



LCIE

Template: Release February 06th, 2020

TEST REPORT

N°: 165479-747277

Version : 01

Subject

Radio spectrum matters
tests according to standards:
47 CFR Part 15.247 [P](#)

Issued to

BeOn IoT SAS
23, rue de la cressonnière
31270 - CUGNAUX
France

Apparatus under test

↗ Product
↗ Trade mark
↗ Manufacturer
↗ Model under test
↗ Serial number
↗ FCC ID

Tracking Device
BeOn A1 / Safran Aero IoT
BeOn IoT SAS
Radio-8
035
2AWL5A01912SA

Conclusion

See Test Program chapter

Test date

March 6, 2020 to March 16, 2020

Test location

Fontenay Aux Roses & Ecuelles

Test Site

6230B-1

Sample receipt date

March 6, 2020

Composition of document

56 pages

Document issued on

April 8, 2020

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Approved by :
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PUBLICATION HISTORY

Version	Date	Author	Modification
01	April 8, 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
- KDB 558074 D01 DTS Meas Guidance v05r02
- ANSI C63.10-2013

Radio requirement:

Clause (47CFR Part 15.247) Test Description	Test result - Comments			
Occupied Bandwidth P	☒ PASS	☐ FAIL	☐ NA	☐ NP(1)
6dB Bandwidth P	☒ PASS	☐ FAIL	☐ NA()	☐ NP(1)
Duty Cycle P	☒ PASS	☐ FAIL	☐ NA	☐ NP(1)
Maximum Conducted Output Power P	☒ PASS	☐ FAIL	☐ NA	☐ NP(1)
Power Spectral Density P	☒ PASS	☐ FAIL	☐ NA	☐ NP(1)
Conducted Spurious Emission at the Band Edge P	☒ PASS	☐ FAIL	☐ NA()	☐ NP(1)
Unwanted Emissions into Non-Restricted Frequency Bands P	☒ PASS	☐ FAIL	☐ NA()	☐ NP(1)
AC Power Line Conducted Emission P	☐ PASS	☐ FAIL	☒ NA(2)	☐ NP(1)
Unwanted Emissions into Restricted Frequency Bands P	☒ PASS	☐ FAIL	☐ NA	☐ NP(1)
Receiver Radiated emissions P	☒ 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

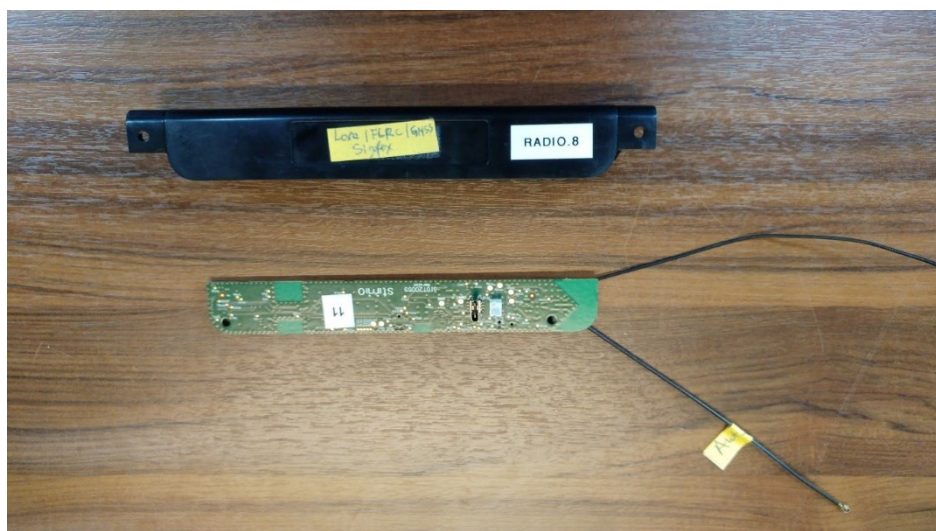
2. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER)

2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

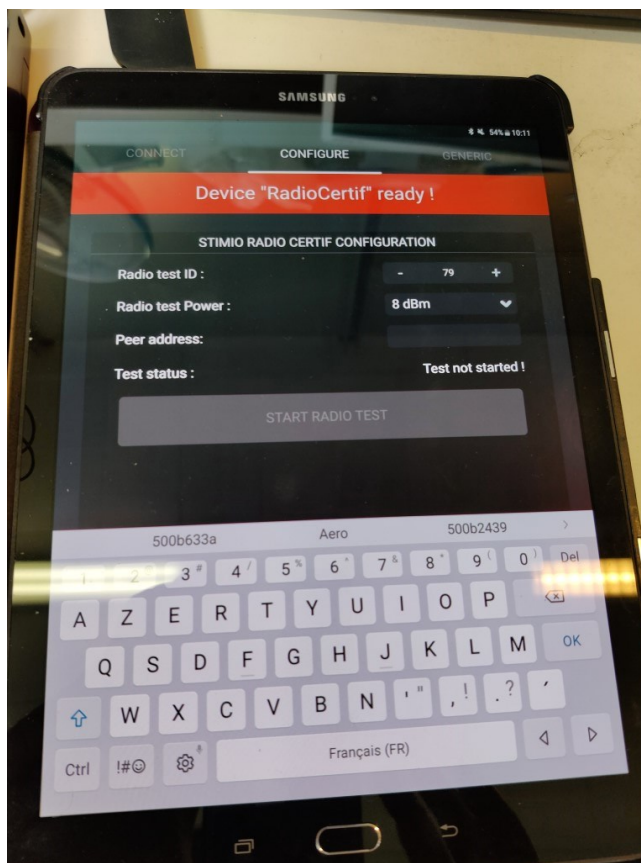
Equipment under test (EUT):

BeOn A1 / Safran Aero IoT Radio-8

Serial Number: 035



Equipment Under Test



Auxiliary equipment

Inputs/outputs - Cable:

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

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Tablet	SAMSUNG	-	Used to set the product on different test mode


Equipment information:

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
	Tnom:	20°C	
	Tmax:	☐ 35°C	☐ 55°C
Type of power source:	☐ AC power supply	☐ DC power supply	☒ Battery
Operating voltage range:	Vnom:	☐ 120V/60Hz	☒ 6 Vdc
		☐ 240V/50Hz	☐ X Vdc

Antenna Characteristic			
Antenna assembly	Gain (dBi)	Frequency Band (MHz)	Impedance(Ω)
1	3,3	2400-2483,5	50
2	2,3	2400-2483,5	50

Hardware information		
Software (if applicable):	V. :	e3719ae64a



CHANNEL PLAN			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
Cmin: 0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	Cmid: 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	LORA	☒

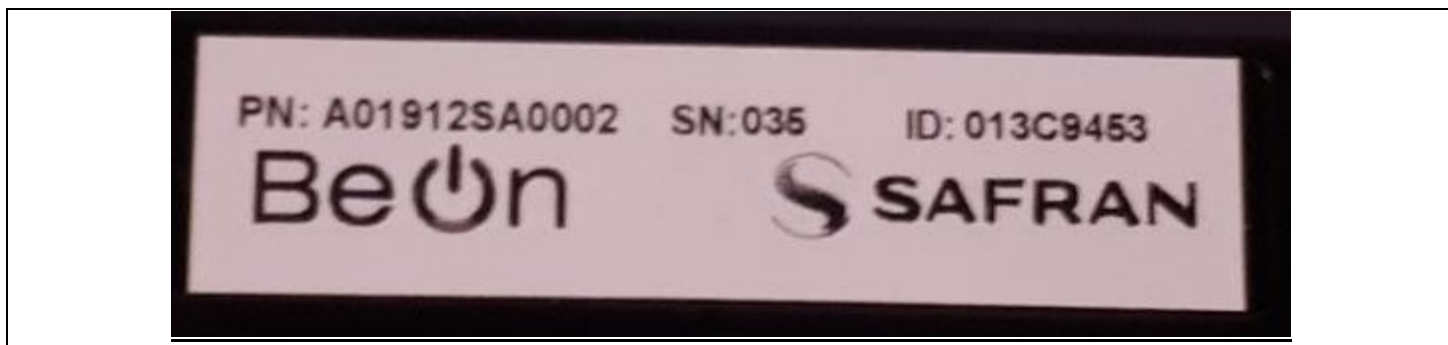
2.2. RUNNING MODE

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

(1) Following commands are used to set the product:

- See document : "Liste_mode_test_certif_radio.xlsx" for the configuration of the EUT

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 : March 12, 2020
Ambient temperature : 24 °C
Relative humidity : 33 %

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:

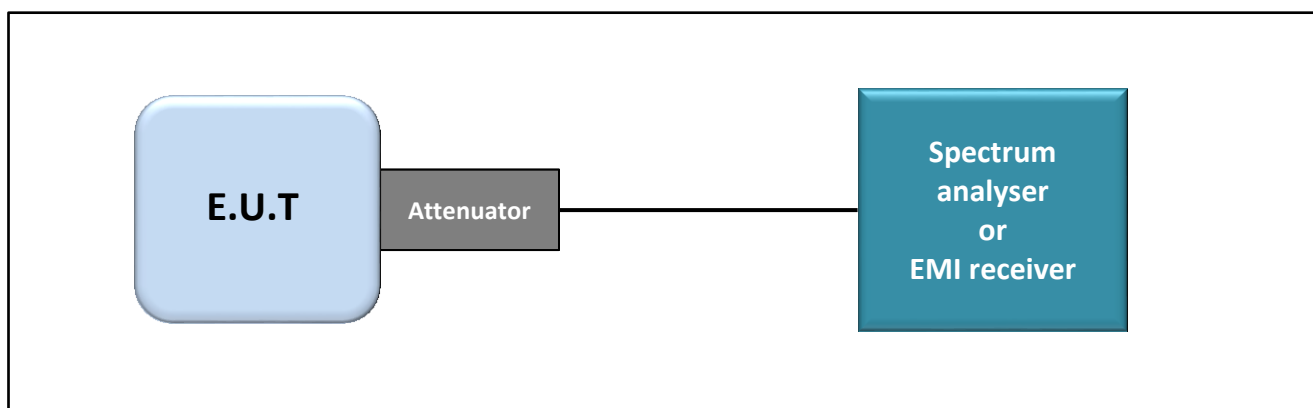
- ☒ Conducted Method
☐ Radiated Method

- Test Procedure:

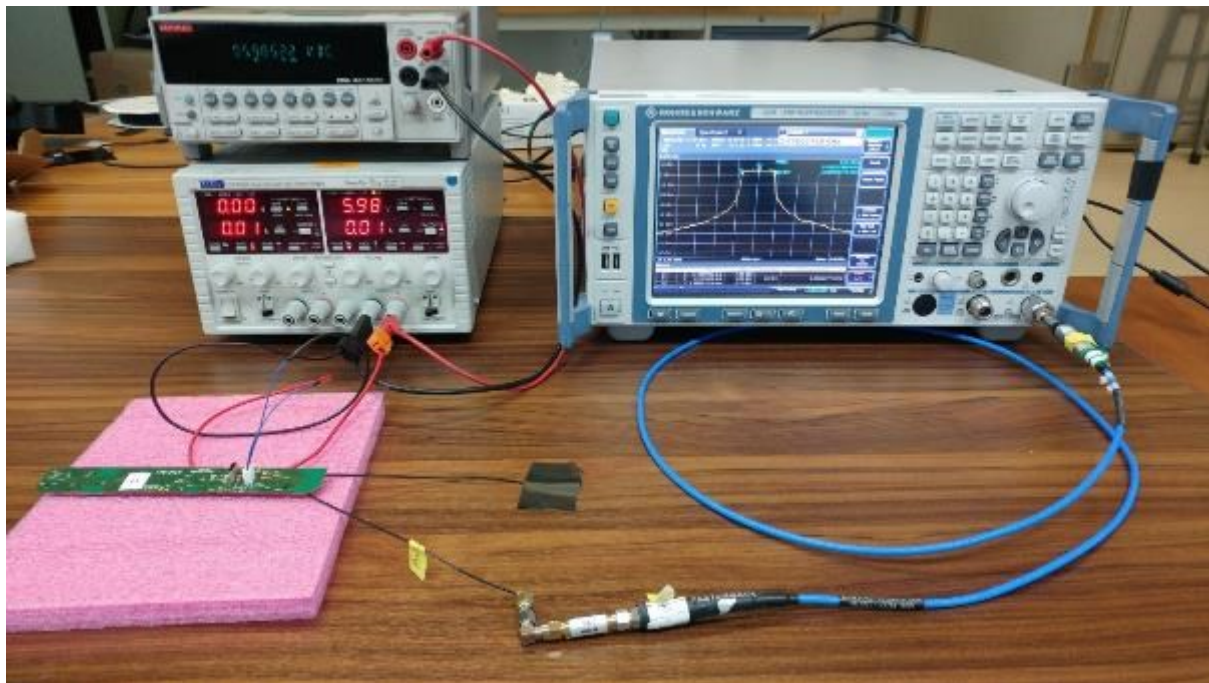
- ☐ RSS-Gen Issue 5 § 6.7
☒ ANSI C63.10 § 6.9.2

Measurement Procedure:

- RBW shall be in the range of 1% to 5% of the anticipated occupied bandwidth
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW
- SPAN = Capture all products of the modulation process
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- OBW 99% function of spectrum analyzer used



Test set up of Occupied Bandwidth



Photograph for Occupied bandwidth

3.3. **LIMIT**

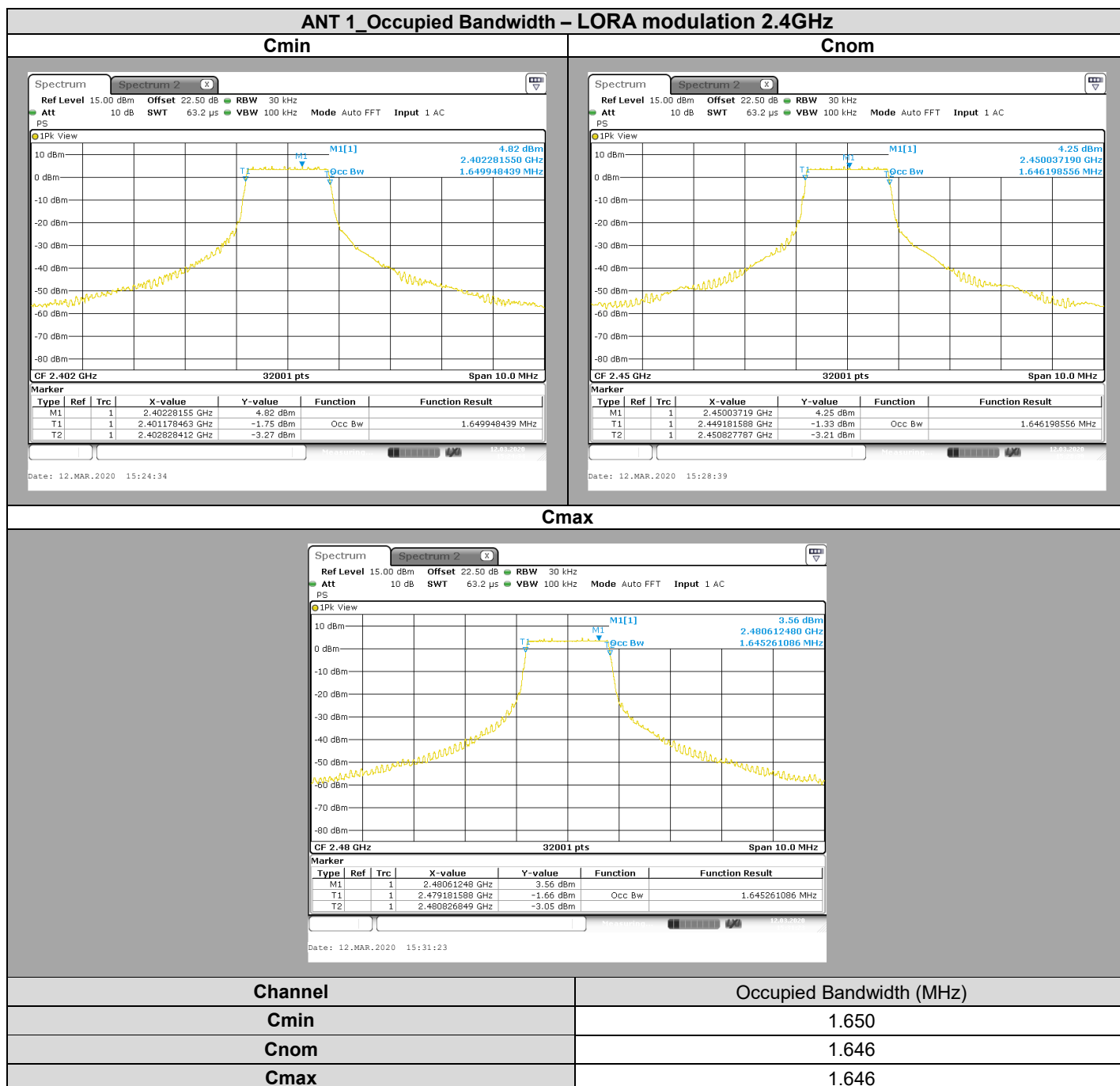
None

3.4. **TEST EQUIPMENT LIST**

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
EMI receiver	ROHDE & SCHWARZ	ESR 7	A2642023	2019/01	2021/01
Cable + Attenuateur 20dB	PASTERNAK	PE350-150CM	A5329866	2020/01	2021/01
Power supply	TTi	CPX400D	-	Calibrate with multimeter	Calibrate with multimeter
Multimeter	KEITHLEY	2000	A1242090	2019/05	2021/05

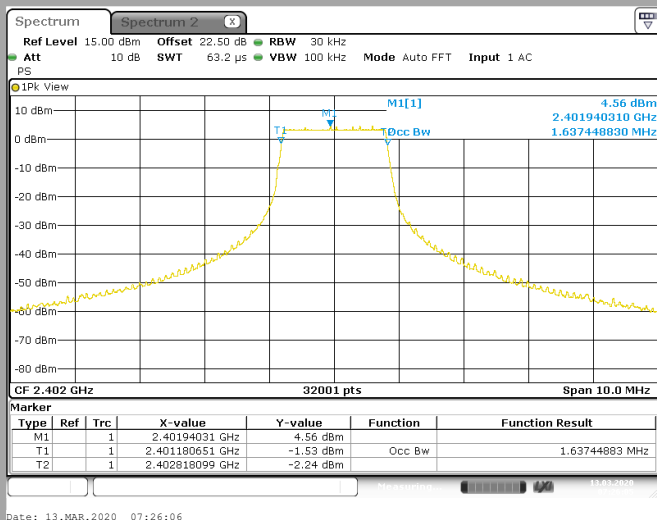
Note: In our quality system, the test equipment calibration due is more & less 2 months

3.5. RESULTS

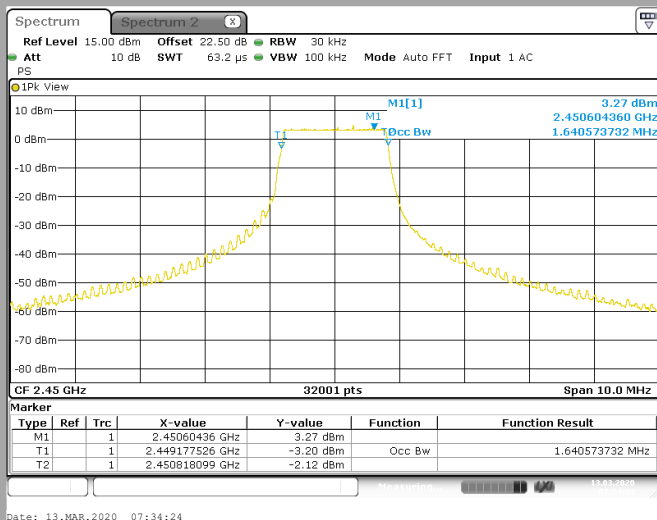


ANT 2_Occupied Bandwidth – LORA modulation 2.4GHz

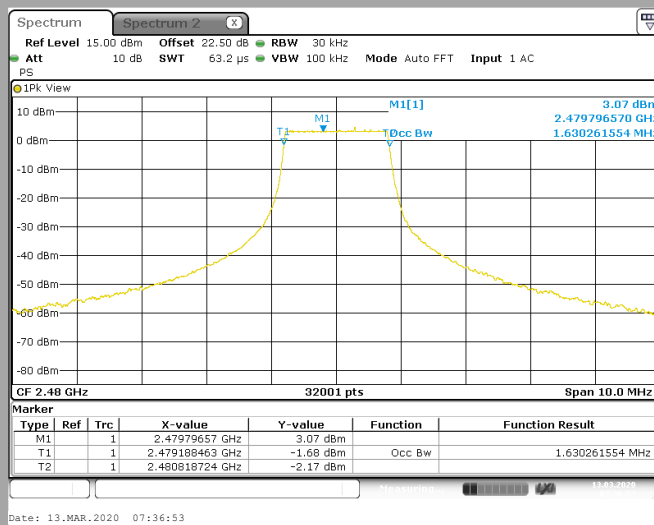
Cmin



Cnom



Cmax



Channel

Occupied Bandwidth (MHz)

Cmin

1.637

Cnom

1.641

Cmax

1.630

3.6. CONCLUSION

Occupied Channel Bandwidth measurement performed on the sample of the product **BeOn A1 / Safran Aero IoT Radio-8**, SN: **035**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247** limits.

4. 6dB EMISSION BANDWIDTH

4.1. TEST CONDITIONS

Test performed by : Julien PALARD
Date of test : March 12, 2020
Ambient temperature : 24 °C
Relative humidity : 33 %

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:

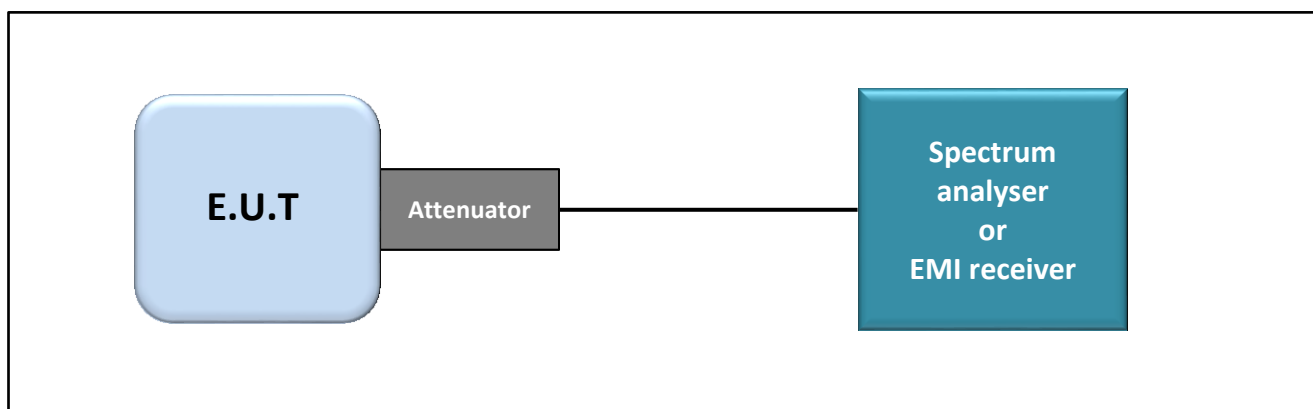
- ☒ Conducted Method
- ☐ Radiated Method

- Test Procedure:

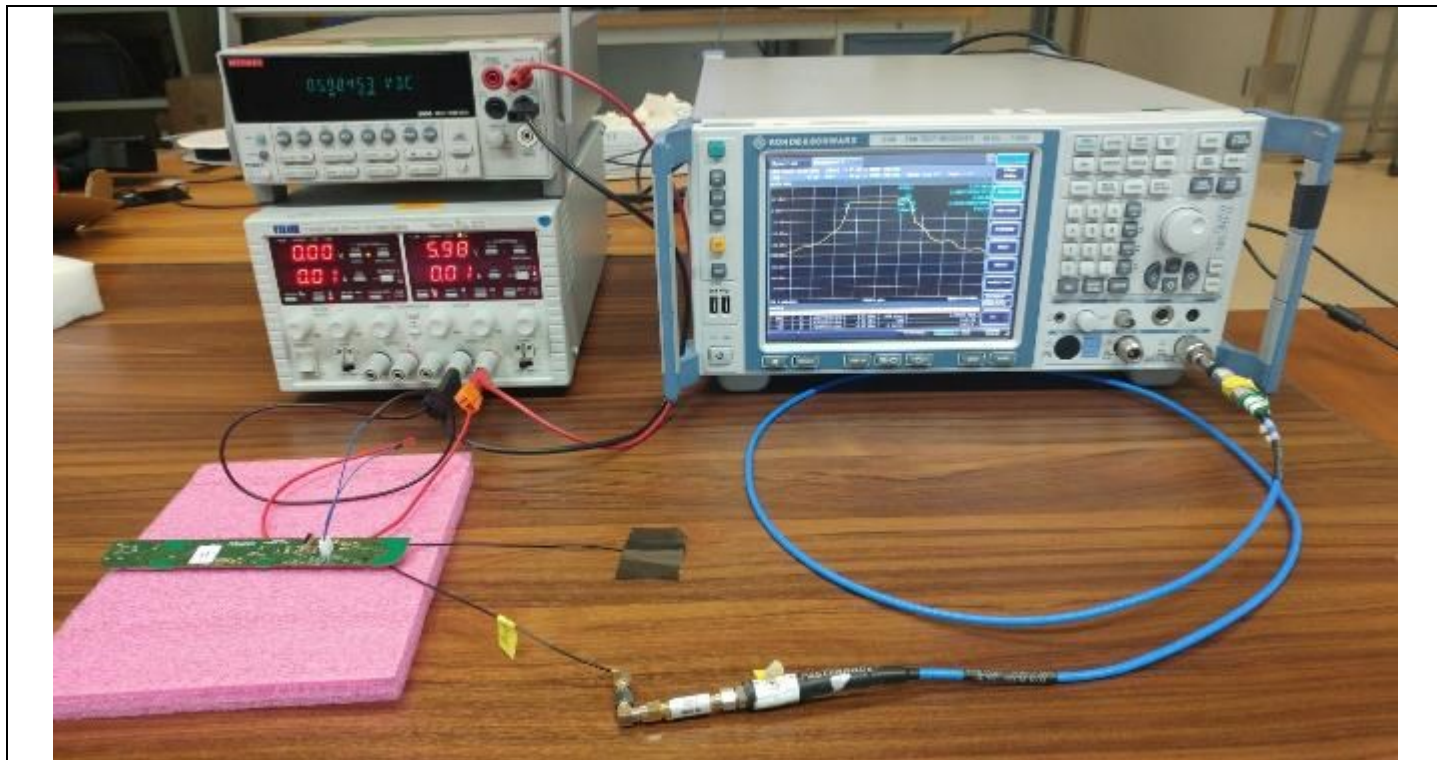
- ☒ ANSI C63.10 § 11.8.1
- ☐ ANSI C63.10 § 11.8.2

Measurement Procedure:

1. Set resolution bandwidth (RBW) = 100kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ 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

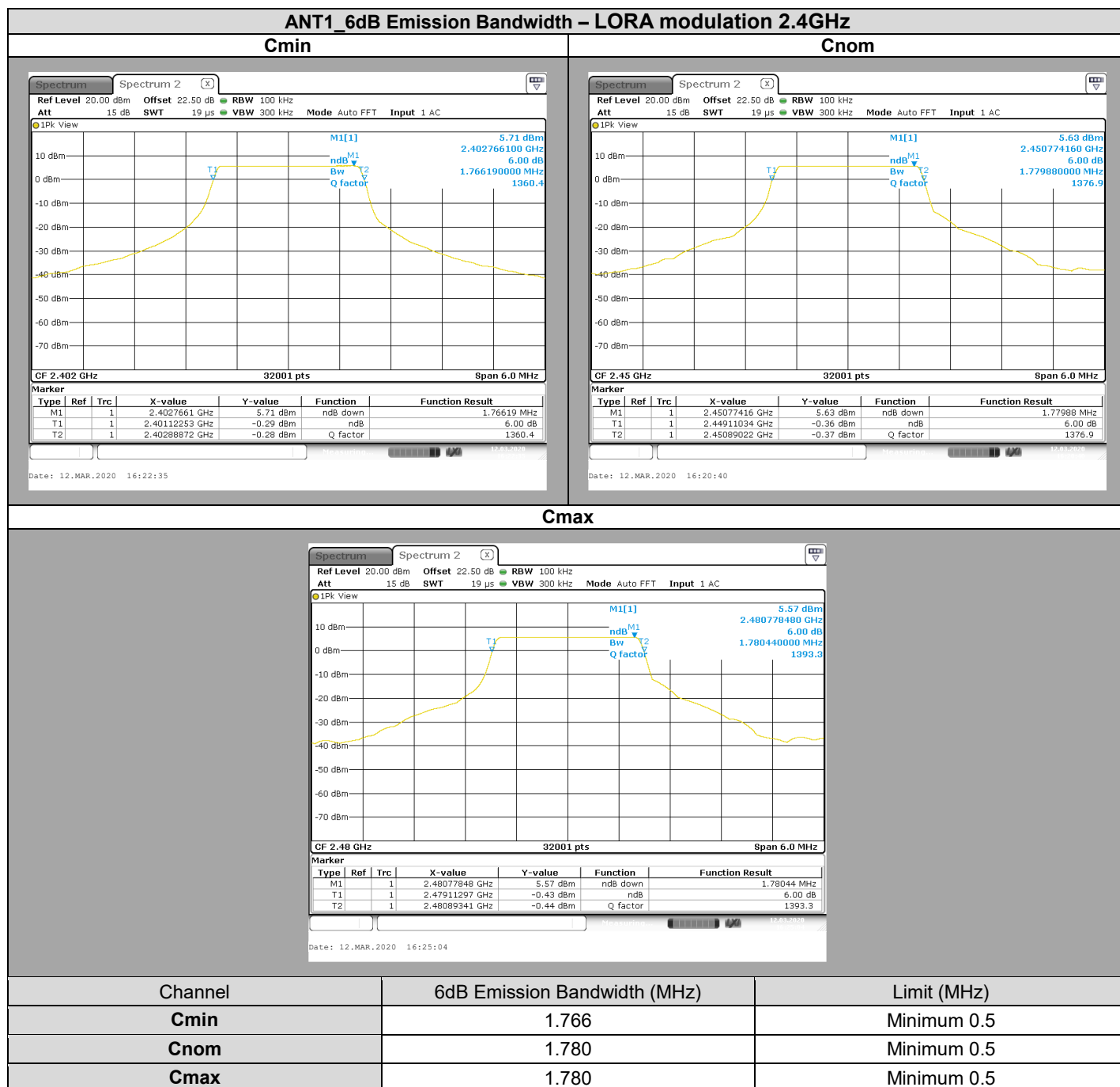
Frequency range	The 6dB bandwidth Limit
2400MHz to 2483.5MHz	$\geq 500\text{kHz}$

4.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
EMI receiver	ROHDE & SCHWARZ	ESR 7	A2642023	2019/01	2021/01
Cable + Attenuateur 20dB	PASTERNAK	PE350-150CM	A5329866	2020/01	2021/01
Power supply	TTi	CPX400D	-	Calibrate with multimeter	Calibrate with multimeter
Multimeter	KEITHLEY	2000	A1242090	2019/05	2021/05

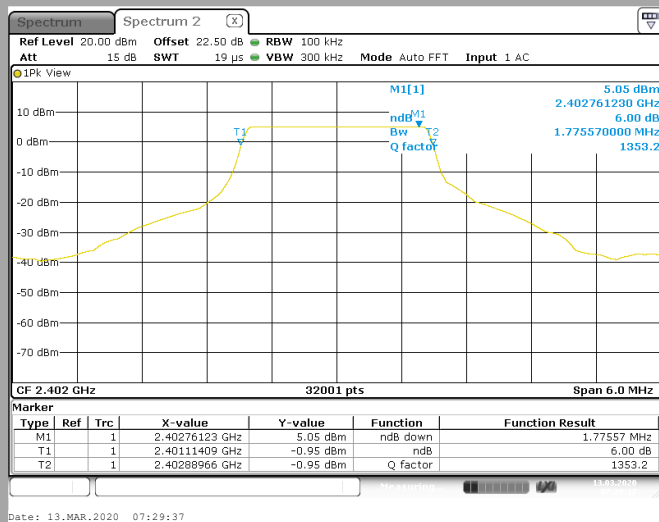
Note: In our quality system, the test equipment calibration due is more & less 2 months

4.5. RESULTS

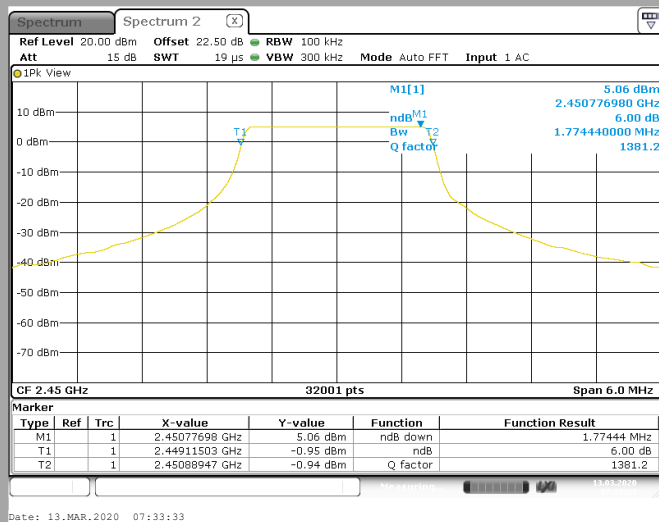


ANT2_6dB Emission Bandwidth – LORA modulation 2.4GHz

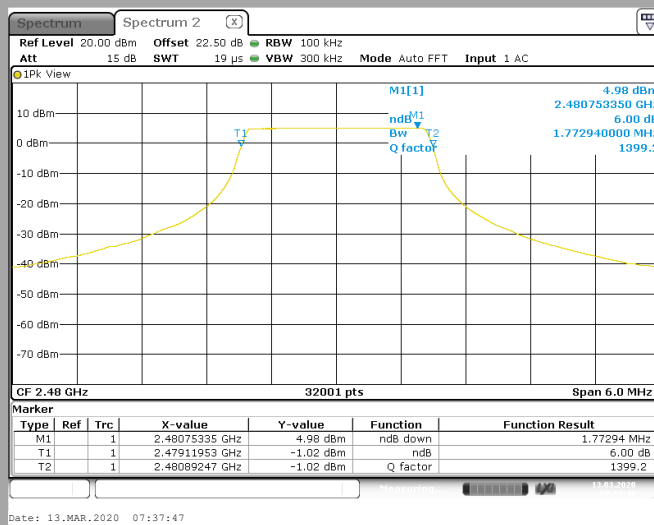
Cmin



Cnom



Cmax



Channel	6dB Emission Bandwidth (MHz)	Limit (MHz)
Cmin	1.776	Minimum 0.5
Cnom	1.774	Minimum 0.5
Cmax	1.773	Minimum 0.5

4.6. CONCLUSION

6dB Emission Bandwidth measurement performed on the sample of the product **BeOn A1 / Safran Aero IoT Radio-8**, SN: **035**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247** limits.

5. DUTY CYCLE

5.1. TEST CONDITIONS

Test performed by : Julien PALARD
Date of test : March 13, 2020
Ambient temperature : 24 °C
Relative humidity : 35 %

5.2. TEST SETUP

- The Equipment under Test is installed:

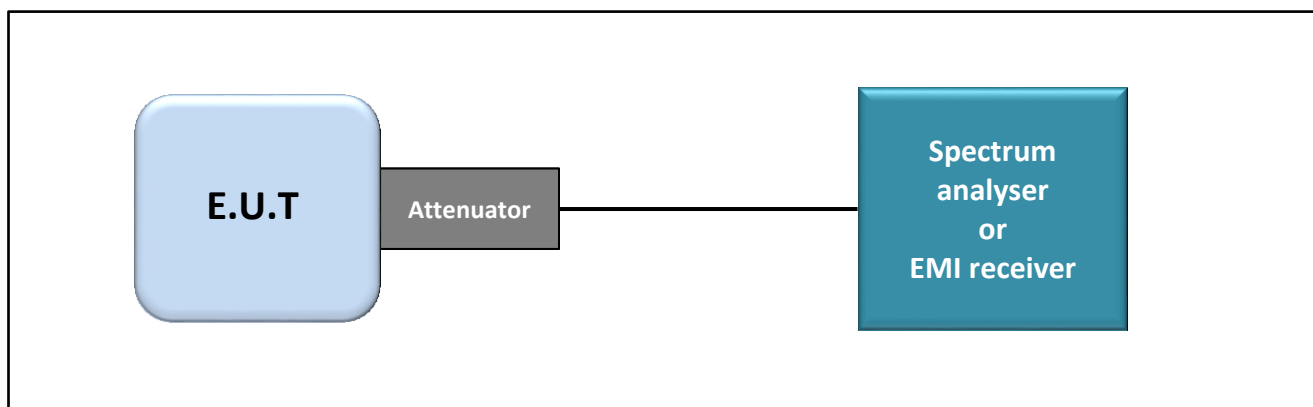
- ☒ On a table
- ☐ In an anechoic chamber

- Measurement is performed with a spectrum analyzer in:

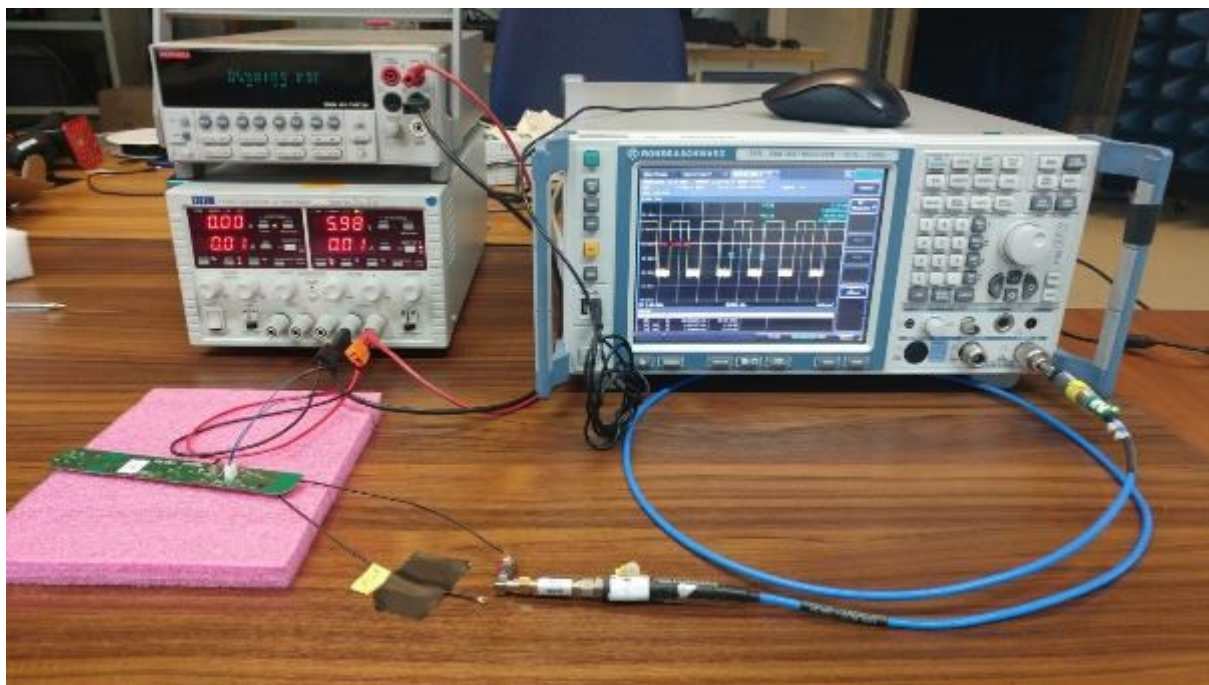
- ☒ Conducted Method
- ☐ Radiated Method

- Test Procedure:

- ☒ ANSI C63.10 § 11.6



Test set up of Duty Cycle



Photograph for Duty Cycle

5.3. LIMIT

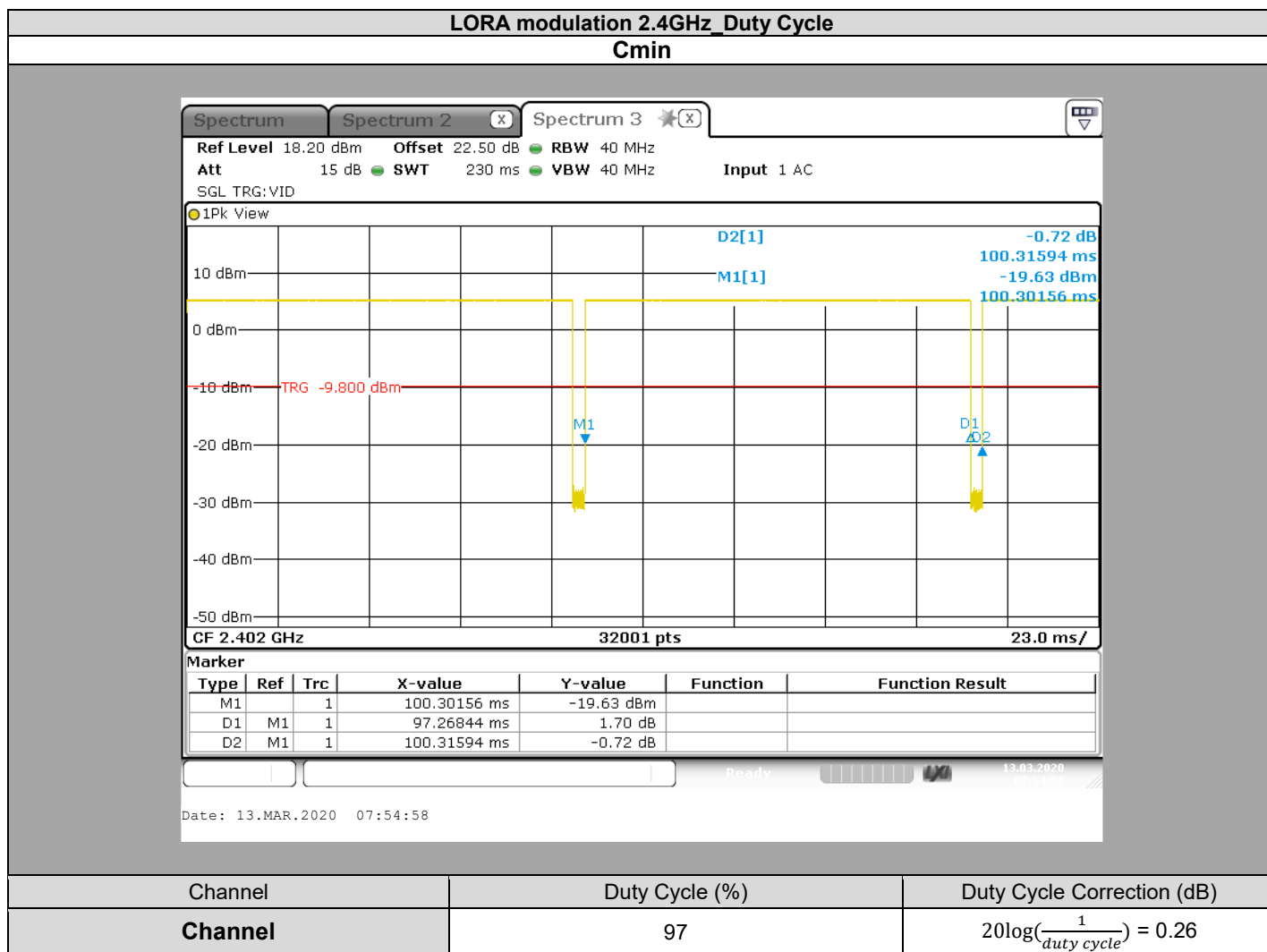
None

5.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
EMI receiver	ROHDE & SCHWARZ	ESR 7	A2642023	2019/01	2021/01
Cable + Attenuateur 20dB	PASTERNAK	PE350-150CM	A5329866	2020/01	2021/01
Power supply	TTi	CPX400D	-	Calibrate with multimeter	Calibrate with multimeter
Multimeter	KEITHLEY	2000	A1242090	2019/05	2021/05

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

5.5. RESULTS



5.6. CONCLUSION

Duty Cycle measurement performed on the sample of the product **BeOn A1 / Safran Aero IoT Radio-8**, SN: **035**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247** limits.

6. MAXIMUM CONDUCTED OUTPUT POWER

6.1. TEST CONDITIONS

Test performed by : Julien PALARD
Date of test : March 13, 2020
Ambient temperature : 24 °C
Relative humidity : 35 %

6.2. TEST SETUP

- The Equipment under Test is installed:

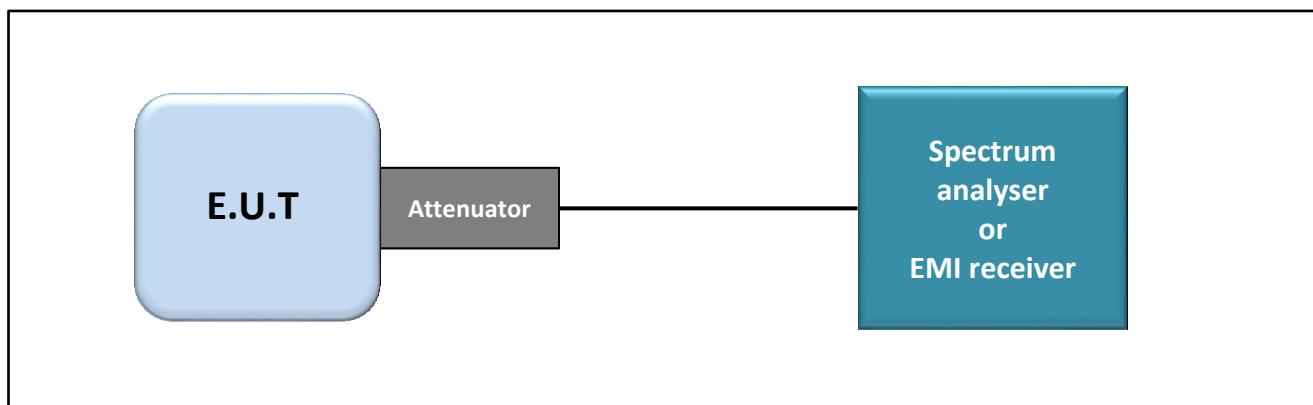
- ☒ On a table
- ☐ In an anechoic chamber

- Measurement is performed with a spectrum analyzer in:

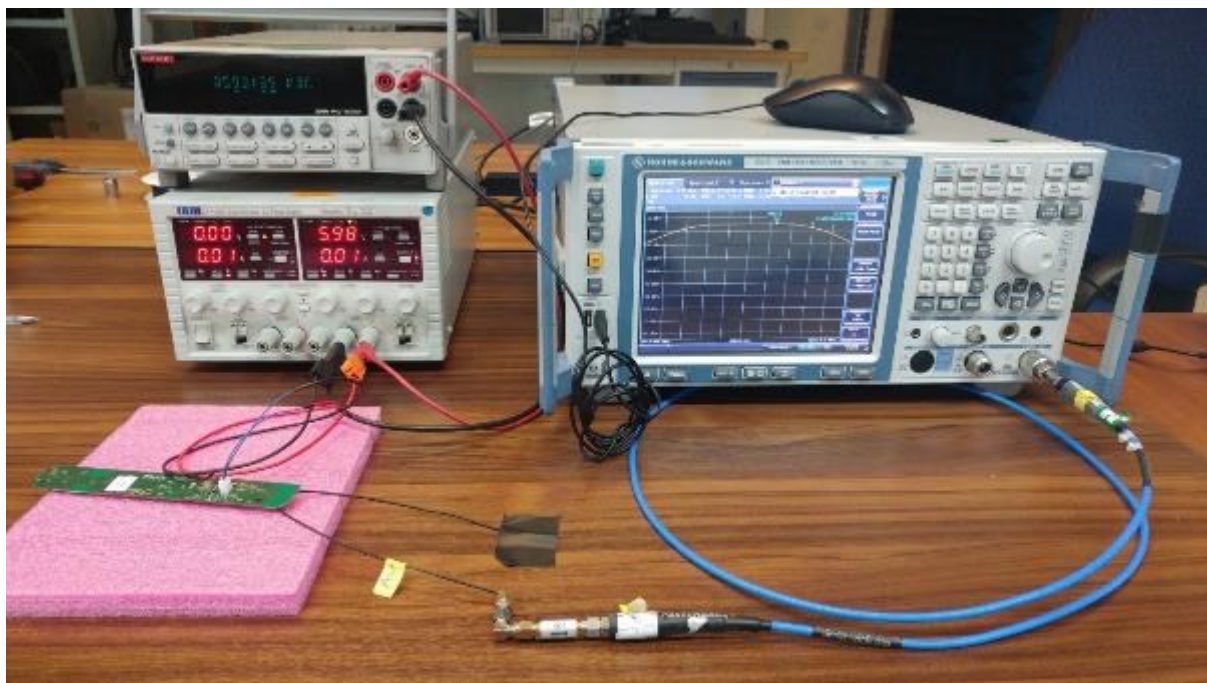
- ☒ Conducted Method
- ☐ Radiated Method

- 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

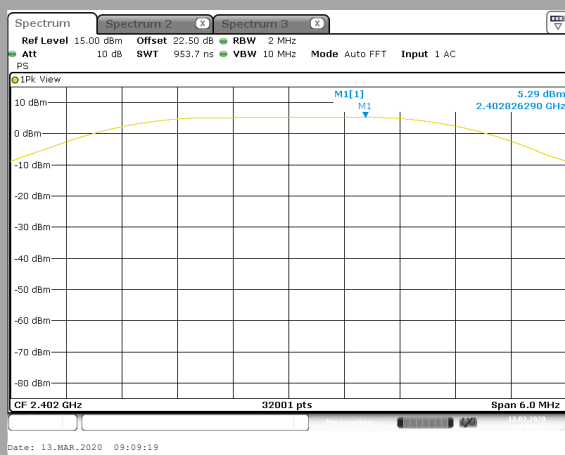
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
EMI receiver	ROHDE & SCHWARZ	ESR 7	A2642023	2019/01	2021/01
Cable + Attenuateur 20dB	PASTERNAK	PE350-150CM	A5329866	2020/01	2021/01
Power supply	TTi	CPX400D	-	Calibrate with multimeter	Calibrate with multimeter
Multimeter	KEITHLEY	2000	A1242090	2019/05	2021/05

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

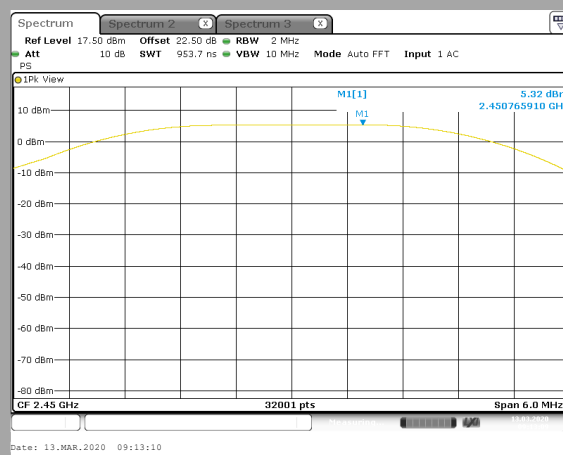
6.5. RESULTS

ANT 3_LORA modulation 2.4GHz_ Maximum Conducted Output Power

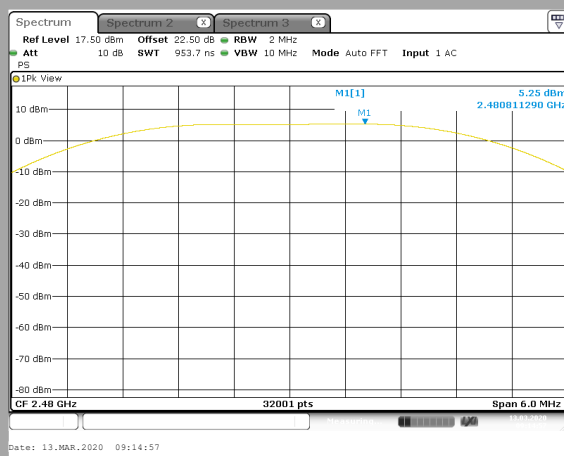
Cmin



Cnom



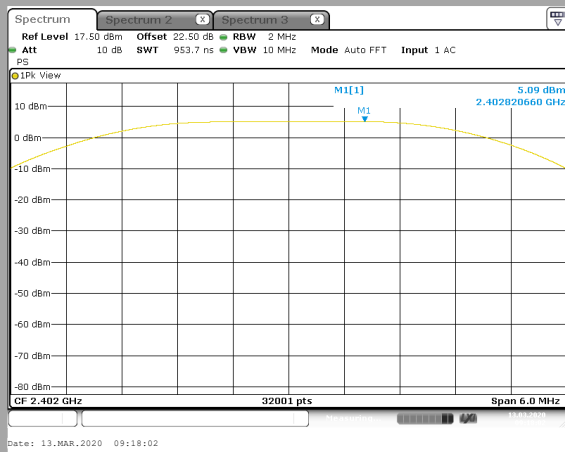
Cmax



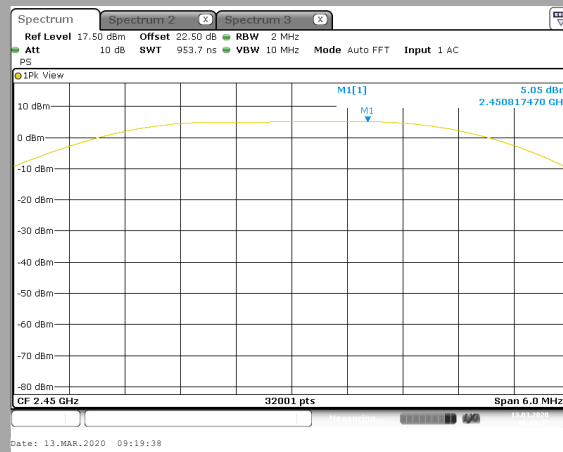
Channel	Offset Cable + Att (dB)	Antenna Gain (dBi)	Maximum Conducted Power (dBm)	Limit (dBm)
Cmin	22.5	3.3	5.29	30
Cnom	22.5	3.3	5.32	30
Cmax	22.5	3.3	5.25	30

ANT 4_LORA modulation 2.4GHz_ Maximum Conducted Output Power

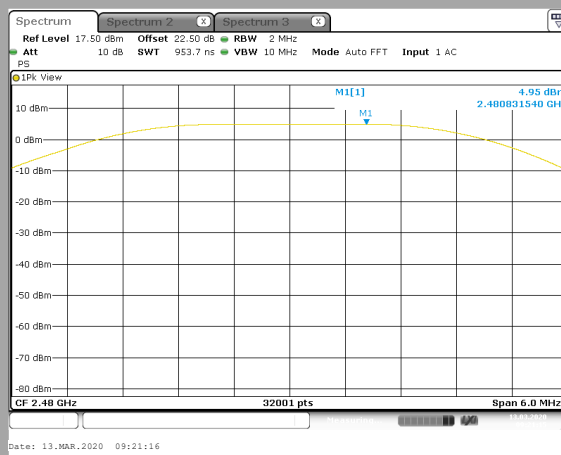
Cmin



Cnom



Cmax



Channel	Offset Cable + Att (dB)	Antenna Gain (dBi)	Maximum Conducted Power (dBm)	Limit (dBm)
Cmin	22.5	2.3	5.09	30
Cnom	22.5	2.3	5.05	30
Cmax	22.5	2.3	4.95	30

6.6. CONCLUSION

Maximum Conducted Output Power measurement performed on the sample of the product **BeOn A1 / Safran Aero IoT Radio-8**, SN: **035**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247** limits.

7. POWER SPECTRAL DENSITY

7.1. TEST CONDITIONS

Test performed by : Julien PALARD
Date of test : March 13, 2020
Ambient temperature : 24 °C
Relative humidity : 35 %

7.2. TEST SETUP

- The Equipment Under Test is installed:

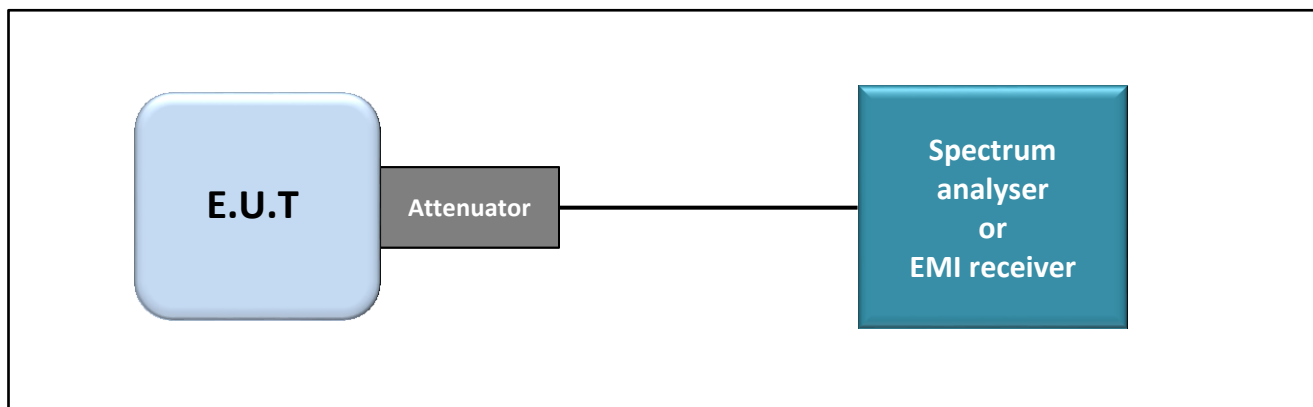
- ☒ On a table
- ☐ In an anechoic chamber

- Measurement is performed with a spectrum analyzer in:

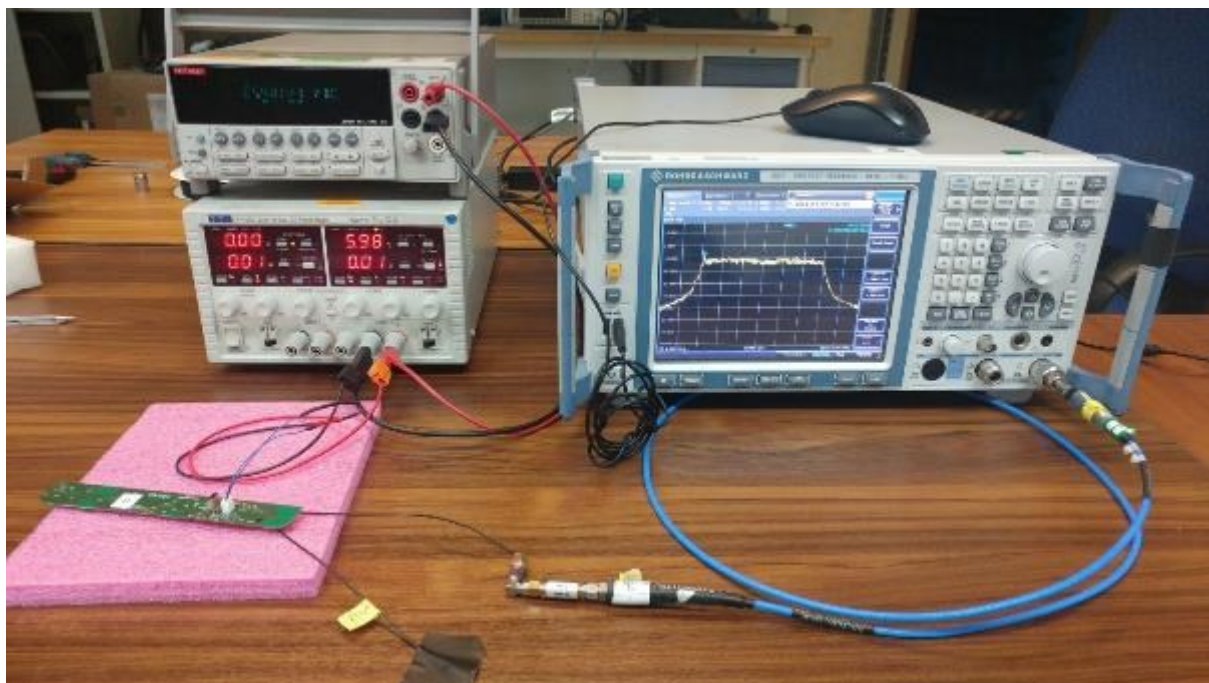
- ☒ Conducted Method
- ☐ Radiated Method

- Test Procedure:

- ☒ ANSI C63.10 § 11.10.2 (Method PKPSD)
- ☐ ANSI C63.10 § 11.10.3 (Method AVGPS-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	$\leq 8\text{dBm}/3\text{kHz}^*$

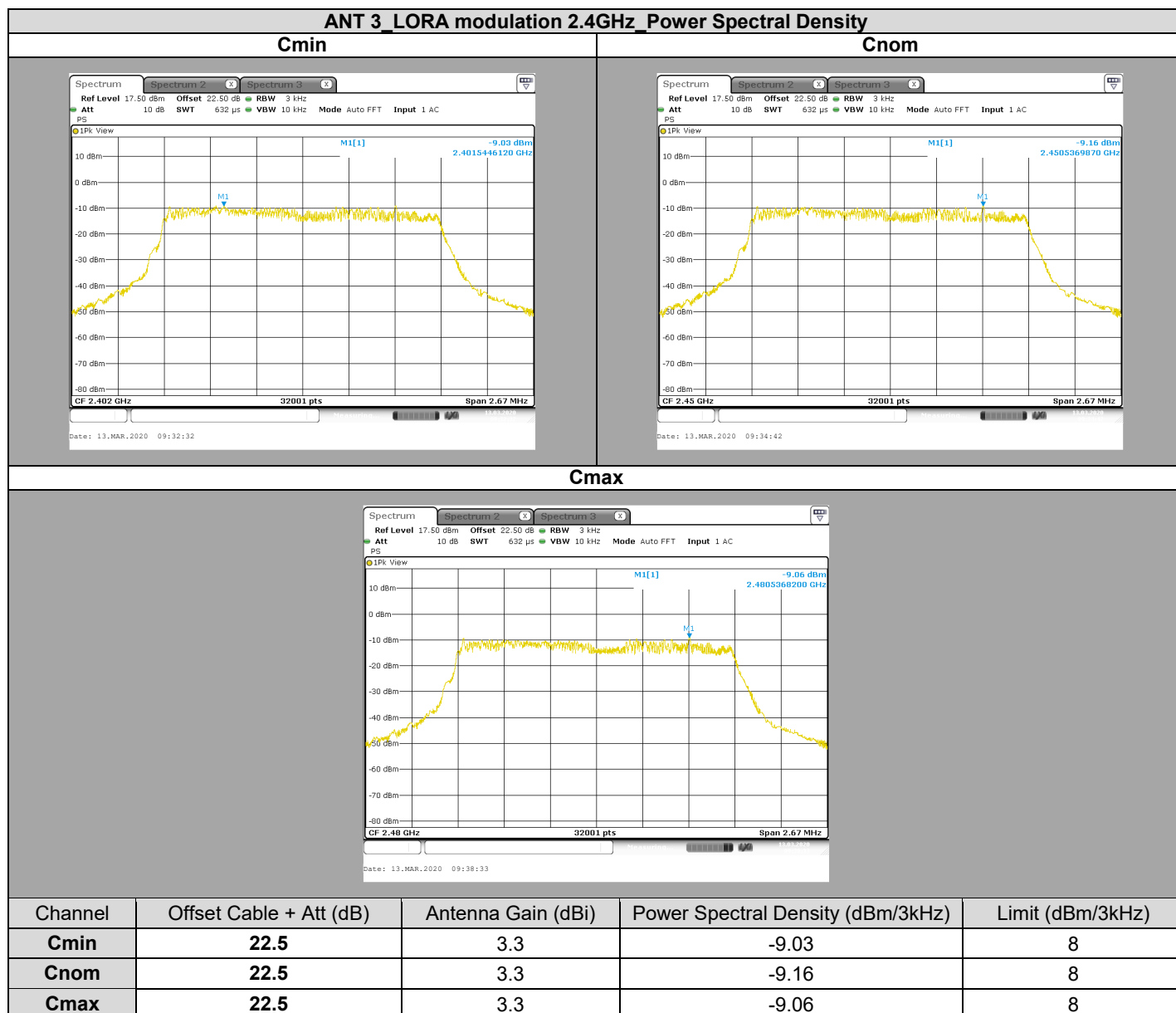
*Remark: Limits are reduced by G-6dBi if Overall Antenna Gain above 6dBi

7.4. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
EMI receiver	ROHDE & SCHWARZ	ESR 7	A2642023	2019/01	2021/01
Cable + Attenuateur 20dB	PASTERNAK	PE350-150CM	A5329866	2020/01	2021/01
Power supply	TTi	CPX400D	-	Calibrate with multimeter	Calibrate with multimeter
Multimeter	KEITHLEY	2000	A1242090	2019/05	2021/05

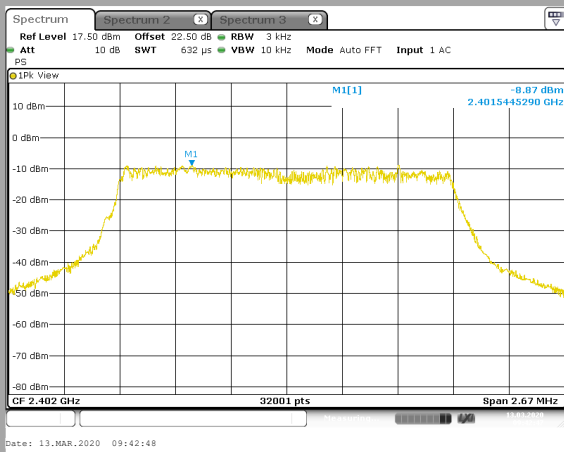
Note: In our quality system, the test equipment calibration due is more & less 2 months

7.5. RESULTS

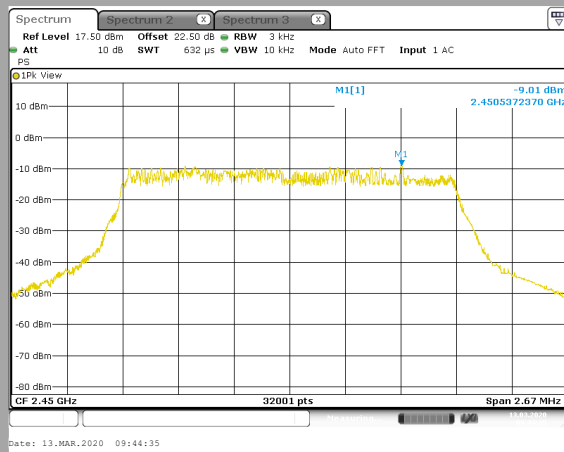


ANT 4_LORA modulation 2.4GHz_Power Spectral Density

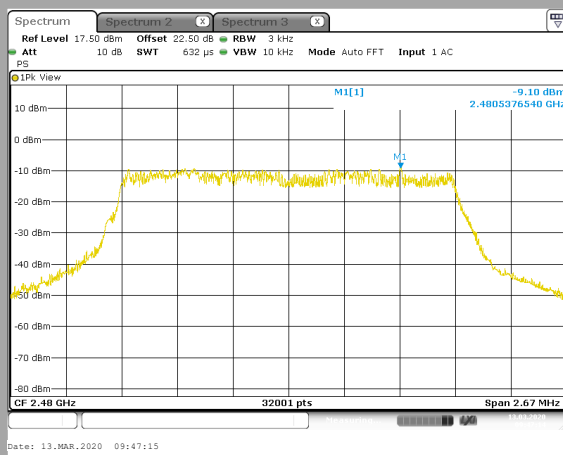
Cmin



Cnom



Cmax



Channel	Offset Cable + Att (dB)	Antenna Gain (dBi)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
Cmin	22.5	2.3	-8.87	8
Cnom	22.5	2.3	-9.01	8
Cmax	22.5	2.3	-9.10	8

7.6. CONCLUSION

Power Spectral Density measurement performed on the sample of the product **BeOn A1 / Safran Aero IoT Radio-8**, SN: **035**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247** 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 : March 13, 2020
Ambient temperature : 24 °C
Relative humidity : 35 %

8.2. TEST SETUP

- The Equipment Under Test is installed:

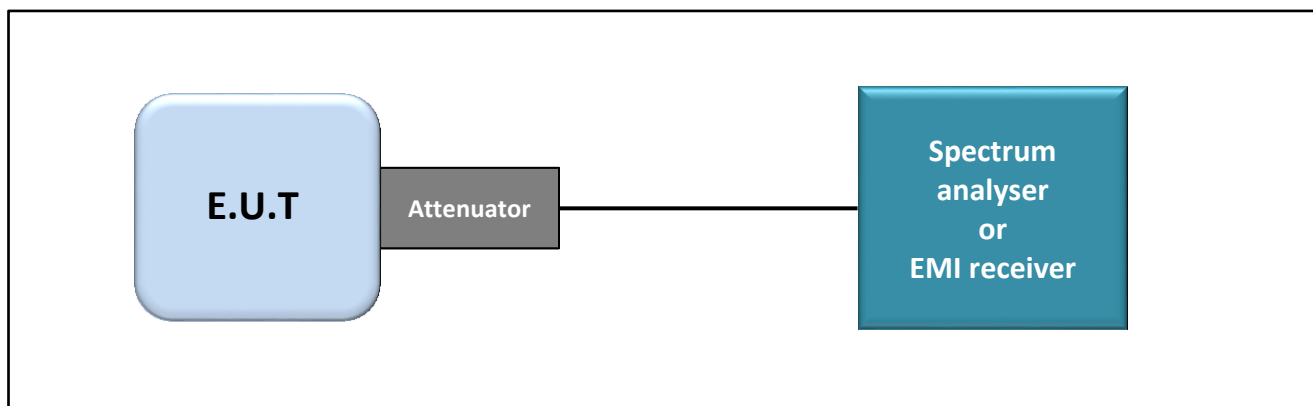
- ☒ On a table
- ☐ In an anechoic chamber

- Measurement is performed with a spectrum analyzer in:

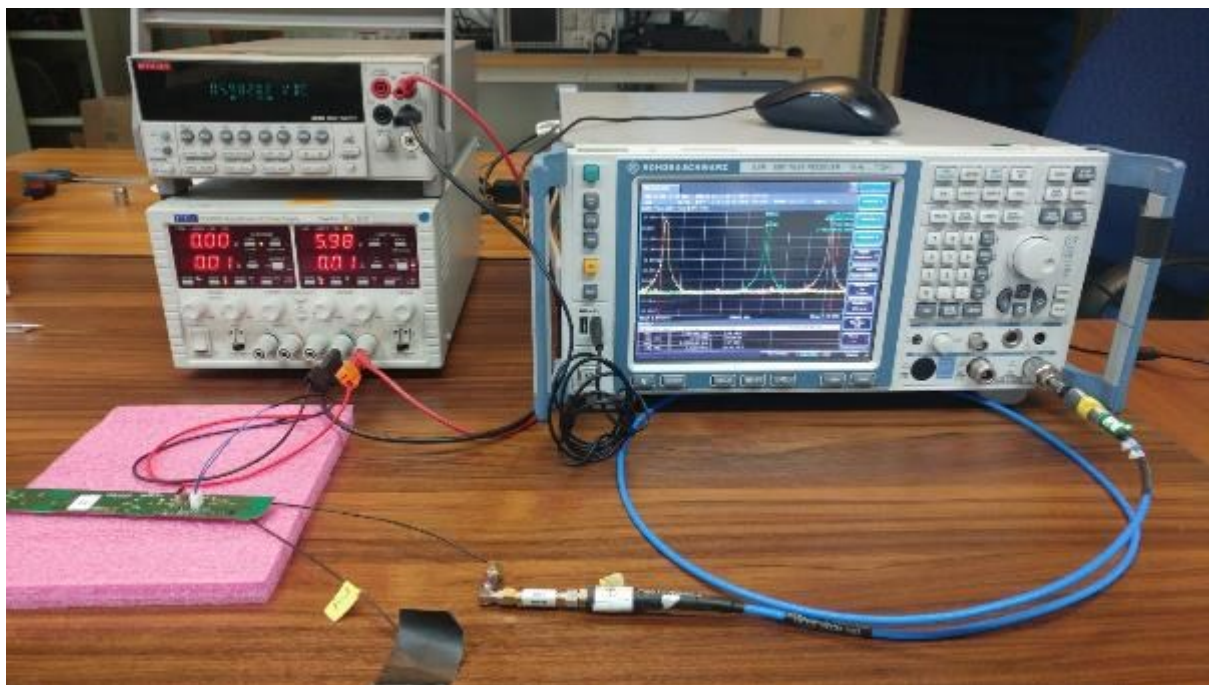
- ☒ Conducted Method
- ☐ Radiated Method

- 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

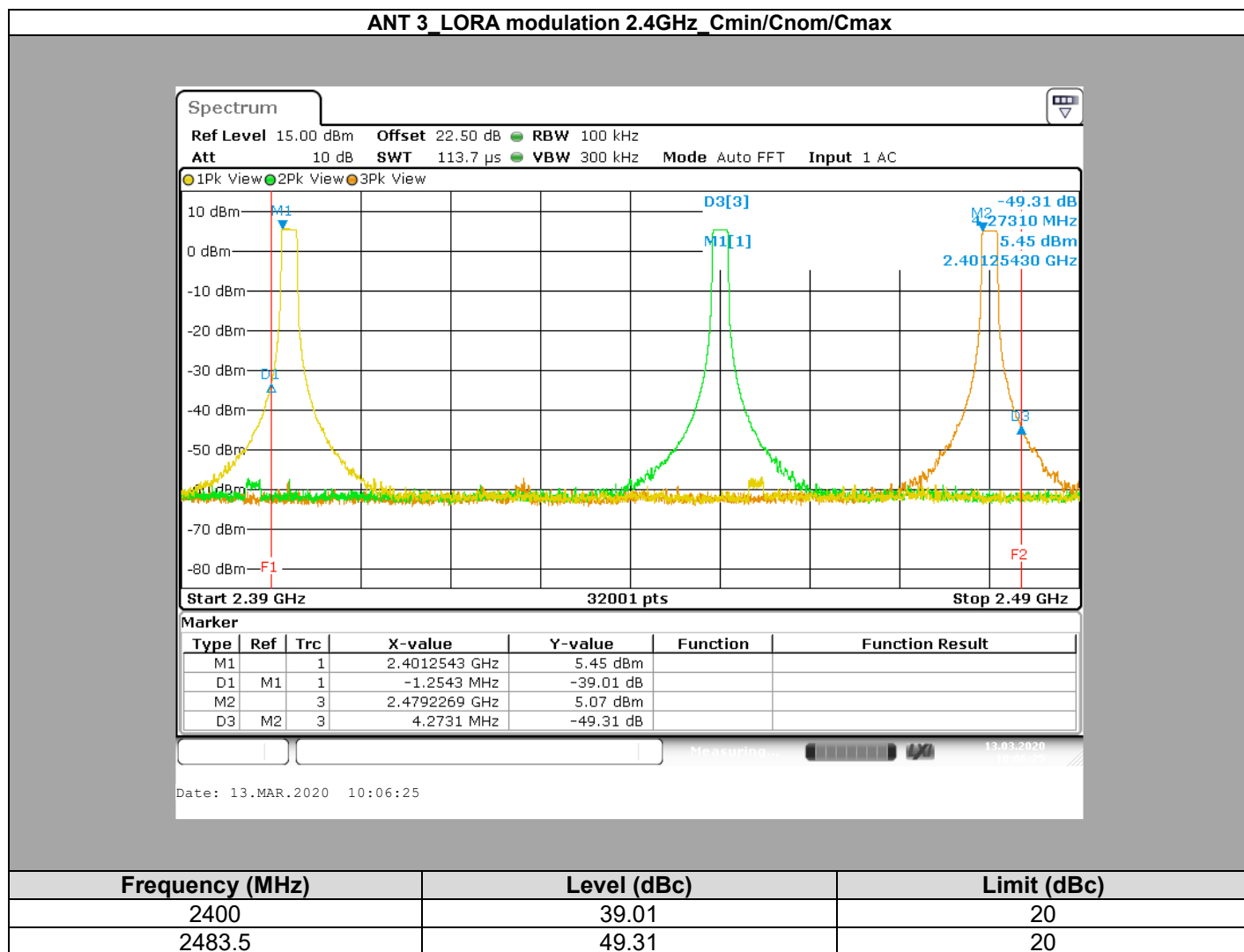
All Spurious Emissions must be at least 20dB (Maximum Conducted Power) below the Fundamental Radiator Level at the Band Edge "2400MHz & 2483,5MHz"

8.4. TEST EQUIPMENT LIST

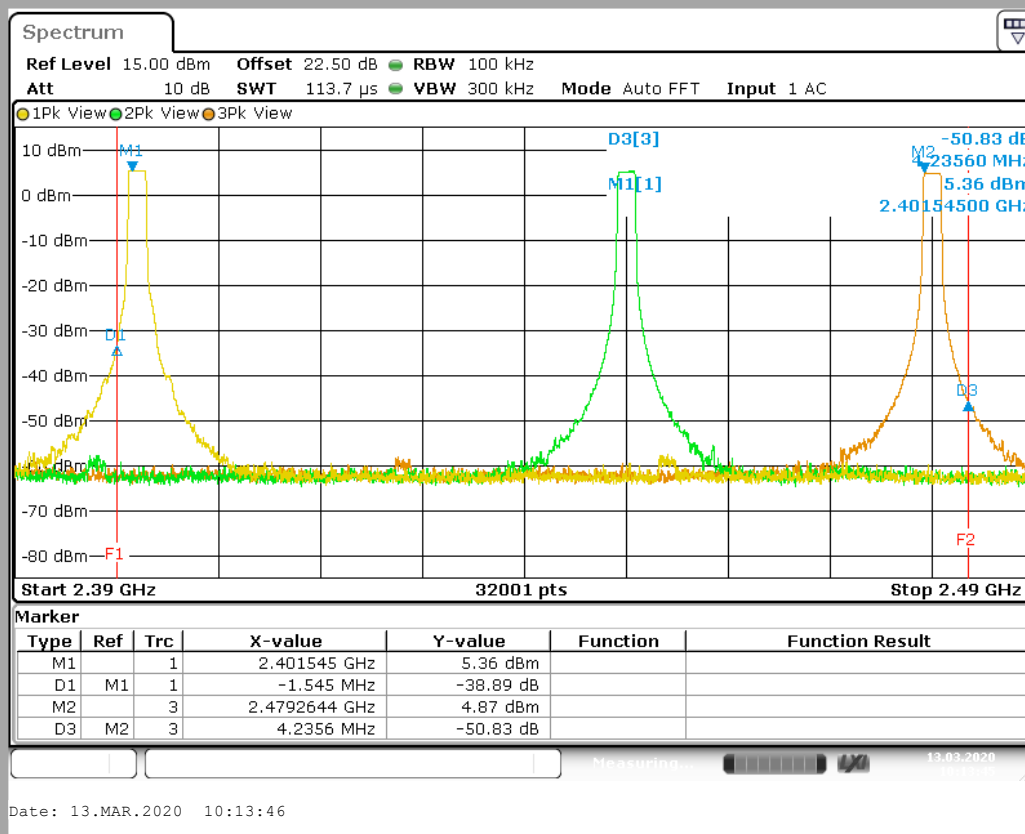
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
EMI receiver	ROHDE & SCHWARZ	ESR 7	A2642023	2019/01	2021/01
Cable + Attenuateur 20dB	PASTERNAK	PE350-150CM	A5329866	2020/01	2021/01
Power supply	TTi	CPX400D	-	Calibrate with multimeter	Calibrate with multimeter
Multimeter	KEITHLEY	2000	A1242090	2019/05	2021/05

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

8.5. RESULTS



ANT 4_LORA modulation 2.4GHz_Cmin/Cnom/Cmax



Frequency (MHz)	Level (dBc)	Limit (dBc)
2400	38.89	20
2483.5	50.83	20

8.6. CONCLUSION

Unwanted Emission into non-restricted frequency bands at the band edge measurement performed on the sample of the product **BeOn A1 / Safran Aero IoT Radio-8**, SN: **035**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247** limits.

9. UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

9.1. TEST CONDITIONS

Test performed by : Armand MAHOUNGOU
Date of test : March 9, 2020
Ambient temperature : 24 °C
Relative humidity : 45 %

9.2. TEST SETUP

- The Equipment under Test is installed:

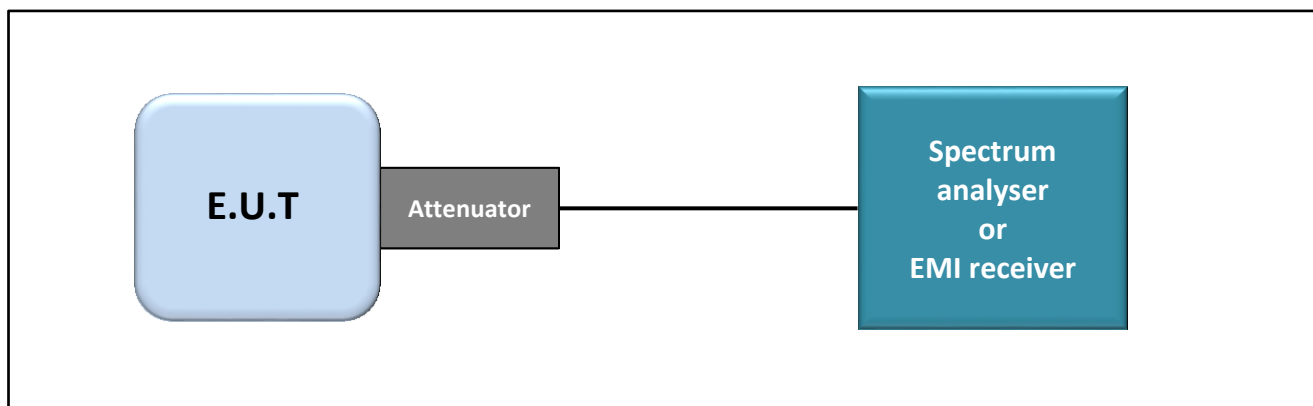
- ☒ On a table
- ☐ In an anechoic chamber

- Measurement is performed with a spectrum analyzer in:

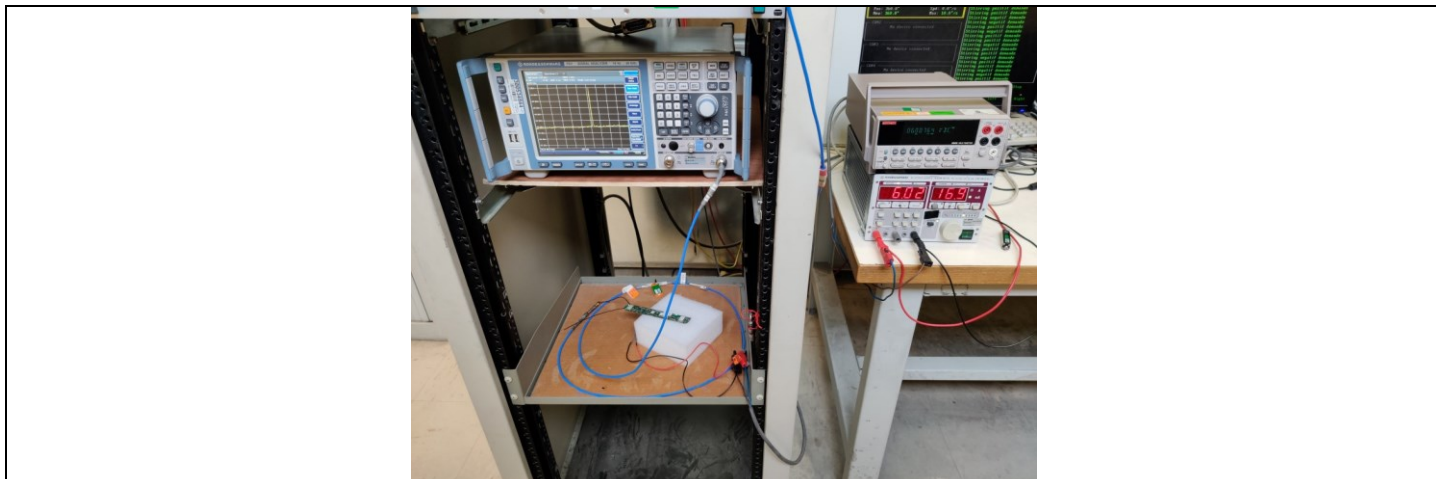
- ☒ Conducted Method
- ☐ Radiated Method

- 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

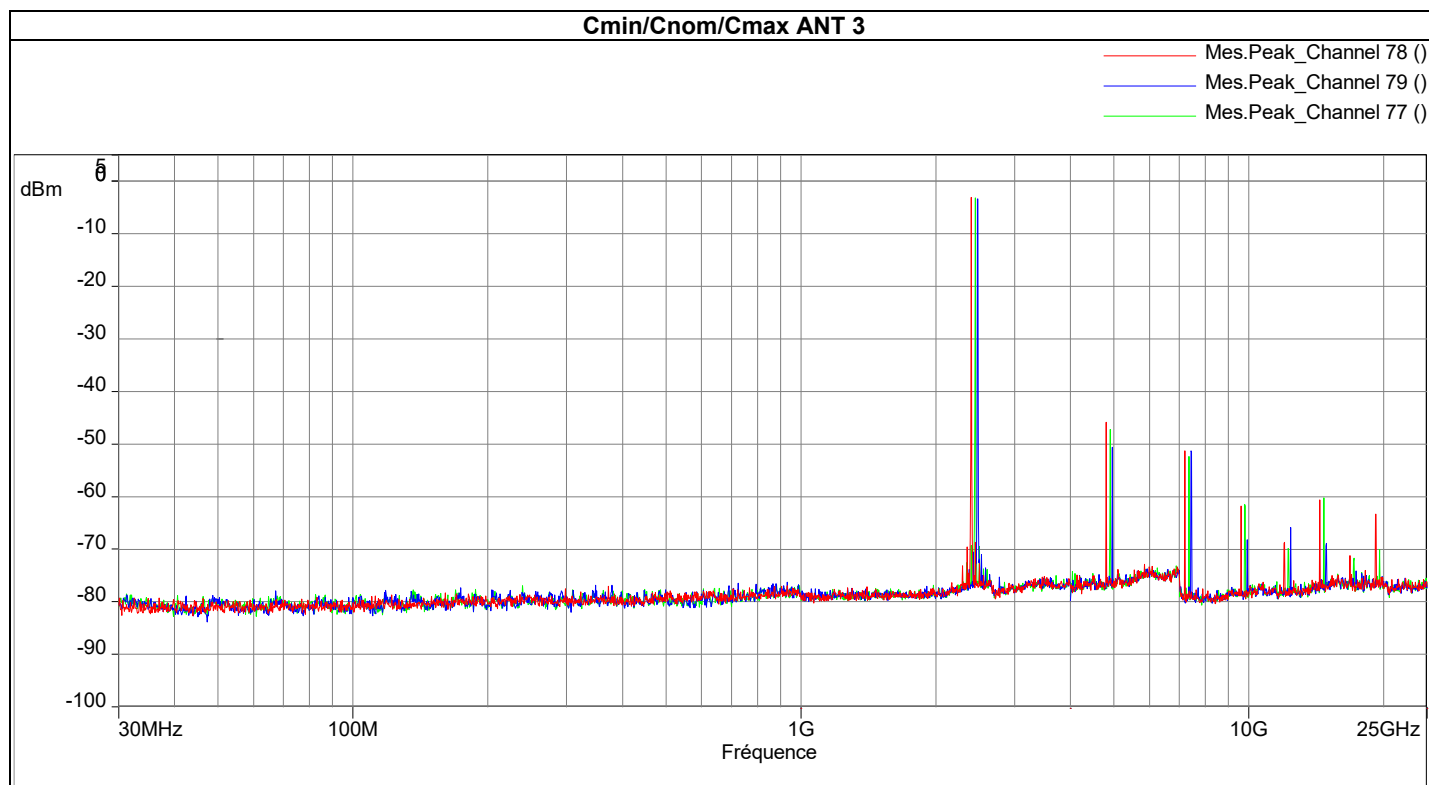
All Spurious Emissions must be at least 20dB (Maximum Conducted Power) below the Fundamental Radiator Level

9.4. TEST EQUIPMENT LIST

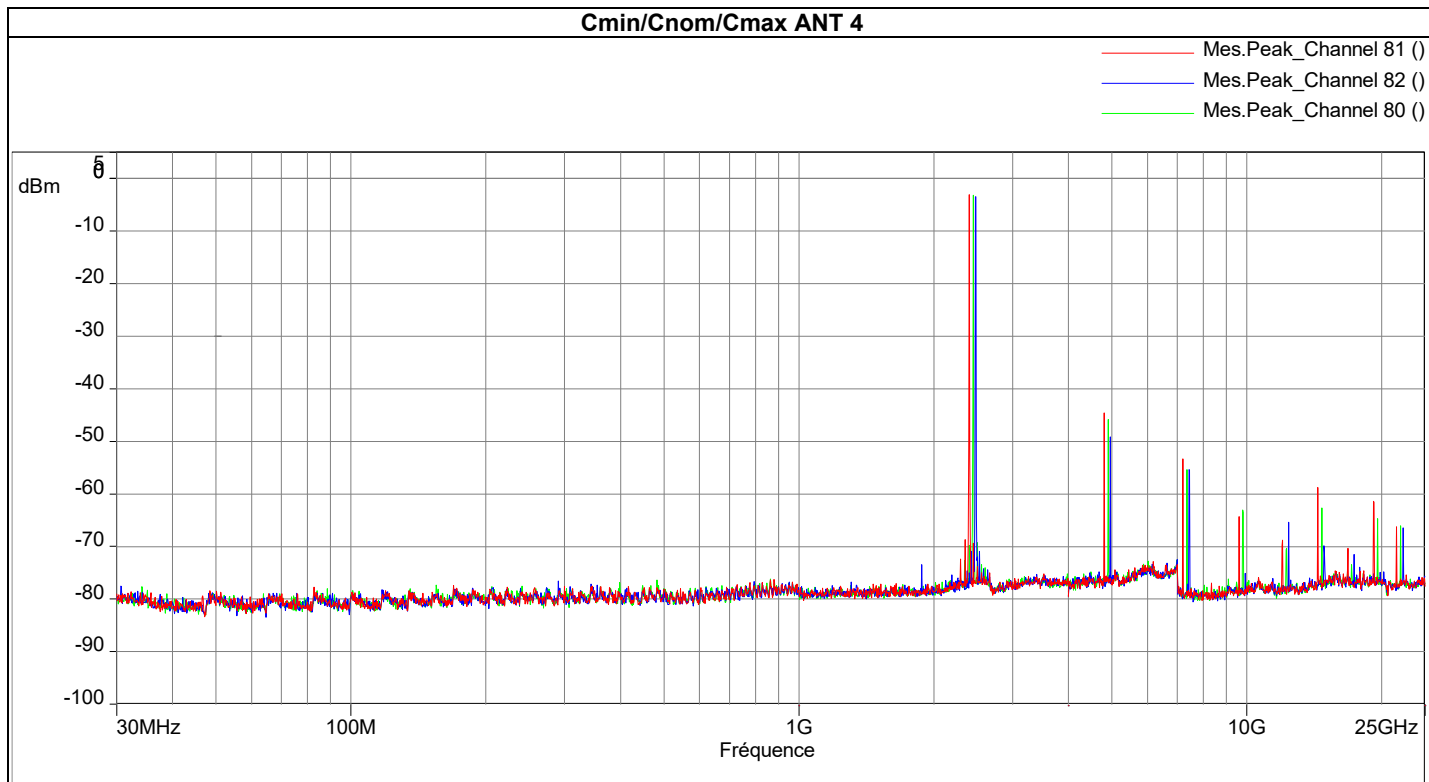
DESCRIPTION	MANUFACTURER	MODEL	N° LCIE	Cal_Date	Cal_Due
Cable Conducted S36 chamber	TELEDYNE	084-0555-2MTR	A5329758	2019/02	2020/02
EMI receiver	ROHDE & SCHWARZ	FSV40GHz	A4060061	2019/05	2021/05
Attenuator 3dB Cable Spurious Conducted	-	WA54-3-12	A7122223	2019/02	2020/02
High Pass Filter 2,4GHz	WAINWRIGHT	WHK12-2494	A7484068	2019/07	2021/07
Multimeter	KEITHLEY	2000	A1242090	2019/05	2021/05
Programmable DC power supply	ROHDE & SCHWARZ	NGSM32/10	A7040074	See multimeter	See multimeter

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

9.5. RESULTS



Frequency (MHz)	Level (dBm)	Level (dBc)	Limit (dBc)
2402.00	-3.05		
4804.00	-45.8	42.75	20
7206.00	-51.24	48.20	20
9608.00	-61.83	58.78	20
12010.00	-68.72	65.67	20
14412.00	-60.59	57.54	20
16814.00	-71.21	68.17	20
19216.00	-63.31	60.26	20
2450.00	-3.13		
4900.00	-47.24	44.11	20
7351.5	-52.30	49.17	20
9798.62	-61.54	58.41	20
12251.69	-69.85	66.72	20
14695.56	-60.19	57.06	20
17155.19	-71.68	68.54	20
19597.10	-70.09	66.96	20
2480.00	-3.37		
4961.41	-50.61	47.24	20
7438.09	-51.31	47.94	20
9921.34	-68.23	64.86	20
12398.03	-65.89	62.52	20
14882.59	-68.85	65.48	20



Frequency (MHz)	Level (dBm)	Level (dBc)	Limit (dBc)
2402.00	-3.05		
4804.00	-44.53	41.48	20
7206.00	-53.34	50.29	20
9608.00	-64.31	61.25	20
12010.00	-68.78	65.73	20
14412.00	-58.81	55.75	20
16814.00	-70.30	67.25	20
19216.00	-61.39	58.34	20
21601.28	-66.29	63.23	20
2450.00	-3.15		
4900.00	-45.84	42.69	20
7351.5	-55.34	52.19	20
9798.62	-63.08	59.93	20
12251.69	-70.32	67.16	20
14695.56	-62.65	59.50	20
19597.10	-64.73	61.58	20
22053.44	-66.10	62.95	20
2480.00	-3.47		
4961.41	-49.16	45.68	20
7438.09	-55.38	51.91	20
12398.03	-65.41	61.94	20
14882.59	-69.89	66.42	20
17363.22	-71.54	68.07	20
22316.59	-66.44	62.97	20



9.6. CONCLUSION

Unwanted Emission into non-restricted frequency bands measurement performed on the sample of the product **BeOn A1 / Safran Aero IoT Radio-8**, SN: **035**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247** limits.

10. UNWANTED EMISSIONS IN RESTRICTED FREQUENCY BANDS

10.1. TEST CONDITIONS

Test performed by : Armand MAHOUGOU & Laurent DENEUX
 Date of test : March 3, 2020 to March 9, 2020
 Ambient temperature : 24°C & 27°C
 Relative humidity : 47% & 45%

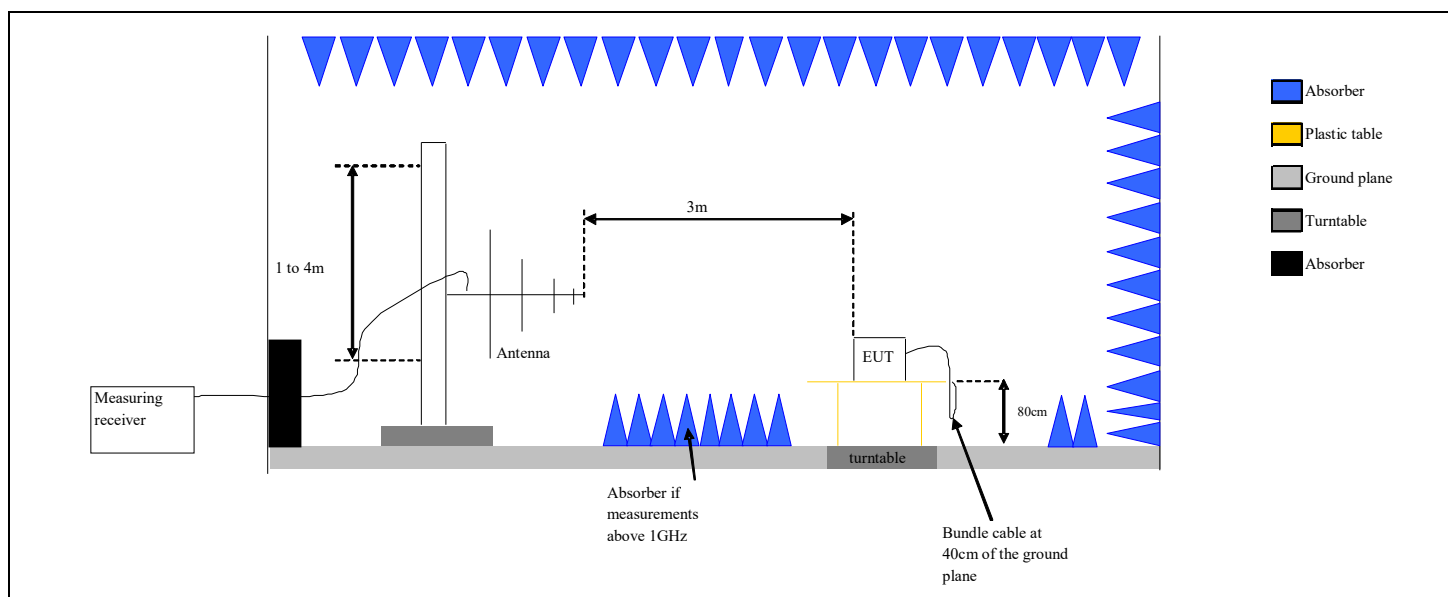
10.2. TEST SETUP

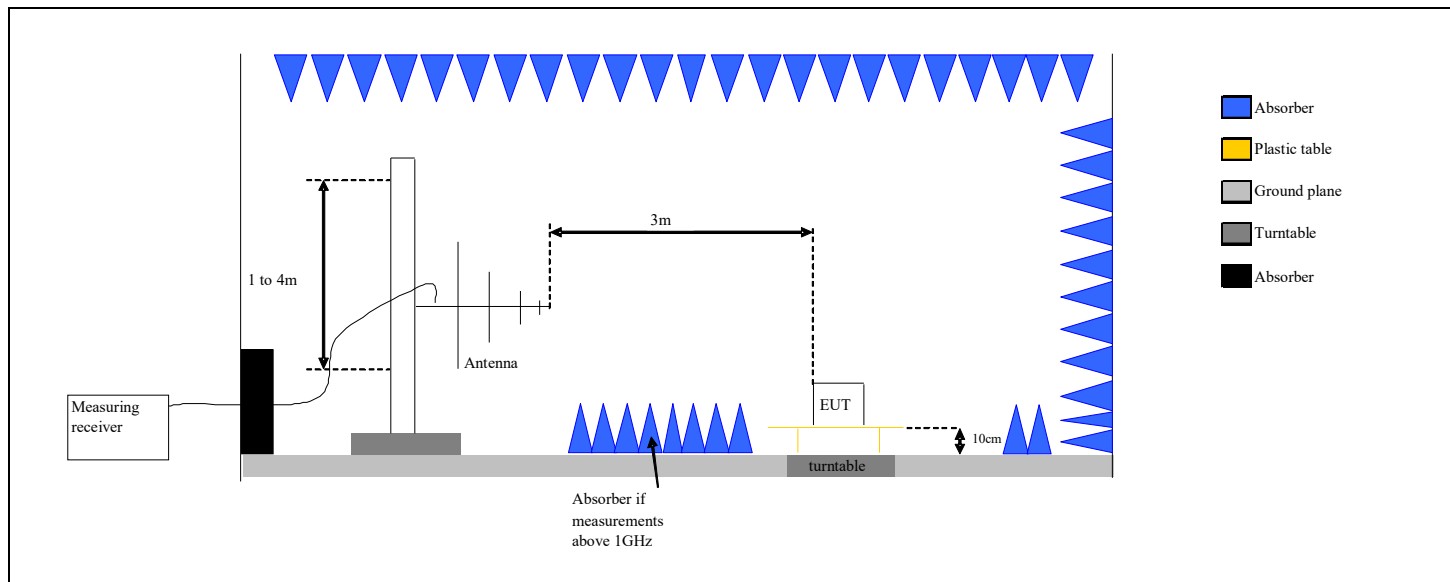
The product has been tested according to ANSI C63.10 (2013) and FCC part 15 subpart C. Test is performed in parallel, perpendicular and ground parallel axis with a loop antenna below 30MHz. Measurement bandwidth was 200Hz below 150kHz and 9kHz between 150kHz & 30MHz. The level has been maximised by the turntable rotation of 360 degrees range on all axis of EUT used in normal configuration. Antenna height was 1m. The EUT is placed **on an open area test site**. Distance between measuring antenna and the EUT is **10m**.

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 all axis of EUT used in normal configuration. The EUT is placed at 1.5m high above 1GHz and at 0.8m high under 1GHz. The EUT is placed **in a full anechoic chamber** above 1GHz and **on an open area test site** from 30MHz to 1GHz. Distance between measuring antenna and the EUT is **10m**. The height antenna is varied from 1m to 4m from 30MHz to 1GHz and above 1GHz is :

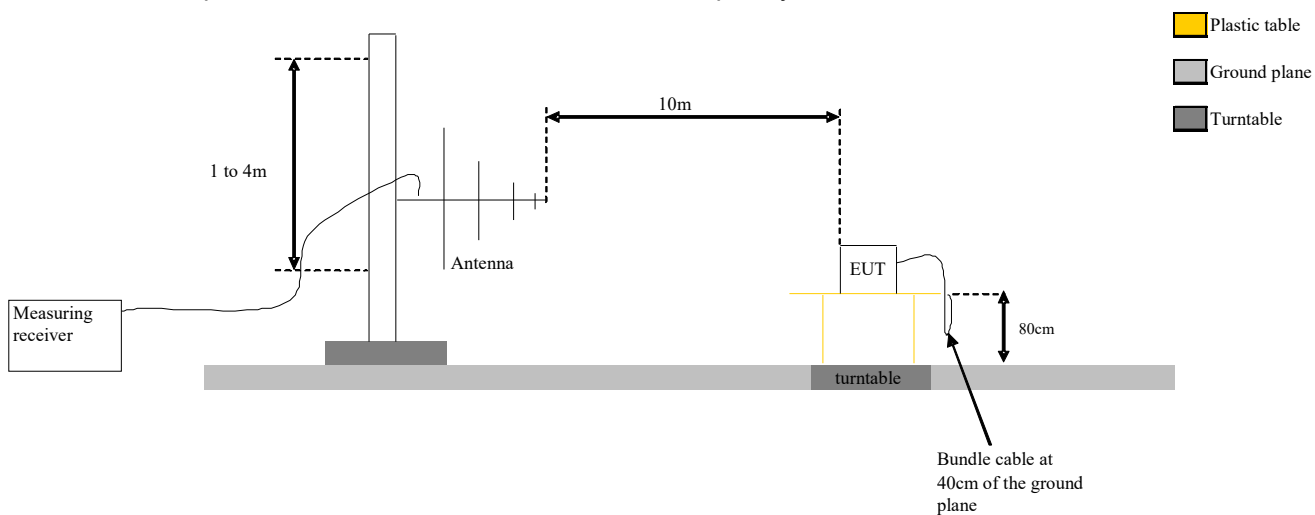
☒ On mast, varied from 1m to 4m

☐ Fixed and centered on the EUT (EUT smaller than the bandwidth of the measurement antenna, ANSI C63.10 §6.6.5)





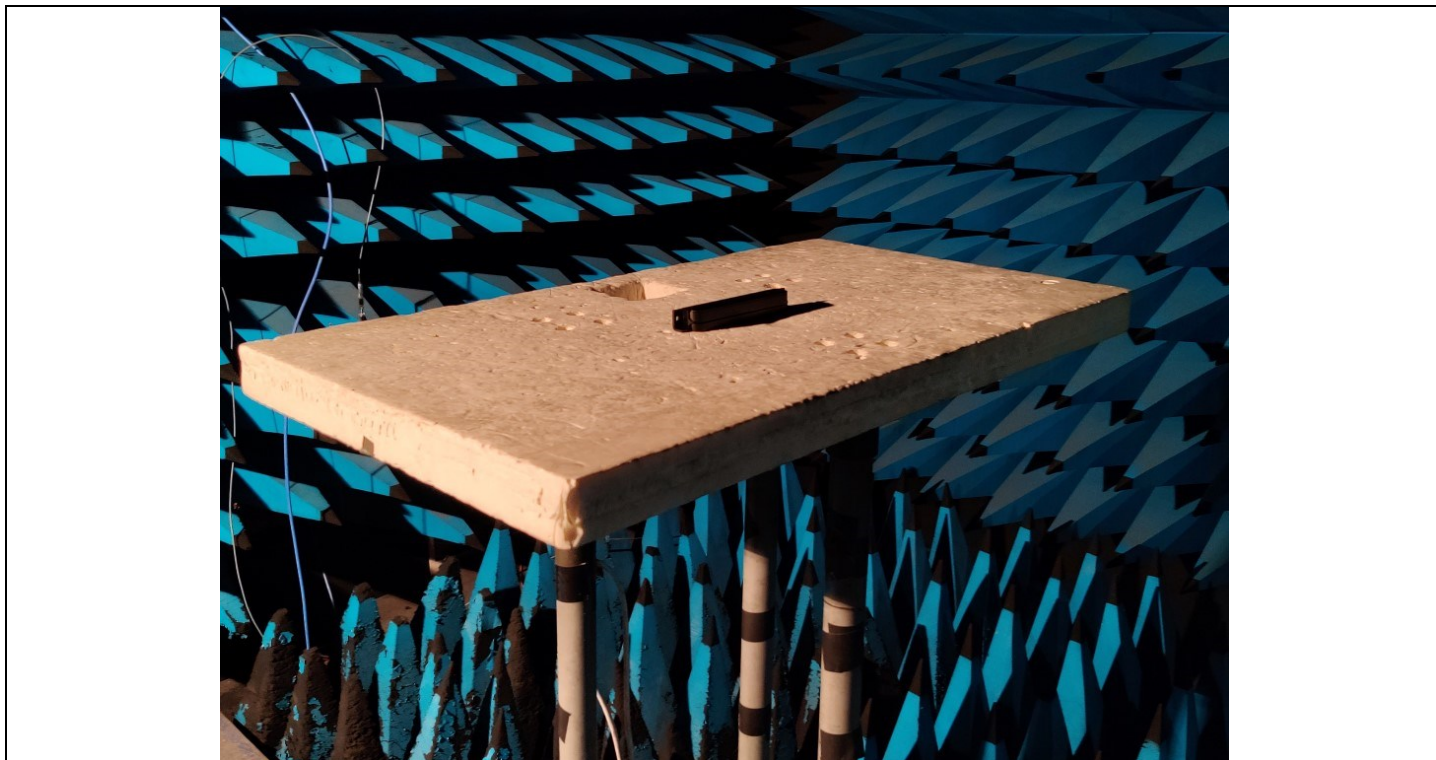
Test set up of Unwanted Emissions in Restricted Frequency Bands in semi anechoic chamber



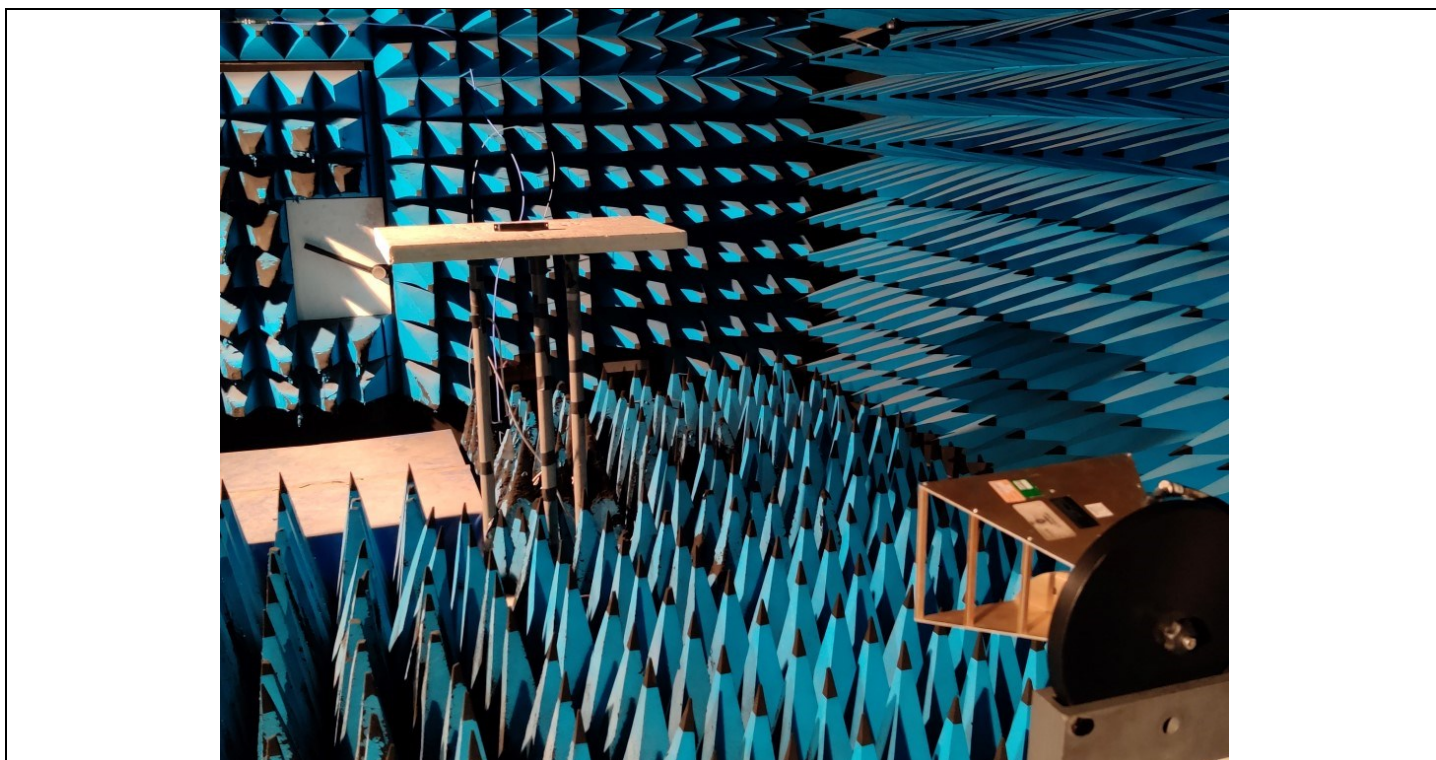
Test Set up for radiated measurement in open area test site



Photograph for Unwanted Emission in restricted frequency bands



Photograph for Unwanted Emission in restricted frequency bands



Photograph for Unwanted Emission in restricted frequency bands

10.3. LIMIT

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

10.4. TEST EQUIPMENT LIST

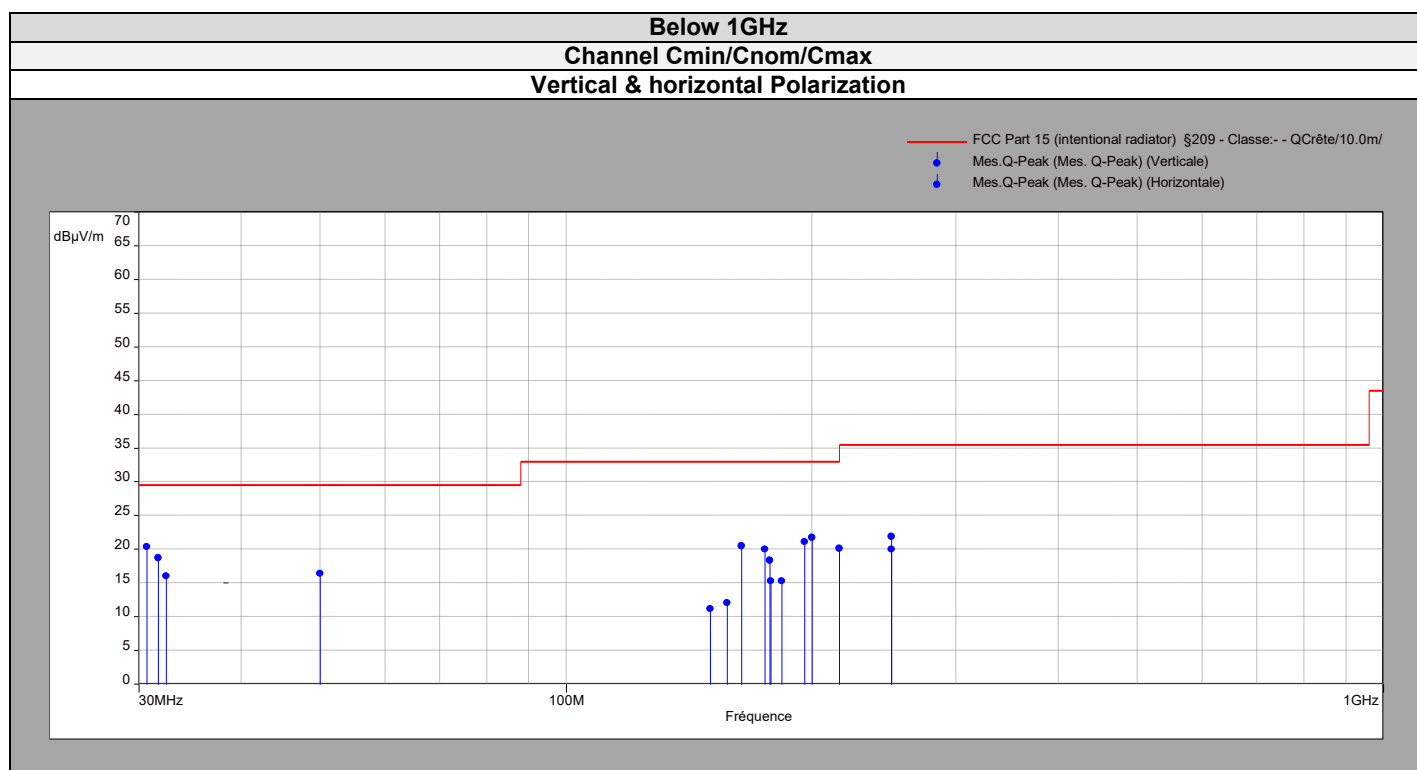
Test equipment used					
Description	Manufacturer	Model	Identifier	Last Calibration date	Calibration due date
Open test site	LCIE	-	F2000400	2019-06	2020-06
EMI Test Receiver	ROHDE & SCHWARZ	ESIB26	A2642021	2018-10	2020-10
Cable	-	-	A5329444	2019-12	2020-12
Bilog antenna	CHASE	CBL 6112A	C2040040	2019-04	2020-04
Cable	-	-	A5329442	2019-12	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	SCHWARZBECK	FMZB1513	C2040209	2018-03	2020-03
Cable	-	-	A5329416	2019-12	2020-12
Full anechoic chamber	SIEPEL	-	D3044019	2018/10	2022/10
Preamplifier	LCIE	LCIE-ALB-001	A7080073	2018/12	2020/12
EMI receiver	ROHDE & SCHWARZ	FSV40GHz	A4060061	2019/05	2021/05
Cable S36 chamber	PASTERNAK	PE360-1000CM	A5329939	2020/01	2021/01
Cable S36 chamber	PASTERNAK	PE360-1500CM	A5329940	2020/01	2021/01
Cable S36 chamber	PASTERNAK	PE360-3000CM	A5329872	2020/01	2021/01
Logperiodic antenna	AMPLIFIER RESEARCH	ATR80M6G	C2040149	2019/11	2021/11
Horn antenna	AH SYSTEMS	SAS 571	C2042041	2019/11	2021/11
Horn antenna (18-26,5GHz)	PASTERNAK	PE9852/2F-20	C2042049	2019/12	2021/12
High Pass Filter 2,4GHz	WAINWRIGHT	WHK12-2494	A7484068	2019/07	2021/07

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



Above 1GHz / LORA Modulation
Above 1GHz Zoom 2310MHz-2500MHz
Cmin/Cnom/Cmax

Vertical Polarization / Antenna 3

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Avg_Channel 79 - Verticale (Verticale)
- Mes.Peak_Channel 77 - Verticale (Verticale)
- Mes.Avg_Channel 77 - Verticale (Verticale)
- Mes.Peak_Channel 78 - Verticale (Verticale)
- Mes.Peak_Channel 79 - Verticale (Verticale)
- Mes.Avg_Channel 78 - Verticale (Verticale)

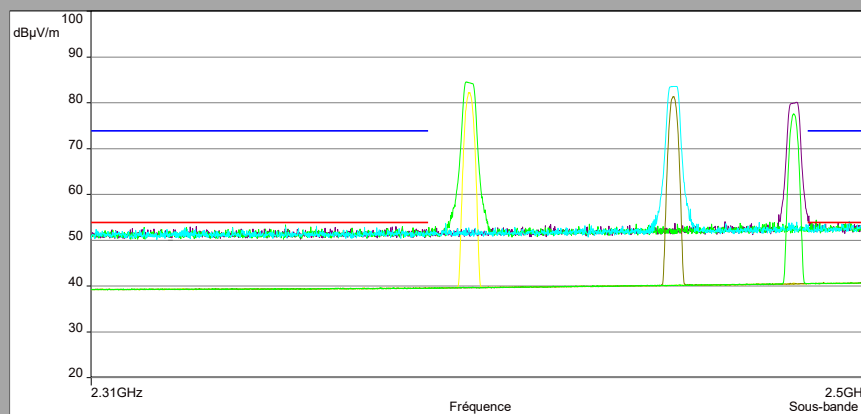
Description Sous-bande 2

Fréquences:2.31 GHz - 2.5 GHz (Mode analyseur) 32001 Points

Réglages: RBW: 1MHz, VBW: 3MHz, Durée balayage : 2 ms/Pts, Atténuation : 5 dB, Nombre de Balayages : 1, Preamp :

Polarisation:Verticale

Distance: 3 m



Horizontal polarization

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak_Channel 78 - Horizontale (Horizontale)
- Mes.Peak_Channel 79 - Horizontale (Horizontale)
- Mes.Avg_Channel 78 - Horizontale (Horizontale)
- Mes.Avg_Channel 79 - Horizontale (Horizontale)
- Mes.Peak_Channel 77 - Horizontale (Horizontale)
- Mes.Avg_Channel 77 - Horizontale (Horizontale)

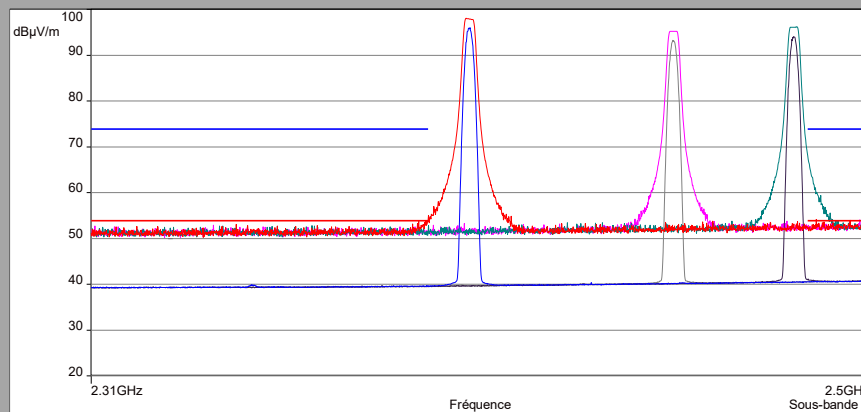
Description Sous-bande 1

Fréquences:2.31 GHz - 2.5 GHz (Mode analyseur) 32001 Points

Réglages: RBW: 1MHz, VBW: 3MHz, Durée balayage : 2 ms/Pts, Atténuation : 5 dB, Nombre de Balayages : 1, Preamp :

Polarisation:Horizontale

Distance: 3 m

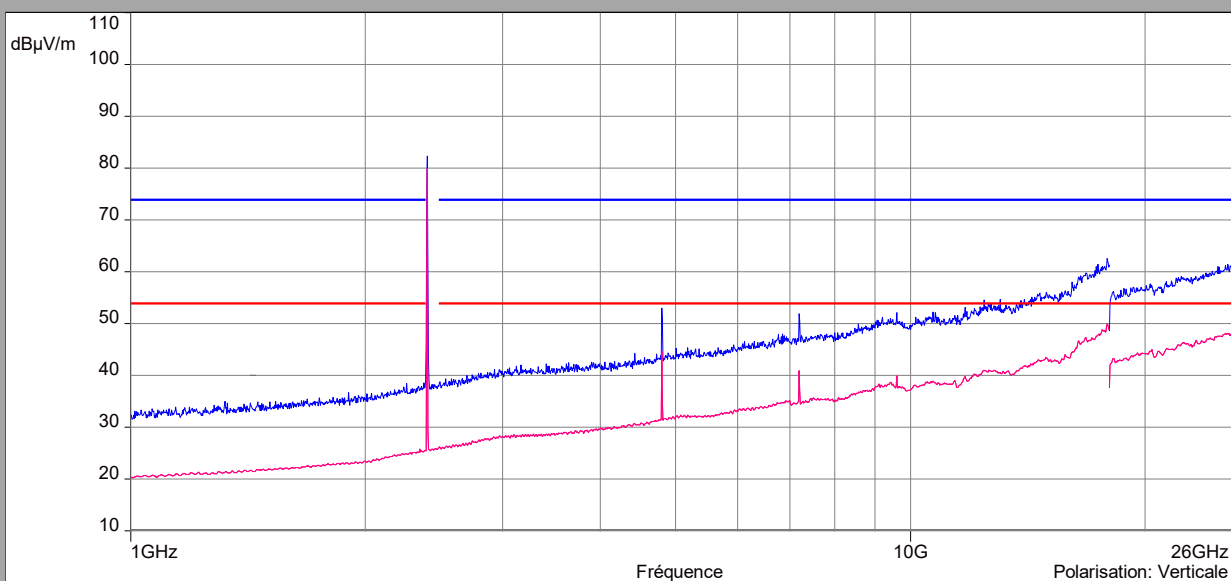


Above 1GHz / LORA Modulation

Cmin

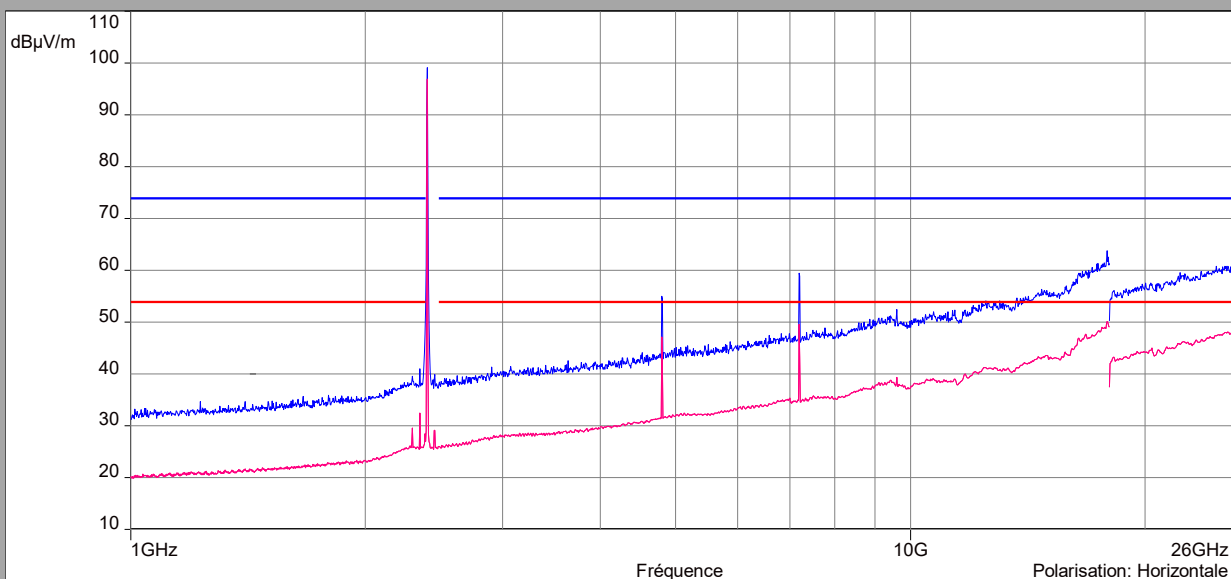
Vertical Polarization / Antenna 3

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak (Verticale)
- Mes.Avg (Verticale)



Horizontal polarization

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak (Horizontale)
- Mes.Avg (Horizontale)

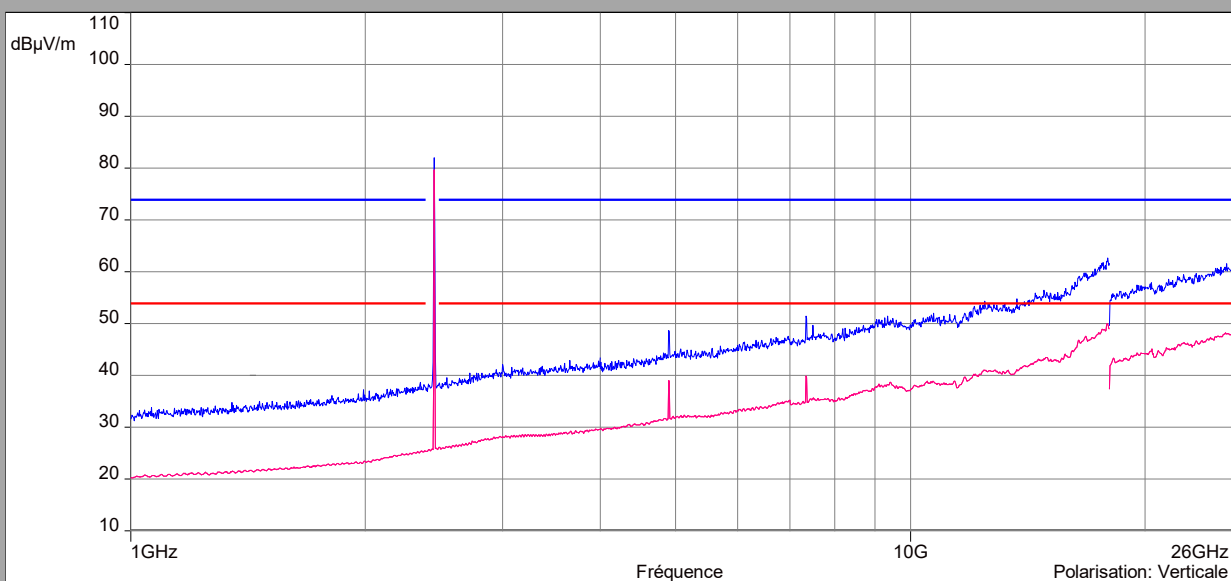


Above 1GHz / LORA Modulation

Cnom

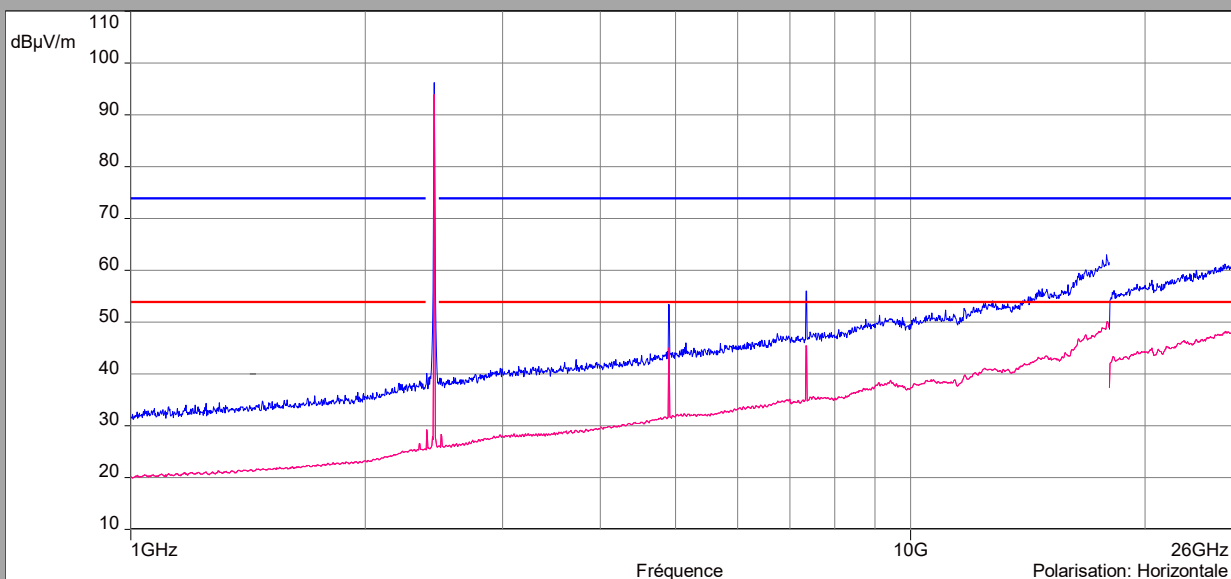
Vertical Polarization / Antenna 3

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak (Verticale)
- Mes.Avg (Verticale)



Horizontal polarization

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak (Horizontale)
- Mes.Avg (Horizontale)

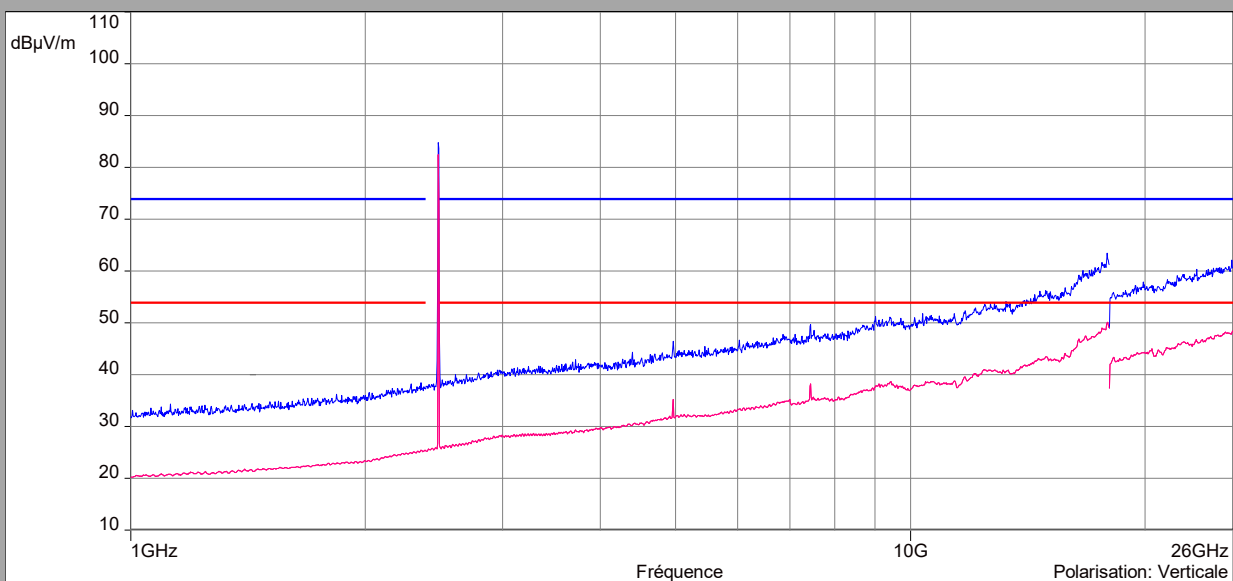


Above 1GHz / LORA Modulation

Cmax

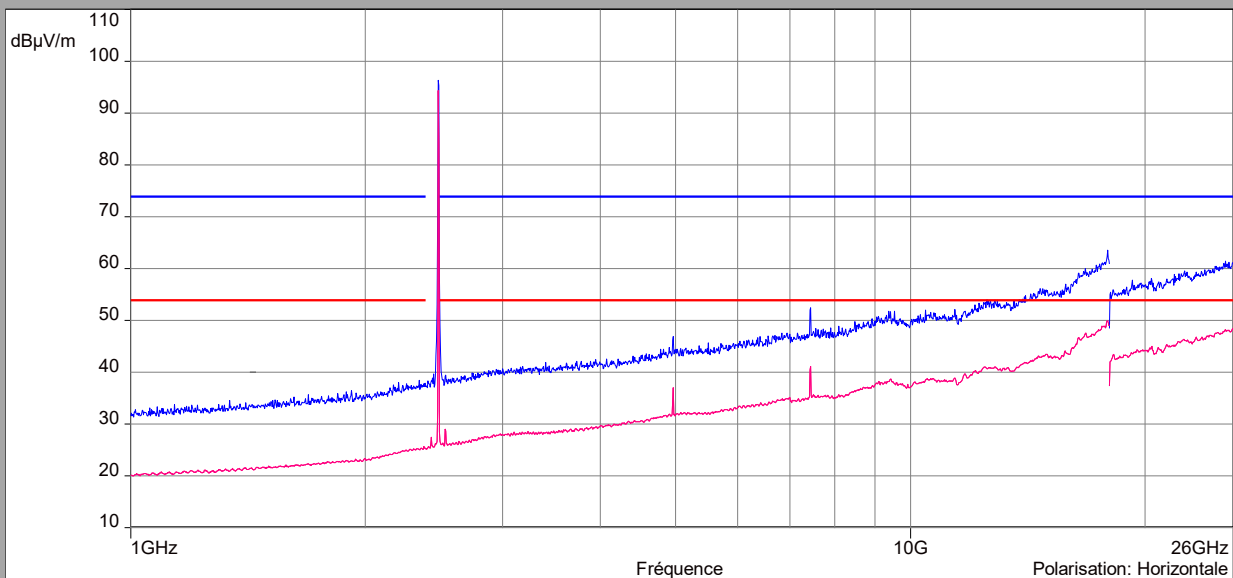
Vertical Polarization / Antenna 3

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak (Verticale)
- Mes.Avg (Verticale)



Horizontal polarization

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak (Horizontale)
- Mes.Avg (Horizontale)



Above 1GHz / LORA Modulation
Above 1GHz Zoom 2310MHz-2500MHz
Cmin/Cnom/Cmax

Vertical Polarization / Antenna 4

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Avg_Channel 82 - Verticale (Verticale)
- Mes.Peak_Channel 80 - Verticale (Verticale)
- Mes.Avg_Channel 80 - Verticale (Verticale)
- Mes.Peak_Channel 81 - Verticale (Verticale)
- Mes.Peak_Channel 82 - Verticale (Verticale)
- Mes.Avg_Channel 81 - Verticale (Verticale)

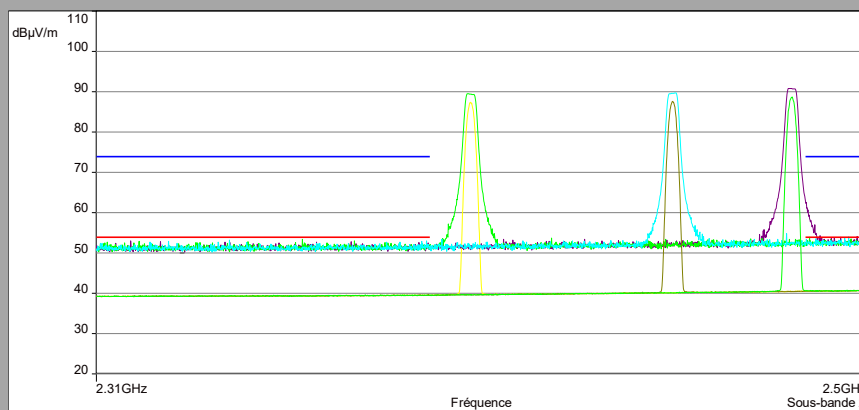
Description Sous-bande 2

Fréquences:2.31 GHz - 2.5 GHz (Mode analyseur) 32001 Points

Réglages: RBW: 1MHz, VBW: 3MHz, Durée balayage : 2 ms/Pts, Atténuation : 5 dB, Nombre de Balayages : 1, Preamp : (

Polarisation:Verticale

Distance: 3 m



Horizontal polarization

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak_Channel 81 - Horizontale (Horizontale)
- Mes.Peak_Channel 82 - Horizontale (Horizontale)
- Mes.Avg_Channel 81 - Horizontale (Horizontale)
- Mes.Avg_Channel 82 - Horizontale (Horizontale)
- Mes.Peak_Channel 80 - Horizontale (Horizontale)
- Mes.Avg_Channel 80 - Horizontale (Horizontale)

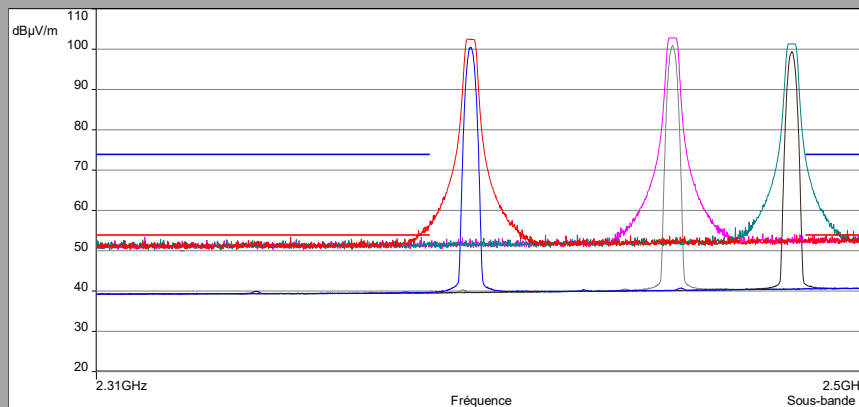
Description Sous-bande 1

Fréquences:2.31 GHz - 2.5 GHz (Mode analyseur) 32001 Points

Réglages: RBW: 1MHz, VBW: 3MHz, Durée balayage : 2 ms/Pts, Atténuation : 5 dB, Nombre de Balayages : 1, Preamp : (

Polarisation:Horizontale

Distance: 3 m

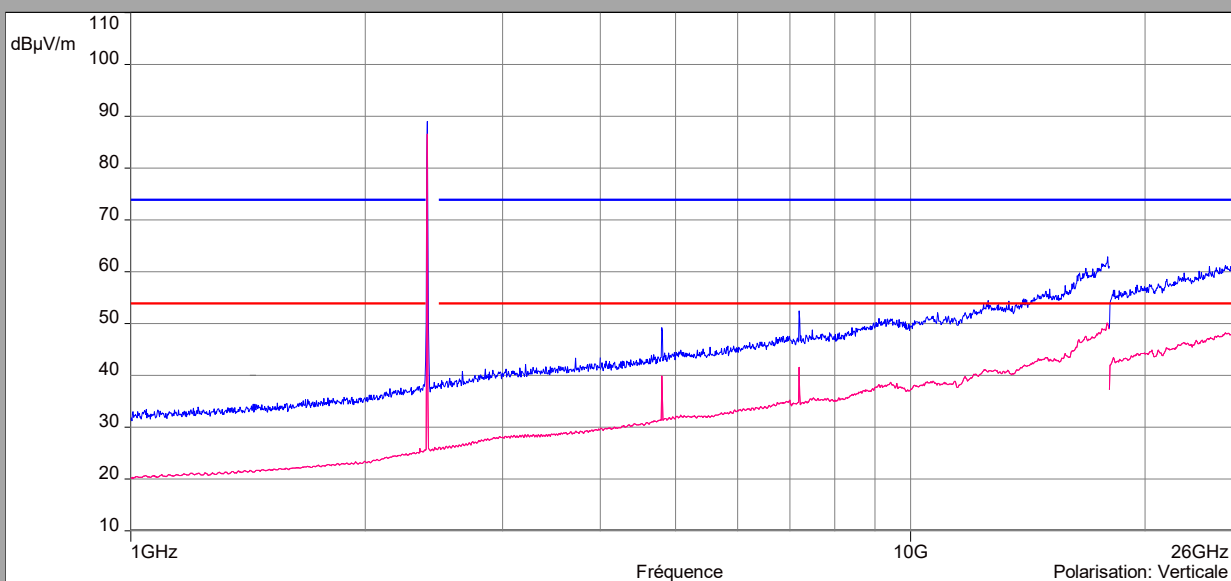


Above 1GHz / LORA Modulation

Cmin

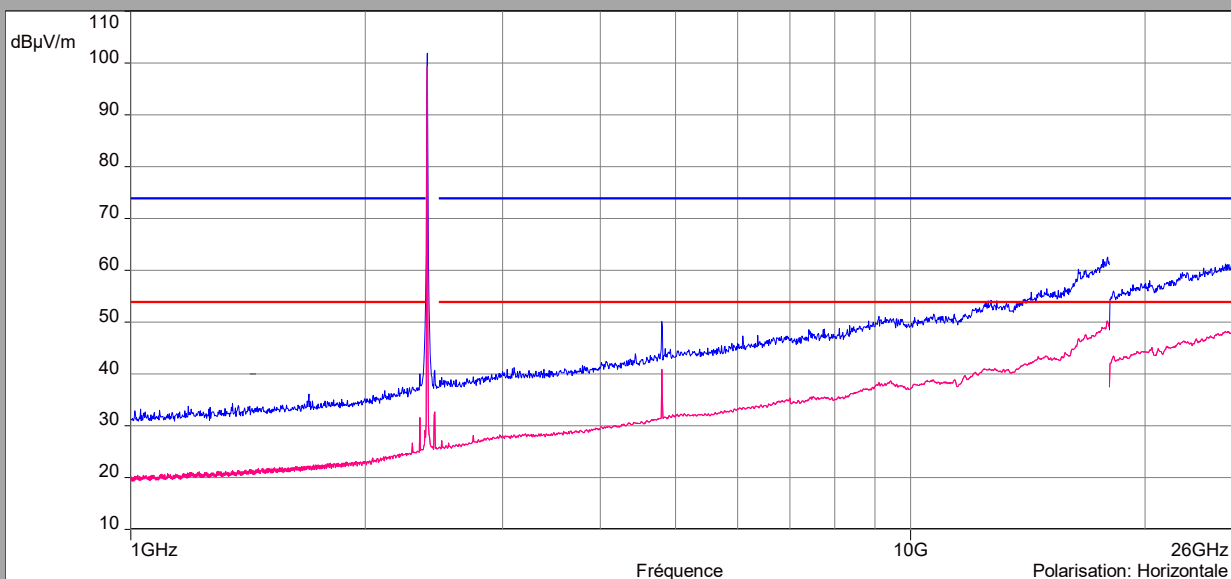
Vertical Polarization / Antenna 4

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak (Verticale)
- Mes.Avg (Verticale)



Horizontal polarization

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak (Horizontale)
- Mes.Avg (Horizontale)

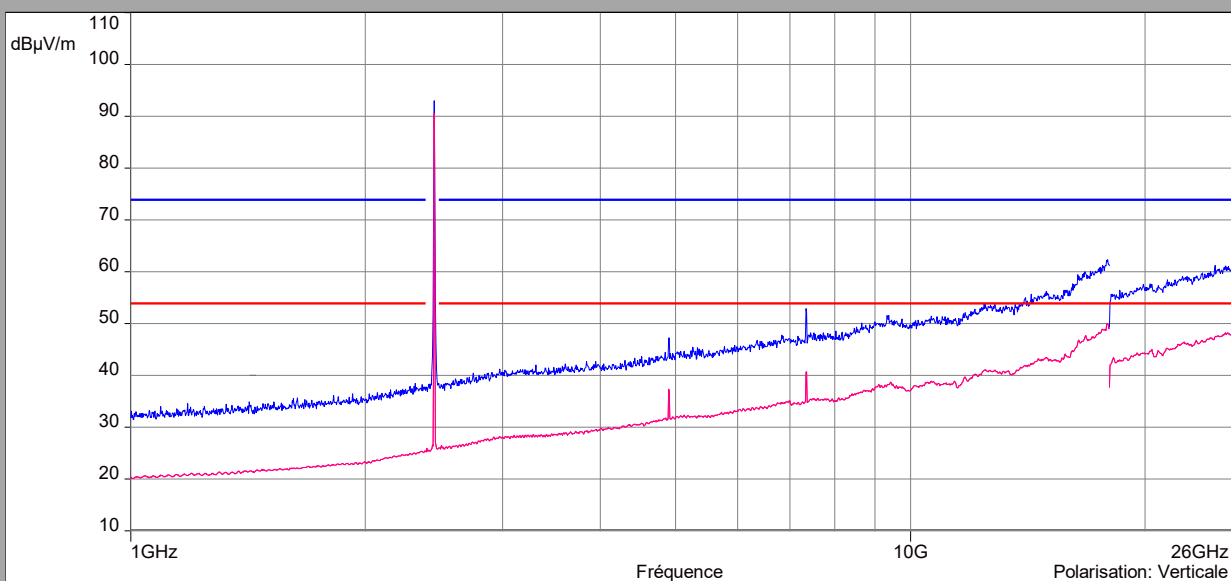


Above 1GHz / LORA Modulation

Cnom

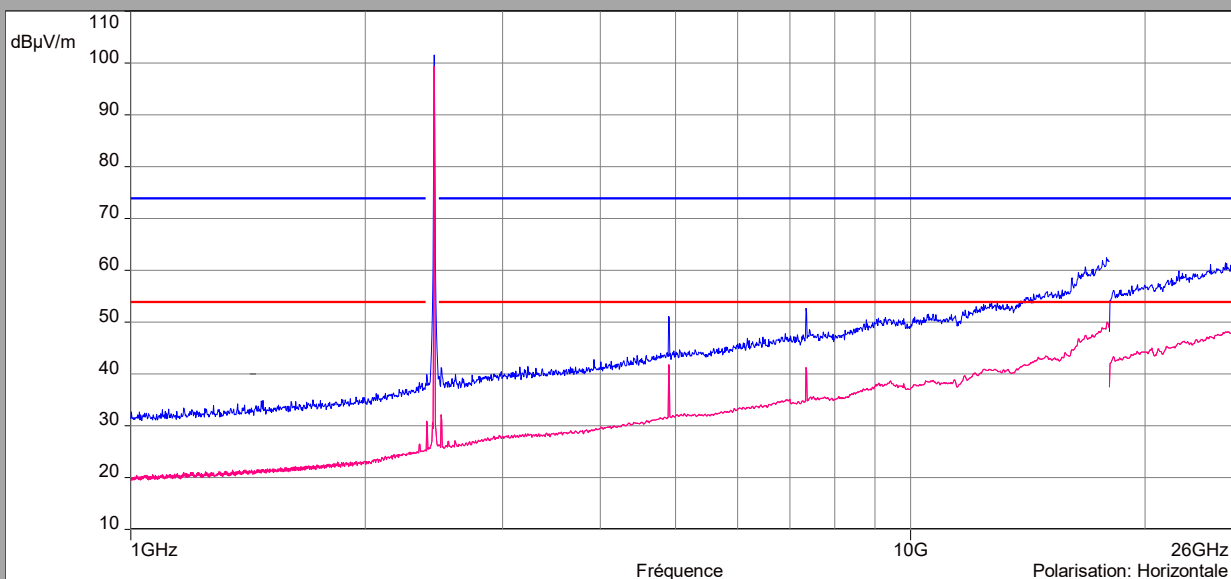
Vertical Polarization / Antenna 4

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak (Verticale)
- Mes.Avg (Verticale)



Horizontal polarization

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak (Horizontale)
- Mes.Avg (Horizontale)

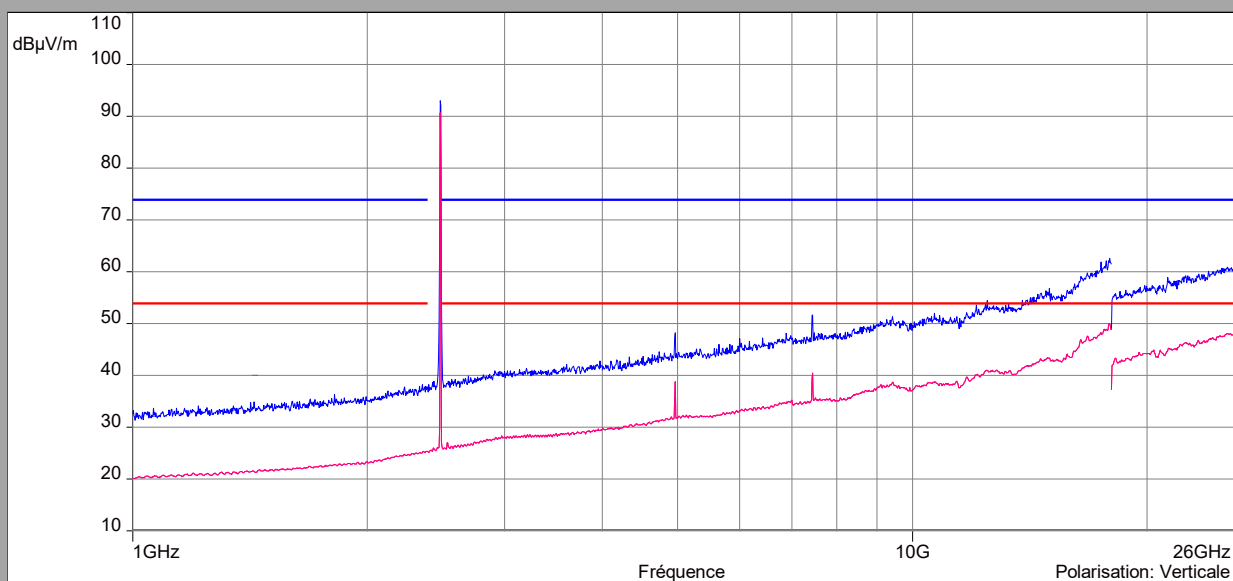


Above 1GHz / LORA Modulation

Cmax

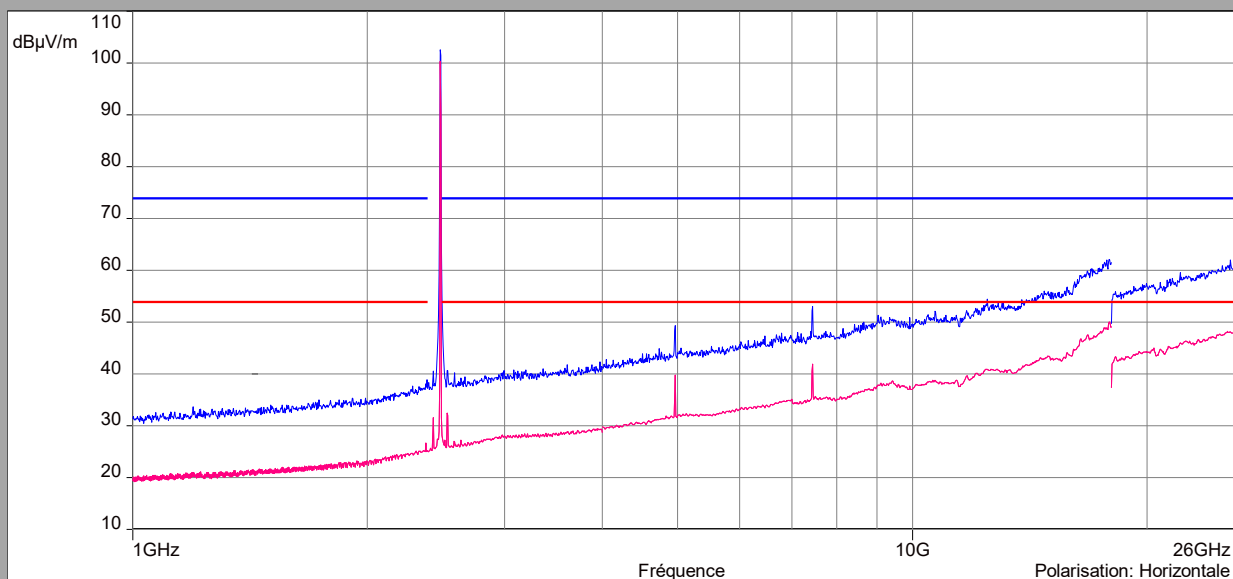
Vertical Polarization / Antenna 4

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak (Verticale)
- Mes.Avg (Verticale)



Horizontal polarization

- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Moyenne/3.0m/
- FCC/FCC 15.209 2400MHz-2483MHz Band - Classe:1 - Crête/3.0m/
- Mes.Peak (Horizontale)
- Mes.Avg (Horizontale)



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	30.7	-	20.42	29.5	9.08
Vertical	31.7	-	18.67	29.5	10.83
Vertical	32.4	-	16.05	29.5	13.45
Vertical	50	-	16.39	29.5	13.11
Vertical	164	-	20.49	33	12.51
Vertical	177.4	-	18.36	33	14.64
Vertical	195.7	-	21.12	33	11.88
Vertical	216	-	20.1	33	12.9
Vertical	250	-	21.87	35.5	13.63
Horizontal	150	-	11.17	33	21.83
Horizontal	157.5	-	12.07	33	20.93
Horizontal	175	-	20.06	33	12.94
Horizontal	177.9	-	15.34	33	17.66
Horizontal	183.7	-	15.34	33	17.66
Horizontal	200	-	21.74	33	11.26
Horizontal	250	-	20.03	35.5	15.47

Above 1GHz								
Cmin/Cnom/Cmax ANT 3								
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)
Horizontale	2390	39.39	39,65	54	14,35	51.07	74	22,93
Verticale	2390	39.39	39,65	54	14,35	49.41	74	24,59
Horizontale	2483.5	42.14	42,4	54	11,6	67.70	74	6,3
Verticale	2483.5	40.50	40,76	54	13,24	51.78	74	22,22
Horizontale	4799.75	47.17	47,43	54	6,57	54.97	74	19,03
Verticale	4799.75	44.71	44,97	54	9,03	53.06	74	20,94
Horizontale	4899.94	45.04	45,3	54	8,7	53.46	74	20,54
Verticale	4899.94	38.99	39,25	54	14,75	48.66	74	25,34
Horizontale	4960.31	36.98	37,24	54	16,76	46.87	74	27,13
Horizontale	7199.88	49.54	49,8	54	4,2	59.46	74	14,54
Verticale	7199.88	40.92	41,18	54	12,82	51.90	74	22,1
Horizontale	7350.81	45.47	45,73	54	8,27	56.02	74	17,98
Verticale	7350.81	39.93	40,19	54	13,81	51.46	74	22,54
Horizontale	7440.94	41.07	41,33	54	12,67	52.50	74	21,5

Above 1GHz								
Cmin/Cnom/Cmax ANT4								
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)
Horizontale	2390	39.54	39,8	54	14,2	54.44	74	19,56
Verticale	2390	39.38	39,64	54	14,36	49.40	74	24,6
Horizontale	2483.5	41.14	41,4	54	12,6	72.88	74	1,12
Verticale	2483.5	40.38	40,64	54	13,36	61.70	74	12,3
Horizontale	4798.44	40.93	41,19	54	12,81	50.12	74	23,88
Verticale	4798.44	39.88	40,14	54	13,86	49.18	74	24,82
Horizontale	4898.62	41.77	42,03	54	11,97	51.15	74	22,85
Verticale	4898.62	37.33	37,59	54	16,41	47.23	74	26,77
Horizontale	4960.75	39.73	39,99	54	14,01	49.32	74	24,68
Verticale	4960.75	38.80	39,06	54	14,94	48.25	74	25,75
Verticale	7202.06	41.52	41,78	54	12,22	52.44	74	21,56
Horizontale	7349.94	41.25	41,51	54	12,49	52.65	74	21,35
Verticale	7349.94	40.69	40,95	54	13,05	52.87	74	21,13
Horizontale	7440.06	41.86	42,12	54	11,88	52.96	74	21,04
Verticale	7440.06	40.44	40,7	54	13,3	51.69	74	22,31

10.7. CONCLUSION

Unwanted Emission in restricted frequency bands measurement performed on the sample of the product **BeOn A1 / Safran Aero IoT Radio-8**, SN: **035**, in configuration and description presented in this test report, show levels **compliant** to the 47 CFR PART 15.247 limits.

11. UNCERTAINTIES CHART

47 CFR Part 15.209 & 15.207 Kind of test	Wide uncertainty laboratory (k=2) $\pm x(\text{dB}) / (\text{Hz}) / \text{ms}$	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