FCC - TEST REPORT

Report Number	:	**68.950.24.0394.01**	Date of Issue:	**2024-04-19**
Model	:	**ASTRUM MZ PRO, HT330, HT260, HT510, HT520**		
Product Type	:	Bluetooth Headset		
Applicant	:	ASTRUM WORLD INC		
Address	:	3580 WILSHIRE BLVD, 1410 LOS ANGELES, CA 90010 United States		
Manufacturer	:	SHENZHEN AKAUDIO CO., LIMITED		
Address	:	7F, Bldg A (#2), 1st Shuichanjingwan Industrial Area, Nanchang Village, Gushu, Bao'an Dist., Shenzhen, China		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	**54**		

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1 Table of Contents

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12 & 13, Zhiheng Wisdomland Business Park, Guankou Erlu, Nantou, Nanshan District Shenzhen 518052 P.R. China
Telephone:	86 755 8828 6998
Fax:	86 755 828 5299
FCC Registration No.:	514049
FCC Designation Number:	CN5009

3 Description of the Equipment Under Test

Product:	Bluetooth Headset
Model No.:	ASTRUM MZ PRO, HT330, HT260, HT510, HT520
Model difference.:	All models have the same technical construction including circuit diagram, PCB layout, components and component layout. Only the model's name and outlook/color are different. So the main test model is ASTRUM MZ PRO.
Brand name:	ASTRUM
FCC ID:	2BFJ5-ASTRUMMZPRO
Options and accessories:	N/A
Battery information:	Rechargeable Li-ion Battery Model:ST 902040 Rated:3.7VDC 2.59Wh
Rating:	3.7VDC rechargeable Li-ion battery or supplied by external USB Input (5VDC)
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	79
Modulation:	GFSK, π/4-DQPSK, 8DPSK
Antenna Type:	FPC Antenna
Antenna	Gain: 1.97dBi
Description of the EUT:	The Equipment Under Test (EUT) is a Bluetooth Headset which support Bluetooth function operated at 2.4GHz. Only Bluetooth (BR+EDR) included in this report.

NOTE: The above EUT's information is declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2023 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 Measurement Guidance and ANSI C63.10-2020.

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5 Summary of Test Results

Technical Requirements			
FCC Part 15 Subpart C			
Test Condition		Test Site	Test Result
§15.207	Conducted emission AC power port*	N/A	N/A
§15.247(b)(1)	Conducted peak output power	Site 1	Pass
§15.247(a)(1)	20dB bandwidth	Site 1	Pass
§15.247(a)(1)	Carrier channel frequency separation	Site 1	Pass
§15.247(a)(1)(iii)	Number of hopping frequencies	Site 1	Pass
§15.247(a)(1)(iii)	Dwell Time - Average Time of Occupancy	Site 1	Pass
§15.247(d)	Spurious RF conducted emissions	Site 1	Pass
§15.247(d)	Band edge	Site 1	Pass
§15.247(d) & §15.209 &§15.205	Spurious radiated emissions for transmitter	Site 1	Pass
§15.203	Antenna requirement	See note 2	Pass

Note: * The EUT cannot charging and Transmitting at the same time.
Note 1: N/A=Not Applicable.
Note 2: The EUT uses a FPC antenna, which gain is 1.97dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2BFJ5-ASTRUMMZPRO, complies with Section 15.209, 15.247 of the FCC Part 15, Subpart C rules.

SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

☐ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements.

☐ - **Does not** fulfill the general approval requirements.

Sample Received Date:	2024-04-10
Testing Start Date:	2024-04-10
Testing End Date:	2024-04-18

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by:	Prepared by:	Tested by:
John Zhi	Sanvin Zheng	Carry Cai
Section Manager	Project Engineer	Test Engineer

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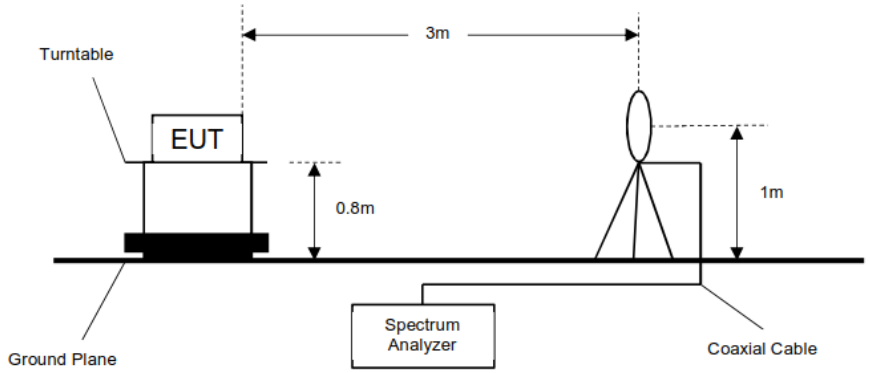
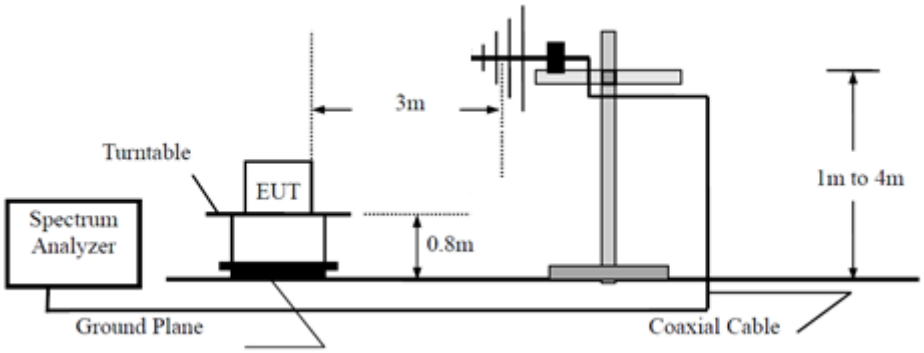
7 Test Setups

7.1 Radiated test setups

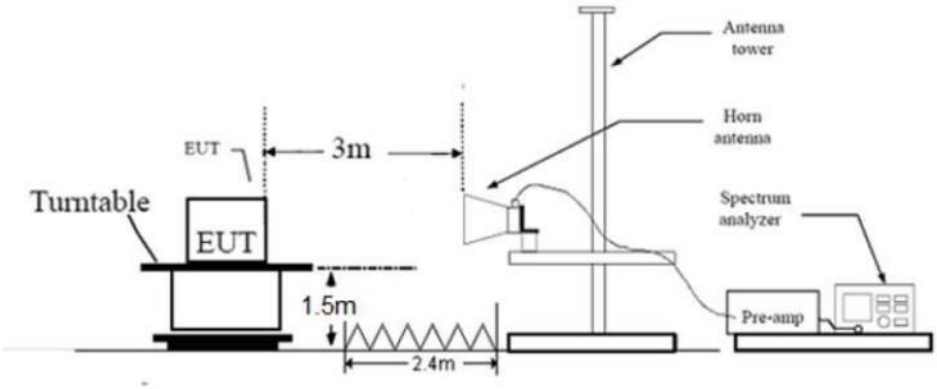
9KHz - 30MHz



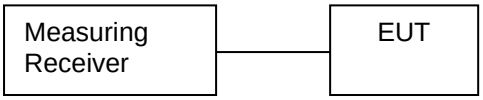
30MHz - 1GHz



Above 1GHz



7.3 Conducted RF test setups



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8 Systems Test Configuration

Auxiliary Equipment Used during Test:

Description	Manufacturer	Model NO.	S/N
Notebook	LENOVO	X220	---

Cables Used During Test:

Cable	Length	Shielded/unshielded	With / without ferrite
---	---	---	---

Test software information:

Test Software Version	Blue Test3_V3.3.7.exe	
Modulation	Setting TX Power	Packet Type
GFSK	5	PRBS9
π/4-DQPSK	5	PRBS9
8DPSK	5	PRBS9

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status)

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

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9 Technical Requirement

9.1 Conducted Peak Output Power

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. 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 test receiver settings:
   Span = approximately 5 times the 20dB bandwidth, centered on a hopping channel
   RBW > the 20dB bandwidth of the emission being measured, VBW≥RBW,
   Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power and record the results in the test report.
5. Repeat above procedures until all frequencies measured were complete.

Limits

According to §15.247 (b) (1), conducted peak output power limit as below:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

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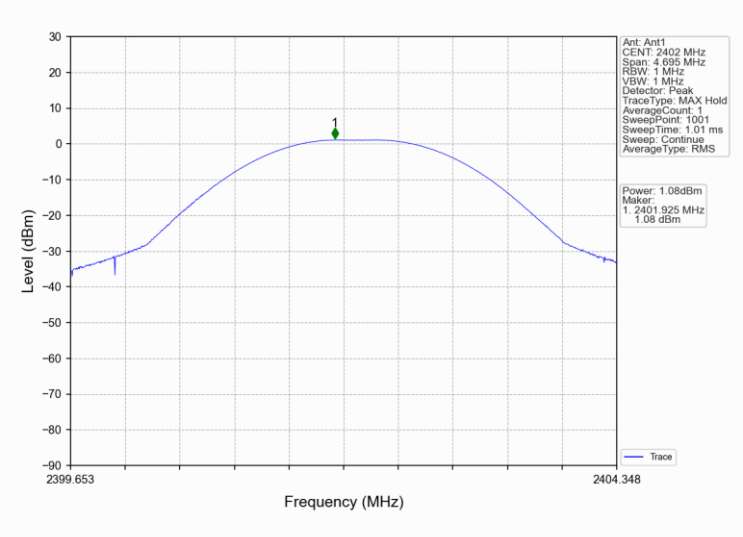
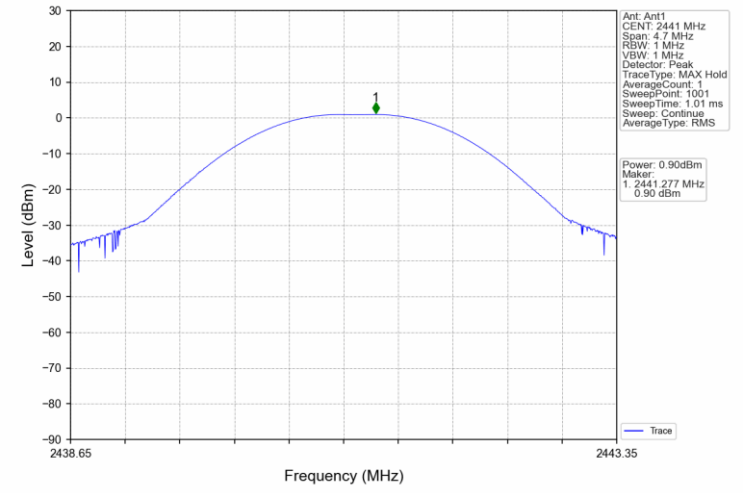
Conducted Peak Output Power

Mode	TX Type	Frequency (MHz)	Packet Type	Maximum Peak Conducted Output Power (dBm)		Verdict
				ANT1	Limit	
GFSK	SISO	2402	DH5	1.08	<=30	Pass
		2441	DH5	0.90	<=30	Pass
		2480	DH5	0.83	<=30	Pass
Pi/4DQPSK	SISO	2402	2DH5	3.43	<=30	Pass
		2441	2DH5	3.18	<=30	Pass
		2480	2DH5	3.22	<=30	Pass
8DPSK	SISO	2402	3DH5	**3.93**	<=30	Pass
		2441	3DH5	3.69	<=30	Pass
		2480	3DH5	3.72	<=30	Pass

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



GFSK_DH5_MCH_2441MHz_Ant1_NTNV



GFSK_DH5_HCH_2480MHz_Ant1_NTNV

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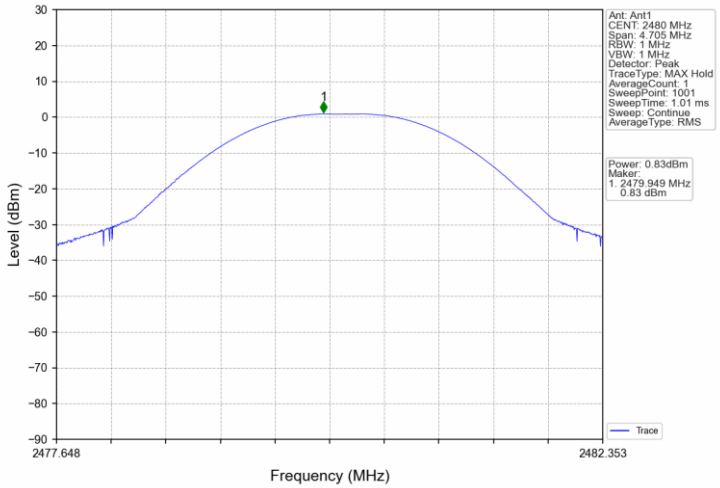
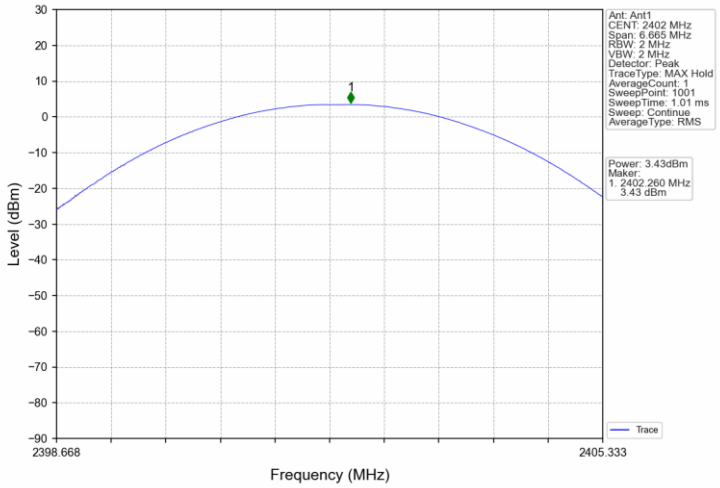


Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV



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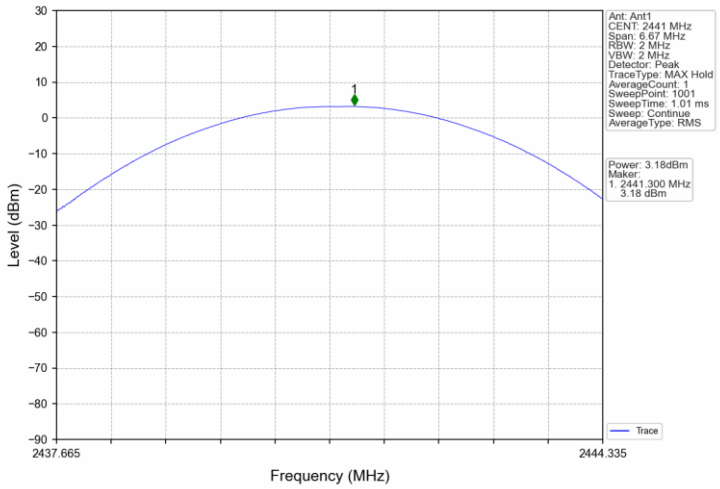

Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV

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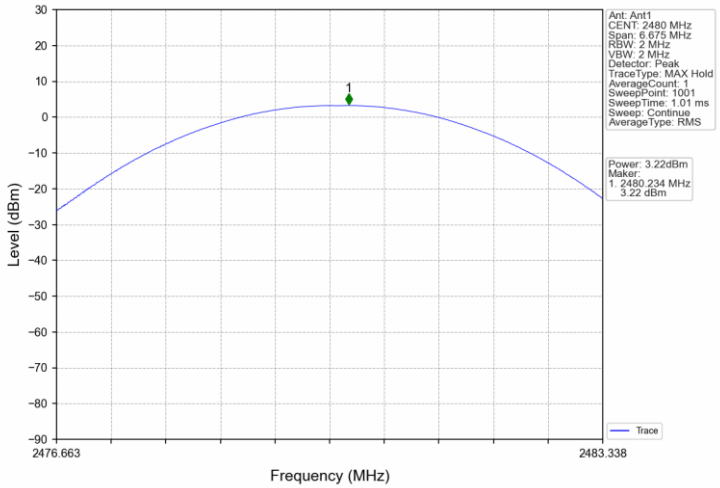
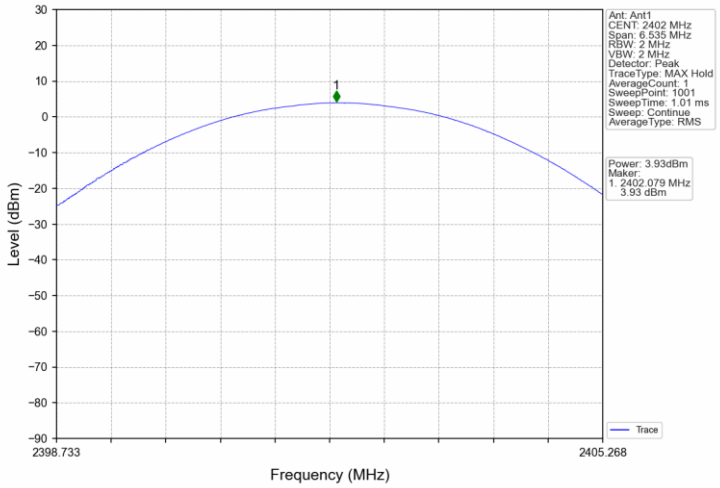
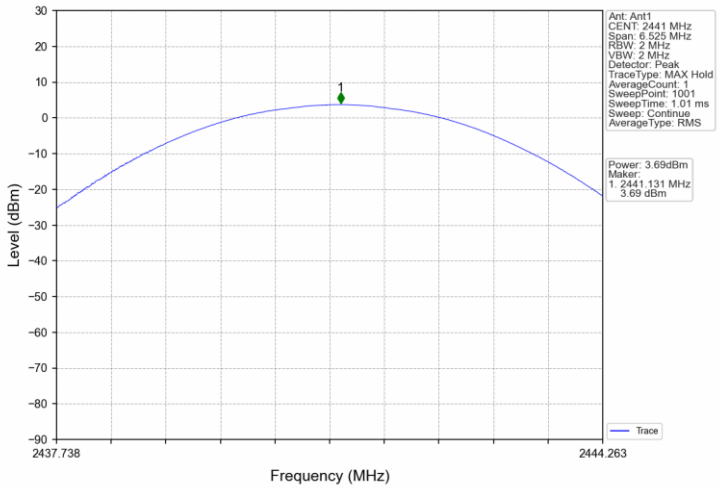


8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV

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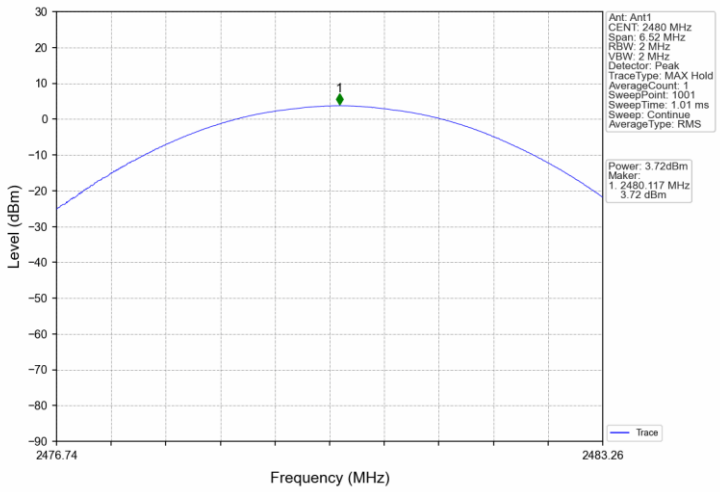

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9.2 20 dB Bandwidth

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. 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 test receiver settings:
   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
   RBW ≥ 1% to 5% of the 20 dB bandwidth/99% OBW, VBW≥3RBW,
   Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth. Record the results.
5. Repeat above procedures until all frequencies measured were complete.

Limit

According to §15.247(a)(1), 20 dB Bandwidth limit as below:

Limit [kHz]
N/A

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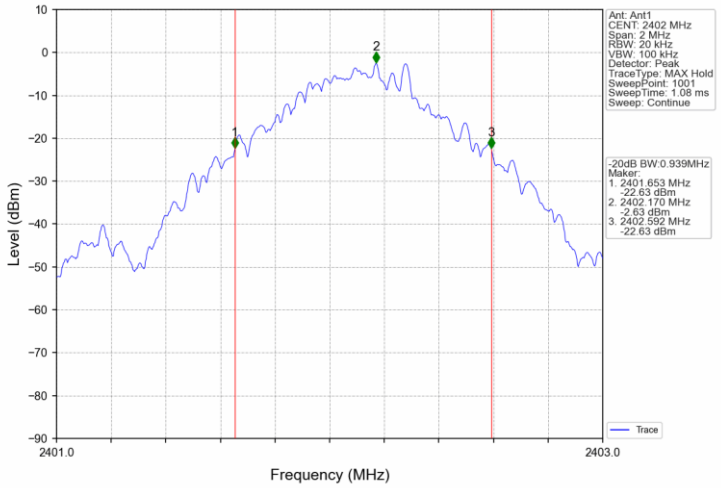
20 dB bandwidth

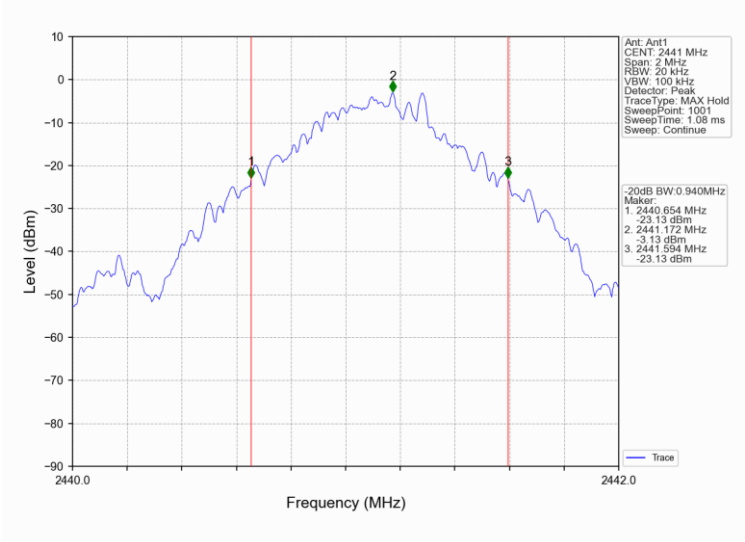
Test result

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	20dB Bandwidth (MHz)		Verdict
					Result	Limit	
GFSK	SISO	2402	DH5	1	0.939	/	Pass
		2441	DH5	1	0.940	/	Pass
		2480	DH5	1	0.941	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.333	/	Pass
		2441	2DH5	1	1.334	/	Pass
		2480	2DH5	1	1.335	/	Pass
8DPSK	SISO	2402	3DH5	1	1.307	/	Pass
		2441	3DH5	1	1.305	/	Pass
		2480	3DH5	1	1.304	/	Pass

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



GFSK_DH5_MCH_2441MHz_Ant1_NTNV



GFSK_DH5_HCH_2480MHz_Ant1_NTNV

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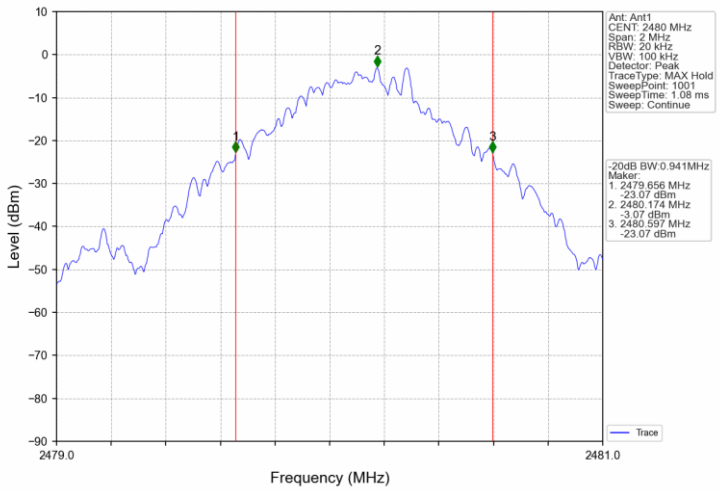
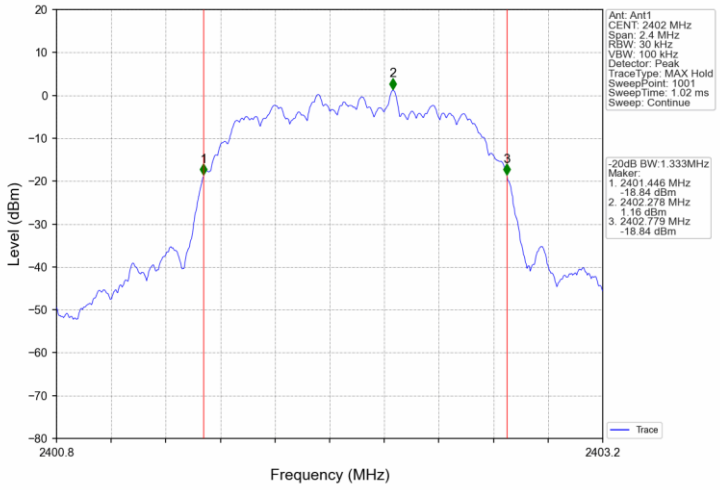


Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV



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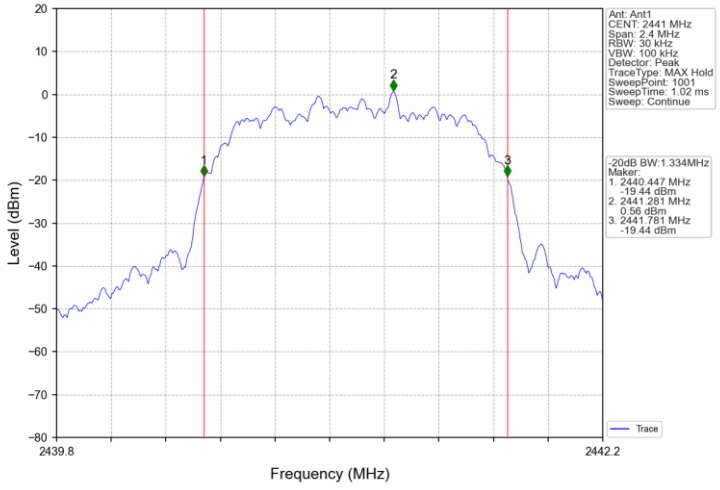

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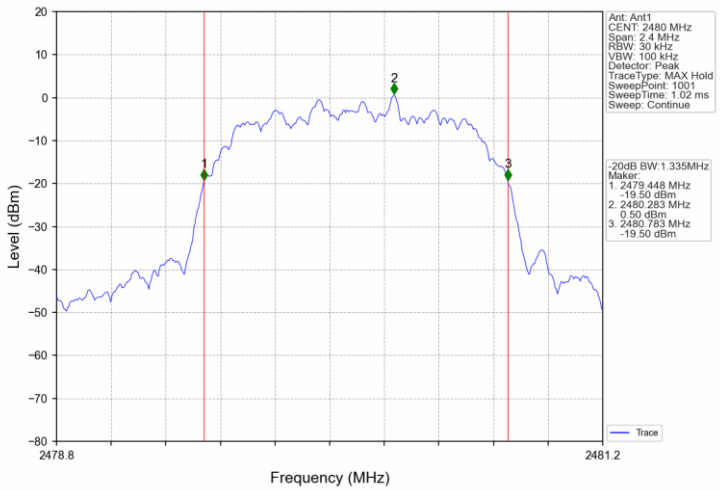
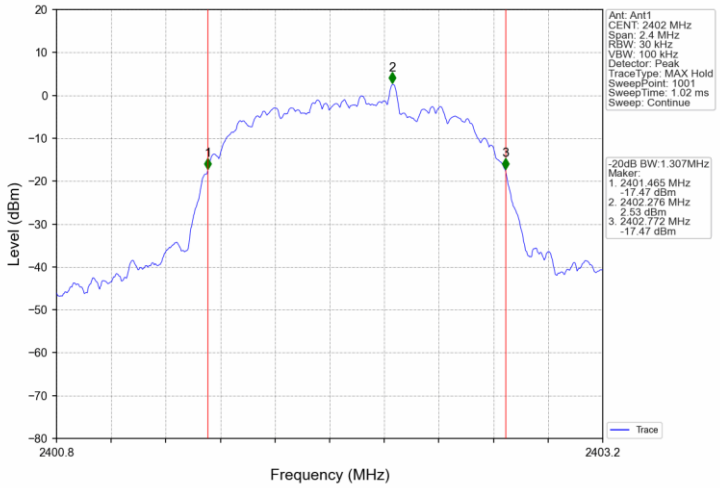
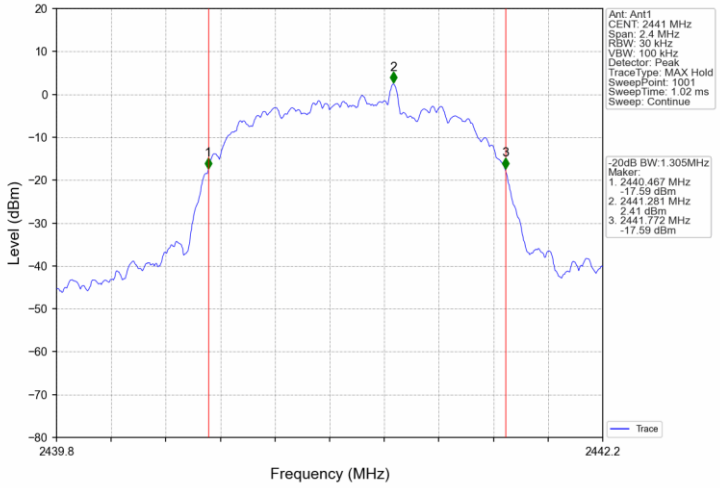


8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV

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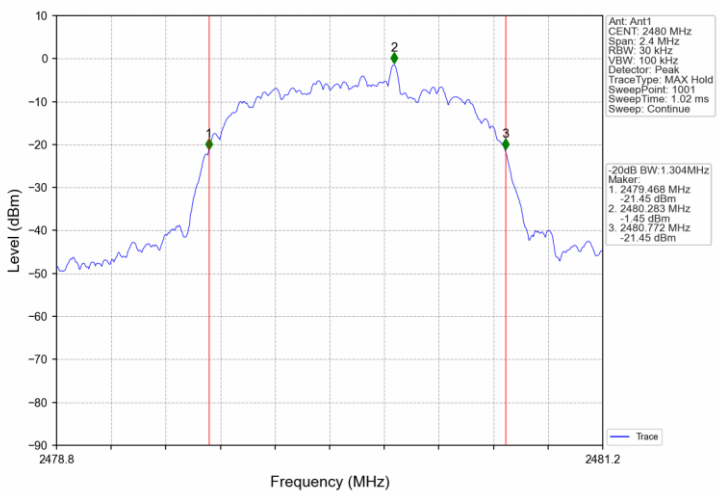

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9.3 Carrier Frequency Separation

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit to hopping mode.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels, RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel. VBW ≥RBW, Sweep = auto, Detector function = peak.
4. By using the Max-Hold function record the separation of two adjacent channels.
5. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function. Record the results.
6. Repeat above procedures until all frequencies measured were complete.

Limit

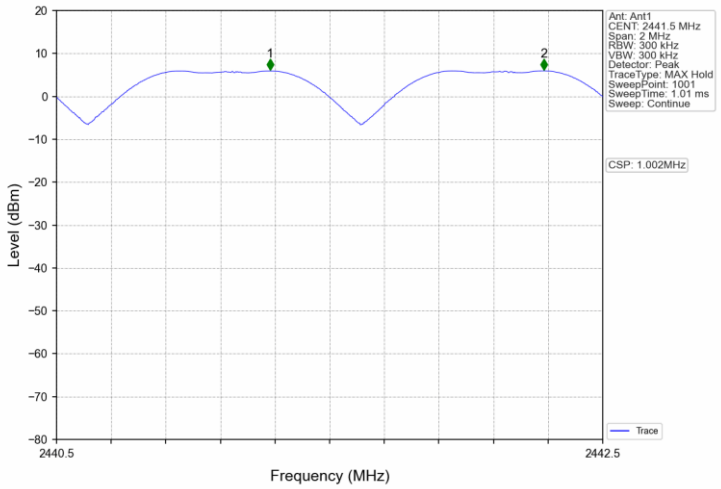
According to §15.247(a)(1), Carrier Frequency Separation limit as below:

Limit
kHz
⩾25kHz or 2/3 of the 20 dB bandwidth which is greater

Test result: The measurement was performed with the typical configuration (normal hopping status).

Ant1							
Mode	TX Type	Frequency (MHz)	Packet Type	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Verdict
GFSK	SISO	HOPP	DH5	1.002	0.941	>=0.628	Pass
Pi/4DQPSK	SISO	HOPP	2DH5	1.008	1.335	>=0.890	Pass
8DPSK	SISO	HOPP	3DH5	1.001	1.307	>=0.872	Pass

GFSK_DH5_HOPP_Ant1_NTNV



Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV

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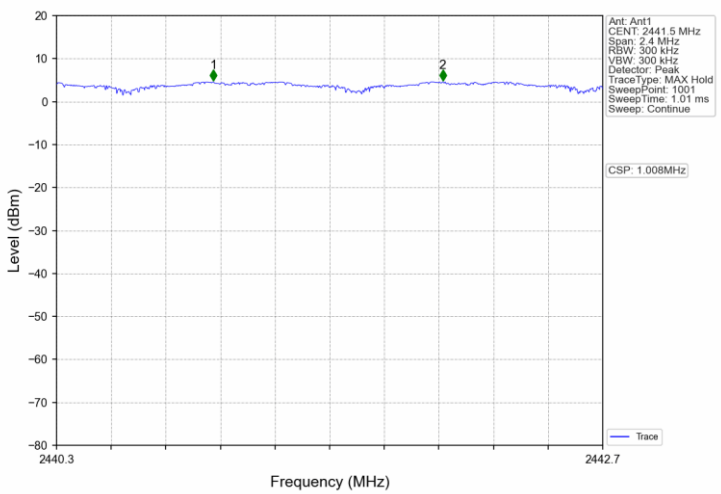
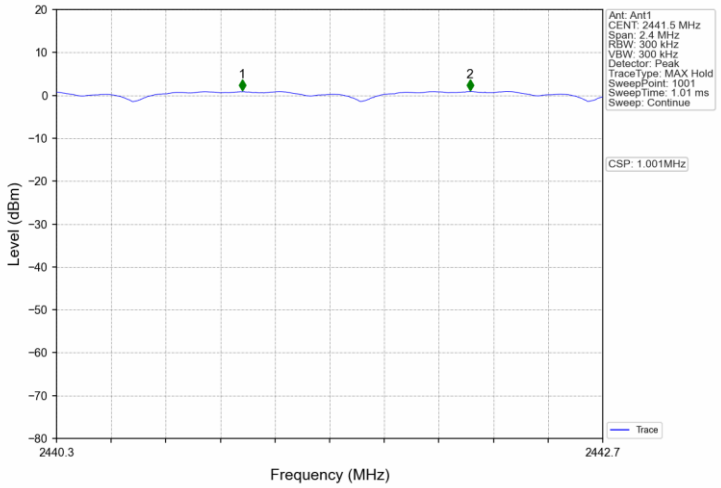


8DPSK_3DH5_HOPP_Ant1_NTNV



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9.4 Number of Hopping Frequencies

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit to hopping mode.
3. Use the following spectrum analyzer settings:
   Span = the frequency band of operation, RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller, VBW ≥RBW, Sweep = auto, Detector function = peak, Trace=Max hold.
4. Allow the trace to stabilize. It may prove necessary to break the span up to sections, in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

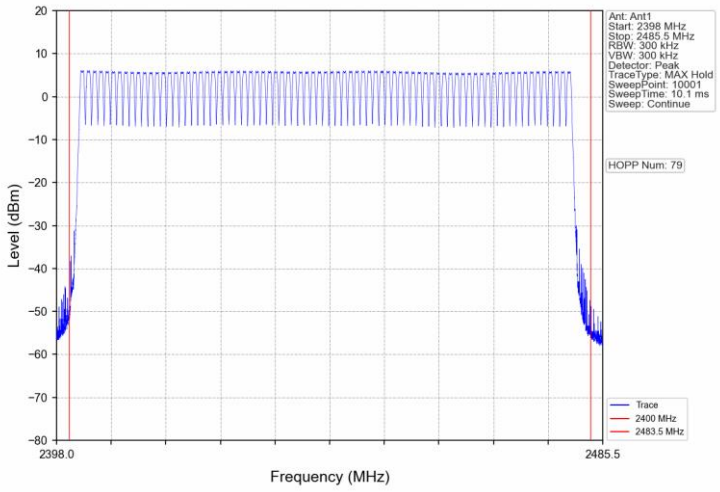
Limit

According to §15.247(a)(1)(iii), Number of Hopping Frequencies limit as below:

Limit number
⩾ 15

Mode	TX Type	Frequency (MHz)	Packet Type	Num of Hopping Frequencies		Verdict
				ANT1	Limit	
GFSK	SISO	HOPP	DH5	79	>=15	Pass
Pi/4DQPSK	SISO	HOPP	2DH5	79	>=15	Pass
8DPSK	SISO	HOPP	3DH5	79	>=15	Pass

GFSK_DH5_HOPP_Ant1_NTNV



Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV

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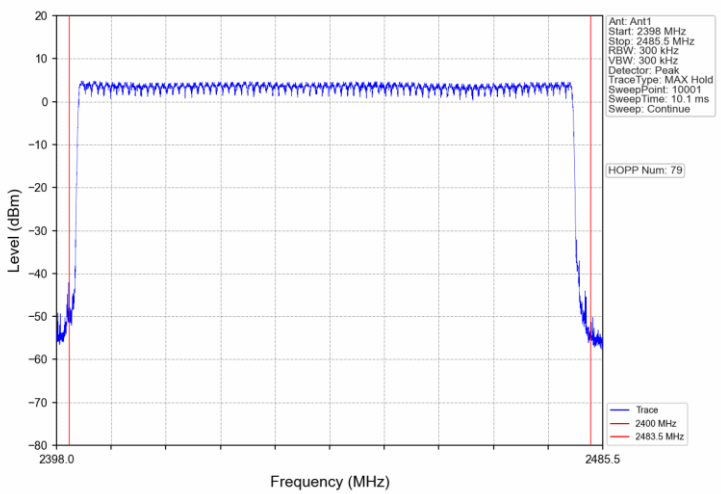
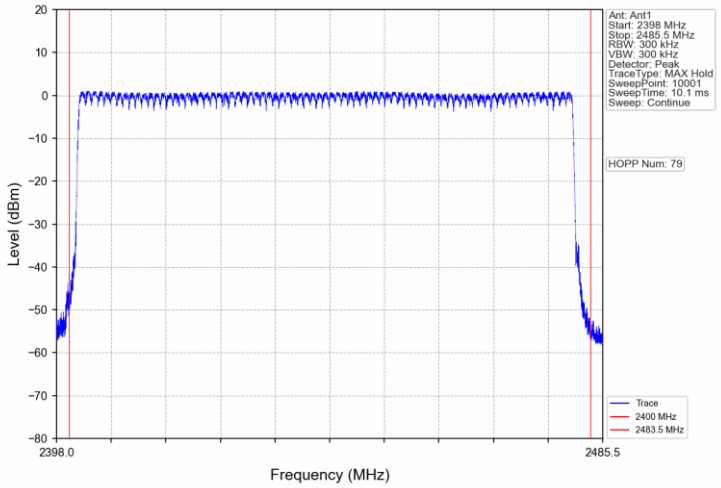


8DPSK_3DH5_HOPP_Ant1_NTNV



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9.5 Dwell Time

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit to hopping mode.
3. Span: Zero span, centered on a hopping channel.
4. RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
5. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
6. Detector function: Peak.
7. Trace: Max hold. Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Limit

According to §15.247(a)(1)(iii), Dwell Time limit as below:

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

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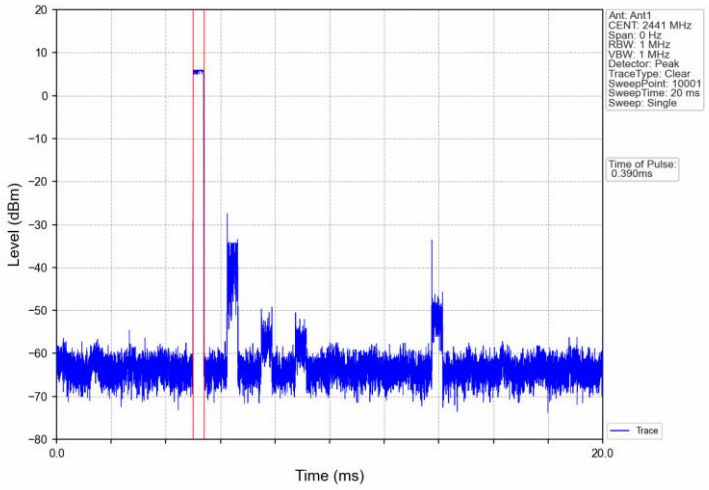
Dwell Time

Dwell time

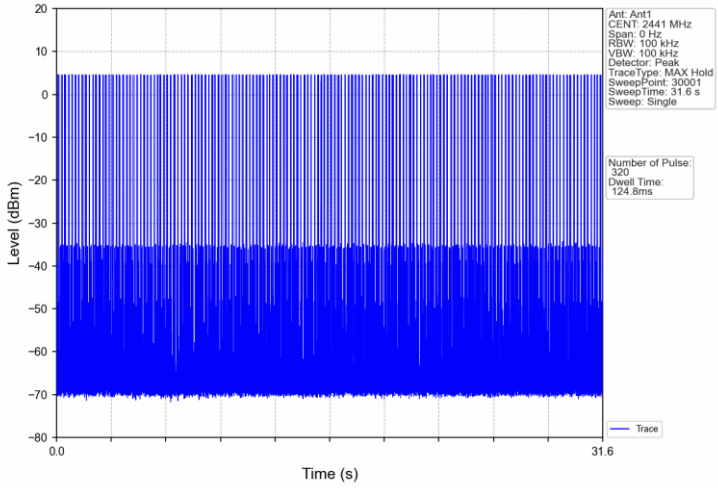
The maximum dwell time shall be 0.4 s.
According to the Bluetooth Core Specification,
The duration for dwell time calculation: 0.4 [s] * hopping number = 0.4 [s] * 79 [ch] = 31.6 [s]
The Dwell Time = Burst Width * Total Hops.

Ant1									
Mode	TX Type	Frequency (MHz)	Packet Type	Duration of Single Pulse (ms)	Observation Period (s)	Num of Pulse in Observation Period	Dwell Time (ms)	Limit (ms)	Verdict
GFSK	SISO	HOPP	DH1	0.390	31.600	320	124.800	<=400	Pass
			DH3	1.644	31.600	160	263.040	<=400	Pass
			DH5	2.906	31.600	109	316.754	<=400	Pass
Pi/4DQPSK	SISO	HOPP	2DH1	0.392	31.600	320	125.440	<=400	Pass
			2DH3	1.656	31.600	163	269.928	<=400	Pass
			2DH5	2.906	31.600	108	313.848	<=400	Pass
8DPSK	SISO	HOPP	3DH1	0.390	31.600	320	124.800	<=400	Pass
			3DH3	1.644	31.600	165	271.260	<=400	Pass
			3DH5	2.906	31.600	113	328.378	<=400	Pass

GFSK_DH1_HOPP_Ant1_NTNV



GFSK_DH1_HOPP_Ant1_NTNV



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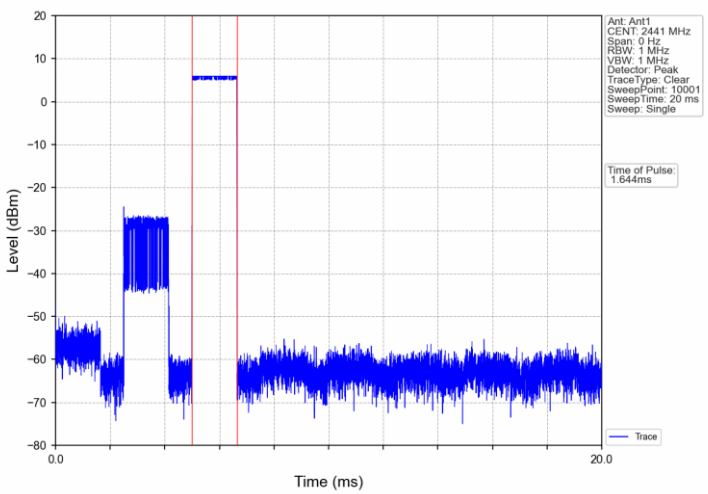
GFSK_DH3_HOPP_Ant1_NTNV

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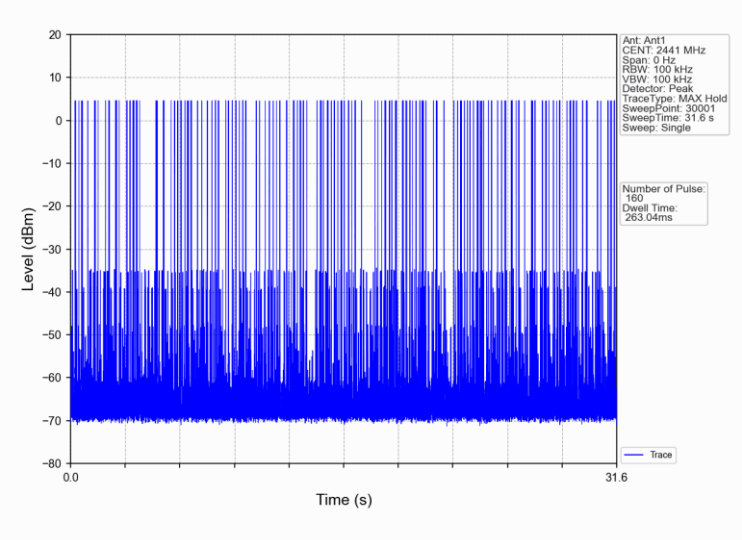
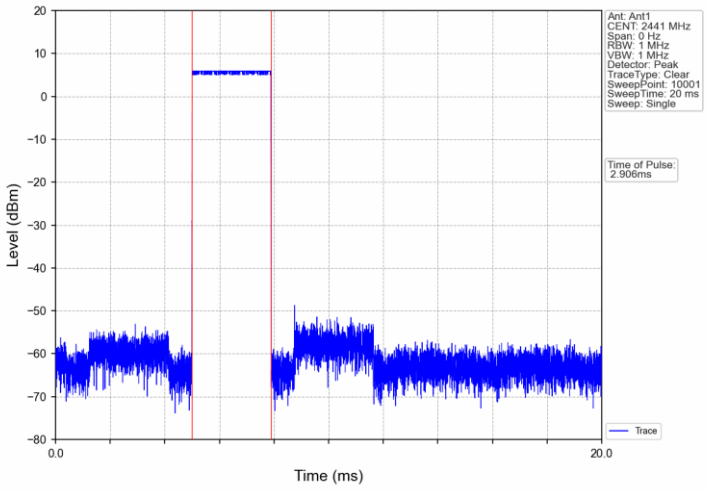

GFSK_DH5_HOPP_Ant1_NTNV

GFSK_DH5_HOPP_Ant1_NTNV

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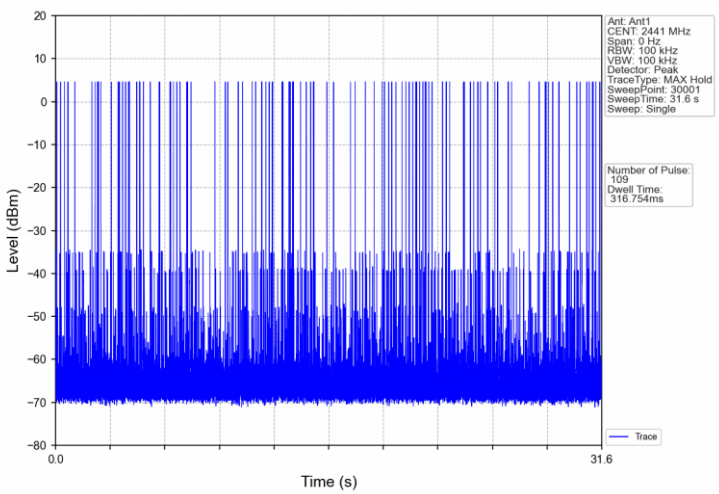
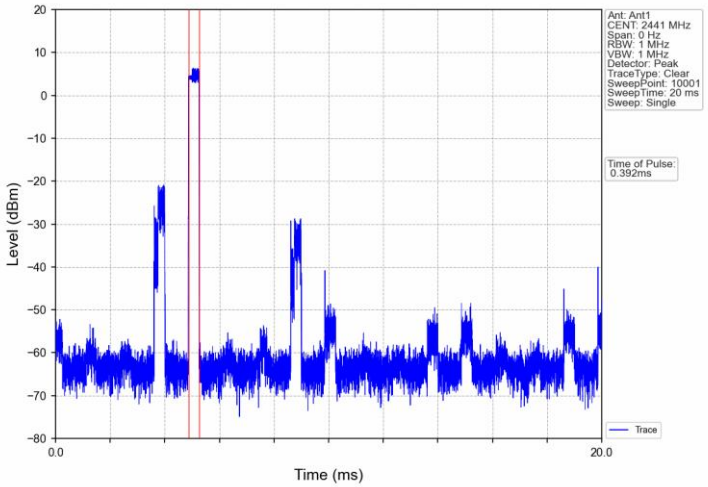
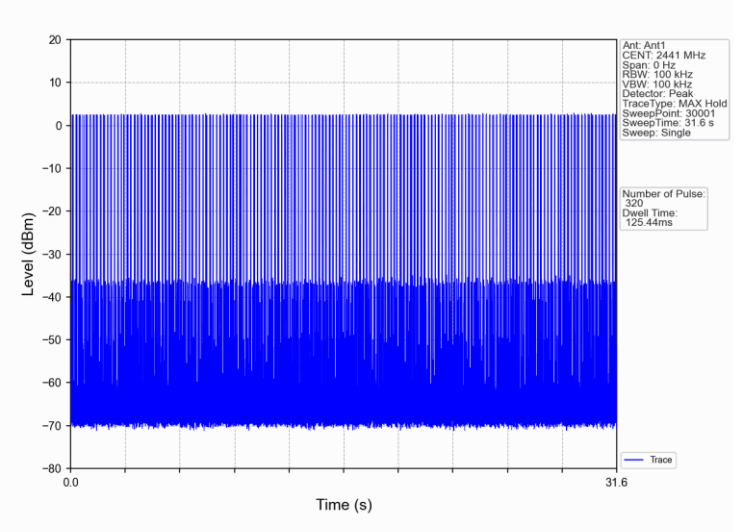


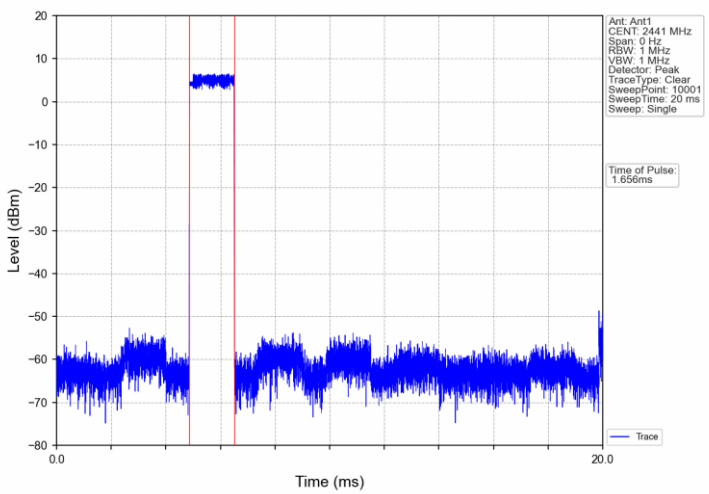
Pi/4DQPSK_2DH1_HOPP_Ant1_NTNV



Pi/4DQPSK_2DH1_HOPP_Ant1_NTNV



Pi/4DQPSK_2DH3_HOPP_Ant1_NTNV



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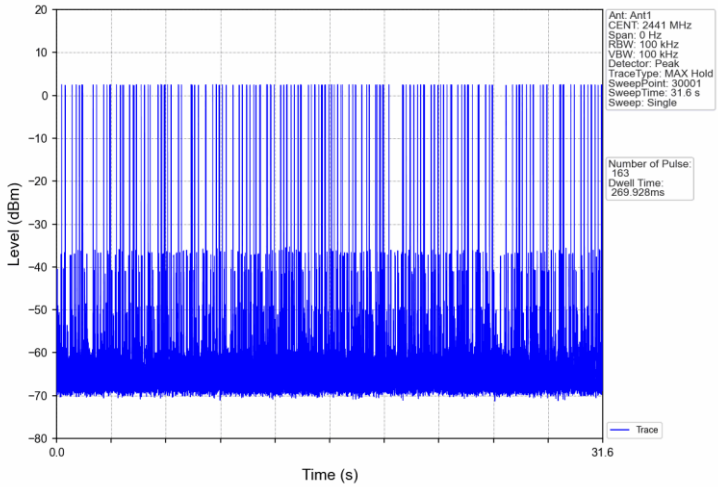

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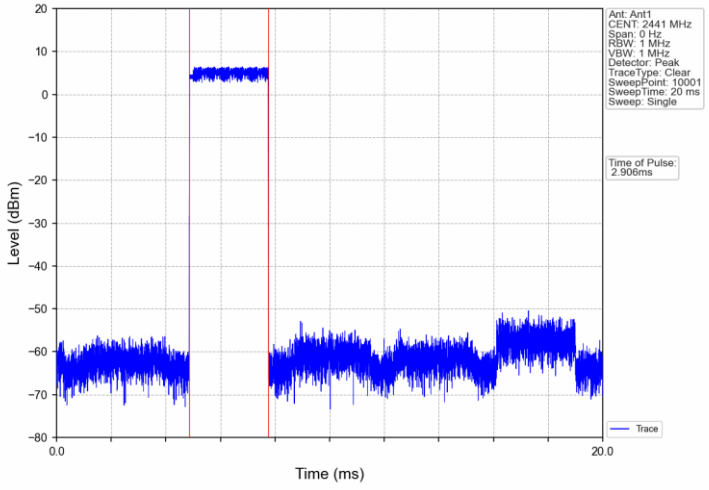

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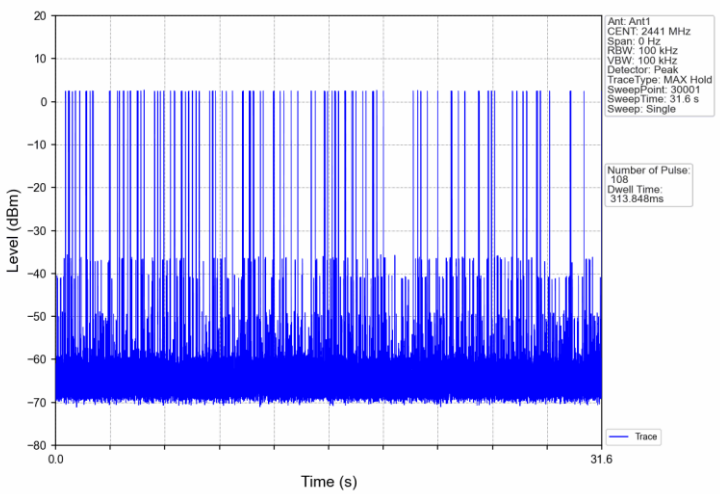
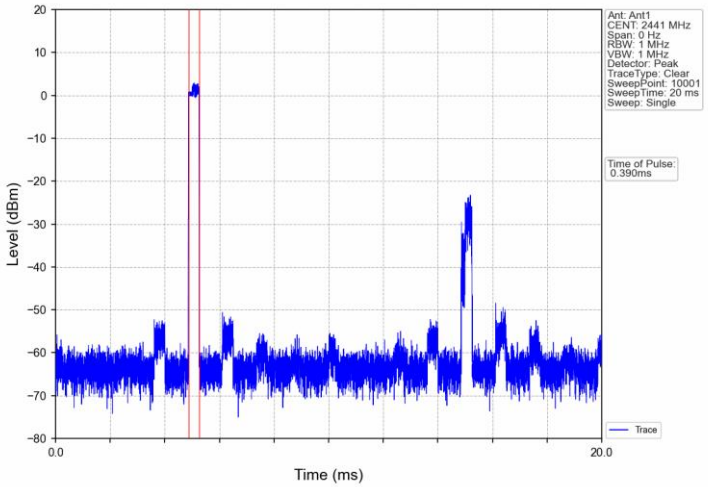
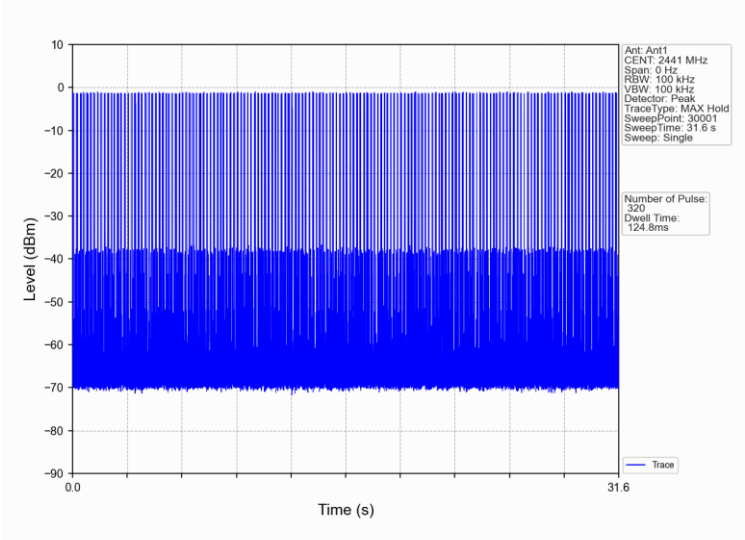


8DPSK_3DH1_HOPP_Ant1_NTNV



8DPSK_3DH1_HOPP_Ant1_NTNV



8DPSK_3DH3_HOPP_Ant1_NTNV

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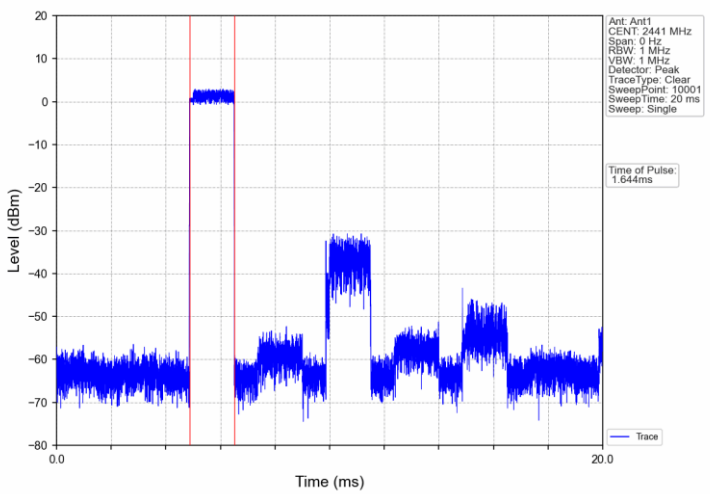

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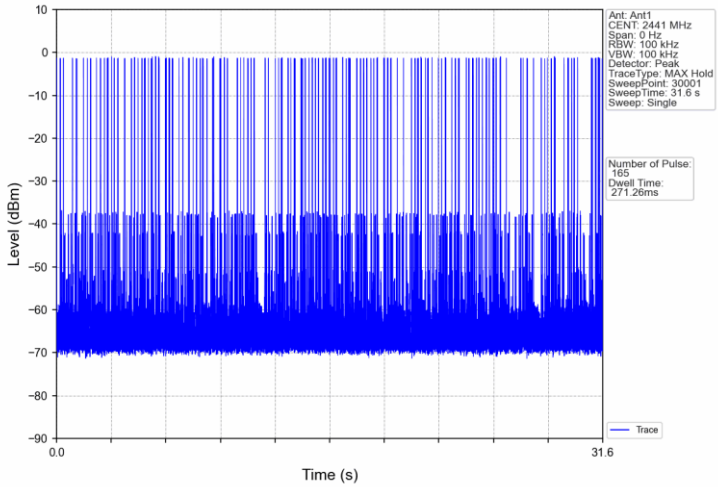

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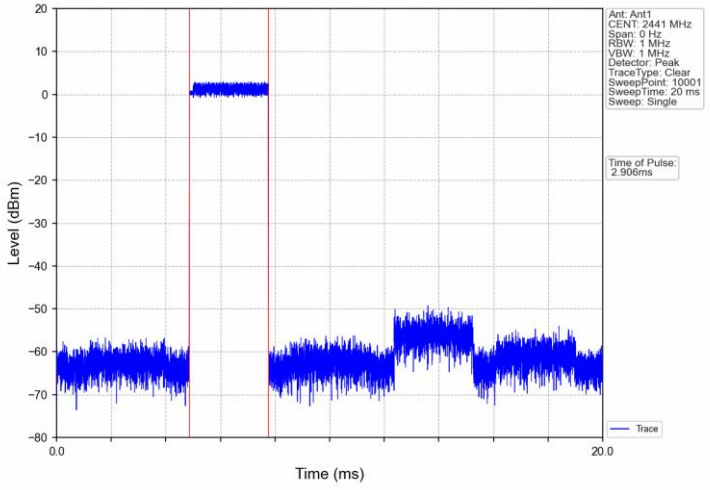

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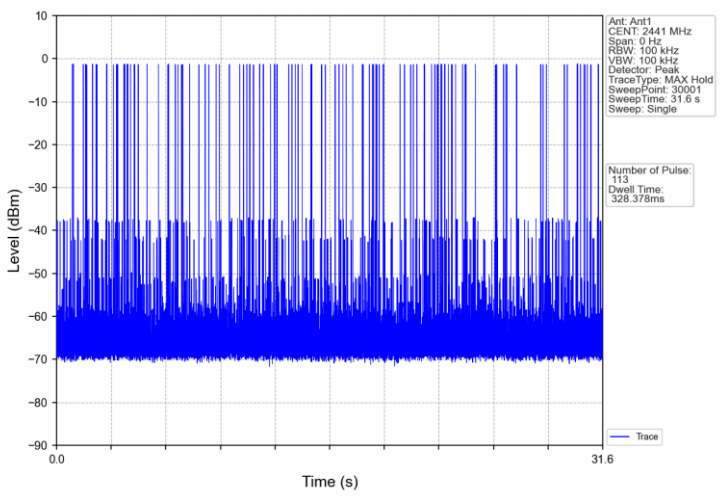

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9.6 Spurious RF Conducted Emissions

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. 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. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector, Sweep = auto, Span = wide enough to capture the peak level of the in-band emission and all spurious emissions, Trace = max hold. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section.
4. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency.

Limit

According to §15.247(d), Spurious RF Conducted Emissions limit as below:

Frequency Range MHz	Limit (dBc)
30-25000	-20

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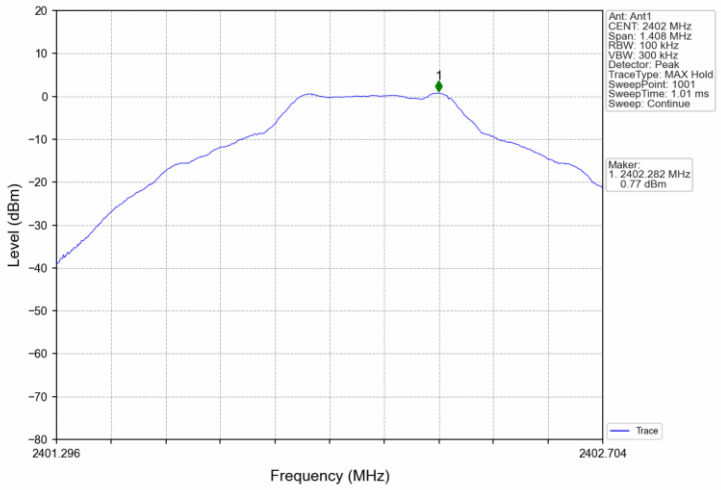
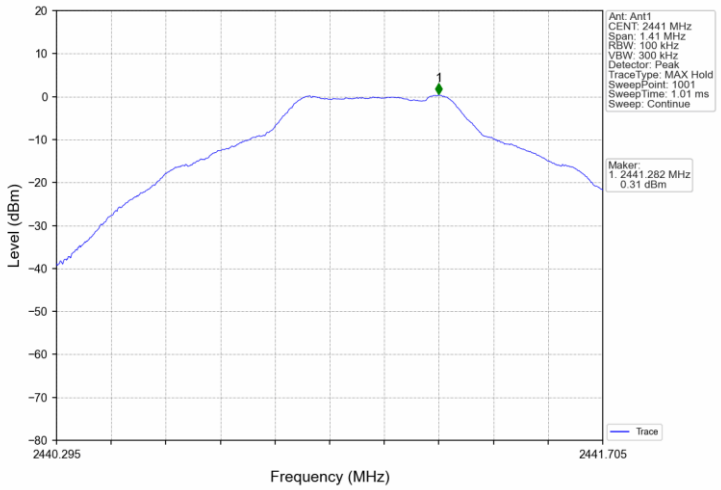
Spurious RF Conducted Emissions

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
GFSK	SISO	2402	DH5	1	0.77	-19.23	Pass
		2441	DH5	1	0.31	-19.69	Pass
		2480	DH5	1	0.36	-19.64	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	4.32	-15.68	Pass
		2441	2DH5	1	3.66	-16.34	Pass
		2480	2DH5	1	3.69	-16.31	Pass
8DPSK	SISO	2402	3DH5	1	4.81	-15.19	Pass
		2441	3DH5	1	4.61	-15.39	Pass
		2480	3DH5	1	0.77	-19.23	Pass

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



GFSK_DH5_MCH_2441MHz_Ant1_NTNV



GFSK_DH5_HCH_2480MHz_Ant1_NTNV

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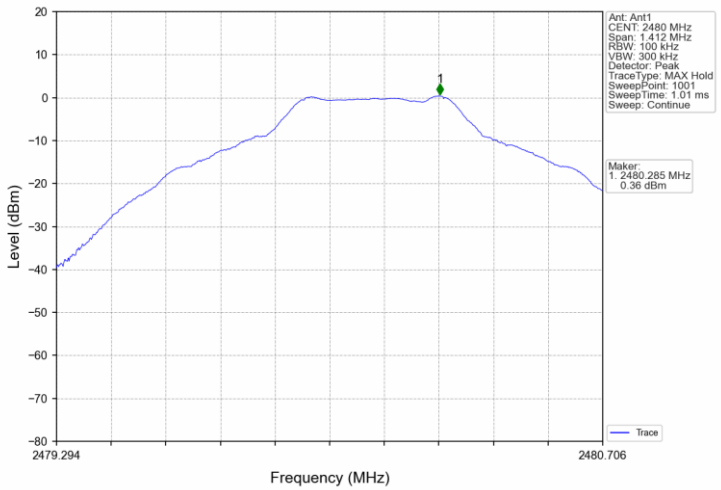
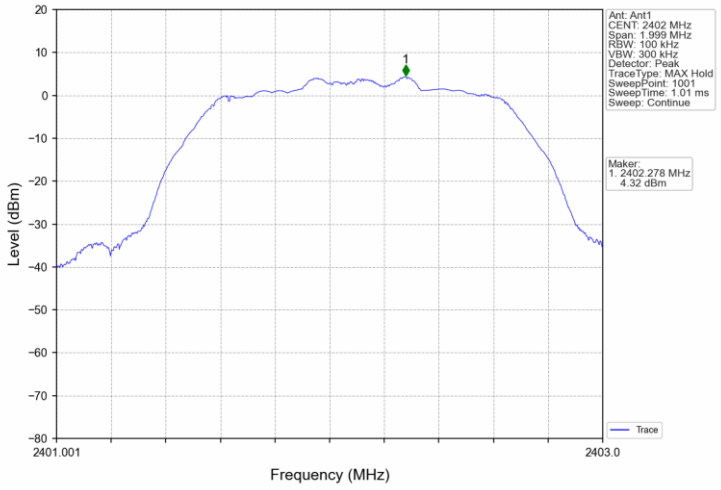
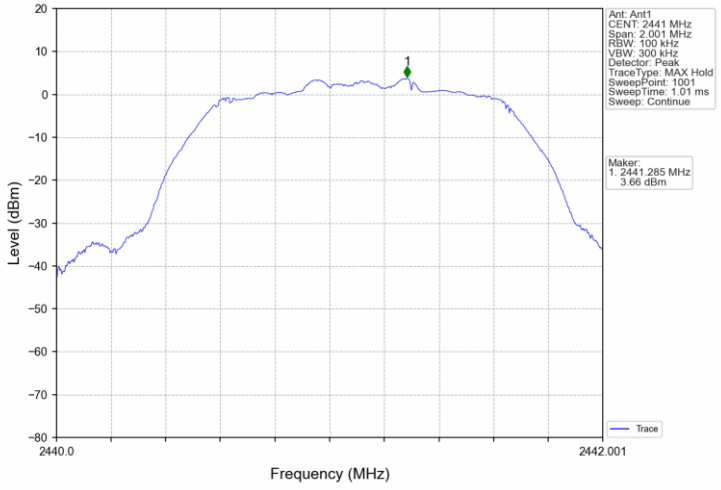


Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV



Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV



Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV

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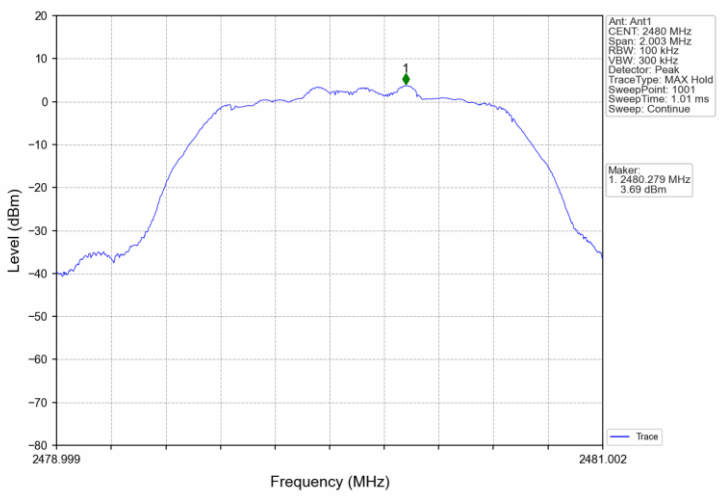
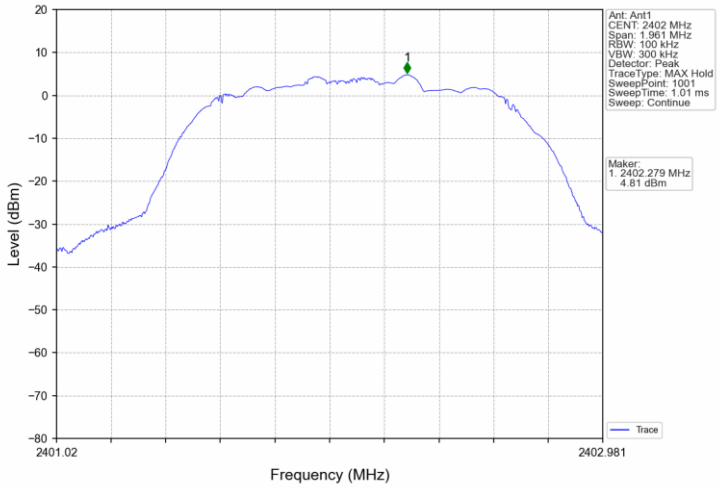
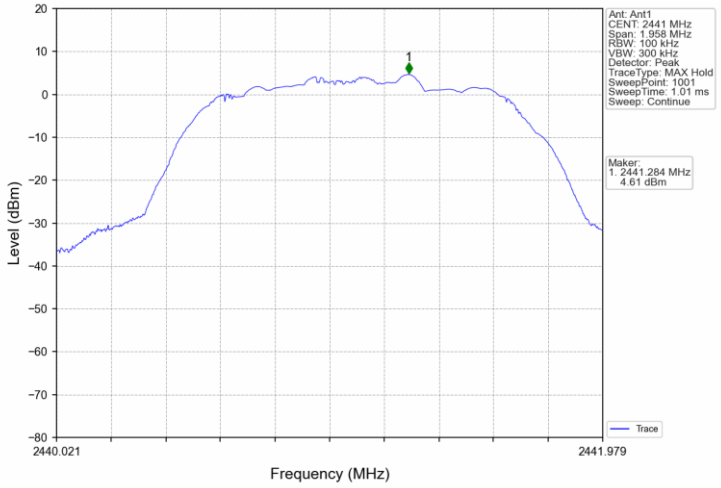


8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV

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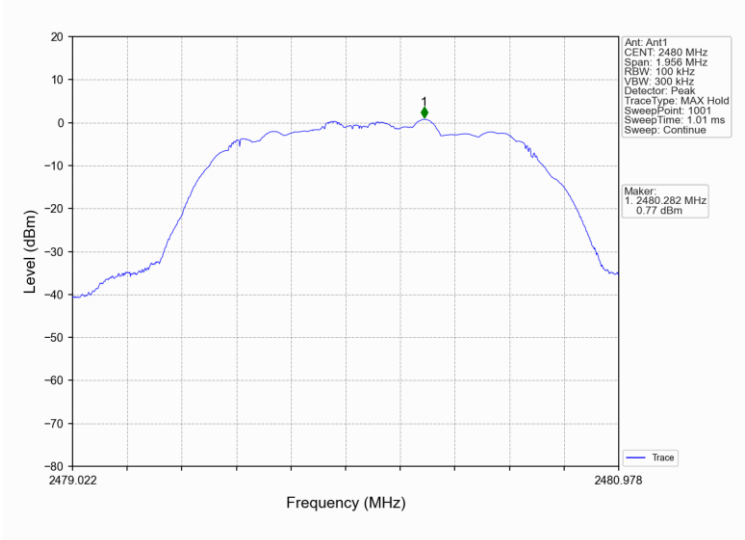
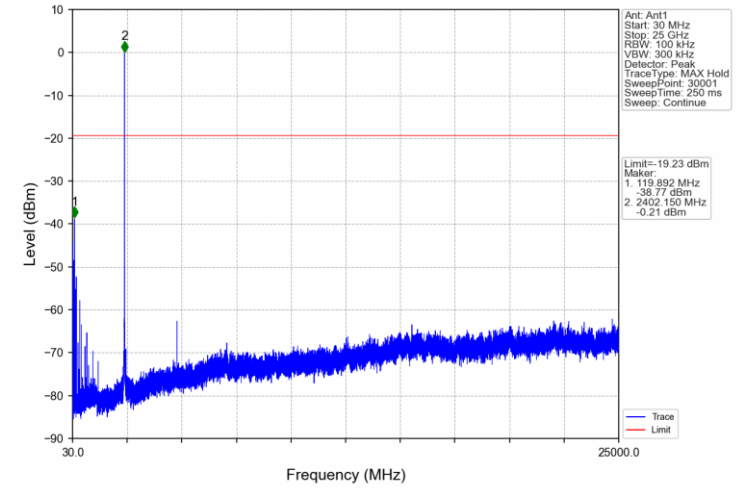
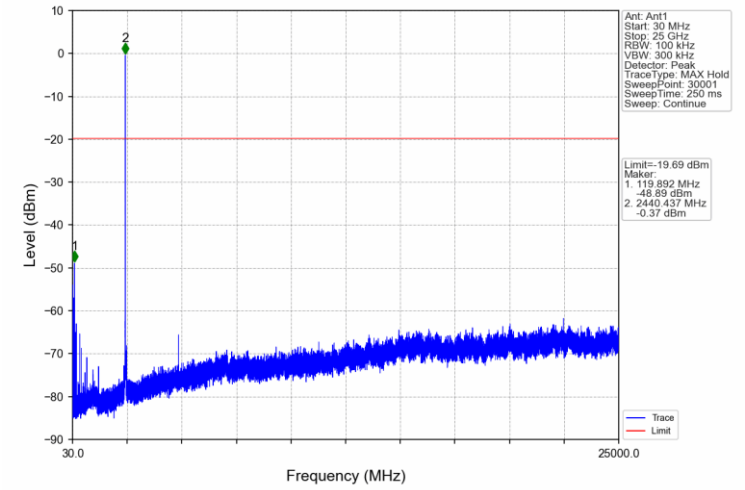


GFSK_DH5_LCH_2402MHz_Ant1_NTNV



GFSK_DH5_MCH_2441MHz_Ant1_NTNV



GFSK_DH5_HCH_2480MHz_Ant1_NTNV

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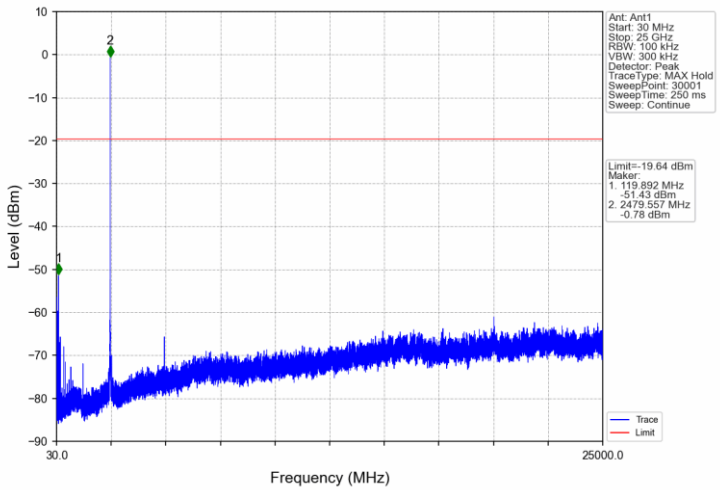
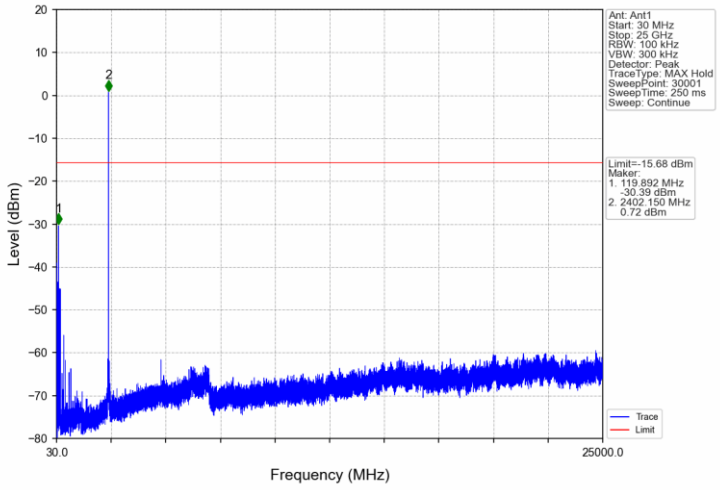
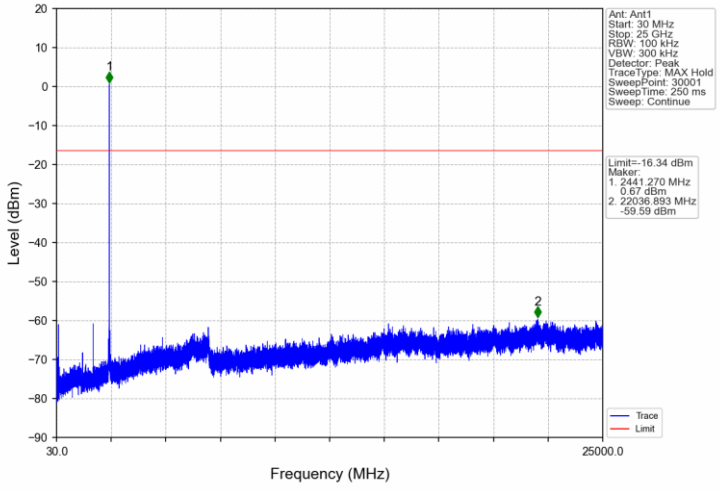


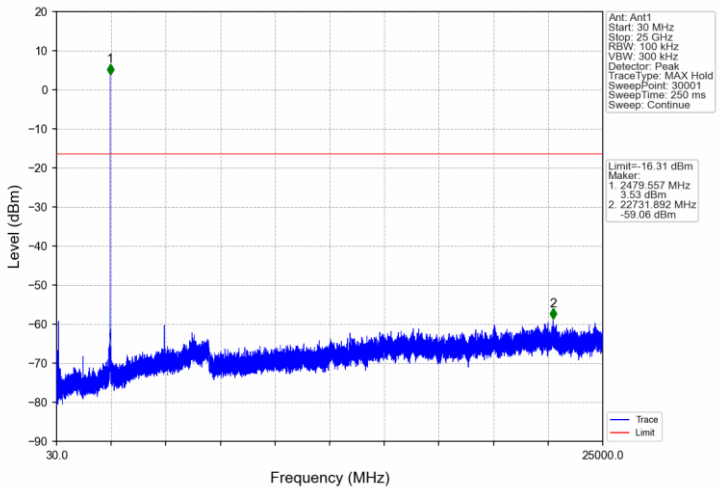
Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV



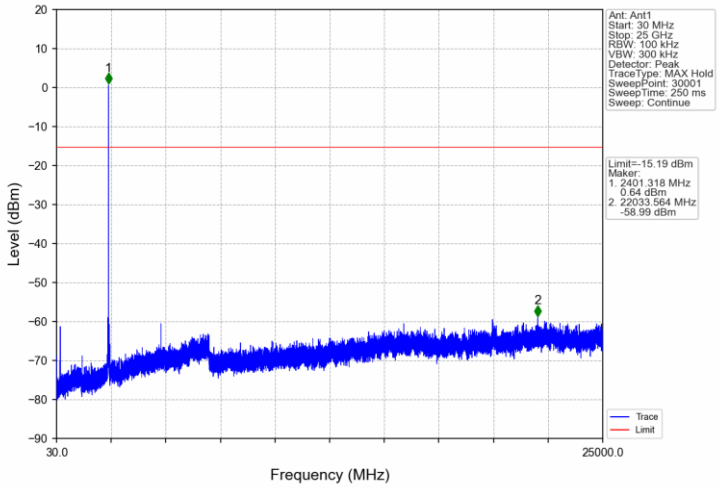
Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV



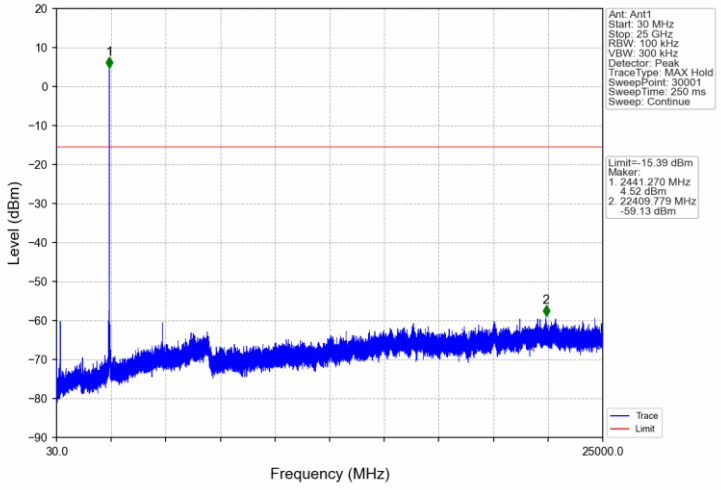
Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV



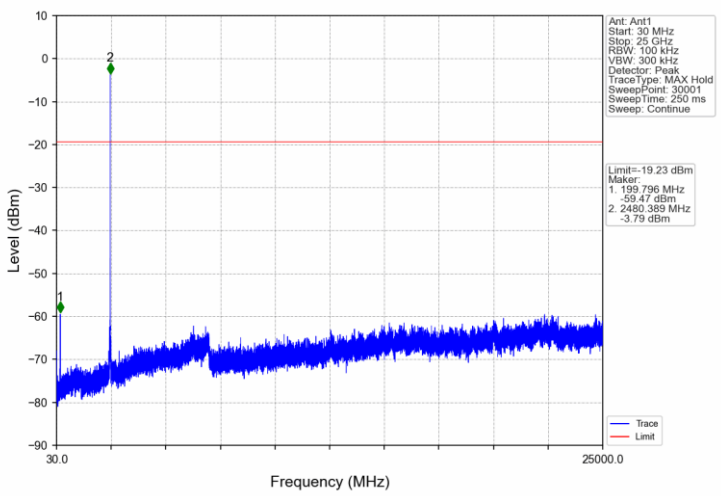
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV



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