

RCE-100-18-100847-1-A

E.M.C Test Report

According to the standard:
FCC 47 CFR PART 15 : 2017 (§15.247)

Equipment under test:
LINK Nano SPY Ethernet
FCC ID: W4511672

Company:
JRI

FCC accredited: FR0004

DISTRIBUTION: Mr. PEYRICHOU

(Company: JRI)

Number of pages: 28 with 2 annexes

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			Name	Visa	Name	Visa
0	19/03/18	Creation	F. ROHRI		B. Pellerin	
			F.R.			

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TEST CERTIFICATION FOR: FCC Certification

NAME OF THE EQUIPMENT UNDER TEST: LINK Nano SPY Ethernet

Serial number: FA0291

Reference / model (P/N): NanoSpy LINK

Software version: V0.30

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 / G. BAKARY-GANDO

TESTS TUTOR: B. PELLERIN

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ANNEX 1: 6 dB BANDWIDTH, 20 dB BANDWIDTH

ANNEX 2: BAND EDGE

1. INTRODUCTION

This document presents the results of Electromagnetic Compatibility tests performed on the equipment « **LINK Nano SPY Ethernet** » 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

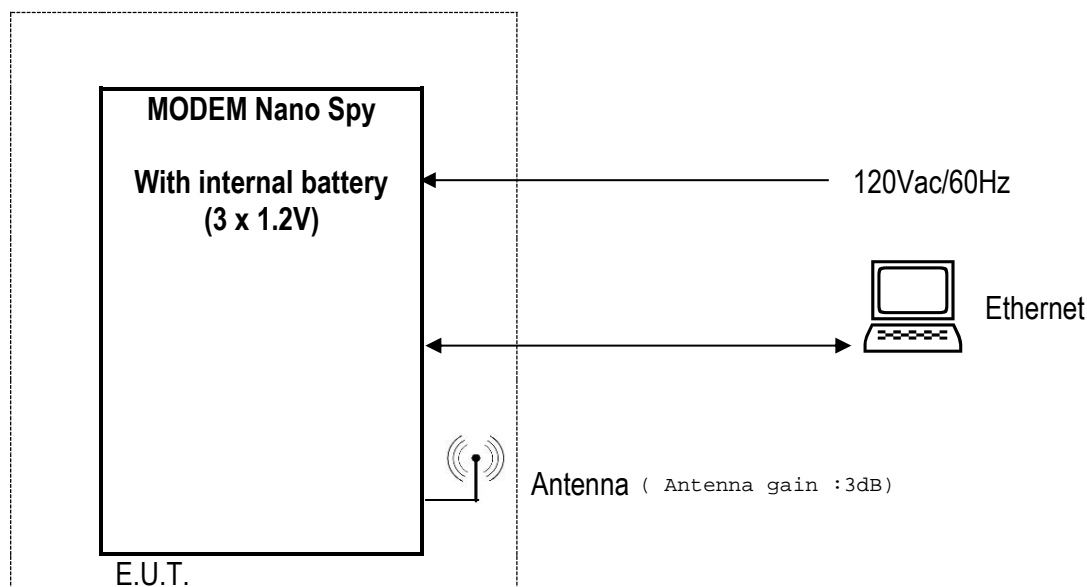
3. PRODUCT DESCRIPTION

Class:	B
Antenna type and gain:	External 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:	120Vac / 60Hz
Software power setting:	V0.27

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

Modification of the equipment during the tests: None

Information concentrator powered by a mains unit (120 Vac / 60 Hz). It receives temperature values from the sensor via the Zigbee module and then transmits its temperature values via the Ethernet module on a network.



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				
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				
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 bandwidth)	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 « **LINK Nano SPY Ethernet** » 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	N° 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: 120Vac / 60Hz

6 dB bandwidth

Frequency	Results	Comments
2405 MHz	928.670 KHz	See annex n°3
2440 MHz	954.000 KHz	
2480 MHz	912.900 MHz	

20 dB bandwidth

Frequency	Results	Comments
2405 MHz	2.620 MHz	See annex n°3
2440 MHz	2.407 MHz	
2480 MHz	2.331 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	N° 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: 120Vac / 60Hz

Frequency	Electro-magnetic field (dB μ V/m)	TP* (dBm)	Limit (dBm)
2405 MHz	93.16	- 4.31	+ 30
2440 MHz	89.24	- 8.13	
2480 MHz	93.98	- 3.39	

* 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	N° 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: 120Vac / 60Hz

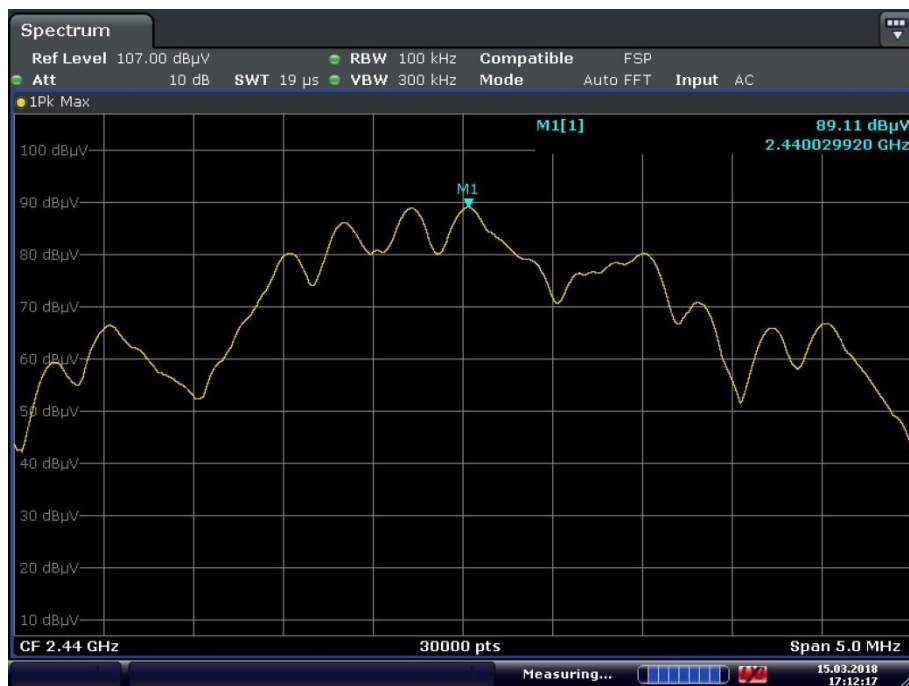
Frequency	Electro-magnetic field (dB μ V/m)	PPSD * (dBm)	Limit (dBm)
2405 MHz	89.44	- 8.12	+ 8.0
2440 MHz	89.28	- 8.09	
2480 MHz	87.55	- 9.82	

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

2405 MHz



2440 MHz



Date: 15.MAR.2018 17:12:17

2480 MHz



Date: 15.MAR.2018 17:31:48

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	N° 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 2420 MHz
Upper Band Edge: from 2483.5 MHz to 2500 MHz

2405 MHz

Polarization of test antenna: Vertical (height = 150 cm)
Position of equipment: azimuth = 30°

2440 MHz

Polarization of test antenna: Vertical (height = 150 cm)
Position of equipment: azimuth = 30°

2480 MHz

Polarization of test antenna: Vertical (height = 150 cm)
Position of equipment: azimuth = 30°

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	93.16	Peak	2338.000	57.58	35.58	54.0	18.42
2480.000	93.98	Peak	2488.000	45.11	48.87	54.0	5.13

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: 120Vac / 60Hz

Frequency 2405 MHz

Frequency (MHz)	Polarization	Height (cm)	Azimuth (°)	Field Strength Level (dBμV/m)	Limit (dBμV/m)
93.200	Vertical	100	20	32.5	43.5
520.000	Horizontal	100	0	40.9	46
4809.000	Vertical	150	300	50.5	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)
93.200	Vertical	100	20	32.5	43.5
520.000	Horizontal	100	0	40.9	46
4879.000	Vertical	150	320	51.3	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)
93.200	Vertical	100	20	32.5	43.5
520.000	Horizontal	100	0	40.9	46
4959.000	Vertical	150	340	52.1	54

No more significant frequency has been found other than those.

Test conclusion:

The equipment complies with the requirements of the standard.

10. CONDUCTED EMISSION

Standard: FCC 47 CFR PART 15 : 2017

Test method: Part 15.107 and 15.207

Test configuration:

Tested cable	Measure with	E.U.T. height
Power supply (radio OFF)	L.I.S.N	80cm
Power supply (radio ON)	L.I.S.N	80cm

Frequencies band	Tested cable	Detection	Resolution bandwidth	Video bandwidth
150kHz - 30MHz	Power supply (radio OFF)	Peak	10kHz	30kHz
150kHz - 30MHz	Power supply (radio ON)	Average value	9kHz	Auto
150kHz - 30MHz	Power supply (radio OFF)	Peak	10kHz	30kHz
150kHz - 30MHz	Power supply (radio ON)	Average value	9kHz	Auto

Test method deviation: No.

Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH
Cable	C&C	BNC-0.3m	9952
Cable	C&C	N-5m	10031
Limiter	Hewlett Packard	11947A	0237
LISN	Rohde & Schwarz	ENV216	14570
PE choke	EMITECH	CISPR 16-2-1 : 2008	10063
Receiver	Rohde & Schwarz	ESH3 (V 335.8017.52)	0181
Sheath current absorber	EMITECH	Sheath current absorber	12356
Software	Nexio	BAT EMC v3.6.0.32	0000
Spectrum analyzer	Agilent Technologies	E7405A (V A.14.06)	2205
Tests enclosure	EMITECH	JD 3P1	14875

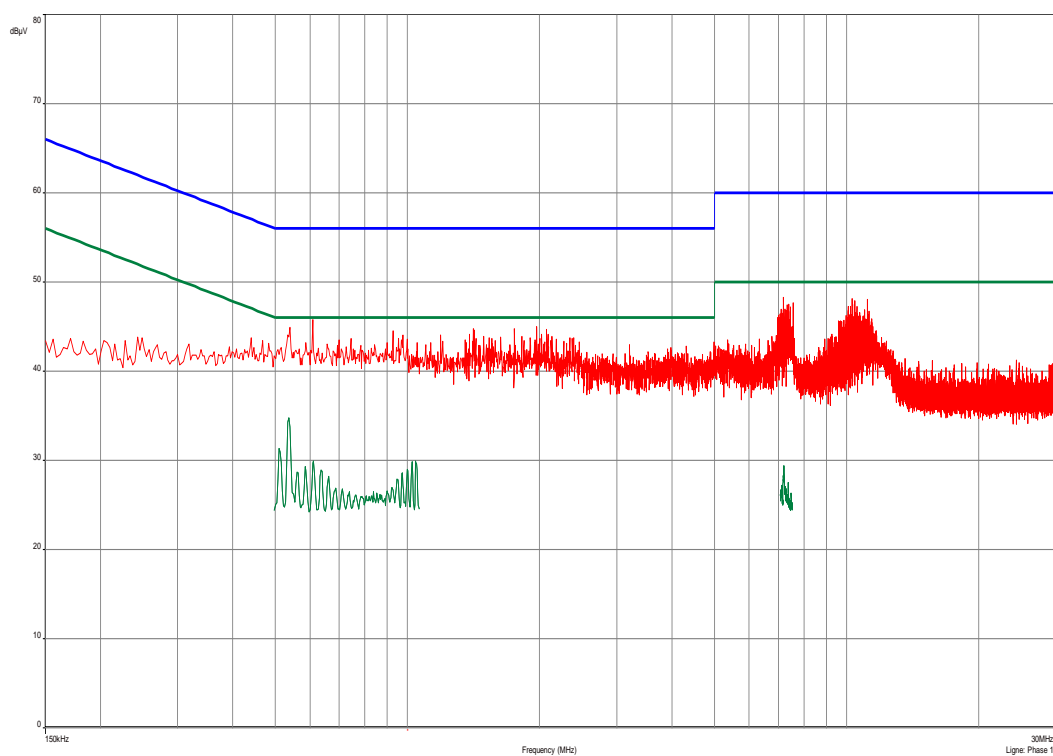
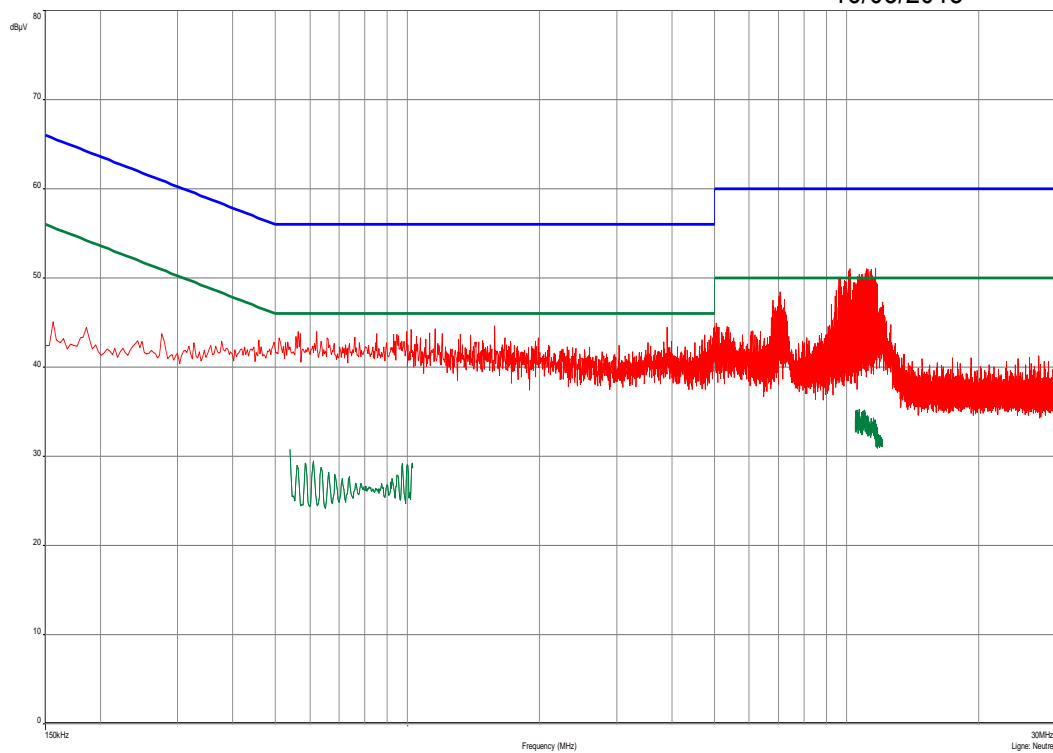
Results: See curves below including detections and limits in peak (red), average (green) and quasi-peak (blue).

Curves 1 and 2

LINK Nano SPY Ethernet

Conducted voltage emission (measurement): Power supply (radio OFF) in peak and average value detection.

16/03/2018

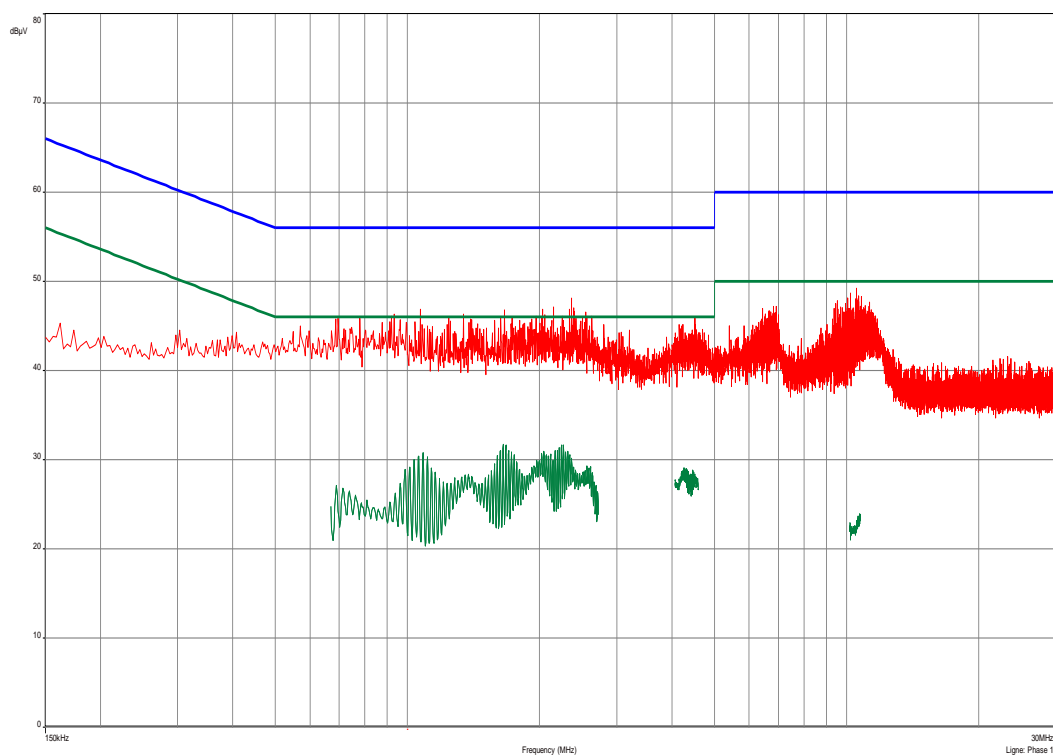
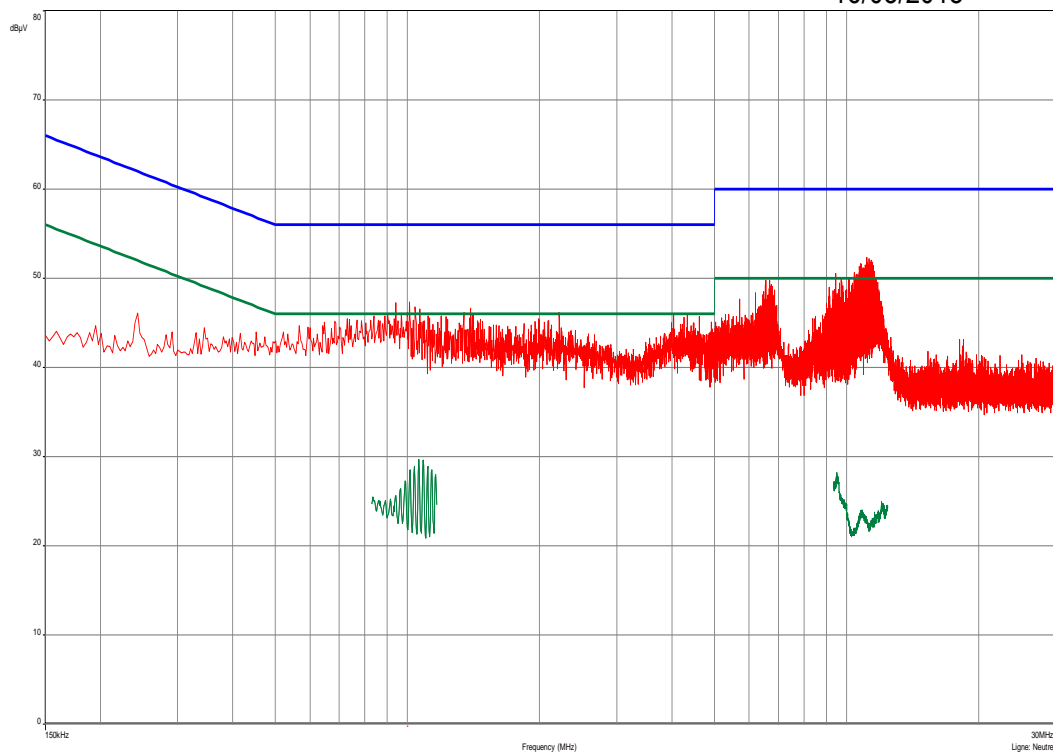


Class: B of the standard FCC 47 CFR PART 15: 2017 (§107)

LINK Nano SPY Ethernet

Conducted voltage emission (measurement): Power supply (radio ON) in peak and average value detection.

16/03/2018



Limit of the standard FCC 47 CFR PART 15: 2017 (§207)

« ☐☐☐ End of report, 2 annexes to be forwarded ☐☐☐ »

ANNEX 1:

6 dB BANDWIDTH
20 dB BANDWIDTH

6 dB BANDWIDTH

Frequency 2405 MHz



Date: 15.MAR.2018 12:09:01

Frequency 2440 MHz



Date: 15.MAR.2018 16:57:56

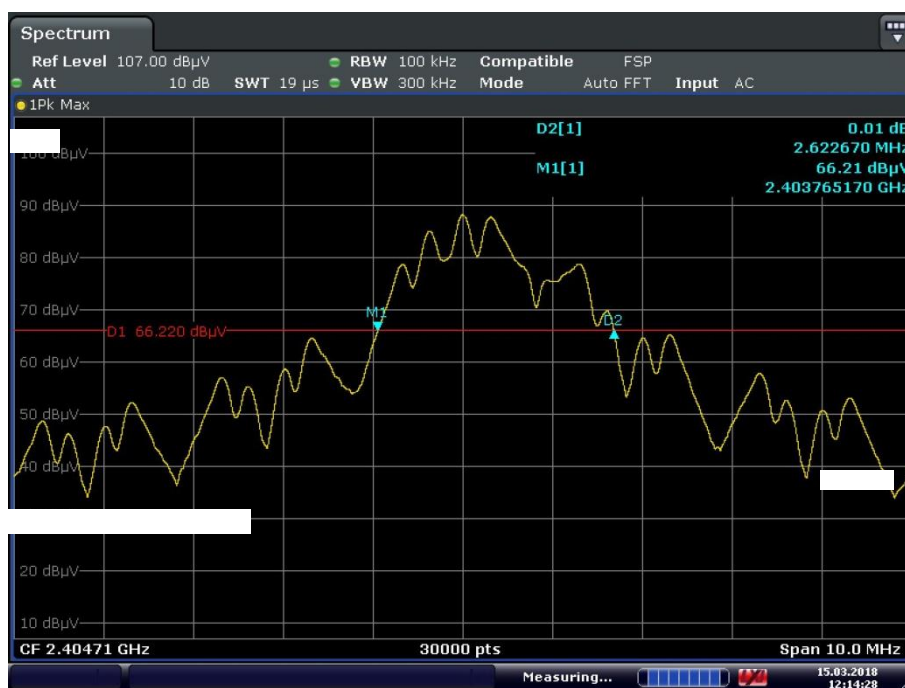
Frequency 2480 MHz



Date: 15.MAR.2018 17:21:19

20 dB BANDWIDTH

Frequency 2405 MHz



Date: 15.MAR.2018 12:14:28

Frequency 2440 MHz



Date: 15.MAR.2018 17:00:19

Frequency 2480 MHz

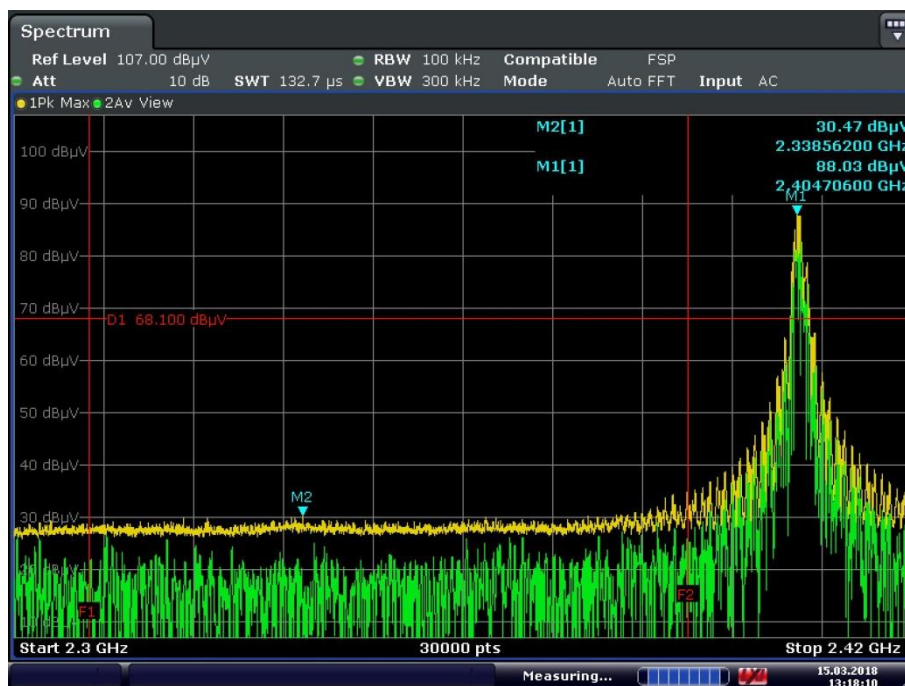


Date: 15.MAR.2018 17:22:25

ANNEX 2:

BAND EDGE

Frequency 2405 MHz



Date: 15.MAR.2018 13:18:10

Frequency 2480 MHz

