



Report No.: XEWA2310000073RG03
Rev.: 01
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TEST REPORT

Application No.: XEWA2310000073RG
Applicant: Harman International Industries Incorporated
Address of Applicant: 30001, Cabot Drive, Novi, MI 48377, USA
Manufacturer: Harman International Industries Incorporated
Address of Manufacturer: 30001, Cabot Drive, Novi, MI 48377, USA
EUT Description: Toyota La-DCM
Model No.: TYT25_LT_AA
Trade Mark: HARMAN
FCC ID: 2AHPN-TYT25-LT-AA
Standards: FCC 47 CFR Part 2, Subpart J
FCC 47 CFR Part 15, Subpart C
Date of Receipt: 2023/11/01
Date of Test: 2023/11/18 to 2024/01/08
Date of Issue: 2024/01/10

Test Result :	PASS *
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* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:

Linus Chen
Wireless Laboratory Manager



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Wireless Laboratory

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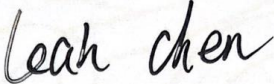
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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2024/01/10		Original

Prepared By	 (Leah Chen) / Test Engineer
Checked By	 (Andy Yao) /Reviewer

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2 Test Summary

Test Item	FCC Rule No.	Test Method	Test Result	Result	Test Lab*
Antenna Requirement	15.203/15.247(b)	--	Clause 4.1	PASS	--
AC Power Line Conducted Emission	15.207	ANSI C63.10-2013 Section 6.2	Clause 4.3	PASS	A
Conducted Peak Output Power	15.247 (b)(1)	ANSI C63.10-2013 Section 11.9.1.3	Clause 4.4	PASS	B
20dB Emission Bandwidth & 99% Occupied Bandwidth	15.247 (a)(1)	ANSI C63.10-2013 Section 6.9.2/6.9.3	Clause 4.5	For Report Purpose	B
Carrier Frequencies Separation	15.247 (a)(1)	ANSI C63.10-2013 Section 7.8.2	Clause 4.6	PASS	B
Hopping Channel Number	15.247 (a)(1)	ANSI C63.10-2013 Section 7.8.3	Clause 4.7	PASS	B
Dwell Time	15.247 (a)(1)	ANSI C63.10-2013 Section 7.8.4	Clause 4.8	PASS	B
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10-2013 Section 7.8.7.2	Clause 4.9	PASS	B
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10-2013 Section 7.8.7.1	Clause 4.10	PASS	B
Radiated Spurious emissions	15.247(d); 15.205/15.209	ANSI C63.10-2013 Section 6.4 / 6.5 / 6.6	Clause 4.11	PASS	A
Restricted bands around fundamental frequency (Radiated Emission)	15.247(d); 15.205/15.209	ANSI C63.10-2013 Section 6.10.5	Clause 4.12	PASS	A

Remark*:

Lab A SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd.

Lab B Compliance Certification Services (Kunshan) Inc.



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3 General Information

3.1 Details of Client

Applicant:	Harman International Industries Incorporated
Address of Applicant:	30001, Cabot Drive, Novi, MI 48377, USA
Manufacturer:	Harman International Industries Incorporated
Address of Manufacturer:	30001, Cabot Drive, Novi, MI 48377, USA

3.2 Test Location

Lab A:	
Company:	SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd.
Address:	1/F, Unit D, Building 1, Kanghong Orange Science Park, No.137, Keyuan 3rd Road, Fengdong New Town, Xi' an, Shaanxi China
Post code:	710086
Test engineer:	Jacky Xue
Lab B:	
Company:	Compliance Certification Services (Kunshan) Inc.
Address:	No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.
Contact Information:	Tel: +86 512 5735 5888 Fax: +86 512 5737 0818
Test engineer:	Hans Han



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3.3 Test Facility

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

Lab A:

•A2LA (Certificate No. 4854.01)

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0095.

IC#: 25613.

• FCC –Designation Number: CN1337

SGS-CSTC Standards Technical Services (Xi'an) Co., Ltd. has been recognized as an accredited testing laboratory.

Designation Number: CN1337.

Test Firm Registration Number: 917410

Lab B:

• A2LA

Compliance Certification Services (Kunshan) Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 2541.01.

• FCC

Compliance Certification Services (Kunshan) Inc. has been recognized as an accredited testing laboratory. Designation Number: CN1172.

• ISED

Compliance Certification Services (Kunshan) Inc. has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory. Company Number: 2324E

• VCCI

The 3m and 10m Semi-anechoic chamber and Shielded Room of Compliance Certification Services (Kunshan) Inc. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.:R-20134, R-11600, C-11707, T-11499, G-10216 respectively.



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3.4 General Description of EUT

EUT Description:	Toyota La-DCM	
Model No.:	TYT25_LT_AA	
Trade Mark:	HARMAN	
Hardware Version:	0.0.3	
Software Version:	TYTLLADCM_R04.5D	
Power Supply:	12V	
IMEI:	RF Conducted	356590670015700
	RSE & AC power line	356590670015866
Operation Frequency:	2400MHz~2483.5MHz fc = 2402 MHz + N * 1 MHz, where: -fc = “Operating Frequency” in MHz, -N = “Channel Number” with the range from 0 to 78.	
Bluetooth version:	Bluetooth V5.0	
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)	
Modulation Type:	GFSK, π/4DQPSK, 8DPSK	
Number of Channel:	79	
Hopping Channel Type:	Adaptive Frequency Hopping systems	
Antenna Type:	☐ External, ☒ Integrated	
Antenna Gain:	2.92 dBi(Ant2)	
	Note: The antenna gain are derived from the gain information report provided by the manufacturer.	
RF Cable:	1.0dB	
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Operation Frequency of each channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
2	2404MHz	22	2424MHz	42	2444MHz	62	2464MHz
3	2405MHz	23	2425MHz	43	2445MHz	63	2465MHz
4	2406MHz	24	2426MHz	44	2446MHz	64	2466MHz
5	2407MHz	25	2427MHz	45	2447MHz	65	2467MHz
6	2408MHz	26	2428MHz	46	2448MHz	66	2468MHz
7	2409MHz	27	2429MHz	47	2449MHz	67	2469MHz
8	2410MHz	28	2430MHz	48	2450MHz	68	2470MHz
9	2411MHz	29	2431MHz	49	2451MHz	69	2471MHz
10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
11	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
12	2414MHz	32	2434MHz	52	2454MHz	72	2474MHz
13	2415MHz	33	2435MHz	53	2455MHz	73	2475MHz
14	2416MHz	34	2436MHz	54	2456MHz	74	2476MHz
15	2417MHz	35	2437MHz	55	2457MHz	75	2477MHz
16	2418MHz	36	2438MHz	56	2458MHz	76	2478MHz
17	2419MHz	37	2439MHz	57	2459MHz	77	2479MHz
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
19	2421MHz	39	2441MHz	59	2461MHz		

Remark:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest channel(CH0)	2402MHz
The Middle channel(CH39)	2441MHz
The Highest channel(CH78)	2480MHz



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3.5 Test Environment

Environment Parameter	96.0~101.0 kPa Selected Values During Tests	
Relative Humidity	40-60 % RH Ambient	
Value	Temperature(°C)	Voltage(V)
NTNV	22~25	12
Remark: NV: Normal Voltage NT: Normal Temperature		

3.6 Description of Support Units

The EUT has been tested as an independent unit.



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4 Test results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(b)
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 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.	
The antenna is Integrated Antenna and no consideration of replacement. The best case gain of the antenna is 2.92 dBi(Ant2).* *Note: The antenna gain are derived from the gain information report provided by the manufacturer. Remark: As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.	



4.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

4.2.1 Test Requirement:

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

4.2.2 Conclusion

Standard Requirement:

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudo randomly 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 pseudo random 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.

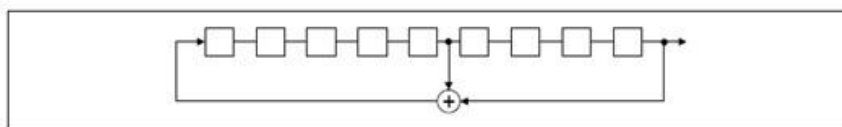
> Number of shift register stages: 9

> 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:



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:

20	62	46	77	7	64	8	73	16	75	1

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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 RF 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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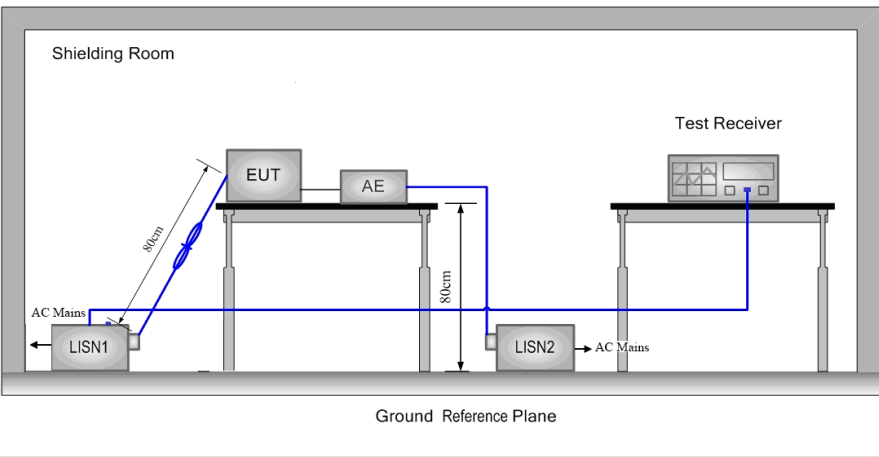
4.3 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10-2013 Section 6.2		
Test Frequency Range:	150kHz to 30MHz		
Receiver Setup:	RBW = 9kHz, VBW = 30kHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		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.			
Test Procedure:	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 50Ω/50μH + 5Ω 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 C63.10-2013 on conducted measurement.		

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Test Setup:	
Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type at the lowest, middle, high channel. DC Supply+ Transmitting mode.
Final Test Mode:	Through Pre-scan, find the DH5 of data type and GFSK modulation is the worst case. DC Supply+ Transmitting mode Only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details.
Test Results:	Pass

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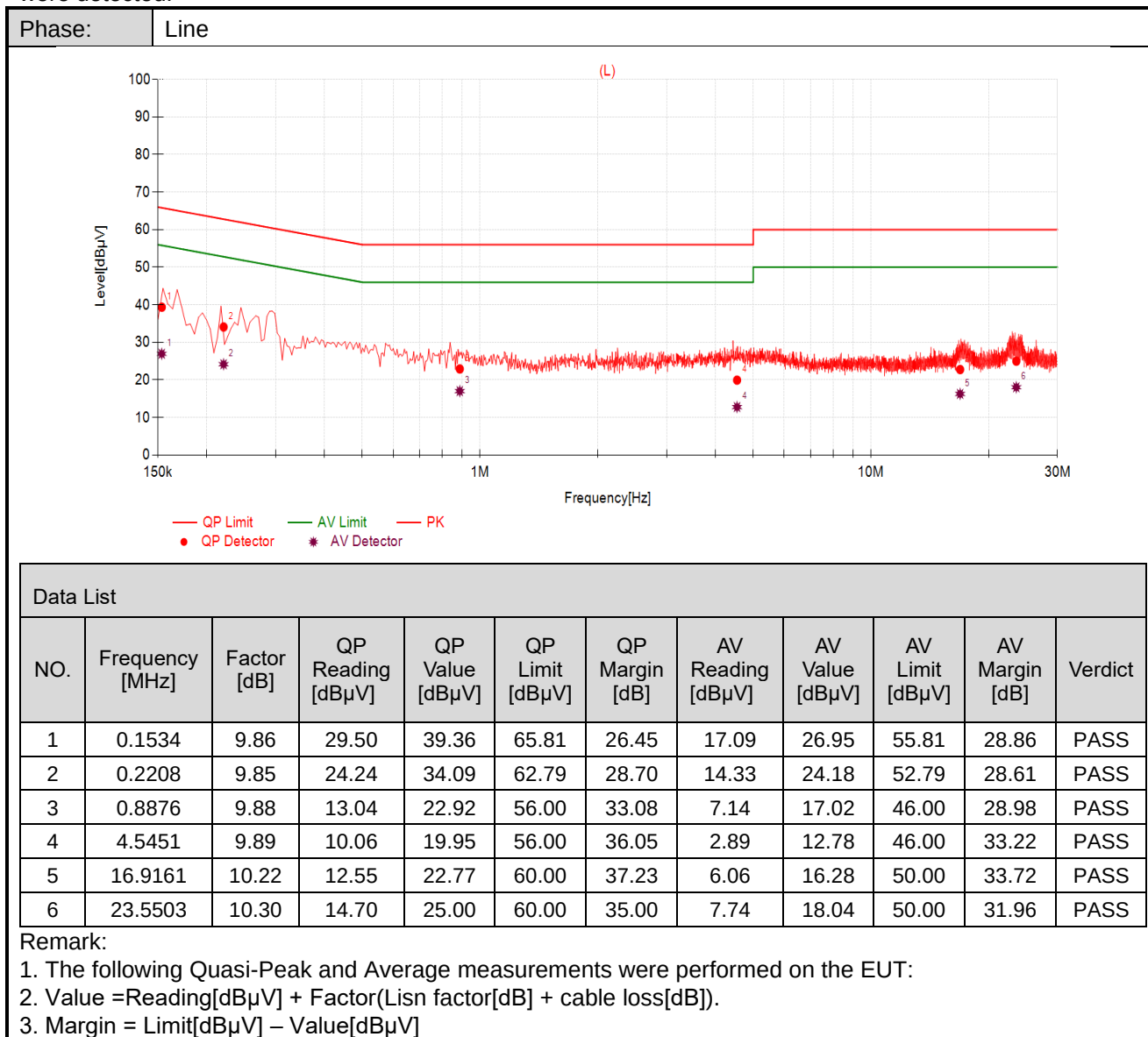
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Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

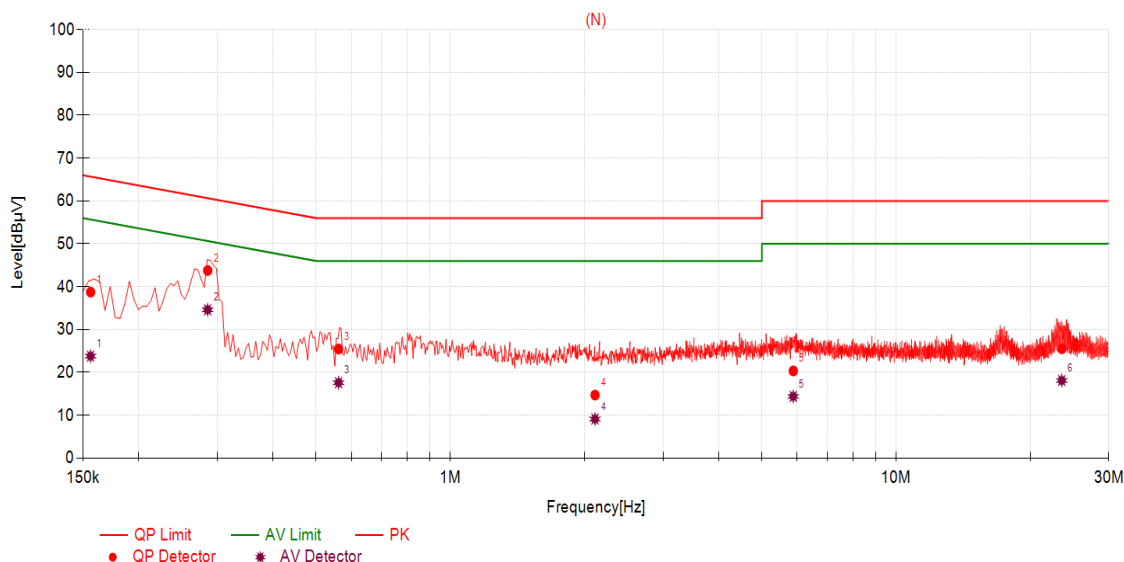


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Phase: Neutral



Data List

NO.	Frequency [MHz]	Factor [dB]	QP Reading [dBμV]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Reading [dBμV]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Verdict
1	0.1559	9.78	28.96	38.74	65.68	26.94	14.01	23.79	55.68	31.89	PASS
2	0.2854	9.79	33.99	43.78	60.66	16.88	24.83	34.62	50.66	16.04	PASS
3	0.5614	9.86	15.61	25.47	56.00	30.53	7.74	17.60	46.00	28.40	PASS
4	2.1116	9.87	4.85	14.72	56.00	41.28	-0.75	9.12	46.00	36.88	PASS
5	5.8812	10.02	10.33	20.35	60.00	39.65	4.38	14.40	50.00	35.60	PASS
6	23.5437	10.31	15.21	25.52	60.00	34.48	7.81	18.12	50.00	31.88	PASS

Remark:

1. The following Quasi-Peak and Average measurements were performed on the EUT:

2. Value = Reading[dBμV] + Factor(Lin factor[dB] + cable loss[dB]).

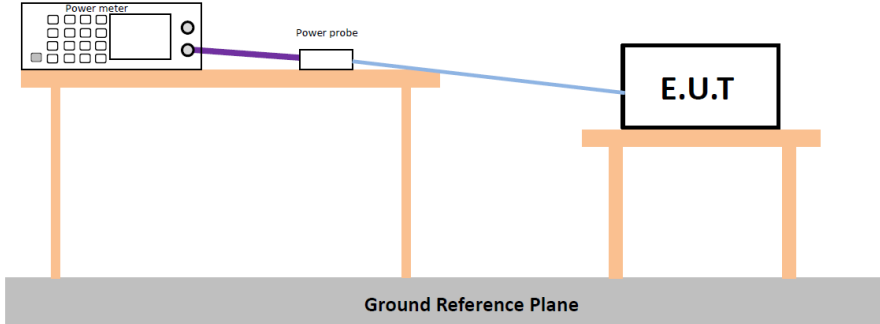
3. Margin = Limit[dBμV] – Value[dBμV]

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4.4 Conducted Output Power

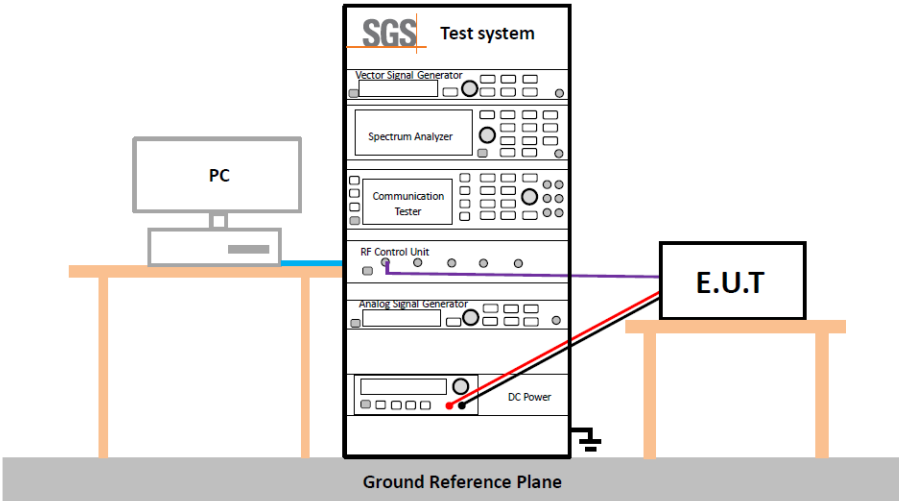
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)&15.247 (b)(1)
Test Method:	ANSI C63.10-2013 Section 11.9.1.3
Test Setup:	 * Test with power meter (Detector function: Peak)
Test Instruments:	Refer to section 6 for details
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type.
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Limit:	0.125 watts
Test Results:	Pass
The detailed test data see: Appendix	

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4.5 20dB Emission Bandwidth & 99% Occupied Bandwidth

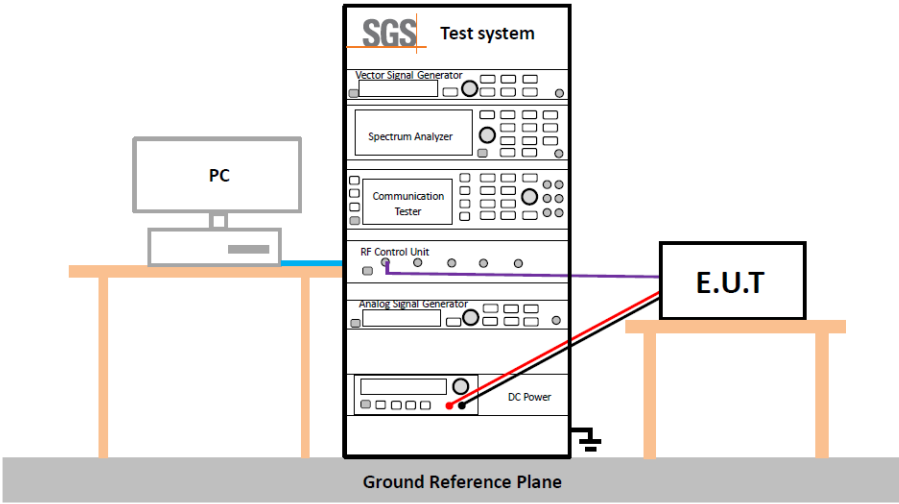
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10-2013 Section 6.9.2 and 6.9.3
Test Setup:	
Instruments Used:	Refer to section 6 for details
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type.
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Limit:	No restriction limits
Test Results:	For Report Purpose
The detailed test data see: Appendix	

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4.6 Carrier Frequencies Separation

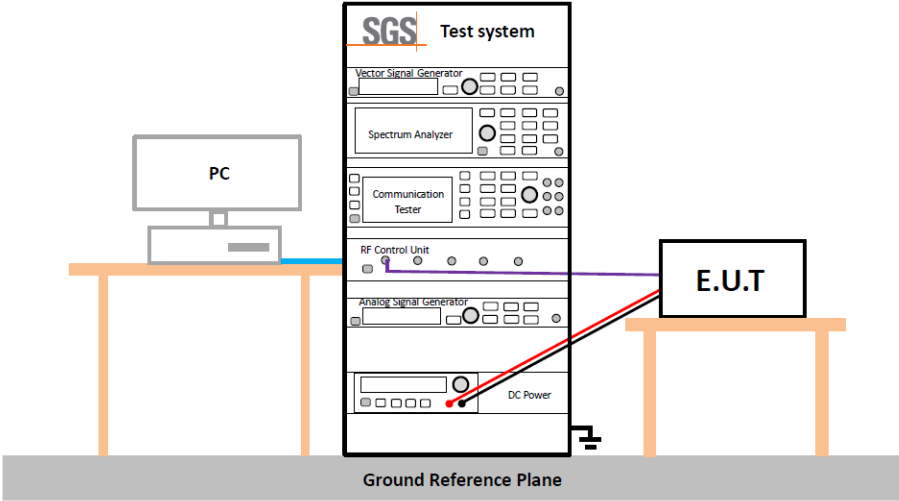
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10-2013 Section 7.8.2
Test Setup:	
Test Instruments:	Refer to section 6 for details
Exploratory Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type.
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Limit:	2/3 of the 20dB bandwidth Remark: the transmission power is less than 0.125W.
Test Results:	Pass
The detailed test data see: Appendix	

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4.7 Hopping Channel Number

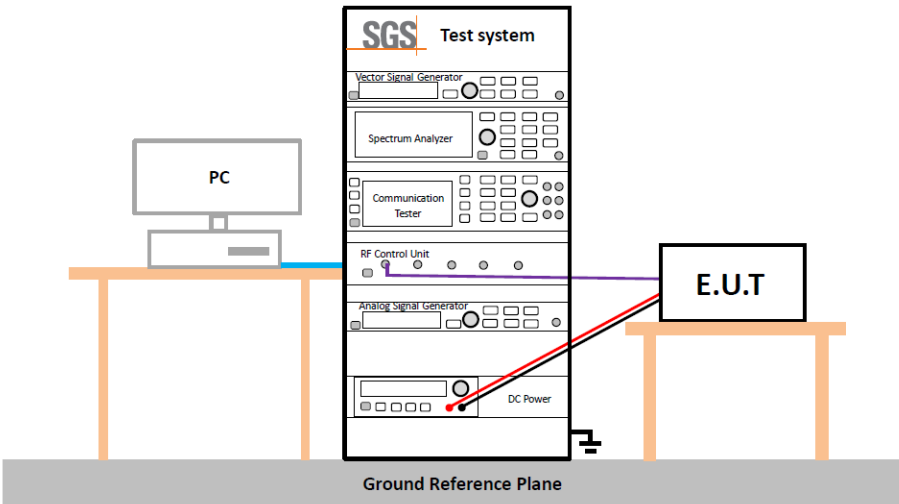
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10-2013 Section 7.8.3
Test Setup:	
Instruments Used:	Refer to section 6 for details
Test Mode:	Hopping transmitting with all kind of modulation
Limit:	At least 15 channels
Test Results:	Pass
The detailed test data see: Appendix	

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4.8 Dwell Time

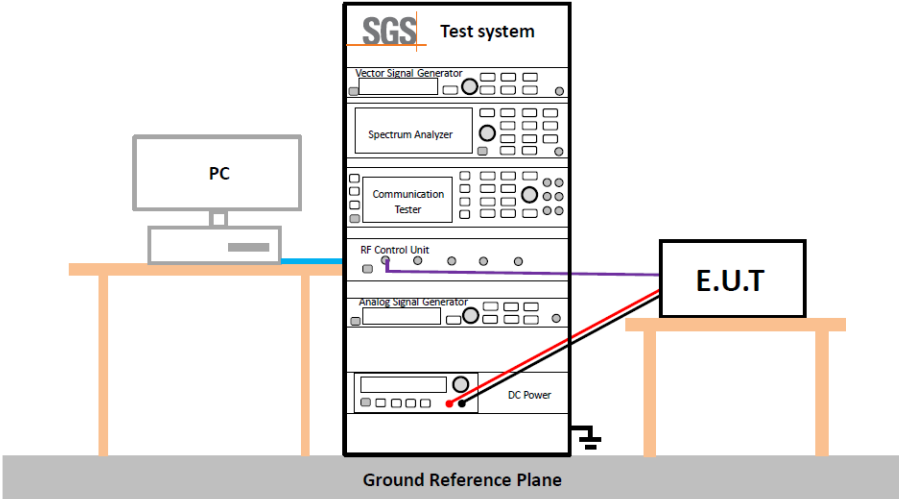
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10-2013 Section 7.8.4
Test Setup:	
Instruments Used:	Refer to section 6 for details
Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type.
Limit:	0.4 Second
Test Results:	Pass
The detailed test data see: Appendix	

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4.9 Band-edge for RF Conducted Emissions

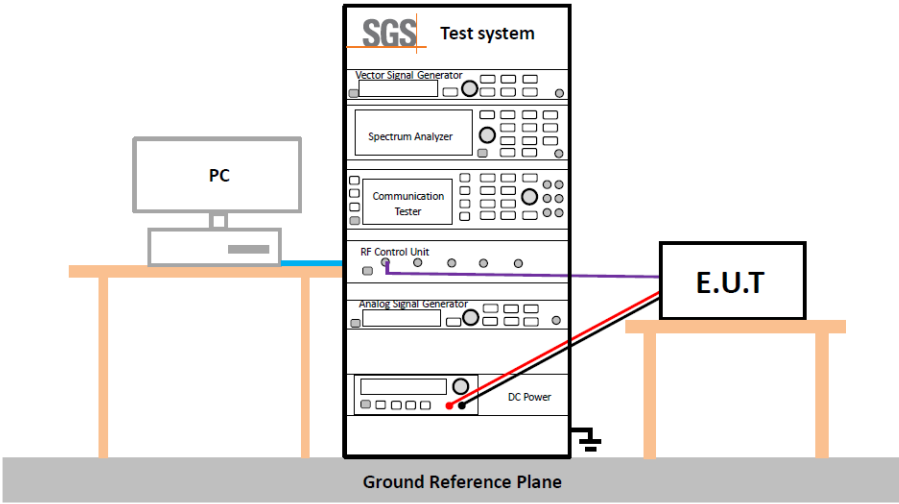
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10-2013 Section 7.8.7.2
Test Setup:	
Instruments Used:	Refer to section 6 for details
Exploratory Test Mode:	Hopping and Non-hopping transmitting with all kind of modulation and all kind of data type.
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Test Results:	Pass
The detailed test data see: Appendix	

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4.10 Spurious RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10-2013 Section 7.8.7.1
Test Setup:	
Instruments Used:	Refer to section 6 for details
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type.
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Test Results:	Pass
The detailed test data see: Appendix	

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4.11 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10-2013 Section 6.4 / 6.5 / 6.6				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Test Frequency:	9kHz ~ 25GHz				
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
Remark: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.					

Test Setup:

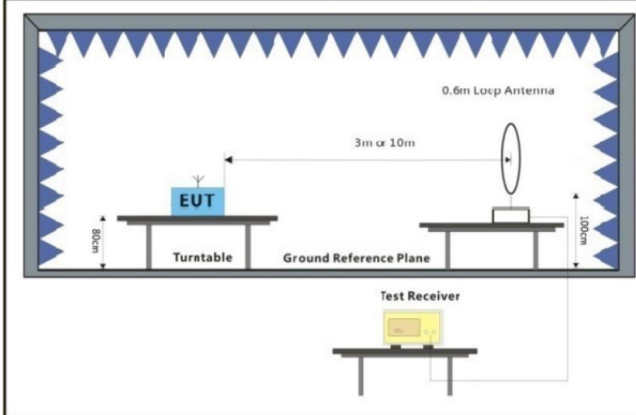


Figure 1. Below 30MHz

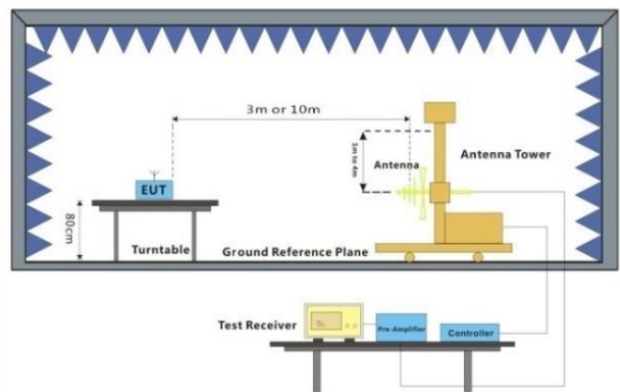


Figure 2. 30MHz to 1GHz

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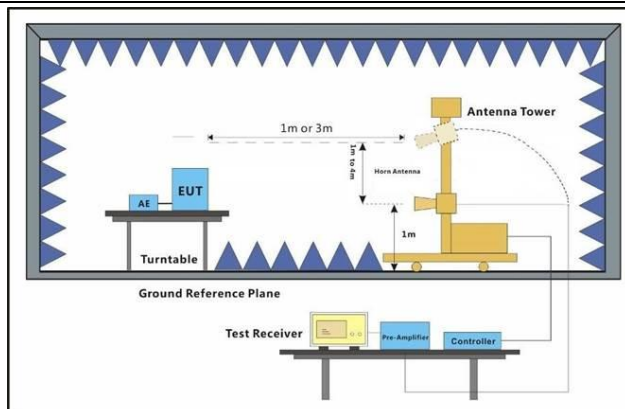


Figure 3. Above 1 GHz

Test Procedure:	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 semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation (Distance from antenna to EUT is 1m for measurements >18GHz). 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. 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 worse case. i. Repeat above procedures until all frequencies measured was complete. j. The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported. k. The disturbance above 18GHz was very low, and the harmonics were the highest point could be found when testing, so only the harmonics had been displayed. l. At a measurement distance of 1 meter the limit line was increased by $20 \cdot \log(3/1) = 9.54 \text{ dB}$.
Test Configuration:	Measurements below 30MHz - RBW = 10 kHz - VBW = 30 kHz - Detector = Peak & Average & Quasi-peak

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	• Trace mode = max hold Measurements Below 1000MHz • RBW = 120 kHz • VBW = 300 kHz • Detector = Quasi-peak • Trace mode = max hold Peak Measurements Above 1000 MHz • RBW = 1 MHz • VBW ≥ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold Average Measurements Above 1000MHz Use duty cycle correction factor method per 15.35(c). Duty cycle = On time / 100 milliseconds On time = $N_1 \cdot L_1 + N_2 \cdot L_2 \dots + N_{N-1} \cdot L_{N-1} + N_N \cdot L_N$ Where N_1 is number of type 1 pulse, L_1 is length of type 1 pulses, etc. Average Value = Peak Value + 20*log(Duty cycle).
Exploratory Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type DC Supply+ Transmitting mode.
Final Test Mode:	Through Pre-scan, find the DH5 of data type and GFSK modulation is the worst case. Pretest the EUT at DC Supply+ Transmitting mode For below 1GHz part, through pre-scan all channels, but only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details
Test Results:	Pass
The detailed test data see: Appendix	



4.12 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10-2013 Section 6.10.5		
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)		
Limit:	Frequency	Limit (dBuV/m)	Remark
	30MHz-88MHz	40.0	Quasi-peak
	88MHz-216MHz	43.5	Quasi-peak
	216MHz-960MHz	46.0	Quasi-peak
	960MHz-1GHz	54.0	Quasi-peak
	Above 1GHz	54.0	Average Value
		74.0	Peak Value

Test Setup:

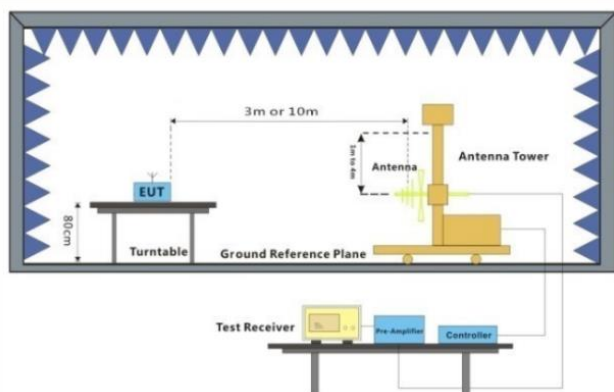


Figure 1. 30MHz to 1GHz

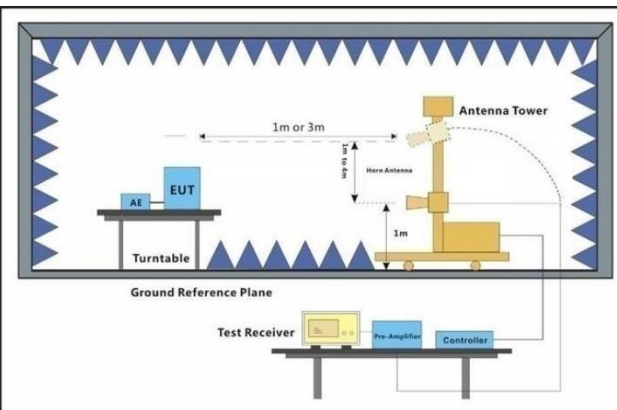


Figure 2. Above 1 GHz

Test Procedure:

- 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.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 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.
- 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.
- 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 and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified

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	Bandwidth with Maximum Hold Mode. g. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel. 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 worse case. j. Repeat above procedures until all frequencies measured was complete.
Test Configuration:	Measurements Below 1000MHz • RBW = 120 kHz • VBW = 300 kHz • Detector = Quasi-peak • Trace mode = max hold Peak Measurements Above 1000 MHz • RBW = 1 MHz • VBW ≥ 3 MHz • Detector = Peak • Sweep time = auto • Trace mode = max hold Average Measurements Above 1000MHz Use duty cycle correction factor method per 15.35(c). Duty cycle = On time / 100 milliseconds On time = $N_1 \cdot L_1 + N_2 \cdot L_2 + \dots + N_{N-1} \cdot L_{N-1} + N_N \cdot L_N$ Where N_1 is number of type 1 pulse, L_1 is length of type 1 pulses, etc. Average Value = Peak Value + $20 \cdot \log(\text{Duty cycle})$.
Exploratory Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type DC Supply+ Transmitting mode.
Final Test Mode:	Through Pre-scan, find the DH5 of data type and GFSK modulation is the worst case. Pretest the EUT at DC Supply+ Transmitting mode, Only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details
Test Results:	Pass
The detailed test data see: Appendix	

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5 Measurement Uncertainty (95% confidence levels, k=2)

Lab A:

No.	Item	Measurement Uncertainty
1	Conduction Emission	$\pm 3.0\text{dB}$ (150kHz to 30MHz)
2	Radiated Emission	$\pm 4.6\text{dB}$ (9KHz to 30MHz)
		$\pm 4.9\text{dB}$ (30MHz to 1GHz)
		$\pm 4.9\text{dB}$ (1GHz to 6GHz)
		$\pm 4.7\text{dB}$ (6GHz to 18GHz)
		$\pm 5.26\text{dB}$ (Above 18GHz)

Remark:

The U_{lab} (lab Uncertainty) is less than $U_{\text{CISPR/ETSI}}$ (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.

Lab B:

No.	Item	Measurement Uncertainty
1	Radio Frequency	8.4×10^{-8} GHz
2	Timeout	2s
3	Duty Cycle	0.37%
4	Occupied Bandwidth	3%
5	RF Conducted Power	0.6dB
6	RF Power Density	2.9dB
7	Conducted Spurious Emissions	0.75dB

Remark:

The U_{lab} (lab Uncertainty) is less than $U_{\text{CISPR/ETSI}}$ (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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6 Equipment List

Lab A:

CE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date (yyyy/mm/dd)	Cal Due Date (yyyy/mm/dd)
Shielding Room	Brilliant-emc	N/A	XAW04-03-01	N/A	N/A
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2023/08/30	2024/08/29
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-01	2023/06/30	2024/06/29
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2023/08/30	2024/08/29
Measurement Software	Tonscend	TS+ V4.0.0.0	XAW02-07-01	NCR	NCR
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-07	2023/08/30	2024/08/29
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-02	2023/06/30	2024/06/29

Remark: NCR=No Calibration Requirement

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RSE Test System					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/d)	Cal.Due date (yyyy/mm/d)
Semi-Anechoic Chamber	Brilliant-emc	N/A	XAW03-35-01	2021/09/09	2024/09/08
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2023/02/16	2024/02/15
Spectrum Analyzer	ROHDE&SCHWARZ	FSV3044	XAW01-13-05	2023/05/15	2024/05/14
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2023/08/30	2024/08/29
Receiving antenna (30MHz-3GHz)	Schwarzbeck	VULB 9163	XAW01-09-01	2022/07/28	2024/07/27
Receiving antenna (1GHz~18GHz)	Schwarzbeck	BBHA 9120D	XAW01-09-02	2022/07/28	2024/07/27
Receiving antenna (15GHz~40GHz)	Schwarzbeck	BBHA 9170	XAW01-09-03	2022/07/23	2024/07/22
Directional antenna rack controller	Max-Full	MF-7802BS	XAW03-03-01	NCR	NCR
High-speed antenna rack controller	Max-Full	MF-7802	XAW03-04-01	NCR	NCR
Filter bank	Tonscend	JS0806-F	XAW03-05-01	NCR	NCR
Filter bank	Tonscend	JS0806s	XAW03-05-02	NCR	NCR
Amplifier	Tonscend	TAP9K3G32	XAW01-41-01	2023/05/15	2024/05/14
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2023/08/30	2024/08/29
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2023/08/30	2024/08/29
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2023/08/30	2024/08/29
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2023/09/04	2024/09/03
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-07	2023/08/30	2024/08/29
Measurement Software	Tonscend	TS+ V4.0.0.0	XAW02-05-01	NCR	NCR
Loop Antenna	Schwarzbeck	FMZB 1519B	XAW01-48-02	2022/05/26	2024/05/25

Remark: NCR=No Calibration Requirement



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Lab B:

RF Test Equipment					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
Spectrum Analyzer	Keysight	N9020A	KUS1911E004-2	2023/08/24	2024/08/23
Spectrum Analyzer	Keysight	N9020A	KUS2001M001-2	2023/08/24	2024/08/23
Spectrum Analyzer	Keysight	N9030B	KSEM021-1	2023/02/03	2024/02/02
Signal Generator	R&S	SMBV100B	KSEM032	2023/03/16	2024/03/15
Signal Generator	R&S	SMW200A	KSEM020-1	2023/08/24	2024/08/23
Signal Generator	Agilent	N5182A	KUS2001M001-1	2023/08/24	2024/08/23
Radio Communication Test Station	Anritsu	MT8000A	KSEM001-1	2023/08/24	2024/08/23
Radio Communication Analyzer	Anritsu	MT8821C	KSEM002-1	2023/03/16	2024/03/15
Universal Radio Communication Tester	R&S	CMW500	KUS1911E004-1	2023/08/24	2024/08/23
Switcher	CCSRF	FY562	KUS2001M001-3	2023/08/24	2024/08/23
AC Power Source	EXTECH	6605	KS301178	NCR	NCR
DC Power Supply	Aglient	E3632A	KS301180	NCR	NCR
Conducted Test Cable	Thermax	RF01-RF04	CZ301111- CZ301120	2023/02/03	2024/02/02
Temp. / Humidity Chamber	TERCHY	MHK-120AK	KS301190	2023/08/24	2024/08/23
Temperature & Humidity Recorder	Renke Control	RS-WS-N01-6J	KSEM024-5	2023/03/22	2024/03/21
Software	BST	TST-PASS	/	NCR	NCR

Remark: NCR=No Calibration Requirement



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7 Photographs - Setup Photos

Refer to Appendix A.2 WLAN Setup Photos.



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Appendix



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Occupied Channel Bandwidth Test Result

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	99% Occupied Bandwidth (MHz)		Verdict
					Result	Limit	
GFSK	SISO	2402	DH5	2	0.918	/	Pass
		2441	DH5	2	0.916	/	Pass
		2480	DH5	2	0.919	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	2	1.179	/	Pass
		2441	2DH5	2	1.178	/	Pass
		2480	2DH5	2	1.180	/	Pass
8DPSK	SISO	2402	3DH5	2	1.183	/	Pass
		2441	3DH5	2	1.185	/	Pass
		2480	3DH5	2	1.185	/	Pass



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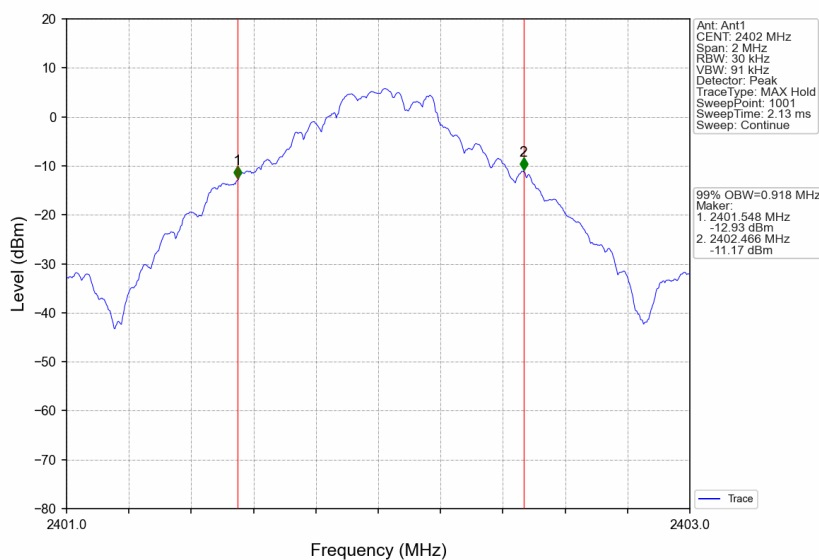
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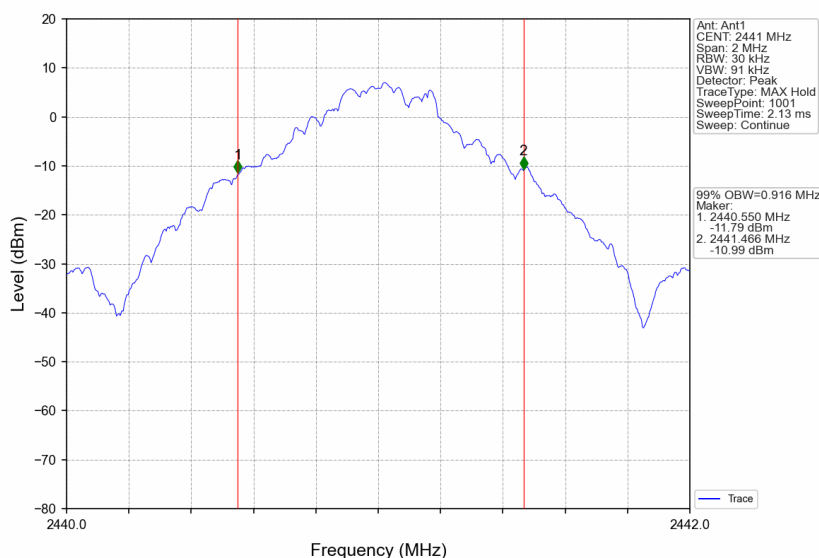
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Test Graphs

GFSK_DH5_LCH_2402MHz_Ant2_NTNV



GFSK_DH5_MCH_2441MHz_Ant2_NTNV

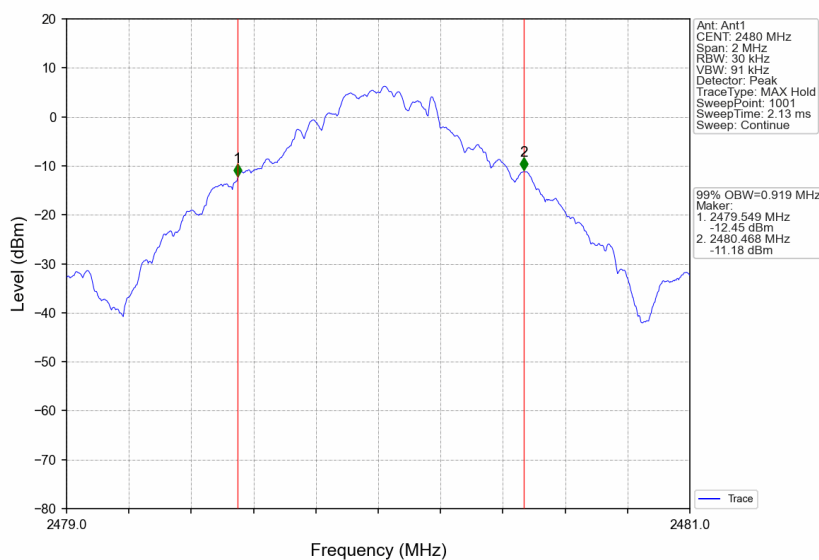


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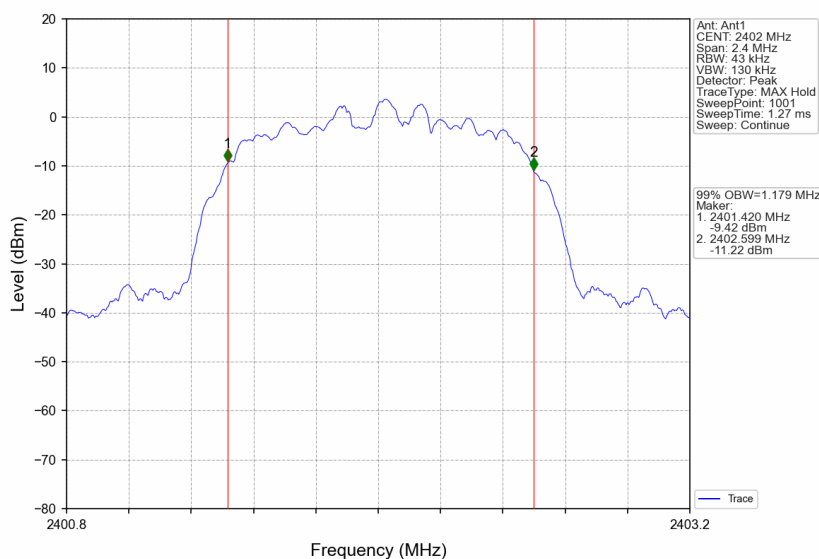
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GFSK DH5 HCH 2480MHz Ant2 NTN



Pi/4DQPSK_2DH5_LCH_2402MHz_Ant2_NTN



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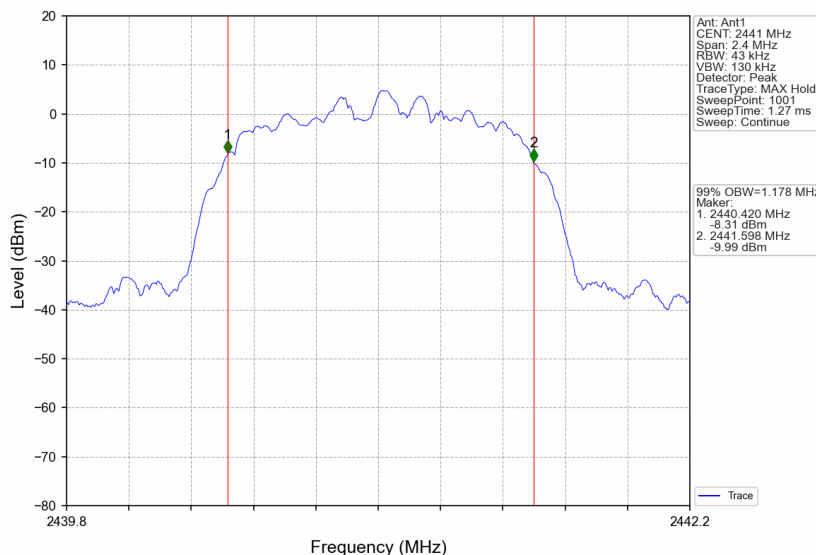
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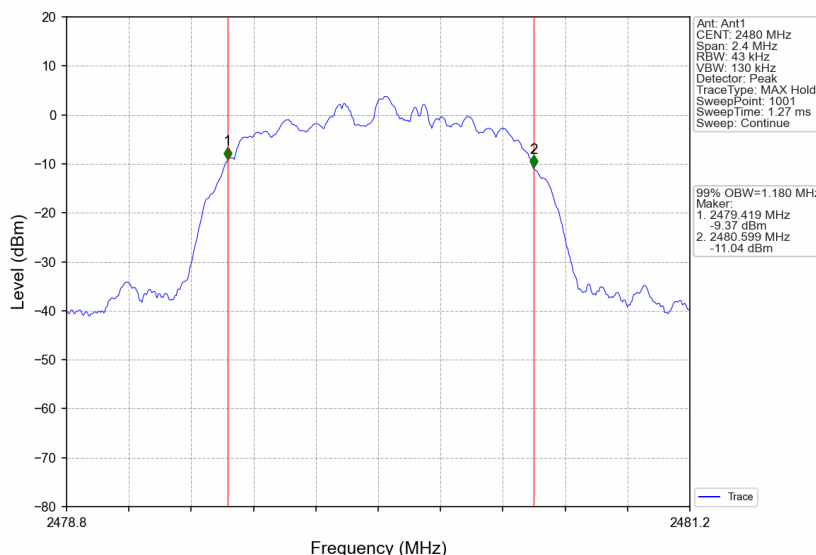
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Pi/4DQPSK 2DH5 MCH 2441MHz Ant2 NTV



Pi/4DQPSK 2DH5 HCH 2480MHz Ant2 NTV



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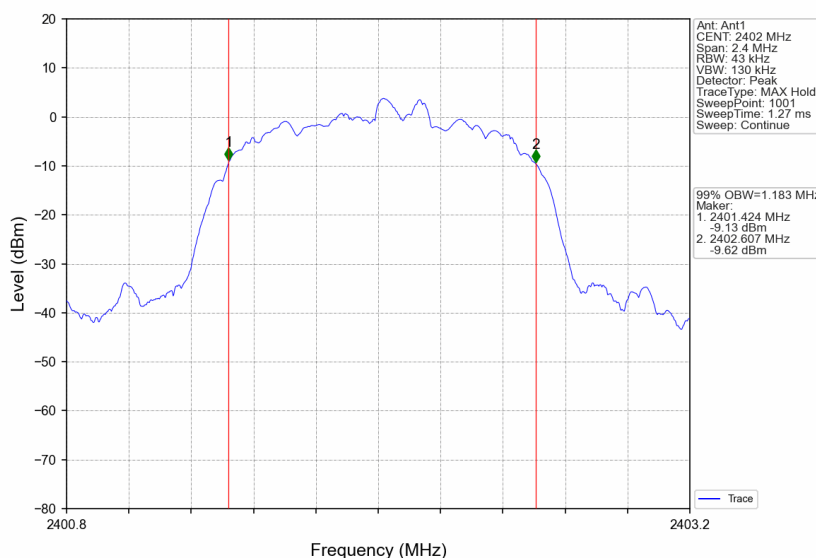
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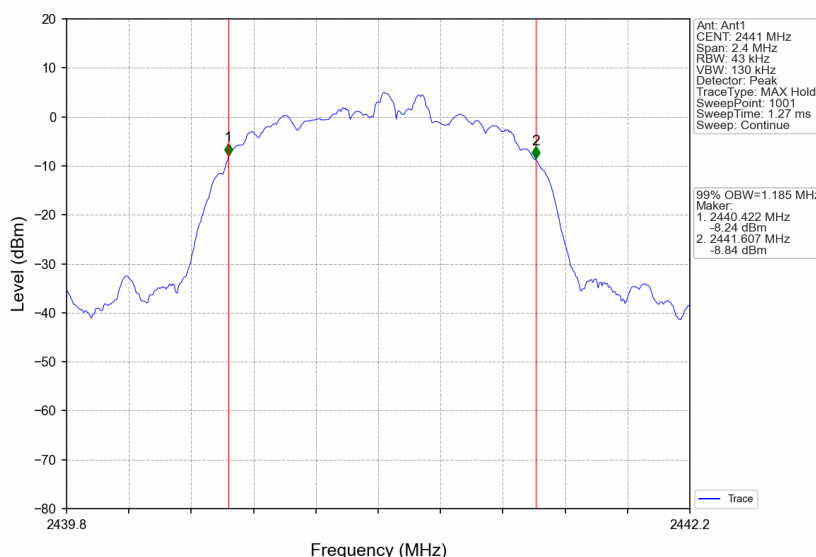
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8DPSK 3DH5 LCH 2402MHz Ant2 NTN



8DPSK 3DH5 MCH 2441MHz Ant2 NTN



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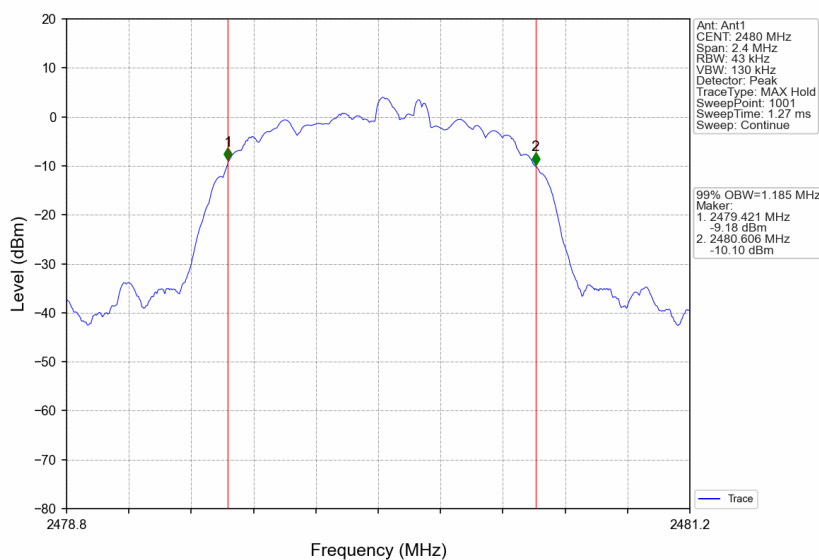
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8DPSK 3DH5 HCH 2480MHz Ant2 NTN





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20dB Emission Bandwidth Test Result

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	20dB Bandwidth (MHz)		Verdict
					Result	Limit	
GFSK	SISO	2402	DH5	2	1.013	/	Pass
		2441	DH5	2	1.017	/	Pass
		2480	DH5	2	1.000	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	2	1.310	/	Pass
		2441	2DH5	2	1.319	/	Pass
		2480	2DH5	2	1.308	/	Pass
8DPSK	SISO	2402	3DH5	2	1.317	/	Pass
		2441	3DH5	2	1.317	/	Pass
		2480	3DH5	2	1.319	/	Pass



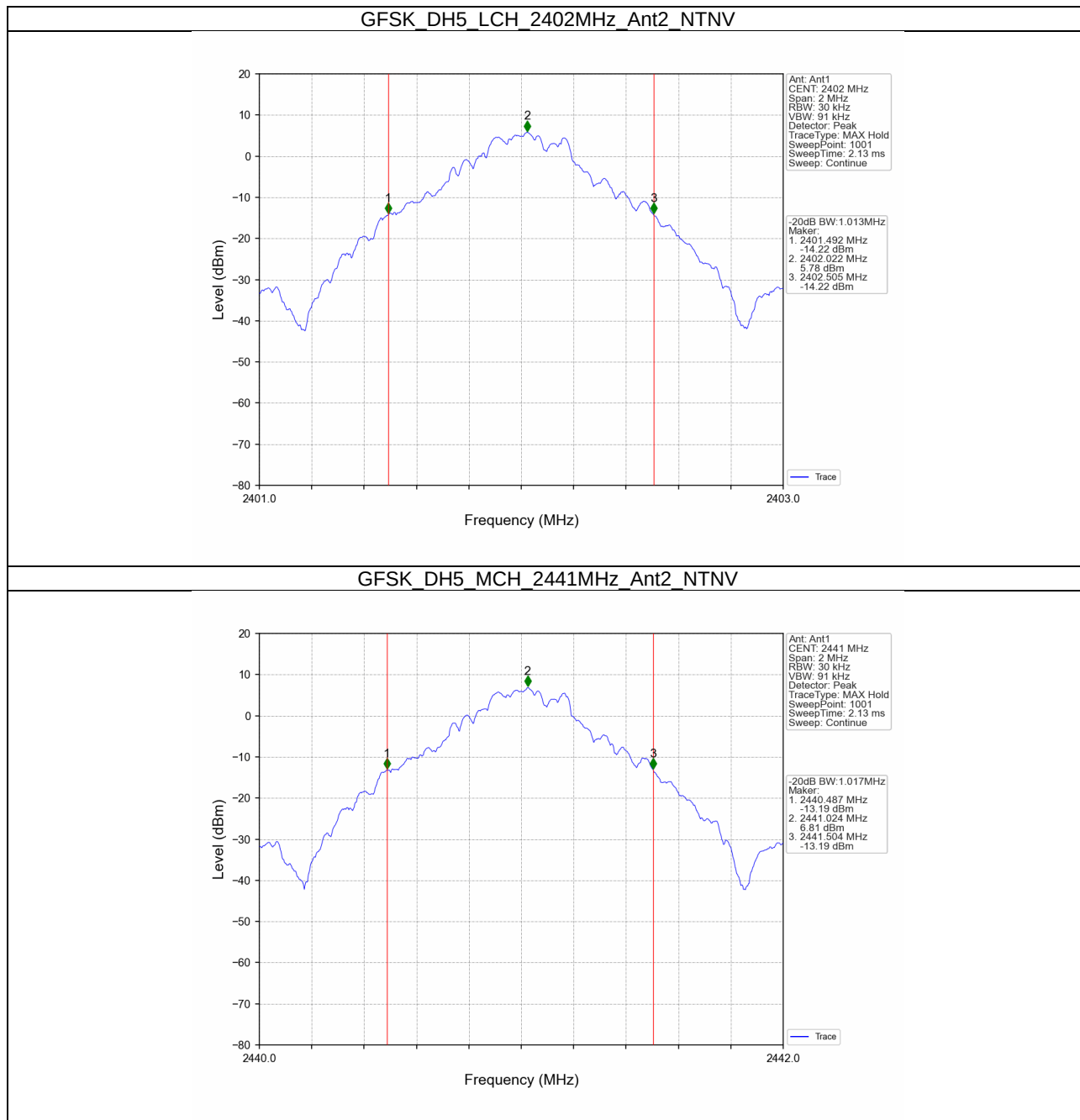
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Test Graphs



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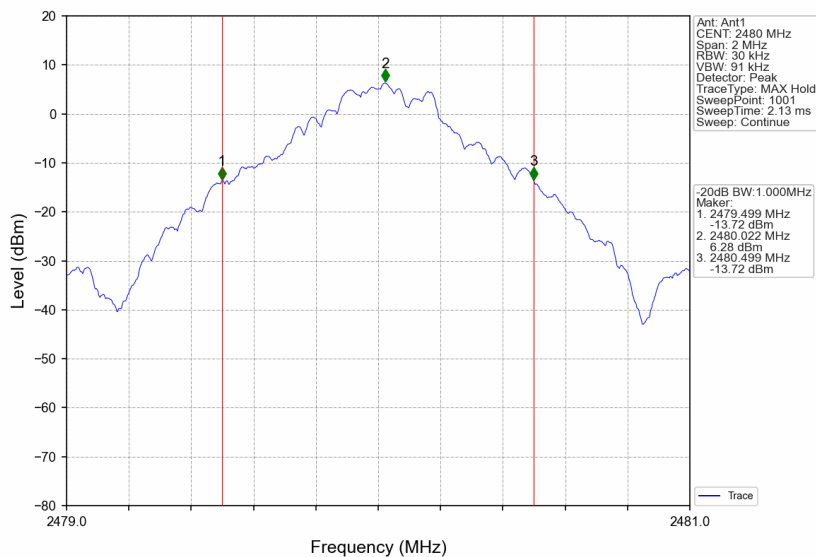
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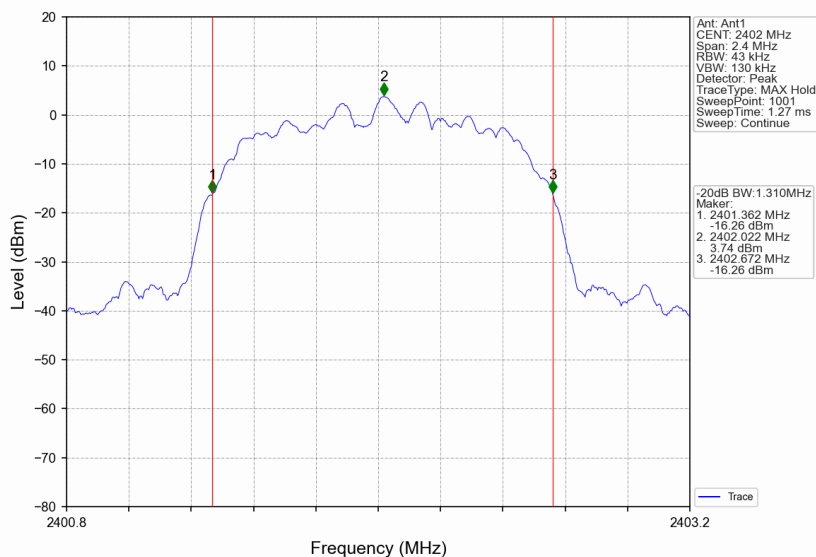
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GFSK DH5 HCH 2480MHz Ant2 NTN



Pi/4DQPSK_2DH5_LCH_2402MHz_Ant2_NTN

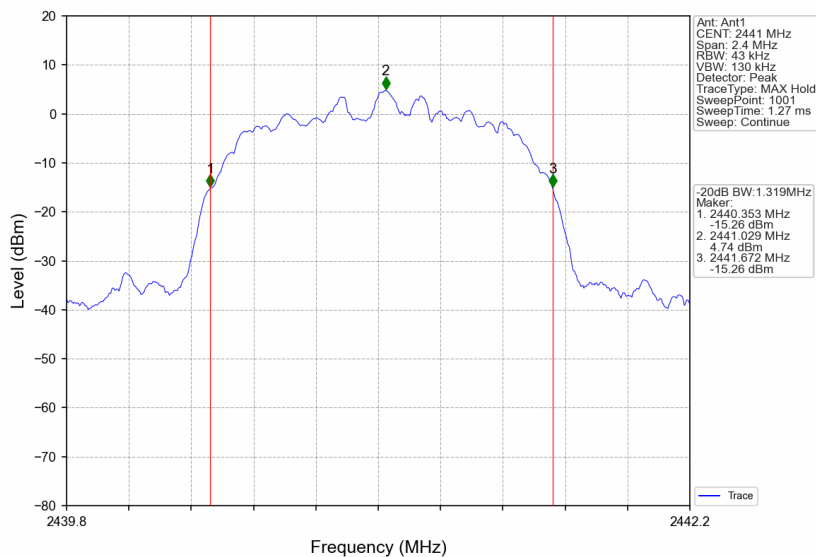


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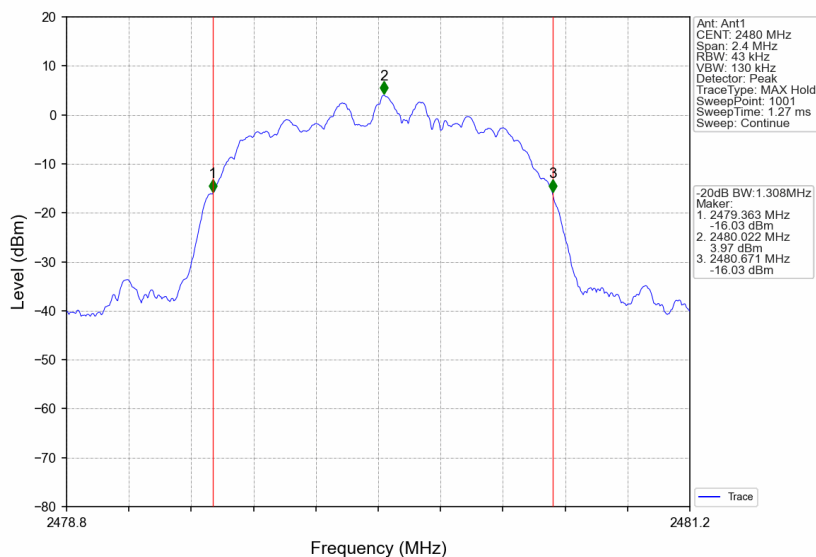
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Pi/4DQPSK 2DH5 MCH 2441MHz Ant2 NTN



Pi/4DQPSK 2DH5 HCH 2480MHz Ant2 NTN



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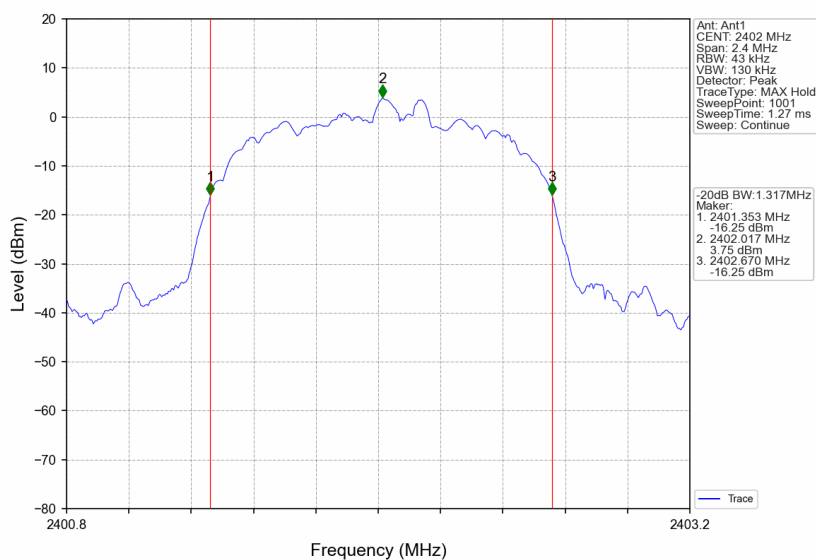
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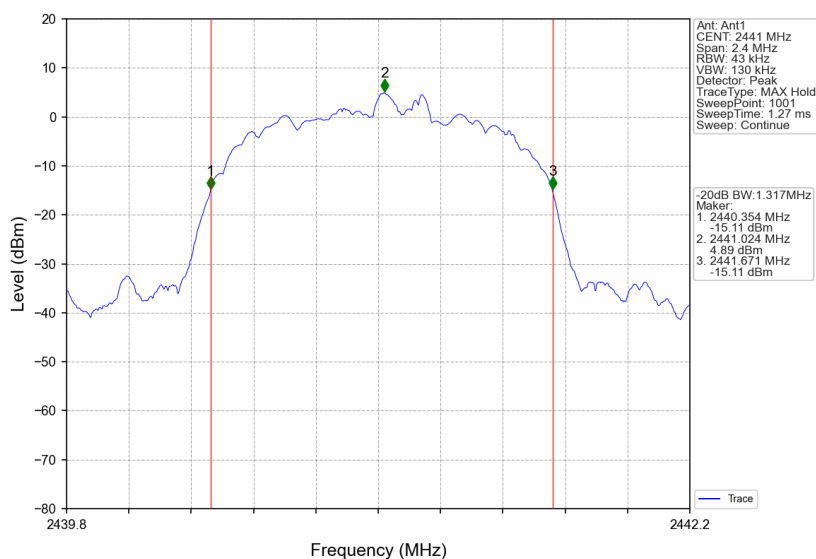
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8DPSK 3DH5 LCH 2402MHz Ant2 NTN



8DPSK 3DH5 MCH 2441MHz Ant2 NTN



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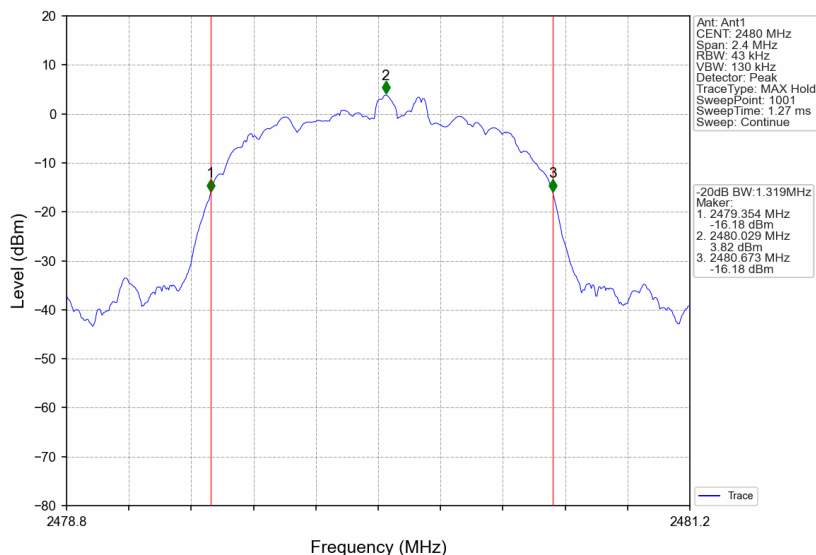
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8DPSK 3DH5 HCH 2480MHz Ant2 NTN



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Maximum conducted output power Test Result

Mode	TX Type	Frequency (MHz)	Packet Type	Maximum Peak Conducted Output Power (dBm)		Verdict
				ANT2	Limit	
GFSK	SISO	2402	DH5	7.88	<=30.00	Pass
		2441	DH5	8.94	<=30.00	Pass
		2480	DH5	8.02	<=30.00	Pass
Pi/4DQPSK	SISO	2402	2DH5	7.03	<=20.97	Pass
		2441	2DH5	8.10	<=20.97	Pass
		2480	2DH5	7.16	<=20.97	Pass
8DPSK	SISO	2402	3DH5	7.49	<=20.97	Pass
		2441	3DH5	8.55	<=20.97	Pass
		2480	3DH5	7.61	<=20.97	Pass

Note1: Antenna Gain: Ant2: 2.92dBi;



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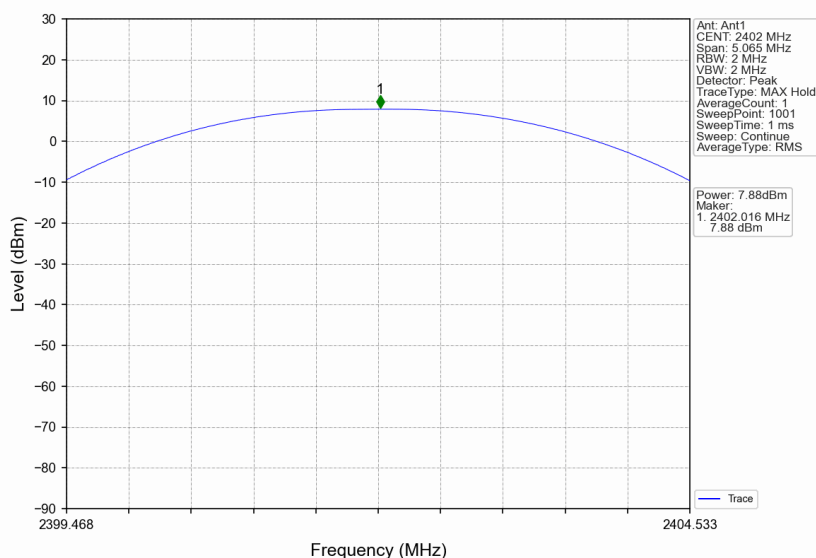
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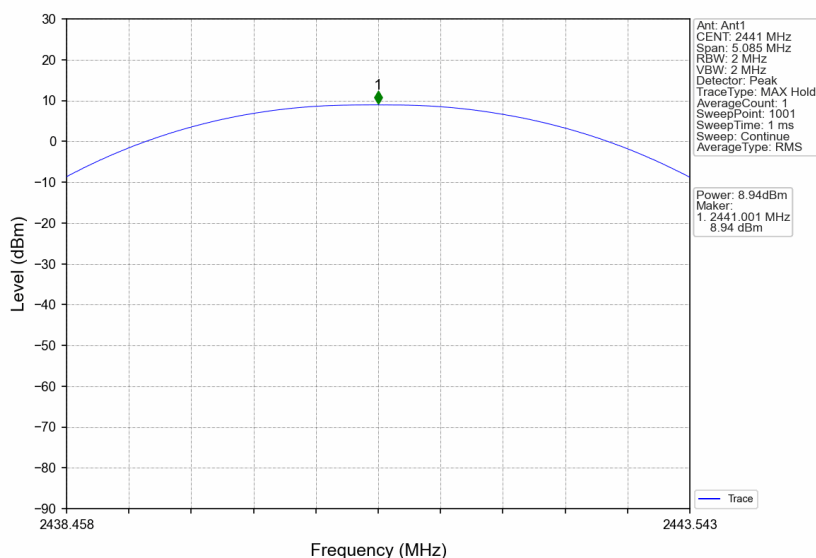
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Test Graphs

GFSK_DH5_LCH_2402MHz_Ant2_NTNV



GFSK_DH5_MCH_2441MHz_Ant2_NTNV

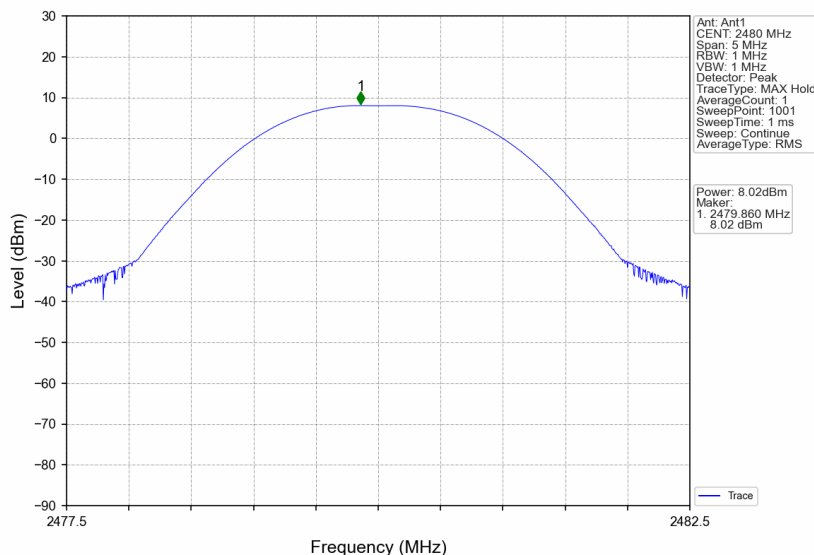


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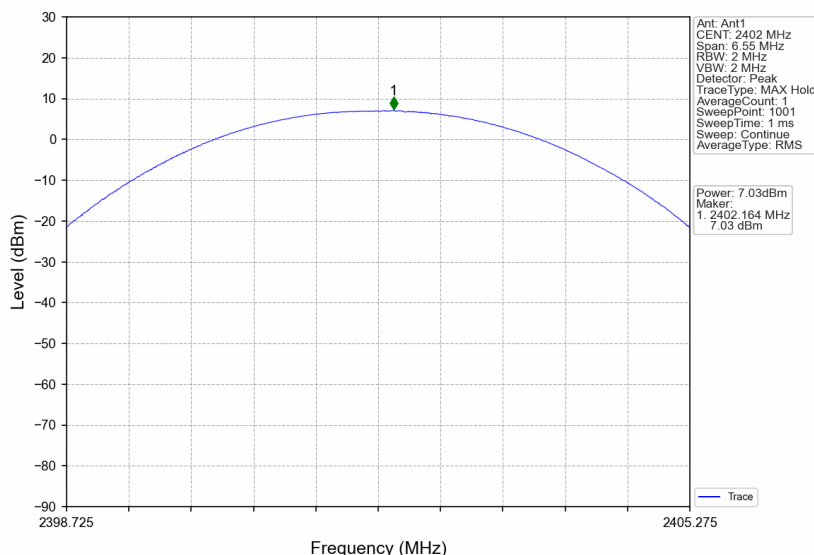
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GFSK DH5 HCH 2480MHz Ant2 NTN



Pi/4DQPSK 2DH5 LCH 2402MHz Ant2 NTN



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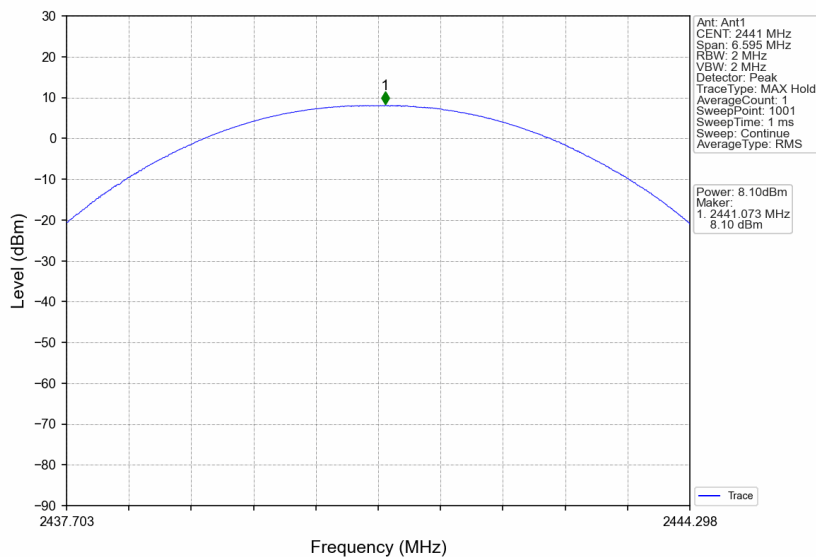
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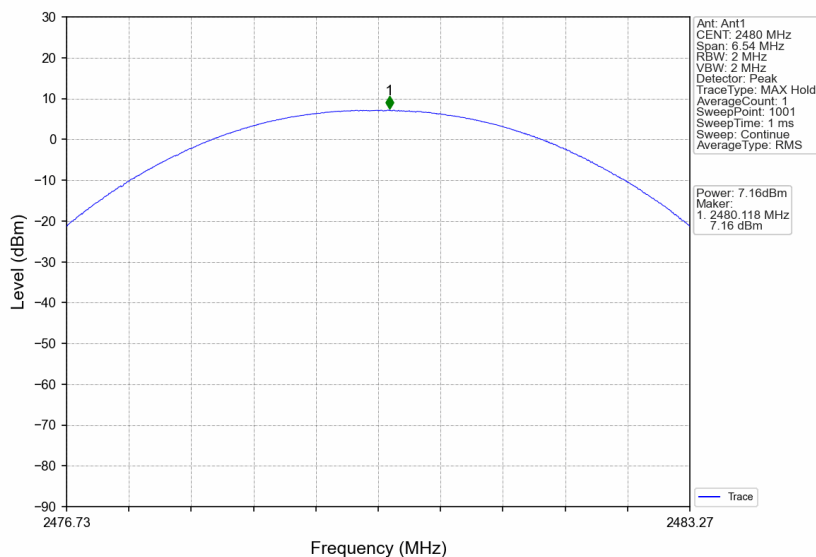
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Pi/4DQPSK 2DH5 HCH 2480MHz Ant2 NTN

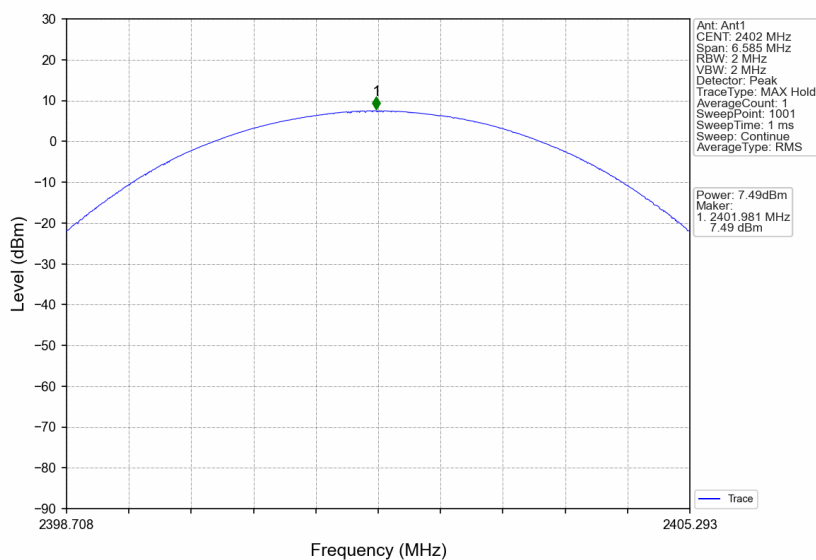


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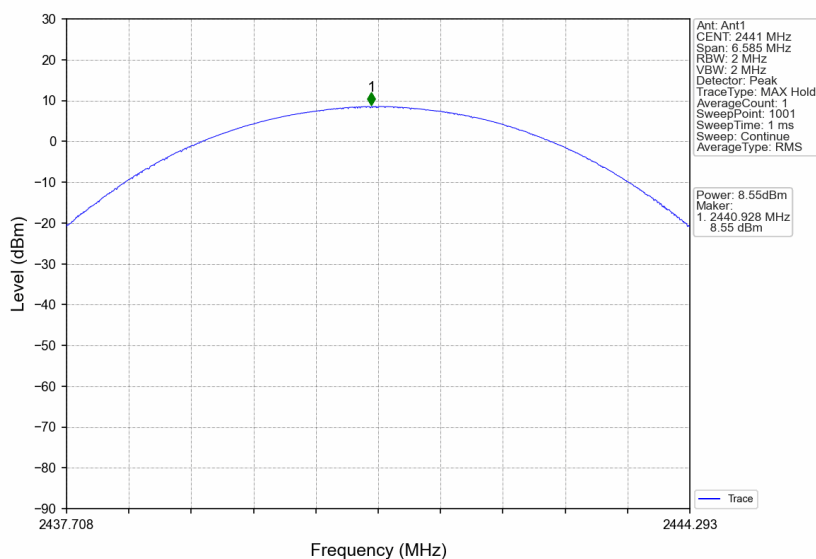
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8DPSK 3DH5 LCH 2402MHz Ant2 NTN



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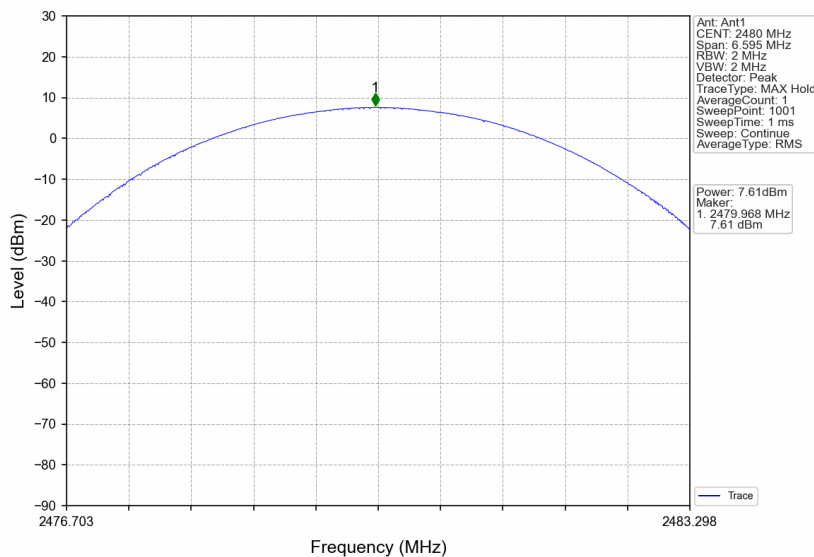
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Carrier frequency separation Test Result

Ant2							
Mode	TX Type	Frequency (MHz)	Packet Type	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Verdict
GFSK	SISO	HOPP	DH5	1.012	1.017	≥ 0.678	Pass
Pi/4DQPSK	SISO	HOPP	2DH5	1.001	1.319	≥ 0.879	Pass
8DPSK	SISO	HOPP	3DH5	1.001	1.319	≥ 0.879	Pass



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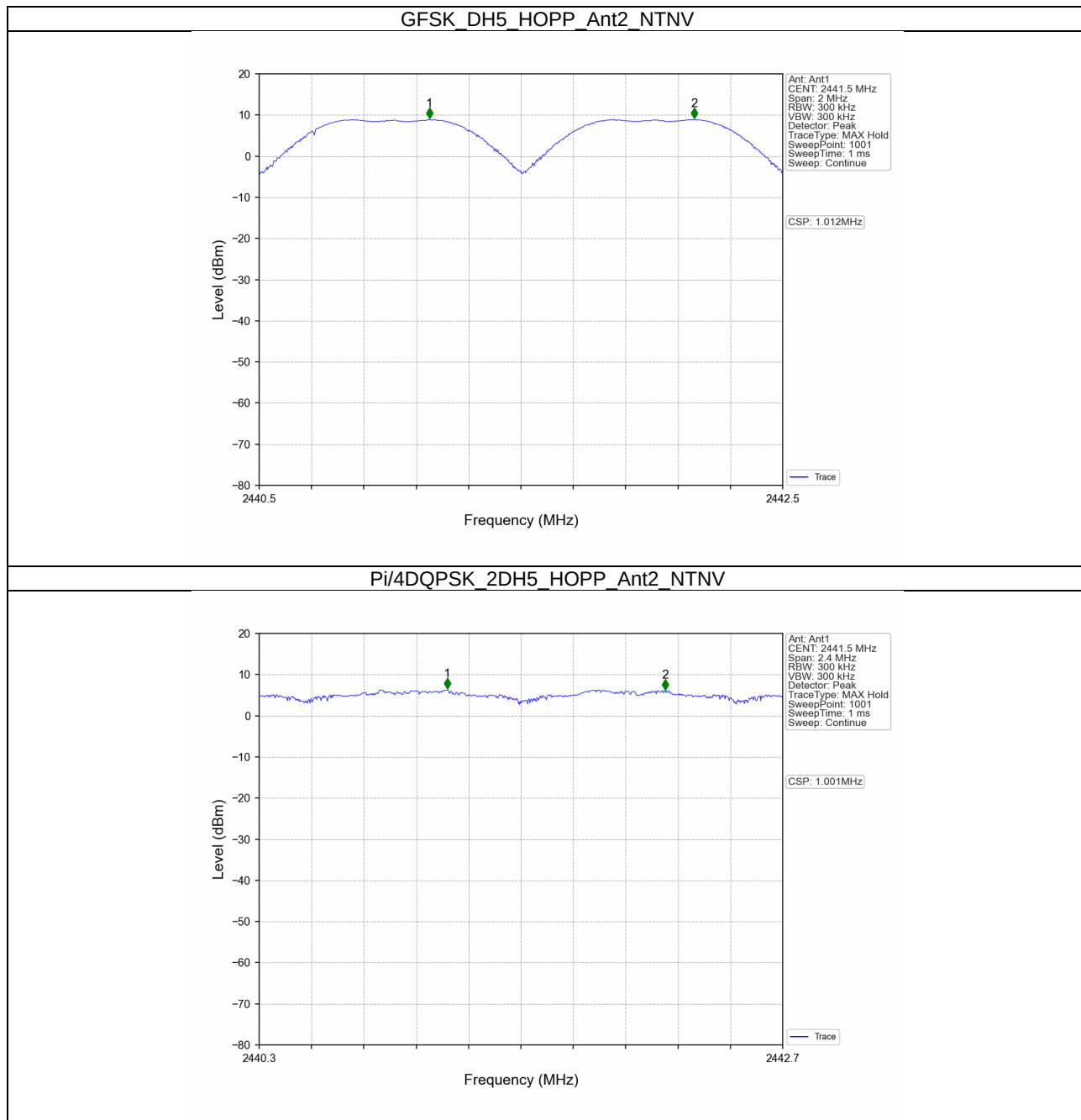
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Test Graphs

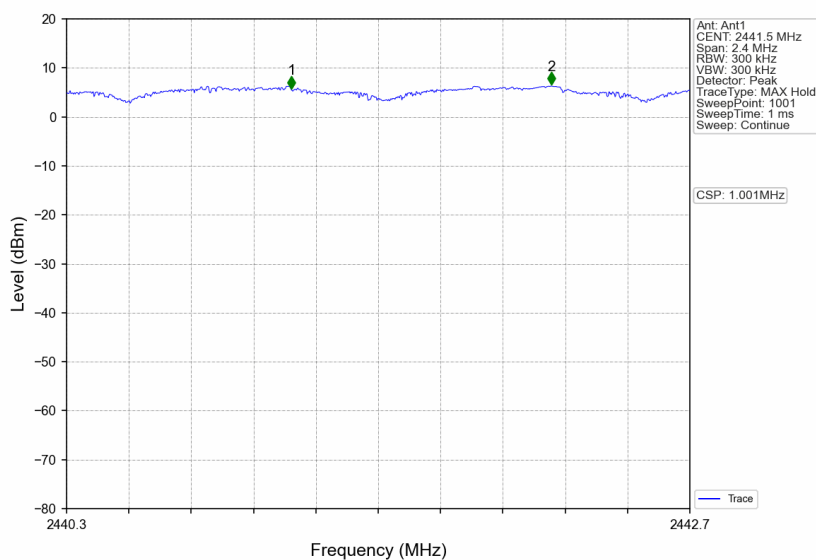


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8DPSK 3DH5 HOPP Ant2 NTN



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Number of hopping channels

Test Result

Mode	TX Type	Frequency (MHz)	Packet Type	Num of Hopping Frequencies		Verdict
				ANT2	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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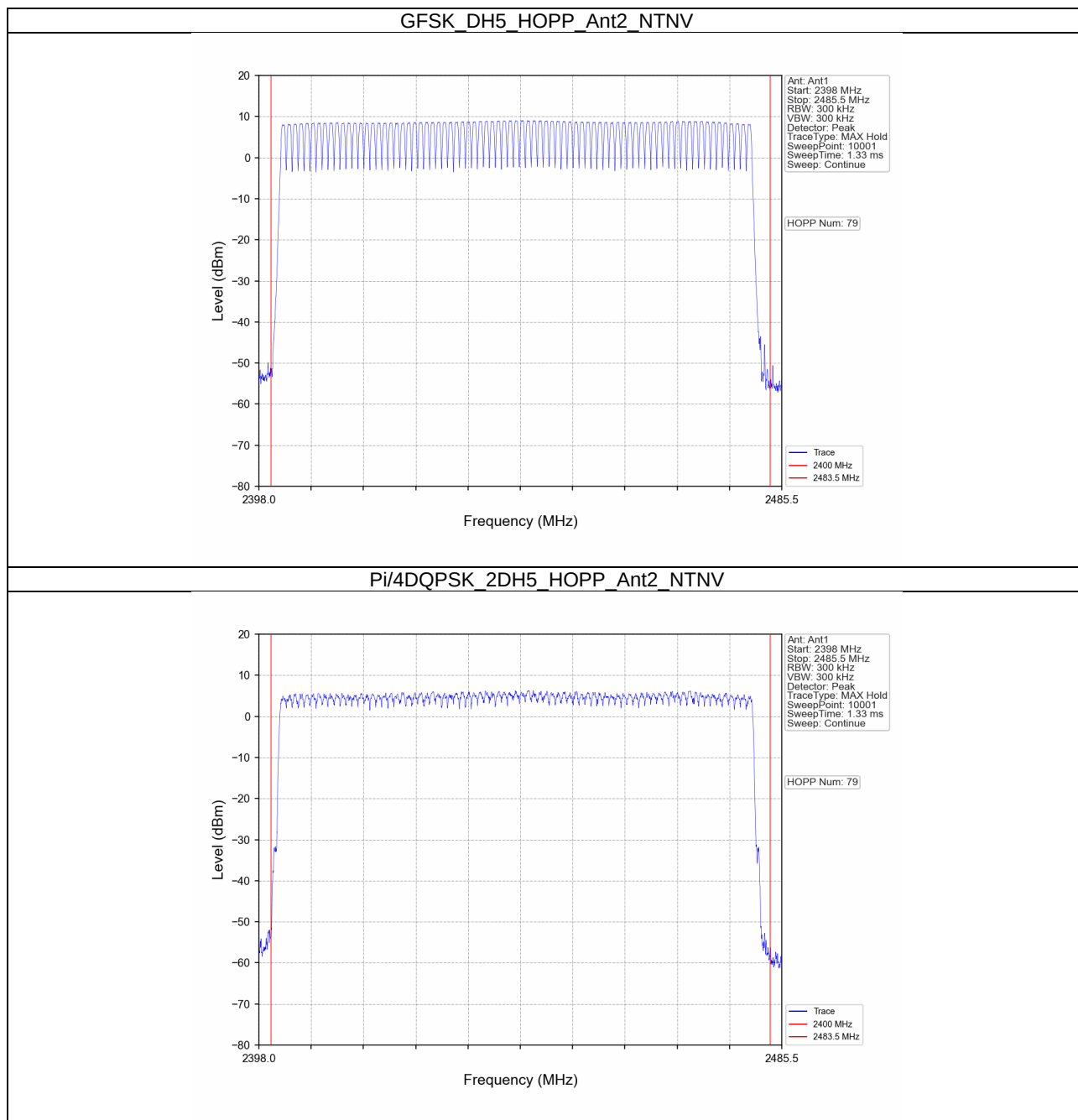
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Test Graphs



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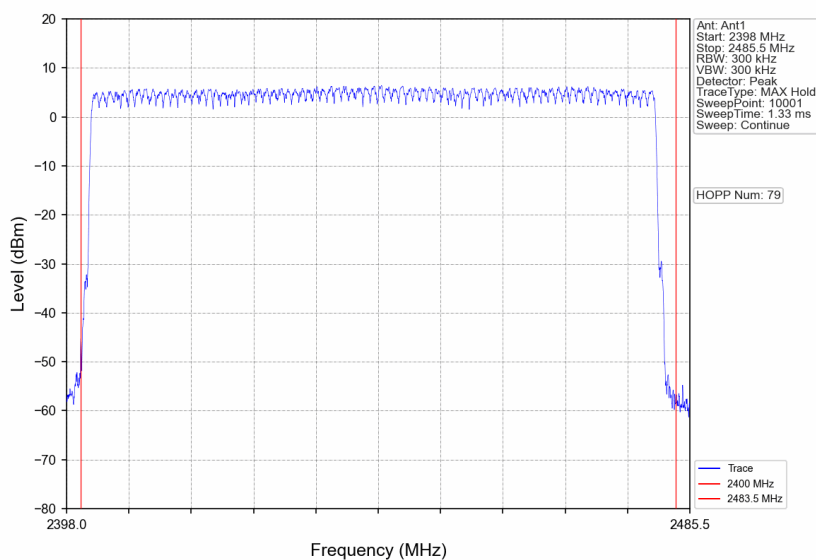
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Time of Occupancy (Dwell Time) Test Result

Ant2									
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	0.388	31.600	321	124.548	<=400	Pass
			DH3	1.644	31.600	161	264.684	<=400	Pass
			DH5	2.888	31.600	118	340.784	<=400	Pass
Pi/4DQPSK	SISO	HOPP	2DH1	0.392	31.600	320	125.440	<=400	Pass
			2DH3	1.652	31.600	153	252.756	<=400	Pass
			2DH5	2.892	31.600	109	315.228	<=400	Pass
8DPSK	SISO	HOPP	3DH1	0.392	31.600	320	125.440	<=400	Pass
			3DH3	1.650	31.600	156	257.400	<=400	Pass
			3DH5	2.906	31.600	103	299.318	<=400	Pass



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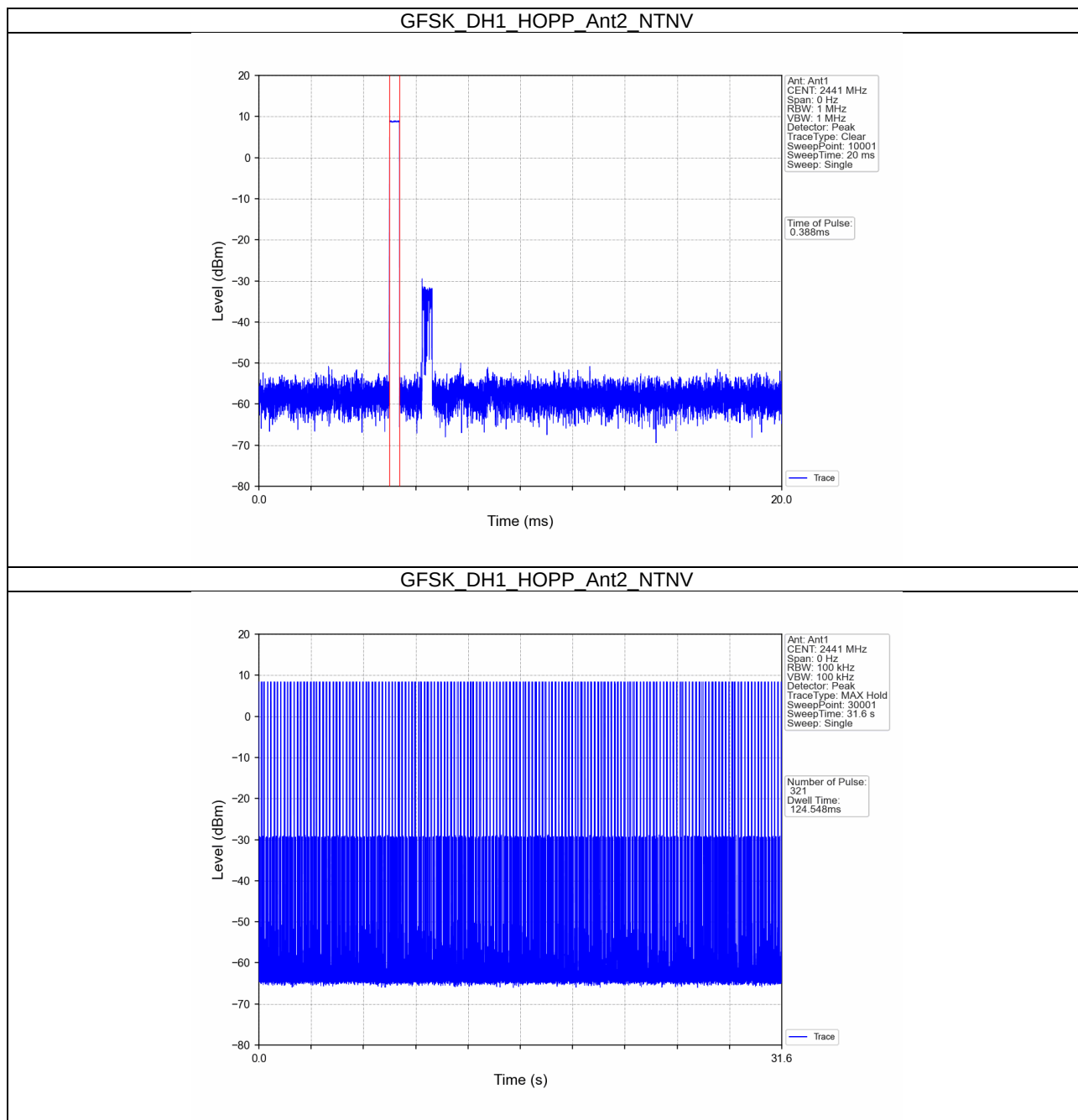
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Test Graphs

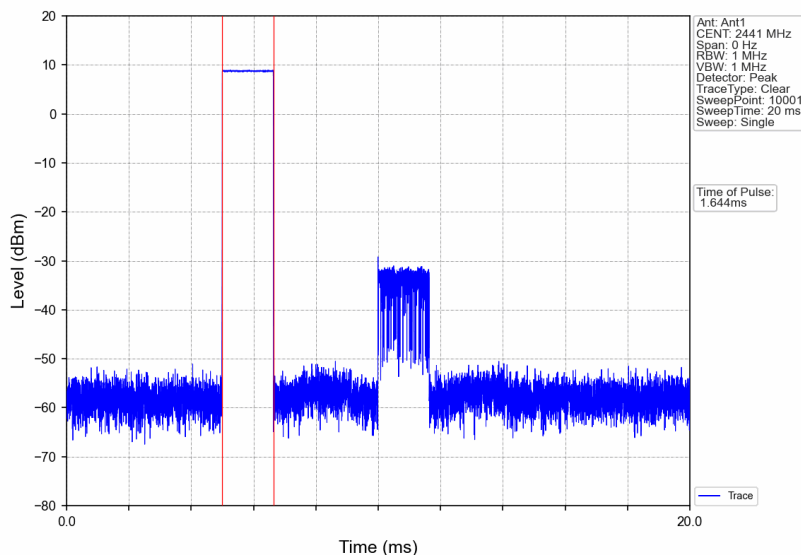


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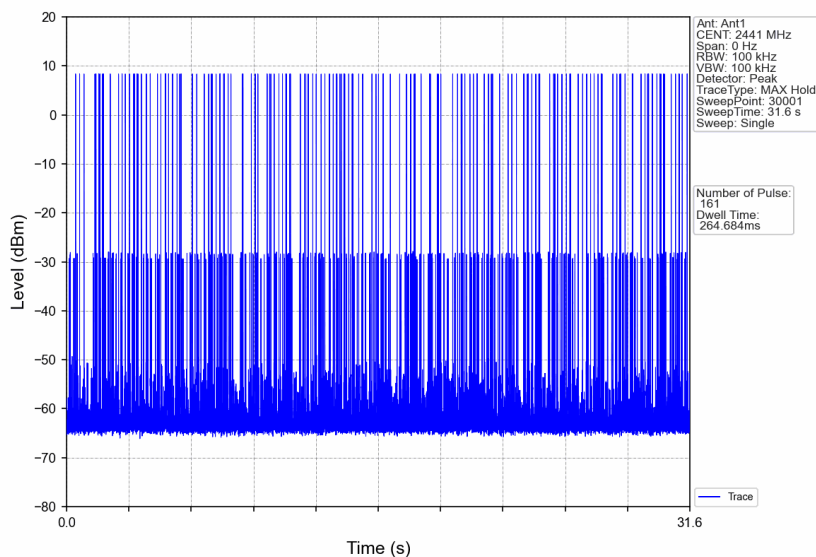
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GFSK DH3 HOPP Ant2 NTN



GFSK DH3 HOPP Ant2 NTN



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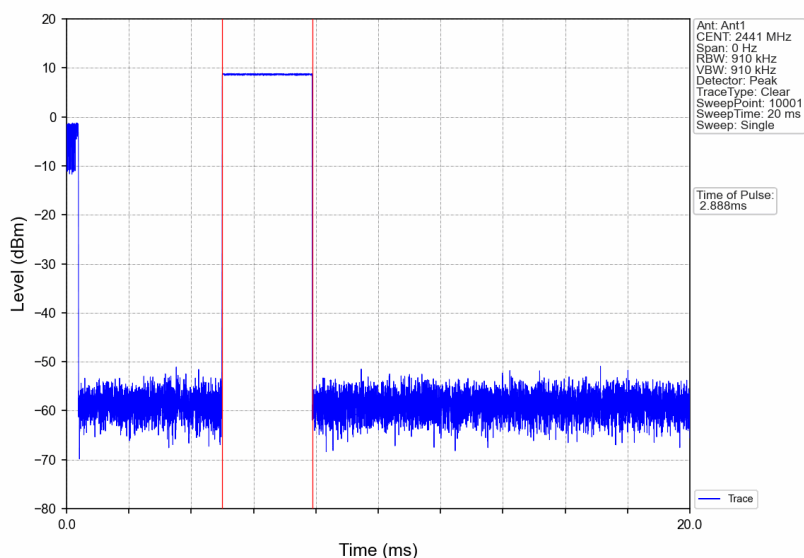
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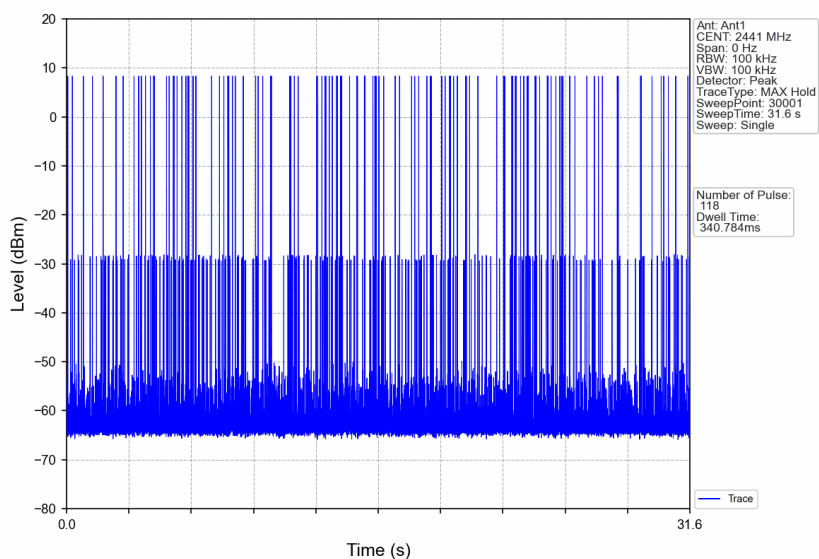
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GFSK DH5 HOPP Ant2 NTN



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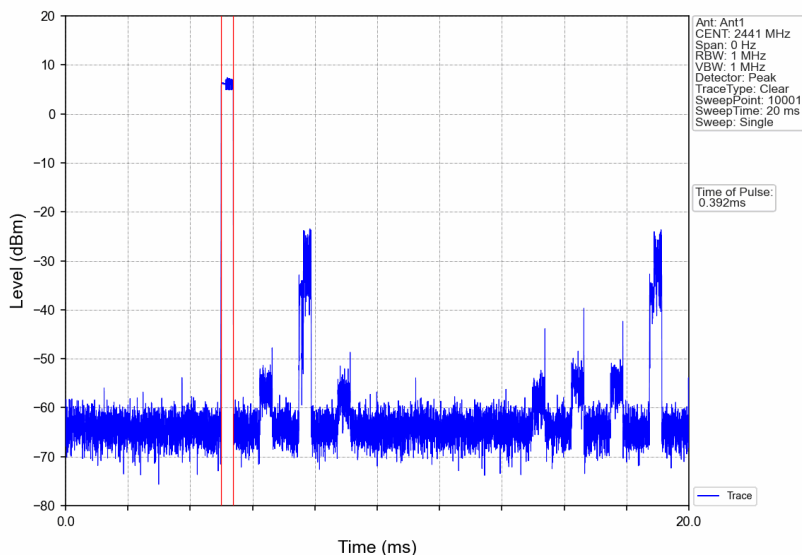
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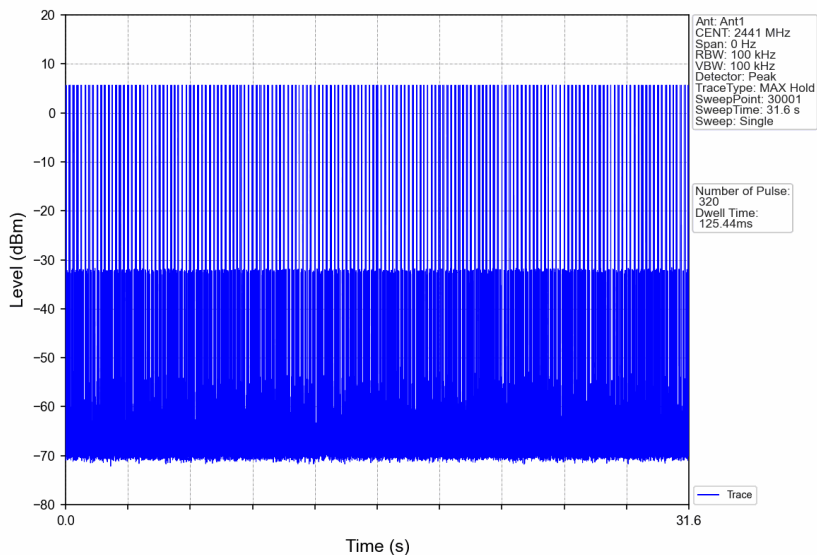
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Pi/4DQPSK_2DH1_HOPP_Ant2_NTNV



Pi/4DQPSK_2DH1_HOPP_Ant2_NTNV



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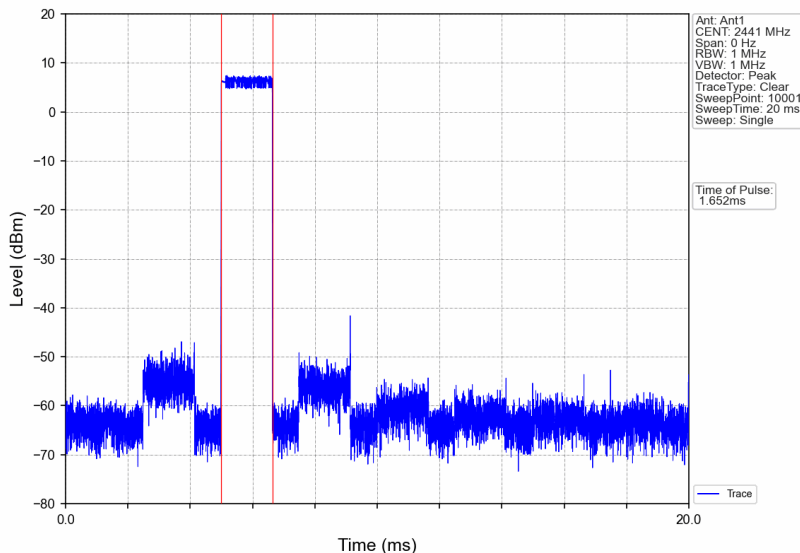
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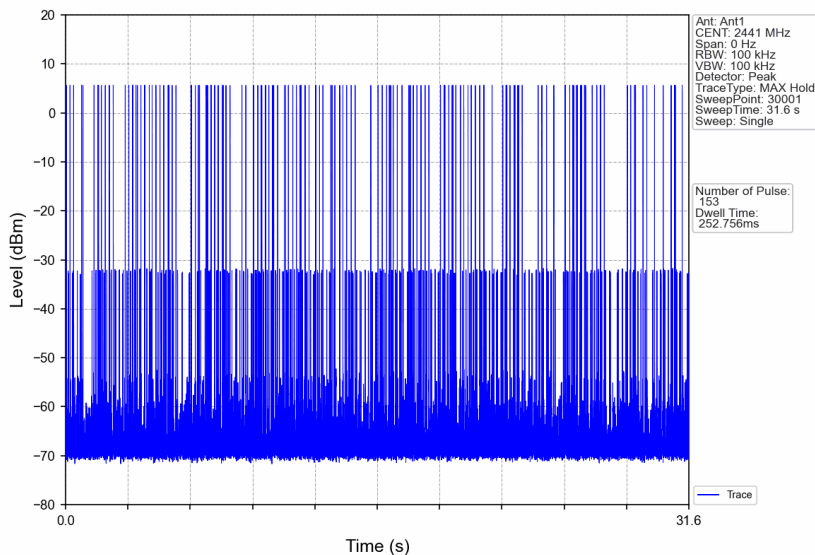
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Pi/4DQPSK_2DH3_HOPP_Ant2_NTNV



Pi/4DQPSK_2DH3_HOPP_Ant2_NTNV



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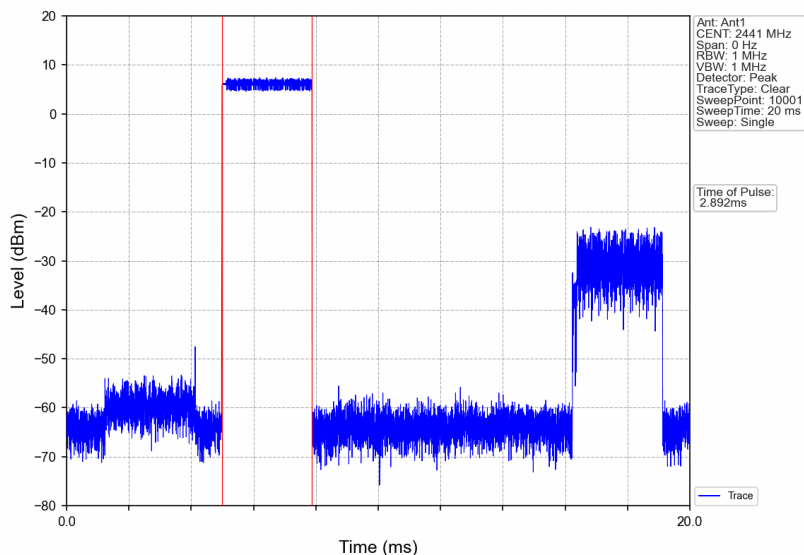
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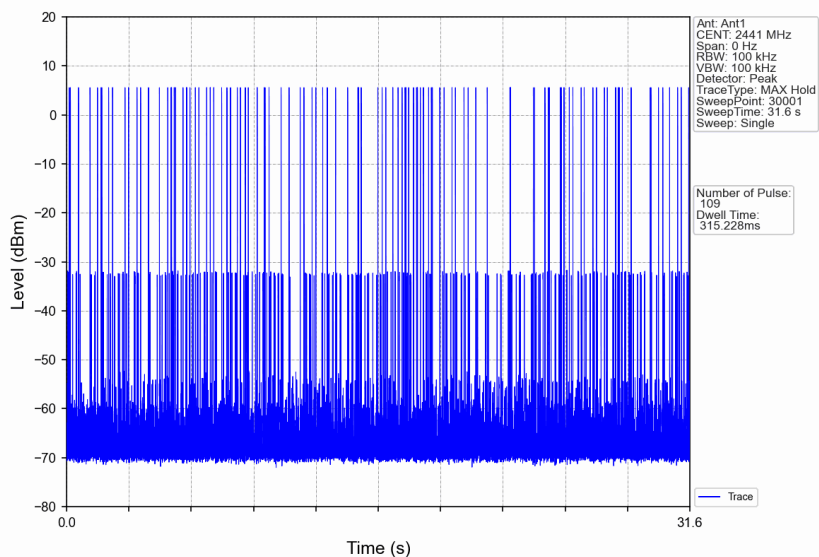
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Pi/4DQPSK_2DH5_HOPP_Ant2_NTNV



Pi/4DQPSK_2DH5_HOPP_Ant2_NTNV

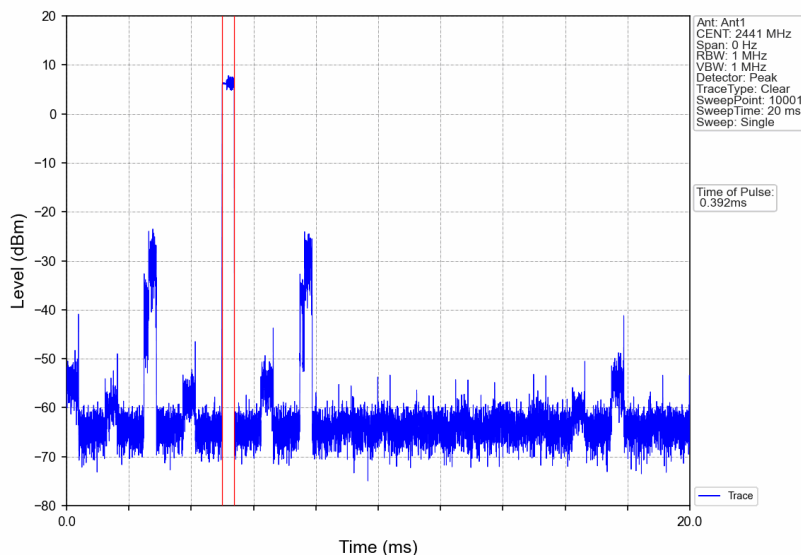


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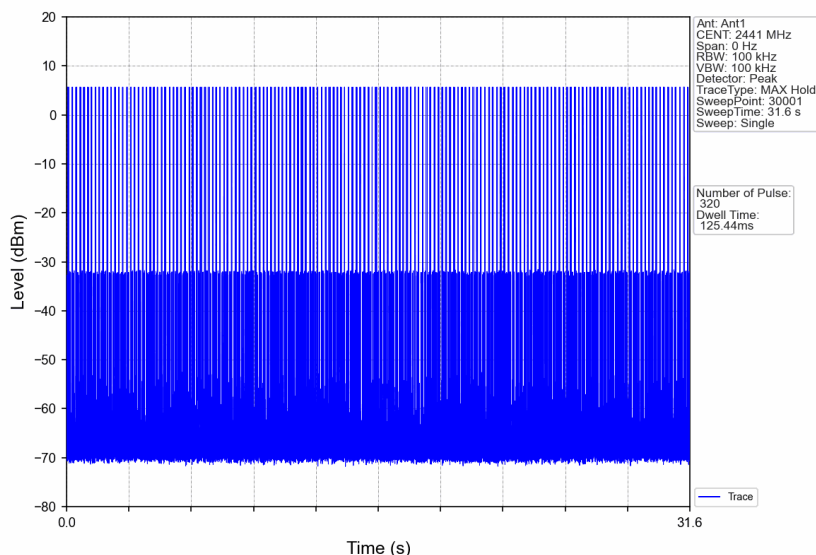
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8DPSK 3DH1 HOPP Ant2 NTN



8DPSK 3DH1 HOPP Ant2 NTN



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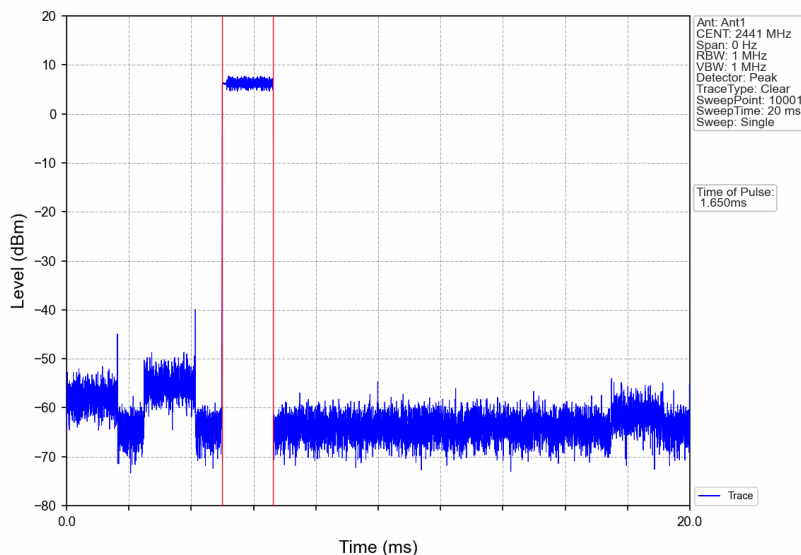
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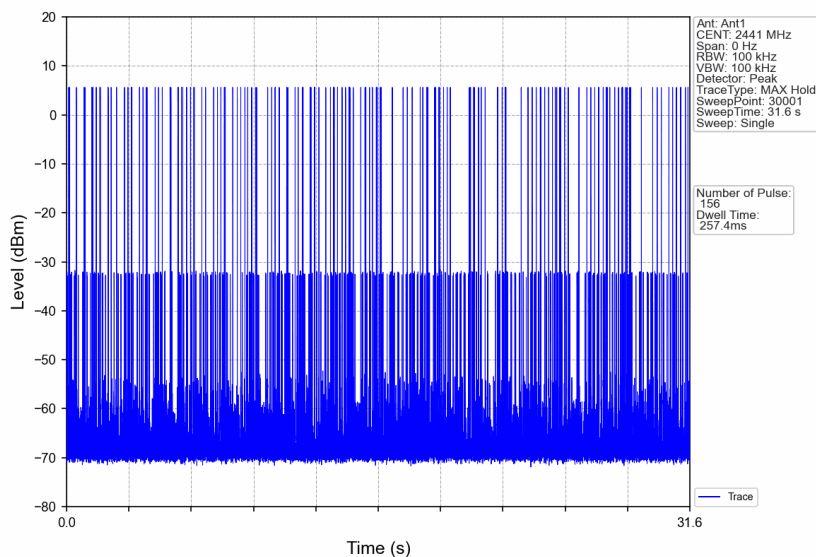
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8DPSK 3DH3 HOPP Ant2 NTN



8DPSK 3DH3 HOPP Ant2 NTN



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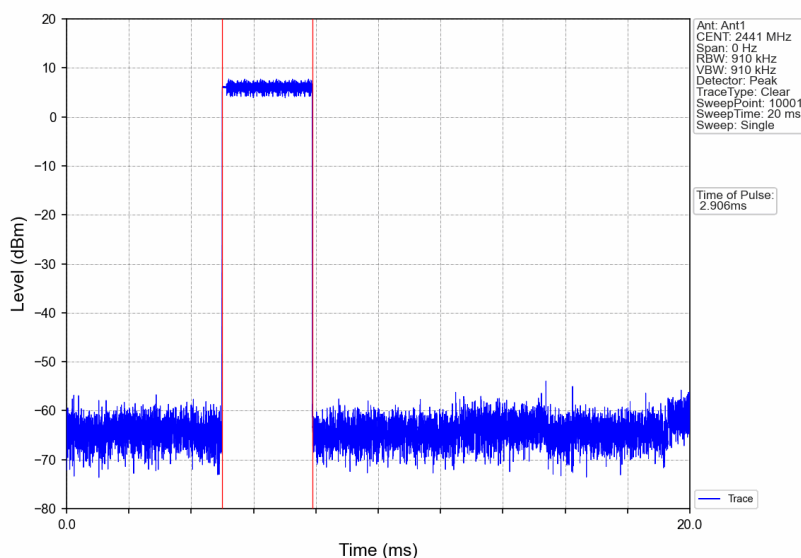
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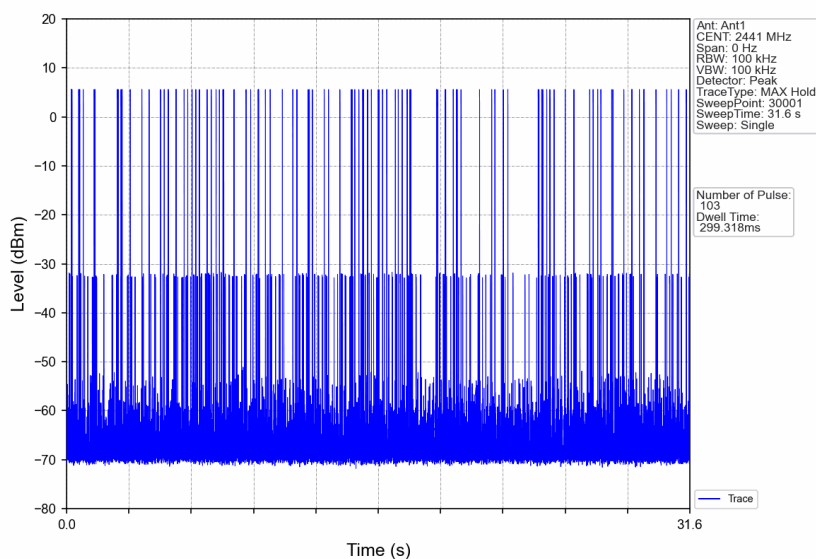
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8DPSK 3DH5 HOPP Ant2 NTN



8DPSK 3DH5 HOPP Ant2 NTN



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Unwanted Emissions In Non-restricted Frequency Bands Test Result

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	Level of Reference (dBm)
GFSK	SISO	2402	DH5	2	7.58
		2441	DH5	2	8.62
		2480	DH5	2	7.64
Pi/4DQPSK	SISO	2402	2DH5	2	4.84
		2441	2DH5	2	5.96
		2480	2DH5	2	5.06
8DPSK	SISO	2402	3DH5	2	5.04
		2441	3DH5	2	6.12
		2480	3DH5	2	5.13

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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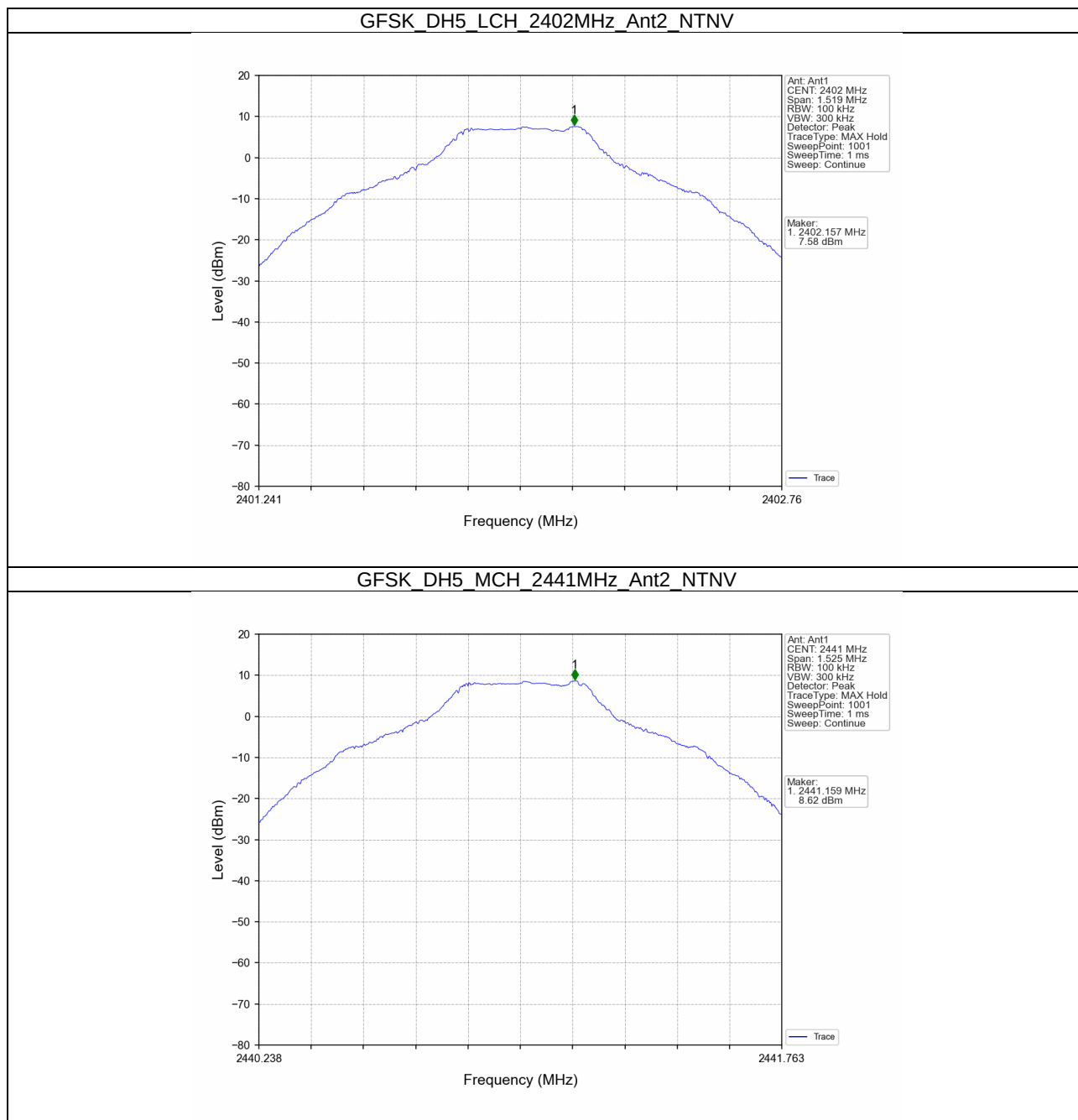
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Test Graphs



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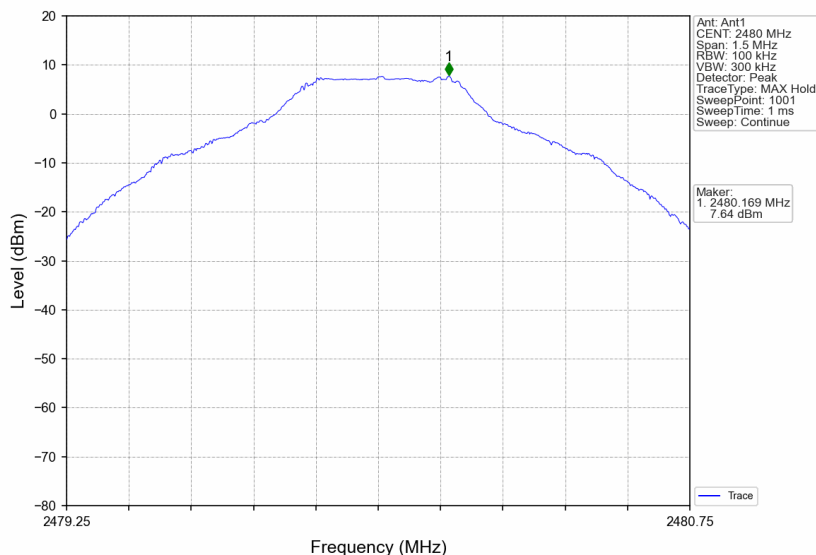
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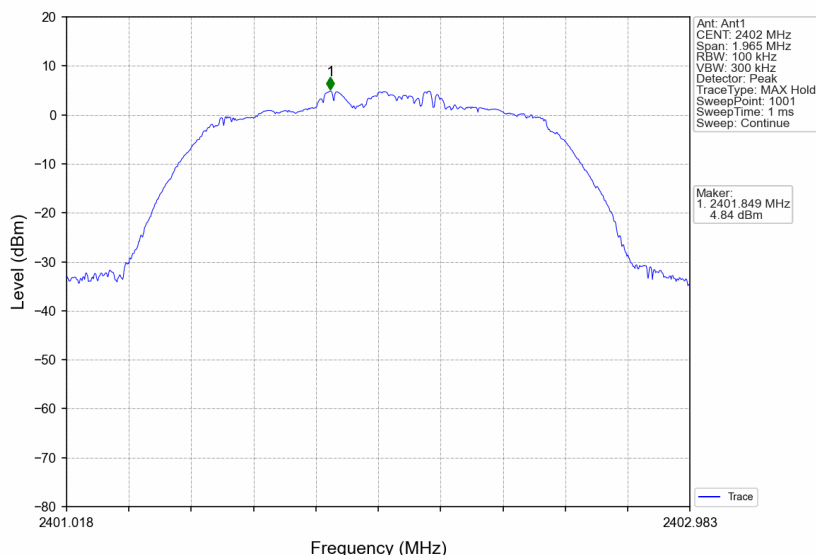
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GFSK DH5 HCH 2480MHz Ant2 NTN



Pi/4DQPSK_2DH5_LCH_2402MHz_Ant2_NTN



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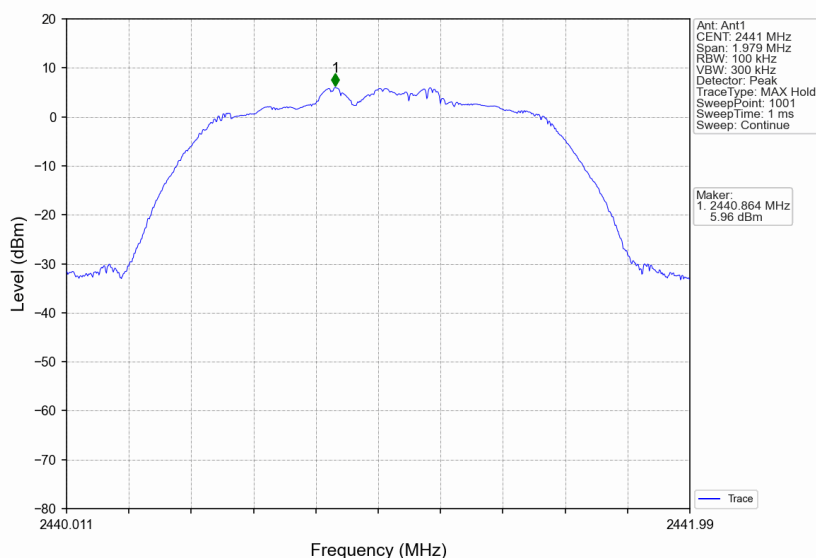
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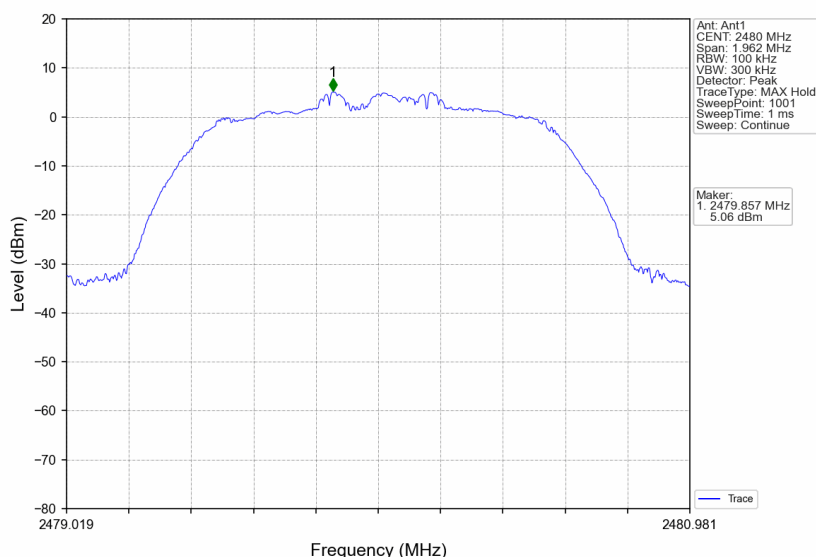
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Pi/4DQPSK 2DH5 MCH 2441MHz Ant2 NTV



Pi/4DQPSK 2DH5 HCH 2480MHz Ant2 NTV



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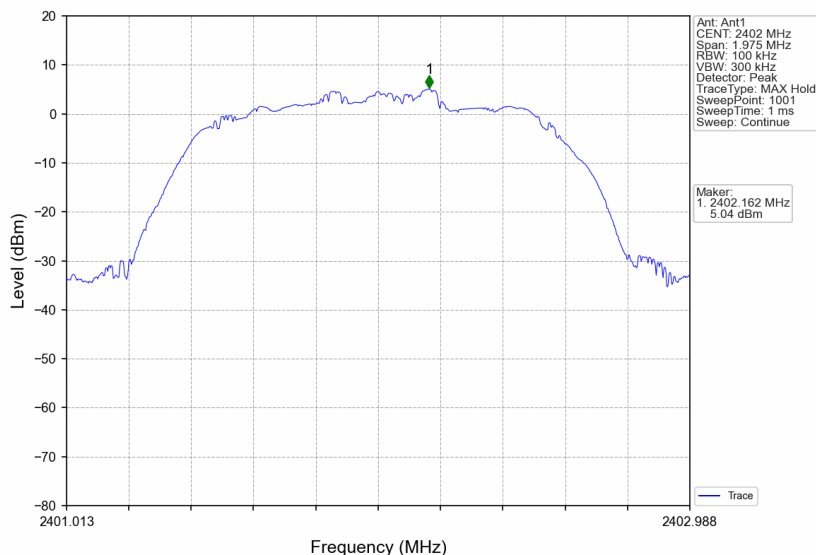
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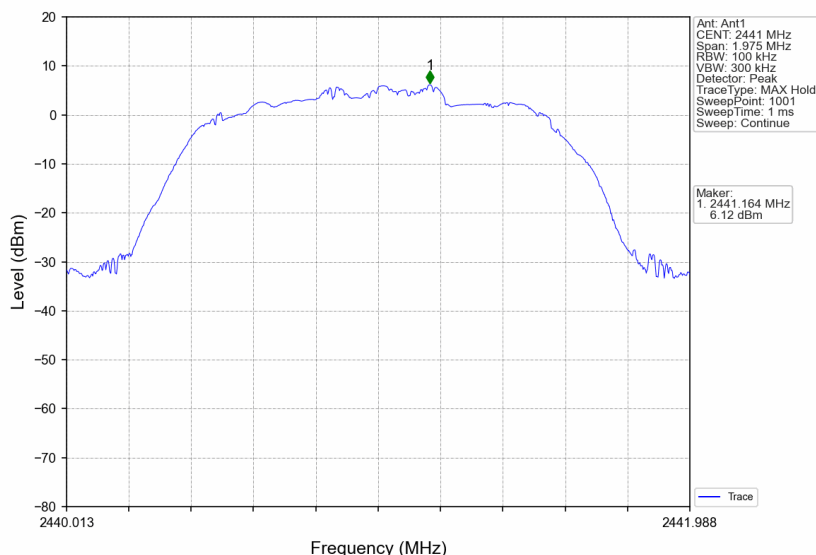
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8DPSK 3DH5 LCH 2402MHz Ant2 NTN



8DPSK 3DH5 MCH 2441MHz Ant2 NTN



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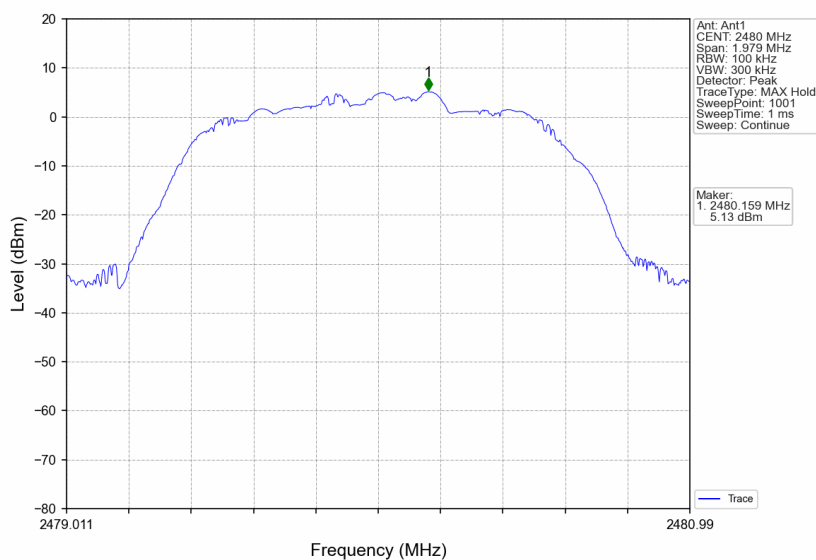
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8DPSK 3DH5 HCH 2480MHz Ant2 NTN



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Conducted Spurious Emission Test Result

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
GFSK	SISO	2402	DH5	2	8.62	-11.38	Pass
		2441	DH5	2	8.62	-11.38	Pass
		2480	DH5	2	8.62	-11.38	Pass
		HOPP	DH5	2	8.62	-11.38	Pass
					8.62	-11.38	Pass
Pi/4DQPSK	SISO	2402	2DH5	2	5.96	-14.04	Pass
		2441	2DH5	2	5.96	-14.04	Pass
		2480	2DH5	2	5.96	-14.04	Pass
		HOPP	2DH5	2	5.96	-14.04	Pass
					5.96	-14.04	Pass
8DPSK	SISO	2402	3DH5	2	6.12	-13.88	Pass
		2441	3DH5	2	6.12	-13.88	Pass
		2480	3DH5	2	6.12	-13.88	Pass
		HOPP	3DH5	2	6.12	-13.88	Pass
					6.12	-13.88	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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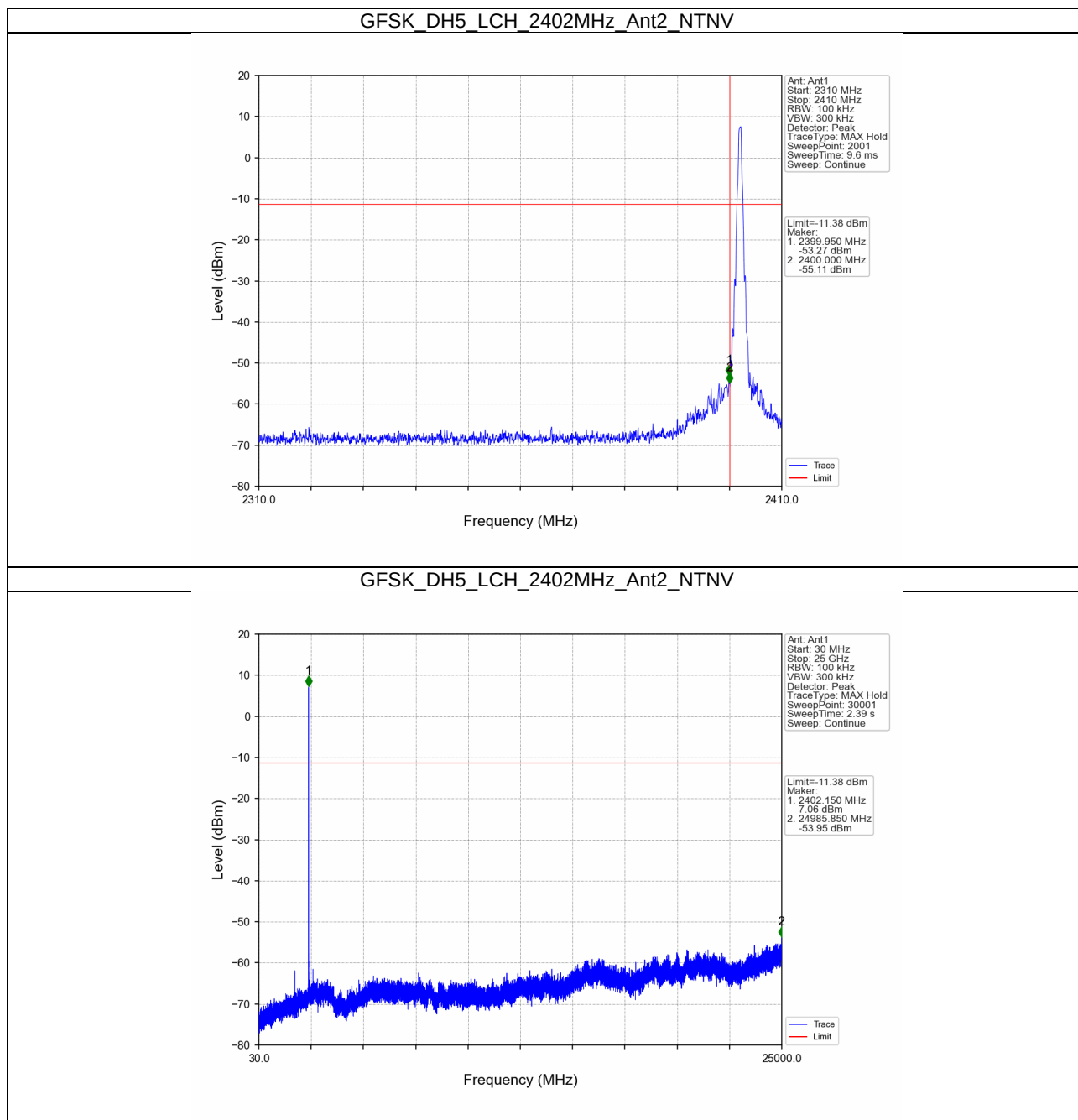
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Test Graphs

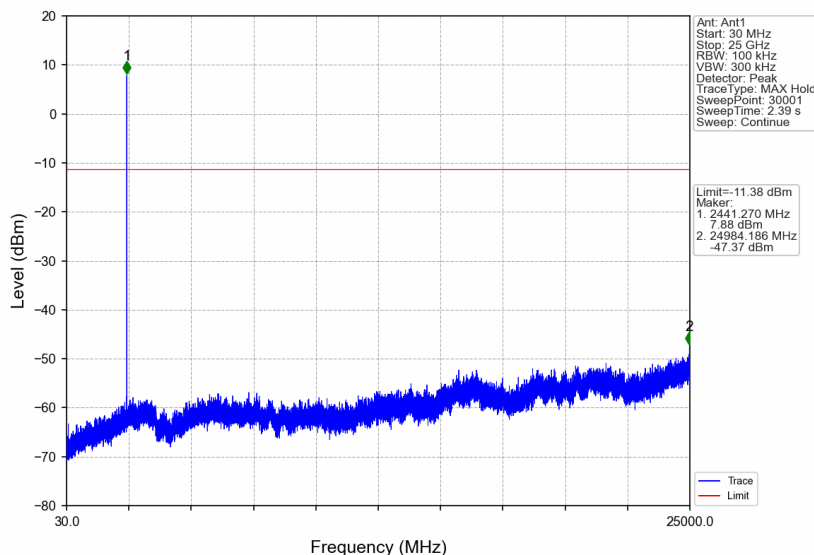


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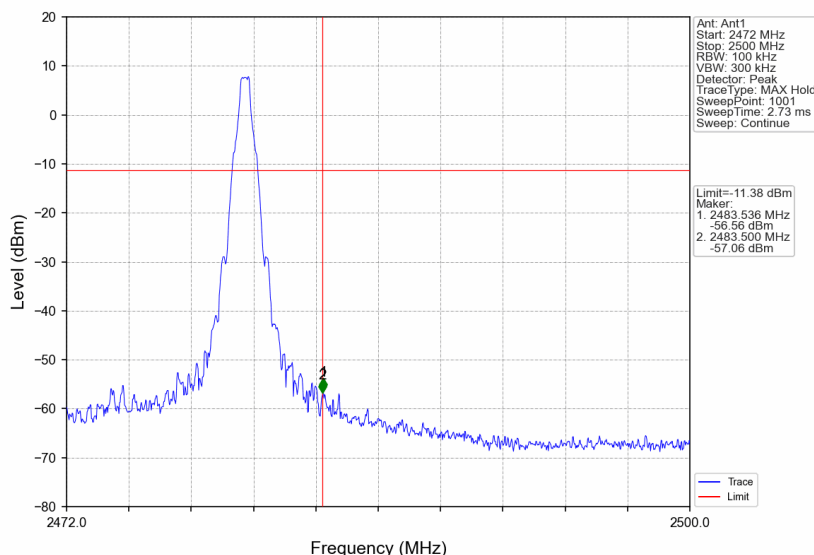
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GFSK DH5 MCH 2441MHz Ant2 NTN



GFSK DH5 HCH 2480MHz Ant2 NTN



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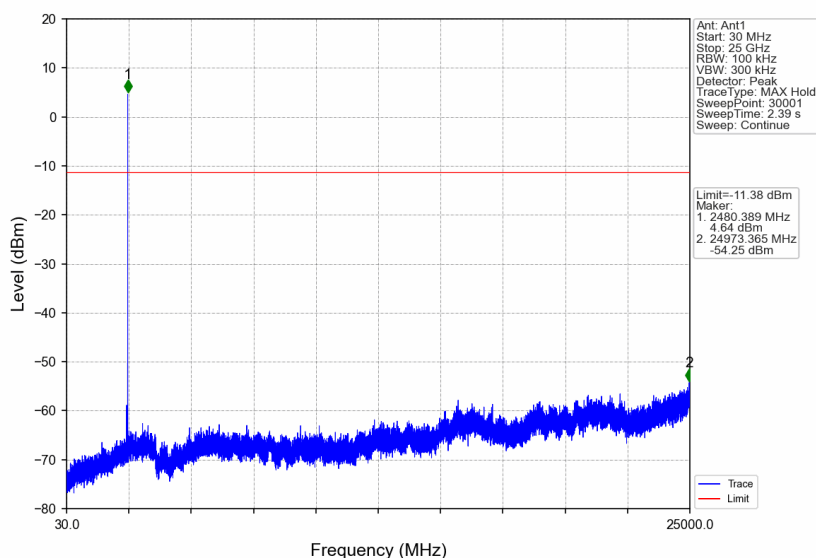
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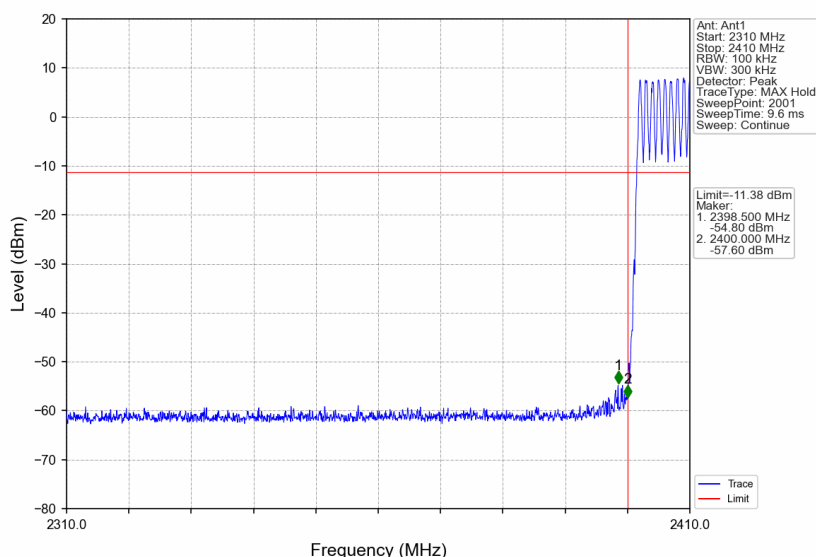
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GFSK DH5 HCH 2480MHz Ant2 NTN



GFSK DH5 HOPP Ant2 NTN



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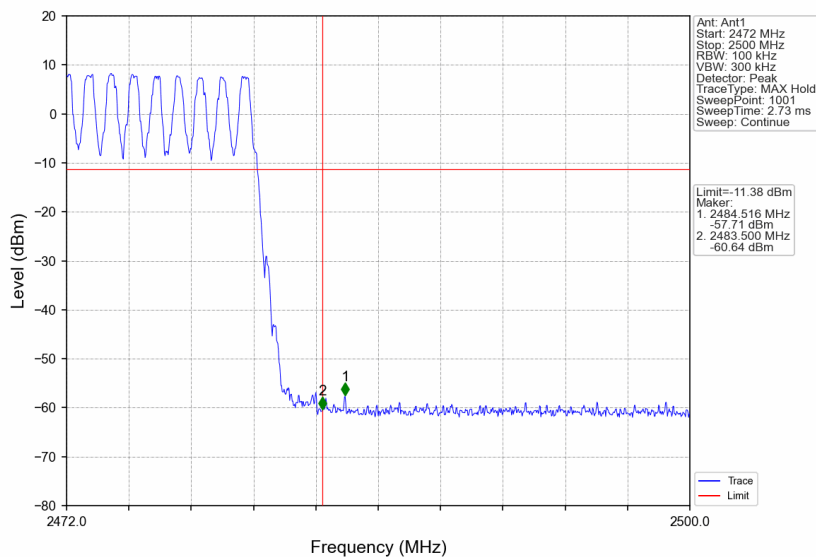
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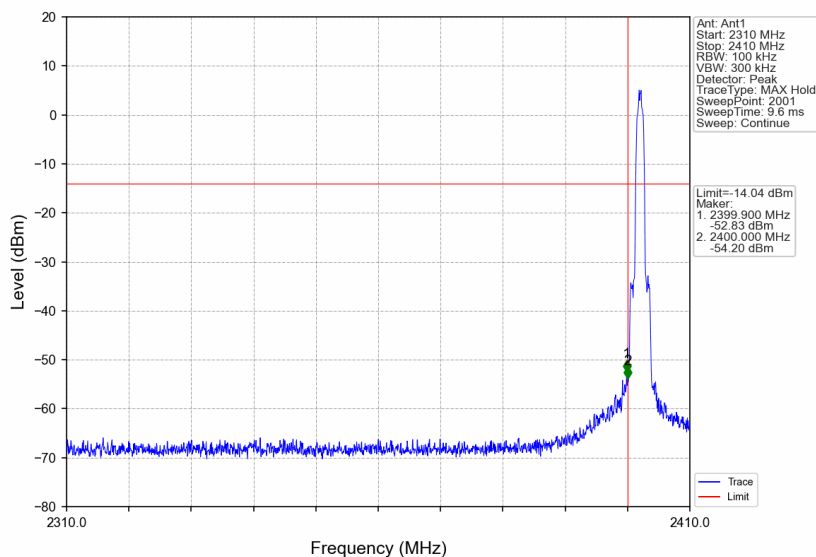
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GFSK DH5 HOPP Ant2 NTN



Pi/4DQPSK_2DH5_LCH_2402MHz_Ant2_NTN



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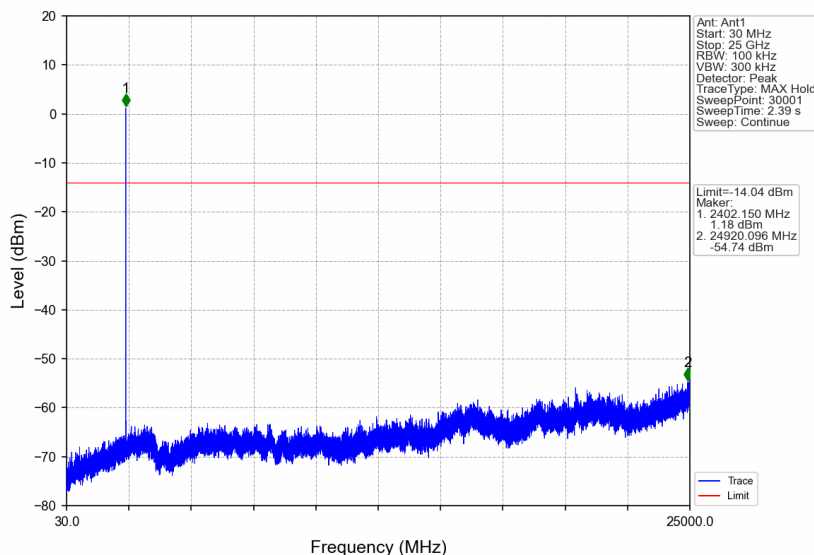
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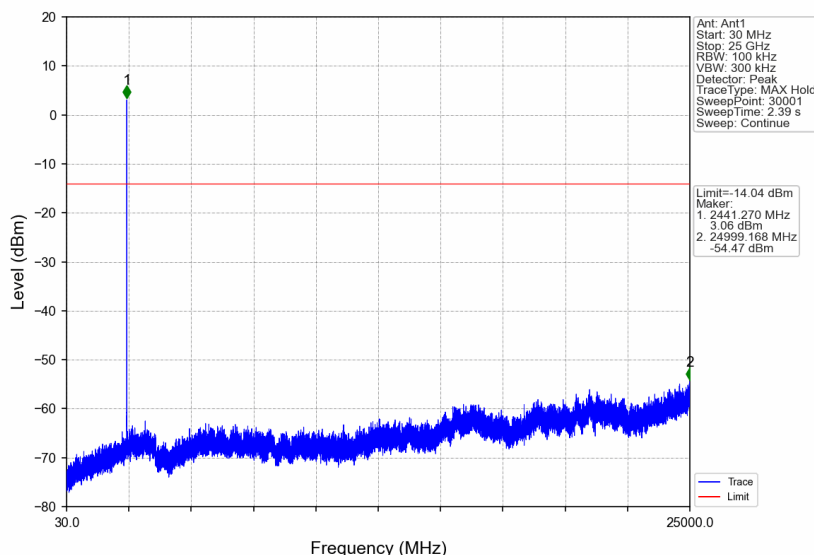
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Pi/4DQPSK 2DH5 LCH 2402MHz Ant2 NTN



Pi/4DQPSK 2DH5 MCH 2441MHz Ant2 NTN



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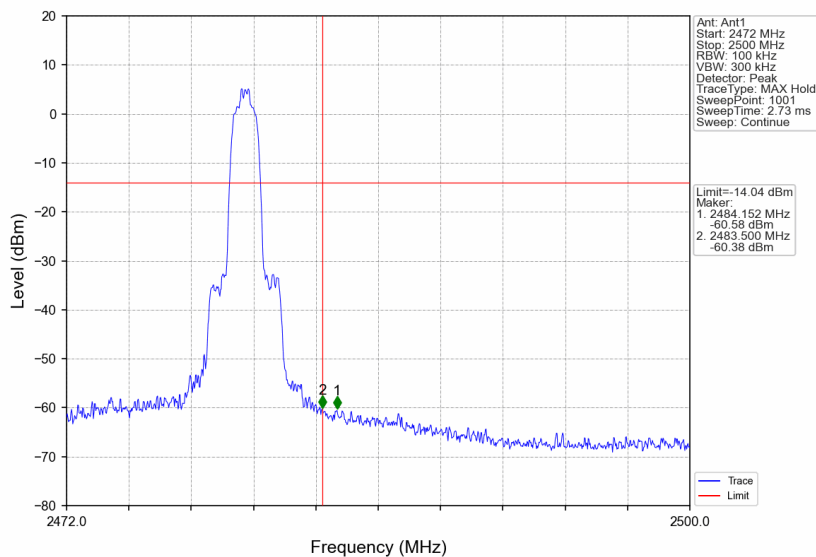
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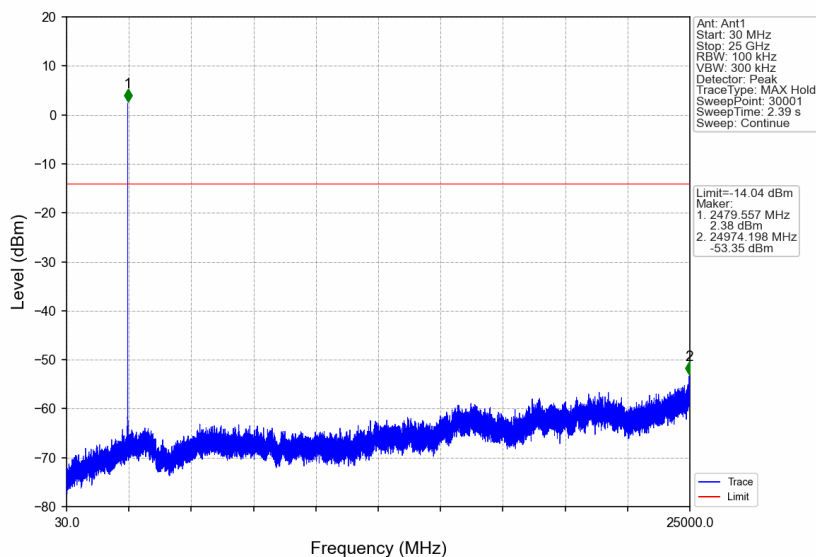
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Pi/4DQPSK 2DH5 HCH 2480MHz Ant2 NTV



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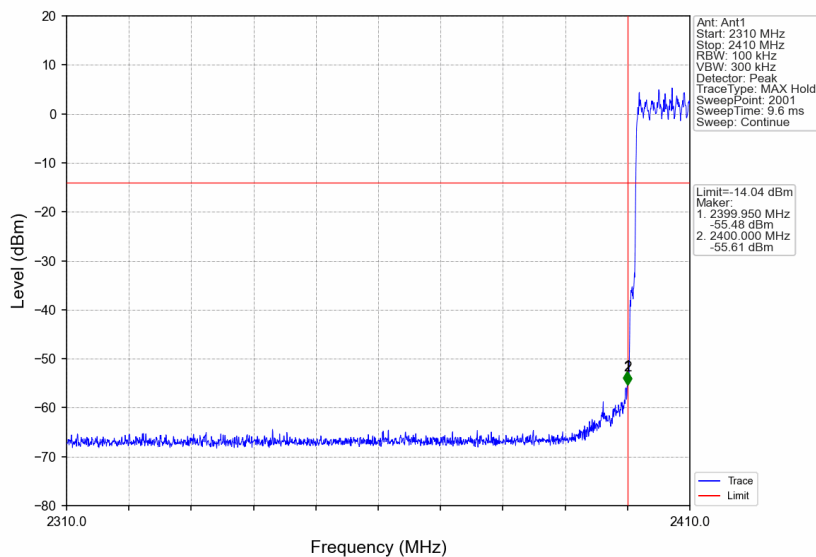
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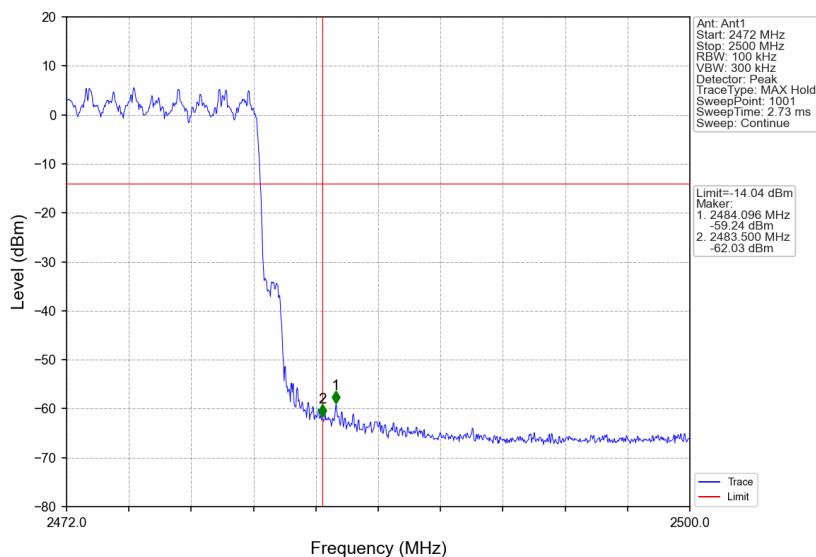
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Pi/4DQPSK_2DH5_HOPP_Ant2_NTNV



Pi/4DQPSK_2DH5_HOPP_Ant2_NTNV



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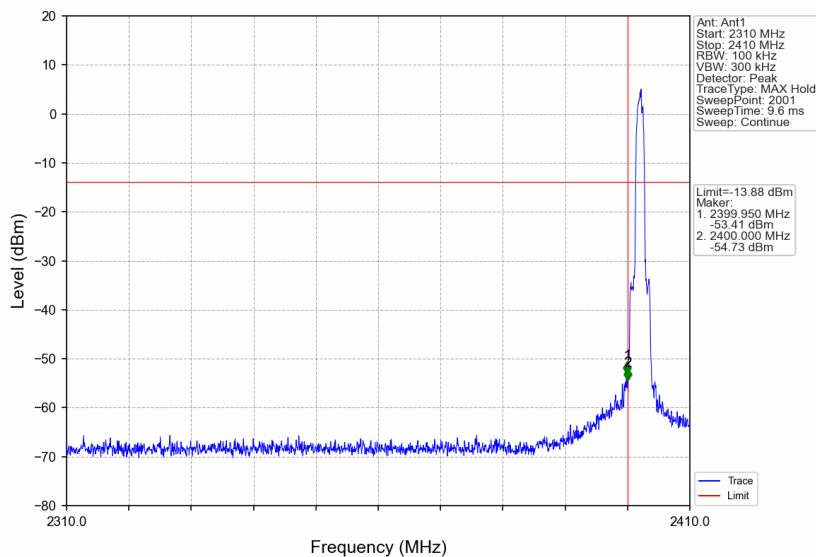
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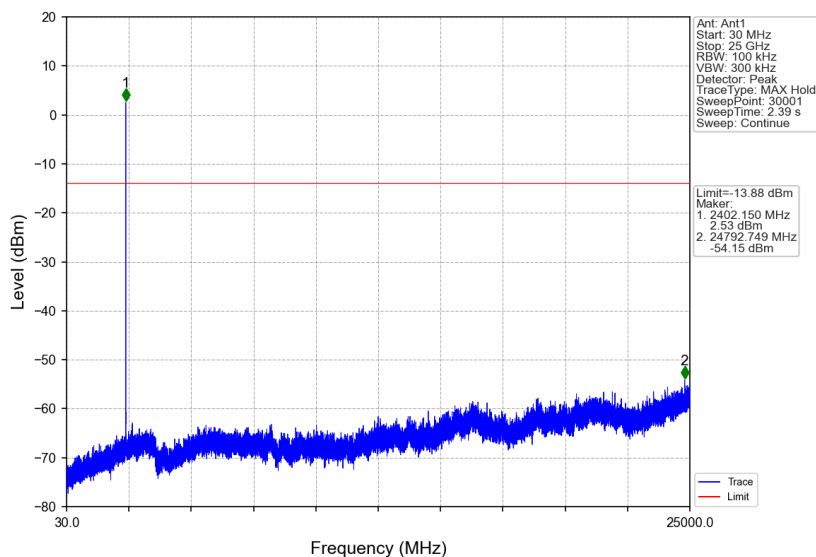
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8DPSK 3DH5 LCH 2402MHz Ant2 NTN



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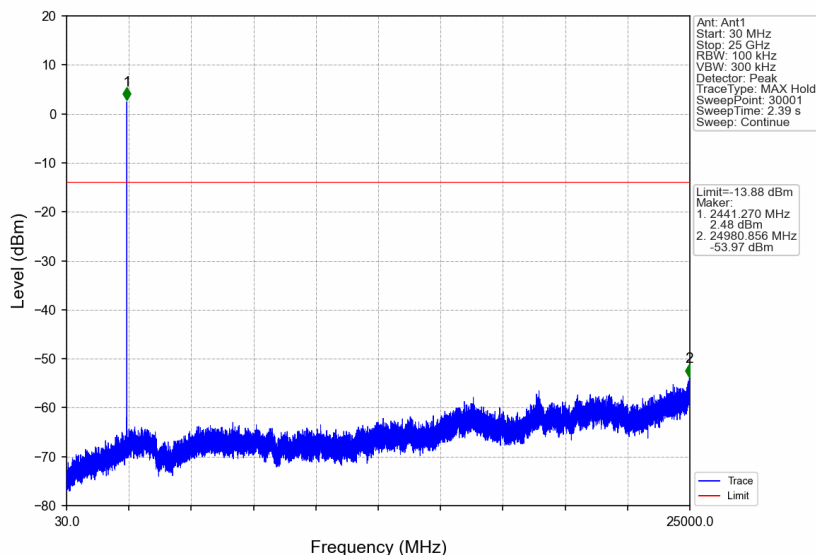
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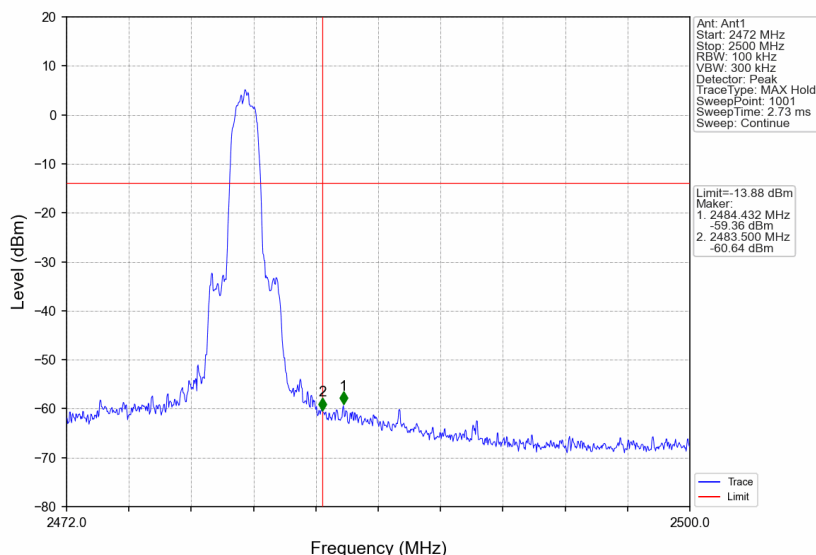
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8DPSK 3DH5 MCH 2441MHz Ant2 NTN



8DPSK 3DH5 HCH 2480MHz Ant2 NTN



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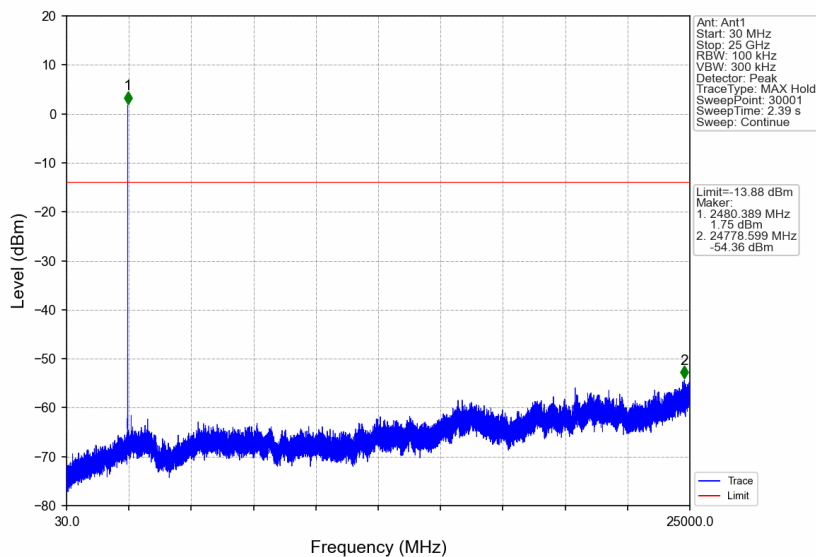
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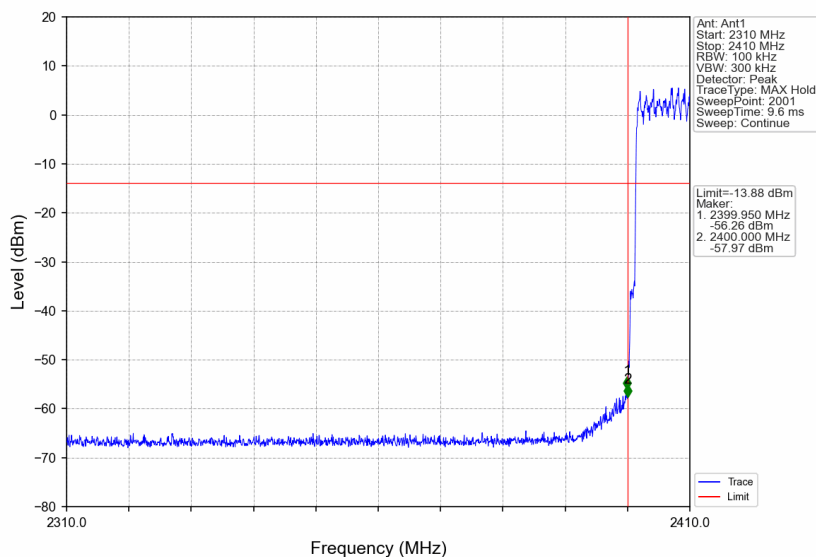
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8DPSK 3DH5 HCH 2480MHz Ant2 NTN



8DPSK 3DH5 HOPP Ant2 NTN



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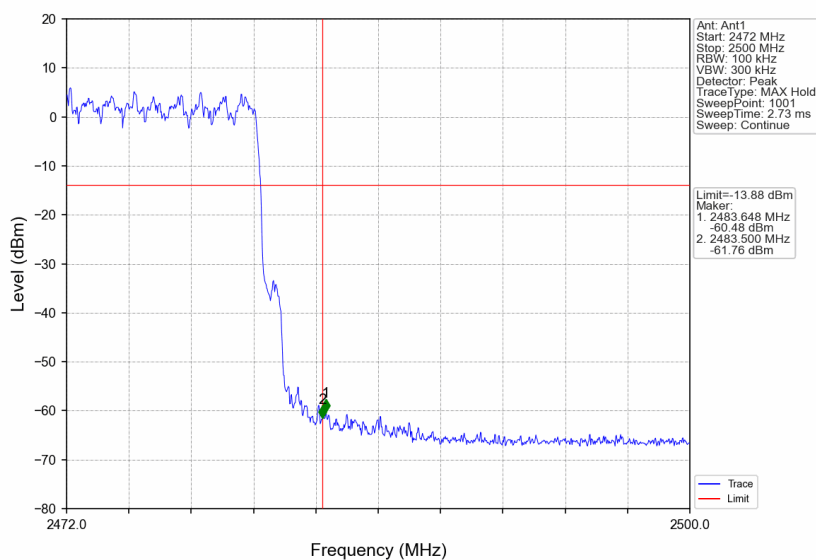
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8DPSK 3DH5 HOPP Ant2 NTN



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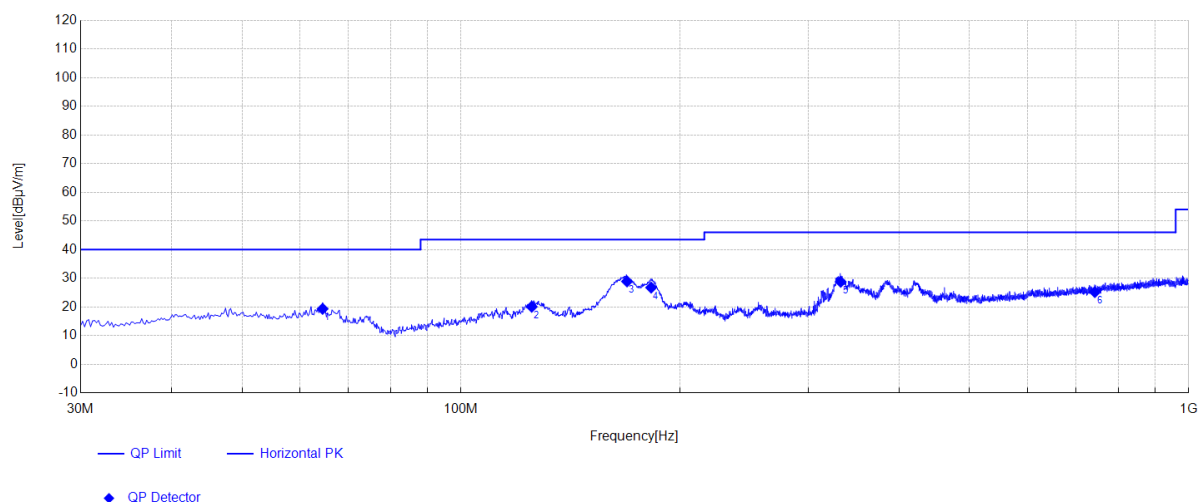
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Radiated Spurious Emissions

Radiated emission below 1GHz

Worst case Mode: GFSK_Channel 78

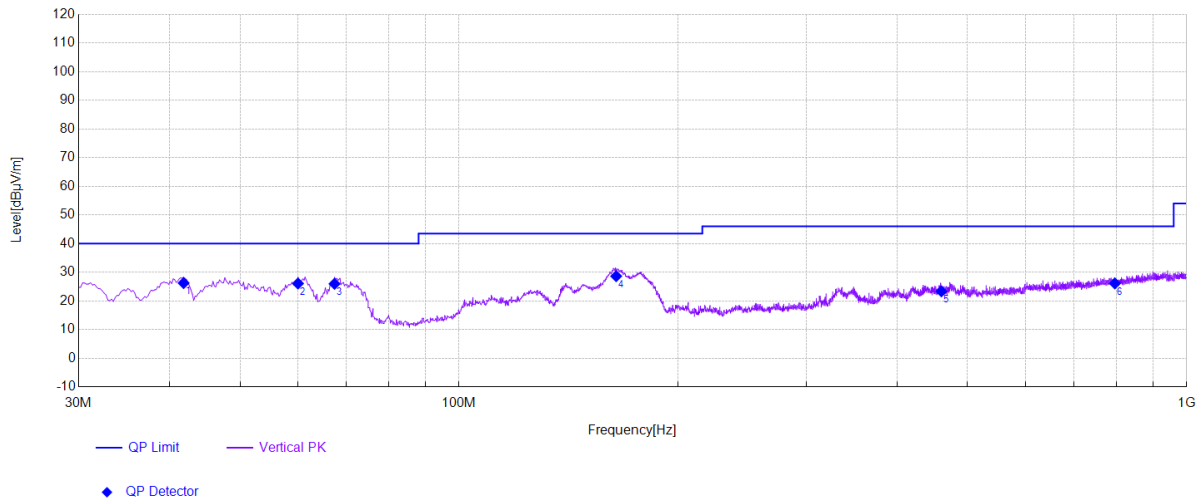


Data List								
NO.	Freq. [MHz]	AF[dB/m]	Factor [dB]	QP Reading[dBμV]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Polarity
1	64.5389	12.10	-27.04	34.26	19.32	40.00	20.68	Horizontal
2	125.079	8.72	-26.75	38.08	20.05	43.50	23.45	Horizontal
3	169.1258	8.86	-26.20	46.23	28.89	43.50	14.61	Horizontal
4	182.5145	9.25	-26.28	43.76	26.73	43.50	16.77	Horizontal
5	332.5065	14.15	-25.52	40.12	28.75	46.00	17.25	Horizontal
6	743.0926	20.01	-23.31	28.46	25.16	46.00	20.84	Horizontal

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Data List								
NO.	Freq. [MHz]	AF[dB/m]	Factor [dB]	QP Reading[dBμV]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Polarity
1	41.8364	13.48	-27.64	40.39	26.23	40.00	13.77	Vertical
2	60.076	12.39	-27.25	40.93	26.07	40.00	13.93	Vertical
3	67.4495	10.61	-26.91	42.26	25.96	40.00	14.04	Vertical
4	164.4689	8.59	-26.28	46.32	28.63	43.50	14.87	Vertical
5	460.184	16.11	-24.81	32.02	23.32	46.00	22.68	Vertical
6	796.8414	20.54	-23.25	28.8	26.09	46.00	19.91	Vertical

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier gain. The basic equation with a sample calculation is as follows:

Value = Reading(dBμV) + AF(dB/m) + Factor(dB):

AF = Antenna Factor(dB/m)

Factor = Cable Factor(dB) - Preamplifier gain(dB)

Margin = Limit(dBμV/m) – Value(dBμV/m)

- 2) All channels have been tested, but only the worst case data displayed in this report.



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Transmitter emission Above 1GHz

Duty cycle

Agilent Spectrum Analyzer - Swept SA

Center Freq 2.402000000 GHz

Ref Offset 9.76 dB
Ref 15.00 dBm

Trig Delay 2.000 ms
Trig: Video
IF Gain: Low
#Atten: 20 dB

ΔMkr3 3.750 ms
0.04 dB

Center 2.402000000 GHz
Res BW 8 MHz
#VBW 8.0 MHz
Sweep 7.000 ms (1001 pts)
Span 0 Hz

MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	t	1.980 ms	8.75 dBm			
2	Δ1	1	t (Δ)	2.980 ms (Δ)	-51.94 dB			
3	Δ1	1	t (Δ)	3.750 ms (Δ)	0.04 dB			
4								
5								
6								
7								
8								
9								
10								
11								

Frequency

Auto Tune

Center Freq
2.402000000 GHz

Start Freq
2.402000000 GHz

Stop Freq
2.402000000 GHz

CF Step
8.000000 MHz
Man

Freq Offset
0 Hz

MSG

STATUS

On time (Number on)

Agilent Spectrum Analyzer - Swept SA

Sweep Time 100.0 ms

Ref Offset 9.76 dB
Ref 19.76 dBm

Trig: Free Run
IF Gain: Low
#Atten: 20 dB

Center 2.402000000 GHz
Res BW 8 MHz
#VBW 8.0 MHz
Sweep 100.0 ms (1001 pts)
Span 0 Hz

Sweep/Control

Sweep Time
100.0 ms

Sweep Setup

Gate
[OFF, LO]

Points
1001

MSG

STATUS

Note:

$$\text{Duty cycle} = \text{on time} / 100\text{ms} = 2 * 2.89 / 100 = 5.78\%$$

Duty cycle Correction factor = $20 \cdot \log(\text{Duty cycle}) = -24.76\text{dB}$



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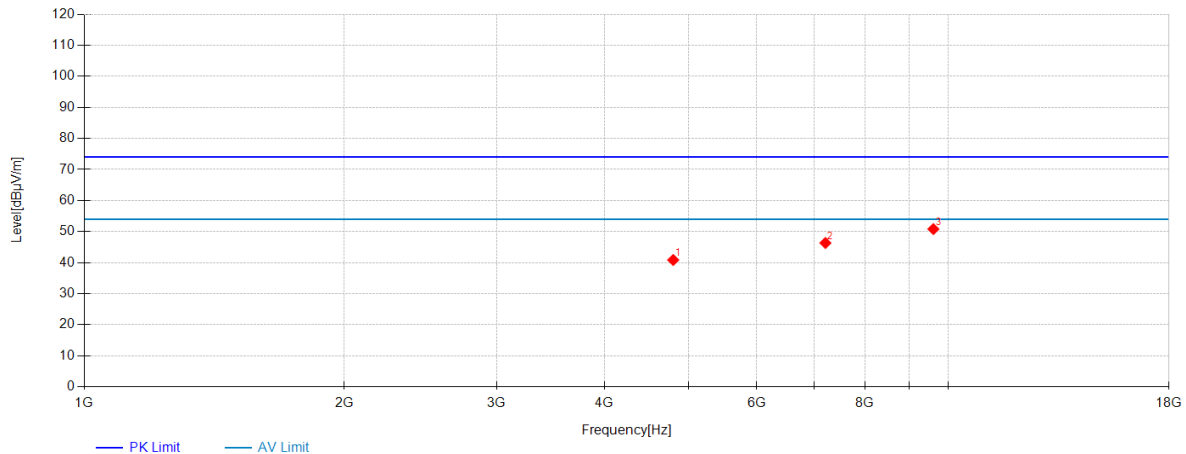
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GFSK_Channel 0



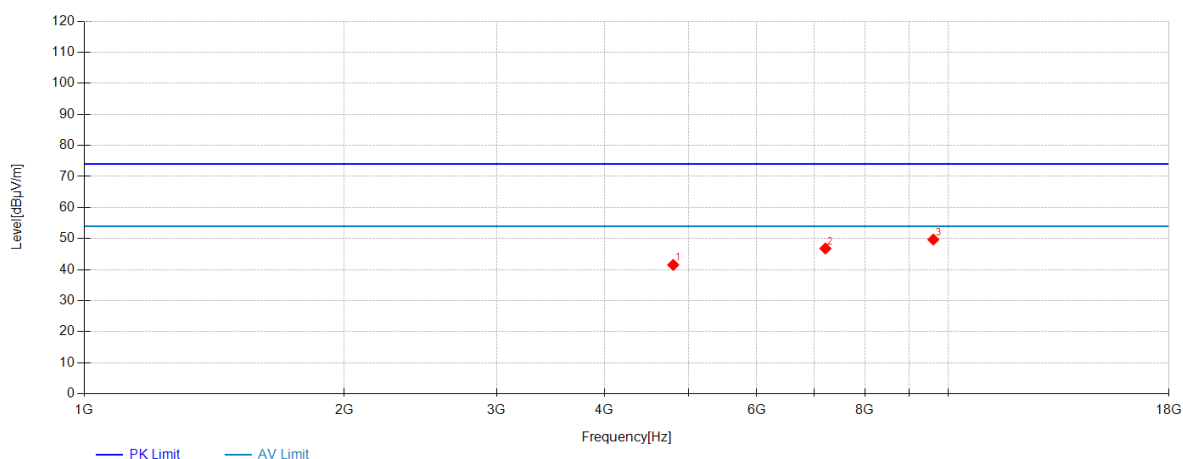
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1	4804	53.03	30.78	-42.95	40.86	74.00	33.14	Horizontal
	4804	-	-	-	16.10	54.00	37.90	-
2	7206	48.48	36.56	-38.71	46.33	74.00	27.67	Horizontal
	7206	-	-	-	21.57	54.00	32.43	-
3	9608	48.66	37.85	-35.70	50.81	74.00	23.19	Horizontal
	9608	-	-	-	26.05	54.00	27.95	-

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GFSK_Channel 0



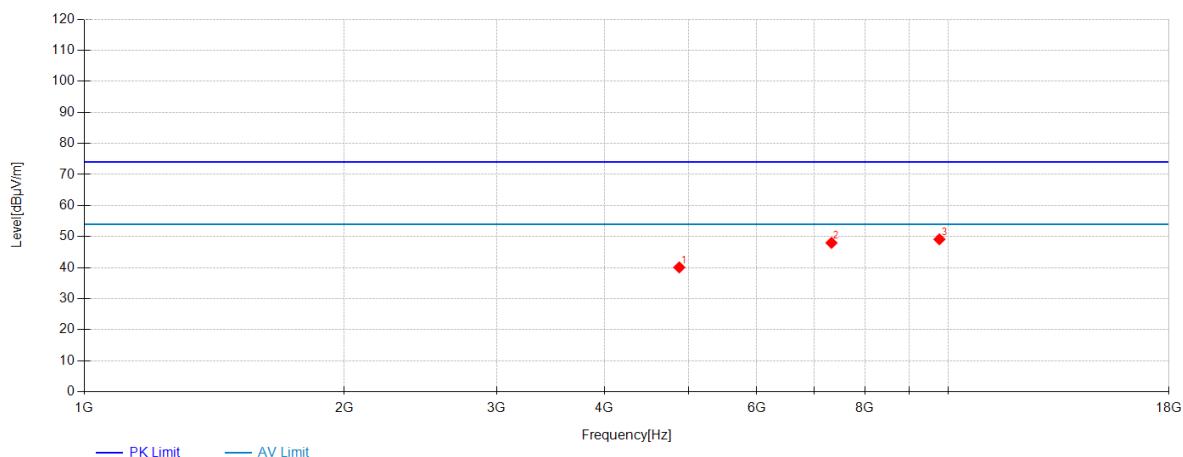
Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	4804	53.70	30.78	-42.95	41.53	74.00	32.47	Vertical
	4804	-	-	-	16.77	54.00	37.23	-
2	7206	48.96	36.56	-38.71	46.81	74.00	27.19	Vertical
	7206	-	-	-	22.05	54.00	31.95	-
3	9608	47.54	37.85	-35.70	49.69	74.00	24.31	Vertical
	9608	-	-	-	24.93	54.00	29.07	-

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GFSK_Channel 39



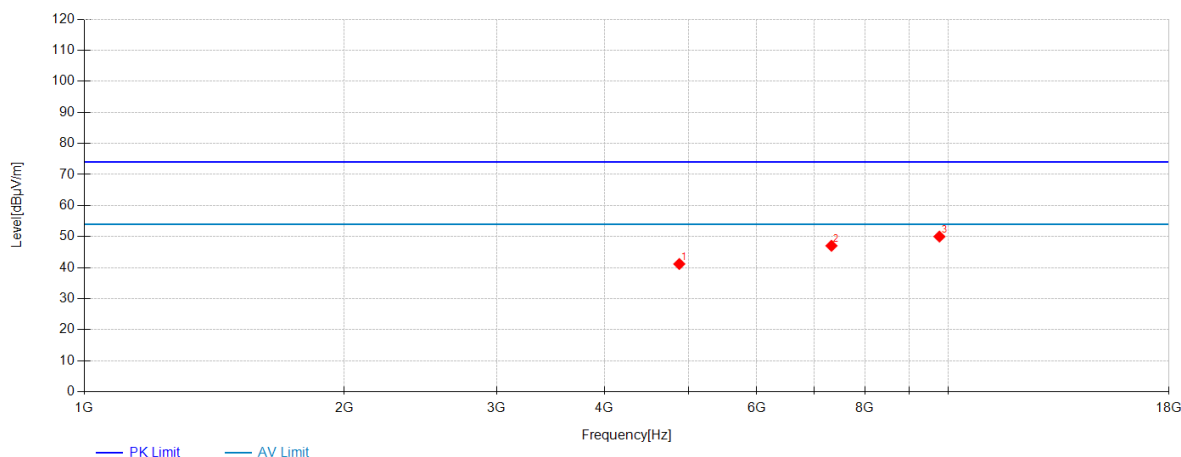
Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	4882	52.19	30.79	-42.89	40.09	74.00	33.91	Horizontal
	4882	-	-	-	15.33	54.00	38.67	-
2	7323	50.27	36.45	-38.74	47.98	74.00	26.02	Horizontal
	7323	-	-	-	13.22	54.00	30.78	-
3	9764	46.72	38.36	-35.95	49.13	74.00	24.87	Horizontal
	9764	-	-	-	24.37	54.00	29.63	-

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GFSK_Channel 39



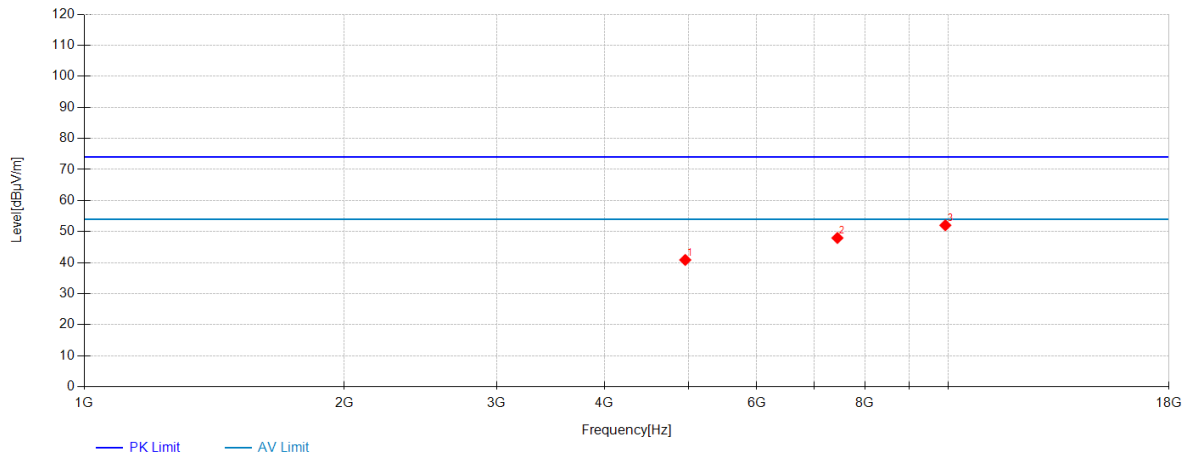
Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	4882	53.29	30.79	-42.89	41.19	74.00	32.81	Vertical
	4882	-	-	-	16.43	54.00	37.57	-
2	7323	49.34	36.45	-38.74	47.05	74.00	26.95	Vertical
	7323	-	-	-	22.29	54.00	31.71	-
3	9764	47.60	38.36	-35.95	50.01	74.00	23.99	Vertical
	9764	-	-	-	25.25	54.00	28.75	-

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GFSK_Channel 78



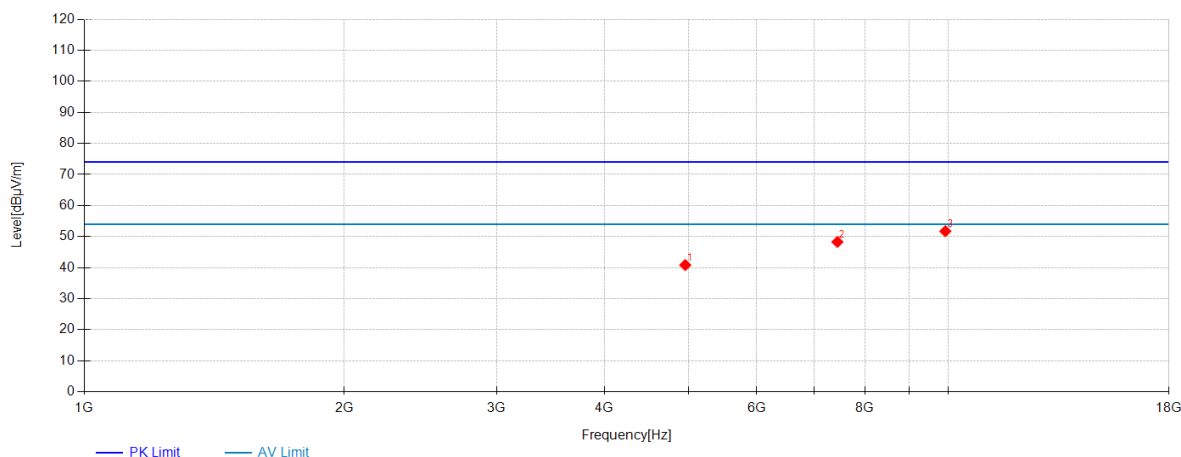
Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	4960	52.61	31.04	-42.78	40.87	74.00	33.13	Horizontal
	4960	-	-	-	16.11	54.00	37.89	-
2	7440	49.45	36.78	-38.28	47.95	74.00	26.05	Horizontal
	7440	-	-	-	23.19	54.00	30.81	-
3	9920	48.91	38.62	-35.49	52.04	74.00	21.96	Horizontal
	9920	-	-	-	27.28	54.00	26.72	-

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GFSK_Channel 78



Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	4960	52.59	31.04	-42.78	40.85	74.00	33.15	Vertical
	4960	-	-	-	16.09	54.00	37.91	-
2	7440	49.78	36.78	-38.28	48.28	74.00	25.72	Vertical
	7440	-	-	-	23.52	54.00	30.48	-
3	9920	48.60	38.62	-35.49	51.73	74.00	22.27	Vertical
	9920	-	-	-	26.97	54.00	27.03	-

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier gain. The basic equation with a sample calculation is as follows:

Level = Reading(dBμV) + AF(dB/m) + Factor(dB):

AF = Antenna Factor(dB/m)

Factor = Cable Factor(dB) - Preamplifier gain(dB)

Margin = Limit(dBμV/m) – Level(dBμV/m)

- 2) All channels have been tested, but only the worst case data displayed in this report.

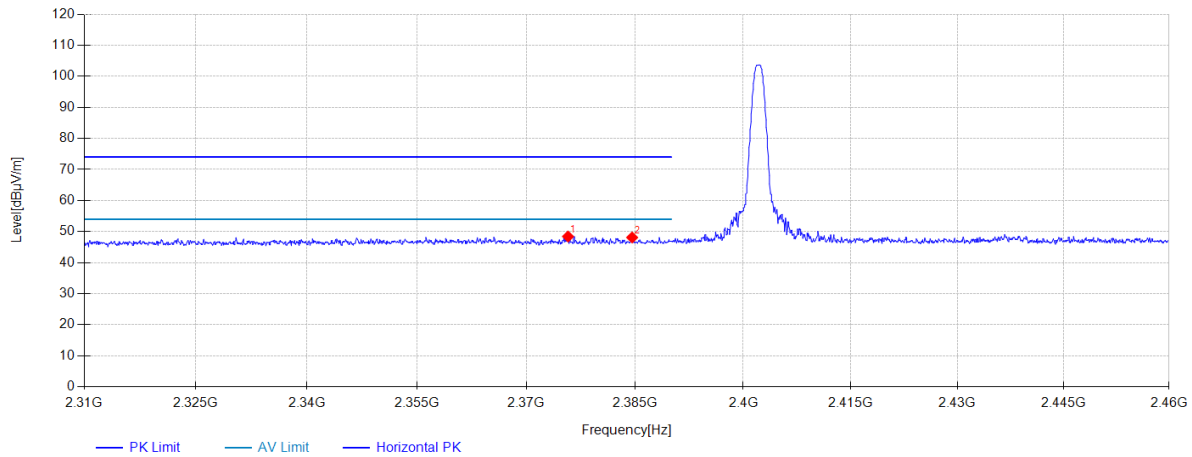
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Restricted bands around fundamental frequency

GFSK_Channel 0



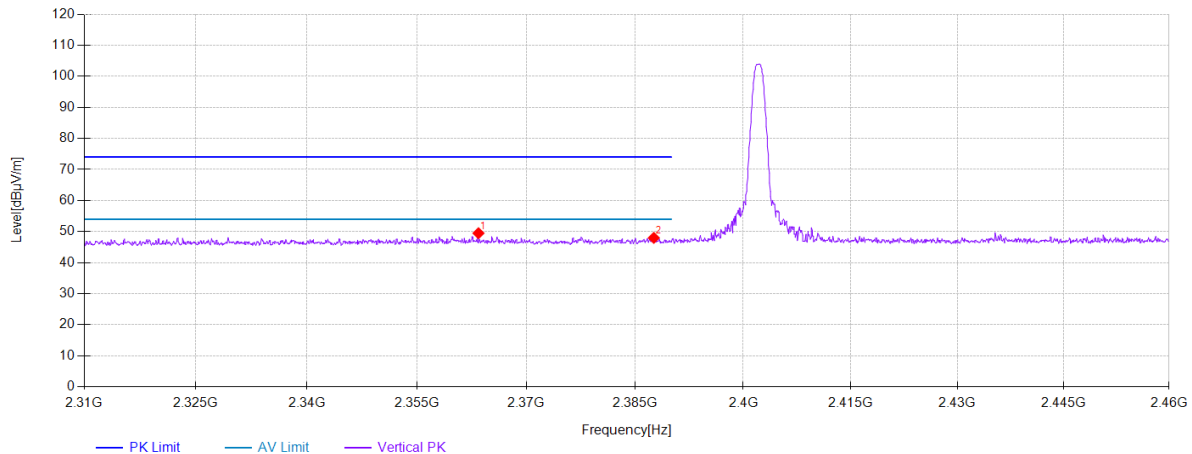
Data List								
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1	2375.7329	39.34	27.50	-18.42	48.42	74.00	25.58	Horizontal
	2375.7329	-	-	-	23.66	54.00	30.34	-
2	2384.5873	38.91	27.46	-18.27	48.10	74.00	25.90	Horizontal
	2384.5873	-	-	-	23.34	54.00	30.66	-

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GFSK_Channel 0



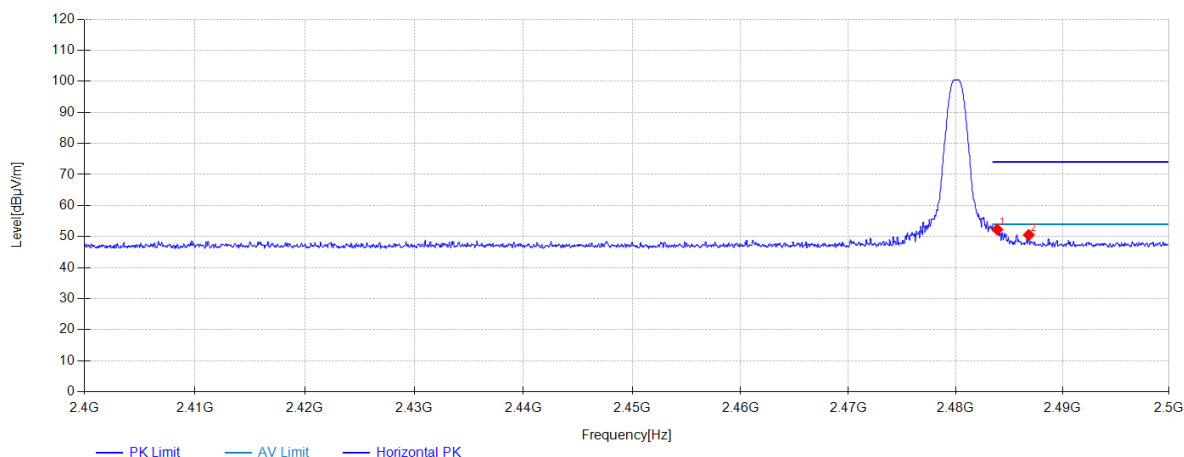
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1	2363.4267	40.26	27.55	-18.32	49.49	74.00	24.51	Vertical
	2363.4267	-	-	-	24.73	54.00	29.27	-
2	2387.5888	38.73	27.45	-18.20	47.98	74.00	26.02	Vertical
	2387.5888	-	-	-	23.22	54.00	30.78	-

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GFSK_Channel 78



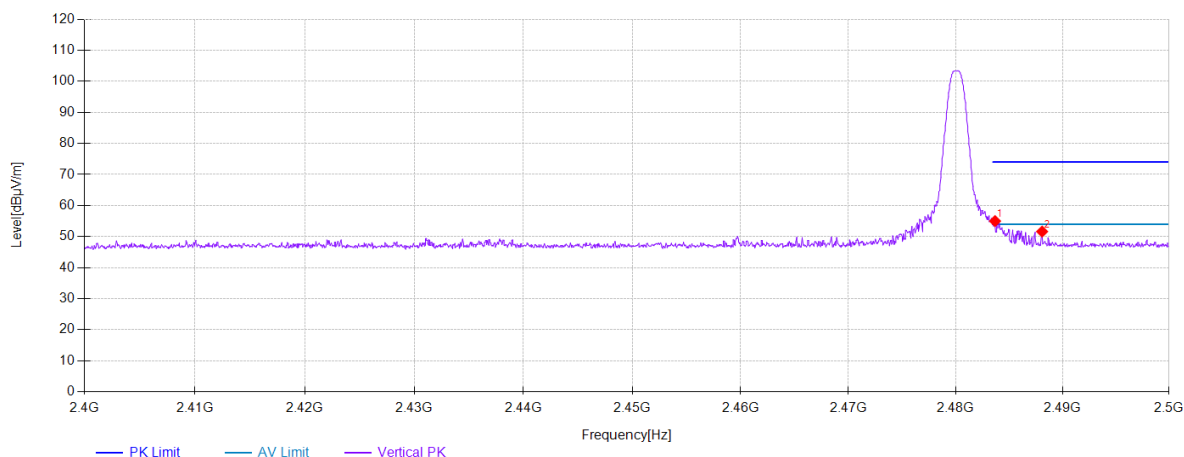
Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2483.8919	42.70	27.74	-18.18	52.26	74.00	21.74	Horizontal
	2483.8919	-	-	-	27.50	54.00	26.50	-
2	2486.8434	40.96	27.75	-18.17	50.54	74.00	23.46	Horizontal
	2483.8919	-	-	-	25.78	54.00	28.22	-

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Data List								
NO.	Frequency [MHz]	Reading [dBμV]	AF[dB/m]	Factor [dB]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity
1	2483.6918	45.46	27.73	-18.19	55.00	74.00	19.00	Vertical
	2483.6918	-	-	-	30.24	54.00	23.76	-
2	2488.094	42.04	27.75	-18.17	51.62	74.00	22.38	Vertical
	2488.094	-	-	-	26.88	54.00	27.14	-

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier gain. The basic equation with a sample calculation is as follows:

Level = Reading(dBμV) + AF(dB/m) + Factor(dB):

AF = Antenna Factor(dB/m)

Factor = Cable Factor(dB) - Preamplifier gain(dB)

Margin = Limit(dBμV/m) – Level(dBμV/m)

---End of Report---