

TEST REPORT

Application No.: SZCR2501000291WM
Applicant: vivo Mobile Communication Co., Ltd.
Address of Applicant: No.1, vivo Road, Chang'an, Dongguan, Guangdong, China
Manufacturer: vivo Mobile Communication Co., Ltd.
Address of Manufacturer: No.1, vivo Road, Chang'an, Dongguan, Guangdong, China
Equipment Under Test (EUT):
EUT Name: Mobile phone
Model No.: V2440
Trade Mark: vivo
FCC ID: 2AUCY-V2440A
Standard(s) : 47 CFR Part 15, Subpart C 15.247
Date of Receipt: 2024-12-30 (for report SZCR241200494506)
2025-01-20 (for report SZCR250100029106)
Date of Test: 2025-01-09 to 2025-02-06 (for report SZCR241200494506)
2025-02-11 to 2025-02-12 (for report SZCR250100029106)
Date of Issue: 2025-02-17

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

Keny Xu

Keny Xu
EMC Laboratory Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2025-02-17		Original

Authorized for issue by:				
		Sherlock Fang		
		Sherlock Fang/Project Engineer		
		Eric Fu		
		Eric Fu/Reviewer		



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2 Test Summary

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

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
Radiated Emissions which fall in the restricted bands		ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions Below 1GHz		ANSI C63.10 (2013) Section 6.4,6.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions Above 1GHz		ANSI C63.10 (2013) Section 6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Conducted Peak Output Power		ANSI C63.10 (2013) Section 11.9.1	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 Spectrum 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



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3 Re-use of Measured Data

3.1 Introduction Section

This application re-uses data collected on a similar device. The subject device of this application (Model: V2440, FCC ID: 2AUCY-V2440A) is electrically identical to the reference device (Model: V2440, FCC ID: 2AUCY-V2440) for the portions of the circuitry corresponding to the data being re-used. Based on their similarity, the FCC Part 15C (equipment class: DTS) reuse the original model's result and do spot-check, following the FCC KDB 484596 D01 Referencing Test Data v02r02.

This test report (Report No.: SZCR250100029106 issue on 2025/02/17) is based on the original test report (Report No.: SZCR241200494506 issue on 2025/02/07).

According to the declaration from the applicant, The main difference between FCC ID: 2AUCY-V2440 and FCC ID: 2AUCY-V2440A is as below:

- Remove NFC.

The applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID: 2AUCY-V2440A .

3.2 Spot Check Verification Data Section

In this report only Radiated Spurious Emission were performed based on the worst case of the original report with report number SZCR241200494506 issue on 2025/02/07 and other test data in this report are based on the previous report with report number SZCR241200494506 issue on 2025/02/07. In this filing to demonstrate the test data from original model remains representative for the variant model.

Spot-check measurements, while being always compliant with the applicable rule part(s) for the test under consideration, show a deviation d_{dB} from the reference data no larger than 3 dB:

$$d_{dB} = |V_{dB} - R_{dB}| \leq 3 \text{ dB} \quad (1)$$

V_{dB} , the variant spot-check level

R_{dB} , the corresponding measurement level for the reference model

An alternative to the limit of eq. (1) is available, and is based on considering how far the reference data R_{dB} is from the compliance threshold C_{dB} (also expressed in dB), for the particular test under consideration. In this case, if $M_{dB} = |C_{dB} - R_{dB}|$ is the margin in dB from the compliance limit, a spot check may be considered acceptable when the deviation d_{dB} from the reference data satisfies the following condition:

$$d_{dB} = |V_{dB} - R_{dB}| \leq (3 + M_{dB} / 20) \text{ dB}, \text{ for } 0 \leq M_{dB} \leq 60 \text{ dB} \quad (2)$$

where “|” is the absolute value of the measured quantity.

When using the option in eq. (2), d_{dB} increases linearly from 3 dB to 6 dB.

Summary for power and RSE spot check for each rule entry and technology is listed as below:

Test Item		Reference FCC ID: 2AUCY-V2440	Variant FCC ID: 2AUCY-V2440A	Deviation (dB)	Limit (dB)
		(dBuV/m)	(dBuV/m)		
Radiated Spurious Emission	BLE	49.88	47.93	1.95	3

Conclusion:

Radiated Spurious Emission test against the variant model based on the worst-case condition from the original model was performed in this filing and the verification test results similar to the original FCC ID.

All tests meet FCC technical limits. Detail sport check test result can be found in the variant model report.

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5 General Information

5.1 Details of E.U.T.

EUT Description:	Mobile phone	
Model No.:	V2440	
Trade Mark:	vivo	
Hardware Version:	MP_0.1	
Software Version:	PD2447EF_EX_A_15.0.2.10.W30	
Power Supply:	DC 3.91V from internal rechargeable battery which can be charged by AC/DC adapter	
Operation Frequency:	2400MHz~2483.5MHz fc = 2402 MHz + N * 2 MHz, where: -fc = "Operating Frequency" in MHz, -N = "Channel Number" with the range from 0 to 39.	
Bluetooth version:	Bluetooth V5.4	
Modulation Type:	GFSK	
Number of Channel:	40	
Rates Type*:	<input checked="" type="checkbox"/> Provided by client	
	1M PHY	2M PHY
Antenna Type:	PIFA Antenna	
Antenna Gain:	0.92dBi(Ant22)	
	Note: The antenna gain are derived from the gain information report provided by the manufacturer.	
RF Cable:	2000MHz ~ 3000MHz (1.1dB)	
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5.2 Environment Parameter

Environment Parameter	Selected Values During Tests	
Relative Humidity	Ambient	
Value	Temperature(°C)	Voltage(V)
NTNV	22~24.5	3.91
Note: NV:Normal Voltage LV:Low Extreme Test Voltage HV:High Extreme Test Voltage NT:Normal Temperature LT:Low Extreme Test Temperature HT:High Extreme Test Temperature		



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5.3 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
--	--	--	--
The EUT has been tested as an independent unit.			

5.4 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	$\pm 3.1\text{dB}$
Radiated Emissions which fall in the restricted bands	$\pm 6.0\text{dB}$ (Below 1GHz); $\pm 4.6\text{dB}$ (Above 1GHz)
Radiated Spurious Emissions Below 1GHz	$\pm 6.0\text{dB}$ for 3m; $\pm 5.0\text{dB}$ for 10m
Radiated Spurious Emissions Above 1GHz	$\pm 4.6\text{dB}$ (1-18GHz); $\pm 4.8\text{dB}$ (18-40GHz)
Conducted Peak Output Power	$\pm 0.75\text{dB}$
Minimum 6dB Bandwidth	$\pm 3\%$
Power Spectrum Density	$\pm 2.84\text{dB}$
Conducted Band Edges Measurement	$\pm 0.75\text{dB}$
Conducted Spurious Emissions	$\pm 0.75\text{dB}$

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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5.5 Test Location

All tests were performed at:

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

No tests were sub-contracted.

5.6 Test Facility

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

• A2LA (Certificate No. 3816.01)

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

• VCCI (Member No. 1937)

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

• FCC –Designation Number: CN1336

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

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

• Innovation, Science and Economic Development Canada

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

CAB identifier: CN0006.

IC#: 4620C.

5.7 Deviation from Standards

None

5.8 Abnormalities from Standard Conditions

None



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6 Equipment List

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

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

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

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

RF Conducted Test					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Power Sensor	TST PASS	TSPS2023R	SEM009-26	2024-03-27	2025-03-26
Power Sensor	KEYSIGHT	U2021XA	SEM009-16	2024-03-14	2025-03-13
DC Power Supply	Chroma	62012P-80-60	SEM011-11	2024-08-14	2025-08-13
MXA Signal Analyzer	KEYSIGHT	N9020A	SEM004-19	2024-03-14	2025-03-13
Measurement Software	TST PASS	TST PASS V2.0	N/A	N/A	N/A
Coaxial Cable	SGS	N/A	SEM031-01	2024-07-06	2025-07-05
Attenuator	Huber+Suhner	6620_SMA-50-1	SEM021-09	2024-03-27	2025-03-26

General used equipment					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	deli	8838	SEM002-32	2024-07-24	2025-07-23
Humidity/ Temperature Indicator	deli	8838	SEM002-33	2024-07-24	2025-07-23
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2024-03-18	2025-03-17



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For report SZCR250100029106:

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

General used equipment					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	deli	8838	SEM002-32	2024-07-24	2025-07-23
Humidity/ Temperature Indicator	deli	8838	SEM002-33	2024-07-24	2025-07-23
Barometer	Changchun Meteorological Industry Factory	DYM3	SEM002-01	2024-03-18	2025-03-17

7 Radio Spectrum Technical Requirement

7.1 Antenna Requirement

7.1.1 Test Requirement:

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

7.1.2 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, 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.

EUT Antenna:

The antenna is a PIFA Antenna, and the connection port is integrated inside the product, and the antenna cannot be replaced.

The best-case gain of the antenna is 0.92dBi(Ant22)*

**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.



8 Radio Spectrum Matter Test Results

8.1 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		

8.1.1 E.U.T. Operation

Operating Environment:

Temperature: 23.5 °C

Humidity: 45.5 % RH

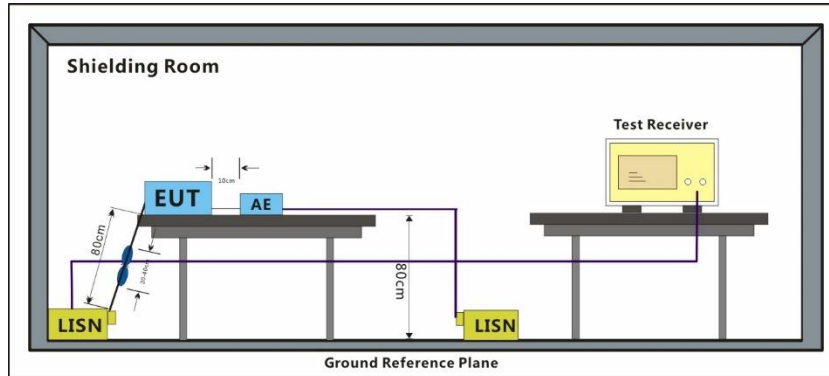
Atmospheric Pressure: 1020 mbar

8.1.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	05	Charge + TX mode(1Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.
Pre-scan	06	Charge + TX mode(2Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.



8.1.3 Test Setup Diagram



8.1.4 Measurement Procedure and Data

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
- 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

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

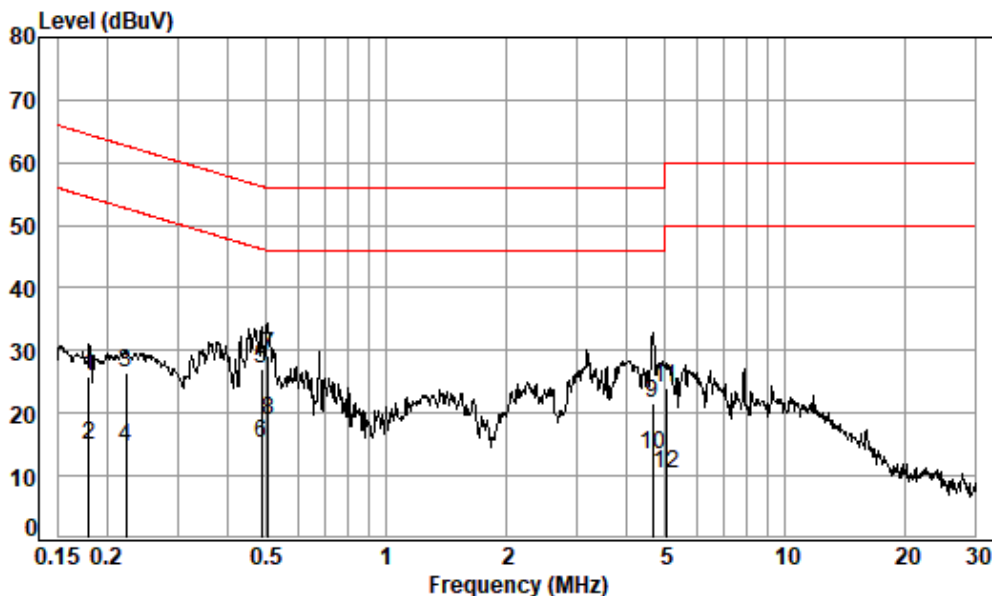
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Test Mode: 05; Line: Live line



Site : Shielding Room
Condition: Line
Job No. : 04945WM
Test mode: 05

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1796	0.06	10.15	15.49	25.70	64.50	-38.80	QP
2	0.1796	0.06	10.15	4.57	14.78	54.50	-39.72	Average
3	0.2232	0.06	10.05	16.50	26.61	62.70	-36.09	QP
4	0.2232	0.06	10.05	4.54	14.65	52.70	-38.05	Average
5	0.4863	0.08	9.56	17.56	27.20	56.23	-29.03	QP
6	0.4863	0.08	9.56	5.59	15.23	46.23	-31.00	Average
7 *	0.5074	0.08	9.54	19.58	29.20	56.00	-26.80	QP
8 *	0.5074	0.08	9.54	9.18	18.80	46.00	-27.20	Average
9	4.6469	0.12	9.66	11.91	21.69	56.00	-34.31	QP
10	4.6469	0.12	9.66	3.58	13.36	46.00	-32.64	Average
11	5.0046	0.12	9.66	14.29	24.07	60.00	-35.93	QP
12	5.0046	0.12	9.66	0.42	10.20	50.00	-39.80	Average



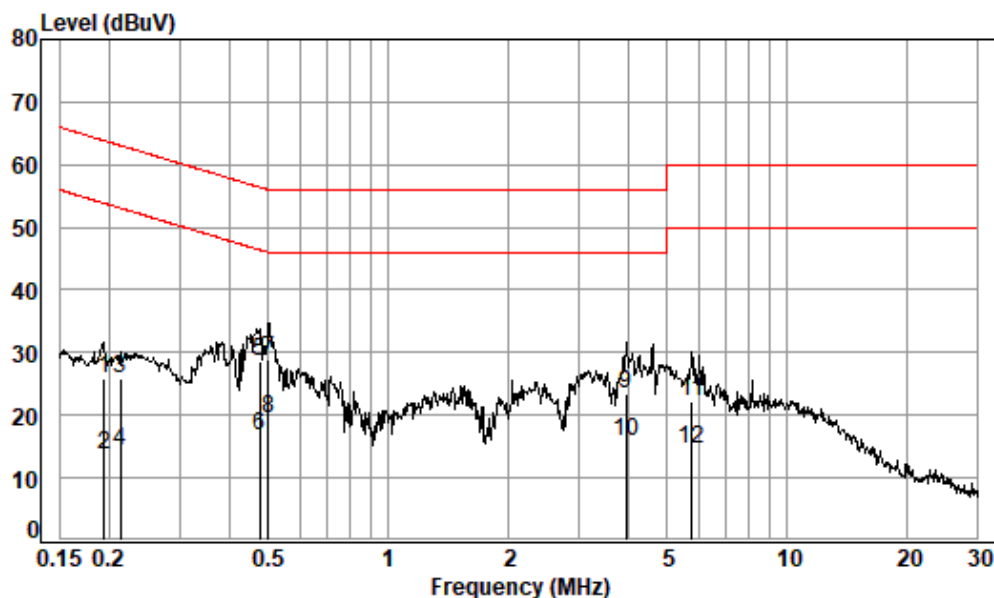
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Test Mode: 05; Line: Neutral Line



Site : Shielding Room
Condition: Neutral
Job No. : 04945WM
Test mode: 05

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.1945	0.06	10.09	15.74	25.89	63.84	-37.95	QP
2	0.1945	0.06	10.09	3.63	13.78	53.84	-40.06	Average
3	0.2139	0.06	10.03	15.84	25.93	63.05	-37.12	QP
4	0.2139	0.06	10.03	4.20	14.29	53.05	-38.76	Average
5	0.4761	0.08	9.72	18.79	28.59	56.41	-27.82	QP
6	0.4761	0.08	9.72	6.95	16.75	46.41	-29.66	Average
7 *	0.5020	0.08	9.71	19.09	28.88	56.00	-27.12	QP
8 *	0.5020	0.08	9.71	9.72	19.51	46.00	-26.49	Average
9	3.9430	0.12	9.55	13.84	23.51	56.00	-32.49	QP
10	3.9430	0.12	9.55	6.14	15.81	46.00	-30.19	Average
11	5.7438	0.14	9.60	12.57	22.31	60.00	-37.69	QP
12	5.7438	0.14	9.60	4.89	14.63	50.00	-35.37	Average



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8.2 Radiated Emissions which fall in the restricted bands

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

Test Method: ANSI C63.10 (2013) Section 6.10.5

Measurement Distance: 3m

Limit:

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

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

8.2.1 E.U.T. Operation

Operating Environment:

Temperature: 24.5 °C

Humidity: 50.8 % RH

Atmospheric Pressure: 1020 mbar

8.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	05	Charge + TX mode(1Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.
Final test	06	Charge + TX mode(2Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.



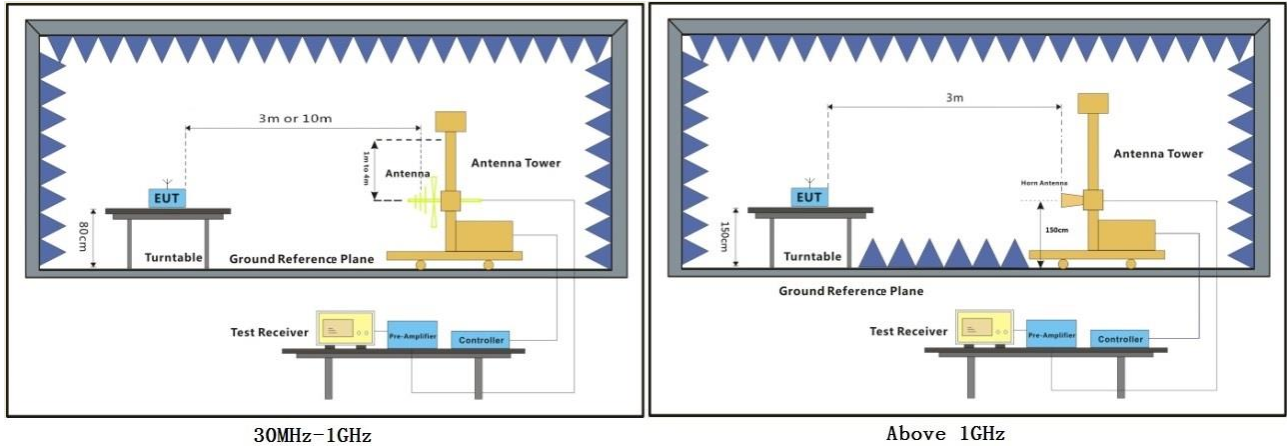
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8.2.3 Test Setup Diagram



8.2.4 Measurement Procedure and Data

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

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

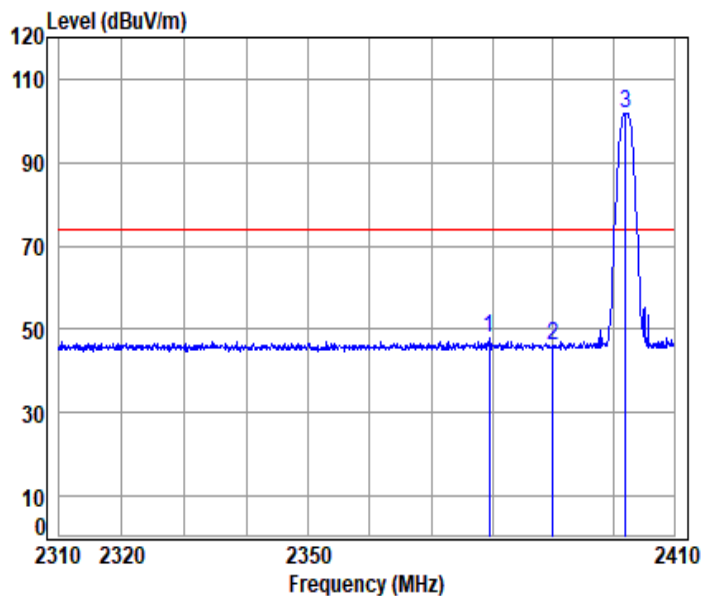
Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level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

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

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



BLE_1M_TX_CH_00_Horizontal-Peak



Condition: 3m HORIZONTAL

Job No : 04945WM

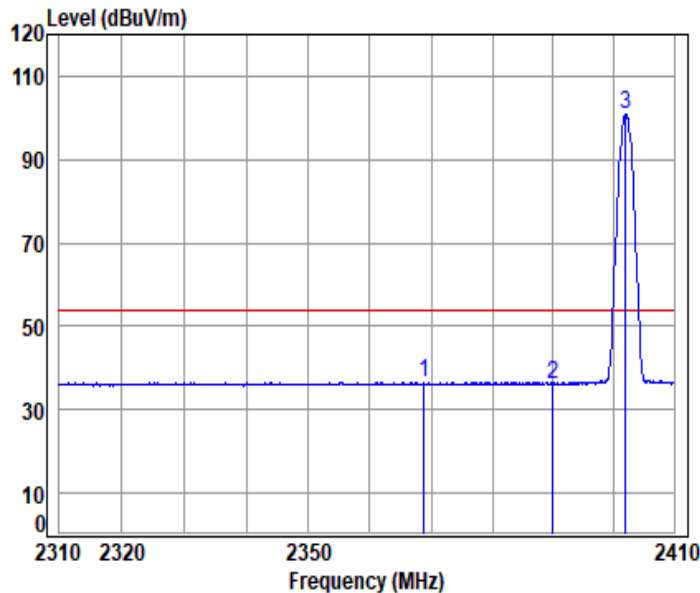
Mode : 2402 Band edge

: BLE 1M

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Line	Limit	Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2379.453	6.82	27.42	31.54	44.98	47.68	74.00 -26.32 peak
2	2390.000	6.82	27.46	31.54	43.17	45.91	74.00 -28.09 peak
3	2402.000	6.84	27.50	31.54	99.03	101.83	74.00 27.83 peak



BLE_1M_TX_CH_00_Horizontal-AVG



Condition: 3m HORIZONTAL

Job No : 04945WM

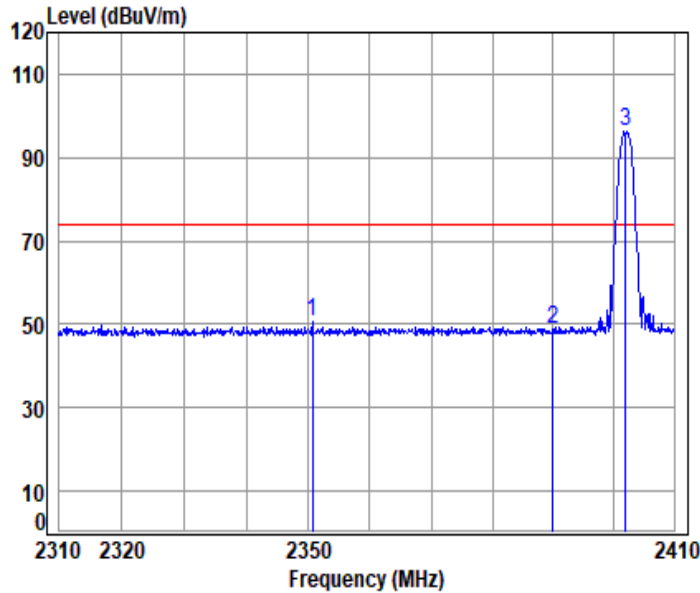
Mode : 2402 Band edge

: BLE 1M

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2368.788	6.81	27.38	31.54	33.97	36.62	54.00	-17.38	Average
2	2390.000	6.82	27.46	31.54	33.39	36.13	54.00	-17.87	Average
3 pp	2402.000	6.84	27.50	31.54	98.24	101.04	54.00	47.04	Average



BLE_1M_TX_CH_00_Verical-Peak



Condition: 3m VERTICAL

Job No : 04945WM

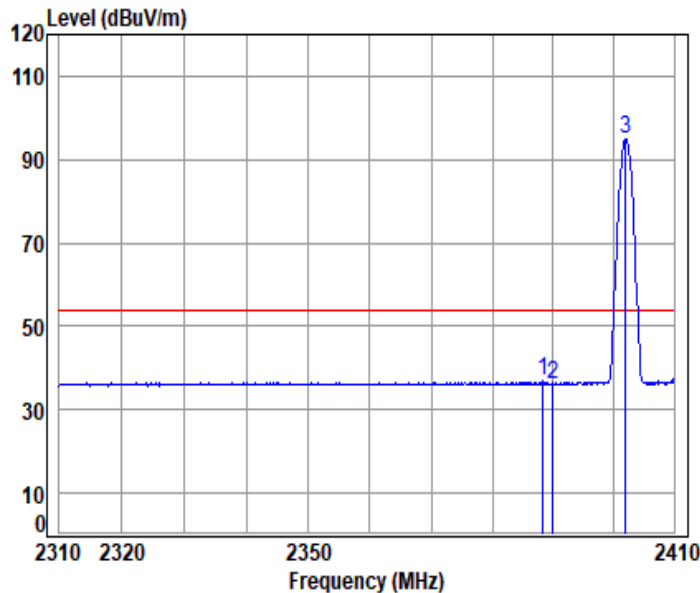
Mode : 2402 Band edge

: BLE 1M

		Cable	Ant	Preamp	Read	Limit	Over	
	Freq	Loss	Factor	Factor	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2350.687	6.81	27.30	31.54	47.91	50.48	74.00	-23.52 peak
2	2390.000	6.82	27.46	31.54	45.87	48.61	74.00	-25.39 peak
3 pp	2402.000	6.84	27.50	31.54	93.28	96.08	74.00	22.08 peak



BLE_1M_TX_CH_00_Vertical-AVG



Condition: 3m VERTICAL

Job No : 04945WM

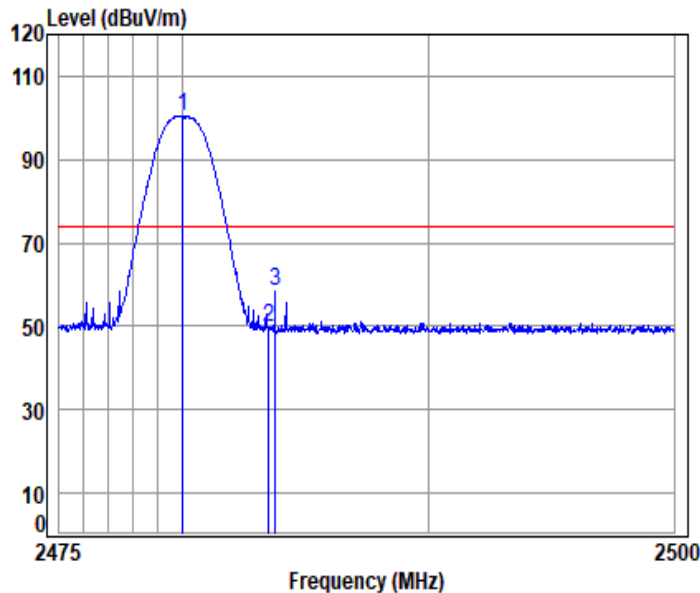
Mode : 2402 Band edge

: BLE 1M

		Cable	Ant	Preamp	Read	Limit	Over	
	Freq	Loss	Factor	Factor	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2388.343	6.82	27.45	31.54	34.04	36.77	54.00	-17.23 Average
2	2390.000	6.82	27.46	31.54	33.34	36.08	54.00	-17.92 Average
3 pp	2402.000	6.84	27.50	31.54	92.15	94.95	54.00	40.95 Average



BLE_1M_TX_CH_39_Horizontal-Peak



Condition: 3m HORIZONTAL

Job No : 04945WM

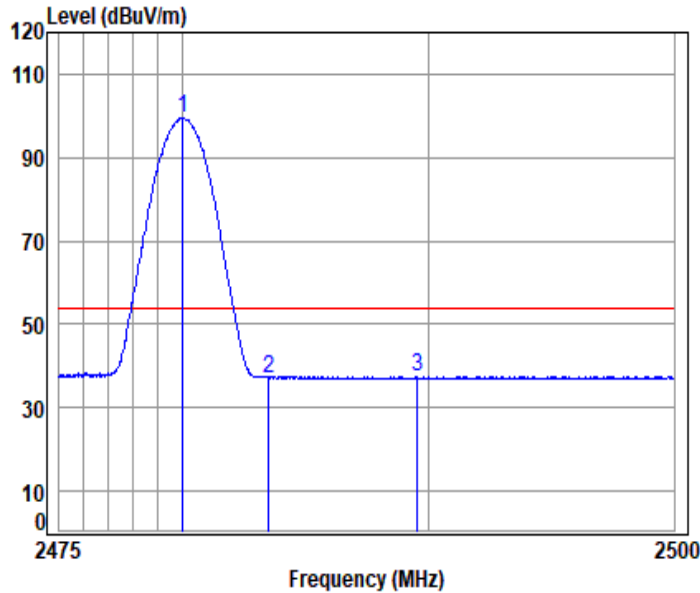
Mode : 2480 Band edge

: BLE 1M

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 pp	2480.000	7.37	27.78	31.55	96.76	100.36	74.00	26.36	peak
2	2483.500	7.40	27.80	31.55	46.31	49.96	74.00	-24.04	peak
3	2483.746	7.40	27.80	31.55	54.54	58.19	74.00	-15.81	Peak



BLE_1M_TX_CH_39_Horizontal-AVG



Condition: 3m HORIZONTAL

Job No : 04945WM

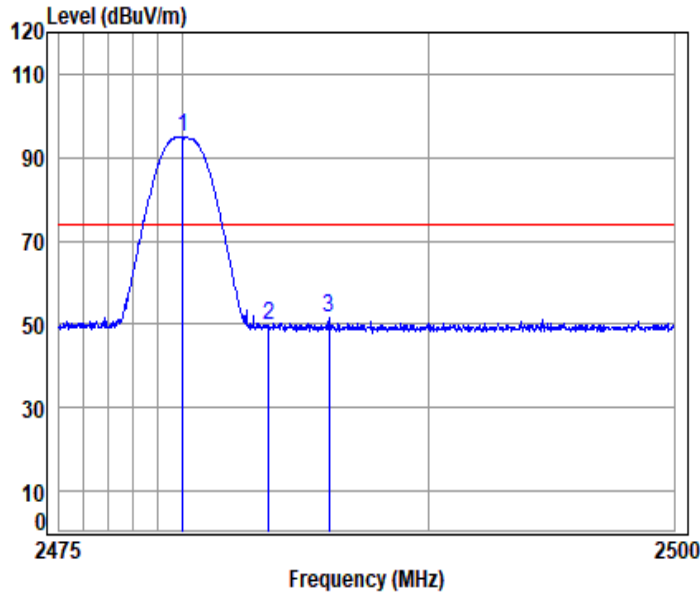
Mode : 2480 Band edge

: BLE 1M

		Cable	Ant	Preamp	Read	Limit	Over	
	Freq	Loss	Factor	Factor	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	pp 2480.000	7.37	27.78	31.55	95.79	99.39	54.00	45.39 Average
2	2483.500	7.40	27.80	31.55	33.50	37.15	54.00	-16.85 Average
3	2489.520	7.44	27.84	31.55	33.79	37.52	54.00	-16.48 Average



BLE_1M_TX_CH_39_Verical-Peak



Condition: 3m VERTICAL

Job No : 04945WM

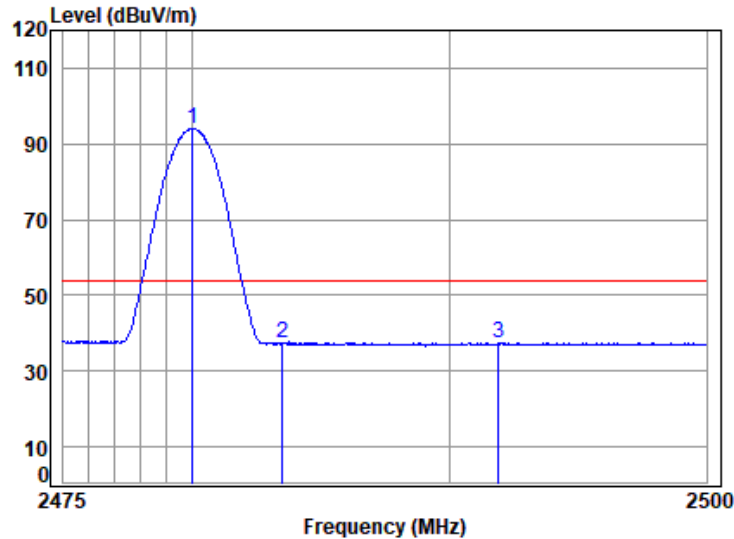
Mode : 2480 Band edge

: BLE 1M

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 pp	2480.000	7.37	27.78	31.55	91.23	94.83	74.00	20.83	peak
2	2483.500	7.40	27.80	31.55	45.86	49.51	74.00	-24.49	peak
3	2485.944	7.41	27.82	31.55	47.81	51.49	74.00	-22.51	peak



BLE_1M_TX_CH_39_Verical-AVG



Condition: 3m VERTICAL

Job No : 04945WM

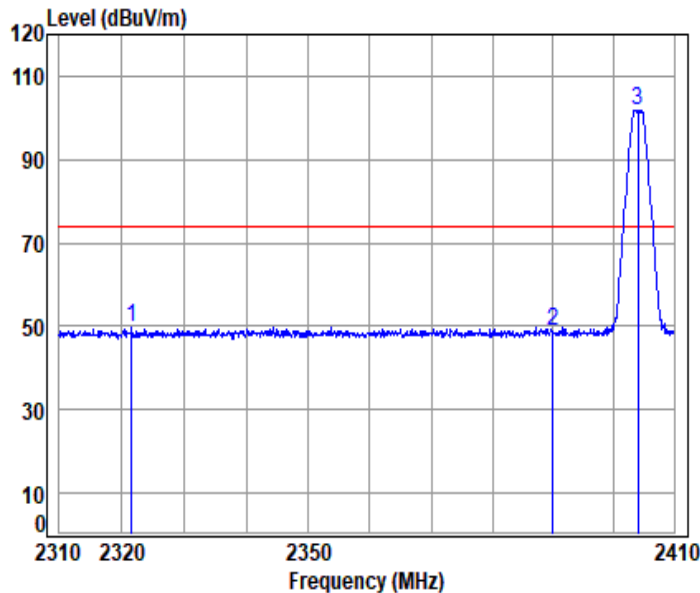
Mode : 2480 Band edge

: BLE 1M

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 pp	2480.000	7.37	27.78	31.55	90.45	94.05	54.00	40.05	Average
2	2483.500	7.40	27.80	31.55	33.60	37.25	54.00	-16.75	Average
3	2491.897	7.45	27.85	31.55	33.80	37.55	54.00	-16.45	Average



BLE_2M_TX_CH_01_Horizontal-Peak



Condition: 3m HORIZONTAL

Job No : 04945WM

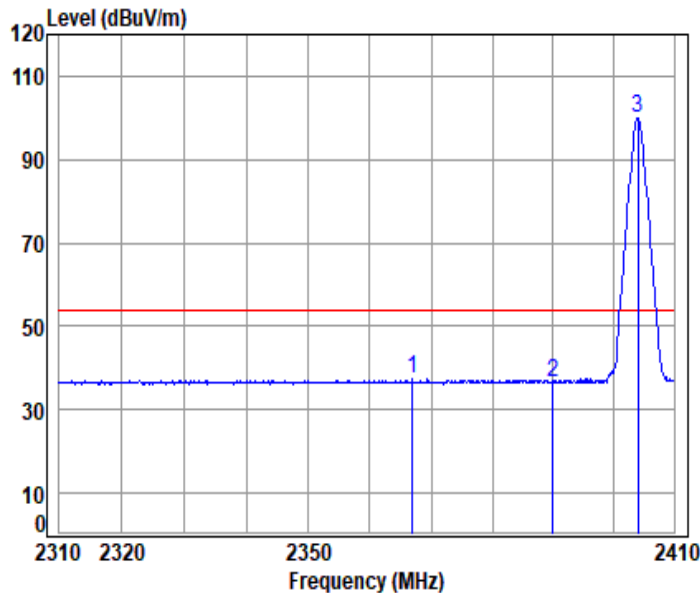
Mode : 2404 Band edge

: BLE 2M

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Level	Line	Limit Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2321.581	6.79	27.24	31.53	47.33	49.83	74.00 -24.17 peak
2	2390.000	6.82	27.46	31.54	46.16	48.90	74.00 -25.10 peak
3	2404.000	6.86	27.51	31.54	98.91	101.74	74.00 27.74 peak



BLE_2M_TX_CH_01_Horizontal-AVG



Condition: 3m HORIZONTAL

Job No : 04945WM

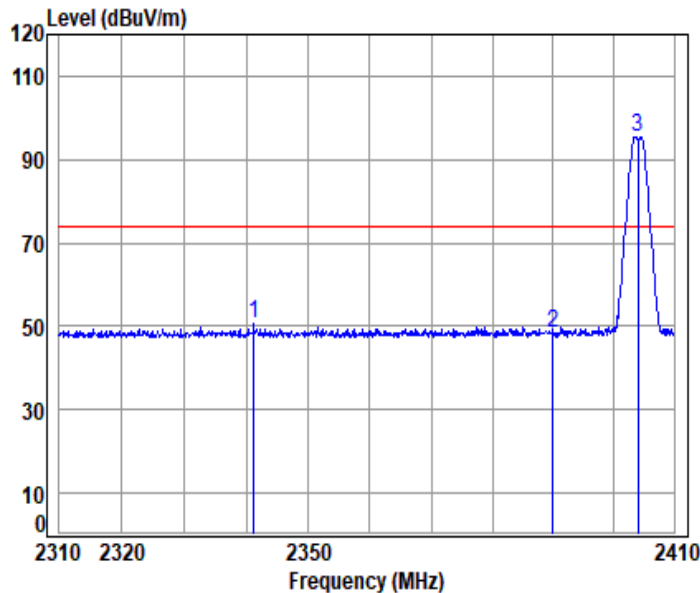
Mode : 2404 Band edge

: BLE 2M

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Line	Limit	Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1 2366.881	6.81	27.37	31.54	34.73	37.37	54.00	-16.63 Average
2 2390.000	6.82	27.46	31.54	33.91	36.65	54.00	-17.35 Average
3 pp 2404.000	6.86	27.51	31.54	97.11	99.94	54.00	45.94 Average



BLE_2M_TX_CH_01_Verical-Peak



Condition: 3m VERTICAL

Job No : 04945WM

Mode : 2404 Band edge

: BLE 2M

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2341.143	6.80	27.28	31.53	47.93	50.48	74.00	-23.52	peak
2	2390.000	6.82	27.46	31.54	45.47	48.21	74.00	-25.79	peak
3 pp	2404.000	6.86	27.51	31.54	92.50	95.33	74.00	21.33	peak



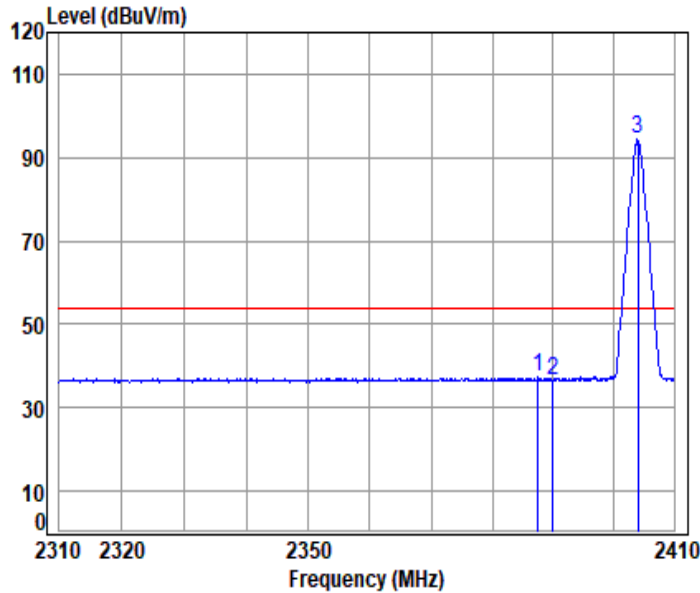
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BLE_2M_TX_CH_01_Vertical-AVG



Condition: 3m VERTICAL

Job No : 04945WM

Mode : 2404 Band edge

: BLE 2M

	Cable	Ant	Preamp	Read	Limit	Over		
Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 2387.534	6.82	27.45	31.54	34.58	37.31	54.00	-16.69	Average
2 2390.000	6.82	27.46	31.54	33.93	36.67	54.00	-17.33	Average
3 pp 2404.000	6.86	27.51	31.54	91.49	94.32	54.00	40.32	Average



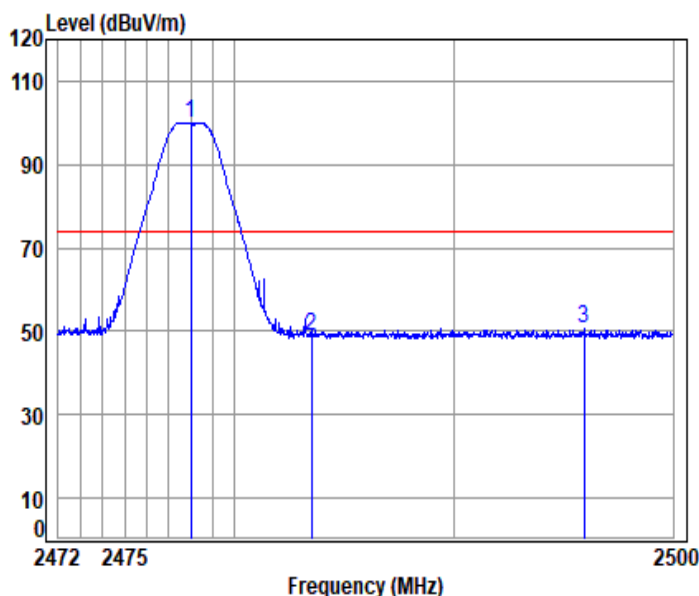
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BLE_2M_TX_CH_38_Horizontal-Peak



Condition: 3m HORIZONTAL

Job No : 04945WM

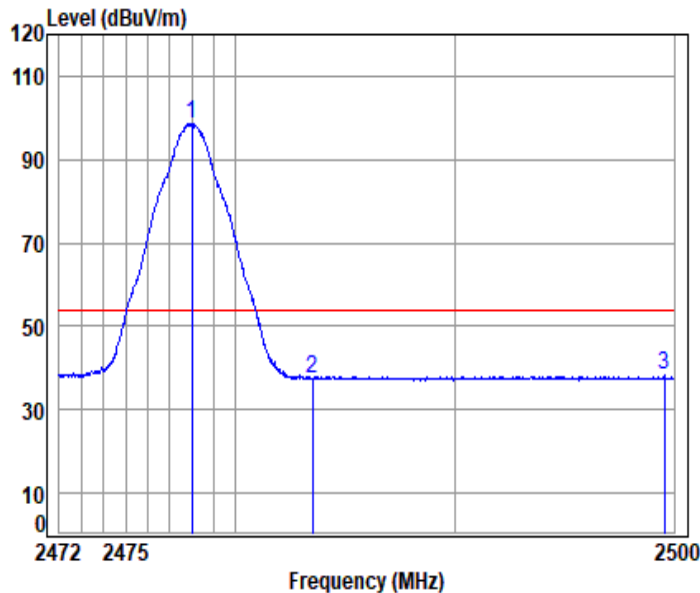
Mode : 2478 Band edge

: BLE 2M

		Cable	Ant	Preamp	Read	Limit	Over	
	Freq	Loss	Factor	Factor	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	pp 2478.000	7.36	27.77	31.55	96.56	100.14	74.00	26.14 peak
2	2483.500	7.40	27.80	31.55	45.03	48.68	74.00	-25.32 peak
3	2495.948	7.48	27.88	31.55	46.72	50.53	74.00	-23.47 peak



BLE_2M_TX_CH_38_Horizontal-AVG



Condition: 3m HORIZONTAL

Job No : 04945WM

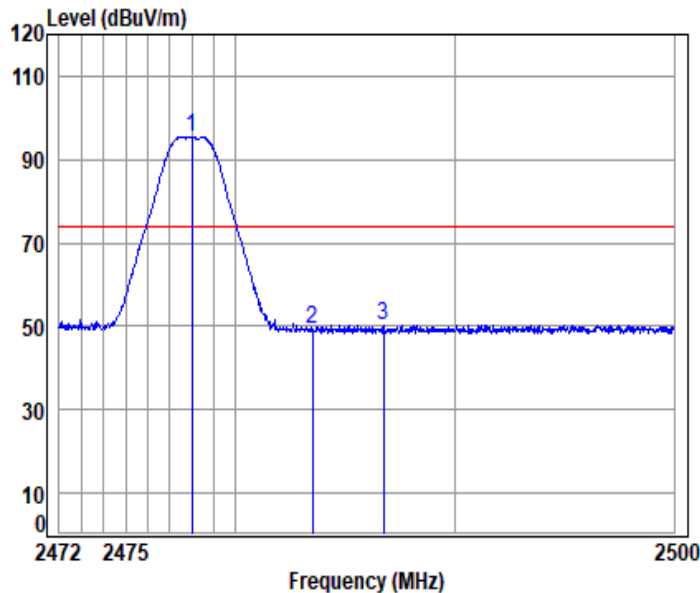
Mode : 2478 Band edge

: BLE 2M

		Cable	Ant	Preamp	Read	Limit	Over	
	Freq	Loss	Factor	Factor	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1 pp	2478.000	7.36	27.77	31.55	95.03	98.61	54.00	44.61 Average
2	2483.500	7.40	27.80	31.55	33.74	37.39	54.00	-16.61 Average
3	2499.550	7.51	27.90	31.55	34.41	38.27	54.00	-15.73 Average



BLE_2M_TX_CH_38_Verical-Peak



Condition: 3m VERTICAL

Job No : 04945WM

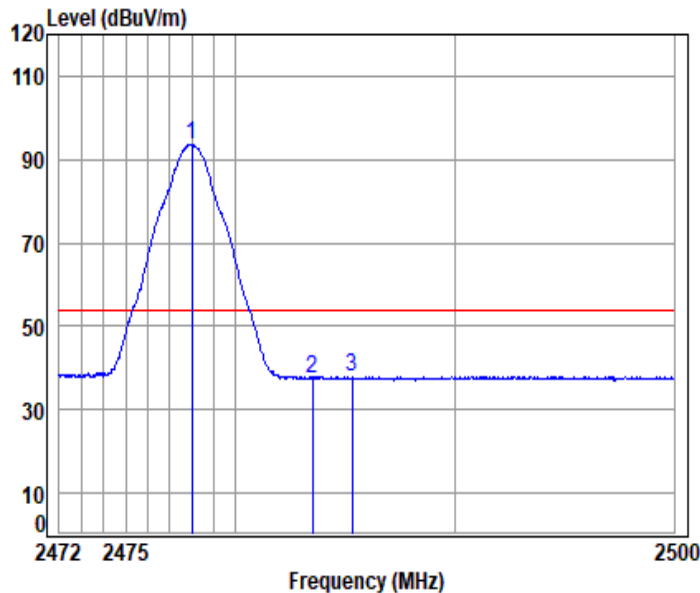
Mode : 2478 Band edge

: BLE 2M

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 pp	2478.000	7.36	27.77	31.55	91.90	95.48	74.00	21.48	peak
2	2483.500	7.40	27.80	31.55	45.85	49.50	74.00	-24.50	peak
3	2486.717	7.42	27.82	31.55	46.69	50.38	74.00	-23.62	peak



BLE_2M_TX_CH_38_Verical-AVG



Condition: 3m VERTICAL

Job No : 04945WM

Mode : 2478 Band edge

: BLE 2M

		Cable	Ant	Preamp	Read	Limit	Over	
	Freq	Loss	Factor	Factor	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1 pp	2478.000	7.36	27.77	31.55	90.01	93.59	54.00	39.59 Average
2	2483.500	7.40	27.80	31.55	33.92	37.57	54.00	-16.43 Average
3	2485.317	7.41	27.81	31.55	34.38	38.05	54.00	-15.95 Average



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8.3 Radiated Spurious Emissions Below 1GHz

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

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

Measurement Distance: 3m

Limit:

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

8.3.1 E.U.T. Operation

Operating Environment:

Temperature: 21.2 °C

Humidity: 46.6 % RH

Atmospheric Pressure: 1020 mbar

8.3.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	05	Charge + TX mode(1Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.
Pre-scan	06	Charge + TX mode(2Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.



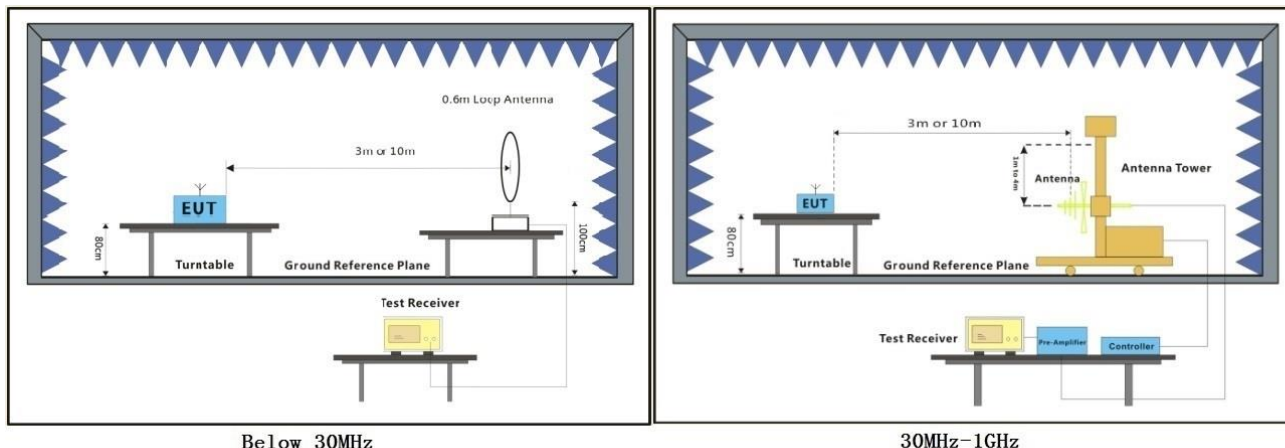
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8.3.3 Test Setup Diagram



8.3.4 Measurement Procedure and Data

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

Remark:

1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
2. Scan from 9kHz to 30MHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.



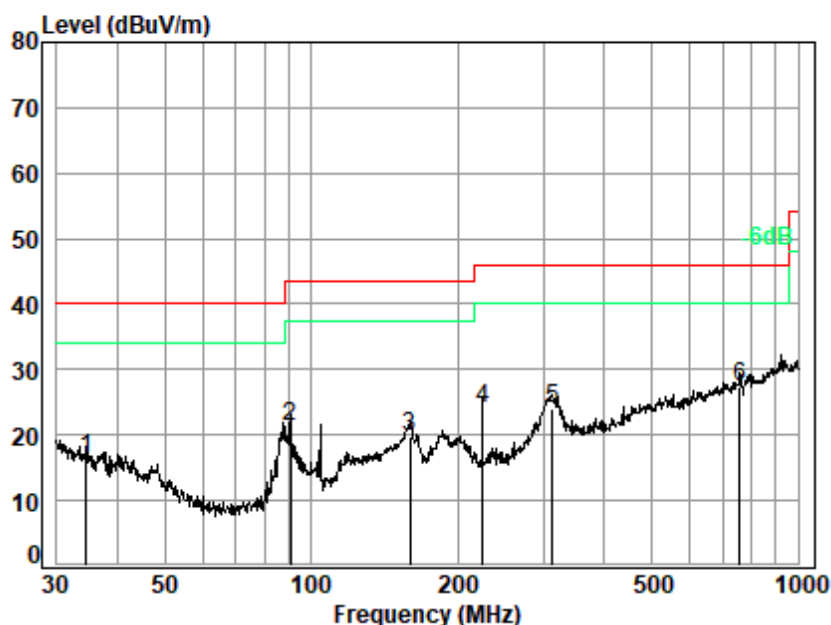
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Test Mode: 05; Polarity: Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : 04945WM
Test Mode: 05

	Ant	Cable	Preamp	Read		Limit	Over	
	Freq	Factor	Loss	Factor	Level	Level	Line	Limit Remark
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB
1	34.517	19.14	0.72	27.78	24.28	16.36	40.00	-23.64 QP
2	90.537	11.77	1.16	27.62	35.86	21.17	43.50	-22.33 QP
3	159.225	13.61	1.58	27.34	32.04	19.89	43.50	-23.61 QP
4	224.519	15.67	1.89	27.07	33.41	23.90	46.00	-22.10 QP
5	312.179	18.41	2.25	26.80	30.31	24.17	46.00	-21.83 QP
6 q	758.041	26.48	3.73	27.58	24.75	27.38	46.00	-18.62 QP



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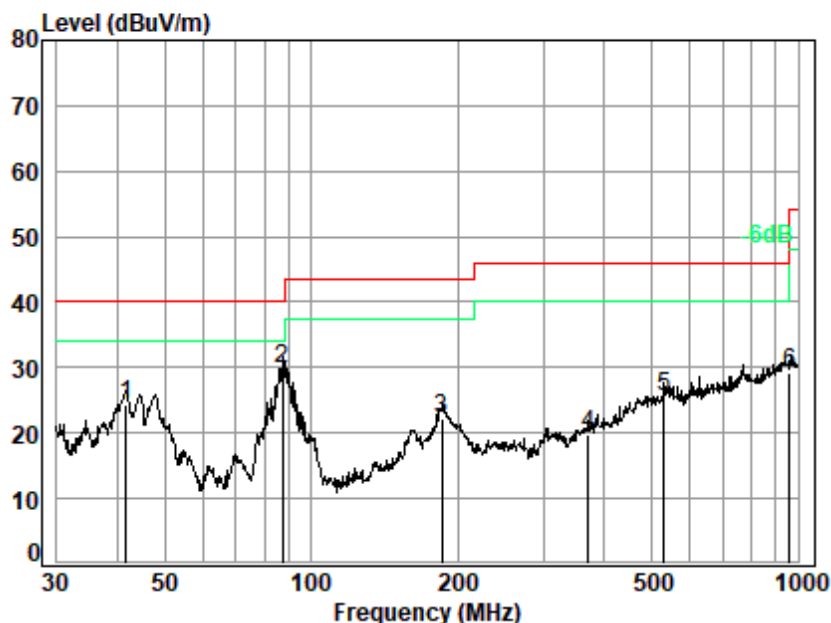
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Test Mode: 05; Polarity: Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : 04945WM
Test Mode: 05

	Ant	Cable	Preamp	Read		Limit	Over	
Freq	Factor	Loss	Factor	Level	Level	Line	Limit	Remark
MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1	41.713	15.55	0.80	27.76	35.89	24.48	40.00	-15.52 QP
2 q	87.112	11.33	1.14	27.63	44.83	29.67	40.00	-10.33 QP
3	185.788	14.29	1.70	27.23	33.44	22.20	43.50	-21.30 QP
4	370.702	20.47	2.48	27.04	23.93	19.84	46.00	-26.16 QP
5	530.101	23.27	3.02	27.69	27.04	25.64	46.00	-20.36 QP
6	962.162	28.07	4.28	26.32	23.14	29.17	54.00	-24.83 QP



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8.4 Radiated Spurious Emissions Above 1GHz

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

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

Measurement Distance: 3m

Limit:

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

8.4.1 E.U.T. Operation

Operating Environment:

Temperature: 24.5 °C

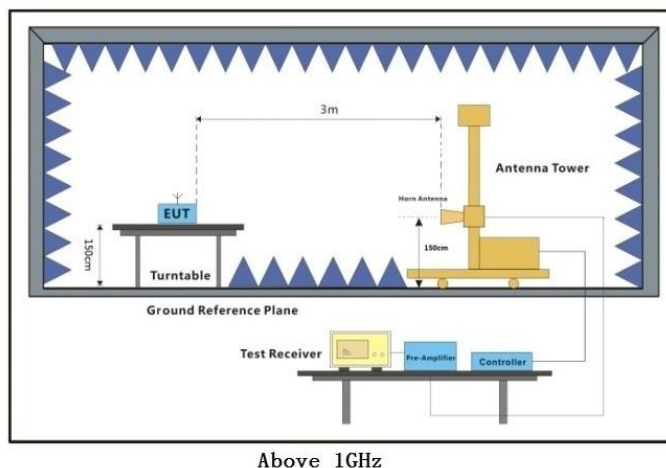
Humidity: 50.8 % RH

Atmospheric Pressure: 1020 mbar

8.4.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	05	Charge + TX mode(1Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.
Final test	06	Charge + TX mode(2Mbps)_Keep the EUT in charging and continuously transmitting mode with GFSK modulation.

8.4.3 Test Setup Diagram



Above 1GHz



8.4.4 Measurement Procedure and Data

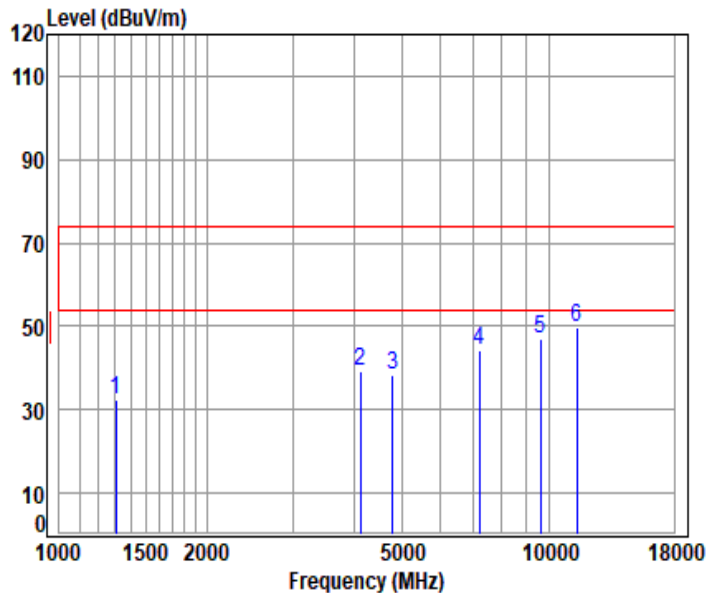
- a. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which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

Remark:

1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
2. Scan from 1GHz to 25GHz, the disturbance above 18GHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
3. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for Peak detection (PK) and Average detection (AV) at frequency above 1GHz.
- 5:For fundamental and harmonic signal measurement, the resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle $\leq 98\%$) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.



BLE_1M_TX_CH_00_Horizontal



Condition: 3m HORIZONTAL

Job No : 04945WM

Mode : 2402 TX RSE

: BLE 1M

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1304.623	7.15	25.19	54.70	54.90	32.54	74.00	-41.46	peak
2	4121.768	8.39	30.44	55.69	56.28	39.42	74.00	-34.58	peak
3	4804.000	8.90	31.92	56.16	53.82	38.48	74.00	-35.52	peak
4	7206.000	11.10	36.60	56.54	53.02	44.18	74.00	-29.82	peak
5	9608.000	12.38	38.78	54.45	50.11	46.82	74.00	-27.18	peak
6	11140.910	14.10	39.70	53.62	49.70	49.88	74.00	-24.12	peak



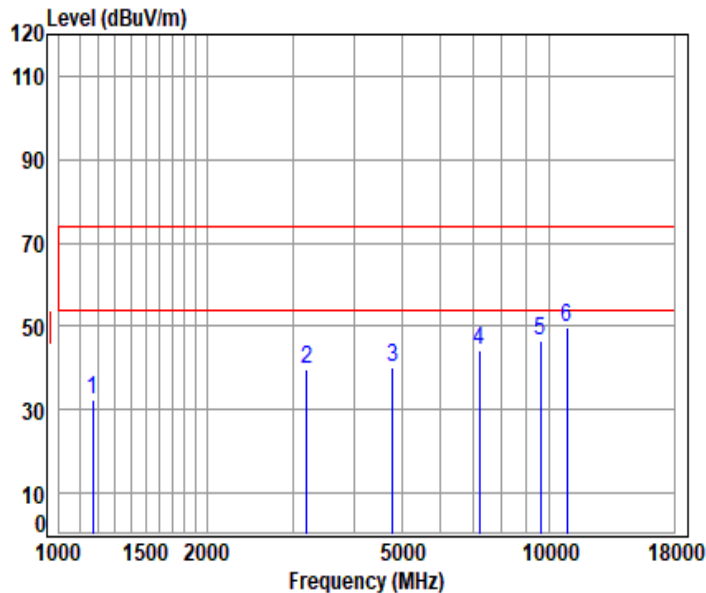
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BLE_1M_TX_CH_00_Vertical



Condition: 3m VERTICAL

Job No : 04945WM

Mode : 2402 TX RSE

: BLE 1M

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Line	Limit	Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1172.303	7.17	25.36	54.70	54.72	32.55	74.00 -41.45 peak
2	3196.094	7.70	29.20	55.12	58.06	39.84	74.00 -34.16 peak
3	4804.000	8.90	31.92	56.16	55.37	40.03	74.00 -33.97 peak
4	7206.000	11.10	36.60	56.54	52.95	44.11	74.00 -29.89 peak
5	9608.000	12.38	38.78	54.45	49.94	46.65	74.00 -27.35 peak
6	pp10885.670	13.59	39.30	53.57	50.38	49.70	74.00 -24.30 peak



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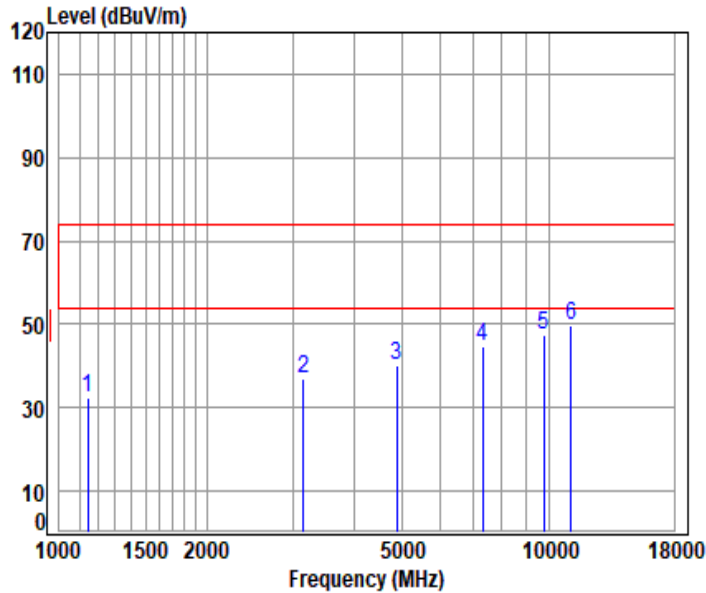
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BLE_1M_TX_CH_19_Horizontal



Condition: 3m HORIZONTAL

Job No : 04945WM

Mode : 2440 TX RSE

: BLE 1M

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1145.507	7.14	25.42	54.70	54.46	32.32	74.00	-41.68	peak
2	3150.237	7.70	29.20	55.09	55.33	37.14	74.00	-36.86	Peak
3	4880.000	8.98	32.16	56.22	55.08	40.00	74.00	-34.00	peak
4	7320.000	11.12	36.74	56.44	53.08	44.50	74.00	-29.50	peak
5	9760.000	12.84	38.60	54.32	50.20	47.32	74.00	-26.68	peak
6	11076.100	14.14	39.48	53.52	49.67	49.77	74.00	-24.23	peak



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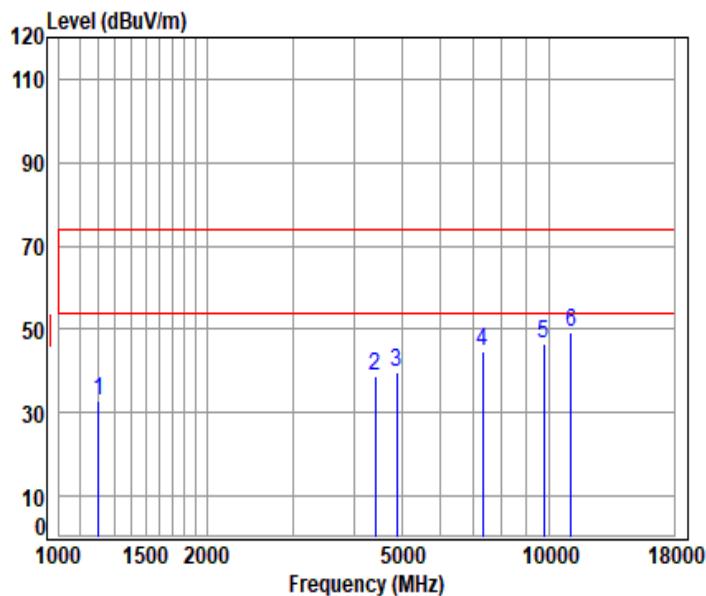
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BLE_1M_TX_CH_19_Verical



Condition: 3m VERTICAL

Job No : 04945WM

Mode : 2440 TX RSE

: BLE 1M

	Cable	Ant	Preamp	Read		Limit	Over	
Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1203.199	7.19	25.30	54.70	55.11	32.90	74.00	-41.10 peak
2	4417.841	8.54	31.27	55.89	54.65	38.57	74.00	-35.43 peak
3	4880.000	8.98	32.16	56.22	54.66	39.58	74.00	-34.42 peak
4	7320.000	11.12	36.74	56.44	53.12	44.54	74.00	-29.46 peak
5	9760.000	12.84	38.60	54.32	49.29	46.41	74.00	-27.59 peak
6	pp11076.100	14.14	39.48	53.52	49.30	49.40	74.00	-24.60 peak



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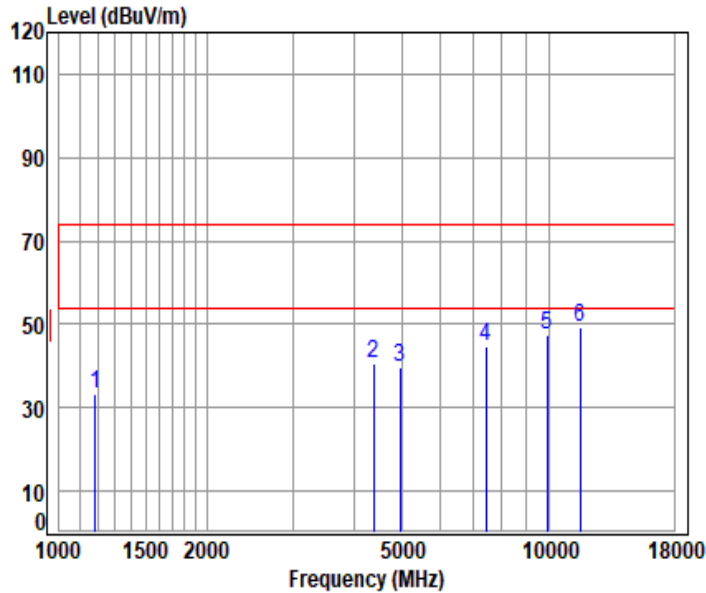
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BLE_1M_TX_CH_39_Horizontal



Condition: 3m HORIZONTAL

Job No : 04945WM

Mode : 2480 TX RSE

: BLE 1M

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Level	Line	Limit Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1185.936	7.18	25.33	54.70	55.63	33.44	74.00 -40.56 peak
2	4392.376	8.53	31.22	55.87	56.54	40.42	74.00 -33.58 peak
3	4960.000	9.07	32.20	56.27	54.86	39.86	74.00 -34.14 peak
4	7440.000	11.08	36.78	56.35	53.03	44.54	74.00 -29.46 peak
5	9920.000	12.73	38.90	54.17	50.03	47.49	74.00 -26.51 peak
6	pp11600.350	14.48	39.60	53.68	49.04	49.44	74.00 -24.56 peak



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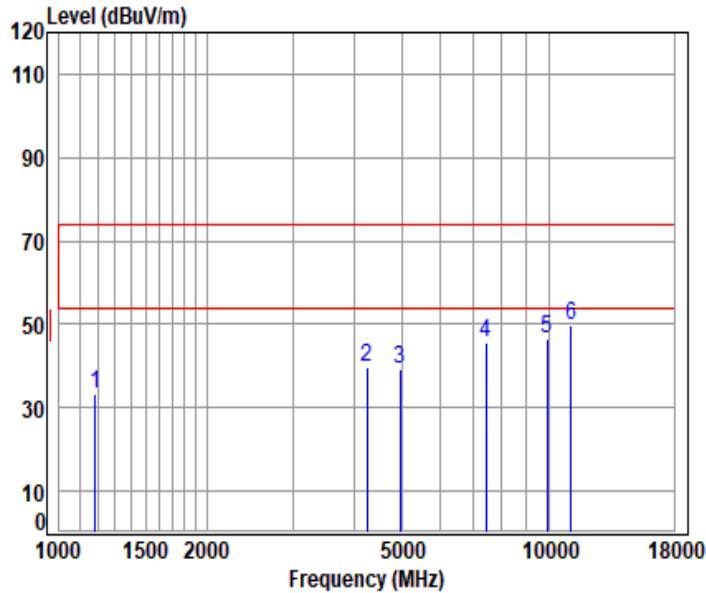
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BLE_1M_TX_CH_39_Veritical



Condition: 3m VERTICAL

Job No : 04945WM

Mode : 2480 TX RSE

: BLE 1M

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Level	Line	Limit Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1185.936	7.18	25.33	54.70	55.49	33.30	74.00 -40.70 peak
2	4242.641	8.48	31.06	55.77	55.96	39.73	74.00 -34.27 peak
3	4960.000	9.07	32.20	56.27	54.16	39.16	74.00 -34.84 peak
4	7440.000	11.08	36.78	56.35	53.91	45.42	74.00 -28.58 peak
5	9920.000	12.73	38.90	54.17	49.29	46.75	74.00 -27.25 peak
6	pp11076.100	14.14	39.48	53.52	49.64	49.74	74.00 -24.26 peak



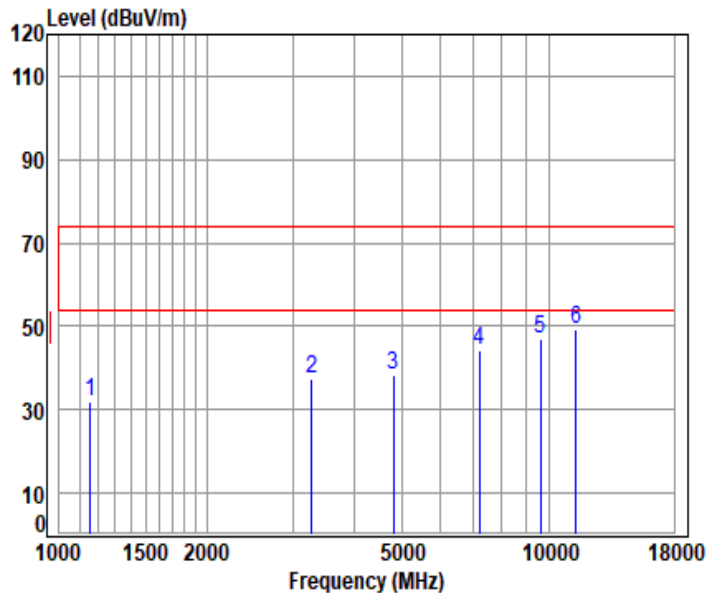
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BLE_2M_TX_CH_01_Horizontal



Condition: 3m HORIZONTAL

Job No : 04945WM

Mode : 2404 TX RSE

: BLE 2M

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Line	Limit	Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1158.828	7.15	25.38	54.70	54.10	31.93	74.00 -42.07 peak
2	3270.858	7.61	29.26	55.16	55.51	37.22	74.00 -36.78 Peak
3	4808.000	8.91	31.93	56.17	53.62	38.29	74.00 -35.71 peak
4	7212.000	11.10	36.60	56.53	53.12	44.29	74.00 -29.71 peak
5	9616.000	12.40	38.77	54.45	50.29	47.01	74.00 -26.99 peak
6	pp11335.190	14.29	39.70	53.60	49.08	49.47	74.00 -24.53 peak



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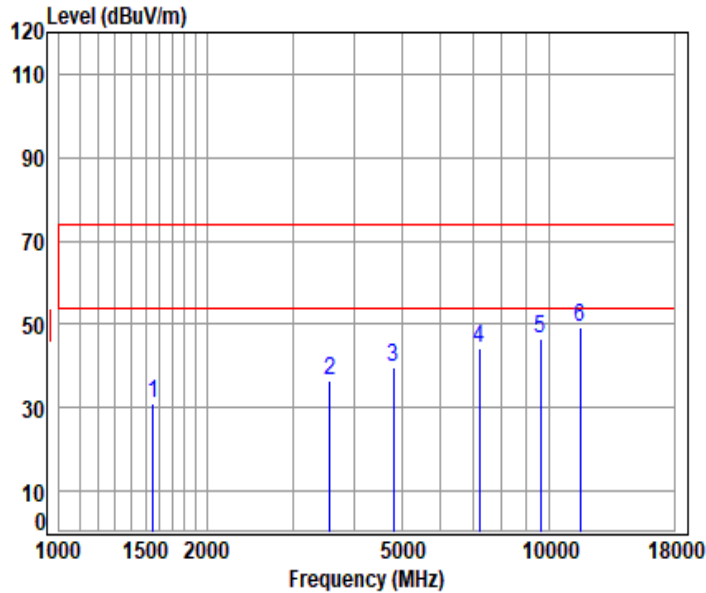
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BLE_2M_TX_CH_01_Vertical



Condition: 3m VERTICAL

Job No : 04945WM

Mode : 2404 TX RSE

: BLE 2M

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Line	Limit	Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1556.169	7.15	25.01	54.70	53.79	31.25	74.00 -42.75 Peak
2	3567.138	7.75	29.83	55.34	54.46	36.70	74.00 -37.30 Peak
3	4808.000	8.91	31.93	56.17	54.84	39.51	74.00 -34.49 peak
4	7212.000	11.10	36.60	56.53	53.17	44.34	74.00 -29.66 peak
5	9616.000	12.40	38.77	54.45	50.02	46.74	74.00 -27.26 peak
6	pp11600.350	14.48	39.60	53.68	48.95	49.35	74.00 -24.65 peak



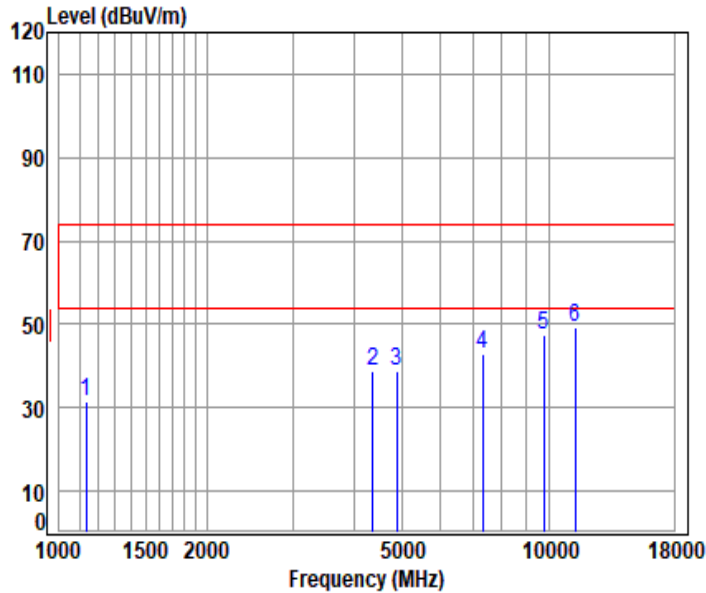
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BLE_2M_TX_CH_19_Horizontal



Condition: 3m HORIZONTAL

Job No : 04945WM

Mode : 2440 TX RSE

: BLE 2M

	Cable	Ant	Preamp	Read	Limit	Over		
Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1135.617	7.13	25.46	54.70	53.81	31.70	74.00	-42.30 peak
2	4367.058	8.51	31.27	55.86	54.92	38.84	74.00	-35.16 peak
3	4880.000	8.98	32.16	56.22	53.68	38.60	74.00	-35.40 peak
4	7320.000	11.12	36.74	56.44	51.69	43.11	74.00	-30.89 peak
5	9760.000	12.84	38.60	54.32	50.23	47.35	74.00	-26.65 peak
6	pp11302.480	14.39	39.70	53.59	48.91	49.41	74.00	-24.59 peak



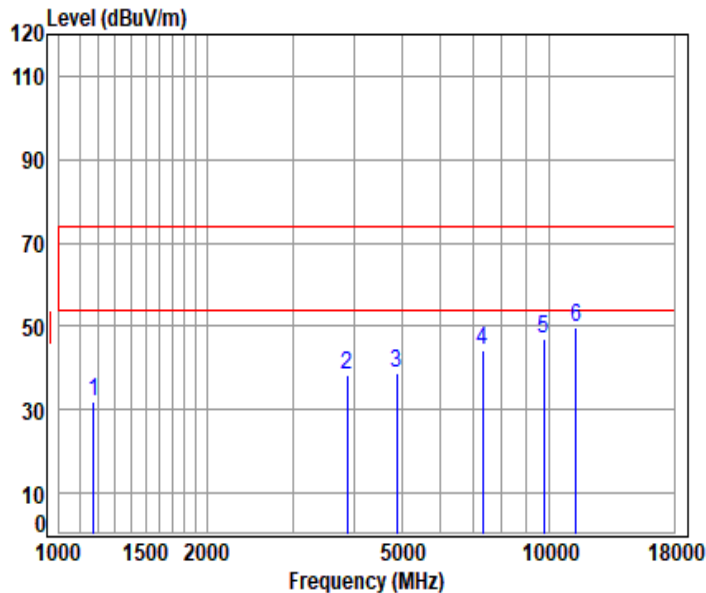
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BLE_2M_TX_CH_19_Vertical



Condition: 3m VERTICAL

Job No : 04945WM

Mode : 2440 TX RSE

: BLE 2M

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Line	Limit	Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	7.17	25.35	54.70	54.09	31.91	74.00	-42.09 peak
2	8.06	29.86	55.53	56.00	38.39	74.00	-35.61 peak
3	8.98	32.16	56.22	54.08	39.00	74.00	-35.00 peak
4	11.12	36.74	56.44	52.78	44.20	74.00	-29.80 peak
5	12.84	38.60	54.32	49.76	46.88	74.00	-27.12 peak
6	14.29	39.70	53.60	49.17	49.56	74.00	-24.44 peak



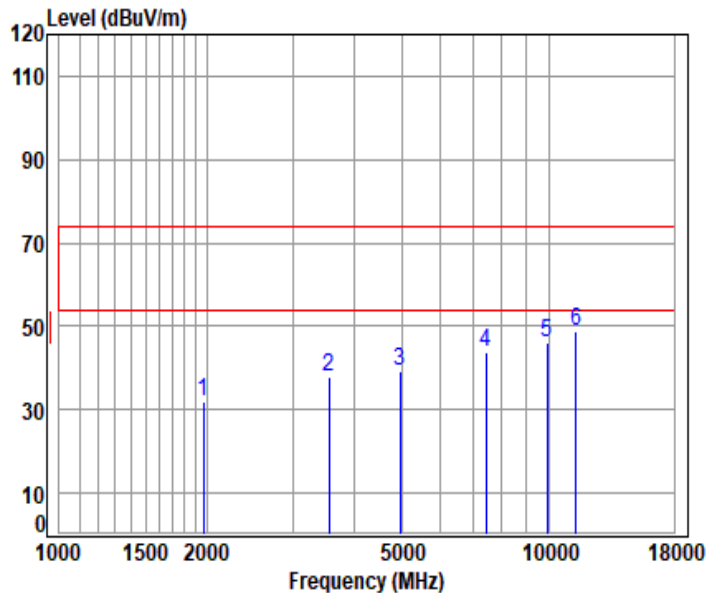
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BLE_2M_TX_CH_38_Horizontal



Condition: 3m HORIZONTAL

Job No : 04945WM

Mode : 2478 TX RSE

: BLE 2M

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Level	Line	Limit Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1972.373	7.27	25.84	54.70	53.56	31.97	74.00 -42.03 Peak
2	3556.843	7.75	29.81	55.33	55.46	37.69	74.00 -36.31 Peak
3	4956.000	9.06	32.20	56.27	54.15	39.14	74.00 -34.86 peak
4	7434.000	11.09	36.77	56.35	52.15	43.66	74.00 -30.34 peak
5	9912.000	12.71	38.90	54.18	48.83	46.26	74.00 -27.74 peak
6	pp11335.190	14.29	39.70	53.60	48.47	48.86	74.00 -25.14 Peak



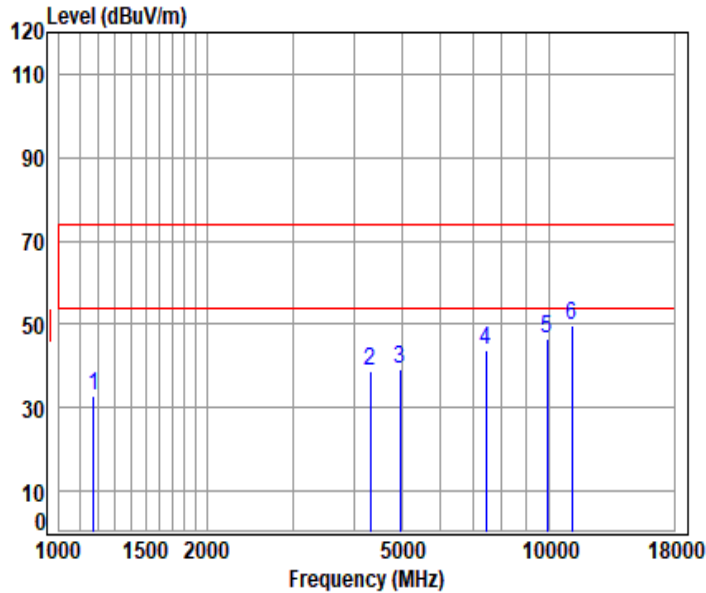
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SZEMC-TRF-01 Rev. A/1

Report No.: SZCR250100029106

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BLE_2M_TX_CH_38_Verical



Condition: 3m VERTICAL

Job No : 04945WM

Mode : 2478 TX RSE

: BLE 2M

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1175.697	7.17	25.35	54.70	55.16	32.98	74.00	-41.02	peak
2	4316.859	8.47	31.30	55.82	54.98	38.93	74.00	-35.07	peak
3	4956.000	9.06	32.20	56.27	54.22	39.21	74.00	-34.79	peak
4	7434.000	11.09	36.77	56.35	52.46	43.97	74.00	-30.03	peak
5	9912.000	12.71	38.90	54.18	49.31	46.74	74.00	-27.26	peak
6	pp11140.310	14.17	39.54	53.54	49.62	49.79	74.00	-24.21	peak



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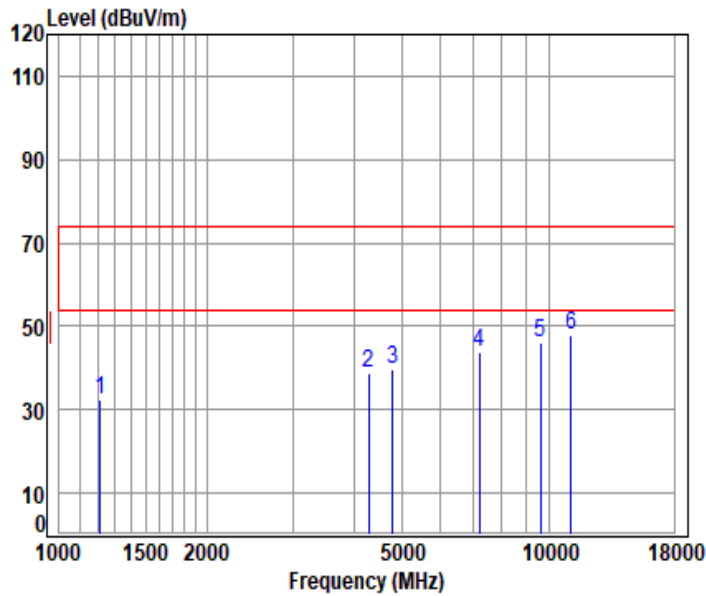
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New test data for report No.: SZCR250100029106

BLE_1M_TX_CH_00_Horizontal



Condition: 3m HORIZONTAL

Job No : 00291WM

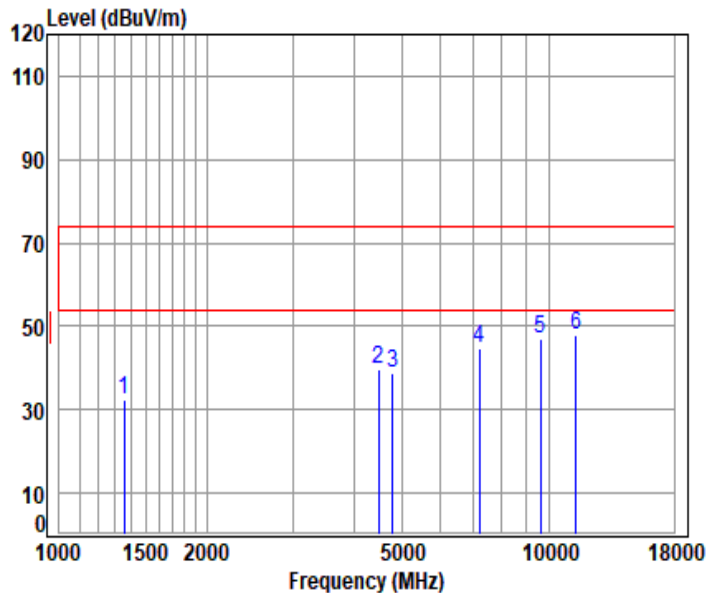
Mode : 2402 TX RSE

: BLE 1M

		Cable	Ant	Preamp	Read		Limit	Over	
	Freq	Loss	Factor	Factor	Level	Level	Line	Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	1213.677	7.18	25.30	54.70	54.53	32.31	74.00	-41.69	peak
2	4291.977	8.45	31.27	55.80	54.79	38.71	74.00	-35.29	peak
3	4804.000	8.90	31.92	56.16	55.05	39.71	74.00	-34.29	peak
4	7206.000	11.10	36.60	56.54	52.85	44.01	74.00	-29.99	peak
5	9608.000	12.38	38.78	54.45	49.18	45.89	74.00	-28.11	peak
6	11076.100	14.14	39.48	53.52	47.59	47.69	74.00	-26.31	Peak



BLE_1M_TX_CH_00_Vertical



Condition: 3m VERTICAL

Job No : 00291WM

Mode : 2402 TX RSE

: BLE 1M

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Line	Limit	Remark
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	1354.577	7.18	25.09	54.70	54.86	32.43	74.00 -41.57 peak
2	4495.125	8.56	31.58	55.95	55.41	39.60	74.00 -34.40 peak
3	4804.000	8.90	31.92	56.16	54.08	38.74	74.00 -35.26 peak
4	7206.000	11.10	36.60	56.54	53.71	44.87	74.00 -29.13 peak
5	9608.000	12.38	38.78	54.45	50.24	46.95	74.00 -27.05 peak
6	pp11335.190	14.29	39.70	53.60	47.54	47.93	74.00 -26.07 Peak



8.5 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

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

8.5.1 E.U.T. Operation

Operating Environment:

Temperature: 21.3 °C

Humidity: 35.3 % RH

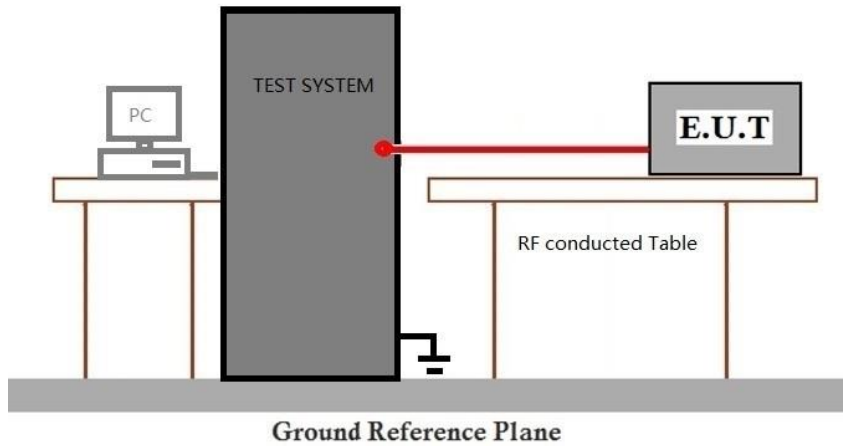
Atmospheric Pressure: 1020 mbar

8.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	04	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.



8.5.3 Test Setup Diagram



8.5.4 Measurement Procedure and Data

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

Please Refer to Appendix for Details

8.6 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

8.6.1 E.U.T. Operation

Operating Environment:

Temperature: 21.3 °C

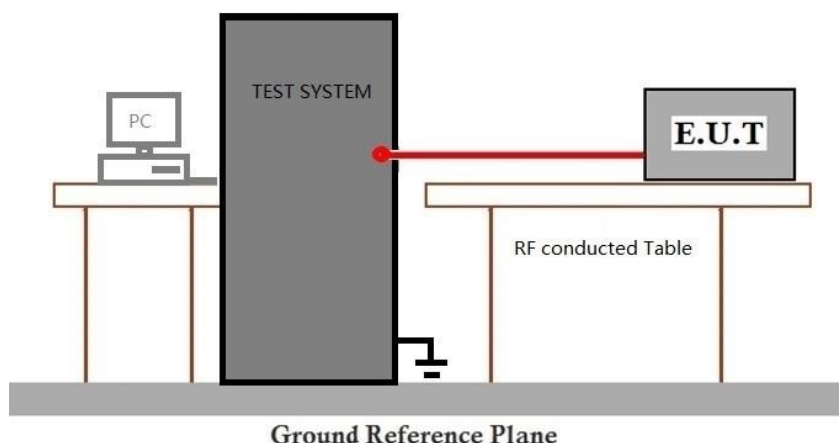
Humidity: 35.3 % RH

Atmospheric Pressure: 1020 mbar

8.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	04	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

8.6.3 Test Setup Diagram



8.6.4 Measurement Procedure and Data

Please Refer to Appendix for Details



8.7 Power Spectrum 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

8.7.1 E.U.T. Operation

Operating Environment:

Temperature: 21.3 °C

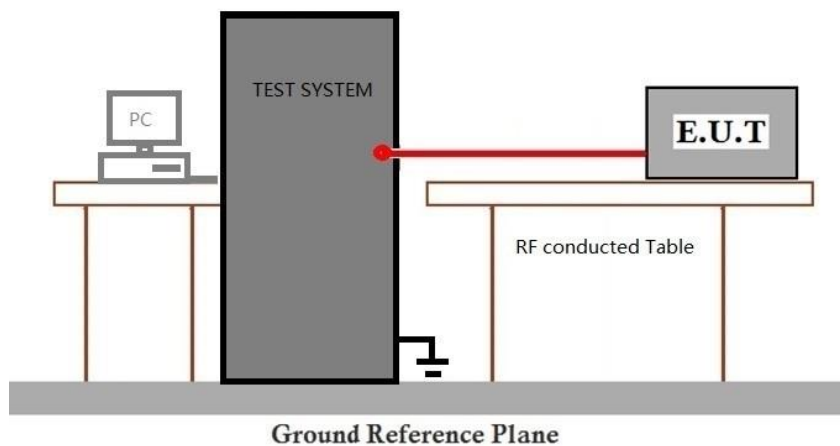
Humidity: 35.3 % RH

Atmospheric Pressure: 1020 mbar

8.7.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	04	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

8.7.3 Test Setup Diagram



8.7.4 Measurement Procedure and Data

Please Refer to Appendix for Details

8.8 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)).

8.8.1 E.U.T. Operation

Operating Environment:

Temperature: 21.3 °C

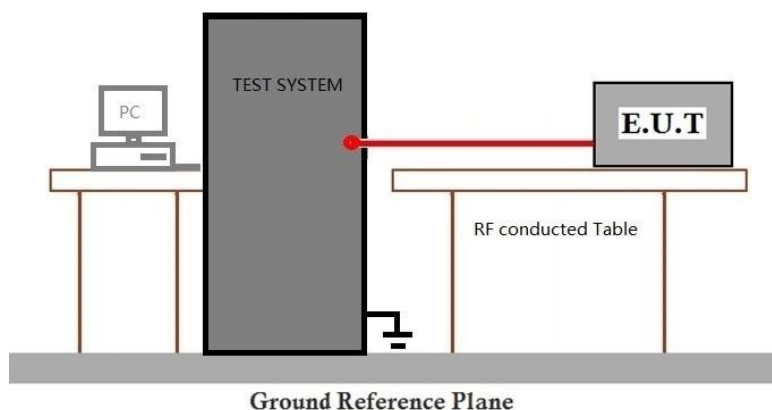
Humidity: 35.3 % RH

Atmospheric Pressure: 1020 mbar

8.8.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	04	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

8.8.3 Test Setup Diagram



8.8.4 Measurement Procedure and Data

Please Refer to Appendix for Details



8.9 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)).

8.9.1 E.U.T. Operation

Operating Environment:

Temperature: 21.3 °C

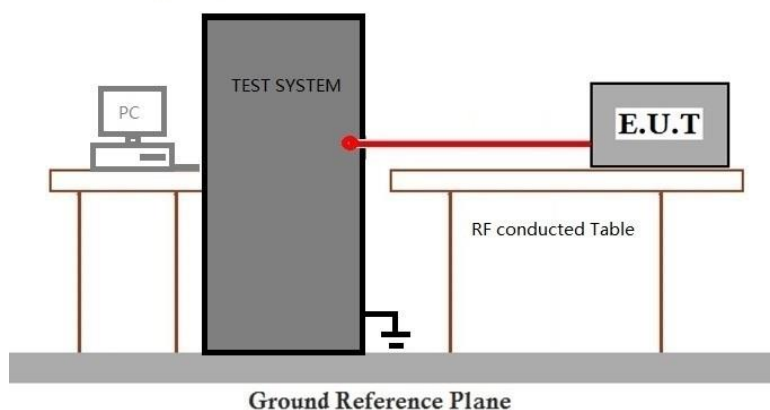
Humidity: 35.3 % RH

Atmospheric Pressure: 1020 mbar

8.9.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	TX mode(1Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.
Final test	04	TX mode(2Mbps)_Keep the EUT in continuously transmitting mode with GFSK modulation.

8.9.3 Test Setup Diagram



8.9.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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9 Test Setup Photo

Please refer to SZCR2501000291 Appendix_Setup Photo

10 EUT Constructional Details (EUT Photos)

Refer to Appendix – External and Internal Photos for SZCR2501000291WM.



11 Appendix

1. Duty Cycle

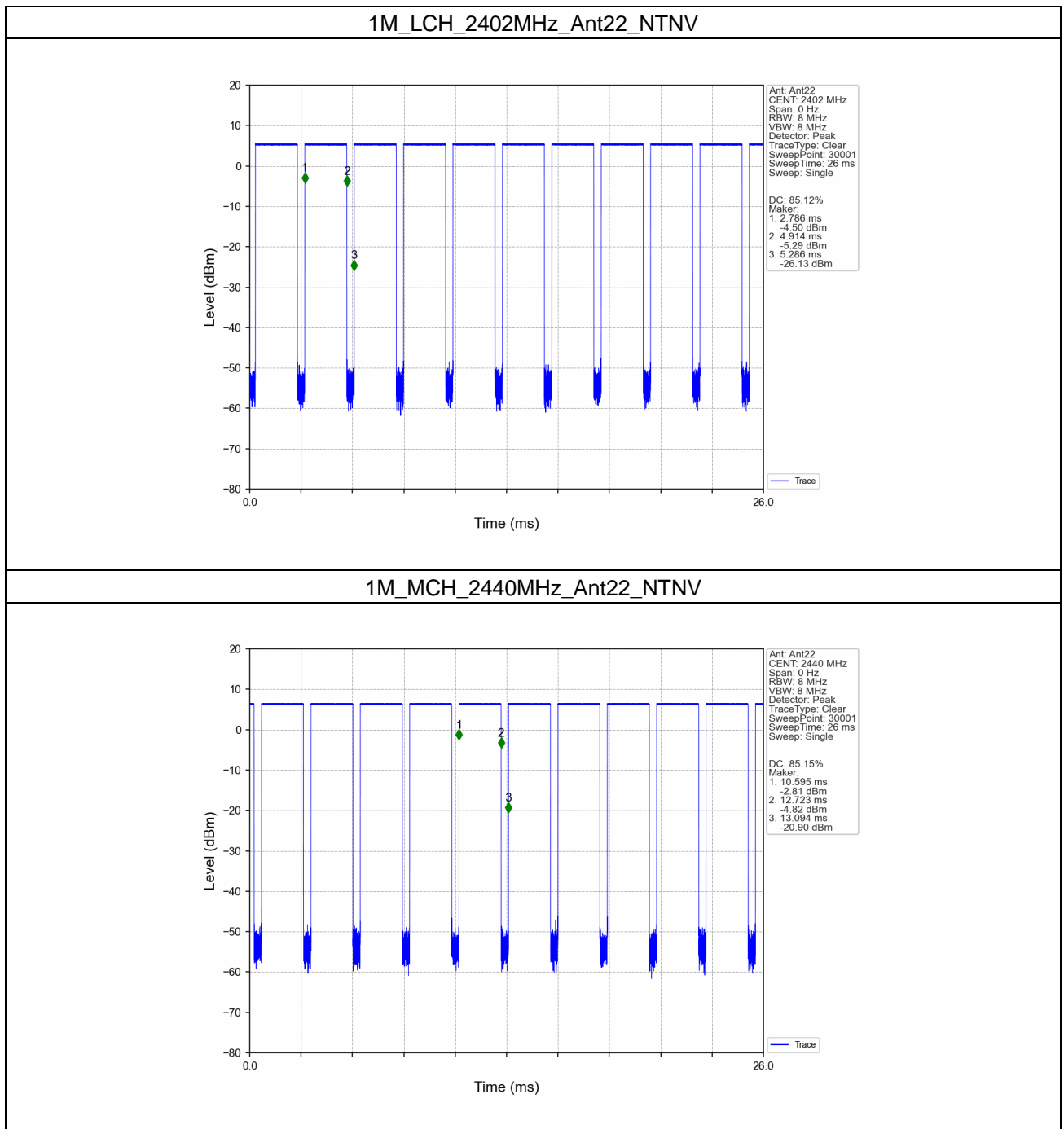
1.1 Test Result

1.1.1 Ant22

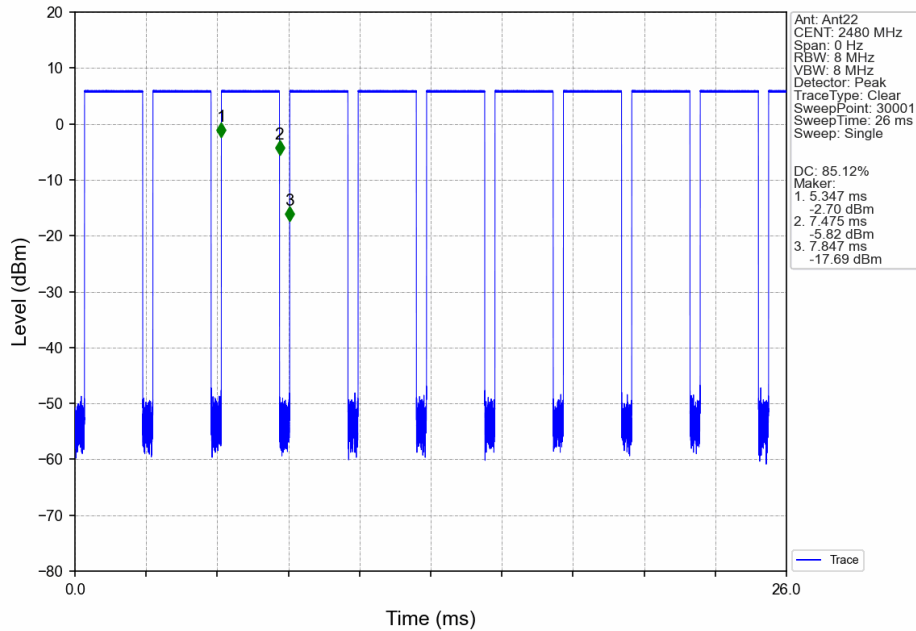
Ant22							
Mode	TX Type	Frequency (MHz)	T_on (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Max. DC Variation (%)
1M	SISO	2402	2.128	2.500	85.12	0.70	0.01
		2440	2.128	2.499	85.15	0.70	0.03
		2480	2.128	2.500	85.12	0.70	0.03
2M	SISO	2404	1.072	1.875	57.17	2.43	0.03
		2440	1.069	1.875	57.01	2.44	0.03
		2478	1.072	1.875	57.17	2.43	0.03

1.2 Test Graph

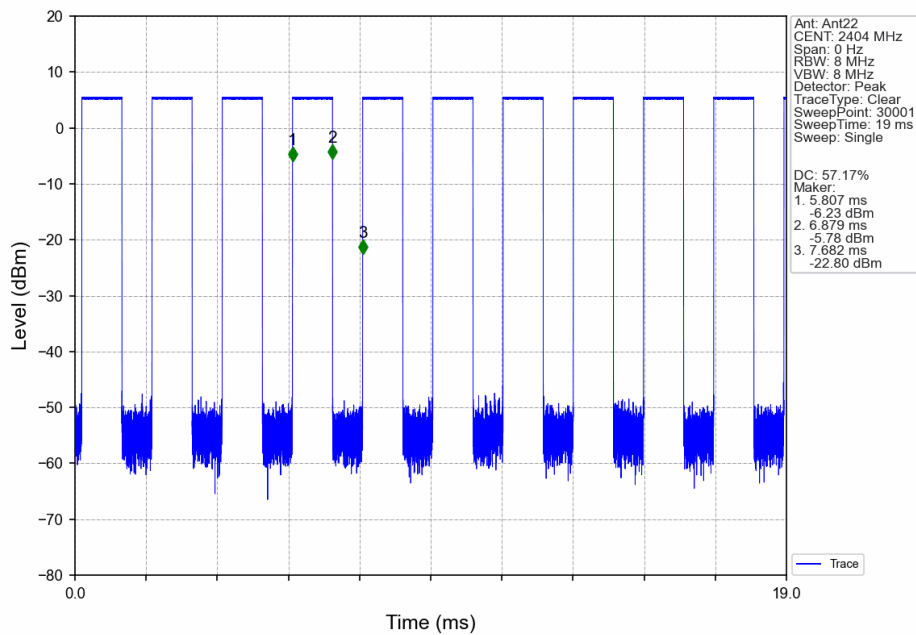
1.2.1 Ant22



1M_HCH_2480MHz_Ant22_NTNV



2M_LCH_2404MHz_Ant22_NTNV



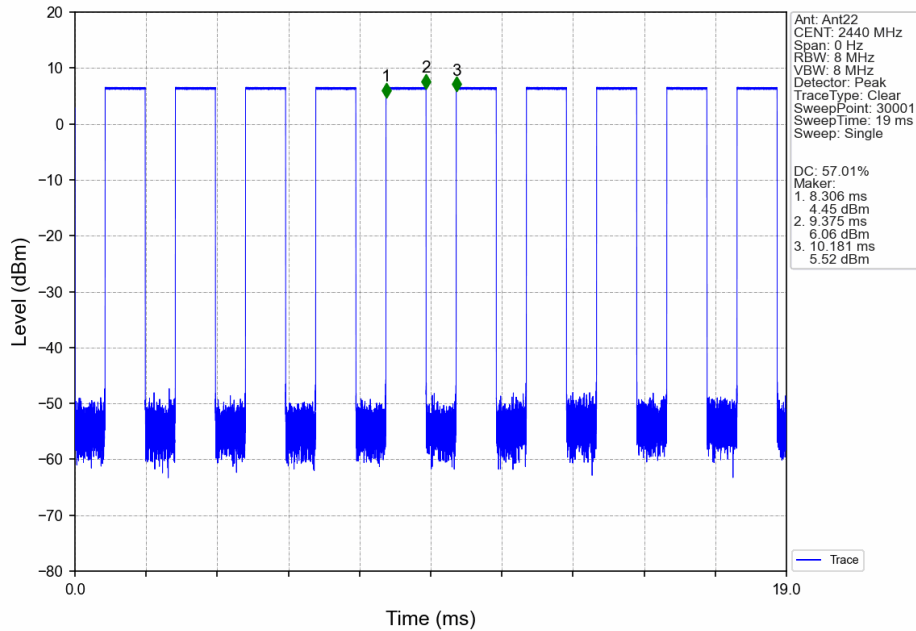
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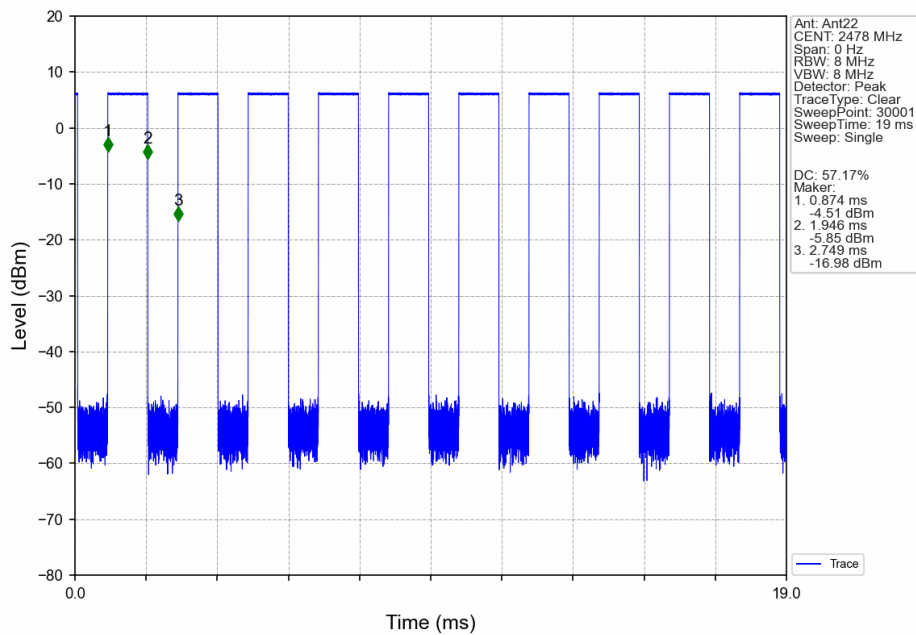
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2M_MCH_2440MHz_Ant22_NTNV



2M_HCH_2478MHz_Ant22_NTNV



2. Bandwidth

2.1 Test Result

2.1.1 OBW

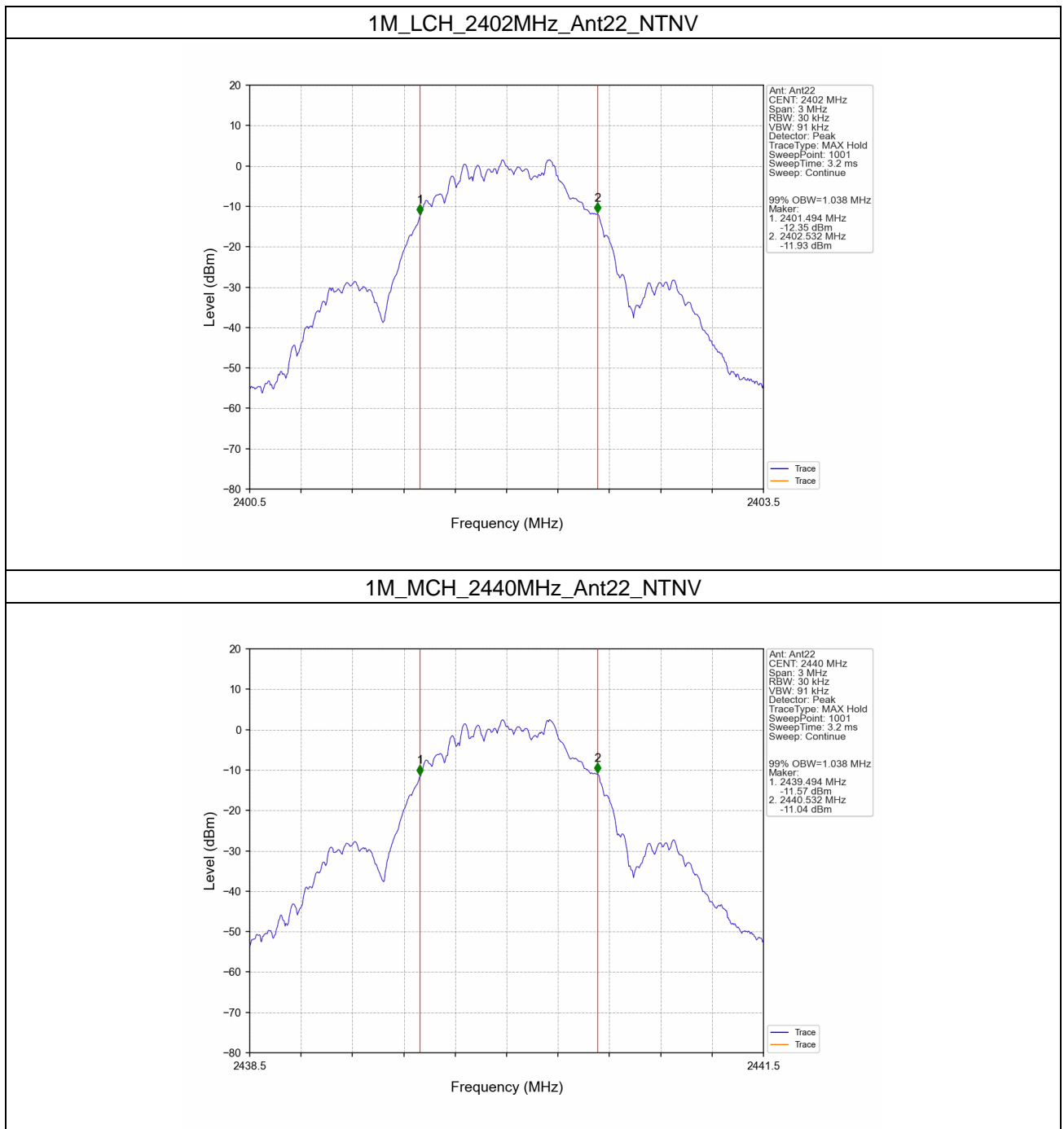
Mode	TX Type	Frequency (MHz)	ANT	99% Occupied Bandwidth (MHz)		Verdict
				Result	Limit	
1M	SISO	2402	22	1.038	/	Pass
		2440	22	1.038	/	Pass
		2480	22	1.037	/	Pass
2M	SISO	2404	22	2.069	/	Pass
		2440	22	2.069	/	Pass
		2478	22	2.068	/	Pass

2.1.2 6dB BW

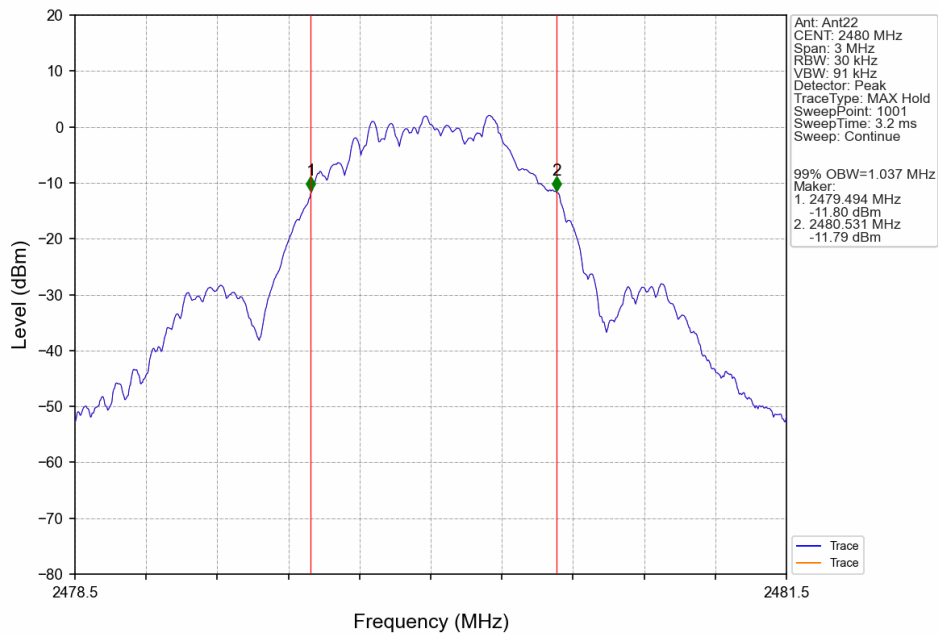
Mode	TX Type	Frequency (MHz)	ANT	6dB Bandwidth (MHz)		Verdict
				Result	Limit	
1M	SISO	2402	22	0.667	≥ 0.5	Pass
		2440	22	0.669	≥ 0.5	Pass
		2480	22	0.669	≥ 0.5	Pass
2M	SISO	2404	22	1.199	≥ 0.5	Pass
		2440	22	1.190	≥ 0.5	Pass
		2478	22	1.196	≥ 0.5	Pass

2.2 Test Graph

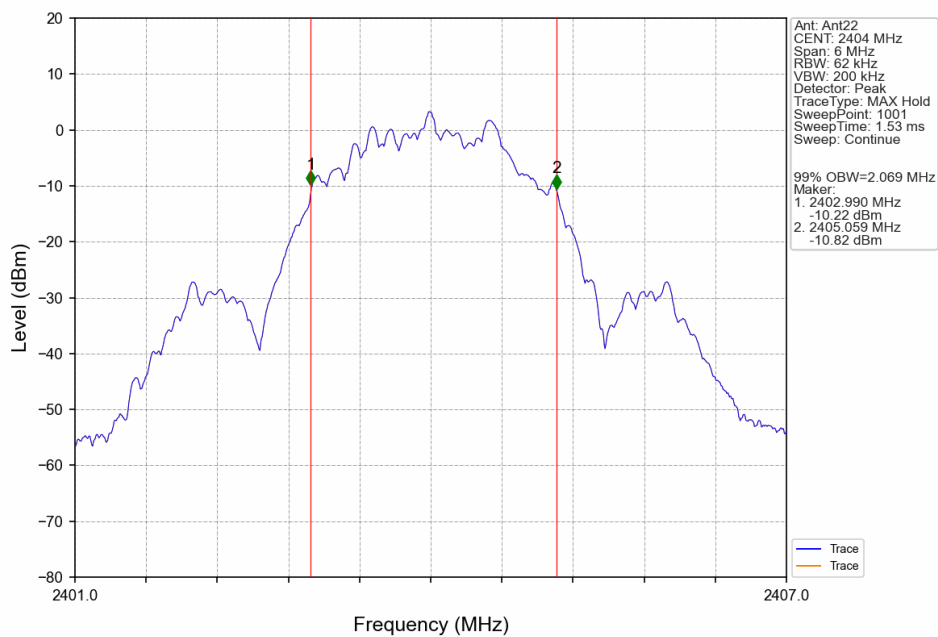
2.2.1 OBW



1M_HCH_2480MHz_Ant22_NTNV



2M_LCH_2404MHz_Ant22_NTNV



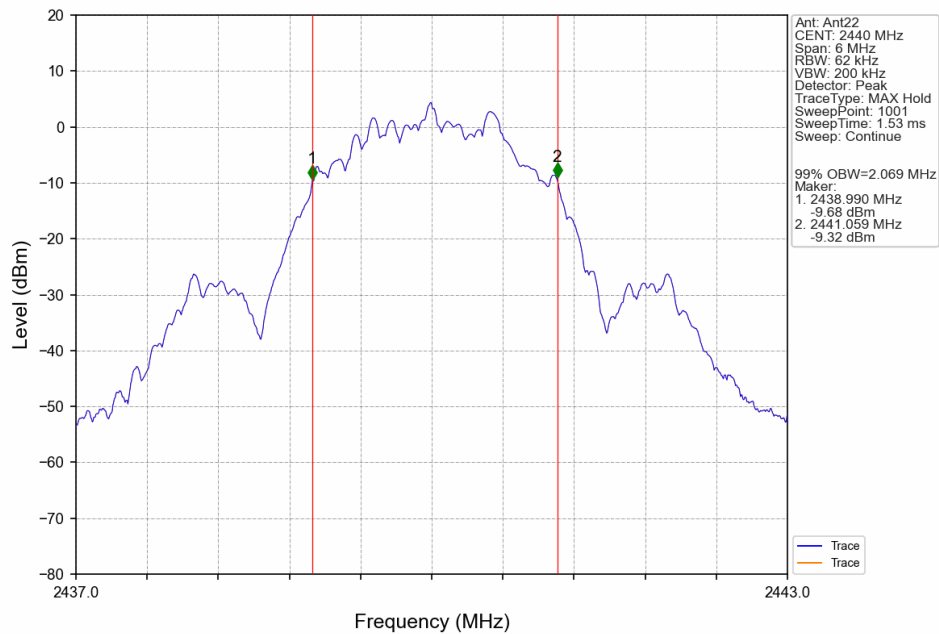
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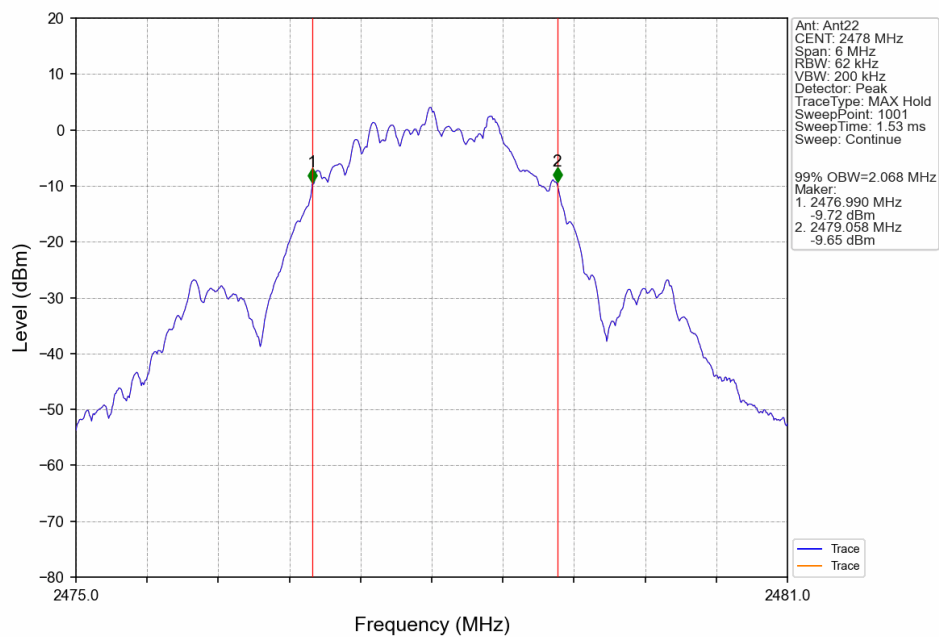
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2M_MCH_2440MHz_Ant22_NTNV



2M_HCH_2478MHz_Ant22_NTNV



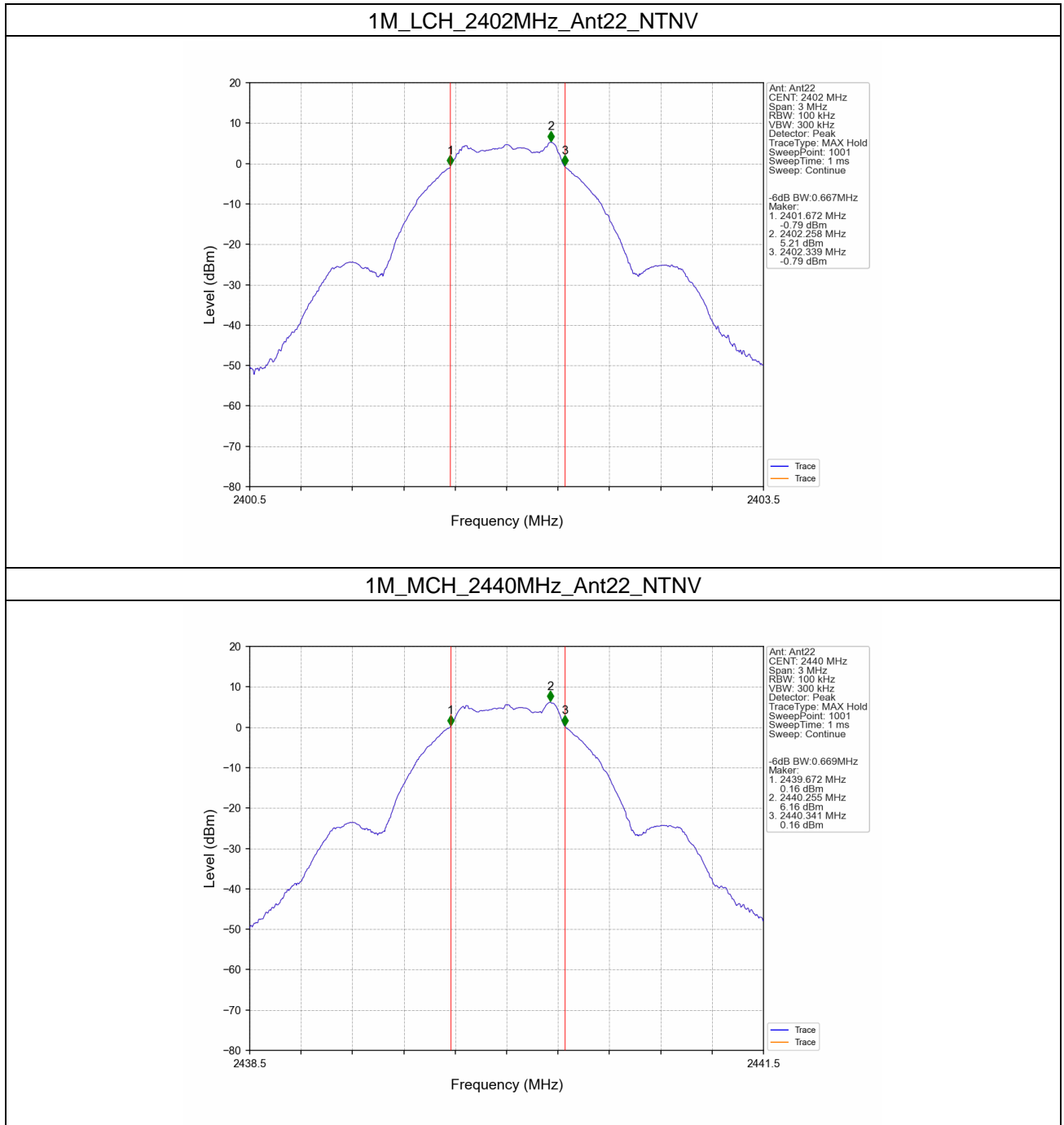
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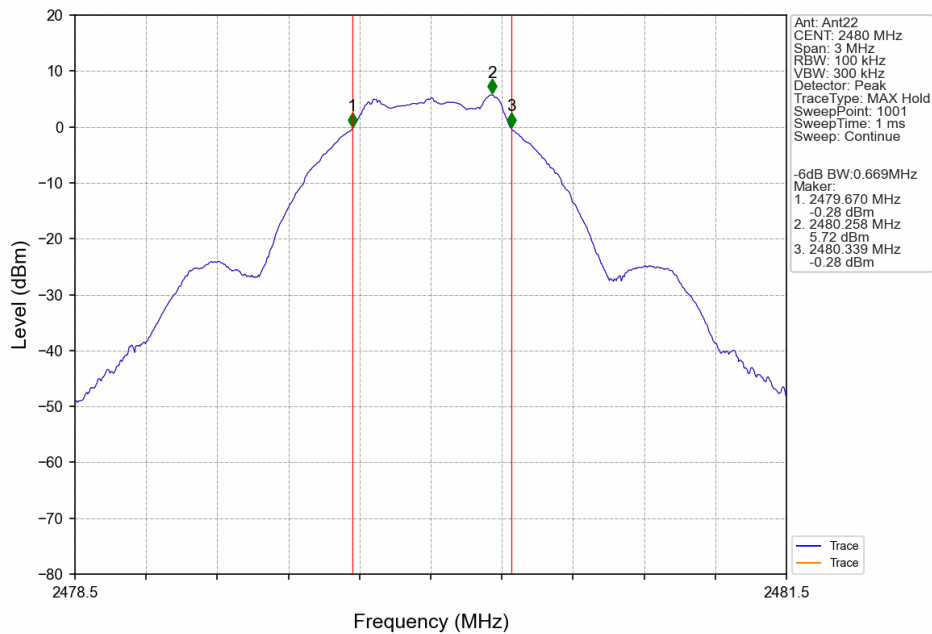
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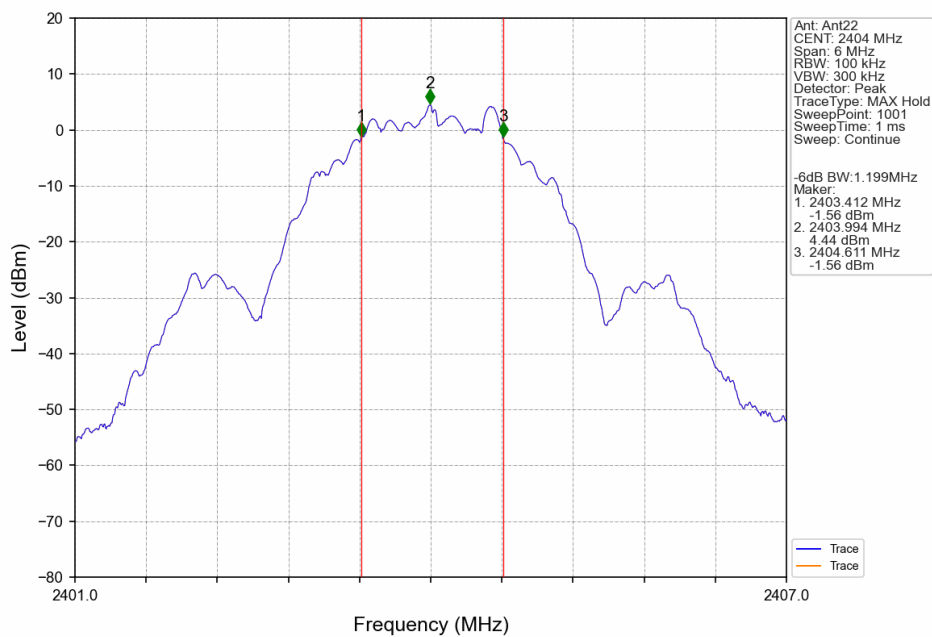
2.2.2 6dB BW



1M_HCH_2480MHz_Ant22_NTNV



2M_LCH_2404MHz_Ant22_NTNV



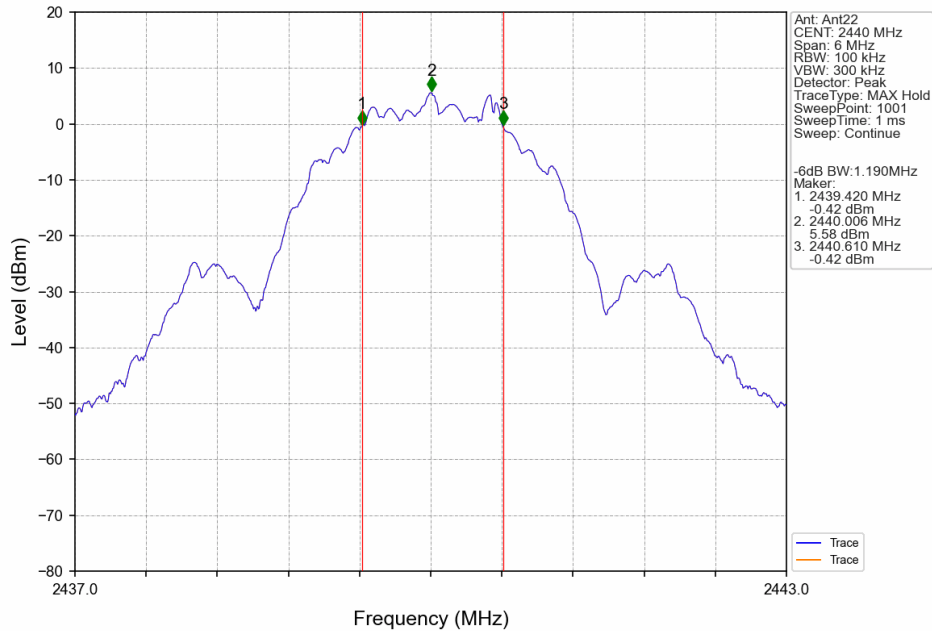
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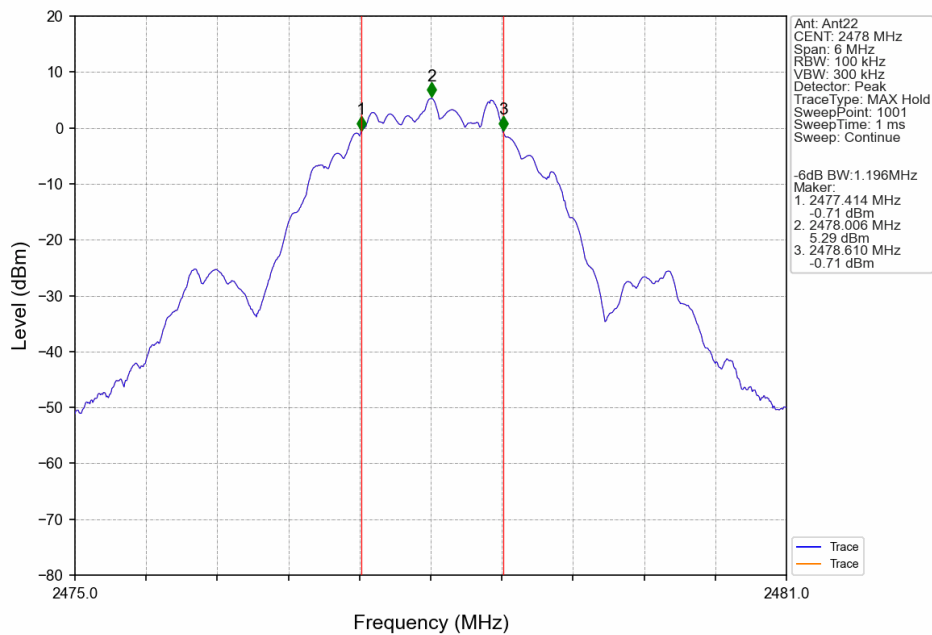
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2M_MCH_2440MHz_Ant22_NTNV



2M_HCH_2478MHz_Ant22_NTNV



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3. Maximum Conducted Output Power

3.1 Test Result

3.1.1 Power

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			ANT22	Limit	
1M	SISO	2402	5.40	≤ 30	Pass
		2440	6.36	≤ 30	Pass
		2480	5.92	≤ 30	Pass
2M	SISO	2404	5.41	≤ 30	Pass
		2440	6.46	≤ 30	Pass
		2478	6.19	≤ 30	Pass

Note1: Antenna Gain: Ant22: 0.92dBi;

4. Maximum Power Spectral Density

4.1 Test Result

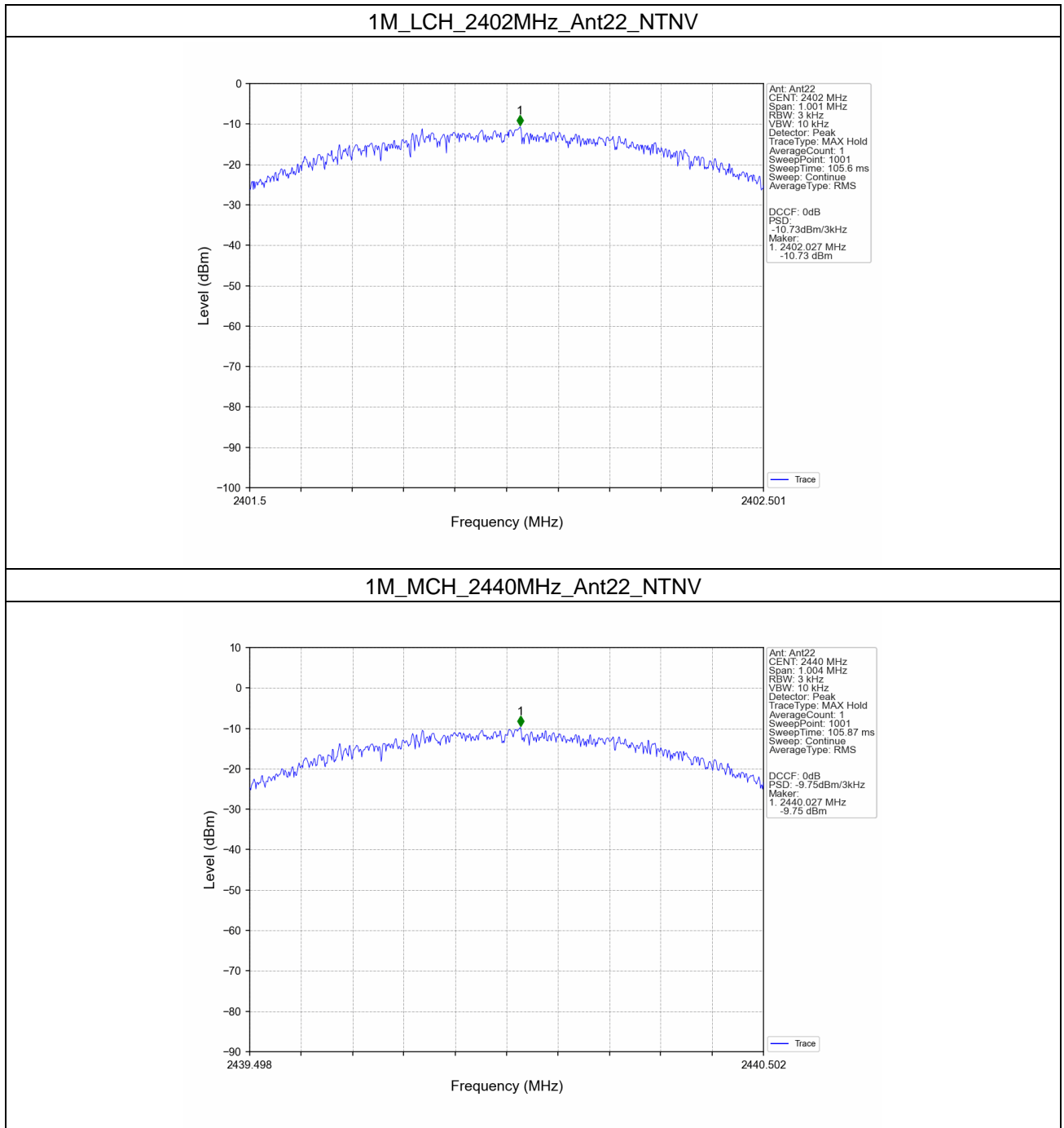
4.1.1 PSD

Mode	TX Type	Frequency (MHz)	Maximum PSD (dBm/3kHz)		Verdict
			ANT22	Limit	
1M	SISO	2402	-10.73	≤ 8	Pass
		2440	-9.75	≤ 8	Pass
		2480	-10.56	≤ 8	Pass
2M	SISO	2404	-13.15	≤ 8	Pass
		2440	-12.19	≤ 8	Pass
		2478	-12.52	≤ 8	Pass

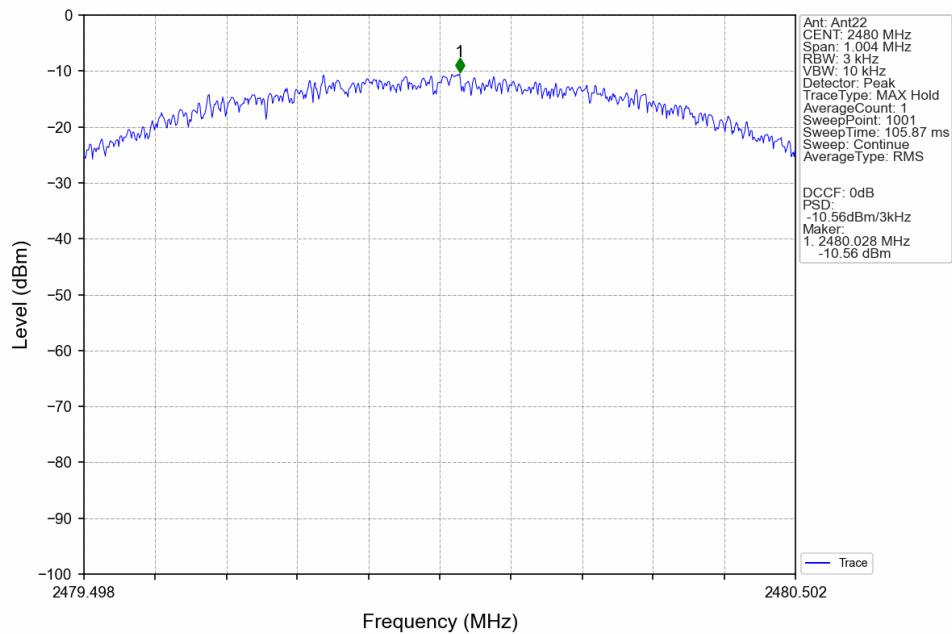
Note1: Antenna Gain: Ant22: 0.92dBi;

4.2 Test Graph

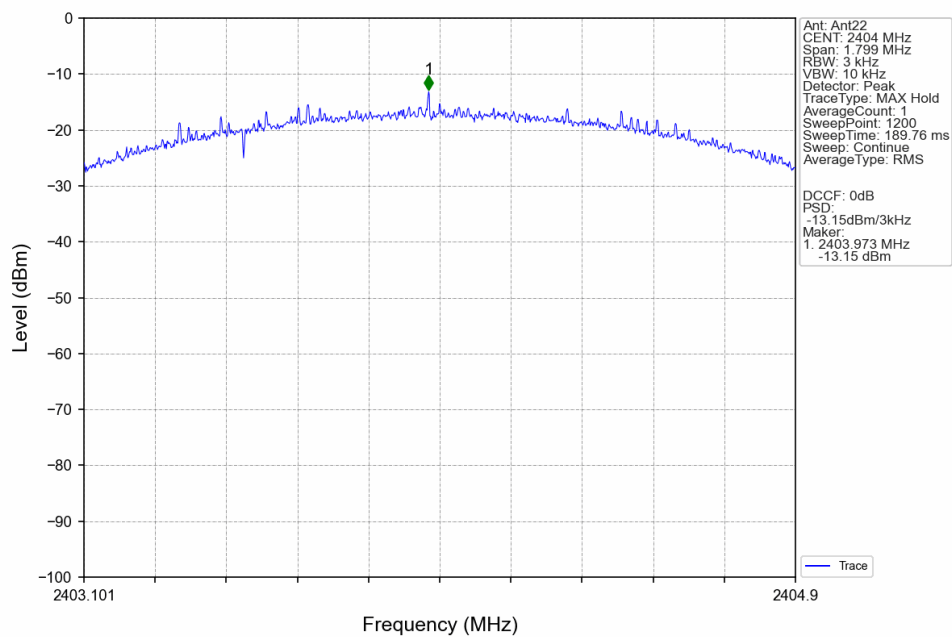
4.2.1 PSD



1M_HCH_2480MHz_Ant22_NTNV



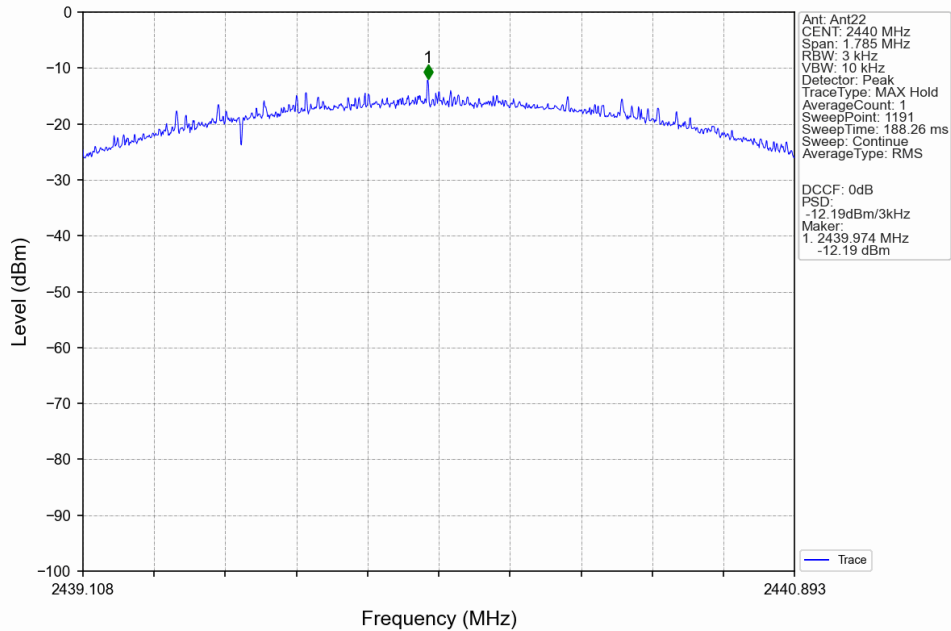
2M_LCH_2404MHz_Ant22_NTNV



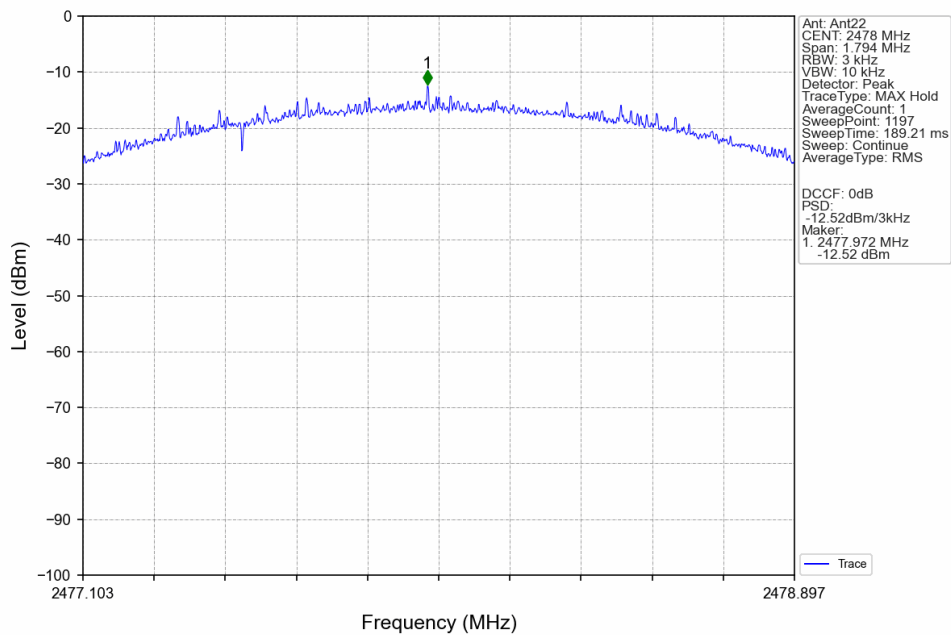
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5. Unwanted Emissions In Non-restricted Frequency Bands

5.1 Test Result

5.1.1 Ref

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
1M	SISO	2402	22	5.22
		2440	22	6.18
		2480	22	5.72
2M	SISO	2404	22	4.47
		2440	22	5.51
		2478	22	5.24

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.

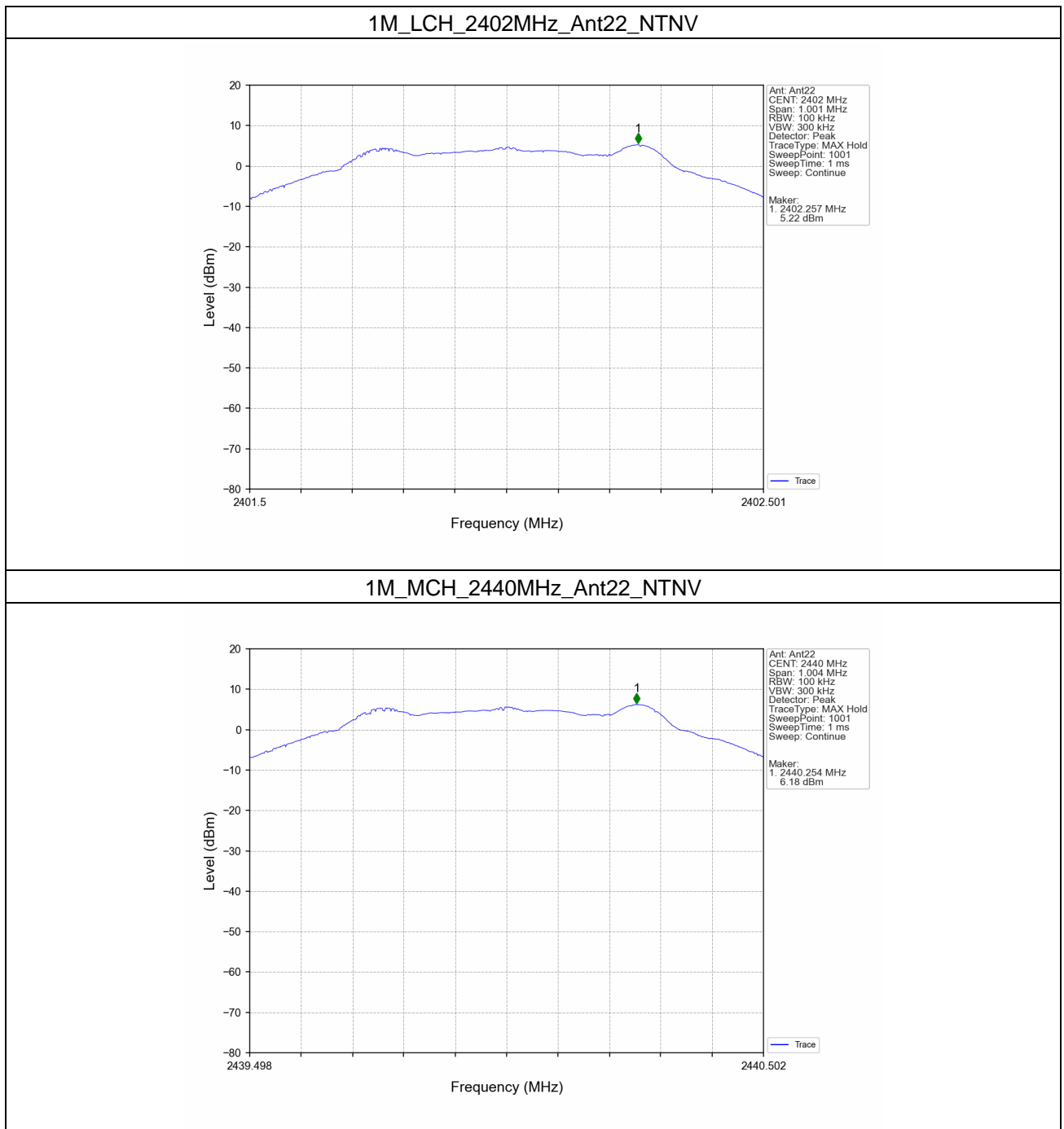
5.1.2 CSE

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
1M	SISO	2402	22	6.18	-13.82	Pass
		2440	22	6.18	-13.82	Pass
		2480	22	6.18	-13.82	Pass
2M	SISO	2404	22	5.51	-14.49	Pass
		2440	22	5.51	-14.49	Pass
		2478	22	5.51	-14.49	Pass

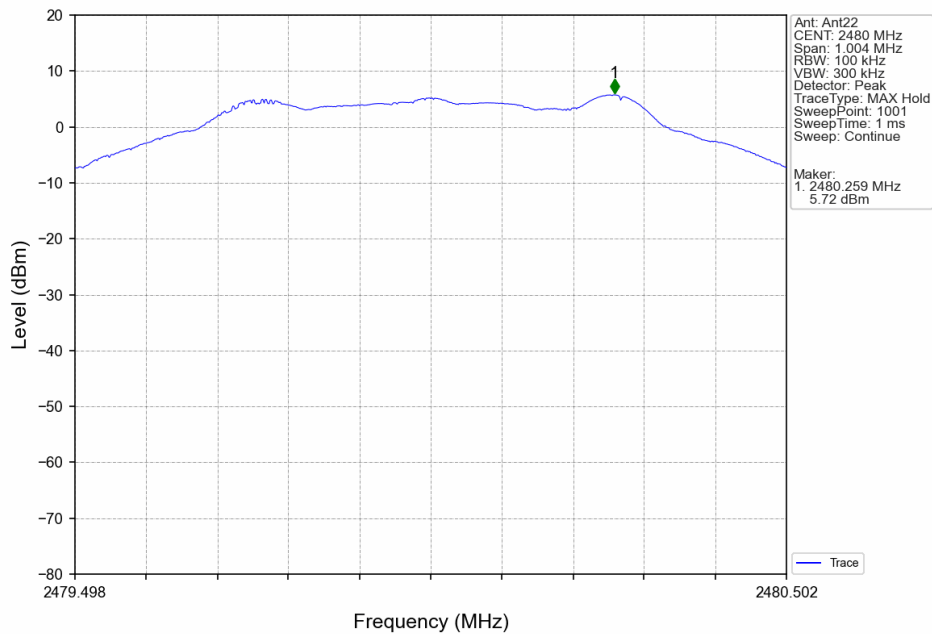
Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.

5.2 Test Graph

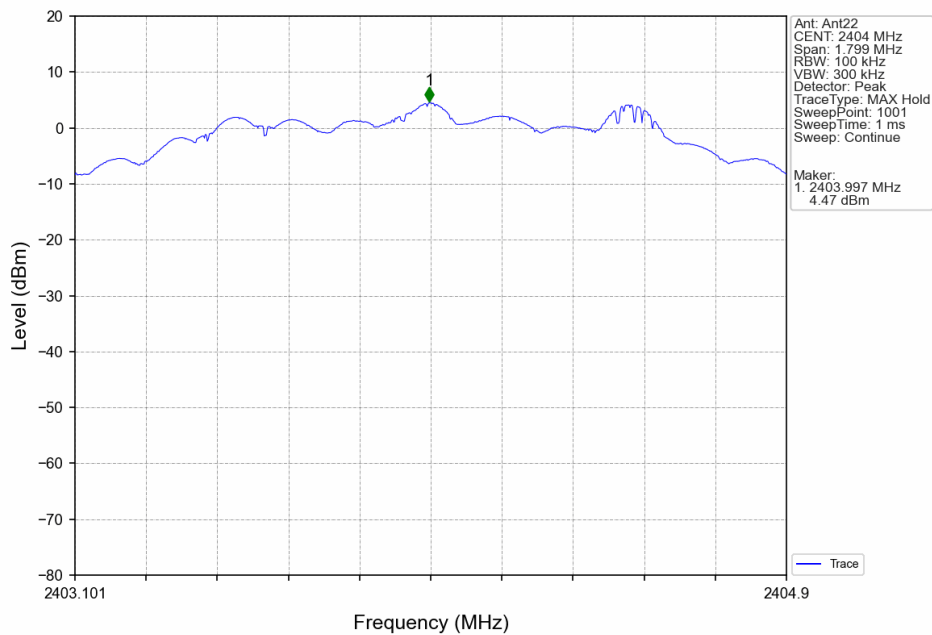
5.2.1 Ref



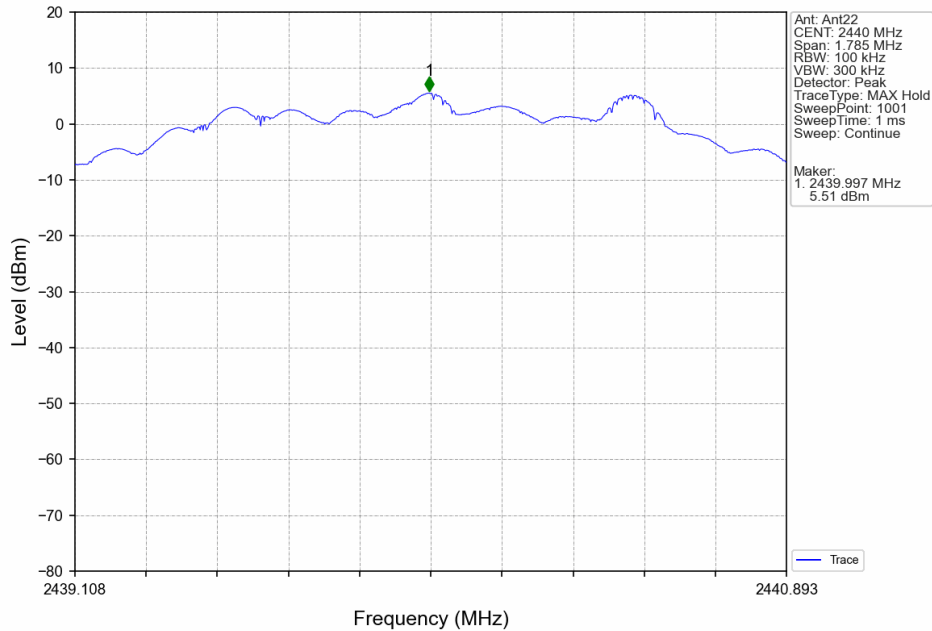
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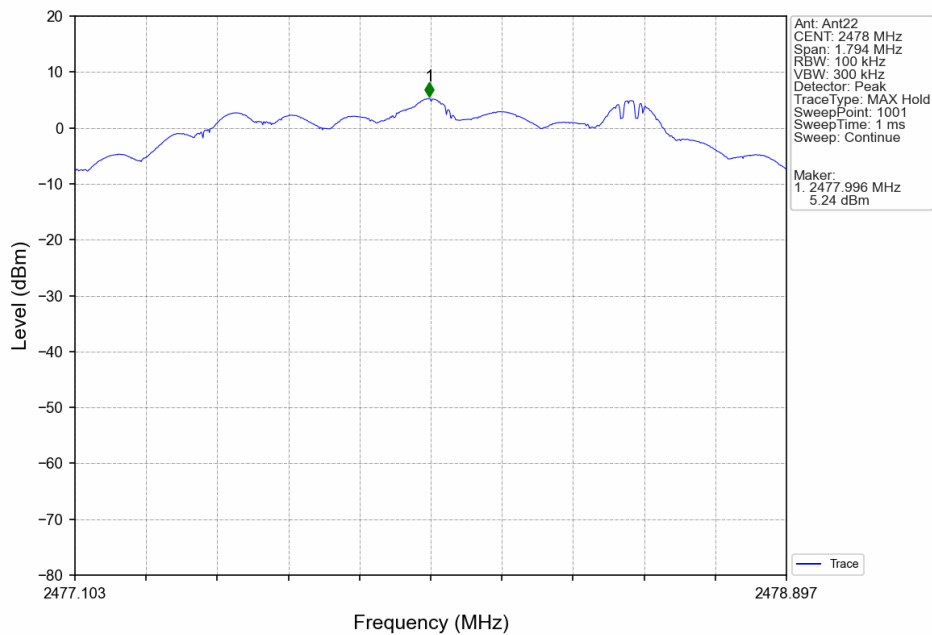
2M_LCH_2404MHz_Ant22_NTNV



2M_MCH_2440MHz_Ant22_NTNV



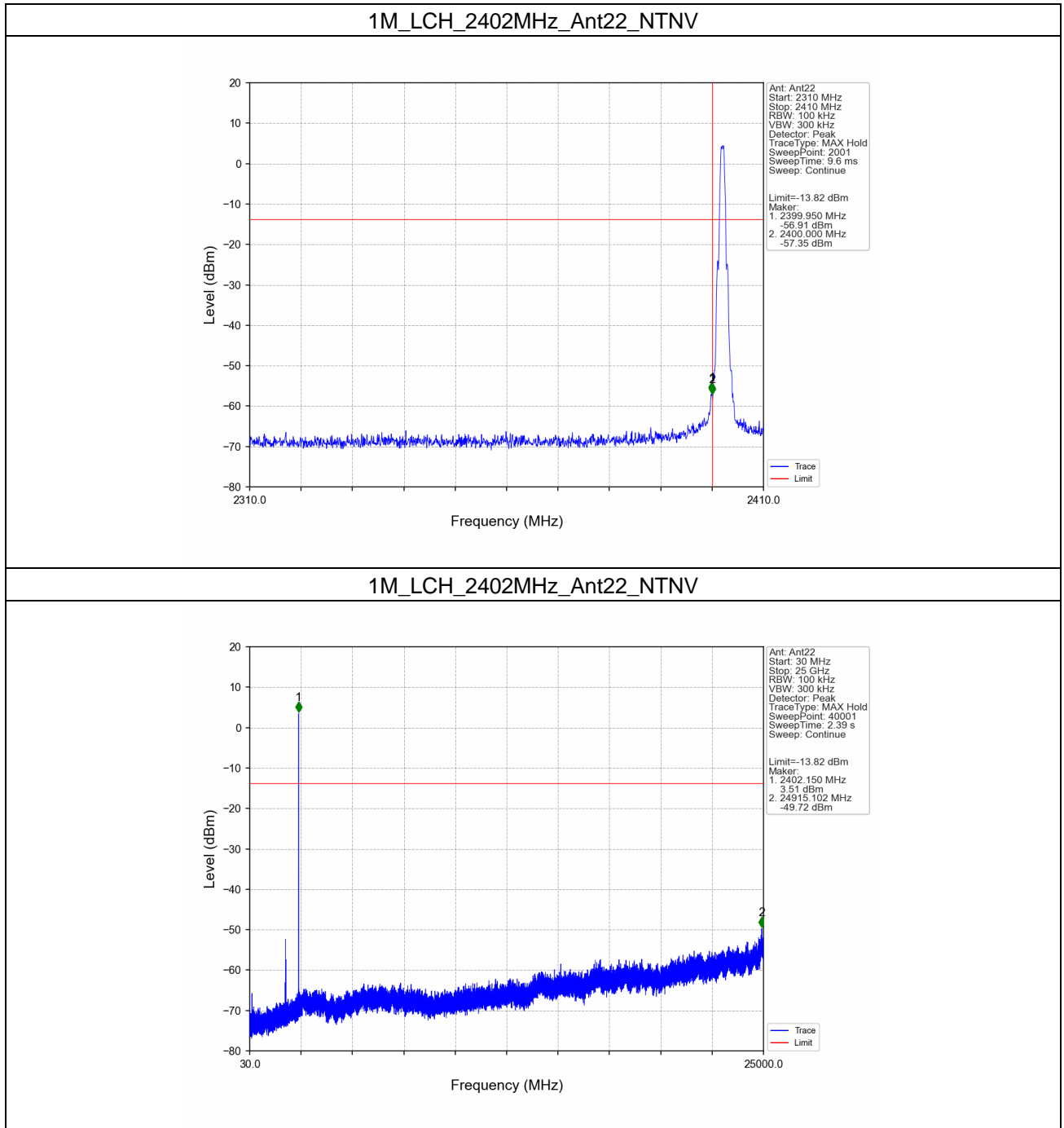
2M_HCH_2478MHz_Ant22_NTNV



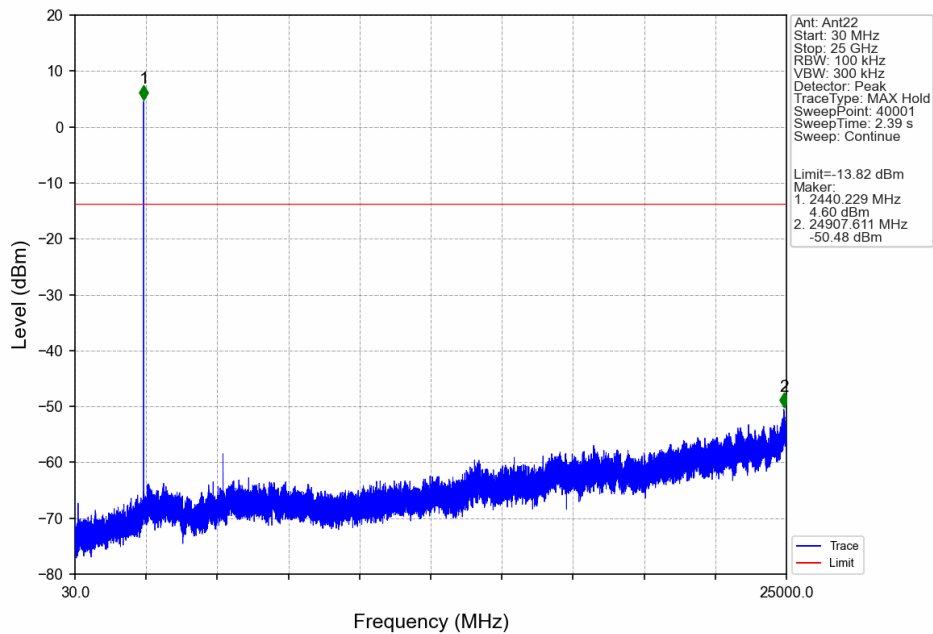
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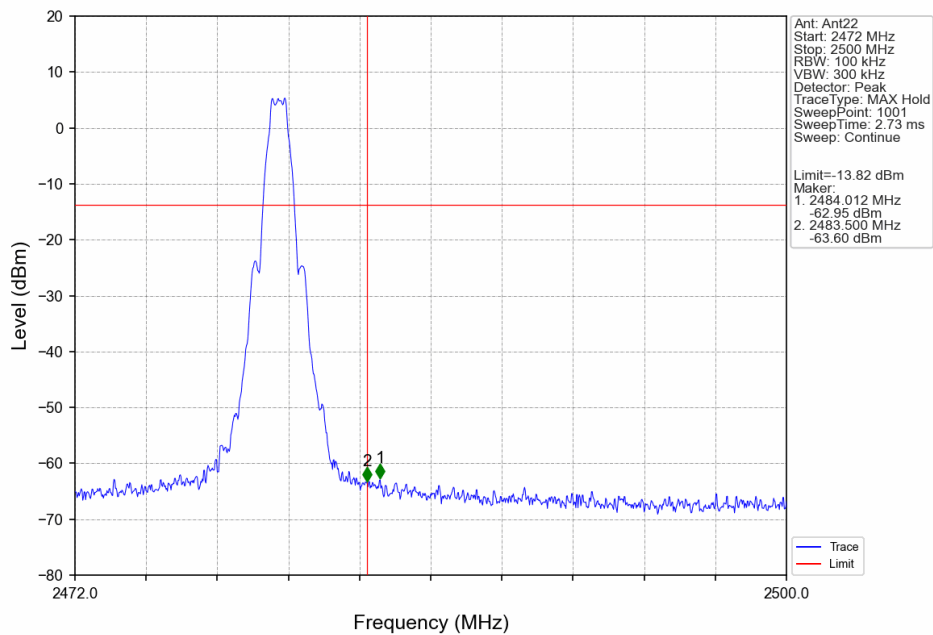
5.2.2 CSE



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1M_HCH_2480MHz_Ant22_NTNV



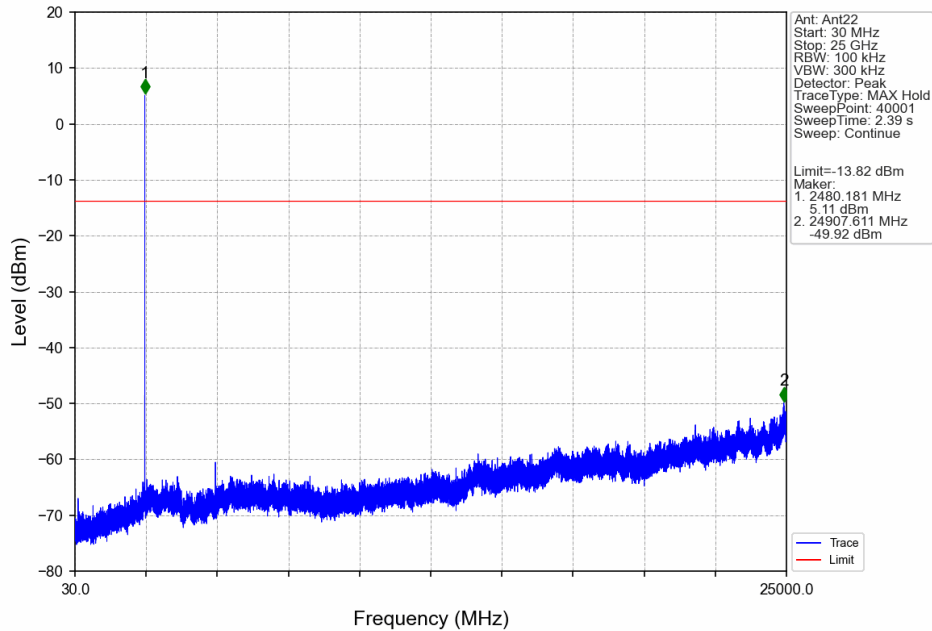
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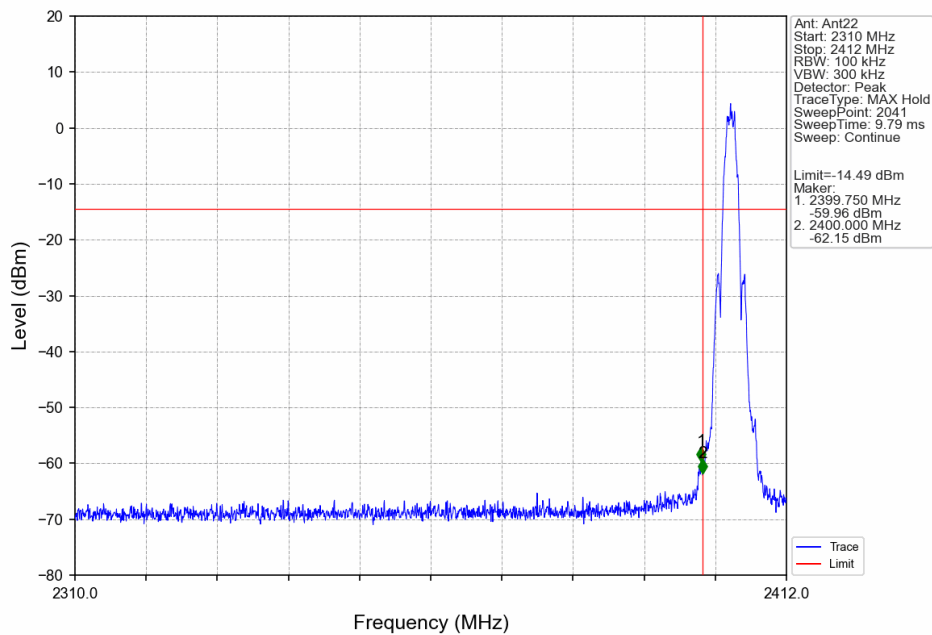
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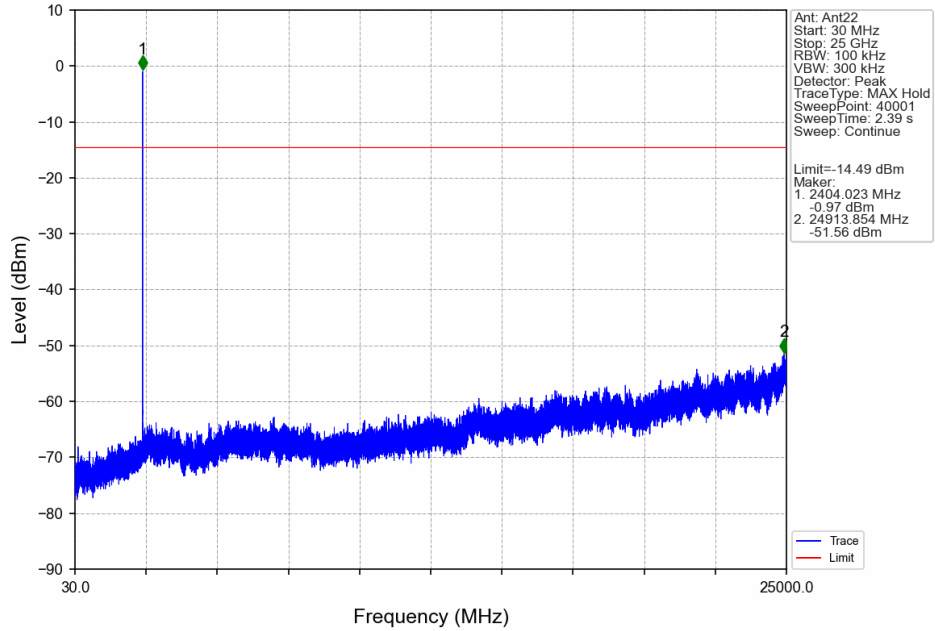
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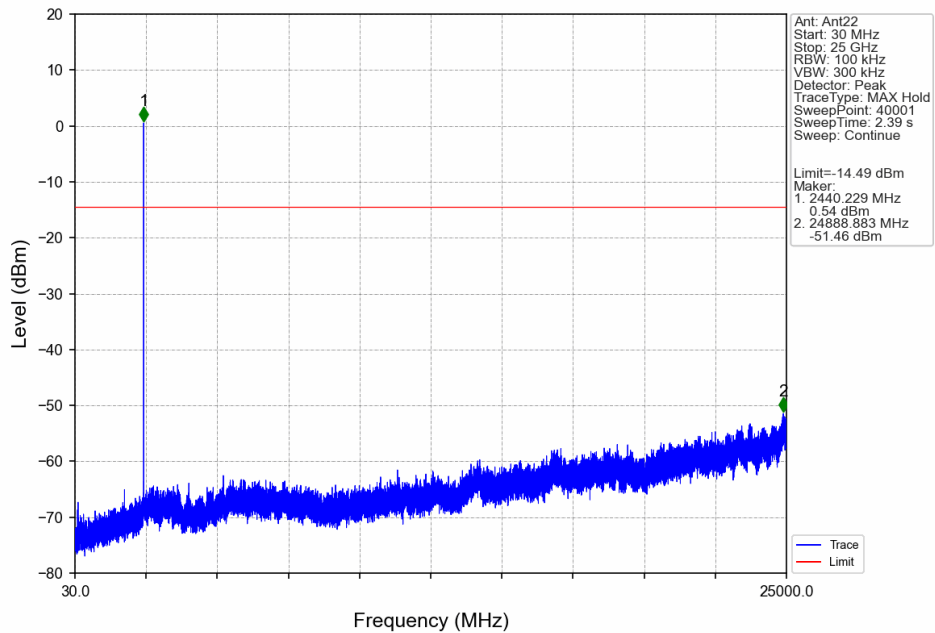
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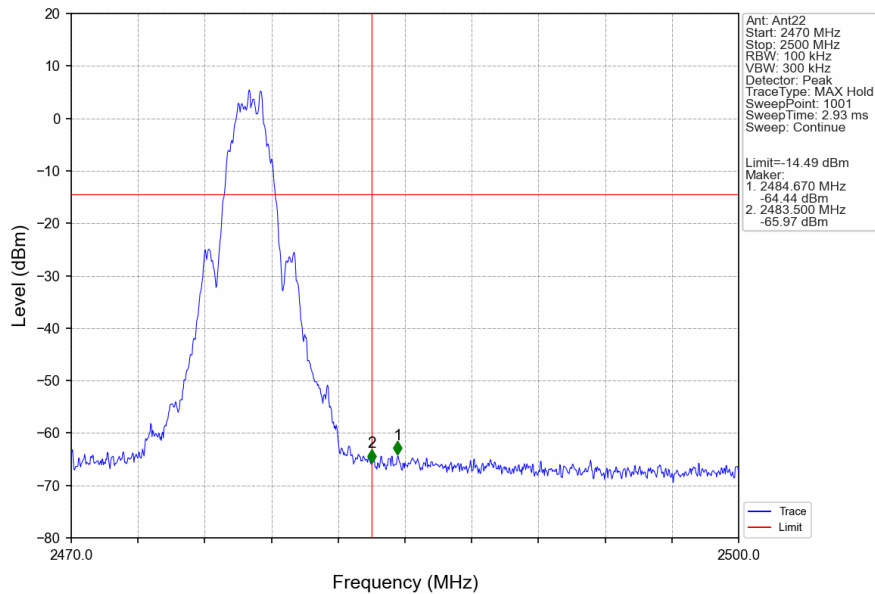
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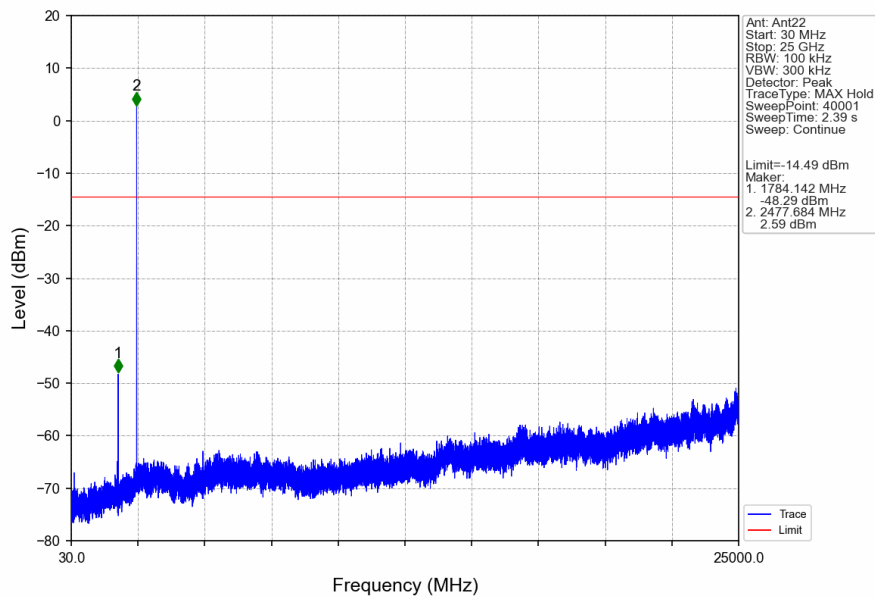
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- End of the Report -

