TEST REPORT

Application No.:	SZCR2504001345MO
Applicant:	Rolling Wireless S.à r.l.
Address of Applicant:	8-10 rue Mathias Hardt 1717 Luxembourg
Manufacturer:	Rolling Wireless S.à r.l.
Address of Manufacturer:	8-10 rue Mathias Hardt 1717 Luxembourg
Equipment Under Test (EUT):	
EUT Name:	RB931A
Model No.:	RB931A
Trade Mark:	Rolling Wireless
FCC ID:	2AX2URB931A
Standard(s) :	47 CFR Part 15, Subpart C 15.247
Date of Receipt:	2025-04-07
Date of Test:	2025-04-10 to 2025-05-06
Date of Issue:	2025-05-08
Test Result:	**Pass***

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

Keny Xu
EMC Laboratory Manager

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Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
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Authorized for issue by:				
		Donjon Huang **Donjon Huang/Project Engineer**		
		Eric Fu **Eric Fu/Reviewer**		

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2 Test Summary

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

Radio Spectrum Matter Part				
Item	**Standard**	**Method**	**Requirement**	**Result**
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

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4 General Information

4.1 Details of E.U.T.

Power supply:	DV 4V from mainboard The motherboard is powered by an adapter
Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V5.4 Classic
Modulation Type:	GFSK, pi/4DQPSK, 8DPSK
Number of Channels:	79
Channel Spacing:	1MHz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Antenna Type:	External Antenna
Antenna Gain:	2.44dBi
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.

4.2 Description of Support Units

Description	Manufacturer	Model No.
Adapter	MEAN WELL	GST60A12
Mainboard	ROLLING	5307306_REV_3
Mainboard	ROLLING	5307366_REV_4

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4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	± 3.1dB
Radiated Emissions which fall in the restricted bands	± 6.0dB (Below 1GHz);± 4.6dB (Above 1GHz)
Radiated Spurious Emissions Below 1GHz	± 6.0dB for 3m; ± 5.0dB for 10m
Radiated Spurious Emissions Above 1GHz	± 4.6dB (1-18GHz);± 4.8dB (18-40GHz)
Conducted Peak Output Power	± 0.75dB
20dB Bandwidth	± 3%
Carrier Frequencies Separation	± 7.25 x 10-8
Hopping Channel Number	± 7.25 x 10-8
Dwell Time	± 0.37%
Conducted Band Edges Measurement	± 0.75dB
Conducted Spurious Emissions	± 0.75dB

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

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4.4 Test Location

All tests were performed at:

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Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.5 Test Facility

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

• A2LA (Certificate No. 3816.01)

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

• VCCI (Member No. 1937)

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

• FCC –Designation Number: CN1336

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

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

• Innovation, Science and Economic Development Canada

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

CAB identifier: CN0006.

IC#: 4620C.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

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5 Equipment List

Conducted Emissions at AC Power Line (150kHz-30MHz)					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
Shielding Room	ZhongYu Electron	GB-88	SEM001-06	2022-05-14	2025-05-13
EMI Test Receiver	Rohde&Schwarz	ESR	SZ-WRG-M-047	2025-01-08	2026-01-07
Measurement Software	AUDIX	e3 V8.2014-6-27a	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM024-01	2024-07-06	2025-07-05
LISN	Rohde&Schwarz	ENV216	SEM007-01	2024-08-15	2025-08-14
LISN	ETS-LINDGREN	3816/2	SEM007-02	2025-03-03	2026-03-02

Radiated Emissions which fall in the restricted bands					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
Signal & Spectrum Analyzer	Rohde & Schwarz	FSV	SZ-WRG-M-048	2025-01-07	2026-01-06
Low Noise Amplifier 30M-8GHz	Tonscend	TAP30M8G30	SZ-WRG-M-050	2025-01-07	2026-01-06
Double Ridge Horn Antenna 1GHz-18GHz	SCHWARZBECK	BBHA 9120 D	SZ-WRG-M-055	2023-12-21	2025-12-20
RSE Test Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Chamber	CRTSGSSAC966	N/A	SZ-WRG-C-063	2025-01-06	2028-01-05
Humidity and Temperature Indicator	deli	8838	SEM002-46	2024-07-24	2025-07-23

Radiated Spurious Emissions Below 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
Loop Antenna	ETS-Lindgren	6502	SEM003-08	2023-11-20	2025-11-19
3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2023-06-19	2026-06-18
MXE EMI Receiver	Agilent Technologies	N9038A	SEM004-15	2024-08-14	2025-08-13
BiConiLog Antenna	ETS-LINDGREN	3142C	SEM003-01	2023-09-16	2025-09-15
Pre-Amplifier	Agilent Technologies	8447D	SEM005-01	2025-03-04	2026-03-03
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM025-01	2024-07-06	2025-07-05

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Radiated Spurious Emissions Above 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
Signal & Spectrum Analyzer	Rohde & Schwarz	FSV	SZ-WRG-M-048	2025-01-07	2026-01-06
Low Noise Amplifier 1G-18GHz	Tonscend	TAP01018050	SZ-WRG-M-051	2025-01-07	2026-01-06
Low Noise Amplifier 18G-40GHz	Tonscend	TAP18040048	SZ-WRG-M-052	2025-01-08	2026-01-07
Double Ridge Horn Antenna 1GHz-18GHz	SCHWARZBECK	BBHA 9120 D	SZ-WRG-M-055	2023-12-21	2025-12-20
SHF-EHF Horn 15GHz-40GHz	SCHWARZBECK	BBHA 9170	SZ-WRG-M-056	2023-12-25	2025-12-24
RSE Test Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
Chamber	CRTSGSSAC966	N/A	SZ-WRG-C-063	2025-01-06	2028-01-05
Humidity and Temperature Indicator	deli	8838	SEM002-46	2024-07-24	2025-07-23

RF Conducted Test					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
Power Sensor	TST PASS	TSPS2023R	SEM009-26	2025-03-04	2026-03-03
Power Sensor	KEYSIGHT	U2021XA	SEM009-16	2025-03-04	2026-03-03
DC Power Supply	Chroma	62012P-80-60	SEM011-11	2024-08-14	2025-08-13
MXA Signal Analyzer	KEYSIGHT	N9020A	SEM004-19	2025-03-04	2026-03-03
Measurement Software	TST PASS	TST PASS V2.0	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-01	2024-07-06	2025-07-05
Attenuator	Huber+Suhner	6620_SMA-50-1	SEM021-09	2025-03-03	2026-03-02

General used equipment					
Equipment	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal Date**	**Cal Due Date**
Humidity/ Temperature Indicator	deli	8838	SEM002-32	2024-07-24	2025-07-23
Humidity/ Temperature Indicator	deli	8838	SEM002-33	2024-07-24	2025-07-23
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2025-03-03	2026-03-02

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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 fixed on the main PCB and does not need to be replaced. The best case gain of the antenna is 2.44 dBi.

Antenna location: Refer to external 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)

Standard Requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

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

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

Compliance for section 15.247(a)(1):

According to Technical Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

> Number of shift register stages: 9

> Length of pseudo-random sequence: 29 -1 = 511 bits

> Longest sequence of zeros: 8 (non-inverted signal)

Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:

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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: 22.0 °C Humidity: 49.7 % RH Atmospheric Pressure: 1020 mbar

7.1.2 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.

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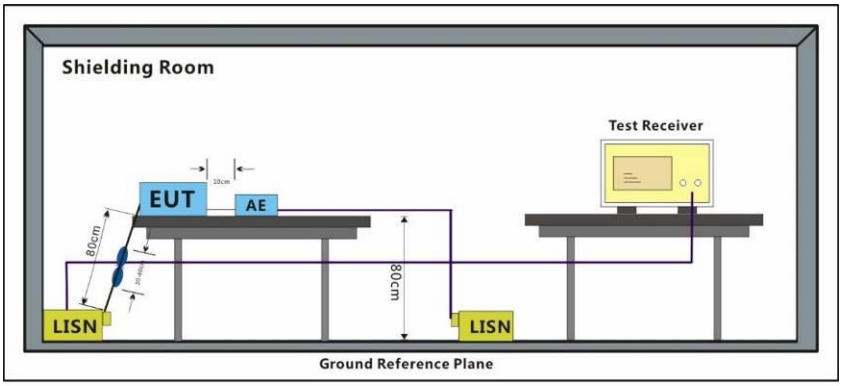
7.1.3 Test Setup Diagram



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

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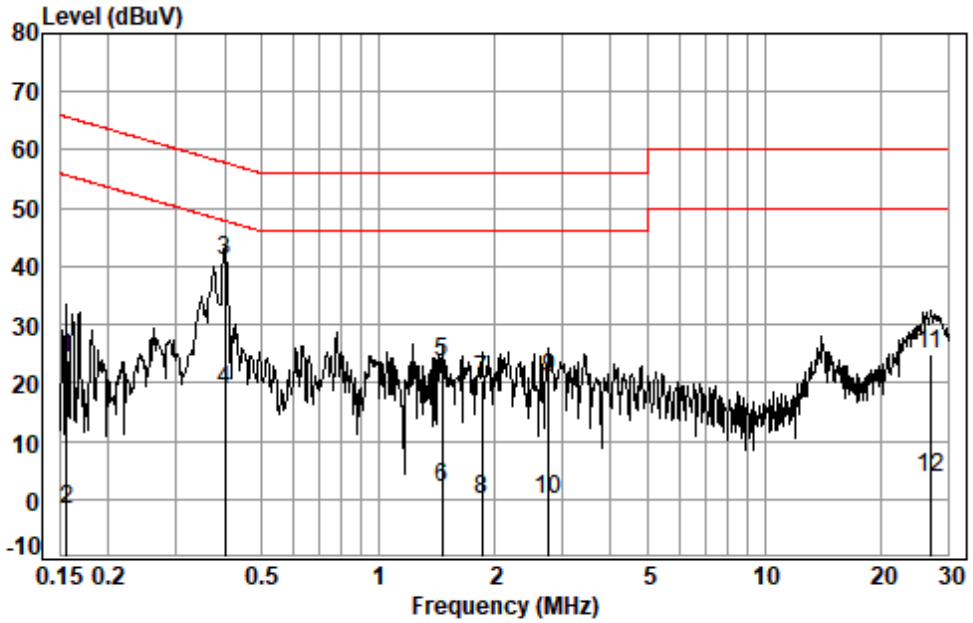
Test Mode: 00; Line: Live line



Site : Shielding Room
Condition: Line
Job No. : 01345MO/01346MO
Test mode: 00

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1557	0.06	10.19	14.01	24.26	65.69	-41.43	QP
2	0.1557	0.06	10.19	-11.88	-1.63	55.69	-57.32	Average
3 *	0.4019	0.07	9.67	31.33	41.07	57.81	-16.74	QP
4 *	0.4019	0.07	9.67	9.09	18.83	47.81	-28.98	Average
5	1.4640	0.10	9.58	13.87	23.55	56.00	-32.45	QP
6	1.4640	0.10	9.58	-7.87	1.81	46.00	-44.19	Average
7	1.8581	0.10	9.58	10.79	20.47	56.00	-35.53	QP
8	1.8581	0.10	9.58	-9.90	-0.22	46.00	-46.22	Average
9	2.7648	0.11	9.64	11.19	20.94	56.00	-35.06	QP
10	2.7648	0.11	9.64	-9.94	-0.19	46.00	-46.19	Average
11	26.8411	0.35	10.40	14.30	25.05	60.00	-34.95	QP
12	26.8411	0.35	10.40	-7.08	3.67	50.00	-46.33	Average

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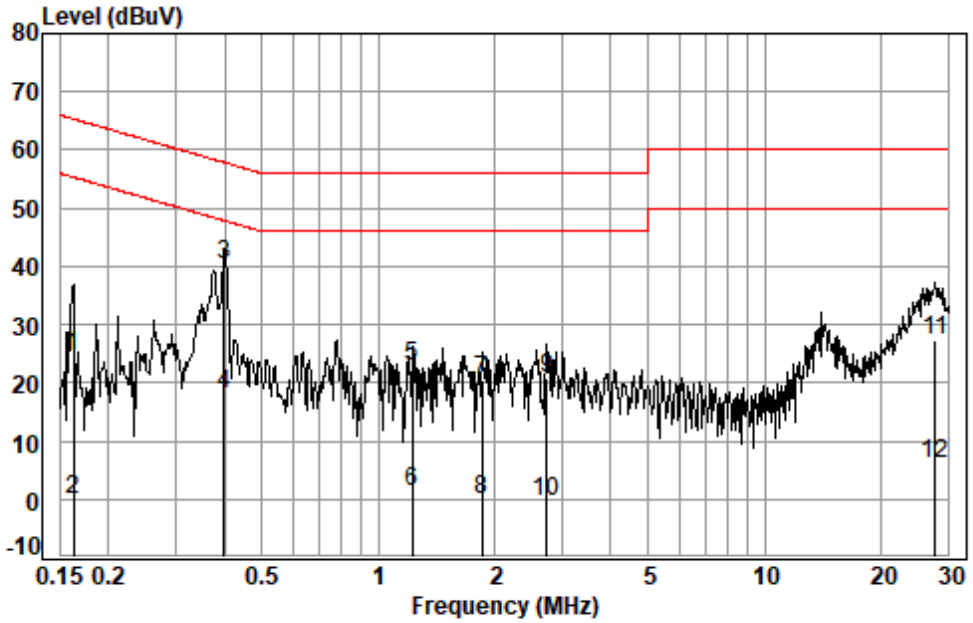
Test Mode: 00; Line: Neutral Line



Site : Shielding Room
Condition: Neutral
Job No. : 01345MO/01346MO
Test mode: 00

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1624	0.06	10.13	14.46	24.65	65.34	-40.69	QP
2	0.1624	0.06	10.13	-10.36	-0.17	55.34	-55.51	Average
3 *	0.3997	0.07	9.74	30.46	40.27	57.86	-17.59	QP
4 *	0.3997	0.07	9.74	8.35	18.16	47.86	-29.70	Average
5	1.2226	0.09	9.54	13.27	22.90	56.00	-33.10	QP
6	1.2226	0.09	9.54	-8.17	1.46	46.00	-44.54	Average
7	1.8581	0.10	9.55	10.81	20.46	56.00	-35.54	QP
8	1.8581	0.10	9.55	-9.68	-0.03	46.00	-46.03	Average
9	2.7356	0.11	9.54	11.00	20.65	56.00	-35.35	QP
10	2.7356	0.11	9.54	-10.24	-0.59	46.00	-46.59	Average
11	27.7080	0.36	10.56	16.22	27.14	60.00	-32.86	QP
12	27.7080	0.36	10.56	-4.92	6.00	50.00	-44.00	Average

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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
Measurement Distance: 3m

Limit:

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

7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 24.5 °C Humidity: 50.8 % RH Atmospheric Pressure: 1020 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, Pi/4DQPSK modulation, 8DPSK modulation. All modes have been tested and only the data of worst case is recorded in the report.

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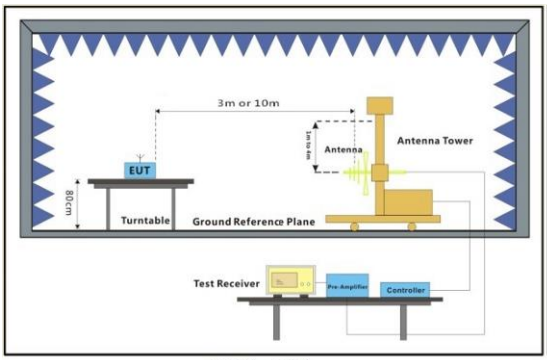
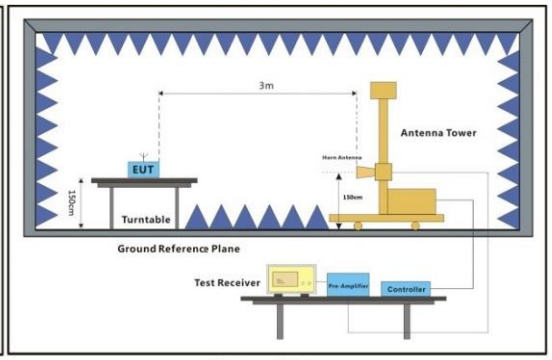
7.2.3 Test Setup Diagram



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 middle channel, the Highest channel.

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

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

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

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

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

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

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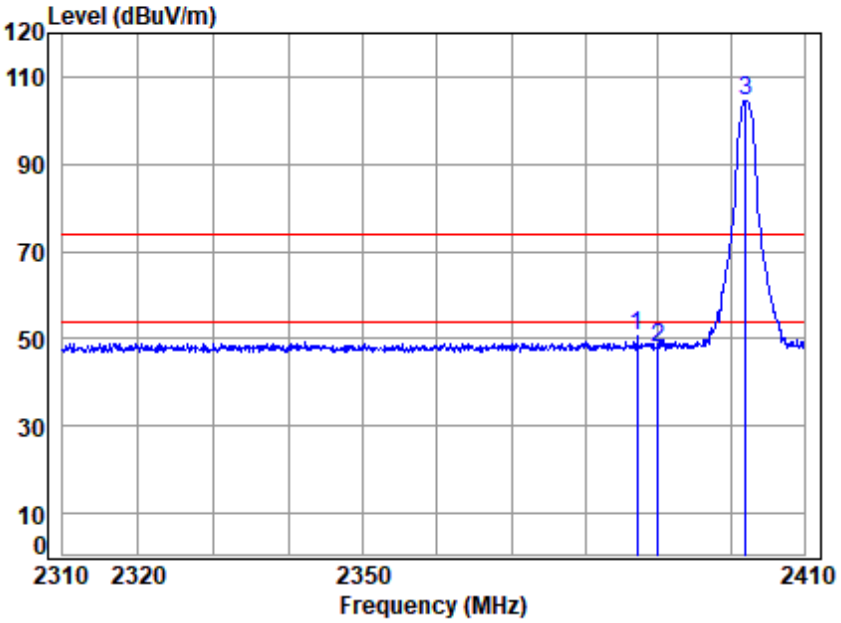
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:Low



Condition: 3m HORIZONTAL
Job No : 01345MO/01346MO
Mode : 2402 Band edge
: BT DH5

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2387.129	6.82	27.45	31.54	47.96	50.69	74.00	-23.31	peak
2	2390.000	6.82	27.46	31.54	45.33	48.07	74.00	-25.93	peak
3 pp	2402.000	6.84	27.50	31.54	101.66	104.46	74.00	30.46	peak

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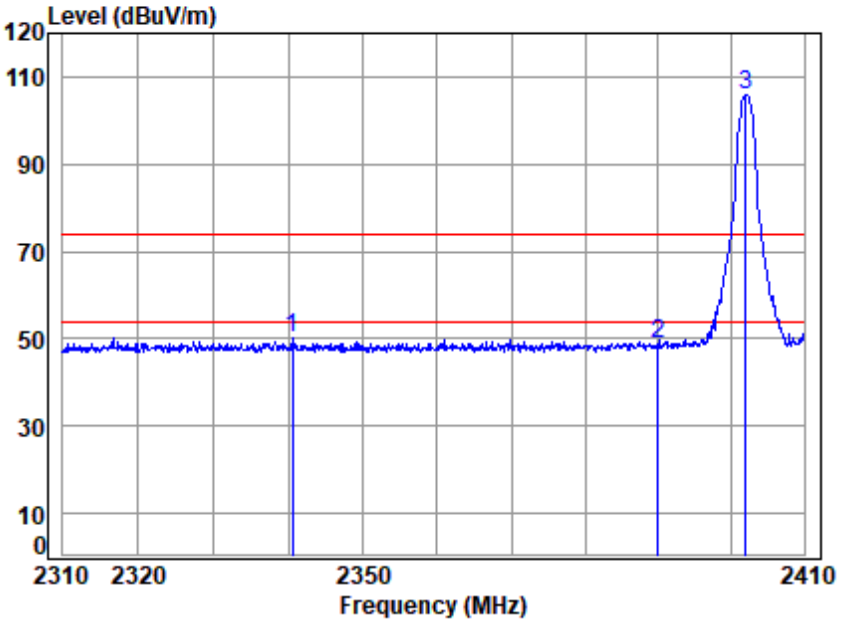
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:Low



Condition: 3m VERTICAL
Job No : 01345MO/01346MO
Mode : 2402 Band edge
: BT DH5

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2340.548	6.80	27.28	31.53	47.70	50.25	74.00	-23.75	peak
2	2390.000	6.82	27.46	31.54	46.17	48.91	74.00	-25.09	peak
3 pp	2402.000	6.84	27.50	31.54	102.90	105.70	74.00	31.70	peak

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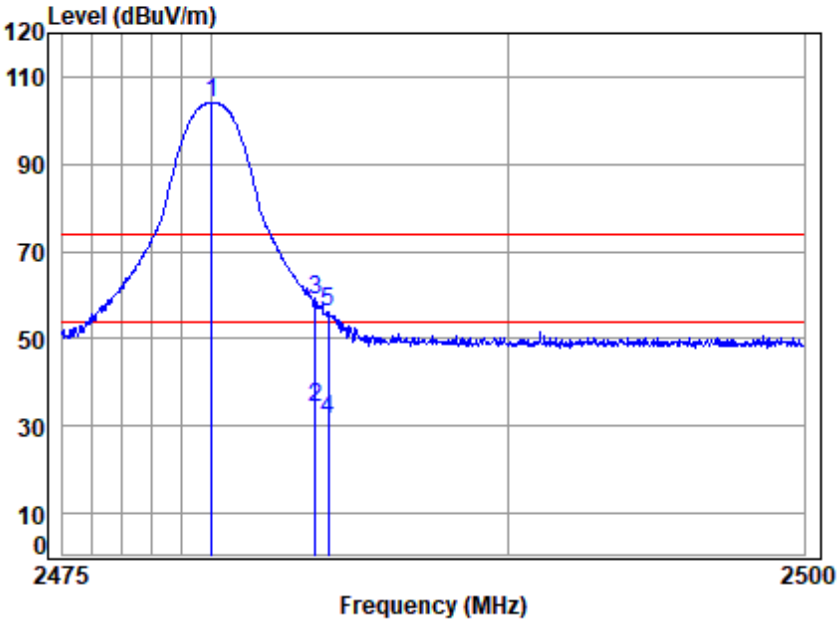
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:High



Condition: 3m HORIZONTAL
Job No : 01345MO/01346MO
Mode : 2480 Band edge
: BT DH5

		Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
		MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	pp	2480.000	7.37	27.78	31.55	100.32	103.92	74.00	29.92	peak
2	av	2483.500	7.40	27.80	31.55	30.44	34.09	54.00	-19.91	Average
3		2483.500	7.40	27.80	31.55	55.22	58.87	74.00	-15.13	peak
4		2483.921	7.40	27.80	31.55	27.83	31.48	54.00	-22.52	Average
5		2483.921	7.40	27.80	31.55	52.61	56.26	74.00	-17.74	peak

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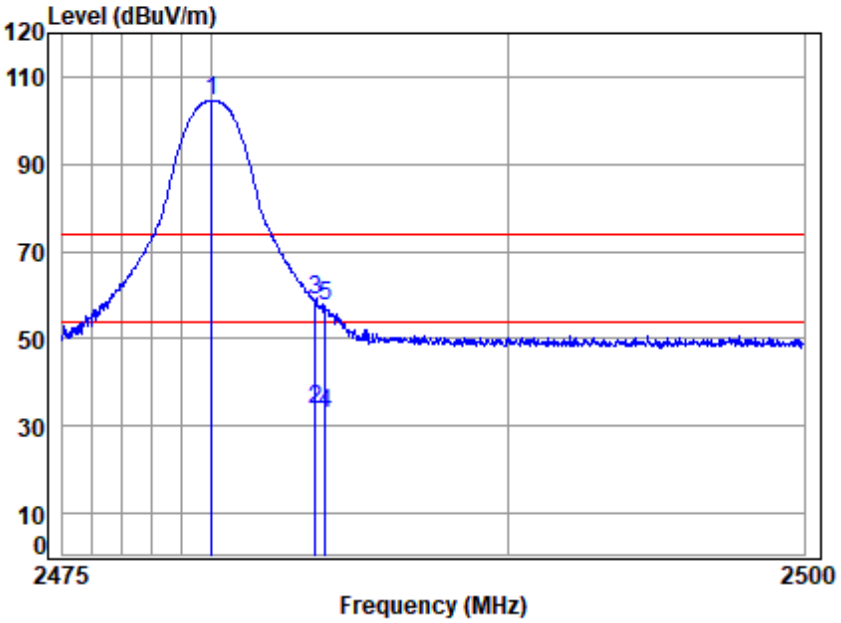
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:High



Condition: 3m VERTICAL
Job No : 01345MO/01346MO
Mode : 2480 Band edge
: BT DH5

		Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
		MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	pp	2480.000	7.37	27.78	31.55	100.74	104.34	74.00	30.34	peak
2	av	2483.500	7.40	27.80	31.55	30.31	33.96	54.00	-20.04	Average
3		2483.500	7.40	27.80	31.55	55.09	58.74	74.00	-15.26	peak
4		2483.821	7.40	27.80	31.55	29.03	32.68	54.00	-21.32	Average
5		2483.821	7.40	27.80	31.55	53.81	57.46	74.00	-16.54	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
Measurement Distance: 3m

Limit:

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

7.3.1 E.U.T. Operation

Operating Environment:
Temperature: 23.3 °C Humidity: 45.1 % 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, 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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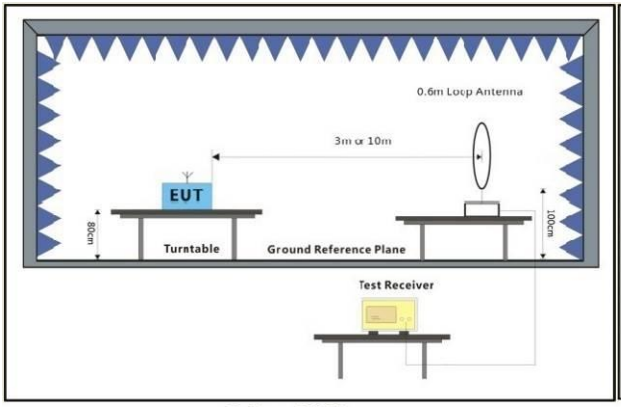
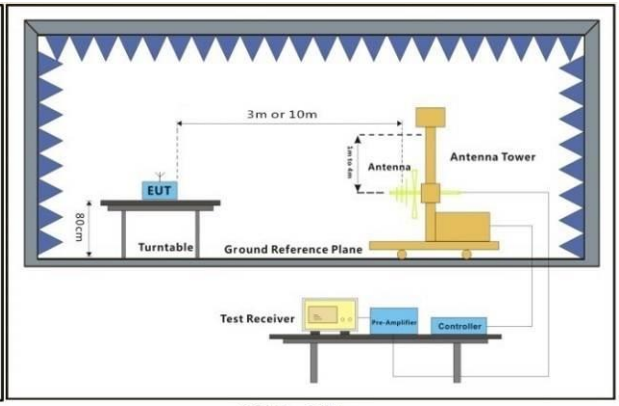
7.3.3 Test Setup Diagram



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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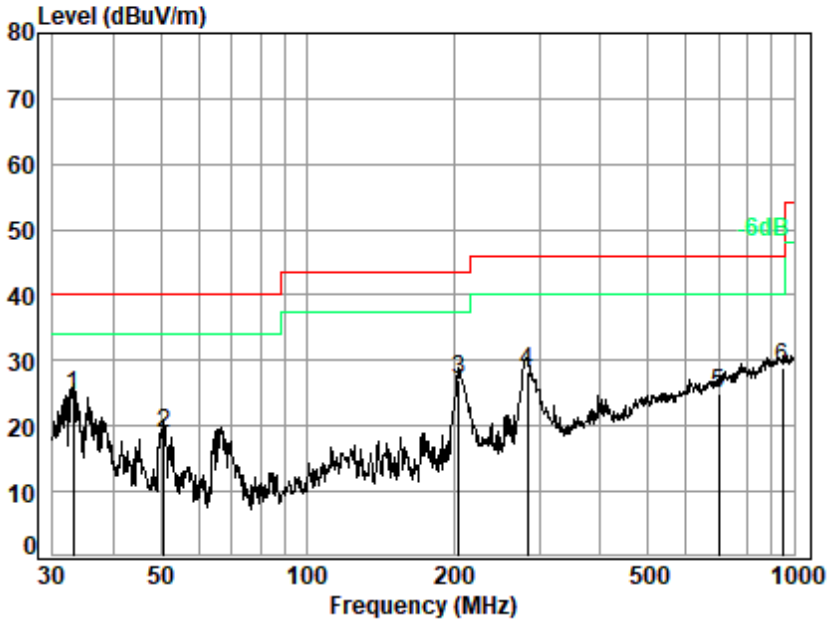
Test Mode: 00; Polarity: Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : 01345MO/01346MO
Test Mode: 00

	Freq	Ant Factor	Cable Loss	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1 q	33.095	19.84	0.71	27.78	31.80	24.57	40.00	-15.43	QP
2	50.764	12.64	0.87	27.73	33.23	19.01	40.00	-20.99	QP
3	204.955	14.54	1.79	27.15	37.77	26.95	43.50	-16.55	QP
4	282.985	16.90	2.14	26.82	36.12	28.34	46.00	-17.66	QP
5	699.305	25.93	3.54	27.73	23.32	25.06	46.00	-20.94	QP
6	948.761	28.23	4.25	26.42	22.80	28.86	46.00	-17.14	QP

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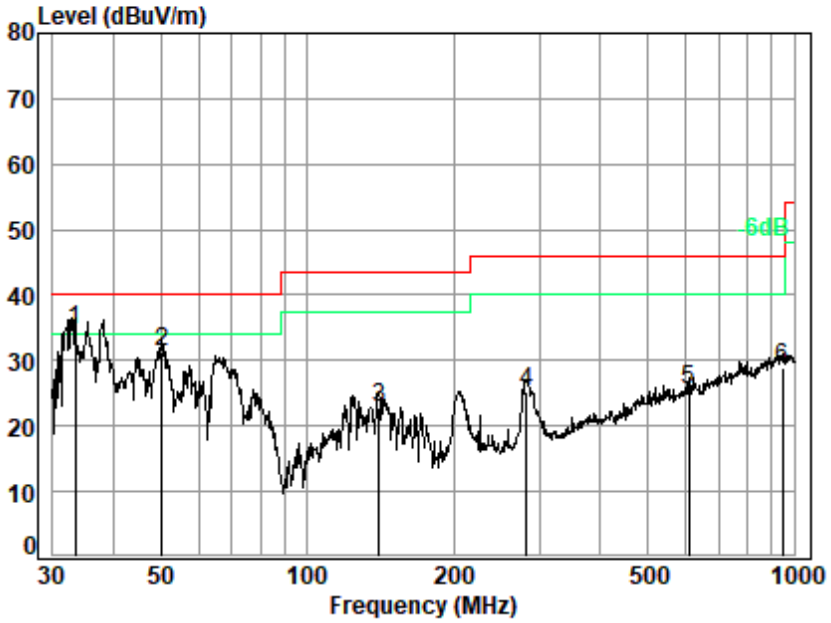
Test Mode: 00; Polarity: Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : 01345MO/01346MO
Test Mode: 00

	Freq	Ant Factor	Cable Loss	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1 q	33.328	19.73	0.71	27.78	41.90	34.56	40.00	-5.44	QP
2	50.232	12.72	0.86	27.73	45.40	31.25	40.00	-8.75	QP
3	140.342	11.85	1.48	27.42	37.00	22.91	43.50	-20.59	QP
4	281.995	16.91	2.13	26.83	32.93	25.14	46.00	-20.86	QP
5	607.787	24.61	3.27	27.95	25.60	25.53	46.00	-20.47	QP
6	948.761	28.23	4.25	26.42	22.87	28.93	46.00	-17.07	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
Measurement Distance: 3m

Limit:

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

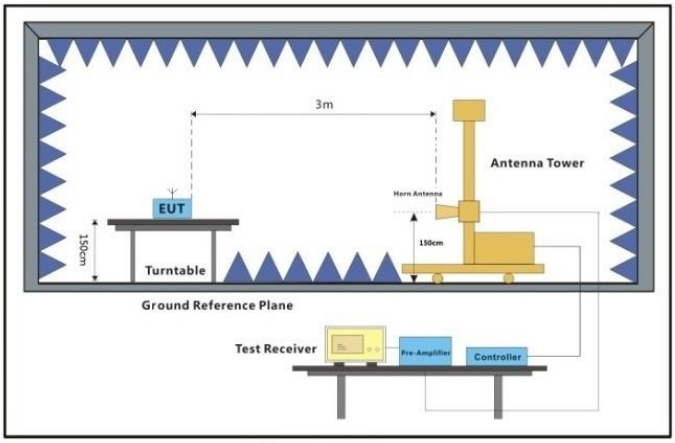
7.4.1 E.U.T. Operation

Operating Environment:
Temperature: 24.5 °C Humidity: 50.8 % RH Atmospheric Pressure: 1020 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, 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

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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.

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

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

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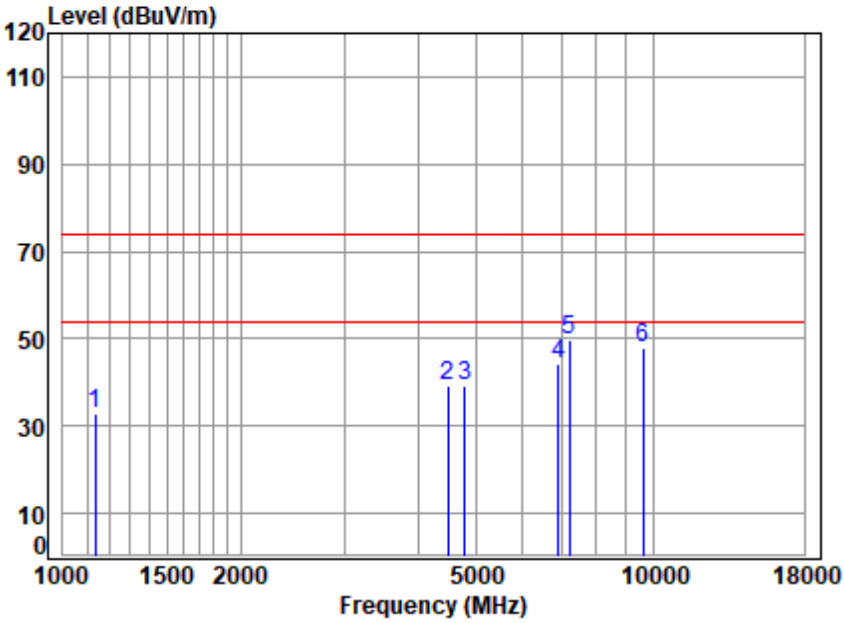
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:Low



Condition: 3m HORIZONTAL
Job No : 06130CO/07291CR
Mode : 2402 TX RSE
: BT DH5

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1135.617	7.13	25.46	54.70	55.16	33.05	74.00	-40.95	peak
2	4482.150	8.56	31.53	55.94	55.24	39.39	74.00	-34.61	peak
3	4804.000	8.90	31.92	56.16	54.72	39.38	74.00	-34.62	peak
4	6914.763	10.94	36.17	56.72	54.08	44.47	74.00	-29.53	peak
5 pp	7206.000	11.10	36.60	56.54	58.51	49.67	74.00	-24.33	peak
6	9608.000	12.38	38.78	54.45	51.24	47.95	74.00	-26.05	peak

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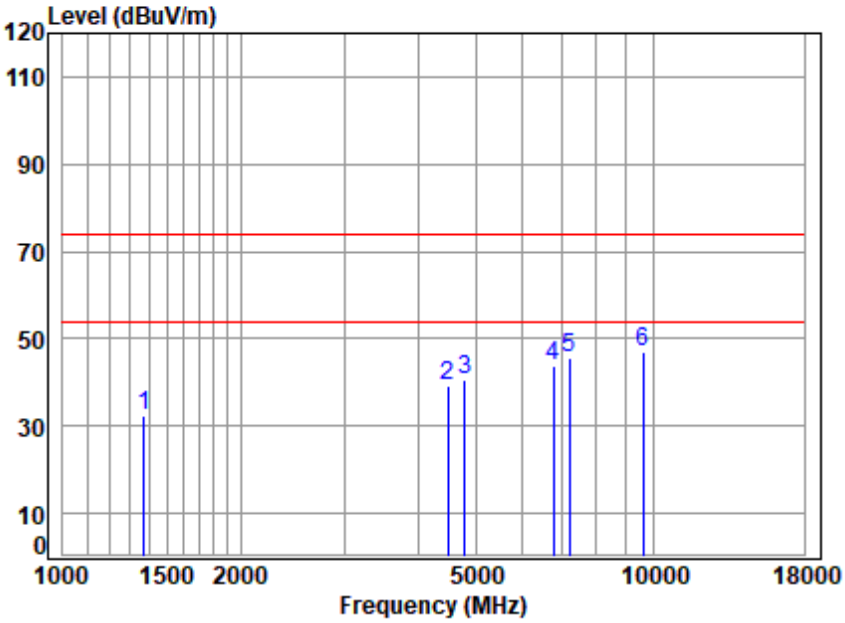
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:Low



Condition: 3m VERTICAL
Job No : 06130CO/07291CR
Mode : 2402 TX RSE
: BT DH5

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1374.295	7.19	25.05	54.70	54.89	32.43	74.00	-41.57	peak
2	4482.150	8.56	31.53	55.94	55.19	39.34	74.00	-34.66	peak
3	4804.000	8.90	31.92	56.16	56.11	40.77	74.00	-33.23	peak
4	6776.265	10.94	35.81	56.74	53.99	44.00	74.00	-30.00	peak
5	7206.000	11.10	36.60	56.54	54.31	45.47	74.00	-28.53	peak
6 pp	9608.000	12.38	38.78	54.45	50.24	46.95	74.00	-27.05	peak

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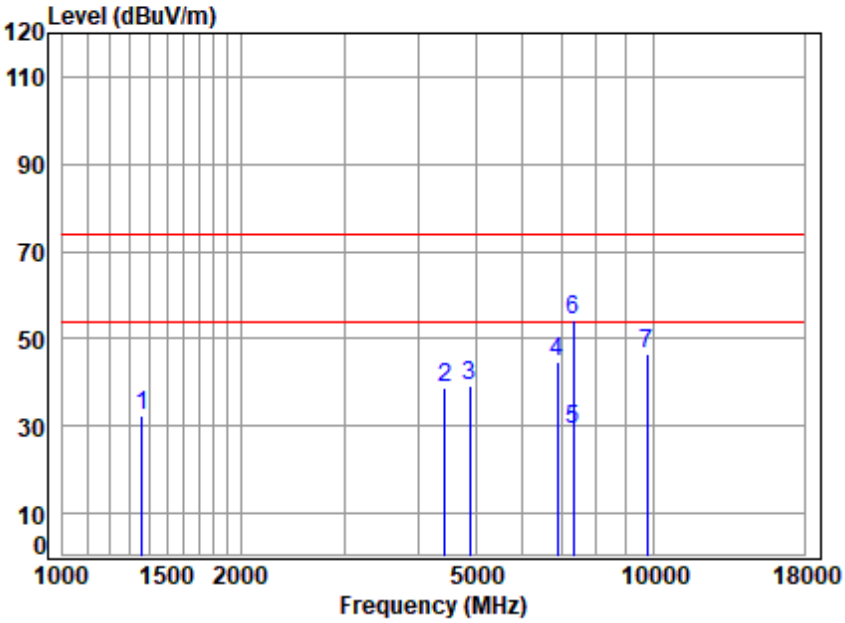
Test Mode: 00; Polarity: Horizontal; Modulation:GFSK; Channel:middle



Condition: 3m HORIZONTAL
Job No : 06130CO/07291CR
Mode : 2441 TX RSE
: BT DH5

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1362.430	7.19	25.08	54.70	54.97	32.54	74.00	-41.46	peak
2	4443.453	8.55	31.37	55.91	54.98	38.99	74.00	-35.01	peak
3	4882.000	8.98	32.16	56.22	54.11	39.03	74.00	-34.97	peak
4	6874.906	10.95	36.10	56.73	54.28	44.60	74.00	-29.40	peak
5 av	7323.000	11.12	36.75	56.44	37.99	29.42	54.00	-24.58	Average
6 pp	7323.000	11.12	36.75	56.44	62.77	54.20	74.00	-19.80	peak
7	9764.000	12.86	38.60	54.31	49.57	46.72	74.00	-27.28	peak

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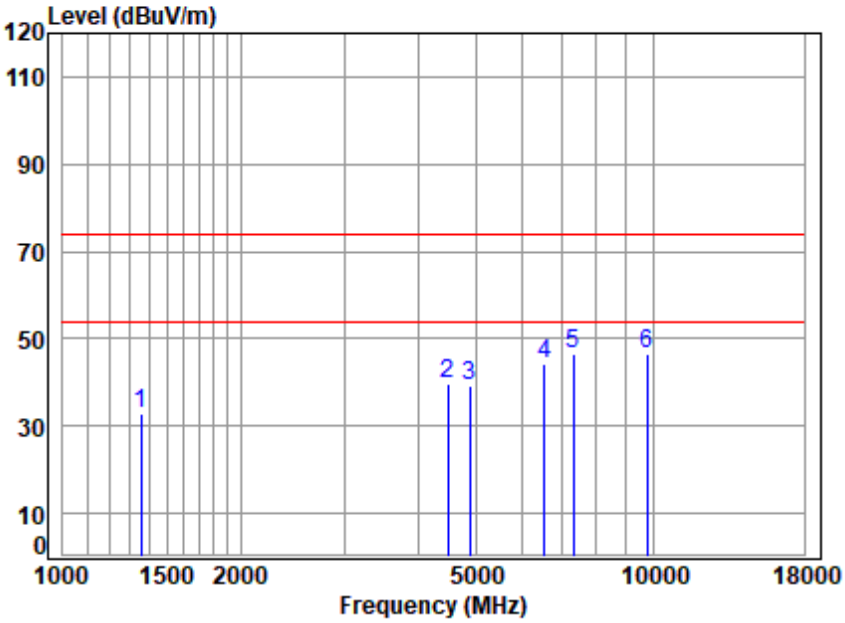
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:middle



Condition: 3m VERTICAL
Job No : 06130CO/07291CR
Mode : 2441 TX RSE
: BT DH5

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1358.498	7.19	25.08	54.70	55.44	33.01	74.00	-40.99	peak
2	4495.125	8.56	31.58	55.95	55.40	39.59	74.00	-34.41	peak
3	4882.000	8.98	32.16	56.22	54.21	39.13	74.00	-34.87	peak
4	6545.263	10.76	34.99	56.79	55.16	44.12	74.00	-29.88	peak
5 pp	7323.000	11.12	36.75	56.44	55.21	46.64	74.00	-27.36	peak
6	9764.000	12.86	38.60	54.31	49.30	46.45	74.00	-27.55	peak

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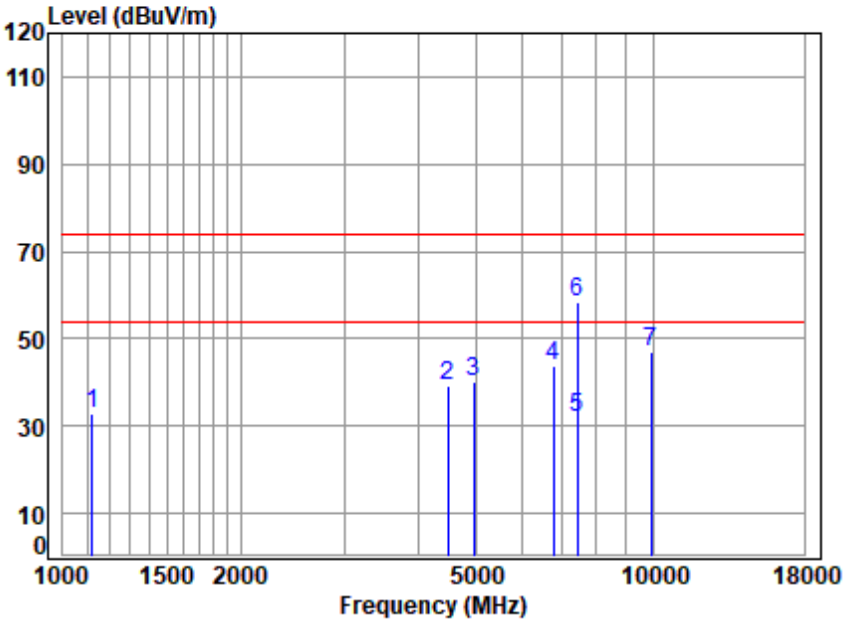

Condition: 3m HORIZONTAL
Job No : 06130CO/07291CR
Mode : 2480 TX RSE
: BT DH5

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1122.563	7.12	25.51	54.70	54.81	32.74	74.00	-41.26	peak
2	4495.125	8.56	31.58	55.95	54.99	39.18	74.00	-34.82	peak
3	4960.000	9.07	32.20	56.27	55.33	40.33	74.00	-33.67	peak
4	6776.265	10.94	35.81	56.74	53.94	43.95	74.00	-30.05	peak
5 av	7440.000	11.08	36.78	56.35	40.43	31.94	54.00	-22.06	Average
6 pp	7440.000	11.08	36.78	56.35	66.99	58.50	74.00	-15.50	peak
7	9920.000	12.73	38.90	54.17	49.41	46.87	74.00	-27.13	peak

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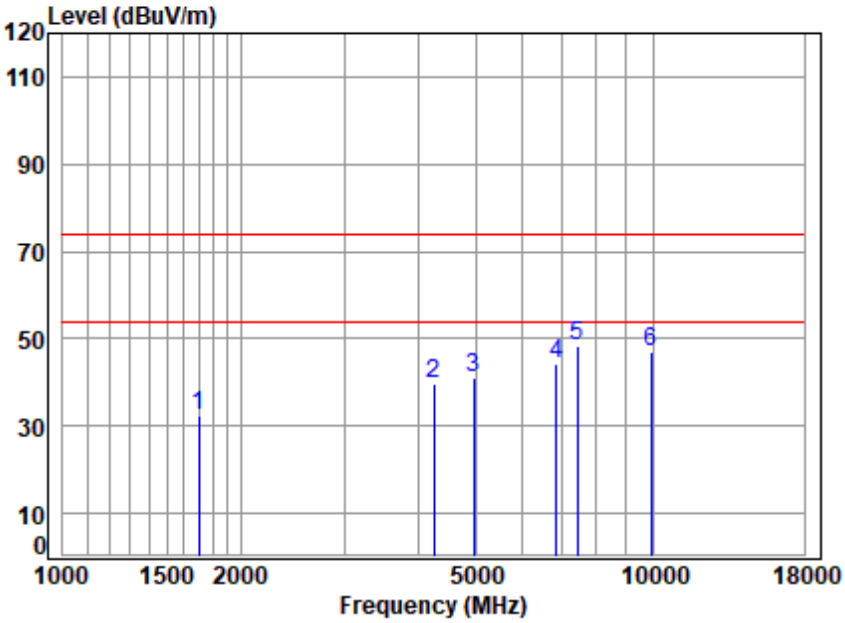
Test Mode: 00; Polarity: Vertical; Modulation:GFSK; Channel:High



Condition: 3m VERTICAL
Job No : 06130CO/07291CR
Mode : 2480 TX RSE
: BT DH5

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1702.042	7.20	25.11	54.70	54.75	32.36	74.00	-41.64	peak
2	4254.921	8.48	31.12	55.78	55.85	39.67	74.00	-34.33	peak
3	4960.000	9.07	32.20	56.27	55.85	40.85	74.00	-33.15	peak
4	6855.063	10.96	36.02	56.73	54.06	44.31	74.00	-29.69	peak
5 pp	7440.000	11.08	36.78	56.35	56.67	48.18	74.00	-25.82	peak
6	9920.000	12.73	38.90	54.17	49.63	47.09	74.00	-26.91	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: 23.4 °C Humidity: 40.3 % RH Atmospheric Pressure: 1020 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, 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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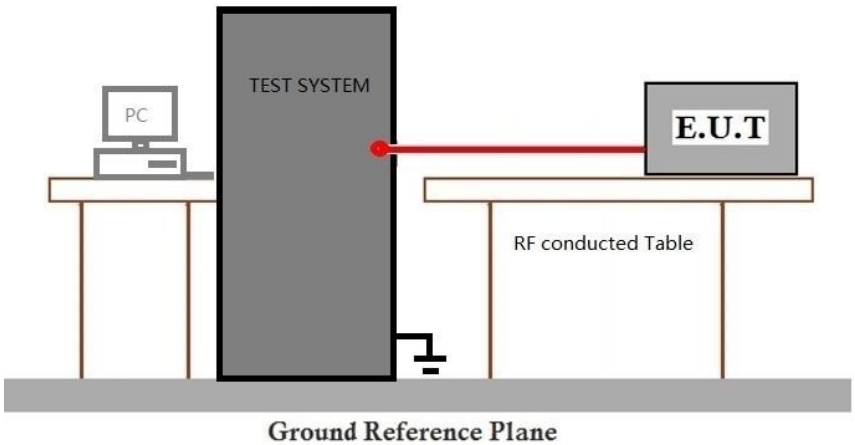
7.5.3 Test Setup Diagram



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.

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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

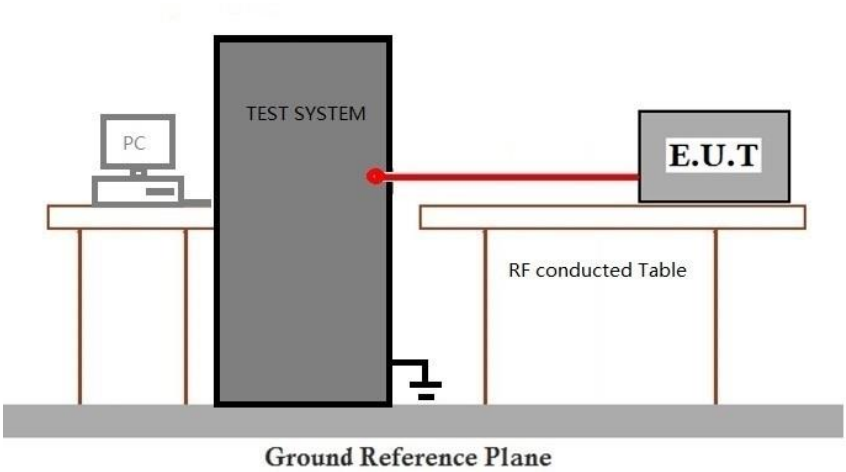
7.6.1 E.U.T. Operation

Operating Environment:
Temperature: 23.4 °C Humidity: 40.3 % RH Atmospheric Pressure: 1020 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, 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

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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

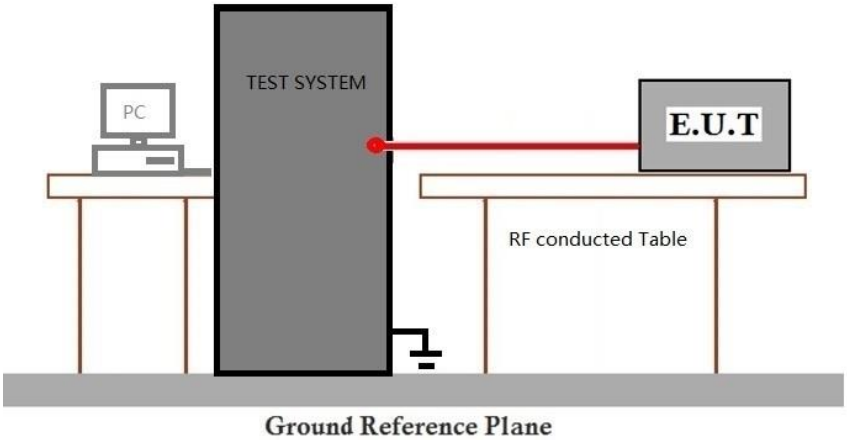
Operating Environment:

Temperature: 23.4 °C Humidity: 40.3 % RH Atmospheric Pressure: 1020 mbar

7.7.2 Test Mode Description

Pre-scan / Final test	Mode 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.

7.7.3 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: 23.4 °C Humidity: 40.3 % RH Atmospheric Pressure: 1020 mbar

7.8.2 Test Mode Description

Pre-scan / Final test	Mode 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.

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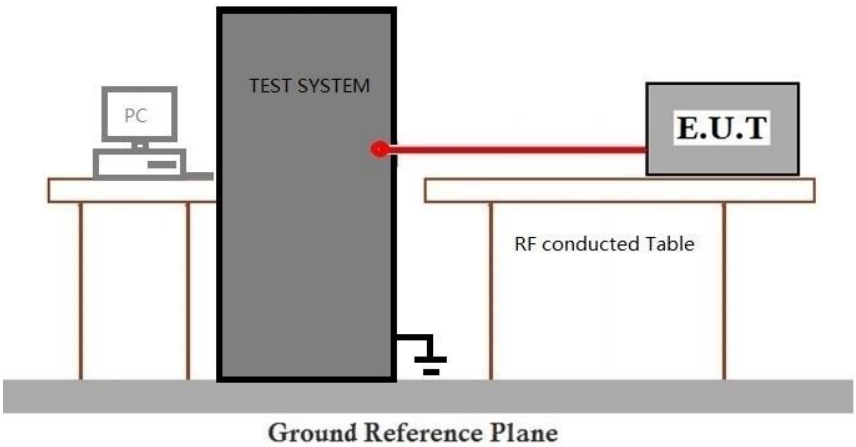
7.8.3 Test Setup Diagram



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: 23.4 °C Humidity: 40.3 % RH Atmospheric Pressure: 1020 mbar

7.9.2 Test Mode Description

Pre-scan / Final test	Mode 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.

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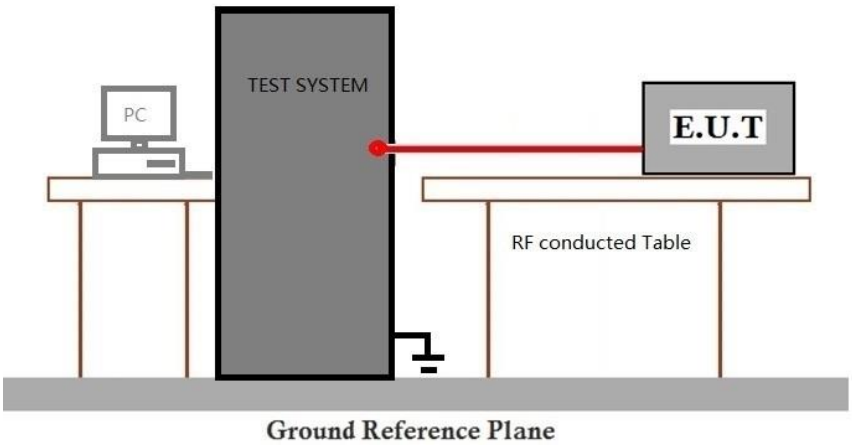
7.9.3 Test Setup Diagram



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: 23.4 °C Humidity: 40.3 % RH Atmospheric Pressure: 1020 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.

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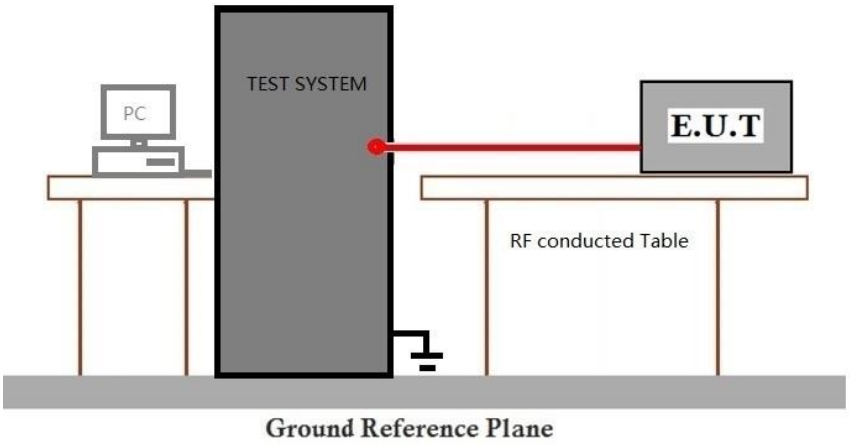
7.10.3 Test Setup Diagram



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: 23.4 °C Humidity: 40.3 % RH Atmospheric Pressure: 1020 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.

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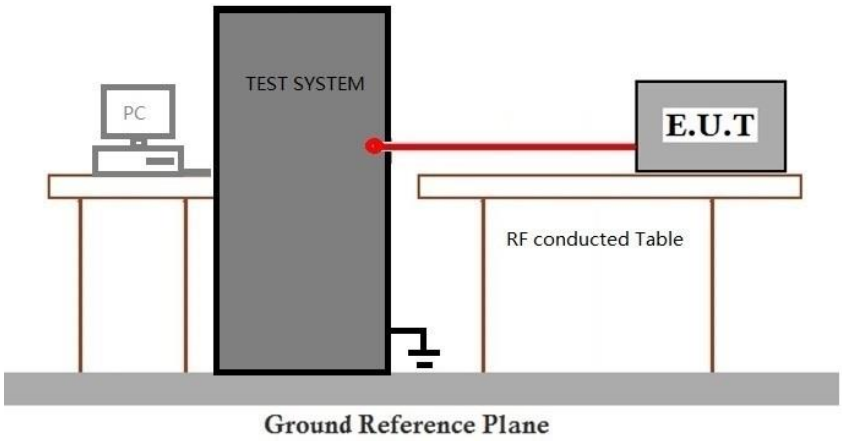
7.11.3 Test Setup Diagram



7.11.4 Measurement Procedure and Data

Please Refer to Appendix for Details

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8 Test Setup Photo

Refer to Setup Photo for SZCR2504001345MO

9 EUT Constructional Details (EUT Photos)

Refer to External and Internal Photos for SZCR2504001345MO

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10 Appendix

1. Bandwidth

1.1 Test Result

1.1.1 OBW

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	99% Occupied Bandwidth (MHz)		Verdict
					Result	Limit	
GFSK	SISO	2402	DH5	1	0.829	/	Pass
		2441	DH5	1	0.831	/	Pass
		2480	DH5	1	0.833	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.177	/	Pass
		2441	2DH5	1	1.173	/	Pass
		2480	2DH5	1	1.176	/	Pass
8DPSK	SISO	2402	3DH5	1	1.184	/	Pass
		2441	3DH5	1	1.183	/	Pass
		2480	3DH5	1	1.184	/	Pass

1.1.2 20dB BW

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	20dB Bandwidth (MHz)		Verdict
					Result	Limit	
GFSK	SISO	2402	DH5	1	0.936	/	Pass
		2441	DH5	1	0.935	/	Pass
		2480	DH5	1	0.937	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.321	/	Pass
		2441	2DH5	1	1.317	/	Pass
		2480	2DH5	1	1.321	/	Pass
8DPSK	SISO	2402	3DH5	1	1.312	/	Pass
		2441	3DH5	1	1.311	/	Pass
		2480	3DH5	1	1.311	/	Pass

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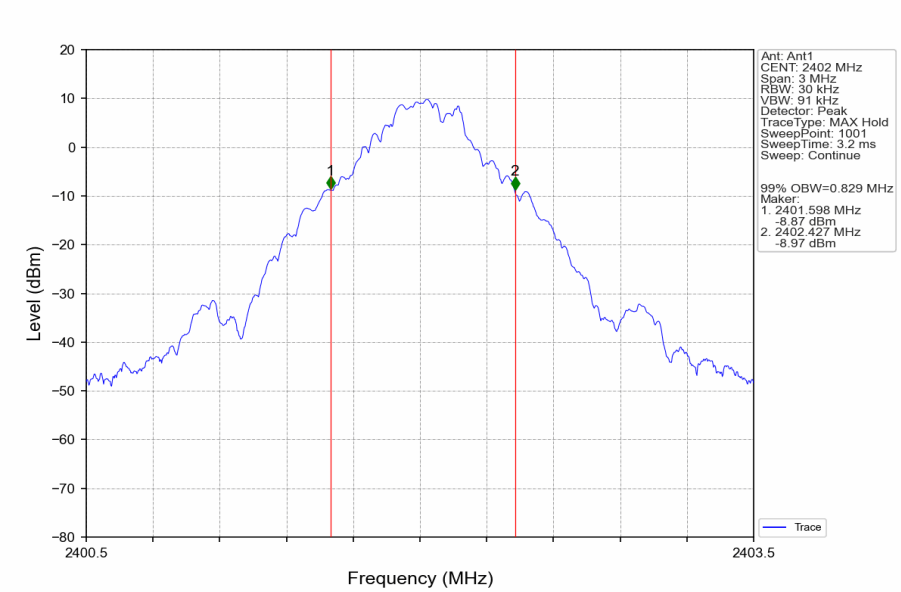
1.2 Test Graph

1.2.1 OBW

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



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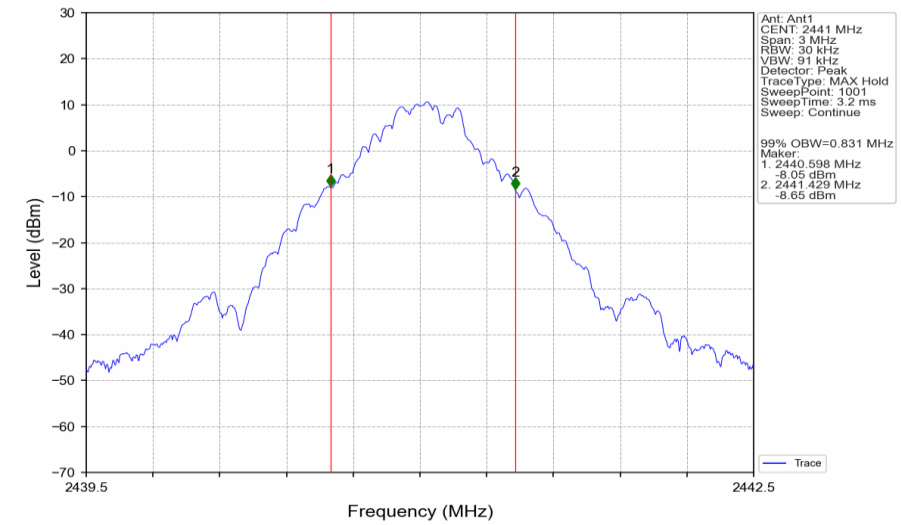

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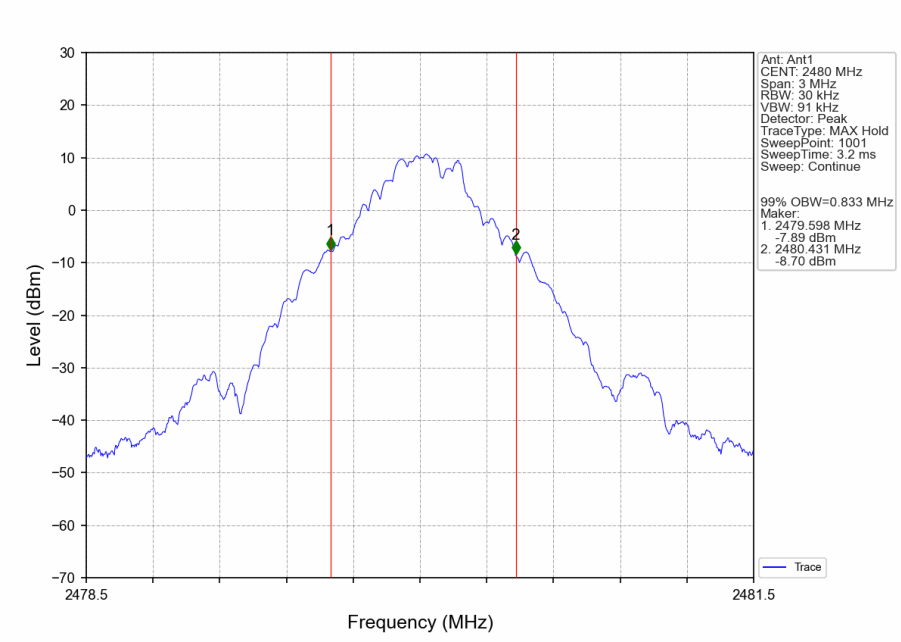
GFSK_DH5_HCH_2480MHz_Ant1_NTNV



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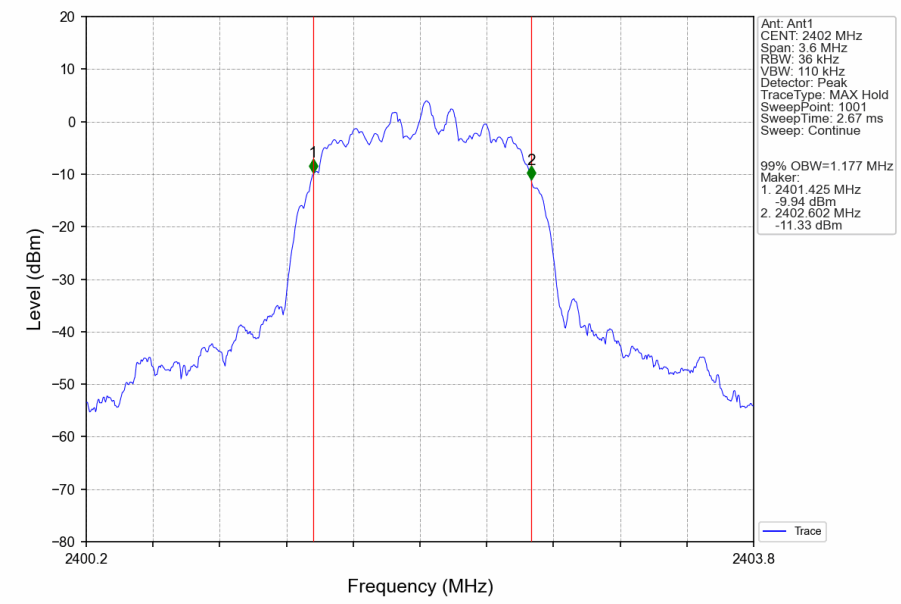

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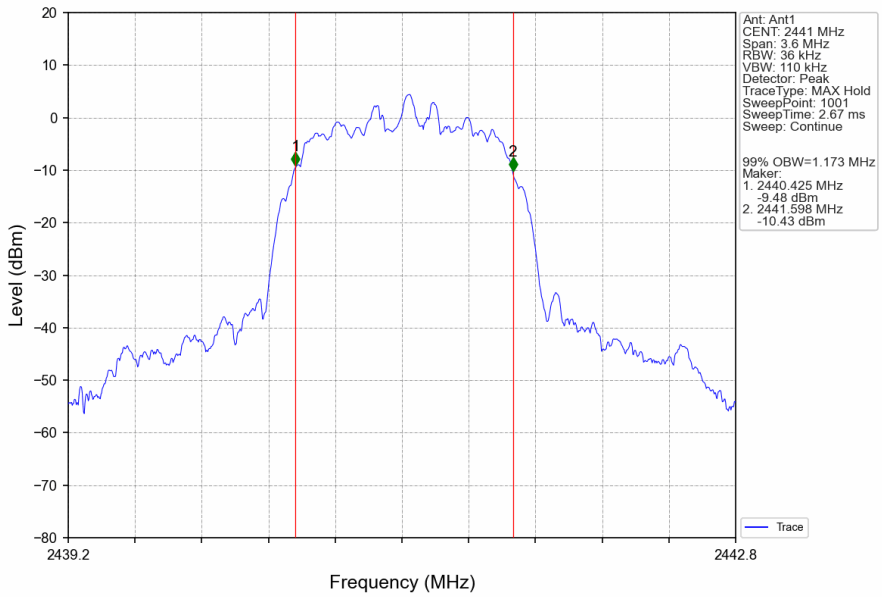
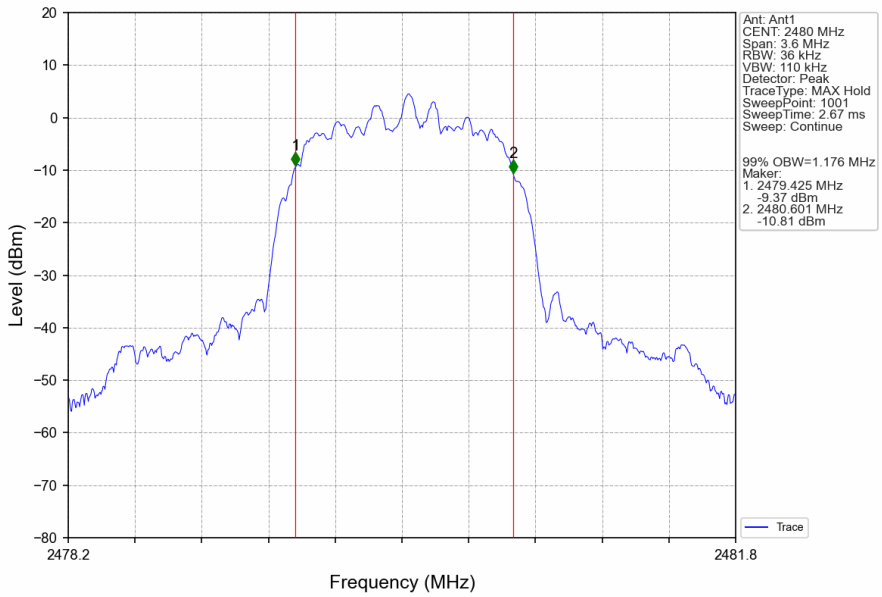
Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV



Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV



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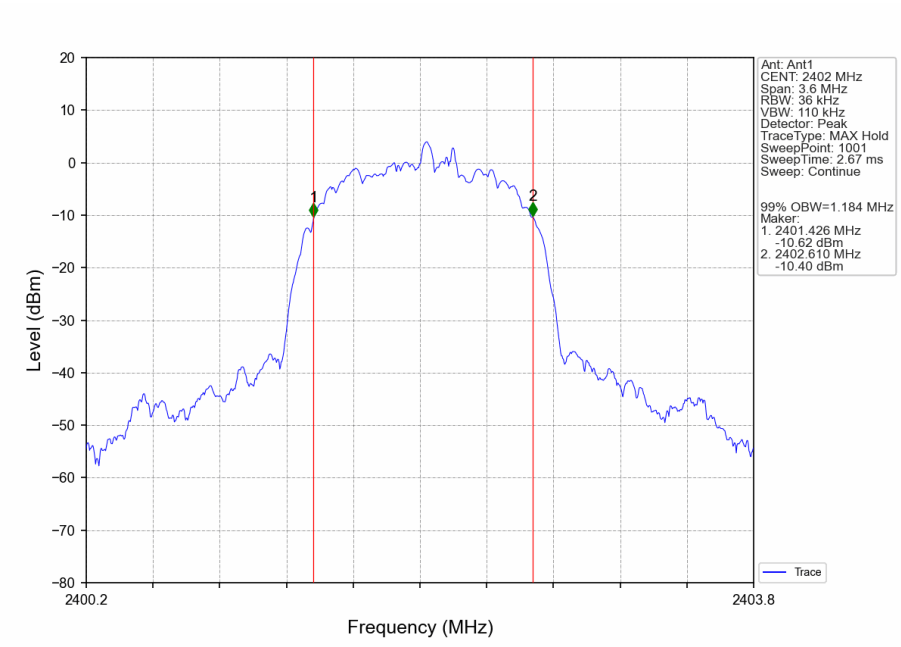
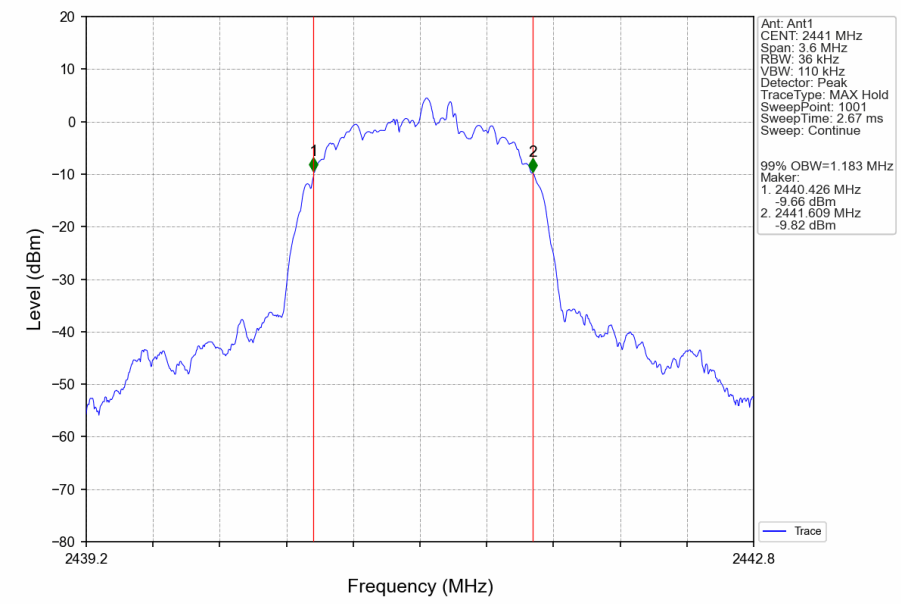
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



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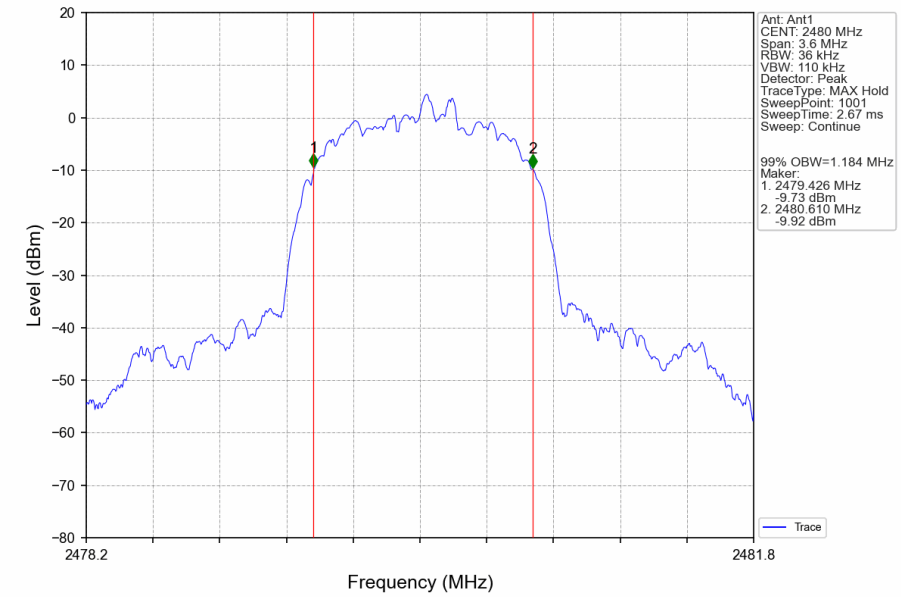

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1.2.2 20dB BW

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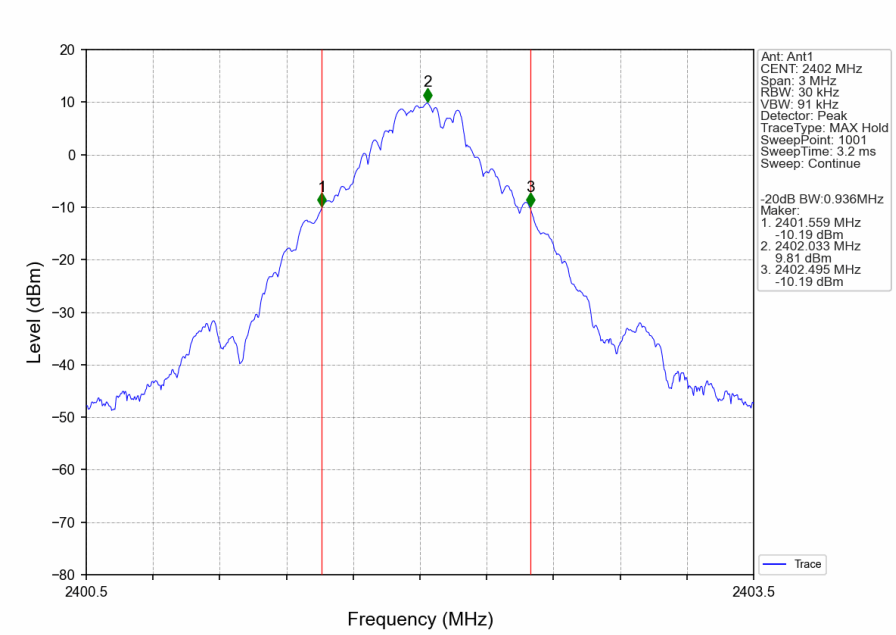

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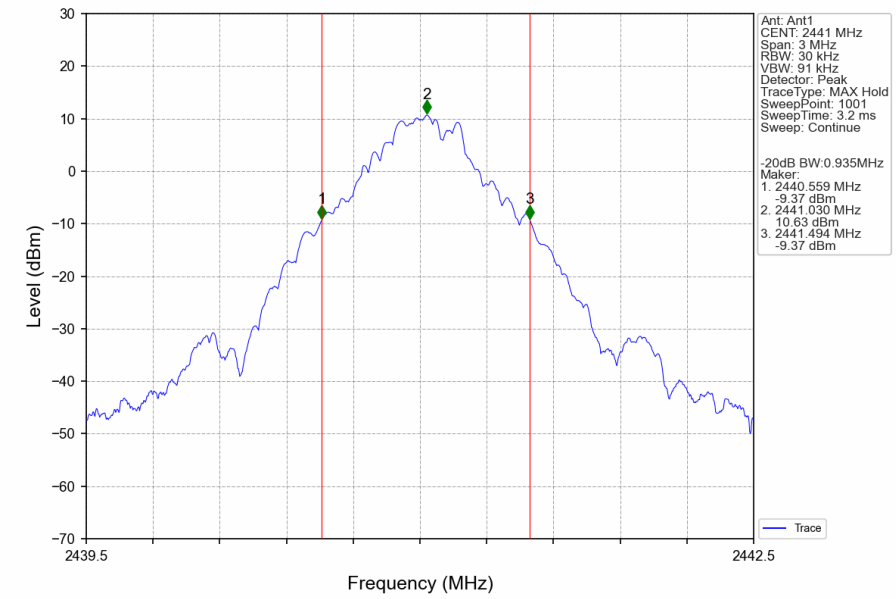

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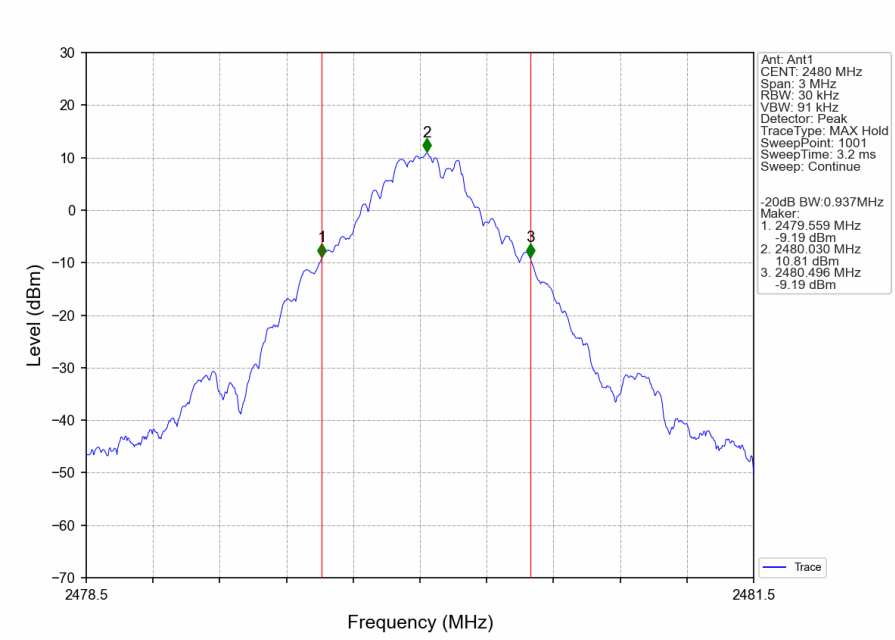

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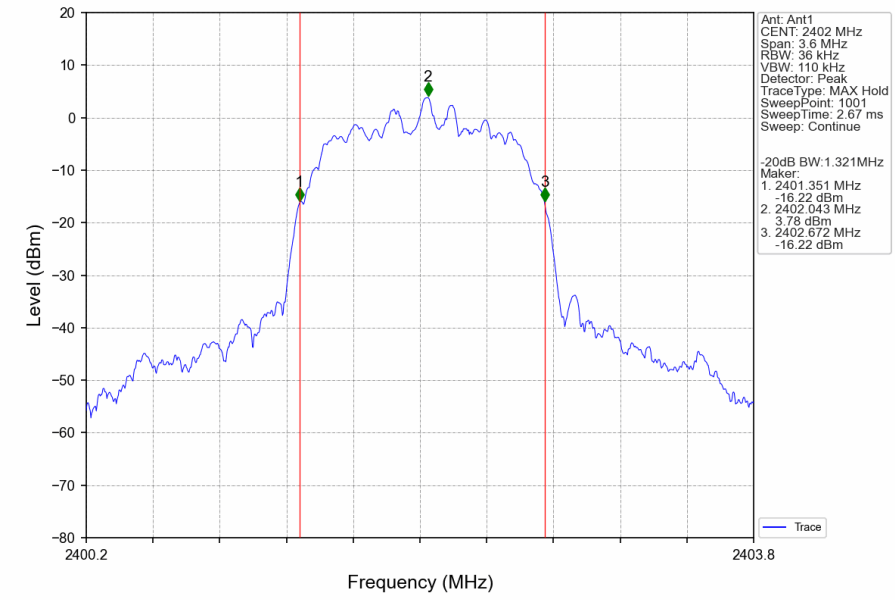

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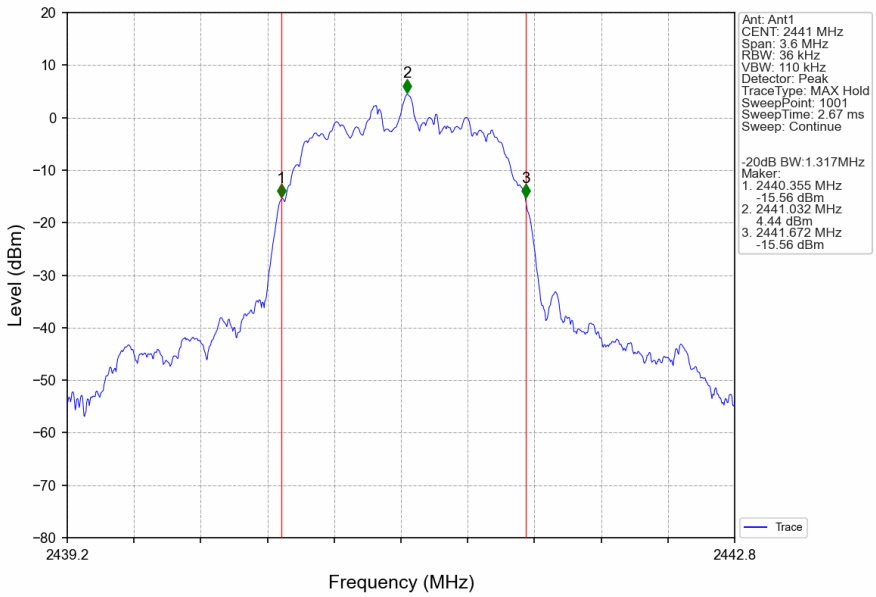
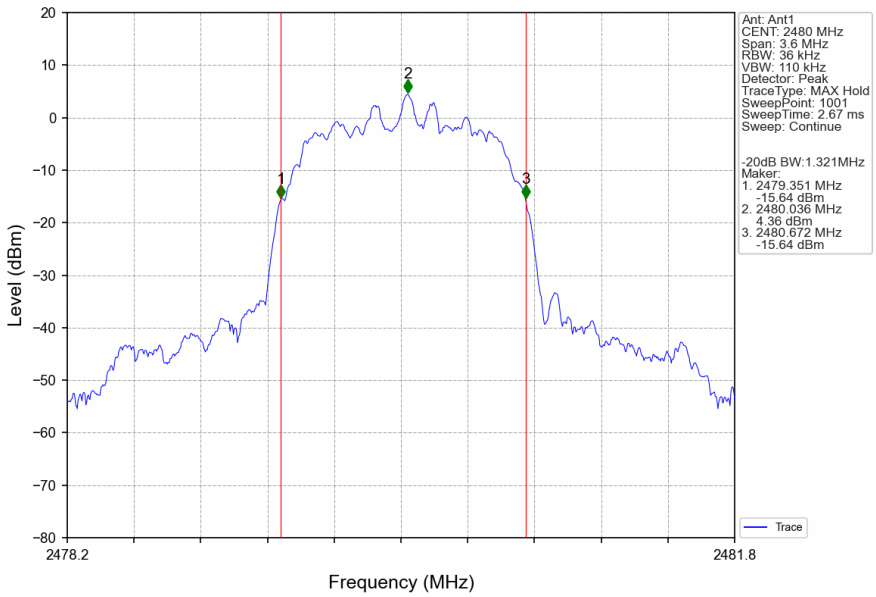


Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV



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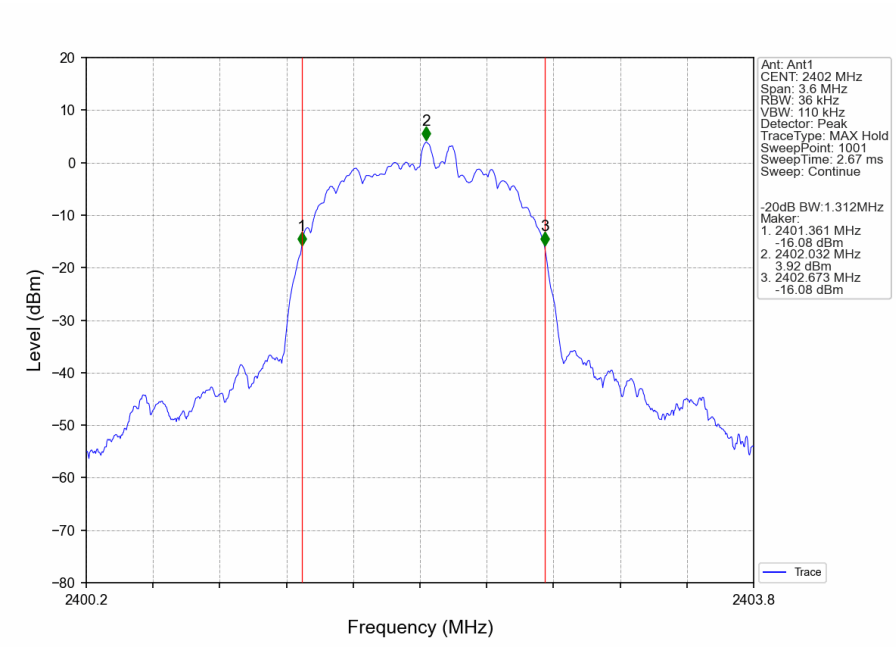
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



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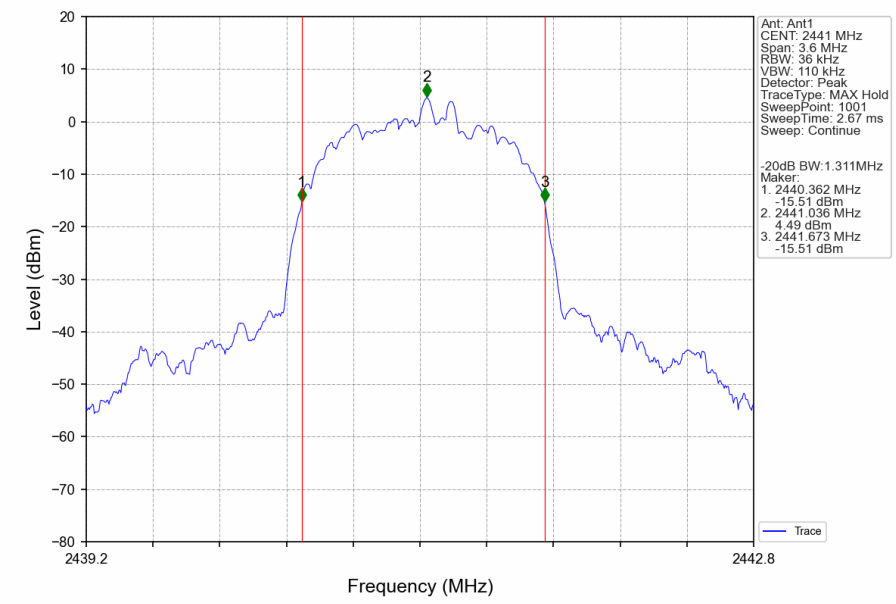

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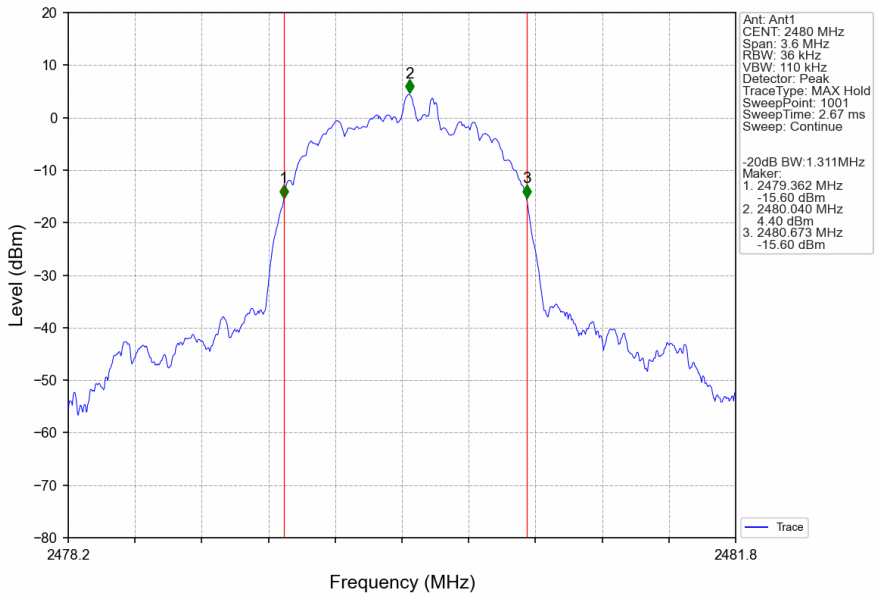
8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV



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2. Maximum Conducted Output Power

2.1 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	11.78	<=30	Pass
		2441	DH5	12.61	<=30	Pass
		2480	DH5	12.79	<=30	Pass
Pi/4DQPSK	SISO	2402	2DH5	11.32	<=20.97	Pass
		2441	2DH5	11.35	<=20.97	Pass
		2480	2DH5	10.15	<=20.97	Pass
8DPSK	SISO	2402	3DH5	11.74	<=20.97	Pass
		2441	3DH5	11.79	<=20.97	Pass
		2480	3DH5	10.61	<=20.97	Pass
Note1: Antenna Gain: Ant1: 2.44dBi;						

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	0.937	>=0.937	Pass
Pi/4DQPSK	SISO	HOPP	2DH5	1.001	1.321	>=0.881	Pass
8DPSK	SISO	HOPP	3DH5	1.001	1.312	>=0.875	Pass

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3.2 Test Graph

3.2.1 Ant1

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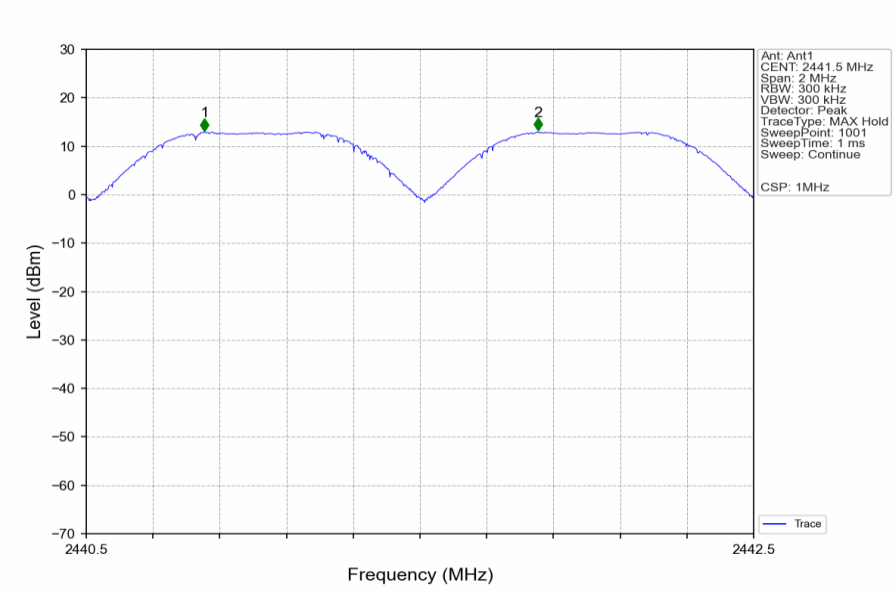
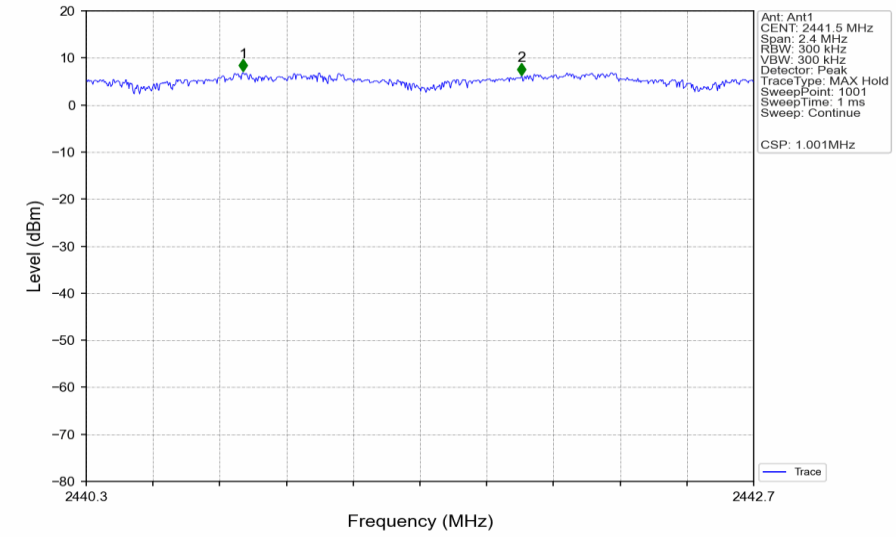


Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV



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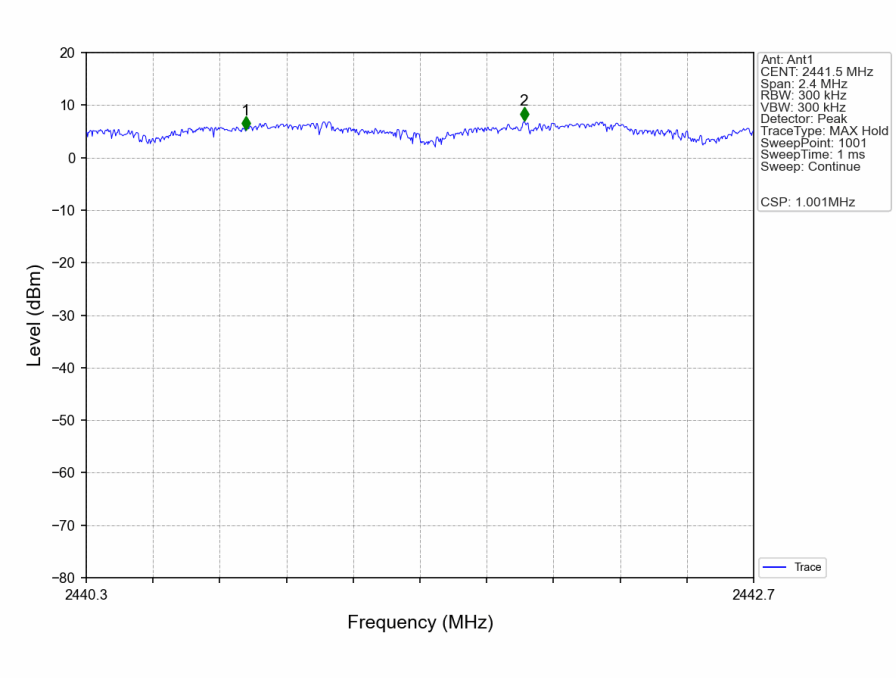

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4. Number of Hopping Frequencies

4.1 Test Result

4.1.1 HoppNum

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

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4.2 Test Graph

4.2.1 HoppNum

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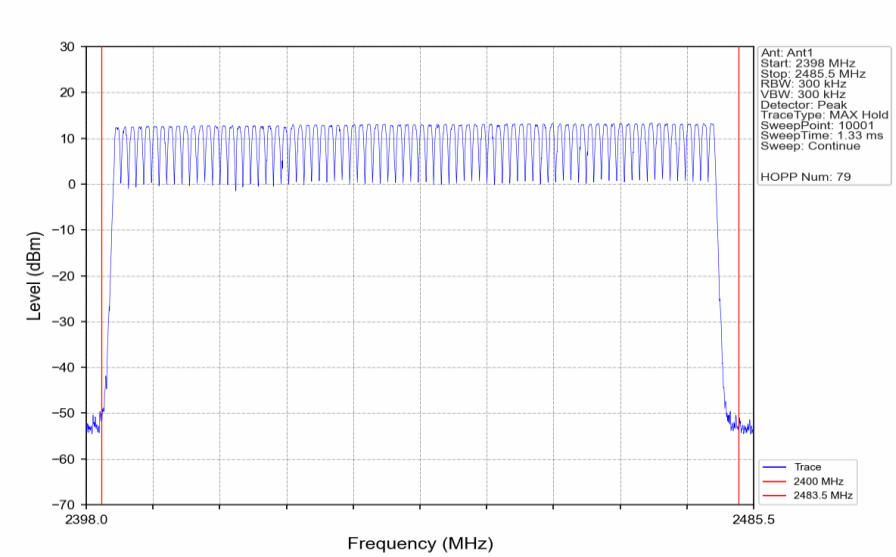
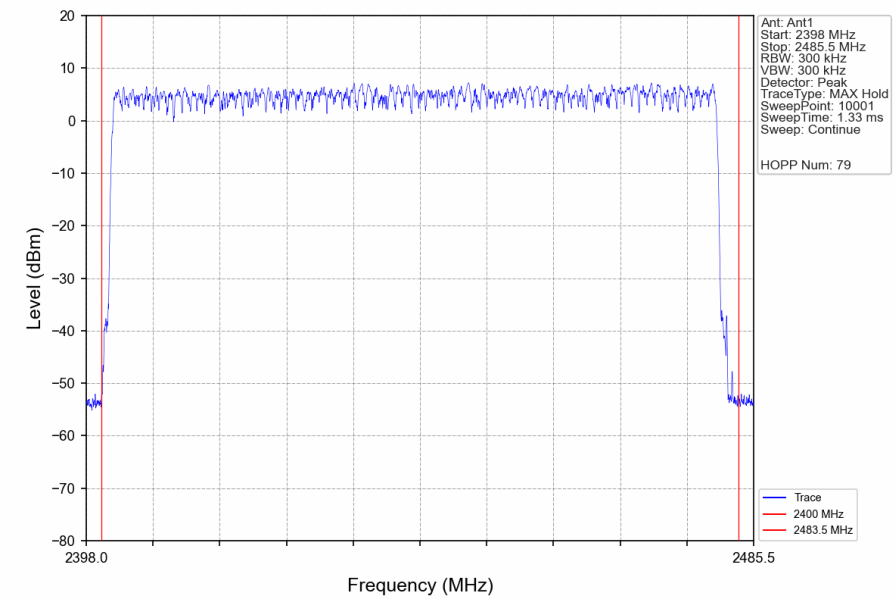


Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV



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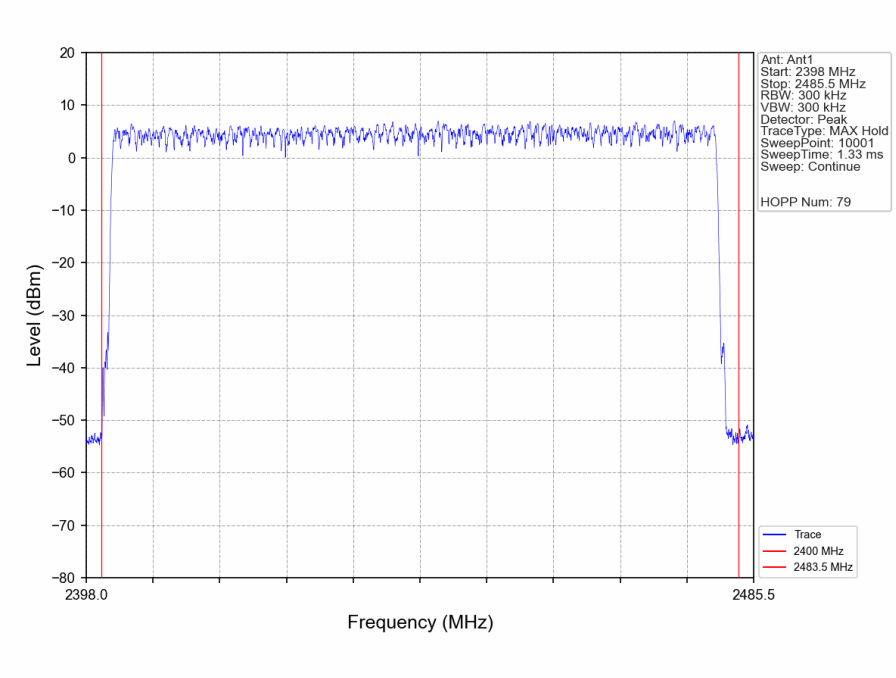

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5. Time of Occupancy (Dwell Time)

5.1 Test Result

5.1.1 Ant1

Ant1									
Mode	TX Type	Frequency (MHz)	Packet Type	Duration of Single Pulse (ms)	Observation Period (s)	Num of Pulse in Observation Period	Dwell Time (ms)	Limit (ms)	Verdict
GFSK	SISO	HOPP	DH1	0.386	31.600	319	123.134	<=400	Pass
			DH3	1.662	31.600	153	254.286	<=400	Pass
			DH5	2.910	31.600	107	311.370	<=400	Pass
Pi/4DQPSK	SISO	HOPP	2DH1	0.410	31.600	320	131.200	<=400	Pass
			2DH3	1.664	31.600	162	269.568	<=400	Pass
			2DH5	2.912	31.600	104	302.848	<=400	Pass
8DPSK	SISO	HOPP	3DH1	0.410	31.600	319	130.790	<=400	Pass
			3DH3	1.660	31.600	158	262.280	<=400	Pass
			3DH5	2.914	31.600	103	300.142	<=400	Pass

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5.2 Test Graph

5.2.1 Ant1

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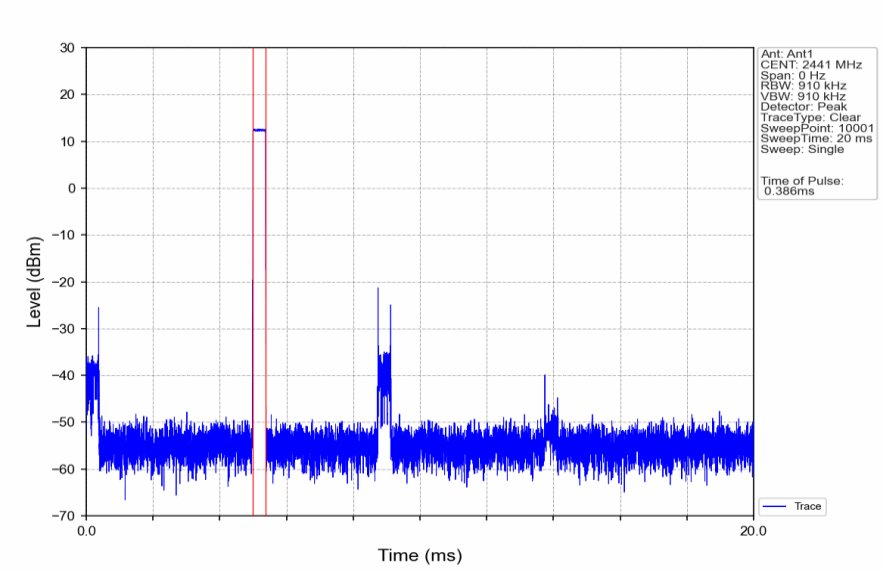

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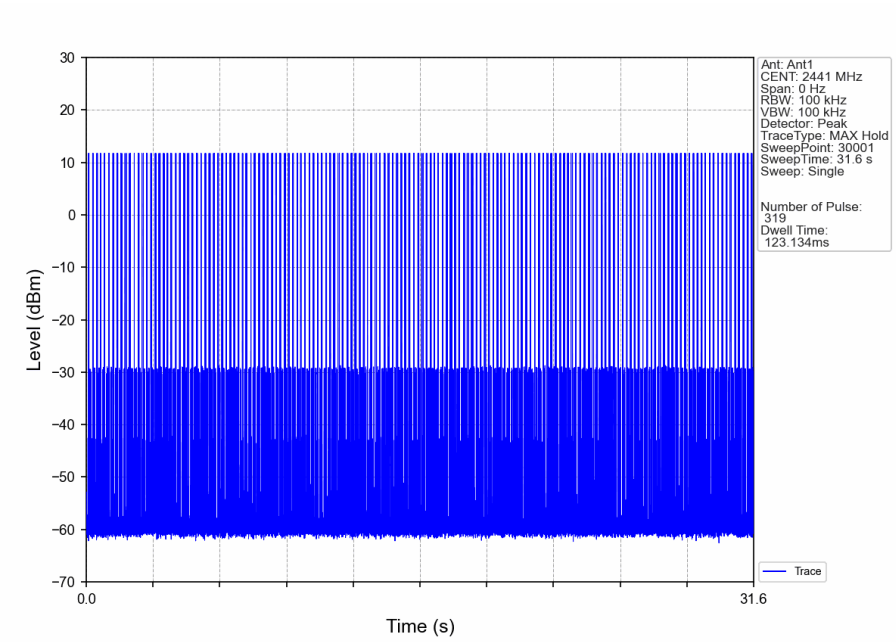

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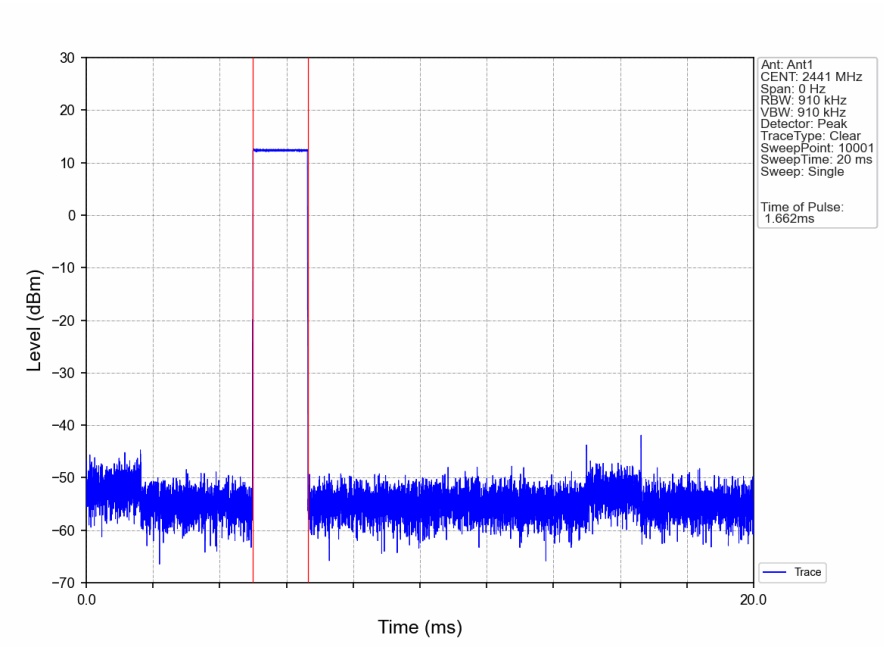
GFSK_DH3_HOPP_Ant1_NTNV



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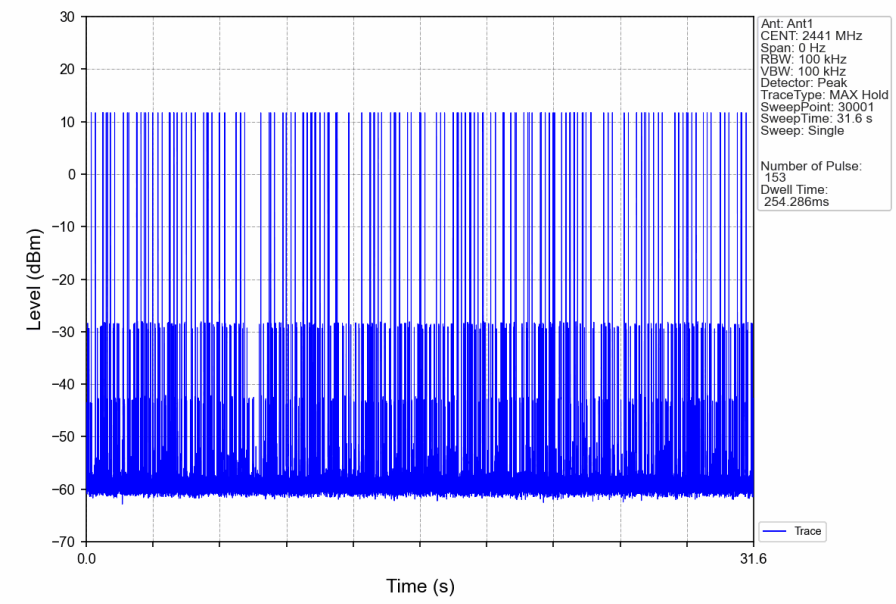

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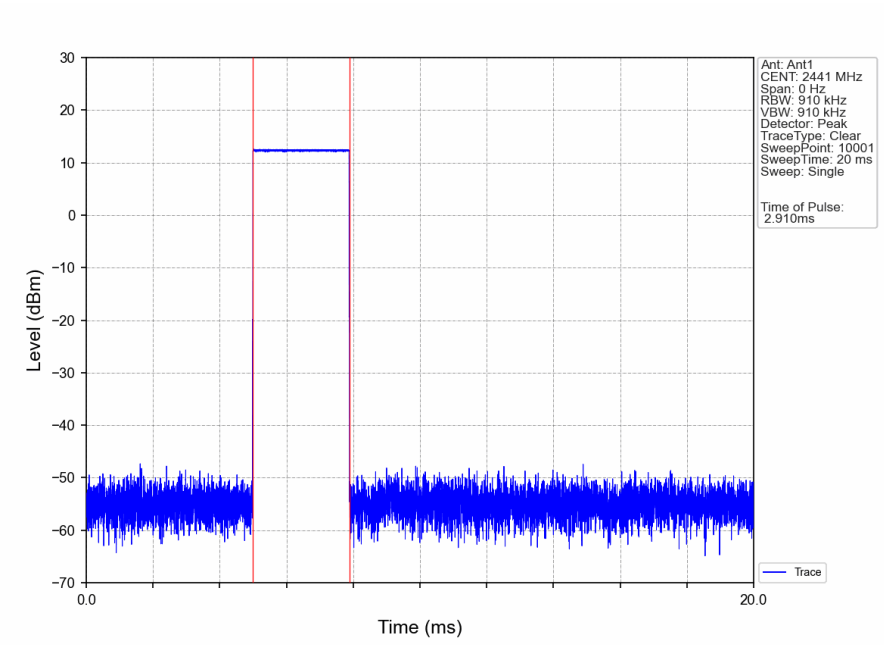
GFSK_DH5_HOPP_Ant1_NTNV



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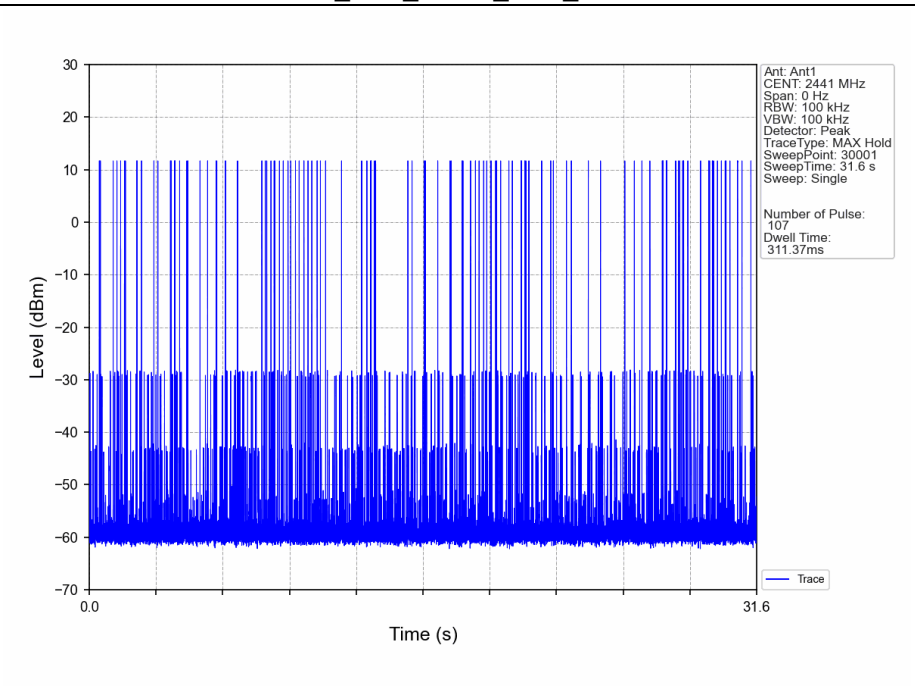

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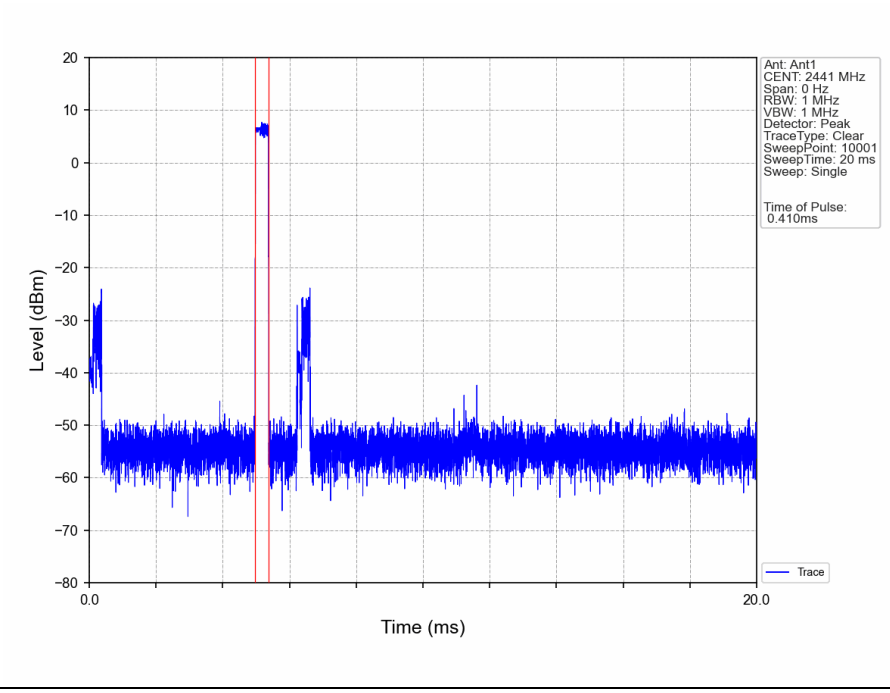

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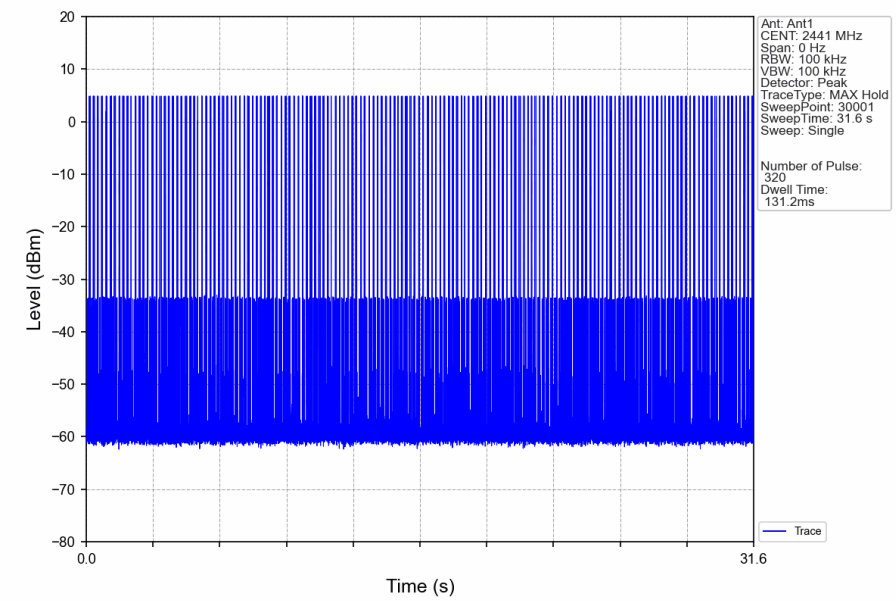

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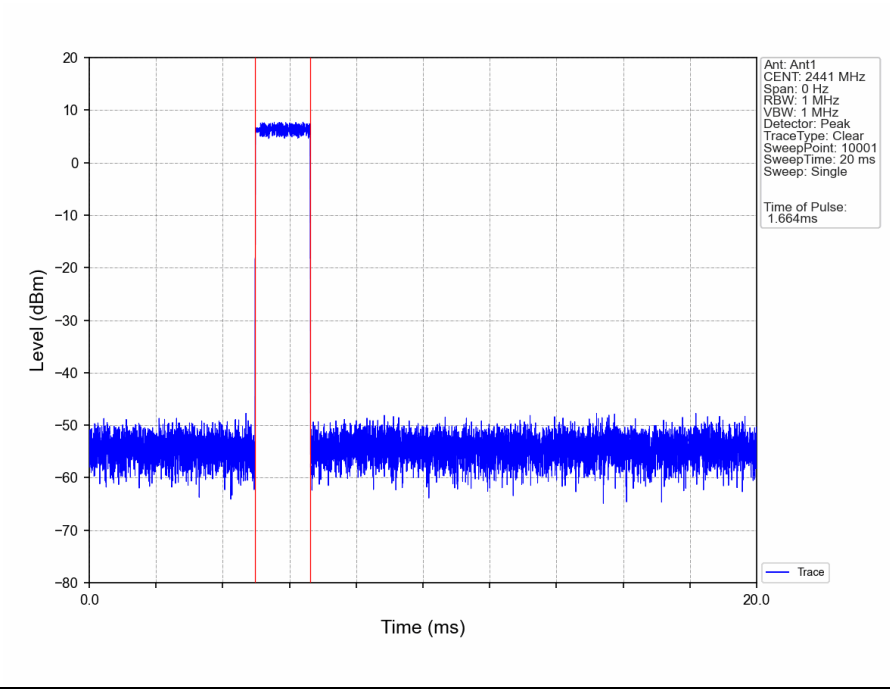

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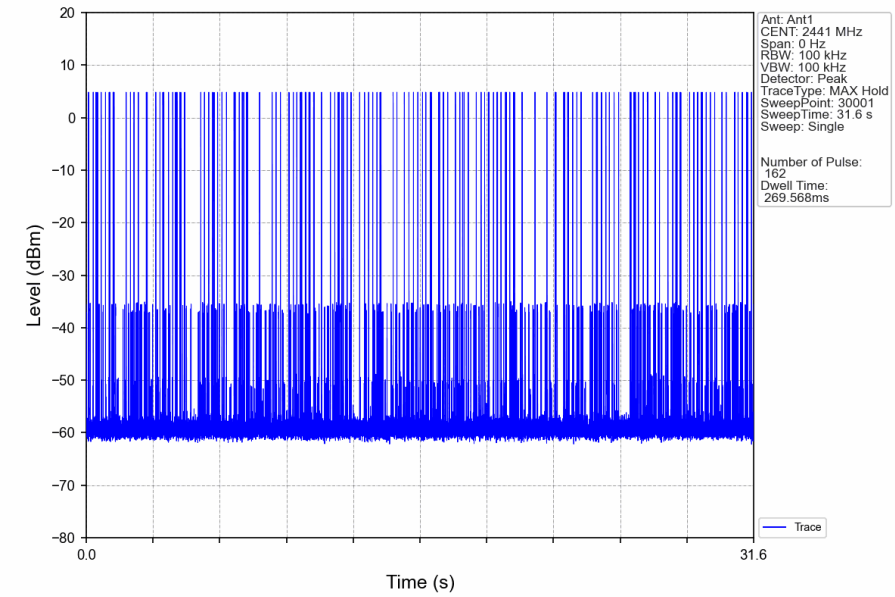

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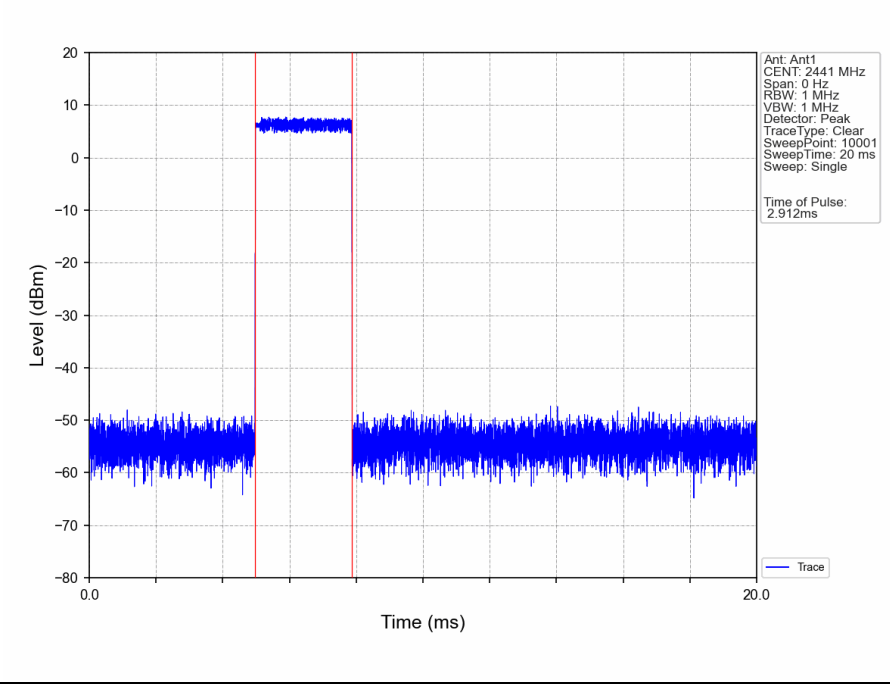

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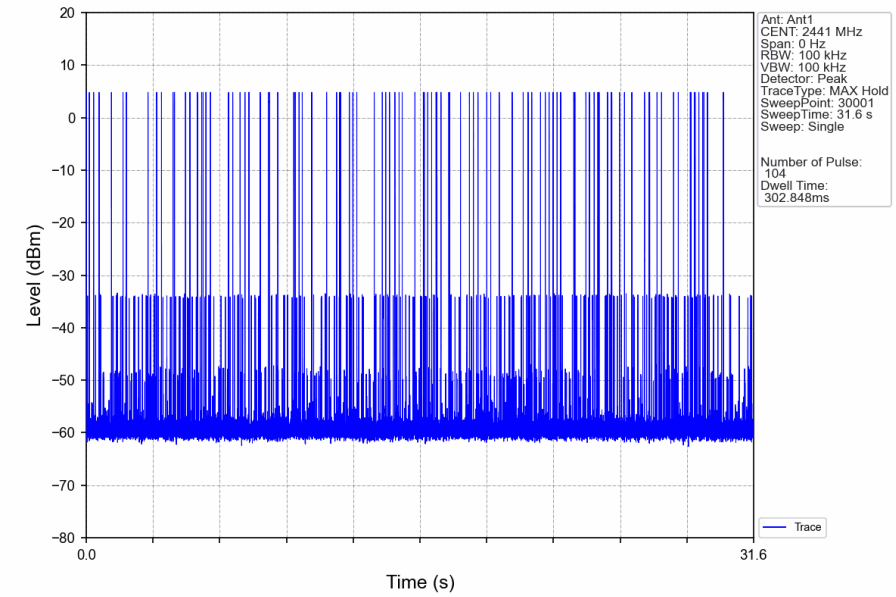

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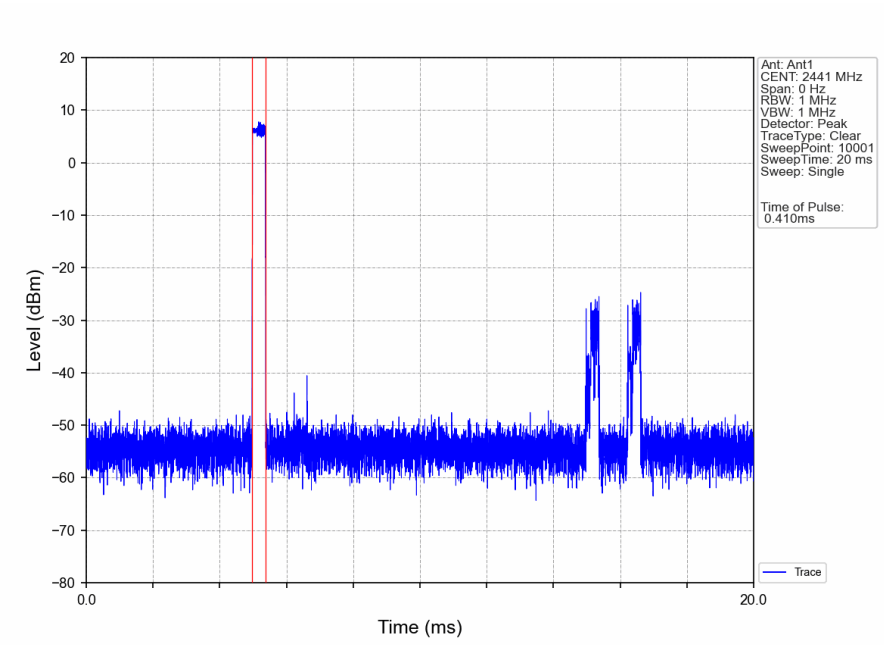
8DPSK_3DH1_HOPP_Ant1_NTNV



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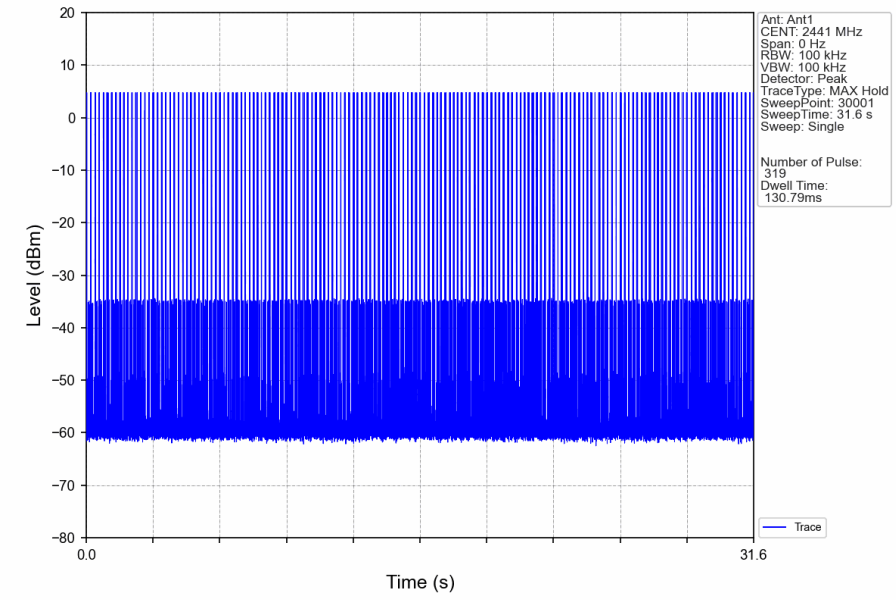

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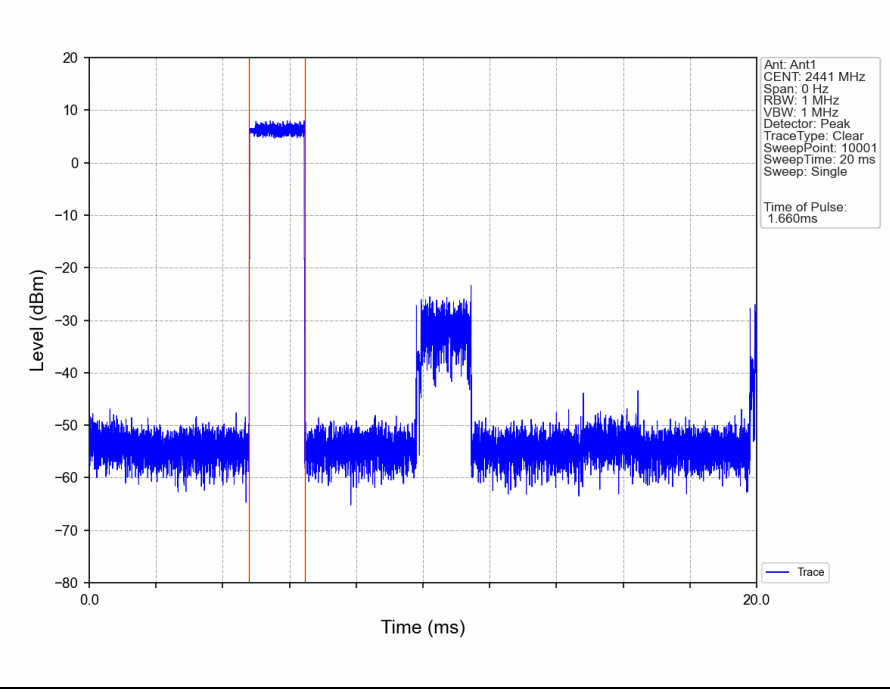
8DPSK_3DH3_HOPP_Ant1_NTNV



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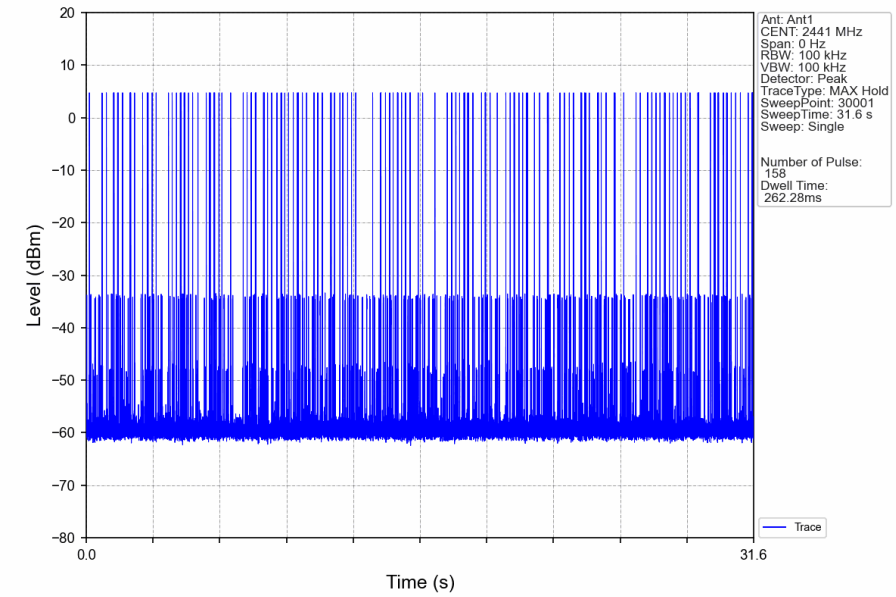

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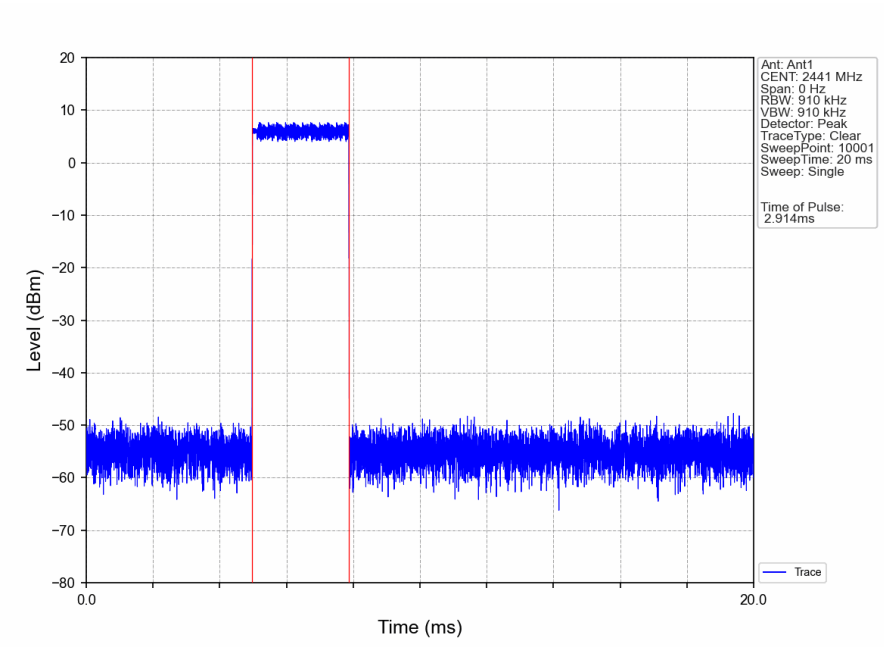
8DPSK_3DH5_HOPP_Ant1_NTNV



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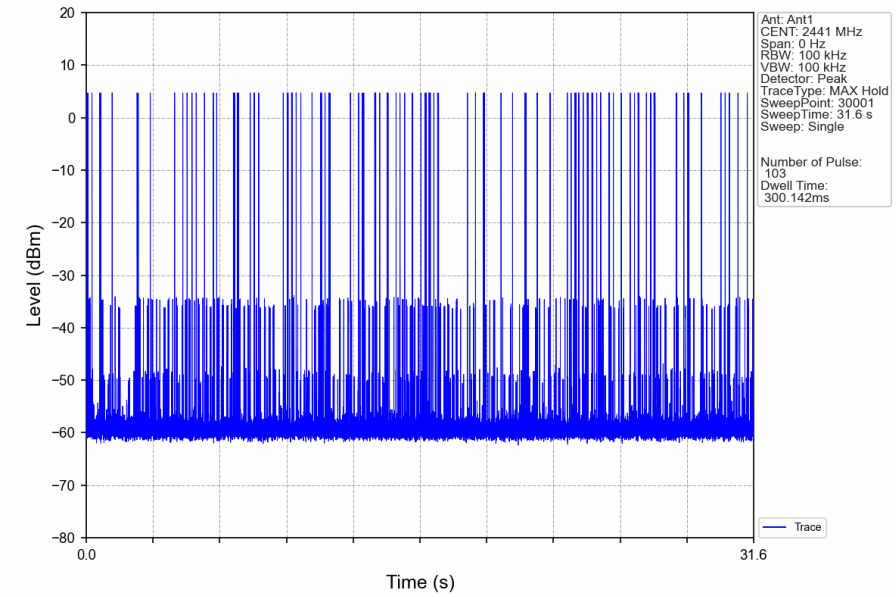

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6. Unwanted Emissions In Non-restricted Frequency Bands

6.1 Test Result

6.1.1 Ref

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	Level of Reference (dBm)
GFSK	SISO	2402	DH5	1	11.55
		2441	DH5	1	12.39
		2480	DH5	1	12.30
Pi/4DQPSK	SISO	2402	2DH5	1	9.37
		2441	2DH5	1	9.34
		2480	2DH5	1	8.04
8DPSK	SISO	2402	3DH5	1	9.32
		2441	3DH5	1	9.44
		2480	3DH5	1	8.04
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.					

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6.1.2 CSE

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
GFSK	SISO	2402	DH5	1	12.39	-7.61	Pass
		2441	DH5	1	12.39	-7.61	Pass
		2480	DH5	1	12.39	-7.61	Pass
		HOPP	DH5	1	12.39	-7.61	Pass
					12.39	-7.61	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	9.37	-10.63	Pass
		2441	2DH5	1	9.37	-10.63	Pass
		2480	2DH5	1	9.37	-10.63	Pass
		HOPP	2DH5	1	9.37	-10.63	Pass
					9.37	-10.63	Pass
8DPSK	SISO	2402	3DH5	1	9.44	-10.56	Pass
		2441	3DH5	1	9.44	-10.56	Pass
		2480	3DH5	1	9.44	-10.56	Pass
		HOPP	3DH5	1	9.44	-10.56	Pass
					9.44	-10.56	Pass
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.							

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6.2 Test Graph

6.2.1 Ref

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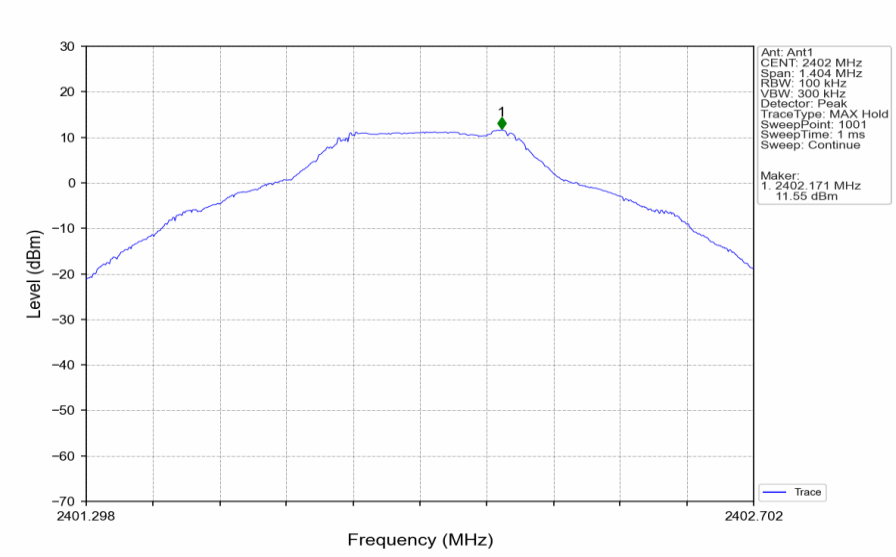

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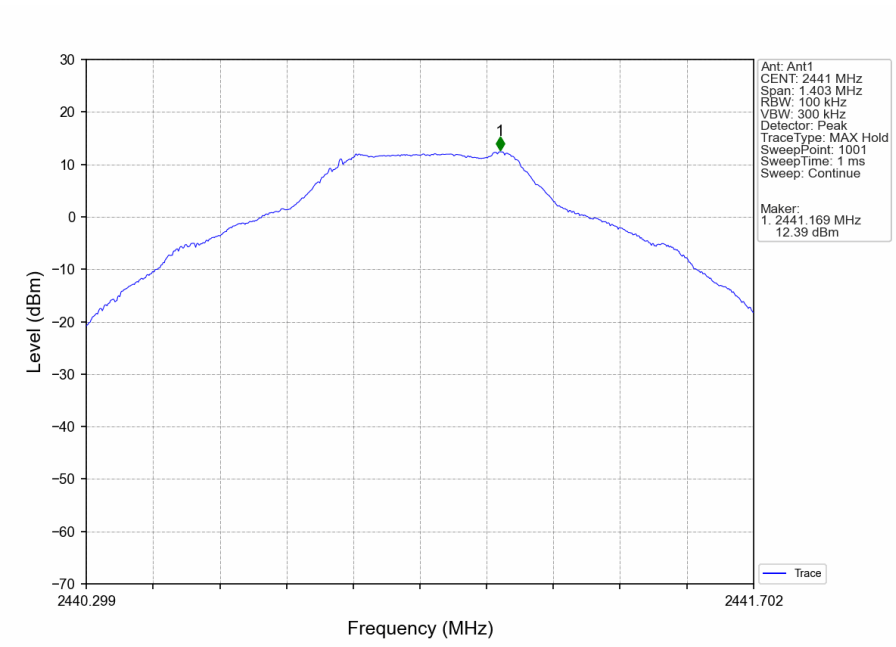

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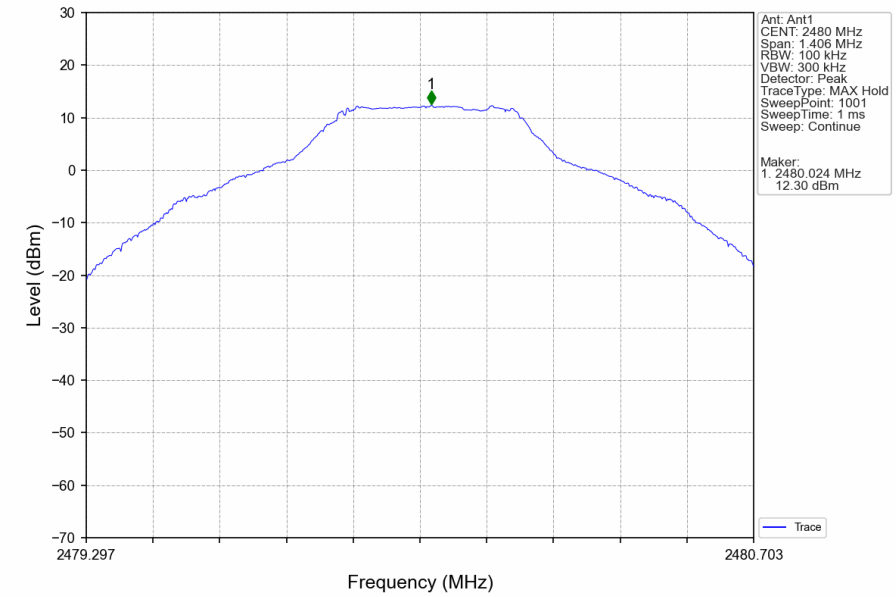

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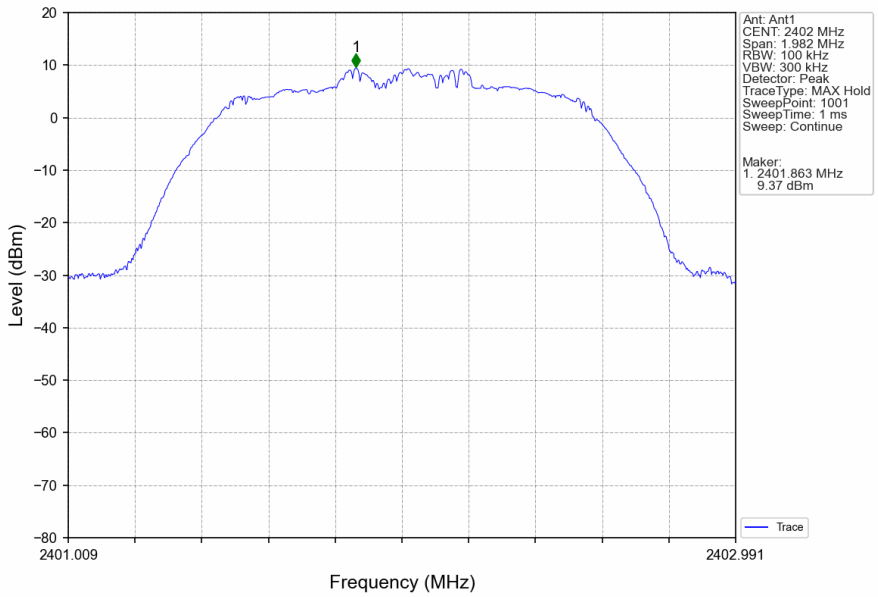
Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV



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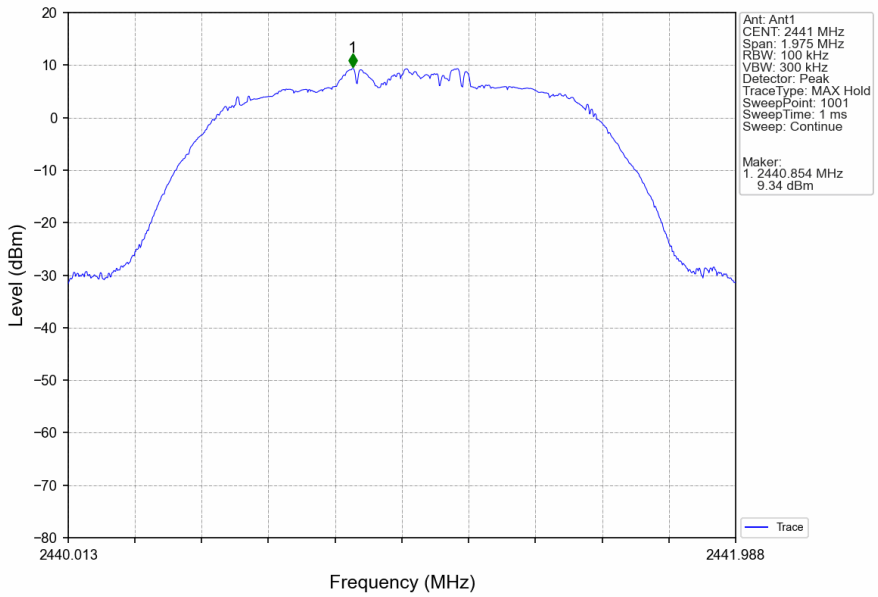

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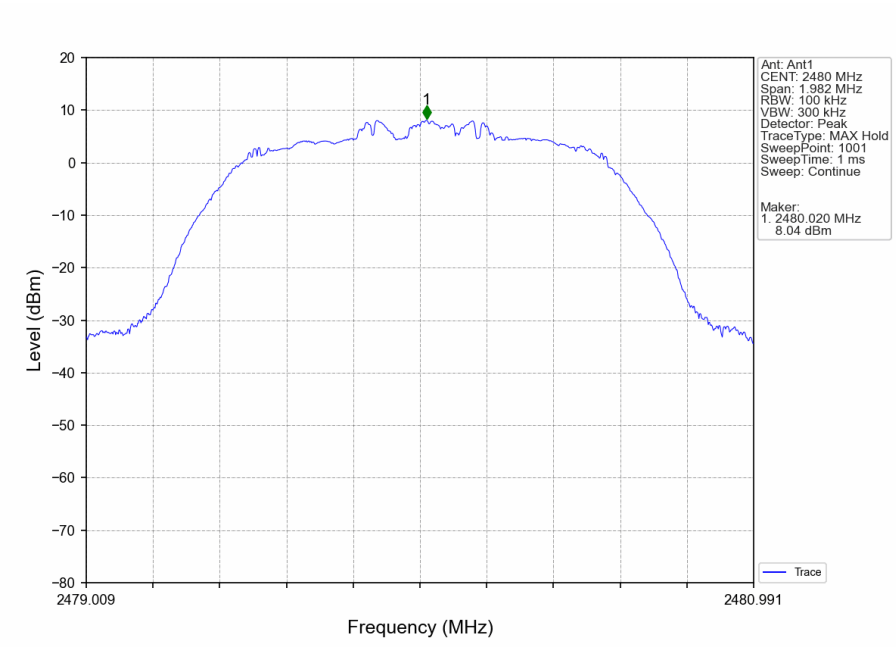
Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV



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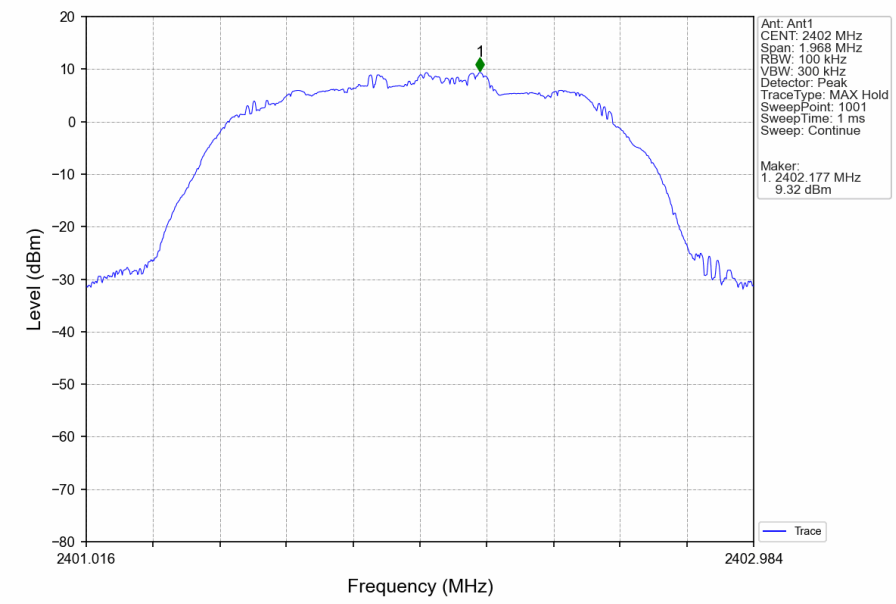

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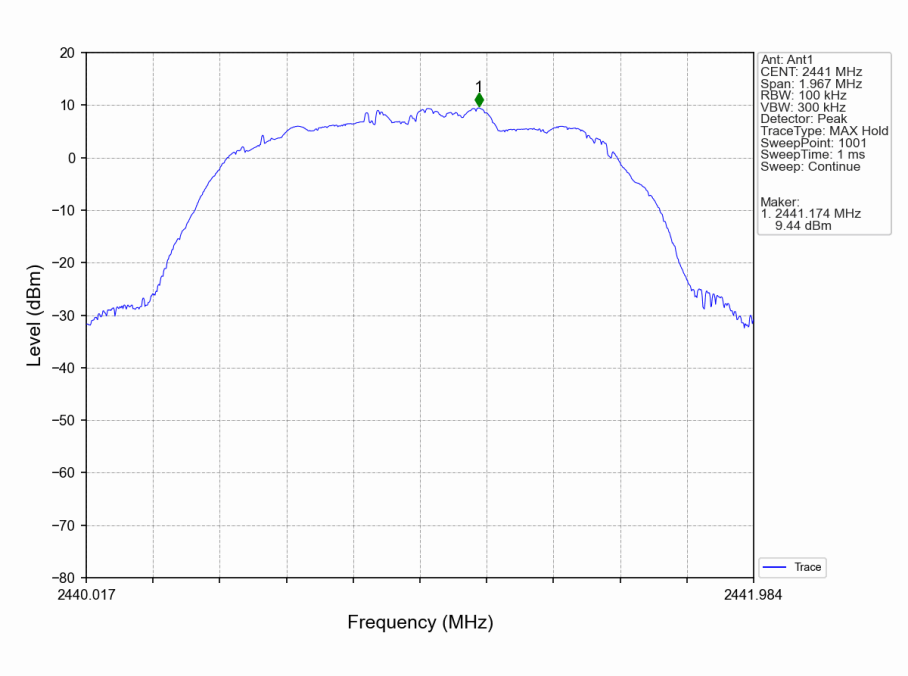
8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



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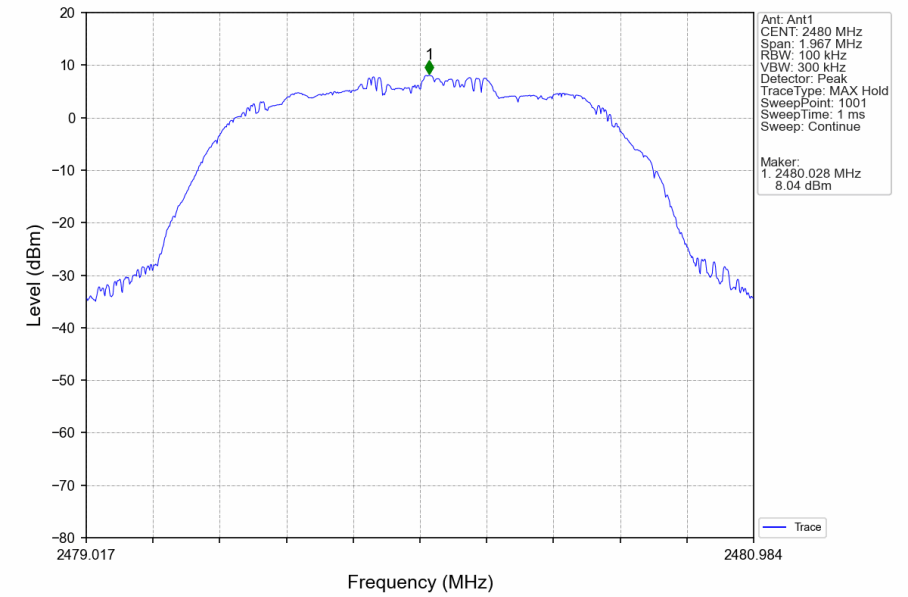

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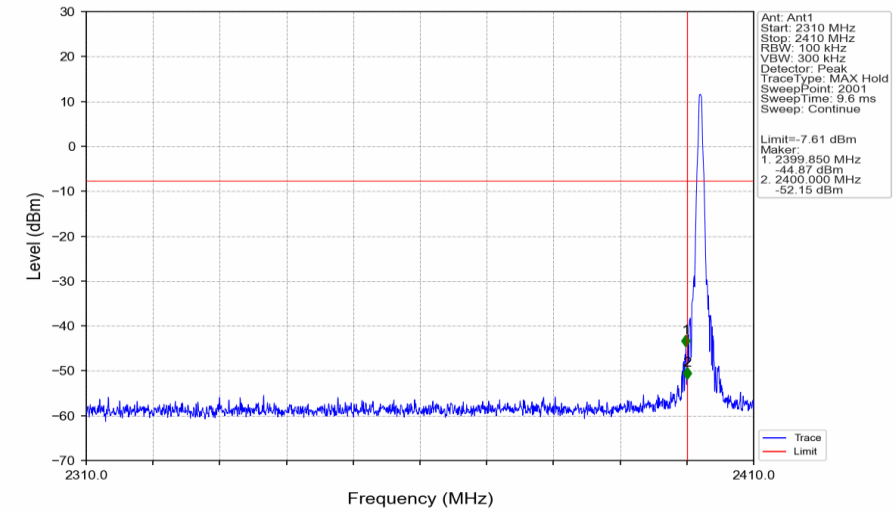
6.2.2 CSE

GFSK_DH5_LCH_2402MHz_Ant1_NTNV



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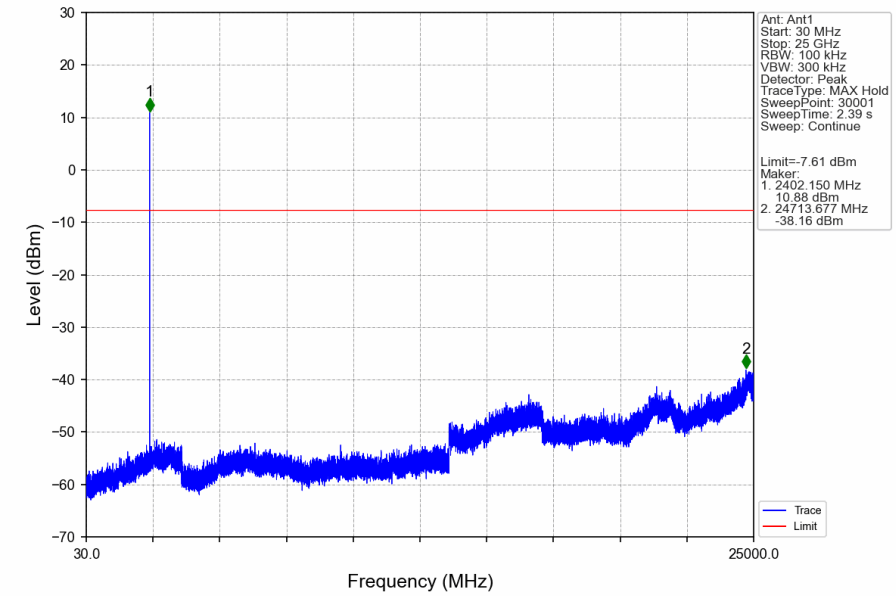

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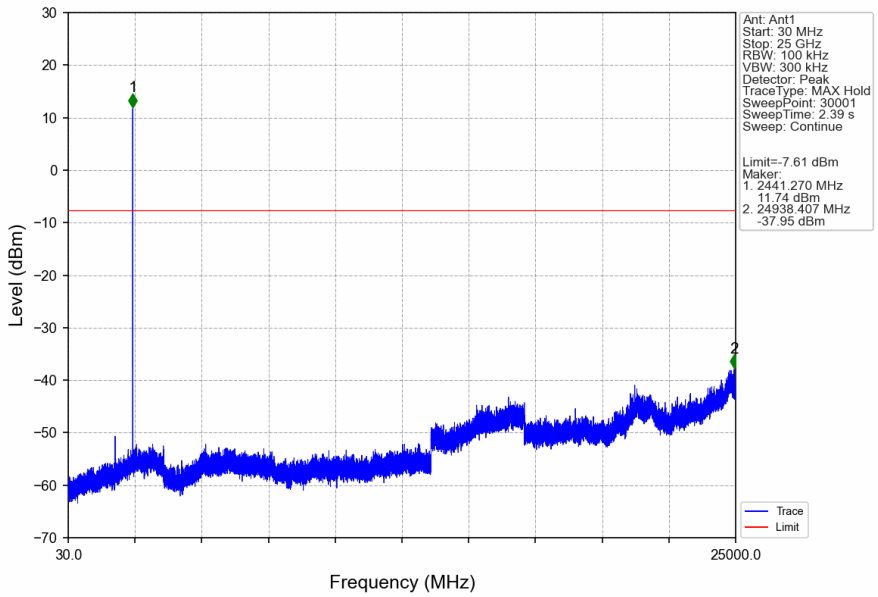
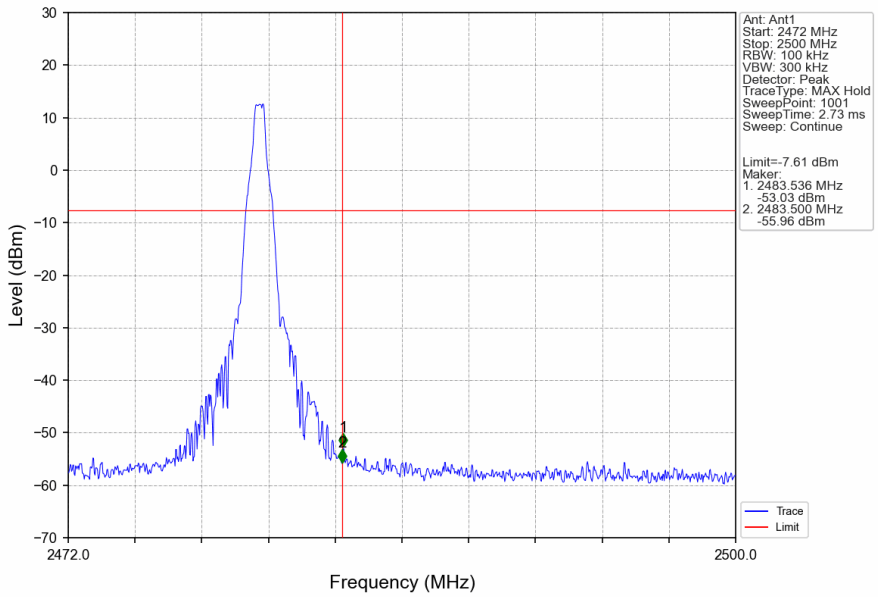
GFSK_DH5_MCH_2441MHz_Ant1_NTNV



GFSK_DH5_HCH_2480MHz_Ant1_NTNV



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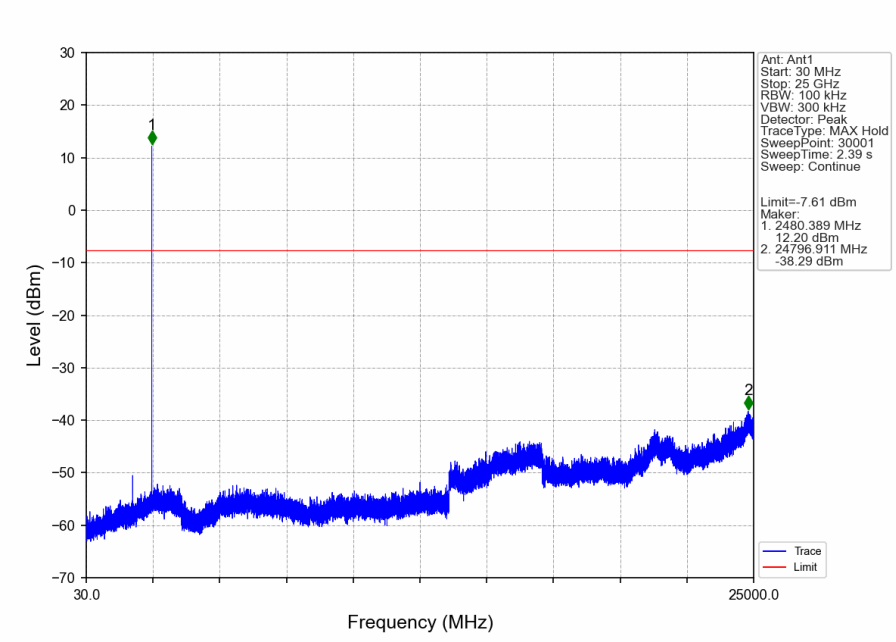
GFSK_DH5_HCH_2480MHz_Ant1_NTNV



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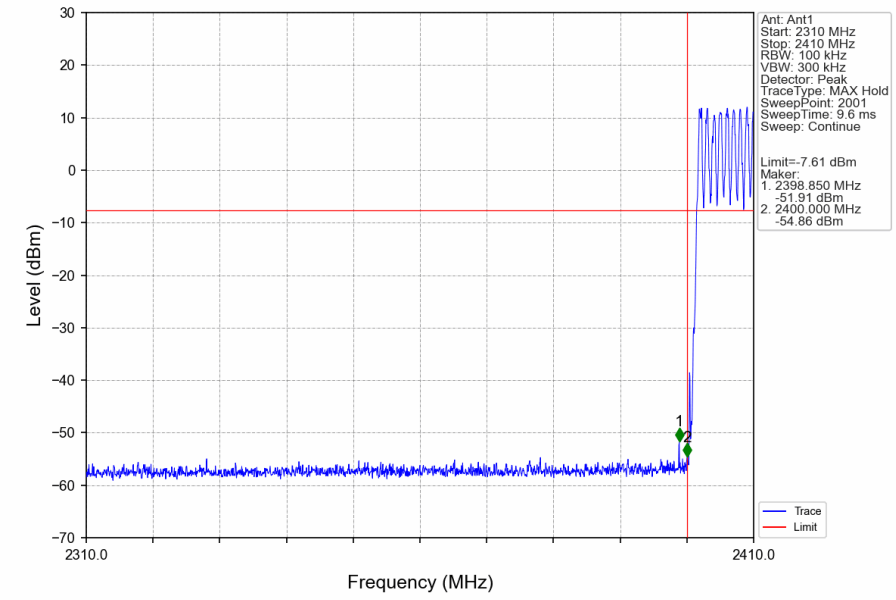

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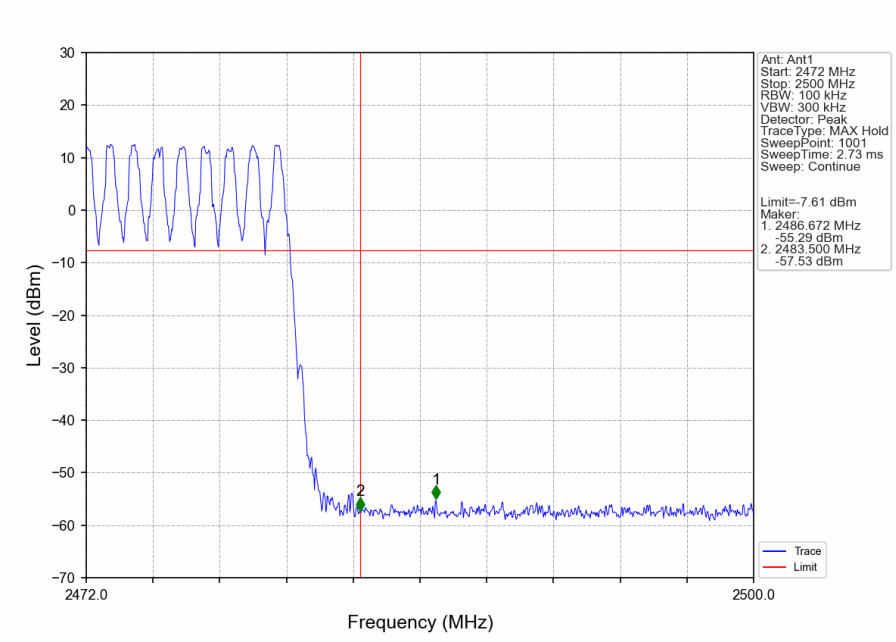
GFSK_DH5_HOPP_Ant1_NTNV



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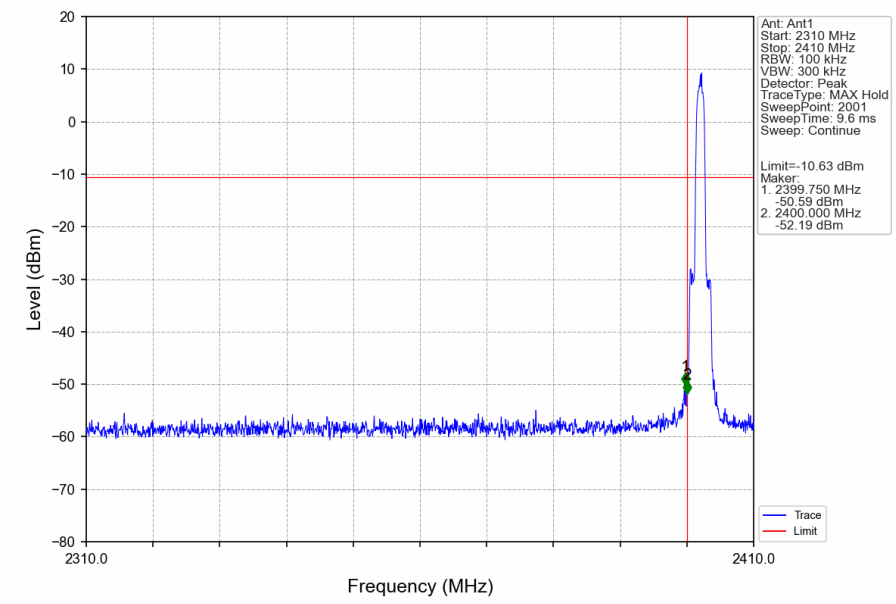

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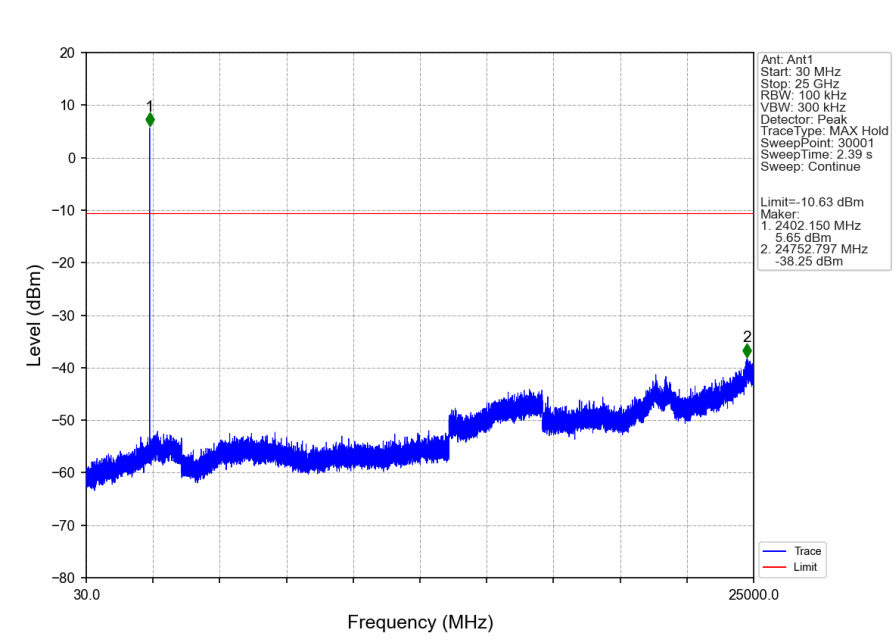
Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV



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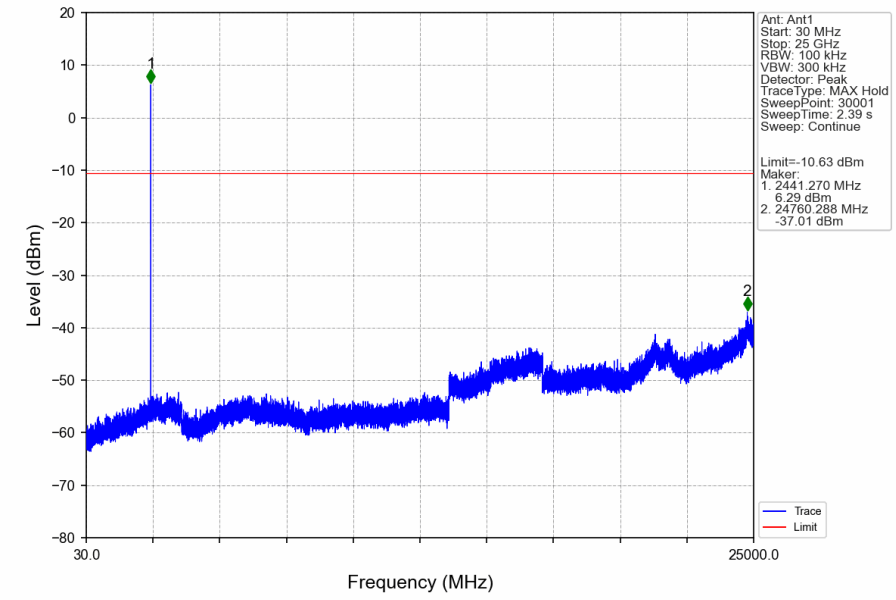

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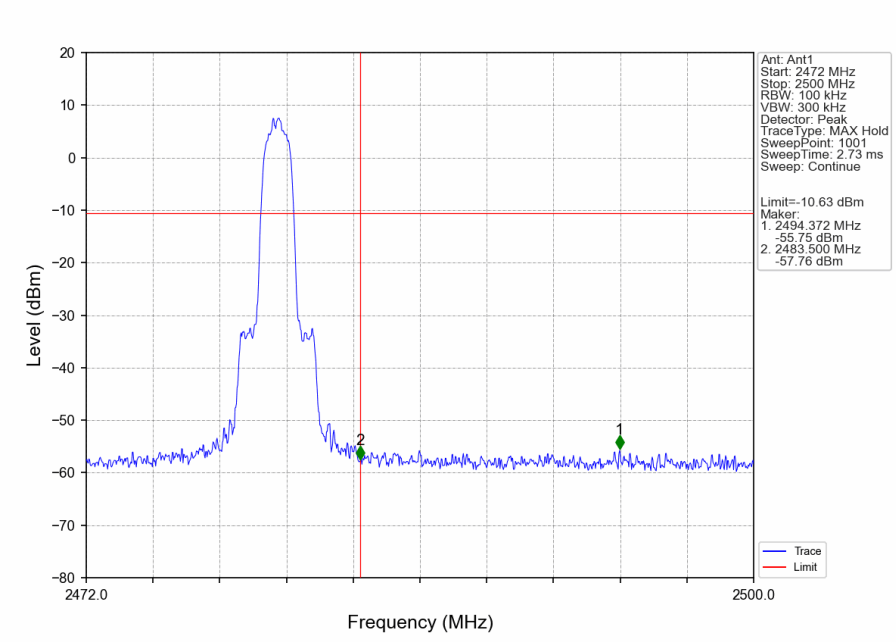
Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV



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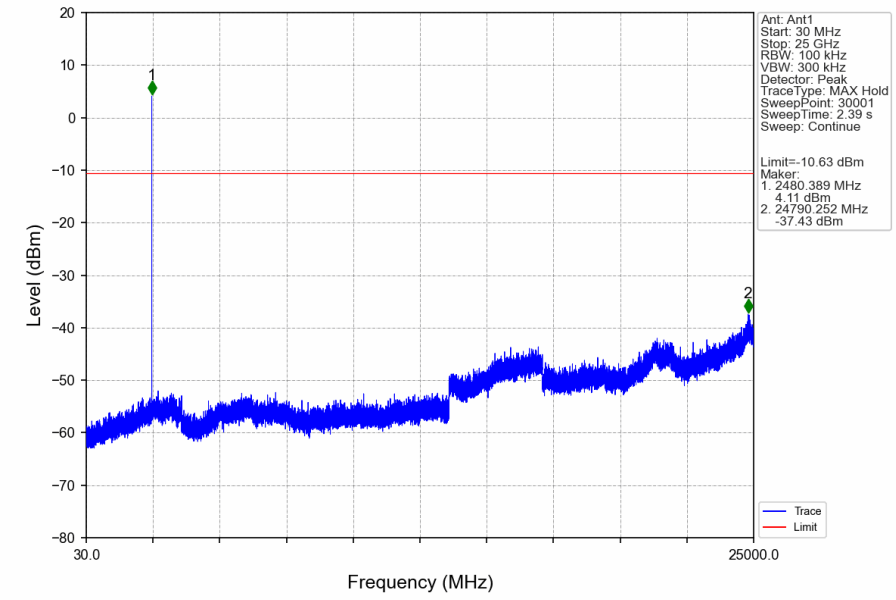

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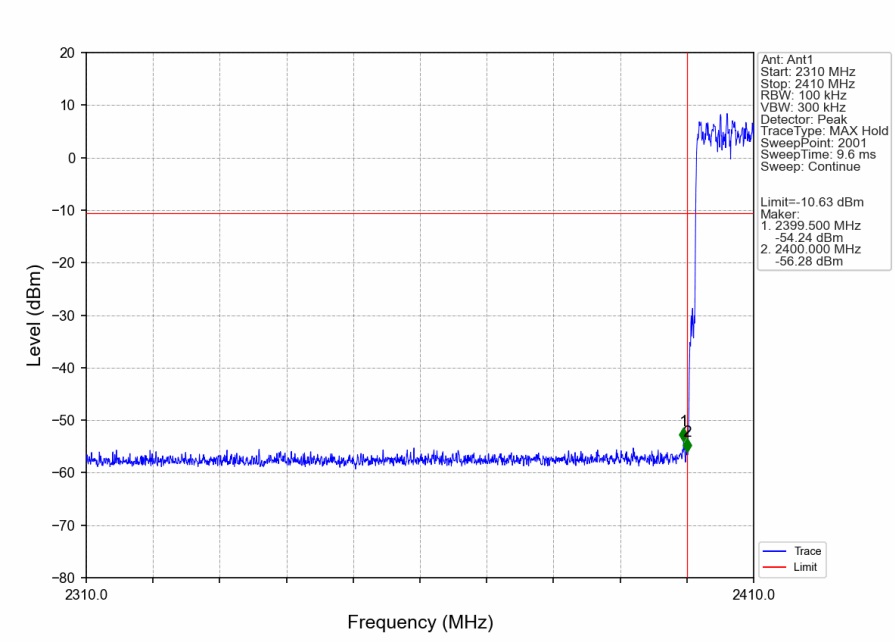

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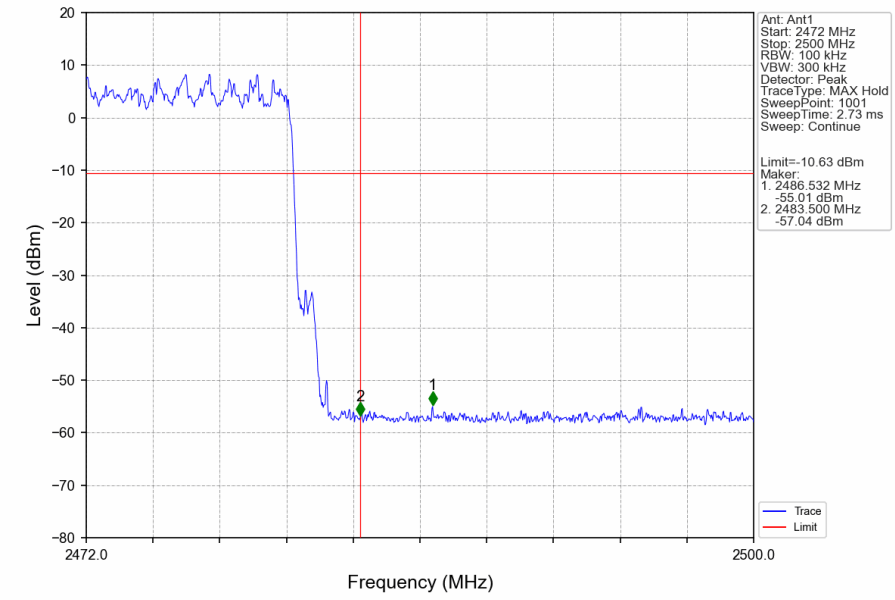

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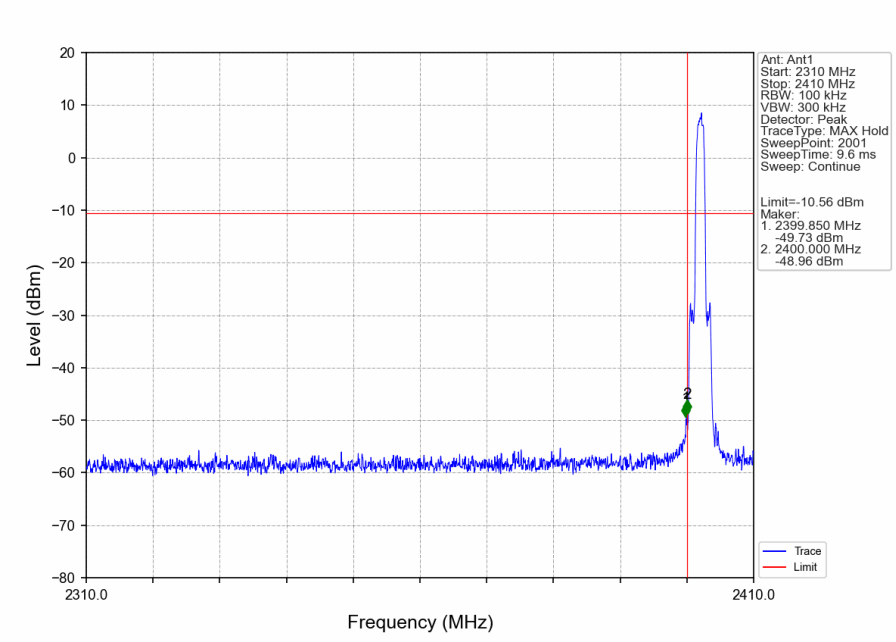
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



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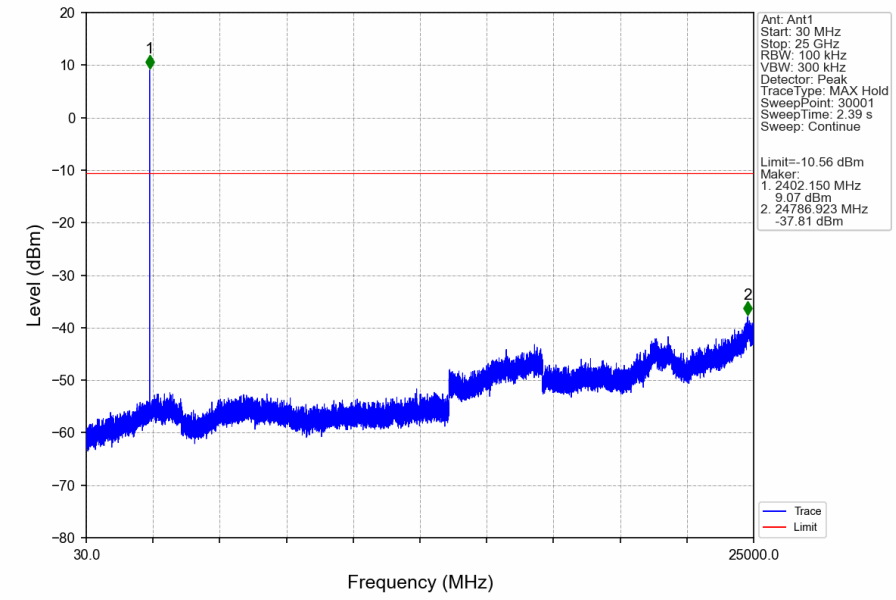

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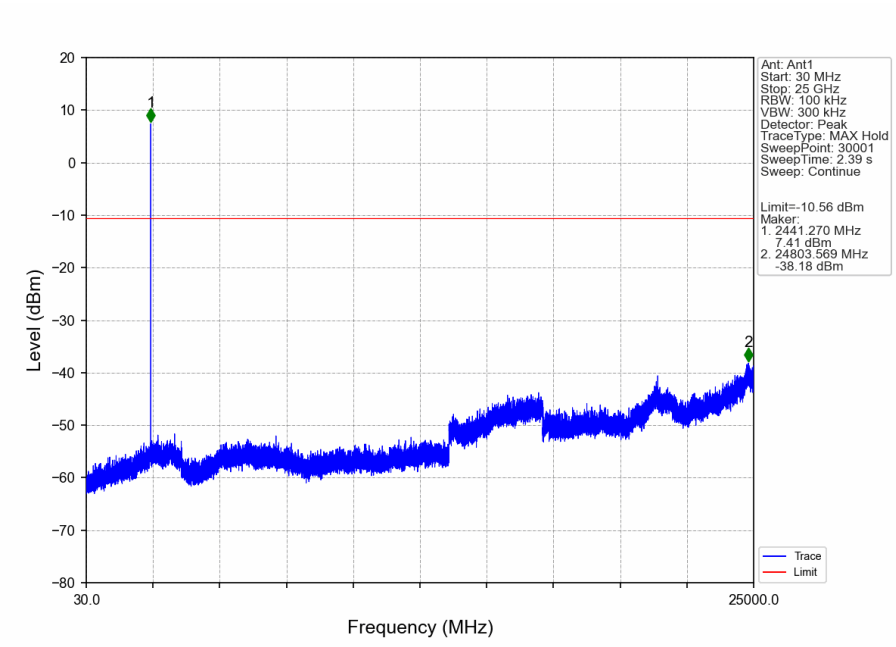
8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



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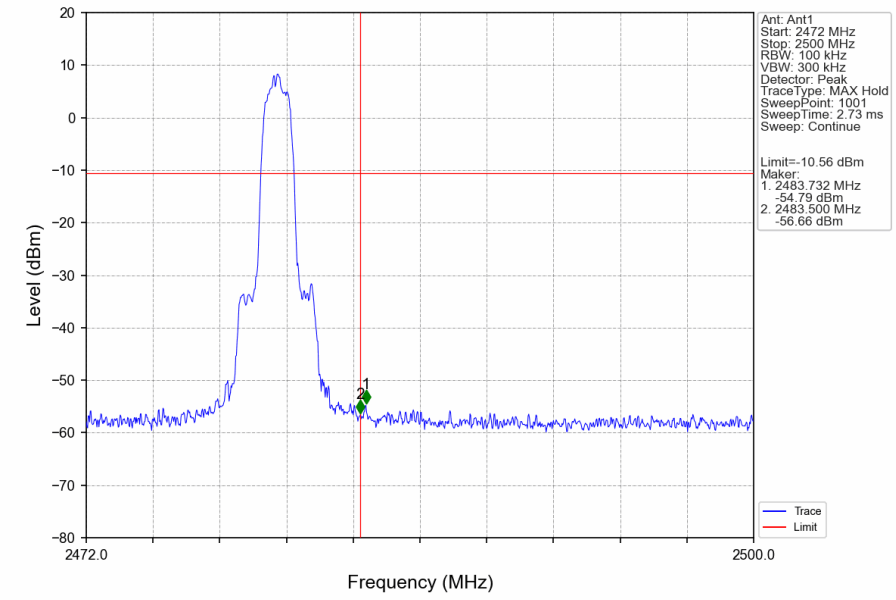

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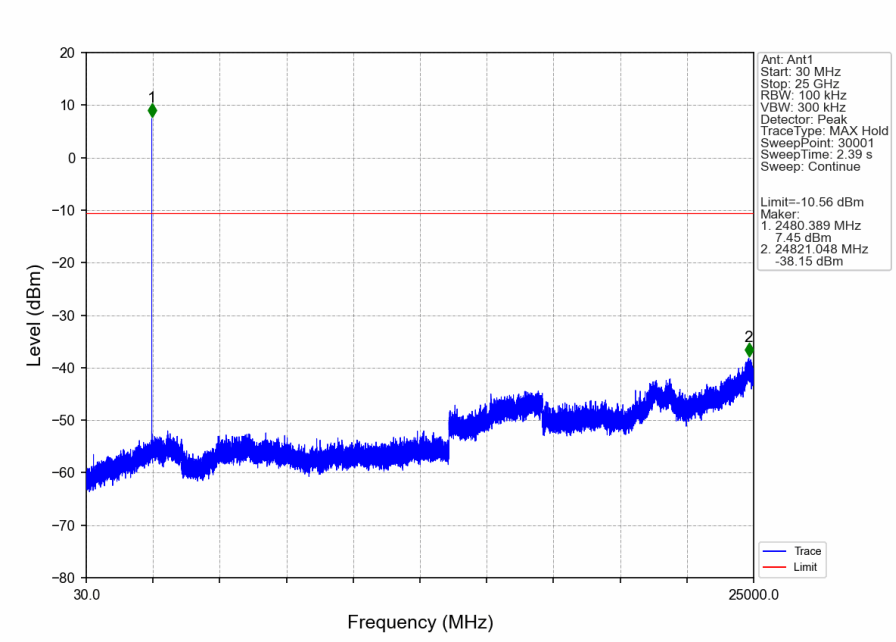
8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV



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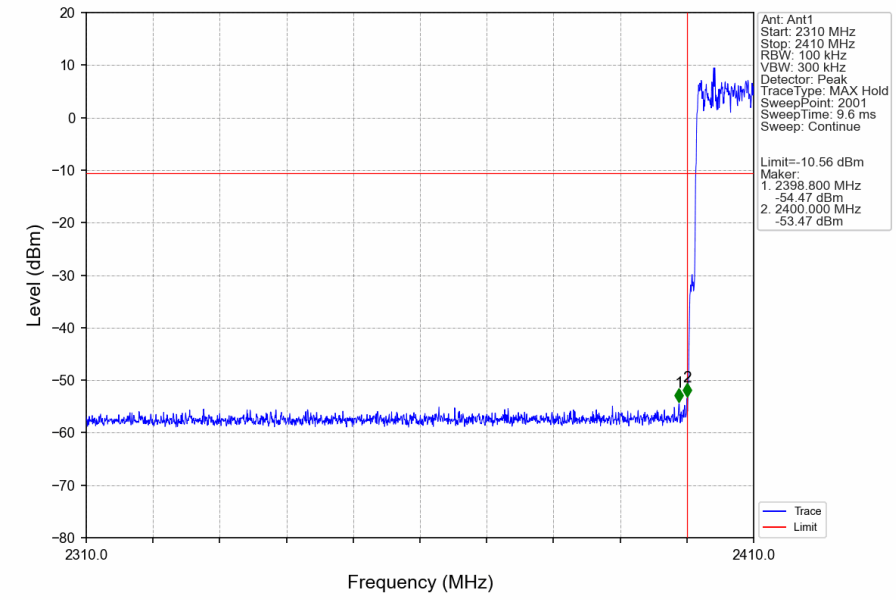

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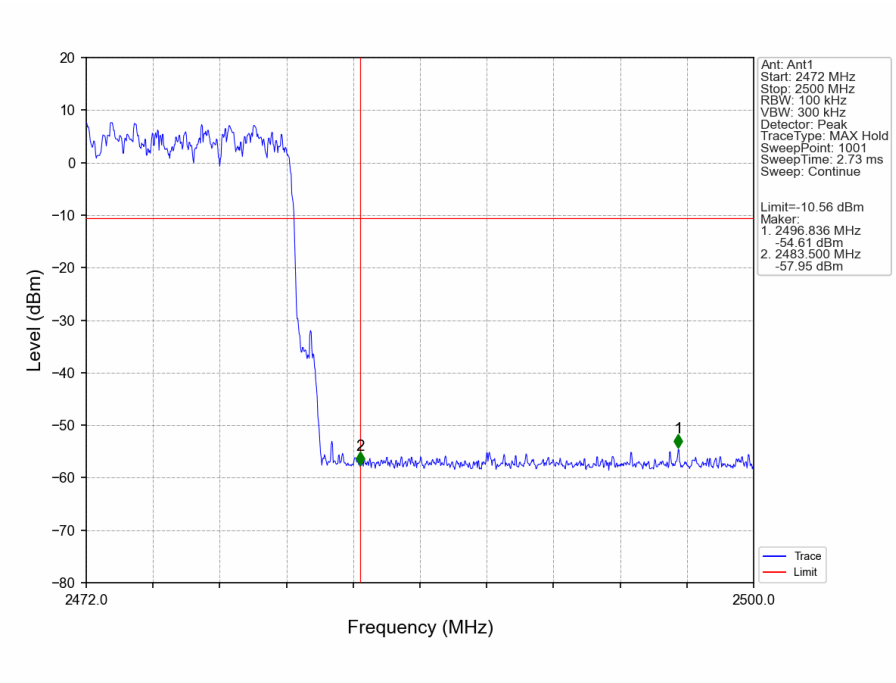
8DPSK_3DH5_HOPP_Ant1_NTNV



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