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Template : March 5th, 2024

TEST REPORT

N°: **21661458-798897-A(FILE#7392635)** Version: **01**

Subject	**Radio spectrum tests according to the standards:** **FCC CFR 47 Part 15.225 & ANSI C63.10** **RSS 210 & RSS-Gen**
Issued to	**MARKEM-IMAJE INDUSTRIES** 9 RUE GASPARD MONGE 26500 – BOURG LES VALENCE FRANCE
Apparatus under test	
Product	**Module RFID : RMCIJ1**
Trade mark	**MARKEM-IMAJE**
Manufacturer	**MARKEM-IMAJE INDUSTRIES**
Family range	**Module RFID for CIJ printers**
Model under test	**RMCIJ1**
Serial number	**G123291187**
FCCID	**2AAW8-RMCIJ1**
IC	**11372A-RMCIJ1**
Conclusion	See Test Program chapter
Test date	March 20, 2024 to March 22, 2024
Test location	LCIE Grenoble
FCC Test site	FR0008 - 918017 (MOI)
ISED Test site	6500A (MOI)
Sample receipt date	March 04, 2024
Composition of document	39 pages
Document issued on	June 06, 2024

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PUBLICATION HISTORY

Version	Date	Author	Modification
01	June 06, 2024	Akram HAKKARI	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

1. TEST PROGRAM

References

- **47 CFR Part 15.225 (2023)**
- **RSS 210 Issue 10.1**
- **RSS Gen Issue 5.2**
- **ANSI C63.10 (2013)**

Radio requirement:

Clause - Test Description		Test result - Comments
Occupied Bandwidth	***ISED***	**PASS**
20dB Bandwidth	***FCC & ISED***	**PASS**
Frequency Tolerance	***FCC & ISED***	**PASS**
Field strength within the band [13.110-14.010] MHz	***FCC & ISED***	**PASS**
Field strength outside of the bands [13.110-14.010] MHz	***FCC & ISED***	**PASS**
Measurement of conducted emission	***FCC & ISED***	**PASS**
Receiver Radiated Emissions	***ISED***	**PASS(2)**
This table is a summary of test report, see conclusion of each clause of this test report for detail.		

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

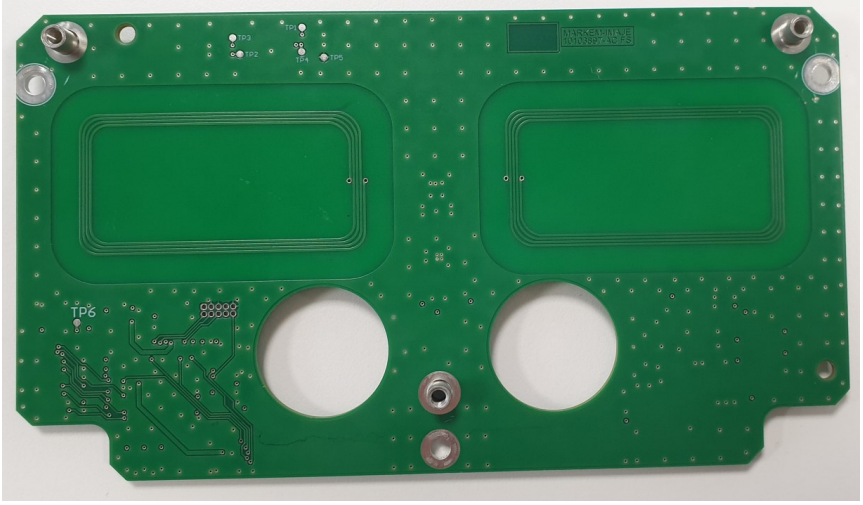
PASS: EUT complies with standard's requirement
FAIL: EUT does not comply with standard's requirement
NA: Not Applicable
NP: Test Not Performed

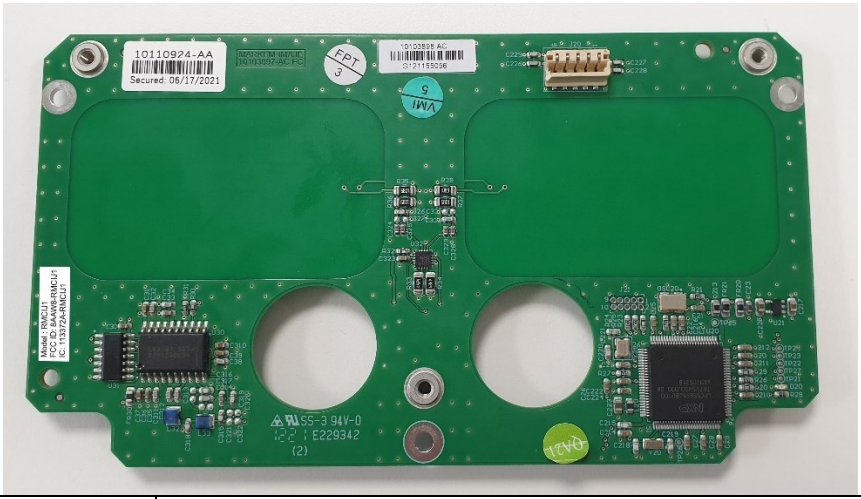
2. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)

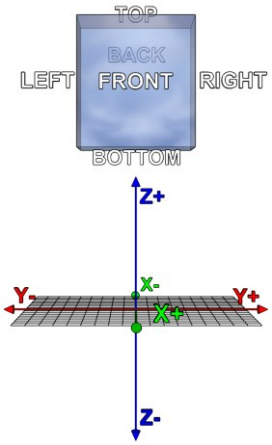
2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES)

Equipment under test (EUT):

Model under test:	**RMCIJ1**
Serial Number:	**G123291187**







Dimensions:	15cm x 8.5cm x 1cm (Length x Width x Height)
Type:	Table-Top

Power supply:

Name	Type	Rating	Reference / Sn	Comments
Supply1	USB	5V	-	-

NC: Not communicated by provider

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Comments
Supply1	USB	-	-	-	-

NC: Not communicated by provider

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Laptop	DELL	-	-
2 x TAG	Markem-Imaje A54691	-	-
Plastic case	Markem-Imaje 10110687	-	
Interface board	Markem-Imaje 10113878	-	
USB UART Cable	-	-	

NC: Not communicated by provider

Equipment information (declaration of provider):

Type:	**RFID**	
Chipset / RF Module	EM Microelectronic - Marin SA, EM4094	
Frequency band:	[13.553 to 13.567] MHz	
Number of Channel:	1	
Antenna Type:	Internal	
Transmit chains:	1	
Receiver chains	1	
Operating temperature range:	T_{min}:	-20 °C
	T_{nom}:	20°C
	T_{max}:	60 °C
Operating voltage:	V_{min} (85% V_{nom}):	4.5 VDC
	V_{nom}:	5 VDC
	V_{max} (115% V_{nom}):	5.5 VDC

Antenna Dimensions
50 mm x 25 mm

Hardware information			
Highest internal frequency (PLL, Quartz, Clock, Microprocessor…):	**$F_{Highest}$:**	**150**	**MHz**
Firmware (if applicable):	**V:**	V 1.0	
Software (if applicable):	**V:**	NA	

NC: Not communicated by provider

2.2. RUNNING MODE

Test mode	Description of test mode
Test mode 1	Permanent emission with modulation on a fixed channel in the data rate that produced the highest power. Tests are performed with "TAG".
Test mode 2	Permanent reception

Test	Running mode
Occupied Bandwidth	Test mode 1
20dB Emission Bandwidth	Test mode 1
Frequency Tolerance	Test mode 1
Field strength within the band 13.110-14.010MHz	Test mode 1
Field strength outside of the bands 13.110-14.010 MHz	Test mode 1
Receiver Radiated Emissions	Test mode 2 (1)

(1) The test can't be performed because the transmitter and receiver are operating at the same frequency and the transmitter cannot be switched off as the carrier is used as receiver injection signal

2.3. EQUIPMENT LABELLING

Label


2.4. EQUIPMENT MODIFICATIONS DURING THE TESTS

None

2.5. FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follow:

$$FS = RA + AF + CF - AG$$

Where:
FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Factor
AG = Amplifier Gain

Example:
Assume a receiver reading of 52.5dBµV is obtained. The antenna factor of 7.4 and a cable factor of 1.1 are added. The amplifier gain of 29dB is subtracted, giving a field strength of 32 dBµV/m.
FS = 52.5 + 7.4 + 1.1 – 29 = 32 dBµV/m
The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.
Level in µV/m = Common Antilogarithm [(32dBµV/m)/20] = 39.8 µV/m.

2.6. TEST DISTANCE EXTRAPOLATION – FCC/ISED

The field strength is extrapolated to the new measurement distance using formula from FCC Part15.31 (f) and §6.5-6.6 RSS-GEN:

Below 30MHz,

$$FS_{\text{limit}} = FS_{\text{max}} - 40\log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right)$$

Above 30MHz,

$$FS_{\text{limit}} = FS_{\text{max}} - 20\log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right)$$

Where:
FS_{limit} is the calculation of field strength at the limit distance, expressed in dBµV/m
FS_{max} is the measured field strength, expressed in dBµV/m
$d_{measure}$ is the distance of the measurement point from the EUT
d_{limit} is the reference limit distance

2.7. 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.

2.8. METHOD TO DETERMINATE THE SPURIOUS 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. OCCUPIED BANDWIDTH

3.1. *TEST CONDITIONS*

Date of test	:	March 21, 2024
Test performed by	:	Akram HAKKARI
Relative humidity (%)	:	33
Ambient temperature (°C)	:	20

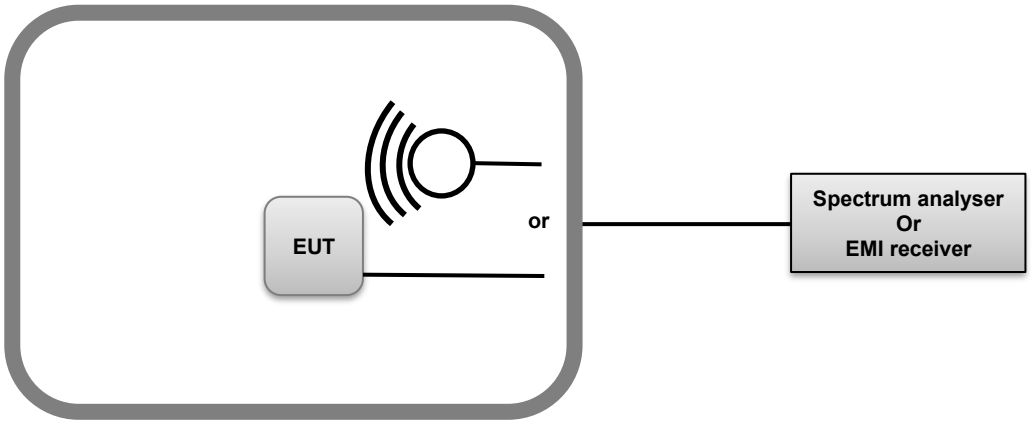
3.2. *TEST SETUP*

The Equipment Under Test is installed in a climatic chamber**.**
Measurement is performed with a spectrum analyzer in radiated method.

The EUT is turned ON, the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

Test Procedure:
RSS-Gen Issue 5 § 6.7

- RBW used in the range of 1% to 5% of the anticipated emission bandwidth
- Set the video bandwidth (VBW) ≥ 3 x RBW.
- Detector = Peak.
- Trace mode = Max Hold.
- Sweep = Auto couple.
- Allow the trace to stabilize.
- OBW 99% function of spectrum analyzer used



Test setup of Occupied Bandwidth

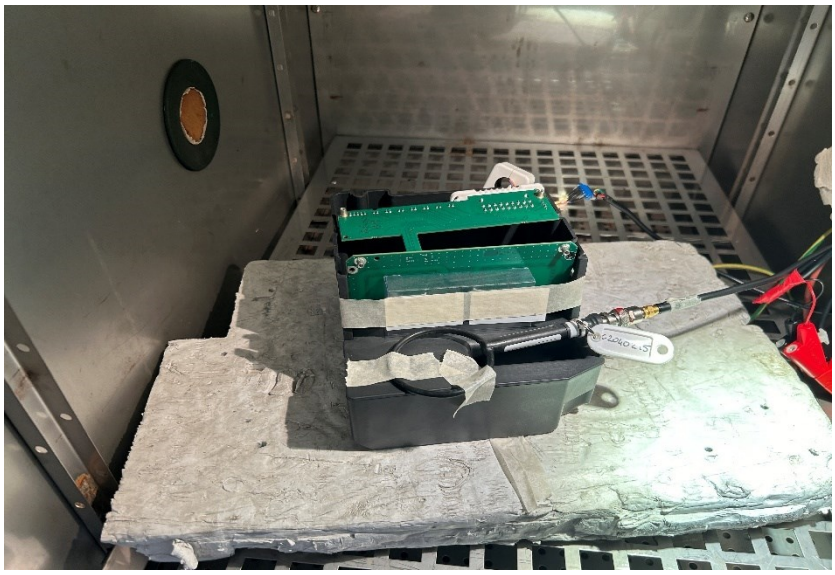


Photo of Occupied bandwidth

3.3. *LIMIT*

None

3.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
AC source 1kW	KEYSIGHT	AC6802A	A7042305		
Antenna Loop (near field)	ELECTRO-METRICS	EM-6993	C2040215	09/22	09/25
Attenuator 10dB	AEROFLEX	_	A7122267	10/23	10/25
Cable SMA 2m	_	6GHz	A5329635	03/22	03/24
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	01/23	01/25
Data Logger (CEM1)	AGILENT	34970A	A6440083	05/23	05/25
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	10/22	10/24
Thermo-hygrometer	TESTO	608-H1	B4204120	03/23	03/25

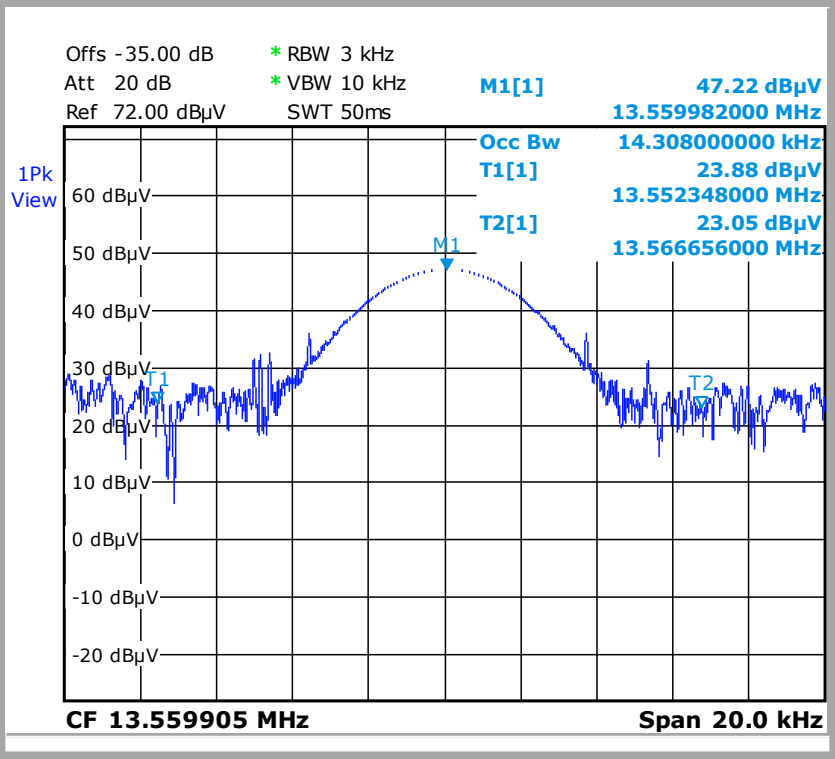
3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

3.6. RESULTS

Occupied Bandwidth

13.56MHz



Frequency (MHz)	Occupied Bandwidth (KHz)
13.56MHz	14.3

3.7. CONCLUSION

Occupied Channel Bandwidth measurement performed on the sample of the product **RMCIJ1**, Sn: **G123291187**, in configuration and description presented in this test report, show levels **compliant** to the **RSS-GEN** limits.

4. 20dB Emission Bandwidth

4.1. *TEST CONDITIONS*

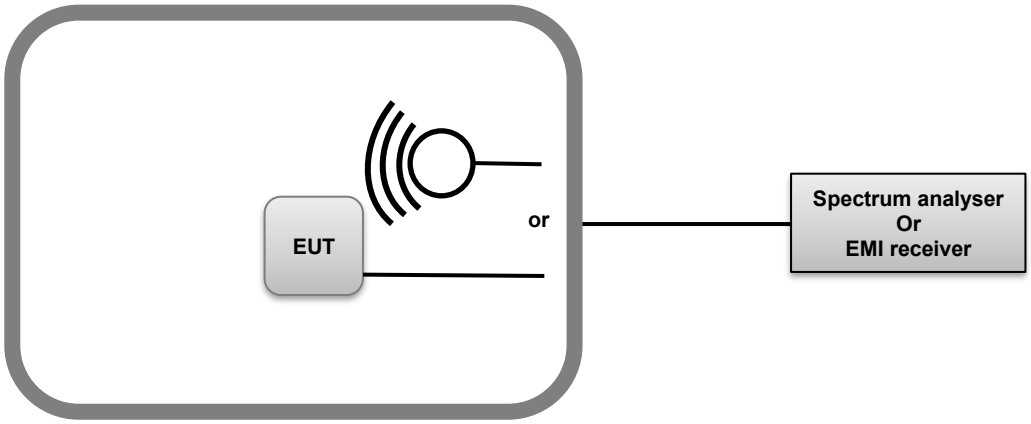
Date of test	:	March 21, 2024
Test performed by	:	Akram HAKKARI
Relative humidity (%)	:	33
Ambient temperature (°C)	:	20

4.2. *TEST SETUP*

The Equipment Under Test is installed **in a climatic chamber.**
Measurement is performed with a spectrum analyzer in **radiated method**.

Test Procedure:
ANSI C63.10 § 6.9.2:

The EUT is turn ON; levels have been corrected to be in compliant with the Peak Output Power measured; and using the MaxHold function, the frequency separation of two frequencies that were attenuated 20dB from the Peak Output Power level. A delta marker is used to measure the frequency difference as the emission bandwidth.



Test setup of 20dB emission bandwidth

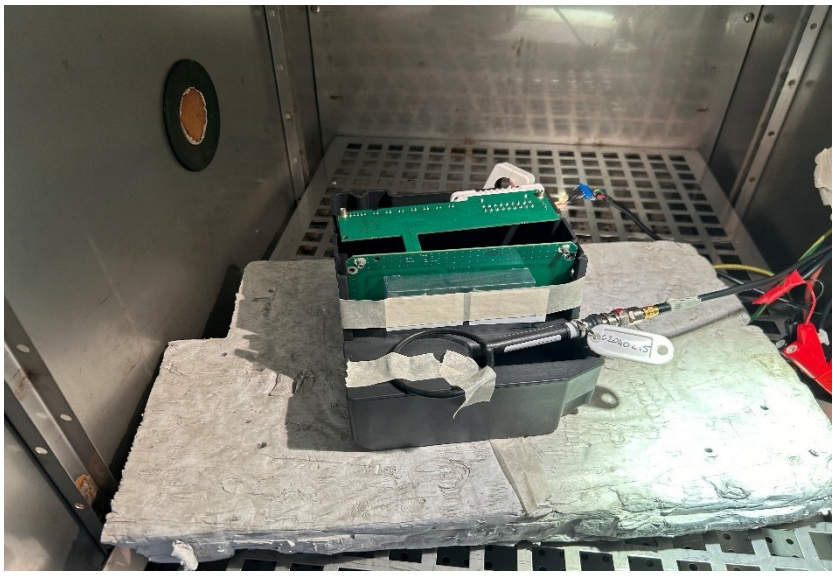


Photo of 20dB emission bandwidth

4.3. *LIMIT*

No Limit

4.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
AC source 1kW	KEYSIGHT	AC6802A	A7042305		
Antenna Loop (near field)	ELECTRO-METRICS	EM-6993	C2040215	09/22	09/25
Attenuator 10dB	AEROFLEX	_	A7122267	10/23	10/25
Cable SMA 2m	_	6GHz	A5329635	03/22	03/24
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	01/23	01/25
Data Logger (CEM1)	AGILENT	34970A	A6440083	05/23	05/25
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	10/22	10/24
Thermo-hygrometer	TESTO	608-H1	B4204120	03/23	03/25

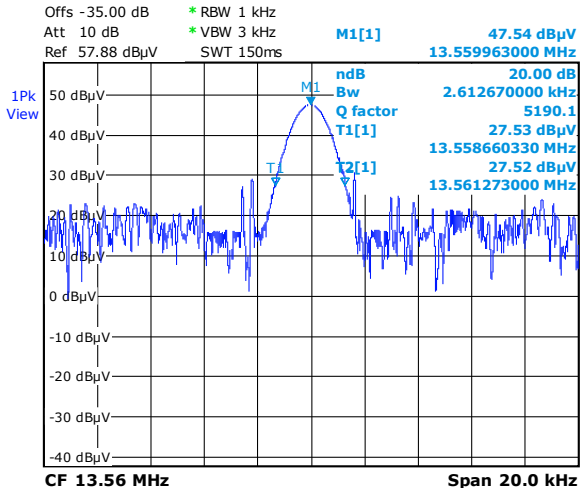
4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

4.6. *RESULTS*

Frequency (MHz)	20 dB Bandwidth (kHz)
13.56	2.61

Graph



4.7. *CONCLUSION*

20dB Emission Bandwidth measurement performed on the sample of the product **RMCIJ1**, Sn: **G123291187**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.225 & RSS 210** limits.

5. FREQUENCY TOLERANCE

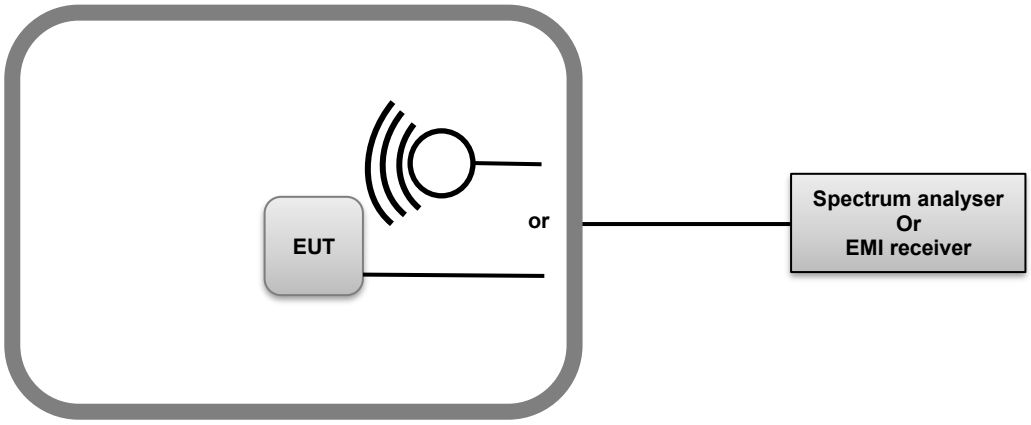
5.1. *TEST CONDITIONS*

Date of test	:	March 22, 2024
Test performed by	:	Akram HAKKARI
Relative humidity (%)	:	32
Ambient temperature (°C)	:	21

5.2. *TEST SETUP*

The Equipment Under Test is installed **in a climatic chamber.**
Measurement is performed with a spectrum analyzer in **radiated method**.

Test Procedure:
ANSI C63.10 § 6.8



Test setup of frequency tolerance

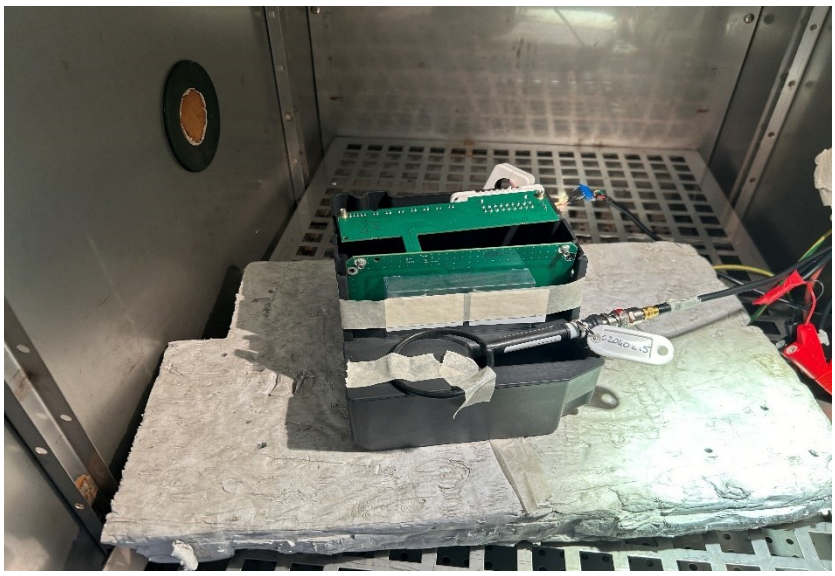


Photo of frequency tolerance

5.3. LIMIT

±0.01% (± 100ppm)

5.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
AC source 1kW	KEYSIGHT	AC6802A	A7042305		
Antenna Loop (near field)	ELECTRO-METRICS	EM-6993	C2040215	09/22	09/25
Attenuator 10dB	AEROFLEX	_	A7122267	10/23	10/25
Cable SMA 2m	_	6GHz	A5329635	03/22	03/24
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	01/23	01/25
Data Logger (CEM1)	AGILENT	34970A	A6440083	05/23	05/25
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	10/22	10/24
Thermo-hygrometer	TESTO	608-H1	B4204120	03/23	03/25

5.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

5.6. *RESULTS*

EUT activation:	**Startup**								
Voltage:	**V_{nom}**								
Temperature:	**-20°C**	**-10°C**	**0°C**	**10°C**	**20°C**	**30°C**	**40°C**	**50°C**	**60°C**
Frequency (MHz)	13.559941	13.559970	13.559749	13.559978	13.559957	13.559930	13.55991907	13.55989707	13.55989679
Frequency Drift (%)	-0.0004%	-0.0002%	-0.0018%	-0.0002%	-0.0003%	-0.0005%	-0.0006%	-0.0008%	-0.0008%
EUT activation:	**2min**								
Voltage:	**V_{nom}**								
Temperature:	**-20°C**	**-10°C**	**0°C**	**10°C**	**20°C**	**30°C**	**40°C**	**50°C**	**60°C**
Frequency (MHz)	13.5599615	13.5599524	13.5599875	13.5597734	13.5599725	13.5599303	13.5599155	13.5599081	13.5599
Frequency Drift (%)	-0.0003%	-0.0004%	-0.0001%	-0.0017%	-0.0002%	-0.0005%	-0.0006%	-0.0007%	-0.0008%
EUT activation:	**5min**								
Voltage:	**V_{nom}**								
Temperature:	**-20°C**	**-10°C**	**0°C**	**10°C**	**20°C**	**30°C**	**40°C**	**50°C**	**60°C**
Frequency (MHz)	13.5599416	13.5600893	13.5599893	13.5599782	13.5598319	13.5599302	13.55992	13.5598786	13.5599
Frequency Drift (%)	-0.0004%	0.0007%	-0.0001%	-0.0002%	-0.0012%	-0.0005%	-0.0006%	-0.0009%	-0.0008%
EUT activation:	**10min**								
Voltage:	**V_{nom}**								
Temperature:	**-20°C**	**-10°C**	**0°C**	**10°C**	**20°C**	**30°C**	**40°C**	**50°C**	**60°C**
Frequency (MHz)	13.5598678	13.559857	13.5599893	13.5600134	13.5597636	13.5599303	13.5599163	13.5598934	13.5599
Frequency Drift (%)	-0.0010%	-0.0011%	-0.0001%	0.0001%	-0.0017%	-0.0005%	-0.0006%	-0.0008%	-0.0008%

Temperature	**T_{nom}**		
Voltage:	**V_{min}**	**V_{nom}**	**V_{max}**
Frequency (MHz)	13.55974536	13.55975461	13.55979675
Frequency Drift (%)	-0.0018%	-0.0018%	-0.0018%

5.7. *CONCLUSION*

Frequency tolerance measurement performed on the sample of the product **RMCIJ1**, Sn: **G123291187**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.225 & RSS 210** limits.

6. FIELD STRENGTH WITHIN THE BAND 13.110-14.010MHz

6.1. *TEST CONDITIONS*

Date of test	:	March 22, 2024
Test performed by	:	Akram HAKKARI
Relative humidity (%)	:	32
Ambient temperature (°C)	:	22

6.2. *TEST SETUP*

The Equipment Under Test is installed **on an Open Area Test Site..**
Measurement is performed with a spectrum analyzer in **radiated method**.

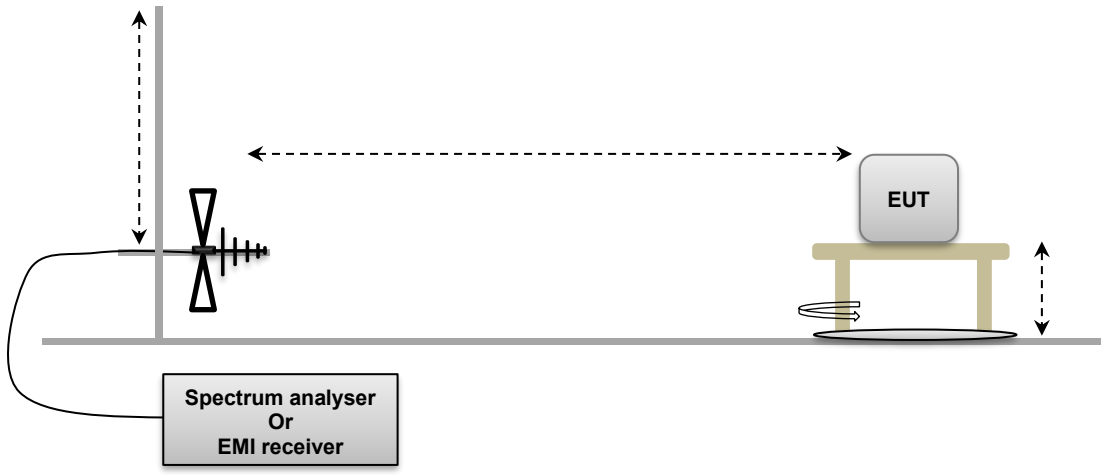
Test Procedure:
ANSI C63.10

The EUT is placed **on an open area test site**. Distance between measuring antenna and the EUT is **10m**. Test is performed in parallel, perpendicular, and ground parallel axis with a loop antenna below 30MHz. Measurement bandwidth was 9kHz between 150kHz & 30MHz. The level has been maximized by the turntable rotation of 360 degrees range on all axis of EUT used in normal configuration. Antenna height search was performed from 1 to 4m. The EUT is place at **0.8m**.

Ambient temperature: 26 °C
Relative humidity: 35 %
Note: It is impracticable to carry out tests under normal condition as specified in standard.

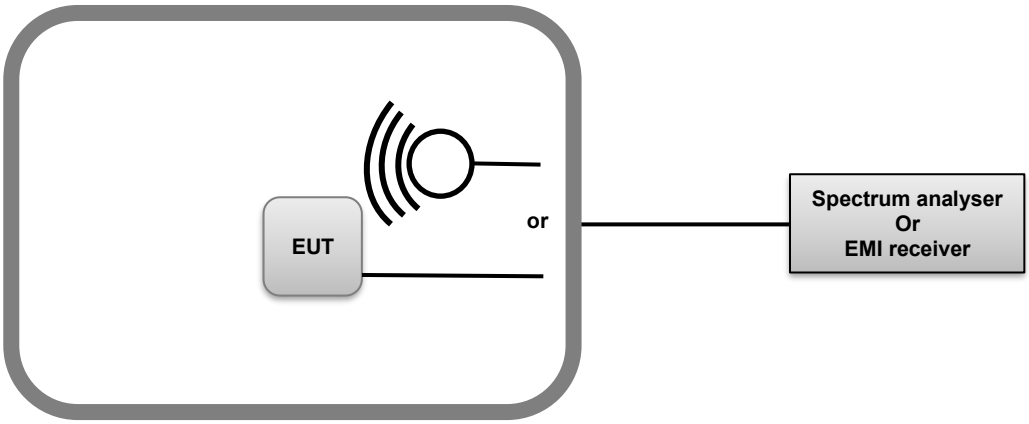
When measurement with test fixture is used, the power level calibration of the spectrum analyzer shall then be related to the power level or field strength measured with temperature during OATS measure taking in consideration in climatic chamber. The calculation will be used to calculate the absolute level of the sideband power.

Frequency band 13.110-14.010MHz
Following plots show radiated emission level in the frequency band 13.110-14.010MHz with a RBW of 9kHz and a quasi-peak detector. The graphs are obtained with a measuring receiver.



Test setup of Field strength within the band 13.110-14.010MHz in OATS

Photo of Field strength within the band 13.110-14.010MHz in OATS



Test setup of Field strength within the band 13.110-14.010MHz in Climatic Chamber

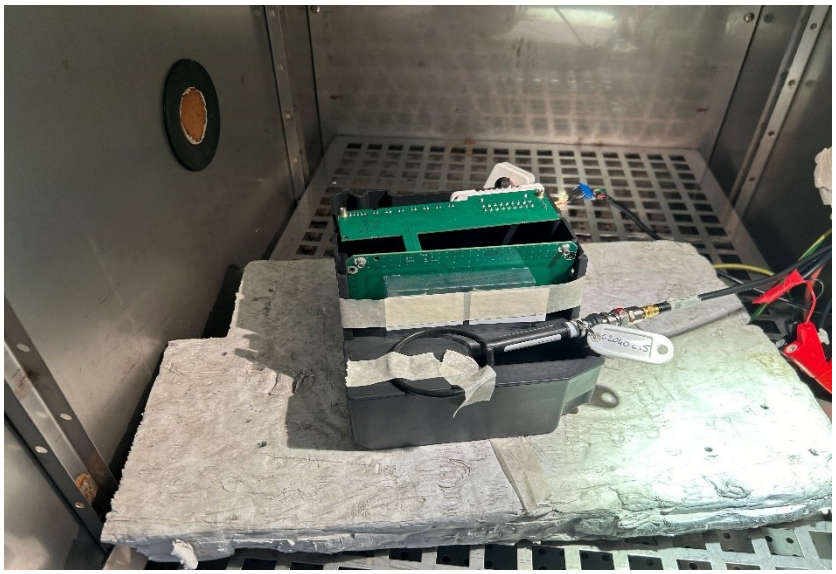


Photo of Field strength within the band 13.110-14.010MHz in Climatic Chamber

6.3. *LIMIT*

Frequency (MHz)	Field strength (µV/m) @30m	Field strength (dBµV/m) @30m
13.553-13.567	15 848	84.0
13.410-13.553 13.567-13.710	334.0	50.5
13.110-13.410 13.710-14.010	106.0	40.5
Below 13.110MHz Above 14.010MHz	30.0	29.5

6.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
AC source 1kW	KEYSIGHT	AC6802A	A7042305		
Antenna Loop (near field)	ELECTRO-METRICS	EM-6993	C2040215	09/22	09/25
Attenuator 10dB	AEROFLEX	_	A7122267	10/23	10/25
Cable SMA 2m	_	6GHz	A5329635	03/22	03/24
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	01/23	01/25
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	10/22	10/24
Thermo-hygrometer	TESTO	608-H1	B4204120	03/23	03/25
Antenna Mat (OATS)	ETS Lingren	2071-2	F2000392		
Cable	RADIALEX	_	A5329062	08/22	08/24
Cable (OATS)	_	1GHz	A5329623	09/23	09/24
Cable substitution (OATS)	RADIALEX		A5329059	09/22	09/24
Cable substitution (OATS)	RADIALEX		A5329057	09/22	09/24
Emission Cable	RADIALEX		A5329061	07/23	07/24
OATS	_	_	F2000409	08/23	08/24
RADIO ERP_EIRP	LCIE SUD EST	RADIO ERP_EIRP v4	L2000034		
Rehausse Table C1/OATS	LCIE	_	F2000512		
Table C1/OATS	LCIE	_	F2000445		
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	05/23	05/25
Turntable (OATS)	ETS Lingren	Model 2187	F2000403		
Turntable / Mast controller (OATS)	ETS Lingren	Model 2066	F2000372		
Antenna loop	ELECTRO-METRICS	EM-6879	C2040294	08/22	08/24
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	03/23	03/25

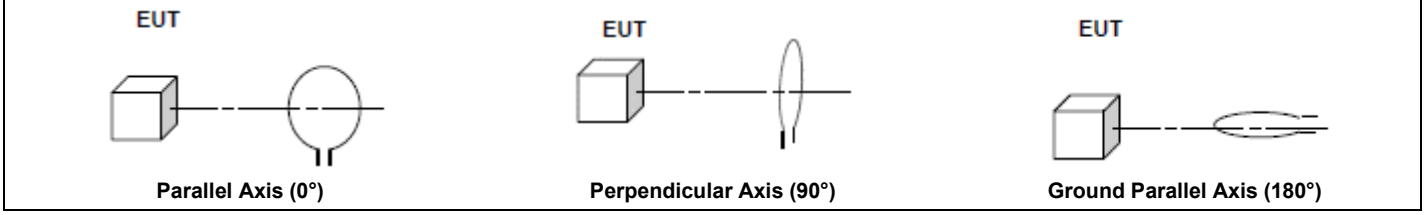
6.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

6.6. *RESULTS*

6.6.1. Results on OATS test conditions:

Frequency (MHz)	QPeak Limit (dBµV/m) @ 30m	QPeak (dBµV/m) @ 30m	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
13.56	84.0	47	**37**	0	90	150	36.3	-

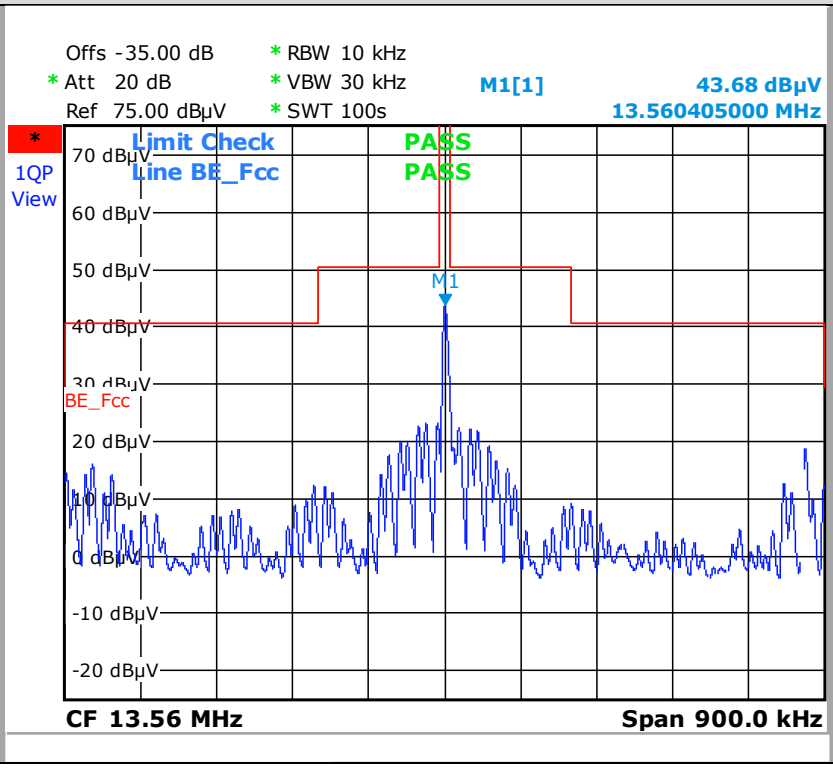


Parallel Axis (0°) | Perpendicular Axis (90°) | Ground Parallel Axis (180°)

Note: Measure have been done at 10m distance and corrected according to requirements of 15.209.e) (M@30m = M@10m-19.1dB)

6.6.2. Results under Normal condition

Plots (Tnom)



6.7. *CONCLUSION*

Field strength within the band 13.110-14.010MHz measurement performed on the sample of the product **RMCIJ1**, Sn: **G123291187**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.225 & RSS 210** limits.

7. FIELD STRENGTH OUTSIDE OF THE BANDS 13.110-14.010 MHz

7.1. *TEST CONDITIONS*

Date of test : March 22, 2024
Test performed by : Akram HAKKARI
Relative humidity (%) : 32
Ambient temperature (°C) : 21

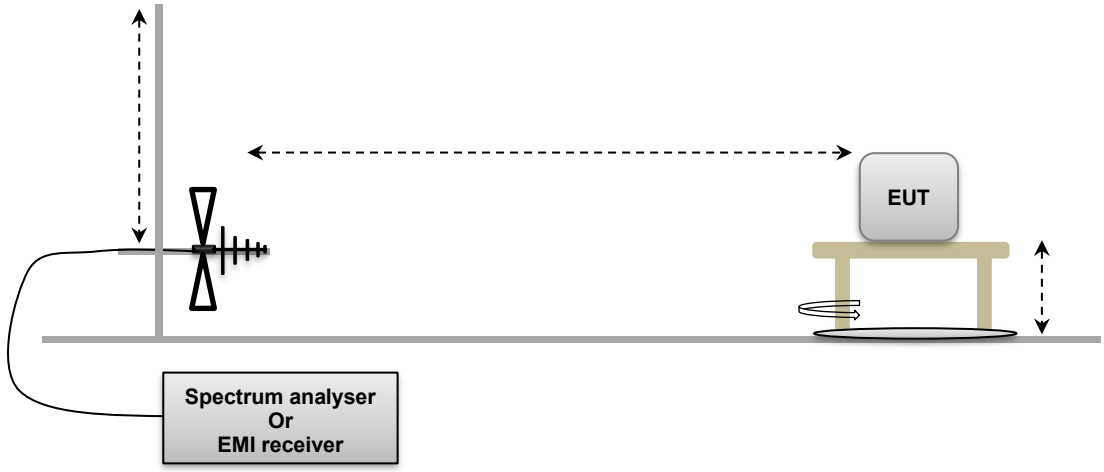
7.2. TEST SETUP

Test procedure:
ANSI C63.10 & FCC Part 15 subpart C

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

Frequency range:	**9kHz to 30MHz**	
Test:	**Pre-Characterization**	**Qualification**
Antenna Polarization:	Parallel, Perpendicular and Ground parallel	
Antenna Height:	Centered on EUT (§6.6.5 ANSI C63-10)	1m
Antenna Type:	Loop	
RBW Filter:	200Hz below 150kHz / 9kHz above 150kHz	
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:	Peak	QPeak

Frequency range:	**30MHz to 1GHz**	
Test:	**Pre-Characterization**	**Qualification**
Antenna Polarization:	Horizontal and Vertical	
Antenna Height:	Centered on EUT (§6.6.5 ANSI C63-10)	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:	Peak	QPeak



Test setup of Field strength outside the band 13.110-14.010MHz

Same setup is used in semi anechoic chamber during pre-characterization, with a distance of 3m between EUT and antenna.

Photo of Field strength outside the band 13.110-14.010MHz

7.3. *LIMIT*

Measure at 300m		
Frequency range	**Level**	**Detector**
9kHz-490kHz	67.6dBµV/m /F(kHz)	QPeak
Measure at 30m		
Frequency range	**Level**	**Detector**
490kHz-1.705MHz	87.6dBµV/m /F(kHz)	QPeak
1.705MHz-30MHz	29.5dBµV/m	QPeak
Measure at 3m		
Frequency range	**Level**	**Detector**
30MHz to 88MHz	40dBµV/m	QPeak
88MHz to 216MHz	43.5dBµV/m	QPeak
216MHz to 960MHz	46BµV/m	QPeak
960MHz to 1000MHz	54dBµV/m	QPeak
Above 1000MHz	74dBµV/m	Peak
	54dBµV/m	Average

7.4. *TEST EQUIPMENT LIST*

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Amplifier 10MHz - 18GHz	LCIE SUD EST	_	A7102082	05/22	05/24
Antenna Bi-log	AH System	SAS-521-7	C2040180	05/23	05/25
Antenna loop	ELECTRO-METRICS	EM-6879	C2040294	08/22	08/24
BAT EMC	NEXIO	v3.21.0.32	L1000115		
Cable 0.75m	-	18GHz	A5329900	08/22	08/24
Comb EMR HF	YORK	CGE01	A3169114		
CONTROLLER	INNCO	CO3000	D3044034		
Filter Matrice	LCIE SUD EST	Combined filters	A7484078	03/23	03/25
Multimeter - CEM	FLUKE	87	A1240251	10/23	10/25
Rehausse Table C3	LCIE	_	F2000511		
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	A5330060	02/23	02/24
SMA Cable 18GHz 0.5m	TELEDYNE	18GHz	A5330059	02/23	02/24
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		
Antenna Mat (OATS)	ETS Lingren	2071-2	F2000392		
Cable (OATS)	_	1GHz	A5329623	09/23	09/24
Emission Cable	RADIALEX		A5329061	07/23	07/24
Emission Cable	CABELTEL	6GHz	A5329069	02/24	02/25
OATS	_	_	F2000409	08/23	08/24
Rehausse Table C1/OATS	LCIE	_	F2000512		
Table C1/OATS	LCIE	_	F2000445		
Turntable (OATS)	ETS Lingren	Model 2187	F2000403		
Turntable / Mast controller (OATS)	ETS Lingren	Model 2066	F2000372		

7.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

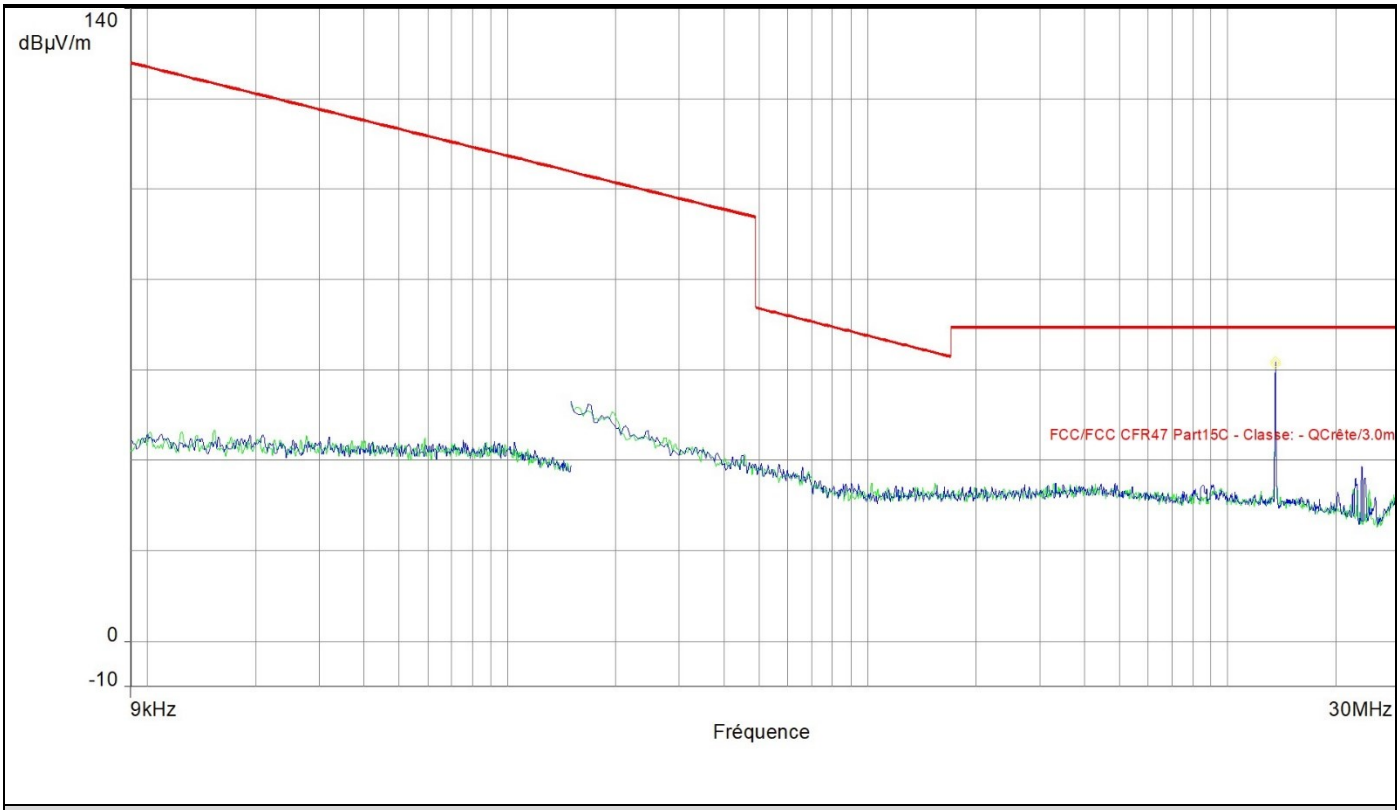
7.6. *RESULTS*

7.6.1. 9kHz to 1 GHz

Graphs – Pre characterization:

Graph identifier		Polarization	Mode	Channel	EUT position	Comments
Emr#	1	0°/90°	TX	Single	Axis XY/Z	9KHz-30MHz
Emr#	2	180°	TX	Single	Axis XY/Z	9KHz-30MHz
Emr#	3	H/V	TX	Single	Axis XY/Z	30MHz-1GHz

RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(0°/90°) - TX mode - Automatic Axis	
Class:			
Frequency range: [9kHz - 30MHz]			
Antenna polarization:		**RBW :**	200Hz to 10kHz
Azimuth:	0° - 360°	**VBW :**	1kHz to 30kHz

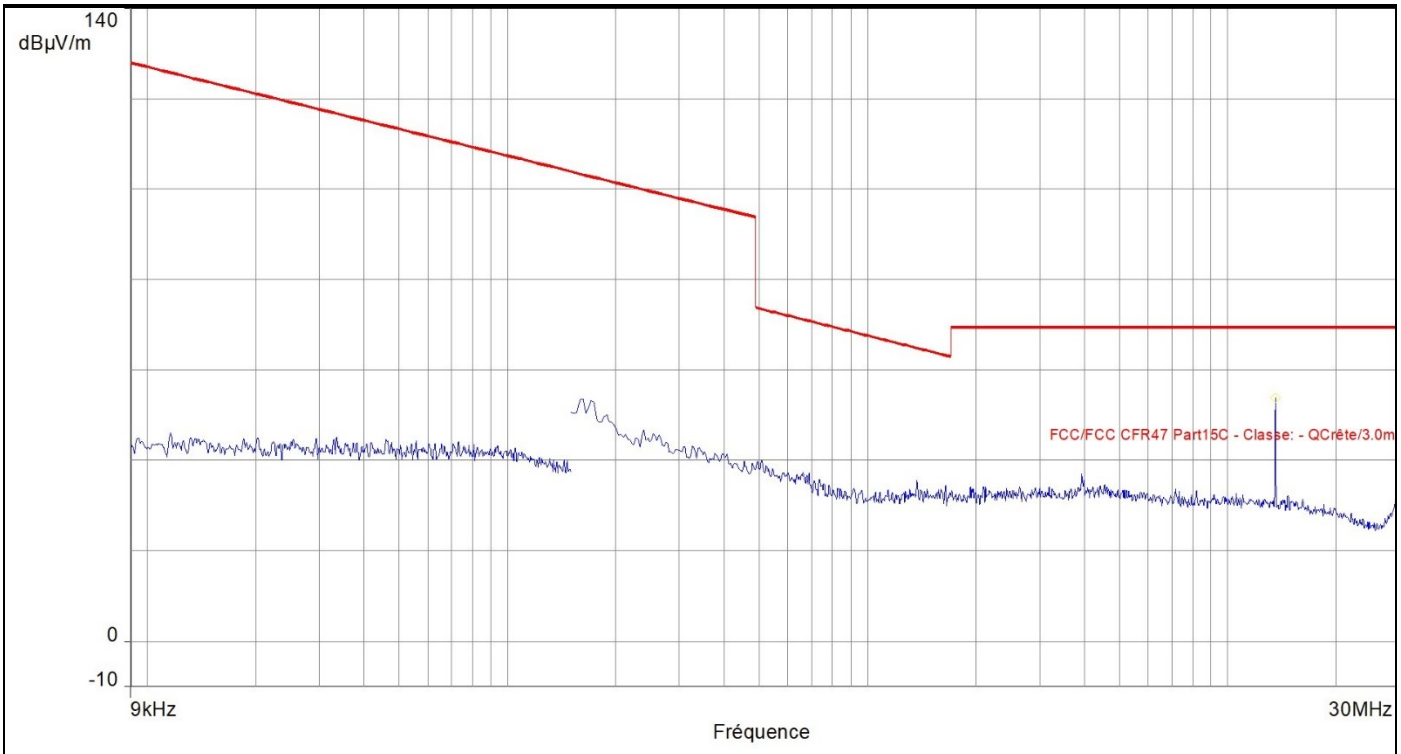


Spurious emissions

Fréquence (MHz)	SB	Peak (dBµV/m)	Lim.Q-Peak (dBµV/m)	Angle1 (°)	Polarisation	Correction (dB)
13.561605*	2	61.94	69.50	86.00	Horizontal	39.01
13.561605*	3	61.25	69.50	63.00	Vertical	39.01

*Carrier frequency
No significant frequency observed

RADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(180°) - TX mode - Automatic Axis	
Class:			
Frequency range: [9kHz - 30MHz]			
Antenna polarization:		**RBW :**	200Hz to 10kHz
Azimuth:	0° - 360°	**VBW :**	1kHz to 30kHz

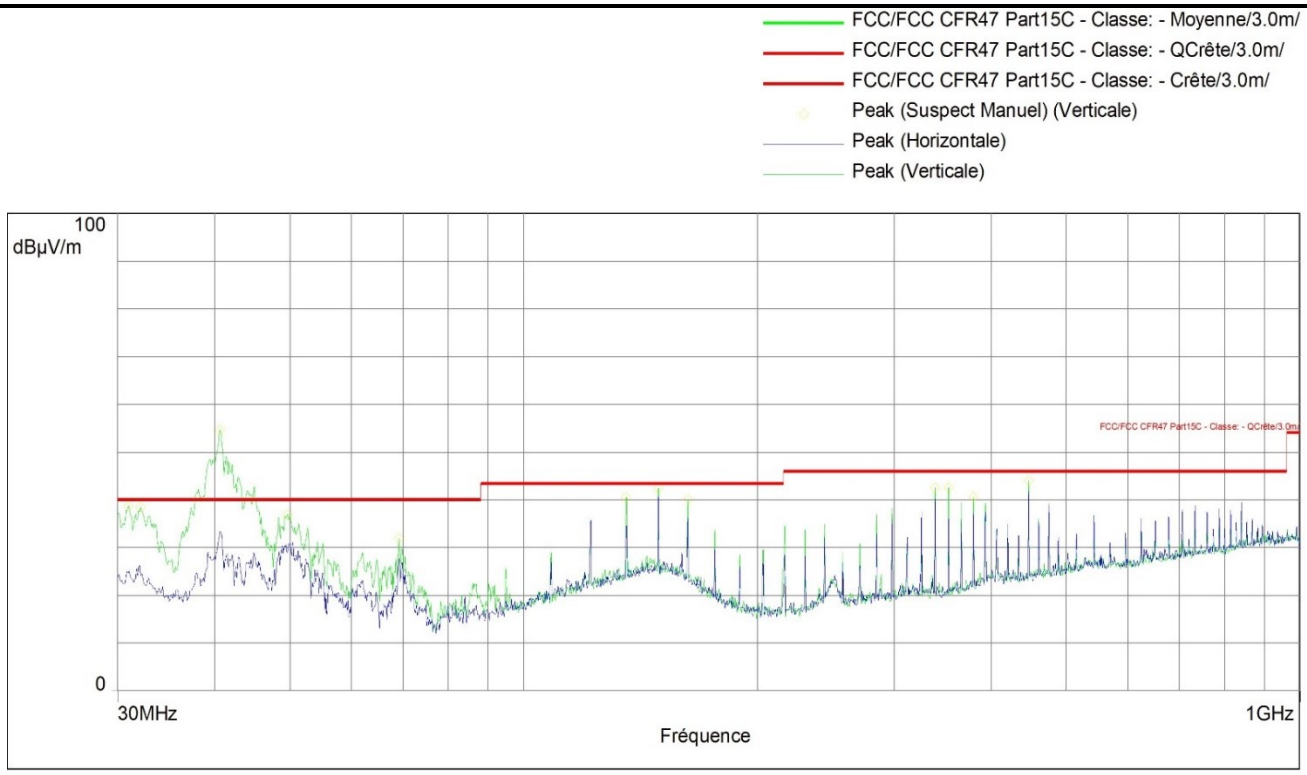


Spurious emissions

Fréquence (MHz)	SB	Peak (dBµV/m)	Lim.Q-Peak (dBµV/m)	Angle1 (°)	Polarisation	Correction (dB)
13.561605*	2	53.93	69.50	0.00	Horizontal	39.01

*Carrier frequency
No significant frequency observed

RADIATED EMISSIONS			
Graph name:	Emr#3	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - TX mode - Automatic Axis	
Class:			
Frequency range: [30MHz - 1GHz]			
Antenna polarization:		**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions

Fréquence (MHz)	SB	Peak (dBµV/m)	Lim.Q-Peak (dBµV/m)	Angle1 (°)	Polarisation	Correction (dB)
32.134	2	38.35	40.00	67.00	Vertical	20.67
40.67	2	54.69	40.00	167.00	Vertical	16.18
49.594	2	36.98	40.00	347.00	Vertical	12.15
69.091	2	31.92	40.00	60.00	Vertical	10.52
135.536	2	40.46	43.50	356.00	Vertical	22.42
149.116	2	42.35	43.50	319.00	Vertical	23.86
162.696	2	40.09	43.50	331.00	Vertical	21.81
338.945	2	42.53	46.00	301.00	Vertical	18.01
352.525	2	42.60	46.00	85.00	Vertical	18.08
379.685	2	40.59	46.00	110.00	Vertical	19.42
447.488	2	43.99	46.00	52.00	Vertical	21.18

Final measurement:

Test Frequency (MHz)	Meter Reading dB(µV)	Detector (Pk/QP/Av)	Transducer Factor (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
32.1300	24.4	QP	14.0	38.4	40.0	-1.6
40.6700	21.0	QP	13.9	34.9	40.0	-5.1
49.5900	21.6	QP	12.2	33.8	40.0	-6.2
30.9700	23.3	QP	13.9	37.2	40.0	-2.8
69.0900	30.7	QP	7.3	38.0	40.0	-2.0
135.5300	20.3	QP	16.2	36.5	43.5	-7.0
149.1100	21.6	QP	18.8	40.4	43.5	-3.1
162.6900	15.9	QP	19.5	35.4	43.5	-8.1
338.9400	26.9	QP	18.6	45.5	46.0	-0.5
352.5200	26.6	QP	19.2	45.8	46.0	-0.2
379.6800	10.5	QP	19.8	30.3	46.0	-15.7
447.4880	10.5	QP	22.2	32.7	46.0	-13.3
176.2700	21.1	QP	18.0	39.1	43.5	-4.4
216.9100	7.4	QP	12.4	19.8	46.0	-26.2
474.6480	19.0	QP	23.1	42.1	46.0	-3.9
542.4500	7.5	QP	25.0	32.5	46.0	-13.5
703.1600	7.3	QP	27.9	35.2	46.0	-10.8
732.2800	7.8	QP	29.7	37.5	46.0	-8.5
759.4400	11.7	QP	29.9	41.6	46.0	-4.4
786.5000	12.8	QP	29.8	42.6	46.0	-3.4

7.7. *CONCLUSION*

Field strength outside of the bands 13.110-14.010 MHz measurement performed on the sample of the product **RMCIJ1**, Sn: **G123291187**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.225 & RSS-Gen** limits.

8. MEASUREMENT OF CONDUCTED EMISSION

8.1. TEST CONDITIONS

Date of test	:	April 12, 2024
Test performed by	:	Akram HAKKARI
Relative humidity (%)	:	32
Ambient temperature (°C)	:	21

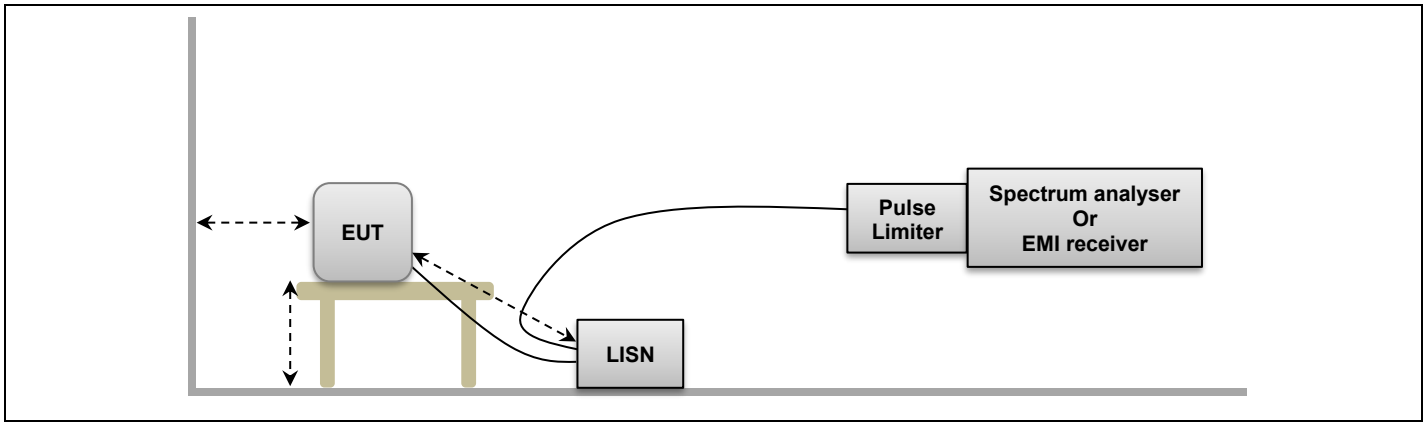
8.2. TEST SETUP

Test procedure:
ANSI C63.10 / C63.4 & FCC Part 15 subpart C

The EUT and auxiliaries are set 80cm above the ground on the non-conducting table (Table-top equipment) at 80cm from the LISN, the cable has been shorted to 1meter length. The distance between the EUT and the vertical ground plane is 40cm. Measurement is made with a receiver in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary. Interconnecting cables and equipment were moved to position that maximized emission. The EUT is powered like specified in following table, through a LISN (measure); auxiliaries are powered by another LISN.

Frequency range:	**150kHz to 30MHz**	
Test:	**Pre-Characterization**	**Qualification**
RBW Filter:	10kHz	9kHz
Detector:	Peak & Average	QPeak & Cispr Average
Mode:	Linear Scan	

Type	**Measurement performed:**	
☑ AC / ☐ DC (Auxiliary used)	☑ 120VAC/60Hz	☑ 240VAC/50Hz
☑ USB (Laptop auxiliary)	☐ 120VAC/60Hz (Laptop auxiliary)	☐ 240VAC/50Hz (Laptop auxiliary)



Test setup of AC Power Line Conducted Emissions	

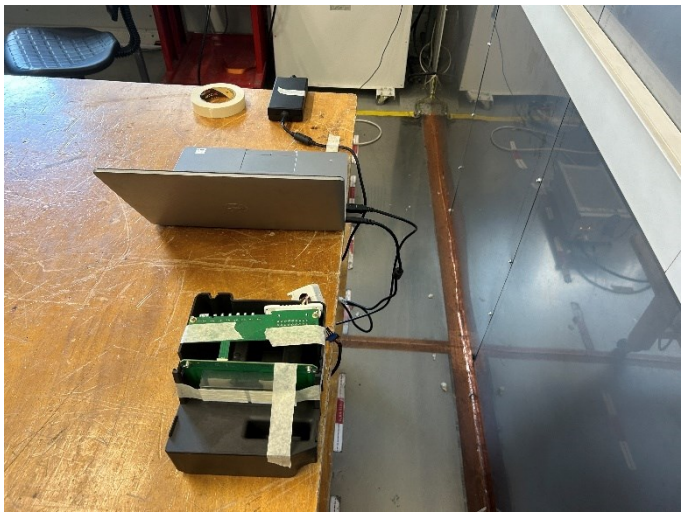



Photo of AC Power Line Conducted Emissions	

8.3. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
BAT EMC	NEXIO	v3.21.0.32	L1000115		
Cable + self	_	_	A5329578	05/22	05/24
EMC comb generator	LCIE SUD EST	_	A3169098		
LISN	ROHDE & SCHWARZ	ENV216	C2320291	07/23	07/24
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	03/23	03/25
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	05/23	05/25
Transient limiter	ROHDE & SCHWARZ	ESH3-Z2	A7122204	08/22	08/24

8.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

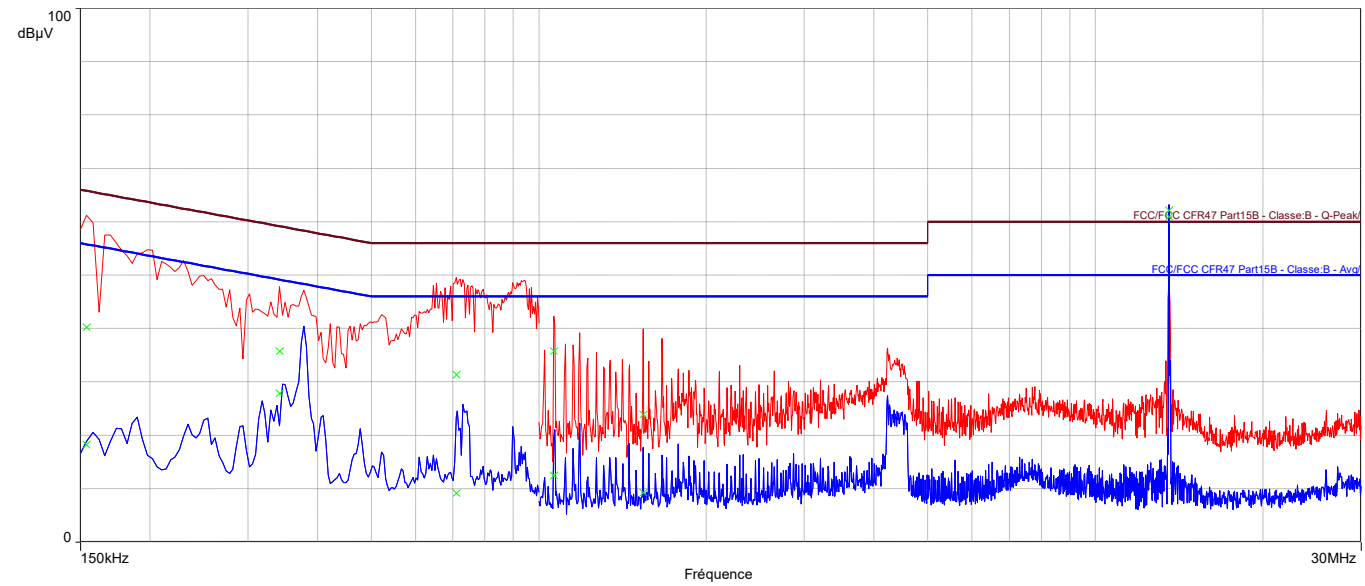
8.5. TEST RESULTS – RUNNING MODE N°1

Measurements are performed on the phase (L1) and neutral (N) of the power line.

Results: (PEAK detection)

Graph identifier		Line	Comments	
Emc#	1	Neutral	240VAC/50Hz	-
Emc#	2	Phase	240VAC/50Hz	-
Emc#	3	Phase	120VAC/60Hz	-
Emc#	4	Neutral	120VAC/60Hz	-

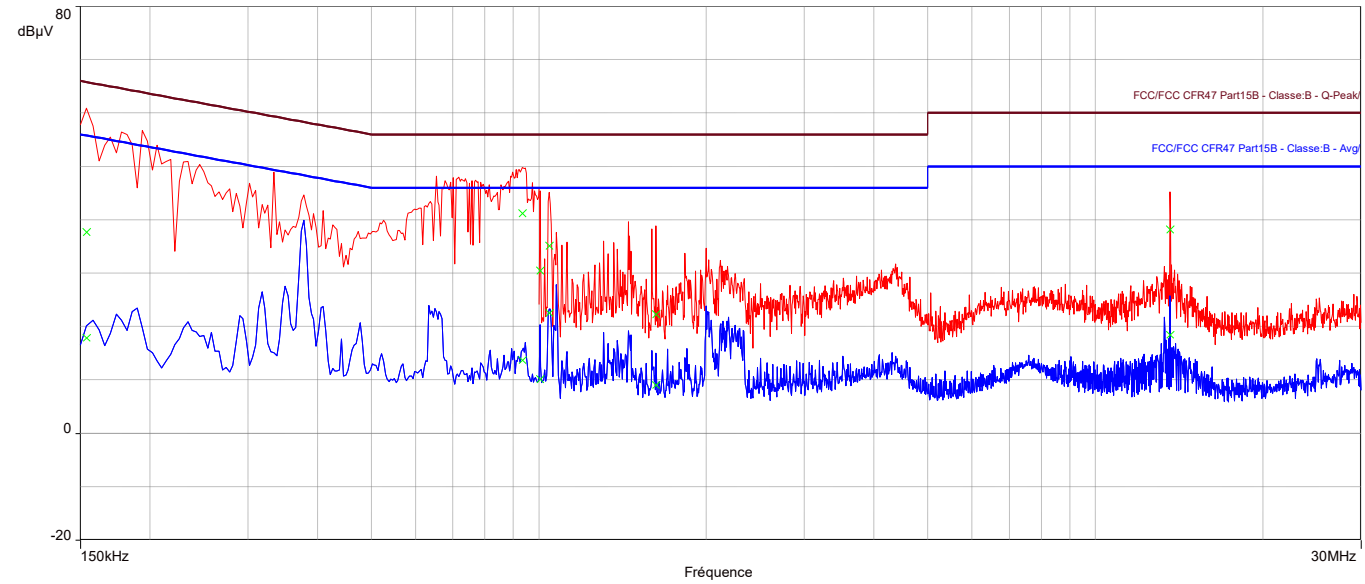
CONDUCTED EMISSIONS			
Graph name:	Emc#1	**Test configuration:**	
Limit:	FCC CFR47 Part15B	Module Markem 240Vac 50Hz Neutral NEW	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:		**RBW:** 10kHz	**VBW:** 30kHz
Line:		**Trace color & detector:**	PEAK AVG



Spurious emissions

Frequency (MHz)	QPeak (dBµV)	Lim.QPeak (dBµV)	QPeak-Lim.QPeak (dB)	CISPR.AVG (dBµV)	Lim.CISPR.AVG (dBµV)	CISPR.AVG-Lim.CISPR.AVG (dB)	Correction (dB)
0.154	40.30	65.78	-25.48	18.23	55.78	-37.55	19.65
0.342	35.88	59.15	-23.28	27.98	49.15	-21.18	19.69
0.71	31.38	56.00	-24.62	9.20	46.00	-36.80	19.69
1.064	35.83	56.00	-20.17	12.53	46.00	-33.47	19.56
1.54	23.93	56.00	-32.07	9.37	46.00	-36.63	19.46
13.56	62.20	60.00	2.20	61.05	50.00	11.05	20.04

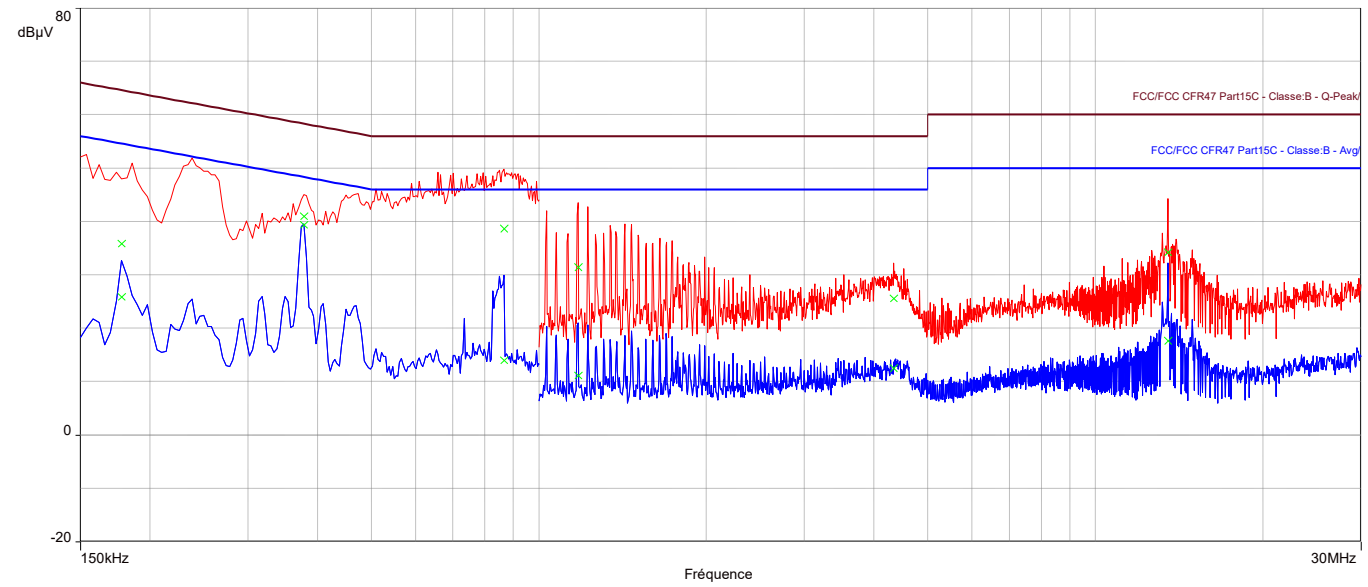
CONDUCTED EMISSIONS			
Graph name:	Emc#2	**Test configuration:**	
Limit:	FCC CFR47 Part15B	Module Markem 240Vac 50Hz Line NEW	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:		**RBW:** 10kHz	**VBW:** 30kHz
Line:		**Trace color & detector:**	PEAK AVG



Spurious emissions

Frequency (MHz)	QPeak (dBµV)	Lim.QPeak (dBµV)	QPeak-Lim.QPeak (dB)	CISPR.AVG (dBµV)	Lim.CISPR.AVG (dBµV)	CISPR.AVG-Lim.CISPR.AVG (dB)	Correction (dB)
0.154	37.73	65.78	-28.05	17.98	55.78	-37.81	19.65
0.934	41.18	56.00	-14.82	13.72	46.00	-32.28	19.60
1.004	30.44	56.00	-25.56	10.13	46.00	-35.87	19.59
1.044	35.12	56.00	-20.88	22.64	46.00	-23.36	19.57
1.624	22.29	56.00	-33.71	9.09	46.00	-36.91	19.54
13.6	38.21	60.00	-21.79	18.49	50.00	-31.51	20.03

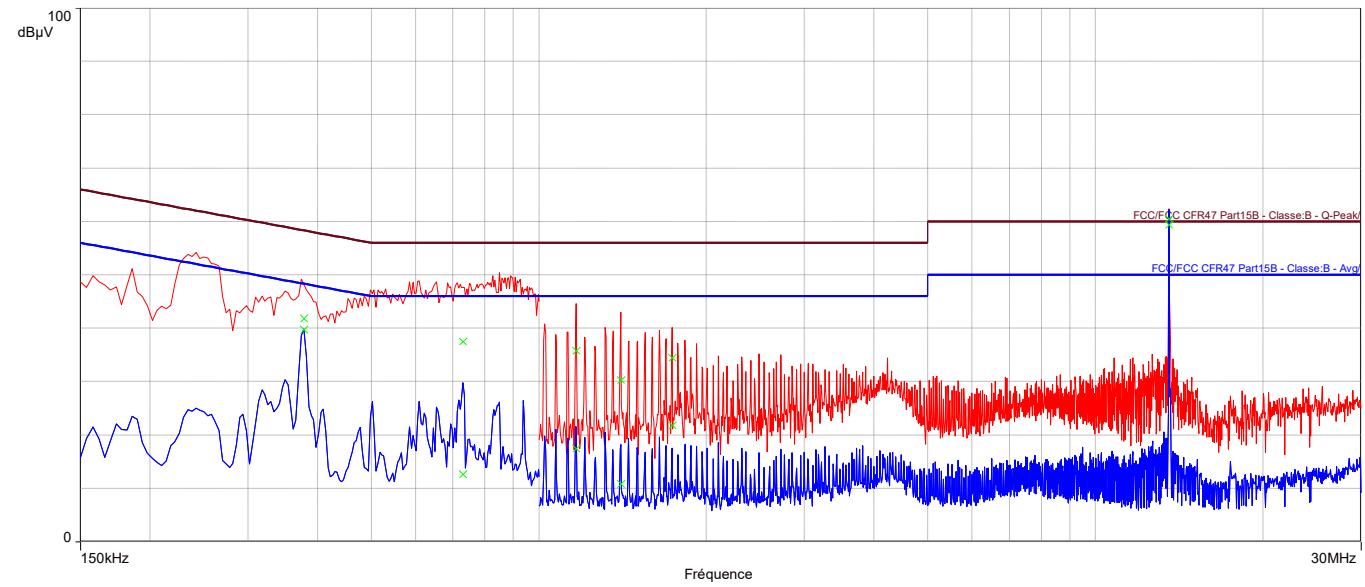
CONDUCTED EMISSIONS			
Graph name:	Emc#3	**Test configuration:**	
Limit:	FCC CFR47 Part15B	Module Markem 120Vac 60Hz Line NEW	
Class:	A		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:		**RBW:** 10kHz	**VBW:** 30kHz
Line:		**Trace color & detector:**	PEAK AVG



Spurious emissions

Frequency (MHz)	QPeak (dBµV)	Lim.QPeak (dBµV)	QPeak-Lim.QPeak (dB)	CISPR.AVG (dBµV)	Lim.CISPR.AVG (dBµV)	CISPR.AVG-Lim.CISPR.AVG (dB)	Correction (dB)
0.178	35.91	79.00	-43.09	25.92	66.00	-40.08	19.87
0.378	41.06	79.00	-37.94	39.42	66.00	-26.58	19.75
0.866	38.66	73.00	-34.34	14.02	60.00	-45.98	19.62
1.176	31.45	73.00	-41.55	11.22	60.00	-48.78	19.42
4.344	25.62	73.00	-47.38	12.54	60.00	-47.46	19.59
13.504	34.24	73.00	-38.76	17.68	60.00	-42.32	20.03

CONDUCTED EMISSIONS			
Graph name:	Emc#4	**Test configuration:**	
Limit:	FCC CFR47 Part15B	Module Markem 120Vac 60Hz Neutral NEW	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:		**RBW:** 10kHz	**VBW:** 30kHz
Line:		**Trace color & detector:**	PEAK AVG



Spurious emissions

Fequency (MHz)	QPeak (dBµV)	Lim.QPeak (dBµV)	QPeak-Lim.QPeak (dB)	CISPR.AVG (dBµV)	Lim.CISPR.AVG (dBµV)	CISPR.AVG-Lim.CISPR.AVG (dB)	Correction (dB)
0.378	41.80	58.32	-16.52	39.70	48.32	-8.62	19.75
0.73	37.53	56.00	-18.47	12.69	46.00	-33.31	19.68
1.168	35.84	56.00	-20.16	17.48	46.00	-28.52	19.41
1.404	30.31	56.00	-25.69	10.85	46.00	-35.15	19.40
1.736	34.50	56.00	-21.50	21.88	46.00	-24.12	19.56
13.56*	60.58	60.00	0.58	59.39	50.00	9.39	20.04

* : The emission at 13.56MHz was retested and passed with 100 Ohm resistor in place of antenna

8.6. CONCLUSION

The sample of the equipment **RMCIJ1**, Sn : **G123291187**, tested in the configuration presented in this test report **satisfies** to requirements of the product family standard applied (See §Test Program) for conducted emissions.

9. UNCERTAINTIES CHART

Kind of measurement	*Wide uncertainty laboratory*
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.