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Template : November 29<sup>th</sup>, 2024

# TEST REPORT

N°: 24329407- 806665-A(FILE# 9310523-SRA)

Version: 01

**Subject** Electromagnetic compatibility tests according to the standards:  
ETSI EN 301 489-1 V2.2.3  
ETSI EN 301 489-17 V3.2.4

**Issued to** STMICROELECTRONICS (Rousset) SAS  
190 Avenue Celestin Coq  
13106 - Rousset  
FRANCE

**Apparatus under test**

↗ Product STM32WBA5MMG  
↗ Trade mark STMICROELECTRONICS  
↗ Manufacturer STMICROELECTRONICS  
↗ Family range None  
↗ Model under test B-WBA5M-WPAN  
↗ Serial number Radiated sample

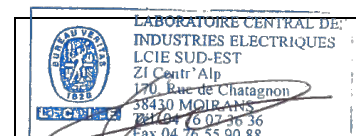
**Conclusion** See Test Program chapter

Test date December 11, 2024 to December 16, 2024  
Test location LCIE Grenoble

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## PUBLICATION HISTORY

Version	Date	Author	Modification
01	March 05, 2025	Majid MOURZAGH	Creation of the document

*Each new edition of this test report replaces and cancels the previous edition. The control of the old editions of report is under responsibility of client.*



## SUMMARY

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## 1. TEST PROGRAM

### Standard

- ✓ ETSI EN 301 489-1 v2.2.3
- ✓ ETSI EN 301 489-3 v2.3.2

### 1.1.1. Requirements for disturbance emissions for Equipment - Class B

EMISSION TEST	LIMITS			RESULTS (Comments)
Limits for conducted disturbance 150kHz-30MHz EN 55032 (2015 + A11/2020)	Access: AC power			NA
	Frequency	Quasi-peak	Average	
	150-500kHz	66 to 56 dBµV	56 to 46 dBµV	
	0.5-5MHz	56 dBµV	46 dBµV	
	5-30MHz	60 dBµV	50 dBµV	
	Access: DC power			NA
	Frequency	Quasi-peak	Average	
	150-500kHz	66 to 56 dBµV	56 to 46 dBµV	
	0.5-5MHz	56 dBµV	46 dBµV	
	5-30MHz	60 dBµV	50 dBµV	
	Access: Wired network			NA
	Frequency	Quasi-peak	Average	
	150-500kHz	40 to 30 dBµA	30 to 20 dBµA	
	0.5-30MHz	30 dBµA	20 dBµA	
	Frequency	Quasi-peak	Average	
150-500kHz	84 to 74 dBµV	74 to 64 dBµV		
0.5-30MHz	74 dBµV	64 dBµV		
Radiated emissions 30MHz-1GHz EN 55032 (2015 + A11/2020)	Access: Enclosure port of ancillary equipment			NA
	Frequency	Quasi-peak @10m		
	30-230MHz	30 dBµV/m		
	230MHz-1GHz	37 dBµV/m		
Radiated emissions 1GHz-6GHz* EN 55032 (2015 + A11/2020)	Access: Enclosure port of ancillary equipment			NA
	Frequency	Peak @3m	Average @3m	
	1-3GHz	70 dBµV/m	50 dBµV/m	
	3-6GHz	74 dBµV/m	54 dBµV/m	

NA: Not Applicable / NP: Not Performed, not requested by the customer (It cannot be taken into account for the declaration of conformity)

<sup>D</sup>: Divergence, the last version is used to make it possible to test the product with the standard which describes the current state of the art and thus to answer as well as possible his environment of final use. If this test is covered by the COFRAC accreditation, the declaration of conformity for product standard only are carried out outside the framework of accreditation.

\*EN 55032:

Highest internal frequency ( $F_x$ )	Highest measured frequency
$F_x \leq 108 \text{ MHz}$	1 GHz
$108 \text{ MHz} < F_x \leq 500 \text{ MHz}$	2 GHz
$500 \text{ MHz} < F_x \leq 1 \text{ GHz}$	5 GHz
$F_x > 1 \text{ GHz}$	$5 \times F_x$ up to a maximum of 6 GHz

Where  $F_x$  is unknown, the radiated emission measurements shall be performed up to 6 GHz



1.1.2. Requirements for harmonics and voltage fluctuations/flickers test

EMISSION TEST	LIMITS	RESULTS (COMMENTS)
Harmonics current emission <b>EN IEC 61000-3-2 (2019) + A1 (2021)</b> <sup>D</sup>	<b>Access: AC power</b>	<b>NA</b>
	<b>Class B</b>	
Voltage fluctuation and flickers test <b>EN 61000-3-3 (2013 + A1/2019 +A2/2021)</b> <sup>D</sup>	<b>Access: AC power</b>	<b>NA</b>
	According to standard EN 61000-3-3	

NA: Not Applicable / NP: Not Performed, not requested by the customer (It cannot be taken into account for the declaration of conformity)

<sup>D</sup>: Divergence, the last version is used to make it possible to test the product with the standard which describes the current state of the art and thus to answer as well as possible his environment of final use. If this test is covered by the COFRAC accreditation, the declaration of conformity for product standard only are carried out outside the framework of accreditation.



### 1.1.3. Requirements for immunity tests

IMMUNITY TEST	ACCESS / TEST LEVEL	RESULTS	Expected criteria
Electrostatic Discharges (ESD) <b>EN 61000-4-2 (2009)</b>	<b>Access: Enclosure</b> ± 4kV Contact Discharges ± 8kV Air Discharges	<b>PASS</b>	Transient phenomena
Radiated immunity to RF field <b>EN 61000-4-3 (2020)<sup>D</sup></b>	<b>Access: Enclosure</b> 3V/m AM 80% @1kHz from 80MHz to 6.0GHz	<b>PASS</b>	Continuous phenomena
Electrical Fast Transient (TRS) <b>EN 61000-4-4 (2012)</b>	<b>Access: AC power</b> ± 1.0kV	<b>NA</b>	Transient phenomena
	<b>Access: DC power (1)</b> ± 0.5kV	<b>NA</b>	
	<b>Access: Signal (1)</b> ± 0.5kV	<b>NA</b>	
	<b>Access: Wired network (1)</b> ± 0.5kV	<b>NA</b>	
Immunity to surges <b>EN 61000-4-5 (2014 + A1/2017)</b>	<b>Access: AC power</b> ± 1.0kV for differential mode ± 2.0kV for common mode	<b>NA</b>	Transient phenomena
	<b>Access: Wired network</b> ± 0.5kV between line or shield and ground (2) ± 0.5kV between line and line (3) ± 1.0kV between line or shield and ground (4)	<b>NA</b>	
RF conducted immunity <b>EN 61000-4-6 (2014)</b>	<b>Access: AC power</b> 3V AM 80% @1kHz from 150kHz to 80MHz	<b>NA</b>	Continuous phenomena
	<b>Access: DC power (1)</b> 3V AM 80% @1kHz from 150kHz to 80MHz	<b>NA</b>	
	<b>Access: Signal (1)</b> 3V AM 80% @1kHz from 150kHz to 80MHz	<b>NA</b>	
	<b>Access: Wired network (1)</b> 3V AM 80% @1kHz from 150kHz to 80MHz	<b>NA</b>	
Voltage dips and short interruptions <b>EN IEC 61000-4-11 (2020)<sup>D</sup></b>	<b>Access: AC power</b> 0% nominal during 0.5 cycle 0% nominal during 1 cycle 0% nominal during 250 cycles (5) 70% nominal during 25 cycles	<b>NA</b>	Transient phenomena

(1) : Only applicable for cables longer than 3m

(2) : For indoor cables, longer than 30m

(3) : For outdoor cables unsymmetrical

(4) : For outdoor cables

(5) : Performance criteria for transient phenomena shall apply if the equipment is fitted with a battery back-up. If the equipment is powered solely from AC mains supply, lost functions may be recovered by user or operator.

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D: Divergence, the last version is used to make it possible to test the product with the standard which describes the current state of the art and thus to answer as well as possible his environment of final use. If this test is covered by the COFRAC accreditation, the declaration of conformity for product standard only are carried out outside the framework of accreditation.

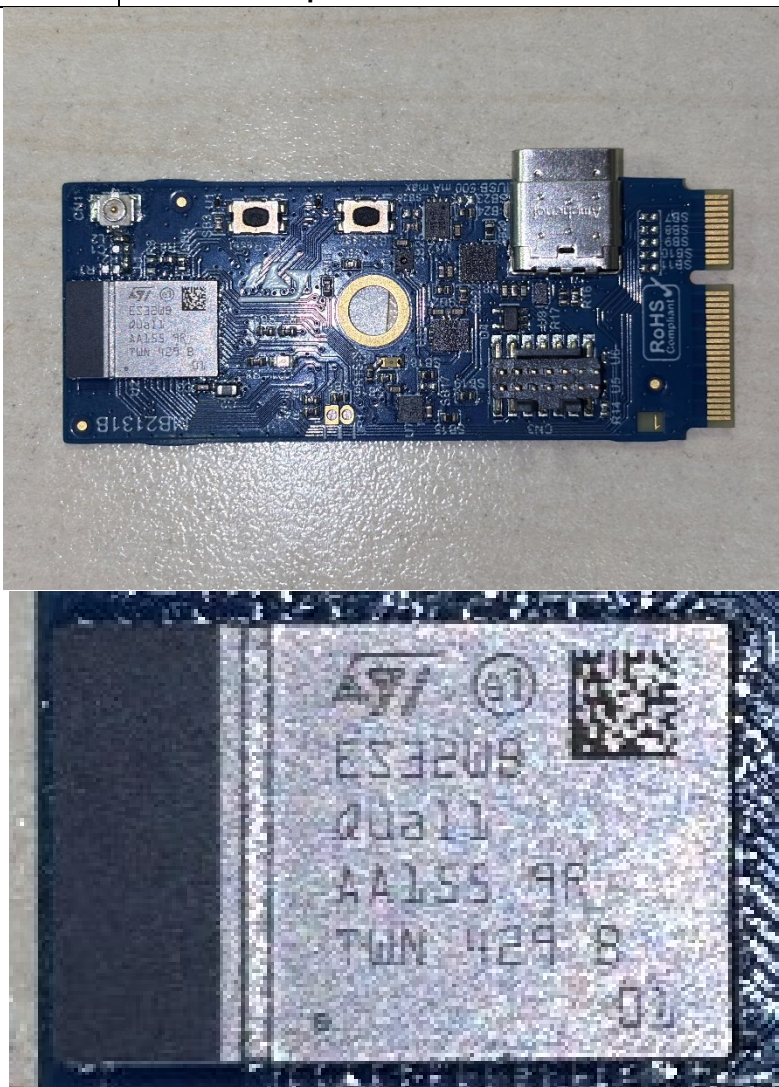
## 2. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)

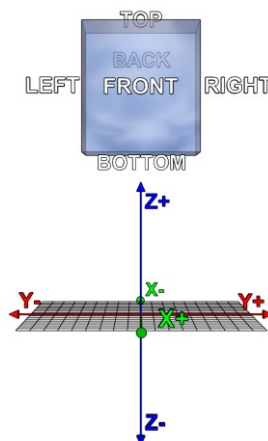
### 2.1. INFORMATIONS – FUNCTIONAL DESCRIPTION

Bluetooth LE and IEEE 802.15.4 radio module

### 2.2. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES)

#### Equipment under test (EUT):

Model under test :	B-WBA5M-WPAN
Serial Number:	Radiated sample
	
Dimensions:	8cm x 12.5cm x 1.372cm (Length x Width x Height)
Type :	Table-Top





### Power supply:

For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply1	DC	1.71 to 3.6 V power supply	/	-
Supply2	AC	100/240VAC – 5VDC	/	Switching Adapter

NC: Not communicated by provider

### Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Comments
Supply1	5VDC USB	1.5	No	No	/
Access1	JTAG	0.1	No	No	Only for debug
Access2	USB C	1.5	No	No	/

NC: Not communicated by provider

### Auxiliary Equipment (AE) used during test:

Type	Reference	Sn	Comments
LAPTOP	LENOVO	/	/
Daughter board	STLINK-V3MINE	/	/

NC: Not communicated by provider

## 2.3. RADIO FREQUENCY - EQUIPMENT INFORMATION (301489)

Type of equipment:	Stand-alone
Equipment intended for use as a:	Fixed use

ETSI 301 489-17	
RF module:	STM32WBA5MMG
Frequency band:	2400 MHz to 2483.5 MHz – 2.4GHz Band
Antenna type:	Internal
Standby mode*:	NC
*Tests in standby, receiver or other mode to show conformity to unintentional emissions don't perform like asked by provider.	
Host and radio device testing together:	Yes
Mode under test:	Bluetooth Low Energy
All frequency bands/modes aren't tested in final product like asked by provider.	
Control signals:	See §criteria and control of good functioning
Level of wanted signal:	Radiated immunity: 30dB (±6dB) above the minimum usable receiver signal level. Other tests : representative of the EUT intended use.
Exclusion bands:	2.4 GHz band: [2 280 MHz-2 603.5MHz]



## 2.4. EUT CONFIGURATION

Hardware information			
Highest internal frequency (PLL, Quartz, Clock, Microprocessor...):	<b>F<sub>Highest</sub>:</b>	<b>2500</b>	<b>MHz</b>
Firmware (if applicable):	<b>V. :</b>	1.4.0	
Software (if applicable):	<b>V. :</b>	-	
Time necessary for the EUT to be exercised and to respond:	<b>Dwell:</b>	<b>1</b>	<b>s</b>

NC: Not communicated by provider

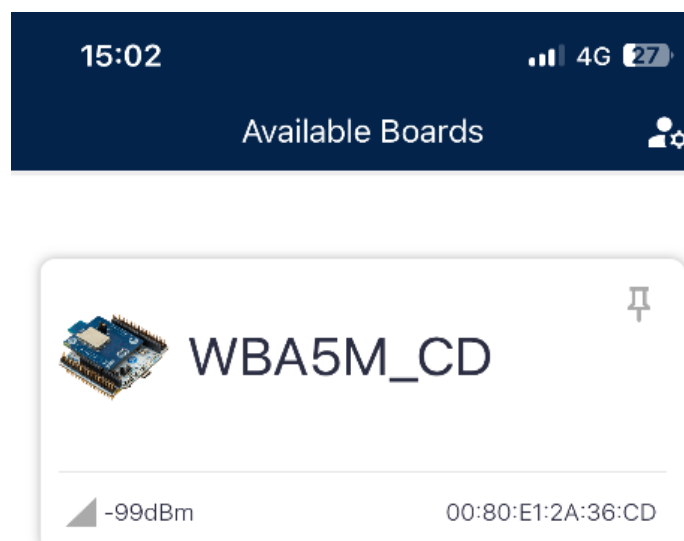
### Running mode n°1:

*Setup:*

After powering the DUT, an application called STE BLE Sensor allows connection and retrieves sensor data such as temperature

*Control:*

A visual check is mandatory to ensure that the information transmitted via BLE is not interrupted.





## 2.5. CRITERIA AND CONTROL OF GOOD FUNCTIONING - GENERIC

### **Criteria A:**

The apparatus shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

**None specific criteria at EUT.**

### **Criteria B:**

The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

**None specific criteria at EUT.**

### **Criteria C:**

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.

**None specific criteria at EUT.**



## 2.6. CRITERIA AND CONTROL OF GOOD FUNCTIONING – SPECIFIC TO 301489

The performance criteria are used to take a decision on whether a radio equipment passes or fails immunity tests. In this test report, categories of performance criteria applied are:

### **Performance criteria for transient phenomena applied to transmitters and receivers**

And

### **Performance criteria for transient phenomena applied to transmitters and receivers**

#### **Performance criteria for continuous phenomena applied to transmitters and receivers:**

If no further details are given in the relevant part of ETSI EN 301 489 series dealing with the particular type of radio equipment, the following general performance criteria for continuous phenomena shall apply.

During and after the test, the equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the equipment is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.

During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

**None specific criteria at EUT.**

#### **Performance criteria for transient phenomena applied to transmitters and receivers:**

If no further details are given in the relevant part of ETSI EN 301 489 series dealing with the particular type of radio equipment, the following general performance criteria for transient phenomena shall apply.

*For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies:*

- ✓ For products with only one symmetrical port intended for connection to outdoor lines, loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A SW reboot is not allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.
- ✓ For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. A SW reboot is not allowed. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

*For all other ports the following applies:*

- ✓ After the test, the equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the equipment is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.
- ✓ During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed.
- ✓ If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

**None specific criteria at EUT.**



## **2.7. EQUIPMENT MODIFICATIONS DURING THE TESTS**

None

## **2.8. CALIBRATION DATE**

The calibration intervals are extended at 12+2 months. This extended interval is based on the fact that there is sufficient calibration data to statistically establish a trend or based on experience of use of the test equipment to assure good measurement results for a longer period.

The symbol -/- replaces the date for equipment checking before test or that have none impact on the test or that have no calibration required by the standard.

### 3. IMMUNITY TO ELECTROSTATIC DISCHARGES (61000-4-2)

#### 3.1. TEST CONDITIONS

Date of test : December 13, 2024  
Test performed by : Majid MOURZAGH / Akram HAKKARI  
Atmospheric pressure (hPa) : 999  
Relative humidity (%) : 39  
Ambient temperature (°C) : 21

#### 3.2. TEST SETUP

The EUT and cables are placed on ESD table of 0.8m height above ground plane (table-top equipment). The EUT is powered by  $V_{nom}$ .



Test setup

#### 3.3. TEST METHOD

Test points for contact discharges application are chosen before the test. Test level is increased from the minimal value (level 1) up to the requested level.

- For each voltage and each test point, 10 positives and 10 negatives discharges are applied with one second interval time between each of them.
- For air discharges a research is performed all around the EUT and also on cable.

Photo

Location of discharges	<span style="color: red;">●</span>	Contact discharges
	<span style="color: blue;">●</span>	Air Discharge

### 3.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
ESD Pistol	EMTEST	esd NX30	A5322029	05/24	05/25
Multimeter	FLUKE	289	A1241119	04/23	04/25
Test station ESD	—	—	A5322010	-/-	-/-
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	05/23	05/25

### 3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

### 3.6. TEST RESULTS – RUNNING MODE N°1

#### \* Indirect contact discharges:

Location \ Voltage	±2kV	±4kV
Horizontal coupling plane	<b>PASS</b>	<b>PASS</b>
Vertical coupling plane	<b>PASS</b>	<b>PASS</b>

#### \* Direct contact discharges:

Location \ Voltage	±2kV	±4kV
No points	<b>NA</b>	<b>NA</b>

#### \* Air discharges:

Location \ Voltage	±2kV	±4kV	±8kV
No points	<b>NA</b>	<b>NA</b>	<b>NA</b>

PASS: No problem observed

NA: Not Applicable

NP: Not Performed

NDO: None Discharge Observed

FAIL - Dysfunction observed.

PASS: No problem observed

NA: Not Applicable

NP: Not Performed

NDO: None Discharge Observed

FAIL - Dysfunction observed.

### 3.7. CONCLUSION

The sample of the equipment **B-WBA5M-WPAN**, Sn : **Radiated sample**, tested in the configuration presented in this test report **satisfies** to requirements of the product family standard applied (See §Test Program) and EN61000-4-2, for immunity to Electrostatic Discharges in accordance with good functioning criteria defined by the manufacturer.



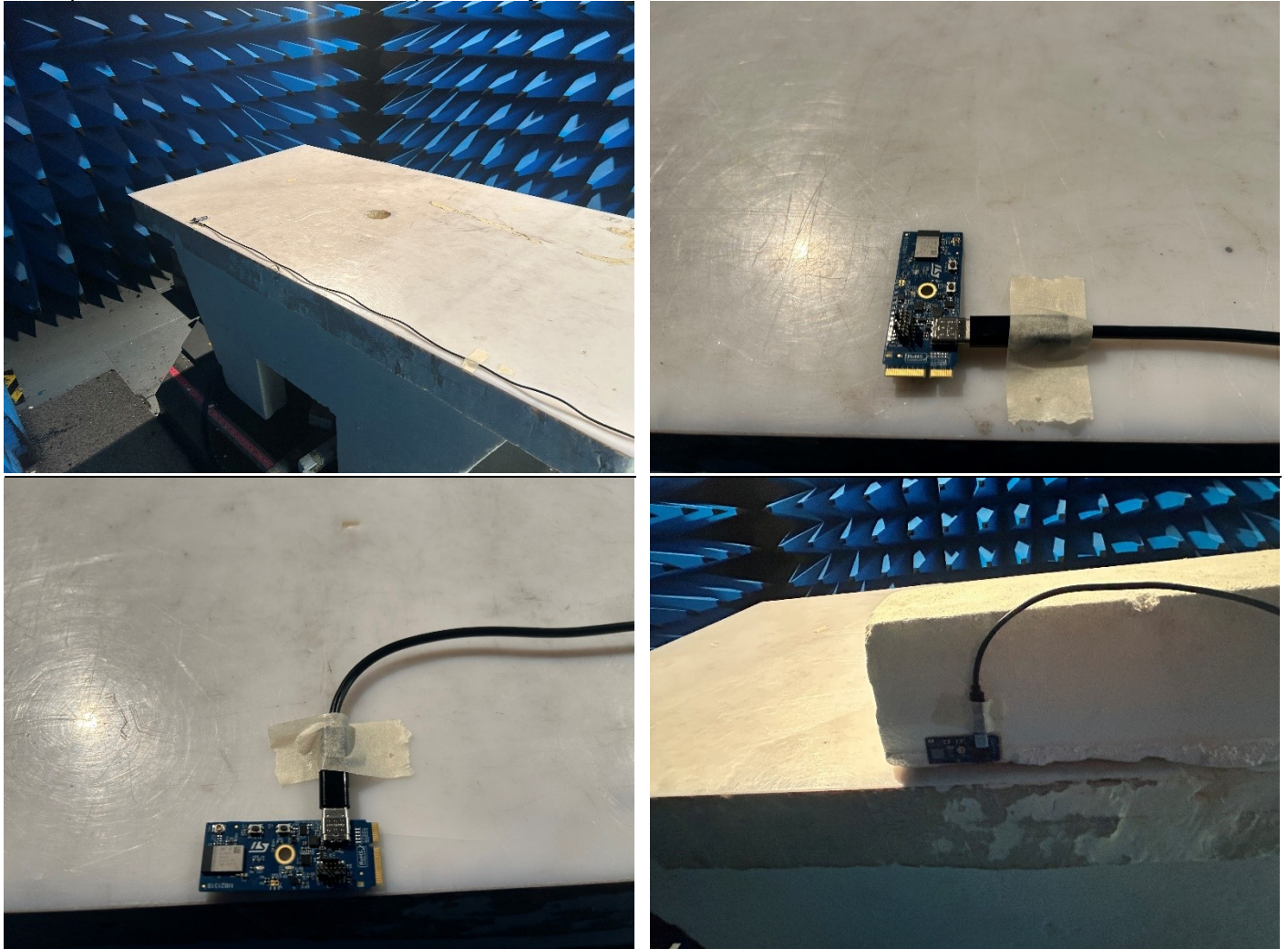
## 4. IMMUNITY TO RF RADIATED ELECTROMAGNETIC FIELD (61000-4-3)

### 4.1. TEST CONDITIONS

Date of test : December 13, 2024  
Test performed by : Majid MOURZAGH / Akram HAKKARI  
Atmospheric pressure (hPa) : 999  
Relative humidity (%) : 39  
Ambient temperature (°C) : 21

### 4.2. TEST SETUP

The EUT is placed on a non-conductive table above the ground in the homogeneous field plane. Inputs/Outputs wires are exposed to the electromagnetic field on a distance of 1 meter from the EUT. A decoupling ferrite tube is set on cables at the output of the chamber. The EUT is powered by  $V_{nom}$ .



Test setup



#### 4.3. TEST METHOD

Tests are performed in the horizontal and vertical polarization, using the calibrated field method.

Signal: AM 80% @ 1 kHz.

Dwell time: 1s on each frequency.

Frequency step: 1% of previous frequency.

Uniform Field Area used: see test equipment list  
75% of calibration points within specifications

#### 4.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
1.5mx1m / Antenna distance 1.2m	LCIE	ZCU 80MHz - 1GHz / 10V/m	D3044015_C2Z1	02/24	02/25
1.5mx1m / Antenna distance 1.65m	LCIE	ZCU 1GHz - 6GHz / 10V/m	D3044015_C2Z2	02/24	02/25
Amplifier 250W 80-1000MHz	AMPLIFIER RESEARCH	250W/1000A	A7102027	02/24	02/25
Amplifier 50W 700MHz-6GHz	AMPLIFIER RESEARCH	50S1G6	A7102078	02/24	02/25
Attenuator 10dB	AEROFLEX	—	A7122266	07/24	07/26
BAT EMC	NEXIO	v3.21.0.32	L1000115	-/-	-/-
Cable 0.75m	-	18GHz	A5329903	08/24	08/26
Cable 0.75m	-	18GHz	A5329901	08/24	08/26
CABLE 3.5m	SUCOFLEX	6GHz	A5330031	08/24	08/25
Coupler bi-directional 50dB 0.08-1GHz	AMPLIFIER RESEARCH	C6180M6	A7130056	07/23	07/25
Coupler directional 40 dB 1-8GHz	PANDA MICROWAVE	DC010080-40N	A7130090	07/24	07/26
Field probe 6GHz	NARDA	EP-601	A2240048	07/23	07/25
Frequency Generator 10kHz - 6GHz	ROHDE & SCHWARZ	SME06	A5400052	09/23	09/25
Load 50Ω	—	—	A7156011	09/23	09/25
Load 50Ω	—	—	A7156009	10/23	10/25
Power meter	ROHDE & SCHWARZ	NRVD	A1500024	04/23	04/25
Power meter sensor	ROHDE & SCHWARZ	NRV-Z4	A1509049	04/23	04/25
Power meter sensor	ROHDE & SCHWARZ	URY-Z4	A1509034	09/23	09/25
Semi-Anechoic chamber #2	SIEPEL	—	D3044015	09/23	01/25
Thermo-hygrometer (C2)	LACROSS Techn.	WS-2357	B4206015	03/23	03/25
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	05/23	05/25





#### 4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

#### 4.6. TEST RESULTS – RUNNING MODE N°1

Frequency band:	80MHz-1.0GHz		
Level:	3V/m		
Axis /side exposed:	X	Y	Z
Polarisation Horizontal	PASS	PASS	PASS
Polarisation Vertical	PASS	PASS	PASS
Frequency band:	1.0GHz-6.0GHz		
Level:	3V/m		
Axis /side exposed:	X	Y	Z
Polarisation Horizontal	PASS	PASS	PASS
Polarisation Vertical	PASS	PASS	PASS

PASS: No problem observed

NA: Not Applicable

NP: Not Performed

FAIL: Dysfunction observed

#### 4.7. CONCLUSION

The sample of the equipment **B-WBA5M-WPAN**, Sn : **Radiated sample**, tested in the configuration presented in this test report **satisfies** to requirements of the product family standard applied (See §Test Program) and EN61000-4-3, for immunity to radiated electromagnetic field in accordance with good functioning criteria defined by the manufacturer.

## 5. UNCERTAINTIES CHART

Type de mesure / <i>Kind of measurement</i>	Incertitude élargie laboratoire / <i>Wide uncertainty laboratory (k=2) ±x</i>	Incertitude limite du CISPR / <i>CISPR uncertainty limit ±y</i>
<b>Mesure des perturbations rayonnées</b> <i>Measurement of radiated disturbances</i> <b>OATS &amp; SAC @3m</b>		
30MHz - 200MHz, Antenne biconique / <i>Biconical antenna</i>	5.79 dB	6.3 dB
30MHz - 1GHz, Antenne hybride / <i>Hybrid antenna</i>	6.26 dB	6.3 dB
<b>Mesure des perturbations rayonnées</b> <i>Measurement of radiated disturbances</i> <b>OATS @10m</b>		
30MHz - 200MHz, Antenne biconique / <i>Biconical antenna</i>	5.77 dB	6.3 dB
30MHz - 1GHz, Antenne hybride / <i>Hybrid antenna</i>	5.99 dB	6.3 dB
<b>Mesure des perturbations rayonnées</b> <i>Measurement of radiated disturbances</i> <b>FAR @3m</b>		
1GHz - 6GHz, Antenne cornet / <i>Horn antenna</i>	5.19 dB	5.2 dB
6GHz - 18GHz, Antenne cornet / <i>Horn antenna</i>	5.48 dB	5.5 dB
1GHz - 6GHz, Antenne hybride / <i>Hybrid antenna</i>	5.20 dB	5.2 dB

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par le CISPR, la conformité de l'échantillon est établie directement par les niveaux limites applicables. Ce tableau regroupe l'ensemble des incertitudes maximales pour les essais réalisables dans le laboratoire, qu'ils aient été ou non réalisés dans le cadre du présent rapport / *The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the CISPR. The conformity of the sample is directly established by the applicable limits values. This table includes all uncertainties maximum feasible for testing in the laboratory, whether or not made in this report*

Note - L'incertitude de mesure instrumentale est déterminée selon la CISPR 16-4-2. / *The instrumentation measurement uncertainty is determined according to CISPR16-4-2*