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Rapport d'essai / *Test report*

N° 743414-A1-R2-E **JDE :** 126889

DELIVRE A / *ISSUED TO*	:	**Gait Up** 17, Avenue d'ouchy CH-1006 LAUSANNE - SUISSE
Objet / *Subject*	:	Essais de compatibilité électromagnétique conformément aux normes *Electromagnetic compatibility tests according to the standards* **FCC CFR 47 Part 15, Subpart B et C**
Matériel testé / *Apparatus under test*	:	
• Produit / *Product*	:	**RF movement analysis**
• Marque / *Trade mark*	:	**Gait Up**
• Constructeur / *Manufacturer*	:	**Gait Up**
• Type / *Model*	:	**PHYSILOG 4 GOLD AND SILVER**
• N° de série / *serial number*	:	**3**
• FCC ID	:	**2AB2JPHYSILOG4**
Date des essais / *Test date*	:	Du 5 au 10 Mars 2014 / *From March 5th to 10th, 2014*
Lieu d'essai / *Test location*	:	**LCIE SUD-EST** ZI Centr'Alp – 170 rue de Chatagnon 38430 MOIRANS - FRANCE
Test réalisé par / *Test performed by*	:	Anthony MERLIN / Gaëtan DESCHAMPS

Ce document comporte / *Composition of document :* 45 pages.

MOIRANS, LE 28 MARS 2014 / *MARCH 28TH, 2014*

Ecrit par / *Written by,*
Anthony MERLIN

Approuvé par / *Approved by*
Jacques LORIQUIN

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SUMMARY

1. TEST PROGRAM

Standard: **- FCC Part 15, Subpart C 15.247**
- ANSI C63.4 (2003)

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)*	**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)* ***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)	**At least 500kHz**			☒**PASS** ☐**FAIL** ☐**NA** ☐**NP**
Maximum Peak Output Power *CFR 47 §*15.247 (b)	**Limit: 30dBm** Conducted or Radiated measurement			☒**PASS** ☐**FAIL** ☐**NA** ☐**NP**
Band Edge Measurement *CFR 47 §15.209 (a)* *CFR 47 §15.247 (d)*	**Limit: -20dBc or** **Radiated emissions limits in restricted bands**			☒**PASS** ☐**FAIL** ☐**NA** ☐**NP**
Power spectral Density *CFR 47 §15.247 (e)*	**Limit: 8dBm/3kHz**			☒**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.

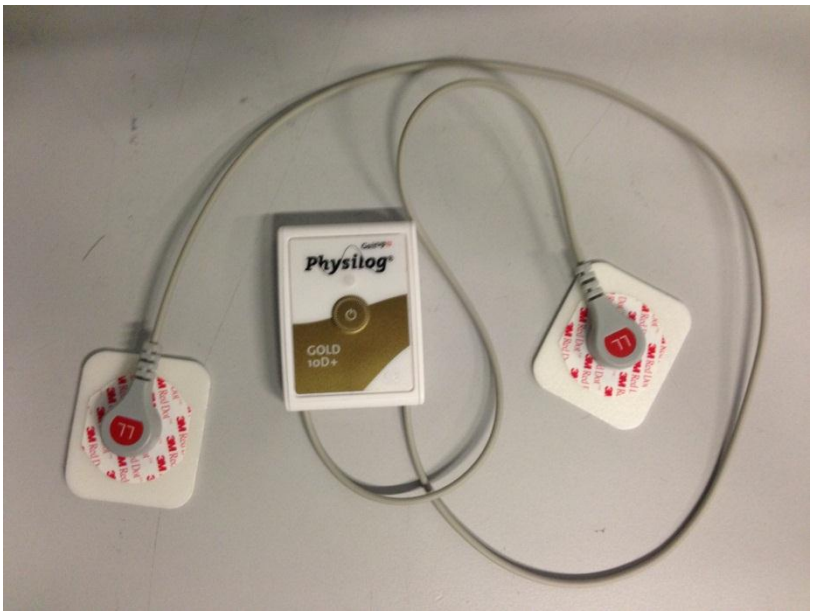
If the highest frequency of the internal sources of the testing device is above 1 GHz, measurement must be only performed until 5 times the highest frequency or 40 GHz, while taking smallest of both.

2. SYSTEM TEST CONFIGURATION

2.1. JUSTIFICATION

The **Physilog 4 Gold and Silver** is wearable standalone measurement unit containing inertial sensors. Physilog provides objective and quantitative assessment of movement disorders and performance. Gold version have 2 ECG sensors added, full option, it will be version tested and presented in this test report.

2.2. HARDWARE IDENTIFICATION



Photograph of EUT

Auxiliary equipment (AE) used for testing:
- Laptop of laboratory for setting configurations

Input/output:
- 2 x ECG sensors, unshielded cable, length: 20cm

Software identification:
-Software version: 4.2

Equipment information:
- Operating frequency range: [2400.0-2483.5]MHz
- Annex REC7003: Annex 1 (h)
- Number of channel: 77 channels
- Channel separation: 1MHz
- Modulation technology: ☐ FHSS ☐ Spread spectrum ☒ Non Spread spectrum
- -6dB Channel bandwidth: ☐ Up to 20MHz ☒ Up to 1MHz ☐ Other: ….MHz
- Transmit operating mode: ☐ Multiples antenna without beam forming
  ☐ Multiples antenna with beam forming
  ☒ Single antenna
- Number of transmit chains: ☒ 1 ☐ 2 ☐ 3 ☐ 4
  ☐ Symmetrical ☐ Asymmetrical
- Number of receiver chains: ☒ 1 ☐ 2 ☐ 3 ☐ 4
- Antenna type: ☒ Integral ☐ External
- Antenna gain: 2.0dBi (Peak)
- Type of power source: ☒ Battery (Lithium-Ion Polymere) ☐ Internal power supply
  ☐ External power supply ☐ Car Charger
- Test sequence/test software used: See 2.2. Running Mode
- Unmodulated mode: ☐ Yes ☒ No
- Equipement type: ☒ Representative production model ☐ Pre-production model

-Channel plan:

Channel	Frequency (MHz)
Cmin:	2404
Cnom:	2438
Cmax:	2480

2.3. RUNNING MODE

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 on a fixed channel
- Permanent link between Master and Slave EUT, for blocking test.

Following commands with the specific test software “FLIP v3.4.7” are used to set the product.

If EUT is plugged to USB port, RF is OFF and load mode begins, see EMC test report for this configuration.

2.4. EQUIPMENT MODIFICATIONS

☒ No equipment modification has been necessary during testing.
☐ Modification applied for following tests:

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.

3. CONDUCTED EMISSION DATA

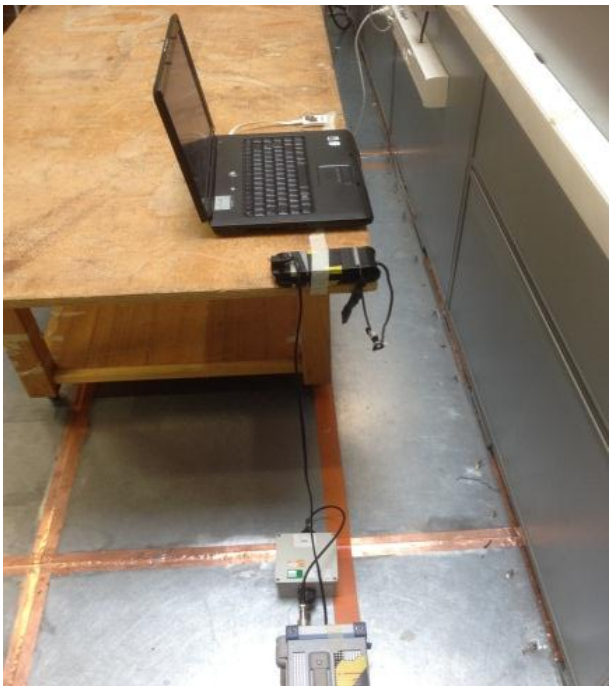
3.1. ENVIRONMENTAL CONDITIONS

Date of test : March 7th, 2014
Test performed by : A. Merlin / G.Deschamps
Atmospheric pressure : 1003hPa
Relative humidity : 28%
Ambient temperature : 21°C

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	-	-	A5329578	05/13	05/14
Conducted emission comb generator	BARDET	-	A3169049	-	-
LISN	RHODE & SCHWARZ	ENV216	C2320123	11/13	11/14
Receiver 20Hz-26.5GHz	ROHDE & SCHWARZ	ESMI	A2642009	06/13	06/14
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	04/13	04/14

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

RESULTS: ☒**PASS** ☐**FAIL**

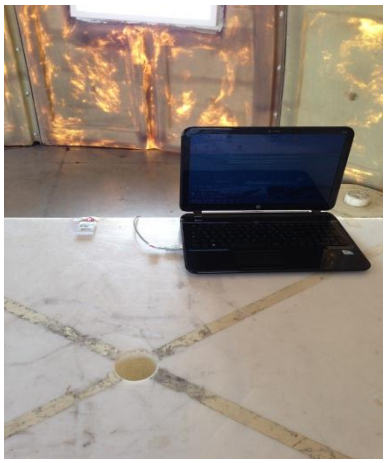
4. RADIATED EMISSION DATA

4.1. ENVIRONMENTAL CONDITIONS

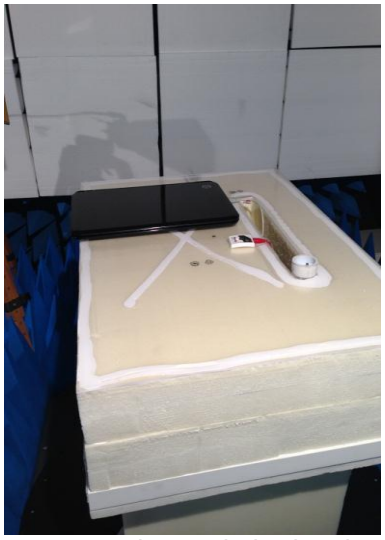
Date of test	: March 5th, 2014	and	March 10th, 2014
Test performed by	: A.MERLIN		A.MERLIN
Atmospheric pressure	: 997hPa		993hPa
Relative humidity	: 32%		31%
Ambient temperature	: 24°C		23°C

4.2. TEST SETUP

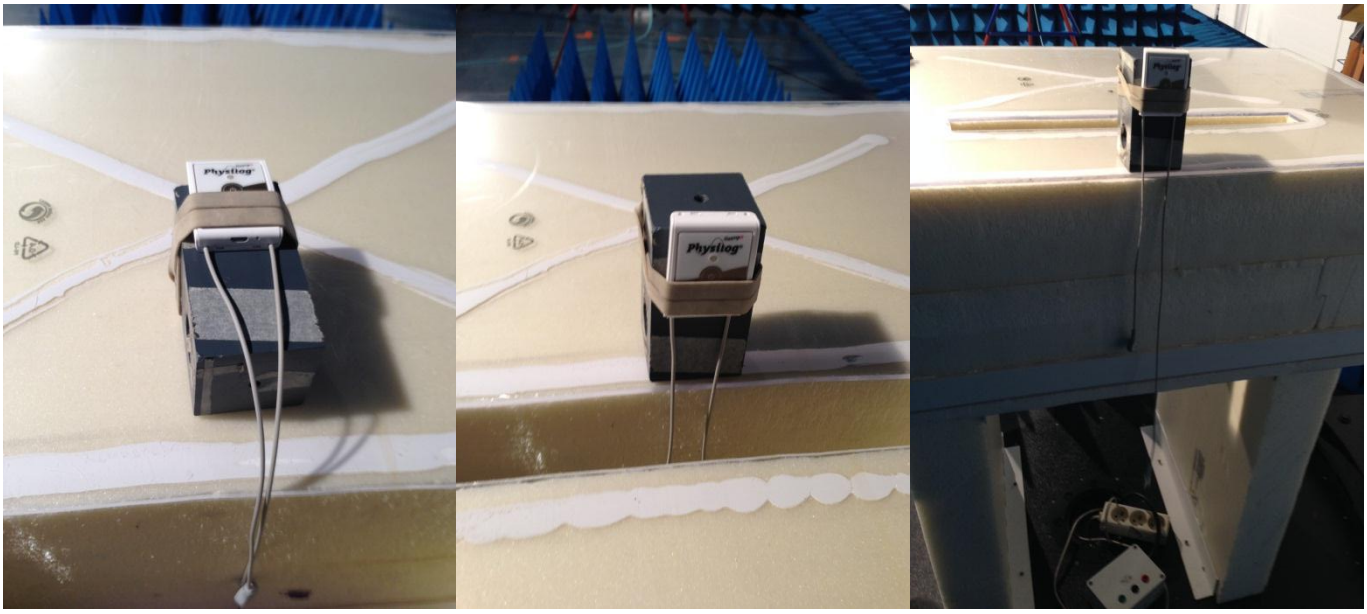
The installation of EUT is identical for pre-characterization measures in a 3 meters semi- anechoic chamber and for measures on the 10 meters Open site.
The EUT and auxiliaries are set:
☐ 80cm above the ground on the non-conducting table (Table-top equipment)
☐ 10cm above the ground on isolating support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


Test setup on OATS



Test setup in anechoic chamber



Test setup in anechoic chamber

4.3. TEST METHOD

Pre-characterisation measurement: (9kHz – 26GHz)
A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber for frequency from 30MHz to 26GHz. 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 26GHz.

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 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 26GHz:
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 26GHz.
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
Antenna Bi-log	CHASE	CBL6111A	C2040051	04/13	04/14
Antenna Bi-log	CHASE	CBL6111A	C2040172	04/13	04/15
Antenna horn	EMCO	3115	C2042027	04/13	04/14
Antenna horn	EMCO	3115	C2042029	04/13	04/14
Cable - Measure	-	-	A5329038	04/13	04/14
Cable	SUCOFLEX	106G	A5329061	02/14	02/15
Cable Measure	-	-	A5329206	01/14	01/15
Cable Measure	-	-	A5329604	04/13	04/14
Cable (OATS)	-	-	A5329623	08/13	08/14
Semi-Anechoic chamber #3	SIEPEL	-	D3044017	-	-
Radiated emission comb generator	BARDET	-	A3169050	-	-
High Pass (4.8-18GHz)	BL Microwave	SH4800-1800	A7484034	03/13	03/15
OATS	-	-	F2000409	08/13	08/14
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	10/13	10/14
Receiver 20Hz-26.5GHz	ROHDE & SCHWARZ	ESMI	A2642009	06/13	06/14
Receiver display	ROHDE & SCHWARZ	ESMI	A2642007	06/13	06/14
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	01/14	01/15
Thermo-hygrometer (PM2)	OREGON	BAR916HG-G	B4206011	04/14	04/15
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	-	-
Table	MATURO Gmbh	-	F2000437	-	-
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 [9kHz-30MHz]

No frequency observed, see test results tables.

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

See graphs for 30MHz-1GHz:

H polarization	**Emr#1**	(See annex 1)
V polarization	**Emr#2**	(See annex 1)
H polarization	**Emr#3**	(See annex 1)
V polarization	**Emr#4**	(See annex 1)
H polarization	**Emr#5**	(See annex 1)
V polarization	**Emr#6**	(See annex 1)
H polarization	**Emr#7**	(See annex 1)
V polarization	**Emr#8**	(See annex 1)
H polarization	**Emr#9**	(See annex 1)
V polarization	**Emr#10**	(See annex 1)

4.6.3. Pre-characterization at 3 meters [1GHz-26GHz]

See 100kHz band edge measurements paragraph and test results tables.

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 (dBµV/m) @ 30m	Qpeak (dBµV/m) @ 30m	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
No frequency observed									

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

Limits Sub clause §15.225

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

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

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

Worst case final data result:
Frequency list has been created with semi-anechoic chamber pre-scan results.
Measurements are performed using a QUASI-PEAK detection.

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
1	976.682	54.0	33.1	**-20.9**	85	V	230	29.8	TX
2	43.998	30.0	24.2	**-5.8**	95	V	100	12.8	Load

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 26GHz

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 (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
1	1125.9	74.0	42.3	**-31.7**	110	V	100	-7.6	Axis Z
2	1201.5	74.0	43.6	**-30.4**	200	H	100	-7.1	Axis Z
3	1230.9	74.0	41.8	**-32.2**	200	V	100	-6.9	Axis Z
4	1426.1	74.0	43.4	**-30.6**	205	H	100	-5.6	Axis Z
5	1577.3	74.0	44.5	**-29.5**	185	H	100	-4.7	Axis Z
6	2255.4	74.0	49.9	**-24.1**	30	V	100	-1.9	Axis Z
7	2328.8	74.0	50.1	**-23.9**	35	V	100	-1.8	Axis Z
8	2352.0	74.0	48.8	**-25.2**	315	H	100	-1.7	Axis Z
9	2388.2	74.0	52.0	**-22.0**	330	V	100	-1.7	Axis XY
10	2483.5	74.0	61.4	**-12.6**	55	V	100	-1.6	Axis XY
11	2500.0	74.0	50.0	**-24.0**	75	V	100	-1.5	Axis XY
12	2712.3	74.0	49.9	**-24.1**	185	V	100	-0.8	Axis Z
13	2790.0	74.0	51.3	**-22.7**	290	H	100	-0.6	Axis XY
14	2887.7	74.0	51.4	**-22.6**	15	V	100	-0.2	Axis Z
15	3719.5	74.0	48.5	**-25.5**	145	V	100	2.4	Axis Z
16	4808.0	74.0	61.1	**-12.9**	180	H	100	4.0	Axis Z
17	4876.0	74.0	61.7	**-12.3**	180	H	100	4.1	Axis Z
18	4960.0	74.0	60.8	**-13.2**	180	H	100	4.3	Axis Z
19	7314.0	74.0	60.0	**-14.0**	195	H	100	8.2	Axis Z
20	7440.0	74.0	59.5	**-14.5**	195	H	100	8.6	Axis Z

No	Frequency (MHz)	Limit Average (dBµV/m)	Measure Average (dBµV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
1	1125.9	54.0	27.0	**-27.0**	110	V	100	-7.6	Axis Z
2	1201.5	54.0	28.2	**-25.8**	200	H	100	-7.1	Axis Z
3	1230.9	54.0	28.2	**-25.8**	200	V	100	-6.9	Axis Z
4	1426.1	54.0	28.9	**-25.1**	205	H	100	-5.6	Axis Z
5	1577.3	54.0	29.5	**-24.5**	185	H	100	-4.7	Axis Z
6	2255.4	54.0	33.4	**-20.6**	30	V	100	-1.9	Axis Z
7	2328.8	54.0	34.7	**-19.3**	35	V	100	-1.8	Axis Z
8	2352.0	54.0	35.0	**-19.0**	315	H	100	-1.7	Axis Z
9	2388.2	54.0	34.0	**-20.0**	330	V	100	-1.7	Axis XY
10	2483.5	54.0	34.5	**-19.5**	55	V	100	-1.6	Axis XY
11	2500.0	54.0	34.2	**-19.8**	75	V	100	-1.5	Axis XY
12	2712.3	54.0	35.5	**-18.5**	185	V	100	-0.8	Axis Z
13	2790.0	54.0	36.5	**-17.5**	290	H	100	-0.6	Axis XY
14	2887.7	54.0	36.4	**-17.6**	15	V	100	-0.2	Axis Z
15	3719.5	54.0	35.4	**-18.6**	145	V	100	2.4	Axis Z
16	4808.0	54.0	40.5	**-13.5**	180	H	100	4.0	Axis Z
17	4876.0	54.0	40.7	**-13.3**	180	H	100	4.1	Axis Z
18	4960.0	54.0	40.6	**-13.4**	180	H	100	4.3	Axis Z
19	7314.0	54.0	43.2	**-10.8**	195	H	100	8.2	Axis Z
20	7440.0	54.0	44.2	**-9.8**	195	H	100	8.6	Axis Z

Note: Measures have been done at 3m distance.

4.7. CONCLUSION

RESULTS: ☒**PASS** ☐**FAIL**

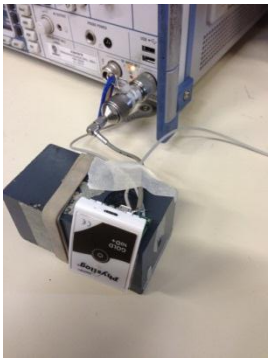
5. BANDWIDTH (15.247)

5.1. TEST CONDITIONS

Date of test : March 5th, 2014
Test performed by : A.MERLIN
Atmospheric pressure : 997hPa
Relative humidity : 32%
Ambient temperature : 24°C

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 10.3dB



☐ ***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

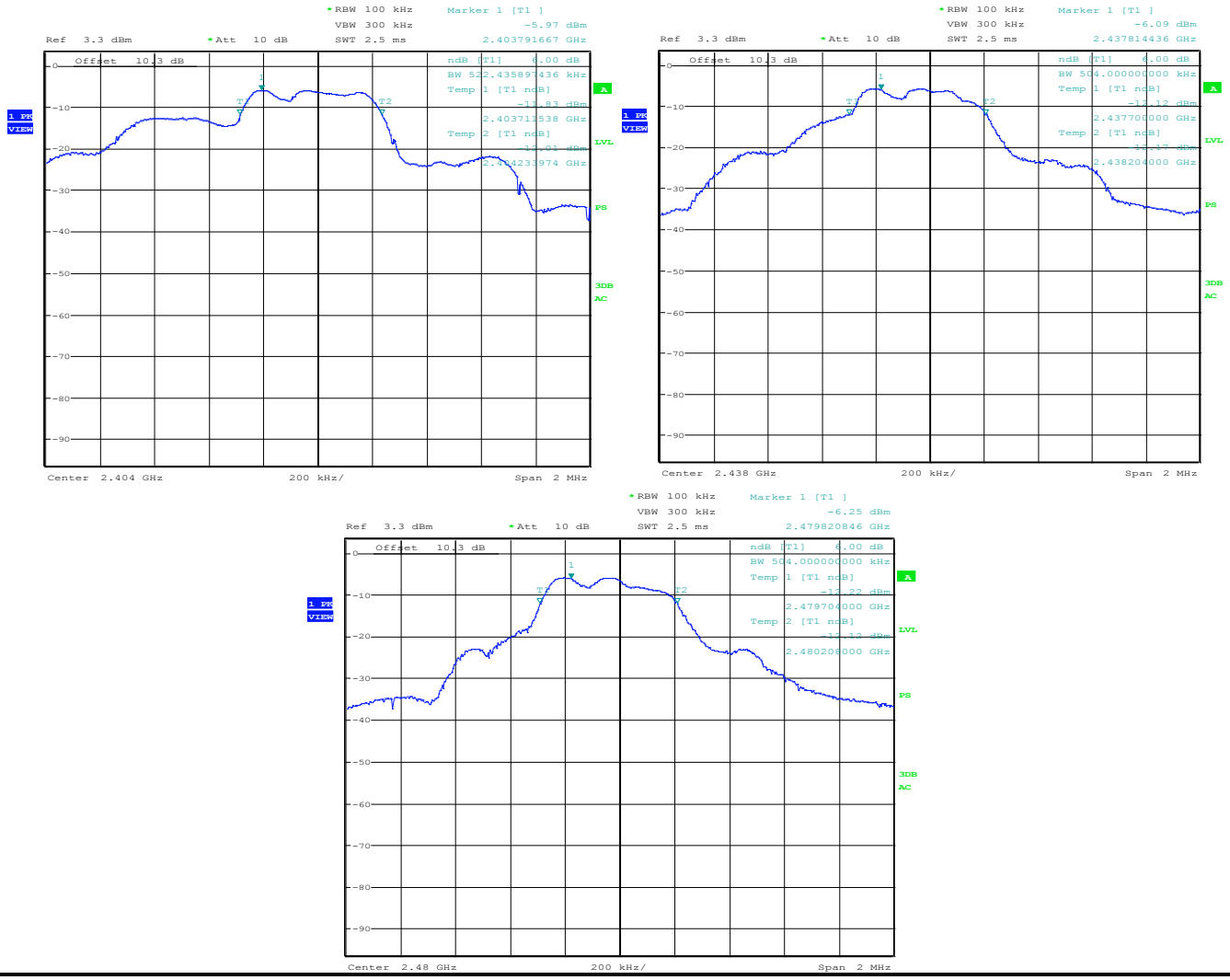
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	JFW	-	A7122166	09/13	09/14
Cable SMA	-	-	A5329580	02/14	02/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	10/13	10/14

5.1. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☒None ☐Divergence:

5.2. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Bandwidth Limit (kHz)
4	2404	**522.4**	**>500**
38	2438	**504.0**	**>500**
80	2480	**504.0**	**>500**



5.3. CONCLUSION

RESULTS: ☒**PASS** ☐**FAIL**

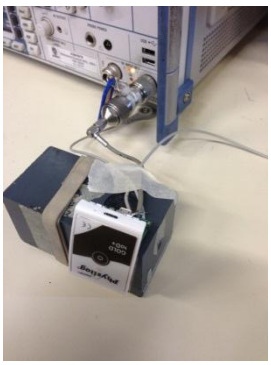
6. MAXIMUM PEAK OUTPUT POWER (15.247)

6.1. TEST CONDITIONS

Date of test : March 5th, 2014
Test performed by : A.MERLIN
Atmospheric pressure : 997hPa
Relative humidity : 32%
Ambient temperature : 24°C

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 10.3dB



☐ ***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

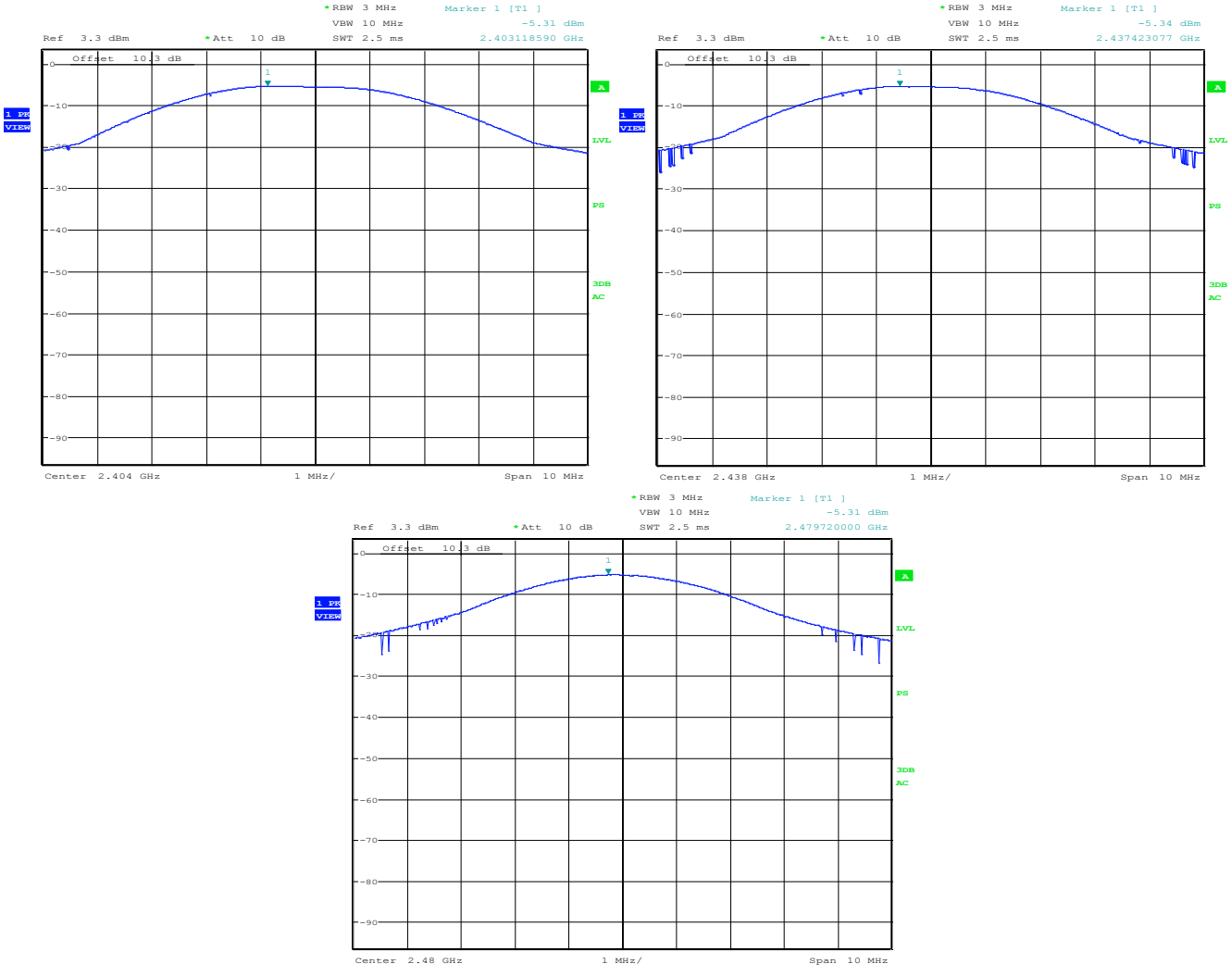
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	JFW	-	A7122166	09/13	09/14
Cable SMA	-	-	A5329580	02/14	02/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	10/13	10/14

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)
4	2404	**-5.3**	30.0
38	2438	**-5.3**	30.0
80	2480	**-5.3**	30.0



6.6. CONCLUSION

RESULTS: ☒**PASS** ☐**FAIL**

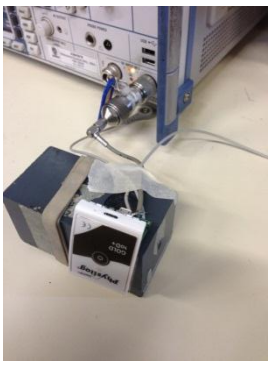
7. POWER SPECTRAL DENSITY (15.247)

7.1. TEST CONDITIONS

Date of test : March 5th, 2014
Test performed by : A.MERLIN
Atmospheric pressure : 997hPa
Relative humidity : 32%
Ambient temperature : 24°C

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 10.3dB



☐ ***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

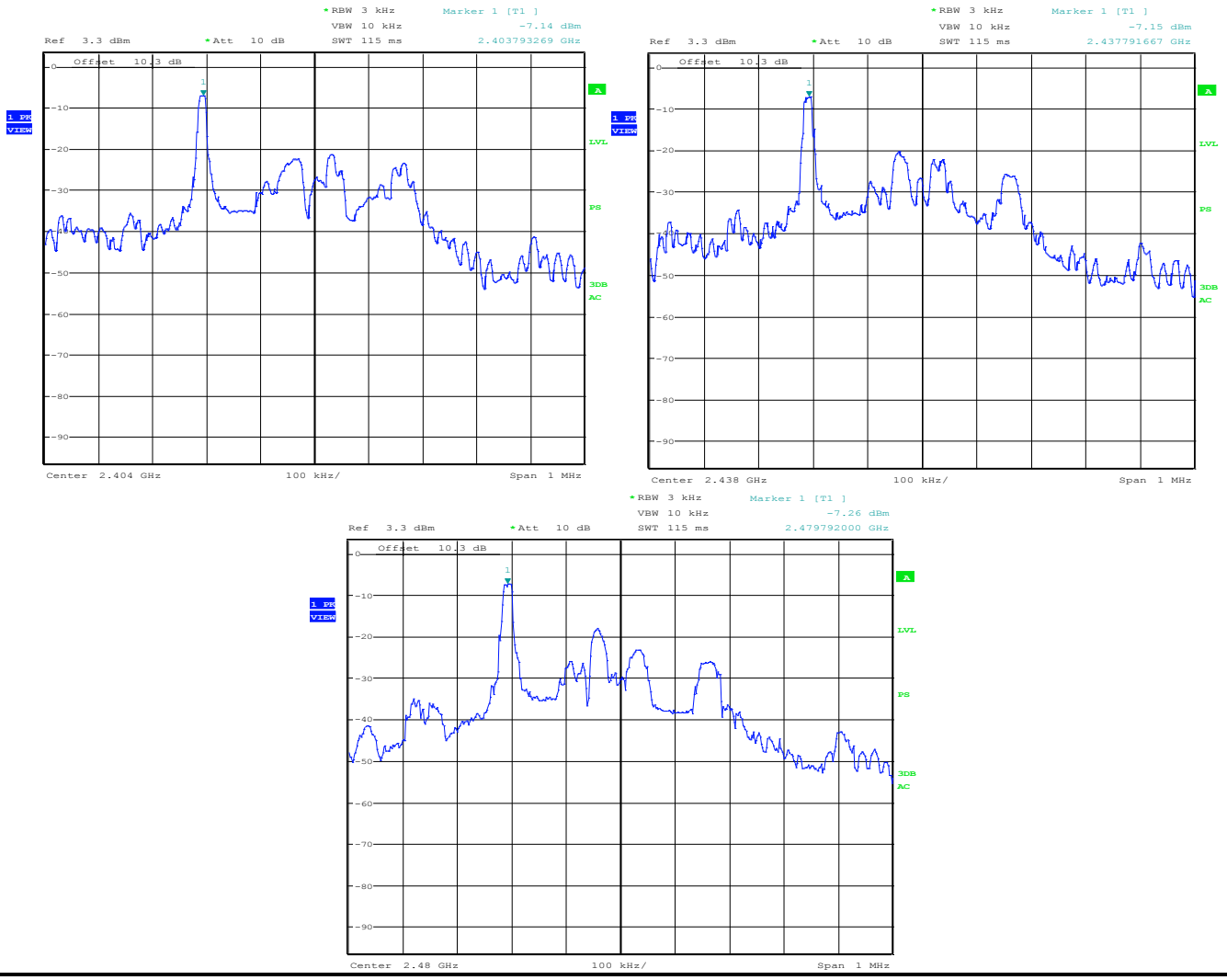
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	JFW	-	A7122166	09/13	09/14
Cable SMA	-	-	A5329580	02/14	02/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	10/13	10/14

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)
4	2404	**-7.1**	8.0
38	2438	**-7.1**	8.0
80	2480	**-7.2**	8.0



7.6. CONCLUSION

RESULTS: ☒**PASS** ☐**FAIL**

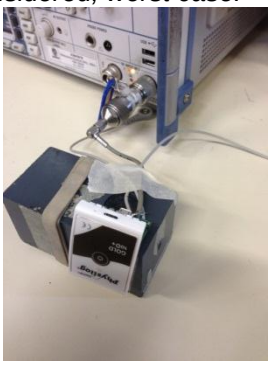
8. BAND EDGE MEASUREMENT (15.247)

8.1. TEST CONDITIONS

Date of test : March 5th, 2014
Test performed by : A.MERLIN
Atmospheric pressure : 997hPa
Relative humidity : 32%
Ambient temperature : 24°C

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

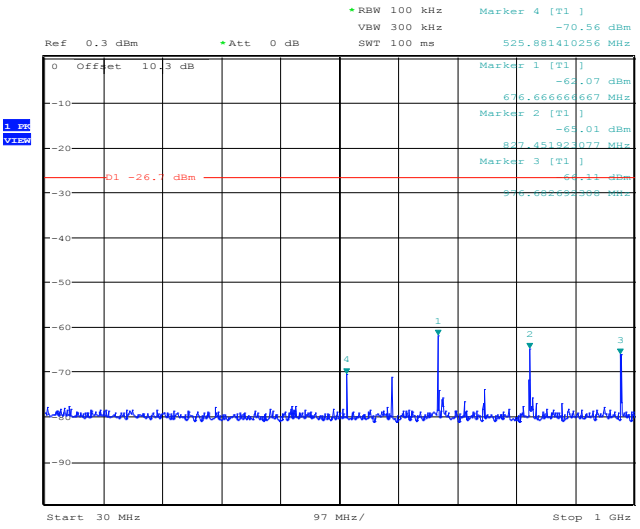
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	JFW	-	A7122166	09/13	09/14
Cable SMA	-	-	A5329580	02/14	02/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	10/13	10/14
Receiver 20Hz-26.5GHz	ROHDE & SCHWARZ	ESMI	A2642009	06/13	06/14
Receiver display	ROHDE & SCHWARZ	ESMI	A2642007	06/13	06/14

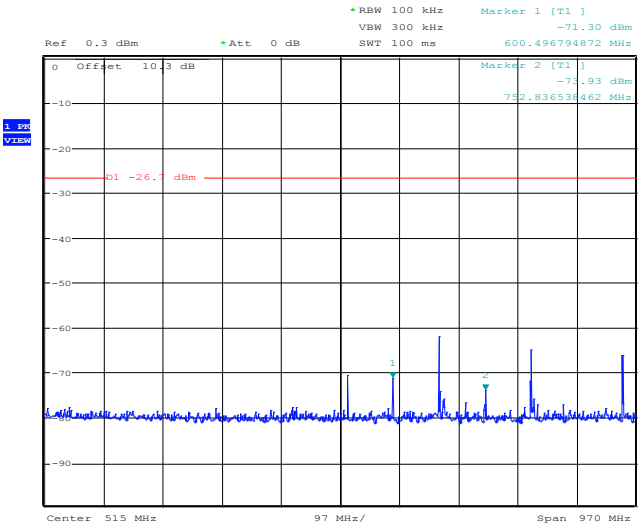
8.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

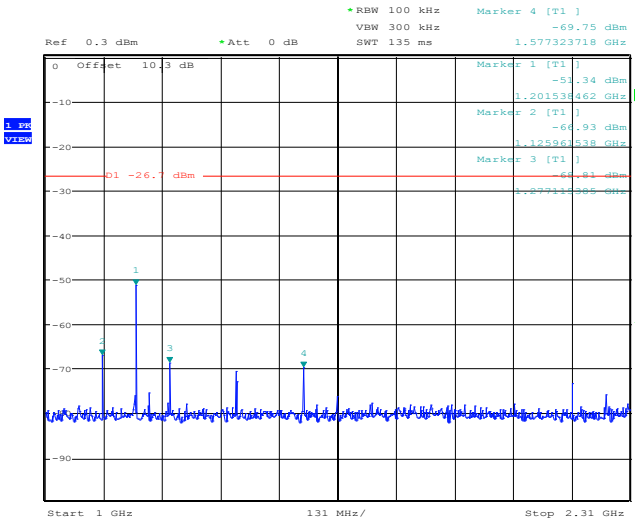
☒None ☐Divergence:

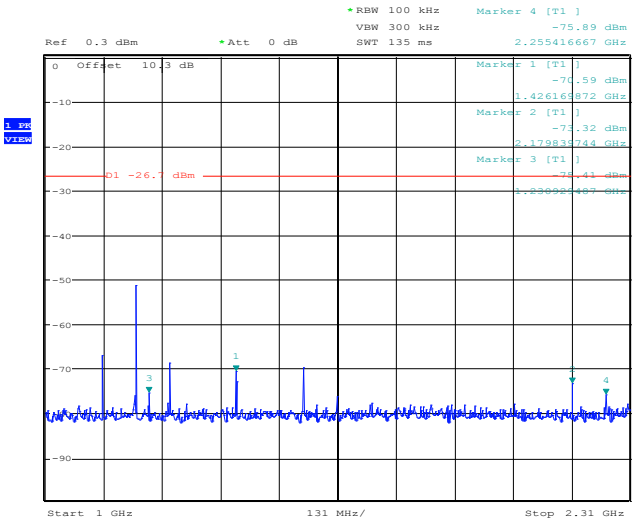
8.6. TEST SEQUENCE AND RESULTS

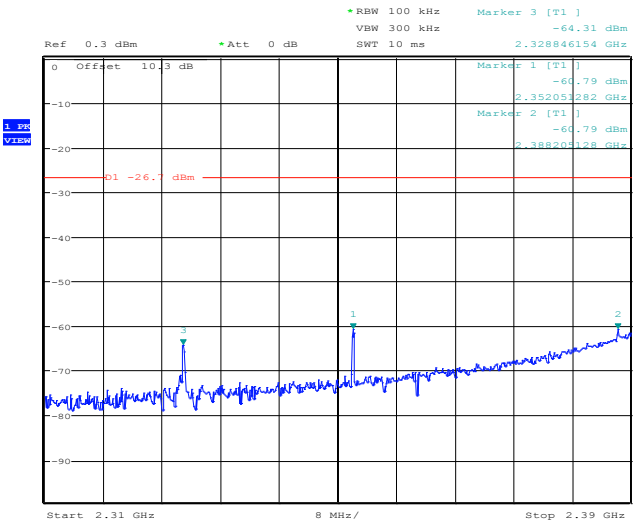
Offset: Attenuator+cable 10.3dB

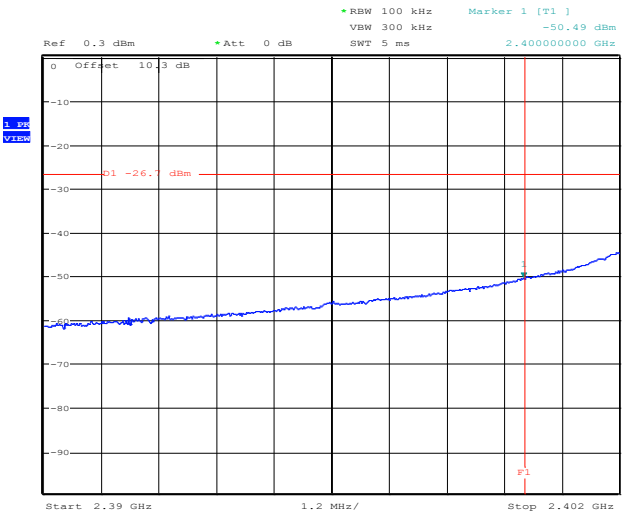


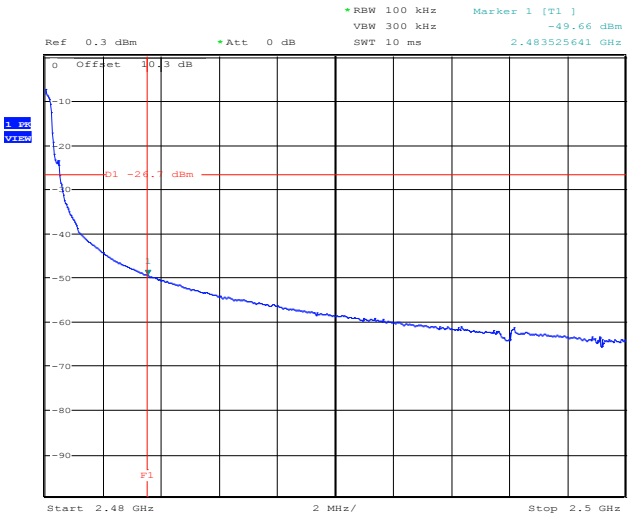


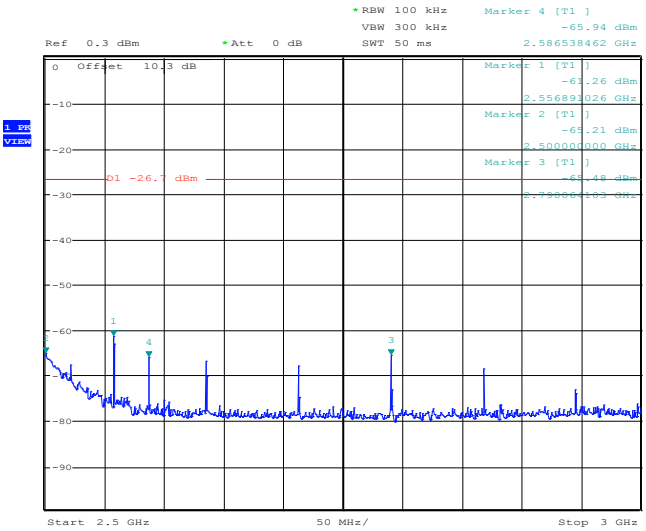


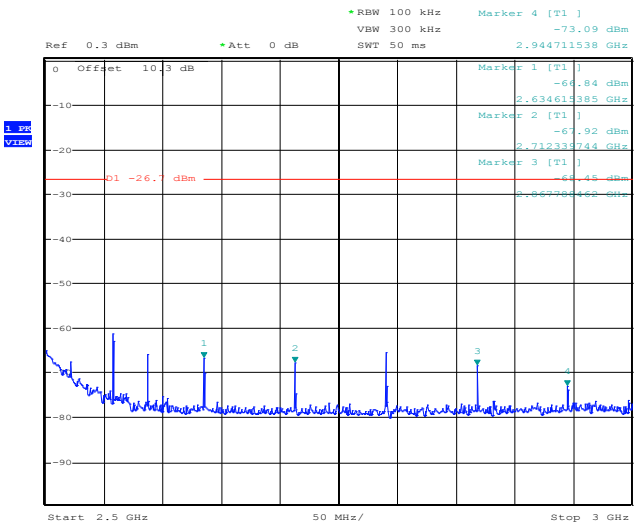


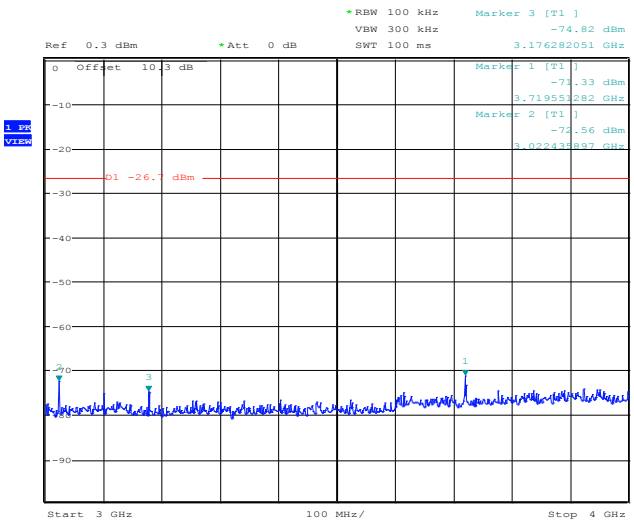

RBW 100 kHz
VBW 300 kHz
SWT 10 ms
Marker 3 [T1]
-64.31 dBm
2.328846154 GHz
Ref 0.3 dBm
Att 0 dB
Offset 10.3 dB
Marker 1 [T1]
-60.79 dBm
2.352053282 GHz
Marker 2 [T1]
-60.79 dBm
2.388205128 GHz
D1 -26.7 dBm
Start 2.31 GHz
8 MHz/
Stop 2.39 GHz

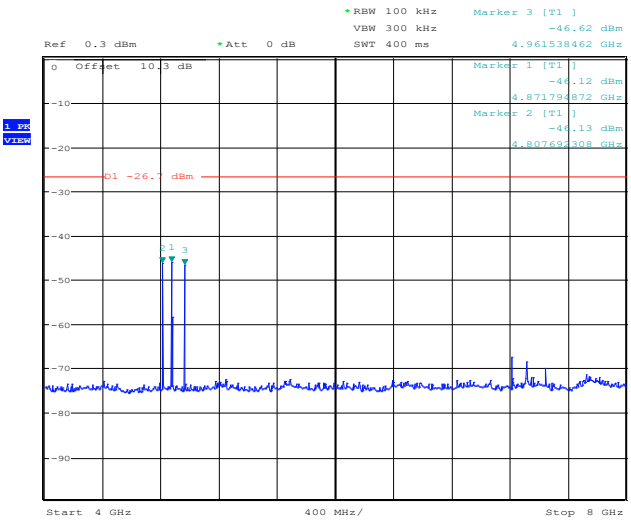

RBW 100 kHz
VBW 300 kHz
SWT 5 ms
Marker 1 [T1]
-50.49 dBm
2.400000000 GHz
Ref 0.3 dBm
Att 0 dB
Offset 10.3 dB
D1 -26.7 dBm
F1
Start 2.39 GHz
1.2 MHz/
Stop 2.402 GHz

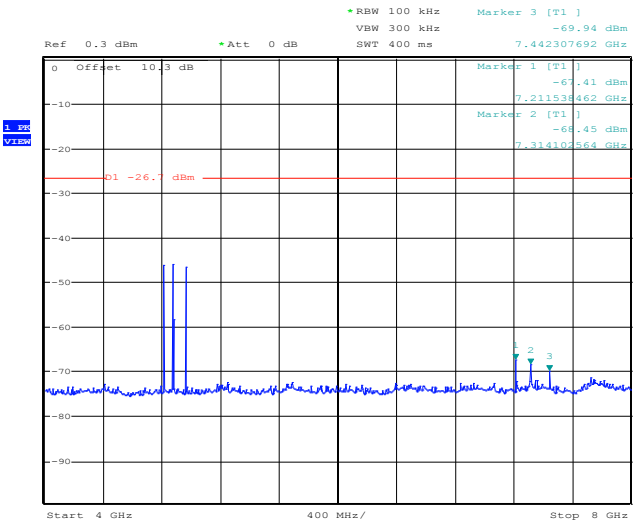

RBW 100 kHz
VBW 300 kHz
SWT 10 ms
Marker 1 [T1]
-49.66 dBm
2.483525641 GHz
Ref 0.3 dBm
Att 0 dB
Offset 10.3 dB
D1 -26.7 dBm
F1
Start 2.48 GHz
2 MHz/
Stop 2.5 GHz

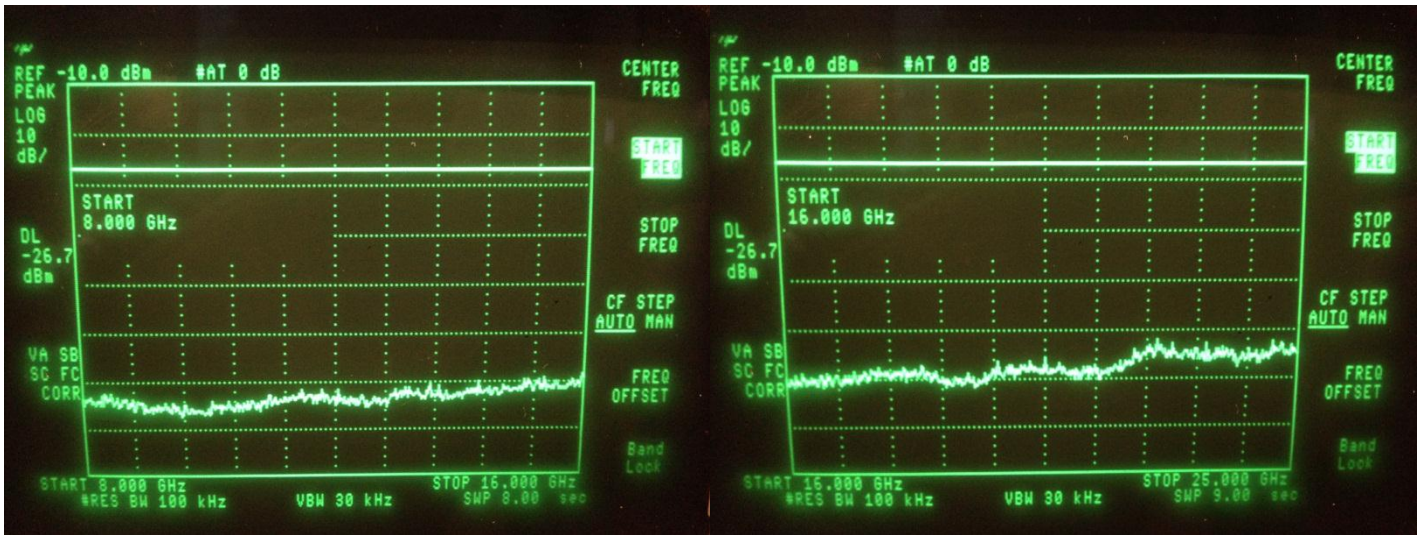

RBW 100 kHz
VBW 300 kHz
SWT 50 ms
Marker 4 [T1]
-65.94 dBm
2.586538462 GHz
Marker 1 [T1]
-61.26 dBm
2.556891026 GHz
Marker 2 [T1]
-65.21 dBm
2.500000000 GHz
Marker 3 [T1]
-65.48 dBm
2.730064103 GHz
Ref 0.3 dBm
Att 0 dB
Offset 10.3 dB
D1 -26.7 dBm
Start 2.5 GHz
50 MHz/
Stop 3 GHz


RBW 100 kHz
VBW 300 kHz
SWT 50 ms
Marker 4 [T1]
-73.09 dBm
2.944711538 GHz
Ref 0.3 dBm
Att 0 dB
Offset 10.3 dB
Marker 1 [T1]
-66.84 dBm
2.634615385 GHz
Marker 2 [T1]
-67.92 dBm
2.712339744 GHz
Marker 3 [T1]
-66.45 dBm
2.867788462 GHz
D1 -26.7 dBm
Start 2.5 GHz
50 MHz/
Stop 3 GHz


RBW 100 kHz
VBW 300 kHz
SWT 100 ms
Marker 3 [T1]
-74.82 dBm
3.176282051 GHz
Ref 0.3 dBm
Att 0 dB
Offset 10.3 dB
Marker 1 [T1]
-71.33 dBm
3.719551282 GHz
Marker 2 [T1]
-72.56 dBm
3.022435897 GHz
D1 -26.7 dBm
Start 3 GHz
100 MHz/
Stop 4 GHz


RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 3 [T1]
-46.62 dBm
4.961538462 GHz
Ref 0.3 dBm
Att 0 dB
Offset 10.3 dB
Marker 1 [T1]
-46.12 dBm
4.871794872 GHz
Marker 2 [T1]
-46.13 dBm
4.807692308 GHz
D1 -26.7 dBm
Start 4 GHz
400 MHz/
Stop 8 GHz


RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 3 [T1]
-69.94 dBm
7.442307692 GHz
Ref 0.3 dBm
Att 0 dB
Offset 10.3 dB
Marker 1 [T1]
-67.41 dBm
7.211538462 GHz
Marker 2 [T1]
-68.45 dBm
7.314102564 GHz
D1 -26.7 dBm
Start 4 GHz
400 MHz/
Stop 8 GHz

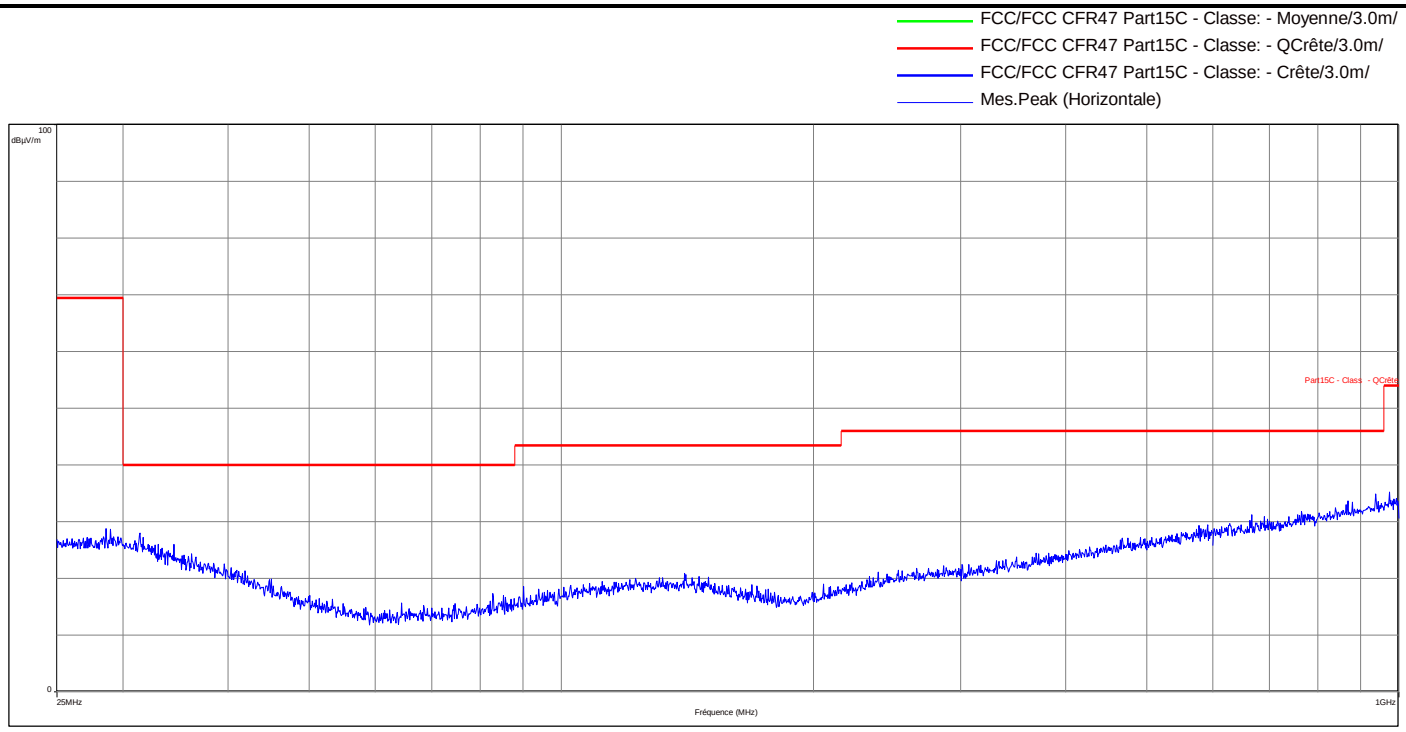


8.7. CONCLUSION

RESULTS: ☒**PASS** ☐**FAIL**

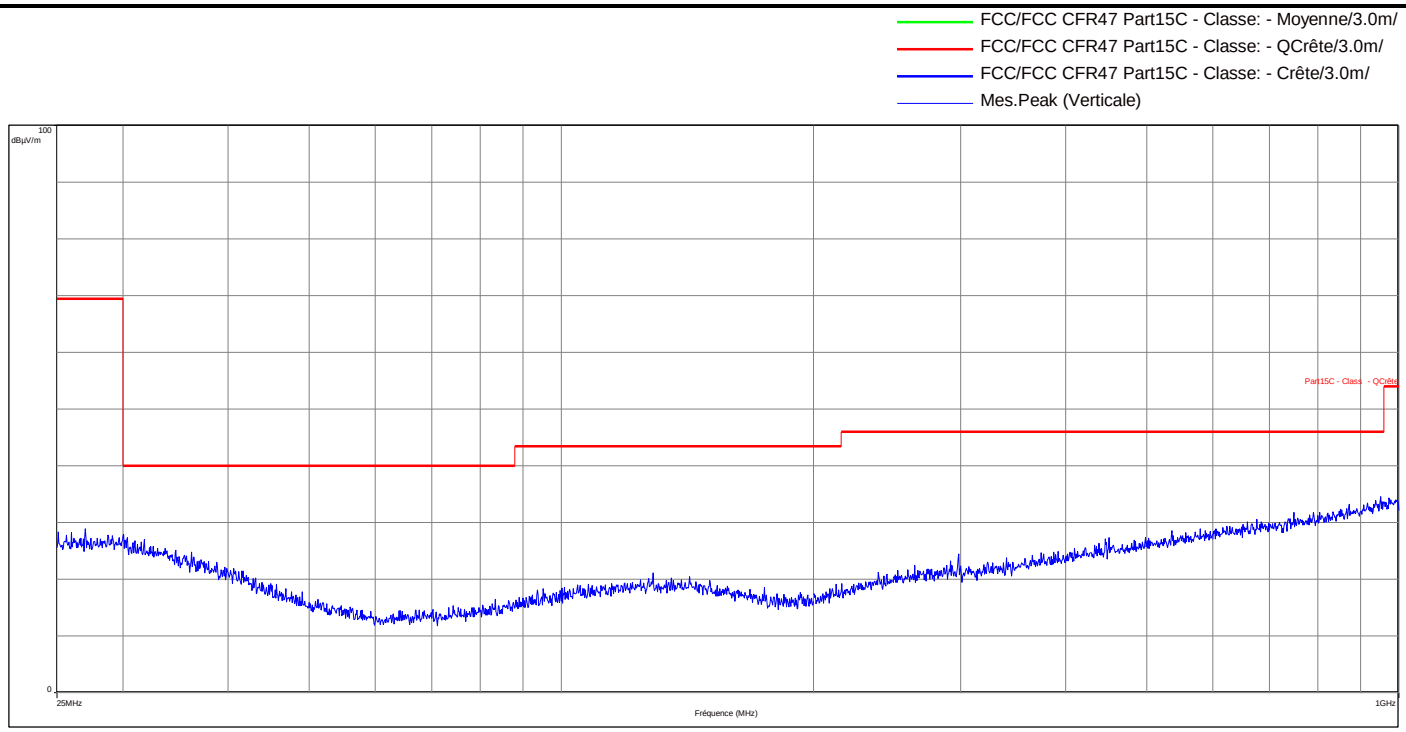
9. ANNEX 1 (GRAPHS)

RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H) Axis XY - Gold CMin TX	
Class:			
Frequency range: [25MHz - 1GHz]			
Antenna polarization:	Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



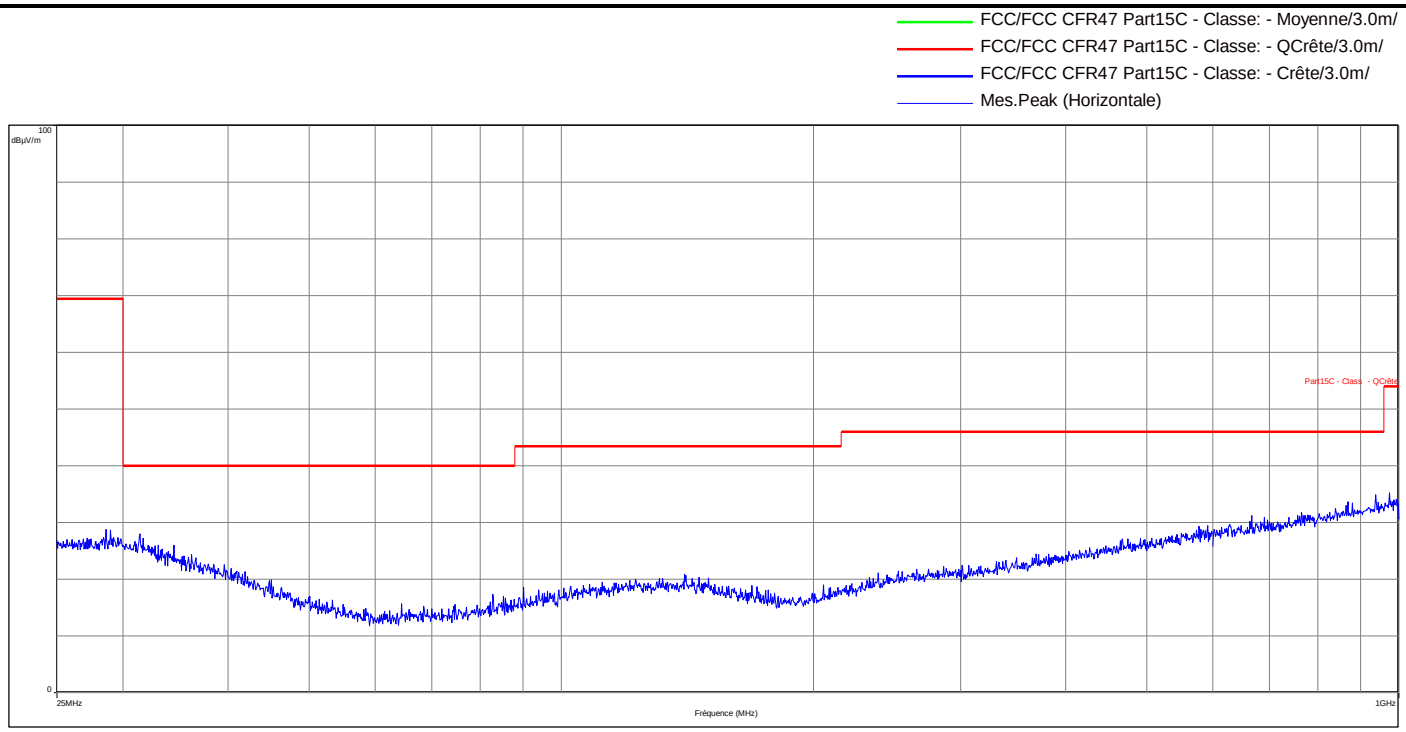
Spurious emissions

RADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(V) Axis XY - Gold CMin TX	
Class:			
Frequency range: [25MHz - 1GHz]			
Antenna polarization:	Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



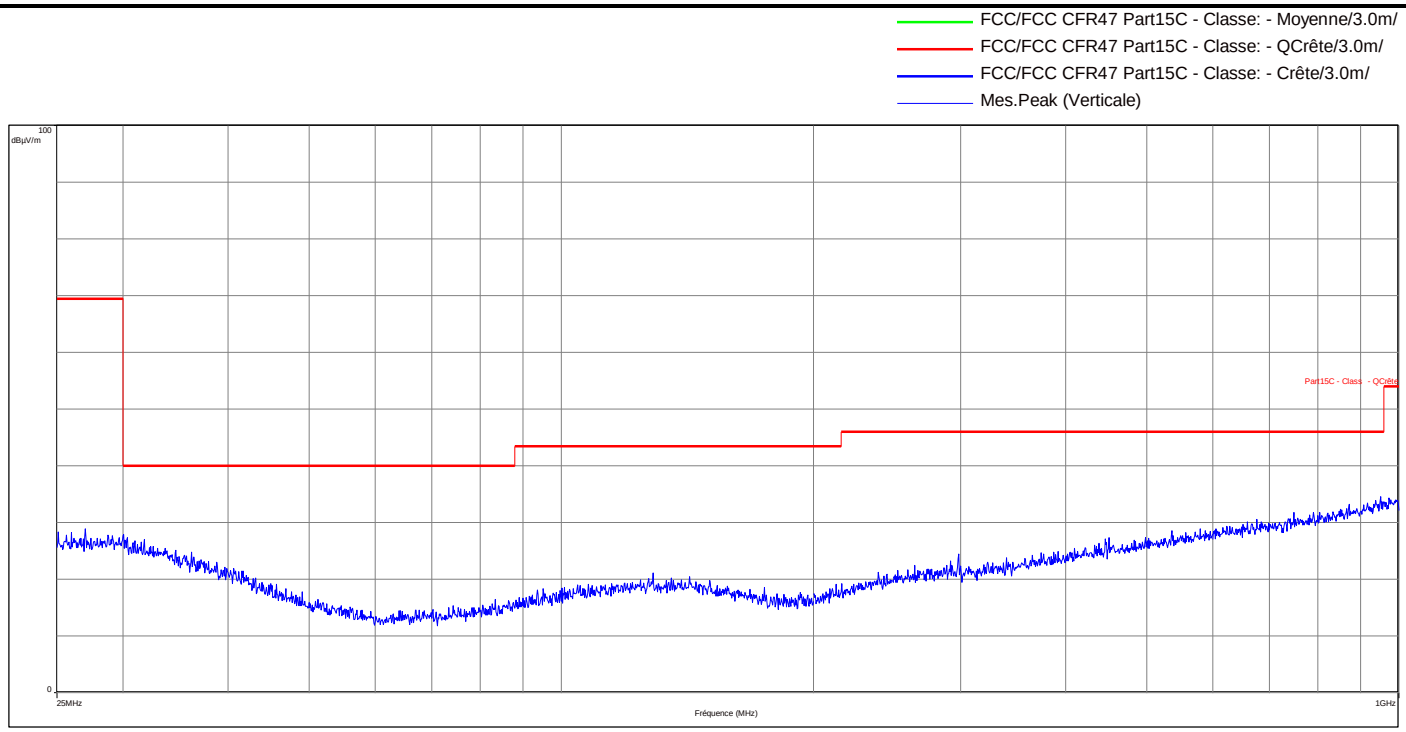
Spurious emissions

RADIATED EMISSIONS			
Graph name:	Emr#3	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H) Axis Z - Gold CMin TX	
Class:			
Frequency range: [25MHz - 1GHz]			
Antenna polarization:	Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



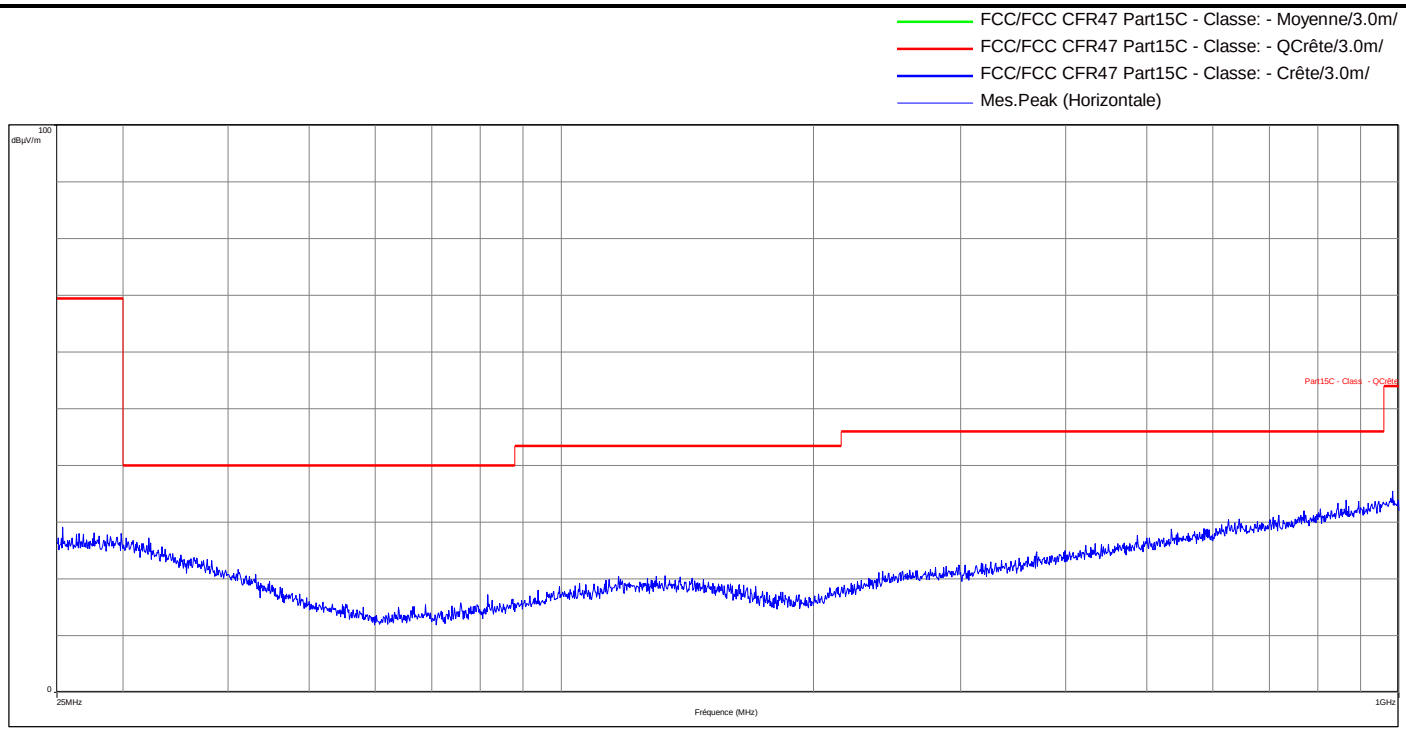
Spurious emissions

RADIATED EMISSIONS			
Graph name:	Emr#4	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(V) Axis Z - Gold CMin TX	
Class:			
Frequency range: [25MHz - 1GHz]			
Antenna polarization:	Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



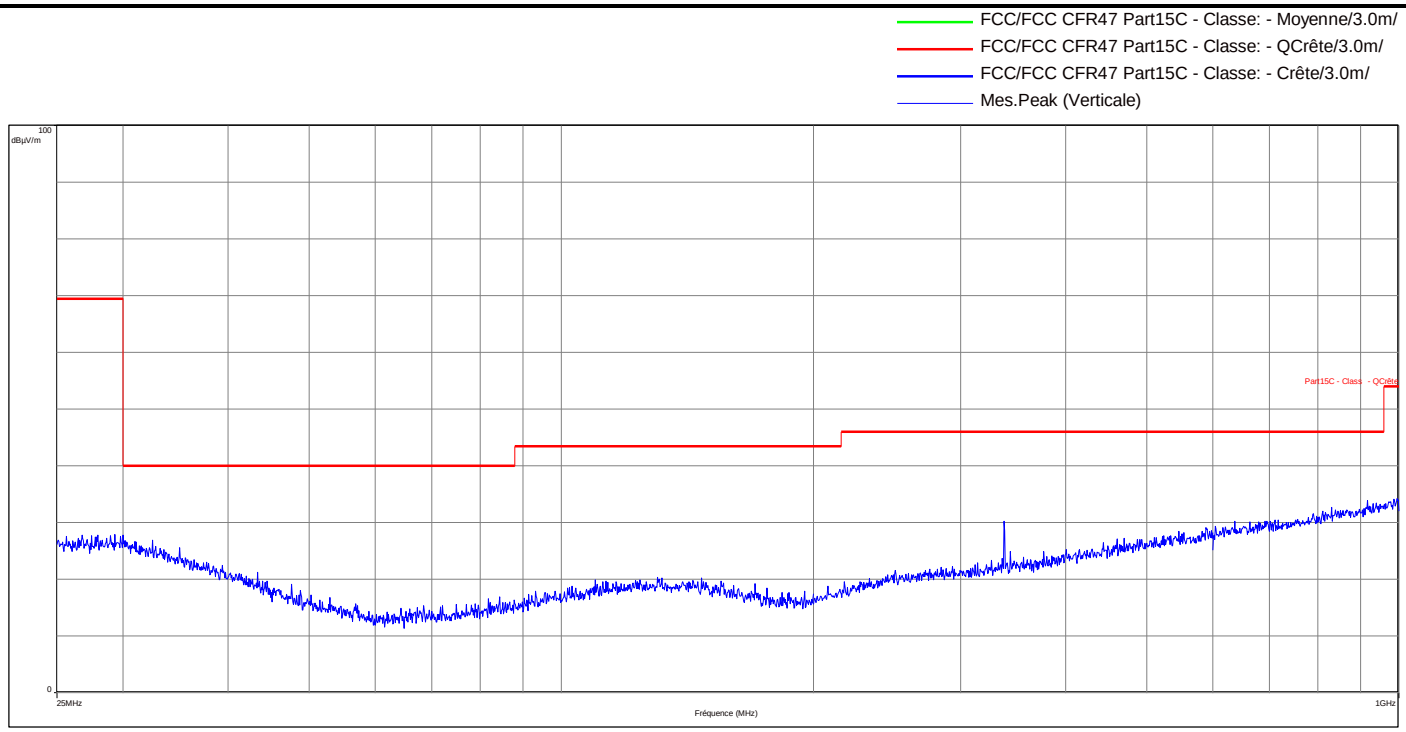
Spurious emissions

RADIATED EMISSIONS			
Graph name:	Emr#5	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H) Axis XY - Gold CMax TX	
Class:			
Frequency range: [25MHz - 1GHz]			
Antenna polarization:	Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



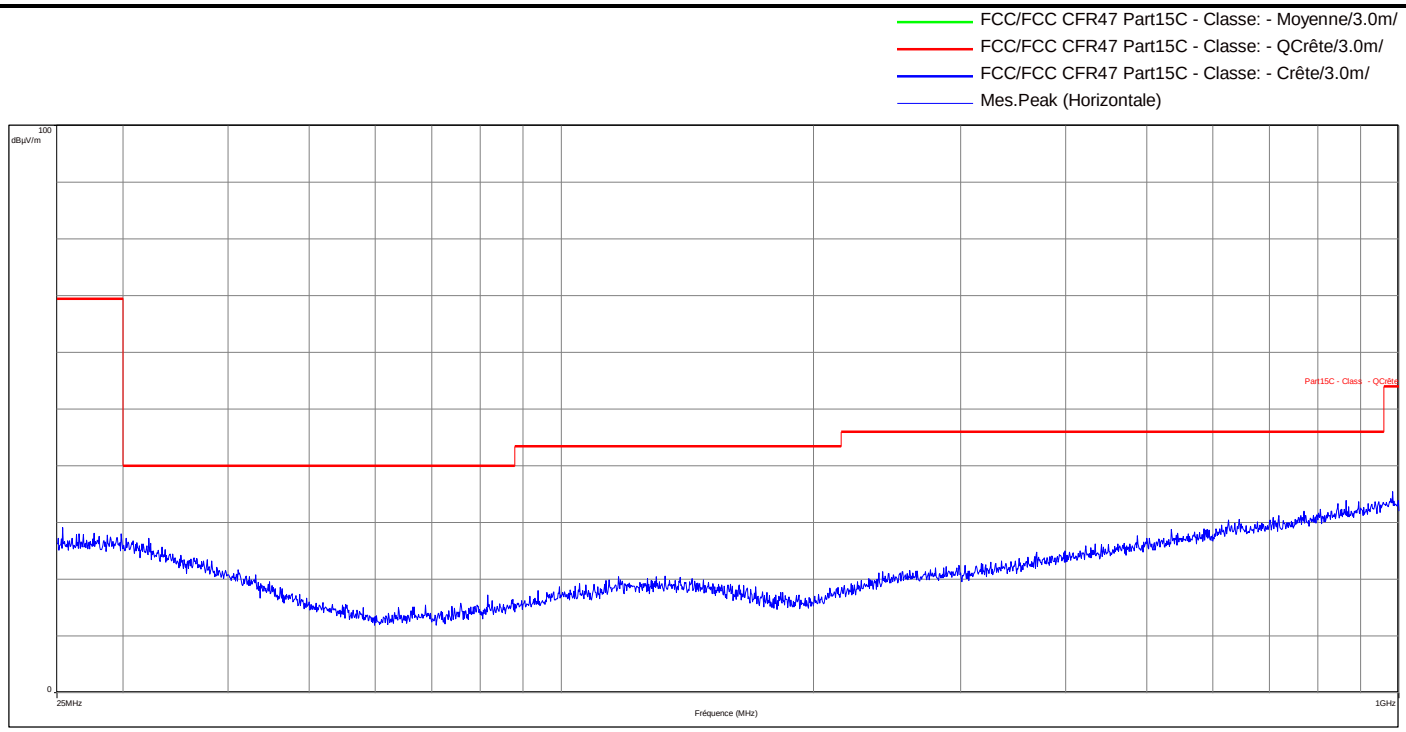
Spurious emissions

RADIATED EMISSIONS			
Graph name:	Emr#6	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(V) Axis XY - Gold CMax TX	
Class:			
Frequency range: [25MHz - 1GHz]			
Antenna polarization:	Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



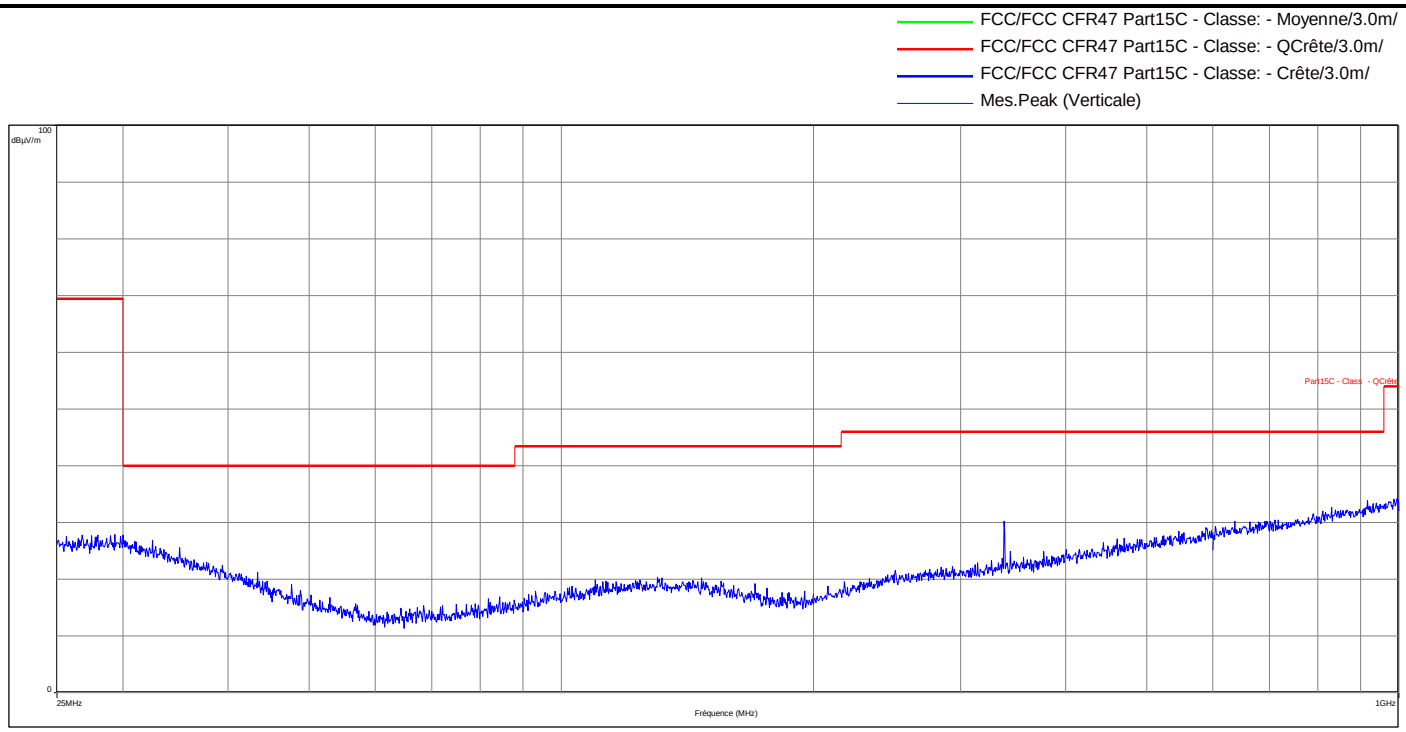
Spurious emissions

RADIATED EMISSIONS			
Graph name:	Emr#7	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H) Axis Z - Gold CMax TX	
Class:			
Frequency range: [25MHz - 1GHz]			
Antenna polarization:	Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



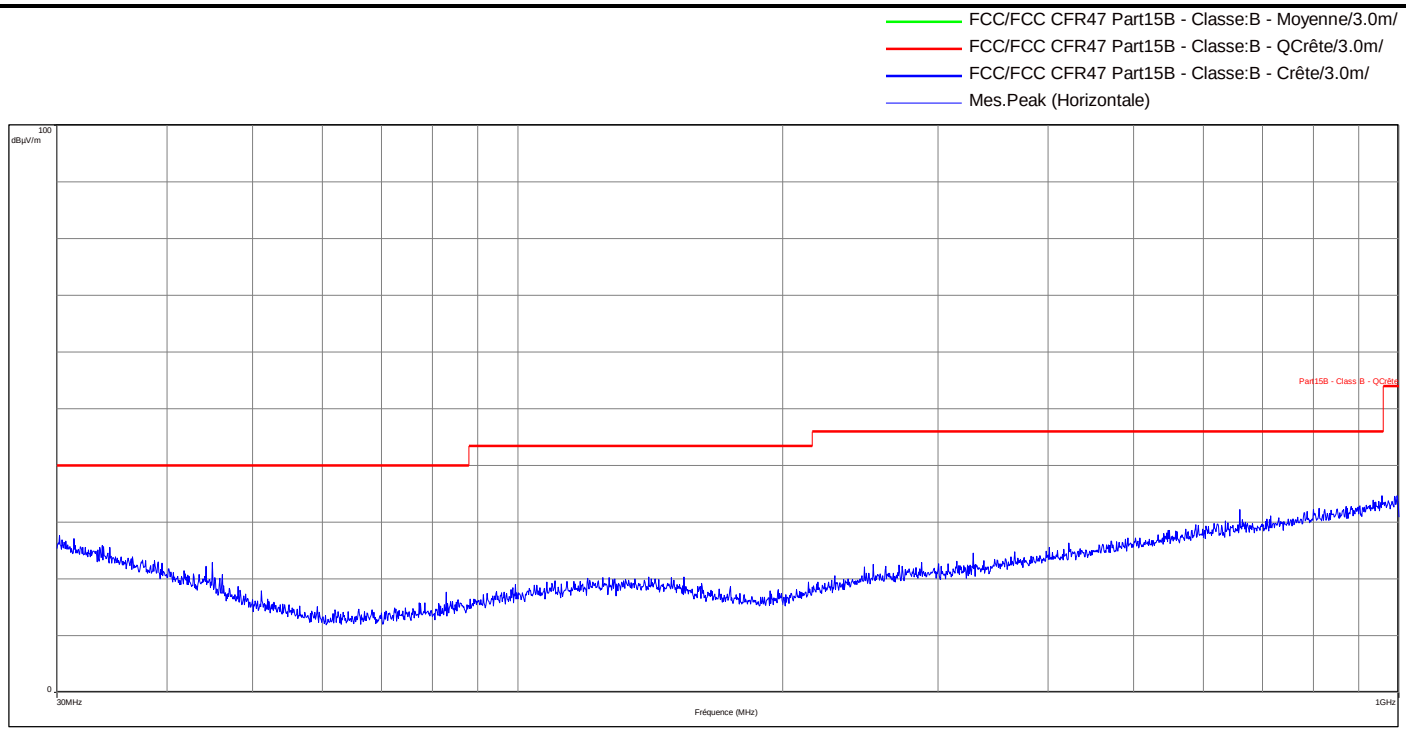
Spurious emissions

RADIATED EMISSIONS			
Graph name:	Emr#8	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(V) Axis Z - Gold CMax TX	
Class:			
Frequency range: [25MHz - 1GHz]			
Antenna polarization:	Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



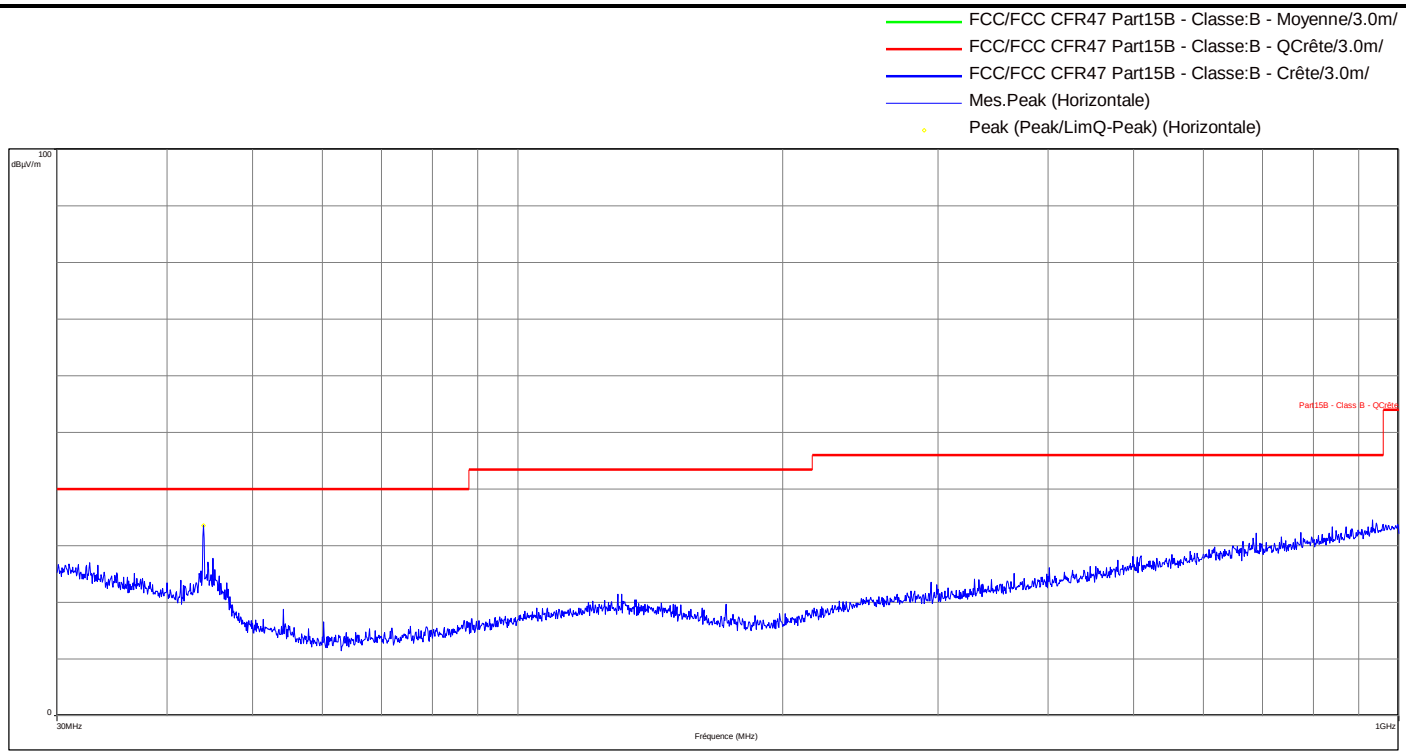
Spurious emissions

RADIATED EMISSIONS			
Graph name:	Emr#9	**Test configuration:**	
Limit:	FCC CFR47 Part15B	(H) Load	
Class:	B		
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions

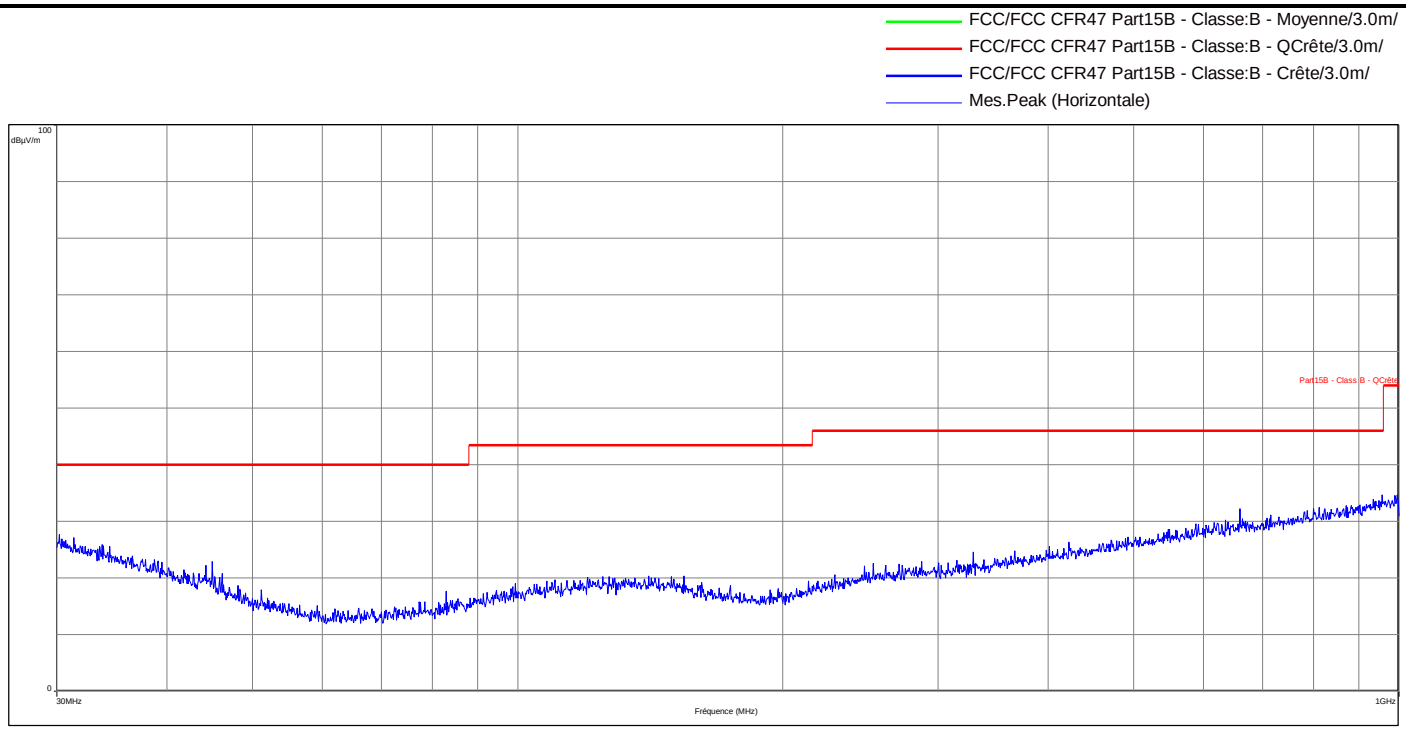
RADIATED EMISSIONS			
Graph name:	Emr#10	**Test configuration:**	
Limit:	FCC CFR47 Part15B	(V) Load	
Class:	B		
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions

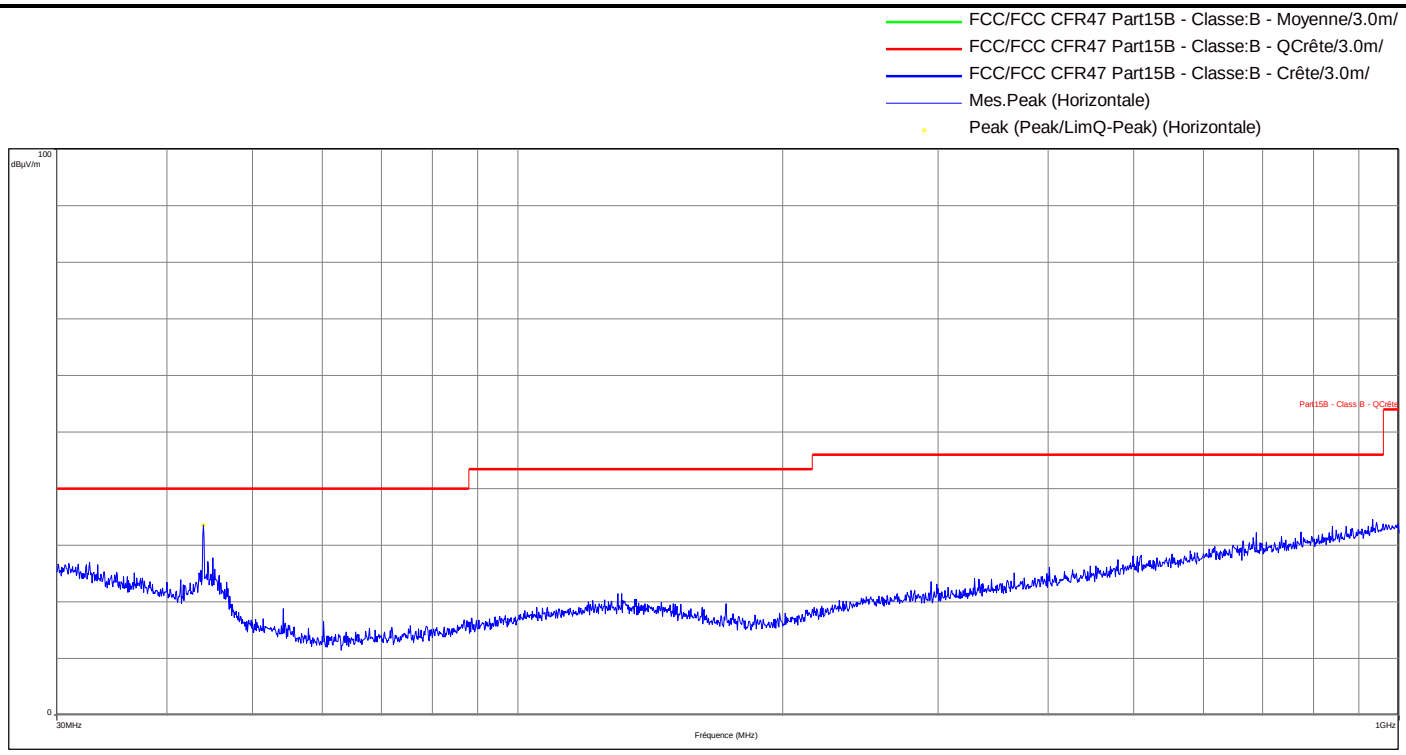
Frequency (MHz)	Peak (dBµV/m)
43.991	33.55

RADIATED EMISSIONS			
Graph name:	Emr#11	**Test configuration:**	
Limit:	FCC CFR47 Part15B	(H) Load	
Class:	B		
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions

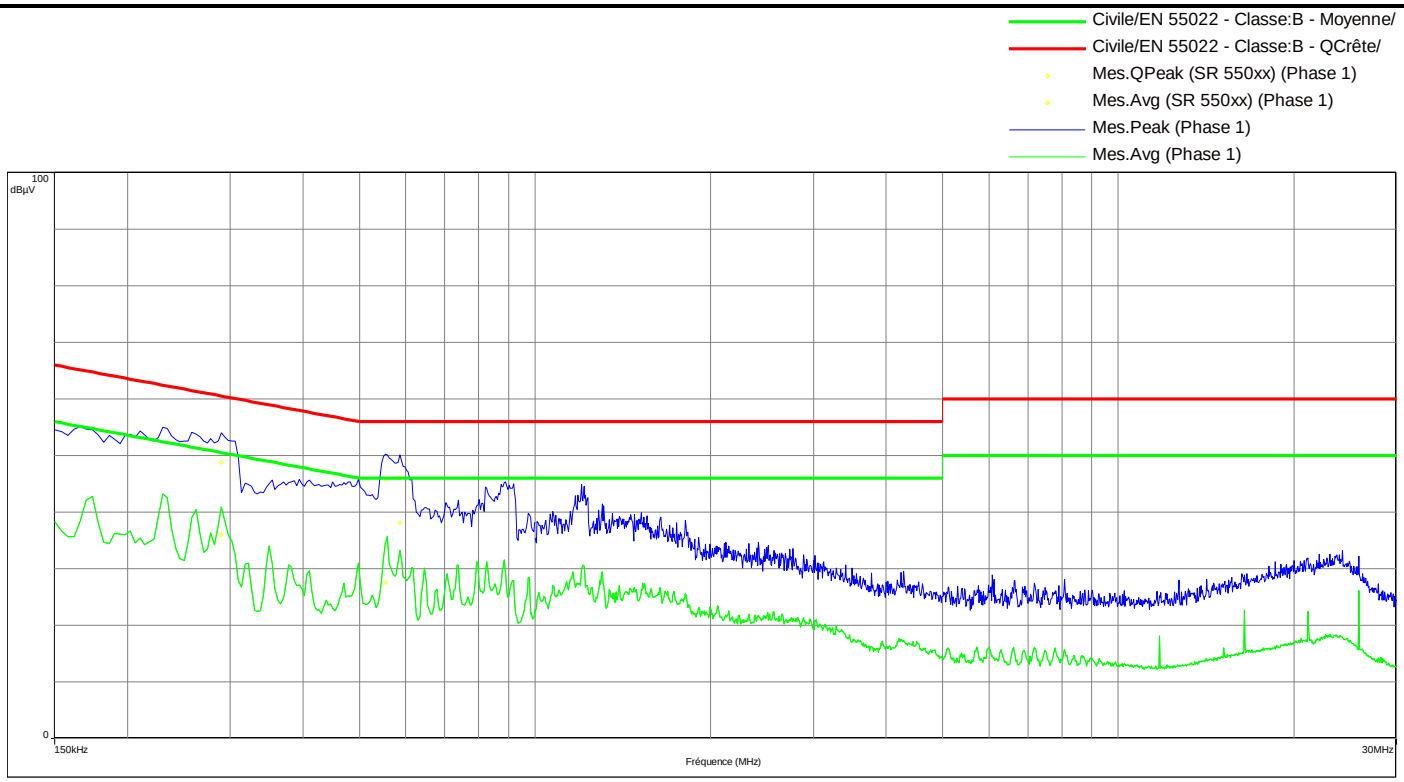
RADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	FCC CFR47 Part15B	(V) Load	
Class:	B		
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions

Fréquence (MHz)	Peak (dBµV/m)
43.991	33.55

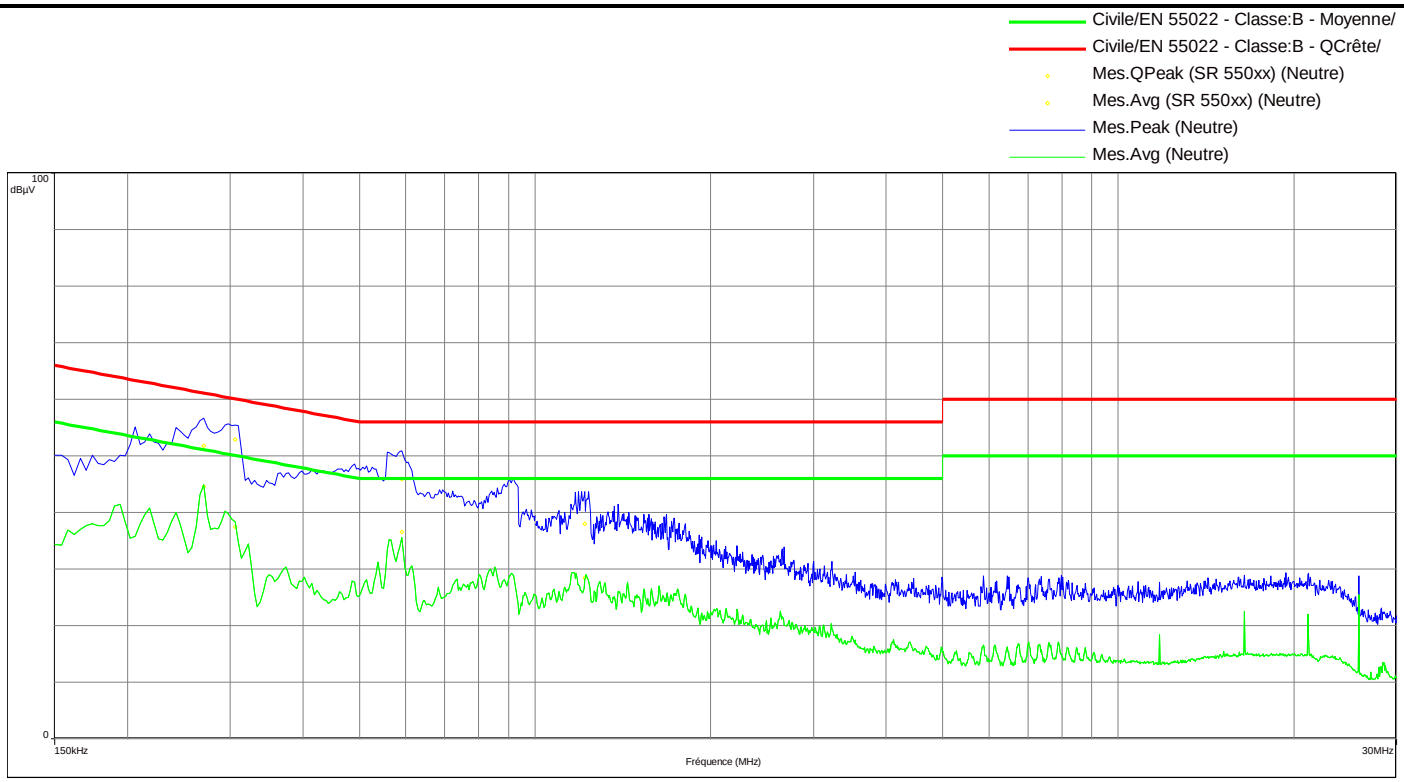
CONDUCTED EMISSIONS			
Graph name:	Emc#1	**Test configuration:**	
Limit:	EN 55022	P4-9 (P)	
Class:	B		
Frequency range: [150kHz - 30MHz]			
Voltage / Frequency:	120VAC / 60Hz	**RBW :**	10kHz
Line:	Phase	**VBW :**	30kHz



Spurious emissions

Frequency (MHz)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)
0.29	48.83	60.52	-11.7	36.03	50.52	-14.5
0.554	45.82	56	-10.18	27.57	46	-18.43
0.586	46.16	56	-9.84	38.13	46	-7.87

CONDUCTED EMISSIONS			
Graph name:	Emc#2	**Test configuration:**	
Limit:	EN 55022	P4-9 (N)	
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)
0.27	51.8	61.12	-9.32	44.56	51.12	-6.56
0.306	52.86	60.08	-7.22	37.42	50.08	-12.66
0.59	45.85	56	-10.15	36.56	46	-9.44
1.216	38.04	56	-17.96	28.39	46	-17.61

10. 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.*