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# TEST REPORT

N°: 160571-735052-A(File#1017218)

Version : 01

**Subject** Electromagnetic compatibility tests according to the standards:  
FCC CFR 47 Part 15, Subpart C.  
ANSI C63.4 (2014)  
RSS-210 Issue 9

**Issued to** **ASTEEL FLASH**  
43 Chemin du Vieux Chêne  
38240 - MEYLAN  
FRANCE

## Apparatus under test

↳ Product Avalanche Beacon  
↳ Trade mark **ARVA**  
↳ Manufacturer **ARVA**  
↳ Model under test **EVO5**  
↳ Serial number **E500102-0324**  
↳ FCCID **O9BARVAEVO5**  
↳ IC **22008-ARVAEVO5**

**Conclusion** See Test Program chapter

**Test date** March 19, 2019 to March 25, 2019

**Test location** FONTENAY AUX ROSES

**Sample receipt date** March 19, 2019

**IC Test site** 6230B-1

**Composition of document** 25 pages

**Document issued on** May 13, 2019

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## PUBLICATION HISTORY

<b>Version</b>	<b>Date</b>	<b>Author</b>	<b>Modification</b>
01	May 13, 2019	Jonathan PAUC	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.*



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## SUMMARY

1.	TEST PROGRAM .....	4
2.	EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER).....	5
3.	MEASUREMENT OF RADIATED EMISSION (9KHZ-1GHZ) .....	8
4.	OCCUPIED BANDWIDTH.....	23
5.	UNCERTAINTIES CHART .....	25



## 1. TEST PROGRAM

### 1.1. FCC PART15B / ICES-003

**Standard:**

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

EMISSION TEST	LIMITS			RESULTS (Comments)
	Frequency	Quasi-peak value (dB $\mu$ V)	Average value (dB $\mu$ V)	
Limits for conducted disturbance at mains ports 150kHz-30MHz CFR 47 §15.207	150-500kHz	66 to 56	56 to 46	<input type="checkbox"/> PASS <input type="checkbox"/> FAIL <input checked="" type="checkbox"/> NA <input type="checkbox"/> NP
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 9kHz-30MHz CFR 47 §15.209 (a) RSS-Gen §4.9	<b>Measure at 300m</b> 9kHz-490kHz : 67.6dB $\mu$ V/m /F(kHz)			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
	<b>Measure at 30m</b> 490kHz-1.705MHz : 87.6dB $\mu$ V/m /F(kHz) 1.705MHz-30MHz : 29.5 dB $\mu$ V/m			
Radiated emissions 30MHz-25GHz* CFR 47 §15.209 (a) RSS-Gen §4.9 Highest frequency : (Declaration of provider)	<b>Measure at 3m</b> 30MHz-88MHz : 40 dB $\mu$ V/m 88MHz-216MHz : 43.5 dB $\mu$ V/m 216MHz-960MHz : 46.0 dB $\mu$ V/m Above 960MHz : 54.0 dB $\mu$ V/m			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Occupied bandwidth RSS-Gen Issue 5 §6.7	No limit			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
Receiver Spurious Emission** RSS-Gen Issue 5 §7.3	See RSS-Gen §7.3			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP

\*§15.33: The highest internal source of a testing device is defined like more the highest frequency generated or used in the testing device or on which the testing device works or agrees.

- If the highest frequency of the internal sources of the testing device is lower than 108 MHz, measurement must be only performed until 1GHz.

- If the highest frequency of the internal sources of the testing device ranges between 108 MHz and 500 MHz, measurement must be only performed until 2GHz.

- If the highest frequency of the internal sources of the testing device ranges between 500 MHz and 1 GHz, measurement must be only performed until 5GHz.

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

\*\*Testing covered the receive mode, and receiver spurious emissions are considered to be the same as transmitter.

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

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

**Equipment under test (EUT):**

**EVO5**

**Serial Number: E500102-0324**



Equipment Under Test

**Power supply:**

During all the tests, EUT is supplied by  $V_{nom}$ : 1.5VDC  
 For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply1	Battery AA	1.5VDC	-	-

**Inputs/outputs - Cable:**

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
None						

**Auxiliary equipment used during test:**

Type	Reference	Sn	Comments
None			



## 2.2. EUT CONFIGURATION – RUNNING MODE

Hardware information			
Highest internal frequency (PLL, Quartz, Clock, Microprocessor...):	<b>F<sub>Highest</sub>:</b>	<b>48MHz</b>	<b>MHz</b>
Firmware (if applicable):	<b>V. :</b>	<b>O17189-1-34-A</b>	
Software (if applicable):	<b>V. :</b>	<b>O17190-105-E</b>	

Frequency band:	<input checked="" type="checkbox"/> [457]kHz		
RF mode:	<input checked="" type="checkbox"/> Transmitter	<input type="checkbox"/> Transceiver	<input checked="" type="checkbox"/> Receiver <input type="checkbox"/> Standby
Type:	<input checked="" type="checkbox"/> Tracking, Tracing and Data Acquisition		<input type="checkbox"/> Other:
Bandwidth:	<input checked="" type="checkbox"/> Narrowband		
Equipment intended for use as a	<input type="checkbox"/> Fixed	<input type="checkbox"/> Mobile	<input checked="" type="checkbox"/> Portable
Type of equipment:	<input checked="" type="checkbox"/> Stand-alone	<input type="checkbox"/> Plug-in	<input type="checkbox"/> Combined
Antenna Type:	<input type="checkbox"/> External		<input checked="" type="checkbox"/> Internal
Antenna connector:	<input type="checkbox"/> Permanent external	<input checked="" type="checkbox"/> Permanent internal	<input type="checkbox"/> None <input type="checkbox"/> Temporary (only for tests)
Duty cycle:	<input type="checkbox"/> Continuous duty	<input type="checkbox"/> Intermittent duty	<input checked="" type="checkbox"/> Continuous operation
Equipment type:	<input checked="" type="checkbox"/> Production model		<input type="checkbox"/> Prototype

### Running mode n°1:

- EUT is set in ARVA transmitter mode

### Running mode n°2:

- EUT is set in ARVA receiver mode

## 2.3. EQUIPMENT MODIFICATIONS

None  Modification:

## 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 RADIATED EMISSION (9KHz-1GHz)

#### 3.1. ENVIRONMENTAL CONDITIONS

Date of test : March 19, 2019  
Test performed by : Jonathan PAUC  
Atmospheric pressure (hPa) : 991  
Relative humidity (%) : 31  
Ambient temperature (°C) : 20

#### 3.2. 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)

The EUT is powered by  $V_{nom}$ .



Test setup in anechoic chamber





### 3.3. TEST METHOD

The product has been tested according to ANSI C63.4, FCC part 15 subpart C.

Pre-characterisation measurement: (9kHz – 1GHz)

A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber for frequency from 30MHz 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. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration.

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 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.

### 3.4. TEST EQUIPMENT LIST

ANECHOIC CHAMBER – SPURIOUS / CARRIER MEASUREMENT					
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	CAL_DATE	CAL_DUE
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	10/18	10/20
Semi-Anechoic chamber #3	SIEPEL	-	D3044017	03/16	03/19*
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371	-	-
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444		
Table C3	LCIE	-	F2000461	-	-
Rehausse Table C3	LCIE	-	F2000511	-	-
BAT EMC	NEXIO	v3.9.0.10	L1000115	-	-
Amplifier 9kHz - 40GHz	LCIE SUD EST		A7102082	10/18	10/19
Cable 1 < GHz	-	< 1GHz	A5329637	02/19	02/20
Cable Measure @3m 18GHz	-	18GHz	A5329069	11/18	11/19
Cable Measure Analyzer-Amplifier SMA	STORMFLEX	26GHz	A5329873	01/19	01/20
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	11/17	11/19
Antenna Bi-log	CHASE	CBL6111A	C2040172	09/18	09/20
HF Radiated emission comb generator	LCIE SUD EST	-	A3169088	-	-
Spectrum analyzer	ROHDE & SCHWARZ	FSV30	A4060050	12/17	12/19

\*: under derogation

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

None                       Divergence:



### 3.6. TEST RESULTS

Pre-characterization at 3 meters [9kHz-30MHz]

#### 3.6.1.

See graph for 9kHz-30MHz band:

Graph identifier	Mode	Comments
Emr# 1,2,3,4	TX	See below
Emr# 7,8,9,10	RX	See below

#### 3.6.2. Pre-characterisation measurement (30MHz-1GHz):

Pre-scan measurement at 3m (PEAK detection, graph examples)

See graphs:

Graph identifier	Mode	Comments
Emr# 5,6	TX	See below
Emr# 11,12	RX	See below

#### 3.6.3. 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) @ 10m	Qpeak (dBµV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. Factor (dB)	Comments
1	0.457	73.5	52.6	-20.9	285	90°	100	45.0	/

\*: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)  
(M@300m = M@10m-59.1dB)

#### 3.6.4. 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)	Transducer Factor (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
No frequency observed, margin >20dB in pre-characterization									

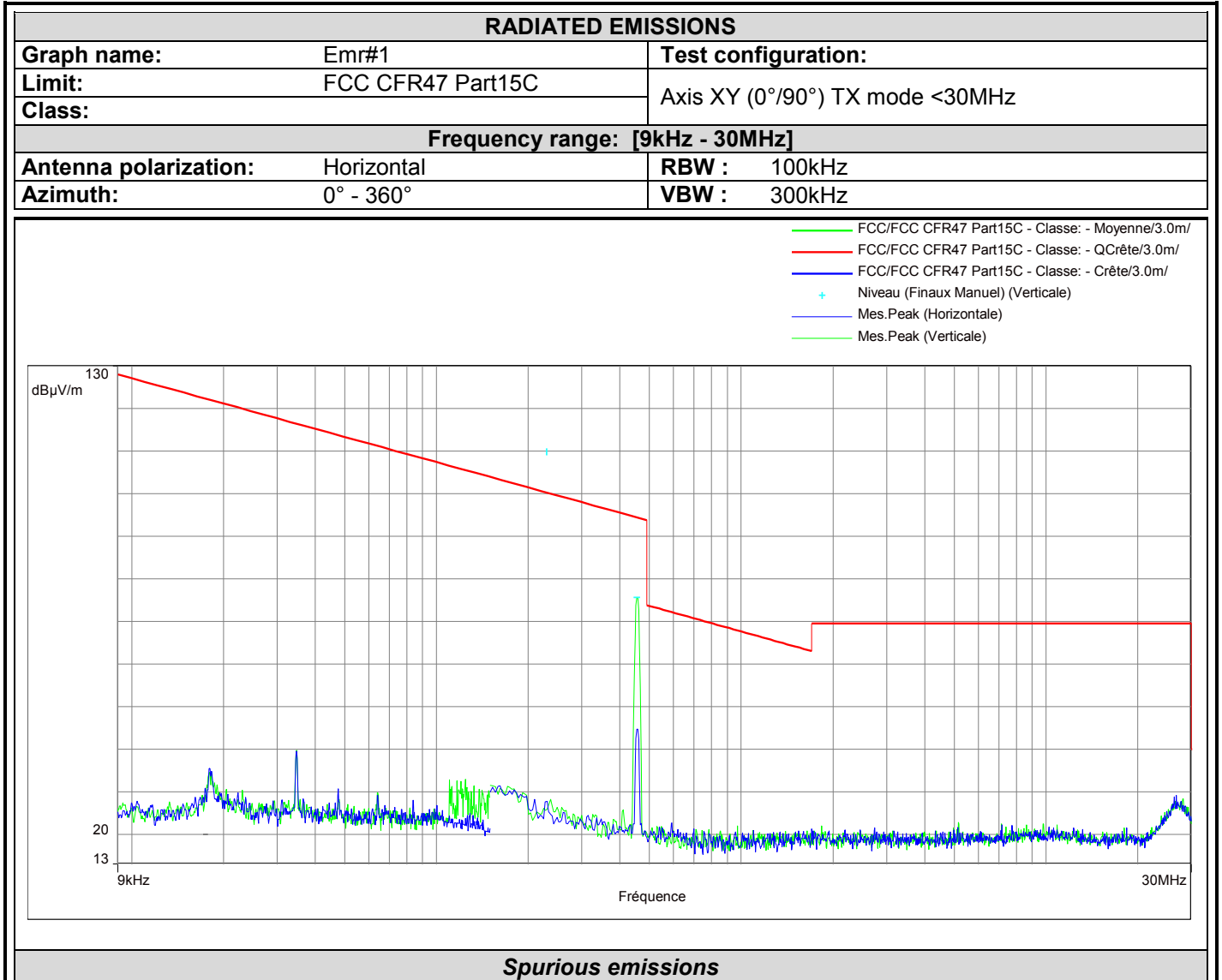
Note: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)  
(M@3m = M@10m+10.5dB)

### 3.7. CONCLUSION

The sample of the equipment EVO5, Sn: E500102-0324, tested in the configuration presented in this test report satisfies to requirements of class B limits of the standard FCC Part15B and ICES-003, for radiated emissions.



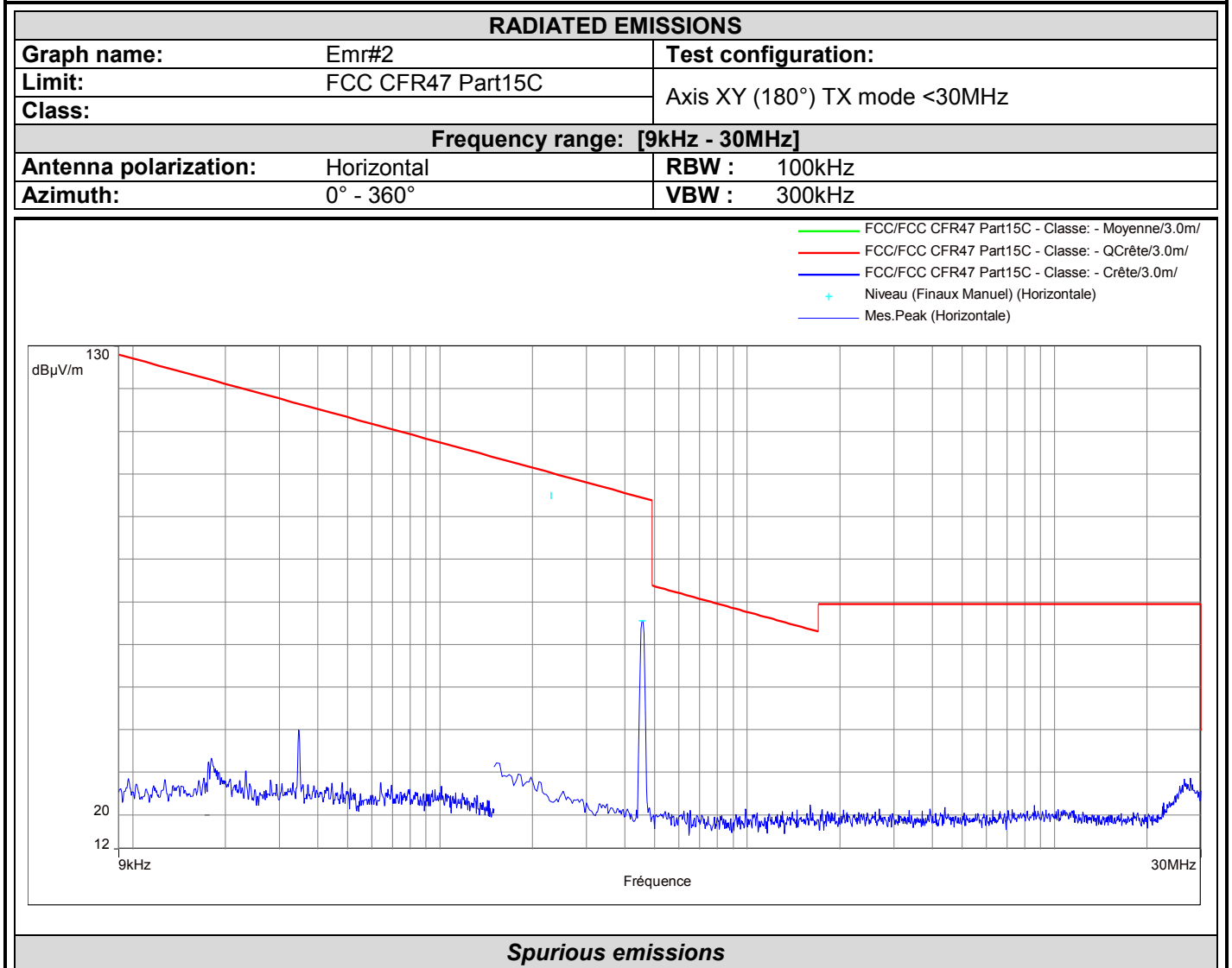
L C I E



Frequency (MHz)	Peak Level (dBµV/m)	Polarization
0.454	75.6	Vertical



L C I E



Frequency (MHz)	Peak Level (dBµV/m)	Polarization
0.454	65.6	Horizontal

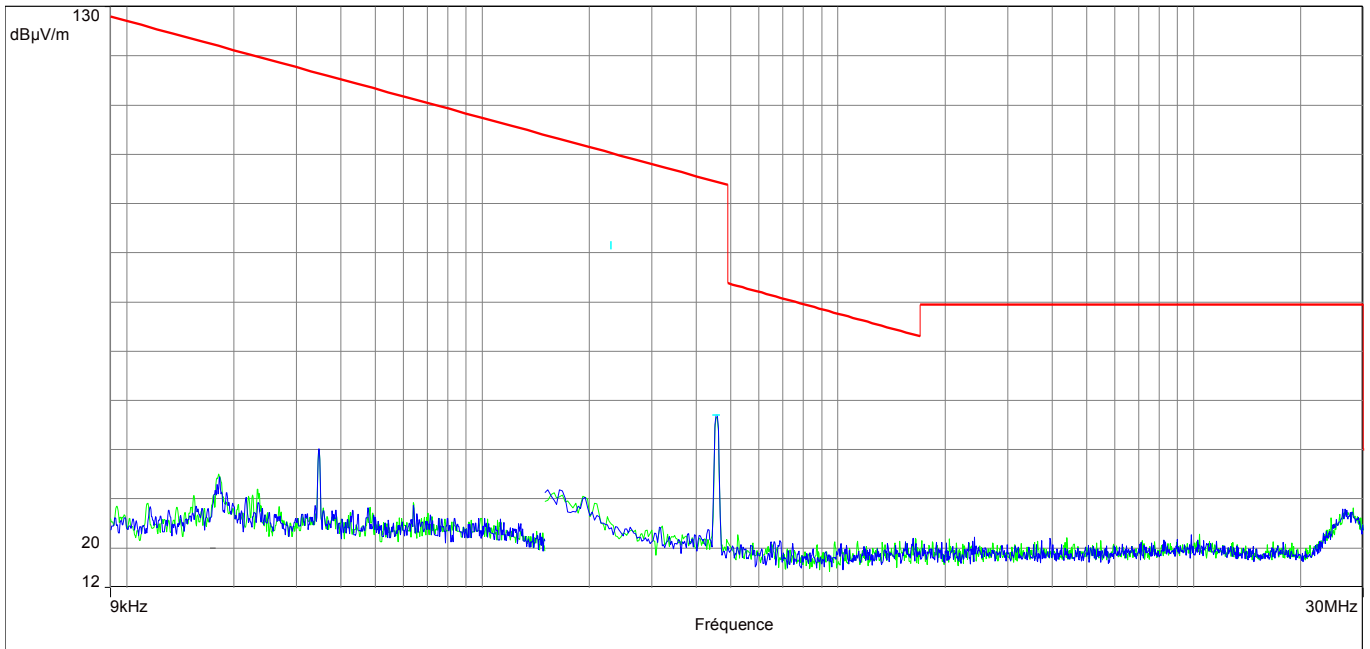


L C I E

### RADIATED EMISSIONS

<b>Graph name:</b>	Emr#3	<b>Test configuration:</b>
<b>Limit:</b>	FCC CFR47 Part15C	Axis Z (0°/90°) TX mode <30MHz
<b>Class:</b>		
<b>Frequency range: [9kHz - 30MHz]</b>		
<b>Antenna polarization:</b>	Horizontal	<b>RBW :</b> 100kHz
<b>Azimuth:</b>	0° - 360°	<b>VBW :</b> 300kHz

- FCC/FCC CFR47 Part15C - Classe: - Moyenne/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - Crête/3.0m/
- + Niveau (Finaux Manuel) (Horizontale)
- Mes.Peak (Horizontale)
- Mes.Peak (Verticale)

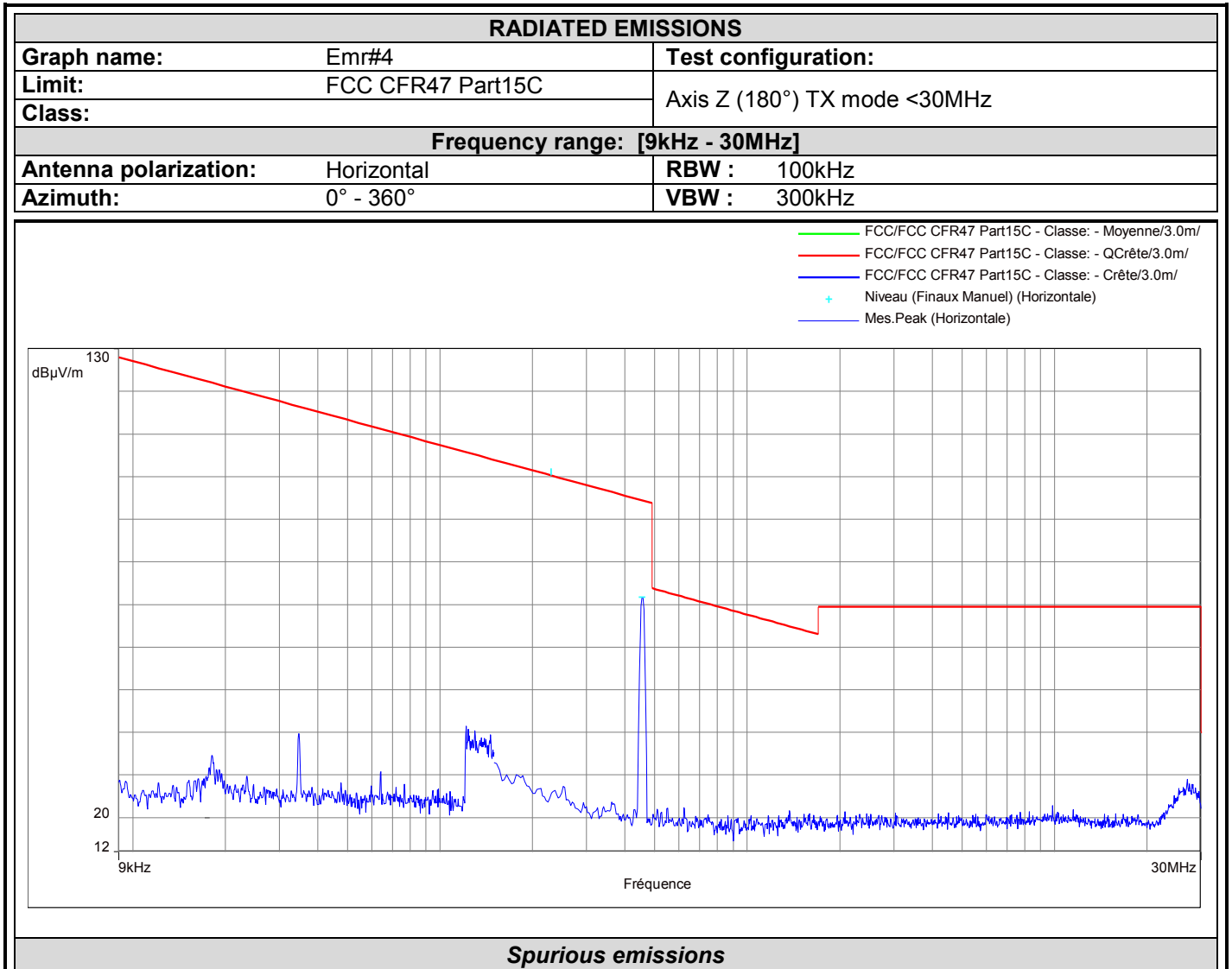


### Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Polarization
0.454	47.1	Horizontal



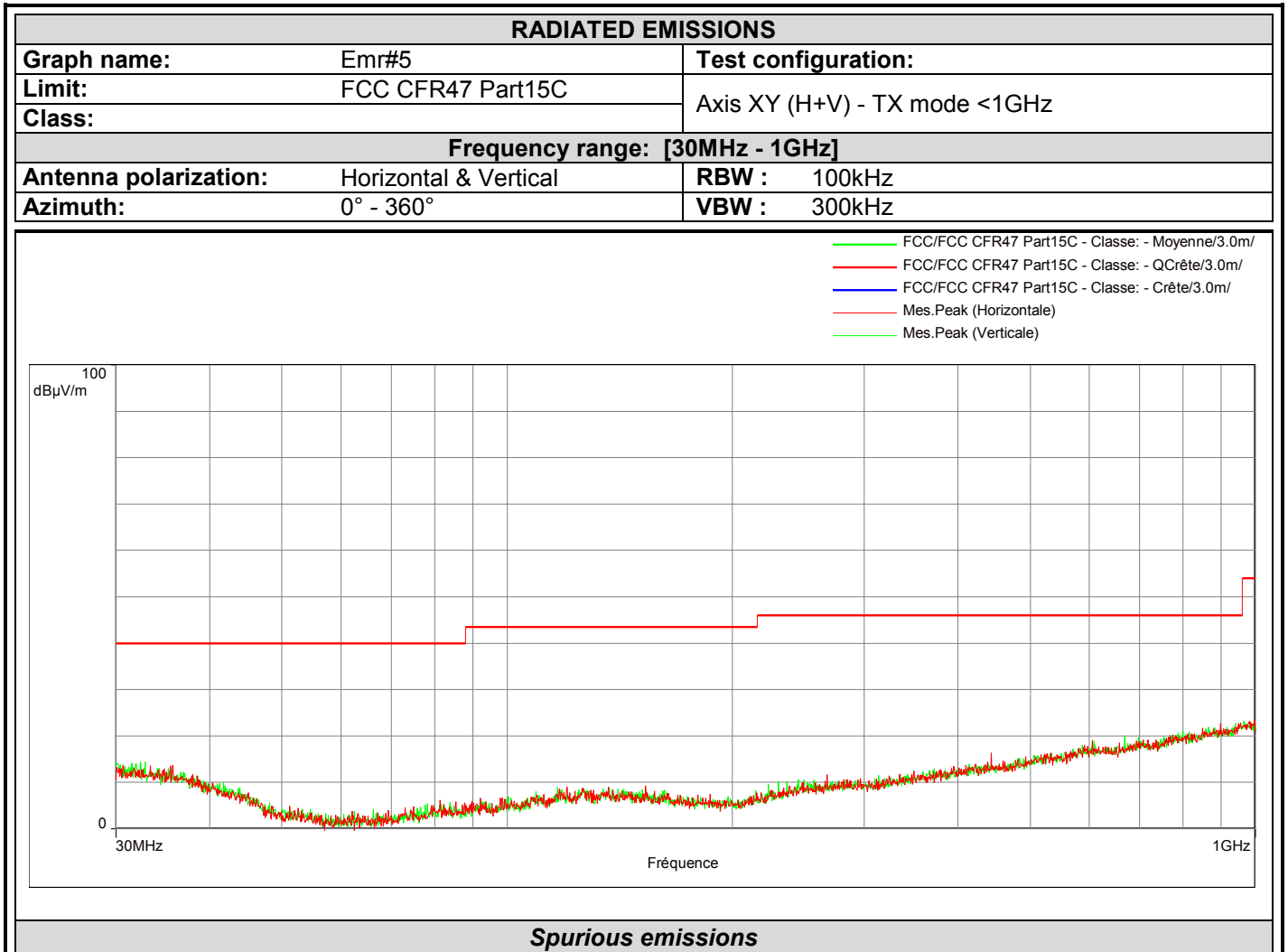
L C I E



Frequency (MHz)	Peak Level (dBµV/m)	Polarization
0.454	71.7	Horizontal



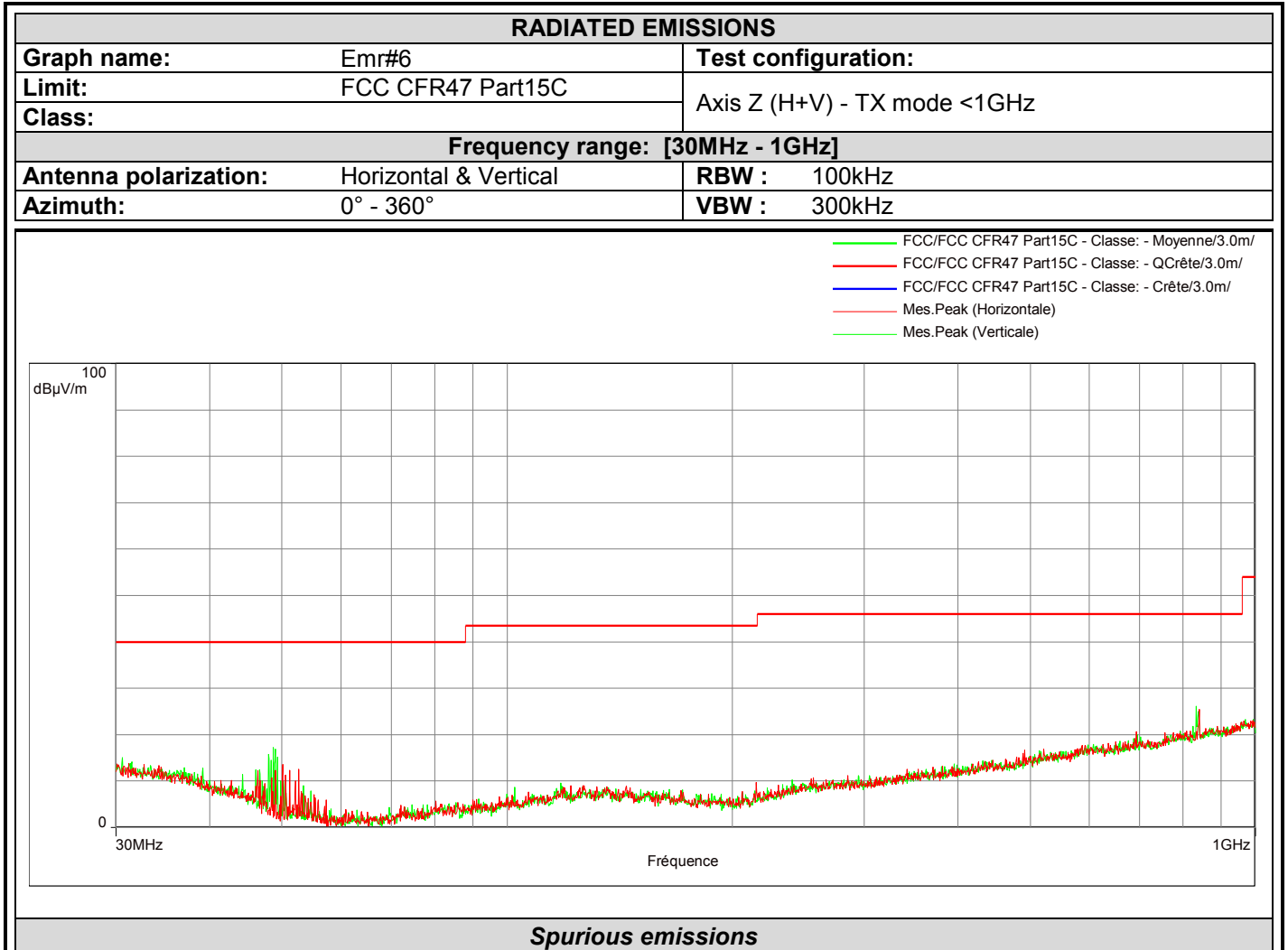
L C I E



No significant frequency observed



L C I E

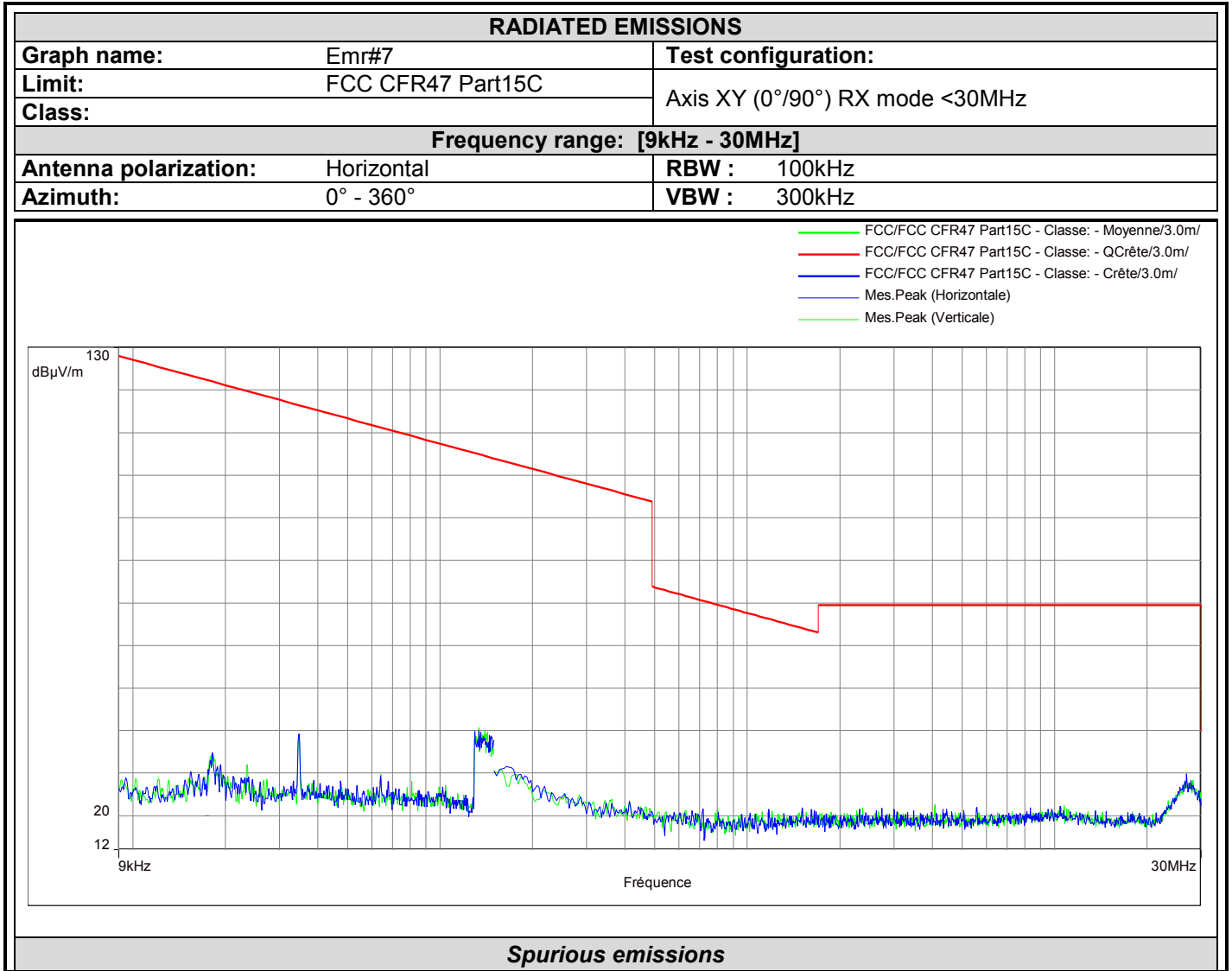


No significative frequency observed





L C I E

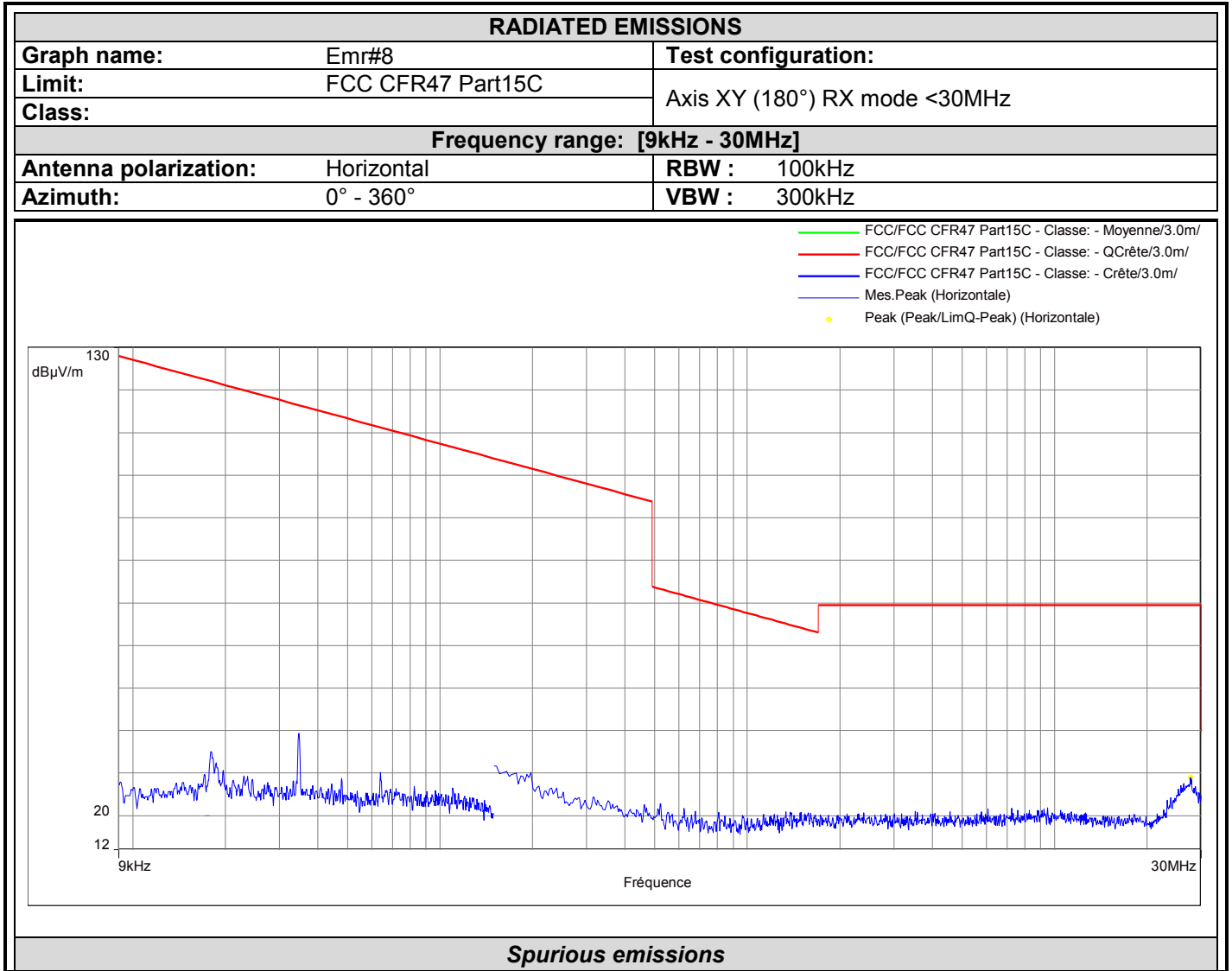


**Spurious emissions**

*No significant frequency observed*



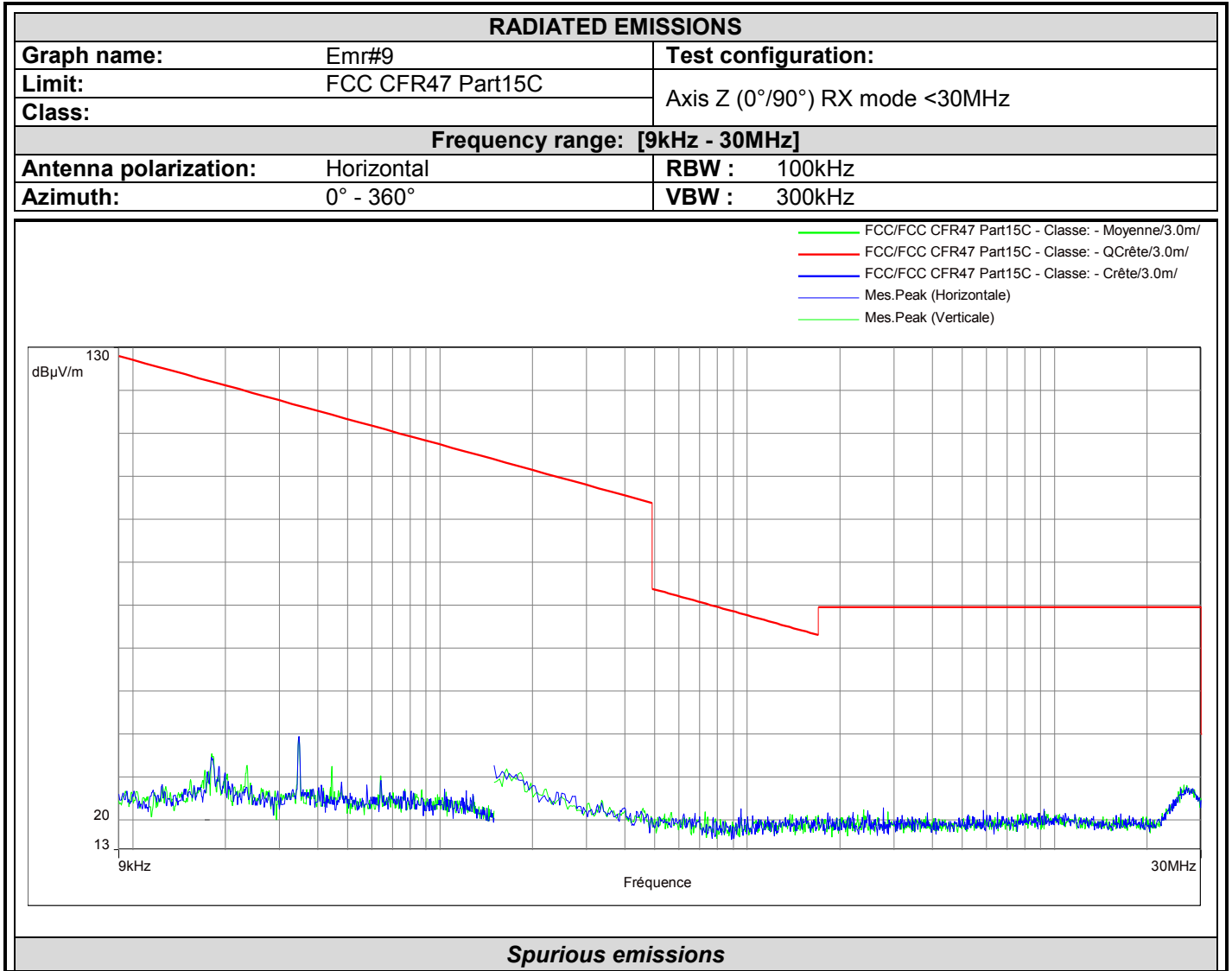
L C I E



Frequency (MHz)	Peak (dBµV/m)	LimQP (dBµV/m)	Peak-LimQP (dB)	Polarization	Correction (dB)
27.737	29.0	69.5	-40.5	Horizontal	6.7



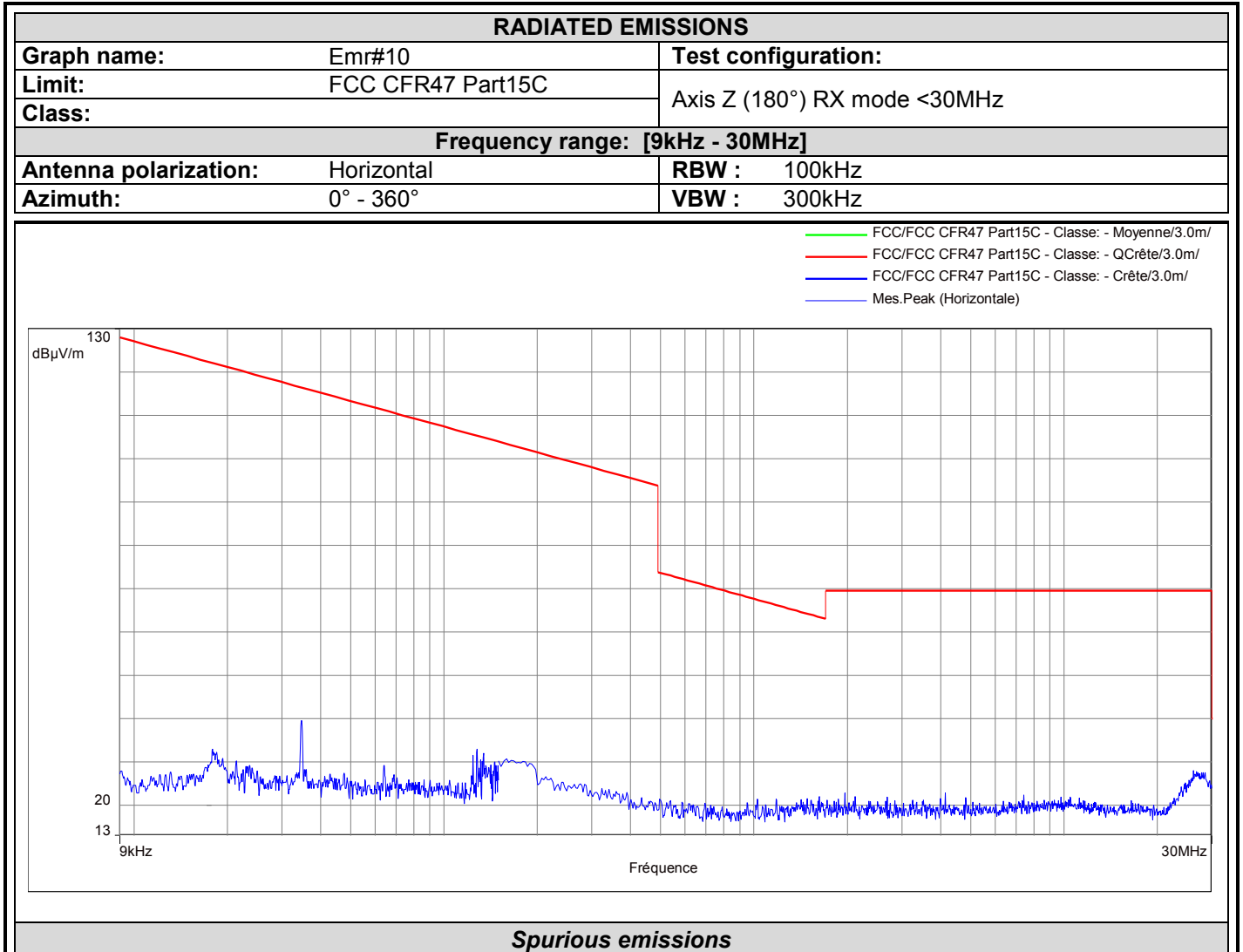
L C I E



No significant frequency observed



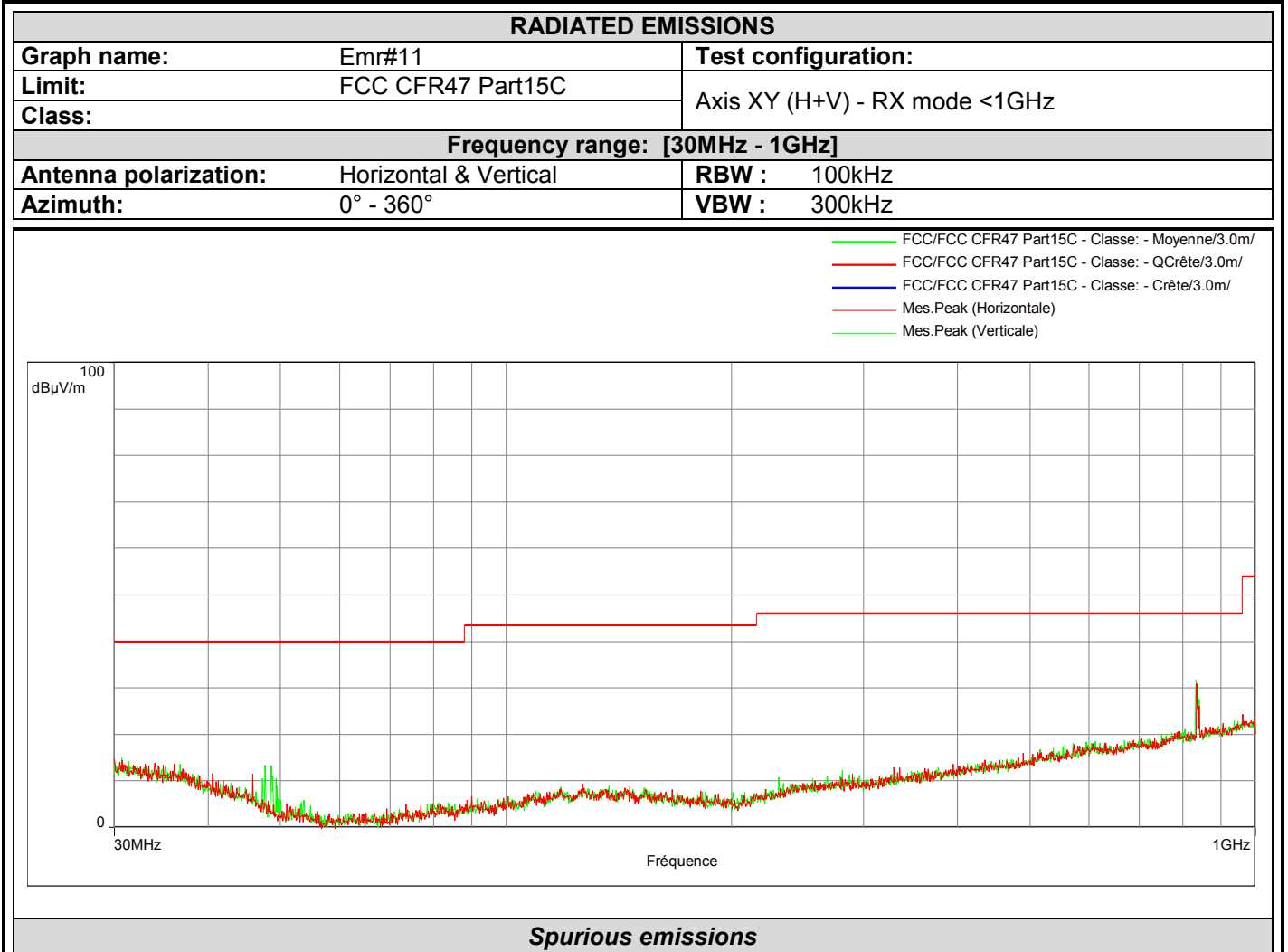
L C I E



No significant frequency observed



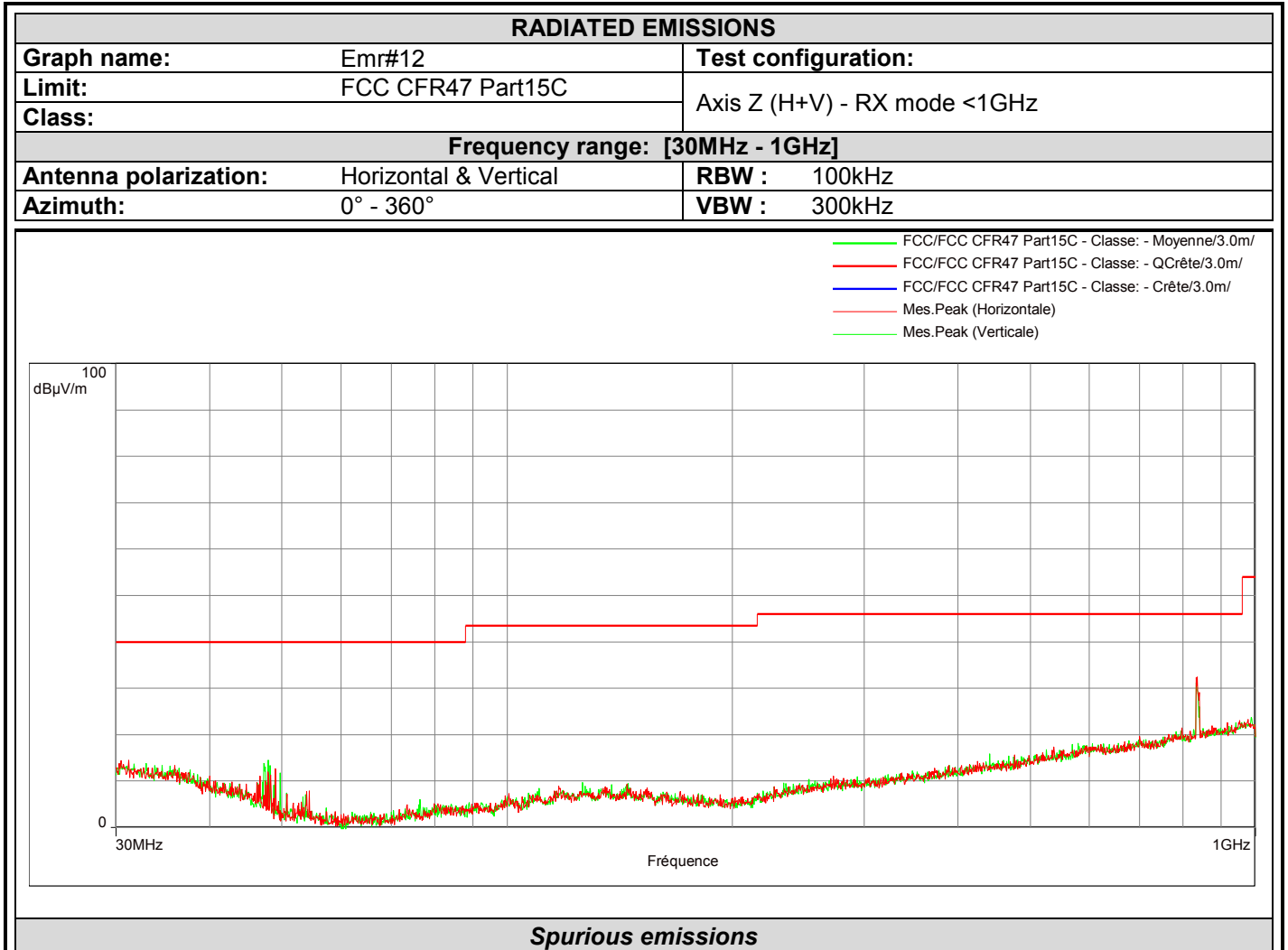
L C I E



No significative frequency observed



L C I E



No significative frequency observed



## 4. OCCUPIED BANDWIDTH

### 4.1. ENVIRONMENTAL CONDITIONS

Date of test : March 19, 2019  
Test performed by : Jonathan PAUC  
Atmospheric pressure (hPa) : 991  
Relative humidity (%) : 31  
Ambient temperature (°C) : 20

### 4.1. 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.

**Radiated measurement:**

The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

**Measurement Procedure:**

1. RBW used in the range of 1% to 5% of the anticipated emission bandwidth
2. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
3. Detector = Peak.
4. Trace mode = Max Hold.
5. Sweep = Auto couple.
6. Allow the trace to stabilize.
7. OBW 99% function of spectrum analyzer used

### 4.2. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	CAL_DATE	CAL_DUE
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	10/18	10/20
Cable 1 < GHz	-	< 1GHz	A5329637	02/19	02/20
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	11/17	11/19
Spectrum analyzer	ROHDE & SCHWARZ	FSV30	A4060050	12/17	12/19

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

None  Divergence:







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

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par la norme, la conformité de l'échantillon est établie directement par les niveaux limites applicables. / *The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the standard. The conformity of the sample is directly established by the applicable limits values.*