TEST REPORT

Application No.:	GZCR2404000400AT
Applicant:	ambie Corporation
Address of Applicant:	Toranomon Hills Business Tower 4F, 1-17-1 Toranomon, Minato-ku, Tokyo, 105-6404, Japan
Manufacturer:	ambie Corporation
Address of Manufacturer:	Toranomon Hills Business Tower 4F, 1-17-1 Toranomon, Minato-ku, Tokyo, 105-6404, Japan
Factory:	Hezhou Zhaoyang Electronics Technology Co., Ltd
Address of Factory:	Registered address:1/F of Building#1 and 1-3/F of Building#2, North of Guishi North 3rd Road (phase I), Left Side of Industrial Avenue in Industrial Park, Zhongshan, Hezhou, Guangxi P.R. China Zip code:542600
Product Name:	AM-TW02
Model No.:	AM-TW02
Trade Mark:	ambie
Standard(s) :	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2024-04-22
Date of Test:	2024-04-29 to 2024-05-15
Date of Issue:	2024-06-04
Test Result:	**Pass***

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

Ricky Liu
Manager

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Revision Record			
Version	**Report No.**	**Date**	**Remark**
01	GZCR240400040003	2024-06-04	Original

Authorized for issue by				
		Jim Li **Jim Li/Project Engineer**		
		vico cui **Vico Cui/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**
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
Radiated Emissions which fall in the restricted bands		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

Note:

E.U.T./EUT means Equipment Under Test.

Pass means the test result passed the test standard requirement, please find the detailed decision rule in the report relative section.

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4 General Information

4.1 Details of E.U.T.

Power supply:	For earbuds DC 3.85 V powered built-in battery as below for normal working: Rated: DC 3.85 V, 0.135Wh, 35mAh DC 3.8 V charged by charging case For charging case DC 3.8 V powered built-in battery as below for normal working: Model: HJ 651535 Rated: DC 3.8 V, 310mAh, 1.178 Wh DC 5V charged by adapter
Cable(s):	For earbuds DC input pins For charging case DC output pins Type C charging ports
Test Voltage:	AC 120 V, 60 Hz & DC 3.85 V
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.3 Classic
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Number of Channels:	79
Channel Spacing:	1MHz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Antenna Type:	Integral Antenna
Antenna Gain:	-0.41 dBi according to the antenna specification
Antenna Number:	1

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.

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4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
AC/DC Adapter	HUAWEI	Model: HW-110600C02; Input: AC 100-240V,1.8A Max.50/60Hz; Output: DC 5V/2A, 10V/4A, 11V/6A Max.	JL28L4NBM03275
USB Cable (1.0m length)	/	/	/
Note Book Computer	LENOVO	ThinkPad T490	PF1D1MVJ

4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	±2.76dB
Radiated Emissions which fall in the restricted bands	±5.00dB (30MHz-1GHz; 3m);±4.38dB (30MHz-1GHz; 10m);± 5.12dB (1GHz-6GHz); ±5.38dB (6GHz-18GHz); ±5.61dB(18GHz-40GHz)
Radiated Spurious Emissions Below 1GHz	±5.00dB (3m); ±4.38dB (10m)
Radiated Spurious Emissions Above 1GHz	±5.12dB (1GHz-6GHz); ±5.38dB (6GHz-18GHz); ±5.61dB(18GHz-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
Conducted Spurious Emissions	± 0.75dB
Remark: The U_{lab} (lab Uncertainty) is less than U_{ETSI} (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.	

4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,

No.198, Kezhu Road, Science City, Economic & Technological Development Area, Guangzhou, Guangdong, China 510663

Tel: +86 20 82155555

No tests were sub-contracted.

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4.5 Test Facility

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

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian/New Zealand Regulatory Compliance Mark (RCM).

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **FCC Recognized Accredited Test Firm(Registration No.: 486818)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818.

- **ISED (Registration No.: 4620B, CAB identifier: CN0052)**

SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Innovation Science and Economic Development Canada for Wireless Device Testing laboratories to test to Canadian radio equipment requirements. Registration No. 4620B, CAB identifier: CN0052.

- **VCCI (Registration No.: R-12460, C-12584, G-20107 and T-11179)**

The 10m Semi-anechoic chamber, 966 Anechoic Chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-12460, C-12584, G-20107 and T-11179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2017, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

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5 Equipment List

Conducted Emissions at AC Power Line (150kHz-30MHz)					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
Coaxial Cable	HangTianXing	2m	EMC0107	2023-08-04	2024-08-03
Shielding Room	ChangZhou ZhongYu	8m x 3m x 3.8m	EMC0306	2022-10-16	2025-10-15
Two-Line V-Network-GZ	Rohde & Schwarz	ENV216	EMC2135	2023-09-08	2024-09-07
EMI Test Receiver (9kHz-3.6GHz)	Rohde & Schwarz	ESR3	EMC2221	2024-05-13	2025-05-12
Test Software E3r	Audix	Ver.6.11812	GZE100-77	N/A	N/A

Radiated Emissions which fall in the restricted bands					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2023-11-10	2024-11-09
EMI Test Receiver (10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2023-12-15	2024-12-14
Chamber cable (Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2022-08-24	2024-08-23
Horn Antenna (1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2022-09-23	2025-09-22
Horn Antenna (14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2023-06-18	2026-06-17
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2023-08-23	2024-08-22
MXE EMI Receiver (10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2023-10-20	2024-10-19
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2023-12-20	2026-12-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

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Radiated Spurious Emissions Below 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
966 Anechoic Chamber	Shenzhen C.R.T	CRTSGSSAC966	EMC2230	2022-04-12	2025-04-11
EMI Test Receiver(1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2229	2024-02-19	2025-02-18
Amplifier(9k-1000MHz)	SONOMA	310	EMC2237	2024-03-22	2025-03-21
TRILOG Broadband Antenna（25M-2GHz)	SCHWRZBECK	VULB 9168	EMC2238	2022-04-20	2025-04-19
Coaxial Cable	Mirco-COAX UTIFLEX ve	LA2-C125-8000	EMC2239	2023-06-14	2025-06-13
Test Software E3	Audix	Ver.6.191211	GZE100-81	N/A	N/A
Active Loop Antenna-RED	ETS-Lindgren	6502	EMC2190	2024-04-08	2026-04-07

Radiated Spurious Emissions Above 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2023-11-10	2024-11-09
EMI Test Receiver (10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2023-12-15	2024-12-14
Chamber cable (Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2022-08-24	2024-08-23
Horn Antenna (1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2022-09-23	2025-09-22
Horn Antenna (14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2023-06-18	2026-06-17
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2023-11-10	2024-11-09
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2023-08-23	2024-08-22
MXE EMI Receiver (10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2023-10-20	2024-10-19
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2023-12-20	2026-12-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

RF Conducted Test					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
MI CABLE	SGS-EMC	0.8M	EMC2137	2023-11-02	2025-11-01
4X4 Power sensor Unit	TST	TSPS2023R	EMC2226	2023-08-23	2024-08-22
Test Software	TST	V2.0	GZE100-78	N/A	N/A
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2023-08-23	2024-08-22

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General used equipment					
Equipment	**Manufacturer**	**Model No**	**Inventory No**	**Cal Date**	**Cal Due Date**
DMM	Fluke	73	EMC0006	2023-06-11	2024-06-10

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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

Standard 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.15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -0.41 dBi.

Antenna location: Refer to internal photo.

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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: 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 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207
Test Method: ANSI C63.10 (2013) Section 6.2
Limit:

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
*Decreases with the logarithm of the frequency.		
Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz		

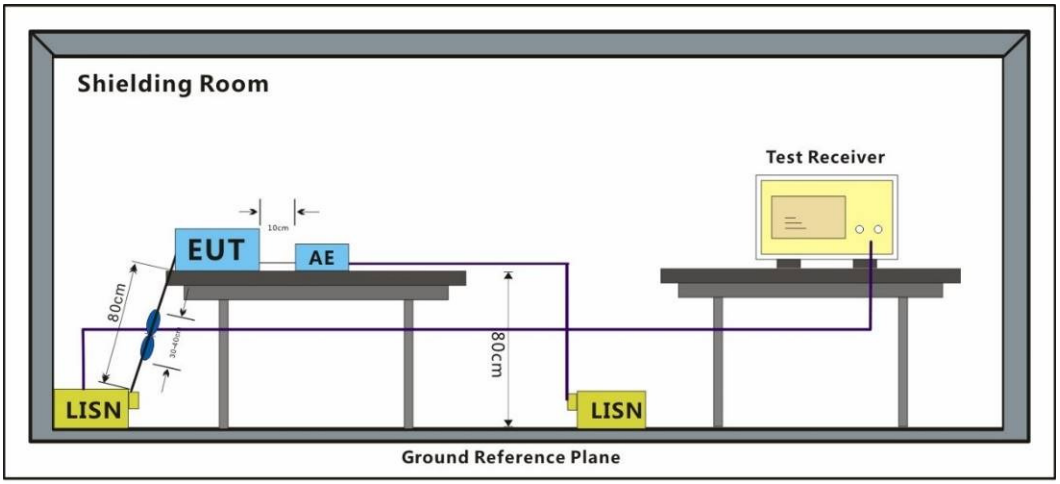
7.1.1 E.U.T. Operation

Operating Environment:
Temperature: 23.6 °C Humidity: 56.7 % RH Atmospheric Pressure: 1020 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	Charge + TX_non-Hop mode_Keep the EUT in charging and continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.1.3 Test Setup Diagram



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7.1.4 Measurement Procedure and Data

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.

4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: Level=Read Level+ Cable Loss+ LISN Factor

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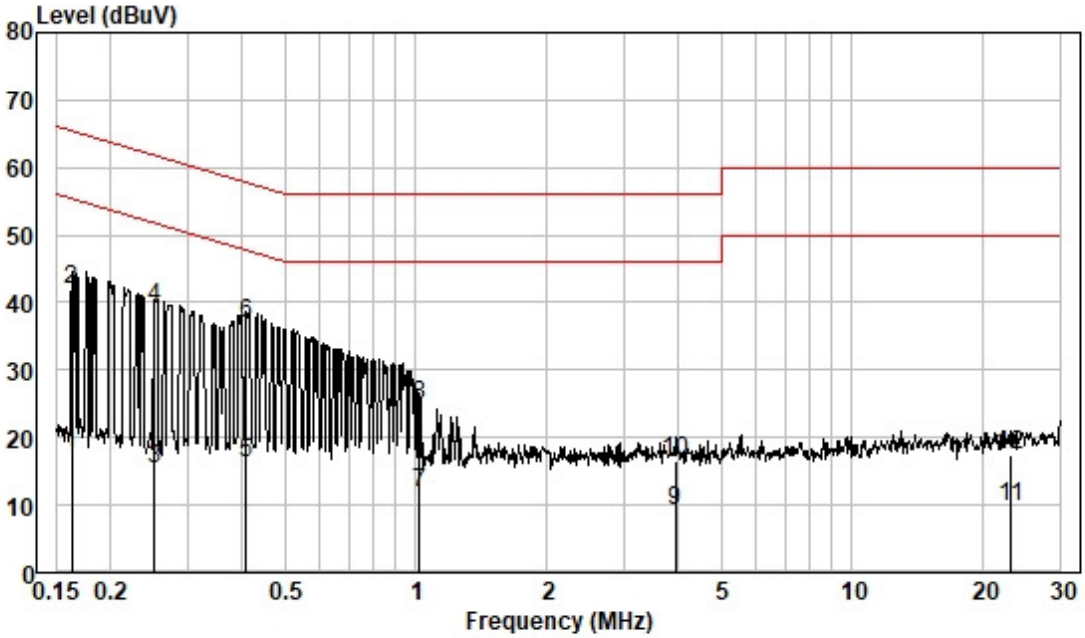
Test Mode: 01; Line: Live line



Pol :LINE
Mode :
Model :
Power :

	Frequenc MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
1	0.162	8.00	0.04	9.55	17.59	55.34	-37.75	Average
2	0.162	32.41	0.04	9.55	42.00	65.34	-23.34	QP
3	0.252	5.84	0.04	9.56	15.44	51.69	-36.25	Average
4	0.252	29.72	0.04	9.56	39.32	61.69	-22.37	QP
5	0.408	6.58	0.05	9.56	16.19	47.68	-31.49	Average
6	0.408	27.39	0.05	9.56	37.00	57.68	-20.68	QP
7	1.021	2.08	0.07	9.57	11.72	46.00	-34.28	Average
8	1.021	15.15	0.07	9.57	24.79	56.00	-31.21	QP
9	3.943	-0.52	0.18	9.60	9.26	46.00	-36.74	Average
10	3.943	6.64	0.18	9.60	16.42	56.00	-39.58	QP
11	23.140	-0.43	0.41	9.86	9.84	50.00	-40.16	Average
12	23.140	7.07	0.41	9.86	17.34	60.00	-42.66	QP

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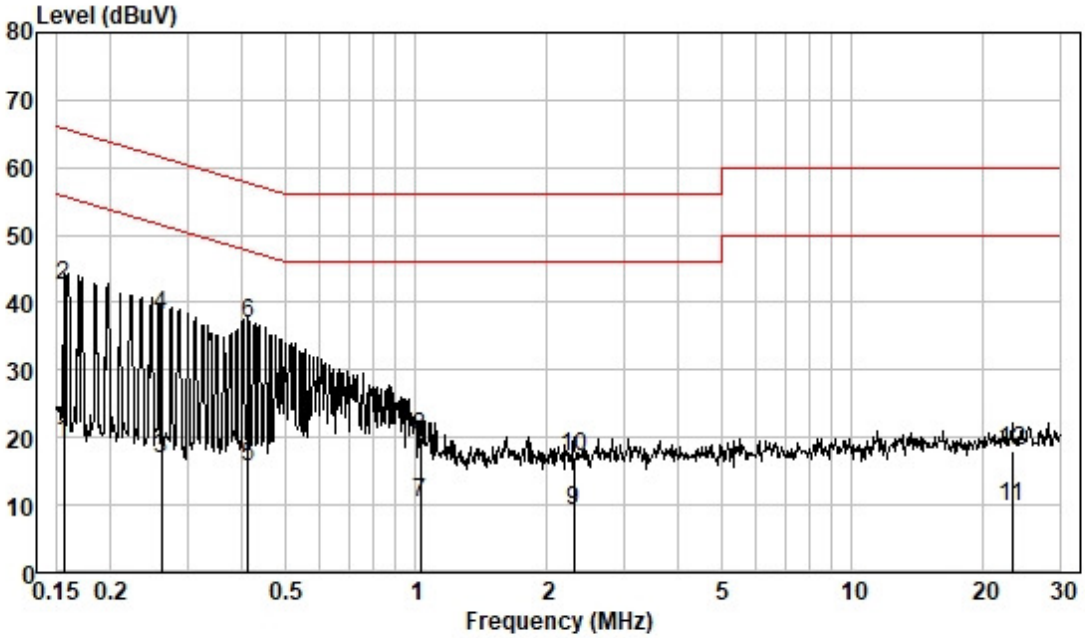
Test Mode: 01; Line: Neutral Line



Pol :NEUTRAL
Mode :
Model :
Power :

	Frequenc MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
1	0.156	9.61	0.04	9.52	19.17	55.69	-36.52	Average
2	0.156	33.07	0.04	9.52	42.63	65.69	-23.06	QP
3	0.262	7.20	0.04	9.53	16.77	51.38	-34.61	Average
4	0.262	28.44	0.04	9.53	38.01	61.38	-23.37	QP
5	0.413	6.09	0.05	9.54	15.68	47.59	-31.91	Average
6	0.413	27.28	0.05	9.54	36.87	57.59	-20.72	QP
7	1.027	0.78	0.07	9.55	10.40	46.00	-35.60	Average
8	1.027	10.51	0.07	9.55	20.13	56.00	-35.87	QP
9	2.297	-0.64	0.14	9.56	9.06	46.00	-36.94	Average
10	2.297	7.38	0.14	9.56	17.08	56.00	-38.92	QP
11	23.263	-0.76	0.41	9.95	9.60	50.00	-40.40	Average
12	23.263	7.76	0.41	9.95	18.12	60.00	-41.88	QP

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7.2 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
Limit:
Test Distance: 3 m

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.		

7.2.1 E.U.T. Operation

Operating Environment:
Temperature: 24.7 °C Humidity: 56.3 % RH Atmospheric Pressure: 1008 mbar

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for left earbuds.
Final test	10	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for right earbuds.

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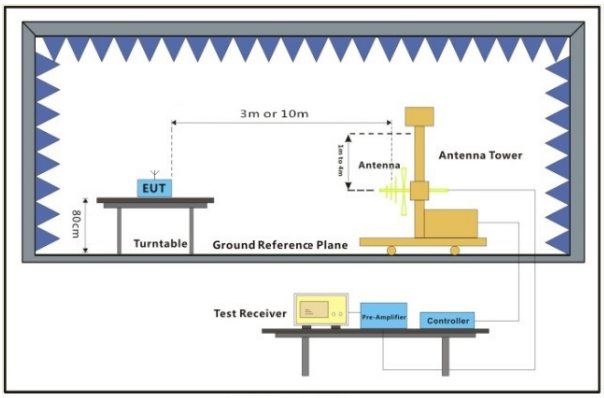
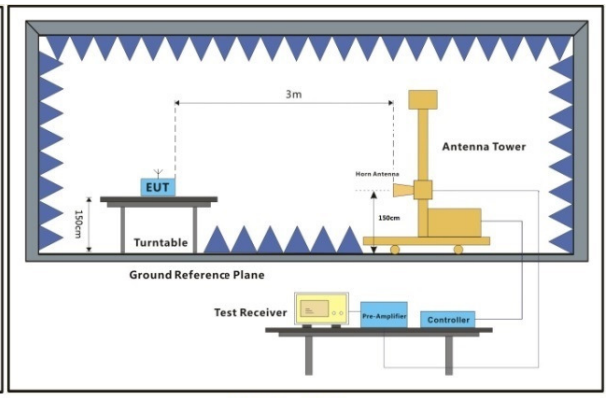
7.2.3 Test Setup Diagram



30MHz-1GHz



Above 1GHz

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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. 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 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.

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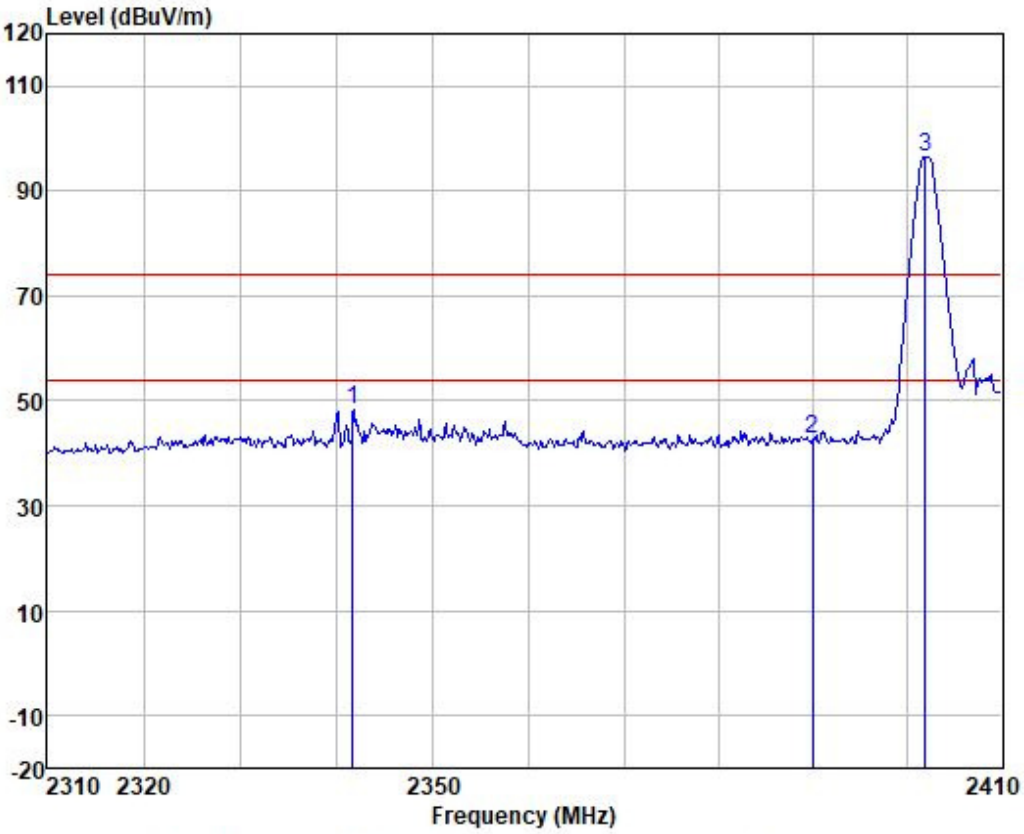
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:Low



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2341.639	54.09	27.57	3.73	37.23	48.16	74.00	-25.84	VERTICAL	peak
2	2390.000	48.38	27.68	3.77	37.21	42.62	74.00	-31.38	VERTICAL	peak
3 *	2402.000	102.20	27.71	3.78	37.21	96.48	74.00	22.48	VERTICAL	peak

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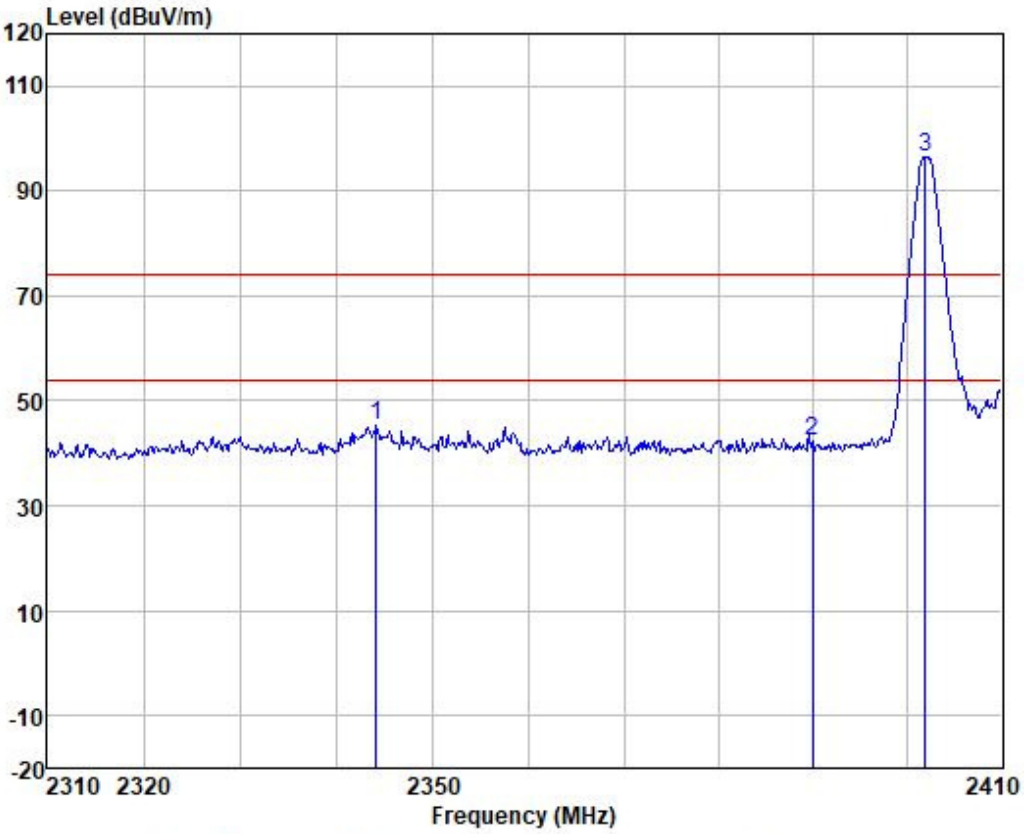
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:Low



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2344.022	51.20	27.59	3.74	37.23	45.30	74.00	-28.70	HORIZONTAL	peak
2	2390.000	48.06	27.68	3.77	37.21	42.30	74.00	-31.70	HORIZONTAL	peak
3 *	2402.000	102.09	27.71	3.78	37.21	96.37	74.00	22.37	HORIZONTAL	peak

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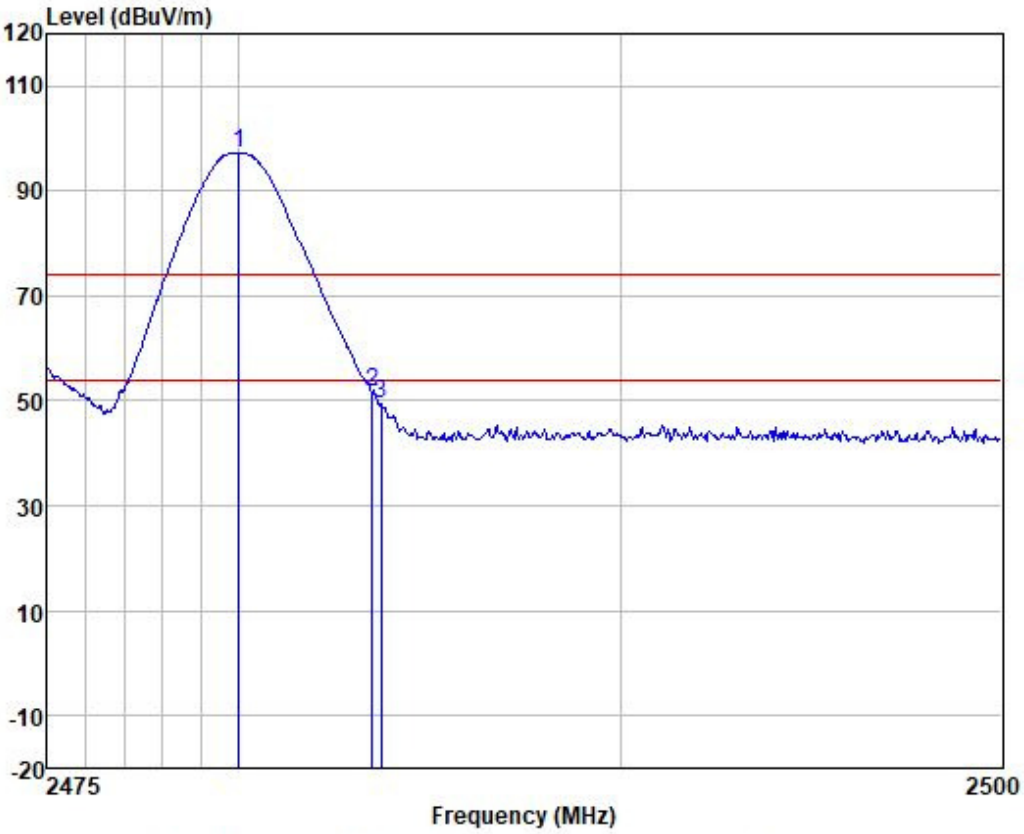
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:High



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 *	2480.000	102.61	27.84	3.82	37.19	97.08	74.00	23.08	VERTICAL	peak
2	2483.500	57.35	27.85	3.82	37.19	51.83	74.00	-22.17	VERTICAL	peak
3	2483.721	55.12	27.85	3.82	37.19	49.60	74.00	-24.40	VERTICAL	peak

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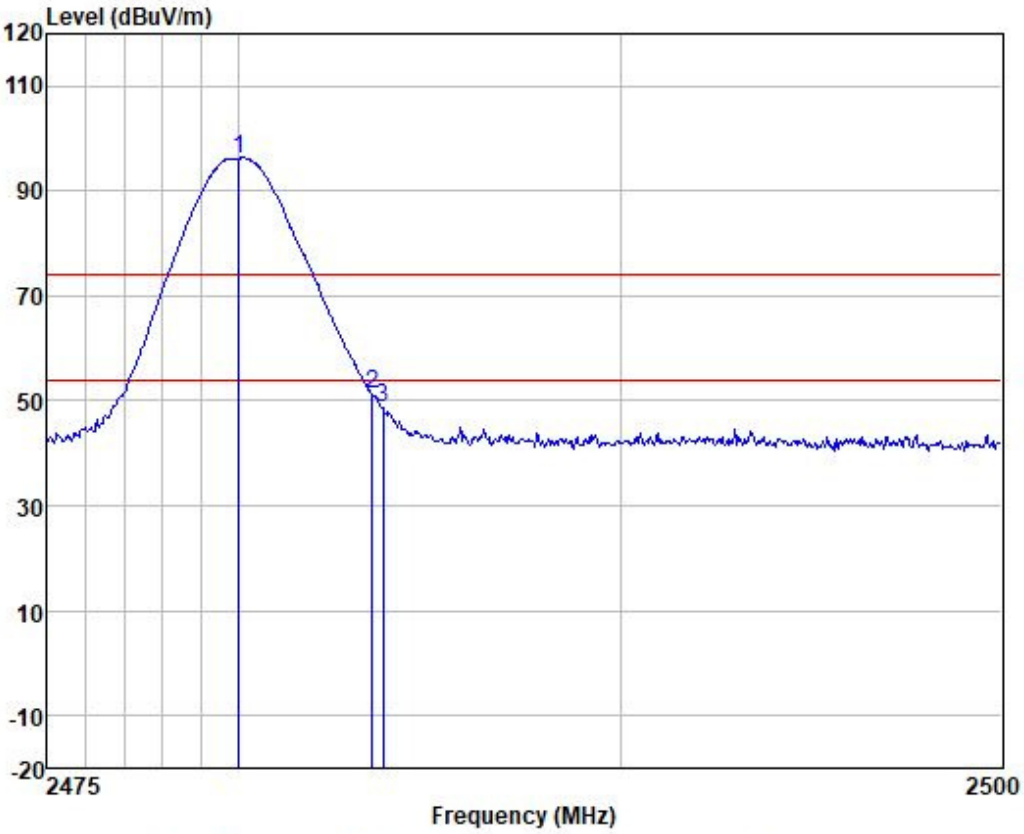
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:High



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 *	2480.000	101.77	27.84	3.82	37.19	96.24	74.00	22.24	HORIZONTAL	peak
2	2483.500	56.75	27.85	3.82	37.19	51.23	74.00	-22.77	HORIZONTAL	peak
3	2483.771	54.32	27.85	3.82	37.19	48.80	74.00	-25.20	HORIZONTAL	peak

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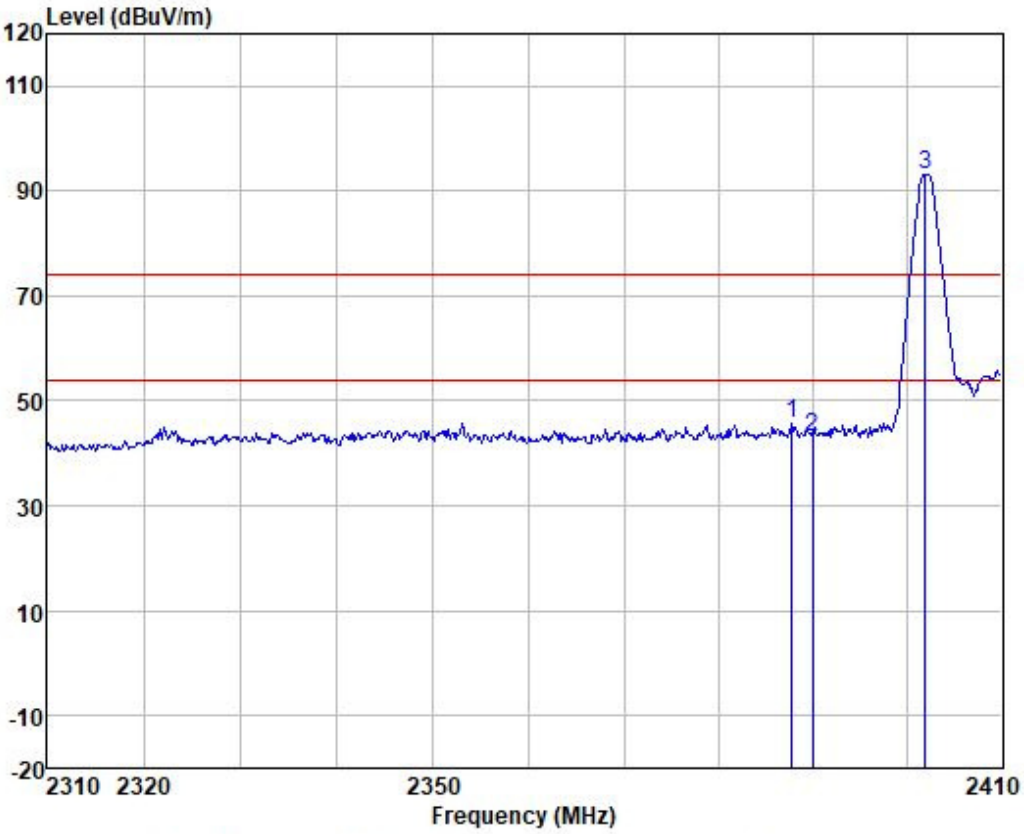
Test Mode: 10; Polarity: Vertical; Modulation:GFSK; Channel:Low



		Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1		2387.736	51.47	27.68	3.77	37.22	45.70	74.00	-28.30	VERTICAL	peak
2		2390.000	48.71	27.68	3.77	37.21	42.95	74.00	-31.05	VERTICAL	peak
3	*	2402.000	98.91	27.71	3.78	37.21	93.19	74.00	19.19	VERTICAL	peak

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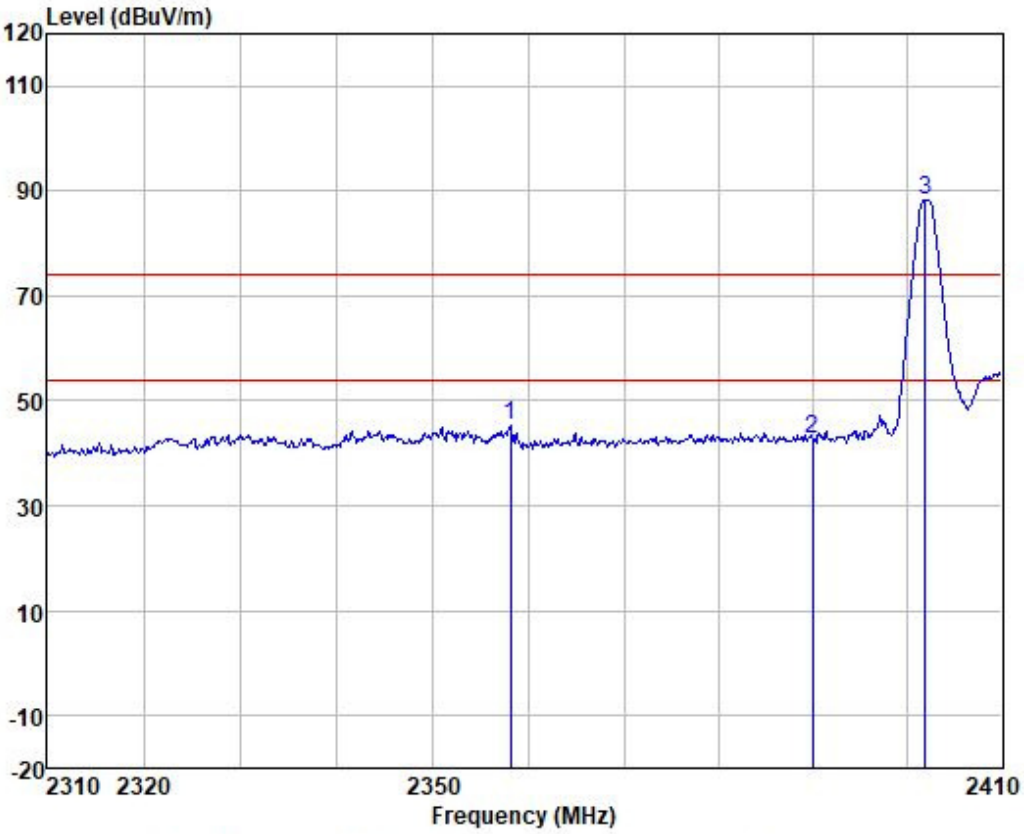
Test Mode: 10; Polarity: Horizontal; Modulation:GFSK; Channel:Low



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2358.071	51.12	27.62	3.75	37.23	45.26	74.00	-28.74	HORIZONTAL	peak
2	2390.000	48.55	27.68	3.77	37.21	42.79	74.00	-31.21	HORIZONTAL	peak
3 *	2402.000	94.07	27.71	3.78	37.21	88.35	74.00	14.35	HORIZONTAL	peak

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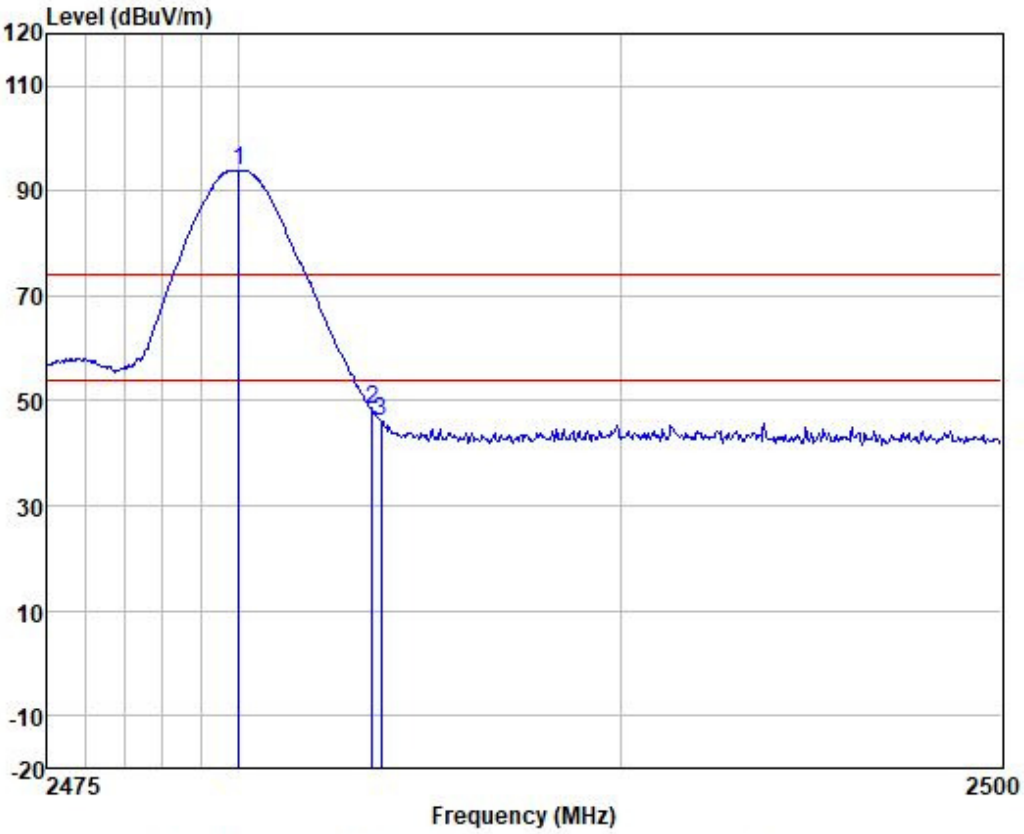
Test Mode: 10; Polarity: Vertical; Modulation:GFSK; Channel:High



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 *	2480.000	99.33	27.84	3.82	37.19	93.80	74.00	19.80	VERTICAL	peak
2	2483.500	53.79	27.85	3.82	37.19	48.27	74.00	-25.73	VERTICAL	peak
3	2483.721	51.72	27.85	3.82	37.19	46.20	74.00	-27.80	VERTICAL	peak

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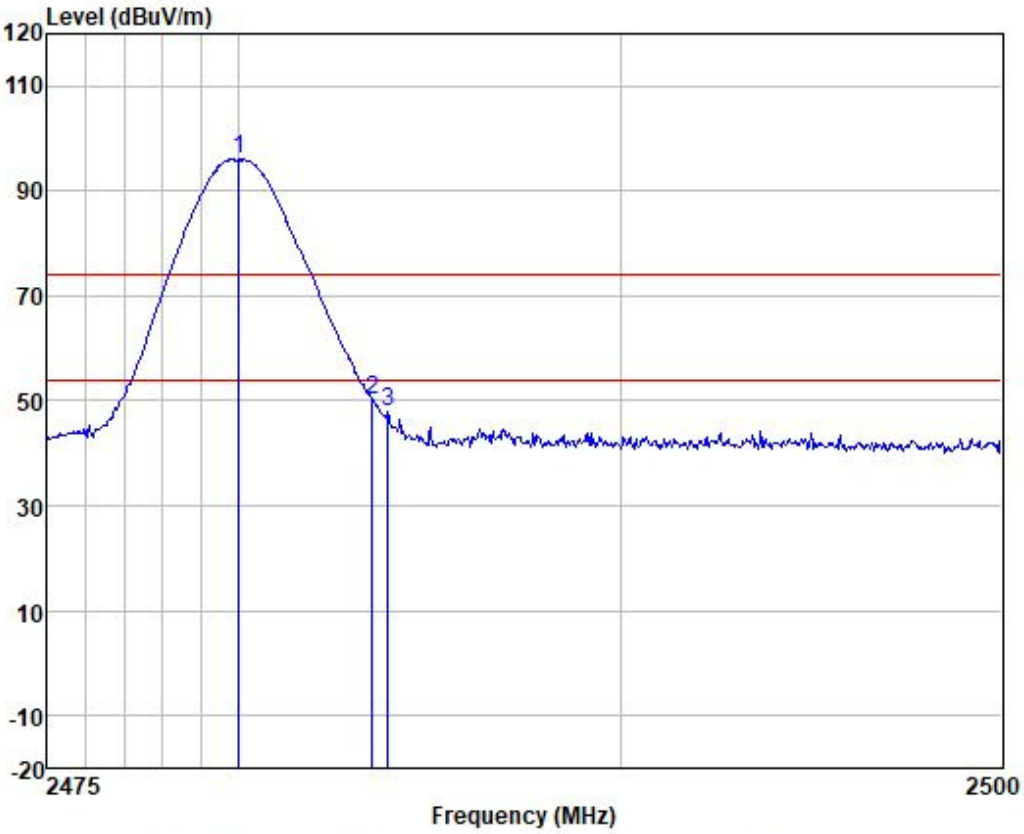
Test Mode: 10; Polarity: Horizontal; Modulation:GFSK; Channel:High



		Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	*	2480.000	101.50	27.84	3.82	37.19	95.97	74.00	21.97	HORIZONTAL	peak
2		2483.500	55.73	27.85	3.82	37.19	50.21	74.00	-23.79	HORIZONTAL	peak
3		2483.921	53.34	27.85	3.82	37.19	47.82	74.00	-26.18	HORIZONTAL	peak

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7.3 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

Limit:

Test Distance: 3 m

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

7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 23.6 °C Humidity: 57.7 % RH Atmospheric Pressure: 1020 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for left earbuds.
Final test	10	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for right earbuds.

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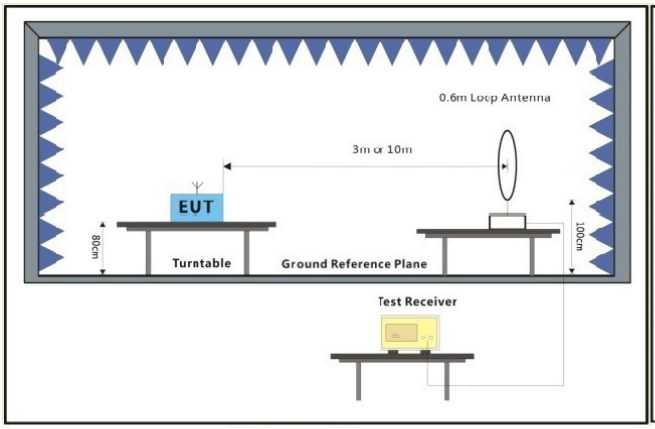
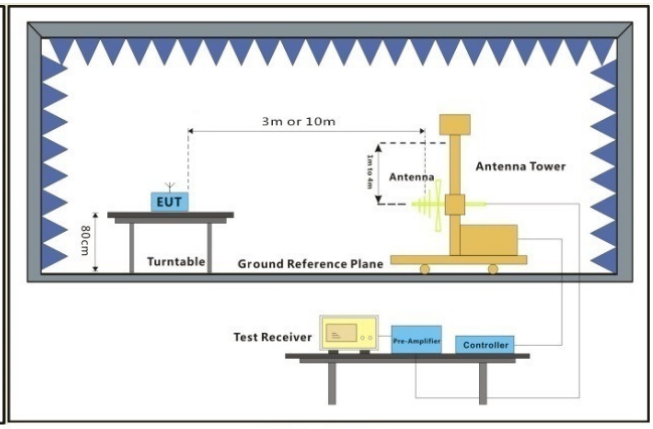
7.3.3 Test Setup Diagram



Below 30MHz



30MHz-1GHz

7.3.4 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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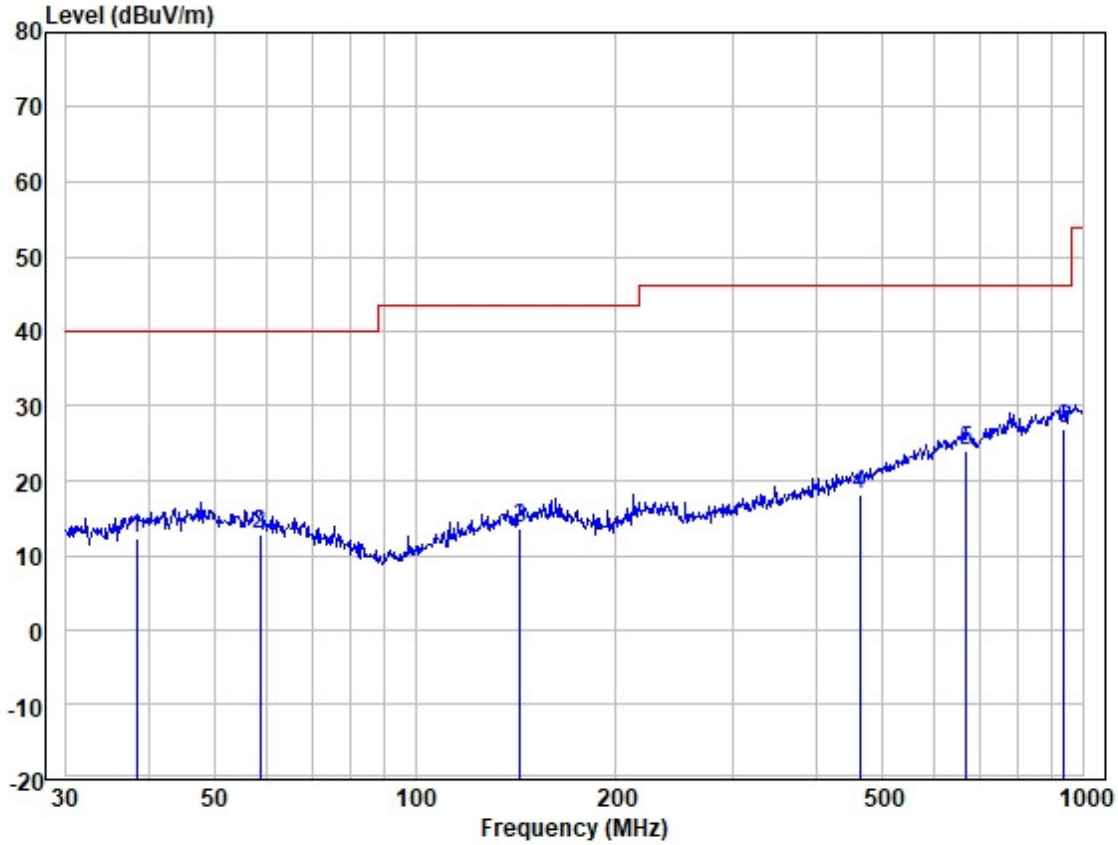
Test Mode: 00 & 10; Polarity: Horizontal



Site : 966 Chamber
Job :
Model :
Power :
Test Mode :

	Freq	Read Level	Anterna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/ Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	38.346	25.93	18.93	0.34	32.84	12.36	40.00	-27.64	HORIZONTAL	QP
2	58.613	26.24	18.99	0.41	32.80	12.84	40.00	-27.16	HORIZONTAL	QP
3	143.830	27.05	18.77	0.65	32.80	13.67	43.52	-29.85	HORIZONTAL	QP
4	463.970	26.70	22.99	1.26	32.87	18.08	46.02	-27.94	HORIZONTAL	QP
5	668.142	28.69	26.64	1.52	32.74	24.11	46.02	-21.91	HORIZONTAL	QP
6	935.546	26.84	29.78	1.78	31.37	27.03	46.02	-18.99	HORIZONTAL	QP

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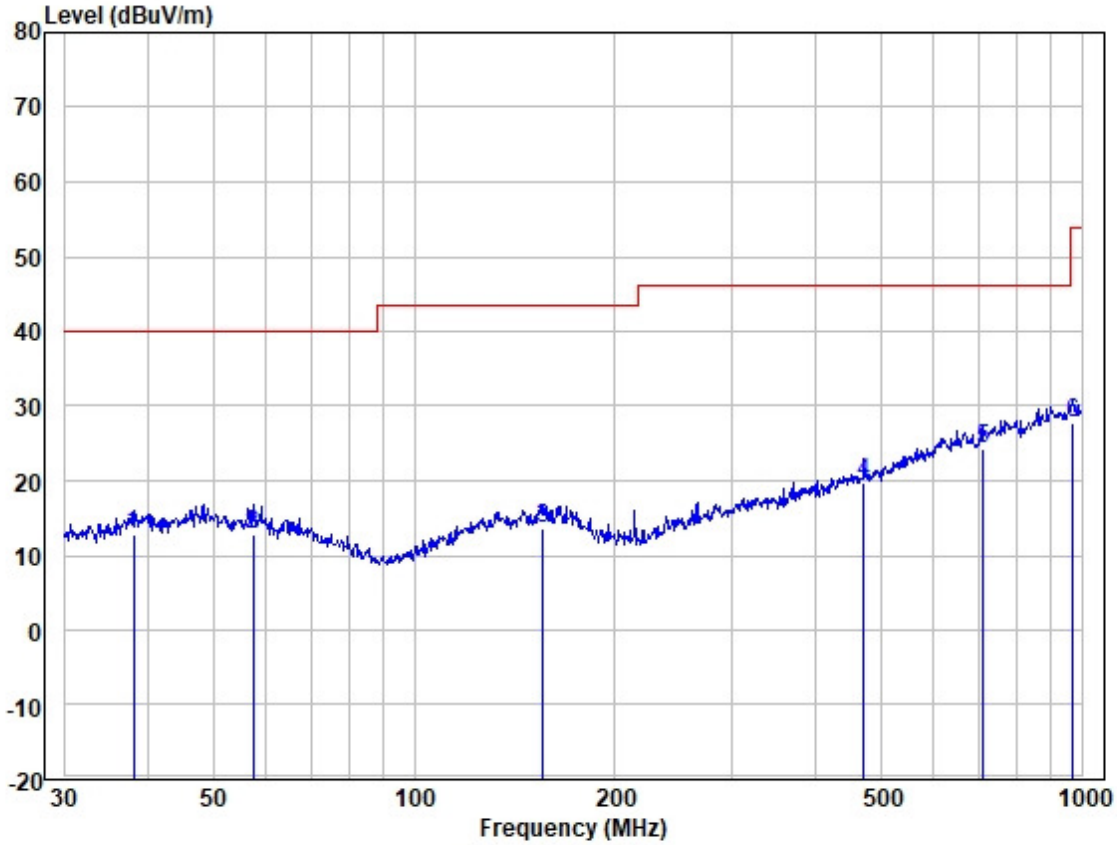
Test Mode: 00 & 10; Polarity: Vertical



Site : 966 Chamber
Job :
Model :
Power :
Test Mode :

	Freq	Read Level	Anterna Factor	Cable Loss	Preamp Factor	Measured Level	Limit Line	Over Limit	Pol/ Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	38.078	26.48	18.73	0.34	32.84	12.71	40.00	-27.29	VERTICAL	QP
2	57.392	26.18	19.08	0.40	32.80	12.86	40.00	-27.14	VERTICAL	QP
3	155.910	26.57	19.17	0.69	32.80	13.63	43.52	-29.89	VERTICAL	QP
4	470.523	28.31	23.11	1.27	32.88	19.81	46.02	-26.21	VERTICAL	QP
5	711.674	28.48	27.03	1.55	32.68	24.38	46.02	-21.64	VERTICAL	QP
6	968.934	27.10	29.78	1.82	30.88	27.82	53.98	-26.16	VERTICAL	QP

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7.4 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

Limit:

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

7.4.1 E.U.T. Operation

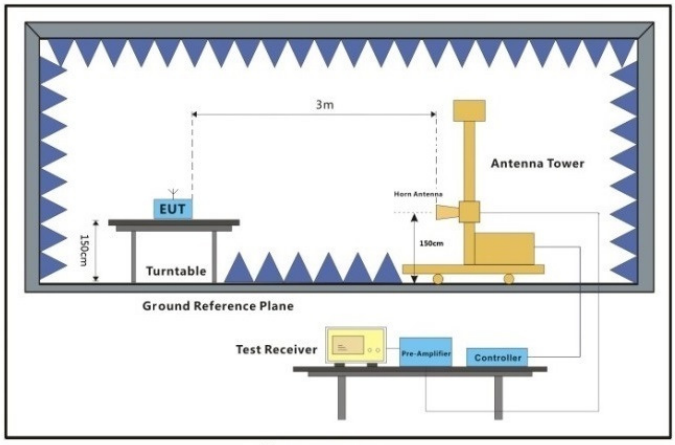
Operating Environment:

Temperature: 24.7 °C Humidity: 56.3 % RH Atmospheric Pressure: 1008 mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for left earbuds.
Final test	10	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for right earbuds.

7.4.3 Test Setup Diagram



Above 1GHz

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7.4.4 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.

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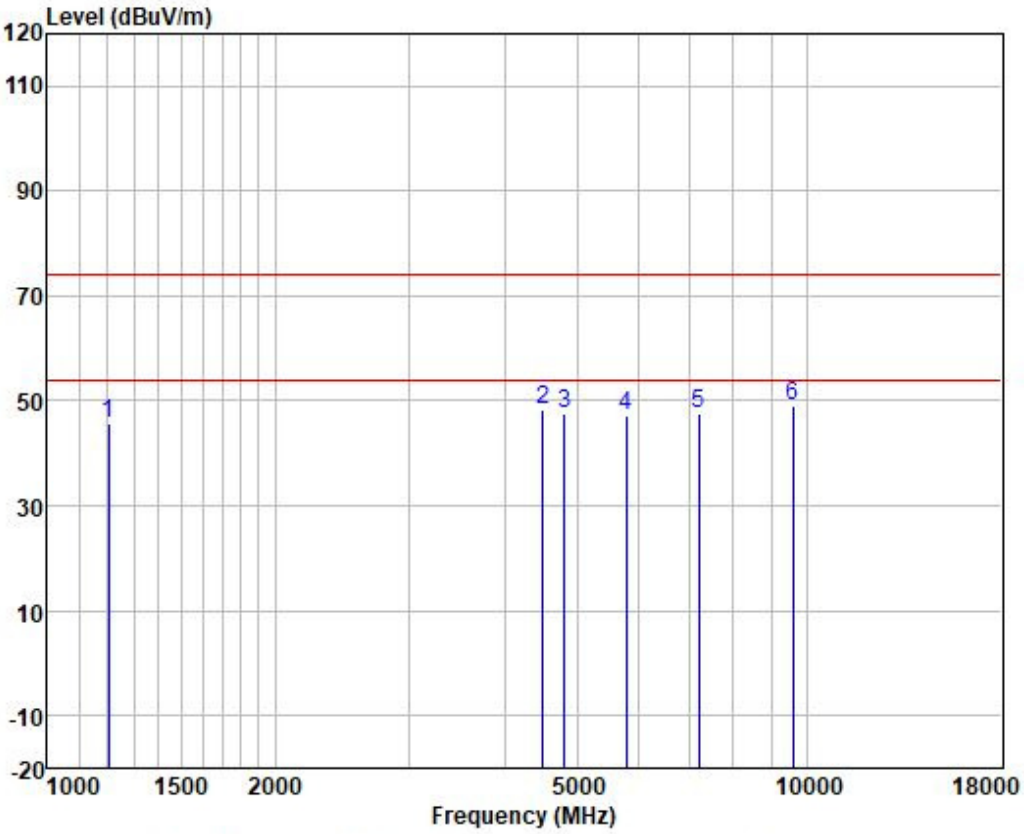
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:Low



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1203.199	57.72	23.20	2.57	37.64	45.85	74.00	-28.15	VERTICAL	peak
2	4495.125	45.96	34.17	4.78	36.63	48.28	74.00	-25.72	VERTICAL	peak
3	4804.000	44.96	34.16	5.15	36.66	47.61	74.00	-26.39	VERTICAL	peak
4	5780.300	45.57	32.66	5.76	36.79	47.20	74.00	-26.80	VERTICAL	peak
5	7206.000	41.74	35.63	6.96	36.93	47.40	74.00	-26.60	VERTICAL	peak
6	9608.000	39.41	38.68	7.65	36.82	48.92	74.00	-25.08	VERTICAL	peak

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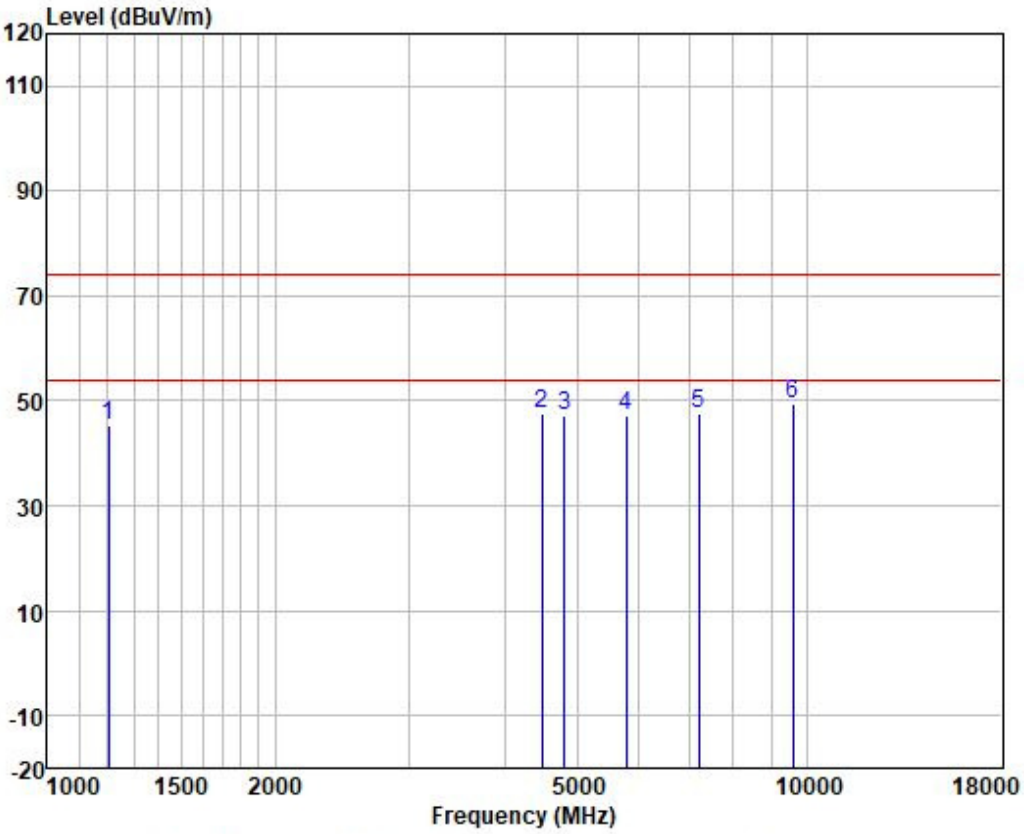
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:Low



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1203.199	57.13	23.20	2.57	37.64	45.26	74.00	-28.74	HORIZONTAL	peak
2	4482.150	45.34	34.12	4.78	36.63	47.61	74.00	-26.39	HORIZONTAL	peak
3	4804.000	44.71	34.16	5.15	36.66	47.36	74.00	-26.64	HORIZONTAL	peak
4	5780.300	45.55	32.66	5.76	36.79	47.18	74.00	-26.82	HORIZONTAL	peak
5	7206.000	41.77	35.63	6.96	36.93	47.43	74.00	-26.57	HORIZONTAL	peak
6	9608.000	40.05	38.68	7.65	36.82	49.56	74.00	-24.44	HORIZONTAL	peak

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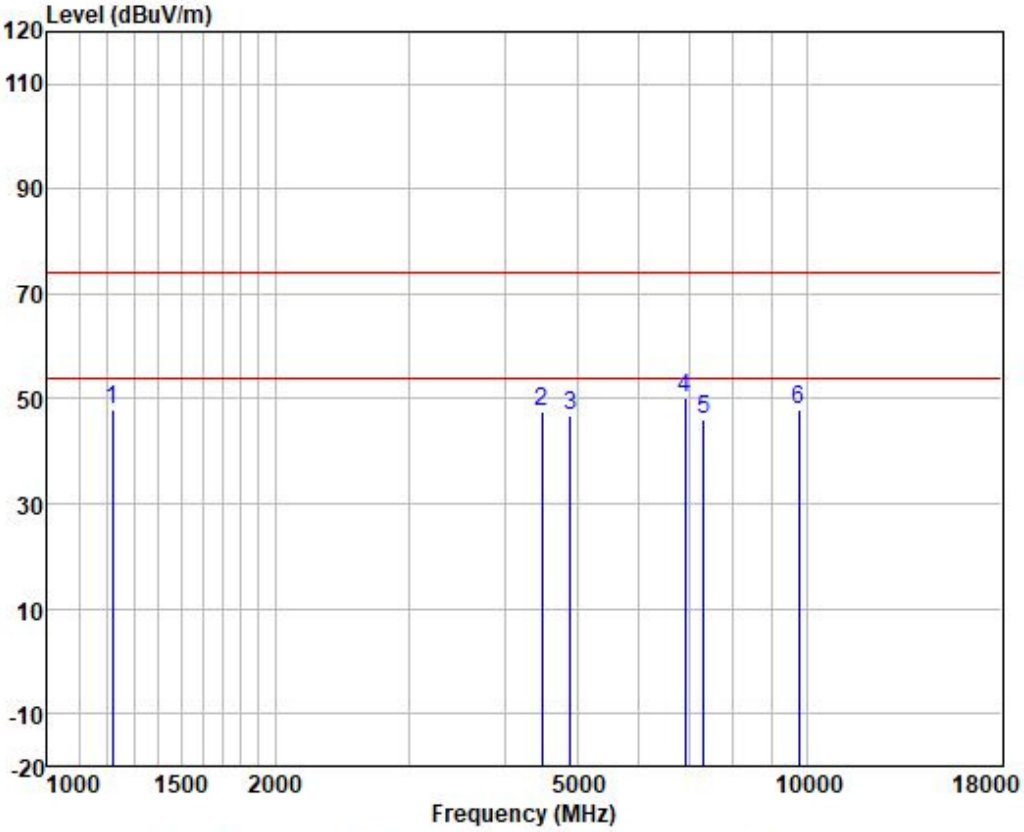
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:middle



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1217.190	59.53	23.34	2.61	37.64	47.84	74.00	-26.16	VERTICAL	peak
2	4482.150	45.21	34.12	4.78	36.63	47.48	74.00	-26.52	VERTICAL	peak
3	4880.000	44.10	34.15	5.22	36.67	46.80	74.00	-27.20	VERTICAL	peak
4	6914.763	45.07	34.97	7.08	36.88	50.24	74.00	-23.76	VERTICAL	peak
5	7320.000	40.28	36.07	6.81	36.95	46.21	74.00	-27.79	VERTICAL	peak
6	9760.000	38.32	38.81	7.65	36.81	47.97	74.00	-26.03	VERTICAL	peak

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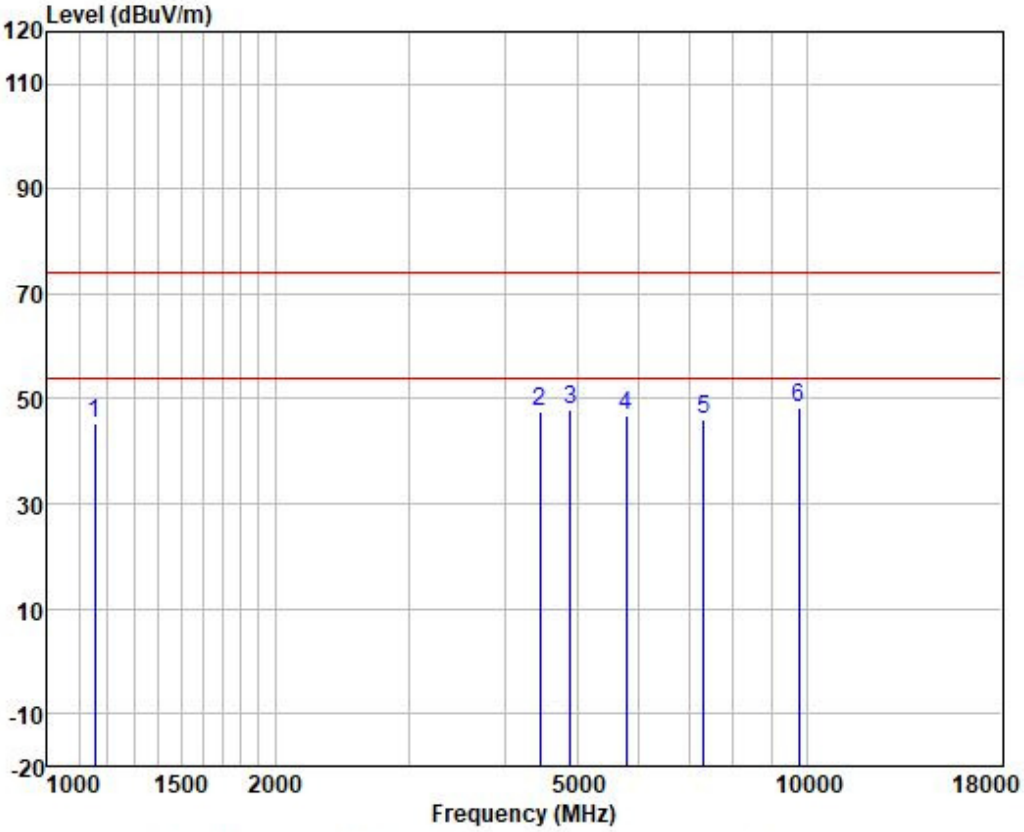
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:middle



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1155.483	57.55	22.89	2.47	37.66	45.25	74.00	-28.75	HORIZONTAL	peak
2	4456.315	45.51	34.00	4.79	36.63	47.67	74.00	-26.33	HORIZONTAL	peak
3	4880.000	45.07	34.15	5.22	36.67	47.77	74.00	-26.23	HORIZONTAL	peak
4	5780.300	45.05	32.66	5.76	36.79	46.68	74.00	-27.32	HORIZONTAL	peak
5	7320.000	40.21	36.07	6.81	36.95	46.14	74.00	-27.86	HORIZONTAL	peak
6	9760.000	38.57	38.81	7.65	36.81	48.22	74.00	-25.78	HORIZONTAL	peak

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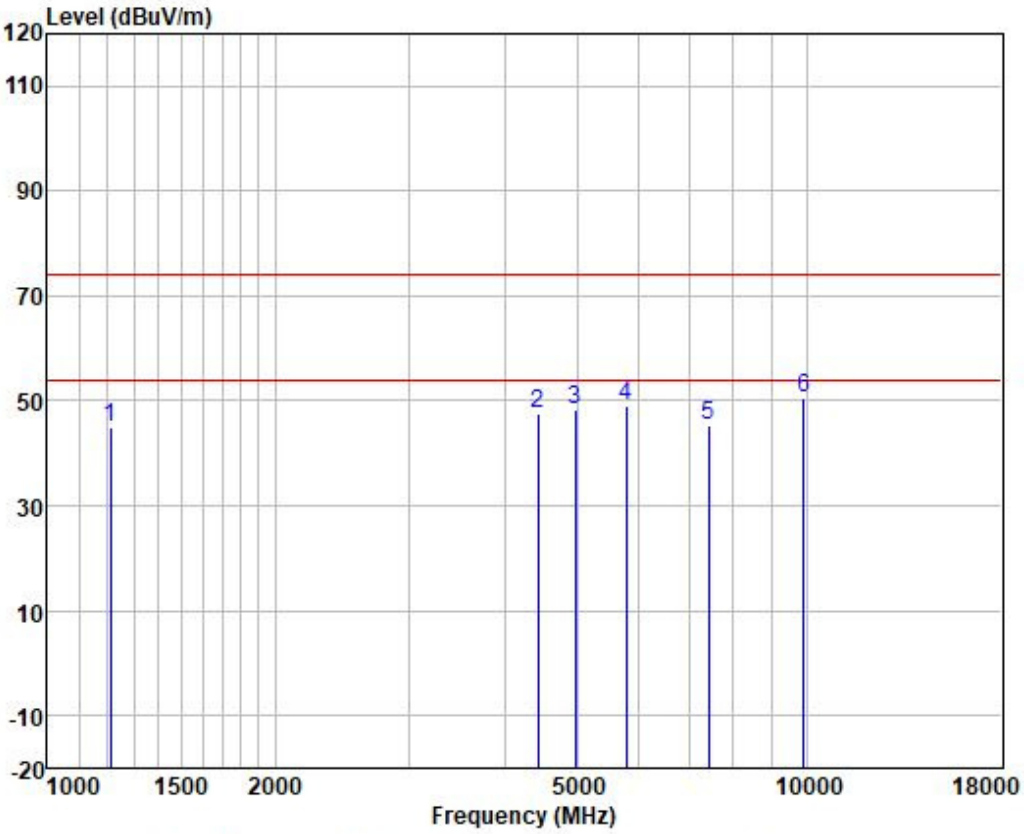
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:High



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1210.174	56.75	23.26	2.59	37.64	44.96	74.00	-29.04	VERTICAL	peak
2	4430.628	45.47	33.87	4.79	36.63	47.50	74.00	-26.50	VERTICAL	peak
3	4960.000	45.39	34.15	5.28	36.69	48.13	74.00	-25.87	VERTICAL	peak
4	5780.300	47.31	32.66	5.76	36.79	48.94	74.00	-25.06	VERTICAL	peak
5	7440.000	39.32	36.33	6.72	36.96	45.41	74.00	-28.59	VERTICAL	peak
6	9920.000	40.68	38.95	7.67	36.80	50.50	74.00	-23.50	VERTICAL	peak

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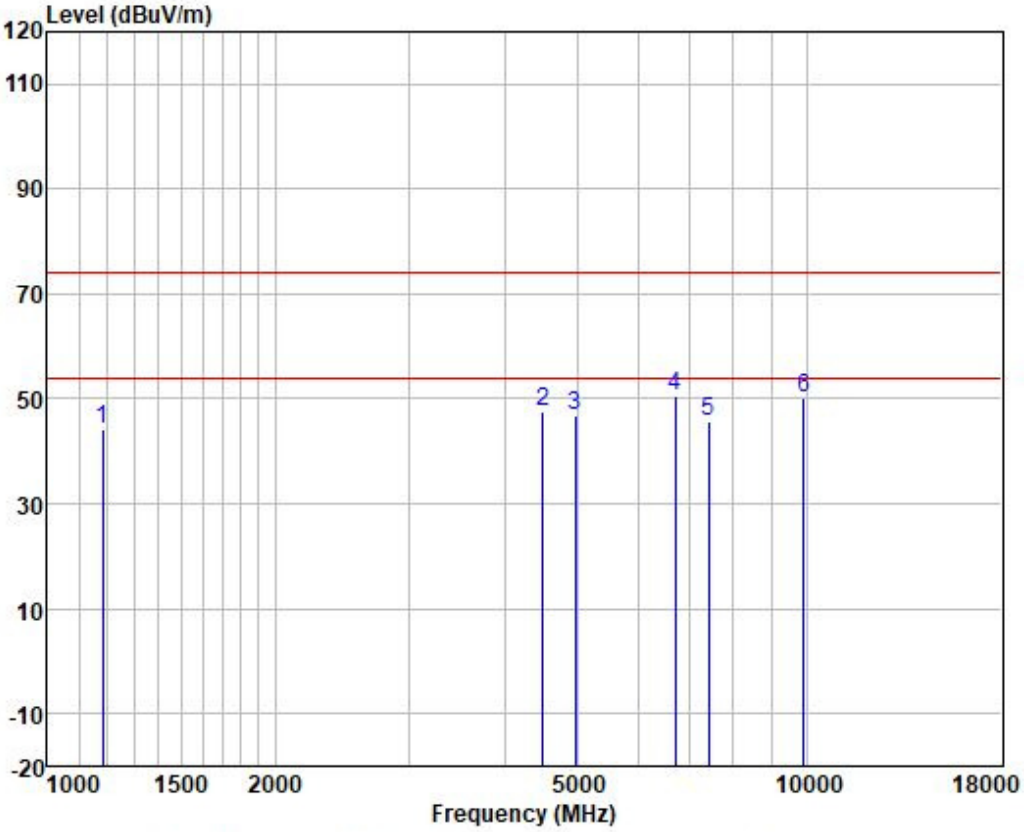
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:High



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1182.513	56.13	23.04	2.52	37.65	44.04	74.00	-29.96	HORIZONTAL	peak
2	4495.125	45.26	34.17	4.78	36.63	47.58	74.00	-26.42	HORIZONTAL	peak
3	4960.000	44.27	34.15	5.28	36.69	47.01	74.00	-26.99	HORIZONTAL	peak
4	6717.762	46.23	34.42	6.87	36.85	50.67	74.00	-23.33	HORIZONTAL	peak
5	7440.000	39.57	36.33	6.72	36.96	45.66	74.00	-28.34	HORIZONTAL	peak
6	9920.000	40.34	38.95	7.67	36.80	50.16	74.00	-23.84	HORIZONTAL	peak

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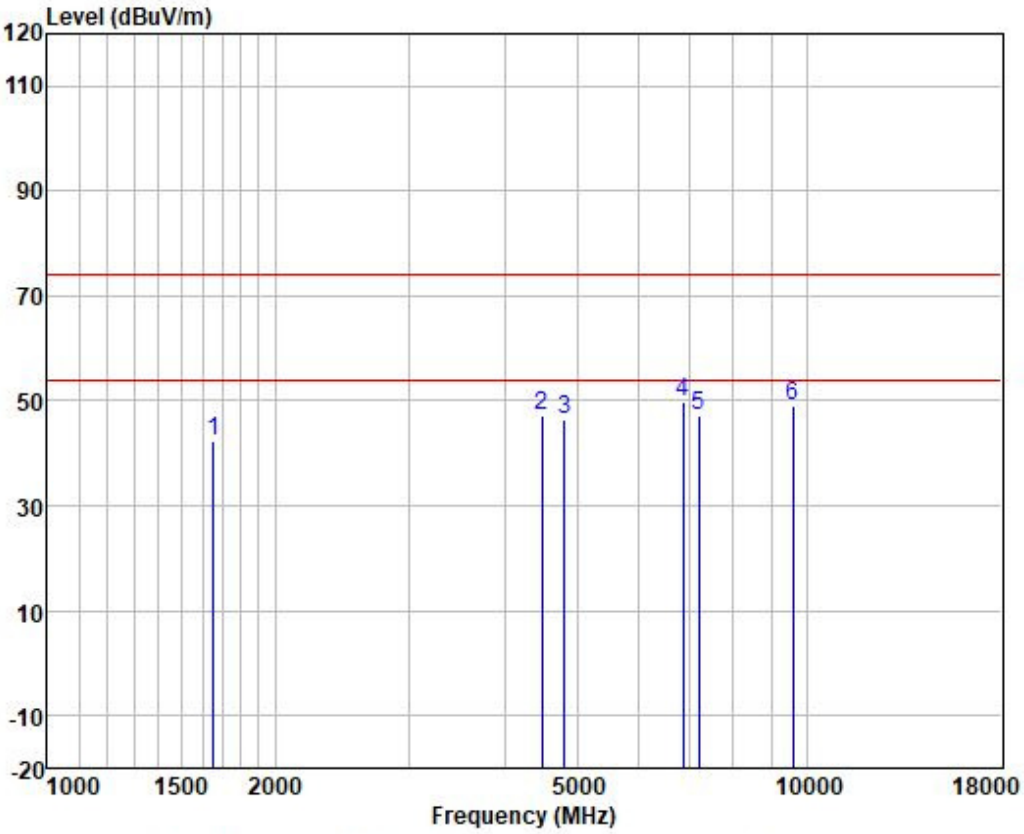
Test Mode: 10; Polarity: Vertical; Modulation:GFSK; Channel:Low



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1653.550	51.96	24.89	3.03	37.41	42.47	74.00	-31.53	VERTICAL	peak
2	4482.150	44.98	34.12	4.78	36.63	47.25	74.00	-26.75	VERTICAL	peak
3	4804.000	43.70	34.16	5.15	36.66	46.35	74.00	-27.65	VERTICAL	peak
4	6874.906	44.95	34.88	7.04	36.87	50.00	74.00	-24.00	VERTICAL	peak
5	7206.000	41.54	35.63	6.96	36.93	47.20	74.00	-26.80	VERTICAL	peak
6	9608.000	39.63	38.68	7.65	36.82	49.14	74.00	-24.86	VERTICAL	peak

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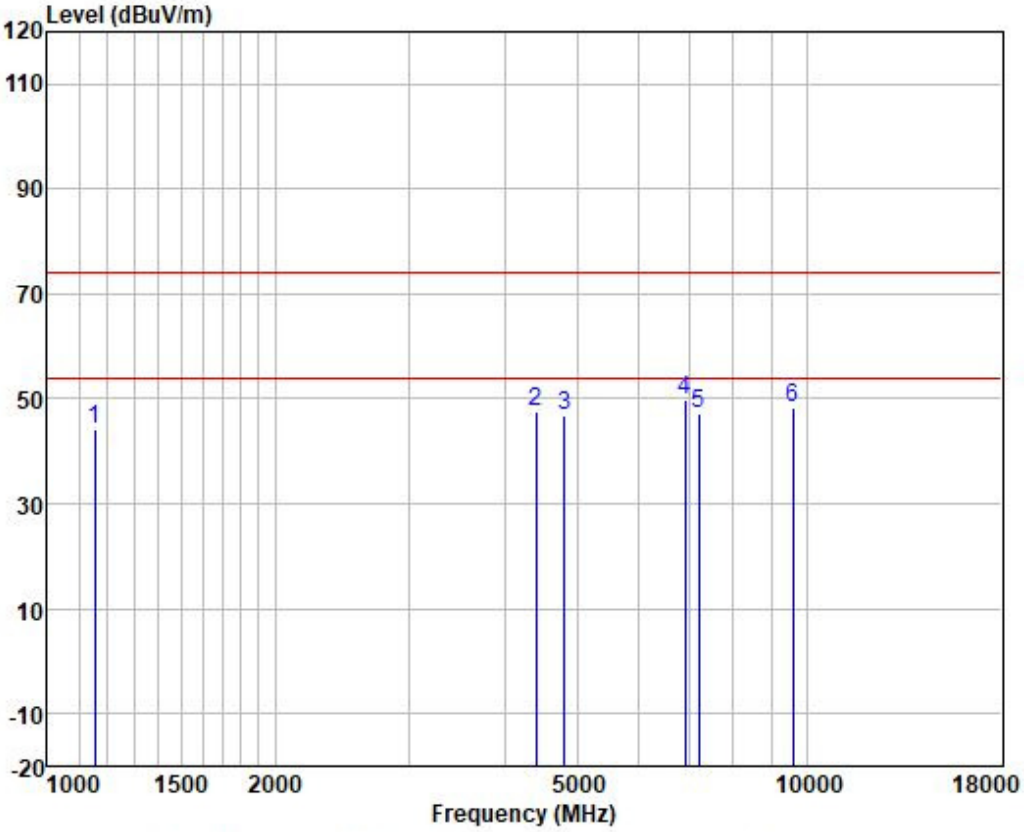
Test Mode: 10; Polarity: Horizontal; Modulation:GFSK; Channel:Low



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1155.483	56.33	22.89	2.47	37.66	44.03	74.00	-29.97	HORIZONTAL	peak
2	4405.090	45.50	33.74	4.79	36.62	47.41	74.00	-26.59	HORIZONTAL	peak
3	4804.000	44.28	34.16	5.15	36.66	46.93	74.00	-27.07	HORIZONTAL	peak
4	6914.763	44.63	34.97	7.08	36.88	49.80	74.00	-24.20	HORIZONTAL	peak
5	7206.000	41.55	35.63	6.96	36.93	47.21	74.00	-26.79	HORIZONTAL	peak
6	9608.000	38.82	38.68	7.65	36.82	48.33	74.00	-25.67	HORIZONTAL	peak

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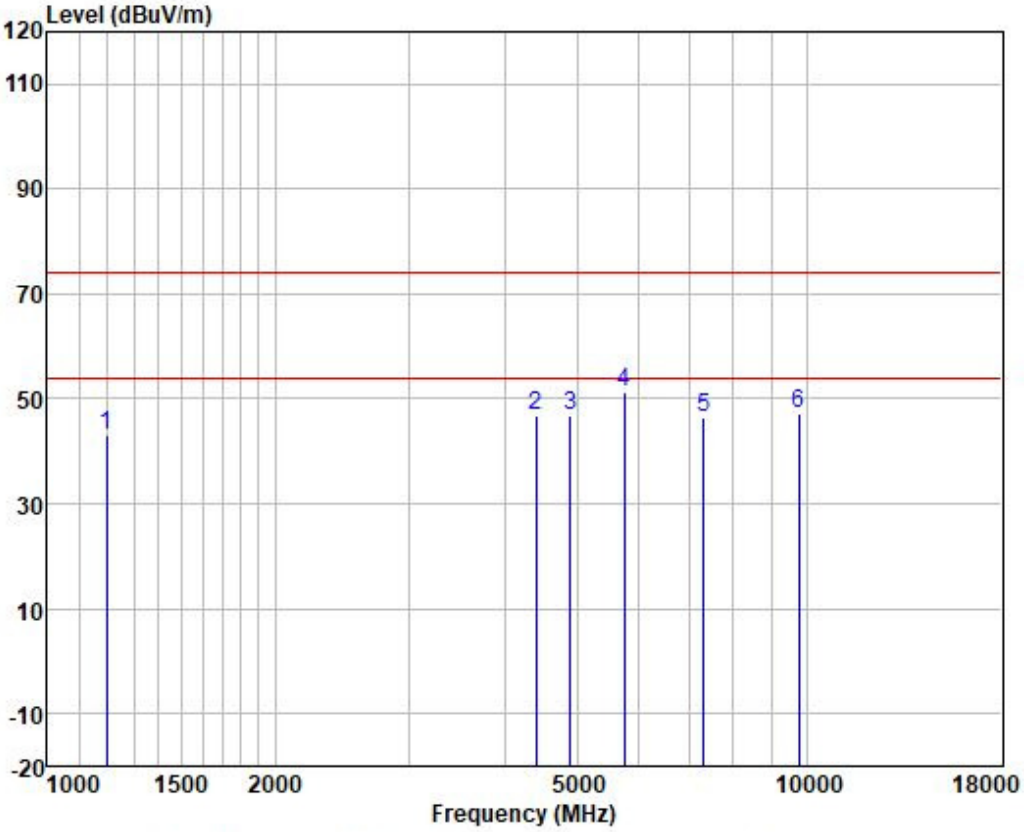
Test Mode: 10; Polarity: Vertical; Modulation:GFSK; Channel:middle



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1196.264	55.05	23.14	2.55	37.64	43.10	74.00	-30.90	VERTICAL	peak
2	4405.090	44.88	33.74	4.79	36.62	46.79	74.00	-27.21	VERTICAL	peak
3	4882.000	44.26	34.15	5.23	36.67	46.97	74.00	-27.03	VERTICAL	peak
4	5746.982	49.89	32.65	5.74	36.79	51.49	74.00	-22.51	VERTICAL	peak
5	7323.000	40.59	36.07	6.81	36.95	46.52	74.00	-27.48	VERTICAL	peak
6	9764.000	37.71	38.81	7.65	36.81	47.36	74.00	-26.64	VERTICAL	peak

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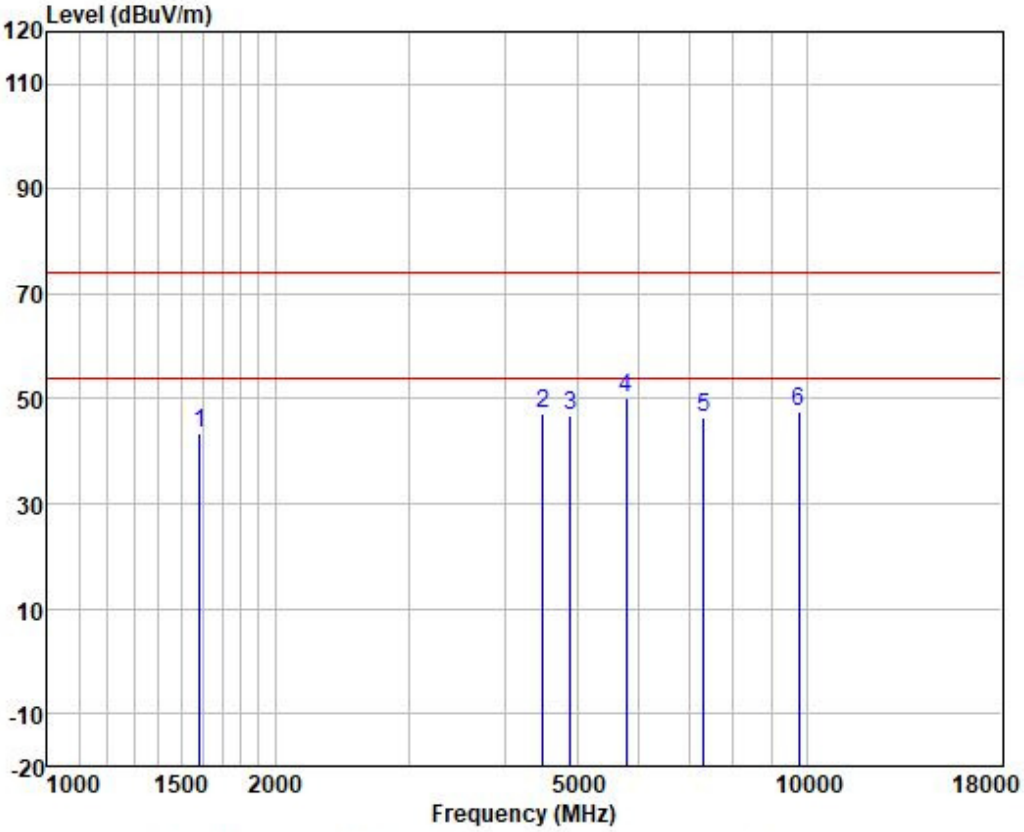
Test Mode: 10; Polarity: Horizontal; Modulation:GFSK; Channel:middle



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1587.975	53.23	24.65	2.99	37.45	43.42	74.00	-30.58	HORIZONTAL	peak
2	4495.125	45.03	34.17	4.78	36.63	47.35	74.00	-26.65	HORIZONTAL	peak
3	4882.000	44.05	34.15	5.23	36.67	46.76	74.00	-27.24	HORIZONTAL	peak
4	5780.300	48.48	32.66	5.76	36.79	50.11	74.00	-23.89	HORIZONTAL	peak
5	7323.000	40.53	36.07	6.81	36.95	46.46	74.00	-27.54	HORIZONTAL	peak
6	9764.000	38.00	38.81	7.65	36.81	47.65	74.00	-26.35	HORIZONTAL	peak

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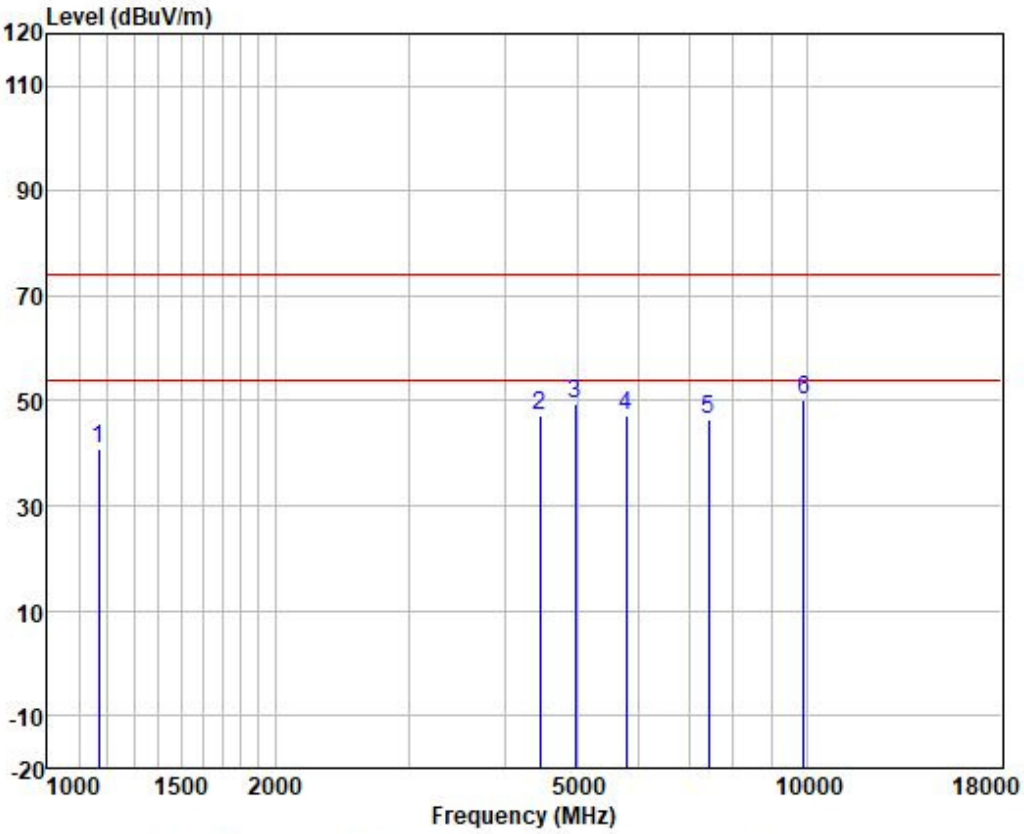
Test Mode: 10; Polarity: Vertical; Modulation:GFSK; Channel:High



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1168.920	53.22	22.96	2.49	37.65	41.02	74.00	-32.98	VERTICAL	peak
2	4456.315	44.86	34.00	4.79	36.63	47.02	74.00	-26.98	VERTICAL	peak
3	4960.000	46.87	34.15	5.28	36.69	49.61	74.00	-24.39	VERTICAL	peak
4	5780.300	45.61	32.66	5.76	36.79	47.24	74.00	-26.76	VERTICAL	peak
5	7440.000	40.18	36.33	6.72	36.96	46.27	74.00	-27.73	VERTICAL	peak
6	9920.000	40.33	38.95	7.67	36.80	50.15	74.00	-23.85	VERTICAL	peak

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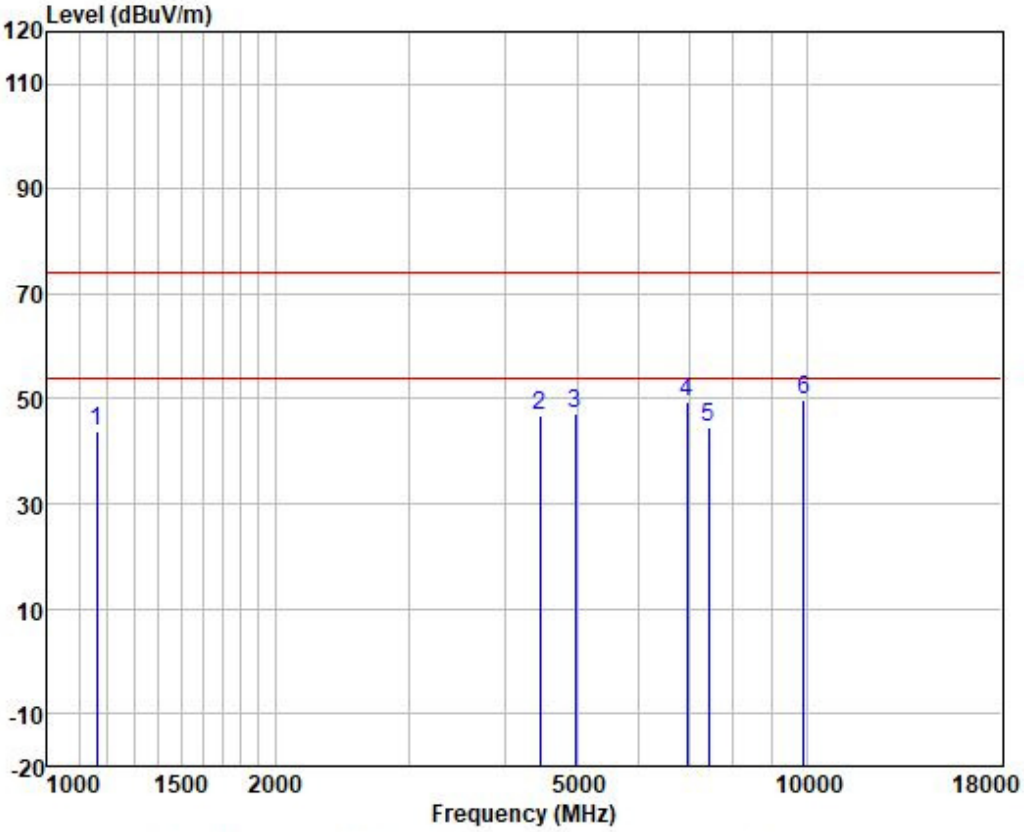
Test Mode: 10; Polarity: Horizontal; Modulation:GFSK; Channel:High



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1162.182	56.23	22.93	2.48	37.66	43.98	74.00	-30.02	HORIZONTAL	peak
2	4456.315	44.64	34.00	4.79	36.63	46.80	74.00	-27.20	HORIZONTAL	peak
3	4960.000	44.45	34.15	5.28	36.69	47.19	74.00	-26.81	HORIZONTAL	peak
4	6954.852	44.09	35.04	7.10	36.89	49.34	74.00	-24.66	HORIZONTAL	peak
5	7440.000	38.67	36.33	6.72	36.96	44.76	74.00	-29.24	HORIZONTAL	peak
6	9920.000	39.91	38.95	7.67	36.80	49.73	74.00	-24.27	HORIZONTAL	peak

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7.5 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

7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 21.0 °C Humidity: 58.4 % RH Atmospheric Pressure: 1008 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for left earbuds.
Final test	10	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for right earbuds.

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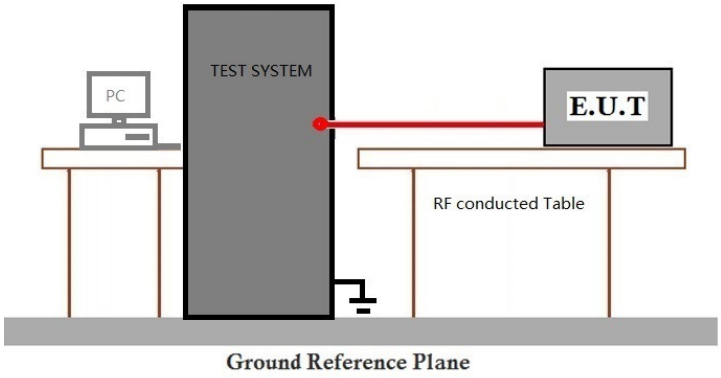
7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

Note: Since the verify power the same operating range bandwidth and smaller power can be covered by the higher power.

Please Refer to Appendix for Details

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7.6 20dB Bandwidth

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

7.6.1 E.U.T. Operation

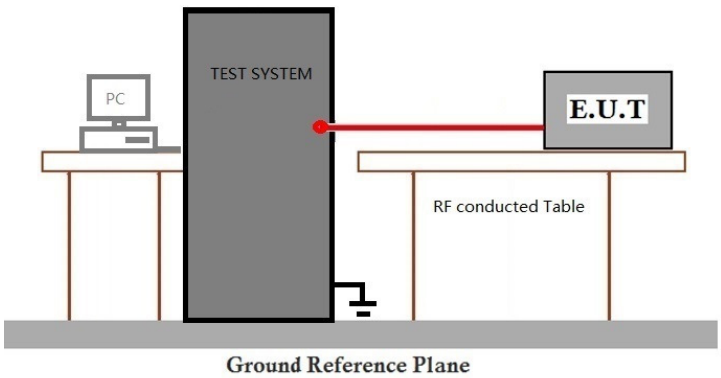
Operating Environment:

Temperature: 21.0 °C Humidity: 58.4 % RH Atmospheric Pressure: 1008 mbar

7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for left earbuds.
Final test	10	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for right earbuds.

7.6.3 Test Setup Diagram



7.6.4 Measurement Procedure and Data

Please Refer to Appendix for Details

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7.7 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.

7.7.1 E.U.T. Operation

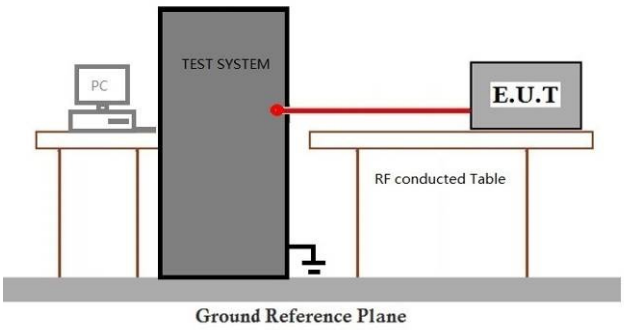
Operating Environment:

Temperature: 21.0 °C Humidity: 58.4 % RH Atmospheric Pressure: 1008 mbar

7.7.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for left earbuds.
Final test	11	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for right earbuds.

7.7.3 Test Setup Diagram



7.7.4 Measurement Procedure and Data

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7.8 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

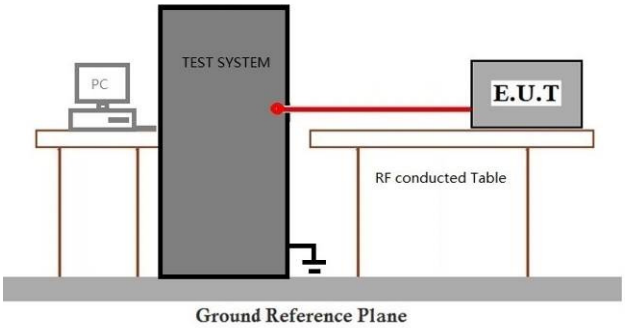
7.8.1 E.U.T. Operation

Operating Environment:
Temperature: 21.0 °C Humidity: 58.4 % RH Atmospheric Pressure: 1008 mbar

7.8.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for left earbuds.
Final test	11	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for right earbuds.

7.8.3 Test Setup Diagram



7.8.4 Measurement Procedure and Data

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7.9 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

7.9.1 E.U.T. Operation

Operating Environment:

Temperature: 21.0 °C Humidity: 58.4 % RH Atmospheric Pressure: 1008 mbar

7.9.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	02	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for left earbuds.
Final test	11	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for right earbuds.

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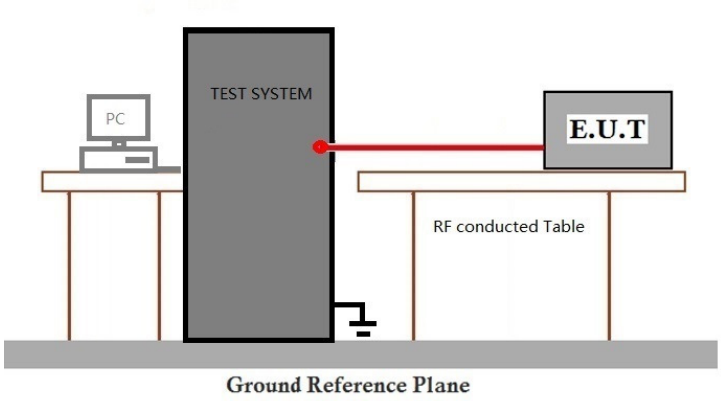
7.9.3 Test Setup Diagram



7.9.4 Measurement Procedure and Data

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7.10 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).

7.10.1 E.U.T. Operation

Operating Environment:

Temperature: 21.0 °C Humidity: 58.4 % RH Atmospheric Pressure: 1008 mbar

7.10.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for left earbuds.
Final test	02	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for left earbuds.
Final test	10	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for right earbuds.
Final test	11	TX_Hop mode_Keep the EUT in frequency hopping mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for right earbuds.

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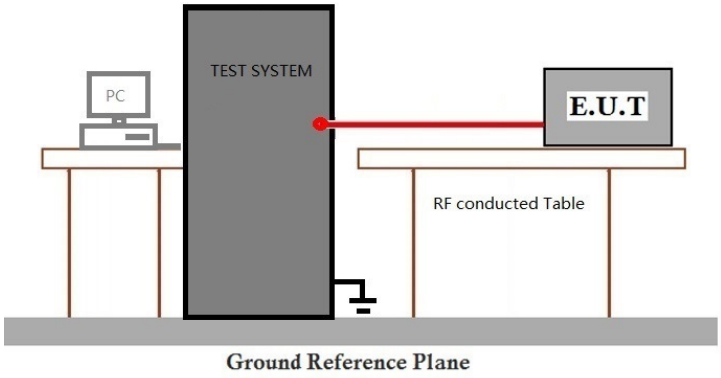
7.10.3 Test Setup Diagram



7.10.4 Measurement Procedure and Data

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7.11 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).

7.11.1 E.U.T. Operation

Operating Environment:

Temperature: 21.0 °C Humidity: 58.4 % RH Atmospheric Pressure: 1008 mbar

7.11.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for left earbuds.
Final test	10	TX_non-Hop mode_Keep the EUT in continuously transmitting mode with GFSK modulation, Π/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report for right earbuds.

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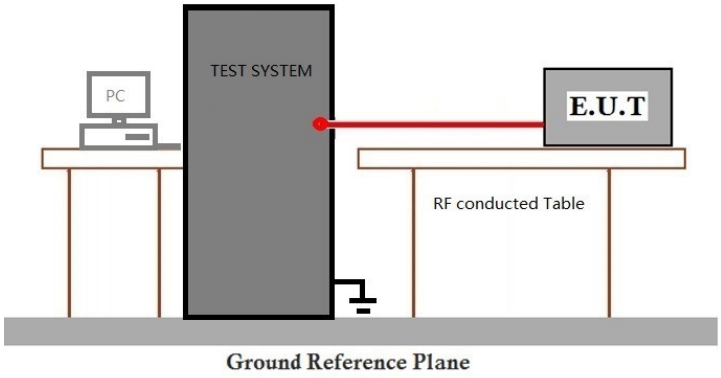
7.11.3 Test Setup Diagram



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8 Test Setup Photo

Refer to Appendix - Test Setup Photo for GZCR240400040003

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9 EUT Constructional Details (EUT Photos)

Refer to Appendix - External and Internal Photos for GZCR2404000400AT

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10 Appendix

For Right Earbud

1. Bandwidth

1.1 20dB BW

1.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	20dB Bandwidth (MHz)		Verdict
					Result	Limit	
GFSK	SISO	2402	DH5	1	1.018	/	Pass
		2441	DH5	1	0.963	/	Pass
		2480	DH5	1	0.965	/	Pass
Π/4DQPSK	SISO	2402	2DH5	1	1.262	/	Pass
		2441	2DH5	1	1.263	/	Pass
		2480	2DH5	1	1.264	/	Pass
8DPSK	SISO	2402	3DH5	1	1.272	/	Pass
		2441	3DH5	1	1.271	/	Pass
		2480	3DH5	1	1.273	/	Pass

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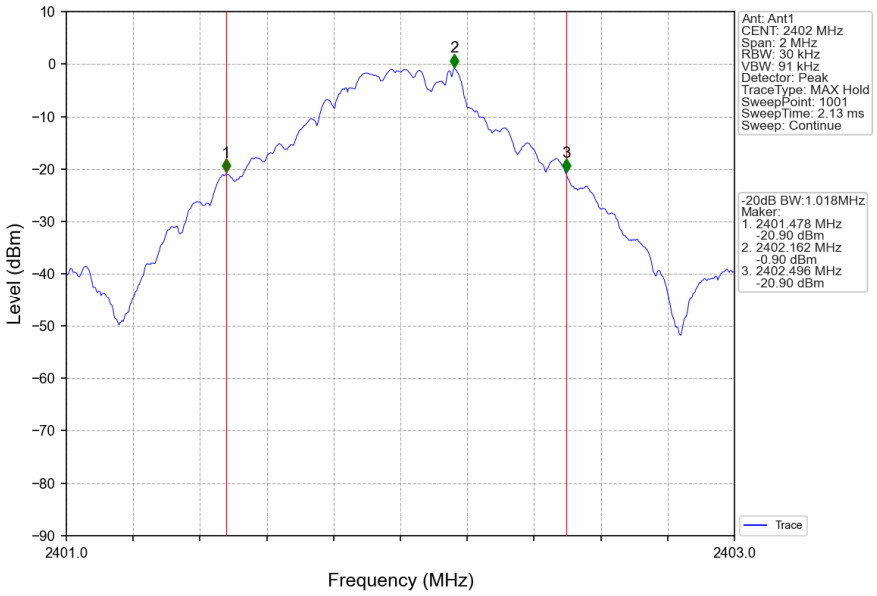
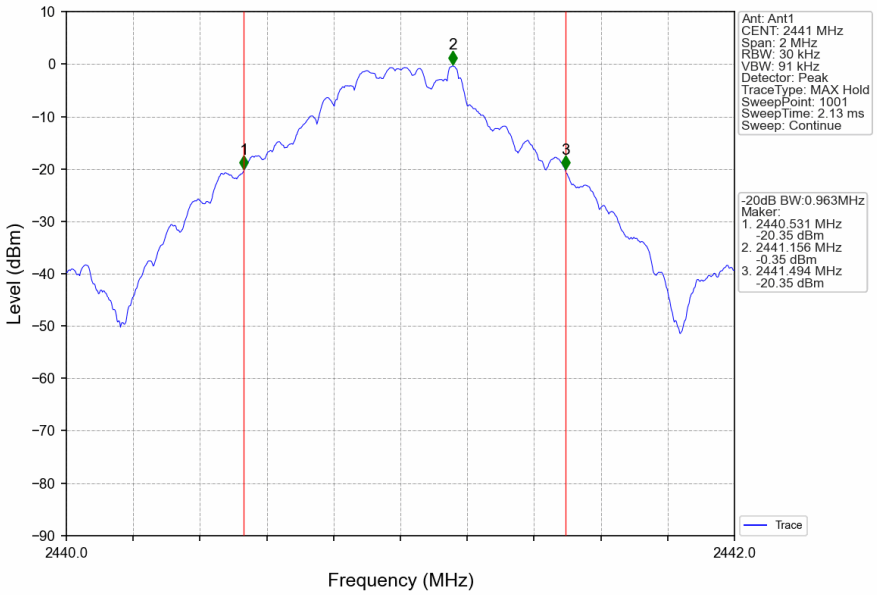
1.1.2 Test Graph

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



GFSK_DH5_MCH_2441MHz_Ant1_NTNV



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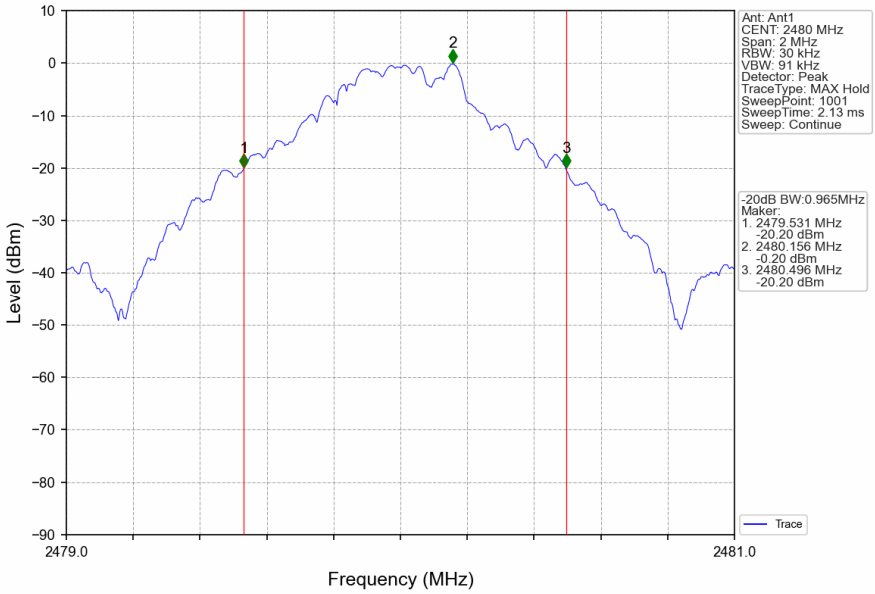
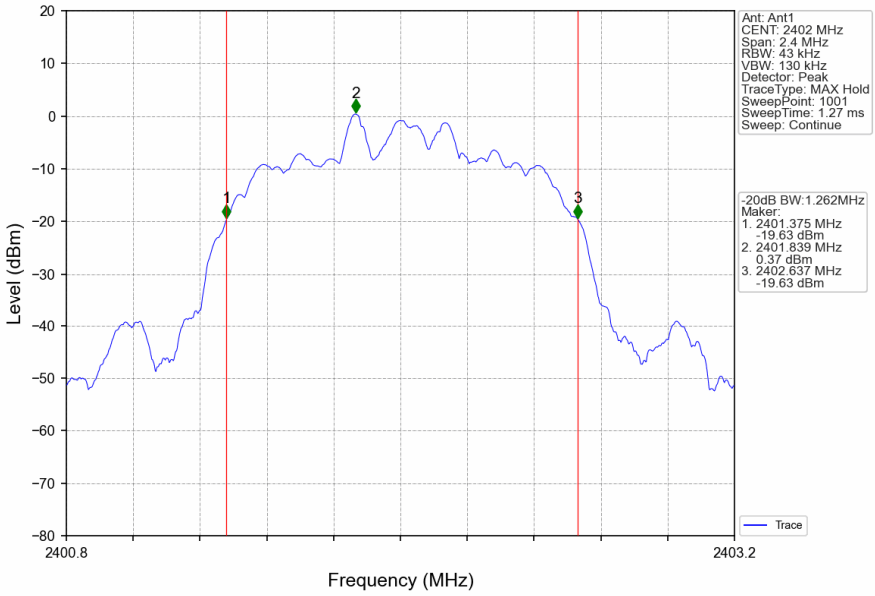
GFSK_DH5_HCH_2480MHz_Ant1_NTNV



Π/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV



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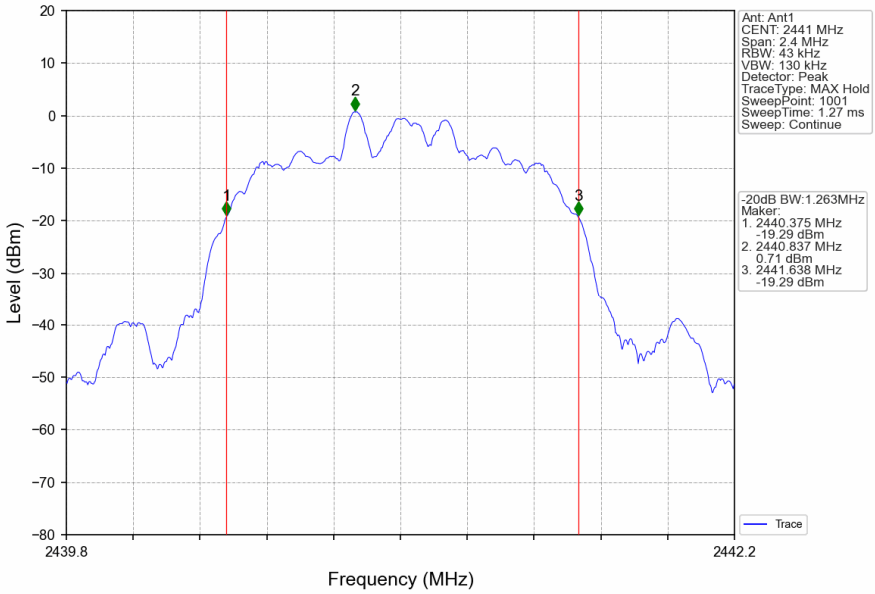
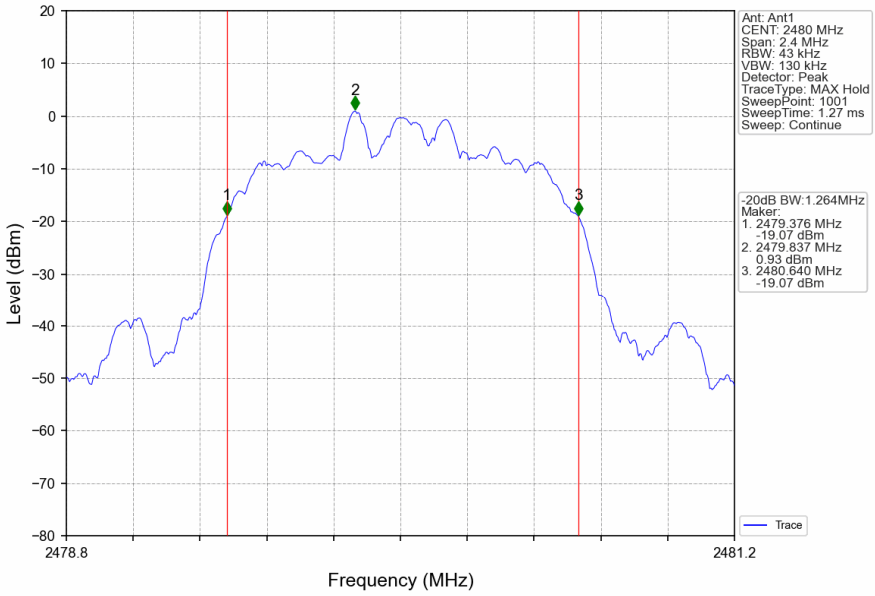
Π/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV



Π/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV



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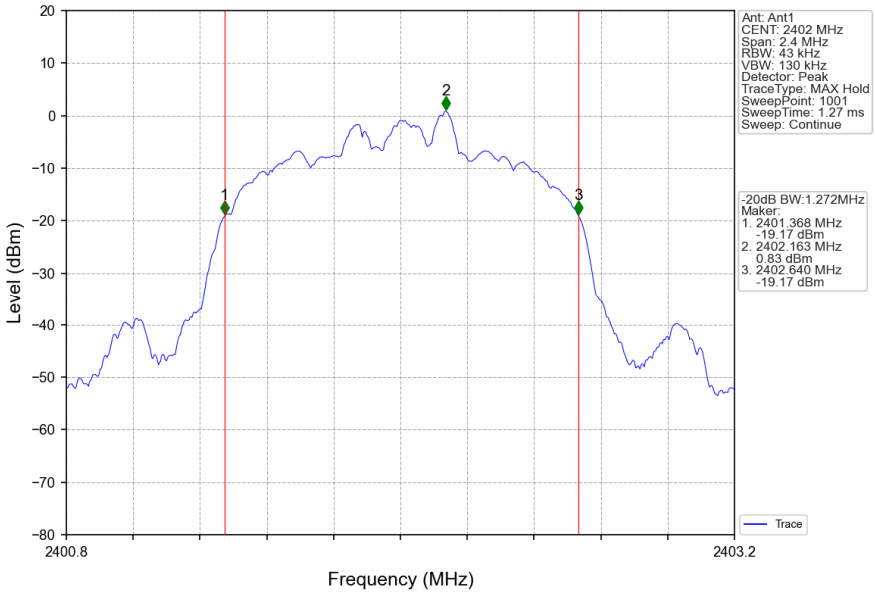
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



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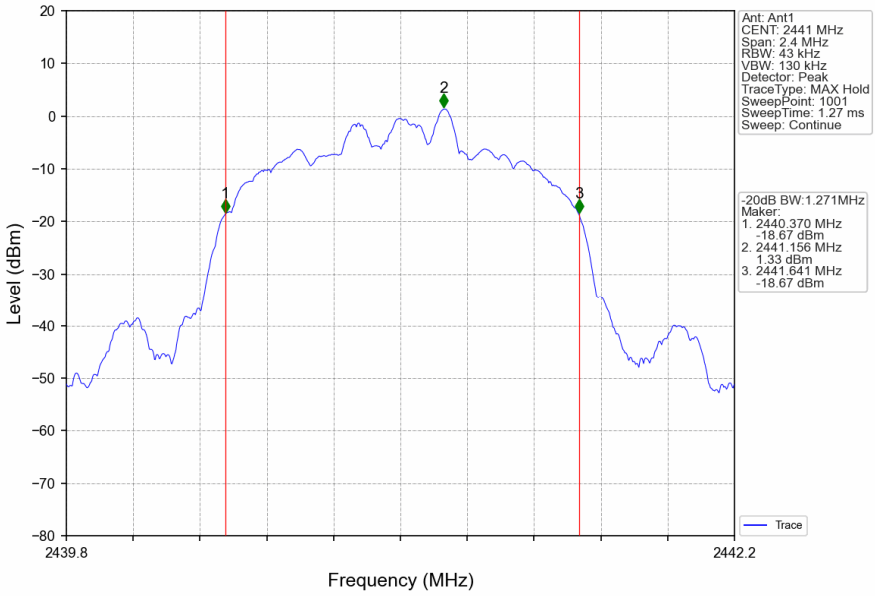

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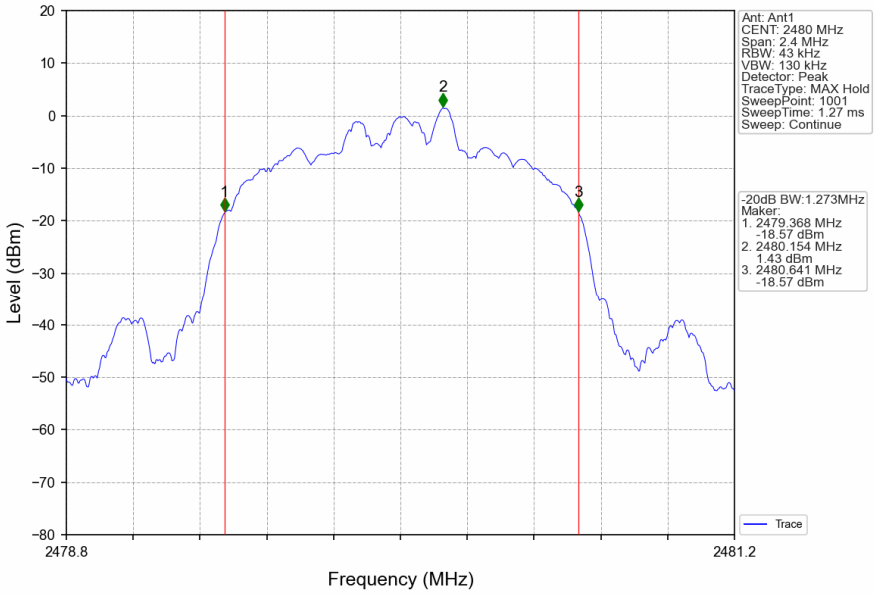
8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV



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2. Maximum Conducted Output Power

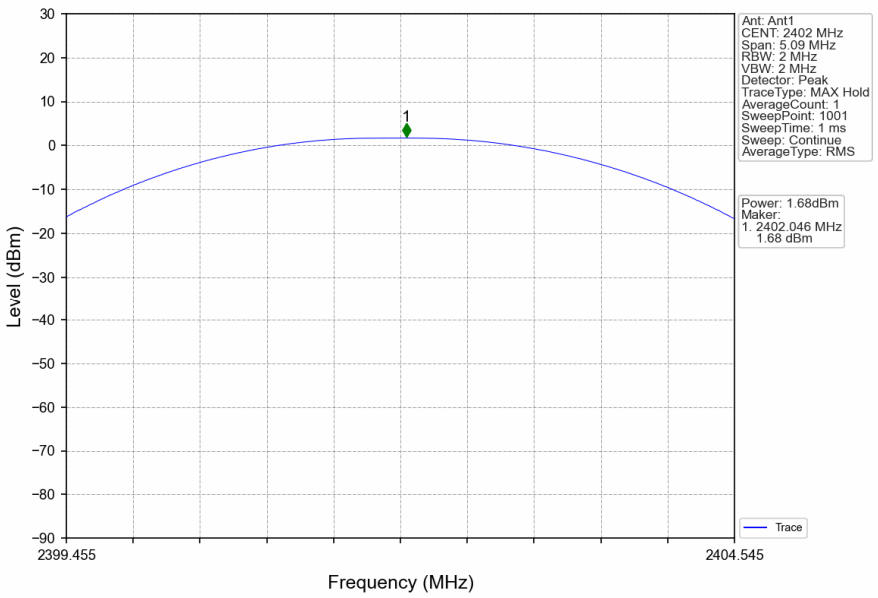
2.1 Power

2.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Packet Type	Maximum Peak Conducted Output Power (dBm)		Verdict
				ANT1	Limit	
GFSK	SISO	2402	DH5	1.68	<=20.97	Pass
		2441	DH5	2.03	<=20.97	Pass
		2480	DH5	2.22	<=20.97	Pass
Π/4DQPSK	SISO	2402	2DH5	1.65	<=20.97	Pass
		2441	2DH5	2.07	<=20.97	Pass
		2480	2DH5	2.25	<=20.97	Pass
8DPSK	SISO	2402	3DH5	1.75	<=20.97	Pass
		2441	3DH5	2.15	<=20.97	Pass
		2480	3DH5	**2.34**	<=20.97	Pass
Note1: Antenna Gain: Ant1: -0.41dBi;						

2.1.2 Test Graph

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



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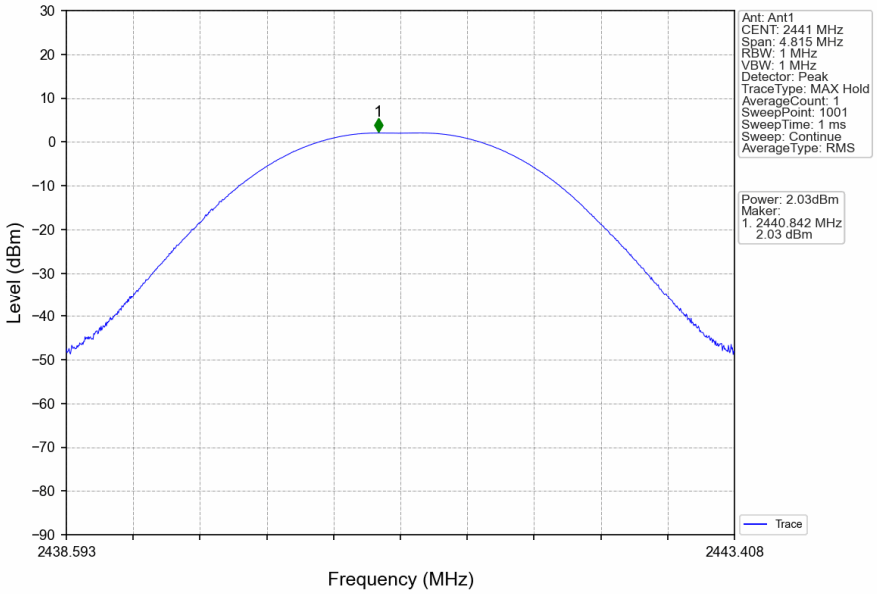
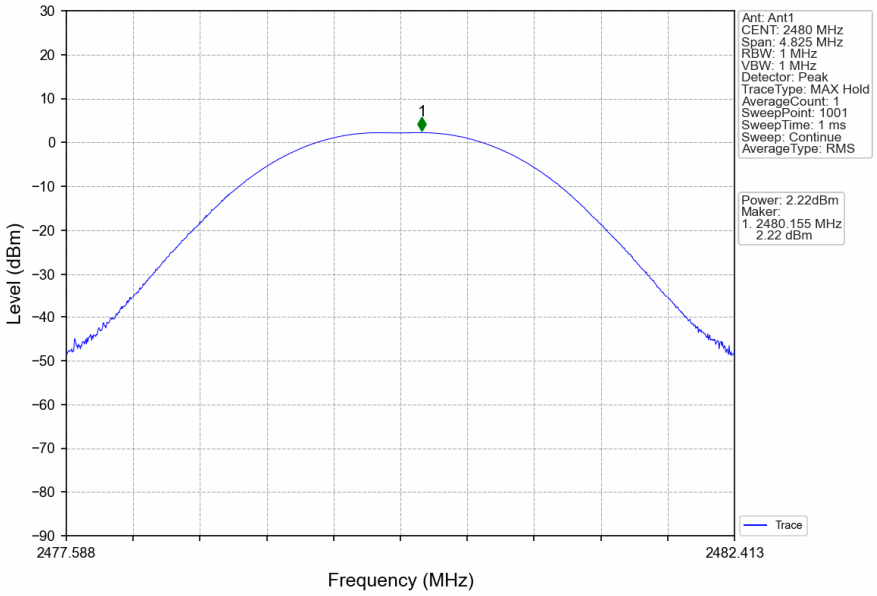
GFSK_DH5_MCH_2441MHz_Ant1_NTNV



GFSK_DH5_HCH_2480MHz_Ant1_NTNV



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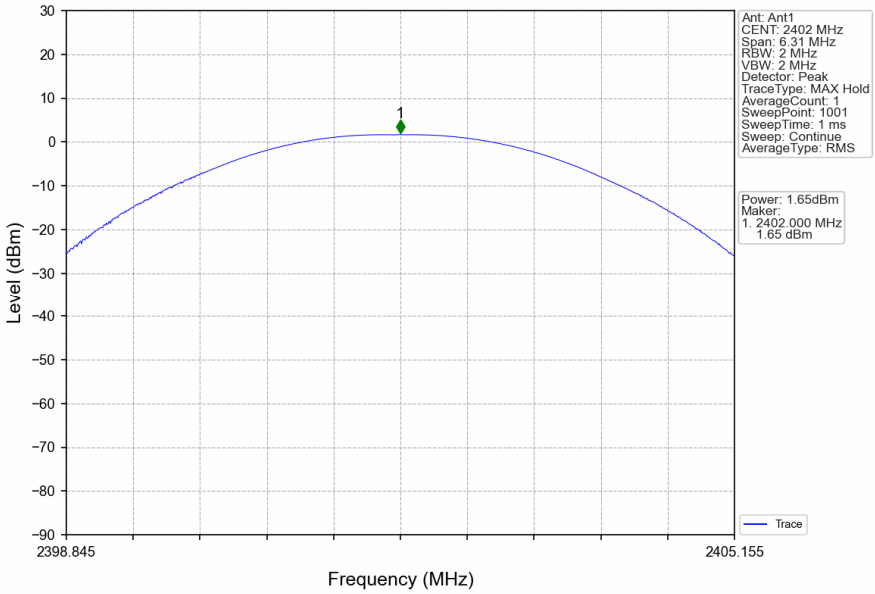
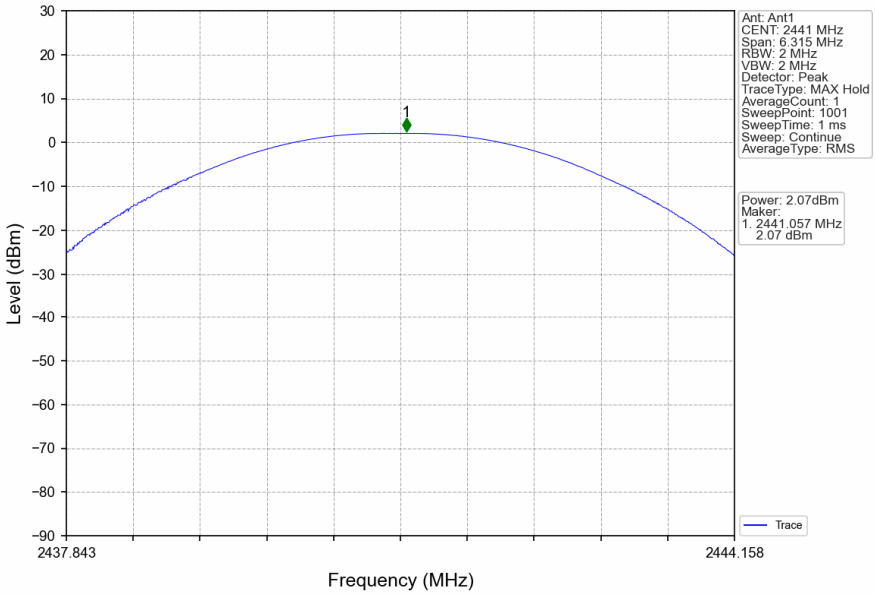
Π/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV



Π/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV



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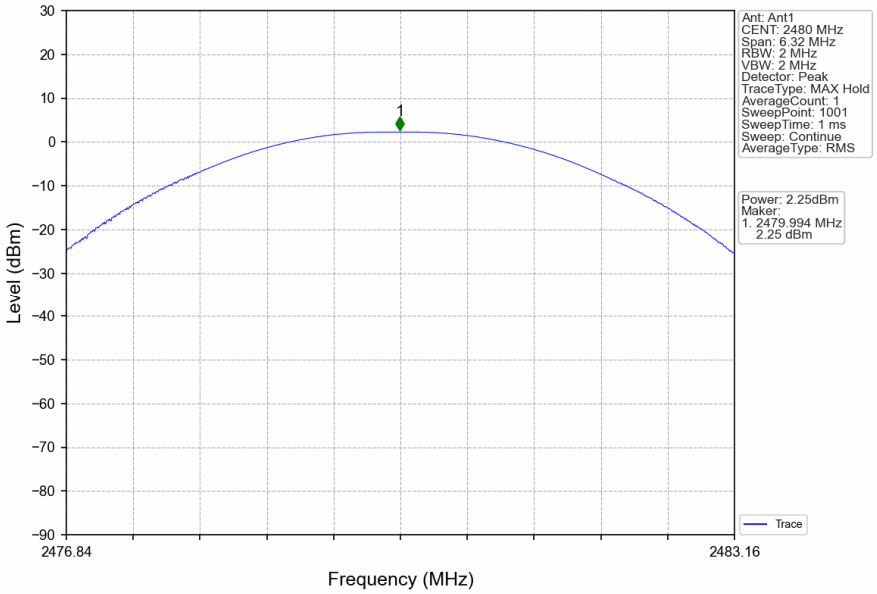
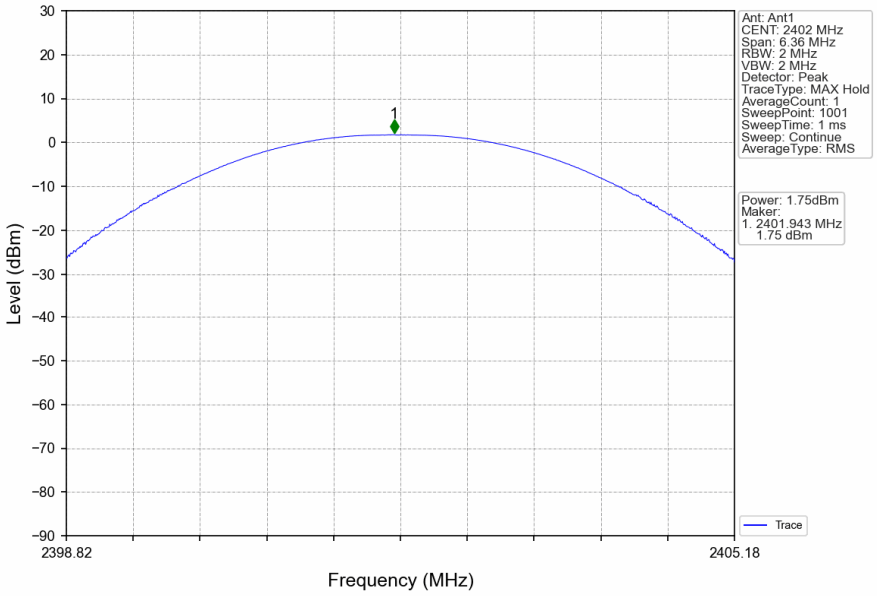


8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



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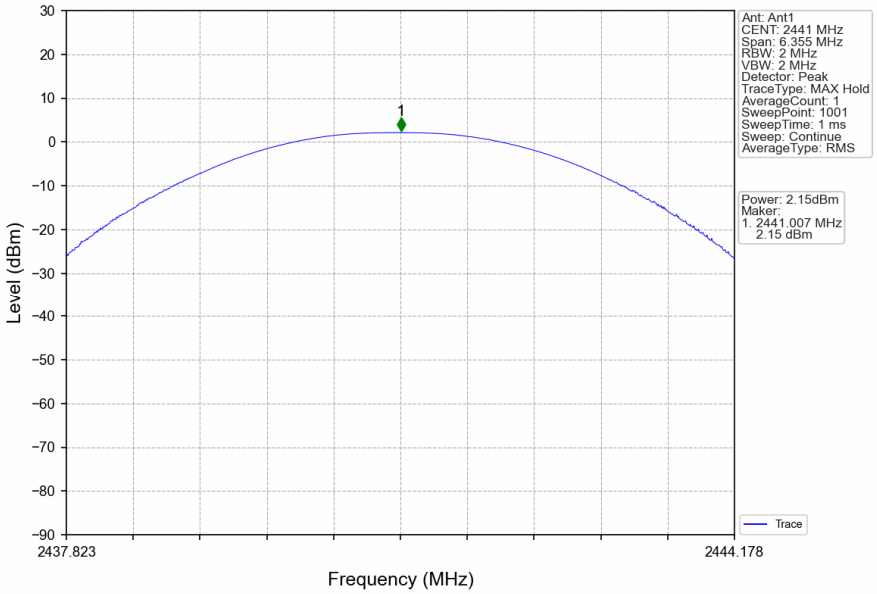

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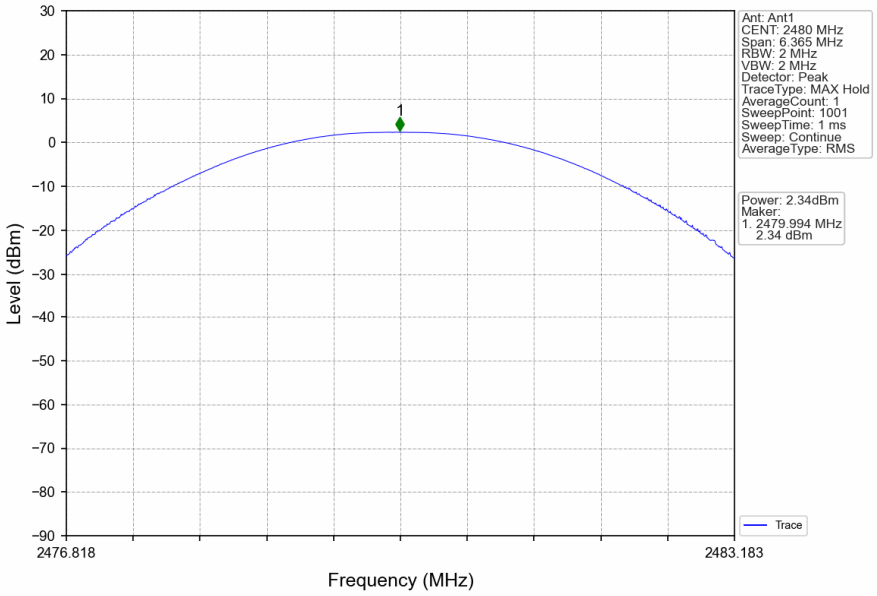

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3. Carrier Frequency Separation

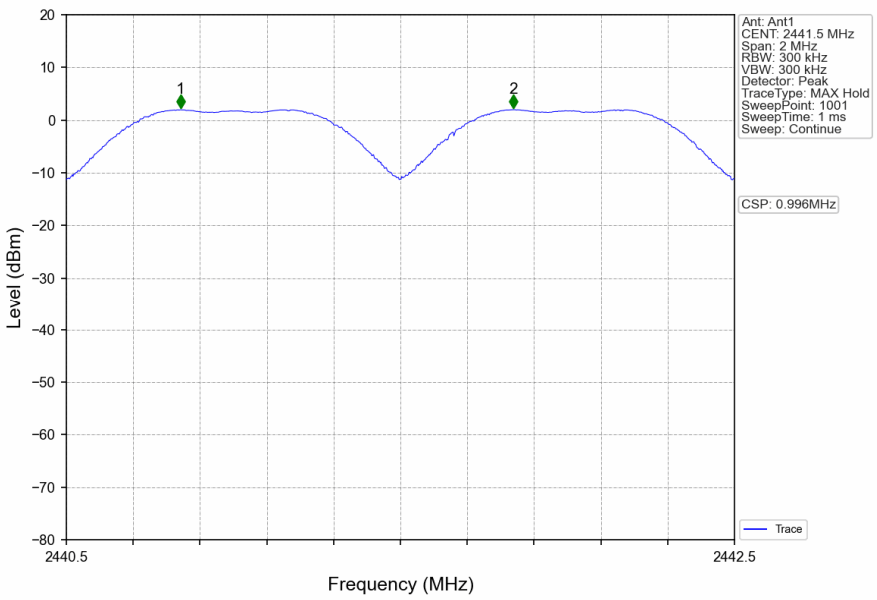
3.1 Ant1

3.1.1 Test Result

Ant1							
Mode	TX Type	Frequency (MHz)	Packet Type	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Verdict
GFSK	SISO	HOPP	DH5	0.996	1.018	>=0.679	Pass
Π/4DQPSK	SISO	HOPP	2DH5	1.001	1.264	>=0.843	Pass
8DPSK	SISO	HOPP	3DH5	0.989	1.273	>=0.849	Pass

3.1.2 Test Graph

GFSK_DH5_HOPP_Ant1_NTNV



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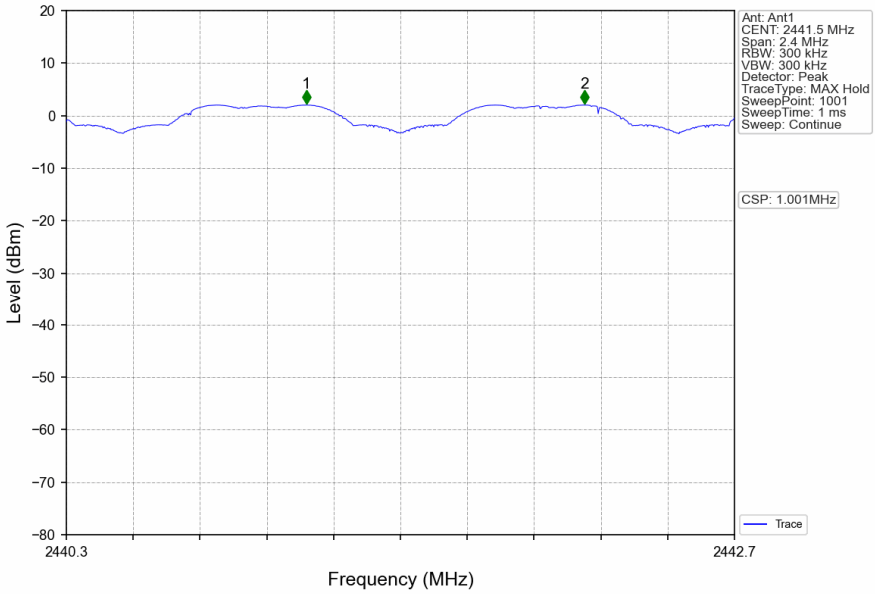
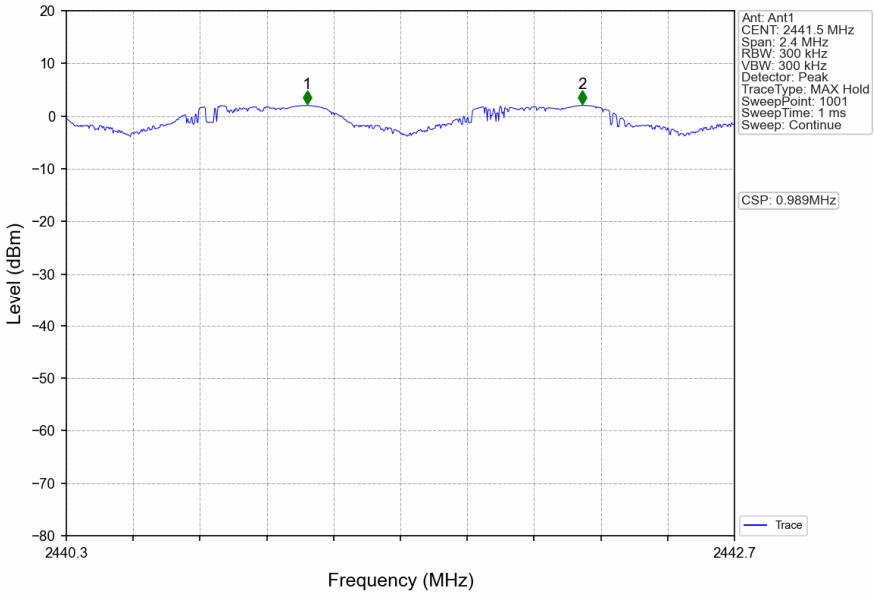


8DPSK_3DH5_HOPP_Ant1_NTNV



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4. Number of Hopping Frequencies

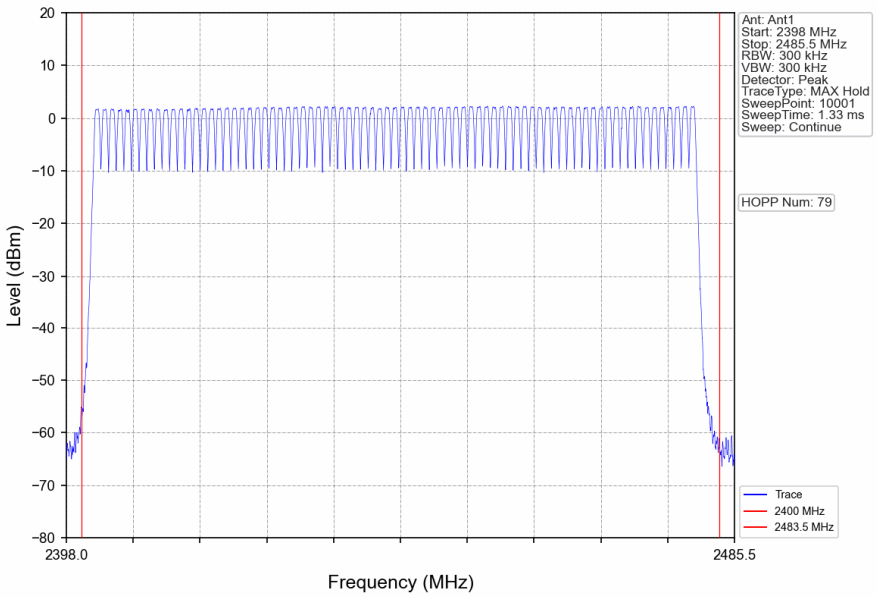
4.1 HoppNum

4.1.1 Test Result

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

4.1.2 Test Graph

GFSK_DH5_HOPP_Ant1_NTNV



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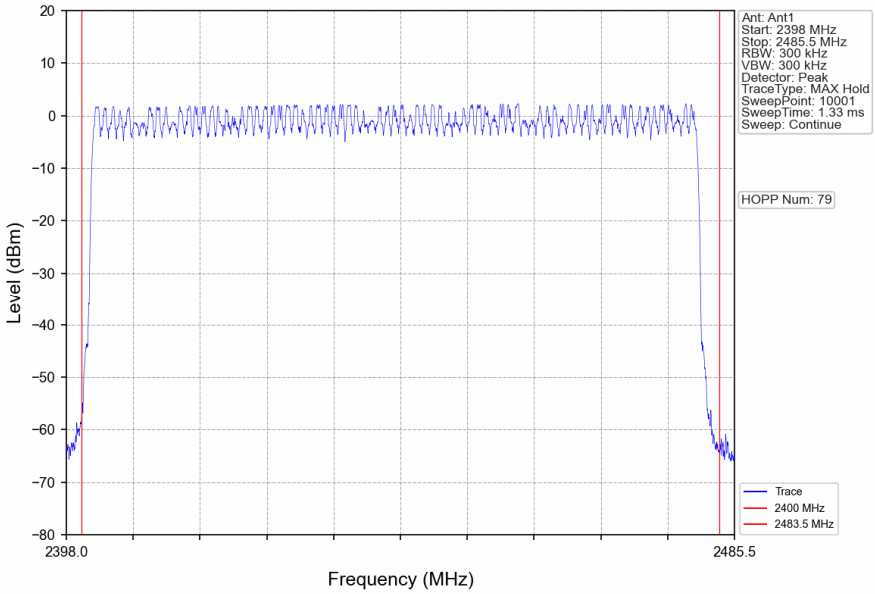

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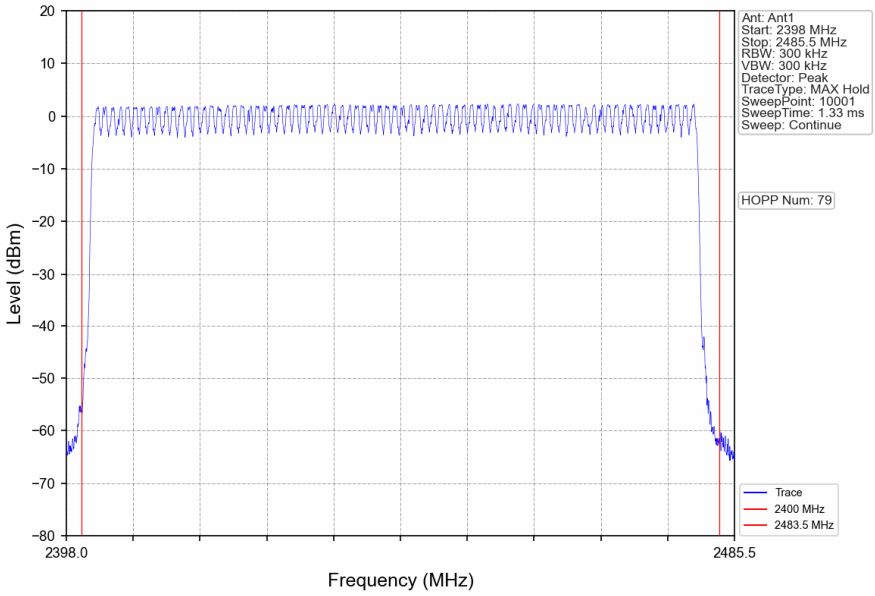

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5. Time of Occupancy (Dwell Time)

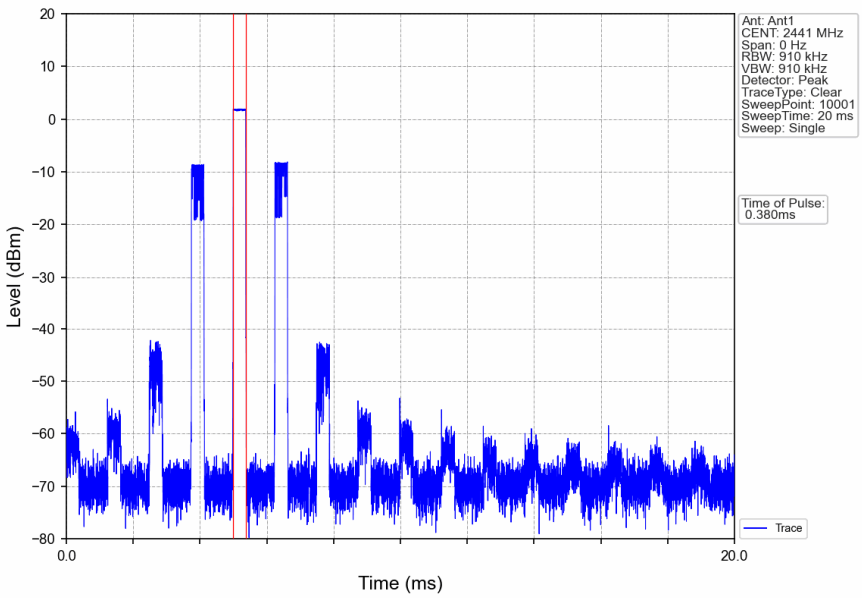
5.1 Ant1

5.1.1 Test Result

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	0.380	31.600	320	121.600	<=400	Pass
			DH3	1.636	31.600	160	261.760	<=400	Pass
			DH5	2.882	31.600	106	305.492	<=400	Pass
Π/4DQPSK	SISO	HOPP	2DH1	2.884	31.600	107	308.588	<=400	Pass
			2DH3	1.634	31.600	160	261.440	<=400	Pass
			2DH5	2.882	31.600	106	305.492	<=400	Pass
8DPSK	SISO	HOPP	3DH1	0.382	31.600	320	122.240	<=400	Pass
			3DH3	1.632	31.600	160	261.120	<=400	Pass
			3DH5	2.884	31.600	107	308.588	<=400	Pass

5.1.2 Test Graph

GFSK_DH1_HOPP_Ant1_NTNV



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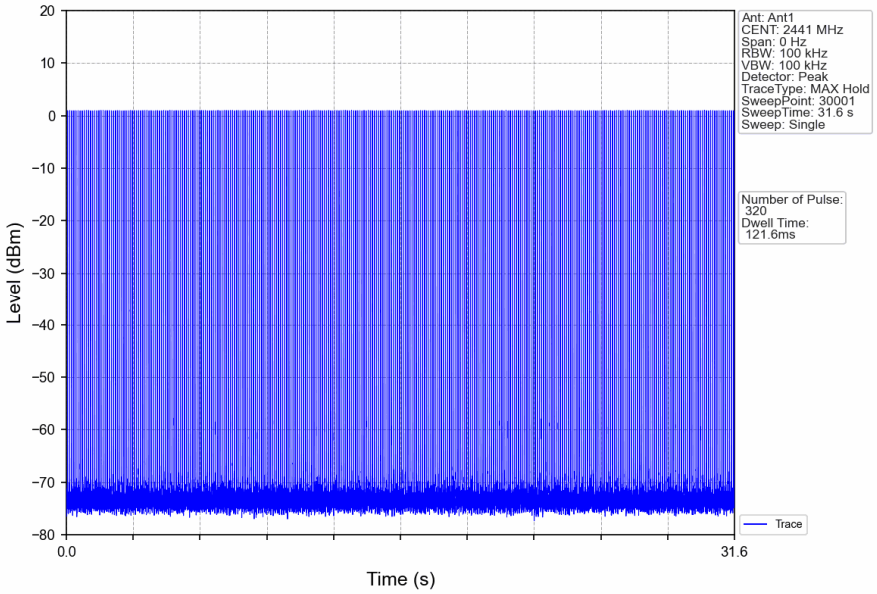

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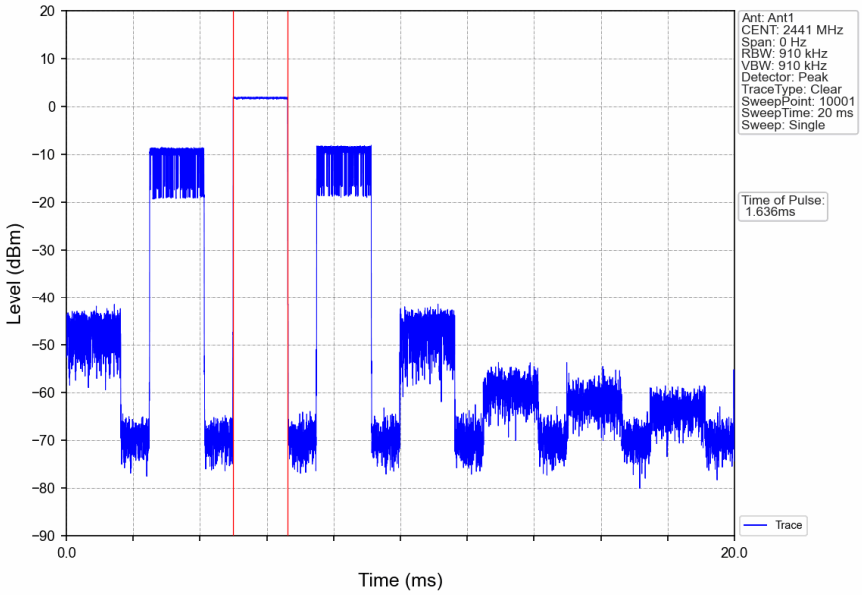

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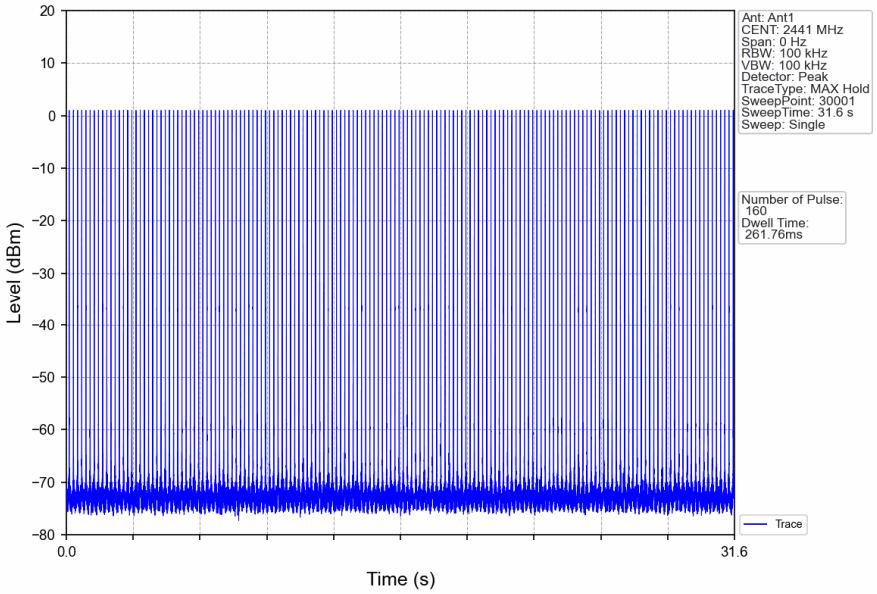
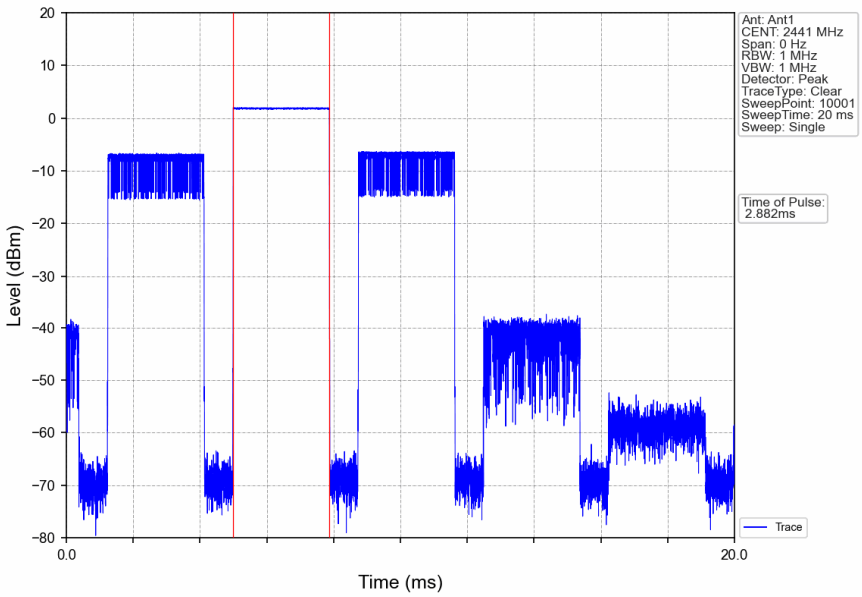


GFSK_DH5_HOPP_Ant1_NTNV



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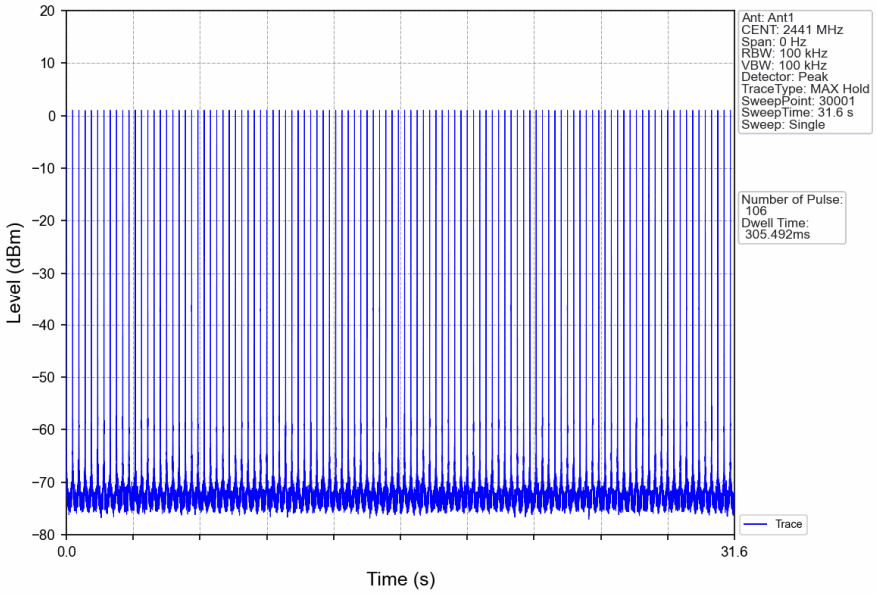

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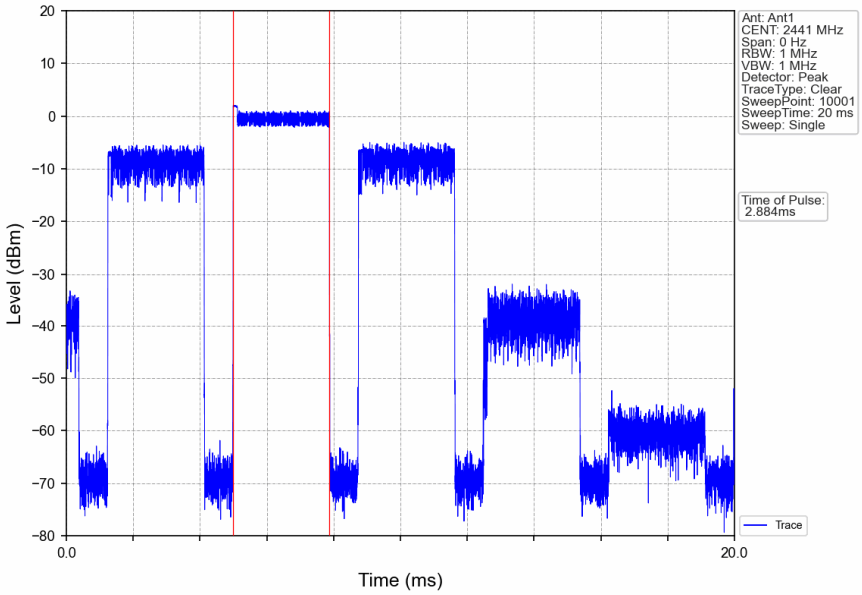

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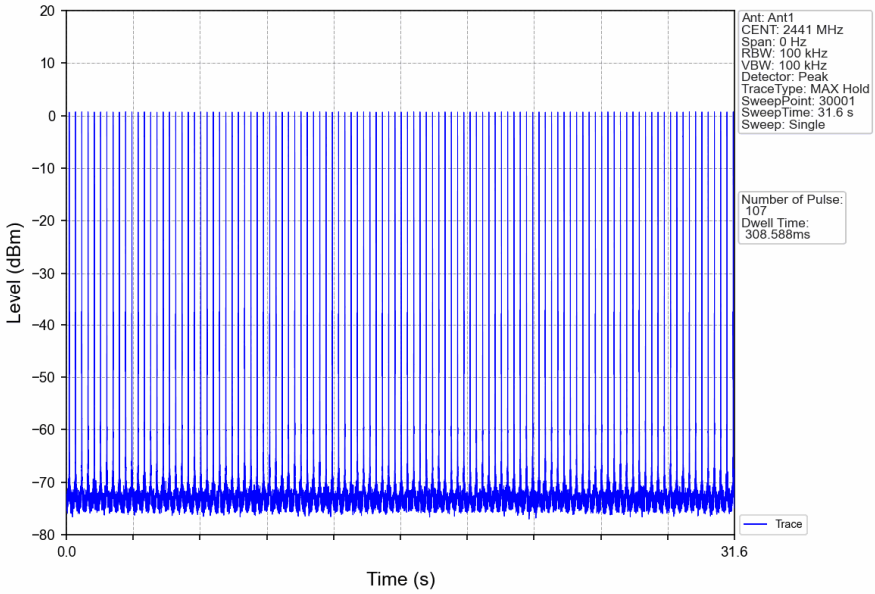

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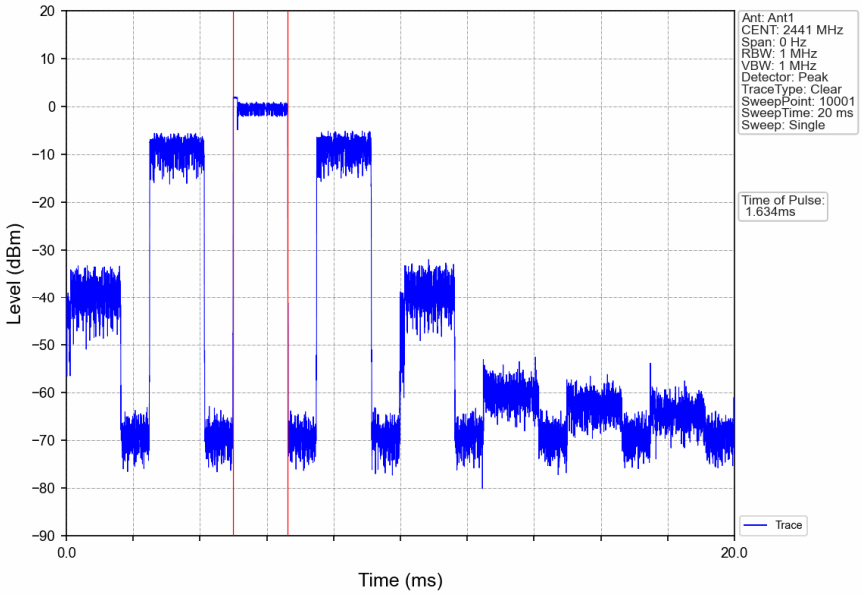

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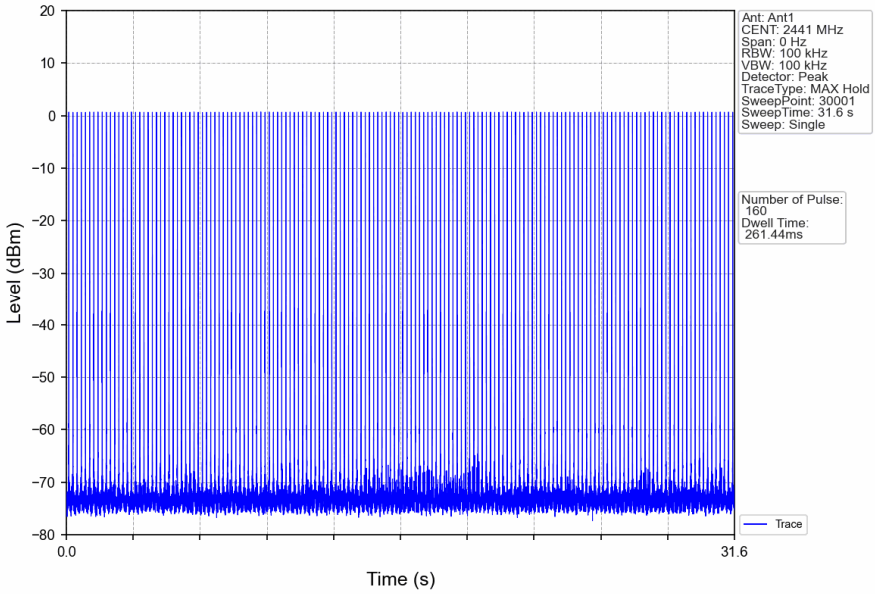

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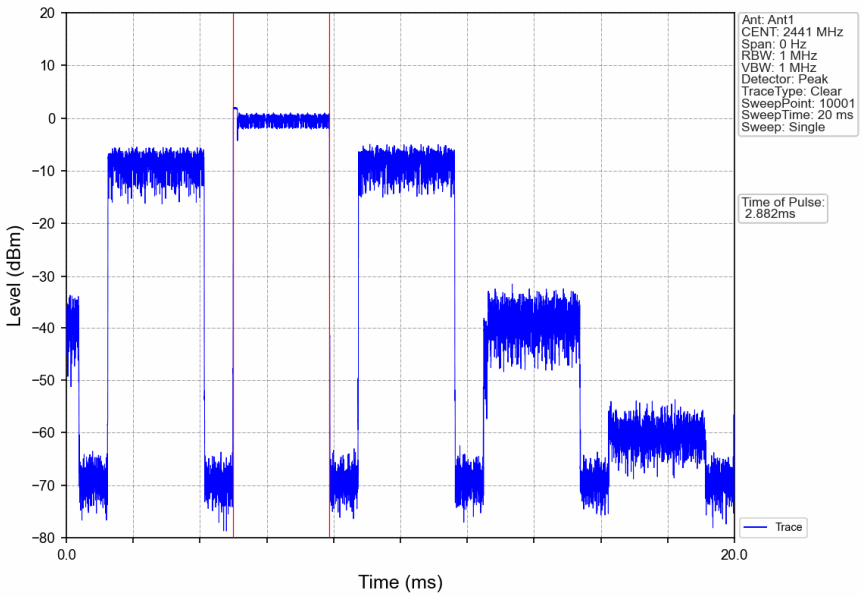

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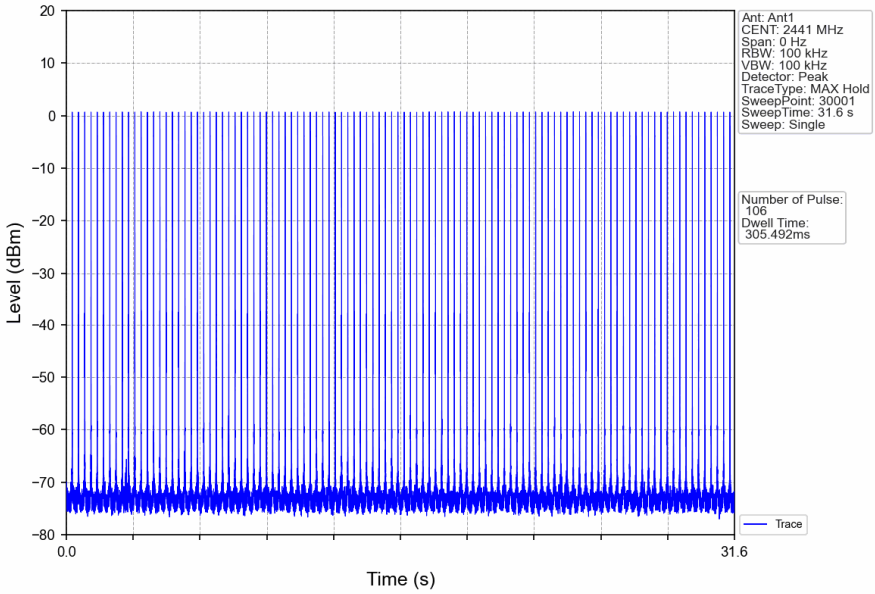

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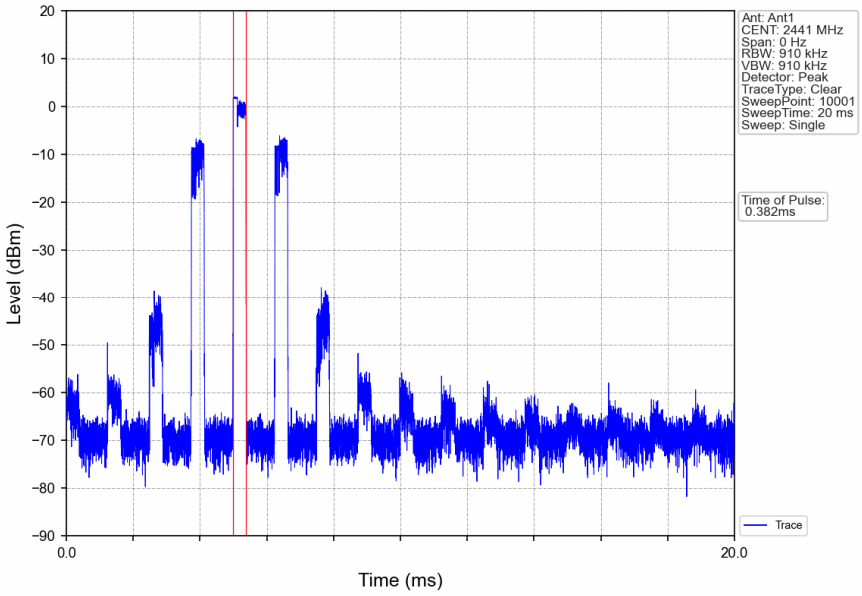

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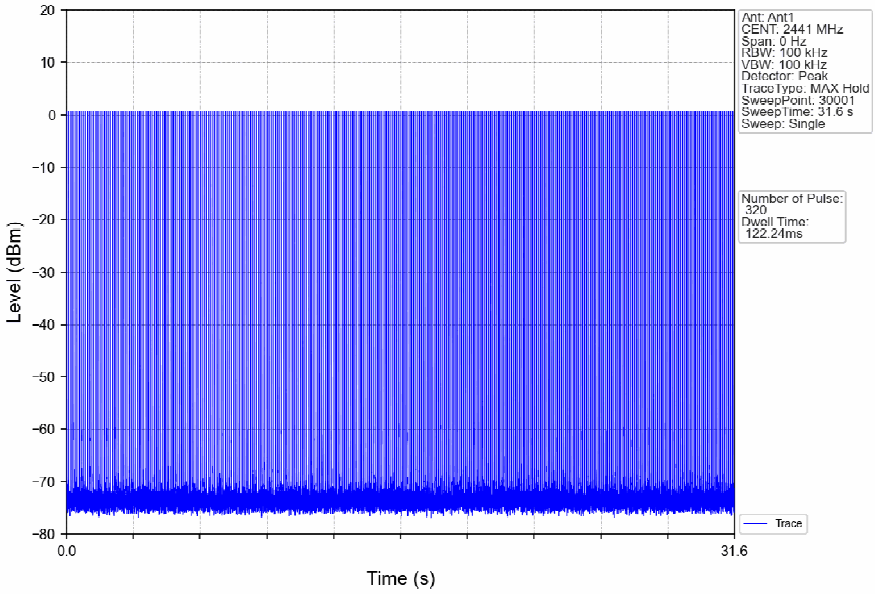

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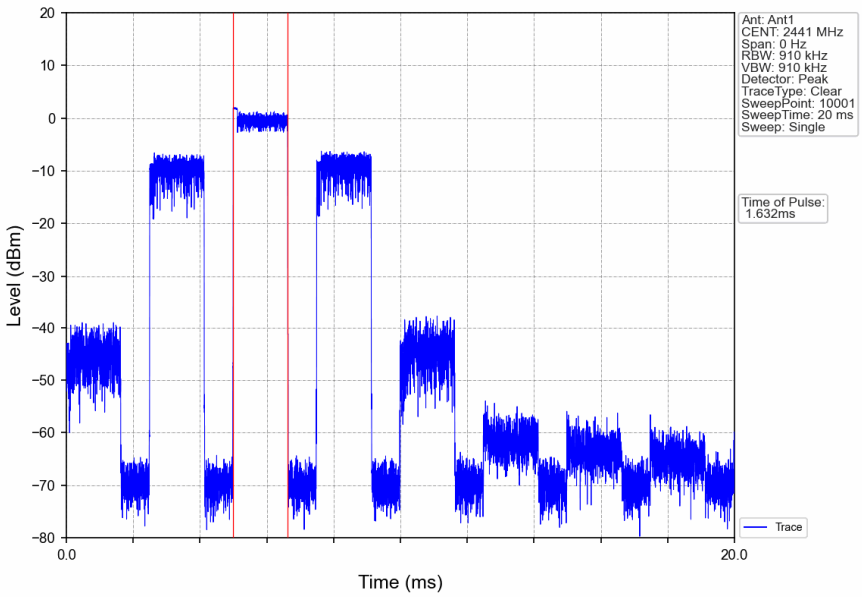

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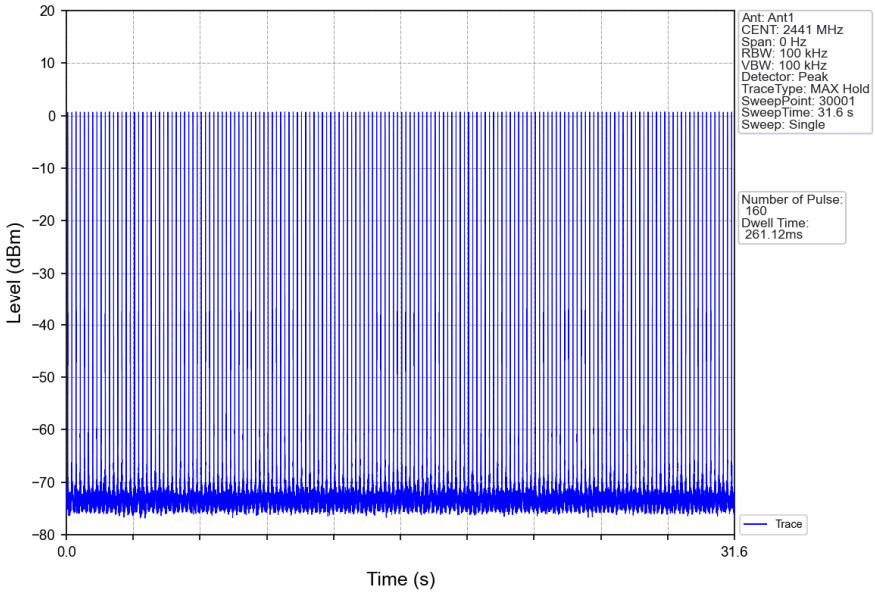

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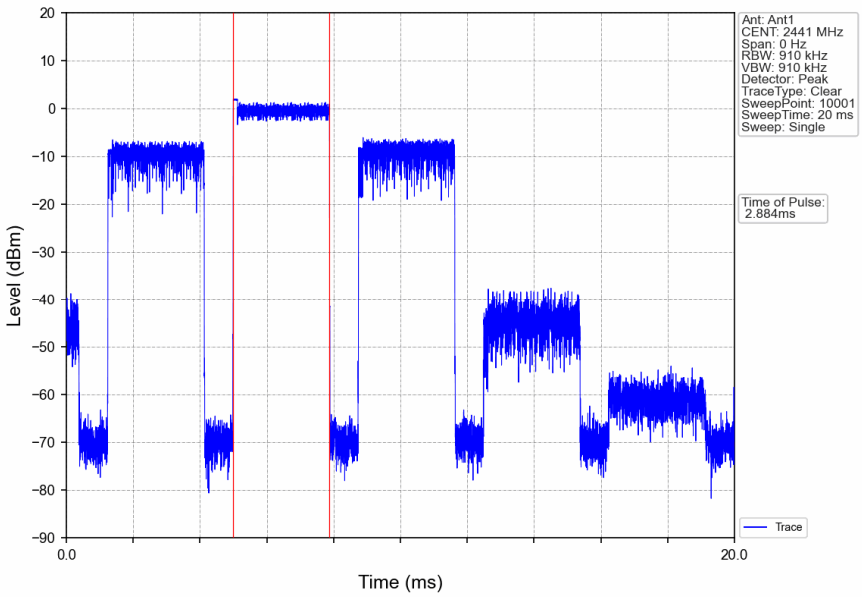

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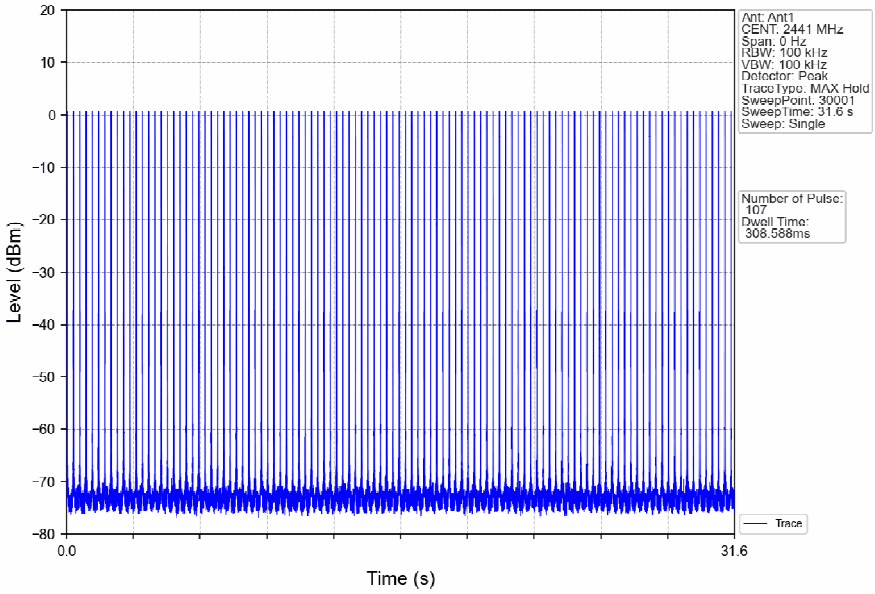

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