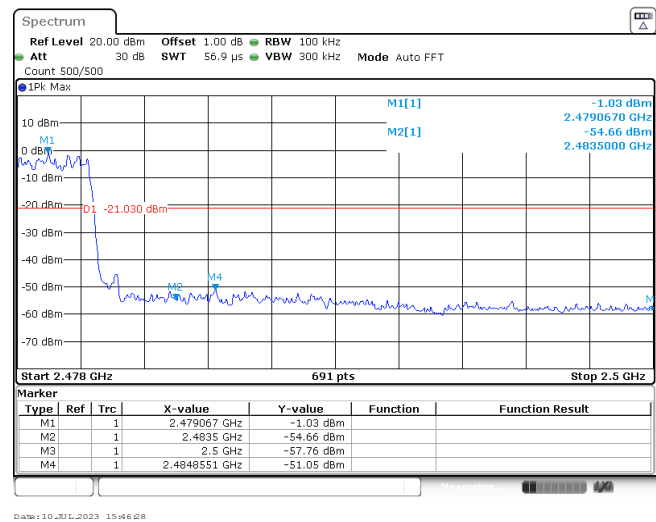
Test Item:	Band edge	Modulation type:	$\pi/4$ DQPSK																																										
CH00 No hopping mode	Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 1.1 ms VBW 300 kHz Mode Auto Sweep Count 500/500 1Pk Max M1[1] 0.27 dBm M2[1] -48.98 dBm D1 -19.730 dBm 2.402040 GHz 2.400000 GHz Start 2.31 GHz 691 pts Stop 2.405 GHz Marker <table><thead><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-value</th><th>Y-value</th><th>Function</th><th>Function Result</th></tr></thead><tbody><tr><td>M1</td><td>1</td><td></td><td>2.40204 GHz</td><td>0.27 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>2.4 GHz</td><td>-48.98 dBm</td><td></td><td></td></tr><tr><td>M3</td><td>1</td><td></td><td>2.39 GHz</td><td>-51.69 dBm</td><td></td><td></td></tr><tr><td>M4</td><td>1</td><td></td><td>2.31 GHz</td><td>-53.92 dBm</td><td></td><td></td></tr><tr><td>M5</td><td>1</td><td></td><td>2.391507 GHz</td><td>-47.53 dBm</td><td></td><td></td></tr></tbody></table> Date: 10/31/2023 16:43:55			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.40204 GHz	0.27 dBm			M2	1		2.4 GHz	-48.98 dBm			M3	1		2.39 GHz	-51.69 dBm			M4	1		2.31 GHz	-53.92 dBm			M5	1		2.391507 GHz	-47.53 dBm		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																							
M1	1		2.40204 GHz	0.27 dBm																																									
M2	1		2.4 GHz	-48.98 dBm																																									
M3	1		2.39 GHz	-51.69 dBm																																									
M4	1		2.31 GHz	-53.92 dBm																																									
M5	1		2.391507 GHz	-47.53 dBm																																									
CH00 Hopping mode	Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 1.1 ms VBW 300 kHz Mode Auto Sweep Count 500/500 1Pk Max M1[1] 0.14 dBm M2[1] -51.16 dBm D1 -19.860 dBm 2.403010 GHz 2.400000 GHz Start 2.31 GHz 691 pts Stop 2.405 GHz Marker <table><thead><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-value</th><th>Y-value</th><th>Function</th><th>Function Result</th></tr></thead><tbody><tr><td>M1</td><td>1</td><td></td><td>2.40301 GHz</td><td>0.14 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>2.4 GHz</td><td>-51.16 dBm</td><td></td><td></td></tr><tr><td>M3</td><td>1</td><td></td><td>2.39 GHz</td><td>-53.99 dBm</td><td></td><td></td></tr><tr><td>M4</td><td>1</td><td></td><td>2.31 GHz</td><td>-53.69 dBm</td><td></td><td></td></tr><tr><td>M5</td><td>1</td><td></td><td>2.396188 GHz</td><td>-48.82 dBm</td><td></td><td></td></tr></tbody></table> Date: 10/31/2023 15:48:48			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.40301 GHz	0.14 dBm			M2	1		2.4 GHz	-51.16 dBm			M3	1		2.39 GHz	-53.99 dBm			M4	1		2.31 GHz	-53.69 dBm			M5	1		2.396188 GHz	-48.82 dBm		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																							
M1	1		2.40301 GHz	0.14 dBm																																									
M2	1		2.4 GHz	-51.16 dBm																																									
M3	1		2.39 GHz	-53.99 dBm																																									
M4	1		2.31 GHz	-53.69 dBm																																									
M5	1		2.396188 GHz	-48.82 dBm																																									
CH78 No hopping mode	Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 56.9 μs VBW 300 kHz Mode Auto FFT Count 500/500 1Pk Max M1[1] 0.94 dBm M2[1] -53.50 dBm D1 -19.060 dBm 2.4799900 GHz 2.4835000 GHz Start 2.478 GHz 691 pts Stop 2.5 GHz Marker <table><thead><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-value</th><th>Y-value</th><th>Function</th><th>Function Result</th></tr></thead><tbody><tr><td>M1</td><td>1</td><td></td><td>2.47999 GHz</td><td>0.94 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>2.4835 GHz</td><td>-53.50 dBm</td><td></td><td></td></tr><tr><td>M3</td><td>1</td><td></td><td>2.5 GHz</td><td>-58.43 dBm</td><td></td><td></td></tr><tr><td>M4</td><td>1</td><td></td><td>2.4890319 GHz</td><td>-50.65 dBm</td><td></td><td></td></tr></tbody></table> Date: 10/31/2023 16:44:43			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.47999 GHz	0.94 dBm			M2	1		2.4835 GHz	-53.50 dBm			M3	1		2.5 GHz	-58.43 dBm			M4	1		2.4890319 GHz	-50.65 dBm									
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																							
M1	1		2.47999 GHz	0.94 dBm																																									
M2	1		2.4835 GHz	-53.50 dBm																																									
M3	1		2.5 GHz	-58.43 dBm																																									
M4	1		2.4890319 GHz	-50.65 dBm																																									

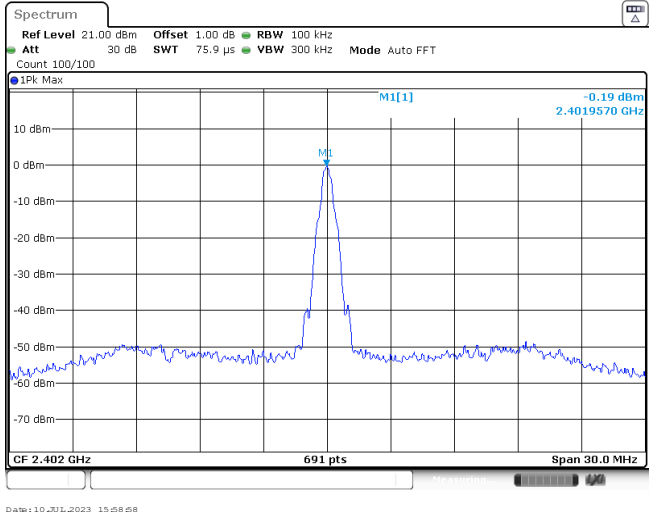
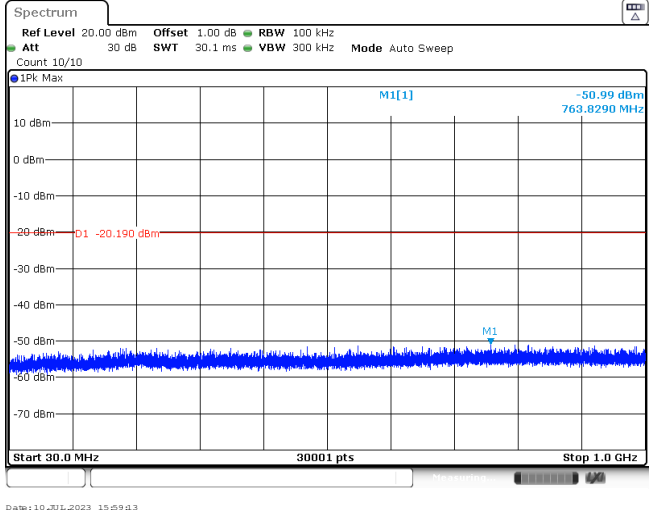
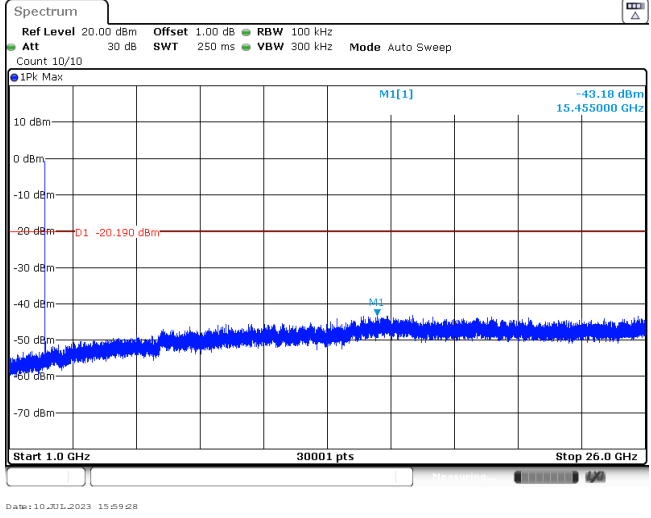
CH78
Hopping mode

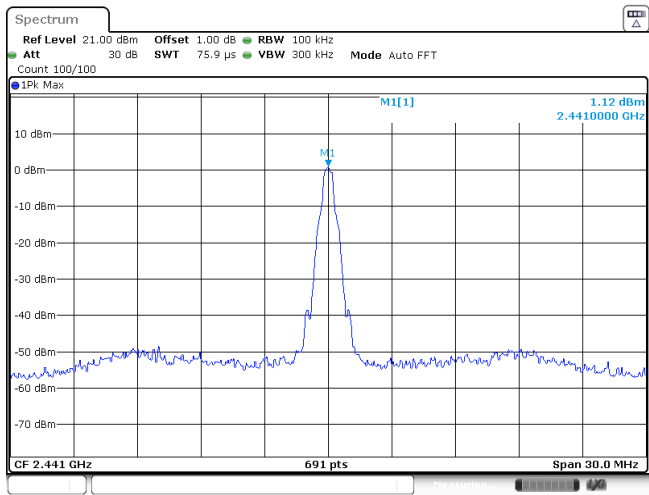
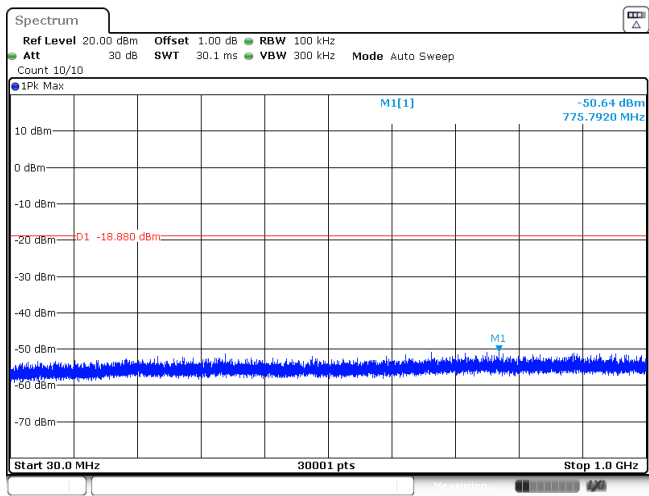
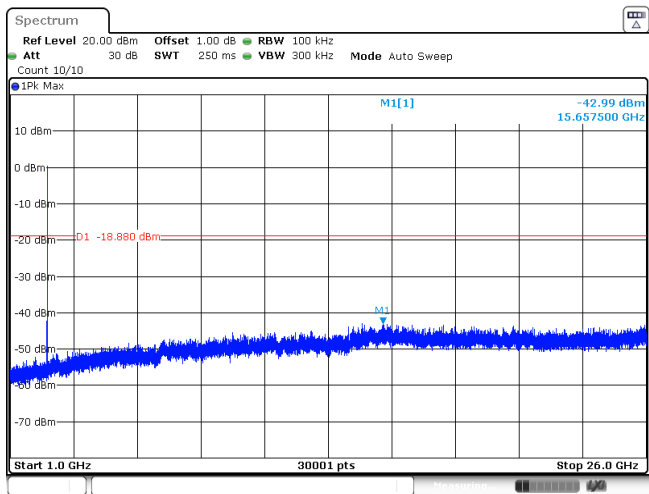


Test Item:	Band edge	Modulation type:	8DPSK																																										
CH00 No hopping mode	Spectrum Ref Level 20.00 dBm Att 30 dB Count 500/500 Offset 1.00 dB SWT 1.1 ms RBW 100 kHz VBW 300 kHz Mode Auto Sweep 1Pk Max 0.28 dBm 2.402180 GHz -50.30 dBm 2.400000 GHz 10 dBm M1[1] M2[1] -10 dBm -20 dBm D1 -19.720 dBm -30 dBm -40 dBm -50 dBm M3 M5 M2 -60 dBm -70 dBm Start 2.31 GHz 691 pts Stop 2.405 GHz Marker <table><thead><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-value</th><th>Y-value</th><th>Function</th><th>Function Result</th></tr></thead><tbody><tr><td>M1</td><td>1</td><td></td><td>2.40218 GHz</td><td>0.28 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>2.4 GHz</td><td>-50.30 dBm</td><td></td><td></td></tr><tr><td>M3</td><td>1</td><td></td><td>2.39 GHz</td><td>-51.52 dBm</td><td></td><td></td></tr><tr><td>M4</td><td>1</td><td></td><td>2.31 GHz</td><td>-53.27 dBm</td><td></td><td></td></tr><tr><td>M5</td><td>1</td><td></td><td>2.394812 GHz</td><td>-47.55 dBm</td><td></td><td></td></tr></tbody></table> 10_201_2023 16:21:49			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.40218 GHz	0.28 dBm			M2	1		2.4 GHz	-50.30 dBm			M3	1		2.39 GHz	-51.52 dBm			M4	1		2.31 GHz	-53.27 dBm			M5	1		2.394812 GHz	-47.55 dBm		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																							
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CH00 Hopping mode	Spectrum Ref Level 20.00 dBm Att 30 dB Count 500/500 Offset 1.00 dB SWT 1.1 ms RBW 100 kHz VBW 300 kHz Mode Auto Sweep 1Pk Max -1.32 dBm 2.404110 GHz -47.65 dBm 2.400000 GHz 10 dBm M1[1] M2[1] -10 dBm -20 dBm D1 -21.320 dBm -30 dBm -40 dBm -50 dBm M3 M5 -60 dBm -70 dBm Start 2.31 GHz 691 pts Stop 2.405 GHz Marker <table><thead><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-value</th><th>Y-value</th><th>Function</th><th>Function Result</th></tr></thead><tbody><tr><td>M1</td><td>1</td><td></td><td>2.40411 GHz</td><td>-1.32 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>2.4 GHz</td><td>-47.65 dBm</td><td></td><td></td></tr><tr><td>M3</td><td>1</td><td></td><td>2.39 GHz</td><td>-53.71 dBm</td><td></td><td></td></tr><tr><td>M4</td><td>1</td><td></td><td>2.31 GHz</td><td>-53.47 dBm</td><td></td><td></td></tr><tr><td>M5</td><td>1</td><td></td><td>2.399906 GHz</td><td>-47.85 dBm</td><td></td><td></td></tr></tbody></table> 10_201_2023 16:26:05			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.40411 GHz	-1.32 dBm			M2	1		2.4 GHz	-47.65 dBm			M3	1		2.39 GHz	-53.71 dBm			M4	1		2.31 GHz	-53.47 dBm			M5	1		2.399906 GHz	-47.85 dBm		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																							
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M5	1		2.399906 GHz	-47.85 dBm																																									
CH78 No hopping mode	Spectrum Ref Level 20.00 dBm Att 30 dB Count 500/500 Offset 1.00 dB SWT 56.9 μs RBW 100 kHz VBW 300 kHz Mode Auto FFT 1Pk Max 0.84 dBm 2.4799900 GHz -53.21 dBm 2.4835000 GHz 10 dBm M1 M2[1] 0 dBm -10 dBm -20 dBm D1 -19.160 dBm -30 dBm -40 dBm -50 dBm M2 M4 -60 dBm -70 dBm Start 2.478 GHz 691 pts Stop 2.5 GHz Marker <table><thead><tr><th>Type</th><th>Ref</th><th>Trc</th><th>X-value</th><th>Y-value</th><th>Function</th><th>Function Result</th></tr></thead><tbody><tr><td>M1</td><td>1</td><td></td><td>2.47999 GHz</td><td>0.84 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>2.4835 GHz</td><td>-53.21 dBm</td><td></td><td></td></tr><tr><td>M3</td><td>1</td><td></td><td>2.5 GHz</td><td>-57.78 dBm</td><td></td><td></td></tr><tr><td>M4</td><td>1</td><td></td><td>2.4902754 GHz</td><td>-50.72 dBm</td><td></td><td></td></tr></tbody></table> 10_201_2023 16:21:43			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.47999 GHz	0.84 dBm			M2	1		2.4835 GHz	-53.21 dBm			M3	1		2.5 GHz	-57.78 dBm			M4	1		2.4902754 GHz	-50.72 dBm									
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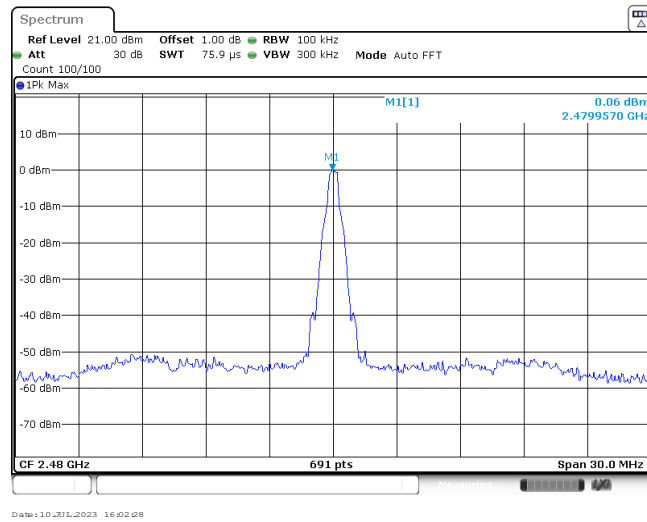
CH78
Hoppig mode



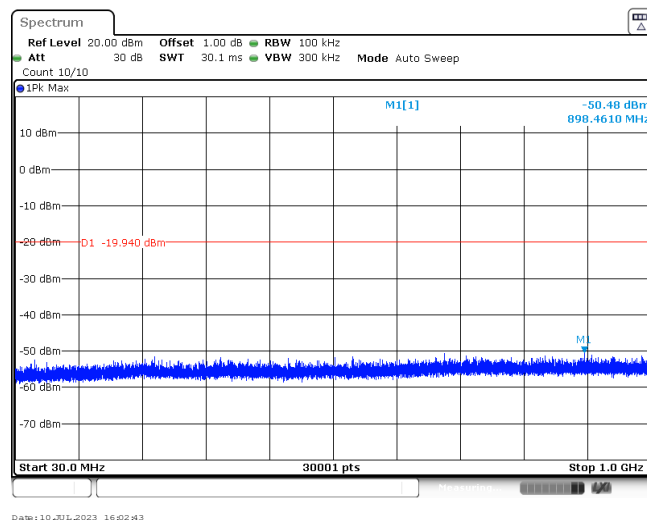
Test Item:	Spurious Emission	Modulation type:	GFSK
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CH00 30MHz~1000MHz			
CH00 1GHz~26GHz			

CH39 Reference level	
CH39 30MHz~1000MHz	
CH39 1GHz~26GHz	

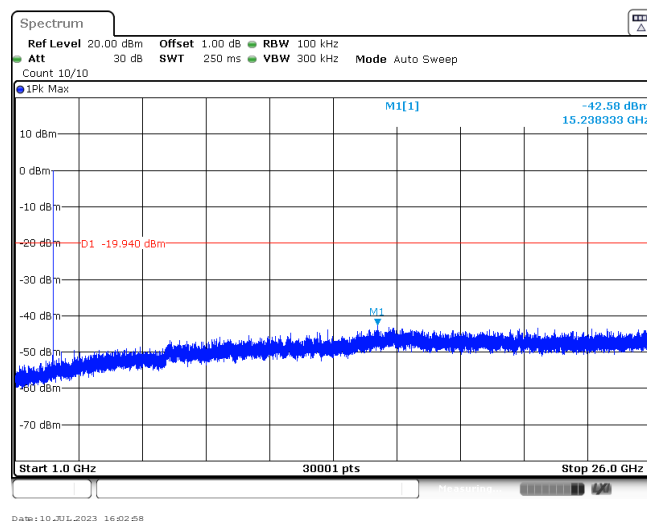
CH78
Reference level

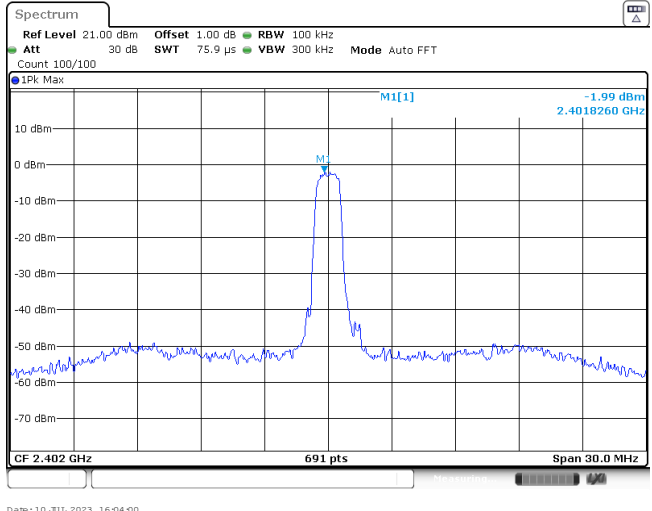
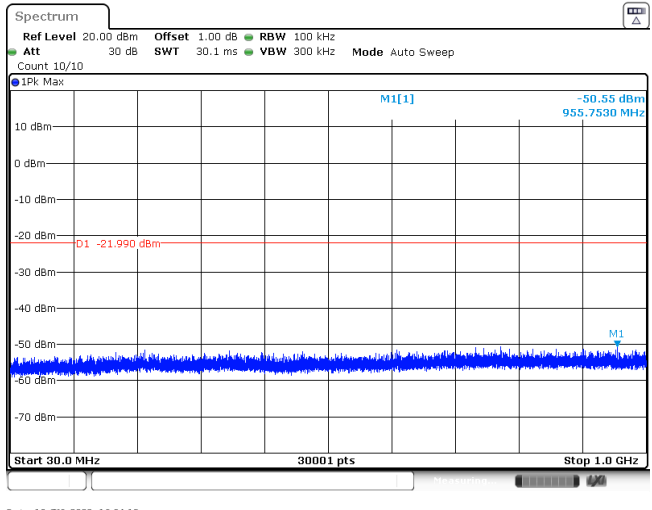
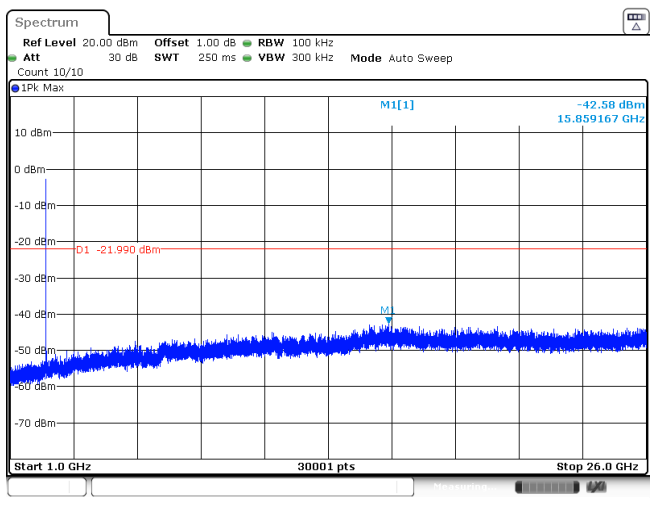


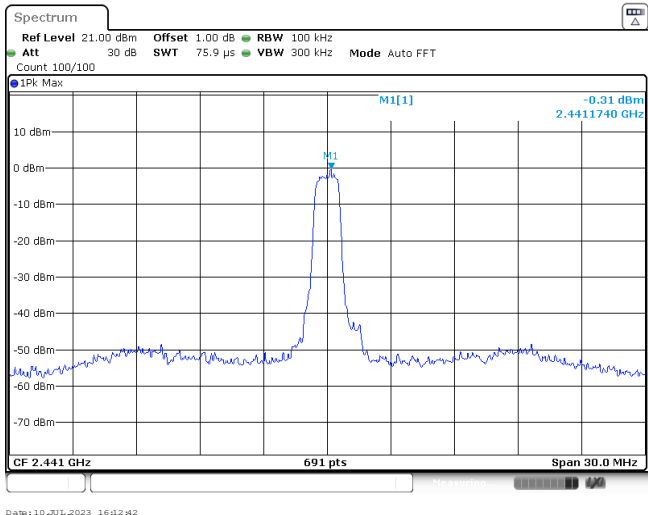
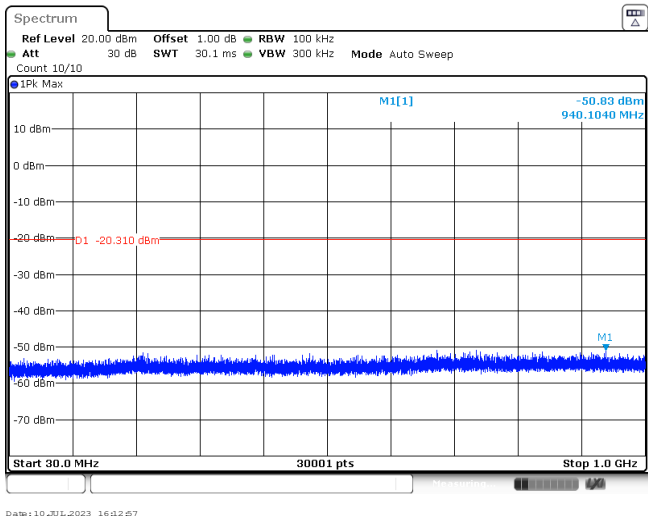
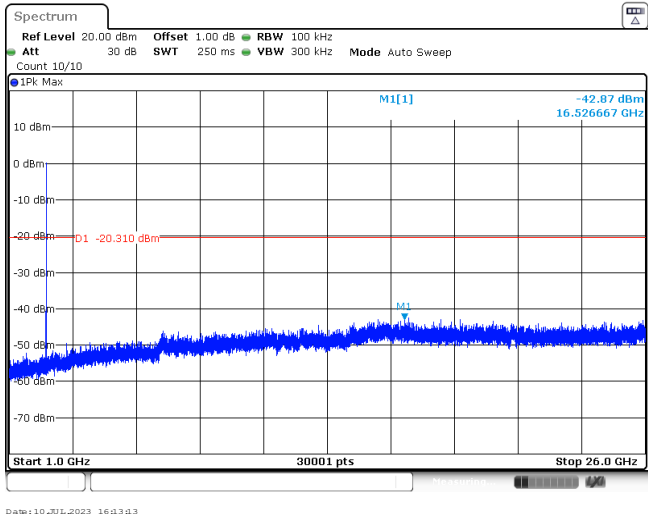
CH78
30MHz~1000MHz

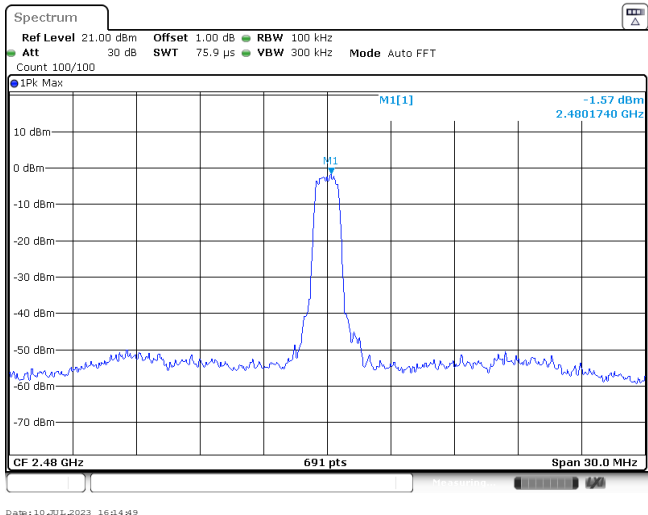
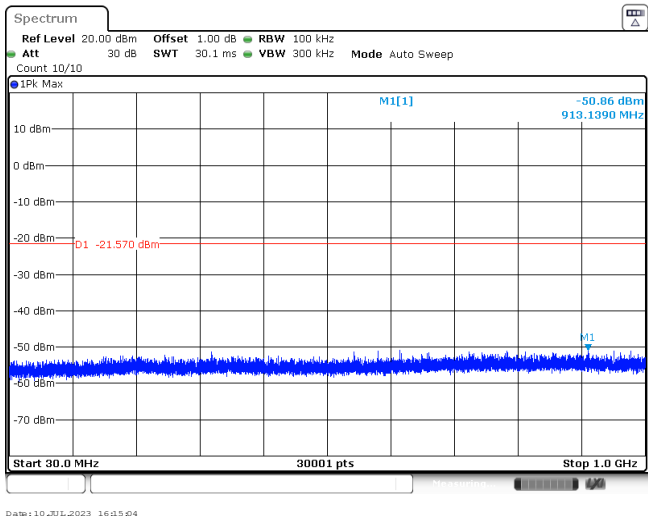
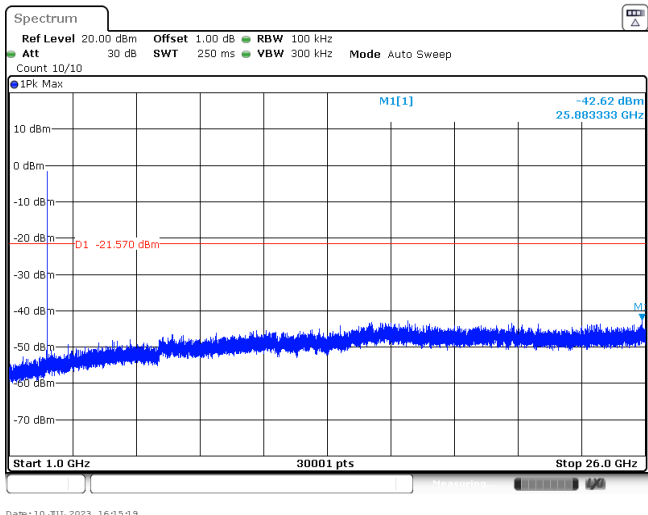


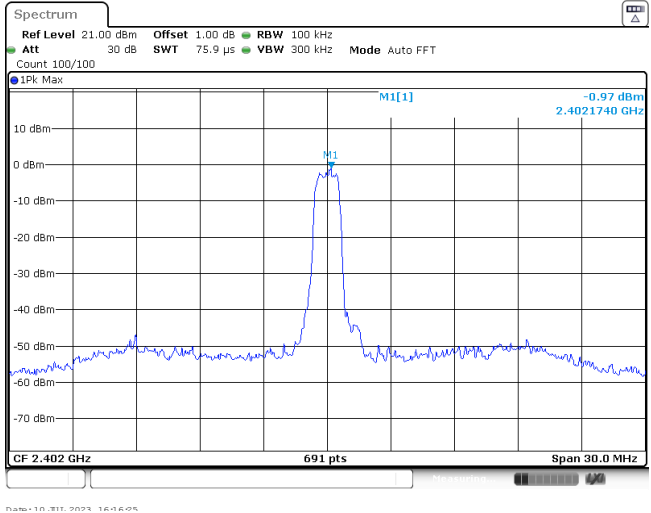
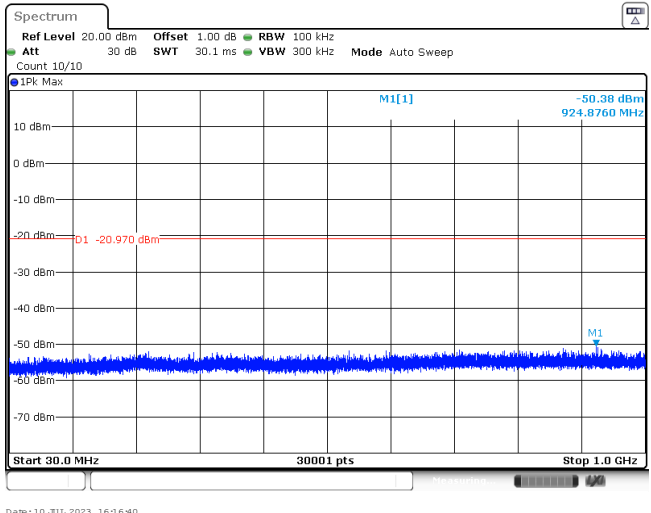
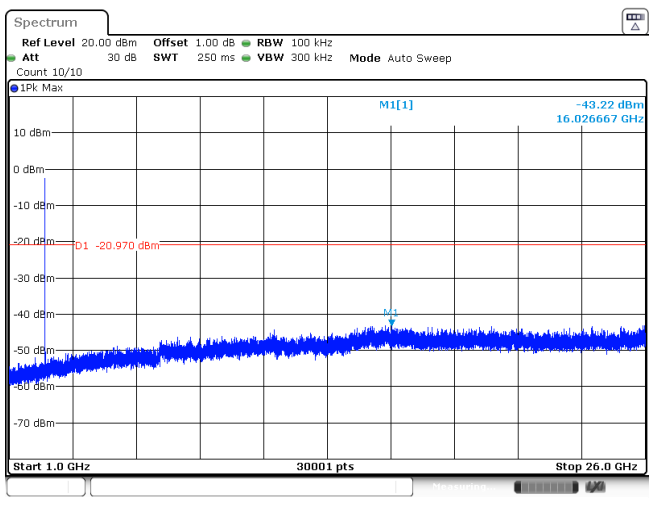
CH78
1GHz~26GHz

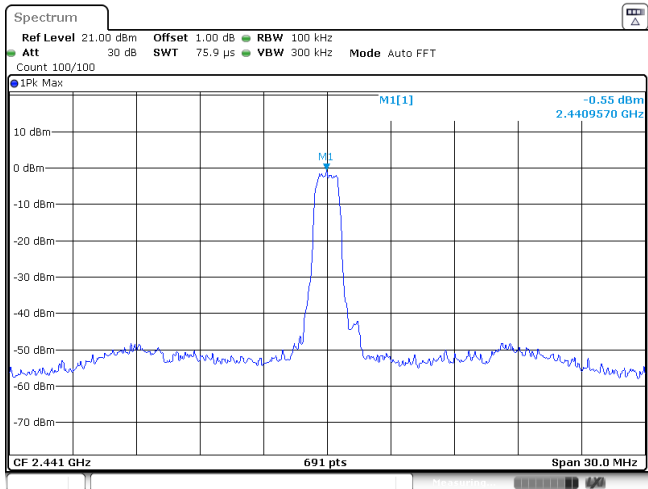
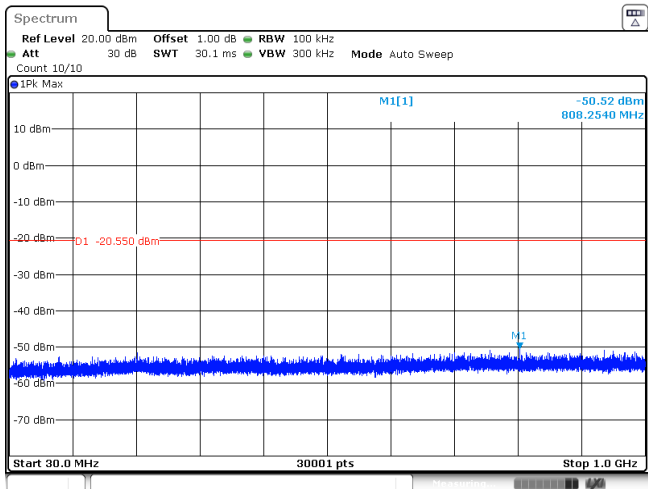
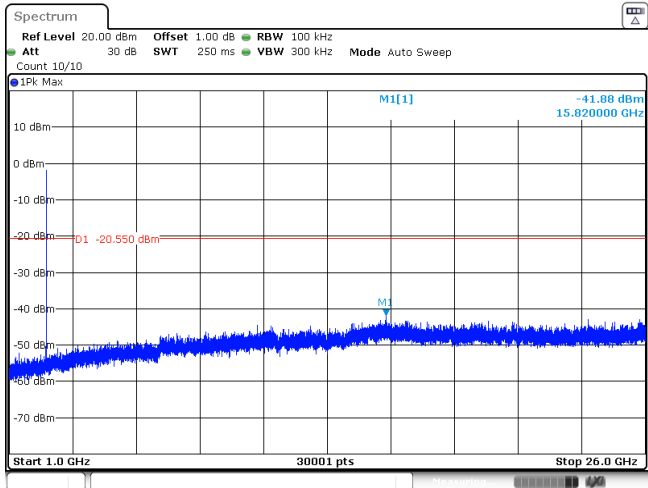


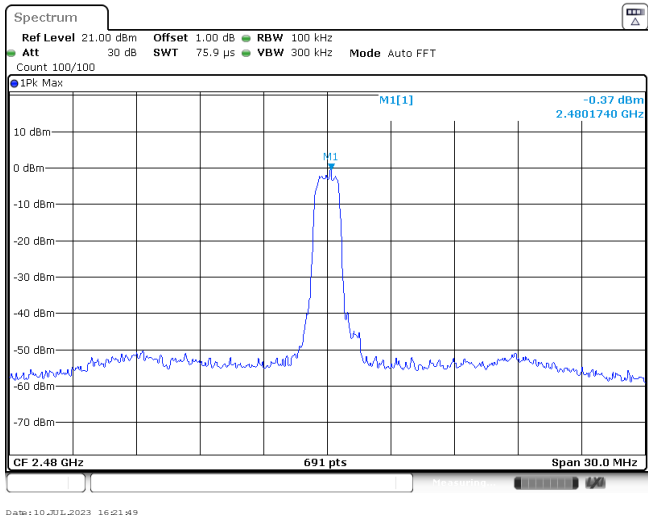
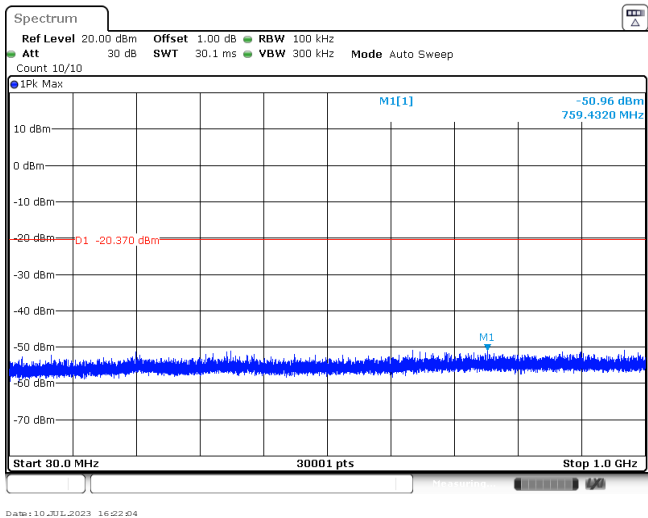
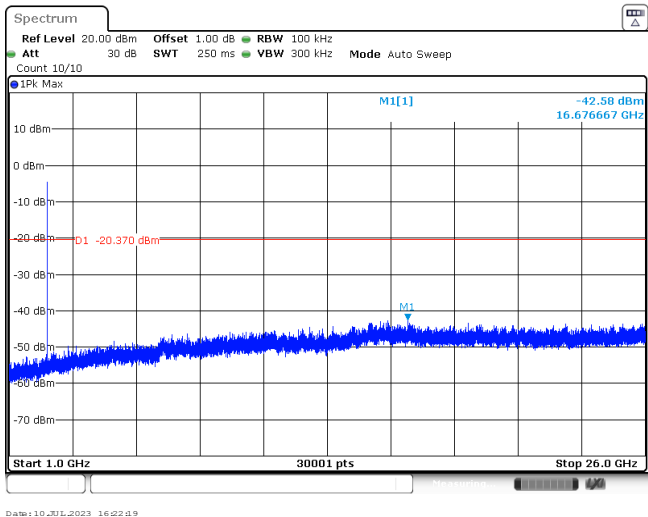
Test Item:	Spurious Emission	Modulation type:	$\pi/4$ DQPSK
CH00 Reference level			
CH00 30MHz~1000MHz			
CH00 1GHz~26GHz			

CH39 Reference level	
CH39 30MHz~1000MHz	
CH39 1GHz~26GHz	

CH78 Reference level	
CH78 30MHz~1000MHz	
CH78 1GHz~26GHz	

Test Item:	Spurious Emission	Modulation type:	8DPSK
CH00 Reference level			
CH00 30MHz~1000MHz			
CH00 1GHz~26GHz			

CH39 Reference level	 Spectrum Ref Level 21.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 75.9 μs VBW 300 kHz Mode Auto FFT Count 100/100 IPk Max M1[1] -0.55 dBm 2.4409570 GHz CF 2.441 GHz 691 pts Span 30.0 MHz Date: 10 JUL 2023 16:20:24
CH39 30MHz~1000MHz	 Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 30.1 ms VBW 300 kHz Mode Auto Sweep Count 10/10 IPk Max M1[1] -50.52 dBm 808.2540 MHz D1 -20.550 dBm Start 30.0 MHz 30001 pts Stop 1.0 GHz Date: 10 JUL 2023 16:20:39
CH39 1GHz~26GHz	 Spectrum Ref Level 20.00 dBm Offset 1.00 dB RBW 100 kHz Att 30 dB SWT 250 ms VBW 300 kHz Mode Auto Sweep Count 10/10 IPk Max M1[1] -41.88 dBm 15.820000 GHz D1 -20.550 dBm Start 1.0 GHz 30001 pts Stop 26.0 GHz Date: 10 JUL 2023 16:20:54

CH78 Reference level	
CH78 30MHz~1000MHz	
CH78 1GHz~26GHz	

-----End of Report-----