RRA-EMIESS23E443DAV-05Av0

Certification Radio test report

According to the standard:

CFR 47 FCC PART 15

RSS GEN – Issue 5
RSS 247 – Issue 3

Equipment under test:

DAVEY TRONIC 5 BLASTHUB

FCC ID: *2AUQC-DT5GBH*
IC NUMBER: *25586-DT5GBH*

Company:

DAVEY BICKFORD

Distribution: Mrs STOJANOVIC (**Company:** DAVEY BICKFORD)

Number of pages: 61 with 2 appendixes

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval Name and Function	Visa
0	16-Jul-24	Creation	M. DUMESNIL, Radio Laboratory Manager	

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

S51 RTY 000 INT 00015 [03]

DESIGNATION OF PRODUCT:	***DAVEY TRONIC 5 BLASTHUB***
Serial number (S/N):	*9235*
Reference / model (P/N):	*BH*
Firmware version:	*0x17 (LoRa Module)*
MANUFACTURER:	*DAVEY BICKFORD*

COMPANY SUBMITTING THE PRODUCT:

Company:	DAVEY BICKFORD
Address:	LE MOULIN GASPARD CHEMIN DE LA PYROTECHNIE 89550 HERY FRANCE
Responsible:	Mrs STOJANOVIC
DATES OF TEST:	From 25-Sep-23 to 17-Oct-23
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
WRITTEN BY:	B. VOVARD

VISA:

CONTENTS

REVISIONS HISTORY

Revision	Date	Modified pages	Modifications
0	**26-Apr-24**	/	Creation

1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: ***DAVEY TRONIC 5 BLASTHUB***, in accordance with normative reference.

The equipment under test integrates:

- 2x LoRa 2.4 GHz transceiver radio module not already certified,
- WiFi 5 GHz transceiver radio module already certified (FCC ID: T7V-9026 / IC: 216Q-9026),
- 13.56MHz RFID Tag,
- GNSS module operational in the band 1559MHz – 1610MHz

This report concerns only LoRa 2.4 GHz Radio parts.

Measurements are done separately on two 2.4 GHz LoRa Module, named “LoRa 2A” and “LoRa 2B”.

The host device of certified module(s) shall be properly labeled to identify the module(s) within.

2. PRODUCT DESCRIPTION

Category of equipment (ISED):	I
Class:	A
Utilization:	Industrial
Antenna type and gain:	Integrated antenna Gain at 2414.8 MHz for LoRa 2A=> +10.15 dBi Gain at 2436.4 MHz for LoRa 2A => +10.83 dBi Gain at 2473.2 MHz for LoRa 2A => +9.58 dBi Gain at 2414.8 MHz for LoRa 2B => +9.43 dBi Gain at 2436.4 MHz for LoRa 2B => +9.76 dBi Gain at 2473.2 MHz for LoRa 2B => +9.88 dBi
Operating frequency band:	From 2400 MHz to 2483.5 MHz
Operating frequency range:	From 2414.8 MHz to 2473.2 MHz
Number of channels:	17

Frequencies tested:	2414.8 MHz, 2436.4 MHz and 2473.2 MHz
Channel spacing:	0.8 to 8 MHz
Modulation:	LoRa
Power soft adjusted to	13 (LoRa 2A & LoRa 2B)
Power source:	Internal rechargeable Li-Ion battery 7.27 Vdc 7000mAh Input used for measurements by adapter 12 Vdc on 120 Vac 60 Hz

The radio is operational during charge mode.

Power level, frequency range and channels characteristics are not user adjustable.
The details pictures of the product and the circuit boards are joined with this file.

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 (2023)	Radio Frequency Devices
ANSI C63.10	2013 Procedures for ComplianceTesting of Unlicensed Wireless Devices.
558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.
RSP-100	Issue 12, August 2019 Certification of Radio Apparatus and Broadcasting equipment
RSS-Gen	Issue 5, April 2018 General Requirements for Compliance of Radio Apparatus
RSS-247	Issue 3, August 2023 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

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 215: Additional provisions to the general radiated emission limitations
- Paragraph 247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 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-247:

- Paragraph 3 - Certification requirements
- Paragraph 4 - Measurement method
- Paragraph 5 - Standard specifications for frequency hopping systems and digital transmission systems operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 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	11/04/2023	1	10/04/2024
4087	Filtek LP03/1000-7GH	Low Pass Filter	07/02/2023	3	06/02/2026
4088	R&S FSP40	Spectrum Analyzer	13/05/2022	2	12/05/2024
4353	ATM WR28	Antenna	02/08/2022	3	01/08/2025
7171	R&S HL223	Antenna	19/05/2022	3	18/05/2025
7190	R&S HL223	Antenna	17/03/2022	3	16/03/2025
7240	Emco 3110	Biconical antenna	17/03/2022	3	16/03/2025
7279	SUCOFLEX SF104 N 1.5m	Cable	20/05/2022	2	19/05/2024
7299	Microtronics BRM50702	Reject band filter	16/08/2022	3	15/08/2025
7566	Testo 608-H1	Meteo station	12/12/2022	2	11/12/2024
8508	California instruments 1251RP	Power source	(1)	(1)	(1)
8528	Schwarzbeck VHA 9103	Biconical antenna	19/05/2022	3	18/05/2025
8535	EMCO 3115	Antenna	13/04/2023	3	12/04/2026
8548	Midwest Microwave 10dB	Attenuator	08/02/2023	3	07/02/2026
8590	RG214 N-5m	Cable	23/02/2022	2	23/02/2024
8593	SIDT Cage 2	Anechoic chamber	31/03/2022	3	30/03/2025
8719	Thurbly Thandar Instruments 1600	LISN	24/02/2022	2	24/02/2024
8732	Emitech	OATS	28/03/2022	3	27/03/2025
8750	La Crosse Technology WS-9232	Meteo station	24/10/2022	1	24/10/2023
8855	EMITECH	Turntable and mat controller	/	/	/
8864	Champ libre Juigné. V3.5	Software	/	/	/

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

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
8974	STORM MICROWAE k-20cm	cable	09/12/2021	2	09/12/2023
9398	N-1.5m	cable	22/07/2022	2	21/07/2024
10523	EMITECH	Absorber sheath current	24/02/2022	2	24/02/2024
10730	Mini-circuit ZFL-1000LN	Low-noise amplifier	30/11/2022	1	30/11/2023
10759	COMTEST Cage 3	Anechoic chamber	/	/	/
10771	EMCO 3117	Antenna	30/11/2022	3	30/11/2025
10788	Emitech	Outside room Hors cage	/	/	/
10789	MATURO	Turntable and mat controller NCD	/	/	/
11535	R&S EZ-25	High pass filter	02/01/2023	3	01/01/2026
12590	LUCIX Corp S005180M3201	Low-noise amplifier	21/06/2023	1	20/06/2024
12911	Huber + Suhner N-2m	cable	20/05/2022	2	19/05/2024
14303	SUCOFLEX N-2m	cable	01/12/2022	2	30/11/2024
14475	Oregon Scientific BAR206	Meteo station	11/04/2023	1	10/04/2024
14736	MATURO	Turntable and mat controller MCU	/	/	/
14903	Fluke 177	Multimeter	01/02/2022	2	01/02/2024
15666	R&S FSV40	Spectrum Analyzer	27/09/2022	2	26/09/2024
15812	COMP-POWER PAM-118A	Low-noise amplifier 18GHz	21/06/2023	1	20/06/2024
15883	SUCOFLEX	cable N 5m	08/02/2023	2	07/02/2025
15913	SUCOFLEX SF104 N 2.5m	Cable	01/12/2022	2	30/11/2024
16109	C&C HPF180400	High pass filter	11/08/2022	3	10/08/2025
17008	R&S ESW44	Test receiver	08/02/2023	1	08/02/2024
18413	MecHANC - N - 5m	Cable	15/02/2022	2	15/02/2024
18418	MecHANC - Type K - 1m	Cable	02/03/2022	2	01/03/2024
19154	QOTANA DBLNA317202120S	Low-noise amplifier 18-26GHz	14/09/2023	1	13/09/2024
//	RS Commander V2.4.2	Software	/	/	/

6. TESTS RESULTS SUMMARY

6.1 CFR 47 part 15requirements

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 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	(a) Alternative to general radiated emission limits	X				
	(b) Unwanted emissions outside of §15.247 frequency bands	X				Note 3
	(c) 20 dB bandwidth and band-edge compliance	X				
FCC Part 15.247	OPERATION WITHIN THE BANDS 902-928 MHZ, 2400-2483.5 MHz and 5725-5850 MHz					
	(a) (1) Hopping systems			X		
	(a) (2) Digital modulation techniques	X				Note 4
	(b) Maximum peak output power	X				
	(c) Operation with directional antenna gains > 6 dBi	X				
	(d) Intentional radiator	X				
	(e) Peak power spectral density	X				
	(f) Hybrid system			X		
	(g) Frequency hopping requirements			X		
	(h) Frequency hopping intelligence			X		
	(i) RF exposure compliance	X				

NAp: Not Applicable NAs: Not Asked

Note 1: Integral antenna with unknow gain.

Note 2: See FCC part 15.247 (d).

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

Note 4: The minimum 6 dB bandwidth of the equipment is 942.75 kHz for LoRa Modulation.

Note 5: We used the radiated method in anechoic room.

6.2 RSS-Gen requirements

Test procedure	Description of test	Criteria respected ?				Comment
		Yes	No	NAp	NAs	
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				Note
§ 8.9	Transmitter emission limits	X				
§ 8.10	Restricted frequency bands	X				
§ 8.11	Frequency stability			X		

NAp: Not Applicable NAs: Not Asked

Note : the conducted emissions shall be performed in the final product.

6.3 RSS-247 requirements

Test Procedure RSS-247	Description of test	Criteria respected ?				Comment
		Yes	No	NAp	NAs	
Paragraph 5	Standard specifications for frequency hopping system and digital transmission systems operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz					
5.1	Frequency hopping systems (FHSS)			X		
5.2	Digital transmission systems	X				Note
5.3	Hybrid systems			X		
5.4	Transmitter output power and equivalent isotropically radiated power (e.i.r.p.) requirements	X				
5.5	Unwanted emissions	X				

NAp: Not Applicable NAs: Not Asked

Note : The minimum 6 dB bandwidth of the equipment is 942.75 kHz for LoRa Modulation.

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	± 0.8dB
Radiated emission valid to 26 GHz 9kHz – 30MHz 30MHz – 1GHz 1GHz – 18GHz 18GHz – 40GHz	 ± 2.7 dB ± 5.0 dB ± 5.3 dB ± 6.1 dB
AC Power Lines conducted emissions	± 3.4 dB
Temperature	± 1 °C
Humidity	± 5 %

8. AC CONDUCTED EMISSIONS

Temperature (°C) : 25 **Humidity (%HR):** 50 **Date :** October 10, 2023

Technician : B. VOVARD

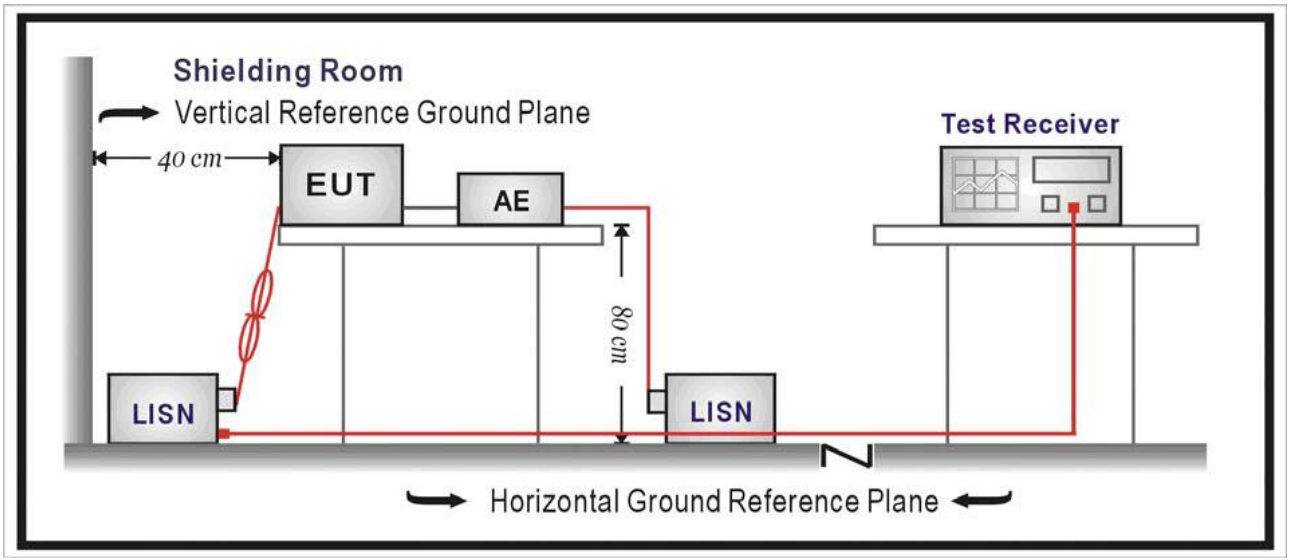
Standard: FCC Part 15
RSS-Gen

Test procedure:
For FCC Part 15: Paragraph 15.207
For RSS-Gen: Paragraph 8.8
Method of paragraph 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 / Quasi-peak / Average

Bandwidth: 10 kHz / 9 kHz

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Results:

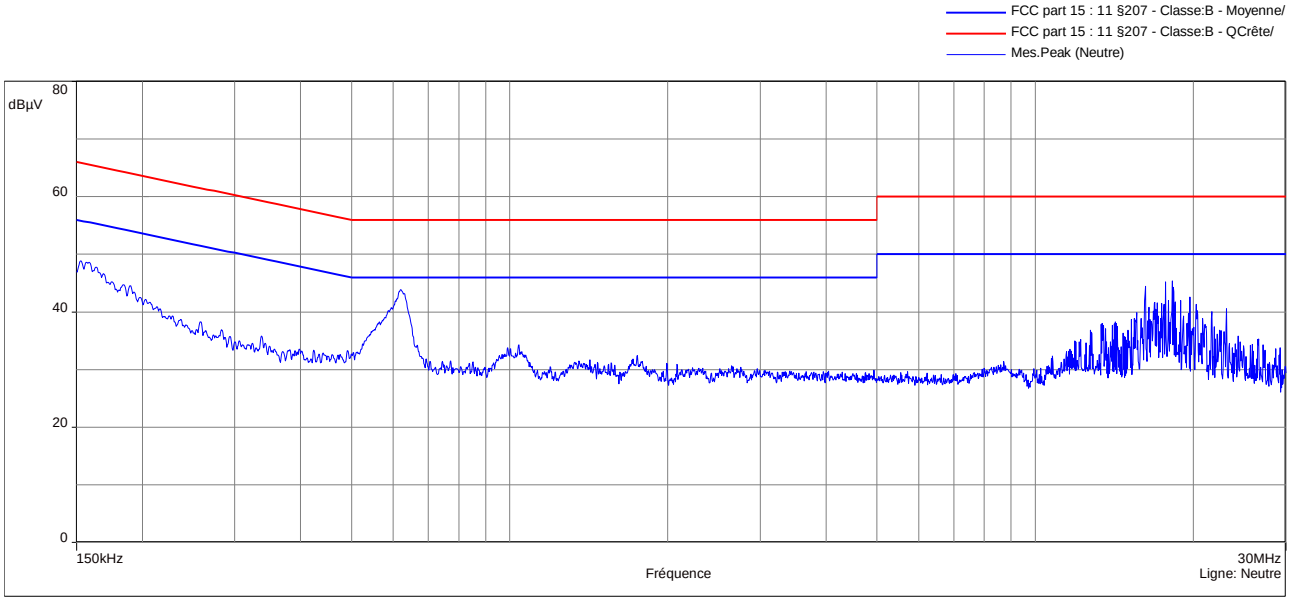
Sample N° 1:

Results for LoRa 2A at 2414.8 MHz:

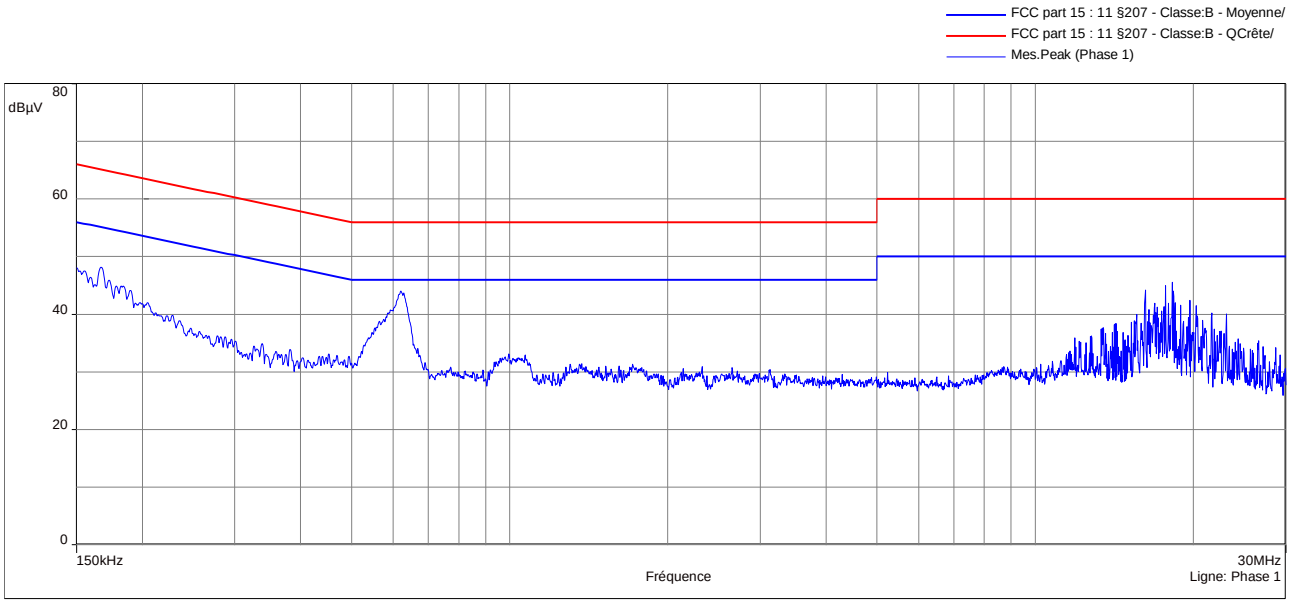
Measurement on the mains power supply:

The measurement is first realized with peak detector.

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)
0.159	39.18	65.54	26.36
0.190	34.79	64.04	29.25
0.535	30.34	56.00	25.66
0.583	36.57	56.00	19.43
0.621	41.4	56.00	14.60
0.643	36.79	56.00	19.21
0.667	28.55	56.00	27.45
0.991	26.51	56.00	29.49
1.041	27.8	56.00	28.20
8.716	25.68	60.00	34.32
10.790	25.48	60.00	34.52
11.890	30.29	60.00	29.71
12.746	33.11	60.00	26.89
13.416	33.76	60.00	26.24
14.210	34.41	60.00	25.59
15.249	34.88	60.00	25.12
15.617	37.82	60.00	22.18
16.227	42.57	60.00	17.43
16.897	37.4	60.00	22.60
17.693	43.67	60.00	16.33
17.937	39.98	60.00	20.02
18.241	42.89	60.00	17.11
18.915	40.11	60.00	19.89
19.707	40.29	60.00	19.71
20.257	39.52	60.00	20.48
20.807	36.88	60.00	23.12
21.663	38.04	60.00	21.96
22.455	34.32	60.00	25.68
23.127	38.33	60.00	21.67
24.349	33.24	60.00	26.76
24.899	30.88	60.00	29.12
25.876	30.87	60.00	29.13
26.608	31.87	60.00	28.13
27.158	31.05	60.00	28.95

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0.159	19.82	55.54	35.72
0.190	17.5	54.04	36.54
0.535	22.19	46.00	23.81
0.583	28.71	46.00	17.29
0.621	34.19	46.00	11.81
0.643	30.38	46.00	15.62
0.667	20.64	46.00	25.36
0.991	18.65	46.00	27.35
1.041	19.78	46.00	26.22
8.716	20.06	50.00	29.94
10.790	20.67	50.00	29.33
11.890	26.56	50.00	23.44
12.746	29.84	50.00	20.16
13.416	30.73	50.00	19.27
14.210	31.46	50.00	18.54
15.249	31.72	50.00	18.28
15.617	34.83	50.00	15.17
16.227	39.73	50.00	10.27
16.897	34.01	50.00	15.99
17.693	40.67	50.00	9.33
17.937	36.67	50.00	13.33
18.241	39.83	50.00	10.17
18.915	37	50.00	13.00
19.707	37.13	50.00	12.87
20.257	36.35	50.00	13.65
20.807	33.6	50.00	16.40
21.663	34.69	50.00	15.31
22.455	30.7	50.00	19.30
23.127	34.84	50.00	15.16
24.349	29.46	50.00	20.54
24.899	26.87	50.00	23.13
25.876	26.92	50.00	23.08
26.608	27.96	50.00	22.04
27.158	27.08	50.00	22.92

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

Frequency (MHz)	Quasi-peak (dBµV)	QP Limit (dBµV)	QP margin (dB)
0.167	38.17	65.10	26.93
0.184	36.1	64.29	28.19
0.453	26.37	56.83	30.46
0.527	28.83	56.00	27.17
0.565	34.7	56.00	21.30
0.621	41.46	56.00	14.54
0.649	34.16	56.00	21.84
0.669	28.51	56.00	27.49
0.996	27.49	56.00	28.51
1.070	26.38	56.00	29.62
1.303	23.85	56.00	32.15
1.714	24.77	56.00	31.23
11.890	30.56	60.00	29.44
12.746	33.22	60.00	26.78
13.478	34.33	60.00	25.67
14.210	34.5	60.00	25.50
15.251	36.46	60.00	23.54
15.617	37.92	60.00	22.08
16.227	42.61	60.00	17.39
16.899	39.52	60.00	20.48
17.693	43.74	60.00	16.26
18.241	42.93	60.00	17.07
18.913	39.11	60.00	20.89
19.707	40.31	60.00	19.69
20.257	39.53	60.00	20.47
20.807	36.92	60.00	23.08
21.661	37.42	60.00	22.58
22.455	34.36	60.00	25.64
23.127	38.38	60.00	21.62
24.349	33.29	60.00	26.71
25.694	30.83	60.00	29.17
26.608	31.95	60.00	28.05
27.158	31.11	60.00	28.89
28.686	29.66	60.00	30.34

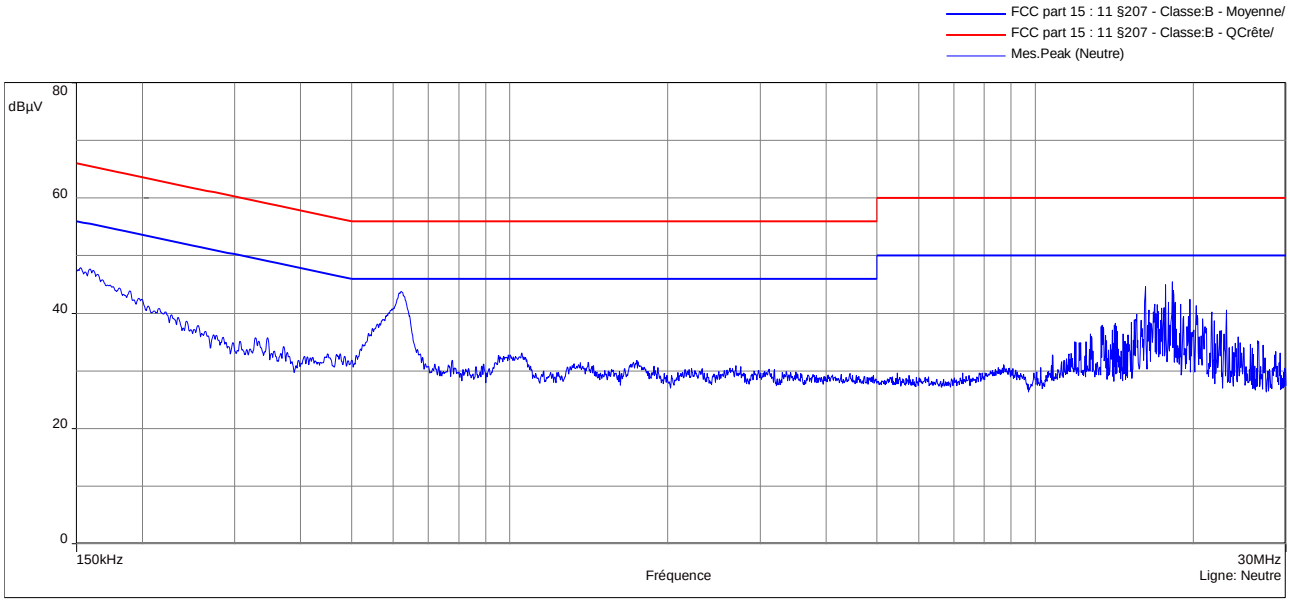
Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0.167	19.99	55.10	35.11
0.184	18.37	54.29	35.92
0.453	19.54	46.83	27.29
0.527	20.84	46.00	25.16
0.565	26.93	46.00	19.07
0.621	34.34	46.00	11.66
0.649	26.78	46.00	19.22
0.669	20.46	46.00	25.54
0.996	19.38	46.00	26.62
1.070	18.73	46.00	27.27
1.303	14.86	46.00	31.14
1.714	15.39	46.00	30.61
11.890	26.71	50.00	23.29
12.746	29.95	50.00	20.05
13.478	31.25	50.00	18.75
14.210	31.54	50.00	18.46
15.251	33.54	50.00	16.46
15.617	34.95	50.00	15.05
16.227	39.79	50.00	10.21
16.899	36.38	50.00	13.62
17.693	40.72	50.00	9.28
18.241	39.86	50.00	10.14
18.913	35.88	50.00	14.12
19.707	37.21	50.00	12.79
20.257	36.34	50.00	13.66
20.807	33.59	50.00	16.41
21.661	34.07	50.00	15.93
22.455	30.75	50.00	19.25
23.127	34.87	50.00	15.13
24.349	29.48	50.00	20.52
25.694	26.81	50.00	23.19
26.608	28.07	50.00	21.93
27.158	27.19	50.00	22.81
28.686	25.73	50.00	24.27

Results for LoRa 2B at 2414.8 MHz:

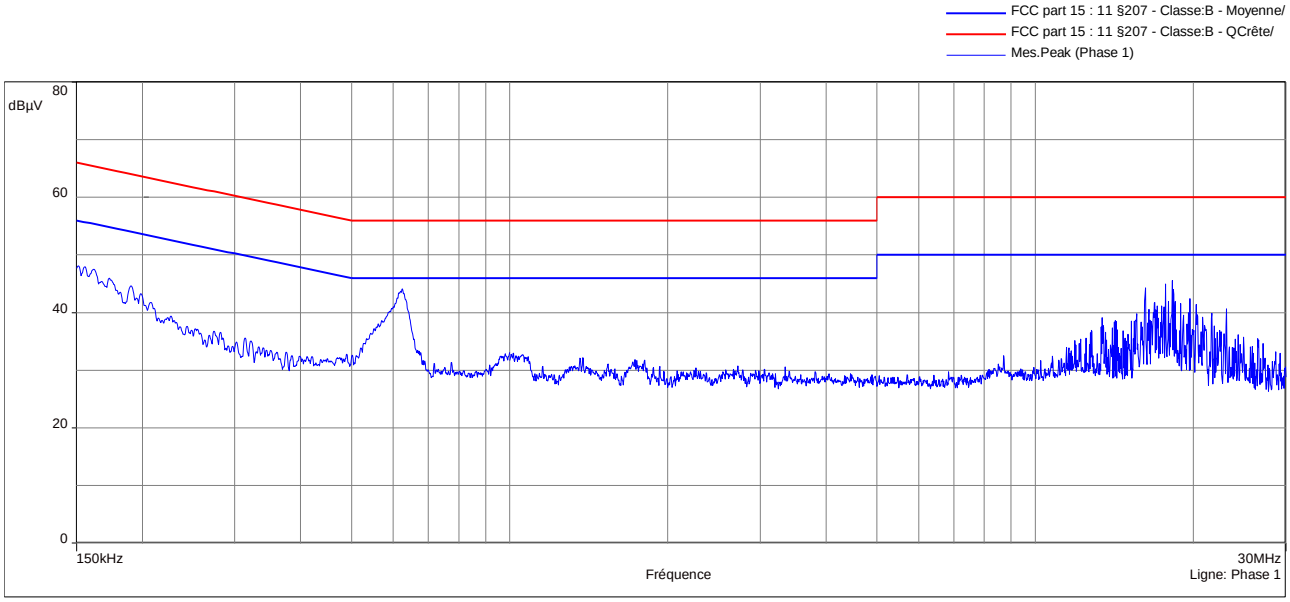
Measurement on the mains power supply:

The measurement is first realized with peak detector.

Curve N° 3: measurement on the Neutral with peak detector



Curve N° 4: measurement on the Line with peak detector



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

Table N° 3: measurement on the Neutral, for the frequency range:

Frequency (MHz)	Quasi-peak (dBµV)	QP Limit (dBµV)	QP margin (dB)
0.524	28.08	56.00	27.92
0.574	35.43	56.00	20.57
0.622	41.34	56.00	14.66
0.646	35.78	56.00	20.22
0.668	28.47	56.00	27.53
1.055	27.32	56.00	28.68
11.890	30.28	60.00	29.72
12.502	31.5	60.00	28.50
12.746	33.05	60.00	26.95
13.416	33.84	60.00	26.16
14.210	34.46	60.00	25.54
14.700	33.82	60.00	26.18
15.251	36.37	60.00	23.63
15.617	37.83	60.00	22.17
15.921	34.82	60.00	25.18
16.227	42.56	60.00	17.44
16.471	38.03	60.00	21.97
16.899	39.45	60.00	20.55
17.693	43.69	60.00	16.31
17.937	39.97	60.00	20.03
18.243	44.36	60.00	15.64
18.485	38.31	60.00	21.69
18.913	39.11	60.00	20.89
19.159	37.31	60.00	22.69
19.707	40.3	60.00	19.70
20.257	39.53	60.00	20.47
20.807	36.9	60.00	23.10
21.663	38.06	60.00	21.94
21.905	34.41	60.00	25.59
22.577	33.59	60.00	26.41
23.127	38.35	60.00	21.65
24.043	31.49	60.00	28.51
24.349	33.26	60.00	26.74
17.693	43.69	60.00	16.31

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0.524	20.33	46.00	25.67
0.574	28.64	46.00	17.36
0.622	34.16	46.00	11.84
0.646	29.1	46.00	16.90
0.668	20.59	46.00	25.41
1.055	19.43	46.00	26.57
11.890	26.56	50.00	23.44
12.502	27.81	50.00	22.19
12.746	29.82	50.00	20.18
13.416	30.73	50.00	19.27
14.210	31.48	50.00	18.52
14.700	30.76	50.00	19.24
15.251	33.45	50.00	16.55
15.617	34.85	50.00	15.15
15.921	31.53	50.00	18.47
16.227	39.69	50.00	10.31
16.471	34.78	50.00	15.22
16.899	36.33	50.00	13.67
17.693	40.7	50.00	9.30
17.937	36.68	50.00	13.32
18.243	41.37	50.00	8.63
18.485	35	50.00	15.00
18.913	35.91	50.00	14.09
19.159	34	50.00	16.00
19.707	37.2	50.00	12.80
20.257	36.35	50.00	13.65
20.807	33.64	50.00	16.36
21.663	34.73	50.00	15.27
21.905	30.9	50.00	19.10
22.577	29.95	50.00	20.05
23.127	34.9	50.00	15.10
24.043	27.66	50.00	22.34
24.349	29.45	50.00	20.55
17.693	40.7	50.00	9.30

Table N° 4: measurement on the Line, for the frequency range:

Frequency (MHz)	Quasi-peak (dBµV)	QP Limit (dBµV)	QP margin (dB)
0.570	35.27	56.00	20.73
0.625	41.19	56.00	14.81
0.649	34.63	56.00	21.37
0.678	26.86	56.00	29.14
12.806	32.43	60.00	27.57
13.416	33.89	60.00	26.11
14.030	34.45	60.00	25.55
14.210	34.5	60.00	25.50
14.700	33.95	60.00	26.05
15.251	36.45	60.00	23.55
15.617	37.89	60.00	22.11
16.227	42.62	60.00	17.38
16.471	38.07	60.00	21.93
16.837	38.36	60.00	21.64
17.387	38.39	60.00	21.61
17.693	43.72	60.00	16.28
17.937	40	60.00	20.00
18.241	42.95	60.00	17.05
18.487	40.06	60.00	19.94
18.915	40.14	60.00	19.86
17.937	40	60.00	20.00
18.241	42.95	60.00	17.05
18.487	40.06	60.00	19.94
19.157	36.01	60.00	23.99
19.707	40.34	60.00	19.66
19.891	34.5	60.00	25.50
20.257	39.53	60.00	20.47
20.807	36.9	60.00	23.10
21.661	37.43	60.00	22.57
22.213	33.21	60.00	26.79
22.455	34.33	60.00	25.67
22.883	33.79	60.00	26.21
23.127	38.4	60.00	21.60
24.349	33.32	60.00	26.68

Frequency (MHz)	Average (dBµV)	Average Limit (dBµV)	Average margin (dB)
0.570	28.08	46.00	17.92
0.625	33.95	46.00	12.05
0.649	27.38	46.00	18.62
0.678	18.71	46.00	27.29
12.806	28.99	50.00	21.01
13.416	30.75	50.00	19.25
14.030	31.43	50.00	18.57
14.210	31.57	50.00	18.43
14.700	30.82	50.00	19.18
15.251	33.51	50.00	16.49
15.617	34.92	50.00	15.08
16.227	39.8	50.00	10.20
16.471	34.83	50.00	15.17
16.837	35.18	50.00	14.82
17.387	35.04	50.00	14.96
17.693	40.7	50.00	9.30
17.937	36.74	50.00	13.26
18.241	39.88	50.00	10.12
18.487	36.8	50.00	13.20
18.915	37.02	50.00	12.98
17.937	36.74	50.00	13.26
18.241	39.88	50.00	10.12
18.487	36.8	50.00	13.20
19.157	32.63	50.00	17.37
19.707	37.17	50.00	12.83
19.891	31.15	50.00	18.85
20.257	36.35	50.00	13.65
20.807	33.65	50.00	16.35
21.661	34.05	50.00	15.95
22.213	29.68	50.00	20.32
22.455	30.77	50.00	19.23
22.883	30.17	50.00	19.83
23.127	34.91	50.00	15.09
24.349	29.53	50.00	20.47

Test conclusion:

RESPECTED STANDARD

9. OCCUPIED BANDWIDTH

Temperature (°C) : 23 **Humidity (%HR):** 35 **Date :** October 16, 2023
Technician : B. VOVARD

Standard: FCC Part 15
RSS-247

Test procedure:
Method of paragraphs 11.8 of ANSI C63.10 (6dB Measurement)
Method of paragraphs 6.9.3 of ANSI C63.10 (99% Measurement)

Test set up:

Test realized in near field.

Setting:

Measure	**6dB**	**99%**
Center frequency	The centre frequency of the channel under test	
Detector	Peak	
Span	2 to 5 times the OBW	1.5 to 5 times the OBW
RBW	100kHz	1% to 5% of the OBW
VBW	300kHz	3 x RBW
Trace	Max hold	
Sweep	Auto	

Test operating condition of the equipment:

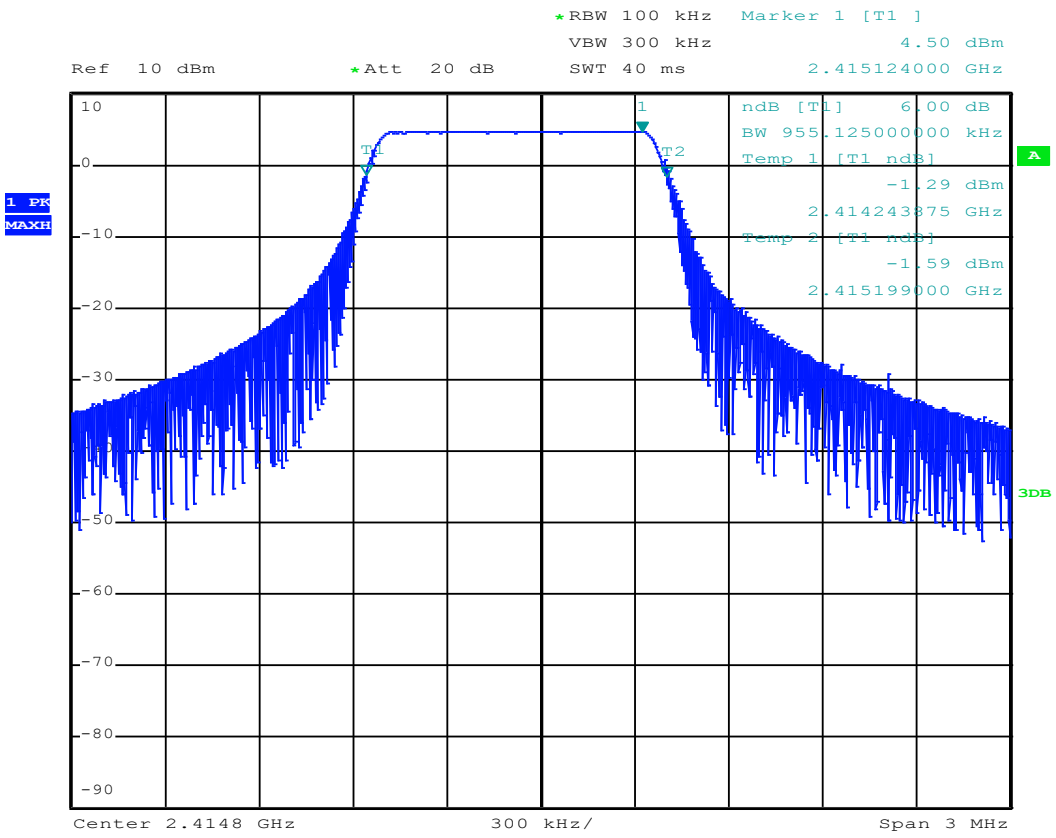
The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Power source: 120 Vac 60 Hz by an external power supply
Percentage of voltage variation during the test (%): ± 1

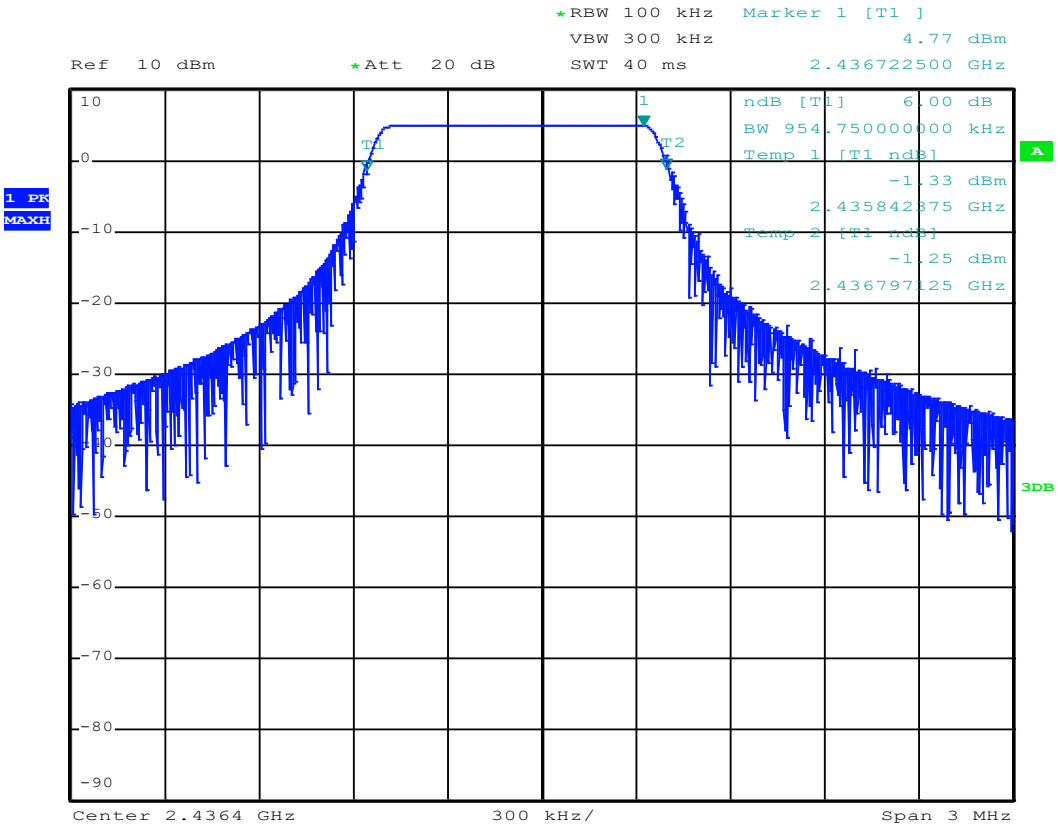
Results for LoRa 2A:

Sample N° 1

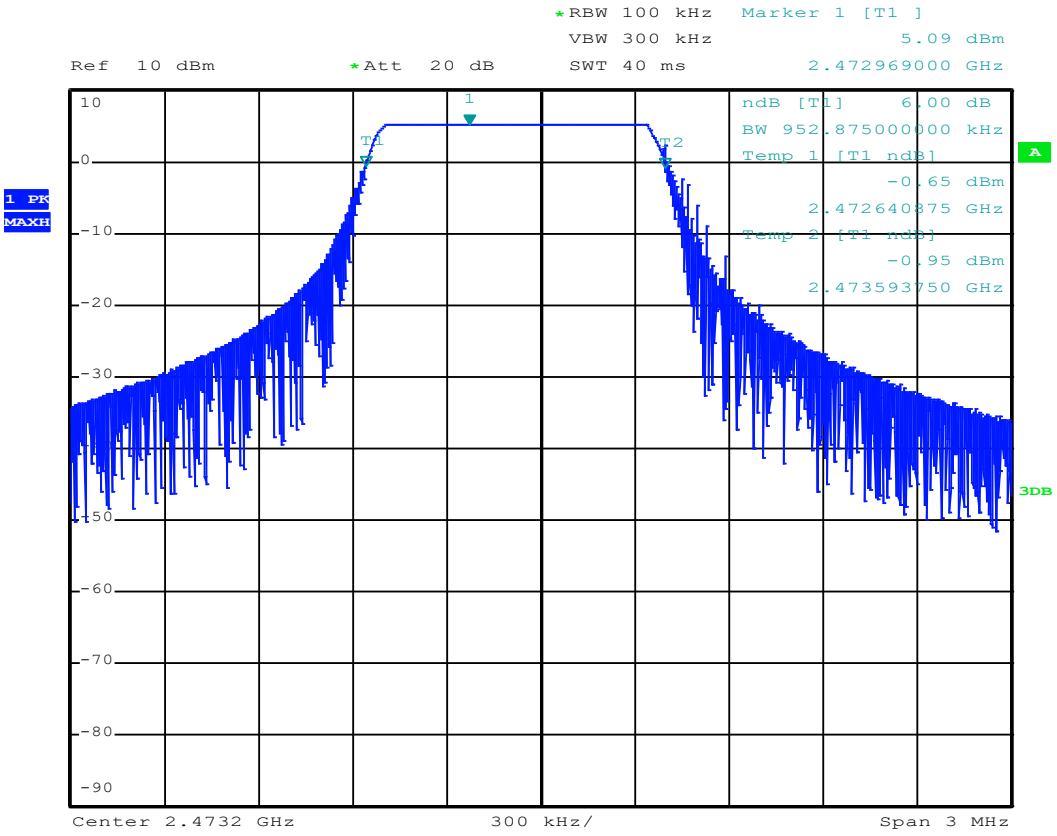
6dB bandwidth – Low Channel 2414.8 MHz



6dB bandwidth – Central Channel 2436.4 MHz



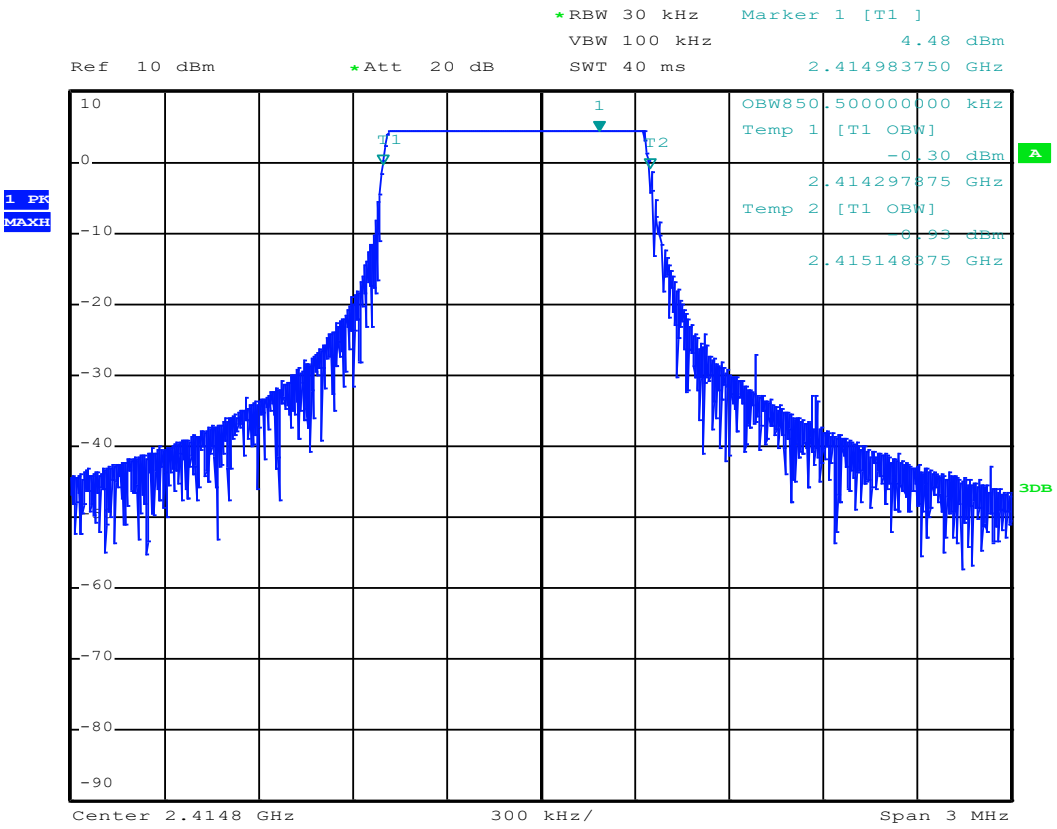
6dB bandwidth – High Channel 2473.2 MHz



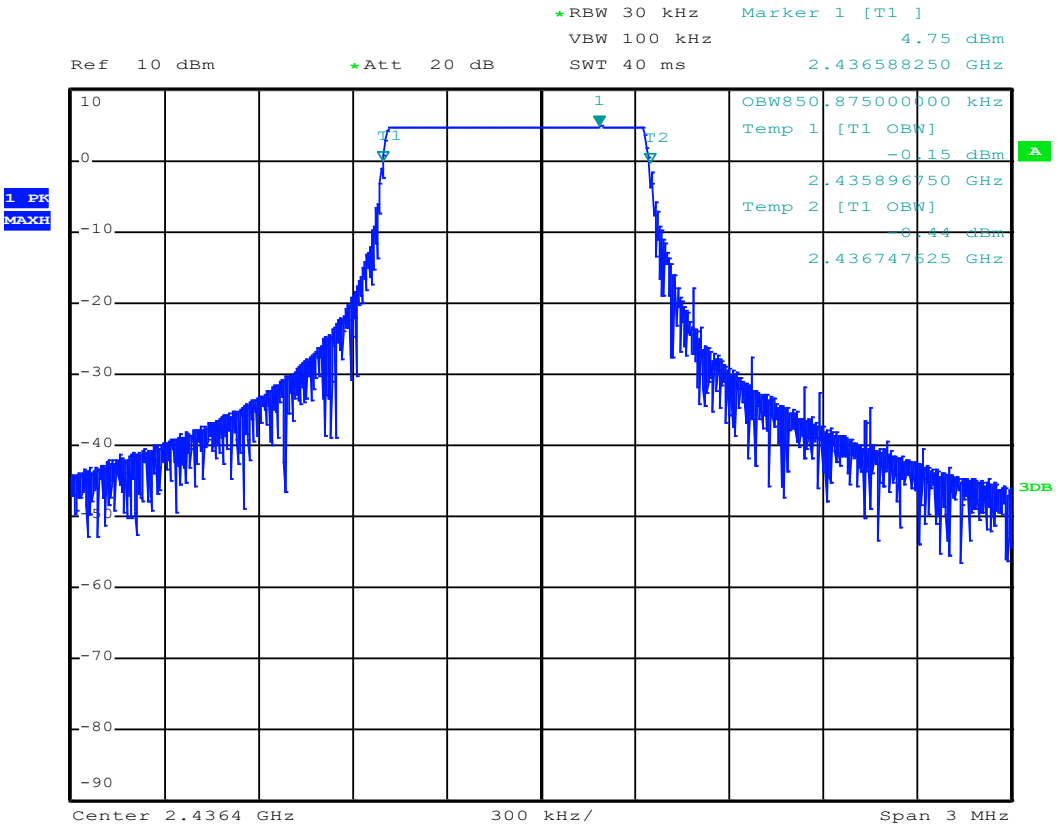
Limit:

Shall be at least 500 kHz

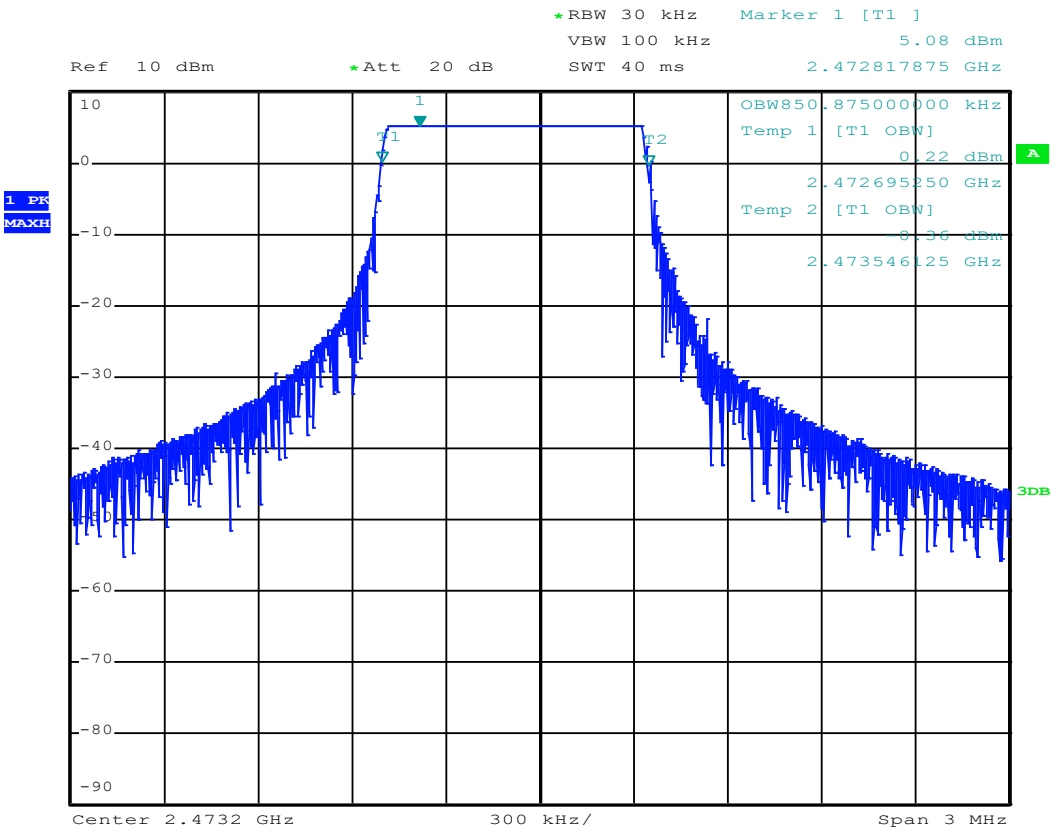
99% bandwidth – Low Channel 2414.8 MHz



99% bandwidth – Central Channel 2436.4 MHz



99% bandwidth – High Channel 2473.2 MHz

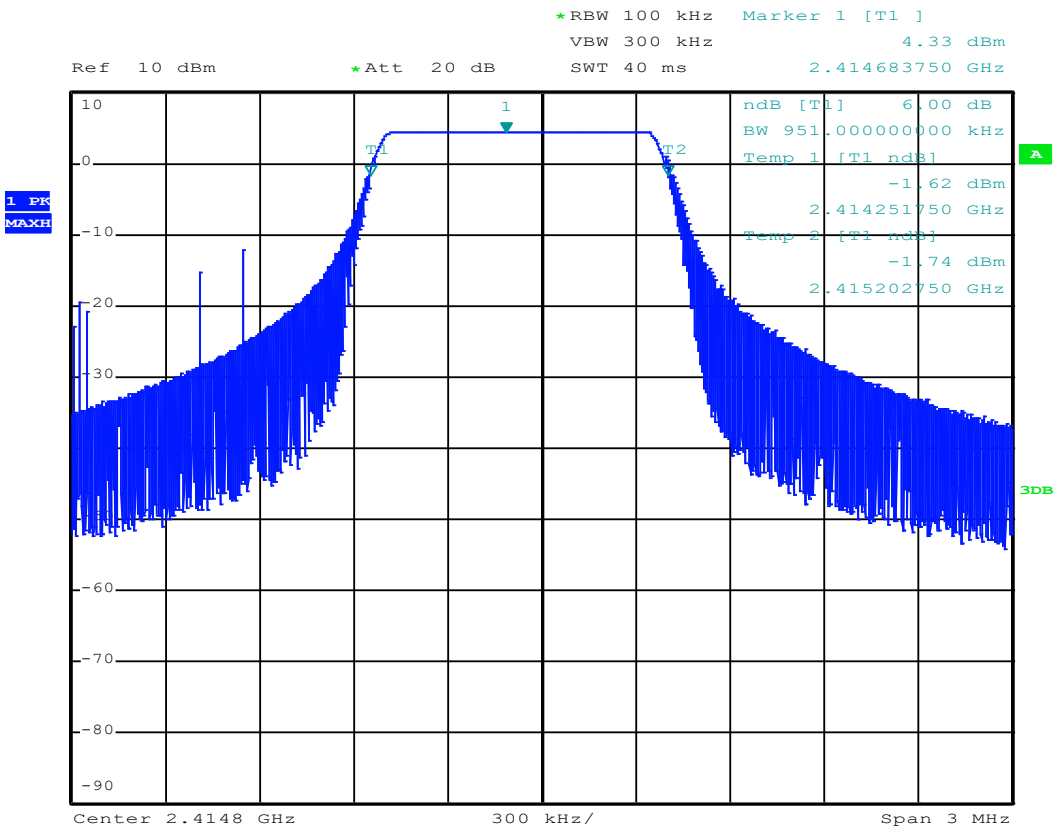


Measure realized for reporting only

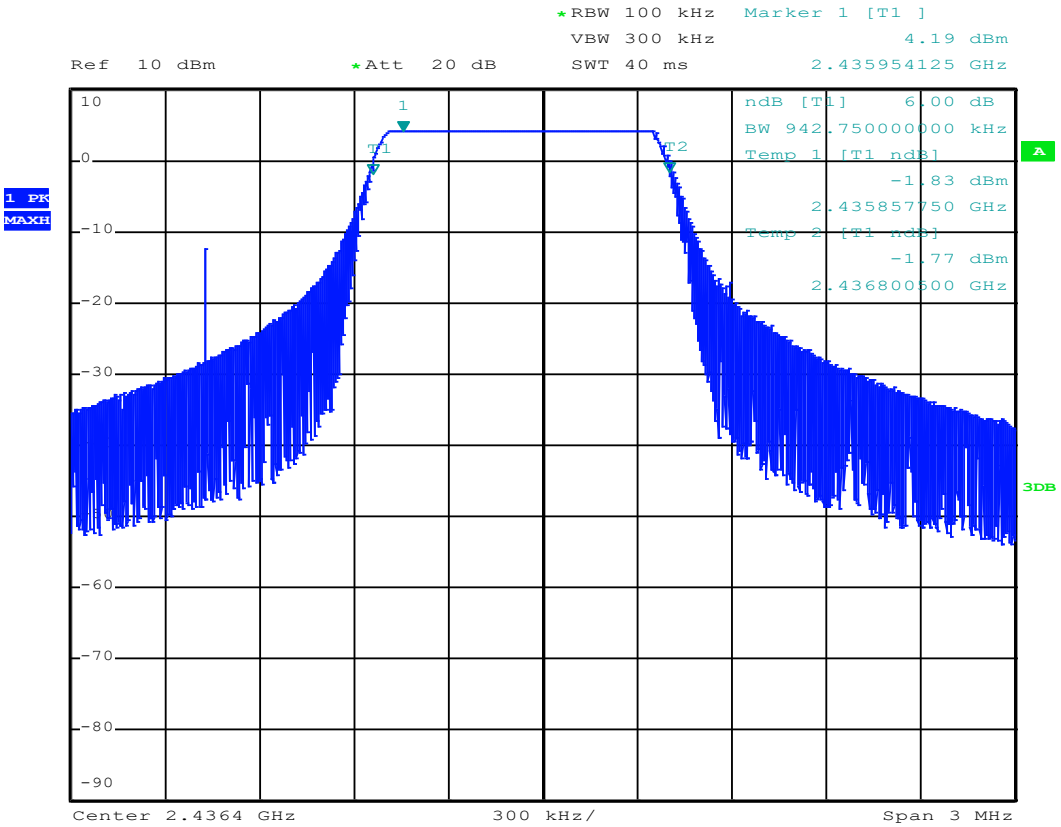
Results for LoRa 2B:

Sample N° 1

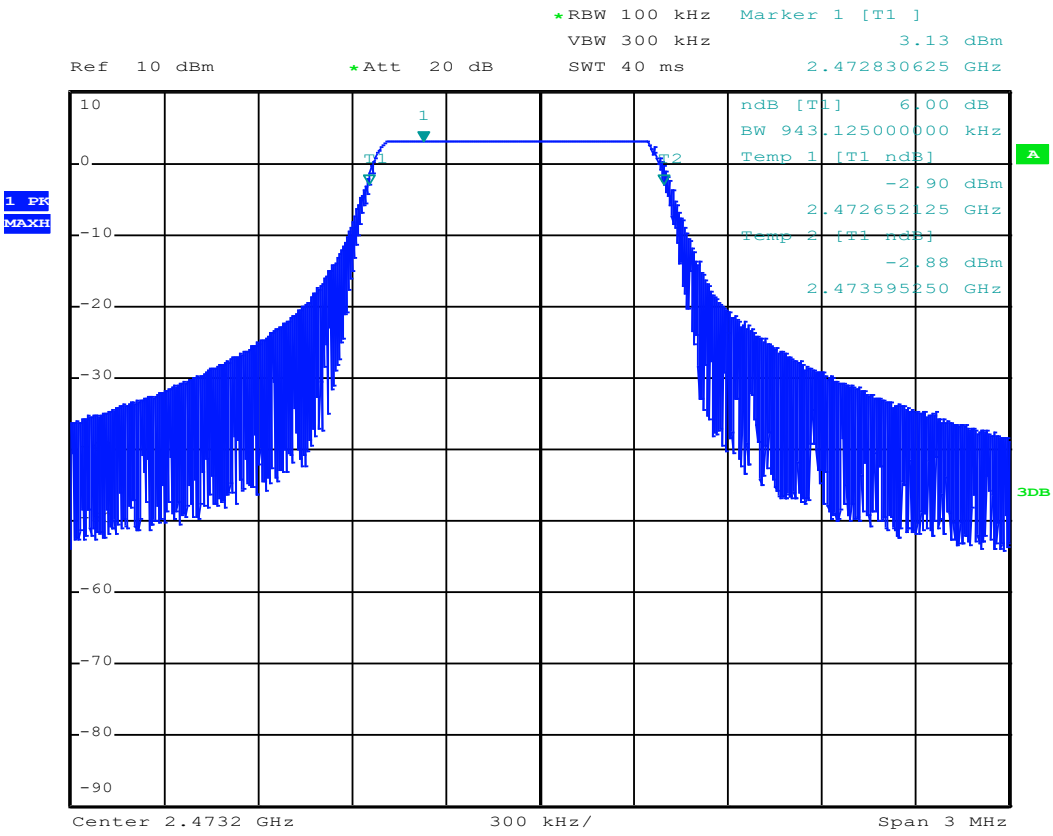
6dB bandwidth – Low Channel 2414.8 MHz



6dB bandwidth – Central Channel 2436.4 MHz



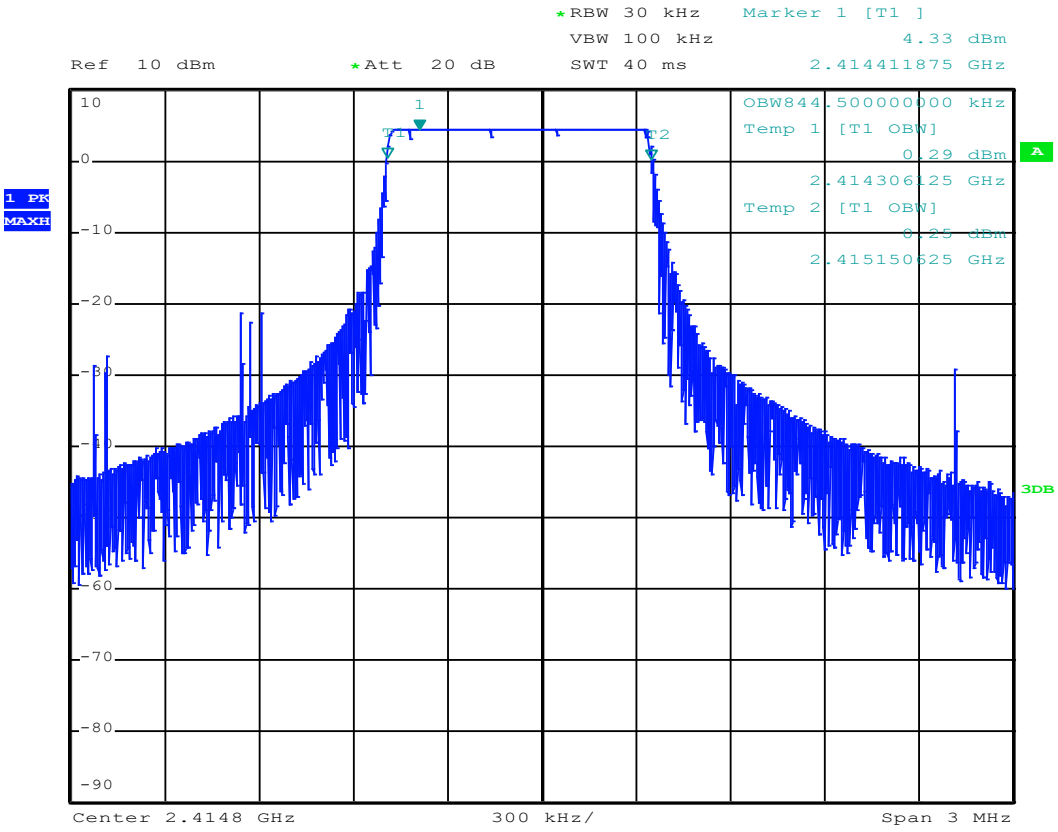
6dB bandwidth – High Channel 2473.2 MHz



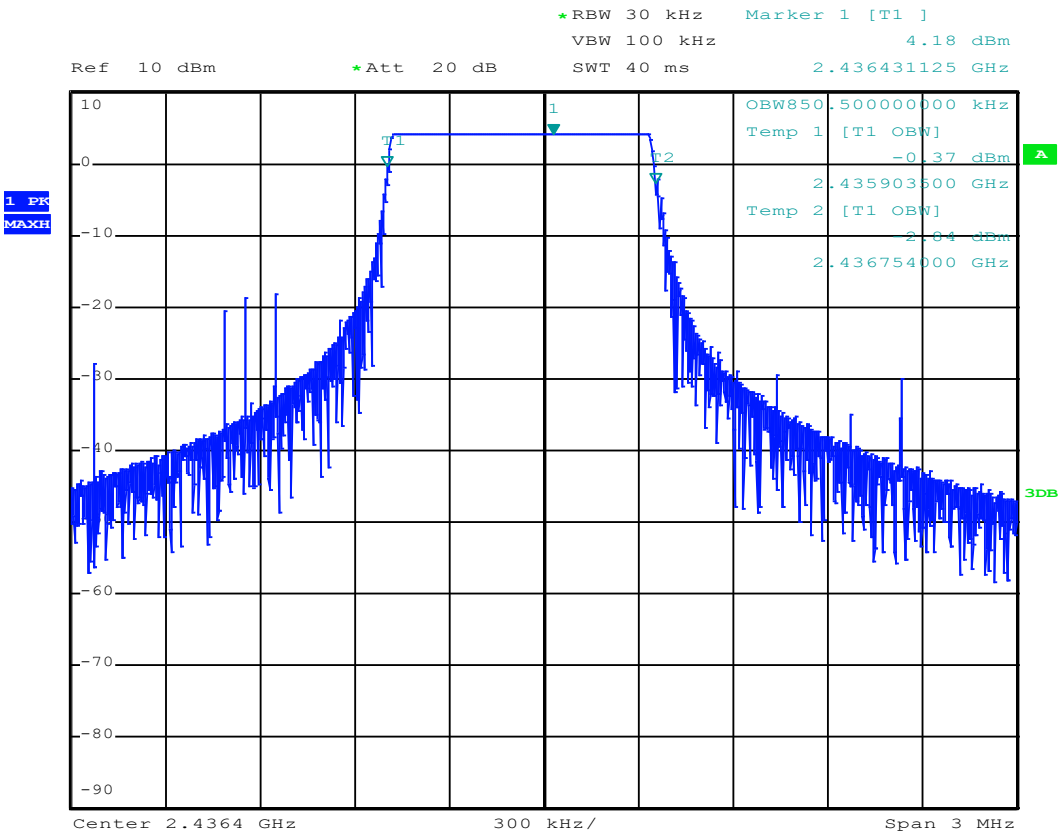
Limit:

Shall be at least 500 kHz

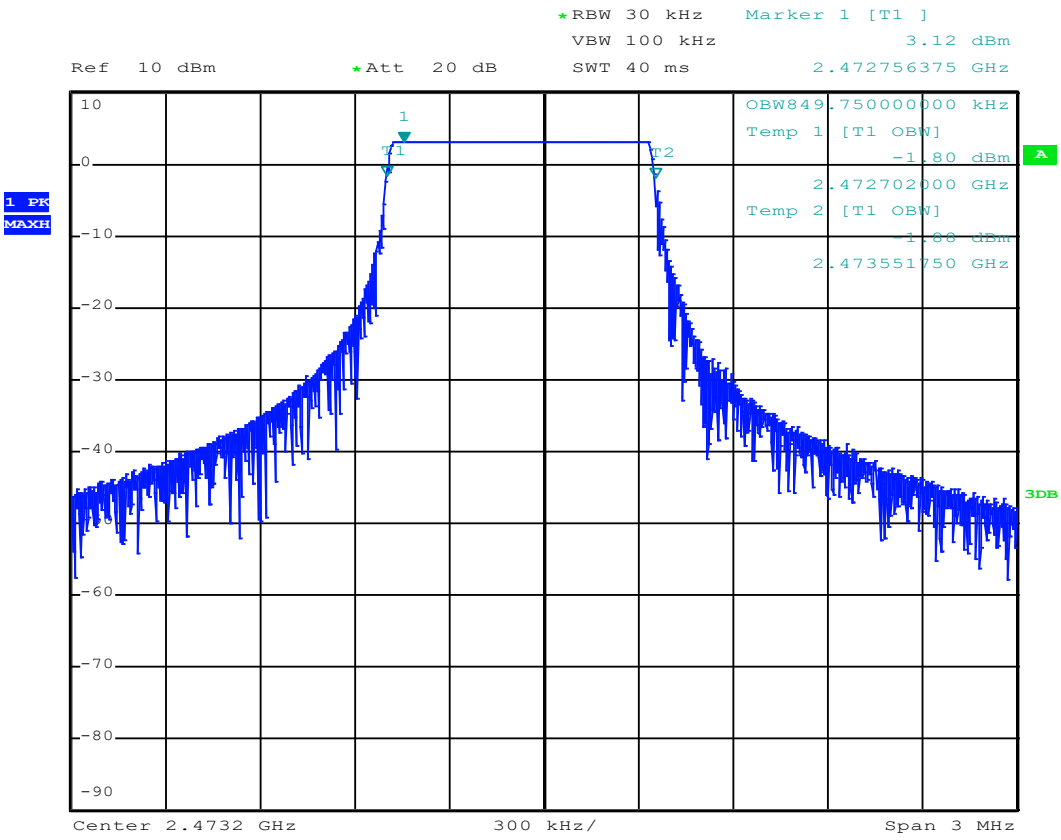
99% bandwidth – Low Channel 2414.8 MHz



99% bandwidth – Central Channel 2436.4 MHz



99% bandwidth – High Channel 2473.2 MHz



Measure realized for reporting only

10. BAND EDGE

Temperature (°C) : 23 **Humidity (%HR):** 35 **Date :** October 16, 2023
Technician : B. VOVARD

Standard: FCC Part 15
RSS-247

Test procedure:

Method of paragraph 11.13.3 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 continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Power source: 120 Vac 60 Hz by an external power supply
Percentage of voltage variation during the test (%): ± 1

Results:

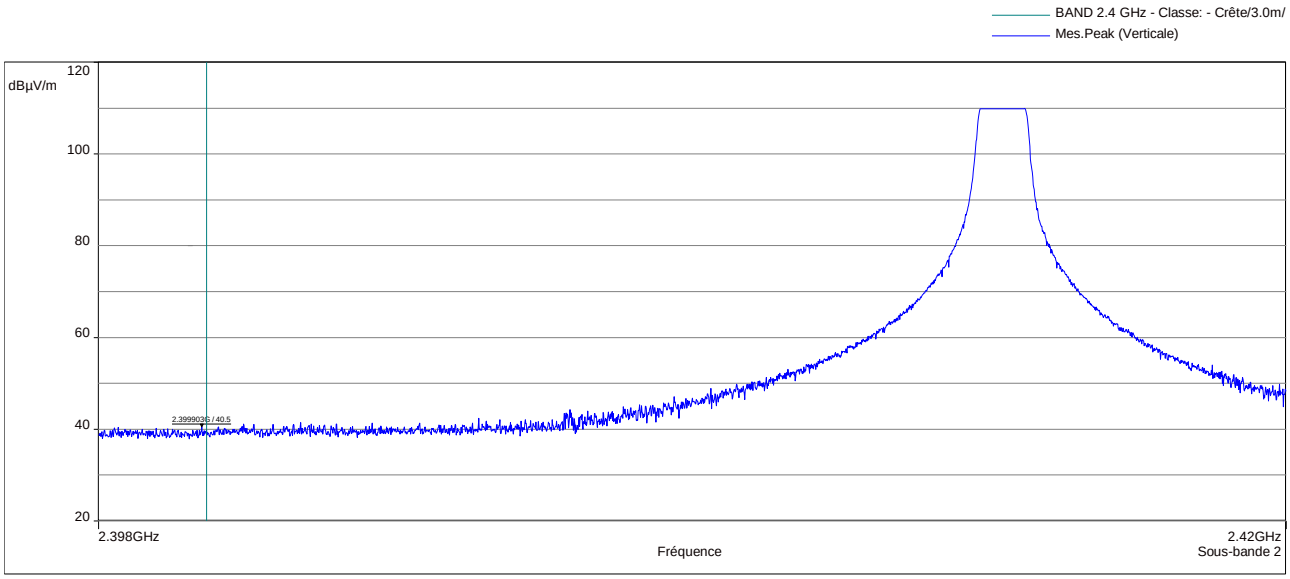
Lower Band Edge: From 2398 MHz to 2400 MHz
Upper Band Edge: From 2483.5 MHz to 2485.5 MHz

Results for LoRa 2A:

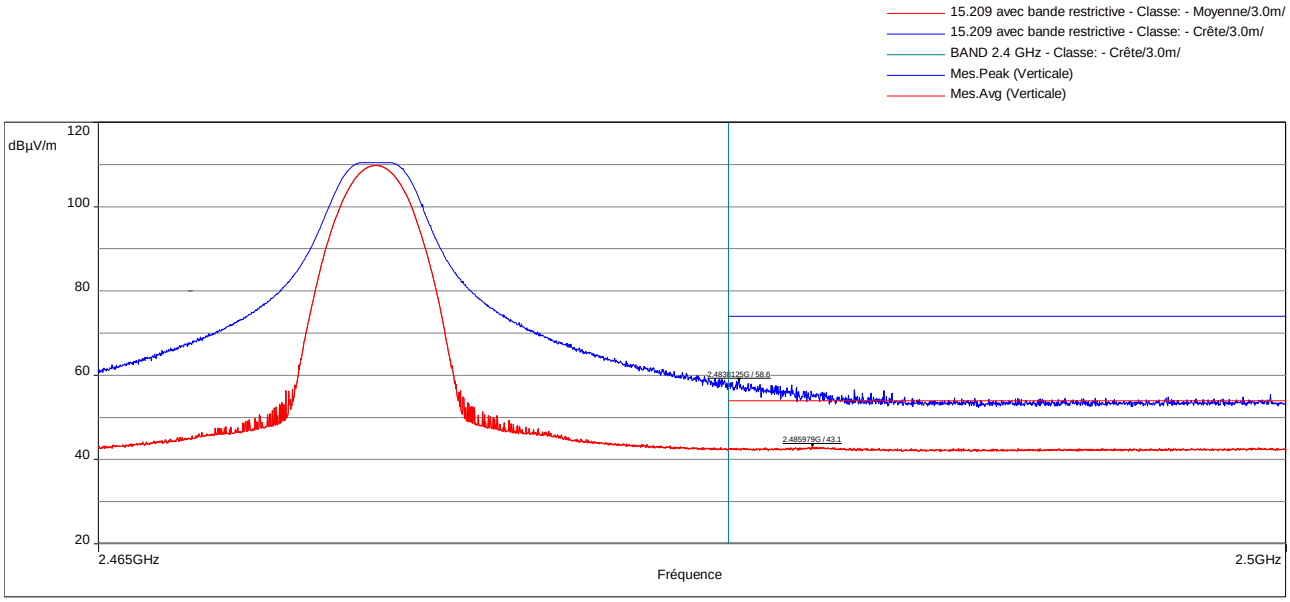
Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Detector (Peak or Average)	RBW (kHz)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2414.8	110	Peak	100	2399.90 (1)	69.5	40.5	90	49.5
2473.2	111.5	Peak	1000	2483.81 (1)	52.9	58.6	74	15.4
2473.2	111.5	Average	1000	2485.97 (1)	68.4	43.1	54	10.9

(1) Marker-Delta method
(2) The peak level is lower than the average limit (54 dBµV/m)

Low Channel – LoRa Modulation: Band edge worst case measurement



High Channel – LoRa Modulation: Band edge worst case measurement

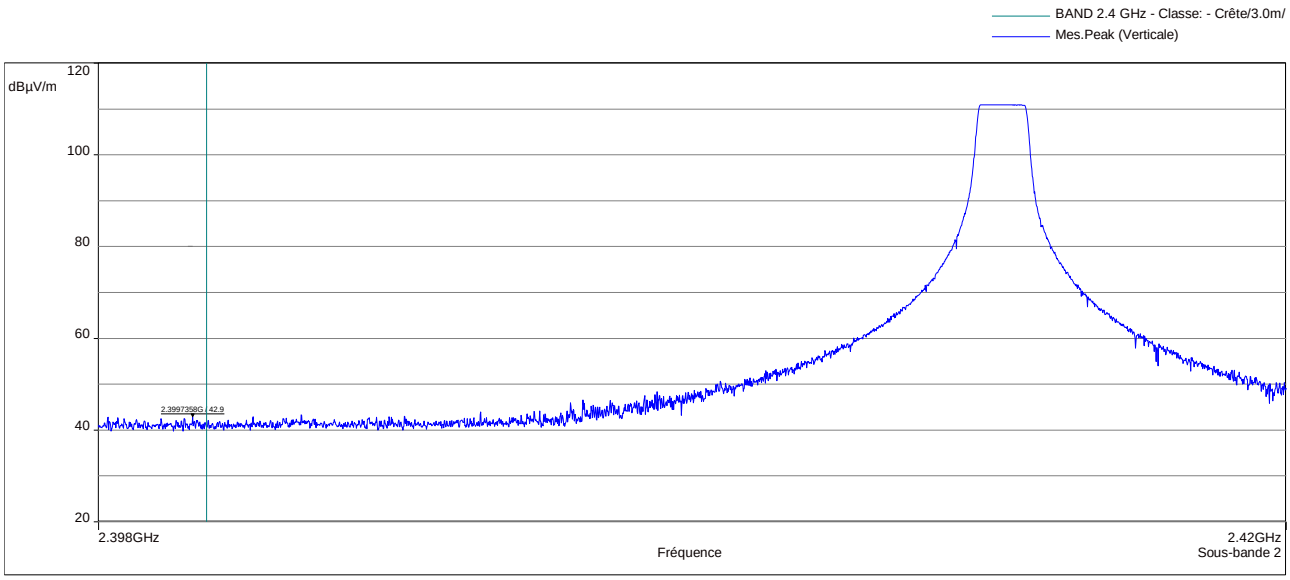


Results for LoRa 2B:

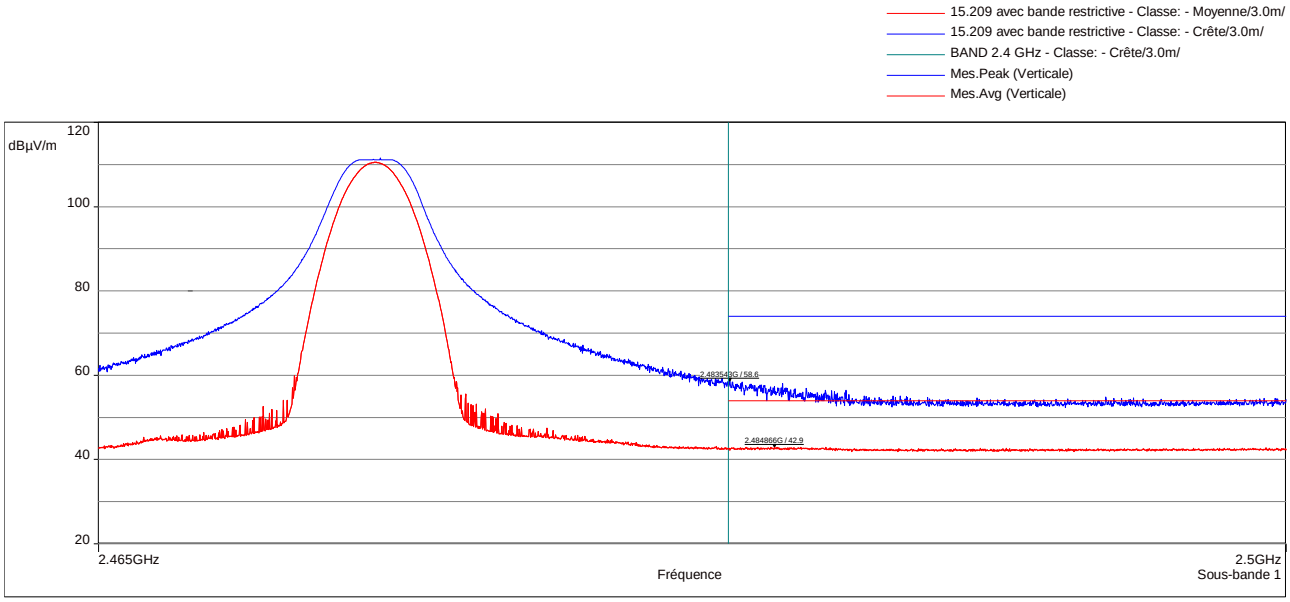
Fundamental frequency (MHz)	Field Strength Level of fundamental (dBµV/m)	Detector (Peak or Average)	RBW (kHz)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Calculated Max Out-of-Band Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2414.8	111.3	Peak	100	2399.73 (1)	68.4	42.9	91.3	48.4
2473.2	109.5	Peak	1000	2483.54 (1)	50.9	58.6	74	15.4
2473.2	109.5	Average	1000	2484.86 (1)	66.6	42.9	54	11.1

(1) Marker-Delta method

Low Channel – LoRa Modulation: Band edge worst case measurement



High Channel – LoRa Modulation: Band edge worst case measurement



Test conclusion:

RESPECTED STANDARD

11. PEAK CONDUCTED OUTPUT POWER

Temperature (°C) : 23 **Humidity (%HR):** 35 **Date :** October 16, 2023
Technician : B. VOVARD

Standard: FCC Part 15
RSS-247

Test procedure:
For FCC Part 15: paragraph 15.247 (b)
For RSS-247: paragraph 5.4

RBW≥DTS bandwidth method of paragraph 11.9.1.1 of ANSI C63.10

Test set up: (Refer Appendix 2)

First an exploratory radiated measurement was performed. During this phase the product is oriented in this normal position.

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

The system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.5 m from a ground plane.

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

See test setup in appendix 2

Distance of antenna: 3 meters (in anechoic room)

Antenna height: 1.5 meter (in anechoic room)

Antenna polarization: vertical and horizontal (only the highest level is recorded)

The measurement of the radiated electro-magnetic field is realized with an analyser and peak detector. The resolution bandwidth is adjusted at 10 MHz and video bandwidth at 10 MHz. (11.9.1.1 of ANSI C63.10)

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Power source: 120 Vac 60 Hz by an external power supply
Percentage of voltage variation during the test (%): ± 1

Results for LoRa 2A:

Sample N° 1 Low Channel (F = 2414.8MHz)

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted output power		Limit
		(dBm)	(W)	(W)
Nominal supply voltage: 120 Vac	110	4.59	0.002878	0.631

Polarization of test antenna: vertical (height: 150 cm)
Position of equipment: Position 1 - (azimuth: 274 degrees)

Maximum Peak conducted output power:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 10.15 dBi.

Sample N° 1 Central Channel (F = 2436.4 MHz)

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted output power		Limit
		(dBm)	(W)	(W)
Nominal supply voltage: 120 Vac	111	4.91	0.003098	0.631

Polarization of test antenna: vertical (height: 150 cm)
Position of equipment: Position 1 - (azimuth: 279 degrees)

Maximum Peak conducted output power:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 10.83 dBi.

Sample N° 1 High Channel (F = 2473.2 MHz)

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted output power		Limit
		(dBm)	(W)	(W)
Nominal supply voltage: 120 Vac	111.5	6.66	0.004636	0.631

Polarization of test antenna: vertical (height: 150 cm)
Position of equipment: Position 1 - (azimuth: 278 degrees)

Maximum Peak conducted output power:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 9.58 dBi.

Results for LoRa 2B:

Sample N° 1 Low Channel (F = 2414.8MHz)

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted output power		Limit
		(dBm)	(W)	(W)
Nominal supply voltage: 120 Vac	111.3	6.61	0.004583	0.631

Polarization of test antenna: vertical (height: 150 cm)
Position of equipment: Position 1 - (azimuth: 69 degrees)

Maximum Peak conducted output power:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 9.43 dBi.

Sample N° 1 Central Channel (F = 2436.4 MHz)

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted output power		Limit
		(dBm)	(W)	(W)
Nominal supply voltage: 120 Vac	111.2	6.18	0.004151	0.631

Polarization of test antenna: vertical (height: 150 cm)
Position of equipment: Position 1 - (azimuth: 58 degrees)

Maximum Peak conducted output power:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 9.76 dBi.

Sample N° 1 High Channel (F = 2473.2 MHz)

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted output power		Limit
		(dBm)	(W)	(W)
Nominal supply voltage: 120 Vac	109.5	4.36	0.002730	0.631

Polarization of test antenna: vertical (height: 150 cm)
Position of equipment: Position 1 - (azimuth: 71 degrees)

Maximum Peak conducted output power:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 9.88 dBi.

Test conclusion:

RESPECTED STANDARD

12. RADIATED SPURIOUS EMISSIONS

Temperature (°C) : 22 **Humidity (%HR):** 41 to 43 **Date :** October 12, 2023 and October 16, 2023

Technician : B. VOVARD

Standard: FCC Part 15
RSS-247

Test procedure:
For FCC Part 15: paragraph 15.205, paragraph 15.209, paragraph 15.247 (d)
For RSS-247: paragraph 5.5

Emissions in non-restricted frequency bands method of paragraph 11.11 of ANSI C63.10
Emissions in restricted frequency bands method of paragraph 11.12 of ANSI C63.10

Test set up: (Refer Appendix 2)

First an exploratory radiated measurement was performed. During this phase the product is oriented in this normal position.

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 and in anechoic chamber above 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.
When the system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.5 m from a ground plane.

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

See test setup in appendix 2

Frequency range: From 9 kHz to 10th harmonic of the highest fundamental frequency (2473.2 MHz)

Detection mode: Quasi-peak (F < 1 GHz) Peak / Average (F > 1 GHz)

Bandwidth: 200Hz (9 kHz < F < 150kHz)
9 kHz (150 kHz < F < 30MHz)
120 kHz (30 MHz < F < 1 GHz)
100 kHz / 1 MHz (F > 1 GHz)

Distance of antenna: 10 meters (in open area test site) / 3 meters (in anechoic room)

Antenna height: 1 to 4 meters (in open area test site) / 1.5 meter (in anechoic room)

Antenna polarization: vertical and horizontal (only the highest level is recorded)

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Power source: 120 Vac 60 Hz by an external power supply
Percentage of voltage variation during the test (%): ± 1

Results for LoRa 2A:

Sample N° 1 Low Channel (F = 2414.8 MHz)

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBµV/m)	Limits (dBµV/m)	Margin (dB)
4829.6 (2)	P	150	1000	1	V	42.1 (1)	74	31.9
7244.4	P	150	100	1	H	47.6 (3)	91.3	43.7
9659.2	P	150	100	1	H	48.6 (3)	91.3	42.7
12074 (2)	P	150	1000	1	H	48.8 (3)	74	25.2
14488.8 (2)	P	150	1000	1	H	53.9 (3)	74	20.1
16903.6	P	150	100	1	H	51.3 (1)	91.3	40

P= Peak, QP=Quasi-peak, Av=Average
(1) Noise Floor
(2) Restricted bands of operation in 15.205
(2) Restricted bands of operation as defined in Table 6 of RSS-Gen
(3) The peak level is lower than the average limit (54 dBµV/m)

Sample N° 1 Central Channel (F = 2436.4 MHz)

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBµV/m)	Limits (dBµV/m) or (dBm)	Margin (dB)
4872.8 (2)	P	150	1000	1	V	42.2 (1)	74	31.8
7309.2 (2)	P	150	1000	1	V	46.2 (1)	74	27.8
9745.6	P	150	100	1	H	47.4	91.3	43.9
12182 (2)	P	150	1000	1	H	48.1 (3)	74	25.9
14618.4	P	150	100	1	V	54.5	91.3	36.8
17054.8	P	150	100	1	V	52.2	91.3	39.1

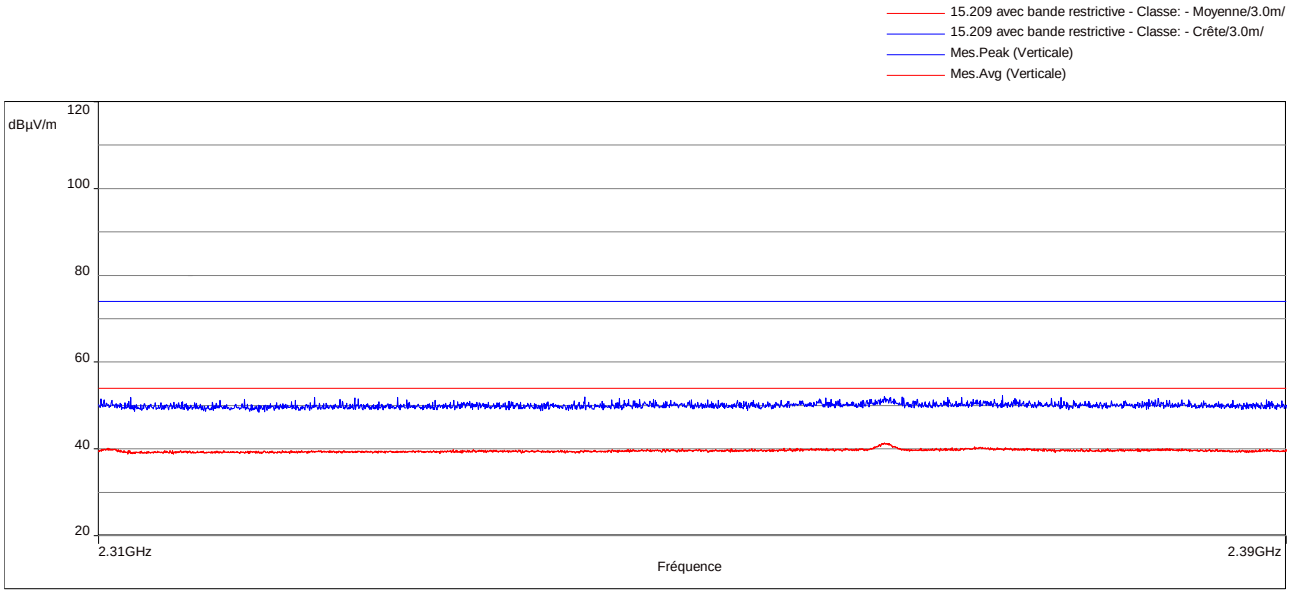
P= Peak, QP=Quasi-peak, Av=Average
(1) Noise Floor
(2) Restricted bands of operation in 15.205
(2) Restricted bands of operation as defined in Table 6 of RSS-Gen
(3) The peak level is lower than the average limit (54 dBµV/m)

Sample N° 1 High Channel (F = 2473.2 MHz)

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBµV/m)	Limits (dBµV/m)	Margin (dB)
4946.3 (2)	P	150	1000	1	V	45.5 (3)	74	28.5
7419.6 (2)	P	150	1000	1	V	46.9 (3)	74	27.1
9892.8	P	150	100	1	H	49.8	91.3	41.5
12366 (2)	P	150	1000	1	H	48.9 (3)	74	25.1
14839.2	P	150	100	1	H	53.1	91.3	38.2
17312.4	P	150	100	1	V	51.4 (1)	91.3	39.9

P= Peak, QP=Quasi-peak, Av=Average
(1) Noise Floor
(2) Restricted bands of operation in 15.205
(2) Restricted bands of operation as defined in Table 6 of RSS-Gen
(3) The peak level is lower than the average limit (54 dBµV/m)

Band edge worst case measurement (band 2.31GHz to 2.39GHz)



Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 111.3 dBµV/m on the lowest channel.

So the applicable limit is 91.3 dBµV/m.

In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

In addition, radiated emissions which fall in the restricted band, as defined in Table 6 of RSS-Gen, must also comply with the radiated emission limits specified in Table 4 and Table 5 of RSS-Gen.

Results for LoRa 2B:

Sample N° 1 Low Channel (F = 2414.8 MHz)

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBµV/m)	Limits (dBµV/m)	Margin (dB)
4829.6 (2)	P	150	1000	1	V	42.3 (1)	74	31.7
7244.4	P	150	100	1	H	48.2 (3)	90.7	42.5
9659.2	P	150	100	1	H	47.4 (3)	90.7	43.3
12074 (2)	P	150	1000	1	H	49.5 (3)	74	24.5
14488.8 (2)	P	150	1000	1	H	53.5 (3)	74	20.5
16903.6	P	150	100	1	V	51.6 (1)	90.7	39.1

P= Peak, QP=Quasi-peak, Av=Average
(1) Noise Floor
(2) Restricted bands of operation in 15.205
(2) Restricted bands of operation as defined in Table 6 of RSS-Gen
(3) The peak level is lower than the average limit (54 dBµV/m)

Sample N° 1 Central Channel (F = 2436.4 MHz)

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBµV/m)	Limits (dBµV/m) or (dBm)	Margin (dB)
4872.8 (2)	P	150	1000	1	V	42.4 (1)	74	31.6
7309.2 (2)	P	150	1000	1	V	46.7 (3)	74	27.3
9745.6	P	150	100	1	V	47.8	90.7	42.9
12182 (2)	P	150	1000	1	V	48.8 (3)	74	25.2
14618.4	P	150	100	1	H	54.3	90.7	36.4
17054.8	P	150	100	1	V	52.5 (1)	90.7	38.2

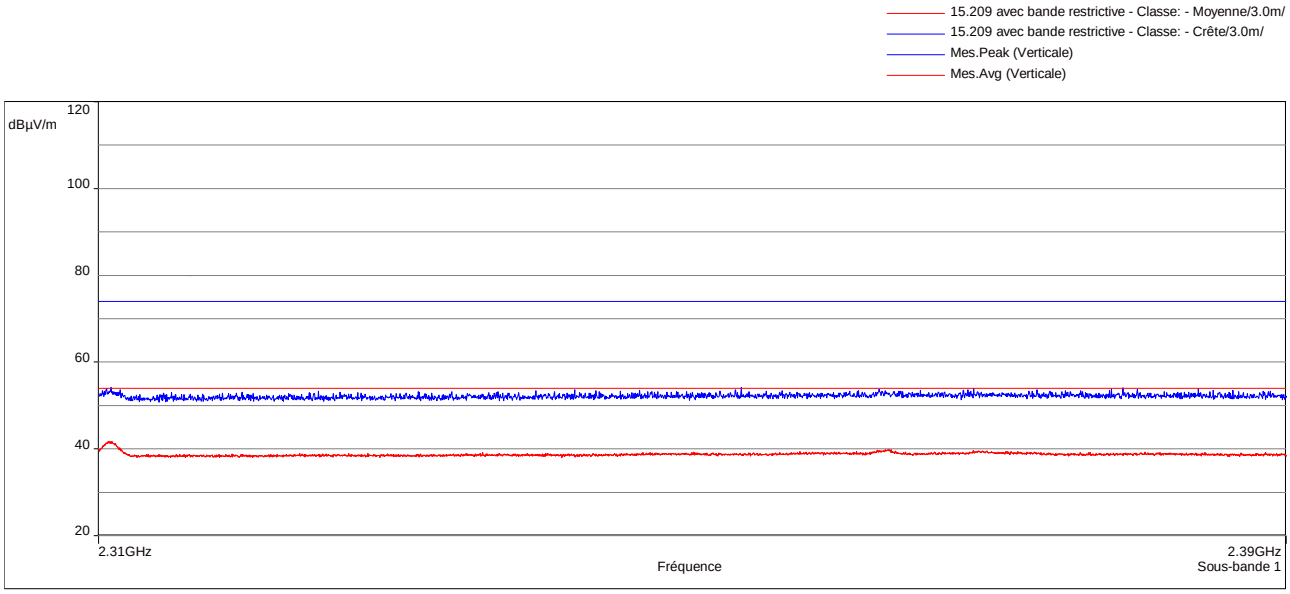
P= Peak, QP=Quasi-peak, Av=Average
(1) Noise Floor
(2) Restricted bands of operation in 15.205
(2) Restricted bands of operation as defined in Table 6 of RSS-Gen
(3) The peak level is lower than the average limit (54 dBµV/m)

Sample N° 1 High Channel (F = 2473.2 MHz)

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Position	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dBµV/m)	Limits (dBµV/m)	Margin (dB)
4946.3 (2)	P	150	1000	1	H	42.2 (1)	74	31.8
7419.6 (2)	P	150	1000	1	H	46.9 (3)	74	27.1
9892.8	P	150	100	1	H	48.6	90.7	42.1
12366 (2)	P	150	1000	1	V	47.8 (1)	74	26.2
14839.2	P	150	100	1	H	52.2 (1)	90.7	38.5
17312.4	P	150	100	1	V	52.1 (1)	90.7	38.6

P= Peak, QP=Quasi-peak, Av=Average
(1) Noise Floor
(2) Restricted bands of operation in 15.205
(2) Restricted bands of operation as defined in Table 6 of RSS-Gen
(3) The peak level is lower than the average limit (54 dBµV/m)

Band edge worst case measurement (band 2.31GHz to 2.39GHz)



Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 110.7 dBµV/m on the lowest channel.

So the applicable limit is 90.7 dBµV/m.

In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

In addition, radiated emissions which fall in the restricted band, as defined in Table 6 of RSS-Gen, must also comply with the radiated emission limits specified in Table 4 and Table 5 of RSS-Gen.

Test conclusion:

RESPECTED STANDARD

13. PEAK CONDUCTED POWER SPECTRAL DENSITY

Temperature (°C) : 23 **Humidity (%HR):** 35 **Date :** October 16, 2023
Technician : B. VOVARD

Standard: FCC Part 15
RSS-247

Test procedure:
For FCC Part 15: paragraph 15.247 (e), paragraph 15.247 (f)
For RSS-247: paragraph 5.2
PKPSD (Peak PSD) method of paragraph 11.10.2 of ANSI C63.10

Test set up: (Refer Appendix 2)

First an exploratory radiated measurement was performed. During this phase the product is oriented in this normal position.

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

The system is tested in anechoic chamber, the EUT is placed on a rotating table, 1.5 m from a ground plane.

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

See test setup in appendix 2

Distance of antenna: 3 meters (in anechoic room)

Antenna height: 1.5 meter (in anechoic room)

Antenna polarization: vertical and horizontal (only the highest level is recorded)

The measurement of the radiated electro-magnetic field is realized with an analyser.

Span:	10MHz
Resolution bandwidth:	3kHz
Video bandwidth:	10kHz
Detector:	Peak
Number of points:	Auto
Sweep time:	Auto
Trace mode:	MaxHold

Then the peak marker function is used.

Finally the radiated electro-magnetic field is converted in dBm with the following formula:
EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 2 dBi.

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the highest output power level at which the transmitter is intended to operate.

Power source: 120 Vac 60 Hz by an external power supply
Percentage of voltage variation during the test (%): ± 1

Results for LoRa 2A:

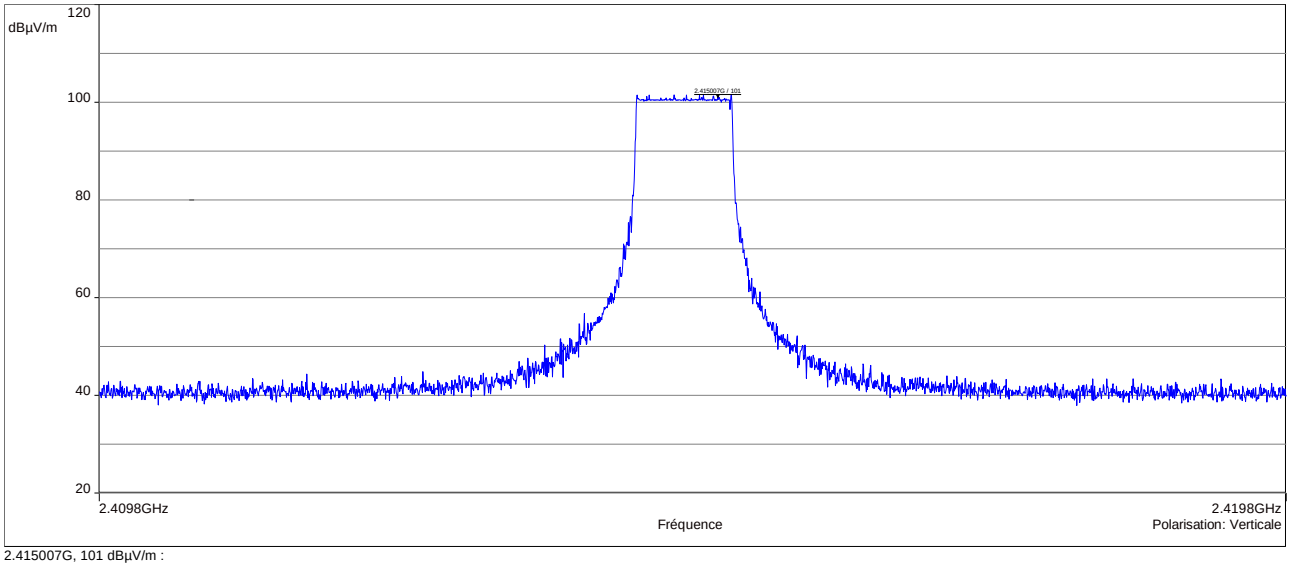
Sample N° 1 Low Channel (F = 2414.8MHz)

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage: 120 Vac	101	-4.41	8

Polarization of test antenna: vertical (height: 150 cm)
Position of equipment: Position 1 - (azimuth: 274 degrees)

Maximum Peak conducted power density:
EIRP(dBm / 3 kHz) = E (dBµV/m / 3 kHz) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 10.15 dBi.

Declared maximum antenna gain: 10.15 dBi



2.415007G, 101 dBµV/m :

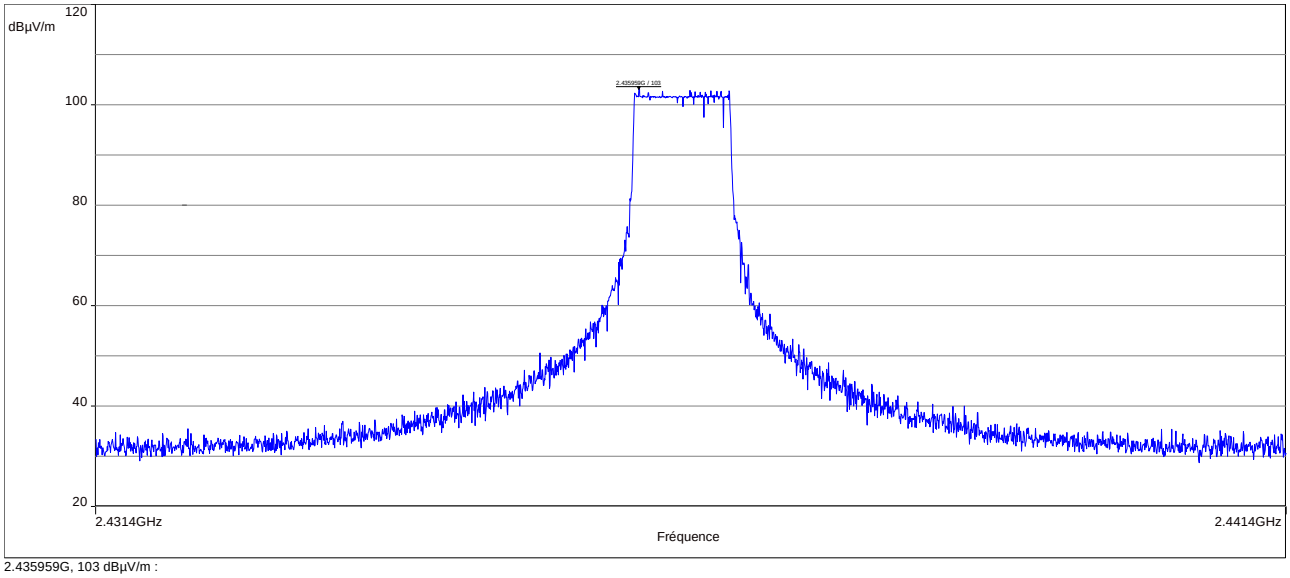
Sample N° 1 Central Channel (F = 2436.4 MHz)

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage: 120 Vac	103	-3.09	8

Polarization of test antenna: vertical (height: 150 cm)
Position of equipment: Position 1 - (azimuth: 279 degrees)

Maximum Peak conducted power density:
EIRP(dBm / 3 kHz) = E (dBµV/m / 3 kHz) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 10.83 dBi.

Declared maximum antenna gain: 10.83 dBi



2.435959G, 103 dBµV/m :

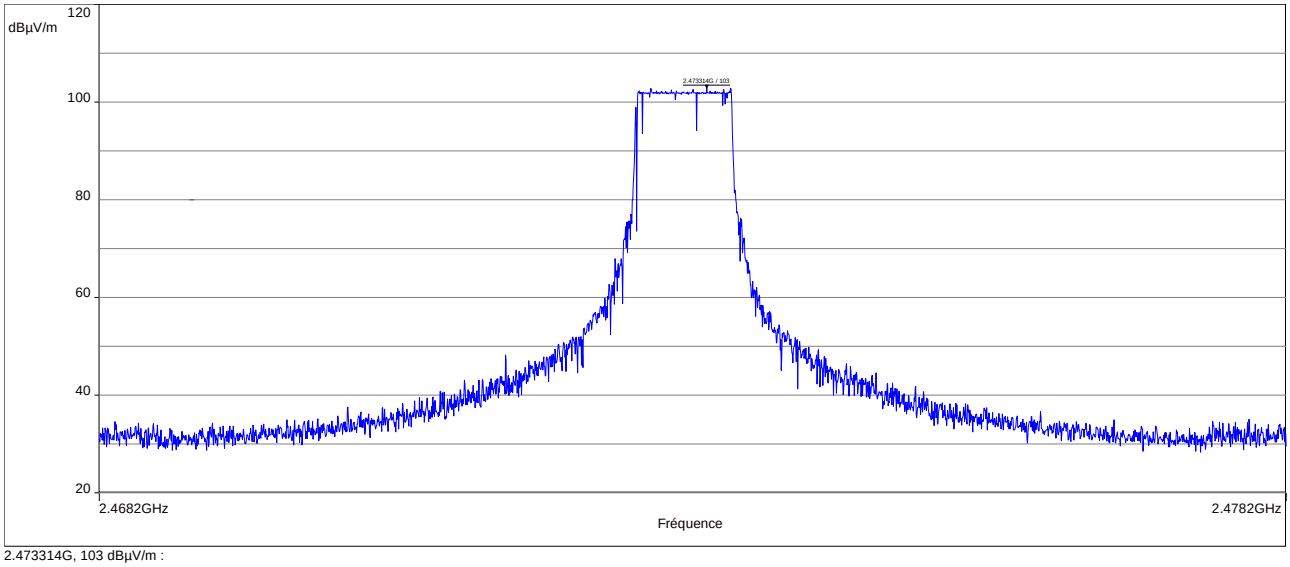
Sample N° 1 High Channel (F = 2473.2 MHz)

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage: 120 Vac	103	-1.84	8

Polarization of test antenna: vertical (height: 150 cm)
Position of equipment: Position 1 - (azimuth: 278 degrees)

Maximum Peak conducted power density:
EIRP(dBm / 3 kHz) = E (dBµV/m / 3 kHz) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 9.61 dBi.

Declared maximum antenna gain: 9.58 dBi



2.473314G, 103 dBµV/m :

Results for LoRa 2B:

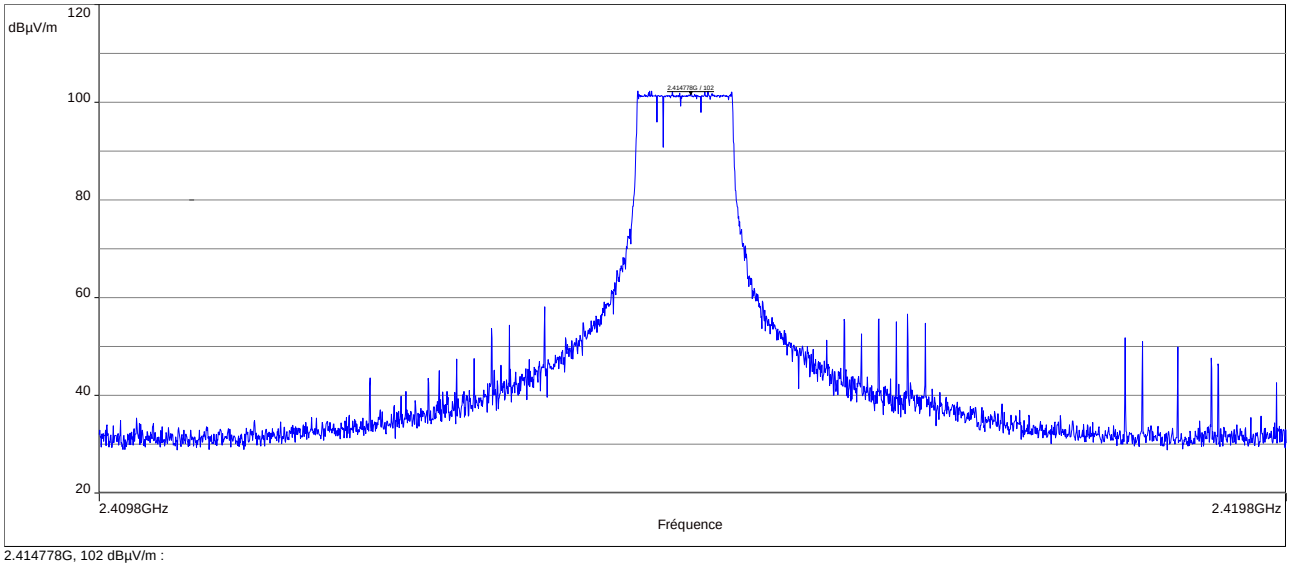
Sample N° 1 Low Channel (F = 2414.8MHz)

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage: 120 Vac	102	-2.69	8

Polarization of test antenna: vertical (height: 150 cm)
Position of equipment: Position 1 - (azimuth: 69 degrees)

Maximum Peak conducted power density:
EIRP(dBm / 3 kHz) = E (dBµV/m / 3 kHz) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 9.43 dBi.

Declared maximum antenna gain: 9.43 dBi



2.414778G, 102 dBµV/m :

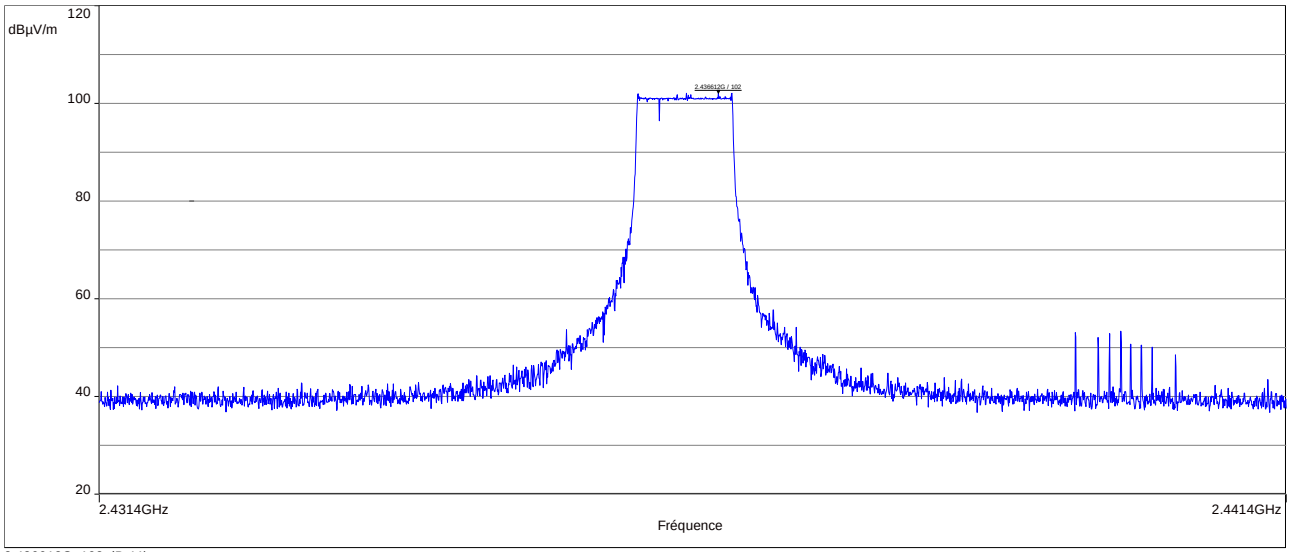
Sample N° 1 Central Channel (F = 2436.4 MHz)

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage: 120 Vac	102	-3.02	8

Polarization of test antenna: vertical (height: 150 cm)
Position of equipment: Position 1 - (azimuth: 58 degrees)

Maximum Peak conducted power density:
EIRP(dBm / 3 kHz) = E (dBµV/m / 3 kHz) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 9.76 dBi.

Declared maximum antenna gain: 9.76 dBi



2.436612G, 102 dBµV/m :

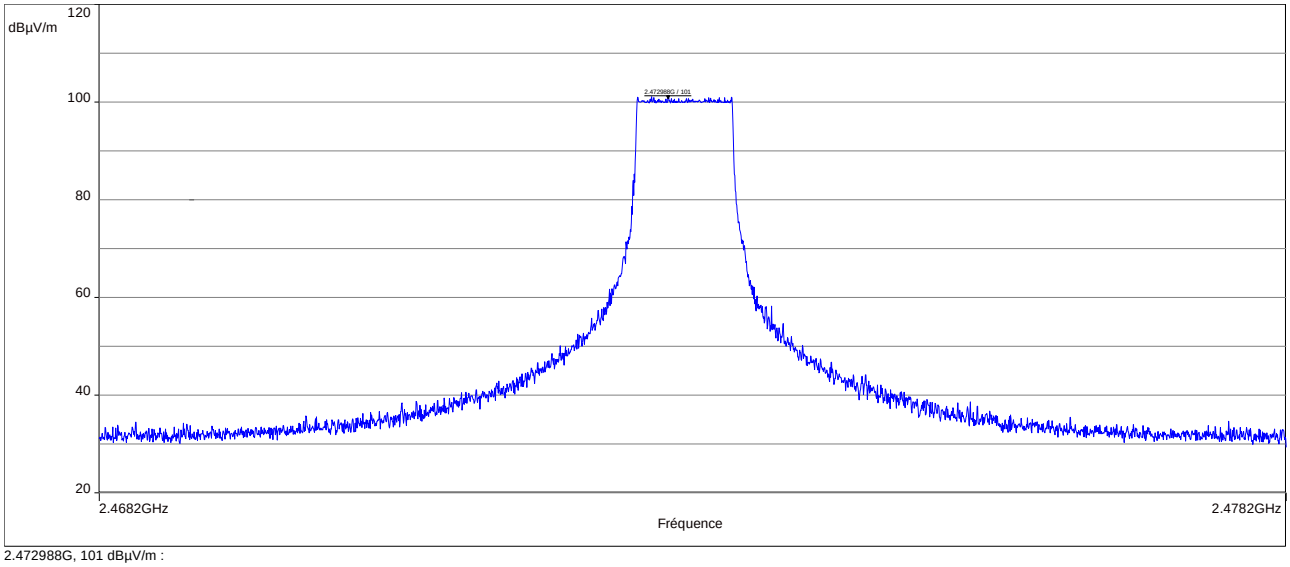
Sample N° 1 High Channel (F = 2473.2 MHz)

	Electro-magnetic field (dBµV/m):	Maximum Peak conducted power density (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage: 120 Vac	101	-4.14	8

Polarization of test antenna: vertical (height: 150 cm)
Position of equipment: Position 1 - (azimuth: 71 degrees)

Maximum Peak conducted power density:
EIRP(dBm / 3 kHz) = E (dBµV/m / 3 kHz) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 9.88 dBi.

Declared maximum antenna gain: 9.88 dBi



2.472988G, 101 dBµV/m :

Test conclusion:

RESPECTED STANDARD

☐☐☐ End of report, 2 appendixes to be forwarded ☐☐☐

APPENDIX 1: Test equipment list

AC Conducted emission

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	11535
Absorber sheath current	Emitech	10523
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
Antenna 3115	EMCO	8535
N-1.5M Cable	SUCOFLEX	7279
N-2M Cable	Huber + Suhner	12911
N-5M Cable	MecHANC	18413
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14903
Meteo station WS-9232	La Crosse Technology	8750
Software	RS Commander V2.4.2	//

Band edge

TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Turntable controller 1060C	MATURO	14736
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	EMCO	8535
Low-noise amplifier PAM-118A	COM-POWER	15812
N-1.5M Cable	SUCOFLEX	7279
N-2M Cable	Huber + Suhner	12911
N-5M Cable	MecHANC	18413
Attenuator 10dB	Midwest Microwave	8548
Power source 1251RP	California instruments	8508
Multimeter 177	Fluke	14903
Meteo station WS-9232	La Crosse Technology	8750

Peak conducted output power

TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Turntable controller 1060C	MATURO	14736
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	EMCO	8535
Low-noise amplifier PAM-118A	COM-POWER	15812
N-1.5M Cable	SUCOFLEX	7279
N-2M Cable	Huber + Suhner	12911
N-5M Cable	MecHANC	18413
Attenuator 10dB	Midwest Microwave	8548
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

Radiated spurious emissions

TYPE	MANUFACTURER	EMITECH NUMBER
Open test site	EMITECH	8732
Turntable and mat controller	EMITECH	8855
Anechoic Chamber	EMITECH	8593
Turntable controller 1060C	MATURO	14736
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 FSP40	Rohde & Schwarz	4088
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	7171
Log periodic antenna HL223	Rohde & Schwarz	7190
Antenna 3117	ETS-Lindgren	10771
Antenna SAS-572	A.H Systems	7124
Low-noise amplifier ZFL-1000LN	Mini-circuit	10730
Low-noise amplifier S005180M3201	LUCIX Corp.	12590
Low-noise amplifier DBLNA317202120S	QOTANA	19154
N-5M Cable	MecHANC	18413
N-1.5M Cable	SUCOFLEX	9398
N-2M Cable	SUCOFLEX	14303
N-5M Cable	SUCOFLEX	15883
N-2.5M Cable	H & S	15913
Cable k-20cm	STORM MICROWAE	8974
Cable k-100cm	MecHANC	18418
Low pass filter LP03/1000-7GH	Filtek	4087
Reject band filter BRM50702	Microtronics	7299
High pass filter F190270-001	HPF180400	16109
Multimeter 177	Fluke	14903
Power source 1251RP	California instruments	8508
Meteo station BAR 206	Oregon Scientific	14475
Meteo station 608-H1	Testo	7566
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.18.0.26	0000
Software	Champ libre Juigné. V3.5	8864

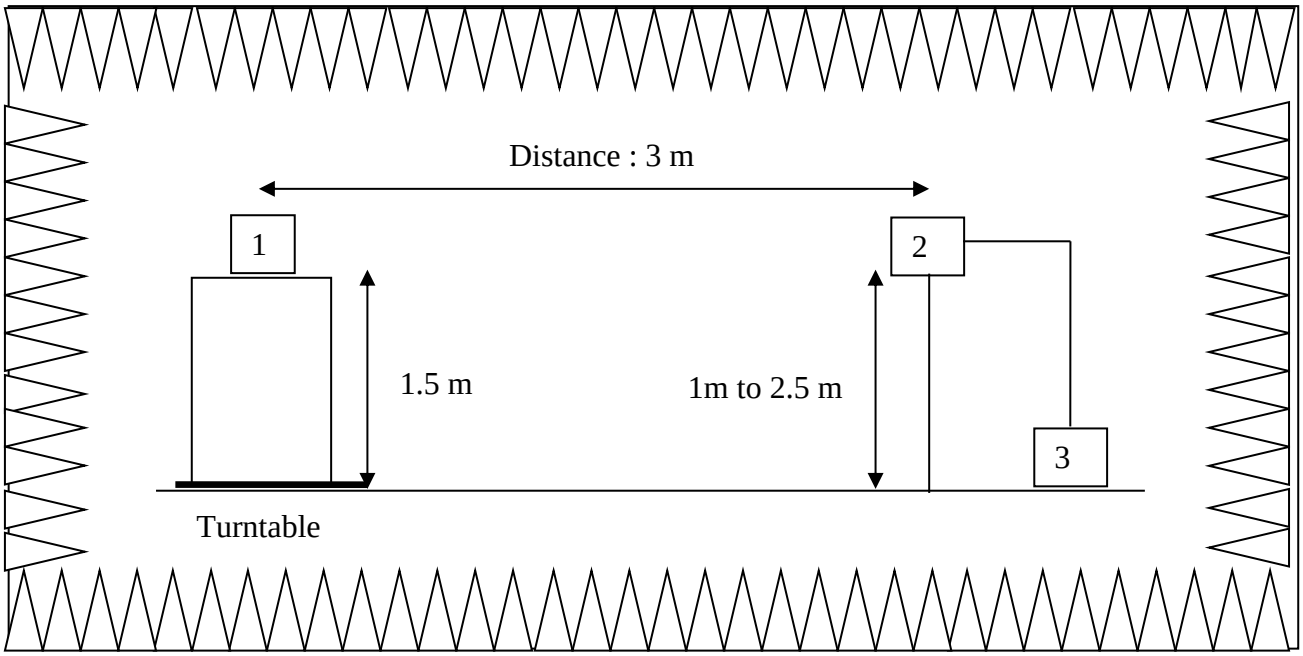
Peak conducted power spectral density

TYPE	MANUFACTURER	EMITECH NUMBER
Anechoic Chamber	EMITECH	8593
Turntable controller 1060C	MATURO	14736
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Antenna 3115	EMCO	8535
Low-noise amplifier PAM-118A	COM-POWER	15812
N-1.5M Cable	SUCOFLEX	7279
N-2M Cable	Huber + Suhner	12911
N-5M Cable	MecHANC	18413
Attenuator 10dB	Midwest Microwave	8548
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

APPENDIX 2: Radiated Test Setup

Anechoic chamber setup

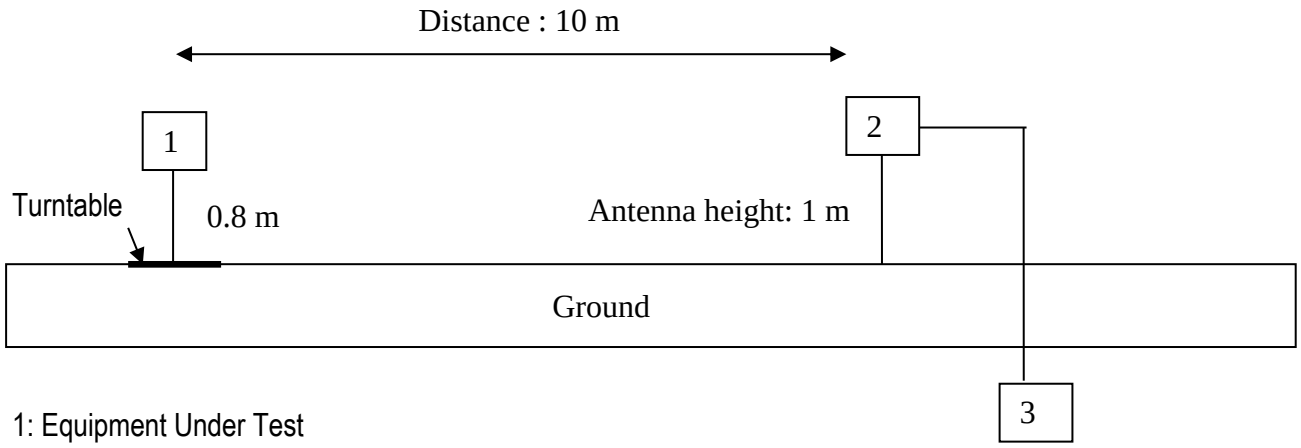
Above 1 GHz



1: Equipment Under Test
2: Measurement antenna
3: Measurement equipment

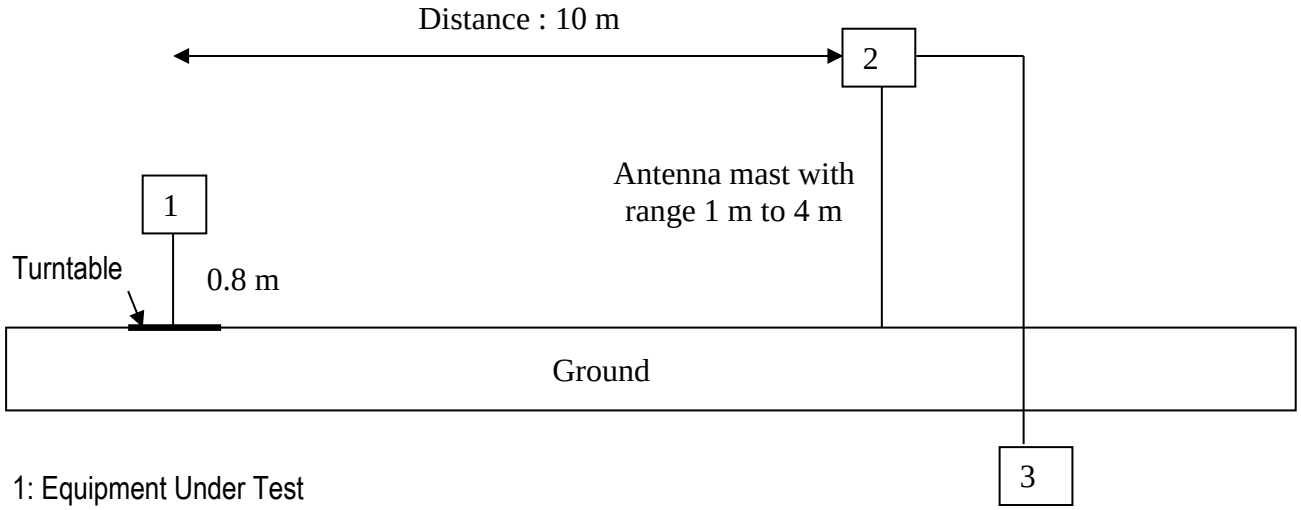
Open area setup

Below 30 MHz



1: Equipment Under Test
2: Measurement antenna
3: Measurement equipment

Between 30 MHz and 1 GHz



1: Equipment Under Test
2: Measurement antenna
3: Measurement equipment