TEST REPORT

N°: 166555-749603-B(FILE#1033512) **Version : 02**

Subject	**Radio spectrum matters tests according to standards: 47 CFR Part 15.247 & RSS-247 Issue 2 & RSS-Gen Issue 5**
Issued to	**CSM** 62 Boulevard Diderot 75012 - PARIS FRANCE
Apparatus under test	
↳ Product	**Human Presence detector – WX sensor**
↳ Trade mark	**CSM**
↳ Manufacturer	**ASTEEL FLASH**
↳ Model range	**WX SENSOR-NC-SR-YPA-DP-1B / WX SENSOR-NC-SR-YPA-DP-2B / WX SENSOR-NC-SR-YPA-CP-1B / WX SENSOR-NC-SR-YPA-CP-2B / WX SENSOR-YC-SR-YPA-CC-2B**
↳ Model under test	**WX SENSOR-YC-SR-YPA-CC-2B**
↳ Serial number	**SCC13 & SCC1**
↳ FCC ID	**2ASLE-NCSR**
↳ IC	**26875-NCSR**
Conclusion	See Test Program chapter
Test date	March 17, 2020 to May 18, 2020
Test location	Moirans
Test Site	6500A
Sample receipt date	May 12, 2020
Composition of document	46 pages
Document issued on	June 10, 2021

Written by :
Gaetan DESCHAMPS
Tests operator

Approved by :
Anthony MERE
Technical manager

LABORATOIRE CENTRAL DES INDUSTRIES ELECTRIQUES
LCIE SUD-EST
ZI Centr'Alp
170 Rue de Chatagnon
38430 MOIRANS
Tél 04 76 07 36 36
Fax 04 76 55 90 88

This document shall not be reproduced, except in full, without the written approval of the LCIE. This document contains results related only to the items tested. It does not imply the conformity of the whole production to the items tested. Unless otherwise specified or rule defined by the test method, the decision of conformity doesn't take into account the uncertainty of measures. This document doesn't anticipate any certification decision.

PUBLICATION HISTORY

Version	Date	Author	Modification
01	August 10, 2020	Gaetan DESCHAMPS	Creation of the document
02	June 10, 2021	Gaetan DESCHAMPS	Adding FCC/IC informations

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

1. TEST PROGRAM 4
2. EQUIPMENT UNDER TEST: CONFIGURATION (DECLARED BY PROVIDER) 5
3. HOPPING : OCCUPIED BANDWIDTH 9
4. HOPPING : 20DB EMISSION BANDWIDTH 13
5. HOPPING : NUMBER OF HOPPING FREQUENCY 17
6. HOPPING : CARRIER FREQUENCY SEPARATION 20
7. HOPPING : TIME OF OCCUPANCY 23
8. HOPPING : DUTY CYCLE 25
9. HOPPING : MAXIMUM CONDUCTED OUTPUT POWER 26
10. HOPPING : UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS AT THE BAND EDGE 29
11. HOPPING : UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS 32
12. HOPPING : UNWANTED EMISSIONS IN RESTRICTED FREQUENCY BANDS 35
13. UNCERTAINTIES CHART 46

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 Hopping mode:

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)
20dB Bandwidth	☑ PASS	☐ FAIL	☐ NA	☐ NP(1)
Number of Hopping Frequency	☑ PASS	☐ FAIL	☐ NA	☐ NP(1)
Carrier Frequency Separation	☑ PASS	☐ FAIL	☐ NA	☐ NP(1)
Time of Occupancy	☑ PASS	☐ FAIL	☐ NA	☐ NP(1)
Duty Cycle	☐ PASS	☐ FAIL	☑ NA	☐ NP(1)
Maximum Conducted Output Power	☑ 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)

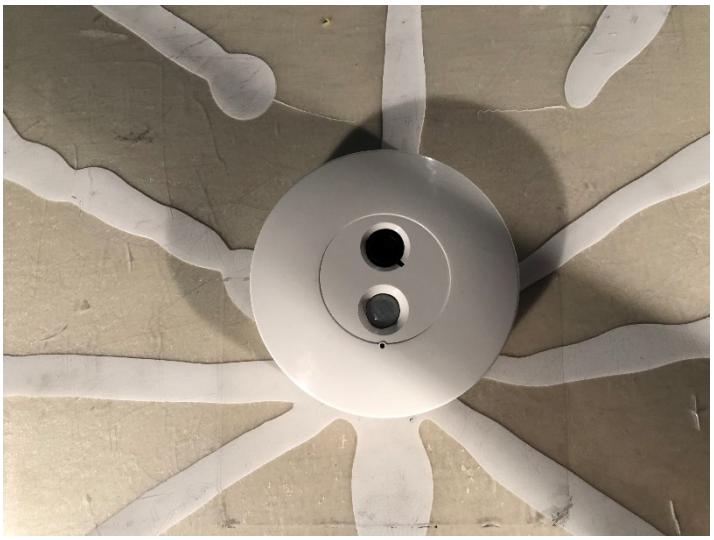
2.1. *INFORMATION*

Tests are performed on the most complete product **CSM WX SENSOR-YC-SR-YPA-CC-2B**, SN: **SCC13 & SCC1** See Table below for difference between products.

Reference	Electronic reference	Mechanical reference	Battery
WX SENSOR-NC-SR-YPA-DP-1B	WX SENSOR-Sigfox with PA	Desk	1
WX SENSOR-NC-SR-YPA-DP-2B	WX SENSOR-Sigfox with PA	Desk	2
WX SENSOR-NC-SR-YPA-CP-1B	WX SENSOR-Sigfox with PA	Ceiling	1
WX SENSOR-NC-SR-YPA-CP-2B	WX SENSOR-Sigfox with PA	Ceiling	2
WX SENSOR-YC-SR-YPA-CC-2B	WX SENSOR-Sigfox with PA + Comptage	Ceiling Comptage	2

2.2. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):
CSM WX SENSOR-YC-SR-YPA-CC-2B **Serial Number: SCC13 & SCC1**



Equipment Under Test

Power supply:
During all the tests, EUT is supplied by V_{nom}: 3VDC
For measurement with different voltage, it will be presented in test method.

Name	Type	Rating	Mark / Sn	Comments
Battery	☐ AC ☐ DC ☑ Battery	3VDC	SZENBAR / CR 17505	Lithium

Inputs/outputs – Cable/:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Comments
None						

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
raspiCEM03	pi / oiadmin	-	-

Equipment information:

Type:	**Sigfox**		
Frequency band:	[902 – 928] MHz		
Number of Channel:	54		
Antenna Type:	☑ Integral	☐ External	☐ Dedicated
Antenna connector:	☐ Yes	☑ No	☑ Temporary for test
Transmit chains:	☑ 1	☐ 2	
Receiver chains	☑ 1	☐ 2	
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	
Type of power source:	☐ AC power supply	☐ DC power supply	☑ Battery
Operating voltage range:	Vnom:	☐ 120V/60Hz	☑3 Vdc
		☐ 240V/50Hz	☐ X Vdc

Antenna Characteristic			
Antenna assembly	**Gain (dBi)**	**Frequency Band (MHz)**	**Impedance(Ω)**
1	0	[902 – 928] MHz	50

	CHANNEL PLAN					
	Micro Channels number					
Macro Channels	**Channel1**	**Channel2**	**Channel3**	**Channel4**	**Channel5**	**Channel6**
N°1	902.1375	902.1625	902.1875	902.2125	902.2375	902.2625
N°2	902.4375	902.4625	902.4875	902.5125	902.5375	902.5625
N°3	902.7375	902.7625	902.7875	902.8125	902.8375	902.8625
N°4	903.0375	903.0625	903.0875	903.1125	903.1375	903.1625
N°5	903.3375	903.3625	903.3875	903.4125	903.4375	903.4625
N°6	903.6375	903.6625	903.6875	903.7175	903.7375	903.7625
N°7	903.9375	903.9625	903.9875	904.0125	904.0375	904.0625
N°8	904.2375	904.2625	904.2875	904.3125	904.3375	904.3625
N°9	904.5375	904.5625	904.5875	904.6125	904.6375	904.6625

Modulation Type	**Worst Case Modulation**
600bps	☑
100bps	☐

Hardware information		
Software (if applicable):raspiCEM_csm_certification	**V. :**	**1.0.28**
The order power is set at 22dBm.		

2.3. 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 mode 2	Permanent emission with modulation & hopping in the data rate that produced the highest power
Test mode 3	Permanent reception

Test	Running mode	
Occupied Bandwidth	☑ Test mode 1 (1)	☐ Alternative test mode()
20dB Bandwidth	☑ Test mode 1 (1)	☐ Alternative test mode()
Number of Hopping Frequency	☑ Test mode 2 (1)	☐ Alternative test mode()
Carrier Frequency Separation	☑ Test mode 1 (1)	☐ Alternative test mode()
Time of Occupancy	☑ Test mode 2 (1)	☐ Alternative test mode()
Duty Cycle	☑ Test mode 1 (1)	☐ Alternative test mode()
Maximum Conducted Output Power	☑ 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()
AC Power Line Conducted Emission	☑ Test mode 2 (1)	☐ Alternative test mode()
Unwanted Emissions into Restricted Frequency Bands	☑ Test mode 1 (1)	☐ Alternative test mode()
Receiver Radiated emissions	☑ Test mode 3 (1)	☐ Alternative test mode()

(1) Following commands with the specific test software “X” are used to set the product:
   a. – See document “X”(provided by customer) for the command used during test.

2.4. EQUIPMENT LABELLING

None

2.5. EQUIPMENT MODIFICATION

☑ None ☐ Modification:

3. HOPPING : OCCUPIED BANDWIDTH

3.1. TEST CONDITIONS

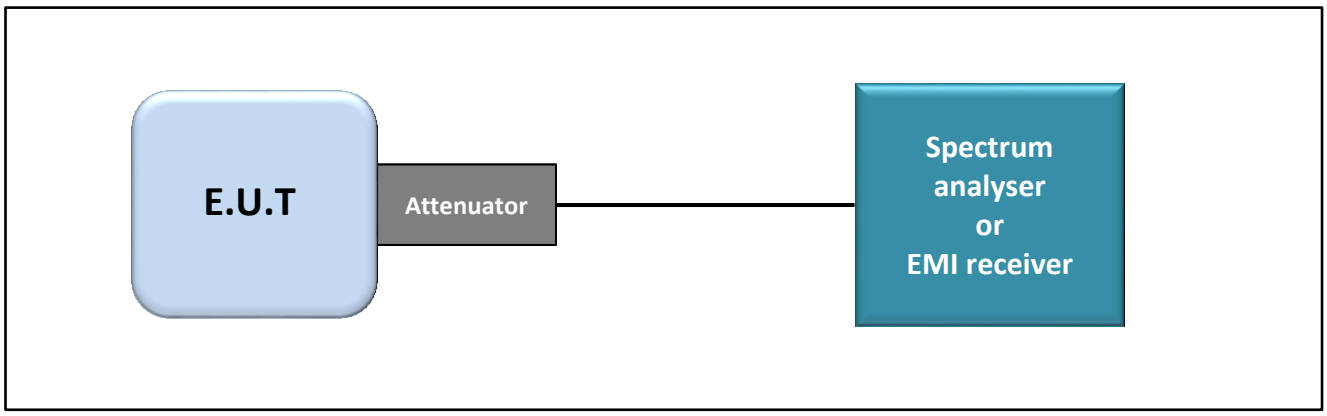
Test performed by	: Gaetan DESCHAMPS
Date of test	: July 21, 2020
Ambient temperature	: 23 °C
Relative humidity	: 32 %

3.2. TEST SETUP

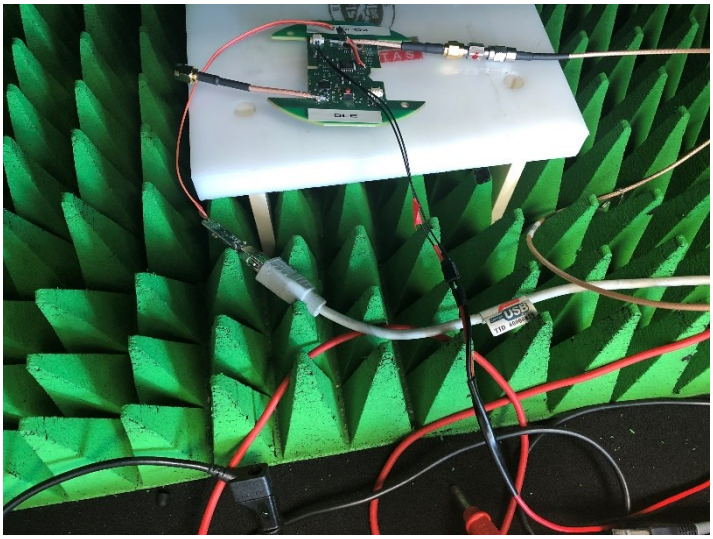
- The Equipment Under Test is installed:
☐ On a table
☑ In an anechoic chamber

- 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



Test set up



Photograph for Occupied bandwidth

3.3. LIMIT

None

3.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
CABLE SMA 1m	RADIALL	18GHz	A5329862	11/18	05/20
DC POWER SUPPLY 20V	HEWLETT PACKARD	6632A	A7042061		
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	05/21	05/23
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Attenuator 10dB	AEROFLEX	_	A7122269	12/18	06/20
SMA 1.5m	SUCOFLEX	18GHz	A5329864	11/18	05/20

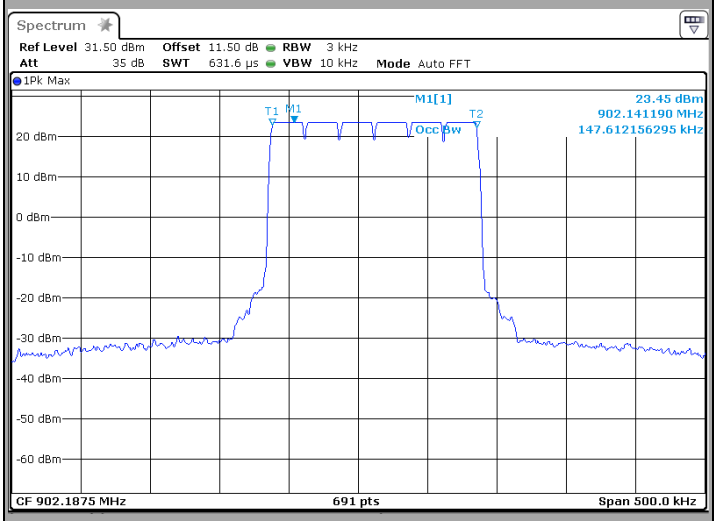
Note: In our quality system, the test equipment calibration due is more & less 4 months

3.5. RESULTS

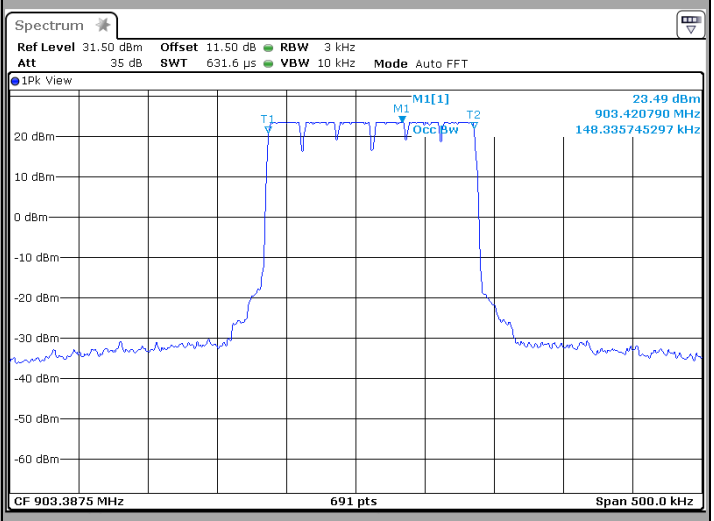
Macro channels:

Occupied Bandwidth

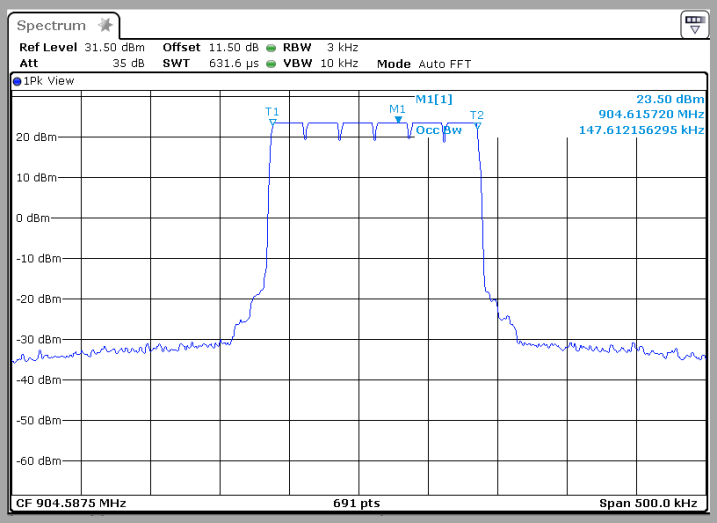
Cmin



Cnom



Cmax

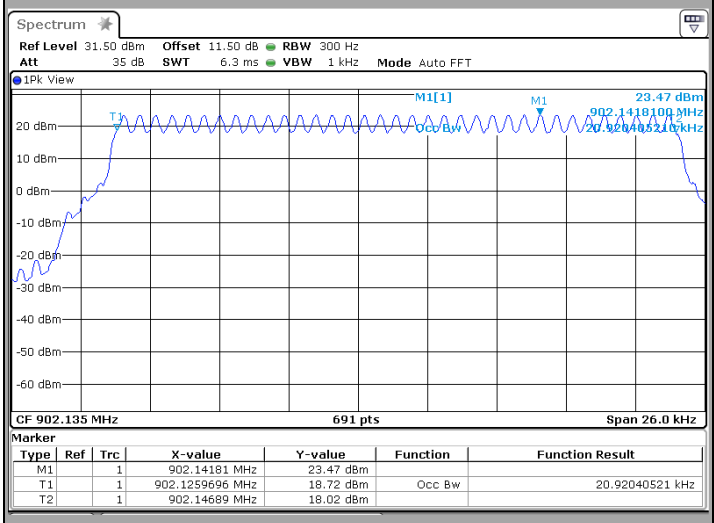


Channel	Occupied Bandwidth (kHz)
Cmin	147.612
Cnom	148.335
Cmax	147.612

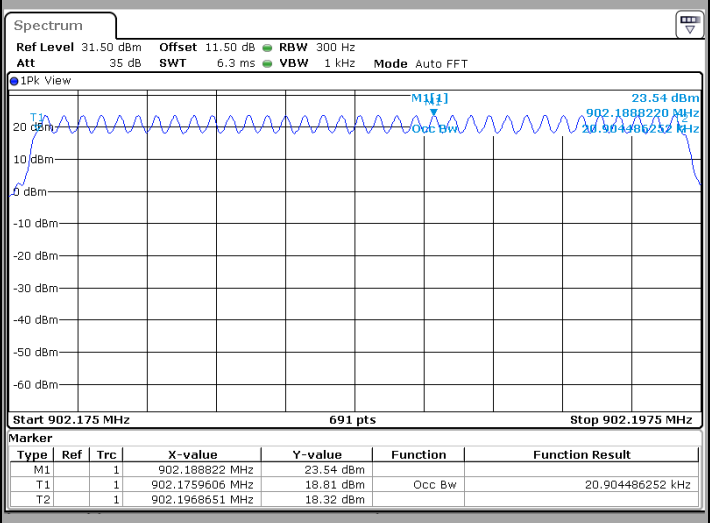
Micro channels (realized on Cmin of Macro-channels):

Occupied Bandwidth

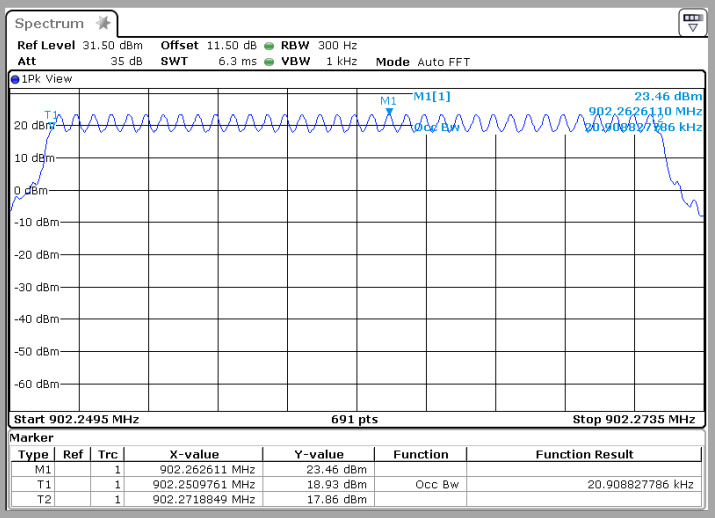
Cmin 902.135



Cnom 902.175 902.1975



Cmax 902.2495 902.2735



Channel	Occupied Bandwidth (kHz)
Cmin	20.920
Cnom	20.904
Cmax	20.908

3.6. CONCLUSION

Occupied Channel Bandwidth measurement performed on the sample of the product **CSM WX SENSOR-YC-SR-YPA-CC-2B**, SN: **SCC13**, 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. HOPPING : 20DB EMISSION BANDWIDTH

4.1. TEST CONDITIONS

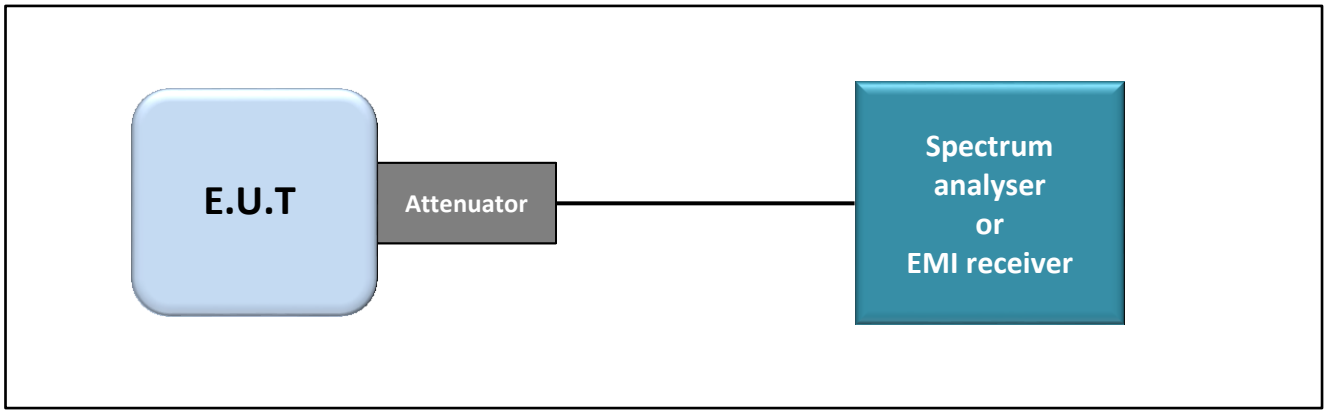
Test performed by	: Gaetan DESCHAMPS
Date of test	: July 21, 2020
Ambient temperature	: 23 °C
Relative humidity	: 32 %

4.2. TEST SETUP

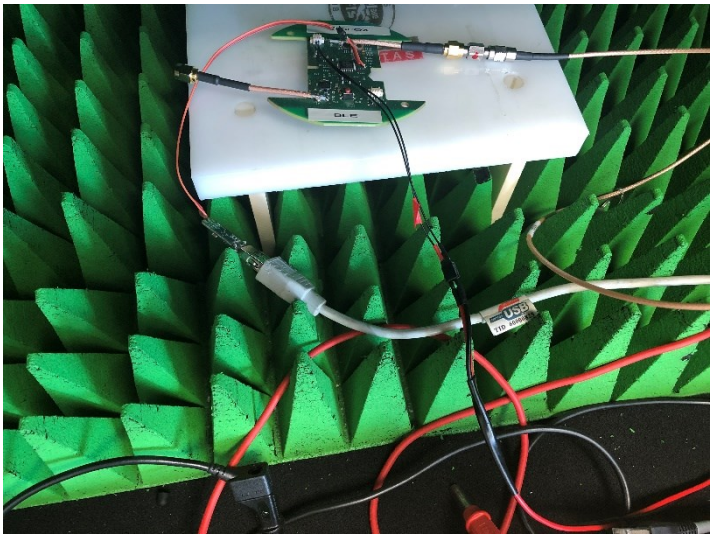
- The Equipment Under Test is installed:
☐ On a table
☑ In an anechoic chamber

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

- Test Procedure:
☑ ANSI C63.10 § 6.9.2



Test set up



Photograph for 20dB emission bandwidth

4.3. LIMIT

There is no limit for Hopping system

4.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
CABLE SMA 1m	RADIALL	18GHz	A5329862	11/18	05/20
DC POWER SUPPLY 20V	HEWLETT PACKARD	6632A	A7042061		
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	05/21	05/23
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Attenuator 10dB	AEROFLEX	_	A7122269	12/18	06/20
SMA 1.5m	SUCOFLEX	18GHz	A5329864	11/18	05/20

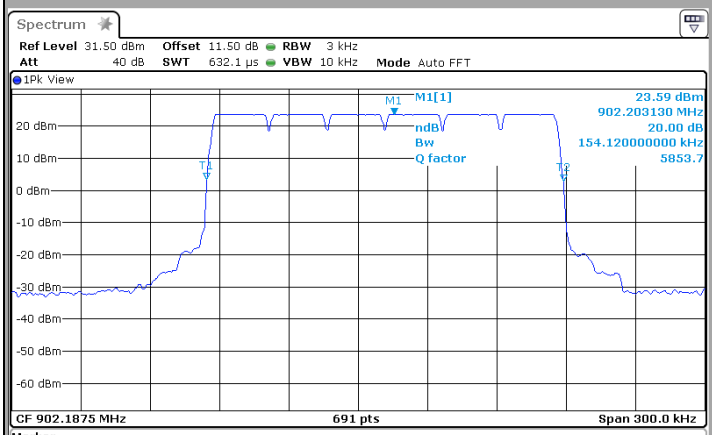
Note: In our quality system, the test equipment calibration due is more & less 4 months

4.5. RESULTS

Macro channels:

20dB Emission Bandwidth

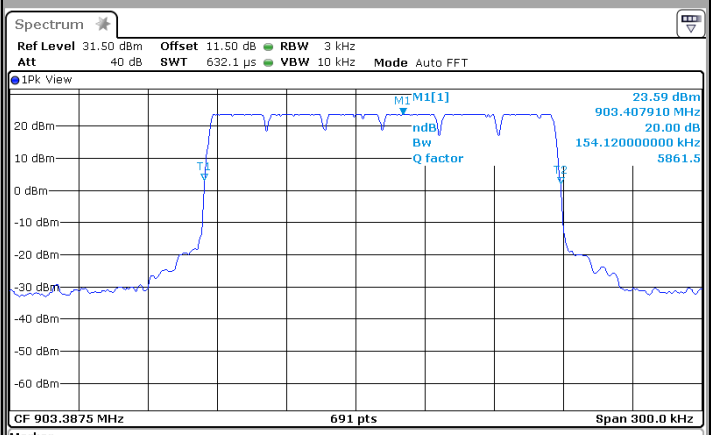
Cmin



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	902.20313 MHz	23.59 dBm	ndB down	154.12 kHz
T1		1	902.12194 MHz	3.50 dBm	ndB	20.00 dB
T2		1	902.27607 MHz	2.78 dBm	Q factor	5853.7

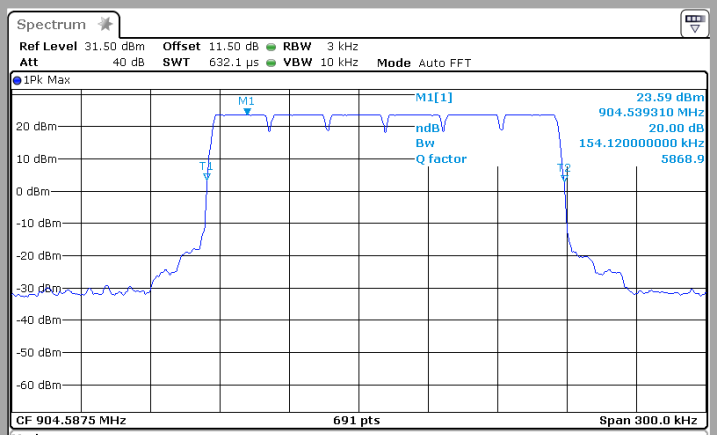
Cnom



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	903.40791 MHz	23.59 dBm	ndB down	154.12 kHz
T1		1	903.32194 MHz	3.25 dBm	ndB	20.00 dB
T2		1	903.47607 MHz	2.15 dBm	Q factor	5861.5

Cmax



Marker

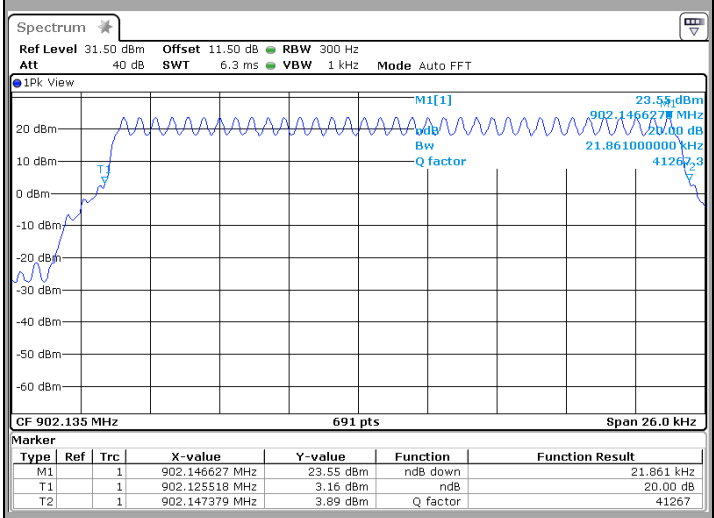
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	904.53931 MHz	23.59 dBm	ndB down	154.12 kHz
T1		1	904.52194 MHz	3.31 dBm	ndB	20.00 dB
T2		1	904.67607 MHz	2.92 dBm	Q factor	5868.9

Channel	6dB Emission Bandwidth (Hz)	Limit (Hz)
Cmin	154.120	None
Cnom	154.120	None
Cmax	154.120	None

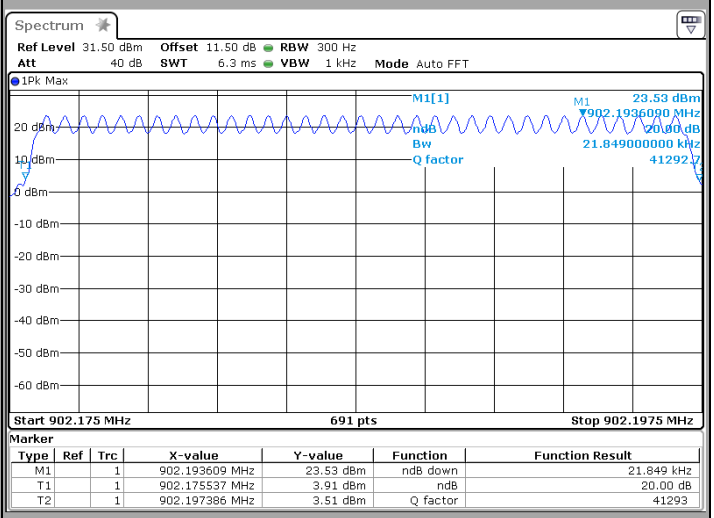
Micro channels (realized on Cmin of Macro-channels):

20dB Emission Bandwidth

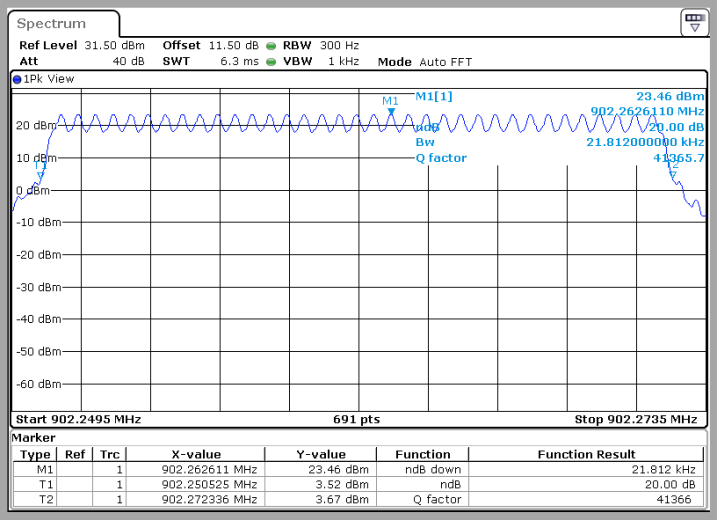
Cmin 902.135 26k



Cnom 902.175 902.1975



Cmax 902.2495 902.2735



Channel	6dB Emission Bandwidth (Hz)	Limit (Hz)
Cmin	21.861	None
Cnom	21.849	None
Cmax	21.812	None

4.6. CONCLUSION

6dB Emission Bandwidth measurement performed on the sample of the product **CSM WX SENSOR-YC-SR-YPA-CC-2B**, SN: **SCC13**, 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. HOPPING : NUMBER OF HOPPING FREQUENCY

5.1. TEST CONDITIONS

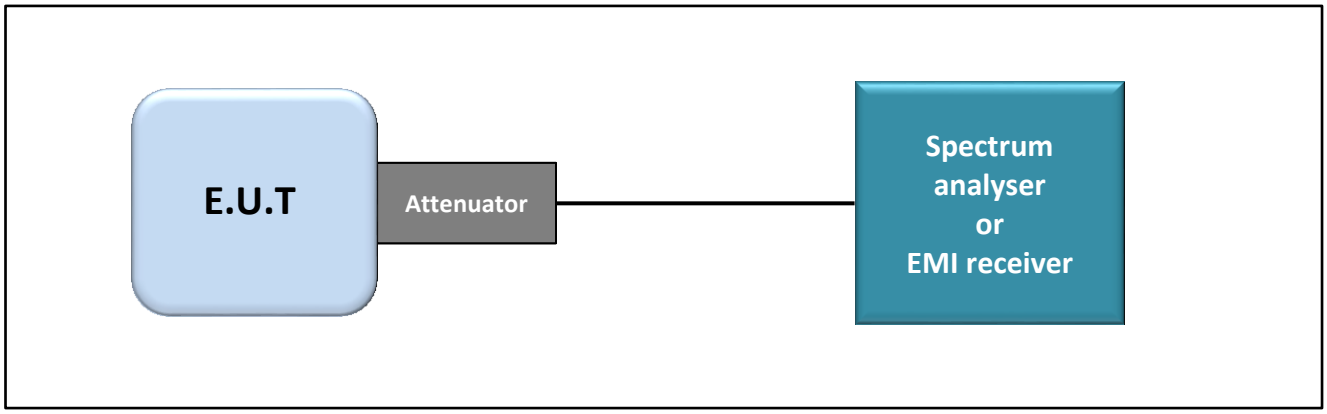
Test performed by	: Gaetan DESCHAMPS
Date of test	: July 22, 2020
Ambient temperature	: 23 °C
Relative humidity	: 32 %

5.2. TEST SETUP

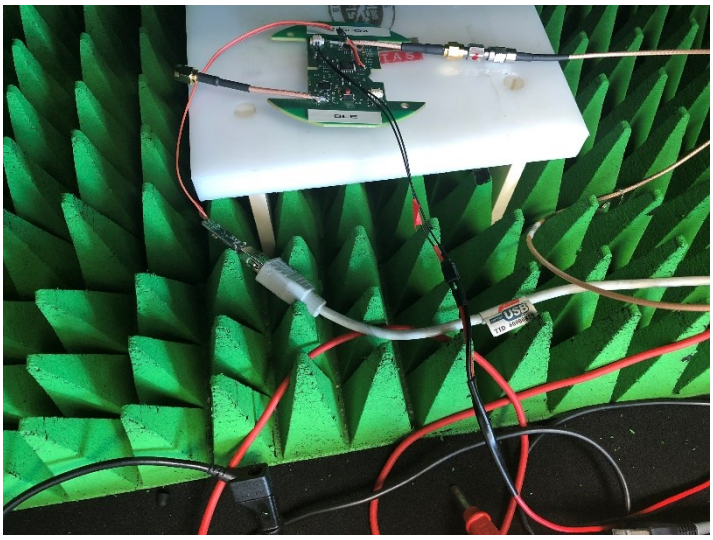
- The Equipment Under Test is installed:
☐ On a table
☑ In an anechoic chamber

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

- Test Procedure:
☑ ANSI C63.10 § 7.8.3



Test set up



Photograph for Number of Frequency Hopping

5.1. LIMIT

Number of Hopping Frequencies shall be at least 50 channels if 20dB bandwidth is less than 250kHz

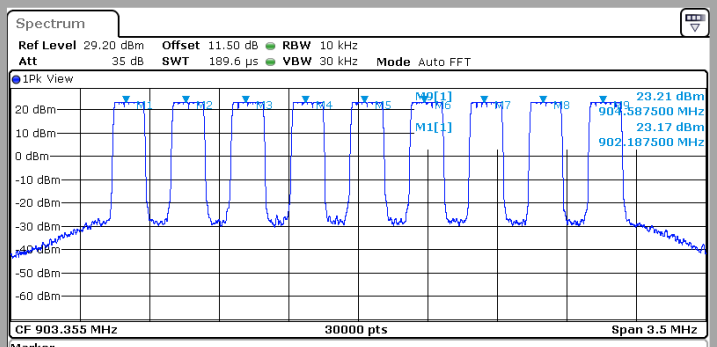
5.2. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
CABLE SMA 1m	RADIALL	18GHz	A5329862	11/18	05/20
DC POWER SUPPLY 20V	HEWLETT PACKARD	6632A	A7042061		
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	05/21	05/23
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Attenuator 10dB	AEROFLEX	_	A7122269	12/18	06/20
SMA 1.5m	SUCOFLEX	18GHz	A5329864	11/18	05/20

Note: In our quality system, the test equipment calibration due is more & less 4 months

5.3. RESULTS

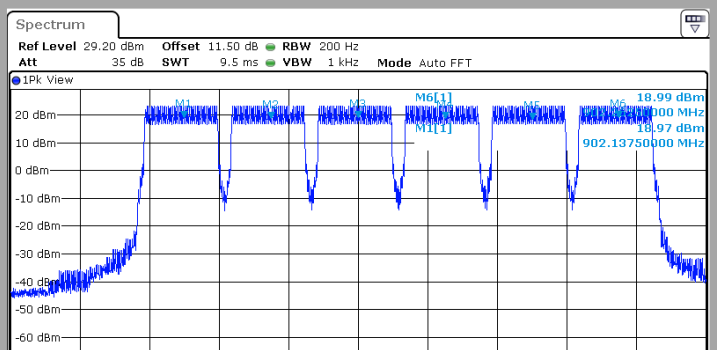
Macro Channels:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	902.1875 MHz	23.17 dBm		
M2		1	902.4875 MHz	23.24 dBm		
M3		1	902.7875 MHz	23.26 dBm		
M4		1	903.0875 MHz	23.27 dBm		
M5		1	903.3875 MHz	23.25 dBm		
M6		1	903.6875 MHz	23.28 dBm		
M7		1	903.9875 MHz	23.22 dBm		
M8		1	904.2875 MHz	23.25 dBm		
M9		1	904.5875 MHz	23.21 dBm		

Micro-Channels into one Macro Channel:
Realized on Cmin (Macro-Channel)



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	902.1375 MHz	18.97 dBm		
M2		1	902.1625 MHz	18.83 dBm		
M3		1	902.1875 MHz	19.10 dBm		
M4		1	902.2125 MHz	18.91 dBm		
M5		1	902.2375 MHz	18.56 dBm		
M6		1	902.2625 MHz	18.99 dBm		

	Macro Channels measured	Micro Channels par Macro channel measured	Total	Limit
Number	9	6	54	Minimum 50

5.4. CONCLUSION

Number of Frequency Hopping measurement performed on the sample of the product **CSM WX SENSOR-YC-SR-YPA-CC-2B**, SN: **SCC13**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS-GEN ISSUE 4** limits.

6. HOPPING : CARRIER FREQUENCY SEPARATION

6.1. TEST CONDITIONS

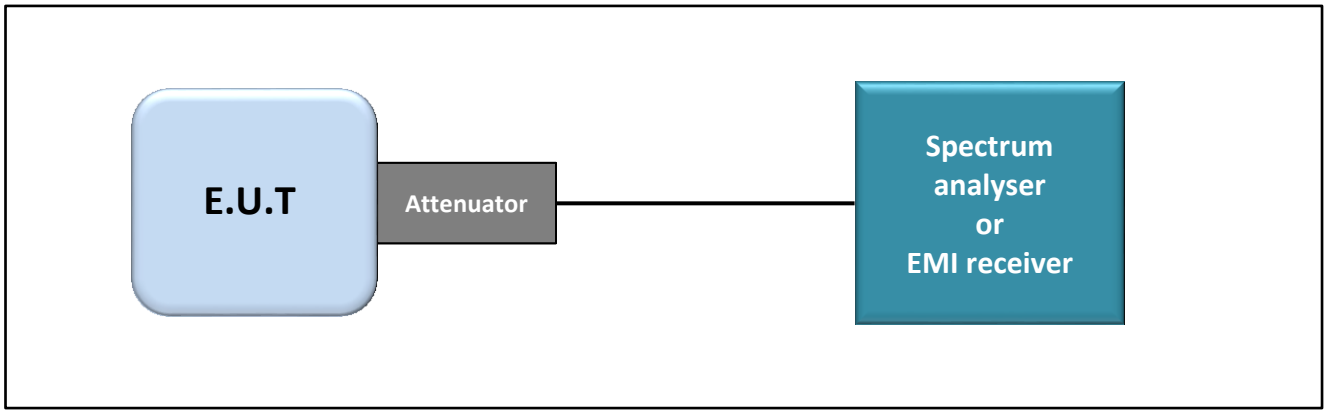
Test performed by	: Gaetan DESCHAMPS
Date of test	: July 22, 2020
Ambient temperature	: 23 °C
Relative humidity	: 32 %

6.2. TEST SETUP

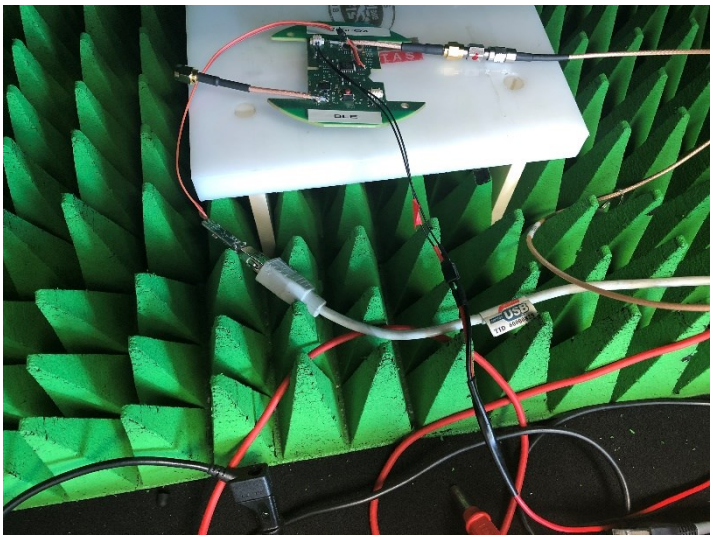
- The Equipment Under Test is installed:
☐ On a table
☑ In an anechoic chamber

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

- Test Procedure:
☑ ANSI C63.10 § 7.8.2



Test set up



Photograph for Carrier Frequency Separation

6.3. LIMIT

Carrier Frequency Separation shall be at 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

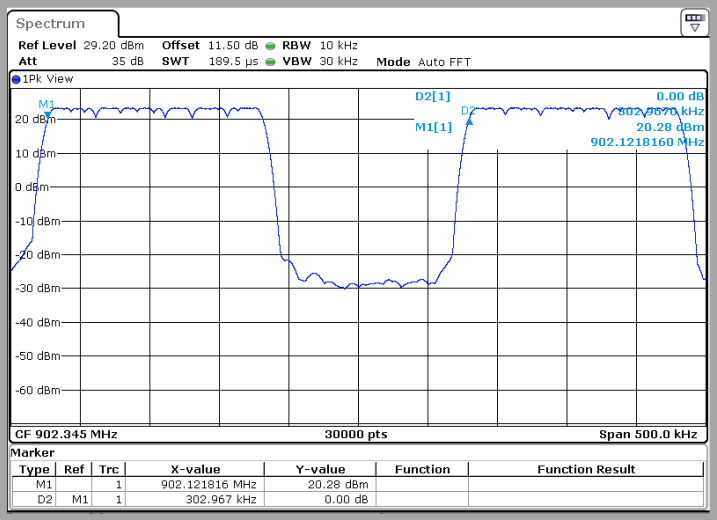
6.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
CABLE SMA 1m	RADIALL	18GHz	A5329862	11/18	05/20
DC POWER SUPPLY 20V	HEWLETT PACKARD	6632A	A7042061		
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	05/21	05/23
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Attenuator 10dB	AEROFLEX	_	A7122269	12/18	06/20
SMA 1.5m	SUCOFLEX	18GHz	A5329864	11/18	05/20

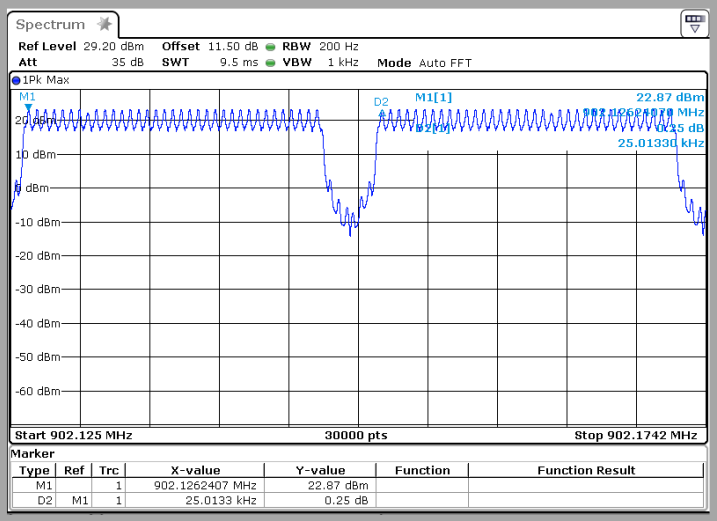
Note: In our quality system, the test equipment calibration due is more & less 4 months

6.5. RESULTS

Macro Channels separation:



Micro-Channels separation into one Macro Channel:
Realized on Cmin (Macro-Channel)



	Macro Channels measured	Micro Channels measured	Limit
Separation (kHz)	302.967	25.0133	25

6.6. CONCLUSION

Carrier Frequency Separation measurement performed on the sample of the product **CSM WX SENSOR-YC-SR-YPA-CC-2B**, SN: **SCC13**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS-GEN ISSUE 4** limits.

7. HOPPING : TIME OF OCCUPANCY

7.1. TEST CONDITIONS

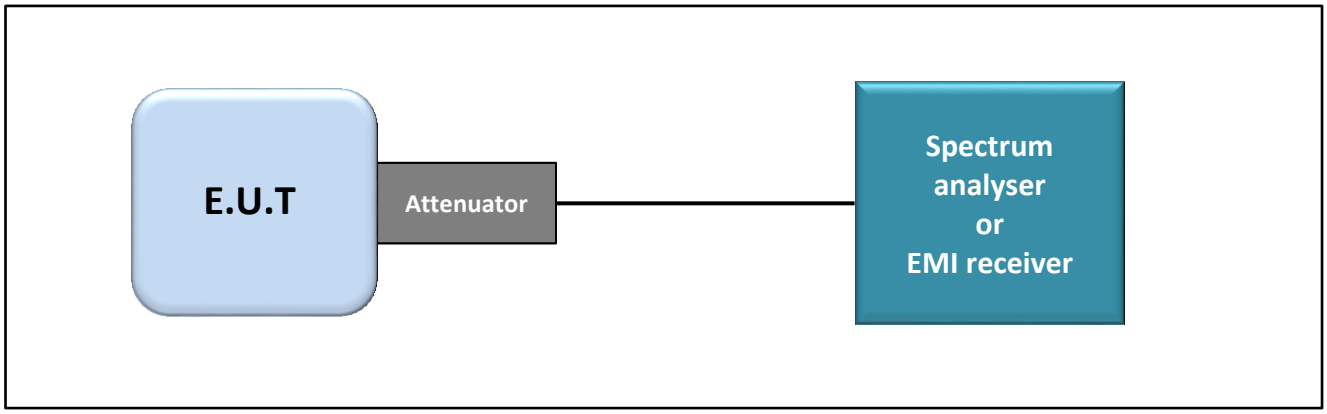
Test performed by	: Gaetan DESCHAMPS
Date of test	: July 22, 2020
Ambient temperature	: 23 °C
Relative humidity	: 32 %

7.2. TEST SETUP

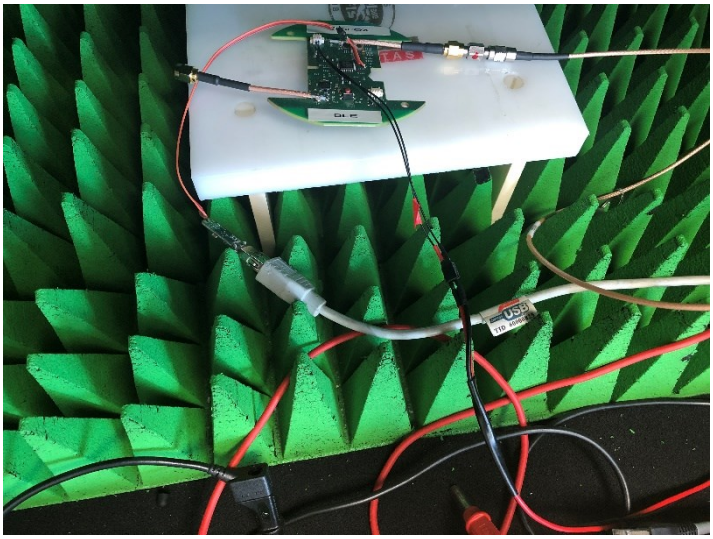
- The Equipment Under Test is installed:
☐ On a table
☑ In an anechoic chamber

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

- Test Procedure:
☑ ANSI C63.10 § 7.8.4



Test set up



Photograph for Time of Occupancy

7.3. LIMIT

The Time of Occupancy shall not exceed 0.4s within a 20 seconds period if 20dB bandwidth is less than 250kHz

7.4. TEST EQUIPMENT LIST

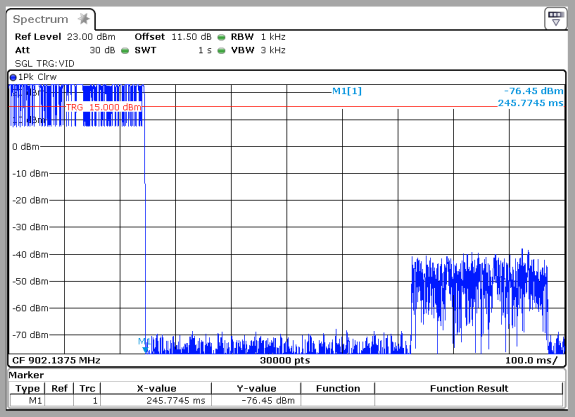
TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
CABLE SMA 1m	RADIALL	18GHz	A5329862	11/18	05/20
DC POWER SUPPLY 20V	HEWLETT PACKARD	6632A	A7042061		
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	05/21	05/23
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Attenuator 10dB	AEROFLEX	_	A7122269	12/18	06/20
SMA 1.5m	SUCOFLEX	18GHz	A5329864	11/18	05/20

Note: In our quality system, the test equipment calibration due is more & less 4 months

7.5. RESULTS

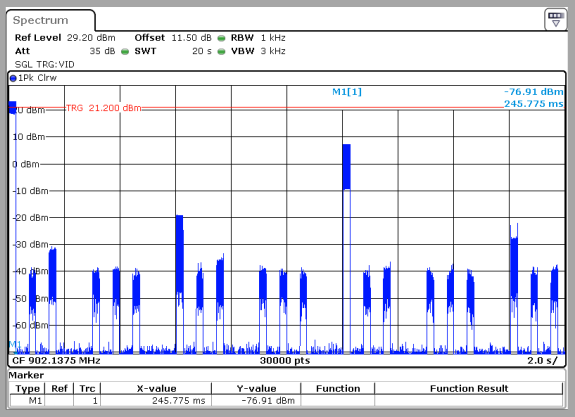
Burst Length

Cmin (Micro-channel)



Time of Occupancy

Cmin (Micro-channel



Channel	Burst Length (ms)	Number of Hopping during Time of Occupancy	Time of Occupancy (ms)	Limit of Time of Occupancy (ms)
Cmin	245.7745	1	245.7745	20 000

7.6. CONCLUSION

Time of Occupancy measurement performed on the sample of the product **CSM WX SENSOR-YC-SR-YPA-CC-2B**, SN: **SCC13**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS-GEN ISSUE 4** limits.

8. HOPPING : MAXIMUM CONDUCTED OUTPUT POWER

8.1. TEST CONDITIONS

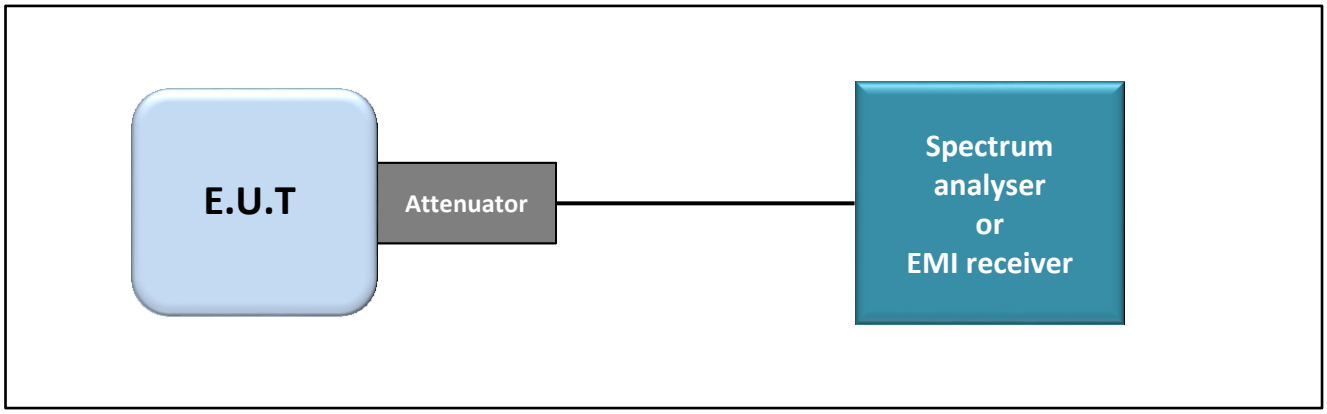
Test performed by	: Gaetan DESCHAMPS
Date of test	: August 5, 2020
Ambient temperature	: 22 °C
Relative humidity	: 36 %

8.2. TEST SETUP

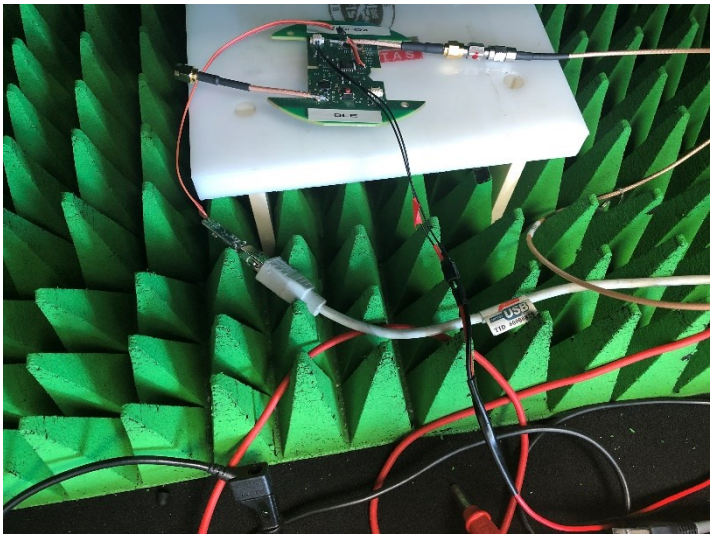
- The Equipment Under Test is installed:
☐ On a table
☑ In an anechoic chamber

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

- Test Procedure:
☑ ANSI C63.10 § 7.8.5



Test set up



Photograph for Maximum Conducted Output Power

8.3. LIMIT

Maximum Conducted Output power:
Shall not exceed 30dBm if number of hopping channels is above 50
Limits are reduced by G-6dBi if Antenna Gain above 6dBi

8.4. TEST EQUIPMENT LIST

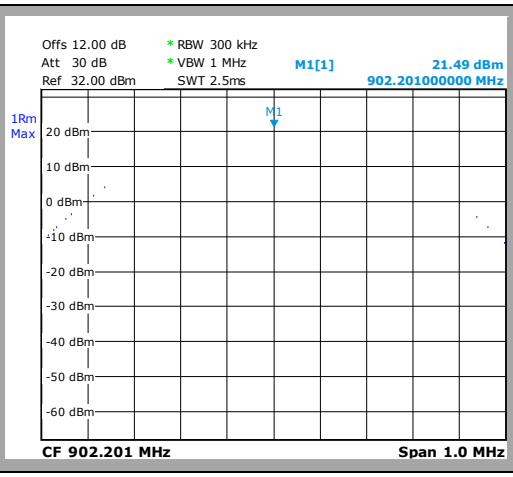
TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
CABLE SMA 1m	RADIALL	18GHz	A5329862	11/18	05/20
DC POWER SUPPLY 20V	HEWLETT PACKARD	6632A	A7042061		
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	05/21	05/23
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Attenuator 10dB	AEROFLEX	_	A7122269	12/18	06/20
SMA 1.5m	SUCOFLEX	18GHz	A5329864	11/18	05/20

Note: In our quality system, the test equipment calibration due is more & less 4 months

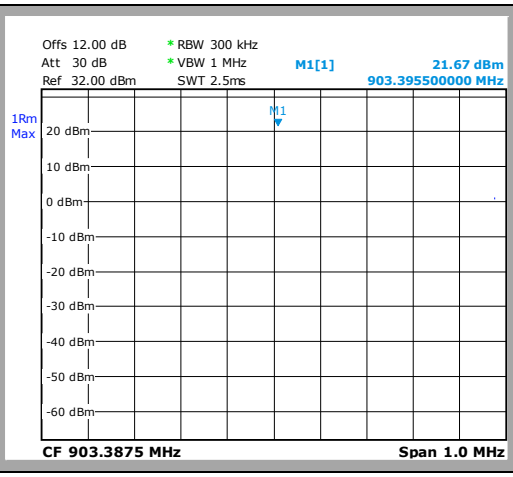
8.5. RESULTS

Maximum Conducted Output Power

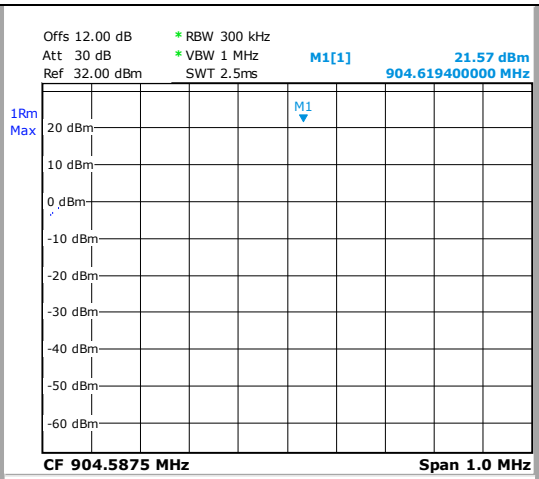
Cmin



Cnom



Cmax



Channel	Offset Cable + Att (dB)	Antenna Gain (dBi)	Maximum Conducted Power (dBm)	Limit (dBm)
Cmin	**11.5**	0	21.49	30 or 24. Reduced by G-6dBi if Antenna Gain above 6dBi
Cnom	**11.5**	0	21.67	30 or 24. Reduced by G-6dBi if Antenna Gain above 6dBi
Cmax	**11.5**	0	21.57	30 or 24. Reduced by G-6dBi if Antenna Gain above 6dBi

8.6. CONCLUSION

Maximum Conducted Output Power measurement performed on the sample of the product **CSM WX SENSOR-YC-SR-YPA-CC-2B**, SN: **SCC13**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247 ISSUE 2** limits.

9. HOPPING : UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS AT THE BAND EDGE

9.1. TEST CONDITIONS

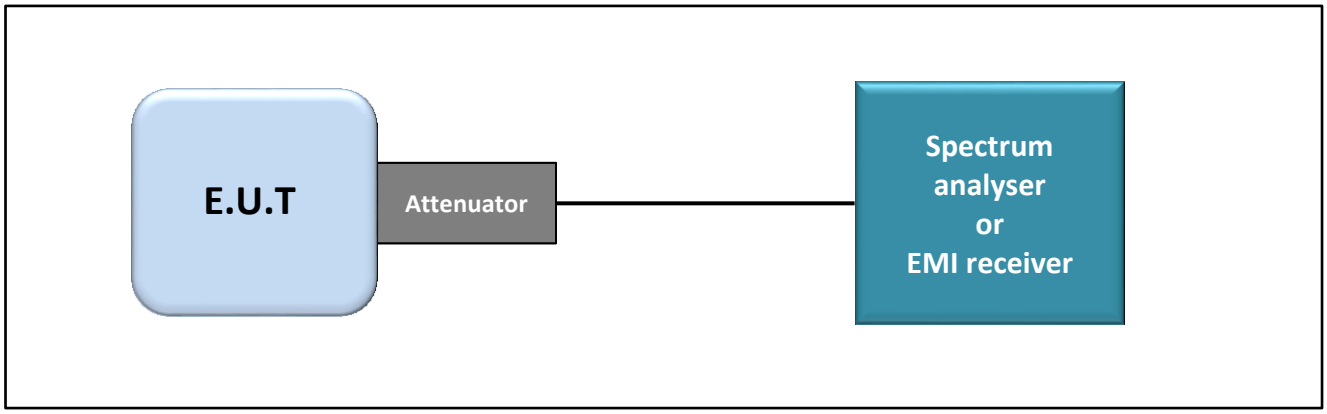
Test performed by	: Gaetan DESCHAMPS
Date of test	: July 22, 2020
Ambient temperature	: 23 °C
Relative humidity	: 32 %

9.2. TEST SETUP

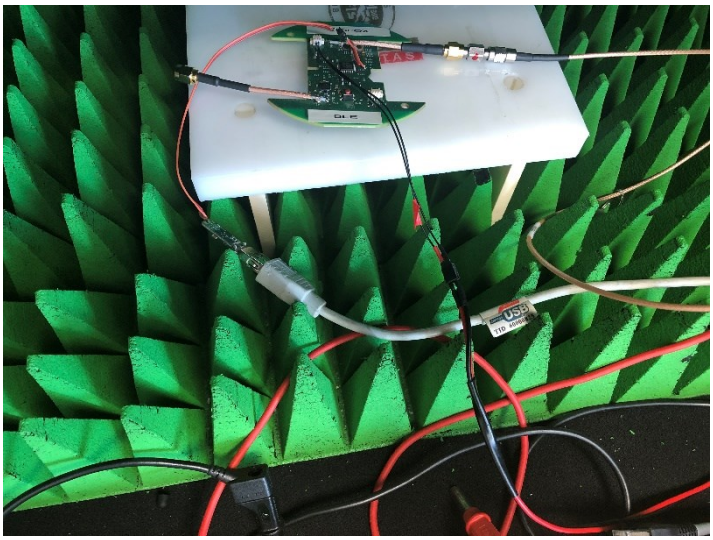
- The Equipment Under Test is installed:
☐ On a table
☑ In an anechoic chamber

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

- Test Procedure:
☑ ANSI C63.10 § 7.8.6



Test set up



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

9.3. LIMIT

All Spurious Emissions must be at least 20dB below the Fundamental Radiator Level at the Band Edge Edge “902MHz & 928MHz”

9.4. TEST EQUIPMENT LIST

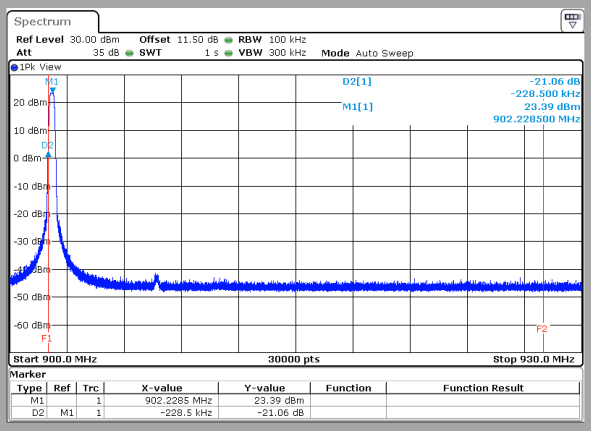
TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
CABLE SMA 1m	RADIALL	18GHz	A5329862	11/18	05/20
DC POWER SUPPLY 20V	HEWLETT PACKARD	6632A	A7042061		
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	05/21	05/23
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Attenuator 10dB	AEROFLEX	_	A7122269	12/18	06/20
SMA 1.5m	SUCOFLEX	18GHz	A5329864	11/18	05/20

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

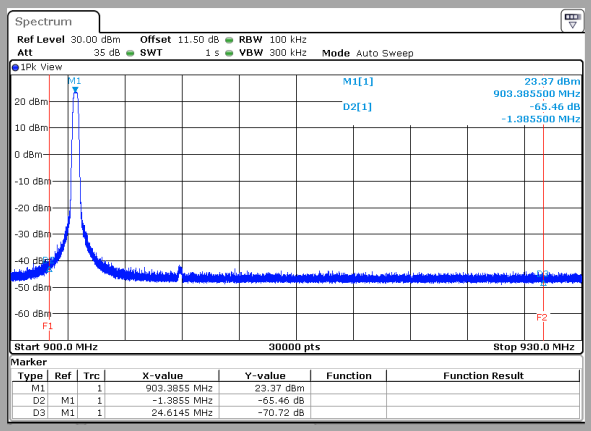
9.5. RESULTS

Single Frequency

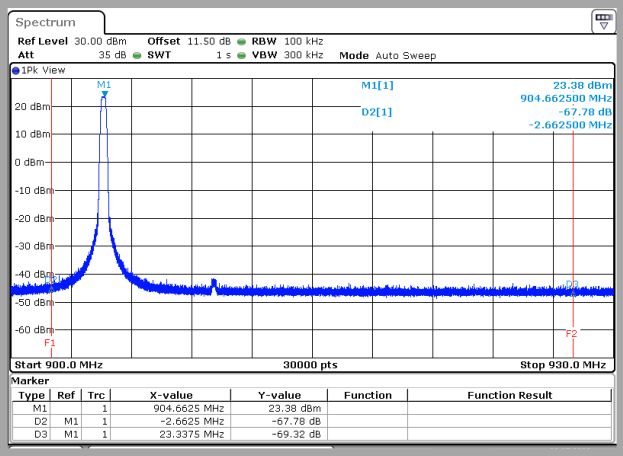
Cmin



Cnom



Cmax



Frequency (MHz)	Level (dBc)	Limit (dBc)
902	21.36 (worst case)	20
928	69.32 (worst case)	20

9.6. *CONCLUSION*

Unwanted Emission into non-restricted frequency bands at the band edge measurement performed on the sample of the product **CSM WX SENSOR-YC-SR-YPA-CC-2B**, SN: **SCC13**, 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. HOPPING : UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

10.1. TEST CONDITIONS

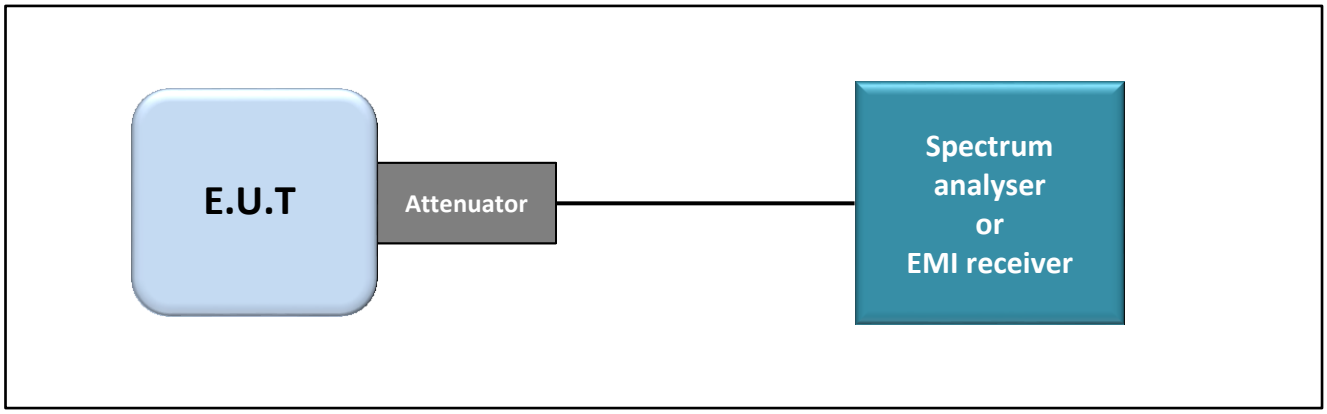
Test performed by	: Gaetan DESCHAMPS
Date of test	: July 22, 2020
Ambient temperature	: 23 °C
Relative humidity	: 32 %

10.2. TEST SETUP

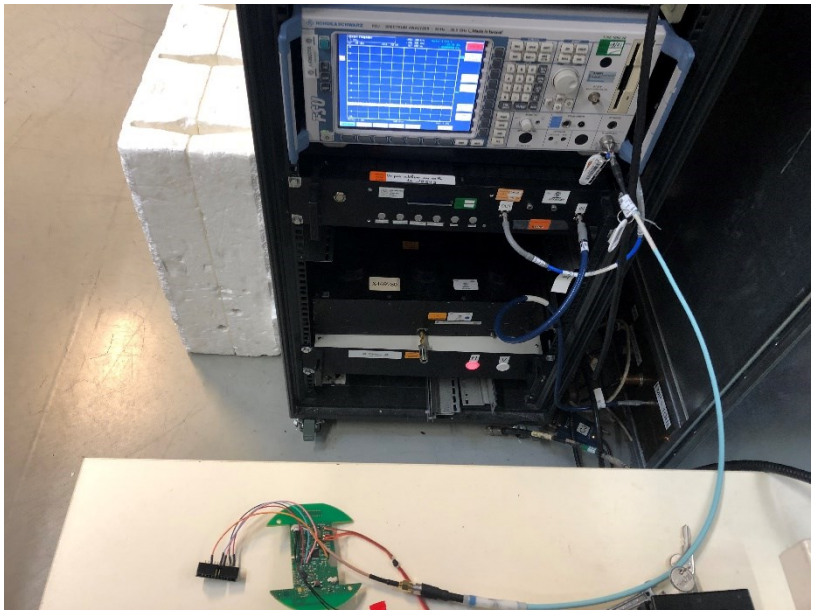
- The Equipment Under Test is installed:
☐ On a table
☑ In an anechoic chamber

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

- Test Procedure:
☑ ANSI C63.10 § 7.8.8



Test set up



Photograph for Unwanted Emission into non-restricted frequency bands

10.3. LIMIT

All Spurious Emissions must be at least 20dB below the Fundamental Radiator Level

10.4. TEST EQUIPMENT LIST

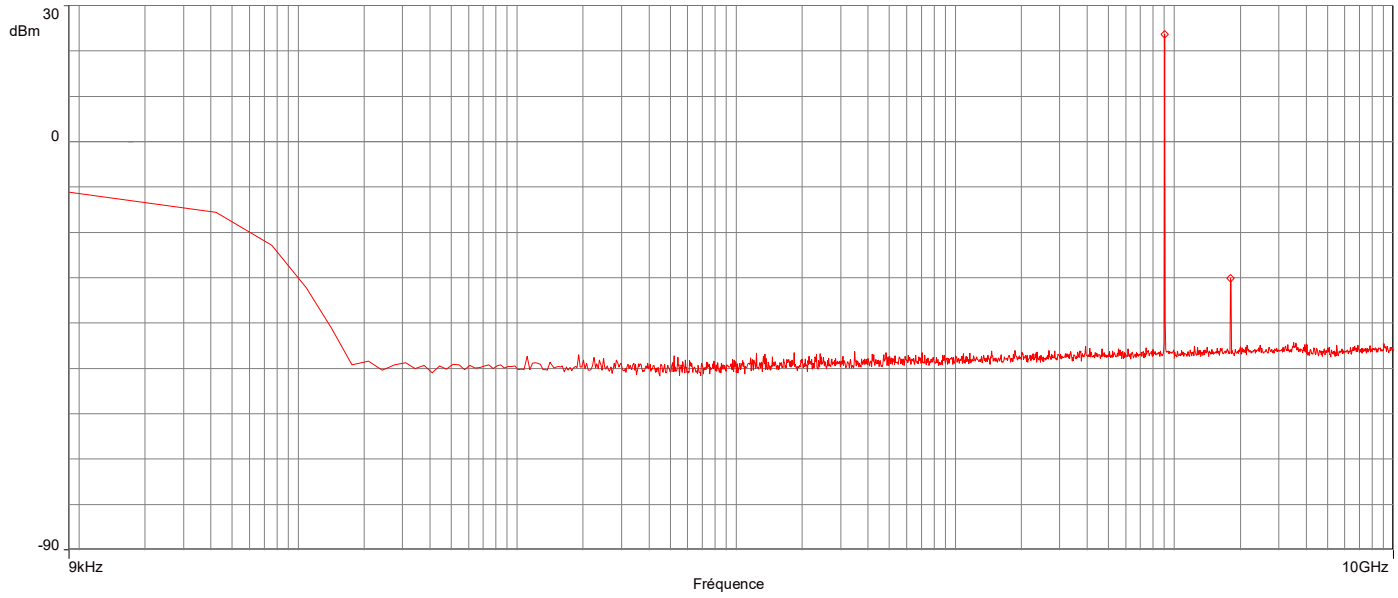
TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Attenuator 10dB	AEROFLEX	_	A7122269	12/18	06/20
Cable Measure	_	36G	A5329604	02/19	08/20
POWER SUPPLY DC 20V	SODILEC	SDRI 205	A7040058		
BAT EMC	NEXIO	v3.19.1.23	L1000115		
Comb EMR HF	YORK	CGE01	A3169114		
Spectrum analyzer	ROHDE & SCHWARZ	FSU 26	A4060058	09/19	09/21

Note: In our quality system, the test equipment calibration due is more & less 4 months

10.5. RESULTS

Single Frequency

Hopping Mode



Frequency (MHz)	Level (dBm)	Level (dBc)	Limit (dBc)
904.5341925	23.72 (worst case)		
1805.7	-30.16	50.88	20

10.6. CONCLUSION

Unwanted Emission into non-restricted frequency bands measurement performed on the sample of the product **CSM WX SENSOR-YC-SR-YPA-CC-2B**, SN: **SCC1**, in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247 ISSUE 2** limits.

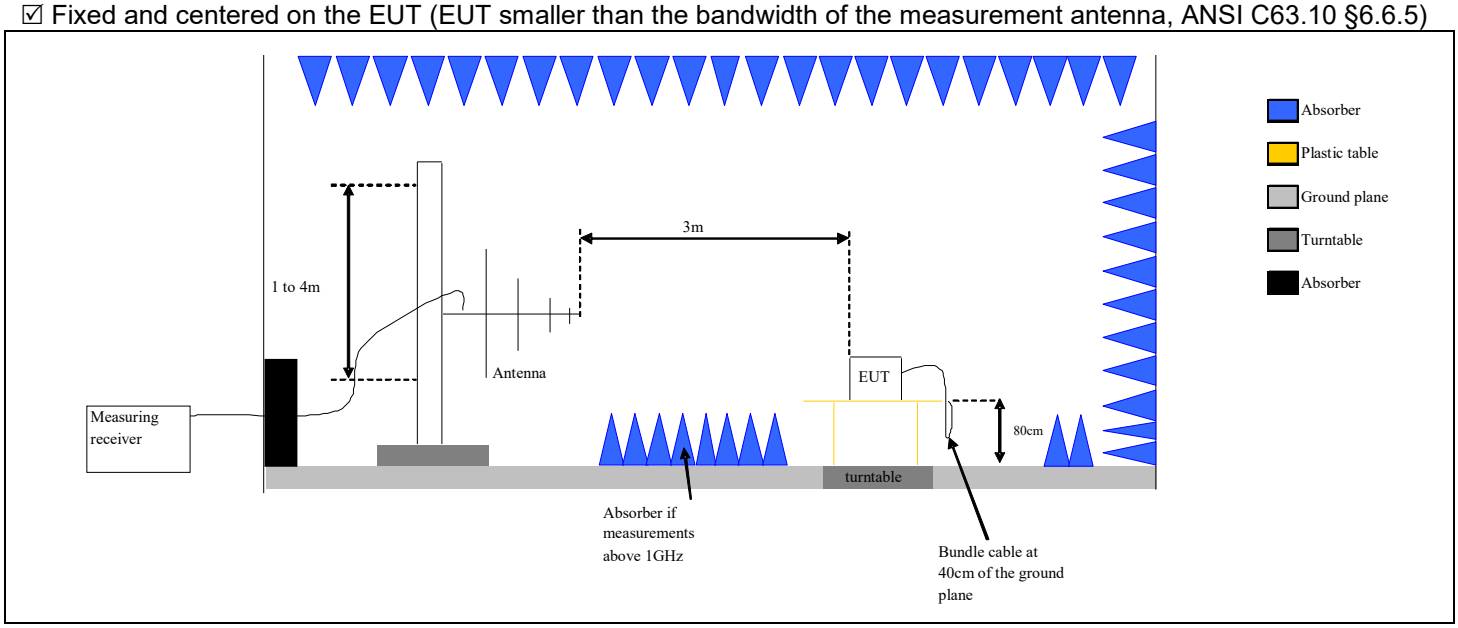
11. HOPPING : UNWANTED EMISSIONS IN RESTRICTED FREQUENCY BANDS

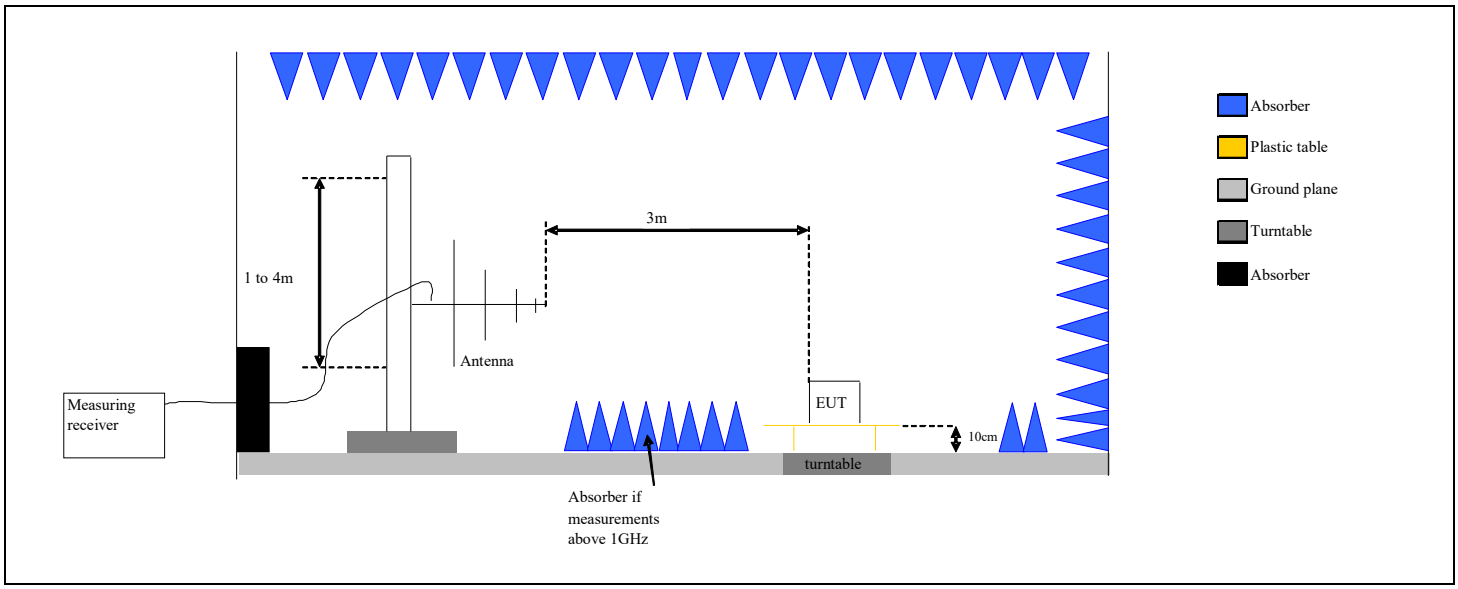
11.1. TEST CONDITIONS

Test performed by	: Gaetan DESCHAMPS
Date of test	: July 22, 2020
Ambient temperature	: 23 °C
Relative humidity	: 32 %

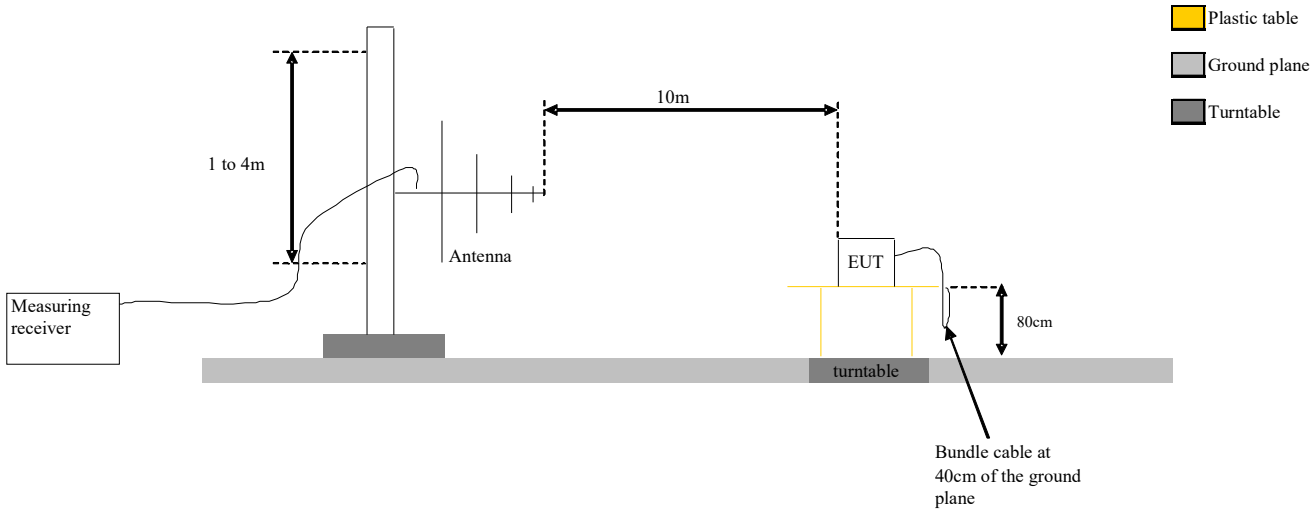
11.2. TEST SETUP

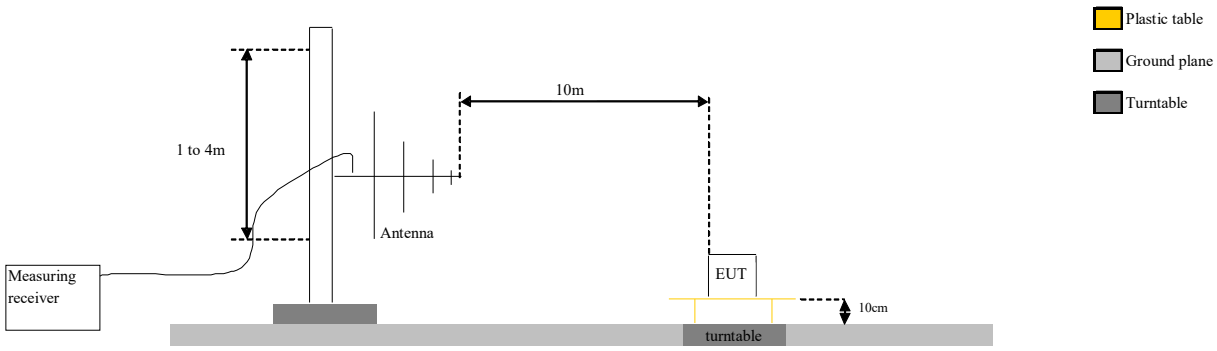
The product has been tested according to ANSI C63.10 (2013) and FCC part 15 subpart C.
Test is performed in parallel, perpendicular and ground parallel axis with a loop antenna below 30MHz. Measurement bandwidth was 200Hz below 150kHz and 9kHz between 150kHz & 30MHz. The level has been maximised by the 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 **biconic** and **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 place 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)





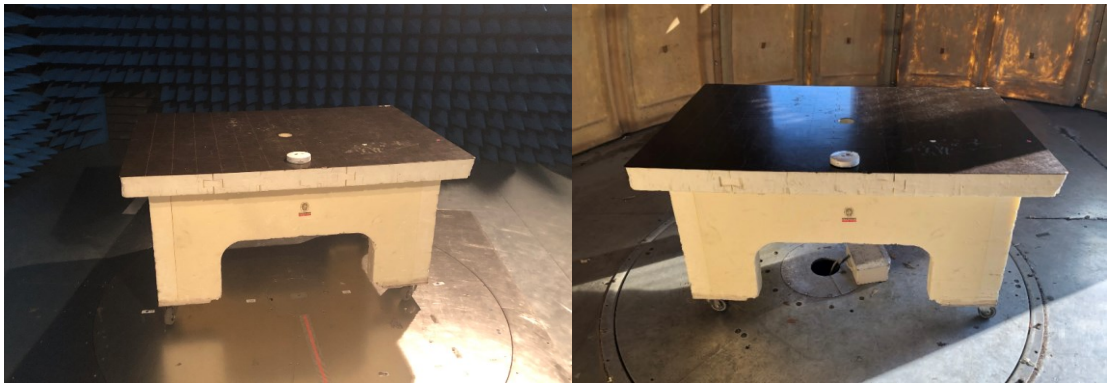
Test set up of Unwanted Emissions in Restricted Frequency Bands in semi anechoic chamber





Test Set up for radiated measurement in open area test site

Test setup in Axis XY (one position declared)



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**	**Cal_Date**	**Cal_Due**
Amplifier 9kHz - 40GHz	LCIE SUD EST	_	A7102082	06/20	06/21
Antenna Bi-Log	CHASE	UPA6192	C2040221	01/18	01/20
Antenna horn 18GHz	EMCO	3115	C2042029	09/17	09/20
BAT EMC	NEXIO	v3.19.1.23	L1000115		
Comb EMR HF	YORK	CGE01	A3169114		
Emission Cable (SMA 1m)	TELEDYNE	26GHz	A5329874	01/19	07/20
Emission Cable (SMA 3.3m)	TELEDYNE	26GHz	A5329875	01/19	07/20
Emission Cable (SMA 30cm)	TELEDYNE	26GHz	A5329873	01/19	07/20
Emission Cable <1GHz (Ampl <-> Cage)	-	18GHz	A5329562	08/19	08/20
Emission Cable <1GHz (Ampl <-> Cage)	-	18GHz	A5329907	08/19	08/20
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20
Rehausse Table C3	LCIE	_	F2000507		
Rehausse Table C3	LCIE	_	F2000511		
Semi-Anechoic chamber #3 (BF)	SIEPEL	_	D3044017_BF	12/19	12/22
Semi-Anechoic chamber #3 (VSWR)	SIEPEL	_	D3044017_VSWR	12/19	12/22
Spectrum analyzer	ROHDE & SCHWARZ	FSU 26	A4060058	09/19	09/21
Table C3	LCIE	_	F2000461		
Thermo-hygrometer (C3)	OREGON	BAR206	B4204078	10/18	10/20
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371		

Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444		
High Pass (1-15GHz)	WAINRIGHT	WHKX 1.03/15G-10SS	A7484035	08/19	08/20

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

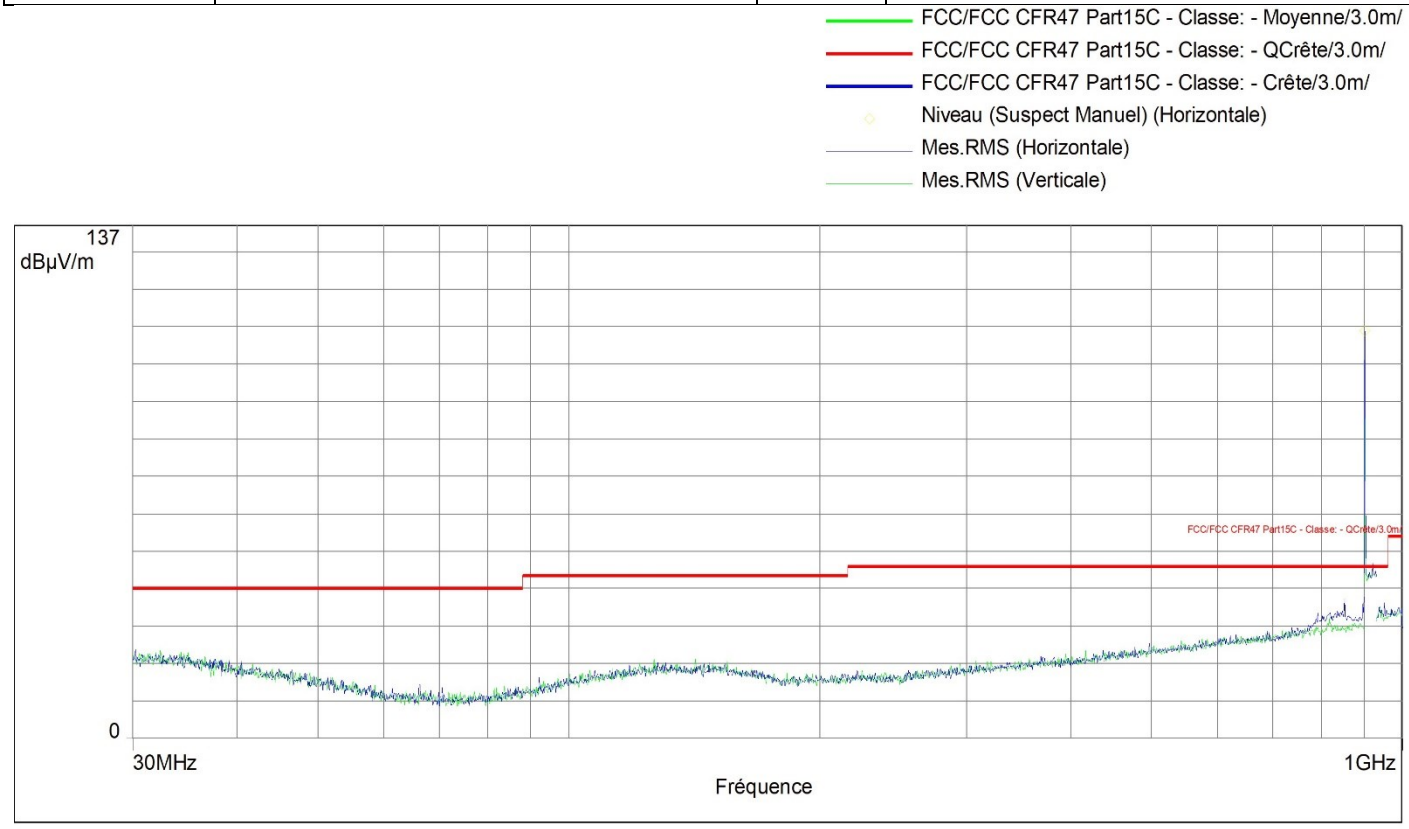
11.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

☑ None ☐ Divergence:

11.6. RESULTS

Results in the frequency band [0.009-30] MHz:
No significant frequency observed due to RF module (See test results in §10.5).

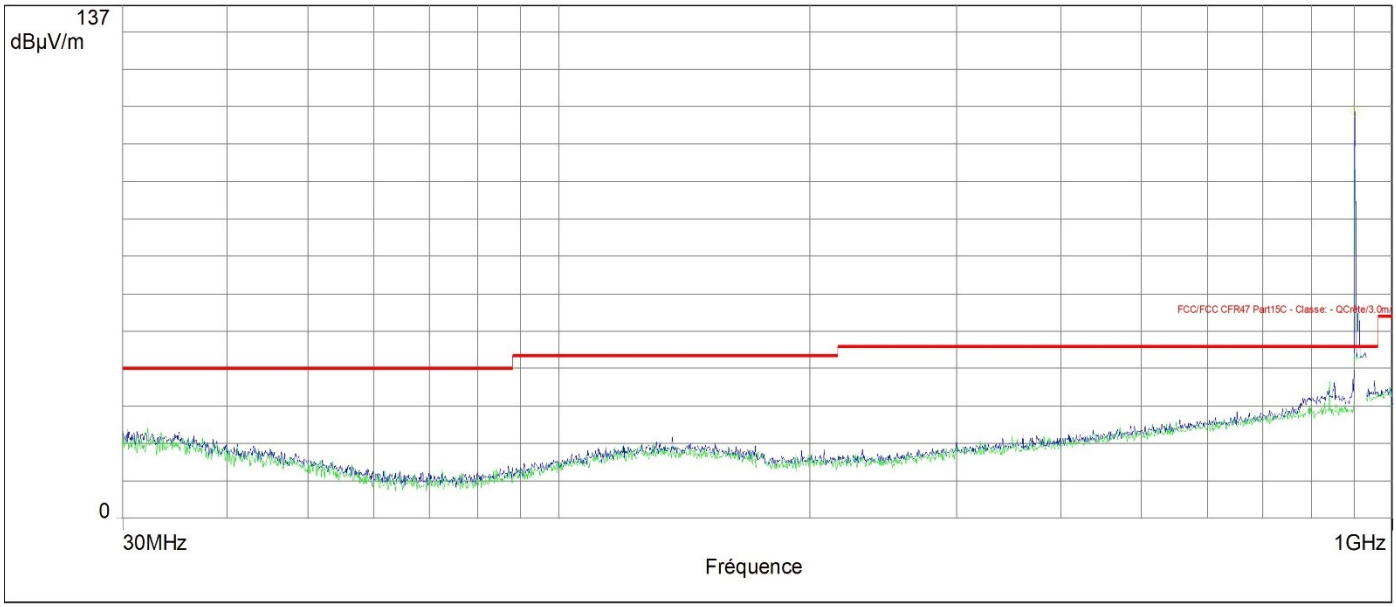
RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - CMin - TX mode - Axis XY	
Class:			
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz



Spurious emissions			
Frequency (MHz)	**Peak Level (dBµV/m)**	**Polarization**	**Correction (dB)**
902.18	108.8	Horizontal	27.6

RADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - CMid - TX mode - Axis XY	
Class:			
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz

FCC/FCC CFR47 Part15C - Classe: - Moyenne/3.0m/
FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/
FCC/FCC CFR47 Part15C - Classe: - Crête/3.0m/
Niveau (Suspect Manuel) (Horizontale)
Mes.RMS (Horizontale)
Mes.RMS (Verticale)

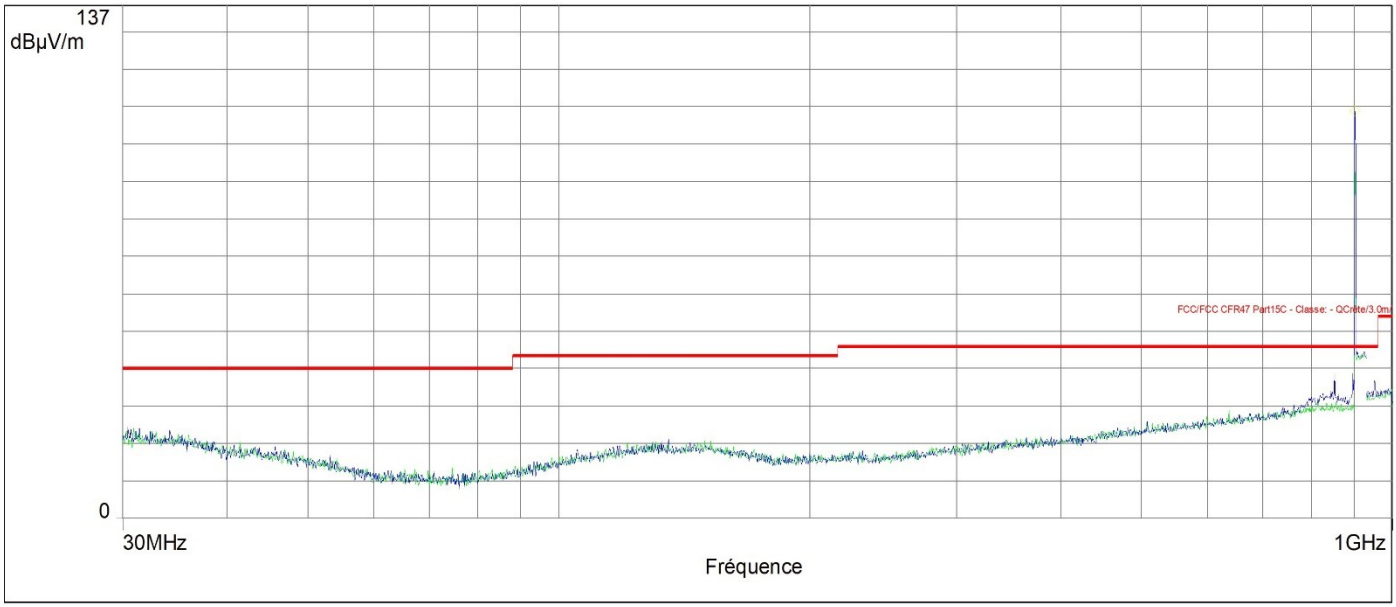


Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Polarization	Correction (dB)
903.38	108.8	Horizontal	27.6

RADIATED EMISSIONS			
Graph name:	Emr#3	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - CMax - TX mode - Axis XY	
Class:			
Frequency range: [30MHz - 1GHz]			
Antenna polarization:	Horizontal & Vertical	**RBW :**	100kHz
Azimuth:	0° - 360°	**VBW :**	300kHz

FCC/FCC CFR47 Part15C - Classe: - Moyenne/3.0m/
FCC/FCC CFR47 Part15C - Classe: - QCrête/3.0m/
FCC/FCC CFR47 Part15C - Classe: - Crête/3.0m/
Niveau (Suspect Manuel) (Horizontale)
Mes.RMS (Horizontale)
Mes.RMS (Verticale)

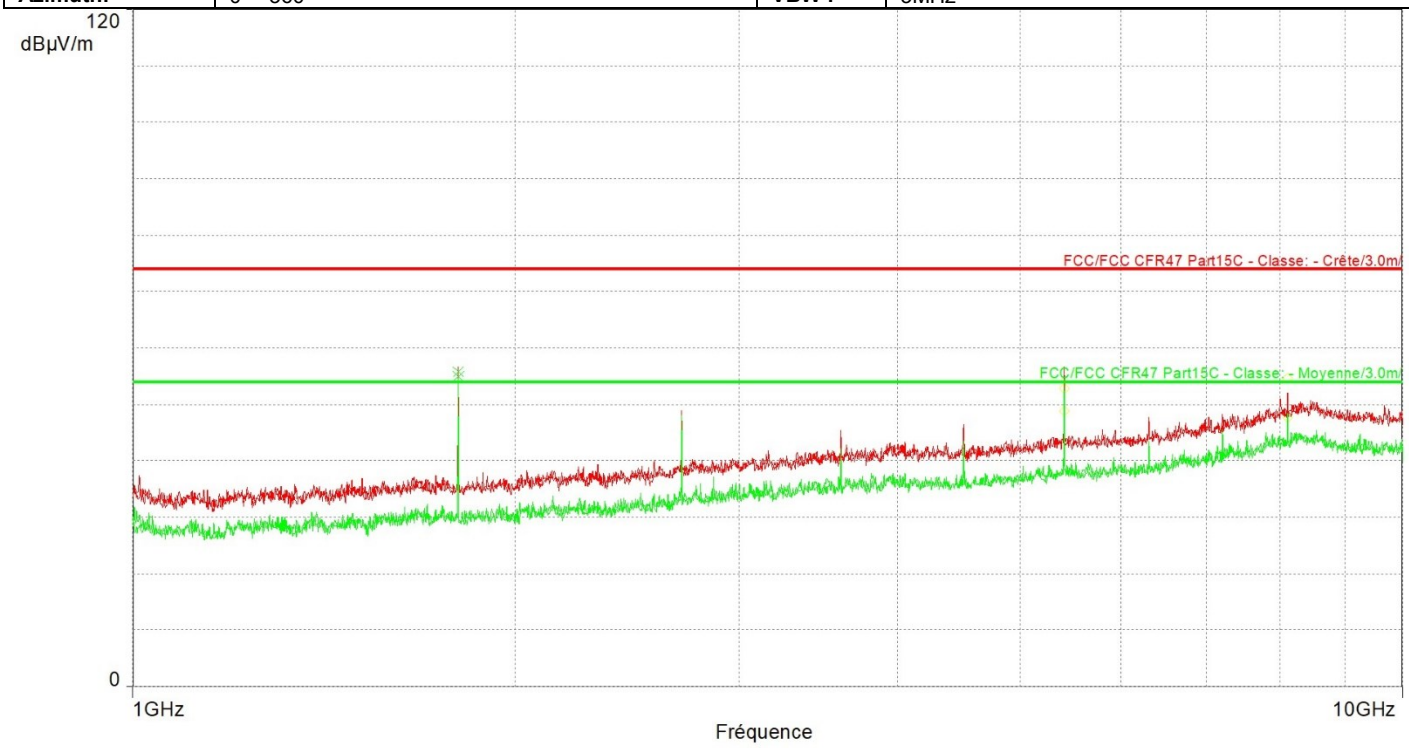


Spurious emissions

Frequency (MHz)	Peak Level (dBµV/m)	Polarization	Correction (dB)
904.58	108.8	Horizontal	27.6

Results in the frequency band [1-10] GHz:

RADIATED EMISSIONS			
Graph name:	Emr#4	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - Worst Case presented - TX mode Cmin - Axis XY	
Class:			
Frequency range: [1GHz - 10GHz]			
Antenna polarization:		**RBW :**	1MHz
Azimuth:	0° - 360°	**VBW :**	3MHz



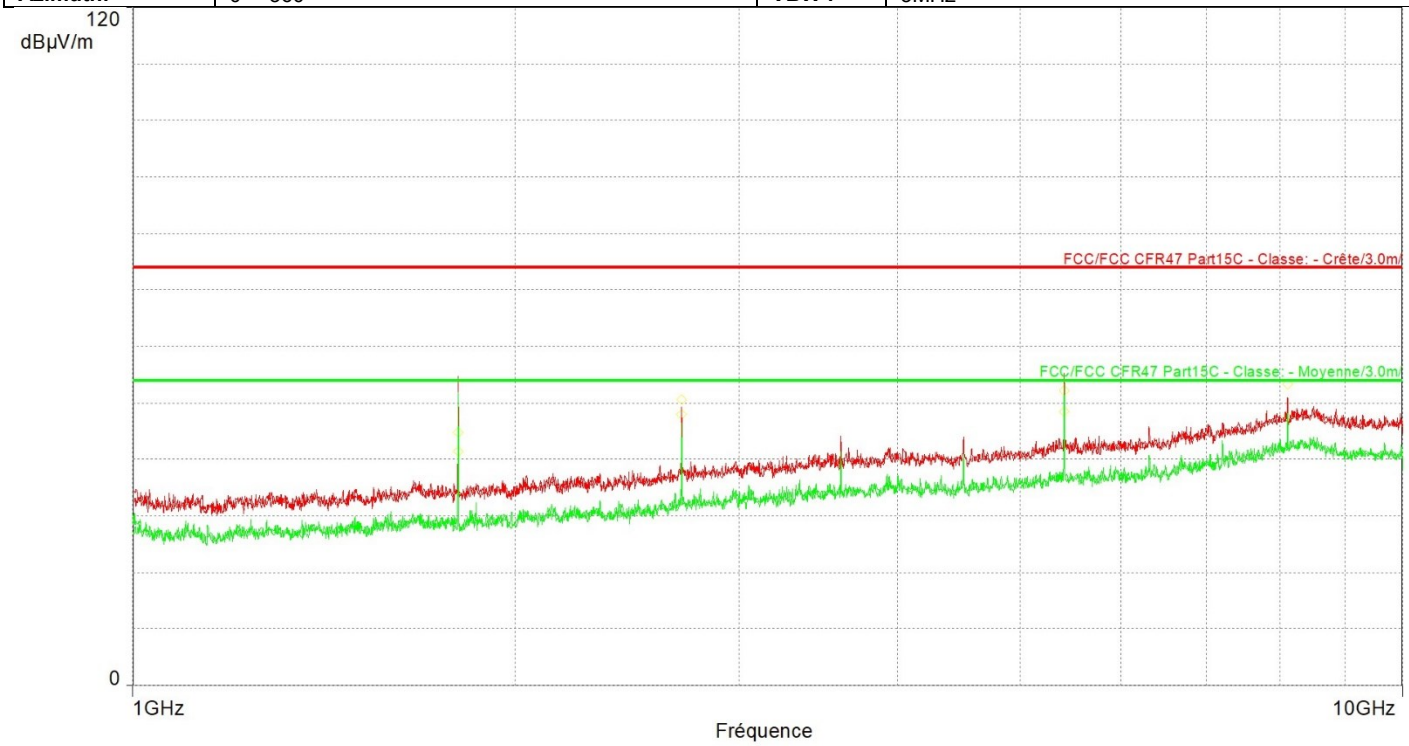
Spurious emissions				
Frequency (MHz)	**Mes.Avg (dBµV/m)**	**Limite (dBµV/m)**	**Mes.-Lim. (dB)**	**Correction (dB)**
5412.620	48.9	54.0	-5.1	-24.0
8118.809	47.6	54.0	-6.4	-18.0

Frequency (MHz)	**Mes.Peak (dBµV/m)**	**Limite (dBµV/m)**	**Mes.-Lim. (dB)**	**Correction (dB)**
5412.620	52.8	74.0	-21.2	-24.0
8118.809	54.7	74.0	-19.3	-18.0

Frequency (MHz)	**Mes.Avg (dBµV/m)**	**Limite (dBµV/m)**	**Mes.-Lim. (dB)**	**Correction (dB)**
1804.158	53.0	54.0	-1.0	-33.0

Frequency (MHz)	**Mes.Peak (dBµV/m)**	**Limite (dBµV/m)**	**Mes.-Lim. (dB)**	**Correction (dB)**
1804.158	55.8	74.0	-18.2	-33.0

RADIATED EMISSIONS			
Graph name:	Emr#5	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - Worst Case presented - TX mode Cmid - Axis XY	
Class:			
Frequency range: [1GHz - 10GHz]			
Antenna polarization:		**RBW :**	1MHz
Azimuth:	0° - 360°	**VBW :**	3MHz

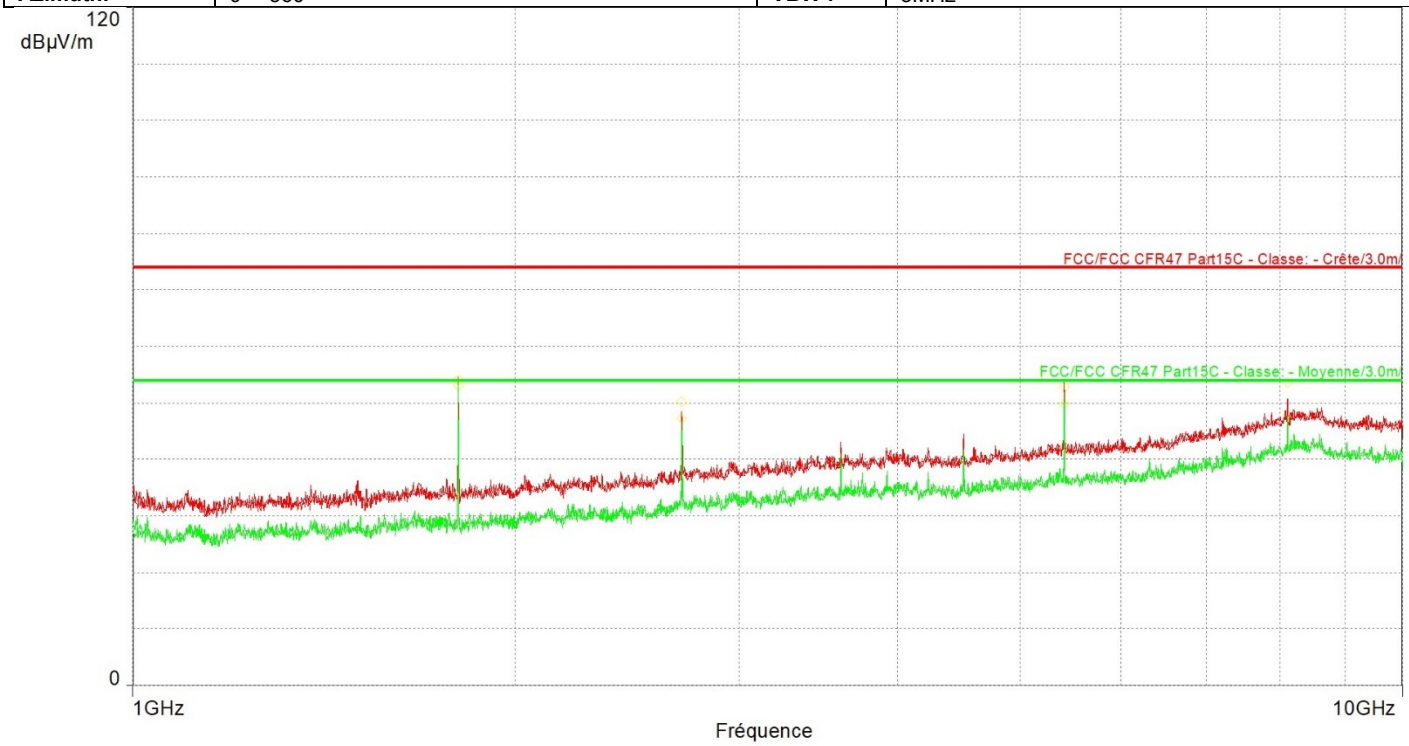


Spurious emissions

Frequency (MHz)	Mes.Avg (dBµV/m)	Limite (dBµV/m)	Mes.-Lim. (dB)	Correction (dB)
1804.306	41.4	54.0	-12.6	-33.0
2706.624	48.0	54.0	-6.0	-30.0
5413.076	48.5	54.0	-5.5	-24.0
8119.833	47.5	54.0	-6.5	-18.0

Frequency (MHz)	Mes.Peak (dBµV/m)	Limite (dBµV/m)	Mes.-Lim. (dB)	Correction (dB)
1804.306	44.8	74.0	-29.2	-33.0
2706.624	50.6	74.0	-23.4	-30.0
5413.076	52.2	74.0	-21.8	-24.0
8119.833	53.3	74.0	-20.7	-18.0

RADIATED EMISSIONS			
Graph name:	Emr#6	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - Worst Case presented - TX mode Cmac - Axis XY	
Class:			
Frequency range: [1GHz - 10GHz]			
Antenna polarization:		**RBW :**	1MHz
Azimuth:	0° - 360°	**VBW :**	3MHz



Spurious emissions				
Frequency (MHz)	**Mes.Avg (dBµV/m)**	**Limite (dBµV/m)**	**Mes.-Lim. (dB)**	**Correction (dB)**
1804.592	53.0	54.0	-1.0	-33.0
2706.873	47.2	54.0	-6.8	-30.0
5413.803	49.8	54.0	-4.2	-24.0
8120.753	47.8	54.0	-6.2	-18.0

Frequency (MHz)	**Mes.Peak (dBµV/m)**	**Limite (dBµV/m)**	**Mes.-Lim. (dB)**	**Correction (dB)**
1804.592	54.1	74.0	-19.9	-33.0
2706.873	50.2	74.0	-23.8	-30.0
5413.803	52.8	74.0	-21.2	-24.0
8120.753	53.5	74.0	-20.5	-18.0

11.7. CONCLUSION

Unwanted Emission in restricted frequency bands measurement performed on the sample of the product **CSM WX SENSOR-YC-SR-YPA-CC-2B**, SN: **SCC13**, 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