LCIE
Etablissement de Moirans
ZI Centr'alp
170, rue de Chatagnon
38430 Moirans
RCS Grenoble 408 363 174
Tel. : +33 4 76 07 36 36
Fax : +33 4 76 55 90 88

TEST REPORT

N°: 810529-A1-R6-E **JDE : 132065**

Subject **Electromagnetic compatibility and Radio spectrum Matters (ERM) tests according to standards: FCC CFR 47 Part 15, Subpart B et C RSS-210 Issue 8**

Issued to	**SOLEM** ZAE la Plaine 5 rue Georges Besses. 34830 - CLAPIER
Apparatus under test	
Product	**Automatic Devices**
Trade mark	**SOLEM**
Manufacturer	**SOLEM**
Model under test	**BL-OL**
Serial number	**BL4OL-0209B7**
FCCID	**YWW-BLOL**
ICID	**9319A-BLOL**
Test date	From December 8th to 24th, 2014
Test location	Moirans
Test performed by	G.Deschamps / M.Mourzagh
Composition of document	33 pages
Modification of the last version	None
Document issued on	February 18th, 2015

Written by :
Gaëtan Deschamps
Tests operator

Approved by :
Anthony Merlin
Technical manager

LABORATOIRE CENTRAL DES INDUSTRIES ELECTRIQUES
LCIE SUD-EST
170, Rue de Chatagnon
38430 MOIRANS
Tél. 04 76 07 36 36
Fax 04 76 55 90 88

SUMMARY

1. TEST PROGRAM

Standard:
- **FCC Part 15, Subpart C 15.247**
- **ANSI C63.4 (2003)**
- **RSS-210 Issue 8 – Dec 2010**
- **RSS-Gen Issue 3 – Dec 2010**

EMISSION TEST	LIMITS			RESULTS
Limits for conducted disturbance at mains ports 150kHz-30MHz	**Frequency**	**Quasi-peak value (dBµV)**	**Average value (dBµV)**	☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
	150-500kHz	66 to 56	56 to 46	
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 9kHz-30MHz *CFR 47 §15.209 (a)* *CFR 47 §15.247 (d)* *RSS-210 §A8.5*	**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 §15.247 (d)* *RSS-210 §A8.5* ***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**
Bandwidth 6dB *CFR 47 §*15.247 (a) (2) *RSS-210 §A8.2*	**At least 500kHz**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Maximum Peak Output Power *CFR 47 §*15.247 (b) *RSS-210 §A8.4 (4)*	**Limit: 30dBm** Conducted or Radiated measurement			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Band Edge Measurement *CFR 47 §15.209 (a)* *CFR 47 §15.247 (d)* *RSS-210 §A8.5*	**Limit: -20dBc or** **Radiated emissions limits in restricted bands**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Power spectral Density *CFR 47 §15.247 (e)* *RSS-210 §A8.2*	**Limit: 8dBm/3kHz**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Occupied bandwidth *RSS-Gen §4.6.1*	**No limit**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Receiver Spurious Emission** *RSS-Gen §4.10*	**See RSS-Gen §4.10**			☐ **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.

2. SYSTEM TEST CONFIGURATION

2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):
BL-OL
Serial Number: BL4OL-0209B7

Photography of EUT

Power supply:
During all the tests, EUT is supplied by V_{nom}: 24VAC
For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply1	☑ AC ☐ DC ☐ Battery			

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply1	AC	3	☐	☐	☑	-
Access1	USB	1	☐	☐	☐	Temporary USB installed for the reception of different orders (power, choice of channel, modulation etc.)
Access2	I/O	0.5	☑	☐	☑	-
Access3	I/O	0.5	☑	☐	☑	-
Access4	I/O	0.5	☑	☐	☑	-
Access5	I/O	0.5	☑	☐	☑	-

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Laptop	ThinkPad Tseries	L3-B746308/01	-

Equipment information:

Type:	**Bluetooth Low Energy v4.0**			
Frequency band:	[2400 – 2483.5] MHz			
Sub-band REC7003:	Annex 3 (a)			
Spectrum Modulation:	☑ DSSS (Tested like it)			
Number of Channel:	40			
Spacing channel:	2MHz			
Channel bandwidth:	1MHz			
Transmit chains:	☑ 1	☐ 2	☐ 3	☐ 4
	☑ Single antenna	☐ Symmetrical	☐ Asymmetrical	
	Gain 1: 3dBi	Gain 2: dBi	Gain 3: dBi	Gain 4: dBi
Beam forming gain:	☐ Yes: dB		☑ No	
Receiver chains	☑ 1	☐ 2	☐ 3	☐ 4
Type of equipment:	☑ Stand-alone	☐ Plug-in	☐ Combined	
Ad-Hoc mode:	☐ Yes		☑ No	
Adaptivity mode:	☐ Yes (Load Based)	☐ Off mode	☑ No	
	Clear Channel Assessment Time:		None	
	q value for Load Based Equipment:		None	
Duty cycle:	☑ Continuous duty	☐ Intermittent duty	☐ Continuous operation	
Equipment type:	☑ Production model		☐ Prototype	
Chip Reference:	nRF51822 By Nordic Semiconductor			

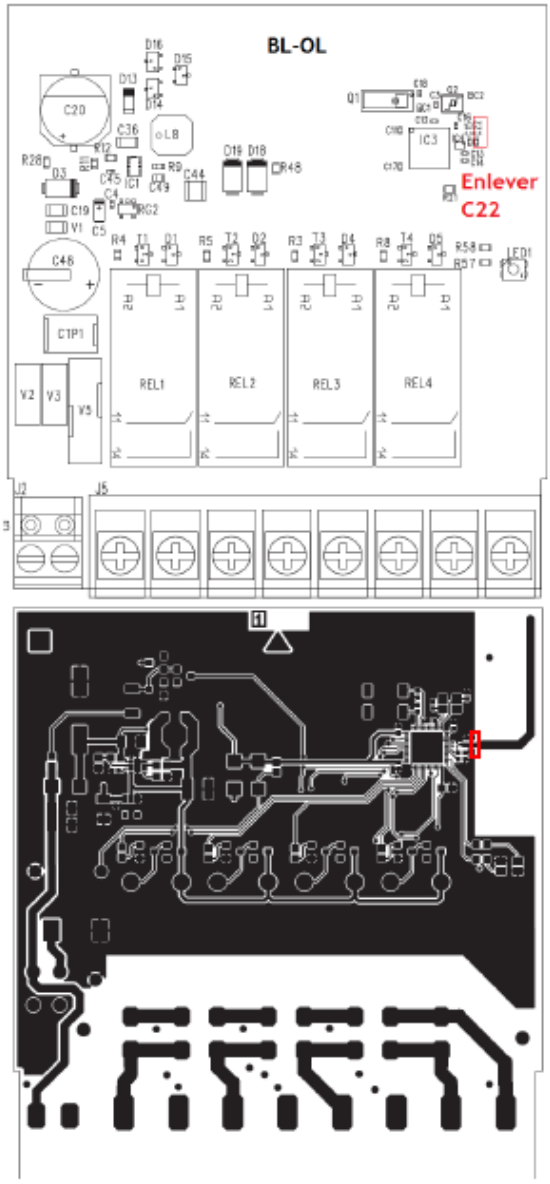
Temperature range:	Tmin:	☑ -20°C	☐ 0°C	☐ °C
	Tnom:	20°C		
	Tmax:	☐ 35°C	☑ 55°C	☐ °C
Test source voltage:	☑ AC: 24	☐ DC:	☐ Battery:	

2.2. EUT CONFIGURATION

The EUT is set in the following modes during tests with simulator / software (v1.93b): “Terminal”
- Permanent emission with modulation on a fixed channel in the data rate that produced the highest power
- Permanent reception
- The Power order sent for the Module is set at 0dBm.

2.1. EQUIPMENT MODIFICATION

☐ None ☑ Modification: The capacity C22 (1pF) between antenna and C15 (capacity) is removed, see following map:



2.2. 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.

3. CONDUCTED EMISSION DATA

3.1. ENVIRONMENTAL CONDITIONS

Date of test	:	December 09th ,2014
Test performed by	:	Majid MOURZAGH
Atmospheric pressure (hPa)	:	996
Relative humidity (%)	:	43
Ambient temperature (°C)	:	22

3.2. TEST SETUP

Mains terminals

The EUT and auxiliaries are set:

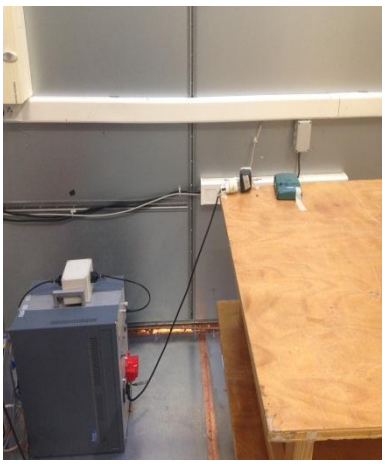
☑ 80cm above the ground on the non-conducting table (Table-top equipment)

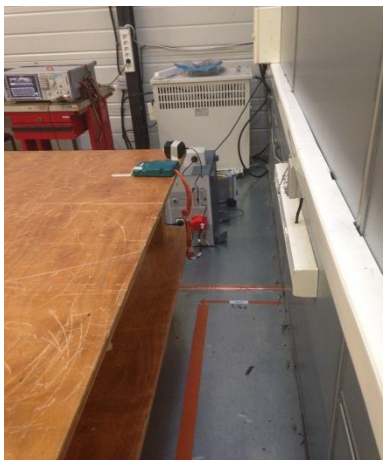
☐ 10cm above the ground on isolating support (Floor standing equipment)

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 C63.4-(2003) and FCC Part 15 subpart B and C. The product has been tested with 120V/60Hz power line voltage and compared to the FCC Part 15 subpart B §15.107 and C §15.207 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 50Ω / 50µH. 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. 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
Cable + self	-	-	A5329578	05/14	05/15
Conducted emission comb generator	BARDET	-	A3169049	-	-
LISN tri-phase ESH2-Z5	RHODE & SCHWARZ	33852.19.53	C2320062	06/14	06/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	10/13	10/14
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	04/14	04/15
Transient limiter	HEWLETT PACKARD	11947A	A4049061	01/14	01/15

3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

3.6. TEST RESULTS

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

Measure on L1:	graph **Emc#1**	(see annex 1)
Measure on N:	graph **Emc#2**	(see annex 1)

3.7. CONCLUSION

Conducted emission data measurement performed on the sample of the product **BL-OL**, SN: **BL4OL-0209B7**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-210 Issue 8 limits.

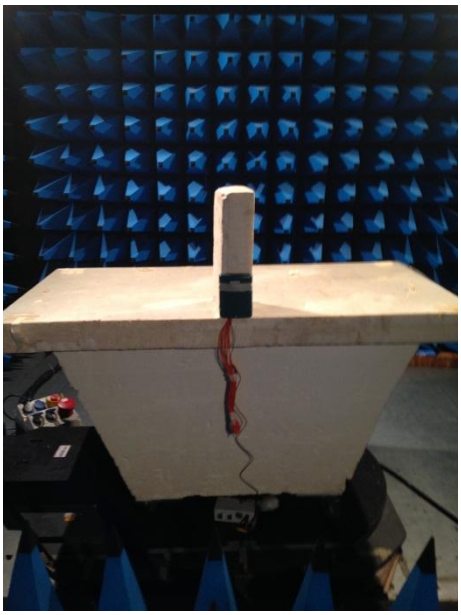
4. RADIATED EMISSION DATA

4.1. ENVIRONMENTAL CONDITIONS

Date of test	:	December 09th ,2014
Test performed by	:	Majid MOURZAGH
Atmospheric pressure (hPa)	:	996
Relative humidity (%)	:	43
Ambient temperature (°C)	:	22

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)
☐ 10cm above the ground on isolating support (Floor standing equipment)
The EUT is powered by V_{nom}.



Test setup in anechoic chamber

4.3. TEST METHOD

Pre-characterisation measurement: (9kHz – 25GHz)
A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber for frequency from 30MHz to 25GHz. Test is performed in horizontal (H) and vertical (V) polarization, the loop antenna was rotated during the test to maximize 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 25GHz.

Characterization on 10 meters open site from 9kHz to 1GHz:
The product has been tested according to ANSI C63.4 (2003), FCC part 15 subpart C. 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 C §15.225 limits in the frequency range 13.553MHz 13.567MHz. 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 to maximize 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 25GHz:
The product has been tested at a distance of **3 meters** from the antenna and compared to the FCC part 15 subpart B §15.109 limits and C §15.209 limits. Measurement bandwidth was 1MHz from 1GHz to XGHz.
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
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 0.1MHz – 1300 MHz	HEWLETT PACKARD	8447D	A7085008	09/14	09/15
Antenna Bi-Log XWing	TESEQ	CBL6144	C2040146	11/14	11/16
Emission Cable	MICRO-COAX	6GHz	A5329654	04/14	04/15
Emission Cable	MICRO-COAX	6GHz	A5329655	04/14	04/15
Emission Cable	MICRO-COAX	6GHz	A5329656	04/14	04/15
Semi-Anechoic chamber #2	SIEPEL	-	D3044015	04/14	04/15
Radiated emission comb generator	BARDET	-	A3169050	-	-
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642049	11/14	11/15
Thermo-hygrometer (C2)	LACROSS Techn.	WS-2357	B4206015	08/14	08/15
Turntable controller (Cage#2)	ETS Lingren	Model 2066	F2000393	-	-
Turntable chamber (Cage#2)	ETS Lingren	Model 2165	F2000404	-	-
Table	LCIE	-	F2000438	-	-

4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

4.6. TEST RESULTS

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

See graphs for 30MHz-1GHz:

Worst case presented:

Graph identifier	Polarization	Mode	EUT position	Channel	Comments
Emr# 1	H	TX	Axis XY / Z	Min/Mid/Max	See annex 2
Emr# 2	V	TX	Axis XY / Z	Min/Mid/Max	See annex 2

4.6.2. 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.

No	Frequency (MHz)	Limit Quasi-Peak (dBµV/m)	Measure Quasi-Peak (dBµV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
No significant frequency observed (see annex 2)									

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

4.6.3. Characterization on 3meters anechoic chamber from 1GHz to 25GHz

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.

No	Frequency (MHz)	Limit Peak (dBµV/m)	Measure Peak (dBµV/m)	Margin Peak (dB)	Limit Average (dBµV/m)	Average* Calculated (dBµV/m))	Margin Average (dB)	Angle Table (°)	Pol. Ant.	Ht. Ant. (cm)	FC (dB)	Remark
1	1201.130	74.0	34.0	**-40.0**	54.0	0.0	**-54.0**	0	H	100	-7.2	
2	1221.100	74.0	34.4	**-39.6**	54.0	0.4	**-53.6**	0	H	100	-7.1	
3	2225.838	74.0	39.5	**-34.5**	54.0	5.5	**-48.5**	0	H	100	-2.0	
4	2241.948	74.0	39.5	**-34.5**	54.0	5.5	**-48.5**	0	H	100	-2.0	
5	2251.823	74.0	39.5	**-34.5**	54.0	5.6	**-48.4**	0	H	100	-2.0	
6	2258.126	74.0	39.5	**-34.5**	54.0	5.6	**-48.4**	0	H	100	-2.0	
7	2273.986	74.0	39.6	**-34.4**	54.0	5.6	**-48.4**	0	H	100	-1.9	
8	2305.640	74.0	39.6	**-34.4**	54.0	5.6	**-48.4**	0	H	100	-1.9	
9	2323.324	74.0	64.8	**-9.2**	54.0	30.8	**-23.2**	100	H	100	-1.9	
10	2337.995	74.0	43.5	**-30.5**	54.0	9.5	**-44.5**	0	H	100	-1.8	
11	2354.037	74.0	43.5	**-30.5**	54.0	9.5	**-44.5**		H	100	-1.8	
12	2370.252	74.0	65.8	**-8.2**	54.0	31.8	**-22.2**	170	H	100	-1.8	
13	2494.861	74.0	53.7	**-20.3**	54.0	19.7	**-34.3**	170	H	100	-1.6	
14	2747.305	74.0	39.7	**-34.3**	54.0	5.7	**-48.3**	0	H	100	-0.8	
15	3603.310	74.0	42.5	**-31.5**	54.0	8.5	**-45.5**	0	H	100	2.0	
16	3662.560	74.0	42.6	**-31.4**	54.0	8.7	**-45.3**	0	H	100	2.1	
17	3719.970	74.0	42.8	**-31.2**	54.0	8.8	**-45.2**	0	H	100	2.3	
18	4804.000	74.0	68.9	**-5.1**	54.0	34.9	**-19.1**	175	H	100	3.9	
19	4884.000	74.0	68.2	**-5.8**	54.0	34.2	**-19.8**	170	H	100	4.1	
20	4960.000	74.0	68.0	**-6.0**	54.0	34.0	**-20.0**	173	H	100	4.3	
21	7326.000	74.0	57.9	**-16.1**	54.0	23.9	**-30.1**	175	H	100	8.2	
22	7440.000	74.0	56.7	**-17.3**	54.0	22.7	**-31.3**	175	H	100	8.5	

***Average results calculated with duty cycle method (Duty=2%):**

*Average = Peak measure – 20*log(duty cycle).*

Note: Measures have been done at 3m distance.

4.7. CONCLUSION

Radiated emission data measurement performed on the sample of the product **BL-OL**, SN: **BL4OL-0209B7**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-210 Issue 8 limits.

5. BANDWIDTH (15.247)

5.1. TEST CONDITIONS

Date of test	:December 10th, 2014
Test performed by	:G.Deschamps
Atmospheric pressure (hPa)	:1005
Relative humidity (%)	:29
Ambient temperature (°C)	:23

5.2. 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 11.7dB

☐ ***Radiated measurement:***
The EUT is placed in an anechoic chamber; 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, a delta marker is used to measure the frequency difference as the emission bandwidth.

Measurement Procedure:
1. Set resolution bandwidth (RBW) = 100kHz.
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. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer.

5.3. TEST EQUIPMENT LIST

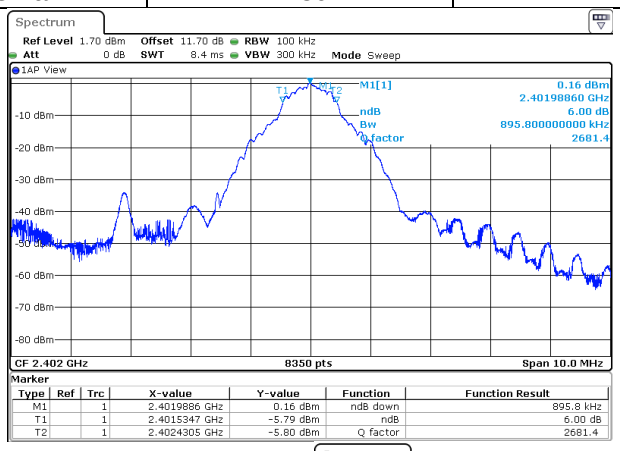
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	AEROFLEX	-	A7122207	12/13	12/14
Cable	-	-	A5329635	11/14	11/15
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	04/14	04/15

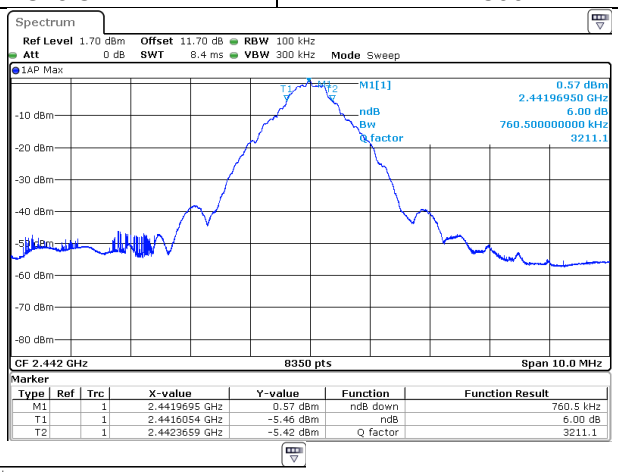
5.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

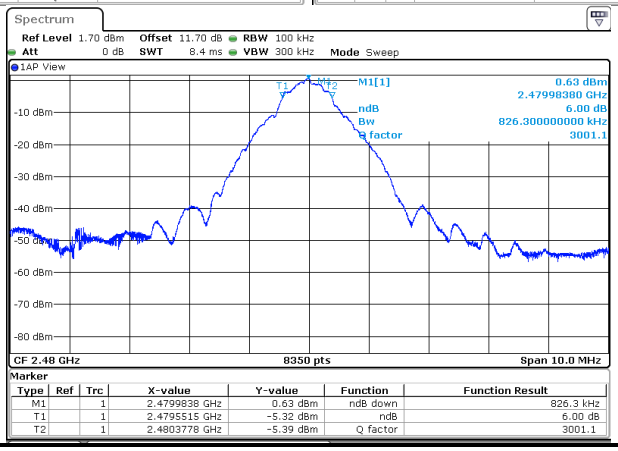
☑ None ☐ Divergence:

5.5. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Bandwidth Limit (kHz)
Cmin	2402	**895.8**	**>500**
Cmid	2442	**760.5**	**>500**
Cmax	2480	**826.3**	**>500**







5.6. CONCLUSION

Bandwidth measurement performed on the sample of the product **BL-OL**, SN: **BL4OL-0209B7**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-210 Issue 8 limits.

6. MAXIMUM PEAK OUTPUT POWER (15.247)

6.1. TEST CONDITIONS

Date of test :December 10th, 2014
Test performed by :G.Deschamps
Atmospheric pressure (hPa) :1005
Relative humidity (%) :29
Ambient temperature (°C) :23

6.2. 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.
Offset: Attenuator+cable 11.7dB

☐ ***Radiated measurement:***
The EUT is placed in an anechoic chamber; the center frequency of the spectrum analyzer is set to the fundamental frequency.
The product has been tested at a distance of 3 meters from the antenna. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on following table. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.
To demonstrate compliance with peak output power requirement of section 15.247 (b), the transmitter's peak output power is calculated using the following equation:

$$E = \frac{\sqrt{30PG}}{d}$$

Where:
- E is the measured maximum fundamental field strength in V/m.
- G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.
- d is the distance in meters from which the field strength was measured.
- P is the power in watts for which you are solving:

$$P = \frac{(Ed)^2}{30G}$$

Maximum peak conducted output power

One of the following procedures may be used to determine the maximum peak conducted output power of a DTS EUT.

- ☑ ***RBW ≥ DTS bandwidth***

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ 3 x RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

- ☐ ***Integrated band power method***

This procedure may be used when the maximum available RBW of the measurement instrument is less than the DTS bandwidth.

a) Set the RBW = 1 MHz.
b) Set the VBW ≥ 3 x RBW
c) Set the span ≥ 1.5 x DTS bandwidth.
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges

6.3. TEST EQUIPMENT LIST

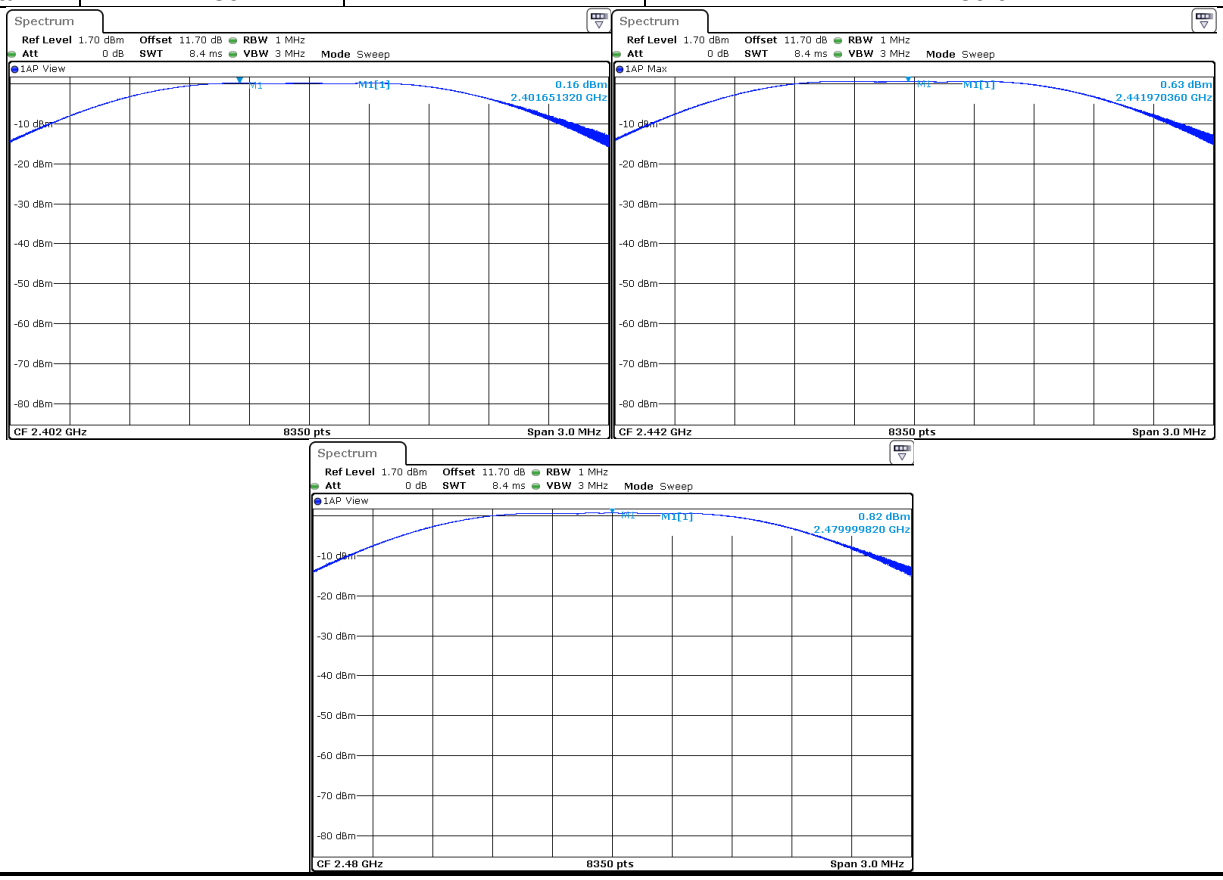
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	AEROFLEX	-	A7122207	12/13	12/14
Cable	-	-	A5329635	11/14	11/15
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	04/14	04/15

6.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

6.5. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)	Power Limit (dBm)
Cmin	2402	**0.16**	30.0
Cmid	2442	**0.63**	30.0
Cmax	2480	**0.82**	30.0



6.6. CONCLUSION

Maximum Peak Output Power measurement performed on the sample of the product **BL-OL**, SN: **BL4OL-0209B7**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-210 Issue 8 limits.

7. POWER SPECTRAL DENSITY (15.247)

7.1. TEST CONDITIONS

Date of test	:December 10th, 2014
Test performed by	:G.Deschamps
Atmospheric pressure (hPa)	:1005
Relative humidity (%)	:29
Ambient temperature (°C)	:23

7.2. 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.
Offset: Attenuator+cable 11.7dB

☐ ***Radiated measurement:***
The EUT is placed in an anechoic chamber; the center frequency of the spectrum analyzer is set to the fundamental frequency.
The product has been tested at a distance of 3 meters from the antenna. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on following table. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.
To demonstrate compliance with peak output power requirement of section 15.247 (b), the transmitter's peak output power is calculated using the following equation:

$$E = \frac{\sqrt{30PG}}{d}$$

Where:
- E is the measured maximum fundamental field strength in V/m.
- G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.
- d is the distance in meters from which the field strength was measured.
- P is the power in watts for which you are solving:

$$P = \frac{(Ed)^2}{30G}$$

Measurement Procedure PKPSD:
a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 □ RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

7.3. TEST EQUIPMENT LIST

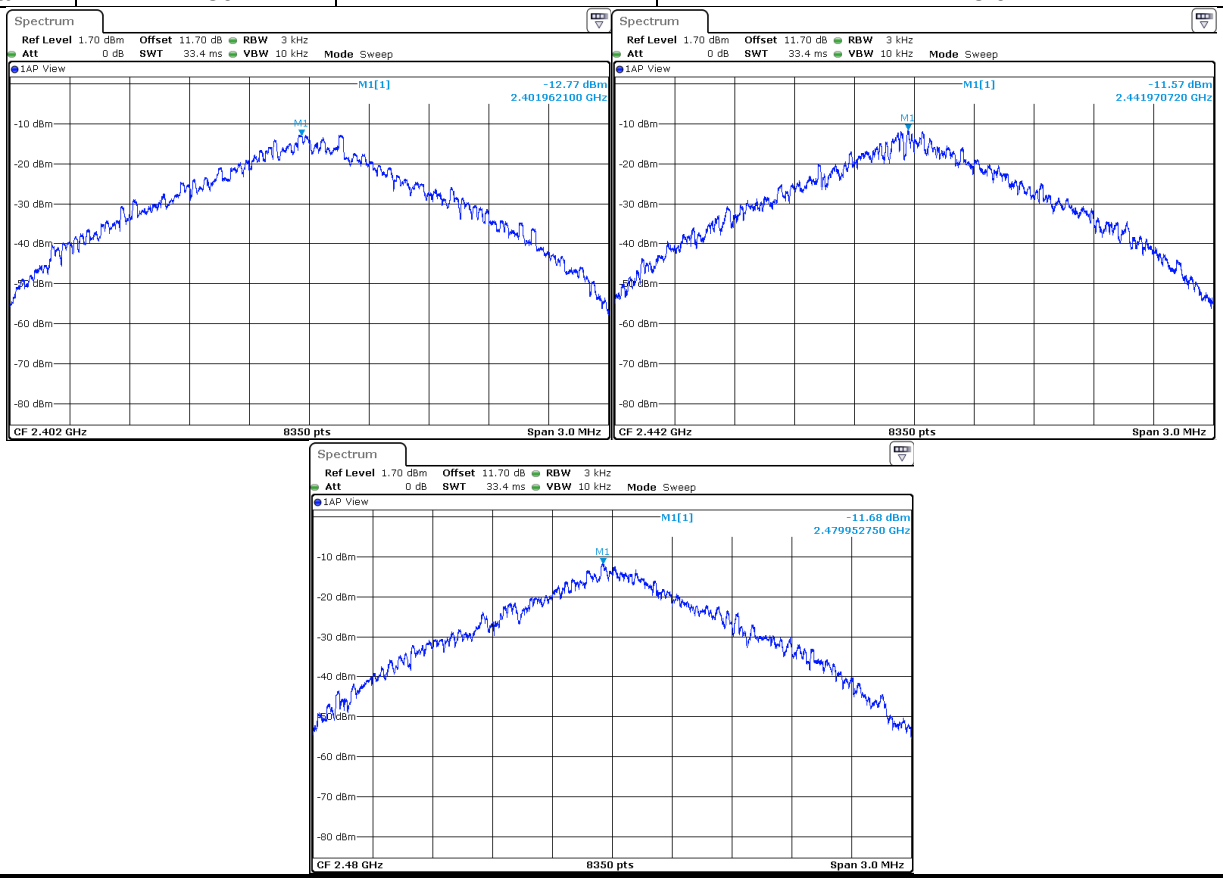
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	AEROFLEX	-	A7122207	12/13	12/14
Cable	-	-	A5329635	11/14	11/15
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	04/14	04/15

7.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

7.5. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	Power Spectral Density (dBm)	PSD Limit (dBm)
Cmin	2402	**-12.77**	8.0
Cmid	2442	**-11.57**	8.0
Cmax	2480	**-11.68**	8.0



7.6. CONCLUSION

Power Spectral Density measurement performed on the sample of the product **BL-OL**, SN: **BL4OL-0209B7**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-210 Issue 8 limits.

8. BAND EDGE MEASUREMENT (15.247)

8.1. TEST CONDITIONS

Date of test :December 10th, 2014
Test performed by :G.Deschamps
Atmospheric pressure (hPa) :1005
Relative humidity (%) :29
Ambient temperature (°C) :23

8.2. LIMIT

RF antenna conducted test:
Set RBW = 100 kHz, Video bandwidth (VBW) > RBW, scan up through 10th harmonic. All harmonics/spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. Note: If the device complies with the use of power option 2 the attenuation under this paragraph shall be 30 dB instead of 20 dB. *For -20dBc limit, lowest power output level is considered, worst case.*

Radiated emission test:
Applies to harmonics/spurs that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209. For measurements above 1 GHz, set RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation. See results in Radiated emissions section before.

8.3. SETUP

The EUT is placed in an anechoic chamber; levels have been corrected to be in compliant with Peak Output Power measurement. The EUT is turn ON; the graphs of the restrict frequency band are recorded with a display line indicating the highest level and other the 20dB offset below to show compliance with 15.247 (d) and 15.205. The emissions in restricted bands are compared to 15.209 limits.
RBW: 100kHz
VBW: 300kHz

8.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	AEROFLEX	-	A7122207	12/13	12/14
Cable	-	-	A5329635	11/14	11/15
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	04/14	04/15

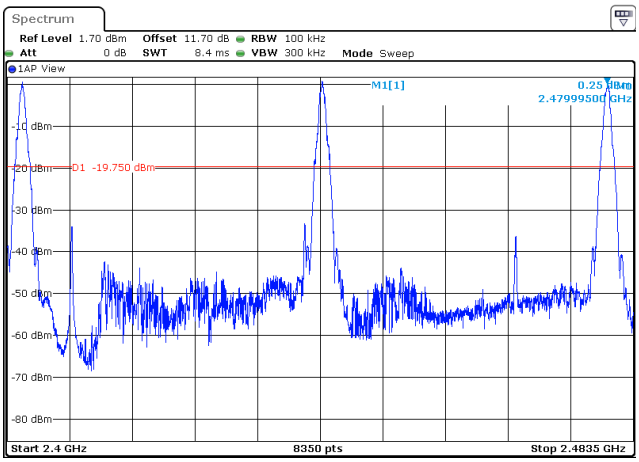
8.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

8.6. TEST SEQUENCE AND RESULTS

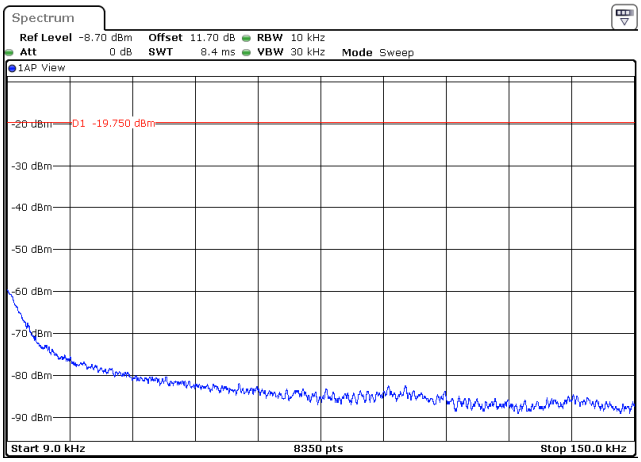
Offset: Attenuator+cable 11.7dB

GRAPH / MODULATION.

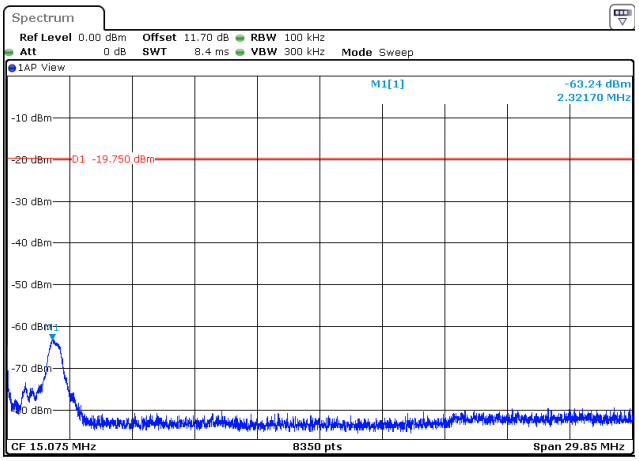


Worst case measured Cmax: 0.25dBm, frequency line at -19.74dBm.

From 9 kHz to 150 kHz, channel min/mid/max:

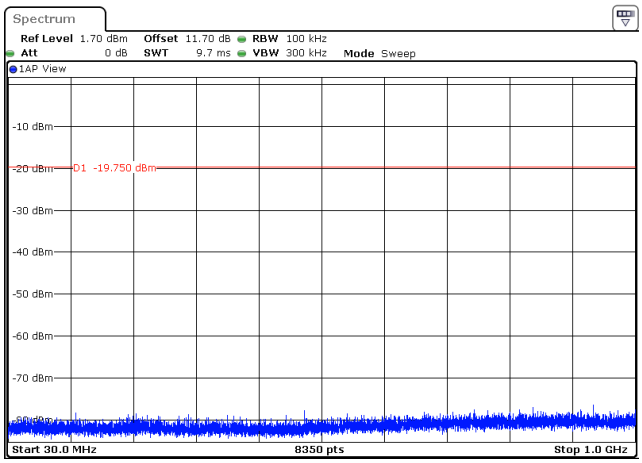


From 150 kHz to 30 MHz, channel min/mid/max:

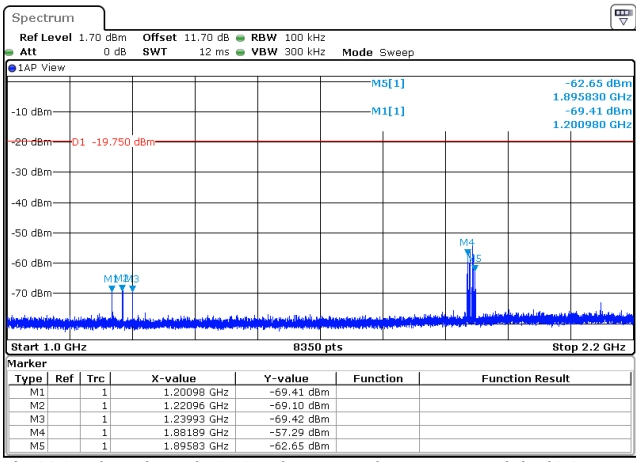


**The frequency of Marker M1 (2.31MHz) is not due to RF module*

From 30 MHz to 1 GHz, channel min/mid/max:



From 1 GHz to 2.2 GHz, channel min/mid/max:

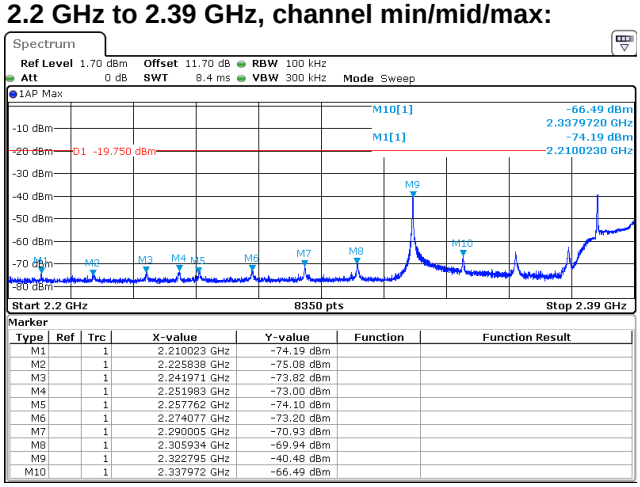


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.20098 GHz	-69.41 dBm		
M2		1	1.22096 GHz	-69.10 dBm		
M3		1	1.23993 GHz	-69.42 dBm		
M4		1	1.88189 GHz	-57.29 dBm		
M5		1	1.89583 GHz	-62.65 dBm		

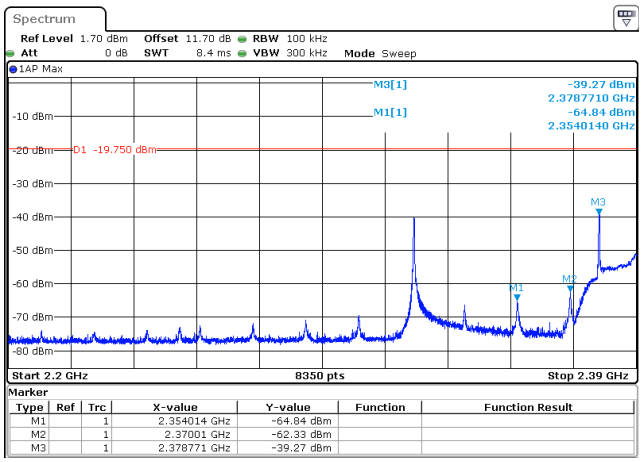
**The frequencies between the Marker M4 (1.88GHz) and M5 (1.89GHz) are not due to RF module (GSM Frequencies).*

From 2.2 GHz to 2.39 GHz, channel min/mid/max:



Marker

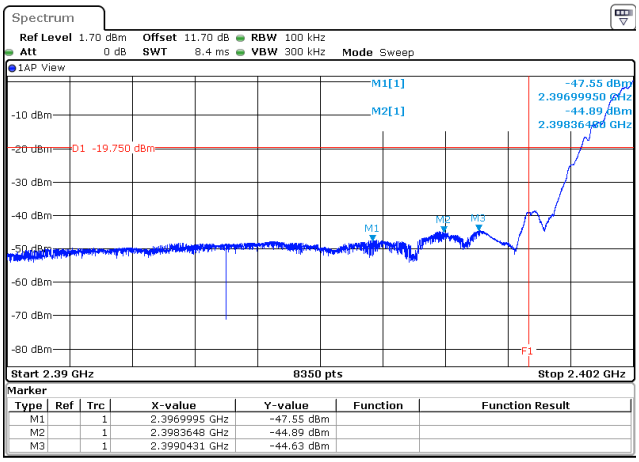
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.210023 GHz	-74.19 dBm		
M2		1	2.225838 GHz	-75.08 dBm		
M3		1	2.241971 GHz	-73.82 dBm		
M4		1	2.251983 GHz	-73.00 dBm		
M5		1	2.257762 GHz	-74.10 dBm		
M6		1	2.274077 GHz	-73.20 dBm		
M7		1	2.290005 GHz	-70.93 dBm		
M8		1	2.305934 GHz	-69.94 dBm		
M9		1	2.322795 GHz	-40.48 dBm		
M10		1	2.337972 GHz	-66.49 dBm		



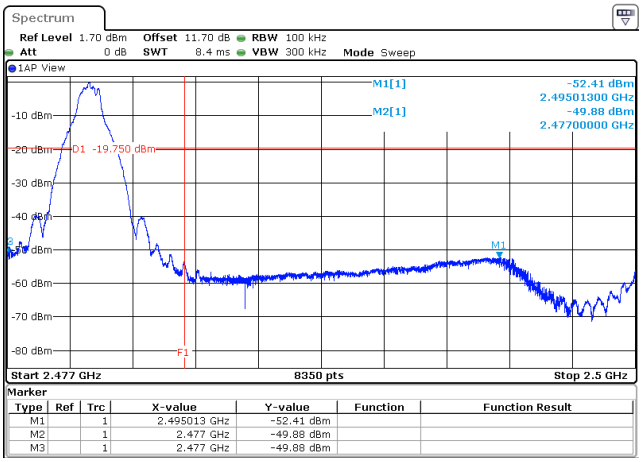
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.354014 GHz	-64.84 dBm		
M2		1	2.37001 GHz	-62.33 dBm		
M3		1	2.378771 GHz	-39.27 dBm		

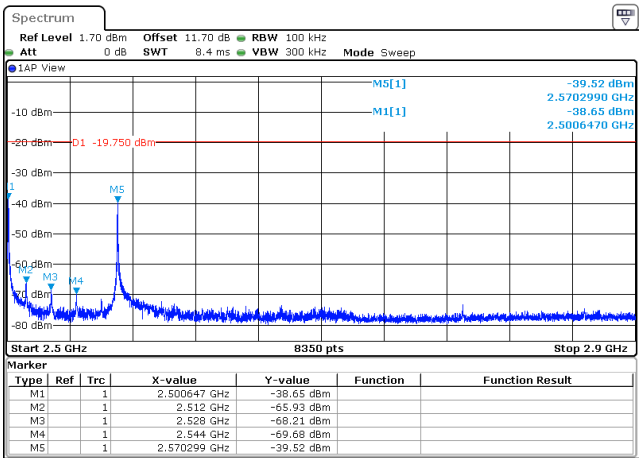
From 2.39 GHz to 2.402 GHz, channel min/mid/max:



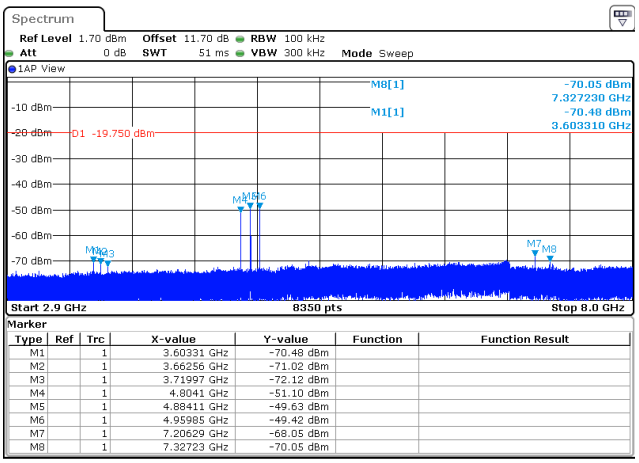
From 2.477 GHz to 2.5 GHz, channel min/mid/max:



From 2.5 GHz to 2.9 GHz, channel min/mid/max:



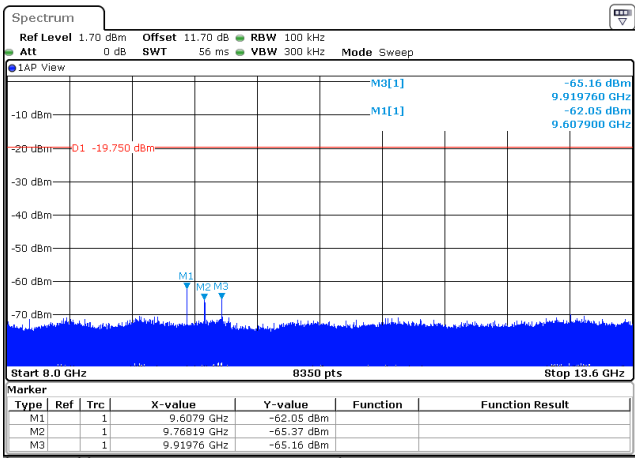
From 2.9 GHz to 8 GHz, channel min/mid/max:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	3.60331 GHz	-70.48 dBm		
M2		1	3.66256 GHz	-71.02 dBm		
M3		1	3.71997 GHz	-72.12 dBm		
M4		1	4.8041 GHz	-51.10 dBm		
M5		1	4.88411 GHz	-49.63 dBm		
M6		1	4.95985 GHz	-49.42 dBm		
M7		1	7.20629 GHz	-68.05 dBm		
M8		1	7.32723 GHz	-70.05 dBm		

From 8 GHz to 25 GHz, channel min/mid/max:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	9.6079 GHz	-62.05 dBm		
M2		1	9.76819 GHz	-65.37 dBm		
M3		1	9.91976 GHz	-65.16 dBm		

Measurement from 13.6GHz to 25GHz:No frequency observed

Note: For frequencies from 13.6GHz to 25GHz, it isn't possible to export screenshots.

8.7. CONCLUSION

Band Edge Measurement performed on the sample of the product **BL-OL**, SN: **BL4OL-0209B7**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-210 Issue 8 limits.

9. OCCUPIED BANDWIDTH

9.1. TEST CONDITIONS

Date of test :December 10th, 2014
Test performed by :G.Deschamps
Atmospheric pressure (hPa) :1005
Relative humidity (%) :29
Ambient temperature (°C) :23

9.2. 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 11.7dB

☐ ***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 should not be lower than 1% of the selected span
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

9.3. TEST EQUIPMENT LIST

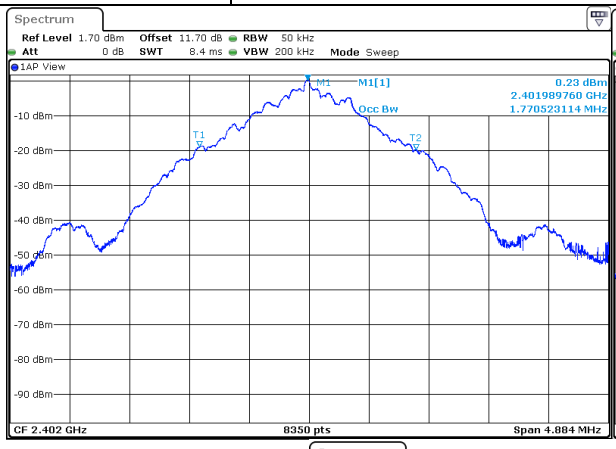
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	AEROFLEX	-	A7122207	12/13	12/14
Cable	-	-	A5329635	11/14	11/15
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	-	-
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	04/14	04/15

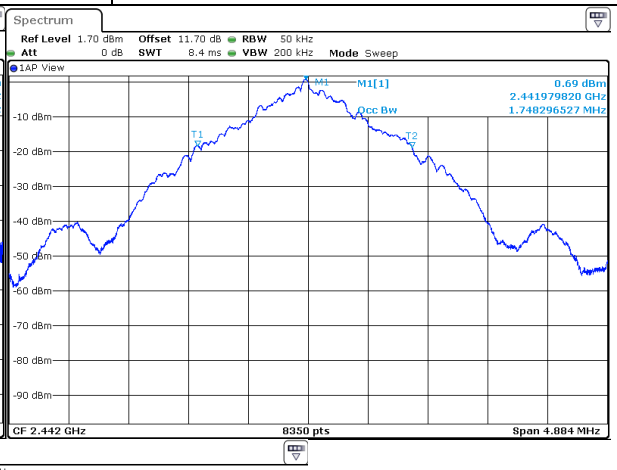
9.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

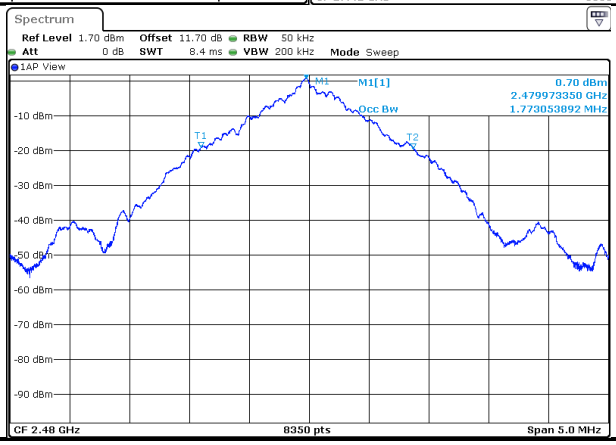
☑ None ☐ Divergence:

9.5. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	99% Occupied Bandwidth (MHz)
Cmin	2402	**1770.5**
Cmid	2442	**1748.2**
Cmax	2480	**1773.0**

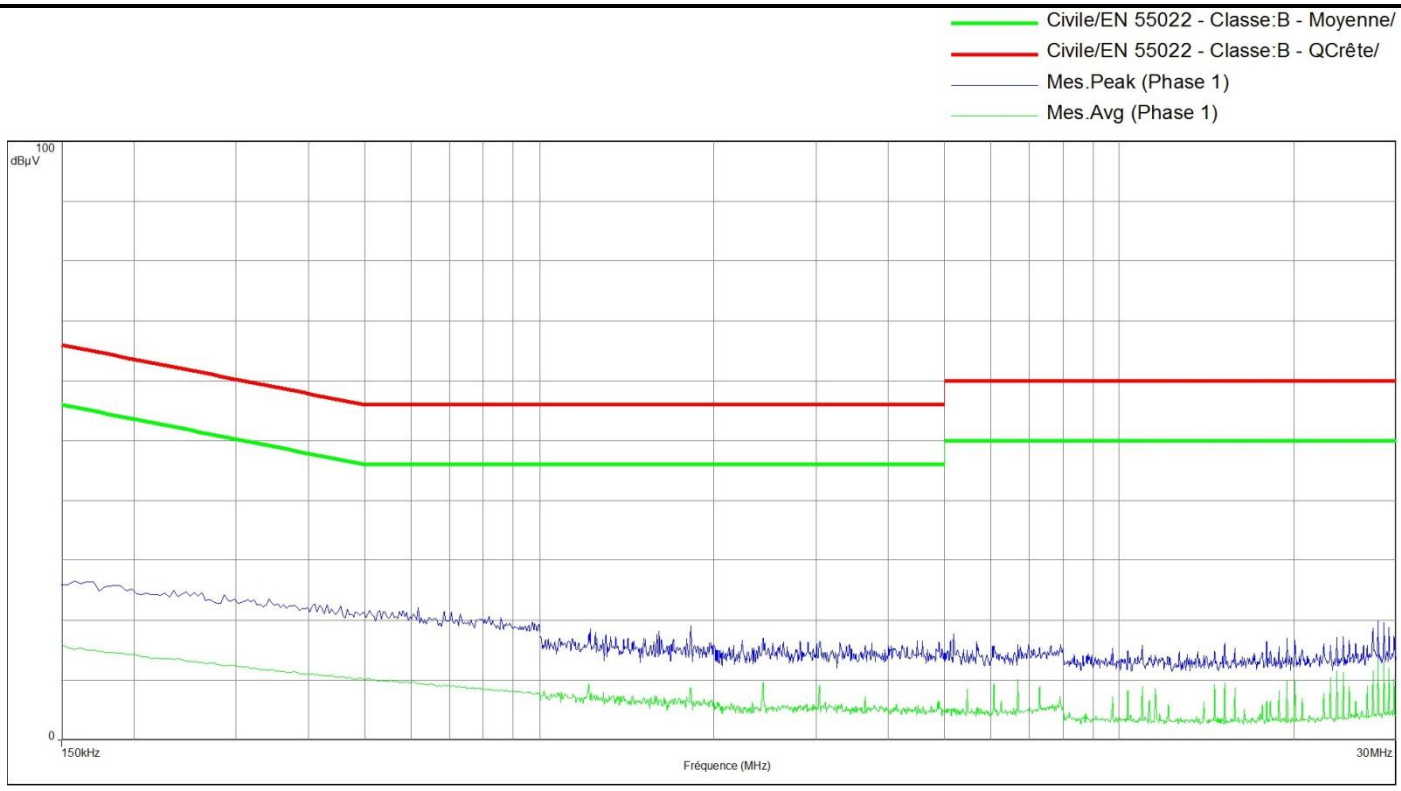






10. ANNEX 1 (GRAPHS)

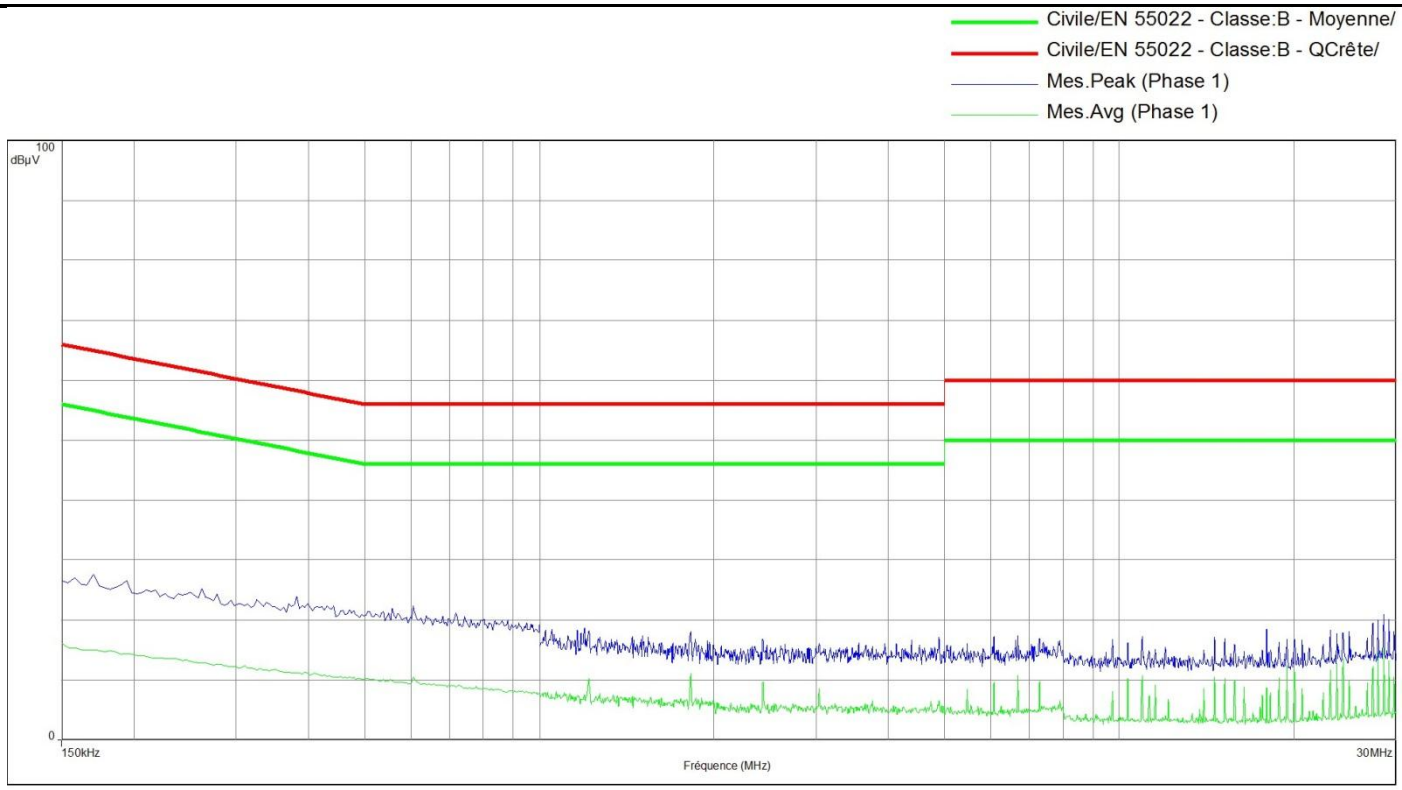
CONDUCTED EMISSIONS			
Graph name:	Emc#1	**Test configuration:**	
Limit:	EN 55022	Line	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	120VAC / 60Hz	**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



Spurious emissions

Frequency (MHz)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)
0.16	20.89	65.57	-44.68	15.11	55.57	-40.46
1.869	12.11	56	-43.89	6.18	46	-39.82
27.939	17	60	-43	11.86	50	-38.14

CONDUCTED EMISSIONS			
Graph name:	Emc#2	**Test configuration:**	
Limit:	EN 55022	Neutral	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	120VAC / 60Hz	**RBW :**	10kHz
Line:	Neutral	**VBW :**	30kHz

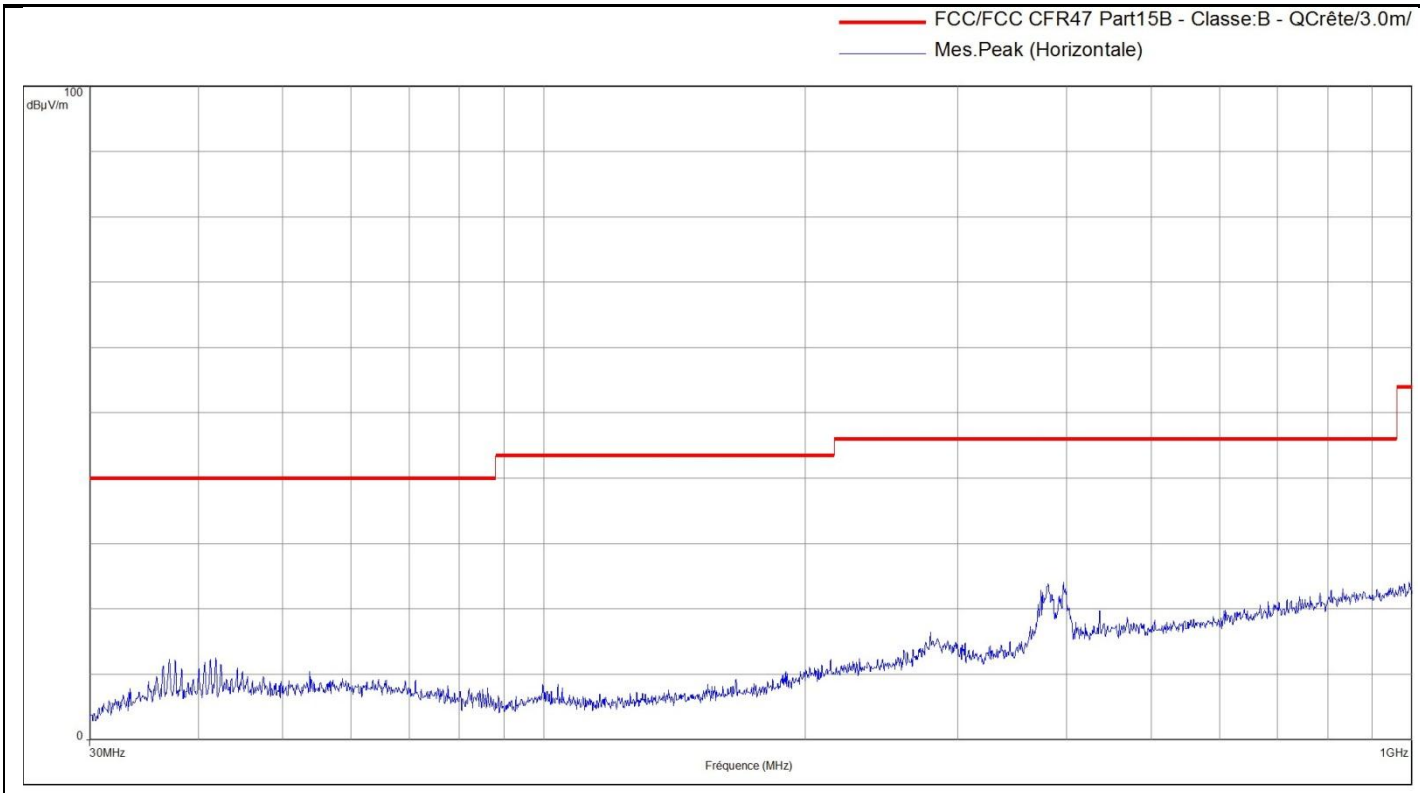


Spurious emissions

Frequency (MHz)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)
0.165	20.65	64.96	-44.31	15.01	54.96	-39.95
1.231	12.85	56	-43.15	7.01	46	-38.99
1.819	14.28	56	-41.72	9.39	46	-36.61
28.539	18.46	60	-41.54	14	50	-36

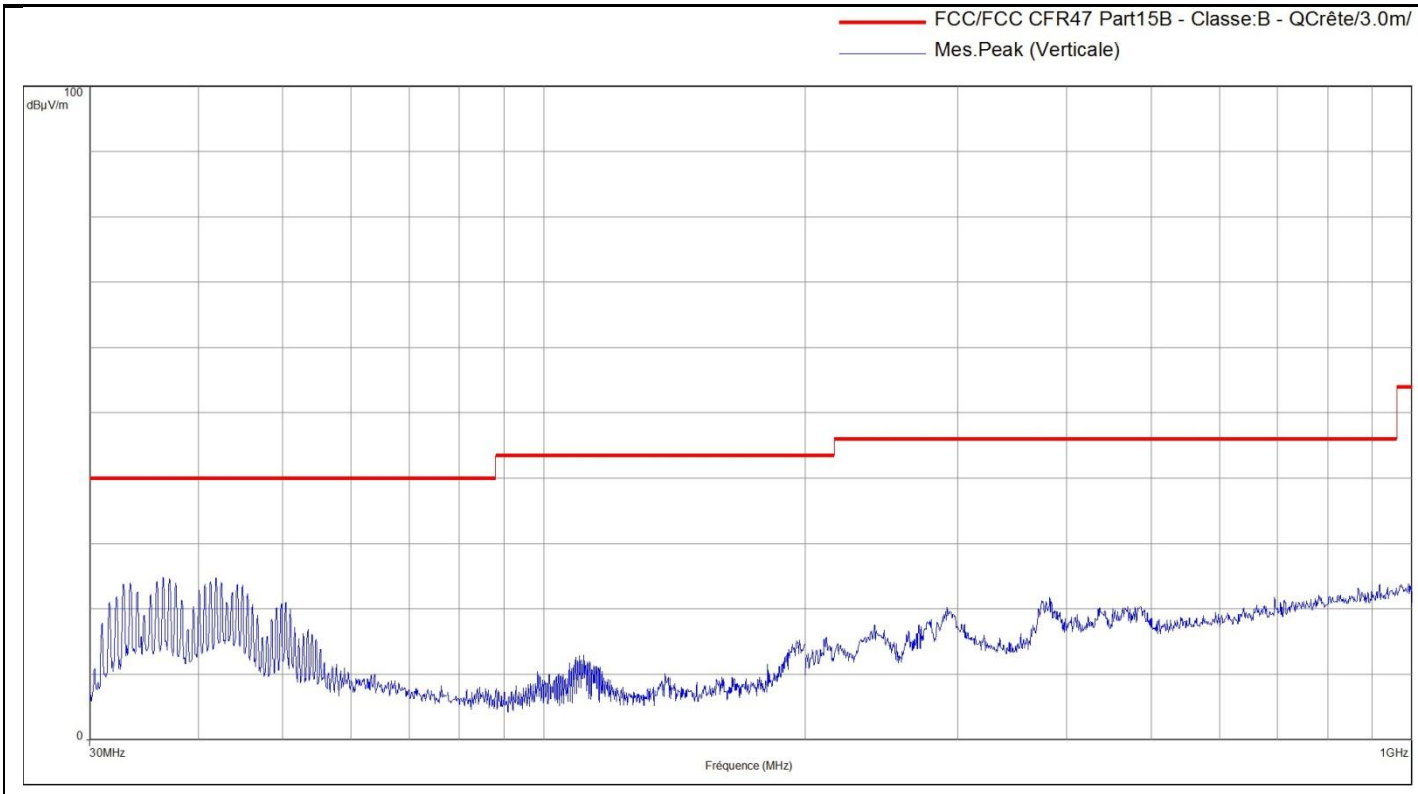
11. ANNEX 2 (GRAPHS)

RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15B	Pol - (H) - BL OL 120V	
Class:	B		
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions

RADIATED EMISSIONS		
Graph name:	Emr#2	**Test configuration:**
Limit:	FCC CFR47 Part15B	Pol - (V) – BL OL 120Vac
Class:	B	
Frequency range: [30MHz - 1GHz]		
Antenna polarization:	Vertical	**RBW :** 100kHz
Azimuth:	0° - 360°	**VBW :** 300kHz



Spurious emissions

12. 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 *Measurement of conducted disturbances in voltage on the power port*	3.57 dB	3.6 dB
Mesure des perturbations conduites en tension sur le réseau de télécommunication *Measurement of conducted disturbances in voltage on the telecommunication port.*	3.28 dB	A l'étude / Under consid.
Mesure des perturbations discontinues conduites en tension *Measurement of discontinuous conducted disturbances in voltage*	3.47 dB	3.6 dB
Mesure des perturbations conduites en courant *Measurement of conducted disturbances in current*	2.90 dB	A l'étude / Under consid.
Mesure du champ électrique rayonné sur le site en espace libre de Moirans *Measurement of radiated electric field on the Moirans open area test site*	5.07 dB	5.2 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.*