FCC - TEST REPORT

Report Number	:	**68.950.24.0553.01**	Date of Issue:	**2024-07-17**
Model	:	**Altos BrainSphere P1 F9**		
Product Type	:	All-in-One PCs		
Applicant	:	ALTOS COMPUTING INDIA PRIVATE LIMITED		
Address	:	6th Floor, No. 13, Embassy Heights, Magrath Road, Karnataka, Bengaluru, 560025, India		
Manufacturer	:	ALTOS COMPUTING INDIA PRIVATE LIMITED		
Address	:	6th Floor, No. 13, Embassy Heights, Magrath Road, Karnataka, Bengaluru, 560025, India		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	**74**		

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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 City, 518052, P. R. China
Telephone:	86 755 8828 6998
Fax:	86 755 828 5299
FCC Registration No.:	514049
FCC Designation No.:	CN5009

3 Description of the Equipment Under Test

Product:	All-in-One PCs
Model no.:	Altos BrainSphere P1 F9
FCC ID:	2BHDD-AQ67ALTOSP1F9
Rating:	19VDC, 7.9A (powered by adapter)
Accessories:	Adapter Model: HKA15019079-6C Input: 100-240VAC 50/60Hz, 2.0A, Output: 19VDC, 7.9A Manufacturer: Shenzhen Huntkey Electric Co., Ltd.
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	79
Modulation:	GFSK, π/4-DQPSK, 8DPSK
Antenna Type:	Internal Antenna
Antenna Gain:	3.41dBi max for 2.4GHz Ant1
Description of the EUT:	The Equipment Under Test (EUT) is an All-in-One PCs supports Bluetooth Low Energy / Bluetooth BR+EDR/ Wi-Fi functions

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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	Site 1	Pass
§15.247(b)(1)	Conducted output power	Site 1	Pass
§15.247(a)(1)	20dB bandwidth and 99% occupied 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 1: N/A=Not Applicable.
Note 2: The EUT uses an Internal Antenna, which gain is 3.41dBi. 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: 2BHDD-AQ67ALTOSP1F9, complies with Section 15.207, 15.209, 15.205, 15.247 of the FCC Part 15, Subpart C.

The Model: Altos BrainSphere P1 F9 supports Bluetooth Low Energy/Bluetooth BR+EDR/Wi-Fi functions.
The TX and RX range is 2402MHz-2480MHz for Bluetooth, 2412MHz – 2462MHz for 2.4GHz Wi-Fi, 5180MHz – 5320MHz, 5500MHz – 5700MHz, 5745MHz – 5825MHz for 5GHz Wi-Fi.

Note: The report is for BR+EDR only.

SUMMARY:

All tests according to the regulations cited on page 6 were

■ - Performed

☐ - **Not** Performed

The Equipment Under Test

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

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

Sample Received Date:	2024-05-21
Testing Start Date:	2024-05-22
Testing End Date:	2024-06-24

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

Reviewed by:	Prepared by:	Tested by:
John Zhi	Joe Gu	Carry Cai
Project Manager	Project Engineer	Test Engineer

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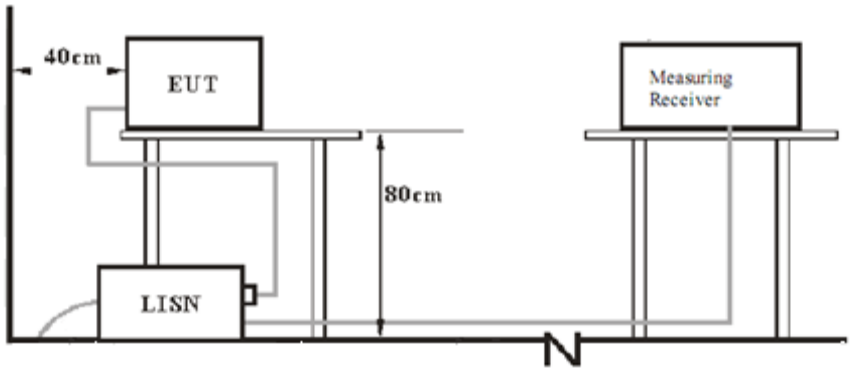
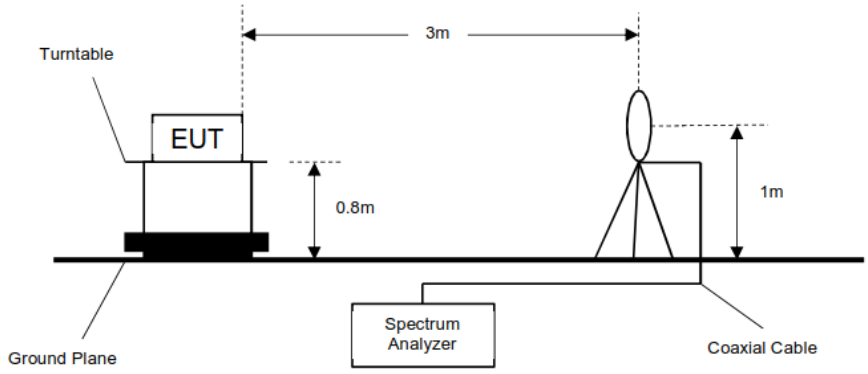
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

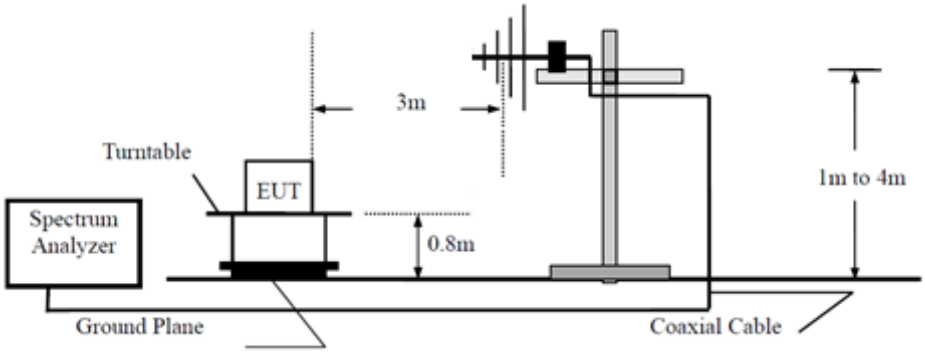


7.2 Radiated test setups

9KHz - 30MHz



30MHz - 1GHz



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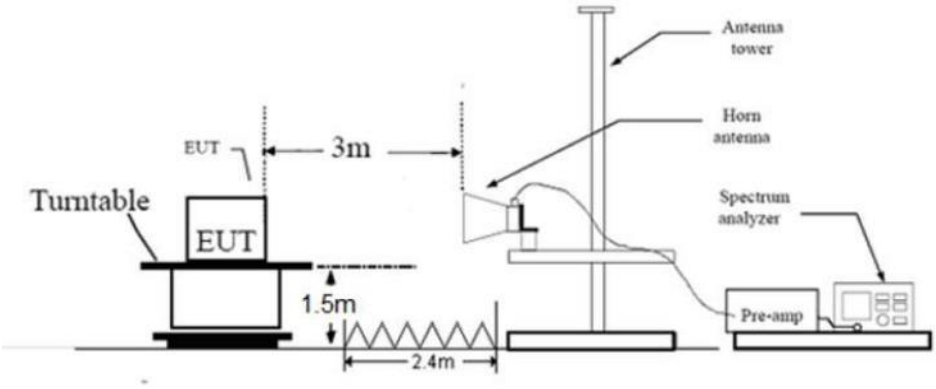
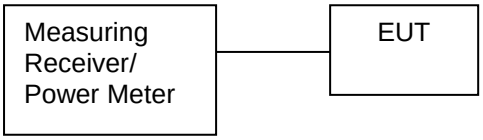
Above 1GHz



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
LAPTOP	LENOVO	T460S	---

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.

9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. Both sides of AC line were checked for maximum conducted interference.
6. The frequency range from 150 kHz to 30 MHz was searched.
7. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

Limit

Frequency MHz	QP Limit dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

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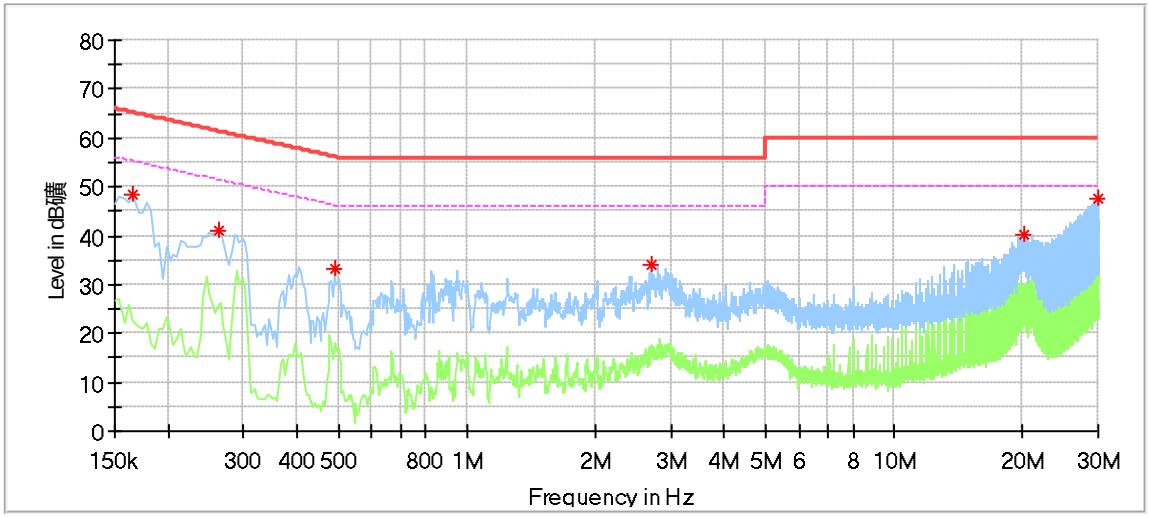
Conducted Emission

Product Type	:	All-in-One PCs
M/N	:	Altos BrainSphere P1 F9
Operating Condition	:	Transmit
Test Specification	:	Line
Comment	:	AC 120V/60Hz



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.166000	48.40	---	65.16	16.76	L1	9.54
0.262000	40.82	---	61.37	20.54	L1	9.56
0.490000	33.33	---	56.17	22.84	L1	9.59
2.698000	34.02	---	56.00	21.98	L1	9.64
20.082000	40.32	---	60.00	19.68	L1	10.01
29.918000	47.43	---	60.00	12.57	L1	10.03

Remark:
Level=Reading Level + Correction Factor
Correction Factor=Cable Loss + LISN Factor
(The Reading Level is recorded by software which is not shown in the sheet)

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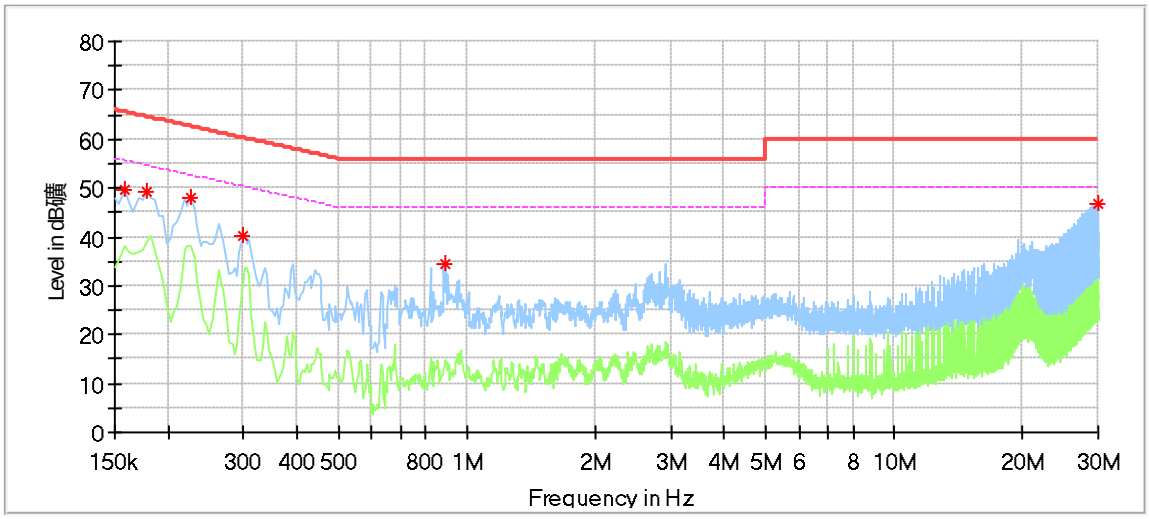
Conducted Emission

Product Type	:	All-in-One PCs
M/N	:	Altos BrainSphere P1 F9
Operating Condition	:	Transmit
Test Specification	:	Neutral
Comment	:	AC 120V/60Hz



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.158000	49.66	---	65.57	15.90	N	9.56
0.178000	49.24	---	64.58	15.34	N	9.57
0.226000	48.10	---	62.60	14.49	N	9.58
0.298000	40.40	---	60.30	19.90	N	9.60
0.894000	34.46	---	56.00	21.54	N	9.63
29.846000	46.97	---	60.00	13.03	N	9.88

Remark:
Level=Reading Level + Correction Factor
Correction Factor=Cable Loss + LISN Factor
(The Reading Level is recorded by software which is not shown in the sheet)

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9.2 Conducted 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 output power limit as below:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤0.125	≤21

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Conducted Output Power

Bluetooth Mode GFSK modulation Test Result

Frequency	Conducted Output Power	Result
MHz	dBm	
Low channel 2402MHz	5.90	Pass
Middle channel 2441MHz	7.13	Pass
High channel 2480MHz	8.55	Pass

Bluetooth Mode π/4-DQPSK modulation Test Result

Frequency	Conducted Output Power	Result
MHz	dBm	
Low channel 2402MHz	4.31	Pass
Middle channel 2441MHz	5.48	Pass
High channel 2480MHz	6.22	Pass

Bluetooth Mode 8DPSK modulation Test Result

Frequency	Conducted Output Power	Result
MHz	dBm	
Low channel 2402MHz	4.40	Pass
Middle channel 2441MHz	5.63	Pass
High channel 2480MHz	6.44	Pass

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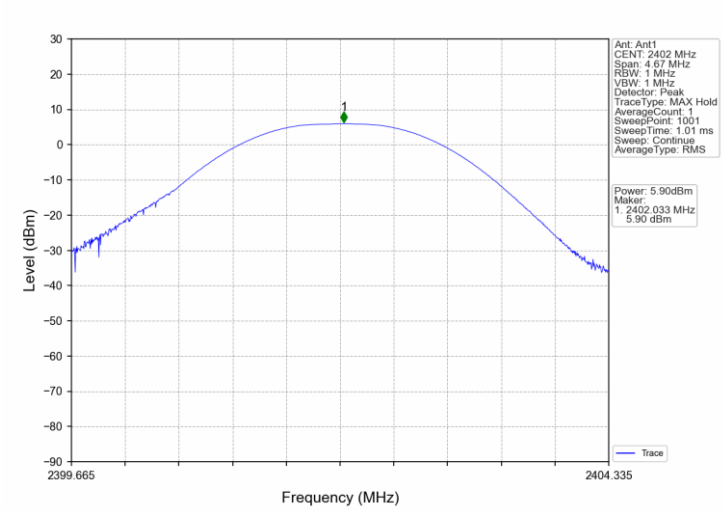
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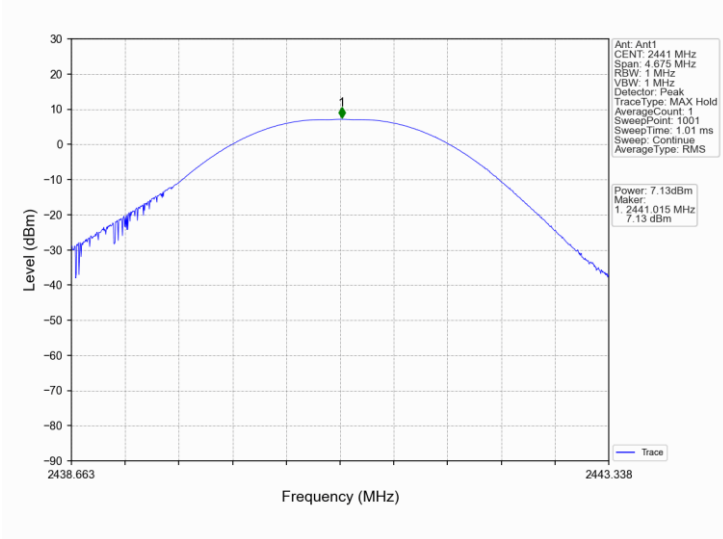
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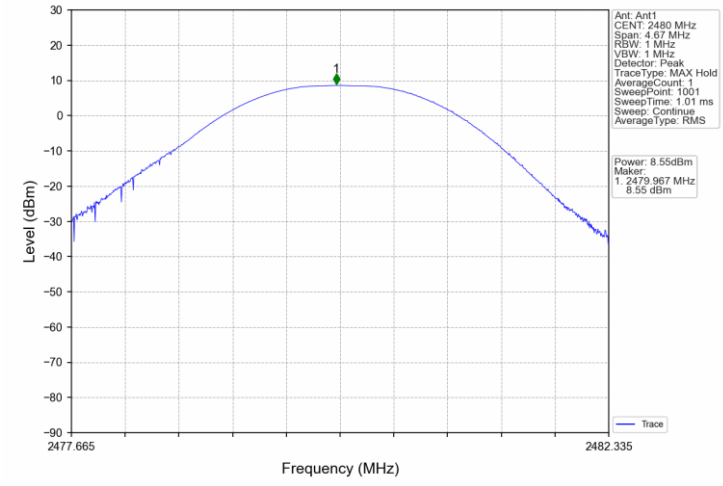

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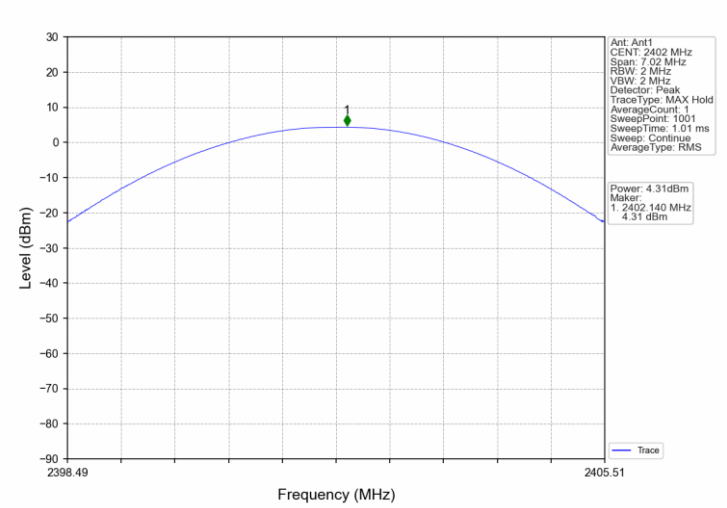
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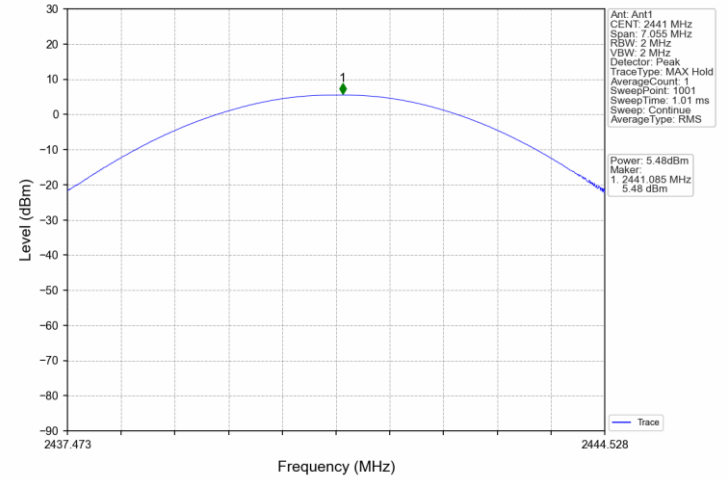
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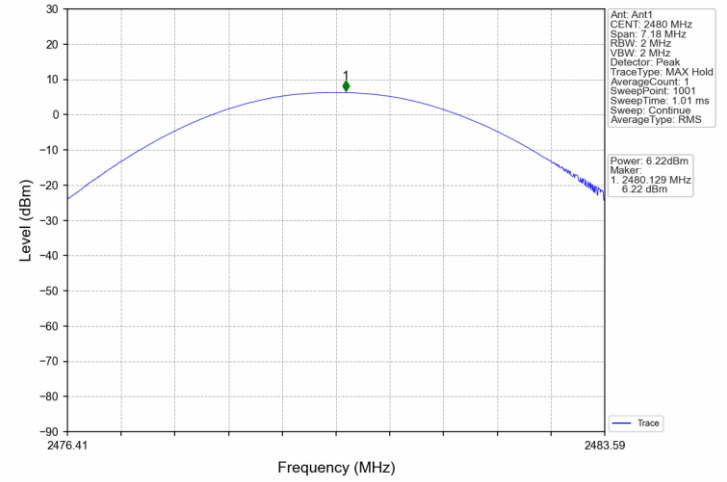

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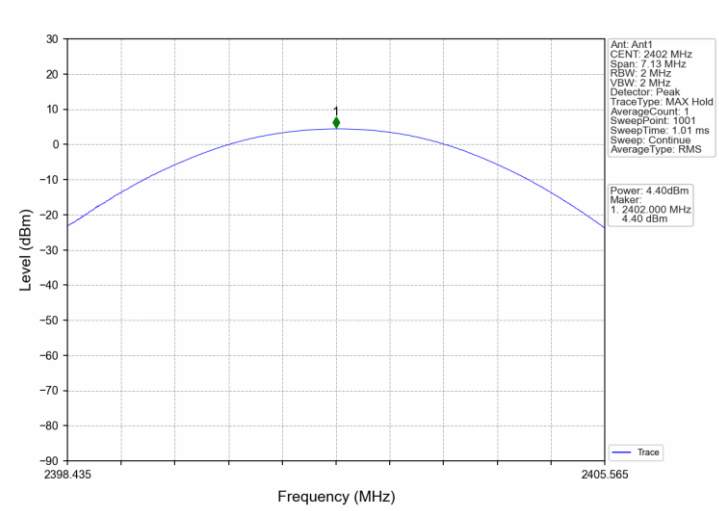
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV

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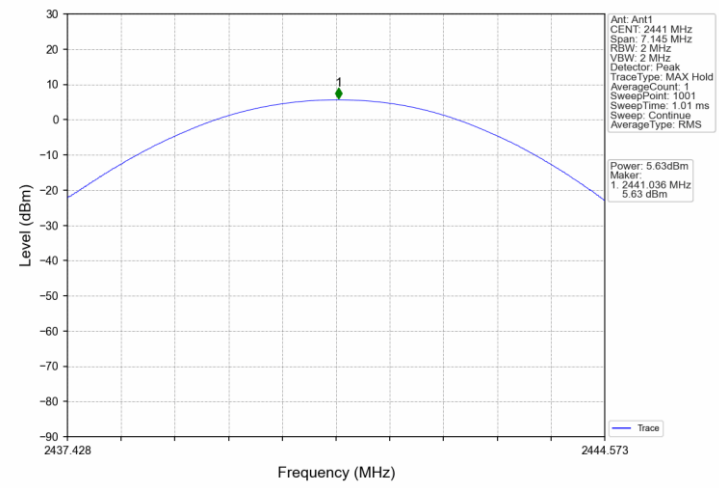
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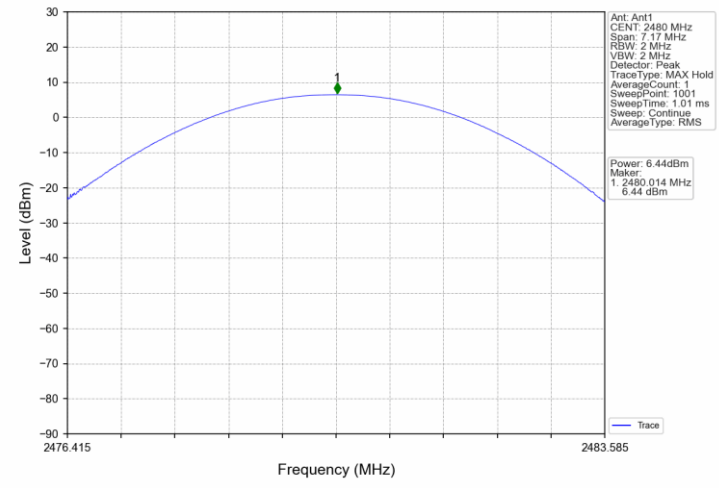

9.3 20 dB Bandwidth and 99% Occupied Bandwidth

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 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/99% OBW 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

Limit [kHz]
N/A

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20 dB bandwidth and 99% Occupied Bandwidth

Test result

TestMode	Frequency MHz	20 dB Bandwidth MHz	99% Bandwidth MHz	Limit MHz	Result
GFSK	2402	0.934	0.864	--	Pass
GFSK	2441	0.935	0.868	--	Pass
GFSK	2480	0.934	0.863	--	Pass
π/4-DQPSK	2402	1.404	1.352	--	Pass
π/4-DQPSK	2441	1.411	1.351	--	Pass
π/4-DQPSK	2480	1.436	1.353	--	Pass
8DPSK	2402	1.426	1.347	--	Pass
8DPSK	2441	1.429	1.345	--	Pass
8DPSK	2480	1.434	1.345	--	Pass

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20 dB Bandwidth

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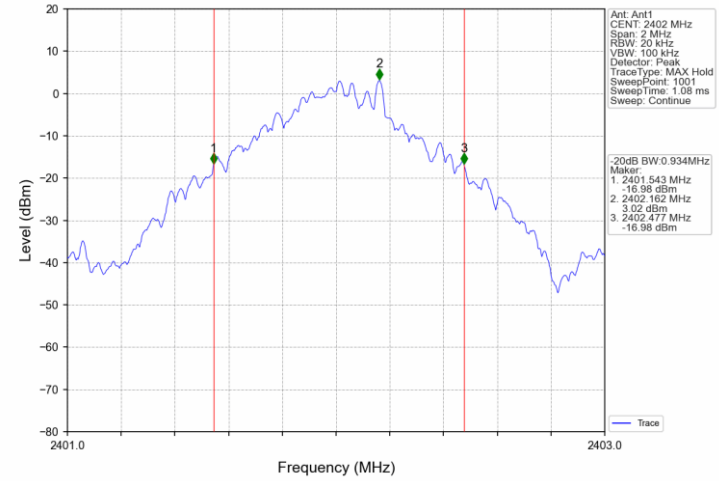
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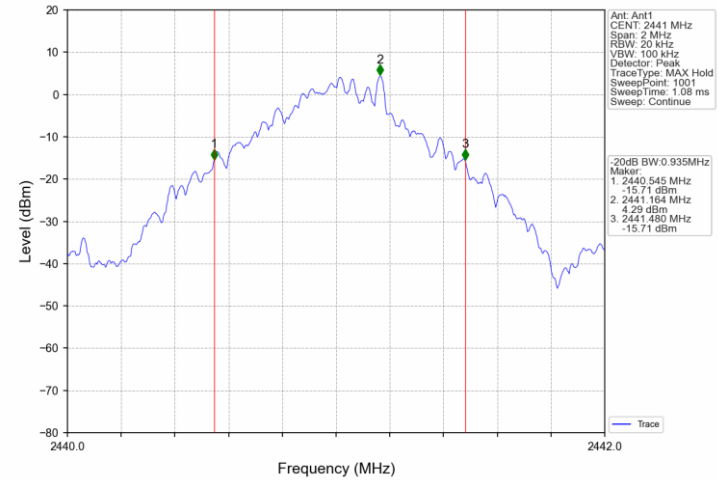
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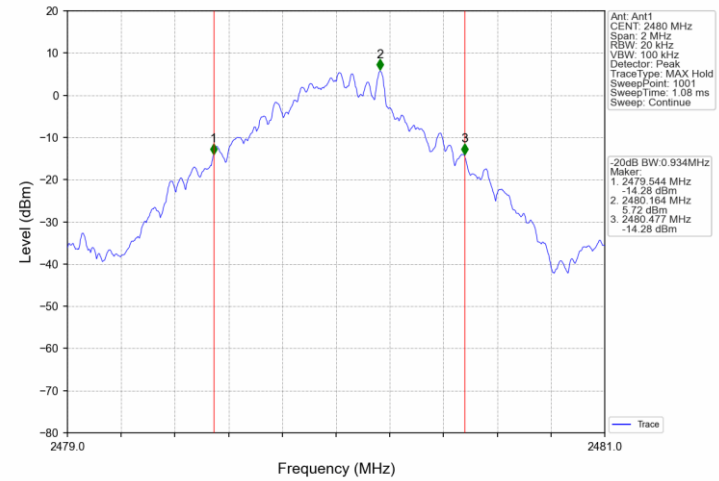

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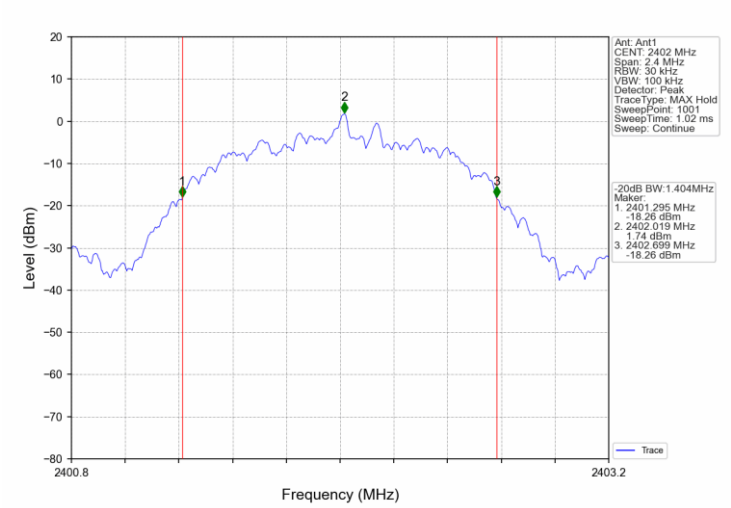
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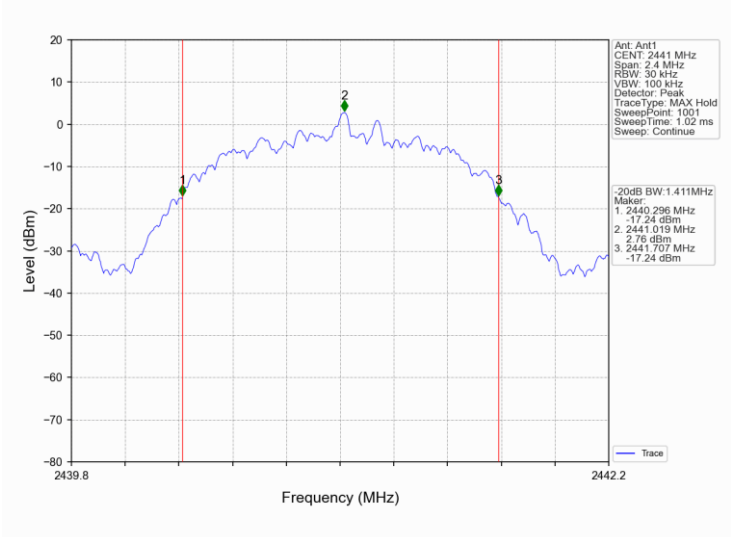
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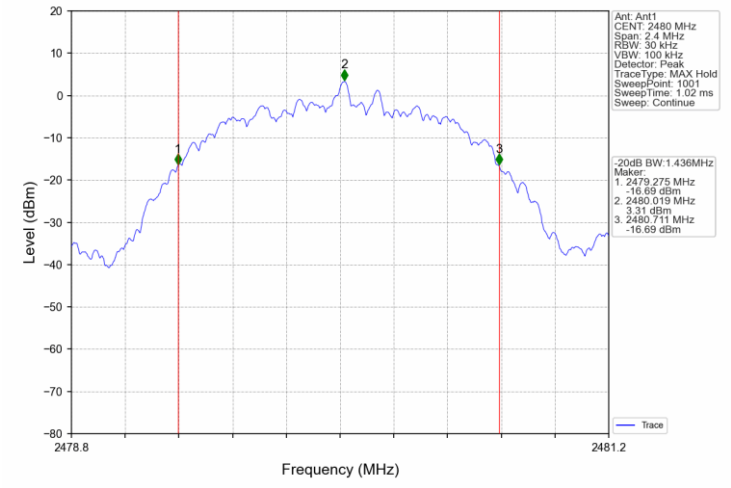

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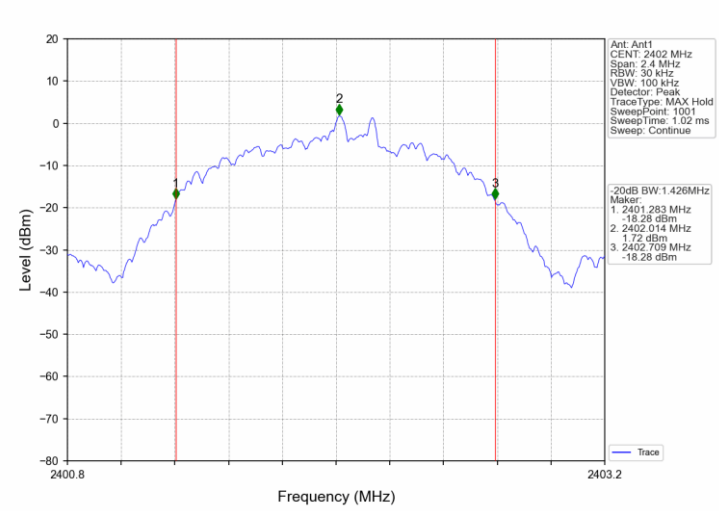
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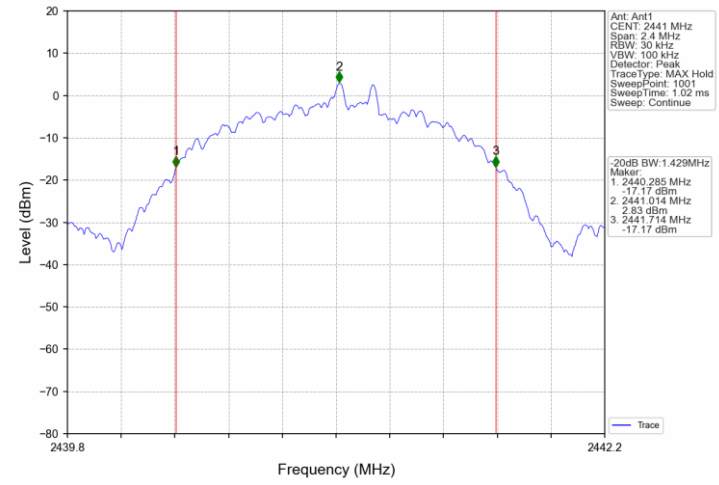
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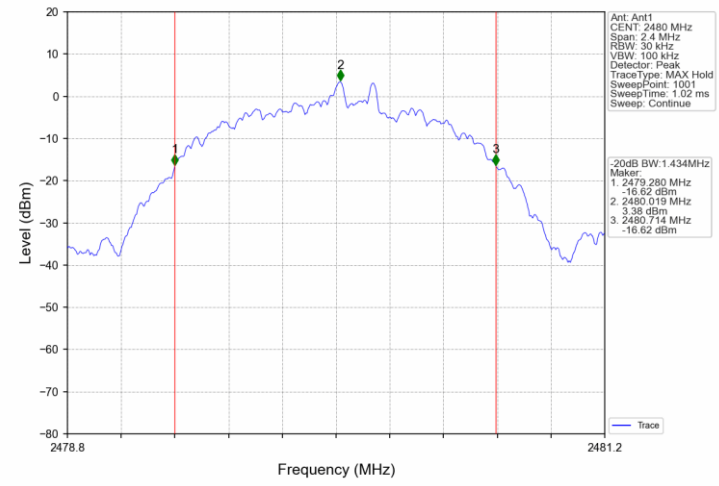

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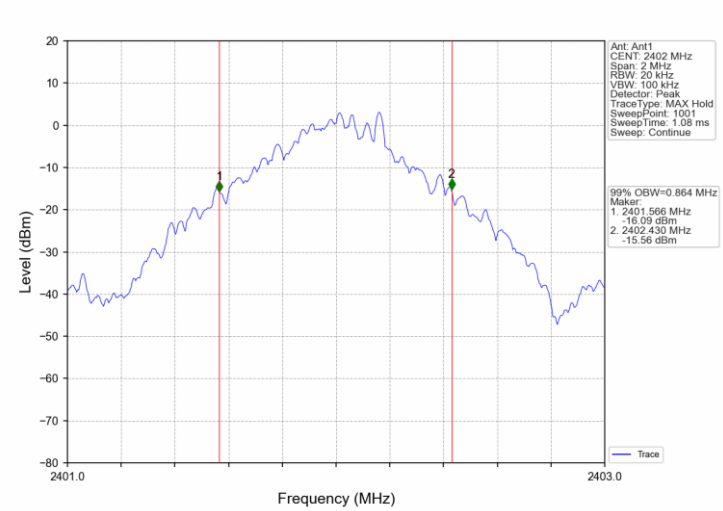
99% Occupied Bandwidth

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



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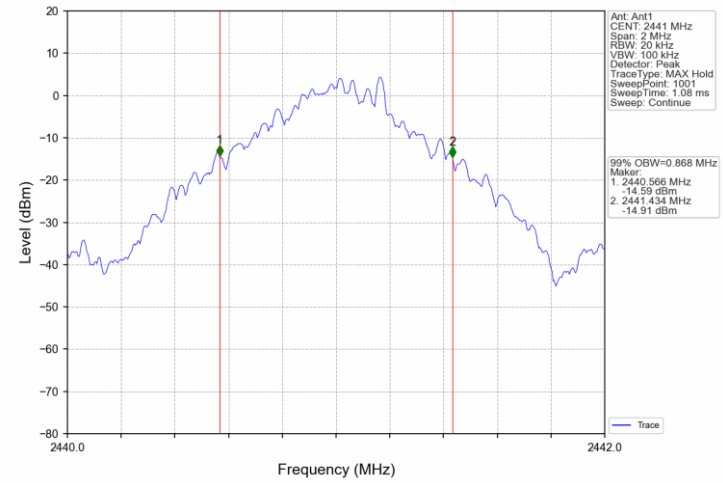
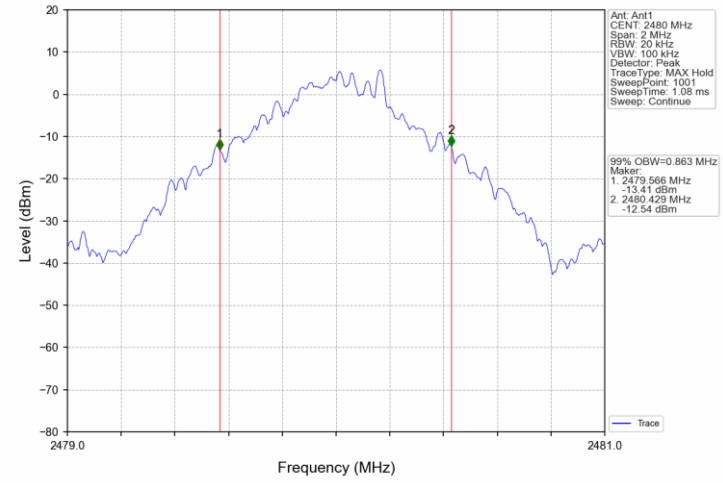


GFSK_DH5_HCH_2480MHz_Ant1_NTNV



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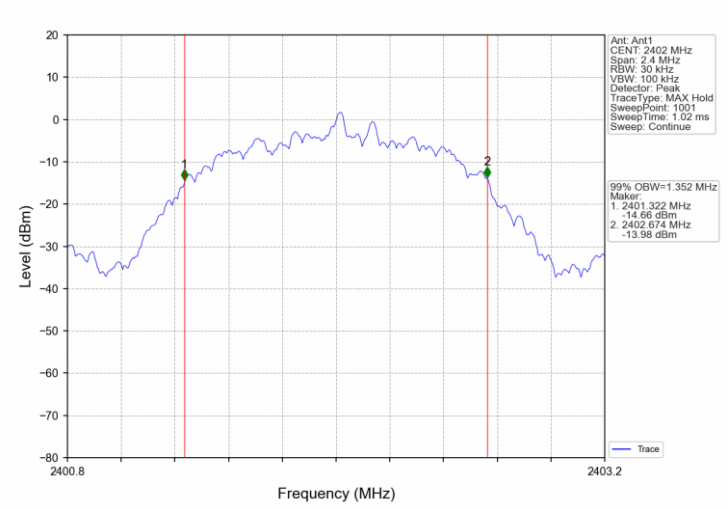
Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV

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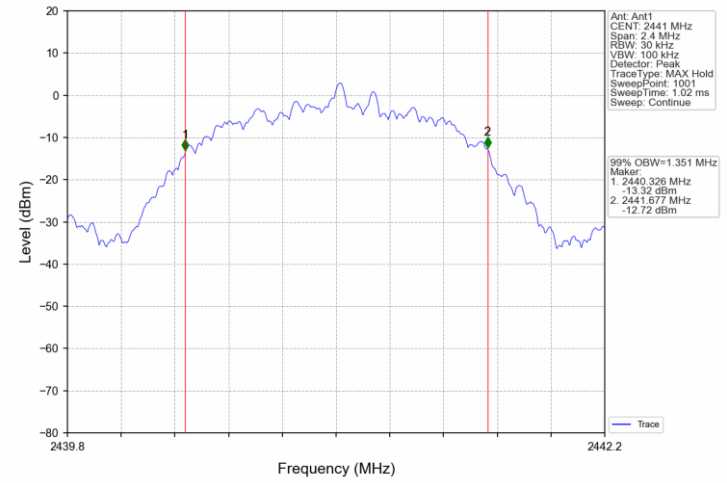
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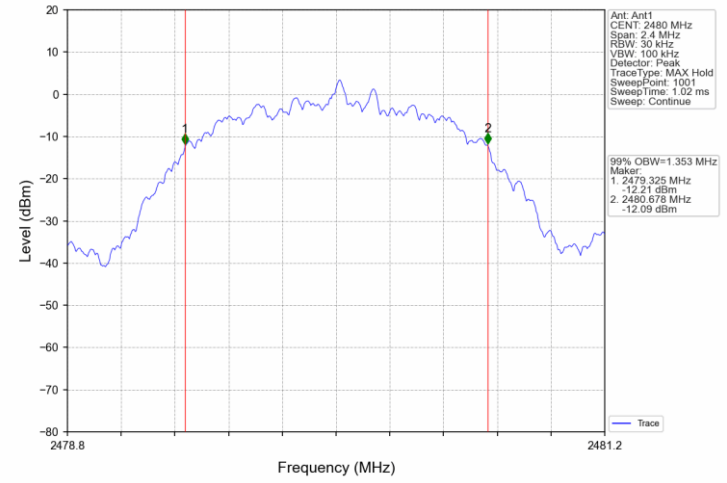

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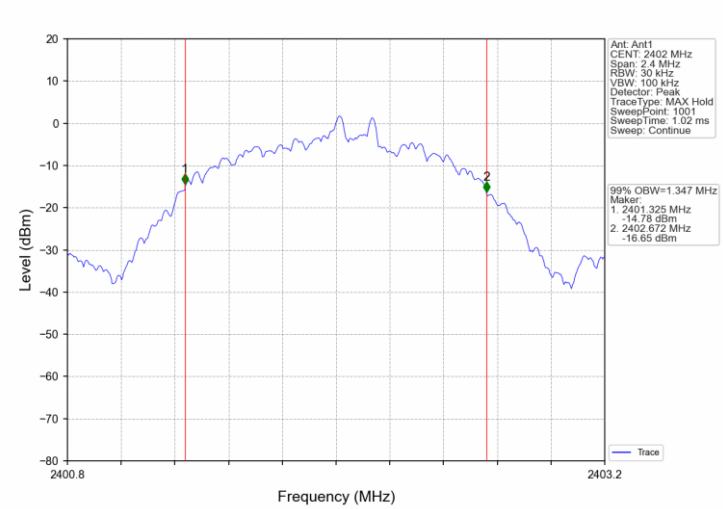
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV

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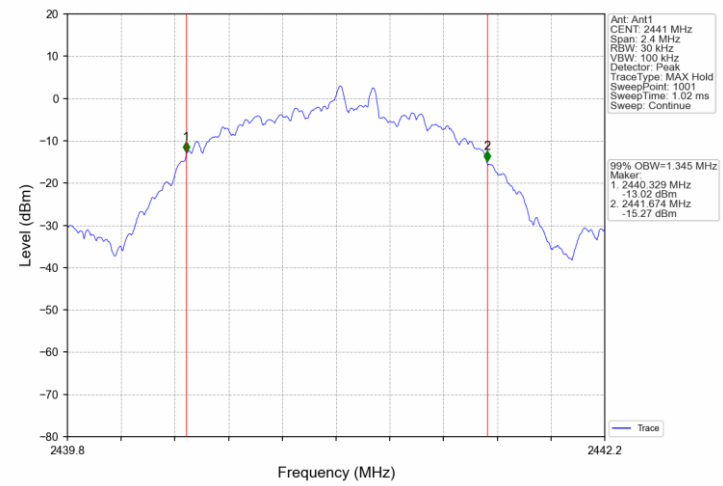
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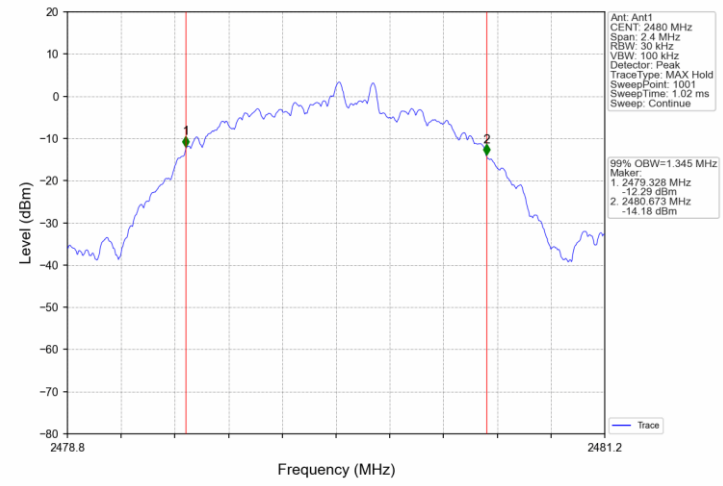

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9.4 Carrier Frequency Separation

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

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

Limit

Modulation	Frequency MHz	2/3 of 20 dB Bandwidth kHz
GFSK	2441	623
π/4-DQPSK	2441	941
8DPSK	2441	953

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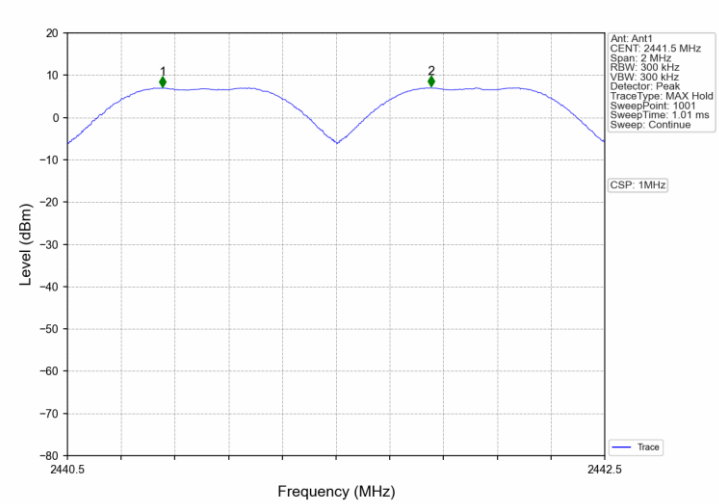
Carrier Frequency Separation

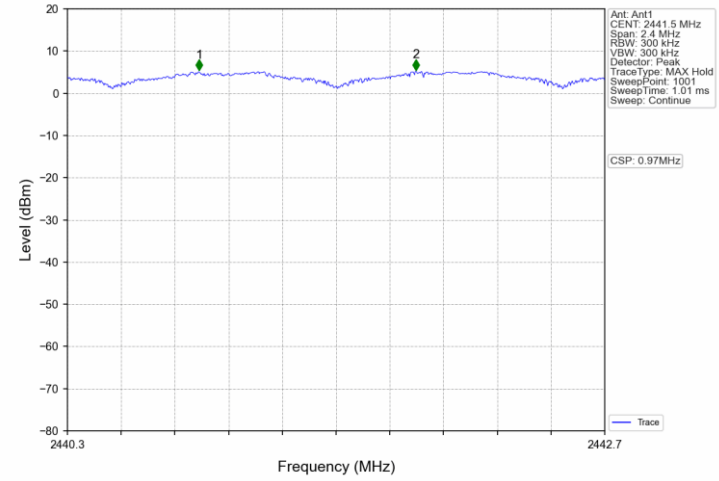
Test result: The measurement was performed with the typical configuration (normal hopping status).

Modulation	Frequency MHz	Carrier Frequency Separation MHz	Result
GFSK	2441	1.000	Pass
π/4-DQPSK	2441	0.970	Pass
8DPSK	2441	1.001	Pass

GFSK_DH5_HOPP_Ant1_NTNV



Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV



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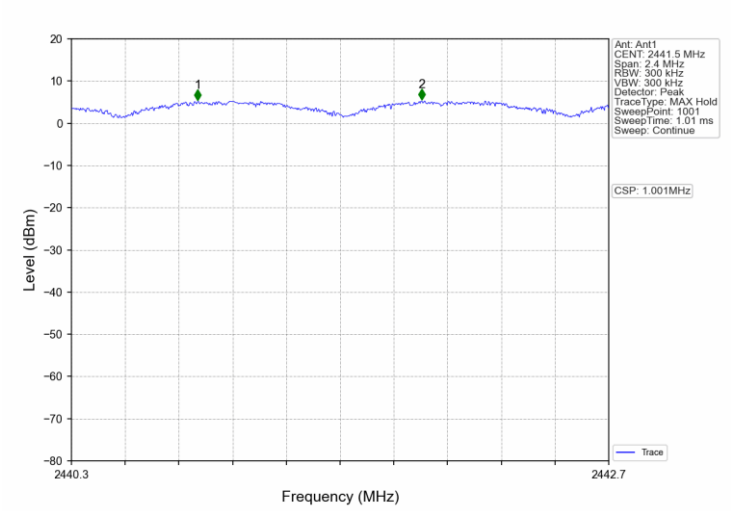
8DPSK_3DH5_HOPP_Ant1_NTNV


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9.5 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

Limit number
⩾ 15

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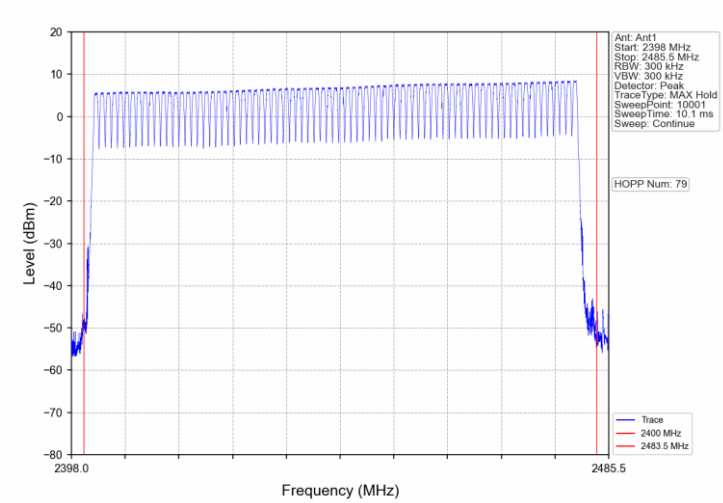
Number of Hopping Frequencies

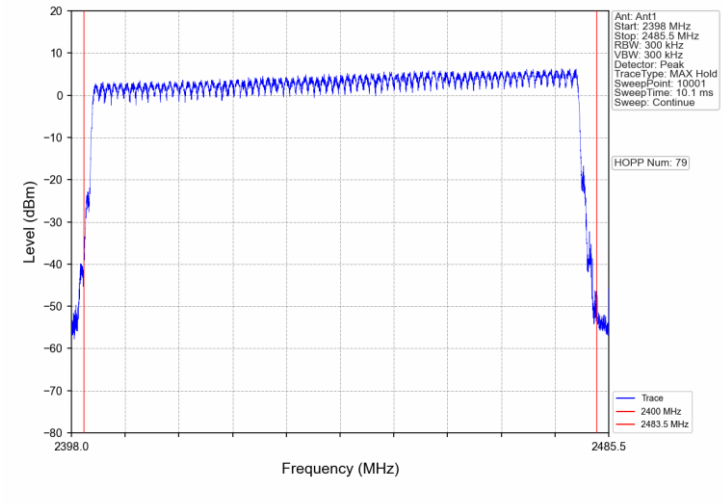
Test result: The measurement was performed with the typical configuration (normal hopping status), and the total hopping channels is constant for the all modulation mode according with the Bluetooth Core Specification.

Number of hopping frequencies	Result
79	Pass

GFSK_DH5_HOPP_Ant1_NTNV



Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV



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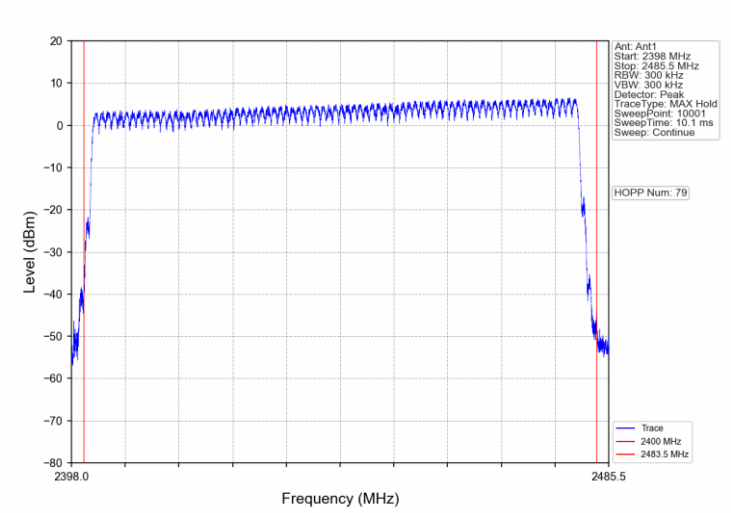
8DPSK_3DH5_HOPP_Ant1_NTNV


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9.6 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

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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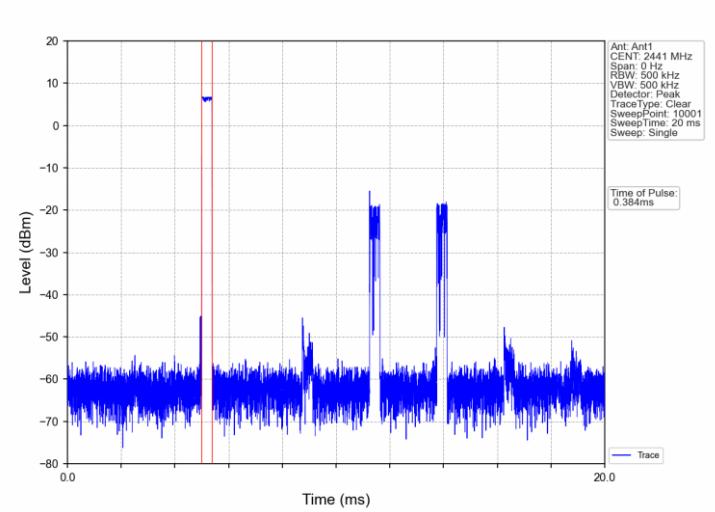
Dwell Time

Dwell time

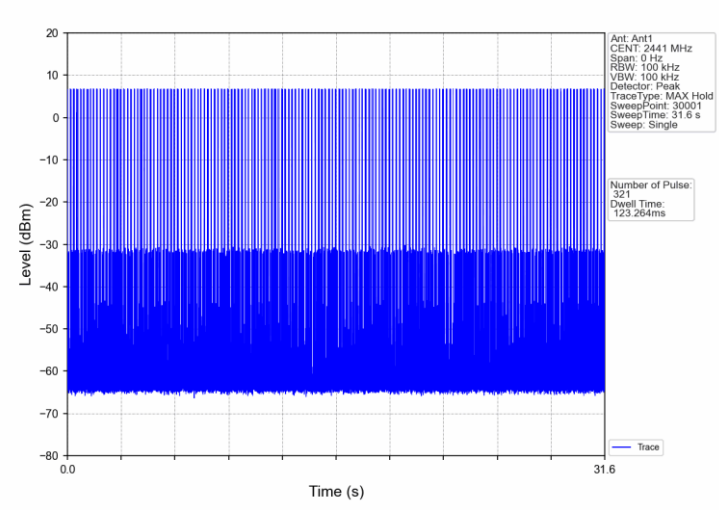
The maximum dwell time shall be 0.4 s.
The duration for dwell time calculation: 0.4 [s] * hopping number = 0.4 [s] * 79 [ch] = 31.6 [s]
The Dwell Time = Burst Width * Total Hops.

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	0.384	31.600	321	123.264	<=400	Pass
			DH3	1.640	31.600	169	277.160	<=400	Pass
			DH5	2.890	31.600	107	309.230	<=400	Pass
Pi/4DQPSK	SISO	HOPP	2DH1	0.398	31.600	318	126.564	<=400	Pass
			2DH3	1.646	31.600	144	237.024	<=400	Pass
			2DH5	2.894	31.600	106	306.764	<=400	Pass
8DPSK	SISO	HOPP	3DH1	0.392	31.600	317	124.264	<=400	Pass
			3DH3	1.644	31.600	152	249.888	<=400	Pass
			3DH5	2.896	31.600	94	272.224	<=400	Pass

GFSK_DH1_HOPP_Ant1_NTNV



GFSK_DH1_HOPP_Ant1_NTNV



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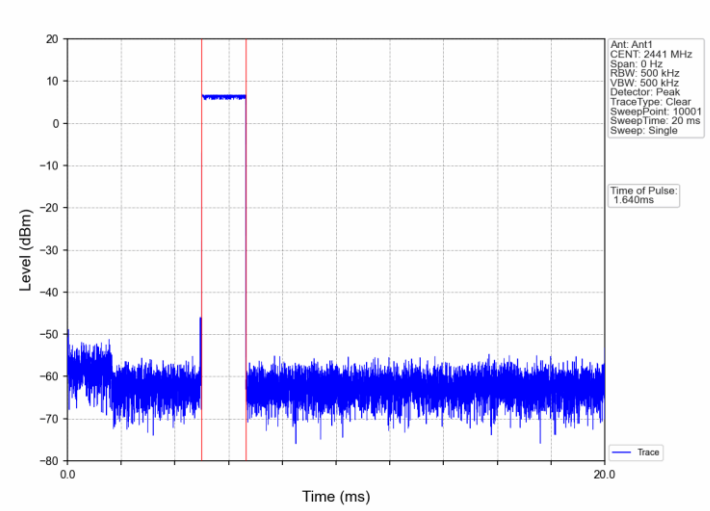
GFSK_DH3_HOPP_Ant1_NTNV

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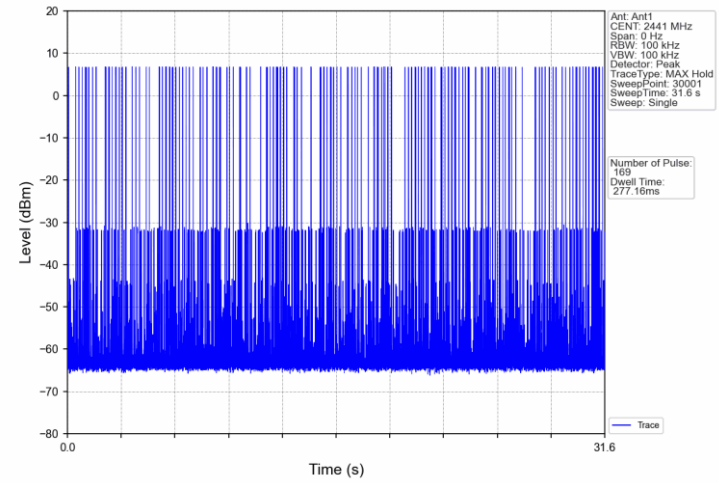
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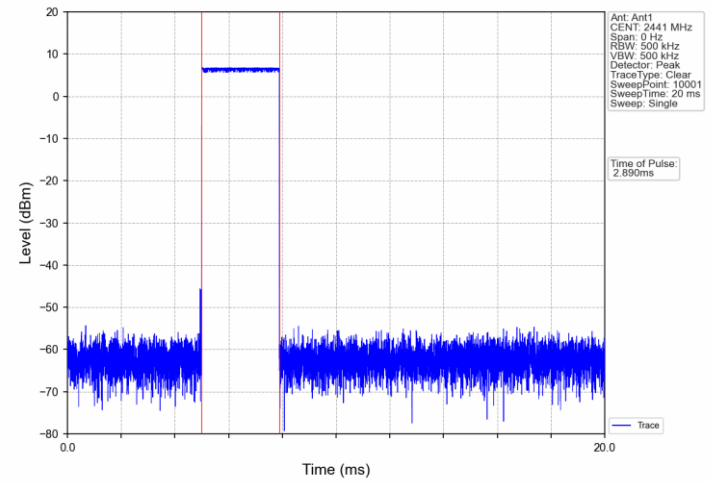

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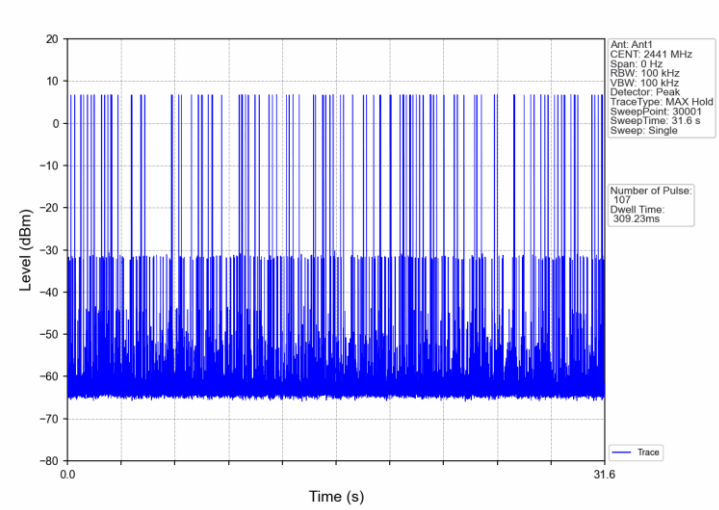
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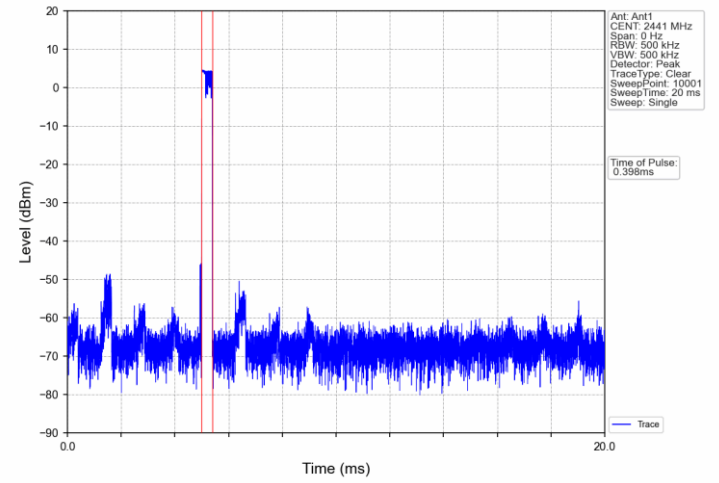
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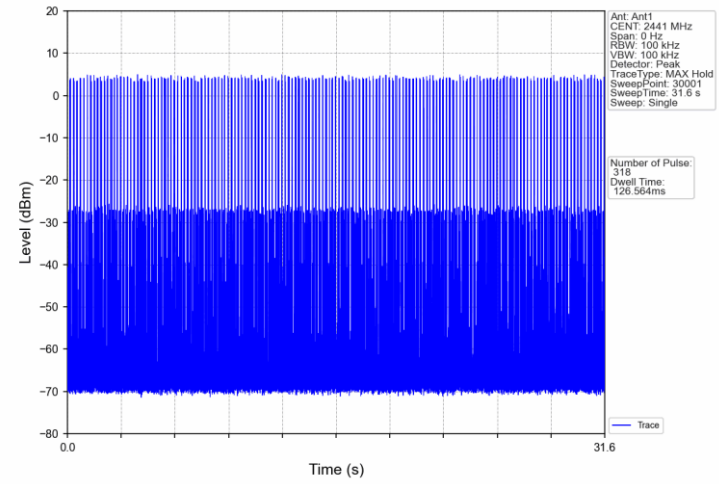

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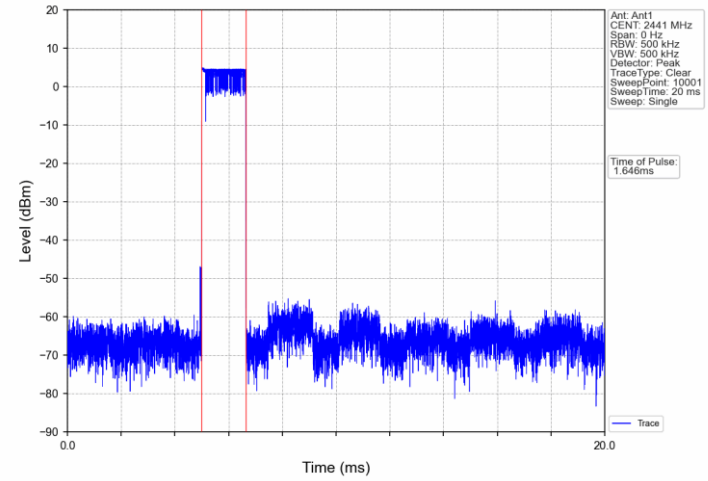
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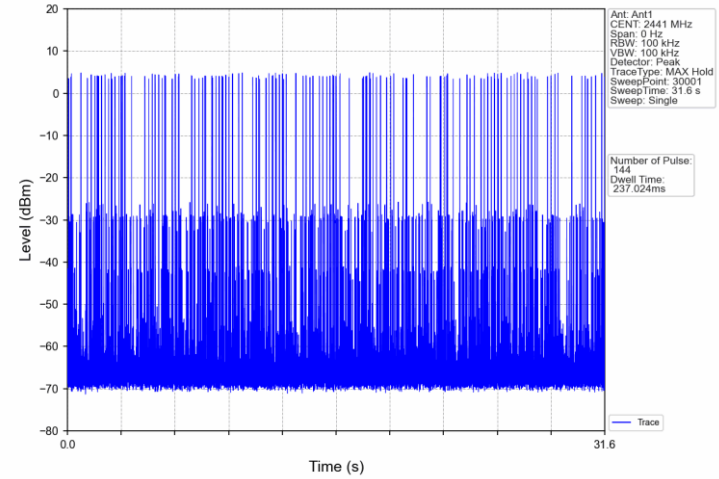
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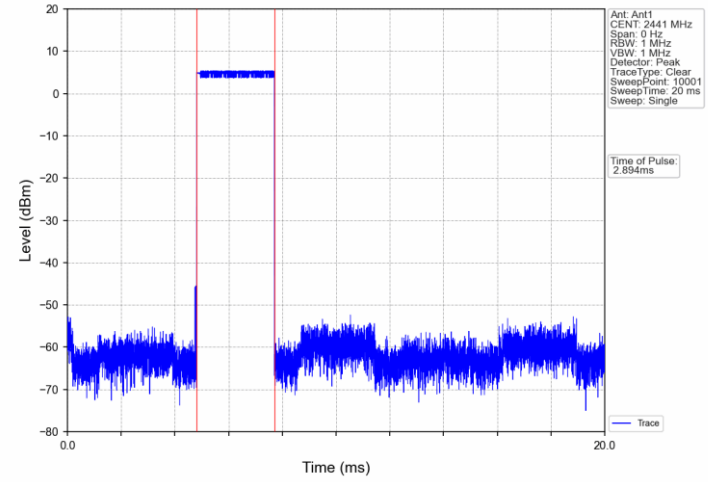

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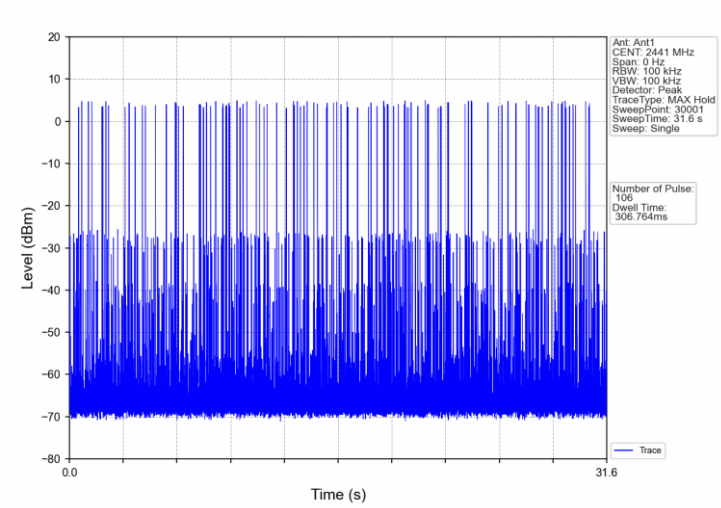
Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV

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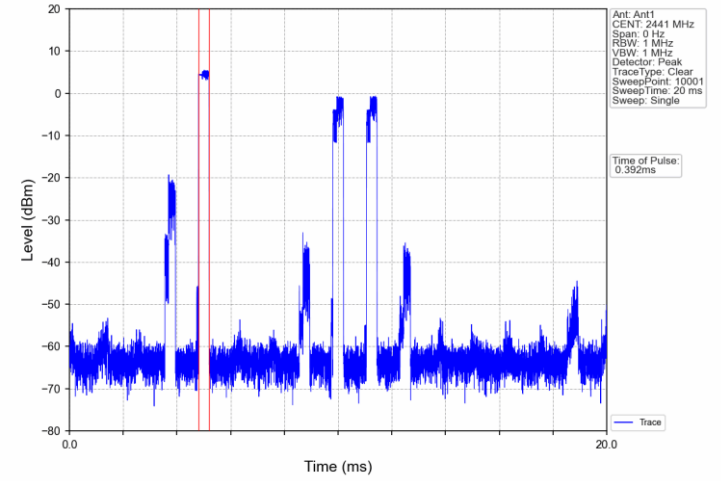
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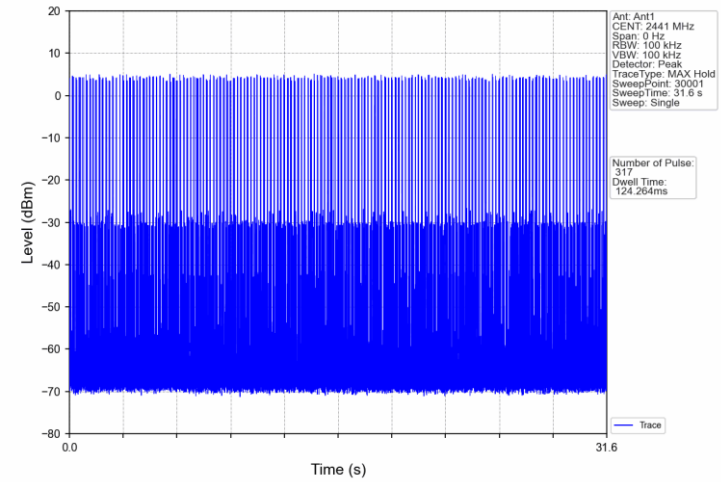

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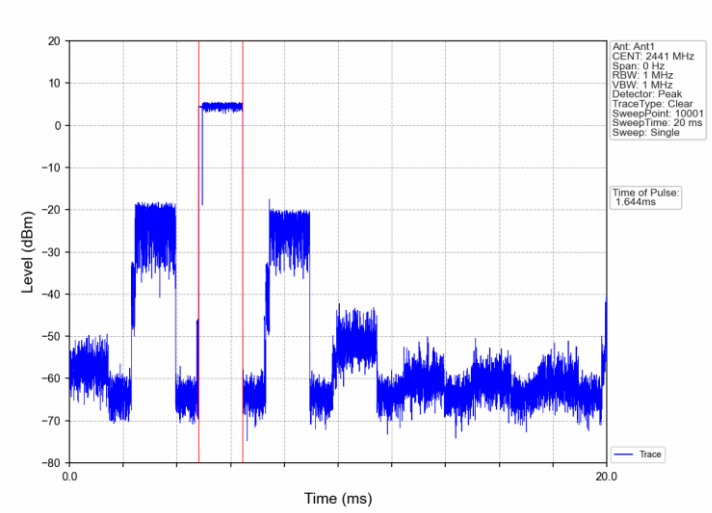
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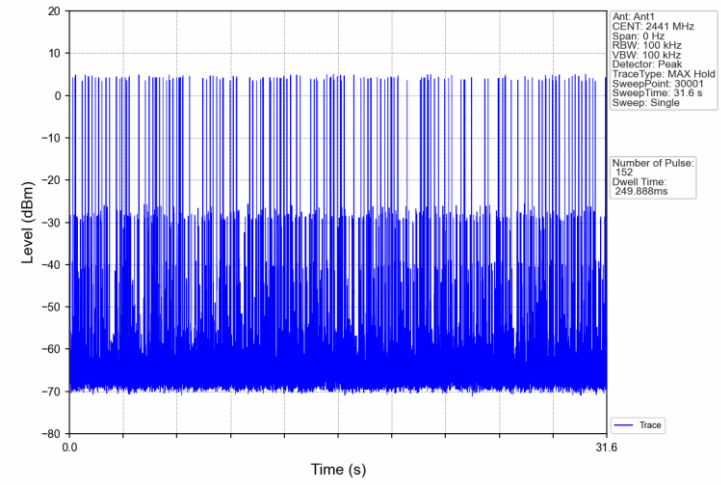
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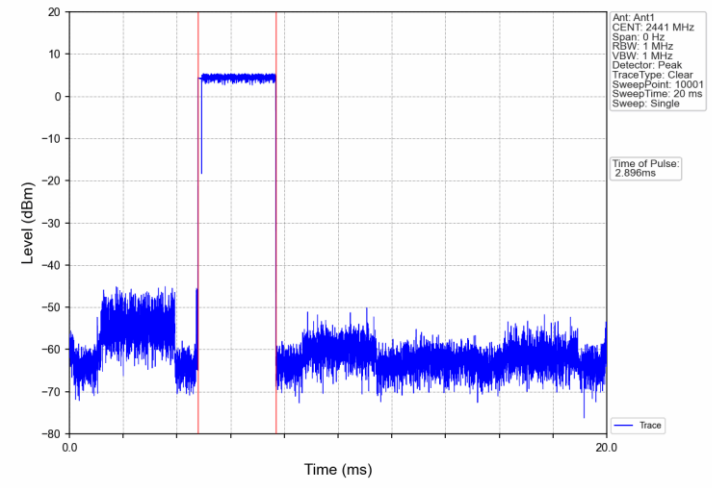

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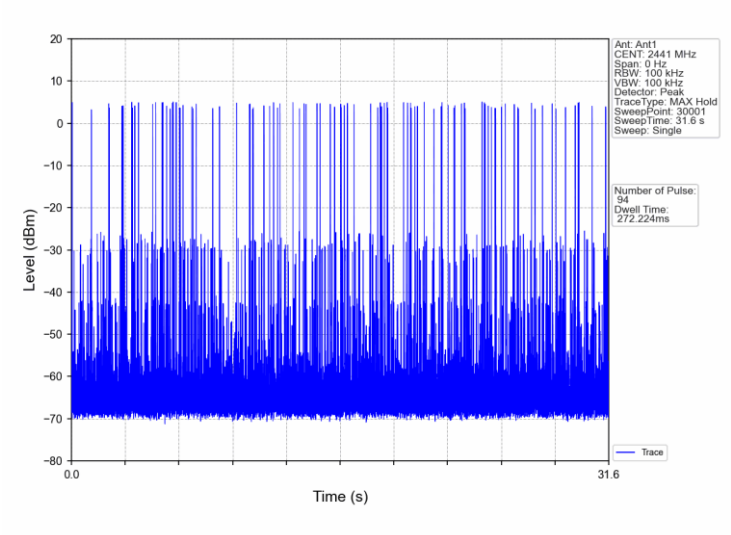

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