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# TEST REPORT

N°: 762842-R1-E

JDE : 128301

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

**Issued to** OPHRYS SYSTEMES  
6 rue Valérien Perrin  
38170 SEYSSINET-PARISSET

**Apparatus under test**

↳ Product **Wireless audio guide**  
↳ Trade mark **ORPHEO**  
↳ Manufacturer **ORPHEO**  
↳ Model under test **Orpheo TG**  
↳ Serial number **L001621014**  
↳ FCCID **VWEORPOTG**

**Test date** From July 1<sup>st</sup> to 6<sup>th</sup>, 2014

**Test location** Moirans

**Test performed by** Anthony MERLIN

**Composition of document** 32 pages

**Modification of the last version** None

**Document issued on** September 18<sup>th</sup>, 2014

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## 1. TEST PROGRAM

**Standard:**

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

EMISSION TEST	LIMITS			RESULTS
<b>Limits for conducted disturbance at mains ports</b> 150kHz-30MHz	<b>Frequency</b>	<b>Quasi-peak value (dBμV)</b>	<b>Average value (dBμV)</b>	<input type="checkbox"/> PASS <input type="checkbox"/> FAIL <input checked="" type="checkbox"/> NA <input type="checkbox"/> NP
	150-500kHz	66 to 56	56 to 46	
	0.5-5MHz	56	46	
	5-30MHz	60	50	
<b>Radiated emissions</b> 9kHz-30MHz CFR 47 §15.209 (a) CFR 47 §15.247 (d)	<b>Measure at 300m</b> 9kHz-490kHz : 67.6dBμV/m /F(kHz) <b>Measure at 30m</b> 490kHz-1.705MHz : 87.6dBμV/m /F(kHz) 1.705MHz-30MHz : 29.5 dBμV/m			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
<b>Radiated emissions</b> 30MHz-25GHz* CFR 47 §15.209 (a) CFR 47 §15.247 (d) <b>Highest frequency : 48MHz</b> <b>(Declaration of provider)</b>	<b>Measure at 3m</b> 30MHz-88MHz : 40 dBμV/m 88MHz-216MHz : 43.5 dBμV/m 216MHz-960MHz : 46.0 dBμV/m Above 960MHz : 54.0 dBμV/m			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
<b>Bandwidth 6dB</b> CFR 47 §15.247 (a) (2)	<b>At least 500kHz</b>			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
<b>Maximum Peak Output Power</b> CFR 47 §15.247 (b)	<b>Limit: 30dBm</b> Conducted or Radiated measurement			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
<b>Band Edge Measurement</b> CFR 47 §15.209 (a) CFR 47 §15.247 (d)	<b>Limit: -20dBc or</b> <b>Radiated emissions limits in restricted bands</b>			<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> NA <input type="checkbox"/> NP
<b>Power spectral Density</b> CFR 47 §15.247 (e)	<b>Limit: 8dBm/3kHz</b>			<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.

## 2. SYSTEM TEST CONFIGURATION

### 2.1. JUSTIFICATION

**Orpheo TG** is equipment for audio tour groups, wireless audio system.

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

#### Equipment under test (EUT):

**Orpheo TG**

**Serial Number: L001621014**




Photography of EUT

#### Power supply:

During all the tests, EUT is supplied by  $V_{nom}$ : 3.7VDC

For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Reference / Sn	Comments
Supply1	<input type="checkbox"/> AC <input type="checkbox"/> DC <input checked="" type="checkbox"/> Battery	3.7VDC		-

#### Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
Supply1	Battery	-	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Access1	Jack Headphone		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Access2	Jack Microphone		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Access3	Multi pin contacts	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	



### Equipment information:

Frequency band:	[2400 – 2483.5] MHz		
Spectrum Modulation:	<input checked="" type="checkbox"/>		
Number of Channel:	50		
Spacing channel:	1.571MHz		
Transmit chains:	<input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
	<input checked="" type="checkbox"/> Single antenna	<input type="checkbox"/> Symmetrical	<input type="checkbox"/> Asymmetrical
	Gain 1: 0dBi	Gain 2: dBi	Gain 3: dBi
Beam forming gain:	<input type="checkbox"/> Yes: dB		<input checked="" type="checkbox"/> No
Receiver chains	<input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3
Type of equipment:	<input checked="" type="checkbox"/> Stand-alone	<input type="checkbox"/> Plug-in	<input type="checkbox"/> Combined
Ad-Hoc mode:	<input type="checkbox"/> Yes		<input checked="" type="checkbox"/> No
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

### CHANNEL PLAN

Channel	Frequency (MHz)	Channel	Frequency (MHz)
<b>Cmin: 2</b>	<b>2401.885253904</b>	27	2441.161376904
3	2403.456298824	28	2442.732421824
4	2405.027343744	29	2444.303466744
5	2406.598388664	30	2445.874511664
6	2408.169433584	31	2447.4455556584
7	2409.740478504	32	2449.016601504
8	2411.311523424	33	2450.587646424
9	2412.882568344	34	2452.158691344
10	2414.453613264	35	2453.729736264
11	2416.024658184	36	2455.300781184
12	2417.595703104	37	2456.871826104
13	2419.166748024	38	2458.442871024
14	2420.737792944	39	2460.013915944
15	2422.308837864	40	2461.584960864
16	2423.879882784	41	2463.156005784
17	2425.450927704	42	2464.727050704
18	2427.021972624	43	2466.298095624
19	2428.593017544	44	2467.869140544
20	2430.164062464	45	2469.440185464
21	2431.735107384	46	2471.011230384
22	2433.306152304	47	2472.582275304
23	2434.877197224	48	2474.153320224
24	2436.448242144	49	2475.724365144
25	2438.019287064	<b>Cmax: 50</b>	<b>2477.295410064</b>
<b>Cmid: 26</b>	<b>2439.590331984</b>		

### DATA RATE

Data Rate (Mbps)	Modulation Type	Worst Case Modulation
0.250	FSK	<input checked="" type="checkbox"/>



## 2.2. EUT CONFIGURATION

The EUT is set in the following modes during tests:

- Permanent emission with modulation on a fixed channel in the data rate that produced the highest power

Firmware Version: v1.1.0.1

## 2.3. EQUIPMENT MODIFICATIONS

☐ None ☒ Modification:

## 2.4. 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.

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

The 32 dBμV/m value can be mathematically converted to its corresponding level in μV/m.

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



### 3. RADIATED EMISSION DATA

#### 3.1. ENVIRONMENTAL CONDITIONS

Date of test : July 6<sup>th</sup>, 2014  
 Test performed by : A.MERLIN  
 Atmospheric pressure (hPa) : 989  
 Relative humidity (%) : 38  
 Ambient temperature (°C) : 22

#### 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)
- ☐ 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

#### 3.3. TEST METHOD

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 to maximize the emission measurement. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration.

The pre-characterization graphs are obtained in PEAK detection.

Characterization on 10 meters open site from 9kHz to 1GHz:

The product has been tested according to ANSI C63.4 (2003), FCC part 15 subpart C. Radiated Emissions were measured on an open area test site. A description of the facility is on file with the FCC. The product has been tested at a distance of **10 meters** from the antenna and compared to the FCC part 15 subpart C §15.225 limits in the frequency



range 13.553MHz 13.567MHz. Measurement bandwidth was 9kHz below 30MHz and 120kHz from 30 MHz to 1GHz. Test is performed in horizontal (H) and vertical (V) polarization, the loop antenna was rotated during the test to maximize the emission measurement. The height antenna is varied from 1m to 4m. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration. A summary of the worst case emissions found in all test configurations and modes is shown. Frequency list has been created with anechoic chamber pre-scan results.

### 3.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Amplifier 8-26GHz	ALDETEC	ALS01452	A7085007	08/14	08/15
Antenna Loop	ELECTRO-METRICS	EM-6879	C2040052	10/13	10/15
Antenna Bi-log	CHASE	CBL6111A	C2040172	04/13	04/15
Antenna horn	EMCO	3115	C2042027	04/14	04/15
Cable - Measure	-	-	A5329038	08/14	08/15
Cable Measure	-	-	A5329206	01/14	01/15
Semi-Anechoic chamber #3	SIEPEL	-	D3044017	-	-
Radiated emission comb generator	BARDET	-	A3169050	-	-
HF Radiated emission comb generator	LCIE SUD EST	-	A3169088	-	-
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	10/13	10/14
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	08/14	08/15
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	01/14	01/15
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371	-	-
Table	LCIE	-	F2000461	-	-
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444	-	-

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

☒ None ☐ Divergence:

### 3.6. TEST RESULTS

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

See graph for 9kHz-30MHz band:

Graph identifier	Polarization	Mode	EUT position	Channel	Comments
Emr# 1	0°	TX	Axis XY/Z	All	See annex 1
Emr# 2	90°	TX	Axis XY/Z	All	See annex 1

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

See graphs for 30MHz-1GHz:

Graph identifier	Polarization	Mode	EUT position	Channel	Comments
Emr# 3	H	TX	Axis XY	All	See annex 1
Emr# 4	H	TX	Axis Z	All	See annex 1
Emr# 5	V	TX	Axis XY	All	See annex 1
Emr# 6	V	TX	Axis Z	All	See annex 1



### 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 (dB $\mu$ V/m) @ 30m	Qpeak (dB $\mu$ V/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 ( $\mu$ V/m)	Measurement distance (m)
13.553-13.567	15 848 84 dB $\mu$ V/m	30
13.410-13.553 13.567-13.710	334 50.5 dB $\mu$ V/m	30
13.110-13.410 13.710-14.010	106 40.5 dB $\mu$ V/m	30

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

### 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.

No	Frequency (MHz)	Limit Quasi-Peak (dB $\mu$ V/m)	Measure Quasi-Peak (dB $\mu$ V/m)	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) ( $M@3m = M@10m + 10.5dB$ )*

## 3.7. CONCLUSION

Radiated emission data measurement performed on the sample of the product **Orpheo TG**, SN: **L001621014**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 limits.



## 4. BANDWIDTH (15.247)

### 4.1. TEST CONDITIONS

Date of test : July 1<sup>st</sup>, 2014  
Test performed by : A.MERLIN  
Atmospheric pressure (hPa) : 993  
Relative humidity (%) : 34  
Ambient temperature (°C) : 21

### 4.2. 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.

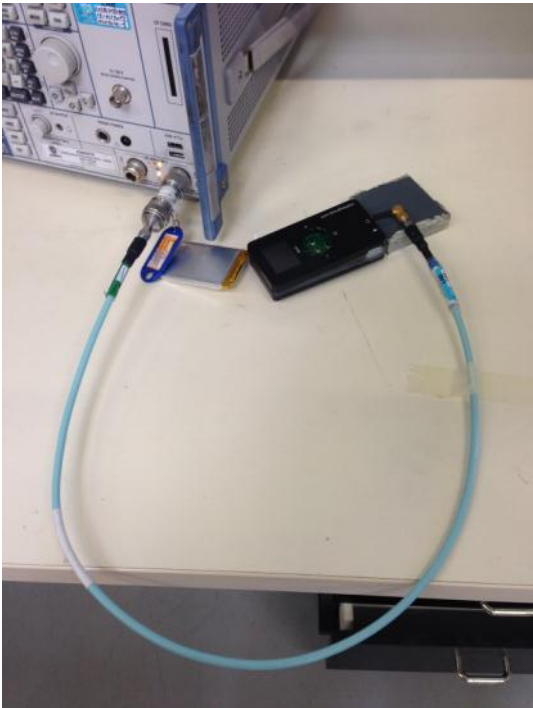
Offset: Attenuator+cable 10.5dB

☐ **Radiated measurement:**

The EUT is placed in an anechoic chamber; the center frequency of the spectrum analyzer is set to the fundamental frequency. The 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)  $\geq 3 \times$  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.



**4.3. TEST EQUIPMENT LIST**

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	JFW	-	A7122166	09/13	09/14
Cable Measure	-	-	A5329603	08/14	08/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	10/13	10/14

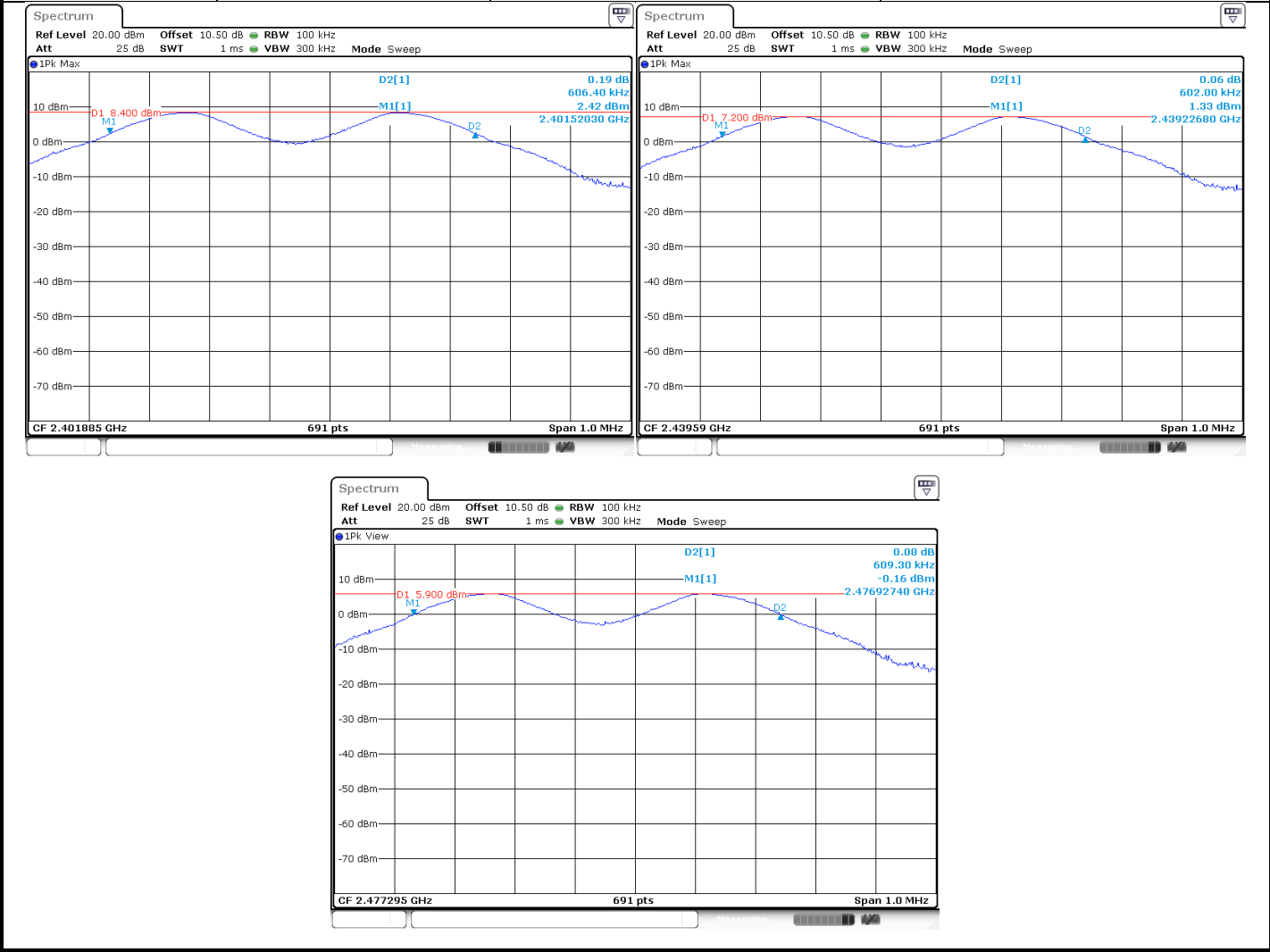
**4.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION**

☒ None      ☐ Divergence:



4.5. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Bandwidth Limit (kHz)
Min	2401.885	604.4	>500
Mid	2439.590	602.0	>500
Max	2477.295	609.3	>500



4.6. CONCLUSION

Bandwidth measurement performed on the sample of the product **Orpheo TG**, SN: **L001621014**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 limits.



## 5. MAXIMUM PEAK OUTPUT POWER (15.247)

### 5.1. TEST CONDITIONS

Date of test : July 1<sup>st</sup>, 2014  
 Test performed by : A.MERLIN  
 Atmospheric pressure (hPa) : 993  
 Relative humidity (%) : 34  
 Ambient temperature (°C) : 21

### 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.

Offset: Attenuator+cable 10.5dB

#### ☐ **Radiated measurement:**

The EUT is placed in an anechoic chamber; the center frequency of the spectrum analyzer is set to the fundamental frequency.

The product has been tested at a distance of 3 meters from the antenna. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on following table. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

To demonstrate compliance with peak output power requirement of section 15.247 (b), the transmitter's peak output power is calculated using the following equation:

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

Where:

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

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

#### **Maximum peak conducted output power**

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

- ☒ **RBW ≥ DTS bandwidth**

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

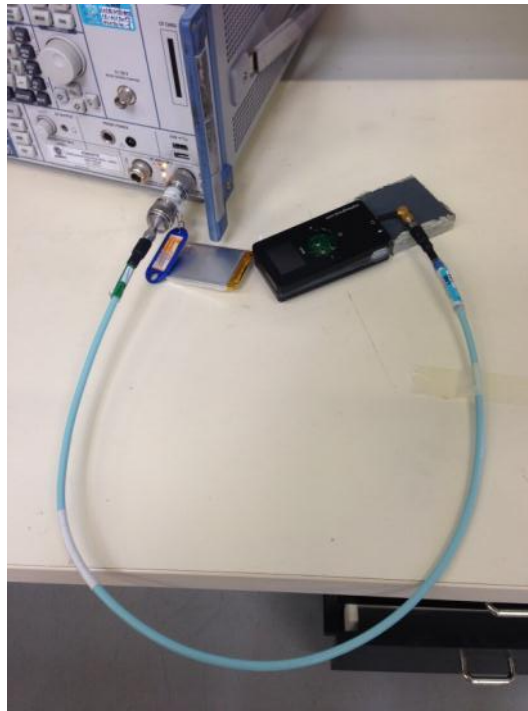
- a) Set the RBW ≥ DTS bandwidth.
- b) Set VBW ≥ 3 x RBW.
- c) Set span ≥ 3 x RBW
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.



• ☐ **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  $\geq 3 \times$  RBW
- c) Set the span  $\geq 1.5 \times$  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



### 5.3. TEST EQUIPMENT LIST

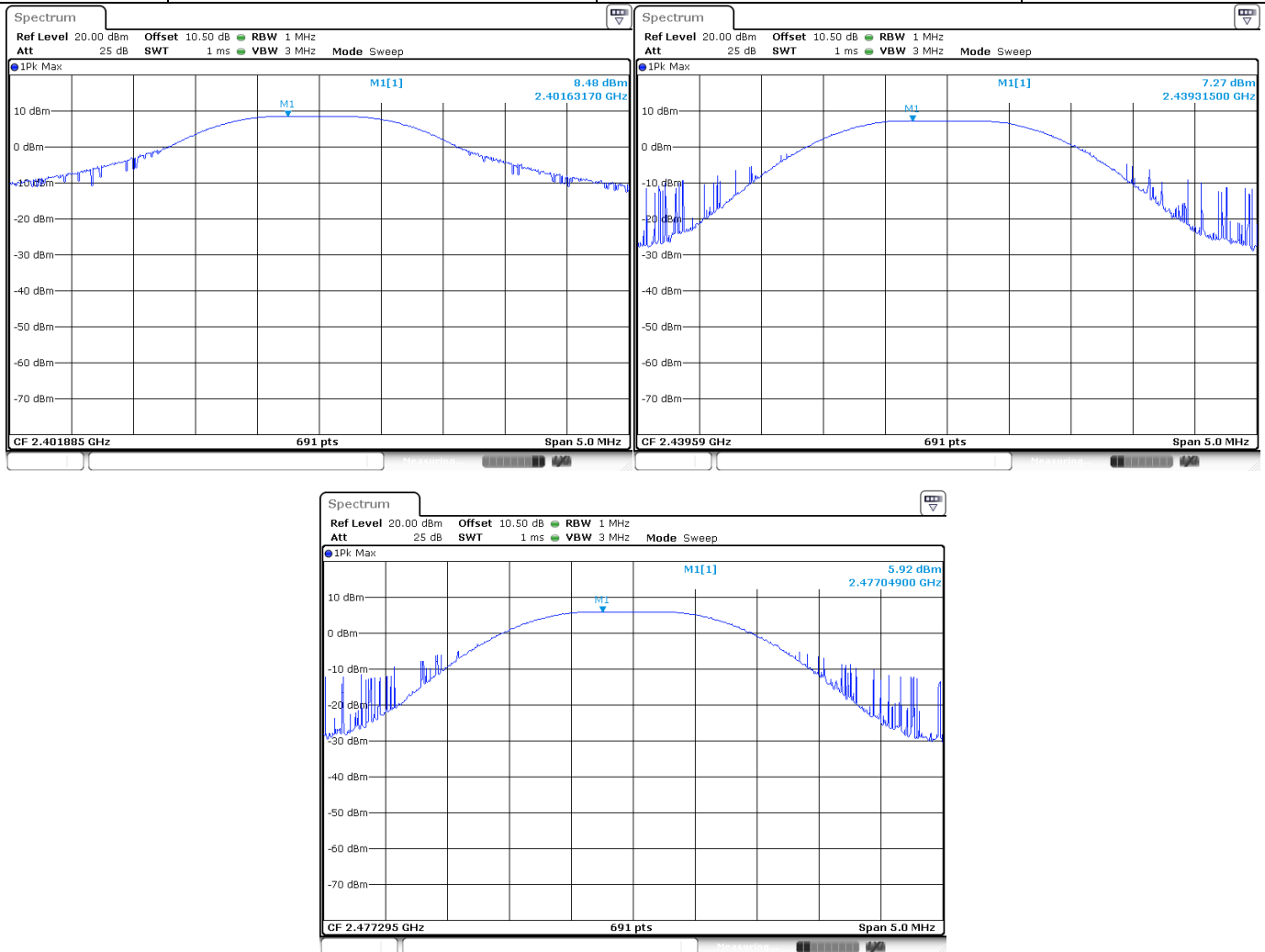
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	JFW	-	A7122166	09/13	09/14
Cable Measure	-	-	A5329603	08/14	08/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	10/13	10/14

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

☒ None ☐ Divergence:

## 5.5. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	Peak Output Power (dBm)	Power Limit (dBm)
Min	2401.885	8.5	30.0
Mid	2439.590	7.3	30.0
Max	2477.295	6.0	30.0



## 5.6. CONCLUSION

Maximum Peak Output Power measurement performed on the sample of the product **Orpheo TG**, SN: **L001621014**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 limits.



## 6. POWER SPECTRAL DENSITY (15.247)

### 6.1. TEST CONDITIONS

Date of test : July 1<sup>st</sup>, 2014  
 Test performed by : A.MERLIN  
 Atmospheric pressure (hPa) : 993  
 Relative humidity (%) : 34  
 Ambient temperature (°C) : 21

### 6.2. SETUP

☒ **Conducted measurement:**

The EUT is turned ON and connected to measurement instrument; the center frequency of the spectrum analyzer is set to the fundamental frequency.

Offset: Attenuator+cable 10.5dB

☐ **Radiated measurement:**

The EUT is placed in an anechoic chamber; the center frequency of the spectrum analyzer is set to the fundamental frequency.

The product has been tested at a distance of 3 meters from the antenna. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on following table. The captured power is measured and recorded; the measurement is repeated until all frequencies required were complete.

To demonstrate compliance with peak output power requirement of section 15.247 (b), the transmitter's peak output power is calculated using the following equation:

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

Where:

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

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

**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:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d) Set the VBW  $\geq 3 \times \text{RBW}$ .
- 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.

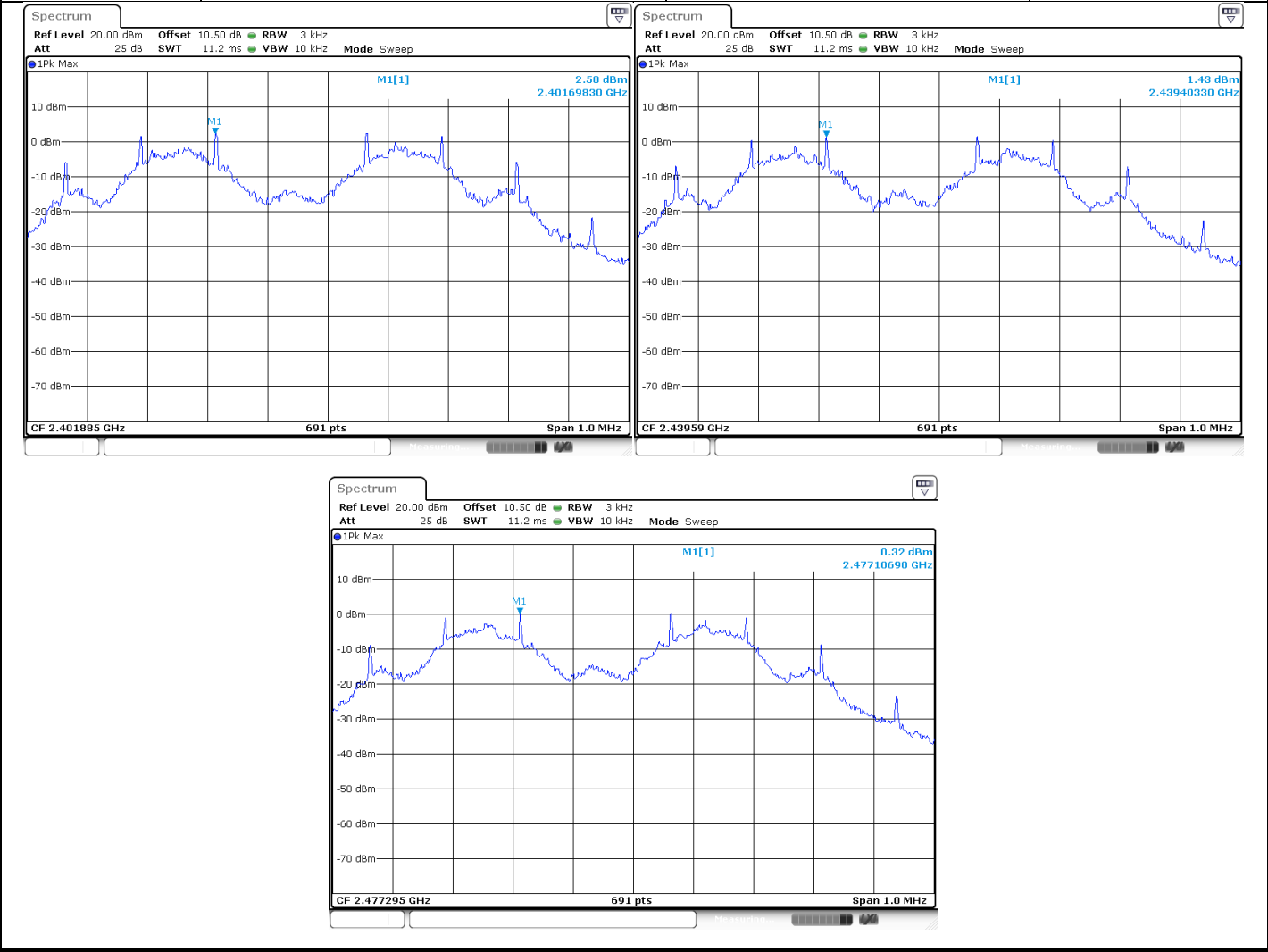
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	JFW	-	A7122166	09/13	09/14
Cable Measure	-	-	A5329603	08/14	08/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	10/13	10/14

☒ None ☐ Divergence:



6.5. TEST SEQUENCE AND RESULTS

Channel	Channel Frequency (MHz)	Power Spectral Density (dBm)	PSD Limit (dBm)
Min	2401.885	2.5	8.0
Mid	2439.590	1.5	8.0
Max	2477.295	0.4	8.0



6.6. CONCLUSION

Power Spectral Density measurement performed on the sample of the product **Orpheo TG**, SN: **L001621014**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 limits.



## 7. BAND EDGE MEASUREMENT (15.247)

### 7.1. TEST CONDITIONS

Date of test : July 1<sup>st</sup>, 2014  
Test performed by : A.MERLIN  
Atmospheric pressure (hPa) : 993  
Relative humidity (%) : 34  
Ambient temperature (°C) : 21

### 7.2. 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:**

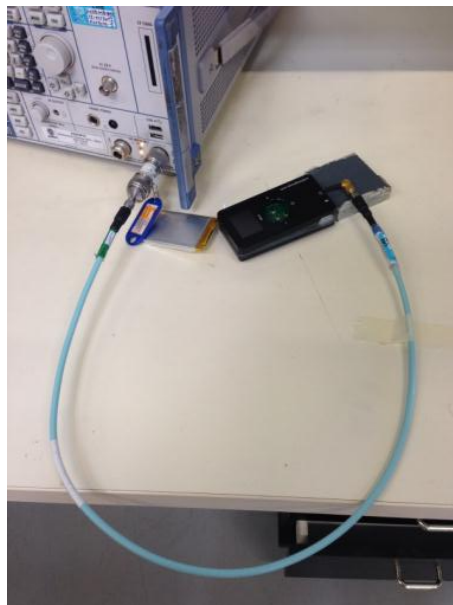
Applies to harmonics/spurs that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209. For measurements above 1 GHz, set RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. If the emission is pulsed, modify the unit for continuous operation; 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.

### 7.3. 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



**7.4. TEST EQUIPMENT LIST**

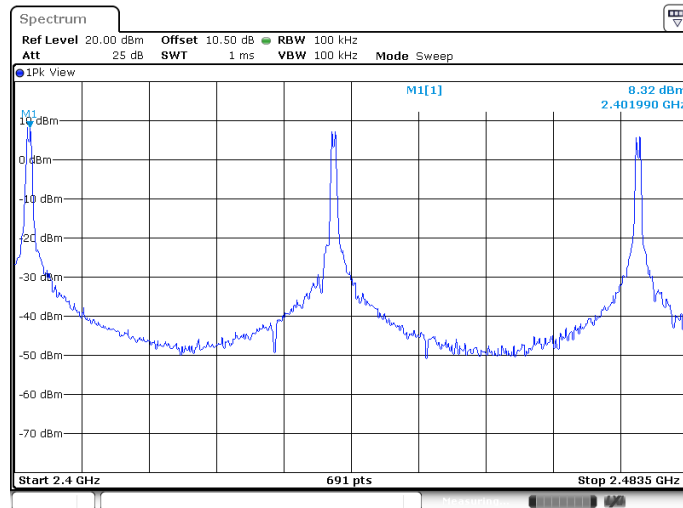
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Attenuator 10dB	JFW	-	A7122166	09/13	09/14
Cable Measure	-	-	A5329603	08/14	08/15
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	10/13	10/14
Amplifier 8-26GHz	ALDETEC	ALS01452	A7085007	08/14	08/15
Antenna horn	EMCO	3115	C2042027	04/14	04/15
Cable - Measure	-	-	A5329038	08/14	08/15
Cable Measure	-	-	A5329206	01/14	01/15
Semi-Anechoic chamber #3	SIEPEL	-	D3044017	-	-
Radiated emission comb generator	BARDET	-	A3169050	-	-
HF Radiated emission comb generator	LCIE SUD EST	-	A3169088	-	-
Spectrum analyzer	ROHDE & SCHWARZ	FSV 30	A4060050	08/14	08/15
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	01/14	01/15
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371	-	-
Table	LCIE	-	F2000461	-	-
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444	-	-

**7.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION**☒ None☐ Divergence:

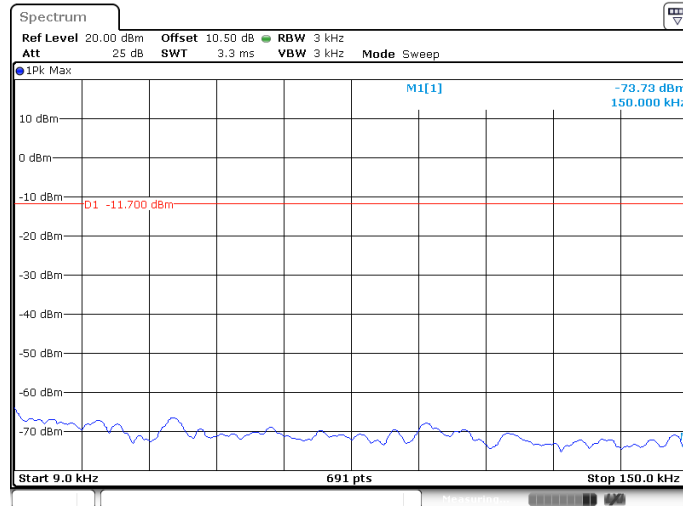
## 7.6. TEST SEQUENCE AND RESULTS

Offset: Attenuator+cable 10.5dB

-20dbc limit used: Channel max, worst case, -11.7dBm

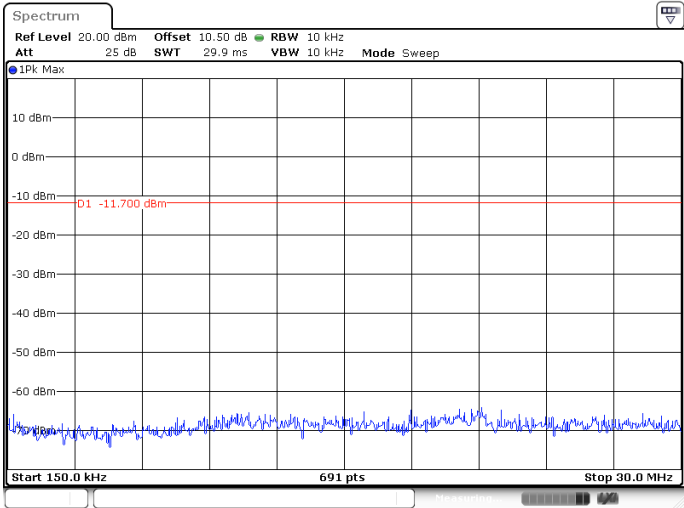


From 9kHz to 150kHz, channel min/mid/max:

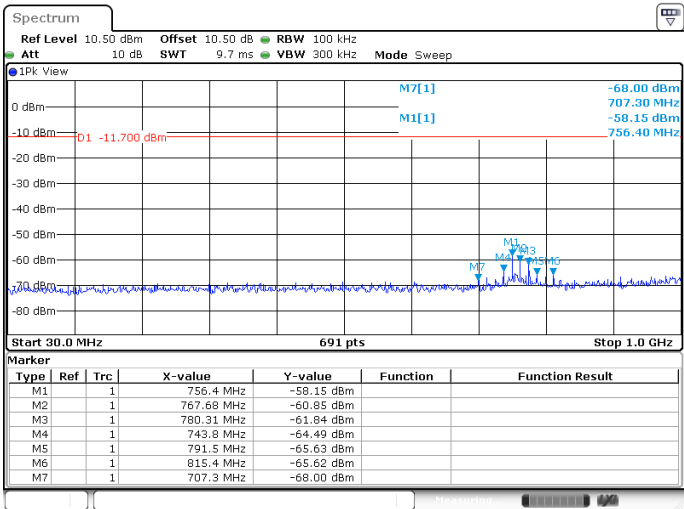




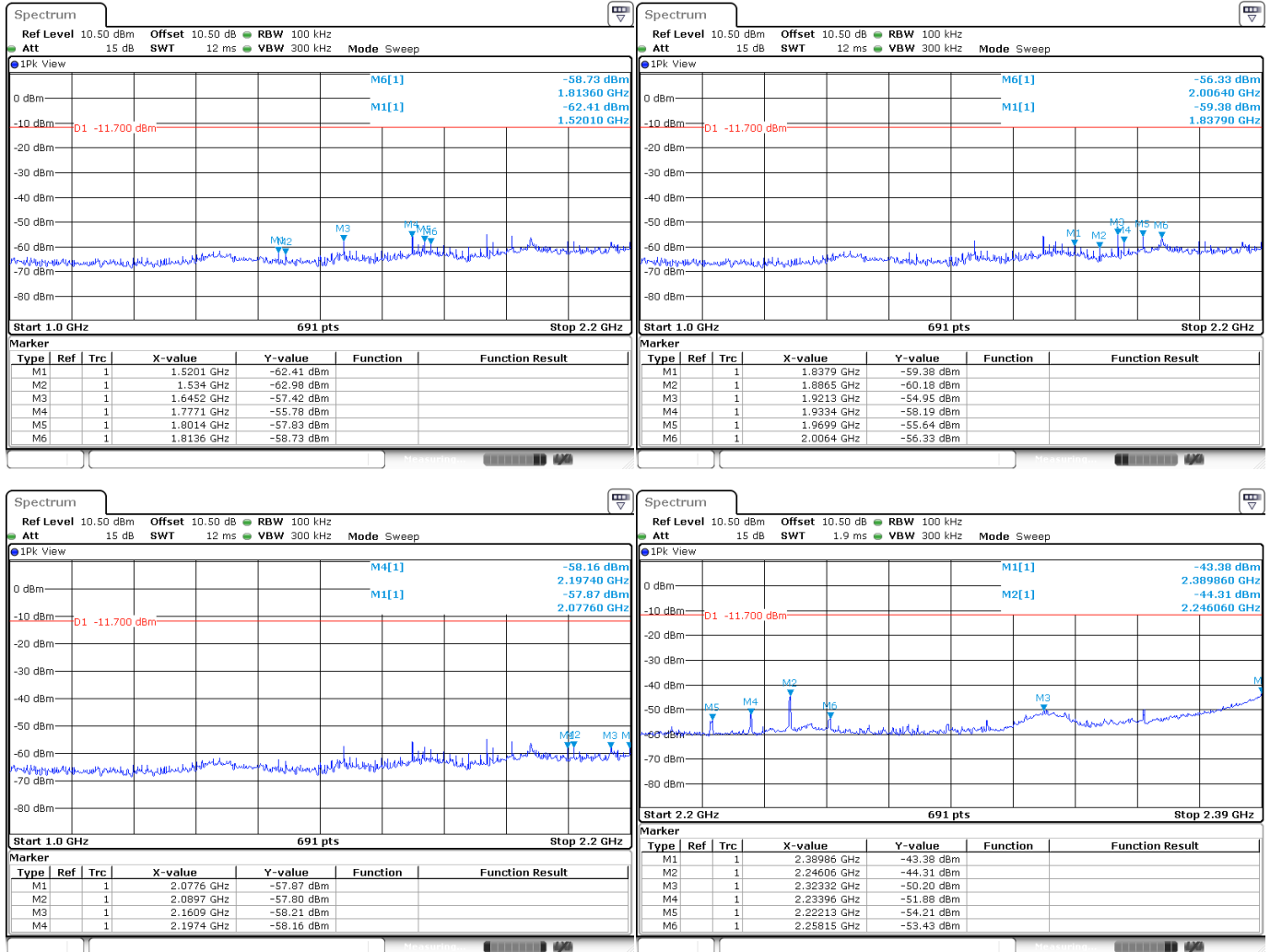
From 150kHz to 30MHz, channel min/mid/max:

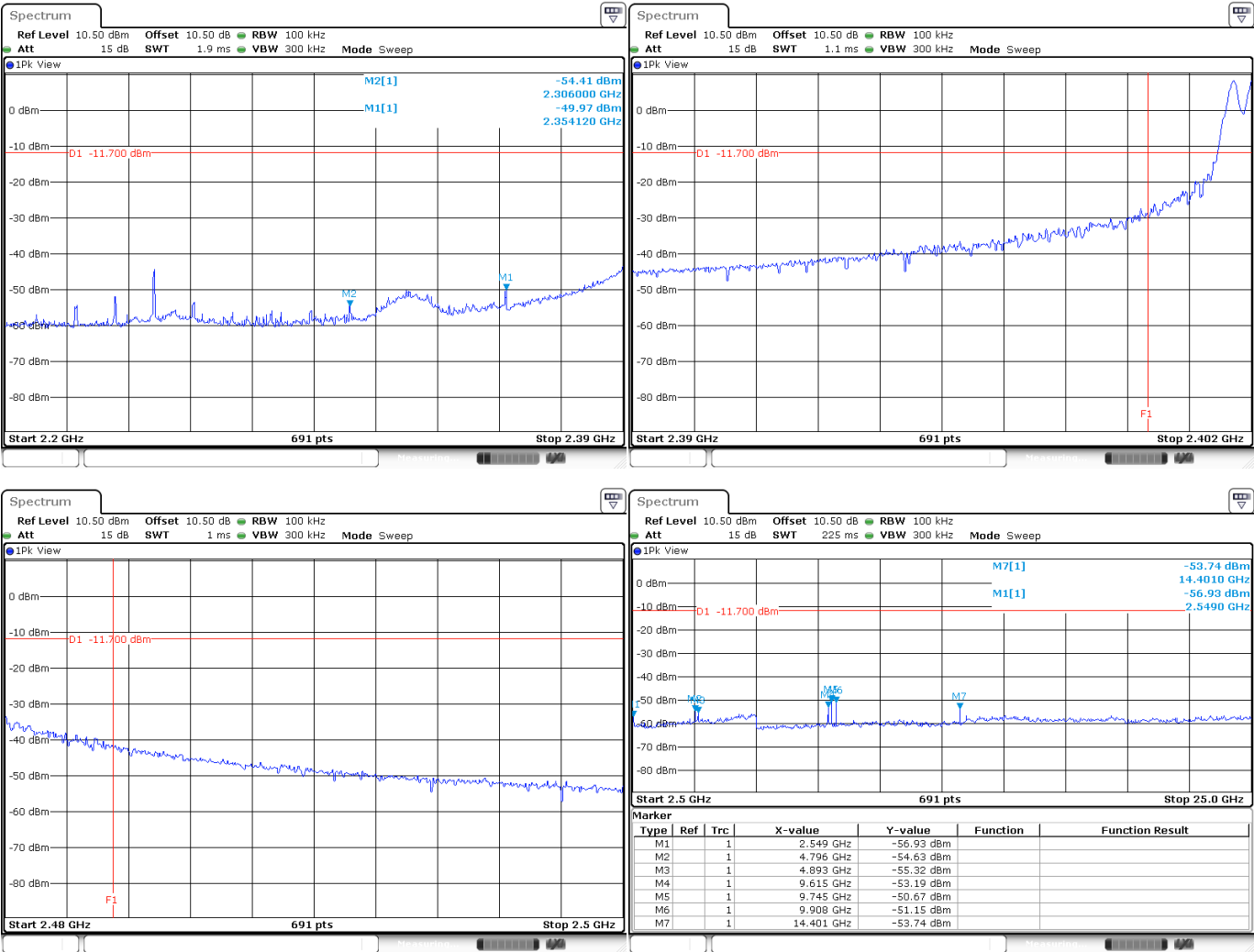


From 30MHz to 1GHz, channel min/mid/max:



From 1GHz to 25GHz, channel min/mid/max:





Characterization on 3 meters full anechoic chamber from 1GHz to 25GHz:

The product has been tested at a distance of **3 meters** from the antenna and compared to the FCC part 15 subpart B §15.109 limits and C §15.209 limits. Measurement bandwidth was 1MHz from 1GHz to 25GHz.

Test is performed in horizontal (H) and vertical (V) polarization. Continuous linear turntable azimuth search was performed with 360 degrees range. Measurement performed on all axis of EUT used in normal configuration. A summary of the worst case emissions found in all test configurations and modes is shown. The height antenna is

☐ On mast, varied from 1m to 4m

☒ Fixed and centered on the EUT

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

**Worst case final data result:**

The frequency list is created from the results obtained during the pre-characterization in anechoic chamber.

Measurements are performed using a PEAK and AVERAGE detection.

No	Frequency (MHz)	Limit Peak (dBµV/m)	Measure Peak (dBµV/m)	Margin Peak (dB)	Limit Average (dBµV/m)	Measure Average (dBµV/m)	Margin Average (dB)	Angle Table (°)	Pol. Ant.	Ht. Ant. (cm)	FC (dB)	Remark
20	4803,600	74,0	58,0	<b>-16,0</b>	54,0	45,7	<b>-8,3</b>	180	V	100	36,8	Z
21	4879,000	74,0	57,4	<b>-16,6</b>	54,0	45,5	<b>-8,5</b>	185	V	100	36,9	Z
22	4954,400	74,0	57,8	<b>-16,2</b>	54,0	45,4	<b>-8,6</b>	180	V	100	37,1	Z
23	7318,500	74,0	58,2	<b>-15,8</b>	54,0	46,6	<b>-7,4</b>	190	V	100	40,8	Z
24	7431,600	74,0	57,8	<b>-16,2</b>	54,0	46,1	<b>-7,9</b>	190	V	100	41,1	Z
25	12009,000	74,0	58,3	<b>-15,7</b>	54,0	46,2	<b>-7,8</b>	210	H	100	45,1	XY
26	12197,500	74,0	58,4	<b>-15,6</b>	54,0	46,2	<b>-7,8</b>	200	H	100	45,0	XY
27	12386,000	74,0	58,0	<b>-16,0</b>	54,0	46,0	<b>-8,0</b>	200	H	100	45,0	XY
28	1520,100	74,0	49,4	<b>-24,6</b>	54,0	35,8	<b>-18,2</b>	155	V	100	27,9	XY
29	1534,000	74,0	50,8	<b>-23,2</b>	54,0	36,8	<b>-17,2</b>	95	H	100	28,0	XY
30	1645,200	74,0	50,4	<b>-23,6</b>	54,0	37,8	<b>-16,2</b>	350	H	100	28,7	XY
31	2246,060	74,0	51,6	<b>-22,4</b>	54,0	41,0	<b>-13,0</b>	205	V	100	31,1	Z
32	2222,130	74,0	54,0	<b>-20,0</b>	54,0	41,2	<b>-12,8</b>	65	V	100	31,1	Z
33	2258,150	74,0	52,9	<b>-21,1</b>	54,0	39,2	<b>-14,8</b>	165	V	100	31,1	Z
34	2389,860	74,0	55,2	<b>-18,8</b>	54,0	41,2	<b>-12,8</b>	115	H	100	31,3	XY
35	2323,320	74,0	61,0	<b>-13,0</b>	54,0	41,7	<b>-12,3</b>	200	H	100	31,2	XY
36	2354,120	74,0	61,3	<b>-12,7</b>	54,0	42,1	<b>-11,9</b>	185	H	100	31,2	XY

Note: Measures have been done at 3m distance.

**7.7. CONCLUSION**

Band Edge Measurement performed on the sample of the product **Orpheo TG**, SN: **L001621014**, in configuration and description presented in this test report, show levels below the FCC CFR 47 Part 15 limits.

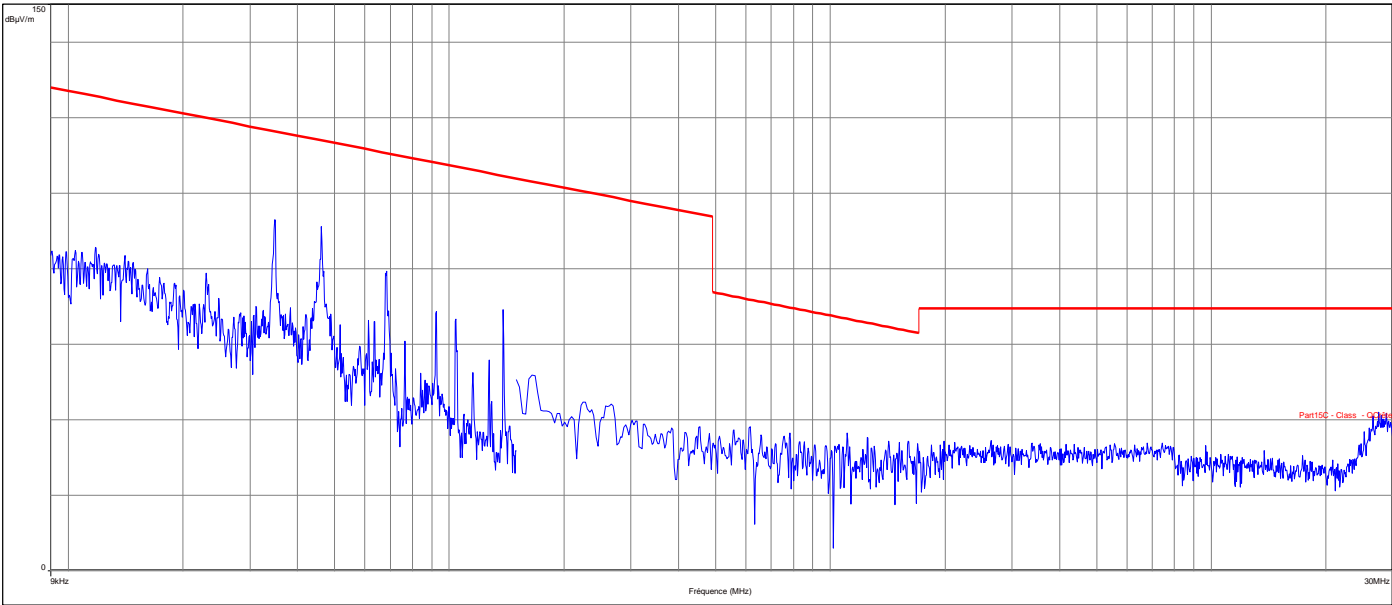


8. ANNEX 1 (GRAPHS)

RADIATED EMISSIONS

Graph name:	Emr#1	Test configuration:
Limit:	FCC CFR47 Part15C	(0°) - TX mode - Axis XY/Z
Class:	-	
Frequency range: [9kHz - 30MHz]		
Antenna polarization:	0°	RBW : 100kHz
Azimuth:	0° - 360°	VBW : 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/
- Mes.Peak (Horizontale)



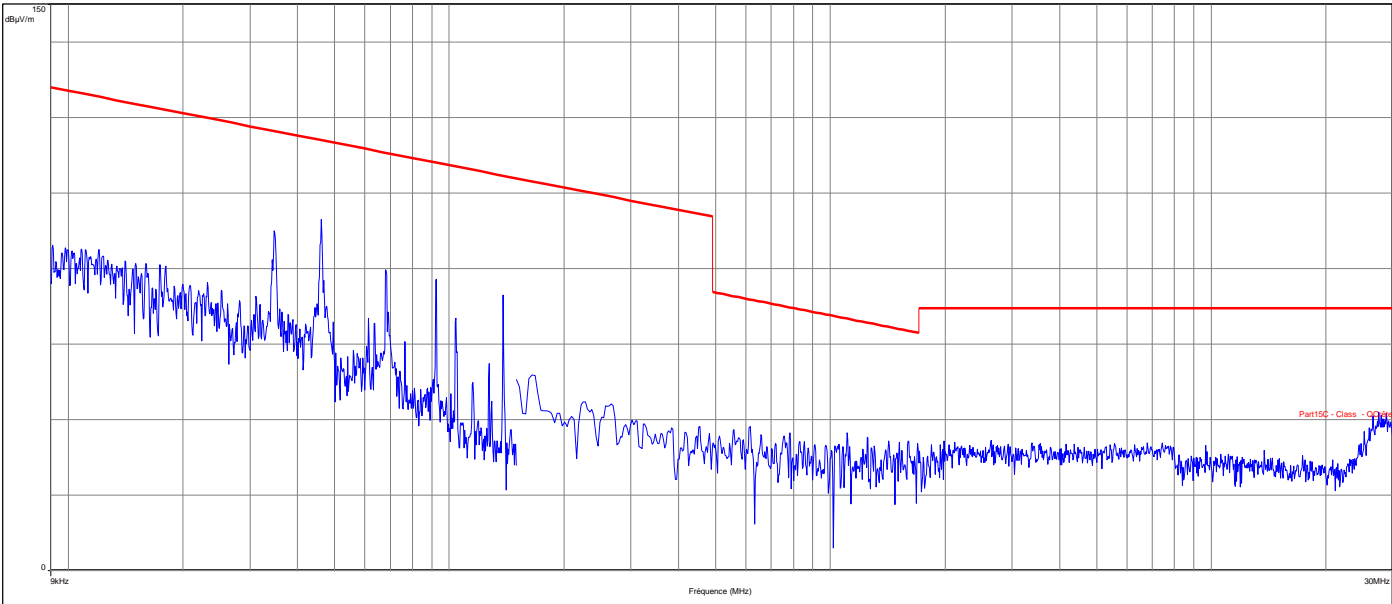
Spurious emissions



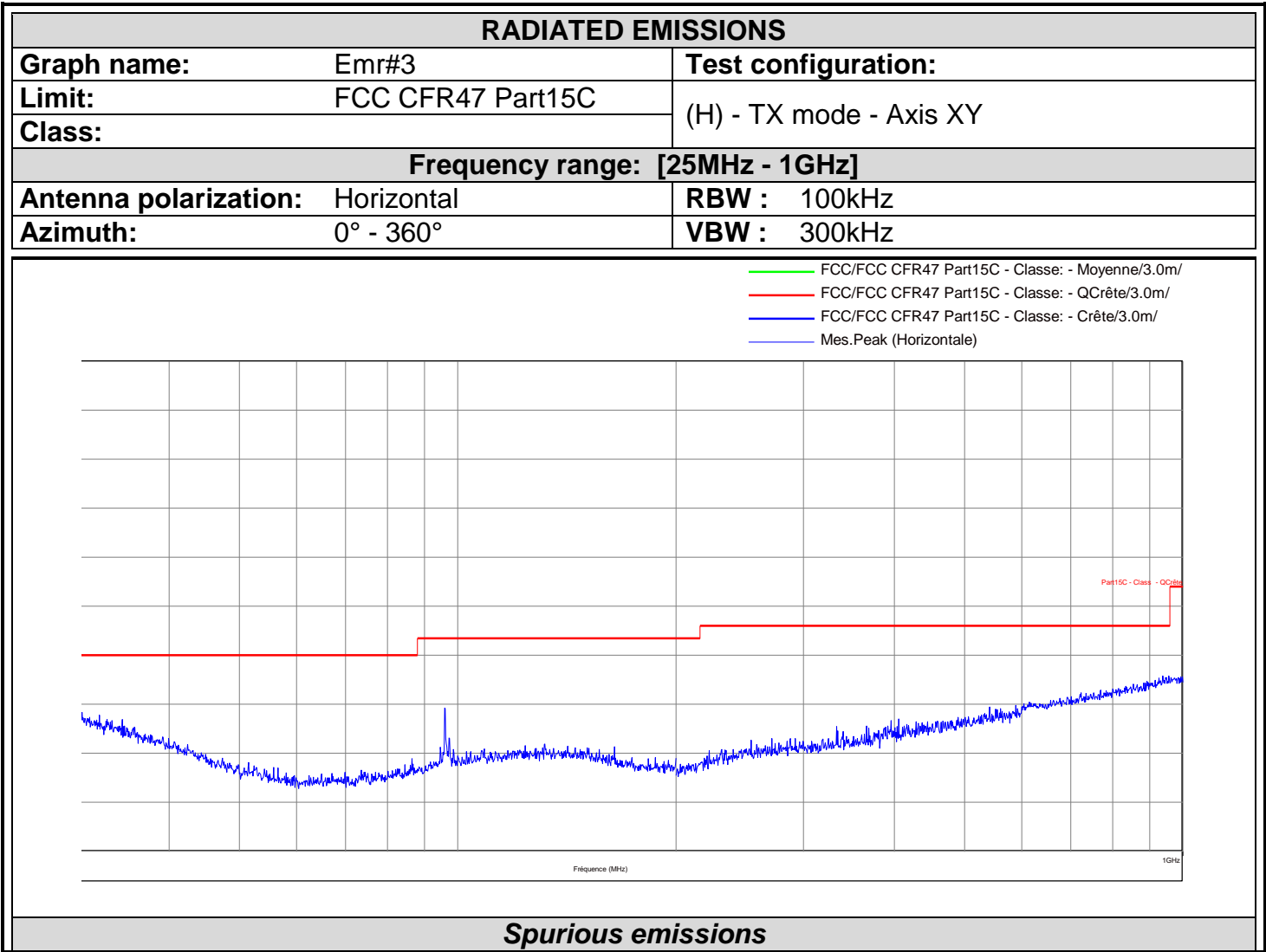
RADIATED EMISSIONS

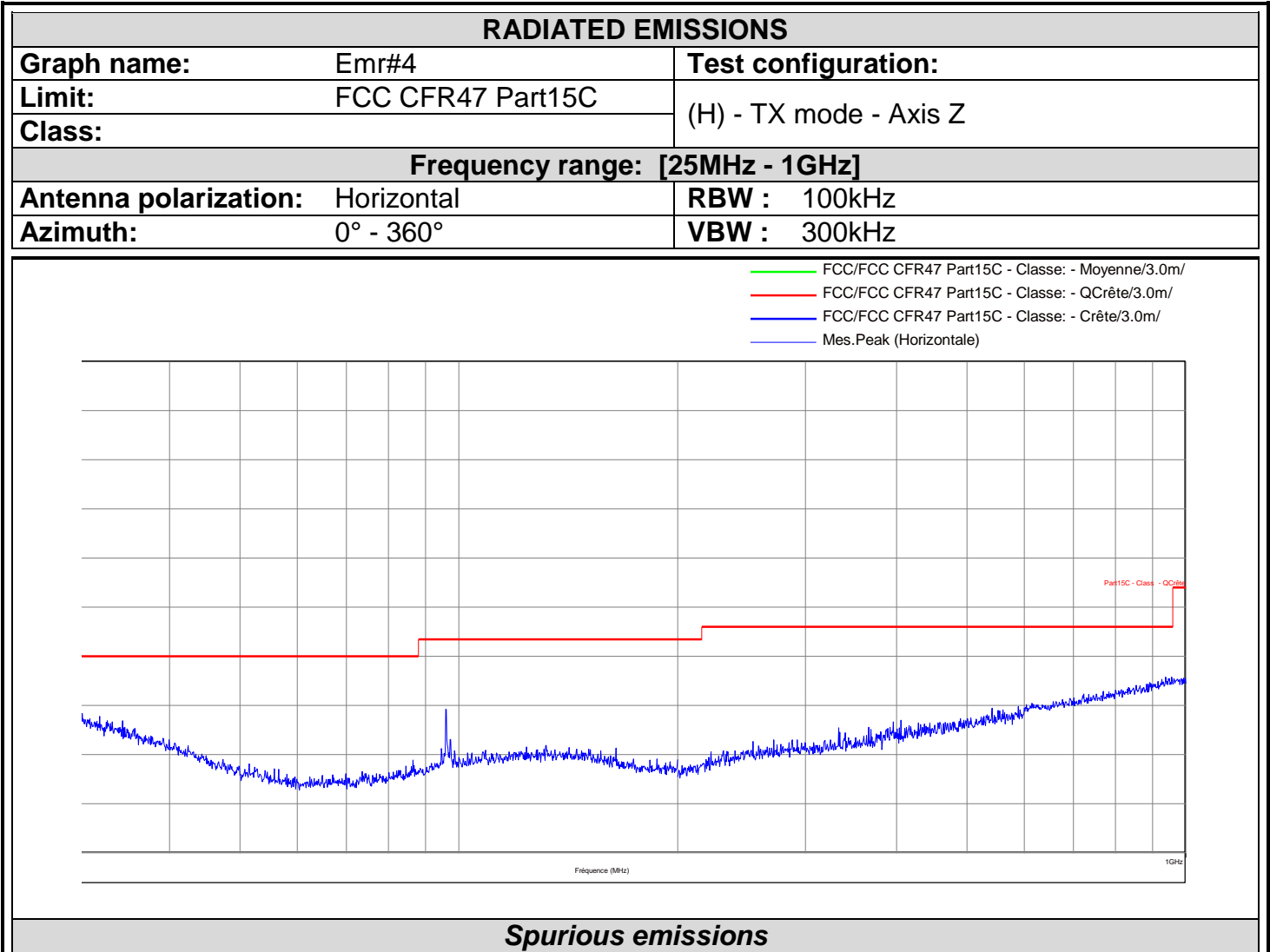
Graph name:	Emr#2	Test configuration:
Limit:	FCC CFR47 Part15C	(90°) - TX mode - Axis XY/Z
Class:	-	
Frequency range: [9kHz - 30MHz]		
Antenna polarization:	90°	RBW : 100kHz
Azimuth:	0° - 360°	VBW : 300kHz

- FCC/FCC CFR47 Part15C - Classe: - Moyenne/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/
- FCC/FCC CFR47 Part15C - Classe: - Crête/3.0m/
- Mes.Peak (Horizontale)



Spurious emissions

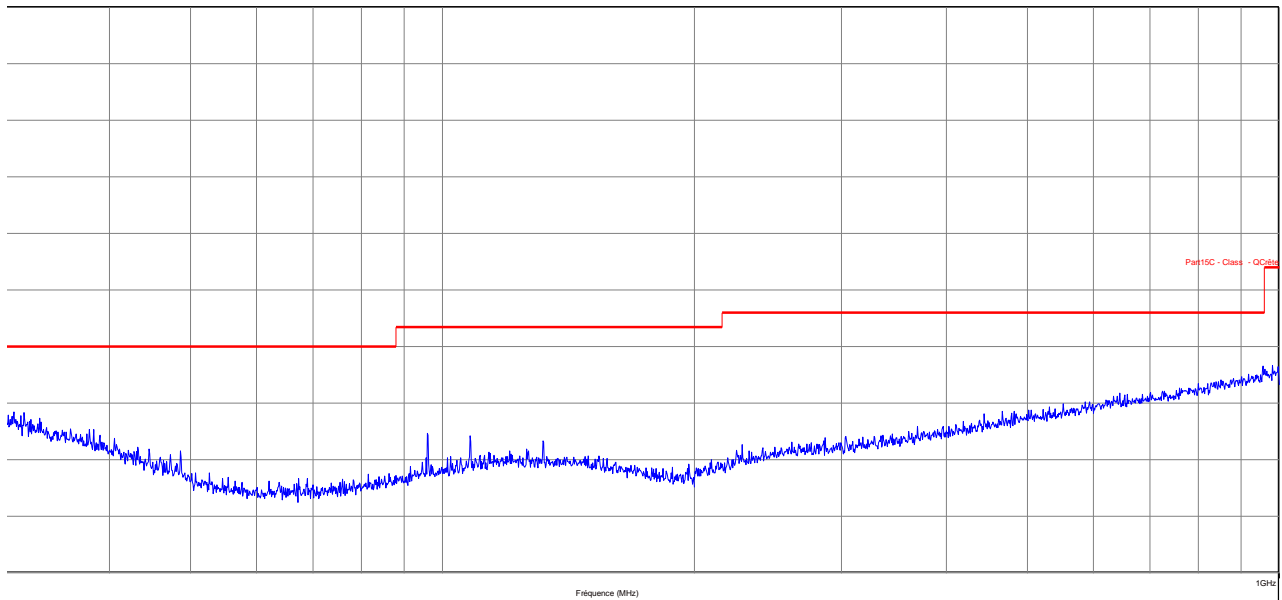


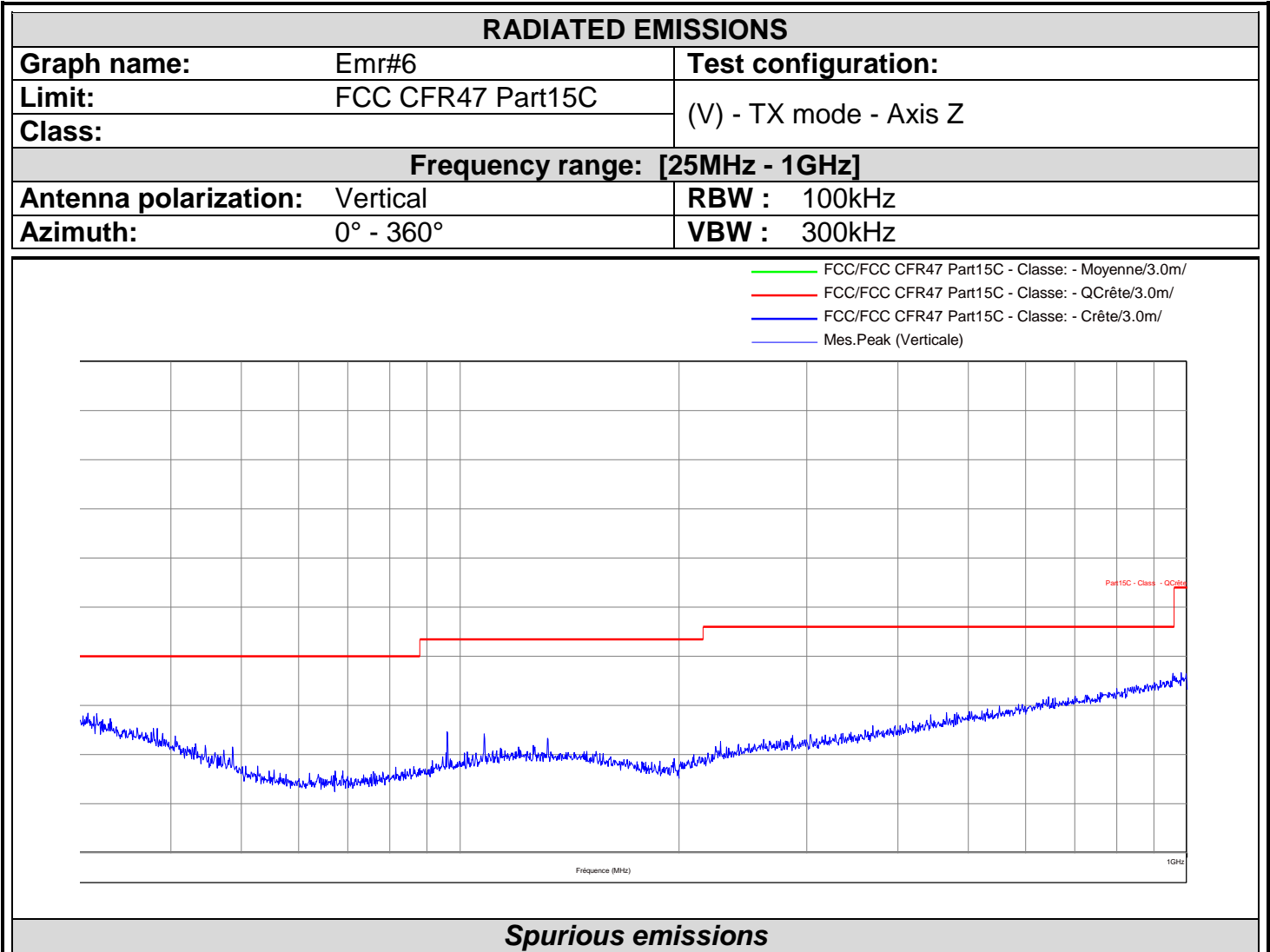


**RADIATED EMISSIONS**

<b>Graph name:</b>	Emr#5	<b>Test configuration:</b>
<b>Limit:</b>	FCC CFR47 Part15C	(V) - TX mode - Axis XY
<b>Class:</b>		
<b>Frequency range: [25MHz - 1GHz]</b>		
<b>Antenna polarization:</b>	Vertical	<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/  
— Mes.Peak (Verticale)

**Spurious emissions**



**9. UNCERTAINTIES CHART**

Type de mesure / Kind of measurement	Incertitude élargie laboratoire / Wide uncertainty laboratory (k=2) $\pm x$	Incertitude limite du CISPR / CISPR uncertainty limit $\pm y$
Mesure des perturbations conduites en tension sur le réseau d'énergie <i>Measurement of conducted disturbances in voltage on the power port</i>	3.57 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>	3.28 dB	A l'étude / Under consid.
Mesure des perturbations discontinues conduites en tension <i>Measurement of discontinuous conducted disturbances in voltage</i>	3.47 dB	3.6 dB
Mesure des perturbations conduites en courant <i>Measurement of conducted disturbances in current</i>	2.90 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>	5.07 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.