



LCIE

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TEST REPORT

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Version : 02

Subject Electromagnetic compatibility tests according to the standards:
FCC CFR 47 Part 15, Subpart B and C
RSS-210 Issue 9

Issued to **INGENICO**
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FRANCE

Apparatus under test

- ↗ Product Payment Terminal
- ↗ Trade mark **INGENICO**
- ↗ Manufacturer **INGENICO**
- ↗ Model under test **Self/2000 CL**
- ↗ Serial number **191637313031143704876144**
- ↗ FCCID **XKB-SEFXCL**
- ↗ IC **2586D-SEFXCL**

Conclusion See Test Program chapter

Test date September 2, 2019 to September 4, 2019

Test location Fontenay aux roses

IC Test site 6230B-1

Composition of document 36 pages

Document issued on **November 22, 2019**

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Version	Date	Author	Modification
01	November 22, 2019	Majid MOURZAGH	Creation of the document
02	November 22, 2019	Majid MOURZAGH	Modification of FCCID and description p1



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1. TEST PROGRAM

Standard:

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

EMISSION TEST	LIMITS			RESULTS (Comments)
	Frequency	Quasi-peak value (dB μ V)	Average value (dB μ V)	
Limits for conducted disturbance at mains ports 150kHz-30MHz <i>CFR 47 §15.207 and 15.107</i>	150-500kHz	66 to 56	56 to 46	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 9kHz-30MHz <i>CFR 47 §15.209 (a)</i> <i>CFR 47 §15.225</i> <i>RSS-Gen §4.9</i>	Measure at 300m 9kHz-490kHz : 67.6dB μ V/m /F(kHz)			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
	Measure at 30m 490kHz-1.705MHz : 87.6dB μ V/m /F(kHz) 1.705MHz-30MHz : 29.5 dB μ V/m			
Radiated emissions 30MHz-25GHz* <i>CFR 47 §15.209 (a) and 15.109</i> <i>CFR 47 §15.225</i> <i>RSS-Gen §4.9</i> <i>Highest frequency :</i> <i>(Declaration of provider)</i>	Measure at 3m 30MHz-88MHz : 40 dB μ V/m 88MHz-216MHz : 43.5 dB μ V/m 216MHz-960MHz : 46.0 dB μ V/m Above 960MHz : 54.0 dB μ V/m			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Fundamental field strength limit <i>CFR 47 §15.225</i> <i>RSS-210 §B.6</i>	Operation within the band 13.110-14.010 MHz			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Fundamental frequency tolerance <i>CFR 47 §15.225</i> <i>RSS-210 §B.6</i>	Operation within the band 13.110-14.010 MHz			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Band edge compliance <i>CFR 47 §15.225</i> <i>RSS-210 §B.6</i>	Operation within the band 13.110-14.010 MHz			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Occupied bandwidth <i>RSS-Gen Issue 5 §6.7</i>	No limit			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Receiver Spurious Emission** <i>RSS-Gen Issue 5 §7.3</i>	See RSS-Gen §7.3			<input type="checkbox"/> PASS <input type="checkbox"/> FAIL <input checked="" type="checkbox"/> NA <input type="checkbox"/> 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.

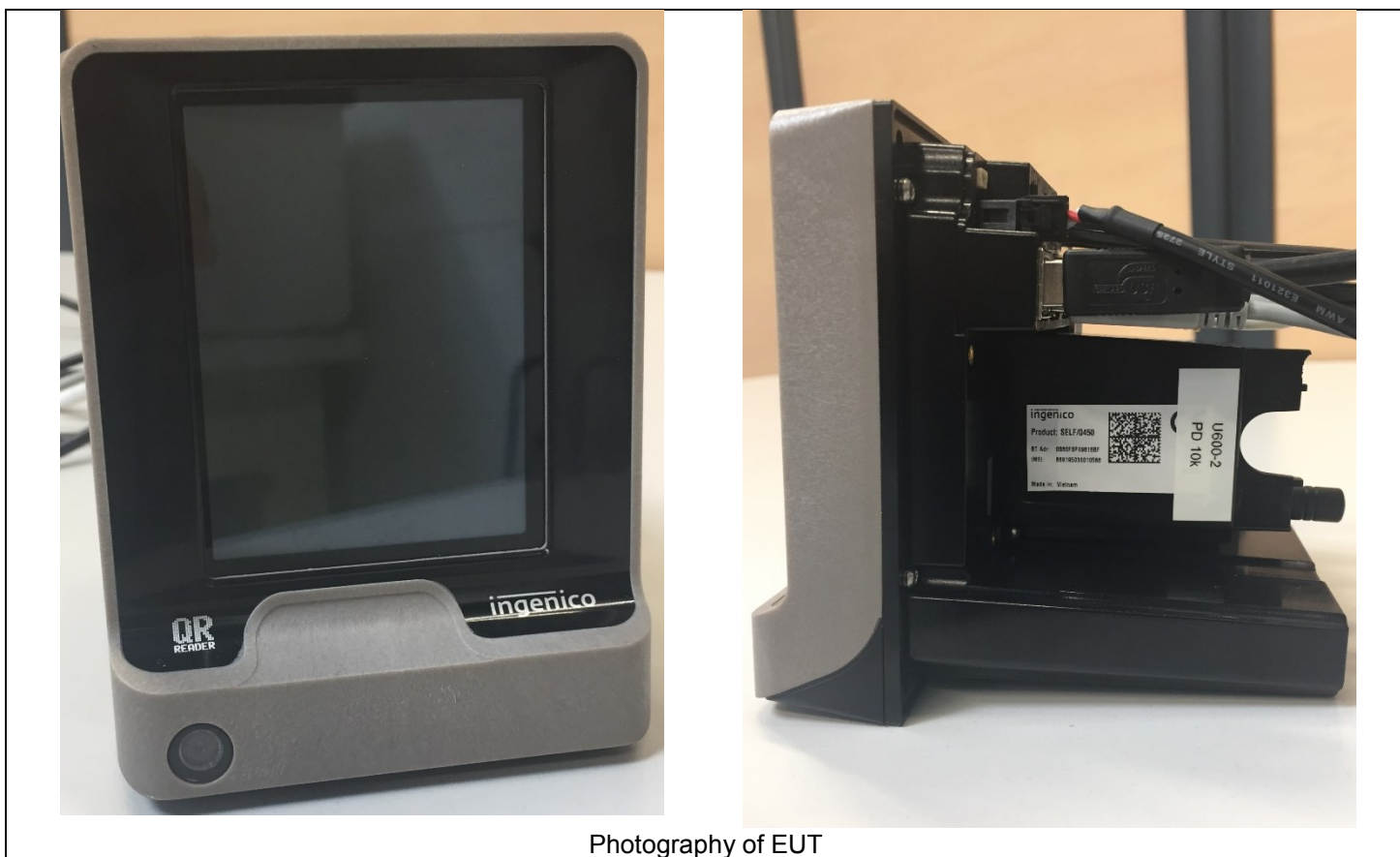
2. SYSTEM TEST CONFIGURATION

2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):

Self/2000 CL

Serial Number: 191637313031143704876144



Photography of EUT

Power supply:

During all the tests, EUT is supplied by V_{nom} : 12VDC

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

Name	Type	Rating	Reference / Sn	Comments
Supply1	<input type="checkbox"/> AC <input checked="" type="checkbox"/> DC <input type="checkbox"/> Battery	9-16VDC	/	/

Voltage table used:

Type	Measurement performed:	
<input checked="" type="checkbox"/> AC	<input checked="" type="checkbox"/> 120VAC/60Hz	<input checked="" type="checkbox"/> 240VAC/50Hz
<input checked="" type="checkbox"/> DC	<input checked="" type="checkbox"/> 9-16VDC	<input type="checkbox"/> -....VDC



Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply1	2 wires	0.30	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	/
COM0	RS232	1.8	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	/
COM2	RS232	1.8	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	/
Host USB1	USB	1.5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	/
Host USB2	USB	1.5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	/
ETH	RJ45 (Ethernet)	1.8	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	/
Access6	SAM1	-	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	/
Access7	SAM2	-	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	/
Access8	µUSB	-	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	/
Slave USB	USB	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	/

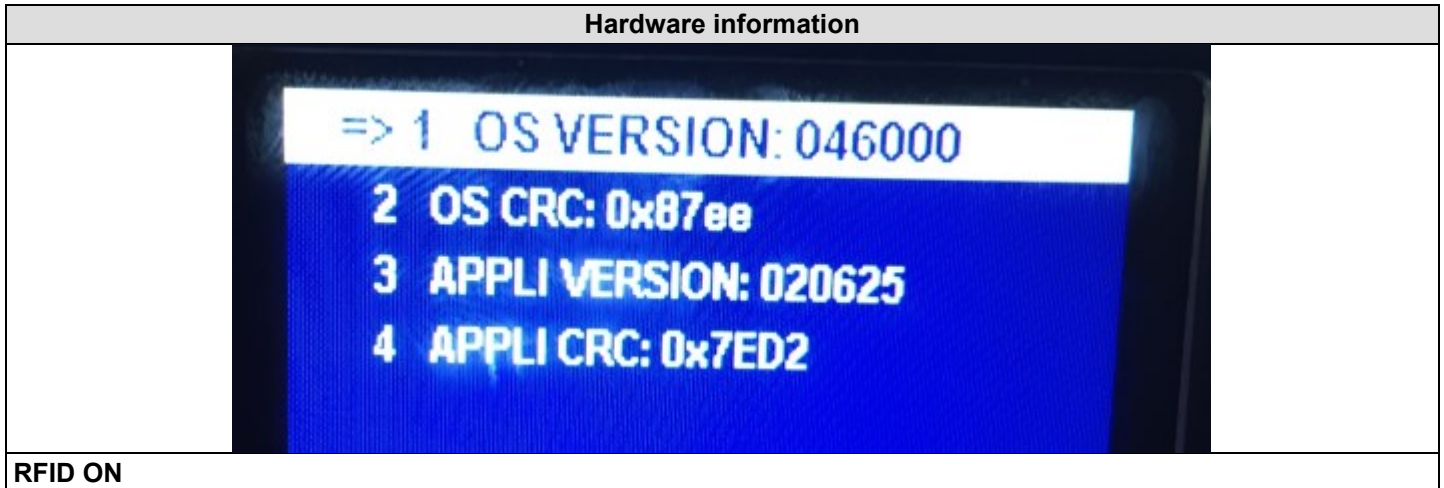
Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Contactless card	Type A	296113752	INGENICO
AC/DC power source	KEYSIGHT	AC6802A -	A7042305
Power supply DC	TDK	LCIE : A7042306	Used during conducted emission data
Laptop	DELL E6430	/	/

Equipment information:

Frequency band:	<input checked="" type="checkbox"/> [13.553–13.567]MHz	<input type="checkbox"/> [125]kHz	<input type="checkbox"/> [-] MHz
RF mode:	<input type="checkbox"/> Transmitter	<input checked="" type="checkbox"/> Transceiver	<input type="checkbox"/> Receiver <input type="checkbox"/> Standby
Type:	<input checked="" type="checkbox"/> RFID	<input type="checkbox"/> EAS	<input type="checkbox"/> Other:
Bandwidth:	<input type="checkbox"/> Narrowband (ISO15693, ISO18000-3...)	<input checked="" type="checkbox"/> Wideband (ISO14443, NFC...)	
Product class – Annex B.2	<input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3 <input type="checkbox"/> 4
Channelized system:	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes, channel spacing: kHz	
Equipment intended for use as a	<input checked="" type="checkbox"/> Fixed	<input type="checkbox"/> Mobile	<input type="checkbox"/> Portable
Type of equipment:	<input checked="" type="checkbox"/> Stand-alone	<input type="checkbox"/> Plug-in	<input type="checkbox"/> Combined
Antenna Type:	<input type="checkbox"/> External		<input checked="" type="checkbox"/> Internal
Antenna connector:	<input type="checkbox"/> Permanent external	<input type="checkbox"/> Permanent internal	<input checked="" type="checkbox"/> None <input type="checkbox"/> Temporary (only for tests)
Antenna Gain:	0 dBi		
Duty cycle:	<input checked="" type="checkbox"/> Continuous duty	<input type="checkbox"/> Intermittent duty	<input type="checkbox"/> Continuous operation
Equipment type:	<input checked="" type="checkbox"/> Production model		<input type="checkbox"/> Prototype
Temperature range:	Tmin:	<input checked="" type="checkbox"/> -20°C	<input type="checkbox"/> 0°C <input type="checkbox"/> °C
	Tnom:	20°C	
	Tmax:	<input type="checkbox"/> 35°C	<input type="checkbox"/> 55°C <input checked="" type="checkbox"/> +65 °C
Type of power source:	<input type="checkbox"/> AC power supply	<input checked="" type="checkbox"/> DC power supply	<input type="checkbox"/> Battery (Select type)
Test source voltage:	Vmin:	<input type="checkbox"/> 207V/50Hz	<input checked="" type="checkbox"/> 9 VDC
	Vnom:	<input type="checkbox"/> 230V/50Hz	<input checked="" type="checkbox"/> 12 VDC
	Vmax:	<input type="checkbox"/> 253V/50Hz	<input checked="" type="checkbox"/> 16 VDC

2.2. EUT CONFIGURATION



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 52.5dB μ V 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 dB μ V/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dB}\mu\text{V/m}$$

The 32 dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(32\text{dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m.}$$

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 DATA

3.1. ENVIRONMENTAL CONDITIONS

Date of test : September 4, 2019
Test performed by : Majid Mourzagh
Atmospheric pressure (hPa) : 998
Relative humidity (%) : 40
Ambient temperature (°C) : 24

3.2. TEST SETUP

Mains terminals

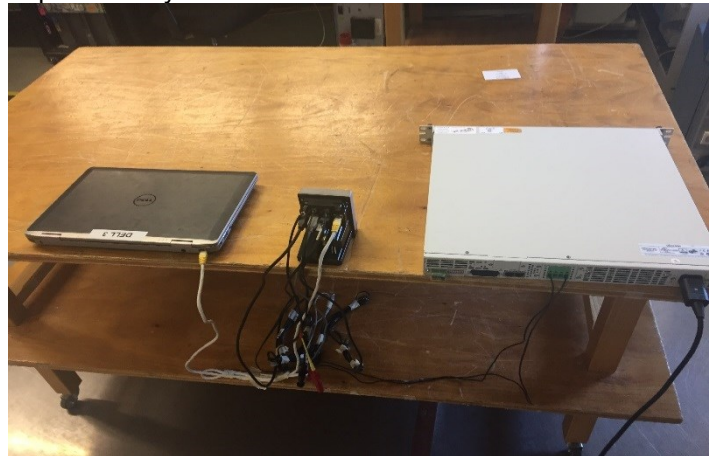
The EUT and auxiliaries are set:

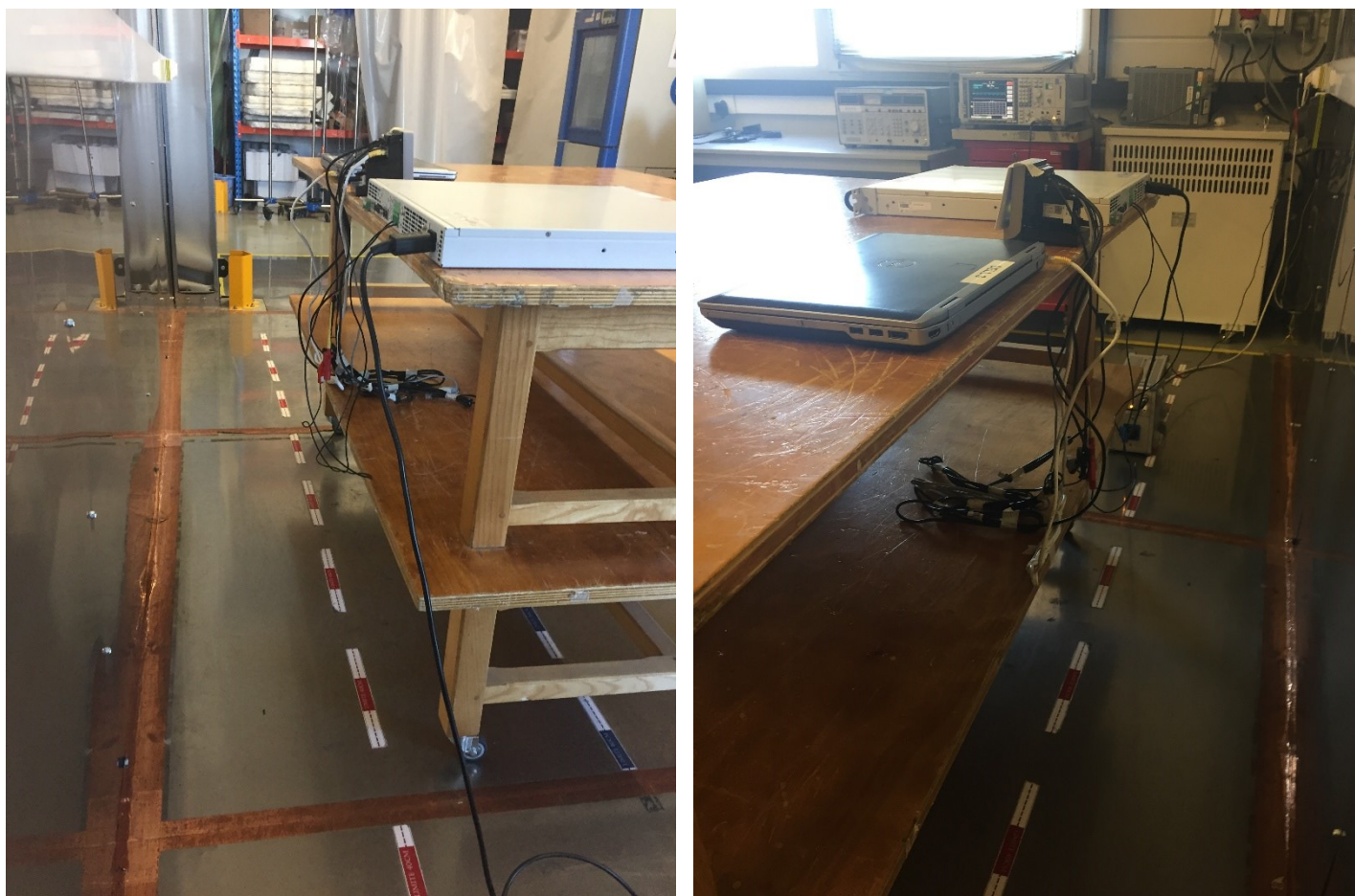
- 80cm above the ground on the non-conducting table (Table-top equipment)
- 10cm above the ground on isolating support (Floor standing equipment)

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 V_{nom} .

The EUT is powered through a LISN (measure). Auxiliaries are powered by another LISN.





Test setup

3.3. TEST METHOD

The product has been tested according to ANSI C63.10 and FCC Part 15 subpart B and C. The product has been tested with a voltage sets (see the table voltage in §2.2) and compared to the FCC Part 15 limits. Measurement bandwidth was 9kHz from 150kHz to 30MHz. 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. The LISN (measure) is $50\Omega / 50\mu\text{H}$. The Peak data are shown on plots in annex 1. Quasi-Peak and Average measurements are detailed in a table with frequencies and levels measured. Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on the following page.

Measurements are performed on the phase (L1) and neutral (N) of power line voltage (for example). Graphs are obtained in PEAK detection. Measures are also performed in Quasi-Peak and Average for any strong signal.



3.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
EMC comb generator	LCIE SUD EST	-	A3169098	-	-
LISN	RHODE & SCHWARZ	ENV216	C2320291	02/19	02/20
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	12/17	12/19
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Transient limiter	RHODE & SCHWARZ	ESH3-Z2	A7122204	02/19	02/20

3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None Divergence:

3.6. TEST RESULTS

AC tests Results on 12VDC:

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

Results: (PEAK detection)

Graph identifier	Line	Comments
Emc# 9	Phase	120VAC/60Hz (With Power supply DC) See Annex
Emc# 10	Neutral	120VAC/60Hz (With Power supply DC) See Annex
Emc# 11	Phase	240VAC/50Hz (With Power supply DC) See Annex
Emc# 12	Neutral	240VAC/50Hz (With Power supply DC) See Annex

3.7. CONCLUSION

The sample of the equipment Self/2000 CL, Sn: 191637313031143704876144, 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 conducted emissions.

4. RADIATED EMISSION DATA (15.209)

4.1. ENVIRONMENTAL CONDITIONS

Date of test : September 2, 2019
Test performed by : Majid Mourzagh
Atmospheric pressure (hPa) : 989
Relative humidity (%) : 45
Ambient temperature (°C) : 23

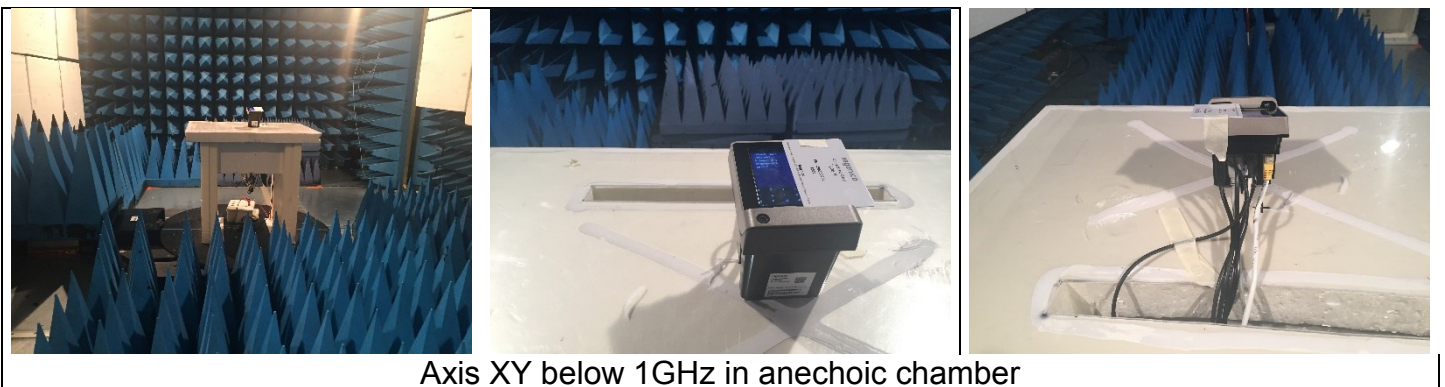
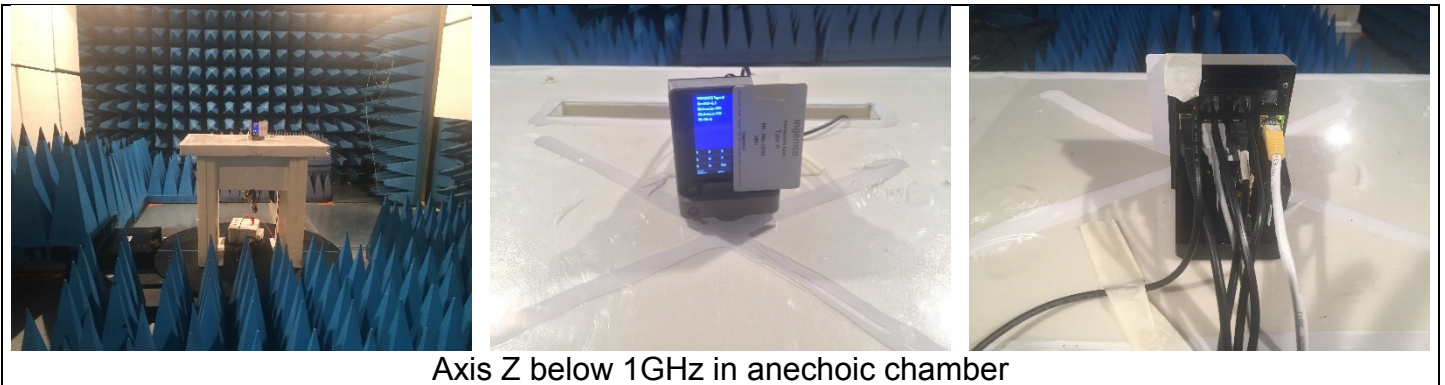
4.2. TEST SETUP

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:

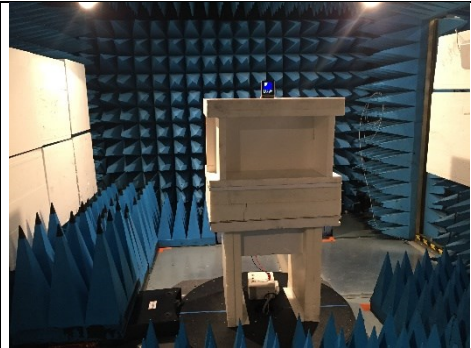
- 80cm above the ground on the non-conducting table (Table-top equipment) - Below 1GHz
- 150cm above the ground on the non-conducting table (Table-top equipment) - Above 1GHz
- 10cm above the ground on isolating support (Floor standing equipment)

The EUT is powered by V_{nom} .

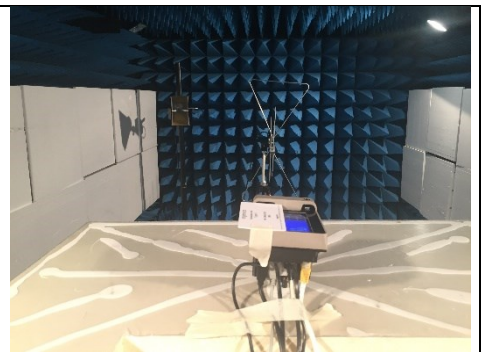
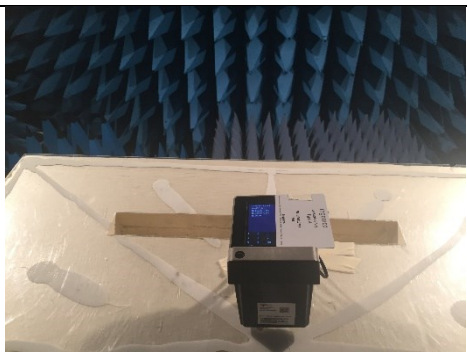




L C I E



Axis Z above 1GHz in anechoic chamber



Axis XY above 1GHz in anechoic chamber



Axis Z on OATS



Axis XY on OATS

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 – 6GHz)

A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber for frequency from 30MHz to 6GHz. 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 6GHz.

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 6GHz:

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 6GHz. 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

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Amplifier 9kHz - 40GHz	LCIE SUD EST	_	A7102082	10/18	10/19
Antenna Bi-Log	CHASE	UPA6192	C2040221	01/18	01/20
Emission Cable C3	-	6GHz	A5329069	11/18	11/19
Emission Cable C3	-	6GHz	A5329637	02/19	02/20
Emission Cable (SMA 30cm)	TELEDYNE	26GHz	A5329873	01/19	01/20
Semi-Anechoic chamber #3	SIEPEL	-	D3044017	03/17	03/20
Radiated emission comb generator	BARDET	-	A3169050	-	-
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/18	03/20
BAT EMC	NEXIO	v3.17.0.10	L1000115	-	-
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371	-	-
Table C3	LCIE	-	F2000461	-	-
Rehausse Table C3	LCIE	-	F2000511	-	-
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444	-	-
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
Emr# 5	0°/90°	Axis Z	/		See annex 1
Emr# 6	180°	Axis Z	/		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	Vertical / Horizontal	Axis XY	/		See annex 1
Emr# 7	Vertical / Horizontal	Axis Z	/		See annex 1

4.6.3. Pre-characterization at 3 meters [1GHz-6GHz]

See graphs for 1GHz-6GHz:

Graph identifier	Polarization	EUT position	Comments		
Emr# 4	Vertical / Horizontal	Axis XY	/		/
Emr# 8	Vertical / Horizontal	Axis Z	/		/

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.

No	Frequency (MHz)	QPeak Limit (dB μ V/m) @ 30m	Qpeak (dB μ V/m) @ 30m	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
1	13.56	84	23	61	0	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 (μ V/m)	Measurement distance (m)
13.553-13.567	15 848 84 dB μ V/m	30
13.410-13.553 13.567-13.710	334 50.5 dB μ V/m	30
13.110-13.410 13.710-14.010	106 40.5 dB μ V/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.

Worst case :

Test Frequency (MHz)	Meter Reading dB(µV)	Detector (Pk/QP/Av)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Transducer Factor (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Remark
40.680	15.5	QP	V	90	110	14.0	29.5	40.0	-10.5	Axis XY
500.000	13.5	QP	V	45	120	22.6	36.1	46.0	-9.9	Axis XY
525.000	14.5	QP	V	45	120	23.3	37.8	46.0	-8.2	Axis XY
548.000	11.5	QP	V	270	120	24.6	36.1	46.0	-9.9	Axis XY

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 6GHz

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 (Pk/)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Transducer Factor (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
No significant frequency observed									

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 Self/2000 CL, Sn: **191637313031143704876144**, 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 : September 3, 2019
Test performed by : Majid Mourzagh
Atmospheric pressure (hPa) : 990
Relative humidity (%) : 38
Ambient temperature (°C) : 24

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 $\pm 0.01\%$ of the operating frequency when the temperature is varied from -30°C to $+65^{\circ}\text{C}$ at the nominal power voltage and the primary power voltage is varied from 85% to 115% of the rated supply voltage at 20°C .



5.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	ELECTRO-METRICS	EM-6993	C2040215	06/19	06/21
Cable SMA	-	18GHz	A5329863	11/18	11/19
Cable SMA	-	18GHz	A5329864	11/18	11/19
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	03/18	03/20
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	06/18	06/20
Thermometer (radio)	FLUKE	52 II	B4043150	08/18	08/19
Thermocouple K (radio)	FLUKE	Type K	B4045004	08/18	08/19
Thermocouple K (radio)	FLUKE	Type K	B4045005	08/18	08/19
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20

5.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None Divergence:

5.6. TEST RESULTS

Temperature	-30°C	20°C	+65°C
Voltage			
Mains voltage: 12VDC			
Frequency Drift (MHz)	- 0.000018	13.559815	+ 0.000067
Carrier level (dBc)	- 1.65	23.681488	+ 2.10
Mains voltage: 9VDC			
Frequency Drift (MHz)	- 0.000018	- 0.000001	+ 0.000064
Carrier level (dBc)	- 1.68	+ 0.11	+ 2.05
Mains voltage: 16VDC			
Frequency Drift (MHz)	- 0.000014	- 0.000001	+ 0.000066
Carrier level (dBc)	- 1.77	+ 0.09	+ 2.44

Frequency drift measured is 67Hz when the temperature is varied from -30°C to +65°C and voltage is varied.

5.1. CONCLUSION

The sample of the equipment **Self/2000 CL**, Sn: **191637313031143704876144**, tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part 15 Subpart B and C, for fundamental frequency tolerance.

6. BAND-EDGE COMPLIANCE §15.209

6.1. ENVIRONMENTAL CONDITIONS

Date of test : September 3, 2019
Test performed by : Majid Mourzagh
Atmospheric pressure (hPa) : 990
Relative humidity (%) : 38
Ambient temperature (°C) : 24

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

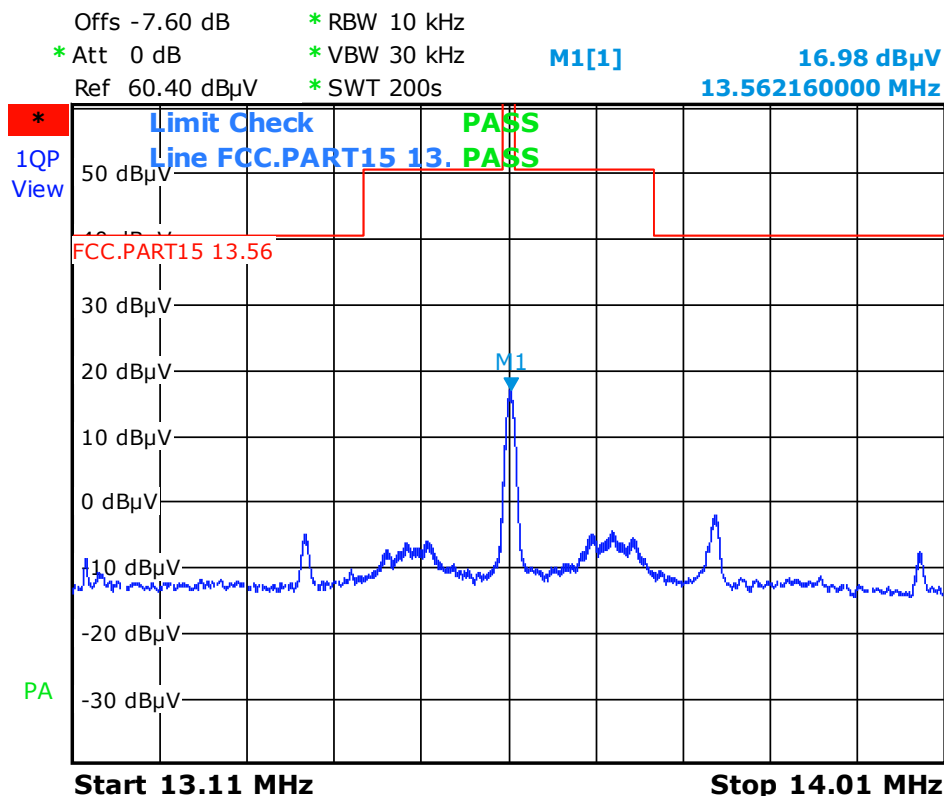
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	ELECTRO-METRICS	EM-6993	C2040215	06/19	06/21
Cable SMA	-	18GHz	A5329863	11/18	11/19
Cable SMA	-	18GHz	A5329864	11/18	11/19
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	03/18	03/20
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	06/18	06/20
Thermometer (radio)	FLUKE	52 II	B4043150	08/18	08/19
Thermocouple K (radio)	FLUKE	Type K	B4045004	08/18	08/19
Thermocouple K (radio)	FLUKE	Type K	B4045005	08/18	08/19
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20

6.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

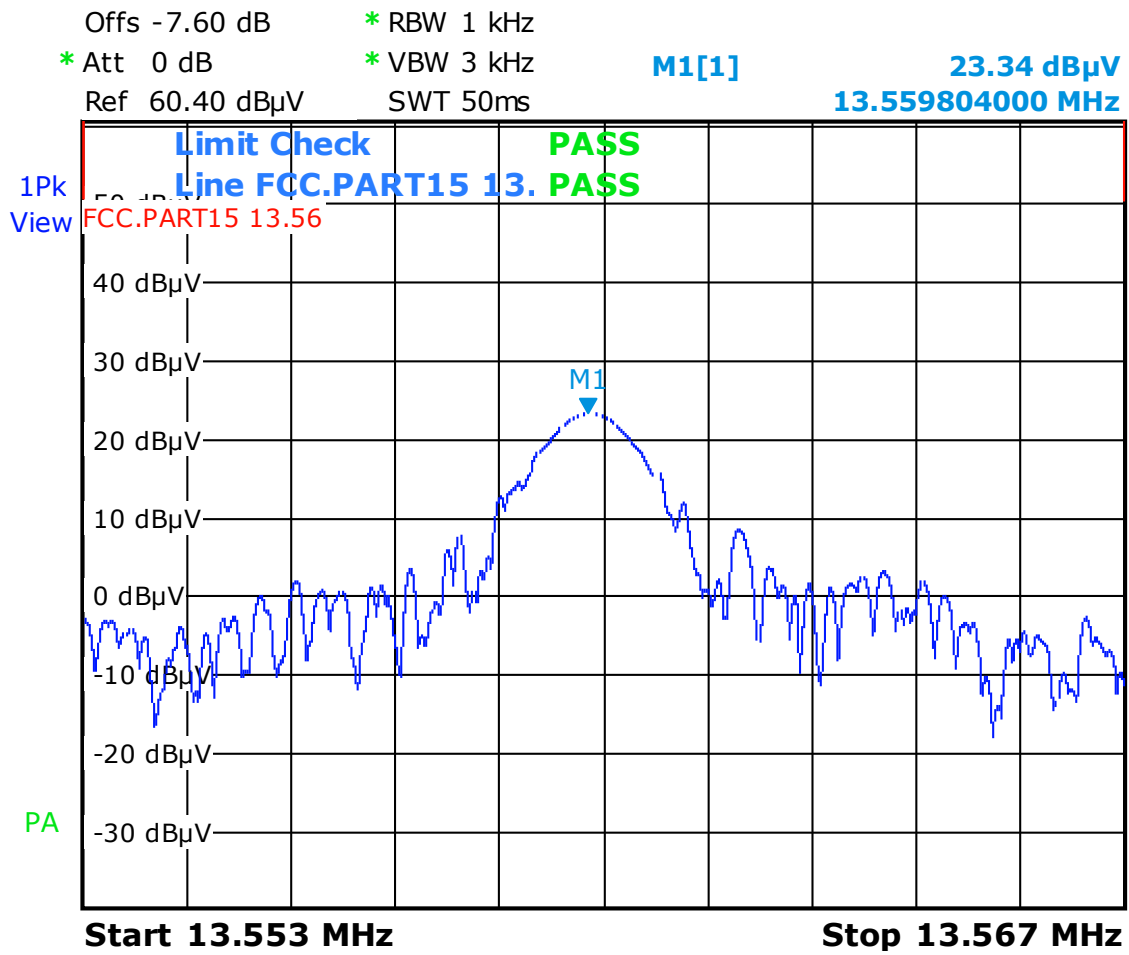
None Divergence:

6.6. TEST RESULTS

Frequency band 13.110-14.010MHz



Frequency band 13.553-13.567MHz



6.7. CONCLUSION

The sample of the equipment Self/2000 CL, Sn: 191637313031143704876144, tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part 15 Subpart B and C, for band-edge compliance.

7. OCCUPIED BANDWIDTH

7.1. ENVIRONMENTAL CONDITIONS

Date of test : September 3, 2019
Test performed by : Majid Mourzagh
Atmospheric pressure (hPa) : 990
Relative humidity (%) : 38
Ambient temperature (°C) : 24

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) $\geq 3 \times$ 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



Test setup



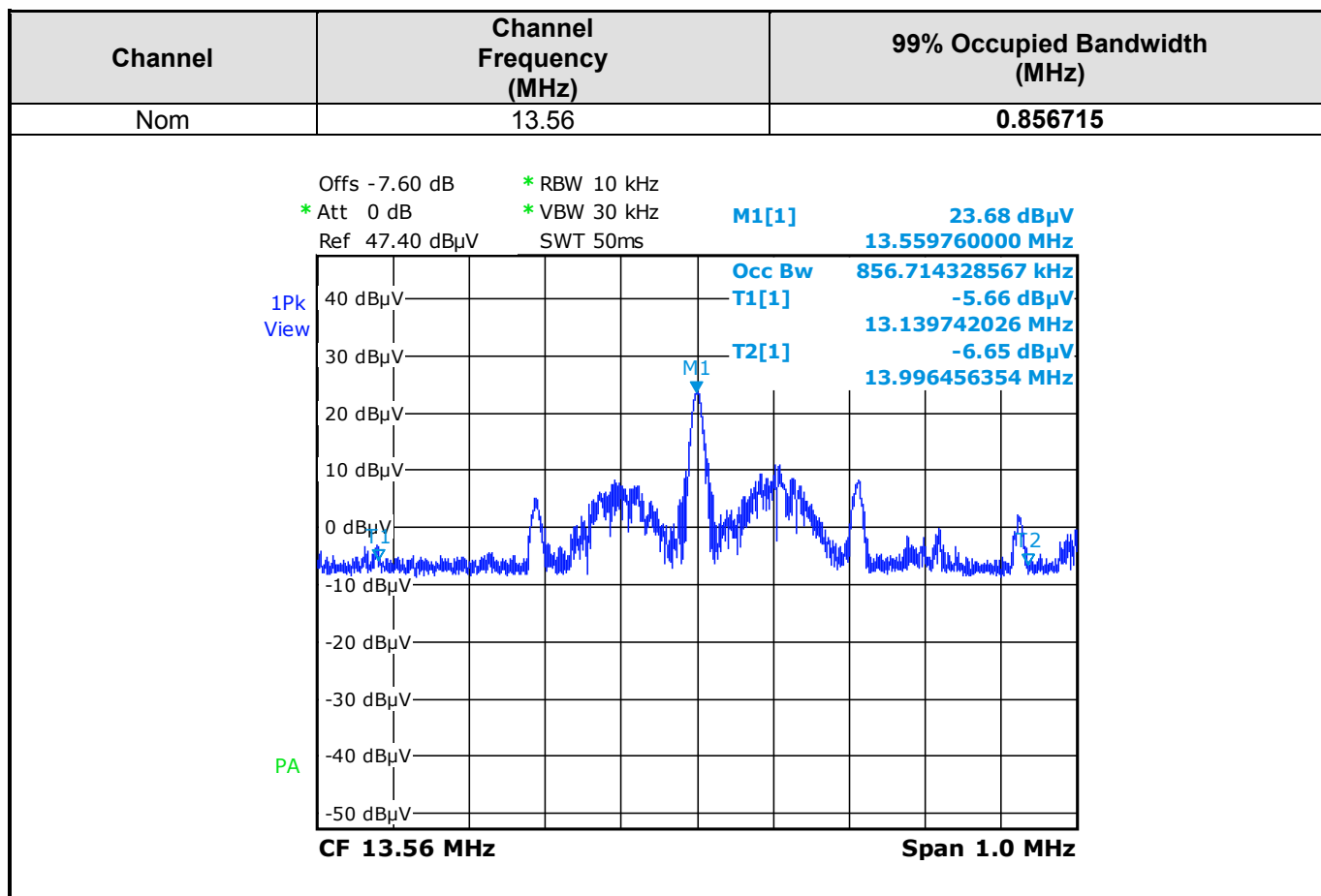
7.3. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Antenna Loop	ELECTRO-METRICS	EM-6993	C2040215	06/19	06/21
Cable SMA	-	18GHz	A5329863	11/18	11/19
Cable SMA	-	18GHz	A5329864	11/18	11/19
Climatic chamber	BIA CLIMATIC	CL 6-25	D1022117	03/18	03/20
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020	06/18	06/20
Thermometer (radio)	FLUKE	52 II	B4043150	08/18	08/19
Thermocouple K (radio)	FLUKE	Type K	B4045004	08/18	08/19
Thermocouple K (radio)	FLUKE	Type K	B4045005	08/18	08/19
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20

7.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None Divergence:

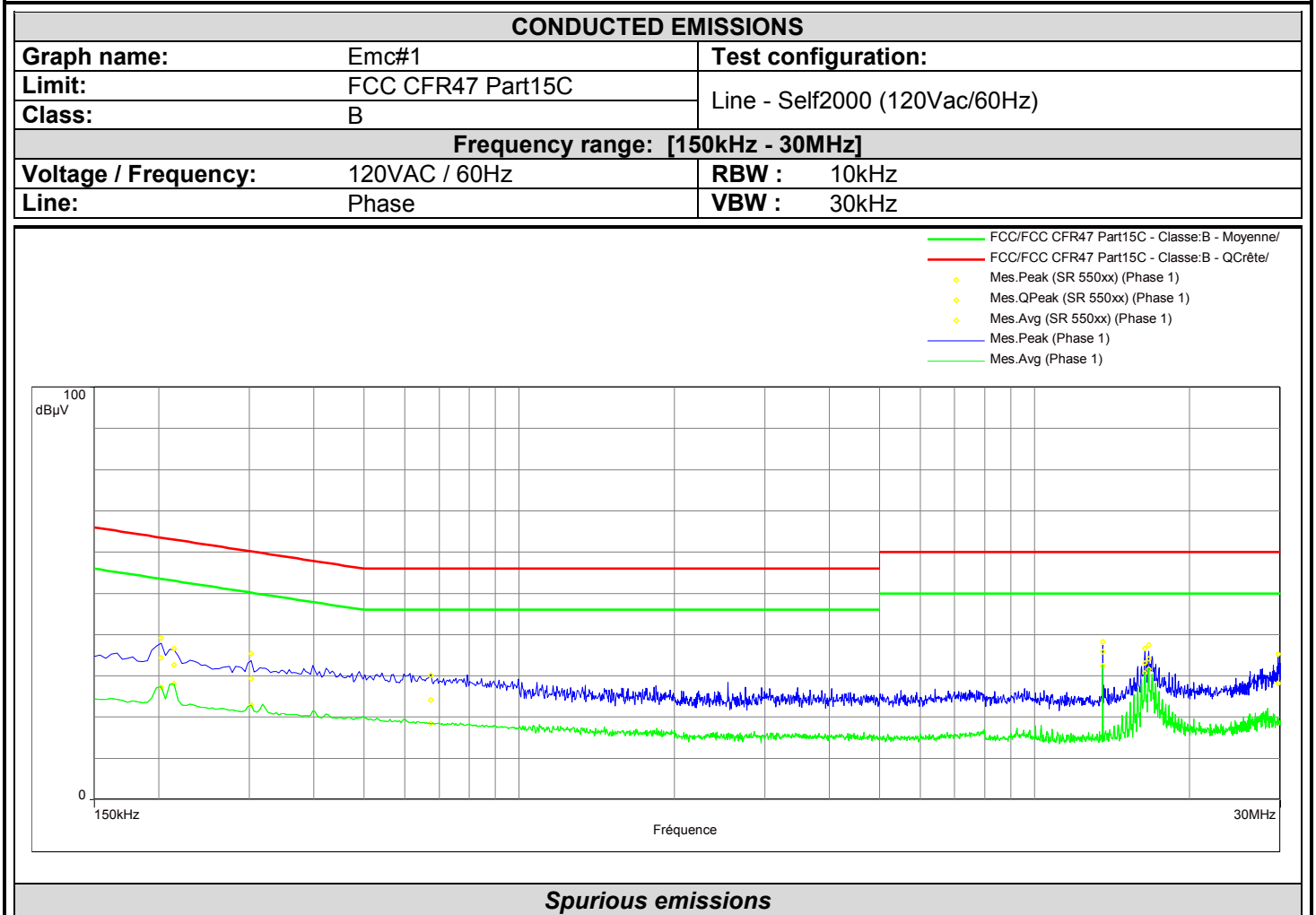
7.5. TEST SEQUENCE AND RESULTS





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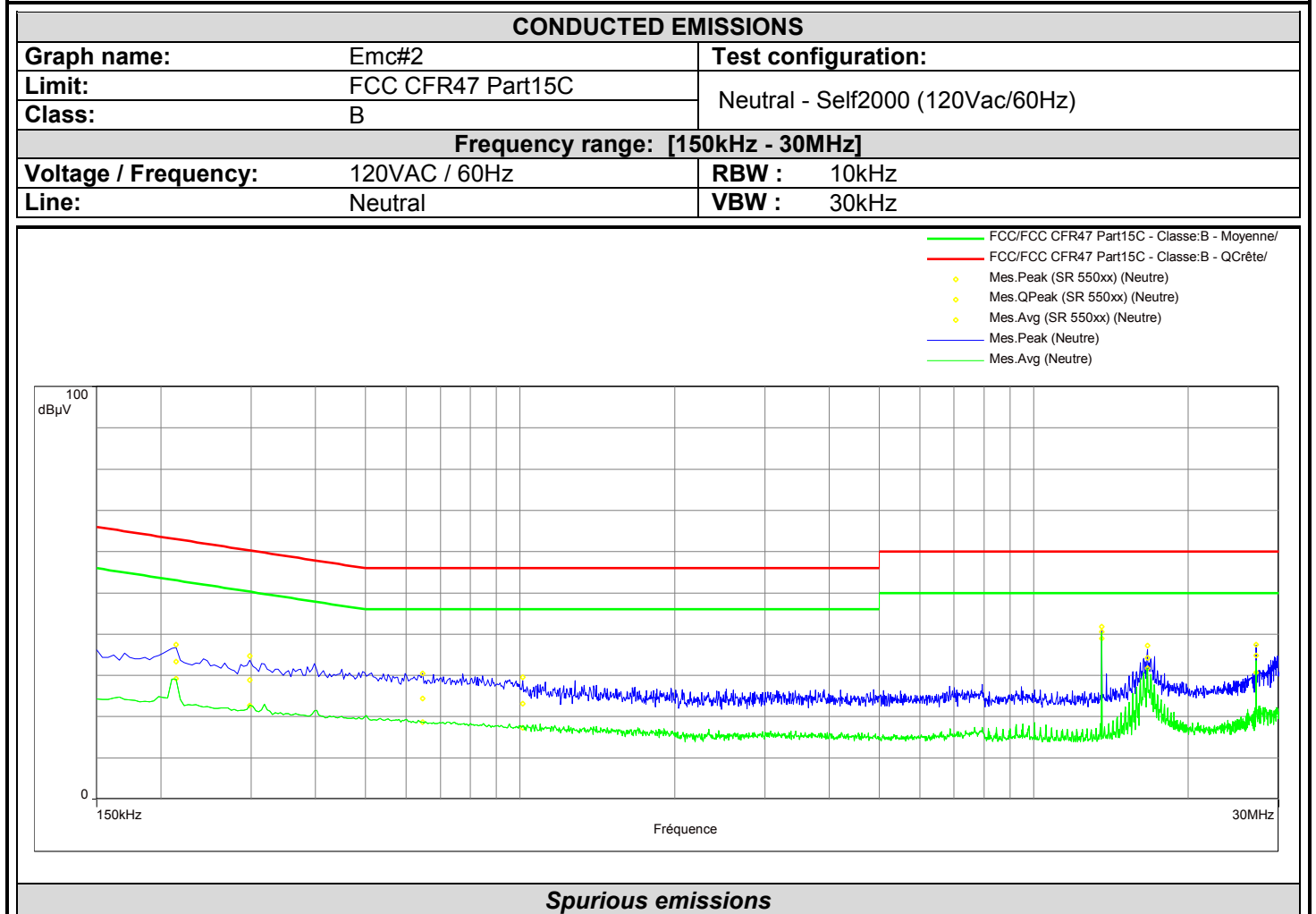
8. ANNEX 1 (GRAPHS)



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)
0.202	39.2	34.4	63.5	-29.1	27.3	53.5	-26.2	Phase 1	19.5
0.214	36.7	32.7	63.0	-30.4	28.1	53.0	-24.9	Phase 1	19.5
0.302	35.4	29.3	60.2	-30.9	22.9	50.2	-27.3	Phase 1	19.4
0.674	30.1	24.2	56.0	-31.8	18.5	46.0	-27.5	Phase 1	19.5
13.564	38.3	35.8	60.0	-24.2	32.4	50.0	-17.6	Phase 1	20.5
16.392	36.7	33.1	60.0	-26.9	30.7	50.0	-19.3	Phase 1	20.7
16.656	37.4	34.1	60.0	-25.9	31.6	50.0	-18.4	Phase 1	20.7
29.688	35.3	28.2	60.0	-31.8	18.6	50.0	-31.4	Phase 1	21.5



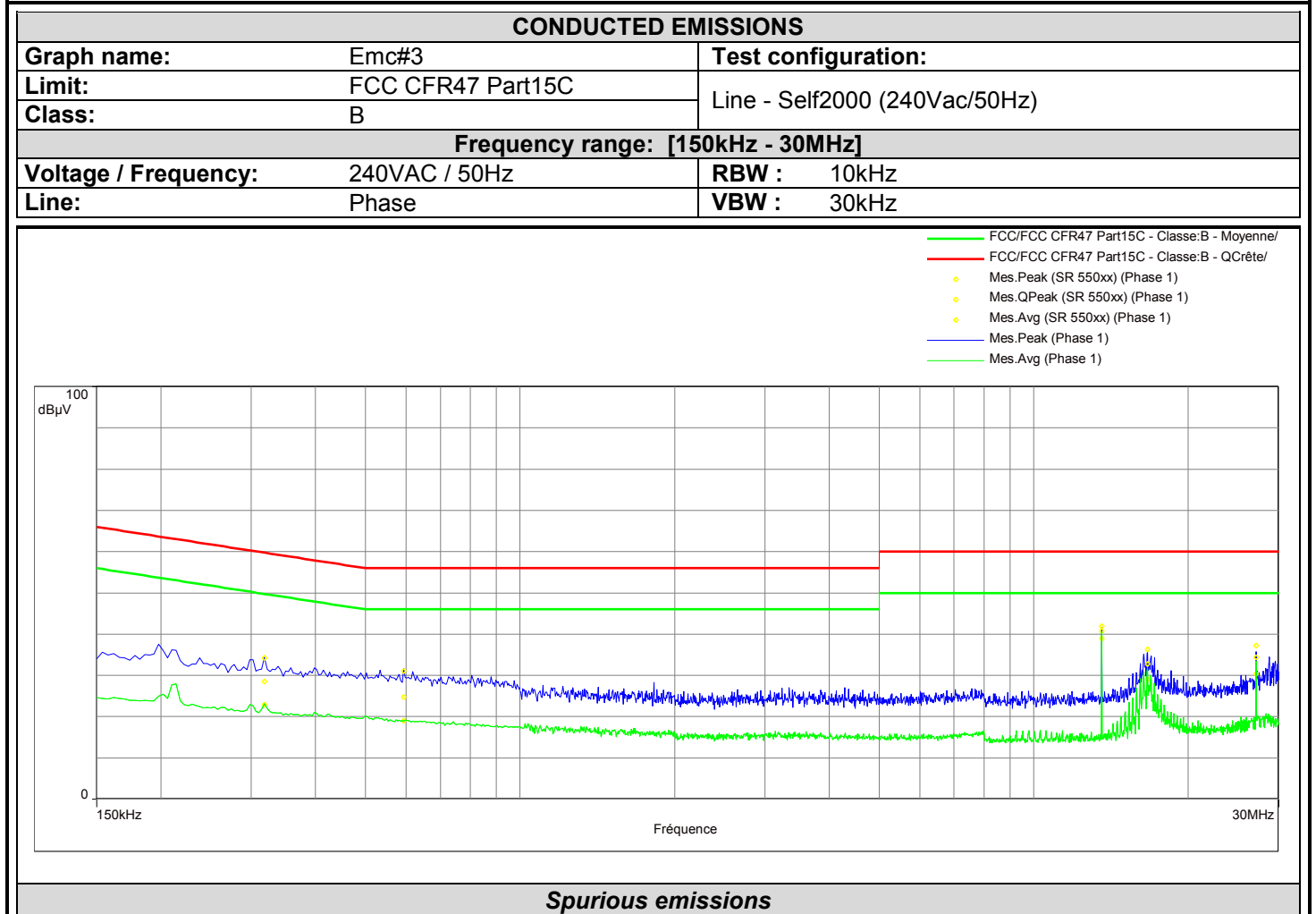
L C I E



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)
0.214	37.4	33.3	63.0	-29.7	29.2	53.0	-23.9	Neutre	19.5
0.298	34.8	28.8	60.3	-31.4	22.7	50.3	-27.6	Neutre	19.4
0.646	30.5	24.4	56.0	-31.6	18.6	46.0	-27.4	Neutre	19.5
1.012	29.6	23.2	56.0	-32.8	17.4	46.0	-28.6	Neutre	19.5
13.560	41.8	40.6	60.0	-19.4	38.9	50.0	-11.1	Neutre	20.5
16.656	37.2	34.2	60.0	-25.8	31.8	50.0	-18.2	Neutre	20.7
27.120	37.5	34.8	60.0	-25.2	30.7	50.0	-19.3	Neutre	21.4



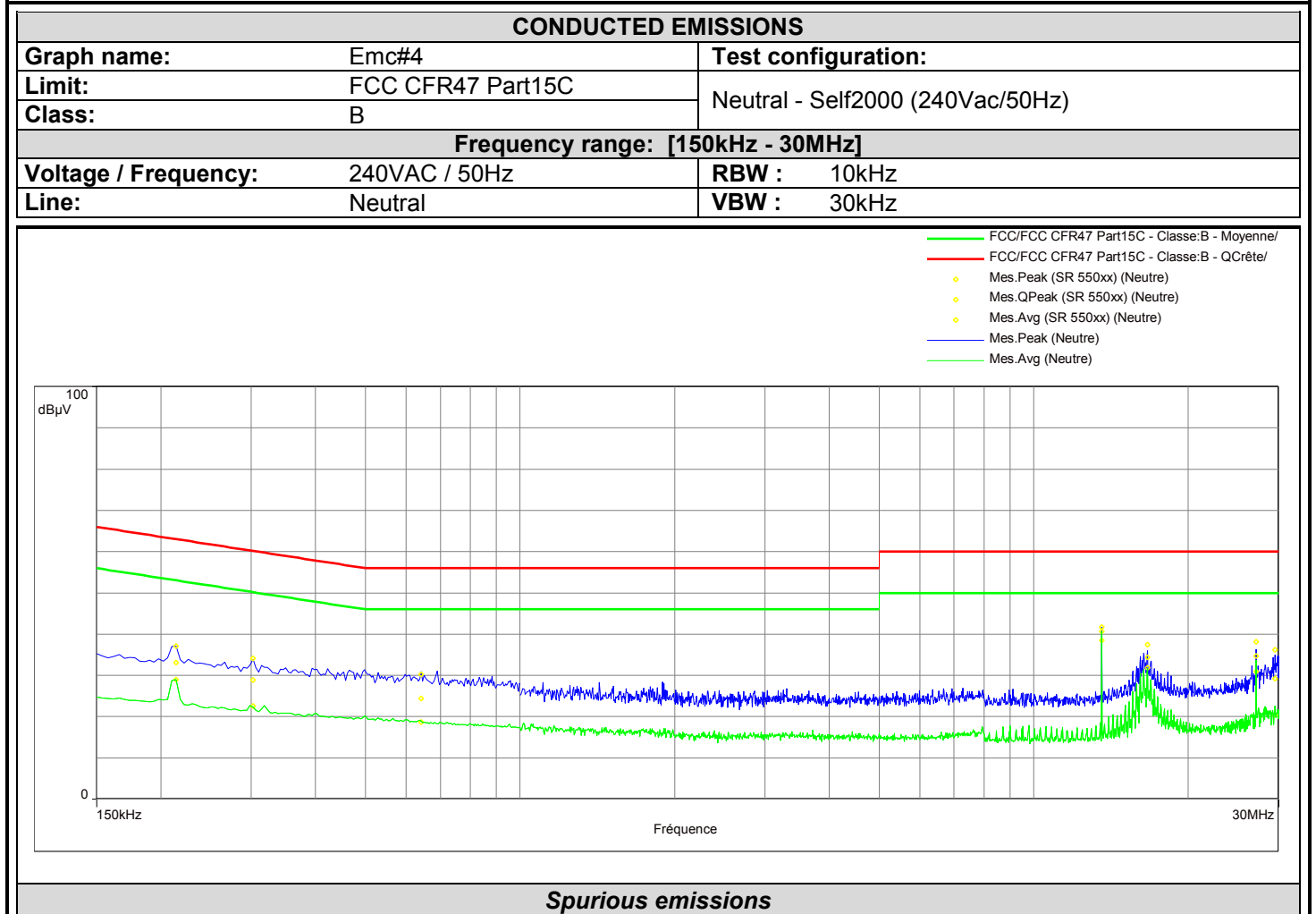
L C I E



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)
0.318	34.3	28.5	59.8	-31.3	22.9	49.8	-26.9	Phase 1	19.5
0.594	31.0	24.8	56.0	-31.2	19.0	46.0	-27.0	Phase 1	19.5
13.560	42.0	40.8	60.0	-19.2	39.0	50.0	-11.0	Phase 1	20.5
16.660	36.3	32.8	60.0	-27.2	29.1	50.0	-20.9	Phase 1	20.7
27.120	37.2	34.4	60.0	-25.6	30.4	50.0	-19.6	Phase 1	21.4



L C I E



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)
0.214	37.1	33.1	63.0	-29.9	29.0	53.0	-24.0	Neutre	19.5
0.302	34.2	28.9	60.2	-31.3	22.5	50.2	-27.6	Neutre	19.4
0.642	30.3	24.4	56.0	-31.6	18.7	46.0	-27.3	Neutre	19.5
13.560	41.7	40.6	60.0	-19.4	38.5	50.0	-11.5	Neutre	20.5
16.656	37.4	34.4	60.0	-25.6	31.9	50.0	-18.1	Neutre	20.7
27.120	38.2	34.8	60.0	-25.2	31.0	50.0	-19.0	Neutre	21.4
29.476	36.2	29.3	60.0	-30.7	20.4	50.0	-29.6	Neutre	21.5

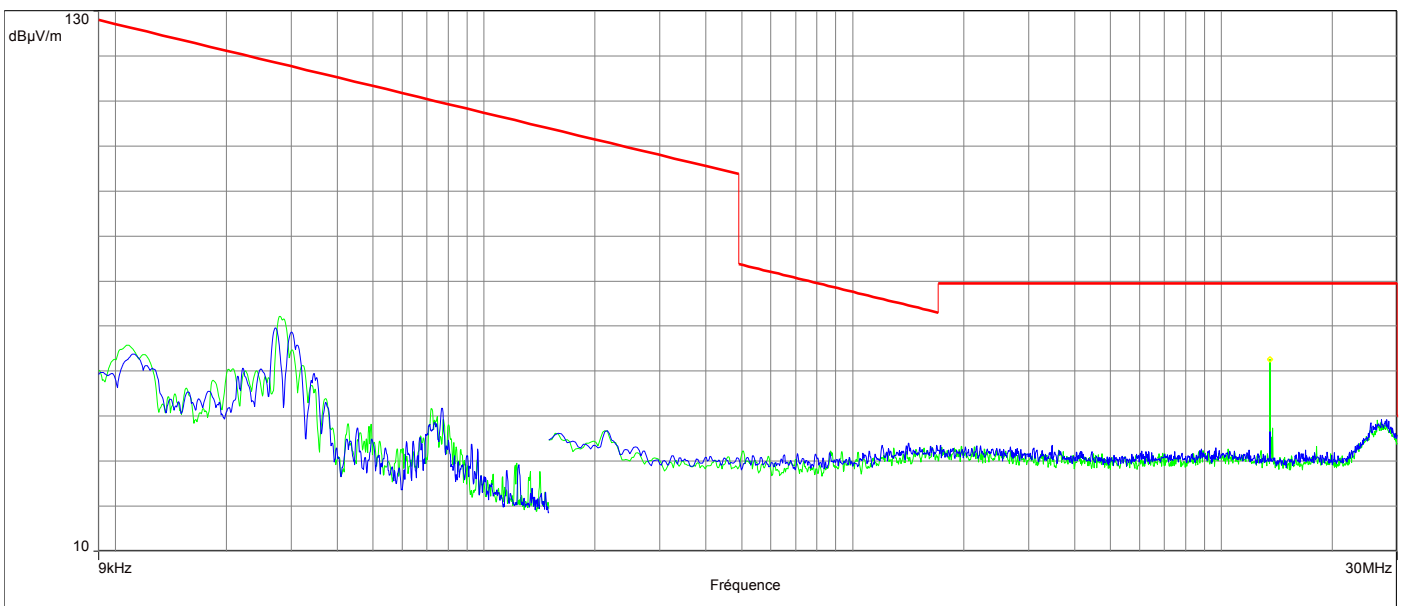


L C I E

RADIATED EMISSIONS

Graph name:	Emr#1	Test configuration:
Limit:	FCC CFR47 Part15C	(0°/90°) - Cfg 1 Axis XY
Class:		
Frequency range: [9kHz - 30MHz]		
Antenna polarization:	0° / 90°	RBW : 300Hz / 10kHz
Azimuth:	0° - 360°	VBW : 1kHz / 30KHz

— FCC/FCC CFR47 Part 15C Class Gpeak3.0m
— Mes Peak (90°)
— Mes Peak (0°)



Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Polarization
13.559	52.6	0°

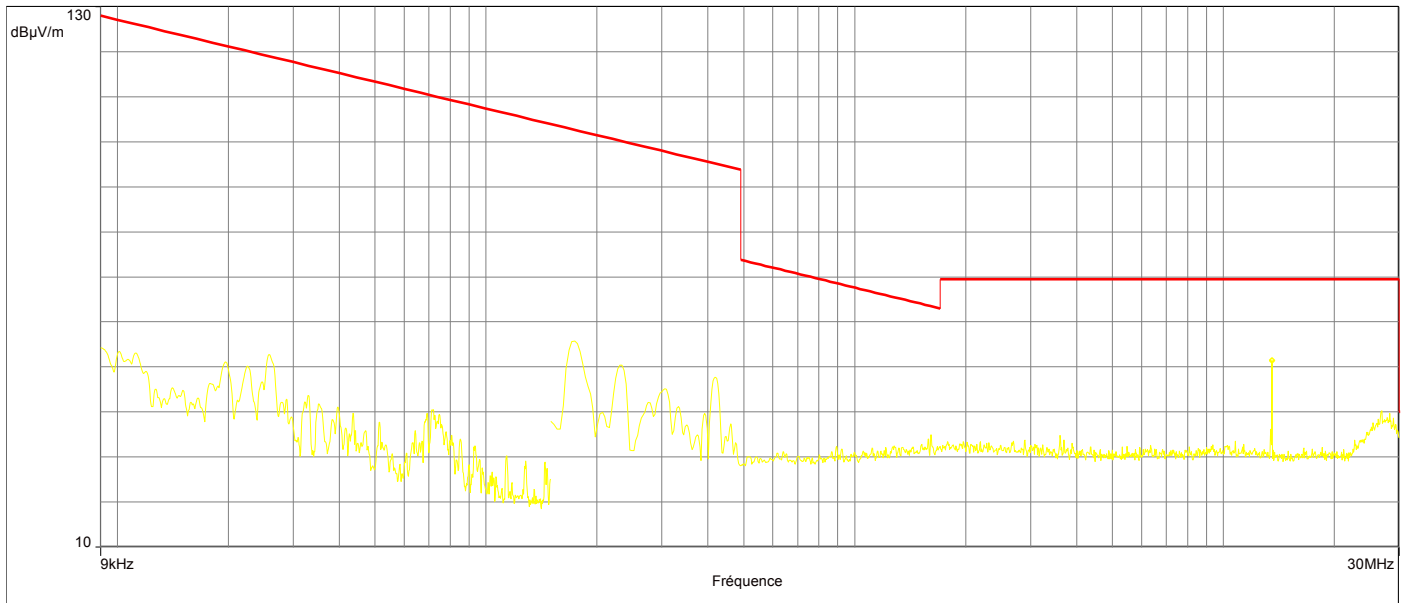


L C I E

RADIATED EMISSIONS

Graph name:	Emr#2	Test configuration:
Limit:	FCC CFR47 Part15C	(180°) - Cfg 1 Axis XY
Class:		
Frequency range: [9kHz - 30MHz]		
Antenna polarization:	180°	RBW : 300Hz /10kHz
Azimuth:	0° - 360°	VBW : 1kHz / 30KHz

— FCC/FCC CFR47 Part 15C Class Qpeak/3.0m
 — Mes Peak (180°)



Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Polarization
13.559	51.4	180°

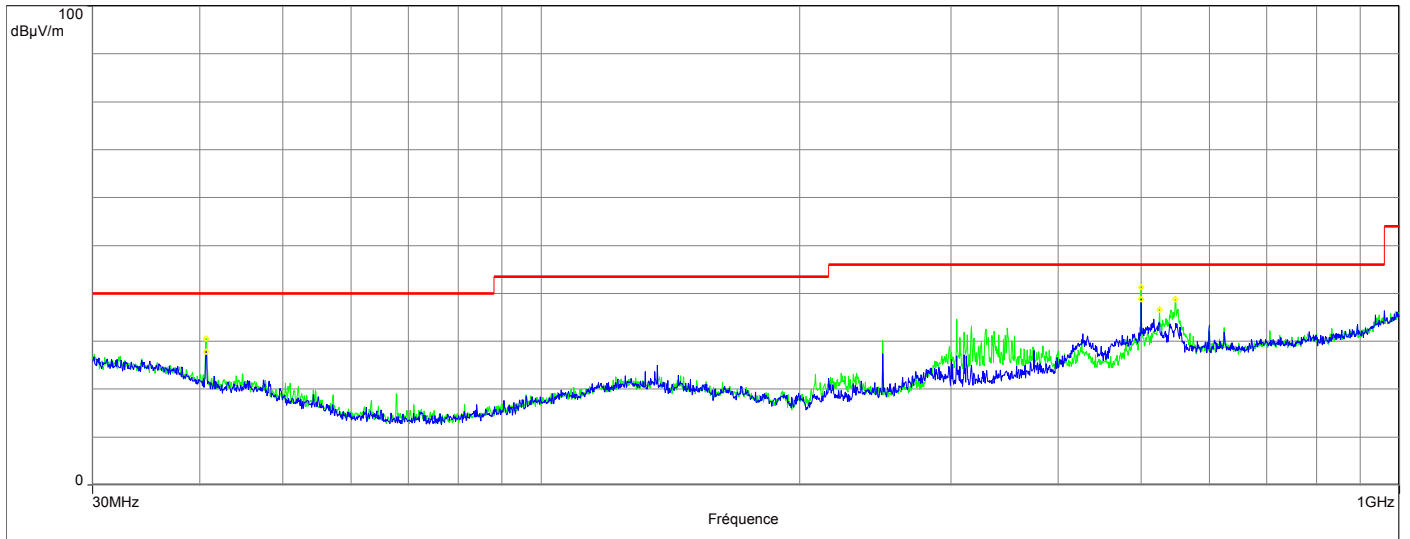


L C I E

RADIATED EMISSIONS

Graph name:	Emr#3	Test configuration:	
Limit:	FCC CFR47 Part15C	C3 - FSV(H+V)[0.03-1]GHz - Cfg 1 AxisXY	
Class:			
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	RBW :	100kHz
Azimuth:	0° - 360°	VBW :	300kHz

- FCC/CCF CFR47 Part15C - Classe: - QCrête/3.0m/
- Niveau (Suspect Manuel) (Horizontale)
- Niveau (Suspect Manuel) (Verticale)
- Mes.Peak (Horizontale)
- Mes.Peak (Verticale)



Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Polarization
40.676	27.8	Horizontal
500.000	38.8	Horizontal
40.676	30.6	Vertical
500.040	41.3	Vertical
525.040	36.6	Vertical
548.200	38.8	Vertical

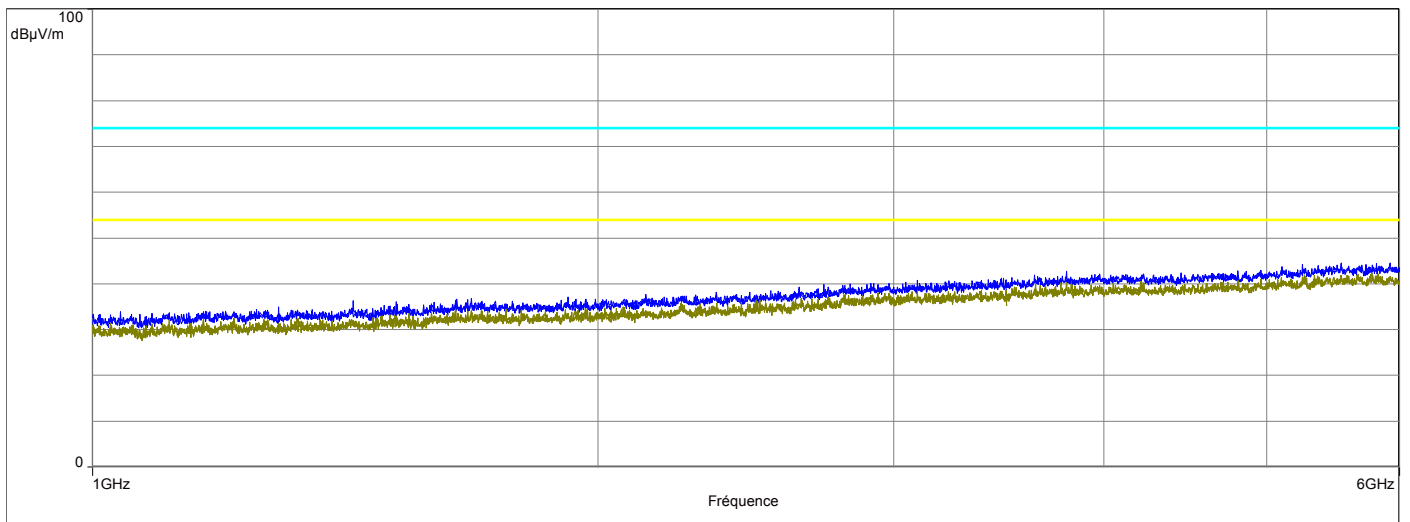


L C I E

RADIATED EMISSIONS

Graph name:	Emr#4	Test configuration:
Limit:	FCC CFR47 Part15C	C3 - FSV(H+V)[1-6]GHz - Cfg 1 Axis XY
Class:		
Frequency range: [1GHz - 6GHz]		
Antenna polarization:	Horizontal & Vertical	RBW : 1MHz
Azimuth:	0° - 360°	VBW : 3MHz

- FCC/FCC CFR47 Part15C - Classe: - Moyenne/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - Crête/3.0m/
- Mes.Peak (Horizontale)
- Mes.Peak (Verticale)
- Mes.Avg (Horizontale)
- Mes.Avg (Verticale)



Spurious emissions

No significative frequency observed

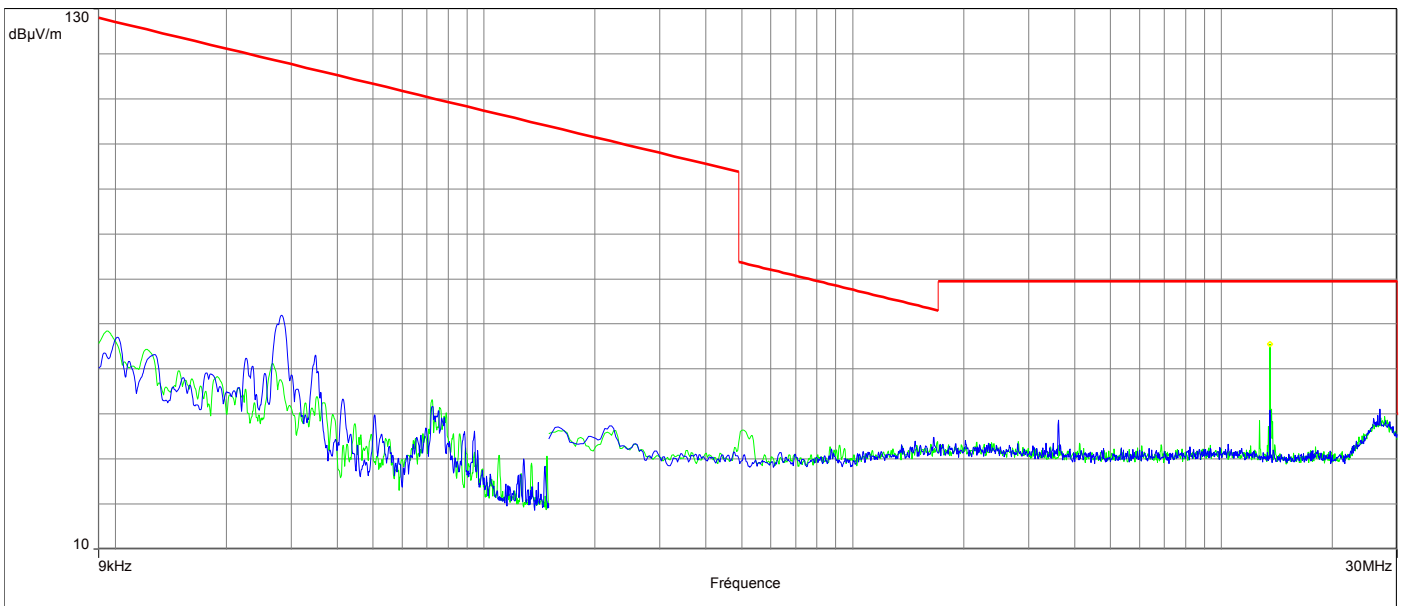


L C I E

RADIATED EMISSIONS

Graph name:	Emr#5	Test configuration:
Limit:	FCC CFR47 Part15C	(0°/90°) - Cfg 1 Axis Z
Class:		
Frequency range: [9kHz - 30MHz]		
Antenna polarization:	0° / 90°	RBW : 300Hz / 10kHz
Azimuth:	0° - 360°	VBW : 1kHz / 30KHz

— FCC/FCC CFR47 Part 15C Class Qpeak/3.0m
— Mes Peak (90°)
— Mes Peak (0°)



Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Polarization
13.559	55.5	0°

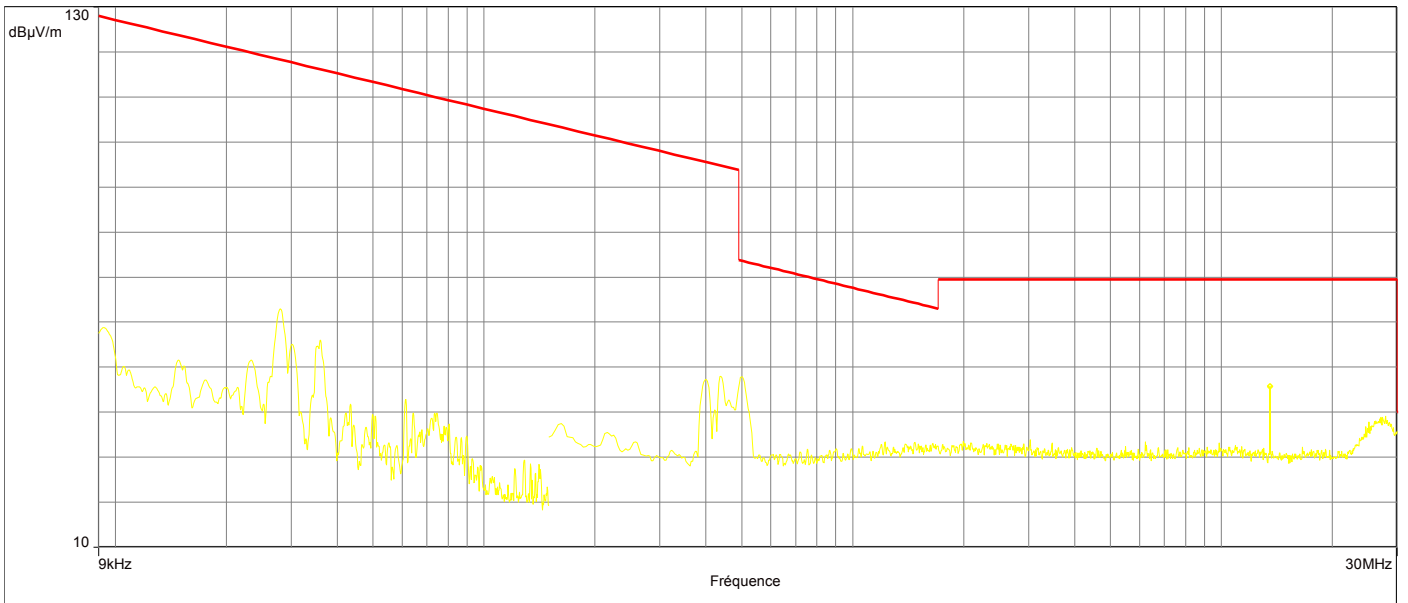


L C I E

RADIATED EMISSIONS

Graph name:	Emr#6	Test configuration:
Limit:	FCC CFR47 Part15C	(180°) - Cfg 1 Axis Z
Class:		
Frequency range: [9kHz - 30MHz]		
Antenna polarization:	180°	RBW : 300Hz /10kHz
Azimuth:	0° - 360°	VBW : 1kHz / 30KHz

— FCC/FCC CFR47 Part 15C Class Gpeak/3.0m
 — Mes Peak (180°)



Spurious emissions

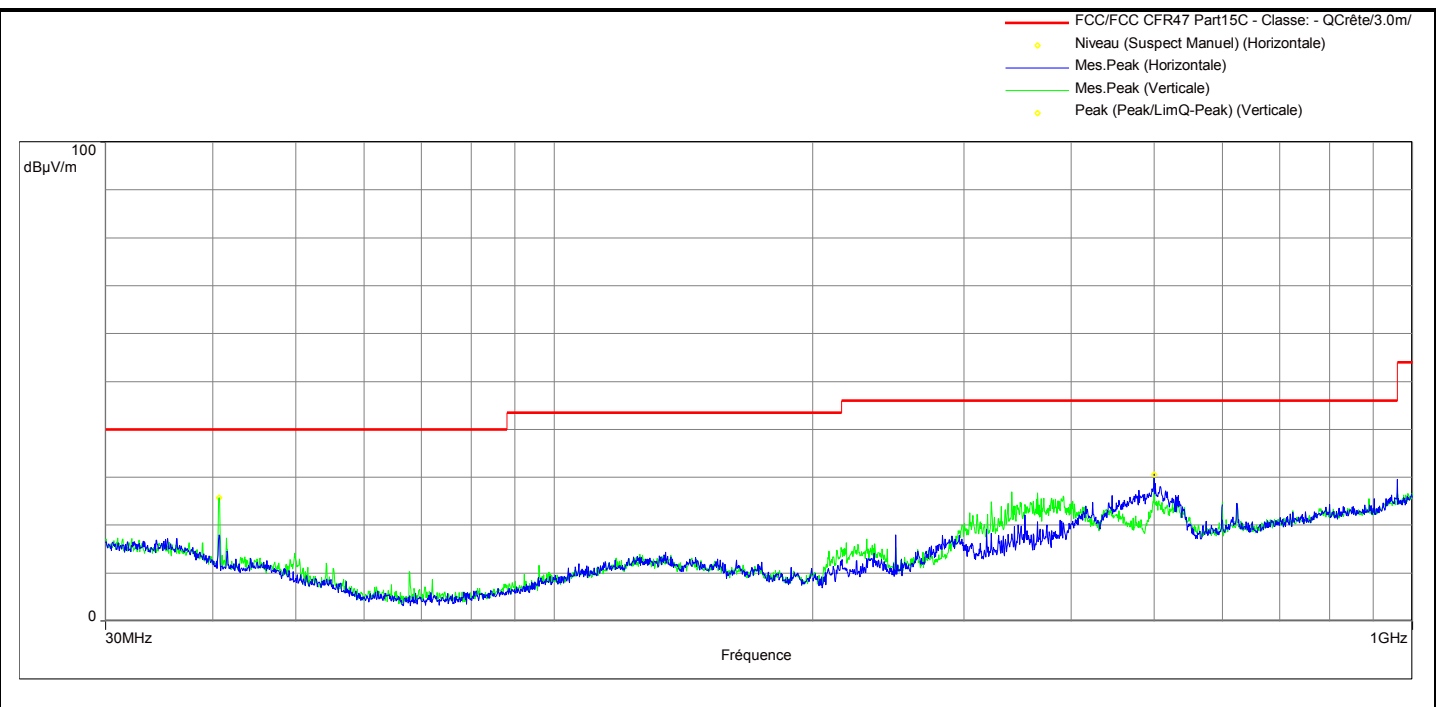
Frequency (MHz)	Peak Level (dBµV/m)	Polarization
13.559	45.8	180°



L C I E

RADIATED EMISSIONS

Graph name:	Emr#7	Test configuration:	
Limit:	FCC CFR47 Part15C	C3 - FSV(H+V)[0.03-1]GHz - Cfg 1 AxisZ	
Class:			
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	RBW :	100kHz
Azimuth:	0° - 360°	VBW :	300kHz



Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	LimQP (dBµV/m)	Peak-LimQP (dB)	Polarization	Correction (dB)
40.676	25.8	40.0	-14.2	Vertical	-18.6

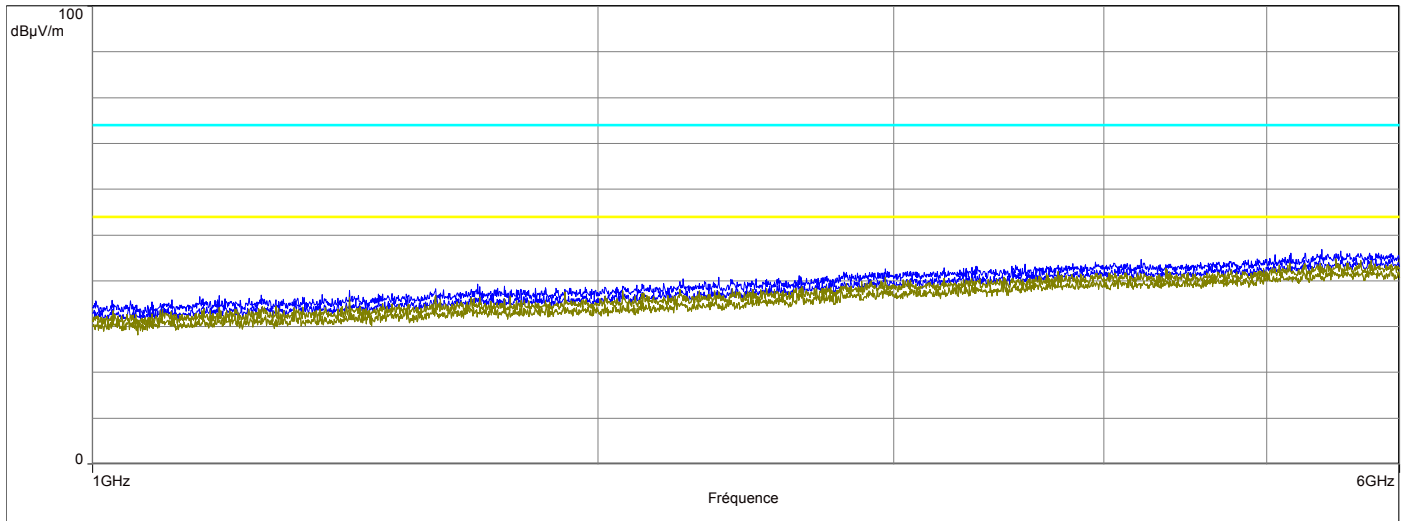


L C I E

RADIATED EMISSIONS

Graph name:	Emr#8	Test configuration:	
Limit:	FCC CFR47 Part15C	C3 - FSV(H+V)[1-6]GHz - Cfg 1 Axis Z	
Class:			
Frequency range: [1GHz - 6GHz]			
Antenna polarization:	Horizontal & Vertical	RBW :	1MHz
Azimuth:	0° - 360°	VBW :	3MHz

- FCC/FCC CFR47 Part15C - Classe: - Moyenne/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - Crête/3.0m/
- Mes.Peak (Horizontale)
- Mes.Peak (Verticale)
- Mes.Avg (Horizontale)
- Mes.Avg (Verticale)



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
Mesure des perturbations conduites en tension sur le réseau d'énergie <i>Measurement of conducted disturbances in voltage on the power port</i>	3.51 dB	3.6 dB
Mesure des perturbations conduites en tension sur le réseau de télécommunication <i>Measurement of conducted disturbances in voltage on the telecommunication port.</i>	3.26 dB	A l'étude / Under consid.
Mesure des perturbations discontinues conduites en tension <i>Measurement of discontinuous conducted disturbances in voltage</i>	3.45 dB	3.6 dB
Mesure des perturbations conduites en courant <i>Measurement of conducted disturbances in current</i>	3.09 dB	A l'étude / Under consid.
Mesure du champ électrique rayonné sur le site en espace libre de Moirans <i>Measurement of radiated electric field on the Moirans open area test site</i>	5.20 dB	6.3 dB

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.