

RC-030-PTC-15-100225-2-A

"This report cancels and replaces the test report N° RC-030-PTC-15-100225-2-A Edition 0"

E.M.C Test Report

According to the standard:
FCC 47 CFR PART 15 : 2015 (§15.247)

Equipment under test:
Microcontroller JN5169-001-M00
With connection ZIGBEE
FCC ID: XXMJN5169M0

Company:
NXP SEMICONDUCTORS

FCC accredited: FR0004

DISTRIBUTION: Mr. LE TOUSEY

(Company: NXP SEMICONDUCTORS)

Number of pages: 47 with 6 annexes

Ed.	Date	Modified pages	Written by		Technical Verification and Quality Approval	
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TEST CERTIFICATION FOR: FCC Certification

NAME OF THE EQUIPMENT UNDER TEST: Microcontroller JN5169-001-M00 with connection Zigbee

Serial number: M0051694

Reference / model (P/N): JN5169-001-M00

Software version: -

NAME OF THE MANUFACTURER: NXP SEMICONDUCTORS

ADDRESS OF THE APPLICANT:

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Person in charge: Mr. LE TOUSEY

DATE OF TESTS: 26/03/2015

TESTS LOCATION: EMITECH laboratory in Montigny Le Bretonneux (78)
FRANCE.

TESTS OPERATOR: F. LHEUREUX

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1. INTRODUCTION

This document presents the results of Electromagnetic Compatibility tests performed on the equipment «**Microcontroller JN5169-001-M00 with connection Zigbee**» according to reference documents listed below.

2. REFERENCE DOCUMENTS

FCC 47 CFR Part 15: 2015

Code of Federal Regulations

Title 47- Telecommunication

Chapter 1- Federal Communication Commission

Part 15- Radio frequency devices

ANSI C63.4: 2003

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 V03r03

Guidance for performing compliance measurement on Digital Transmission Systems (DTS) operating under § 15.247

3. PRODUCT DESCRIPTION

Class: B (residential environment)

Utilization: Development kits

Antenna type and gain: Integral antenna: Not communicated

Operating frequency range: from 2405 MHz to 2480 MHz

Number of channels: 16

Channel spacing: 5 MHz

Modulation: OQPSK

Power source: 5 Vdc by USB port

Software power setting: Teraterm

Modification of the equipment during the tests: No.



The DR1174 motherboard allows you to control the module.

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		
	b) (3) systems using digital modulation in the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz	X				

Test procedure	Designation of test	Test results				Comments
		Pass	Fail	N.A.	N.P.	
	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					
	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					
	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					
	h) to avoid hopping on occupied channels					
	i) RF exposure compliance			X		P < 500 mW

N.A.: Not Applicable

N.P.: Not Performed

Conclusion:

The tested sample «Microcontroller **JN5169-001-M00** with connection **Zigbee**» submitted to the tests complies with the requirements of the standard:

- FCC 47 CFR PART 15 : 2015

according to the limits specified in this report.

5. DIGITAL MODULATION SYSTEMS

Standard: FCC 47 CFR PART 15 : 2015

Section: 15.247 a) (2)

Test configuration:

The system is tested in normalized test site.

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 analyser was recorded.

Distance of antenna: 3 meters

Instrumentation test list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Emco	Emco	0941
Antenna mast	Maturo	Maturo	8410
Antenna mast	Maturo	Maturo	8411
Cable	C&C	C&C	11136
Cable	C&C	C&C	11172
Cable	C&C	C&C	11177
Shielded enclosure	SIDT	SIDT	0549
Spectrum analyzer	Rohde & Schwarz	Rohde & Schwarz	5175

Equipment under test operating condition:

EUT is in continuous transmission mode.

Measure conditions:

Ambient temperature (°C): 20

Relative humidity (%): 50

Resolution bandwidth: 100 kHz

Results:

Power source: 5 Vdc by USB port

Frequency	Mode	Results	Comments
2405 MHz	802.15.4	1.55 MHz	See annex n°4
2440 MHz		1.59 MHz	See annex n°4
2480 MHz		1.61 MHz	See annex n°4

Test conclusion: Complies with the requirements of the standard.

6. TRANSMITTER OUTPUT POWER

Standard: FCC 47 CFR PART 15 : 2015

Section: 15.247 b) (3)

Test configuration:

The system is tested in normalized test site.

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 analyser was recorded.

Distance of antenna: 3 meters

Instrumentation test list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Emco	Cornet 3115	0941
Antenna mast	Maturo	MCU	8410
Cable	C&C	N-10m	8411
Cable	C&C	N-6m	11136
Cable	C&C	N-2m	11172
Shielded enclosure	SIDT	C.4	0549
Shielded enclosure	SIDT	C.4	11177
Spectrum analyzer	Rohde & Schwarz	R&S FSP40	5175

Equipment under test operating condition:

EUT is in continuous transmission mode.

Measure conditions:

Ambient temperature (°C): 20

Relative humidity (%): 50

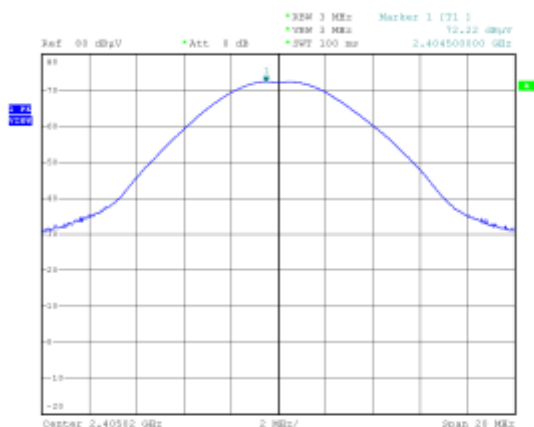
Resolution bandwidth: 3 MHz

Results:

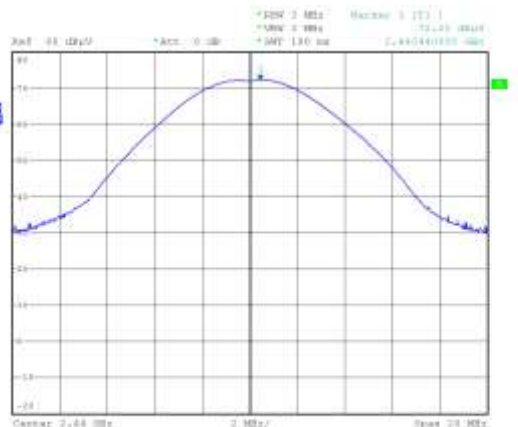
Power source: 5 Vdc by USB port

Frequency	Mode	Electro-magnetic field (dBμV/m)	TP* (dBm)	Limit (dBm)
2405 MHz	802.15.4	106.72	+ 9.35	+ 30
2440 MHz		107.10	+ 9.75	+ 30
2480 MHz		110.45	+ 13.15	+ 30

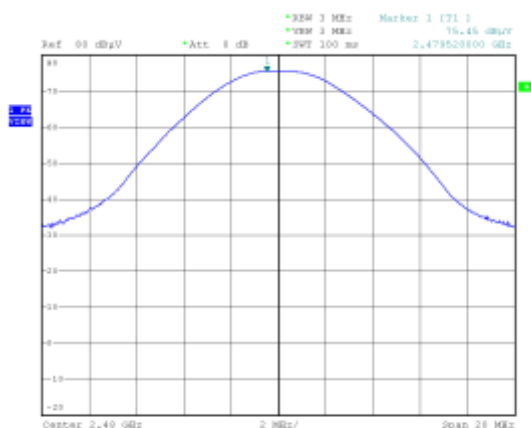
* TP = $(E \times d)^2 / (30 \times 1.64)$ for d = 3 m



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Test conclusion: Complies with the requirements of the standard.

7. PEAK POWER SPECTRAL DENSITY

Standard: FCC 47 CFR PART 15 : 2015

Section: 15.247 e)

Test configuration:

The system is tested in normalized test site.

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 analyser was recorded.

Distance of antenna: 3 meters

Instrumentation test list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Emco	Cornet 3115	0941
Antenna mast	Maturo	MCU	8410
Antenna mast	Maturo	AM 4.0-O	8411
Cable	C&C	N-10m	11136
Cable	C&C	N-6m	11172
Cable	C&C	N-2m	11177
Shielded enclosure	SIDT	C.4	0549
Spectrum analyzer	Rohde & Schwarz	R&S FSP40	5175

Equipment under test operating condition:

EUT is in continuous transmission mode.

Measure conditions:

Ambient temperature (°C): 20

Relative humidity (%): 50

Resolution bandwidth: 3 kHz

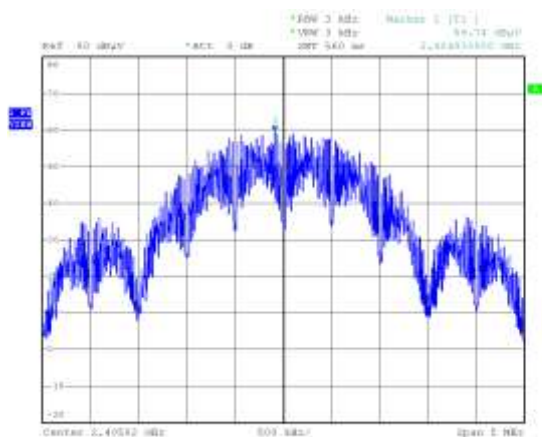
Video bandwidth: 3 kHz

Results:

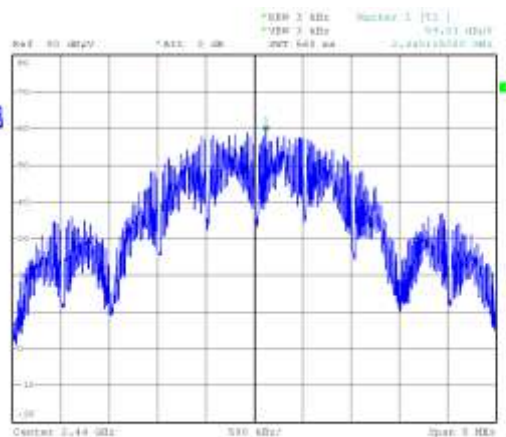
Power source: 5 Vdc by USB port

Frequency	Mode	Electro-magnetic field (dBμV/m)	PPSD* (dBm)	Limit (dBm)
2405 MHz	802.15.4	94.24	- 3.11	+ 8.0
2440 MHz		93.93	- 3.42	
2480 MHz		97.45	+ 0.10	

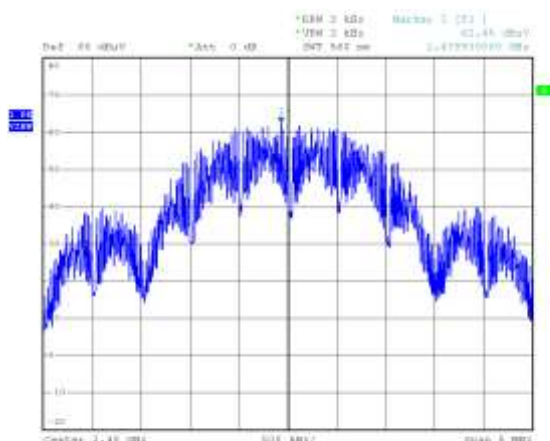
* PPSP = $(E \times d)^2 / (30 \times 1.64)$ for $d = 3$ m



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Date: 26.MAR.2015 15:43:19

Test conclusion: Complies with the requirements of the standard.

8. ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSIONS LIMITATION

Standard: FCC 47 CFR PART 15 : 2015

Sections: 15.215 (b) and 15.247 (d)

Instrumentation test list:

CATEGORY	BRAND	TYPE	N° EMITECH
Antenna	Emco	Cornet 3115	8410
Antenna mast	Maturo	MCU	5175
Antenna mast	Maturo	AM 4.0-O	11177
Cable	C&C	N-10m	11136
Cable	C&C	N-6m	11172
Cable	C&C	N-2m	0941
Shielded enclosure	SIDT	C.4	0549
Spectrum analyzer	Rohde & Schwarz	R&S FSP40	8411

Equipment under test arrangement:

The system is tested in normalized test site.

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 analyser was recorded.

Results:

Ambient temperature (°C): 20

Relative humidity (%): 50

Lower Band Edge: from 2310 MHz to 2390 MHz
Upper Band Edge: from 2483.5 MHz to 2500 MHz

- Mode 802.15.4

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)
2404.83	98.02	Average	2372.93	- 54.0	44.03	54.0	10.0
2480.11	101.50	Average	2483.94	- 37.7	43.76(**)	54.0	10.2

The band edge readings were performed with a peak detector and with the E.U.T. set in a constant 100 % transmit state.

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

** The limit is 54 dBμV/m for average emissions. According to 15.35 (c): when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. For a 10 % duty cycle, the power measured would be reduced by $20 \log (0.01) = -20$ dB. According to the declared duty cycle, therefore, the emissions observed are below the limit after averaging for pulse rate.

Band-edge curves are given in annex 5.

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

Standard: FCC 47 CFR PART 15 : 2015

Sections: 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 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 ($\mu\text{V/m}$)
9 – 490 kHz	$2400/F$ (F in kHz) *
490 – 1705 kHz	$24000/F$ (F in kHz) **
1.705 – 30 MHz	30 **

* Limits in $\mu\text{V/m}$ can be extrapolated to 3 m using 40 dB / decade.

** Limits in $\mu\text{V/m}$ can be extrapolated to 3 m using 20 dB / decade.

From 30 MHz to 25 GHz

Frequencies range (MHz)	Limit	
	(dB $\mu\text{V/m}$)	($\mu\text{V/m}$)
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	N° EMITECH
Antenna	Emco	Emco	0941
Antenna	Oritel	Oritel	1045
Antenna	Emco	Emco	4211
Antenna	Schaffner	Bilog CBL6143A	5647
Antenna mast	Maturo	Maturo	8410
Antenna mast	Maturo	Maturo	8411
Cable	-	-	2881
Cable	Telegartner	Telegartner	7405
Cable	C&C	C&C	11132
Cable	C&C	C&C	11133
Cable	C&C	C&C	11136
Cable	C&C	C&C	11172
Cable	C&C	C&C	11176
Cable	C&C	C&C	11177
Filter	Trilithic	Trilithic	1097
Filter	Micro-tronics	Micro-tronics	4691
Preamplifier	MITEQ	MITEQ	3229
Preamplifier	Mini-Circuits	Mini-Circuits	6368
Receiver	Rohde & Schwarz	Rohde & Schwarz	10517
Shielded enclosure	SIDT	SIDT	0549
Spectrum analyzer	Rohde & Schwarz	Rohde & Schwarz	5175

Results:

Ambient temperature (°C): 20
 Relative humidity (%): 50
 Power source: 5 Vdc by USB port

Frequency 2405 MHz

FREQUENCY (MHz)	Detector	Antenna height (cm)	Azimuth (degree)	Resolution bandwidth	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
33.920	Quasi-peak	130	170	120 kHz	V	29.5	40.0	10.5
33.920	Quasi-peak	160	350	120 kHz	H	24.7	40.0	15.3
60.009	Quasi-peak	100	0	120 kHz	V	29.9	40.0	10.1
4809.04	Average	105	100	1 MHz	V	46.6	54.0	7.4
4809.04	Average	120	0	1 MHz	H	51.4	54.0	2.6
7216.53	Average	183	200	1 MHz	H	45.7	86.7	41.0
7216.53	Average	100	10	1 MHz	V	55.0	86.7	31.7

Frequency 2440 MHz

FREQUENCY (MHz)	Detector	Antenna height (cm)	Azimuth (degree)	Resolution bandwidth	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
41.630	Quasi-peak	100	330	120 kHz	V	32.0	40.0	8.0
41.630	Quasi-peak	350	200	120 kHz	H	19.0	40.0	21.0
4879.05	Average	105	100	1 MHz	H	53.0	54.0	1.0
4879.05	Average	120	90	1 MHz	V	49.1	54.0	4.9
7319.90	Average	177	330	1 MHz	V	52.9	54.0	1.1
7319.90	Average	125	190	1 MHz	H	51.0	54.0	3.0

Frequency 2480 MHz

FREQUENCY (MHz)	Detector	Antenna height (cm)	Azimuth (degree)	Resolution bandwidth	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
42.650	Quasi-peak	100	330	120 kHz	V	32.4	40.0	7.6
42.650	Quasi-peak	400	190	120 kHz	H	19.9	40.0	20.1
67.000	Quasi-peak	140	110	120 kHz	V	29.0	40.0	11.0
67.000	Quasi-peak	230	230	120 kHz	H	17.5	40.0	22.5
4959.01	Average	105	0	1 MHz	H	53.8	54.0	0.2
4959.01	Average	100	80	1 MHz	V	49.6	54.0	4.4
7441.39	Average	187	335	1 MHz	V	55.0	90.4	35.4
7441.39	Average	105	195	1 MHz	H	48.5	90.4	41.9

No significant frequency has been found other than those given above between 9 kHz to 30 MHz and 8 GHz to 25 GHz.

Test conclusion:

The equipment complies with the requirements of the standard.

10. CONDUCTED EMISSION

Standard: FCC 47 CFR PART 15: 2015

Test method: 15.107 and 15.207

Test configuration:

Tested cable	Measure with	E.U.T. height
Power Supply (PC alone)	L.I.S.N.	80 cm
Power Supply (PC with microcontroller JN5169-001-M00)	L.I.S.N.	80 cm

Frequencies band	Tested cable	Resolution bandwidth	Video bandwidth
150 kHz - 1 MHz	Power Supply (PC alone)	10 kHz	30 kHz
1 MHz - 30 MHz	Power Supply (PC alone)	10 kHz	30 kHz
150 kHz - 1 MHz	Power Supply (PC with microcontroller JN5169-001-M00)	10 kHz	30 kHz
1 MHz - 30 MHz	Power Supply (PC with microcontroller JN5169-001-M00)	10 kHz	30 kHz

Test method deviation: No

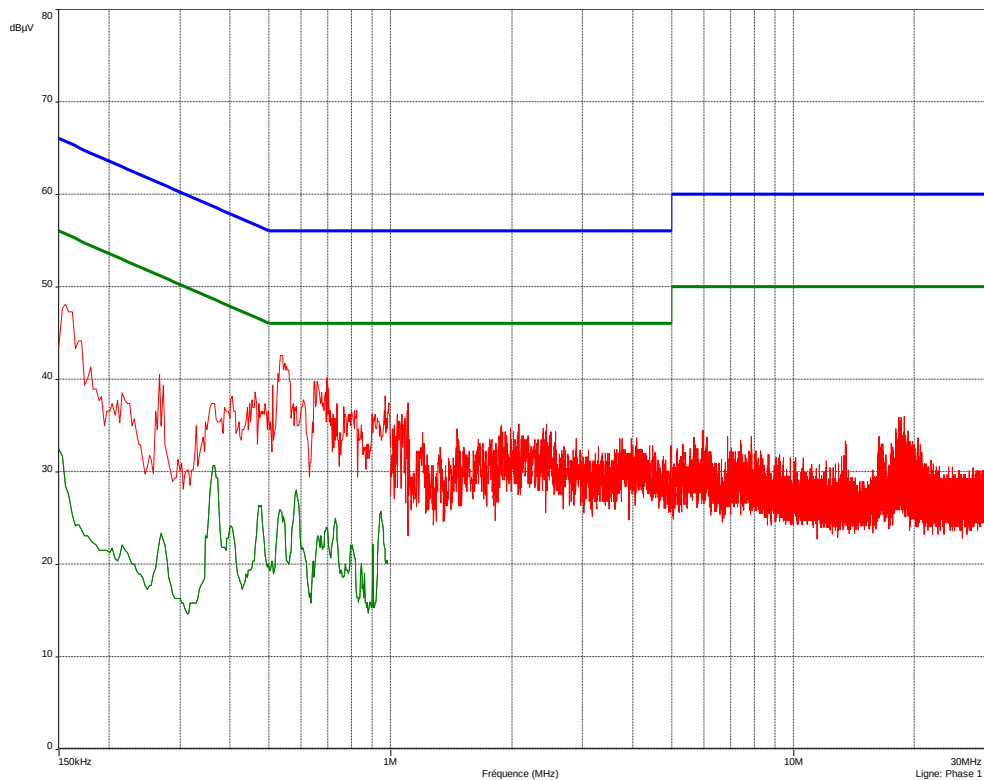
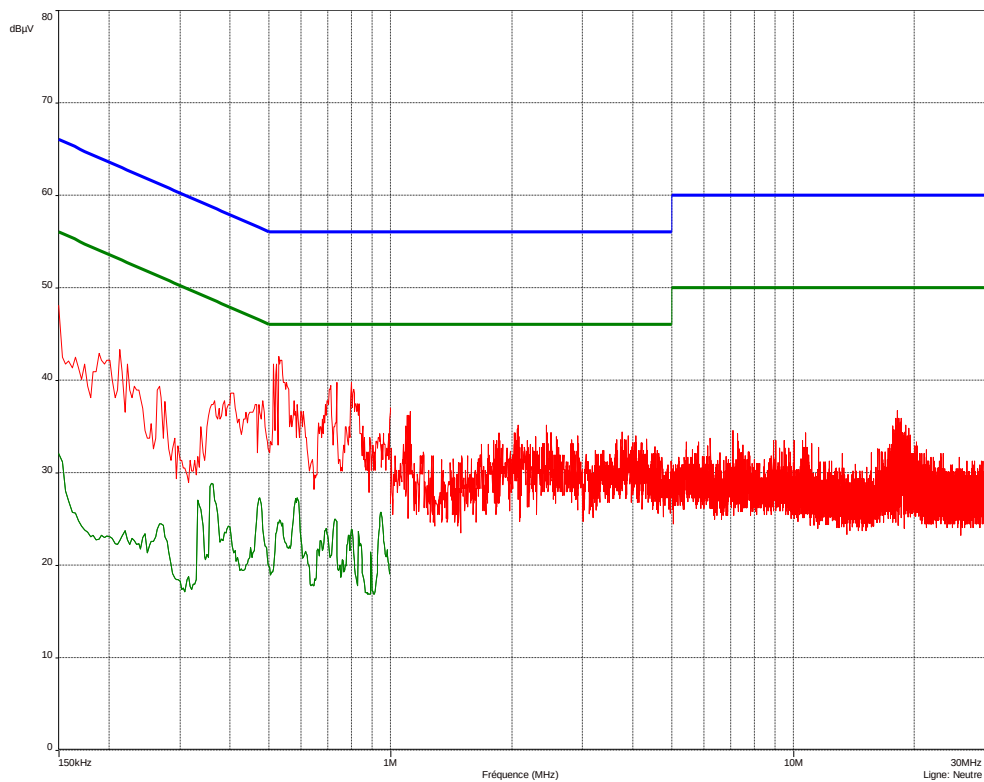
Test equipment list:

CATEGORY	BRAND	TYPE	N° EMITECH
Cable	-	N-4m	2808
Cable	C&C	BNC	9952
Cable	Emitech	Absorbeur courant de gaine	12366
Limiter	Hewlett Packard	HP11947A	1061
LISN	Rohde & Schwarz	ESH2-Z5	0326
Power supply	Schaffner	NSG 1007-5-400	4637
QP Adaptater	Hewlett Packard	HP 85650A	0491
Receiver	Hewlett Packard	HP 8568B Voie 2	0019
Software	Nexio	BAT EMC v3.6.0.32	0000

Results: See curves below including detections and limits in peak (red) and average (green)

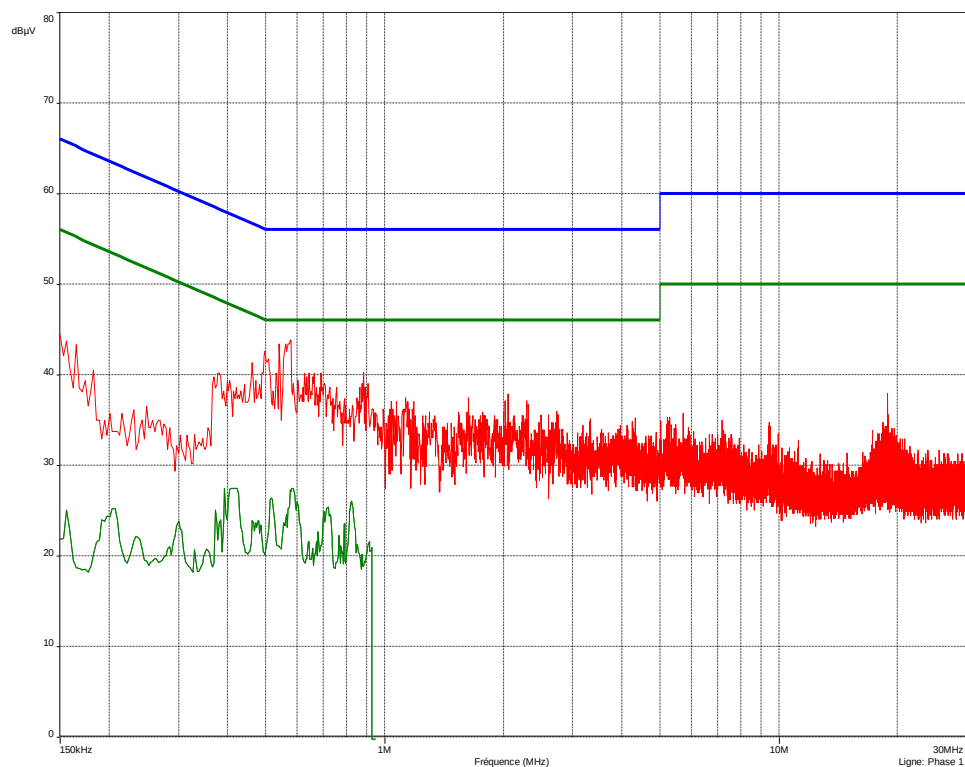
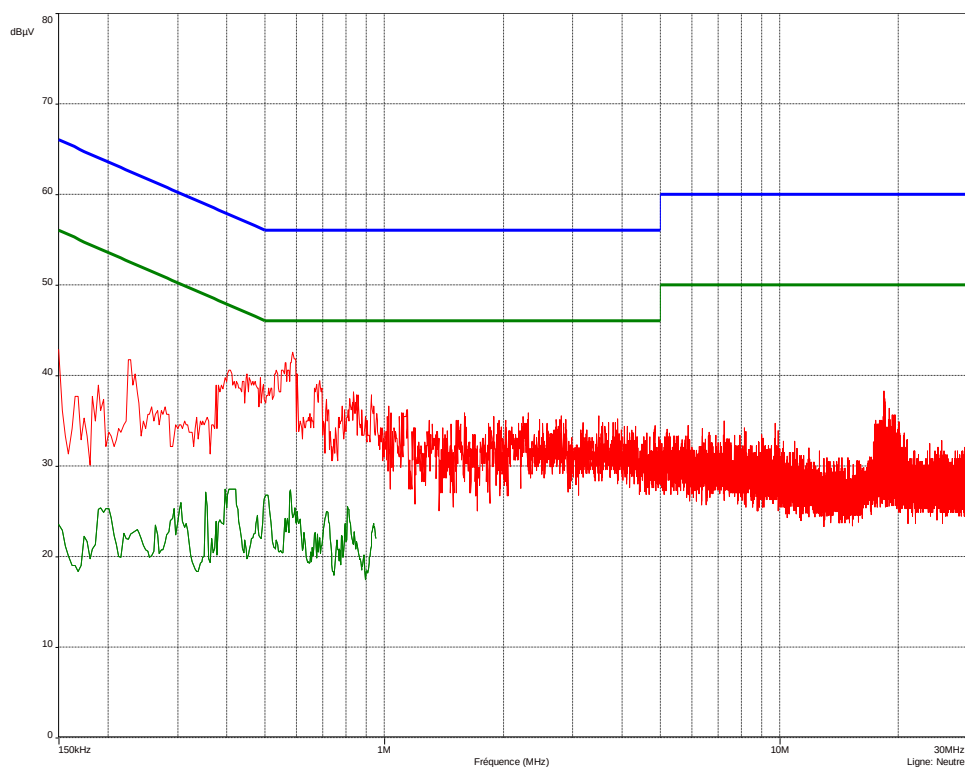
Curves 1 and 2

Microcontroller JN5169-001-M00 with ZIGBEE connection
 Conducted voltage emission (measurement): Power Supply in peak and average detection
 PC alone



Curves 3 and 4

Microcontroller JN5169-001-M00 with ZIGBEE connection
 Conducted voltage emission (measurement): Power Supply in peak and average detection
 PC with Microcontroller JN5169-001-M00



« □□□ End of report, 6 annexes to be forwarded □□□ »

ANNEX 1

ANTENNA FACTORS, INSERTION LOSSES AND AMPLIFIER VALUES

BILL OF MATERIAL

The test antenna used for the radiated emission between 9 kHz and 30 MHz is the active loop antenna n°4211. Antenna factors are given in table 1.

The test antenna used for the radiated emission between 30 MHz and 1 GHz is the biclog antenna n°5647. Antenna factors are given in table 2.

The measuring receiver n°10517 used in the frequency range 30 MHz to 1 GHz has an integrated preamplifier.

The spectrum analyzer n°5175 is used in the frequency range 1 GHz to 25 GHz.

The test cable used between 9 kHz and 30 MHz to connect the antennas to the receiver for measurements at a distance of 30 meters has losses given in table 3.

The test cable used between 30 MHz and 1 GHz to connect the antennas to the receiver for measurements at a distance of 3 meters has losses given in table 4a, 4b and 4c.

The test antenna used for the radiated emission between 1 GHz and 18 GHz is the horn antenna n°3374. Factors are given in table 5.

The test antenna used for the radiated emission between 18 GHz and 25 GHz is the horn antenna n°1045. Factors are given in table 6.

The amplifier n°3229 used to connect the spectrum analyzer to the test cable has gain values given in the table 7.

The test cable used between 1 GHz and 18 GHz to connect the horn antenna to the amplifier for measurements at distance of 3 meters has losses given in table 8.

The test cable used between 18 GHz and 26 GHz to connect the horn antenna to the amplifier for measurements at distance of 3 meters has losses given in table 9a and 9b.

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
0.009	-22.5	0.8	-33.1
0.01	-23.4	1	-33.2
0.015	-26.6	1.5	-33.3
0.02	-28.0	2	-33.3
0.03	-30.2	3	-33.3
0.05	-32.0	5	-33.3
0.08	-32.8	8	-33.3
0.1	-33.0	10	-33.3
0.15	-33.3	15	-33.4
0.2	-33.3	20	-33.8
0.3	-33.4	25	-34.4
0.5	-33.3	30	-35.5

TABLE 1 : ACTIVE LOOP ANTENNA

Frequency (MHz)	Antenna factor (dB/m)	Frequency (MHz)	Antenna factor (dB/m)
30	23.5	180	10.3
35	20.5	200	11.6
40	17.9	250	13.4
45	15.4	300	14.1
50	13.0	400	16.4
60	10.7	500	17.2
70	8.9	600	18.5
80	7.4	700	19.1
90	8.3	800	19.9
100	10.9	900	20.1
120	13.8	1000	20.6
140	12.7	-	-
160	10.8	-	-

TABLE 2 : BILOG ANTENNA

Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
0.009	0.0	6.000	0.5
0.020	0.0	7.000	0.5
0.050	0.0	8.000	0.5
0.100	0.1	9.000	0.6
0.500	0.1	10.00	0.6
1.000	0.2	15.00	0.8
2.000	0.3	20.00	0.9
3.000	0.3	25.00	1.0
4.000	0.4	30.00	1.1
5.000	0.4	-	-

**TABLE 3 : TEST CABLE FOR 30M MEASUREMENT INTO 9 kHz
AND 30 MHz**

Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
30	0.1	250	0.2
40	0.1	300	0.3
50	0.1	400	0.3
60	0.1	500	0.4
70	0.1	600	0.4
80	0.1	700	0.5
90	0.1	800	0.5
100	0.1	900	0.6
150	0.2	1000	0.6
200	0.2	-	-

**TABLE 4a : TEST CABLE FOR 3M MEASUREMENT INTO 30 MHz
AND 1 GHz**

Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
30	0.3	250	0.8
40	0.3	300	0.8
50	0.4	400	1.0
60	0.4	500	1.1
70	0.4	600	1.2
80	0.4	700	1.3
90	0.5	800	1.4
100	0.5	900	1.5
150	0.6	1000	1.5
200	0.7	-	-

**TABLE 4b : TEST CABLE FOR 3M MEASUREMENT INTO 30 MHz
AND 1 GHz**

Frequency (MHz)	Loss (dB)	Frequency (MHz)	Loss (dB)
30	0.3	250	1.1
40	0.4	300	1.2
50	0.5	400	1.4
60	0.5	500	1.7
70	0.5	600	1.8
80	0.6	700	2.0
90	0.6	800	2.1
100	0.7	900	2.3
150	0.8	1000	2.4
200	1.0	-	-

**TABLE 4c : TEST CABLE FOR 3M MEASUREMENT INTO 30 MHz
AND 1 GHz**

Frequency (GHz)	Antenna factor (dB/m)	Frequency (GHz)	Antenna factor (dB/m)
1.0	23.7	10.0	37.6
1.5	25.0	10.5	37.8
2.0	27.5	11.0	38.1
2.5	28.8	11.5	38.3
3.0	29.8	12.0	38.8
3.5	31.2	12.5	38.8
4.0	32.5	13.0	39.4
4.5	32.5	13.5	40.0
5.0	33.5	14.0	40.1
5.5	34.1	14.5	40.6
6.0	34.1	15.0	40.6
6.5	34.4	15.5	39.7
7.0	35.4	16.0	39.3
7.5	36.6	16.5	39.9
8.0	36.6	17.0	41.4
8.5	37.0	17.5	45.1
9.0	37.1	18.0	46.3
9.5	37.2	-	-

TABLE 5 : HORN ANTENNA

Frequency (GHz)	Antenna factor (dB/m)	Frequency (GHz)	Antenna factor (dB/m)
18.0	30.7	22.5	30.9
18.5	30.7	23.0	31.2
19.0	30.5	23.5	31.1
19.5	30.7	24.0	31.3
20.0	30.7	24.5	31.5
20.5	30.8	25.0	31.0
21.0	30.9	25.5	31.0
21.5	30.5	26.0	31.4
22.0	30.6	-	-

TABLE 6 : HORN ANTENNA

Frequency (GHz)	Gain value (dB)	Frequency (GHz)	Gain value (dB)
1.0	33.4	13.0	32.5
1.5	33.7	14.0	31.6
2.0	33.9	15.0	33.0
2.5	34.0	16.0	33.5
3.0	33.9	17.0	33.9
4.0	34.3	18.0	34.3
5.0	35.2	19.0	34.4
6.0	34.7	20.0	32.9
7.0	34.0	21.0	33.2
8.0	33.7	22.0	34.3
9.0	31.8	23.0	34.6
9.5	31.1	24.0	34.4
10.0	30.5	25.0	34.5
10.5	30.7	26.0	32.5
11.0	31.1	-	-
12.0	32.4	-	-

TABLE 7 : AMPLIFIER GAIN VALUE

Frequency (GHz)	Gain value (dB)	Frequency (GHz)	Gain value (dB)
1.0	1.6	13.0	6.4
1.5	2.0	14.0	6.6
2.0	2.4	15.0	7.1
2.5	2.7	16.0	7.3
3.0	3.0	17.0	7.6
4.0	3.4	18.0	7.8
5.0	3.8	-	-
6.0	4.1	-	-
7.0	4.6	-	-
8.0	5.1	-	-
9.0	5.5	-	-
9.5	5.6	-	-
10.0	5.7	-	-
10.5	5.8	-	-
11.0	5.9	-	-
12.0	6.2	-	-

TABLE 8 : TEST CABLE FOR 3M MEASUREMENT INTO 1 TO 18 GHz

Frequency (GHz)	Loss (dB)
18.0	3.8
19.0	3.8
20.0	3.9
21.0	4.0
22.0	4.1
23.0	4.2
24.0	4.3
25.0	4.4
26.0	4.5

TABLE 9a: TEST CABLE FOR 3M MEASUREMENT INTO 18 TO 26 GHz

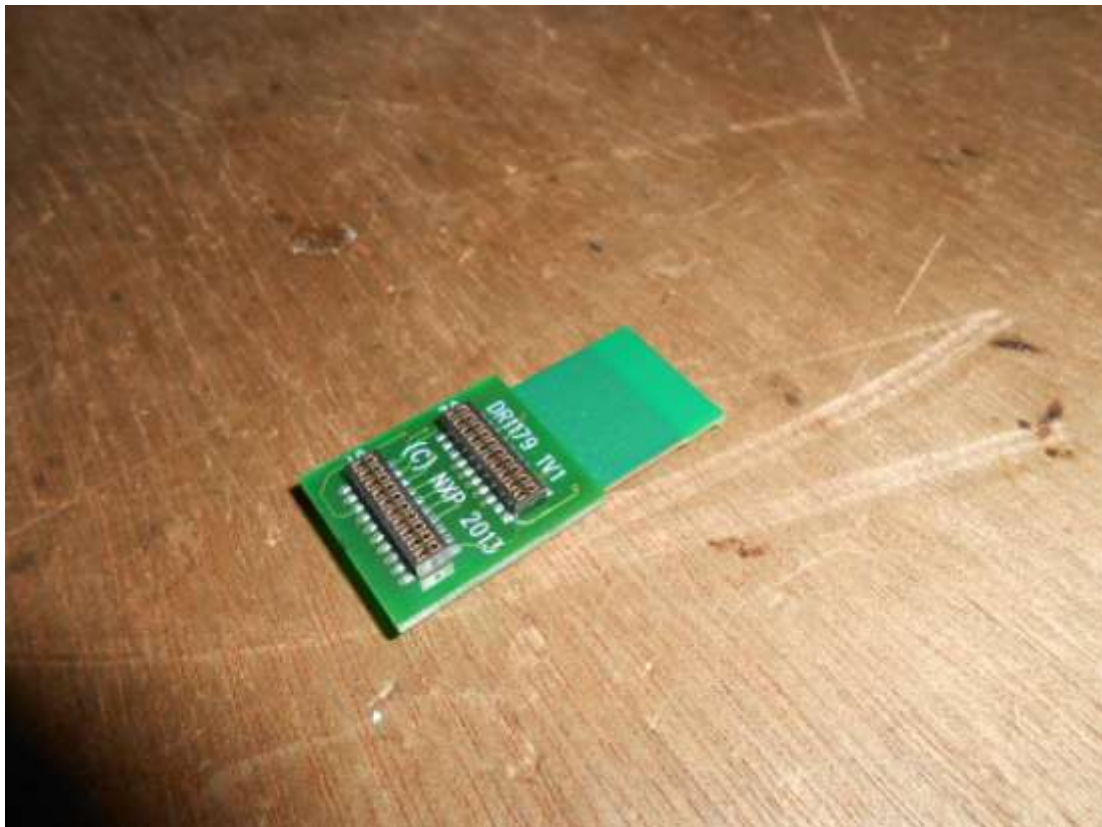
Frequency (GHz)	Loss (dB)
18.0	3.8
19.0	3.8
20.0	3.9
21.0	4.0
22.0	4.1
23.0	4.2
24.0	4.3
25.0	4.4
26.0	4.5

TABLE 9b: TEST CABLE FOR 3M MEASUREMENT INTO 18 TO 26 GHz

ANNEX 2

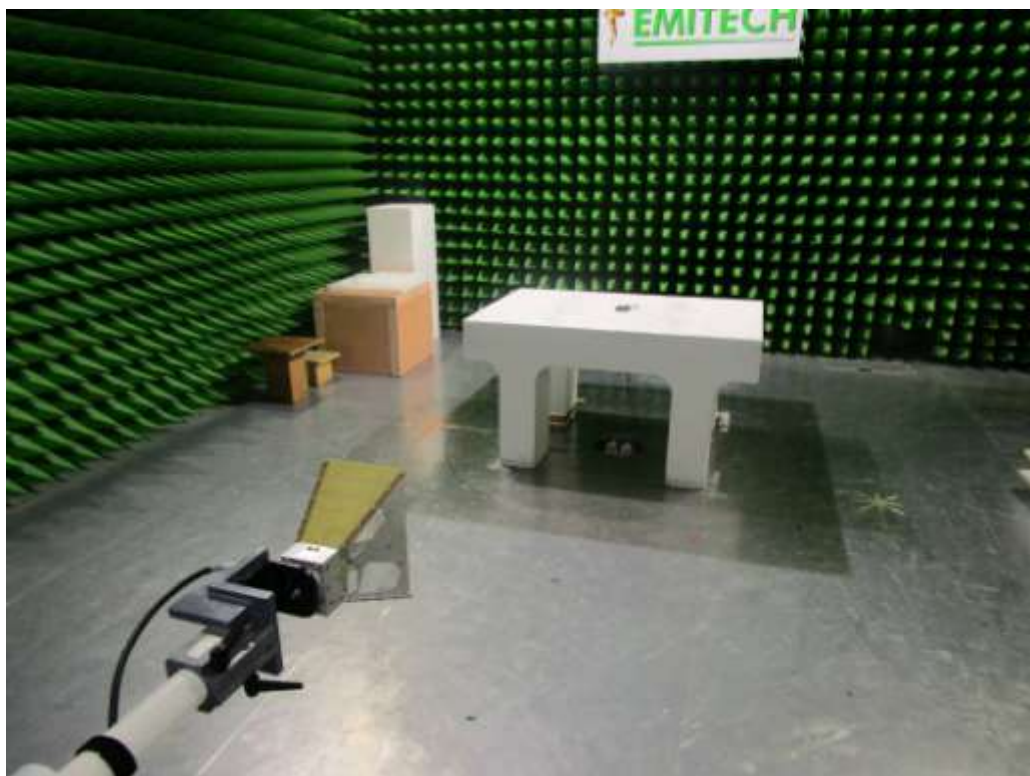
EXTERNAL PHOTOGRAPHS

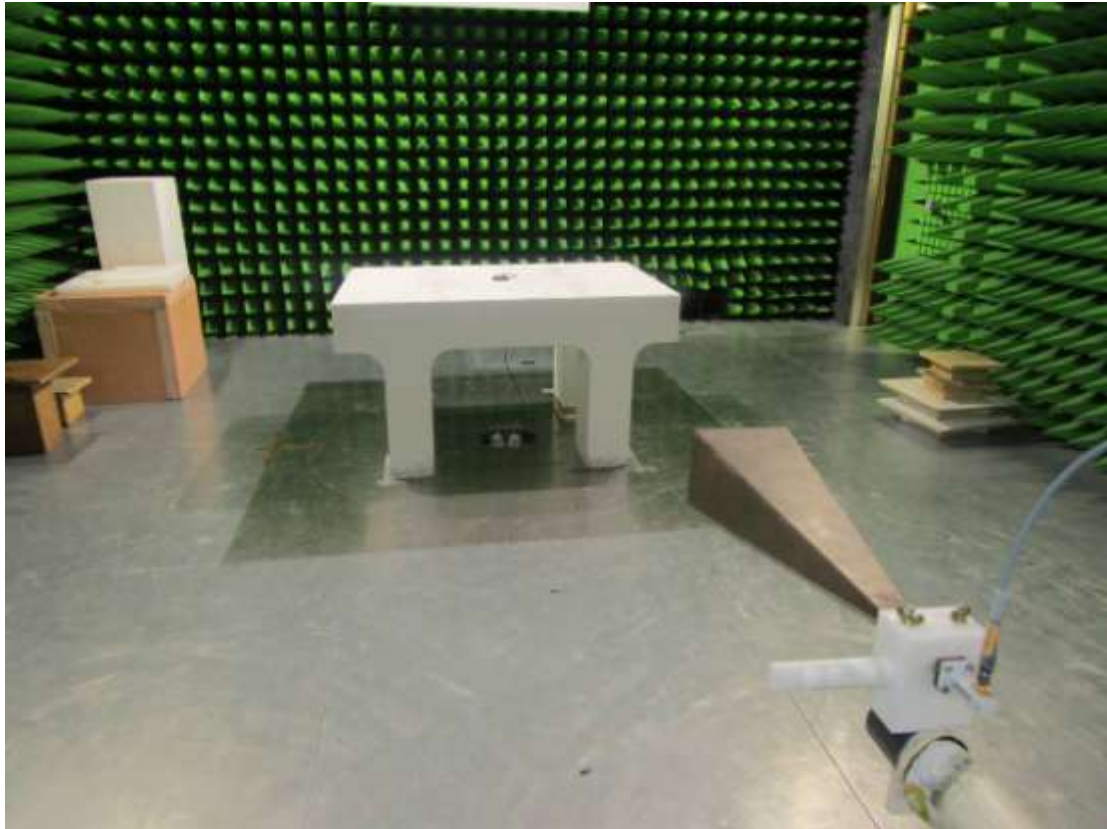




ANNEX 3

TEST SETUP PHOTOGRAPHS









ANNEX 4

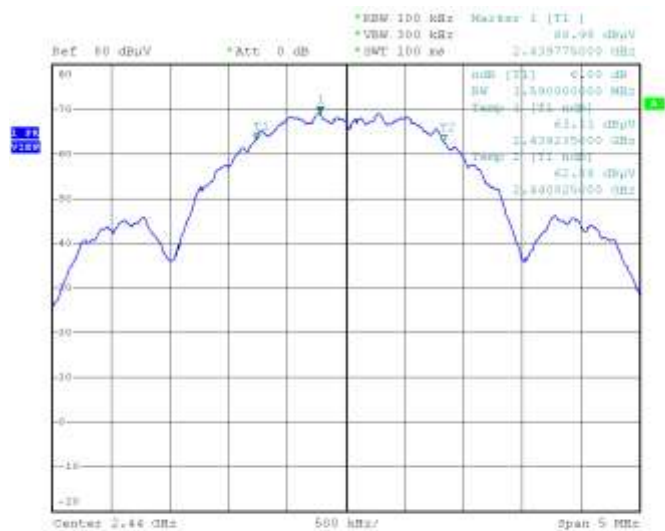
6 dB BANDWIDTH

Frequency 2405 MHz



Date: 26.MAR.2015 14:45:32

Frequency 2440 MHz



Date: 26.MAR.2015 15:27:30

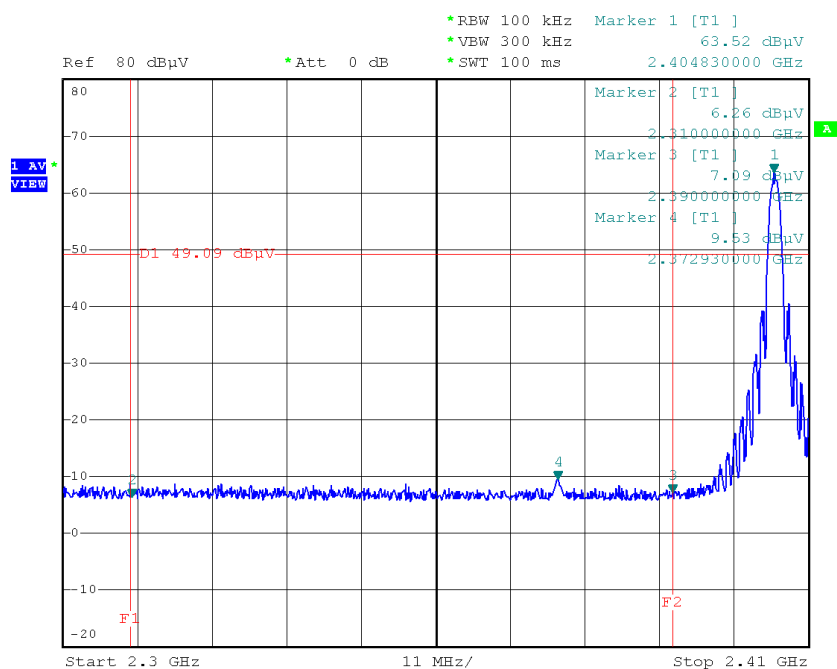
Frequency 2480 MHz



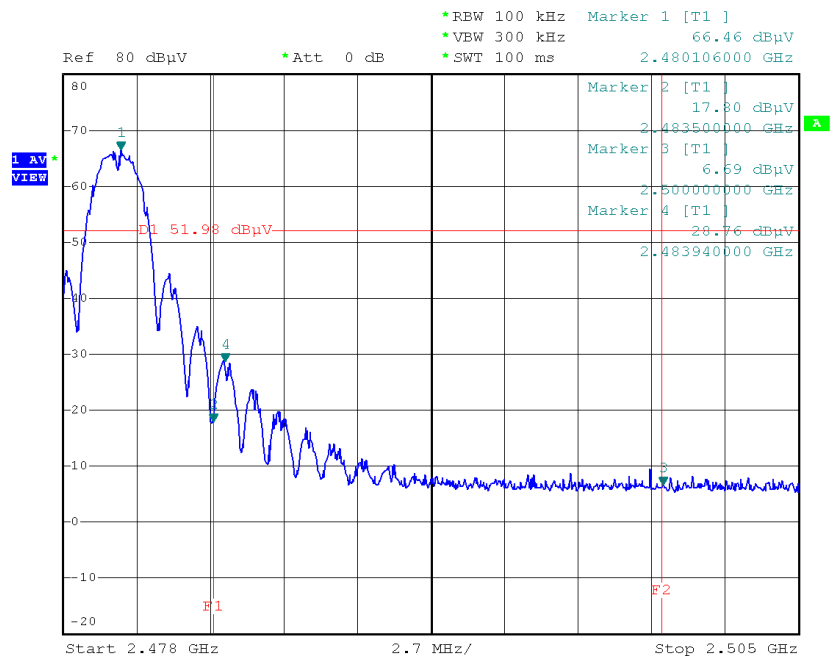
Date: 26.MAR.2015 15:39:07

ANNEX 5

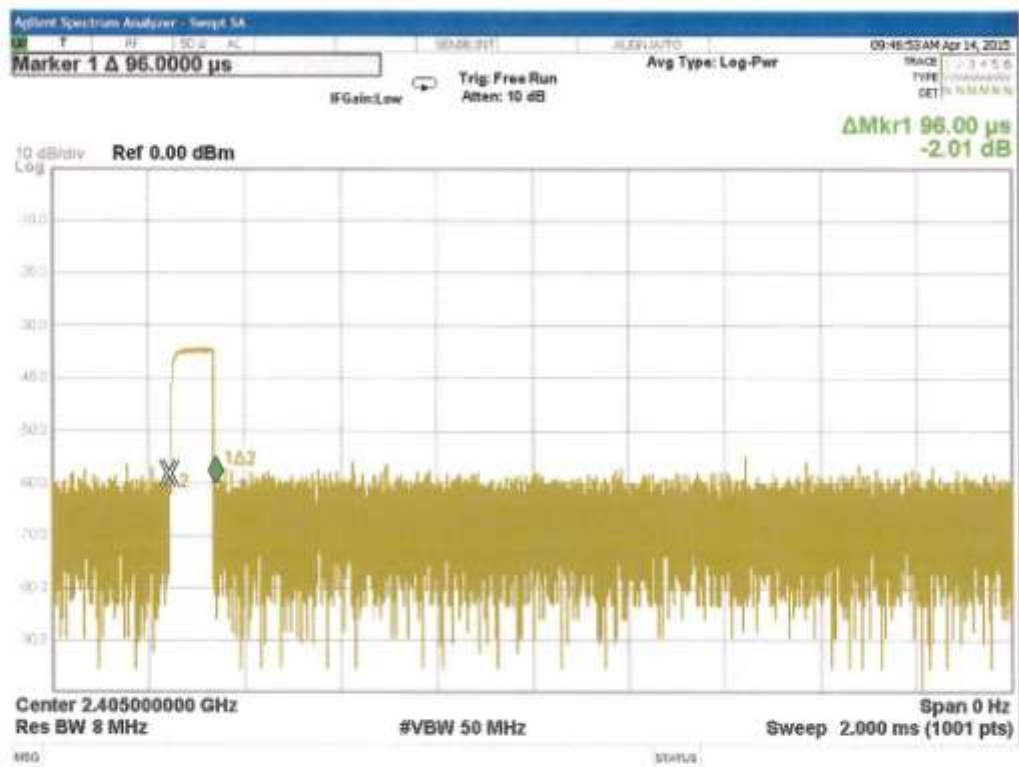
BAND EDGE AND DUTY CYCLE

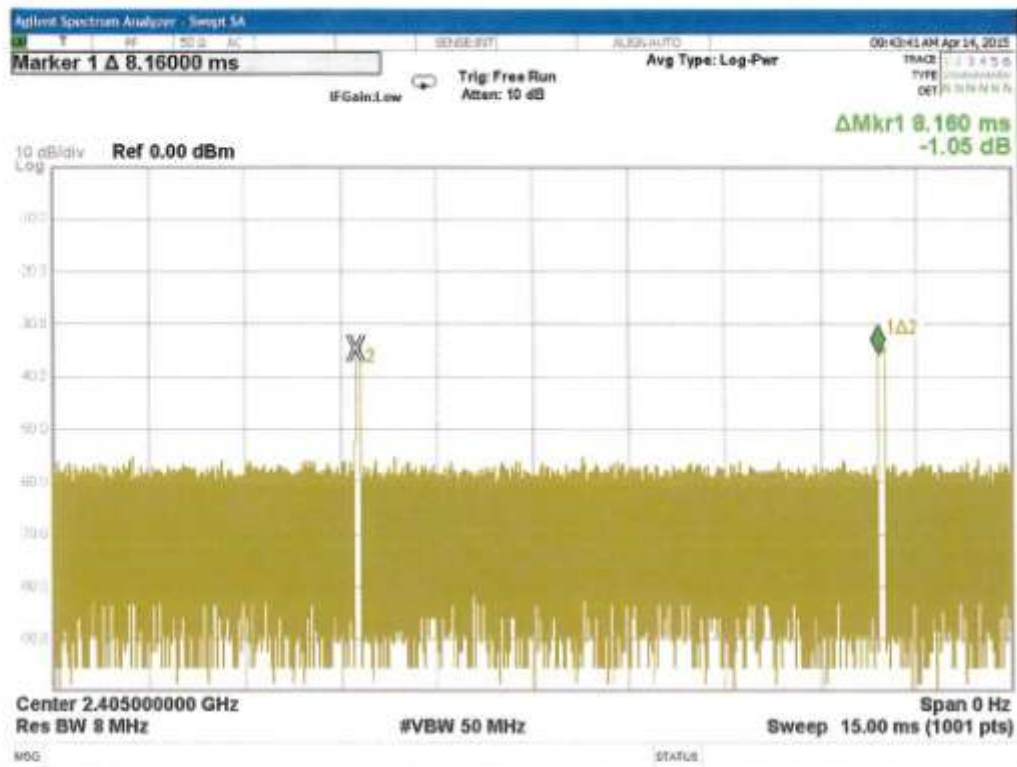


Date: 26.MAR.2015 15:15:40



Date: 26.MAR.2015 16:01:40





ANNEX 6

CALIBRATION DATES

N° EMITECH	LAST CALIBRATION	CALIBRATION DUE DATE
10517	18/09/2014	18/09/2016
0549	15/10/2012	15/10/2015
5647	25/02/2013	25/02/2017
2881	24/05/2014	24/05/2016
11136	10/03/2014	10/03/2016
7405	06/01/2014	06/01/2016
5175	23/06/2014	23/06/2016
3374	08/02/2012	08/02/2016
1045	21/03/2015	21/03/2019
11132	10/03/2014	10/03/2016
11133	10/03/2014	10/03/2016
11172	28/03/2014	28/03/2016
4211	27/01/2015	27/01/2017
0019	19/11/2013	19/11/2015
0491	19/11/2013	19/11/2015
1061	22/11/2014	22/12/2016
0326	09/04/2014	09/04/2016