TEST REPORT

N°: 166555-749603-A(FILE#1033512) **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	**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	38 pages
Document issued on	May 18, 2020

Written by :	**Approved by :**
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PUBLICATION HISTORY

Version	Date	Author	Modification
01	May 18, 2020	Gaetan DESCHAMPS	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. *INFORMATION*

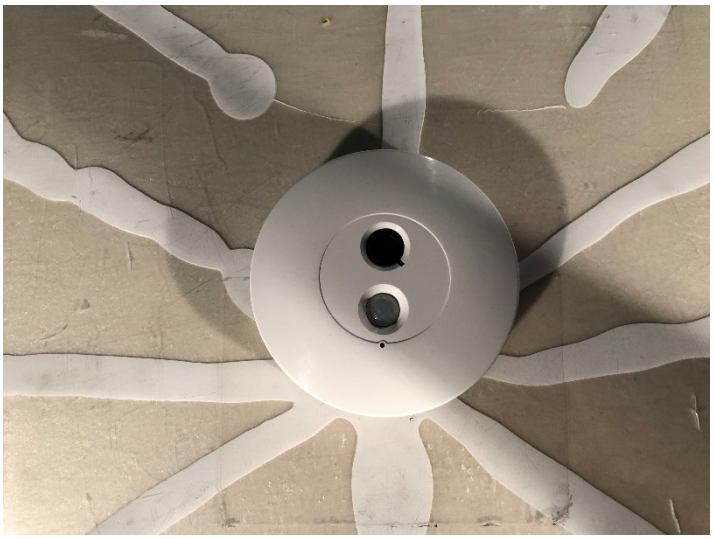
Tests are performed on the most complete product **CSM WX SENSOR-YC-SR-YPA-CC-2B**, SN: **SCC13 & SCC1** See Table below for difference between products.

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:

Bluetooth LE Type:	☑ **BLE**	☐ **v4.1**	☑ **v4.2**	☐ **v5.0**
Frequency band:	[2400 – 2483.5] MHz			
Spectrum Modulation:	☑ DSSS (Tested like it)			
Number of Channel:	40			
Spacing channel:	2MHz			
Channel bandwidth:	☑ 1MHz		☐ 2MHz	
Antenna Type:	☑ Integral	☐ External	☐ Dedicated	
Antenna connector:	☑ Yes	☐ No	☑ Temporary for test	
Transmit chains:	1			
	Single antenna			
	Gain: 0dBi			
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:	☐ 230V/50Hz	☐ 3Vdc	

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			
Available	**Data Rate (Mbps)**	**Modulation Type**	**Worst Case Modulation**
☐	0.25	GFSK	☐
☑	1	GFSK	☑
☐	2	GFSK	☐

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 reception

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()
AC Power Line Conducted Emission	☐ Test mode 1 (1)	☐ Alternative test mode()
Unwanted Emissions into Restricted Frequency Bands	☑ Test mode 1 (1)	☐ Alternative test mode()

Hardware information		
Software (if applicable):raspiCEM_csm_certification	**V. :**	**1.0.28**

2.4. EQUIPMENT MODIFICATION

☑ None ☐ Modification:

3. OCCUPIED BANDWIDTH

3.1. TEST CONDITIONS

Test performed by	: Gaetan DESCHAMPS
Date of test	: May 18, 2020
Ambient temperature	: 23 °C
Relative humidity	: 32 %

3.2. TEST SETUP

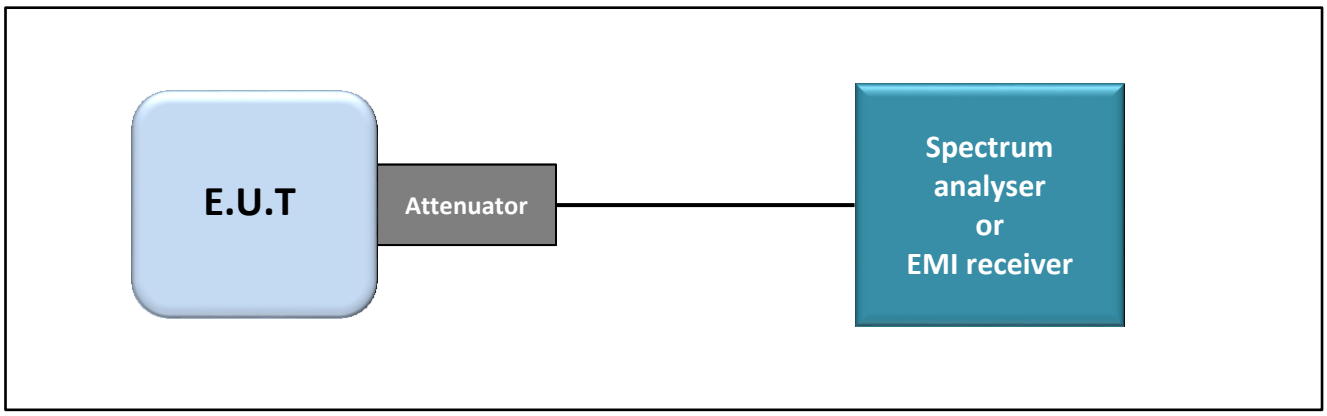
- The Equipment under Test is installed:
☐ On a table
☑ In an anechoic chamber

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

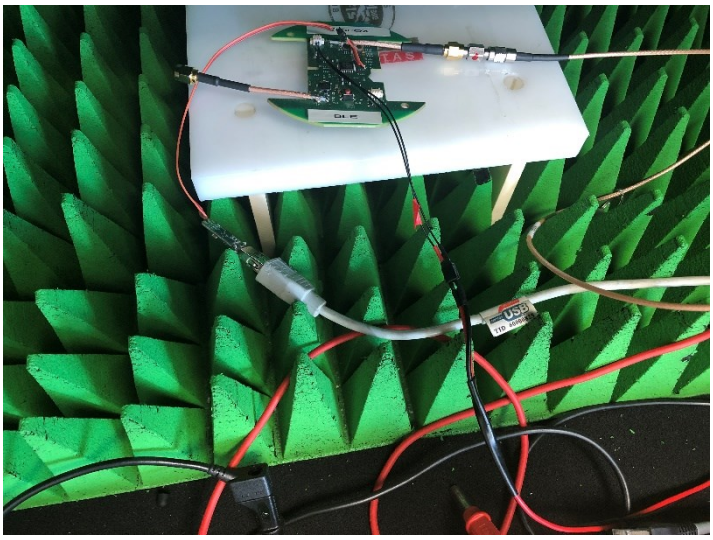
- Test Procedure:
☐ RSS-Gen Issue 5 § 6.7
☑ ANSI C63.10 § 6.9.2

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

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

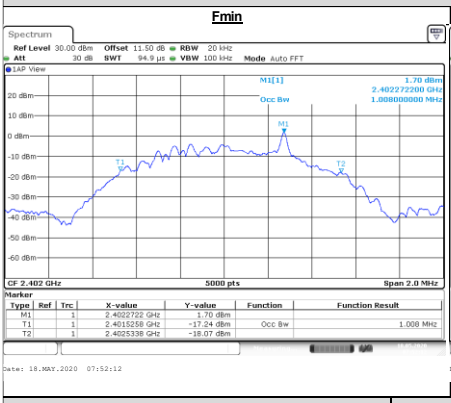
Note: In our quality system, the test equipment calibration due is more & less 4 months

3.5. RESULTS

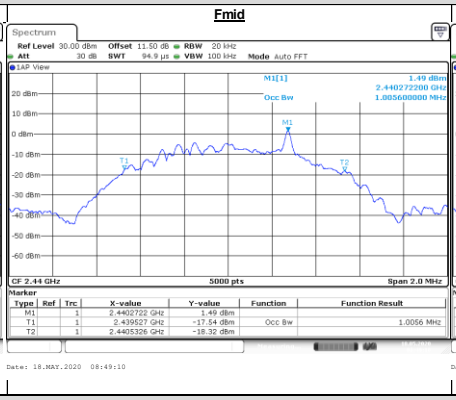
1MBits/s

GFSK DH5 TX1

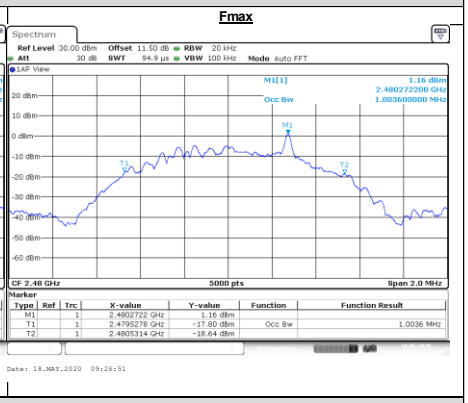
Fmin



Fmid



Fmax



Temperature	Tnom		
Channel	**Cmin**	**Cmid**	**Cmax**
Occupied Channel bandwith (MHz)	**1.008**	**1.0056**	**1.0036**
Lowest frquency (MHz)	**2401.5258**	**2439.527**	**2479.5278**
Highest frequency (MHz)	**2402.5338**	**2440.5326**	**2480.5314**

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. 6DB EMISSION BANDWIDTH

4.1. TEST CONDITIONS

Test performed by	: Gaetan DESCHAMPS
Date of test	: May 18, 2020
Ambient temperature	: 23 °C
Relative humidity	: 32 %

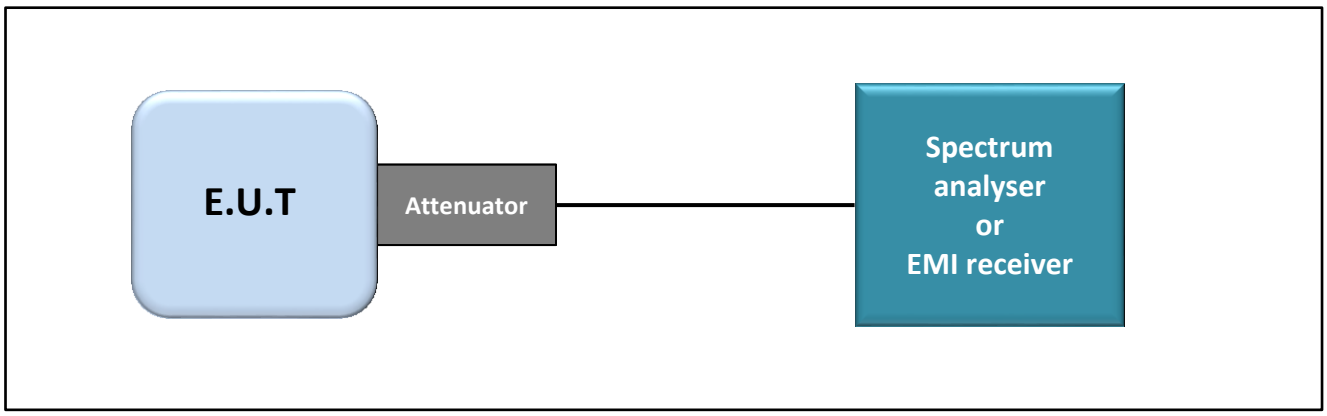
4.2. TEST SETUP

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

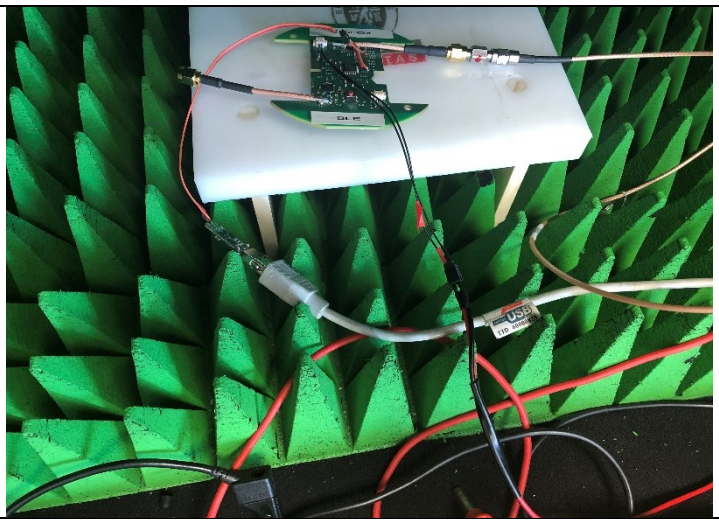
- Measurement is performed with a spectrum analyzer in:
☑ Conducted Method
☐ Radiated Method

- Test Procedure:
☑ KDB 558074 D01 DTS Meas Guidance v05r02 § 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

The 6dB bandwidth shall be at least 500kHz

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

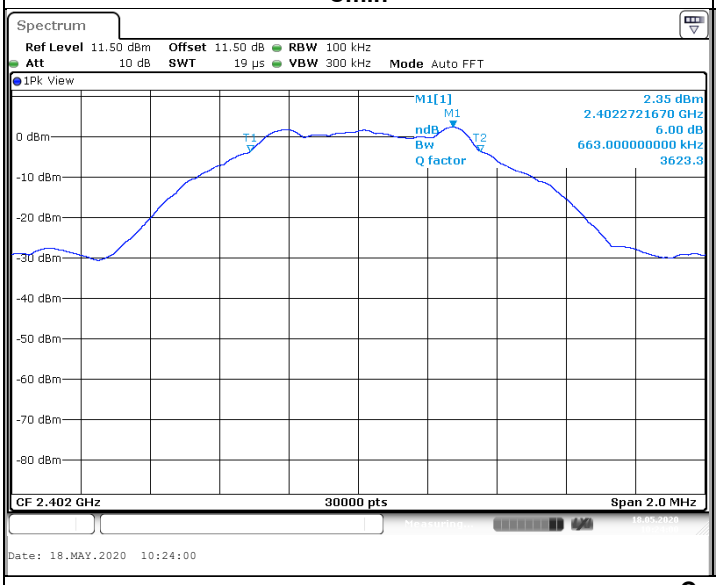
Note: In our quality system, the test equipment calibration due is more & less 4 months

4.5. RESULTS

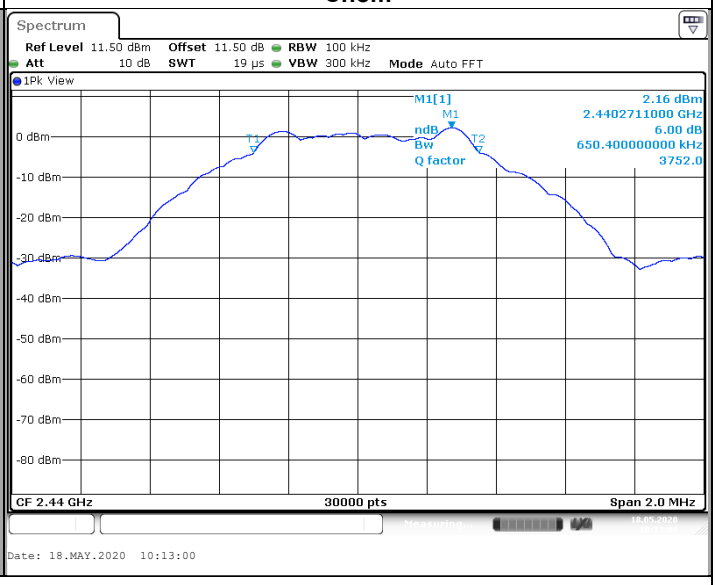
1MBits/s (same modulation)

6dB Emission Bandwidth

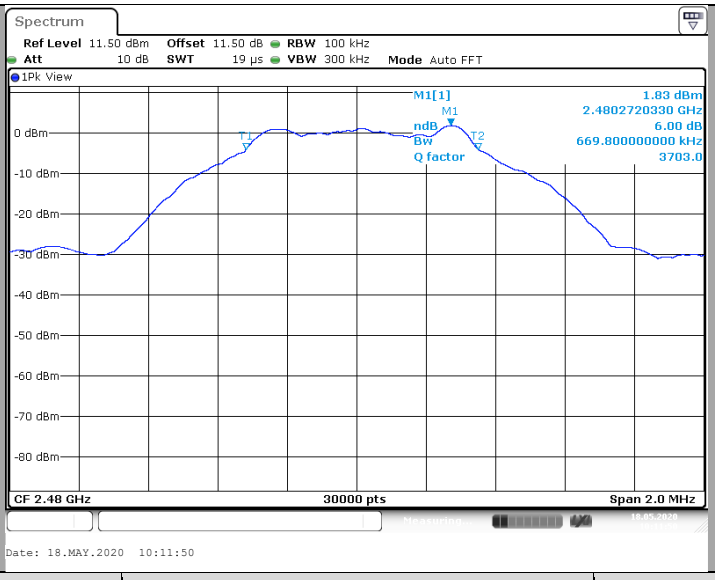
Cmin



Cnom



Cmax



Channel	6dB Emission Bandwidth (MHz)	Limit (MHz)
Cmin	0.6630	Minimum 0.5
Cnom	0.6504	Minimum 0.5
Cmax	0.6698	Minimum 0.5

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. MAXIMUM CONDUCTED OUTPUT POWER

5.1. TEST CONDITIONS

Test performed by	: Gaetan DESCHAMPS
Date of test	: May 18, 2020
Ambient temperature	: 23 °C
Relative humidity	: 32 %

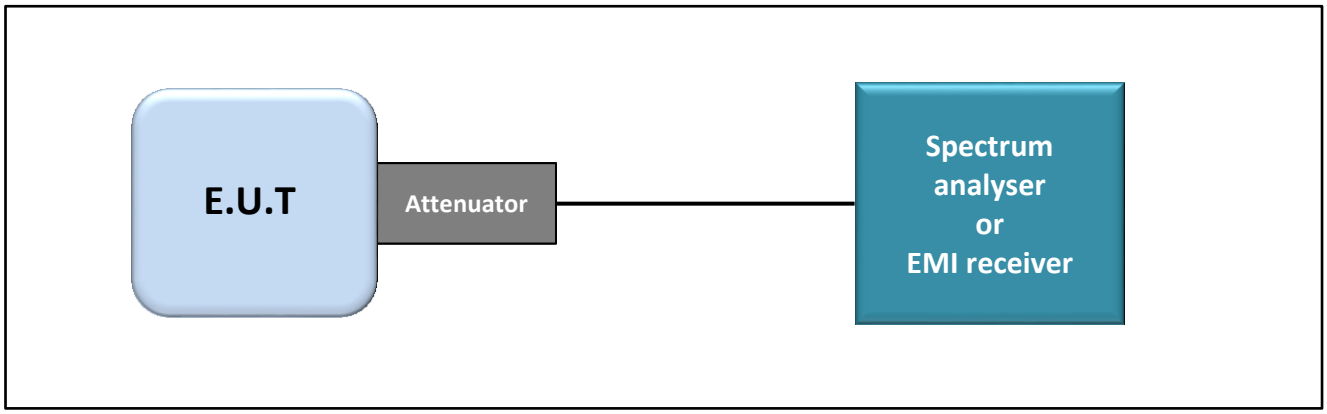
5.2. TEST SETUP

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

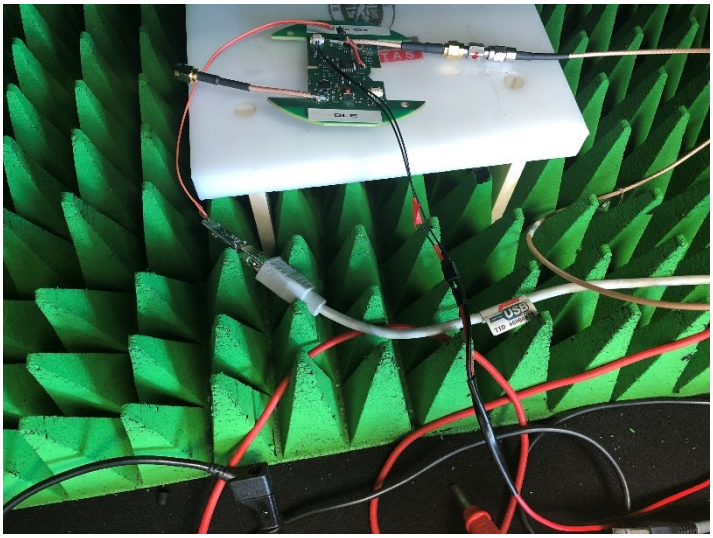
- Measurement is performed with a spectrum analyzer in:
☑ Conducted Method
☐ Radiated Method

- Test Procedure:
☑ KDB 558074 D01 DTS Meas Guidance v05r02 § 8.3.1.1
This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.
a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ 3 x RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

☐ KDB 558074 D01 DTS Meas Guidance v05r02 § 8.3.1.2
This procedure may be used when the maximum available RBW of the measurement instrument is less than the DTS bandwidth.
a) Set the RBW = 1 MHz.
b) Set the VBW ≥ 3 x RBW
c) Set the span ≥ 1.5 x DTS bandwidth.
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges



Test set up of Maximum Conducted Output Power



Photograph for Maximum Conducted Output Power

5.3. LIMIT

Maximum Conducted Output power:
2400MHz-2483.5MHz: Shall not exceed 30dBm
Limits are reduced by G-6dBi if Overall Antenna Gain above 6dBi

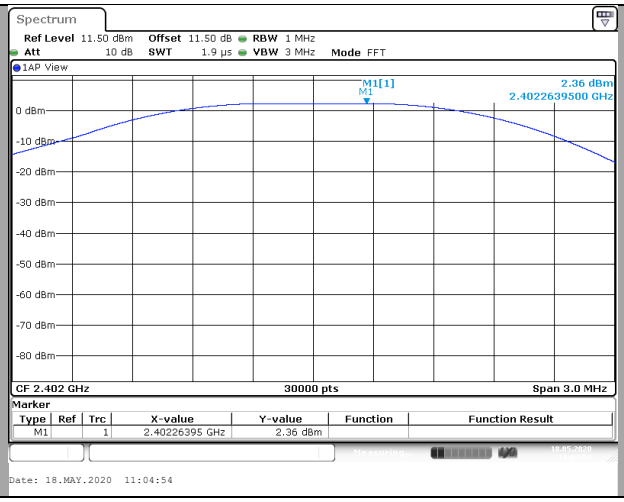
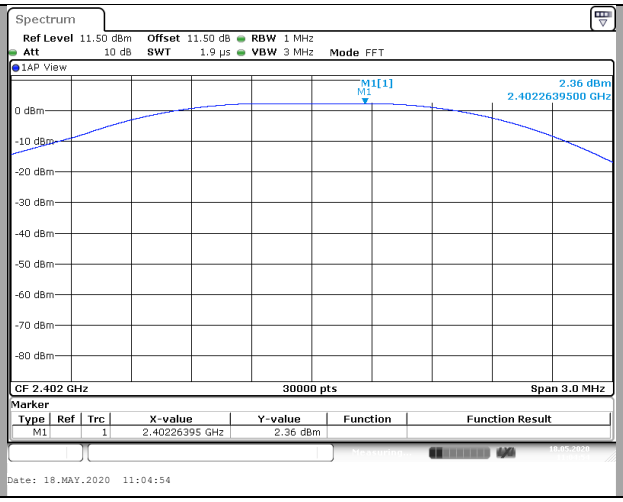
5.4. TEST EQUIPMENT LIST

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

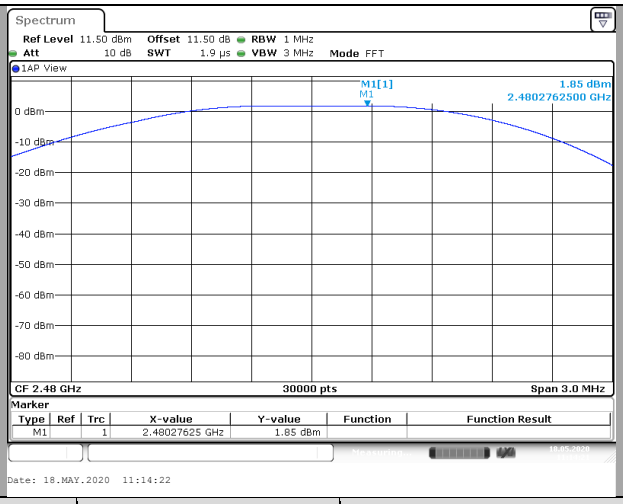
Note: In our quality system, the test equipment calibration due is more & less 4 months

5.5. RESULTS

1MBits/s

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	2.36	30. Reduced by G-6dBi if Antenna Gain above 6dBi
Cnom	**11.5**	0	2.17	30. Reduced by G-6dBi if Antenna Gain above 6dBi
Cmax	**11.5**	0	1.85	30. Reduced by G-6dBi if Antenna Gain above 6dBi

5.6. 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.

6. POWER SPECTRAL DENSITY

6.1. TEST CONDITIONS

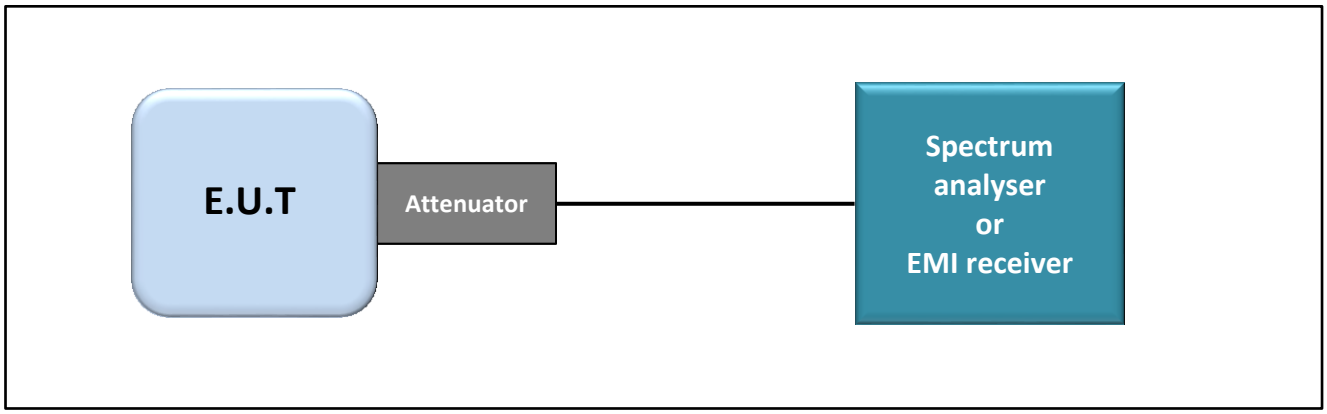
Test performed by	: Gaetan DESCHAMPS
Date of test	: May 18, 2020
Ambient temperature	: 23 °C
Relative humidity	: 32 %

6.2. TEST SETUP

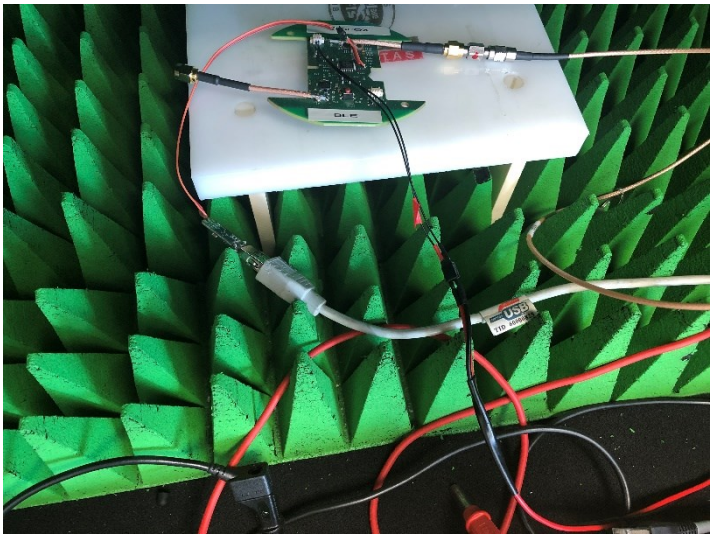
- The Equipment Under Test is installed:
☐ On a table
☑ In an anechoic chamber

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

- Test Procedure:
☑ KDB 558074 D01 DTS Meas Guidance v05r02 § 8.4 (Method PKPSD)
a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Test set up of Power Spectral Density



Photograph for Power Spectral Density

6.3. LIMIT

Power Spectral Density:
2400MHz-2483.5MHz: Shall not exceed 8dBm/3kHz
Limits are reduced by G-6dBi if Overall Antenna Gain above 6dBi

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

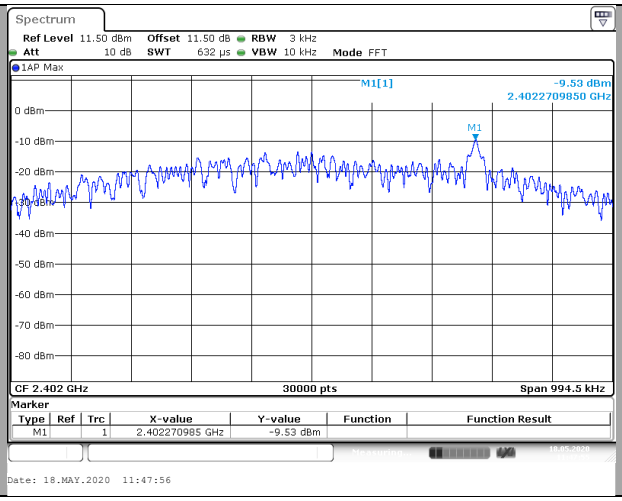
Note: In our quality system, the test equipment calibration due is more & less 4 months

6.5. RESULTS

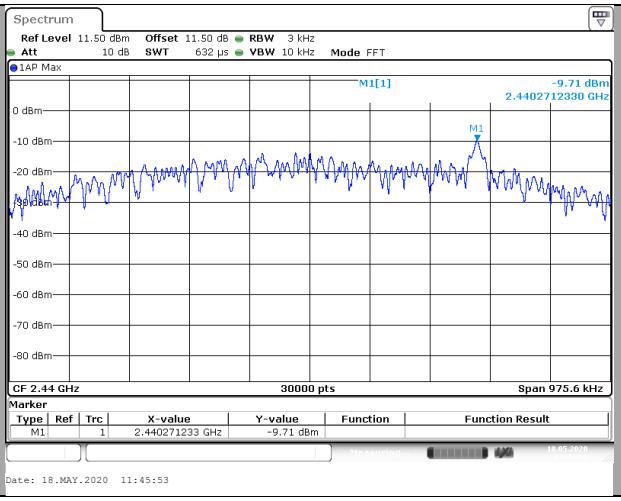
1MBits/s

Power Spectral Density

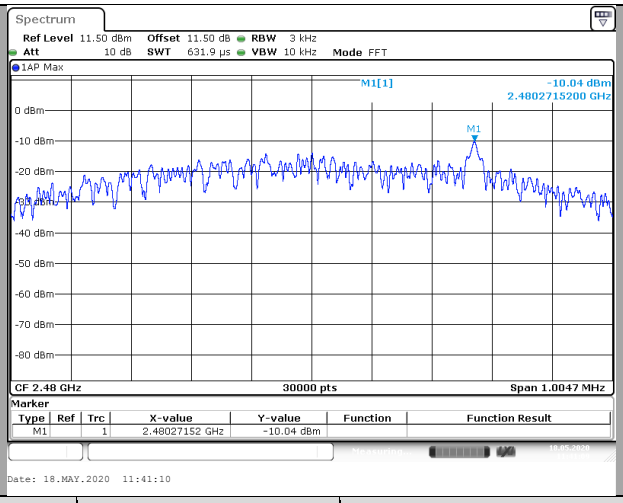
Cmin



Cnom



Cmax



Channel	Offset Cable + Att (dB)	Antenna Gain (dBi)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
Cmin	**11.5**	0	-9.53	8. Reduced by G-6dBi if Antenna Gain above 6dBi
Cnom	**11.5**	0	-9.71	8. Reduced by G-6dBi if Antenna Gain above 6dBi
Cmax	**11.5**	0	-10.04	8. Reduced by G-6dBi if Antenna Gain above 6dBi

6.6. CONCLUSION

Power Spectral Density 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.

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

7.1. TEST CONDITIONS

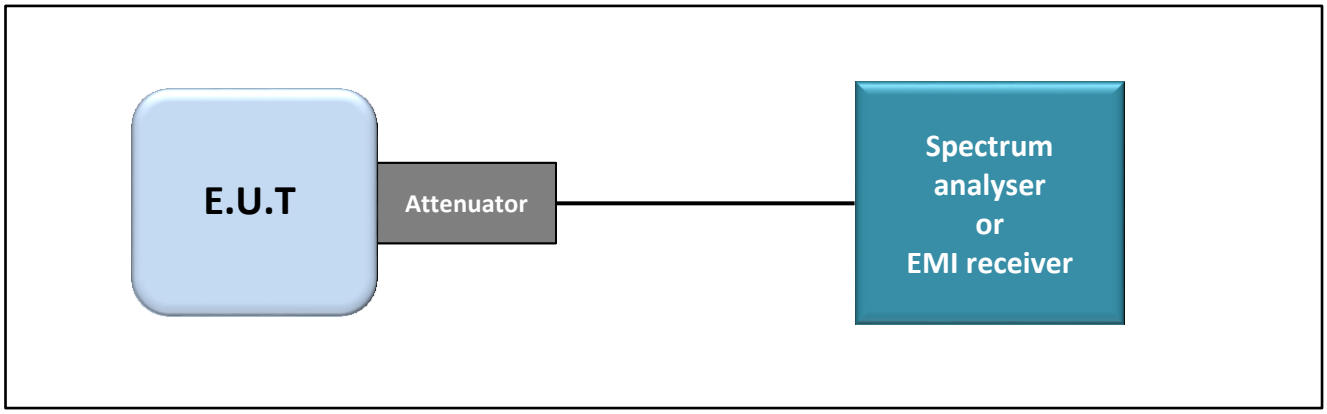
Test performed by	: Gaetan DESCHAMPS
Date of test	: May 18, 2020
Ambient temperature	: 23 °C
Relative humidity	: 32 %

7.2. TEST SETUP

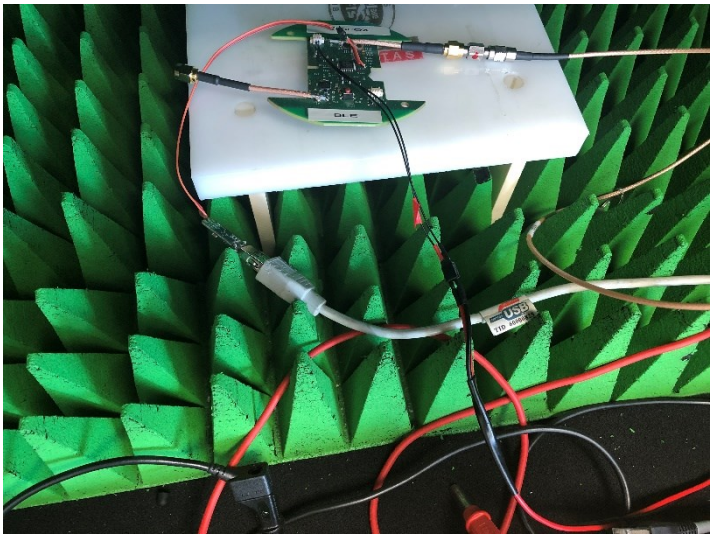
- The Equipment Under Test is installed:
☐ On a table
☑ In an anechoic chamber

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

- Test Procedure:
☑ KDB 558074 D01 DTS Meas Guidance v05r02 § 8.5



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

7.3. LIMIT

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

7.4. TEST EQUIPMENT LIST

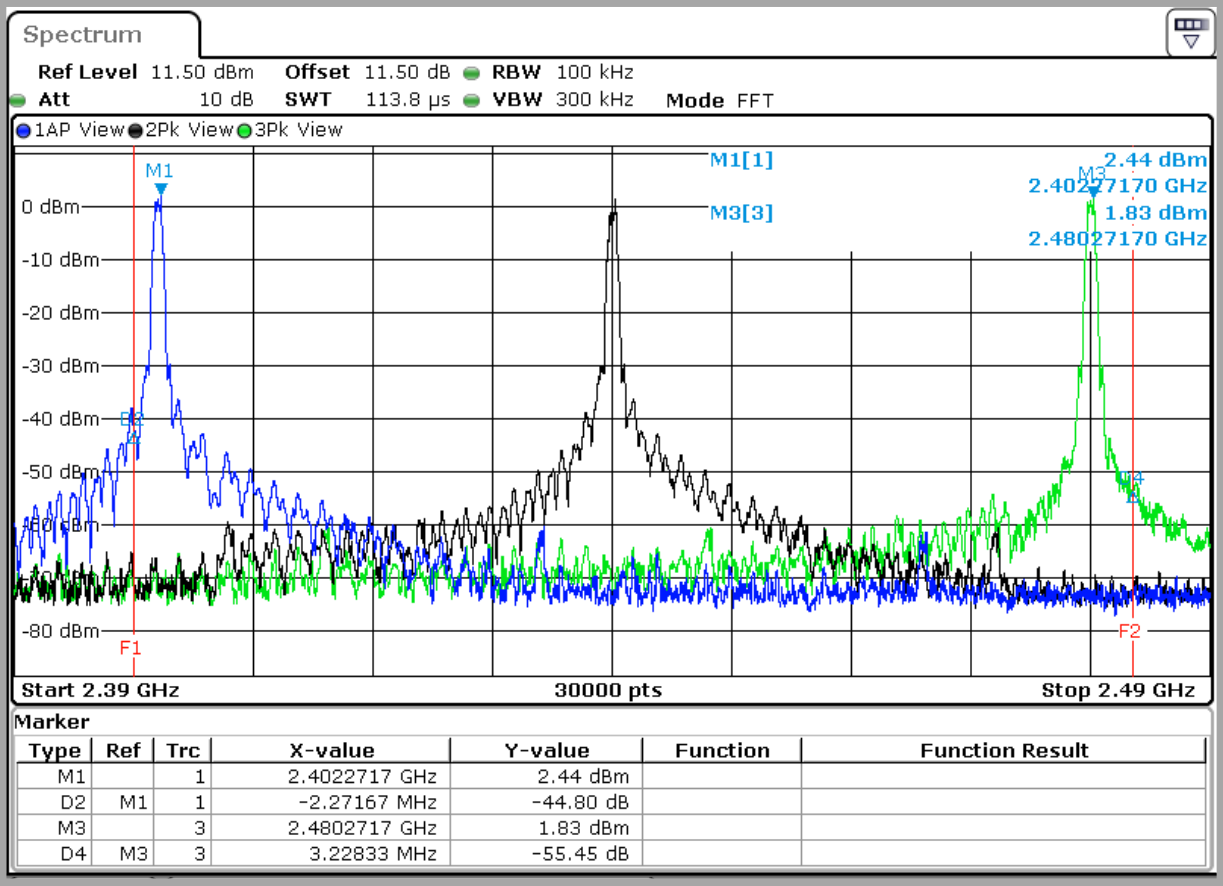
TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
CABLE SMA 1m	RADIALL	18GHz	A5329862	11/18	05/20
DC POWER SUPPLY 20V	HEWLETT PACKARD	6632A	A7042061		
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20
Spectrum analyzer	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

1MBits/s

Cmin/Cnom/Cmax



Frequency (MHz)	Level (dBc)	Limit (dBc)
2400	**44.80**	20
2483.5	**55.45**	20

7.6. 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.

8. UNWANTED EMISSIONS INTO NON-RESTRICTED FREQUENCY BANDS

8.1. TEST CONDITIONS

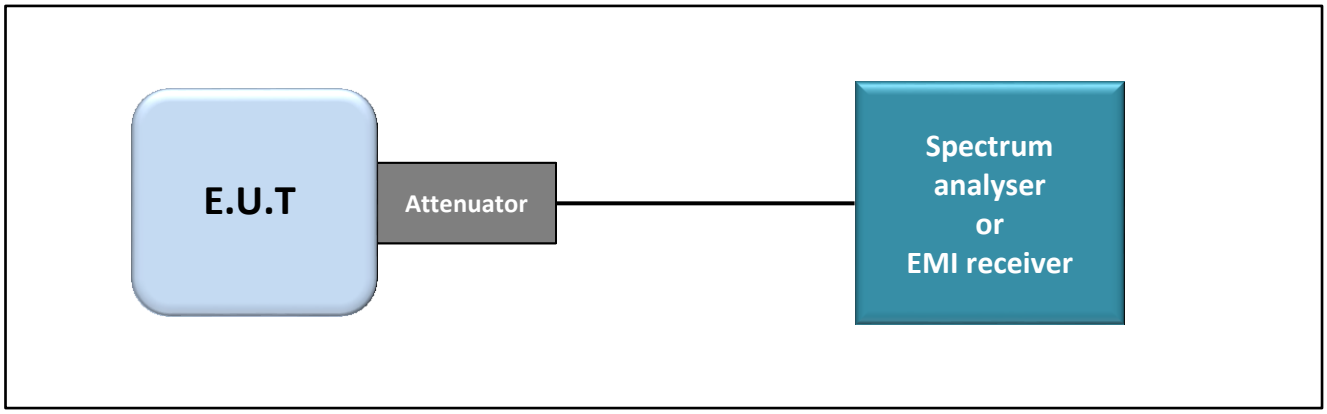
Test performed by	: Gaetan DESCHAMPS
Date of test	: May 25, 2020
Ambient temperature	: 23 °C
Relative humidity	: 33 %

8.2. TEST SETUP

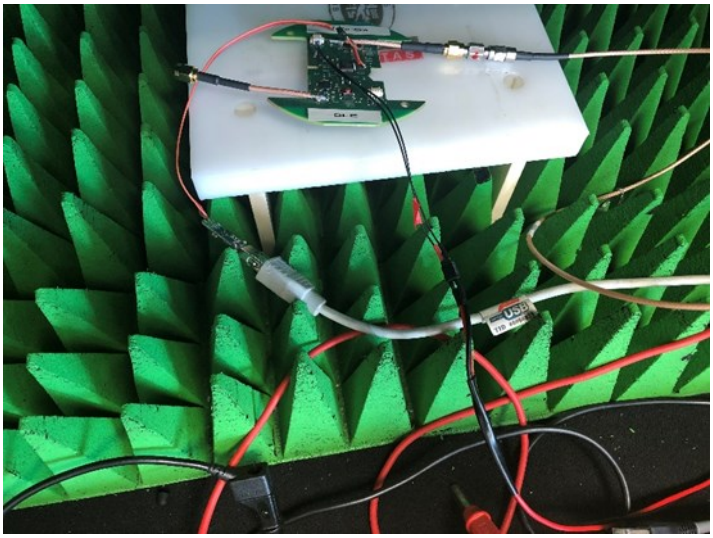
- The Equipment under Test is installed:
☐ On a table
☑ In an anechoic chamber

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

- Test Procedure:
☑ KDB 558074 D01 DTS Meas Guidance v05r02 § 8.5



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



Photograph for Unwanted Emission into non-restricted frequency bands

8.3. LIMIT

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

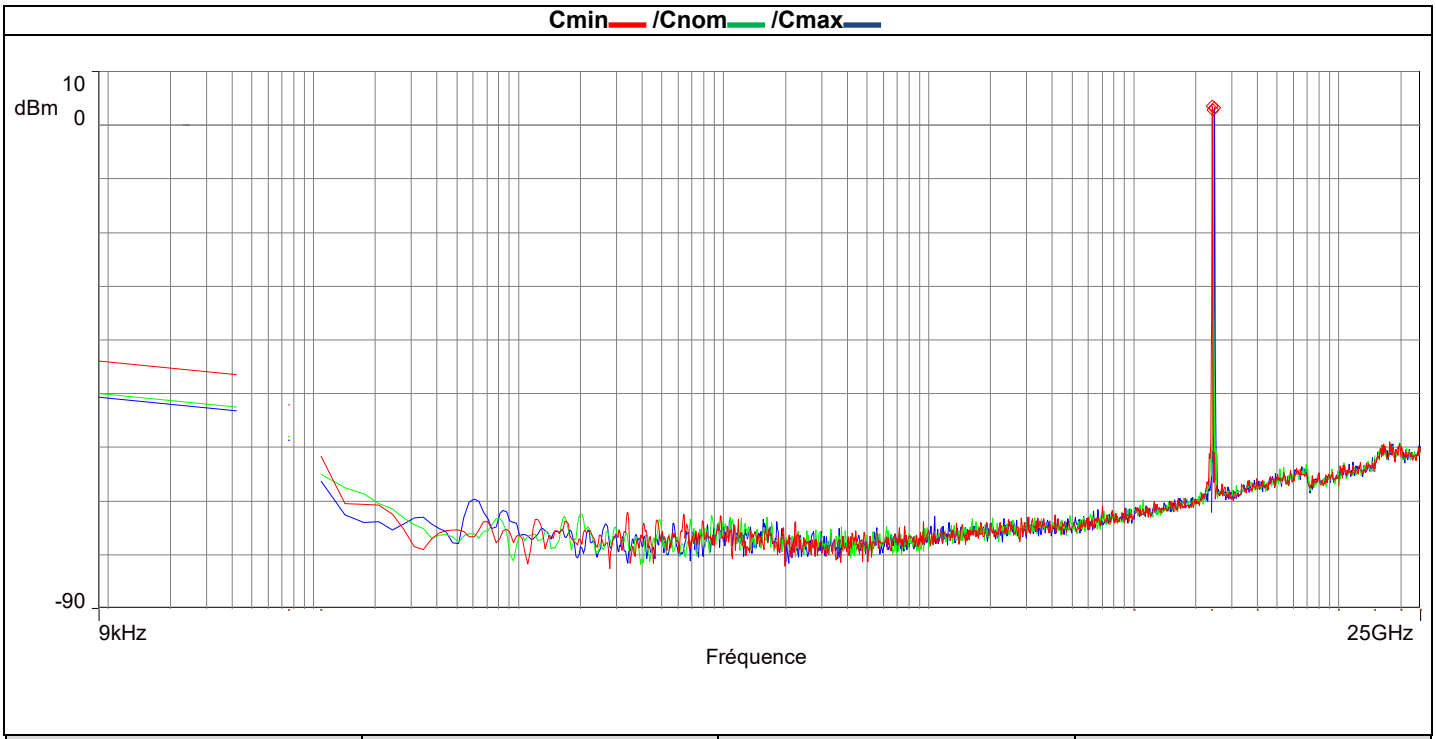
8.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Cable	TELEDYNE	26GHz	A5329680	02/19	08/20
Attenuator 10dB	AEROFLEX	_	A7122269	12/18	06/20
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	05/21	05/23
BAT EMC	NEXIO	v3.19.1.18	L1000115		
Comb EMR HF	YORK	CGE01	A3169114		
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	08/18	08/20
DC POWER SUPPLY 20V	HEWLETT PACKARD	6632A	A7042061		
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	11/18	11/20

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

8.5. RESULTS

1MBits/s



Frequency (MHz)	Level (dBm)	Level (dBc)	Limit (dBc)
2402.00	3.51		
2442.00	2.88		
2480.00	3.284		

8.6. 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: **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.

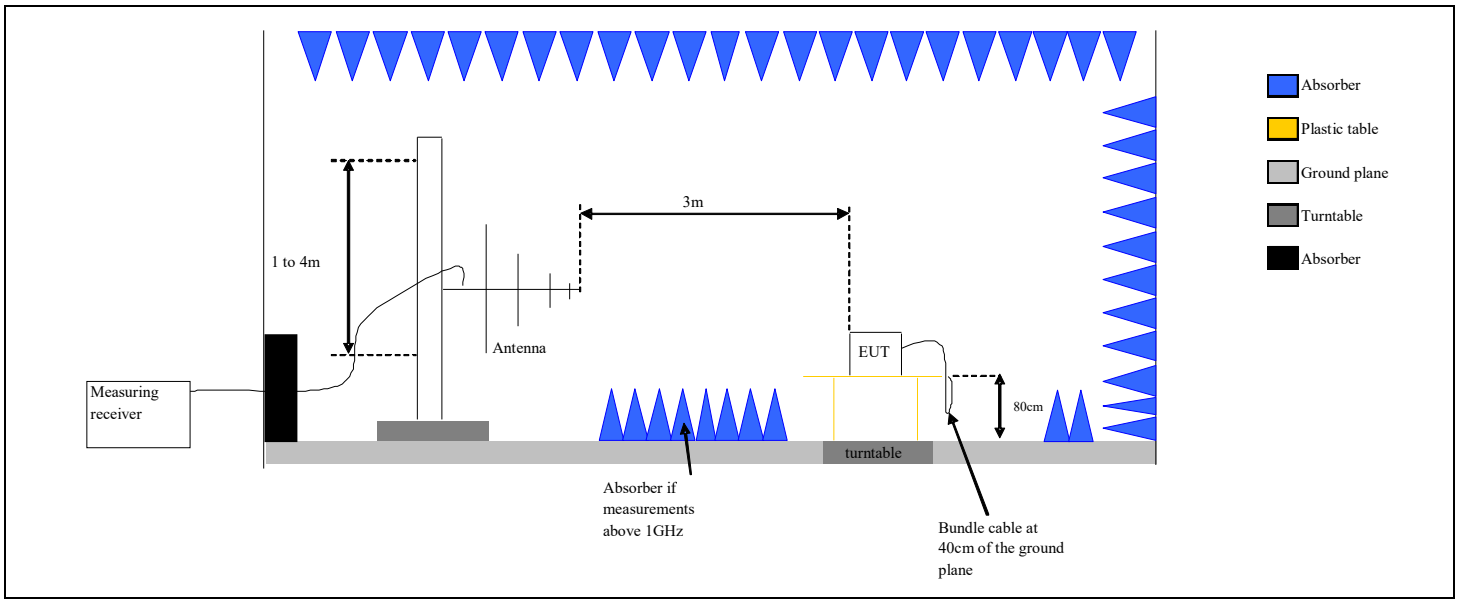
9. UNWANTED EMISSIONS IN RESTRICTED FREQUENCY BANDS

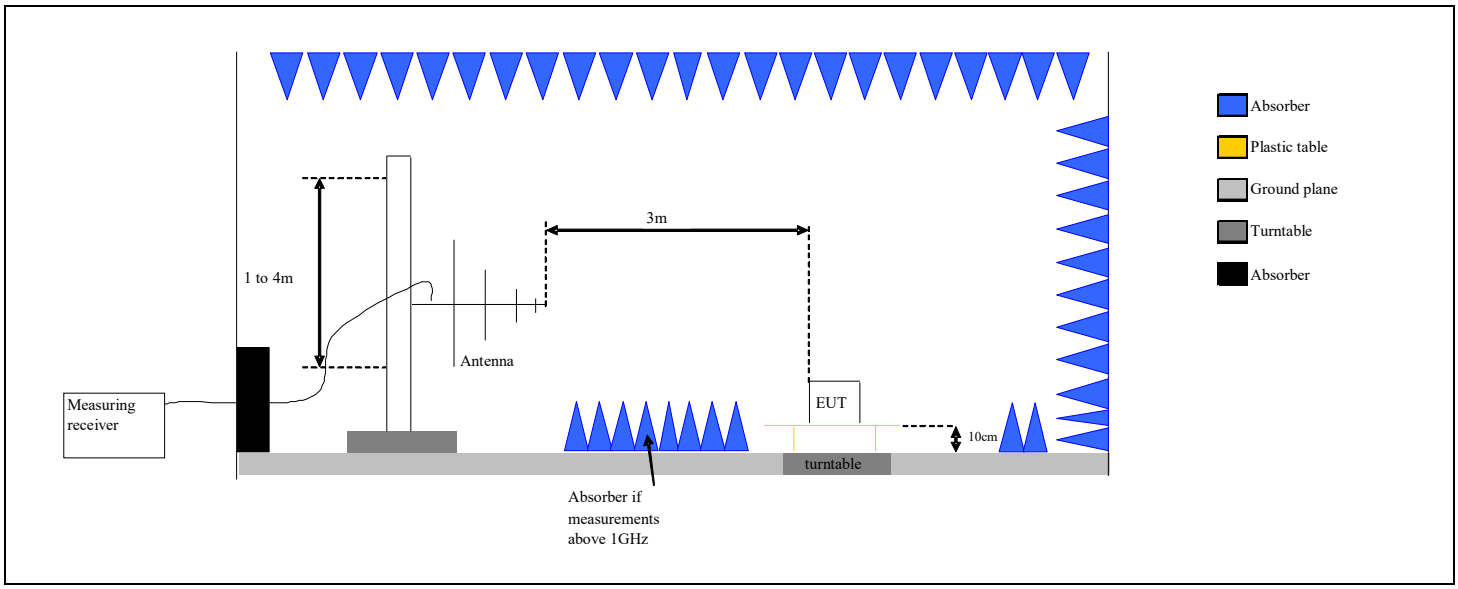
9.1. TEST CONDITIONS

Test performed by	: Gaetan DESCHAMPS
Date of test	: March 17, 2020
Ambient temperature	: 22 °C
Relative humidity	: 32 %

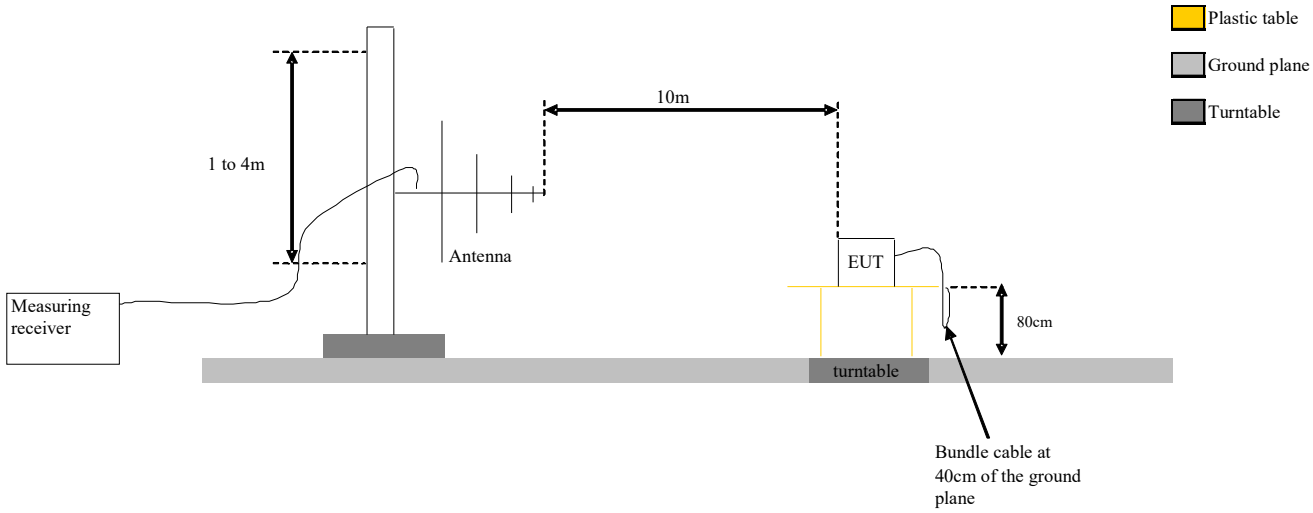
9.2. TEST SETUP

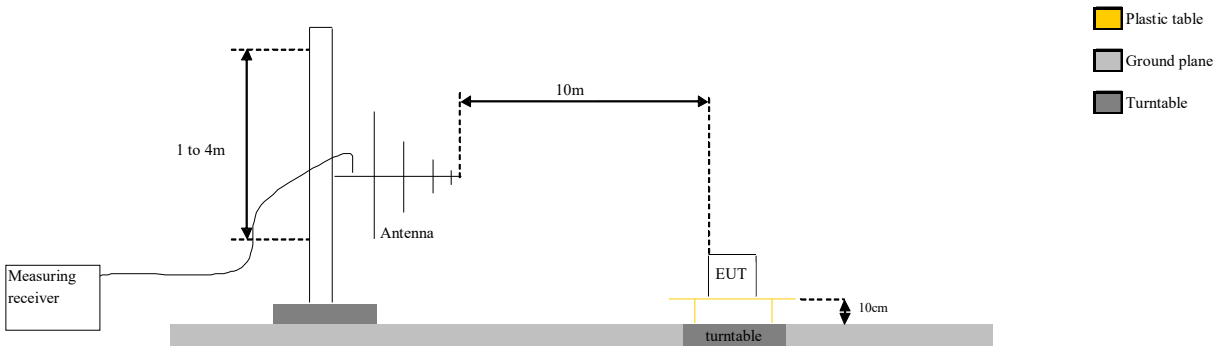
The product has been tested according to ANSI C63.10 (2013) and FCC part15 subpart C.
Test is performed in parallel, perpendicular and ground parallel axis with a loop antenna below 30MHz. Measurement bandwidth was 200Hz below 150kHz and 9kHz between 150kHz & 30MHz. The level has been maximised by the turntable rotation of 360 degrees range on 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 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 **3m**.
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 beamwidth of the measurement antenna, ANSI C63.10 §6.6.5)
Frequency list has been created with anechoic chamber pre-scan results.





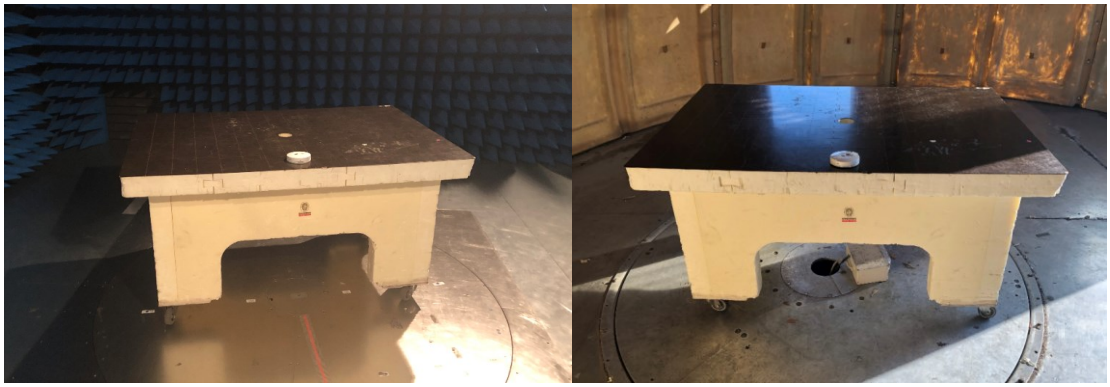
Test set up of Unwanted Emissions in Restricted Frequency Bands in semi anechoic chamber





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

9.3. 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

9.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Amplifier 9kHz - 40GHz	LCIE SUD EST	_	A7102082	10/18	03/20
Antenna Bi-Log	CHASE	UPA6192	C2040221	01/18	01/20
Antenna horn 18GHz	EMCO	3115	C2042029	09/17	09/20
BAT EMC	NEXIO	v3.19.1.18	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
Radiated emission comb generator	BARDET	_	A3169050		

Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019	12/17	04/20
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 (4.8-18GHz)	BL Microwave	SH4800-1800	A7484034	08/19	08/20
Antenna horn 40GHz	SCHWARZBECK	BBHA 9170	C2042028	09/18	09/20

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

9.5. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

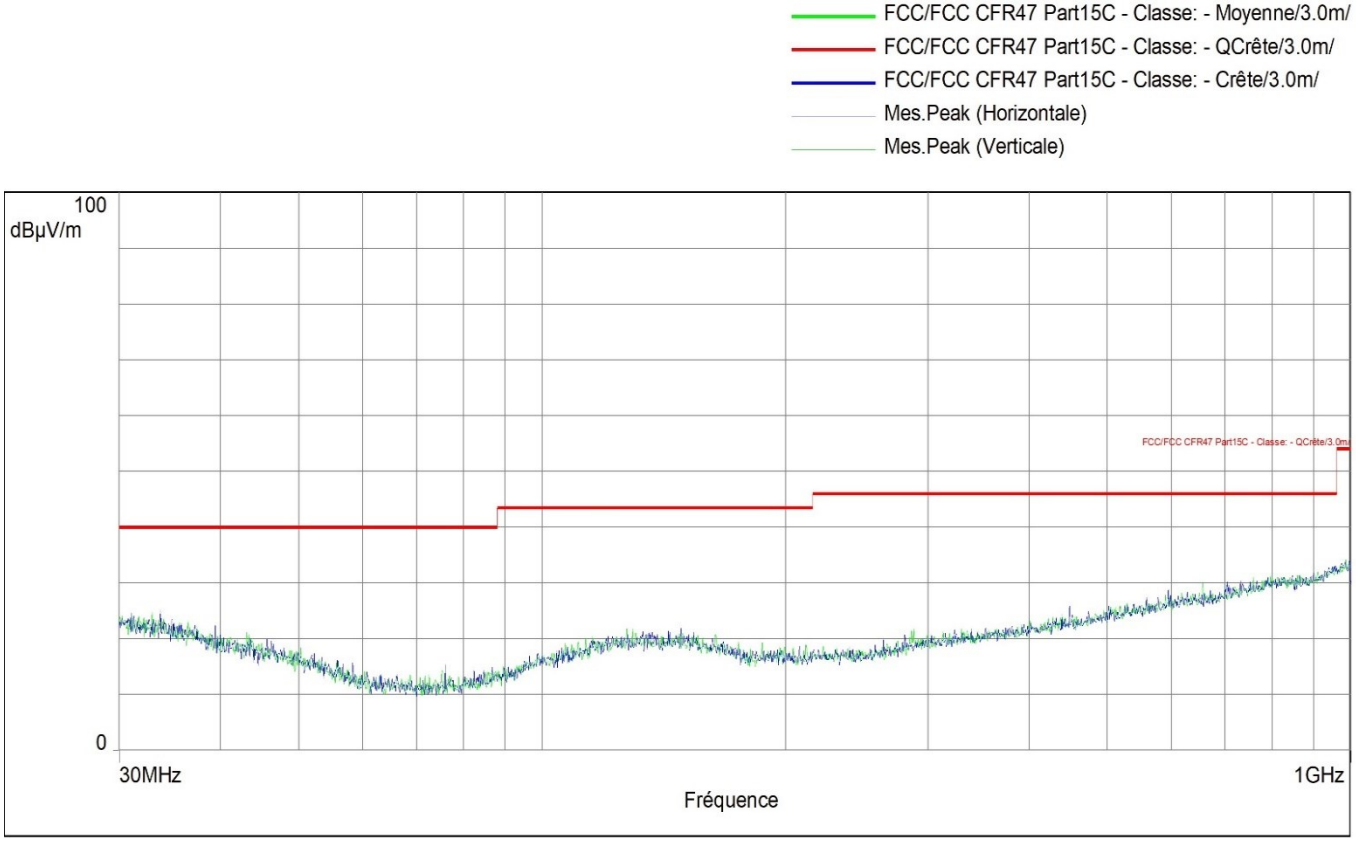
☑ None ☐ Divergence:

9.6. RESULTS

Results in the frequency band [0.009-30] MHz:
No significant frequency observed due to RF module (See test results in §8.5).

Results in the frequency band [30-1000] MHz: Worst case presented see test results in §8.5(Cmin, Cmid or Cmax):

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



Spurious emissions
No significative frequency observed

QUALIFICATION (30MHz-1GHz): 10 meters measurement on the Open Area Test Site.
Frequency list has been created with semi-anechoic chamber pre-scan results.
Measurements are performed using a QUASI-PEAK detection.

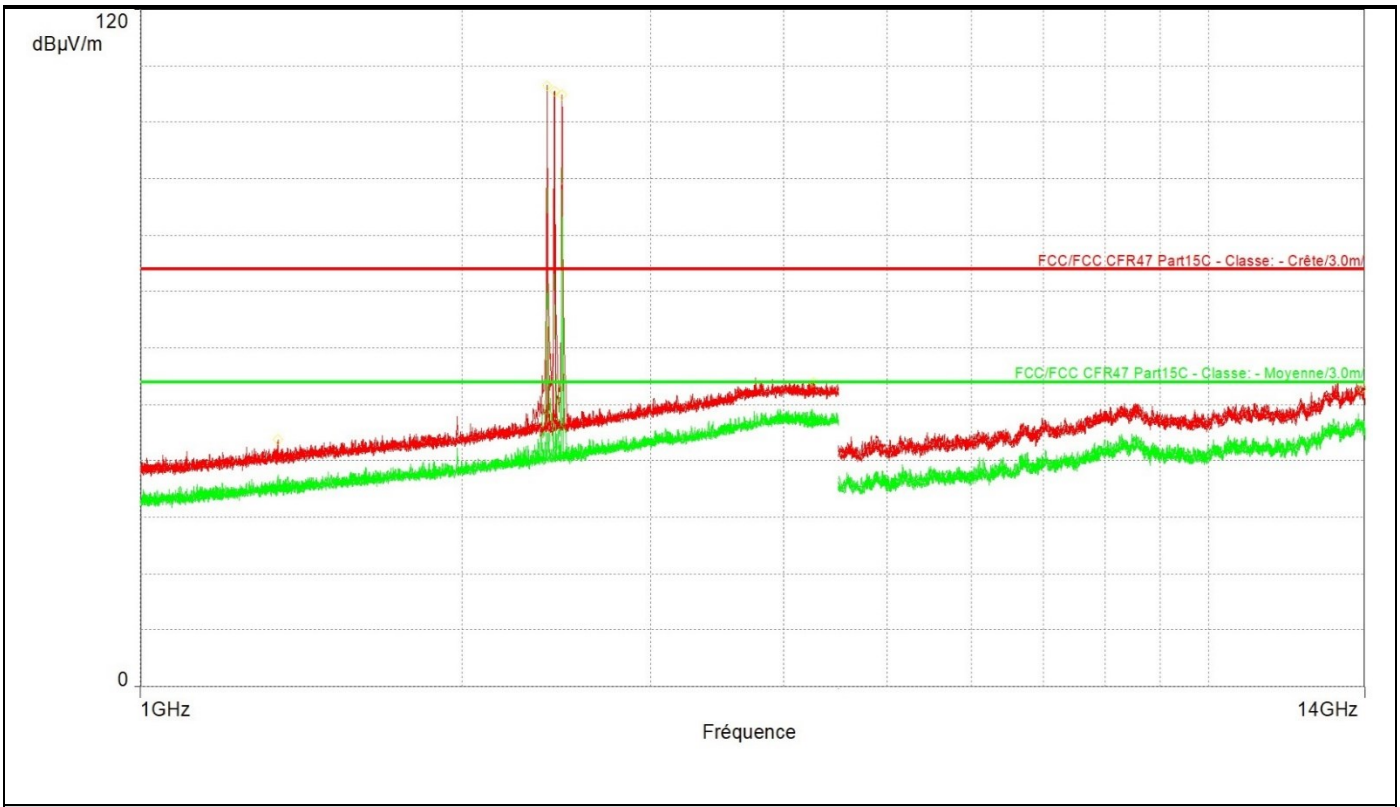
Test Frequency (MHz)	Meter Reading dB(µV)	Detector (Pk/QP/Av)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Transducer Factor (dB)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Remark
No significant frequency observed										

Note: Measure have been done at 10m distance and corrected according to requirements of 15.209.e)
(M@3m = M@10m+10.5dB)

Results in the frequency band [1-14] GHz:

CMIN/CMID/CMAX

RADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - Worst Case presented - TX mode - Axis XY	
Class:			
Frequency range: [1GHz - 14GHz]			
Antenna polarization:		**RBW :**	1MHz
Azimuth:	0° - 360°	**VBW :**	3MHz



Spurious emissions

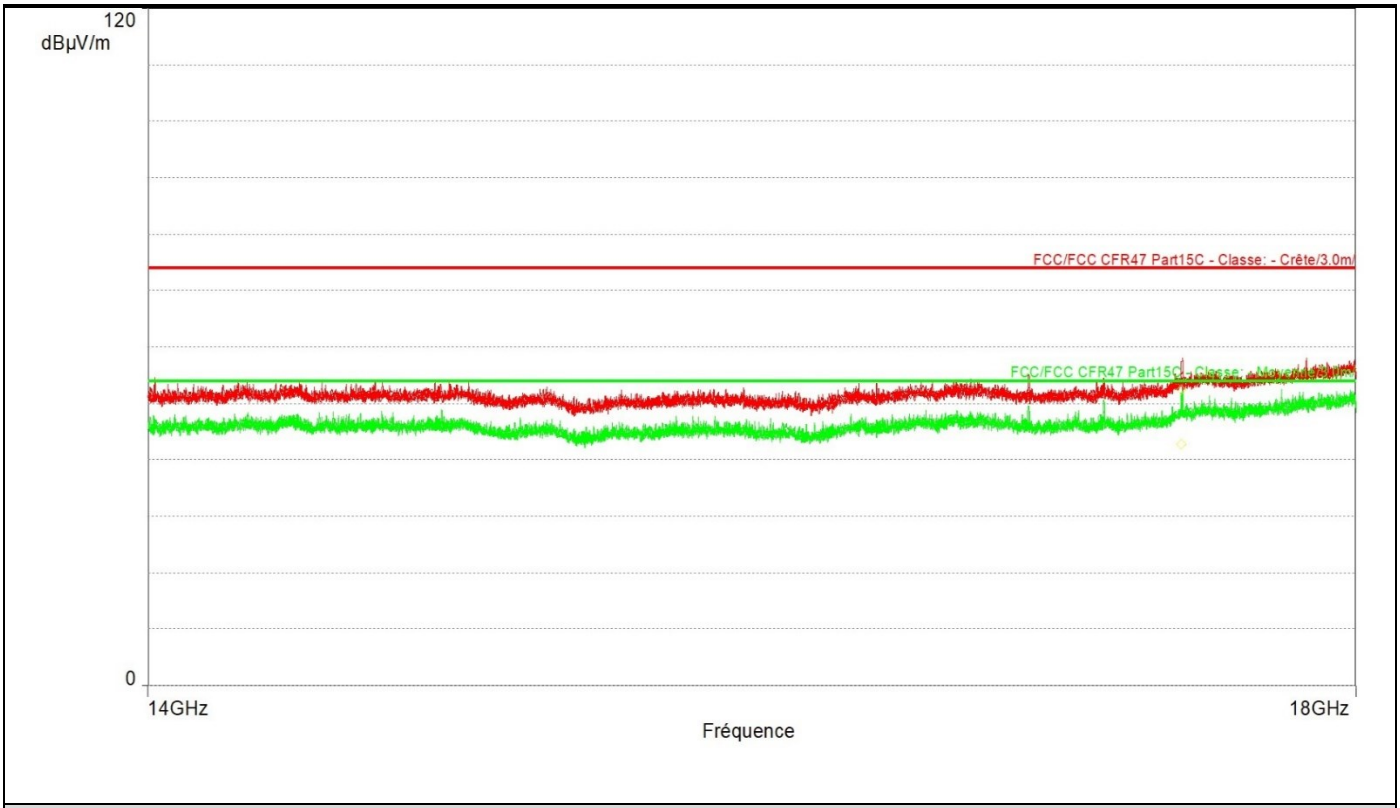
Worst case see in pre-characterization :

Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)	Limit (dBµV/m)		Polarization Worst case
			Peak	Average	
1343.7	43.81	37.52	74	54	H
2402.0*	106.46	104.60			
2440.0*	105.50	104.23			
2480.0*	104.87	104.25			
4267.6	53.90	48.68	74	54	H
13897.4	52.75	47.40	74	54	H

*Carrier frequency

Results in the frequency band [14-18] GHz:

RADIATED EMISSIONS			
Graph name:	Emr#3	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - Worst Case presented - TX mode - Axis XY	
Class:			
Frequency range: [14GHz - 18GHz]			
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)
17358.328	42.8	54.0	-11.2	1.8

Frequency (MHz)	Mes.Peak (dBµV/m)	Limite (dBµV/m)	Mes.-Lim. (dB)	Correction (dB)
17358.328	52.5	74.0	-21.5	1.8

Results in the frequency band [18-26] GHz: No significant frequency observed

9.7. CONCLUSION

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

10. UNCERTAINTIES CHART

Type de mesure / *Kind of measurement*	**Incertitude élargie laboratoire / *Wide uncertainty laboratory* (k=2) ± x**	**Incertitude limite du CISPR / *CISPR uncertainty limit* ± y**
Measurement of conducted disturbances in voltage on the power port	3.29dB	3.4 dB
Measurement of conducted disturbances in voltage on the telecommunication port.	3.26 dB	5dB
Measurement of discontinuous conducted disturbances in voltage	3.33 dB	3.4 dB
Measurement of conducted disturbances in current	2.67 dB	2.9dB
Spurious emission, radiated (Semi anechoic chamber & open test site)	*5.60 dB*	*6 dB*
Spurious emission, radiated (Full anechoic chamber above 1GHz)	*±3.8 dB*	*±6 dB*
Occupied Channel Bandwidth	*±2.8 %*	*±5 %*
RF power, conducted	*±1.2 dB*	*±1.5 dB*
Power Spectral Density, Conducted	*±1.7 dB*	*±3 dB*
Spurious emission, conducted	*±2.3 dB*	*±3 dB*
Temperature	*±0.75 °C*	*±3 °C*
Supply Voltages	*±1.7 %*	*±3 %*

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par la norme, la conformité de l'échantillon est établie directement par les niveaux limites applicables. / *The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the standard. The conformity of the sample is directly established by the applicable limits values.*