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Template : July 19<sup>th</sup>, 2024

# TEST REPORT

N°: 24329407-806664-A(FILE#9310523)

Version: 01






## Subject

Radio spectrum tests according to the standards:  
ETSI EN 300 328 V2.2.2 (Full test)  
Electromagnetic Field (EMF) tests according to the standards:  
EN IEC 62311 (2020) 

## Issued to

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

## Apparatus under test

-  Product
-  Trade mark
-  Manufacturer
-  Model under test
-  Serial number

Bluetooth® LE and IEEE 802.15.4 radio module  
STMICROELECTRONICS  
STMICROELECTRONICS  
STM32WBA5MMG  
None5

## Conclusion

See Test Program chapter

Test date

November 22, 2024 to November 29, 2024

Test location

LCIE Grenoble

Sample receipt date

November 18, 2024

Composition of document

49 pages

Document issued on

February 26, 2025

## Written by :

Majid MOURZAGH

Tests operator




## Approved by :

Anthony MERLIN

Technical manager



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LCIE

Laboratoire Central des Industries Electriques  
Une société Bureau Veritas

Z.I Centr'alp  
170, Rue de Chatagnon  
38430 Moirans  
FRANCE

Tél. + 33 4 76 07 36 36  
[contact@lcie.fr](mailto:contact@lcie.fr)  
[www.lcie.fr](http://www.lcie.fr)



## PUBLICATION HISTORY

Version	Date	Author	Modification
01	February 26, 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

### References

- ETSI EN 300 328 (V2.2.2)
- ERC Rec70-03<sup>(4)</sup> (March 2024) [P](#)
- EN IEC 62311 (2020) [P](#)
- Recommendation N° 1999/519/CE [P](#)

### Radio requirement:

Clause - Test Description	Test result - Comments
4.3.2.2 – RF output power	PASS
4.3.2.3 – Power Spectral Density	PASS
4.3.2.4 – Duty Cycle, Tx-sequence, Tx-gap	NA
4.3.2.5 – Medium Utilisation Factor	NA
4.3.2.6 – Adaptivity	NA
4.3.2.7 – Occupied Channel Bandwidth	PASS
4.3.2.8 – Transmitter Unwanted Emissions in the out-of-band domain	PASS
4.3.2.9 – Transmitter Unwanted Emissions in the spurious domain	PASS
4.3.2.10 – Receiver Spurious Emissions	PASS
4.3.2.11 – Receiver Blocking	PASS
4.3.1.12 – Geo-location capability	NA
This table is a summary of test report, see conclusion of each clause of this test report for detail.	

### Health requirement:

Clause - EN IEC 62311 (2020)	Test result
E-Field calculation	PASS
This table is a summary of test report, see conclusion of each clause of this test report for detail.	

(1) Limited program. The EUT integrates an assessed RF radio module

(2) Limited program - Normal condition only. The EUT integrates an assessed RF radio module

(3) See equipment information in chapter 2.2.


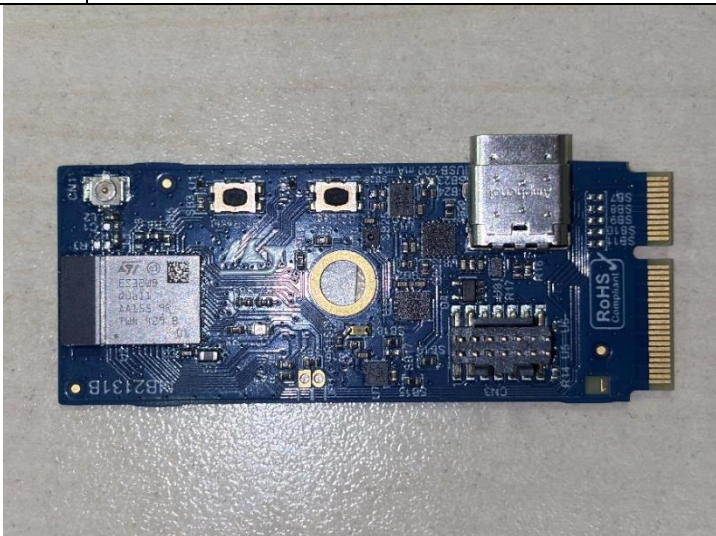
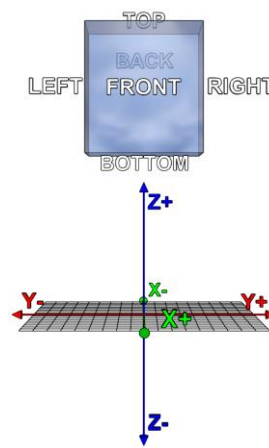
(4) National spectrum usage restrictions indicated in Appendix 1 and Appendix 3 aren't taken into account

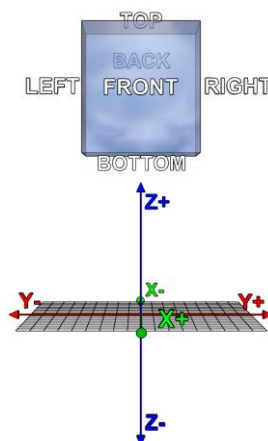
PASS: EUT complies with standard's requirement - FAIL: EUT does not comply with standard's requirement - NA: Not Applicable - NP: Not Performed

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

### 2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

#### Equipment under test (EUT):

Equipment under test: STM32	
Model under test:	STM32WBA5MMG
Serial Number:	None5
<div><div></div><div></div></div>	
Dimensions:	8mm x 12mm x 1.372mm (Length x Width x Height)
Type:	Table-Top



#### Power supply:

Name	Type	Rating	Reference / Sn	Comments
Supply1	DC	1.71 to 3.6 V	/	Module power supply
Supply2	DC	USB power supply (4 – 5.75V)	/	Switching AC/ Adapter

NC: Not communicated by provider

**Inputs/outputs - Cable:**

Access	Type	Length used (m)	Declared <3m	Shielded	Comments
Supply1	USB C	1.5	No	No	USB only on board and only for power
Supply2	USB C	1.5	No	No	100/240VAC – 5VDC
Access1	JTAG	0.1	No	No	Only for debug

NC: Not communicated by provider

**Auxiliary equipment used during test:**

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

NC: Not communicated by provider

**Equipment information (declaration of provider):**

802.15.4:	ZigBee
Chipset / RF Module	STM32WBA5MMG
Frequency band:	[2400 – 2483.5] MHz
Spectrum Modulation:	DSSS
Number of Channel:	16
Spacing channel:	5MHz
Channel bandwidth:	2MHz
Antenna Type:	Internal
Antenna connector:	None
Transmit chains:	1
Receiver chains	1
Adaptivity mode:	No

CHANNEL PLAN	
Channel	Frequency (MHz)
<b>Cmin: 11</b>	2405
12	2410
13	2415
14	2420
15	2425
16	2430
17	2435
<b>Cmid: 18</b>	2440
19	2445
20	2450
21	2455
22	2460
23	2465
24	2470
25	2475
<b>Cmax: 26</b>	2480

DATA RATE		
Data Rate (Mbps)	Modulation Type	Worst Case Modulation
0.25	O-QPSK	<input checked="" type="checkbox"/>

Antenna Characteristic			
Antenna reference	Gain (dBi)	Frequency Band (MHz)	Impedance( $\Omega$ )
ethertronics, Part Number : 1001312	1.8	2400 to 2485 MHz	50

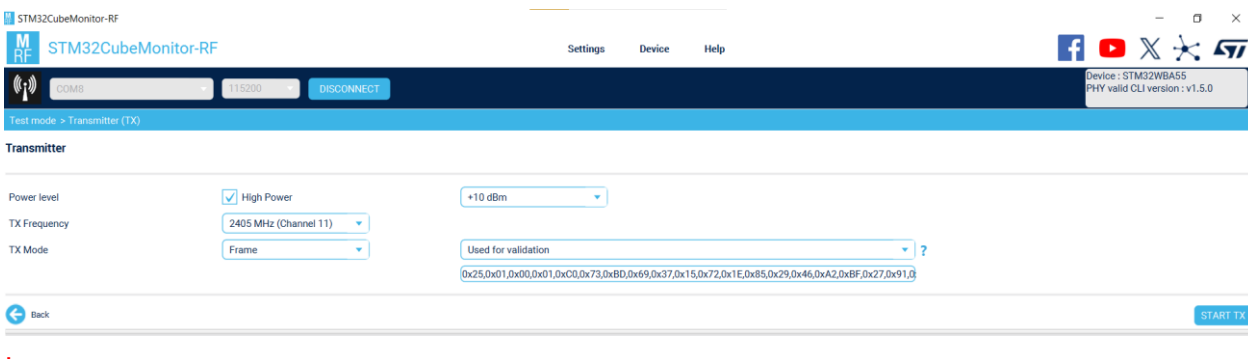
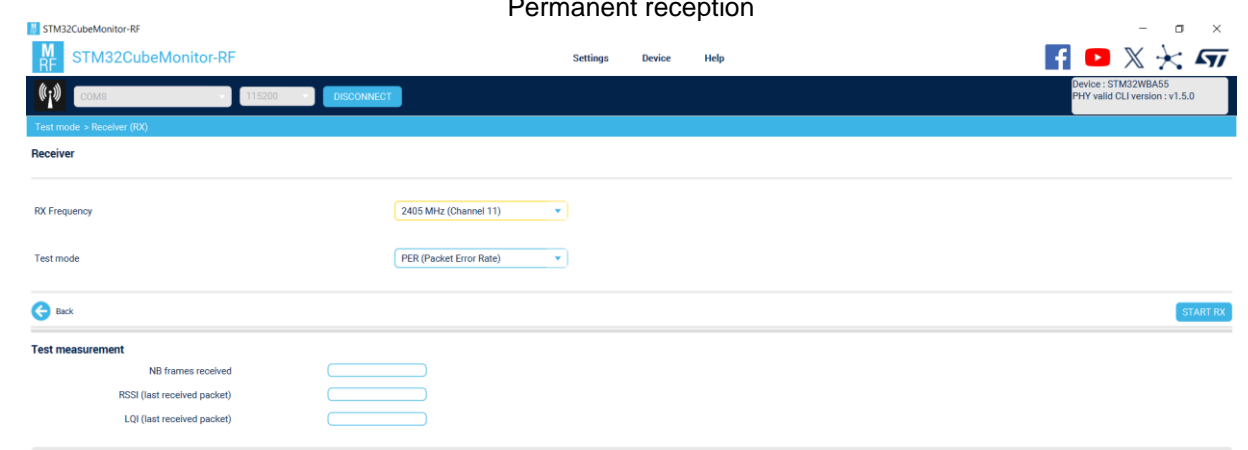
Hardware information				
Highest internal frequency (PLL, Quartz, Clock, Microprocessor...):		F <sub>Highest</sub> :	2500	MHz
Firmware (if applicable):		V:	Device : STM32WBA55 PHY valid CLI version : v1.5.0	
Software (if applicable):		V:		
Equipment intended:		Portable		
Type of equipment:		Stand-alone		
Equipment sample:		Production model		
Duty cycle:		Continuous duty		
Operating temperature range:		T <sub>min</sub> :	-40 °C	
		T <sub>nom</sub> :	20°C	
		T <sub>max</sub> :	+85 °C	
Operating voltage:		V <sub>nom</sub> :	1.71 to 3.6 VDC	

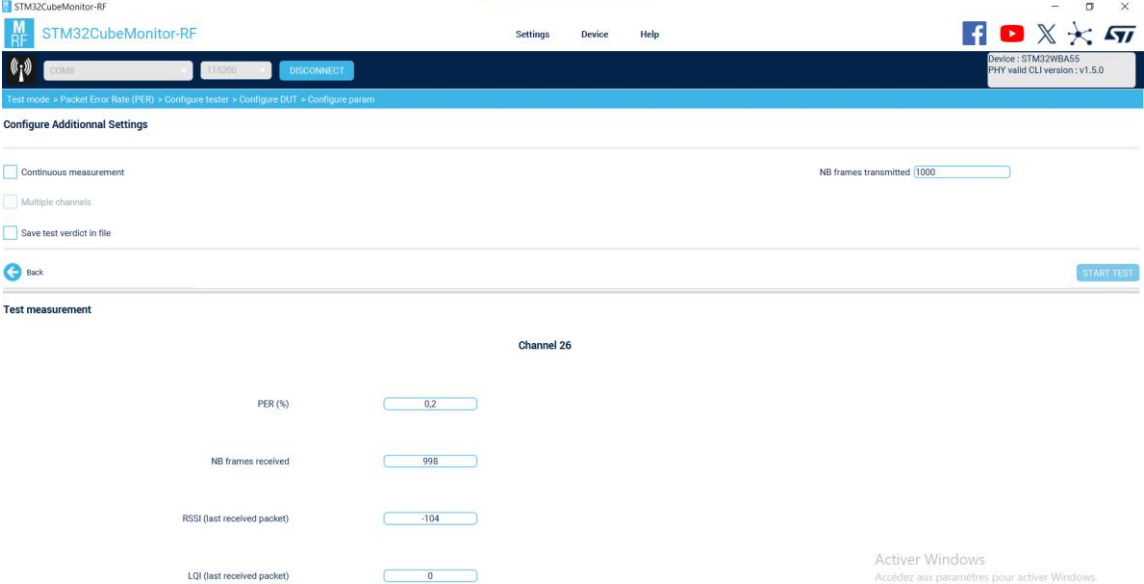
NC: Not communicated by provider

Geo-location capability
No



## 2.2. RUNNING MODE

Test mode	Description of test mode
Test mode 1	<p>Permanent emission with modulation on a fixed channel in the data rate that produced the power set at <b>+10dBm</b>.</p>  <p>The screenshot shows the STM32CubeMonitor-RF Transmitter (TX) interface. It includes a header with the STM32CubeMonitor-RF logo, a settings bar with 'COM8', '115200', and 'DISCONNECT' buttons, and a 'Test mode &gt; Transmitter (TX)' title. The 'Transmitter' section has a 'Power level' dropdown set to 'High Power' with a '+10 dBm' value, a 'TX Frequency' dropdown set to '2405 MHz (Channel 11)', and a 'TX Mode' dropdown set to 'Frame'. A 'Used for validation' field contains a hexadecimal string: '0x25,0x01,0x00,0x01,0xC0,0x73,0xBD,0x69,0x37,0x15,0x72,0x1E,0x85,0x29,0x46,0xA2,0xBF,0x27,0x91,0'. A 'Back' button is at the bottom left, and a 'START TX' button is at the bottom right.</p>
Test mode 2	<p>Permanent reception</p>  <p>The screenshot shows the STM32CubeMonitor-RF Receiver (RX) interface. It includes a header with the STM32CubeMonitor-RF logo, a settings bar with 'COM8', '115200', and 'DISCONNECT' buttons, and a 'Test mode &gt; Receiver (RX)' title. The 'Receiver' section has an 'RX Frequency' dropdown set to '2405 MHz (Channel 11)' and a 'Test mode' dropdown set to 'PER (Packet Error Rate)'. A 'Back' button is at the bottom left, and a 'START RX' button is at the bottom right. The 'Test measurement' section has three input fields: 'NB frames received', 'RSSI (last received packet)', and 'LQI (last received packet)'.</p>

Test mode	Description of test mode
Test Mode 3	<p><b>Receiver Blocking mode</b></p> 

Test	Running mode
RF output power	Test mode 1
Power Spectral Density	Test mode 1
Occupied Channel Bandwidth	Test mode 1
Transmitter Unwanted Emissions in the out-of-band domain	Test mode 1
Transmitter Unwanted Emissions in the spurious domain	Test mode 1
Receiver Spurious Emissions	Test mode 2
Receiver Blocking	Test mode 3

(1) Testing covered the receive mode, and receiver spurious emissions are considered to be the same as transmitter.



### 2.3. EQUIPMENT LABELLING

Label
None

### 2.4. EQUIPMENT MODIFICATIONS DURING THE TESTS

None

### 2.5. CALIBRATION DATE

The calibration intervals are extended at Cal due +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.

### 2.6. METHOD TO DETERMINATE THE POWER RADIATED EMISSION

The Normalized Site Attenuation (NSA) is added to the maximum values observed during the azimuth search in order to obtain the spurious radiated emission. For spurious above -6dB from the limit found with the NSA, the Substitution Method is applied.

The substitution antenna replaces the equipment under test (EUT) for Effective Radiated Power (ERP) or Effective Isotropically Radiated Power (EIRP) measurement following the standard. Power is measured for a high level and calculated for the same level of radiated field strength obtained on the measuring antenna and EUT.



### 3. RF OUTPUT POWER

#### 3.1. TEST CONDITIONS

Date of test : November 22, 2024  
Test performed by : Majid MOURZAGH  
Relative humidity (%) : 42  
Ambient temperature (°C) : 24

#### 3.2. TEST SETUP

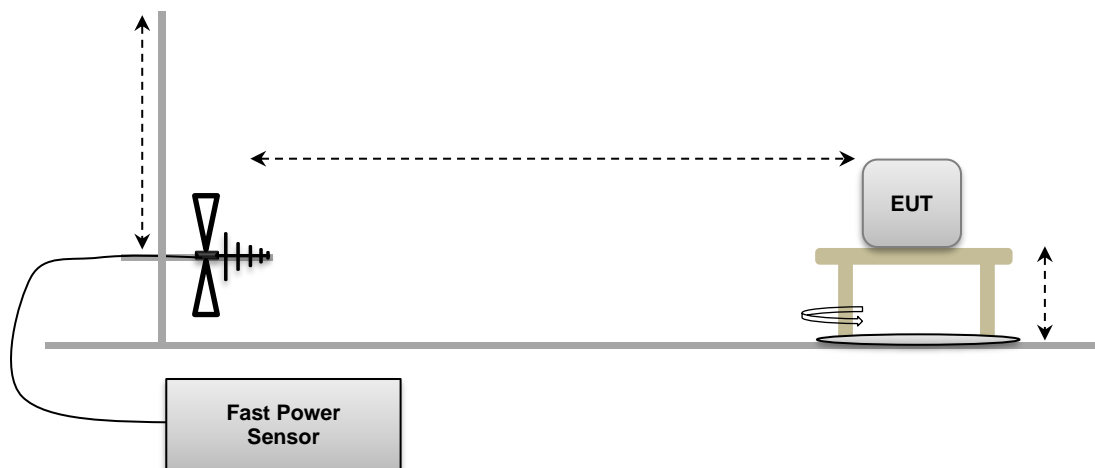
##### 3.2.1. For measurement in normal test conditions

###### Radiated Method

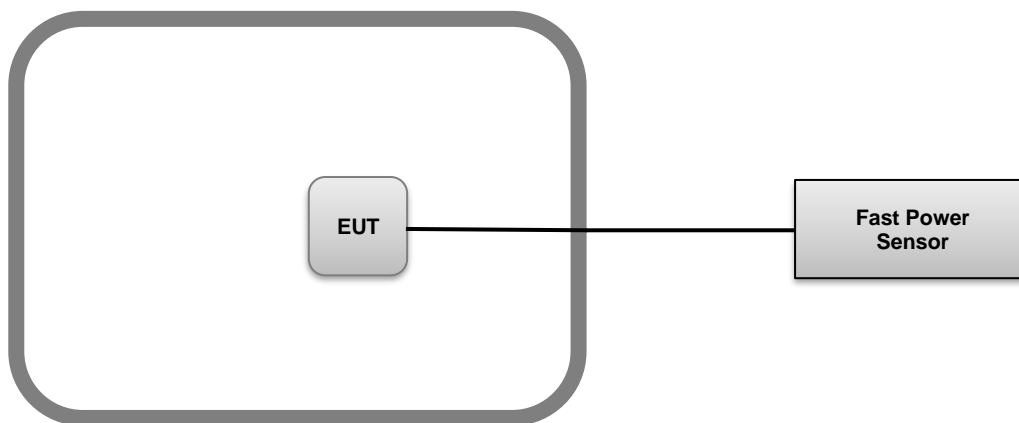
The Equipment Under Test is installed in Full Anechoic Room, 1.5m above the ground reference on an isolating support and distance between EUT and the measuring horn antenna is 3m.

The setup is on an isolating table and the maximum emitted power value from the EUT is found by the rotation of the 360° turntable and with measurement antenna height centered on the EUT, EUT smaller than the beamwidth of the measurement antenna. The measuring antenna is in vertical and then in horizontal polarization. Measurements are performed on all axis of EUT used in normal configuration. A summary of the worst case emissions found in all test configurations and modes is shown.

Mean power at the output of the transmitter and product antenna gain (A+G) are measured with a fast power sensor and deduced after correction due to the gain of the substitution antenna and the RF cables loss between the signal generator and the substitution antenna.



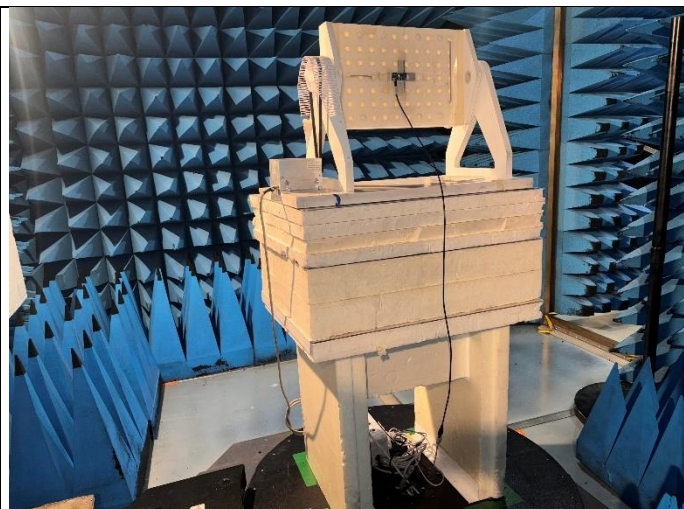
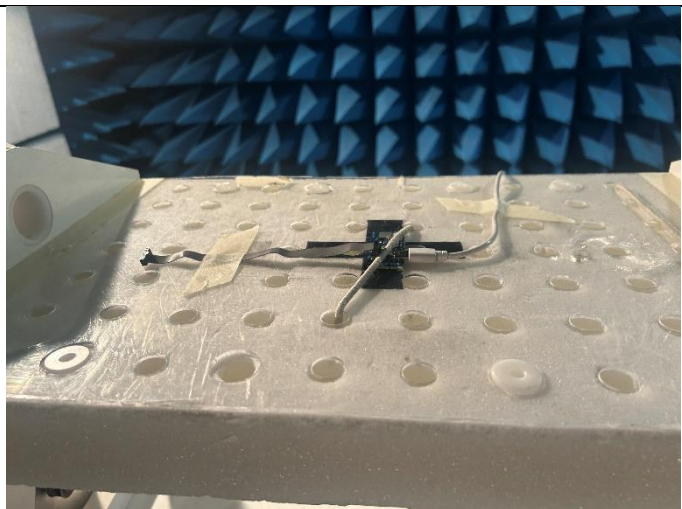
*Test setup of RF Output Power – Radiated Method – Normal Conditions*



*Test setup of RF Output Power – Conducted Method – Normal Conditions*



Axis XY on FAR



Axis Z on FAR



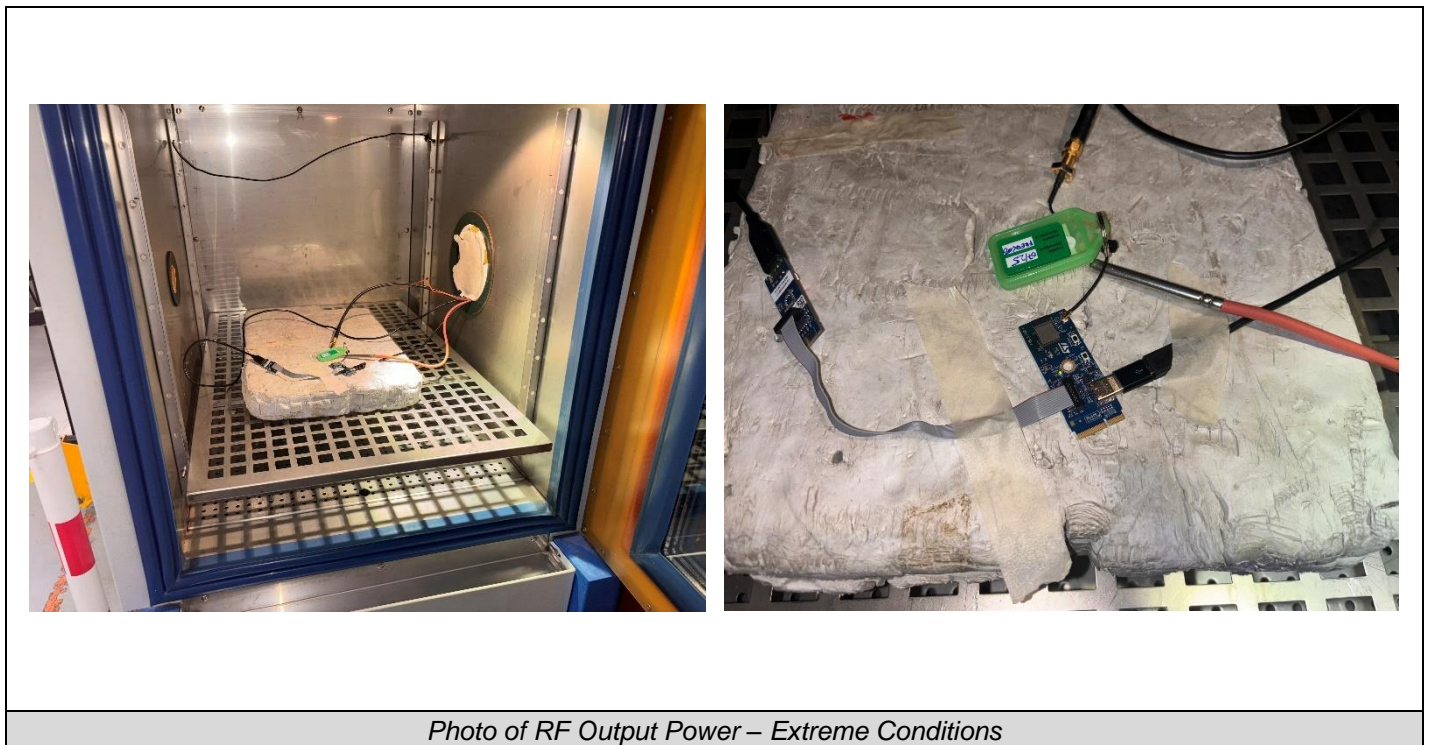
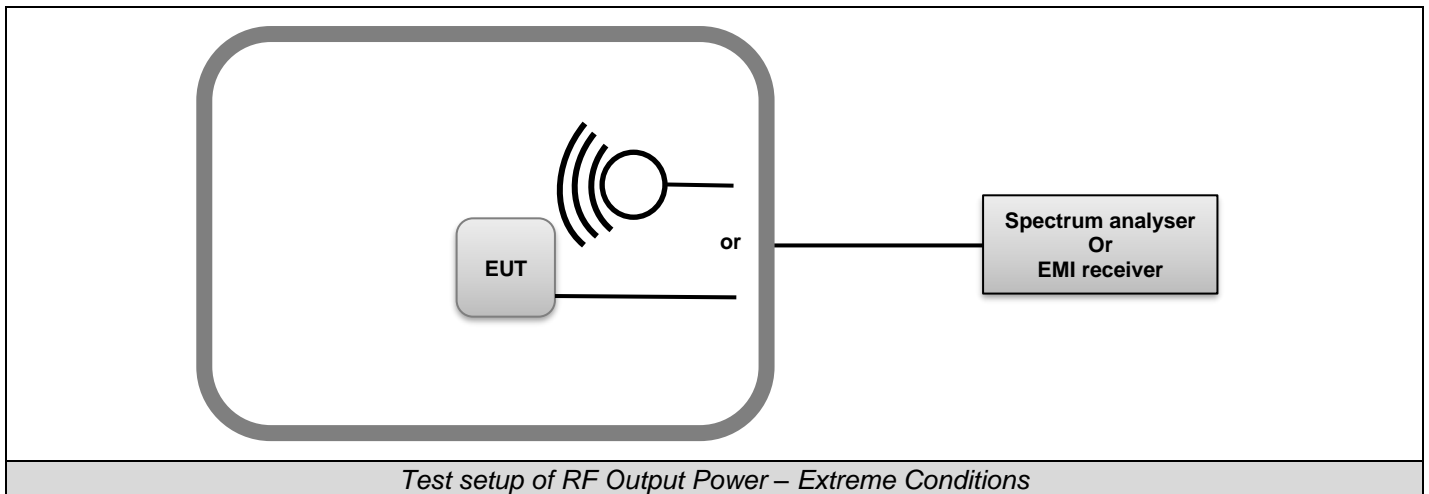
*Photo of RF Output Power– Normal Conditions*



### 3.2.2. For measurement under extreme test conditions

The Equipment under Test is installed in a climatic chamber and powered by a variable power supply. Measurement is performed at the EUT conducted access.

The EIRP in extreme test conditions is measured in relation with the EIRP measured in normal conditions. In case of smart antenna systems operating in a multiple transmit chains active simultaneously, each chain is connected to a fast power sensor & measured synchronously.



### 3.3. LIMIT

The RF output power shall not exceed 20dBm.



### 3.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
Antenna horn 18GHz	EMCO	3115	C2042027	04/22	04/25
Attenuator 10dB	AEROFLEX	—	A7122268	07/23	07/25
CABLE	MICRO-COAX	CABLE N 1m coudé	A5329652	07/23	07/26
Cable SMA 40cm	WITHWAVE	W101-SM1-0.4M	A5329979	10/23	10/26
Emission Cable (SMA 1m)	TELEDYNE	26GHz	A5329874	08/22	08/25
Emission Cable (SMA 3.3m)	TELEDYNE	26GHz	A5329875	08/22	08/25
Frequency generator 10MHz - 27GHz	ROHDE & SCHWARZ	SMR 27	A5442045	04/24	04/26
Multimeter - CEM	FLUKE	87	A1240251	10/23	10/25
RADIMATION	RADIMATION	2023.2.4	L1000139		
RADIO ERP_EIRP	LCIE SUD EST	RADIO ERP_EIRP v4	L2000034		
Rehausse Table C3	LCIE	—	F2000507		
Rehausse Table C3	LCIE	—	F2000511		
RF Power sensor	DARE	RPR3006W	A1503029	12/23	12/25
Semi-Anechoic chamber #3 (BF)	SIEPEL	—	D3044017_BF	04/22	04/25
Semi-Anechoic chamber #3 (VSWR)	SIEPEL	—	D3044017_VSWR	04/22	04/25
SMA Cable 18GHz 0.5m	TELEDYNE	18GHz	A5330059	05/24	05/25
SMA Cable 18GHz 0.5m	TELEDYNE	18GHz	A5330060	05/24	05/25
SMA Cable 18GHz 0.6m	TELEDYNE	18GHz	A5330055	05/24	05/25
SMA Cable 18GHz 3.5m	TELEDYNE	18GHz	A5330058	05/24	05/25
SMK 6.50m	TELEDYNE	A90-010-6.50MTR	A5330061	08/24	08/25
Spectrum analyzer	ROHDE & SCHWARZ	FSU 26	A4060058	09/23	09/25
Table C3	LCIE	—	F2000461		
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	05/23	05/25
TILT	INNCO	TILT	D3044033		
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371		
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444		





TEST EQUIPMENT USED on climatic chamber					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
Attenuator 10dB	AEROFLEX	—	A7122267	10/23	10/25
Cable SMA 2m	—	6GHz	A5329635	09/24	09/26
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	01/23	01/25
Multimeter - CEM	FLUKE	87	A1240251	10/23	10/25
Data Logger (CEM1)	AGILENT	34970A	A6440083	05/23	05/25
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	10/22	02/25
Thermocouple K (radio)	FLUKE	Type K	B4045005	10/23	10/25
Thermocouple K (radio)	FLUKE	Type K	B4045004	10/23	10/25
Thermometer (radio)	FLUKE	52 II	B4043150	10/23	10/25

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

None

### 3.6. RESULTS

Configuration: 802.15.4 - 250kBits/s

Temperature	T <sub>min</sub>			T <sub>nom</sub>			T <sub>max</sub>		
Voltage	V <sub>nom</sub>			V <sub>nom</sub>			V <sub>nom</sub>		
Channel	C <sub>min</sub>	C <sub>mid</sub>	C <sub>max</sub>	C <sub>min</sub>	C <sub>mid</sub>	C <sub>max</sub>	C <sub>min</sub>	C <sub>mid</sub>	C <sub>max</sub>
EIRP (dBm)	8.07	7.10	6.47	8.98	8.04	7.4	9.62	8.67	7.99

### 3.7. CONCLUSION

RF Output Power measurement performed on the sample of the product **STM32WBA5MMG**, Sn: **None5**, in configuration and description presented in this test report, show levels **compliant** to the **ETSI EN 300 328** limits.

## 4. POWER SPECTRAL DENSITY

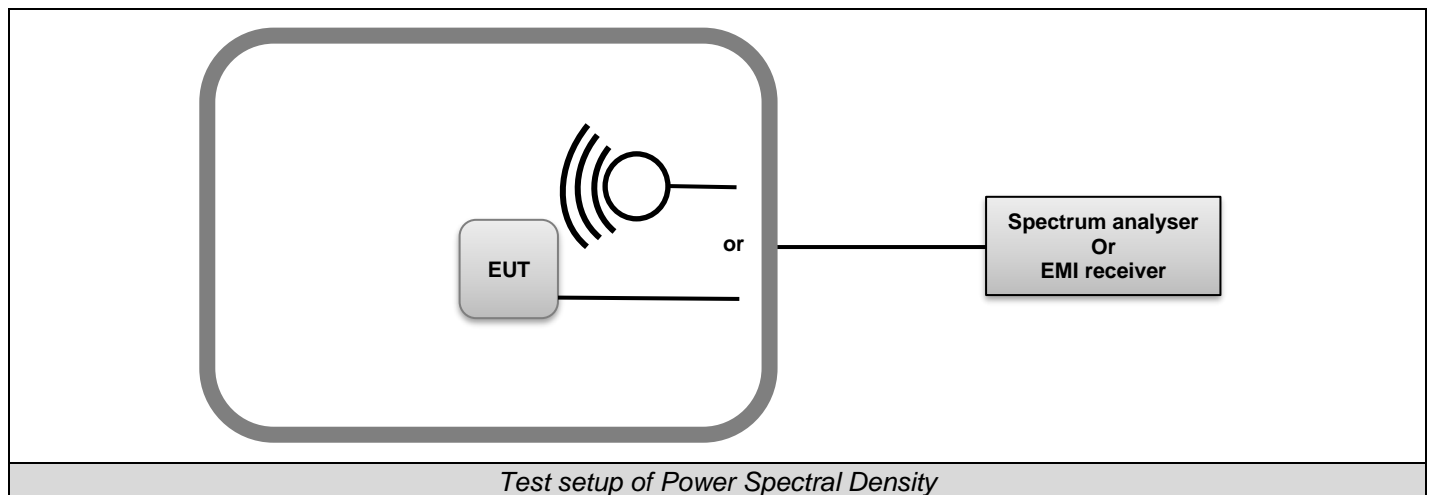
### 4.1. TEST CONDITIONS

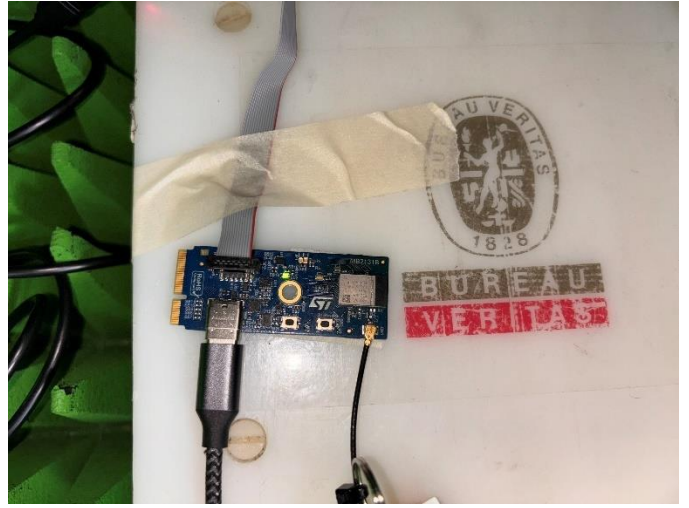
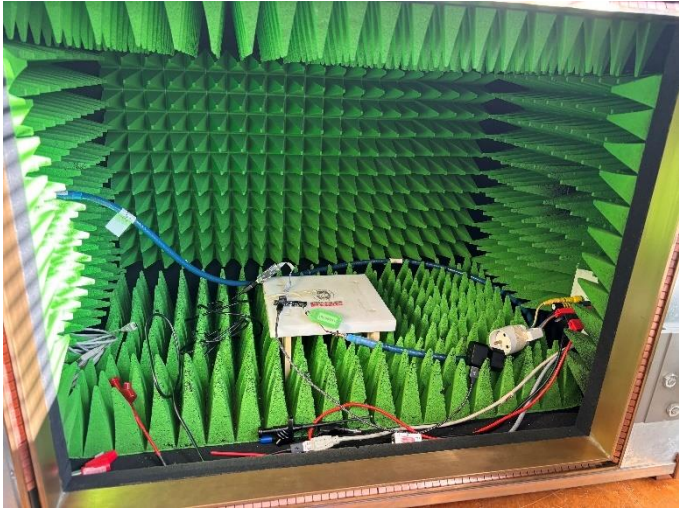
Date of test : November 27, 2024  
Test performed by : Majid MOURZAGH  
Relative humidity (%) : 39  
Ambient temperature (°C) : 24

### 4.2. TEST SETUP

The Equipment Under Test is installed in an anechoic chamber.  
Measurement is performed with a spectrum analyzer or receiver at the EUT conducted access.

The Power Spectral Density is measured in relation with the EIRP measured. In case of measurement on the EUT conducted access for smart antenna systems operating in a multiple transmits chains active simultaneously, each chain is measured separately with a spectrum analyzer.





*Photo of Power Spectral Density*

#### **4.3. LIMIT**

The Power Spectral Density shall not exceed 10dBm/MHz.



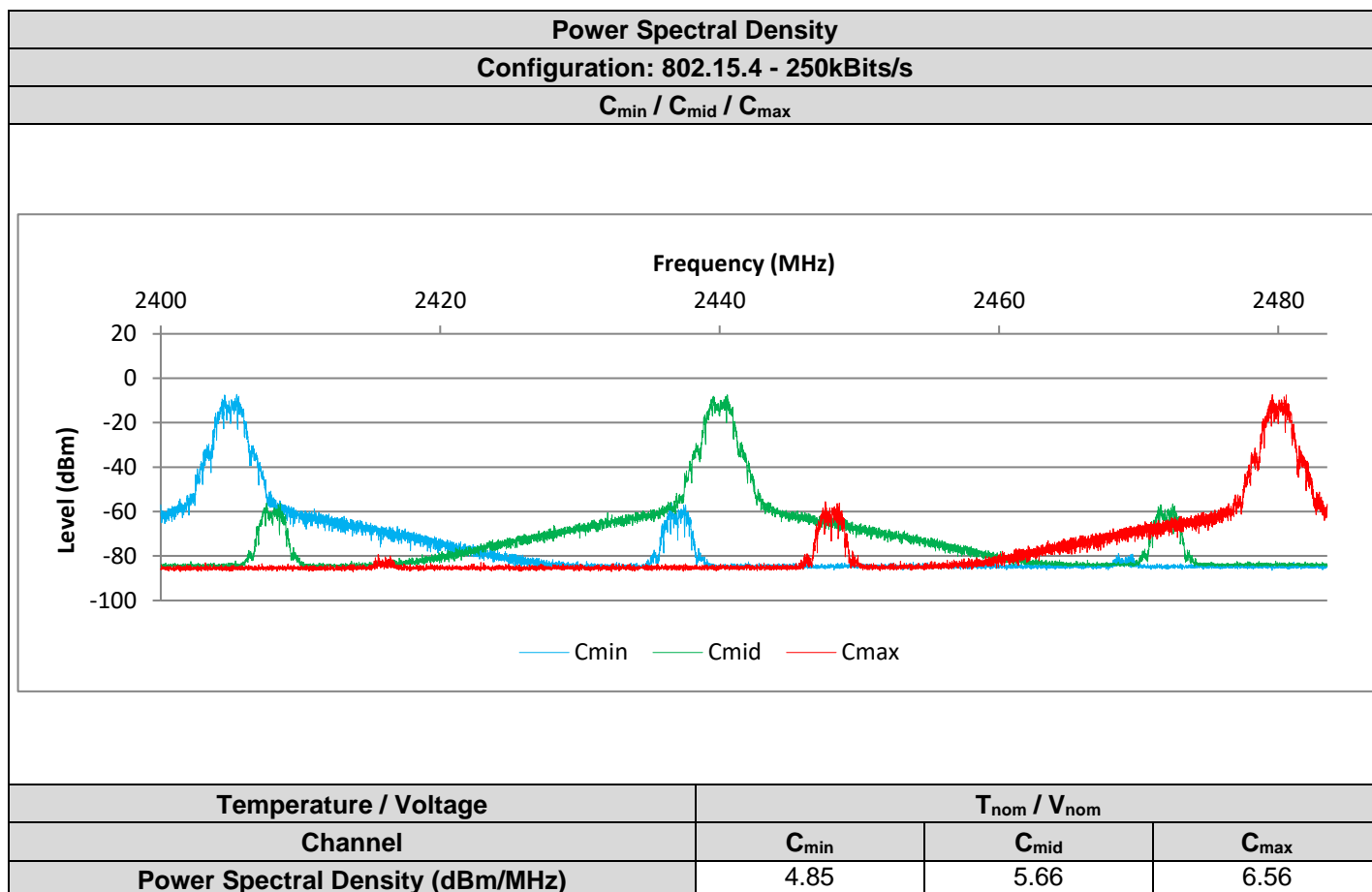
#### 4.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
Full Anechoic Room	SIEPEL	—	D3044024		
Attenuator 10dB	AEROFLEX	—	A7122267	10/23	10/25
SMA 1.5m	SUCOFLEX	18GHz	A5329864	10/23	02/25
Multimeter - CEM	FLUKE	87	A1240251	10/23	10/25
SMA 1.5m	SUCOFLEX	18GHz	A5329863	08/24	08/25
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	04/24	04/26
Thermo-hygrometer	TESTO	608-H1	B4204120	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. RESULTS



#### 4.7. CONCLUSION

Power Spectral Density measurement performed on the sample of the product **STM32WBA5MMG**, Sn: **None5**, in configuration and description presented in this test report, show levels **compliant** to the **ETSI EN 300 328** limits.

## 6. OCCUPIED CHANNEL BANDWIDTH

### 6.1. TEST CONDITIONS

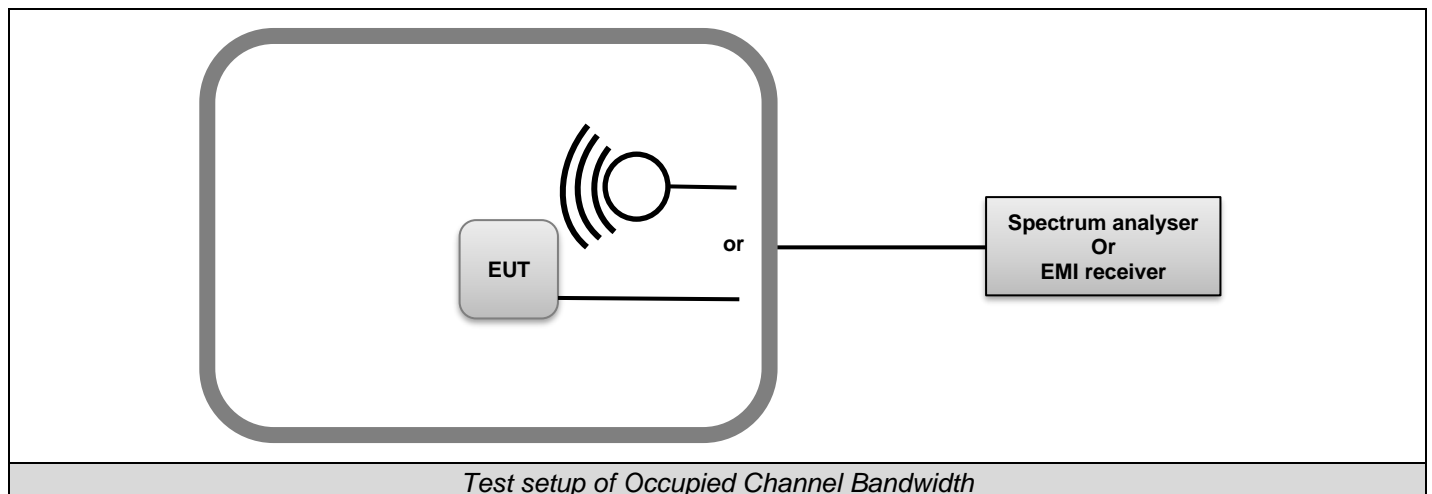
Date of test : November 27, 2024  
Test performed by : Majid MOURZAGH  
Relative humidity (%) : 39  
Ambient temperature (°C) : 24

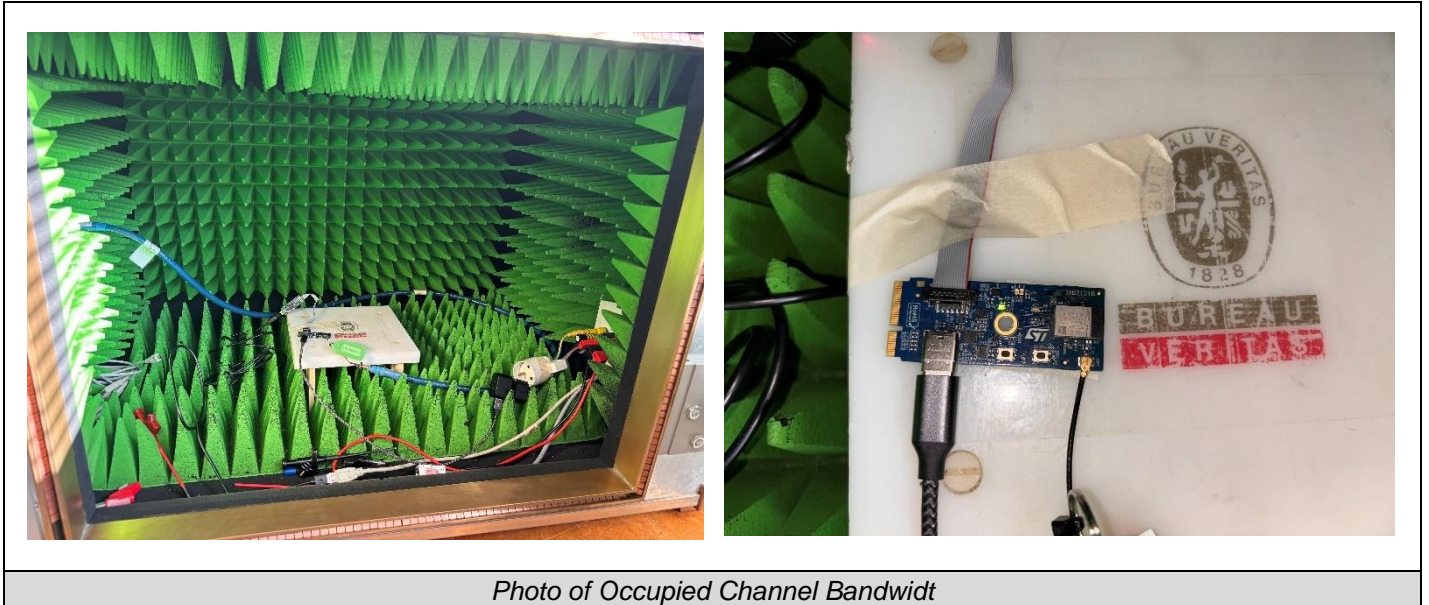
### 6.2. TEST SETUP

The Equipment Under Test is installed in an anechoic chamber.

Measurement is performed with a spectrum analyzer or receiver at the EUT conducted access.

The spectrum analyzer occupied bandwidth function is used to find the occupied channel bandwidth. In case of smart antenna systems operating in a multiple transmit chains active simultaneously, the measurement is only performed on one of the active transmit chains.





### 6.3. LIMIT

The Occupied Bandwidth shall fall completely within the 2400MHz-2483.5MHz Band.



#### 6.4. TEST EQUIPMENT LIST

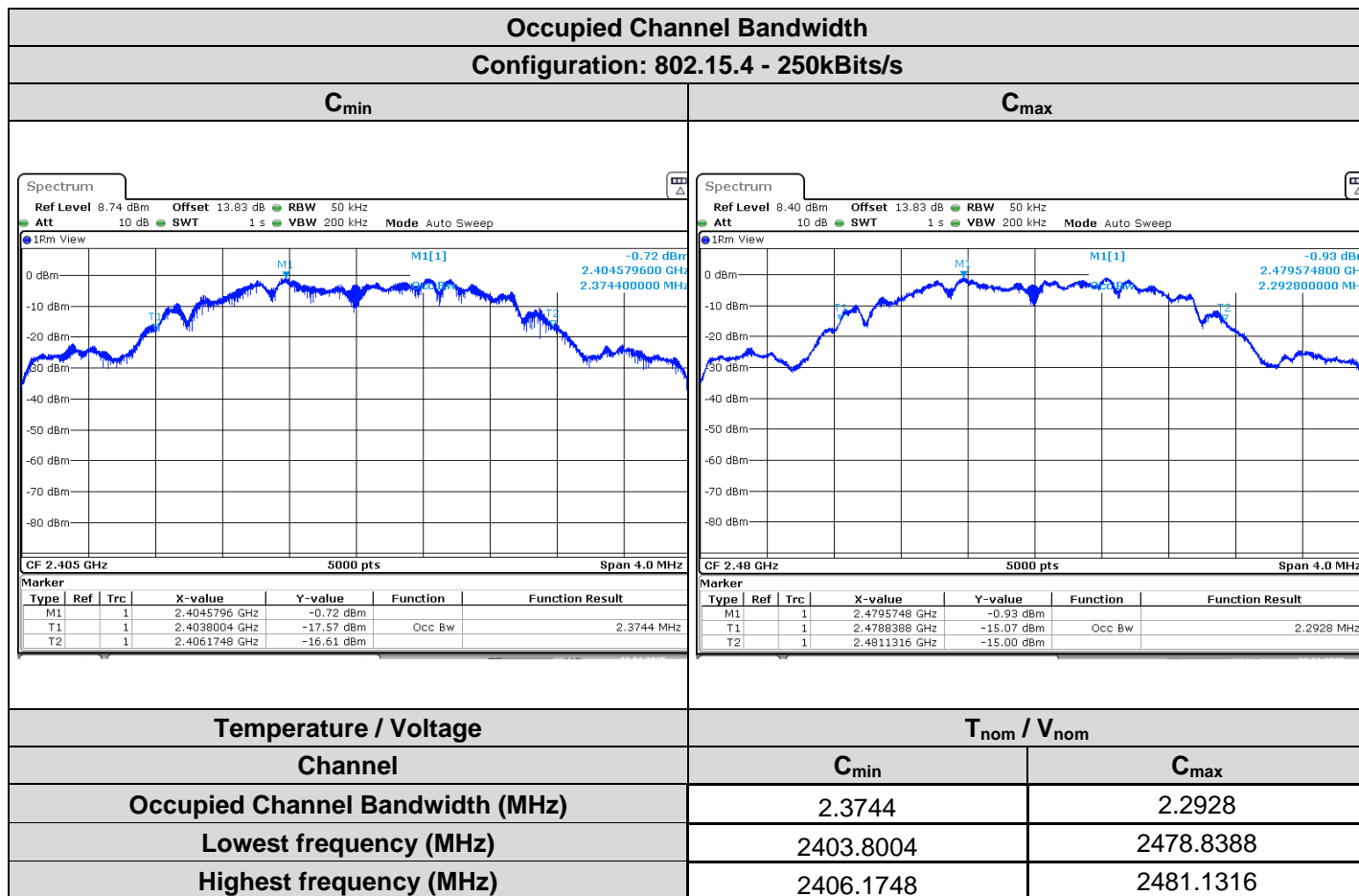
TEST EQUIPMENT USED					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
Full Anechoic Room	SIEPEL	—	D3044024		
Attenuator 10dB	AEROFLEX	—	A7122267	10/23	10/25
Multimeter - CEM	FLUKE	87	A1240251	10/23	10/25
SMA 1.5m	SUCOFLEX	18GHz	A5329864	10/23	02/25
SMA 1.5m	SUCOFLEX	18GHz	A5329863	08/24	08/25
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	04/24	04/26
Thermo-hygrometer	TESTO	608-H1	B4204120	03/23	03/25
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	05/23	05/25

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

None



## 6.6. RESULTS



## 6.7. CONCLUSION

Occupied Channel Bandwidth measurement performed on the sample of the product **STM32WBA5MMG**, Sn: **None5**, in configuration and description presented in this test report, show levels **compliant** to the **ETSI EN 300 328** limits.

## 7. TRANSMITTER UNWANTED EMISSIONS IN THE OUT-OF-BAND DOMAIN

### 7.1. TEST CONDITIONS

Date of test : November 27, 2024  
 Test performed by : Majid MOURZAGH  
 Relative humidity (%) : 39  
 Ambient temperature (°C) : 24

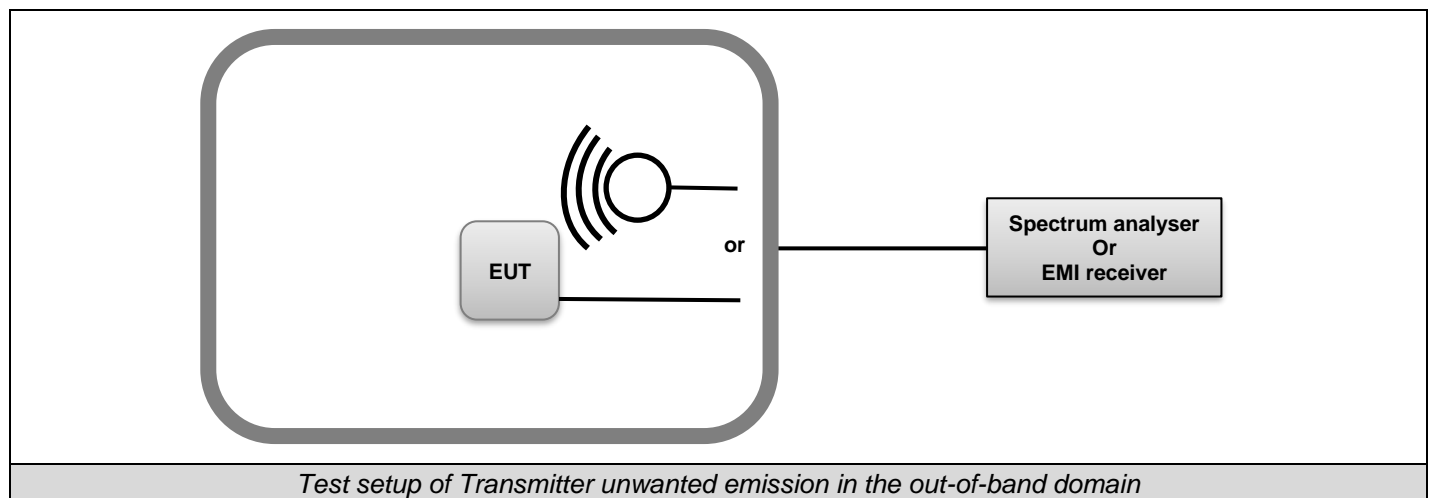
### 7.2. TEST SETUP

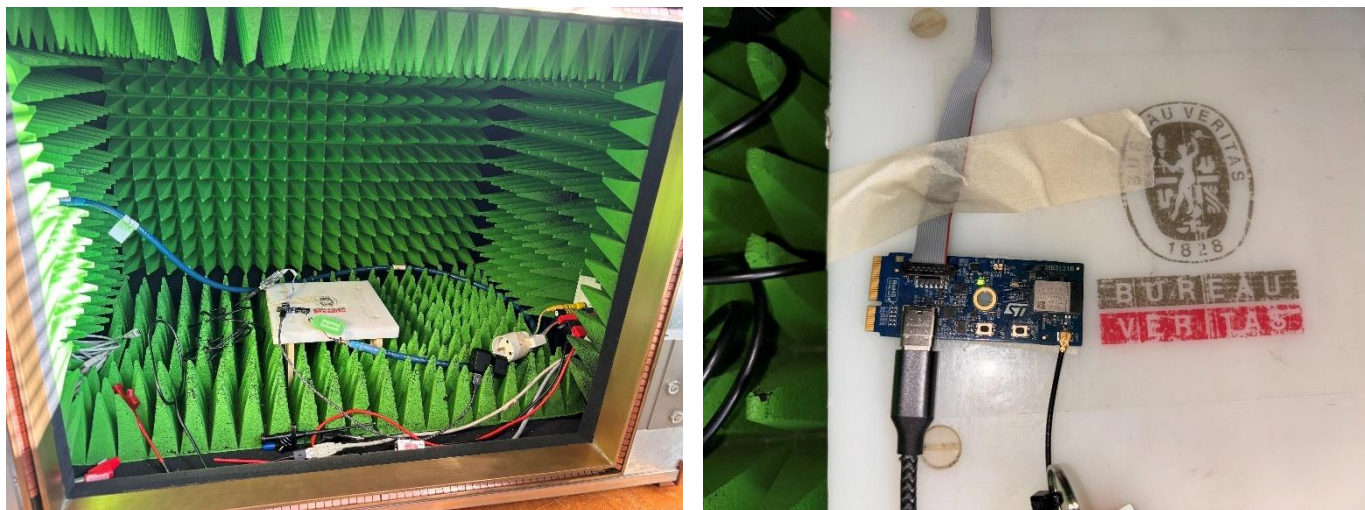
The Equipment Under Test is installed in an anechoic chamber.

Measurement is performed with a spectrum analyzer or receiver at the EUT conducted access.

The Transmitter unwanted emission in the out-of-band domain is measured in relation with the EIRP measured. In case of measurement on the EUT conducted access for smart antenna systems operating in a multiple transmits chains active simultaneously, each chain is measured separately with a spectrum analyzer.

Method of measurement used is Pre-scan Maxhold for each segment. If Pre-scan is above margin limit -6dB, then Time Domain Power is applied.

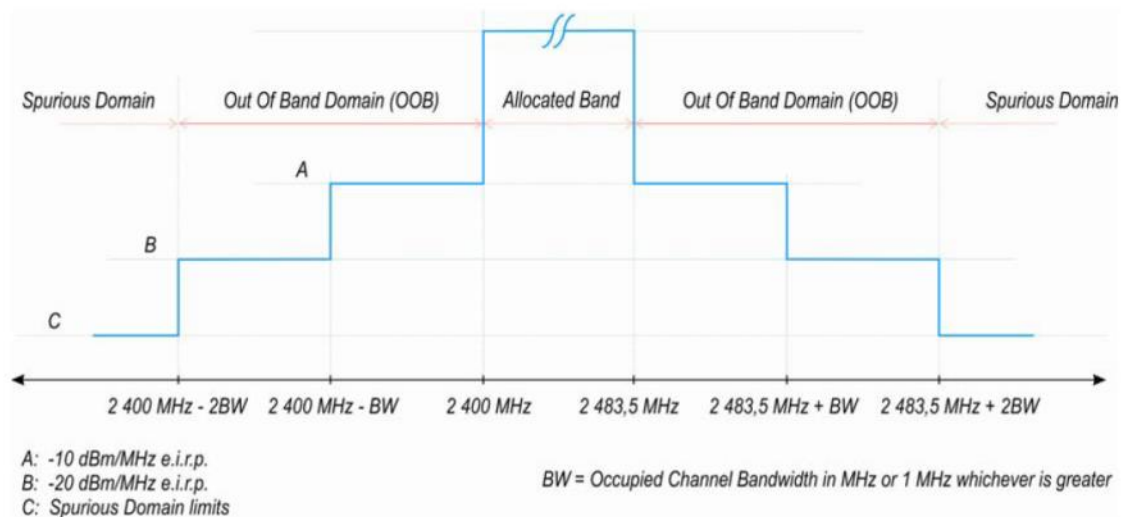




*Photo of Transmitter unwanted emission in the out-of-band domain*

### 7.3. LIMIT

The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the following mask





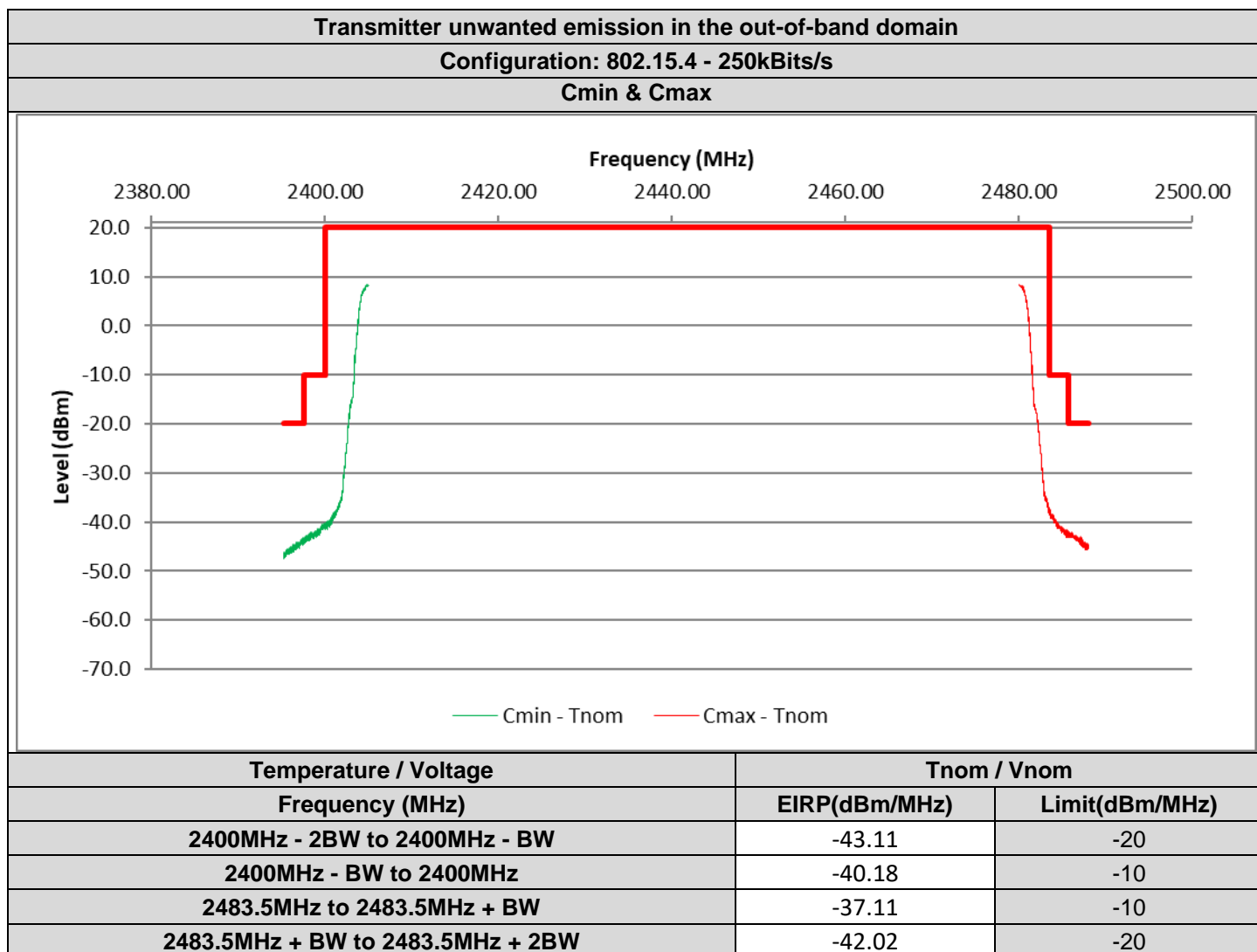
#### 7.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
Full Anechoic Room	SIEPEL	—	D3044024		
Attenuator 10dB	AEROFLEX	—	A7122267	10/23	10/25
Multimeter - CEM	FLUKE	87	A1240251	10/23	10/25
SMA 1.5m	SUCOFLEX	18GHz	A5329864	10/23	02/25
SMA 1.5m	SUCOFLEX	18GHz	A5329863	08/24	08/25
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	04/24	04/26
Thermo-hygrometer	TESTO	608-H1	B4204120	03/23	03/25
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	05/23	05/25

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

None

## 7.6. RESULTS



## 7.7. CONCLUSION

Transmitter unwanted emission in the out-of-band domain measurement performed on the sample of the product **STM32WBA5MMG**, Sn: **None5**, in configuration and description presented in this test report, show levels **compliant** to the **ETSI EN 300 328** limits.



## 8. TRANSMITTER UNWANTED EMISSIONS IN SPURIOUS DOMAIN

### 8.1. TEST CONDITIONS

Date of test : November 21, 2024  
Test performed by : Majid MOURZAGH  
Relative humidity (%) : 42  
Ambient temperature (°C) : 24

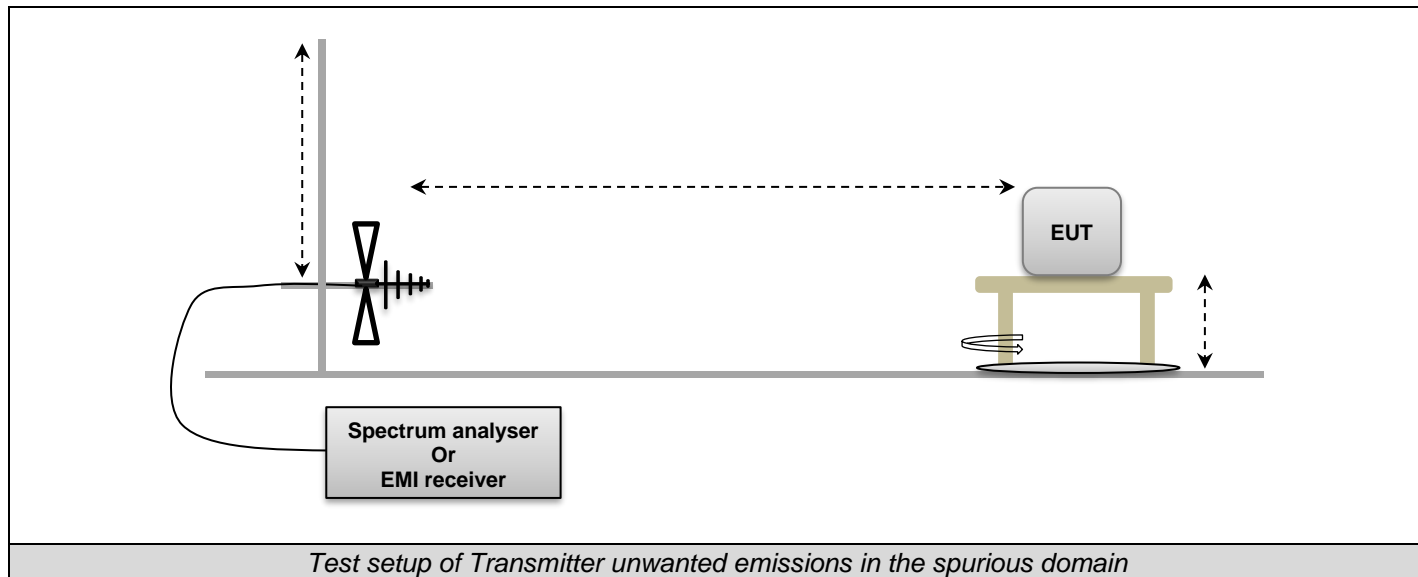
### 8.2. TEST SETUP

Method of measurement used is Effective Radiated Power, cabinet and antenna radiation.

Following frequency ranges, test setup parameters are different and specified in this table:

Frequency range:	30MHz to 1GHz	
Test:	Pre-Characterization	Qualification
Antenna Polarization:	Horizontal and Vertical	
Antenna Height:	Centered on EUT	Varied from 1m to 4m
Antenna Type:	Bi-Log	
RBW Filter:	120kHz	
Maximization:	Turntable rotation of 360 degrees range	
EUT height:	1.5m	1.5m
Test site:	Full Anechoic Chamber	Open Aera Test Site
Distance EUT - Antenna:	3m	10m
Detector:	RMS	RMS
Radiated Power:	E.R.P	

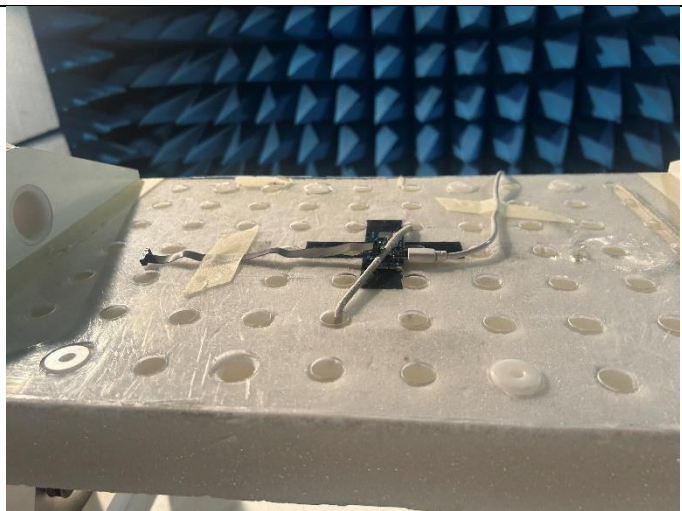
Frequency range:	1GHz to 12.75GHz	
Test:	Pre-Characterization	Qualification
Antenna Polarization:	Horizontal and Vertical	
Antenna Height:	Centered on EUT	Centered on EUT
Antenna Type:	Horn	
RBW Filter:	1MHz	
Maximization:	Turntable rotation of 360 degrees range	
EUT height:	1.5m	1.5m
Test site:	Full Anechoic Chamber	Full Anechoic Chamber
Distance EUT - Antenna:	3m	3m
Detector:	RMS	RMS
Radiated Power:	E.I.R.P	







Axis XY on FAR



Axis Z on FAR



*Photo of Transmitter unwanted emissions in the spurious domain*



### 8.3. *LIMIT*

Transmitter unwanted emissions in the spurious domain	
Frequencies	Limit
30MHz to 47MHz	-36dBm
47MHz to 74MHz	-54dBm
74MHz to 87,5MHz	-36dBm
87,5MHz to 118MHz	-54dBm
118MHz to 174MHz	-36dBm
174MHz to 230MHz	-54dBm
230MHz to 470MHz	-36dBm
470MHz to 694MHz	-54dBm
694MHz to 1GHz	-36dBm
1GHz to 2.4GHz	-30dBm
2.4835GHz to 12.75GHz	-30dBm



#### 8.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
Amplifier 10MHz - 18GHz	LCIE SUD EST	—	A7102082	11/22	03/25
Antenna Bi-log	AH System	SAS-521-7	C2040180	05/23	05/25
BAT EMC	NEXIO	v3.21.0.32	L1000115		
Cable 0.75m	-	18GHz	A5329900	08/24	08/26
Cable SMA 40cm	WITHWAVE	W101-SM1-0.4M	A5329979	10/23	10/26
CONTROLLER	INNCO	CO3000	D3044034		
Filter Matrice	LCIE SUD EST	Combined filters	A7484078	03/23	03/25
HF Radiated emission comb generator	LCIE SUD EST	—	A3169088		
Multimeter - CEM	FLUKE	87	A1240251	10/23	10/25
Rehausse Table C3	LCIE	—	F2000511		
Rehausse Table C3	LCIE	—	F2000507		
Semi-Anechoic chamber #3 (BF)	SIEPEL	—	D3044017_BF	04/22	04/25
Semi-Anechoic chamber #3 (VSWR)	SIEPEL	—	D3044017_VSWR	04/22	04/25
SMA Cable 18GHz 0.5m	TELEDYNE	18GHz	A5330059	05/24	05/25
SMA Cable 18GHz 0.5m	TELEDYNE	18GHz	A5330060	05/24	05/25
SMA Cable 18GHz 0.6m	TELEDYNE	18GHz	A5330055	05/24	05/25
SMA Cable 18GHz 3.5m	TELEDYNE	18GHz	A5330058	05/24	05/25
SMA Cable 18GHz 6m	TELEDYNE	18GHz	A5330057	05/24	05/25
Spectrum analyzer	ROHDE & SCHWARZ	FSU 26	A4060058	09/23	09/25
Table C3	LCIE	—	F2000461		
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	05/23	05/25
TILT	INNCO	TILT	D3044033		
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371		
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444		

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

None

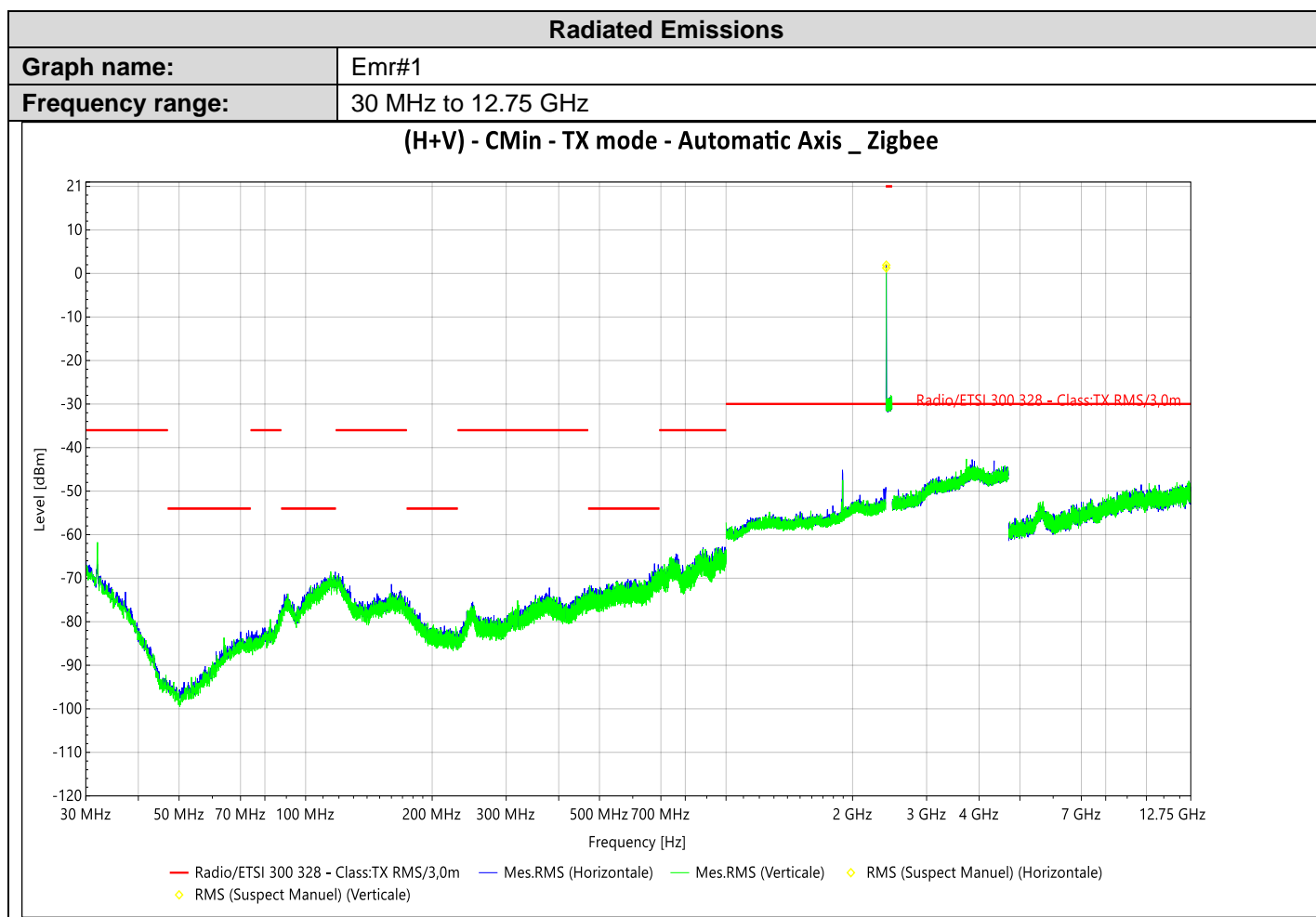
## 8.6. RESULTS

For all following measurements, worst case is presented with different configurations and modulations of EUT at nominal temperature and voltage.

### 8.6.1. 30MHz to 12.75GHz

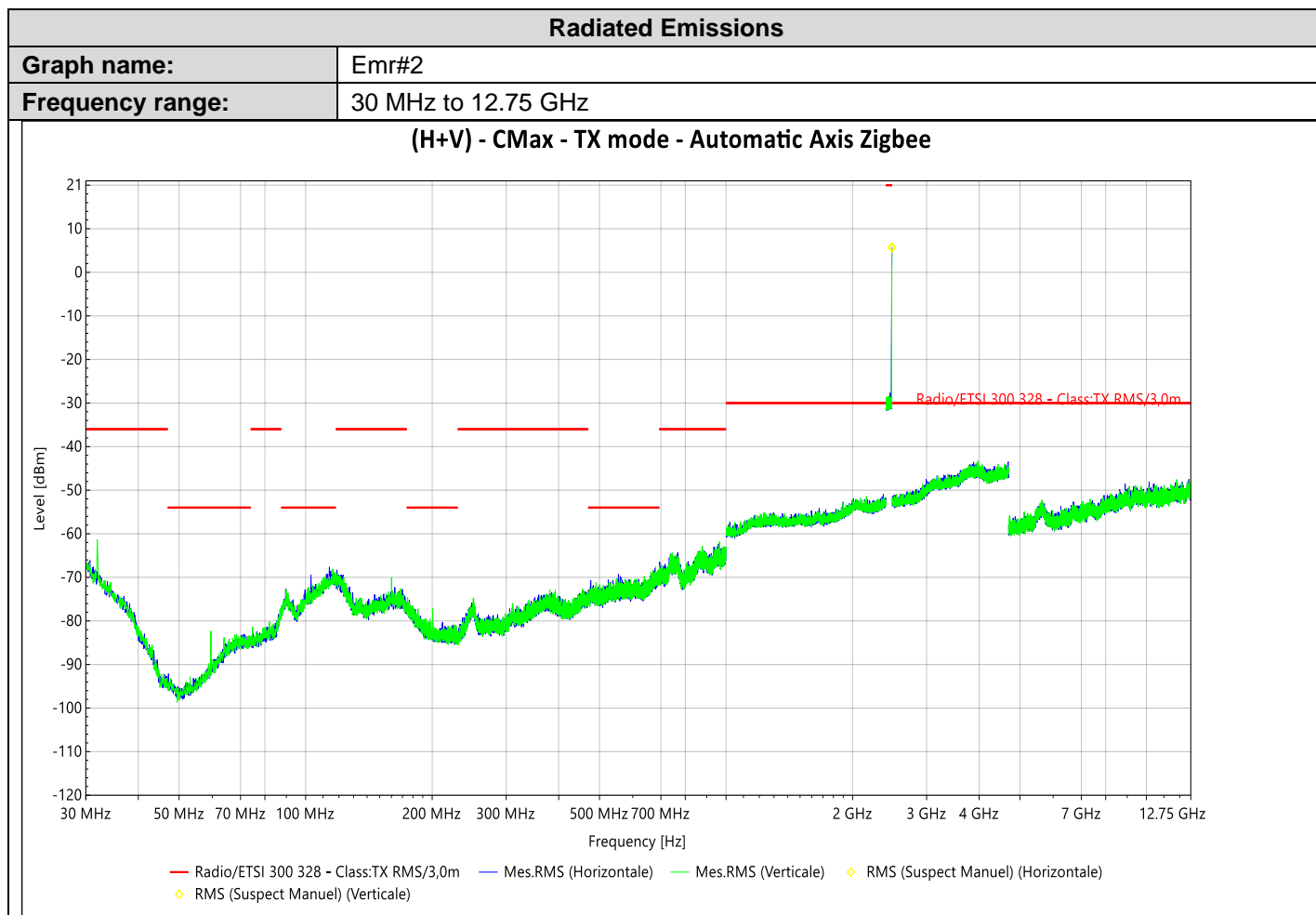
#### Graphs – Pre characterization:

Graph identifier	Polarization	Mode	Channel	EUT position	Comments
Emr# 1	H/V	802.15.4 - 250kBits/s	Cmin	Axis XY/Z	See the following results
Emr# 2	H/V	802.15.4 - 250kBits/s	Cmax	Axis XY/Z	See the following results



#### Pre-Characterization:

Frequency	RMS Level (dBm)	Lim.RMS (dBm)	Angle (°)	Polar.	Correct. (dB)
2.405 GHz	1.91	20.00	87	H	46.90
2.405 GHz	1.25	20.00	100	V	46.90



### Pre-Characterization:

Frequency	RMS Level (dBm)	Lim.RMS (dBm)	Angle (°)	Polar.	Correct. (dB)
2.480 GHz	5.61	20.00	80	H	46.98
2.480 GHz	5.81	20.00	91	V	46.98

### Final measurement:

*No significant frequency observed, NSA margin >6dB*

### 8.7. CONCLUSION

Transmitter unwanted emissions in the spurious domain measurement performed on the sample of the product **STM32WBA5MMG**, Sn: **None5**, in configuration and description presented in this test report, show levels **compliant** to the **ETSI EN 300 328** limits.



## 9. RECEIVER SPURIOUS EMISSIONS

### 9.1. TEST CONDITIONS

Date of test : November 21, 2024  
Test performed by : Majid MOURZAGH  
Relative humidity (%) : 42  
Ambient temperature (°C) : 24

### 9.2. TEST SETUP

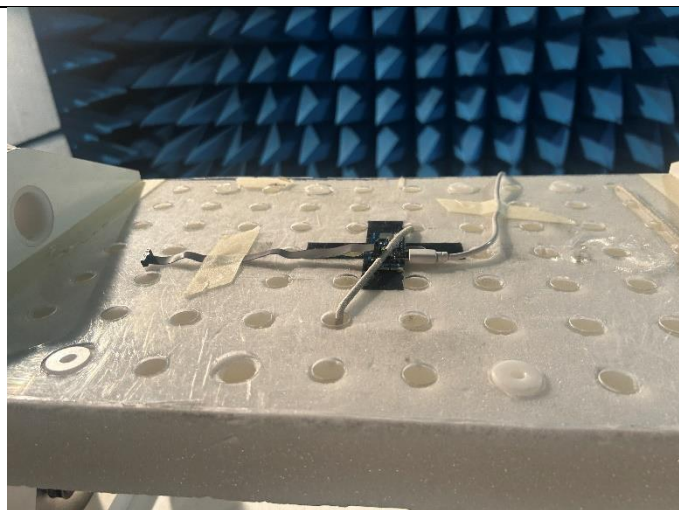
Method of measurement used is Effective Radiated Power, cabinet and antenna radiation.

Following frequency ranges, test setup parameters are different and specified in this table:

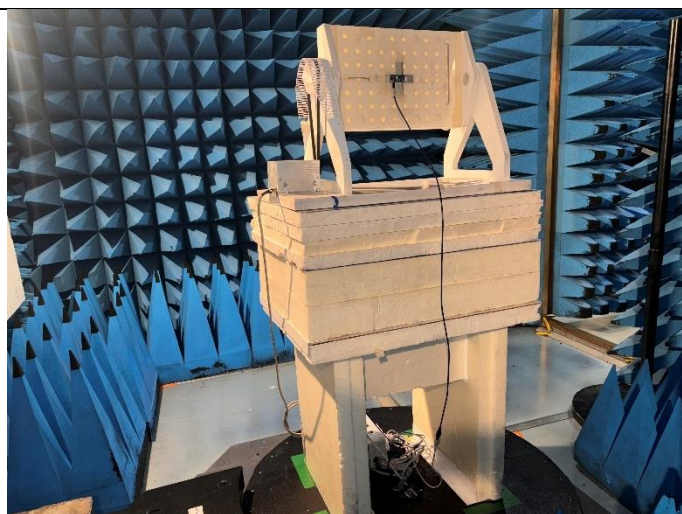
Frequency range:	30MHz to 1GHz	
Test:	Pre-Characterization	Qualification
Antenna Polarization:	Horizontal and Vertical	
Antenna Height:	Centered on EUT	Varied from 1m to 4m
Antenna Type:	Bi-Log	
RBW Filter:	120kHz	
Maximization:	Turntable rotation of 360 degrees range	
EUT height:	1.5m	1.5m
Test site:	Full Anechoic Chamber	Open Aera Test Site
Distance EUT - Antenna:	3m	10m
Detector:	RMS	RMS
Radiated Power:	E.R.P	

Frequency range:	1GHz to 12.75GHz	
Test:	Pre-Characterization	Qualification
Antenna Polarization:	Horizontal and Vertical	
Antenna Height:	Centered on EUT	Centered on EUT
Antenna Type:	Horn	
RBW Filter:	1MHz	
Maximization:	Turntable rotation of 360 degrees range	
EUT height:	1.5m	1.5m
Test site:	Full Anechoic Chamber	Full Anechoic Chamber
Distance EUT - Antenna:	3m	3m
Detector:	RMS	RMS
Radiated Power:	E.I.R.P	





Axis XY on FAR



Axis Z on FAR

*Photo of Receiver Spurious Emissions*





### 9.3. LIMIT

Receiver Spurious Emissions	
Frequencies	Limit
30MHz to 1GHz	-57dBm
1GHz to 12.75GHz	-47dBm

### 9.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
Amplifier 10MHz - 18GHz	LCIE SUD EST	—	A7102082	11/22	03/25
Antenna Bi-log	AH System	SAS-521-7	C2040180	05/23	05/25
BAT EMC	NEXIO	v3.21.0.32	L1000115		
Cable 0.75m	-	18GHz	A5329900	08/24	08/26
Cable SMA 40cm	WITHWAVE	W101-SM1-0.4M	A5329979	10/23	10/26
CONTROLLER	INNCO	CO3000	D3044034		
Filter Matrice	LCIE SUD EST	Combined filters	A7484078	03/23	03/25
HF Radiated emission comb generator	LCIE SUD EST	—	A3169088		
Multimeter - CEM	FLUKE	87	A1240251	10/23	10/25
Rehausse Table C3	LCIE	—	F2000511		
Rehausse Table C3	LCIE	—	F2000507		
Semi-Anechoic chamber #3 (BF)	SIEPEL	—	D3044017_BF	04/22	04/25
Semi-Anechoic chamber #3 (VSWR)	SIEPEL	—	D3044017_VSWR	04/22	04/25
SMA Cable 18GHz 0.5m	TELEDYNE	18GHz	A5330059	05/24	05/25
SMA Cable 18GHz 0.5m	TELEDYNE	18GHz	A5330060	05/24	05/25
SMA Cable 18GHz 0.6m	TELEDYNE	18GHz	A5330055	05/24	05/25
SMA Cable 18GHz 3.5m	TELEDYNE	18GHz	A5330058	05/24	05/25
SMA Cable 18GHz 6m	TELEDYNE	18GHz	A5330057	05/24	05/25
Spectrum analyzer	ROHDE & SCHWARZ	FSU 26	A4060058	09/23	09/25
Table C3	LCIE	—	F2000461		
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	05/23	05/25
TILT	INNCO	TILT	D3044033		
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371		
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444		

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

None



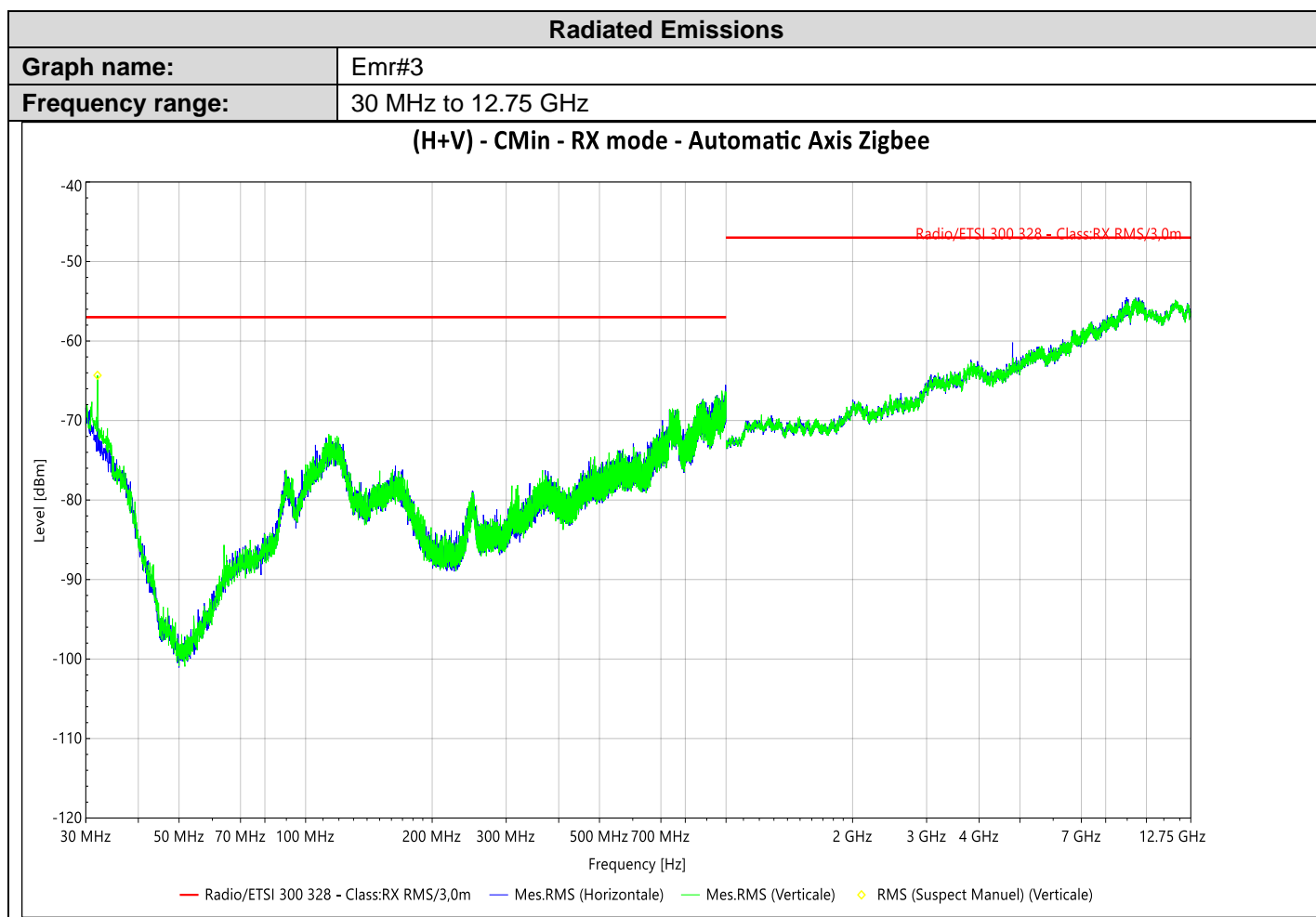
## 9.6. RESULTS

For all following measurements, worst case is presented with different configurations and modulations of EUT at nominal temperature and voltage.

### 9.6.1. 30MHz to 12.75GHz

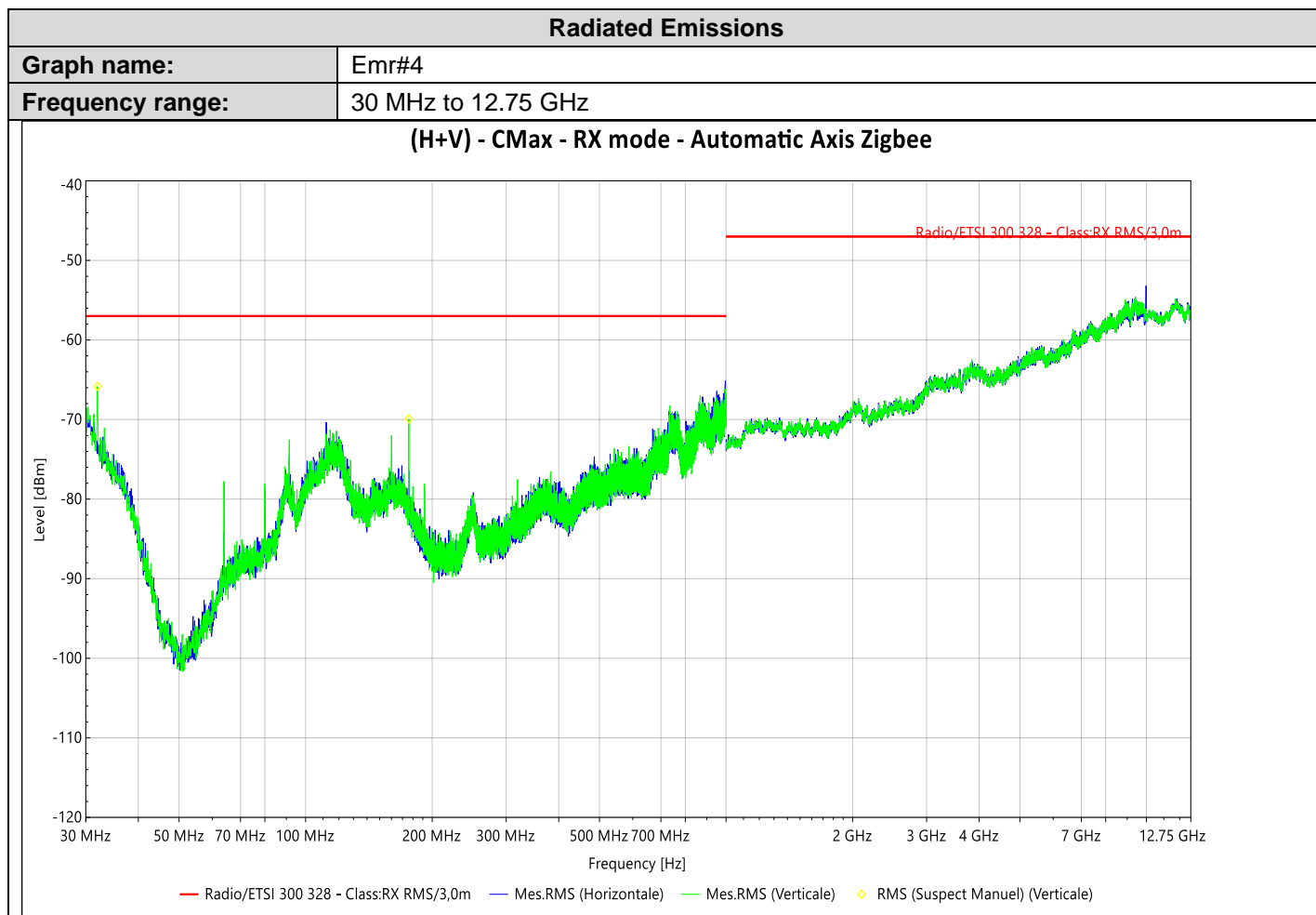
#### Graphs – Pre characterization:

Graph identifier	Polarization	Mode	Channel	EUT position	Comments
Emr# 3	H/V	802.15.4 - 250kBits/s	Cmin	Axis XY/Z	See the following results
Emr# 4	H/V	802.15.4 - 250kBits/s	Cmax	Axis XY/Z	See the following results



#### Pre-Characterization:

Frequency	Lim.PK (dBm)	RMS Level (dBm)	Lim.RMS (dBm)	Angle (°)	Polar.	Correct. (dB)
31.988 MHz	-57.00	-64.32	-57.00	351	V	12.06



#### Pre-Characterization:

Frequency	Lim.PK (dBm)	RMS Level (dBm)	Lim.RMS (dBm)	Angle (°)	Polar.	Correct. (dB)
31.988 MHz	-57.00	-65.83	-57.00	53	V	12.06
175.985 MHz	-57.00	-69.93	-57.00	139	V	5.46

#### Final measurement:

*No significant frequency observed, NSA margin >6dB*

### 9.7. CONCLUSION

Receiver Spurious Emissions measurement performed on the sample of the product **STM32WBA5MMG**, Sn: **None5**, in configuration and description presented in this test report, show levels **compliant** to the **ETSI EN 300 328** limits.

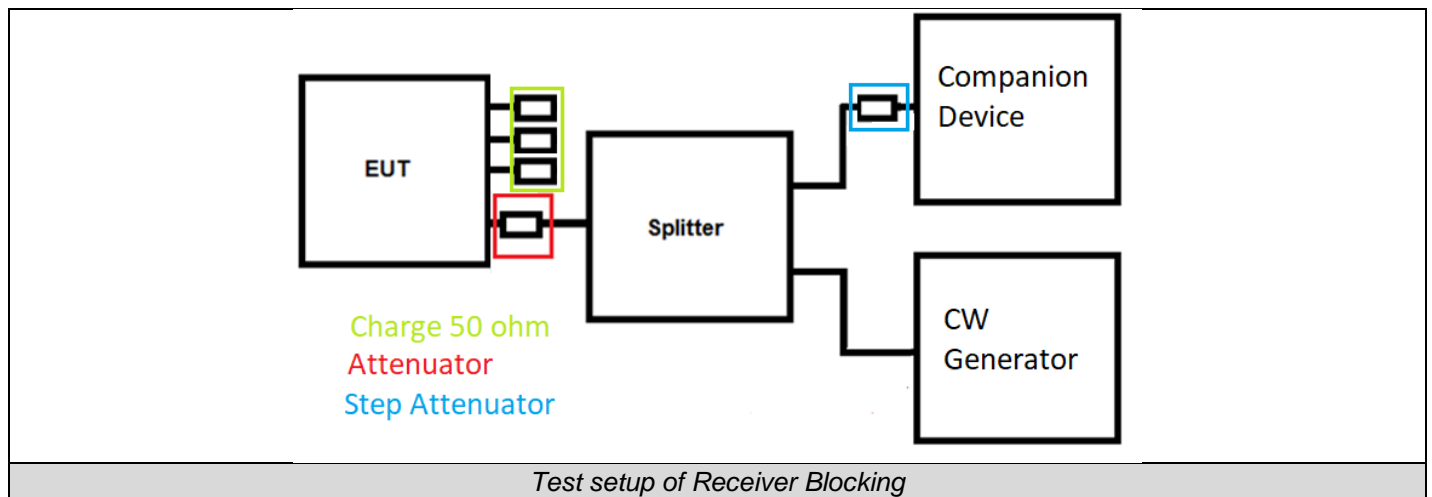
## 10. RECEIVER BLOCKING

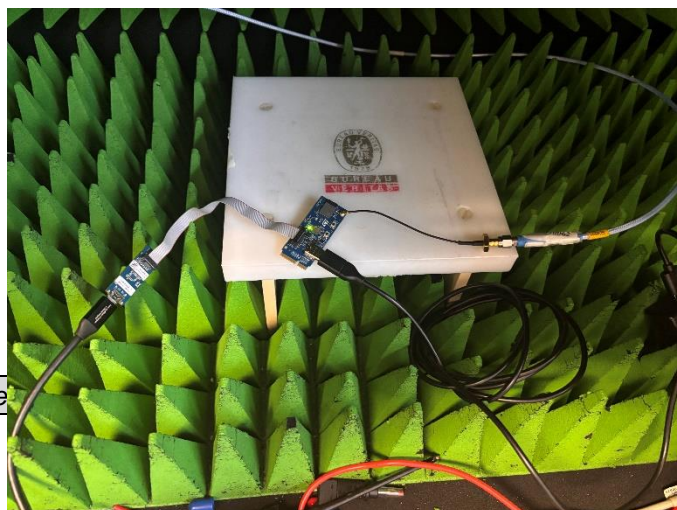
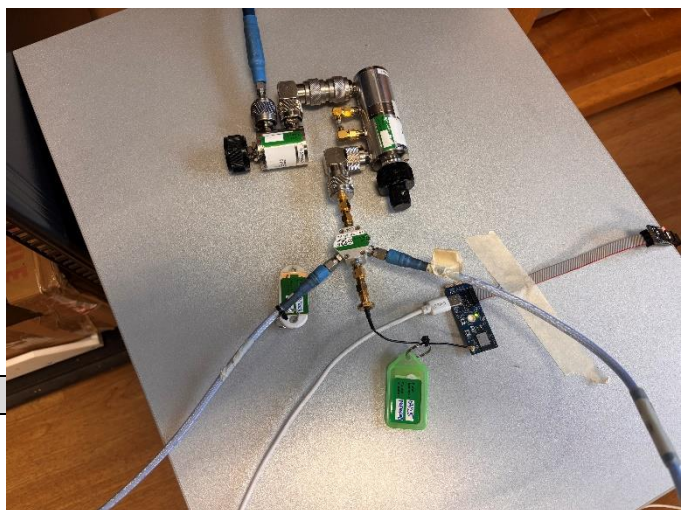
### 10.1. TEST CONDITIONS

Date of test : November 29, 2024  
 Test performed by : Majid MOURZAGH  
 Relative humidity (%) : 39  
 Ambient temperature (°C) : 23

### 10.2. TEST SETUP

The Equipment Under Test is installed on a table.  
 Measurement is performed with a spectrum analyzer or receiver at the EUT conducted access.





### 10.3. LIMIT

#### Receiver Category 1

Wanted signal mean power from companion device (dBm) (see notes 1 and 4)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 4)	Type of blocking signal
$(-133 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}))$ or $-68 \text{ dBm}$ whichever is less (see note 2)	2380 / 2504	-53	CW
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}))$ or $-74 \text{ dBm}$ whichever is less (see note 3)	2300 / 2330 / 2360 2524 / 2584 / 2674	-47	CW

NOTE 1: OCBW is in Hz.

NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to  $P_{\min} + 26 \text{ dB}$  where  $P_{\min}$  is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.

NOTE 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to  $P_{\min} + 20 \text{ dB}$  where  $P_{\min}$  is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.

NOTE 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

#### Receiver Category 2

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}) + 10 \text{ dB})$ or $(-74 \text{ dBm} + 10 \text{ dB})$ whichever is less (see note 2)	2380 / 2504 2300 / 2584	-34	CW

NOTE 1: OCBW is in Hz.

NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to  $P_{\min} + 26 \text{ dB}$  where  $P_{\min}$  is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.

NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

#### Receiver Category 3

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}) + 20 \text{ dB})$ or $(-74 \text{ dBm} + 20 \text{ dB})$ whichever is less (see note 2)	2380 / 2504 2300 / 2584	-34	CW

NOTE 1: OCBW is in Hz.

NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to  $P_{\min} + 26 \text{ dB}$  where  $P_{\min}$  is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.

NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.





#### 10.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
Cable 1m	HUBER & SUHNER	18GHz	A5329705	07/23	07/25
Cable 1m	HUBER & SUHNER	18GHz	A5329706	07/23	07/25
Full Anechoic Room	SIEPEL	—	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	10/23	10/25
RADIMATION	RADIMATION	2023.2.4	L1000139		
RF Power sensor	DARE	RPR3006W	A1503032	11/24	11/26
SMA 1.5m	SUCOFLEX	18GHz	A5329864	10/23	02/25
SMK 1.2m (Ampl <-> chamber)	HUBER-SUHNER	SUCOFLEX 102	A5330062	04/23	04/26
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	04/24	04/26
Splitter	JFW	50PD-469	A7132063	07/23	07/25
Thermo-hygrometer	TESTO	608-H1	B4204120	03/23	03/25
Variable Attenuator	-	ATR-100/10	A7126012	02/24	02/26
Variable Attenuator	-	ATR-10/1	A7126013	02/24	02/26
Vector Signal Generator	ROHDE & SCHWARZ	SMJ100A	A5400043	09/24	09/26

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

None

## 10.6. RESULTS

Temperature / Voltage	$T_{nom} / V_{nom}$
-----------------------	---------------------

Configuration: 802.15.4 - 250kBits/s

Receiver Category 2

Blocking					
Gain (dBi) :					1.88
Wanted signal mean power from companion device on		Blocking signal Frequency (MHz)	Blocking signal Level (dBm)	Blocking signal measured following the Criteria Used	
$C_{min}$ (dBm)	$C_{max}$ (dBm)			$C_{min}$ (dBm)	$C_{max}$ (dBm)
-64	-64	2380	-32.12	-2.3	/
-64	-64	2504	-32.12	/	7.5
-64	-64	2300	-32.12	7.9	/
-64	-64	2584	-32.12	/	7.5

## 10.7. CONCLUSION

Receiver Blocking measurement performed on the sample of the product **STM32WBA5MMG**, Sn: **None5**, in configuration and description presented in this test report, show levels **compliant** to the **ETSI EN 300 328** limits.





## 11. ELECTROMAGNETIC FIELD

### 11.1. TEST CONDITIONS

Date of test : December 16, 2024  
Test performed by : Majid MOURZAGH  
Relative humidity (%) : 42  
Ambient temperature (°C) : 24

### 11.2. TEST SETUP

#### Calculation

With EIRP or ERP of EUT measured in this test report maximum reference level is calculated in using following formula and worst distance User-EUT = 10cm:

$$E = \frac{\sqrt{30PG_{(\theta,\phi)}}}{r}$$

### 11.3. LIMITS

BAND	Electric Field Limit @ 10cm
2400-2483.5MHz	61.0V/m

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

None

### 11.5. TEST RESULTS

802.15.4 - 250kBits/s	
Temperature / Voltage	T <sub>nom</sub> / V <sub>nom</sub>
Channel	C11
Frequency (MHz)	2405
Reference Level (V/m)	5.24

### 11.6. CONCLUSION

EMF measurement, performed on the sample of the product **STM32WBA5MMG**, Sn: **None5**, in configuration and description presented in this test report, show levels **compliant** to the EN 62311 (2020) limits.

## 12. UNCERTAINTIES CHART

<i>Kind of measurement</i>	<i>Wide uncertainty laboratory</i>
Occupied Channel Bandwidth	±2.8 %
Humidity	±3.2 %
Power Spectral Density, Conducted	±1.7 dB
Radio frequency	±0.3 ppm
RF power, conducted	±1.2 dB
RF power, radiated (Full anechoic chamber above 1GHz)	±3.7 dB
RF power, radiated (Semi anechoic chamber & open test site)	±5.6 dB
Spurious emission, conducted	±2.3 dB
Spurious emission, radiated (Full anechoic chamber above 1GHz)	±3.8 dB
Spurious emission, radiated (Semi anechoic chamber & open test site)	±5.7 dB
Temperature	±0.75 °C
Time	±2.3 %
Voltage	±1.7 %

The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the standard. The conformity of the sample is directly established by the applicable limit values. This table includes all uncertainties maximum feasible for testing in the laboratory, whether or not made in this report.