



LCIE

# TEST REPORT

N°: 169405-756988-A (File#1053657)

Version : 01

**Subject** Electromagnetic compatibility tests according to the standards:  
FCC CFR 47 Part 18

**Issued to** **POLYGON PHYSICS**  
Bureau 13 - Bâtiment 4 du LPSC (CNRS)  
53 rue des Martyrs  
38026 - GRENOBLE  
France

**Apparatus under test**

↗ Product Electronic rack for plasma source  
↗ Trade mark **POLYGON PHYSICS**  
↗ Manufacturer **POLYGON PHYSICS**  
↗ Model under test **TES-63**  
↗ Serial number **TES-15-037**

**Conclusion** See Test Program chapter

**Test date** September 28, 2020 to September 30, 2020

**Test location** MOIRANS

**Sample receipt date** September 28, 2020

**Composition of document** 25 pages

**Document issued on** October 6, 2020

**Written by :**  
Jonathan SARTO  
**Tests operator**

**Approved by :**  
Nathalie BUGANZA  
**Technical manager**

This document shall not be reproduced, except in full, without the written approval of the LCIE. This document contains results related only to the items tested. It does not imply the conformity of the whole production to the items tested. Unless otherwise specified or rule defined by the test method, the decision of conformity doesn't take into account the uncertainty of measures. This document doesn't anticipate any certification decision.

**LCIE**

Laboratoire Central des Industries Electriques  
Une société de Bureau Veritas

ZI Centr'alp  
170 rue de Chatagnon  
38430 Moirans FRANCE

Tél : +33 4 76 07 36 36  
contact@lcie.fr  
www.lcie.fr



## PUBLICATION HISTORY

<b>Version</b>	<b>Date</b>	<b>Author</b>	<b>Modification</b>
01	October 6, 2020	Jonathan SARTO	Creation of the document

*Each new edition of this test report replaces and cancels the previous edition. The control of the old editions of report is under responsibility of client.*



**L C I E**

## SUMMARY

1.	TEST PROGRAM .....	4
2.	EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER) .....	5
3.	MEASUREMENT OF CONDUCTED EMISSION.....	9
4.	MEASUREMENT OF RADIATED EMISSION (30MHZ-24.5GHZ).....	17
5.	UNCERTAINTIES CHART .....	25



## 1. TEST PROGRAM

### 1.1. FCC PART18

#### Standard:

✓ FCC Part 18 (ISM)

#### 1.1.1. Requirements for ISM equipment – RF power <500W

EMISSION TEST	LIMITS			RESULTS (Comments)
Limits for conducted disturbance 150kHz-30MHz	Access: AC power			PASS
	Frequency	Quasi-peak	Average	
	150-500kHz	66 to 56 dBµV	56 to 46 dBµV	
	0.5-5MHz	56 dBµV	46 dBµV	
	5-30MHz	60 dBµV	50 dBµV	
Radiated emissions 150kHz-24.5GHz	Access: Enclosure port of ancillary equipment			PASS
	Frequency	Average @10m		
	ISM frequency	57.5 dBµV/m		
	Non-ISM frequency	53.0 dBµV/m		

NP: Not Performed / NA: Not Applicable / NR: Not Requested by the customer (It cannot be taken into account for the declaration of conformity)  
§FCC Part18 §18.309 (a):

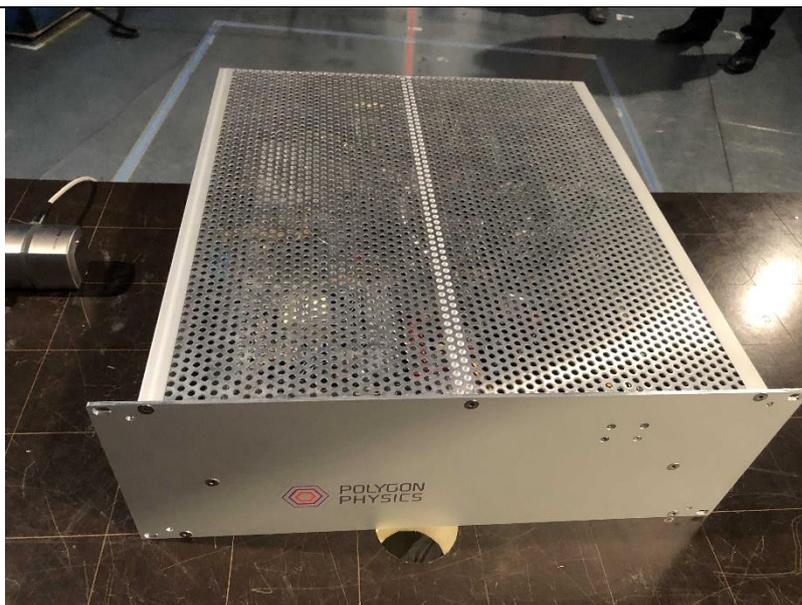
Frequency band in which device operates (MHz)	Range of frequency measurements	
	Lowest frequency	Highest frequency
Below 1.705	Lowest frequency generated in the device, but not lower than 9 kHz	30 MHz.
1.705 to 30	Lowest frequency generated in the device, but not lower than 9 kHz	400 MHz.
30 to 500	Lowest frequency generated in the device or 25 MHz, whichever is lower	Tenth harmonic or 1,000 MHz, whichever is higher.
500 to 1,000	Lowest frequency generated in the device or 100 MHz, whichever is lower	Tenth harmonic.
Above 1,000	.....do	Tenth harmonic or highest detectable emission.

**2. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)**

**2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):**

**Equipment under test (EUT):**  
TES-63

Serial Number: TES-15-037



Equipment Under Test

**Power supply:**

During all the tests, EUT is supplied by  $V_{nom}$ : 240 VAC  
For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply1	<input checked="" type="checkbox"/> AC <input type="checkbox"/> DC <input type="checkbox"/> Battery	100-240VAC	-	-

**Voltage table used for conducted emission:**

Type	Measurement performed:	
<input checked="" type="checkbox"/> AC	<input checked="" type="checkbox"/> 120VAC/60Hz	<input checked="" type="checkbox"/> 240VAC/50Hz
<input type="checkbox"/> DC	<input type="checkbox"/> 120VAC/60Hz (Supply auxiliary)	<input type="checkbox"/> 240VAC/50Hz (Supply auxiliary)
<input type="checkbox"/> USB (Laptop auxiliary)	<input type="checkbox"/> 120VAC/60Hz (Laptop auxiliary)	<input type="checkbox"/> 240VAC/50Hz(Laptop auxiliary)



**Voltage table used for radiated emission:**

Type	Measurement performed:	
<input checked="" type="checkbox"/> AC	<input type="checkbox"/> 120VAC/60Hz	<input checked="" type="checkbox"/> 240VAC/50Hz
<input type="checkbox"/> DC	<input type="checkbox"/> 120VAC/60Hz (Supply auxiliary)	<input type="checkbox"/> 240VAC/50Hz (Supply auxiliary)
<input type="checkbox"/> USB (Laptop auxiliary)	<input type="checkbox"/> 120VAC/60Hz (Laptop auxiliary)	<input type="checkbox"/> 240VAC/50Hz(Laptop auxiliary)

**Inputs/outputs - Cable:**

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply1	C13	2.5	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-
Access1	HV1 (Hight voltage cable)	5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-
Access2	HV2 (Hight voltage cable)	5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-
Access3	Coaxial cable (microwave power)	5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-
Access4	RJ45 Ethernet	10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Connected on laptop
Access5	Subd9 (serial)	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Connected on laptop
Access6	Subd9 (gas valve)	5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Connected to EVR valve
Access7	Subd9 (data enter)	-	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Termination plug
Access8	Subd15 (data enter 2)	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
Access9	Earth	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-

**Auxiliary equipment used during test:**

Type	Reference	Sn	Comments
Laptop	LENOVO	-	-
Vacuum	Pfeiffer EVR 116	-	-





## 2.4. SPECIAL ACCESSORIES

None

## 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 52.5dB $\mu$ V is obtained. The antenna factor of 7.4 and a cable factor of 1.1 is added. The amplifier gain of 29dB is subtracted, giving field strength of 32 dB $\mu$ V/m.

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

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

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

## 2.6. 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. MEASUREMENT OF CONDUCTED EMISSION

#### 3.1. ENVIRONMENTAL CONDITIONS

Date of test : September 30, 2020  
Test performed by : Jonathan SARTO  
Atmospheric pressure (hPa) : 992  
Relative humidity (%) : 51  
Ambient temperature (°C) : 19

#### 3.2. TEST SETUP

##### **Mains terminals**

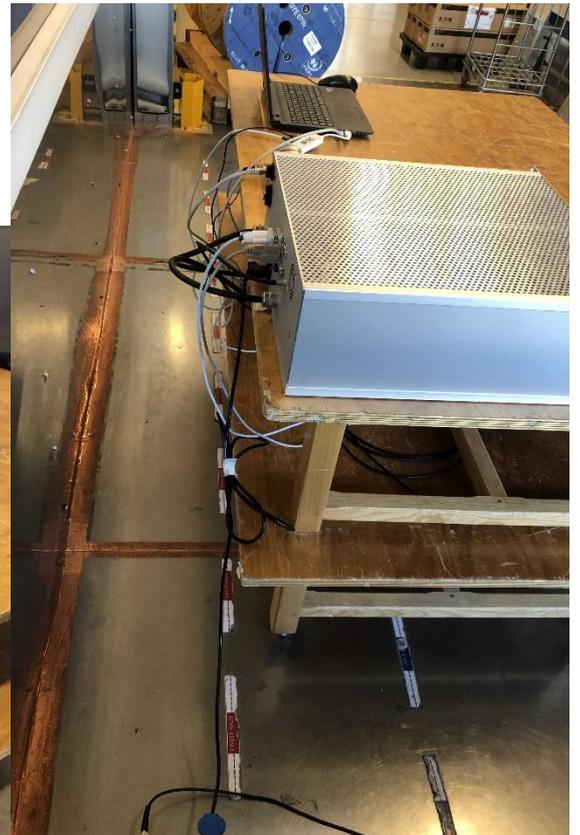
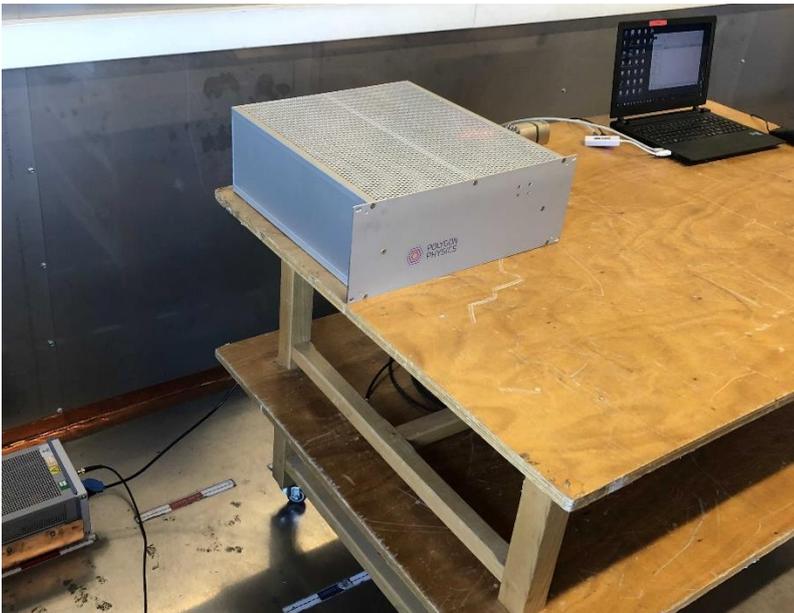
The EUT and auxiliaries are set:

- 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 FCC Part 18. The product has been tested with a voltage sets (see the table voltage in §2.2) and compared to the FCC Part 18. 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 (for example). Graphs are obtained in PEAK detection. Measures are also performed in Quasi-Peak and Average for any strong signal.

### 3.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
BAT EMC	NEXIO	v3.19.1.23	L1000115		
Cable + self	–	–	A5329578	02/20	02/21
EMC comb generator	LCIE SUD EST	–	A3169098		
LISN	ROHDE & SCHWARZ	ENV216	C2320291	06/20	06/21
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	12/17	09/20
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	12/20
Transient limiter	ROHDE & SCHWARZ	ESH3-Z2	A7122204	08/20	08/21

### 3.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

- None                       Divergence:



### 3.6. TEST RESULTS

#### AC tests Results:

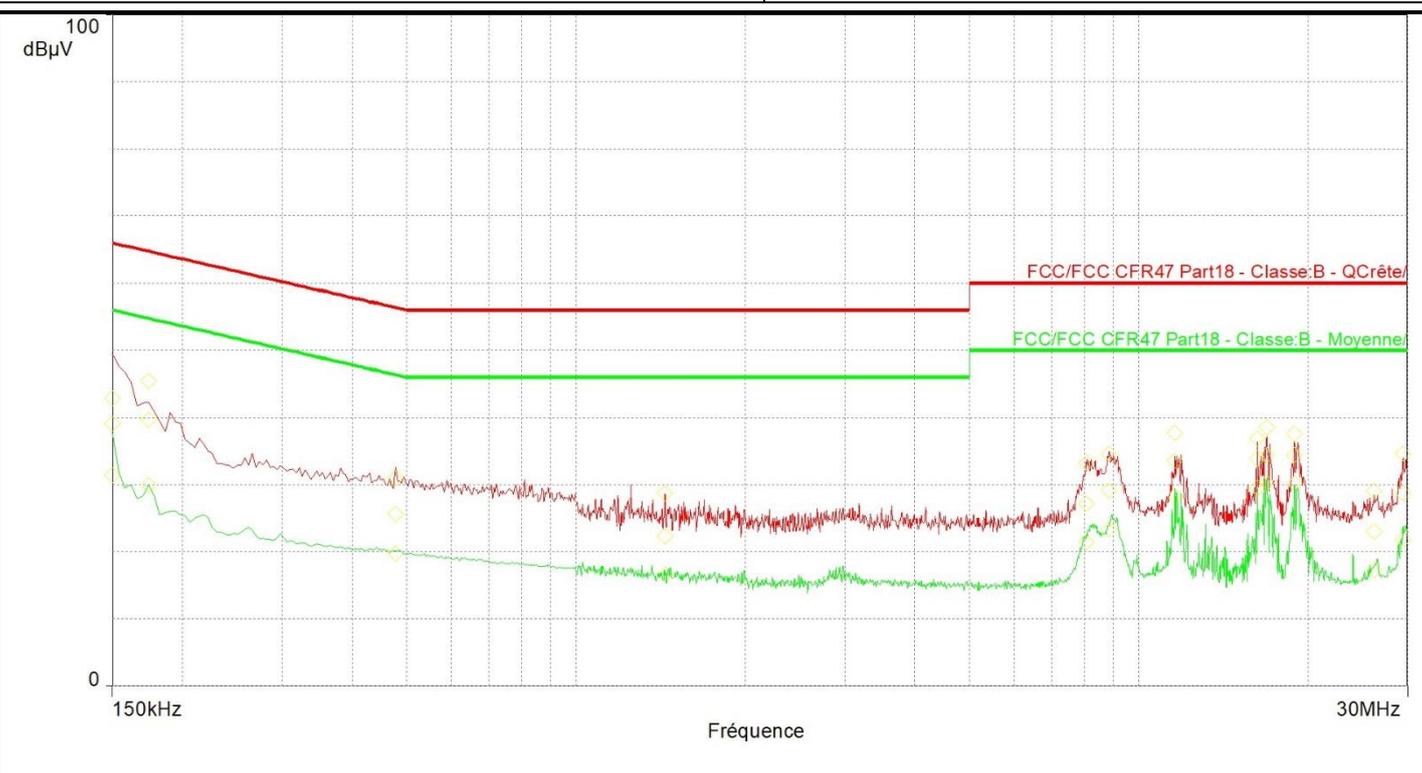
Measurements are performed on the phase (L1) and neutral (N) of the power line.

#### Results: (PEAK detection)

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

#### CONDUCTED EMISSIONS

<b>Graph name:</b>	Emc#1	<b>Test configuration:</b>
<b>Limit:</b>	FCC CFR47 Part18	Phase 120/60Hz
<b>Class:</b>	-	
<b>Frequency range: [150kHz - 30MHz]</b>		
<b>Voltage / Frequency:</b>	120VAC / 60Hz	<b>RBW :</b> 10kHz
<b>Line:</b>	Phase	<b>VBW :</b> 30kHz



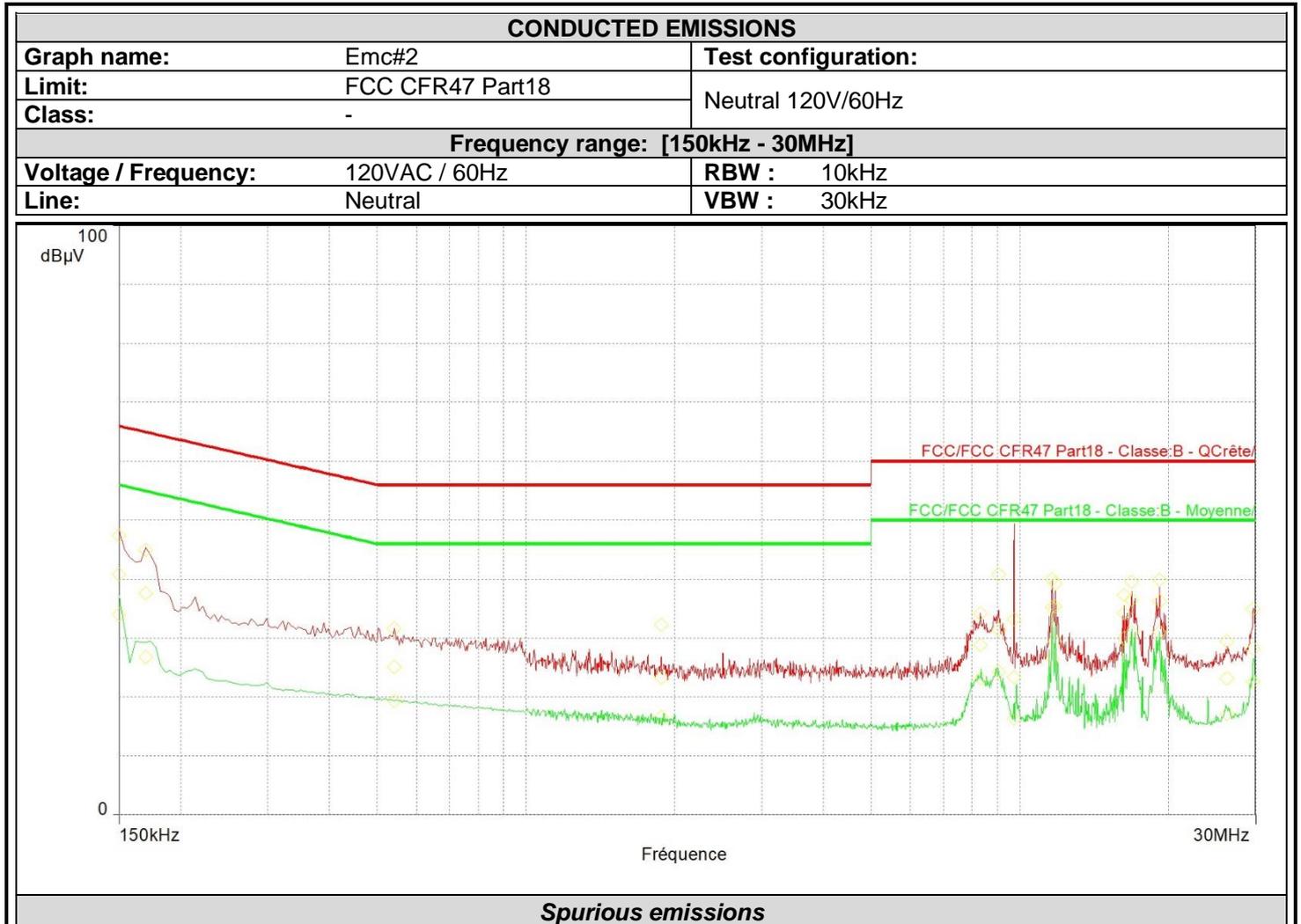
#### Spurious emissions

Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)	Correction (dB)
0.150	42.9	39.1	66.0	-26.9	31.4	56.0	-24.6	19.4
0.174	45.5	39.7	64.8	-25.1	30.0	54.8	-24.8	19.4
0.478	31.0	25.6	56.4	-30.8	19.8	46.4	-26.6	19.5



L C I E

Frequency (MHz)	Mes.Peak (dBμV)	Mes.QPeak (dBμV)	LimQP (dBμV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBμV)	LimAvg (dBμV)	Mes.Avg-LimAvg (dB)	Correction (dB)
1.440	28.8	22.4	56.0	-33.6	16.6	46.0	-29.4	19.6
8.080	33.2	27.2	60.0	-32.8	21.4	50.0	-28.6	20.1
8.856	34.6	29.1	60.0	-30.9	23.3	50.0	-26.7	20.2
11.588	37.7	33.5	60.0	-26.5	28.4	50.0	-21.6	20.4
16.228	36.9	33.9	60.0	-26.1	29.5	50.0	-20.5	20.7
16.900	38.6	34.4	60.0	-25.6	30.2	50.0	-19.8	20.8
18.916	37.6	34.4	60.0	-25.6	30.2	50.0	-19.8	20.9
26.152	29.0	23.1	60.0	-36.9	17.2	50.0	-32.8	21.3
29.432	34.6	28.7	60.0	-31.3	21.8	50.0	-28.2	21.5





L C I E

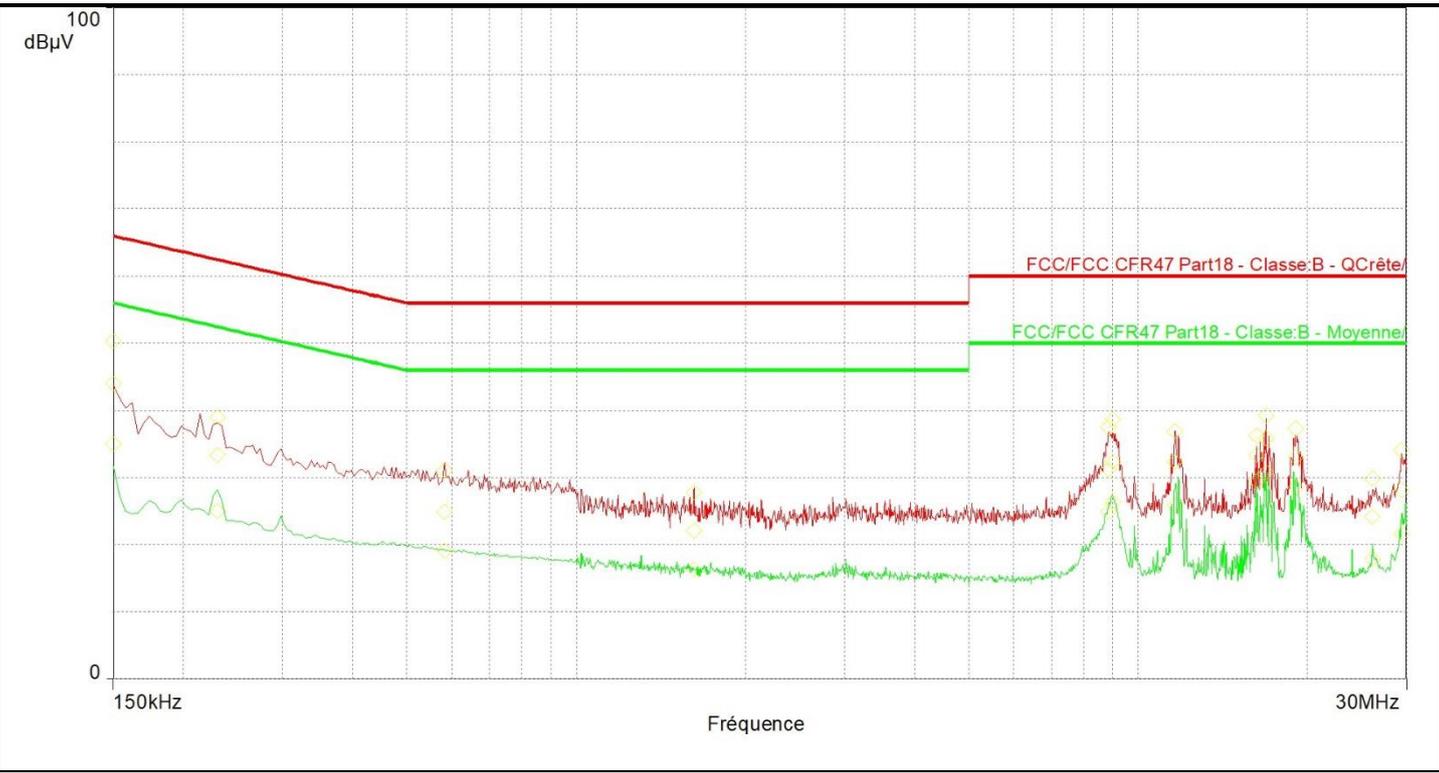
Frequency (MHz)	Mes.Peak (dB $\mu$ V)	Mes.QPeak (dB $\mu$ V)	LimQP (dB $\mu$ V)	Mes.QPeak-LimQP (dB)	Mes.Avg (dB $\mu$ V)	LimAvg (dB $\mu$ V)	Mes.Avg-LimAvg (dB)	Correction (dB)
0.150	47.5	40.8	66.0	-25.2	34.0	56.0	-22.0	19.4
0.170	45.0	37.6	65.0	-27.4	26.8	55.0	-28.2	19.4
0.542	31.6	25.1	56.0	-30.9	19.4	46.0	-26.6	19.5
1.880	32.3	23.3	56.0	-32.7	16.6	46.0	-29.4	19.6
8.312	34.2	28.8	60.0	-31.2	23.1	50.0	-26.9	20.2
9.056	40.9	31.4	60.0	-28.6	24.3	50.0	-25.7	20.2
9.720	33.2	23.4	60.0	-36.6	16.4	50.0	-33.6	20.2
11.612	40.0	35.2	60.0	-24.8	26.5	50.0	-23.5	20.4
11.804	39.3	35.4	60.0	-24.6	29.5	50.0	-20.5	20.4
16.228	37.3	34.2	60.0	-25.8	30.0	50.0	-20.0	20.7
16.840	39.6	36.5	60.0	-23.5	31.0	50.0	-19.0	20.8
19.156	39.8	36.2	60.0	-23.8	31.0	50.0	-19.0	20.9
26.260	29.4	23.1	60.0	-36.9	17.2	50.0	-32.8	21.3
29.668	34.9	28.2	60.0	-31.8	22.6	50.0	-27.4	21.5



L C I E

**CONDUCTED EMISSIONS**

<b>Graph name:</b>	Emc#3	<b>Test configuration:</b>	
<b>Limit:</b>	FCC CFR47 Part18	Phase 240V/50Hz	
<b>Class:</b>	-		
<b>Frequency range: [150kHz - 30MHz]</b>			
<b>Voltage / Frequency:</b>	240VAC / 50Hz	<b>RBW :</b>	10kHz
<b>Line:</b>	Phase	<b>VBW :</b>	30kHz

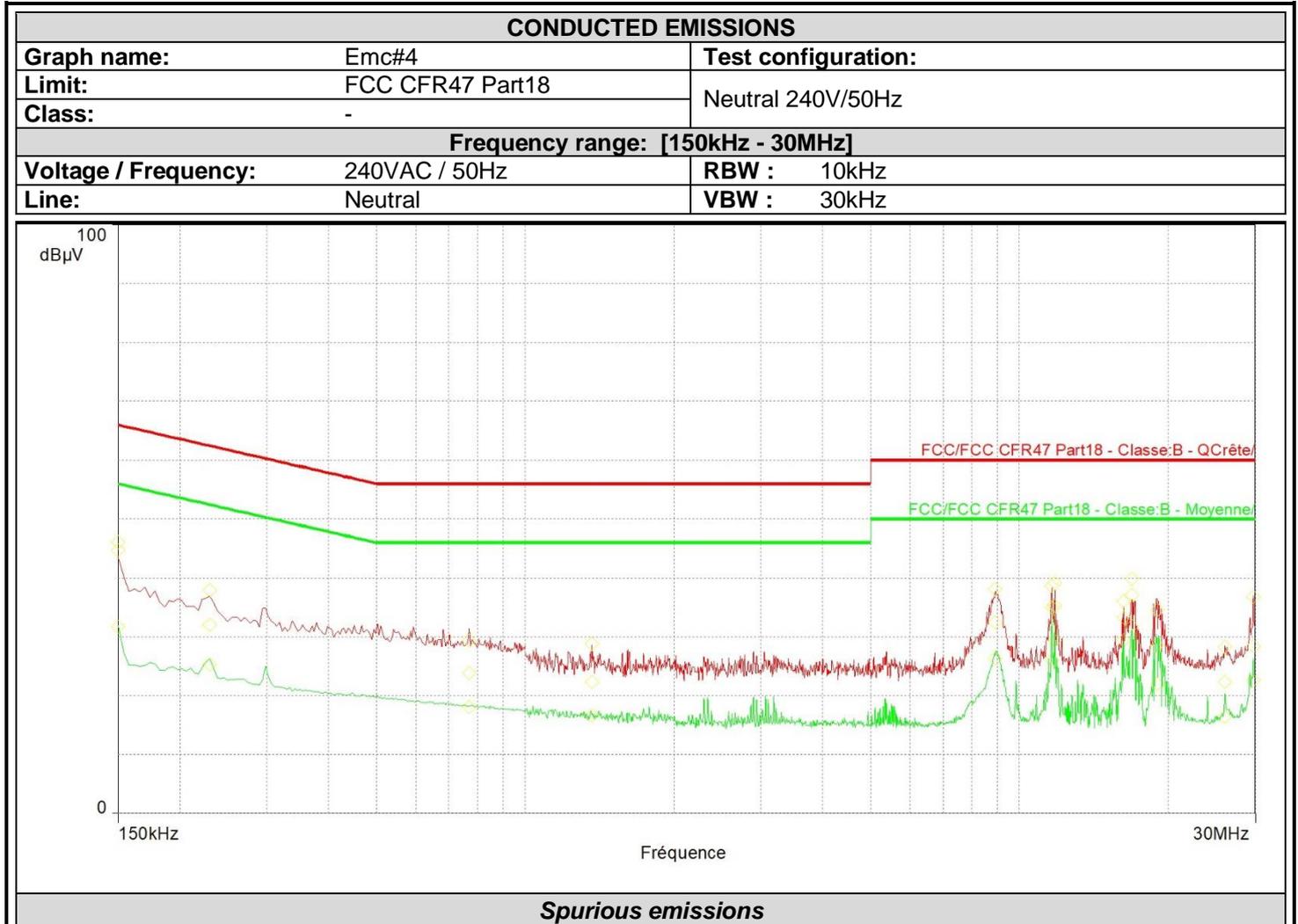


**Spurious emissions**

Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)	Correction (dB)
0.150	50.4	44.0	66.0	-22.0	35.0	56.0	-21.0	19.4
0.230	39.0	33.4	62.4	-29.0	25.0	52.4	-27.5	19.5
0.582	31.2	24.9	56.0	-31.1	19.1	46.0	-26.9	19.5
1.620	27.8	22.1	56.0	-33.9	16.3	46.0	-29.7	19.6
8.844	37.5	31.2	60.0	-28.8	24.9	50.0	-25.1	20.2
9.020	38.6	32.4	60.0	-27.6	26.3	50.0	-23.7	20.2
11.620	36.9	32.3	60.0	-27.7	25.9	50.0	-24.1	20.4
16.228	36.2	33.4	60.0	-26.6	29.4	50.0	-20.6	20.7
16.900	39.3	35.8	60.0	-24.2	30.8	50.0	-19.2	20.8
19.052	37.3	33.1	60.0	-26.9	28.5	50.0	-21.5	20.9
26.132	29.9	24.2	60.0	-35.8	17.9	50.0	-32.1	21.3
29.416	34.1	28.1	60.0	-31.9	21.6	50.0	-28.4	21.5



L C I E



Frequency (MHz)	Mes.Peak (dBµV)	Mes.QPeak (dBµV)	LimQP (dBµV)	Mes.QPeak-LimQP (dB)	Mes.Avg (dBµV)	LimAvg (dBµV)	Mes.Avg-LimAvg (dB)	Correction (dB)
0.150	46.1	44.7	66.0	-21.3	31.7	56.0	-24.3	19.4
0.230	37.9	32.1	62.4	-30.4	25.3	52.4	-27.1	19.5
0.770	29.4	23.9	56.0	-32.1	18.1	46.0	-27.9	19.5
1.364	28.9	22.4	56.0	-33.6	16.6	46.0	-29.4	19.6
8.936	38.1	32.4	60.0	-27.6	26.4	50.0	-23.6	20.2
11.616	38.6	35.1	60.0	-24.9	26.0	50.0	-24.0	20.4
11.804	39.1	35.2	60.0	-24.8	29.3	50.0	-20.7	20.4
16.228	36.1	33.2	60.0	-26.8	29.4	50.0	-20.6	20.7
16.900	39.9	37.1	60.0	-22.9	31.8	50.0	-18.2	20.8
19.032	34.6	28.6	60.0	-31.4	22.0	50.0	-28.0	20.9
26.048	28.3	22.4	60.0	-37.6	16.5	50.0	-33.5	21.3
29.748	36.8	28.4	60.0	-31.6	22.7	50.0	-27.3	21.5



### 3.7. CONCLUSION

The sample of the equipment **TES-63**, Sn: **TES-15-037**, tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part18, for conducted emissions.

## 4. MEASUREMENT OF RADIATED EMISSION (30MHz-24.5GHz)

### 4.1. ENVIRONMENTAL CONDITIONS

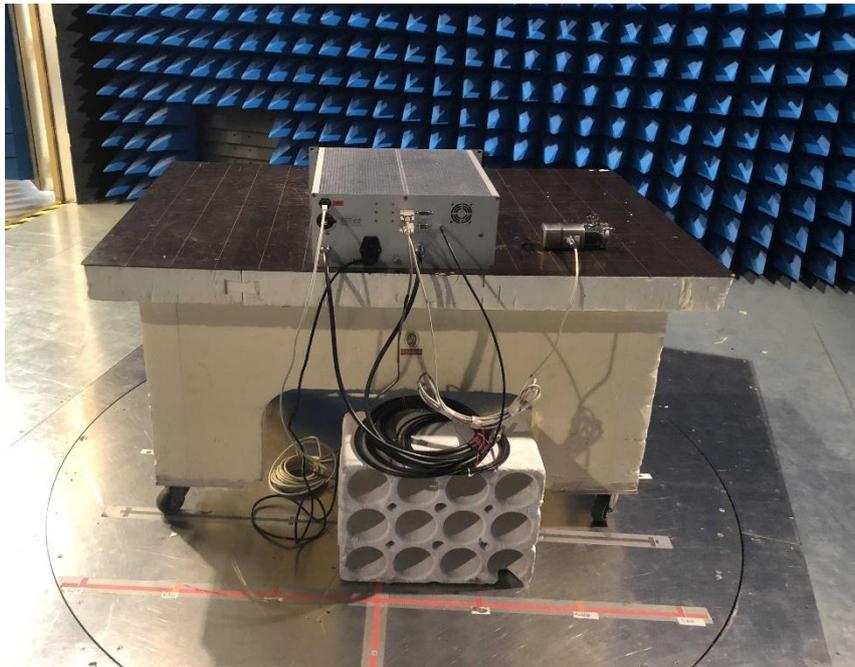
Date of test	: September 28, 2020	September 30, 2020
Test performed by	: Jonathan SARTO	Jonathan SARTO
Atmospheric pressure (hPa)	: 993	992
Relative humidity (%)	: 512	51
Ambient temperature (°C)	: 20	19

### 4.2. TEST SETUP

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

The product has been tested according to FCC Part 18.

Pre-characterisation measurement: (150kHz – 24.5GHz)

A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber for frequency from 150kHz to 24.5GHz. 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 from 150kHz to 1GHz and AVERAGE from 1GHz to 24.5GHz. Note: graphs are only for 150kHz – 12GHz



Characterization on 3 meters full anechoic chamber from 1GHz to 24.5GHz:

The product has been tested at a distance of **3 meters** from the antenna and compared to the FCC part 18 limits. Measurement bandwidth was 1MHz from 1GHz to 24.5GHz.

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)

Frequency list has been created with anechoic chamber pre-scan results.

#### 4.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	Manufacturer	Model	Identifier	Cal_Date	Cal_Due
Amplifier 10kHz - 18GHz	LCIE SUD EST	_	A7085028	10/19	10/20
Antenna Bi-log	AH System	SAS-521-7	C2040180	10/18	10/20
Antenna horn 18GHz	EMCO	3115	C2042027	04/18	09/20
Antenna mast (Cage#1)	MATURO Gmbh	AM 4.0	F2000407		
BAT EMC	NEXIO	v3.19.1.23	L1000115		
Cable 0.75m	SUCOFLEX	18GHz	A5329920	09/19	09/20
CALCUL_FACTEURS	LCIE SUD EST	V4	L2000035		
Emission Cable	SUCOFLEX	18GHz	A5329899	07/19	11/20
HF Radiated emission comb generator	LCIE SUD EST	_	A3169088		
Immunity Cable	MICRO-COAX	6GHz	A5329650	07/20	07/21
Radiated emission comb generator	BARDET	_	A3169050		
Semi-Anechoic chamber #1 (BF)	SIEPEL	_	D3044016_BF	07/19	07/22
Semi-Anechoic chamber #1 (VSWR)	SIEPEL	_	D3044016_VSWR	07/19	07/22
Table C1/OATS	MATURO Gmbh	_	F2000437		
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	12/20
Turntable chamber (Cage#1)	MATURO Gmbh	TT 2.0 SI	F2000406		
Turntable controller (Cage#1)	MATURO Gmbh	Control Unit	F2000408		
CABLE N 3m	_	-	A5329206	07/20	07/21
Spectrum analyzer	ROHDE & SCHWARZ	FSU 26	A4060058	09/19	09/21
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	05/21	05/23

#### 4.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

Divergence:

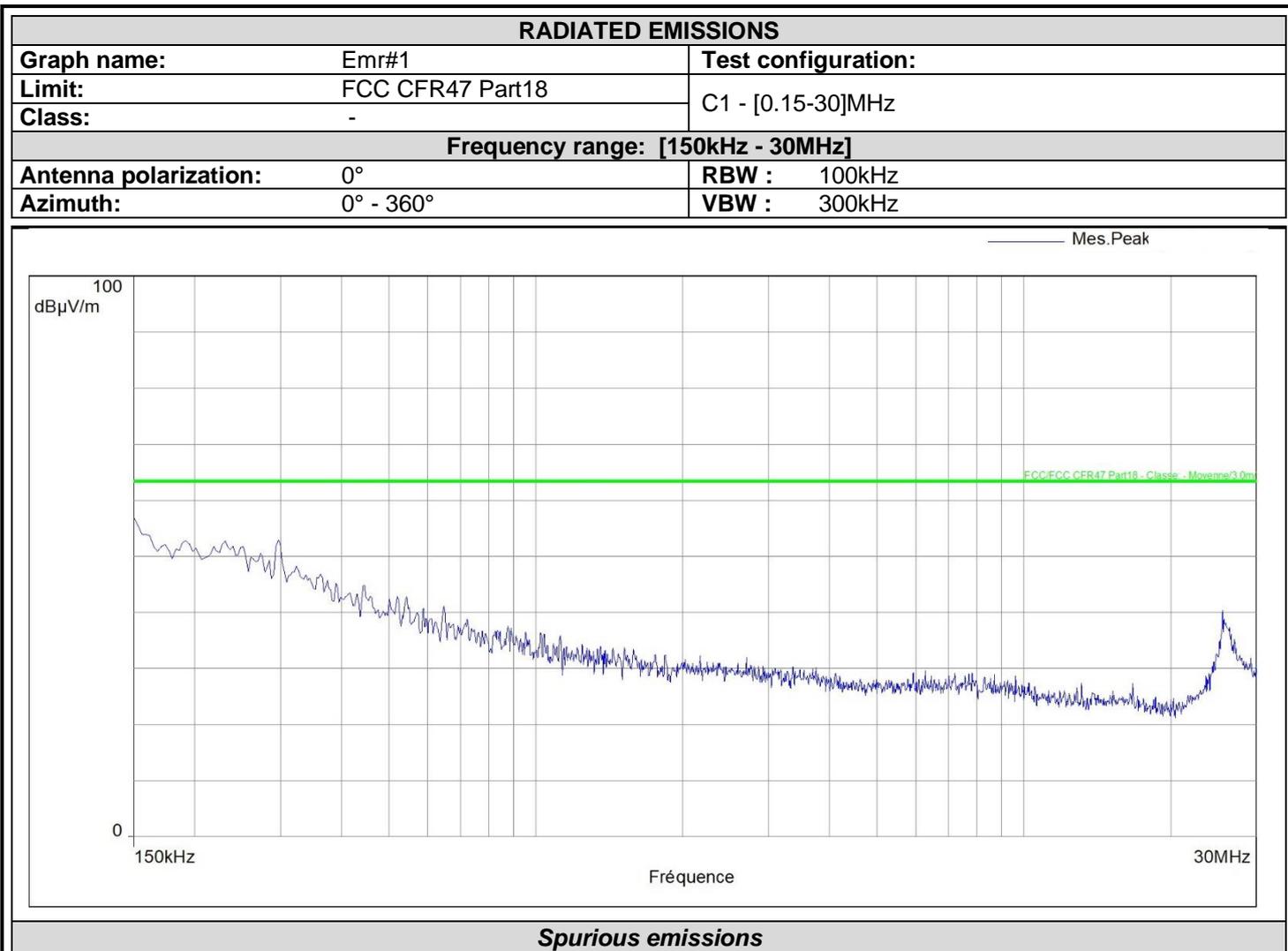


**4.6. TEST RESULTS**

**4.6.1. Pre-characterization at 3 meters [150kHz-30MHz]**

See graph for 150kHz-30MHz band:

Graph identifier	Polarization	EUT position	Comments	
Emr# 1	0°	Axis XY	-	See below
Emr# 2	90°	Axis XY	-	See below
Emr# 3	180°	Axis XY	-	See below



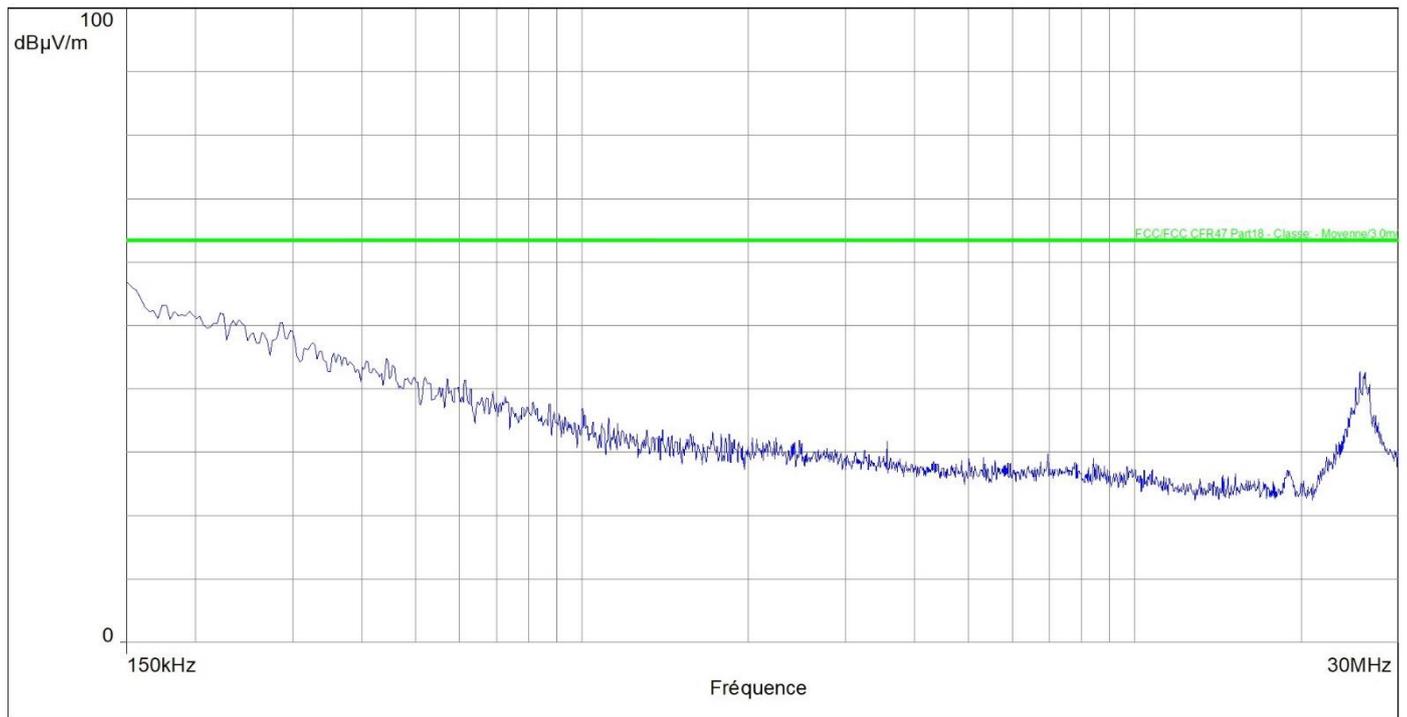
No significant frequency observed



L C I E

### RADIATED EMISSIONS

<b>Graph name:</b>	Emr#2	<b>Test configuration:</b>
<b>Limit:</b>	FCC CFR47 Part18	C1 - [0.15-30]MHz
<b>Class:</b>	-	
<b>Frequency range: [150kHz - 30MHz]</b>		
<b>Antenna polarization:</b>	90°	<b>RBW :</b> 100kHz
<b>Azimuth:</b>	0° - 360°	<b>VBW :</b> 300kHz



### Spurious emissions

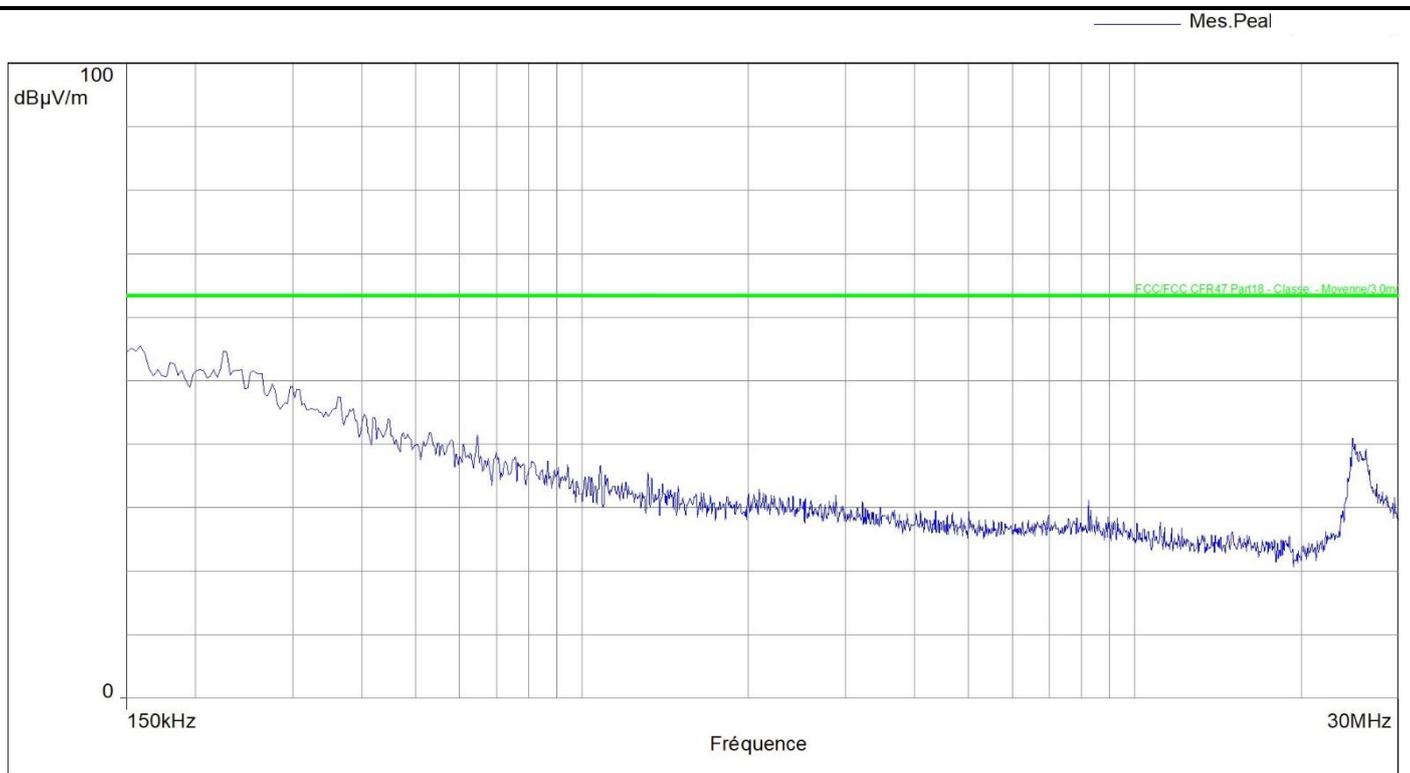
No significative frequency observed



L C I E

### RADIATED EMISSIONS

<b>Graph name:</b>	Emr#3	<b>Test configuration:</b>
<b>Limit:</b>	FCC CFR47 Part18	C1 - [0.15-30]MHz
<b>Class:</b>	-	
<b>Frequency range: [150kHz - 30MHz]</b>		
<b>Antenna polarization:</b>	180°	<b>RBW :</b> 100kHz
<b>Azimuth:</b>	0° - 360°	<b>VBW :</b> 300kHz



### Spurious emissions

*No significant frequency observed*



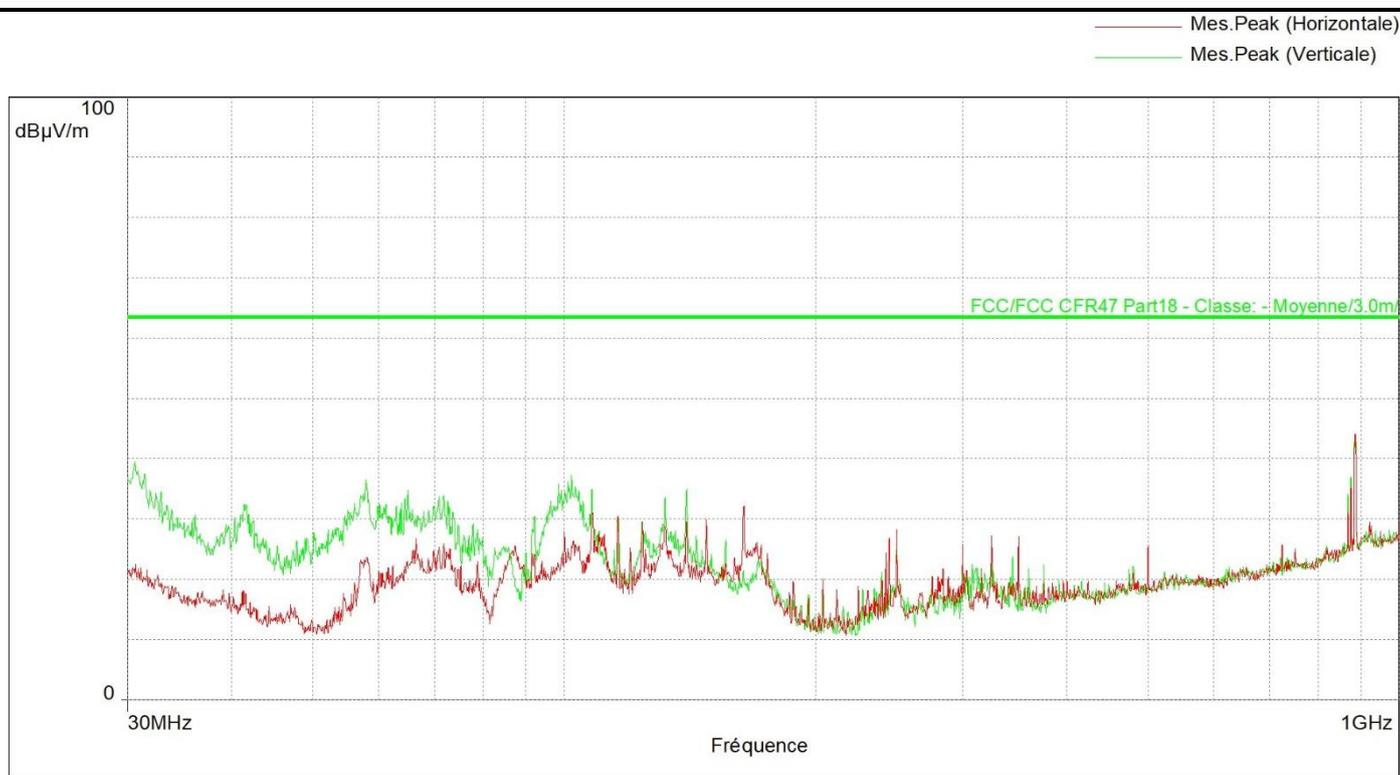
#### 4.6.2. Pre-characterization at 3 meters [30MHz-1GHz]

See graphs for 30MHz-1GHz:

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

#### RADIATED EMISSIONS

<b>Graph name:</b>	Emr#4	<b>Test configuration:</b>
<b>Limit:</b>	FCC CFR47 Part18	C1 - (H+V)[0.03-1]GHz
<b>Class:</b>	-	
<b>Frequency range: [30MHz - 1GHz]</b>		
<b>Antenna polarization:</b>	Horizontal & Vertical	<b>RBW :</b> 100kHz
<b>Azimuth:</b>	0° - 360°	<b>VBW :</b> 300kHz



#### Spurious emissions

No significant frequency observed

#### 4.6.3. Pre-characterization at 3 meters [1GHz-24.5GHz]

See graphs for 1GHz-12GHz:

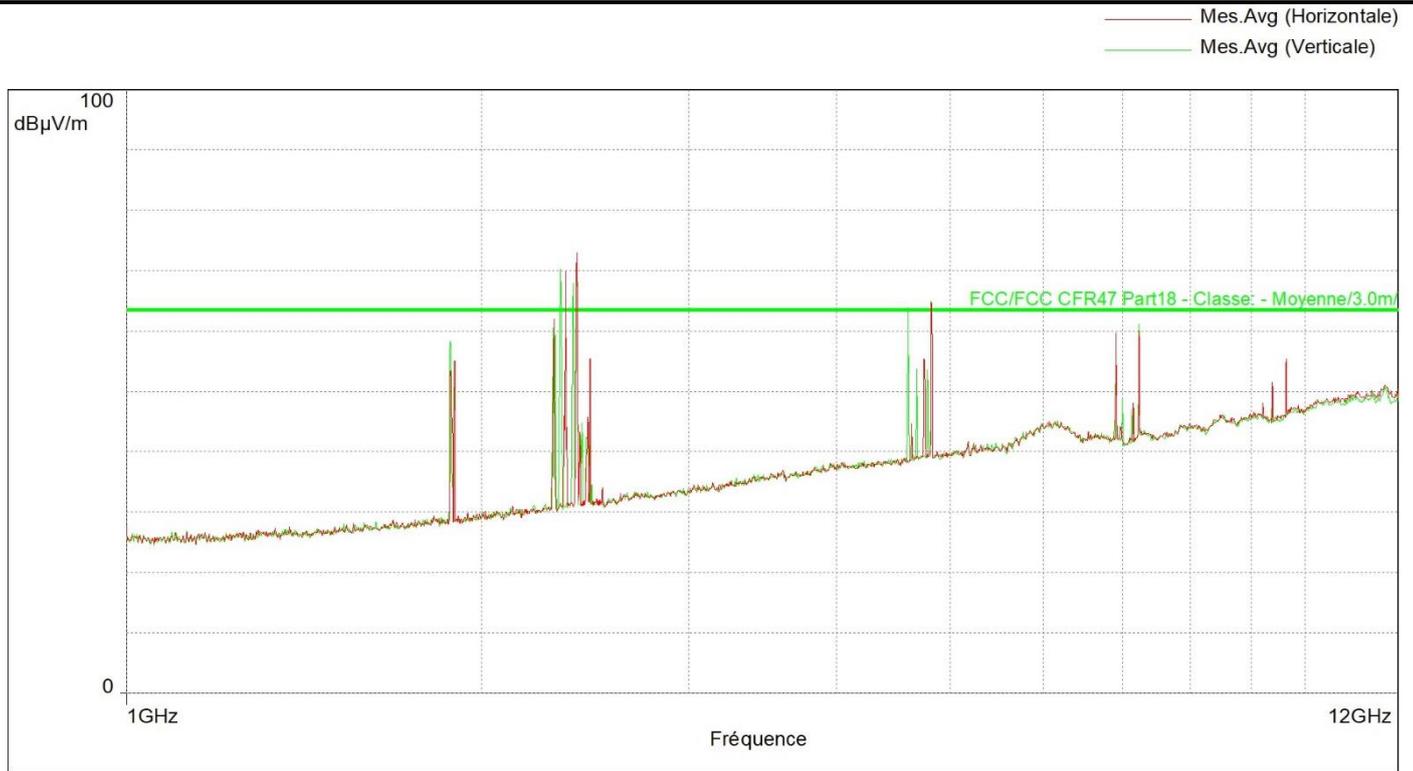
Graph identifier	Polarization	EUT position	Comments
Emr# 5	Horizontal & Vertical	Axis XY	- See annex 1



L C I E

**RADIATED EMISSIONS**

<b>Graph name:</b>	Emr#5	<b>Test configuration:</b>
<b>Limit:</b>	FCC CFR47 Part18	C1 - (H+V)[1-12]GHz
<b>Class:</b>	-	
<b>Frequency range: [1GHz - 12GHz]</b>		
<b>Antenna polarization:</b>	Horizontal & Vertical	<b>RBW :</b> 1MHz
<b>Azimuth:</b>	0° - 360°	<b>VBW :</b> 3MHz



**Spurious emissions**

Frequency (MHz)	Mes.Avg (dBµV/m)	Limite (dBµV/m)	Mes.-Lim. (dB)	Hauteur (m)	Correction (dB)
2357.000	41.4	63.5	-22.1	1.0	7.6
6911.125	53.0	63.5	-10.6	1.0	17.2
1881.300	35.4	63.5	-28.1	1.0	5.5
2304.250	41.5	63.5	-22.0	1.0	7.2
2334.312	41.6	63.5	-22.0	1.0	7.4
2392.625	41.5	63.5	-22.0	1.0	7.8
4602.469	43.6	63.5	-19.9	1.0	15.0
4819.812	51.3	63.5	-12.2	1.0	15.7
7229.875	53.9	63.5	-9.6	1.0	17.9

No significant frequencies above 12GHz



#### 4.6.1. Characterization 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 Average detection.

No	Frequency (MHz)	Average Limit (dBμV/m) @ 10m	Average (dBμV/m) @ 10m	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
No significative frequency observed									

Note: Measure have been done at 10m distance and corrected according to  $20\log(300/10)$ dB.

#### 4.6.2. Characterization 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 Average detection.

No	Frequency (MHz)	Average Limit (dBμV/m) @ 10m	Average (dBμV/m) @ 10m	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
No significative frequency observed									

Note: Measure have been done at 10m distance and corrected according to  $20\log(300/10)$ dB.

#### 4.6.3. Characterization on 3meters anechoic chamber from 1GHz to 24.5GHz

##### 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 Average detection.

No	Frequency (MHz)	Average Limit (dBμV/m) @ 10m	Average (dBμV/m) @ 10m	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
For 1-12GHz: see result board below graph									
For 12-24.5GHz: No significative frequency observed									

Note: Measure have been done at 10m distance and corrected according to  $20\log(300/3)$ dB.

##### Fundamental level:

Limite @3m 18.305 ISM band

$25\mu V/m @ 300m = 67.95dB\mu V/m @ 3m$

Fundamental power =  $65.6dB\mu V/m @ 3m$

## 4.7. CONCLUSION

The sample of the equipment **TES-63**, Sn: **TES-15-037**, tested in the configuration presented in this test report **satisfies** to requirements of the standard FCC Part18, for radiated emissions.



## 5. 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 (monophasé / triphasé) 150kHz-30MHz <i>Measurement of conducted disturbances in voltage on the power port ( single &amp; three phases) 150kHz-30MHz</i>	3.29dB	3.4dB
Mesure du champ électrique rayonné en cage de Faraday semi-anechoïque de 30MHz à 1GHz <i>Measurement of radiated electric field in half-anechoic Faraday room From 30MHz to 1GHz</i>	5.06dB	5.3dB
Mesure du champ électrique rayonné en cage de Faraday semi-anechoïque de 1GHz à 6GHz <i>Measurement of radiated electric field in half-anechoic Faraday room From 1GHz to 6GHz</i>	5.18dB	5.2dB
Mesure du champ électrique rayonné en cage de Faraday semi-anechoïque de 6GHz à 18GHz <i>Measurement of radiated electric field in half-anechoic Faraday room From 6GHz to 18GHz</i>	5.21dB	5.5dB

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par le CISPR, la conformité de l'échantillon est établie directement par les niveaux limites applicables. Ce tableau regroupe l'ensemble des incertitudes maximales pour les essais réalisables dans le laboratoire, qu'ils aient été ou non réalisés dans le cadre du présent rapport / *The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the CISPR. The conformity of the sample is directly established by the applicable limits values. This table includes all uncertainties maximum feasible for testing in the laboratory, whether or not made in this report*

Note - L'incertitude de mesure instrumentale est déterminée selon la CISPR 16-4-2. / *The instrumentation measurement uncertainty is determined according to CISPR16-4-2*