TEST REPORT

N°: 161998-746798 **Version : 01**

Subject	**Radio spectrum matters tests according to standards: 47 CFR Part 15.247 & RSS-247 Issue 2 & RSS-Gen Issue 5**
Issued to	**NETATMO 93 rue nationale 92100 - Boulogne-Billancourt FRANCE**
Apparatus under test	
Product	DOORBELL
Trade mark	**NETATMO**
Manufacturer	**NETATMO**
Model under test	**NDB01**
Serial number	**g549ba4**
FCC ID	**N3A-NDB01**
IC	**10860A-NDB01**
Conclusion	See Test Program chapter
Test date	January 22, 2020 to January 27, 2020
Test location	Fontenay Aux Roses & Ecuelles
Test Site	6230B-1
Sample receipt date	
Composition of document	50 pages
Document issued on	February 11, 2020

Written by :
Julien Palard
Tests operator

Approved by :
Arnaud LAVETTE
Technical manager

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PUBLICATION HISTORY

Version	Date	Author	Modification
01	February 11, 2020	Julien Palard	Creation of the document

Each new edition of this test report replaces and cancels the previous edition. The control of the old editions of report is under responsibility of client.

SUMMARY

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1. TEST PROGRAM

References

- **47 CFR Part 15.247**
- **RSS 247 Issue 2**
- **RSS Gen Issue 5**
- **KDB 558074 D01 DTS Meas Guidance v05r02**
- **ANSI C63.10-2013**

Radio requirement:

Clause (47CFR Part 15.247 & RSS-247 Issue 2 & RSS-Gen Issue 5) Test Description	Test result - Comments			
Occupied Bandwidth	☑ PASS	☐ FAIL	☐ NA	☐ NP(1)
6dB Bandwidth	☑ PASS	☐ FAIL	☐ NA()	☐ NP(1)
Duty Cycle	☑ PASS	☐ FAIL	☐ NA	☐ NP(1)
Maximum Conducted Output Power	☑ PASS	☐ FAIL	☐ NA	☐ NP(1)
Power Spectral Density	☑ PASS	☐ FAIL	☐ NA	☐ NP(1)
Conducted Spurious Emission at the Band Edge	☑ PASS	☐ FAIL	☐ NA()	☐ NP(1)
Unwanted Emissions into Non-Restricted Frequency Bands	☑ PASS	☐ FAIL	☐ NA()	☐ NP(1)
AC Power Line Conducted Emission	☑ PASS	☐ FAIL	☐ NA(2)	☐ NP(1)
Unwanted Emissions into Restricted Frequency Bands	☑ PASS	☐ FAIL	☐ NA	☐ NP(1)
Receiver Radiated emissions	☑ PASS	☐ FAIL	☐ NA	☐ NP(1)
This table is a summary of test report, see conclusion of each clause of this test report for detail.				

(1): Limited program
(2): EUT not directly or indirectly connected to the AC Power Public Network

PASS: EUT complies with standard's requirement
FAIL: EUT does not comply with standard's requirement
NA: Not Applicable
NP: Test Not Performed

2. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)

2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):

NETATMO NDB01 **Serial Number: g549ba4**

Equipment Under Test

Power supply:

During all the tests, EUT is supplied by V_{nom}: 5 VDC

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

Name	Type	Rating	Reference / Sn	Comments
Supply1	☐ AC ☑ DC ☐ Battery	5VDC	-	-

Voltage table used (for Power Line Conducted Emissions):

Type	Measurement performed:	
☑ AC	☑ **120VAC/60Hz**	☑ **240VAC/50Hz**

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
1	Power supply	-	☐	☐	☐	-

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Laptop Computer	-	-	-
SMA Cable antenna	-	-	For conducted test
USB cable	-	-	For sending command to the EUT

Equipment information:

Bluetooth LE Type:	☑ **BLE**	☐ **v4.0**	☐ **v4.1**	☑ **v4.2**
Frequency band:	[2400 – 2483.5] MHz			
Number of Channel:	40			
Spacing channel:	2MHz			
Channel bandwidth:	1MHz			
Antenna Type:	☑ Integral	☐ External	☐ Dedicated	
Antenna connector:	☐ Yes	☐ No	☑ Temporary for test	
Transmit chains:	1			
	Single antenna			
Receiver chains	1			
Type of equipment:	☑ Stand-alone	☐ Plug-in	☐ Combined	
Ad-Hoc mode:	☐ Yes	☑ No		
Duty cycle:	☑ Continuous duty	☐ Intermittent duty	☐ 100% duty	
Equipment type:	☑ Production model	☐ Pre-production model		
Operating temperature range:	Tmin:	☐ -20°C	☐ 0°C	☑ -10°C
	Tnom:	20°C		
	Tmax:	☐ 35°C	☐ 55°C	☑ 40°C
Type of power source:	☑ AC power supply	☑ DC power supply ☑ 8VAC to 24VAC/50Hz-60Hz	☑ Battery	
Operating voltage range:	Vnom:	☐ 120V/60Hz	☑ 5 Vdc	
		☐ 240V/50Hz	☐ X Vdc	

Antenna Characteristic			
Antenna assembly	**Gain (dBi)**	**Frequency Band (MHz)**	**Impedance(Ω)**
1	1.4	2400-2483.5	50

Hardware information		
Software (if applicable):	**V. :**	v.27

CHANNEL PLAN			
Channel	**Frequency (MHz)**	**Channel**	**Frequency (MHz)**
Cmin: 0	2402	**Cmid: 20**	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	**Cmax: 39**	2480

DATA RATE		
Data Rate (Mbps)	**Modulation Type**	**Worst Case Modulation**
1	GFSK	☑

2.2. RUNNING MODE

Test mode	Description of test mode
Test mode 1	Permanent emission with modulation on a fixed channel in the data rate that produced the highest power

Test	Running mode	
Occupied Bandwidth	☑ Test mode 1	☐ Alternative test mode()
6dB Bandwidth	☑ Test mode 1	☐ Alternative test mode()
Duty Cycle	☑ Test mode 1	☐ Alternative test mode()
Maximum Conducted Output Power	☑ Test mode 1	☐ Alternative test mode()
Power Spectral Density	☑ Test mode 1	☐ Alternative test mode()
Conducted Spurious Emission at the Band Edge	☑ Test mode 1	☐ Alternative test mode()
Unwanted Emissions into Non-Restricted Frequency Bands	☑ Test mode 1	☐ Alternative test mode()
AC Power Line Conducted Emission	☑ Test mode 1	☐ Alternative test mode()
Unwanted Emissions into Restricted Frequency Bands	☑ Test mode 1	☐ Alternative test mode()

2.3. EQUIPMENT LABELLING

2.4. EQUIPMENT MODIFICATION

☑ None ☐ Modification:

3. OCCUPIED BANDWIDTH

3.1. TEST CONDITIONS

Test performed by	: Julien PALARD
Date of test	: January 23, 2020
Ambient temperature	: 24 °C
Relative humidity	: 39 %

3.2. TEST SETUP

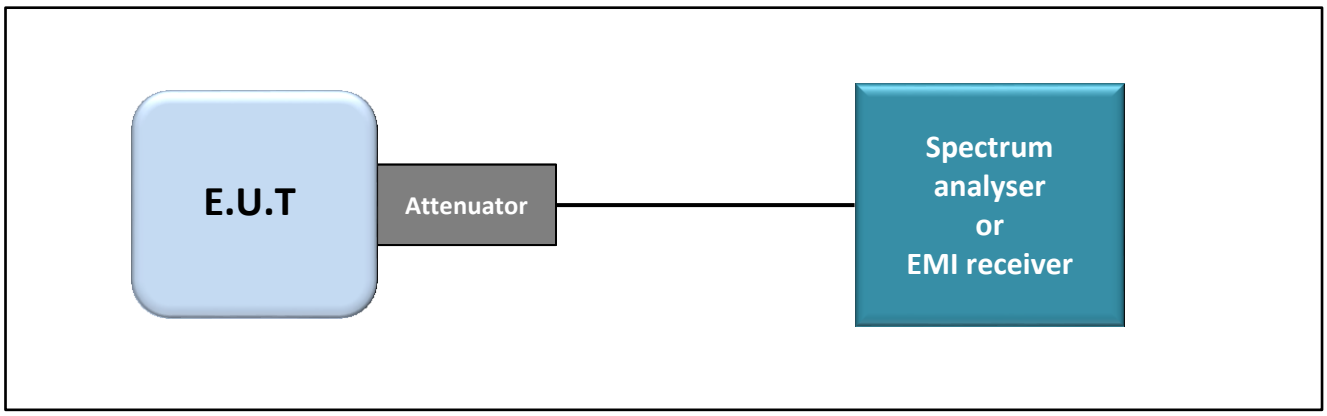
- The Equipment under Test is installed:
☑ On a table
☐ In an anechoic chamber

- Measurement is performed with a spectrum analyzer in:
☑ Conducted Method
☐ Radiated Method

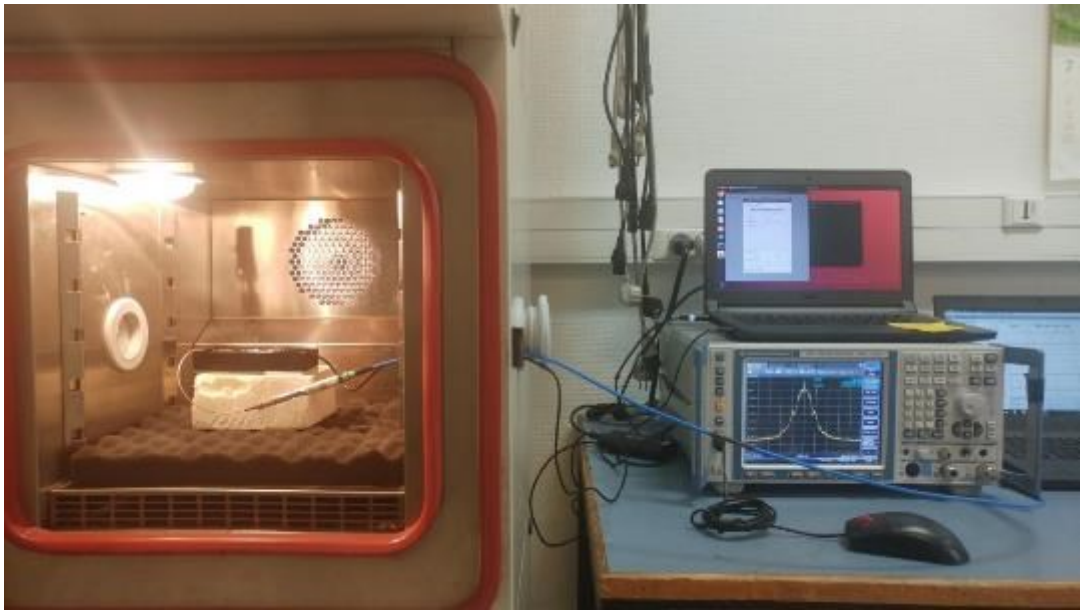
- Test Procedure:
☐ RSS-Gen Issue 5 § 6.7
☑ ANSI C63.10 § 6.9.2

Measurement Procedure:

a) RBW shall be in the range of 1% to 5% of the anticipated occupied bandwidth
b) Set the video bandwidth (VBW) ≥ 3 x RBW
c) SPAN = Capture all products of the modulation process
d) Detector = Peak.
e) Trace mode = max hold.
f) Sweep = auto couple.
g) Allow the trace to stabilize.
h) OBW 99% function of spectrum analyzer used



Test set up of Occupied Bandwidth



Photograph for Occupied bandwidth

3.3. LIMIT

None

3.4. TEST EQUIPMENT LIST

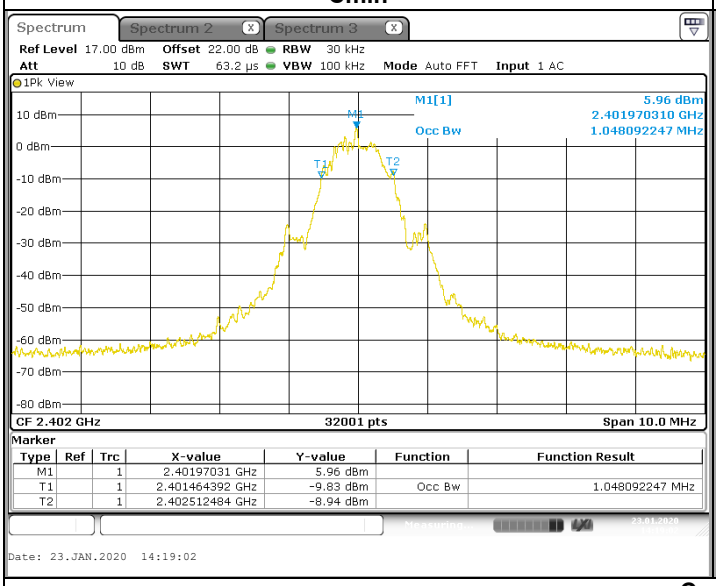
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Cable + Attenuator 20dB	PASTERNACK	PE350-100CM	A5329768	2019/08	2020/08
EMI receiver	ROHDE & SCHWARZ	ESR 7	A2642023	2019/01	2021/01

Note: In our quality system, the test equipment calibration due is more & less 2 months

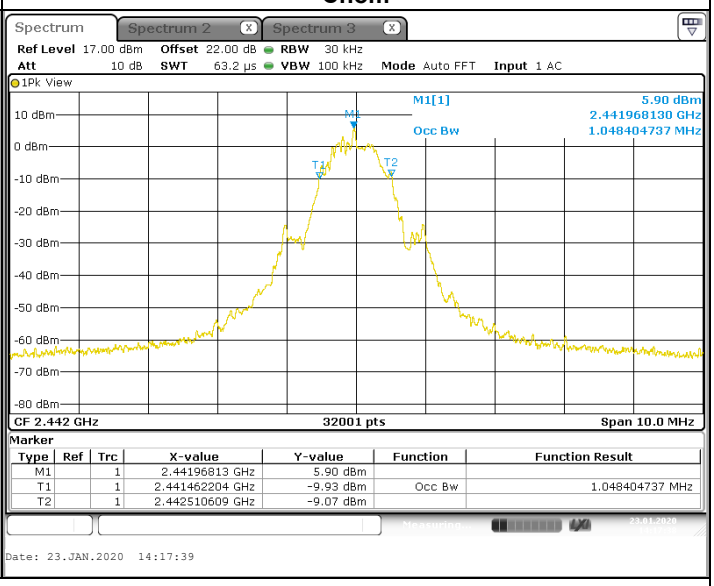
3.5. RESULTS

Occupied Bandwidth

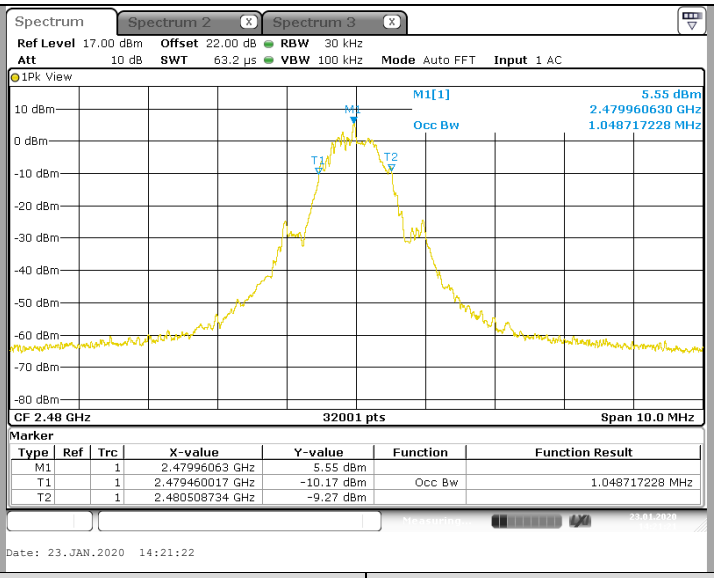
Cmin



Cnom



Cmax



Channel	Occupied Bandwidth (MHz)
Cmin	1.048
Cnom	1.048
Cmax	1.049

3.6. *CONCLUSION*

Occupied Channel Bandwidth measurement performed on the sample of the product **NETATMO NDB01**, SN: **g549ba4**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS-GEN ISSUE 5** limits.

4. 6dB Emission Bandwidth

4.1. TEST CONDITIONS

Test performed by	: Julien PALARD
Date of test	: January 23, 2020
Ambient temperature	: 24 °C
Relative humidity	: 39 %

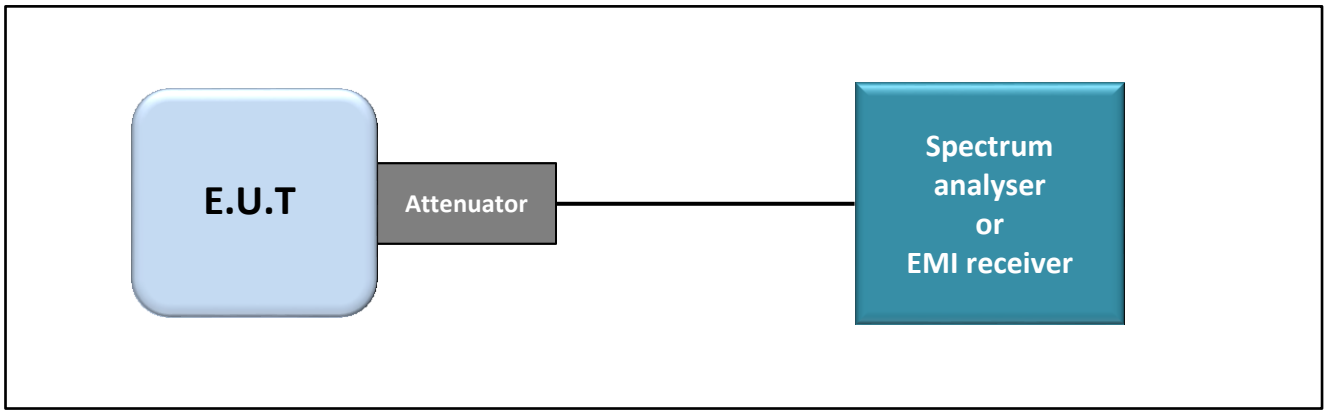
4.2. TEST SETUP

- The Equipment under Test is installed:
☑ On a table
☐ In an anechoic chamber

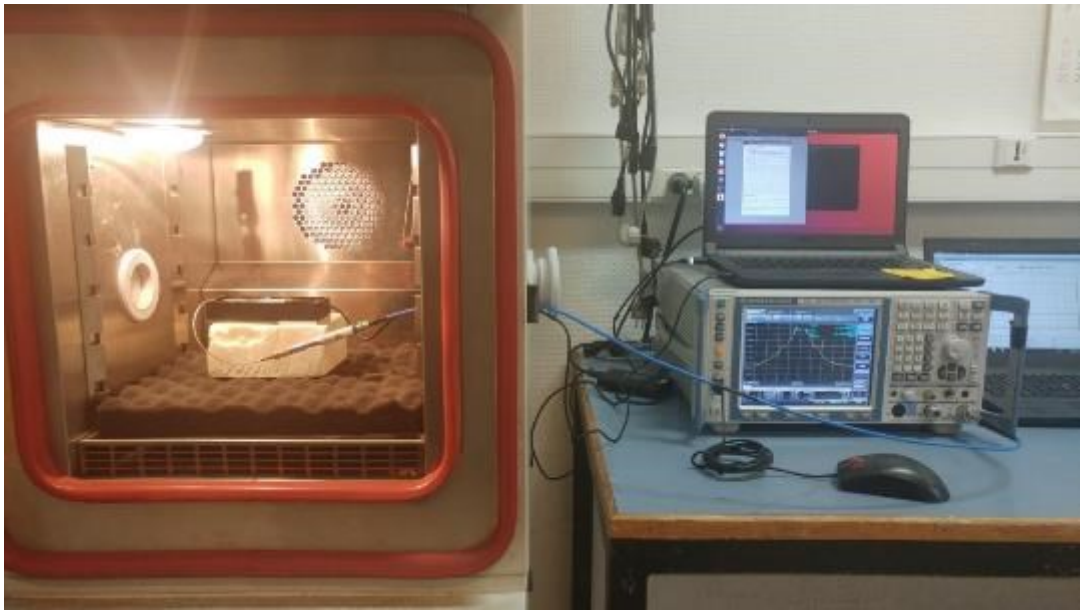
- Measurement is performed with a spectrum analyzer in:
☑ Conducted Method
☐ Radiated Method

- Test Procedure:
☑ ANSI C63.10 § 11.8.1
☐ ANSI C63.10 § 11.8.2

Measurement Procedure:
1. Set resolution bandwidth (RBW) = 100kHz.
2. Set the video bandwidth (VBW) ≥ 3 x 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.



Test set up of 6dB Emission Bandwidth



Photograph for 6dB emission bandwidth

4.3. LIMIT

Frequency range	The 6dB bandwidth Limit
2400MHz to 2483.5MHz	≥ 500kHz

4.4. TEST EQUIPMENT LIST

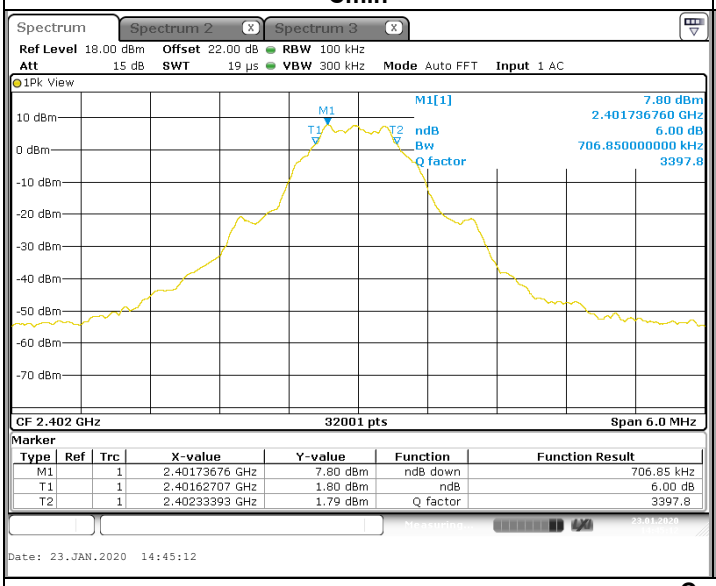
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Cable + Attenuator 20dB	PASTERNACK	PE350-100CM	A5329768	2019/08	2020/08
EMI receiver	ROHDE & SCHWARZ	ESR 7	A2642023	2019/01	2021/01

Note: In our quality system, the test equipment calibration due is more & less 2 months

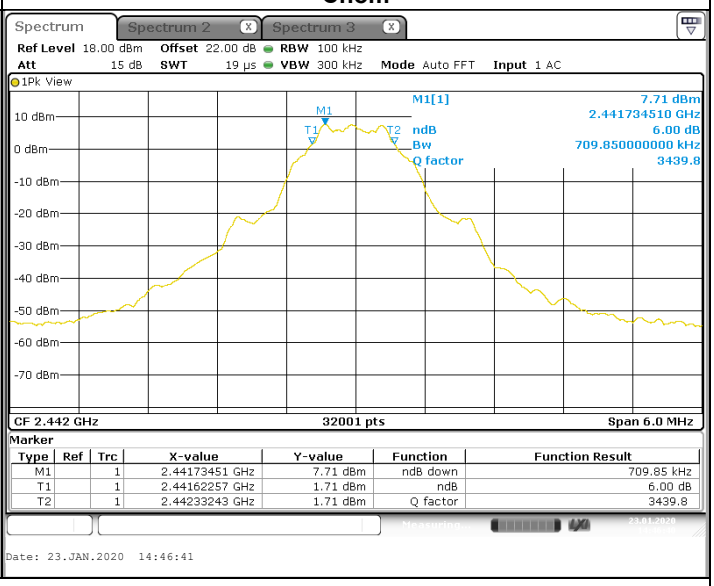
4.5. RESULTS

6dB Emission Bandwidth

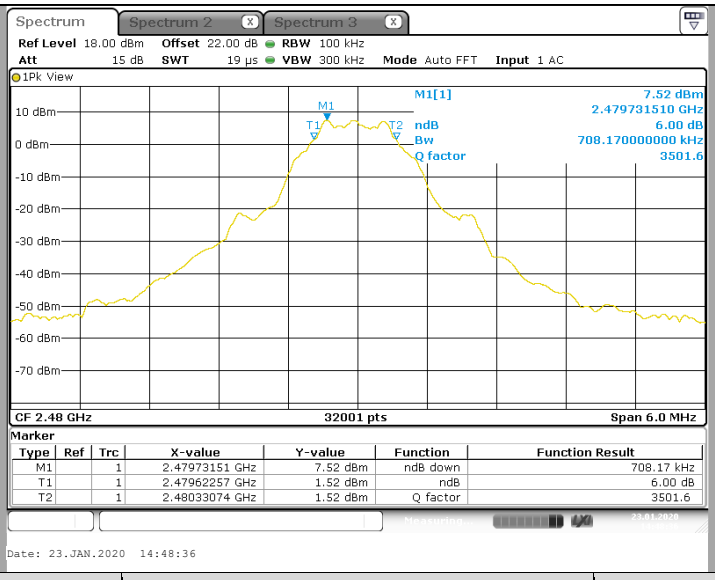
Cmin



Cnom



Cmax



Channel	6dB Emission Bandwidth (MHz)	Limit (MHz)
Cmin	0.707	Minimum 0.5
Cnom	0.710	Minimum 0.5
Cmax	0.708	Minimum 0.5

4.6. CONCLUSION

6dB Emission Bandwidth measurement performed on the sample of the product **NETATMO NDB01**, SN: **g549ba4**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247 ISSUE 2** limits.

5. DUTY CYCLE

5.1. TEST CONDITIONS

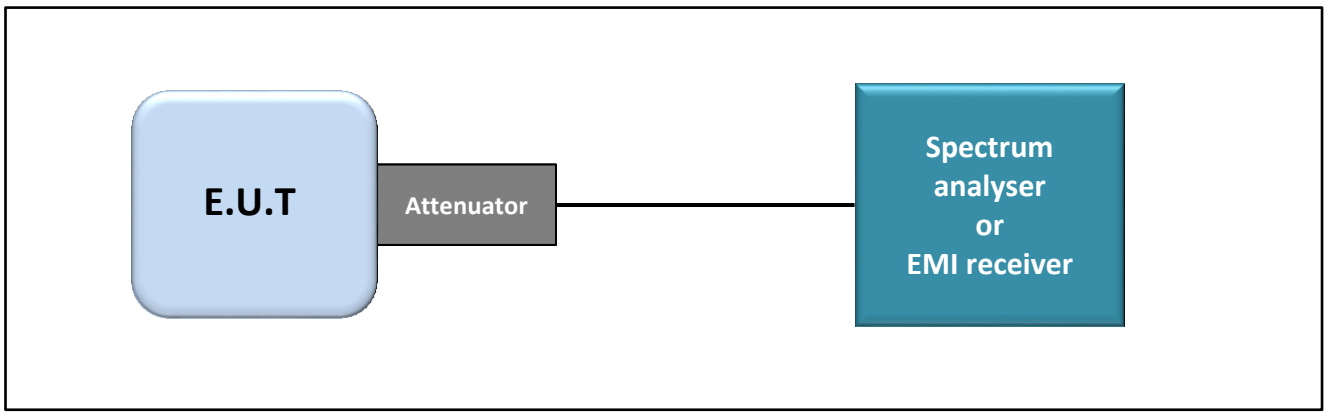
Test performed by	: Julien PALARD
Date of test	: January 23, 2020
Ambient temperature	: 24 °C
Relative humidity	: 39 %

5.2. TEST SETUP

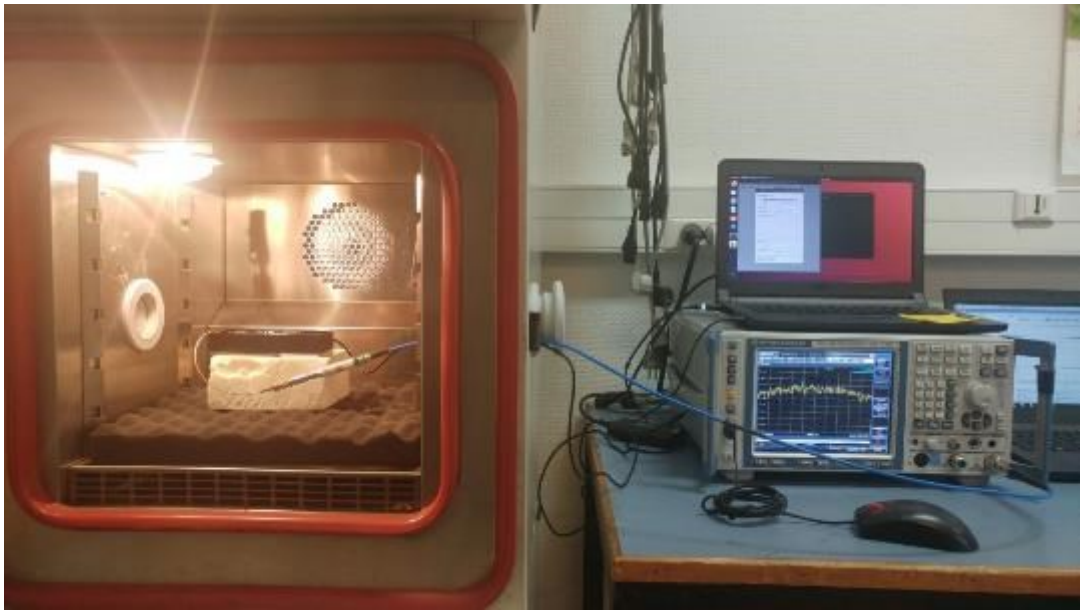
- The Equipment under Test is installed:
☑ On a table
☐ In an anechoic chamber

- Measurement is performed with a spectrum analyzer in:
☑ Conducted Method
☐ Radiated Method

- Test Procedure:
☑ ANSI C63.10 § 11.6



Test set up of Duty Cycle



Photograph for Duty cycle

5.3. LIMIT

None

5.4. TEST EQUIPMENT LIST

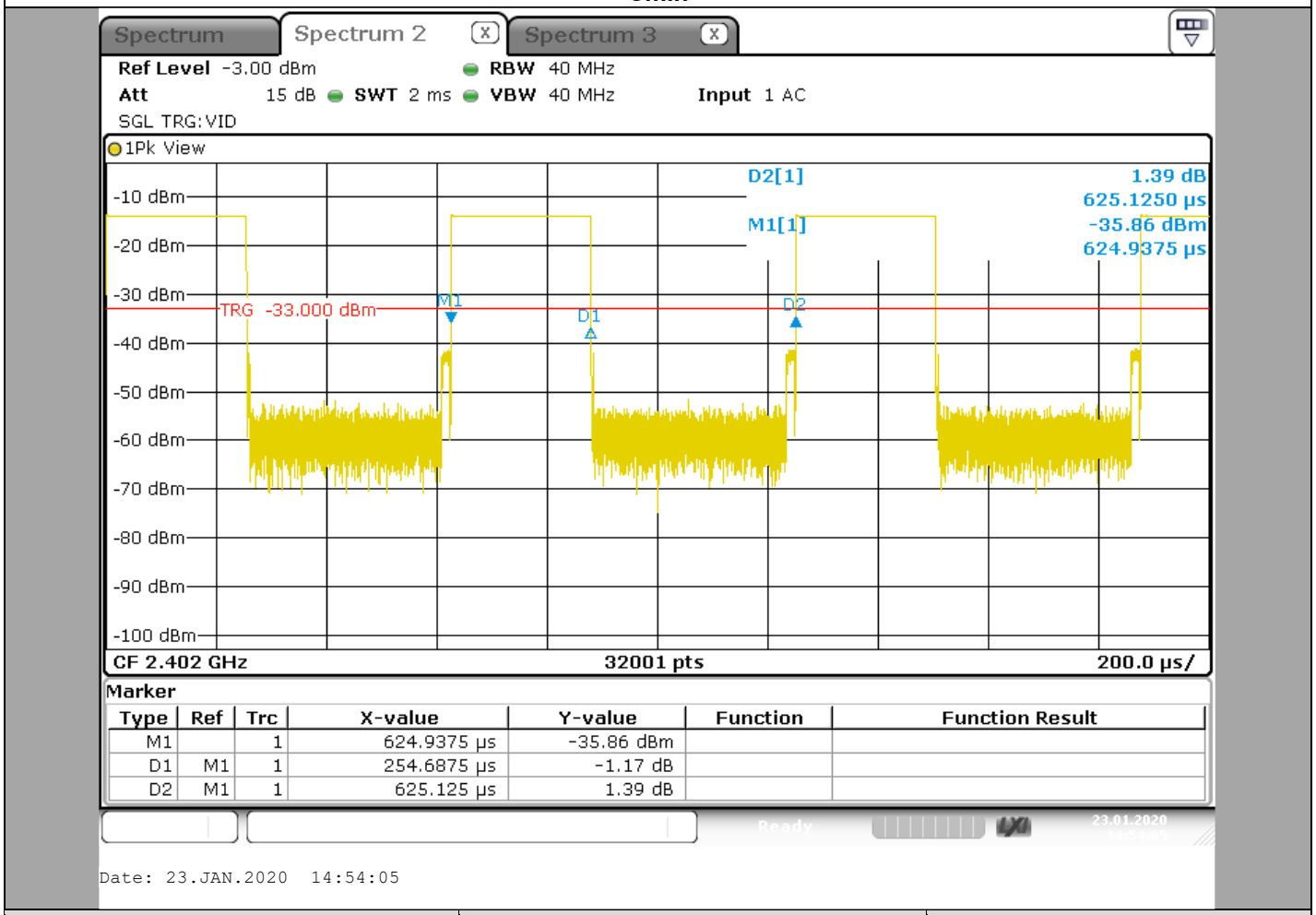
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Cable + Attenuator 20dB	PASTERNACK	PE350-100CM	A5329768	2019/08	2020/08
EMI receiver	ROHDE & SCHWARZ	ESR 7	A2642023	2019/01	2021/01

Note: In our quality system, the test equipment calibration due is more & less 2 months

5.5. RESULTS

Duty Cycle

Cmin



Channel	Duty Cycle (%)	Duty Cycle Correction (dB)
Channel	40.74	$20\log(\frac{1}{duty\ cycle})$ = 7.79

5.6. CONCLUSION

Duty Cycle measurement performed on the sample of the product **NETATMO NDB01**, SN: **g549ba4**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247 ISSUE 2** limits.

6. MAXIMUM CONDUCTED OUTPUT POWER

6.1. TEST CONDITIONS

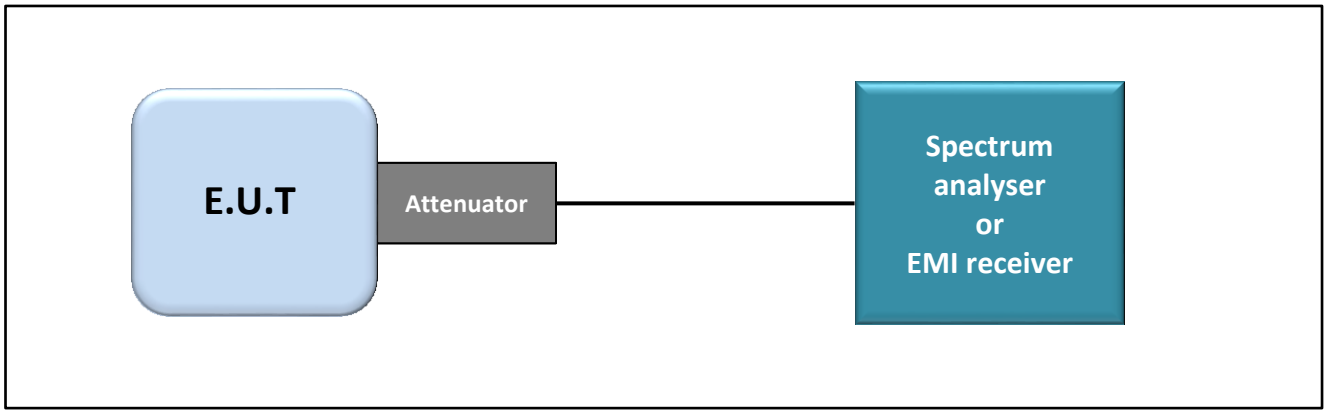
Test performed by	: Julien PALARD
Date of test	: January 23, 2020
Ambient temperature	: 24 °C
Relative humidity	: 39 %

6.2. TEST SETUP

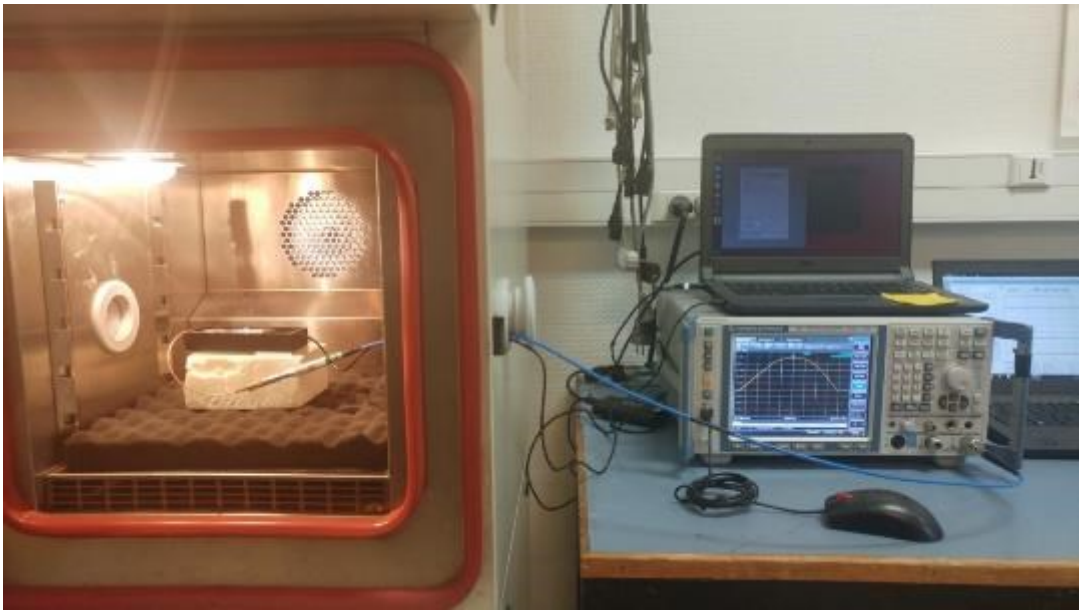
- The Equipment under Test is installed:
☑ On a table
☐ In an anechoic chamber

- Measurement is performed with a spectrum analyzer in:
☑ Conducted Method
☐ Radiated Method

- Test Procedure:
☑ ANSI C63.10 § 11.9.1.1
☐ ANSI C63.10 § 11.9.1.2
☐ ANSI C63.10 § 11.9.2.2.2 (Method AVGSA-1)
☐ ANSI C63.10 § 11.9.2.2.4 (Method AVGSA-2)



Test set up of Maximum Conducted Output Power



Photograph for Maximum Conducted Output Power

6.3. LIMIT

Frequency range	Maximum Conducted Output Power
2400MHz to 2483.5MHz	≤30dBm*

*Remark: Limits are reduced by G-6dBi if Overall Antenna Gain above 6dBi

6.4. TEST EQUIPMENT LIST

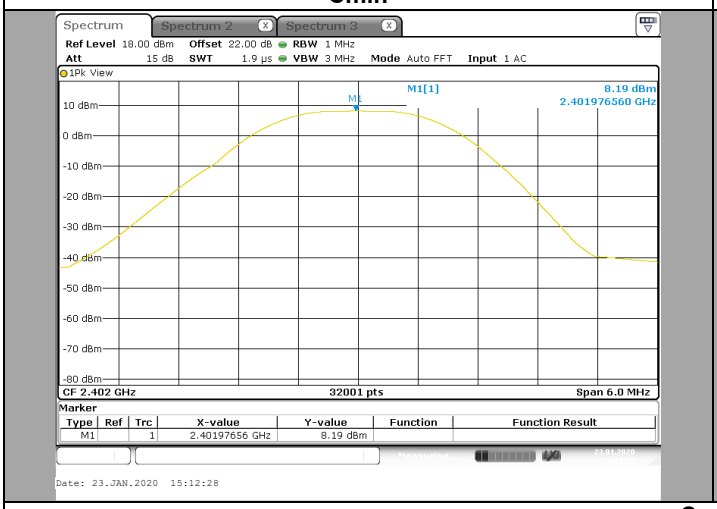
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Cable + Attenuator 20dB	PASTERNACK	PE350-100CM	A5329768	2019/08	2020/08
EMI receiver	ROHDE & SCHWARZ	ESR 7	A2642023	2019/01	2021/01

Note: In our quality system, the test equipment calibration due is more & less 2 months

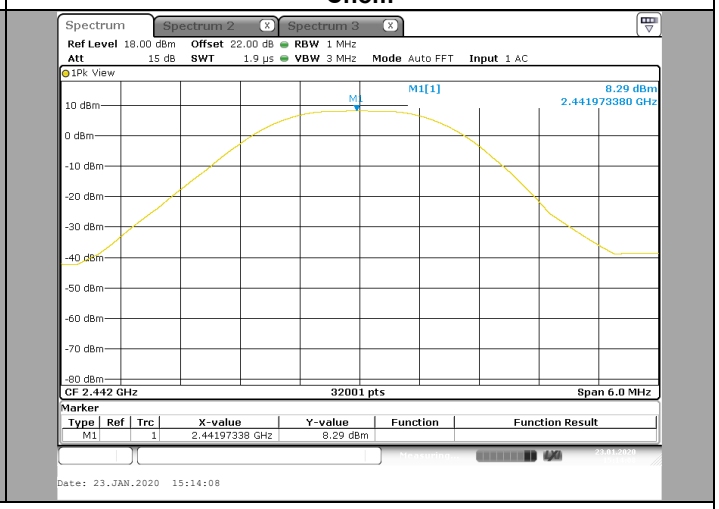
6.5. RESULTS

Maximum Conducted Output Power

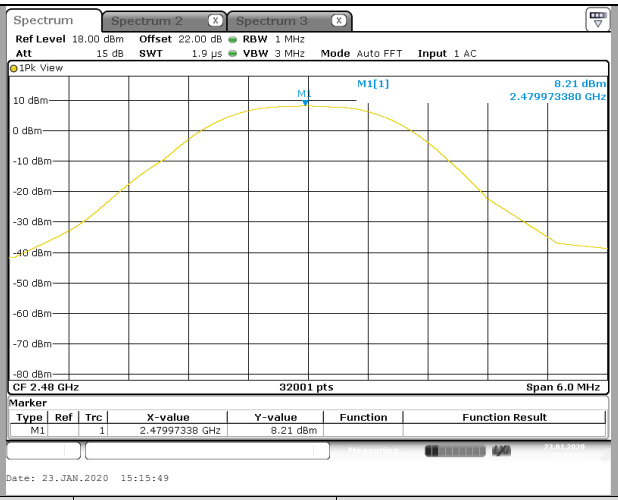
Cmin



Cnom



Cmax



Channel	Offset Cable + Att (dB)	Antenna Gain (dBi)	Maximum Conducted Power (dBm)	Limit (dBm)
Cmin	**22**	1.4	8.19	30
Cnom	**22**	1.4	8.29	30
Cmax	**22**	1.4	8.21	30

6.6. CONCLUSION

Maximum Conducted Output Power measurement performed on the sample of the product **NETATMO NDB01**, SN: **g549ba4**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247 ISSUE 2** limits.

7. POWER SPECTRAL DENSITY

7.1. TEST CONDITIONS

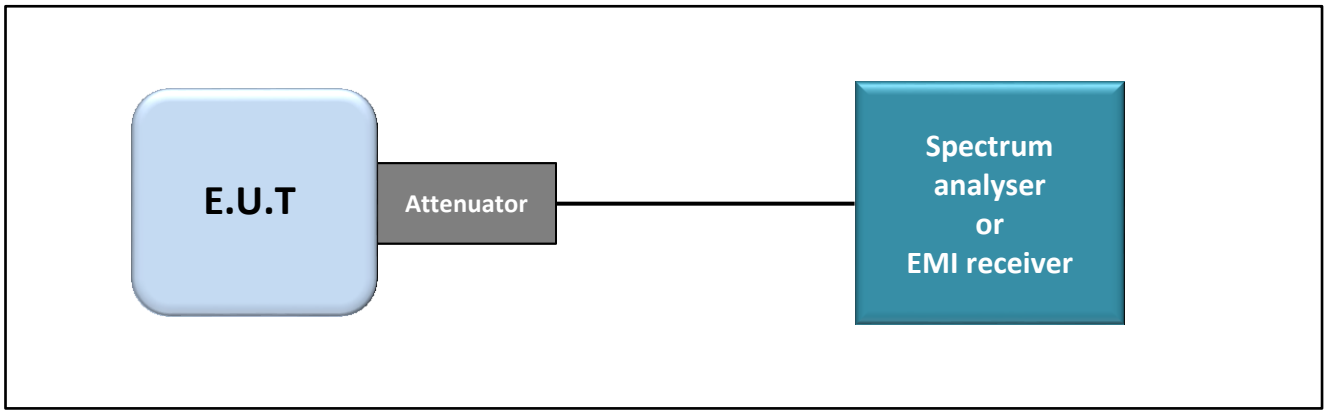
Test performed by	: Julien PALARD
Date of test	: January 23, 2020
Ambient temperature	: 24 °C
Relative humidity	: 39 %

7.2. TEST SETUP

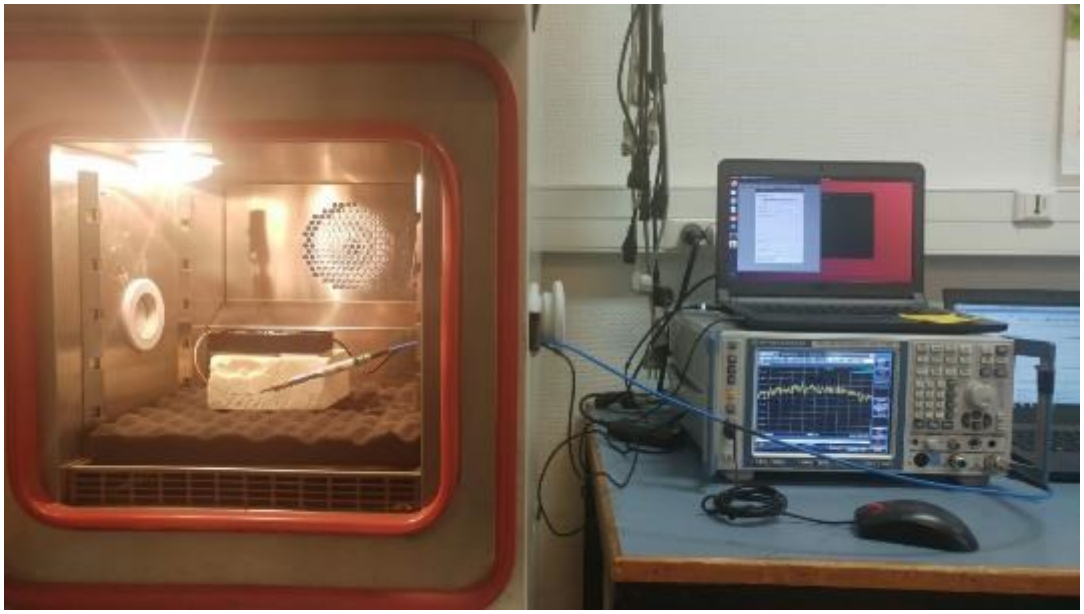
- The Equipment Under Test is installed:
☑ On a table
☐ In an anechoic chamber

- Measurement is performed with a spectrum analyzer in:
☑ Conducted Method
☐ Radiated Method

- Test Procedure:
☑ ANSI C63.10 § 11.10.2 (Method PKPSD)
☐ ANSI C63.10 § 11.10.3 (Method AVGPSD-1)



Test set up of Power Spectral Density



Photograph for Power Spectral Density

7.3. LIMIT

Frequency range	Power Spectral Density
2400MHz to 2483.5MHz	≤8dBm/3kHz*

*Remark: Limits are reduced by G-6dBi if Overall Antenna Gain above 6dBi

7.4. TEST EQUIPMENT LIST

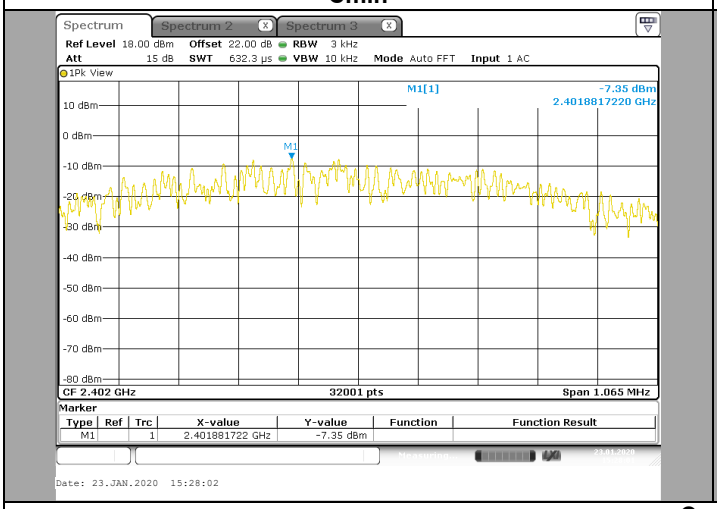
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Cable + Attenuator 20dB	PASTERNACK	PE350-100CM	A5329768	2019/08	2020/08
EMI receiver	ROHDE & SCHWARZ	ESR 7	A2642023	2019/01	2021/01

Note: In our quality system, the test equipment calibration due is more & less 2 months

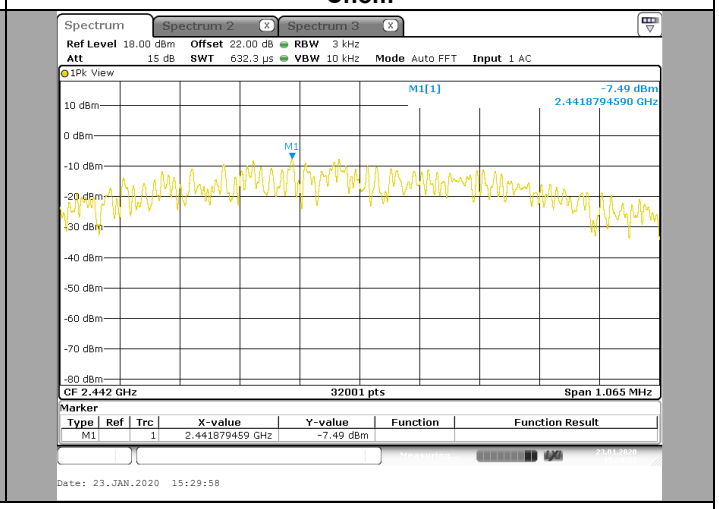
7.5. RESULTS

Power Spectral Density

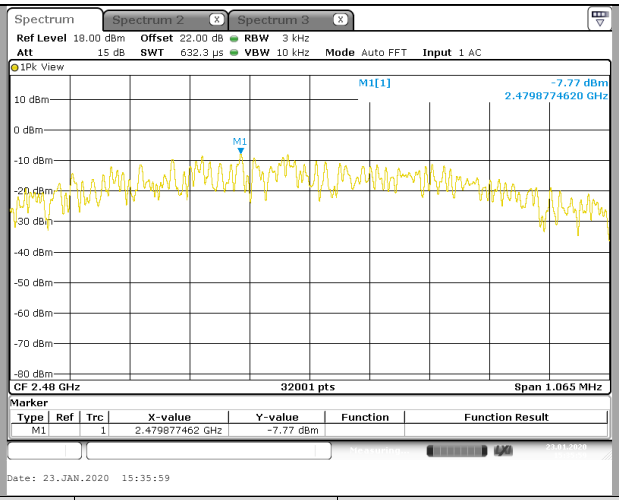
Cmin



Cnom



Cmax



Channel	Offset Cable + Att (dB)	Antenna Gain (dBi)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
Cmin	**22**	1.4	-7.35	8
Cnom	**22**	1.4	-7.49	8
Cmax	**22**	1.4	-7.77	8

7.6. CONCLUSION

Power Spectral Density measurement performed on the sample of the product **NETATMO NDB01**, SN: **g549ba4**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247 ISSUE 2** limits.

8. UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS AT THE BAND EDGE

8.1. TEST CONDITIONS

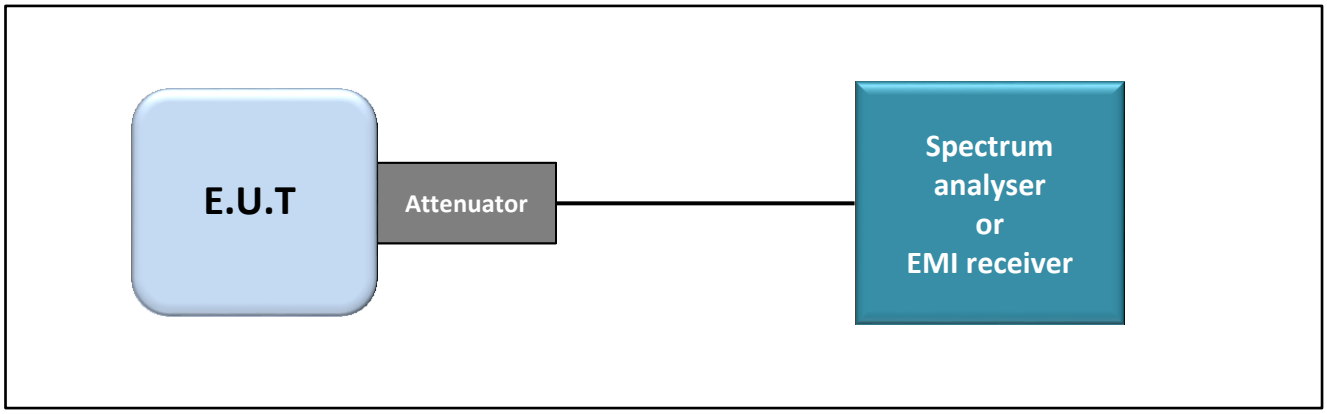
Test performed by	: Julien PALARD
Date of test	: January 23, 2020
Ambient temperature	: 24 °C
Relative humidity	: 39 %

8.2. TEST SETUP

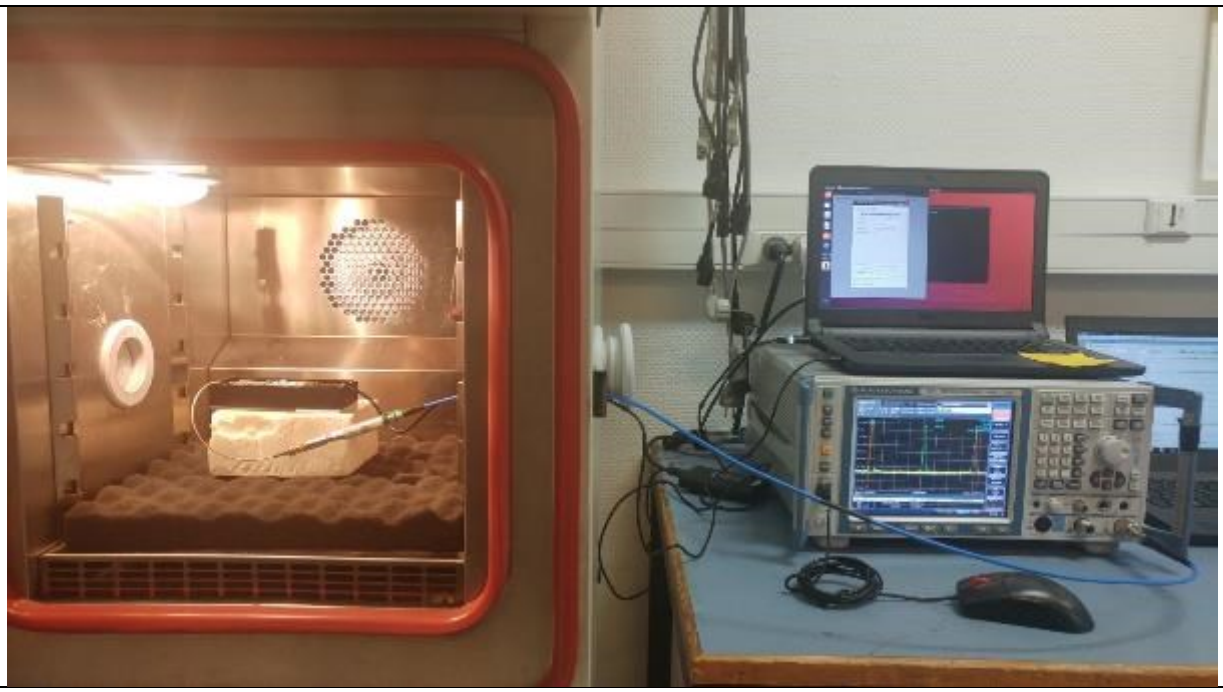
- The Equipment Under Test is installed:
☑ On a table
☐ In an anechoic chamber

- Measurement is performed with a spectrum analyzer in:
☑ Conducted Method
☐ Radiated Method

- Test Procedure:
☑ ANSI C63.10 § 11.11



Test set up of Unwanted Emissions into Non-Restricted Frequency Bands at the Band Edge



Photograph for Unwanted Emission into non-restricted frequency bands at the band edge

8.3. LIMIT

All Spurious Emissions must be at least 20dB (Maximum Conduted Power) below the Fundamental Radiator Level at the Band Edge “2400MHz & 2483,5MHz”

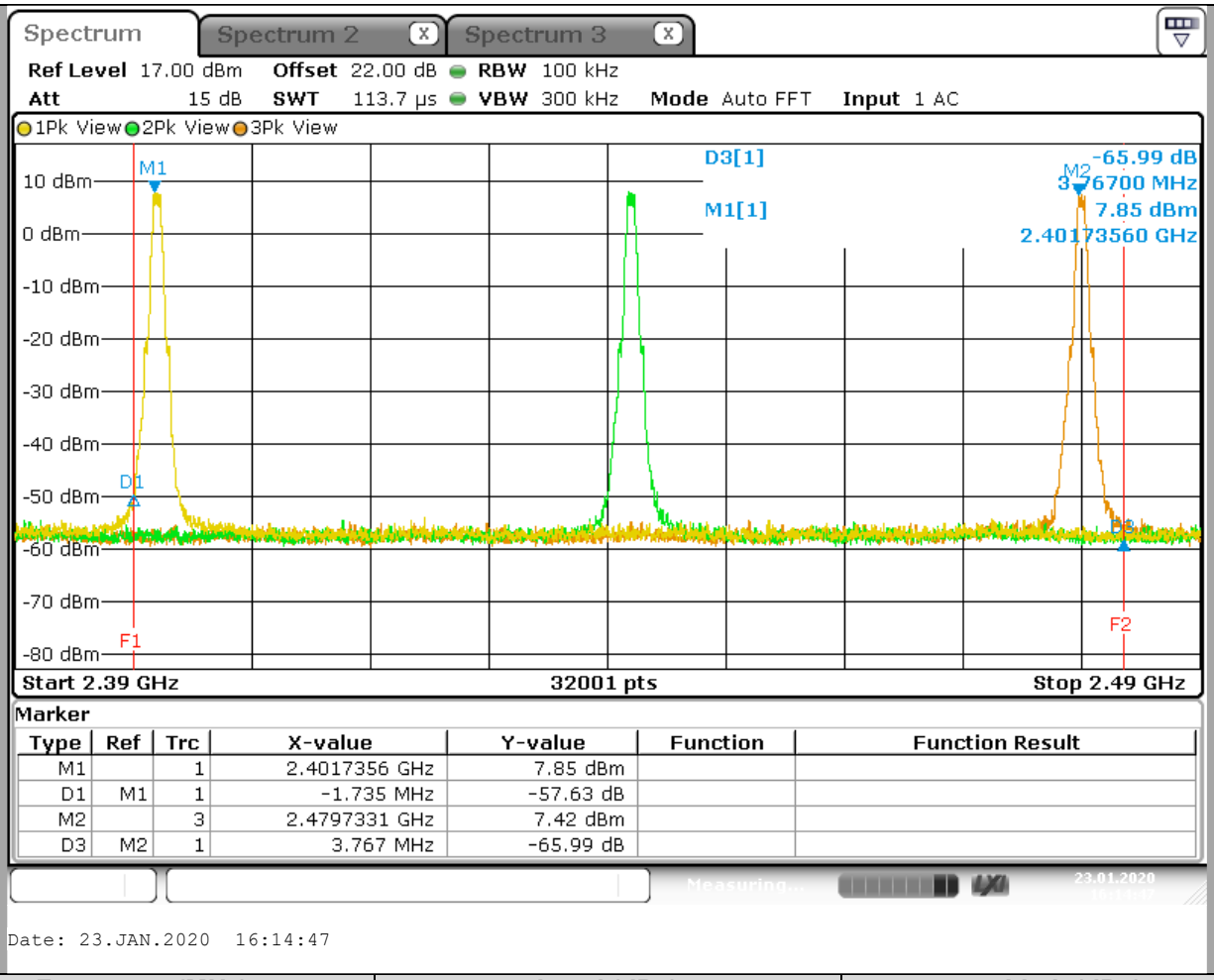
8.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Cable + Attenuator 20dB	PASTERNACK	PE350-100CM	A5329768	2019/08	2020/08
EMI receiver	ROHDE & SCHWARZ	ESR 7	A2642023	2019/01	2021/01

Note: In our quality system, the test equipment calibration due is more & less 2 months

8.5. RESULTS

Cmin/Cnom/Cmax



Frequency (MHz)	Level (dBc)	Limit (dBc)
2400	57.63	20
2483.5	65.99	20

8.6. CONCLUSION

Unwanted Emission into non-restricted frequency bands at the band edge measurement performed on the sample of the product **NETATMO NDB01**, SN: **g549ba4**, in configuration and description presented in this test report, show levels **Select Result** to the **47 CFR PART 15.247 & RSS 247 ISSUE 2** limits.

9. UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

9.1. TEST CONDITIONS

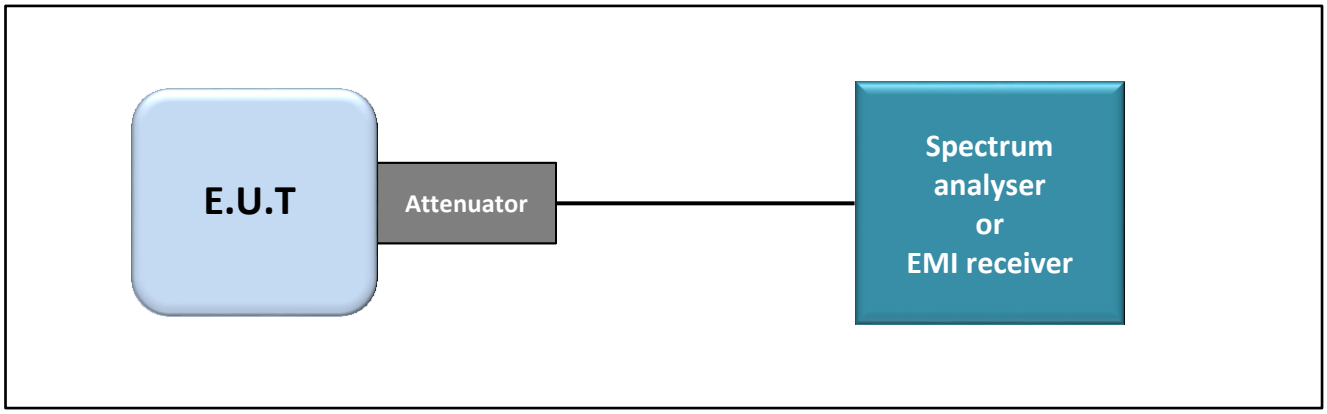
Test performed by	: Julien Palard
Date of test	: January 28, 2020
Ambient temperature	: 25 °C
Relative humidity	: 39 %

9.2. TEST SETUP

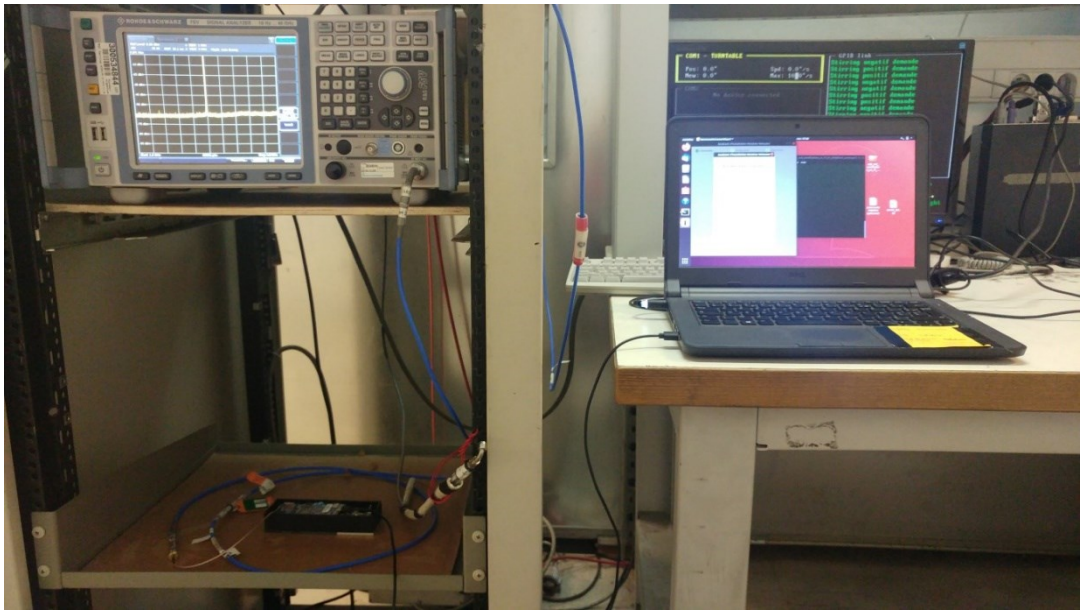
- The Equipment under Test is installed:
☑ On a table
☐ In an anechoic chamber

- Measurement is performed with a spectrum analyzer in:
☑ Conducted Method
☐ Radiated Method

- Test Procedure:
☑ ANSI C63.10 § 11.11



Test set up of Unwanted Emissions into Non-Restricted Frequency Bands



Photograph for Unwanted Emission into non-restricted frequency bands

9.3. LIMIT

All Spurious Emissions must be at least 20dB (Maximum Conduted Power) below the Fundamental Radiator Level

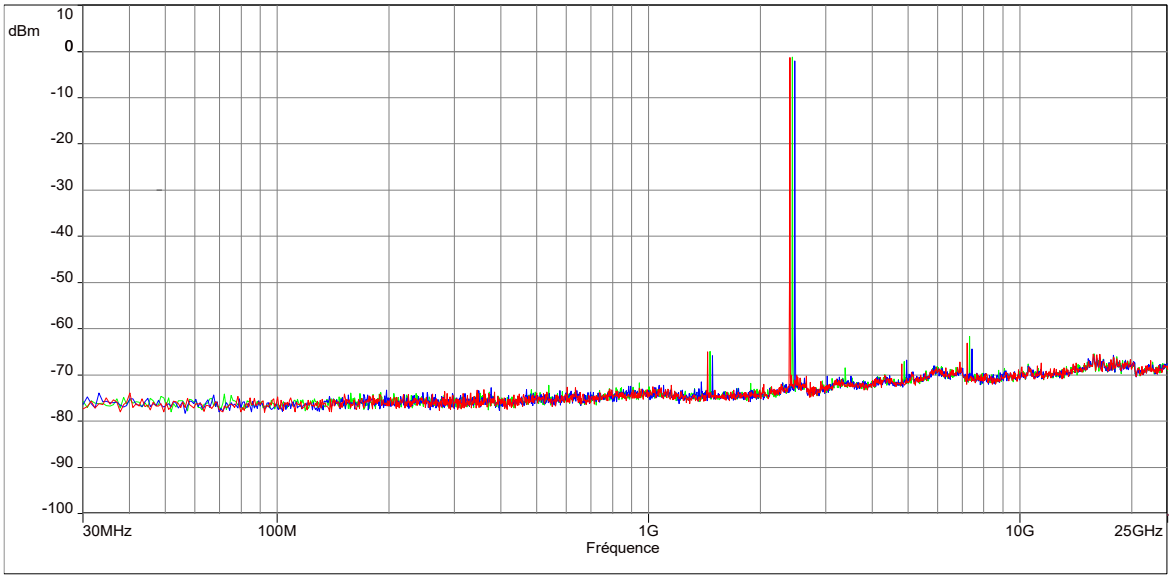
9.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
EMI receiver	ROHDE & SCHWARZ	FSV40GHz	A4060061	2019/05	2021/05
Attenuator 3dB Cable Spurious Conducted	-	WA54-3-12	A7122223	2019/02	2020/02
Cable Conducted S36 chamber	TELEDYNE	084-0555-2MTR	A5329758	2019/02	2020/02
High Pass Filter 2,4GHz	WAINWRIGHT	WHK12-2494	A7484068	2019/03	2021/03

Note: In our quality system, the test equipment calibration due is more & less 2 months

9.5. RESULTS

Cmin/Cnom/Cmax



Frequency (MHz)	Level (dBm)	Level (dBc)	Limit (dBc)
2402.00	-1.28		
1440.80	-65	63.72	20
4803.17	-67.61	66.33	20
7204.97	-63.15	61.87	20
2442.00	-1.16		
1465	-64.90	63.74	20
4882.76	-67.09	65.93	20
7325.14	-61.61	60.45	20
2480.00	-2.01		
1487.76	-65.82	63.81	20
4960	-66.80	64.79	20
7440.63	-64.34	62.33	20

9.6. CONCLUSION

Unwanted Emission into non-restricted frequency bands measurement performed on the sample of the product **NETATMO NDB01**, SN: **g549ba4**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247 ISSUE 2** limits.

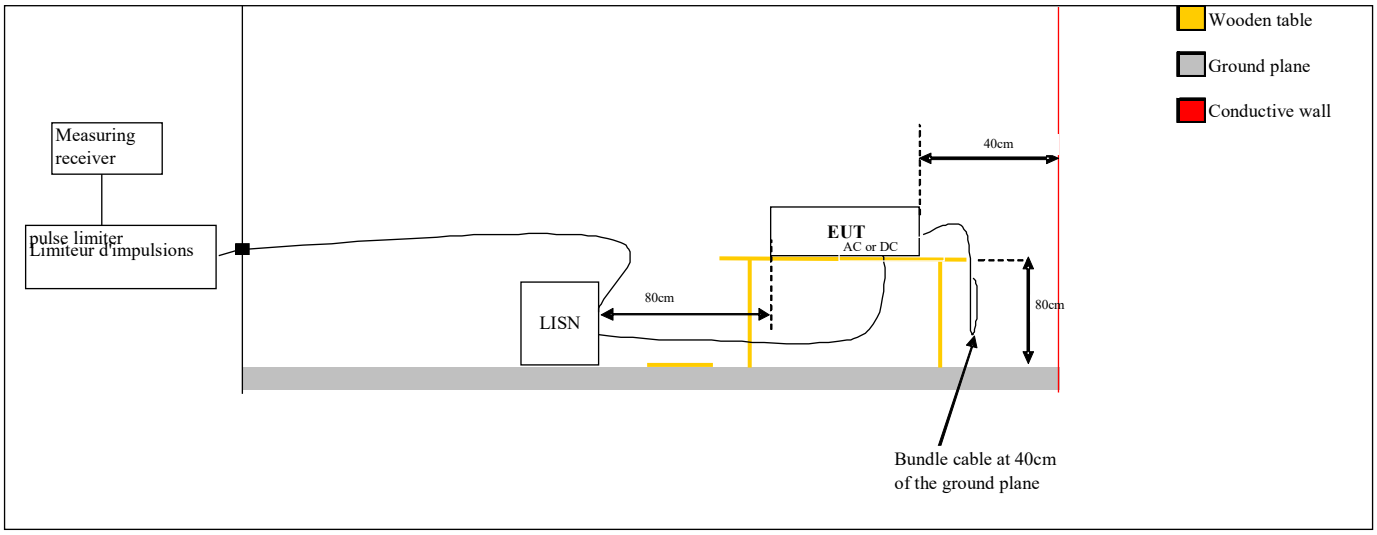
10. AC POWER LINE CONDUCTED EMISSIONS

10.1. TEST CONDITIONS

Test performed by	: Laurent DENEUX
Date of test	: January 24, 2020
Ambient temperature	: 22 °C
Relative humidity	: 50 %

10.2. TEST SETUP

The product has been tested according to ANSI C63.10 (2013) method. The EUT is placed on the ground reference plane, at 80cm from the LISN. The distance between the EUT and the vertical ground plane is 40cm. Auxiliaries are powered by another LISN. The cable has been shorted to 1meter length. The EUT is powered through the LISN. Measurement is made with a receiver in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary. The LISN (measure) is 50Ω / 50µH. Interconnecting cables and equipment's were moved to position that maximized emission.



Photograph for AC Power Line Conducted Emissions (Front view)

Photograph for AC Power Line Conducted Emissions (Front view)

10.3. LIMIT

Frequency range	Level	Detector
0,15kHz to 0,5MHz	66dBµV to 56µV*	QPeak
	56dBµV to 46µV*	Average
0,5MHz to 5MHz	56dBµV	QPeak
	46dBµV	Average
5MHz to 30MHz	60BµV	QPeak
	50dBµV	Average

*Decreases with the logarithm of the frequency

10.4. TEST EQUIPMENT LIST

Test equipment used					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Calibration date**	**Calibration due date**
Open test site	LCIE	-	F2000400	2019/06	2020/06
EMI Test Receiver	ROHDE & SCHWARZ	ESIB26	A2642021	2018/10	2020/10
V ISLN	ROHDE & SCHWARZ	ESH2-Z5	C2322002	2019/08	2020/08
Pulse limiter	ROHDE & SCHWARZ	ESH3-Z2	A2649008	2019/03	2020/03
Cable	-	-	A5329417	2019/12	2020/12
Reference ground plan 2 x 3m	L.C.I.E.	-	-	-	-

Note: In our quality system, the test equipment calibration due is more & less 2 months

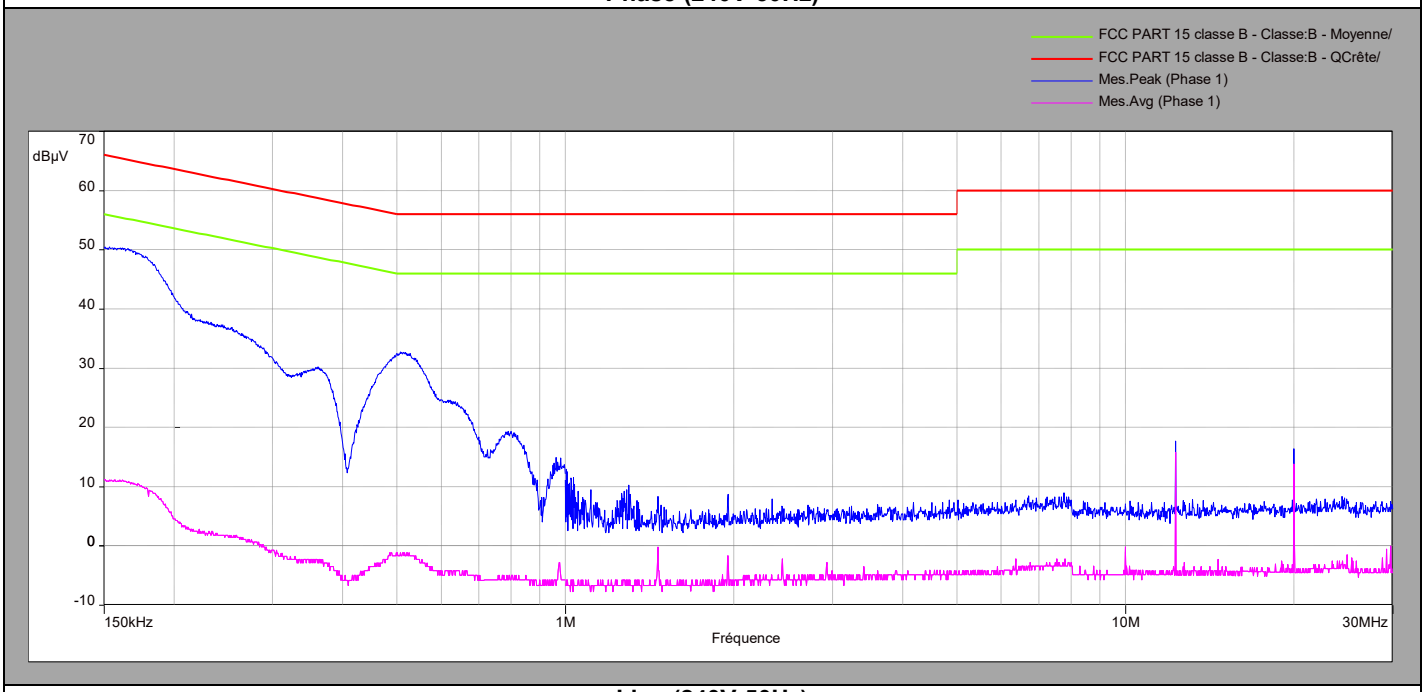
10.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

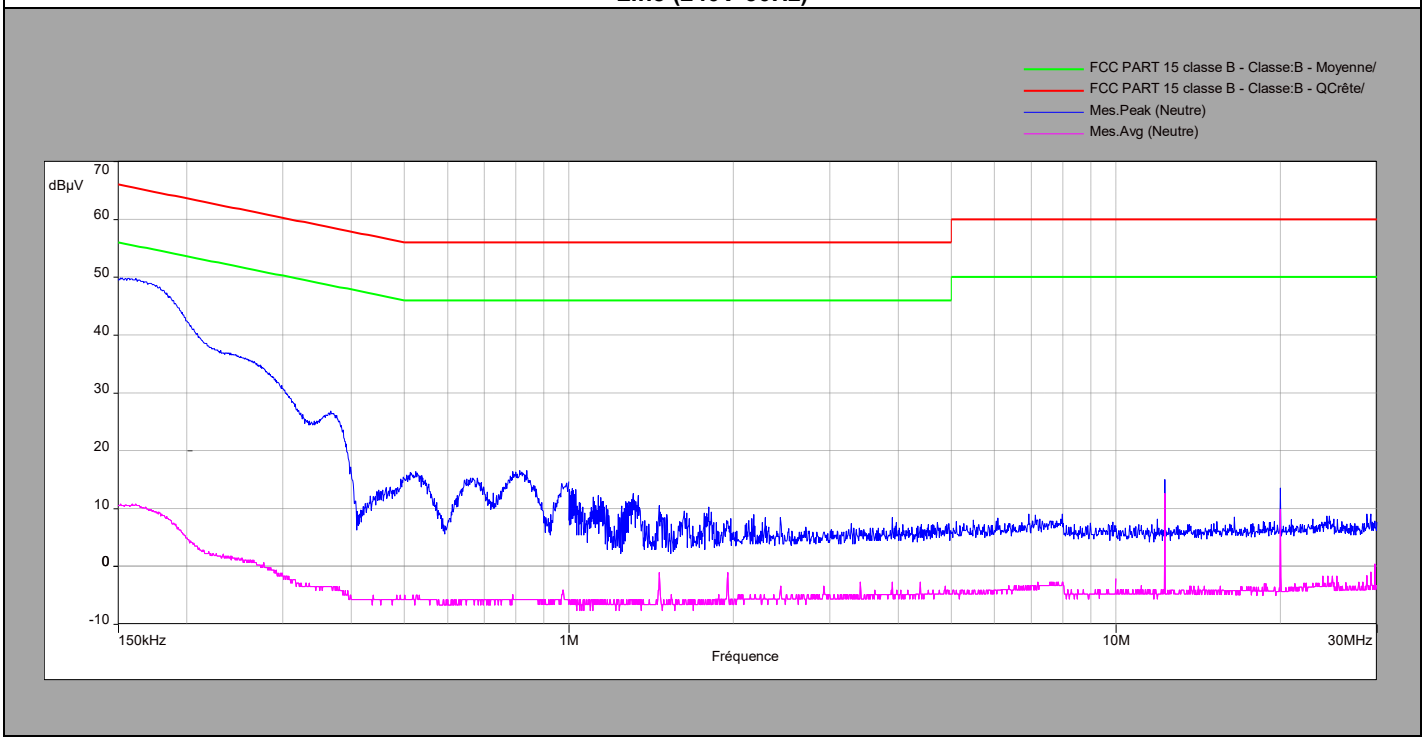
10.6. RESULTS

Cnom

Phase (240V-50Hz)



Line (240V-50Hz)

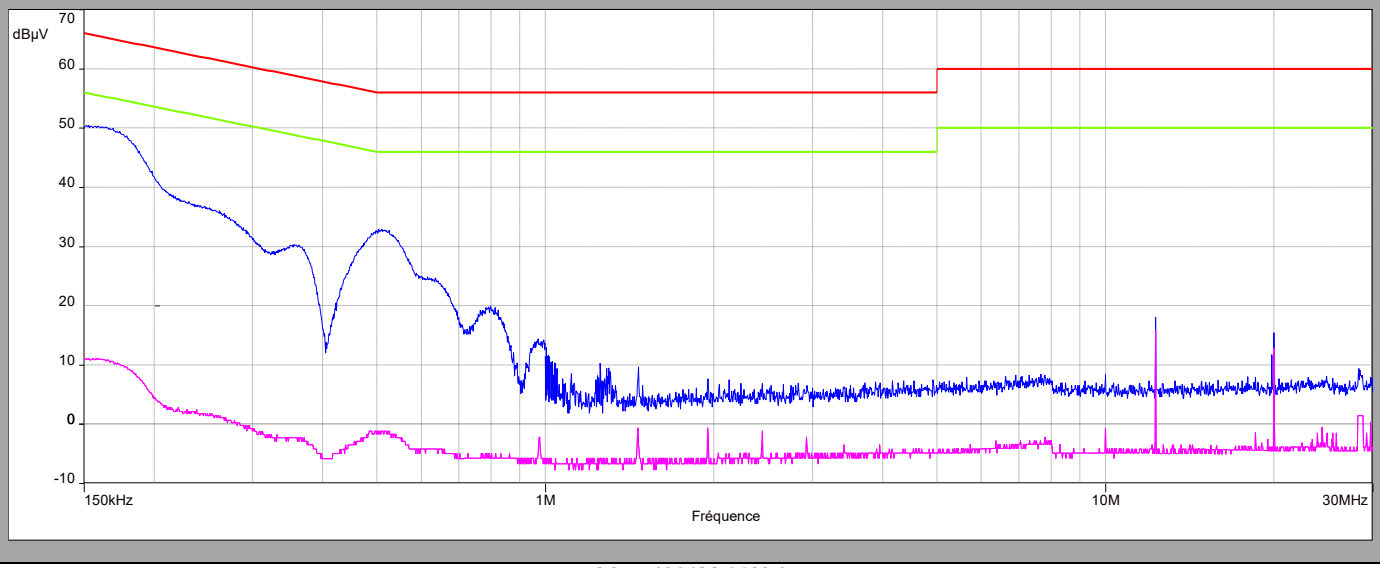


Phase Line							
Frequency (MHz)	Peak Level (dBµV)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Margin Quasi-Peak (dBµV)	Average Level (dBµV)	Average Limit (dBµV)	Margin Average (dBµV)
0,15	50,2	-	66	15,8	11,1	56	44,9
0,52	32,3	-	56	23,7	-1,7	46	47,7
0,8	18,5	-	56	37,5	-5	46	51
12,28	17,7	-	60	42,3	15,8	50	34,2
20	16,5	-	60	43,5	13,8	50	36,2
0,15	50,2	-	66	15,8	11,1	56	44,9

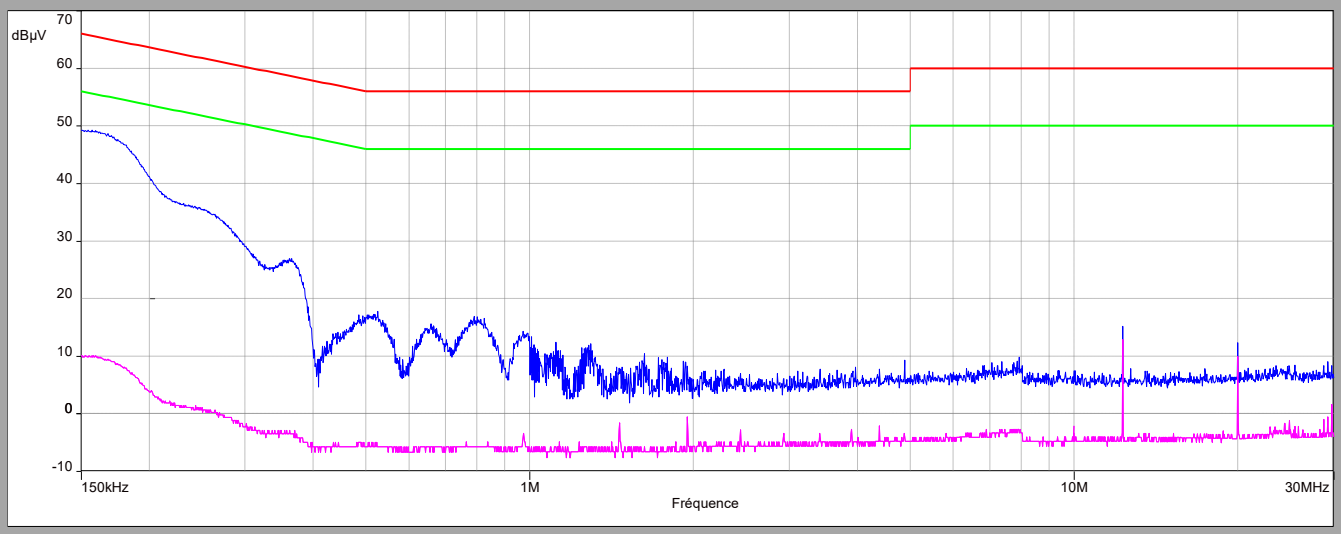
Neutral Line							
Frequency (MHz)	Peak Level (dBµV)	Quasi-Peak Level (dBµV)	Quasi-Peak Limit (dBµV)	Margin Quasi-Peak (dBµV)	Average Level (dBµV)	Average Limit (dBµV)	Margin Average (dBµV)
0,15	39	-	66	27	10,4	56	45,6
0,36	26,5	-	58,5	32	-3,7	48,5	52,2
0,81	16,5	-	56	39,5	-5,7	46	51,7
12,28	15	-	60	45	12,5	50	37,5
20	13,5	-	60	46,5	10	50	40
0,15	39	-	66	27	10,4	56	45,6

Cnom

Phase (120V-60Hz)



Line (120V-60Hz)



Phase Line							
Frequency (MHz)	**Peak Level (dBµV)**	**Quasi-Peak Level (dBµV)**	**Quasi-Peak Limit (dBµV)**	**Margin Quasi-Peak (dBµV)**	**Average Level (dBµV)**	**Average Limit (dBµV)**	**Margin Average (dBµV)**
0,15	50	-	66	16	11	56	45
0,51	32,7	-	56	23,3	-1,2	46	47,2
0,79	19,5	-	56	36,5	-5,7	46	51,7
12,28	18	-	60	42	15,7	50	34,3
20	15,2	-	60	44,8	12,8	50	37,2
0,15	50	-	66	16	11	56	45

Neutral Line							
Frequency (MHz)	**Peak Level (dBµV)**	**Quasi-Peak Level (dBµV)**	**Quasi-Peak Limit (dBµV)**	**Margin Quasi-Peak (dBµV)**	**Average Level (dBµV)**	**Average Limit (dBµV)**	**Margin Average (dBµV)**
0,15	39	-	64	66	10	56	46
0,52	17,8	-	56	38,2	-5,7	46	51,7
0,97	18	-	56	38	-4	46	50
12,29	15	-	60	45	12,6	50	37,4
20	12,3	-	60	47,7	10	50	40
0,15	39	-	64	66	10	56	46

10.7. CONCLUSION

Ac Power Line Conducted Emission measurement performed on the sample of the product **NETATMO NDB01**, SN: **g549ba4**, in configuration and description presented in this test report, show levels **compliant** to the 47 CFR PART 15.247 & RSS 247 ISSUE 2 limits.

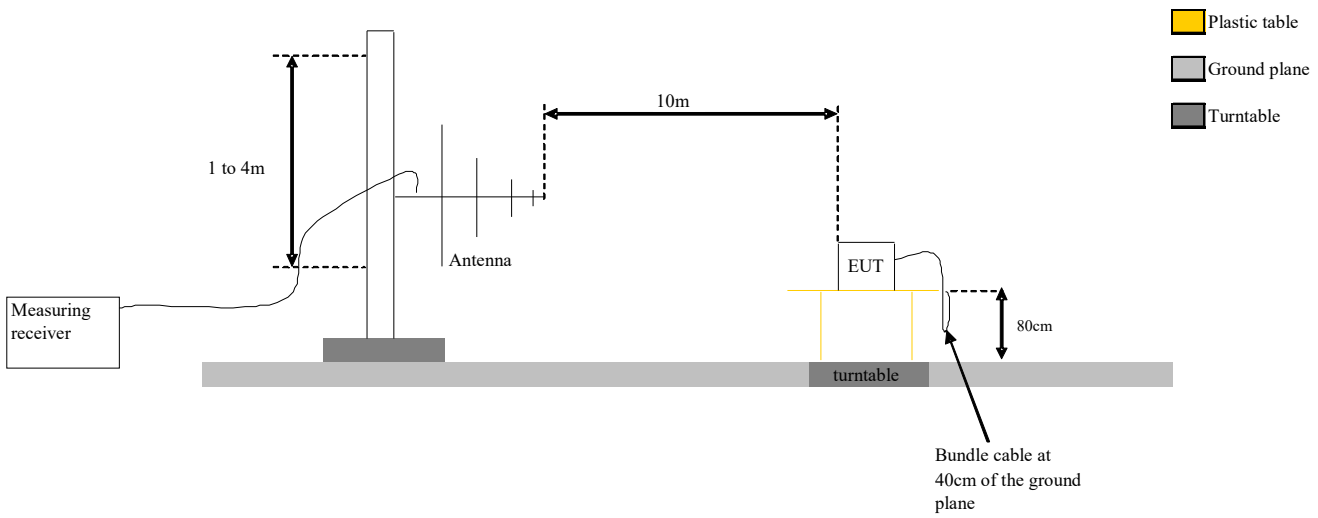
11. UNWANTED EMISSIONS IN RESTRICTED FREQUENCY BANDS

11.1. TEST CONDITIONS

Test performed by	: Laurent DENEUX
Date of test	: January 24, 2020 to January 27, 2020
Ambient temperature	: 20 °C
Relative humidity	: 48 %

11.2. TEST SETUP

The product has been tested according to ANSI C63.10 (2013) and FCC part15 subpart C.
Test is performed in parallel, perpendicular and ground parallel axis with a loop antenna below 30MHz. Measurement bandwidth was 200Hz below 150kHz and 9kHz between 150kHz & 30MHz. The level has been maximised by the turntable rotation of 360 degrees range on the 3 axis of EUT. Antenna height was 1m. The EUT is placed **on an open area test site**. Distance between measuring antenna and the EUT is **3m**.
Test is performed in horizontal (H) and vertical (V) polarization with **bilog** between 30MHz & 1GHz and with a horn antenna above 1GHz. Measurement bandwidth was 120kHz below 1GHz and 1MHz above 1GHz. The level has been maximised by the turntable rotation of 360 degrees range on the 3 axis of EUT. Antenna height search was performed from 1 to 4m. The EUT is place at 1.5m high above 1GHz and at 0.8m high under 1GHz. The EUT is placed **on an open area test site** above 1GHz and **on an open area test site** from 30MHz to 1GHz. Distance between measuring antenna and the EUT is **10m**.



Test Set up for radiated measurement in open area test site

Photograph for Unwanted Emission in restricted frequency bands

Photograph for Unwanted Emission in restricted frequency bands

11.3. LIMIT

Measure at 300m		
Frequency range	**Level**	**Detector**
9kHz-490kHz	67.6dBµV/m /F(kHz)	QPeak
Measure at 30m		
Frequency range	**Level**	**Detector**
490kHz-1.705MHz	87.6dBµV/m /F(kHz)	QPeak
1.705MHz-30MHz	29.5dBµV/m	QPeak
Measure at 10m		
Frequency range	**Level**	**Detector**
30MHz to 88MHz	29.5dBµV/m	QPeak
88MHz to 216MHz	33dBµV/m	QPeak
216MHz to 960MHz	35.5BµV/m	QPeak
960MHz to 1000MHz	43.5dBµV/m	QPeak
Above 1000MHz	63.5dBµV/m	Peak
	43.5dBµV/m	Average
Measure at 3m		
Frequency range	**Level**	**Detector**
30MHz to 88MHz	40dBµV/m	QPeak
88MHz to 216MHz	43.5dBµV/m	QPeak
216MHz to 960MHz	46BµV/m	QPeak
960MHz to 1000MHz	54dBµV/m	QPeak
Above 1000MHz	74dBµV/m	Peak
	54dBµV/m	Average

11.4. TEST EQUIPMENT LIST

Test equipment used					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Calibration date**	**Calibration due date**
Open test site	LCIE	-	F2000400	2019-06	2020-06
EMI Test Receiver	ROHDE & SCHWARZ	ESIB26	A2642021	2018-10	2020-10
Cable	-	-	A5329444	2019-12	2020-12
Bilog antenna	CHASE	CBL 6112A	C2040040	2019-04	2020-04
Cable	-	-	A5329442	2019-129	2020-12
Cable	-	-	A5329876	2019-12	2020-12
Cable	-	-	A5329542	2019-08	2020-08
Preamplifier	HEWLETT PACKARD	8449B	A4069002	2018-04	2020-04
Horn	EMCO	3115	C2042016	2019-06	2020-06
loop antenna	RHODE & SCHWARZ	HFH2-Z2	C2040007	2017-11	2019-11
Cable	-	-	A5329416	2019-12	2020-12

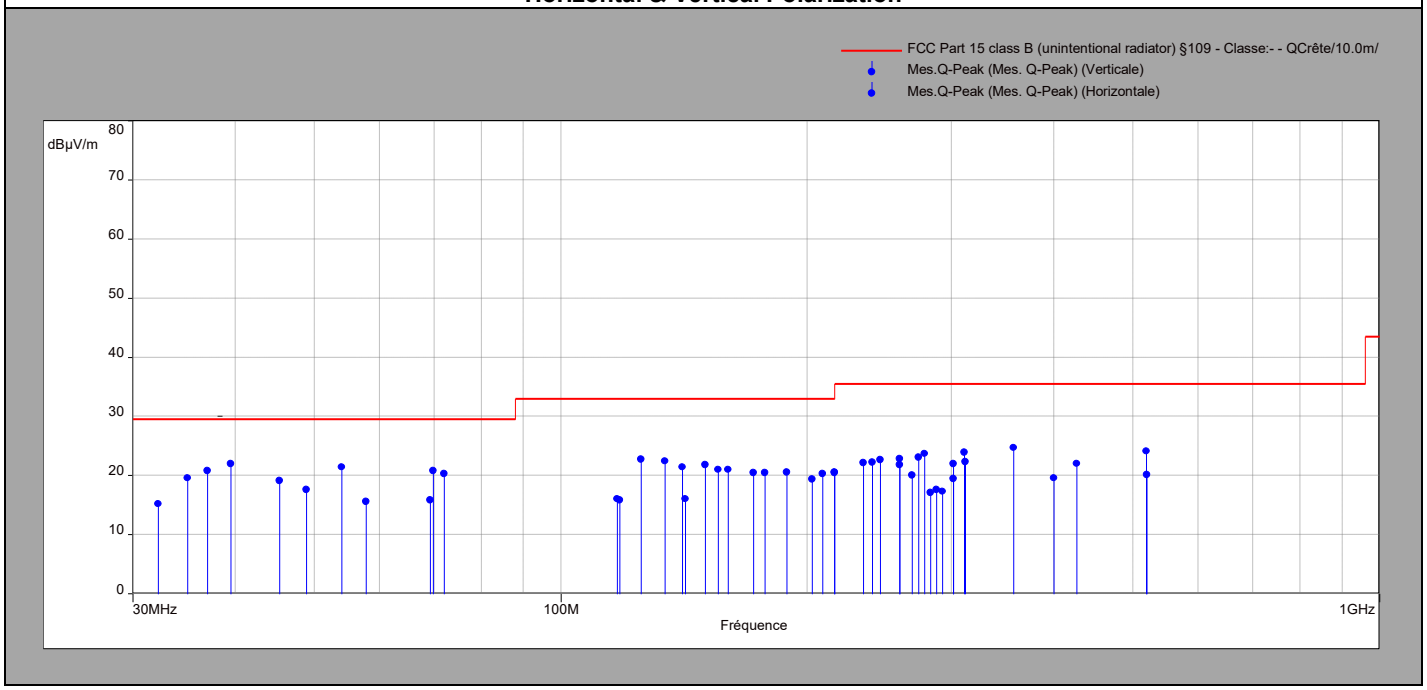
Note: In our quality system, the test equipment calibration due is more & less 2 months

11.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

11.6. RESULTS

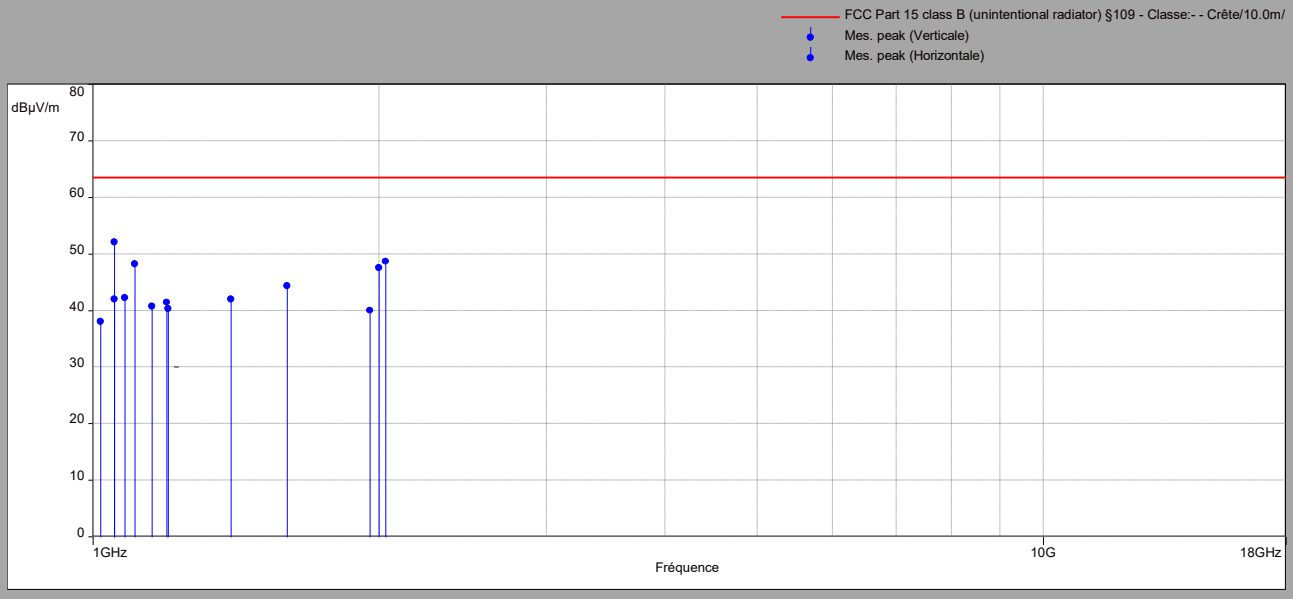
Below 1GHz
Cmin
Horizontal & Vertical Polarization



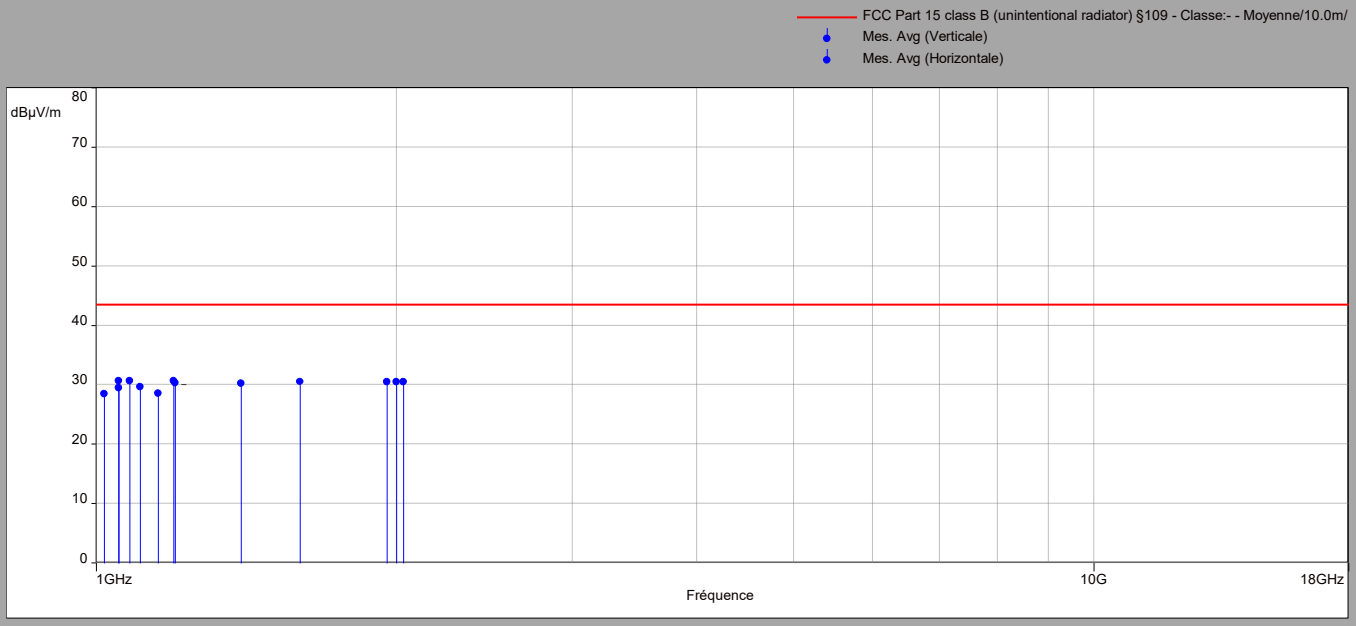
Above 1GHz

Cmin/Cnom/Cmax

Horizontal & Vertical Polarization
Peak measurement



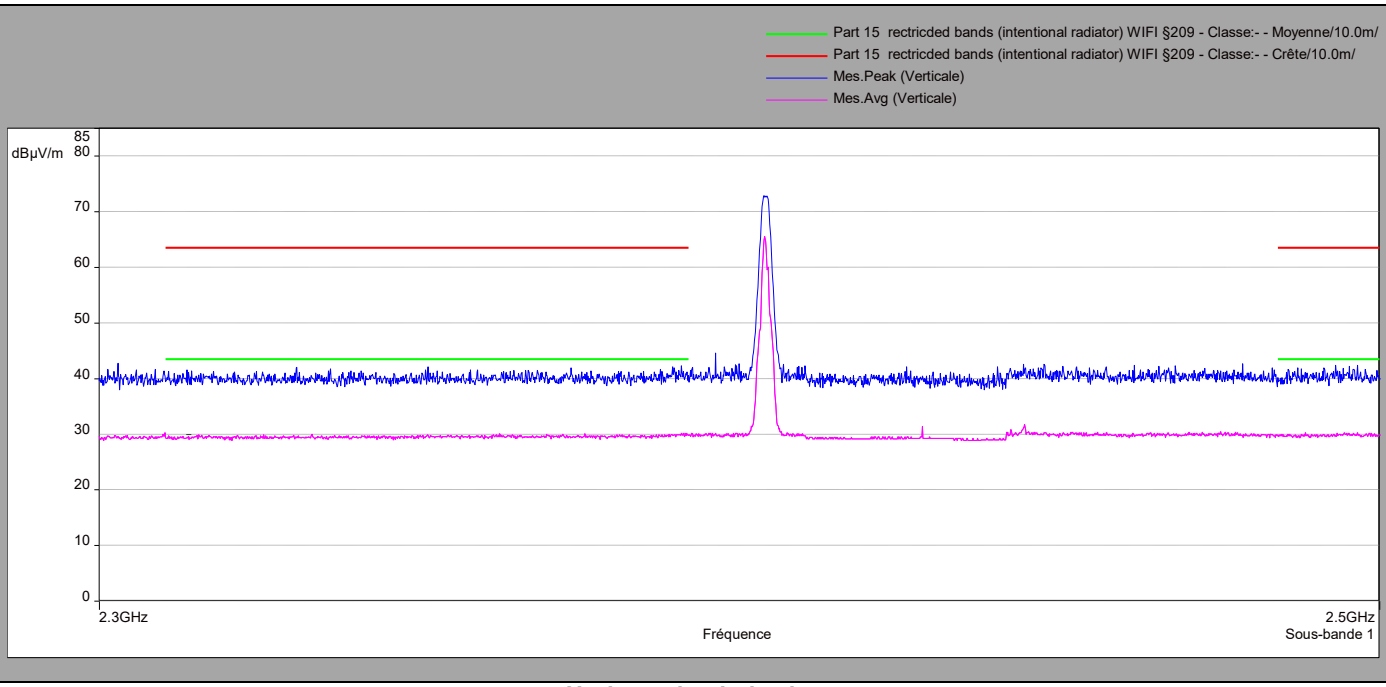
Horizontal & Vertical Polarization
Average value



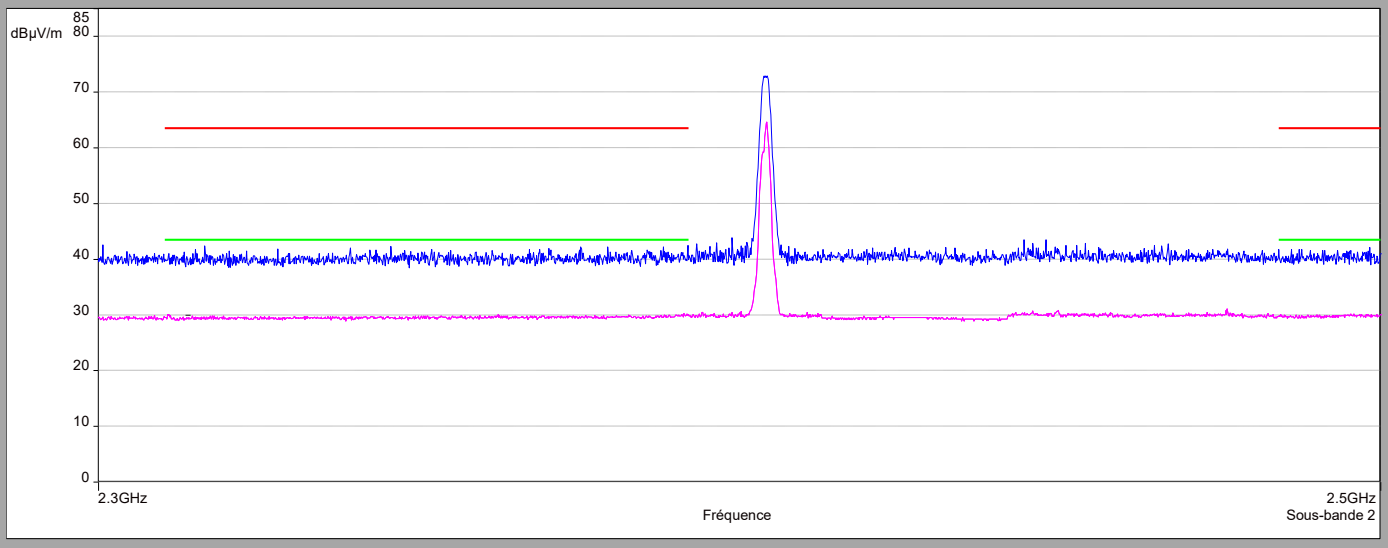
Above 1GHz Zoom 2310MHz-2500MHz

Cmin

Vertical Polarization



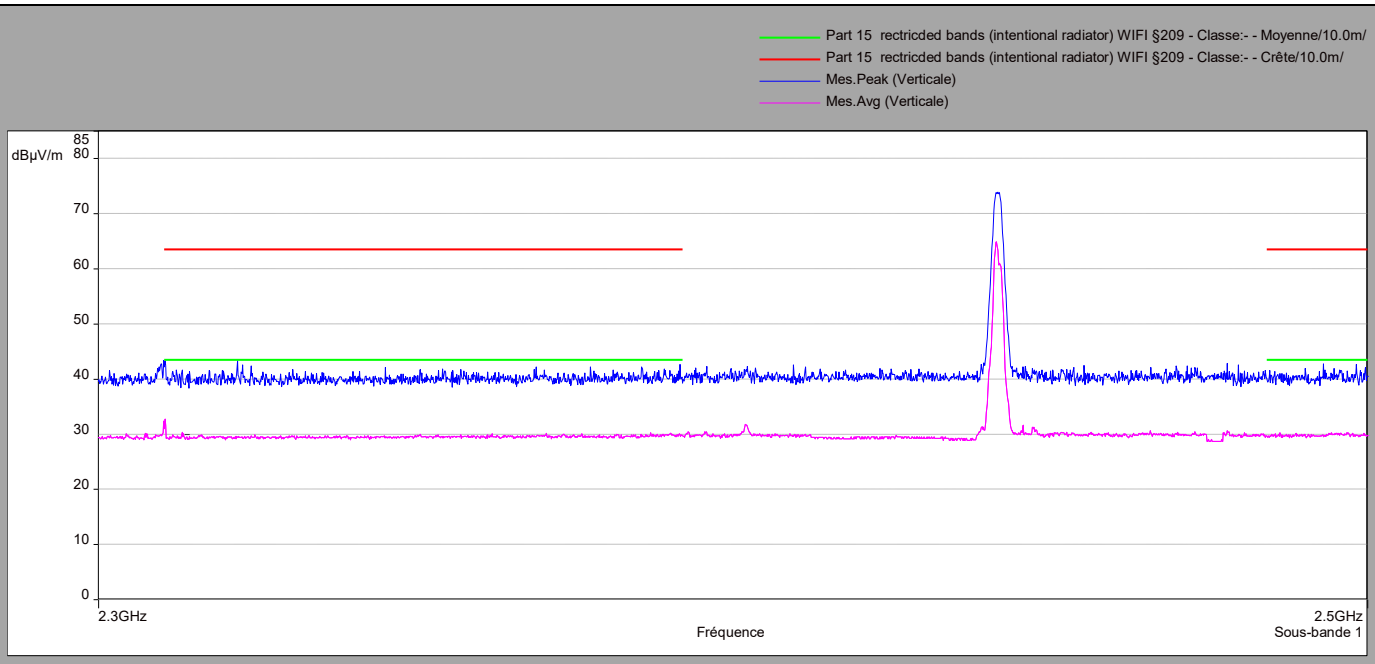
Horizontal polarization



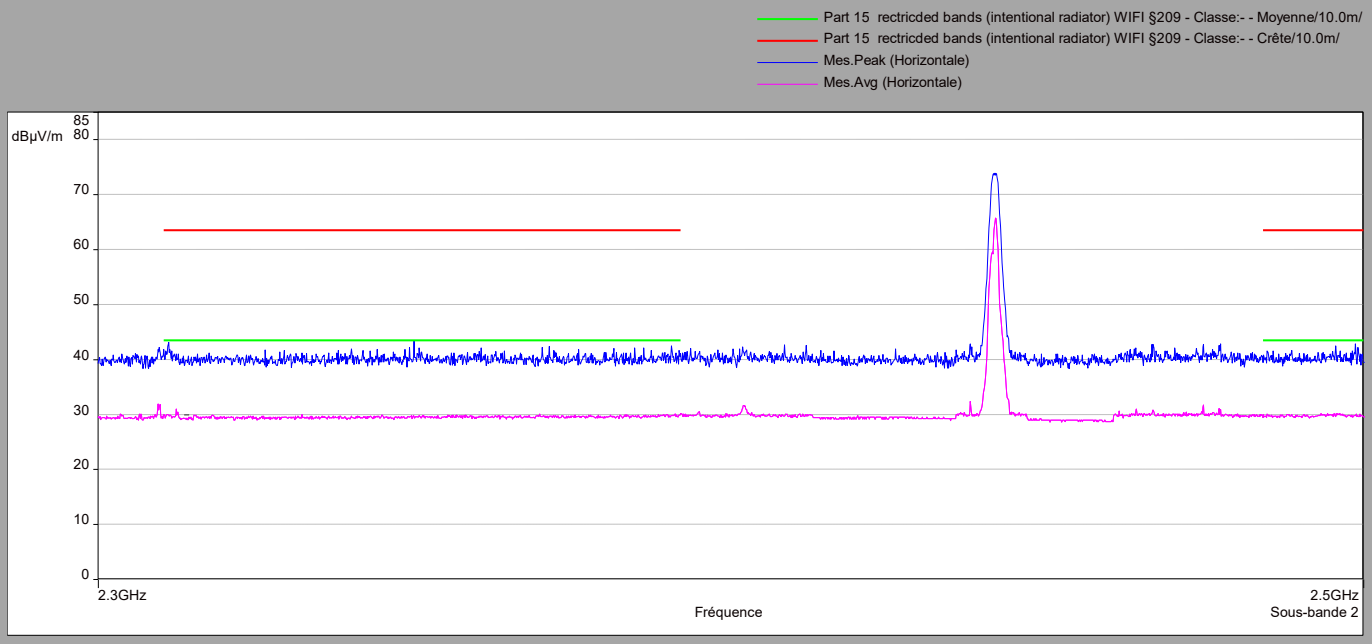
Above 1GHz Zoom 2310MHz-2500MHz

Cnom

Vertical Polarization



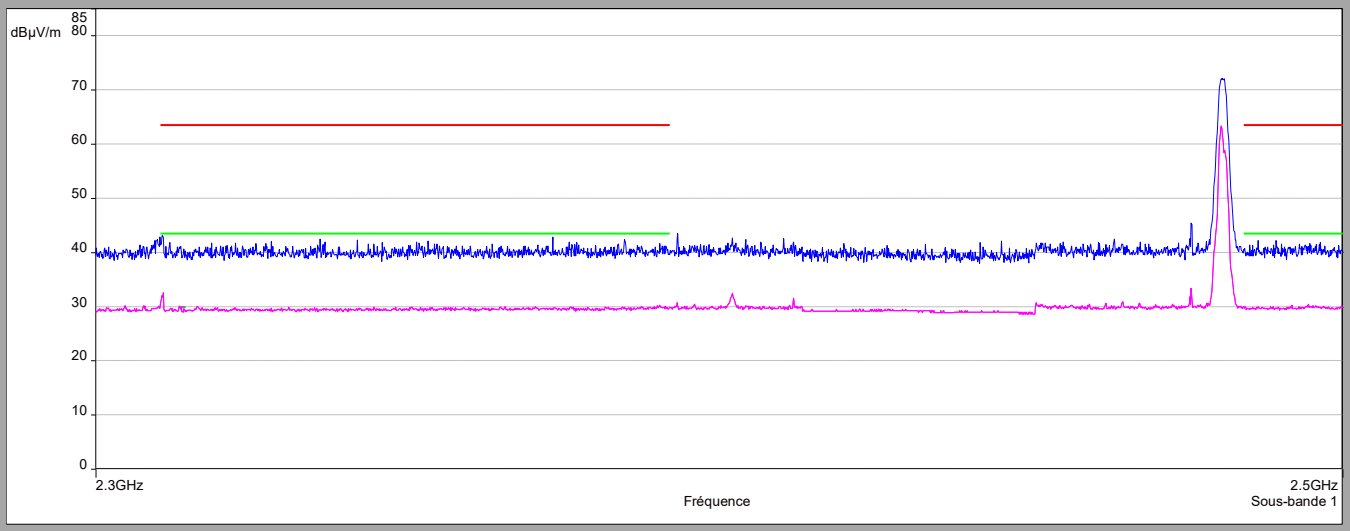
Horizontal polarization



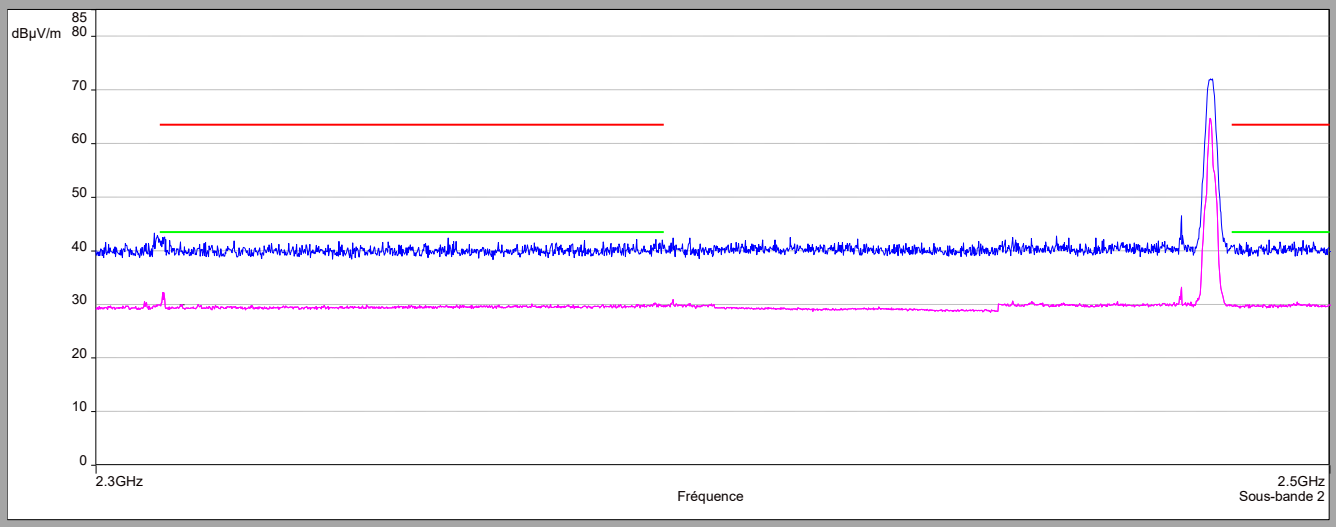
Above 1GHz Zoom 2310MHz-2500MHz

Cmax

Vertical Polarization



Horizontal polarization



9kHz to 30MHz				
Polarization	**Frequency (MHz)**	**Peak Level (dBµV/m)**	**QPeak Level (dBµV/m)**	**Limit (dBµV/m)**
all emissions were greater than 20 dB below the limit				

Below 1GHz					
Polarization	**Frequency (MHz)**	**Peak Level (dBµV/m)**	**QPeak Level (dBµV/m)**	**Limit (dBµV/m)**	**Margin (dBµV/m)**
Vertical	40	-	21.73	29.5	7.77
Vertical	43	-	20.46	29.5	9.04
Vertical	55.1	-	22.9	29.5	6.6
Vertical	264	-	25.9	35.5	9.6
Vertical	360	-	25.65	35.5	9.85
Vertical	445.5	-	22.67	35.5	12.83
Vertical	459	-	25.84	35.5	9.66
Vertical	528.4	-	23.37	35.5	12.13
Vertical	594	-	22.31	35.5	13.19
Vertical	621	-	28.67	35.5	6.83
Horizontal	264	-	27.54	35.5	7.96
Horizontal	459	-	27.77	35.5	7.73
Horizontal	484.4	-	25.01	35.5	10.49

Above 1GHz								
Cmin								
Polarization	**Frequency (MHz)**	**Average Level (dBµV/m)**	**Average Level + Duty Cycle Factor (dBµV/m)**	**Average Limit (dBµV/m)**	**Average Margin Level (dBµV/m)**	**Peak Level (dBµV/m)**	**Peak Limit (dBµV/m)**	**Peak Margin Level (dBµV/m)**
Vertical	1018.1	28.44	36,23	43.5	7,27	38.03	63.5	25.47
Vertical	1053	29.46	37,25	43.5	6,25	52.04	63.5	11.46
Horizontal	1053	30.63	38,42	43.5	5,08	42	63.5	21.5
Vertical	1153.6	28.5	36,29	43.5	7,21	40.71	63.5	22.79
Vertical	1196	30.61	38,4	43.5	5,1	41.45	63.5	22.05
Vertical	1396.4	30.24	38,03	43.5	5,47	42.02	63.5	21.48
Vertical	1599.8	30.56	38,35	43.5	5,15	44.33	63.5	19.17
Horizontal	2390	30	37,79	43.5	5,71	42.4	63.5	21.1
Vertical	2390	30.2	37,99	43.5	5,51	42.2	63.5	21.3
Horizontal	2483.5	29.5	37,29	43.5	6,21	41.7	63.5	21.8
Vertical	2483.5	29.7	37,49	43.5	6,01	41	63.5	22.5

Above 1GHz								
Cnom								
Polarization	Frequency (MHz)	Average Level (dBµV/m)	Average Level + Duty Cycle Factor (dBµV/m)	Average Limit (dBµV/m)	Average Margin Level (dBµV/m)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin Level (dBµV/m)
Vertical	1018.1	28.44	36,23	43.5	7,27	38.03	63.5	25.47
Vertical	1053	29.46	37,25	43.5	6,25	52.04	63.5	11.46
Horizontal	1053	30.63	38,42	43.5	5,08	42	63.5	21.5
Vertical	1153.6	28.5	36,29	43.5	7,21	40.71	63.5	22.79
Vertical	1196	30.61	38,4	43.5	5,1	41.45	63.5	22.05
Vertical	1396.4	30.24	38,03	43.5	5,47	42.02	63.5	21.48
Vertical	1599.8	30.56	38,35	43.5	5,15	44.33	63.5	19.17
Horizontal	2390	29.8	37,59	43.5	5,91	42.5	63.5	21
Vertical	2390	29.9	37,69	43.5	5,81	42.6	63.5	20.9
Horizontal	2483.5	30	37,79	43.5	5,71	41.5	63.5	22
Vertical	2483.5	29.5	37,29	43.5	6,21	41.5	63.5	22

Above 1GHz								
Cmax								
Polarization	Frequency (MHz)	Average Level (dBµV/m)	Average Level + Duty Cycle Factor (dBµV/m)	Average Limit (dBµV/m)	Average Margin Level (dBµV/m)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin Level (dBµV/m)
Vertical	1018.1	28.44	36,23	43.5	7,27	38.03	63.5	25.47
Vertical	1053	29.46	37,25	43.5	6,25	52.04	63.5	11.46
Horizontal	1053	30.63	38,42	43.5	5,08	42	63.5	21.5
Vertical	1153.6	28.5	36,29	43.5	7,21	40.71	63.5	22.79
Vertical	1196	30.61	38,4	43.5	5,1	41.45	63.5	22.05
Vertical	1396.4	30.24	38,03	43.5	5,47	42.02	63.5	21.48
Vertical	1599.8	30.56	38,35	43.5	5,15	44.33	63.5	19.17
Horizontal	2390	29.6	37,39	43.5	6,11	42	63.5	21.5
Vertical	2390	30.2	37,99	43.5	5,51	41.6	63.5	21.9
Horizontal	2483.5	30	37,79	43.5	5,71	41	63.5	22.5
Vertical	2483.5	30	37,79	43.5	5,71	42.6	63.5	20.9

11.7. CONCLUSION

Unwanted Emission in restricted frequency bands measurement performed on the sample of the product **NETATMO NDB01**, SN: **g549ba4**, in configuration and description presented in this test report, show levels **compliant** to the 47 CFR PART 15.247 & RSS 247 ISSUE 2 limits.

12. UNCERTAINTIES CHART

47 CFR Part 15.209 & 15.207 Kind of test	Wide uncertainty laboratory (k=2) ±x(dB) / (Hz)/ ms	Uncertainty limit
Measurement of conducted disturbances in voltage on the AC power port (9 kHz – 150 kHz)	2,67	3.8
Measurement of conducted disturbances in voltage on the AC power port (150 kHz – 30 MHz)	2,67	3.4
Measurement of conducted disturbances in voltage on the telecommunication port. (AAN)	3,67	5.0
Measurement of conducted disturbances in current (current clamp)	2,73	2.9
Measurement of disturbance power	2,67	4.5
Measurement of radiated magnetic field from 10kHz to 30MHz in SAC V01	4,48	/
Measurement of radiated magnetic field from 10kHz to 30MHz in SAC C01	4,48	/
Measurement of radiated electric field from 30 to 1000MHz in horizontal position on the OATS (Ecuelles)	4,88	6.3
Measurement of radiated electric field from 1 to 18GHz on the Ecuelles site	5.16	/
Measurement of radiated electric field from 30 to 1000MHz in vertical position on the OATS (Ecuelles)	4,99	6.3
Measurement of radiated electric field from 30 to 1000MHz in horizontal position in SAC C01	5,08	6.3
Measurement of radiated electric field from 30 to 1000MHz in vertical position in SAC C01	5,16	6.3
Measurement of radiated electric field from 30 to 1000MHz in horizontal position in SAC V01	5,08	6.3
Measurement of radiated electric field from 30 to 1000MHz in vertical position in SAC V01	5,15	6.3
Measurement of radiated electric field from 1 to 6 GHz C01	5,1	5.2
Measurement of radiated electric field from 1 to 6 GHz V01	4,85	5.2
Measurement of radiated magnetic field from 10kHz to 30MHz on the OATS (Ecuelles)	4,48	/

The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the CISPR. The conformity of the sample is directly established by the applicable limits values. This table includes all uncertainties maximum feasible for testing in the laboratory, whether or not made in this report