TEST REPORT

N°: 145119-694212-C(FILE#924548) **Version : 02**

Subject	**Electromagnetic compatibility and Radio spectrum Matters (ERM) tests according to standards: FCC CFR 47 Part 15, Subpart C RSS-247 Issue 2.0**
Issued to	**Gait Up** EPFL Innov' Park - C CH – 1015 LAUSANNE SUISSE
Apparatus under test	
↳ Product	**Pomocup & Physilog5**
↳ Trade mark	**Gait UP**
↳ Manufacturer	**Gait UP**
↳ Model under test	**Pomocup**
↳ Serial number	**PHY5_55 & PHY5_05**
↳ FCCID	**2AB2JPHYS5POMOC**
↳ IC	**22805-PHYS5POMOC**
Conclusion	See Test Program chapter
Test date	May 15, 2017 to May 19, 2017
Test location	MOIRANS
IC Test site	6500A-1
Composition of document	34 pages
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PUBLICATION HISTORY

Version	Date	Author	Modification
01	June 14, 2017	Gaetan DESCHAMPS	Creation of the document
02	September 8, 2017	Gaetan DESCHAMPS	Typing error

SUMMARY

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1. TEST PROGRAM

Standard:

- **FCC Part 15, Subpart C 15.247**
- **ANSI C63.10 (2013)**
- **RSS-247 Issue 2.0**
- **RSS-Gen Issue 4**
- **558074 D01 DTS Measurement Guidance v04**

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-247 §5.5*	**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-247 §5.5* ***Highest frequency :<108MHz*** ***(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-247 §5.2*	**At least 500kHz**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Power spectral Density *CFR 47 §15.247 (e)* *RSS-247 §5.2*	**Limit: 8dBm/3kHz**			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Maximum Peak Output Power *CFR 47 §15.247 (b)* *RSS-247 §5.4*	**Limit: 30dBm** Conducted or Radiated measurement			☑ **PASS** ☐ **FAIL** ☐ **NA** ☐ **NP**
Band Edge Measurement *CFR 47 §15.209 (a)* *CFR 47 §15.247 (d)* *RSS-247 §5.5*	**Limit: -20dBc or** **Radiated emissions limits in restricted bands**			☑ **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

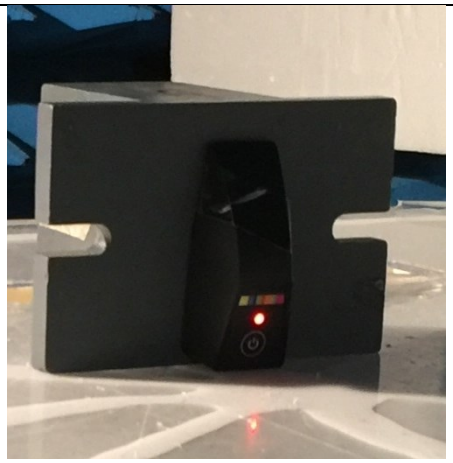
2.1. JUSTIFICATION

All test are performed on the product <Pomocup>, the <Physilog> product has the same electronic board. The difference is the plastic enclosure (shape) and the internal battery.

Products	Rating	Mark / Model
Pomocup	3.7vdc 240mAh	RENATA / ICP521630PM-01
Physilog	3.7cdc 155mAh	RENATA / ICP641620PA-01

2.2. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):
Pomocup
Serial Number: PHY5_55 & PHY5_05



Photography of EUT

Power supply:
During all the tests, EUT is supplied by V_{nom}: 3.7Vdc
For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Mark / Model	Comments
Internal Supply	☐ AC ☐ DC ☑ Battery	3.7Vdc	RENATA / ICP521630PM-01	-

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Access1	Mini USB	0.2	☑	☑	☑	-

Auxiliary equipment used during test:

Type	Reference	Model	Comments
Laptop	LENOVO	L450	-

Equipment information:

RF module:	Nordic			
Frequency band:	[2400 – 2483.5] MHz			
Sub-band REC7003:				
RF mode:	☑Transmitter	☐Transceiver	☑Receiver	☐Standby
Spread Spectrum Modulation:	☑ DSSS	☐ FHSS	☐ None	
-6dB Channel bandwidth:	☐ Up to 20MHz	☐ Up to 1MHz	☑ Other: 1MHz	
Number of Channel:	79			
Channel separation:	1MHz			
Transmit chains:	☑ 1	☐ 2	☐ 3	☐ 4
	☑ Single antenna	☐ Symmetrical	☐ Asymmetrical	
	Gain 1: 0.5dBi	Gain 2: dBi	Gain 3: dBi	Gain 4: dBi
Receiver classification § 4.1.1	☐1	☐2	☑3	
Receiver bandwidth:	1MHz			
Antenna type:	☐External:	☑Internal:		
Antenna gain:	dBi			
Extreme temperature range:	☑Category I (General) -20°C to +55°C	☐Category II (Portable) -10°C to +55°C	☐Category III (Indoor) +5°C to +35°C	
Test source voltage:	☐ AC:	☐ DC: VDC	☑ Battery: 3.7VDC / Lithium-Ion	
Extreme test source voltage:	☐±10%:	☑other:3.1Vdc		
Equipment type:	☐ Production model	☑ Prototype		

CHANNEL PLAN					
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
Cmin: 0	**2402**	27	2429	54	2456
1	2403	28	2430	55	2457
2	2404	29	2431	56	2458
3	2405	30	2432	57	2459
4	2406	31	2433	58	2460
5	2407	32	2434	59	2461
6	2408	33	2435	60	2462
7	2409	34	2436	61	2463
8	2410	35	2437	62	2464
9	2411	36	2438	63	2465
10	2412	**Cmid 37**	**2439**	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	**Cmax: 78**	**2480**
25	2427	52	2454		
26	2428	53	2455		

2.3. EUT CONFIGURATION

Hardware information			
Highest internal frequency (PLL, Quartz, Clock, Microprocessor…):	**$F_{Highest}$:**	**64**	**MHz**
Firmware (if applicable):	**V. :**	1.0.0	

Radio configuration:
The EUT is set in the following modes during tests:
- Permanent emission with modulation on a fixed channel in the data rate that produced the highest power
- Permanent reception

All tests are performed at Cmin, Cmid or Cmax.

Configuration for Conducted and radiated emission:
The EUT is set in the following mode during tests with the specific test software “Gaitup” (tablet application):
- Permanent emission and reception

2 configurations are performed on EUT.
Configuration 1: communication with EUT on load.
Configuration 2: communication with EUT on battery.

2.4. EQUIPMENT MODIFICATIONS

☑ None ☐ Modification:

2.5. FIELD STRENGTH CALCULATION

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

FS = RA + AF + CF – AG

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

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

2.6. 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

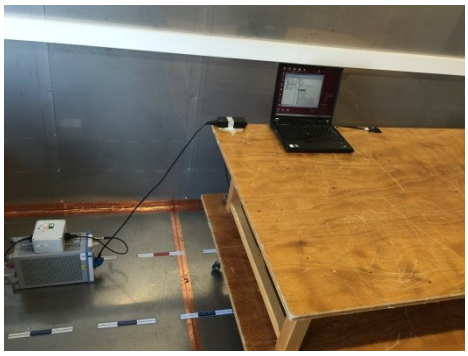
3.1. ENVIRONMENTAL CONDITIONS

Date of test	:	May 17, 2017
Test performed by	:	Gaëtan DESCHAMPS
Atmospheric pressure (hPa)	:	1024
Relative humidity (%)	:	32
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 C63.10 and FCC Part 15 subpart C. The product has been tested with 120V/60Hz power line voltage 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 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	02/17	02/18
EMC comb generator	LCIE SUD EST	-	A3169098	-	-
LISN	RHODE & SCHWARZ	ENV216	C2320291	12/16	12/17
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	08/16	08/17
BAT EMC	NEXIO	v3.9.0.10	L1000115	-	-
Thermo-hygrometer (PM2)	KIMO	HQ 210	B4206022	08/16	08/17
Transient limiter	RHODE & SCHWARZ	ESH3-Z2	A7122204	01/17	01/18

3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

3.6. TEST RESULTS

Configuration 1:
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 **Pomocup**, SN: **PHY5_05PHY5_55**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 limits.

4. RADIATED EMISSION DATA

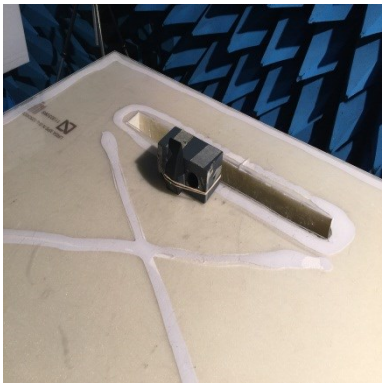
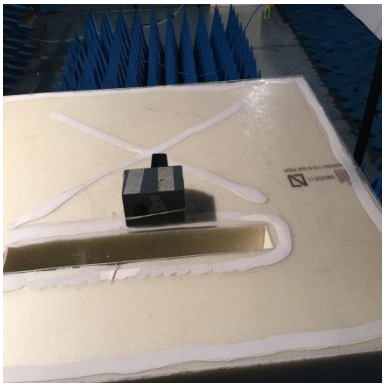
4.1. ENVIRONMENTAL CONDITIONS

Date of test	:	May 17, 2017
Test performed by	:	Gaëtan DESCHAMPS
Atmospheric pressure (hPa)	:	1024
Relative humidity (%)	:	32
Ambient temperature (°C)	:	23

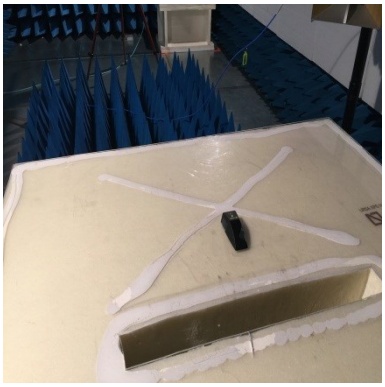
4.2. TEST SETUP

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}.

Test setup on OATS (worst case measured)

Test setup in anechoic chamber (Axis Z & configuration 2):



Test setup in anechoic chamber (Axis XY & configuration 2):

Test setup in anechoic chamber (Axis Z & configuration 1):

Test setup in anechoic chamber (Axis XY & configuration 1):

4.3. TEST METHOD

The product has been tested according to ANSI C63.10, FCC part 15 subpart C.

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:
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 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 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 C limits. Measurement bandwidth was 1MHz from 1GHz to 25GHz.
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	05/16	05/17
Amplifier 0.1MHz – 6000 MHz	HEWLETT PACKARD	8447F	A7486006	05/16	05/17
Antenna Bi-log	CHASE	CBL6111A	C2040051	06/16	06/18
Antenna Bi-Log XWing	TESEQ	CBL6144	C2040146	03/17	03/19
Antenna horn 18GHz	EMCO	3115	C2042029	08/16	08/18
Cable	-	-	A5329069	12/16	12/17
Cable (OATS)	-	-	A5329623	03/17	03/18
Emission Cable	MICRO-COAX	6GHz	A5329654	05/16	05/17
Emission Cable	MICRO-COAX	6GHz	A5329655	05/16	05/17
Emission Cable	MICRO-COAX	6GHz	A5329656	05/16	05/17
Cable Measure @1m	STORMFLEX	0	A5329680	05/16	05/17
Cable Measure Analyzer-Amplifier SMA	STORMFLEX	0	A5329681	05/16	05/17
Cable Measure @1m	STORMFLEX	0	A5329682	05/16	05/17
Semi-Anechoic chamber #2	SIEPEL	-	D3044015	04/17	04/18
Semi-Anechoic chamber #3	SIEPEL	-	D3044017	03/16	03/19
Radiated emission comb generator	BARDET	-	A3169050	-	-
HF Radiated emission comb generator	LCIE SUD EST	-	A3169088	-	-
High Pass (4.8-18GHz)	BL Microwave	SH4800-1800	A7484034	05/15	05/17
OATS	-	-	F2000409	08/16	08/17
Spectrum Analyzer 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A4060049	02/16	02/18
Receiver 20-1000MHz	ROHDE & SCHWARZ	ESVS30	A2642006	05/15	05/17
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	08/16	08/17
BAT EMC	NEXIO	v3.9.0.10	L1000115	-	-
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	10/16	10/17
Thermo-hygrometer (PM2)	KIMO	HQ 210	B4206022	08/16	08/17
Thermo-hygrometer (C2)	LACROSS Techn.	WS-2357	B4206015	10/16	10/17
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371	-	-
Turntable / Mast controller (OATS)	ETS Lindgren	Model 2066	F2000372	-	-
Antenna mast (OATS)	ETS Lindgren	2071-2	F2000392	-	-
Turntable controller (Cage#2)	ETS Lingren	Model 2066	F2000393	-	-
Turntable (OATS)	ETS Lindgren	Model 2187	F2000403	-	-
Turntable chamber (Cage#2)	ETS Lingren	Model 2165	F2000404	-	-
Table	MATURO Gmbh	-	F2000437	-	-
Table	LCIE	-	F2000438	-	-
Table	LCIE	-	F2000461	-	-
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444	-	-

Note: In our quality system, the test equipment calibration due is more & less 2 months

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:

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

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.

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
191.800	17.3	QP	V	0	175	-	11.4	28.7	43.5	**-14.8**	
202.900	16.2	QP	V	110	170	-	11.5	27.7	43.5	**-15.8**	

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.

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
2274.060	51.8	Pk	V	0	150	-	-11.5	40.3	74.0	**-33.7**	RF
2274.060	36.9	Av	V	0	150	-	-11.5	25.4	54.0	**-28.6**	RF
4804.000	57.4	Pk	V	170	150	-	-5.1	52.3	74.0	**-21.7**	RF
4804.000	50.2	Av	V	170	150	-	-5.1	45.1	54.0	**-8.9**	RF
4880.000	56.5	Pk	V	170	150	-	-4.9	51.6	74.0	**-22.4**	RF
4880.000	48.9	Av	V	170	150	-	-4.9	44.0	54.0	**-10.0**	RF
4960.000	57.0	Pk	V	170	150	-	-4.7	52.3	74.0	**-21.7**	RF
4960.000	48.5	Av	V	170	150	-	-4.7	43.8	54.0	**-10.2**	RF

Note: Measures have been done at 3m distance.

4.7. CONCLUSION

Radiated emission data measurement performed on the sample of the product **Pomocup**, SN: **PHY5_05**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 limits.

5. BANDWIDTH (15.247)

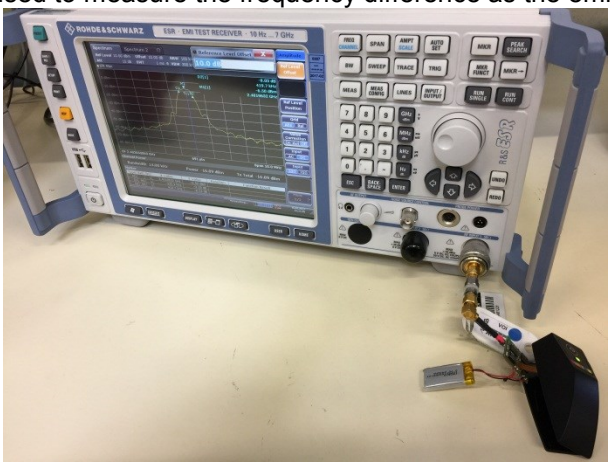
5.1. TEST CONDITIONS

Date of test	:	May 16, 2017
Test performed by	:	Gaëtan DESCHAMPS
Atmospheric pressure (hPa)	:	1004
Relative humidity (%)	:	32
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 10dB

☐ ***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: §8.1 Option 1 (DTS Measurement Guidance)
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

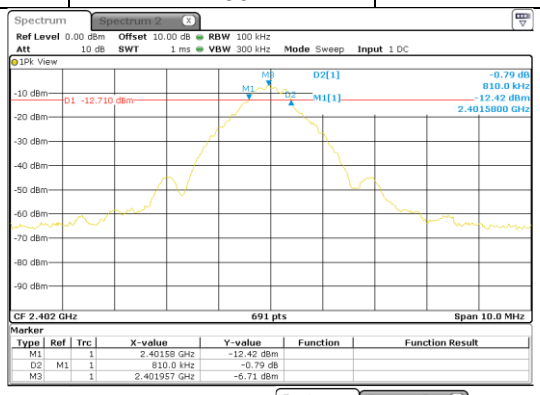
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	AEROFLEX	-	A7122269	08/16	08/17
Receiver 10Hz – 7GHz	ROHDE & SCHWARZ	ESR	A2642026	02/17	08/18
RSCommander	R&S	v1.6.4	L1000116	-	-
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	10/16	10/17
Thermo-hygrometer (PM2)	KIMO	HQ 210	B4206022	08/16	08/17

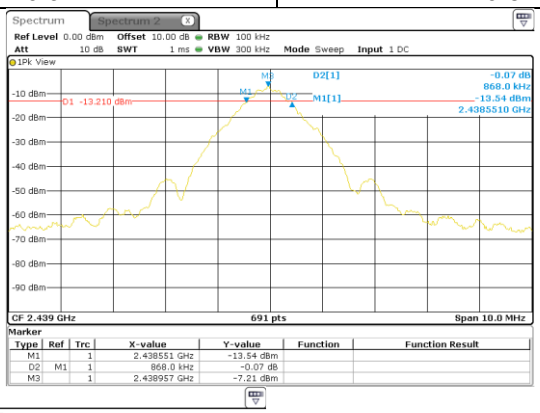
5.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

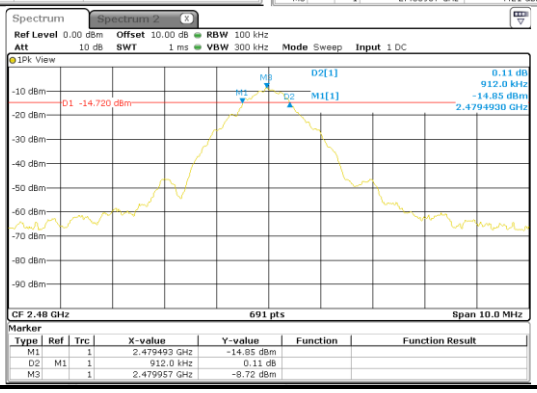
☑ None ☐ Divergence:

5.5. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Bandwidth Limit (MHz)
Cmin	2402	**0.810**	**>0.5**
Cmid	2439	**0.868**	**>0.5**
Cmax	2480	**0.912**	**>0.5**







5.6. CONCLUSION

Bandwidth measurement performed on the sample of the product **Pomocup**, SN: **PHY5_55**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 limits.

6. MAXIMUM PEAK OUTPUT POWER (15.247)

6.1. TEST CONDITIONS

Date of test	:	May 16, 2017
Test performed by	:	Gaëtan DESCHAMPS
Atmospheric pressure (hPa)	:	1004
Relative humidity (%)	:	32
Ambient temperature (°C)	:	23

6.2. SETUP

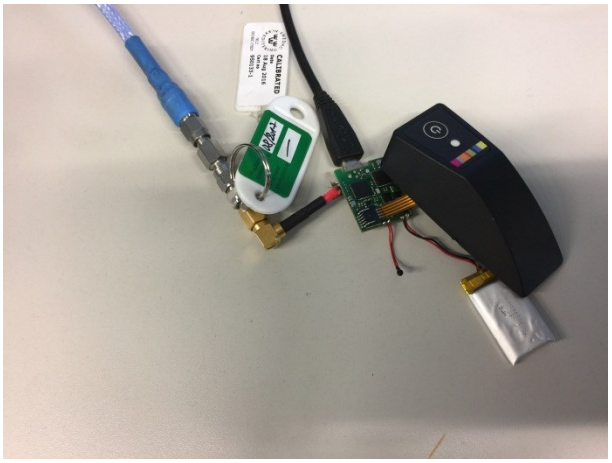
☑ ***Conducted measurement:***
The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency.
Offset: Attenuator+cable 10.5dB

☐ ***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*** ***§9.1.1 (DTS Measurement Guidance)***

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	-	A7122269	08/16	08/17
RSCommander	R&S	v1.6.4	L1000116	-	-
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	10/16	10/17
Thermo-hygrometer (PM2)	KIMO	HQ 210	B4206022	08/16	08/17
Cable Measure	-	40G	A5329604	08/16	08/17
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/17	03/18

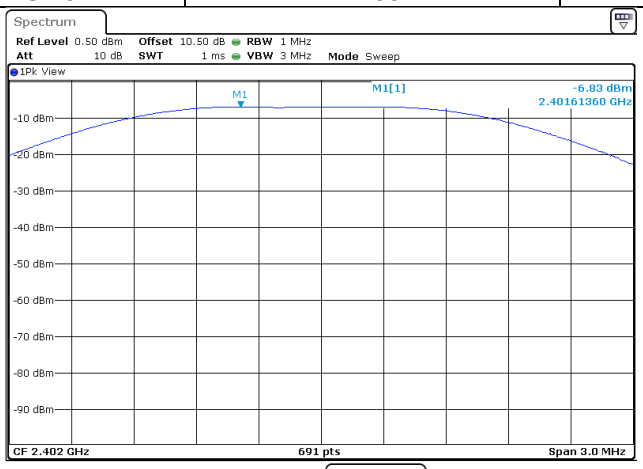
6.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

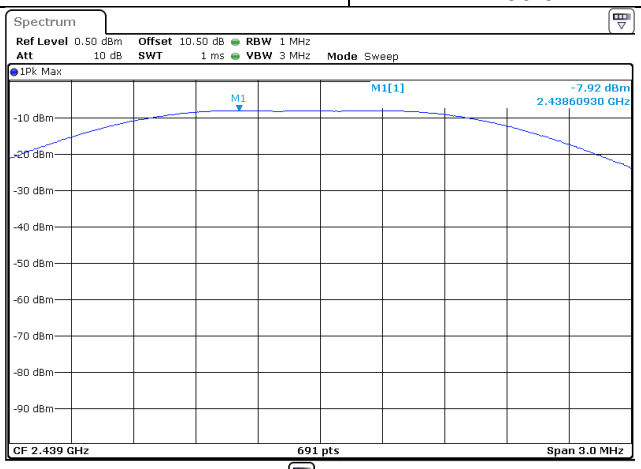
☑ None ☐ Divergence:

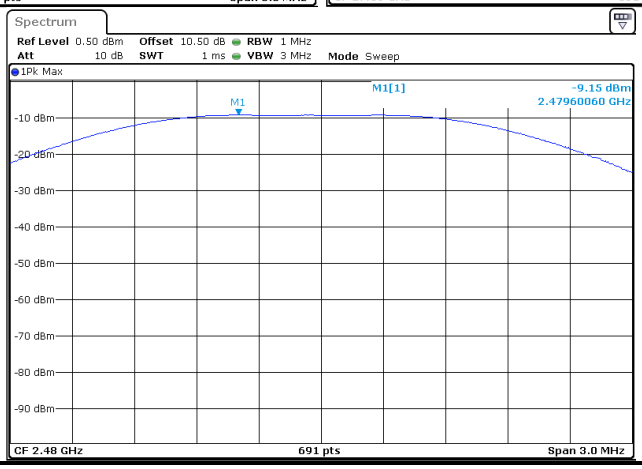
6.5. TEST SEQUENCE AND RESULTS

Modulation:

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)	Power Limit (dBm)
Cmin	2402	**-6.83**	30.0
Cmid	2439	**-7.92**	30.0
Cmax	2480	**-9.15**	30.0







6.6. CONCLUSION

Maximum Peak Output Power measurement performed on the sample of the product **Pomocup**, SN: PHY5_**55**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 limits.

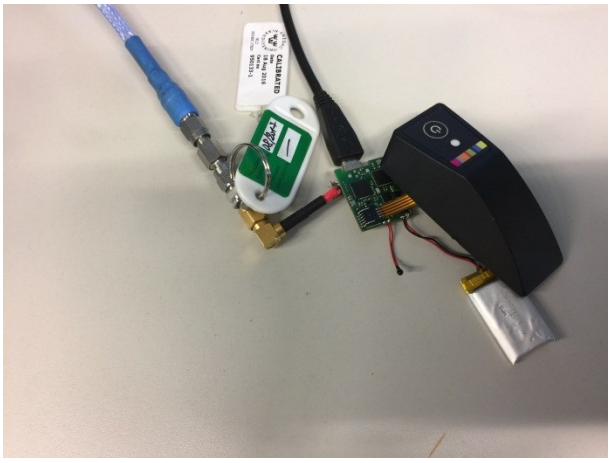
7. POWER SPECTRAL DENSITY (15.247)

7.1. TEST CONDITIONS

Date of test	:	May 19, 2017
Test performed by	:	Gaëtan DESCHAMPS
Atmospheric pressure (hPa)	:	1024
Relative humidity (%)	:	32
Ambient temperature (°C)	:	22

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 10.5dB



☐ ***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: §10.2 (DTS Measurement Guidance)

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.
d) Set the VBW ≥ 3 x 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	-	A7122269	08/16	08/17
RSCommander	R&S	v1.6.4	L1000116	-	-
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	10/16	10/17
Thermo-hygrometer (PM2)	KIMO	HQ 210	B4206022	08/16	08/17
Cable Measure	-	40G	A5329604	08/16	08/17
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/17	03/18

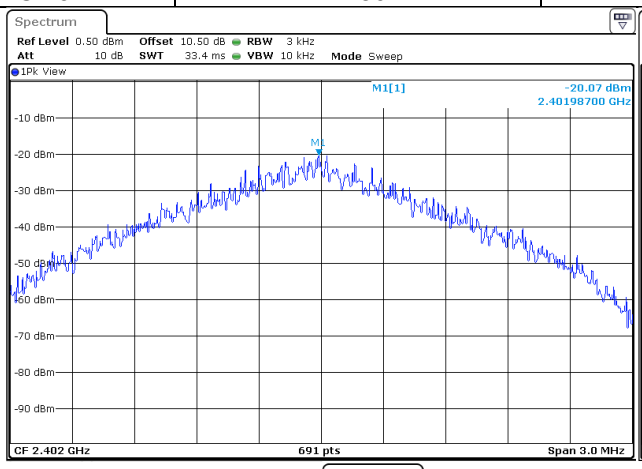
7.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

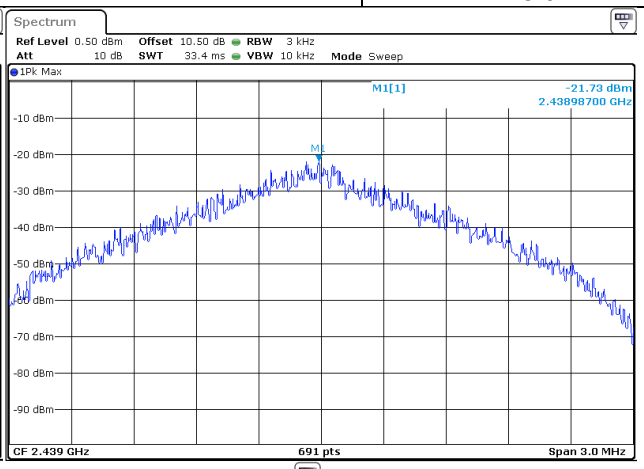
☑ None ☐ Divergence:

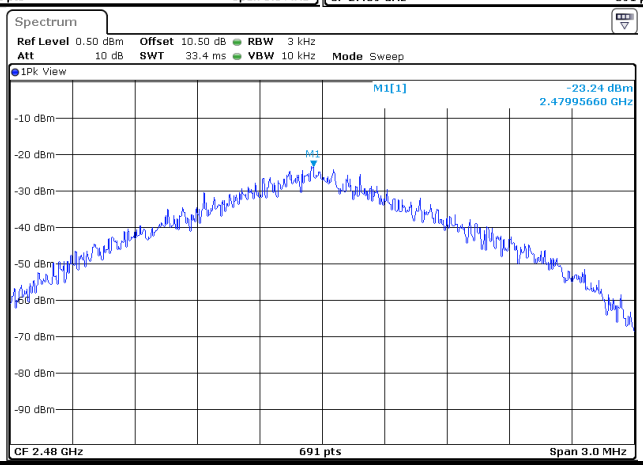
7.5. TEST SEQUENCE AND RESULTS

Modulation:

Channel	Channel Frequency (MHz)	Power Spectral Density (dBm)	PSD Limit (dBm)
Cmin	2402	**-20.07**	8.0
Cmid	2439	**-21.73**	8.0
Cmax	2480	**-23.24**	8.0







7.6. CONCLUSION

Power Spectral Density measurement performed on the sample of the product **Pomocup**, SN: **PHY5_55**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 limits.

8. BAND EDGE MEASUREMENT (15.247)

8.1. TEST CONDITIONS

Date of test : May 16, 2017
Test performed by : Gaëtan DESCHAMPS
Atmospheric pressure (hPa) : 1004
Relative humidity (%) : 32
Ambient temperature (°C) : 23

8.2. LIMIT

RF antenna conducted test: § 11 (DTS Measurement Guidance)
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: § 12 (DTS Measurement Guidance)
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
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/17	03/18
RSCommander	R&S	v1.6.4	L1000116	-	-
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	10/16	10/17
Thermo-hygrometer (PM2)	KIMO	HQ 210	B4206022	08/16	08/17

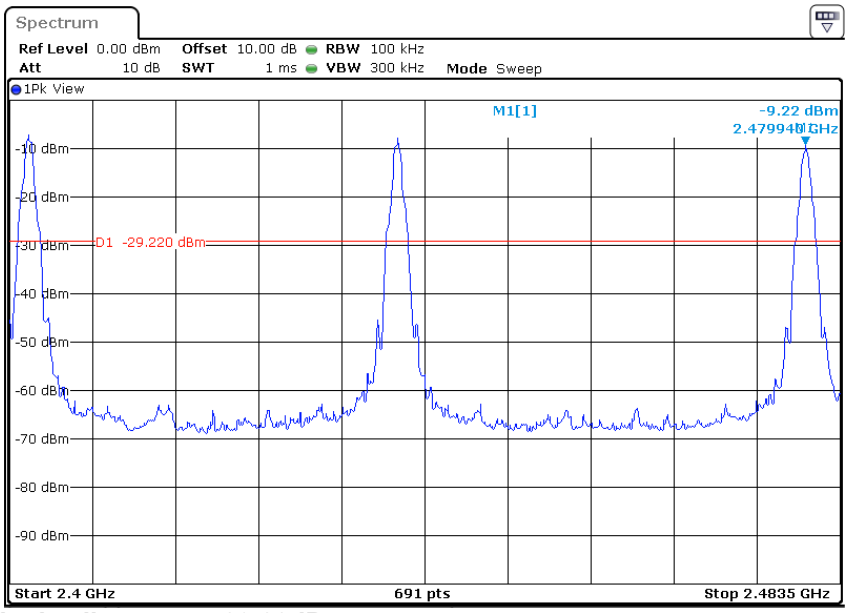
8.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

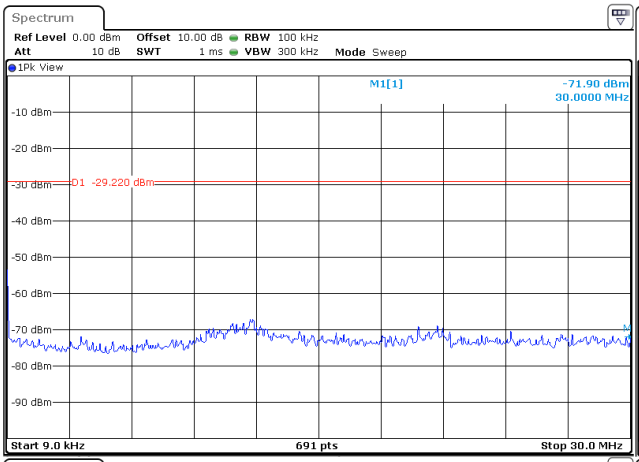
8.6. TEST SEQUENCE AND RESULTS

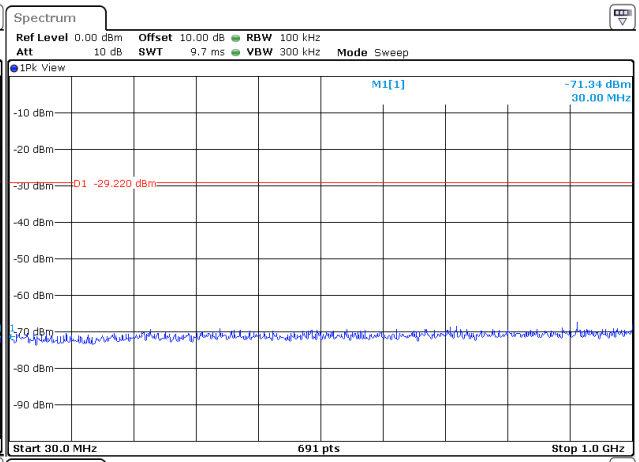
Offset: Attenuator+cable 10dB

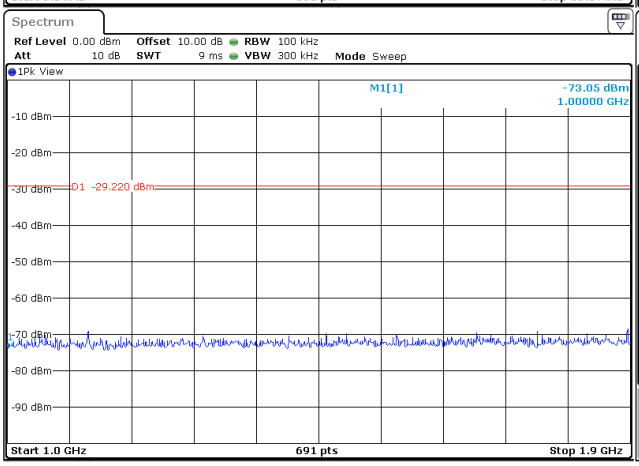
GRAPH / MODULATION.

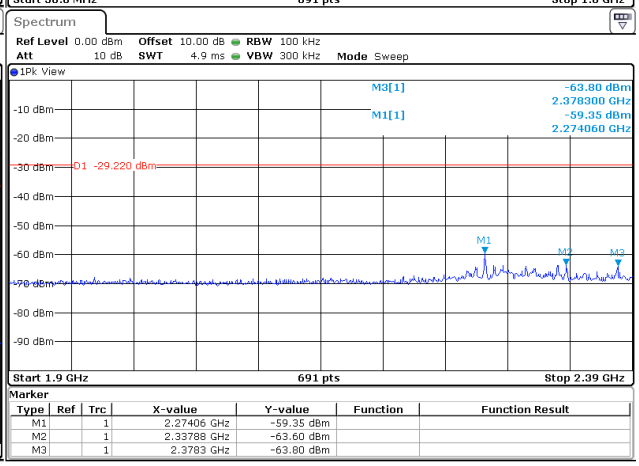


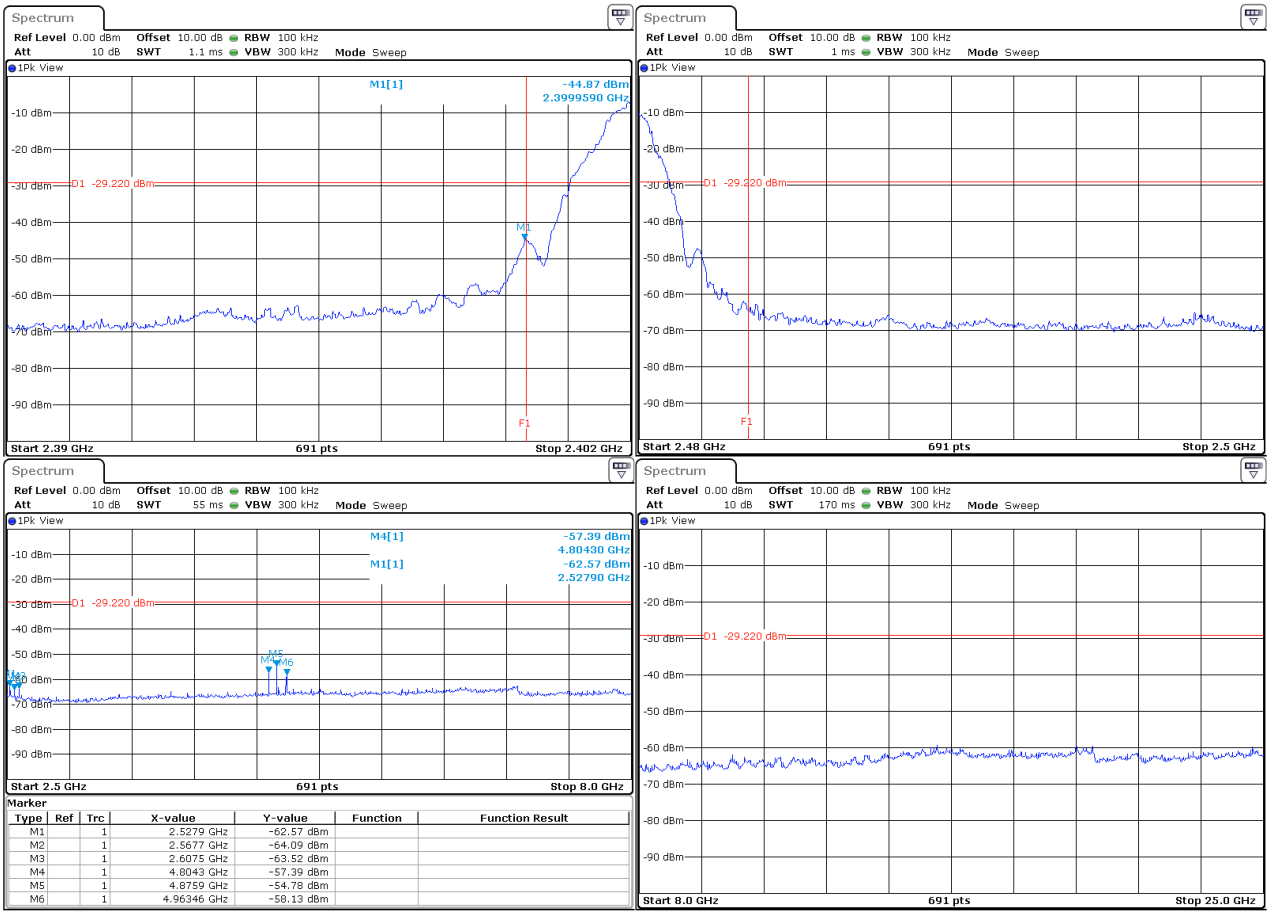
Worst case in Cmax, display line set at -29.22dBm


Spectrum
Ref Level 0.00 dBm Offset 10.00 dB RBW 100 kHz
Att 10 dB SWT 1 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -71.90 dBm
30.0000 MHz
D1 -29.220 dBm
Start 9.0 kHz 691 pts Stop 30.0 MHz


Spectrum
Ref Level 0.00 dBm Offset 10.00 dB RBW 100 kHz
Att 10 dB SWT 9.7 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -71.34 dBm
30.00 MHz
D1 -29.220 dBm
Start 30.0 MHz 691 pts Stop 1.0 GHz


Spectrum
Ref Level 0.00 dBm Offset 10.00 dB RBW 100 kHz
Att 10 dB SWT 9 ms VBW 300 kHz Mode Sweep
1Pk View
M1[1] -73.05 dBm
1.00000 GHz
D1 -29.220 dBm
Start 1.0 GHz 691 pts Stop 1.9 GHz


Spectrum
Ref Level 0.00 dBm Offset 10.00 dB RBW 100 kHz
Att 10 dB SWT 4.9 ms VBW 300 kHz Mode Sweep
1Pk View
M3[1] -63.80 dBm
2.378300 GHz
M1[1] -59.35 dBm
2.274060 GHz
D1 -29.220 dBm
M1
M2
M3
Start 1.9 GHz 691 pts Stop 2.39 GHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.27406 GHz -59.35 dBm
M2 1 2.33788 GHz -63.60 dBm
M3 1 2.3783 GHz -63.80 dBm



8.7. CONCLUSION

Band Edge Measurement performed on the sample of the product **Pomocup**, SN: **PHY5_55**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 and RSS-247 limits.

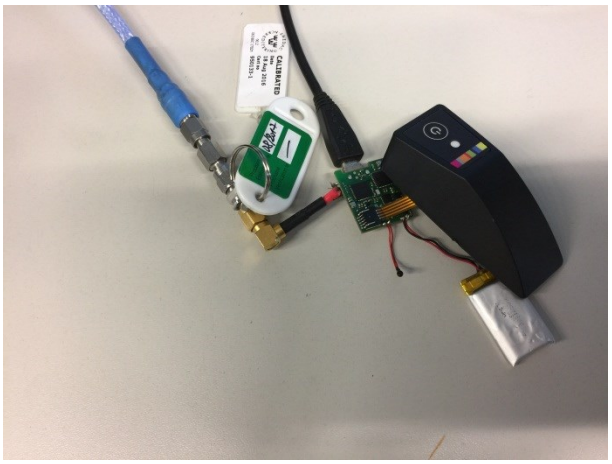
9. OCCUPIED BANDWIDTH

9.1. TEST CONDITIONS

Date of test	:	May 19, 2017
Test performed by	:	Gaëtan DESCHAMPS
Atmospheric pressure (hPa)	:	1024
Relative humidity (%)	:	32
Ambient temperature (°C)	:	22

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 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:

a) RBW shall be in the range of 1% to 5% of the anticipated occupied bandwidth
b) Set the video bandwidth (VBW) ≥ 3 x RBW
c) SPAN = Capture all products of the modulation process
d) Detector = Peak.
e) Trace mode = max hold.
f) Sweep = auto couple.
g) Allow the trace to stabilize.
h) OBW 99% function of spectrum analyzer used

9.3. TEST EQUIPMENT LIST

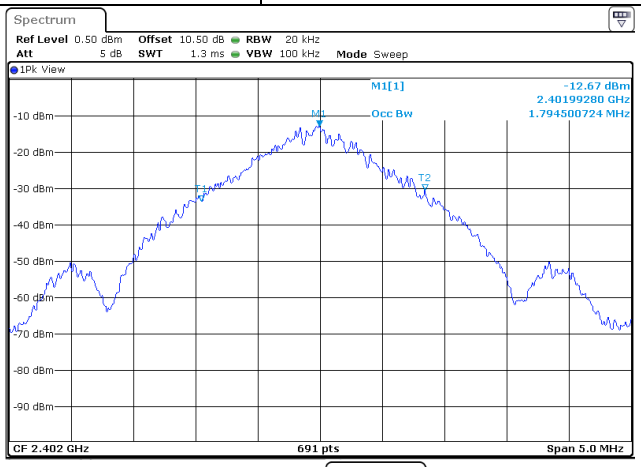
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	AEROFLEX	-	A7122269	08/16	08/17
RSCommander	R&S	v1.6.4	L1000116	-	-
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	10/16	10/17
Thermo-hygrometer (PM2)	KIMO	HQ 210	B4206022	08/16	08/17
Cable Measure	-	40G	A5329604	08/16	08/17
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060051	03/17	03/18

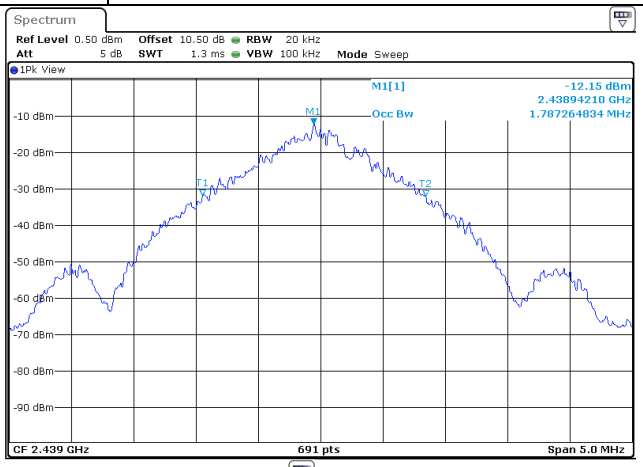
9.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

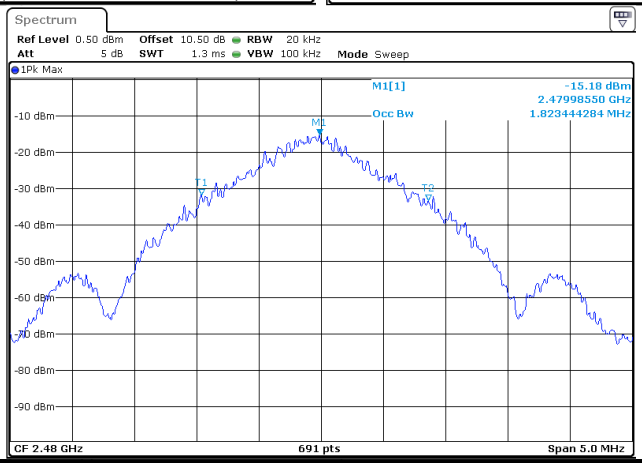
☑ None ☐ Divergence:

9.5. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	99% Occupied Bandwidth (MHz)
Cmin	2402	**1.794**
Cmid	2439	**1.787**
Cmax	2480	**1.823**

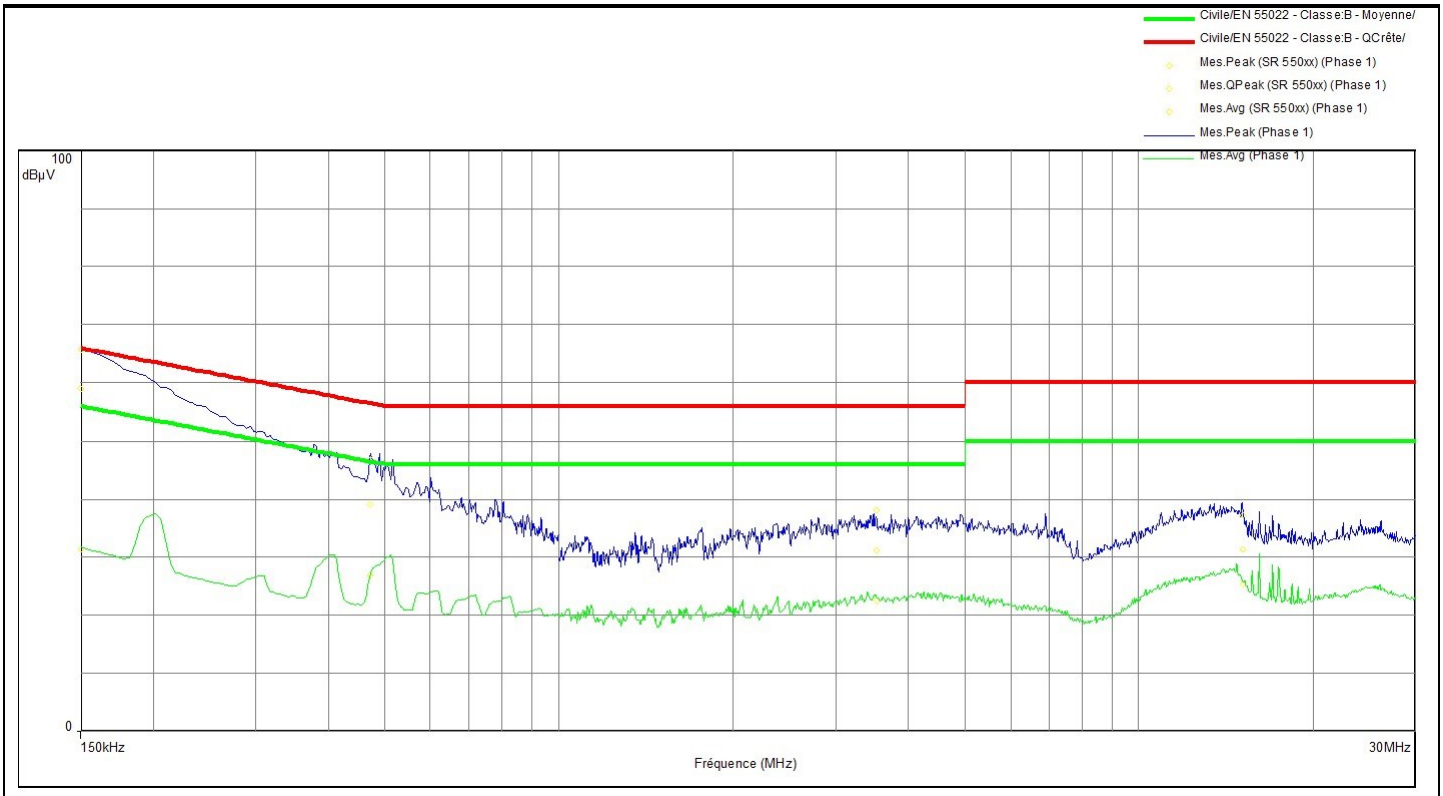






10. ANNEX 1 (GRAPHS)

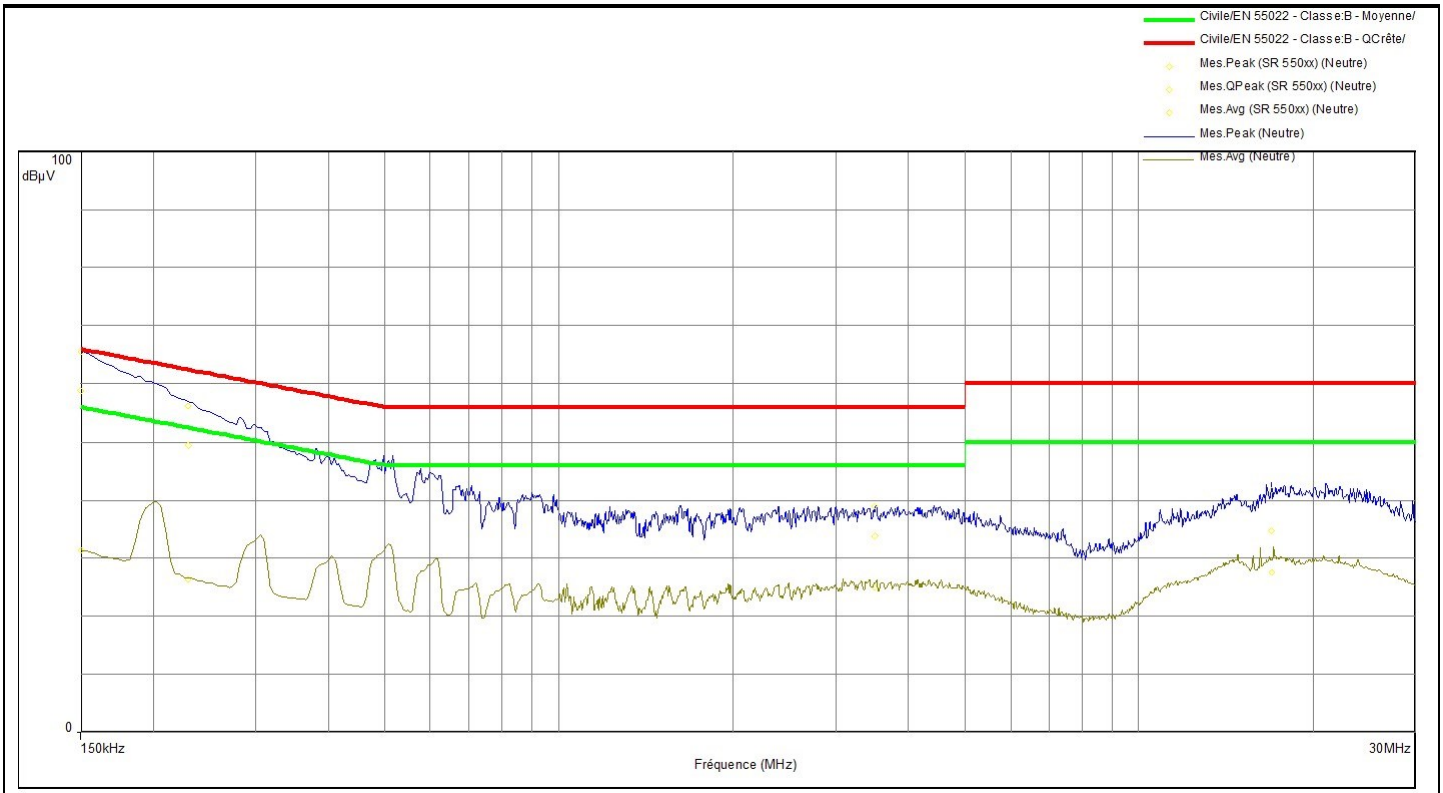
CONDUCTED EMISSIONS			
Graph name:	Emc#1	**Test configuration:**	
Limit:	EN 55022	Phase (RSIL)	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	120VAC / 60Hz	**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



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
0.150	65.6	59.0	65.8	-6.8	31.4	55.8	-24.4	Phase 1
0.474	46.8	39.1	56.4	-17.3	26.8	46.4	-19.7	Phase 1
3.533	38.1	31.2	56.0	-24.8	22.4	46.0	-23.6	Phase 1
15.104	37.1	31.3	60.0	-28.7	25.2	50.0	-24.8	Phase 1

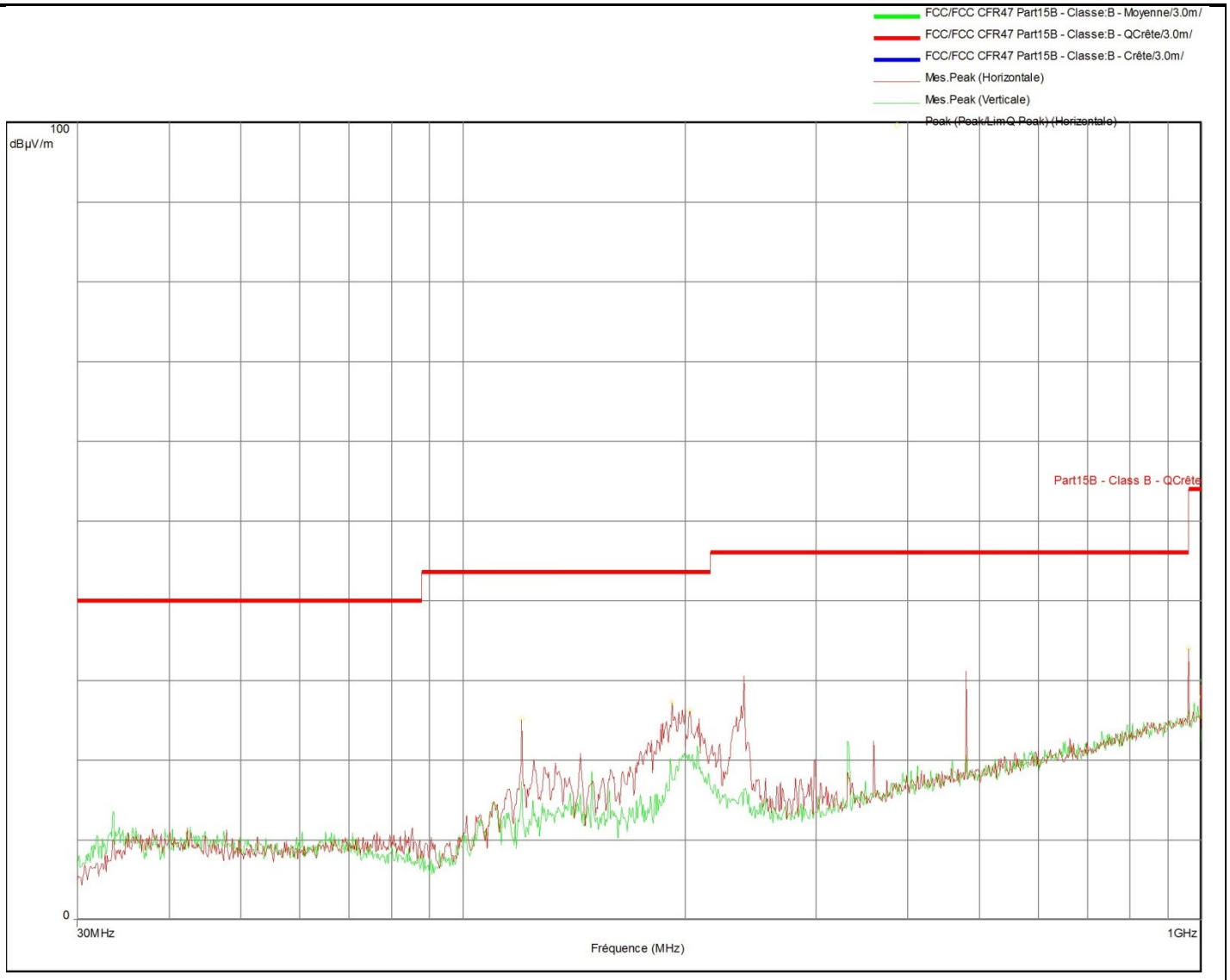
CONDUCTED EMISSIONS			
Graph name:	Emc#2	**Test configuration:**	
Limit:	EN 55022	Neutral (RSIL)	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	120VAC / 60Hz	**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



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
0.150	65.6	58.8	66.0	-7.2	31.3	56.0	-24.7	Neutre
0.232	56.3	49.3	60.8	-11.4	26.2	50.8	-24.5	Neutre
3.507	38.9	33.8	56.0	-22.2	24.9	46.0	-21.1	Neutre
16.947	41.7	34.8	60.0	-25.2	27.6	50.0	-22.4	Neutre

RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15B	(H+V) - pomocup <1GHz	
Class:	B		
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
959.960	34.0	46.0	-12.0	Horizontal

11. 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*	3.51 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.*	3.26 dB	A l'étude / Under consid.
Mesure des perturbations discontinues conduites en tension *Measurement of discontinuous conducted disturbances in voltage*	3.45 dB	3.6 dB
Mesure des perturbations conduites en courant *Measurement of conducted disturbances in current*	3.09 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*	5.20 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.*