

Certification Radio test report

According to the standard:

CFR 47 FCC PART 15

RSS GEN – Issue 5

RSS 210 - Issue 10

Equipment under test:

ASK Contact Less Reader

With 5 antennas

FCC ID: T2X-V3-CLESS

IC NUMBER: 9489A-V3-CLESS

Company:

FLOWBIRD

Distribution: Mr EPENYOY

(Company: FLOWBIRD)

Number of pages: 50 with 1 appendix

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval	
			Name and Function	Visa
0	8-Mar-23	Creation	M. DUMESNIL, Radio Laboratory Manager	

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Information in italics are declared by the manufacturer/customer and are under his responsibility



Siège Social : Emitech - 3, rue des Coudriers - Z.A. de l'Observatoire - 78180 MONTIGNY LE BX - France

Siret : 344 545 645 00022 - Tél. : 33 (0)1 30 57 55 55 - Fax : 33 (0)1 30 43 74 48 - E-mail : contact@emitech.fr - URL : www.emitech.fr

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ACCREDITATIONS N° 1-0107, 1-0826, 1-0827, 1-1925, 1-2069, 1-2070, 1-2206, 1-2376 & 1-6086
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DESIGNATION OF PRODUCT: *ASK Contact Less Reader with 5 antennas*

Serial number (S/N): *Module: 000401*
Antenna 1: 302506
Antenna 2: 314043
Antenna 3: 103865
Antenna 4: 103092
Antenna 5: 322469

Reference / model (P/N): *Module: ELM1000035854*
Antenna 1: ELM1000004108
Antenna 2: ELM404304686
Antenna 3: ELM1000006460
Antenna 4: CAR1000000081
Antenna 5: ELM1000008317

Software version: *CSC 1.24*

MANUFACTURER: *FLOWBIRD*

COMPANY SUBMITTING THE PRODUCT:

Company: *FLOWBIRD*

Address: *PARC LAFAYETTE*
6 RUE ISAAC NEWTON
25075 – BESANCON CEDEX 9 - FRANCE

Responsible: *Mr EPENYOY*

Person(s) present during the tests: *Mr EPENYOY*

DATES OF TEST: *From 3-Nov-21 to 9-Nov-21*

TESTING LOCATION: *EMITECH ANGERS laboratory at JUIGNE SUR LOIRE (49) FRANCE*
FCC Accredited under US-EU MRA Designation Number: FR0009
Test Firm Registration Number: 873677

ISED Accredited under CANADA-EU MRA Designation Number: FR0001
Industry Canada Registration Number: 4452A

TESTED BY: *B. VOVARD*

VISA:



WRITTEN BY: *B. VOVARD*

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REVISIONS HISTORY

Revision	Date	Modified pages	Modifications
0	10-Nov-21	/	Creation

1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **ASK Contact Less Reader with 5 antennas**, in accordance with normative reference.

The equipment under test integrates:

- 13.56 MHz function not already certified

2. PRODUCT DESCRIPTION

Category of equipment (ISED): I

Utilization: "contactless" system of validation, payment or identification

Antenna type and gain: 5 External antennas (unknown gains)

Operating frequency range: From 13.110 MHz to 14.010 MHz

Number of channels: 1

Channel spacing: Not concerned

Modulation: ASK

Power source: 12 Vdc

Power level, frequency range and channels characteristics are not user adjustable.

3. NORMATIVE REFERENCE

The standards and testing methods related throughout this report are those listed below.

They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

CFR 47 FCC Part 15 (2021)	Radio Frequency Devices
ANSI C63.10	2013 Procedures for Compliance Testing of Unlicensed Wireless Devices.
RSP-100	Issue 12, August 2019 Certification of Radio Apparatus
RSS-Gen	Issue 5, April 2018 General Requirements for Compliance of Radio Apparatus
RSS-210	Issue 10, December 2019 Licence-Exempt Radio Apparatus: Category I equipment.

4. TEST METHODOLOGY

Radio performance tests procedures given in CFR 47 part 15:

Subpart C – Intentional Radiators

- Paragraph 203: Antenna requirement
- Paragraph 205: Restricted bands of operation
- Paragraph 207: Conducted limits
- Paragraph 209: Radiated emission limits; general requirements
- Paragraph 212: Modular transmitter
- Paragraph 215: Additional provisions to the general radiated emission limitations
- Paragraph 225: Operation within the band 13.110-14.010 MHz

Radio performance tests procedures given in RSS-Gen:

- Paragraph 2 - General
- Paragraph 3 - Normative publications and related documents
- Paragraph 4 - Labelling requirements
- Paragraph 6 - General administrative and technical requirements
- Paragraph 8 - Licence-exempt Radio Apparatus

Radio performance tests procedures given in RSS-210:

- Paragraph 5 – RSS-Gen compliance
- Paragraph 7 - Technical specifications
- Annex B - Devices Operating in Frequency Bands for Any Application
 - Annex B.6 Band 13.110-14.010 MHz

5. TEST EQUIPMENT CALIBRATION DATES

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due
0	BAT-EMC V3.18.0.26	Software	/	/	/
1406	EMCO 6502	Loop antenna	13/04/2021	1	13/04/2022
4088	R&S FSP40	Spectrum Analyzer	04/05/2020	2	04/05/2022
7190	R&S HL223	Antenna	09/03/2019	3	08/03/2022
7240	Emco 3110	Biconical antenna	09/03/2019	3	08/03/2022
7566	Testo 608-H1	Meteo station	22/09/2020	2	22/09/2022
8508	California instruments 1251RP	Power source	(1)	(1)	(1)
8528	Schwarzbeck VHA 9103	Biconical antenna	09/03/2019	3	08/03/2022
8578	N-2GHz	Cable	11/06/2020	2	11/06/2022
8590	RG214 N-5m	Cable	25/02/2020	2	24/02/2022
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8635	R&S EZ-25	High-pass filter	04/09/2021	3	03/09/2024
8707	R&S ESI7	Test receiver	23/08/2021	1	23/08/2022
8719	Thurbly Thandar Instruments 1600	LISN	26/02/2020	2	25/02/2022
8732	Emitech	OATS	03/07/2019	3	02/07/2022
8750	La Crosse Technology WS-9232	Meteo station	22/09/2020	2	22/09/2022
8855	EMITECH	Turntable and mat controller	/	/	/
8864	Champ libre Juigné. V3.5	Software	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
9398	N-1.5m	cable	11/06/2020	2	11/06/2022
9489	Absorber sheath current	Emitech	20/04/2020	2	20/04/2022
10730	Mini-circuit ZFL-1000LN	Low-noise amplifier	26/01/2021	1	26/01/2022
10759	COMTEST Cage 3	Anechoic chamber	/	/	/
10788	Emitech	Outside room Hors cage	/	/	/
10789	MATURO	Turntable and mat controller NCD	/	/	/
12912	Huber + Suhner N-5m	cable	11/06/2020	2	11/06/2022
14303	SUCOFLEX N-2m	cable	26/01/2021	2	26/01/2023
14304	SUCOFLEX N-2.5m	cable	26/01/2021	2	26/01/2023
14475	Oregon Scientific BAR206	Meteo station	27/10/2021	2	27/10/2023

14903	Fluke 177	Multimeter	25/02/2020	2	24/02/2022
15666	R&S FSV40	Spectrum Analyzer	24/09/2020	2	24/09/2022
15882	SUCOFLEX	cable N 5m	26/01/2021	2	26/01/2023
17008	R&S ESW44	Test receiver	17/04/2020	2	17/04/2022
//	RS Commander V1.6.4	Software	/	/	/

(1) The equipment is not verified; instead, the output voltage is checked before each measurement with the calibrated multimeter.

6. TESTS RESULTS SUMMARY

6.1 CFR 47 part 15 requirements

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				Note 1
FCC Part 15.205	RESTRICTED BANDS OF OPERATION	X				
FCC Part 15.207	CONDUCTED LIMITS	X				
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				Note 2
FCC Part 15.212	MODULAR TRANSMITTERS			X		
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	(a) Alternative to general radiated emission limits	X				
	(b) Unwanted emissions outside of §15.225 frequency bands	X				Note 4
	(c) 20 dB bandwidth and band-edge compliance	X				
FCC Part 15.225	OPERATION WITHIN THE BAND 13.110-14.010 MHZ					
	(a) Field strength within the band 13.553-13.567 MHz	X				
	(b) Field strength within the bands 13.410-13.553 MHz and 13.567-13.710 MHz	X				
	(c) Field strength within the bands 13.110-13.410 MHz and 13.710-14.010 MHz	X				
	(d) Field strength outside the band 13.110-14.010 MHz	X				
	(e) Carrier frequency tolerance	X				
	(f) Powered tags			X		

NAp: Not Applicable NAs: Not Asked

Note 1: Dedicated antenna with SMB connector.

Note 2: See FCC part 15.225 (d).

Note 3: See FCC part 15.209. Unwanted emissions levels are all below the fundamental emission field strength level.

6.2 RSS-Gen requirements

Test procedure	Description of test	Criteria respected ?				Comment
		Yes	No	NAp	NAs	
Paragraph 2	General	X				
Paragraph 3	Normative publications and related documents	X				
Paragraph 4	Labelling requirements	X				
Paragraph 6	General administrative and technical requirements	X				
§ 6.7	Occupied bandwidth (or 99% emission bandwidth) and x dB bandwidth	X				
Paragraph 8	Licence-exempt radio apparatus					
§ 8.1	Measurement Bandwidths and Detector Functions	X				
§ 8.2	Pulsed operation	X				
§ 8.3	Prohibition of amplifiers	X				
§ 8.4	User manual notice	X				see certification documents
§ 8.5	Measurement of licence-exempt devices on-site (in-situ)			X		
§ 8.6	Operating frequency range of devices in master/slave networks			X		
§ 8.7	Radio frequency identification (RFID) devices	X				
§ 8.8	AC power line conducted emissions limits	X				
§ 8.9	Transmitter emission limits	X				
§ 8.10	Restricted frequency bands	X				
§ 8.11	Frequency stability	X				

NAp: Not Applicable

NAs: Not Asked

6.3 RSS-210 requirements

Test Procedure RSS-210	Description of test	Criteria respected ?				Comment
		Yes	No	NAp	NAs	
Paragraph 5	RSS-Gen compliance	X				
Paragraph 7	Technical Specifications					
7.1	Emission Falling Within Restricted Frequency Bands	X				
7.2	General Field Strength Limits	X				
7.3	Transmitters with wanted and unwanted emissions that are within the general field strength limits	X				
7.4	Cordless Telephones			X		
Annex B	Device Operating in Frequency Bands for Any Application					
Annex B.6	Band 13.110-14.010 MHz					
(a) i	Field strength within the band 13.553-13.567 MHz	X				
(a) ii	Field strength within the bands 13.410-13.553 MHz and 13.67-13.710 MHz	X				
(a) iii	Field strength within the bands 13.110-13.410 MHz and 13.710-14.010 MHz	X				
(a) iv	Field strength outside the band 13.110-14.010 MHz	X				
(b)	Carrier frequency stability	X				

NAp: Not Applicable

NAs: Not Asked

7. MEASUREMENT UNCERTAINTY

To declare, or not, the compliance with the specifications, it was not explicitly taken into account of uncertainty associated with the result(s)

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for normal distribution corresponds to a coverage probability of approximately 95%.

Parameter	Emitech Uncertainty
RF power, conducted	$\pm 0.8\text{dB}$
Radiated emission valid to 26 GHz	
9kHz – 30MHz	$\pm 2.7. \text{ dB}$
30MHz – 1GHz	$\pm 5.0 \text{ dB}$
1GHz – 18GHz	$\pm 5.3 \text{ dB}$
18GHz – 40GHz	$\pm 6.1 \text{ dB}$
AC Power Lines conducted emissions	$\pm 3.4 \text{ dB}$
Temperature	$\pm 1 \text{ }^{\circ}\text{C}$
Humidity	$\pm 5 \%$

8. AC CONDUCTED EMISSIONS**Temperature (°C) :** 23**Humidity (%HR):** 42**Date :** November 8, 2021**Technician :** B. VOVARD**Standard:** FCC Part 15
RSS-Gen**Test procedure:**

For FCC Part 15: § 15.207

For RSS-Gen: § 8.8

Method of § 6.2 of ANSI C63.10

Software used: BAT-EMC V3.18.0.26**Test set up:**

The EUT is isolated and placed on a wooden table, 0.8 m over an horizontal reference plane and 0.4 m from a vertical reference plane. It is powered by an artificial main network placed on the ground reference plane. The equipment is powered with the AC power operating voltage of 120 V / 60 Hz.

Frequency range: 150 kHz - 30 MHz**Detection mode:** Peak**Bandwidth:** 10 kHz**Equipment under test operating condition:**

The equipment under test is blocked in alternance of emission and reception mode without tag, at the highest output power level at which the transmitter is intended to operate.

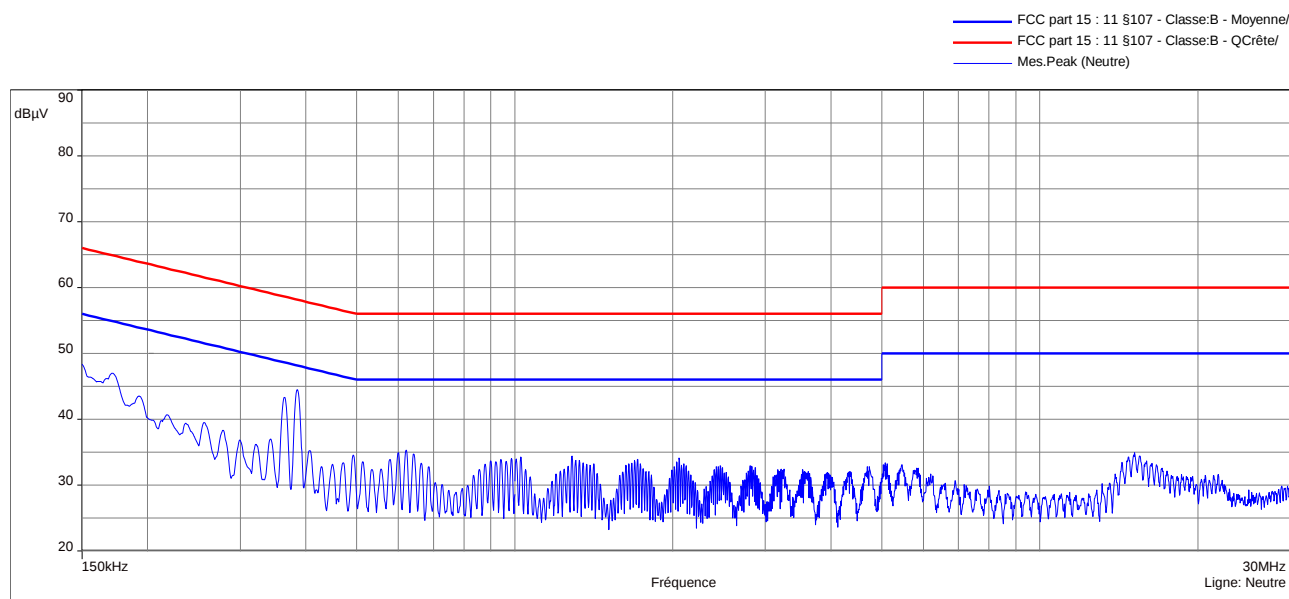
Results:

The module is tested with all antennas and with 50 Ω load because the 13.56MHz fundamental appear in antenna measurements.

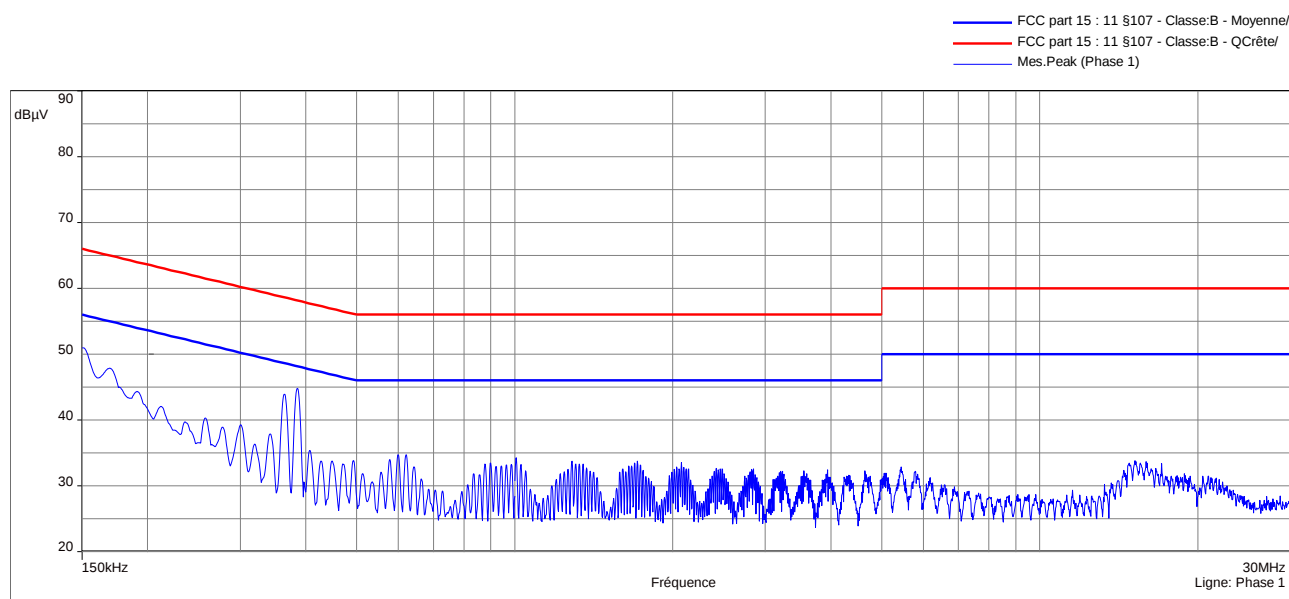
Sample N° 1: Module with 50 Ω load:

Measurement on the mains power supply:

Curve N° 1: measurement on the Neutral with peak detector



Curve N° 2: measurement on the Line with peak detector



The highest frequencies are then analyzed with Quasi-peak detector and Average detector

Table N° 1: measurement on the Neutral, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.172	41.6	64.9	23.28
0.364	41.95	58.6	16.68
0.385	43.7	58.2	14.47
0.621	31.72	56.0	24.28
1.285	30.16	56.0	25.84
15.157	27.74	60.0	32.26

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.172	28.84	54.9	26.04
0.364	41.17	48.6	7.46
0.385	42.78	48.2	5.39
0.621	30.84	46.0	15.16
1.285	29.34	46.0	16.66
15.157	21.01	50.0	28.99

Table N° 2: measurement on the Line, for the frequency range:

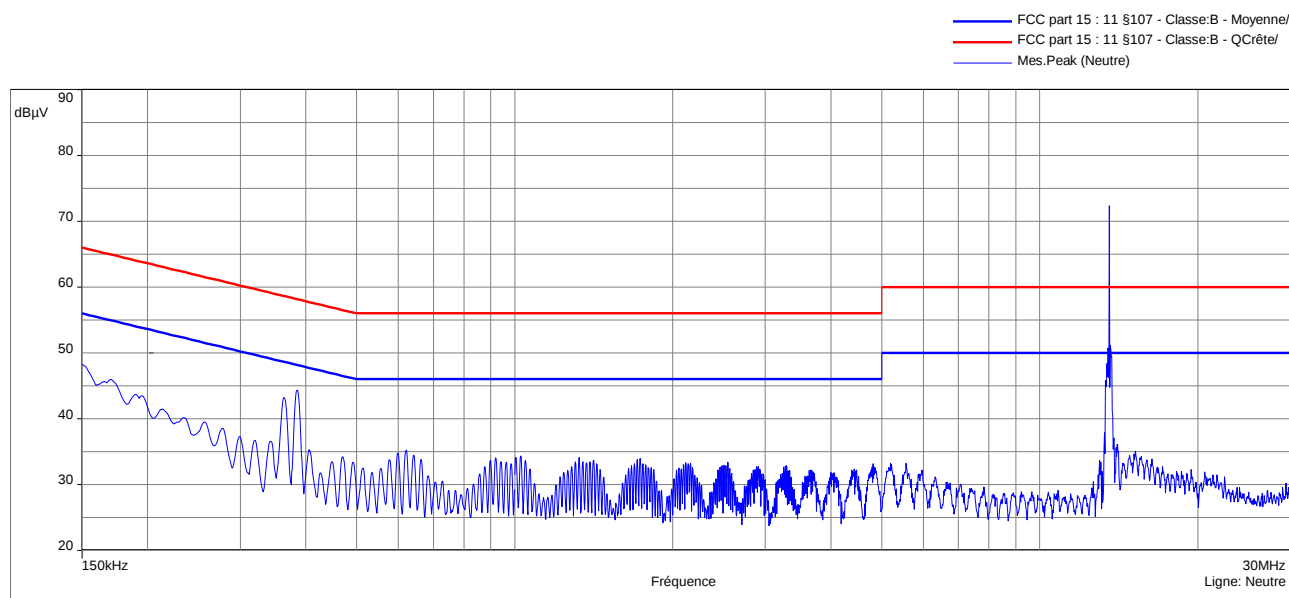
Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.151	45.31	66.0	20.64
0.364	42.79	58.6	15.84
0.386	44.17	58.2	13.99
1.006	30.19	56.0	25.81
1.713	29.79	56.0	26.21
15.187	28.83	60.0	31.17

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.151	32.49	56.0	23.46
0.364	42.14	48.6	6.49
0.386	43.35	48.2	4.81
1.006	29.27	46.0	16.73
1.713	28.7	46.0	17.30
15.187	24.44	50.0	25.56

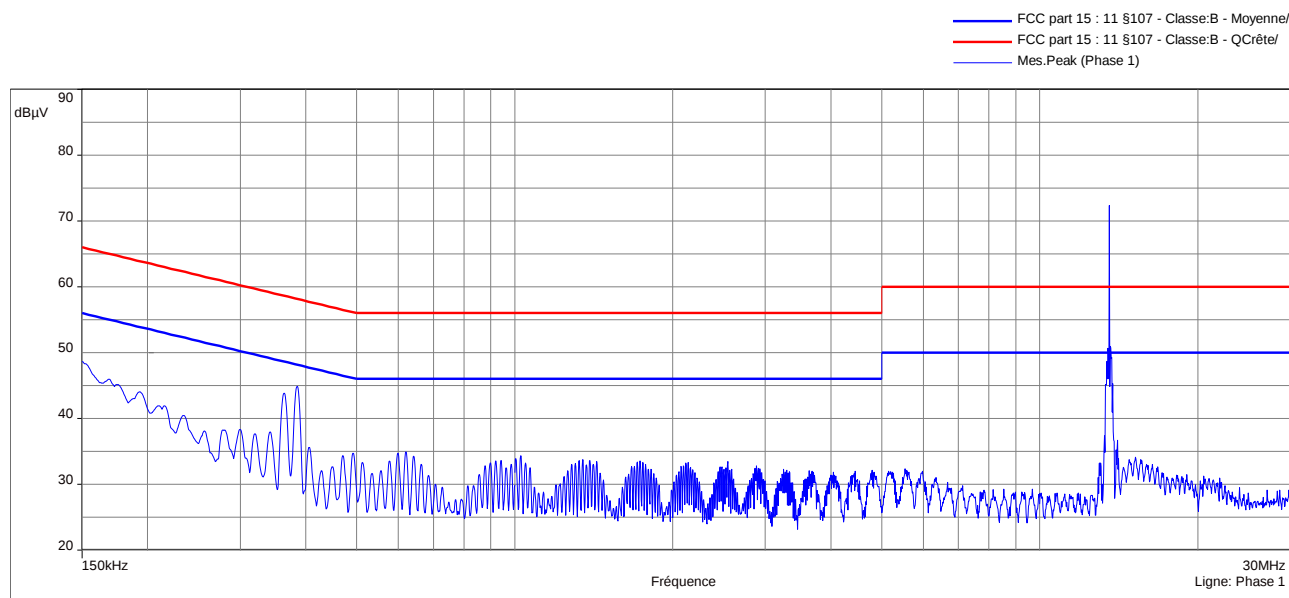
Sample N° 1: Antenna 1 - ELM1000004108:

Measurement on the mains power supply:

Curve N° 1: measurement on the Neutral with peak detector



Curve N° 2: measurement on the Line with peak detector



The highest frequencies are then analyzed with Quasi-peak detector and Average detector

Table N° 1: measurement on the Neutral, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.150	43.69	66.0	22.31
0.170	40.36	64.9	24.58
0.364	41.82	58.6	16.83
0.385	43.67	58.2	14.50
0.621	32.1	56.0	23.90
1.027	31.16	56.0	24.84

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.150	29.96	56.0	26.04
0.170	28.28	54.9	26.66
0.364	41.03	48.6	7.62
0.385	42.78	48.2	5.39
0.621	31.27	46.0	14.73
1.027	30.36	46.0	15.64

Table N° 2: measurement on the Line, for the frequency range:

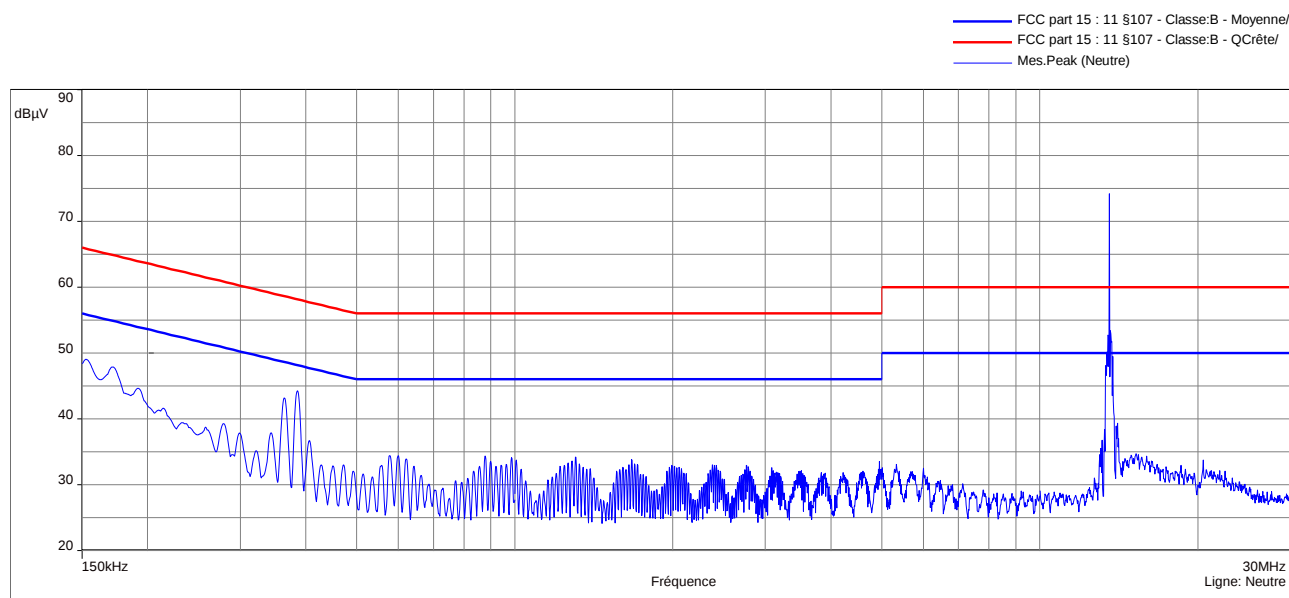
Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.150	44.85	66.0	21.15
0.193	38.22	63.9	25.67
0.364	42.74	58.6	15.91
0.385	44.15	58.2	14.01
0.621	31.82	56.0	24.18
1.027	30.59	56.0	25.41

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.150	32.4	56.0	23.60
0.193	27.28	53.9	26.61
0.364	42.09	48.6	6.56
0.385	43.35	48.2	4.81
0.621	30.93	46.0	15.07
1.027	29.68	46.0	16.32

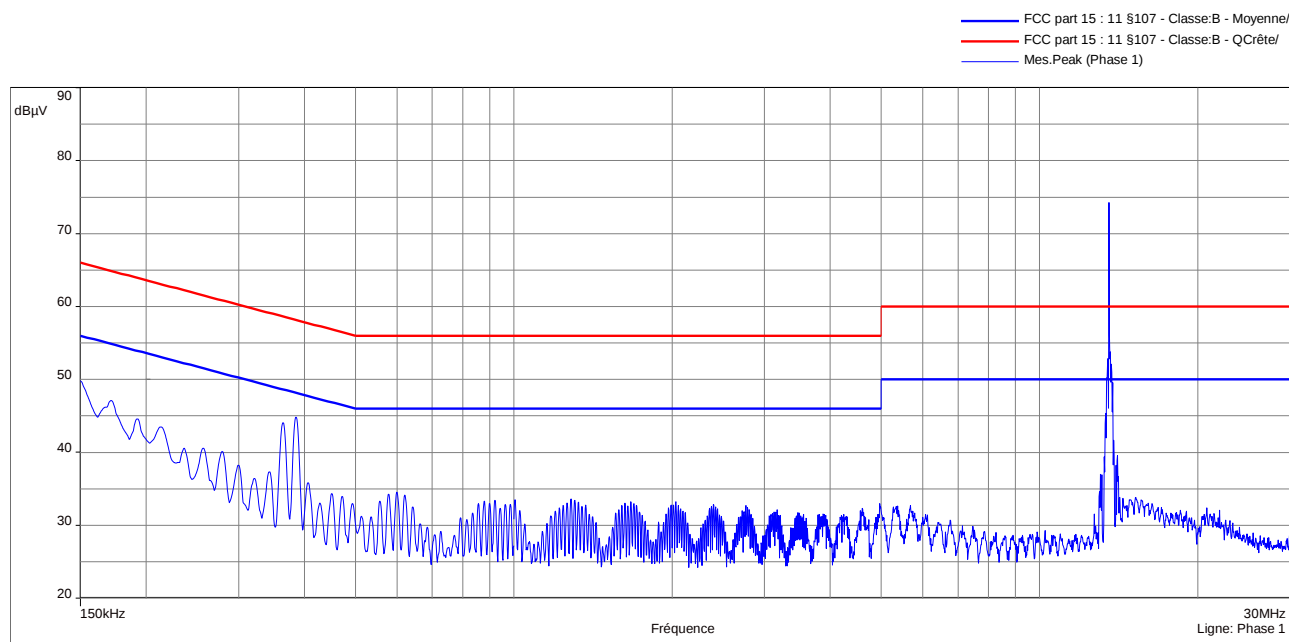
Sample N° 1: Antenna 2 - ELM404304686:

Measurement on the mains power supply:

Curve N° 1: measurement on the Neutral with peak detector



Curve N° 2: measurement on the Line with peak detector



The highest frequencies are then analyzed with Quasi-peak detector and Average detector

Table N° 1: measurement on the Neutral, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.153	41.55	65.8	24.29
0.172	41.1	64.9	23.77
0.279	34.41	60.8	26.44
0.364	41.95	58.6	16.69
0.386	43.55	58.2	14.61
0.600	31.59	56.0	24.41

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.153	27.27	55.8	28.57
0.172	28.5	54.9	26.37
0.279	29.56	50.8	21.29
0.364	41.16	48.6	7.48
0.386	42.65	48.2	5.51
0.600	30.74	46.0	15.26

Table N° 2: measurement on the Line, for the frequency range:

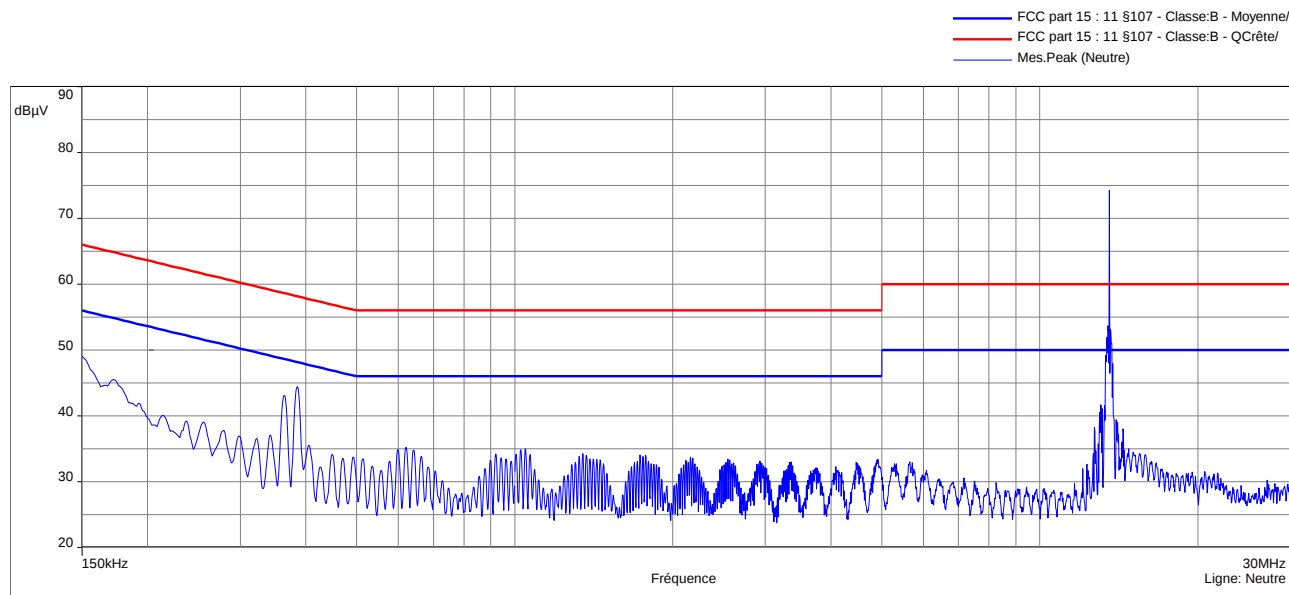
Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.150	45.54	66.0	20.46
0.172	42.23	64.9	22.64
0.364	42.83	58.6	15.80
0.386	44.03	58.2	14.13
0.600	31.21	56.0	24.79
1.005	28.54	56.0	27.46

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.150	32.77	56.0	23.23
0.172	30.55	54.9	24.32
0.364	42.19	48.6	6.44
0.386	43.22	48.2	4.94
0.600	30.32	46.0	15.68
1.005	27.41	46.0	18.59

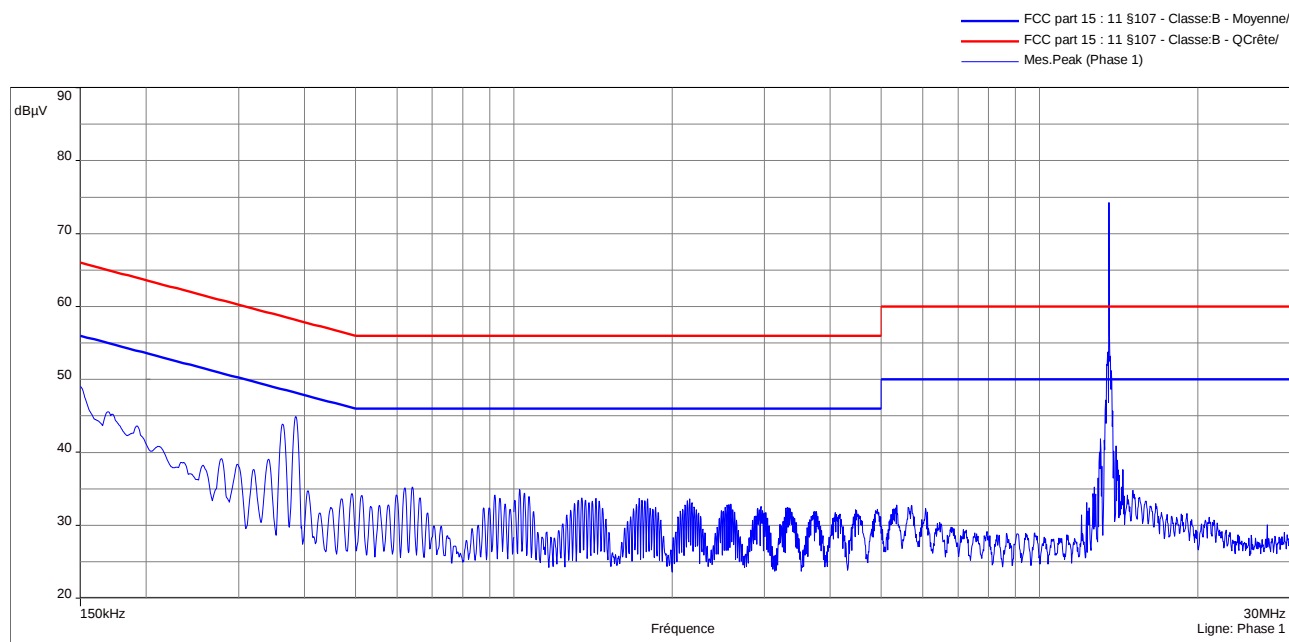
Sample N° 1: Antenna 3 - ELM1000006460:

Measurement on the mains power supply:

Curve N° 1: measurement on the Neutral with peak detector



Curve N° 2: measurement on the Line with peak detector



The highest frequencies are then analyzed with Quasi-peak detector and Average detector

Table N° 1: measurement on the Neutral, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.150	44.03	66.0	21.97
0.173	40.15	64.8	24.68
0.364	41.78	58.6	16.86
0.385	43.81	58.2	14.35
0.621	32.36	56.0	23.64
1.048	31.14	56.0	24.86

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.150	30.2	56.0	25.80
0.173	28.12	54.8	26.71
0.364	40.99	48.6	7.65
0.385	42.92	48.2	5.24
0.621	31.57	46.0	14.43
1.048	30.36	46.0	15.64

Table N° 2: measurement on the Line, for the frequency range:

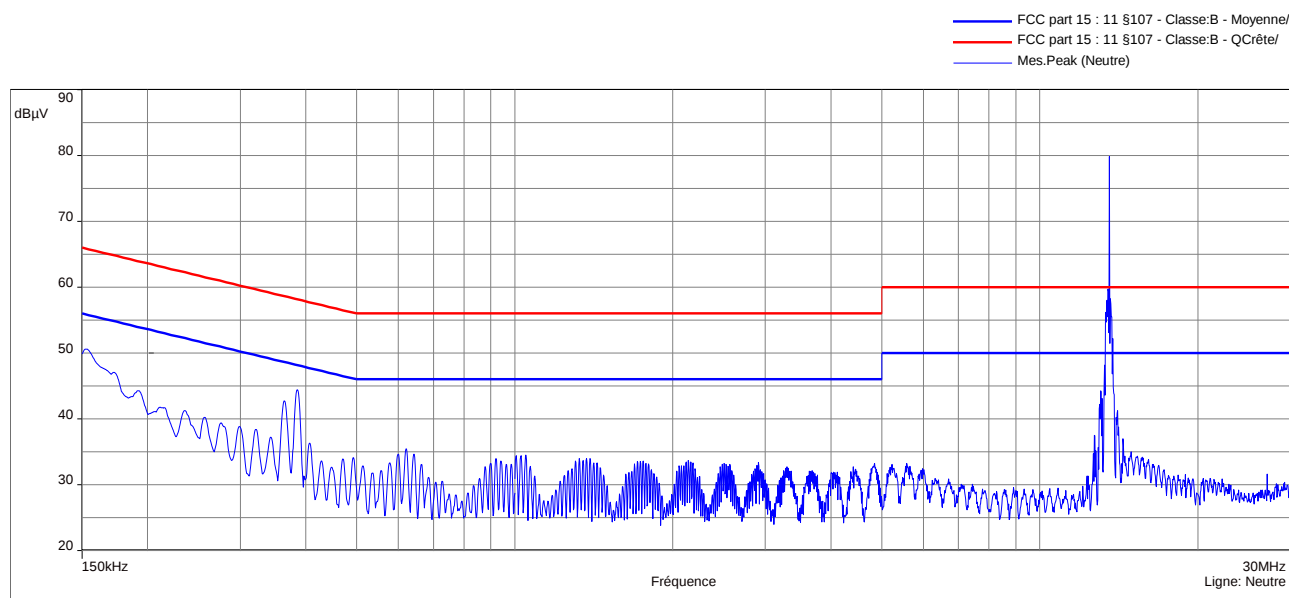
Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.150	45.04	66.0	20.96
0.170	41.15	65.0	23.83
0.363	42.63	58.6	16.02
0.385	44.29	58.2	13.88
0.642	31.52	56.0	24.48
1.027	30.74	56.0	25.26

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.150	32.48	56.0	23.52
0.170	30.09	55.0	24.89
0.363	41.98	48.6	6.67
0.385	43.5	48.2	4.67
0.642	30.63	46.0	15.37
1.027	29.92	46.0	16.08

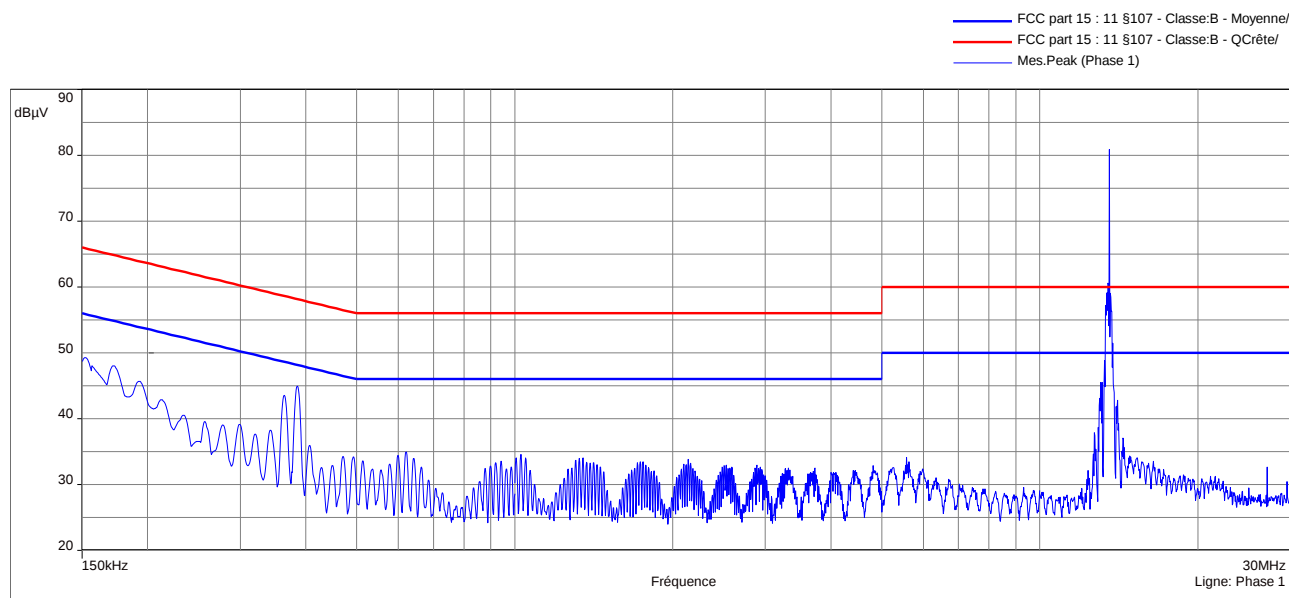
Sample N° 1: Antenna 4 - CAR1000000081:

Measurement on the mains power supply:

Curve N° 1: measurement on the Neutral with peak detector



Curve N° 2: measurement on the Line with peak detector



The highest frequencies are then analyzed with Quasi-peak detector and Average detector

Table N° 1: measurement on the Neutral, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.153	41.69	65.8	24.16
0.236	35.52	62.2	26.73
0.364	41.74	58.6	16.90
0.385	43.92	58.2	14.24
0.621	32.35	56.0	23.65
1.050	30.33	56.0	25.67

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.153	27.44	55.8	28.41
0.236	24.93	52.2	27.32
0.364	40.96	48.6	7.68
0.385	42.99	48.2	5.17
0.621	31.62	46.0	14.38
1.050	29.56	46.0	16.44

Table N° 2: measurement on the Line, for the frequency range:

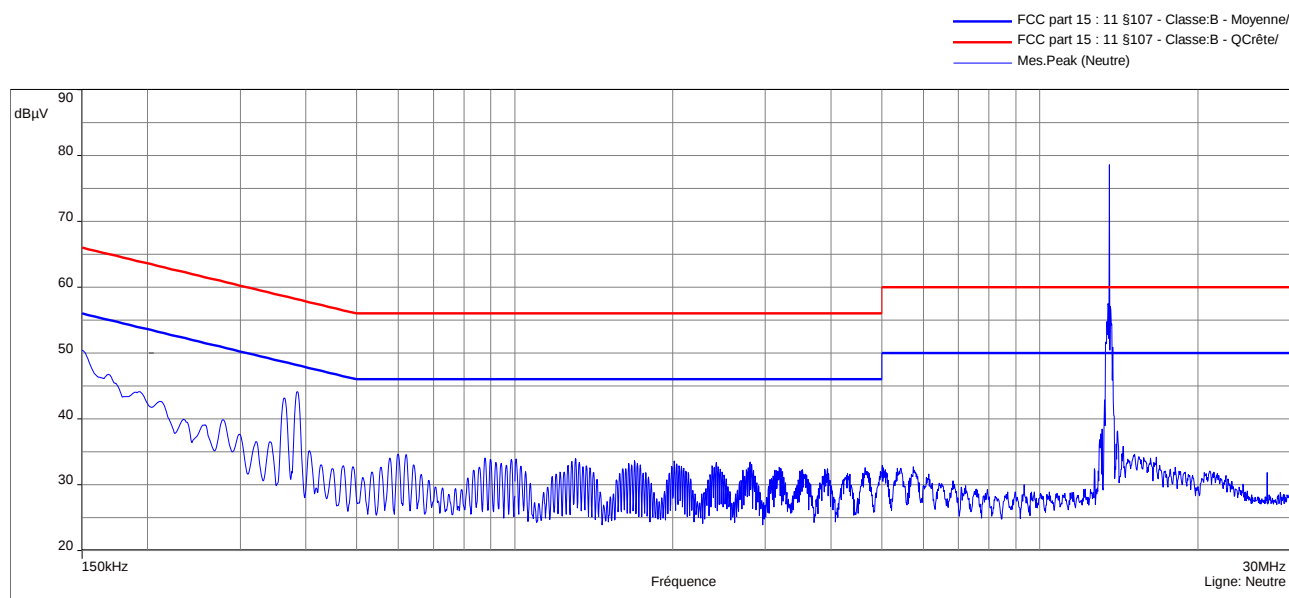
Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.152	43.98	65.9	21.90
0.172	42.2	64.8	22.64
0.364	42.54	58.6	16.10
0.385	44.33	58.2	13.83
0.621	31.89	56.0	24.11
1.028	30.7	56.0	25.30

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.152	30.96	55.9	24.92
0.172	30.67	54.8	24.17
0.364	41.92	48.6	6.72
0.385	43.53	48.2	4.63
0.621	31.1	46.0	14.90
1.028	29.92	46.0	16.08

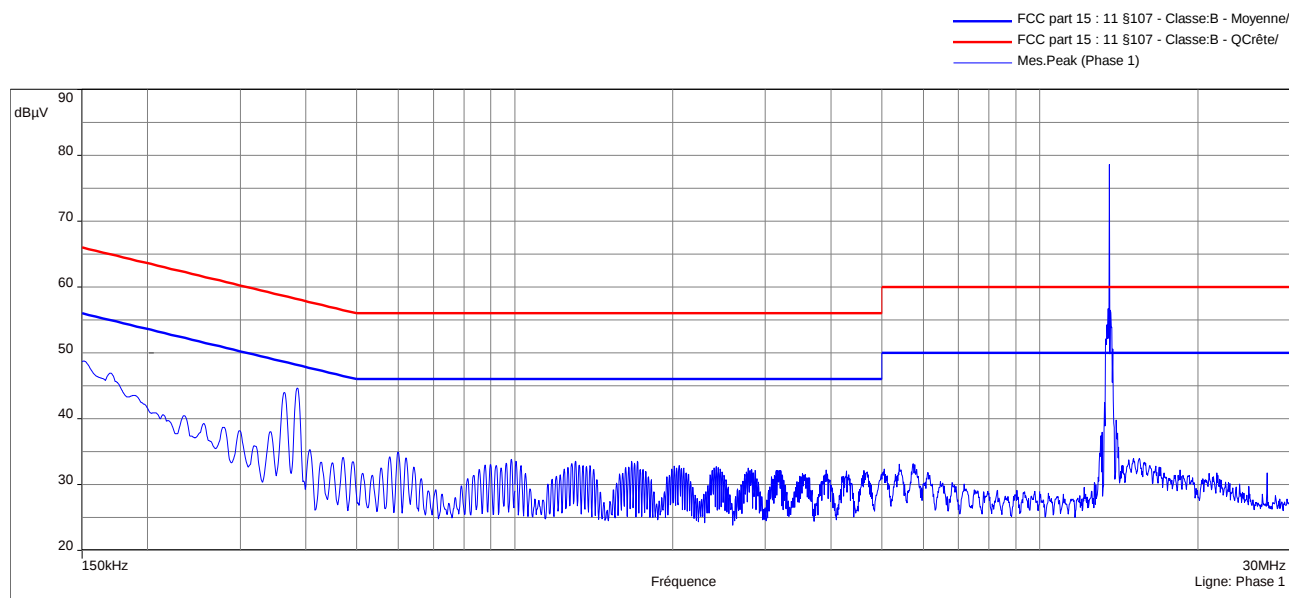
Sample N° 1: Antenna 5 - ELM1000008317:

Measurement on the mains power supply:

Curve N° 1: measurement on the Neutral with peak detector



Curve N° 2: measurement on the Line with peak detector



The highest frequencies are then analyzed with Quasi-peak detector and Average detector

Table N° 1: measurement on the Neutral, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.150	43.93	66.0	22.07
0.278	34.31	60.9	26.55
0.364	41.97	58.6	16.67
0.386	43.53	58.2	14.63
0.599	31.65	56.0	24.35
0.878	29.79	56.0	26.21

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.150	30.11	56.0	25.89
0.278	29.64	50.9	21.22
0.364	41.17	48.6	7.47
0.386	42.64	48.2	5.52
0.599	30.85	46.0	15.15
0.878	29.04	46.0	16.96

Table N° 2: measurement on the Line, for the frequency range:

Frequency (MHz)	Quasi-peak (dBμV)	QP Limit (dBμV)	QP margin (dB)
0.151	44.48	65.9	21.46
0.170	41.48	64.9	23.47
0.364	42.88	58.6	15.76
0.385	44.02	58.2	14.14
0.599	31.35	56.0	24.65
0.985	29.6	56.0	26.40

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average margin (dB)
0.151	31.88	55.9	24.06
0.170	30.17	54.9	24.78
0.364	42.24	48.6	6.40
0.385	43.21	48.2	4.95
0.599	30.49	46.0	15.51
0.985	28.78	46.0	17.22

Test conclusion:

RESPECTED STANDARD

9. OCCUPIED BANDWIDTH**Temperature (°C) :** 23**Humidity (%HR):** 42**Date :** November 8, 2021**Technician :** B. VOVARD**Standard:** FCC Part 15
RSS-210**Test procedure:**

Method of § 6.9.3 of ANSI C63.10 (99% Measurement)

Method of § 6.9.2 of ANSI C63.10 (20dB Measurement)

Test set up:

Test realized in near field.

Setting:

Measure	99%	20dB
Center frequency	The centre frequency of the channel under test	
Detector	Peak	
Span	1.5 to 5 times the OBW	2 to 5 times the OBW
RBW	1% to 5% of the OBW	1% to 5% of the OBW
VBW	3 x RBW	3 x RBW
Trace	Max hold	
Sweep	Auto	

Test operating condition of the equipment:

The equipment under test is blocked in alternance of emission and reception mode without tag, at the highest output power level at which the transmitter is intended to operate.

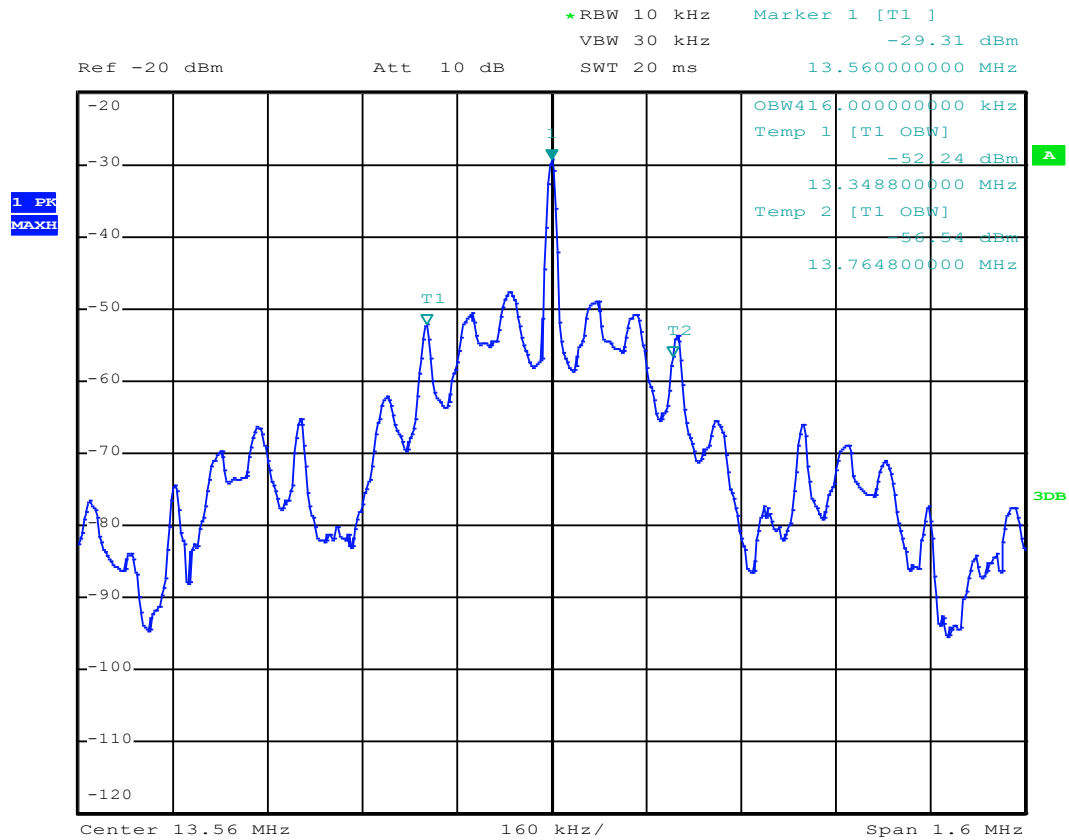
Power source: 12 Vdc by an adapter on power supply at 120 Vac 60 Hz

Percentage of voltage variation during the test (%): ± 1

Results:

Sample N° 1:

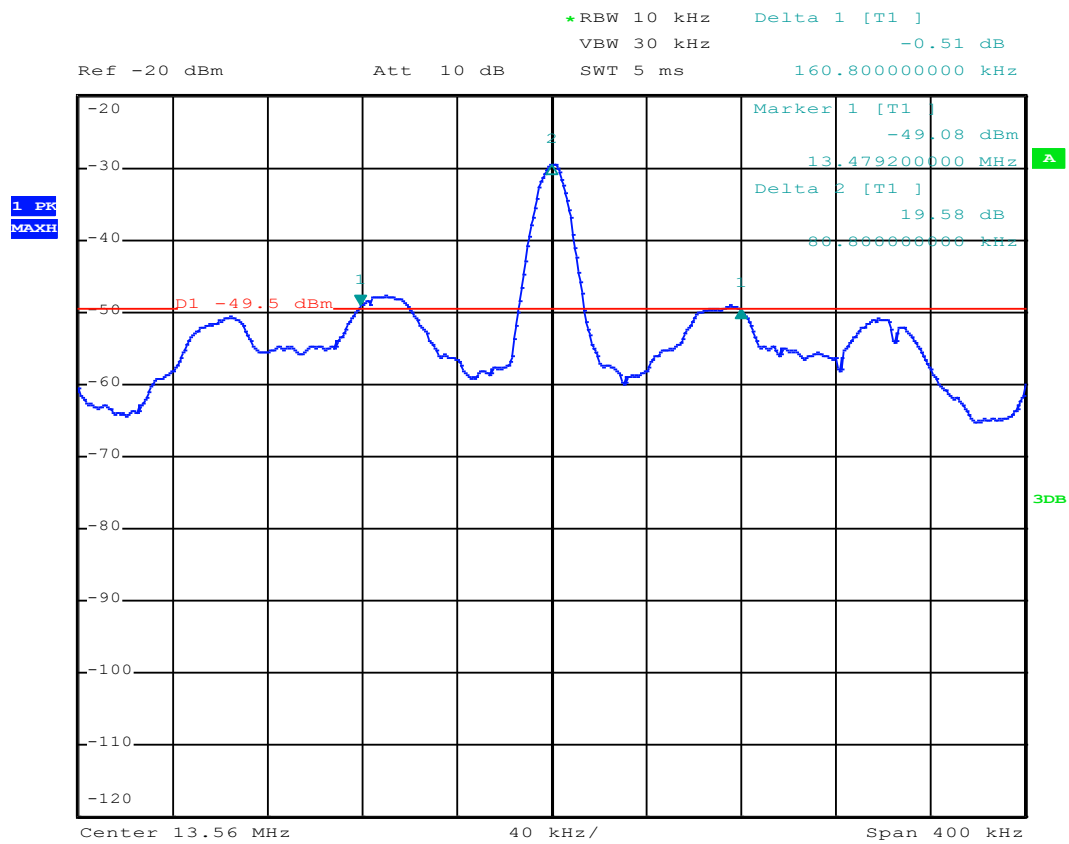
99% bandwidth – 13.56 MHz



Limit:

Measure realized for reporting only

20dB bandwidth – 13.56 MHz



Limit:

Measure realized for reporting only

10. BAND EDGE**Temperature (°C) :** 23**Humidity (%HR):** 42**Date :** November 8, 2021**Technician :** B. VOVARD**Standard:** FCC Part 15**Test procedure:**

For FCC Part 15: § 15.215

Method of § 6.10.6 of ANSI C63.10

Test set up:

Test realized in near field. All field strength measurements are correlated with the radiated maximum peak output power

Test operating condition of the equipment:

The equipment under test is blocked in alternance of emission and reception mode without tag, at the highest output power level at which the transmitter is intended to operate.

Power source: 12 Vdc by an adapter on power supply at 120 Vac 60 Hz

Percentage of voltage variation during the test (%): ± 1

Results:

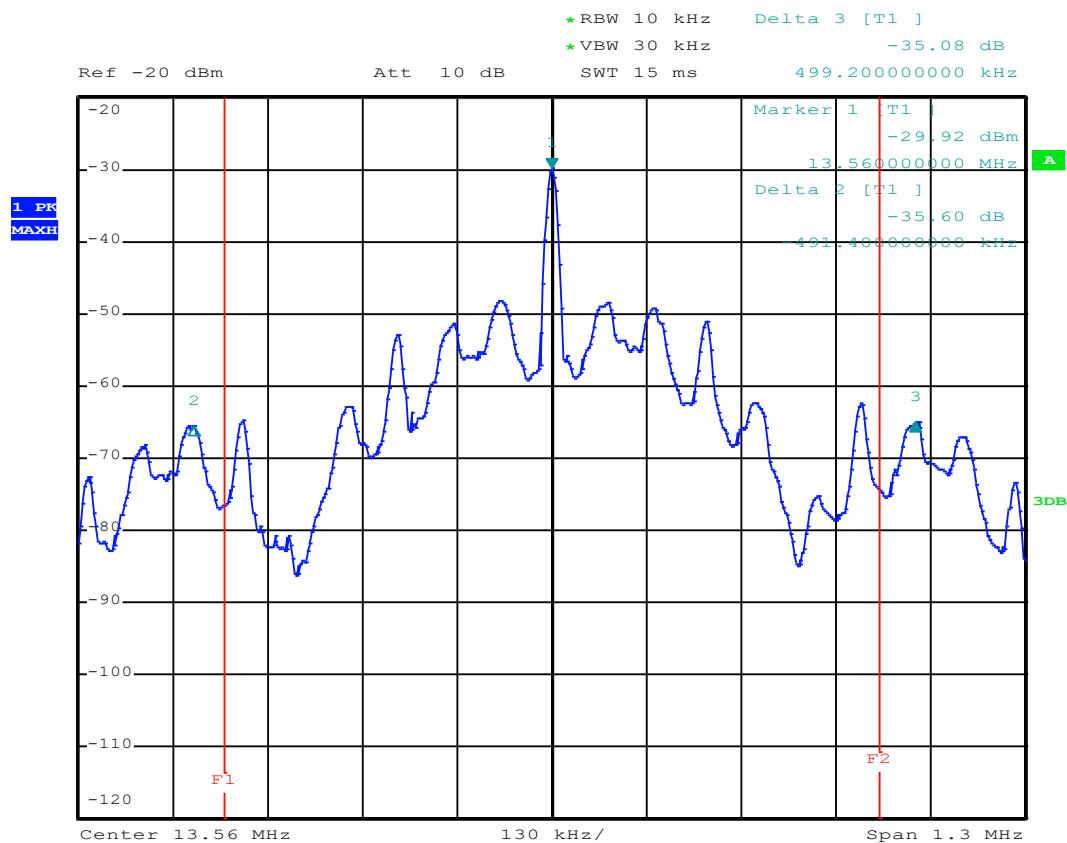
Lower Band Edge: From 13.090 MHz to 13.110 MHz

Upper Band Edge: From 14.010 MHz to 14.030 MHz

Sample N° 1: Antenna 1 - ELM1000004108:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
13.56	36.47	Peak	13.068	-35.60	0.87	48.63	47.76
13.56	36.47	Peak	14.059	-35.08	1.39	48.63	47.24

(1) Marker-Delta method

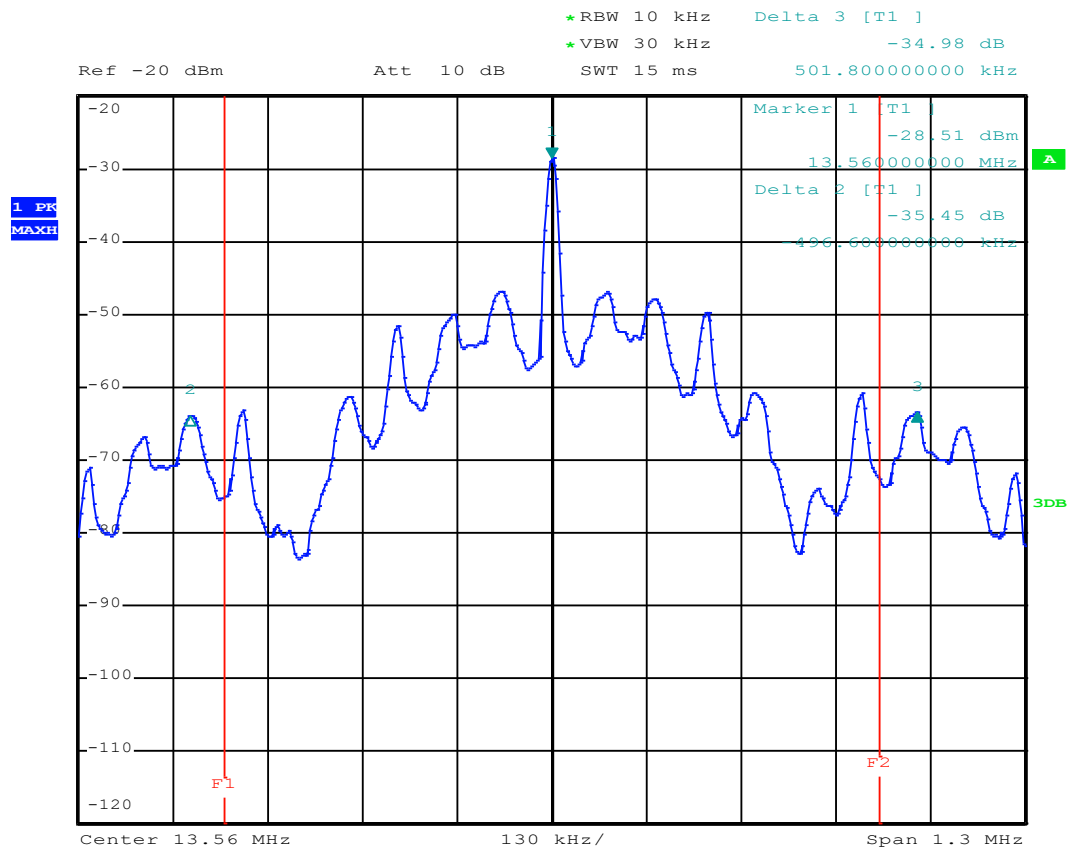


Lower Band Edge: From 13.090 MHz to 13.110 MHz
Upper Band Edge: From 14.010 MHz to 14.030 MHz

Sample N° 1: Antenna 2 - ELM404304686:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
13.56	37.04	Peak	13.063	-35.45	1.59	48.63	47.04
13.56	37.04	Peak	14.061	-34.98	2.06	48.63	46.57

(1) Marker-Delta method

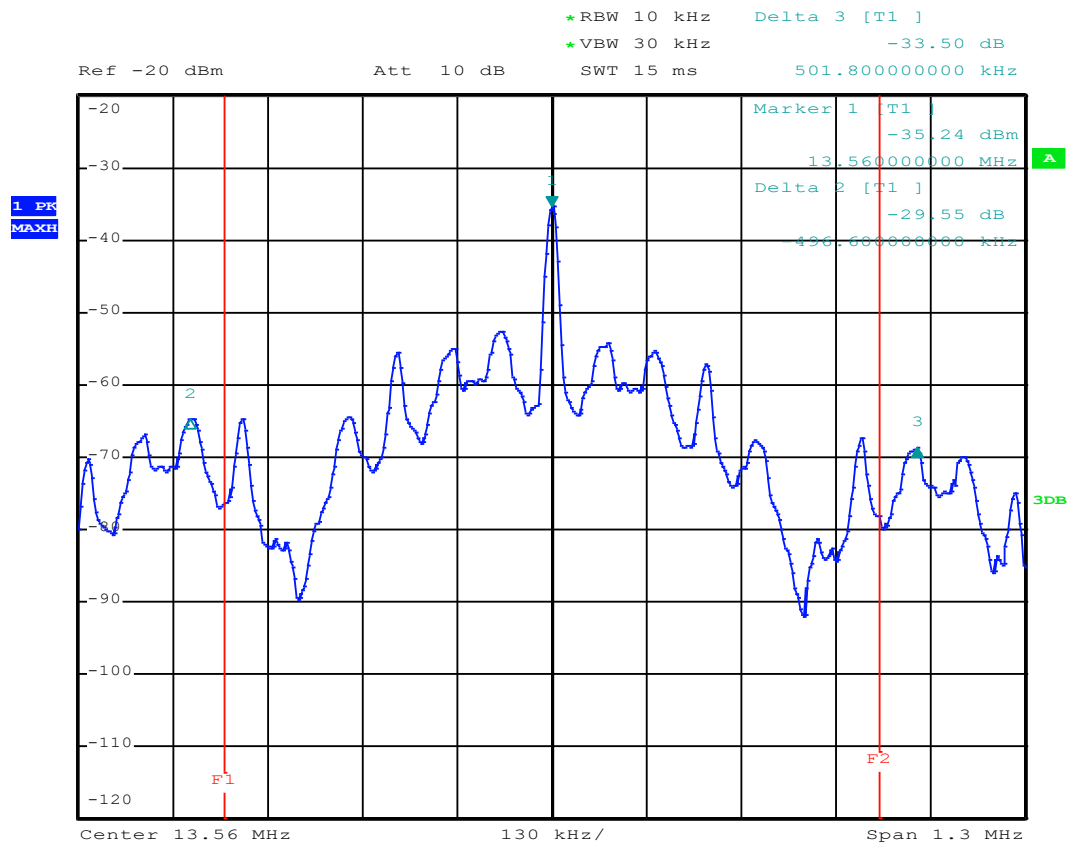


Lower Band Edge: From 13.090 MHz to 13.110 MHz
Upper Band Edge: From 14.010 MHz to 14.030 MHz

Sample N° 1: Antenna 3 - ELM1000006460:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
13.56	35.76	Peak	13.063	-29.55	6.21	48.63	42.42
13.56	35.76	Peak	14.061	-33.50	2.26	48.63	46.37

(1) Marker-Delta method

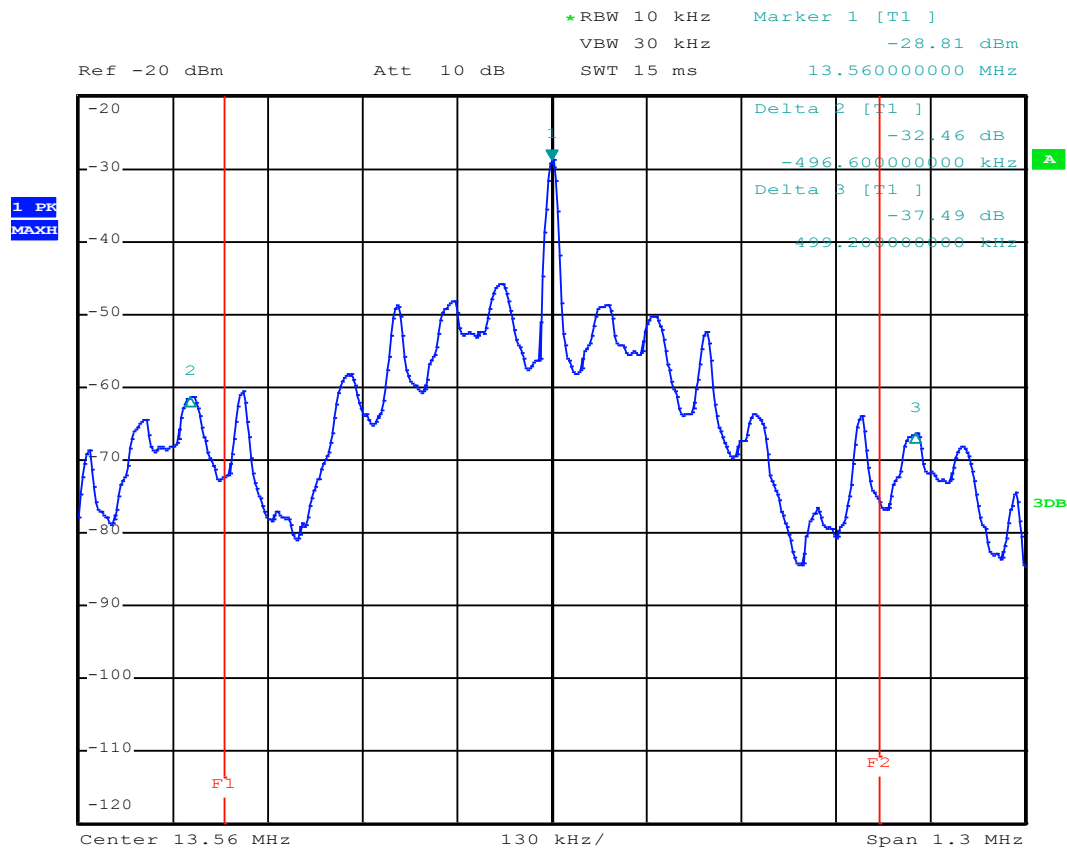


Lower Band Edge: From 13.090 MHz to 13.110 MHz
Upper Band Edge: From 14.010 MHz to 14.030 MHz

Sample N° 1: Antenna 4 - CAR1000000081:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
13.56	42.97	Peak	13.063	-32.46	10.51	48.63	38.12
13.56	42.97	Peak	14.059	-37.49	5.48	48.63	43.15

(1) Marker-Delta method

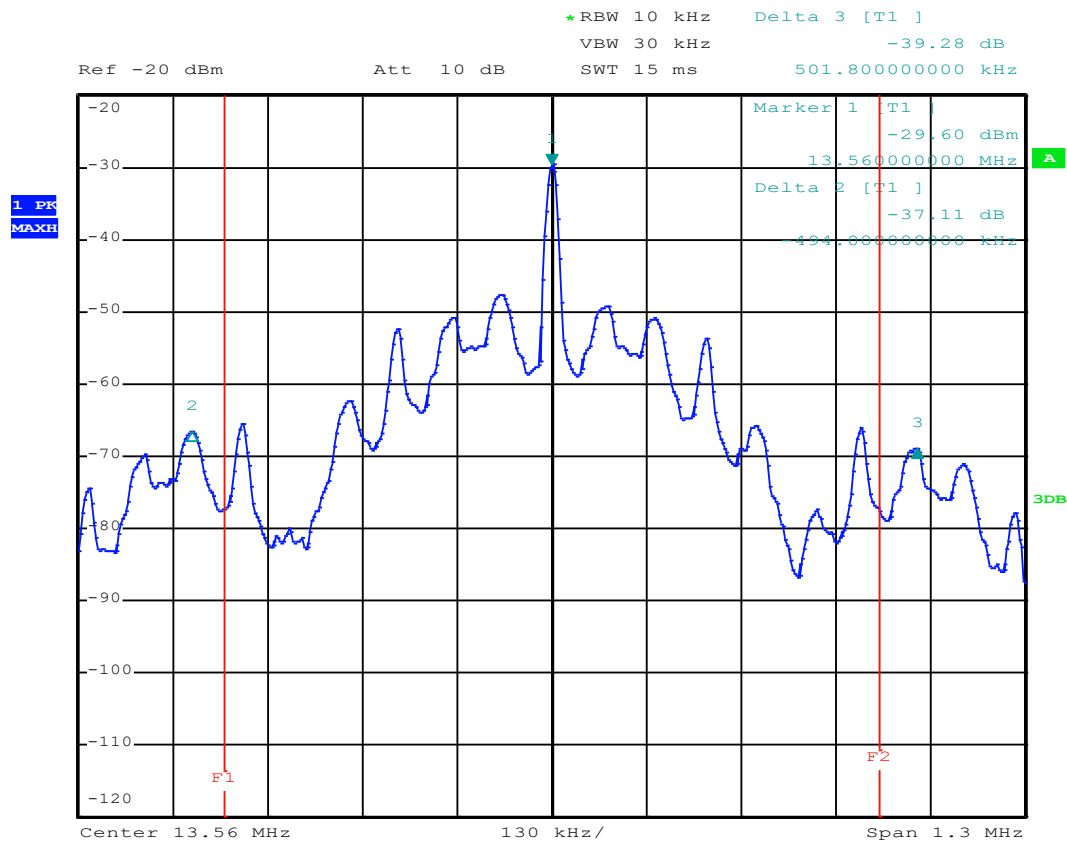


Lower Band Edge: From 13.090 MHz to 13.110 MHz
Upper Band Edge: From 14.010 MHz to 14.030 MHz

Sample N° 1: Antenna 5 - ELM1000008317:

Fundamental frequency (MHz)	Field Strength Level of fundamental (dBμV/m)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
13.56	45.04	Peak	13.066	-37.11	7.93	48.63	40.70
13.56	45.04	Peak	14.061	-39.28	5.76	48.63	42.87

(1) Marker-Delta method



Test conclusion:

RESPECTED STANDARD

11. OPERATION WITHIN THE BAND 13.110 – 14.010 MHZ**Temperature (°C) :** 23**Humidity (%HR):** 42**Date :** November 8, 2021**Technician :** B. VOVARD**Standard:** FCC Part 15
RSS-210**Test procedure:**

For FCC Part 15: § 15.209, § 15.225 (a), (b), (c), (e)

For RSS-210: § Annex B.6 (a), (b), (c)

Method of § 6.3 of ANSI C63.10

Method of § 6.4 of ANSI C63.10

Method of § 6.8 of ANSI C63.10

Test set up:

First an exploratory radiated measurement was performed.

During this phase the product is oriented in in three orthogonal planes.

Then the final measurement is realized with the product on the most critical orientation.

The system is tested in an open area test site (OATS). The EUT is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

The frequency stability measure is realized via a 50 Ω attenuator with the product in a climatic chamber.**Detection mode:** Quasi-peak ($F < 1$ GHz)**Bandwidth:** 9 kHz ($150 \text{ kHz} < F < 30\text{MHz}$)**Distance of antenna:** 10 meters**Antenna height:** 1 meter**Antenna polarization:** oriented in the vertical plane. The lowest point of the loop is 1m above ground level.**Equipment under test operating condition:**

The equipment under test is blocked in alternance of emission and reception mode without tag, at the highest output power level at which the transmitter is intended to operate.

Power source: 12 Vdc by an adapter on power supply at 120 Vac 60 Hz

Percentage of voltage variation during the test (%): ± 1

Results:

Sample N° 1: Antenna 1 - ELM1000004108:

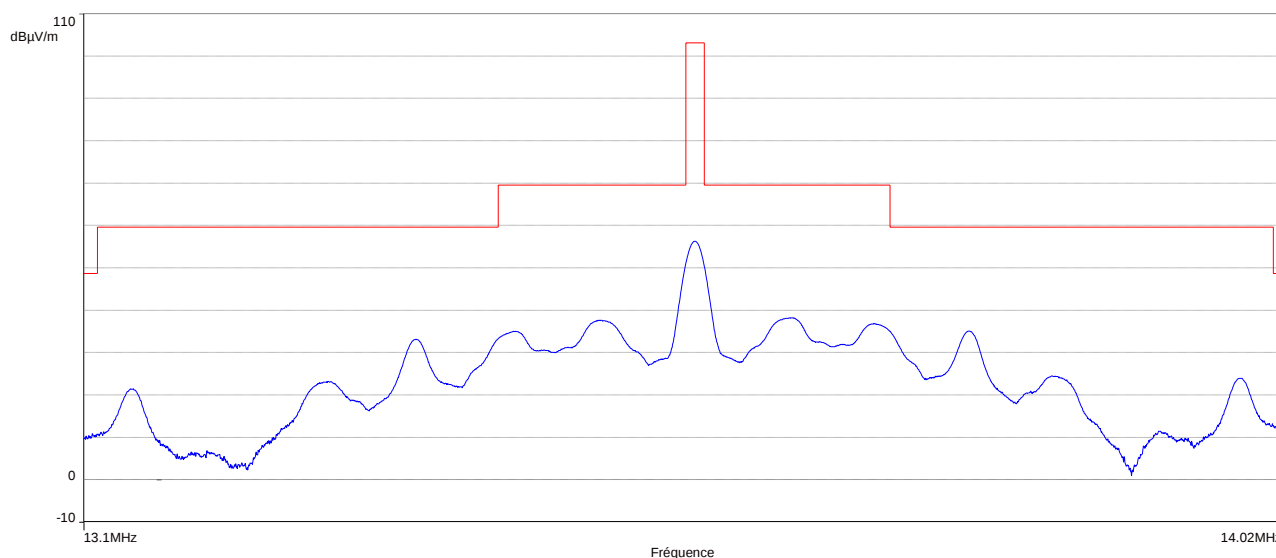
Carrier field strength

	Field strength (dB μ V/m) at frequency: 13.56 MHz
Normal test conditions measure at 10 m	55.55
Normal test conditions correlated at 30 m	36.47
Limits at 30m (dB μ V/m)	84
Margin (dB)	47.53

Polarization of test antenna: perpendicular at the equipment at 0 degree.

Position of equipment: 3 see photos in appendix 2 (azimuth: 160°)

Field strength within the band 13.110-14.010 MHz



Sample N° 1: Antenna 2 - ELM404304686:

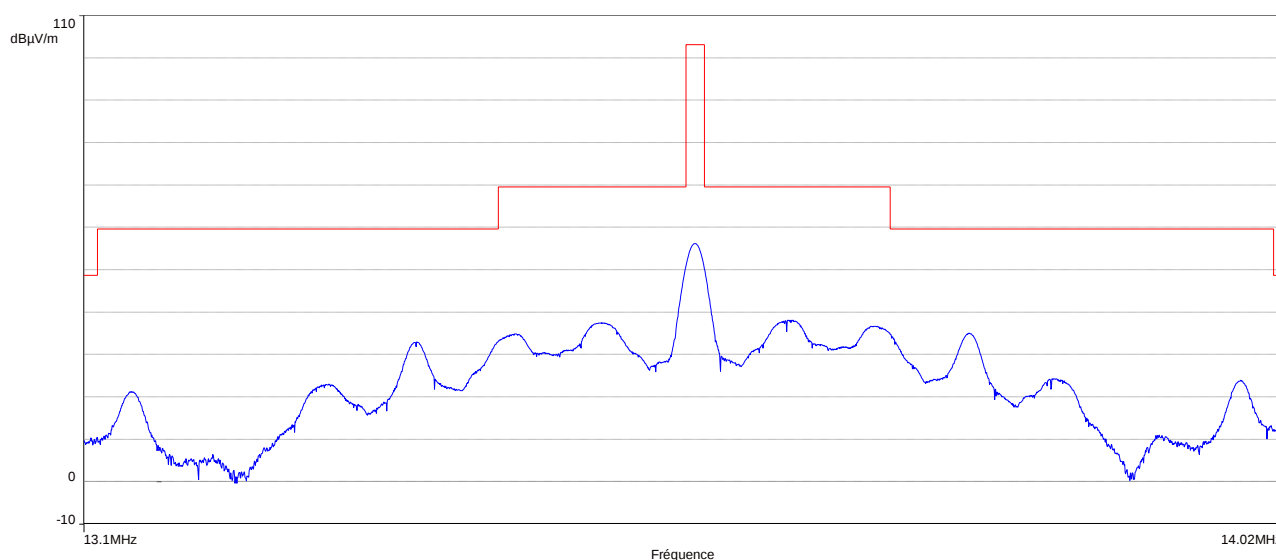
Carrier field strength

	Field strength (dB μ V/m) at frequency: 13.56 MHz
Normal test conditions measure at 10 m	56.12
Normal test conditions correlated at 30 m	37.04
Limits at 30m (dB μ V/m)	84
Margin (dB)	46.96

Polarization of test antenna: perpendicular at the equipment at 0 degree.

Position of equipment: 1 see photos in appendix 2 (azimuth: 270°)

Field strength within the band 13.110-14.010 MHz



Sample N° 1: Antenna 3 - ELM1000006460:

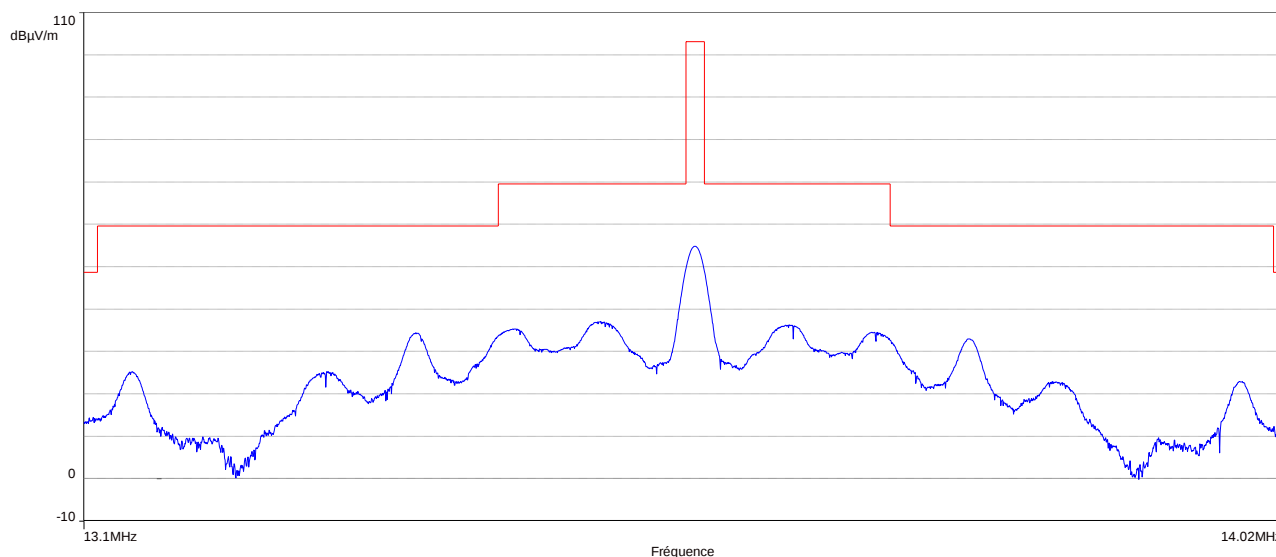
Carrier field strength

	Field strength (dB μ V/m) at frequency: 13.56 MHz
Normal test conditions measure at 10 m	54.84
Normal test conditions correlated at 30 m	35.76
Limits at 30m (dB μ V/m)	84
Margin (dB)	48.24

Polarization of test antenna: perpendicular at the equipment at 0 degree.

Position of equipment: 3 see photos in appendix 2 (azimuth: 110°)

Field strength within the band 13.110-14.010 MHz



Sample N° 1: Antenna 4 - CAR1000000081:

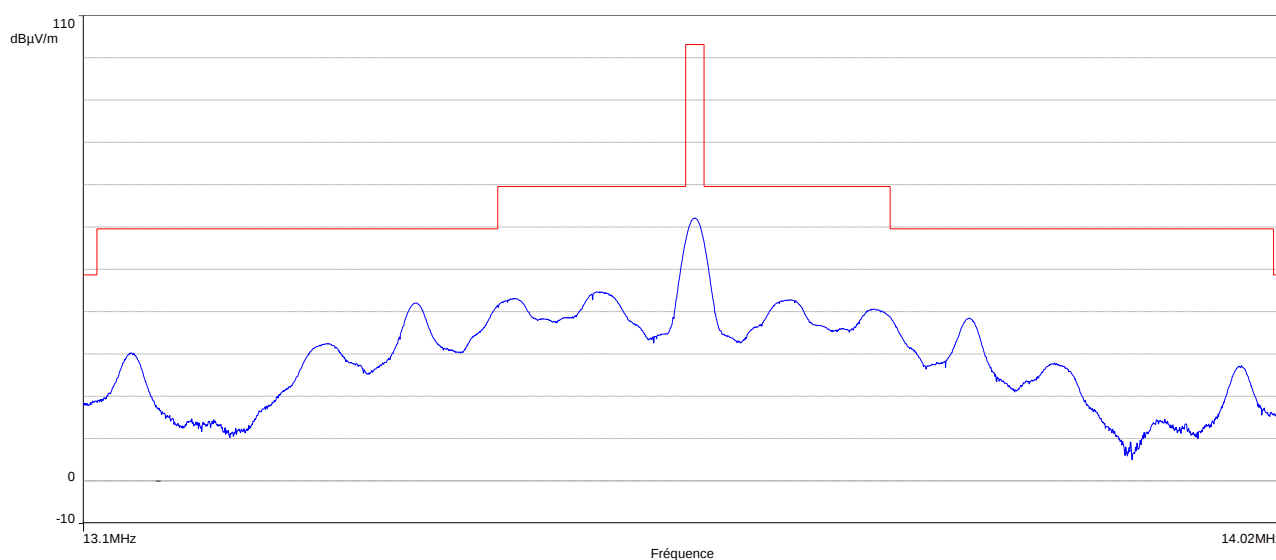
Carrier field strength

	Field strength (dB μ V/m) at frequency: 13.56 MHz
Normal test conditions measure at 10 m	62.05
Normal test conditions correlated at 30 m	42.97
Limits at 30m (dB μ V/m)	84
Margin (dB)	41.03

Polarization of test antenna: perpendicular at the equipment at 0 degree.

Position of equipment: 1 see photos in appendix 2 (azimuth: 280°)

Field strength within the band 13.110-14.010 MHz



Sample N° 1: Antenna 5 - ELM1000008317:

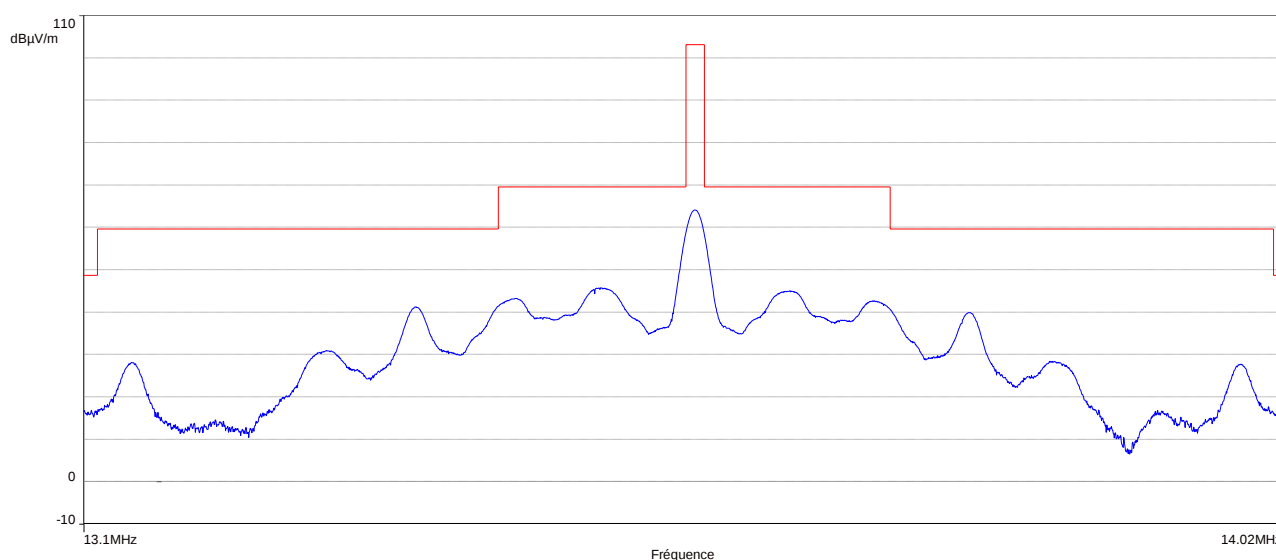
Carrier field strength

	Field strength (dB μ V/m) at frequency: 13.56 MHz
Normal test conditions measure at 10 m	64.12
Normal test conditions correlated at 30 m	45.04
Limits at 30m (dB μ V/m)	84
Margin (dB)	38.96

Polarization of test antenna: perpendicular at the equipment at 0 degree.

Position of equipment: 1 see photos in appendix 2 (azimuth: 90°)

Field strength within the band 13.110-14.010 MHz



Sample N° 1:

Frequency stability

Results for temperature variation

Realized with a power source at 120 Vac – 60 Hz through a variac

Temperature (°C)	Mesure at startup		Measure at 2 min		Measure at 5 min		Measure at 10 min		Drift limit (kHz)
	Frequency measured (MHz)	Frequency drift (kHz)	Frequency measured (MHz)	Frequency drift (kHz)	Frequency measured (MHz)	Frequency drift (kHz)	Frequency measured (MHz)	Frequency drift (kHz)	
50	13.559787	-0.213	13.559769	-0.231	13.559766	-0.234	13.559766	-0.234	± 1.356 (a)
40	13.55982	-0.18	13.559794	-0.206	13.559788	-0.212	13.559787	-0.213	
30	13.559881	-0.119	13.559838	-0.162	13.559828	-0.172	13.559925	-0.075	
20	13.559927	-0.073	13.559889	-0.111	13.559877	-0.123	13.559874	-0.126	
10	13.559974	-0.026	13.559938	-0.062	13.55993	-0.07	13.559926	-0.074	
0	13.559984	-0.016	13.55988	-0.12	13.559974	-0.026	13.559974	-0.026	
-10	13.559982	-0.018	13.559983	-0.017	13.559974	-0.026	13.559972	-0.028	
-20	13.559984	-0.016	13.559982	-0.018	13.559985	-0.015	13.559981	-0.019	

(a) $\pm 0.01\%$ of the operating frequency

Results for power supply variation

Realized at +20 °C

Power supply (Vdc)	Frequency measured (MHz)	Frequency drift (kHz)	Drift limit (kHz)
10.2	13.55988	-0.12	± 1.356 (b)
12	13.55988	-0.12	
13.8	13.559879	-0.121	

(b) $\pm 0.01\%$ of the operating frequency

Test conclusion:

RESPECTED STANDARD

12. FIELD STRENGTH OUTSIDE THE BAND 13.110-14.01 MHZ**Temperature (°C) :** 23**Humidity (%HR):** 42**Date :** November 5, 2021**Technician :** B. VOVARD**Standard:** FCC Part 15**Standard:** FCC Part 15
RSS-210**Test procedure:**

For FCC Part 15: § 15.209, § 15.225 (d)

For RSS-210: § Annex B.6 (d)

Method of § 6.3 of ANSI C63.10

Method of § 6.4 of ANSI C63.10

Method of § 6.5 of ANSI C63.10

Test set up:

First an exploratory radiated measurement was performed.

During this phase the product is oriented in three orthogonal planes.

Then the final measurement is realized with the product on the most critical orientation.

The measure is realized on open area test site under 1 GHz.

When the system is tested in an open area test site (OATS), the EUT is placed on a rotating table, 0.8m from a ground plane.

Zero degree azimuths correspond to the front of the device under test.

See photos in appendix 2.

Frequency range: From 9 kHz to 140MHz (10th harmonic of the highest fundamental frequency (13.56MHz)**Detection mode:** Quasi-peak ($F < 1$ GHz)**Bandwidth:** 200Hz ($9 \text{ kHz} < F < 150\text{kHz}$)
9 kHz ($150 \text{ kHz} < F < 30\text{MHz}$)
120 kHz ($30 \text{ MHz} < F < 1 \text{ GHz}$)**Distance of antenna:** 10 meters (in open area test site)**Antenna height:** 1 to 4 meters (in open area test site)**Antenna polarization:** vertical and horizontal (only the highest level is recorded)

Equipment under test operating condition:

The equipment under test is blocked in alternance of emission and reception mode without tag, at the highest output power level at which the transmitter is intended to operate.

Power source: 12 Vdc by an adapter on power supply at 120 Vac 60 Hz

Percentage of voltage variation during the test (%): ± 1

Results:

Sample N° 1: Antenna 1 - ELM1000004108:

Below 30 MHz

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Position	RBW (kHz)	Polarization (Parallel Perpendicular)	Field strength Measured at 10 m (dBμV/m)	Field strength Computed at 30 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
27.12	QP	100	3	9	Parallel	12.03	-7.05	29.5	36.55

Above 30 MHz

Frequencies (MHz)	Detector P QP Av	Position	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 10 m (dBμV/m)	Field strength Computed at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
40.68	QP	1	92	100	V	24.31	34.77	40	5.23
54.24	QP	2	156	100	V	21.73	32.19	40	7.81
67.80	QP	1	250	100	V	22.25	32.71	40	7.29
81.36	QP	3	102	100	V	19.64	30.1	40	9.9
108.48	QP	1	277	100	V	29.25	39.71	43.5	3.79
122.04	QP	1	288	100	V	25.32	35.78	43.5	7.72

P= Peak, QP=Quasi-peak, Av=Average

Applicable limits: for $9 \text{ kHz} \leq F \leq 490 \text{ kHz}$: $2400/F(\text{kHz})$ at 300 meters
for $490 \text{ kHz} < F \leq 1.705 \text{ MHz}$: $24000/F(\text{kHz})$ at 30 meters
for $1.705 \text{ MHz} < F \leq 30 \text{ MHz}$: $29.5 \text{ dB}\mu\text{V/m}$ at 30 meters
for $30 \text{ MHz} < F \leq 88 \text{ MHz}$: $40 \text{ dB}\mu\text{V/m}$ at 3 meters
for $88 \text{ MHz} < F \leq 216 \text{ MHz}$: $43.5 \text{ dB}\mu\text{V/m}$ at 3 meters
for $216 \text{ MHz} < F \leq 960 \text{ MHz}$: $46 \text{ dB}\mu\text{V/m}$ at 3 meters
Above 960 MHz : $54 \text{ dB}\mu\text{V/m}$ at 3 meters

Sample N° 1: Antenna 2 - ELM404304686:

Below 30 MHz

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Position	RBW (kHz)	Polarization (Parallel Perpendicular)	Field strength Measured at 10 m (dBμV/m)	Field strength Computed at 30 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
27.12	QP	100	3	9	Parallel	10.38	-8.70	29.5	38.2

Above 30 MHz

Frequencies (MHz)	Detector P QP Av	Position	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 10 m (dBμV/m)	Field strength Computed at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
40.68	QP	1	254	100	V	18.07	28.53 (1)	40	11.47
54.24	QP	2	50	100	V	20.18	30.64	40	9.36
67.80	QP	1	266	100	V	18.53	28.99 (1)	40	11.01
81.36	QP	1	284	100	V	23.01	33.47	40	6.53
108.48	QP	2	219	100	V	21.57	32.03 (1)	43.5	11.47
135.6	QP	1	244	100	V	20.61	31.07 (1)	43.5	12.43

P= Peak, QP=Quasi-peak, Av=Average

(1) Noise floor

Applicable limits: for $9 \text{ kHz} \leq F \leq 490 \text{ kHz}$: $2400/F(\text{kHz})$ at 300 meters
for $490 \text{ kHz} < F \leq 1.705 \text{ MHz}$: $24000/F(\text{kHz})$ at 30 meters
for $1.705 \text{ MHz} < F \leq 30 \text{ MHz}$: $29.5 \text{ dB}\mu\text{V/m}$ at 30 meters
for $30 \text{ MHz} < F \leq 88 \text{ MHz}$: $40 \text{ dB}\mu\text{V/m}$ at 3 meters
for $88 \text{ MHz} < F \leq 216 \text{ MHz}$: $43.5 \text{ dB}\mu\text{V/m}$ at 3 meters
for $216 \text{ MHz} < F \leq 960 \text{ MHz}$: $46 \text{ dB}\mu\text{V/m}$ at 3 meters
Above 960 MHz : $54 \text{ dB}\mu\text{V/m}$ at 3 meters

Sample N° 1: Antenna 3 - ELM1000006460:

Below 30 MHz

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Position	RBW (kHz)	Polarization (Parallel Perpendicular)	Field strength Measured at 10 m (dBμV/m)	Field strength Computed at 30 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
27.12	QP	100	3	9	Parallel	12.55	-6.53	29.5	36.03

Above 30 MHz

Frequencies (MHz)	Detector P QP Av	Position	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 10 m (dBμV/m)	Field strength Computed at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
40.68	QP	3	85	100	V	28.44	38.9	40	1.1
54.24	QP	3	234	100	V	29.26	39.72	40	0.28
67.80	QP	3	278	100	V	29.11	39.57	40	0.43
81.36	QP	1	123	100	V	24.35	34.81	40	5.19
108.48	QP	1	145	100	V	22.15	32.61 (1)	43.5	10.89

P= Peak, QP=Quasi-peak, Av=Average

(1) Noise floor

Applicable limits: for 9 kHz ≤ F ≤ 490 kHz : 2400/F(kHz) at 300 meters
for 490 kHz < F ≤ 1.705 MHz : 24000/F(kHz) at 30 meters
for 1.705 MHz < F ≤ 30 MHz : 29.5 dBμV/m at 30 meters
for 30 MHz < F ≤ 88 MHz : 40 dBμV/m at 3 meters
for 88 MHz < F ≤ 216 MHz : 43.5 dBμV/m at 3 meters
for 216 MHz < F ≤ 960 MHz : 46 dBμV/m at 3 meters
Above 960 MHz : 54 dBμV/m at 3 meters

Sample N° 1: Antenna 4 - CAR1000000081:

Below 30 MHz

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Position	RBW (kHz)	Polarization (Parallel Perpendicular)	Field strength Measured at 10 m (dBμV/m)	Field strength Computed at 30 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
27.12	QP	100	1	9	Parallel	14.03	-5.05	29.5	34.55

Above 30 MHz

Frequencies (MHz)	Detector P QP Av	Position	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 10 m (dBμV/m)	Field strength Computed at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
40.68	QP	3	266	100	V	28.47	38.93	40	1.07
54.24	QP	1	58	100	V	25.46	35.92	40	4.08
67.80	QP	3	268	100	V	28.69	39.15	40	0.85
81.36	QP	1	250	100	V	26.94	37.4	40	2.6
108.48	QP	2	222	100	V	22.13	32.59 (1)	43.5	10.91
122.04	QP	1	285	100	V	28.29	38.75	43.5	4.75

P= Peak, QP=Quasi-peak, Av=Average

(1) Noise floor

Applicable limits: for $9 \text{ kHz} \leq F \leq 490 \text{ kHz}$: $2400/F(\text{kHz})$ at 300 meters
for $490 \text{ kHz} < F \leq 1.705 \text{ MHz}$: $24000/F(\text{kHz})$ at 30 meters
for $1.705 \text{ MHz} < F \leq 30 \text{ MHz}$: $29.5 \text{ dB}\mu\text{V/m}$ at 30 meters
for $30 \text{ MHz} < F \leq 88 \text{ MHz}$: $40 \text{ dB}\mu\text{V/m}$ at 3 meters
for $88 \text{ MHz} < F \leq 216 \text{ MHz}$: $43.5 \text{ dB}\mu\text{V/m}$ at 3 meters
for $216 \text{ MHz} < F \leq 960 \text{ MHz}$: $46 \text{ dB}\mu\text{V/m}$ at 3 meters
Above 960 MHz : $54 \text{ dB}\mu\text{V/m}$ at 3 meters

Sample N° 1: Antenna 5 - ELM1000008317:

Below 30 MHz

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	Position	RBW (kHz)	Polarization (Parallel Perpendicular)	Field strength Measured at 10 m (dBμV/m)	Field strength Computed at 30 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
27.12	QP	100	3	9	Parallel	13.75	-5.33	29.5	34.83

Above 30 MHz

Frequencies (MHz)	Detector P QP Av	Position	Azimuth (degree)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 10 m (dBμV/m)	Field strength Computed at 3 m (dBμV/m)	Limits (dBμV/m)	Margin (dB)
40.68	QP	1	275	100	V	22.66	33.12	40	6.88
54.24	QP	3	81	100	V	22.31	32.77	40	7.23
67.80	QP	3	272	100	V	18.21	28.67 (1)	40	11.33
81.36	QP	2	236	100	V	15.64	26.1	40	13.9
108.48	QP	2	212	100	V	21.80	32.26 (1)	43.5	11.24
122.04	QP	2	128	100	V	21.10	31.56 (1)	43.5	11.94

P= Peak, QP=Quasi-peak, Av=Average

(1) Noise floor

Applicable limits: for $9 \text{ kHz} \leq F \leq 490 \text{ kHz}$: $2400/F(\text{kHz})$ at 300 meters
for $490 \text{ kHz} < F \leq 1.705 \text{ MHz}$: $24000/F(\text{kHz})$ at 30 meters
for $1.705 \text{ MHz} < F \leq 30 \text{ MHz}$: $29.5 \text{ dB}\mu\text{V/m}$ at 30 meters
for $30 \text{ MHz} < F \leq 88 \text{ MHz}$: $40 \text{ dB}\mu\text{V/m}$ at 3 meters
for $88 \text{ MHz} < F \leq 216 \text{ MHz}$: $43.5 \text{ dB}\mu\text{V/m}$ at 3 meters
for $216 \text{ MHz} < F \leq 960 \text{ MHz}$: $46 \text{ dB}\mu\text{V/m}$ at 3 meters
Above 960 MHz : $54 \text{ dB}\mu\text{V/m}$ at 3 meters

Test conclusion:

RESPECTED STANDARD

□□□ End of report, 1 appendix to be forwarded □□□

APPENDIX 1: Test equipment list

AC Conducted emissions

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	10788
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESW44	Rohde & Schwarz	17008
LISN 1600	Thurbly Thandar Instruments	8719
High-pass filter EZ-25	Rohde & Schwarz	8635
Absorber sheath current	Emitech	9489
Cable N-5m RG214	Gyl Technologies	8590
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14903
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.18.0.26	0000

Occupied bandwidth

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
N-5M Cable	SUCOFLEX	15882
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14903
Meteo station WS-9232	La Crosse Technology	8750
Software RS Commander	Rohde et Schwarz	//

Band edge

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	10788
Anechoic Chamber	EMITECH	8593
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
N-5M Cable	SUCOFLEX	15882
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14903
Meteo station WS-9232	La Crosse Technology	8750
Software	GPBShot V2.4	-

Operation within the band 13.110 – 14.010 MHz

TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Turntable and mat controller	EMITECH	8855
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESW44	Rohde & Schwarz	17008
Loop antenna 6502	EMCO	1406
N-2GHz Cable	EMITECH	8578
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14903
Meteo station BAR206	Oregon Scientific	14475
Software	BAT-EMC V3.18.0.26	0000

Field strength outside the band 13.110-14.010 MHz

TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Turntable and mat controller	EMITECH	8855
Full anechoic chamber	EMITECH	10759
Turntable and mat controller NCD	MATURO	10789
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESW44	Rohde & Schwarz	17008
Spectrum Analyzer FSV40	Rohde & Schwarz	15666
Loop antenna 6502	EMCO	1406
Biconical antenna VHA 9103	Schwarzbeck	8528
Biconical antenna 3110	Emco	7240
Log periodic antenna HL223	Rohde & Schwarz	7190
Low-noise amplifier ZFL-1000LN	Mini-circuit	10730
N-1.5M Cable	SUCOFLEX	9398
N-2M Cable	SUCOFLEX	14303
N-2.5M Cable	SUCOFLEX	14304
N-5M Cable	Huber + Suhner	12912
N-2GHz Cable	EMITECH	8578
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14903
Meteo station 608-H1	Testo	7566
Meteo station BAR206	Oregon Scientific	14475
Software	BAT-EMC V3.18.0.26	0000
Software	Champ libre Juigné. V3.5	8864