EMITECH GROUPE

RCE-100-18-100846-1-A

E.M.C Test Report

According to the standard:

FCC 47 CFR PART 15 : 2017 (§15.247)

Equipment under test:

Sensor Nano SPY
FCC ID: W4511560

Company:

JRI

FCC accredited: FR0004

DISTRIBUTION: Mr. PEYRICHOU **(Company:** JRI)

Number of pages: 26 with 2 annexes

Ed.	Date	Modified page(s)	Written by Name	Written by Visa	Technical Verification and Quality Approval Name	Technical Verification and Quality Approval Visa
0	12/06/2018	Creation	F. ROHRI	FR	B. Pellerin	

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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 production of the item tested.

TEST CERTIFICATION FOR:	FCC Certification
NAME OF THE EQUIPMENT UNDER TEST:	Sensor Nano SPY
Serial number:	SY1609800132
Reference / model (P/N):	NanoSpy
Software version:	2.0
NAME OF THE MANUFACTURER:	JRI
ADDRESS OF THE APPLICANT:	
Company:	JRI
Address:	16 rue Louis Rameau 95870 BEZONS - FRANCE
Responsible:	Mr. PEYRICHOU
Person present during the tests:	None
DATES OF TESTS:	2018, from the 14th to the 16th of March
TESTS LOCATION:	EMITECH laboratory in Montigny Le Bretonneux (78) FRANCE.
TESTS OPERATOR:	F. ROHRI / G. SCIPION
TESTS TUTOR:	B. PELLERIN

TABLE OF CONTENTS

1. INTRODUCTION

This document presents the results of Electromagnetic Compatibility tests performed on the equipment **« Sensor Nano SPY »** according to reference documents listed below.

2. REFERENCE DOCUMENTS

FCC 47 CFR Part 15: 2017
Code of Federal Regulations. Title 47- Telecommunication
Chapter 1- Federal Communication Commission
Part 15- Radio frequency devices

ANSI C63.4: 2014
Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronics Equipment in the range of 9 kHz to 40 GHz.

KDB 558074 D01 DTS Meas Guidance V04
Guidance for performing compliance measurement on Digital Transmission Systems (DTS) operating under § 15.247

ANSI C63.10:2013
American national Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

3. PRODUCT DESCRIPTION

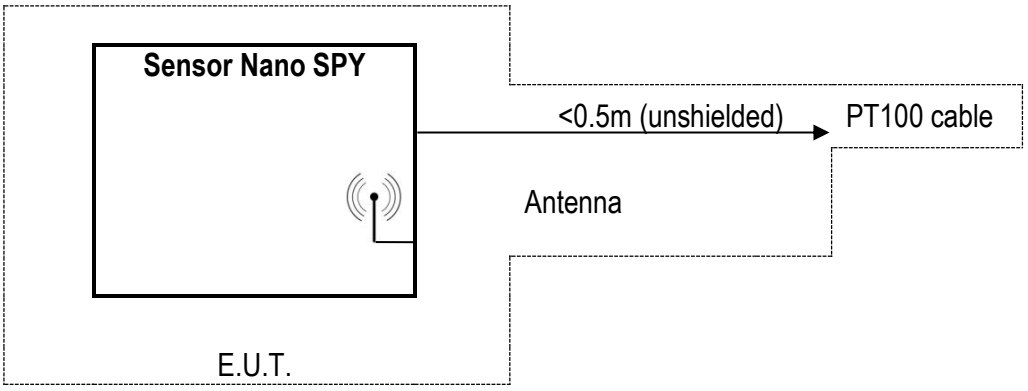
Class:	B
Antenna type and gain:	Integrated antenna: Not communicated
Operating frequency range:	I.S.M. band from 2400 MHz to 2483.5 MHz
Number of channels:	16
Channel spacing:	5 MHz
Modulation:	ZIGBEE
Power source:	Internal battery (Lithium 3.6V)
Software power setting:	-

I.S.M.: Industrial, Scientific and Medical.

Modification of the equipment during the tests: None

Temperature sensor with a regular radio transmission of its measurements. The transmission frequency is in the frequency band 2.4 GHz to 2.4835 GHz.

The sensor is supplied in a plastic housing; it is composed of a temperature sensor with a length <0.5m and is powered by a battery of 3.6 Vdc.



4. TESTS AND CONCLUSION

The following table summarizes test results of the EUT.

Subpart B of the standard FCC part 15 – Unintentional radiators

Test procedure	Designation of test	Test results				Comments
		Pass	Fail	N.A.	N.P.	
15.107	Measurement of conducted emission on AC mains ports			X		internal battery
15.109	Radiated emission limits	X				

Subpart C of the standard FCC part 15 – Intentional radiators

Test procedure	Designation of test	Test results				Comments
		Pass	Fail	N.A.	N.P.	
15.205	Restricted bands of operation	X				
15.207	Measurement of conducted emission on AC mains ports			X		internal battery
15.209	Radiated emission limits; general requirements	X				
15.215	Additional provisions to the general radiated emission limitations					
	(a) Alternative to general radiated emission limits	X				
	(b) Unwanted emissions outside of § 15.247 frequency bands	X				
	(c) 20 dB bandwidth and band-edge compliance	X				
15.247	Intentional radiated emissions					
	a) frequency hopping and digitally modulated					
	a) (1) hopping mode			X		
	a) (1) (i) frequency hopping in the band 902-928 MHz			X		
	a) (1) (ii) frequency hopping in the band 5725–5850 MHz			X		
	a) (1) (iii) frequency hopping in the band 2400–2483.5 MHz			X		
	a) (2) systems using digital modulation in the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz (6 dB bandwith)	X				
	b) maximum peak conducted					
	b) (1) frequency hopping in the bands 2400–2483.5 MHz or 5725–5850 MHz			X		
	b) (2) frequency hopping in the band 902-928 MHz			X		

Test procedure	Designation of test	Test results				Comments
		Pass	Fail	N.A.	N.P.	
	b) (3) systems using digital modulation in the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz	X				
	b) (4) maximum peak conducted > 6 dBi					
	b) (4) (i) frequency hopping in the band 2400–2483.5 MHz			X		
	b) (4) (ii) frequency hopping in the band 5725–5850 MHz			X		
	b) (4) (iii) fixed, point-to-point			X		
	c) directional antenna > 6 dBi					
	c) (1) fixed, point-to-point operation			X		
	c) (1) (i) in the band 2400–2483.5 MHz			X		
	c) (1) (ii) in the band 5725–5850 MHz			X		
	c) (1) (iii) fixed, point-to-point			X		
	c) (2) multiple directional beams in the band 2400–2483.5 MHz			X		
	c) (2) (i) information			X		
	c) (2) (ii) sum of the power supplied to all antennas			X		
	c) (2) (iii) one antenna for multiple directional beams			X		
	c) (2) (iv) single directional beam			X		
	d) intentional radiator	X				
	e) peak power spectral density	X				
	f) hybrid system			X		
	g) continuous data stream during the test			X		
	h) to avoid hopping on occupied channels			X		
	i) RF exposure compliance			X		P < 500 mW

N.A.: Not Applicable
N.P.: Not Performed

Conclusion:

The tested sample « **Sensor Nano SPY** » submitted to the tests complies with the requirements of the standard:

- FCC 47 CFR PART 15 : 2017

According to the limits specified in this report.

5. DIGITAL MODULATION SYSTEMS

Standard: FCC 47 CFR PART 15 : 2017

Section: §15.247 a) (2)

Test configuration:

The system is tested in normalized test site.

The test unit is placed on a rotating table, 1.5 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 analyser was recorded.

Distance of antenna: 3 meters

Instrumentation test list:

CATEGORY	BRAND	TYPE	Nr EMITECH	Last validity date	Next validity date
Amplifier	Agilent	8449B	14487	11/05/2017	11/07/2018
Antenna	Emco	3115	0941	28/10/2015	28/12/2018
Antenna mast	Maturo	MCU	8410	---	---
Antenna mast	Maturo	AM 4.0	8411	---	---
Cable	C&C	N-8m	11174	18/04/2016	18/06/2018
Cable	C&C	N-2m	11178	16/04/2016	16/06/2018
Cable	C&C	N-2m	11182	20/04/2016	20/06/2018
Receiver	Rohde & Schwarz	ESRP7	10517	20/10/2017	20/12/2019
Shielded enclosure	COMTEST	SAC 3m	14803	---	---

Equipment under test operating condition:

E.U.T. is in continuous transmission mode.

Measure conditions:

Ambient temperature (°C): 22
Relative humidity (%): 40

Resolution bandwidth: 100 kHz

Results:

Power source: Internal battery (Lithium 3.6V)

6 dB bandwidth

Frequency	Results	Comments
2405 MHz	912.900 KHz	See annex n°3
2440 MHz	915.670 KHz	
2480 MHz	932.880 MHz	

20 dB bandwidth

Frequency	Results	Comments
2405 MHz	2.331 MHz	See annex n°3
2440 MHz	2.432 MHz	
2480 MHz	2.542 MHz	

Test conclusion: Complies with the requirements of the standard.

6. TRANSMITTER OUTPUT POWER

Standard: FCC 47 CFR PART 15 : 2017

Section: §15.247 b) (3)

Test configuration:

The system is tested in normalized test site.

The test unit is placed on a rotating table, 1.5 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 analyser was recorded.

Distance of antenna: 3 meters

Instrumentation test list:

CATEGORY	BRAND	TYPE	Nr EMITECH	Last validity date	Next validity date
Amplifier	Agilent	8449B	14487	11/05/2017	11/07/2018
Antenna	Emco	3115	0941	28/10/2015	28/12/2018
Antenna mast	Maturo	MCU	8410	---	---
Antenna mast	Maturo	AM 4.0	8411	---	---
Cable	C&C	N-8m	11174	18/04/2016	18/06/2018
Cable	C&C	N-2m	11178	16/04/2016	16/06/2018
Cable	C&C	N-2m	11182	20/04/2016	20/06/2018
Receiver	Rohde & Schwarz	ESRP7	10517	20/10/2017	20/12/2019
Shielded enclosure	COMTEST	SAC 3m	14803	---	---

Equipment under test operating condition:

E.U.T. is in continuous transmission mode.

Measure conditions:

Ambient temperature (°C): 22
Relative humidity (%): 40

Resolution bandwidth: 1 MHz

Results:

Power source: Internal battery (Lithium 3.6V)

Frequency	Electro-magnetic field (dBµV/m)	TP* (dBm)	Limit (dBm)
2405 MHz	96.31	- 1.06	+ 30
2440 MHz	97.96	0.58	
2480 MHz	96.45	- 0.92	

* TP = $(E \times d)^2 / (30 \times 1.64)$ for d = 3 m

Test conclusion: Complies with the requirements of the standard.

7. PEAK POWER SPECTRAL DENSITY

Standard: FCC 47 CFR PART 15 : 2017

Section: §15.247 e)

Test configuration:

The system is tested in normalized test site.

The test unit is placed on a rotating table, 1.5 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 analyser was recorded.

Distance of antenna: 3 meters

Instrumentation test list:

CATEGORY	BRAND	TYPE	Nr EMITECH	Last validity date	Next validity date
Amplifier	Agilent	8449B	14487	11/05/2017	11/07/2018
Antenna	Emco	3115	0941	28/10/2015	28/12/2018
Antenna mast	Maturo	MCU	8410	---	---
Antenna mast	Maturo	AM 4.0	8411	---	---
Cable	C&C	N-8m	11174	18/04/2016	18/06/2018
Cable	C&C	N-2m	11178	16/04/2016	16/06/2018
Cable	C&C	N-2m	11182	20/04/2016	20/06/2018
Receiver	Rohde & Schwarz	ESRP7	10517	20/10/2017	20/12/2019
Shielded enclosure	COMTEST	SAC 3m	14803	---	---

Equipment under test operating condition:

E.U.T. is in continuous transmission mode.

Measure conditions:

Ambient temperature (°C): 22
Relative humidity (%): 40

Resolution bandwidth: 100 kHz
Video bandwidth: 300 kHz

Results:

Power source: Internal battery (Lithium 3.6V)

Frequency	Electro-magnetic field (dBµV/m)	PPSD * (dBm)	Limit (dBm)
2405 MHz	92.70	- 4.67	+ 8.0
2440 MHz	92.52	- 4.85	
2480 MHz	92.15	- 5.22	

* PPSD = $(E \times d)^2 / (30 \times 1.64)$ for d = 3 m

2405 MHz

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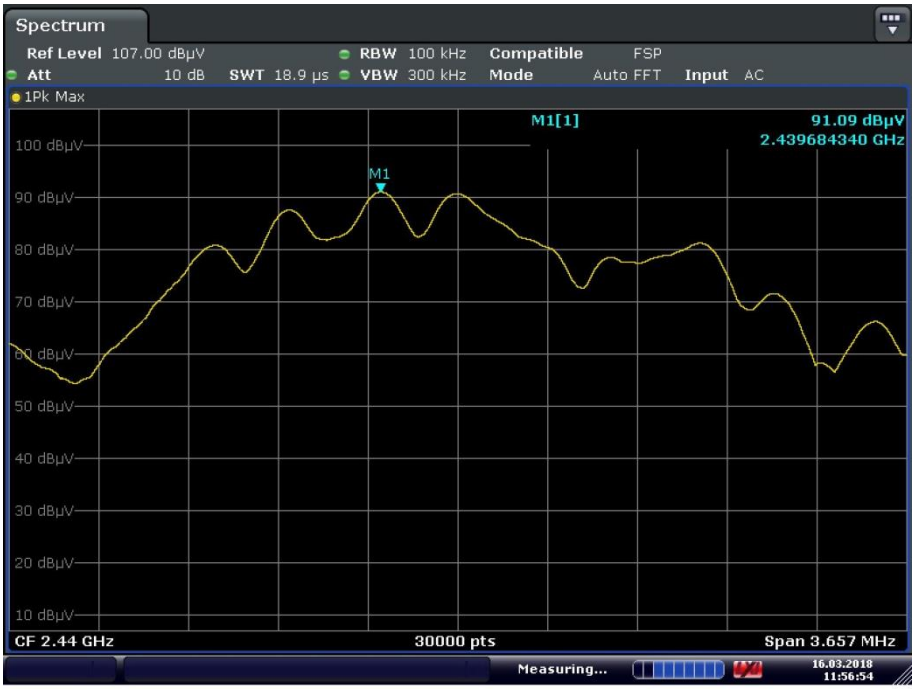
2440 MHz



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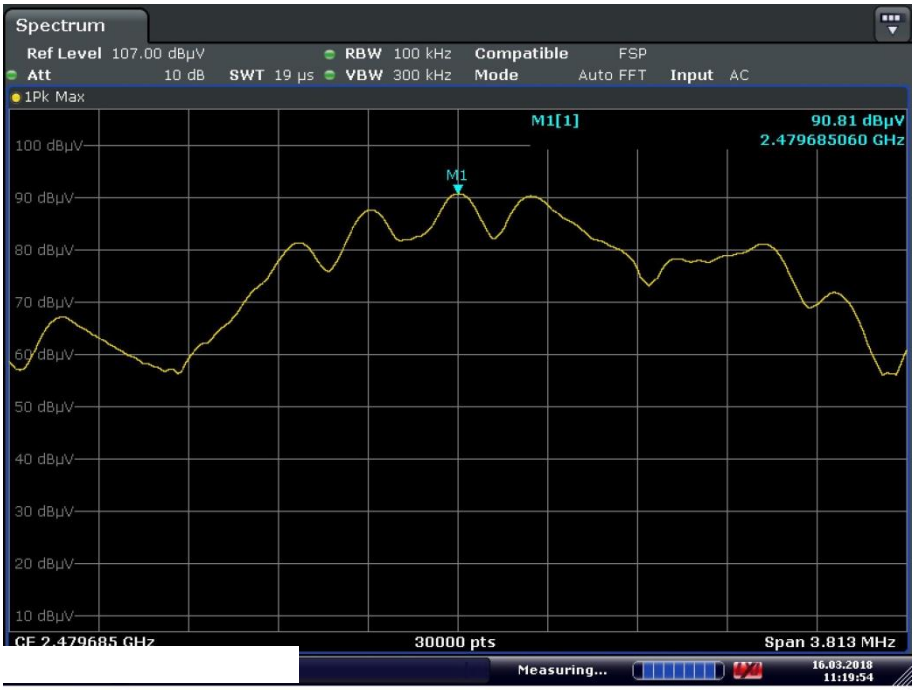
2480 MHz



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Test conclusion: Complies with the requirements of the standard.

8. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSIONS LIMITATION

Standard: FCC 47 CFR PART 15 : 2017

Sections: §15.215 (b) and §15.247 (d)

Instrumentation test list:

CATEGORY	BRAND	TYPE	Nr EMITECH	Last validity date	Next validity date
Amplifier	Agilent	8449B	14487	11/05/2017	11/07/2018
Antenna	Emco	3115	0941	28/10/2015	28/12/2018
Antenna mast	Maturo	MCU	8410	---	---
Antenna mast	Maturo	AM 4.0	8411	---	---
Cable	C&C	N-8m	11174	18/04/2016	18/06/2018
Cable	C&C	N-2m	11178	16/04/2016	16/06/2018
Cable	C&C	N-2m	11182	20/04/2016	20/06/2018
Receiver	Rohde & Schwarz	ESRP7	10517	20/10/2017	20/12/2019
Shielded enclosure	COMTEST	SAC 3m	14803	---	---

Equipment under test arrangement:

The system is tested in normalized test site.
The test unit is placed on a rotating table, 1.5 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 analyser was recorded.

Results:

Ambient temperature (°C): 22
Relative humidity (%): 40

Lower Band Edge: from 2300 MHz to 2400 MHz
Upper Band Edge: from 2483.5 MHz to 2500 MHz

2405 MHz
Polarization of test antenna: Horizontal (height = 150 cm)
Position of equipment: azimuth = 0°

2440 MHz
Polarization of test antenna: Horizontal (height = 150 cm)
Position of equipment: azimuth = 0°

2480 MHz
Polarization of test antenna: Horizontal (height = 150 cm)
Position of equipment: azimuth = 0°

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) *	Calculated Max Out of Band Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)
2405.000	96.31	Peak	2388.000	57.04	49.27	54.0	4.73
2480.000	96.45	Peak	2489.000	47.86	48.59	54.0	5.41

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

Band-edge curves are given in annex 4.

9. UNINTENTIONAL RADIATED EMISSIONS AND TRANSMITTER UNWANTED EMISSION IN THE BAND 9 kHz – 25 GHz

Standard: FCC 47 CFR PART 15 : 2017

Section: §15.205; 15.209 and §15.247

Equipment under test arrangement:

The equipment under test (EUT) is placed on a non-conductive test table at 0.8 m or 1.5 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.

The E.U.T. is blocked in continuous transmission.

Frequencies range:
9 kHz – 30 MHz
30 MHz - 1 GHz
1 GHz – 25 GHz

Detection mode:
Quasi-peak for 9 kHz – 30 MHz
Quasi-peak for 30 MHz - 1 GHz
Average for 1 GHz – 25 GHz

Resolution bandwidth:
200 Hz for 9 kHz – 150 kHz
9 kHz for 150 kHz – 30 MHz
120 kHz for 30 MHz - 1 GHz
1 MHz for 1 GHz – 25 GHz

Measurement distance:
3 meters from 9 kHz to 30 MHz
3 meters from 30 MHz to 25 GHz

- Limit for emission radiated outside the frequency band, except the harmonics, shall be attenuated by at least 20 dB below the level of fundamental or the general radiated emission limits.

From 9 kHz to 30 MHz

Frequencies range	Limit (µV/m)
9 – 490 kHz	2400/F (F in kHz) *
490 – 1705 kHz	24000/F (F in kHz) **
1.705 – 30 MHz	30 **

* Limits in µV/m can be extrapolated to 3 m using 40 dB / decade.
** Limits in µV/m can be extrapolated to 3 m using 20 dB / decade.

From 30 MHz to 25 GHz

Frequencies range (MHz)	Limit (dBµV/m)	(µV/m)
30 to 88	40.0	100
88 to 216	43.5	150
216 to 960	46.0	200
Above 960	54.0	500

Instrumentation test list:

CATEGORY	BRAND	TYPE	Nr EMITECH	Last validity date	Next validity date
Antenna	Schwarzbeck	VHA 9103	0317	18/02/15	18/04/18
Antenna	Schwarzbeck	UHALP 9108	3106	07/04/17	07/06/19
Antenna	Emco	6502	7179	05/07/17	05/09/19
Antenna	Emco	3115	0941	28/10/15	28/12/18
Antenna	Oritel	CM 42/25	1045	21/03/15	21/05/18
Antenna mast	Maturo	MCU	8410	---	---
Antenna mast	Maturo	AM 4.0	8411	---	---
Cable	C&C	N-8m	11174	18/04/2016	18/06/2018
Cable	C&C	N-2m	11178	16/04/2016	16/06/2018
Cable	C&C	N-2m	11182	20/04/2016	20/06/2018
Cable	SUCOFLEX	N-3m	12929	29/04/16	29/06/18
Cable	MICRO-COAX	N-5m	11511	02/11/16	02/01/19
Cable	câbles et connectiques	N-SMA	2864	26/02/18	26/04/20
Cable	câbles et connectiques	N-2m	2451	29/04/17	29/06/19
Cable	SUCOFLEX	SMA-2m	12916	28/04/16	28/06/18
Preamplifier	Agilent	8449B	14487	11/05/17	11/07/18
Preamplifier	Mini-circuit	ZFL-1000LN	5744	25/09/2017	25/11/2018
Receiver	Rohde & Schwarz	ESRP7	10517	20/10/2017	20/12/2019
Spectrum analyzer	Agilent Technologies	E7405A (V A.14.06)	2205	09/12/16	09/02/19
Filter	Micro-Tronics	HPM 14758	4691	10/05/17	10/07/19
Shielded enclosure	Comtest	SAC 3m	14803	---	---
Software	Nexio	BAT EMC v3.6.0.32	0000	---	---

Results:

Ambient temperature (°C): 22
Relative humidity (%): 40
Power source: Internal battery (Lithium 3.6V)

Frequency 2405 MHz

Frequency (MHz)	Polarization	Height (cm)	Azimuth (°)	Field Strength Level (dBµV/m)	Limit (dBµV/m)
4809.000	Horizontal	150	170	50.2	54

No more significant frequency has been found other than those.

Frequency 2440 MHz

Frequency (MHz)	Polarization	Height (cm)	Azimuth (°)	Field Strength Level (dBµV/m)	Limit (dBµV/m)
4879.000	Horizontal	150	0	51.1	54

No more significant frequency has been found other than those

Frequency 2480 MHz

Frequency (MHz)	Polarization	Height (cm)	Azimuth (°)	Field Strength Level (dBµV/m)	Limit (dBµV/m)
4959.000	Horizontal	150	150	48.8	54

No more significant frequency has been found other than those.

Test conclusion:

The equipment complies with the requirements of the standard.

« □□□ *End of report, 2 annexes to be forwarded* □□□ »

ANNEX 1:

6 dB BANDWIDTH
20 dB BANDWIDTH

6 dB BANDWIDTH

Frequency 2405 MHz

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Frequency 2440 MHz

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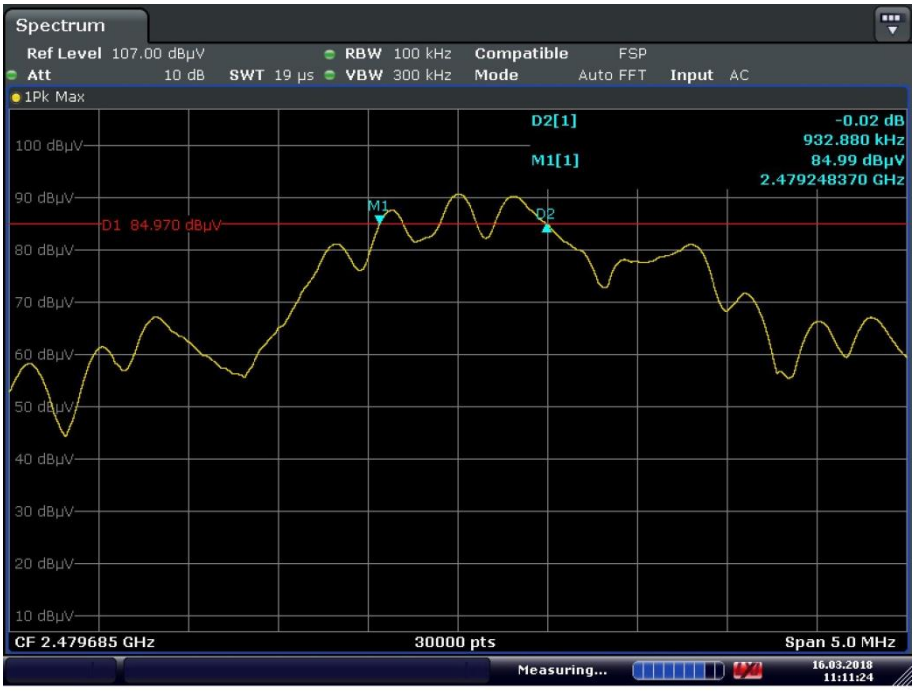
Frequency 2480 MHz



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20 dB BANDWIDTH

Frequency 2405 MHz

Date: 16.MAR.2018 12:30:53

Frequency 2440 MHz

Date: 16.MAR.2018 11:49:03

Frequency 2480 MHz

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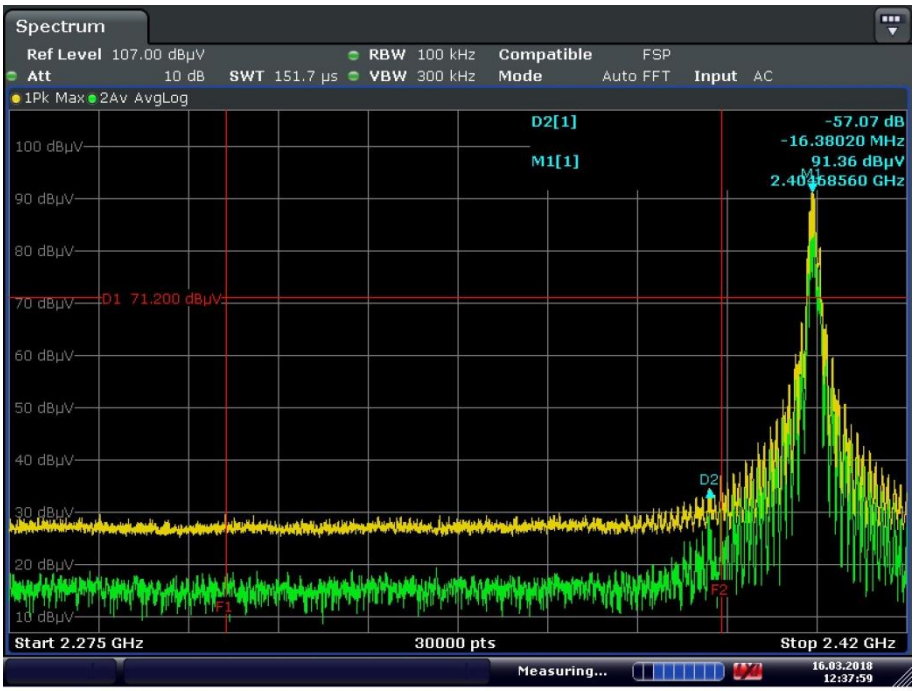
ANNEX 2:

BAND EDGE

Frequency 2405 MHz



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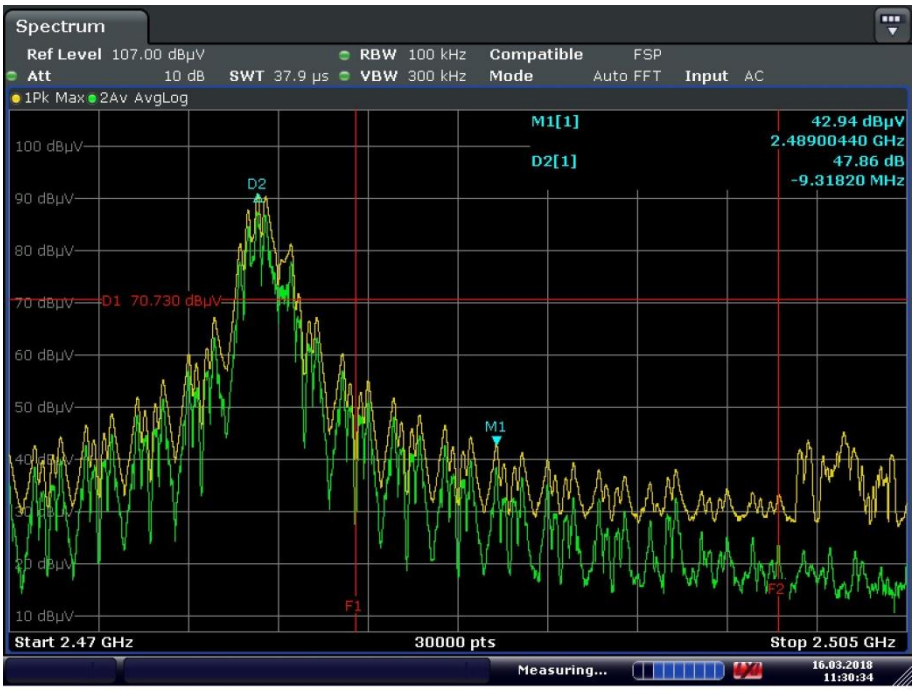
Frequency 2480 MHz



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