TEST REPORT

Application No.:	SZCR2411004137AT
Applicant:	SKULLCANDY,INC.
Address of Applicant:	6301 N Landmark Dr Park City, UT 84098, United States of America
Manufacturer:	SKULLCANDY,INC.
Address of Manufacturer:	6301 N Landmark Dr Park City, UT 84098, United States of America
Equipment Under Test (EUT):	
EUT Name:	MOD 180
Model No.:	S2MGW
Trade Mark:	Skullcandy
FCC ID:	Y22-S2MGW
Standard(s) :	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2024-11-06
Date of Test:	2024-11-12 to 2024-11-16
Date of Issue:	2024-11-28
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu
EMC Laboratory Manager

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Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		*2024-11-28*		*Original*

Authorized for issue by:				
		Charlie Dai **Charlie Dai/Project Engineer**		
		Eric Fu **Eric Fu/Reviewer**		

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2 Test Summary

Radio Spectrum Technical Requirement				
Item	**Standard**	**Method**	**Requirement**	**Result**
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass
Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence		N/A	47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)	Pass

Radio Spectrum Matter Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions Below 1GHz		ANSI C63.10 (2013) Section 6.4,6.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions Above 1GHz		ANSI C63.10 (2013) Section 6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Conducted Peak Output Power		ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(1)	Pass
20dB Bandwidth		ANSI C63.10 (2013) Section 7.8.7	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass
Carrier Frequencies Separation		ANSI C63.10 (2013) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
Hopping Channel Number		ANSI C63.10 (2013) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Dwell Time		ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Conducted Band Edges Measurement		ANSI C63.10 (2013) Section 7.8.6	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions		ANSI C63.10 (2013) Section 7.8.8	47 CFR Part 15, Subpart C 15.247(d)	Pass

Remark: The EUT comes in different colors.

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4 General Information

4.1 Details of E.U.T.

Power supply:	Left earbuds: Li-Ion Polymer Battery 3.7V 45mAh(Charge by travel case) Right earbuds: Li-Ion Polymer Battery 3.7V 45mAh(Charge by travel case) travel case with backup battery: Li-Ion Polymer Battery 3.7V 370mAh (Charged by Type-C port)
Cable(s):	USB-A to C cable 11cm unshielded
Bluetooth Version:	V5.3 Dual mode
Operation Frequency:	2402MHz to 2480MHz
Modulation Type:	GFSK, Pi/4DQPSK, 8DPSK
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Channel Spacing:	1MHz
Number of Channels:	79
Antenna Type:	FPC Antenna
Antenna Gain:	Left earbuds:1.46dBi, Right earbuds:1.61dBi
Cable Loss (for RF conducted test):	0.8dB

Remark:The information in this section is provided by the applicant or manufacturer, SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
--	--	--	--
The EUT has been tested as an independent unit.			

4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Radiated Emissions which fall in the restricted bands	± 6.0dB (Below 1GHz);± 4.6dB (Above 1GHz)
Radiated Spurious Emissions Below 1GHz	± 6.0dB for 3m; ± 5.0dB for 10m
Radiated Spurious Emissions Above 1GHz	± 4.6dB (1-18GHz);± 4.8dB (18-40GHz)
Conducted Peak Output Power	± 0.75dB
20dB Bandwidth	± 3%
Carrier Frequencies Separation	± 7.25 x 10-8
Hopping Channel Number	± 7.25 x 10-8
Dwell Time	± 0.37%
Conducted Band Edges Measurement	± 0.75dB

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Conducted Spurious Emissions	± 0.75dB
Remark: The U_{lab} (lab Uncertainty) is less than $U_{cispr/ETSI}$ (CISPR/ETSI Uncertainty), so the test results – compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit; – non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.	

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4.4 Test Location

All tests were performed at:

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No tests were sub-contracted.

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI (Member No. 1937)

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen EMC laboratory have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1336

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1336. Test Firm Registration Number: 787754.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

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5 Equipment List

Radiated Emissions which fall in the restricted bands					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
3m Fully-Anechoic Chamber	AUDIX	N/A	SEM001-02	2024-05-11	2027-05-10
Signal Analyzer	Rohde & Schwarz	FSV40	SEM008-04	2024-03-15	2025-03-14
Horn Antenna	Rohde&Schwarz	HF907	SEM003-07	2023-07-23	2025-07-22
Microwave system amplifier	Agilent	83017A	SEM005-25	2024-09-14	2025-09-13
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2024-07-06	2025-07-05
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	SEM003-15	2024-08-10	2025-08-09
Pre-Amplifier	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2024-03-15	2025-03-14

Radiated Spurious Emissions Below 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
10m Semi-Anechoic Chamber	SAEMC	FSAC1018	SEM001-03	2024-03-26	2025-03-25
MXE EMI receiver	KEYSIGHT	N9038A	SEM004-16	2024-08-14	2025-08-13
Trilog-Broadband Antenna	Schwarzbeck	VULB9168	SEM003-18	2023-09-23	2025-09-22
Pre-amplifier	Sonoma Instrument Co	310N	SEM005-04	2024-03-27	2025-03-26
Loop Antenna	ETS-Lindgren	6502	SEM003-08	2023-11-20	2025-11-19
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM029-01	2024-07-06	2025-07-05

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Radiated Spurious Emissions Above 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
3m Fully-Anechoic Chamber	AUDIX	N/A	SEM001-02	2024-05-11	2027-05-10
Signal Analyzer	Rohde & Schwarz	FSV40	SEM008-04	2024-03-15	2025-03-14
Horn Antenna	Rohde&Schwarz	HF907	SEM003-07	2023-07-23	2025-07-22
Microwave system amplifier	Agilent	83017A	SEM005-25	2024-09-14	2025-09-13
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM026-01	2024-07-06	2025-07-05
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	SEM003-15	2024-08-10	2025-08-09
Pre-Amplifier	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2024-03-15	2025-03-14

RF Conducted Test					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
Power Sensor	TST PASS	TSPS2023R	SEM009-26	2024-03-27	2025-03-26
Power Sensor	KEYSIGHT	U2021XA	SEM009-16	2024-03-14	2025-03-13
DC Power Supply	Chroma	62012P-80-60	SEM011-11	2024-08-14	2025-08-13
MXA Signal Analyzer	KEYSIGHT	N9020A	SEM004-19	2024-03-14	2025-03-13
Measurement Software	TST PASS	TST PASS V2.0	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-01	2024-07-06	2025-07-05
Attenuator	Huber+Suhner	6620_SMA-50-1	SEM021-09	2024-03-27	2025-03-26

General used equipment					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
Humidity/ Temperature Indicator	deli	8838	SEM002-32	2024-07-24	2025-07-23
Humidity/ Temperature Indicator	deli	8838	SEM002-33	2024-07-24	2025-07-23
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2024-03-18	2025-03-17

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SGS-CSTC Standards Technical Services Co.,Ltd. Shenzhen Branch Testing Center LLC Laboratory.
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6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

6.1.2 Conclusion

15.203 requirement:

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.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is Left earbuds:1.46dBi, Right earbuds:1.61dBi.

Antenna location: Refer to internal photos

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检验检测专用章
Inspection & Testing Services
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6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

6.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

6.2.2 Conclusion

Standard Requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom 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.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1):

According to Technical Specification, the pseudorandom 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; i.e. the shift register is initialized with nine ones.

> Number of shift register stages: 9

> Length of pseudo-random sequence: 29 -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 follow:

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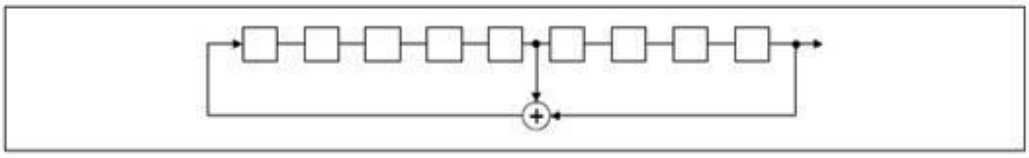
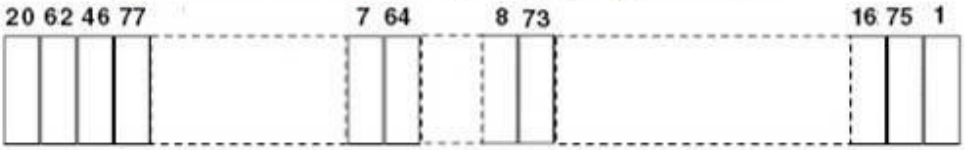


Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g):

According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h):

According to Technical specification, the system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

The system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

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7 Radio Spectrum Matter Test Results

7.1 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.10.5
Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.		

7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 23.7 °C Humidity: 61.0 % RH Atmospheric Pressure: 1020 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	04	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

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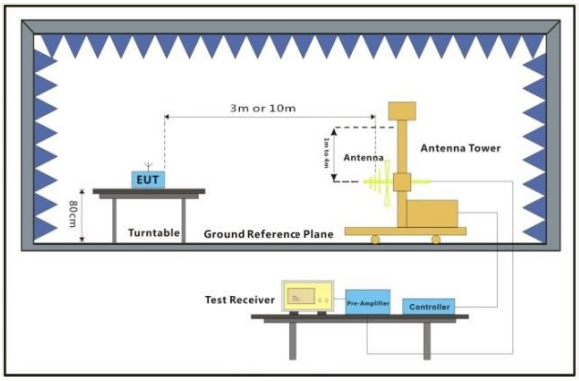
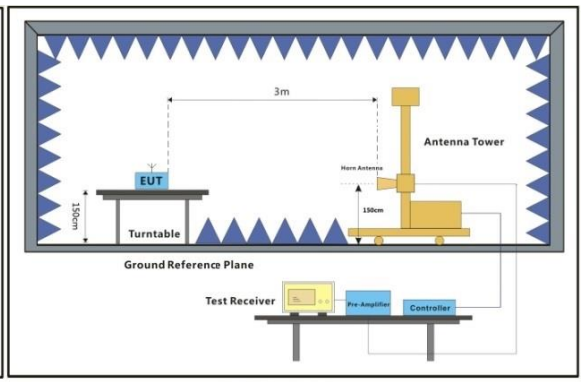
7.1.3 Test Setup Diagram



30MHz-1GHz



Above 1GHz

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7.1.4 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.

i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

j. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Remark 3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for Peak detection (PK) and Average detection (AV) at frequency above 1GHz.

Remark 4:For fundamental and harmonic signal measurement, the resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ⩾1/T (Duty cycle＜98%) or 10Hz (Duty cycle⩾98%) for Average detection (AV) at frequency above 1GHz.

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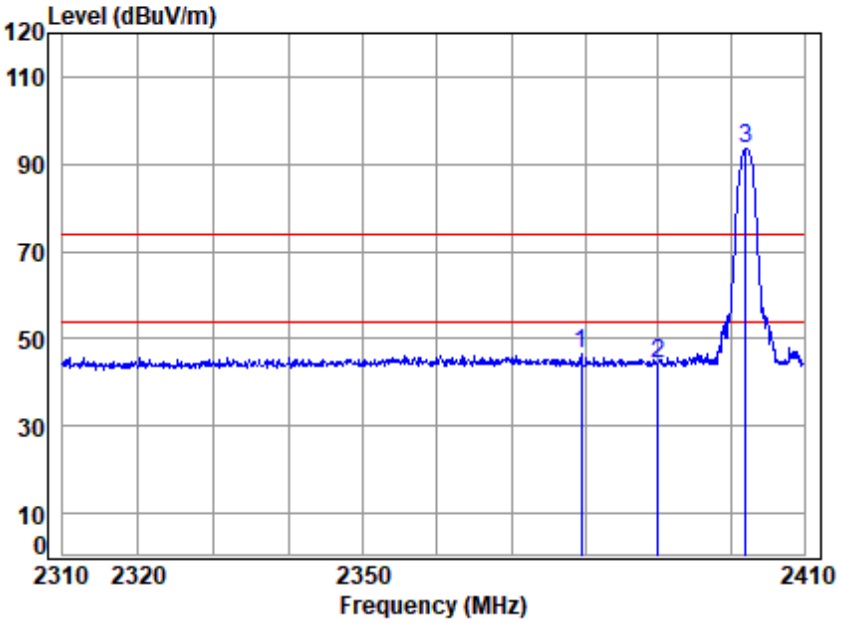
Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:Low



Site : chamber
Condition: 3m HORIZONTAL
Job No : 04137AT\04138AT
Mode : 2402 Band edge
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2379.453	15.80	29.10	32.79	34.27	46.38	74.00	-27.62	peak
2	2390.000	15.81	29.10	32.78	32.18	44.31	74.00	-29.69	peak
3 p	2402.000	15.82	29.09	32.77	81.23	93.37	74.00	19.37	peak

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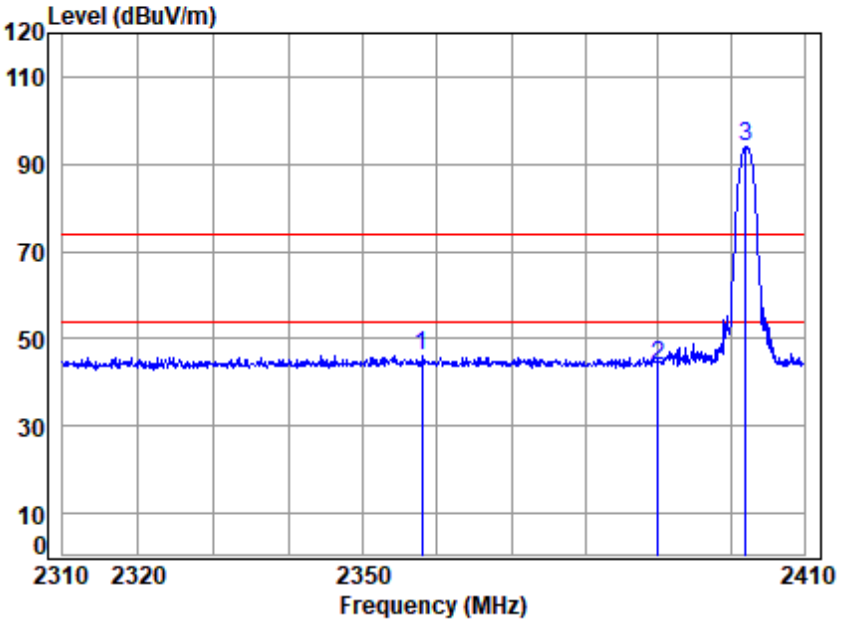
Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:Low



Site : chamber
Condition: 3m VERTICAL
Job No : 04137AT\04138AT
Mode : 2402 Band edge
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2357.871	15.79	29.10	32.80	34.19	46.28	74.00	-27.72	peak
2	2390.000	15.81	29.10	32.78	31.67	43.80	74.00	-30.20	peak
3 p	2402.000	15.82	29.09	32.77	81.67	93.81	74.00	19.81	peak

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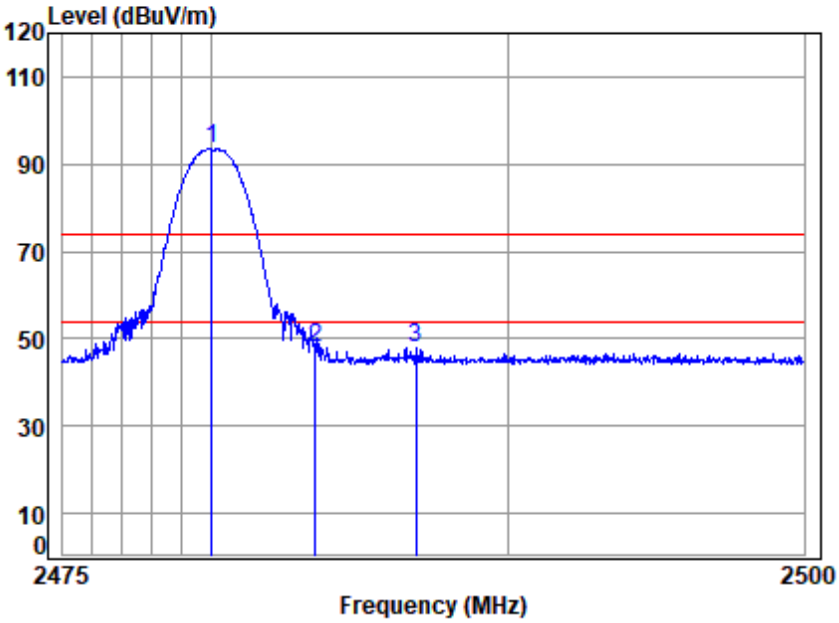
Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:High



Site : chamber
Condition: 3m HORIZONTAL
Job No : 04137AT\04138AT
Mode : 2480 Band edge
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 p	2480.000	15.86	28.90	32.73	81.31	93.34	74.00	19.34	peak
2	2483.500	15.86	28.90	32.73	35.82	47.85	74.00	-26.15	peak
3	2486.869	15.86	28.90	32.73	35.93	47.96	74.00	-26.04	peak

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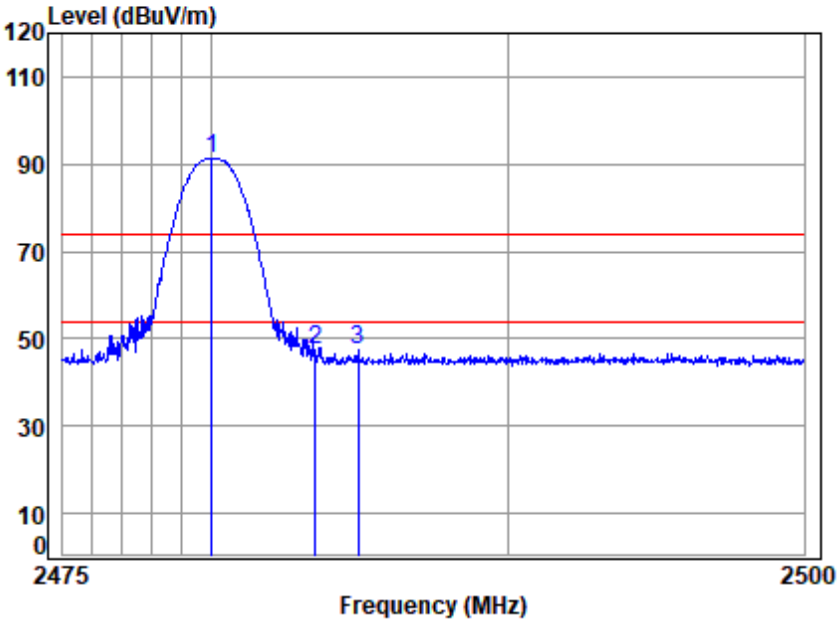
Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:High



Site : chamber
Condition: 3m VERTICAL
Job No : 04137AT\04138AT
Mode : 2480 Band edge
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 p	2480.000	15.86	28.90	32.73	79.17	91.20	74.00	17.20	peak
2	2483.500	15.86	28.90	32.73	35.30	47.33	74.00	-26.67	peak
3	2484.920	15.86	28.90	32.73	35.25	47.28	74.00	-26.72	peak

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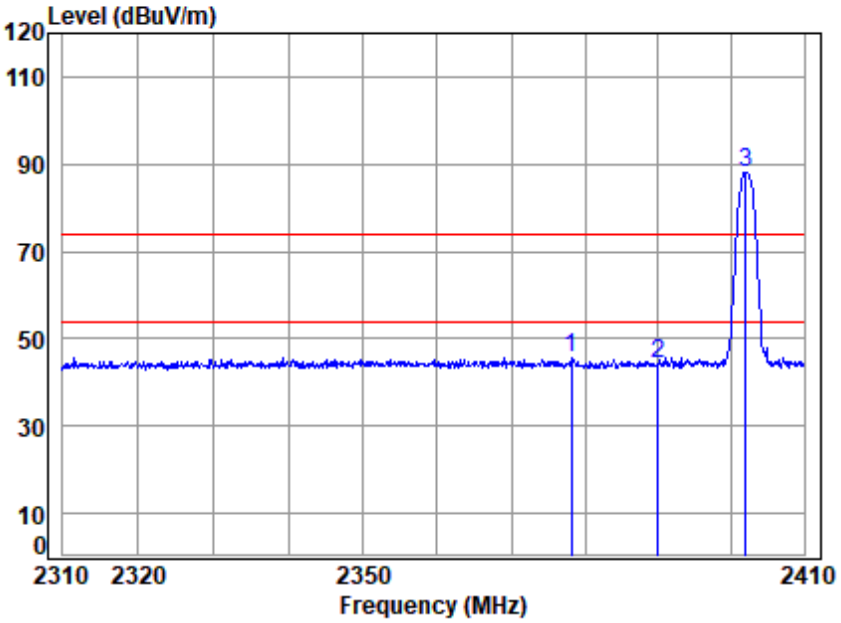
Test Mode: 04; Polarity: Horizontal; Modulation:GFSK; Channel:Low



Site : chamber
Condition: 3m HORIZONTAL
Job No : 04137AT\04138AT
Mode : 2402 Band edge
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2378.142	15.80	29.10	32.79	33.73	45.84	74.00	-28.16	peak
2	2390.000	15.81	29.10	32.78	32.33	44.46	74.00	-29.54	peak
3 p	2402.000	15.82	29.09	32.77	75.77	87.91	74.00	13.91	peak

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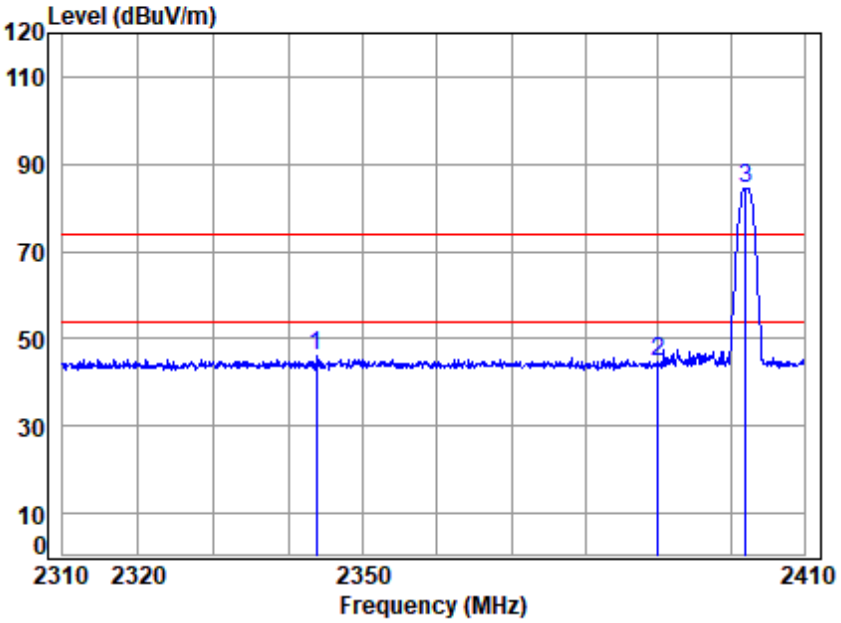
Test Mode: 04; Polarity: Vertical; Modulation:GFSK; Channel:Low



Site : chamber
Condition: 3m VERTICAL
Job No : 04137AT\04138AT
Mode : 2402 Band edge
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2343.724	15.78	29.01	32.80	34.18	46.17	74.00	-27.83	peak
2	2390.000	15.81	29.10	32.78	32.70	44.83	74.00	-29.17	peak
3 p	2402.000	15.82	29.09	32.77	72.49	84.63	74.00	10.63	peak

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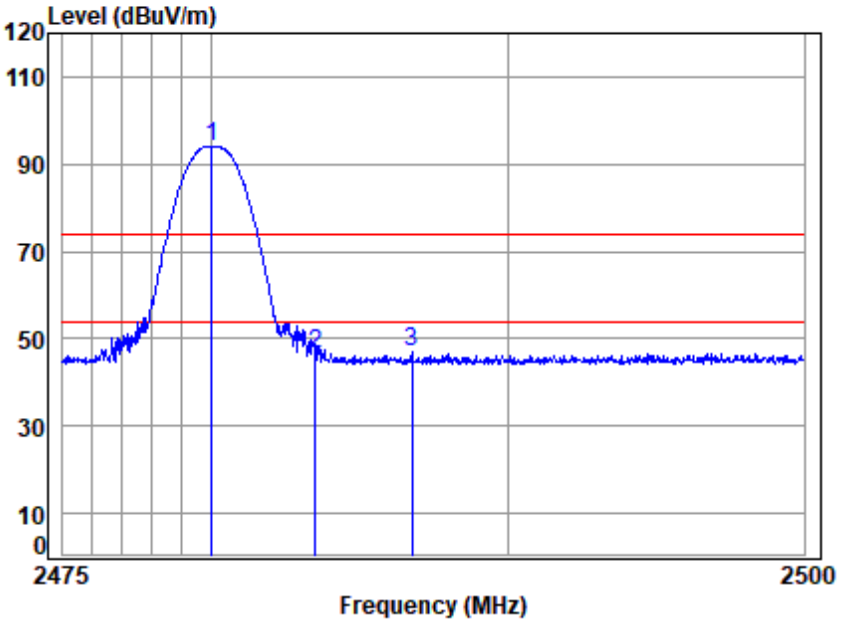
Test Mode: 04; Polarity: Horizontal; Modulation:GFSK; Channel:High



Site : chamber
Condition: 3m HORIZONTAL
Job No : 04137AT\04138AT
Mode : 2480 Band edge
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 p	2480.000	15.86	28.90	32.73	81.94	93.97	74.00	19.97	peak
2	2483.500	15.86	28.90	32.73	34.61	46.64	74.00	-27.36	peak
3	2486.744	15.86	28.90	32.73	34.76	46.79	74.00	-27.21	peak

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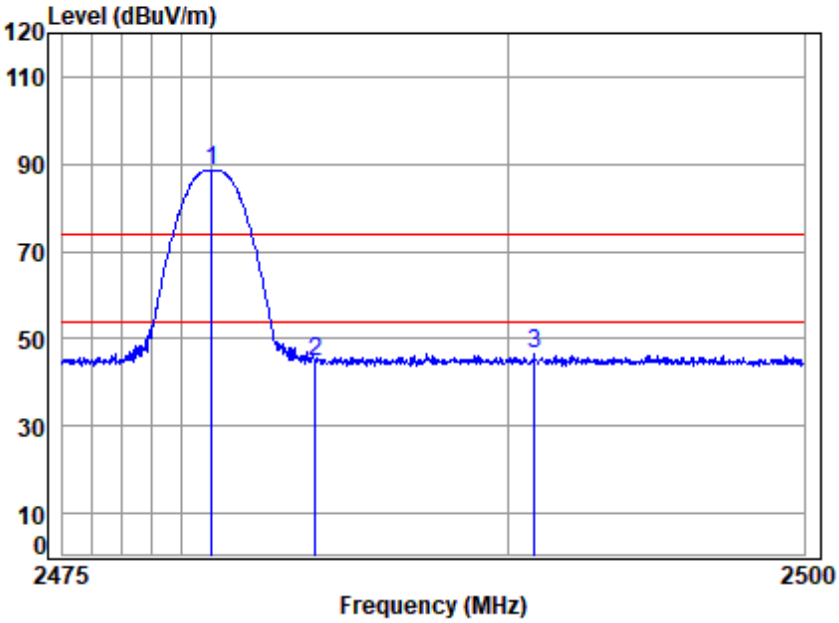
Test Mode: 04; Polarity: Vertical; Modulation:GFSK; Channel:High



Site : chamber
Condition: 3m VERTICAL
Job No : 04137AT\04138AT
Mode : 2480 Band edge
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 p	2480.000	15.86	28.90	32.73	76.49	88.52	74.00	14.52	peak
2	2483.500	15.86	28.90	32.73	32.65	44.68	74.00	-29.32	peak
3	2490.871	15.87	28.90	32.73	34.46	46.50	74.00	-27.50	peak

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7.2 Radiated Spurious Emissions Below 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4,6.5
Measurement Distance: 10m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
960-1000	500	3

7.2.1 E.U.T. Operation

Operating Environment:
Temperature: 23.6 °C Humidity: 50.9 % RH Atmospheric Pressure: 1020 mbar

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	04	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

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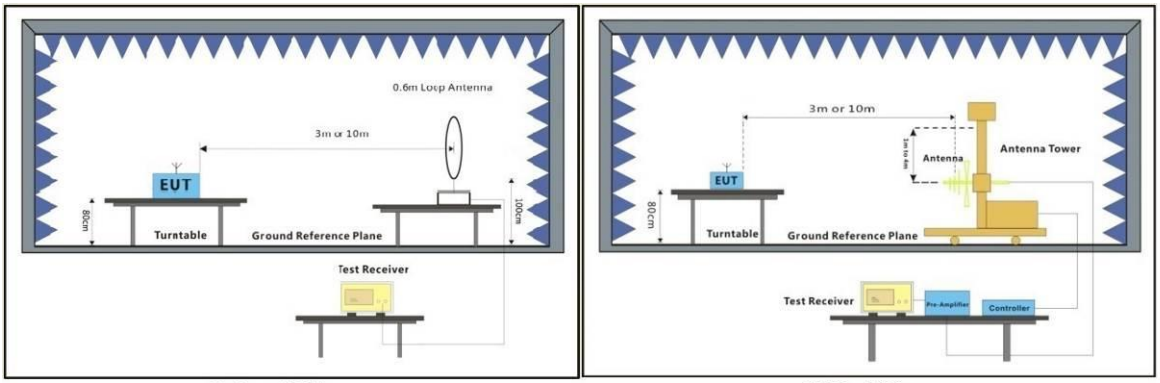
7.2.3 Test Setup Diagram



Below 30MHz 30MHz-1GHz

7.2.4 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using quasi-peak method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel, the middle channel, the Highest channel.

h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

i. Repeat above procedures until all frequencies measured was complete.

Remark:

1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

2. Scan from 9kHz to 30MHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

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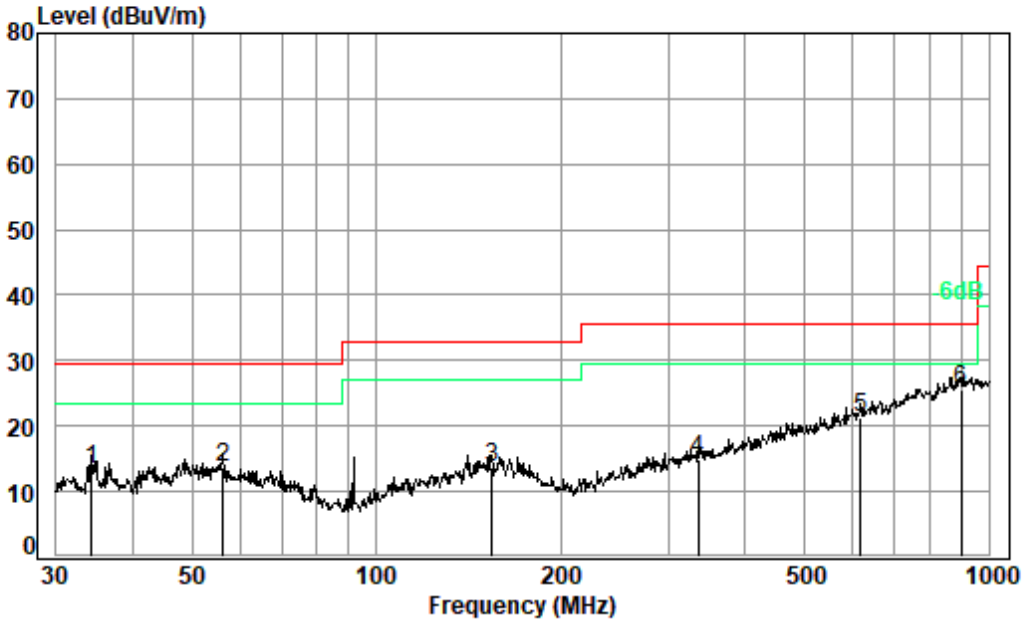
Test Mode: 01; Polarity: Horizontal



Condition: 10m HORIZONTAL
Job No. : 04137AT/04138AT
Test Mode: 01

	Freq	Read Level	Ant Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	34.276	29.07	16.39	0.40	32.50	13.36	29.50	-16.14	QP
2	56.197	28.00	17.78	0.50	32.48	13.80	29.50	-15.70	QP
3	154.279	27.13	17.92	0.90	32.40	13.55	33.00	-19.45	QP
4	334.859	27.46	18.50	1.30	32.30	14.96	35.60	-20.64	QP
5	618.537	27.36	24.50	1.80	32.38	21.28	35.60	-14.32	QP
6 pp	900.147	27.36	27.35	2.10	31.40	25.41	35.60	-10.19	QP

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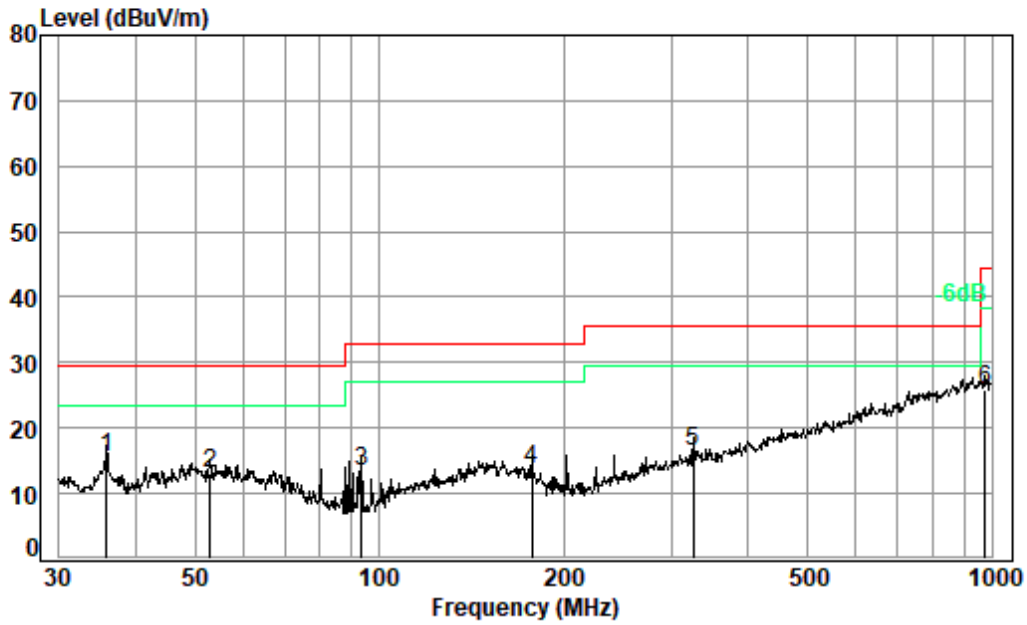
Test Mode: 01; Polarity: Vertical



Condition: 10m VERTICAL
Job No. : 04137AT/04138AT
Test Mode: 01

	Freq	Read Level	Ant Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1 pp	35.875	30.92	16.63	0.40	32.50	15.45	29.50	-14.05	QP
2	52.945	26.90	18.18	0.50	32.49	13.09	29.50	-16.41	QP
3	93.440	32.92	12.24	0.70	32.41	13.45	33.00	-19.55	QP
4	177.509	28.97	16.25	0.98	32.40	13.80	33.00	-19.20	QP
5	325.596	29.19	18.29	1.30	32.30	16.48	35.60	-19.12	QP
6	975.753	27.00	27.87	2.28	31.25	25.90	44.40	-18.50	QP

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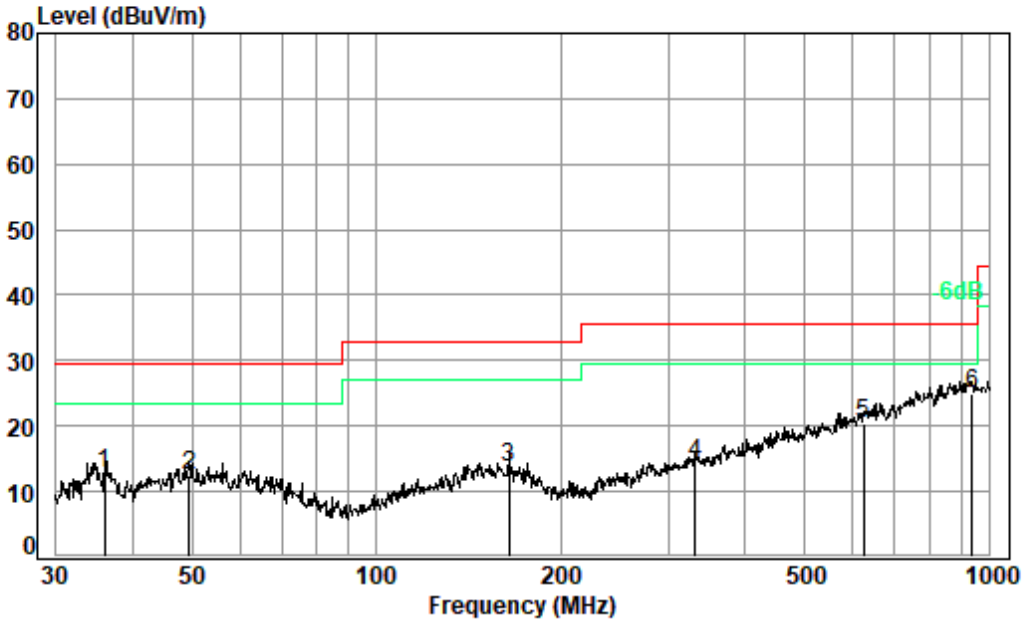
Test Mode: 04; Polarity: Horizontal



Condition: 10m HORIZONTAL
Job No. : 04137AT/04138AT
Test Mode: 04

	Freq	Read Level	Ant Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	36.001	28.16	16.64	0.40	32.50	12.70	29.50	-16.80	QP
2	49.533	26.39	18.15	0.50	32.50	12.54	29.50	-16.96	QP
3	164.908	27.79	17.52	0.91	32.40	13.82	33.00	-19.18	QP
4	331.355	26.79	18.43	1.30	32.30	14.22	35.60	-21.38	QP
5	625.078	26.32	24.59	1.80	32.37	20.34	35.60	-15.26	QP
6 pp	938.833	26.08	27.94	2.20	31.32	24.90	35.60	-10.70	QP

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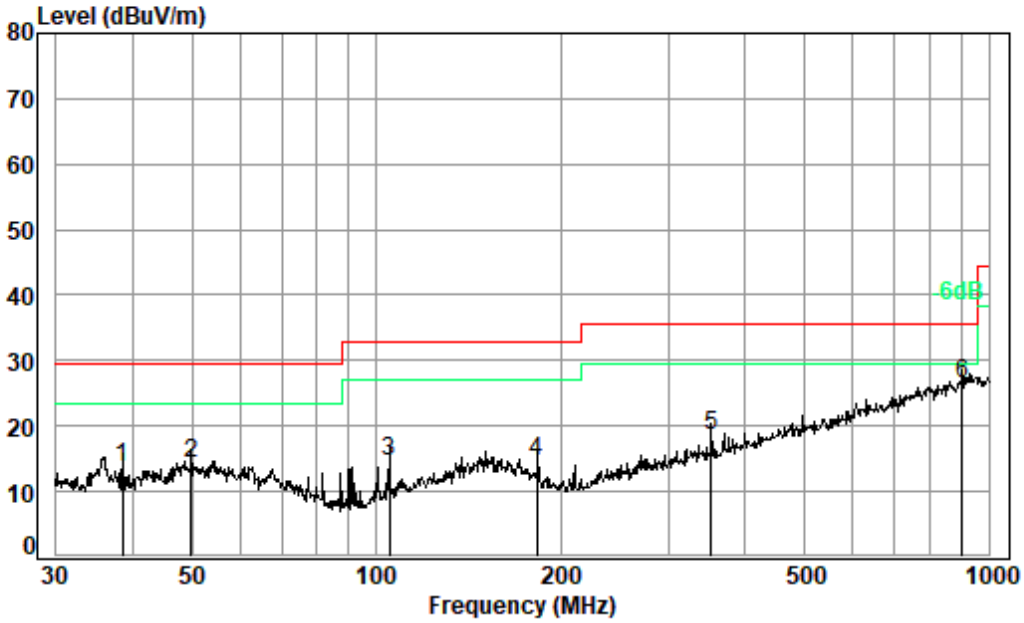
Test Mode: 04; Polarity: Vertical



Condition: 10m VERTICAL
Job No. : 04137AT/04138AT
Test Mode: 04

	Freq	Read Level	Ant Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	38.481	29.11	16.69	0.40	32.50	13.70	29.50	-15.80	QP
2	49.881	28.26	18.19	0.50	32.50	14.45	29.50	-15.05	QP
3	104.903	32.36	13.89	0.78	32.40	14.63	33.00	-18.37	QP
4	183.201	30.40	15.55	1.00	32.40	14.55	33.00	-18.45	QP
5	351.708	30.83	18.54	1.40	32.30	18.47	35.60	-17.13	QP
6 pp	903.309	28.38	27.41	2.10	31.39	26.50	35.60	-9.10	QP

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The test was performed at a 10m test site. According to below formulate and the test data at 10m test distance,

$L_3 / L_{10} = D_{10} / D_3$

Note:

L_3: Level @ 3m distance. Unit: uV/m;

L_{10}: Level @ 10m distance. Unit: uV/m;

D_3: 3m distance. Unit: m

D_{10}: 10m distance. Unit: m

The level at 3m test distance is below:

Test Mode: 01

Frequency (MHz)	Level @ 10m (dBuV/m)	Level @ 10m (uV/m)	Level @ 3m (uV/m)	Level @ 3m (dBuV/m)	Limit @ 3m (dBuV/m)	Margin (dB)	Ant. Polarization
34.276	13.36	4.66	15.52	23.82	40.00	-16.18	H
56.197	13.80	4.90	16.33	24.26	40.00	-15.74	H
154.279	13.55	4.76	15.86	24.01	43.50	-19.49	H
334.859	14.96	5.60	18.66	25.42	46.00	-20.58	H
618.537	21.28	11.59	38.63	31.74	46.00	-14.26	H
900.147	25.41	18.64	62.14	35.87	46.00	-10.13	H
35.875	15.45	5.92	19.74	25.91	40.00	-14.09	V
52.945	13.09	4.51	15.04	23.55	40.00	-16.45	V
93.44	13.45	4.70	15.68	23.91	43.50	-19.59	V
177.509	13.80	4.90	16.33	24.26	43.50	-19.24	V
325.596	16.48	6.67	22.23	26.94	46.00	-19.06	V
975.753	25.90	19.72	65.75	36.36	54.00	-17.64	V

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Test Mode: 04

Frequency (MHz)	Level @ 10m (dBuV/m)	Level @ 10m (uV/m)	Level @ 3m (uV/m)	Level @ 3m (dBuV/m)	Limit @ 3m (dBuV/m)	Margin (dB)	Ant. Polarization
36.001	12.70	4.32	14.38	23.16	40.00	-16.84	H
49.533	12.54	4.24	14.12	23.00	40.00	-17.00	H
164.908	13.82	4.91	16.36	24.28	43.50	-19.22	H
331.355	14.22	5.14	17.13	24.68	46.00	-21.32	H
625.078	20.34	10.40	34.66	30.80	46.00	-15.20	H
938.833	24.90	17.58	58.60	35.36	46.00	-10.64	H
38.481	13.70	4.84	16.14	24.16	40.00	-15.84	V
49.881	14.45	5.28	17.59	24.91	40.00	-15.09	V
104.903	14.63	5.39	17.96	25.09	43.50	-18.41	V
183.201	14.55	5.34	17.80	25.01	43.50	-18.49	V
351.708	18.47	8.38	27.95	28.93	46.00	-17.07	V
903.309	26.50	21.13	70.45	36.96	46.00	-9.04	V

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7.3 Radiated Spurious Emissions Above 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.6
Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
Above 1000	500	3

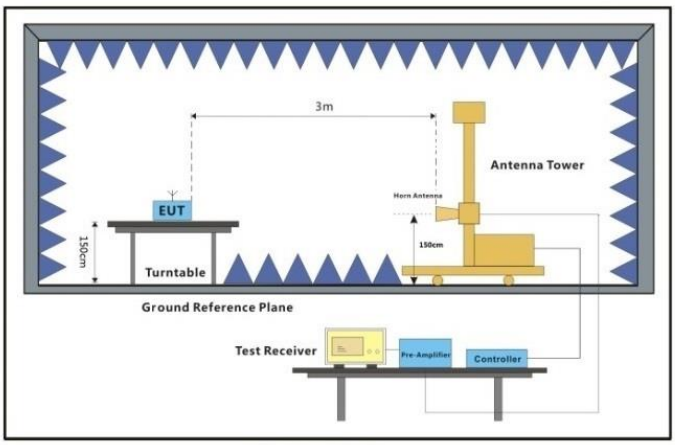
7.3.1 E.U.T. Operation

Operating Environment:
Temperature: 23.7 °C Humidity: 61.0 % RH Atmospheric Pressure: 1020 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	04	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.3.3 Test Setup Diagram



Above 1GHz

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7.3.4 Measurement Procedure and Data

a. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak or average method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel, the middle channel, the Highest channel.

h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.

i. Repeat above procedures until all frequencies measured was complete.

Remark:

1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

2. Scan from 1GHz to 25GHz, the disturbance above 18GHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

3. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for Peak detection (PK) and Average detection (AV) at frequency above 1GHz.

5:For fundamental and harmonic signal measurement, the resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ⩾1/T (Duty cycle＜98%) or 10Hz (Duty cycle⩾98%) for Average detection (AV) at frequency above 1GHz.

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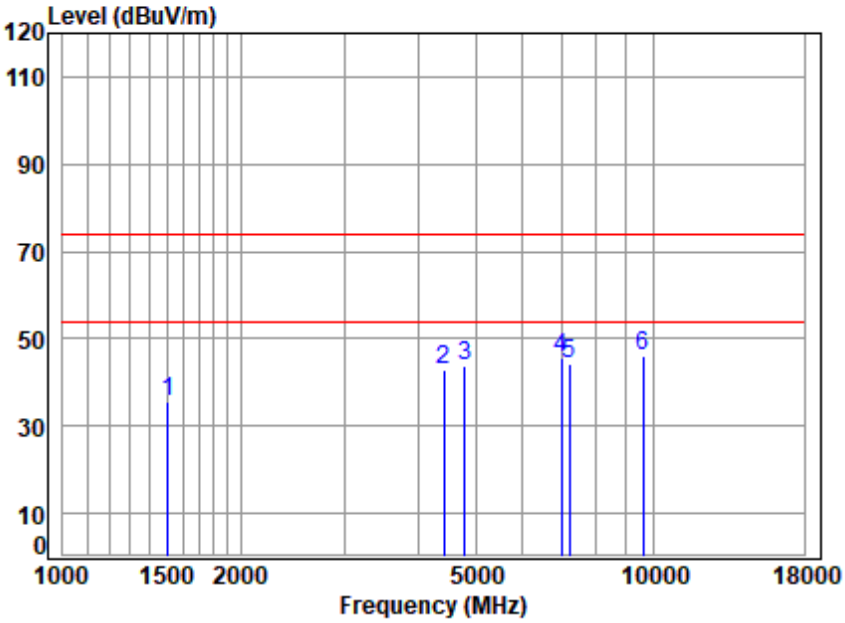
Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:Low



Site : chamber
Condition: 3m HORIZONTAL
Job No : 04137AT\04138AT
Mode : 2402 TX RSE
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1507.470	4.59	26.83	61.49	65.52	35.45	74.00	-38.55	peak
2	4417.841	7.97	34.59	61.19	61.70	43.07	74.00	-30.93	peak
3	4804.000	8.00	34.32	61.03	62.69	43.98	74.00	-30.02	peak
4	6974.982	9.51	35.75	60.43	60.88	45.71	74.00	-28.29	peak
5	7206.000	9.32	35.70	60.39	59.79	44.42	74.00	-29.58	peak
6 p	9608.000	11.41	37.42	61.25	58.52	46.10	74.00	-27.90	peak

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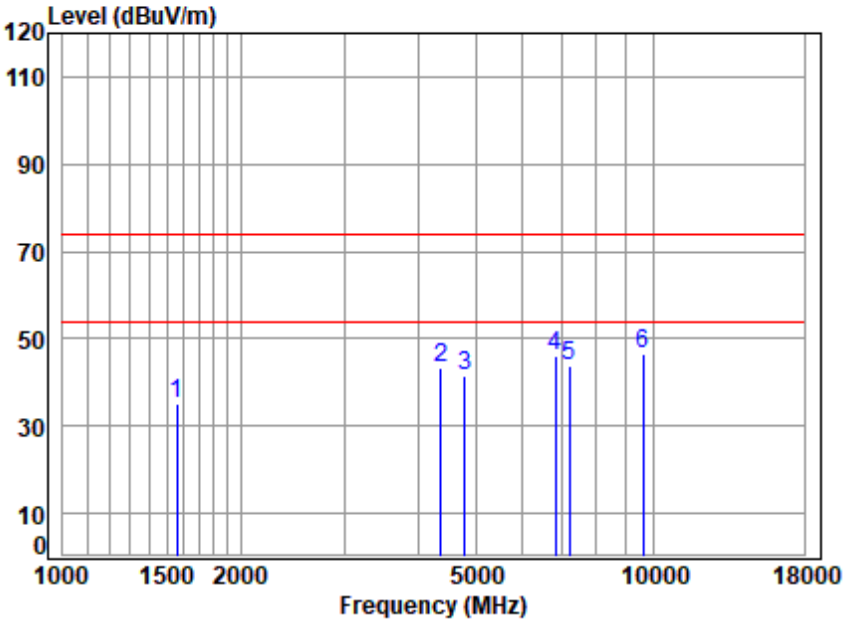
Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:Low



Site : chamber
Condition: 3m VERTICAL
Job No : 04137AT\04138AT
Mode : 2402 TX RSE
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1560.673	4.70	26.96	61.51	65.08	35.23	74.00	-38.77	peak
2	4367.058	8.04	34.54	61.21	62.01	43.38	74.00	-30.62	peak
3	4804.000	8.00	34.32	61.03	60.40	41.69	74.00	-32.31	peak
4	6815.551	9.39	35.36	60.46	61.68	45.97	74.00	-28.03	peak
5	7206.000	9.32	35.70	60.39	59.30	43.93	74.00	-30.07	peak
6 p	9608.000	11.41	37.42	61.25	58.91	46.49	74.00	-27.51	peak

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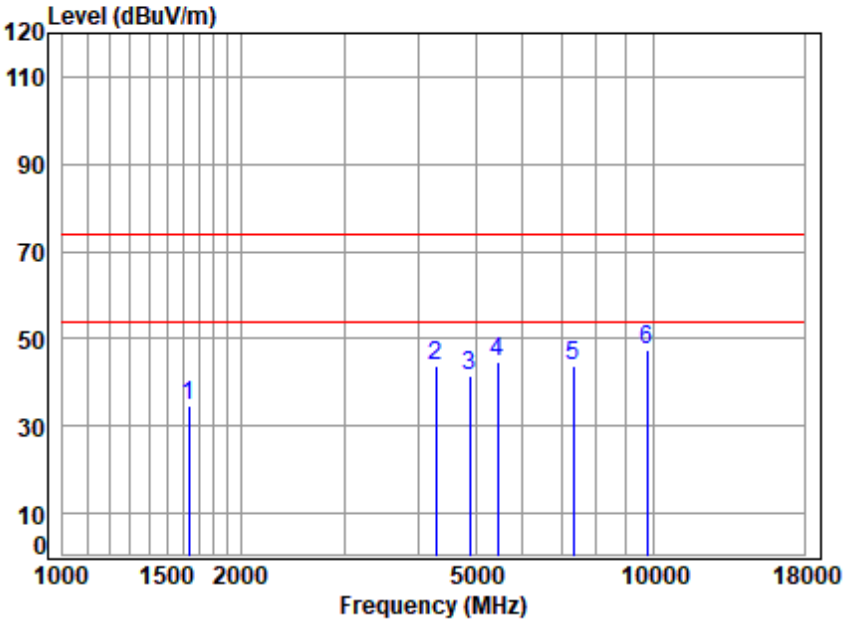
Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:middle



Site : chamber
Condition: 3m HORIZONTAL
Job No : 04137AT\04138AT
Mode : 2441 TX RSE
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1634.543	4.86	26.45	61.53	64.81	34.59	74.00	-39.41	peak
2	4291.977	8.14	33.97	61.25	63.14	44.00	74.00	-30.00	peak
3	4882.000	8.03	34.63	61.00	59.90	41.56	74.00	-32.44	peak
4	5439.885	9.16	34.68	60.80	61.54	44.58	74.00	-29.42	peak
5	7323.000	9.20	35.70	60.37	59.48	44.01	74.00	-29.99	peak
6 p	9764.000	11.32	37.37	61.33	60.23	47.59	74.00	-26.41	peak

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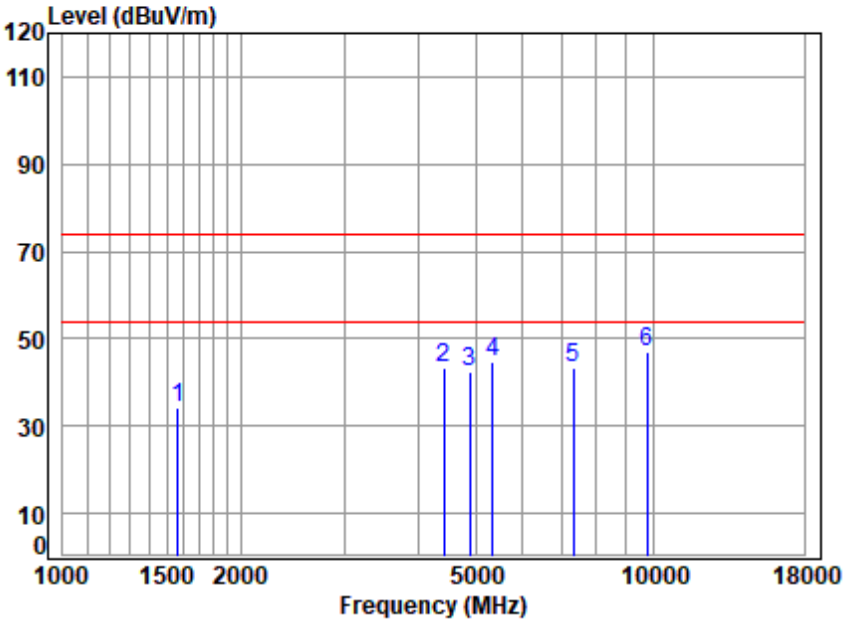
Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:middle



Site : chamber
Condition: 3m VERTICAL
Job No : 04137AT\04138AT
Mode : 2441 TX RSE
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1569.721	4.72	26.92	61.51	64.02	34.15	74.00	-39.85	peak
2	4417.841	7.97	34.59	61.19	61.89	43.26	74.00	-30.74	peak
3	4882.000	8.03	34.63	61.00	60.85	42.51	74.00	-31.49	peak
4	5346.358	8.94	34.39	60.83	62.26	44.76	74.00	-29.24	peak
5	7323.000	9.20	35.70	60.37	58.87	43.40	74.00	-30.60	peak
6 p	9764.000	11.32	37.37	61.33	59.47	46.83	74.00	-27.17	peak

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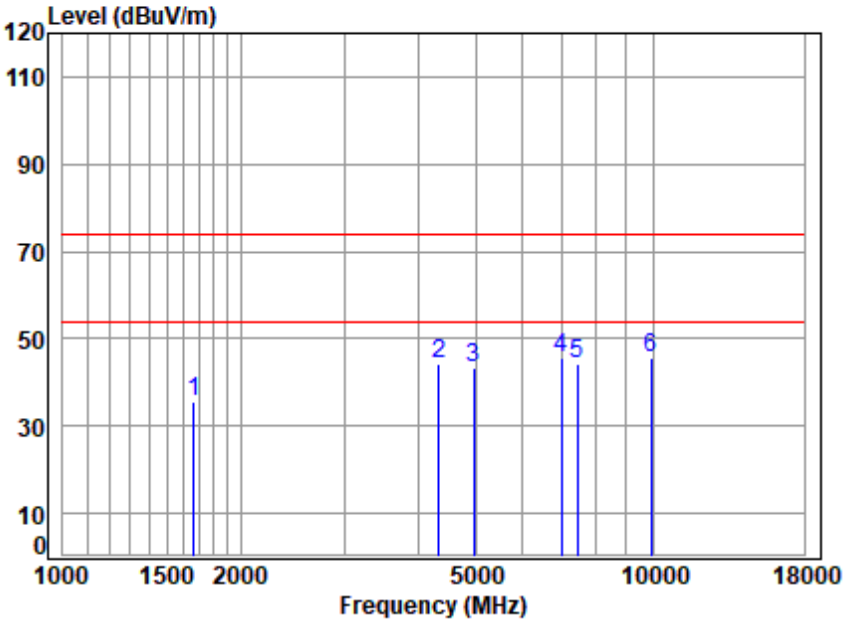
Test Mode: 01; Polarity: Horizontal; Modulation:GFSK; Channel:High



Site : chamber
Condition: 3m HORIZONTAL
Job No : 04137AT\04138AT
Mode : 2480 TX RSE
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1667.951	4.93	26.26	61.54	65.90	35.55	74.00	-38.45	peak
2	4329.354	8.09	34.23	61.23	63.15	44.24	74.00	-29.76	peak
3	4960.000	8.06	34.56	60.97	61.69	43.34	74.00	-30.66	peak
4	6995.172	9.53	35.71	60.43	60.80	45.61	74.00	-28.39	peak
5	7440.000	9.09	35.96	60.36	59.74	44.43	74.00	-29.57	peak
6 p	9920.000	11.23	37.30	61.42	58.71	45.82	74.00	-28.18	peak

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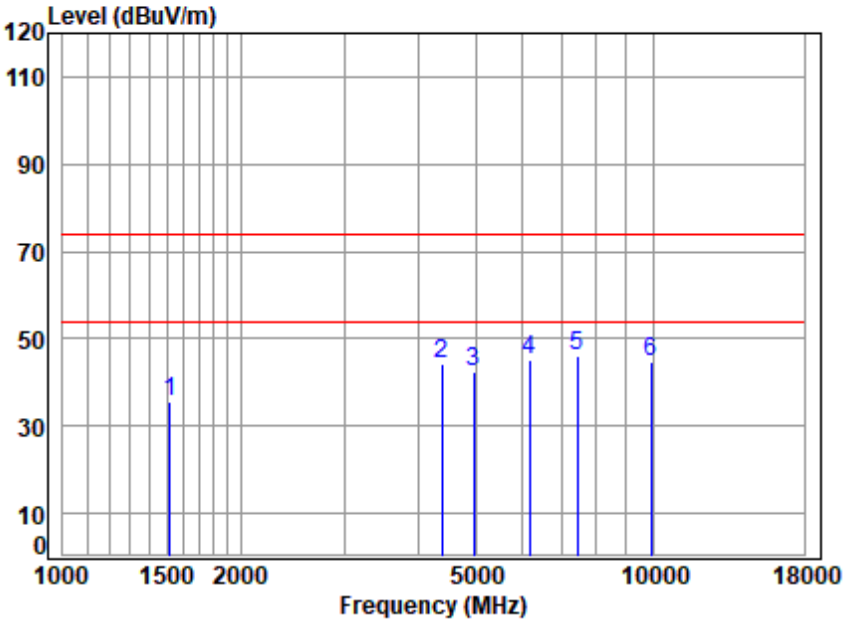
Test Mode: 01; Polarity: Vertical; Modulation:GFSK; Channel:High



Site : chamber
Condition: 3m VERTICAL
Job No : 04137AT\04138AT
Mode : 2480 TX RSE
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1520.598	4.62	26.88	61.49	65.40	35.41	74.00	-38.59	peak
2	4379.699	8.02	34.64	61.21	62.83	44.28	74.00	-29.72	peak
3	4960.000	8.06	34.56	60.97	60.91	42.56	74.00	-31.44	peak
4	6159.797	9.40	34.86	60.58	61.30	44.98	74.00	-29.02	peak
5 p	7440.000	9.09	35.96	60.36	61.36	46.05	74.00	-27.95	peak
6	9920.000	11.23	37.30	61.42	57.67	44.78	74.00	-29.22	peak

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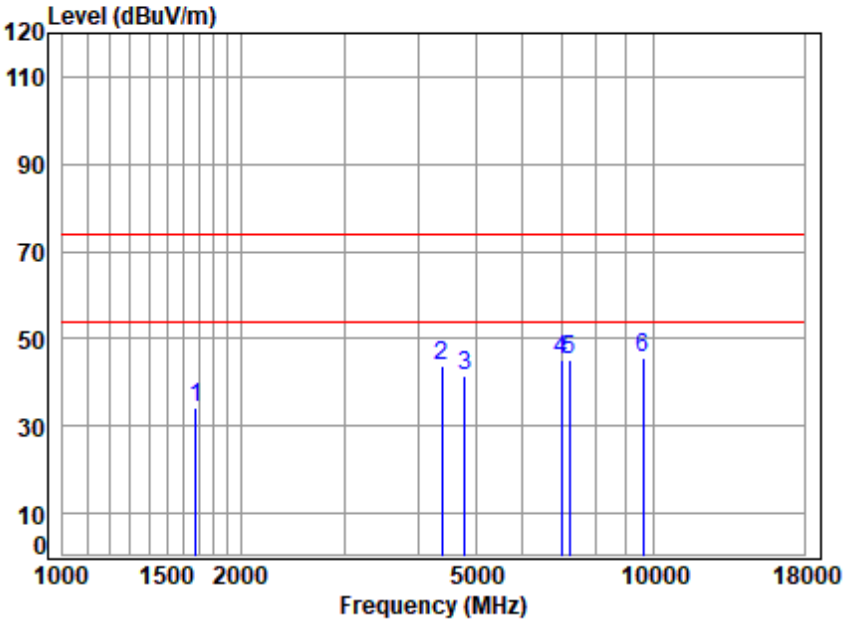
Test Mode: 04; Polarity: Horizontal; Modulation:GFSK; Channel:Low



Site : chamber
Condition: 3m HORIZONTAL
Job No : 04137AT\04138AT
Mode : 2402 TX RSE
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1677.621	4.95	26.24	61.54	64.44	34.09	74.00	-39.91	peak
2	4379.699	8.02	34.64	61.21	62.33	43.78	74.00	-30.22	peak
3	4804.000	8.00	34.32	61.03	60.05	41.34	74.00	-32.66	peak
4	6995.172	9.53	35.71	60.43	60.17	44.98	74.00	-29.02	peak
5	7206.000	9.32	35.70	60.39	60.40	45.03	74.00	-28.97	peak
6 p	9608.000	11.41	37.42	61.25	57.98	45.56	74.00	-28.44	peak

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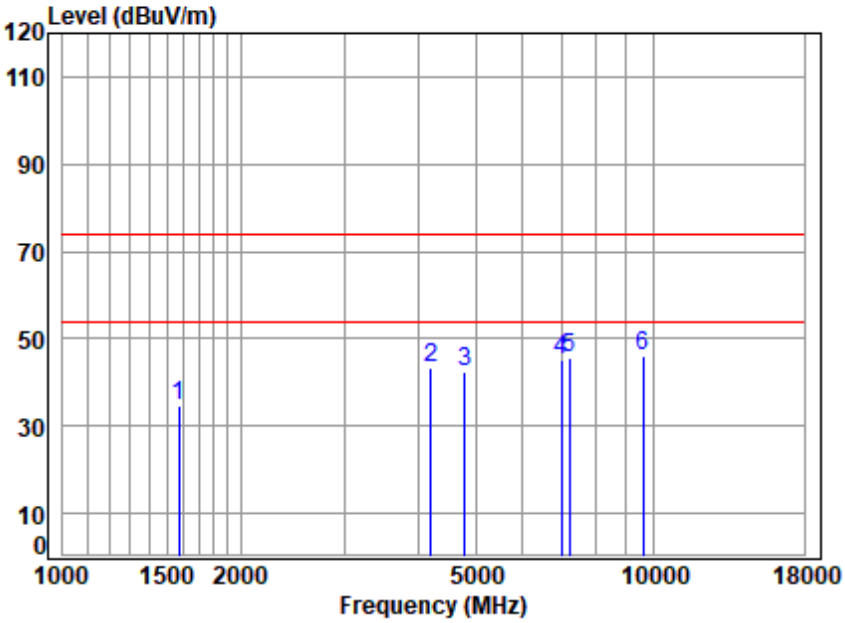
Test Mode: 04; Polarity: Vertical; Modulation:GFSK; Channel:Low



Site : chamber
Condition: 3m VERTICAL
Job No : 04137AT\04138AT
Mode : 2402 TX RSE
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1574.265	4.73	26.90	61.51	64.55	34.67	74.00	-39.33	peak
2	4193.872	8.28	33.80	61.29	62.47	43.26	74.00	-30.74	peak
3	4804.000	8.00	34.32	61.03	61.00	42.29	74.00	-31.71	peak
4	6995.172	9.53	35.71	60.43	60.16	44.97	74.00	-29.03	peak
5	7206.000	9.32	35.70	60.39	61.18	45.81	74.00	-28.19	peak
6 p	9608.000	11.41	37.42	61.25	58.46	46.04	74.00	-27.96	peak

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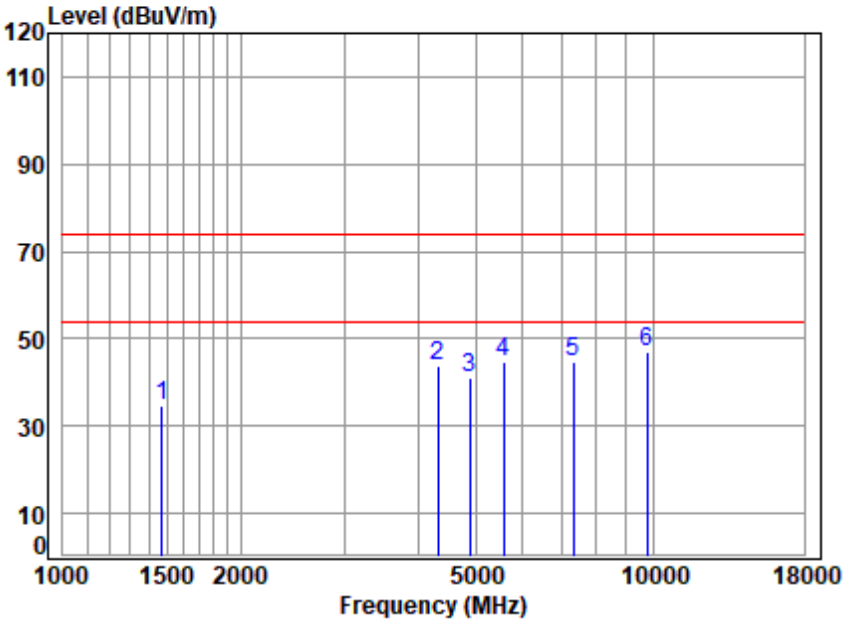
Test Mode: 04; Polarity: Horizontal; Modulation:GFSK; Channel:middle



Site : chamber
Condition: 3m HORIZONTAL
Job No : 04137AT\04138AT
Mode : 2441 TX RSE
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1473.013	4.57	26.04	61.48	65.55	34.68	74.00	-39.32	peak
2	4316.859	8.11	34.13	61.24	62.88	43.88	74.00	-30.12	peak
3	4882.000	8.03	34.63	61.00	59.54	41.20	74.00	-32.80	peak
4	5583.251	9.34	34.70	60.75	61.37	44.66	74.00	-29.34	peak
5	7323.000	9.20	35.70	60.37	60.25	44.78	74.00	-29.22	peak
6 p	9764.000	11.32	37.37	61.33	59.81	47.17	74.00	-26.83	peak

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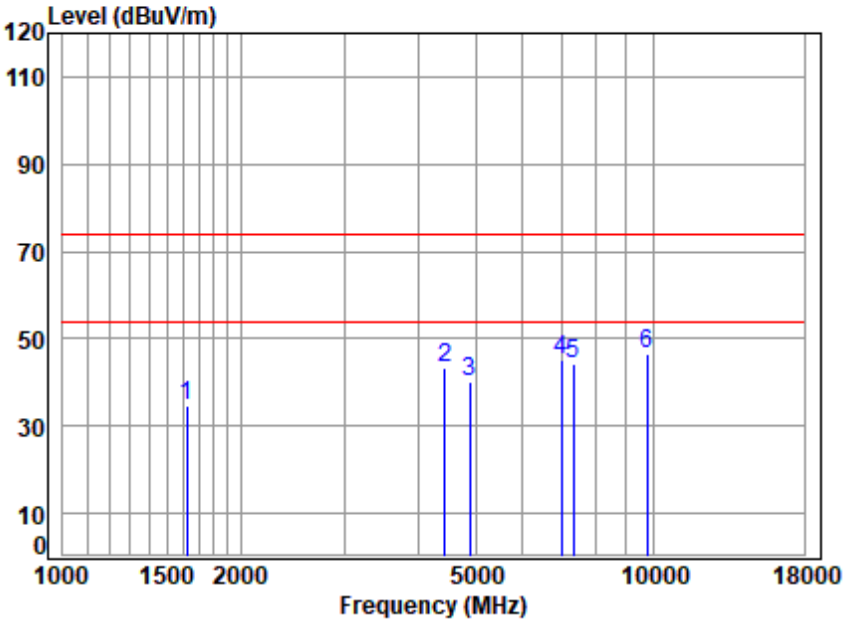
Test Mode: 04; Polarity: Vertical; Modulation:GFSK; Channel:middle



Site : chamber
Condition: 3m VERTICAL
Job No : 04137AT\04138AT
Mode : 2441 TX RSE
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1620.431	4.83	26.60	61.52	64.94	34.85	74.00	-39.15	peak
2	4430.628	7.95	34.43	61.19	62.14	43.33	74.00	-30.67	peak
3	4882.000	8.03	34.63	61.00	58.50	40.16	74.00	-33.84	peak
4	6995.172	9.53	35.71	60.43	60.24	45.05	74.00	-28.95	peak
5	7323.000	9.20	35.70	60.37	59.76	44.29	74.00	-29.71	peak
6 p	9764.000	11.32	37.37	61.33	59.24	46.60	74.00	-27.40	peak

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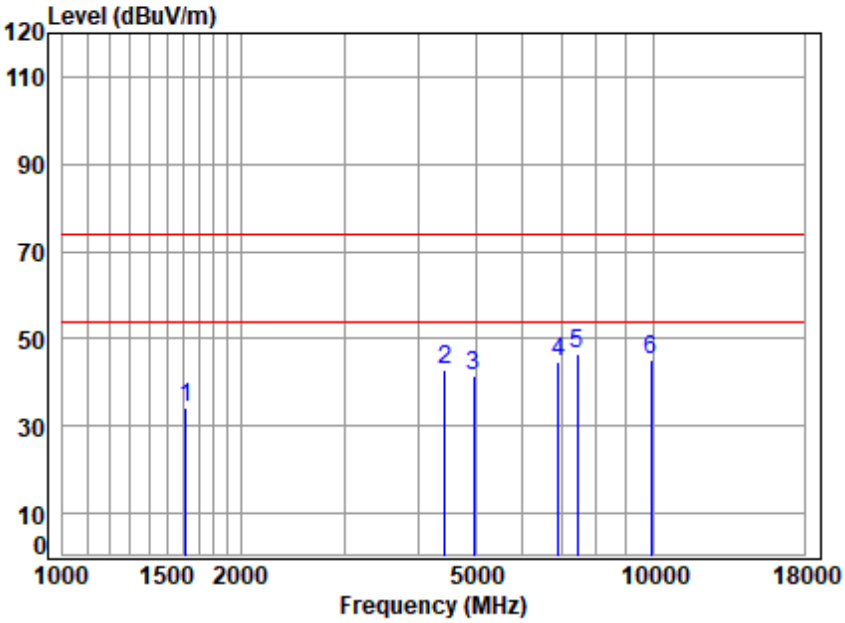
Test Mode: 04; Polarity: Horizontal; Modulation:GFSK; Channel:High



Site : chamber
Condition: 3m HORIZONTAL
Job No : 04137AT\04138AT
Mode : 2480 TX RSE
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1615.754	4.82	26.64	61.52	64.31	34.25	74.00	-39.75	peak
2	4430.628	7.95	34.43	61.19	61.72	42.91	74.00	-31.09	peak
3	4960.000	8.06	34.56	60.97	59.65	41.30	74.00	-32.70	peak
4	6914.763	9.47	35.66	60.44	60.04	44.73	74.00	-29.27	peak
5 p	7440.000	9.09	35.96	60.36	61.67	46.36	74.00	-27.64	peak
6	9920.000	11.23	37.30	61.42	58.20	45.31	74.00	-28.69	peak

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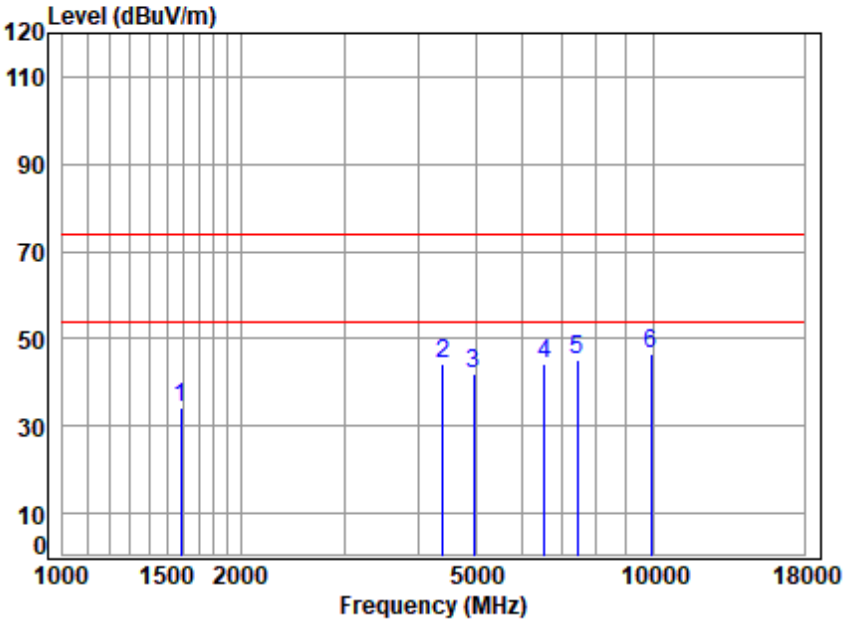
Test Mode: 04; Polarity: Vertical; Modulation:GFSK; Channel:High



Site : chamber
Condition: 3m VERTICAL
Job No : 04137AT\04138AT
Mode : 2480 TX RSE
: BT

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1583.392	4.75	26.87	61.51	64.10	34.21	74.00	-39.79	peak
2	4405.090	7.99	34.74	61.20	62.80	44.33	74.00	-29.67	peak
3	4960.000	8.06	34.56	60.97	60.12	41.77	74.00	-32.23	peak
4	6545.263	9.18	35.51	60.51	59.94	44.12	74.00	-29.88	peak
5	7440.000	9.09	35.96	60.36	60.49	45.18	74.00	-28.82	peak
6 p	9920.000	11.23	37.30	61.42	59.25	46.36	74.00	-27.64	peak

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7.4 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(1)

Test Method: ANSI C63.10 (2013) Section 7.8.5

Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥50 hopping channels
	0.25 for 25≤ hopping channels <50
	1 for digital modulation
2400-2483.5	1 for ≥75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 24.0 °C Humidity: 38.8 % RH Atmospheric Pressure: 1020 mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	04	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

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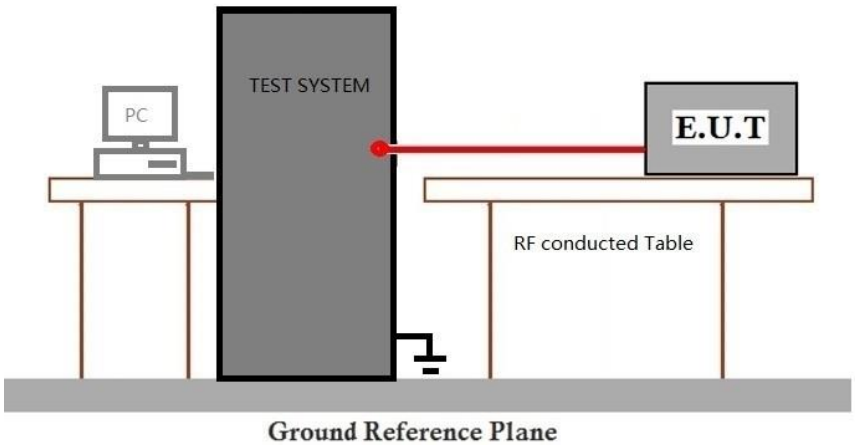
7.4.3 Test Setup Diagram



7.4.4 Measurement Procedure and Data

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7.5 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247(a)(1)
Test Method: ANSI C63.10 (2013) Section 7.8.7

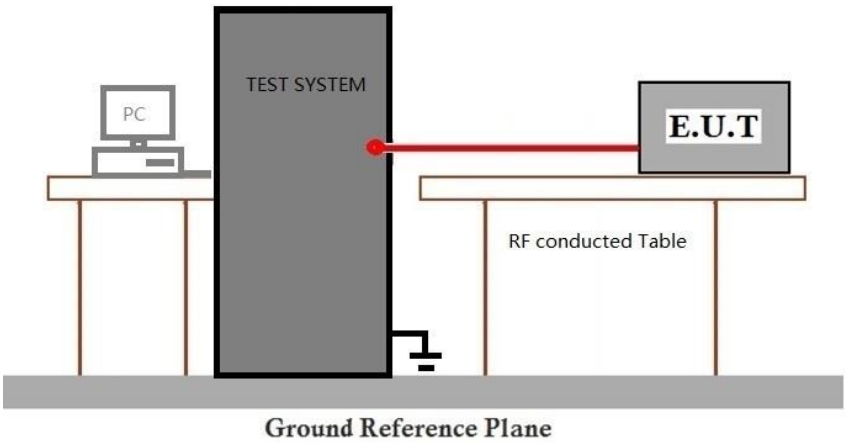
7.5.1 E.U.T. Operation

Operating Environment:
Temperature: 24.0 °C Humidity: 38.8 % RH Atmospheric Pressure: 1020 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	04	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

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7.6 Carrier Frequencies Separation

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)

Test Method: ANSI C63.10 (2013) Section 7.8.2

Limit:

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.

7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 24.0 °C Humidity: 38.8 % RH Atmospheric Pressure: 1020 mbar

7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_Hop mode(Left earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	03	TX_Hop mode(Right earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

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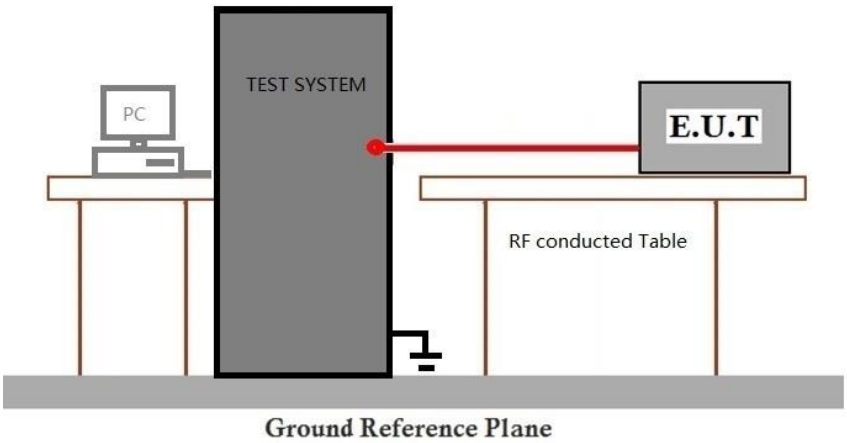
7.6.3 Test Setup Diagram



7.6.4 Measurement Procedure and Data

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7.7 Hopping Channel Number

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method: ANSI C63.10 (2013) Section 7.8.3

Limit:

Frequency range(MHz)	Number of hopping channels (minimum)
902-928	50 for 20dB bandwidth <250kHz
	25 for 20dB bandwidth ≥250kHz
2400-2483.5	15
5725-5850	75

7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 24.0 °C Humidity: 38.8 % RH Atmospheric Pressure: 1020 mbar

7.7.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_Hop mode(Left earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	03	TX_Hop mode(Right earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

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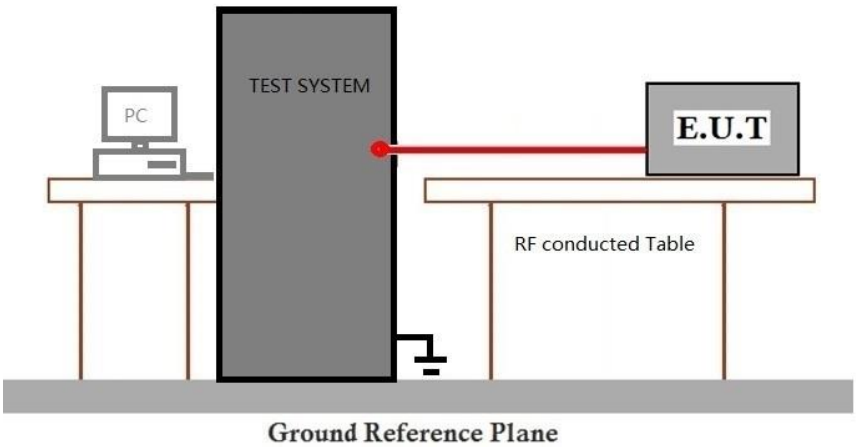
7.7.3 Test Setup Diagram



7.7.4 Measurement Procedure and Data

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7.8 Dwell Time

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method: ANSI C63.10 (2013) Section 7.8.4

Limit:

Frequency(MHz)	Limit
902-928	0.4S within a 20S period(20dB bandwidth<250kHz)
	0.4S within a 10S period(20dB bandwidth≥250kHz)
2400-2483.5	0.4S within a period of 0.4S multiplied by the number of hopping channels
5725-5850	0.4S within a 30S period

7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 24.0 °C Humidity: 38.8 % RH Atmospheric Pressure: 1020 mbar

7.8.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_Hop mode(Left earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	03	TX_Hop mode(Right earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

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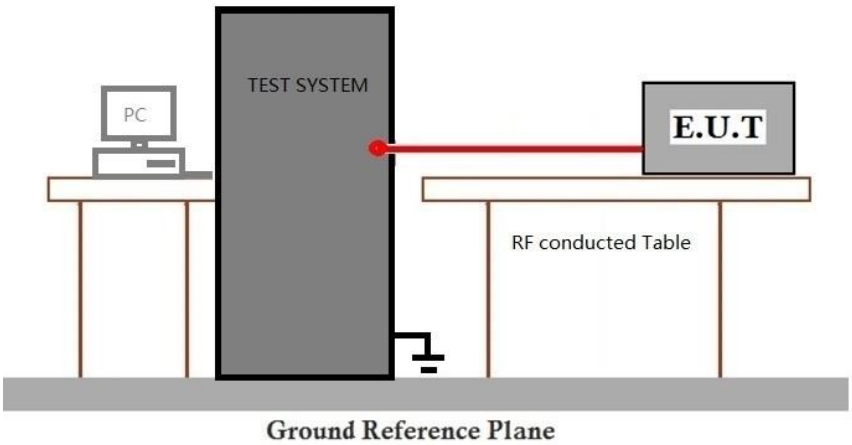
7.8.3 Test Setup Diagram



7.8.4 Measurement Procedure and Data

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7.9 Conducted Band Edges Measurement

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 7.8.6

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

7.9.1 E.U.T. Operation

Operating Environment:

Temperature: 24.0 °C Humidity: 38.8 % RH Atmospheric Pressure: 1020 mbar

7.9.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_Hop mode(Left earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	01	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	03	TX_Hop mode(Right earbuds)_Keep the EUT in frequency hopping mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	04	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

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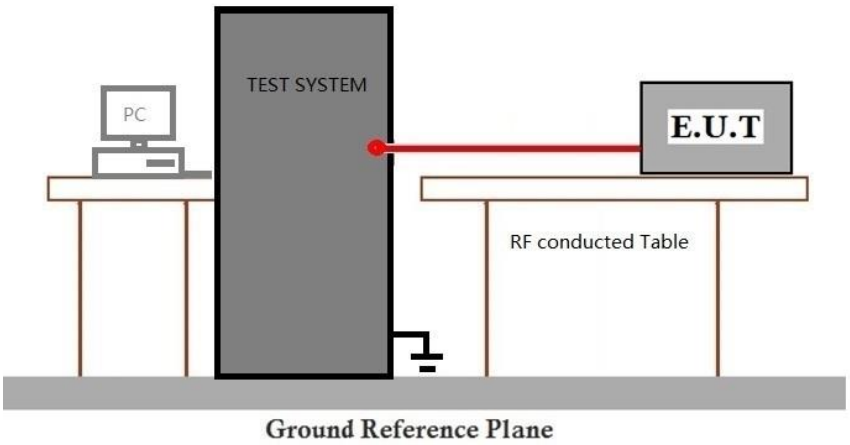
7.9.3 Test Setup Diagram



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7.10 Conducted Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 7.8.8

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c).

7.10.1 E.U.T. Operation

Operating Environment:

Temperature: 24.0 °C Humidity: 38.8 % RH Atmospheric Pressure: 1020 mbar

7.10.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX_non-Hop mode(Left earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.
Final test	04	TX_non-Hop mode(Right earbuds)_Keep the EUT in continuously transmitting mode with GFSK modulation, pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

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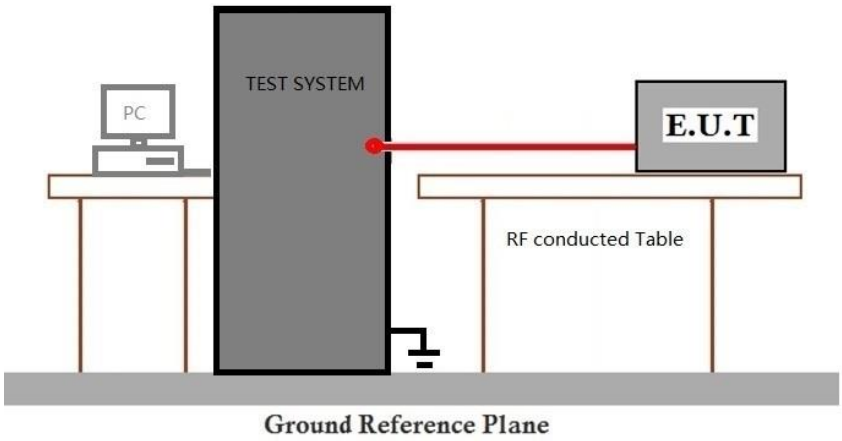
7.10.3 Test Setup Diagram



7.10.4 Measurement Procedure and Data

Please Refer to Appendix for Details

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8 Test Setup Photo

Refer to Appendix - Test Setup Photo for SZCR2411004137AT

9 EUT Constructional Details (EUT Photos)

Refer to External and Internal Photos for SZCR2411004137AT

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10 Appendix

For right earbud:

1. Bandwidth

1.1 Test Result

1.1.1 OBW

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	99% Occupied Bandwidth (MHz)		Verdict
					Result	Limit	
GFSK	SISO	2402	DH5	1	0.890	/	Pass
		2441	DH5	1	0.891	/	Pass
		2480	DH5	1	0.885	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.193	/	Pass
		2441	2DH5	1	1.198	/	Pass
		2480	2DH5	1	1.203	/	Pass
8DPSK	SISO	2402	3DH5	1	1.201	/	Pass
		2441	3DH5	1	1.214	/	Pass
		2480	3DH5	1	1.212	/	Pass

1.1.2 20dB BW

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	20dB Bandwidth (MHz)		Verdict
					Result	Limit	
GFSK	SISO	2402	DH5	1	1.007	/	Pass
		2441	DH5	1	1.015	/	Pass
		2480	DH5	1	1.015	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.321	/	Pass
		2441	2DH5	1	1.330	/	Pass
		2480	2DH5	1	1.327	/	Pass
8DPSK	SISO	2402	3DH5	1	1.312	/	Pass
		2441	3DH5	1	1.316	/	Pass
		2480	3DH5	1	1.315	/	Pass

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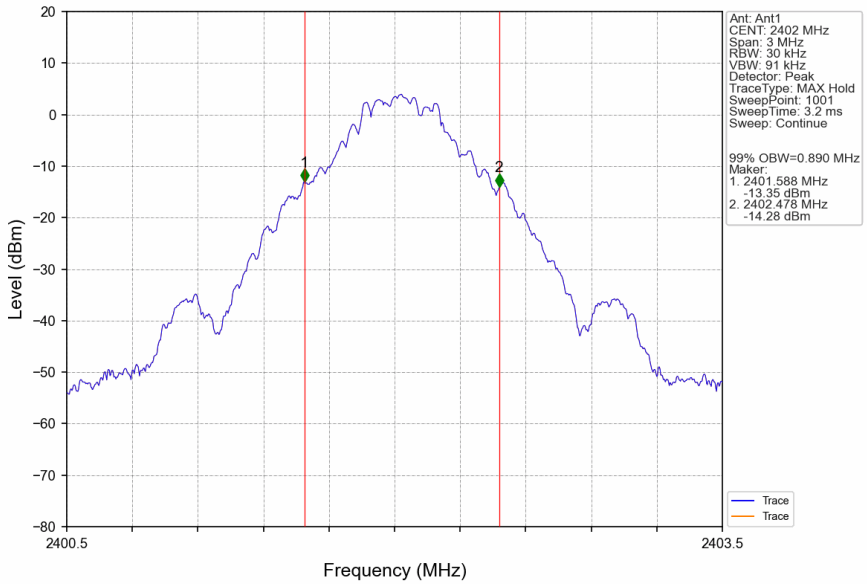
1.2 Test Graph

1.2.1 OBW

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



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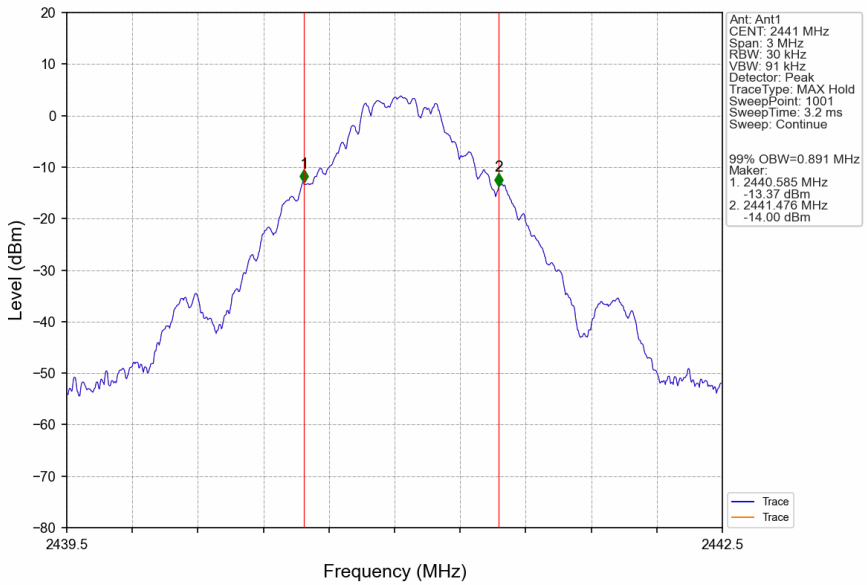

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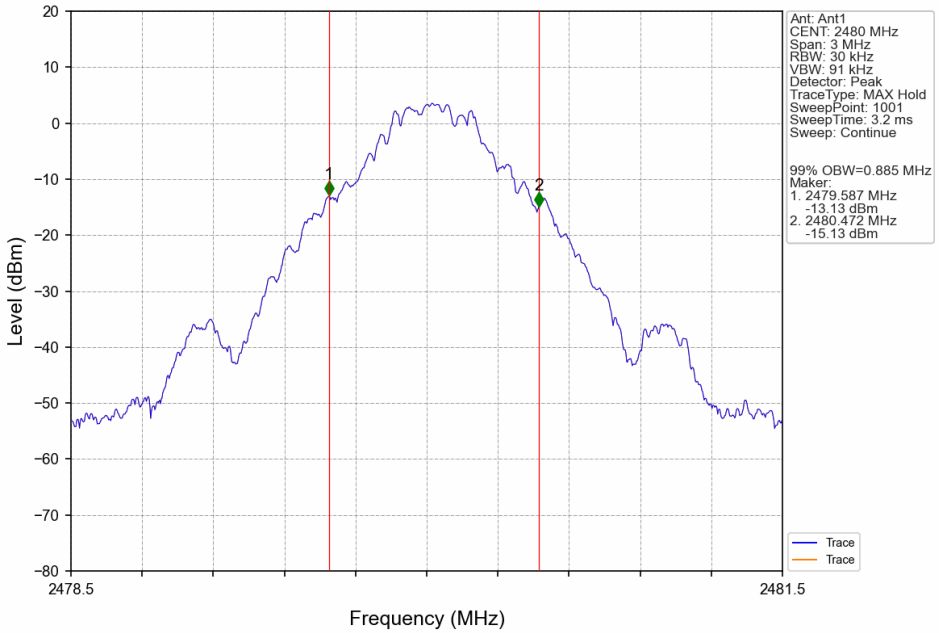
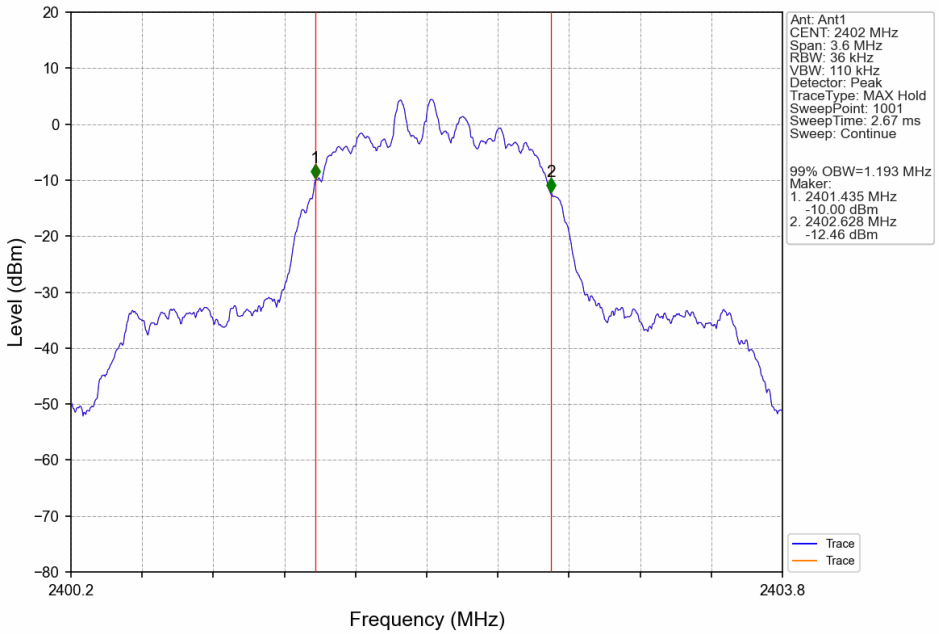
GFSK_DH5_HCH_2480MHz_Ant1_NTNV



Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV



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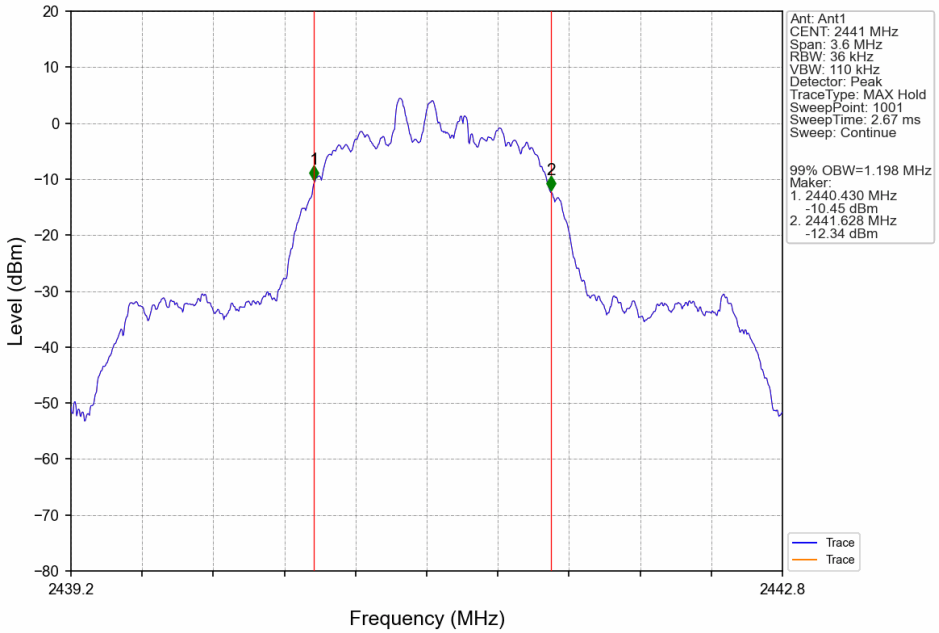
Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV



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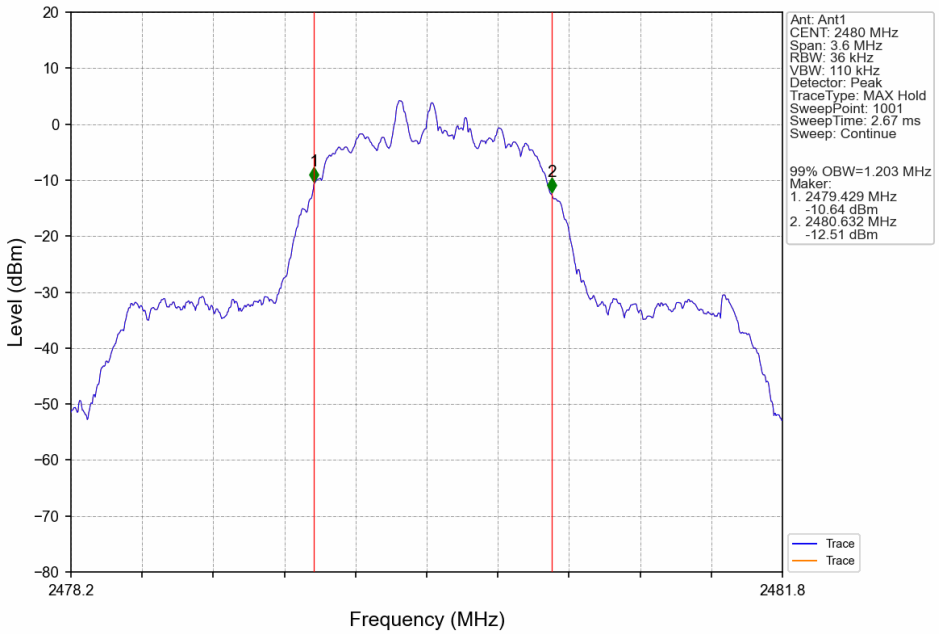

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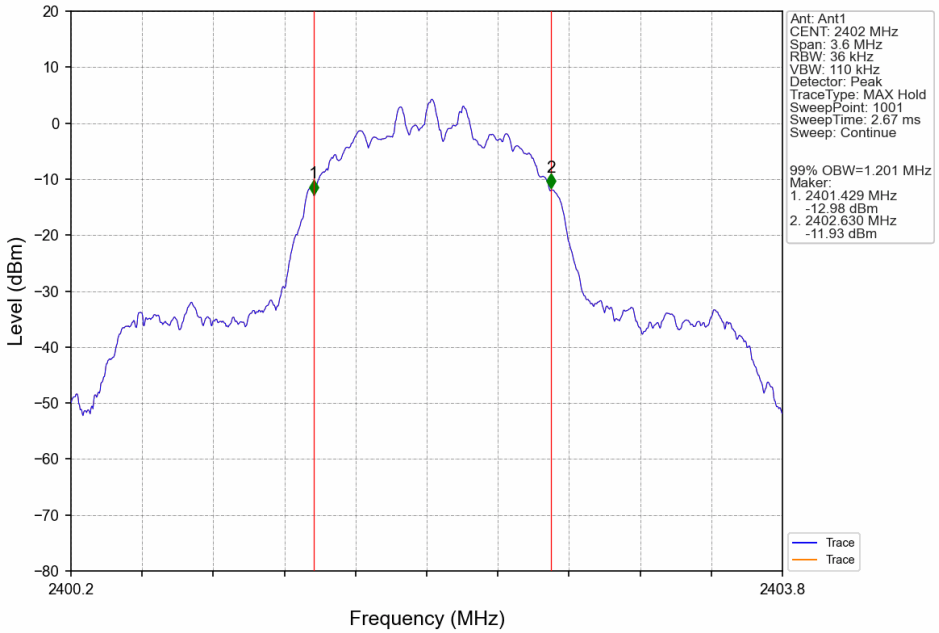
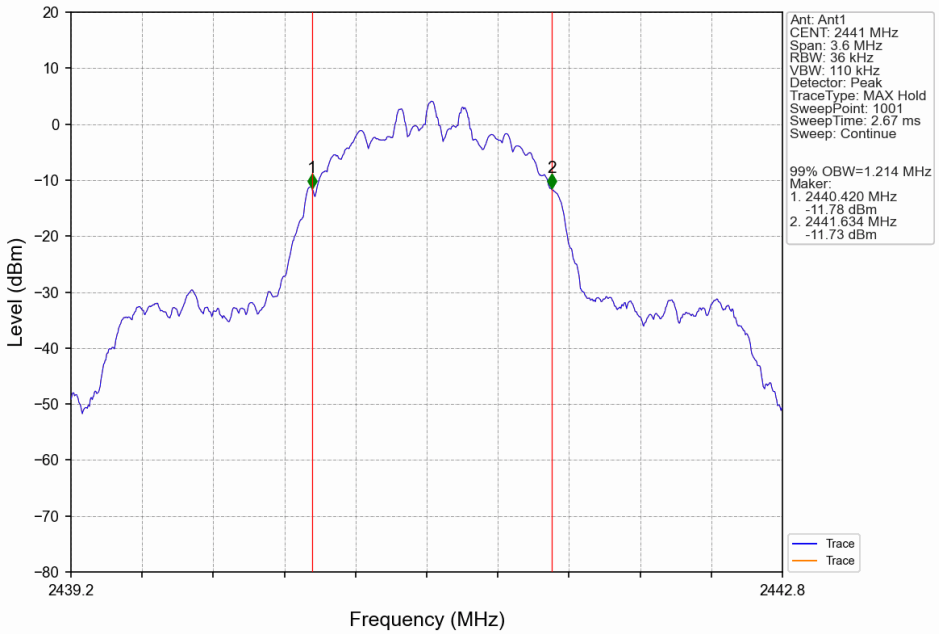
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



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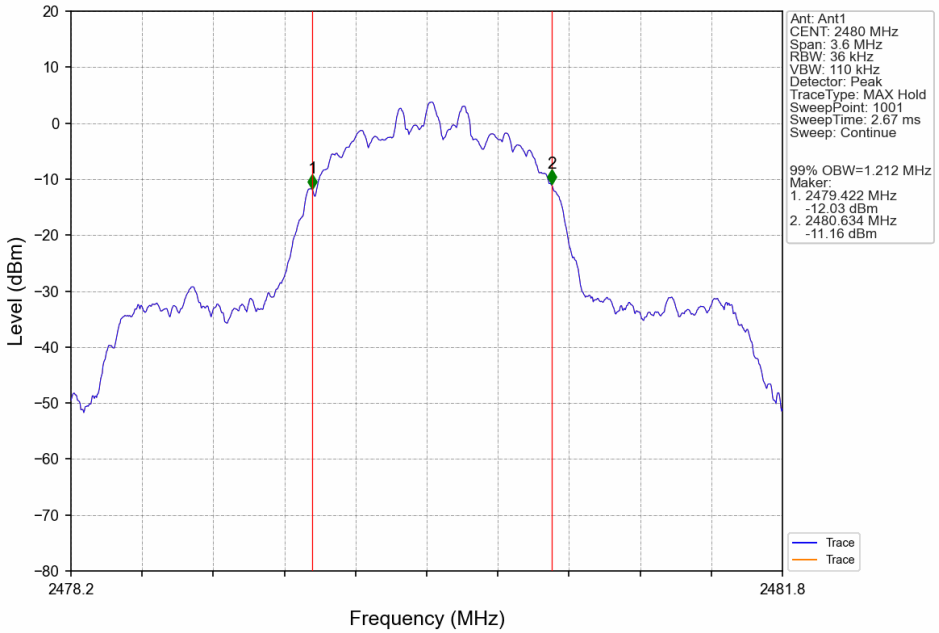

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1.2.2 20dB BW

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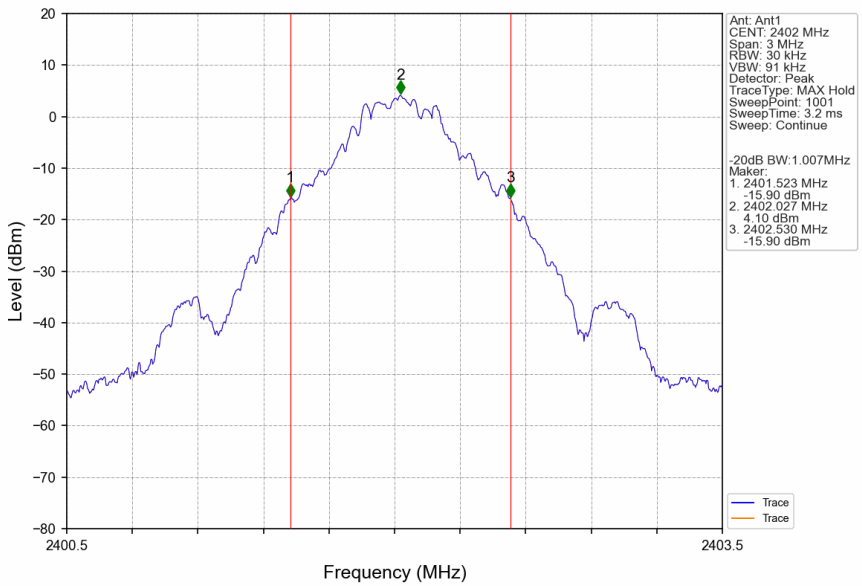

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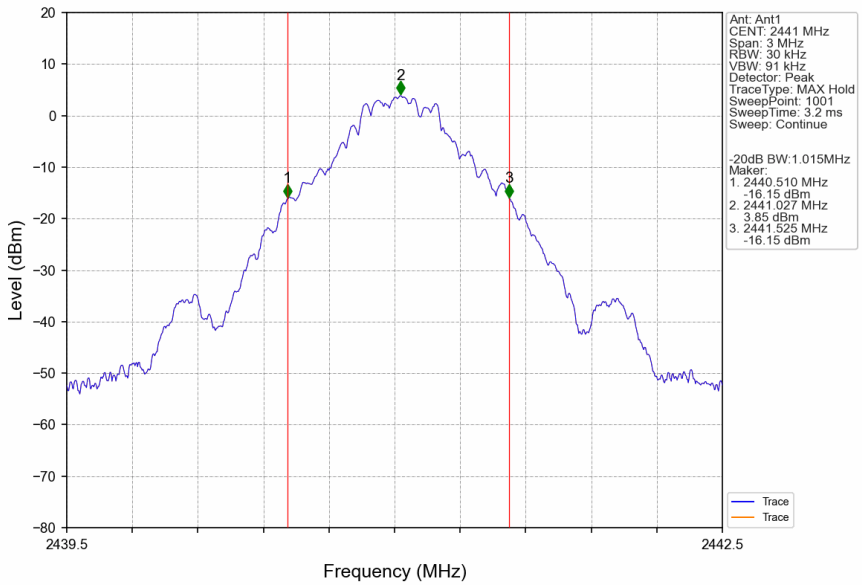

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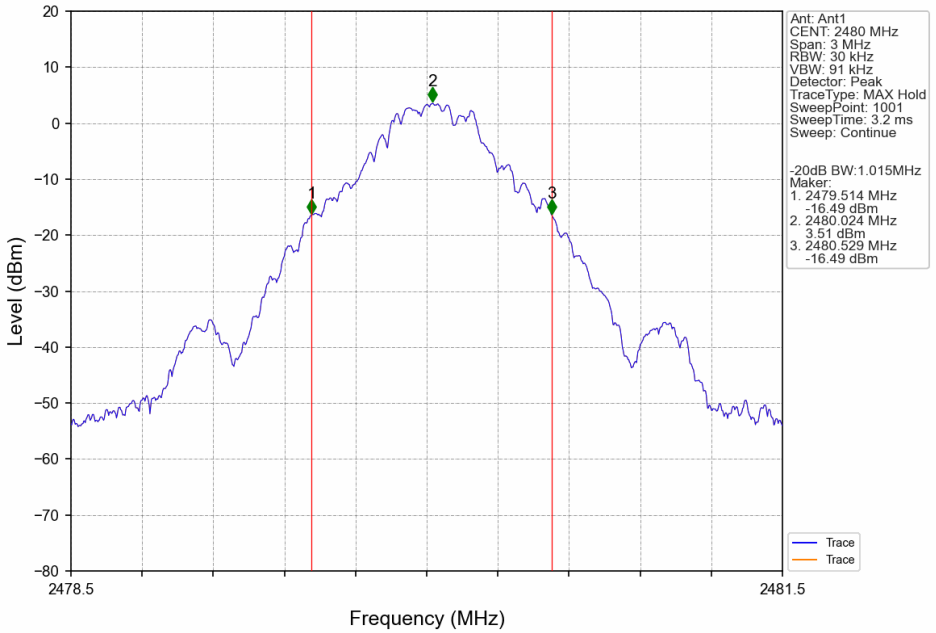

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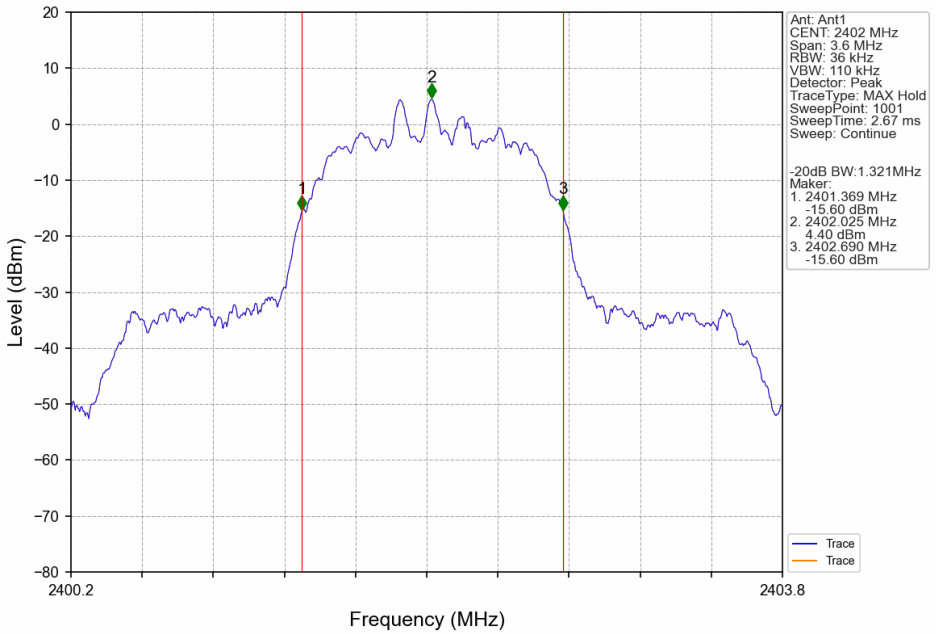

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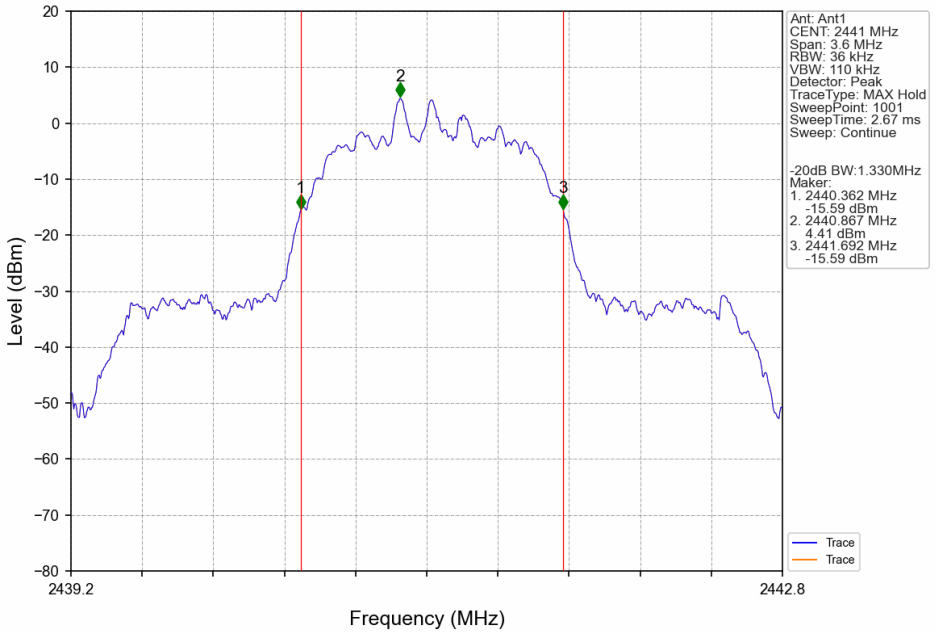

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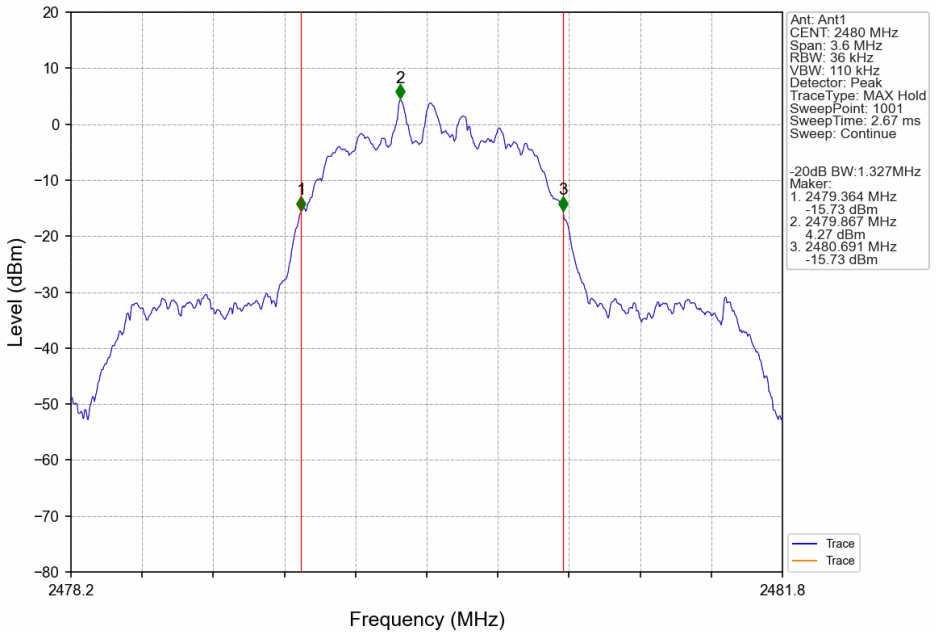

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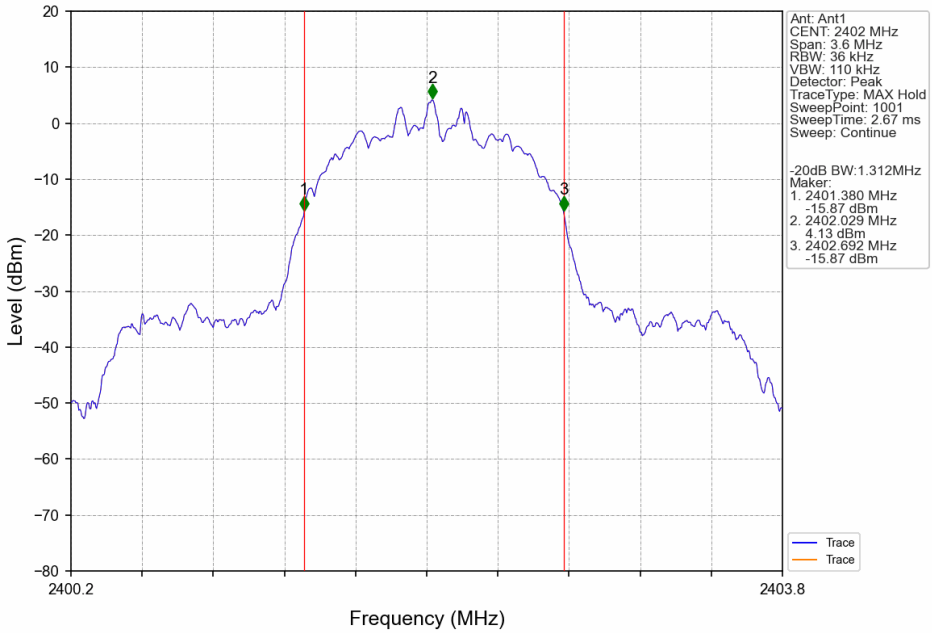
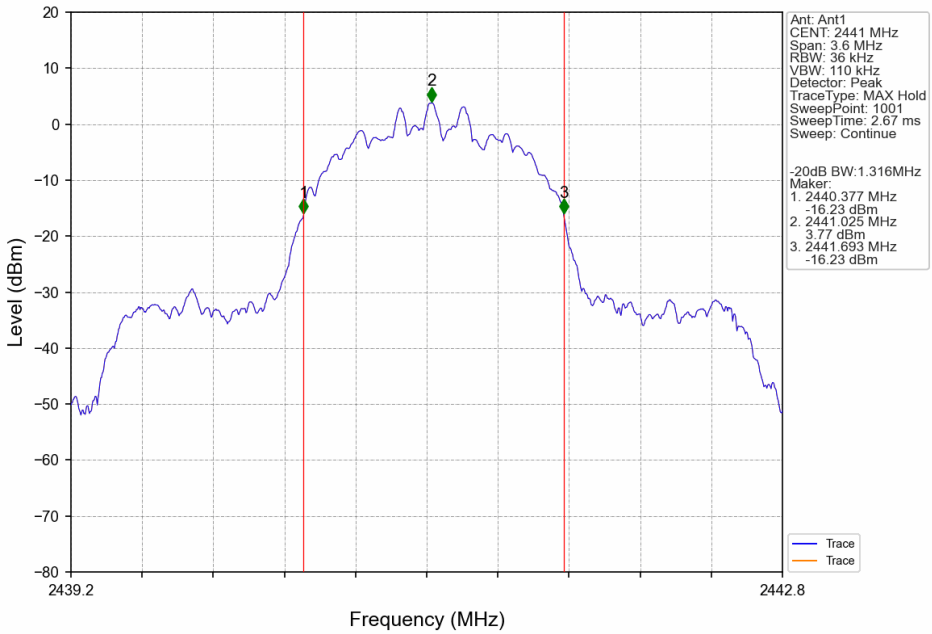
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



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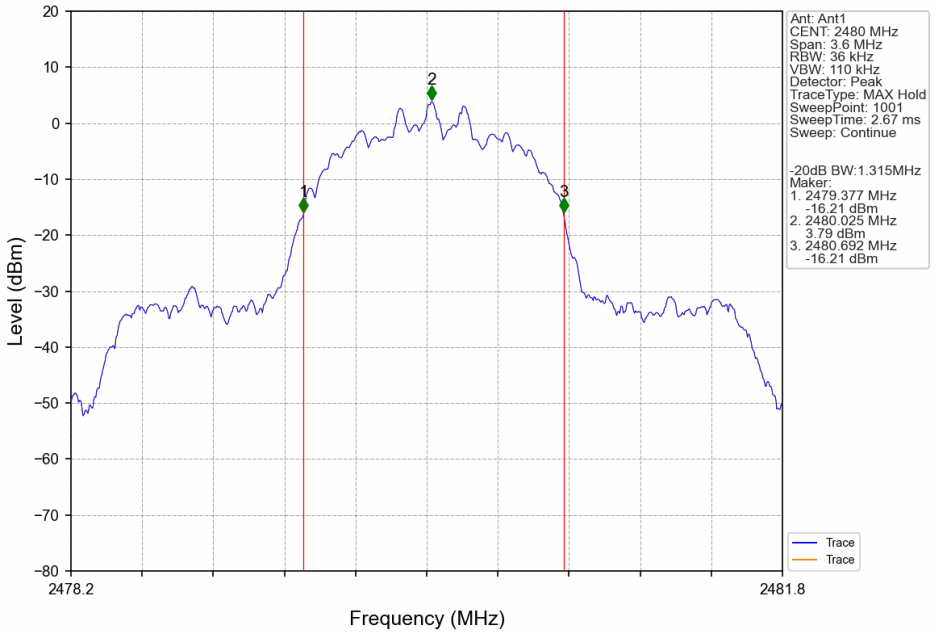
8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV



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2. Maximum Conducted Output Power

2.1 Test Result

2.1.1 Power

Mode	TX Type	Frequency (MHz)	Packet Type	Maximum Peak Conducted Output Power (dBm)		Verdict
				ANT1	Limit	
GFSK	SISO	2402	DH5	6.08	<=30	Pass
		2441	DH5	6.10	<=30	Pass
		2480	DH5	5.98	<=30	Pass
Pi/4DQPSK	SISO	2402	2DH5	6.69	<=20.97	Pass
		2441	2DH5	6.70	<=20.97	Pass
		2480	2DH5	6.54	<=20.97	Pass
8DPSK	SISO	2402	3DH5	6.96	<=20.97	Pass
		2441	3DH5	6.89	<=20.97	Pass
		2480	3DH5	6.71	<=20.97	Pass

3. Carrier Frequency Separation

3.1 Test Result

3.1.1 Ant1

Ant1							
Mode	TX Type	Frequency (MHz)	Packet Type	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Verdict
GFSK	SISO	HOPP	DH5	1.030	1.015	>=1.015	Pass
Pi/4DQPSK	SISO	HOPP	2DH5	1.006	1.330	>=0.887	Pass
8DPSK	SISO	HOPP	3DH5	1.044	1.316	>=0.877	Pass

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3.2 Test Graph

3.2.1 Ant1

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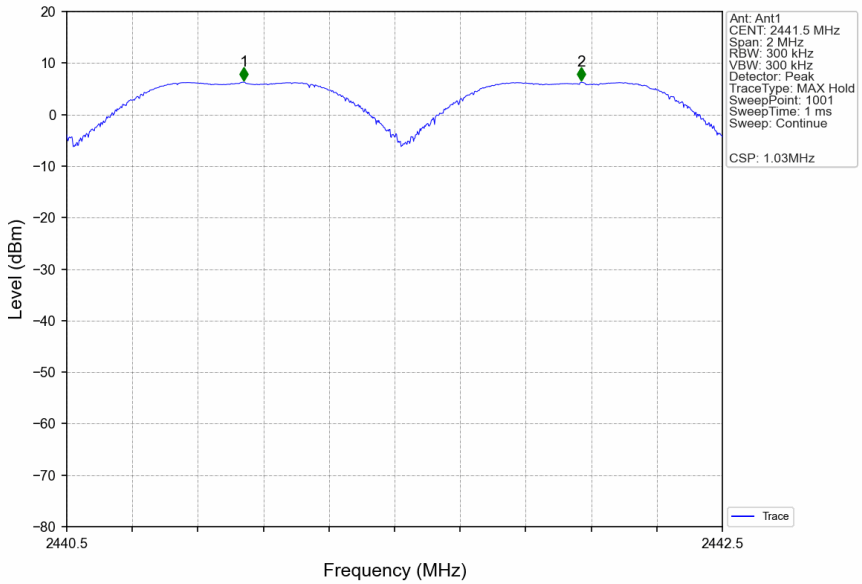
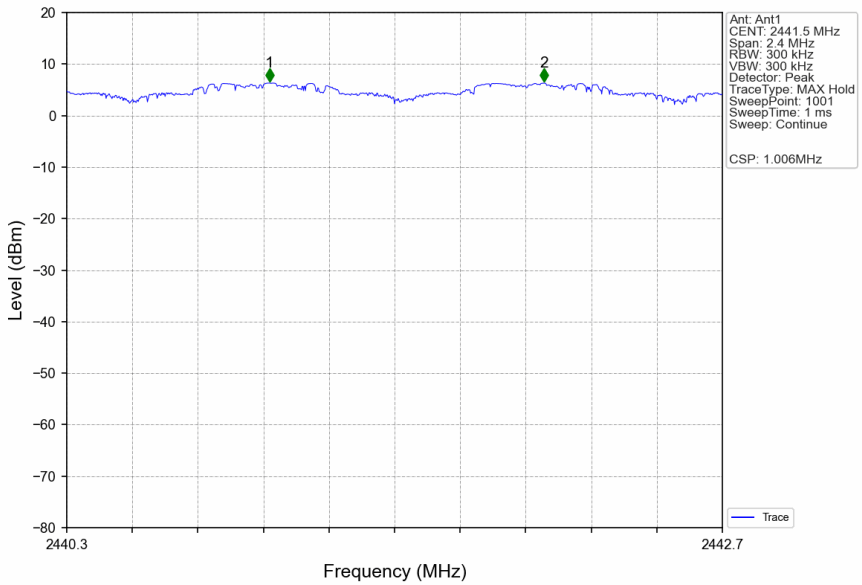


Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV



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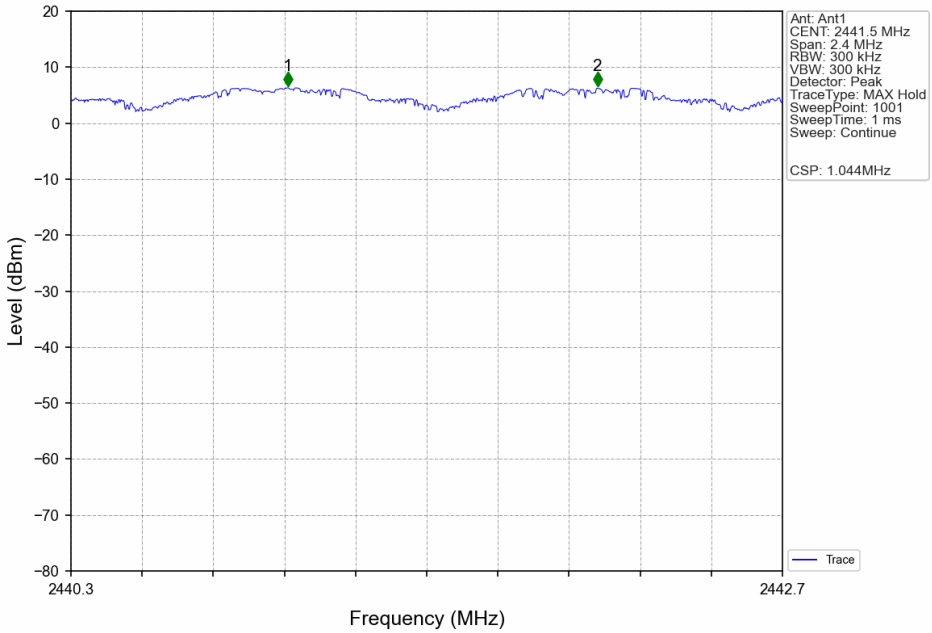

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4. Number of Hopping Frequencies

4.1 Test Result

4.1.1 HoppNum

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

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4.2 Test Graph

4.2.1 HoppNum

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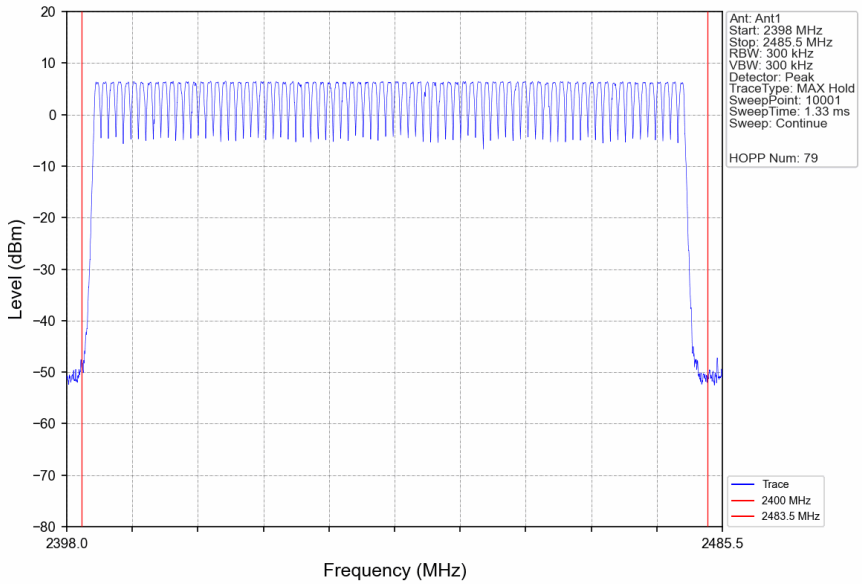
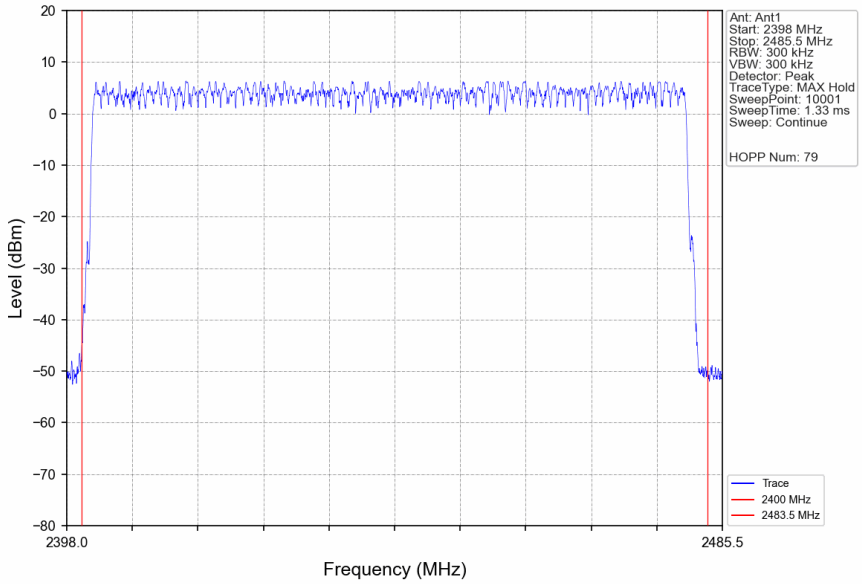


Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV



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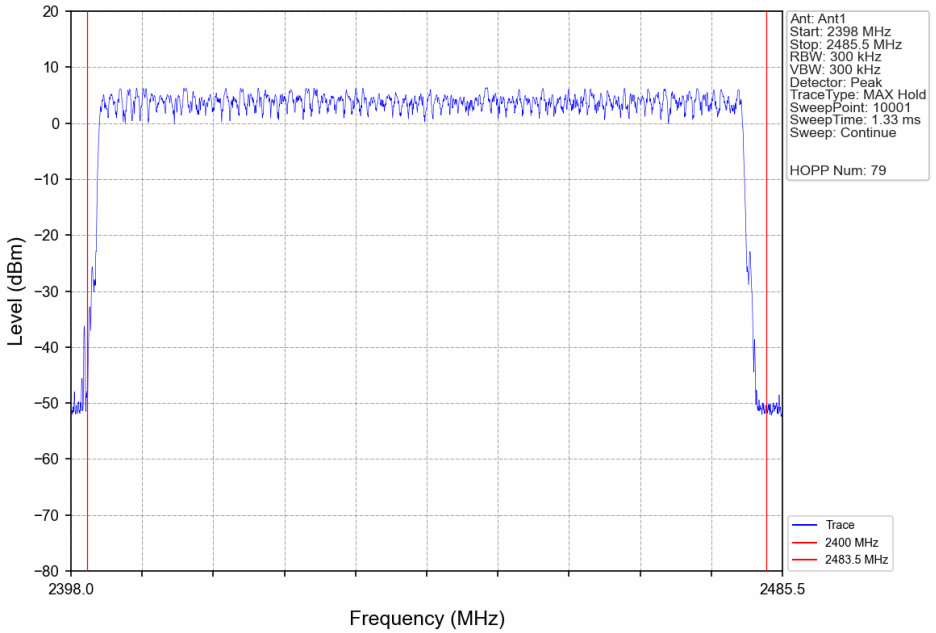

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5. Time of Occupancy (Dwell Time)

5.1 Test Result

5.1.1 Ant1

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	0.386	31.600	413	159.418	<=400	Pass
			DH3	1.648	31.600	161	265.328	<=400	Pass
			DH5	2.896	31.600	115	333.040	<=400	Pass
Pi/4DQPSK	SISO	HOPP	2DH1	0.396	31.600	320	126.720	<=400	Pass
			2DH3	1.648	31.600	153	252.144	<=400	Pass
			2DH5	2.900	31.600	94	272.600	<=400	Pass
8DPSK	SISO	HOPP	3DH1	0.394	31.600	321	126.474	<=400	Pass
			3DH3	1.650	31.600	161	265.650	<=400	Pass
			3DH5	2.896	31.600	99	286.704	<=400	Pass

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5.2 Test Graph

5.2.1 Ant1

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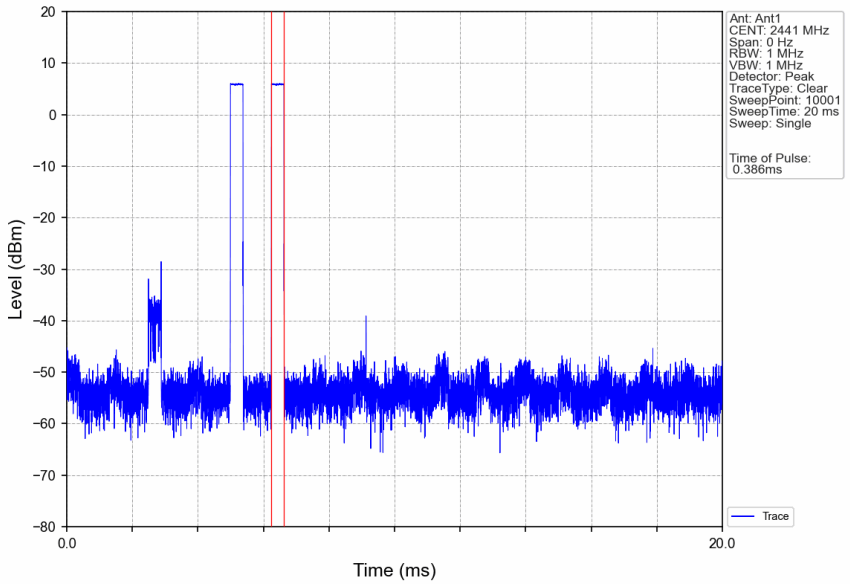

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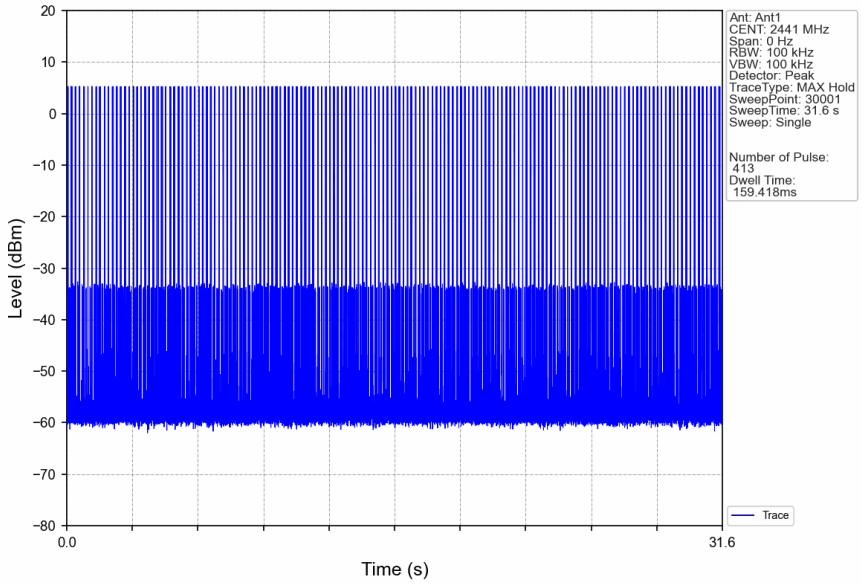

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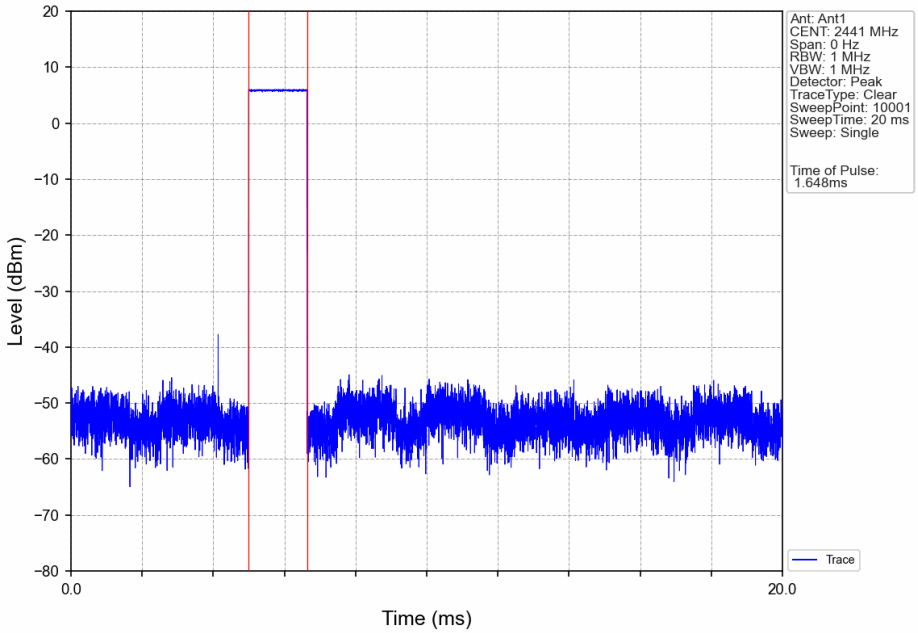

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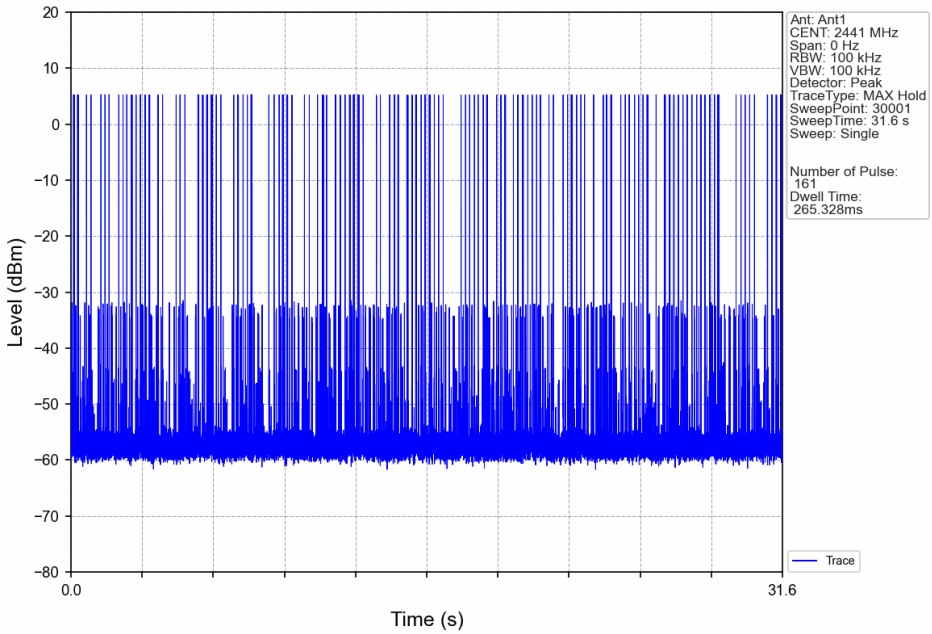

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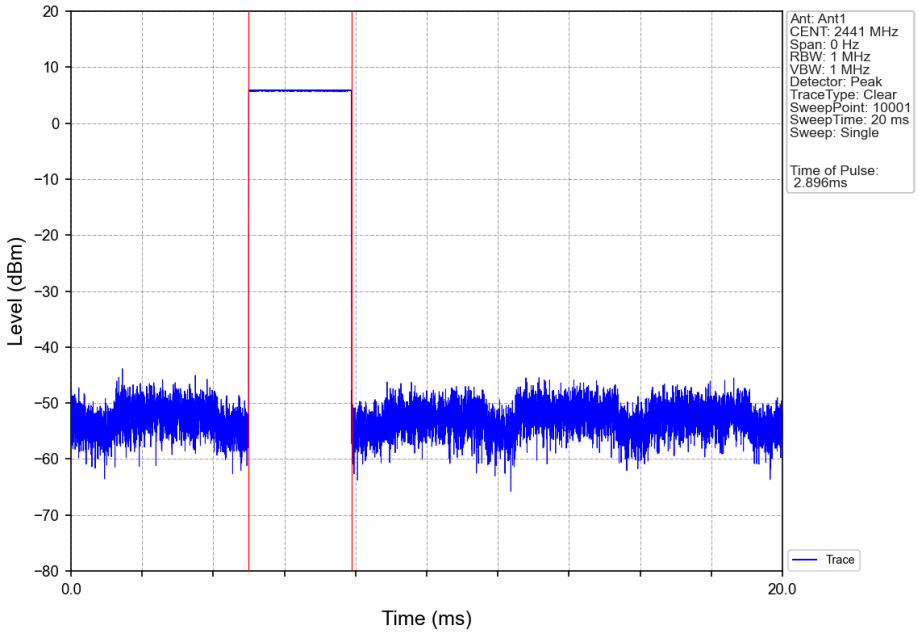
GFSK_DH5_HOPP_Ant1_NTNV



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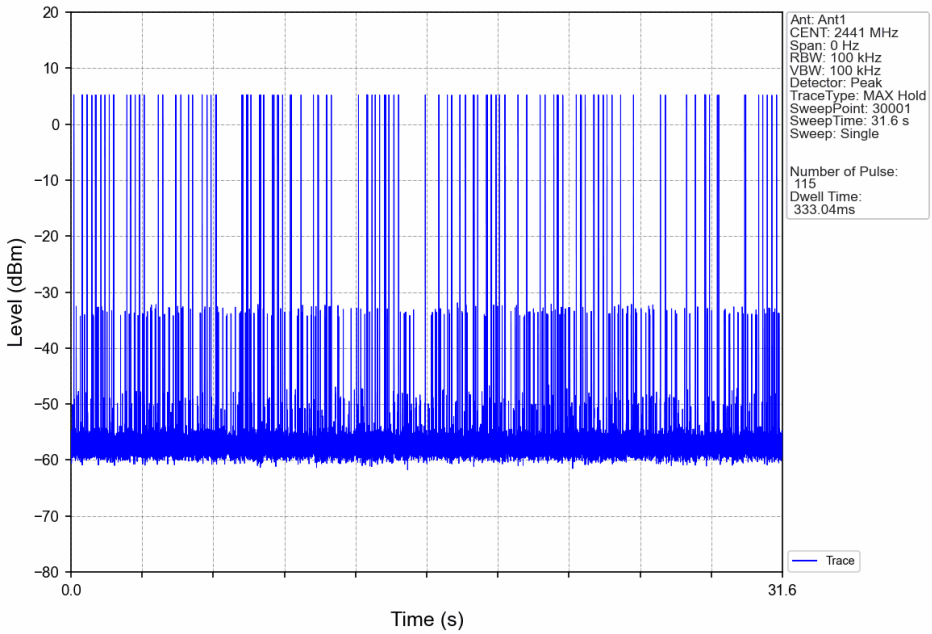

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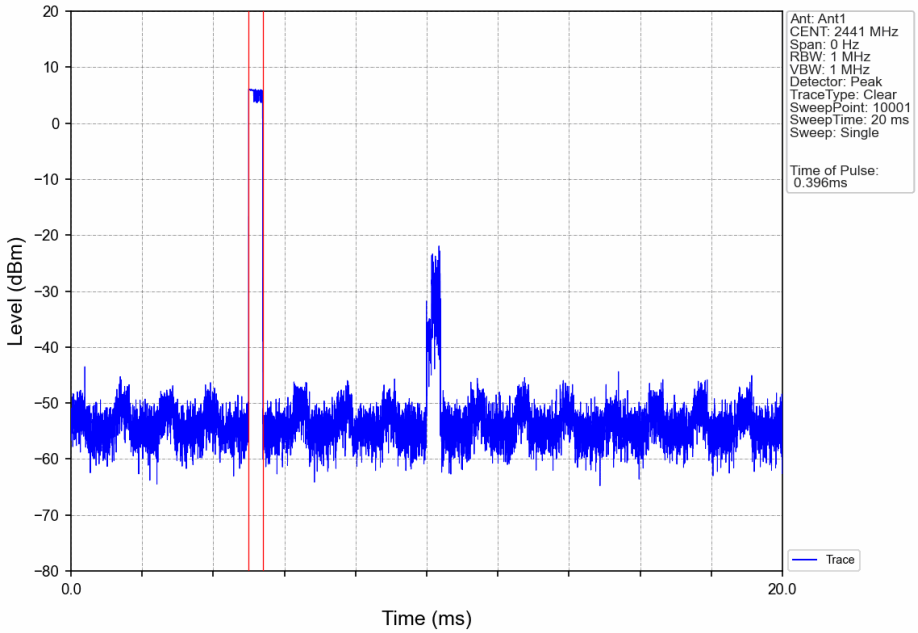
Pi/4DQPSK_2DH1_HOPP_Ant1_NTNV



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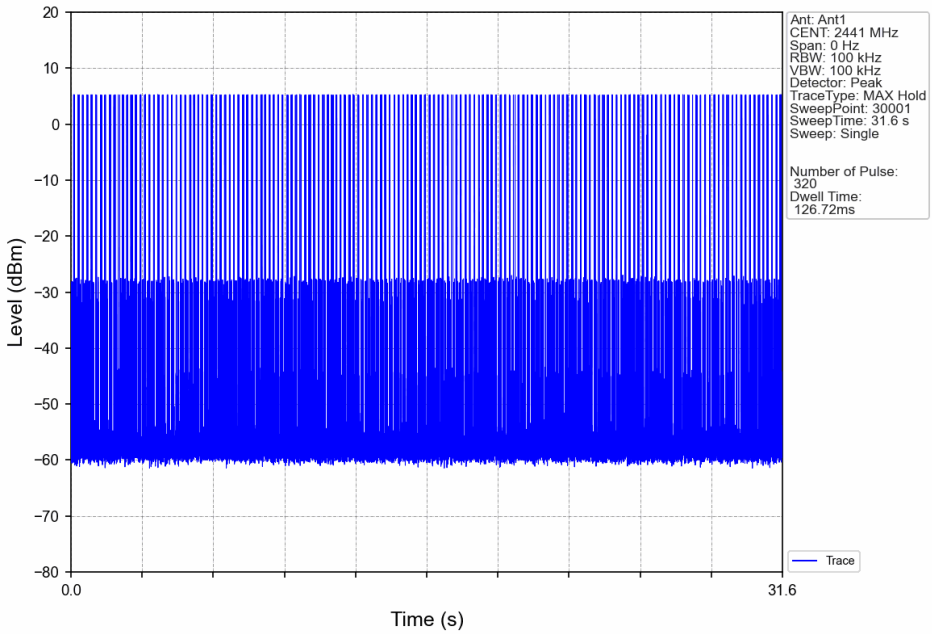

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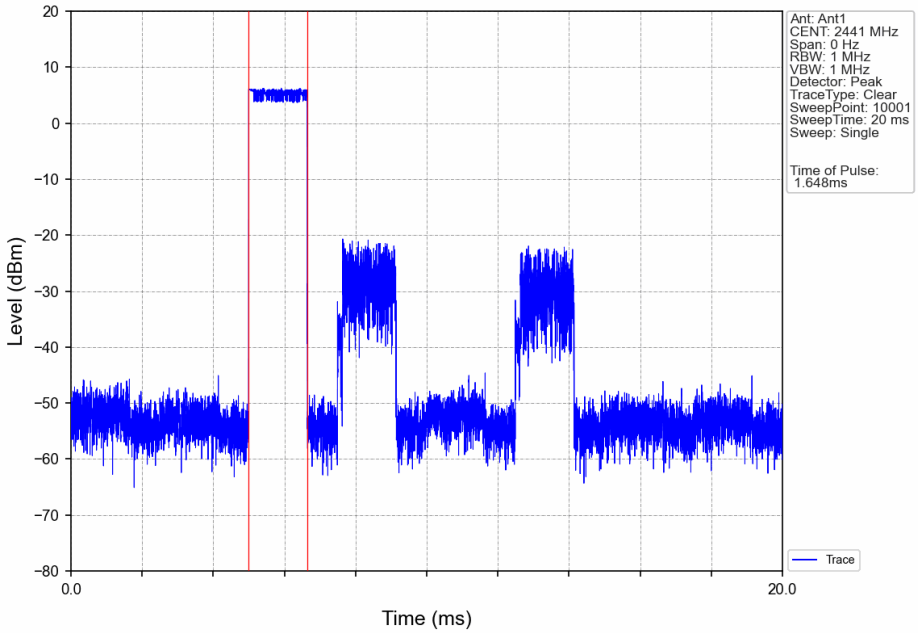
Pi/4DQPSK_2DH3_HOPP_Ant1_NTNV



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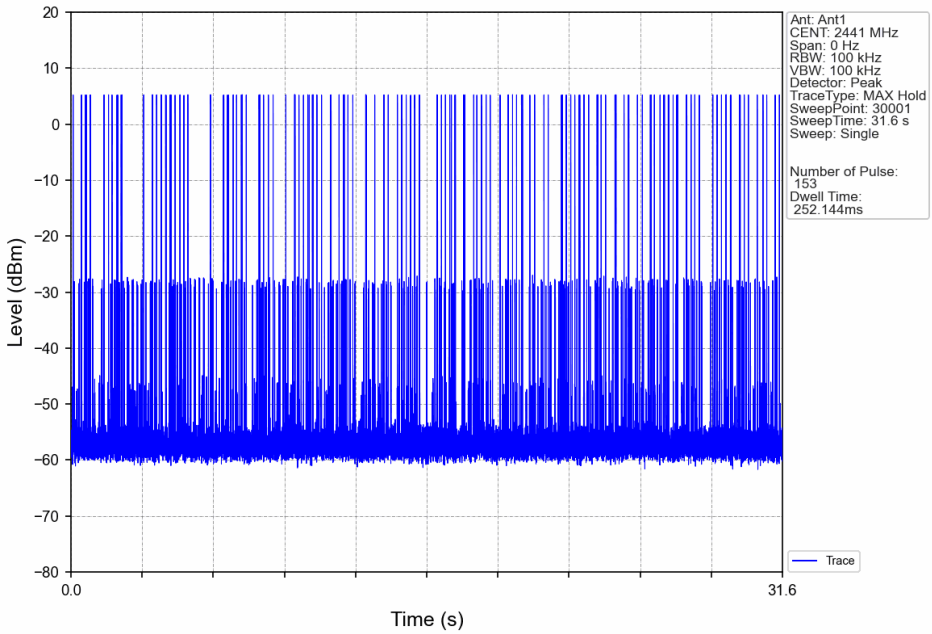

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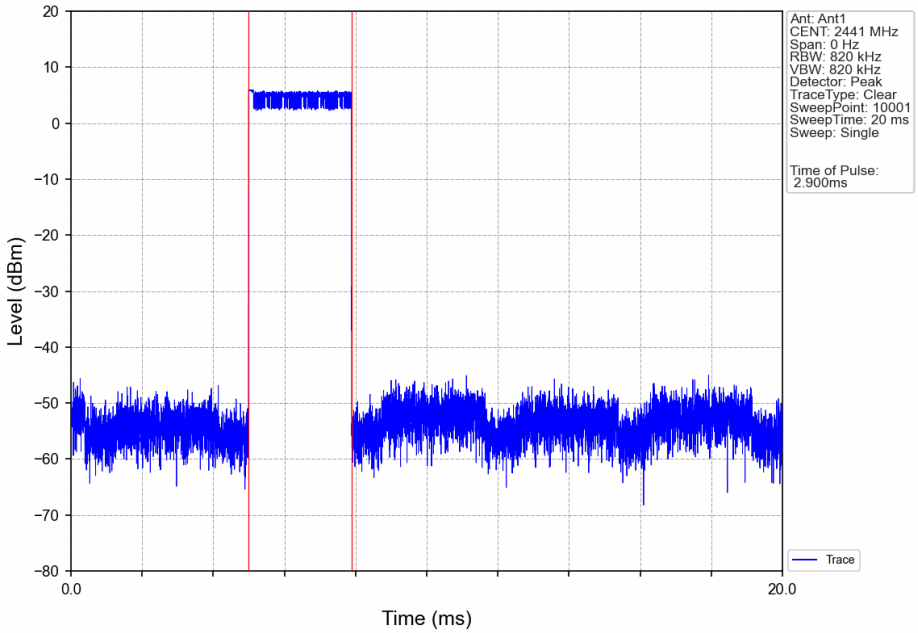
Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV



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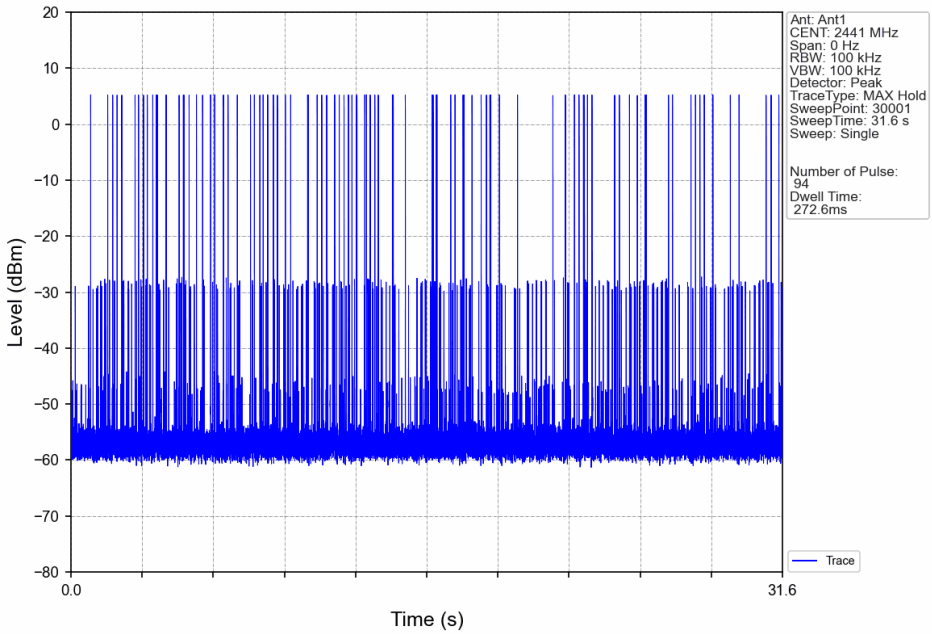

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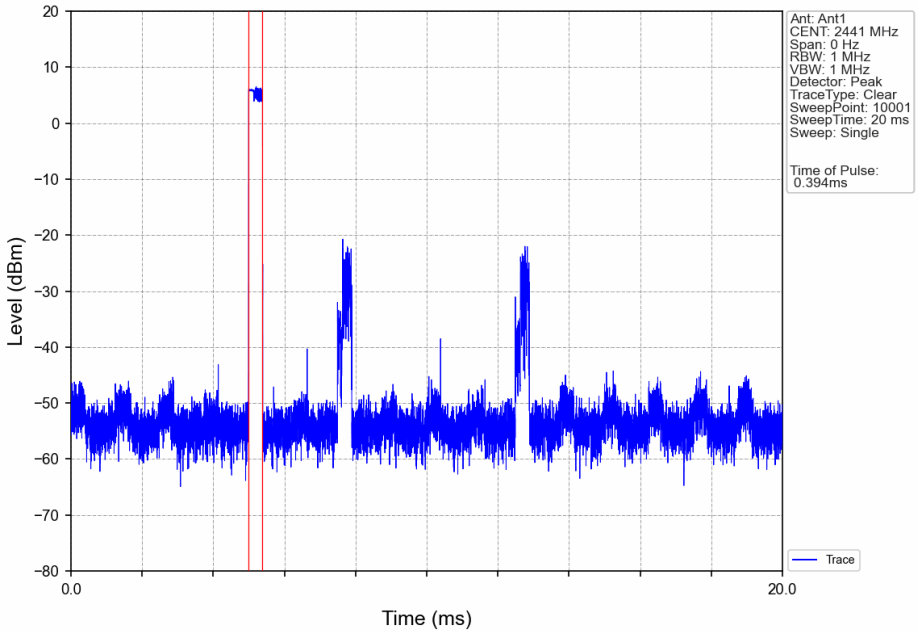
8DPSK_3DH1_HOPP_Ant1_NTNV



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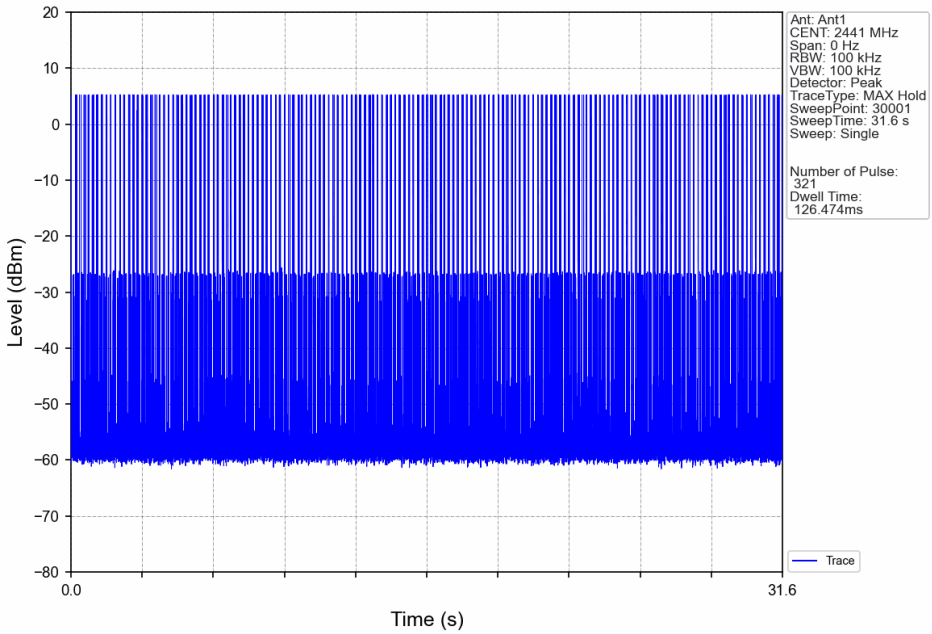

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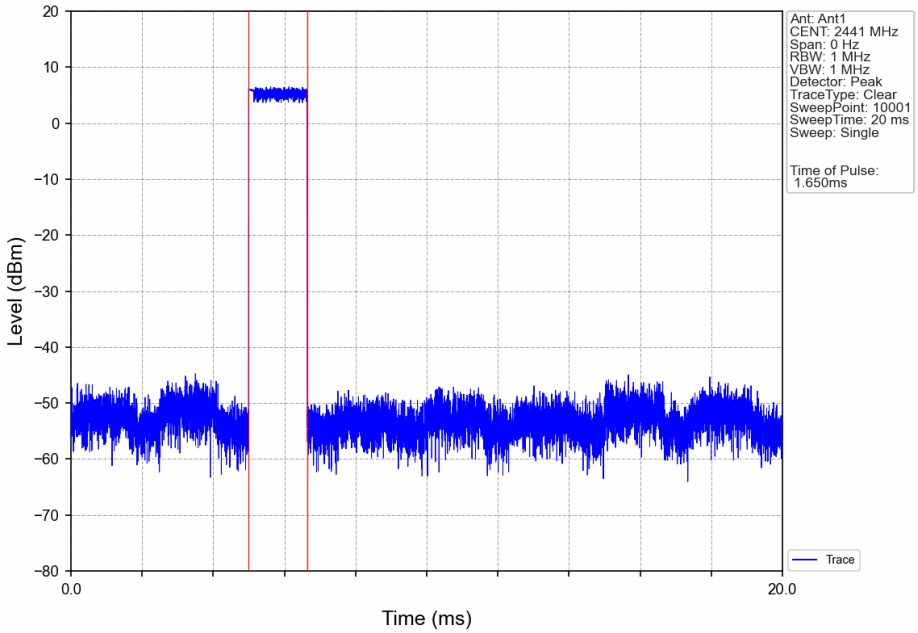
8DPSK_3DH3_HOPP_Ant1_NTNV



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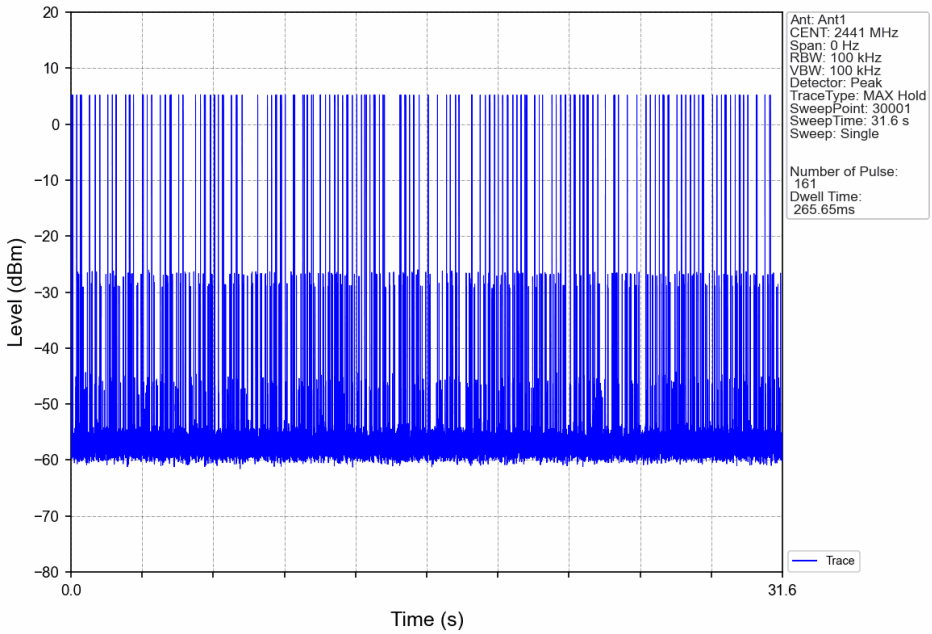

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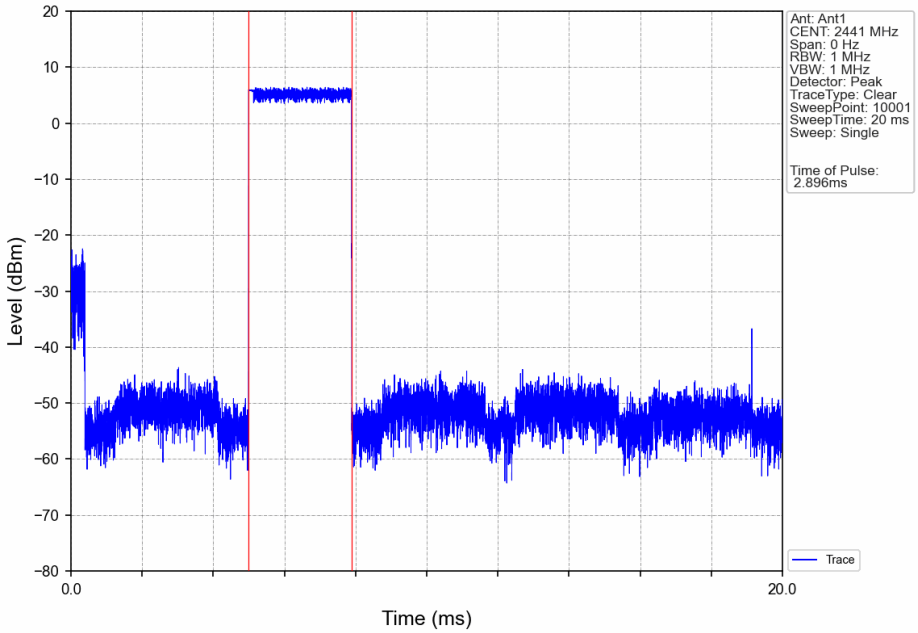
8DPSK_3DH5_HOPP_Ant1_NTNV



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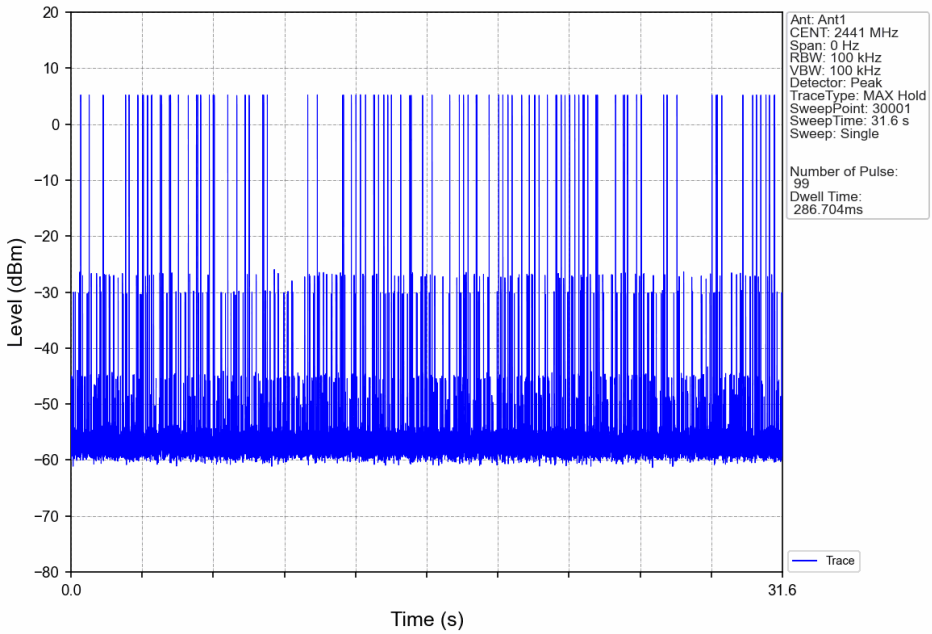

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6. Unwanted Emissions In Non-restricted Frequency Bands

6.1 Test Result

6.1.1 Ref

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	Level of Reference (dBm)
GFSK	SISO	2402	DH5	1	5.83
		2441	DH5	1	5.87
		2480	DH5	1	5.83
Pi/4DQPSK	SISO	2402	2DH5	1	5.89
		2441	2DH5	1	5.87
		2480	2DH5	1	5.86
8DPSK	SISO	2402	3DH5	1	5.80
		2441	3DH5	1	5.88
		2480	3DH5	1	5.79

6.1.2 CSE

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
GFSK	SISO	2402	DH5	1	5.87	-14.13	Pass
		2441	DH5	1	5.87	-14.13	Pass
		2480	DH5	1	5.87	-14.13	Pass
		HOPP	DH5	1	5.87	-14.13	Pass
					5.87	-14.13	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	5.89	-14.11	Pass
		2441	2DH5	1	5.89	-14.11	Pass
		2480	2DH5	1	5.89	-14.11	Pass
		HOPP	2DH5	1	5.89	-14.11	Pass
					5.89	-14.11	Pass
8DPSK	SISO	2402	3DH5	1	5.88	-14.12	Pass
		2441	3DH5	1	5.88	-14.12	Pass
		2480	3DH5	1	5.88	-14.12	Pass
		HOPP	3DH5	1	5.88	-14.12	Pass
					5.88	-14.12	Pass

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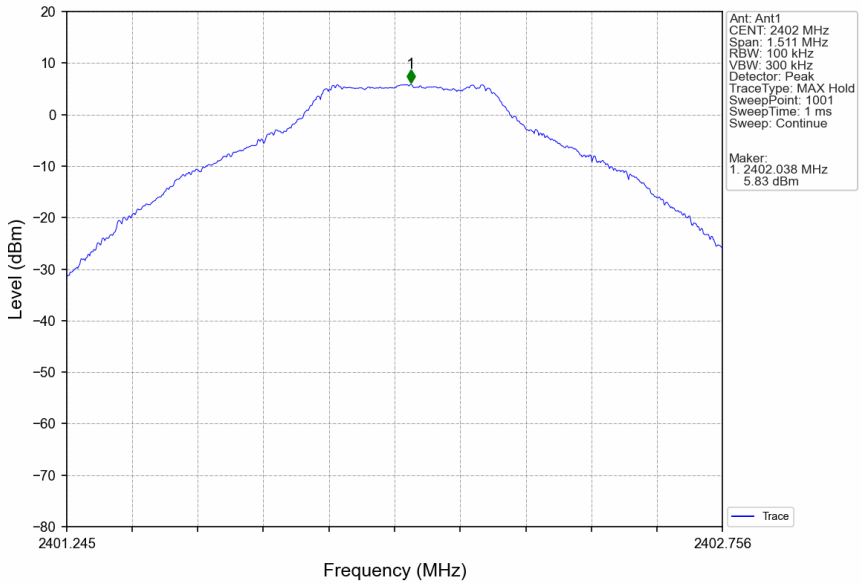
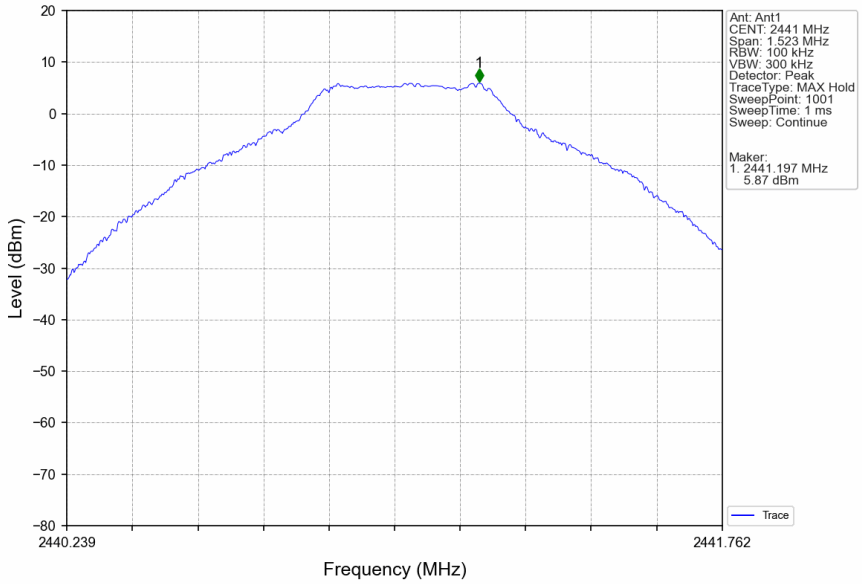
6.2 Test Graph

6.2.1 Ref

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



GFSK_DH5_MCH_2441MHz_Ant1_NTNV



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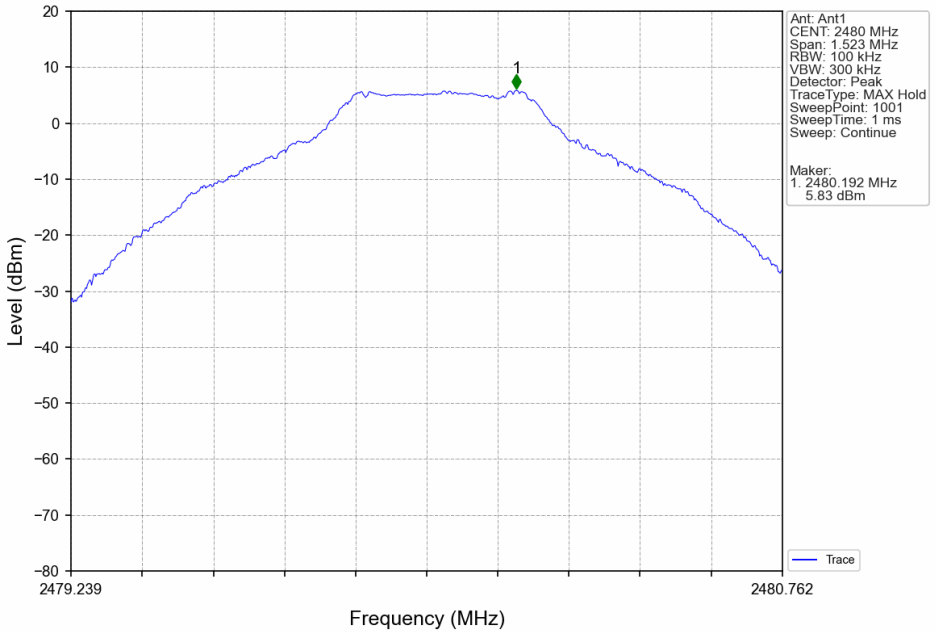
GFSK_DH5_HCH_2480MHz_Ant1_NTNV



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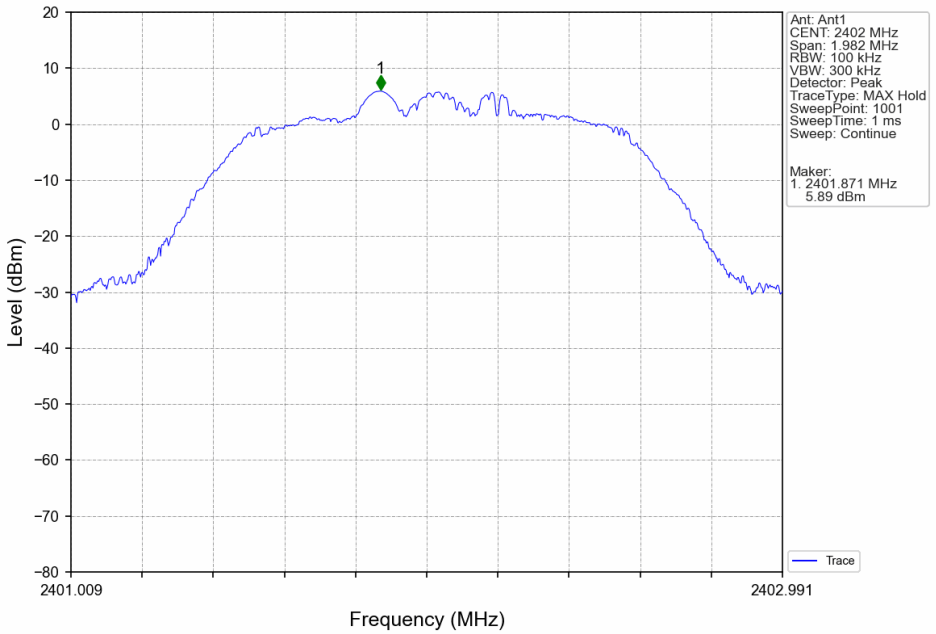

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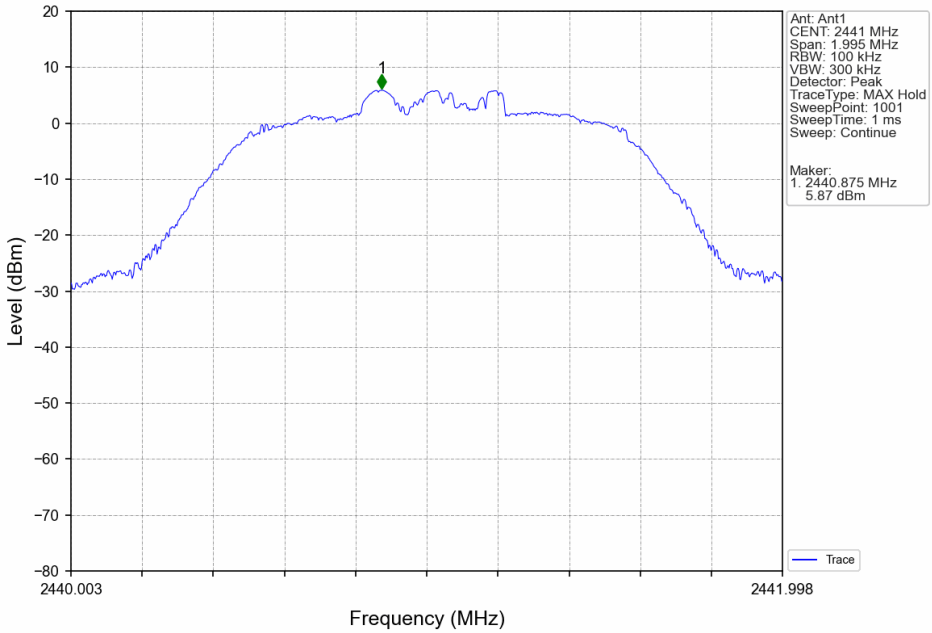
Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV



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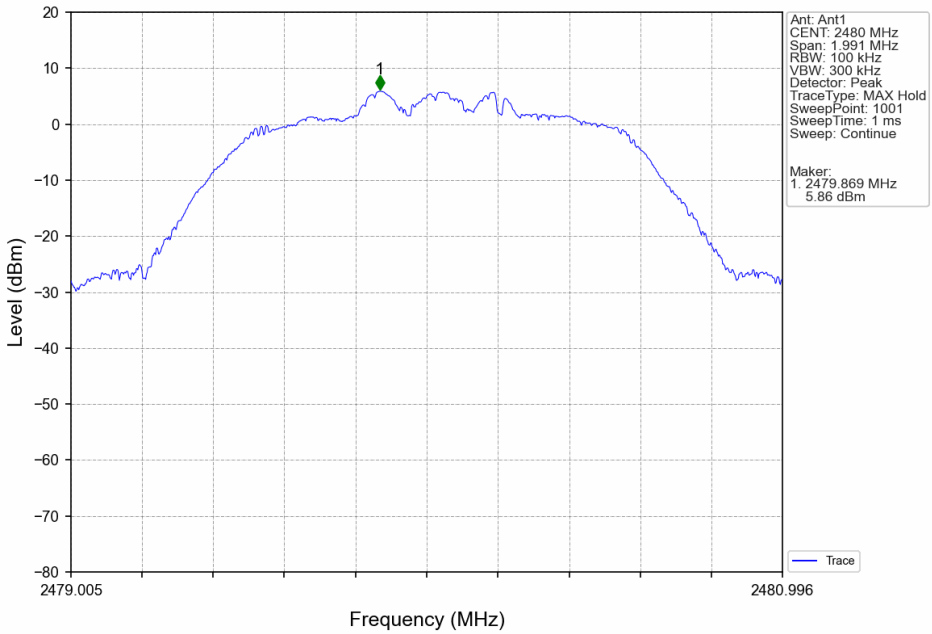

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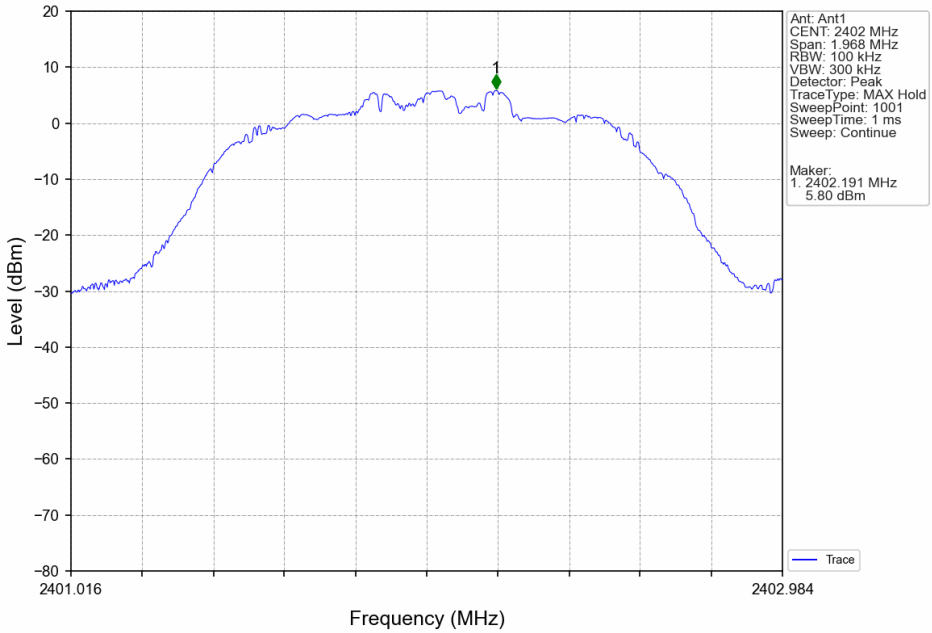
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



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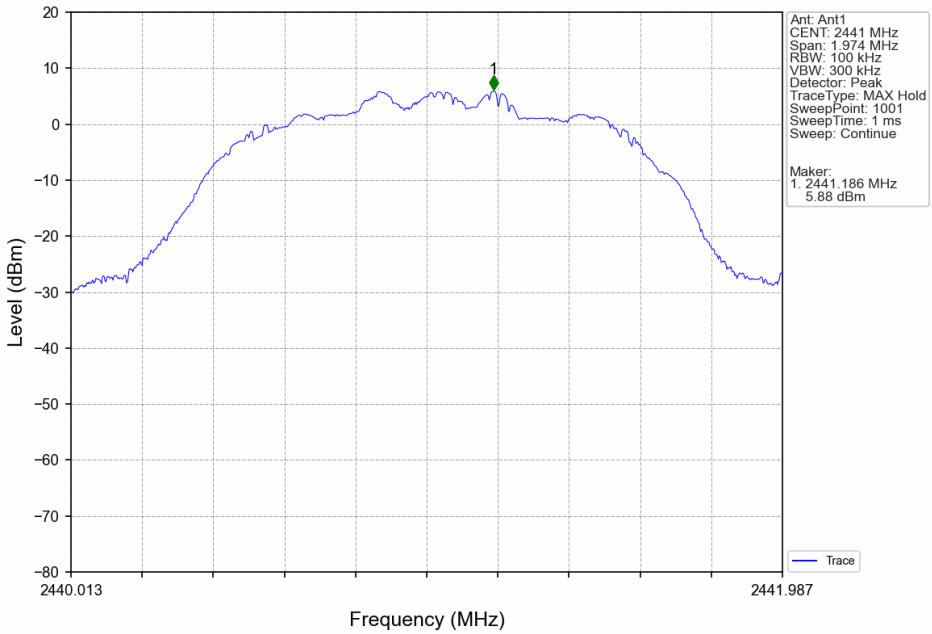

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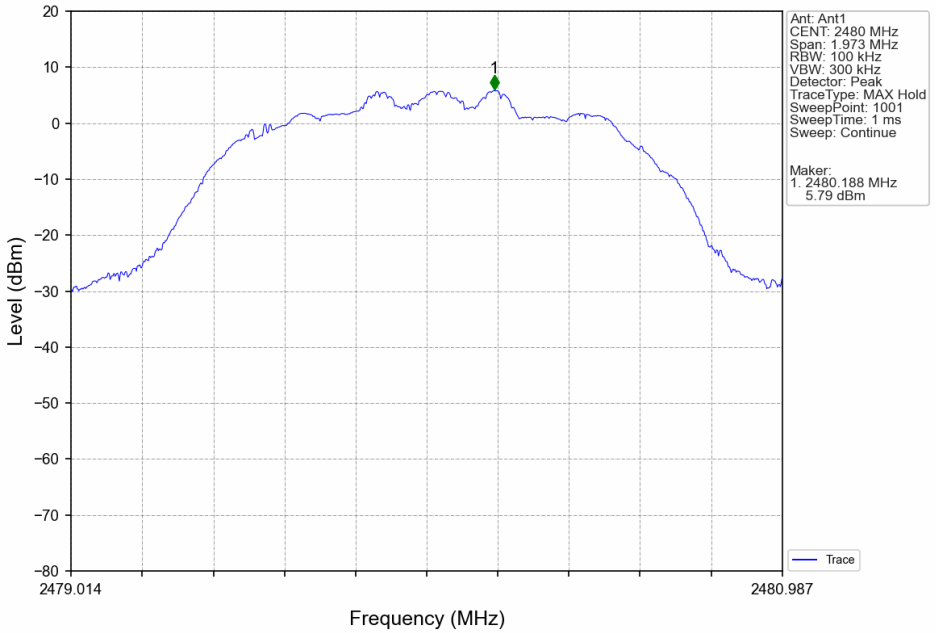
8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV



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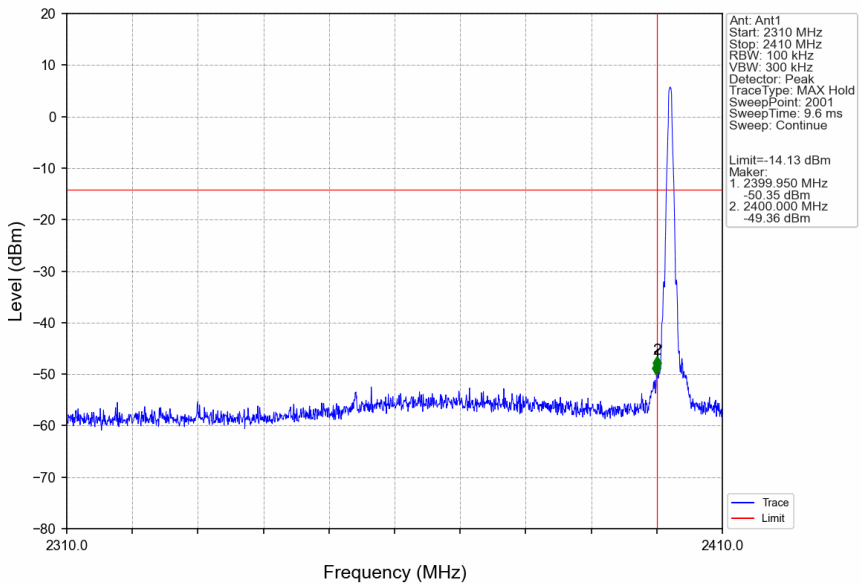
6.2.2 CSE

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



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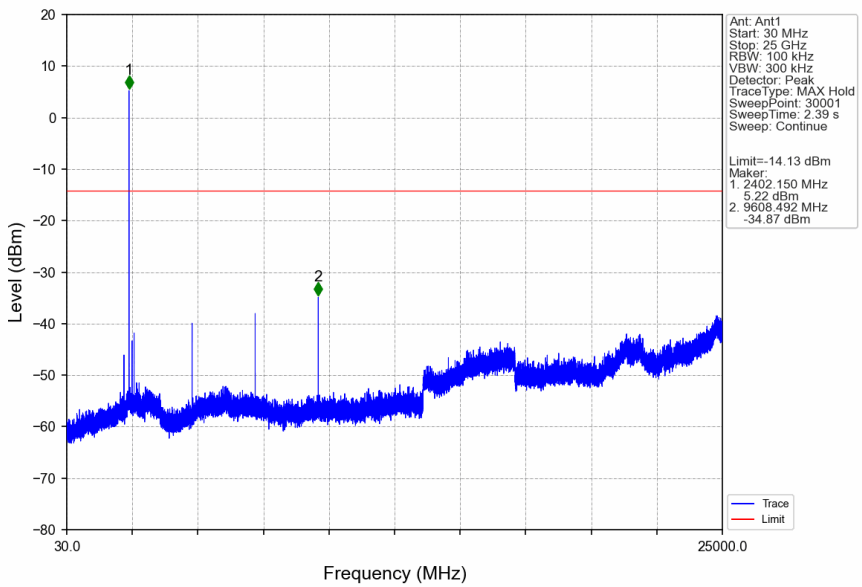

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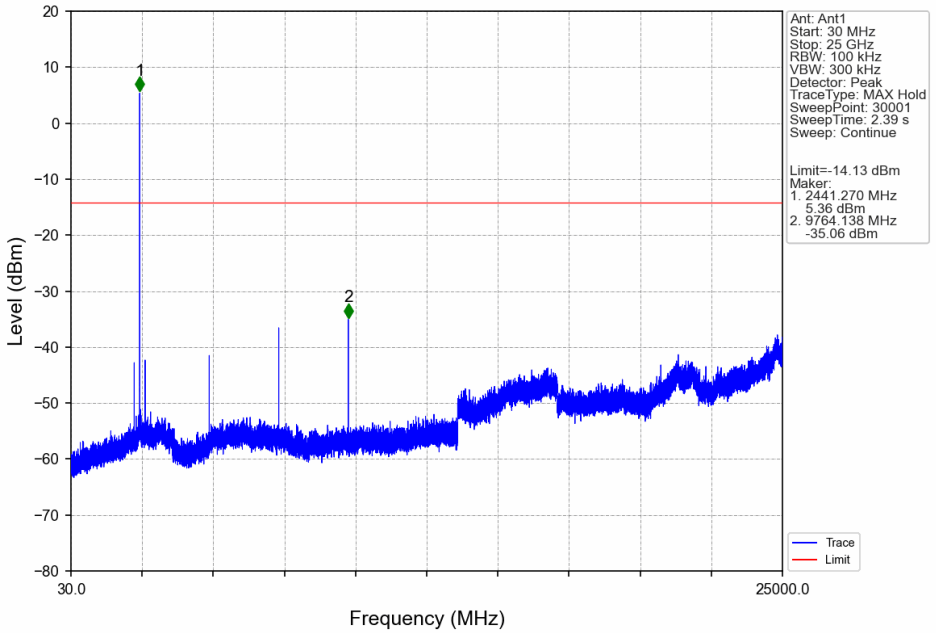
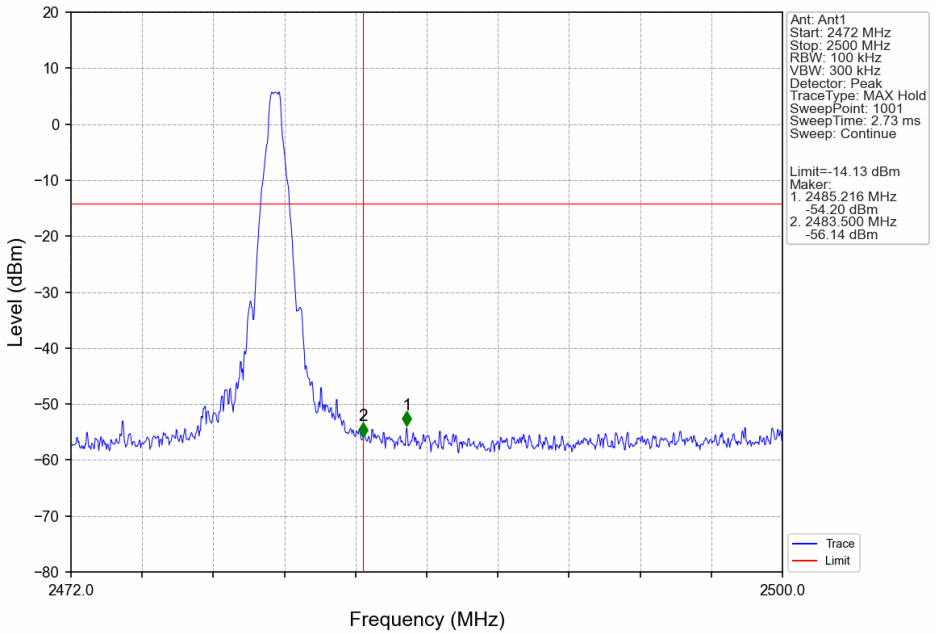
GFSK_DH5_MCH_2441MHz_Ant1_NTNV



GFSK_DH5_HCH_2480MHz_Ant1_NTNV



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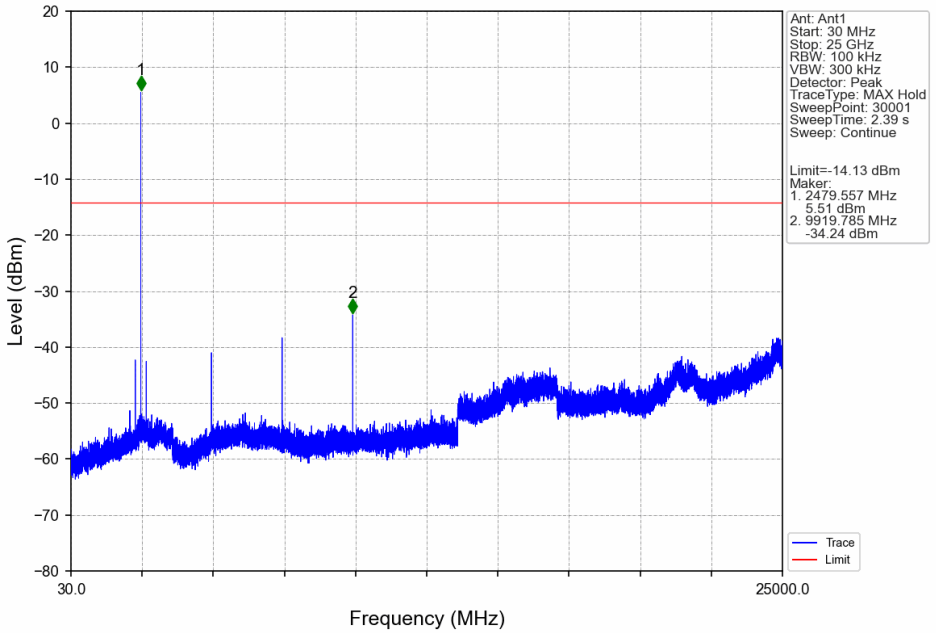
GFSK_DH5_HCH_2480MHz_Ant1_NTNV



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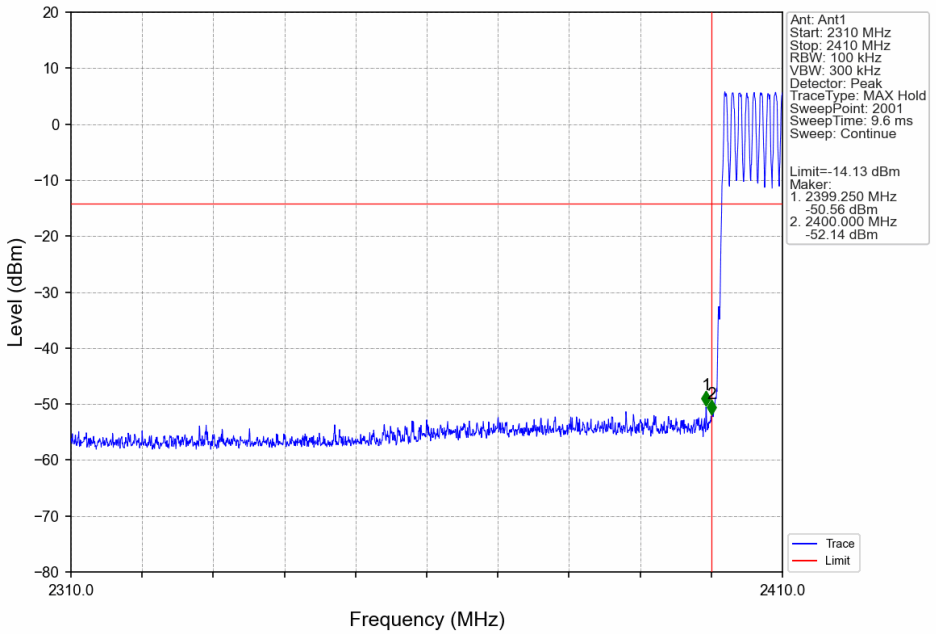

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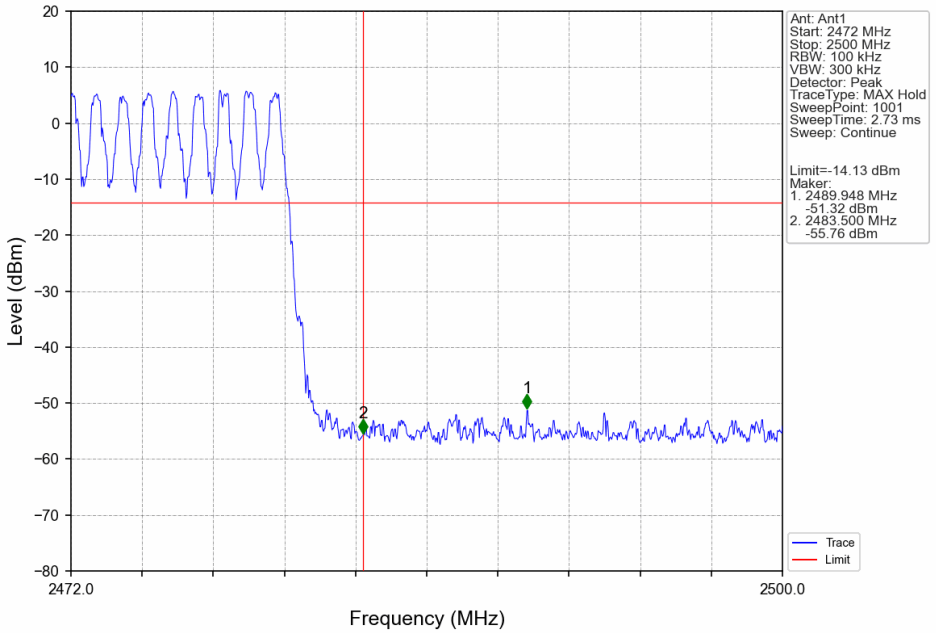
GFSK_DH5_HOPP_Ant1_NTNV



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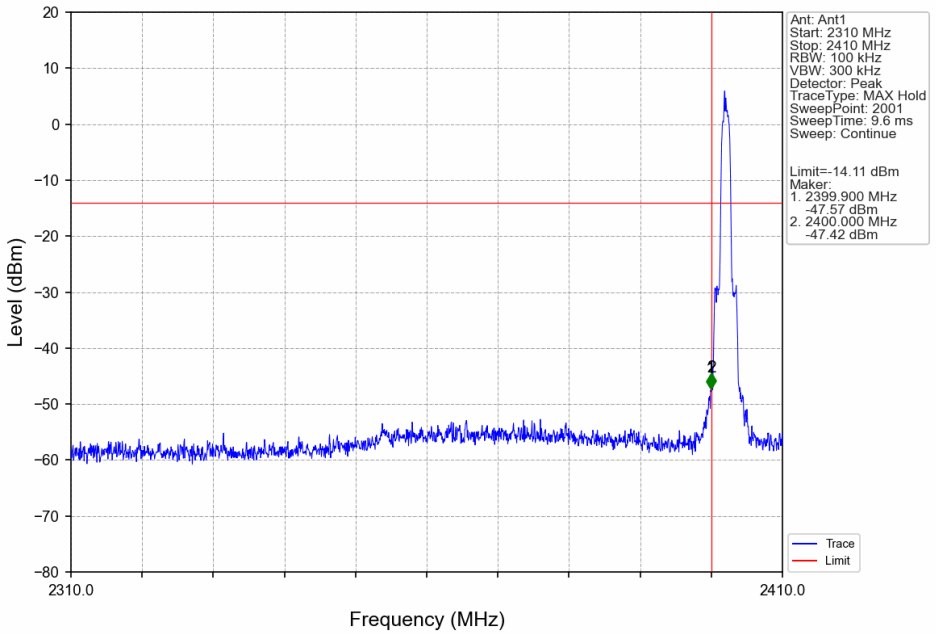

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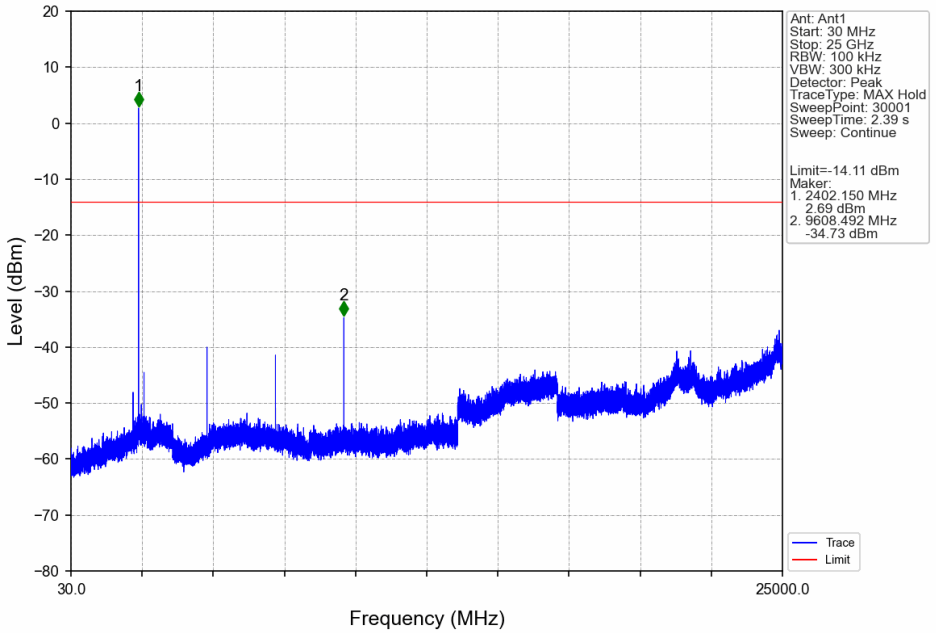
Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV



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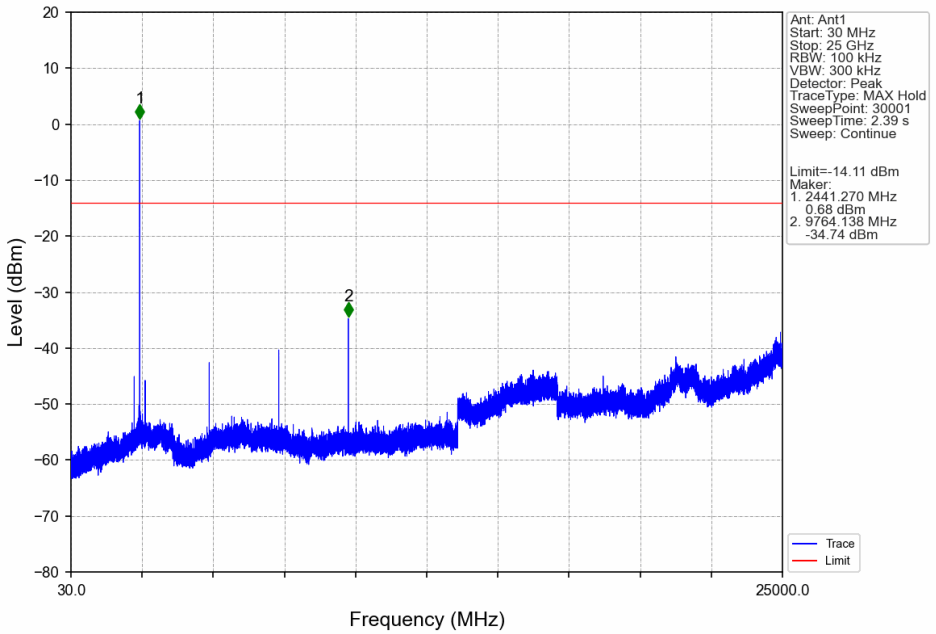

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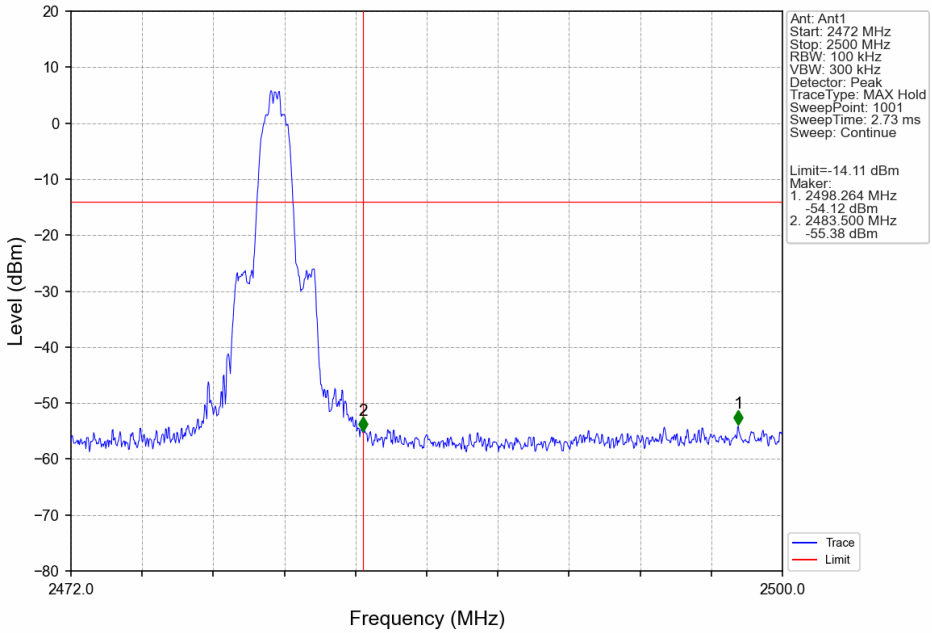
Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV



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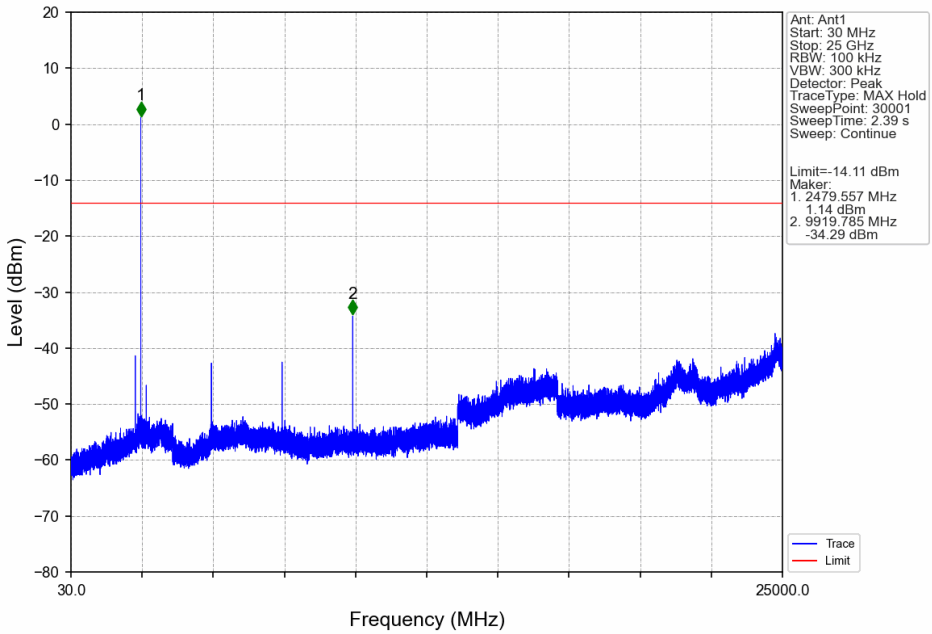

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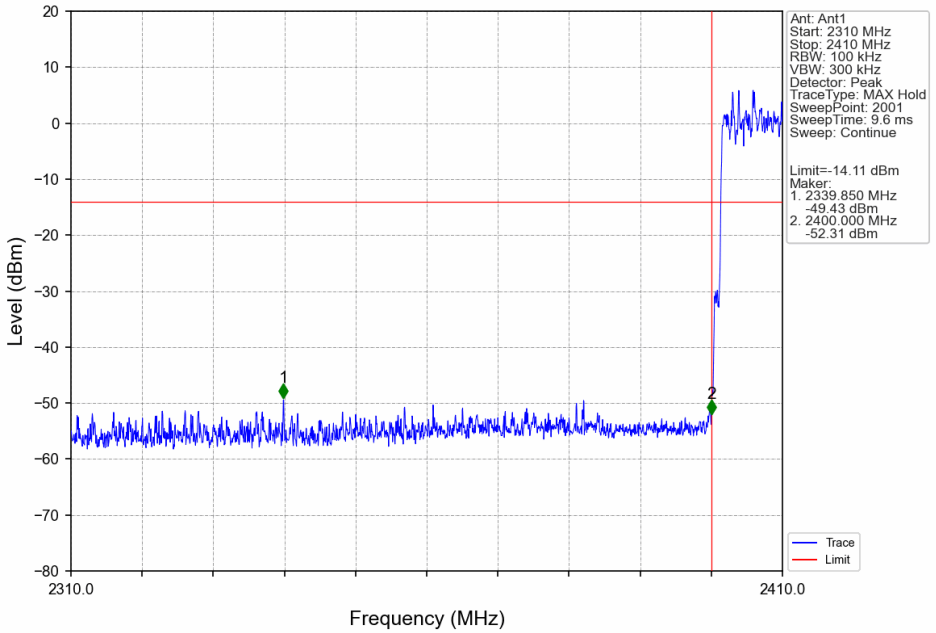
Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV



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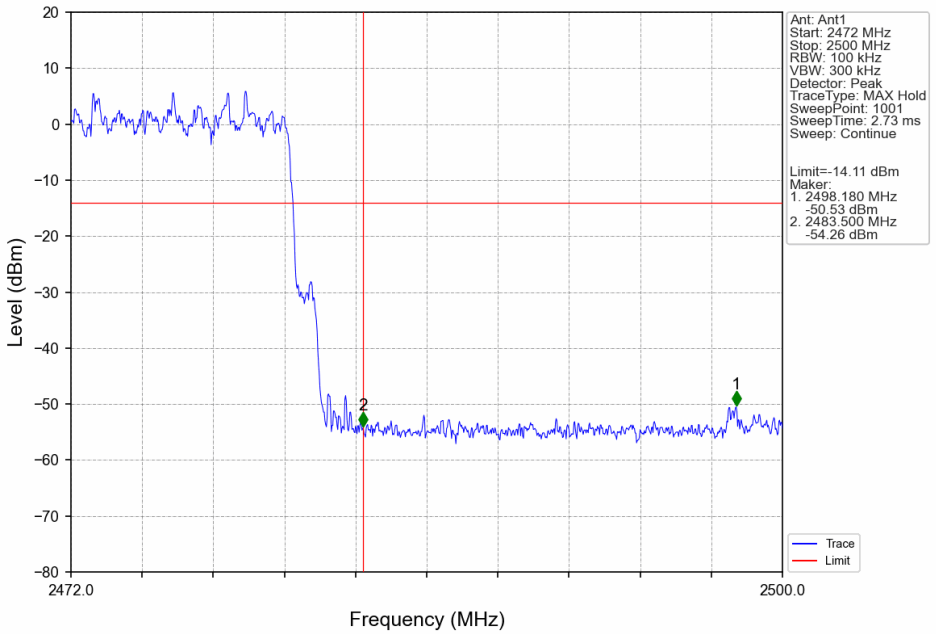

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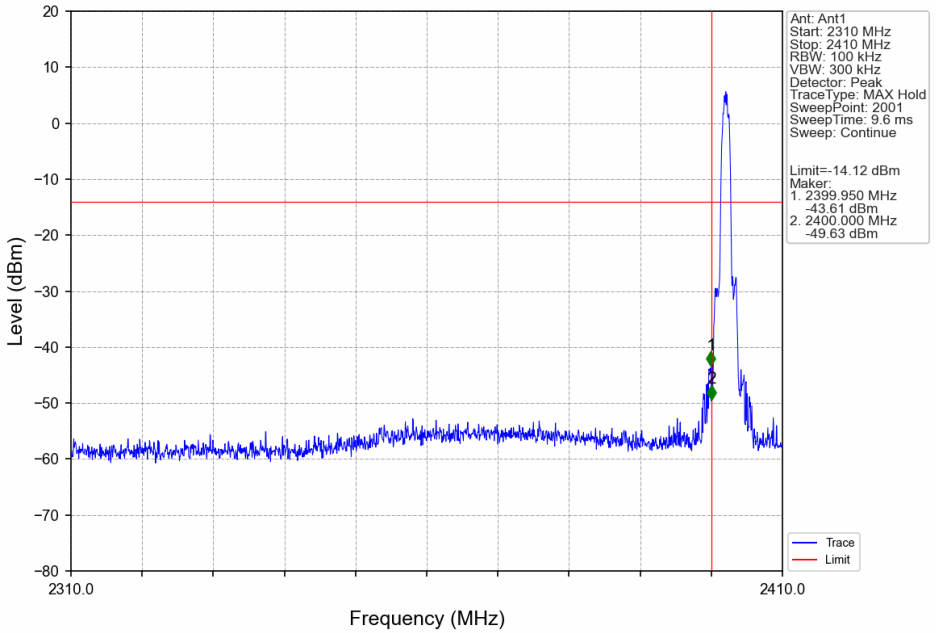
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



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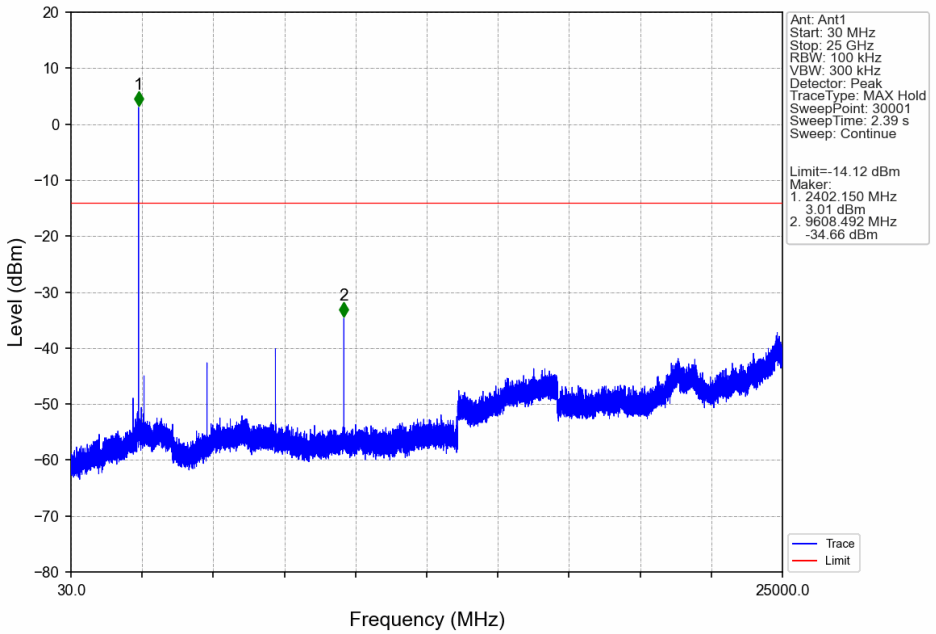

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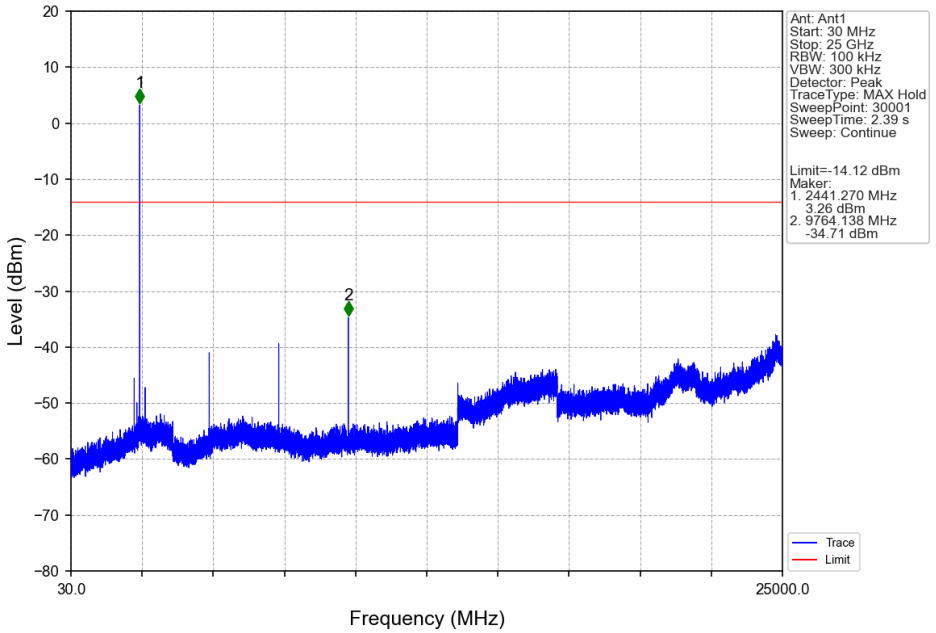
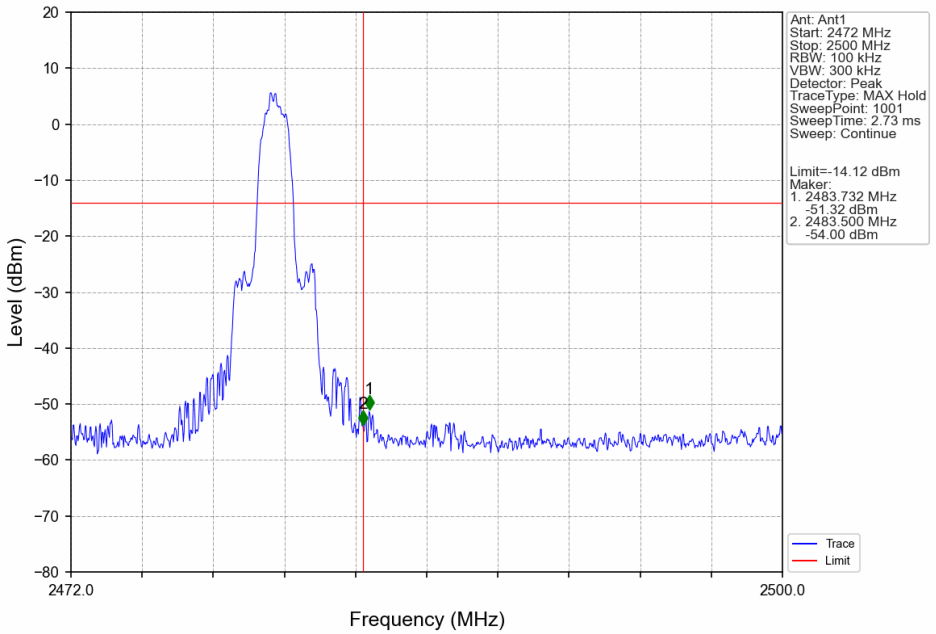
8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV



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