



TEST REPORT

Application No.: GZCR2203000256AT
Applicant: IVATIV, Inc
Address of Applicant: 6141 Running Springs Rd, San Jose, CA 95135, USA
Manufacturer: IVATIV, Inc
Address of Manufacturer: 6141 Running Springs Rd, San Jose, CA 95135, USA
Factory: IVATIV, Inc
Address of Factory: 6141 Running Springs Rd, San Jose, CA 95135, USA
Equipment Under Test (EUT):
EUT Name: NILE series
BT 5.0 BLE + 802.15.4 module
Model No.: I540M0L8, I541M0L8, I540E0L0, I541E0L0, I540E0L7,
I541E0L7, I540E0L9, I541E0L9 ♣
♣ Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Standard(s) : 47 CFR Part 15, Subpart C 15.247
Date of Receipt: 2020-12-03
Date of Test: 2022-02-16 to 2022-03-23
Date of Issue: 2022-03-24

Test Result:

Pass*

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

Kobe Jian
EMC Laboratory Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2022-03-24		Original

Authorized for issue by				
Tested By				
		Curry Wu/Project Engineer		
Reviewed By				
		Ricky Liu/Reviewer		

2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass

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
Conducted Peak Output Power		ANSI C63.10 (2013) Section 11.9.1.3	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass
Minimum 6dB Bandwidth		ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247a(2)	Pass
Power Spectral Density		ANSI C63.10 (2013) Section 11.10.2	47 CFR Part 15, Subpart C 15.247(e)	Pass
Conducted Band Edges Measurement		ANSI C63.10 (2013) Section 11.13.3.2	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Spurious Emissions		ANSI C63.10 (2013) Section 11.11	47 CFR Part 15, Subpart C 15.247(d)	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 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions (Above 1GHz)		ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Duty Cycle		ANSI C63.10 (2013) Section 11.6	KDB 558074 D01 v05r02 section 6	Pass

Note:

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

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



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Declaration of EUT Family Grouping:

Model No.: I540M0L8, I541M0L8, I540E0L0, I541E0L0, I540E0L7,
I541E0L7, I540E0L9, I541E0L9

Only the model I540M0L8/I541M0L8 (PCB Antenna/MHF4 Connector) were tested, since according to the declaration from the applicant, the electrical circuit design, PCB layout, components used and internal wiring and functions were identical for the above models, with only difference as below.

I540E0L0/I541E0L0 support UART/SPI host interface and disable 802.15.4 by software.

I540E0L7/I541E0L7 and I540E0L9/I541E0L9 Support UART/SPI host interface by software.

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4 General Information

4.1 Details of E.U.T.

Power supply: DC 3.3V
Operation Frequency: 2405MHz to 2480MHz
Modulation Type: O-QPSK
Number of Channels: 16
Channel Spacing: 5MHz
Antenna Type: ANT1: PCB Antenna; ANT2: Dipole Antenna
Antenna Gain: ANT1:0.5dBi; ANT2: 3dBi

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Adapter	Apple	A1443	REF. No.SEA05D11D

4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	±2.76dB
Conducted Peak Output Power	± 0.75dB
Minimum 6dB Bandwidth	± 3%
Power Spectral Density	± 2.84dB
Conducted Band Edges Measurement	± 0.75dB
Conducted Spurious Emissions	± 0.75dB
Radiated Emissions which fall in the restricted bands	±5.00dB (30MHz-1GHz; 3m);±4.38dB (30MHz-1GHz; 10m);± 4.52dB (1GHz-6GHz);± 4.54dB (above 6GHz)
Radiated Spurious Emissions (Below 1GHz)	±5.00dB (30MHz-1GHz; 3m);±4.38dB (30MHz-1GHz; 10m)
Radiated Spurious Emissions (Above 1GHz)	± 4.52dB (1GHz-6GHz);± 4.54dB (above 6GHz)
Duty Cycle	± 0.37%

4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,
198 Kezhu Road, Sciencetech Park, Guangzhou Economic & Technology Development District,
Guangzhou, China 510663

Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.

4.5 Test Facility

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

- **NVLAP (Lab Code: 200611-0)**

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

- **ACMA**

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

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

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

- **CNAS (Lab Code: L0167)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2018 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of Testing Laboratories.

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

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

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

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

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

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

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

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



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4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

5 Equipment List

Conducted Emissions at AC Power Line (150kHz-30MHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Shielding Room	ChangZhou ZhongYu	8m x 3m x 3.8m	EMC0306	N/A	N/A
Two-Line V-Network	Rohde & Schwarz	ENV216	EMC0118	2021-12-23	2022-12-22
Two-Line V-Network-GZ	Rohde & Schwarz	ENV216	EMC2135	2021-09-24	2022-09-23
Coaxial Cable	HangTianXing	2m	EMC0107	2020-09-09	2022-09-08
Test Software E3c	Audix	Ver. 5.4.1221b	GZE100-62	N/A	N/A
EMI Test Receiver(9kHz-3.6GHz)	Rohde & Schwarz	ESR3	EMC2221	2021-06-01	2022-05-31

Conducted Peak Output Power					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Power Meter (U2021XA_Ch2)	Agilent Technologies	U2021XA_Ch2	SEM009-02	2021-05-19	2022-05-18
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A

Minimum 6dB Bandwidth					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A

Power Spectral Density					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A

Conducted Band Edges Measurement					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14



MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A

Conducted Spurious Emissions					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A

Radiated Emissions which fall in the restricted bands					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test Receiver(20Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2021-12-17	2022-12-16
Chamber cable(Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2020-09-09	2022-09-08
Horn Antenna(1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2019-09-25	2022-09-24
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2021-12-17	2022-12-16
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2021-12-17	2022-12-16
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19
MXE EMI Receiver(10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2021-11-01	2022-10-31
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-16	2022-09-15
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Notch Filter (5150-5880)	Mico-Tronics	BRM50716	EMC2168	2021-07-29	2022-07-28
Horn Antenna(14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27
Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	EMC2172	2021-08-30	2022-08-29

Radiated Spurious Emissions (Below 1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test Receiver(10Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2021-12-17	2022-12-16
Chamber cable	HangTianXing	N/A	EMC0542	2020-09-09	2022-09-08



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Trilog Broadband Antenna(25MHz-1GHz)-Lab	SCHWARZBECK MESS-ELEKTRONIK	VULB 9168	SEM003-18	2019-02-22	2022-02-22
Amplifier(9kHz-1.3GHz)	HP	8447F	EMC2065	2021-05-19	2022-05-18
High Pass Filter (915MHz)	FSY MICROWAVE	HM1465-9SS	EMC2079	2021-12-17	2022-12-16
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2019-10-20	2022-10-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
EMI Test Receiver(1Hz-8GHz)	Rohde & Schwarz	ESW8	EMC2220	2021-05-26	2022-05-25

Radiated Spurious Emissions (Above 1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test Receiver(20Hz-26.5GHz)	Rohde & Schwarz	ESIB26	EMC0522	2021-12-17	2022-12-16
Chamber cable(Above 1GHz)	Scoflex	KMKM-8.0m	EMC0545	2020-09-09	2022-09-08
Horn Antenna(1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2019-09-25	2022-09-24
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2021-12-17	2022-12-16
2.4GHz Filter	Micro-Tronics	BRM 50702	EMC2069	2021-12-17	2022-12-16
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19
MXE EMI Receiver(10Hz-8.4GHz)	Keysight	N9038A	EMC2139	2021-11-01	2022-10-31
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-16	2022-09-15
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Notch Filter (5150-5880)	Mico-Tronics	BRM50716	EMC2168	2021-07-29	2022-07-28
Horn Antenna(14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27
Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	EMC2172	2021-08-30	2022-08-29



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Duty Cycle					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
6dB Attenuator	HP	8491A	EMC2062	2020-04-15	2022-04-14
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01
Test Software	TST	V2.0	GZE100-78	N/A	N/A

General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
DMM	Fluke	73	EMC0006	2021-07-05	2022-07-05
DMM	Fluke	73	EMC0007	2021-07-05	2022-07-05

6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

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

6.1.2 Conclusion

15.203 Requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of 15.211, 15.213, 15.217, 15.219, 15.221, or 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

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:

ANT1 is integrated on main PCB and no consideration of replacement. An optional external antenna similar to ANT2 can be connected by following the Integration Guidelines from module vendor. The best case gain of the antenna is ANT1:0.5dBi; ANT2: 3dBi.

Antenna location: Refer to external&internal photo.

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: 20.8 °C

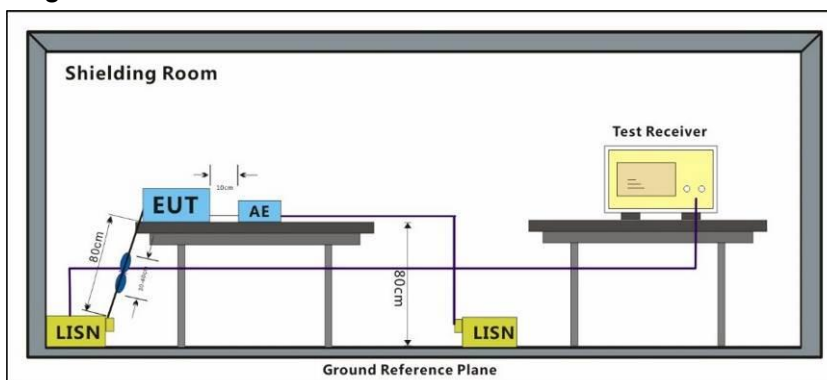
Humidity: 52.7 % RH

Atmospheric Pressure: 1020 mbar

7.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in continuously transmitting with O-QPSK modulation mode.

7.1.3 Test Setup Diagram

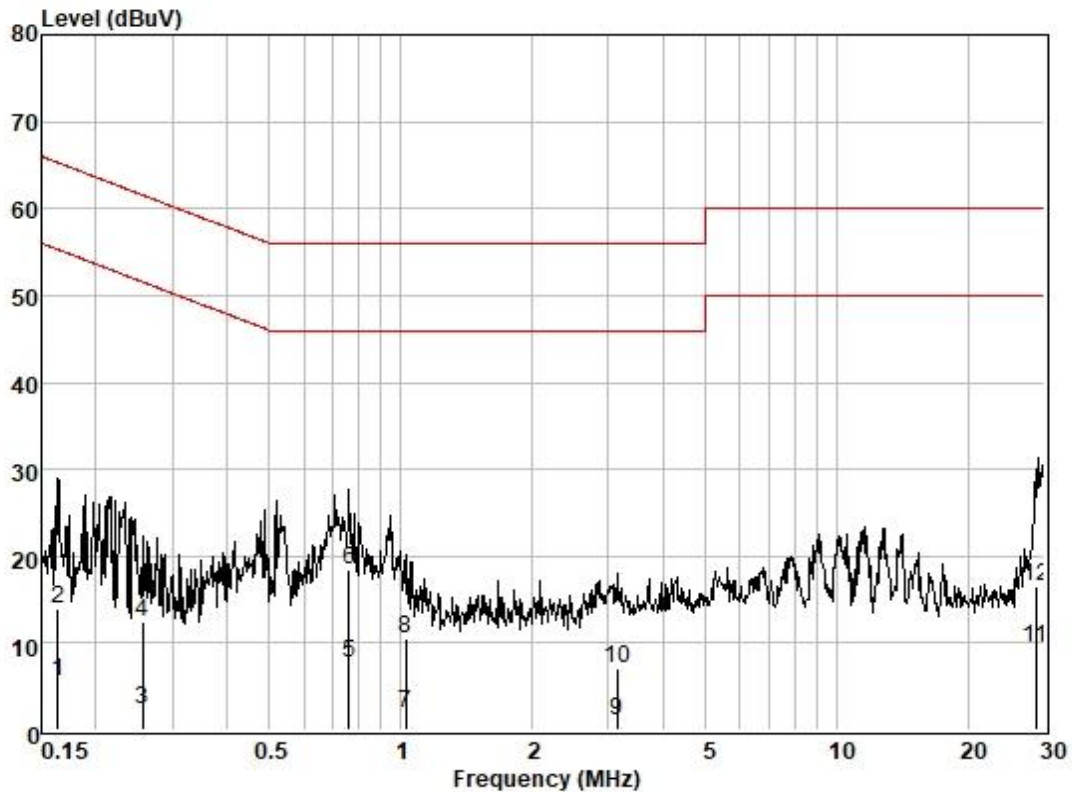


7.1.4 Measurement Procedure and Data

- 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.

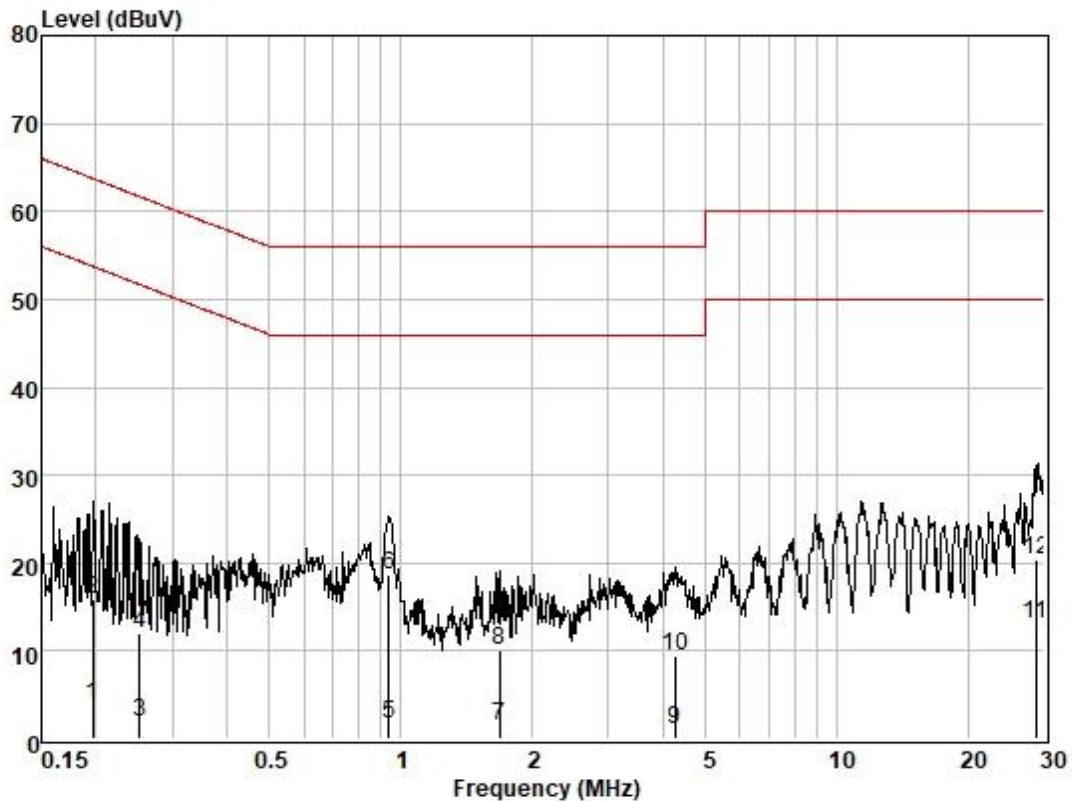
Remark: LISN=Read Level+ Cable Loss+ LISN Factor

Test Mode: 01; Polarity: Neutral; Modulation: O-QPSK; Channel: Low

Condition: NEUTRAL
Mode : ZIGBEE
Model :

	Freq	Read	Cable	LISN	Limit	Over	
	MHz	Level	Loss	Factor	Line	Limit	Remark
		dBuV	dB	dB	dBuV	dB	
1	0.163	-3.97	0.06	9.54	55.30	-49.67	Average
2	0.163	4.38	0.06	9.54	65.30	-51.32	QP
3	0.256	-7.36	0.06	9.56	51.56	-49.30	Average
4	0.256	2.75	0.06	9.56	61.56	-49.19	QP
5	0.763	-2.02	0.07	9.59	46.00	-38.36	Average
6	0.763	8.72	0.07	9.59	56.00	-37.62	QP
7	1.027	-7.71	0.07	9.59	46.00	-44.05	Average
8	1.027	0.94	0.07	9.59	56.00	-45.40	QP
9	3.140	-8.77	0.15	9.61	46.00	-45.01	Average
10	3.140	-2.70	0.15	9.61	56.00	-48.94	QP
11	28.755	-0.85	0.43	9.91	50.00	-40.51	Average
12	28.755	6.24	0.43	9.91	60.00	-43.42	QP

Test Mode: 01; Polarity: Line; Modulation: O-QPSK; Channel: Low



Condition: LINE
Mode : ZIGBEE
Model :

	Freq	Read Level	Cable Loss	LISN Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.197	-5.73	0.06	9.56	3.89	53.76	-49.87	Average
2	0.197	6.18	0.06	9.56	15.80	63.76	-47.96	QP
3	0.252	-7.66	0.06	9.57	1.97	51.69	-49.72	Average
4	0.252	2.47	0.06	9.57	12.10	61.69	-49.59	QP
5	0.938	-7.89	0.07	9.60	1.78	46.00	-44.22	Average
6	0.938	8.91	0.07	9.60	18.58	56.00	-37.42	QP
7	1.689	-8.20	0.11	9.60	1.51	46.00	-44.49	Average
8	1.689	0.37	0.11	9.60	10.08	56.00	-45.92	QP
9	4.269	-8.73	0.17	9.65	1.09	46.00	-44.91	Average
10	4.269	-0.49	0.17	9.65	9.33	56.00	-46.67	QP
11	28.755	2.84	0.43	9.75	13.02	50.00	-36.98	Average
12	28.755	10.17	0.43	9.75	20.35	60.00	-39.65	QP

7.2 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)

Test Method: ANSI C63.10 (2013) Section 11.9.1.3

Limit:

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

7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 21.3 °C

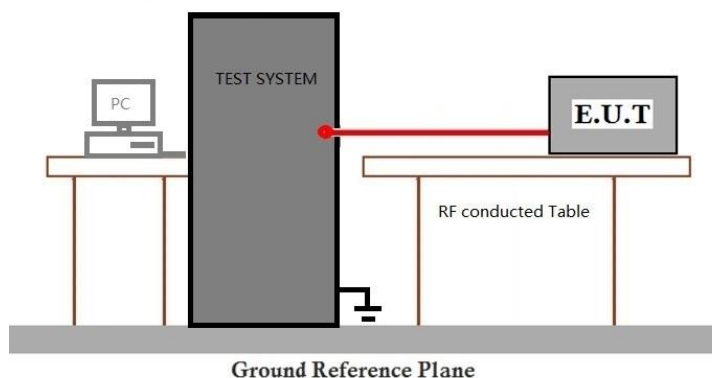
Humidity: 50.6 % RH

Atmospheric Pressure: 1020 mbar

7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in continuously transmitting with O-QPSK modulation mode.

7.2.3 Test Setup Diagram



7.2.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details



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7.3 Minimum 6dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247a(2)

Test Method: ANSI C63.10 (2013) Section 11.8.1

Limit:

≥500 kHz

7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 21.3 °C

Humidity: 50.6 % RH

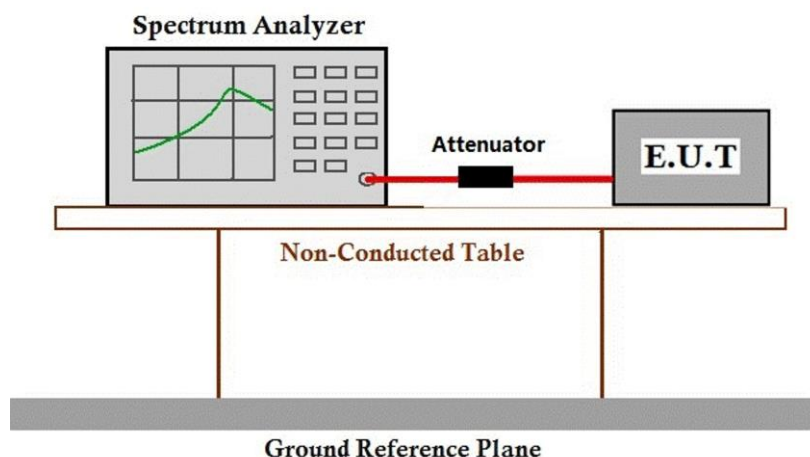
Atmospheric Pressure: 1020 mbar

7.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
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Final test	01	TX mode_Keep the EUT in continuously transmitting with O-QPSK modulation mode.
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7.3.3 Test Setup Diagram



7.3.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details

7.4 Power Spectral Density

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

Test Method: ANSI C63.10 (2013) Section 11.10.2

Limit:

≤8dBm in any 3 kHz band during any time interval of continuous transmission

7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 21.3 °C

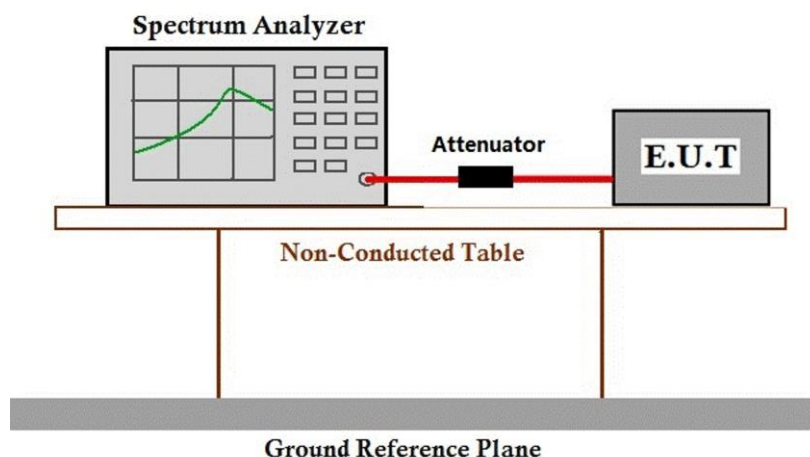
Humidity: 50.6 % RH

Atmospheric Pressure: 1020 mbar

7.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in continuously transmitting with O-QPSK modulation mode.

7.4.3 Test Setup Diagram



7.4.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details

7.5 Conducted Band Edges Measurement

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)
Test Method: ANSI C63.10 (2013) Section 11.13.3.2
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)).

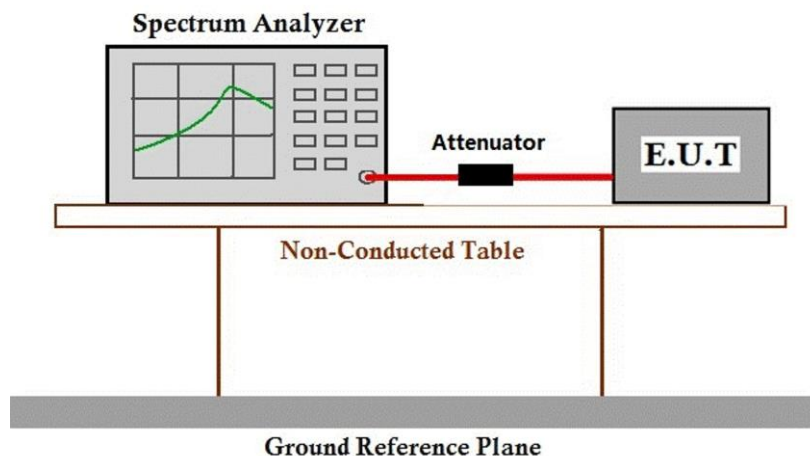
7.5.1 E.U.T. Operation

Operating Environment:
Temperature: 21.3 °C Humidity: 50.6 % RH Atmospheric Pressure: 1020 mbar

7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in continuously transmitting with O-QPSK modulation mode.

7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details



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7.6 Conducted Spurious Emissions

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

Test Method: ANSI C63.10 (2013) Section 11.11

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)).

7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 21.3 °C

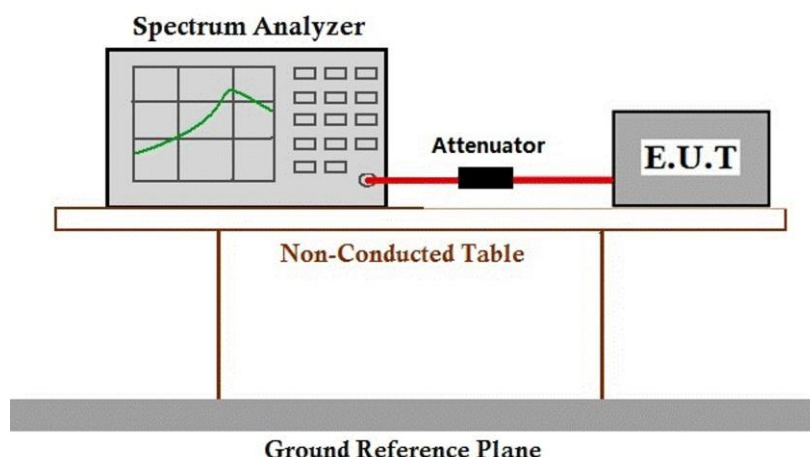
Humidity: 50.6 % RH

Atmospheric Pressure: 1020 mbar

7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in continuously transmitting with O-QPSK modulation mode.

7.6.3 Test Setup Diagram



7.6.4 Measurement Procedure and Data

cable loss=0.9dB

Please Refer to Appendix for Details



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7.7 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.

7.7.1 E.U.T. Operation

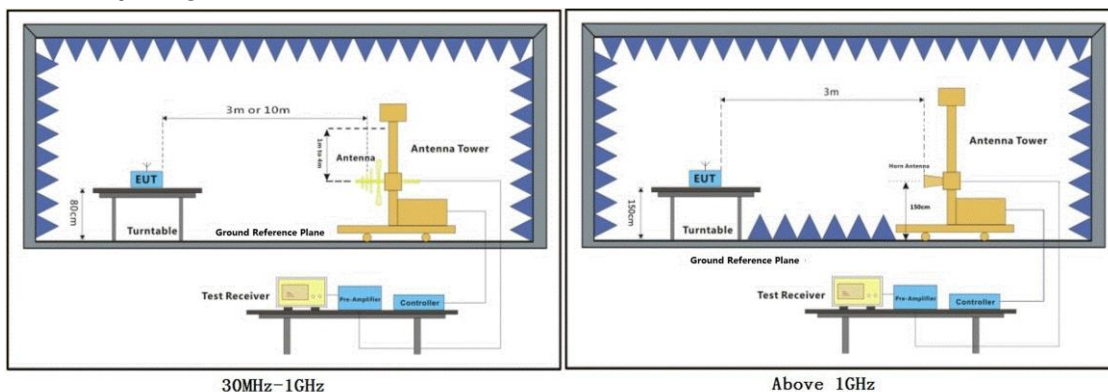
Operating Environment:

Temperature: 22.3 °C Humidity: 54.4 % RH Atmospheric Pressure: 1020 mbar

7.7.2 Test Mode Description

Pre-scan / Mode	Description
Final test Code	
Final test 01	TX mode_Keep the EUT in continuously transmitting with O-QPSK modulation mode.

7.7.3 Test Setup Diagram



7.7.4 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

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

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

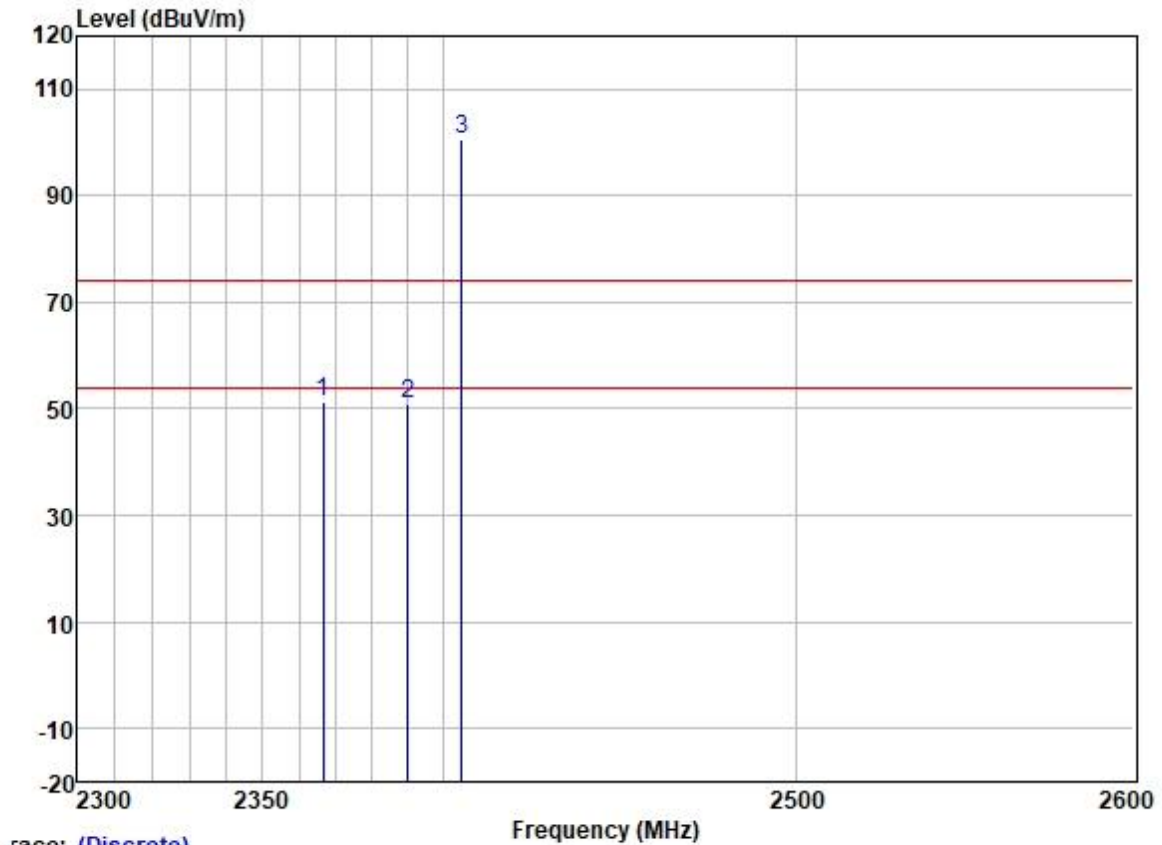


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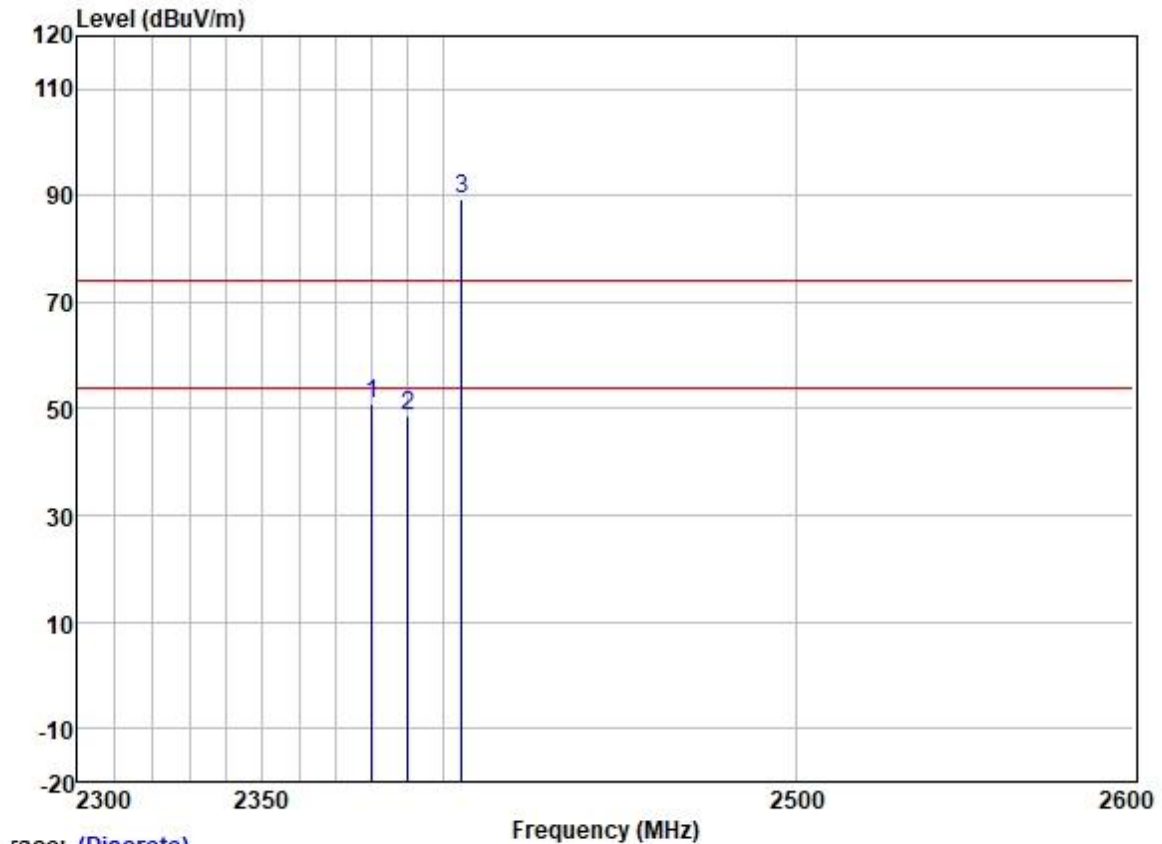
ANT1

Test Mode: 01; Polarity: Horizontal; Modulation: O-QPSK; Channel: Low



	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
		Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2366.380	58.11	27.28	3.43	37.60	51.22	74.00	-22.78	HORIZONTAL	Peak
2	2390.000	57.77	27.33	3.48	37.59	50.99	74.00	-23.01	HORIZONTAL	Peak
3 *	2405.000	107.25	27.36	3.48	37.59	100.50	74.00	26.50	HORIZONTAL	Peak

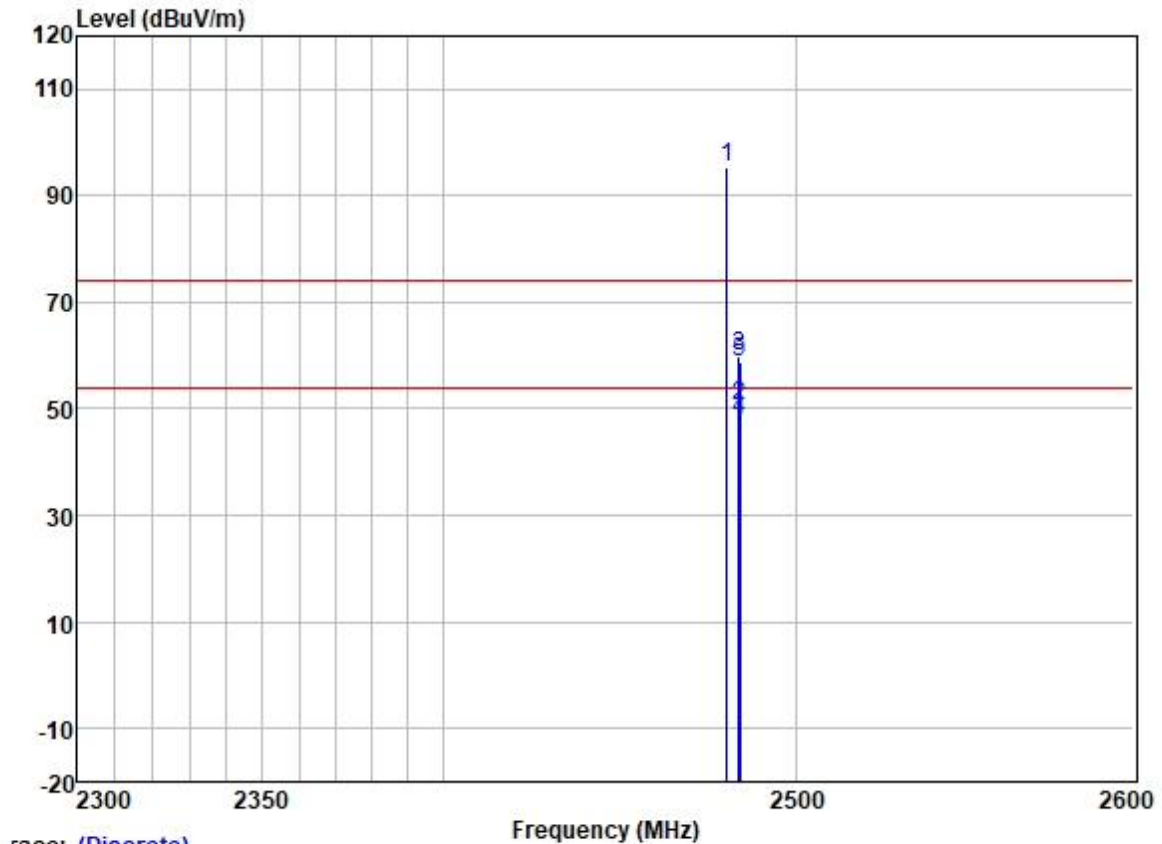
Test Mode: 01; Polarity: Vertical; Modulation: O-QPSK; Channel:Low



Trace: (Discrete)

	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2379.856	57.92	27.31	3.46	37.60	51.09	74.00	-22.91	VERTICAL	Peak
2	2390.000	55.44	27.33	3.48	37.59	48.66	74.00	-25.34	VERTICAL	Peak
3 *	2405.000	96.26	27.36	3.48	37.59	89.51	74.00	15.51	VERTICAL	Peak

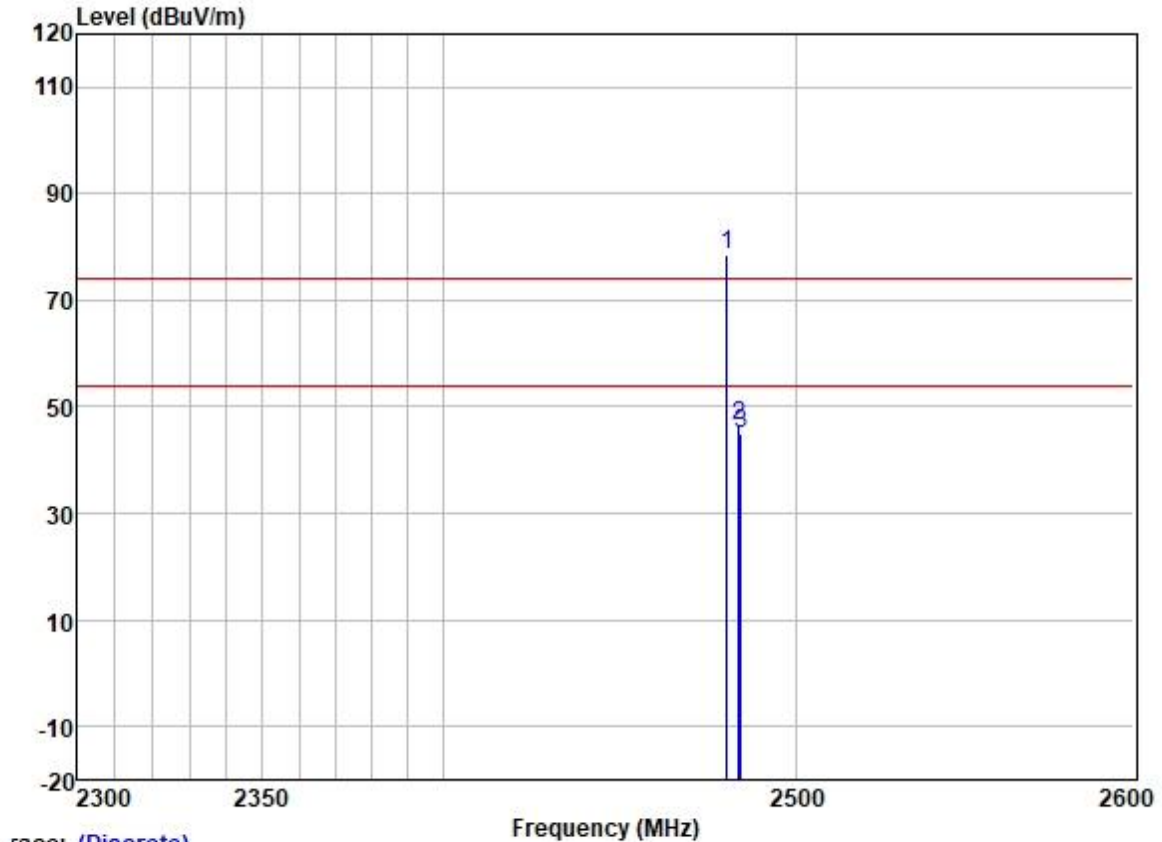
Test Mode: 01; Polarity: Horizontal; Modulation: O-QPSK; Channel: High



Trace: (Discrete)

	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
		Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 *	2480.000	101.97	27.47	3.60	37.57	95.47	74.00	21.47	HORIZONTAL	Peak
2	2483.500	57.03	27.48	3.53	37.57	50.47	54.00	-3.53	HORIZONTAL	Average
3	2483.500	66.35	27.48	3.53	37.57	59.79	74.00	-14.21	HORIZONTAL	Peak
4	2483.821	54.45	27.48	3.53	37.57	47.89	54.00	-6.11	HORIZONTAL	Average
5	2483.821	65.38	27.48	3.53	37.57	58.82	74.00	-15.18	HORIZONTAL	Peak

Test Mode: 01; Polarity: Vertical; Modulation: O-QPSK; Channel: High



Trace: (Discrete)

	Read Freq	Antenna Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 *	2480.000	85.08	27.47	3.60	37.57	78.58	74.00	4.58	VERTICAL	Peak
2	2483.500	53.06	27.48	3.53	37.57	46.50	74.00	-27.50	VERTICAL	Peak
3	2483.921	51.40	27.48	3.53	37.57	44.84	74.00	-29.16	VERTICAL	Peak

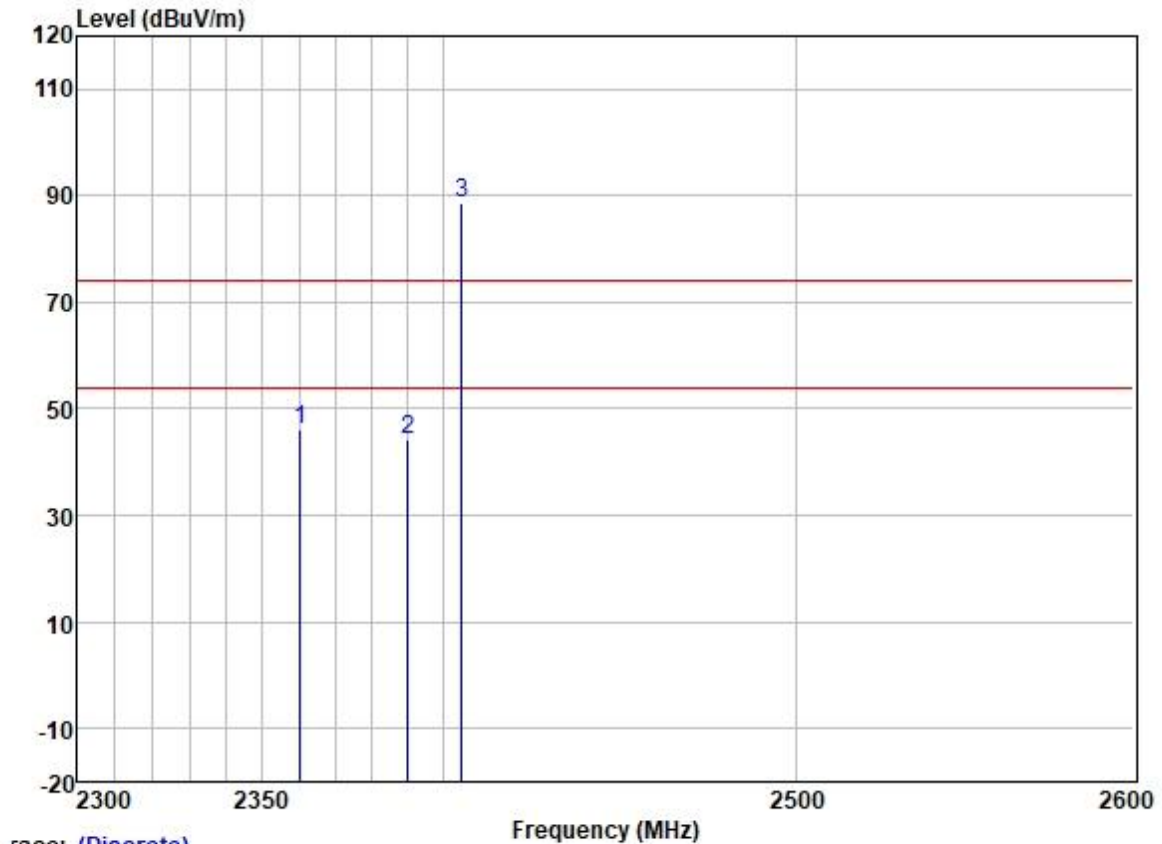


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ANT2

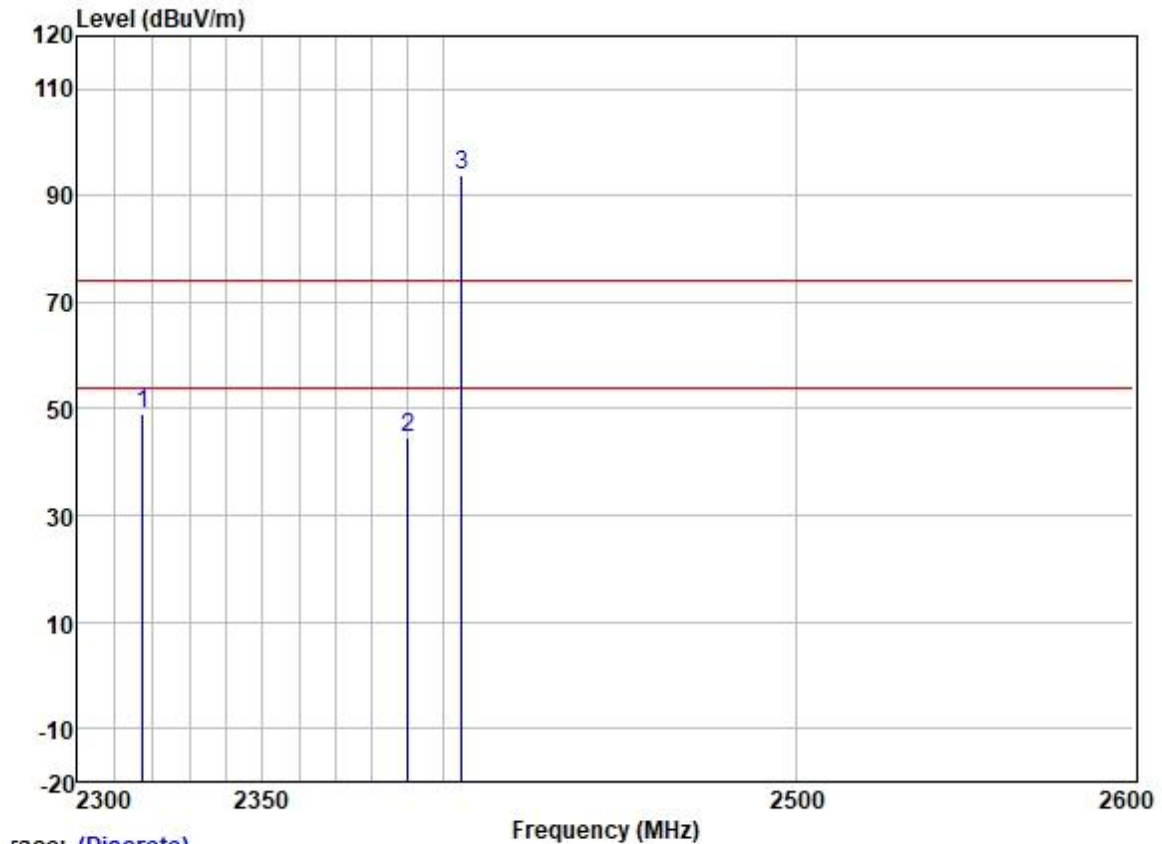
Test Mode: 01; Polarity: Horizontal; Modulation: O-QPSK; Channel: Low



Trace: (Discrete)

	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2360.237	52.84	27.27	3.42	37.61	45.92	74.00	-28.08	HORIZONTAL	Peak
2	2390.000	50.94	27.33	3.48	37.59	44.16	74.00	-29.84	HORIZONTAL	Peak
3 *	2405.000	95.25	27.36	3.48	37.59	88.50	74.00	14.50	HORIZONTAL	Peak

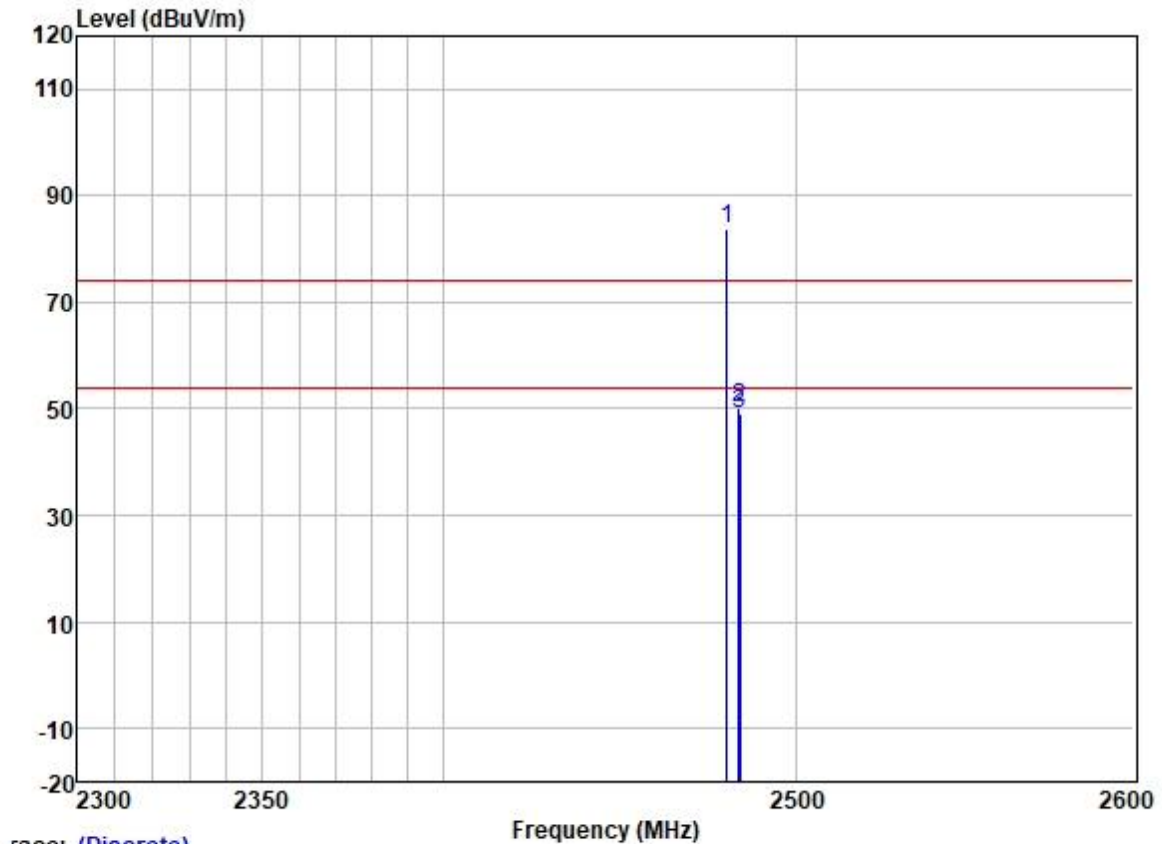
Test Mode: 01; Polarity: Vertical; Modulation: O-QPSK; Channel:Low



Trace: (Discrete)

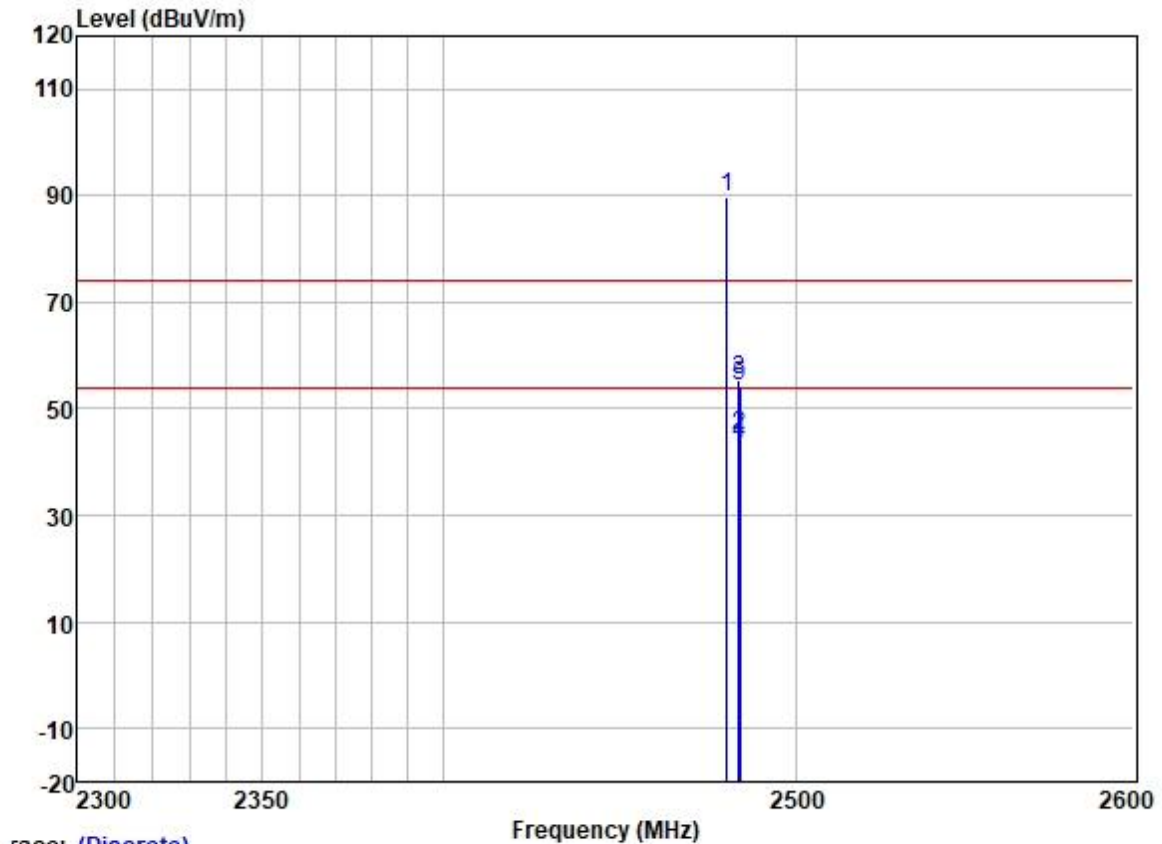
	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
		Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	2317.405	56.36	27.17	3.33	37.62	49.24	74.00	-24.76	VERTICAL	Peak
2	2390.000	51.46	27.33	3.48	37.59	44.68	74.00	-29.32	VERTICAL	Peak
3 *	2405.000	100.46	27.36	3.48	37.59	93.71	74.00	19.71	VERTICAL	Peak

Test Mode: 01; Polarity: Horizontal; Modulation: O-QPSK; Channel: High



		ReadAntenna		Cable	Preamp		Limit	Over		
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 *	2480.000	90.40	27.47	3.60	37.57	83.90	74.00	9.90	HORIZONTAL	Peak
2	2483.500	56.68	27.48	3.53	37.57	50.12	74.00	-23.88	HORIZONTAL	Peak
3	2483.815	55.50	27.48	3.53	37.57	48.94	74.00	-25.06	HORIZONTAL	Peak

Test Mode: 01; Polarity: Vertical; Modulation: O-QPSK; Channel: High



Trace: (Discrete)

	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 *	2480.000	96.25	27.47	3.60	37.57	89.75	74.00	15.75	VERTICAL	Peak
2	2483.500	51.37	27.48	3.53	37.57	44.81	54.00	-9.19	VERTICAL	Average
3	2483.500	62.09	27.48	3.53	37.57	55.53	74.00	-18.47	VERTICAL	Peak
4	2483.845	49.99	27.48	3.53	37.57	43.43	54.00	-10.57	VERTICAL	Average
5	2483.845	61.03	27.48	3.53	37.57	54.47	74.00	-19.53	VERTICAL	Peak

7.8 Radiated Spurious Emissions (Below 1GHz)

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

Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6

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.

7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 20.6 °C

Humidity: 53.2 % RH

Atmospheric Pressure: 1020 mbar

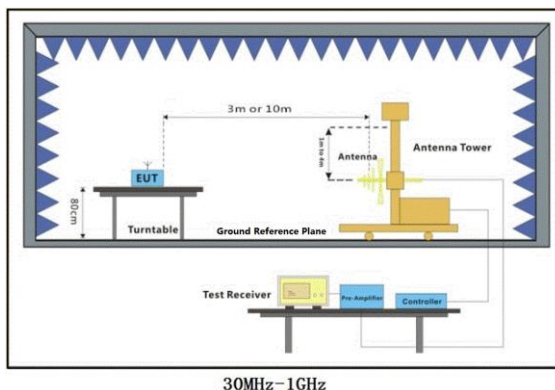
7.8.2 Test Mode Description

Pre-scan / Mode
Final test Code Description

Final test 01

TX mode_Keep the EUT in continuously transmitting with O-QPSK modulation mode.

7.8.3 Test Setup Diagram



7.8.4 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 peak, quasi-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) Through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.

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

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor

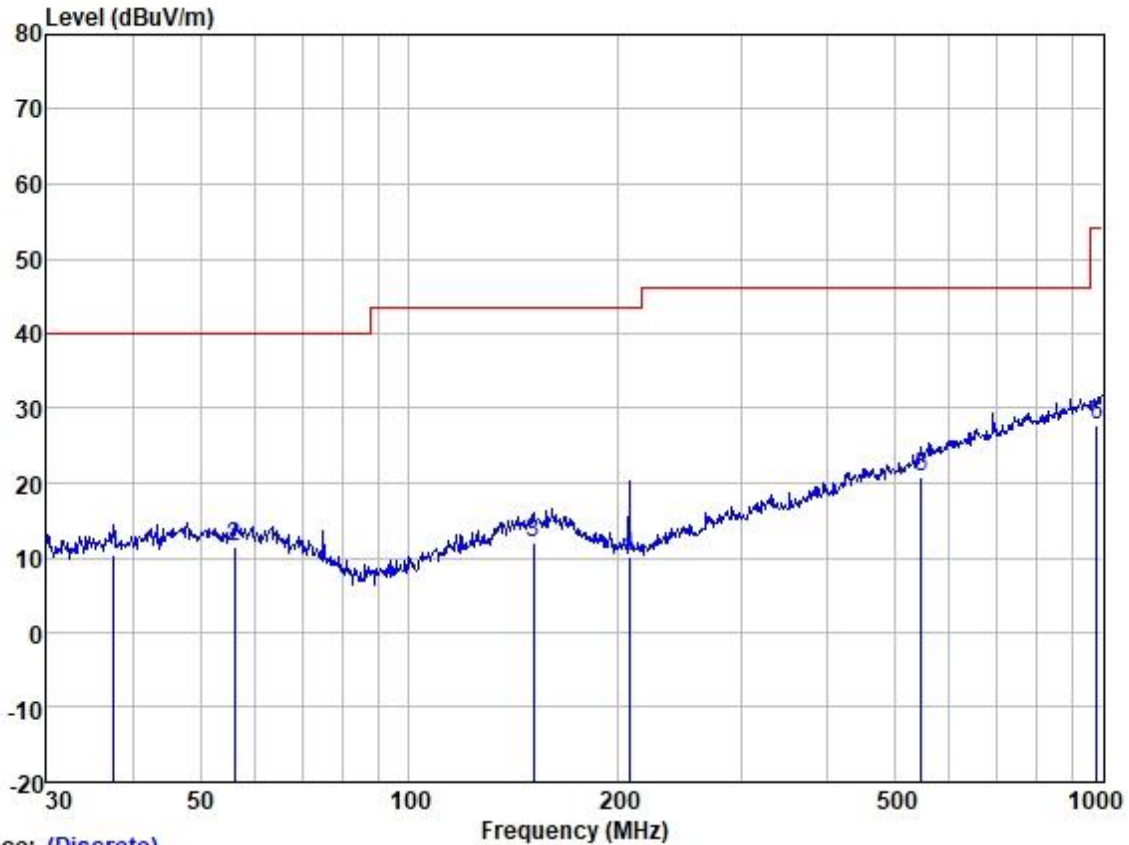
3) Scan from 9kHz to 1 GHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.



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Test Mode: 01; Polarity: Horizontal; Modulation: O-QPSK; Channel:Low



Trace: (Discrete)

Site : SGS

Condition:

Job :

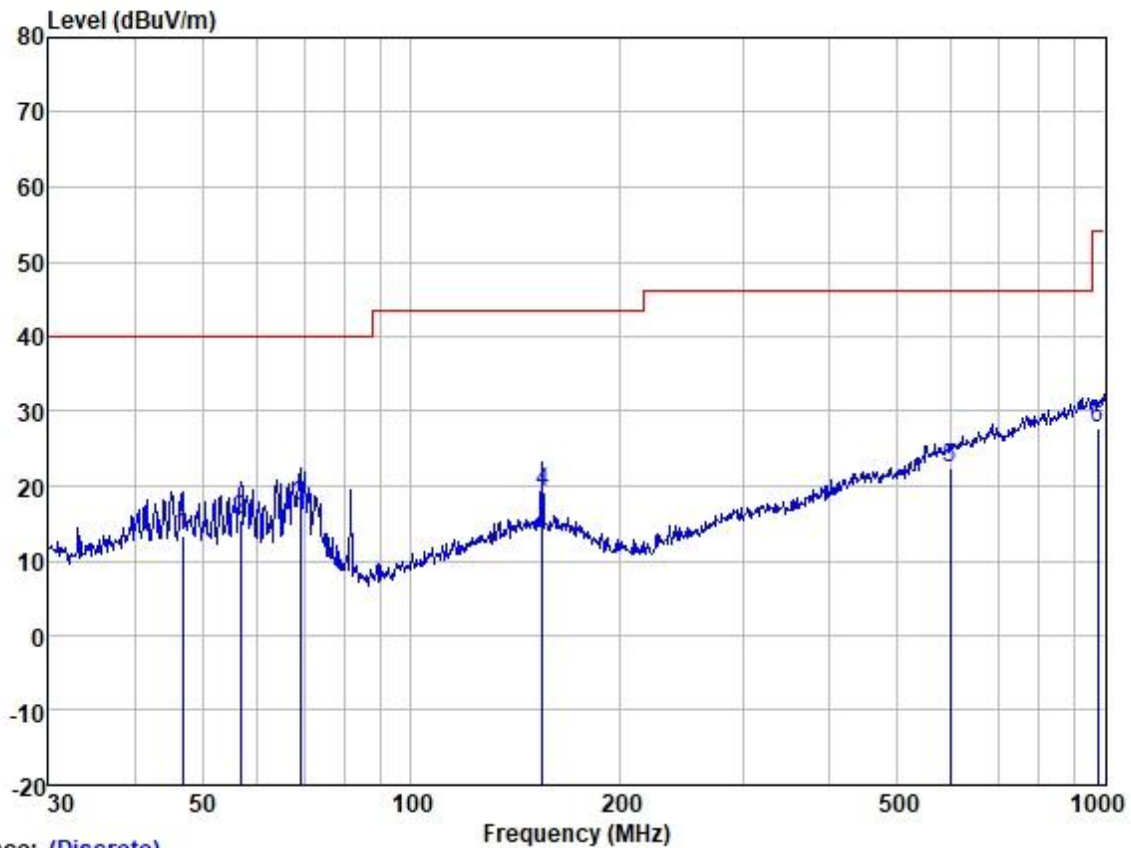
Model :

Power :

Test Mode: 01-Zigbee

		ReadAntenna	Cable Preamp		Limit	Over				
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	37.548	23.68	12.75	1.09	27.18	10.34	40.00	-29.66	HORIZONTAL	QP
2	56.001	23.93	13.40	1.20	27.16	11.37	40.00	-28.63	HORIZONTAL	QP
3	151.067	23.17	13.49	2.24	26.83	12.07	43.50	-31.43	HORIZONTAL	QP
4	207.123	24.69	9.68	2.56	26.72	10.21	43.50	-33.29	HORIZONTAL	QP
5	547.098	25.84	18.24	4.76	28.09	20.75	46.00	-25.25	HORIZONTAL	QP
6	979.180	24.38	23.80	7.31	27.69	27.80	54.00	-26.20	HORIZONTAL	QP

Test Mode: 01; Polarity: Vertical; Modulation: O-QPSK; Channel: Low



Trace: (Discrete)

Site : SGS

Condition:

Job :

Model :

Power :

Test Mode: 01-Zigbee

		ReadAntenna	Cable	Preamp		Limit	Over		
	Freq	Level	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	46.830	25.67	13.70	1.13	27.17	13.33	40.00	-26.67	VERTICAL QP
2	56.792	28.08	13.44	1.21	27.16	15.57	40.00	-24.43	VERTICAL QP
3	69.114	31.22	11.90	1.40	27.13	17.39	40.00	-22.61	VERTICAL QP
4	154.279	30.27	13.46	2.28	26.82	19.19	43.50	-24.31	VERTICAL QP
5	597.223	25.96	19.60	5.14	28.21	22.49	46.00	-23.51	VERTICAL QP
6	975.753	24.24	23.77	7.31	27.69	27.63	54.00	-26.37	VERTICAL QP

7.9 Radiated Spurious Emissions (Above 1GHz)

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

Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6

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.

7.9.1 E.U.T. Operation

Operating Environment:

Temperature: 22.3 °C Humidity: 54.4 % RH Atmospheric Pressure: 1020 mbar

7.9.2 Test Mode Description

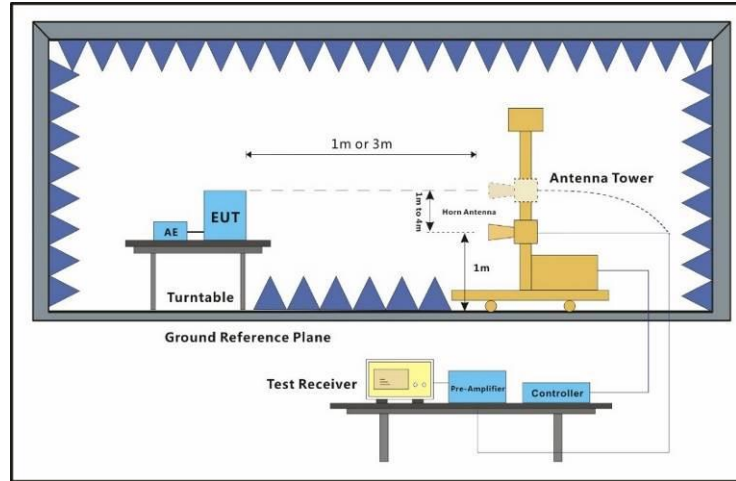
Pre-scan / Final test	Mode Code	Description
Final test	01	TX mode_Keep the EUT in continuously transmitting with O-QPSK modulation mode.



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7.9.3 Test Setup Diagram



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

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier 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) The field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

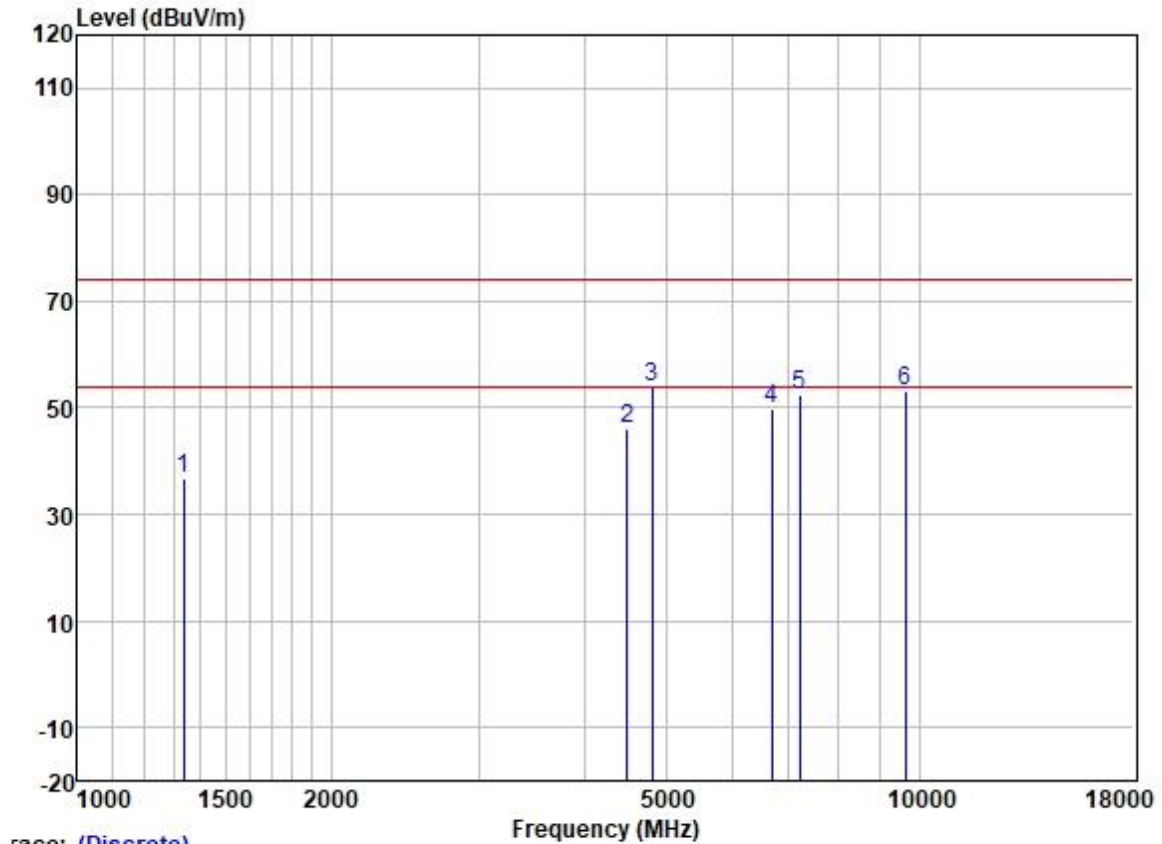


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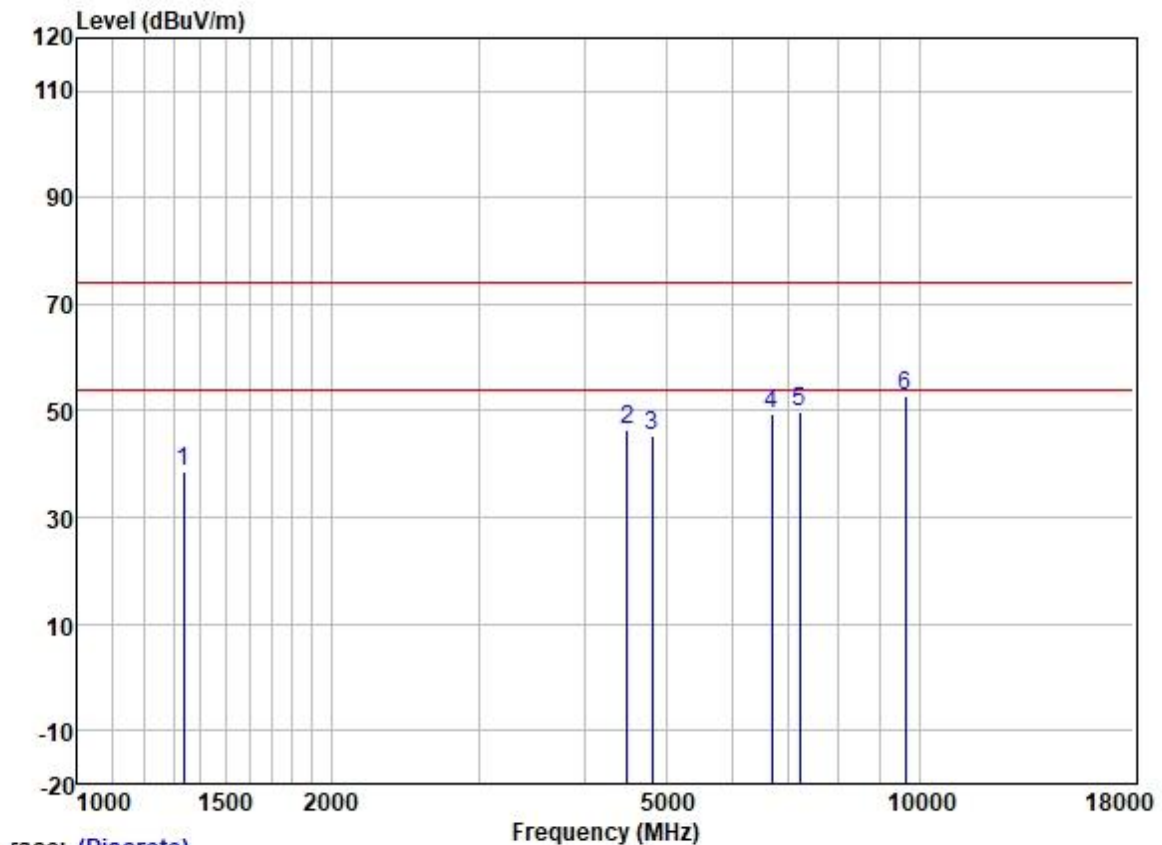
ANT1

Test Mode: 00; Polarity: Horizontal; Modulation: O-QPSK; ; Channel: Low



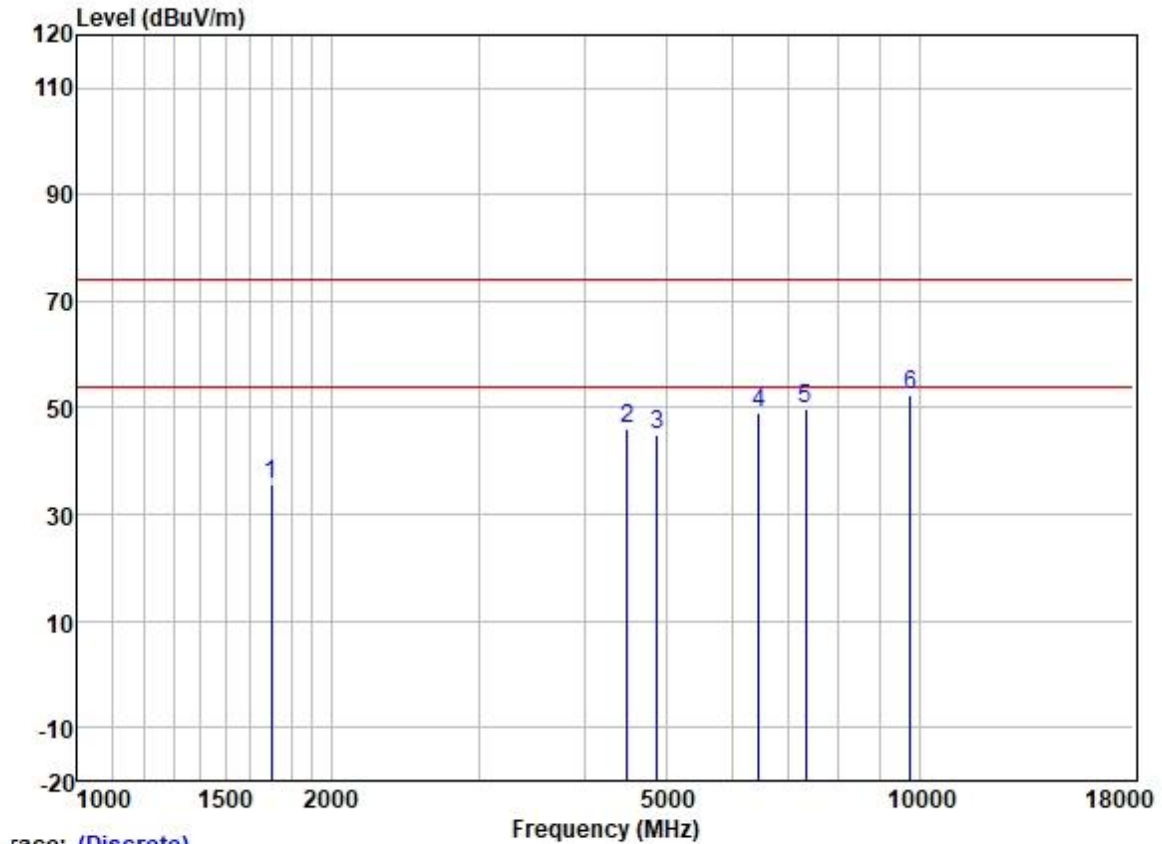
	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1335.141	47.20	25.28	2.60	38.29	36.79	74.00	-37.21	HORIZONTAL	Peak
2	4495.125	47.10	30.80	5.05	36.82	46.13	74.00	-27.87	HORIZONTAL	Peak
3	4810.000	53.81	31.42	5.40	36.83	53.80	74.00	-20.20	HORIZONTAL	Peak
4	6679.040	46.80	34.33	5.83	37.07	49.89	74.00	-24.11	HORIZONTAL	Peak
5	7215.000	48.16	35.62	6.01	37.39	52.40	74.00	-21.60	HORIZONTAL	Peak
6	9620.000	45.20	38.37	7.07	37.42	53.22	74.00	-20.78	HORIZONTAL	Peak

Test Mode: 00; Polarity: Vertical; Modulation: O-QPSK; ; Channel: Low



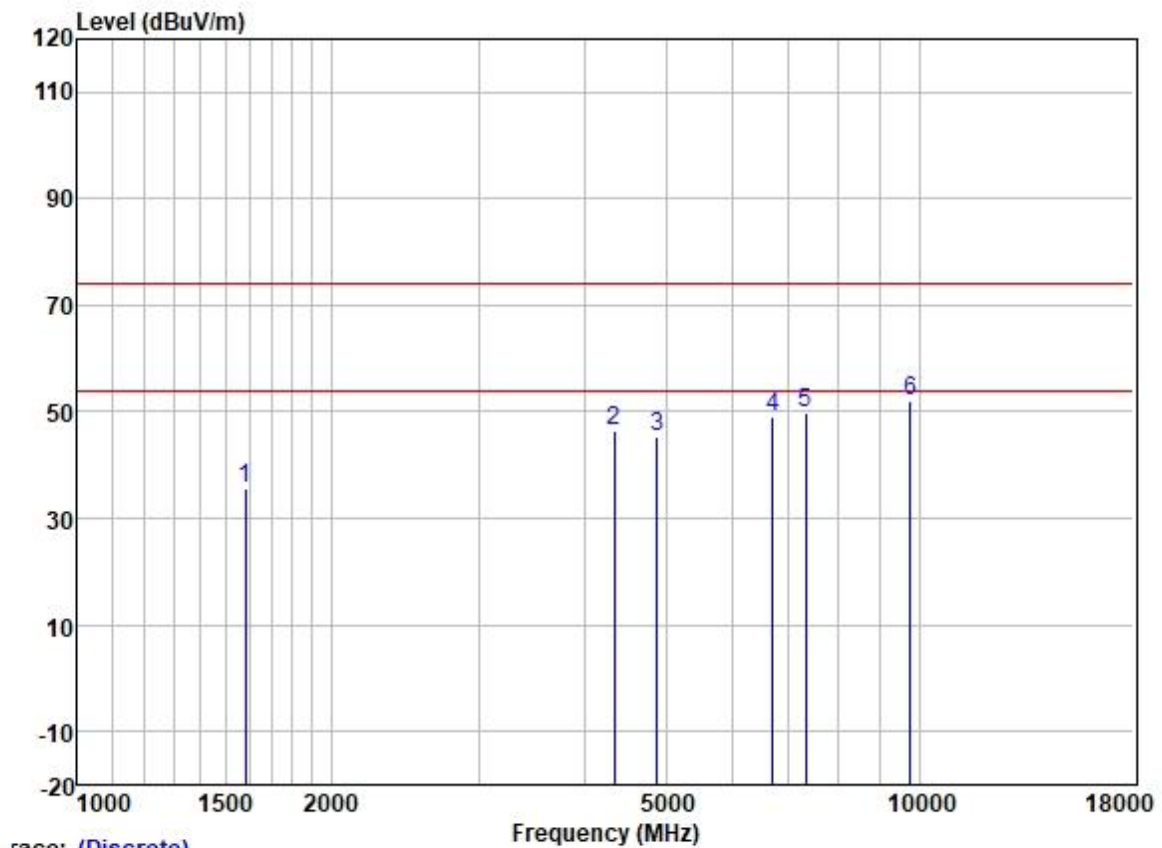
	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1335.141	48.85	25.28	2.60	38.29	38.44	74.00	-35.56	VERTICAL	Peak
2	4495.125	47.28	30.80	5.05	36.82	46.31	74.00	-27.69	VERTICAL	Peak
3	4810.000	45.31	31.42	5.40	36.83	45.30	74.00	-28.70	VERTICAL	Peak
4	6679.040	46.45	34.33	5.83	37.07	49.54	74.00	-24.46	VERTICAL	Peak
5	7215.000	45.44	35.62	6.01	37.39	49.68	74.00	-24.32	VERTICAL	Peak
6	9620.000	44.67	38.37	7.07	37.42	52.69	74.00	-21.31	VERTICAL	Peak

Test Mode: 00; Polarity: Horizontal; Modulation: O-QPSK; ; Channel:middle



	Freq	ReadAntenna	Cable	Preamp		Limit	Over		
		Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1697.129	45.04	25.71	2.80	37.89	35.66	74.00	-38.34	HORIZONTAL Peak
2	4495.125	46.95	30.80	5.05	36.82	45.98	74.00	-28.02	HORIZONTAL Peak
3	4880.000	44.84	31.54	5.50	36.84	45.04	74.00	-28.96	HORIZONTAL Peak
4	6451.353	46.27	33.88	5.87	37.00	49.02	74.00	-24.98	HORIZONTAL Peak
5	7320.000	44.98	36.00	6.13	37.43	49.68	74.00	-24.32	HORIZONTAL Peak
6	9760.000	44.22	38.50	7.02	37.41	52.33	74.00	-21.67	HORIZONTAL Peak

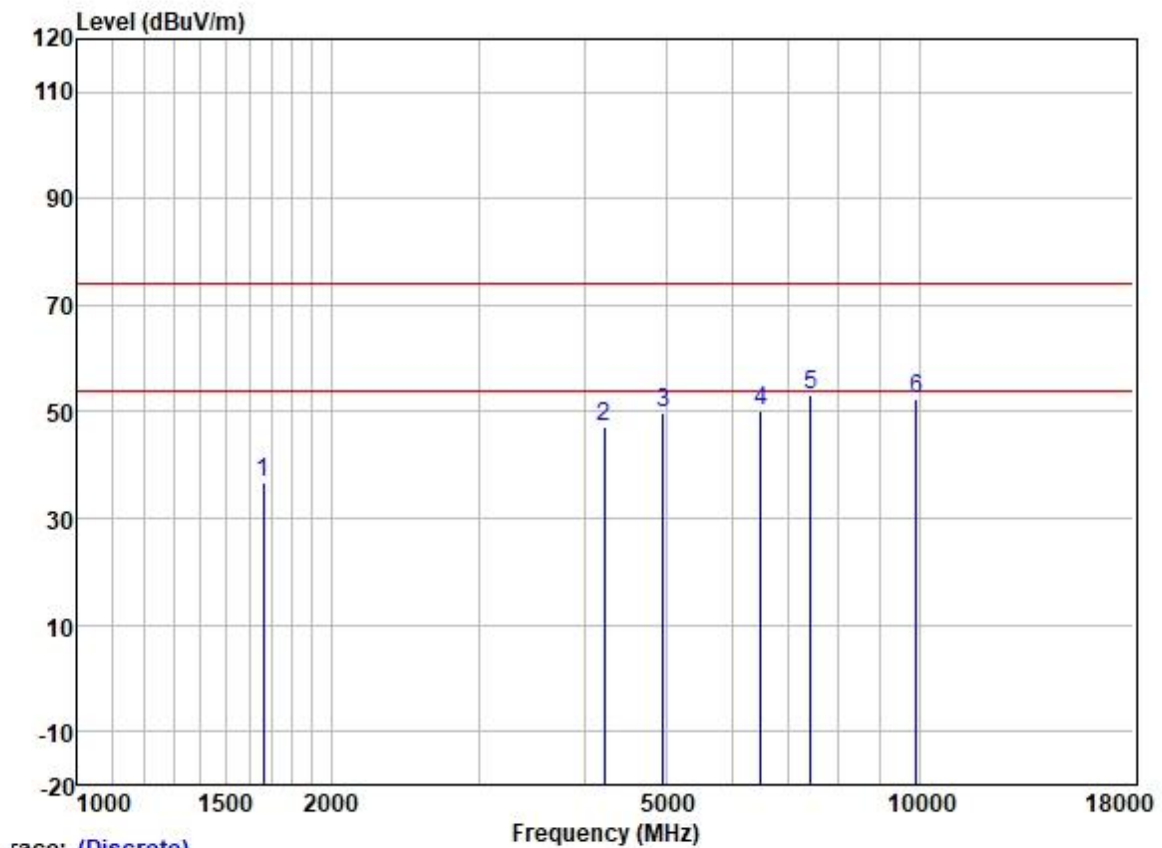
Test Mode: 00; Polarity: Vertical; Modulation: O-QPSK; ; Channel:middle



race: (Discrete)

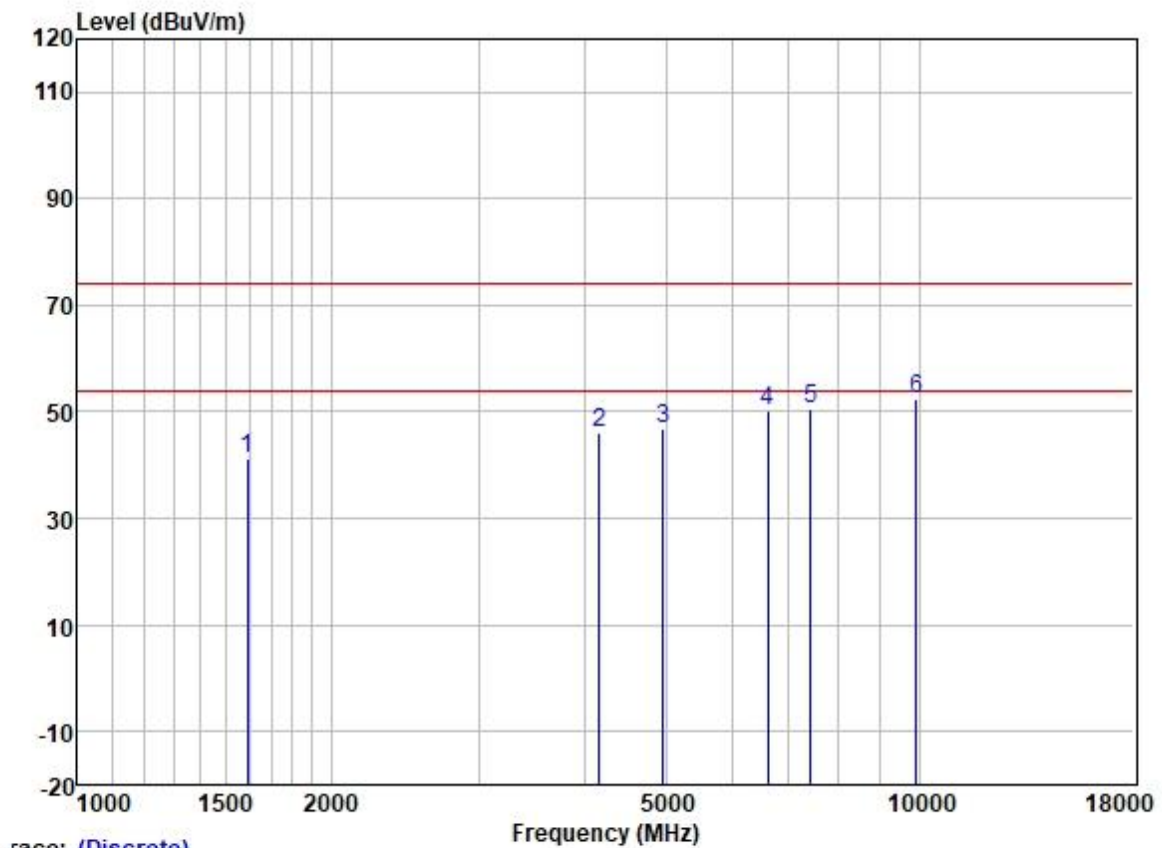
	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
		Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1583.392	45.32	25.56	2.80	38.00	35.68	74.00	-38.32	VERTICAL	Peak
2	4341.886	48.07	30.57	4.67	36.81	46.50	74.00	-27.50	VERTICAL	Peak
3	4880.000	45.29	31.54	5.50	36.84	45.49	74.00	-28.51	VERTICAL	Peak
4	6698.373	45.93	34.38	5.83	37.08	49.06	74.00	-24.94	VERTICAL	Peak
5	7320.000	45.11	36.00	6.13	37.43	49.81	74.00	-24.19	VERTICAL	Peak
6	9760.000	44.03	38.50	7.02	37.41	52.14	74.00	-21.86	VERTICAL	Peak

Test Mode: 00; Polarity: Horizontal; Modulation: O-QPSK; ; Channel: High



	Freq	ReadAntenna	Cable	Preamp		Limit	Over		
	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	1663.137	46.08	25.65	2.80	37.91	36.62	74.00	-37.38	HORIZONTAL Peak
2	4230.396	49.27	30.26	4.61	36.81	47.33	74.00	-26.67	HORIZONTAL Peak
3	4960.000	49.18	31.65	5.65	36.84	49.64	74.00	-24.36	HORIZONTAL Peak
4	6488.754	47.39	33.96	5.85	37.01	50.19	74.00	-23.81	HORIZONTAL Peak
5	7440.000	48.01	36.27	6.22	37.47	53.03	74.00	-20.97	HORIZONTAL Peak
6	9920.000	44.31	38.65	6.96	37.40	52.52	74.00	-21.48	HORIZONTAL Peak

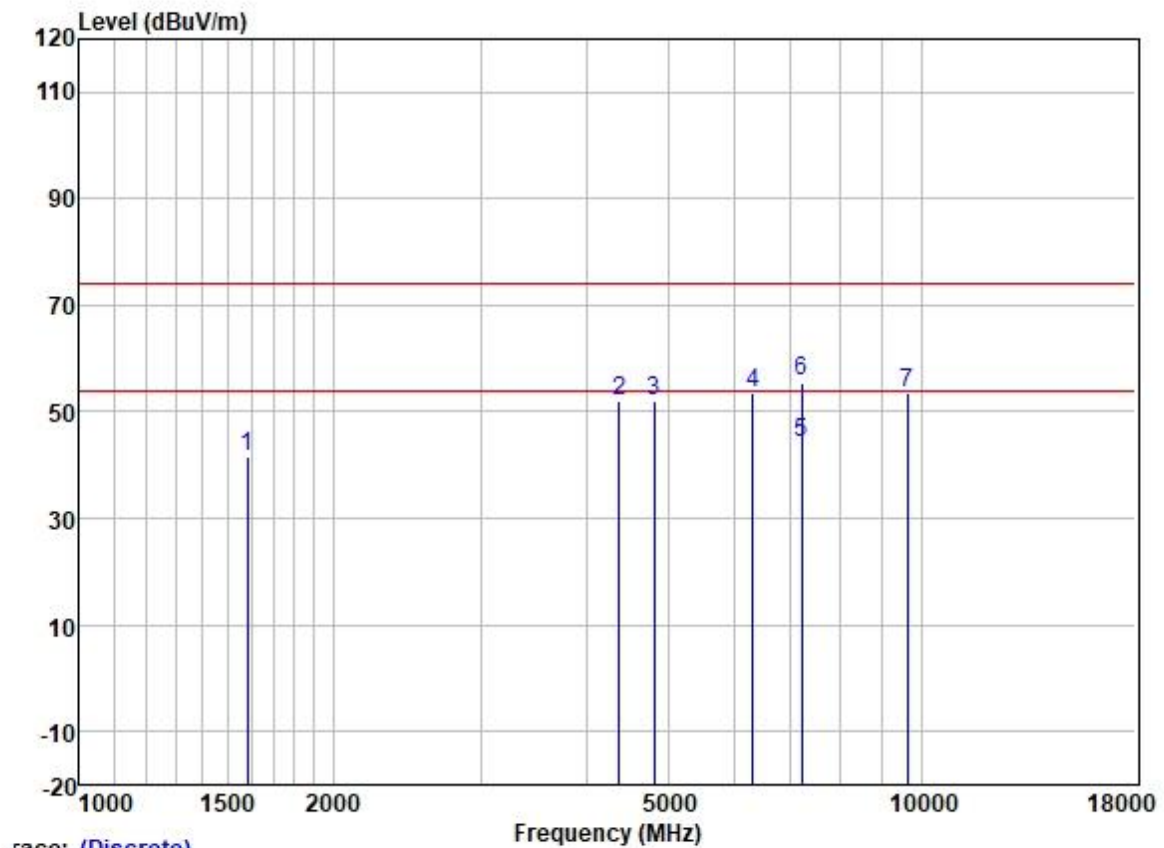
Test Mode: 00; Polarity: Vertical; Modulation: O-QPSK; ; Channel:High



race: (Discrete)	Frequency (MHz)									
	Freq	ReadAntenna	Cable	Preamp		Limit	Over	Pol/Phase	Remark	
		Level	Factor	Loss	Factor	Level	Line			Limit
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1592.571	50.80	25.57	2.80	37.98	41.19	74.00	-32.81	VERTICAL	Peak
2	4169.698	48.27	30.09	4.60	36.80	46.16	74.00	-27.84	VERTICAL	Peak
3	4960.000	46.34	31.65	5.65	36.84	46.80	74.00	-27.20	VERTICAL	Peak
4	6602.265	47.22	34.16	5.84	37.04	50.18	74.00	-23.82	VERTICAL	Peak
5	7440.000	45.54	36.27	6.22	37.47	50.56	74.00	-23.44	VERTICAL	Peak
6	9920.000	44.29	38.65	6.96	37.40	52.50	74.00	-21.50	VERTICAL	Peak

ANT2

Test Mode: 00; Polarity: Horizontal; Modulation: O-QPSK; Channel: Low



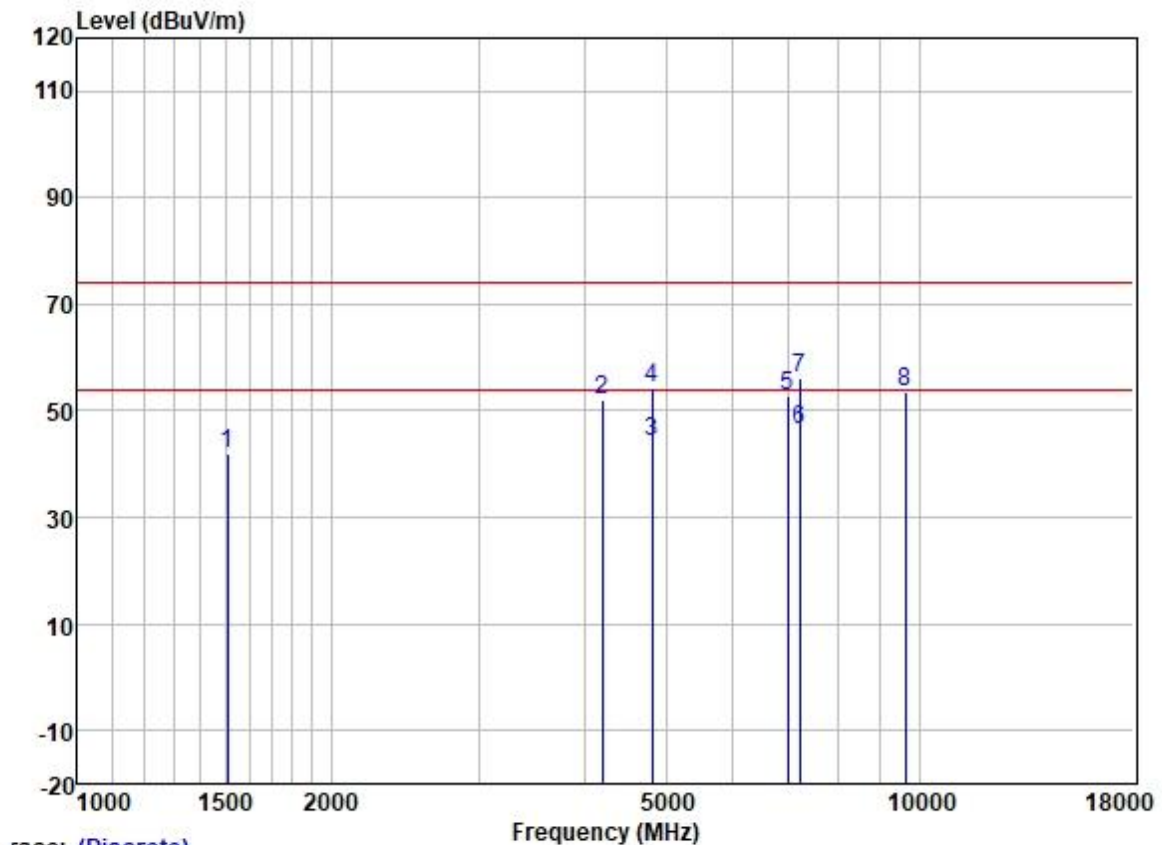
race: (Discrete)

	Freq	ReadAntenna Level	Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1583.392	51.15	25.56	2.80	38.00	41.51	74.00	-32.49	HORIZONTAL	Peak
2	4379.699	53.45	30.64	4.69	36.81	51.97	74.00	-22.03	HORIZONTAL	Peak
3	4810.000	51.90	31.42	5.40	36.83	51.89	74.00	-22.11	HORIZONTAL	Peak
4	6303.890	51.06	33.44	5.97	36.96	53.51	74.00	-20.49	HORIZONTAL	Peak
5	7215.000	39.82	35.62	6.01	37.39	44.06	54.00	-9.94	HORIZONTAL	Average
6	7215.000	51.36	35.62	6.01	37.39	55.60	74.00	-18.40	HORIZONTAL	Peak
7	9620.000	45.34	38.37	7.07	37.42	53.36	74.00	-20.64	HORIZONTAL	Peak



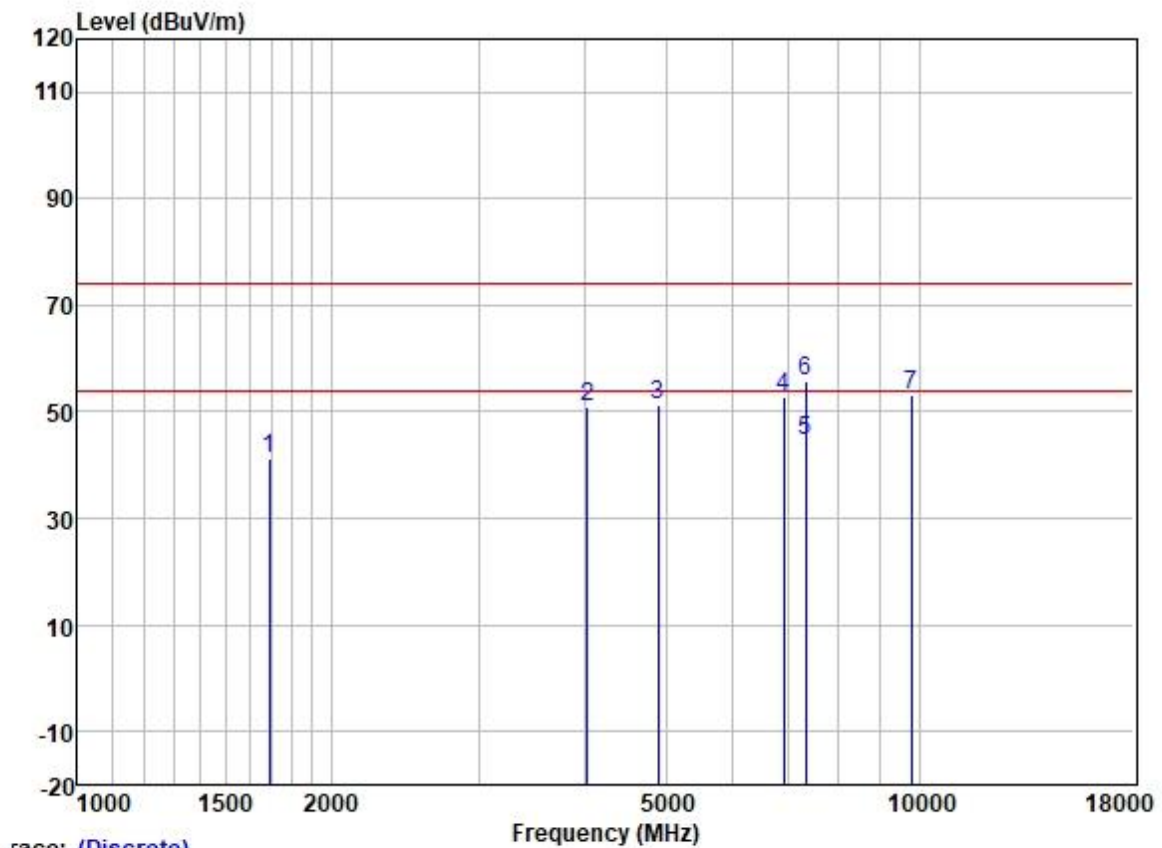
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Test Mode: 00; Polarity: Vertical; Modulation: O-QPSK; ; Channel: Low



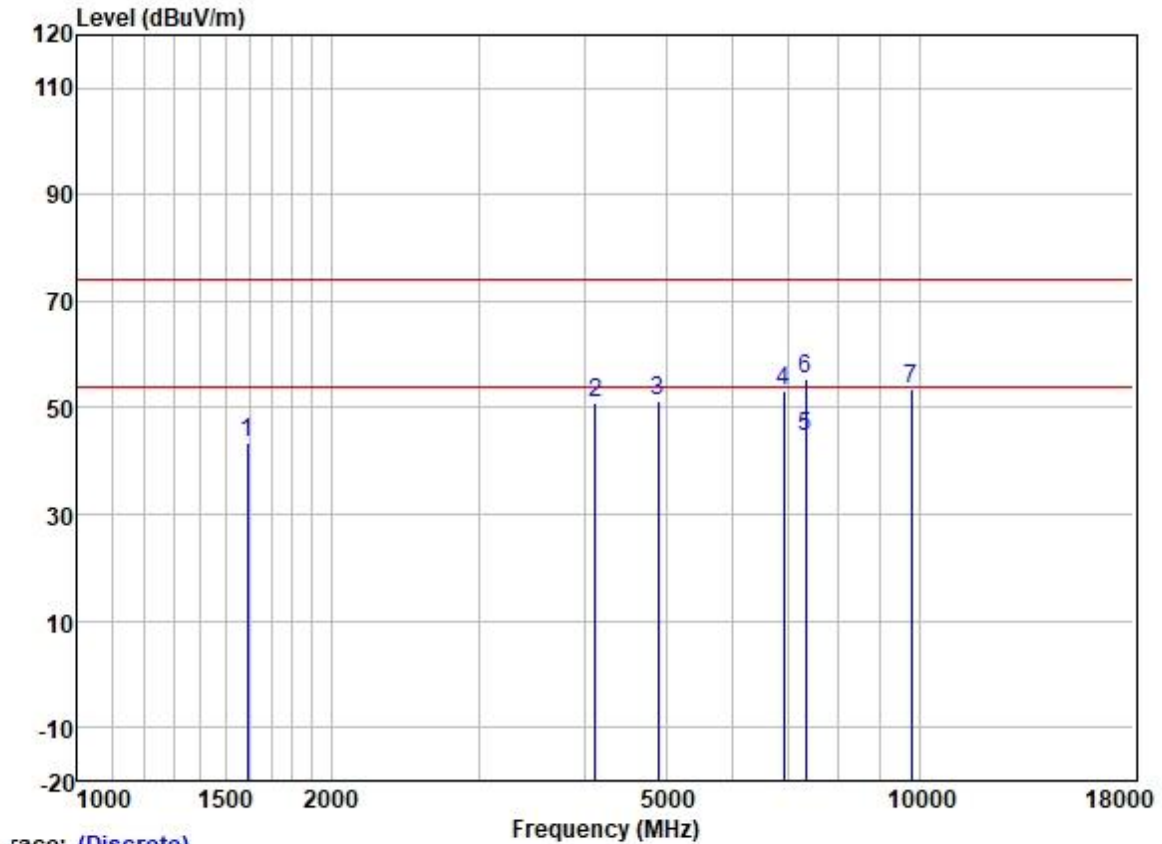
	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1507.470	51.63	25.51	2.80	38.10	41.84	74.00	-32.16	VERTICAL	Peak
2	4206.011	53.95	30.18	4.60	36.81	51.92	74.00	-22.08	VERTICAL	Peak
3	4810.000	44.06	31.42	5.40	36.83	44.05	54.00	-9.95	VERTICAL	Average
4	4810.000	54.34	31.42	5.40	36.83	54.33	74.00	-19.67	VERTICAL	Peak
5	6974.982	49.18	34.97	5.81	37.23	52.73	74.00	-21.27	VERTICAL	Peak
6	7215.000	42.22	35.62	6.01	37.39	46.46	54.00	-7.54	VERTICAL	Average
7	7215.000	51.81	35.62	6.01	37.39	56.05	74.00	-17.95	VERTICAL	Peak
8	9620.000	45.55	38.37	7.07	37.42	53.57	74.00	-20.43	VERTICAL	Peak

Test Mode: 00; Polarity: Horizontal; Modulation: O-QPSK; ; Channel:middle



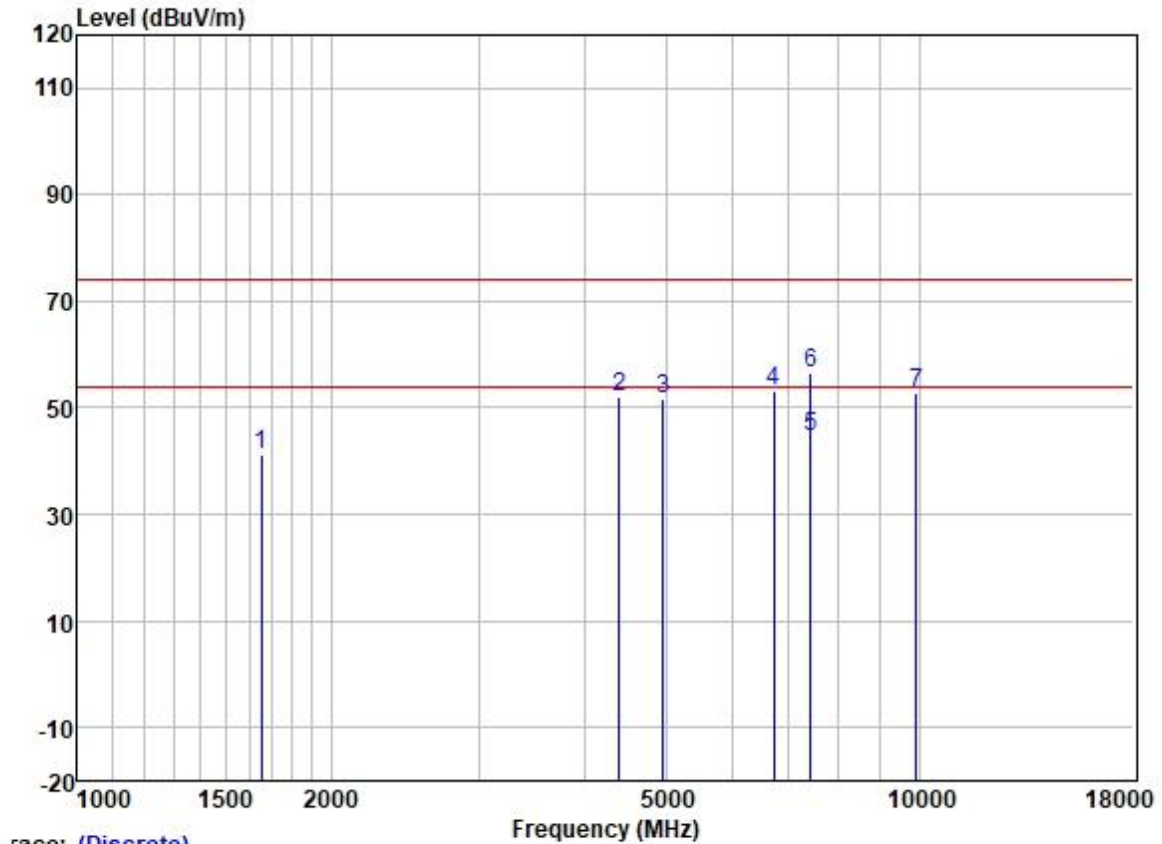
	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1692.231	50.76	25.70	2.80	37.89	41.37	74.00	-32.63	HORIZONTAL	Peak
2	4039.212	53.39	29.85	4.60	36.80	51.04	74.00	-22.96	HORIZONTAL	Peak
3	4890.000	51.13	31.56	5.52	36.84	51.37	74.00	-22.63	HORIZONTAL	Peak
4	6894.806	49.49	34.85	5.81	37.18	52.97	74.00	-21.03	HORIZONTAL	Peak
5	7335.000	39.89	36.00	6.13	37.43	44.59	54.00	-9.41	HORIZONTAL	Average
6	7335.000	51.19	36.00	6.13	37.43	55.89	74.00	-18.11	HORIZONTAL	Peak
7	9780.000	45.07	38.53	7.01	37.41	53.20	74.00	-20.80	HORIZONTAL	Peak

Test Mode: 00; Polarity: Vertical; Modulation: O-QPSK; ; Channel:middle



	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1592.571	53.16	25.57	2.80	37.98	43.55	74.00	-30.45	VERTICAL	Peak
2	4121.768	53.19	29.98	4.60	36.80	50.97	74.00	-23.03	VERTICAL	Peak
3	4890.000	51.07	31.56	5.52	36.84	51.31	74.00	-22.69	VERTICAL	Peak
4	6894.806	49.75	34.85	5.81	37.18	53.23	74.00	-20.77	VERTICAL	Peak
5	7335.000	39.92	36.00	6.13	37.43	44.62	54.00	-9.38	VERTICAL	Average
6	7335.000	50.74	36.00	6.13	37.43	55.44	74.00	-18.56	VERTICAL	Peak
7	9780.000	45.31	38.53	7.01	37.41	53.44	74.00	-20.56	VERTICAL	Peak

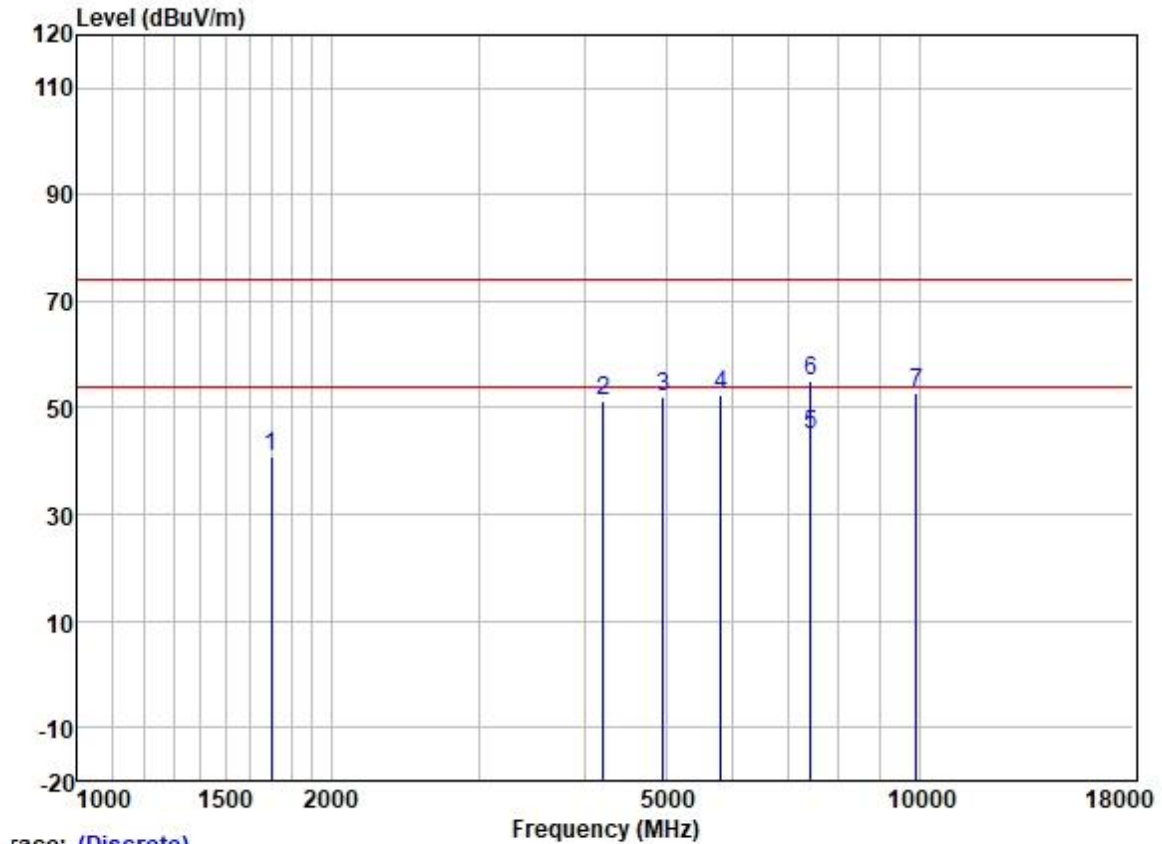
Test Mode: 00; Polarity: Horizontal; Modulation: O-QPSK; ; Channel: High



race: (Discrete)

	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1653.550	50.70	25.64	2.80	37.93	41.21	74.00	-32.79	HORIZONTAL	Peak
2	4405.090	53.55	30.68	4.70	36.81	52.12	74.00	-21.88	HORIZONTAL	Peak
3	4960.000	51.36	31.65	5.65	36.84	51.82	74.00	-22.18	HORIZONTAL	Peak
4	6717.762	49.84	34.44	5.83	37.09	53.02	74.00	-20.98	HORIZONTAL	Peak
5	7440.000	39.64	36.27	6.22	37.47	44.66	54.00	-9.34	HORIZONTAL	Average
6	7440.000	51.52	36.27	6.22	37.47	56.54	74.00	-17.46	HORIZONTAL	Peak
7	9920.000	44.51	38.65	6.96	37.40	52.72	74.00	-21.28	HORIZONTAL	Peak

Test Mode: 00; Polarity: Vertical; Modulation: O-QPSK; ; Channel:High



	Freq	ReadAntenna	Cable	Preamp		Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Pol/Phase	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	1697.129	50.38	25.71	2.80	37.89	41.00	74.00	-33.00	VERTICAL	Peak
2	4218.186	53.44	30.22	4.60	36.81	51.45	74.00	-22.55	VERTICAL	Peak
3	4960.000	51.69	31.65	5.65	36.84	52.15	74.00	-21.85	VERTICAL	Peak
4	5813.812	51.22	32.21	6.07	36.90	52.60	74.00	-21.40	VERTICAL	Peak
5	7440.000	39.77	36.27	6.22	37.47	44.79	54.00	-9.21	VERTICAL	Average
6	7440.000	49.94	36.27	6.22	37.47	54.96	74.00	-19.04	VERTICAL	Peak
7	9920.000	44.77	38.65	6.96	37.40	52.98	74.00	-21.02	VERTICAL	Peak

8 Test Setup Photo

Refer to Appendix –Setup Photos for GZCR2203000256AT

9 EUT Constructional Details (EUT Photos)

Refer to Appendix – External and Internal Photos for GZCR2203000256AT

10 Appendix

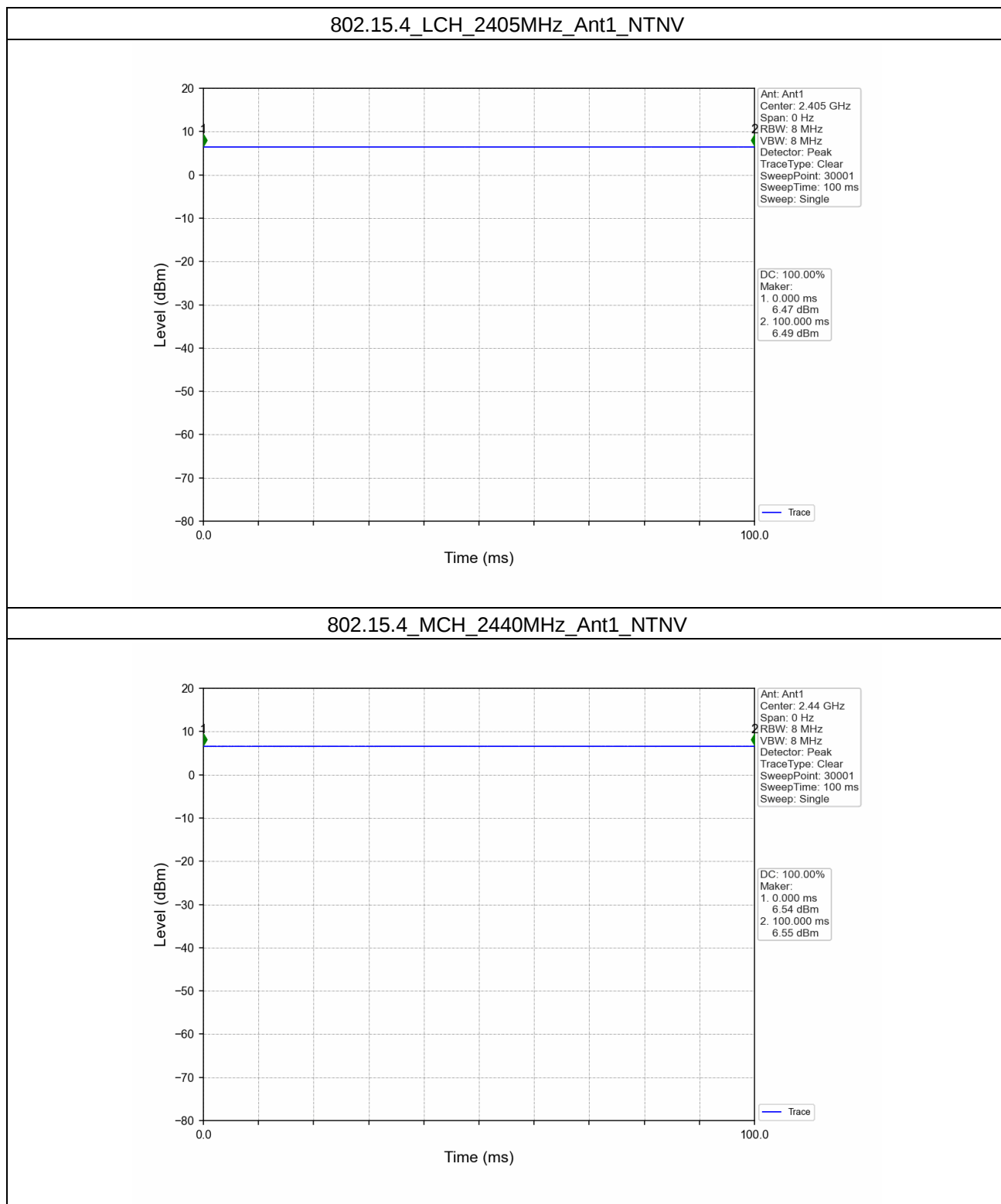
1. Duty Cycle

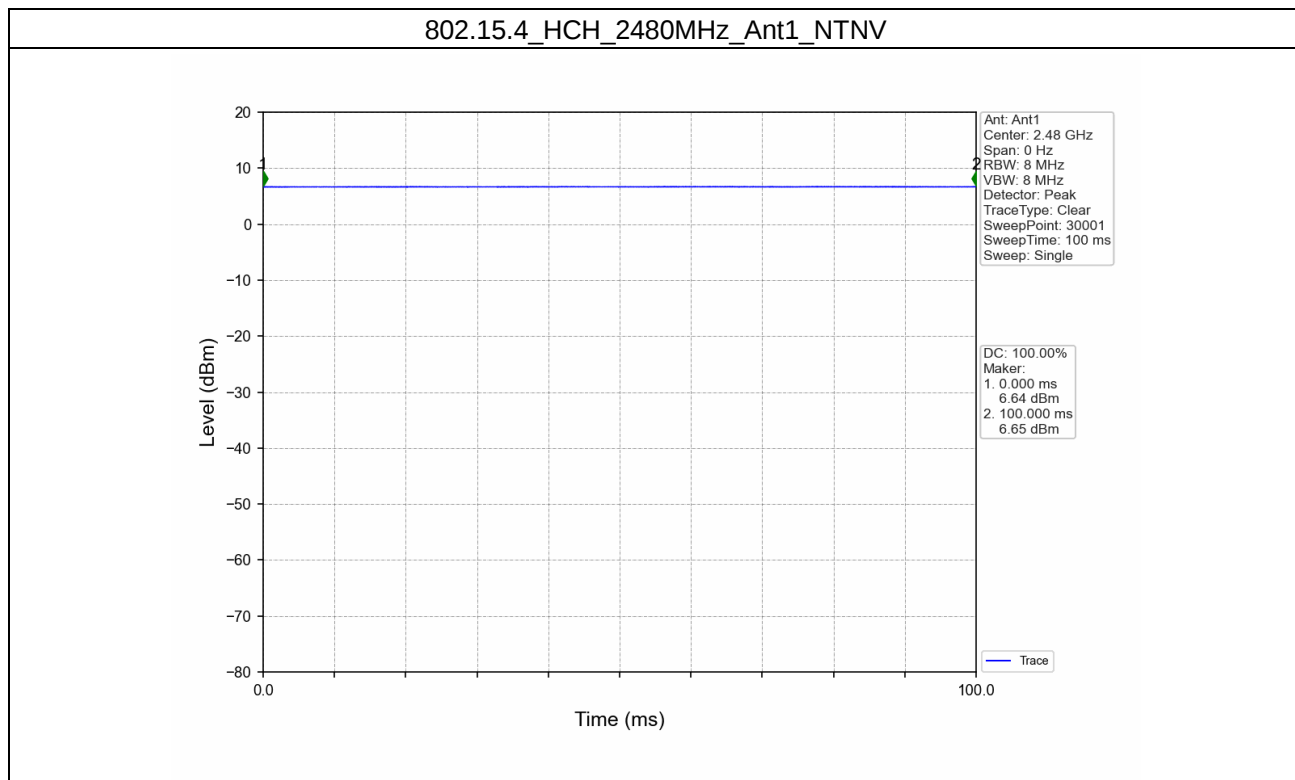
1.1 Ant1

1.1.1 Test Result

Ant1							
Mode	TX Type	Frequency (MHz)	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)
802.15.4	SISO	2405	100.000	100.000	100.00	0.00	0.00
		2440	100.000	100.000	100.00	0.00	0.00
		2480	100.000	100.000	100.00	0.00	0.00

1.1.2 Test Graph





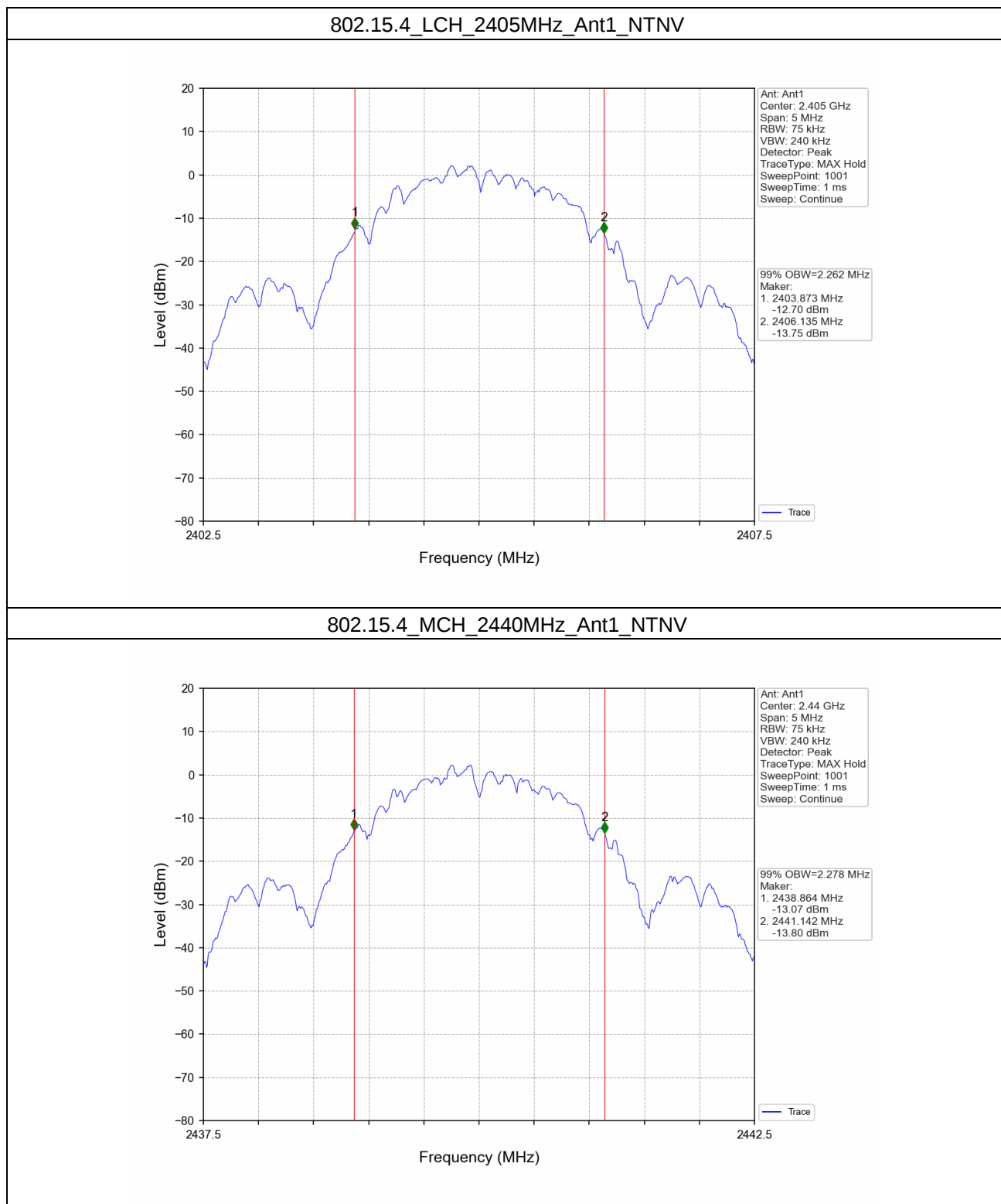
2. Bandwidth

2.1 OBW

2.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Ant	99% Occupied Bandwidth (MHz)	Verdict
				Result	
802.15.4	SISO	2405	1	2.262	Pass
		2440	1	2.278	Pass
		2480	1	2.278	Pass

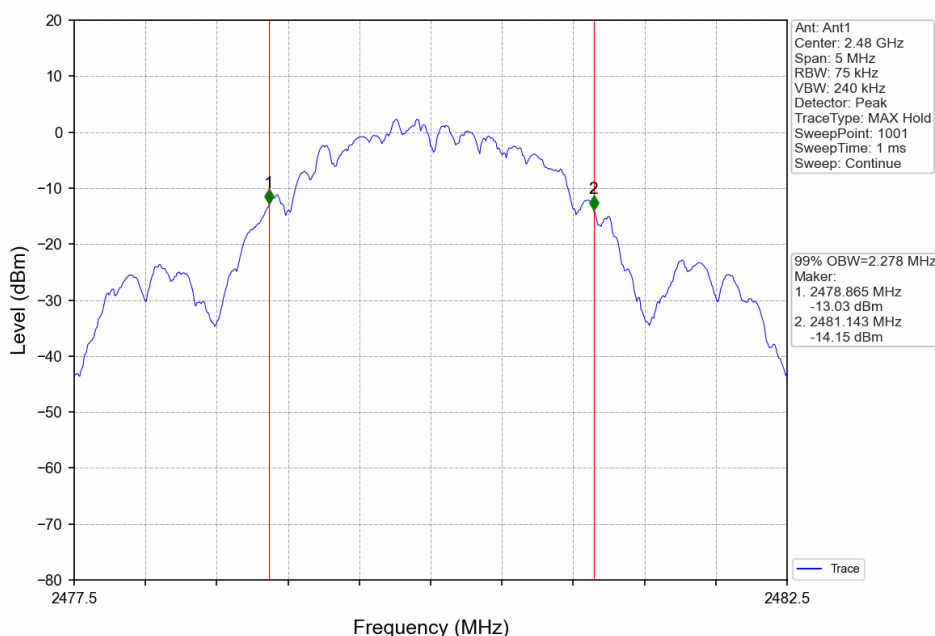
2.1.2 Test Graph



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802.15.4_HCH_2480MHz_Ant1_NTNV

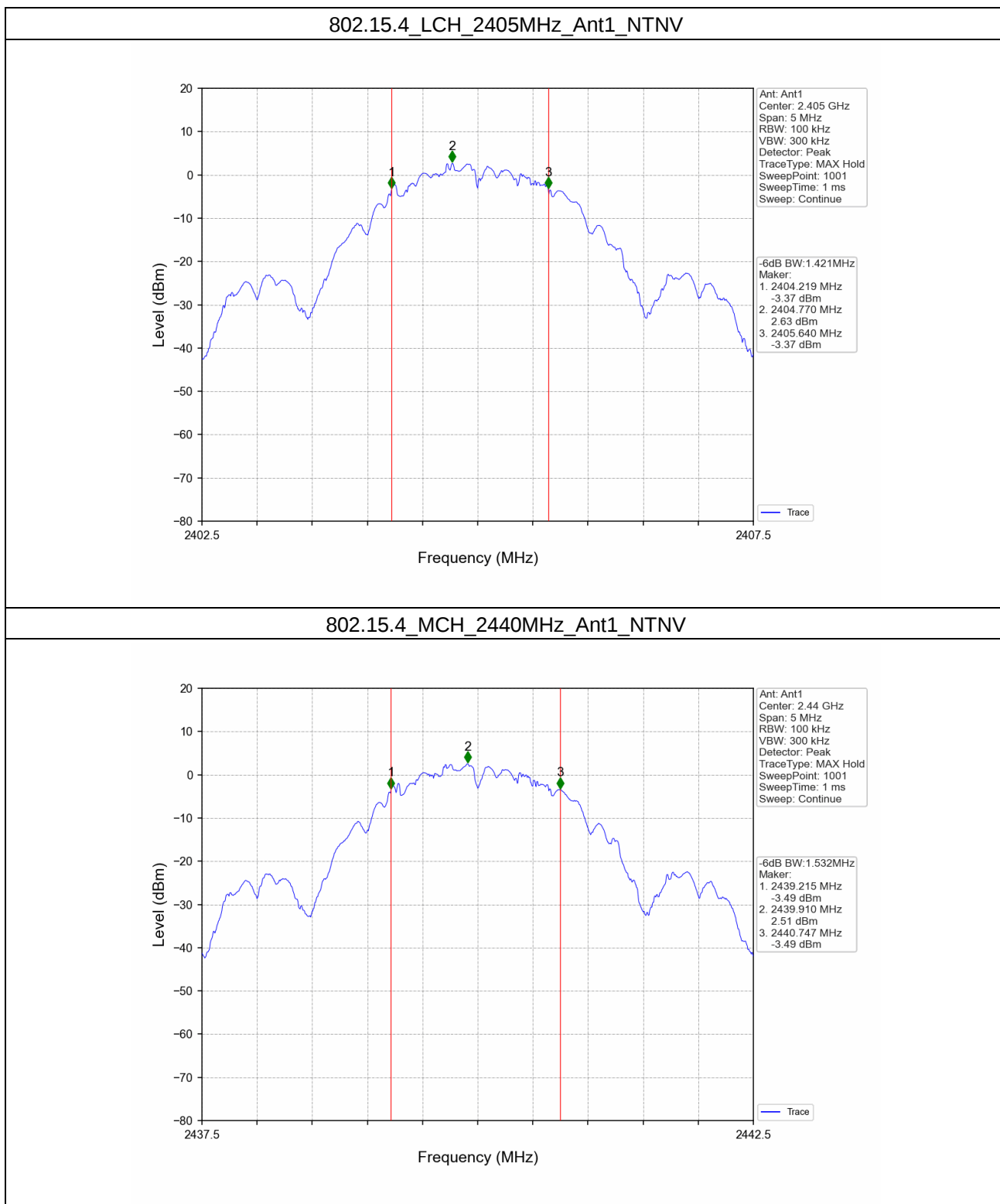


2.2 Minimum 6dB Bandwidth

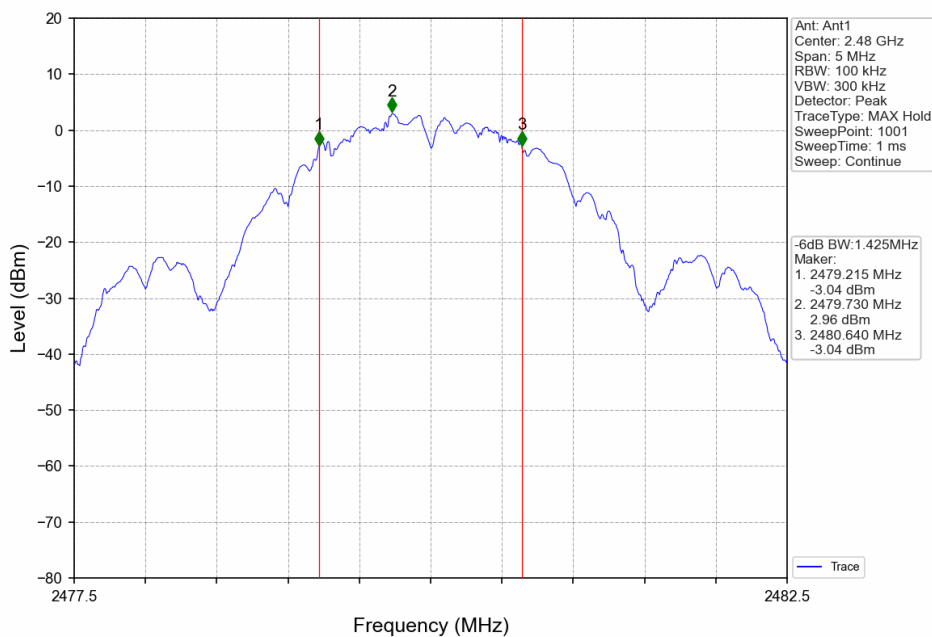
2.2.1 Test Result

Mode	TX Type	Frequency (MHz)	Ant	6dB Bandwidth (MHz)		Verdict
				Result	Limit	
802.15.4	SISO	2405	1	1.421	≥ 0.5	Pass
		2440	1	1.532	≥ 0.5	Pass
		2480	1	1.425	≥ 0.5	Pass

2.2.2 Test Graph



802.15.4_HCH_2480MHz_Ant1_NTNV



3. Conducted Peak Output Power

3.1 Power

3.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			Ant1	Limit	
802.15.4	SISO	2405	6.36	<=30	Pass
		2440	6.44	<=30	Pass
		2480	6.55	<=30	Pass

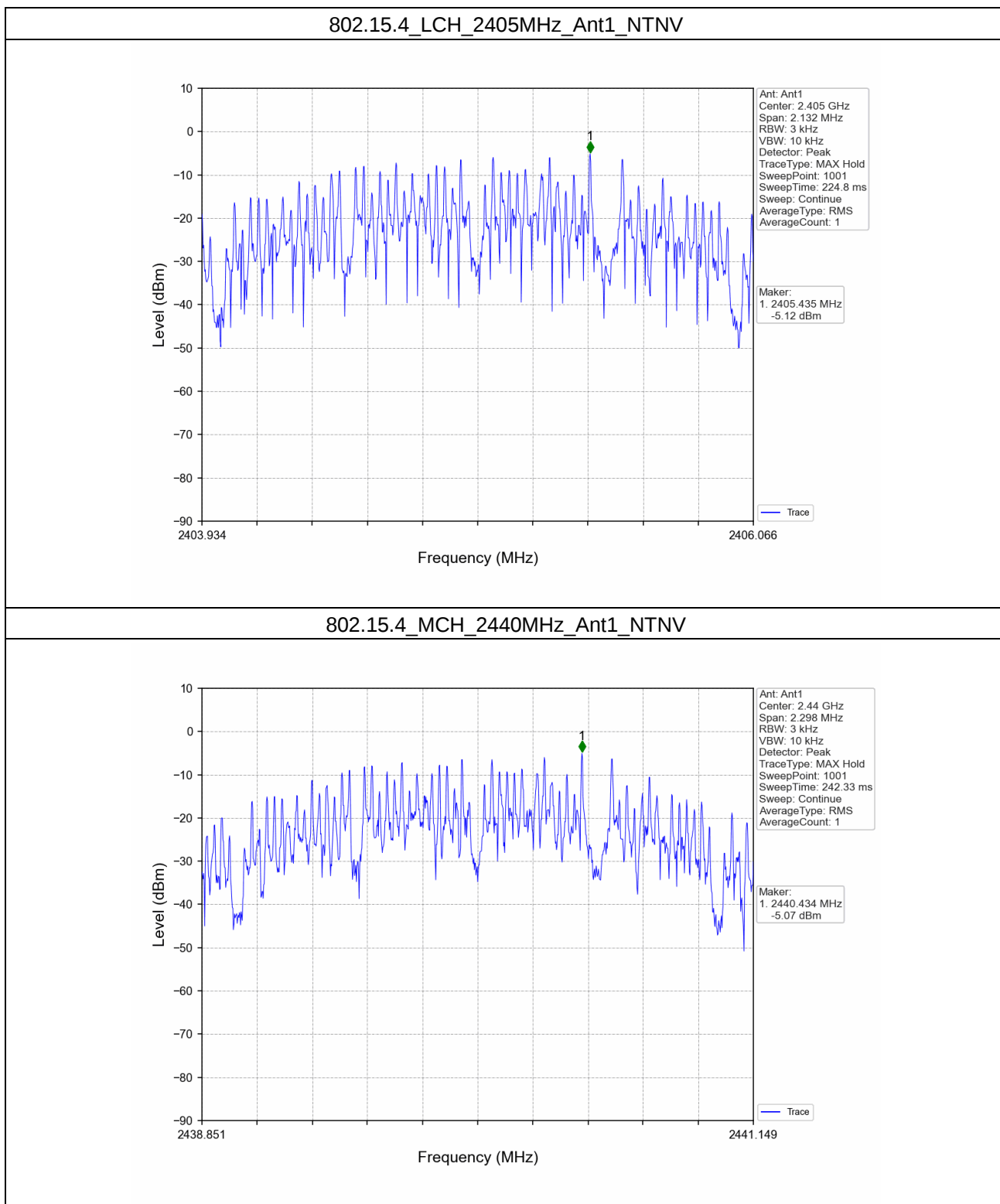
4. Power Spectral Density(PSD)

4.1 PSD

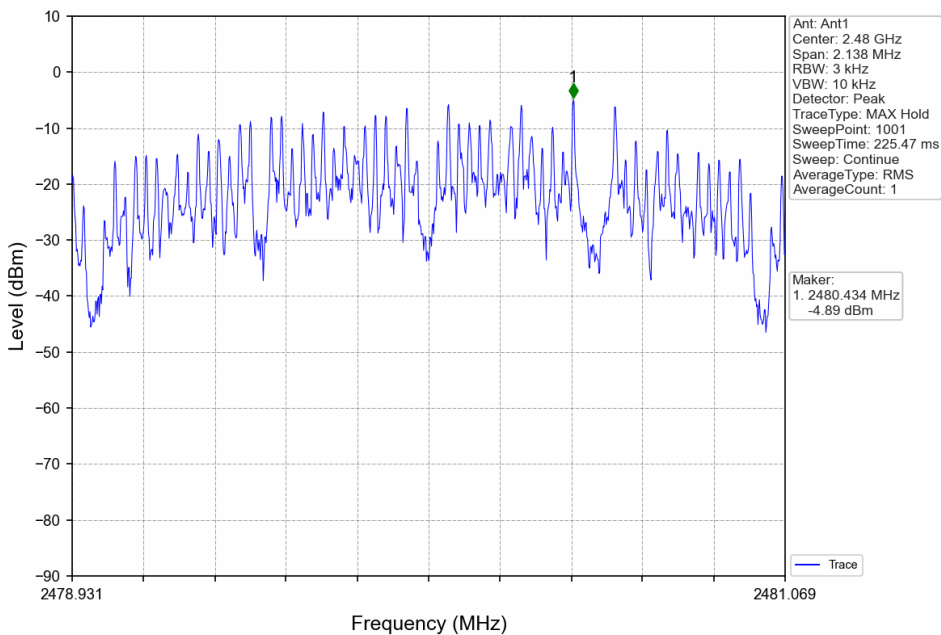
4.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
			Ant1	Limit	
802.15.4	SISO	2405	-5.12	<=8	Pass
		2440	-5.07	<=8	Pass
		2480	-4.89	<=8	Pass

4.1.2 Test Graph



802.15.4_HCH_2480MHz_Ant1_NTNV



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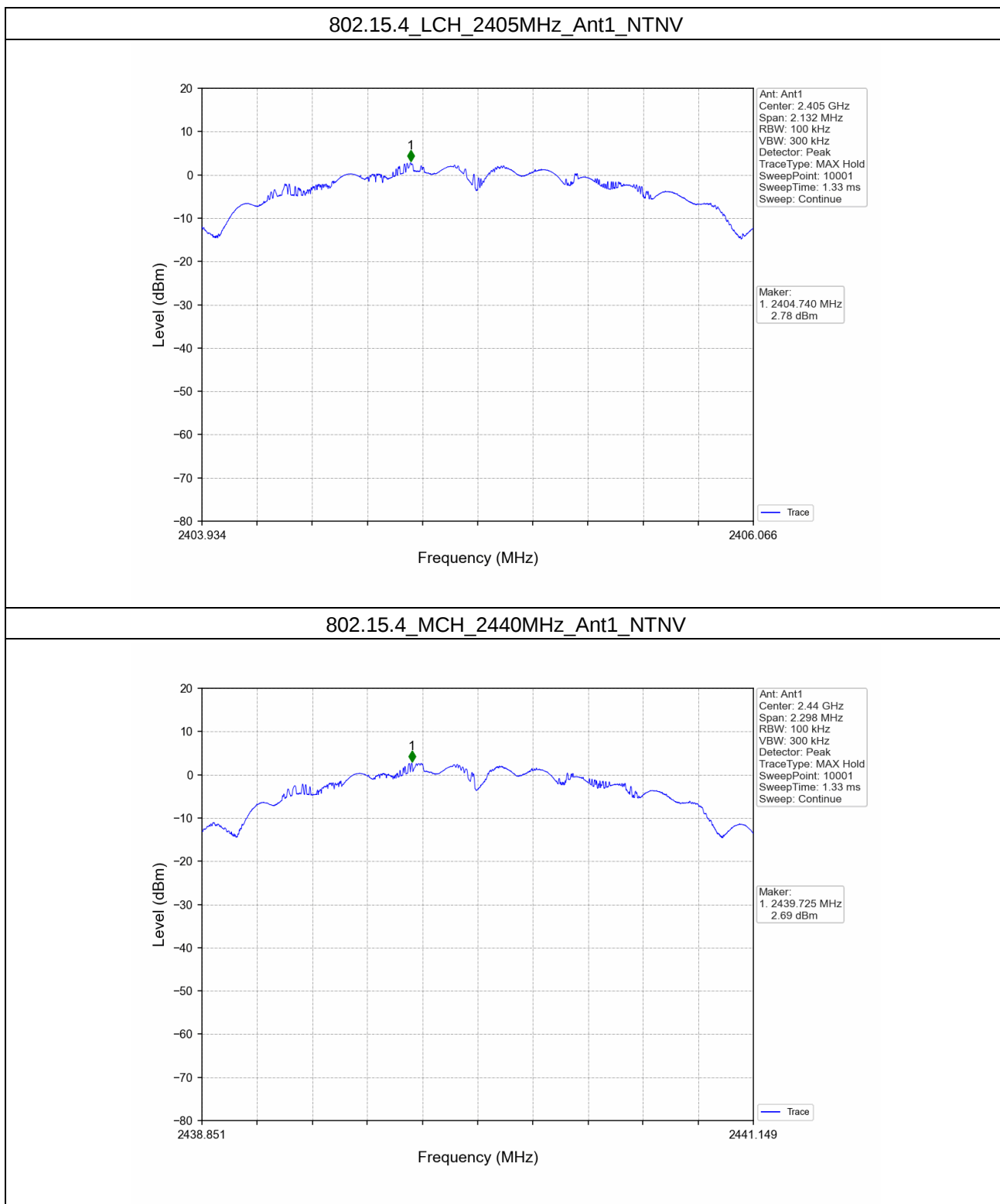
5. Unwanted Emissions In Non-restricted Frequency Bands

5.1 Ref

5.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Ant	Level of Reference (dBm)
802.15.4	SISO	2405	1	2.78
		2440	1	2.69
		2480	1	2.90

5.1.2 Test Graph

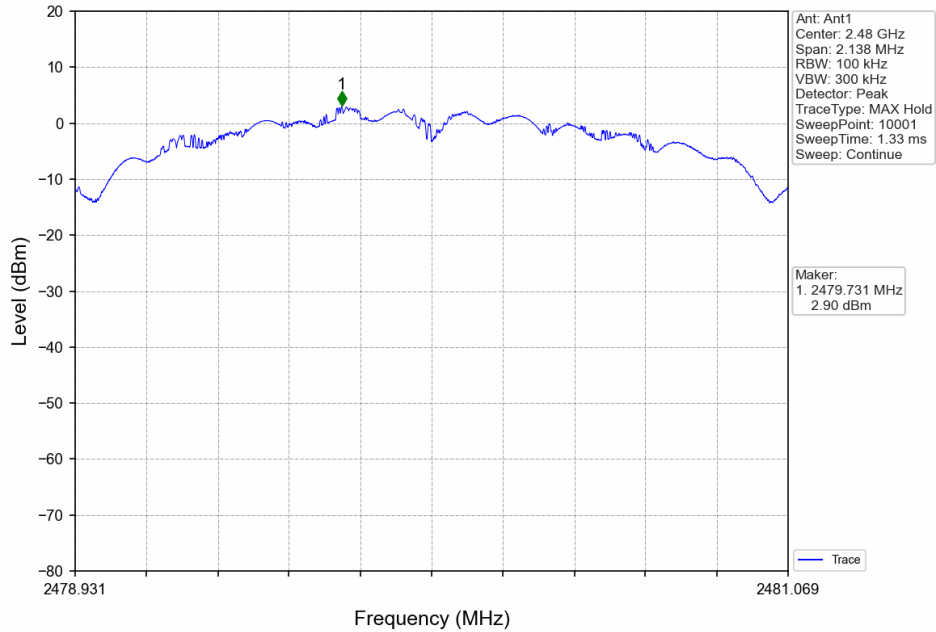


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802.15.4_HCH_2480MHz_Ant1_NTNV



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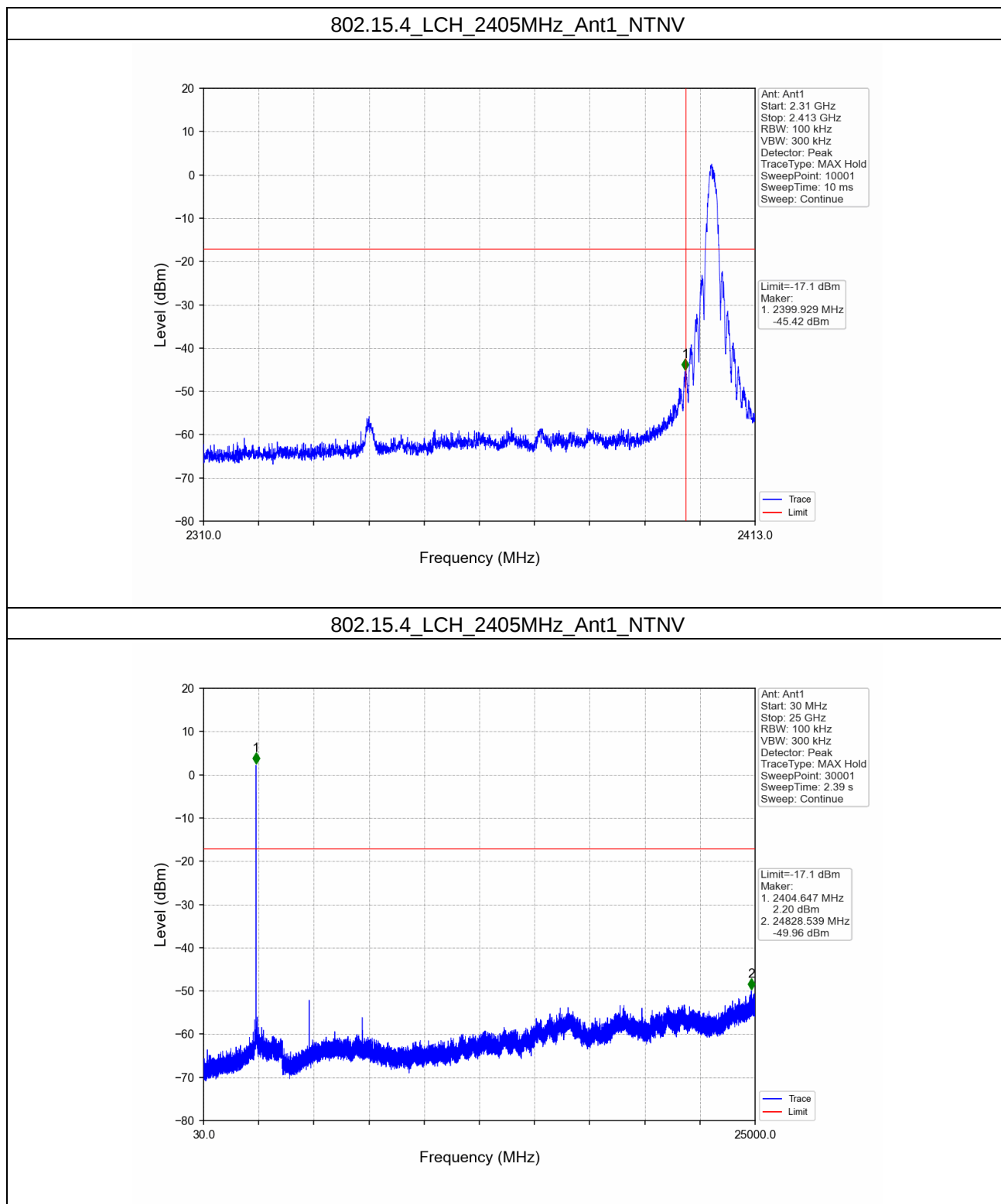
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5.2 Conducted Band Edges Measurement& Conducted Spurious Emissions

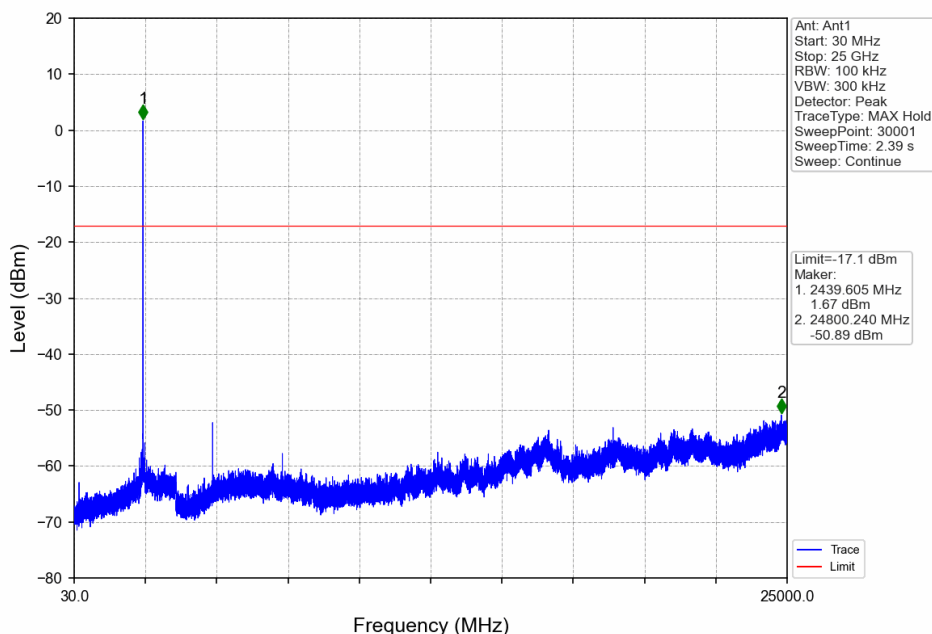
5.2.1 Test Result

Mode	TX Type	Frequency (MHz)	Ant	Level of Reference (dBm)	Limit (dBm)	Verdict
802.15.4	SISO	2405	1	2.90	-17.10	Pass
		2440	1	2.90	-17.10	Pass
		2480	1	2.90	-17.10	Pass

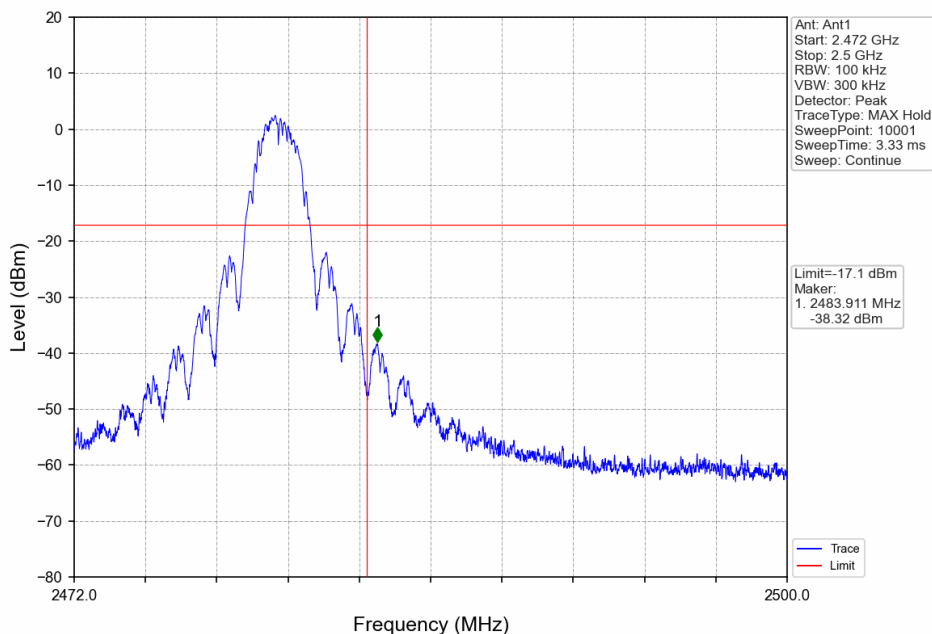
5.2.2 Test Graph



802.15.4_MCH_2440MHz_Ant1_NTNV



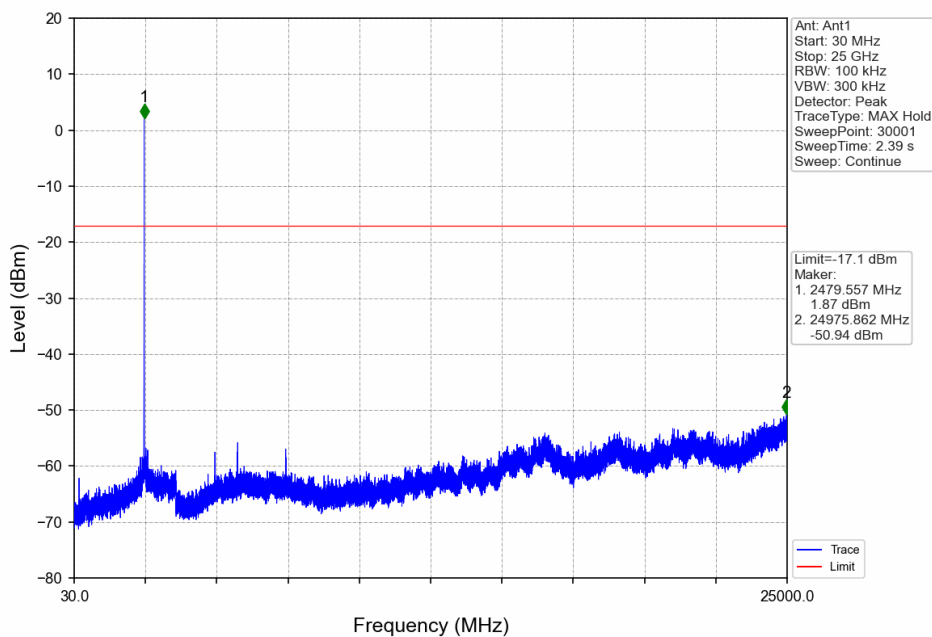
802.15.4_HCH_2480MHz_Ant1_NTNV



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802.15.4_HCH_2480MHz_Ant1_NTNV



ANT2

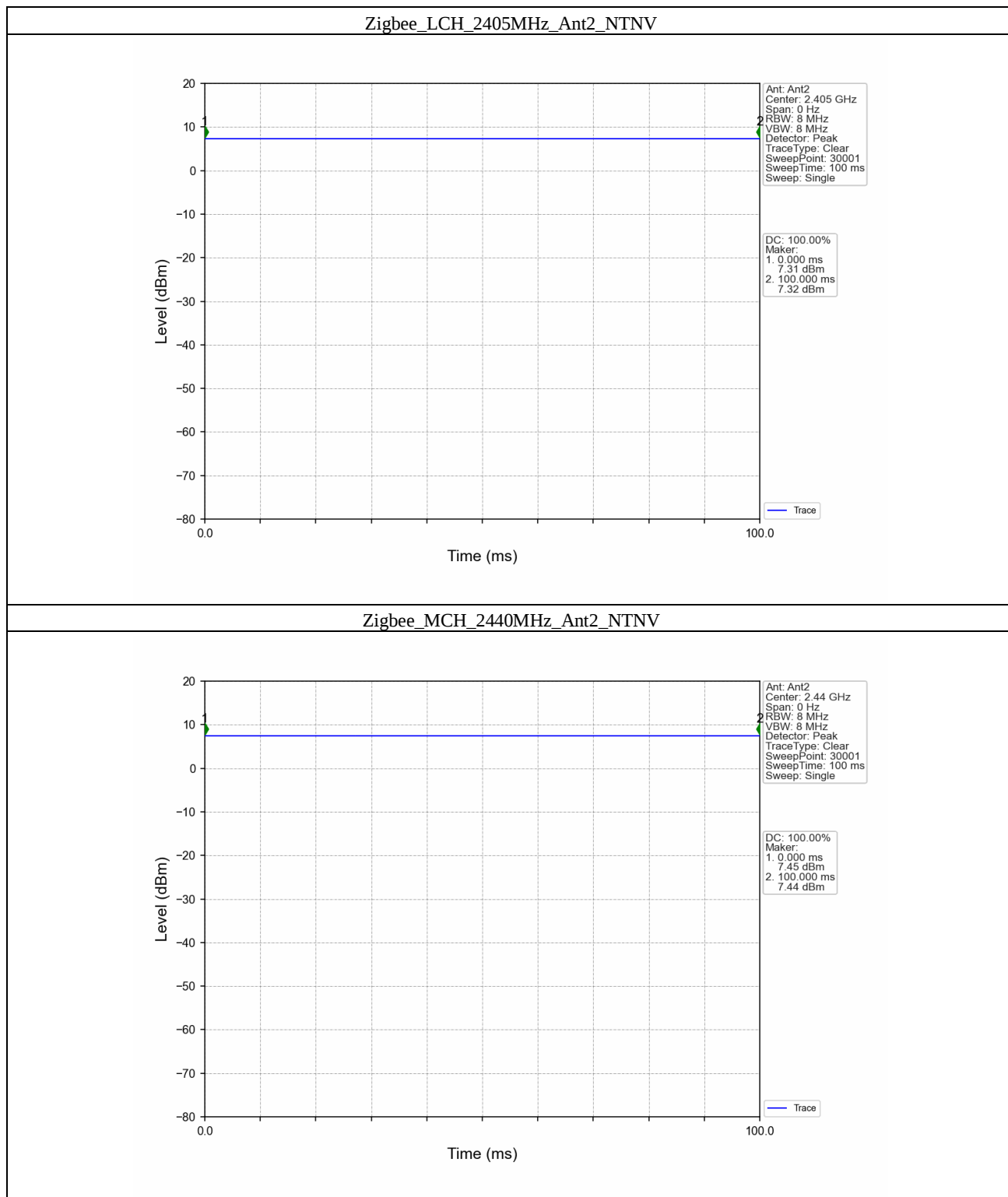
1. Duty Cycle

1.1 Ant2

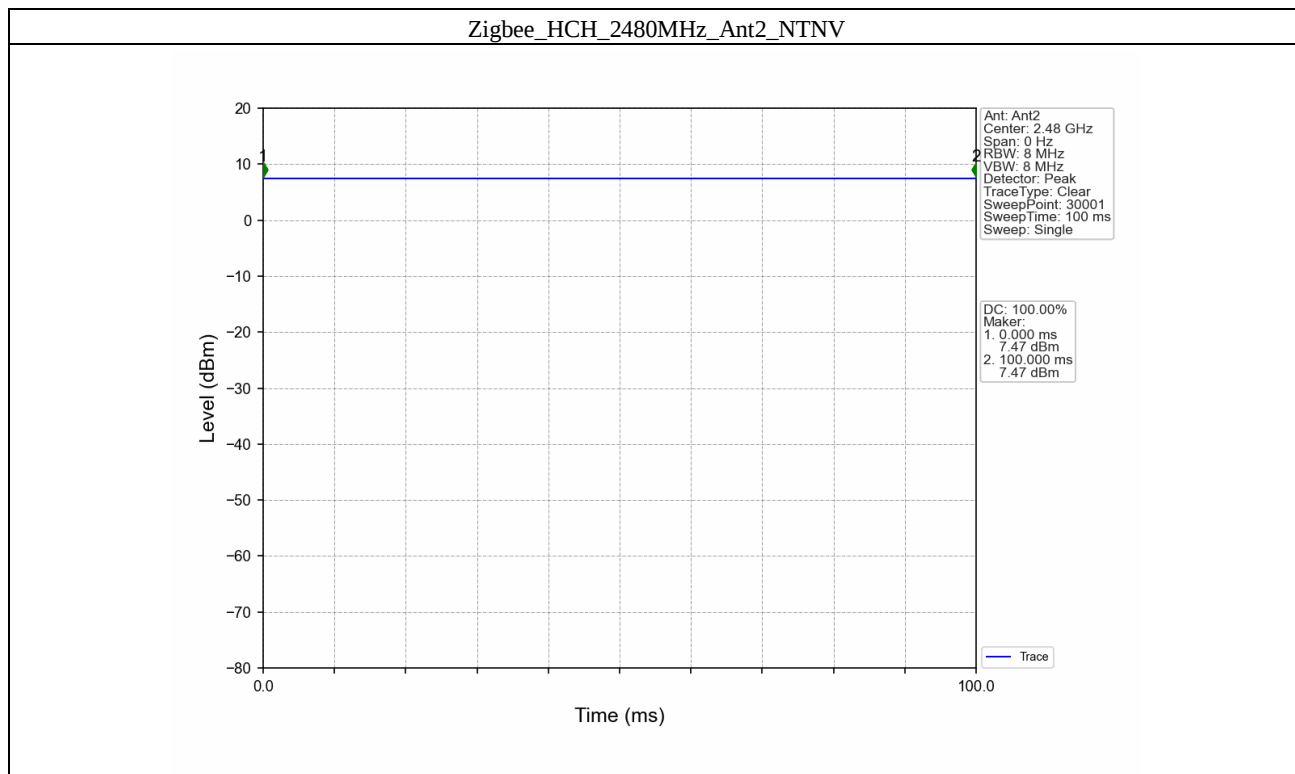
1.1.1 Test Result

Ant2							
Mode	TX Type	Frequency (MHz)	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)
Zigbee	SISO	2405	100.000	100.000	100.00	0.00	0.00
		2440	100.000	100.000	100.00	0.00	0.00
		2480	100.000	100.000	100.00	0.00	0.00

1.1.2 Test Graph



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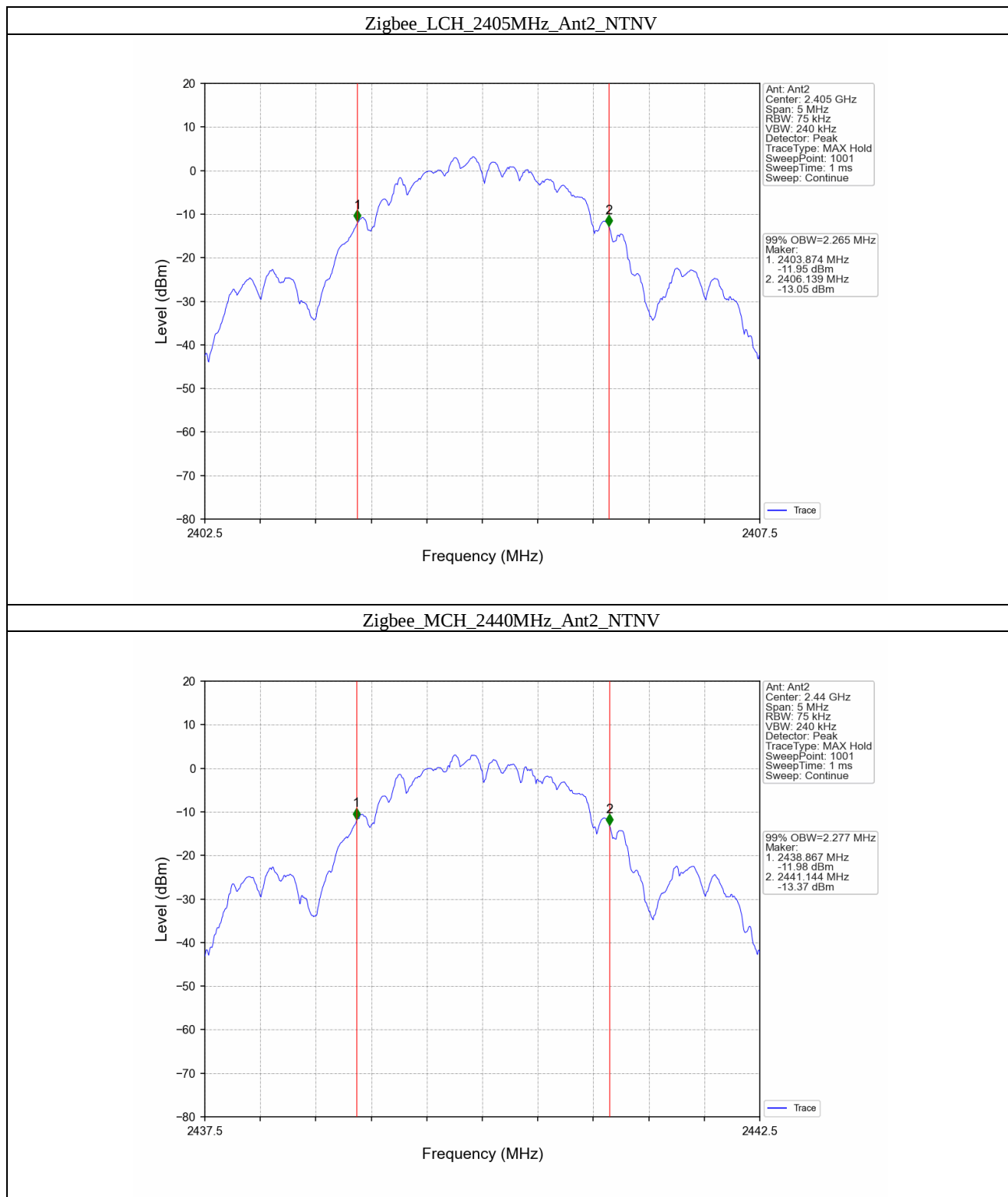
2. Bandwidth

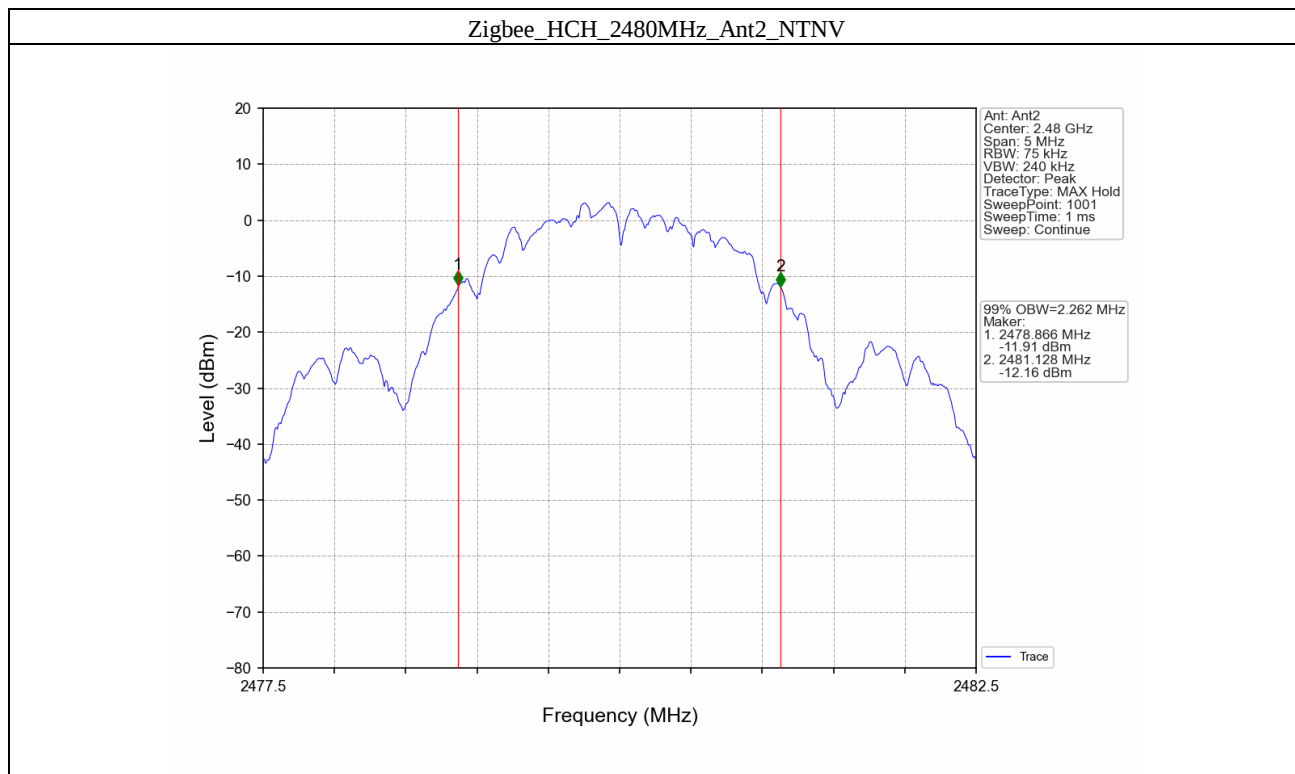
2.1 OBW

2.1.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	99% Occupied Bandwidth (MHz)	Verdict
				Result	
Zigbee	SISO	2405	2	2.265	Pass
		2440	2	2.277	Pass
		2480	2	2.262	Pass

2.1.2 Test Graph



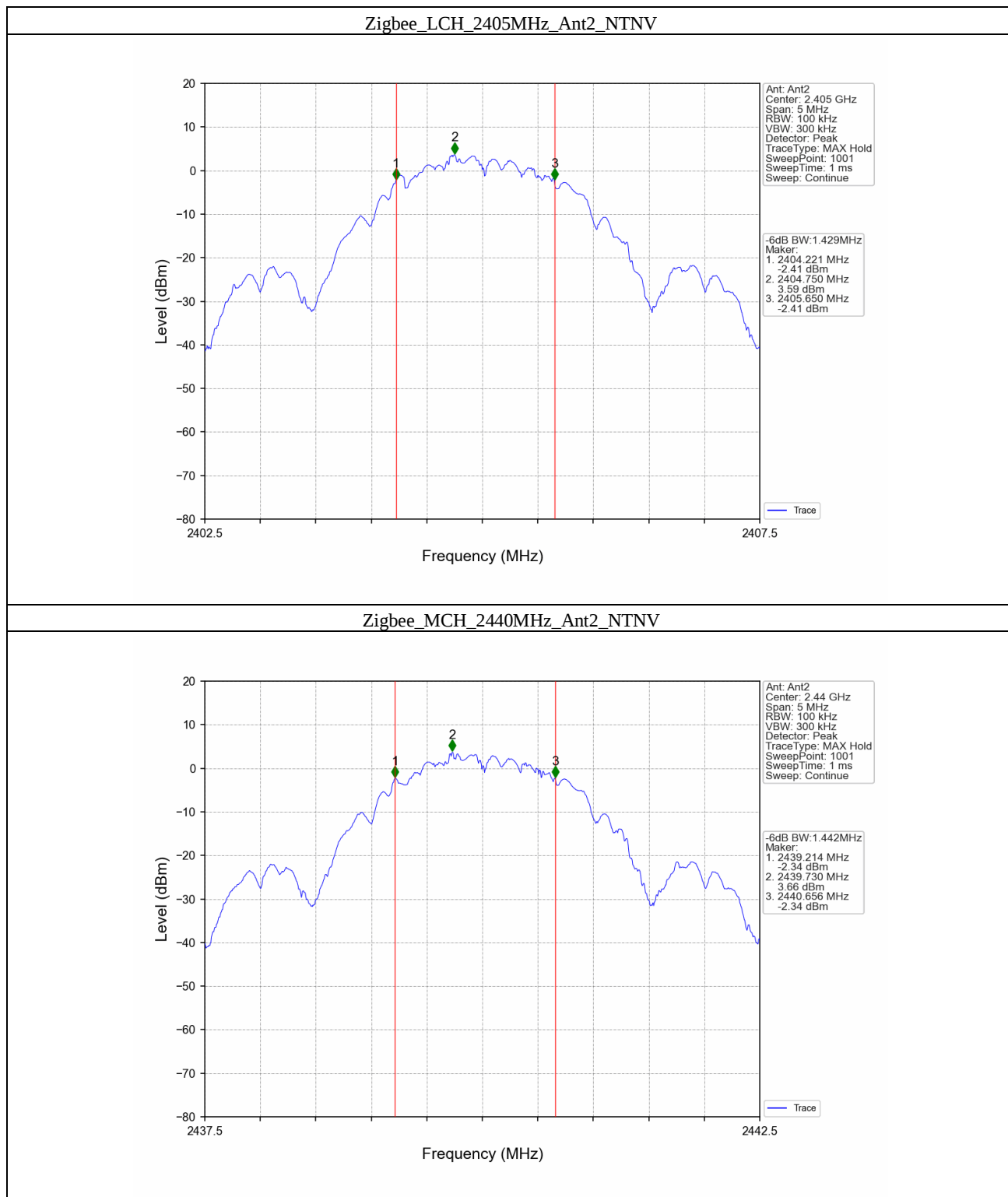


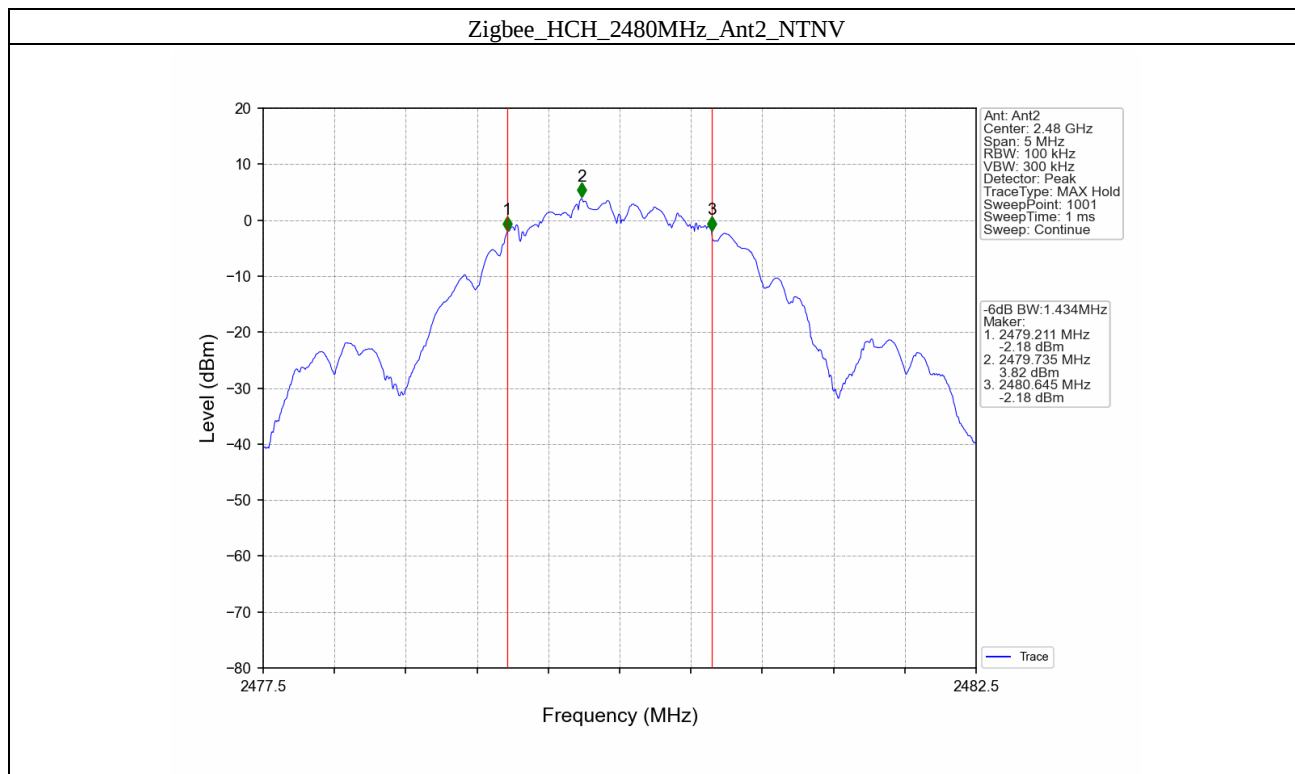
2.2 6dB BW

2.2.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	6dB Bandwidth (MHz)		Verdict
				Result	Limit	
Zigbee	SISO	2405	2	1.429	>=0.5	Pass
		2440	2	1.442	>=0.5	Pass
		2480	2	1.434	>=0.5	Pass

2.2.2 Test Graph





3. Maximum Conducted Output Power

3.1 Power

3.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			ANT2	Limit	
Zigbee	SISO	2405	7.51	≤ 30	Pass
		2440	7.32	≤ 30	Pass
		2480	7.71	≤ 30	Pass

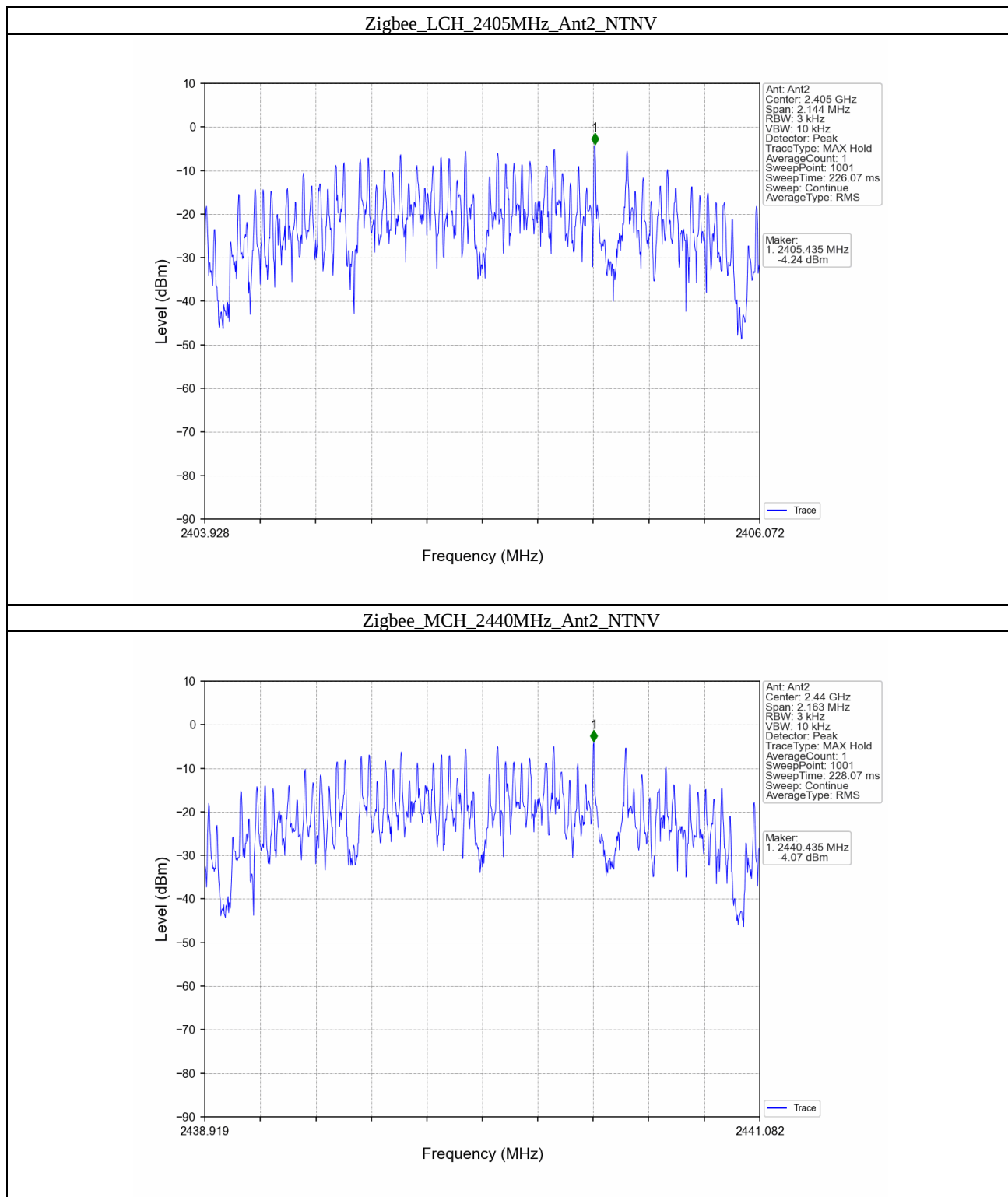
4. Maximum Power Spectral Density

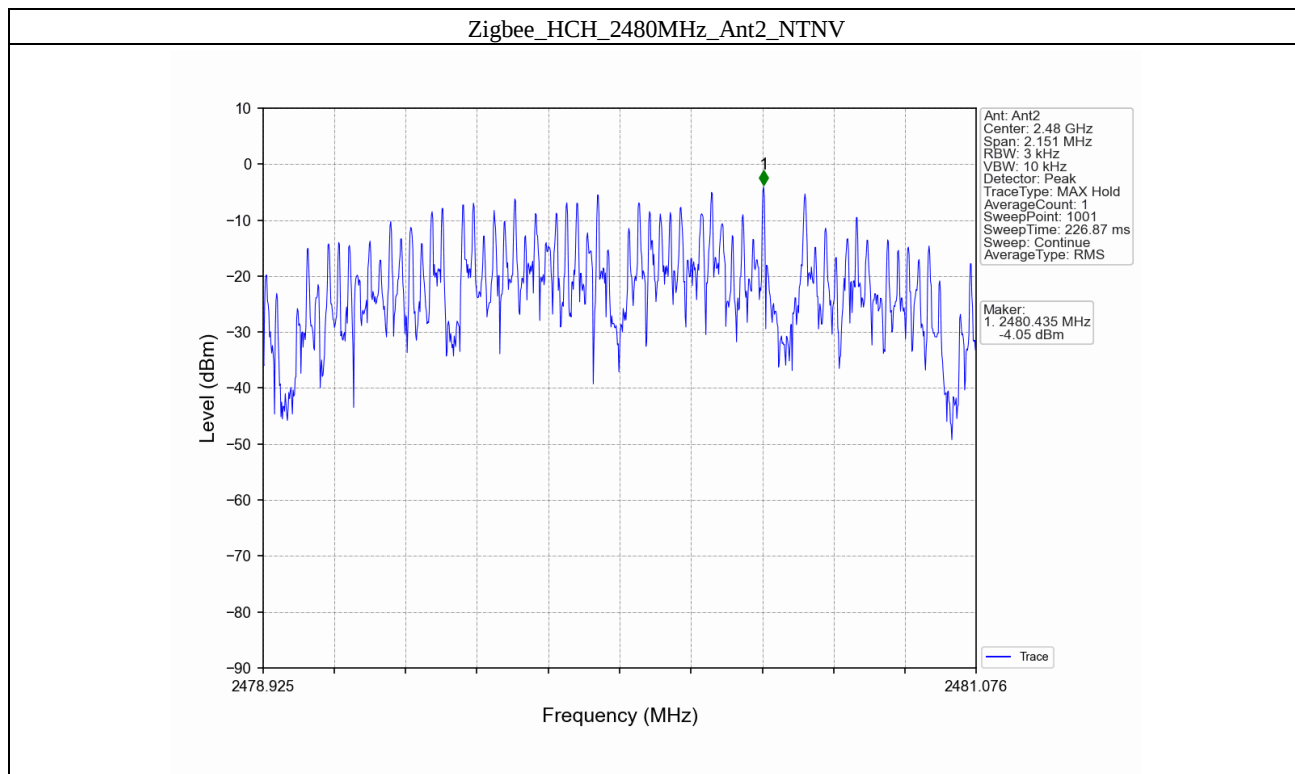
4.1 PSD

4.1.1 Test Result

Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
			ANT2	Limit	
Zigbee	SISO	2405	-4.24	≤ 8	Pass
		2440	-4.07	≤ 8	Pass
		2480	-4.05	≤ 8	Pass

4.1.2 Test Graph





5. Unwanted Emissions In Non-restricted Frequency Bands

5.1 Ref

5.1.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
Zigbee	SISO	2405	2	3.64
		2440	2	3.81
		2480	2	3.86

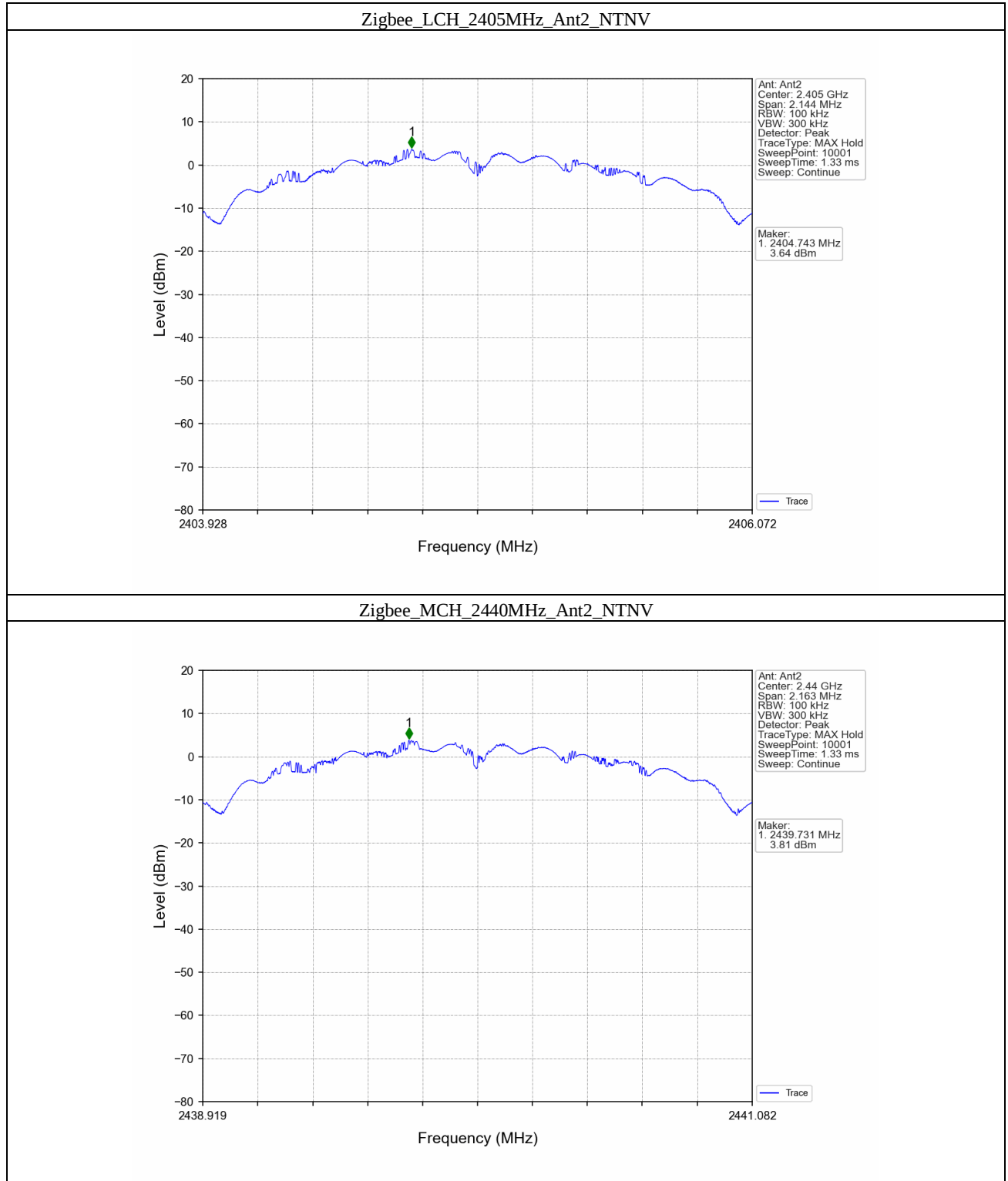


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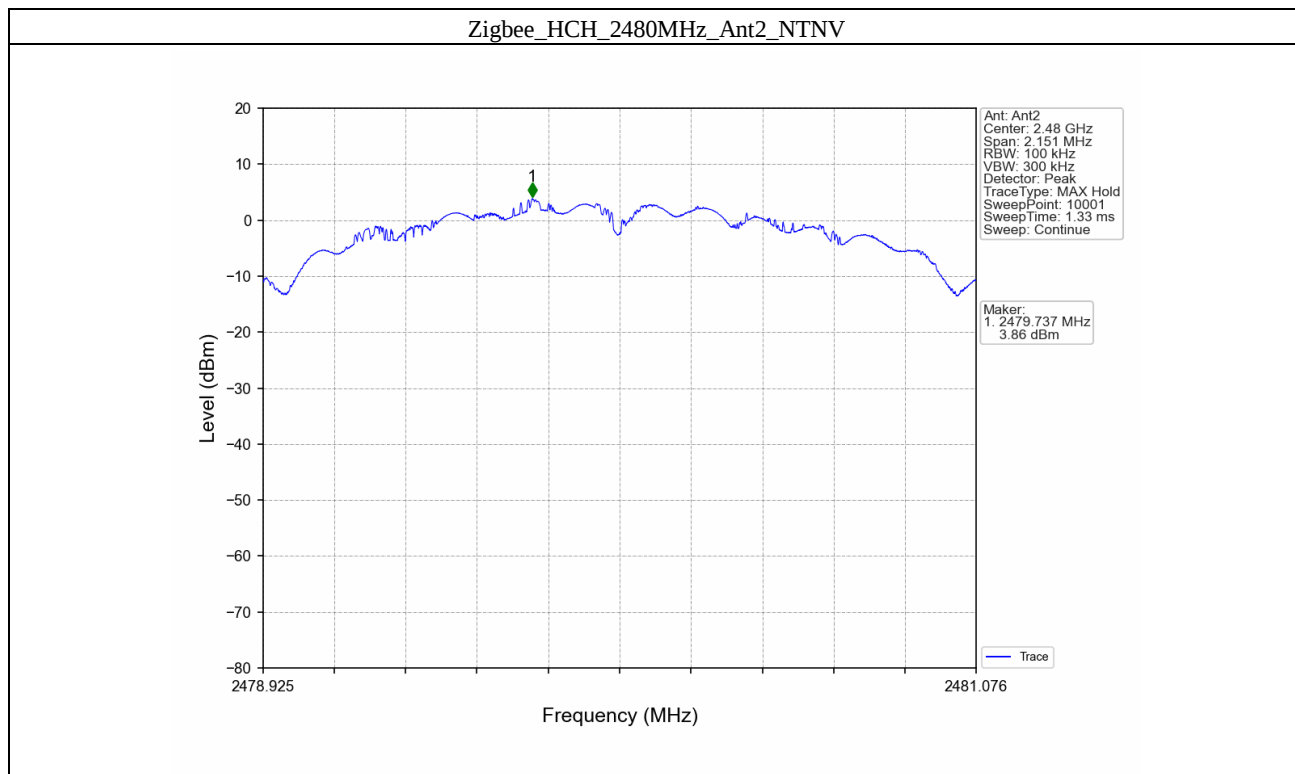
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5.1.2 Test Graph



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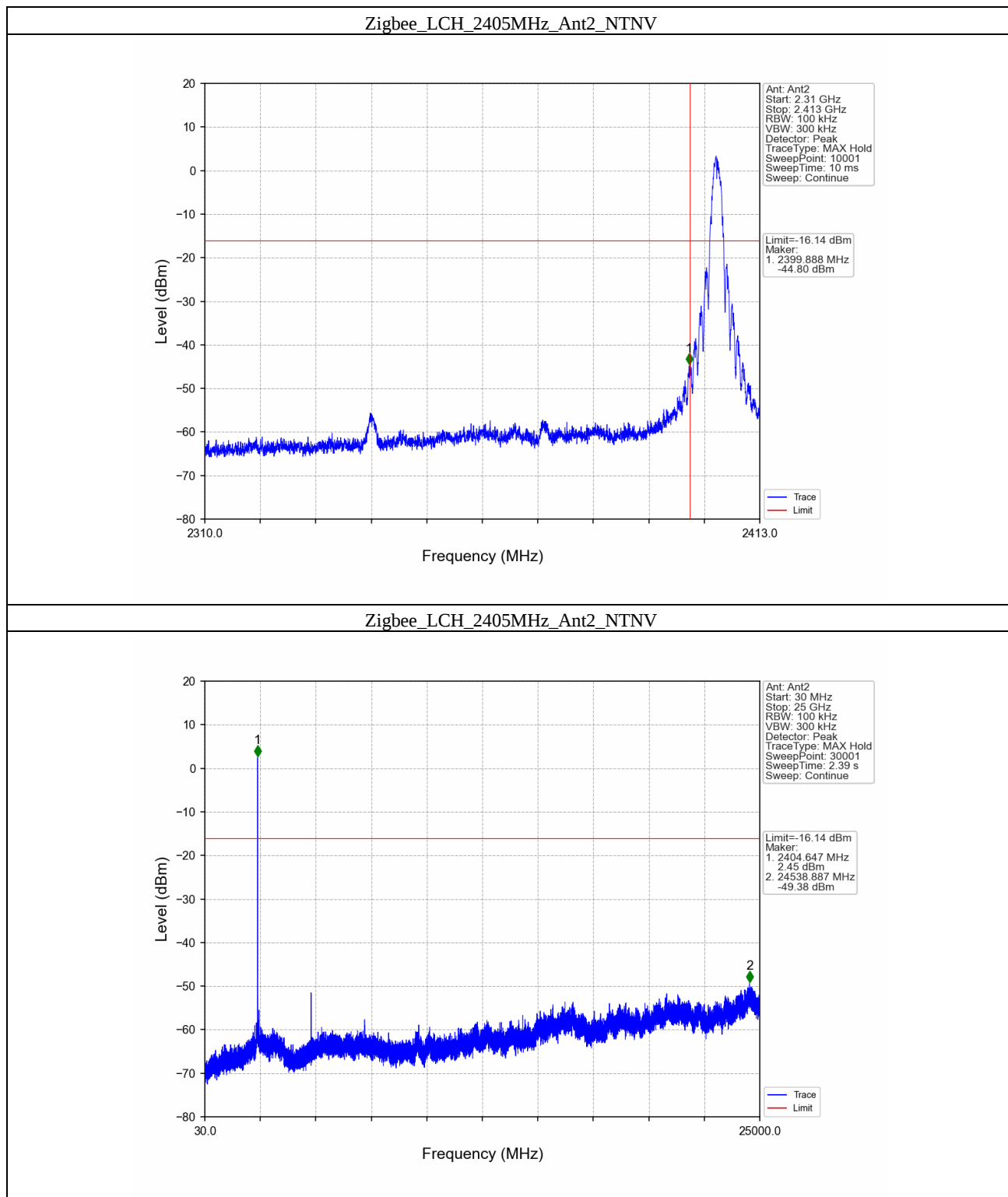


5.2 CSE

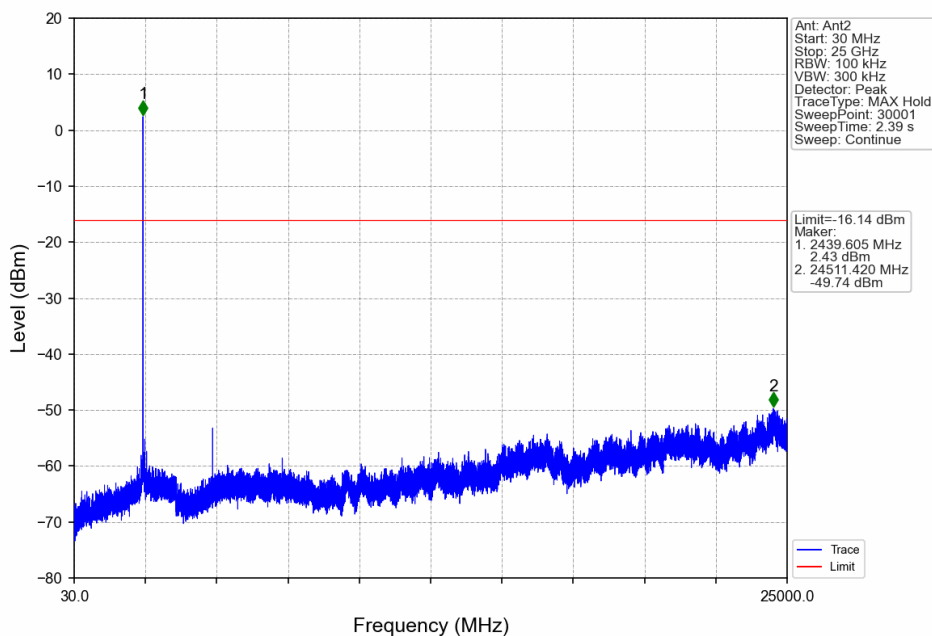
5.2.1 Test Result

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
Zigbee	SISO	2405	2	3.86	-16.14	Pass
		2440	2	3.86	-16.14	Pass
		2480	2	3.86	-16.14	Pass

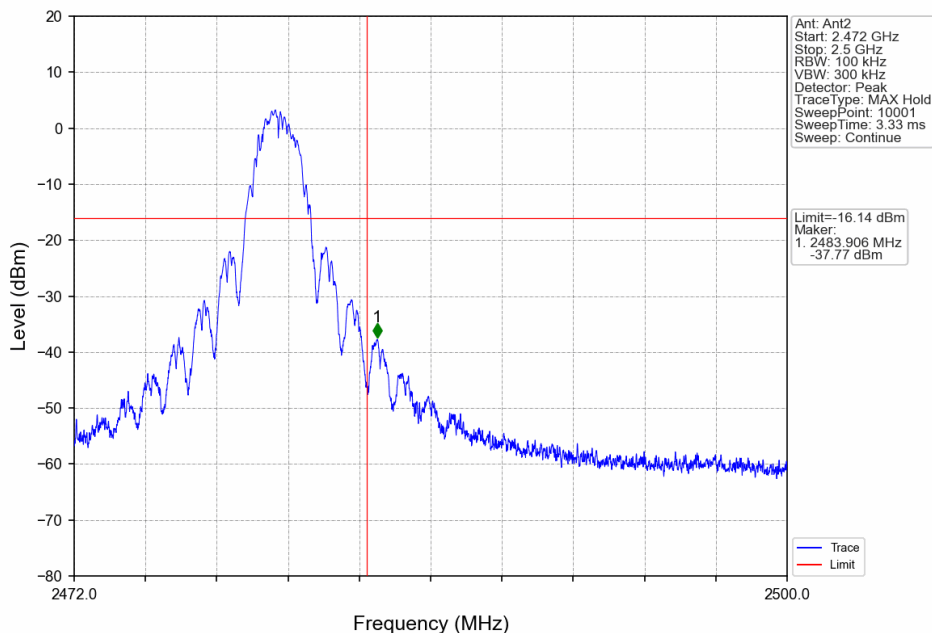
5.2.2 Test Graph

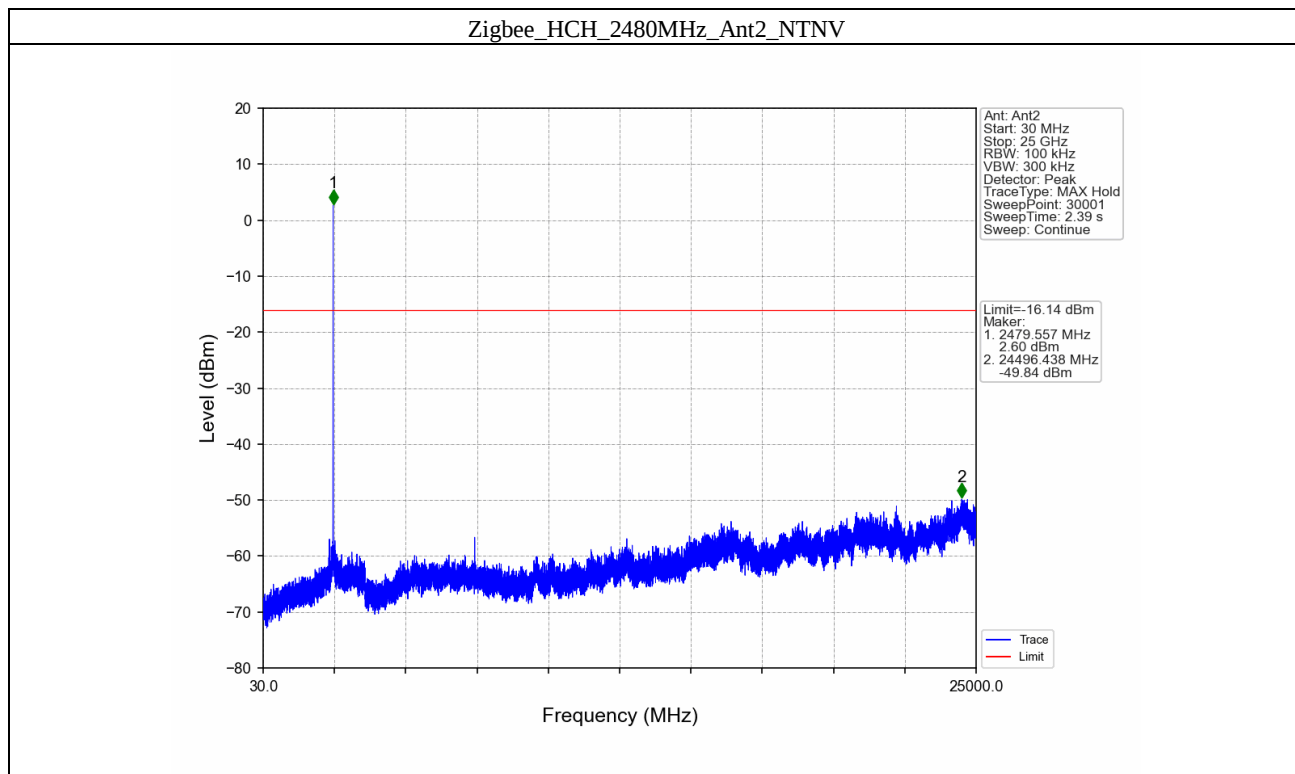


Zigbee_MCH_2440MHz_Ant2_NTNV



Zigbee_HCH_2480MHz_Ant2_NTNV





- End of the Report -