

RC-032-C45-07-100518-3-A

"This report cancels and replaces the test report N° RC-032-C45-07-100518-3-A Edition 0"

<h2 style="margin: 0;">RADIO test report</h2> <p style="margin: 20px 0;">According to the standard: FCC PART 15 : 2007</p> <p style="margin: 20px 0;">Equipment under test: Industrial battery controller WI - IQ</p> <p style="margin: 20px 0;">Company: HAWKER</p>

FCC Listed : 910 701

DISTRIBUTION: Mr VANDEVYVER

(COMPANY: HAWKER)

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This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of the whole manufactured products of the tested sample.*

TEST CERTIFICATION FOR: FCC Certification

EQUIPMENT UNDER TEST: Industrial battery controller WI - IQ

Reference: -

Serial number: 200 802 181 6243

MANUFACTURER: HAWKER

APPLICANT:

Company: HAWKER

Address: Site de Brebières
Parc d'activité Horizon 2000
62117 BREBIERES
FRANCE

Product manager: Mr VANDEVYVER

DATES OF TESTS: 2008, the 14th and 15th of April

TESTS SITES: EMITECH open site at AUNAINVILLE (28) - FRANCE
EMITECH laboratory at MONTIGNY-LE-BRETONNEUX (78) - FRANCE

TESTS OPERATOR: F. LHEUREUX

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ANNEX 1: ANTENNAS FACTORS, INSERTION LOSSES AND AMPLIFIER VALUES

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ANNEX 4: CHANNEL SEPARATION

ANNEX 5: NUMBER OF CHANNELS AND AVERAGE TIME OF OCCUPANCY ANY FREQUENCY

ANNEX 6: CALIBRATION DATE

1. **INTRODUCTION**

This report presents the results of Electromagnetic Compatibility tests performed on the equipment: “Industrial battery controller WI – IQ” according to reference document listed below.

2. **REFERENCE DOCUMENT**

FCC Part 15 : 2007

Code of Federal Regulations

Title 47 – Telecommunication

Chapter 1 – Federal Commission

Part 15 – Radio frequency devices

3. **PRODUCT DESCRIPTION**

ITU Emission code:	-
Class:	B (residential environment)
Utilization:	Controller of battery with radio link
Operating frequency range:	From 2402 MHz to 2483 MHz
Number of channels:	Limited to 15 channels
Channel spacing:	5 MHz
Frequency generation:	-
Modulation:	O - QPSK
Power source:	24 Vdc

4. **EQUIPMENT UNDER TEST (EUT) CONFIGURATION**

- See antenna factors, insertion losses and amplifier values in annex 1.
- See internal photographs in annex 2.
- See setup photographs in annex 3.

Modification of the equipment during the tests: No.

5. TESTS AND CONCLUSION

The following table summarizes test results of the EUT.

Test procedure	Designation of test	Test results				Comments
		Pass	Fail	N.A.	N.P.	
15.107 and 15.207	Measurement of conducted emission on AC mains ports			X		
15.247 (b) (1)	Maximum peak power measurement	X				
15.247 (b) (1)	RF exposure compliance			X		Note 1
15.247 (e)	Power spectral density measurement	X				
15.247 (a) (2)	6 dB bandwidth measurement	X				
15.247 (d)	Band edge measurement	X				
15.109, 15.205 and 15.209	Spurious and unintentional radiated emissions in the band 30 MHz – 25 GHz	X				
15.247 (a) (1)	Hopping mode measurement	X				Note 2
15.247 (a) (1) (iii)	Hopping timing measurement	X				Note 3

N.A.: Not Applicable

N.P.: Not Performed

Note 1: This type of equipment uses less than 0.5 W

Note 2: See annex 4, the frequency hopping system have hopping channel carrier frequencies separated by 5 MHz. The system hop to channel frequencies from a pseudo rand only ordered list happening frequencies. Each frequency is use equally on the average by the transmitter and separated by a minimum of 20 dB bandwidth of the hopping channel.

Note 3: The frequency hopping system use 16 non overlapping channels. The timing by channel is 233.7 ms (see annex 5). During 16 channels 0.4 s (part 15) = 6.4 s any channel is used 27 times then $27 \times 1.055 \text{ ms} = 28.48 \text{ ms}$, than the average time of occupancy on any channel is less than 400 ms within a period of 0.4 s multiplied by the number of hopping channels employed in normal operating mode.

Conclusion:

The tested sample "**Industrial battery controller WI – IQ**" submitted to the tests complies with the requirements of the standard:

➤ FCC PART 15: 2007

According to the limits specified in this report.

6. MAXIMUM PEAK POWER MEASUREMENT

Standard: FCC PART 15: 2007

Section: 15.247 (b) (1)

Test procedure: Public Notice DA 00-705, alternative test procedure.

Test configuration:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

The level was maximised in antenna height, azimuth and polarization. The maximum level measured on the spectrum analyzer was recorded.

Distance of antenna: 3 meters.

Test equipment used:

Nr Emitech	Category	Brand	Type
3374	Antenna	Emco	Cornet 3115
2341	Antenna mast	HD GmbH	MA 240
5624	Band pass filter	BL Microwave	Band pass
2896	Cable	Cables & Connectiques	N-13m
2342	Mast controller	HD GmbH	HD 100
187	Open site	Emitech	Aunainville
2205	Spectrum analyzer	Agilent	E7405A

Equipment under test operating condition:

EUT is in continuous transmission on channel 0, channel 7 and channel 15.

Measure conditions:

Ambient temperature (°C): 14

Relative humidity (%): 70

Power source: 24 Vd.c.

For RF peak level: Resolution bandwidth: 1 MHz

Video bandwidth: 1 MHz

Results:

Polarization of test antenna: horizontal (height: 132 cm, Az: 30°).

Channel 0 (2405.52 MHz) Curve 1

		Level dBμV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBμV/m)	P* (W)
Normal test conditions	Nominal power source (V): 24	-	-	-	92.99	0.597×10^{-3}

Channel 7 (2439.65 MHz) Curve 2

		Level dBμV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBμV/m)	P* (W)
Normal test conditions	Nominal power source (V): 24	-	-	-	90.19	0.313×10^{-3}

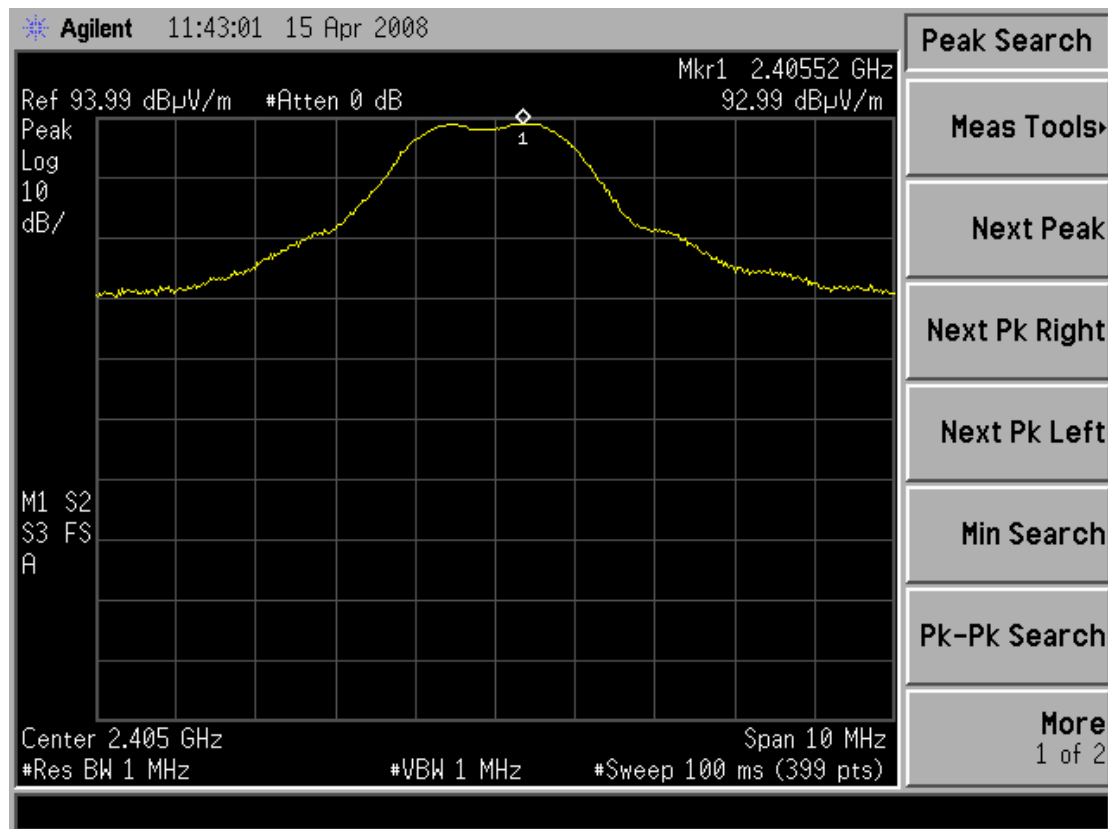
Channel 15 (2480.58 MHz) Curve 3

		Level dBμV	Cable loss dB	Antenna factor dB	Electro-magnetic field (dBμV/m)	P* (W)
Normal test conditions	Nominal power source (V): 24	-	-	-	91.21	0.396×10^{-3}

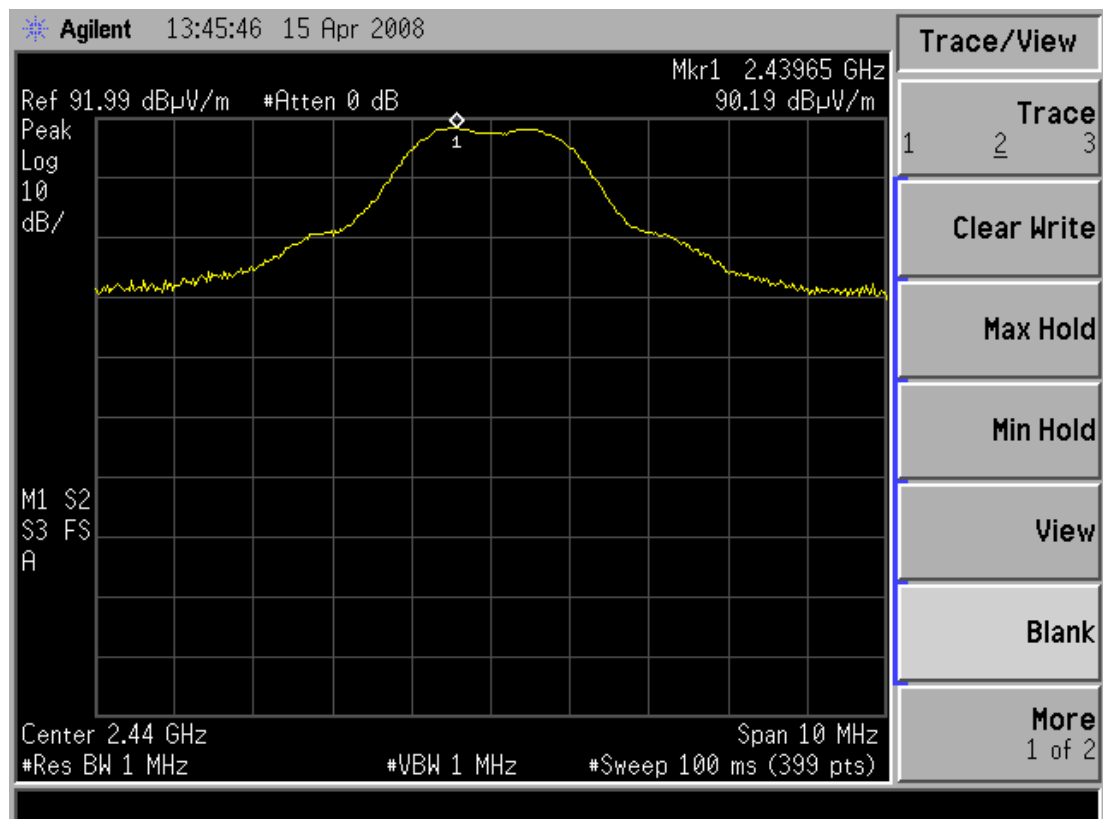
* $P = (E \times d)^2 / (30 \times G_p)$ with $d = 3m$ and $G_p = 1$

Test conclusion: Complies with the requirements of the standard.

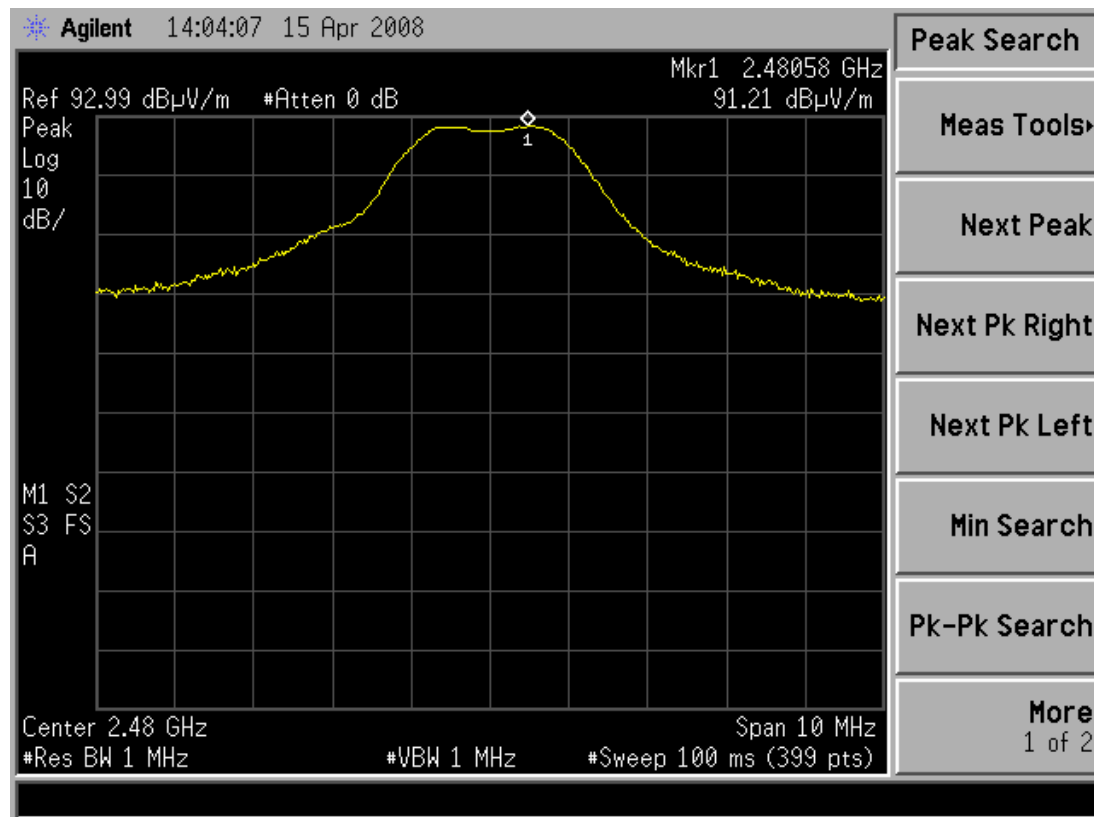
Curve 1



Curve 2



Curve 3



7. POWER SPECTRAL DENSITY MEASUREMENT

Standard: FCCC PART 15 : 2007

Section: 15.247 (e)

Test procedure: Public Notice DA 00-705, alternative test procedure.

Instrumentation test list:

Nr Emitech	Category	Brand	Type
3374	Antenna	Emco	3115
2341	Antenna mast	HD GmbH	MA 240
5624	Band pass filter	BL Microwave	Band pass
2896	Cable	Cables & Connectiques	N-13m
2342	Mast controller	HD GmbH	HD 100
187	Open site	Emitech	Aunainville
2205	Spectrum analyzer	Agilent	E7405A

Test configuration:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

The level was maximised in antenna height, azimuth and polarization. The maximum level measured on the spectrum analyzer was recorded.

Measured condition: Resolution bandwidth: 3 kHz.

Video bandwidth: 3 kHz.

SPAN: 1.5 MHz.

Sweep: 500 seconds.

Ambient temperature C°: 14

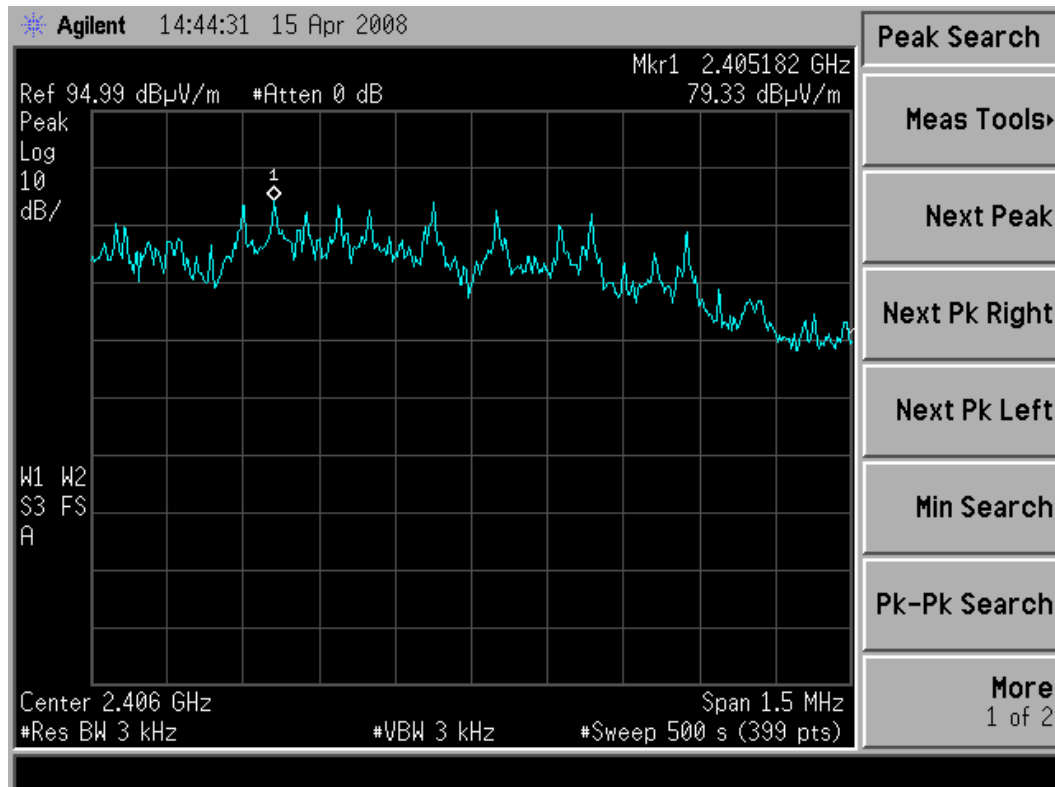
Relative humidity (%): 70

Result:

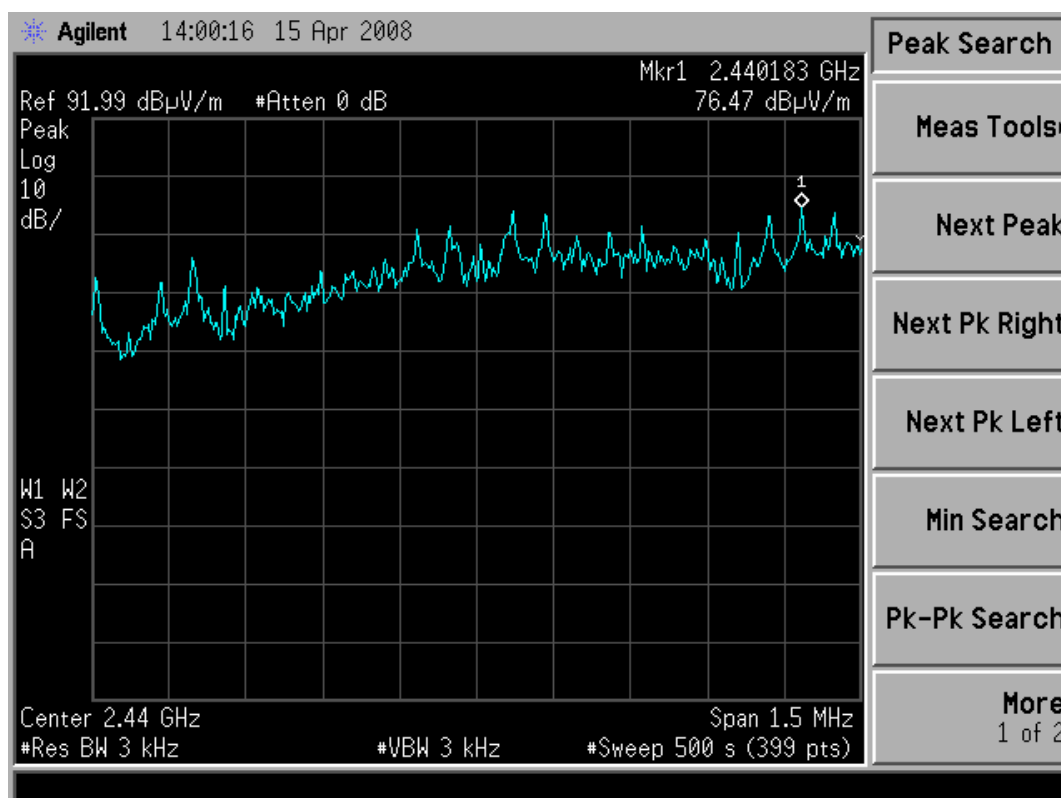
Channel	Channel frequency (MHz)	RF power level (dBm)	Limit (dBm)	Curve reference
0	2405	- 15.90	8	Curve 4
7	2440	- 18.76	8	Curve 5
15	2480	- 16.51	8	Curve 6

Test conclusion: Respect the standard.

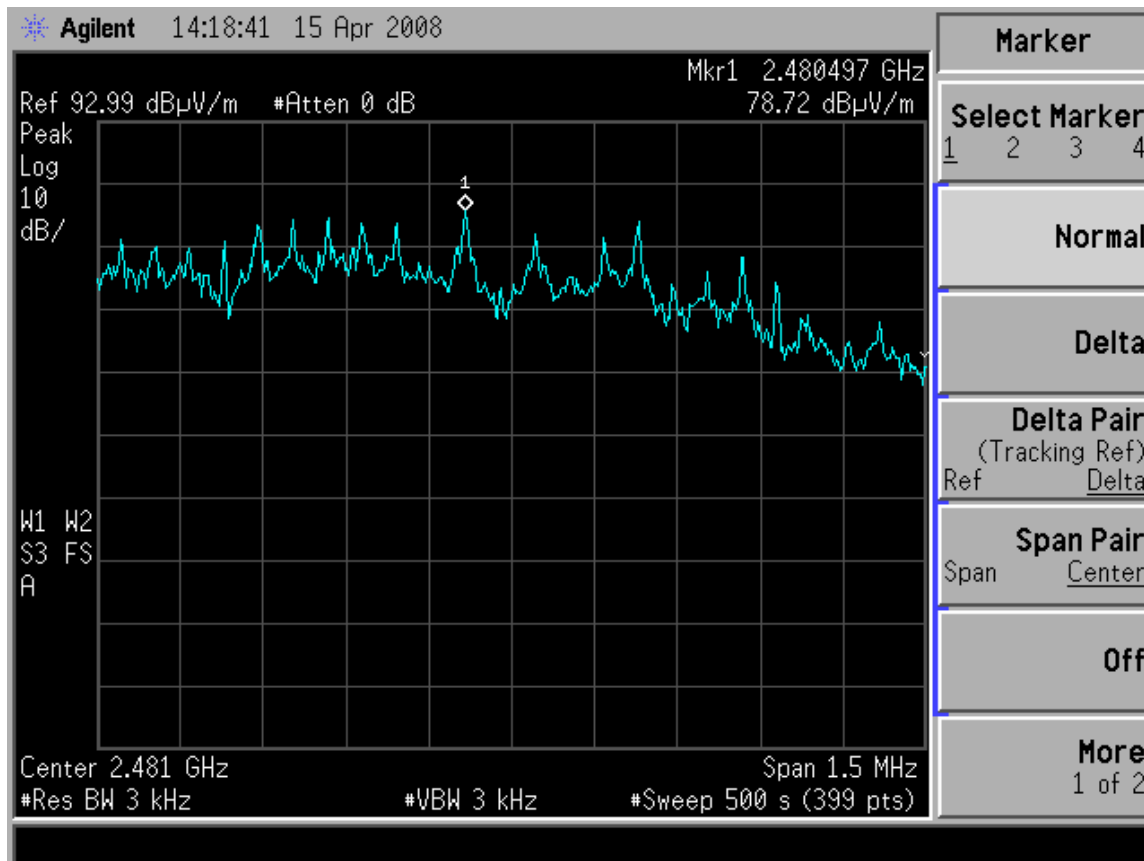
Curve 4



Curve 5



Curve 6



8. 6 dB BANDWIDTH MEASUREMENT

Standard: FCC PART 15 : 2007

Section: 15.247 (a) (2)

Test configuration:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

The level was maximised in antenna height, azimuth and polarization.

The 6 dB bandwidth was recorded on spectrum analyzer.

Instrumentation test list:

Nr Emitech	Category	Brand	Type
3374	Antenna	Emco	3115
2341	Antenna mast	HD GmbH	MA 240
5624	Band pass filter	BL Microwave	Band pass
2896	Cable	Cables & Connectiques	N-13m
2342	Mast controller	HD GmbH	HD 100
187	Open site	Emitech	Aunainville
2205	Spectrum analyzer	Agilent	E7405A

Equipment under test operating condition:

EUT is in continuous transmission mode on channel 0, channel 7 and channel 15.

Measure condition:

Resolution bandwidth: 100 kHz

Video bandwidth: 100 kHz

Ambient temperature (°C): 14

Relative humidity (%): 70

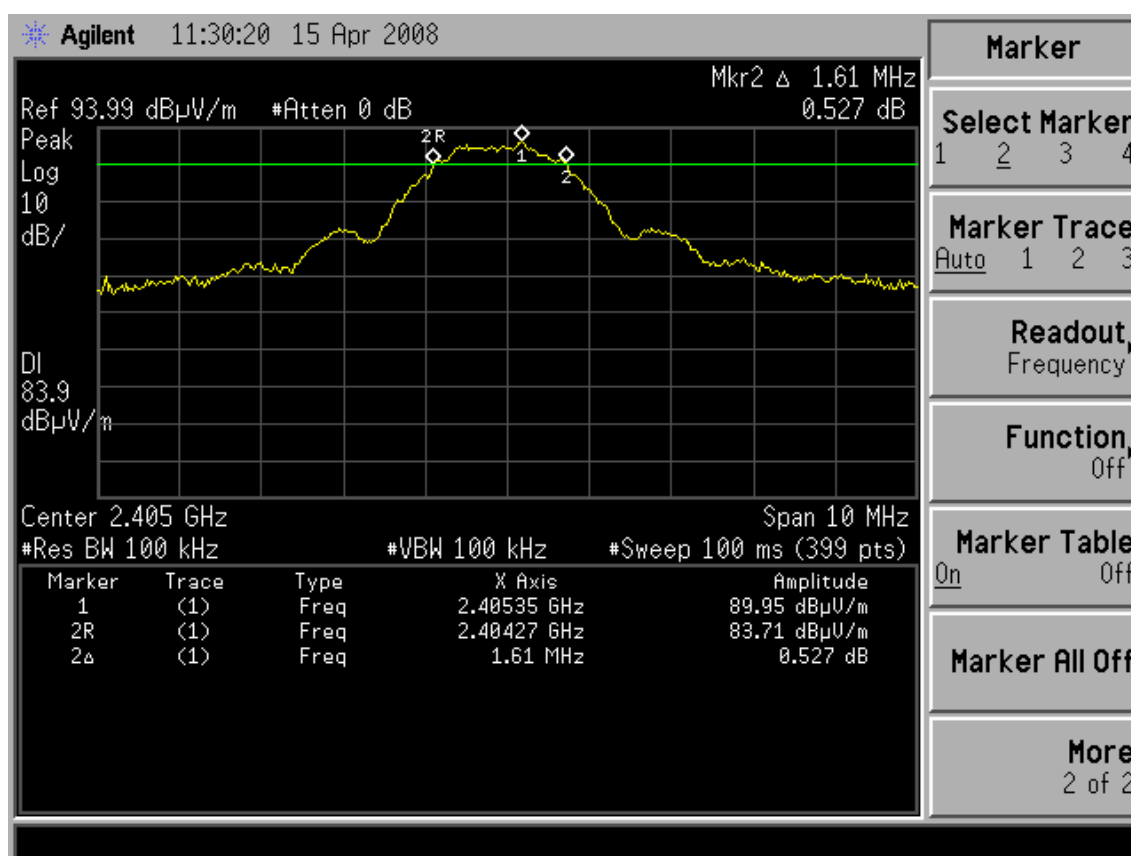
Results:

Polarization of test antenna: Horizontal (height: 132 cm, Az: 30°)

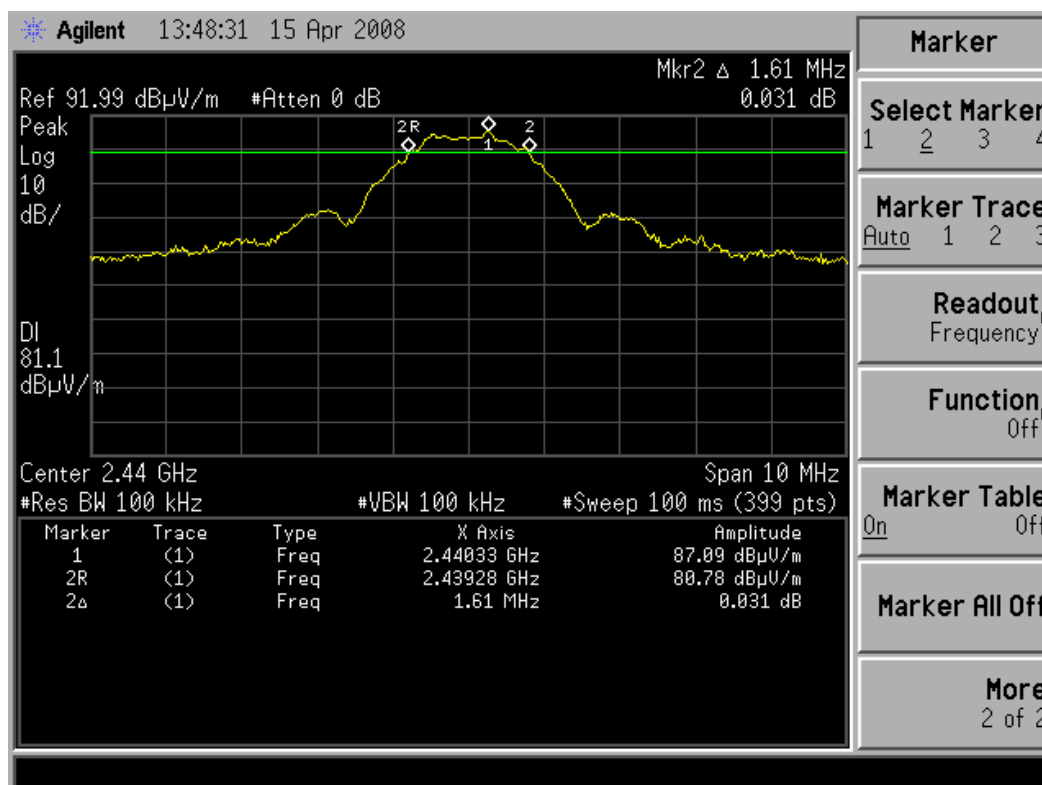
Channel frequency (MHz)	Limit (kHz)	6 dB bandwidth (MHz)	Curve reference
2405	> 500	1.61	Curve 7
2440	> 500	1.61	Curve 8
2480	> 500	1.56	Curve 9

Test conclusion: Complies with the requirements of the standard.

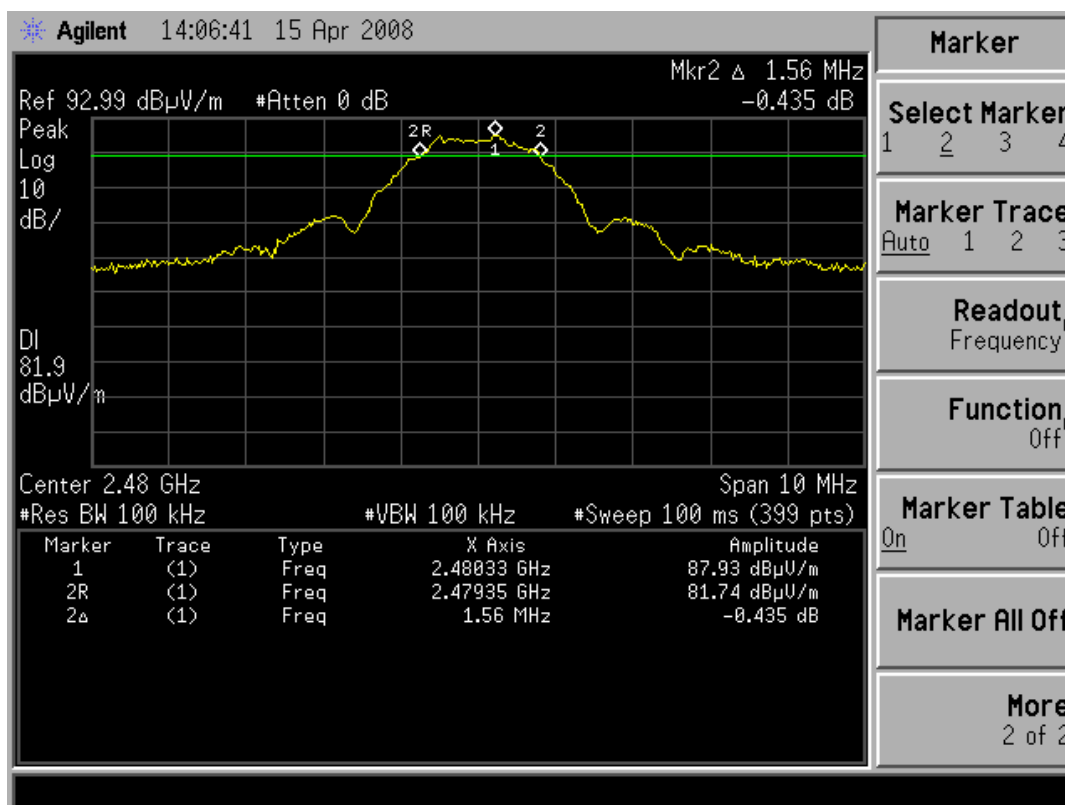
Curve 7



Curve 8



Curve 9



9. **BAND EDGE MEASUREMENT**

Standard: FCC PART 15 : 2007

Section: 15.247 (d)

Test procedure: Public Notice DA 00-705, Delta Marker method.

Test configuration:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

The level was maximised in antenna height, azimuth and polarization. Then the level at 20 dB under the maximum level on the analyzer was recorded.

Distance of antenna: 3 meters.

Test equipment used:

Nr Emitech	Category	Brand	Type
3374	Antenna	Emco	3115
2341	Antenna mast	HD GmbH	MA 240
2896	Cable	Cables & Connectiques	N-13m
1097	High pass filter	Trilithic	6HC1300-2.5-KK
2342	Mast controller	HD GmbH	HD 100
187	Open site	Emitech	Aunainville
2205	Spectrum analyzer	Agilent	E7405A

Equipment under test operating condition:

EUT is in continuous transmission mode on channel 0 and channel 15.

Measured condition:

Resolution bandwidth: 100 kHz Ambient temperature (°C): 14

Video bandwidth: 100 kHz Relative humidity (%): 70

Results:

Polarization of test antenna: horizontal (height: 132 cm, Az: 30°).

Lowest frequency limit: from 2310 MHz to 2390 MHz, curve n° 10

Upper Band Edge: from 2483.5 MHz to 2500 MHz, curve n° 11

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	Detector	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB)*	Calculated Max Out of Band Emission Level (dBμV/m)**	Limit (dBμV/m)	Margin (dB)
2405	89.87	Peak	2386.6	- 39.8	50.07	69.9	19.83
2480	87.74	Peak	2484.1	- 35.4	52.34	67.7	15.36

* according to step 2 of Marker-Delta Method DA 00-705.

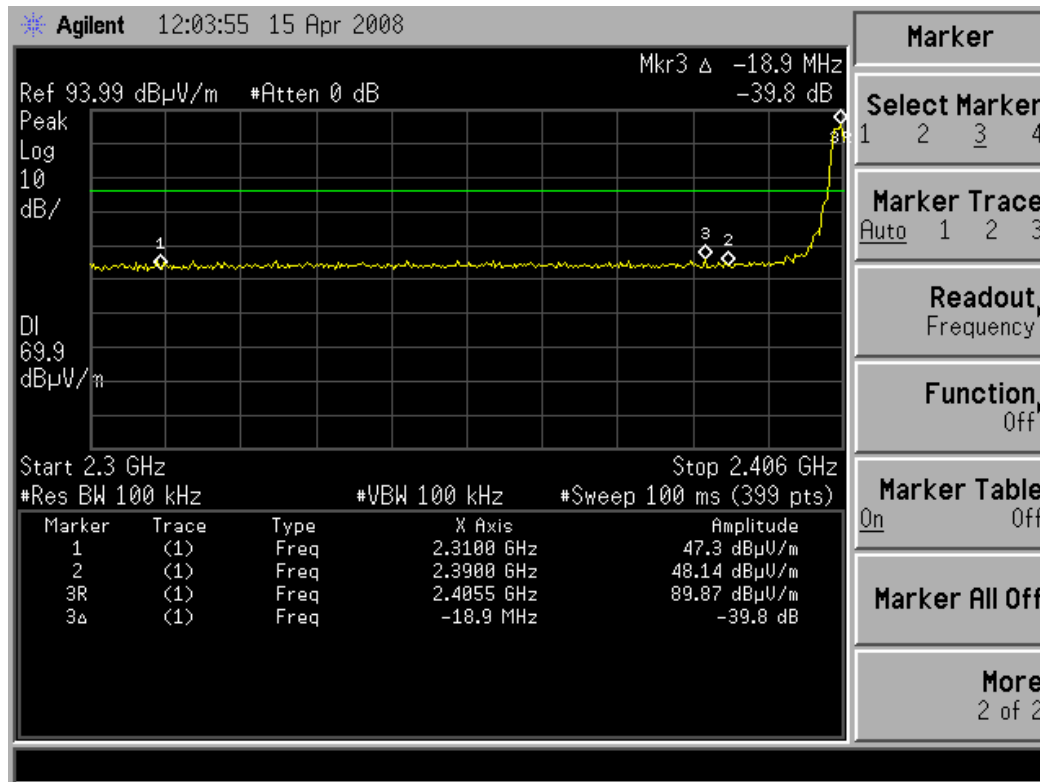
** according to step 3 of Marker-Delta Method:

Calculated Emission Level = Field Strength Level - Delta Marker Level

Test conclusion: Complies with the requirements of the standard.

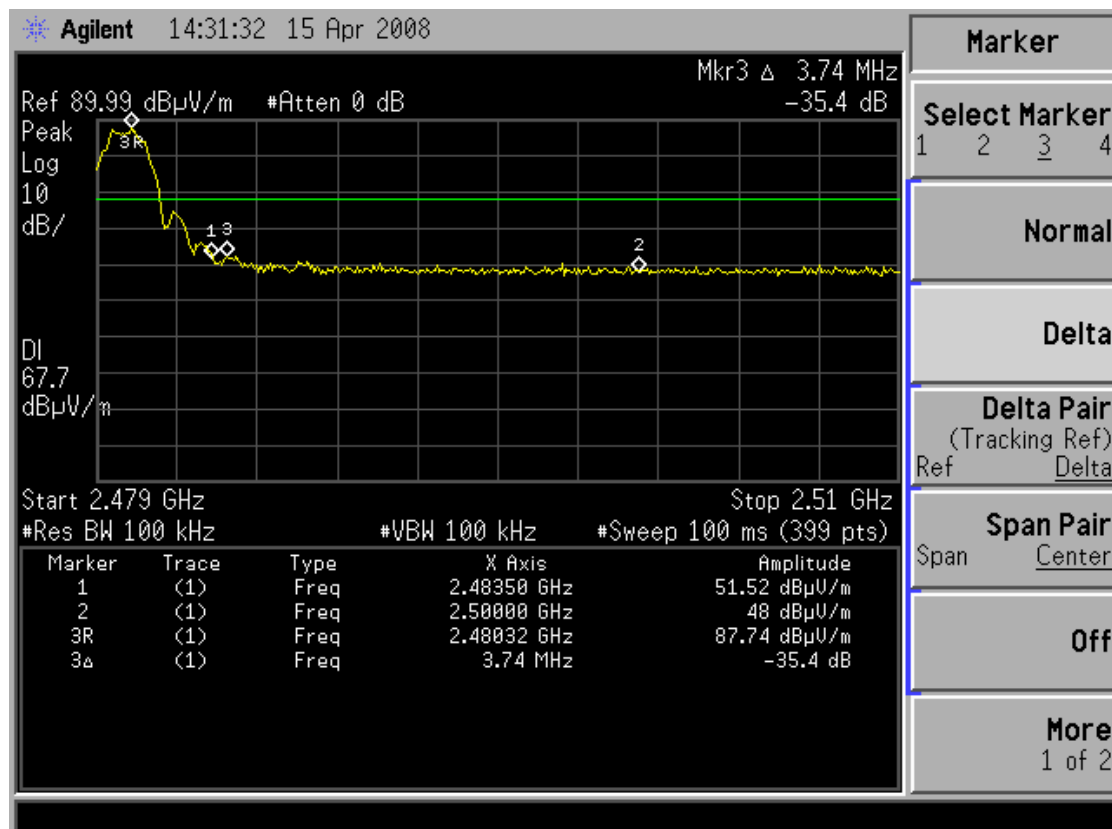
Channel 0

Curve 10



Channel 15

Curve 11



10. SPURIOUS EMISSIONS

Standard: FCC PART 15: 2007

Sections: 15.205 and 15.209

Equipment under test arrangement:

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal metal ground plane.

For maximum meter reading at each frequency, the antenna height is adjusted between 1 m and 4 m above the ground plane. A 360 degrees rotation of the EUT is performed in vertical and horizontal polarization. The frequency azimuth and antenna height are presented in the table on the next pages.

Frequency range: 1 GHZ – 25 GHz

Detection mode: Average for 1 GHz – 25 GHz

Resolution bandwidth: 1 MHz for 1 GHz – 25 GHz

Measurement distance: 3 meters

Limit: For restrictive bands (see paragraph 15.205), the EUT must satisfy requirements of the section 15.209 as shown in table below (for 3 m).

Frequency range (MHz)	Limit (dB μ V/m)
30 to 88	40.0
88 to 216	43.5
216 to 960	46.0
960 to 25000	54.0

Instrumentation tests list:

Nr Emitech	Category	Marque	Type
3374	Antenna	Emco	3115
2341	Antenna mast	HD GmbH	MA 240
2450	Cable	Cables & Connectiques	HF 12m
2451	Cable	Cables & Connectiques	HF 2m
2452	Cable	Cables & Connectiques	HF 13m
2864	Cable	Cables & Connectiques	N-SMA
2896	Cable	Cables & Connectiques	N-13m
1097	High pass filter	Trilitic	6HC1300-2.5-KK
1529	High pass filter	Trilitic	5EHLX500-3-KK
4691	High pass filter	Micro-tronics	-
1045	Horn antenna	Oritel	CM 42/25
187	Open site	Emitech	Aunainville
2352	Optical acquisition module	TESEO	OAM 02B
3229	Preamplifier	Miteq	AMF-6D-010250-70-7P
2205	Spectrum analyzer	Agilent	E7405A

Results:

Frequency (MHz)	Polarization	Antenna height (cm)	Azimuth (degrees)	Measurement (dBμV/m)	Limit (dBμV/m)
4881.17	Vertical	224	110	52.4	54.0
7321.69	Vertical	265	303	53.2	54.0
4881.21	Horizontal	216	143	53.3	54.0
7321.69	Horizontal	153	155	52.9	54.0

Test performed on channel 1.7 and 15, no frequencies are observed between 1 GHz to 25 GHz other that frequency write on the table.

Test conclusion:

The equipment complies with the requirements of the standard FCC PART 15.205 and 15.209.

11. UNINTENTIONAL RADIATED EMISSIONS IN THE BAND 30 MHZ – 25 GHZ

Standard: FCC PART 15: 2007

Section: 15.109

Equipment under test arrangement:

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m above the horizontal metal ground plane.

For maximum meter reading at each frequency, the antenna height is adjusted between 1 m and 4 m above the ground plane. A 360 degrees rotation of the EUT is performed in vertical and horizontal polarization. The frequency azimuth and antenna height are presented in the table on the next pages.

Frequency range: 30 MHz – 1 GHz
1 GHz – 25 GHz

Detection mode: Quasi-peak for 30 MHz – 1 GHz
Average for 1 GHz – 25 GHz

Resolution bandwidth: 120 kHz for 30 MHz – 1 GHz
1 MHz for 1 GHz – 25 GHz

Measurement distance: 3 meters

Limit:

Frequency range (MHz)	Limit (dB μ V/m)
30 to 88	40.0
88 to 216	43.5
216 to 960	46.0
960 to 25000	54.0

Instrumentation tests list:

Nr Emitech	Category	Marque	Type
187	Open site	Emitech	Aunainville
1045	Horn antenna	Oritel	CM 42/25
1097	High pass filter	Trilithic	6HC1300-2.5-KK
1144	Biconical antenna	Schwarzbeck	VHBA 9123
1216	Receiver	Rohde & Schwarz	ESVS10
1529	High pass filter	Trilitic	5EHLX500-3-KK
2205	Spectrum analyzer	Agilent	E7405A
2341	Antenna mast	HD GmbH	MA 240
2352	Optical acquisition module	TESEO	OAM 02B
2450	Cable	Cables & Connectiques	HF 12m
2451	Cable	Cables & Connectiques	HF 2m
2452	Cable	Cables & Connectiques	HF 13m
2864	Cable	Cables & Connectiques	N-SMA
2896	Cable	Cables & Connectiques	N-13m
3106	Antenna	Schwarzbeck	UHALP 9108
3229	Preamplifier	Miteq	AMF-6D-010250-70-7P
3374	Antenna	Emco	3115
4691	High pass filter	Micro-tronics	-

Results:

Test performed on channel 1.7 and 15, no frequencies are observed between 30 MHz to 25 GHz.

Test conclusion:

The equipment complies with the requirements of the standard FCC PART 15.109.

□□□ End of report,

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