902MHz-928MHz Template: Release March 22nd, 2022

TEST REPORT

N°: 14198293-776033-B(FILE#3899006) **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	**SRETT** 121 rue d'aguesseau 92100 – Boulogne Billancourt France
Apparatus under test	
Product	**Wireless pressure and temperature sensors**
Trade mark	**BumbleBee**
Manufacturer	**SRETT**
Family Range (see annex 1)	**P*****32* / 1001910 / T***32**** / 1001920**
Model under test	**1001910**
Serial number	**070049**
FCC ID	**RDT-1003135**
Conclusion	See Test Program chapter
Test date	February 1, 2023 to February 3, 2023
Test location	Moirans
FCC Test site	FR0008 - 197516
Sample receipt date	November 28, 2022
Composition of document	44 pages
Document issued on	February 6, 2023

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PUBLICATION HISTORY

Version	Date	Author	Modification
01	January 3, 2023	Majid MOURZAGH	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

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. INFORMATIONS

Tests are performed on the most complete product **BumbleBee** 1001910, SN: **070049** . See Table on chapter annex 1 for difference between products.

2.2. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

Equipment under test (EUT):

BumbleBee 1001910 **Serial Number: 070049**

Equipment Under Test

Power supply:

During all the tests, EUT is supplied by V_{nom}: 3.6VDC

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

Name	Type	Rating	Reference / Sn	Comments
Supply1	☑ Battery	3.6V	/	/

Inputs/outputs - Cable:

Access	Type	Length used (m)	Declared <3m	Shielded	Under test	Reference
Antenna	Type N	/	/	/		SOLEXY : ANH52
None						

Auxiliary equipment used during test:

Type	Reference	Sn	Comments
Laptop	LENOVO L460	/	/

Equipment information:

Type:			
Frequency band:	[902 – 928] MHz		
Number of Channel:	64		
Spacing channel:	200 kHz		
Channel bandwidth:	150 kHz		
Antenna Type:	☐ Integral	☑ External	☐ Dedicated
Antenna connector:	☑ Yes	☐ No	☐ Temporary for test
Transmit chains:	☑ 1	☐ 2	
Receiver chains	☑ 1	☐ 2	
Antenna Requirements §15.203	The transmitter uses an external an with N connector which is classified as a unique connector		
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	
	Tnom:	20°C	
	Tmax:	☑ 55°C	
Type of power source:	☑ Battery		
Operating voltage range:	Vnom:	☑ 3.6 Vdc	

		Antenna Characteristic			
Antenna n°	**Antenna Model**	**Gain (dBi)**	**Frequency Band (MHz)**	**Connector type**	**Impedance(Ω)**
1	SOLEXY Dipole ANH 52	2	890 – 935 MHz	N	50

CHANNEL PLAN	
Channel	**Frequency (MHz)**
Cmin	902.3
Cmid	908.5
Cmax	914.9

Modulation Type	**Worst Case Modulation**
CSS	☑

Hardware information		
Software (if applicable):	**V. :**	**RealTerm V 2.0.0.70**

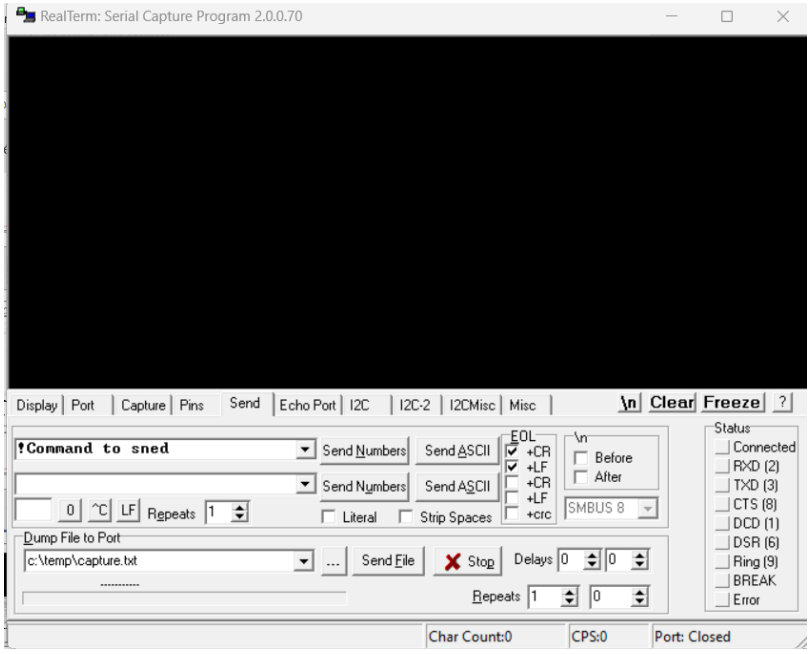
2.3. RUNNING MODE

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()
Receiver Radiated emissions	☑ Test mode 2 (1)	☐ Alternative test mode()

(1) Following commands with the specific test software “RealTerm” are used to set the product:

a. – See document below for the command used during test.



Mode	Start (1)	Mode (2)	End (1)	Frequency (Hz) (6)	Description
Modulated permanent emission	!	TM	;	XXXXX e.g. 902300	Recurring emission of messages whose payload is counter starting from 0. Each time a number is sent, the counter is incremented. Modulation is at 125 KHz.
Permanent reception	!	RX	;	XXXXX e.g. 868100	Permanent reception. Each time a message is received on the chosen frequency, it is displayed on the Hyperterminal. Note: Only the messages sent by the SRETT signal generator will be displayed (The transmission and reception messages include a text to filter other messages, or corrupted messages).
Modulated ON/OFF emission	!	TO	;	XXXXX e.g. 9149000	ON/OFF emission. The device sends the same messages as the 'TM' mode, but with a 1 second delay between two messages.

- '!TM;902300' : permanent modulated emission on 902.3 MHz.
- '!TM;908500' : permanent modulated emission on 908.5 MHz.
- '!TM;914900' : permanent modulated emission on 914.9 MHz.
- ! TO;908500': ON/OFF emission on 908.5 MHz.

2.4. EQUIPMENT LABELLING

None

2.5. EQUIPMENT MODIFICATION

☑ None ☐ Modification:

2.6. *FIELD STRENGTH CALCULATION*

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follow:

FS = RA + AF + CF – AG

Where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Factor
AG = Amplifier Gain

Assume a receiver reading of 52.5dBµV is obtained. The antenna factor of 7.4 and a cable factor of 1.1 are added. The amplifier gain of 29dB is subtracted, giving a field strength of 32 dBµV/m.
FS = 52.5 + 7.4 + 1.1 – 29 = 32 dBµV/m
The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.
Level in µV/m = Common Antilogarithm [(32dBµV/m)/20] = 39.8 µV/m.

2.7. *TEST DISTANCE EXTRAPOLATION – FCC/ISED*

The field strength is extrapolated to the new measurement distance using formula from FCC Part15.31 (f) and §6.5-6.6 RSS-GEN:

Below 30MHz,

$$FS_{\text{limit}} = FS_{\max} - 40\log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right)$$

Above 30MHz,

$$FS_{\text{limit}} = FS_{\max} - 20\log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right)$$

Where:
FS_{limit} is the calculation of field strength at the limit distance, expressed in dBµV/m
FS_{max} is the measured field strength, expressed in dBµV/m
$d_{measure}$ is the distance of the measurement point from the EUT
d_{limit} is the reference limit distance

2.8. *CALIBRATION DATE*

The calibration intervals are extended at 12+2 months. This extended interval is based on the fact that there is sufficient calibration data to statistically establish a trend or based on experience of use of the test equipment to assure good measurement results for a longer period.

3. OCCUPIED BANDWIDTH

3.1. TEST CONDITIONS

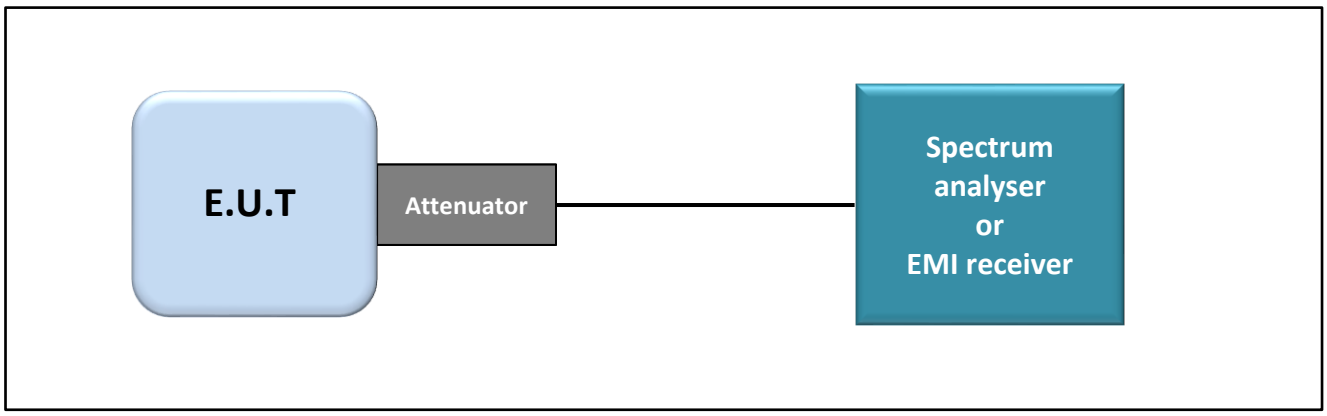
Test performed by	: Majid MOURZAGH
Date of test	: February 3, 2023
Ambient temperature	: 22 °C
Relative humidity	: 41 %

3.2. TEST SETUP

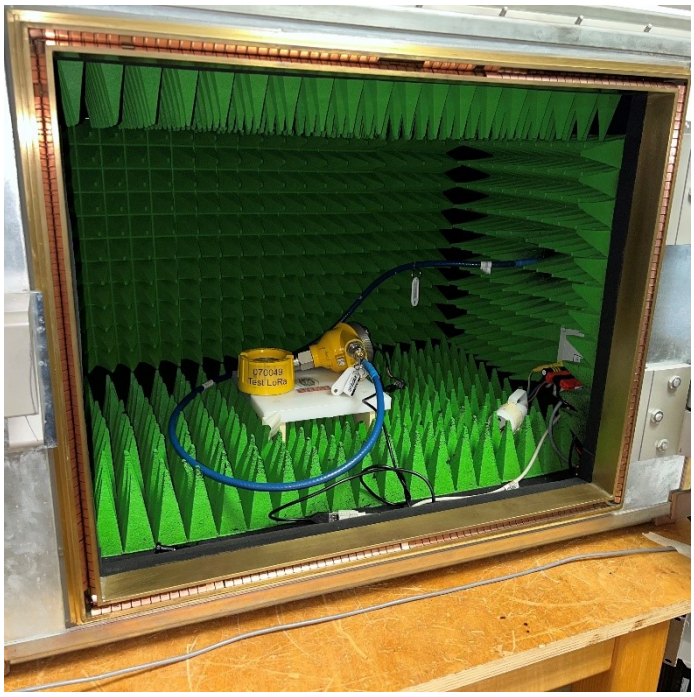
- The Equipment Under Test is installed:
☐ On a table
☑ In an anechoic chamber

- 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 of Occupied Bandwidth



Photograph for Occupied bandwidth

3.3. LIMIT

None

3.4. TEST EQUIPMENT LIST

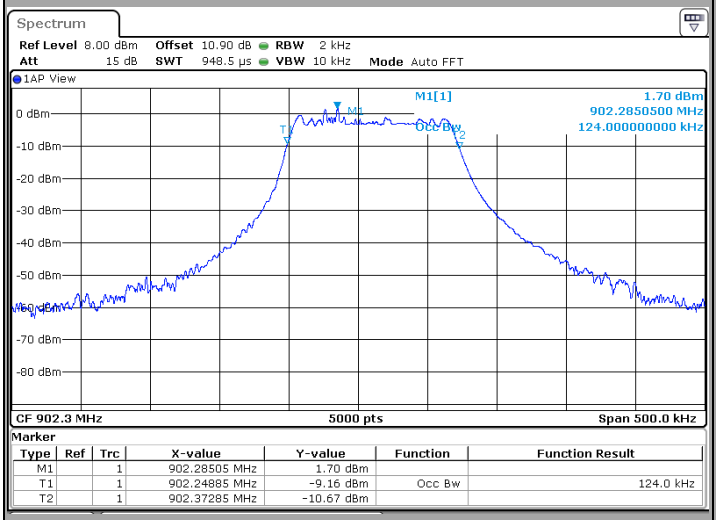
TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Attenuator 10dB	AEROFLEX	_	A7122269	09/20	01/23
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	03/21	03/23
SMA 1.5m	SUCOFLEX	18GHz	A5329863	05/22	05/23
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	11/21	11/23
Thermo-hygrometer	TESTO	608-H1	B4204120	12/20	12/22
SMA 1.5m	SUCOFLEX	18GHz	A5329864	09/22	09/23

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

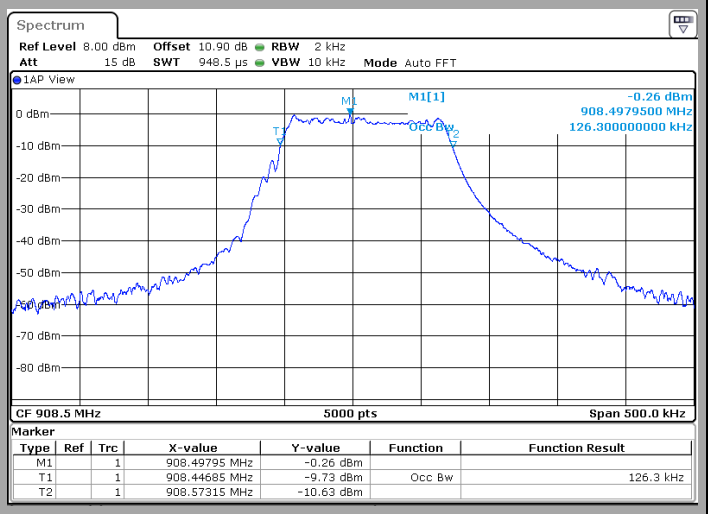
3.5. RESULTS

Occupied Bandwidth

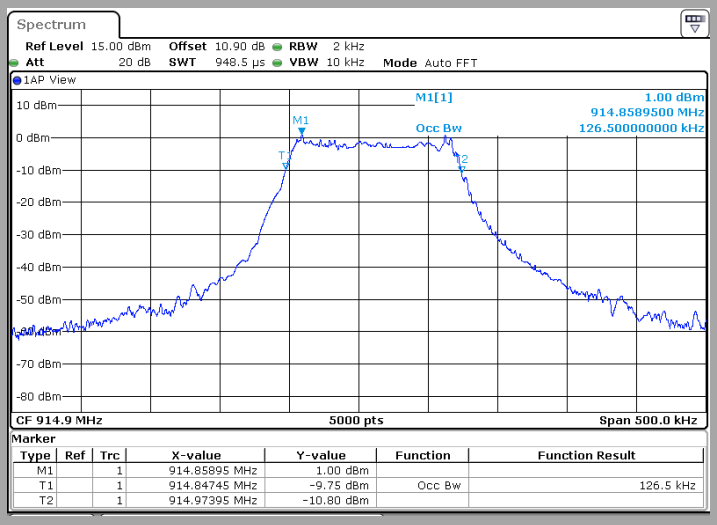
Cmin



Cnom



Cmax



Channel	Occupied Bandwidth (kHz)
Cmin	**124.0**
Cnom	**126.3**
Cmax	**126.5**

3.6. CONCLUSION

Occupied Channel Bandwidth measurement performed on the sample of the product **BumbleBee** 1001910, SN: **070049** , 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	: Majid MOURZAGH
Date of test	: February 3, 2023
Ambient temperature	: 22 °C
Relative humidity	: 41 %

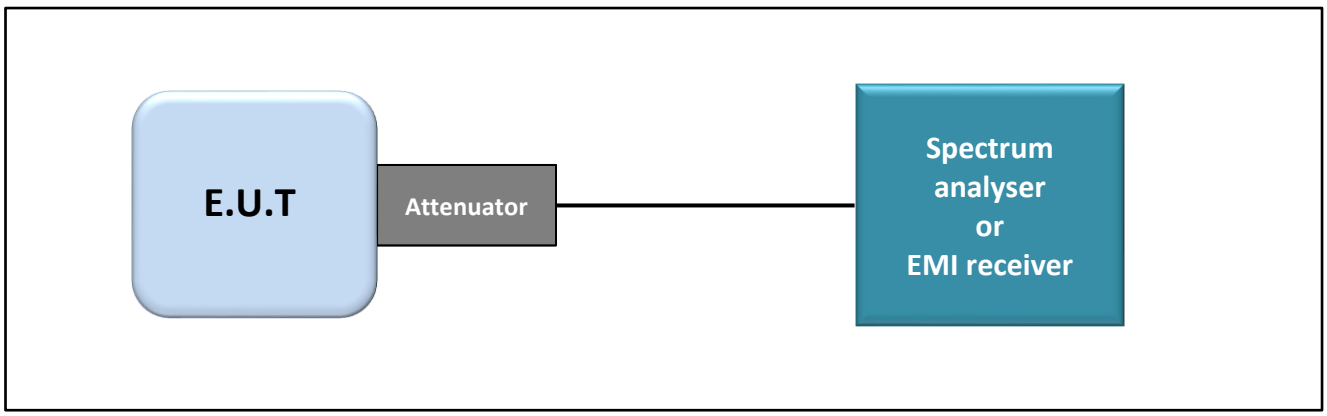
4.2. TEST SETUP

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

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

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

Measurement Procedure:
1. Set resolution bandwidth (RBW) = 100kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer.



Test set up of 6dB Emission Bandwidth

Photograph for 6dB emission bandwidth

4.3. LIMIT

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

4.4. TEST EQUIPMENT LIST

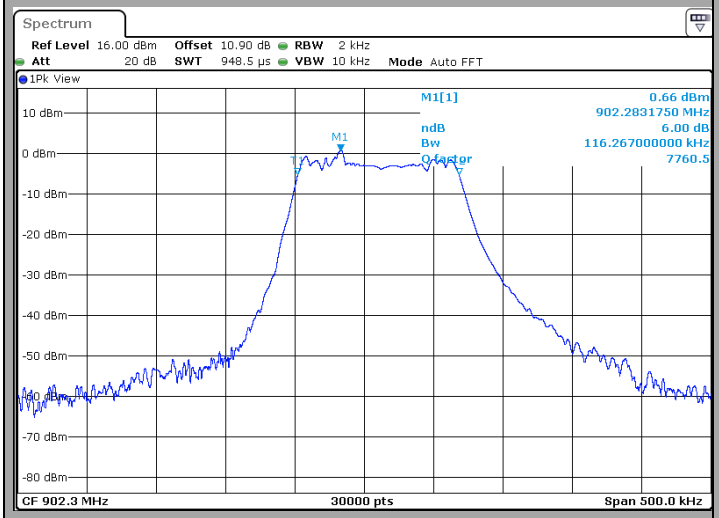
TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Attenuator 10dB	AEROFLEX	_	A7122269	09/20	01/23
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	03/21	03/23
SMA 1.5m	SUCOFLEX	18GHz	A5329863	05/22	05/23
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	11/21	11/23
Thermo-hygrometer	TESTO	608-H1	B4204120	12/20	12/22
SMA 1.5m	SUCOFLEX	18GHz	A5329864	09/22	09/23

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

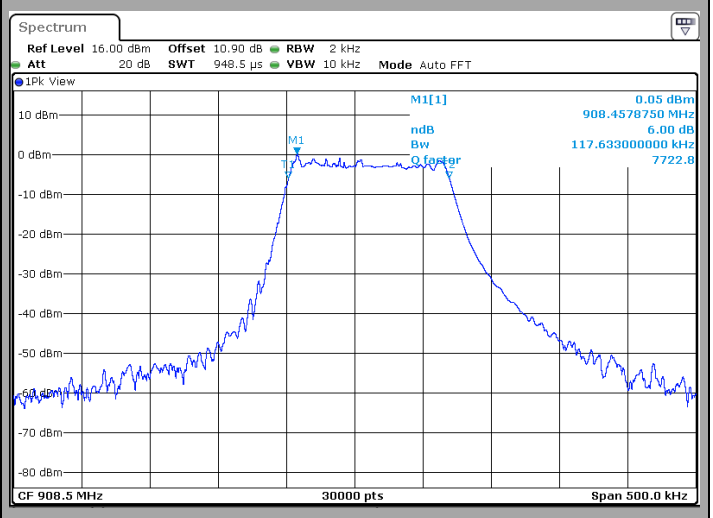
4.5. RESULTS

6dB Emission Bandwidth

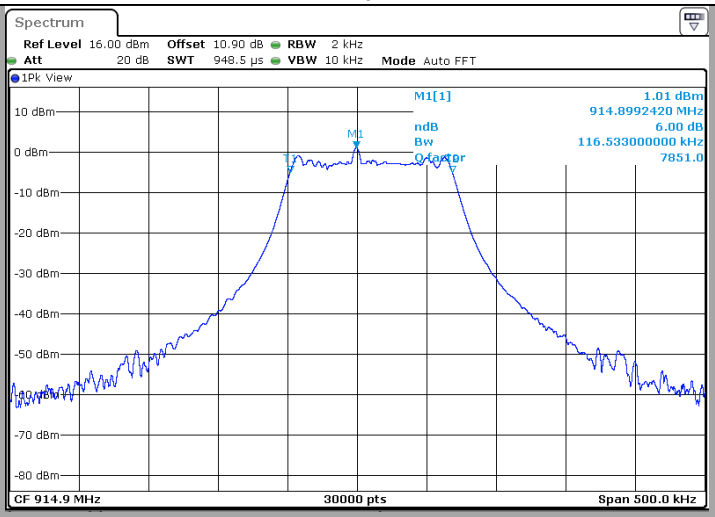
Cmin



Cnom



Cmax



Channel	6dB Emission Bandwidth (kHz)	Limit (MHz)
Cmin	**11.6267**	Minimum 0.5
Cnom	**11.7633**	Minimum 0.5
Cmax	**11.6533**	Minimum 0.5

4.6. CONCLUSION

6dB Emission Bandwidth measurement performed on the sample of the product **BumbleBee** 1001910, SN: **070049** , in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247 ISSUE 2** limits.

5. DUTY CYCLE

5.1. TEST CONDITIONS

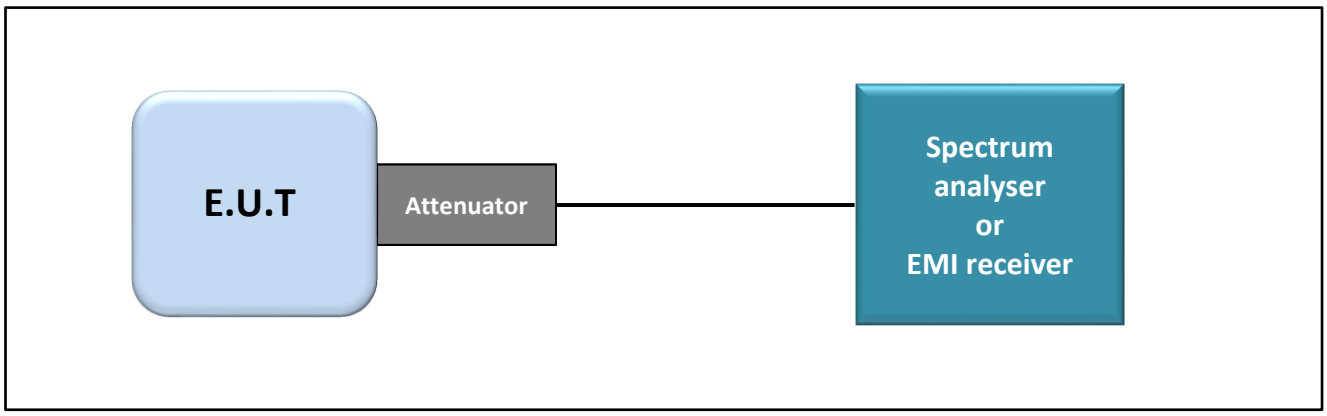
Test performed by	: Majid MOURZAGH
Date of test	: February 3, 2023
Ambient temperature	: 22 °C
Relative humidity	: 41 %

5.2. TEST SETUP

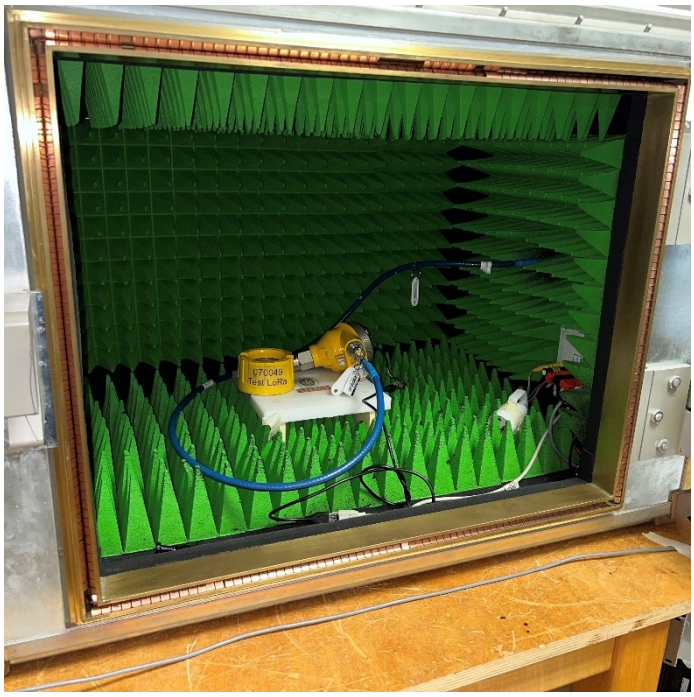
- The Equipment Under Test is installed:
☐ On a table
☑ In an anechoic chamber

- 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

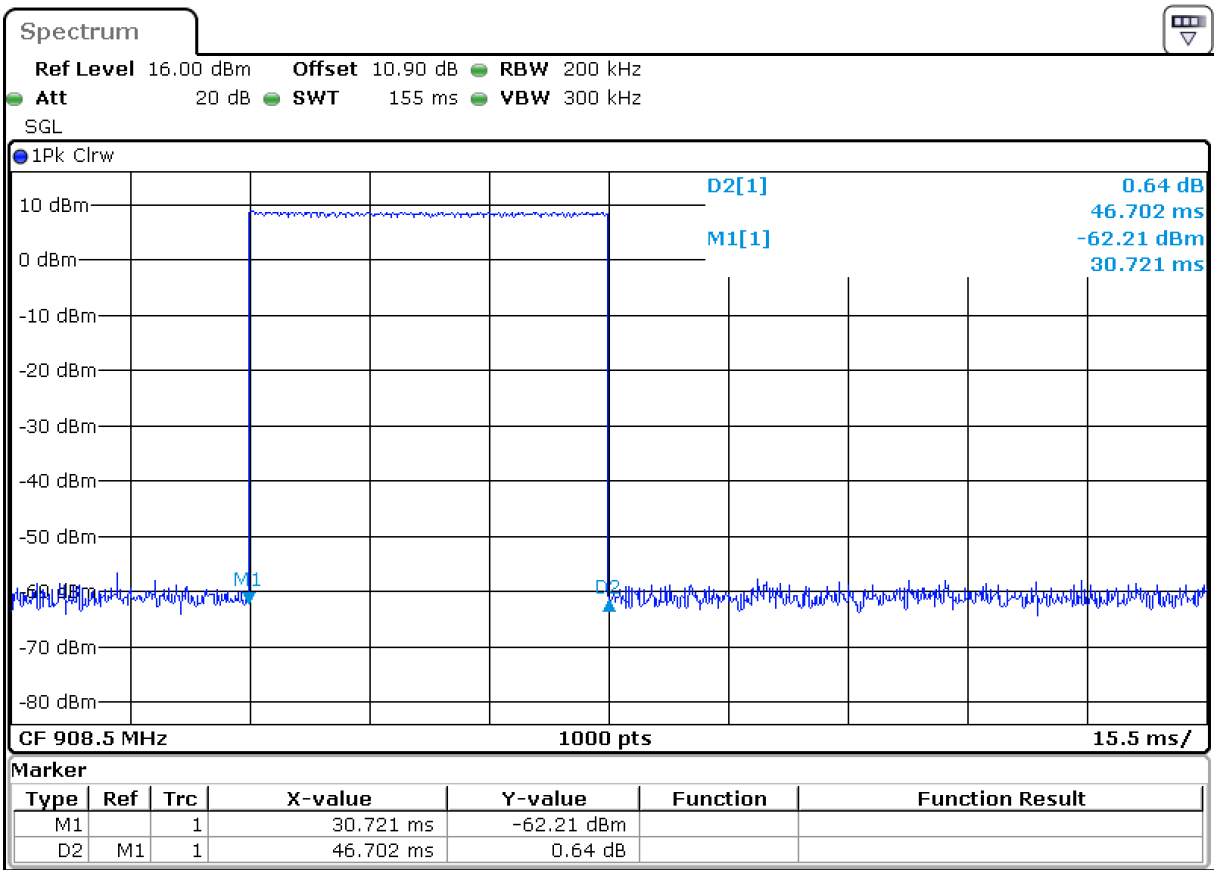
5.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Attenuator 10dB	AEROFLEX	_	A7122269	09/20	01/23
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	03/21	03/23
SMA 1.5m	SUCOFLEX	18GHz	A5329863	05/22	05/23
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	11/21	11/23
Thermo-hygrometer	TESTO	608-H1	B4204120	12/20	12/22
SMA 1.5m	SUCOFLEX	18GHz	A5329864	09/22	09/23

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

5.5. RESULTS

Duty Cycle
Channel



5.6. CONCLUSION

Duty Cycle measurement performed on the sample of the product **BumbleBee** 1001910, SN: **070049** , in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247 ISSUE 2** limits.

6. MAXIMUM CONDUCTED OUTPUT POWER

6.1. TEST CONDITIONS

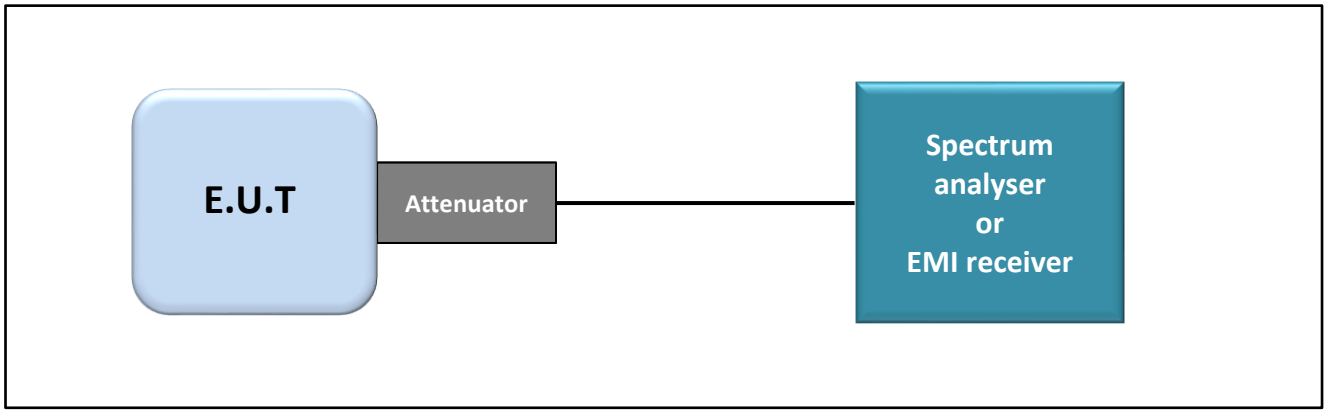
Test performed by	: Majid MOURZAGH
Date of test	: February 3, 2023
Ambient temperature	: 22 °C
Relative humidity	: 41 %

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

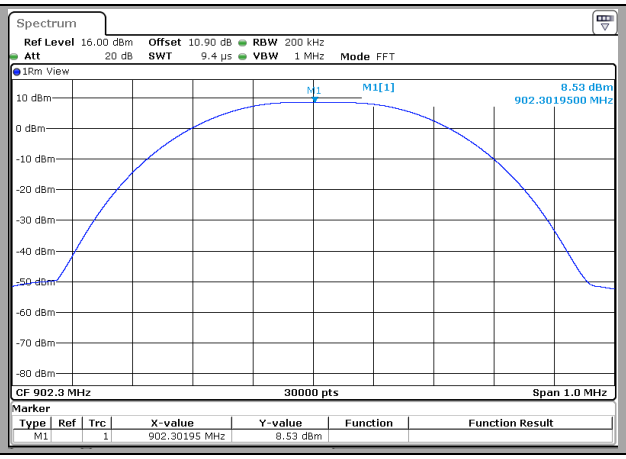
TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Attenuator 10dB	AEROFLEX	_	A7122269	09/20	01/23
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	03/21	03/23
SMA 1.5m	SUCOFLEX	18GHz	A5329863	05/22	05/23
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	11/21	11/23
Thermo-hygrometer	TESTO	608-H1	B4204120	12/20	12/22
SMA 1.5m	SUCOFLEX	18GHz	A5329864	09/22	09/23

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

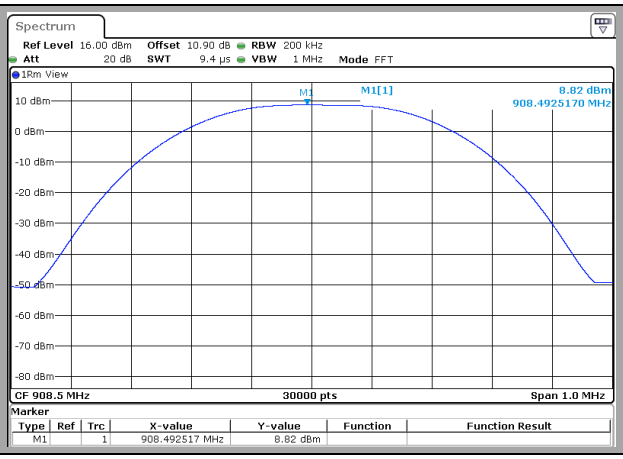
6.5. RESULTS

Maximum Conducted Output Power

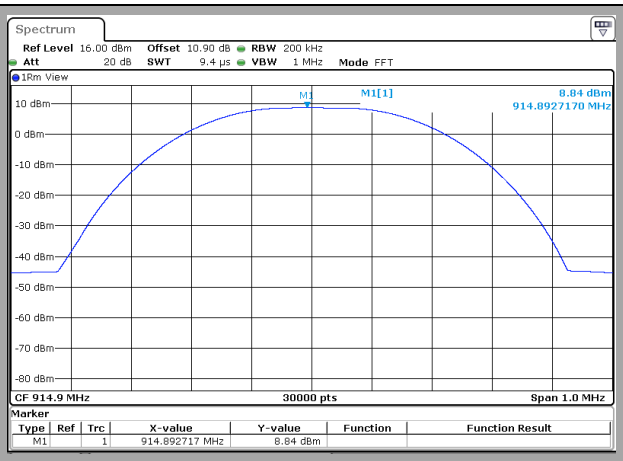
Cmin



Cnom



Cmax



Channel	Offset Cable + Att (dB)	Antenna Gain (dBi)	Maximum Conducted Power (dBm)	Limit (dBm)
Cmin	**10.9**	2	8.53	30. Reduced by G-6dBi if Antenna Gain above 6dBi
Cnom	**10.9**	2	8.82	30. Reduced by G-6dBi if Antenna Gain above 6dBi
Cmax	**10.9**	2	8.84	30. Reduced by G-6dBi if Antenna Gain above 6dBi

6.6. CONCLUSION

Maximum Conducted Output Power measurement performed on the sample of the product **BumbleBee** 1001910, SN: **070049** , in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247 ISSUE 2** limits.

7. POWER SPECTRAL DENSITY

7.1. TEST CONDITIONS

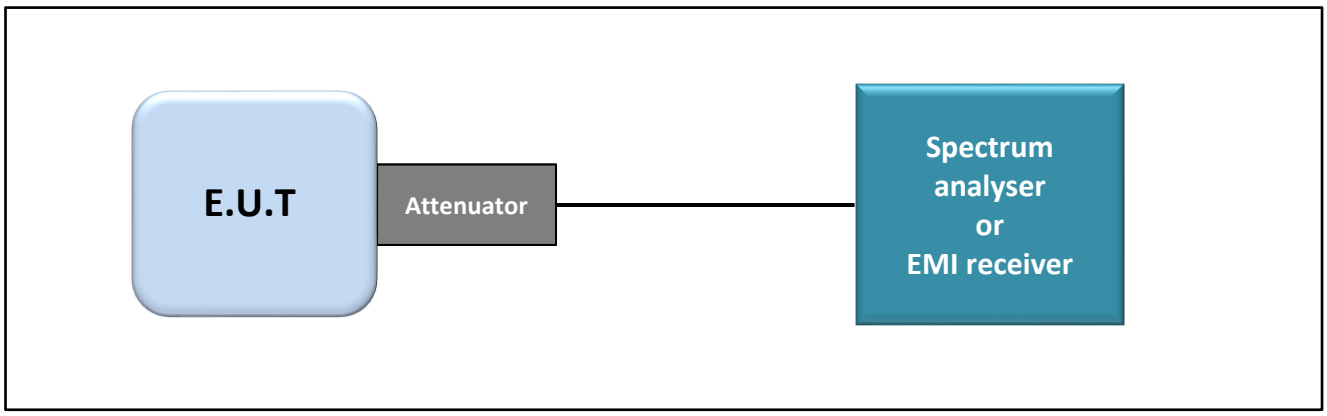
Test performed by	: Majid MOURZAGH
Date of test	: February 3, 2023
Ambient temperature	: 22 °C
Relative humidity	: 41 %

7.2. TEST SETUP

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

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

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



Test set up of Power Spectral Density

Photograph for Power Spectral Density

7.3. LIMIT

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

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

7.4. TEST EQUIPMENT LIST

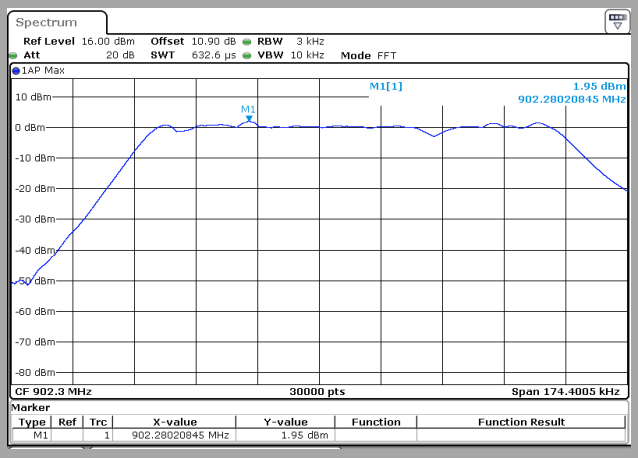
TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Attenuator 10dB	AEROFLEX	_	A7122269	09/20	01/23
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	03/21	03/23
SMA 1.5m	SUCOFLEX	18GHz	A5329863	05/22	05/23
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	11/21	11/23
Thermo-hygrometer	TESTO	608-H1	B4204120	12/20	12/22
SMA 1.5m	SUCOFLEX	18GHz	A5329864	09/22	09/23

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

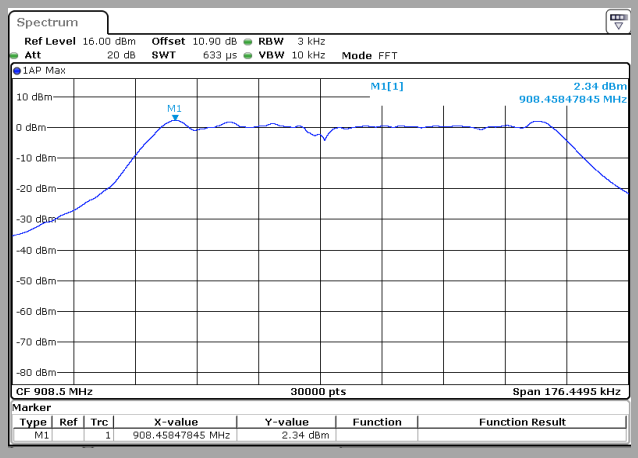
7.5. RESULTS

Power Spectral Density

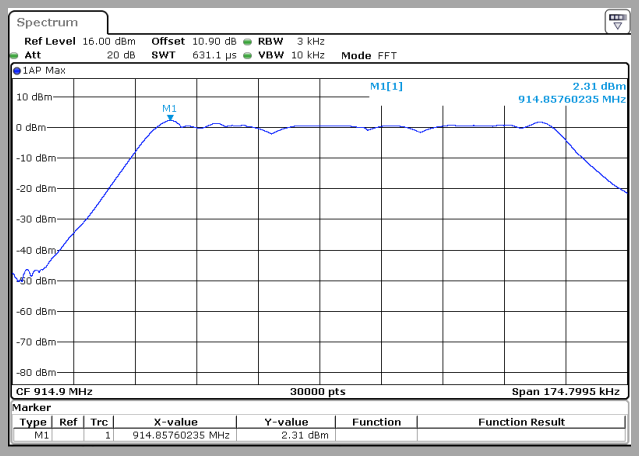
Cmin



Cnom



Cmax



Channel	Offset Cable + Att (dB)	Antenna Gain (dBi)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
Cmin	**10.9**	2	1.95	8. Reduced by G-6dBi if Antenna Gain above 6dBi
Cnom	**10.9**	2	2.34	8. Reduced by G-6dBi if Antenna Gain above 6dBi
Cmax	**10.9**	2	2.31	8. Reduced by G-6dBi if Antenna Gain above 6dBi

7.6. CONCLUSION

Power Spectral Density measurement performed on the sample of the product **BumbleBee** 1001910, SN: **070049** , in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.247 & RSS 247 ISSUE 2** limits.

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

8.1. TEST CONDITIONS

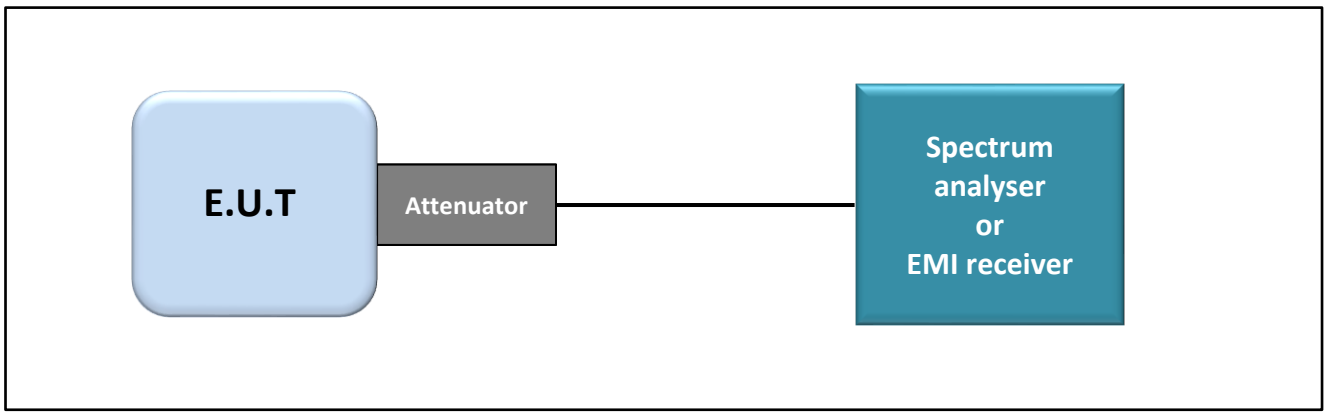
Test performed by	: Majid MOURZAGH
Date of test	: December 21, 2022
Ambient temperature	: 22 °C
Relative humidity	: 43 %

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 Choose limit below the Fundamental Radiator Level at the Band Edge Edge “902 MHz & 928MHz”

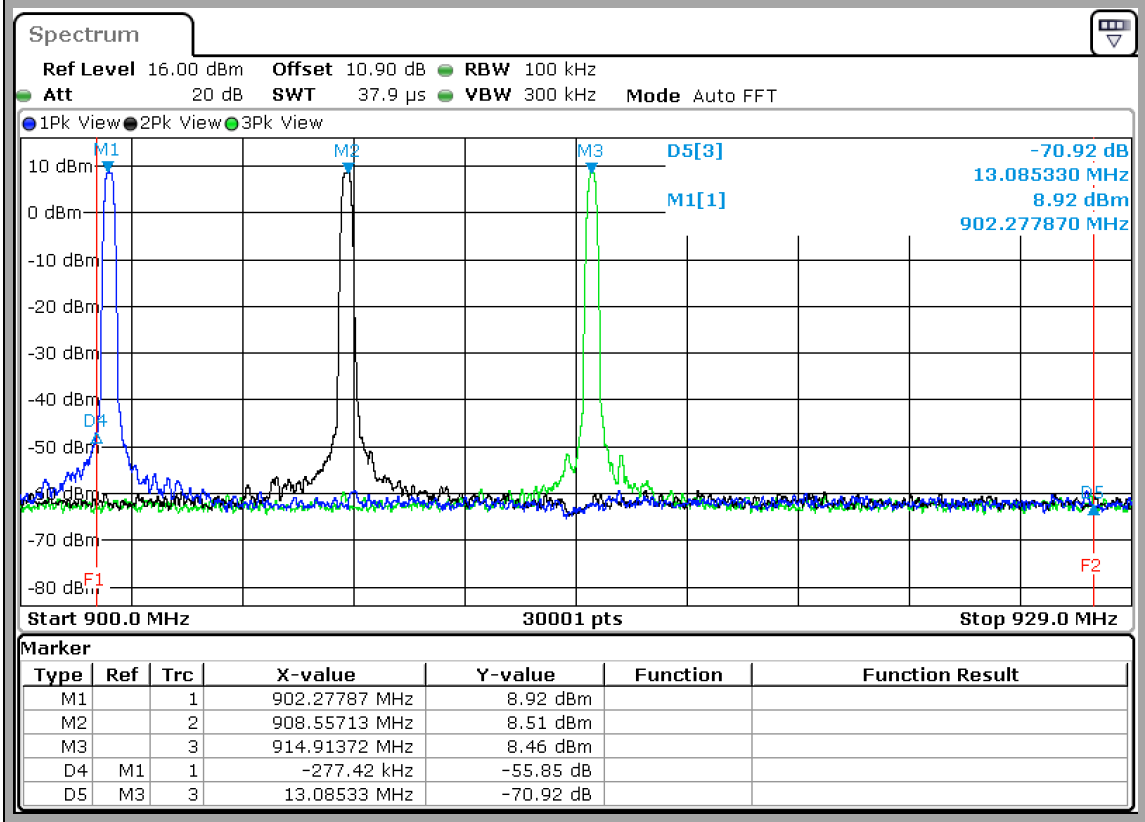
8.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Attenuator 10dB	AEROFLEX	_	A7122269	09/20	01/23
Full Anechoic Room	SIEPEL	_	D3044024		
Multimeter - CEM	FLUKE	87	A1240251	03/21	03/23
SMA 1.5m	SUCOFLEX	18GHz	A5329863	05/22	05/23
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	11/21	11/23
Thermo-hygrometer	TESTO	608-H1	B4204120	12/20	12/22
SMA 1.5m	SUCOFLEX	18GHz	A5329864	09/22	09/23

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

8.5. RESULTS

Cmin/Cnom/Cmax



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	902.27787 MHz	8.92 dBm		
M2		2	908.55713 MHz	8.51 dBm		
M3		3	914.91372 MHz	8.46 dBm		
D4	M1	1	-277.42 kHz	-55.85 dB		
D5	M3	3	13.08533 MHz	-70.92 dB		

Frequency (MHz)	Level (dBc)	Limit (dBc)
902	-55.85	
928	-70.92	

8.6. CONCLUSION

Unwanted Emission into non-restricted frequency bands at the band edge measurement performed on the sample of the product **BumbleBee** 1001910, SN: **070049** , 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 INTO NON-RESTRICTED FREQUENCY BANDS

9.1. TEST CONDITIONS

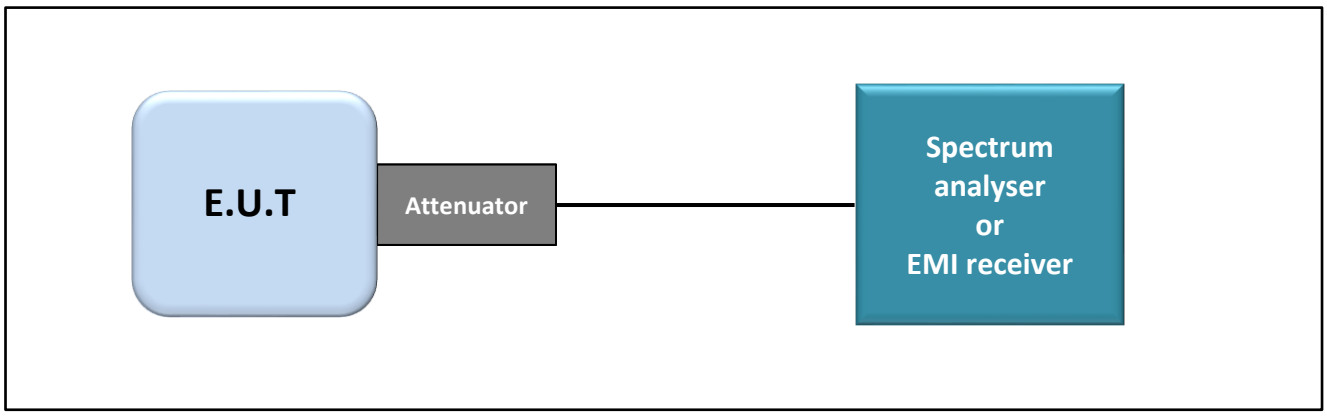
Test performed by	: Majid MOURZAGH
Date of test	: February 3, 2023
Ambient temperature	: 22 °C
Relative humidity	: 41 %

9.2. TEST SETUP

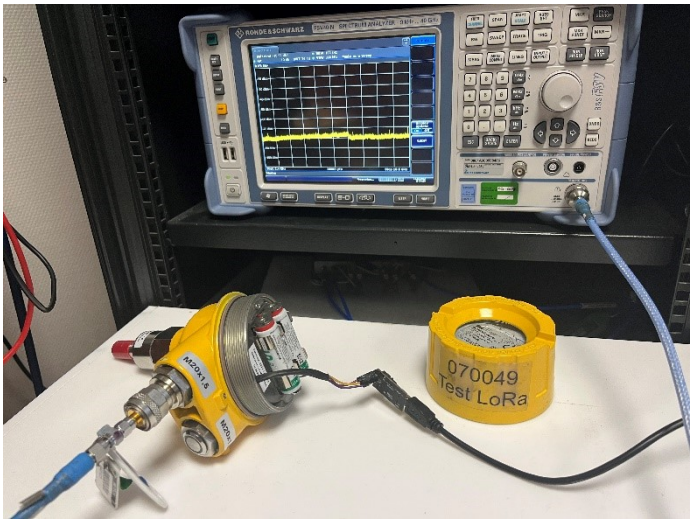
- The Equipment Under Test is installed:
☐ On a table
☐ In an anechoic chamber

- 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 Choose limit below the Fundamental Radiator Level

9.4. TEST EQUIPMENT LIST

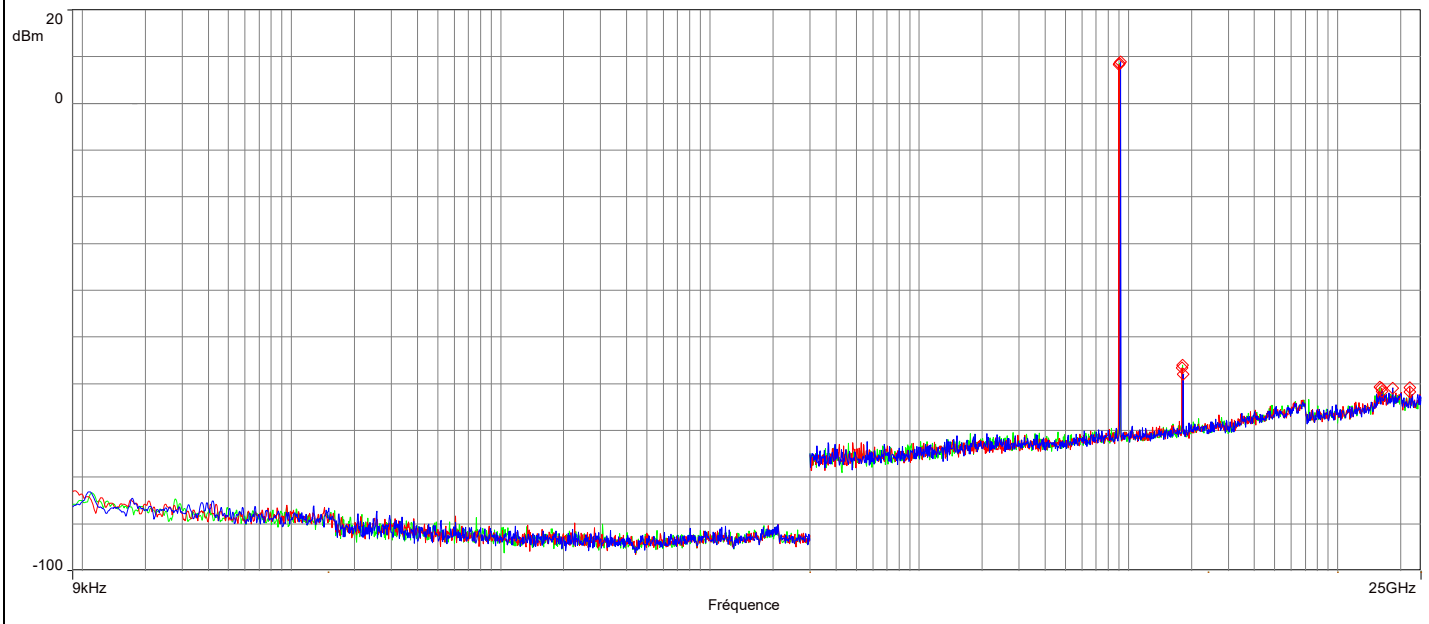
TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
Attenuator 10dB	AEROFLEX	_	A7122269	09/20	01/23
Cable Measure	_	36G	A5329604	09/22	09/23
Multimeter - CEM	FLUKE	87	A1240251	03/21	03/23
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	11/21	11/23
Thermo-hygrometer	TESTO	608-H1	B4204120	12/20	12/22
BAT EMC	NEXIO	v3.21.0.32	L1000115		

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

9.5. RESULTS

Cmin /Cnom /Cmax

Cmin/Cnom/Cmax



Frequency (MHz)	Level (dBm)	Level (dBc)	Limit (dBc)
902.3	8.33		
1804.6	-56.63	64.96	20
15941	-60.7	69.03	20
18259	-60.89	69.22	20
908.5	8.58		
1817	-56.03	64.61	20
16169	-61	69.58	20
22041.5	-60.8	69.38	20
914.9	8.89		
1929.8	-57.98	66.87	20
16263	-61.64	70.53	20
22101	-61.76	70.65	20

9.6. CONCLUSION

Unwanted Emission into non-restricted frequency bands measurement performed on the sample of the product **BumbleBee** 1001910, SN: **070049** , 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. UNWANTED EMISSIONS IN RESTRICTED FREQUENCY BANDS

10.1. TEST CONDITIONS

Test performed by : Majid MOURZAGH
Date of test : February 1, 2023
Ambient temperature : 21 °C
Relative humidity : 40 %

10.2. TEST SETUP

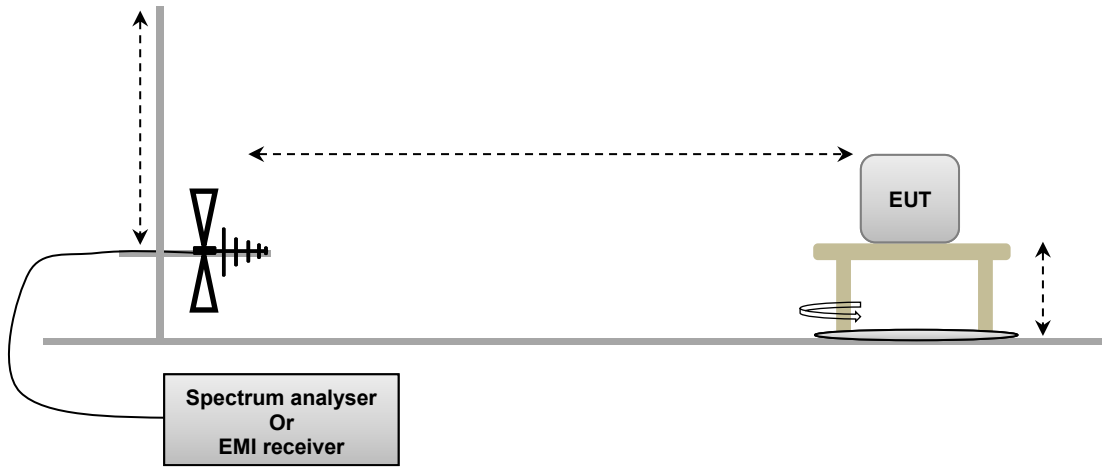
Test procedure:
☑ ANSI C63.10 & FCC Part 15 subpart C

Following frequency ranges, test setup parameters are different and specified in this table:

Frequency range:	**9kHz to 30MHz**	
Test:	**Pre-Characterization**	**Qualification**
Antenna Polarization:	Parallel, Perpendicular and Ground parallel	
Antenna Height:	1m	1m
Antenna Type:	Loop	
RBW Filter:	200Hz below 150kHz / 9kHz above 150kHz	
Maximization:	Turntable rotation of 360 degrees range	
EUT height:	1.5m	0.8m
Test site:	Full Anechoic Chamber	Open Aera Test Site
Distance EUT - Antenna:	3m	10m
Detector:	Peak	QPeak

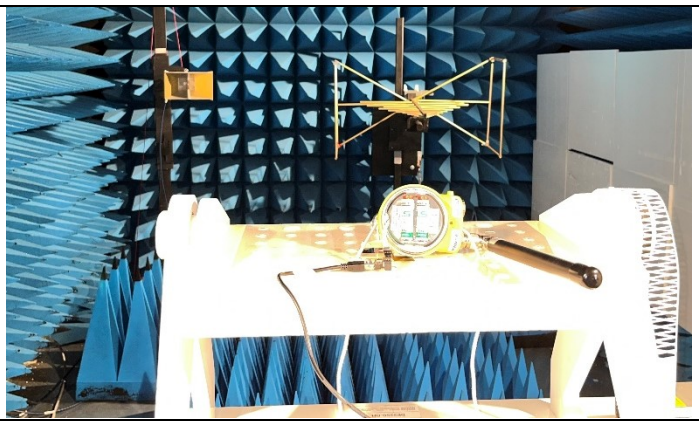
Frequency range:	**30MHz to 1GHz**	
Test:	**Pre-Characterization**	**Qualification**
Antenna Polarization:	Horizontal and Vertical	
Antenna Height:	Centered on EUT (§6.6.5 ANSI C63-10)	Varied from 1m to 4m
Antenna Type:	Bi-Log	
RBW Filter:	120kHz	
Maximization:	Turntable rotation of 360 degrees range	
EUT height:	1.5m	1.5m
Test site:	Full Anechoic Chamber	Full Anechoic Chamber
Distance EUT - Antenna:	3m	3m
Detector:	Peak	QPeak

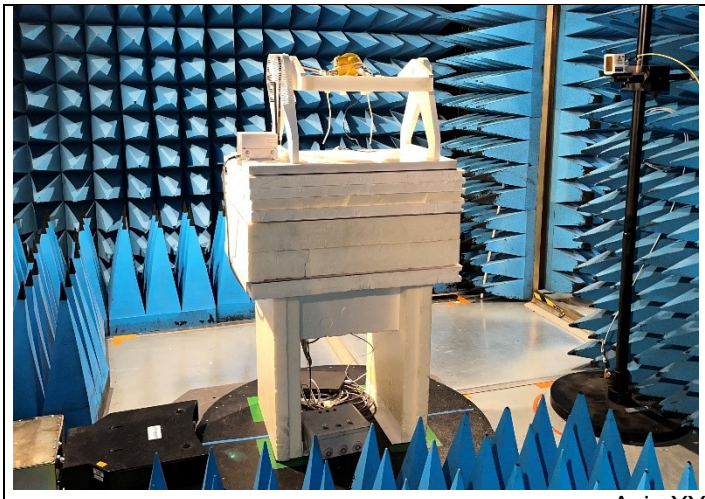
Frequency range:	1GHz to 9.5GHz	
Test:	**Pre-Characterization**	**Qualification**
Antenna Polarization:	Horizontal and Vertical	
Antenna Height:	Centered on EUT (§6.6.5 ANSI C63-10)	Centered on EUT (§6.6.5 ANSI C63-10)
Antenna Type:	Bi-Log	
RBW Filter:	120kHz	
Maximization:	Turntable rotation of 360 degrees range	
EUT height:	1.5m	1.5m
Test site:	Full Anechoic Chamber	Full Anechoic Chamber
Distance EUT - Antenna:	3m	3m
Detector:	Peak & Average	Peak & Average

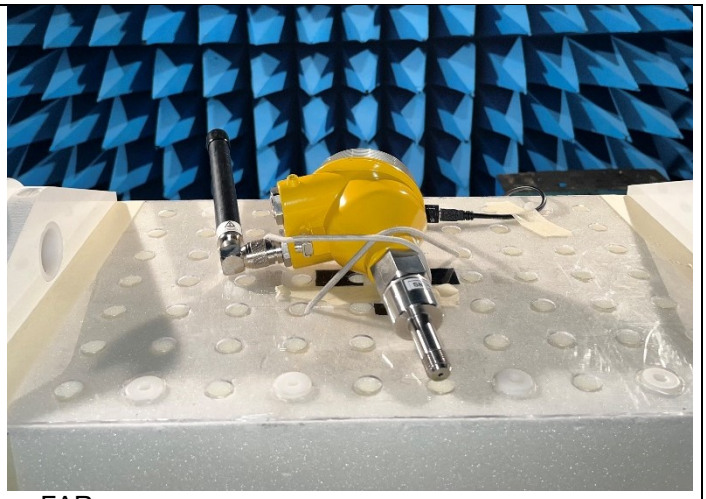


Test setup of Unwanted Emissions in Restricted Frequency Bands

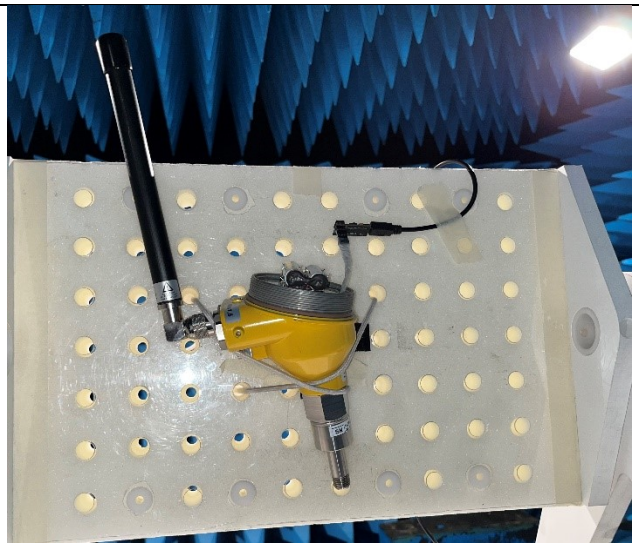
Same setup is used in semi anechoic chamber during pre-characterization, with a distance of 3m between EUT and antenna.







Axis XY on FAR



Axis Z on FAR

Photograph of Unwanted Emissions in Restricted Frequency Bands

Axis XY on OATS

Axis Z on OATS

Photograph of Unwanted Emissions in Restricted Frequency Bands

10.3. 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

10.4. TEST EQUIPMENT LIST

TEST EQUIPMENT USED					
Description	**Manufacturer**	**Model**	**Identifier**	**Cal_Date**	**Cal_Due**
BAT EMC	NEXIO	v3.21.0.32	L1000115		
Amplifier 9kHz - 40GHz	LCIE SUD EST	_	A7102082	05/22	05/24
Antenna Bi-log	AH System	SAS-521-7	C2040180	02/21	02/23
Antenna horn 18GHz	EMCO	3115	C2042029	03/22	03/25
CABLE	TELEDYNE	R82-0404-8M	A5330008	02/22	02/24
Cable 0.75m	-	18GHz	A5329900	08/22	08/24
Cable 1m	HUBER & SUHNER	18GHz	A5329705	08/21	08/23
Cable 1m	HUBER & SUHNER	18GHz	A5329706	08/21	08/23
Cable SMA 40GHz 40cm	WITHWAVE	W101-SM1-0.4M	A5329979	04/21	04/23
Comb EMR HF	YORK	CGE01	A3169114		
CONTROLLER	INNCO	CO3000	D3044034		
Emission Cable (SMA 1m)	TELEDYNE	26GHz	A5329874	08/22	08/23
Emission Cable (SMA 3.3m)	TELEDYNE	26GHz	A5329875	08/22	08/23
Filter Matrice	LCIE SUD EST	Combined filters	A7484078	09/20	01/23
Multimeter - CEM	FLUKE	189	A1240171	09/21	09/23
Rehausse Table C3	LCIE	_	F2000511		
Rehausse Table C3	LCIE	_	F2000507		
Semi-Anechoic chamber #3 (BF)	SIEPEL	_	D3044017_BF	04/22	04/25
Semi-Anechoic chamber #3 (VSWR)	SIEPEL	_	D3044017_VSWR	04/22	04/25
Spectrum analyzer	ROHDE & SCHWARZ	FSU 26	A4060058	09/21	09/23
Table C3	LCIE	_	F2000461		
Thermo-hygrometer (PM1/2/3)	KIMO	HQ 210	B4206022	01/21	01/23
TILT	INNCO	TILT	D3044033		
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371		
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444		
Antenna horn 40GHz	SCHWARZBECK	BBHA 9170	C2042028	06/22	06/25
SMA 1.5m	SUCOFLEX	18GHz	A5329864	09/22	09/23
Spectrum analyzer	ROHDE & SCHWARZ	FSV 40	A4060059	11/21	11/23

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

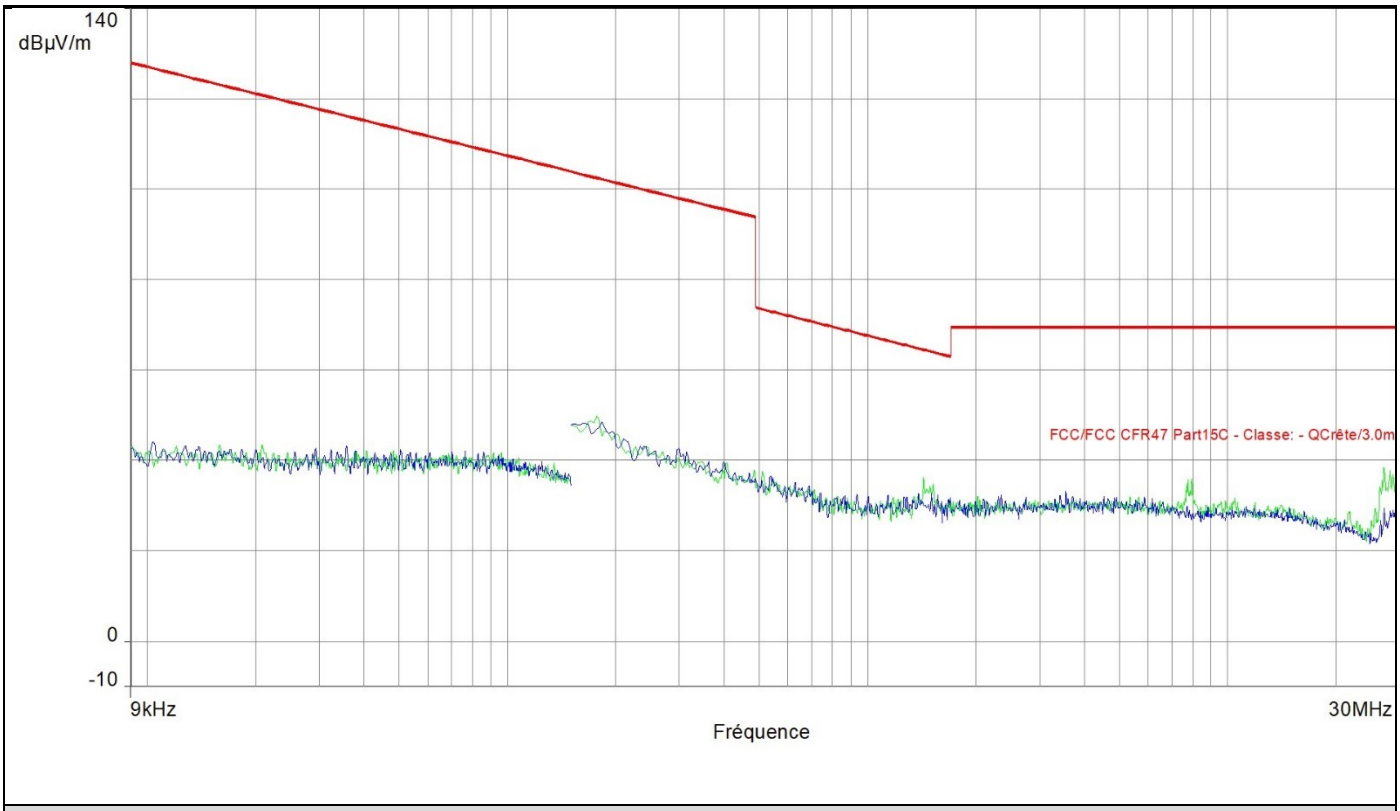
None

10.6. RESULTS

10.6.1. 9kHz to 30MHz

Graphs – Pre characterization:

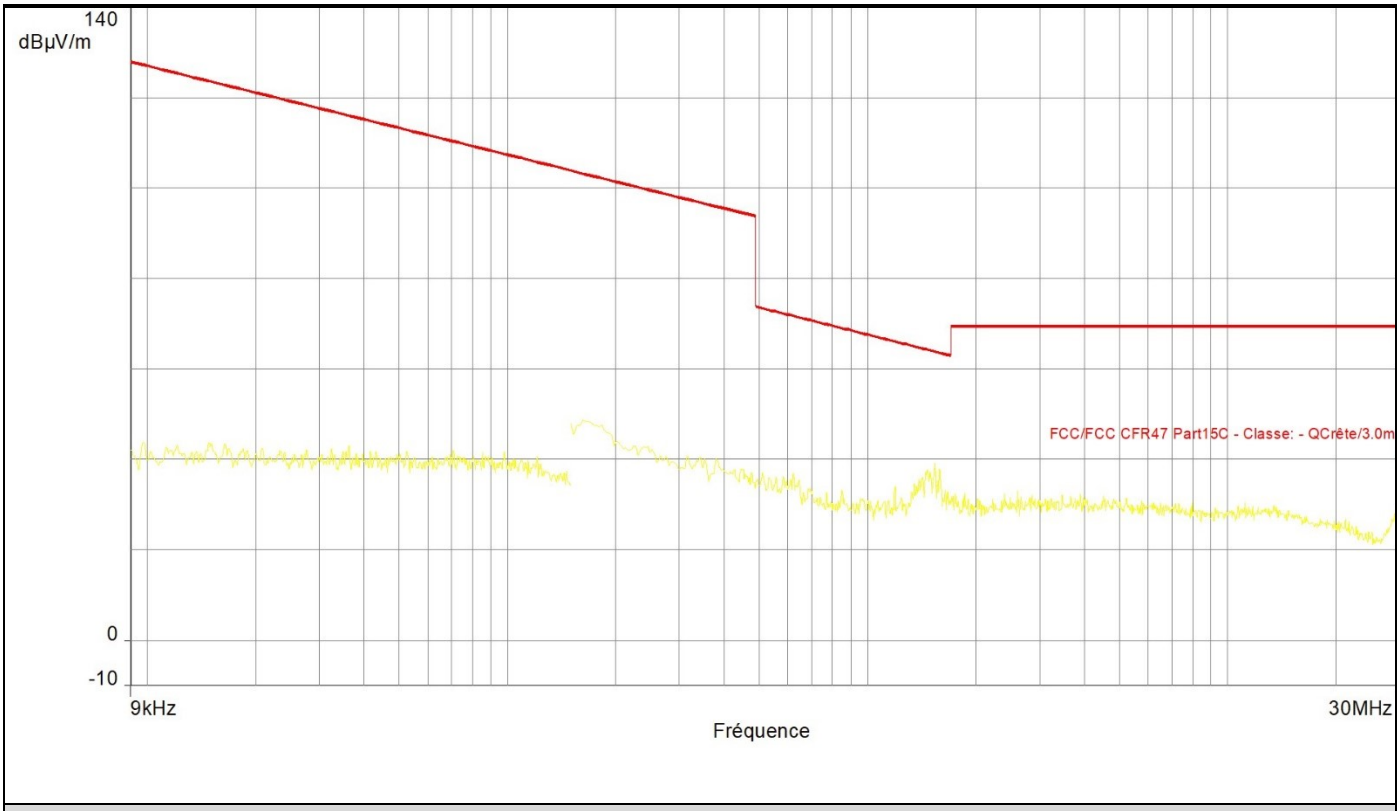
RADIATED EMISSIONS			
Graph name:	Emr#1	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(0°/90°) - TX mode - Axis 0° (Worst case presented)	
Class:			
Frequency range: [9kHz - 30MHz]			
Antenna polarization:		**RBW :**	200Hz to 10kHz
Azimuth:	0° - 360°	**VBW :**	1kHz to 30kHz



Spurious emissions

No significative frequency observed

RADIATED EMISSIONS			
Graph name:	Emr#2	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(180°) - TX mode - Axis 0° (Worst case presented)	
Class:			
Frequency range: [9kHz - 30MHz]			
Antenna polarization:		**RBW :**	200Hz to 10kHz
Azimuth:	0° - 360°	**VBW :**	1kHz to 30kHz



Spurious emissions

No significative frequency observed

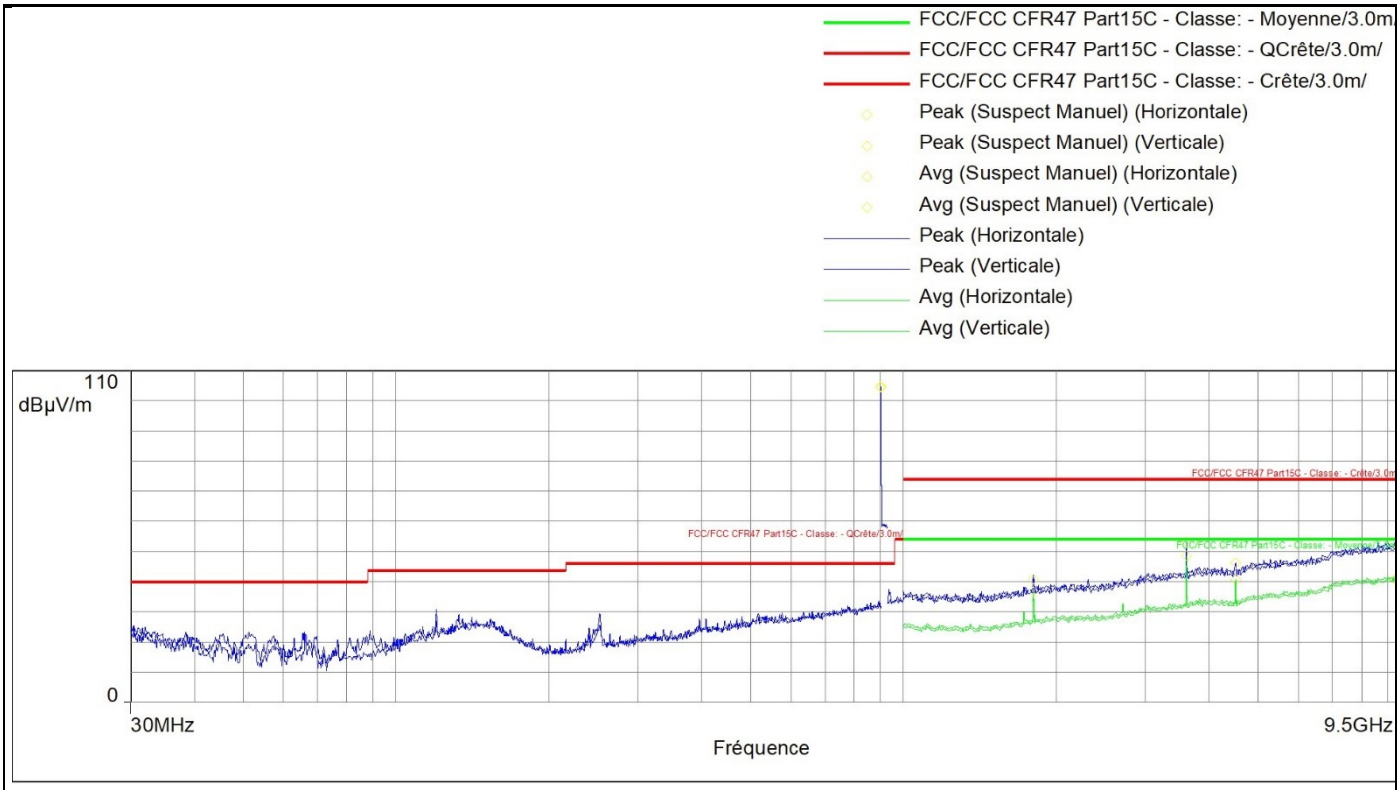
Final measurement:

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

10.6.2. 30MHz to 9.5GHz

Graphs – Pre characterization:

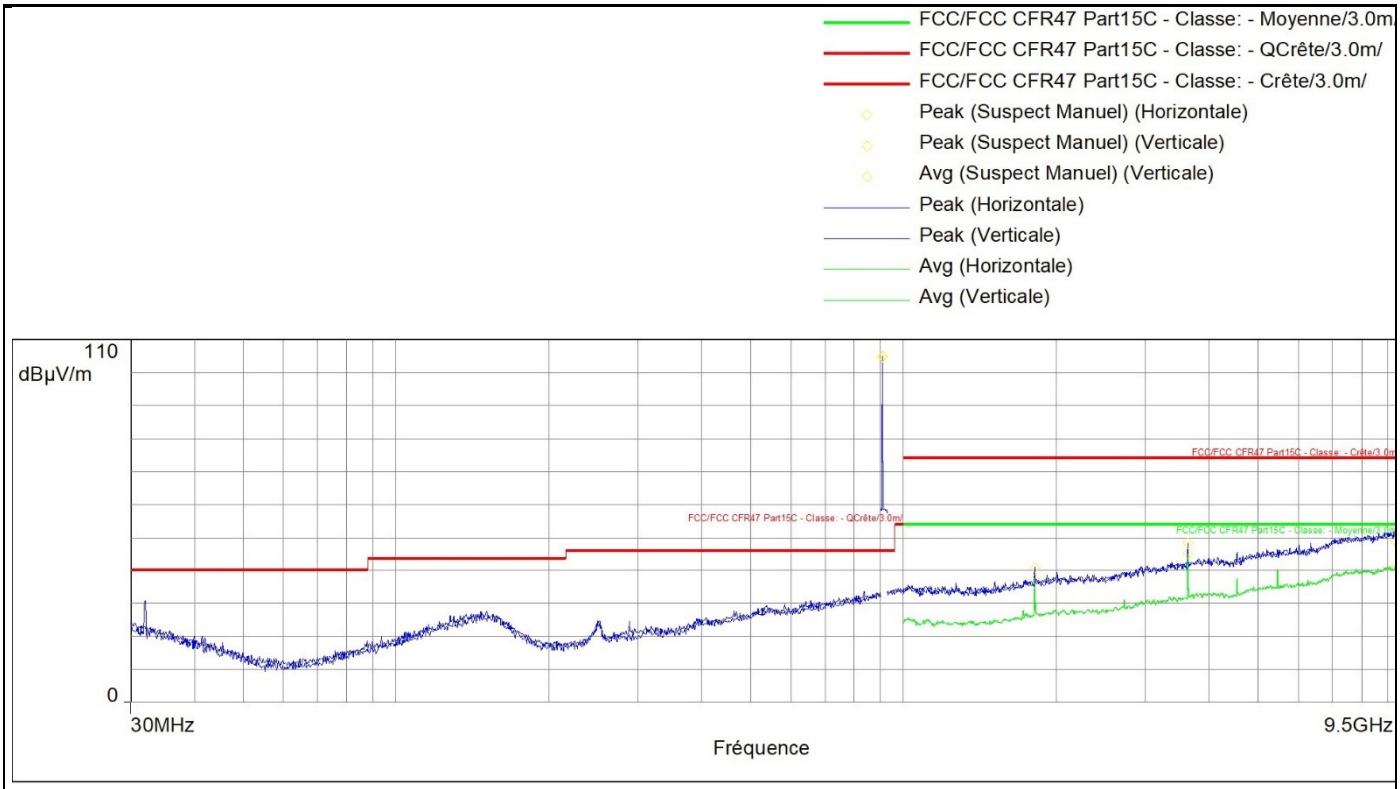
RADIATED EMISSIONS			
Graph name:	Emr#3	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - Cmin - TX mode - Automatic Axis	
Class:			
Frequency range: [30MHz - 9.5GHz]			
Antenna polarization:		**RBW :**	100kHz to 1MHz
Azimuth:	0° - 360°	**VBW :**	300kHz to 3MHz



Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	Lim.Peak (dBµV/m)	Avg (dBµV/m)	Lim.Avg (dBµV/m)	Lim.Q-Peak (dBµV/m)	Polarization	Correction (dB)
902.338	104.5	/	/		/	Horizontal	28.8
4511.350	46.3	74.0	40.8	54.0	/	Horizontal	-21.6
9276.450	53.1	74.0	40.7	54.0	/	Horizontal	-12.1
1804.100	40.8	74.0	36.8	54.0	/	Vertical	-28.6
3609.500	53.1	74.0	48.7	54.0	/	Vertical	-22.5
902.260	104.8	/	/		/	Vertical	28.8

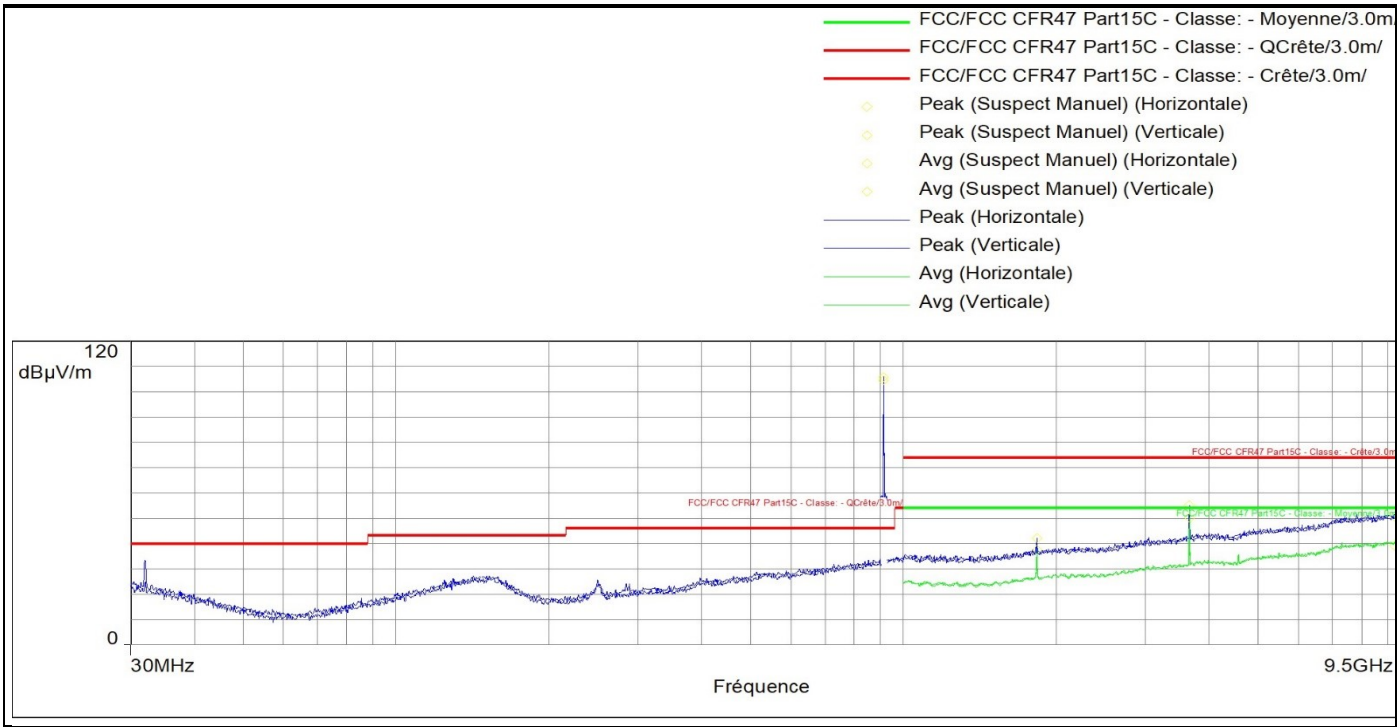
RADIATED EMISSIONS			
Graph name:	Emr#4	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - Cmid - TX mode - Automatic Axis	
Class:			
Frequency range: [30MHz - 9.5GHz]			
Antenna polarization:		**RBW :**	100kHz to 1MHz
Azimuth:	0° - 360°	**VBW :**	300kHz to 3MHz



Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	Lim.Peak (dBµV/m)	Avg (dBµV/m)	Lim.Avg (dBµV/m)	Lim.Q-Peak (dBµV/m)	Polarization	Correction (dB)
908.474	104.9	/	-	/	/	Horizontal	28.9
1816.850	40.9	74.0	37.3	54.0	/	Vertical	-28.6
3634.150	48.4	74.0	45.0	54.0	/	Vertical	-22.4
9313.850	48.8	74.0	41.2	54.0	/	Vertical	-12.1
908.448	104.9	/	/		/	Vertical	28.9

RADIATED EMISSIONS			
Graph name:	Emr#5	**Test configuration:**	
Limit:	FCC CFR47 Part15C	(H+V) - Cmax - TX mode - Automatic Axis	
Class:			
Frequency range: [30MHz - 9.5GHz]			
Antenna polarization:		**RBW :**	100kHz to 1MHz
Azimuth:	0° - 360°	**VBW :**	300kHz to 3MHz



Spurious emissions

Frequency (MHz)	Peak (dBµV/m)	Lim.Peak (dBµV/m)	Avg (dBµV/m)	Lim.Avg (dBµV/m)	Lim.Q-Peak (dBµV/m)	Polarization	Correction (dB)
1829.600	42.0	74.0	37.4	54.0	/	Horizontal	-28.6
9293.450	50.7	74.0	39.2	54.0	/	Horizontal	-12.1
915.026	104.5	/	/	/	/	Horizontal	28.9
915.026	105.8	/	/	/	/	Vertical	28.9
3659.650	55.2	74.0	50.3	54.0		Vertical	-22.2

Final measurement:

30MHz to 9.5GHz					
Polarization	**Frequency (MHz)**	**Peak Level (dBµV/m)**	**QPeak Level (dBµV/m)**	**Limit (dBµV/m)**	**Margin QPeak (dBµV/m)**
all emissions were below the limit					

10.7. *CONCLUSION*

Unwanted Emissions in Restricted Frequency Bands measurement performed on the sample of the product 1001910, Sn : **070049** , in configuration and description presented in this test report, show levels **compliant** to the **47 CFR PART 15.209 & RSS-Gen** limits.

11. 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

12. ANNEX 1

Bumblebee Pressure products are ordered following a series of Letter and Numbers.
The part Number is that will be used as a SN is the first 7 characters. The last 2 characters is only related to accessories.

Détails de la gamme / *Range details*

P * * * * * * * * * *

Emballage / *Packing*
1 = Pelicase / *Pelicase*
2 = Carton / *Cardboard*

Adapteur / Adaptor
1 = Aucun / *None*
2 = 1/2 NPT 316L
3 1/2 NPT Inconel
4 = Autre (A préciser) / Other (to be specified)

Certificat / *Certificate*
1 = Aucun / *None*
2 = ATEX / IECEx / UKCA
3 = US

Antenne / *Antenna*
1 = EU – Europe / *EU – Europe*
2 = Monde / *World*
3 = EU – Europe Déporté / *EU – Europe Deported*
4 = Monde Dépoté / *World Deported*

Région d'Installation / *Installation Region*
1 = EU – Europe / *EU – Europe*
2 = AS – Asia / *AS - Asiaa*
3 = US – Amerique du Nord / *US – North America*
4 AU – Australie / *AU – Australia*
5 = Autre / *Other*

Boitier / Housing
1 = Al couleur Signal Yellow / *Al Signal Yellow Color*
2 = Al couleur White Alu / *Al White Alu Color*
3 = 316 L pas de couleur / *316 L no color*
4 = Al couleur spécifique / *Aluminum Specific color*

Type de Capteur / *Sensor Type*
1 = Standard / *Standard*
2 = Effleurant / *Flush*
3 = Pression Différentielle / *Differential Pressure*
4 = NA

Environnement / *Environment*
1 = H2 : Application Hydrogène / *Hydrogen application*
2 = Application Standard / *Standard application*

Pression d'Opération / *Operating Pressure*
1 = 0 - 10 bar
2 = 0 - 100 bar
3 = 0 - 200 bar
4 = 0 - 400 bar
5 = 0 - 1000 bar
6 = 0 – 600 bar
7 = NA
8 = NA
9 = -0.3 - 0.3 bar

Matériel en contact avec le Fluide / *Material in contact with fluid*
1 = SS 316 L
2 = Inconel / Hastelloy C-276

Type du produit / *Product Type*
P = Pression / *Pressure*

Bumblebee Pressure products are ordered following a series of Letter and Numbers.
The part Number SN is the first 8 characters. The last character is related to accessories.

Détails de la gamme / *Range details*

T	*	*	*	*	*	*	*	*	*	*

Emballage / *Packing*
1 = Pelicase / *Pelicase*
2 = Carton / *Cardboard*

Certificat / *Certificate*
1 = Aucun / *None*
2 = ATEX / IECEx

Connection du Doigt de Gant / *Thermowell Connection*
1 = NA (Pas de Doigt de Gant) / *NA (No thermowell required)*
2 = ¾ NPT
2 = Autre, à préciser / *Other to be specified*

Matériel du Doigt de Gant / *Thermowell Material*
1 = NA (Pas de Doigt de Gant) / *NA (No thermowell required)*
2 = Inox – 316 L / *Stainless Steel – 316 L*
3 = Inconel / *Inconel*
4 = Autre, à préciser / *Other to be specified*

Longueur du Doigt de Gant / *Thermowell Length*
1 = Pas de Doigt de Gant / No thermowell required
2 = A Préciser / To be specified

Antenne / *Antenna*
1 = EU – Europe / *EU – Europe*
2 = Monde / *World*
3 = EU – Europe Déporté / *EU – Europe Deported*
4 = Monde Dépoté / *World Deported*

Région d'Installation / *Installation Region*
1 = EU – Europe / *EU – Europe*
2 = AS – Malaisie / *AS – Malaisia*
3 = US – Amerique du Nord / *US – North America*
4 = AU – Australie / *AU – Australia*
5 = Autre à préciser / *Other to be specified*

Boitier / Housing
1 = Al couleur Signal Yellow / *Al Signal Yellow Color*
2 = Al couleur White Alu / *Al White Alu Color*
3 = 316 L pas de couleur / *316 L no color*
4 = Al couleur spécifique / *Aluminum Specific color*

Longueur de la sonde / *Sensing Probe Length*
1 = 0 - 380 mm
2 = 0 - 450 mm
3 = 0 - 500 mm
4 = 0 - 550 mm
5 = 0 - 600 mm
6 = 0 - 650 mm
7 = 0 - 750 mm
8 = 0 - 1000 mm
9 = Autre / *Other*

Température du Fluide / *Process Temperature*
1 = -20 deg C - 180 deg C
2 = -40 deg C - 200 deg C
3 = -50 deg C - 400 deg C
4 = -10 deg C - 600 deg C
5 = Autre / *Other*

Type du produit / *Product Type*
T = Température / *Temperature*