


TEST REPORT

For Bluetooth-EDR

Report No. : **CHTEW23100068** Report Verification: 

Project No..... : SHT2304024504EW

FCC ID..... : **2AE6C-EP8100VHF**

Applicant's name : **Shenzhen Excera Technology Co., Ltd.**

Address..... : 201, Building B, Tongfang Information Harbour, No.11 Langshan Road, Nanshan District, Shenzhen 518057, P.R.China

Product Name : **Digital Portable Radio**

Trade Mark : EXCERA

Model No. : EP8100 VHF

Listed Model(s) : EP8000 VHF

Standard : **FCC CFR Title 47 Part 15 Subpart C § 15.247**

Date of receipt of test sample..... : Aug. 10, 2023

Date of testing..... : Aug. 29, 2023- Oct. 13, 2023

Date of issue..... : Oct. 19, 2023

Result..... : **PASS**

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Xu Yang

Testing Laboratory Name : **Shenzhen Huatongwei International Inspection Co., Ltd.**

Address..... : 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

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The test report merely correspond to the test sample.

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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	2023-10-19	Original

2. TEST DESCRIPTION

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

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:	Shenzhen Excera Technology Co., Ltd.
Address:	201, Building B, Tongfang Information Harbour, No.11 Langshan Road, Nanshan District, Shenzhen 518057, P.R.China
Manufacturer:	Shenzhen Excera Technology Co., Ltd.
Address:	201, Building B, Tongfang Information Harbour, No.11 Langshan Road, Nanshan District, Shenzhen 518057, P.R.China
Factory:	Shenzhen Excera Technology Co., Ltd.
Address:	201, Building B, Tongfang Information Harbour, No.11 Langshan Road, Nanshan District, Shenzhen 518057, P.R.China

3.2. Product Description

Main unit information:	
Product Name:	Digital Portable Radio
Trade Mark:	EXCERA
Model No.:	EP8100 VHF
Listed Model(s):	EP8000 VHF
Power supply:	DC 7.2V from Battery
Hardware version:	EP8100 VHF -F
Software version:	EXCERA OneKeyUpdate 1.4.01.15D
Accessory unit information:	
Battery information:	MODEL: EB242L DC 7.2V 2400mAh/17.28Wh
Adapter information:	MODEL: DSA-12PFU-12 FCA 120100 INPUT:100-240V~50/60Hz 0.5A OUTPUT: DC 12V 1.0A, 12W
desktop charger:	MODEL: ESC102L INPUT: DC 12V 1A OUTPUT: DC 8.4V 1A

3.3. Radio Specification Description

Bluetooth version:	V4.0
Support function:	EDR
Modulation:	GFSK, $\pi/4$ DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz

Antenna type:	intenal antenna
Antenna gain:	0.00dBi

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 GFSK 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 1Mbps 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	YPHT23040245005
EMI test items	-

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?			
✓ No			
Item	Equipment	Trade Name	Model No.
1			
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

● RF 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	2023/08/22	2024/08/21
●	Signal & Spectrum Analyzer	R&S	HTWE0262	FSW26	103440	2023/08/22	2024/08/21
●	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- 9kHz~30MHz

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	2023/4/6	2026/4/5
●	EMI Test Receiver	R&S	HTWE0099	ESCI 7	100900	2023/08/22	2024/08/21
●	Loop Antenna	R&S	HTWE0170	HFH2-Z2	100020	2021/4/6	2024/4/5
●	Test Software	R&S	N/A	EMC32	N/A	N/A	N/A

● Radiated emission- 30MHz~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	2023/4/6	2026/4/5
●	EMI Test Receiver	R&S	HTWE0099	ESCI 7	100900	2023/08/22	2024/08/21
●	Ultra-Broadband Antenna	SCHWARZBECK	HTWE0119	VULB9163	546	2023/2/22	2026/2/21
●	Pre-Amplifier	SCHWARZBECK	HTWE0295	BBV 9742	/	2023/5/25	2024/5/24
●	Test Software	R&S	N/A	EMC32	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	2023/4/17	2026/4/16
●	Spectrum Analyzer	R&S	HTWE0098	FSP40	100597	2023/08/22	2024/08/21
●	Spectrum Analyzer	R&S	HTWE0385	N9020A	MY54486658	2023/08/22	2024/08/21
●	Horn Antenna	SCHWARZBECK	HTWE0126	BBHA 9120D	1011	2023/2/14	2026/2/13
●	Pre-Amplifier	CD	HTWE0071	PAP-0102	12004	2023/5/25	2024/5/24
●	Broadband Pre-amplifier	SCHWARZBECK	HTWE0201	BBV 9718	9718-248	2023/5/25	2024/5/24
●	Test Software	Audix	N/A	E3	N/A	N/A	N/A

5. TEST CONDITIONS AND RESULTS

5.1. Antenna Requirement

REQUIREMENT

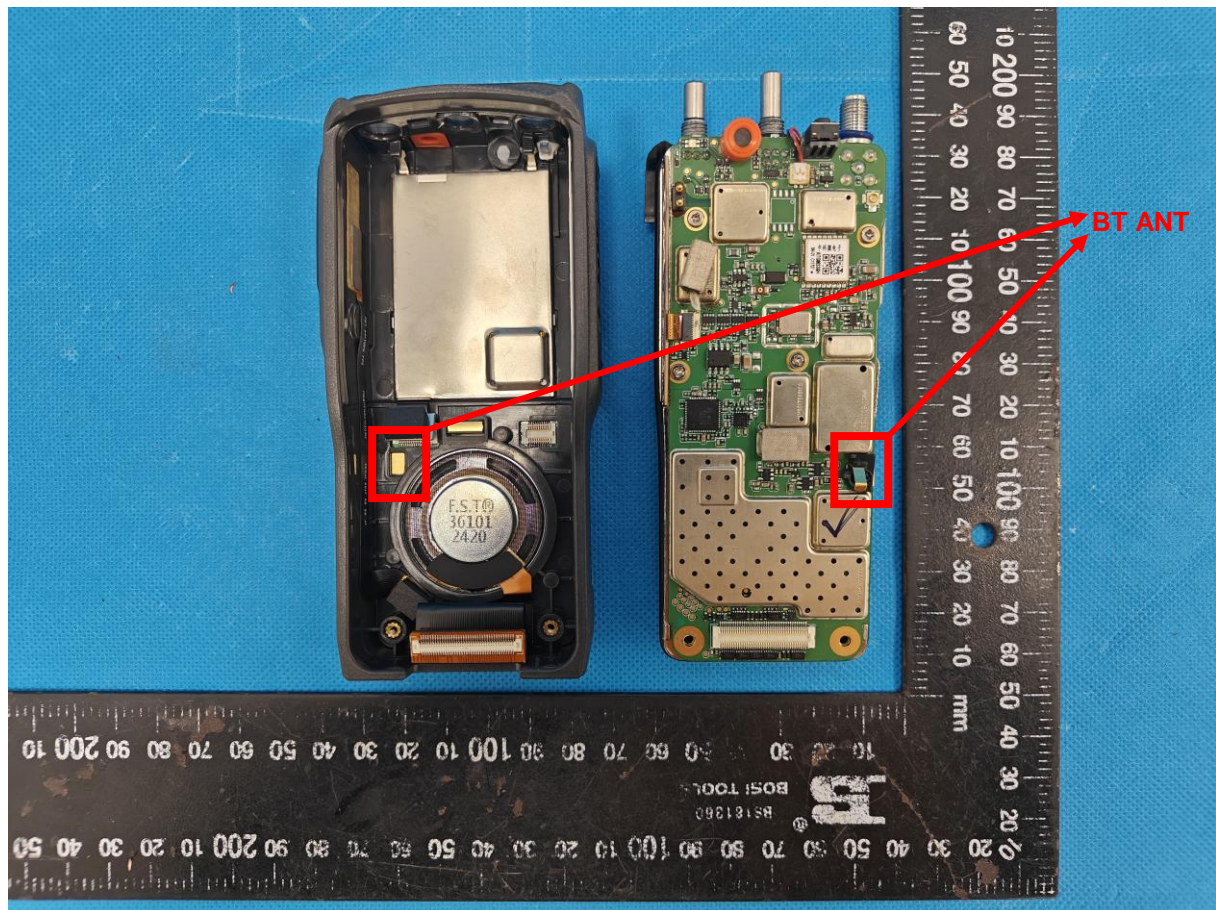
FCC CFR Title 47 Part 15 Subpart C Section 15.203:

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 internal antenna, please refer to the below antenna photo.



5.2. AC Conducted Emission

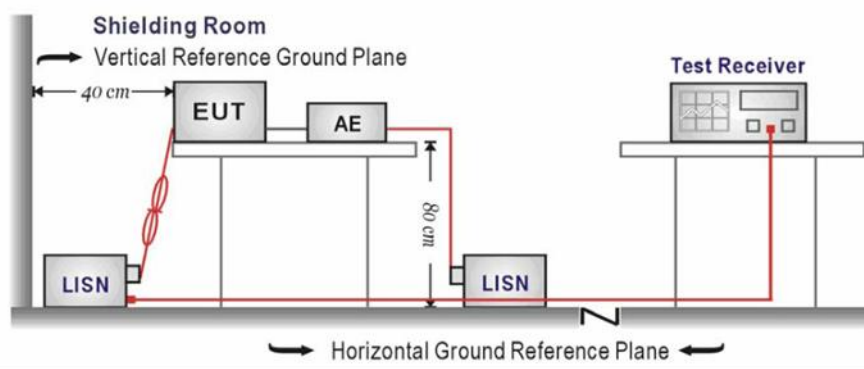
LIMIT

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

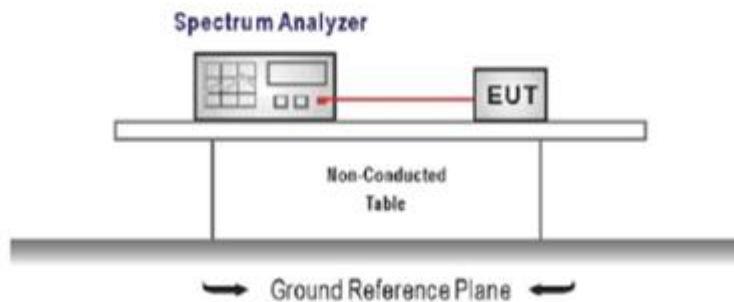
5.3. Peak Output Power

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

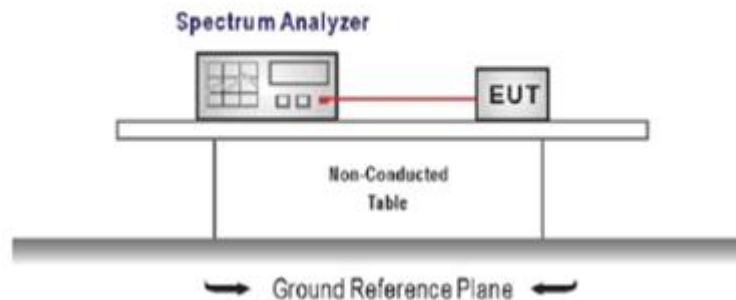
Refer to the appendix report

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

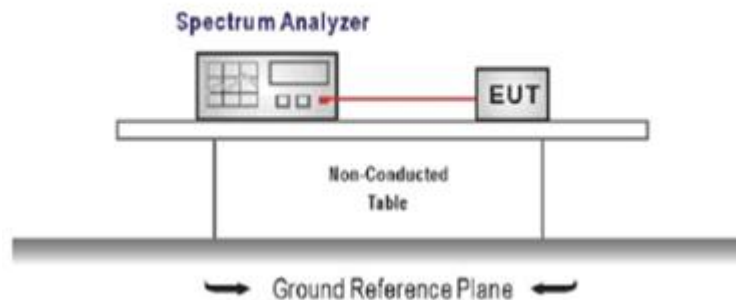
Refer to the appendix report

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

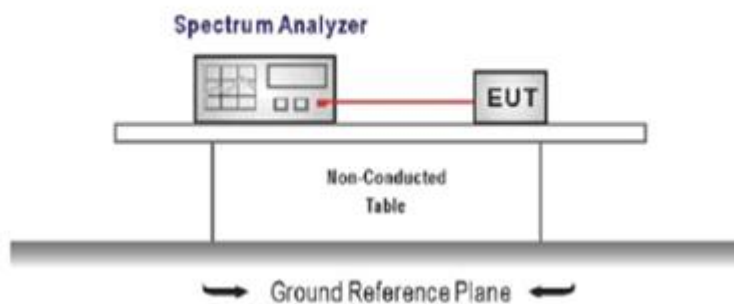
5.6. Carrier Frequencies Separation

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

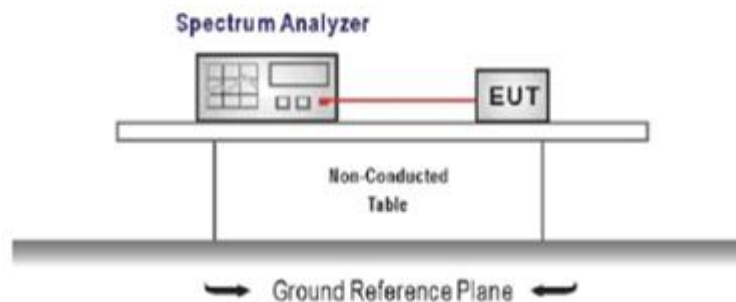
5.7. Hopping Channel Number

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

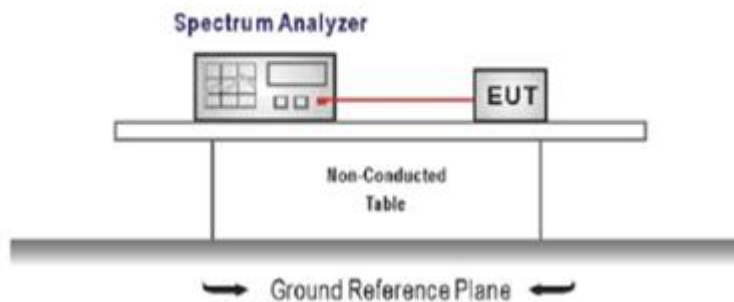
Refer to the appendix report

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

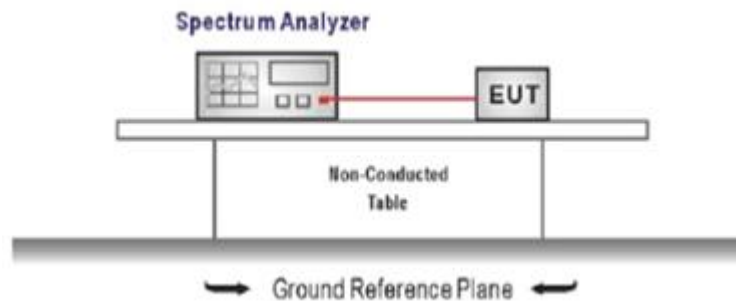
Refer to the appendix report

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

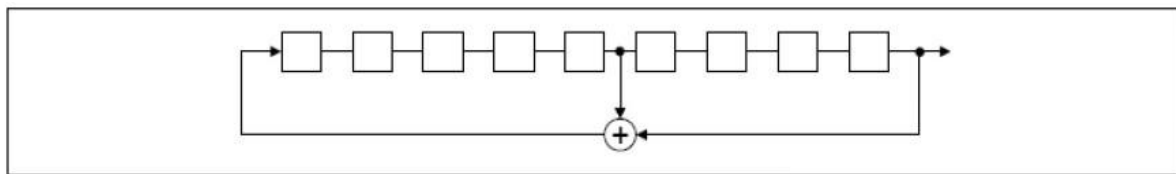
LIMIT

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

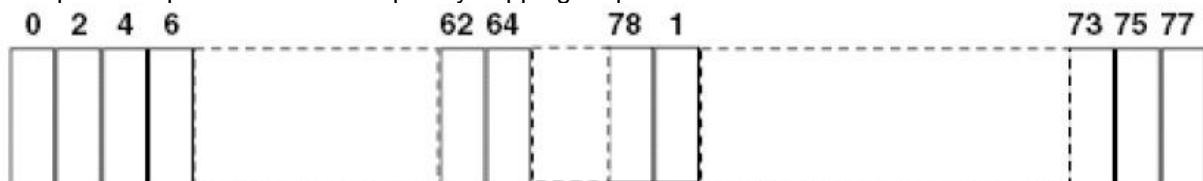
The pseudorandom frequency hopping sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: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

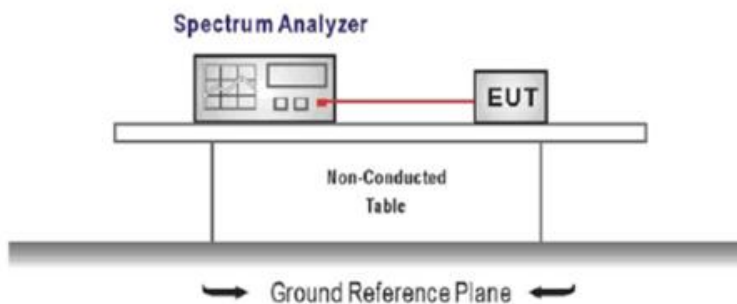
The system receiver has input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shifts frequencies in synchronization with the transmitted signals.

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
 $RBW = 100 \text{ kHz}$, $VBW \geq 3 \times RBW$
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

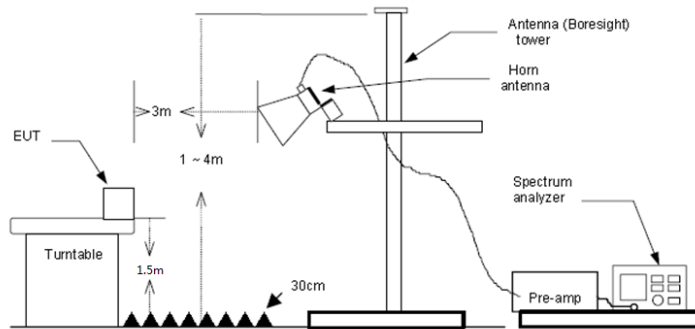
5.12. Radiated Band edge Emission

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 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; 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	40.55	27.86	4.01	37.55	34.87	74.00	-39.13	Peak
2	2390.03	39.73	27.54	4.31	37.55	34.03	74.00	-39.97	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	40.34	27.86	4.01	37.55	34.66	74.00	-39.34	Peak
2	2327.36	46.03	27.79	4.05	37.59	40.28	74.00	-33.72	Peak
3	2390.03	40.50	27.54	4.31	37.55	34.80	74.00	-39.20	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	42.81	27.33	4.18	37.64	36.68	74.00	-37.32	Peak
2	2500.00	41.13	27.30	4.19	37.67	34.95	74.00	-39.05	Peak

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	43.28	27.33	4.18	37.64	37.15	74.00	-36.85	Peak
2	2500.00	41.21	27.30	4.19	37.67	35.03	74.00	-38.97	Peak

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

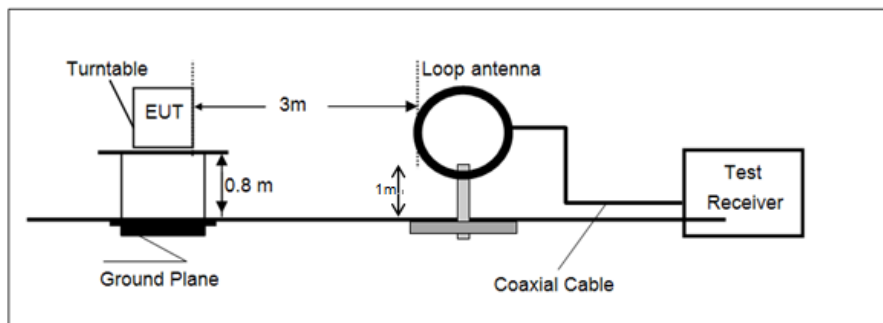
Note: Limit dBuV/m @3m = Limit dBuV/m @300m + 40*log(300/3)= Limit dBuV/m @300m +80,

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

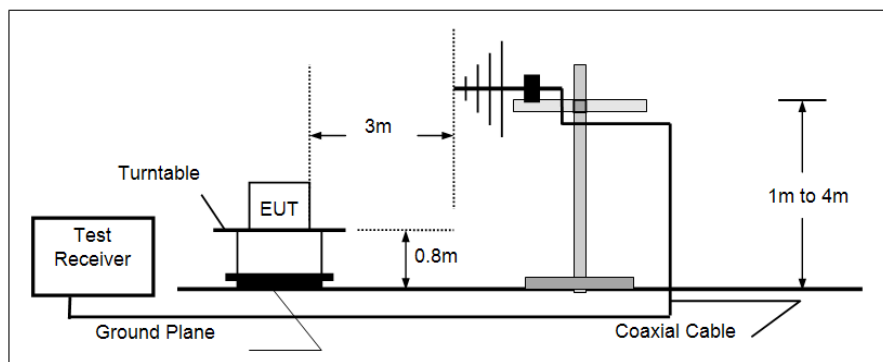
Frequency	Limit (dBuV/m @3m)	Value
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz~1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

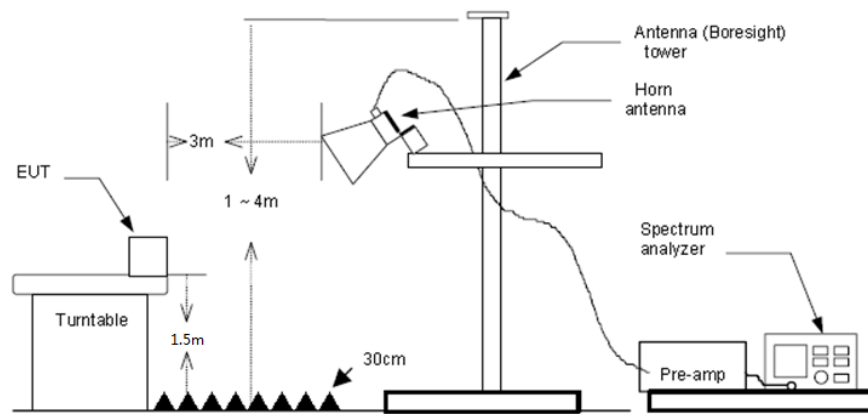
- 9 kHz ~ 30 MHz



- 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

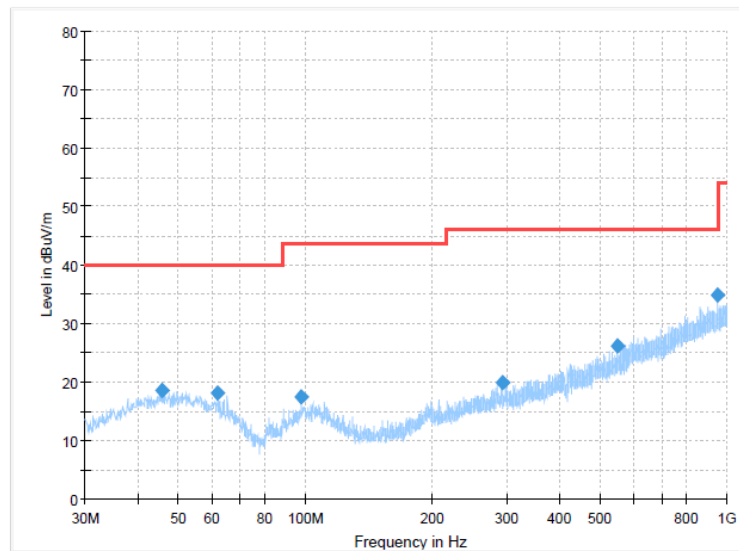
The EUT was pre-scanned this frequency band, found the radiated level 20dB lower than the limit, so don't show data on this report.

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:

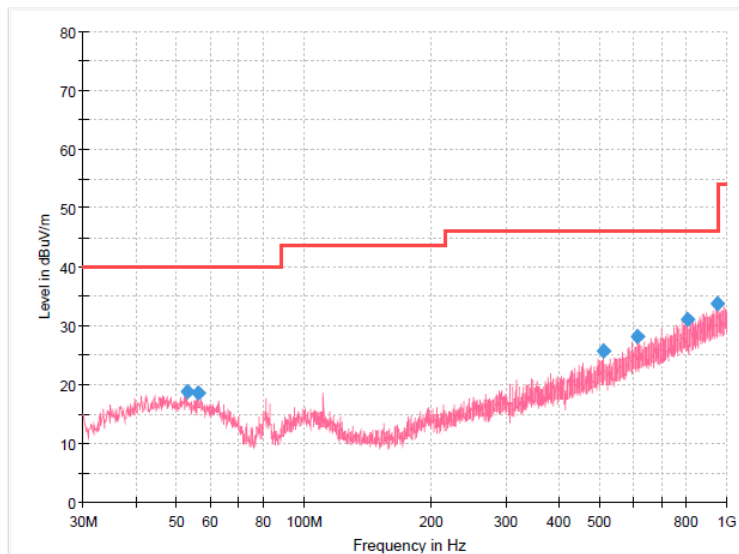
Horizontal

**Final Result**

Frequency (MHz)	MaxPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
45.7625	18.62	40.00	21.38	300.0	H	0.0	-8.8
61.7675	18.18	40.00	21.82	100.0	H	60.0	-10.4
97.7788	17.48	43.50	26.02	100.0	H	0.0	-11.1
294.2038	19.79	46.00	26.21	100.0	H	72.0	-7.5
550.5263	26.08	46.00	19.92	300.0	H	222.0	-0.9
948.4688	34.95	46.00	11.05	300.0	H	0.0	7.1

Polarization:

Vertical

**Final Result**

Frequency (MHz)	MaxPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
52.7950	18.70	40.00	21.30	100.0	V	229.0	-8.9
56.1900	18.55	40.00	21.45	100.0	V	349.0	-9.1
509.4225	25.73	46.00	20.27	100.0	V	79.0	-1.8
616.4863	28.13	46.00	17.87	100.0	V	79.0	1.3
806.0000	31.06	46.00	14.94	100.0	V	79.0	4.8
948.5900	33.73	46.00	12.27	100.0	V	268.0	7.1

For 1 GHz ~ 25 GHz

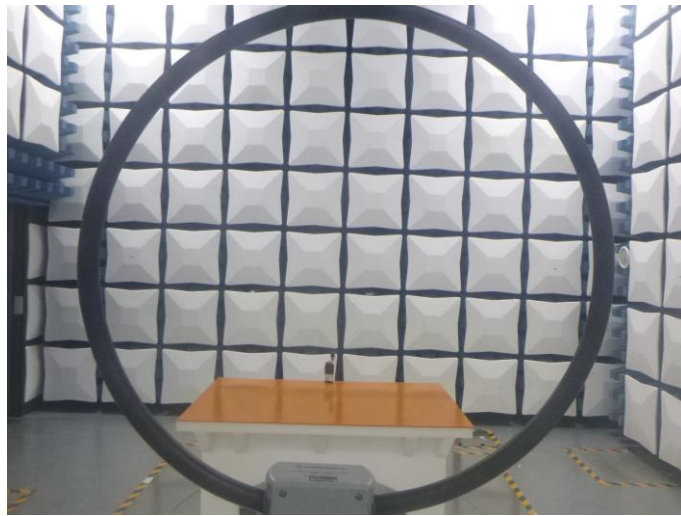
Test channel		CH00			Polarity		Horizontal		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	3104.22	41.29	28.81	4.65	37.42	37.33	74.00	-36.67	Peak
2	4809.50	47.53	31.28	6.00	35.88	48.93	74.00	-25.07	Peak
3	6868.65	39.49	34.44	7.34	34.20	47.07	74.00	-26.93	Peak
4	9759.59	35.43	39.30	9.46	33.66	50.53	74.00	-23.47	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	3525.56	41.96	29.10	5.15	37.45	38.76	74.00	-35.24	Peak
2	4809.50	44.66	31.28	6.00	35.88	46.06	74.00	-27.94	Peak
3	7009.96	38.84	35.14	7.35	34.24	47.09	74.00	-26.91	Peak
4	10560.94	37.69	40.00	9.79	36.03	51.45	74.00	-22.55	Peak

Test channel		CH39			Polarity		Horizontal		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	3274.67	41.26	28.45	4.82	37.44	37.09	74.00	-36.91	Peak
2	4883.52	49.15	31.20	6.21	35.97	50.59	74.00	-23.41	Peak
3	6992.14	38.64	35.07	7.34	34.22	46.83	74.00	-27.17	Peak
4	10560.94	36.94	40.00	9.79	36.03	50.70	74.00	-23.30	Peak
Test channel		CH39			Polarity		Vertical		
Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	3561.64	40.79	29.22	5.16	37.36	37.81	74.00	-36.19	Peak
2	4883.52	46.71	31.20	6.21	35.97	48.15	74.00	-25.85	Peak
3	6956.63	38.75	34.93	7.35	34.16	46.87	74.00	-27.13	Peak
4	9784.47	34.75	39.30	9.48	33.44	50.09	74.00	-23.91	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	3588.94	40.65	29.28	5.08	37.24	37.77	74.00	-36.23	Peak
2	4958.68	40.96	31.23	6.07	35.83	42.43	74.00	-31.57	Peak
3	6974.36	39.13	35.00	7.34	34.15	47.32	74.00	-26.68	Peak
4	9734.78	36.43	39.30	9.43	33.89	51.27	74.00	-22.73	Peak
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	3151.99	40.34	28.90	4.70	37.27	36.67	74.00	-37.33	Peak
2	4354.97	40.64	30.40	5.84	36.39	40.49	74.00	-33.51	Peak
3	6921.30	39.04	34.67	7.39	34.41	46.69	74.00	-27.31	Peak
4	10614.84	36.97	40.00	9.81	36.01	50.77	74.00	-23.23	Peak

6. TEST SETUP PHOTOS

Radiated Emission





7. EXTERNAL AND INTERNAL PHOTOS

Refer to the test report No.: CHTEW23100067

8. APPENDIX REPORT

APPENDIX REPORT

Project No.	SHT2304024504EW	Radio Specification	Bluetooth EDR
Test sample No.	YPHT23040245005	Model No.	EP8100 VHF
Start test date	2023/9/5	Finish date	2023/9/19
Temperature	23.9℃	Humidity	47%
Test Engineer	<i>Casper Chen</i>	Auditor	<i>Xiaodong Zhao</i>

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

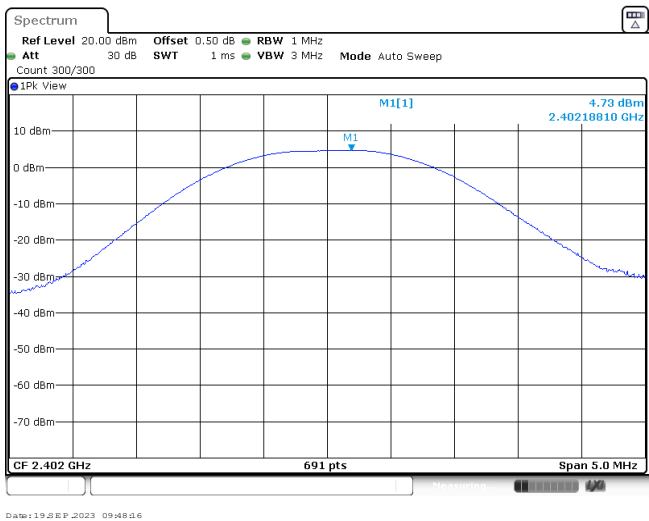
Appendix A: Peak Output Power

Modulation type	Channel	Peak Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
GFSK	00	4.73	4.67	≤ 30.00	Pass
	39	3.06	2.98		
	78	3.89	3.83		
$\pi/4$ DQPSK	00	3.58	3.51	≤ 21.00	Pass
	39	1.67	1.59		
	78	3.62	3.56		
8DPSK	00	3.76	3.69	≤ 21.00	Pass
	39	2.01	1.97		
	78	3.71	3.66		

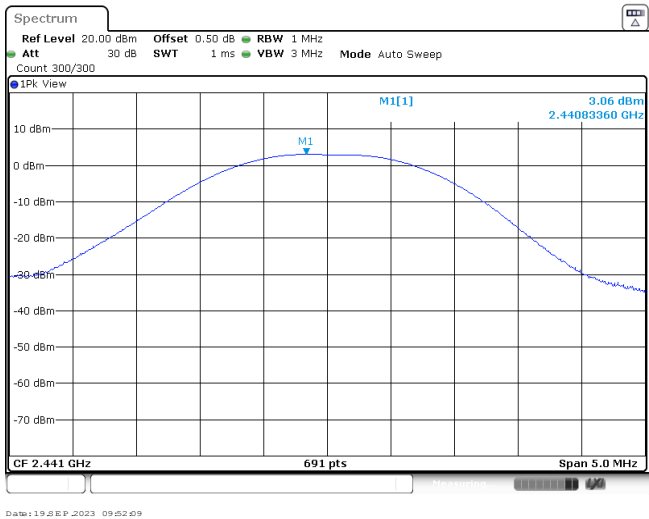
Modulation Type:

GFSK

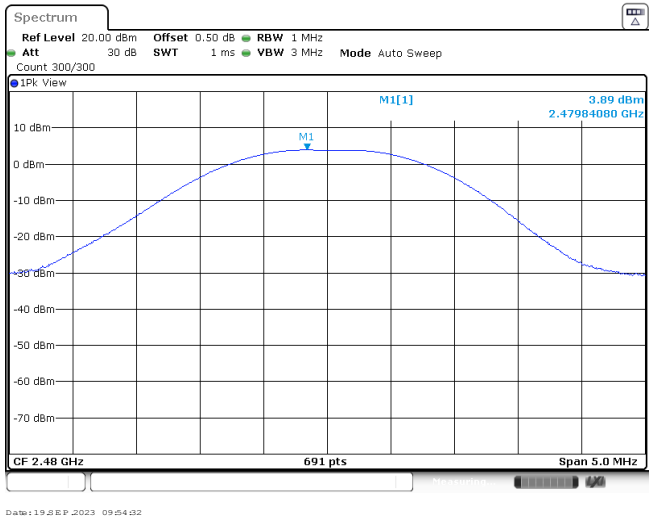
CH00



CH39



CH78

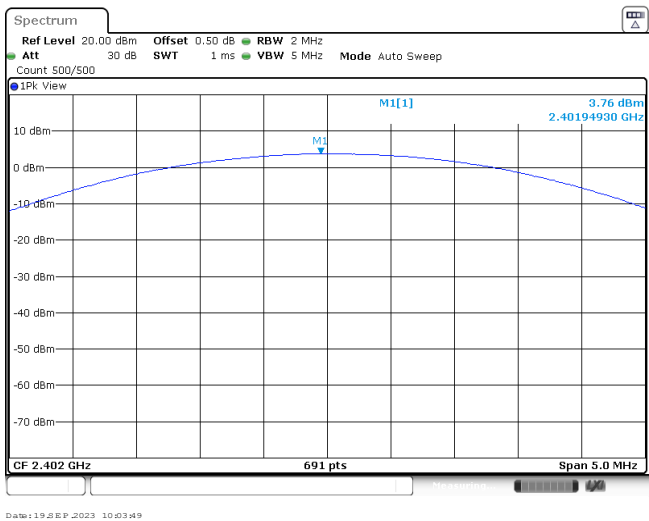


Modulation Type: $\pi/4$ DQPSK	
CH00	<div><div><div><div>Spectrum</div><div><div>Ref Level 20.00 dBm</div><div>Att 30 dB</div><div>Count 500/500</div></div><div><div>Offset 0.50 dB</div><div>SWT 1 ms</div><div>RBW 2 MHz</div><div>VBW 5 MHz</div><div>Mode Auto Sweep</div></div></div></div><div><div>1Pk View</div><div><div>M1[1]</div><div>3.58 dBm</div><div>2.40215200 GHz</div></div><div><div>10 dBm</div><div>0 dBm</div><div>-10 dBm</div><div>-20 dBm</div><div>-30 dBm</div><div>-40 dBm</div><div>-50 dBm</div><div>-60 dBm</div><div>-70 dBm</div></div><div><div>CF 2.402 GHz</div><div>691 pts</div><div>Span 5.0 MHz</div></div></div><div>Date: 19 SEP 2023 09:56:20</div></div>
CH39	<div><div><div><div>Spectrum</div><div><div>Ref Level 20.00 dBm</div><div>Att 30 dB</div><div>Count 500/500</div></div><div><div>Offset 0.50 dB</div><div>SWT 1 ms</div><div>RBW 2 MHz</div><div>VBW 5 MHz</div><div>Mode Auto Sweep</div></div></div></div><div><div>1Pk View</div><div><div>M1[1]</div><div>1.67 dBm</div><div>2.44081190 GHz</div></div><div><div>10 dBm</div><div>0 dBm</div><div>-10 dBm</div><div>-20 dBm</div><div>-30 dBm</div><div>-40 dBm</div><div>-50 dBm</div><div>-60 dBm</div><div>-70 dBm</div></div><div><div>CF 2.441 GHz</div><div>691 pts</div><div>Span 5.0 MHz</div></div></div><div>Date: 19 SEP 2023 09:59:15</div></div>
CH78	<div><div><div><div>Spectrum</div><div><div>Ref Level 20.00 dBm</div><div>Att 30 dB</div><div>Count 500/500</div></div><div><div>Offset 0.50 dB</div><div>SWT 1 ms</div><div>RBW 2 MHz</div><div>VBW 5 MHz</div><div>Mode Auto Sweep</div></div></div></div><div><div>1Pk View</div><div><div>M1[1]</div><div>3.62 dBm</div><div>2.47986250 GHz</div></div><div><div>10 dBm</div><div>0 dBm</div><div>-10 dBm</div><div>-20 dBm</div><div>-30 dBm</div><div>-40 dBm</div><div>-50 dBm</div><div>-60 dBm</div><div>-70 dBm</div></div><div><div>CF 2.48 GHz</div><div>691 pts</div><div>Span 5.0 MHz</div></div></div><div>Date: 19 SEP 2023 10:01:21</div></div>

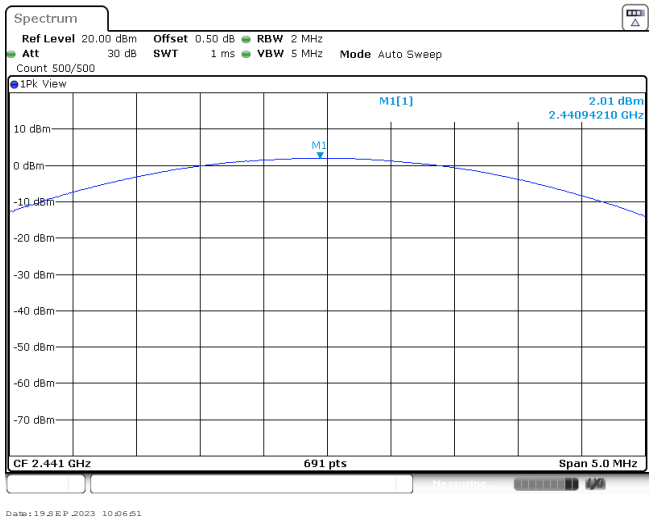
Modulation Type:

8DPSK

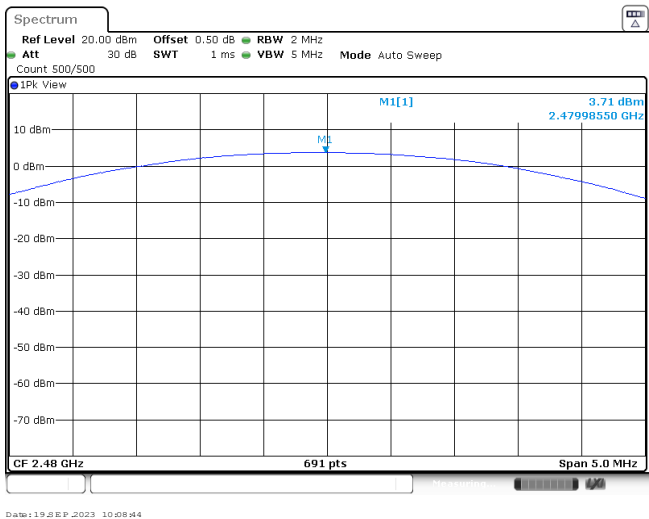
CH00



CH39



CH78



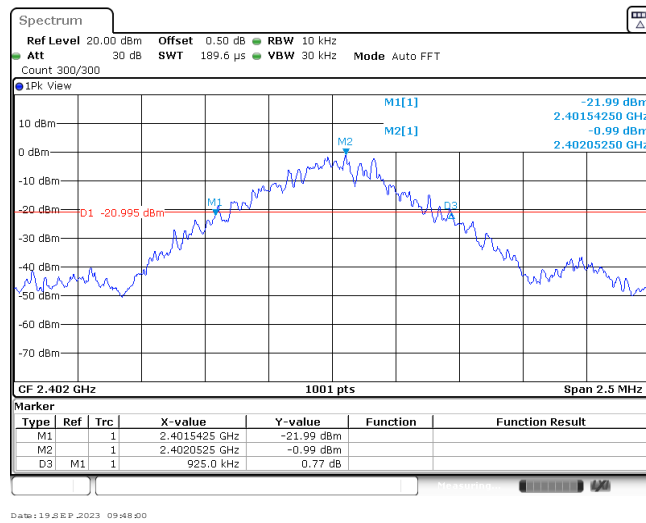
Appendix B : 20 dB Bandwidth

Modulation type	Channel	20 dB Bandwidth (kHz)	Limit (kHz)	Result
GFSK	00	925.00	-	Pass
	39	925.00		
	78	925.00		
$\pi/4$ DQPSK	00	1273.00	-	Pass
	39	1240.00		
	78	1293.00		
8DPSK	00	1275.00	-	Pass
	39	1258.00		
	78	1290.00		

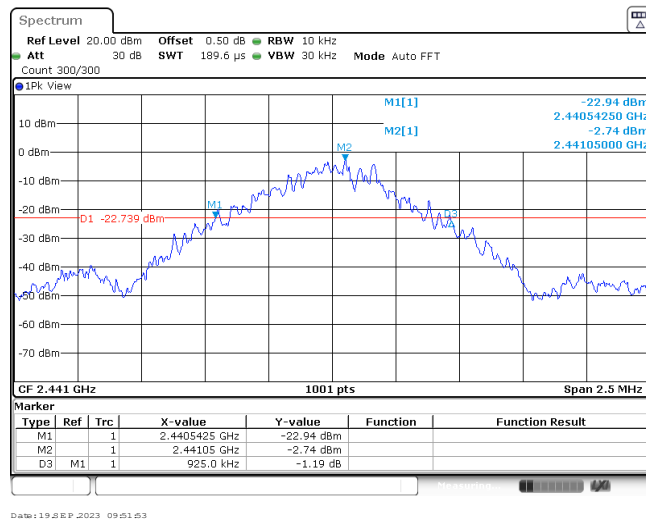
Modulation Type:

GFSK

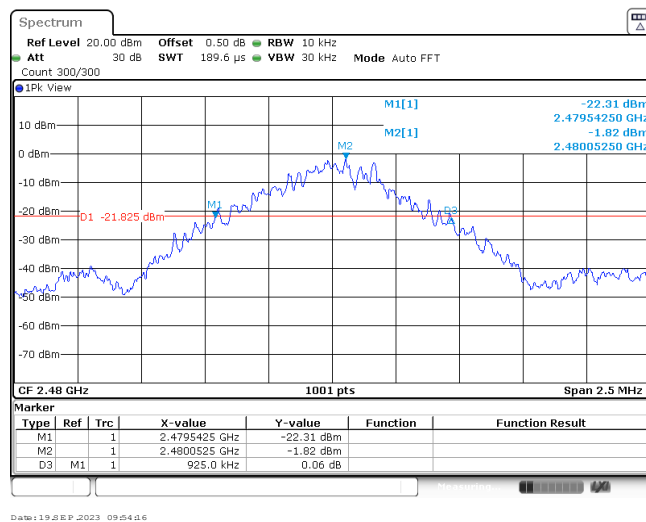
CH00



CH39



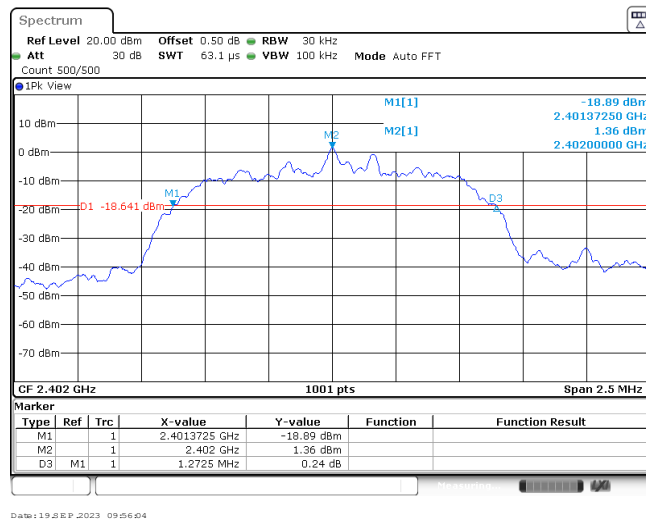
CH78



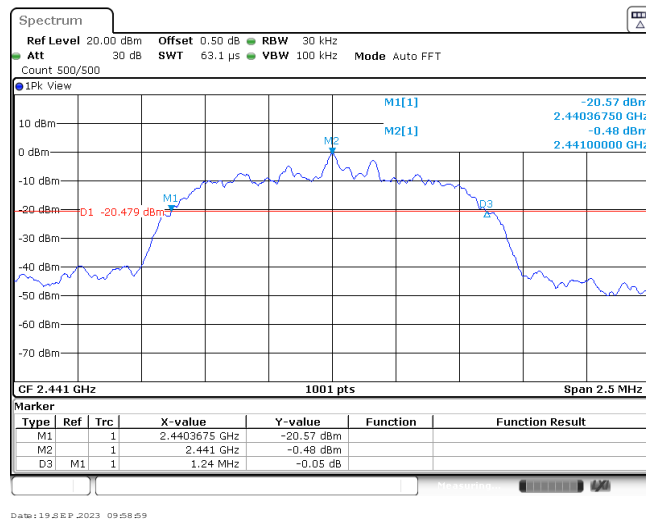
Modulation Type:

 $\pi/4$ DQPSK

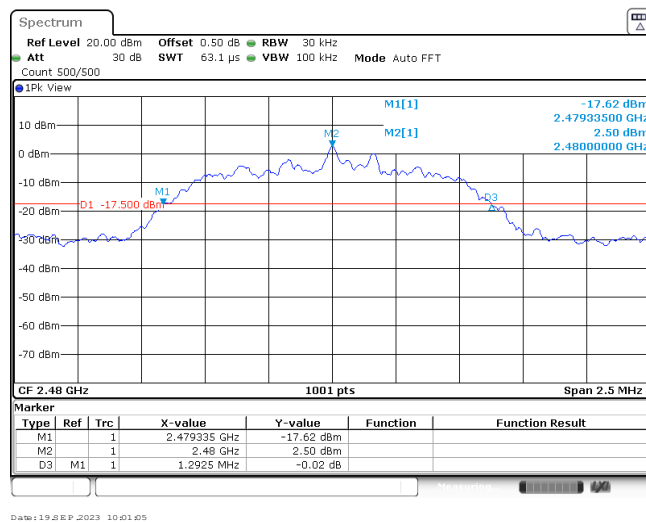
CH00



CH39



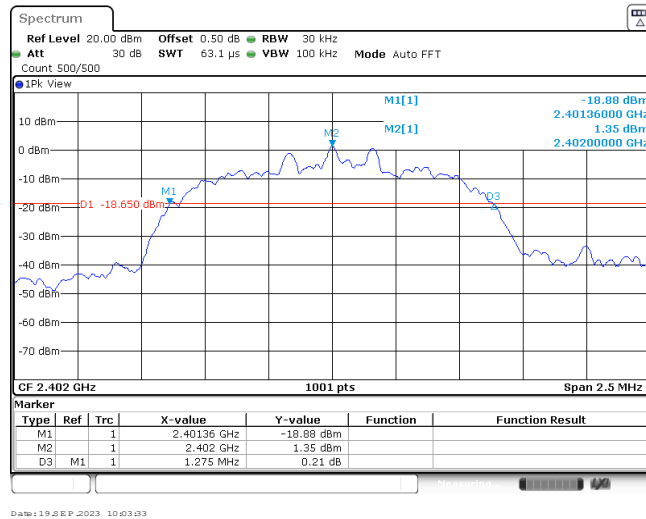
CH78



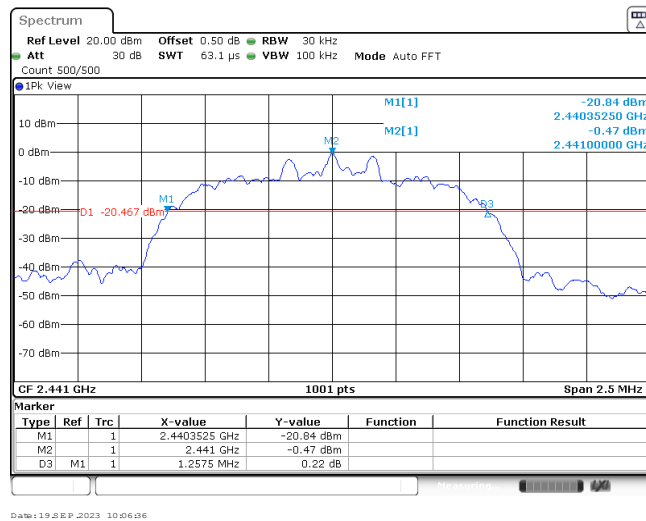
Modulation Type:

8DPSK

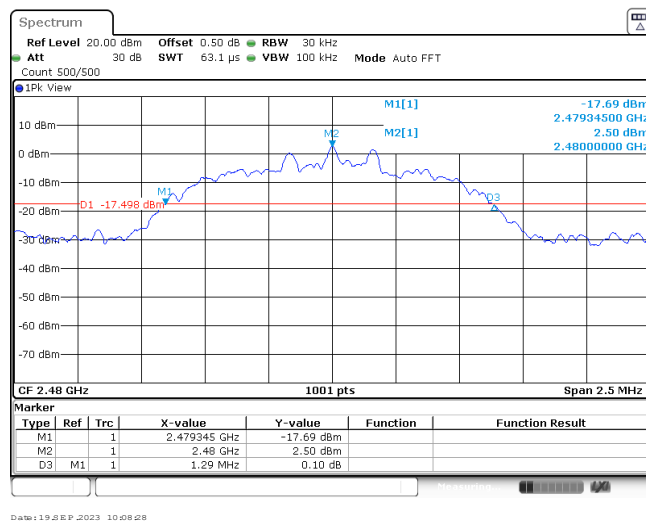
CH00



CH39

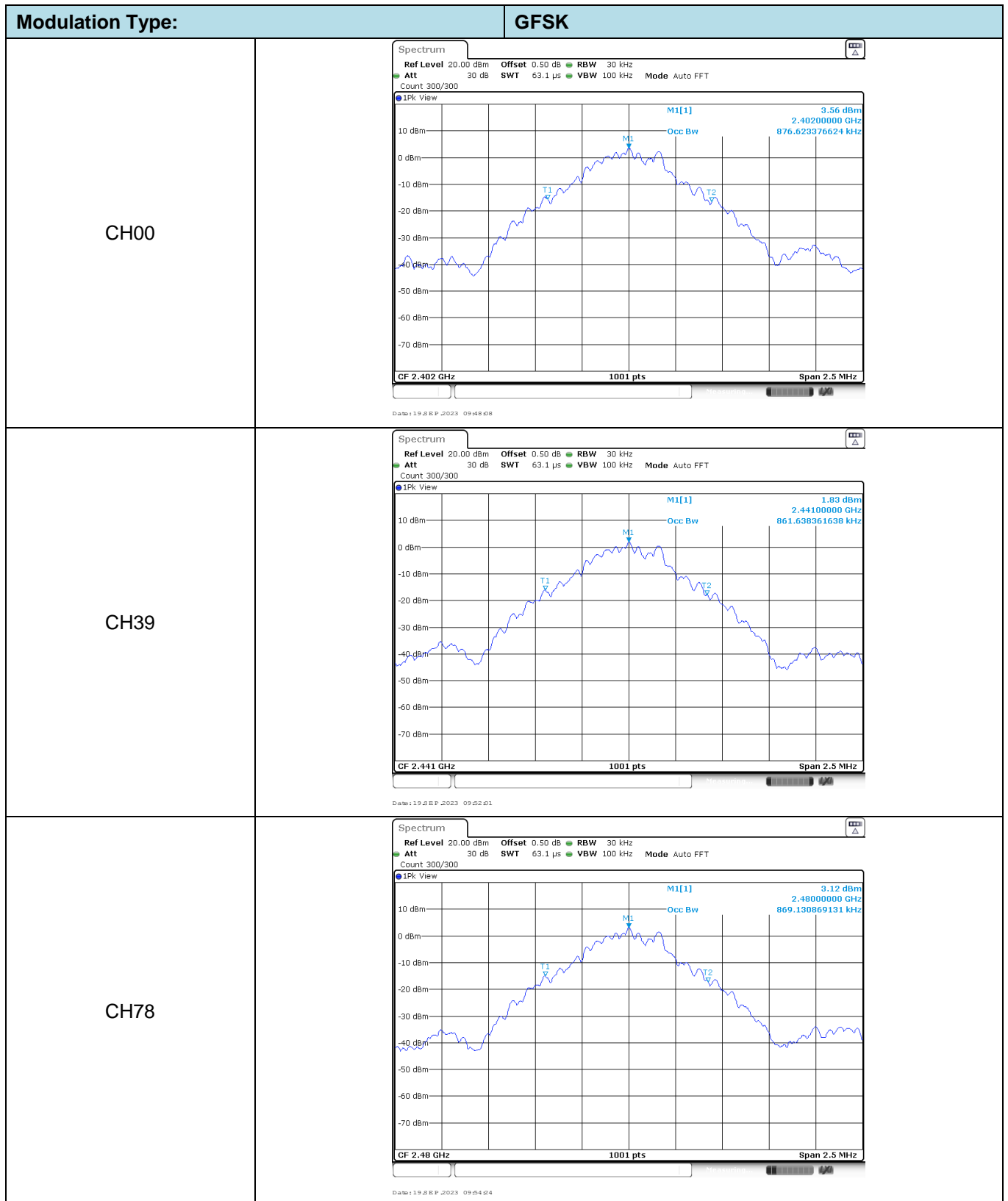


CH78

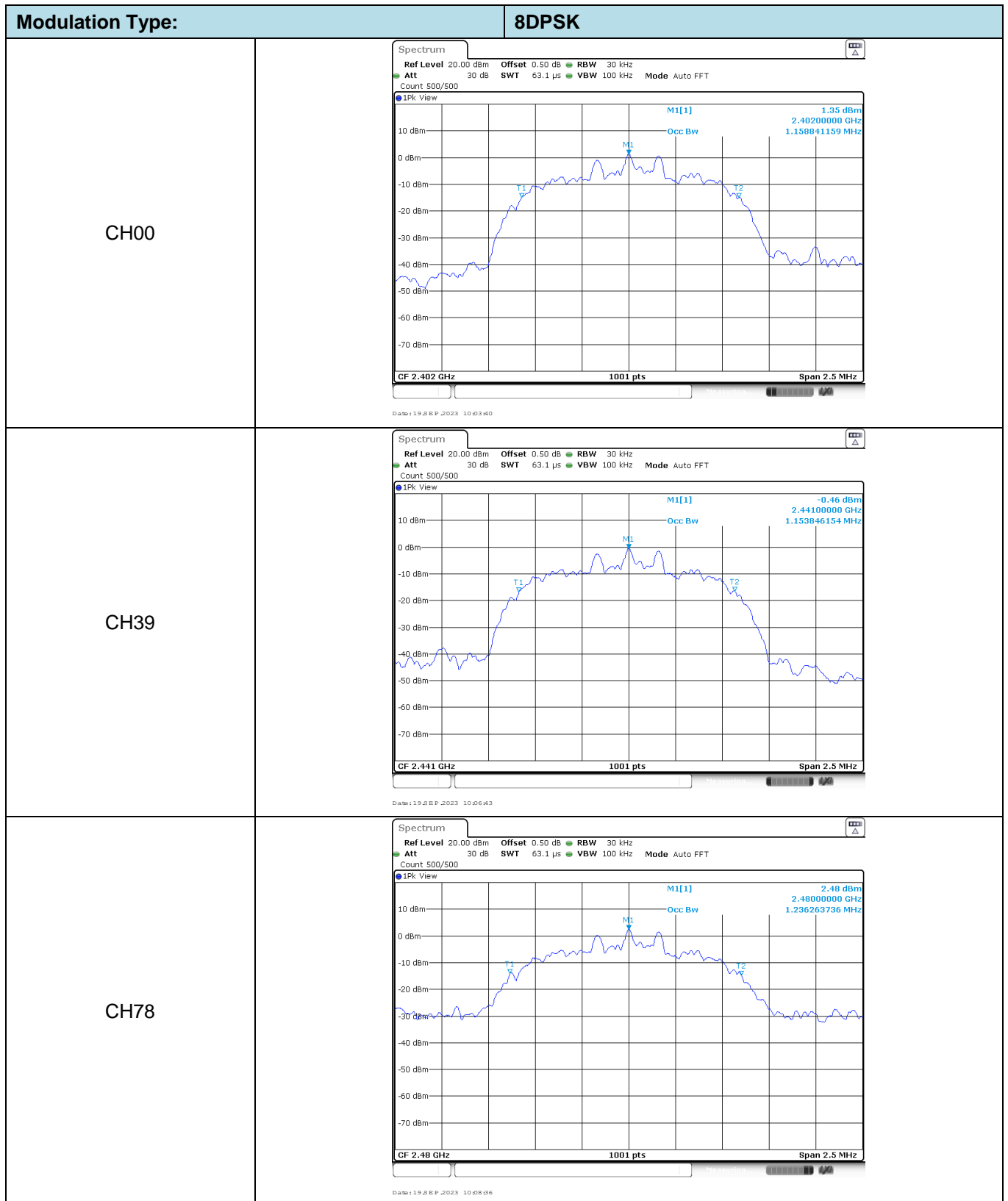


Appendix C: 99% Occupied Bandwidth

Modulation type	Channel	99% Occupied Bandwidth (MHz)	Limit (MHz)	Result
GFSK	00	0.88	-	Pass
	39	0.86		
	78	0.87		
$\pi/4$ DQPSK	00	1.18	-	Pass
	39	1.17		
	78	1.24		
8DPSK	00	1.16	-	Pass
	39	1.15		
	78	1.24		



Modulation Type: $\pi/4$ DQPSK	
CH00	<div><div><div><div><div>Spectrum</div><div><div>Ref Level 20.00 dBm</div><div>Offset 0.50 dB</div><div>RBW 30 kHz</div><div>Att 30 dB</div><div>SWT 63.1 μs</div><div>VBW 100 kHz</div><div>Mode Auto FFT</div><div>Count 500/500</div></div><div>1Pk View</div></div><div><div><div><div><div>M1[1]</div><div>1.35 dBm</div><div>2.40200000 GHz</div><div>1.176323676 MHz</div></div><div><div>Occ Bw</div></div></div><div><div><div>T1</div><div>T2</div></div></div></div><div><div>CF 2.402 GHz</div><div>1001 pts</div><div>Span 2.5 MHz</div></div></div><div>Date: 19 SEP 2023 09:56:12</div></div></div></div>
CH39	<div><div><div><div><div>Spectrum</div><div><div>Ref Level 20.00 dBm</div><div>Offset 0.50 dB</div><div>RBW 30 kHz</div><div>Att 30 dB</div><div>SWT 63.1 μs</div><div>VBW 100 kHz</div><div>Mode Auto FFT</div><div>Count 500/500</div></div><div>1Pk View</div></div><div><div><div><div><div>M1[1]</div><div>-0.49 dBm</div><div>2.44100000 GHz</div><div>1.166333666 MHz</div></div><div><div>Occ Bw</div></div></div><div><div><div>T1</div><div>T2</div></div></div></div><div><div>CF 2.441 GHz</div><div>1001 pts</div><div>Span 2.5 MHz</div></div></div><div>Date: 19 SEP 2023 09:59:07</div></div></div></div>
CH78	<div><div><div><div><div>Spectrum</div><div><div>Ref Level 20.00 dBm</div><div>Offset 0.50 dB</div><div>RBW 30 kHz</div><div>Att 30 dB</div><div>SWT 63.1 μs</div><div>VBW 100 kHz</div><div>Mode Auto FFT</div><div>Count 500/500</div></div><div>1Pk View</div></div><div><div><div><div><div>M1[1]</div><div>2.48 dBm</div><div>2.48000000 GHz</div><div>1.243756244 MHz</div></div><div><div>Occ Bw</div></div></div><div><div><div>T1</div><div>T2</div></div></div></div><div><div>CF 2.48 GHz</div><div>1001 pts</div><div>Span 2.5 MHz</div></div></div><div>Date: 19 SEP 2023 10:01:13</div></div></div></div>



Appendix D: Carrier Frequencies Separation

Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (kHz) *	Result
GFSK	39	1.00	≥925.00	Pass
π/4DQPSK	39	1.00	≥862.00	Pass
8DPSK	39	1.00	≥860.00	Pass

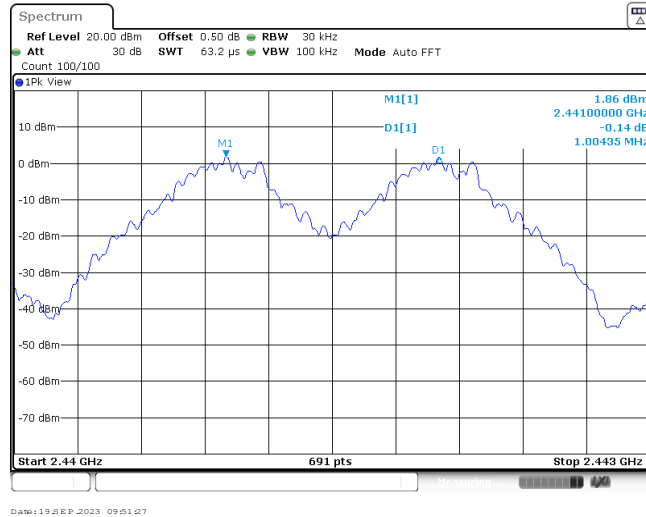
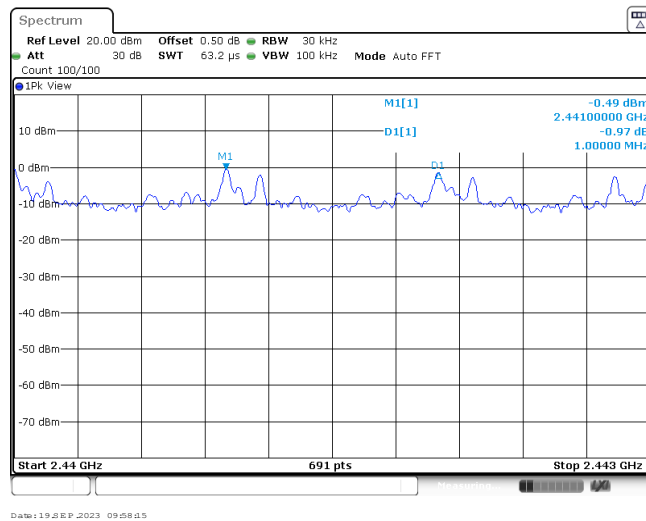
Note:

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

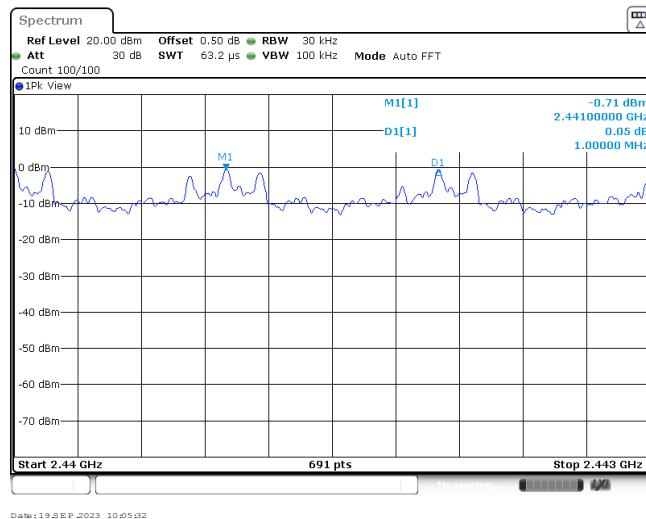
π/4DQPSK limit = 2/3 * The maximum 20 dB Bandwidth for π/4DQPSK modulation on the appendix B.

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

GFSK

 $\pi/4$ DQPSK

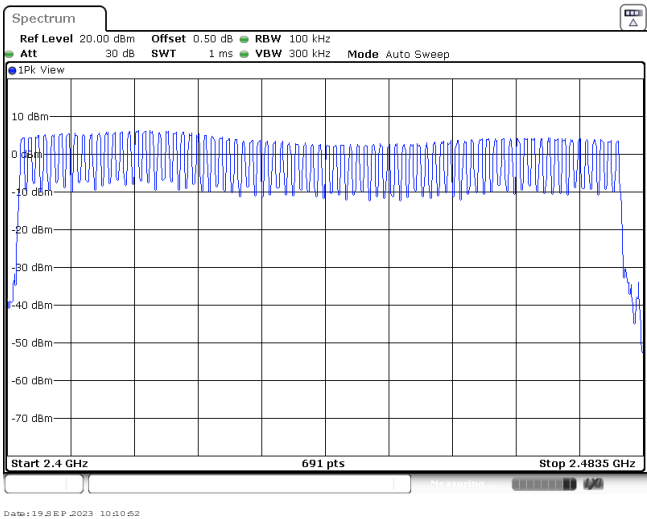
8DPSK



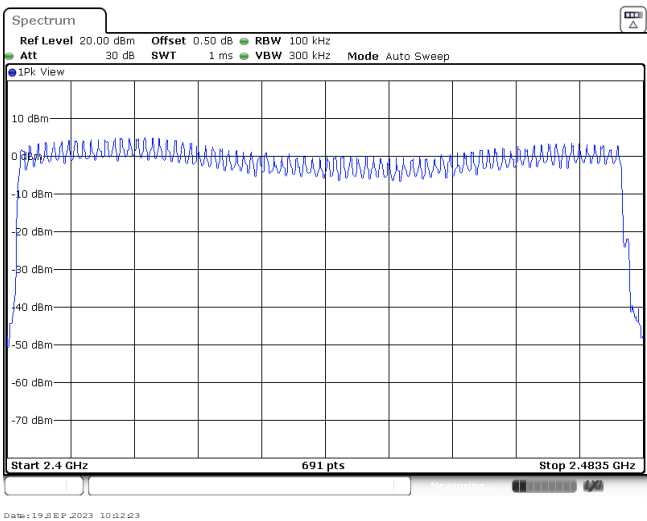
Appendix E: Hopping Channel Number

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

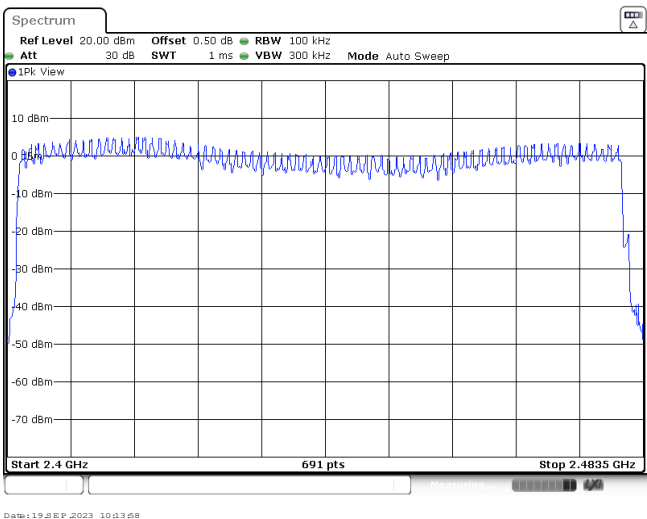
GFSK



$\pi/4$ DQPSK



8DPSK



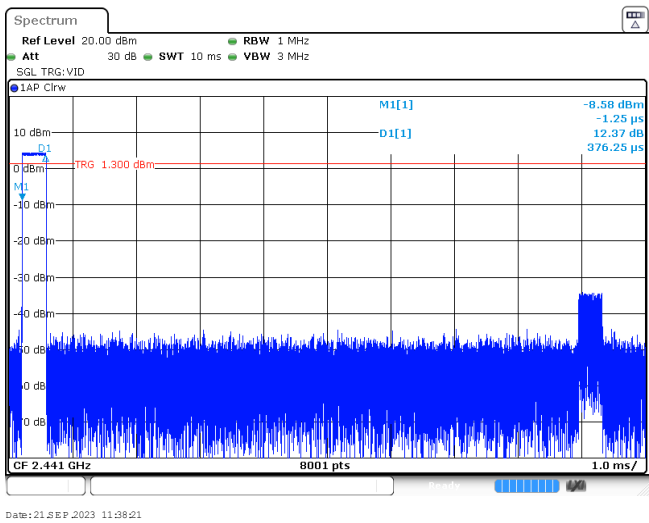
Appendix F: Dwell Time

Modulation type	Packet	Burst Width [ms]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.38	313.00	0.12	≤ 0.40	Pass
	DH3	1.63	160.00	0.26		
	DH5	2.91	107.00	0.31		
$\pi/4$ DQPSK	2DH1	0.38	314.00	0.12	≤ 0.40	Pass
	2DH3	1.64	160.00	0.26		
	2DH5	2.91	107.00	0.31		
8DPSK	3DH1	0.39	313.00	0.12	≤ 0.40	Pass
	3DH3	1.64	159.00	0.26		
	3DH5	2.91	116.00	0.34		

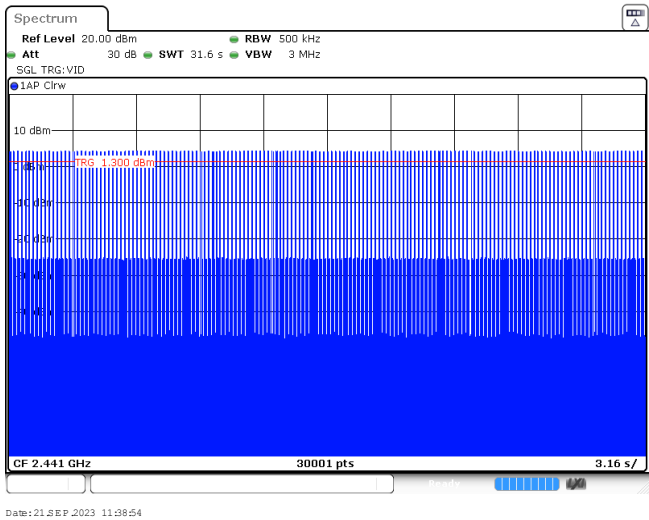
Modulation Type:

GFSK

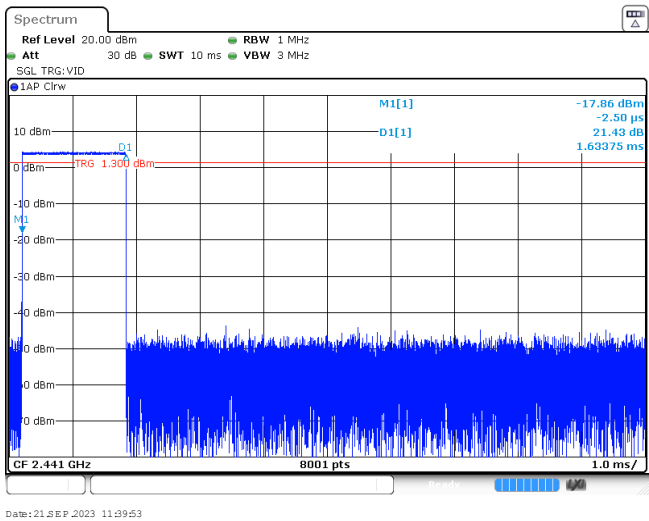
DH1
Burst width



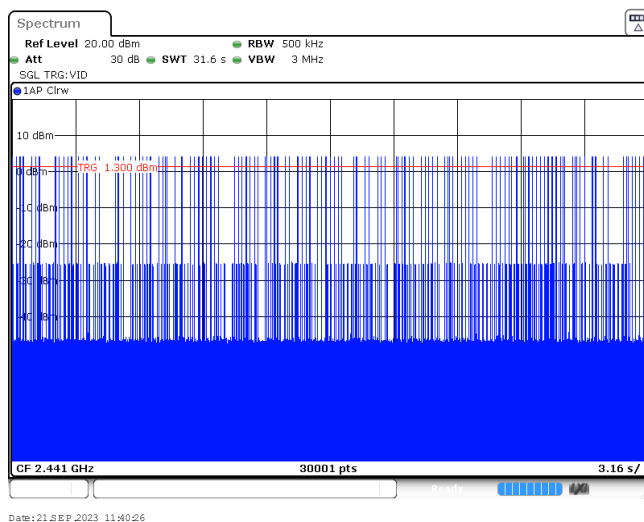
DH1
Burst number



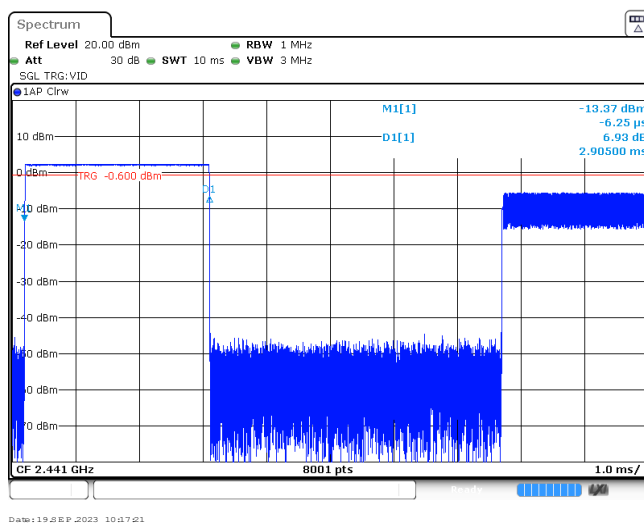
DH3
Burst width



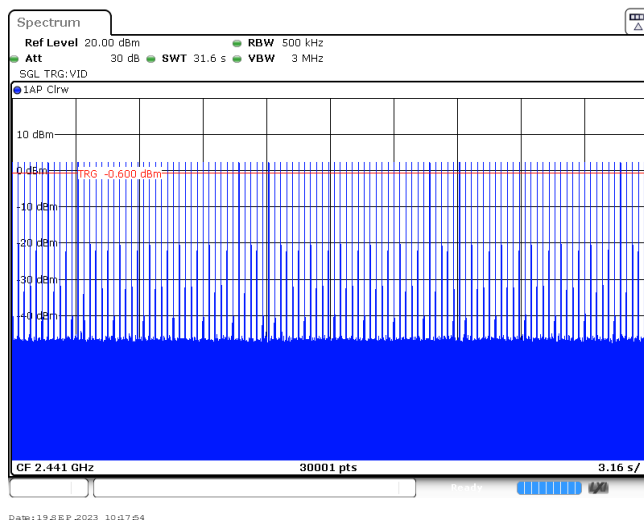
DH3
Burst number



DH5
Burst width



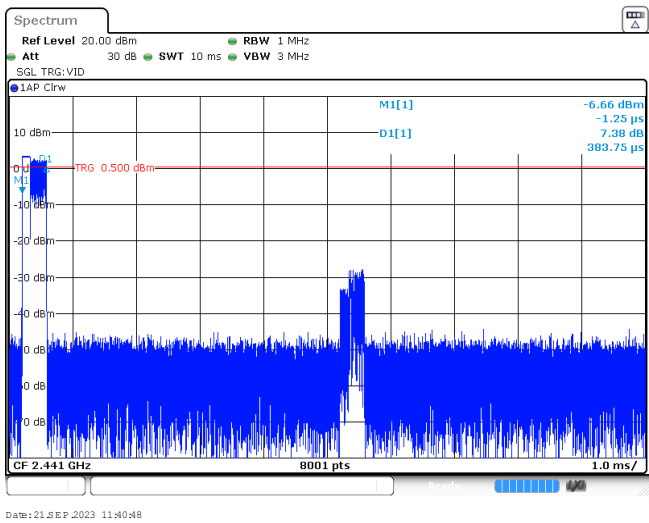
DH5
Burst number



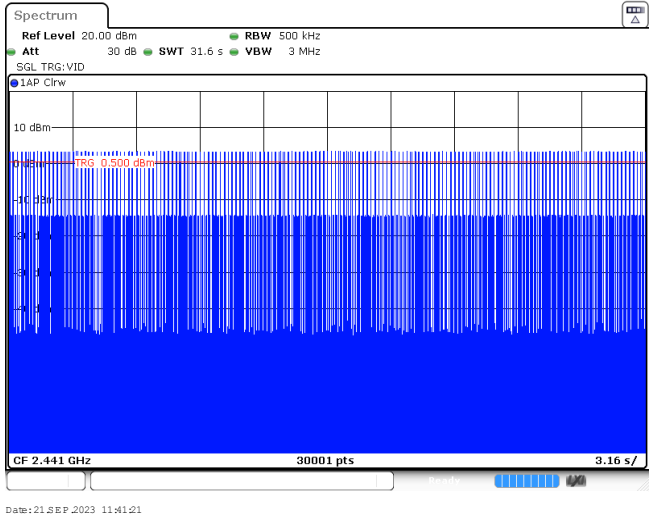
Modulation Type:

$\pi/4$ DQPSK

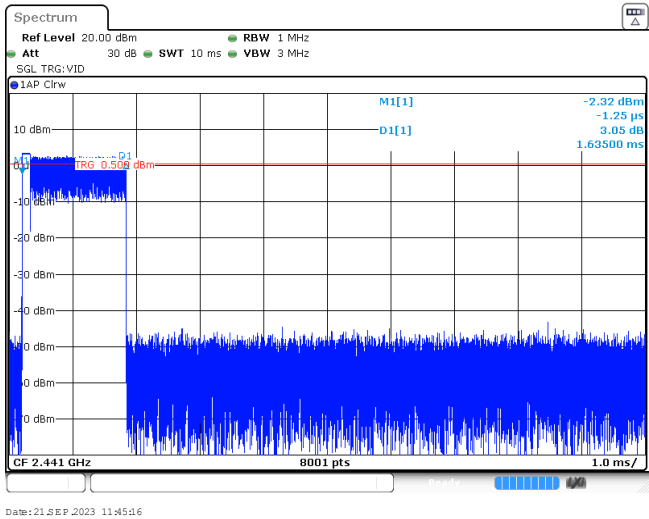
2DH1
Burst width

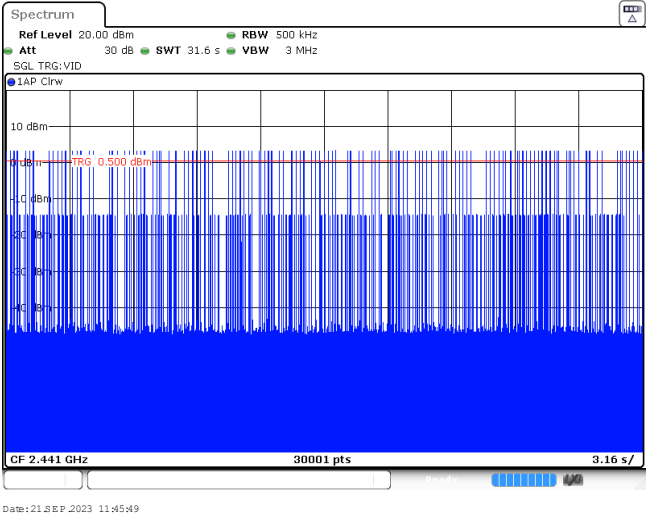
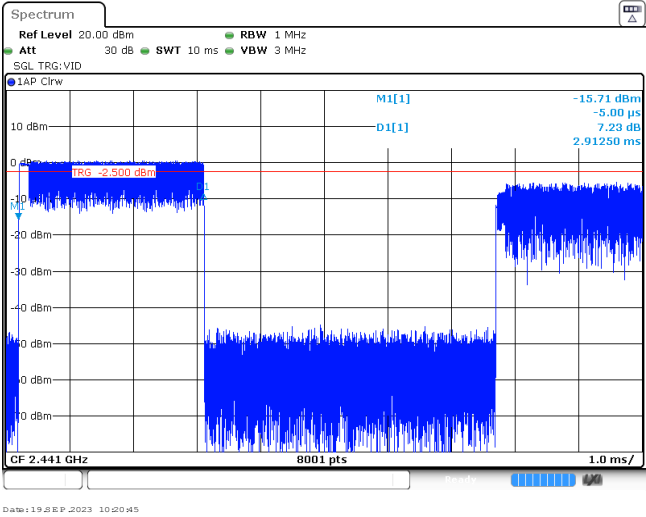
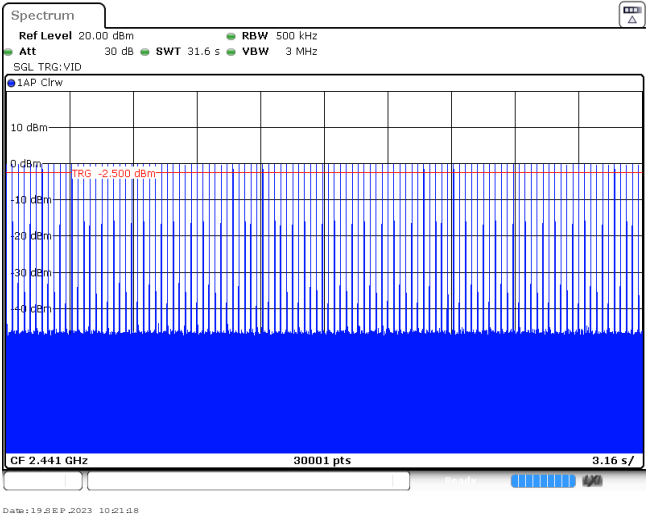


2DH1
Burst number

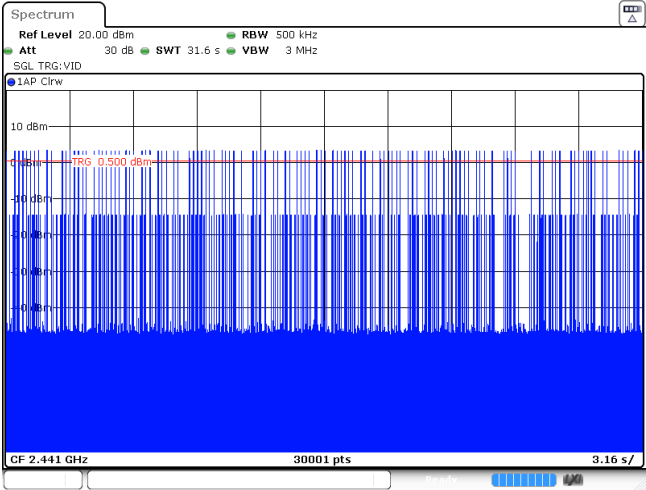
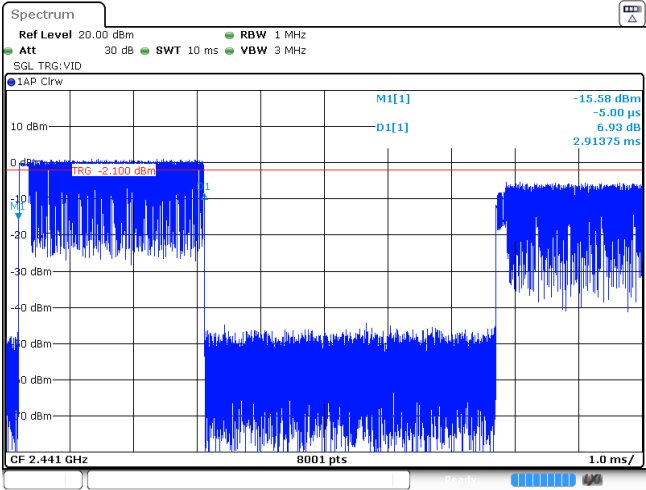
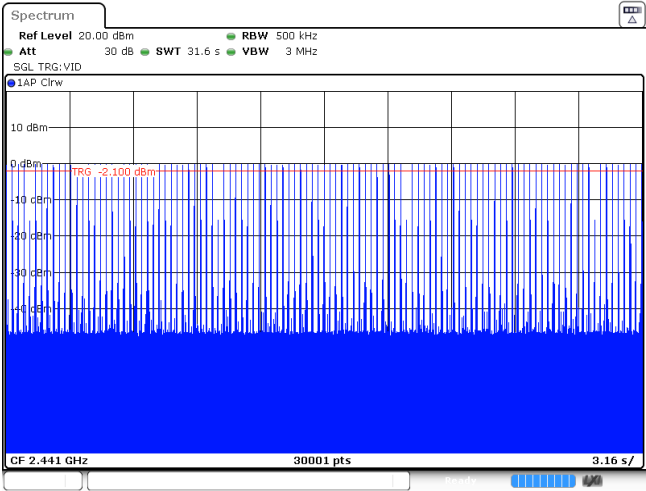


2DH3
Burst width



<p>2DH3 Burst number</p>	
<p>2DH5 Burst width</p>	
<p>2DH5 Burst number</p>	

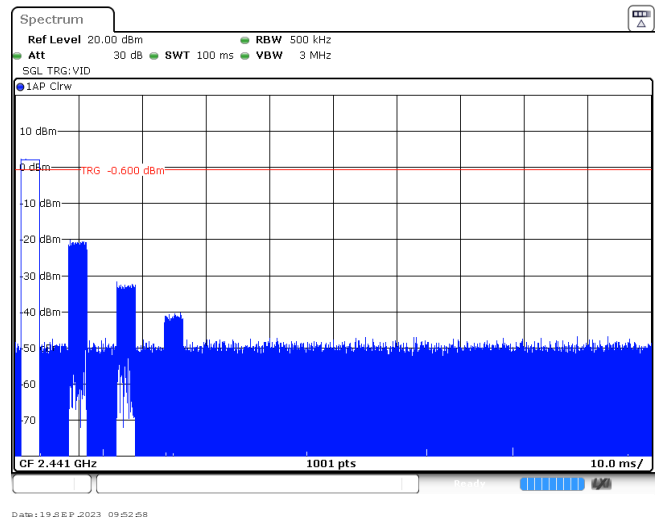
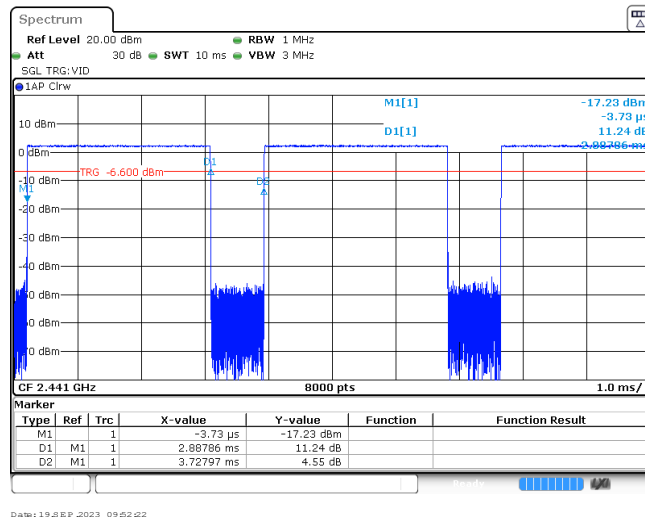
Appendix report page: 23 of 41

<p>3DH3 Burst number</p>	 <p>The spectrum plot shows a dense signal across the frequency range from 2.441 GHz to 3.16 s. The y-axis represents power in dBm, ranging from -40 dBm to 10 dBm. A red trigger line is set at -2.100 dBm. The plot title is 'Spectrum' and the reference level is 20.00 dBm. The bandwidth (RBW) is 500 kHz, and the video bandwidth (VBW) is 3 MHz. The sweep time (SWT) is 31.6 s. The plot shows a dense signal across the frequency range from 2.441 GHz to 3.16 s. The y-axis represents power in dBm, ranging from -40 dBm to 10 dBm. A red trigger line is set at -2.100 dBm. The plot title is 'Spectrum' and the reference level is 20.00 dBm. The bandwidth (RBW) is 500 kHz, and the video bandwidth (VBW) is 3 MHz. The sweep time (SWT) is 31.6 s. The plot shows a dense signal across the frequency range from 2.441 GHz to 3.16 s. The y-axis represents power in dBm, ranging from -40 dBm to 10 dBm. A red trigger line is set at -2.100 dBm. The plot title is 'Spectrum' and the reference level is 20.00 dBm. The bandwidth (RBW) is 500 kHz, and the video bandwidth (VBW) is 3 MHz. The sweep time (SWT) is 31.6 s.</p>
<p>3DH5 Burst width</p>	 <p>The spectrum plot shows a signal with a burst width. The y-axis represents power in dBm, ranging from -40 dBm to 10 dBm. A red trigger line is set at -2.100 dBm. The plot title is 'Spectrum' and the reference level is 20.00 dBm. The bandwidth (RBW) is 1 MHz, and the video bandwidth (VBW) is 3 MHz. The sweep time (SWT) is 10 ms. The plot shows a signal with a burst width. The y-axis represents power in dBm, ranging from -40 dBm to 10 dBm. A red trigger line is set at -2.100 dBm. The plot title is 'Spectrum' and the reference level is 20.00 dBm. The bandwidth (RBW) is 1 MHz, and the video bandwidth (VBW) is 3 MHz. The sweep time (SWT) is 10 ms. The plot shows a signal with a burst width. The y-axis represents power in dBm, ranging from -40 dBm to 10 dBm. A red trigger line is set at -2.100 dBm. The plot title is 'Spectrum' and the reference level is 20.00 dBm. The bandwidth (RBW) is 1 MHz, and the video bandwidth (VBW) is 3 MHz. The sweep time (SWT) is 10 ms.</p>
<p>3DH5 Burst number</p>	 <p>The spectrum plot shows a dense signal across the frequency range from 2.441 GHz to 3.16 s. The y-axis represents power in dBm, ranging from -40 dBm to 10 dBm. A red trigger line is set at -2.100 dBm. The plot title is 'Spectrum' and the reference level is 20.00 dBm. The bandwidth (RBW) is 500 kHz, and the video bandwidth (VBW) is 3 MHz. The sweep time (SWT) is 31.6 s. The plot shows a dense signal across the frequency range from 2.441 GHz to 3.16 s. The y-axis represents power in dBm, ranging from -40 dBm to 10 dBm. A red trigger line is set at -2.100 dBm. The plot title is 'Spectrum' and the reference level is 20.00 dBm. The bandwidth (RBW) is 500 kHz, and the video bandwidth (VBW) is 3 MHz. The sweep time (SWT) is 31.6 s.</p>

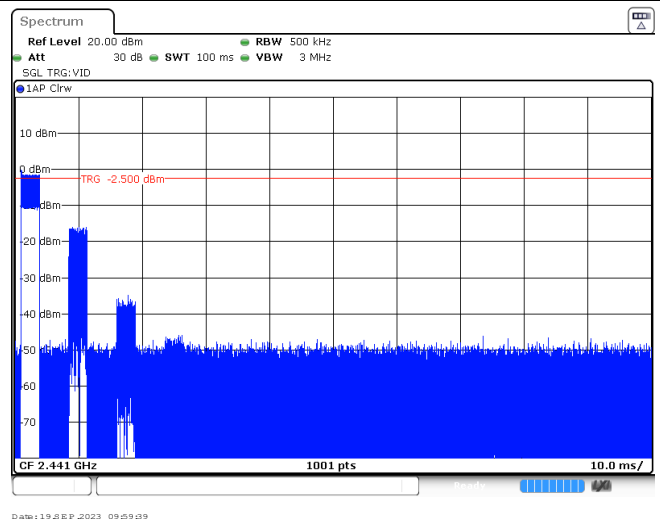
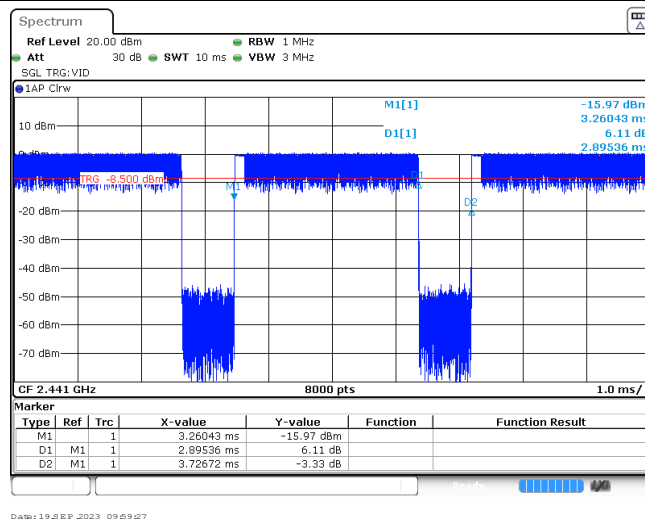
Appendix G: Duty Cycle Correction Factor (DCCF)

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	2.89	100	1.00	-30.78
$\pi/4$ DQPSK	2441	2.90	100	1.00	-30.75
8DPSK	2441	2.90	100	1.00	-30.75

GFSK

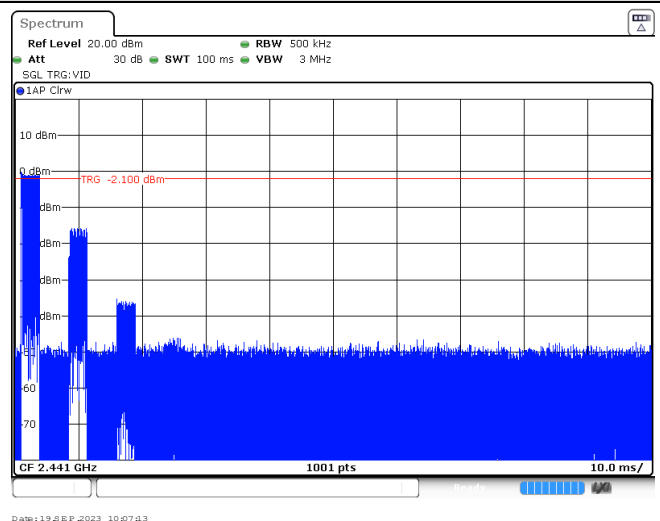
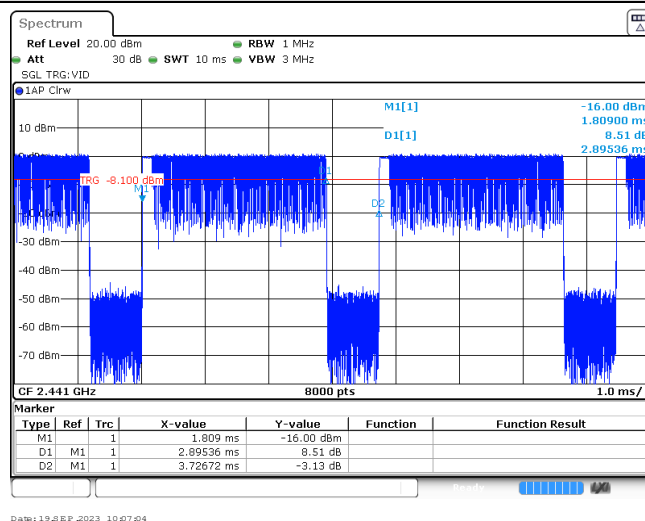
T_{on} time for single burst

Burst Quantity

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

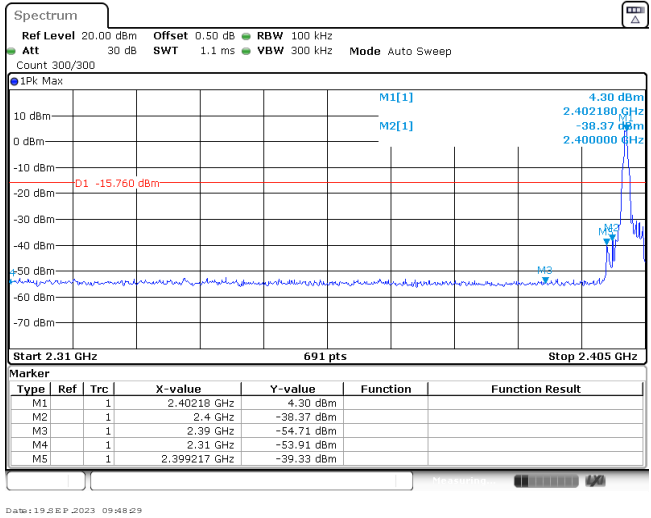
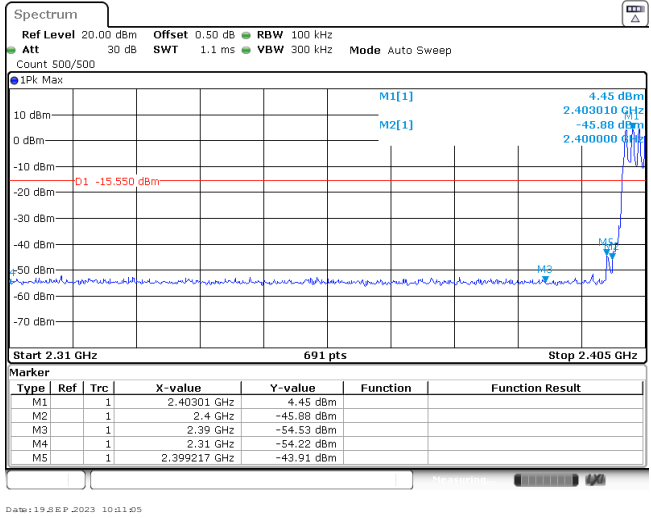
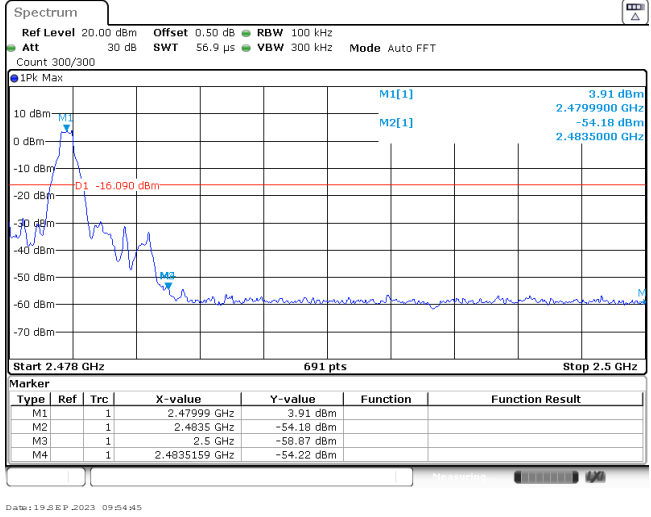
Burst Quantity

8DPSK

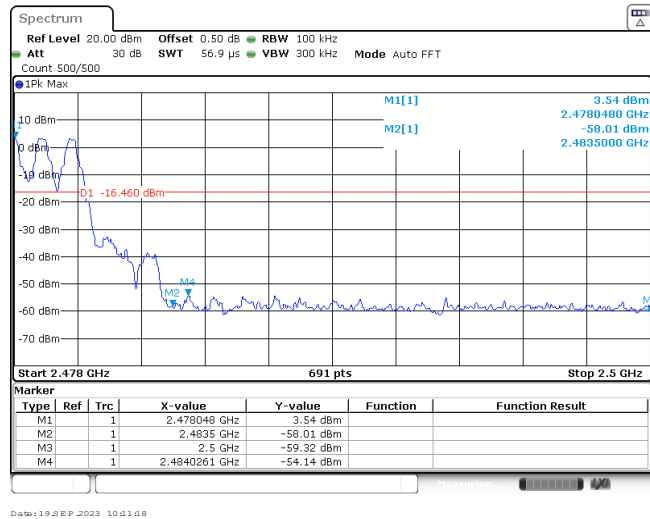
T_{on} time for single burst

Burst Quantity

Appendix H: Band edge and Spurious Emissions (conducted)

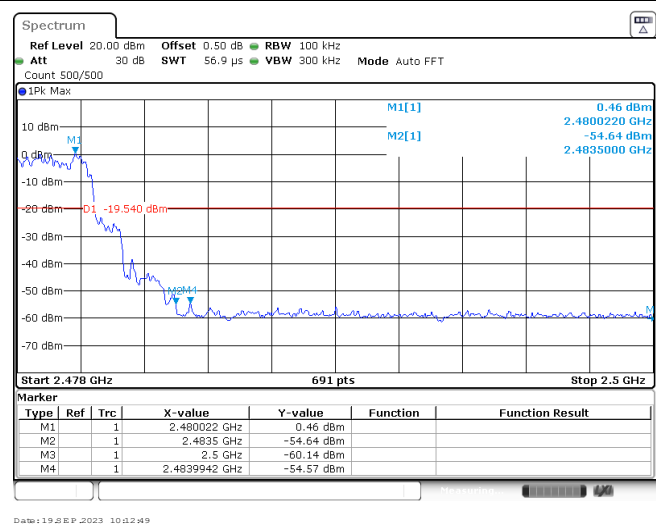
Test Item:	Band edge	Modulation type:	GFSK
CH00 No hopping mode			
CH00 Hopping mode			
CH78 No hopping mode			

CH78
Hopping mode



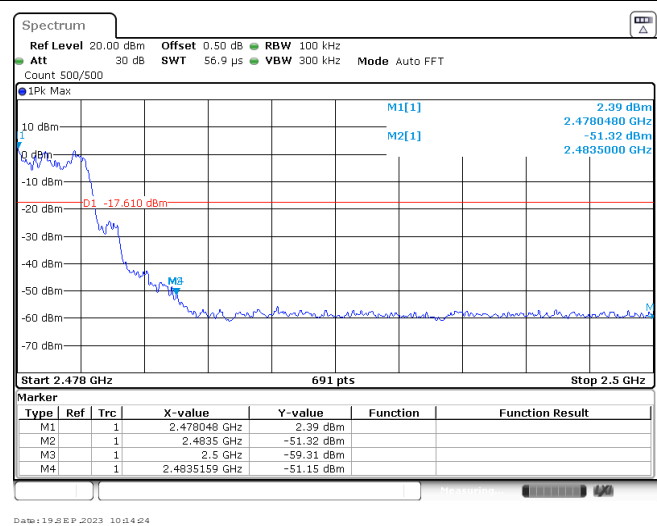
Test Item:	Band edge	Modulation type:	$\pi/4$ DQPSK																																										
CH00 No hopping mode	<div><div>Spectrum</div><div><div>Ref Level 20.00 dBm</div><div>Offset 0.50 dB</div><div>RBW 100 kHz</div><div>Att 30 dB</div><div>SWT 1.1 ms</div><div>VBW 300 kHz</div><div>Mode Auto Sweep</div><div>Count 500/500</div></div><div><div>1Pk Max</div><div><div><div>10 dBm</div><div>0 dBm</div><div>-10 dBm</div><div>-20 dBm</div><div>-30 dBm</div><div>-40 dBm</div><div>-50 dBm</div><div>-60 dBm</div><div>-70 dBm</div></div><div><div>M1[1]</div><div>M2[1]</div><div>M3</div><div>M4</div><div>M5</div></div><div><div>1.81 dBm</div><div>2.402180 GHz</div><div>-46.55 dBm</div><div>2.400000 GHz</div></div></div><div><div>D1 -18.190 dBm</div></div><div><div>Start 2.31 GHz</div><div>691 pts</div><div>Stop 2.405 GHz</div></div><div><div>Marker</div><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>1.81 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>2.4 GHz</td><td>-46.55 dBm</td><td></td><td></td></tr><tr><td>M3</td><td>1</td><td></td><td>2.39 GHz</td><td>-55.04 dBm</td><td></td><td></td></tr><tr><td>M4</td><td>1</td><td></td><td>2.31 GHz</td><td>-54.06 dBm</td><td></td><td></td></tr><tr><td>M5</td><td>1</td><td></td><td>2.399768 GHz</td><td>-50.48 dBm</td><td></td><td></td></tr></tbody></table></div></div><div><div>Date: 19 SEP 2023 09:56:33</div></div></div>			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.40218 GHz	1.81 dBm			M2	1		2.4 GHz	-46.55 dBm			M3	1		2.39 GHz	-55.04 dBm			M4	1		2.31 GHz	-54.06 dBm			M5	1		2.399768 GHz	-50.48 dBm		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																							
M1	1		2.40218 GHz	1.81 dBm																																									
M2	1		2.4 GHz	-46.55 dBm																																									
M3	1		2.39 GHz	-55.04 dBm																																									
M4	1		2.31 GHz	-54.06 dBm																																									
M5	1		2.399768 GHz	-50.48 dBm																																									
CH00 Hopping mode	<div><div>Spectrum</div><div><div>Ref Level 20.00 dBm</div><div>Offset 0.50 dB</div><div>RBW 100 kHz</div><div>Att 30 dB</div><div>SWT 1.1 ms</div><div>VBW 300 kHz</div><div>Mode Auto Sweep</div><div>Count 500/500</div></div><div><div>1Pk Max</div><div><div><div>10 dBm</div><div>0 dBm</div><div>-10 dBm</div><div>-20 dBm</div><div>-30 dBm</div><div>-40 dBm</div><div>-50 dBm</div><div>-60 dBm</div><div>-70 dBm</div></div><div><div>M1[1]</div><div>M2[1]</div><div>M3</div><div>M4</div><div>M5</div></div><div><div>1.04 dBm</div><div>2.403970 GHz</div><div>-53.02 dBm</div><div>2.400000 GHz</div></div></div><div><div>D1 -18.960 dBm</div></div><div><div>Start 2.31 GHz</div><div>691 pts</div><div>Stop 2.405 GHz</div></div><div><div>Marker</div><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>2.40397 GHz</td><td>1.04 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>2.4 GHz</td><td>-53.02 dBm</td><td></td><td></td></tr><tr><td>M3</td><td>1</td><td></td><td>2.39 GHz</td><td>-55.08 dBm</td><td></td><td></td></tr><tr><td>M4</td><td>1</td><td></td><td>2.31 GHz</td><td>-54.06 dBm</td><td></td><td></td></tr><tr><td>M5</td><td>1</td><td></td><td>2.39908 GHz</td><td>-51.76 dBm</td><td></td><td></td></tr></tbody></table></div></div><div><div>Date: 19 SEP 2023 10:12:36</div></div></div>			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.40397 GHz	1.04 dBm			M2	1		2.4 GHz	-53.02 dBm			M3	1		2.39 GHz	-55.08 dBm			M4	1		2.31 GHz	-54.06 dBm			M5	1		2.39908 GHz	-51.76 dBm		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																							
M1	1		2.40397 GHz	1.04 dBm																																									
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M3	1		2.39 GHz	-55.08 dBm																																									
M4	1		2.31 GHz	-54.06 dBm																																									
M5	1		2.39908 GHz	-51.76 dBm																																									
CH78 No hopping mode	<div><div>Spectrum</div><div><div>Ref Level 20.00 dBm</div><div>Offset 0.50 dB</div><div>RBW 100 kHz</div><div>Att 30 dB</div><div>SWT 56.9 μs</div><div>VBW 300 kHz</div><div>Mode Auto FFT</div><div>Count 500/500</div></div><div><div>1Pk Max</div><div><div><div>10 dBm</div><div>0 dBm</div><div>-10 dBm</div><div>-20 dBm</div><div>-30 dBm</div><div>-40 dBm</div><div>-50 dBm</div><div>-60 dBm</div><div>-70 dBm</div></div><div><div>M1[1]</div><div>M2[1]</div><div>M3</div><div>M4</div></div><div><div>3.16 dBm</div><div>2.4799900 GHz</div><div>-51.05 dBm</div><div>2.4835000 GHz</div></div></div><div><div>D1 -16.840 dBm</div></div><div><div>Start 2.478 GHz</div><div>691 pts</div><div>Stop 2.5 GHz</div></div><div><div>Marker</div><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>3.16 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>2.4835 GHz</td><td>-51.05 dBm</td><td></td><td></td></tr><tr><td>M3</td><td>1</td><td></td><td>2.5 GHz</td><td>-59.56 dBm</td><td></td><td></td></tr><tr><td>M4</td><td>1</td><td></td><td>2.4835159 GHz</td><td>-51.59 dBm</td><td></td><td></td></tr></tbody></table></div></div><div><div>Date: 19 SEP 2023 10:01:34</div></div></div>			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.47999 GHz	3.16 dBm			M2	1		2.4835 GHz	-51.05 dBm			M3	1		2.5 GHz	-59.56 dBm			M4	1		2.4835159 GHz	-51.59 dBm									
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M2	1		2.4835 GHz	-51.05 dBm																																									
M3	1		2.5 GHz	-59.56 dBm																																									
M4	1		2.4835159 GHz	-51.59 dBm																																									

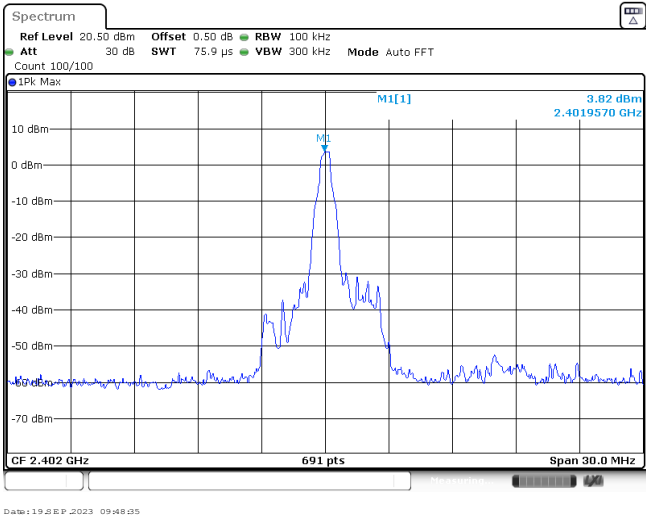
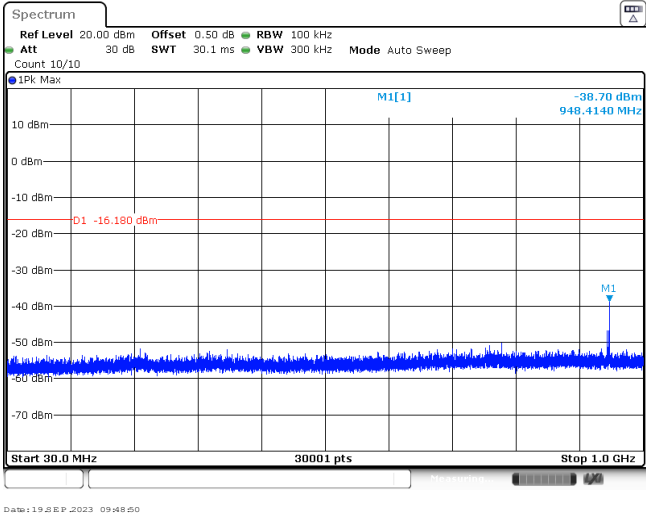
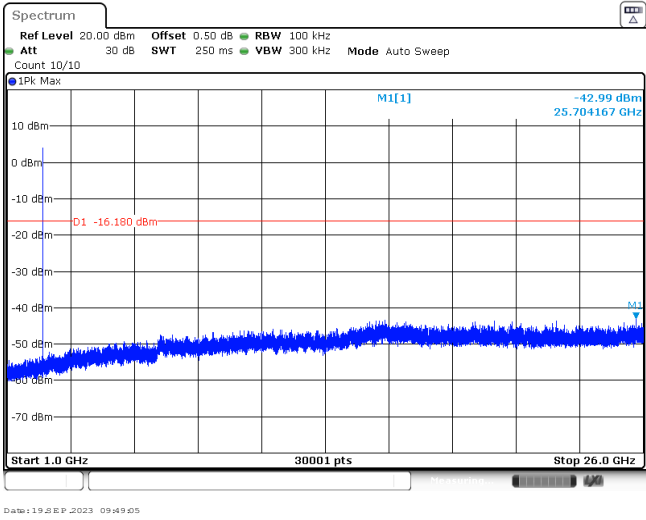
CH78
Hopping mode



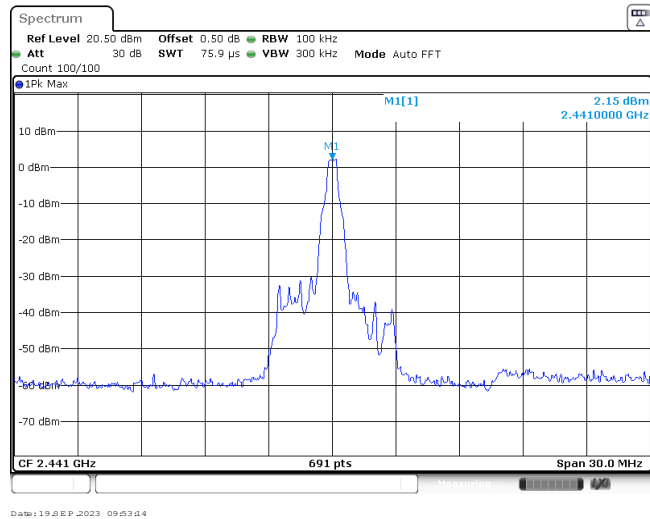
Test Item:	Band edge	Modulation type:	8DPSK																																										
CH00 No hopping mode	<div><div>Spectrum</div><div><div>Ref Level 20.00 dBm</div><div>Offset 0.50 dB</div><div>RBW 100 kHz</div><div>Att 30 dB</div><div>SWT 1.1 ms</div><div>VBW 300 kHz</div><div>Mode Auto Sweep</div><div>Count 500/500</div></div><div><div>1Pk Max</div><div><div><div>10 dBm</div><div>0 dBm</div><div>-10 dBm</div><div>-20 dBm</div><div>-30 dBm</div><div>-40 dBm</div><div>-50 dBm</div><div>-60 dBm</div><div>-70 dBm</div></div><div><div>M1[1]</div><div>M2[1]</div><div>M3</div><div>M4</div><div>M5</div></div><div><div>1.92 dBm</div><div>2.402180 GHz</div><div>-47.07 dBm</div><div>2.400000 GHz</div><div>-55.43 dBm</div><div>-54.04 dBm</div><div>-48.06 dBm</div></div></div><div><div>D1 -18.080 dBm</div></div><div><div>Start 2.31 GHz</div><div>691 pts</div><div>Stop 2.405 GHz</div></div><div><div>Marker</div><table><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><tr><td>M1</td><td>1</td><td></td><td>2.40218 GHz</td><td>1.92 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>2.4 GHz</td><td>-47.07 dBm</td><td></td><td></td></tr><tr><td>M3</td><td>1</td><td></td><td>2.39 GHz</td><td>-55.43 dBm</td><td></td><td></td></tr><tr><td>M4</td><td>1</td><td></td><td>2.31 GHz</td><td>-54.04 dBm</td><td></td><td></td></tr><tr><td>M5</td><td>1</td><td></td><td>2.399906 GHz</td><td>-48.06 dBm</td><td></td><td></td></tr></table></div></div><div>Date: 19 SEP 2023 10:04:02</div></div>			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.40218 GHz	1.92 dBm			M2	1		2.4 GHz	-47.07 dBm			M3	1		2.39 GHz	-55.43 dBm			M4	1		2.31 GHz	-54.04 dBm			M5	1		2.399906 GHz	-48.06 dBm		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																							
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M5	1		2.399906 GHz	-48.06 dBm																																									
CH00 Hopping mode	<div><div>Spectrum</div><div><div>Ref Level 20.00 dBm</div><div>Offset 0.50 dB</div><div>RBW 100 kHz</div><div>Att 30 dB</div><div>SWT 1.1 ms</div><div>VBW 300 kHz</div><div>Mode Auto Sweep</div><div>Count 500/500</div></div><div><div>1Pk Max</div><div><div><div>10 dBm</div><div>0 dBm</div><div>-10 dBm</div><div>-20 dBm</div><div>-30 dBm</div><div>-40 dBm</div><div>-50 dBm</div><div>-60 dBm</div><div>-70 dBm</div></div><div><div>M1[1]</div><div>M2[1]</div><div>M3</div><div>M4</div><div>M5</div></div><div><div>0.93 dBm</div><div>2.403010 GHz</div><div>-50.72 dBm</div><div>2.400000 GHz</div><div>-54.66 dBm</div><div>-54.33 dBm</div><div>-51.99 dBm</div></div></div><div><div>D1 -19.070 dBm</div></div><div><div>Start 2.31 GHz</div><div>691 pts</div><div>Stop 2.405 GHz</div></div><div><div>Marker</div><table><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><tr><td>M1</td><td>1</td><td></td><td>2.40301 GHz</td><td>0.93 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>2.4 GHz</td><td>-50.72 dBm</td><td></td><td></td></tr><tr><td>M3</td><td>1</td><td></td><td>2.39 GHz</td><td>-54.66 dBm</td><td></td><td></td></tr><tr><td>M4</td><td>1</td><td></td><td>2.31 GHz</td><td>-54.33 dBm</td><td></td><td></td></tr><tr><td>M5</td><td>1</td><td></td><td>2.327348 GHz</td><td>-51.99 dBm</td><td></td><td></td></tr></table></div></div><div>Date: 19 SEP 2023 10:14:11</div></div>			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.40301 GHz	0.93 dBm			M2	1		2.4 GHz	-50.72 dBm			M3	1		2.39 GHz	-54.66 dBm			M4	1		2.31 GHz	-54.33 dBm			M5	1		2.327348 GHz	-51.99 dBm		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																																							
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M3	1		2.39 GHz	-54.66 dBm																																									
M4	1		2.31 GHz	-54.33 dBm																																									
M5	1		2.327348 GHz	-51.99 dBm																																									
CH78 No hopping mode	<div><div>Spectrum</div><div><div>Ref Level 20.00 dBm</div><div>Offset 0.50 dB</div><div>RBW 100 kHz</div><div>Att 30 dB</div><div>SWT 56.9 μs</div><div>VBW 300 kHz</div><div>Mode Auto FFT</div><div>Count 500/500</div></div><div><div>1Pk Max</div><div><div><div>10 dBm</div><div>0 dBm</div><div>-10 dBm</div><div>-20 dBm</div><div>-30 dBm</div><div>-40 dBm</div><div>-50 dBm</div><div>-60 dBm</div><div>-70 dBm</div></div><div><div>M1[1]</div><div>M2[1]</div><div>M3</div><div>M4</div></div><div><div>3.25 dBm</div><div>2.4798310 GHz</div><div>-50.16 dBm</div><div>2.4835000 GHz</div><div>-59.25 dBm</div><div>-50.57 dBm</div></div></div><div><div>D1 -16.750 dBm</div></div><div><div>Start 2.478 GHz</div><div>691 pts</div><div>Stop 2.5 GHz</div></div><div><div>Marker</div><table><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><tr><td>M1</td><td>1</td><td></td><td>2.479831 GHz</td><td>3.25 dBm</td><td></td><td></td></tr><tr><td>M2</td><td>1</td><td></td><td>2.4835 GHz</td><td>-50.16 dBm</td><td></td><td></td></tr><tr><td>M3</td><td>1</td><td></td><td>2.5 GHz</td><td>-59.25 dBm</td><td></td><td></td></tr><tr><td>M4</td><td>1</td><td></td><td>2.4835159 GHz</td><td>-50.57 dBm</td><td></td><td></td></tr></table></div></div><div>Date: 19 SEP 2023 10:08:57</div></div>			Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.479831 GHz	3.25 dBm			M2	1		2.4835 GHz	-50.16 dBm			M3	1		2.5 GHz	-59.25 dBm			M4	1		2.4835159 GHz	-50.57 dBm									
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M3	1		2.5 GHz	-59.25 dBm																																									
M4	1		2.4835159 GHz	-50.57 dBm																																									

CH78
Hoppig mode

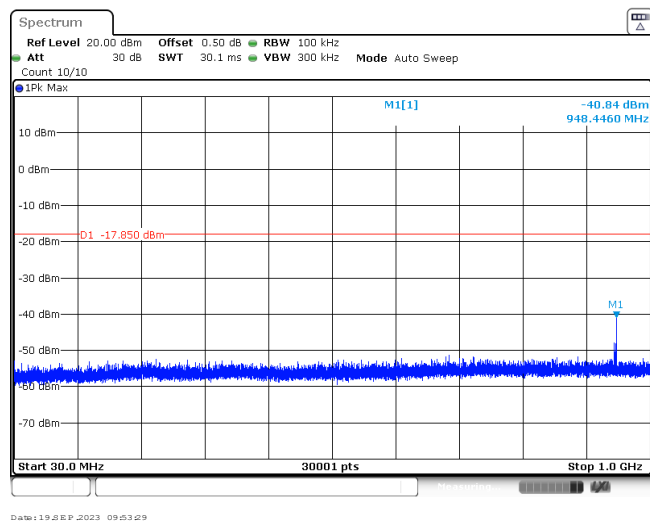


Test Item:	Spurious Emission	Modulation type:	GFSK
CH00 Reference level			
CH00 30MHz~1000MHz			
CH00 1GHz~26GHz			

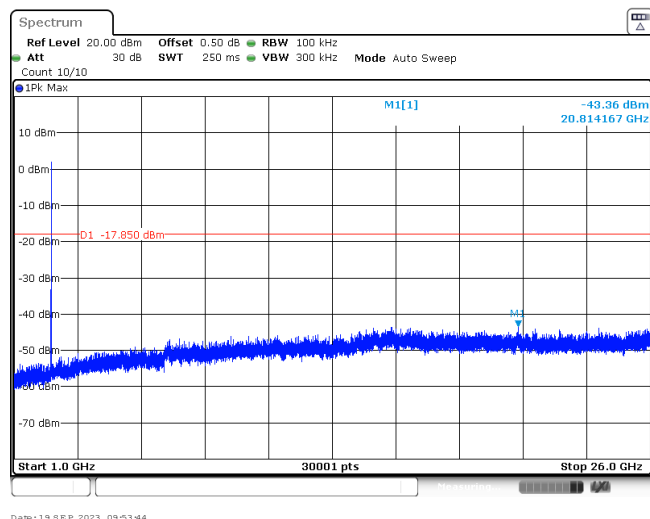
CH39
Reference level



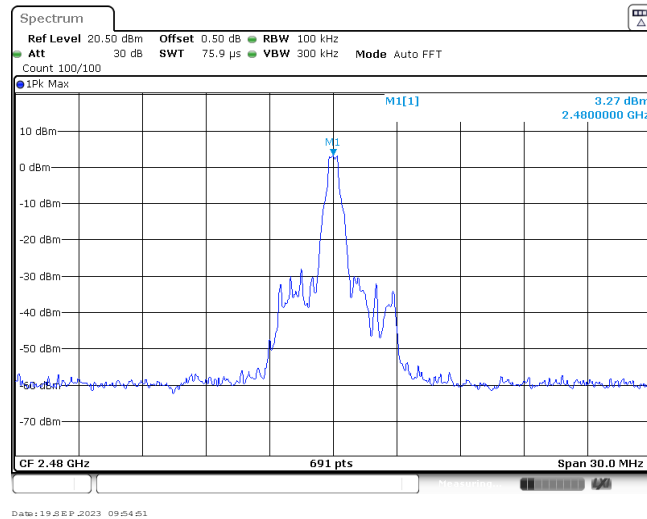
CH39
30MHz~1000MHz



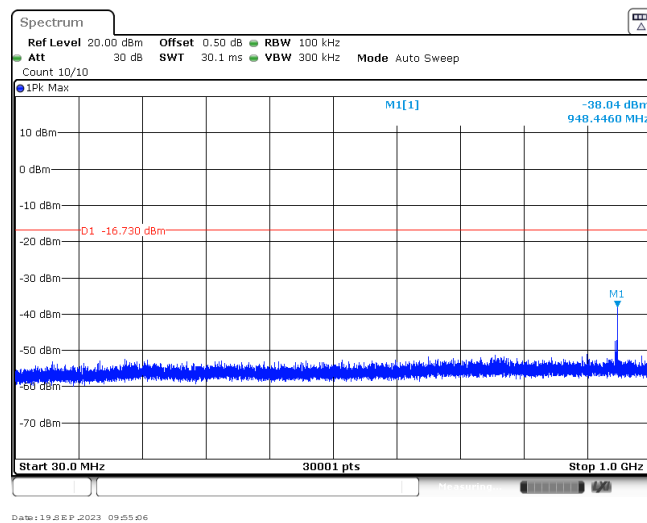
CH39
1GHz~26GHz



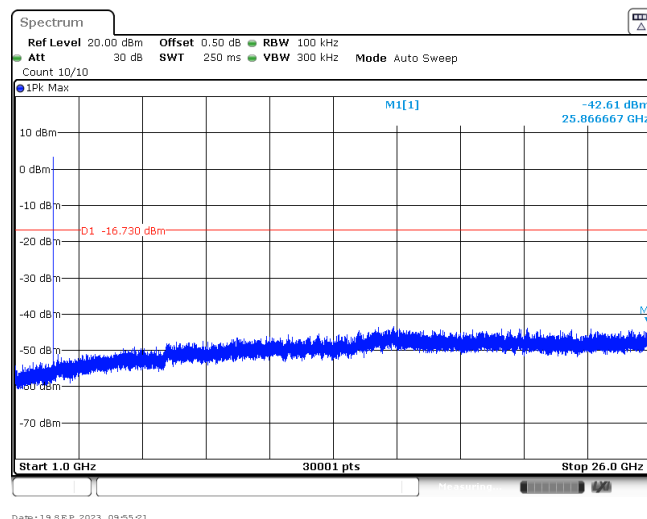
CH78
Reference level

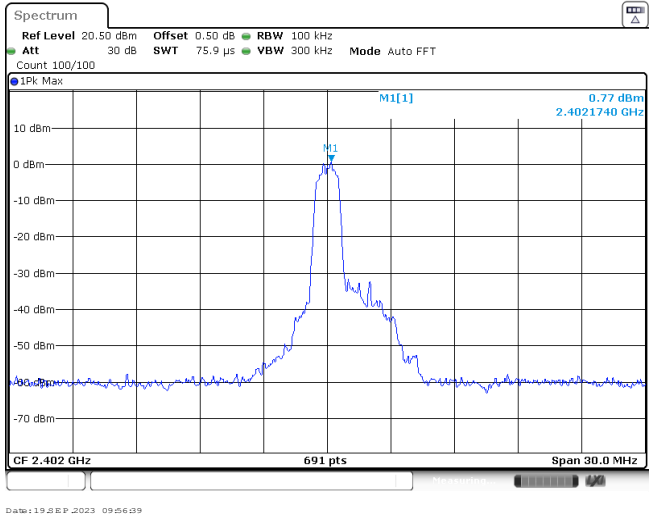
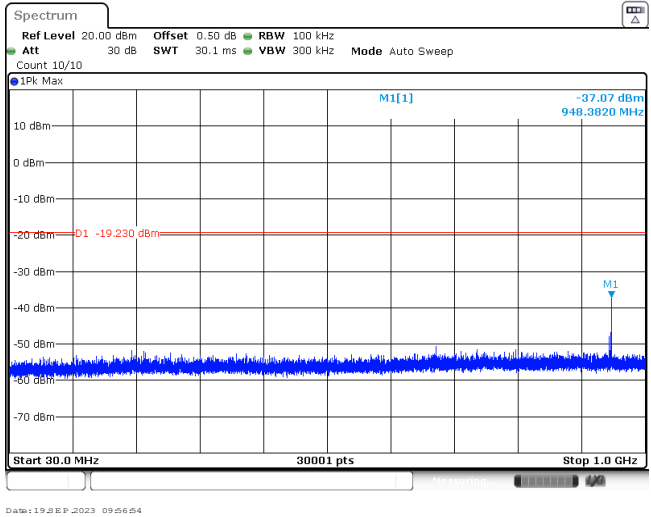
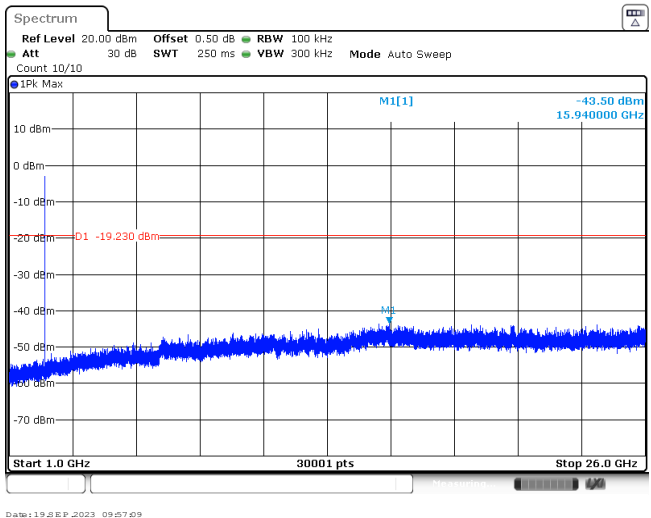


CH78
30MHz~1000MHz

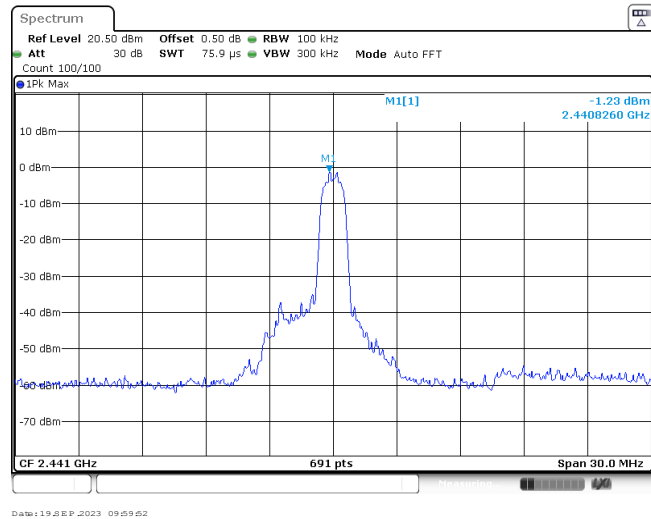


CH78
1GHz~26GHz

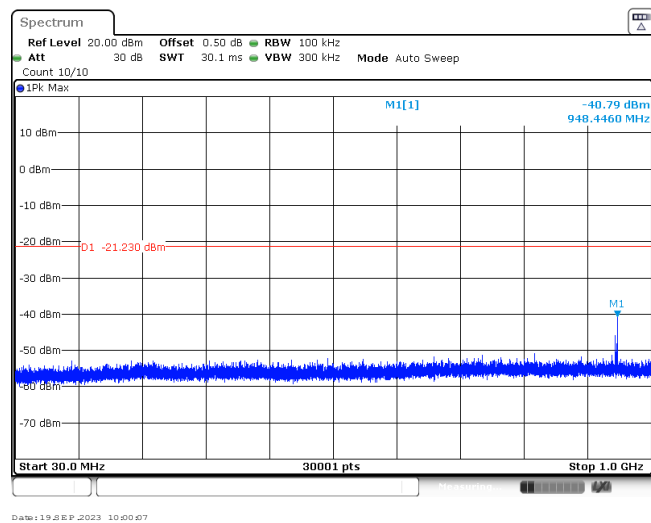


Test Item:	Spurious Emission	Modulation type:	$\pi/4$ DQPSK
CH00 Reference level			
CH00 30MHz~1000MHz			
CH00 1GHz~26GHz			

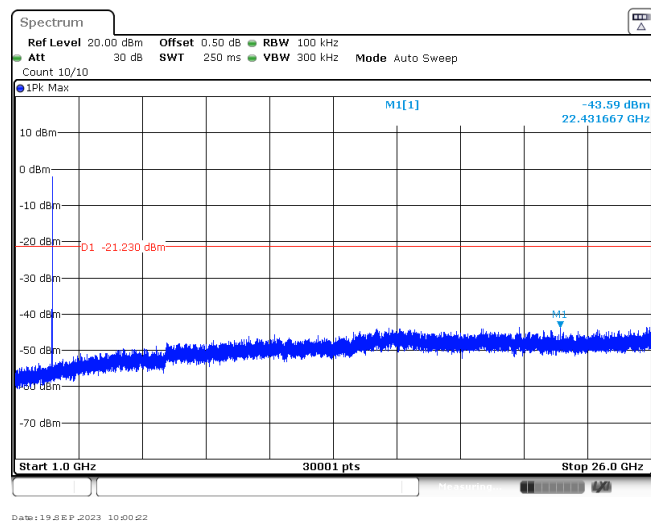
CH39
Reference level

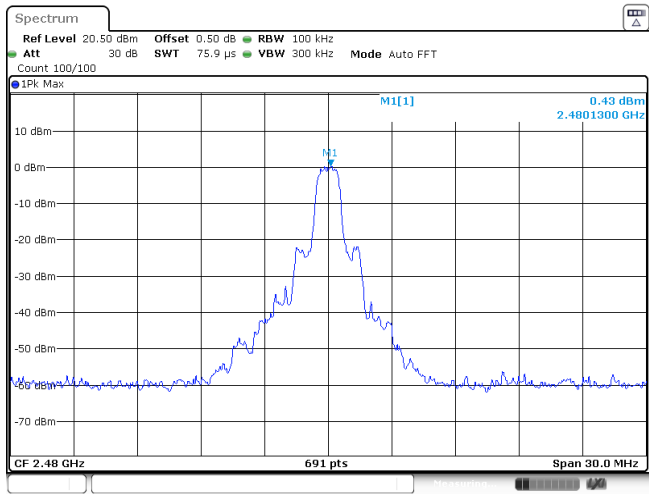
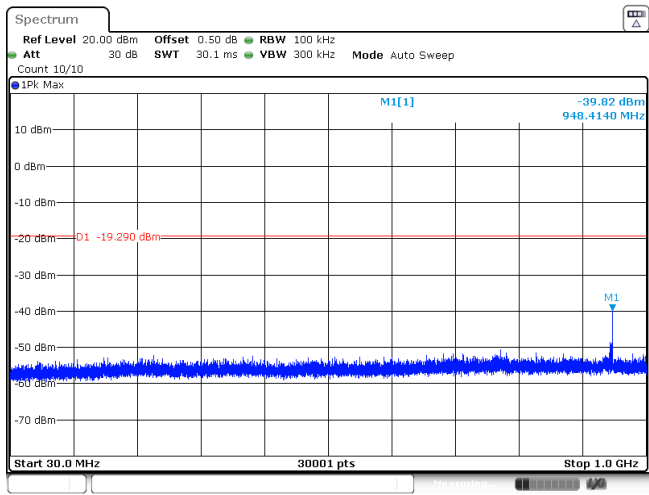
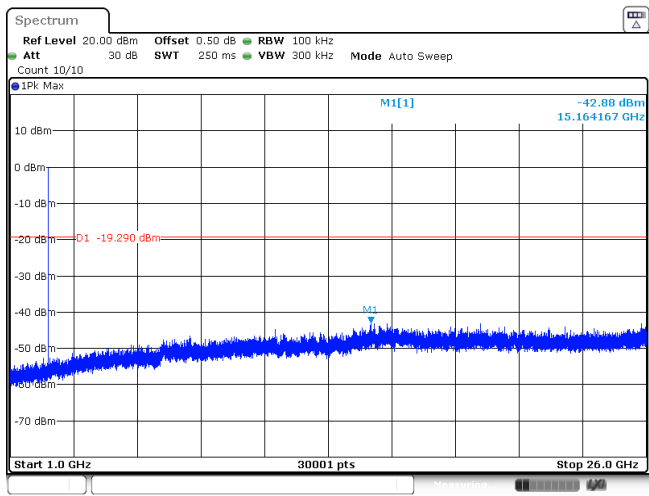


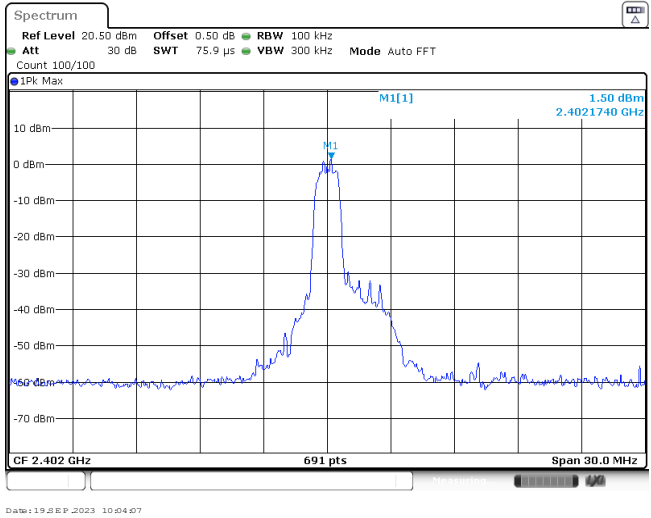
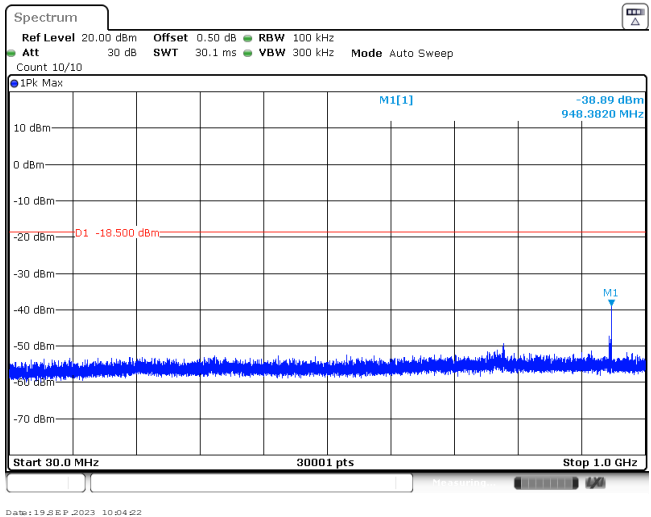
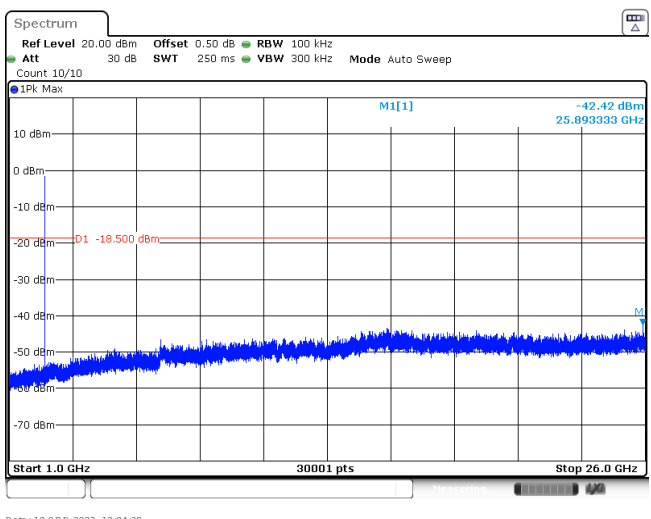
CH39
30MHz~1000MHz

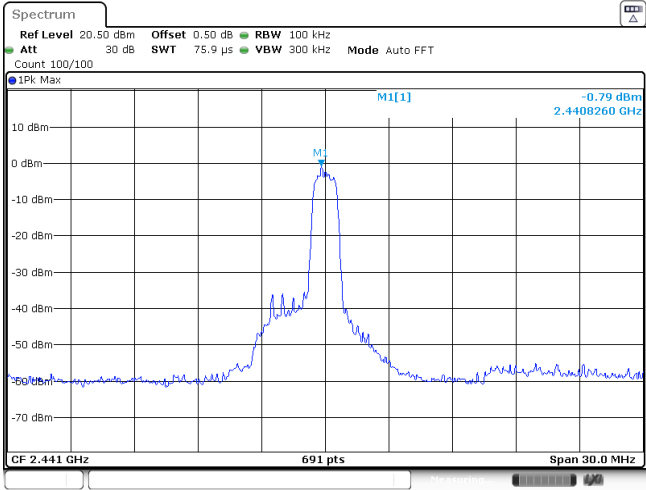
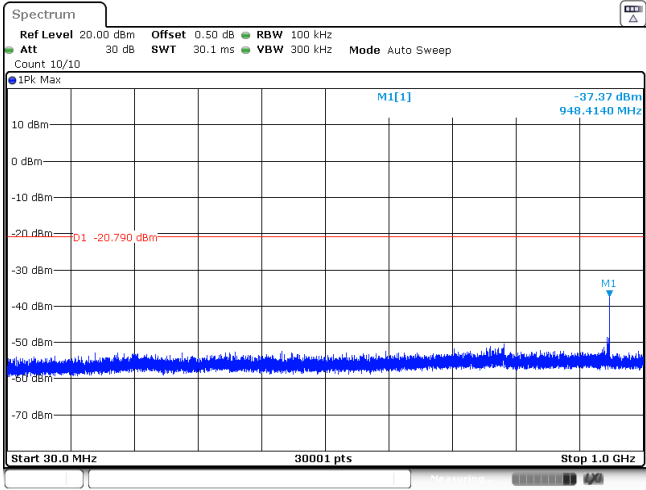
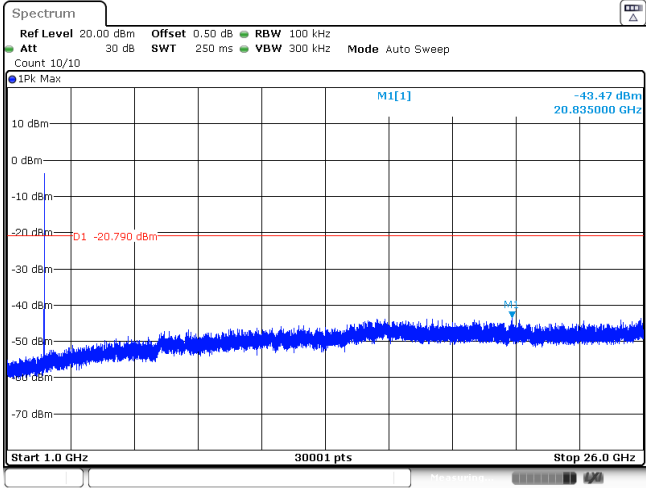


CH39
1GHz~26GHz

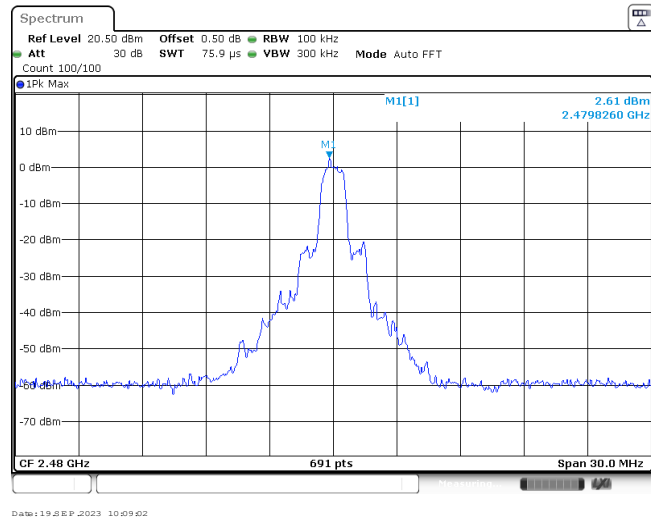


<p>CH78</p> <p>Reference level</p>	 <p>Spectrum</p> <p>Ref Level 20.50 dBm Offset 0.50 dB RBW 100 kHz</p> <p>Att 30 dB SWT 75.9 μs VBW 300 kHz Mode Auto FFT</p> <p>Count 100/100</p> <p>IPk Max</p> <p>M1[1] 0.43 dBm 2.4801300 GHz</p> <p>CF 2.48 GHz 691 pts Span 30.0 MHz</p> <p>Date: 19 SEP 2023 10:01:39</p>
<p>CH78</p> <p>30MHz~1000MHz</p>	 <p>Spectrum</p> <p>Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz</p> <p>Att 30 dB SWT 30.1 ms VBW 300 kHz Mode Auto Sweep</p> <p>Count 10/10</p> <p>IPk Max</p> <p>M1[1] -39.82 dBm 948.4140 MHz</p> <p>Start 30.0 MHz 30001 pts Stop 1.0 GHz</p> <p>Date: 19 SEP 2023 10:01:54</p>
<p>CH78</p> <p>1GHz~26GHz</p>	 <p>Spectrum</p> <p>Ref Level 20.00 dBm Offset 0.50 dB RBW 100 kHz</p> <p>Att 30 dB SWT 250 ms VBW 300 kHz Mode Auto Sweep</p> <p>Count 10/10</p> <p>IPk Max</p> <p>M1[1] -42.88 dBm 15.164167 GHz</p> <p>Start 1.0 GHz 30001 pts Stop 26.0 GHz</p> <p>Date: 19 SEP 2023 10:02:10</p>

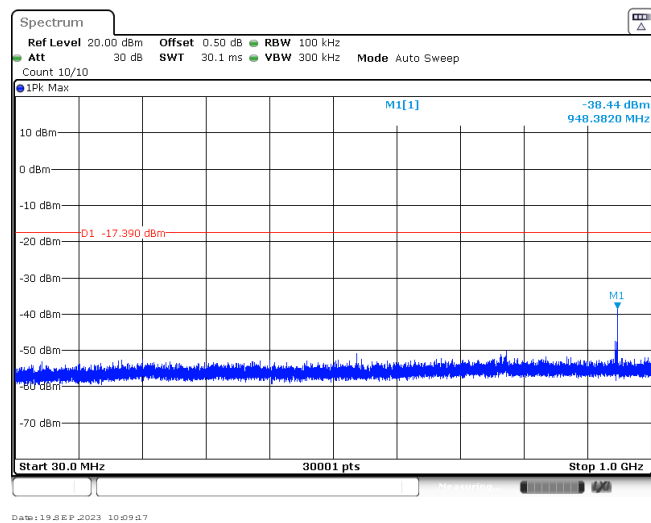
Test Item:	Spurious Emission	Modulation type:	8DPSK
CH00 Reference level			
CH00 30MHz~1000MHz			
CH00 1GHz~26GHz			

<div>CH39</div> <div>Reference level</div>	
<div>CH39</div> <div>30MHz~1000MHz</div>	
<div>CH39</div> <div>1GHz~26GHz</div>	

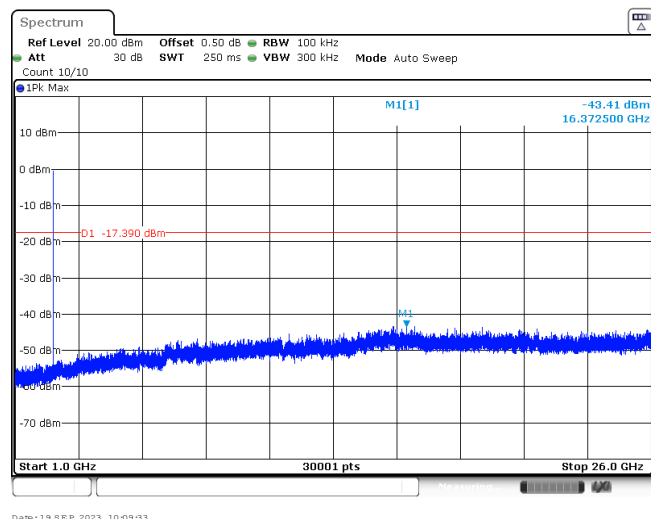
CH78
Reference level



CH78
30MHz~1000MHz



CH78
1GHz~26GHz



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