Release July, 2017

TEST REPORT

N°: 165861-747886-A (FILE#1036390) **Version : 01**

Subject	**Electromagnetic compatibility tests according to the standards:** **FCC CFR 47 Part 15, Subpart B and C** **RSS-210 Issue 9**
Issued to	**MARKEM-IMAJE** 9 rue Gaspard Monge 26500 BOURG LES VALENCE France
Apparatus under test	
⇘ Product	**Continuous Inkjet Marking and Coding equipment**
⇘ Trade mark	**MARKEM IMAJE**
⇘ Manufacturer	**MARKEM IMAJE INDUSTRIES**
⇘ Model under test	**9330**
⇘ Serial number	**9330-BETA 1.9**
⇘ FCCID	**2AAW8-MI9330**
⇘ IC	**11372A-MI9330**
Conclusion	See Test Program chapter
Test date	February 18, 2020 to February 20, 2020
Test location	Fontenay-aux-roses
IC Test site	6230B-1
Composition of document	34 pages
Document issued on	March 23, 2020

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PUBLICATION HISTORY

Version	Date	Author	Modification
01	March 23, 2020	Gaetan DESCHAMPS	Creation of the document

SUMMARY

1. TEST PROGRAM

Standard:

- **FCC Part 15, Subpart C and B**
- **FCC Part 15 §15.225**
- **ANSI C63.10 (2013) and ANSI C63.4 (2014)**
- **RSS-210 Issue 9**
- **RSS-Gen Issue 5**

EMISSION TEST	LIMITS			RESULTS (Comments)
Limits for conducted disturbance at mains ports 150kHz-30MHz *CFR 47 §15.207*	**Frequency**	**Quasi-peak value (dBµV)**	**Average value (dBµV)**	☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
	150-500kHz	79	66	
	0.5-30MHz	73	60	
Radiated emissions 9kHz-30MHz *CFR 47 §15.209 (a)* *CFR 47 §15.225* *RSS-Gen §4.9*	**Measure at 300m** 9kHz-490kHz : 67.6dBµV/m /F(kHz) **Measure at 30m** 490kHz-1.705MHz : 87.6dBµV/m /F(kHz) 1.705MHz-30MHz : 29.5 dBµV/m			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Radiated emissions 30MHz-25GHz* *CFR 47 §15.209 (a)* *CFR 47 §15.225* *RSS-Gen §4.9* ***Highest frequency :*** ***(Declaration of provider)***	**Measure at 3m** 30MHz-88MHz : 40 dBµV/m 88MHz-216MHz : 43.5 dBµV/m 216MHz-960MHz : 46.0 dBµV/m Above 960MHz : 54.0 dBµV/m			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Fundamental field strength limit *CFR 47 §15.225* *RSS-210 §B.6*	**Operation within the band** **13.110-14.010 MHz**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Fundamental frequency tolerance *CFR 47 §15.225* *RSS-210 §B.6*	**Operation within the band** **13.110-14.010 MHz**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Band edge compliance *CFR 47 §15.225* *RSS-210 §B.6*	**Operation within the band** **13.110-14.010 MHz**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Occupied bandwidth *RSS-Gen Issue 5 §6.7*	**No limit**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Receiver Spurious Emission** *RSS-Gen Issue 5 §7.3*	**See RSS-Gen §7.3**			☐ **PASS** ☐ **FAIL** ☑ **NA** ☐ **NP**

***§15.33:** The highest internal source of a testing device is defined like more the highest frequency generated or used in the testing device or on which the testing device works or agrees.
- If the highest frequency of the internal sources of the testing device is lower than 108 MHz, measurement must be only performed until 1GHz.
- If the highest frequency of the internal sources of the testing device ranges between 108 MHz and 500 MHz, measurement must be only performed until 2GHz.
- If the highest frequency of the internal sources of the testing device ranges between 500 MHz and 1 GHz, measurement must be only performed until 5GHz.

If the highest frequency of the internal sources of the testing device is above 1 GHz, measurement must be only performed until 5 times the highest frequency or 40 GHz, while taking smallest of both.

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

2. SYSTEM TEST CONFIGURATION

2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):
9330: Ink Jet Printer
Serial Number: 9330-BETA 1.9

Equipment Under Test

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

Name	Type	Rating	Reference / Sn	Comments
Supply1	☑ AC ☐ DC ☐ Battery	100-240 VAC (50Hz -60Hz)		

Voltage table used in Conducted Emission:

Type	Measurement performed:	
☑ AC	☑ **120VAC/60Hz**	☑ **240VAC/50Hz**
☐ DC	☐ **+....VDC**	☐ **-....VDC**
☐ USB (Laptop auxiliary)	☐ **120VAC/60Hz (Laptop auxiliary)**	☐ **240VAC/50Hz(Laptop auxiliary)**

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply1	C13 (3 wires: L+N+PE)	2	☑	☐	☑	-
Access1	Umbilical cable	3	☐	☑	☑	-
Access2	Beacon cable	3	☐	☐	☑	-
Access3	Tachymeter cable	5	☐	☑	☑	-
Access4	Proximity Cell cable	5	☐	☐	☑	-
Access5	RJ45 (Ethernet)	10	☐	☐	☑	-
Access6	StopLine - Dry contact	10	☐	☑	☑	-
Access7	RS232	15	☐	☑	☑	-

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Printing Head	IMAJE A46508	CN20020214	-
Proximity cell	IMAJE A16469/B	-	-
Pulse encoder	IMAJE A35356	200502111757	-
Beacon	PATLITE	MP02C	-
Lenovo Laptop	L460	-	
AC source 2kW	KEYSIGHT(AC6802A)	-	LCIE refrence: A7042305
Multimeter - CEM	FLUKE	-	LCIE refrence: A1240251

Equipment information:

RF mode:	☐ Transmitter	☑ Transceiver	☐ Receiver	☐ Standby
Type:	☑ RFID	☐ EAS	☐ Other:	
Bandwidth:	☐ Narrowband		☑ Wideband : **13.56MHz**	
Equipment intended for use as a	☑ Fixed	☐ Mobile	☐ Portable	
Type of equipment:	☑ Stand-alone	☐ Plug-in	☐ Combined	
Antenna Type:	☐ External		☑ Internal	
Antenna connector:	☐ Permanent external	☑ Permanent internal	☐ None	☐ Temporary (only for tests)
Antenna Gain:	Nc* dBi			
Duty cycle:	☑ Continuous duty	☐ Intermittent duty	☐ Continuous operation	
Equipment type:	☐ Production model		☑ Prototype	
Temperature range:	Tmin:	☐ -20°C	☐ 0°C	☑ 5 °C
	Tnom:	20°C		
	Tmax:	☐ 35°C	☐ 55°C	☑ 40 °C
Type of power source:	☑ AC power supply	☐ DC power supply	☐ Battery (Select type)	
Test source voltage in §5:	Vmin:	☑ 90.0V/50Hz	☐ VDC	
	Vnom:	☑ 230V/50Hz	☐ VDC	
	Vmax	☑ 264V/50Hz	☐ VDC	

Nc*: Not communicated

2.2. EUT CONFIGURATION

Hardware information		
Firmware (if applicable):	**V. :**	**Nc***
Software (if applicable):	**V. :**	**Nc***

Nc*: Not communicated
Permanent emission with or without Tag (Worst case presented).

2.3. EQUIPMENT MODIFICATIONS

☑ None ☐ Modification:

2.4. 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

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.

2.5. 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

3. CONDUCTED EMISSION

3.1. ENVIRONMENTAL CONDITIONS

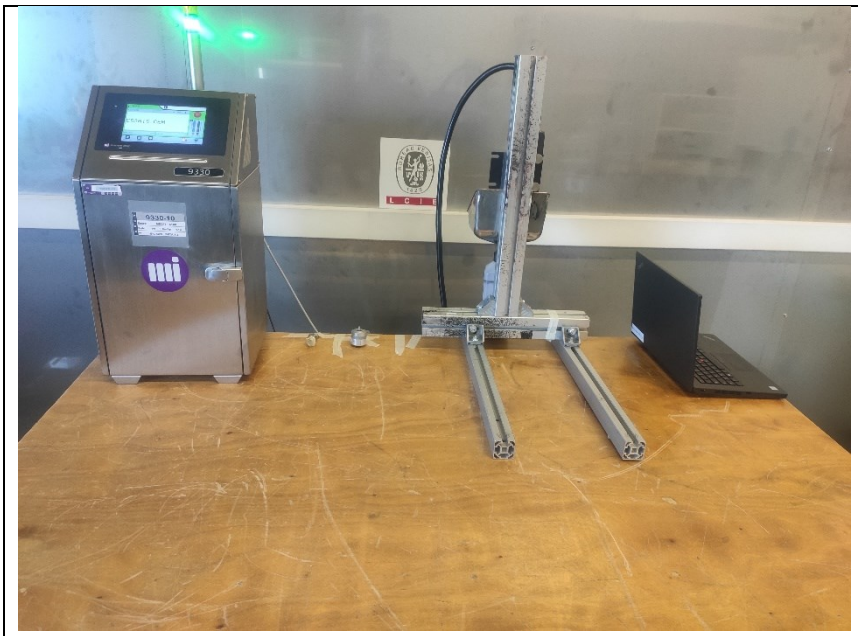
Date of test	:	February 11, 2020
Test performed by	:	Hamza GHAFILI
Atmospheric pressure (hPa)	:	998
Relative humidity (%)	:	44
Ambient temperature (°C)	:	24

3.2. TEST SETUP

Mains terminals

The EUT and auxiliaries are set:
☑ 80cm above the ground on the non-conducting table (Table-top equipment)
☐ up to 15cm above the ground on isolating support (Floor standing equipment)
The distance between the EUT and the LISN is 80cm. The EUT is 40cm away for the vertical ground plane.

The EUT is powered by 240 VAC-50Hz.
The EUT is powered through a LISN (measure). Auxiliaries are powered by another LISN.



Test setup

3.3. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
BAT EMC	NEXIO	v3.19.1.18	L1000115	_	_
Cable + self	_	_	A5329585	12/18	02/20
EMC comb generator	LCIE SUD EST	_	A3169098	_	_
LISN	ROHDE & SCHWARZ	ENV216	C2320291	02/19	02/20
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	12/17	02/20
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Transient limiter	ROHDE & SCHWARZ	ESH3-Z2	A7122204	02/19	02/20
ISN 8 wires	TESEQ	T800	C2320170	02/19	02/21

3.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

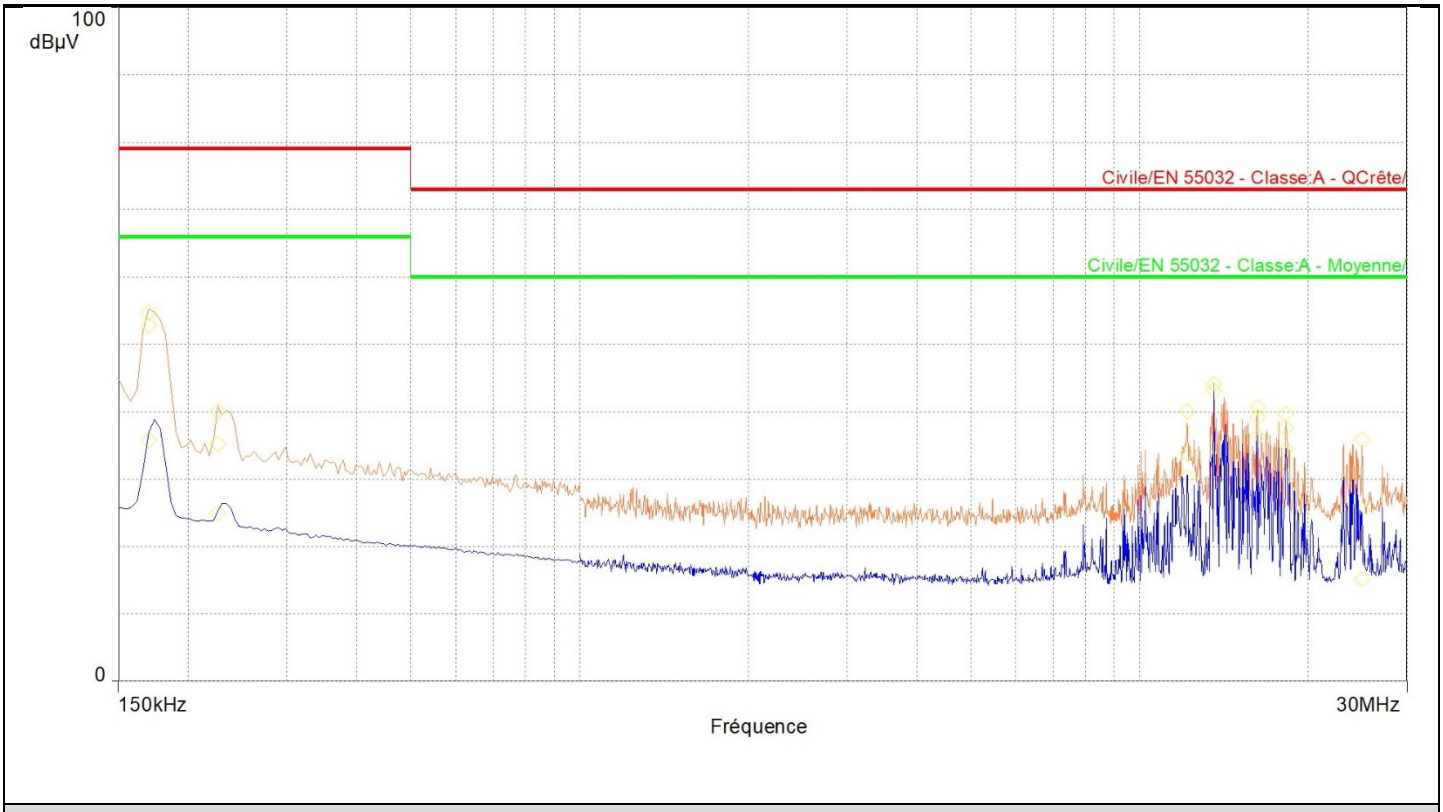
3.5. TEST RESULTS

Mains terminals:

Supply1
Measurements are performed on the phase (L1) and neutral (N) of the power line.
Results: (PEAK detection)

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

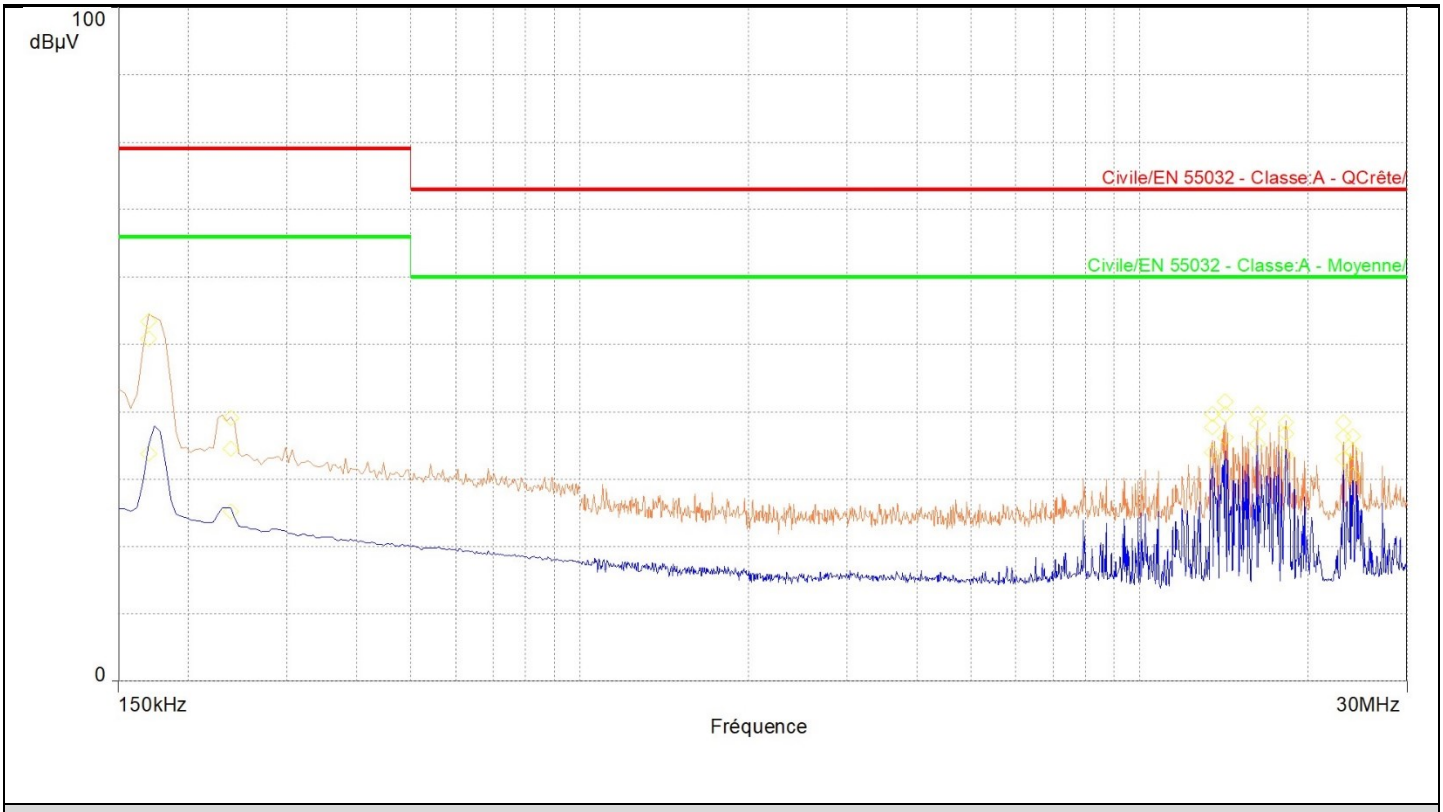
CONDUCTED EMISSIONS			
Graph name:	Emc#1	**Test configuration:**	
Limit:	EN 55032	Phase_120VAC-60Hz	
Class:	A		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:		**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



Spurious emissions

Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)	Line	Correction (dB)
0.170	54.6	52.8	79.0	-26.2	35.8	66.0	-30.2	Phase 1	19.5
0.226	40.1	35.2	79.0	-43.8	25.0	66.0	-41.0	Phase 1	19.5
12.136	40.1	33.8	73.0	-39.2	30.4	60.0	-29.6	Phase 1	20.4
13.560	44.1	43.2	73.0	-29.8	22.8	60.0	-37.2	Phase 1	20.4
16.228	40.8	39.3	73.0	-33.7	36.4	60.0	-23.6	Phase 1	20.6
18.244	39.7	37.6	73.0	-35.4	34.6	60.0	-25.4	Phase 1	20.7
24.944	35.9	25.4	73.0	-47.6	15.2	60.0	-44.8	Phase 1	21.1

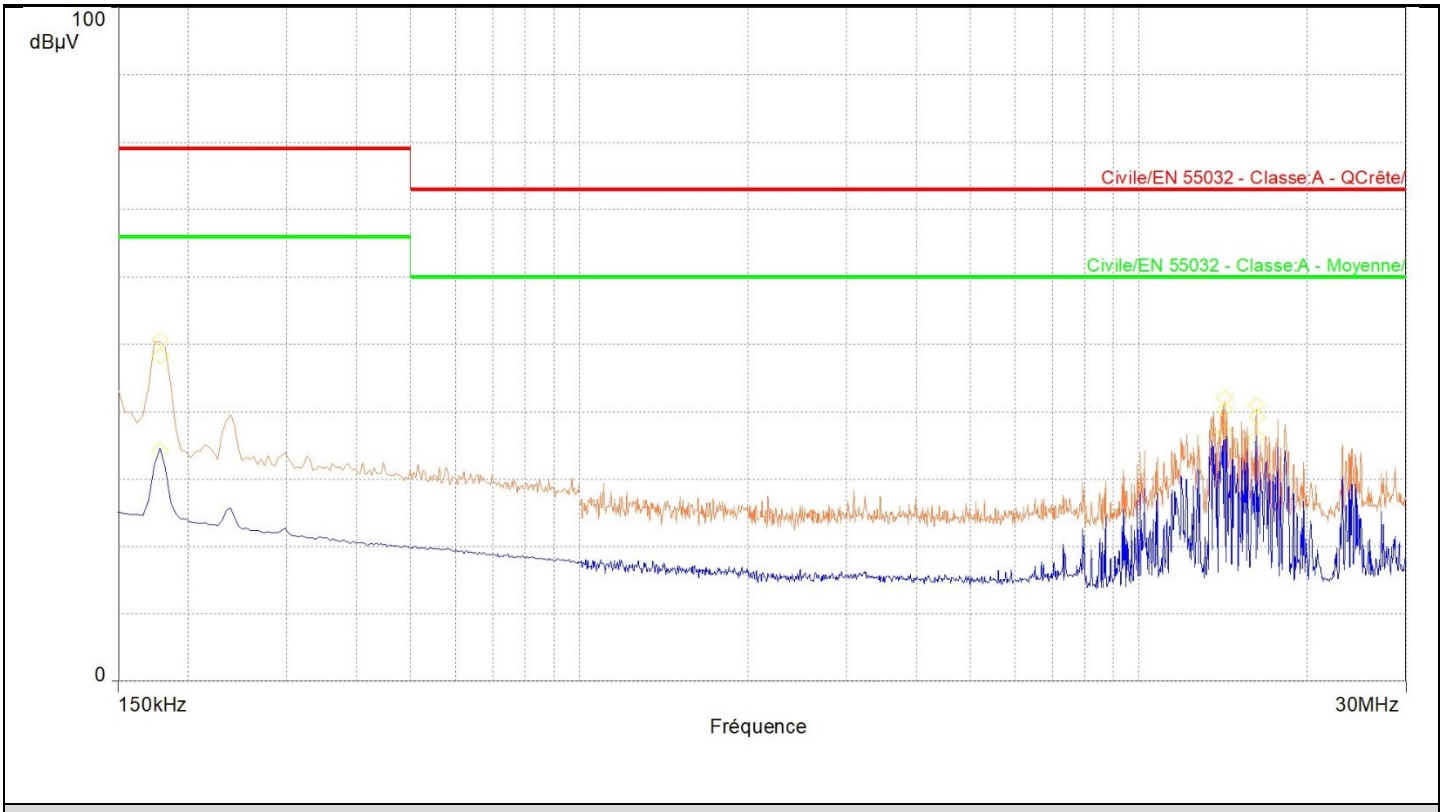
CONDUCTED EMISSIONS			
Graph name:	Emc#2	**Test configuration:**	
Limit:	EN 55032	Neutral_120VAC-60Hz	
Class:	A		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:		**RBW :**	10kHz
Line:	Neutral	**VBW :**	30kHz



Spurious emissions

Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)	Line	Correction (dB)
0.170	53.4	50.9	79.0	-28.1	33.8	66.0	-32.2	Neutre	19.5
0.238	39.0	34.5	79.0	-44.5	25.2	66.0	-40.8	Neutre	19.5
13.480	39.7	37.7	73.0	-35.3	34.0	60.0	-26.0	Neutre	20.4
14.212	41.5	39.7	73.0	-33.3	36.1	60.0	-23.9	Neutre	20.5
16.228	39.7	38.3	73.0	-34.7	35.3	60.0	-24.7	Neutre	20.6
18.244	38.4	36.7	73.0	-36.3	33.6	60.0	-26.4	Neutre	20.7
23.128	38.4	36.3	73.0	-36.7	33.0	60.0	-27.0	Neutre	21.0
24.044	36.3	34.1	73.0	-38.9	30.6	60.0	-29.4	Neutre	21.0

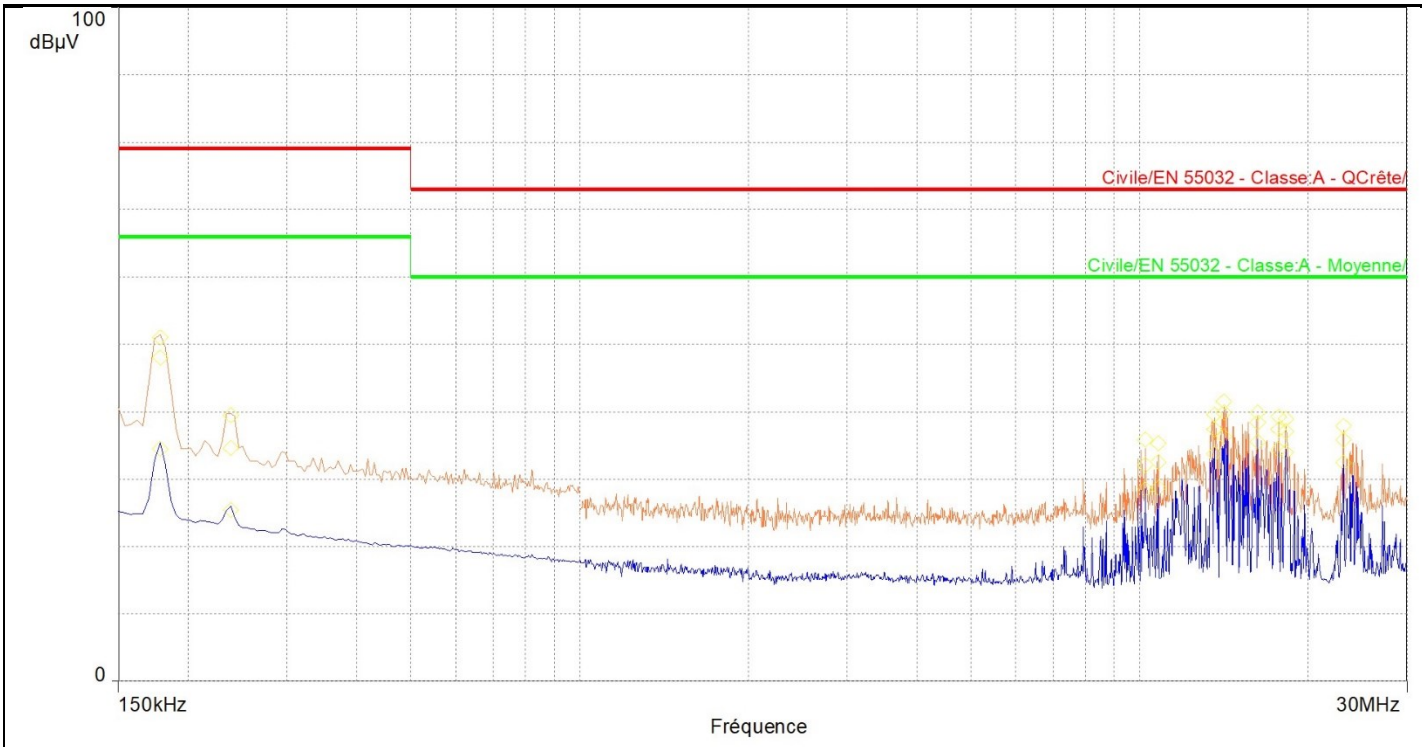
CONDUCTED EMISSIONS			
Graph name:	Emc#3	**Test configuration:**	
Limit:	EN 55032	Phase_240VAC / 50Hz	
Class:	A		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:		**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



Spurious emissions

Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)	Line	Correction (dB)
0.178	50.6	48.2	79.0	-30.8	34.3	66.0	-31.7	Phase 1	19.5
14.212	42.1	40.3	73.0	-32.7	36.9	60.0	-23.1	Phase 1	20.5
16.228	41.1	39.2	73.0	-33.8	36.3	60.0	-23.7	Phase 1	20.6

CONDUCTED EMISSIONS			
Graph name:	Emc#4	**Test configuration:**	
Limit:	EN 55032	Neutral_240VAC / 50Hz	
Class:	A		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:		**RBW :**	10kHz
Line:	Neutral	**VBW :**	30kHz



Spurious emissions

Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)	Line	Correction (dB)
0.178	51.0	48.1	79.0	-30.9	34.5	66.0	-31.5	Neutre	19.5
0.238	39.5	34.6	79.0	-44.4	25.4	66.0	-40.6	Neutre	19.5
10.244	35.9	32.2	73.0	-40.8	28.6	60.0	-31.4	Neutre	20.2
10.792	35.3	32.6	73.0	-40.4	28.8	60.0	-31.2	Neutre	20.3
13.604	39.5	37.4	73.0	-35.6	33.8	60.0	-26.2	Neutre	20.4
14.152	41.5	39.9	73.0	-33.1	36.3	60.0	-23.7	Neutre	20.5
16.228	39.9	38.5	73.0	-34.5	35.6	60.0	-24.4	Neutre	20.6
17.692	39.2	37.4	73.0	-35.6	34.4	60.0	-25.6	Neutre	20.7
18.244	39.0	37.1	73.0	-35.9	34.0	60.0	-26.0	Neutre	20.7
23.128	38.0	35.8	73.0	-37.2	32.4	60.0	-27.6	Neutre	21.0

3.6. CONCLUSION

The sample of the equipment **9330**, Sn: **9330-BETA 1.9**, tested in the configuration presented in this test report **satisfies** to requirements of class A limits of the standards FCC subpart15B and C and EN 55032, for conducted emissions.

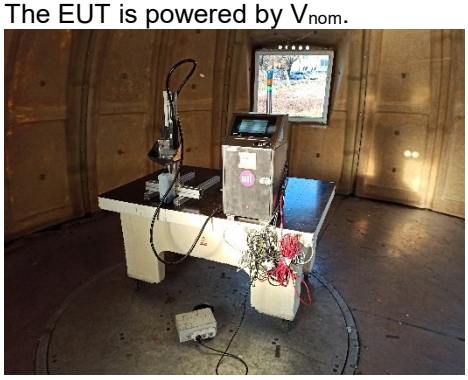
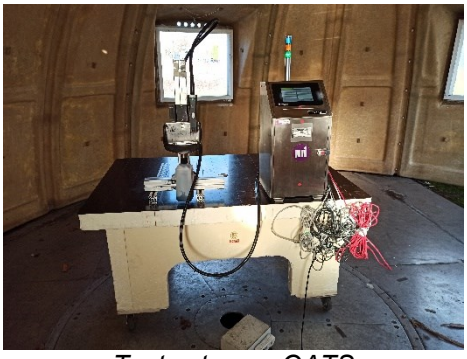
4. RADIATED EMISSION DATA (15.209)

4.1. ENVIRONMENTAL CONDITIONS

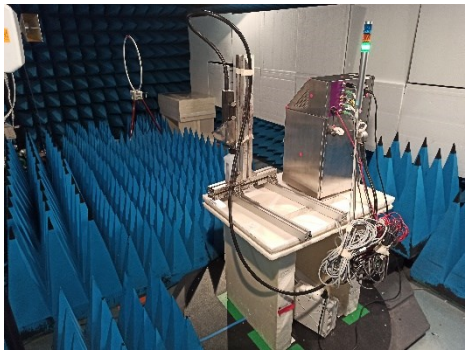
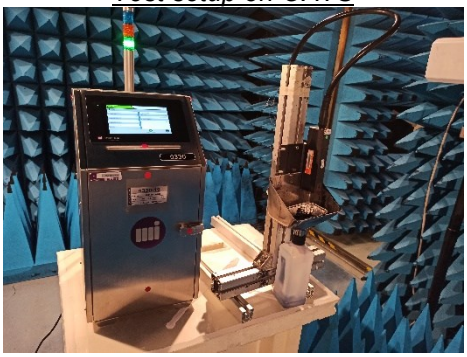
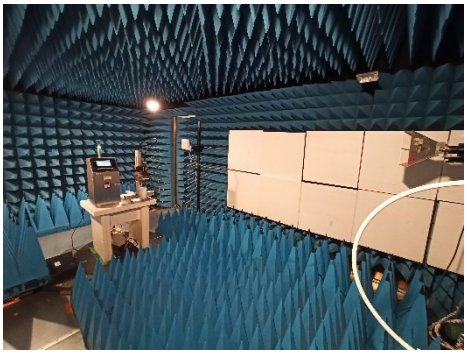
Date of test	:	February 18, 2020
Test performed by	:	Mounir BOUAMARA / Gaetan DESCHAMPS
Atmospheric pressure (hPa)	:	999
Relative humidity (%)	:	33
Ambient temperature (°C)	:	19

4.2. TEST SETUP

The installation of EUT is identical for pre-characterization measures in a 3 meters semi- anechoic chamber and for measures on the 10 meters Open site.
The EUT and auxiliaries are set:
☑ 80cm above the ground on the non-conducting table (Table-top equipment) - Below 1GHz
☐ 150cm above the ground on the non-conducting table (Table-top equipment) - Above 1GHz
☐ 10cm above the ground on isolating support (Floor standing equipment)
The EUT is powered by V_{nom}.


Test setup on OATS

Test setup in anechoic chamber

4.3. TEST METHOD

The product has been tested according to ANSI C63.10, FCC Part 15 Subpart B and C.
Pre-characterisation measurement: (9kHz – 1GHz)
A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber for frequency from 9kHz to 1GHz. Test is performed in horizontal (H) and vertical (V) polarization, the loop antenna was rotated during the test for maximized the emission measurement. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration.

The pre-characterization graphs are obtained in PEAK detection and PEAK/AVERAGE from 1GHz to 2 GHz.

Characterization on 10 meters open site from 9kHz to 1GHz:
Radiated Emissions were measured on an open area test site. A description of the facility is on file with the FCC. The product has been tested at a distance of **10 meters** from the antenna and compared to the FCC Part 15 Subpart B and C limits. Measurement bandwidth was 9kHz below 30MHz and 120kHz from 30 MHz to 1GHz. Test is performed in horizontal (H) and vertical (V) polarization, the loop antenna was rotated during the test for maximized the emission measurement. The height antenna is varied from 1m to 4m. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement 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.
Frequency list has been created with anechoic chamber pre-scan results.

Characterization on 3 meters full anechoic chamber from 1GHz to 2GHz:
The product has been tested at a distance of **3 meters** from the antenna and compared to the FCC Part 15 Subpart B and C limits. Measurement bandwidth was 1MHz from 1GHz to 2GHz. Test is performed in horizontal (H) and vertical (V) polarization. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement 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.The height antenna is
☐ On mast, varied from 1m to 4m
☑ Fixed and centered on the EUT (EUT smaller than the beamwidth of the measurement antenna, ANSI C63.10 §6.6.5)
Frequency list has been created with anechoic chamber pre-scan results.

4.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Amplifier 9kHz - 40GHz	LCIE SUD EST	_	A7102082	10/18	03/20
Antenna Bi-Log	CHASE	UPA6192	C2040221	01/18	01/20
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	06/19	06/21
Comb EMR HF	YORK	CGE01	A3169114		
Emission Cable (SMA 30cm)	TELEDYNE	26GHz	A5329873	01/19	01/20
Emission Cable <1GHz (Ampl <-> Cage)	-	18GHz	A5329562	08/19	08/20
Emission Cable <1GHz (Ampl <-> Cage)	-	18GHz	A5329907	08/19	08/20
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	12/17	02/20
Semi-Anechoic chamber #3 (BF)	SIEPEL	_	D3044017_BF	03/17	03/20
Semi-Anechoic chamber #3 (VSWR)	SIEPEL	_	D3044017_VSWR	03/17	03/20
Spectrum analyzer	ROHDE & SCHWARZ	FSU 26	A4060058	09/19	09/21
Table C3	LCIE	_	F2000461		
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371		
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444		
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20
Antenna Bi-log	CHASE	CBL6111A	C2040051	06/19	06/20
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	06/19	06/21
Emission Cable	SUCOFLEX	6GHz	A5329061	02/19	02/20
Cable (OATS)	-	1GHz	A5329623	03/19	03/20
Radiated emission comb generator	BARDET	-	A3169050	-	-
OATS	-	-	F2000409	02/19	02/20
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	12/17	12/19
Turntable / Mast controller (OATS)	ETS Lindgren	Model 2066	F2000372	-	-
Antenna mast (OATS)	ETS Lindgren	2071-2	F2000392	-	-
Turntable (OATS)	ETS Lindgren	Model 2187	F2000403	-	-
Table C1/OATS	MATURO Gmbh	-	F2000437	-	-

4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

4.6. TEST RESULTS

4.6.1. Pre-characterization at 3 meters [9kHz-30MHz]

See graph for 9kHz-30MHz band:

Graph identifier		Polarization	EUT position	Comments	
Emr#	1	0°&90°	Axis XY		See annex 1
Emr#	2	180°	Axis XY		See annex 1

4.6.2. Pre-characterization at 3 meters [30MHz-1GHz]

See graphs for 30MHz-1GHz:

Graph identifier		Polarization	EUT position	Comments	
Emr#	3	Horizontal & Vertical	Axis XY		See annex 1

4.6.3. Pre-characterization at 3 meters [1GHz-2GHz]

See graphs for 1GHz-2GHz:

Graph identifier		Polarization	EUT position	Comments	
Emr#	4	Horizontal & Vertical	Axis XY		See annex 1

4.6.4. Characterization on 10 meters open site below 30 MHz

Worst case final data result:

Frequency list has been created with semi-anechoic chamber pre-scan results.
Measurements are performed using a QUASI-PEAK detection.
Test performed:
☑ OATS
Ambient temperature: 12 °C
Relative humidity: 50 %
Note: It is impracticable to carry out tests under normal condition as specified in standard.

No	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
1	13,56	84	16	**-68**	280°	90°	150	35,5	-

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

Limits Sub clause §15.225

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
13.553-13.567	15 848 84 dBµV/m	30
13.410-13.553 13.567-13.710	334 50.5 dBµV/m	30
13.110-13.410 13.710-14.010	106 40.5 dBµV/m	30

See following chapter of this test report for band edge measurements.

4.6.5. Characterization on 10 meters open site from 30MHz to 1GHz

Worst case final data result:

Frequency list has been created with semi-anechoic chamber pre-scan results.
Measurements are performed using a QUASI-PEAK detection.

Test Frequency (MHz)	Meter Reading dB(µV)	Detector (Pk/QP/Av)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Gain/Loss Factor (dB)	Transducer Factor (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Remark
30.900	14.2	QP	V	360	100	-	19.2	33.4	40.0	**-6.6**	
41.170	24.5	QP	V	360	100	-	13.7	38.2	40.0	**-1.8**	
41.550	25.7	QP	V	360	100	-	13.5	39.2	40.0	**-0.8**	
41.550	22.6	QP	H	360	400	-	13.5	36.1	40.0	**-3.9**	
37.440	23.9	QP	H	360	400	-	15.7	39.6	40.0	**-0.4**	
120.350	25.5	QP	V	360	100	-	14.0	39.5	43.5	**-4.0**	
120.490	25.9	QP	V	360	100	-	14.0	39.9	43.5	**-3.6**	
120.350	22.9	QP	H	234	400	-	14.0	36.9	43.5	**-6.6**	
130.990	16.8	QP	V	46	100	-	13.9	30.7	43.5	**-12.8**	
666.690	19.3	QP	H	42	100	-	25.8	45.1	46.0	**-0.9**	
145.740	17.5	QP	V	239	100	-	13.4	30.9	43.5	**-12.6**	
130.980	18.5	QP	V	68	100	-	13.9	32.4	43.5	**-11.1**	
112.190	29.5	QP	V	283	100	-	13.4	42.9	43.5	**-0.6**	
71.080	28.3	QP	V	230	100	-	7.7	36.0	40.0	**-4.0**	
112.340	20.0	QP	H	360	400	-	13.4	33.4	43.5	**-10.1**	

Note: Measure have been done at 10m distance and corrected according to requirements of 15.209.e) (M@3m = M@10m+10.5dB)

4.6.6. Characterization on 3meters anechoic chamber from 1GHz to 2GHz

Worst case final data result:

The frequency list is created from the results obtained during the pre-characterization in anechoic chamber. Measurements are performed using a PEAK and AVERAGE detection.

Test Frequency (MHz)	Meter Reading dB(µV)	Detector (Av)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Transducer Factor (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
No significant frequency observed									

Note: Measures have been done at 3m distance.

4.7. CONCLUSION

The sample of the equipment **9330**. Sn: **9330-BETA 1.9**. tested in the configuration presented in this test report **satisfies** to requirements of class B limits of the standard FCC Part 15 Subpart B and C. for radiated emissions.

5. FUNDAMENTAL FREQUENCY TOLERANCE (15.225E)

5.1. ENVIRONMENTAL CONDITIONS

Date of test	:	February 19, 2020
Test performed by	:	Mounir BOUAMARA /Gaetan DESCHAMPS
Atmospheric pressure (hPa)	:	999
Relative humidity (%)	:	34
Ambient temperature (°C)	:	23

5.2. TEST SETUP

Frequency of carrier: 13.56 MHz
Upper limit: 13.561356 MHz
Lower limit: 13.558644 MHz
The equipment (RF box) is set in a climatic chamber. Measure is performed on one channel of RF module.

Test setup

5.3. TEST METHOD

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency when the temperature is varied from 5°C to +40°C at the nominal power voltage and the primary power voltage is varied from 90% to 110% of the rated supply voltage at 20°C.

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	06/19	06/21
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	02/19	02/20
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20
SMA 1.5m	SUCOFLEX	18GHz	A5329863	11/18	03/20
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	06/18	06/20
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Thermocouple K (radio)	FLUKE	Type K	B4045005	09/19	09/20
Thermocouple K (radio)	FLUKE	Type K	B4045004	09/19	09/20
Thermometer (radio)	FLUKE	52 II	B4043150	09/19	09/20

5.5. DIVERGENCE. ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

5.6. TEST RESULTS

Voltage \ Temperature	+5°C	+10°C	+20°C	+30°C	+40°C
Mains voltage: 230V/60Hz Frequency Drift (MHz) Carrier level (dBc)	 + 0.000031 - 0.46	 + 0.000007 - 0.64	 **13.560107** **16.890000**	 - 0.000048 - 0.48	 - 0.000048 - 0.48
Mains voltage:190V/60Hz Frequency Drift (MHz) Carrier level (dBc)	 + 0.000031 - 0.48	 + 0.000007 - 0.58	 + 0.000001 **-0.07**	 - 0.000048 - 0.52	 - 0.000048 - 0.52
Mains voltage: 264V/60Hz Frequency Drift (MHz) Carrier level (dBc)	 + 0.000032 - 0.44	 + 0.000007 - 0.57	 + 0.000000 **- 0.01**	 - 0.000048 - 0.58	 - 0.000048 - 0.58

Frequency drift measured is 48**Hz** when the temperature is varied from +5°C to +40°C and voltage is varied.

5.7. CONCLUSION

The sample of the equipment **9330**. Sn: **9330-BETA 1.9**. tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part 15 Subpart C. for fundamental frequency tolerance.

6. BAND-EDGE COMPLIANCE §15.209

6.1. ENVIRONMENTAL CONDITIONS

Date of test	:	February 19, 2020
Test performed by	:	Mounir BOUAMARA /Gaetan DESCHAMPS
Atmospheric pressure (hPa)	:	999
Relative humidity (%)	:	34
Ambient temperature (°C)	:	23

6.2. TEST SETUP

For measurement. the power level calibration of the spectrum analyzer is related to the field strength measured in chapter radiated emission data.

Test setup

6.3. TEST METHOD

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.

Frequency band 13.553-13.567MHz
Following plots show radiated emission level in the frequency band 13.55.-13.567MHz with a RBW of 1kHz. The graphs are obtained with a measuring receiver.

6.4. TEST EQUIPMENT LIST

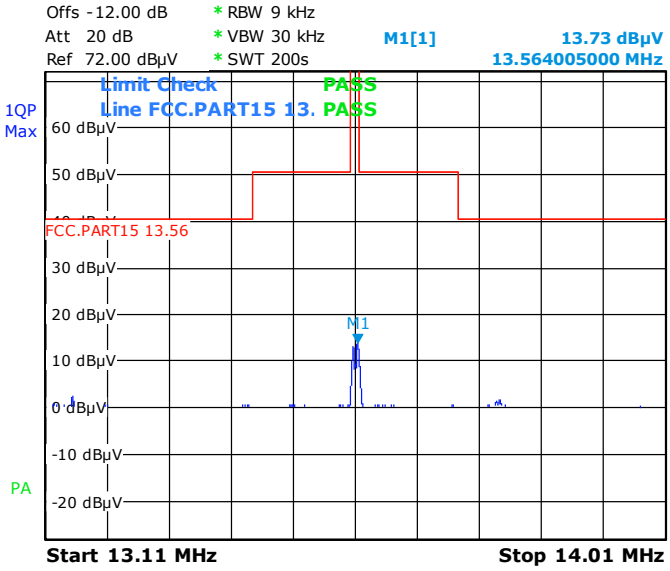
TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
AC source 1kW	KEYSIGHT	AC6802A	A7042305		
Antenna Loop (near field)	ELECTRO-METRICS	EM-6993	C2040215	06/19	06/21
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	02/19	02/20
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20
SMA 1.5m	SUCOFLEX	18GHz	A5329863	11/18	03/20
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	06/18	06/20
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Thermocouple K (radio)	FLUKE	Type K	B4045005	09/19	09/20
Thermocouple K (radio)	FLUKE	Type K	B4045004	09/19	09/20
Thermometer (radio)	FLUKE	52 II	B4043150	09/19	09/20

6.5. DIVERGENCE. ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

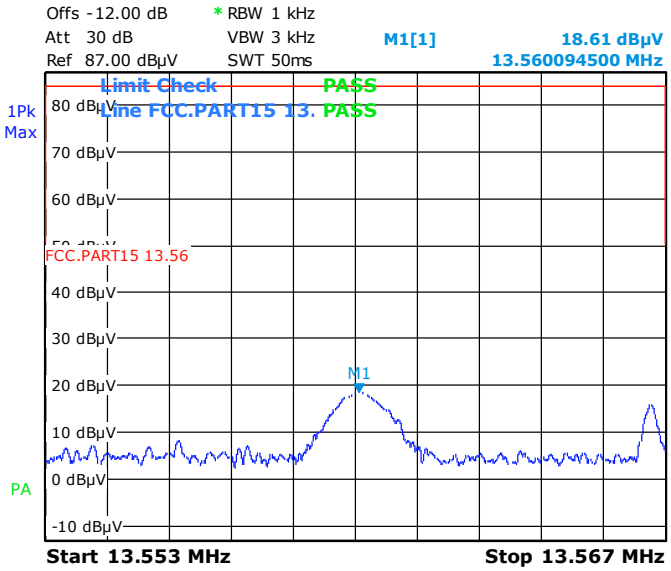
☑ None ☐ Divergence:

6.6. TEST RESULTS

Frequency band 13.110-14.010MHz



Frequency band 13.553-13.567MHz



6.7. CONCLUSION

The sample of the equipment **9330**. Sn: **9330-BETA 1.9** tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part 15 Subpart C. for band-edge compliance.

7. OCCUPIED BANDWIDTH

7.1. ENVIRONMENTAL CONDITIONS

Date of test : February 19, 2020
Test performed by : Mounir BOUAMARA /Gaetan DESCHAMPS
Atmospheric pressure (hPa) : 999
Relative humidity (%) : 34
Ambient temperature (°C) : 23

7.2. TEST SETUP

☐ ***Conducted measurement:***
The EUT is turned ON and connected to measurement instrument; 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.
Offset: Attenuator+cable 10.3dB

☑ ***Radiated measurement:***
The EUT is turned ON and connected to measurement instrument; 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.

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

7.3. TEST EQUIPMENT LIST

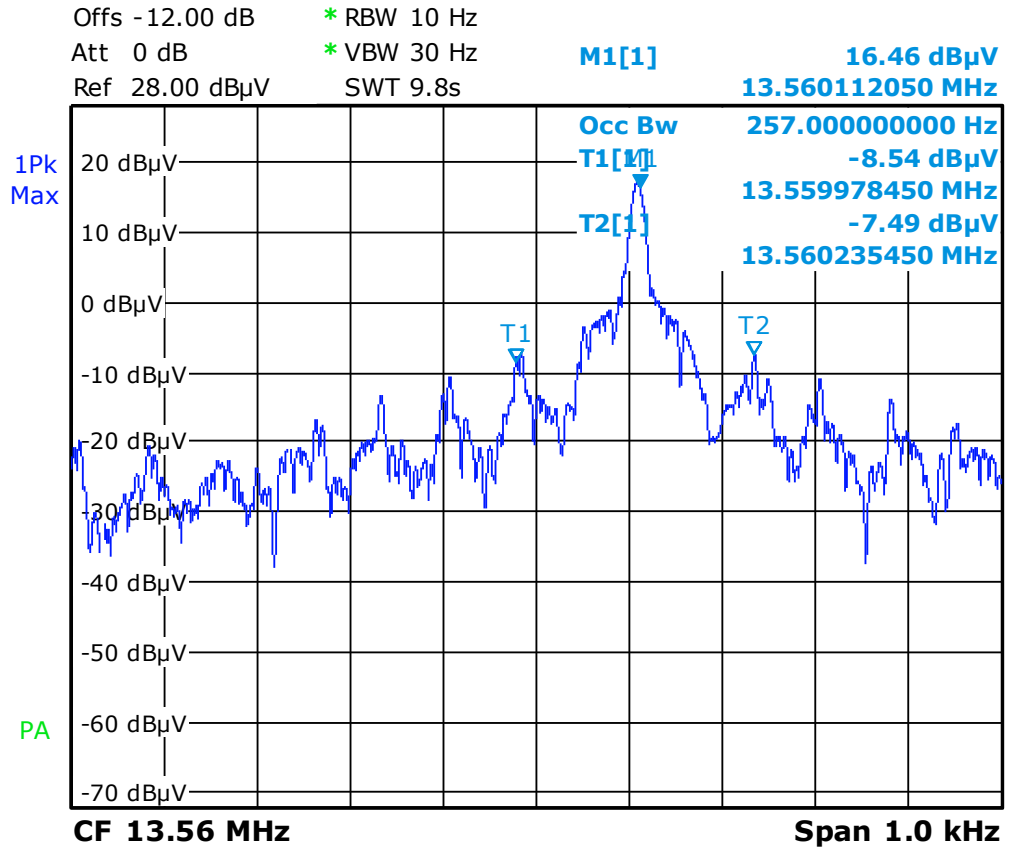
TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
AC source 1kW	KEYSIGHT	AC6802A	A7042305		
Antenna Loop (near field)	ELECTRO-METRICS	EM-6993	C2040215	06/19	06/21
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	02/19	02/20
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20
SMA 1.5m	SUCOFLEX	18GHz	A5329863	11/18	03/20
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	06/18	06/20
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Thermocouple K (radio)	FLUKE	Type K	B4045005	09/19	09/20
Thermocouple K (radio)	FLUKE	Type K	B4045004	09/19	09/20
Thermometer (radio)	FLUKE	52 II	B4043150	09/19	09/20

7.4. DIVERGENCE. ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

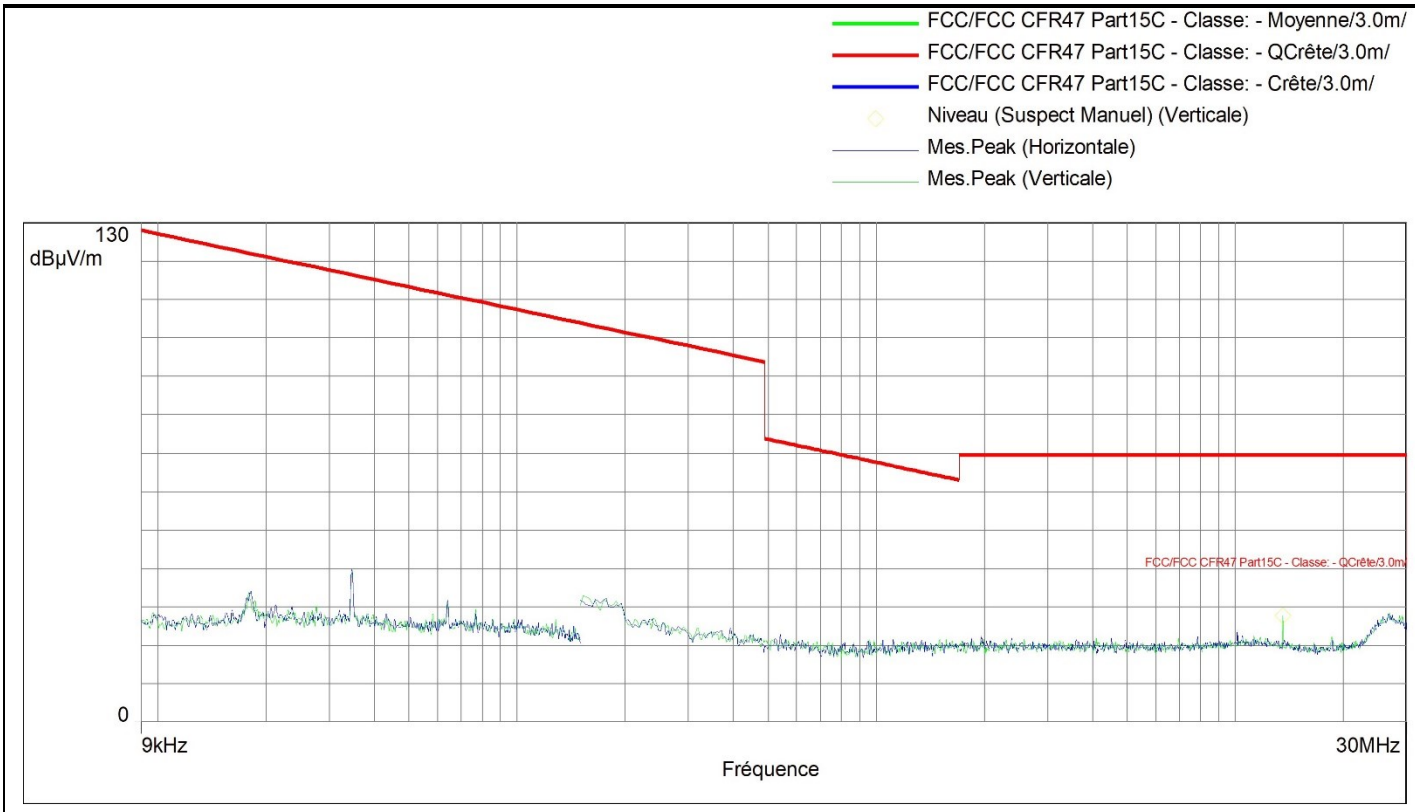
7.5. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	99% Occupied Bandwidth (MHz)
Nom	13.56	**0.000257**



8. ANNEX 1 (GRAPHS)

RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15C	13.56 MHz (0°/90°) XY porte fermée FCC	
Class:			
Frequency range: [9kHz - 30MHz]			
Antenna polarization:	Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz

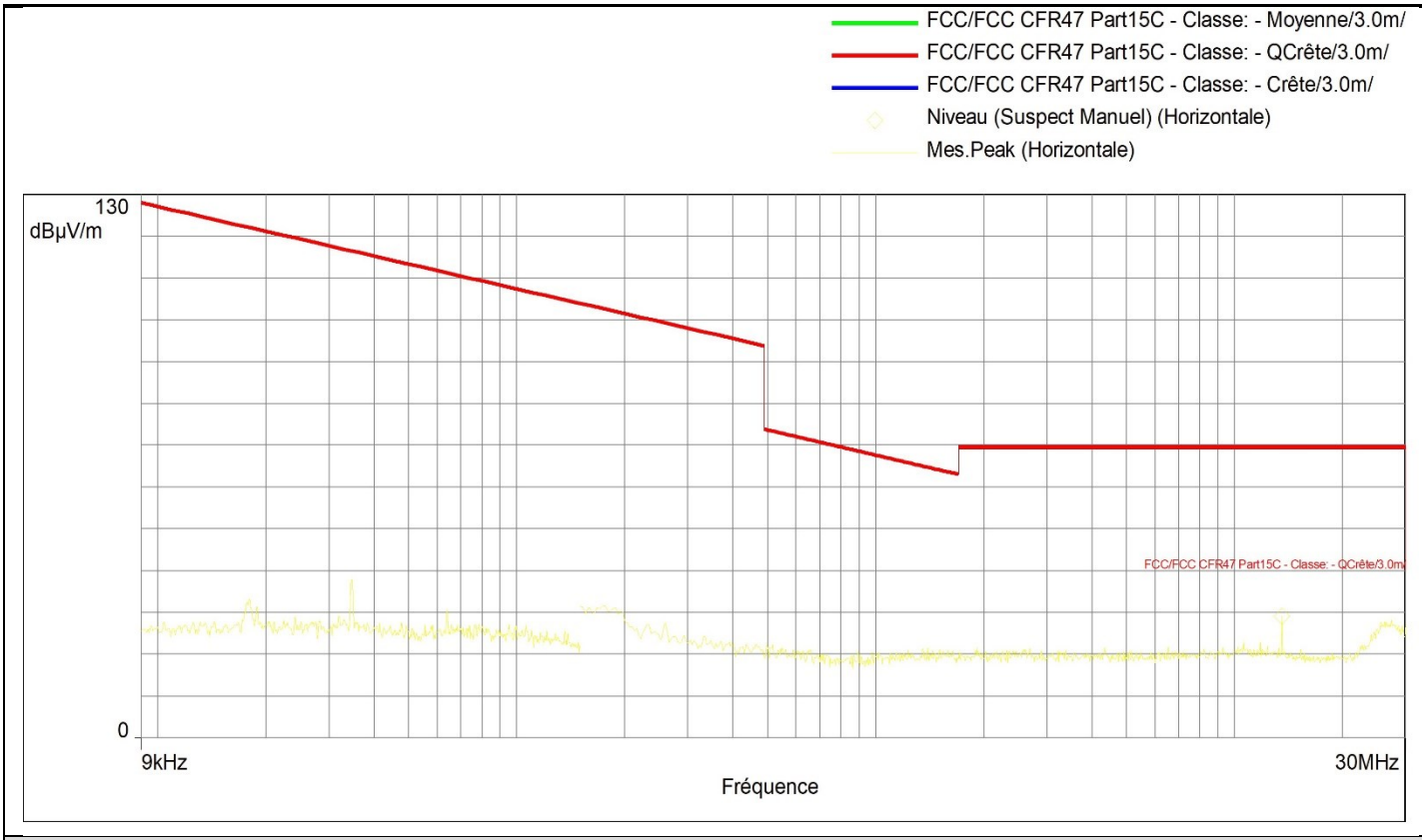


Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Polarization	Correction (dB)
13.562*	27.6	Vertical	0.0

*Carrier frequency

ADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	FCC CFR47 Part15C	13.56 MHz (180°) XY porte fermée FCC	
Class:			
Frequency range: [9kHz - 30MHz]			
Antenna polarization:	Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz

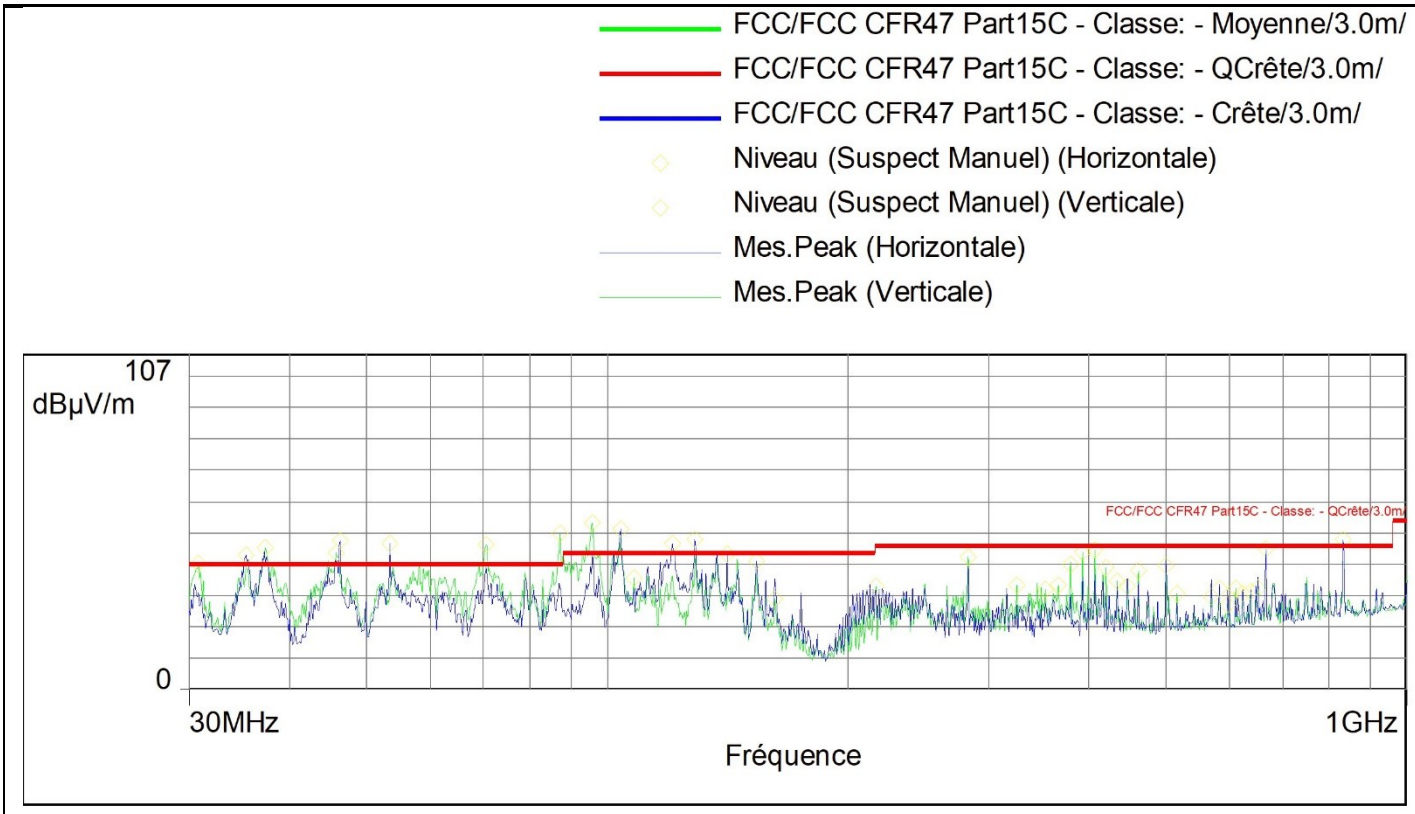


Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Polarization	Correction (dB)
13.562*	29.1	180°	0.0

*Carrier frequency

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

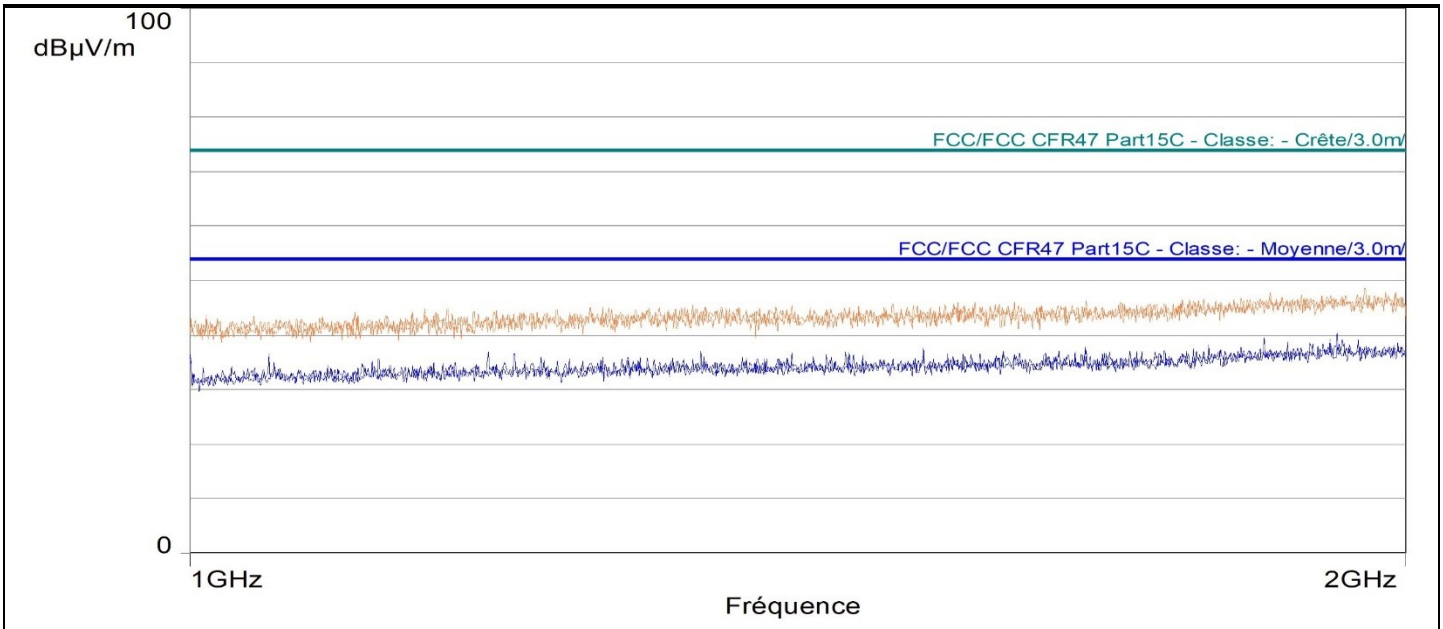


Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Polarization	Correction (dB)
35335.000	4275.0	Horizontal	-1555.0
46296.000	4751.0	Horizontal	-2007.0
534255.000	4655.0	Horizontal	-2269.0
1038655.000	5116.0	Horizontal	-2135.0
1205495.000	4665.0	Horizontal	-1909.0
128746.000	4792.0	Horizontal	-1850.0
141259.000	4308.0	Horizontal	-1861.0
153675.000	4078.0	Horizontal	-1874.0
308245.000	4033.0	Vertical	-1479.0
37372.000	4531.0	Vertical	-1671.0
458595.000	4348.0	Vertical	-1991.0

Frequency (MHz)	Peak Level (dBµV/m)	Polarization	Correction (dB)
705945.000	4623.0	Vertical	-2637.0
872785.000	4987.0	Vertical	-2488.0
95863.000	5317.0	Vertical	-2292.0
107988.000	3567.0	Vertical	-2073.0
162017.000	2906.0	Vertical	-1961.0
2169675.000	3294.0	Vertical	-2146.0
282588.000	4230.0	Vertical	-1997.0
3254135.000	3338.0	Vertical	-1885.0
352525.000	3208.0	Vertical	-1842.0
366105.000	3316.0	Vertical	-1820.0
3796365.000	3987.0	Vertical	-1799.0
3932165.000	4404.0	Vertical	-1777.0
4067965.000	4461.0	Vertical	-1751.0
4203765.000	3902.0	Vertical	-1719.0
433908.000	3475.0	Vertical	-1688.0
447488.000	3292.0	Vertical	-1658.0
4610195.000	3776.0	Vertical	-1630.0
5000135.000	3965.0	Vertical	-1555.0
515291.000	3047.0	Vertical	-1528.0
5695625.000	2973.0	Vertical	-1432.0
5833365.000	3231.0	Vertical	-1409.0
596674.000	2704.0	Vertical	-1387.0
6102055.000	3238.0	Vertical	-1369.0
6237855.000	3046.0	Vertical	-1351.0
637317.000	3117.0	Vertical	-1333.0
650897.000	3236.0	Vertical	-1315.0
666708.000	4473.0	Vertical	-1294.0
8334025.000	4785.0	Vertical	-1069.0

RADIATED EMISSIONS			
Graph name:	Emr#4	**Test configuration:**	
Limit:	CISPR32 / EN 55032	EUT1-Beta1.9_TEST2-2GHZ_C2 - FSL(H+V)[1-5]GHz	
Class:	A		
Frequency range: [1GHz - 2GHz]			
Antenna polarization:		**RBW :**	1MHz
Azimuth:	0° - 360°	**VBW :**	3MHz



Spurious emissions

No significative frequency observed

9. UNCERTAINTIES CHART

Type de mesure / *Kind of measurement*	**Incertitude élargie laboratoire / *Wide uncertainty laboratory* (k=2) ± x**	**Incertitude limite du CISPR / *CISPR uncertainty limit* ± y**
Measurement of conducted disturbances in voltage on the power port	3.29dB	3.4 dB
Measurement of conducted disturbances in voltage on the telecommunication port.	3.26 dB	5dB
Measurement of discontinuous conducted disturbances in voltage	3.33 dB	3.4 dB
Measurement of conducted disturbances in current	2.67 dB	2.9dB
Spurious emission. radiated (Semi anechoic chamber & open test site)	*5.60 dB*	*6 dB*
Spurious emission. radiated (Full anechoic chamber above 1GHz)	*±3.8 dB*	*±6 dB*
Occupied Channel Bandwidth	*±2.8 %*	*±5 %*
Temperature	*±0.75 °C*	*±3 °C*
Supply Voltages	*±1.7 %*	*±3 %*

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par la norme. la conformité de l'échantillon est établie directement par les niveaux limites applicables. / *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 limits values.*