

TEST REPORT

Application No.: GZCR2603000625AT
Applicant: Positive LLC
Address of Applicant: 2820 S Alma School Rd Suite 18 PMB 2011, Chandler, Arizona 85286, United States
Manufacturer: Jia Ge Digital Technology Co. Ltd
Address of Manufacturer: 11F, No. 176, Changchun Rd., Zhongshan Dist., Taipei City 104082, Taiwan
Product Name: Wireless Foot Controller
Model No.: Spark PEDAL
Trade Mark: Positive Grid
Standard(s) : 47 CFR Part 15, Subpart C 15.247
Date of Receipt: 2026-04-03
Date of Test: 2026-04-20 to 2026-06-06
Date of Issue: 2026-06-12

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.



Revision Record			
Version	Report No.	Date	Remark
01	GZCR2603000625003	2026-06-12	Original

Authorized for issue by:			
		Luke Lin	
		Luke Lin/Project Engineer	
Approved By		Vico Cui	
		Vico Cui/Reviewer	



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 (2020) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
Radiated Emissions which fall in the restricted bands		ANSI C63.10 (2020) Section 6.10.5 & 7.8.8	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions Below 1GHz		ANSI C63.10 (2020) Section 6.4,6.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions Above 1GHz		ANSI C63.10 (2020) Section 6.6 & 7.8.8	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Maximum Conducted Output Power		ANSI C63.10 (2020) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(1)	Pass
20dB Bandwidth		ANSI C63.10 (2020) Section 6.9.2	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass
Carrier Frequencies Separation		ANSI C63.10 (2020) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
Hopping Channel Number		ANSI C63.10 (2020) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Dwell Time		ANSI C63.10 (2020) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Conducted Band Edges Measurement		ANSI C63.10 (2020) Section 7.8.7.2	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions		ANSI C63.10 (2020) Section 7.8.7	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.

N/A means Not applicable, please find the detailed decision rule in the report relative section.



Remark:

For model Spark PEDAL with optional USB port isolator IC **ISOUSB111** or **AduM3160**. And all RF modules selected for use are the same. So the EUT with optional IC **AduM3160** was tested Conducted Emissions at AC Power Line (150kHz-30MHz) & Radiated Spurious Emissions Below 1GHz for verification, and the EUT with optional IC **ISOUSB111** was full tested in this report.



3 Contents

	Page
1 Cover Page	1
2 Test Summary	3
3 Contents	5
4 General Information	7
4.1 Details of E.U.T.	7
4.2 Description of Support Units	7
4.3 Measurement Uncertainty	8
4.4 Test Location	8
4.5 Test Facility	9
4.6 Deviation from Standards	9
4.7 Abnormalities from Standard Conditions	9
5 Equipment List	10
6 Radio Spectrum Technical Requirement	13
6.1 Antenna Requirement	13
6.1.1 Test Requirement:	13
6.1.2 Conclusion	13
6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence	14
6.2.1 Test Requirement:	14
6.2.2 Conclusion	14
7 Radio Spectrum Matter Test Results	15
7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)	15
7.1.1 E.U.T. Operation	15
7.1.2 Test Mode Description	15
7.1.3 Test Setup Diagram	16
7.1.4 Measurement Procedure and Data	16
7.2 Radiated Emissions which fall in the restricted bands	21
7.2.1 E.U.T. Operation	21
7.2.2 Test Mode Description	21
7.2.3 Test Setup Diagram	22
7.2.4 Measurement Procedure and Data	23
7.3 Radiated Spurious Emissions Below 1GHz	28
7.3.1 E.U.T. Operation	28
7.3.2 Test Mode Description	28
7.3.3 Test Setup Diagram	29
7.3.4 Measurement Procedure and Data	30
7.4 Radiated Spurious Emissions Above 1GHz	35
7.4.1 E.U.T. Operation	35
7.4.2 Test Mode Description	35
7.4.3 Test Setup Diagram	35
7.4.4 Measurement Procedure and Data	36
7.5 Maximum Conducted Output Power	45



7.5.1	E.U.T. Operation	45
7.5.2	Test Mode Description	45
7.5.3	Test Setup Diagram	45
7.5.4	Measurement Procedure and Data	46
7.6	20dB Bandwidth	47
7.6.1	E.U.T. Operation	47
7.6.2	Test Mode Description	47
7.6.3	Test Setup Diagram	47
7.6.4	Measurement Procedure and Data	47
7.7	Carrier Frequencies Separation	48
7.7.1	E.U.T. Operation	48
7.7.2	Test Mode Description	48
7.7.3	Test Setup Diagram	48
7.7.4	Measurement Procedure and Data	48
7.8	Hopping Channel Number	49
7.8.1	E.U.T. Operation	49
7.8.2	Test Mode Description	49
7.8.3	Test Setup Diagram	49
7.8.4	Measurement Procedure and Data	49
7.9	Dwell Time	50
7.9.1	E.U.T. Operation	50
7.9.2	Test Mode Description	50
7.9.3	Test Setup Diagram	50
7.9.4	Measurement Procedure and Data	50
7.10	Conducted Band Edges Measurement	51
7.10.1	E.U.T. Operation	51
7.10.2	Test Mode Description	51
7.10.3	Test Setup Diagram	52
7.10.4	Measurement Procedure and Data	52
7.11	Conducted Spurious Emissions	53
7.11.1	E.U.T. Operation	53
7.11.2	Test Mode Description	53
7.11.3	Test Setup Diagram	53
7.11.4	Measurement Procedure and Data	53
8	Test Setup Photo	54
9	EUT Constructional Details (EUT Photos)	55
10	Appendix	56



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4 General Information

4.1 Details of E.U.T.

Power supply:	Powered by built in rechargeable battery as below: Model: GSP872693 Rated: DC 3.7V, 3000mAh DC 5V 2A for charging
Cable(s):	AUX-IN output *1pcs Audio OUTPUT port L & R *1pcs EXP port *1pcs USB-C port *1pcs (charge and transmit data) MIDI IN/OUT port Earphone port
Test Voltage:	AC 120 V 60 Hz powered by Notebook computer refer to section 4.2
Operation Frequency:	2402MHz to 2480MHz
Modulation Type:	GFSK, pi/4DQPSK, 8DPSK
Number of Channels:	79
Channel Spacing:	1MHz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Antenna Type:	FPC antenna
Antenna Gain:	3.74dBi according to antenna specification for BT
Antenna Number:	1 for BT 1 for BLE/2.4GHz Wi-Fi

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.
Note Book Computer	LENOVO	ThinkPad T490	PF1D1MVJ



4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	±3.22dB
Radiated Emissions which fall in the restricted bands	±5.14dB (3m); ±4.90dB (10m); ±4.88dB (1GHz-6GHz); ±5.06dB (6GHz-18GHz); ±5.30dB (18GHz-40GHz)
Radiated Spurious Emissions Below 1GHz	±3.08dB (9kHz to 150kHz); ±3.19dB(150kHz to 30MHz); ±5.14dB (30MHz-1GHz) (3m); ±4.90dB (30MHz-1GHz) (10m)
Radiated Spurious Emissions Above 1GHz	±4.88dB (1GHz-6GHz); ±5.06dB (6GHz-18GHz); ±5.30dB (18GHz-40GHz)
Maximum Conducted Output Power	± 0.75dB
20dB Bandwidth	± 0.274%
Carrier Frequencies Separation	± 7.25 x 10 ⁻⁸
Hopping Channel Number	± 7.25 x 10 ⁻⁸
Dwell Time	± 0.029%
Conducted Band Edges Measurement	± 0.75dB
Conducted Spurious Emissions	± 0.75dB
Remark: The U_{lab} (lab Uncertainty) is less than U_{cispr} (CISPR Uncertainty) or U_{ETSI}(ETSI Uncertainty). Emission decision rule: – Compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit, marked as Pass in the report. – Non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit, marked as Fail in the report.	

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



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	BL03-NMNM-6.00M	EMC0107	2025-08-12	2026-08-11
Shielding Room	ChangZhou ZhongYu	8m x 3m x 3.8m	EMC0306	2025-08-14	2028-08-13
Two-Line V-Network-GZ	Rohde & Schwarz	ENV216	EMC2135	2025-08-13	2026-08-12
EMI Test Receiver (9kHz-3.6GHz)	Rohde & Schwarz	ESR3	EMC2221	2025-11-18	2026-11-17
Test Software E3r	Audix	Ver.6.191211	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
1-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2025-08-11	2026-08-10
EMI Test Receiver (10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2025-08-11	2026-08-10
Chamber cable (Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2024-08-19	2026-08-18
Horn Antenna (1-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2025-05-13	2027-05-12
Horn Antenna (14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2023-06-18	2026-06-17
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2025-08-12	2026-08-11
MXE EMI Receiver (10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2025-08-11	2026-08-10
966 Anechoic Chamber	Shenzhen C.R.T	CRTSGSSAC966	EMC2230	2025-03-22	2028-03-21
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
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2025-08-13	2028-08-12
Coaxial cable	Mirco-COAX UTIFLEX	311A	EMC0540	2024-08-19	2026-08-18
Amplifier (9kHz-1.3GHz)	HP	8447F	EMC2065	2025-11-25	2026-11-24
Active Loop Antenna-RED	ETS-Lindgren	6502	EMC2190	2026-03-28	2028-03-27
EMI Test Receiver (9kHz-7GHz)	Rohde & Schwarz	ESR7	EMC2220	2025-11-18	2026-11-17
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Trilog Broadband Antenna (25MHz-2GHz)	Schwarzbeck Mess-Elektronik	VULB 9168	EMC2174	2025-04-21	2027-04-20

Radiated Spurious Emissions Above 1GHz					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
1-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2025-08-11	2026-08-10
EMI Test Receiver (10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2025-08-11	2026-08-10
Chamber cable (Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2024-08-19	2026-08-18
Horn Antenna (1-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2025-05-13	2027-05-12
Horn Antenna (14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2023-06-18	2026-06-17
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2025-08-12	2026-08-11
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2025-08-12	2026-08-11
MXE EMI Receiver (10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2025-08-11	2026-08-10
966 Anechoic Chamber	Shenzhen C.R.T	CRTSGSSAC966	EMC2230	2025-03-22	2028-03-21
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Preamplifier (1-18GHz)	Shenzhen TST	LNA010180G50	EMC6036	2026-04-14	2027-04-13
Intelligent Coaxial RF Switch (DC-18GHz)	Shenzhen TST	ICS01018	EMC6037	2026-04-14	2027-04-13



RF Conducted Test					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
MI CABLE	SGS-EMC	0.8M	EMC2137	2025-11-02	2026-11-01
4X4 Power sensor Unit	TST	TSPS2023R	EMC2226	2025-08-12	2026-08-11
Test Software	TST	V2.0	GZE100-78	N/A	N/A
EXA Signal Analyzer (10Hz-44GHz)	Keysight	N9010A	EMC2138	2025-08-12	2026-08-11

General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DMM	Fluke	73	EMC0006	2026-05-14	2027-05-13



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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 3.74 dBi.

Antenna location: Refer to internal photo.



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: $2^9 - 1 = 511$ bits> Longest sequence of zeros: 8 (non-inverted signal)Linear Feedback Shift Register for Generation of the PRBS sequence An example of Pseudorandom Frequency Hopping Sequence as 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.



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 (2020) Section 6.2

Test Engineer: Luffy Chen

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: 22.0 °C

Humidity: 56.2 % RH

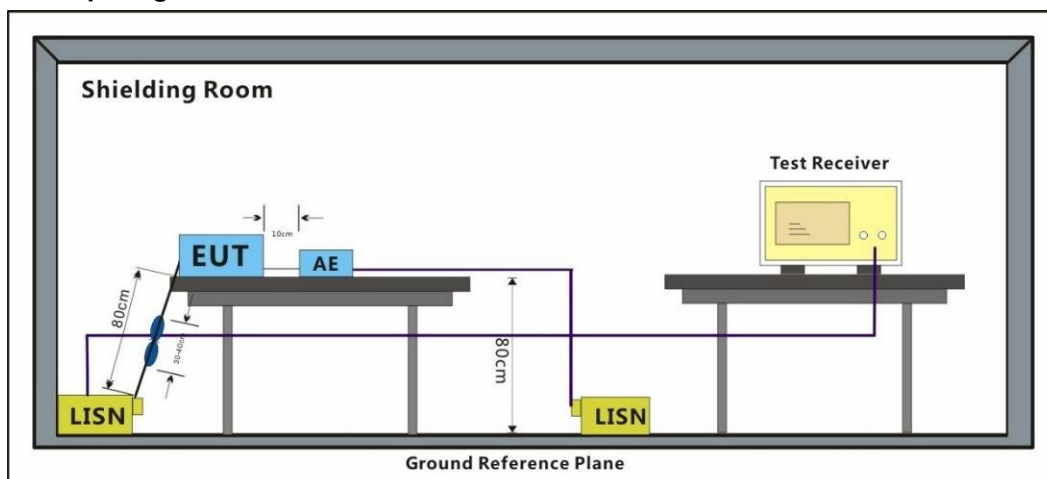
Atmospheric Pressure: 1010 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_non-Hop mode_Keep the EUT (ISOUSB111) 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	21	TX_non-Hop mode_Keep the EUT (AduM3160) 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.



7.1.3 Test Setup Diagram



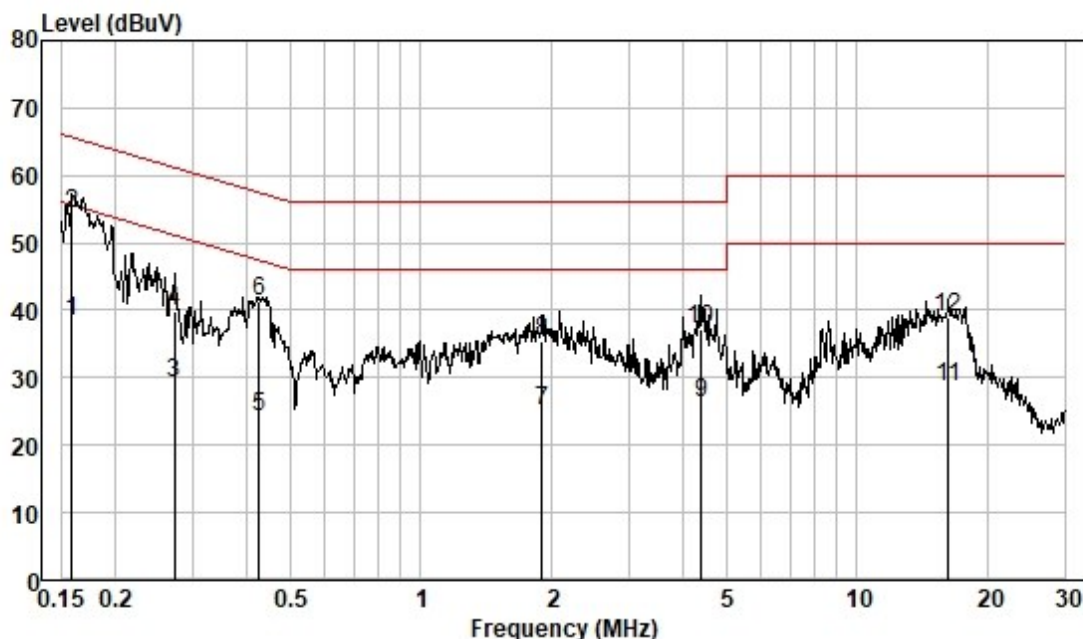
7.1.4 Measurement Procedure and Data

- 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



Test Mode: 00; Line: Live line

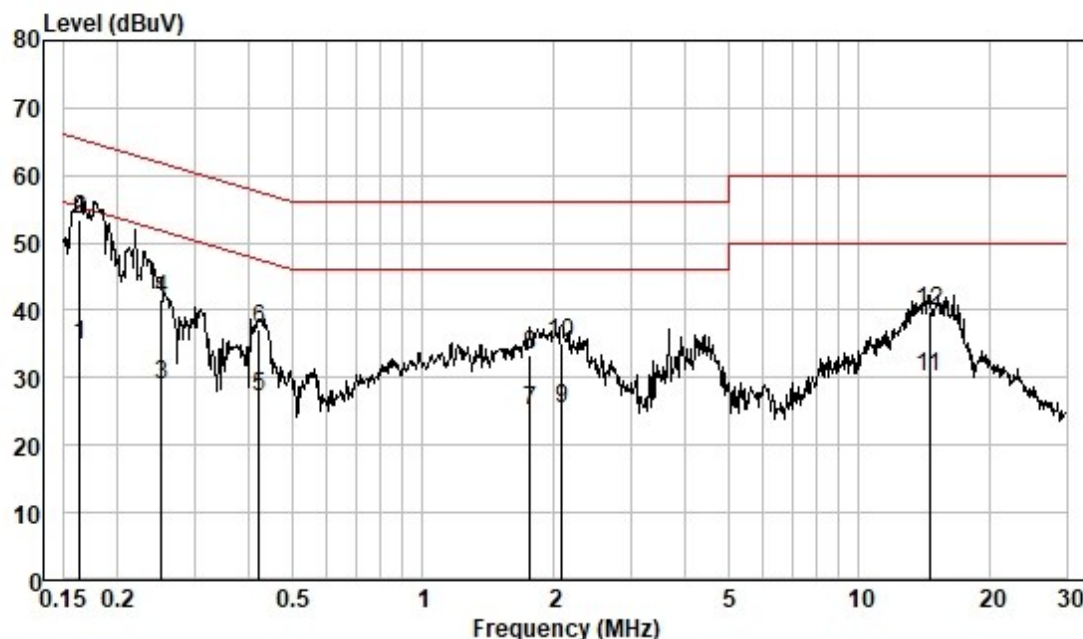


Pol :LINE
Mode :
Model :
Power :

	Freque	Read	Cable	LISN	Measured	Limit	Over	Remark
	nc	Level	Loss	Factor	Level	Line	Limit	
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.158	28.84	0.04	9.53	38.41	55.56	-17.15	Average
2	0.158	44.64	0.04	9.53	54.21	65.56	-11.35	QP
3	0.272	19.56	0.04	9.54	29.14	51.07	-21.93	Average
4	0.272	30.35	0.04	9.54	39.93	61.07	-21.14	QP
5	0.426	14.57	0.05	9.56	24.18	47.33	-23.15	Average
6	0.426	31.72	0.05	9.56	41.33	57.33	-16.00	QP
7	1.898	15.29	0.12	9.56	24.97	46.00	-21.03	Average
8	1.898	25.69	0.12	9.56	35.37	56.00	-20.63	QP
9	4.384	16.50	0.19	9.62	26.31	46.00	-19.69	Average
10	4.384	27.26	0.19	9.62	37.07	56.00	-18.93	QP
11	16.226	18.33	0.34	9.83	28.50	50.00	-21.50	Average
12	16.226	28.70	0.34	9.83	38.87	60.00	-21.13	QP



Test Mode: 00; Line: Neutral Line

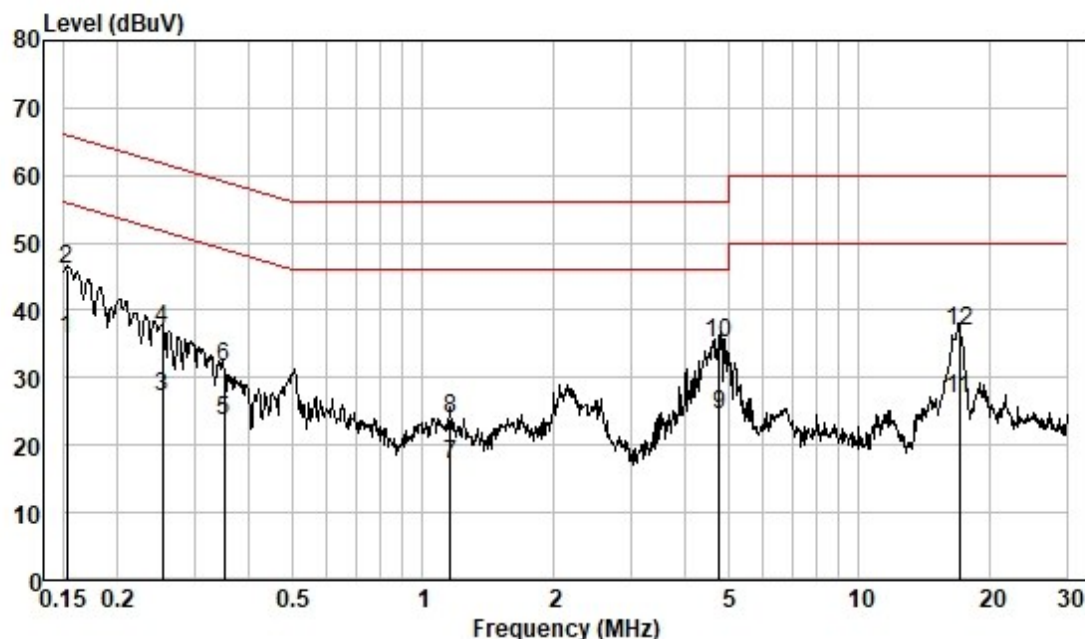


Pol : NEUTRAL
Mode :
Model :
Power :

	Frequency MHz	Read Level dBUV	Cable Loss dB	LISN Factor dB	Measured Level dBUV	Limit Line dBUV	Over Limit dB	Remark
1	0.163	25.18	0.04	9.52	34.74	55.30	-20.56	Average
2	0.163	43.98	0.04	9.52	53.54	65.30	-11.76	QP
3	0.252	19.44	0.04	9.53	29.01	51.69	-22.68	Average
4	0.252	32.17	0.04	9.53	41.74	61.69	-19.95	QP
5	0.421	17.50	0.05	9.57	27.12	47.42	-20.30	Average
6	0.421	27.50	0.05	9.57	37.12	57.42	-20.30	QP
7	1.762	15.40	0.11	9.56	25.07	46.00	-20.93	Average
8	1.762	23.71	0.11	9.56	33.38	56.00	-22.62	QP
9	2.088	15.63	0.13	9.56	25.32	46.00	-20.68	Average
10	2.088	25.52	0.13	9.56	35.21	56.00	-20.79	QP
11	14.517	19.83	0.32	9.92	30.07	50.00	-19.93	Average
12	14.517	29.62	0.32	9.92	39.86	60.00	-20.14	QP



Test Mode: 21; Line: Live line

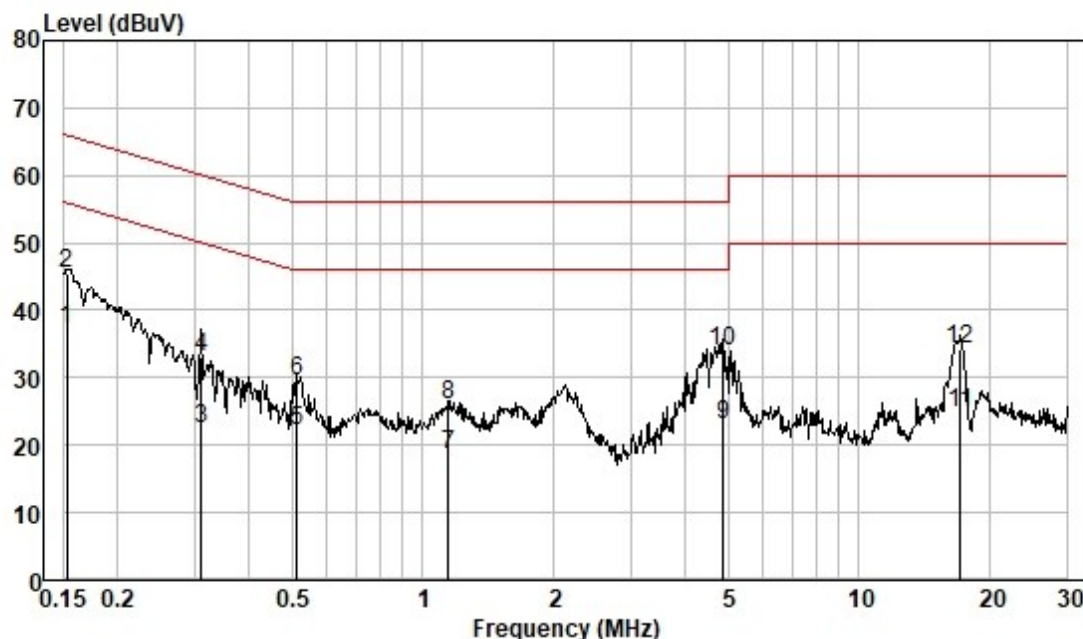


Pol :LINE
Mode :
Model :
Power :

	Frequeunc MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
1	0.152	26.28	0.04	9.54	35.86	55.87	-20.01	Average
2	0.152	36.39	0.04	9.54	45.97	65.87	-19.90	QP
3	0.253	17.74	0.04	9.52	27.30	51.64	-24.34	Average
4	0.253	27.56	0.04	9.52	37.12	61.64	-24.52	QP
5	0.350	13.90	0.05	9.56	23.51	48.96	-25.45	Average
6	0.350	21.97	0.05	9.56	31.58	58.96	-27.38	QP
7	1.153	7.54	0.08	9.59	17.21	46.00	-28.79	Average
8	1.153	14.18	0.08	9.59	23.85	56.00	-32.15	QP
9	4.772	14.76	0.19	9.62	24.57	46.00	-21.43	Average
10	4.772	25.45	0.19	9.62	35.26	56.00	-20.74	QP
11	16.928	16.77	0.35	9.83	26.95	50.00	-23.05	Average
12	16.928	26.80	0.35	9.83	36.98	60.00	-23.02	QP



Test Mode: 21; Line: Neutral Line



Pol : NEUTRAL
Mode :
Model :
Power :

	Frequency MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
1	0.152	27.62	0.04	9.50	37.16	55.87	-18.71	Average
2	0.152	36.02	0.04	9.50	45.56	65.87	-20.31	QP
3	0.310	12.93	0.04	9.53	22.50	49.97	-27.47	Average
4	0.310	23.38	0.04	9.53	32.95	59.97	-27.02	QP
5	0.516	12.39	0.05	9.56	22.00	46.00	-24.00	Average
6	0.516	19.93	0.05	9.56	29.54	56.00	-26.46	QP
7	1.141	8.86	0.08	9.57	18.51	46.00	-27.49	Average
8	1.141	16.46	0.08	9.57	26.11	56.00	-29.89	QP
9	4.874	13.22	0.19	9.63	23.04	46.00	-22.96	Average
10	4.874	23.99	0.19	9.63	33.81	56.00	-22.19	QP
11	17.018	14.57	0.35	9.90	24.82	50.00	-25.18	Average
12	17.018	24.01	0.35	9.90	34.26	60.00	-25.74	QP



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 (2020) Section 6.10.5 & 7.8.8
 Test Engineer: Lily Kuang
 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

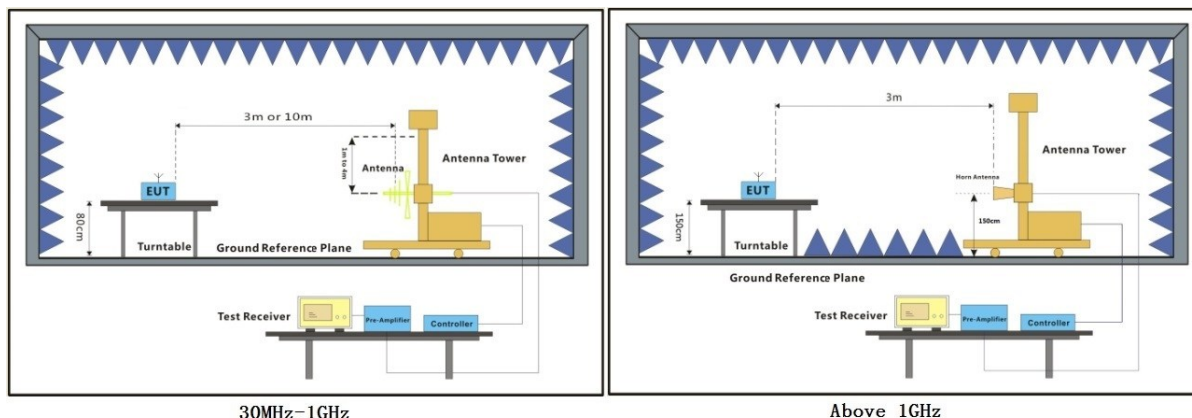
Operating Environment:
 Temperature: 25.3 °C Humidity: 52.7 % RH Atmospheric Pressure: 1010 mbar

7.2.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 00	TX_non-Hop mode 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.



7.2.3 Test Setup Diagram



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

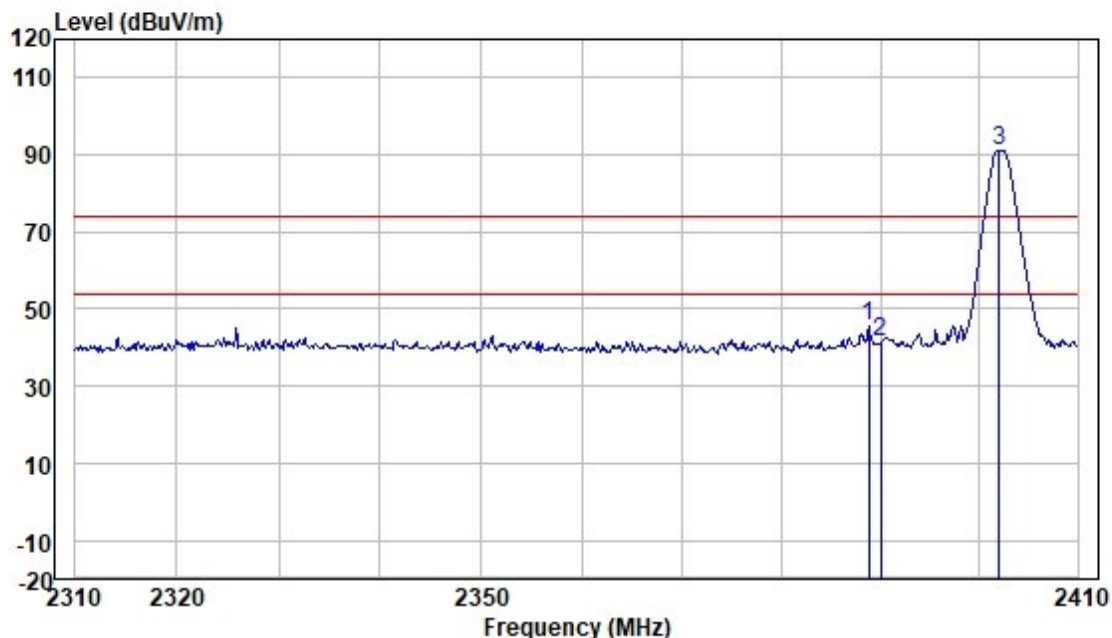
Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level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

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 $\geq 1/T$ (Duty cycle $\leq 98\%$) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.



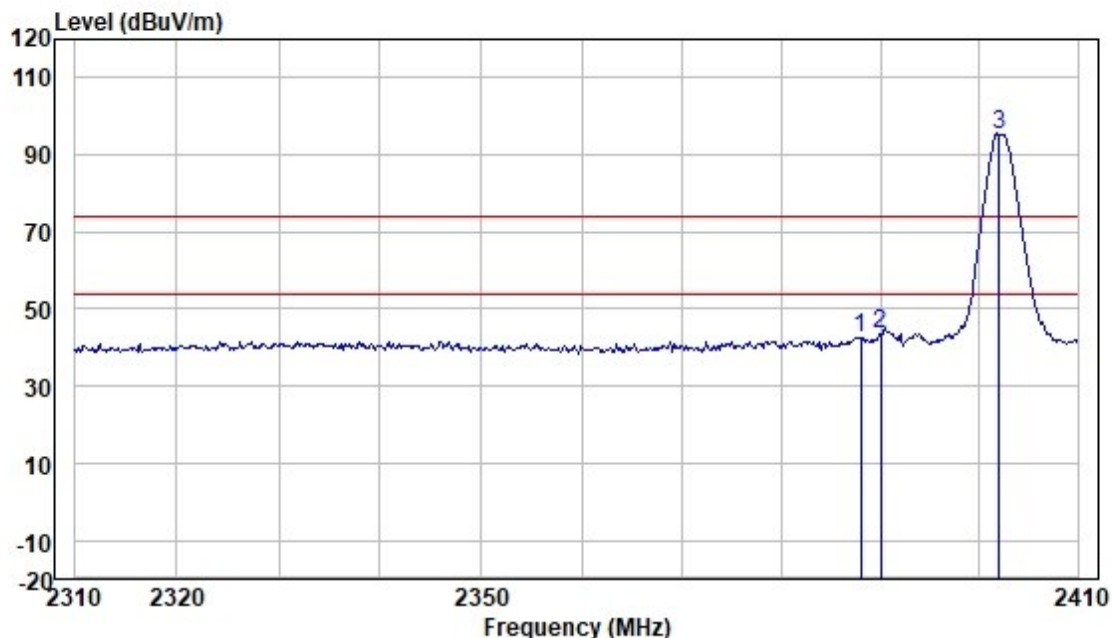
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:Low



	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	2388.75	52.38	27.63	3.44	37.77	45.68	74.00	-28.32	VERTICAL	peak
2	2390.00	48.12	27.63	3.44	37.77	41.42	74.00	-32.58	VERTICAL	peak
3*	2402.00	97.68	27.65	3.45	37.77	91.01	74.00	17.01	VERTICAL	peak



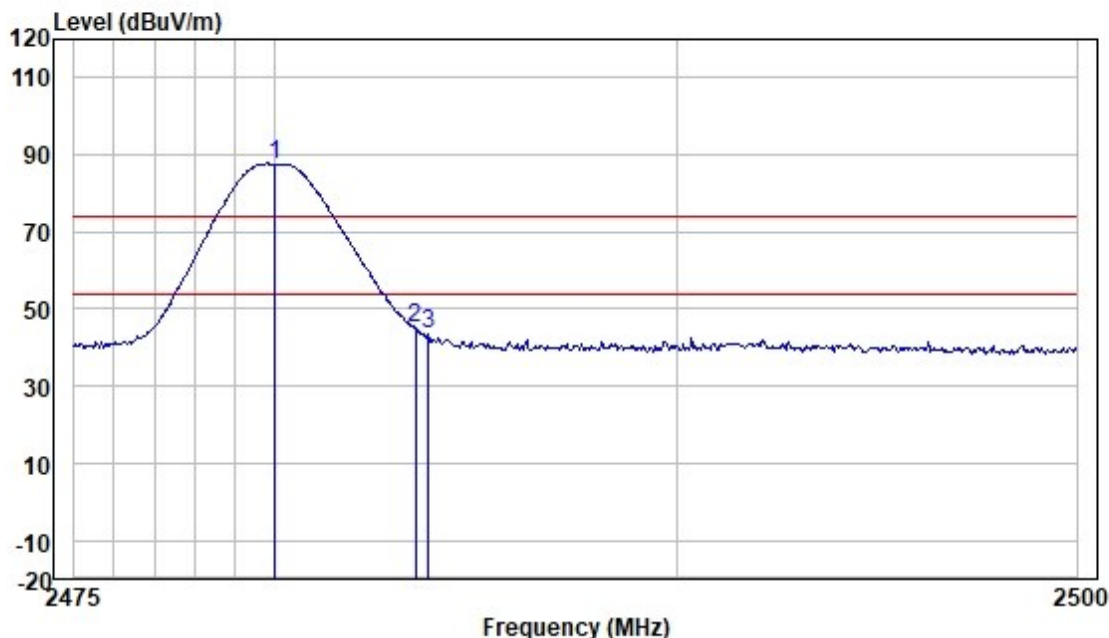
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:Low



	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	2387.94	49.36	27.63	3.44	37.77	42.66	74.00	-31.34	HORIZONTAL	peak
2	2390.00	50.29	27.63	3.44	37.77	43.59	74.00	-30.41	HORIZONTAL	peak
3*	2402.00	102.12	27.65	3.45	37.77	95.45	74.00	21.45	HORIZONTAL	peak



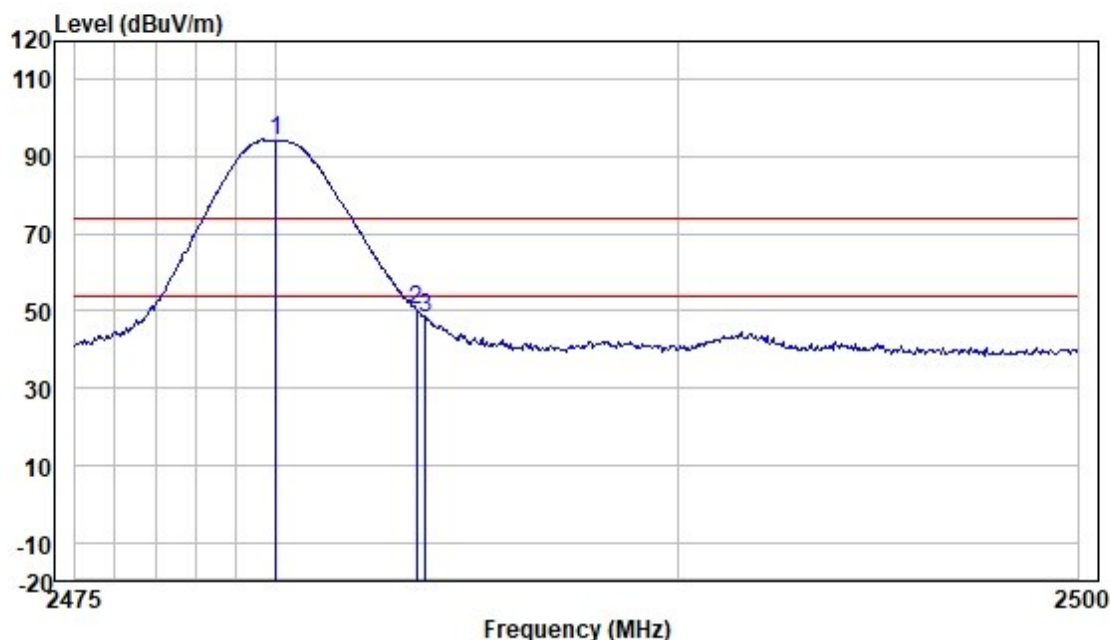
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:High



	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*	2480.00	94.14	27.75	3.48	37.76	87.61	74.00	13.61	VERTICAL	peak
2	2483.50	51.41	27.76	3.49	37.76	44.90	74.00	-29.10	VERTICAL	peak
3	2483.82	49.96	27.76	3.49	37.76	43.45	74.00	-30.55	VERTICAL	peak



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*	2480.00	100.66	27.75	3.48	37.76	94.13	74.00	20.13	HORIZONTAL	peak
2	2483.50	56.93	27.76	3.49	37.76	50.42	74.00	-23.58	HORIZONTAL	peak
3	2483.72	54.78	27.76	3.49	37.76	48.27	74.00	-25.73	HORIZONTAL	peak



7.3 Radiated Spurious Emissions Below 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2020) Section 6.4,6.5

Test Engineer: Luffy Chen

Limit:

Test Distance: 10m

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
30-88	100	3
88-216	150	3
216-960	200	3
960-1000	500	3

Note

1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

2. At frequencies below 1GHz, measurements may be performed at a distance different to specified in the regulations.

Limit = The limit above - Aux Factor (if applicable)

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

The aux factor needs to be added when measurements are performed at a distance other than the limit distance provided.

EX. Below 30MHz, Aux Factor = 40 dB/decade of distance, the aux factor is $40\log(3/300) = -80\text{dB}$ (for 3m test distance).

EX. Above 30MHz, Aux Factor = 20 dB/decade of distance, the aux factor is $20\log(10/3) = 10.46\text{dB}$ (for 10m test distance).

7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 23.0 °C

Humidity: 53.3 % RH

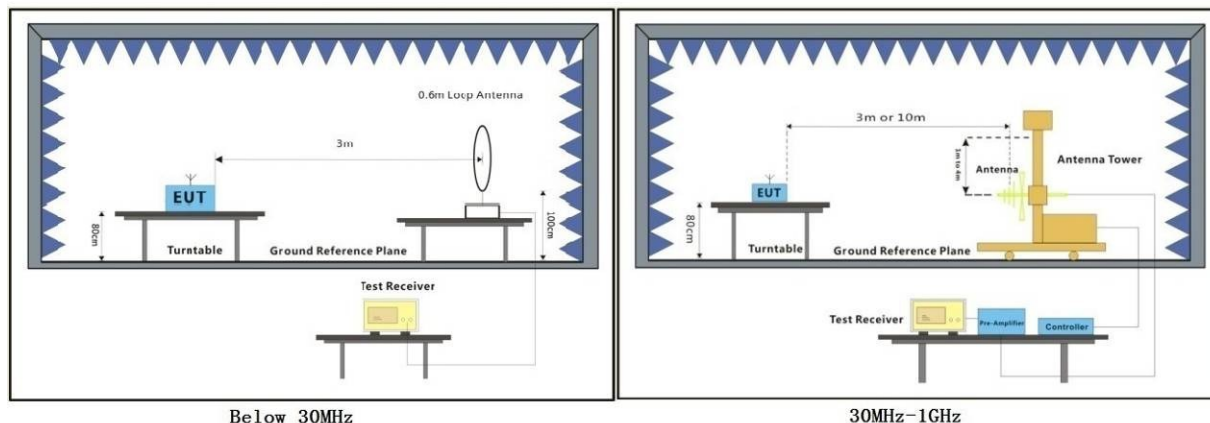
Atmospheric Pressure: 1010 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	00	TX_non-Hop mode_Keep the EUT (ISOUSB111) 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	21	TX_non-Hop mode_Keep the EUT (AduM3160) 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



7.3.4 Measurement Procedure and Data

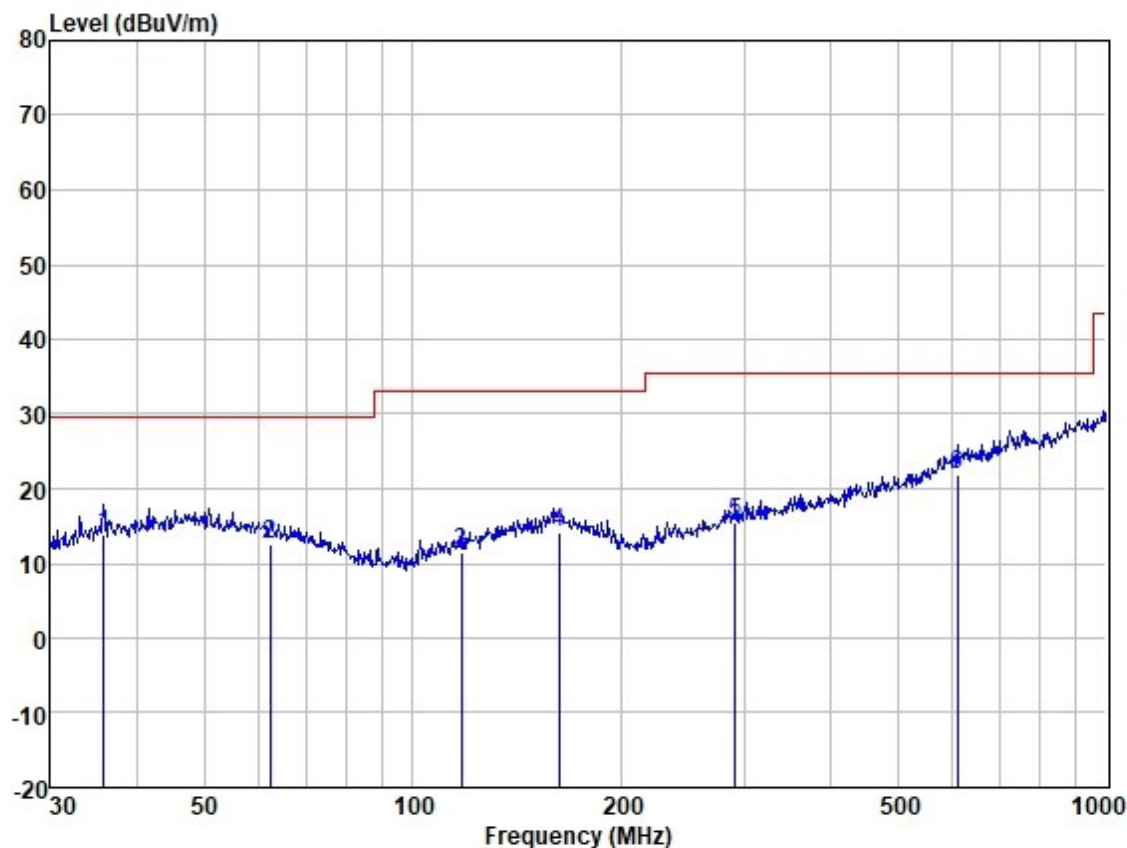
- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8m above the ground at a semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3m or 10m away from the interference-receiving antenna, which was mounted on the variable-height antenna tower.
- c. The antenna height is varied from 1m to 4m 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 1m to 4m (for the test frequency of below 30MHz, the antenna was tuned to heights 1m) 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. Scan from 9kHz to 30MHz, the disturbance below 30MHz was very low. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
2. The disturbance below 1GHz was very low and the harmonics were the highest point could be found when testing, so only the worst-case test curve is displayed.



Test Mode: 00; Polarity: Horizontal

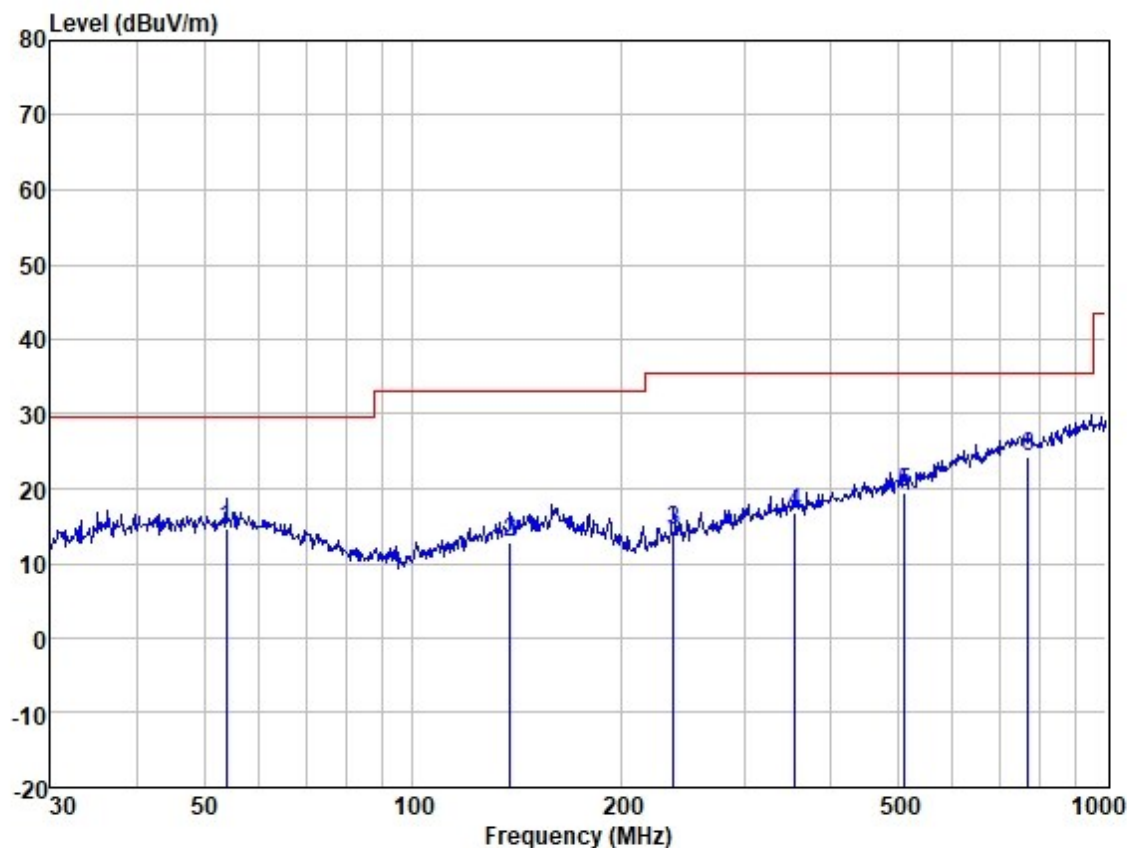


Site : SGS
Job :
Model :
Power :
Test Mode : TX

	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	35.749	28.26	13.06	0.64	27.99	13.97	29.50	-15.53	HORIZONTAL	QP
2	62.213	26.55	12.99	0.78	27.92	12.40	29.50	-17.10	HORIZONTAL	QP
3	117.360	27.32	11.12	0.89	27.78	11.55	33.10	-21.55	HORIZONTAL	QP
4	162.611	27.46	13.39	1.03	27.69	14.19	33.10	-18.91	HORIZONTAL	QP
5	292.058	27.54	13.46	1.67	27.21	15.46	35.60	-20.14	HORIZONTAL	QP
6	609.922	27.92	20.36	2.06	28.46	21.88	35.60	-13.72	HORIZONTAL	QP



Test Mode: 00; Polarity: Vertical

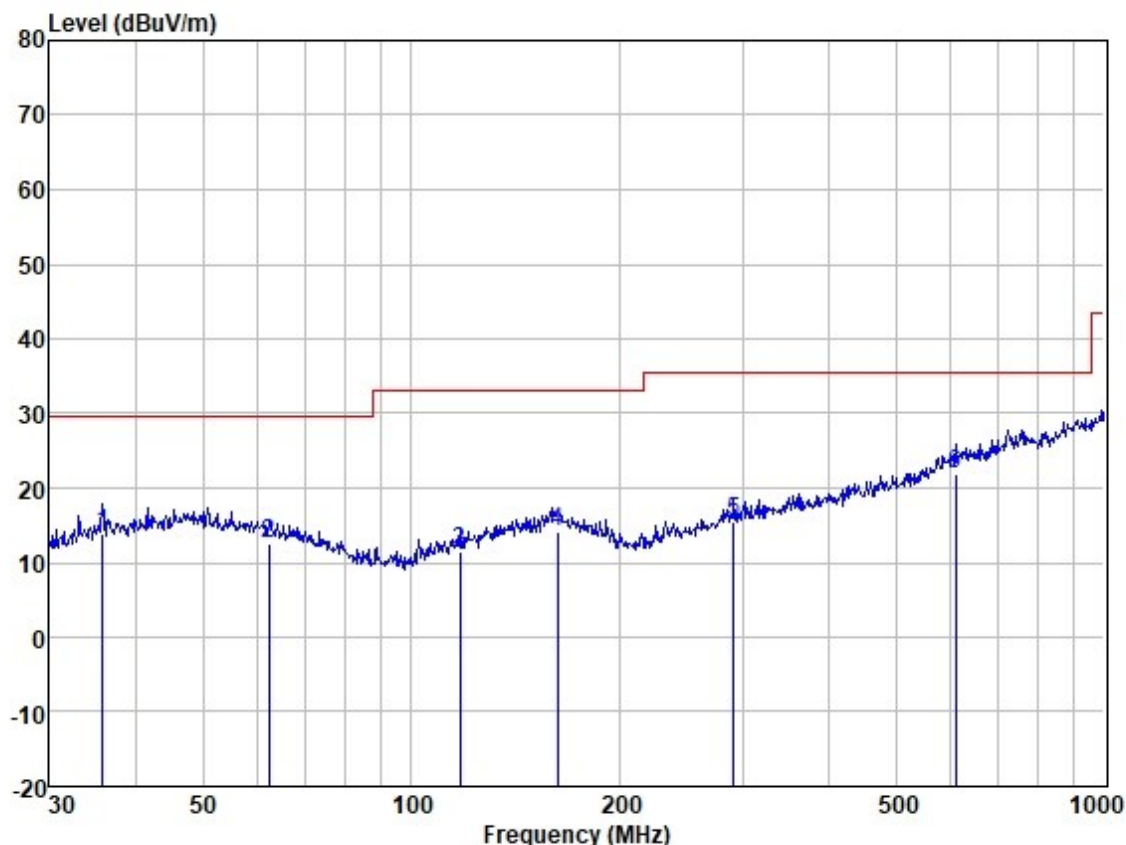


Site : SGS
Job :
Model :
Power :
Test Mode : TX

	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	53.693	27.91	13.83	0.76	27.95	14.55	29.50	-14.95	VERTICAL	QP
2	137.903	26.58	12.96	0.95	27.75	12.74	33.10	-20.36	VERTICAL	QP
3	237.476	28.75	11.53	1.47	27.30	14.45	35.60	-21.15	VERTICAL	QP
4	355.427	27.73	14.62	1.77	27.39	16.73	35.60	-18.87	VERTICAL	QP
5	511.835	27.89	18.20	1.91	28.50	19.50	35.60	-16.10	VERTICAL	QP
6	771.449	27.76	22.46	2.48	28.31	24.39	35.60	-11.21	VERTICAL	QP



Test Mode: 21; Polarity: Horizontal

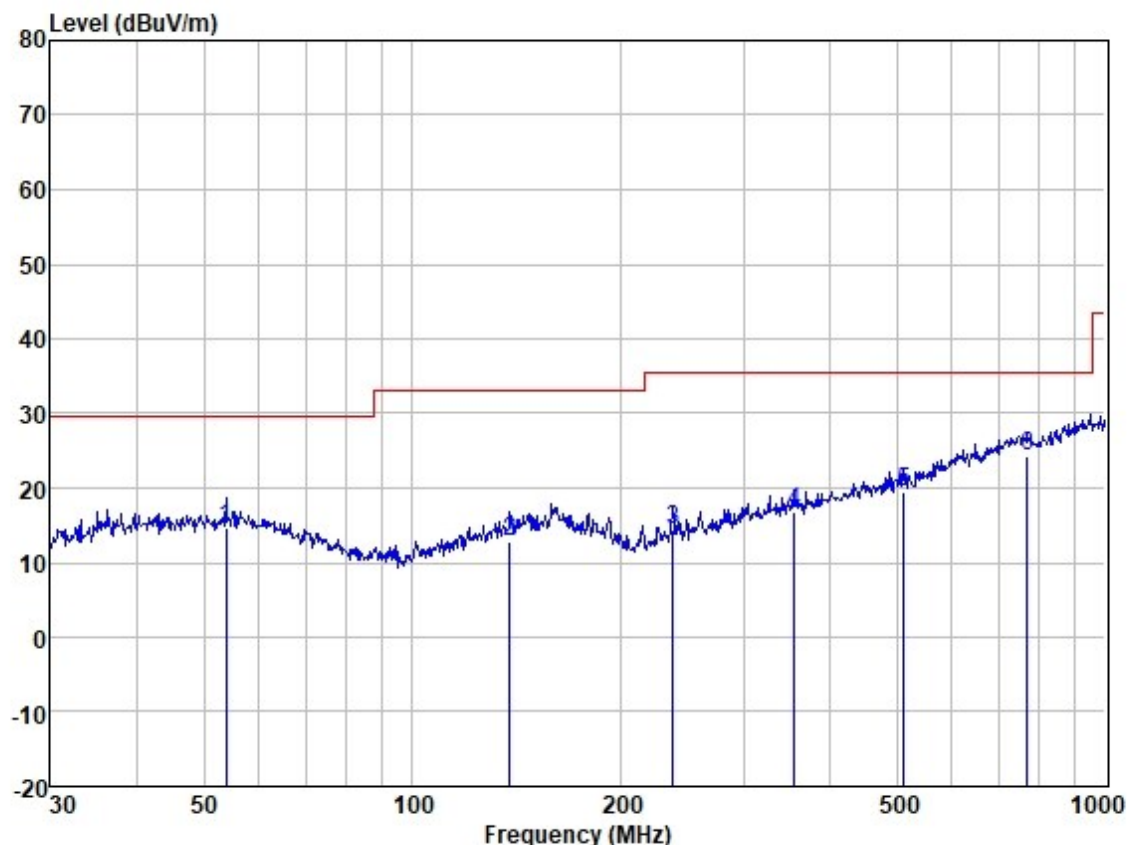


Site : SGS
Job :
Model :
Power :
Test Mode : TX

	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	35.749	28.26	13.06	0.64	27.99	13.97	29.50	-15.53	HORIZONTAL	QP
2	62.213	26.55	12.99	0.78	27.92	12.40	29.50	-17.10	HORIZONTAL	QP
3	117.360	27.32	11.12	0.89	27.78	11.55	33.10	-21.55	HORIZONTAL	QP
4	162.611	27.46	13.39	1.03	27.69	14.19	33.10	-18.91	HORIZONTAL	QP
5	292.058	27.54	13.46	1.67	27.21	15.46	35.60	-20.14	HORIZONTAL	QP
6	609.922	27.92	20.36	2.06	28.46	21.88	35.60	-13.72	HORIZONTAL	QP



Test Mode: 21; Polarity: Vertical



Site : SGS
Job :
Model :
Power :
Test Mode : TX

	Freq	Read Level	Antenna Factor	Cable Loss	Preamplifier Factor	Measured Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	53.693	27.91	13.83	0.76	27.95	14.55	29.50	-14.95	VERTICAL	QP
2	137.903	26.58	12.96	0.95	27.75	12.74	33.10	-20.36	VERTICAL	QP
3	237.476	28.75	11.53	1.47	27.30	14.45	35.60	-21.15	VERTICAL	QP
4	355.427	27.73	14.62	1.77	27.39	16.73	35.60	-18.87	VERTICAL	QP
5	511.835	27.89	18.20	1.91	28.50	19.50	35.60	-16.10	VERTICAL	QP
6	771.449	27.76	22.46	2.48	28.31	24.39	35.60	-11.21	VERTICAL	QP



7.4 Radiated Spurious Emissions Above 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2020) Section 6.6 & 7.8.8

Test Engineer: Lily Kuang

Limit:

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

Note:

At Above 18GHz, measurements may be performed at a distance shorter than that specified in the regulations

Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor+ Aux Factor (if applicable)

The aux factor needs to be added when measurements are performed at a distance other than the limit distance provided.

EX. Above 18GHz, Aux Factor = 20 dB/decade of distance, the aux factor is $20\log(1/3) = -9.54\text{dB}$ (for 1m test distance).

7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 25.3 °C

Humidity: 52.7 % RH

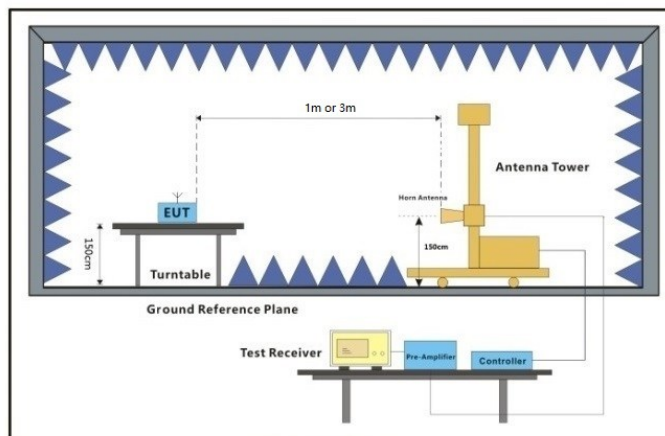
Atmospheric Pressure: 1010 mbar

7.4.2 Test Mode Description

Pre-scan / Mode
Final test Code Description

Final test 00 TX_non-Hop mode_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.

7.4.3 Test Setup Diagram



Above 1GHz



7.4.4 Measurement Procedure and Data

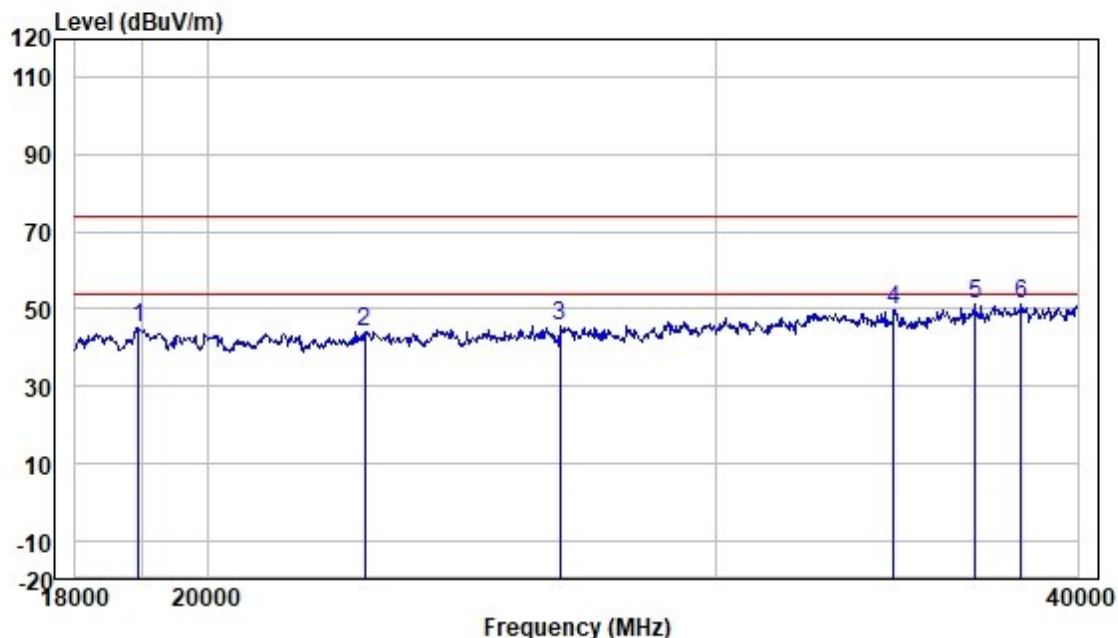
- a. For above 1GHz, the EUT was placed on the top of a rotating table 1.5m above the ground at a 3m fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. The EUT was set 3m away from the interference-receiving antenna from 1GHz to 18GHz, and 1m away from the interference-receiving antenna above 18GHz.
- b. The interference-receiving antenna was mounted on the variable-height antenna tower, with its boresight facing the EUT throughout the test.
- c. The antenna height is varied from 1m to 4m 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 1m to 4m 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. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- g. 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.
- h. Repeat above procedures until all frequencies measured was complete.

Remark:

1. Scan from 1GHz to 10th harmonic of the highest frequency or 40 GHz, whichever is lower.
2. 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.
3. For the frequency above 18GHz, testing had been executed under all test modes, only the worst-case test curve is displayed in the report.
4. For devices with multiple operating modes, measurements on the middle channel is used to determine the worst-case mode(s).



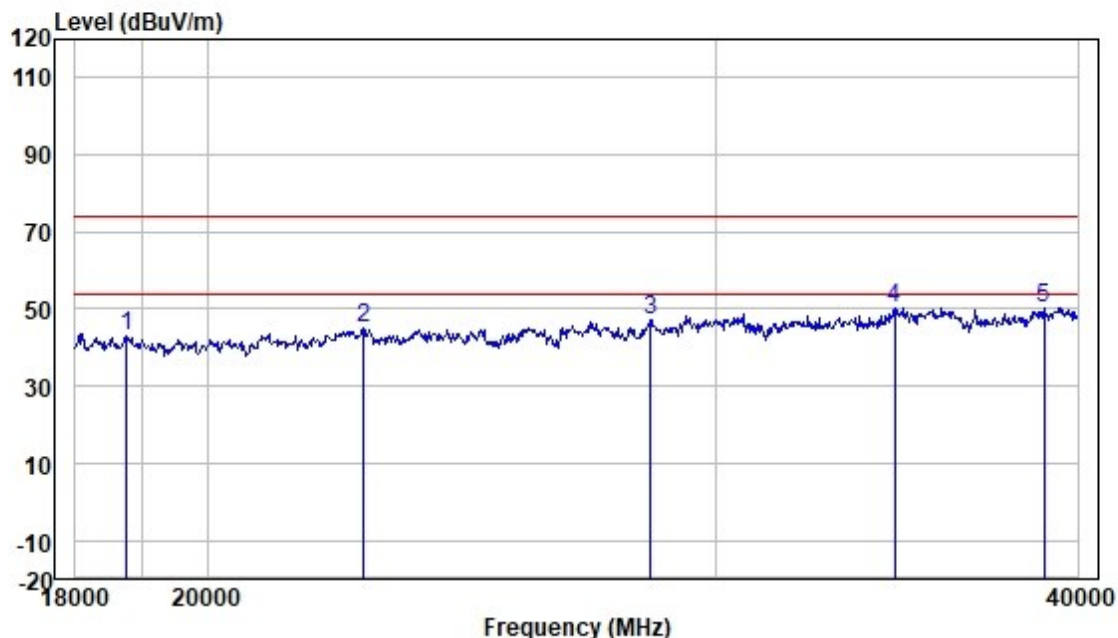
Test Mode: 00; Polarity: Vertical; Modulation:GFSK;



	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	18943.79	44.20	37.08	3.21	39.30	45.19	74.00	-28.81	VERTICAL	Peak
2	22672.22	40.99	38.23	3.34	38.60	43.96	74.00	-30.04	VERTICAL	Peak
3	26492.18	41.05	38.80	3.80	37.93	45.72	74.00	-28.28	VERTICAL	Peak
4	34534.34	41.94	40.91	6.19	39.08	49.96	74.00	-24.04	VERTICAL	Peak
5	36841.80	41.28	41.60	5.69	37.48	51.09	74.00	-22.91	VERTICAL	Peak
6	38220.21	39.74	42.65	5.15	36.12	51.42	74.00	-22.58	VERTICAL	Peak



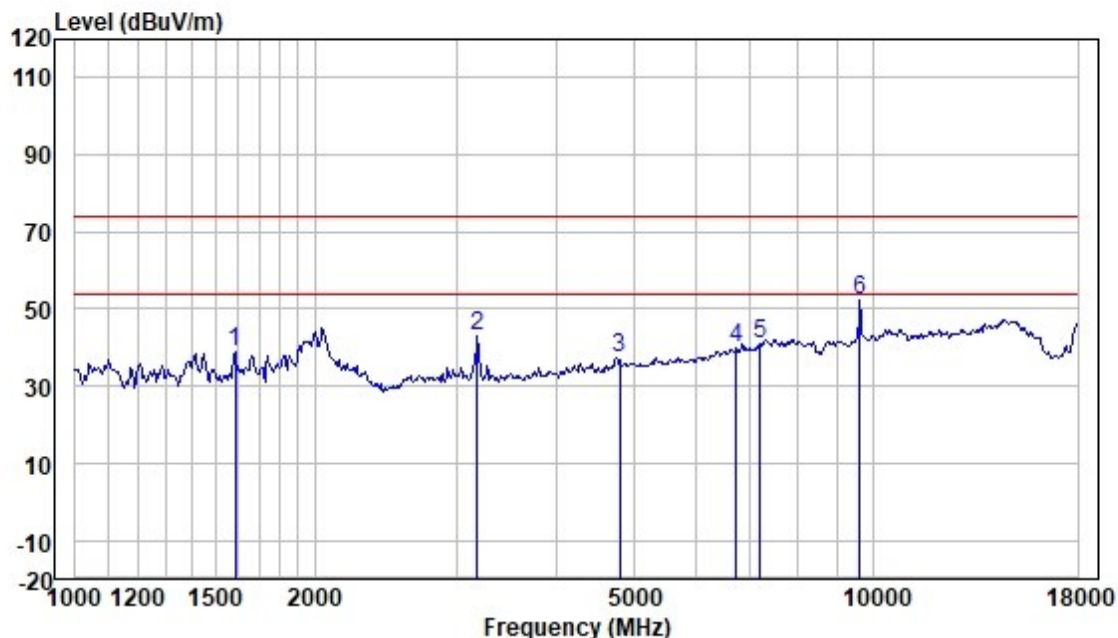
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK;



	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	18763.14	41.95	37.00	3.19	39.28	42.86	74.00	-31.14	HORIZONTAL	
2	22654.13	42.28	38.21	3.34	38.63	45.20	74.00	-28.80	HORIZONTAL	
3	28466.14	42.93	38.99	3.95	38.50	47.37	74.00	-26.63	HORIZONTAL	
4	34561.92	42.42	40.91	6.19	39.06	50.46	74.00	-23.54	HORIZONTAL	
5	38928.64	38.52	42.96	5.17	36.36	50.29	74.00	-23.71	HORIZONTAL	



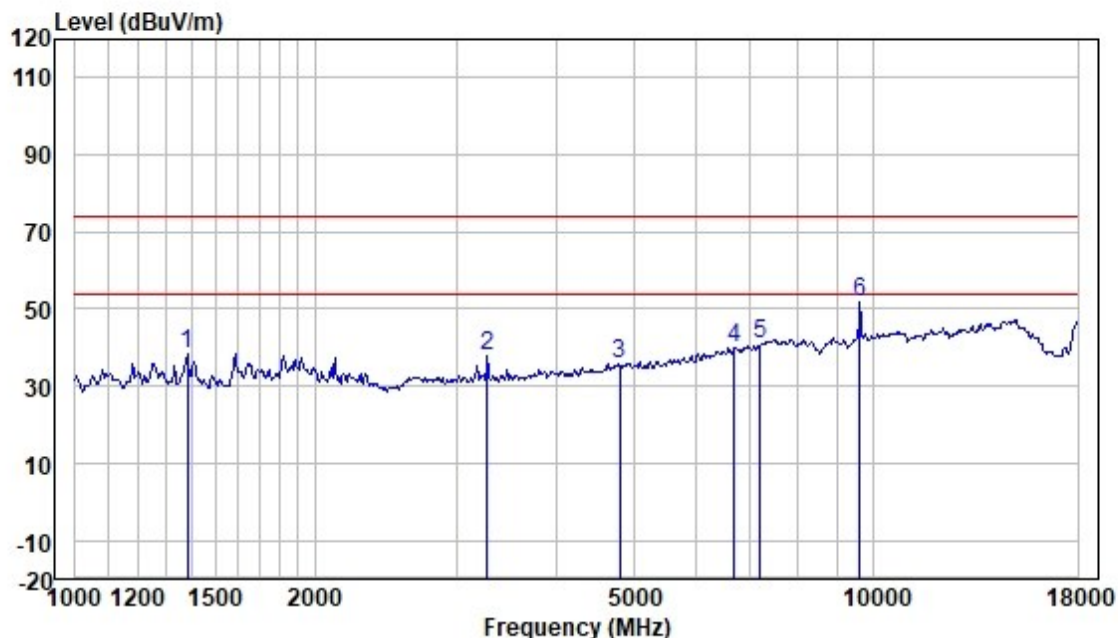
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel: Low



	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	1587.98	64.77	25.99	2.75	54.63	38.88	74.00	-35.12	VERTICAL	peak
2	3186.87	65.25	28.79	3.91	54.79	43.16	74.00	-30.84	VERTICAL	peak
3	4804.00	54.77	31.51	4.81	53.91	37.18	74.00	-36.82	VERTICAL	peak
4	6717.76	52.92	34.64	5.75	53.20	40.11	74.00	-33.89	VERTICAL	peak
5	7206.00	52.59	35.80	5.93	53.24	41.08	74.00	-32.92	VERTICAL	peak
6	9608.00	59.93	38.70	7.04	53.44	52.23	74.00	-21.77	VERTICAL	peak



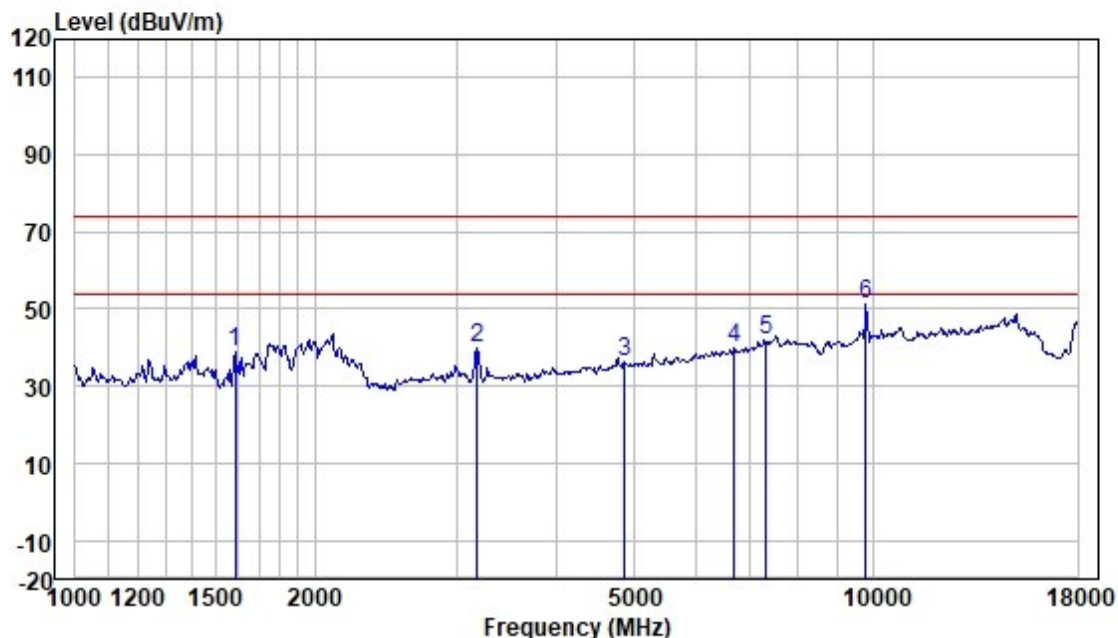
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel: Low



	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	1382.26	64.57	25.77	2.65	54.53	38.46	74.00	-35.54	HORIZONTAL	peak
2	3280.33	59.50	28.87	3.99	54.74	37.62	74.00	-36.38	HORIZONTAL	peak
3	4804.00	53.28	31.51	4.81	53.91	35.69	74.00	-38.31	HORIZONTAL	peak
4	6679.04	52.94	34.53	5.72	53.20	39.99	74.00	-34.01	HORIZONTAL	peak
5	7206.00	52.23	35.80	5.93	53.24	40.72	74.00	-33.28	HORIZONTAL	peak
6	9608.00	59.57	38.70	7.04	53.44	51.87	74.00	-22.13	HORIZONTAL	peak



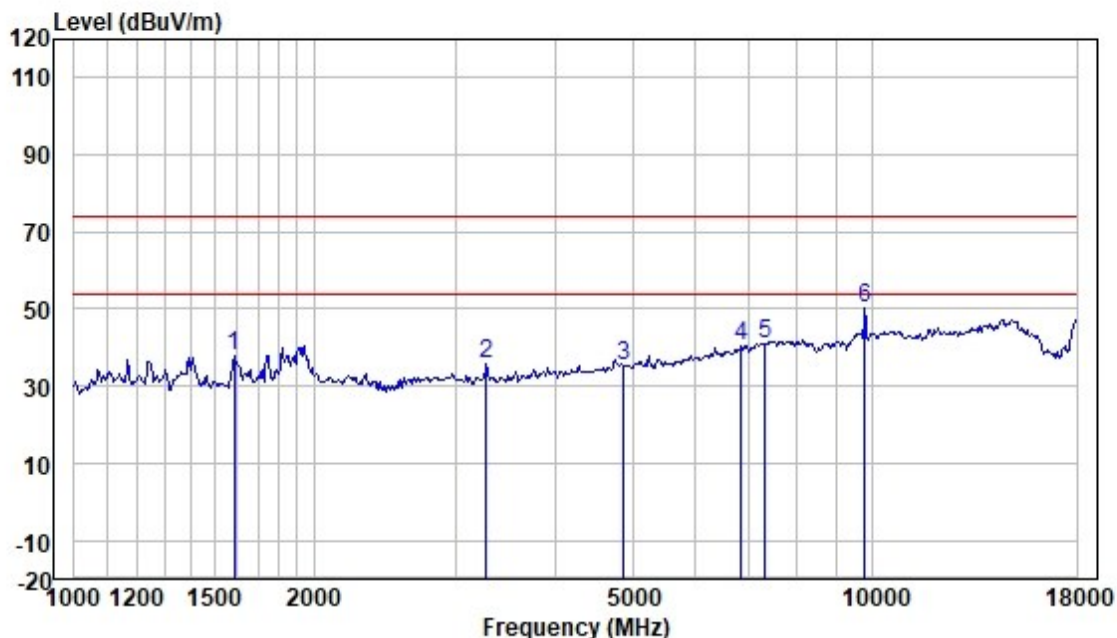
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel: Middle



	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	1587.98	64.94	25.99	2.75	54.63	39.05	74.00	-34.95	VERTICAL	peak
2	3186.87	62.27	28.79	3.91	54.79	40.18	74.00	-33.82	VERTICAL	peak
3	4880.00	53.79	31.63	4.85	53.87	36.40	74.00	-37.60	VERTICAL	peak
4	6679.04	52.91	34.53	5.72	53.20	39.96	74.00	-34.04	VERTICAL	peak
5	7320.00	52.83	36.29	5.98	53.27	41.83	74.00	-32.17	VERTICAL	peak
6	9760.00	58.69	38.87	7.11	53.42	51.25	74.00	-22.75	VERTICAL	peak



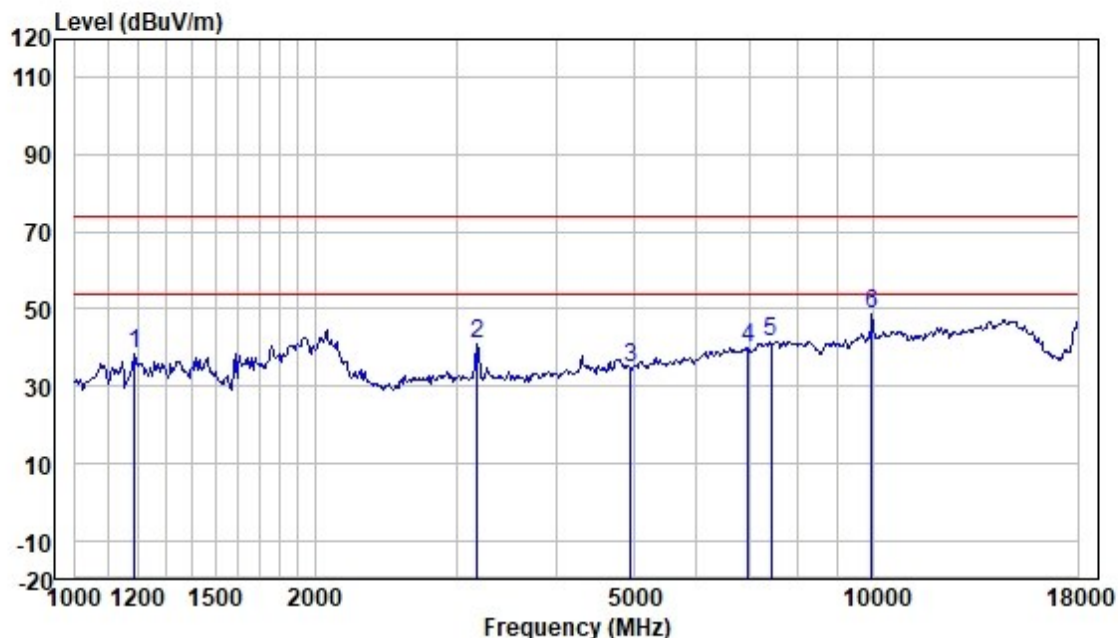
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel: Middle



	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	1587.98	63.88	25.99	2.75	54.63	37.99	74.00	-36.01	HORIZONTAL	peak
2	3280.33	57.48	28.87	3.99	54.74	35.60	74.00	-38.40	HORIZONTAL	peak
3	4880.00	52.67	31.63	4.85	53.87	35.28	74.00	-38.72	HORIZONTAL	peak
4	6835.28	52.99	34.96	5.81	53.20	40.56	74.00	-33.44	HORIZONTAL	peak
5	7320.00	51.98	36.29	5.98	53.27	40.98	74.00	-33.02	HORIZONTAL	peak
6	9760.00	57.90	38.87	7.11	53.42	50.46	74.00	-23.54	HORIZONTAL	peak



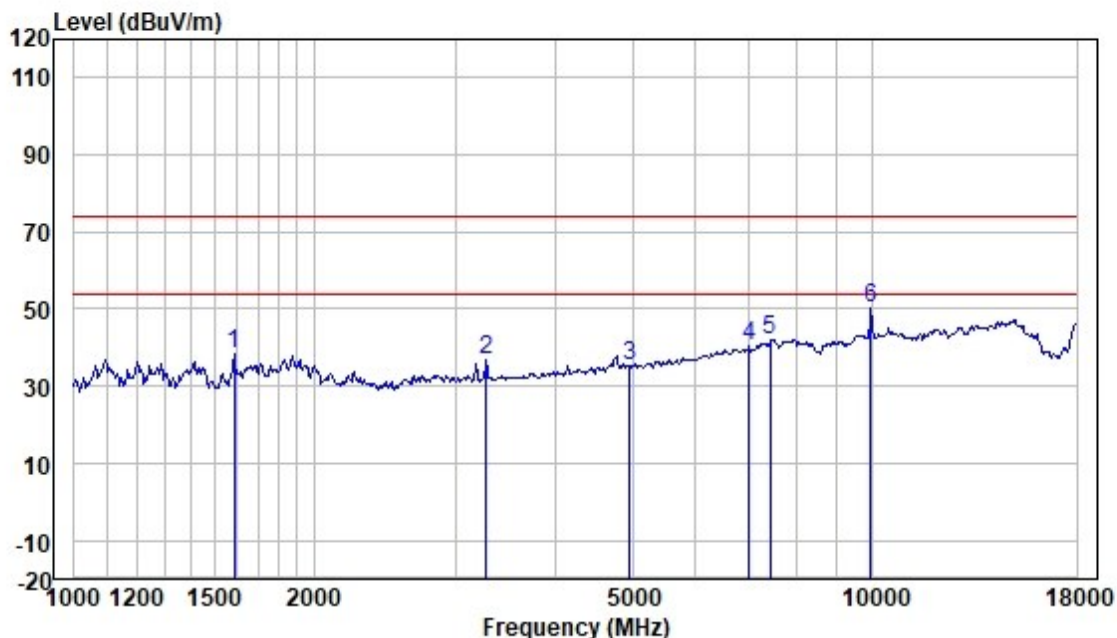
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel: High



	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	1189.37	65.68	25.00	2.37	54.43	38.62	74.00	-35.38	VERTICAL	peak
2	3186.87	63.30	28.79	3.91	54.79	41.21	74.00	-32.79	VERTICAL	peak
3	4960.00	51.95	31.74	4.89	53.82	34.76	74.00	-39.24	VERTICAL	peak
4	6954.85	52.11	35.17	5.86	53.20	39.94	74.00	-34.06	VERTICAL	peak
5	7440.00	52.07	36.57	6.02	53.29	41.37	74.00	-32.63	VERTICAL	peak
6	9920.00	55.83	39.07	7.19	53.41	48.68	74.00	-25.32	VERTICAL	peak



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	1587.98	64.27	25.99	2.75	54.63	38.38	74.00	-35.62	HORIZONTAL	peak
2	3280.33	58.57	28.87	3.99	54.74	36.69	74.00	-37.31	HORIZONTAL	peak
3	4960.00	52.23	31.74	4.89	53.82	35.04	74.00	-38.96	HORIZONTAL	peak
4	6995.17	52.39	35.23	5.87	53.20	40.29	74.00	-33.71	HORIZONTAL	peak
5	7440.00	52.52	36.57	6.02	53.29	41.82	74.00	-32.18	HORIZONTAL	peak
6	9920.00	57.41	39.07	7.19	53.41	50.26	74.00	-23.74	HORIZONTAL	peak



7.5 Maximum Conducted Output Power

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

Test Method: ANSI C63.10 (2020) Section 7.8.5

Test Engineer: Banna Ban

Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥ 50 hopping channels
	0.25 for $25 \leq$ 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: 22.2 °C

Humidity: 71.2 % RH

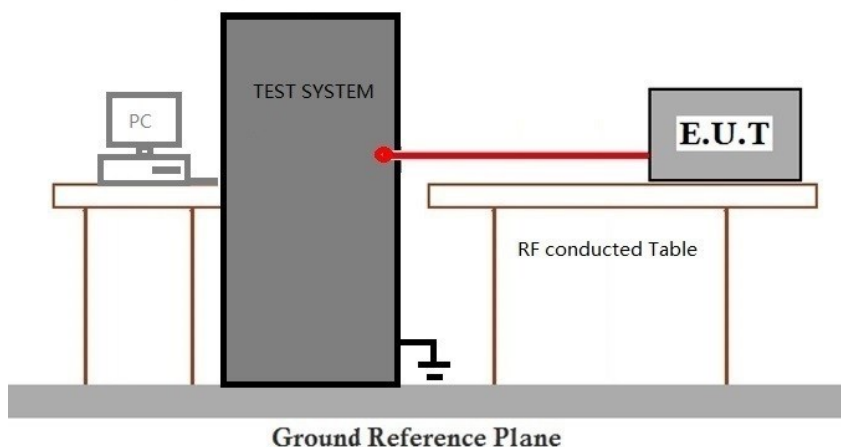
Atmospheric Pressure: 1010 mbar

7.5.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	

Final test	00	TX_non-Hop mode_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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7.5.3 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



7.6 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247(a)(1)
 Test Method: ANSI C63.10 (2020) Section 6.9.2
 Test Engineer: Banna Ban

7.6.1 E.U.T. Operation

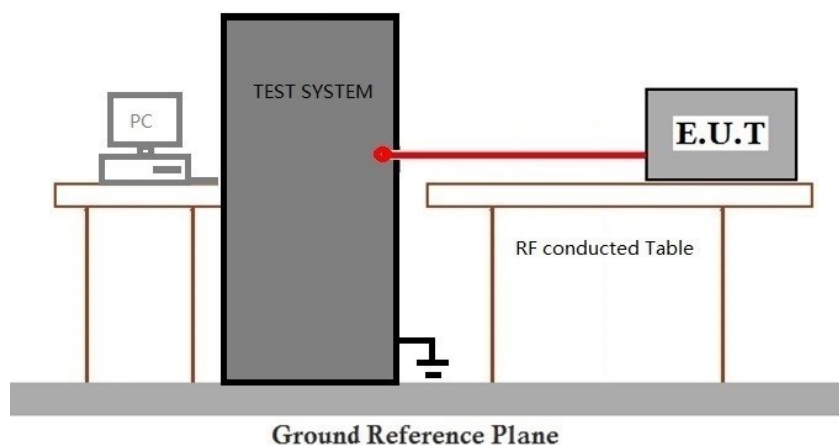
Operating Environment:

Temperature: 22.2 °C Humidity: 71.2 % RH Atmospheric Pressure: 1010 mbar

7.6.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 00	TX_non-Hop mode_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.

7.6.3 Test Setup Diagram



7.6.4 Measurement Procedure and Data

Please Refer to Appendix for Details

7.7 Carrier Frequencies Separation

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

Test Method: ANSI C63.10 (2020) Section 7.8.2

Test Engineer: Banna Ban

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: 22.2 °C

Humidity: 71.2 % RH

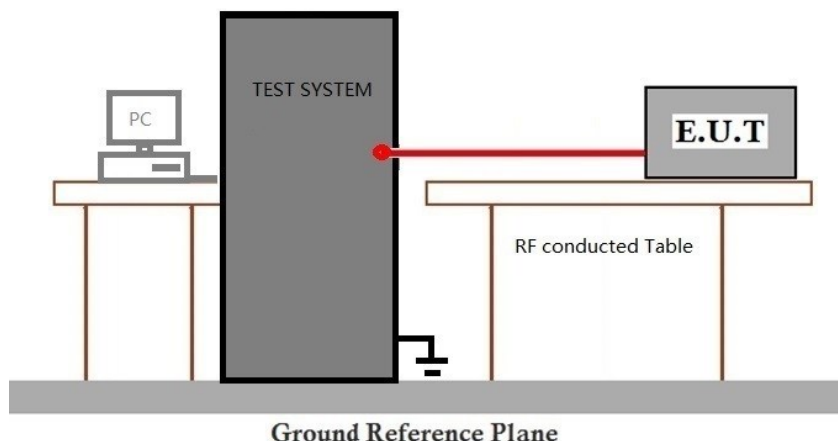
Atmospheric Pressure: 1010 mbar

7.7.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	

Final test	01	TX_Hop mode_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

Please Refer to Appendix for Details



7.8 Hopping Channel Number

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

Test Method: ANSI C63.10 (2020) Section 7.8.3

Test Engineer: Banna Ban

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:

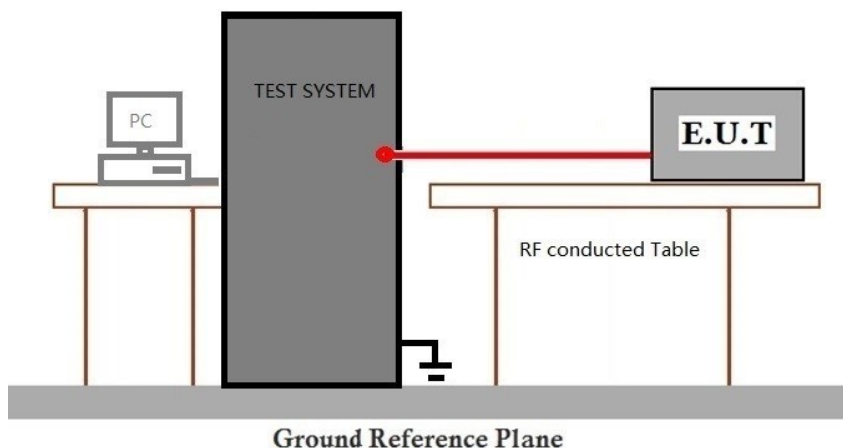
Temperature: 22.2 °C Humidity: 71.2 % RH Atmospheric Pressure: 1010 mbar

7.8.2 Test Mode Description

Pre-scan / Mode
Final test Code Description

Final test 01 TX_Hop mode_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.

7.8.3 Test Setup Diagram



7.8.4 Measurement Procedure and Data

Please Refer to Appendix for Details



7.9 Dwell Time

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

Test Method: ANSI C63.10 (2020) Section 7.8.4

Test Engineer: Banna Ban

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: 22.2 °C

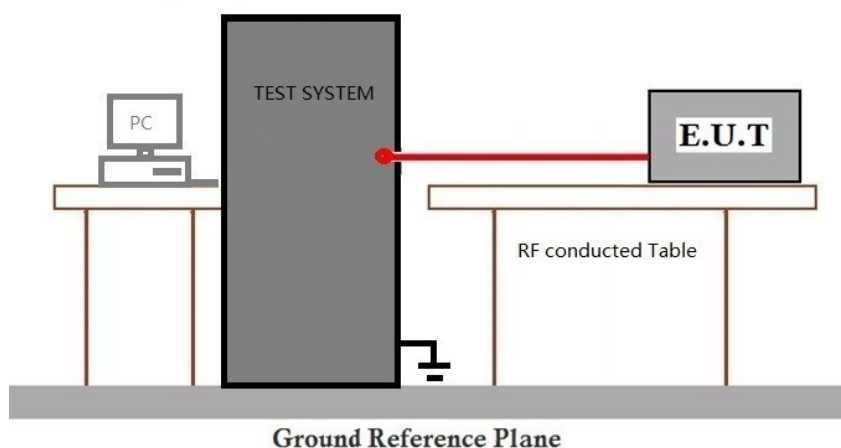
Humidity: 71.2 % RH

Atmospheric Pressure: 1010 mbar

7.9.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 01	TX_Hop mode_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.

7.9.3 Test Setup Diagram



7.9.4 Measurement Procedure and Data

Please Refer to Appendix for Details



7.10 Conducted Band Edges Measurement

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

Test Method: ANSI C63.10 (2020) Section 7.8.7.2

Test Engineer: Banna Ban

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: 22.2 °C

Humidity: 71.2 % RH

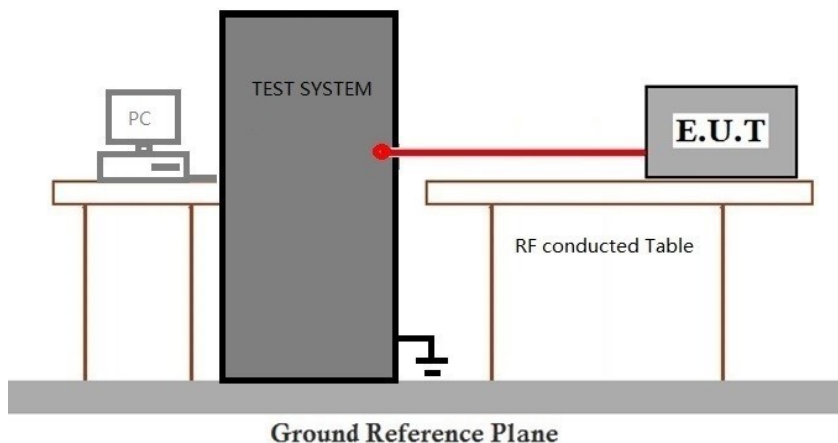
Atmospheric Pressure: 1010 mbar

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, 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_Hop mode 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.



7.10.3 Test Setup Diagram



7.10.4 Measurement Procedure and Data

Please Refer to Appendix for Details



7.11 Conducted Spurious Emissions

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

Test Method: ANSI C63.10 (2020) Section 7.8.7

Test Engineer: Banna Ban

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: 22.2 °C

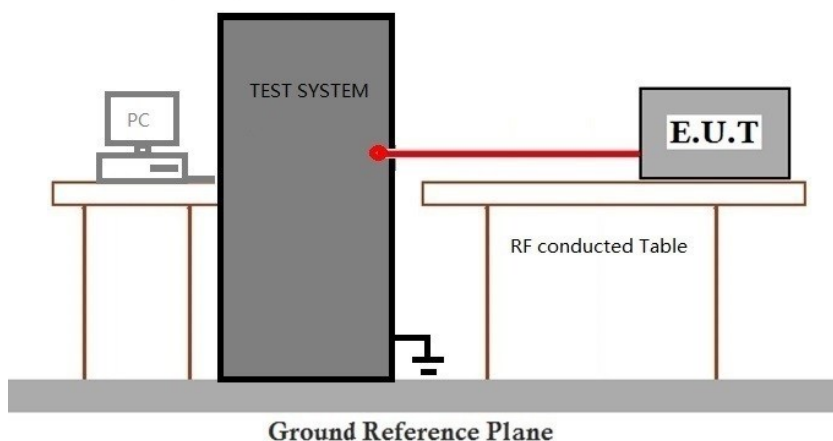
Humidity: 71.2 % RH

Atmospheric Pressure: 1010 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, Pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

7.11.3 Test Setup Diagram



7.11.4 Measurement Procedure and Data

Please Refer to Appendix for Details



8 Test Setup Photo

Refer to Appendix - Test Setup Photo for GZCR260300062503



9 EUT Constructional Details (EUT Photos)

Refer to Appendix - External and Internal Photos for GZCR2603000625AT



10 Appendix

1. Bandwidth

1.1 Test Result

1.1.1 20dB BW

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	20dB Bandwidth (MHz)		Verdict
					Result	Limit	
GFSK	SISO	2402	DH5	1	0.870	/	Pass
		2441	DH5	1	0.869	/	Pass
		2480	DH5	1	0.953	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.261	/	Pass
		2441	2DH5	1	1.258	/	Pass
		2480	2DH5	1	1.283	/	Pass
8DPSK	SISO	2402	3DH5	1	1.202	/	Pass
		2441	3DH5	1	1.201	/	Pass
		2480	3DH5	1	1.300	/	Pass



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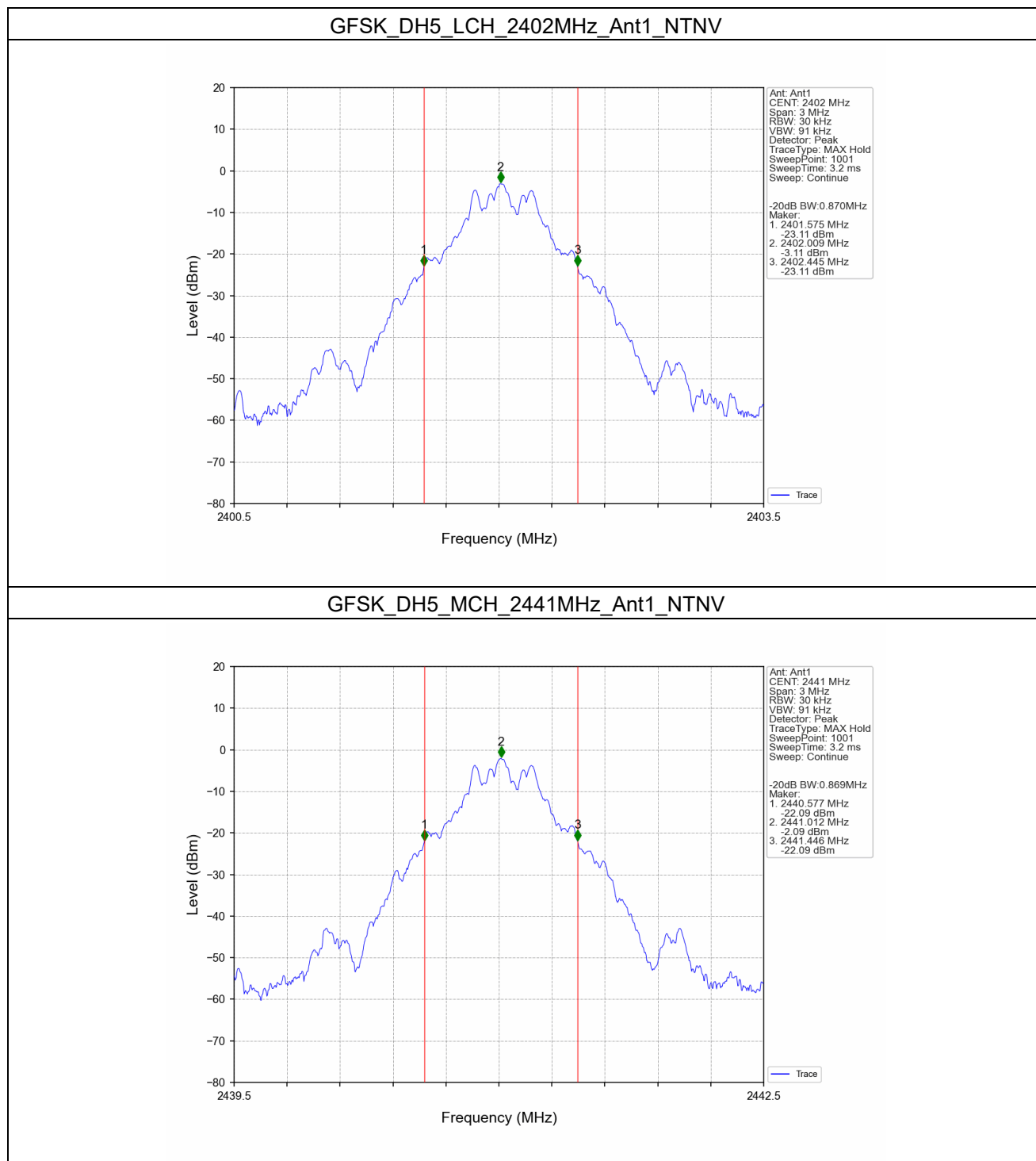
SGS-CSTC Standards Technical Services Co., Ltd.
Guangzhou Branch Competency Laboratory

No.198, Kezhu Road, Science City, Economic & Technological Development Area, Guangzhou, Guangdong, China 510663
中国·广东·广州高新技术产业开发区科学城科珠路198号 邮编: 510663

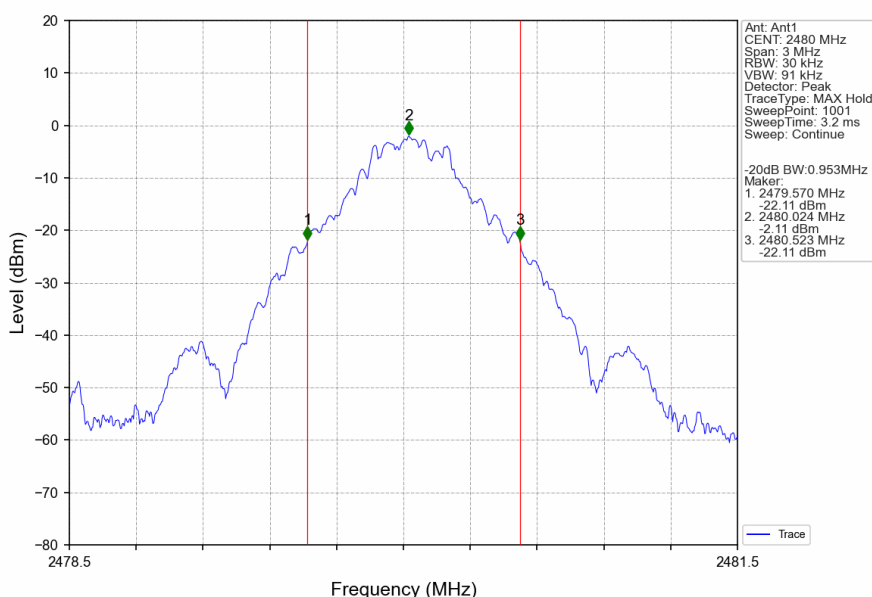
t (86-20) 82155555 www.ssgroup.com.cn
t (86-20) 82155555 sgs.china@sgs.com

1.2 Test Graph

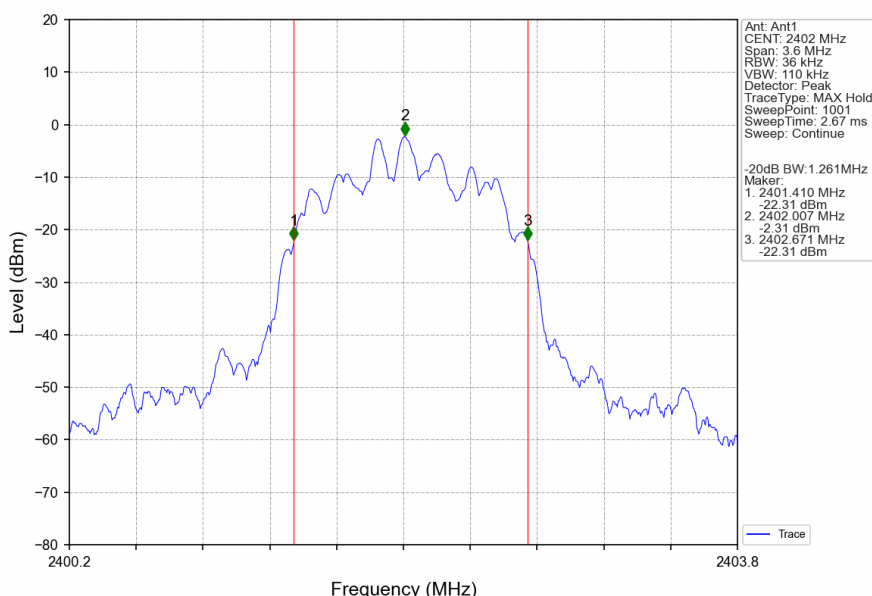
1.2.1 20dB BW



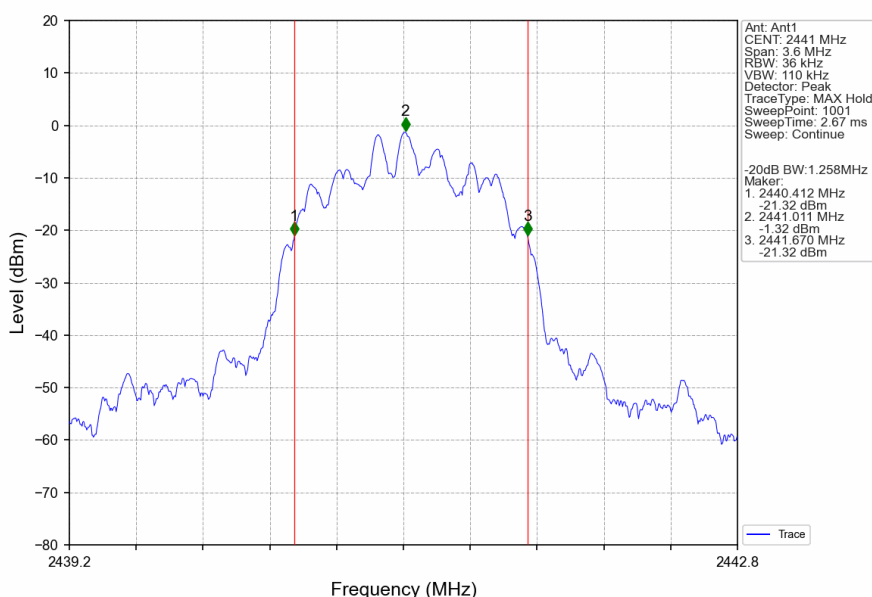
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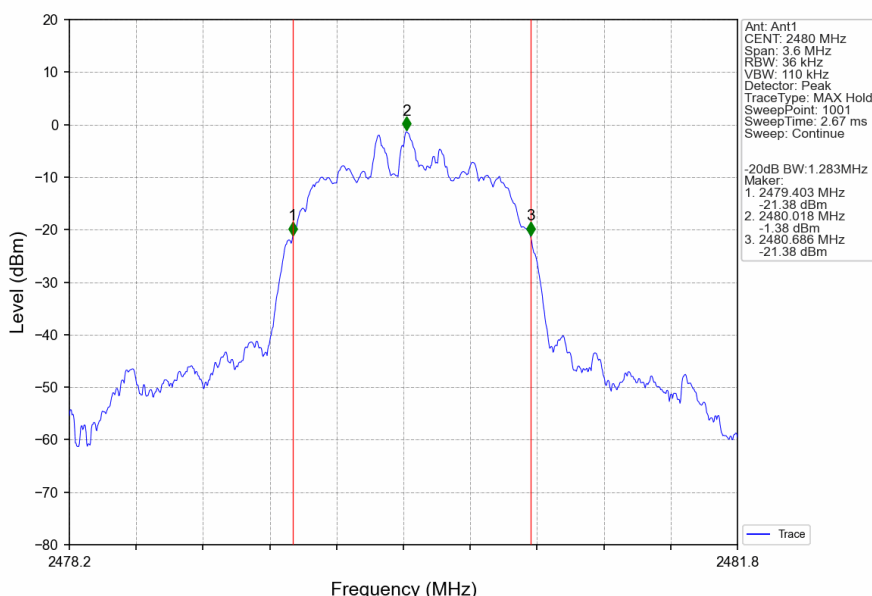
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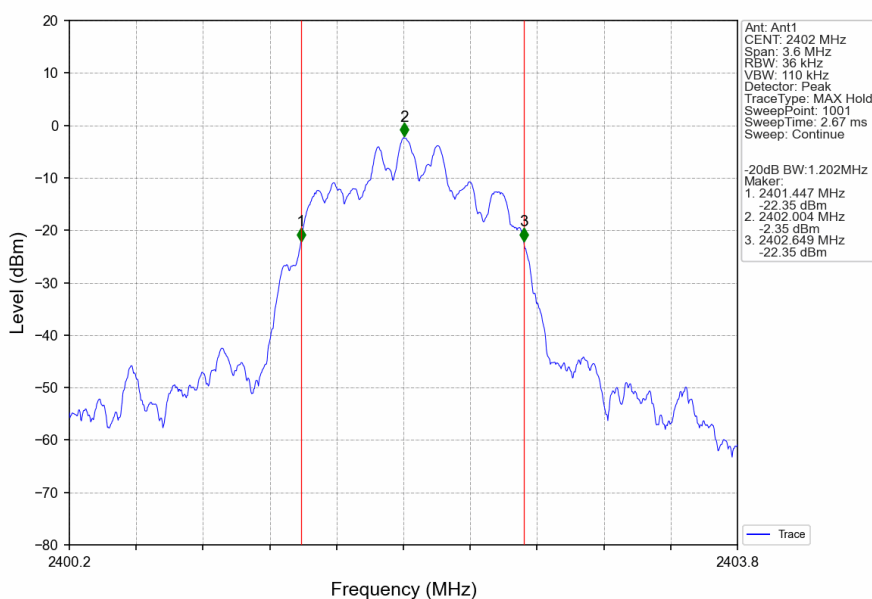
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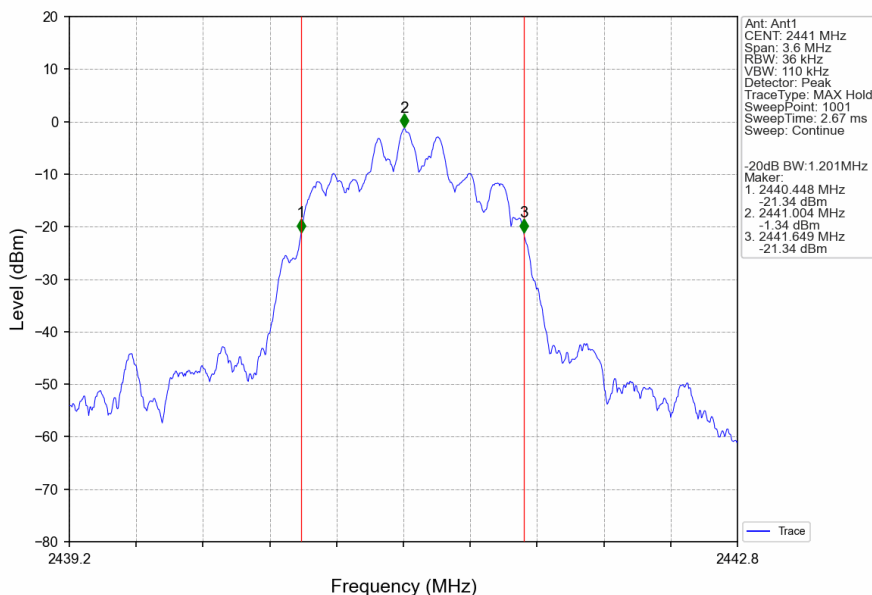
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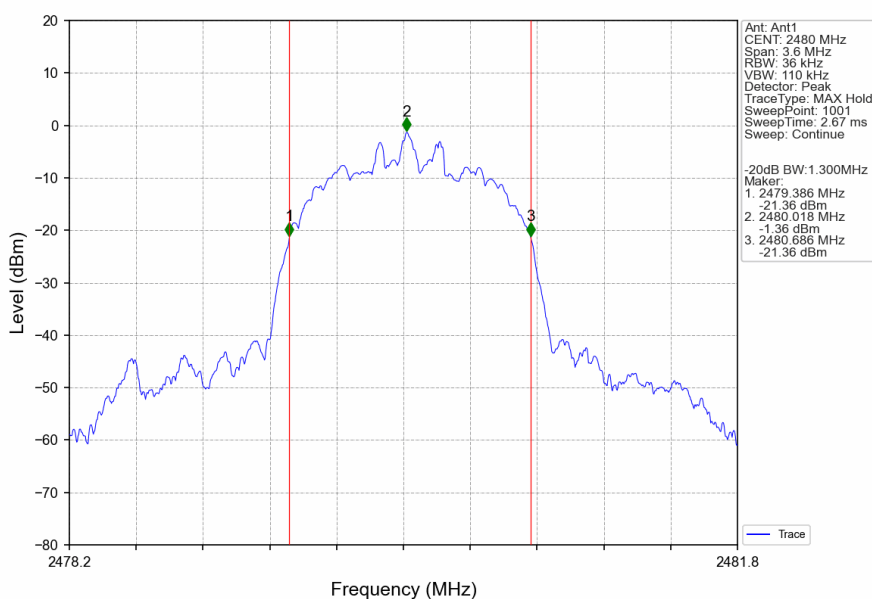
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV



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	-0.91	<=30	Pass
		2441	DH5	0.03	<=30	Pass
		2480	DH5	0.53	<=30	Pass
Pi/4DQPSK	SISO	2402	2DH5	-0.06	<=20.97	Pass
		2441	2DH5	0.86	<=20.97	Pass
		2480	2DH5	1.29	<=20.97	Pass
8DPSK	SISO	2402	3DH5	0.30	<=20.97	Pass
		2441	3DH5	1.22	<=20.97	Pass
		2480	3DH5	1.70	<=20.97	Pass



3. Carrier Frequency Separation

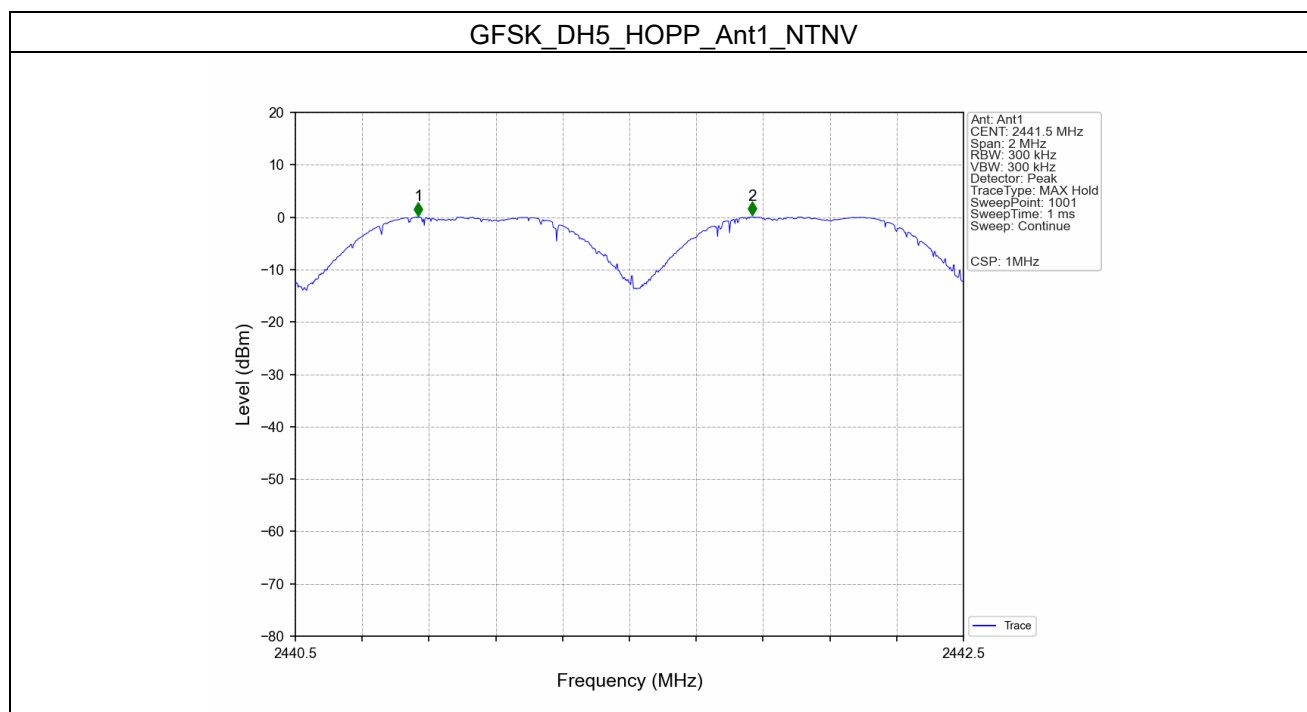
3.1 Test Result

3.1.1 Ant1

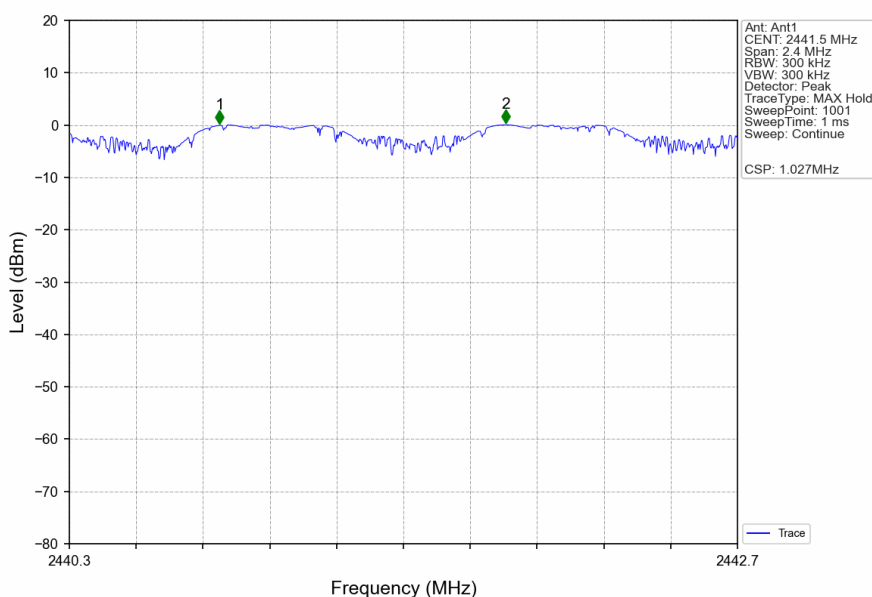
Ant1							
Mode	TX Type	Frequency (MHz)	Packet Type	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Verdict
GFSK	SISO	HOPP	DH5	1.000	0.953	≥ 0.953	Pass
Pi/4DQPSK	SISO	HOPP	2DH5	1.027	1.283	≥ 0.855	Pass
8DPSK	SISO	HOPP	3DH5	1.025	1.300	≥ 0.867	Pass

3.2 Test Graph

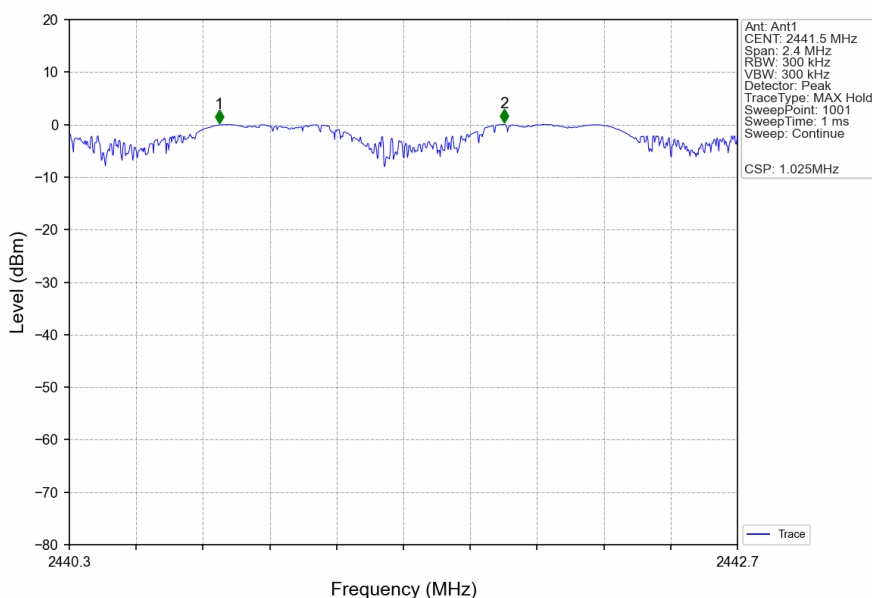
3.2.1 Ant1



Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV



8DPSK_3DH5_HOPP_Ant1_NTNV



4. Number of Hopping Frequencies

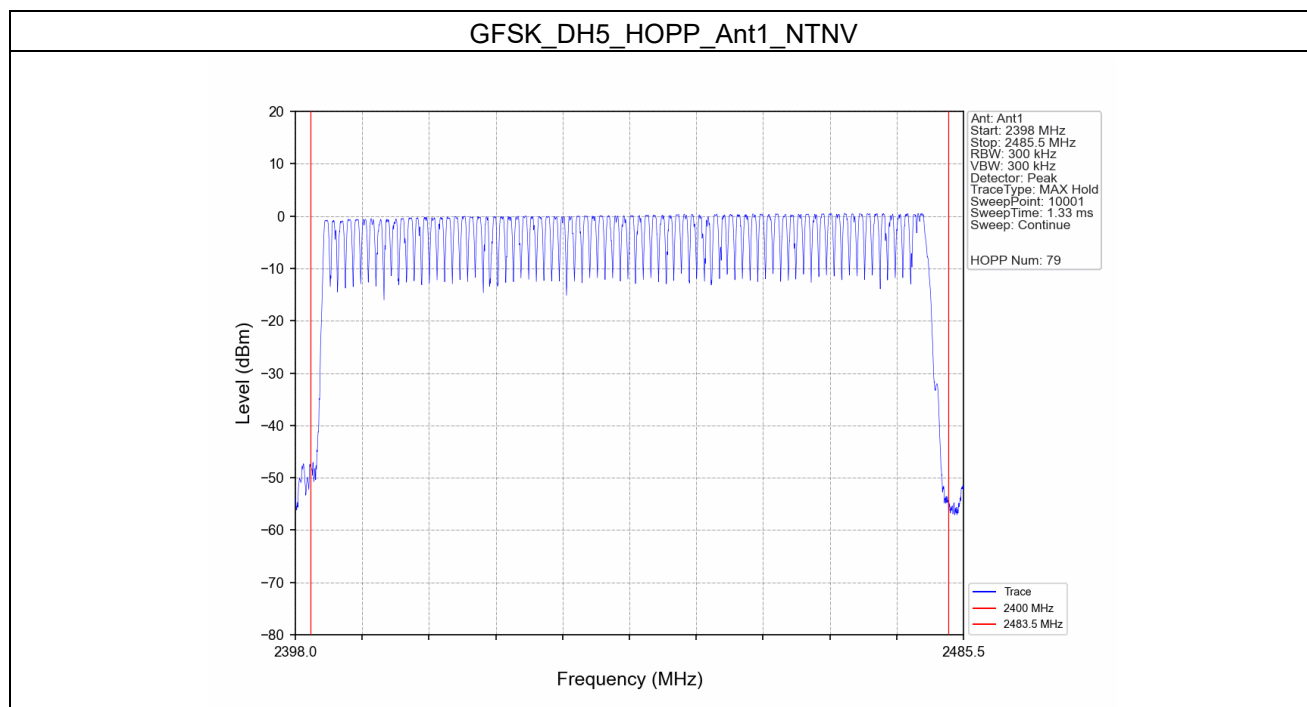
4.1 Test Result

4.1.1 HoppNum

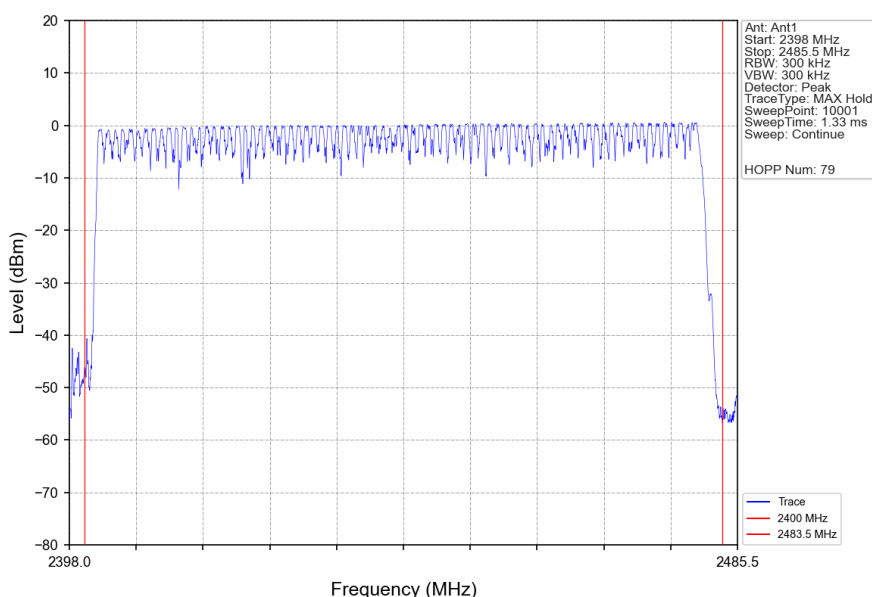
Mode	TX Type	Frequency (MHz)	Packet Type	Num of Hopping Frequencies		Verdict
				ANT1	Limit	
GFSK	SISO	HOPP	DH5	79	>=15	Pass
PI/4DQPSK	SISO	HOPP	2DH5	79	>=15	Pass
8DPSK	SISO	HOPP	3DH5	79	>=15	Pass

4.2 Test Graph

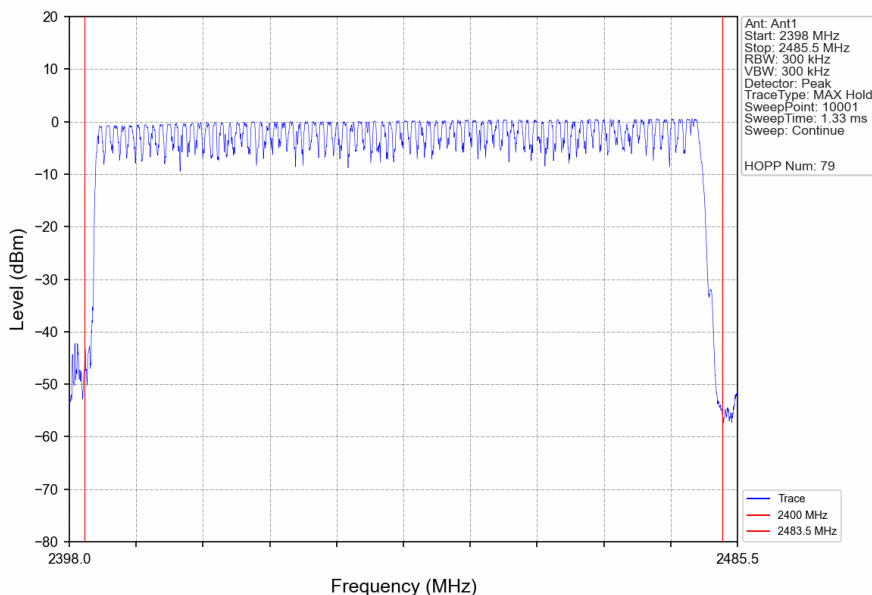
4.2.1 HoppNum



Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV



8DPSK_3DH5_HOPP_Ant1_NTNV



5. Time of Occupancy (Dwell Time)

5.1 Test Result

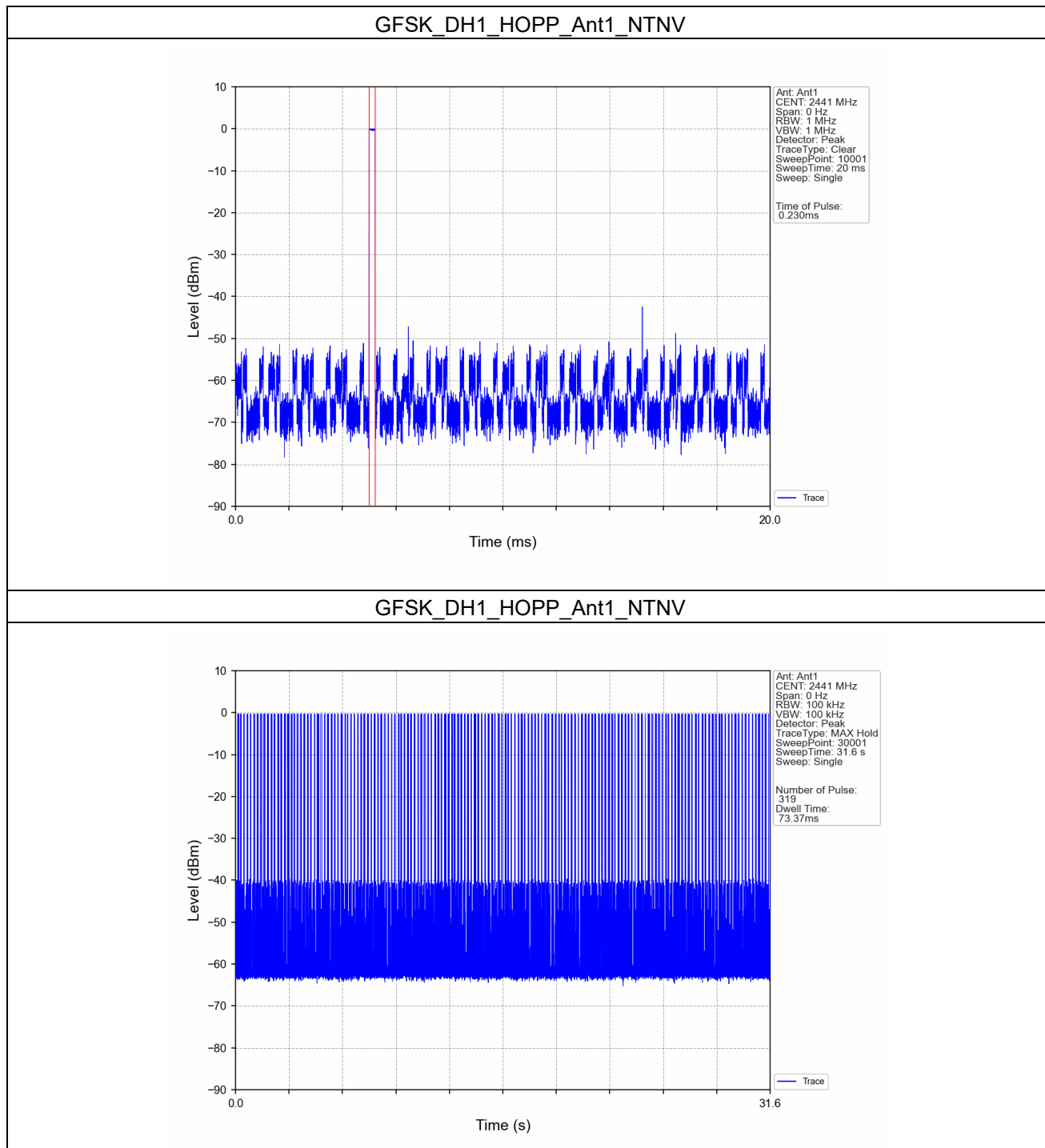
5.1.1 Ant1

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	0.230	31.600	319	73.370	<=400	Pass
			DH3	0.230	31.600	320	73.600	<=400	Pass
			DH5	0.230	31.600	320	73.600	<=400	Pass
Pi/4DQPSK	SISO	HOPP	2DH1	0.230	31.600	320	73.600	<=400	Pass
			2DH3	0.228	31.600	319	72.732	<=400	Pass
			2DH5	0.230	31.600	320	73.600	<=400	Pass
8DPSK	SISO	HOPP	3DH1	0.230	31.600	320	73.600	<=400	Pass
			3DH3	0.230	31.600	319	73.370	<=400	Pass
			3DH5	0.230	31.600	319	73.370	<=400	Pass

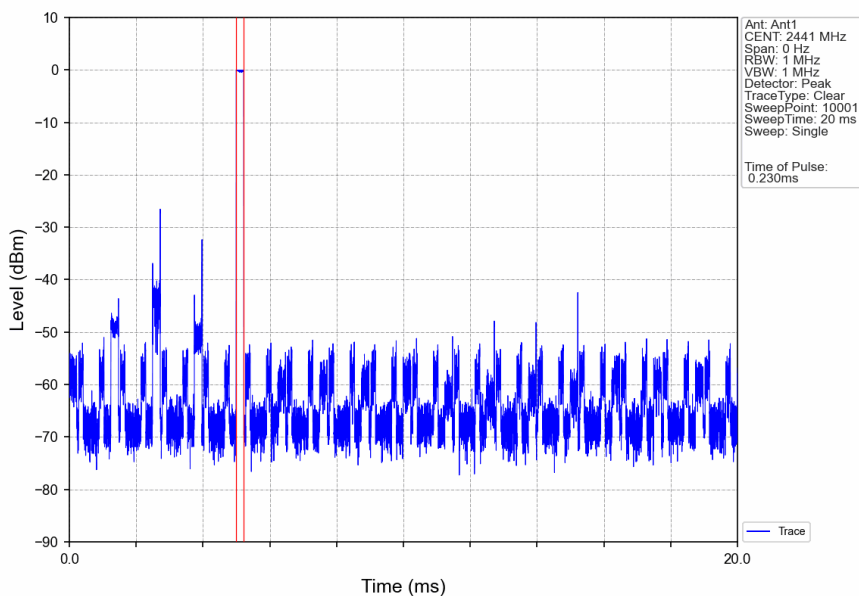


5.2 Test Graph

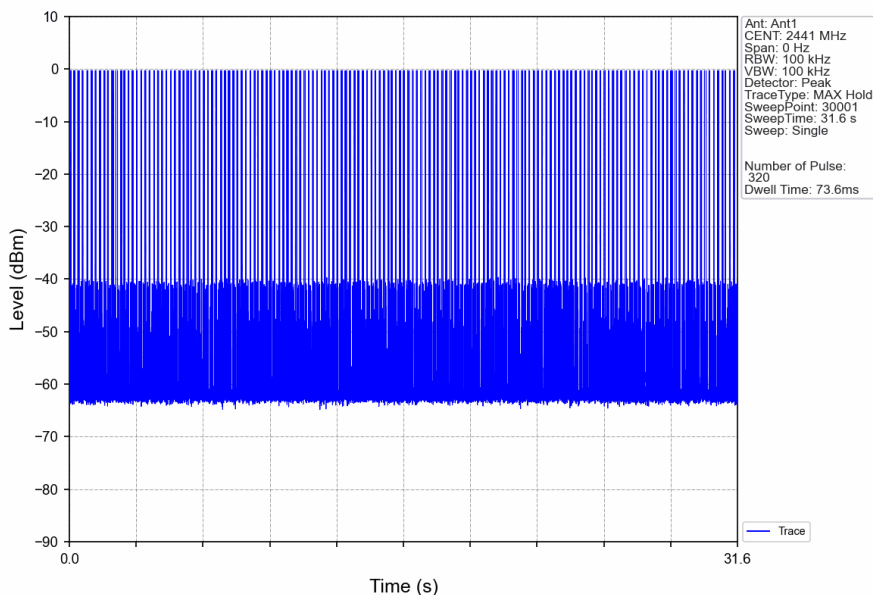
5.2.1 Ant1



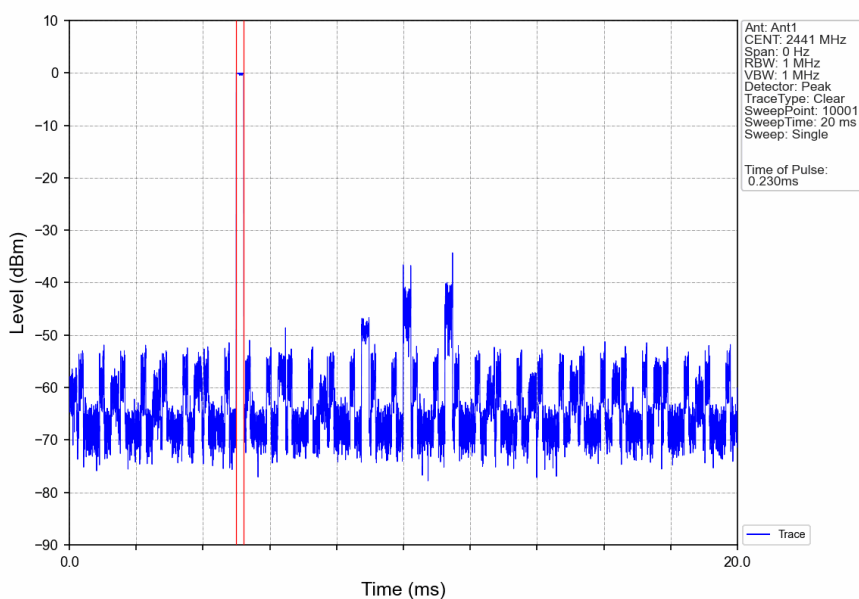
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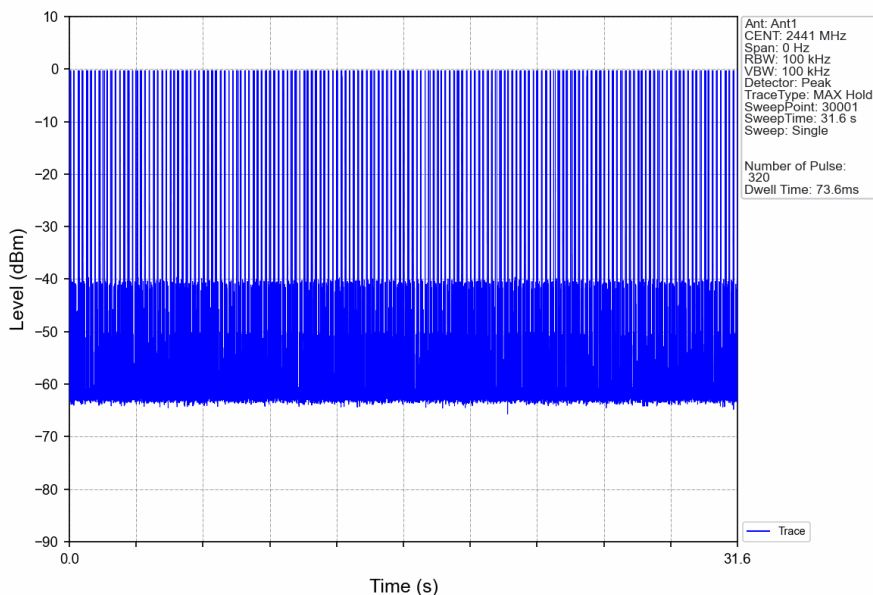
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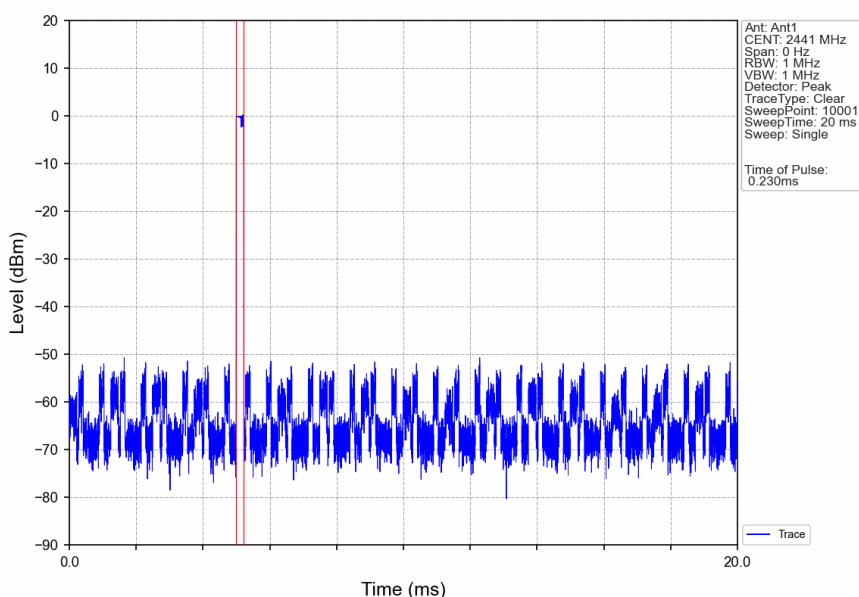
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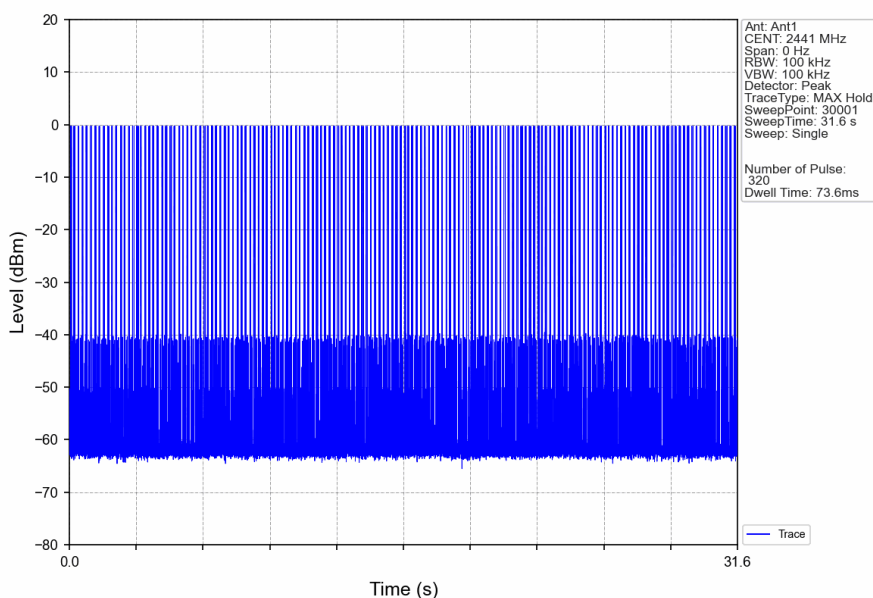
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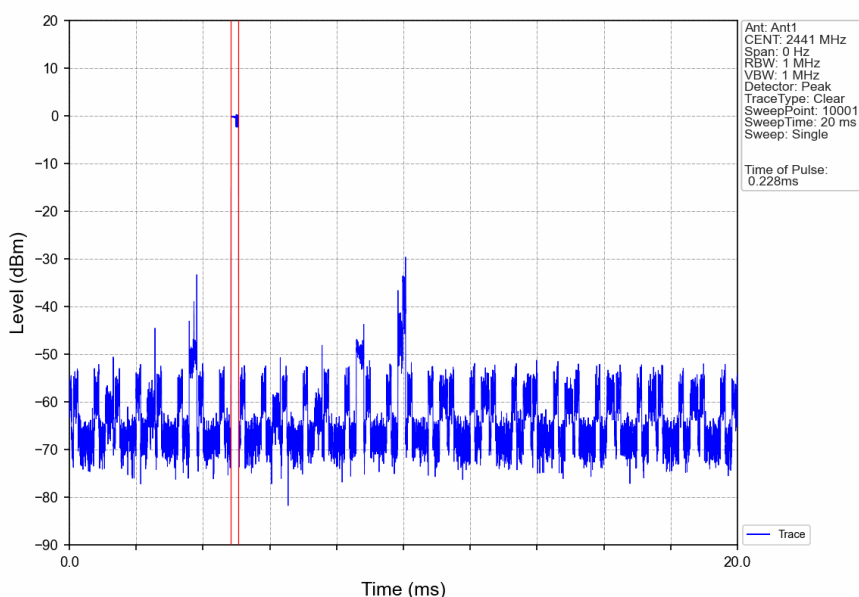
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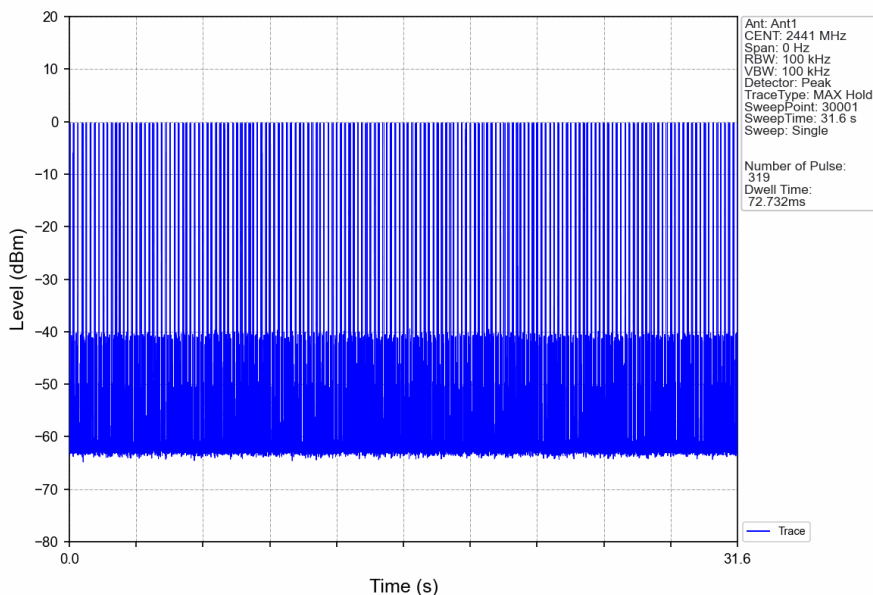
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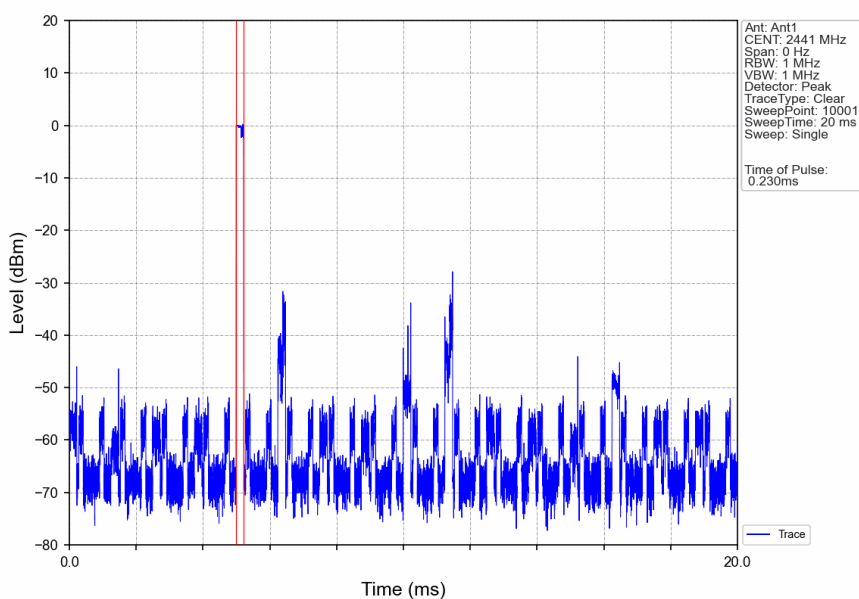
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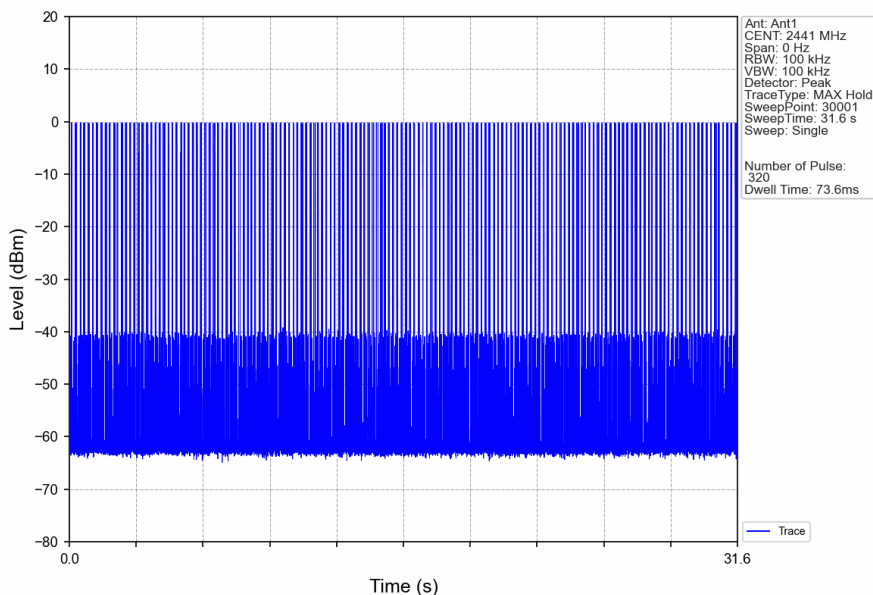
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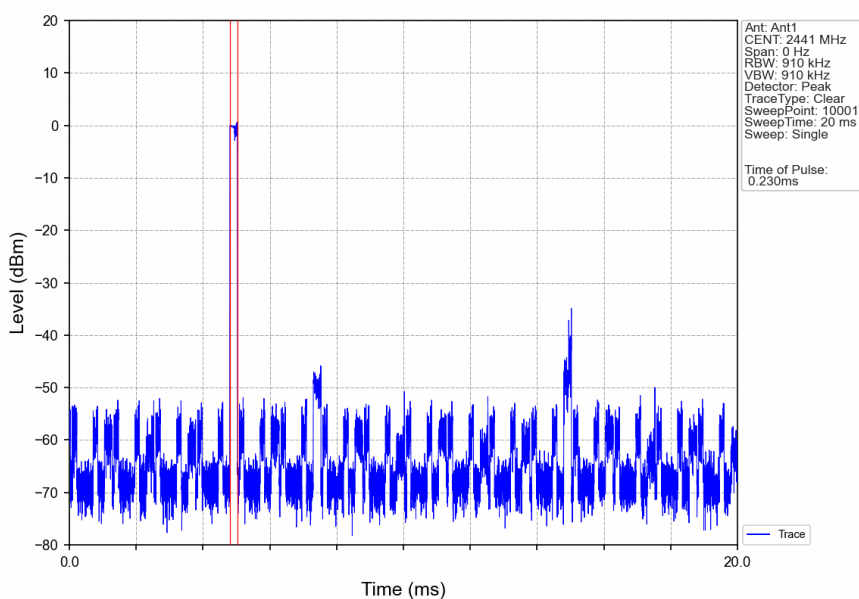
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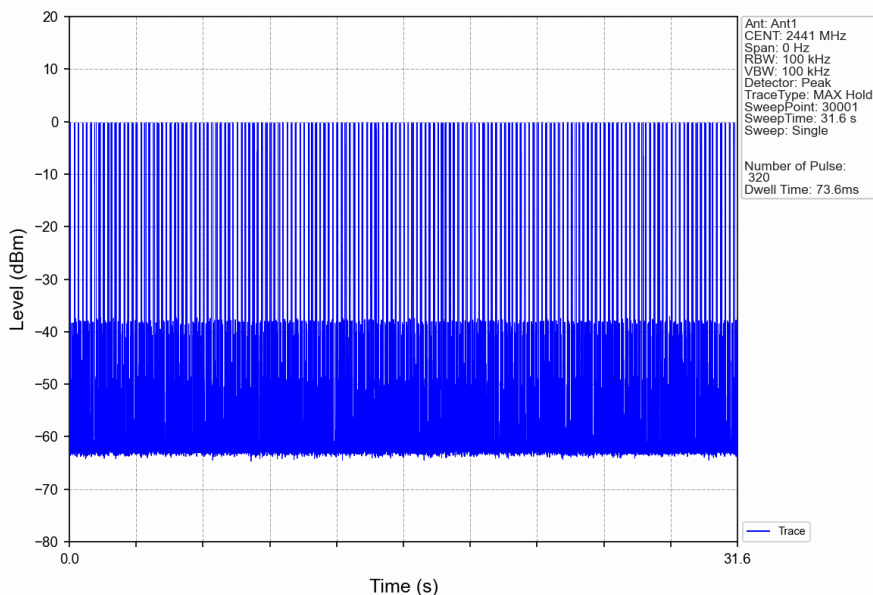
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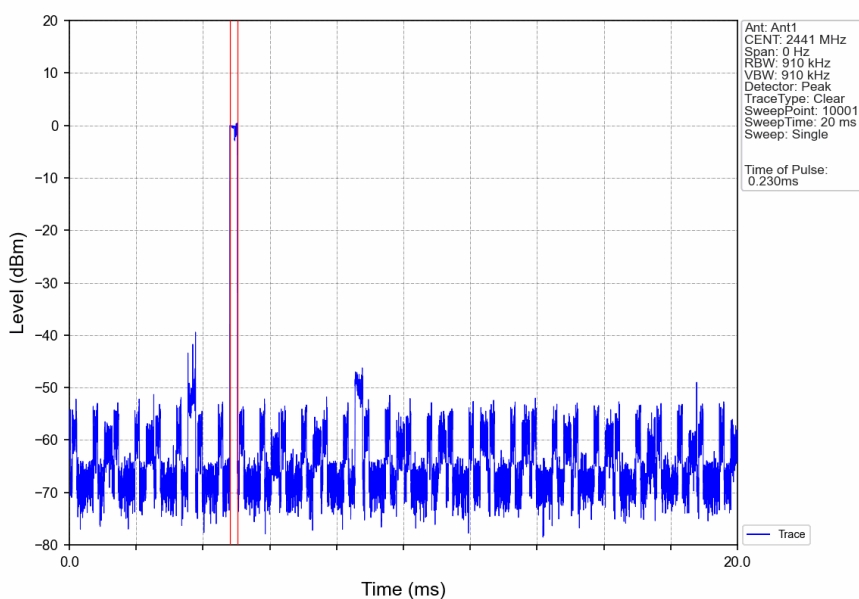
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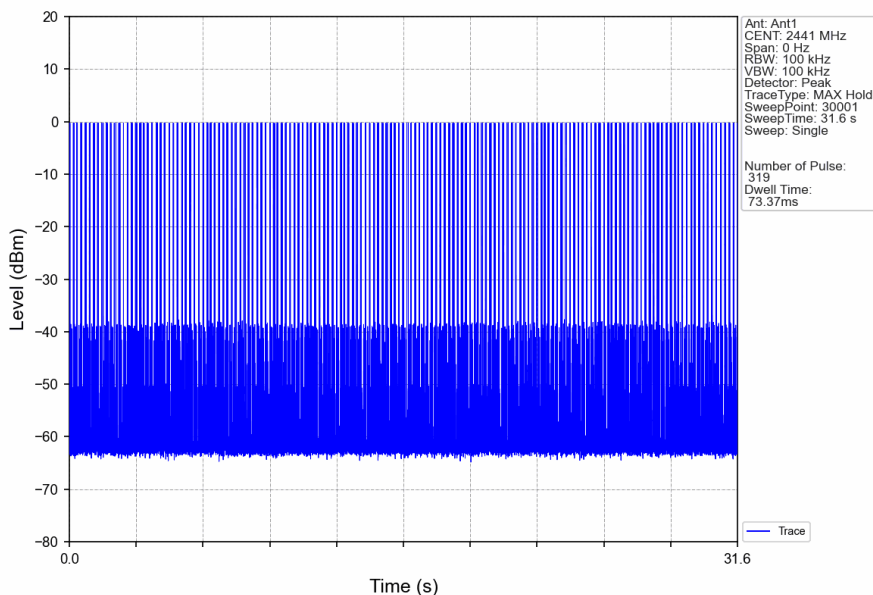
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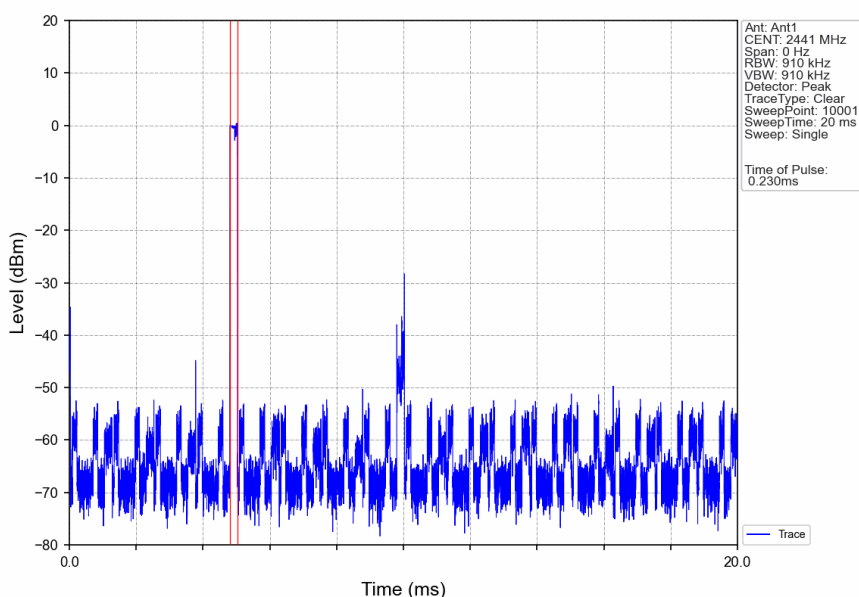
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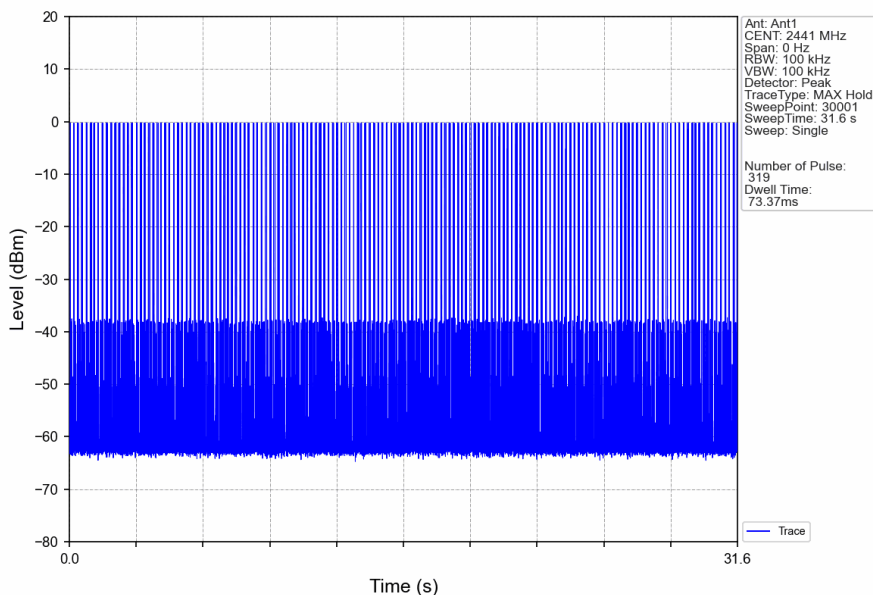
8DPSK_3DH3_HOPP_Ant1_NTNV



8DPSK_3DH5_HOPP_Ant1_NTNV



8DPSK_3DH5_HOPP_Ant1_NTNV



6. Unwanted Emissions In Non-restricted Frequency Bands

6.1 Test Result

6.1.1 Ref

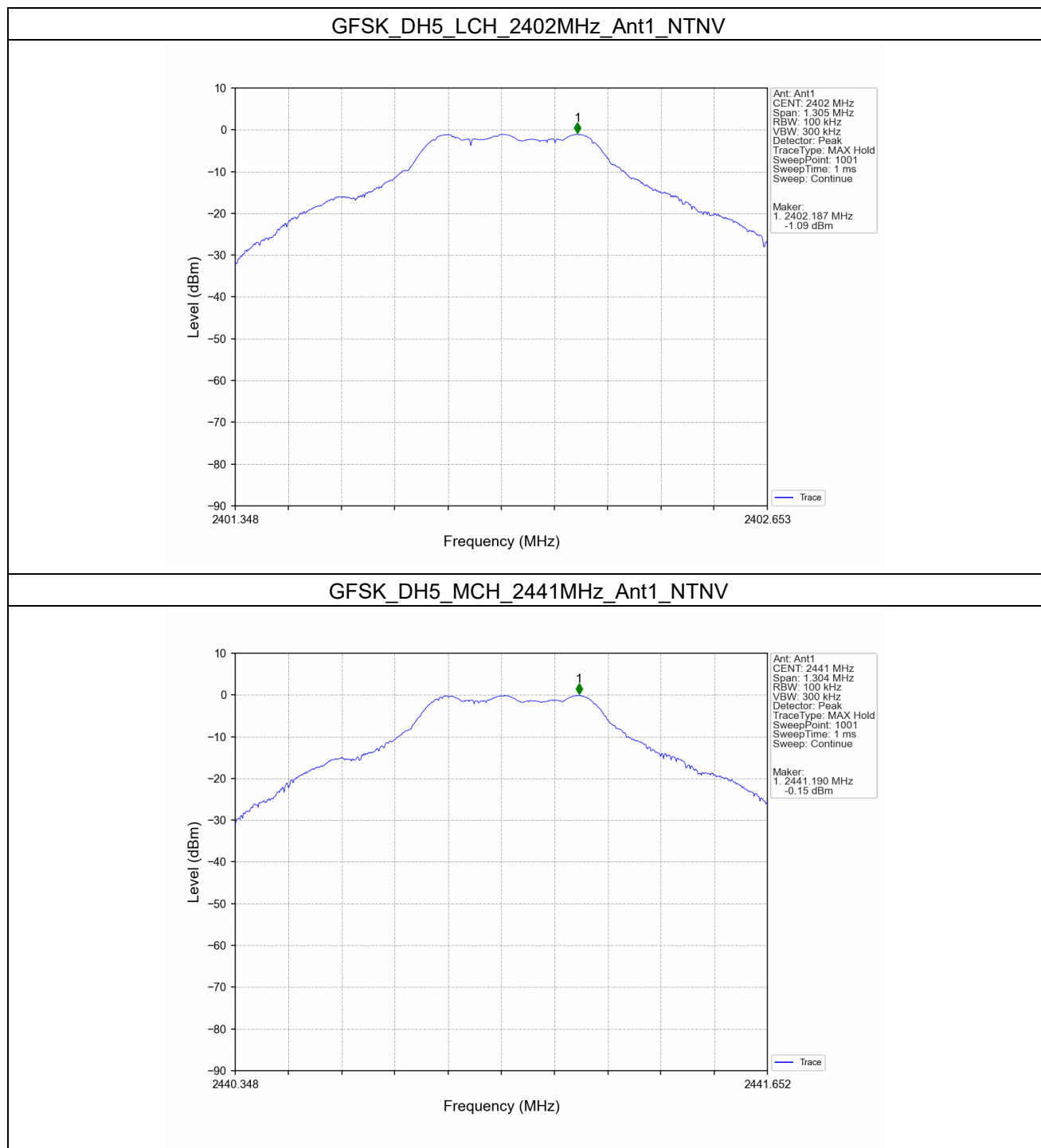
Mode	TX Type	Frequency (MHz)	Packet Type	ANT	Level of Reference (dBm)
GFSK	SISO	2402	DH5	1	-1.09
		2441	DH5	1	-0.15
		2480	DH5	1	0.34
Pi/4DQPSK	SISO	2402	2DH5	1	-1.01
		2441	2DH5	1	-0.07
		2480	2DH5	1	0.33
8DPSK	SISO	2402	3DH5	1	-1.10
		2441	3DH5	1	-0.14
		2480	3DH5	1	0.34

6.1.2 CSE and Band Edge

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
GFSK	SISO	2402	DH5	1	0.34	-19.66	Pass
		2441	DH5	1	0.34	-19.66	Pass
		2480	DH5	1	0.34	-19.66	Pass
		HOPP	DH5	1	0.34	-19.66	Pass
					0.34	-19.66	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	0.33	-19.67	Pass
		2441	2DH5	1	0.33	-19.67	Pass
		2480	2DH5	1	0.33	-19.67	Pass
		HOPP	2DH5	1	0.33	-19.67	Pass
					0.33	-19.67	Pass
8DPSK	SISO	2402	3DH5	1	0.34	-19.66	Pass
		2441	3DH5	1	0.34	-19.66	Pass
		2480	3DH5	1	0.34	-19.66	Pass
		HOPP	3DH5	1	0.34	-19.66	Pass
					0.34	-19.66	Pass

6.2 Test Graph

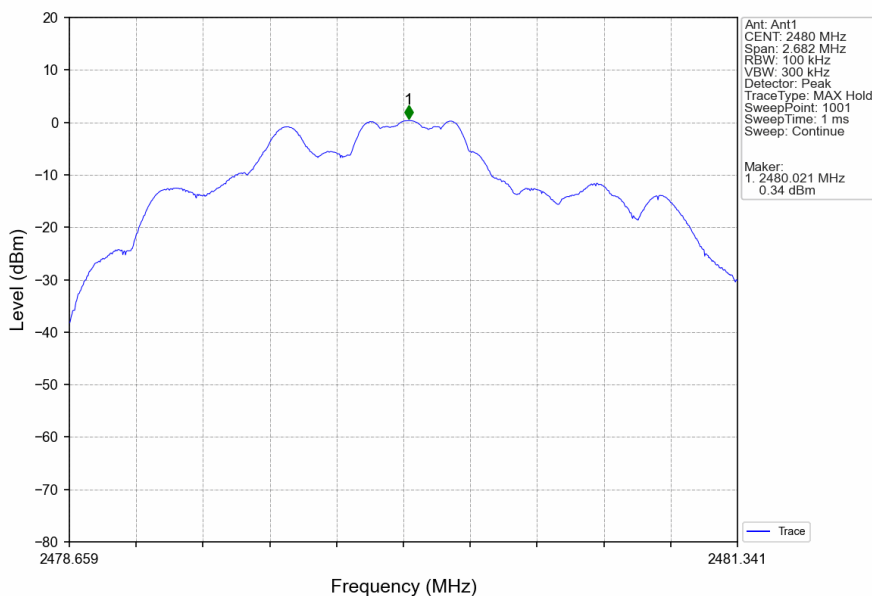
6.2.1 Ref



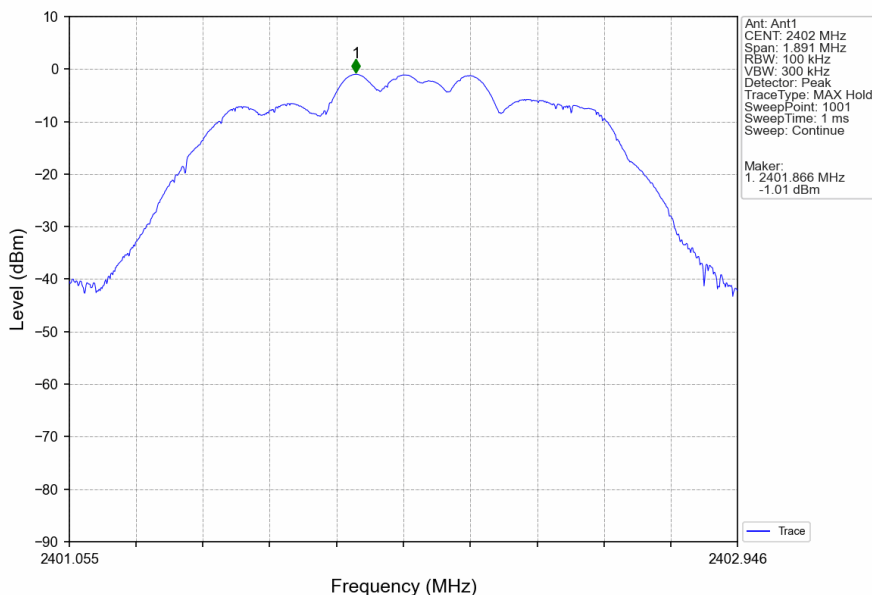
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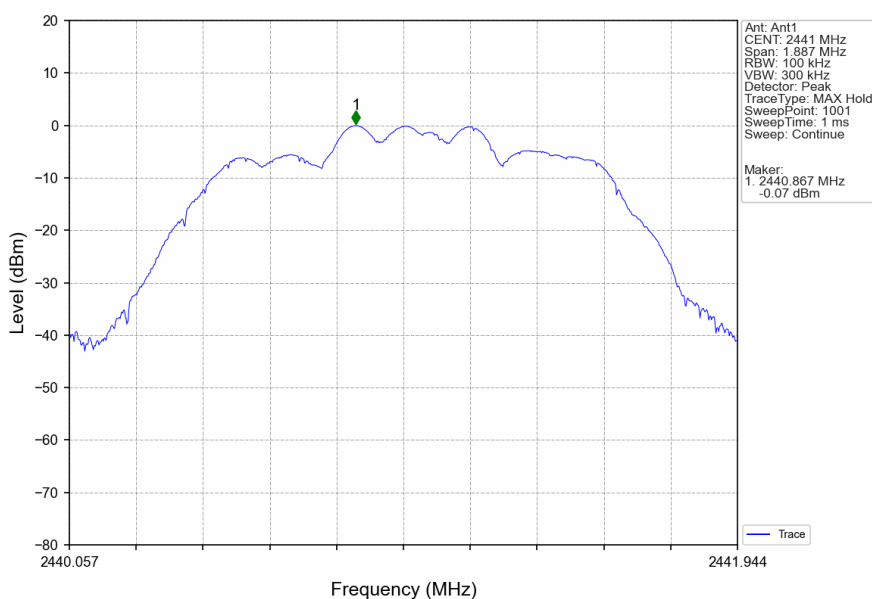
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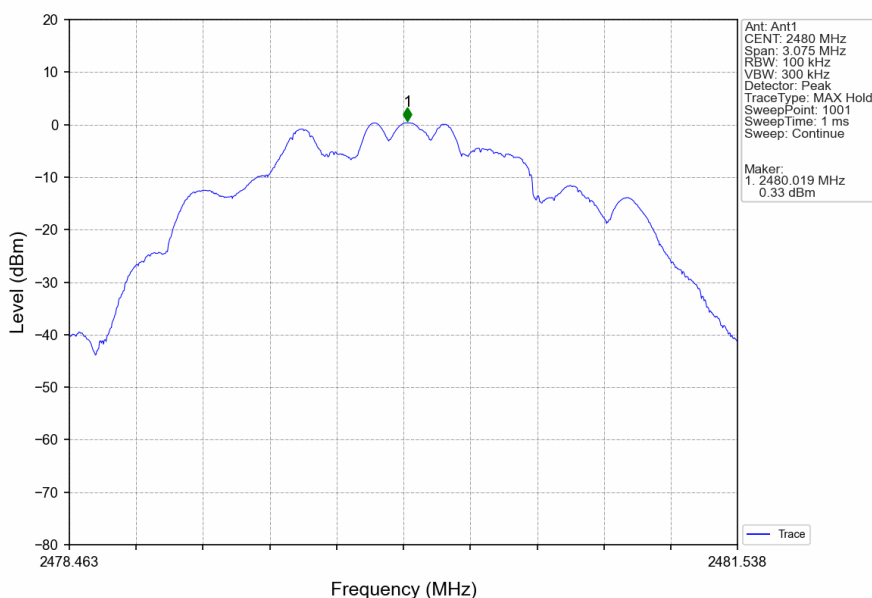
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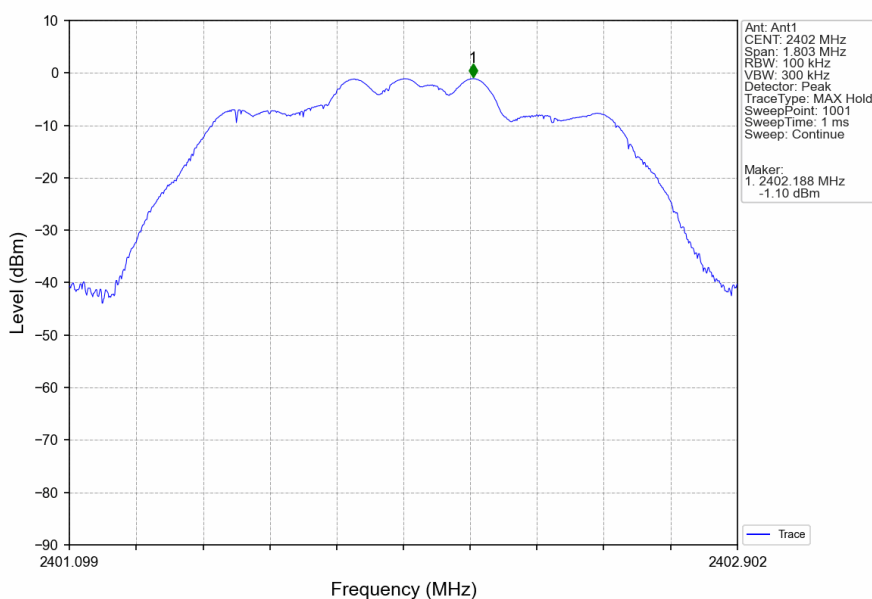
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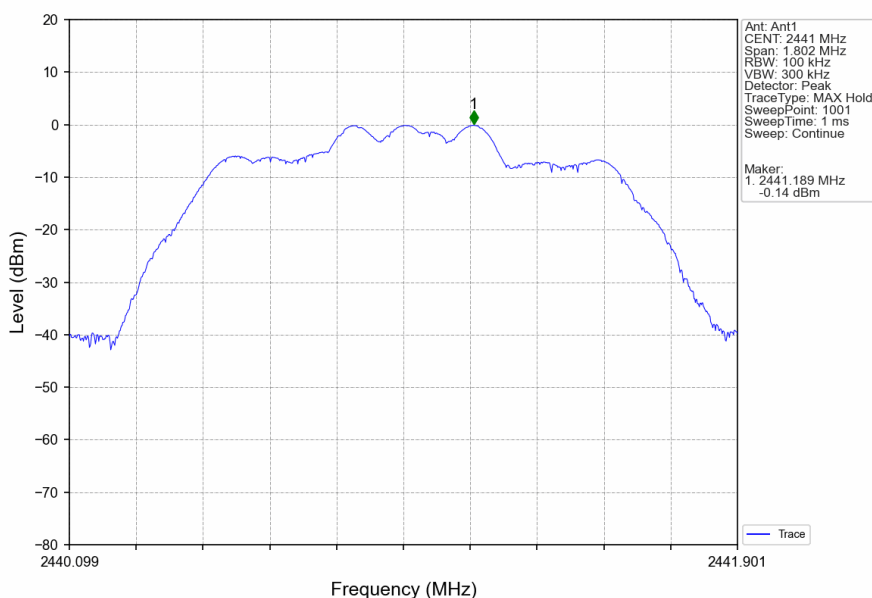
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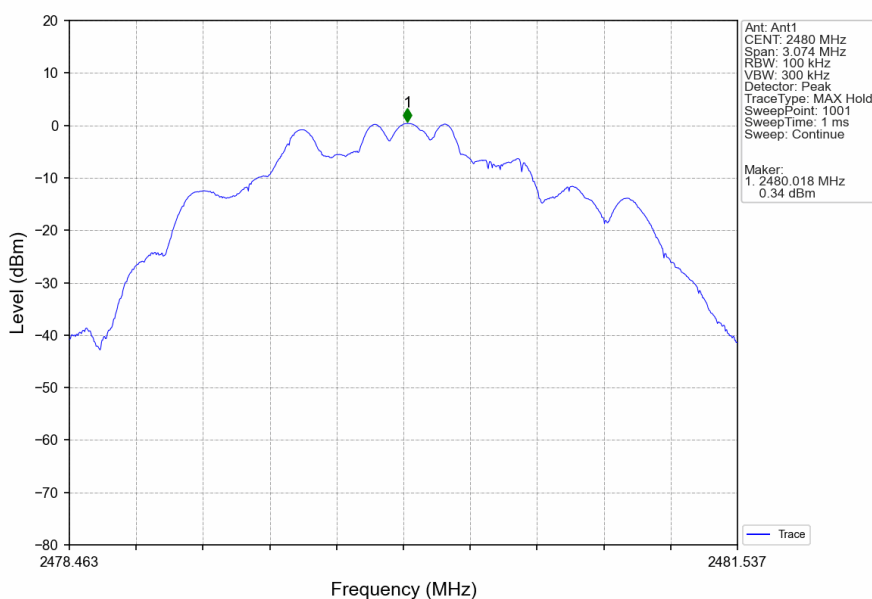
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



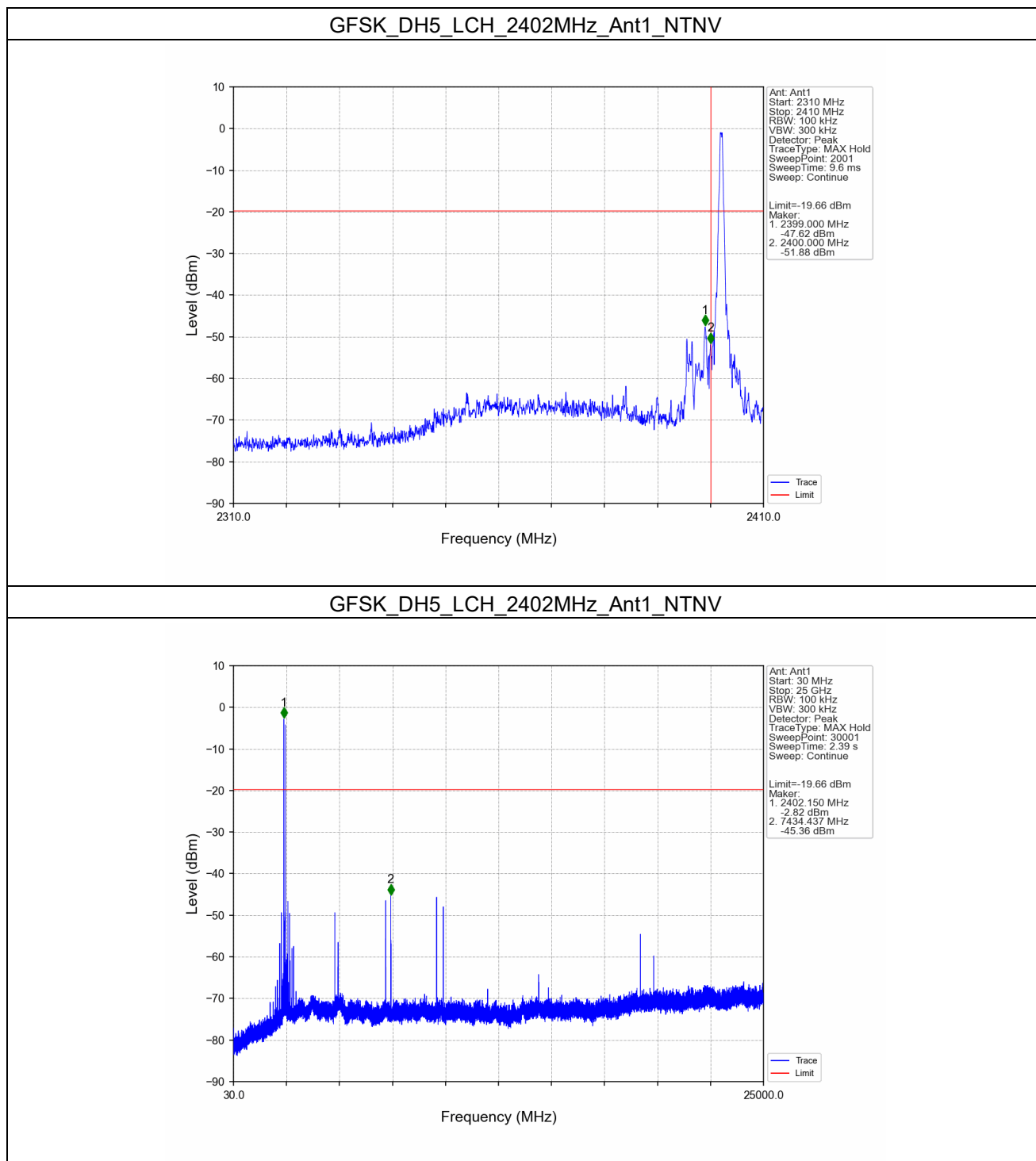
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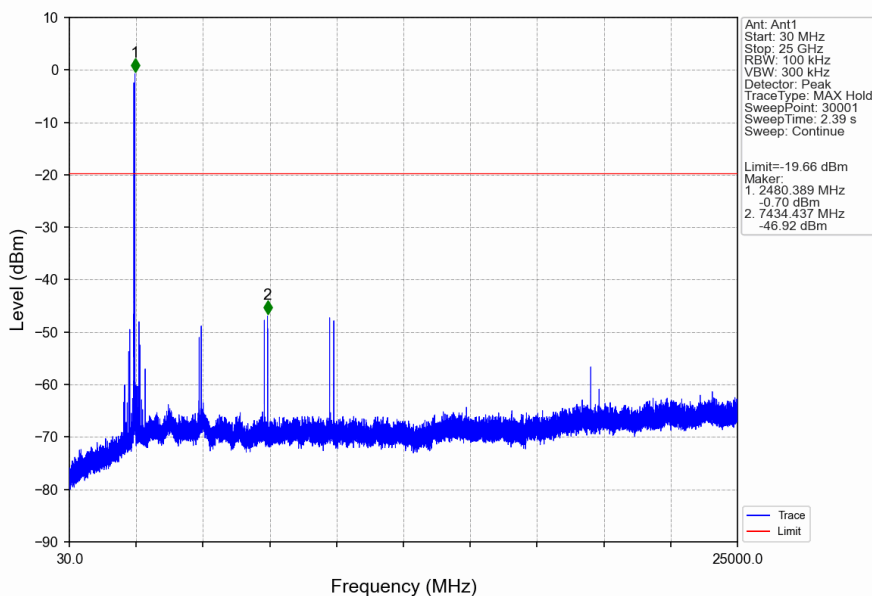
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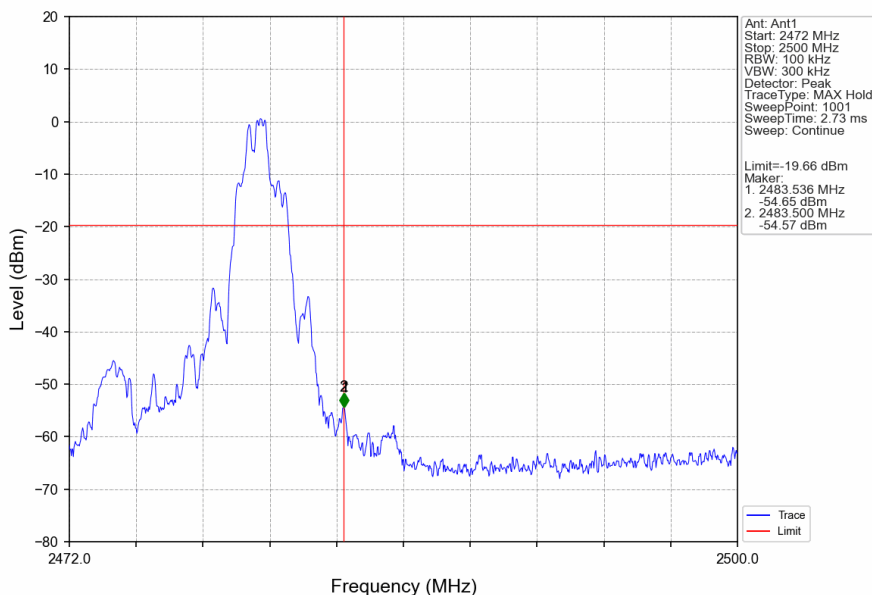
6.2.2 CSE and Band Edge



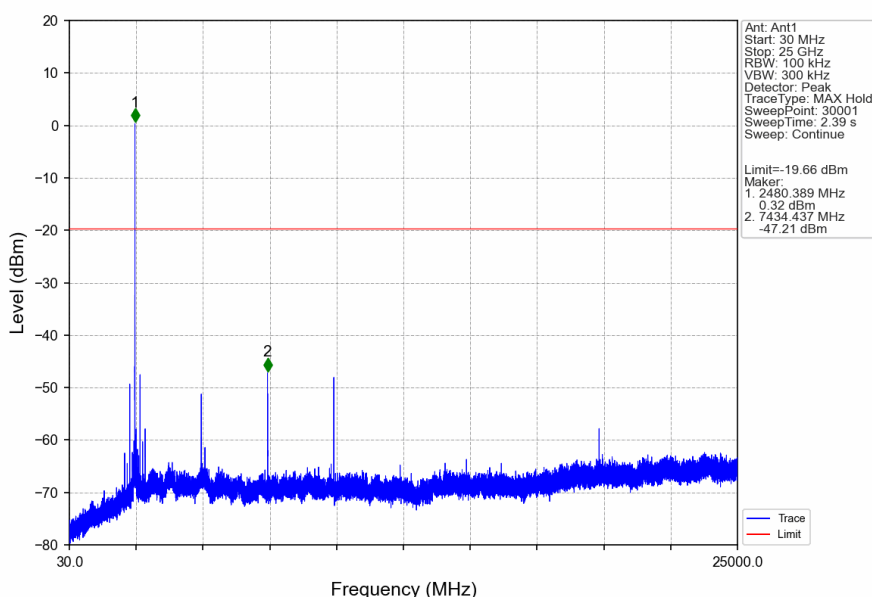
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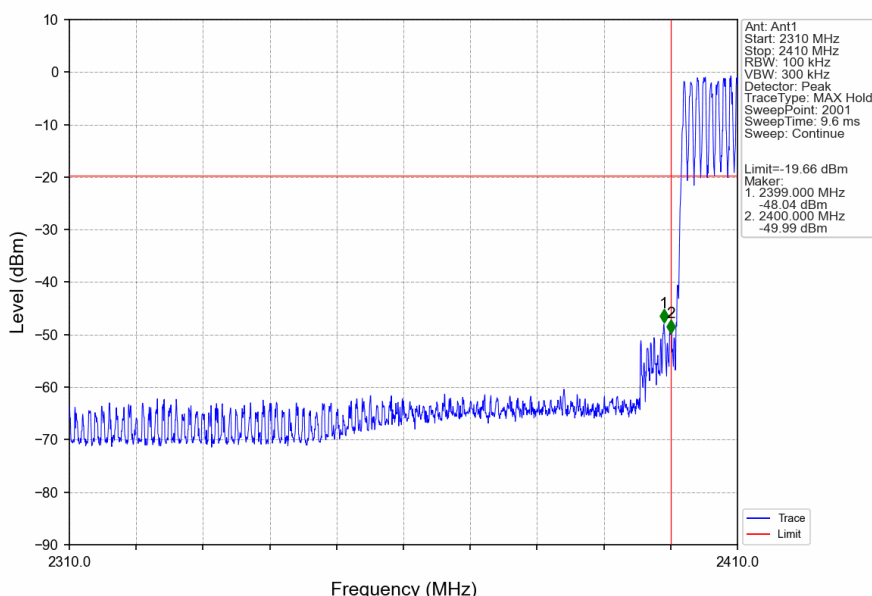
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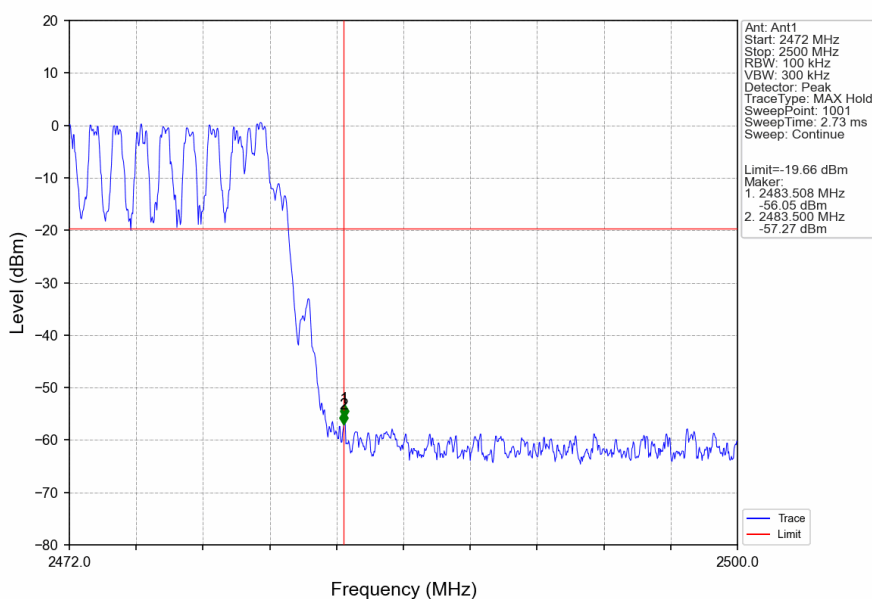
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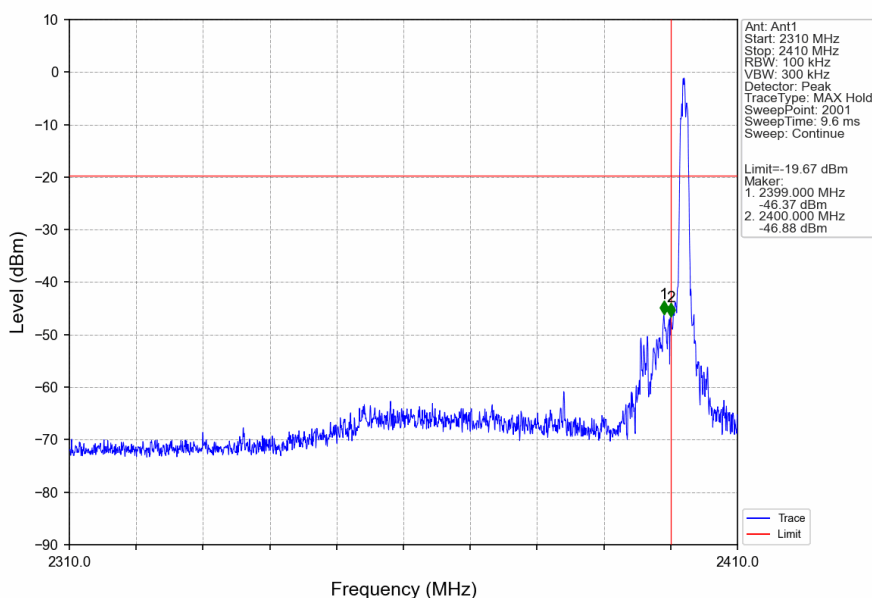
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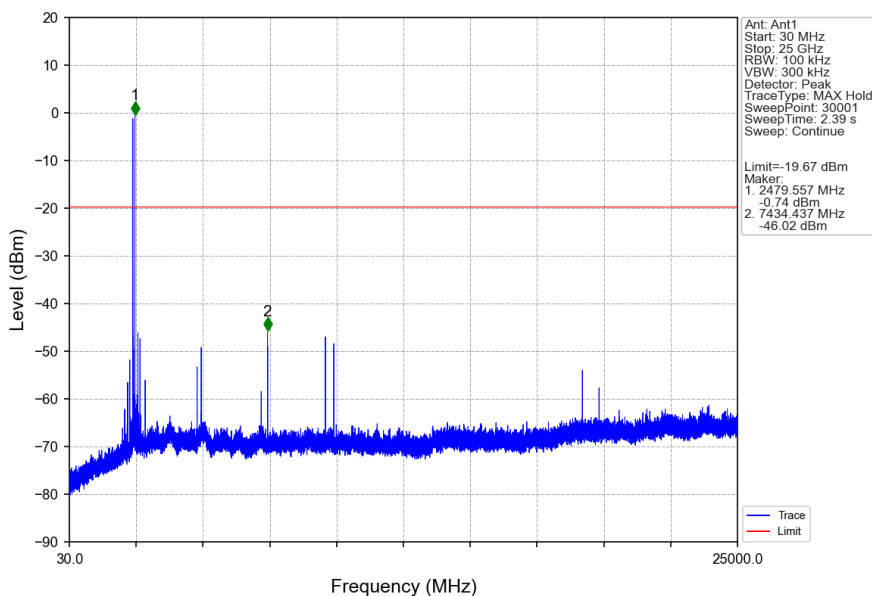
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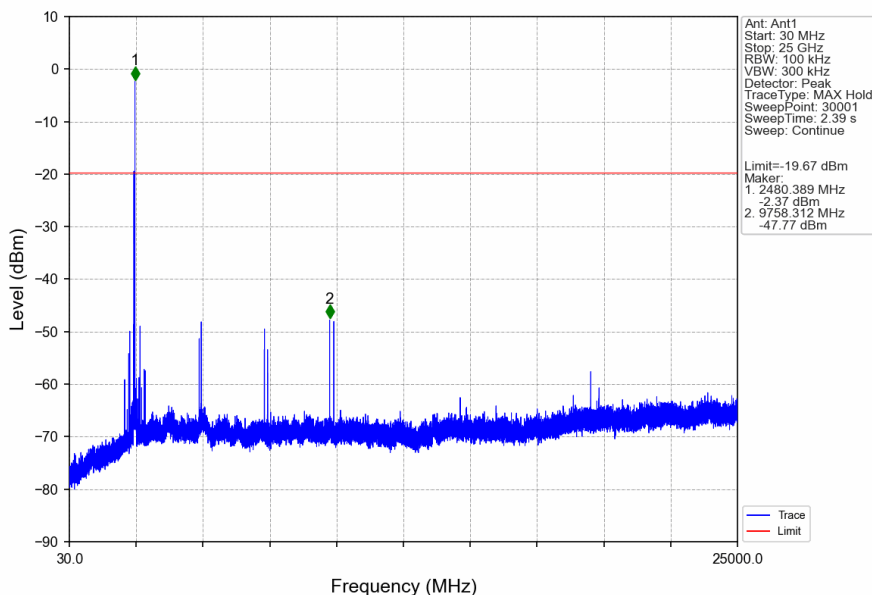
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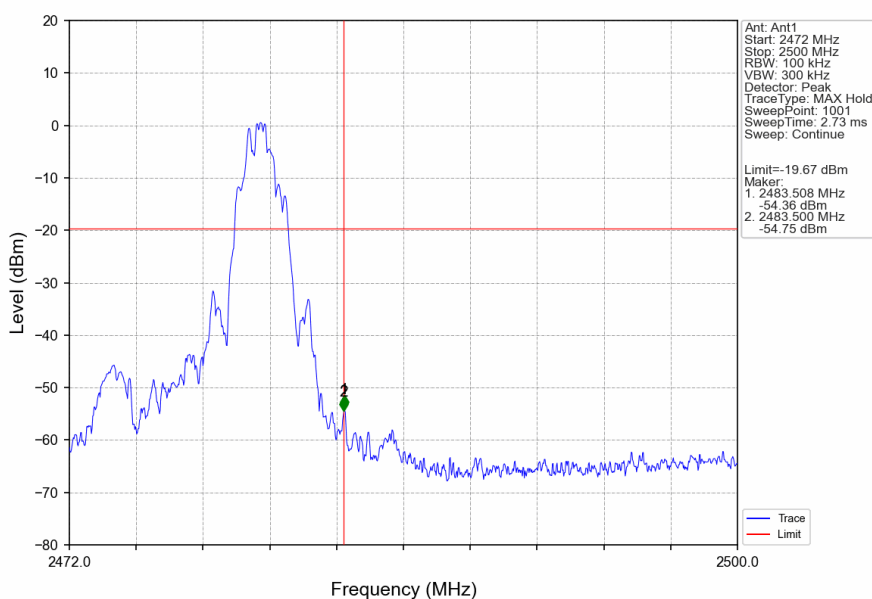
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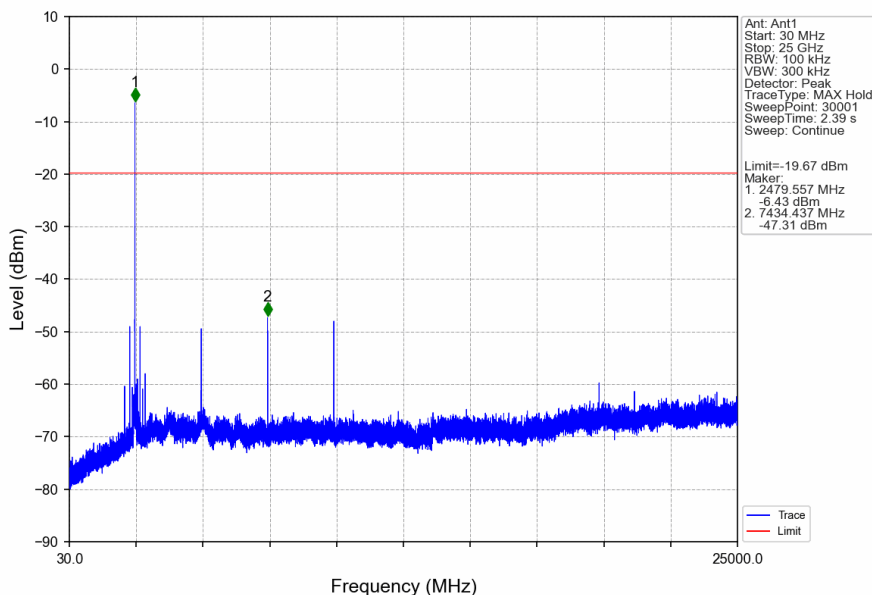
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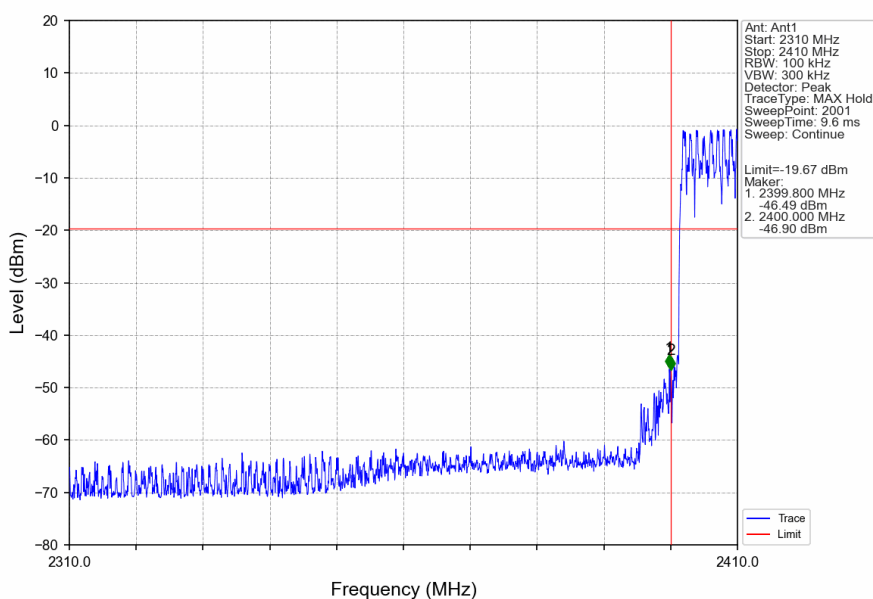
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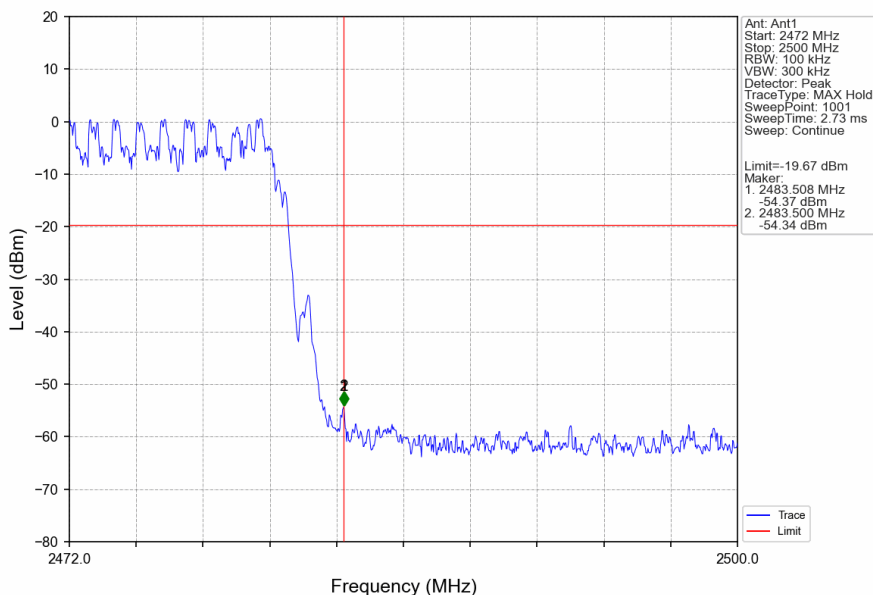
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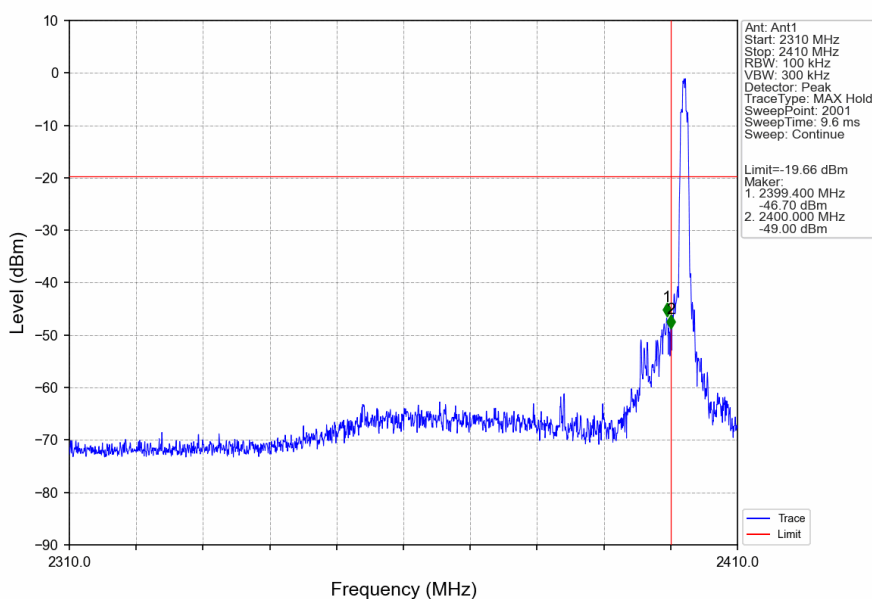
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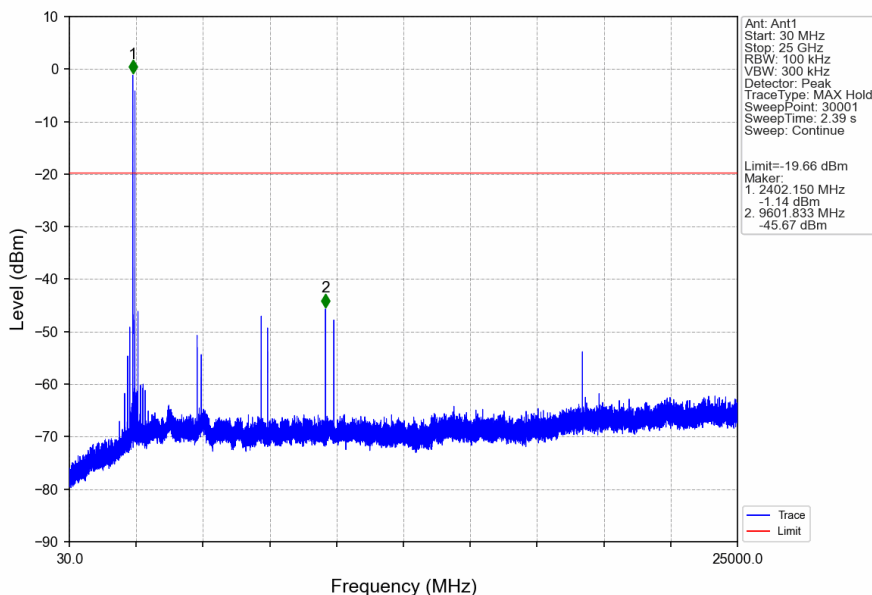
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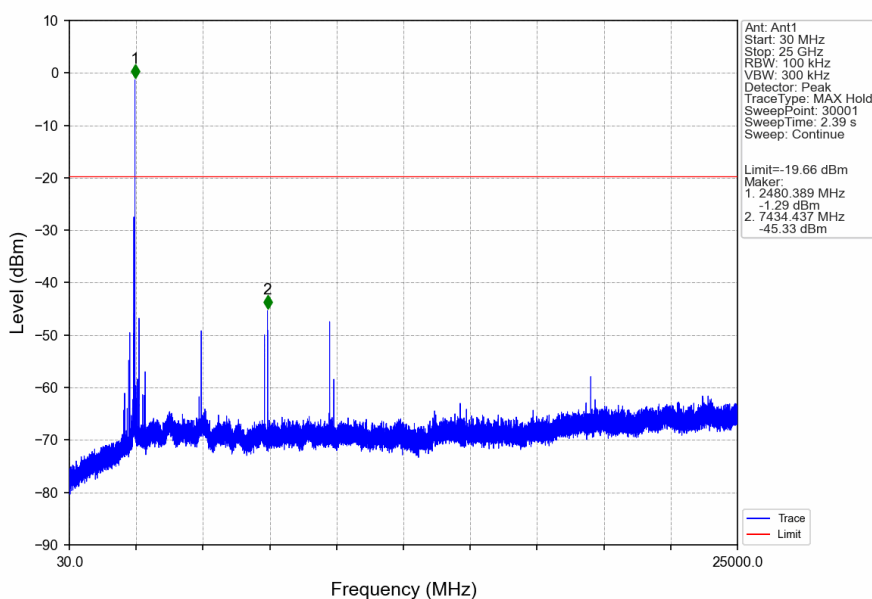
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



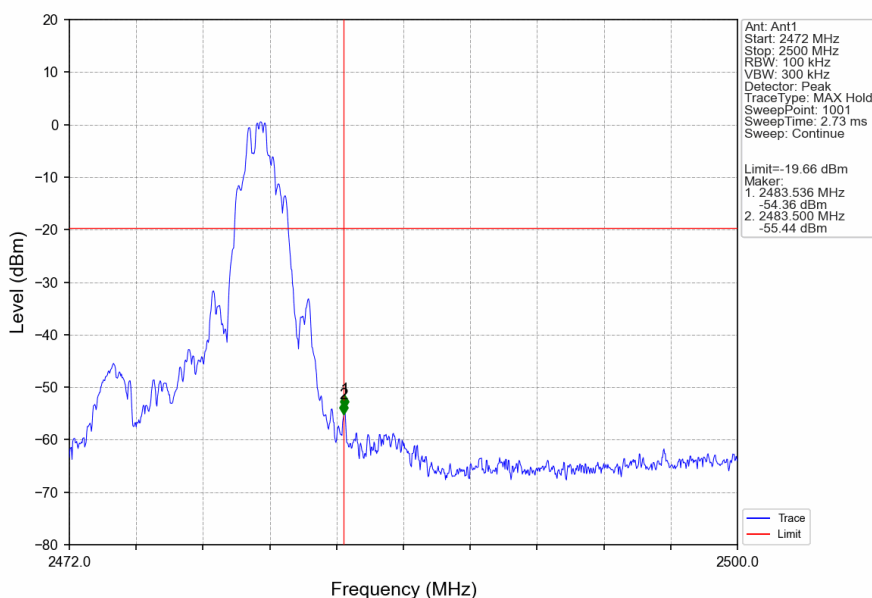
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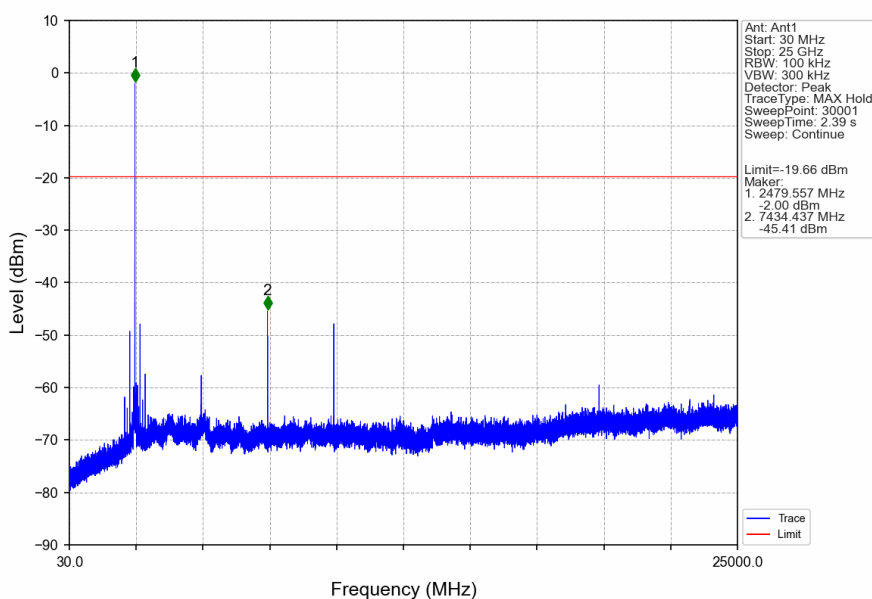
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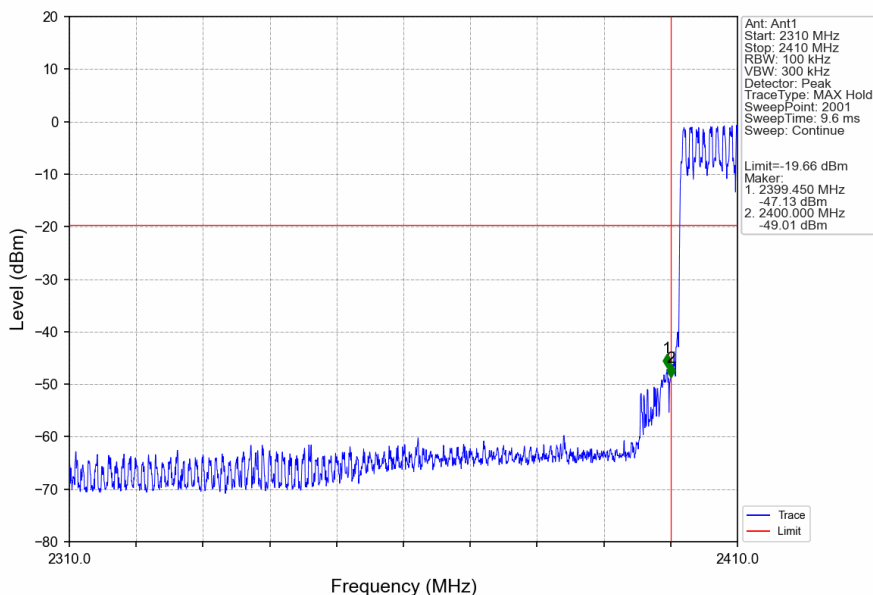
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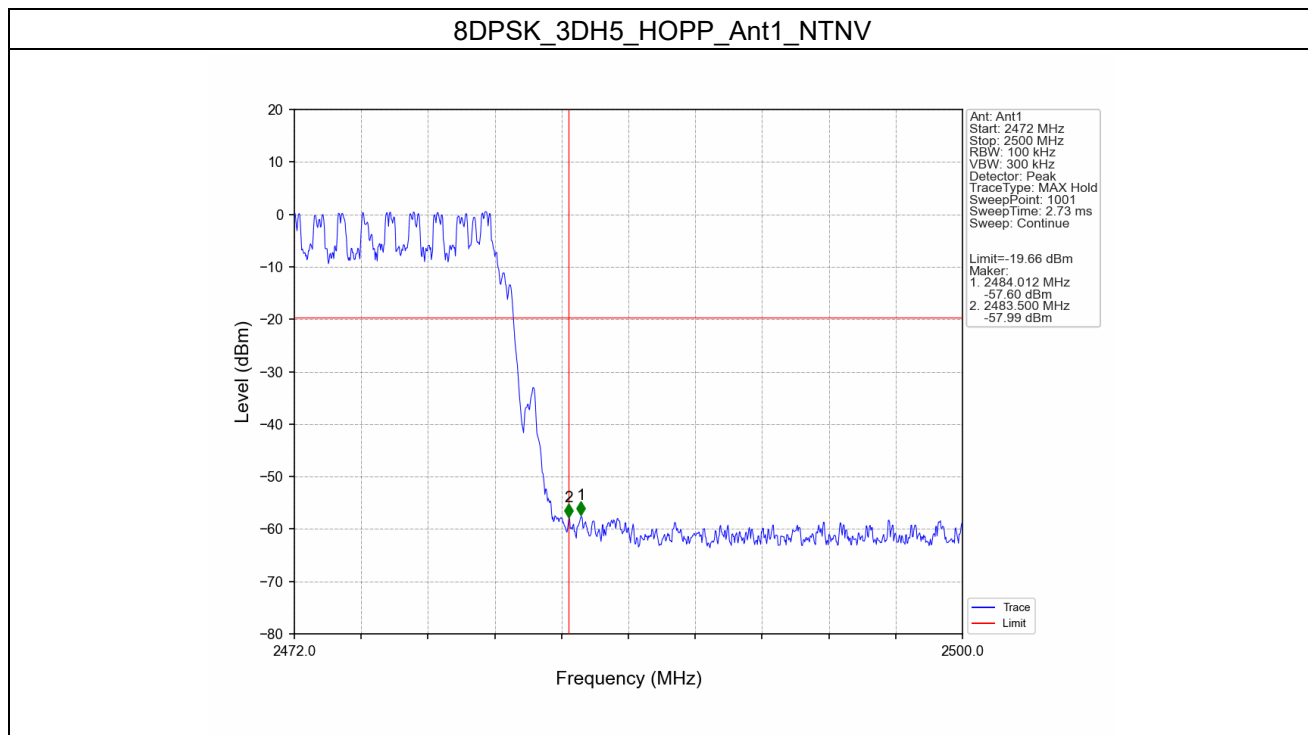


8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV



8DPSK_3DH5_HOPP_Ant1_NTNV





- End of the Report -



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Guangzhou Branch Competency Laboratory

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