Test report issued under the responsibility of:
EMITECH MONTPELLIER laboratory
MRA US-EU Designation Number: FR0006
Canadian CAB Identifier: FR0003

RADIO TEST REPORT

FCC 47 CFR Part 15.225
RSS-210 Issue 10

Company ..... :	**STMicroelectronics SAS**
Address..... :	190 Avenue Celestin Coq 13106 ROUSSET FRANCE

Test item description. ..... :	**NFC card reader expansion board**
Trade Mark. ..... :	ST Microelectronics
Manufacturer..... :	STMicroelectronics SAS
Model/Type reference..... :	X-NUCLEO-NFC08A1
FCC ID ..... :	YCPNFC08A1
IC ..... :	8976A-NFC08A1
Ratings..... :	5V +/-5%

Testing Laboratory ..... :	**EMITECH MONTPELLIER laboratory**
Address..... :	145 rue de Massacan 34740 VENDARGUES FRANCE

Report Reference No..... :	**RR-EVE-21F231-2A**
Test procedure. ..... :	FCC IC Certification
Diffusion..... :	Mr. Joel HULOUX
Applicant's name. ..... :	STMicroelectronics SAS
Date of issue..... :	May 4, 2022
Total number of pages..... :	46
Revision. ..... :	0
Modified page(s). ..... :	Creation
Compiled by..... :	Célien FOUGEROLLE
Approved by (+ signature). ..... :	Olivier HEYER (Laboratory Manager)

REPORT INDEX:

REVISION HISTORY:

Revision	Date	Modified pages	Modifications
0	May 4, 2022	/	Creation

1. GENERAL INFORMATIONS

This document submits the results of Radio tests performed on the equipment **X-NUCLEO-NFC08A1** (denominated hereafter E.U.T.: equipment under test) according to document(s) listed in §2 of this test report.

TESTING PROCEDURE AND TESTING LOCATION:

Testing Location ..... :	EMITECH MONTPELLIER laboratory & Open Area Test Site in SALINELLES (30)
Address. ..... :	145 rue de Massacan 34740 VENDARGUES FRANCE
Test procedure. ..... :	FCC IC Certification
Tested by ..... :	Célien FOUGEROLLE
Test supervisor ..... :	Olivier AELBRECHT & Morgan PATEY
Date of receipt of test item ..... :	N/A
Date (s) of performance of tests ..... :	October, from the 25th to the 28th of 2021

APPLICANT'S GENERAL INFORMATIONS:

Company name ..... :	STMicroelectronics SAS
Company address. ..... :	190 Avenue Celestin Coq 13106 ROUSSET FRANCE
Person(s) present during the tests. ..... :	No representative for company attended the tests.
Responsible. ..... :	Mr. Joel HULOUX

GENERAL REMARKS:

The information in italics is declared by the manufacturer and is under his responsibility
The test results presented in this report relate only to the object tested.
The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.
Throughout this report the decimal separator is point.

POSSIBLE TEST CASE VERDICTS:

Test case does not apply to the test object.:	N/A
Test case not performed..... :	N/P
Test object does meet the requirement..... :	P (Pass)
Test object does not meet the requirement. ..... :	F (Fail)

DEFINITIONS AND ABBREVIATIONS:

E.U.T.	Equipment under test	AE	Ancillary equipment	Pk	Peak detector
RBW	Resolution bandwidth	VBW	Video bandwidth	QP	Quasi-peak detector
OATS	Open area test site	FAR	Full anechoic room	Av	Average detector
VP	Vertical Polarization	HP	Horizontal Polarization	RMS	Root Mean Square
RF	Radio frequency	NTR	Nothing to report	N/C	Not communicated

2. REFERENCE DOCUMENT(S)

NORMATIVE REFERENCES:

The following referenced documents are necessary for the application of the present test report.

FCC 47 CFR PART 15:2020
Code of federal regulations. Title 47- Telecommunication Chapter 1- Federal Communication Commission. Part 15- Radio frequency devices Subpart B- Unintentional Radiators. Limits and methods of measurement of radio disturbance. Characteristic of information technology equipment.

FCC 47 CRF Part 15.225: 2020
Operation within the bands 13.553-13.567MHz

RSS-210 _ Issue 10, December 2019
Licence-exempt Radio Apparatus: Category I Equipment
Annex B – Devices Operating in Frequency Bands for Any Application

RSS-Gen - Issue 5, March 2019 Amendment 1
General requirements and Information for the Certification of radio Apparatus

ANSI C 63.10: 2013
American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

ANSI C 63.4:2014
American National Standard for Methods of measurement of Radio-Noise from low-voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

Although the product standard uses obsolete technical standards, the latest versions of standards achievable by the laboratory will be used for testing.

INFORMATIVE REFERENCES:

The following referenced documents are not necessary for the application of the present test report but they assist the user with regard to a particular subject area.

3. EQUIPMENT TECHNICAL DESCRIPTION

3.1. Test Conditions

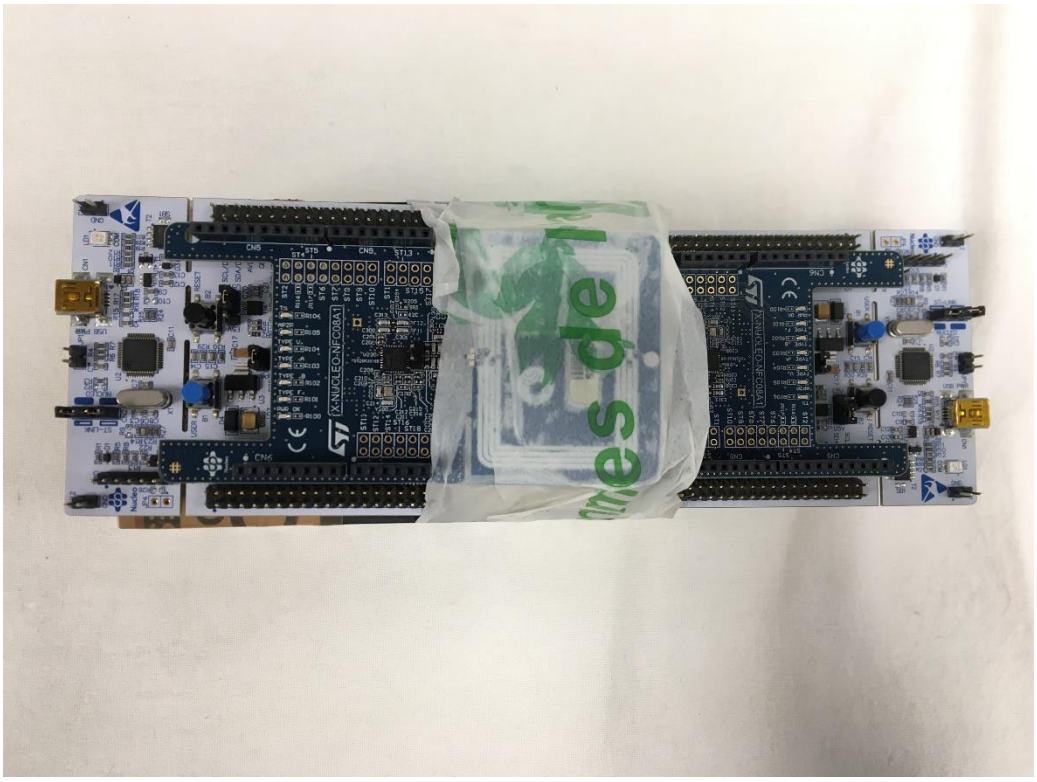
Test item description.	:	NFC card reader expansion board
Model/Type reference	:	X-NUCLEO-NFC08A1
FCC ID	:	YCPNFC08A1
IC	:	8976A-NFC08A1
Trade Mark.	:	ST Microelectronics
Serial number (S/N).	:	Not communicated
Part number (P/N).	:	Not communicated
Software version.	:	*Not communicated*
Firmware version.	:	*Not communicated*
Type of sample.	:	Prototype
Function(s).	:	Demonstration card of the chip ST25R3916B: RFID reader
Manufacturer name.	:	Not communicated
Address.	:	Not communicated

General product information:

N/A

3.2. EUT Marking plate

3.3. EUT General view

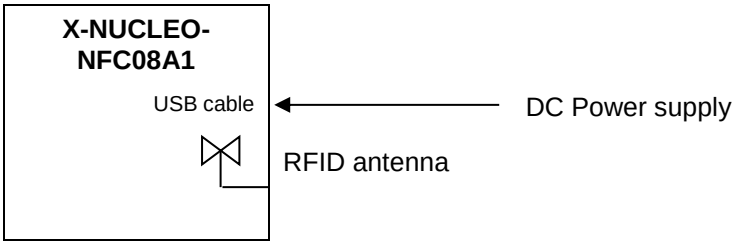


3.4. EUT Mechanical and Electrical Design

Power supply. ..... : *5Vdc*
Power supply range. ..... : *5V +/-5%*
Power type. ..... : *USB*
Power (W). ..... : *2*
Nominal current (A). ..... : *0.2*
Dimensions (L x W x H) (m). ..... : *Not communicated*
Weight (kg). ..... : *0.05*
Temperature range (°C). ..... : *10 to 40*
Ground bounding strap. ..... : *No*

Comments:
N/A

3.5. EUT Input/Output ports



PORT	NAME	TYPE	LENGTH	CABLE TYPE	COMMENTS
0	Main frame	N/E	N/A	Plastic	N/A
1	DC Power supply	AC/DC	N/A	Shielded	N/A
2	RFID antenna	RF	N/A	N/A	N/A

AC/DC : AC/DC Converter port
AC: Alternative current port
DC: Discontinuous current port
I/O: Input or Output port
TP: Telecommunication port
RF: Radio frequency port
N/E: Non Electrical port

3.6. Supporting Equipment Used During Test

Sample subject to the tests was tested with following equipment.

PRODUCT TYPE	MANUFACTURER	MODEL	N°EMITECH / COMMENTS
Power bank	Xindao B.V	P234.25	Use for all mode
RFID tag	STMICROELECTRONICS	ST25TV02KC	Use for reader mode
Demo board	STMICROELECTRONICS	NUCLEO-L476RG	Use for card emulation mode
Tag board	STMICROELECTRONICS	NUCLEO-L476RG	Use to simulate RFID tag for card emulation mode
Test Laptop	DELL	Latitude 510	Use for conducted emission
AC/DC loader (standard power supply)	ANSMANN	1001-0066	Use to supply power during extreme condition test

POWER BANK AND STANDARD POWER SUPPLY (EA)

LAPTOP (EA)


DELL
65.0W
IS 13252(Part 1):
IEC 60950-1
R-41012432
NSW27649
www.bis.gov.in

RFID TAG (EA)
   

3.7. EUT Radio Specifications

a) GENERAL INFORMATIONS

According to manufacturer's declarations:

EUT type	:	*Transmitter*
Technology	:	*RFID HF*
Environmental profile	:	*Not communicated*
Temperature range	:	*Category III (Indoor) (+10°C to +40°C)*
Antenna type	:	*Integral*
Antenna Gain	:	*1 dBi*

Comments:

N/A

b) TRANSMITTER PARAMETERS (TX)

Frequency bands	:	*N/A*
RF Power	:	*1.7W*
Number of channels / Separation	:	*Not communicated*
Modulation type	:	*AM*
Duty cycle	:	*2/5*
Tested frequency	:	*13.56MHz*

c) RECEIVER PARAMETERS (RX)

Frequency bands	:	*Not communicated*
Category/Class	:	*Not communicated*
Bandwidth	:	*Not communicated*

4. RESULT SUMMARY

TEST DESIGNATION	SEVERITY	VERDICT	COMMENTS
GENERAL			
Labeling requirements		N/P	See certification documents
Information to user		N/P	See certification documents
Home-built devices		N/A	
Kits		N/A	
Special Accessories		N/P	See certification documents
Inspection by the Commission		N/A	
Measurement standards		PASS	
Test procedure for CPU boards and computer power supplies		N/A	
Frequency range of radiated measurements		PASS	
Measurement detector functions and bandwidths		PASS	
Transition provisions for compliance with the rules		N/P	See certification documents
UNINTENTIONAL RADIATORS			
Equipment authorization			
- Verification		N/A	
- Declaration of Conformity		N/A	
CPU boards and power supplies used in personal computers		N/A	
Exempted device		N/A	
Information to the user		N/P	See certification documents
Conducted limits		PASS	
Radiated emission limits	Class B	PASS	
Antenna power conduction limits for receivers		N/A	
Power line carrier systems		N/A	
TV interface devices, including cable system terminal devices		N/A	
TV broadcast receivers		N/A	
Cable ready consumer electronics equipment		N/A	
Program blocking technology requirements for TV receivers		N/A	
Scanning receivers and frequency converters used with scanning receivers		N/A	
Labeling of digital cable ready products		N/A	
INTENTIONAL RADIATORS			

TEST DESIGNATION	SEVERITY	VERDICT	COMMENTS
Equipment authorization requirement		**PASS**	**Transmitter part is subject to Certification procedure**
Certified operating frequency range		**N/A**	
Antenna requirement		**PASS**	**Dedicated integral antenna**
External radio frequency power amplifiers and antenna modifications		**N/A**	
Restricted bands of operation		**PASS**	**15.205**
Conducted limits (measurement)	**Class B**	**PASS**	**ANSI C63.10: 2013**
Occupied bandwidth		**PASS**	**FCC part 15.225 & RSS-210**
Field strength outside the band 13.110-14.010MHz		**PASS**	**FCC PART 15 Radio part 15.225 b) c) & d) & RSS-210**
Field strength in the band 13.553-13.567MHz	**15848µV/m at 30m**	**PASS**	**FCC part 15 Radio part 15.225 a) & RSS-210**
Radiated emission limits	**15.209**	**PASS**	**FCC PART 15.109, 15.209, 15.205, 15.215, CNR-Gen**
Measurement of Frequency Stability	**+/- 0.01%**	**PASS**	**FCC 47 CRF Part 15.225 e) & RSS-210**

Sample subject to the test complies for tests done with the requirements of the reference document(s) listed in §2 of this test report and, where applicable, with deviation(s) specified in this document.

To declare, or not, the compliance with the specifications, it was not explicitly taken into account of uncertainty associated with the results with the exception of emission tests based on CISPR standards.

5. MEASUREMENT UNCERTAINTY

PARAMETER	MAXIMAL EMITECH UNCERTAINTY	MINIMAL STANDARD UNCERTAINTY
Radio frequency	± 1 x 10^{-7}	±1 x 10^{-7}
Occuped bandwidth		
RF power	± 3.8 %	± 5 %
Radiated emission (magnetic field)		
9kHz – 30MHz	± 3 dB	± 6 dB
RF level for a given BER	± 0.8 dB	± 1.5 dB
Supply voltages	± 3 %	± 3 %
Temperature	± 1 °C	± 1°C
Humidity	± 5 %	± 5 %
Time / Duty cycle	± 4.4 %	± 5 %
Conducted emission (FCC)		
(Artificial Mains Network) 150kHz – 30MHz	± 3.4 dB	± 3.4 dB
Radiated emission (electric field for FCC standard)		
9kHz – 30MHz	± 2.7 dB	/
30MHz – 1GHz	± 5.0 dB	/
1GHz – 18GHz	± 5.6 dB	/
18GHz – 26GHz	± 5.7 dB	/
26GHz – 40GHz	± 5.7 dB	/

For the calculation of expanded uncertainty, the confidence interval is 95 % (k=2).

6. RF EXPOSURE

In accordance with RSS-102, Issue 5, Section 2.5.2 :

TEST CONDITION	FREQUENCY	Level at 10m	EIRP Level (W) Calculation : see below	EIRP Limit (W)
X-NUCLEO-NFC08A1 (OATS)	13.56MHz	**0.87 dBµA/m**	0.7x10^{-6}	1

From ANSI C63.10 Annexe G.2 :

EIRP = (E x d)^2/30 = (377H x d)^2/30

where

E = electric field strend in V/m
H = magnetic field strend in A/m
D = measurement distance in m

7. TEST CONDITIONS AND RESULTS

7.1. Conducted limits (measurement)

Reference standard:	FCC Part 15.107 , 15.207 and RSS-Gen
Test method:	ANSI C63.10: 2013
General test setup: EUT is set on an insulating support at 80cm from the ground reference plane. All power was connected to the system through Artificial Mains Network (AMN). The AMN is placed at 80cm from the boundary of the EUT and bonded to a ground reference plane. All tested telecommunications lines (if applicable) were connected to an Asymmetric Artificial Network (AAN) and conducted voltage measurements on telecommunications lines were made at the output of the AAN. Where an AAN was not appropriate or available, measurements were made using a Capacitive Voltage Probe and/or a Current probe. Additionnal ground terminals (if any) are connected to earth terminal of the AMN.	

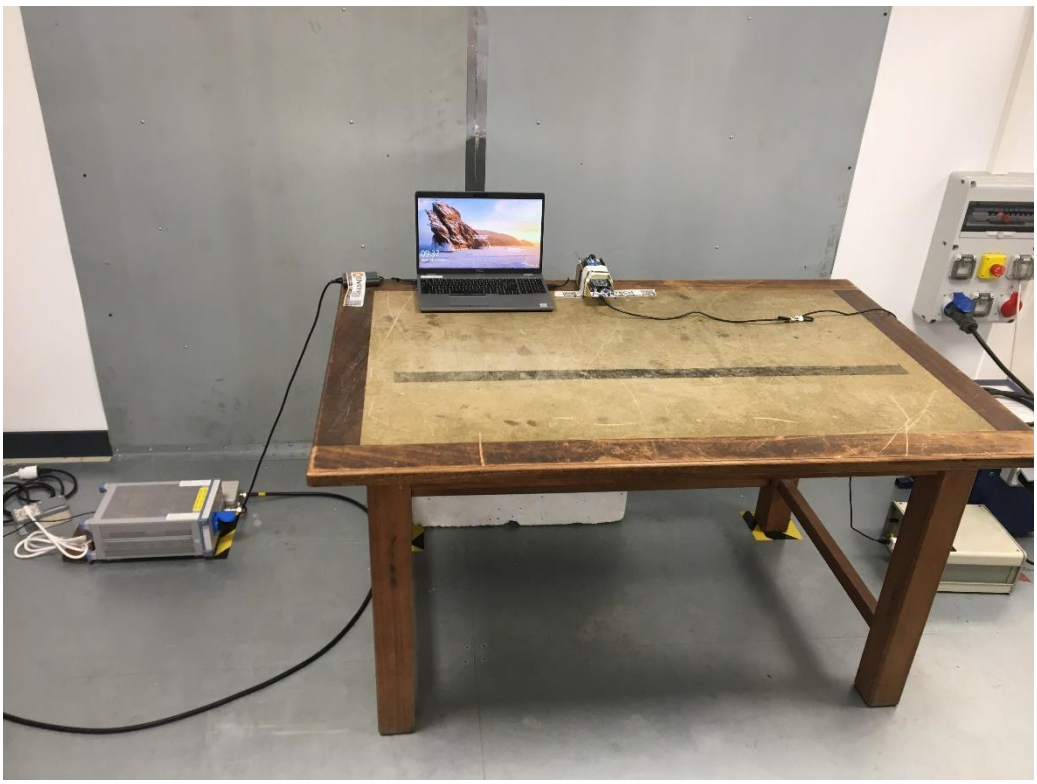
TESTED CABLE	PARAMETER	SEVERITY	RESULT TAB.	VERDICT
120Vac/60Hz power supply / Card emulation mode	150kHz-30MHz	Class B	EMI4723	**PASS**
120Vac/60Hz power supply / Reader mode	150kHz-30MHz	Class B	EMI4724	**PASS**

LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	*See Graph(s)*
Relative Humidity	30 to 60 %	*See Graph(s)*
Atmospheric pressure	N/A	*See Graph(s)*
Test method deviation: N/A		
Supplementary information:: EUT power supply is done trought a “standard power supply” wich meets FCC and RSS requirements.		

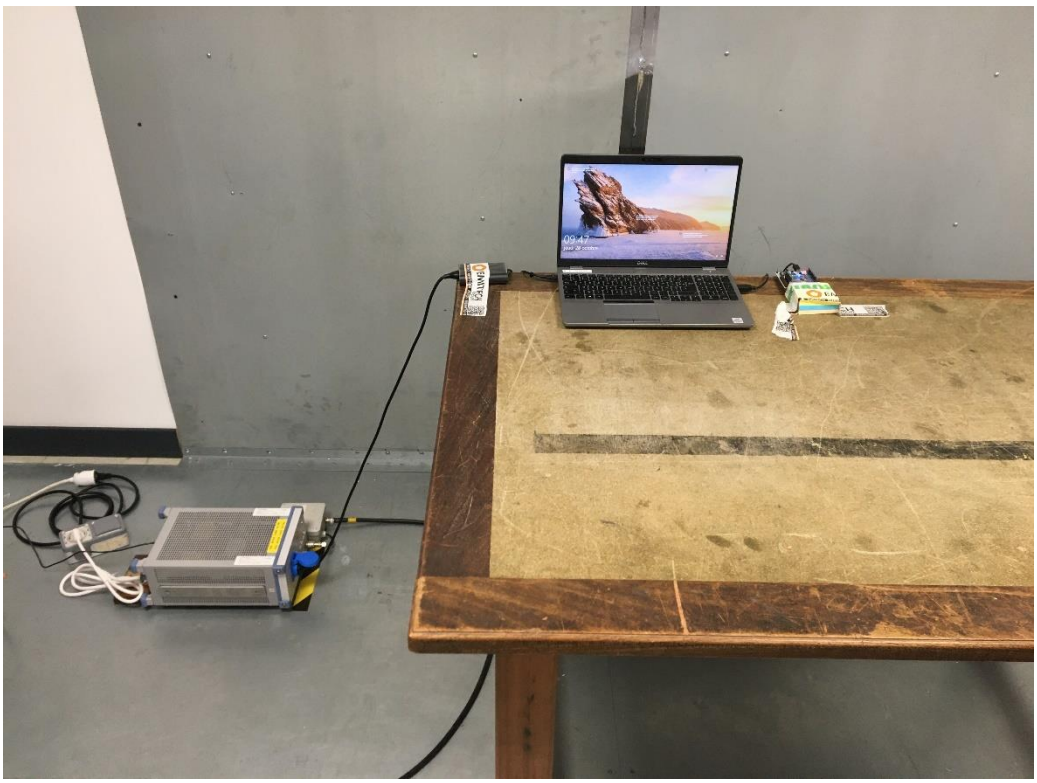
TEST EQUIPMENT USED					
CATEGORY	**BRAND**	**TYPE**	**IDENTIFIER**	**CAL. DATE**	**CAL. DUE**
AC power source	KIKUSUI	PCR 4000L	15322	-	-
Cable	EMITECH	Current absorber sheath	9491	23/06/2020	23/08/2022
Cable	C&C	N-3m	14335	18/03/2021	18/05/2023
Ground plane	EMITECH	Test area	11569		
LISN	Rohde & Schwarz	ENV216	17925	24/09/2021	24/11/2023
Multimeter	FLUKE	8808A	12446	29/09/2020	29/11/2021
PE choke	EMITECH	CISPR 16-2-1: 2008	10071		
Receiver	Rohde & Schwarz	ESI	9704	24/08/2021	24/10/2022
Software	Nexio	BAT EMC	0000		
Thermohygrometer	Testo	608-H2	12268	07/05/2020	07/07/2022
Thermohygrometer	Bioblock Scientific	Météostar	0963	07/06/2021	07/08/2023

BAT-EMC software version: V3.18.0.26 Blank cells = Permanent validity

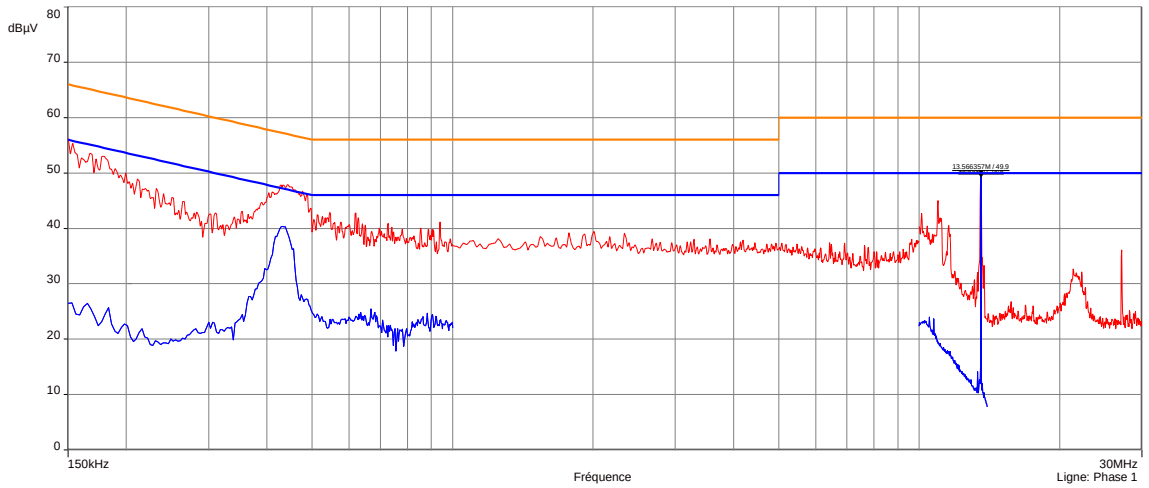
TEST SETUP PHOTO(S) - 120VAC/60HZ POWER SUPPLY / CARD EMULATION MODE

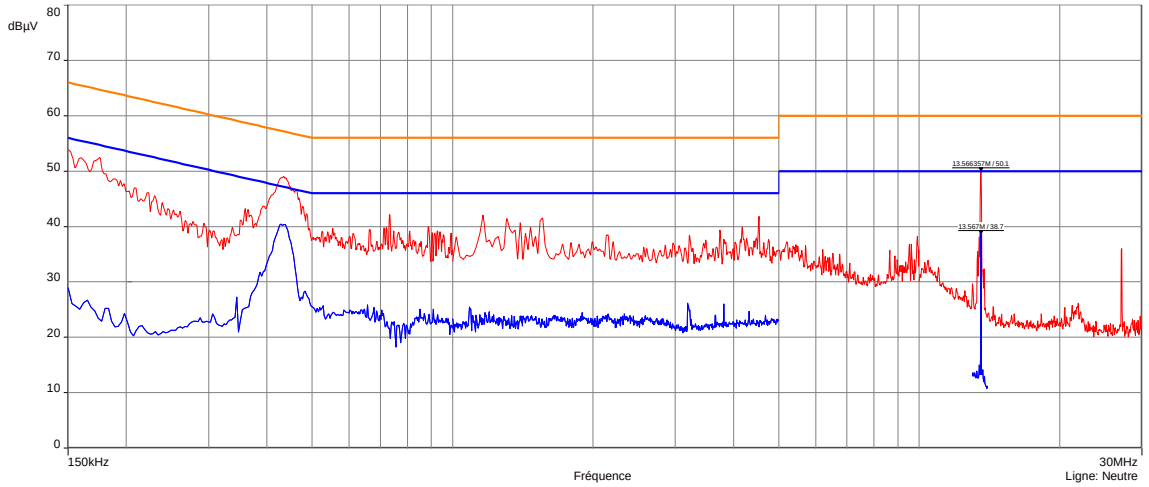


TEST SETUP PHOTO(S) - 120VAC/60HZ POWER SUPPLY / READER MODE



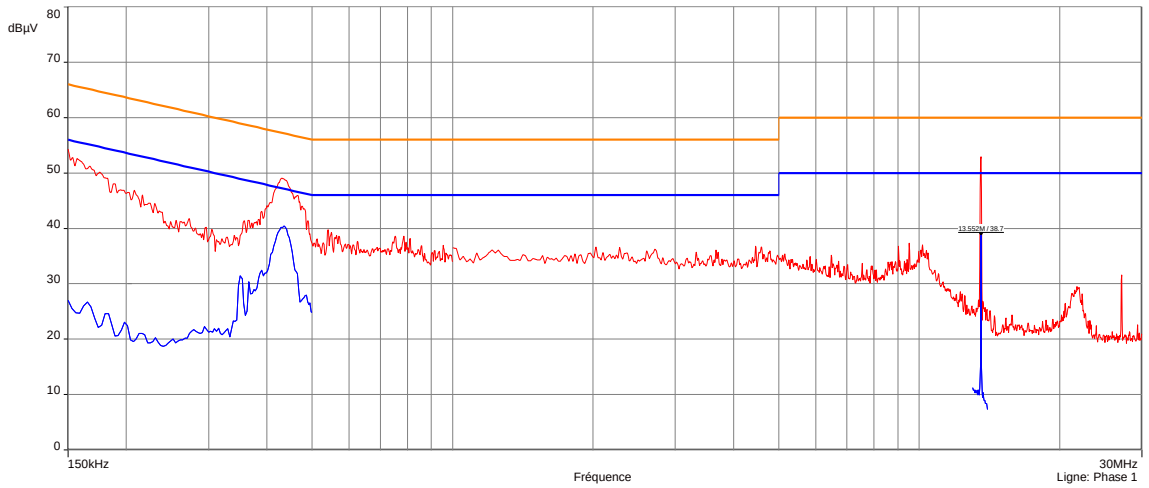
CONDUCTED LIMITS (MEASUREMENT) - GRAPH			
120VAC/60HZ POWER SUPPLY / CARD EMULATION MODE		EMI4723	
EUT mode:	Modulated Tx continuous	**T (°C):**	52.4
Test Date:	28/10/2021	**H (%):**	19.7
Test Operator:	CFO & MPA	**P (hPa):**	1011

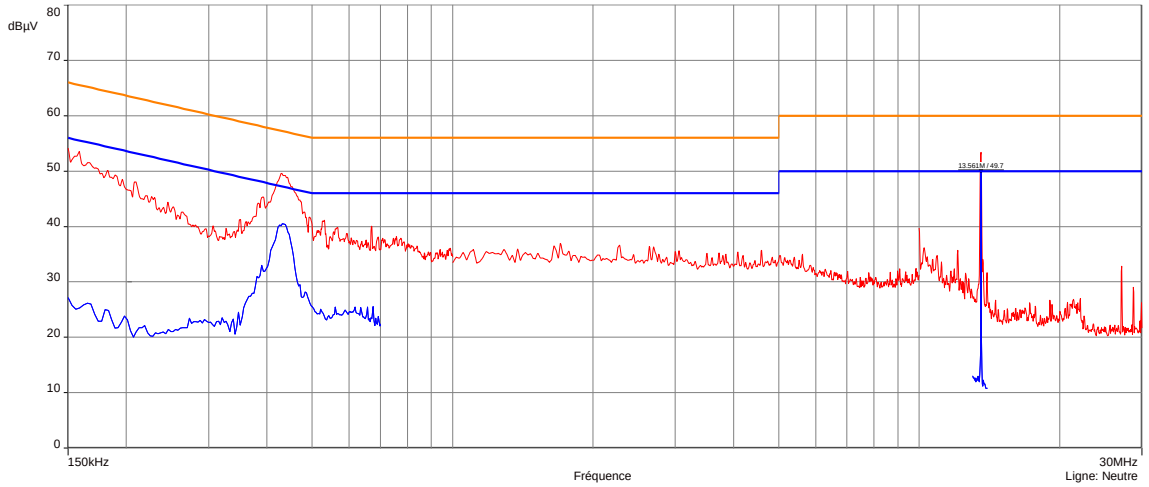




POSITION	FREQUENCIES	RBW	VBW	DETECTOR
Neutral	150kHz-1MHz	10kHz	30kHz	Peak
Neutral	1MHz-10MHz	10kHz	30kHz	Peak
Neutral	10MHz-30MHz	10kHz	30kHz	Peak
Phase 1	150kHz-1MHz	10kHz	30kHz	Peak
Phase 1	1MHz-10MHz	10kHz	30kHz	Peak
Phase 1	10MHz-30MHz	10kHz	30kHz	Peak
Neutral	150kHz-1MHz	10kHz	30kHz	Average
Neutral	1MHz-5MHz	10kHz	30kHz	Average
Neutral	13MHz-14MHz	10kHz	30kHz	Average
Phase 1	150kHz-1MHz	10kHz	30kHz	Average
Phase 1	10MHz-14MHz	10kHz	30kHz	Average
Measure with:	A.M.N.			
Comments:	13.56MHz is the RFID main carrier signal frequency			
EUT modification(s): N/A				

CONDUCTED LIMITS (MEASUREMENT) - GRAPH			
120VAC/60HZ POWER SUPPLY / READER MODE		EMI4724	
EUT mode:	Modulated Tx continuous	**T (°C):**	52.4
Test Date:	28/10/2021	**H (%):**	19.7
Test Operator:	CFO & MPA	**P (hPa):**	1011





POSITION	FREQUENCIES	RBW	VBW	DETECTOR
Neutral	150kHz-1MHz	10kHz	30kHz	Peak
Neutral	1MHz-10MHz	10kHz	30kHz	Peak
Neutral	10MHz-30MHz	10kHz	30kHz	Peak
Phase 1	150kHz-1MHz	10kHz	30kHz	Peak
Phase 1	1MHz-10MHz	10kHz	30kHz	Peak
Phase 1	10MHz-30MHz	10kHz	30kHz	Peak
Neutral	150kHz-700kHz	10kHz	30kHz	Average
Neutral	13MHz-14MHz	10kHz	30kHz	Average
Phase 1	150kHz-500kHz	10kHz	30kHz	Average
Phase 1	13MHz-14MHz	10kHz	30kHz	Average
Measure with:	A.M.N.			
Comments:	13.56MHz is the RFID main carrier signal frequency			
EUT modification(s): N/A				

7.2. Occupied bandwidth

Reference standard:	FCC part 15 Radio part 15.225 & RSS-210
Test method:	FCC part 15.225 & RSS-210
Test description: The occupied bandwidth (OBW) is the Frequency Range in which 99 % of the total mean power of a given emission falls. The residual part of the total power being denoted as β, which, in cases of symmetrical spectra, splits up into β/2 on each side of the spectrum. Unless otherwise specified, β/2 is taken as 0,5 %. The maximum occupied bandwidth includes all associated side bands above the appropriate emissions level and the frequency error or drift under extreme test conditions. EUT is connected to the measuring receiver via 50Ω attenuator(s).	

TEST CASE AND CONDITIONS	OBW	RESULT TAB.	VERDICT
Reader mode / 25°C / 5Vdc	1.4666kHz	EMI4522	**PASS**
Card emulation mode / 25°C / 5Vdc	1.6224kHz	EMI4687	**PASS**

LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	20 °C
Relative Humidity	20 to 75 %	44.9 %
Atmospheric pressure	N/A	1014 hPa
Test method deviation: N/A		
Supplementary information: N/A		

TEST EQUIPMENT USED					
CATEGORY	**BRAND**	**TYPE**	**IDENTIFIER**	**CAL. DATE**	**CAL. DUE**
Cable	C&C	N-3m	14334	18/03/2021	18/05/2023
Cable	/	N-3m	2710	28/08/2021	28/10/2023
Climatic enclosure	CLIMATS	EXCAL 7714-HA	14261	07/04/2021	07/06/2022
Spectrum analyzer	Rohde & Schwarz	FPL1007	17908	26/08/2021	26/10/2022
Thermohygrometer	Testo	608-H1	7562	09/06/2021	09/08/2023
Multimeter	FLUKE	8808A	12446	29/09/2020	29/11/2021
Thermohygrometer	Bioblock Scientific	Météostar	0963	07/06/2021	07/08/2023
Antenna	EMITECH	Lopp 3.5cm	4653		
Thermometer contactless	GHM Greisinger	GMH 3710	12968	06/10/2020	06/06/2022

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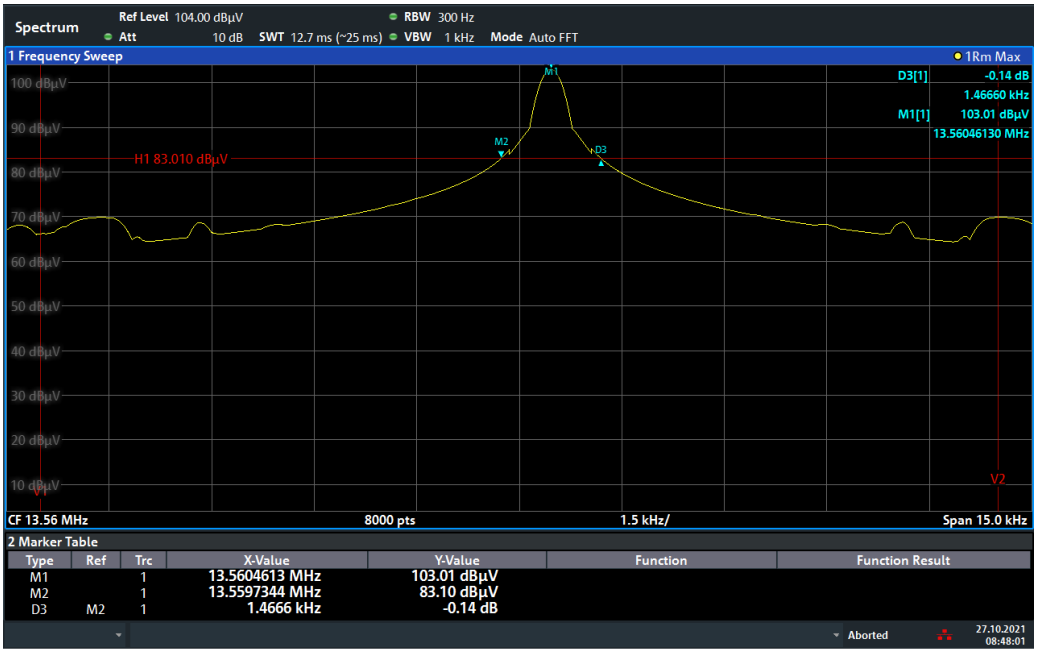
MODULATION BANDWIDTH - TABULATED RESULTS				
TEST CASE	**FREQUENCIES**	**LIMITS**	**OBW**	**RESULT TAB.**
Reader mode / 25°C / 5Vdc	13.559734MHz	13.553MHz	1.4666kHz	EMI4522
	13.561200MHz	13.567MHz		
Card emulation mode / 25°C / 5Vdc	13.559516MHz	13.553MHz	1.6224kHz	EMI4687
	13.561138MHz	13.567MHz		

EUT MODIFICATIONS	OPERATOR	TEST DATE	RESULT TAB.
N/A	CFO	27/10/2021	EMI4522
N/A	CFO	27/10/2021	EMI4687

OCCUPIED BANDWIDTH - GRAPH		
READER MODE / 25°C / 5VDC		EMI4522
EUT mode:	Tx continious	
Test Date:	27/10/2021	
Test Operator:	CFO	



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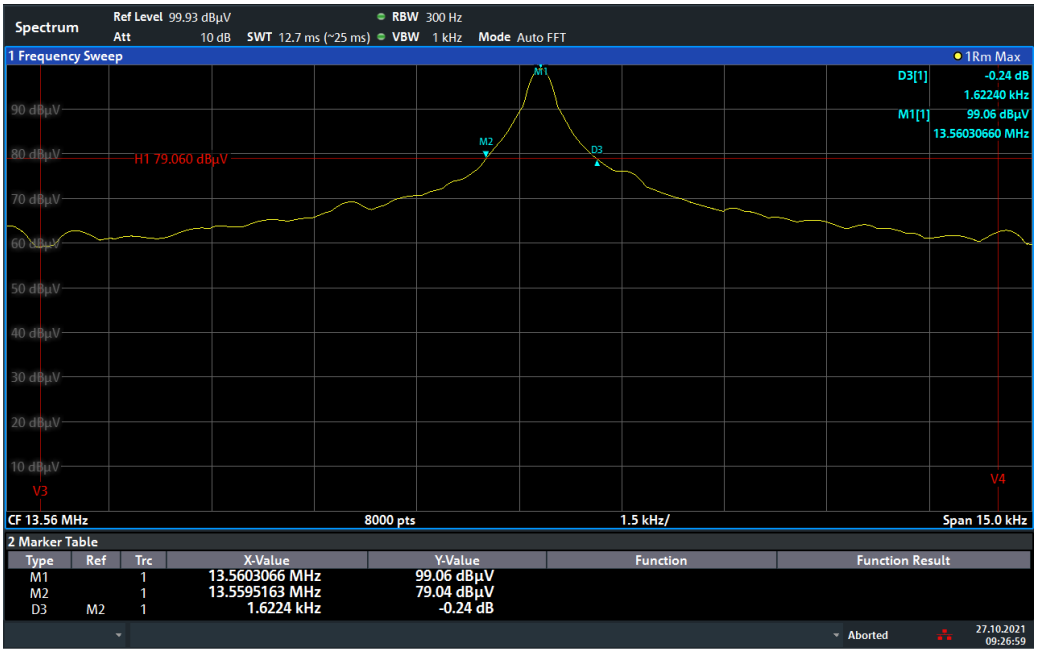
EUT modification(s): N/A

OCCUPIED BANDWIDTH - GRAPH		
CARD EMULATION MODE / 25°C / 5VDC		EMI4687
EUT mode:	Tx continious	
Test Date:	27/10/2021	
Test Operator:	CFO	



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EUT modification(s): N/A

7.3. Field strength outside the band 13.110-14.010MHz

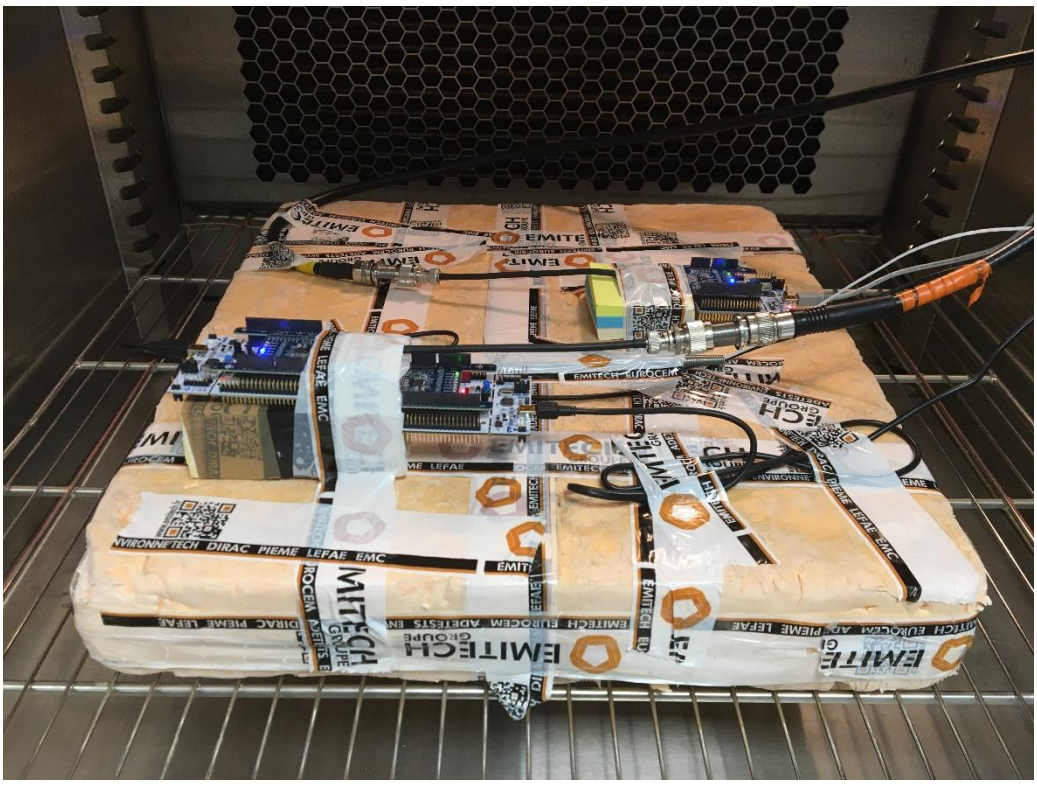
Reference standard:	FCC PART 15 Radio part 15.225 b) c) & d) & RSS-210
Test method:	FCC PART 15 Radio part 15.225 b) c) & d) & RSS-210
Test description: EUT is set inside the climatic enclosure. Carrier level are correlated with the maximum carrier level measured in normal conditions.	

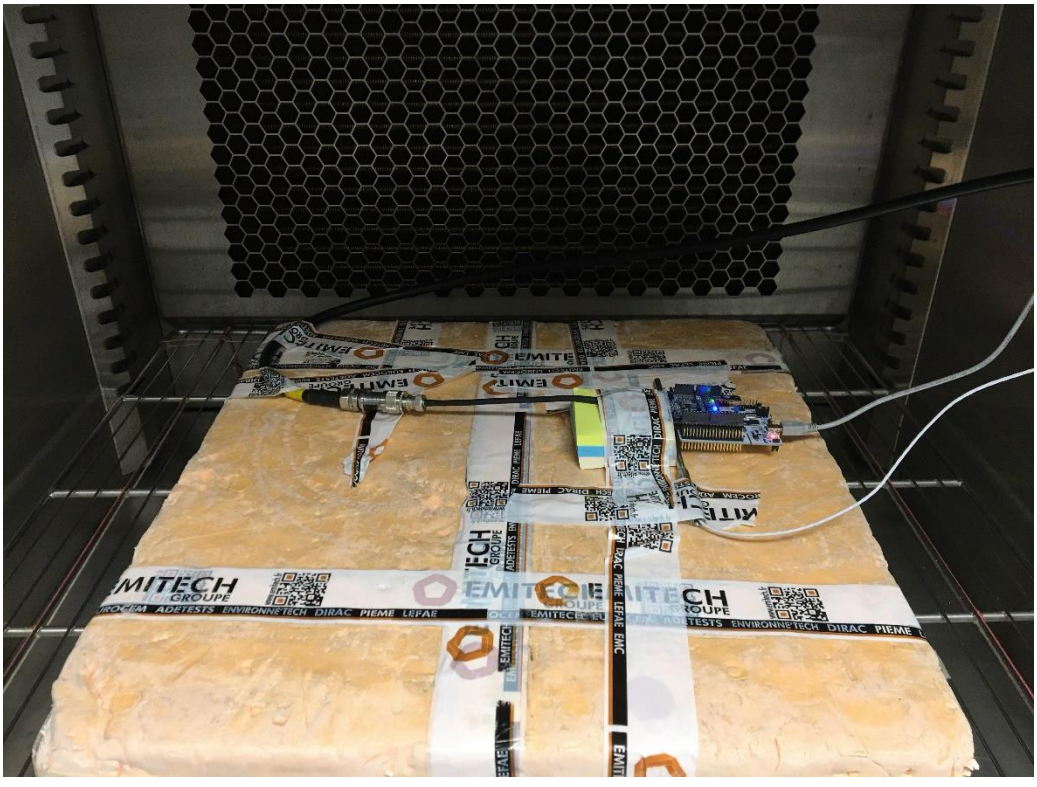
FREQUENCY BAND	SEVERITY	RESULT TAB.	VERDICT
Below 13.110MHz	§15.209	See graphic & §6.5 of this report	**PASS**
13.110-13.410MHz	106µV/m at 30m	See graphic	**PASS**
13.410-13.553MHz	334µV/m at 30m	See graphic	**PASS**
13.553-13.567MHz	15,848µV/m at 30m	See graphic & §6.4 of this report	**PASS**
13.567-13.710MHz	334µV/m at 30m	See graphic	**PASS**
13.710-14.010MHz	106µV/m at 30m	See graphic	**PASS**
Above 14.010MHz	§15.209	See graphic & §6.5 of this report	**PASS**

LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	*See Graph(s)*
Relative Humidity	20 to 75 %	*See Graph(s)*
Atmospheric pressure	N/A	*See Graph(s)*
Test method deviation: N/A		
Supplementary information: Worst case (the mode with the largest modulation bandwidth was chosen, with the maximum power measured in OATS).		

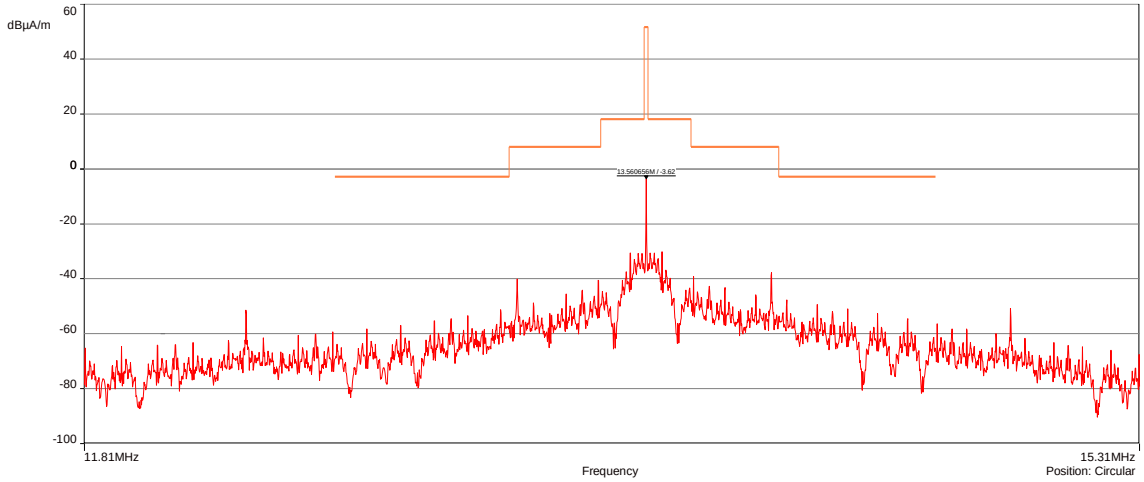
TEST EQUIPMENT USED					
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Attenuator	Radiall	R412710124	17328	22/06/2020	22/08/2023
Attenuator	Radiall	R412710124	17329	22/06/2020	22/08/2023
Cable	C&C	N-3m	14334	18/03/2021	18/05/2023
Cable	/	N-3m	2710	28/08/2021	28/10/2023
Climatic enclosure	CLIMATS	EXCAL 7714-HA	14261	07/04/2021	07/06/2022
Receiver	Rohde & Schwarz	FPL1003	16027	15/08/2020	15/02/2022
Software	Nexio	BAT EMC	0000		
Spectrum analyzer	Rohde & Schwarz	FPL1007	17908	26/08/2021	26/10/2022
Thermohygrometer	Testo	608-H1	7562	09/06/2021	09/08/2023
Antenna	EMITECH	Lopp 3.5cm	4653		
Thermohygrometer	Bioblock Scientific	Météostar	0963	07/06/2021	07/08/2023
Thermometer contactless	GHM Greisinger	GMH 3710	12968	06/10/2020	06/06/2022

BAT-EMC software version: V3.18.0.26 Blank cells = Permanent validity

TEST SETUP PHOTO(S) - FIELD STRENGTH IN THE BAND 13.110-14.010MHZ AND OUTSIDE / CARD EMULATION MODE


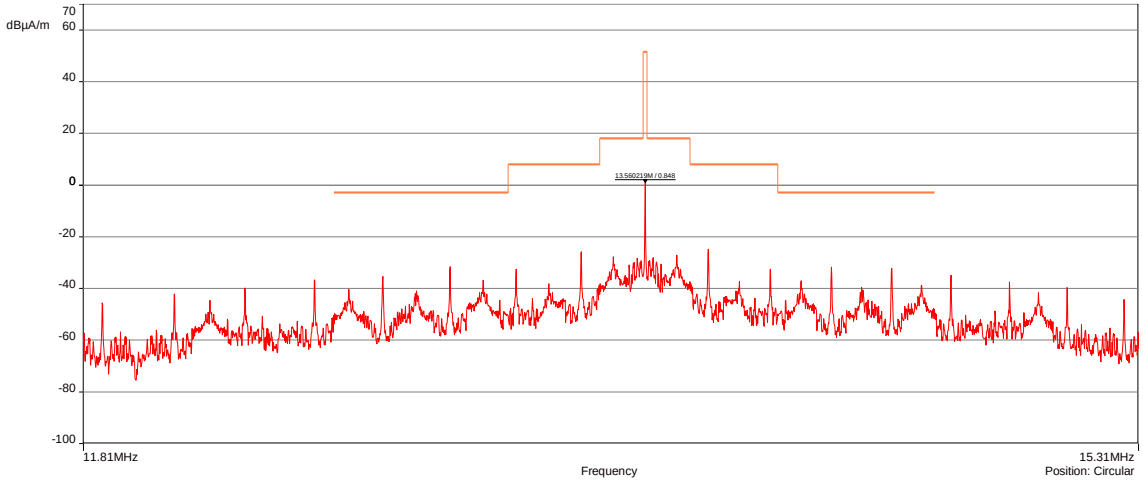
TEST SETUP PHOTO(S) - FIELD STRENGTH IN THE BAND 13.110-14.010MHZ AND OUTSIDE / READER MODE


FIELD STRENGTH IN THE BAND 13.110-14.010MHZ AND OUTSIDE - GRAPH			
FIELD STRENGTH IN THE BAND 13.110-14.010MHZ AND OUTSIDE / 25°C / 5VDC / CARD EMULATION MODE		EMI4704	
EUT mode:	Modulated Tx continuous	**T (°C):**	20
Test Date:	27/10/2021	**H (%):**	44.9
Test Operator:	CFO	**P (hPa):**	1014



POSITION	FREQUENCIES	RBW	VBW	DETECTOR
Circular	11.81MHz-15.31MHz	300Hz	1kHz	Peak
Configuration:	N/A			
Comments:	Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.			
EUT modification(s): N/A				

FIELD STRENGTH IN THE BAND 13.110-14.010MHZ AND OUTSIDE - GRAPH			
FIELD STRENGTH IN THE BAND 13.110-14.010MHZ AND OUTSIDE / 25°C / 5VDC / READER MODE		EMI4705	
EUT mode:	Modulated Tx continuous	**T (°C):**	20
Test Date:	27/10/2021	**H (%):**	44.9
Test Operator:	CFO	**P (hPa):**	1014



POSITION	FREQUENCIES	RBW	VBW	DETECTOR
Circular	11.81MHz-15.31MHz	300Hz	1kHz	Peak
Configuration:	N/A			
Comments:	Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.			
EUT modification(s): N/A				

7.4. Field strength in the band 13.553-13.567MHz

Reference standard:	FCC part 15 Radio part 15.225 a) & RSS-210
Test method:	FCC part 15 Radio part 15.225 a) & RSS-210
Test description: EUT is set on an insulating support at 80cm. Measurements were then performed in a 10-meter Open Area Test Site that complies to CISPR 16. The EUT was rotated 360° in order to maximize radiated levels. Test antenna was oriented in 3 axes (0°, 45° and 90°). For portable equipements a research of maximum level is done on the 3 axes. Only the highest levels are recorded.	

TEST CASE	EUT MODE	SEVERITY	RESULT TAB.	VERDICT
13.56MHz	Modulated Tx continuous	15848µV/m at 30m	EMI4523	**PASS**

LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	17.6 °C
Relative Humidity	20 to 75 %	49 %
Atmospheric pressure	N/A	N/A
Test method deviation: N/A		
Supplementary information: Only maximum level is recorded		

TEST EQUIPMENT USED

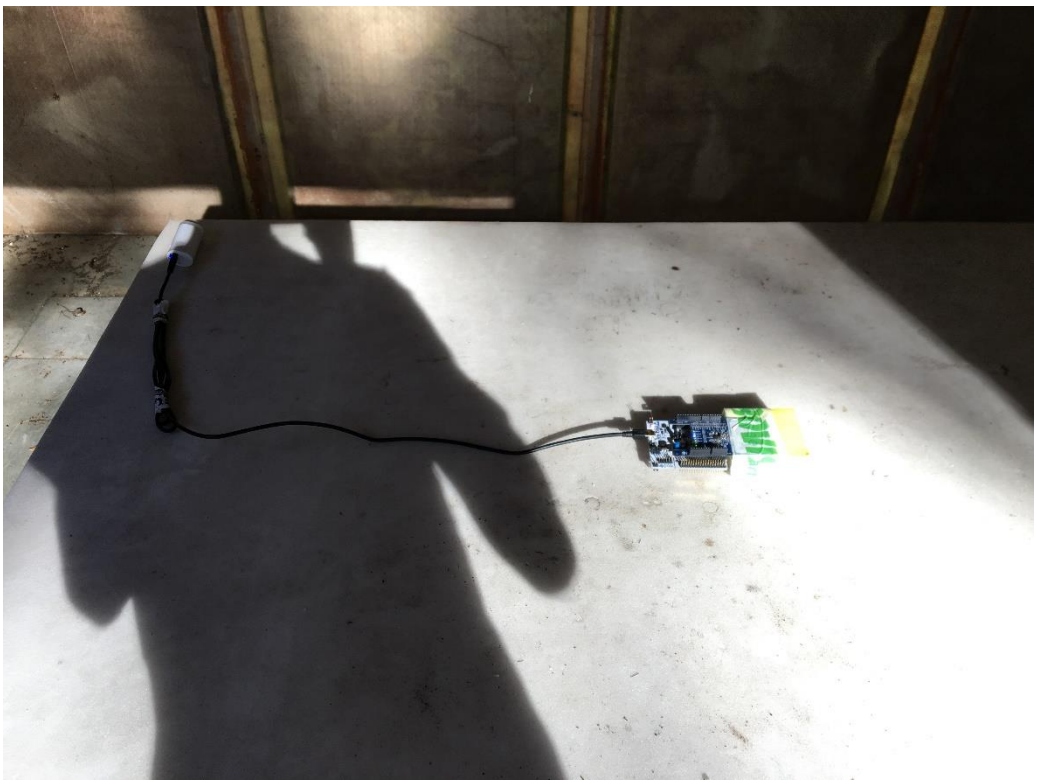
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Antenna	Rohde & Schwarz	HFH2-Z2	5825	24/04/2020	24/06/2022
Cable	Huber + Suhner	N-20m	8385	07/01/2021	07/03/2023
Open area test site	EMITECH	Salinelles	3482	11/10/2017	11/12/2021
Mast controller	Heinrich Deisel	HD100	4036		
Receiver	Rohde & Schwarz	ESHS10	3371	28/04/2020	28/12/2021
Spectrum analyzer	Rohde & Schwarz	FPL1007	17908	26/08/2021	26/10/2022
Thermometer contactless	GHM Greisinger	GMH 3710	12968	06/10/2020	06/06/2022

Blank cells = Permanent validity

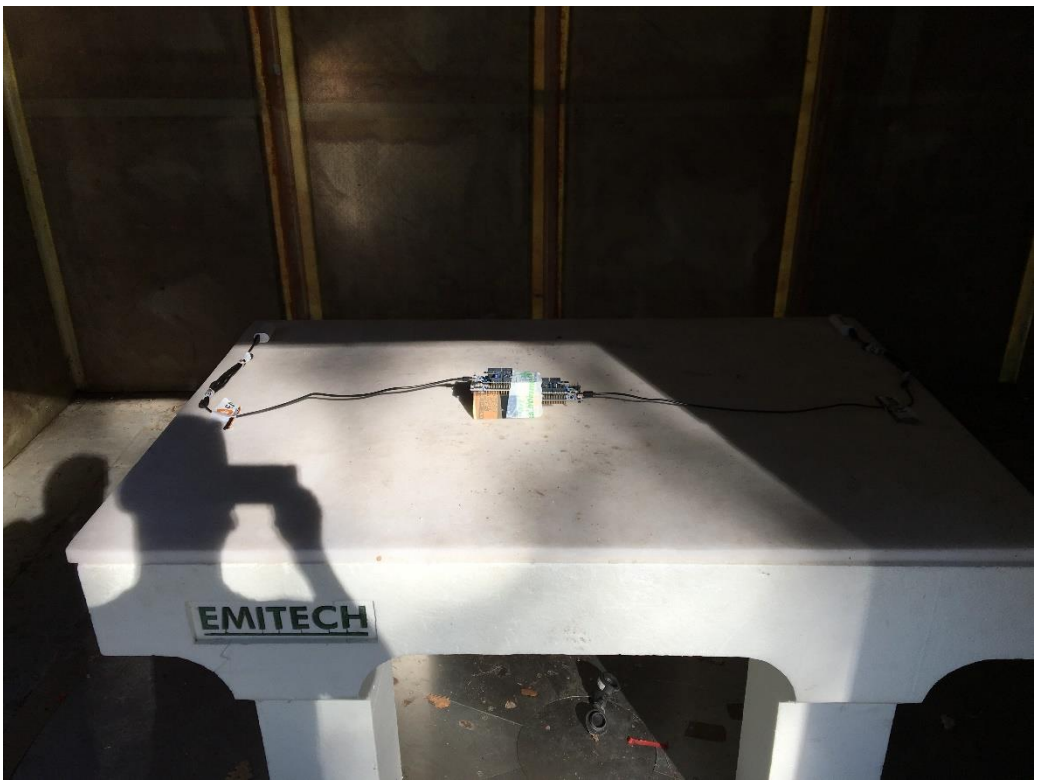
FIELD STRENGHT - TABULATED RESULTS						
Test Condition	**Frequency (MHz)**	**Polarization (°)**	**Level at 10m (dBµA/m)**	**Limit at 10m (dBµA/m)**	**Limit at 30m (dBµV/m)**	**Result Tab.**
Reader mode	13.56	90	-3.63	51.58	15848	EMI4523
Reader mode	13.56	45	-5.73	51.58	15848	EMI4686
Reader mode	13.56	90	-5.93	51.58	15848	EMI4523
Card emulation mode	13.56	0	-3.43	51.58	15848	EMI4686
Card emulation mode	13.56	45	-2.13	51.58	15848	EMI4523
Card emulation mode	13.56	90	0.87	51.58	15848	EMI4686

Maximum level at 10m is 0.87dBµA/m for a limit at 51.58 dBµA/m.
Using an extrapolation factor of 40dB/dec and a conversion factor of 51.5dB, level at 30m is 33.29dBµV/m for a limit at 84dBµV.

TEST SETUP PHOTO(S) – READER MODE (OATS)



TEST SETUP PHOTO(S) – CARD EMULATION MODE (OATS)



7.5. Radiated emission limits

Reference standard:	FCC PART 15 Radio part 15.225 & CNR-Gen
Test method:	FCC PART 15.109, 15.209, 15.205, 15.215, CNR-Gen

General test setup: For f <30MHz, EUT is set on an insulating support at 80cm above the ground reference plane.

Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter in a semi-anechoic chamber. The EUT was rotated 360°in order to maximize radiated levels. Test antenna was oriented in 3 axes (0°, 45° and 90°).

Final measurements (quasi-peak) were then performed in a 10-meter Open Area Test Site that complies to CISPR 16 in the same measurement conditions.

For f > 30MHz, EUT is set on an insulating support at 80cm above the ground reference plane (150cm for f >1GHz).

Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities.

Final measurements (quasi-peak or average) were then performed in a semi-anechoic chamber or Open Area Test Site that complies to CISPR 16. The EUT was rotated 360° about its azimuth and adjusting the receive antenna height from 1 to 4 m.

All frequencies were investigated, where applicable.

For portable equipements a research of maximum level is done on the 3 axes. Only the highest levels are recorded.

TESTED CONFIGURATION	PARAMETER	SEVERITY	RESULT TAB.	VERDICT
Spurious / TX Reader mode / 0°	9kHz-30MHz	15.209	EMI4726	**PASS**
Spurious / TX Reader mode / 45°	9kHz-30MHz	15.209	EMI4727	**PASS**
Spurious / TX Reader mode / 90°	9kHz-30MHz	15.209	EMI4728	**PASS**
Spurious / TX Card emulation mode / 0°	9kHz-30MHz	15.209	EMI4729	**PASS**
Spurious / TX Card emulation mode / 45°	9kHz-30MHz	15.209	EMI4730	**PASS**
Spurious / TX Card emulation mode / 90°	9kHz-30MHz	15.209	EMI4731	**PASS**
Spurious / Tx mode / Card emulation mode	30MHz-1GHz	15.209	EMI4549	**PASS**
Spurious / Tx mode / Reader mode	30MHz-1GHz	15.209	EMI4570	**PASS**

LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	*See Graph(s)*
Relative Humidity	20 to 75 %	*See Graph(s)*
Atmospheric pressure	N/A	*See Graph(s)*

Test method deviation: N/A

Supplementary information: From 9 kHz to 30MHz: limit indicated on the curves is calculated with 40 dB/decade extrapolation factor and 51.5 dB conversion factor.

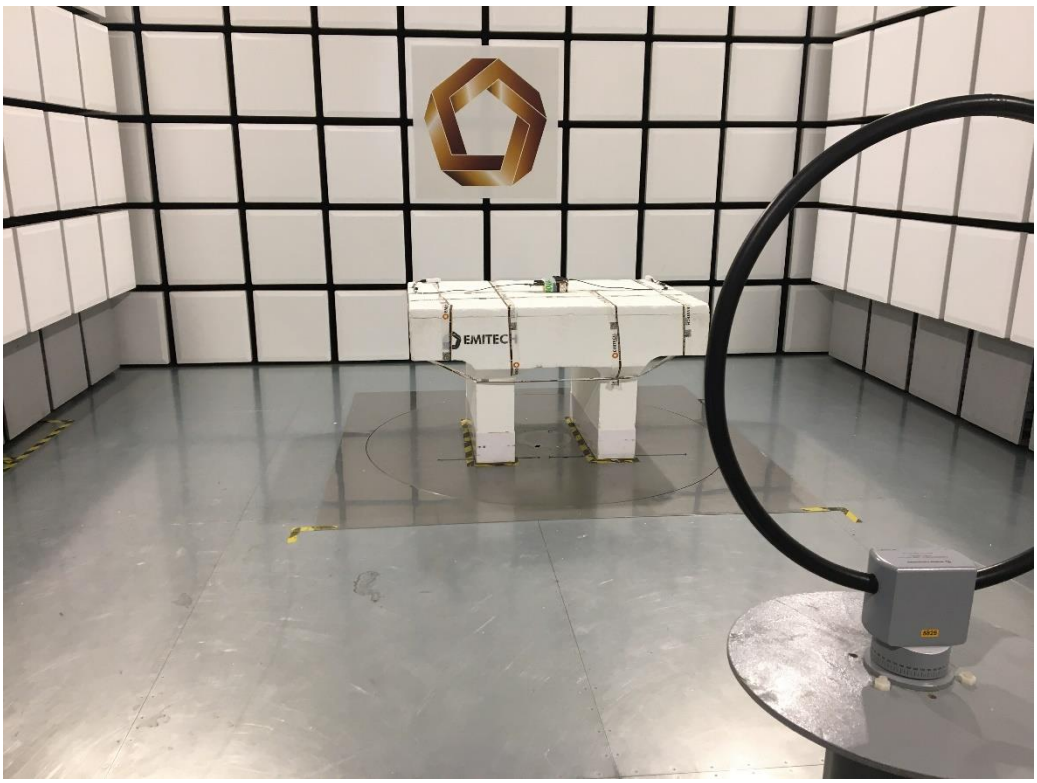
From 30MHz to 1GHz Quasi peak limit provided is the limit given in §15.209.

TEST EQUIPMENT USED – 9KHZ TO 30MHZ					
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Antenna	Rohde & Schwarz	HFH2-Z2	5825	24/04/2020	24/06/2022
Cable	SUCOFLEX	N-6,5m	14380	23/08/2021	23/10/2023
Cable	MegaPhase	N-8m	15813	14/01/2021	14/03/2023
Cable	MegaPhase	TM18-N1N1-118	12842	02/12/2020	02/02/2023
Receiver	Rohde & Schwarz	ESW26	17791	14/04/2021	14/06/2022
Shielded enclosure	COMTEST	SAC 3m	14494	02/10/2019	02/12/2022
Software	Nexio	BAT EMC	0000		
Thermohygrometer	Testo	608-H2	12269	07/05/2020	07/07/2022
Thermohygrometer	Bioblock Scientific	Météostar	0963	07/06/2021	07/08/2023

BAT-EMC software version: V3.18.0.26 Blank cells = Permanent validity

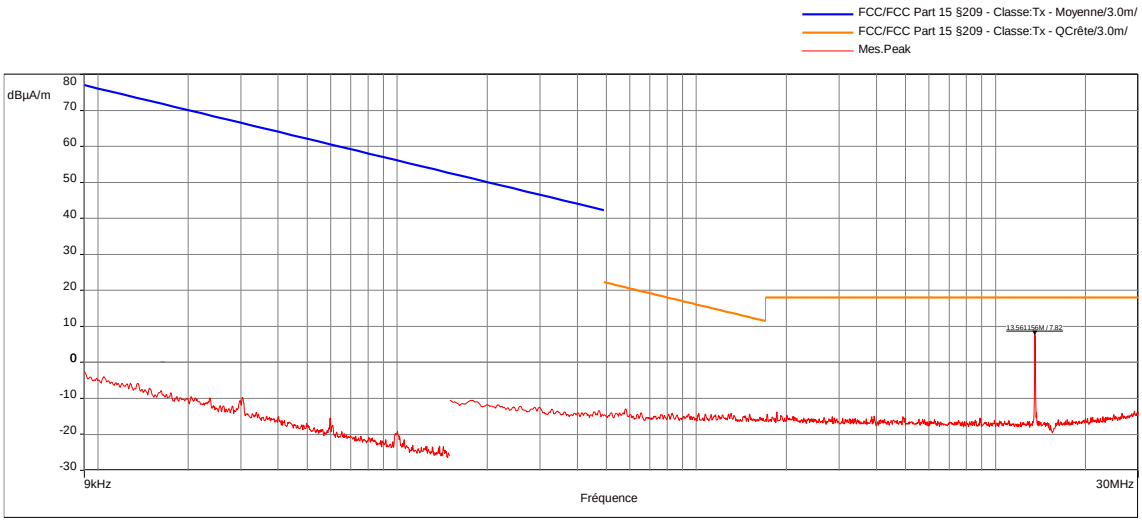
TEST EQUIPMENT USED – 30MHZ TO 1GHZ					
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Antenna	Electro Metrics	BIA-30HF	0824	21/08/2021	21/10/2024
Antenna	Rohde & Schwarz	HL223	1137	21/08/2021	21/10/2024
Cable	MegaPhase	F135N1N28	16664	24/10/2019	24/12/2021
Cable	MegaPhase	F135N1N28	16668	24/10/2019	24/12/2021
Cable	SUCOFLEX	N-6,5m	14380	23/08/2021	23/10/2023
Cable	MegaPhase	N-8m	15813	14/01/2021	14/03/2023
Cable	MegaPhase	TM18-N1N1-118	12842	02/12/2020	02/02/2023
Receiver	Rohde & Schwarz	ESW26	17791	14/04/2021	14/06/2022
Shielded enclosure	COMTEST	SAC 3m	14494	02/10/2019	02/12/2022
Software	Nexio	BAT EMC	0000		
Thermohygrometer	Testo	608-H2	12269	07/05/2020	07/07/2022
Thermohygrometer	Bioblock Scientific	Météostar	0963	07/06/2021	07/08/2023

BAT-EMC software version: V3.18.0.26 Blank cells = Permanent validity

TEST SETUP PHOTO(S)


TEST SETUP PHOTO(S)

RADIATED EMISSION LIMITS - GRAPH			
SPURIOUS / TX READER MODE / 0°		EMI4726	
EUT mode:	Modulated Tx continuous	**T (°C):**	18.6
Test Date:	26/10/2021	**H (%):**	51.6
Test Operator:	CFO & OAT	**P (hPa):**	1009

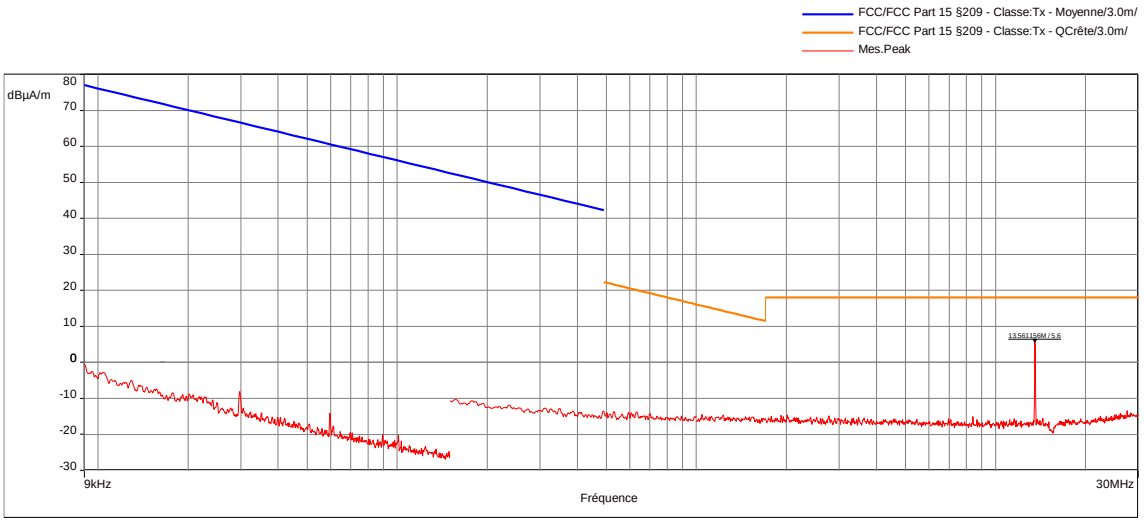


POSITION	FREQUENCIES	RBW	VBW	DETECTOR
Circular	9kHz-150kHz	300Hz	1kHz	Peak
Circular	150kHz-1MHz	10kHz	30kHz	Peak
Circular	1MHz-30MHz	10kHz	30kHz	Peak

Configuration:	N/A
Comments:	13.56MHz is the RFID signal main carrier frequency Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.
EUT modification(s): N/A	

No spurious emissions were detected.

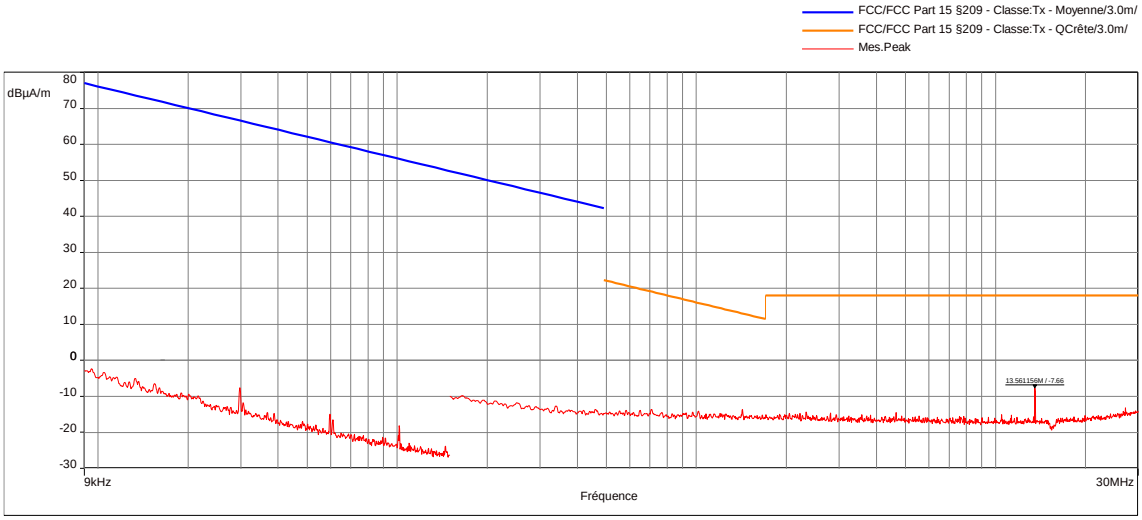
RADIATED EMISSION LIMITS - GRAPH			
SPURIOUS / TX READER MODE / 45°		EMI4727	
EUT mode:	MODULATED TX CONTINUOUS	**T (°C):**	18.6
Test Date:	26/10/2021	**H (%):**	51.6
Test Operator:	CFO & OAT	**P (hPa):**	1009



POSITION	FREQUENCIES	RBW	VBW	DETECTOR
Circular	9kHz-150kHz	300Hz	1kHz	Peak
Circular	150kHz-1MHz	10kHz	30kHz	Peak
Circular	1MHz-30MHz	10kHz	30kHz	Peak
Configuration:	N/A			
Comments:	13.56MHz is the RFID signal main carrier frequency Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.			
EUT modification(s): N/A				

No spurious emissions were detected.

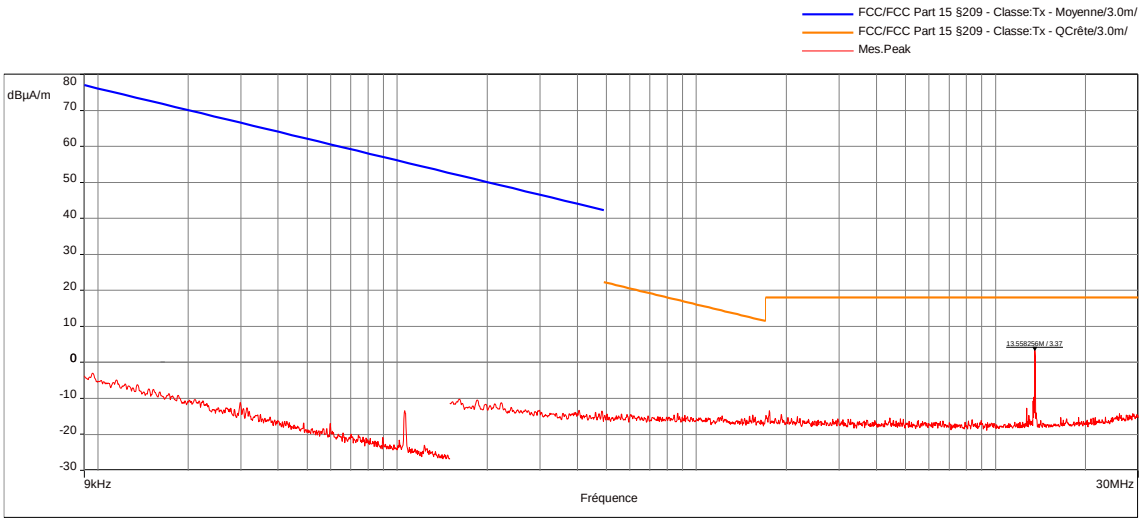
RADIATED EMISSION LIMITS - GRAPH			
SPURIOUS / TX READER MODE / 90°		EMI4728	
EUT mode:	Modulated Tx continuous	**T (°C):**	18.6
Test Date:	26/10/2021	**H (%):**	51.6
Test Operator:	CFO & OAT	**P (hPa):**	1009



POSITION	FREQUENCIES	RBW	VBW	DETECTOR
Circular	9kHz-150kHz	300Hz	1kHz	Peak
Circular	150kHz-1MHz	10kHz	30kHz	Peak
Circular	1MHz-30MHz	10kHz	30kHz	Peak
Configuration:	N/A			
Comments:	13.56MHz is the RFID signal main carrier frequency Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.			
EUT modification(s): N/A				

No spurious emissions were detected.

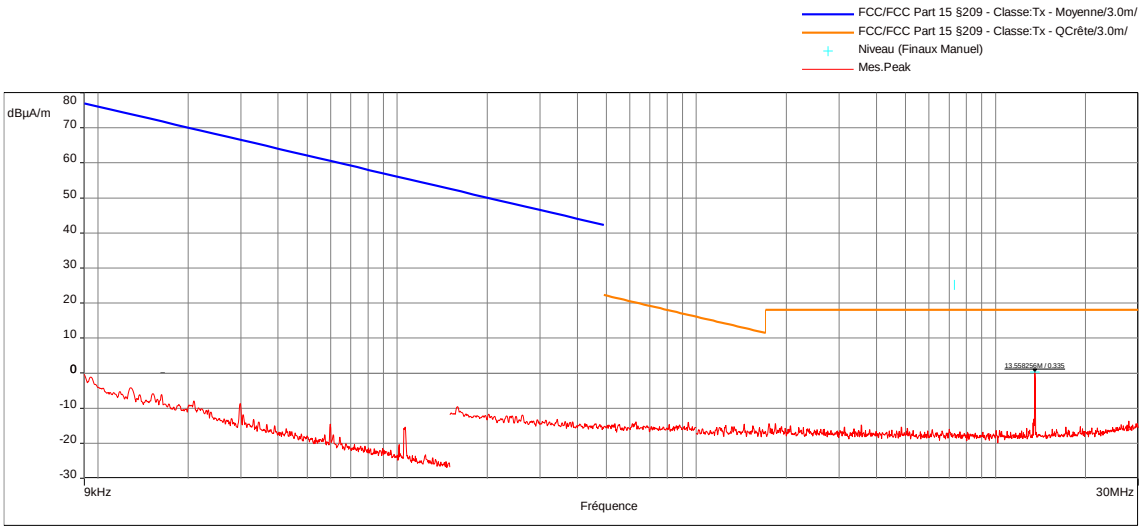
RADIATED EMISSION LIMITS - GRAPH			
SPURIOUS / TX CARD EMULATION MODE / 0°		EMI4729	
EUT mode:	Modulated Tx continuous	**T (°C):**	18.6
Test Date:	26/10/2021	**H (%):**	51.6
Test Operator:	CFO & OAT	**P (hPa):**	1009



POSITION	FREQUENCIES	RBW	VBW	DETECTOR
Circular	9kHz-150kHz	300Hz	1kHz	Peak
Circular	150kHz-1MHz	10kHz	30kHz	Peak
Circular	1MHz-30MHz	10kHz	30kHz	Peak
Configuration:	N/A			
Comments:	13.56MHz is the RFID signal main carrier frequency Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.			
EUT modification(s): N/A				

No spurious emissions were detected.

RADIATED EMISSION LIMITS - GRAPH			
SPURIOUS / TX CARD EMULATION MODE / 45°		EMI4730	
EUT mode:	Modulated Tx continuous	**T (°C):**	18.6
Test Date:	26/10/2021	**H (%):**	51.6
Test Operator:	CFO & OAT	**P (hPa):**	1009

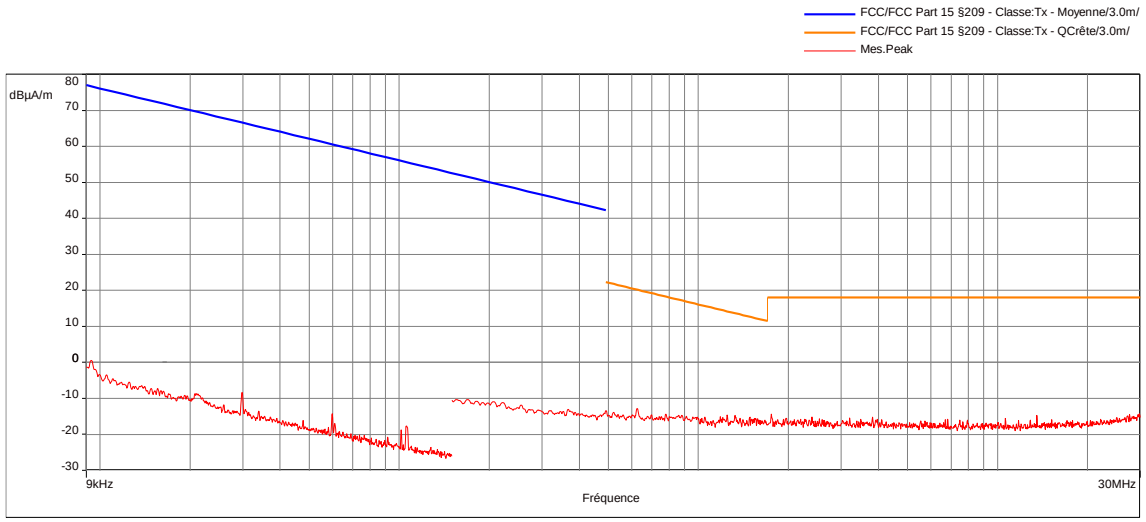


POSITION	FREQUENCIES	RBW	VBW	DETECTOR
Circular	9kHz-150kHz	300Hz	1kHz	Peak
Circular	150kHz-1MHz	10kHz	30kHz	Peak
Circular	1MHz-30MHz	10kHz	30kHz	Peak

Configuration:	N/A
Comments:	13.56MHz is the RFID signal main carrier frequency Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.
EUT modification(s): N/A	

No spurious emissions were detected.

RADIATED EMISSION LIMITS - GRAPH			
SPURIOUS / TX CARD EMULATION MODE / 90°		EMI4731	
EUT mode:	Modulated Tx continuous	**T (°C):**	18.6
Test Date:	26/10/2021	**H (%):**	51.6
Test Operator:	CFO & OAT	**P (hPa):**	1009

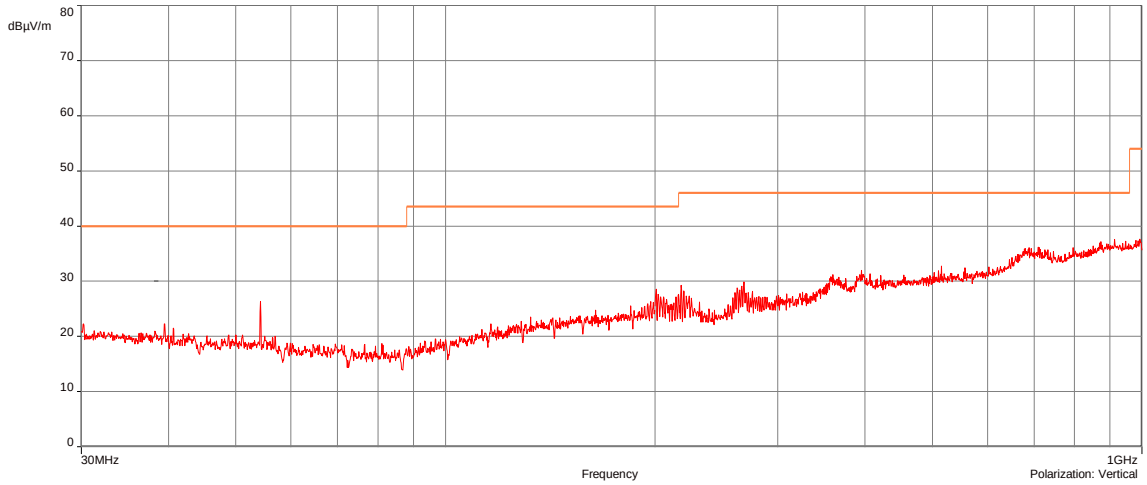


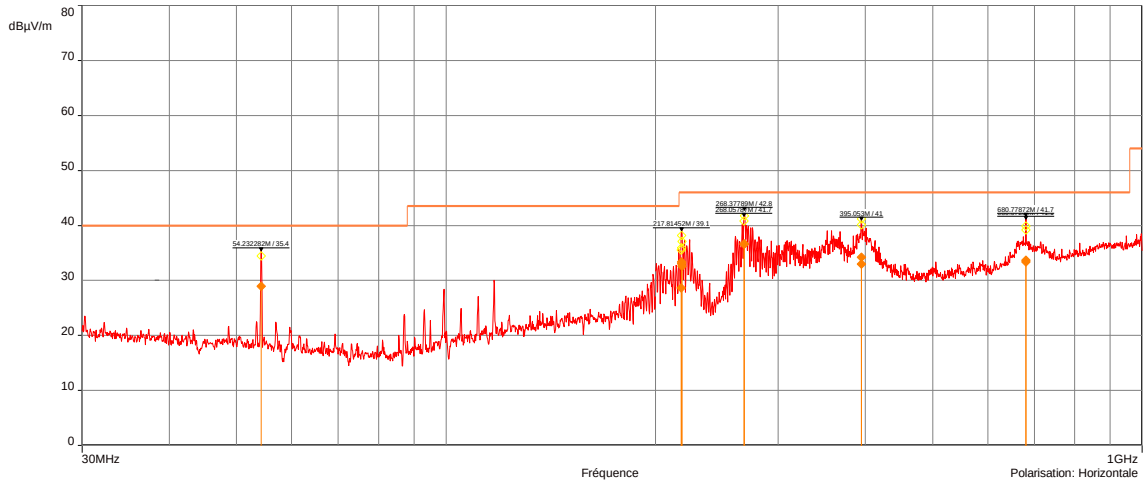
POSITION	FREQUENCIES	RBW	VBW	DETECTOR
Circular	9kHz-150kHz	300Hz	1kHz	Peak
Circular	150kHz-1MHz	10kHz	30kHz	Peak
Circular	1MHz-30MHz	10kHz	30kHz	Peak

Configuration:	N/A
Comments:	13.56MHz is the RFID signal main carrier frequency Limit indicated on these plots are calculated with 40 dB/decade extrapolation factor and 51.5dB conversion factor.
EUT modification(s): N/A	

No spurious emissions were detected.

RADIATED EMISSION LIMITS - GRAPH			
SPURIOUS / TX MODE / CARD EMULATION MODE		EMI4549	
EUT mode:	Modulated Tx continuous	**T (°C):**	20.9
Test Date:	26/11/2021	**H (%):**	52
Test Operator:	CFO & OAT	**P (hPa):**	1011

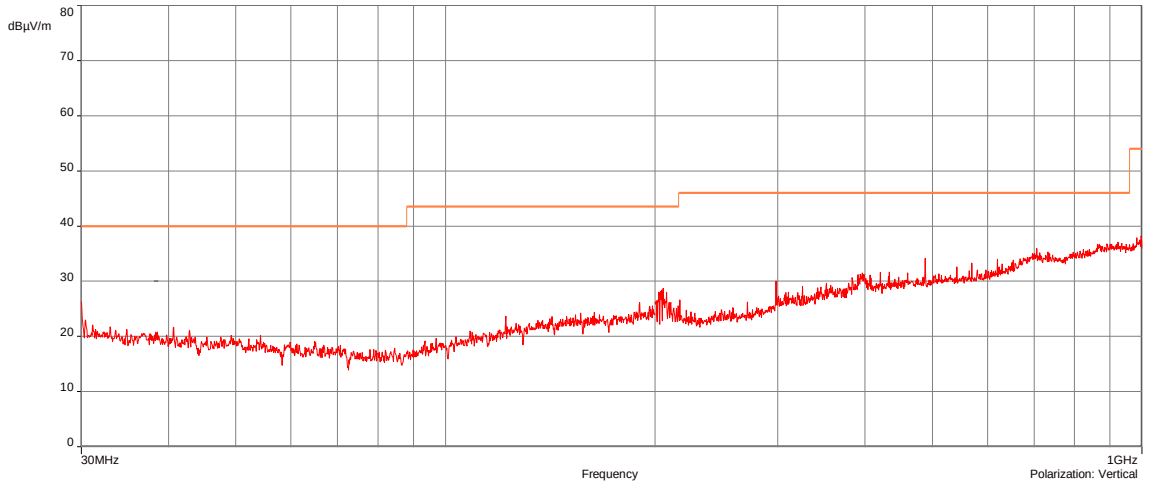


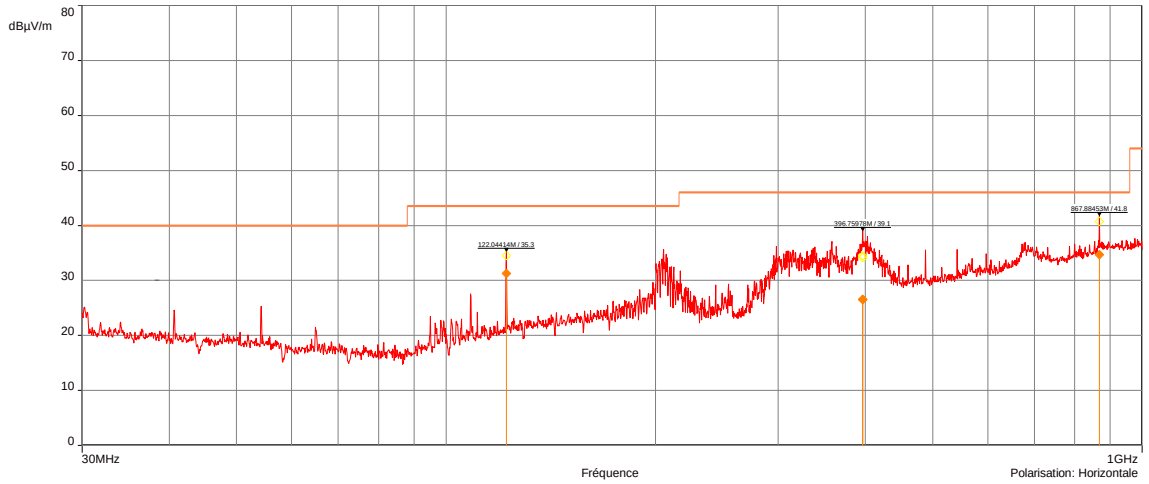


POSITION	FREQUENCIES	RBW	VBW	DETECTOR
Verticale	30MHz-200MHz	100kHz	300kHz	Peak
Horizontale	30MHz-200MHz	100kHz	300kHz	Peak
Horizontale	200MHz-1GHz	100kHz	300kHz	Peak
Verticale	200MHz-1GHz	100kHz	300kHz	Peak
Configuration:	N/A			
Comments:	N/A			
EUT modification(s): N/A				

RADIATED EMISSION LIMITS – TABULATED RESULTS					
SPURIOUS / TX MODE / CARD EMULATION MODE					
FREQUENCY (MHZ)	POLARIZATION	QPEAK LEVEL (DBµV/M)	PEAK LEVEL (DBµV/M)	QPEAK LIMIT (DBµV/M)	MARGING
54.23	Horizontal	28.95	35.42	40	-11.05
217.60	Horizontal	28.61	38.21	46	-17.39
217.81	Horizontal	33.34	39.06	46	-12.66
218.03	Horizontal	33.05	38.34	46	-12.95
218.19	Horizontal	32.56	39.07	46	-13.44
268.06	Horizontal	36.67	41.68	46	-9.33
268.38	Horizontal	36.62	42.76	46	-9.38
395.05	Horizontal	33.00	41.00	46	-13.00
395.21	Horizontal	34.23	42.15	46	-11.77
680.67	Horizontal	33.37	41.12	46	-12.63
680.78	Horizontal	33.68	41.69	46	-12.32
Supplementary information: Spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported					

RADIATED EMISSION LIMITS - GRAPH			
SPURIOUS / TX MODE / READER MODE		EMI4570	
EUT mode:	Modulated Tx continuous	**T (°C):**	20.9
Test Date:	26/11/2021	**H (%):**	52
Test Operator:	CFO & OAT	**P (hPa):**	1011





POSITION	FREQUENCIES	RBW	VBW	DETECTOR
Verticale	30MHz-200MHz	100kHz	300kHz	Peak
Horizontale	30MHz-200MHz	100kHz	300kHz	Peak
Horizontale	200MHz-1GHz	100kHz	300kHz	Peak
Verticale	200MHz-1GHz	100kHz	300kHz	Peak
Configuration:	N/A			
Comments:	N/A			
EUT modification(s): N/A				

RADIATED EMISSION LIMITS – TABULATED RESULTS					
SPURIOUS / TX MODE / READER MODE					
FREQUENCY (MHZ)	POLARIZATION	QPEAK LEVEL (DBµV/M)	PEAK LEVEL (DBµV/M)	QPEAK LIMIT (DBµV/M)	MARGING
122.044	Horizontal	31.25	35.30	43.5	-12.25
396.706	Horizontal	26.56	39.22	46.0	-19.44
396.760	Horizontal	26.56	39.09	46.0	-19.44
867.885	Horizontal	34.72	41.79	46.0	-11.28
Supplementary information: Spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported					

7.6. Measurement of Frequency Stability

Reference standard:	FCC 47 CRF Part 15.225 e) & RSS-210
Test method:	FCC 47 CRF Part 15.225 e) & RSS-210
General test setup: The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation. EUT is set inside the climatic enclosure. Carrier level are correlated with the maximum carrier level measured in normal conditions.	

TEST CASE	EUT MODE	SEVERITY	RESULT TAB.	VERDICT
Card emulation mode	Modulated Tx mode	+/-0.01%	-	**PASS**
Reader mode	Modulated Tx mode	+/-0.01%	-	**PASS**

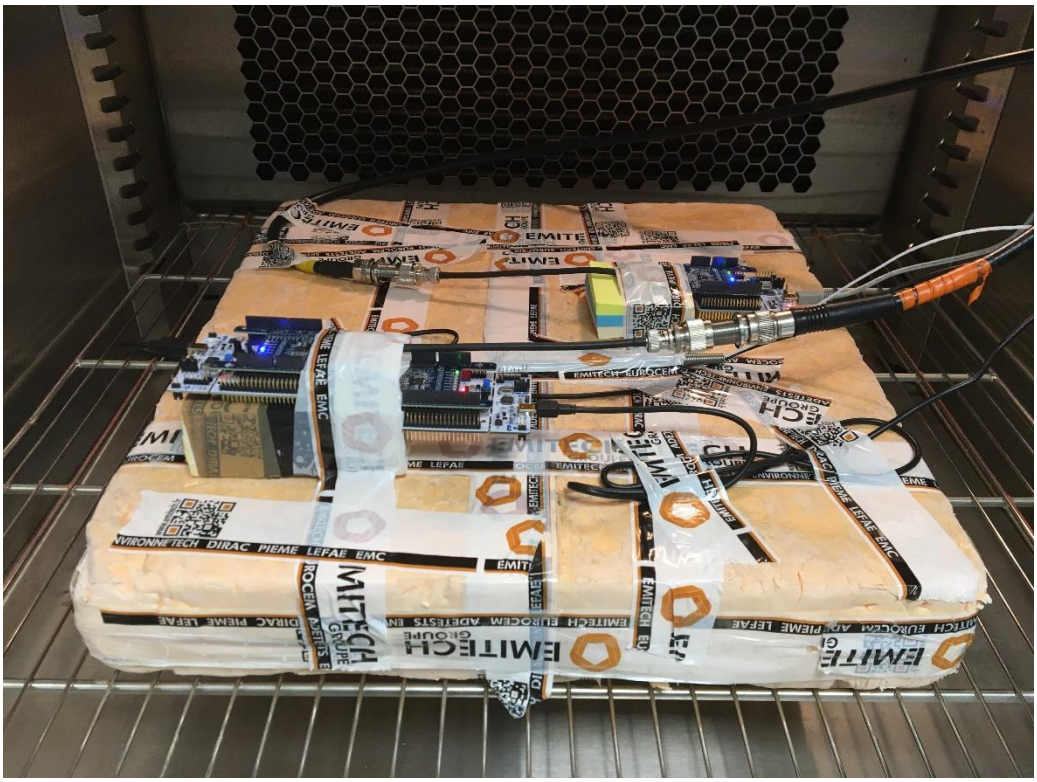
LABORATORY PARAMETERS:	REQUIRED PRIOR TO THE TEST	DURING THE TEST
Ambient Temperature	15 to 35 °C	20 °C
Relative Humidity	20 to 75 %	44.9 %
Atmospheric pressure	N/A	1014 hPa
Test method deviation: N/A		
Supplementary information: The power supply is 110Vac/60Hz, however the EUT is supplied by an AC/DC (5Vdc) convertor		

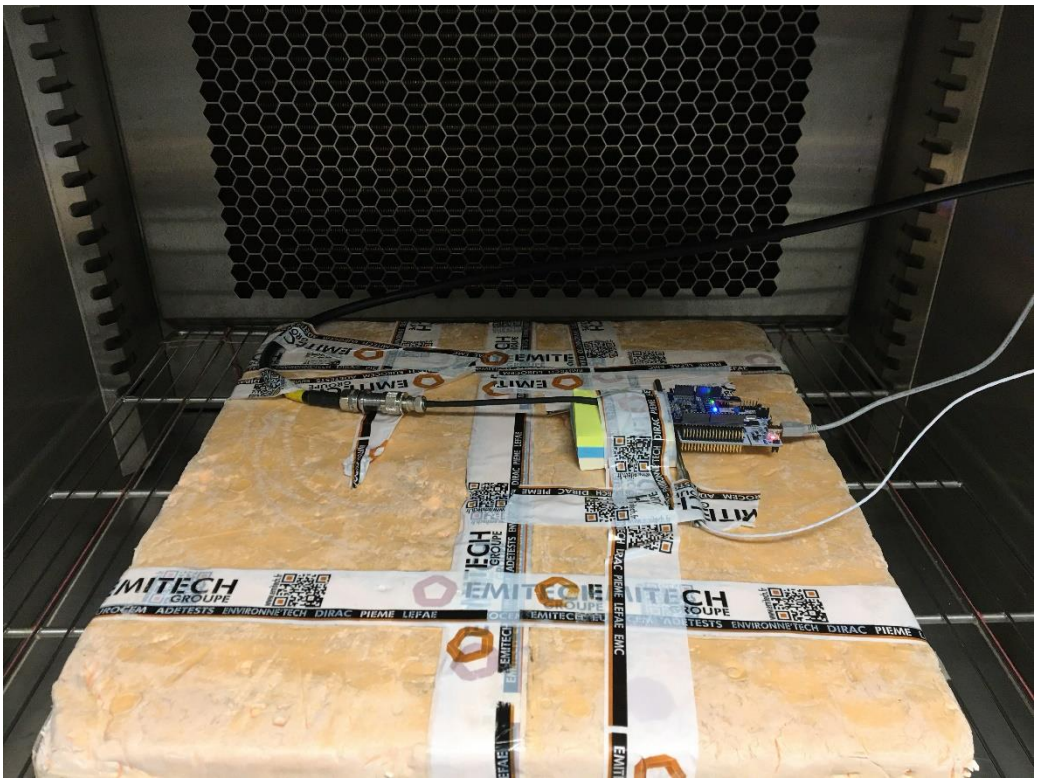
TEST EQUIPMENT USED					
CATEGORY	BRAND	TYPE	IDENTIFIER	CAL. DATE	CAL. DUE
Attenuator	Radiall	R412710124	17328	22/06/2020	22/08/2023
Attenuator	Radiall	R412710124	17329	22/06/2020	22/08/2023
Cable	C&C	N-3m	14334	18/03/2021	18/05/2023
AC power source	GW Instek	APS-1102	17782	15/04/2021	15/04/2022
Cable	/	N-3m	2710	28/08/2021	28/10/2023
Climatic enclosure	CLIMATS	EXCAL 7714-HA	14261	07/04/2021	07/06/2022
Receiver	Rohde & Schwarz	FPL1003	16027	15/08/2020	15/02/2022
Software	Nexio	BAT EMC	0000		
Spectrum analyzer	Rohde & Schwarz	FPL1007	17908	26/08/2021	26/10/2022
Thermohygrometer	Testo	608-H1	7562	09/06/2021	09/08/2023
Thermohygrometer	Bioblock Scientific	Météostar	0963	07/06/2021	07/08/2023
Thermometer contactless	GHM Greisinger	GMH 3710	12968	06/10/2020	06/06/2022

BAT-EMC software version: V3.18.0.26 Blank cells = Permanent validity

EFFECTIVE RADIATED POWER - TABULATED RESULTS – READER MODE				
Test Case (Temperature variation)	**Temperature (°C)**	**Power supply (VDC)**	**Frequency (MHz)**	**Frequency error (%)**
Normal conditions	+25	120	13.5604719	0
		102	13.5604719	0
		138	13.5604719	0
Extremes tests conditions	+10	120	13.5605156	0.00000044
		102	13.5605156	0.00000044
		138	13.5605156	0.00000044
	+40	120	13.5604344	-0.00000081
		102	13.5604344	-0.00000081
		138	13.5604344	-0.00000081

EFFECTIVE RADIATED POWER - TABULATED RESULTS – CARD EMULATION MODE				
Test Case (Temperature variation)	**Temperature (°C)**	**Power supply (VDC)**	**Frequency (MHz)**	**Frequency error (%)**
Normal conditions	+25	120	13.5603219	0
		102	13.5603219	0
		138	13.5603219	0
Extremes tests conditions	+10	120	13.5603406	0.00000019
		102	13.5603406	0.00000019
		138	13.5603406	0.00000019
	+40	120	13.5602719	-0.00000069
		102	13.5602719	-0.00000069
		138	13.5602719	-0.00000069

TEST SETUP PHOTO(S) – CLIMATIC ENCLOSURE


TEST SETUP PHOTO(S) – CLIMATIC ENCLOSURE


End of test report