
FCC Test Report

Report No.: AGC09881200501FE03C

FCC ID : XPYNINAB4

APPLICATION PURPOSE : Class II permissive change

PRODUCT DESIGNATION : NINA-B411

BRAND NAME : u-blox

MODEL NAME : NINA-B411

APPLICANT : u-blox AG

DATE OF ISSUE : May 25, 2023

STANDARD(S) : FCC Part 15.247

REPORT VERSION : V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd



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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	May 25, 2023	Valid	Initial Release

Note: The original test report AGC09881200501FE03B (dated Oct. 19, 2021 and tested from Oct. 12, 2021 to Oct. 19, 2021) was modified on May 25, 2023, including the following changes and additions:

- Change the EUT photos;
- Change the EMC test photos;
- Change the Product Designation;
- Change the Test model;
- Change the Antenna Gain;
- Shield 2.4G wireless technology by software;
- The Radiated Emission and Band edge Emission tests have been updated.

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1. VERIFICATION OF COMPLIANCE

Applicant	u-blox AG
Address	Zuercherstrasse 68, Thalwil, Ch-8800, Switzerland
Manufacturer	u-blox AG
Address	Zuercherstrasse 68, Thalwil, Ch-8800, Switzerland
Product Designation	NINA-B411
Brand Name	u-blox
Test Model	NINA-B411
Date of test	May 24, 2023
Deviation	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BLE/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC part 15.247.

Prepared By



Cool Cheng
(Project Engineer)

May 25, 2023

Reviewed By



Calvin Liu
(Reviewer)

May 25, 2023

Approved By



Max Zhang
(Authorized Officer)

May 25, 2023

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as a “NINA-B411”. It is designed by way of utilizing the GFSK technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	2.402GHz to 2.480GHz
RF Output Power	5.864dBm (Max)
Bluetooth Version	V5.1
Modulation	BR <input type="checkbox"/> GFSK, EDR <input type="checkbox"/> π /4-DQPSK, <input type="checkbox"/> 8DPSK BLE <input type="checkbox"/> GFSK 1Mbps <input checked="" type="checkbox"/> GFSK 2Mbps
Number of channels	40 Channels
Antenna Designation	Patch Antenna(Comply with requirements of the FCC part 15.203)
Antenna Gain	Antenna 1:-13.9dBi Antenna 2:-13.9dBi Antenna 3:-13.9dBi Antenna 4:-13.9dBi Antenna 5:-13.9dBi Antenna 6:-13.9dBi Antenna 7:-13.9dBi Antenna 8:-13.9dBi
Hardware Version	A
Software Version	V1.0
Power Supply	DC 3.3V
Note: 1. The EUT has eight Antennas. Only Antenna 1 the test data were recorded in the test report. 2. ANT-B10” is an antenna designed to be used for Bluetooth Direction Finding with the Bluetooth LE module NINA-B411.The antenna element of ANT-B10 is connected to the RF-port of NINA-B411 via printed board microstrip trace layout thus NINA-B411 is soldered onto the ANT-B10 When operating together with ANT-B10 NINA-B411 uses GFSK 1 Mbps and 2 Mbps Bluetooth LE modes.	

2.2. TABLE OF CARRIER FREQUENCIES

Frequency Band	Channel Number	Frequency
2400~2483.5MHz	0	2402 MHz
	1	2404 MHz
	:	:
	38	2478 MHz
	39	2480 MHz

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2.3. RELATED SUBMITTAL(S)/GRANT(S)

This submittal(s) (test report) is intended for **FCC ID: XPYNINAB4** filing to comply with the FCC Part 15.247 requirements.

2.4. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

2.5. SPECIAL ACCESSORIES

Refer to section 5.2.

2.6. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

2.7. ANTENNA REQUIREMENT

This intentional radiator is designed with a permanently attached antenna of an antenna 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.

For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

Item	Measurement Uncertainty
Uncertainty of Conducted Emission for AC Port	$U_c = \pm 2.9 \text{ dB}$
Uncertainty of Radiated Emission below 1GHz	$U_c = \pm 3.8 \text{ dB}$
Uncertainty of Radiated Emission above 1GHz	$U_c = \pm 4.9 \text{ dB}$
Uncertainty of total RF power, conducted	$U_c = \pm 0.8 \text{ dB}$
Uncertainty of RF power density, conducted	$U_c = \pm 2.6 \text{ dB}$
Uncertainty of spurious emissions, conducted	$U_c = \pm 2.7 \%$
Uncertainty of Occupied Channel Bandwidth	$U_c = \pm 2 \%$

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4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX_2402MHz_GFSK_2Mbps
2	Middle channel TX_2440MHz_GFSK_2Mbps
3	High channel TX_2480MHz_GFSK_2Mbps

Note: 1. Only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
3. For Conducted Test method, a temporary antenna connector is provided by the manufacture.
4.The test software is the Putty which can set the EUT into the individual test modes.

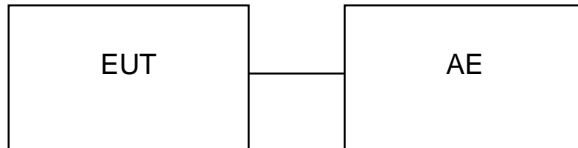
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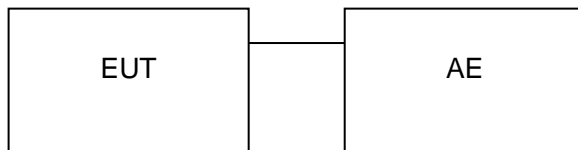
5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF TESTED SYSTEM

Radiated Emission Configure:



Conducted Emission Configure:



5.2. EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	NINA-B411	NINA-B411	XPYNINAB4	EUT
2	Control board	USB-to-TTL	DC 3.3V	Accessory
3	PC	D15	N/A	AE
4	PC Adapter	HW-200325CP0	2.2m unshielded	AE

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
15.209	Radiated Emission	Compliant

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6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance (Shenzhen) Co., Ltd is accredited by A2LA

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
Test Receiver	R&S	ESCI	10096	Feb. 18, 2023	Feb. 17, 2024
Signal Analyzer	Agilent	N9020A	MY52090123	Aug. 04, 2022	Aug. 03, 2023
EXA Signal Analyzer	Agilent	N9010A	MY53470504	Aug. 04, 2022	Aug. 03, 2023
2.4GHz Filter	EM Electronics	N/A	N/A	Mar. 18, 2022	Mar. 19, 2024
Attenuator	ZHINAN	E-002	N/A	Aug. 04, 2022	Aug. 03, 2024
Horn Antenna	SCHWARZBEC	BBHA9170	768	Oct. 31, 2021	Oct. 30, 2023
Active Loop Antenna (9K-30Mhz)	ZHINAN	ZN30900C	18051	Mar. 12, 2022	Mar. 11, 2024
Double-Ridged Waveguide Horn	ETS	3117	00034609	Mar. 23, 2023	Mar. 22, 2024
Preamplifier	ETS	3117-PA	00246148	Aug. 04, 2022	Aug. 03, 2024
Wideband Antenna	SCHWARZBECK	VULB9168	VULB9168-494	Jan. 05, 2023	Jan. 04, 2024
Test software	FARA	V.RA-03A	N/A	N/A	N/A

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7. RADIATED EMISSION

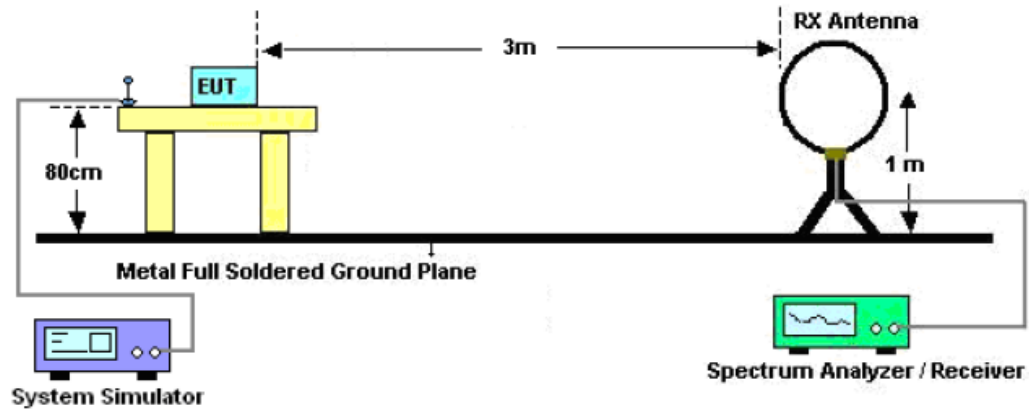
7.1. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

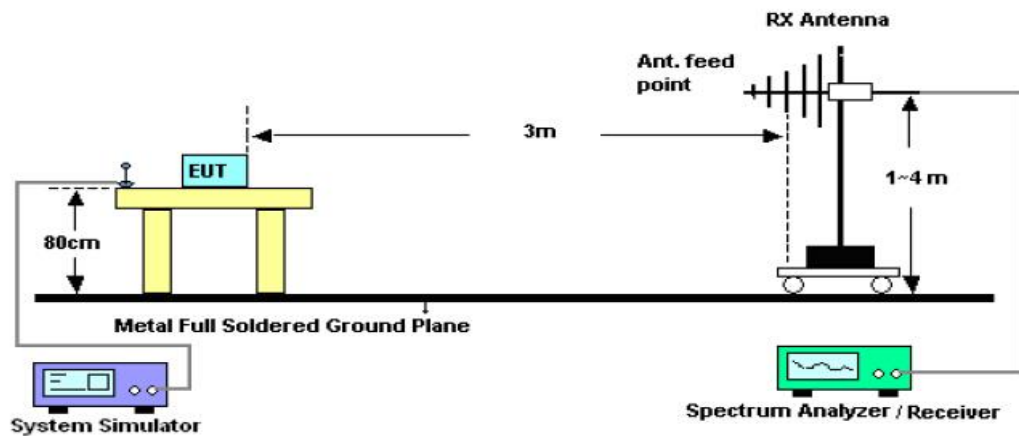
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7.2. TEST SETUP

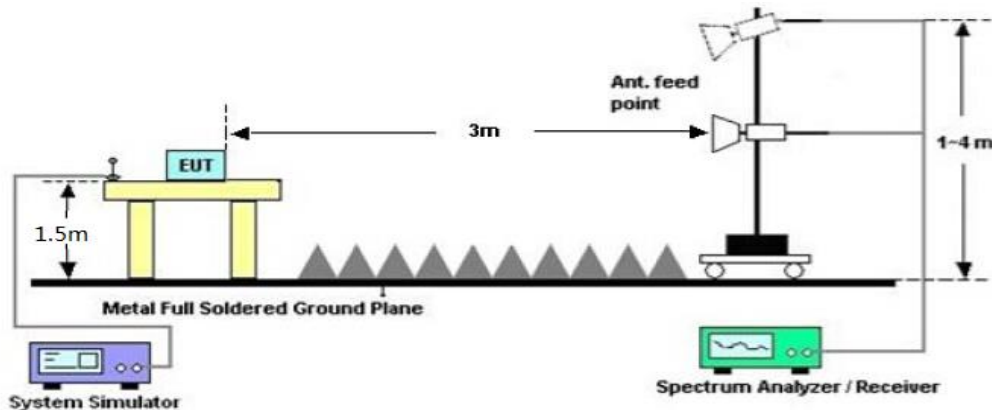
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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7.3. LIMITS AND MEASUREMENT RESULT

15.209 Limit in the below table has to be followed

Frequencies (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

Note: All modes were tested for restricted band radiated emission, the test records reported below are the worst result compared to other modes.

7.4. TEST RESULT

RADIATED EMISSION BELOW 30MHz

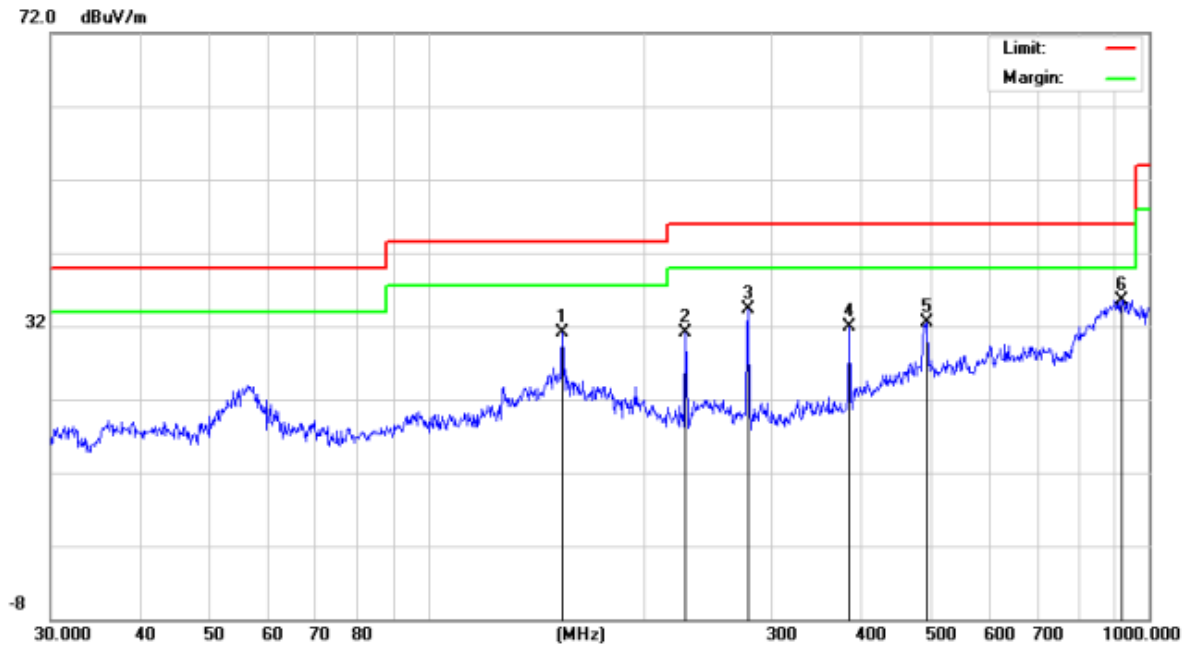
The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the permissible value need not be reported.

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RADIATED EMISSION BELOW 1GHZ

EUT	NINA-B411	Model Name	NINA-B411
Temperature	22.5°C	Relative Humidity	62.8%
Pressure	985hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		153.7384	17.87	13.14	31.01	43.50	-12.49	peak
2		227.6904	16.39	14.78	31.17	46.00	-14.83	peak
3		278.0668	18.50	15.79	34.29	46.00	-11.71	peak
4		383.9318	13.30	18.63	31.93	46.00	-14.07	peak
5		492.4685	10.53	21.99	32.52	46.00	-13.48	peak
6	*	916.0687	6.03	29.55	35.58	46.00	-10.42	peak

RESULT: PASS

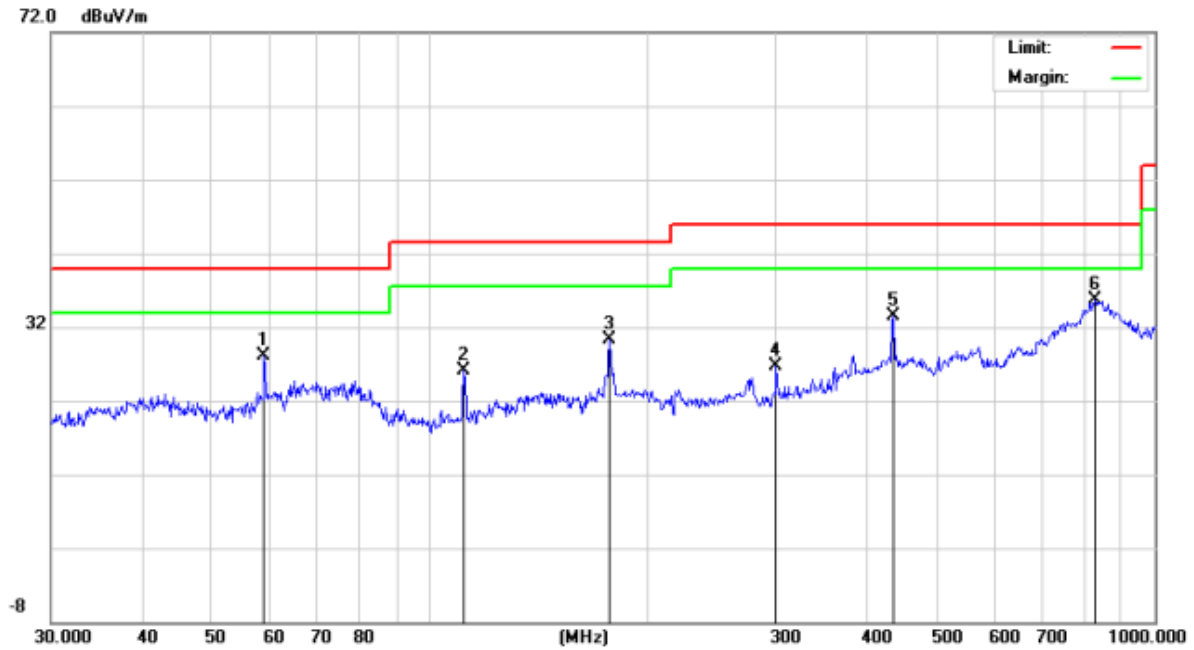
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EUT	NINA-B411	Model Name	NINA-B411
Temperature	22.5°C	Relative Humidity	62.8%
Pressure	985hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		59.0251	10.97	17.09	28.06	40.00	-11.94	peak
2		111.3468	9.92	16.19	26.11	43.50	-17.39	peak
3		176.8874	11.78	18.45	30.23	43.50	-13.27	peak
4		300.3672	7.86	18.93	26.79	46.00	-19.21	peak
5		435.5898	8.09	25.39	33.48	46.00	-12.52	peak
6	*	827.4932	8.15	27.62	35.77	46.00	-10.23	peak

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Over=Measurement-Limit.

2. All test modes had been tested. The mode 3 is the worst case and recorded in the report.

3. The EUT has eight Antenna. only Antenna 1 the test data were recorded in the test report.

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RADIATED EMISSION ABOVE 1GHZ

EUT	NINA-B411	Model Name	NINA-B411
Temperature	22°C	Relative Humidity	51%
Pressure	985hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.000	50.23	0.08	50.31	74	-23.69	peak
4804.000	39.27	0.08	39.35	54	-14.65	AVG
7206.000	44.71	2.21	46.92	74	-27.08	peak
7206.000	34.86	2.21	37.07	54	-16.93	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	NINA-B411	Model Name	NINA-B411
Temperature	22°C	Relative Humidity	51%
Pressure	985hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.000	48.36	0.08	48.44	74	-25.56	peak
4804.000	37.21	0.08	37.29	54	-16.71	AVG
7206.000	43.42	2.21	45.63	74	-28.37	peak
7206.000	33.47	2.21	35.68	54	-18.32	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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EUT	NINA-B411	Model Name	NINA-B411
Temperature	22°C	Relative Humidity	51%
Pressure	985hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.000	49.78	0.14	49.92	74	-24.08	peak
4880.000	38.78	0.14	38.92	54	-15.08	AVG
7320.000	44.59	2.36	46.95	74	-27.05	peak
7320.000	33.17	2.36	35.53	54	-18.47	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	NINA-B411	Model Name	NINA-B411
Temperature	22°C	Relative Humidity	51%
Pressure	985hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.000	48.63	0.14	48.77	74	-25.23	peak
4880.000	37.28	0.14	37.42	54	-16.58	AVG
7320.000	43.91	2.36	46.27	74	-27.73	peak
7320.000	32.61	2.36	34.97	54	-19.03	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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EUT	NINA-B411	Model Name	NINA-B411
Temperature	22°C	Relative Humidity	51%
Pressure	985hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.000	49.37	0.22	49.59	74	-24.41	peak
4960.000	37.51	0.22	37.73	54	-16.27	AVG
7440.000	45.23	2.64	47.87	74	-26.13	peak
7440.000	33.47	2.64	36.11	54	-17.89	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	NINA-B411	Model Name	NINA-B411
Temperature	22°C	Relative Humidity	51%
Pressure	985hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.000	46.84	0.22	47.06	74	-26.94	peak
4960.000	36.74	0.22	36.96	54	-17.04	AVG
7440.000	43.02	2.64	45.66	74	-28.34	peak
7440.000	32.44	2.64	35.08	54	-18.92	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

RESULT: PASS

Note:

The amplitude of other spurious emissions from 1G to 25 GHz which are attenuated more than 20 dB below the permissible value need not be reported.

Factor = Antenna Factor + Cable loss - Amplifier gain, Margin=Emission Level-Limit.

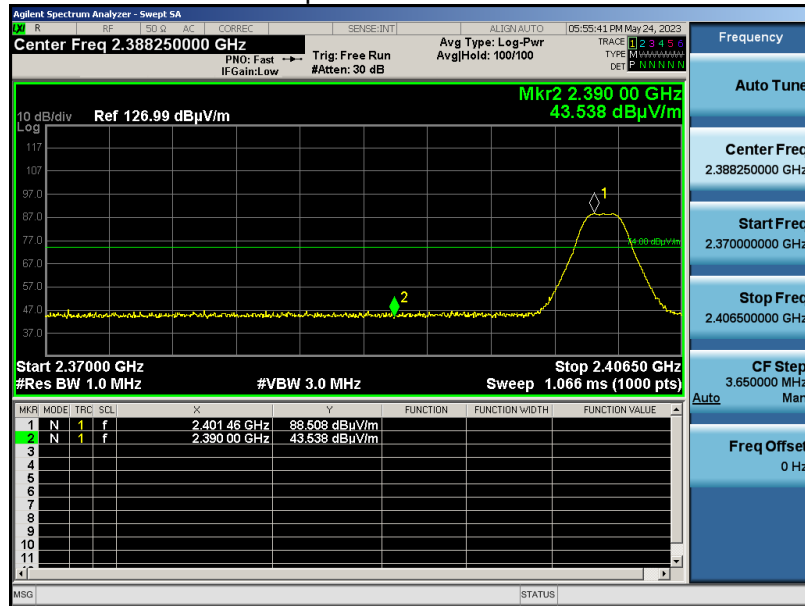
The “Factor” value can be calculated automatically by software of measurement system.

The EUT has eight Antenna. only Antenna 1 the test data were recorded in the test report.

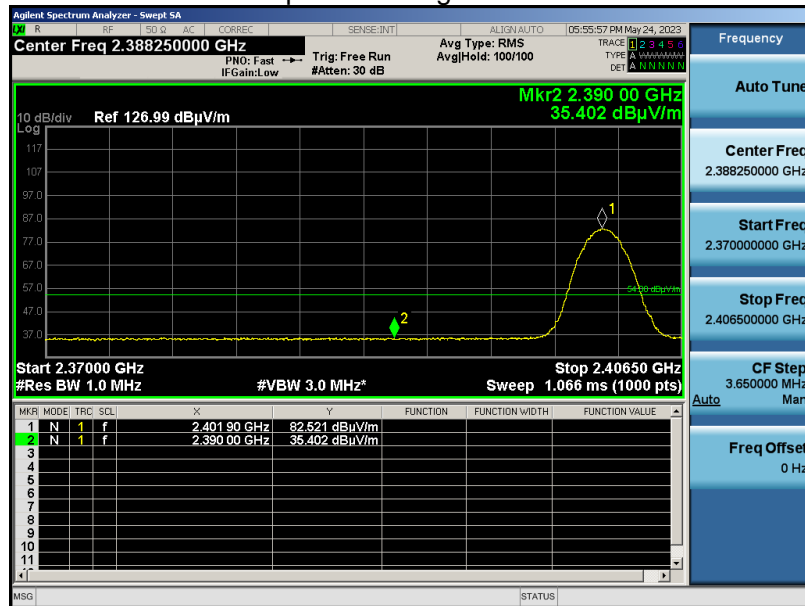
Test result for band edge emission at restricted bands

EUT	NINA-B411	Model Name	NINA-B411
Temperature	25°C	Relative Humidity	55%
Pressure	985hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



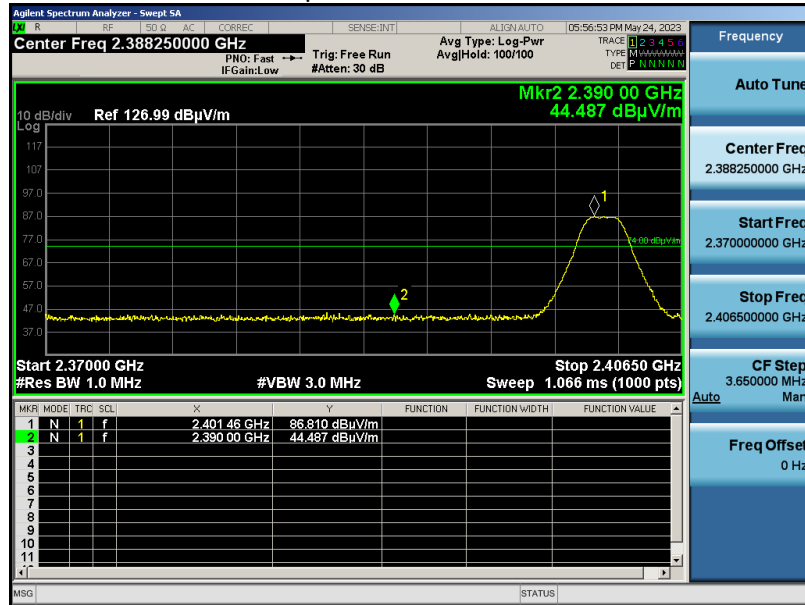
RESULT: PASS

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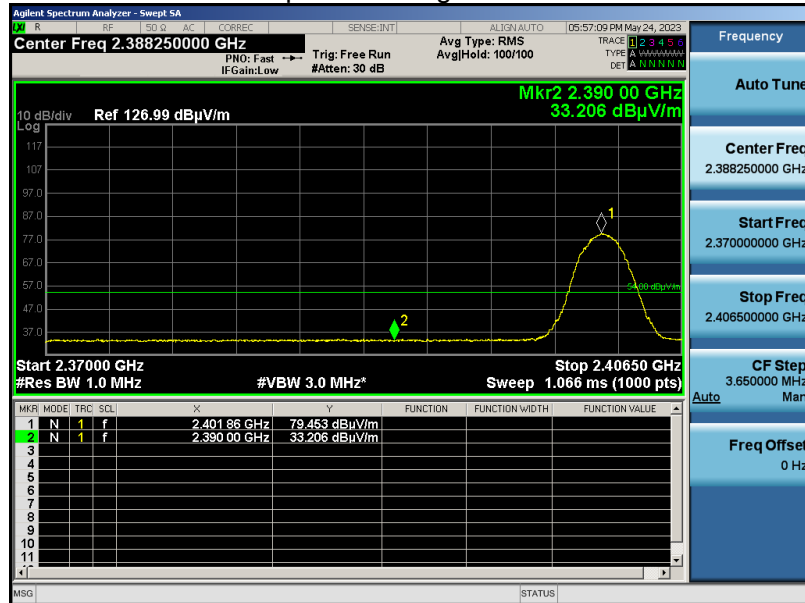
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EUT	NINA-B411	Model Name	NINA-B411
Temperature	25°C	Relative Humidity	55%
Pressure	985hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



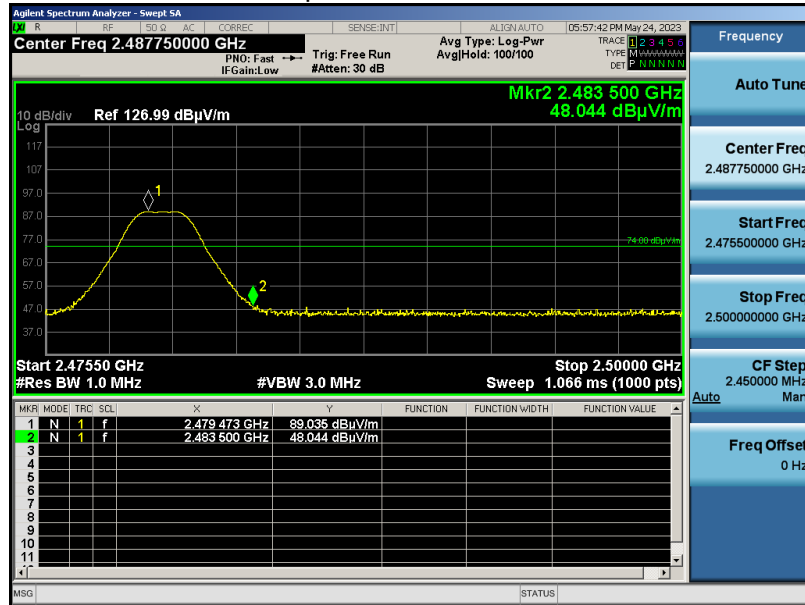
RESULT: PASS

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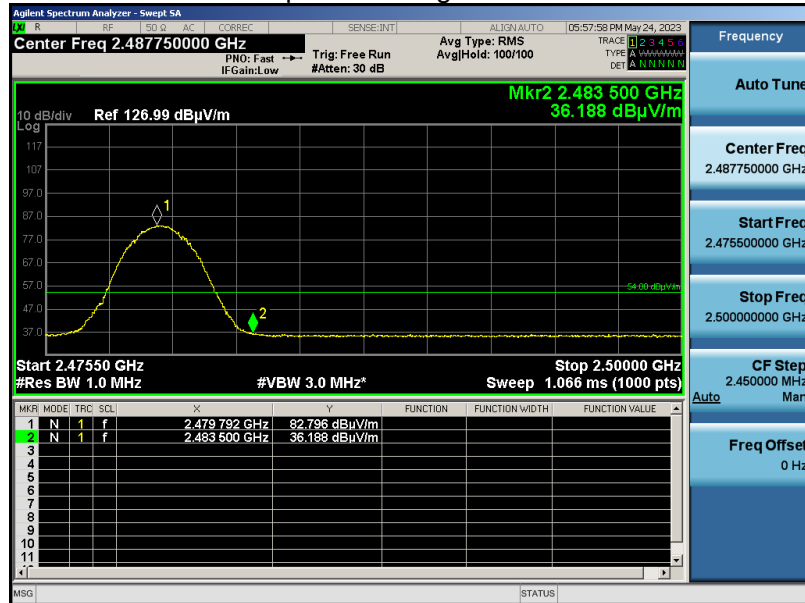
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EUT	NINA-B411	Model Name	NINA-B411
Temperature	25°C	Relative Humidity	55%
Pressure	985hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



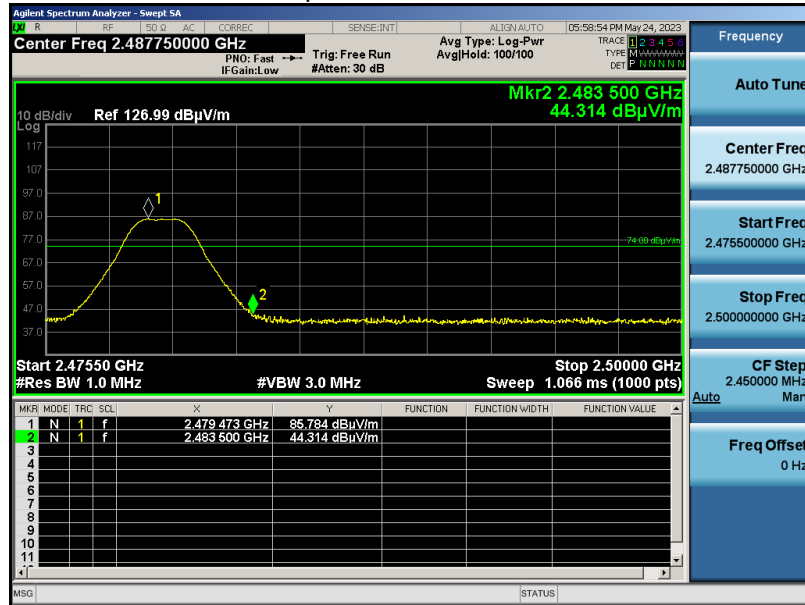
RESULT: PASS

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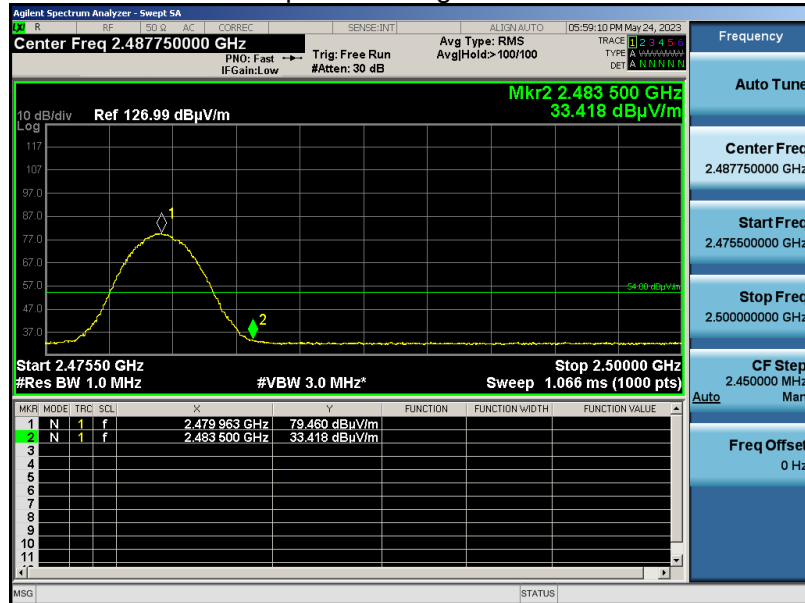
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EUT	NINA-B411	Model Name	NINA-B411
Temperature	25°C	Relative Humidity	55%
Pressure	985hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

- Note: 1. The factor had been edited in the “Input Correction” of the Spectrum Analyzer.
2. The EUT has eight Antenna. only Antenna 1 the test data were recorded in the test report.

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APPENDIX A: PHOTOGRAPHS OF TEST SETUP

Refer to the Report No.: AGC09881200501AP02C

APPENDIX B: PHOTOGRAPHS OF TEST EUT

Refer to the Report No.: AGC09881200501AP03C

----END OF REPORT----

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