

RRA- EMISS24D468ADE-04Av0

Certification Radio test report

According to the standard:

CFR 47 FCC PART 15

RSS GEN – Issue 5

RSS 247 – Issue 3

Equipment under test:

ARF52840

FCC ID: U3Z-ARF52840

IC NUMBER: 7016A-ARF52840

Company:

ADEUNIS

Distribution: Mr Emmanuel MONNET

(Company: ADEUNIS)

Number of pages: 35 with 2 appendixes

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval	
			Name and Function	Visa
0	10-Jan-25	Creation	J.C. BOGA, Laboratories Manager 	

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

DESIGNATION OF PRODUCT: ARF52840

Serial number (S/N): 8393AAAA244200014

Reference / model (P/N): ARF52840

Software version: Not communicated

MANUFACTURER: ADEUNIS

COMPANY SUBMITTING THE PRODUCT:

Company: ADEUNIS

Address: 283 rue Louis NEEL
38920 CROLLES
FRANCE

Responsible: Mr Emmanuel MONNET

DATE(S) OF TEST: From 13-Nov-24 to 15-Nov-24

TESTING LOCATION: EMITECH LYON laboratory at CHASSIEU (69) FRANCE

FCC Accredited under US-EU MRA Designation Number: FR0013
Test Firm Registration Number: 807590

ISED Accredited under CANADA-EU MRA Designation Number: FR0007
Industry Canada Registration Number: 4379D

TESTED BY: T. LEDRESSEUR

VISA:



WRITTEN BY: T. LEDRESSEUR

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REVISIONS HISTORY

Revision	Date	Modified pages	Modifications
0	20-Dec-24	/	Creation

1. INTRODUCTION

This report presents the results of radio test carried out on the following radio equipment: **ARF52840** , in accordance with normative reference.

The equipment under test is a Bluetooth Low Energy radio module

2. PRODUCT DESCRIPTION

Category of equipment (ISED): I

Class: B

Utilization: Residential use

Antenna type and gain: 0.1 dBi / integral antenna PCB

Operating frequency range: From 2400 MHz to 2483.5 MHz

Number of channels: 40

Channel spacing: 2MHz

Modulation: GFSK

Test frequencies:

Frequencies tested:

Sample N°= 1 ⇒ 2402 MHz Full tests

Sample N°= 1 ⇒ 2440 MHz Full tests

Sample N°= 1 ⇒ 2480 MHz Full tests

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 (2024)	Radio Frequency Devices
ANSI C63.10	2013 Procedures for Compliance Testing 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 212: Modular transmitter
- 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	/	/	/
5609	EMCO 3146A	Log periodic antenna	14/12/2021	3	14/12/2024
6118	Rohde et Schwarz HK116	Biconical antenna	14/12/2021	3	14/12/2024
6217	Rohde & Schwarz ESH3-Z5	LISN	27/07/2024	1	27/07/2025
6290	HAEFELY PHF555	Power source	(1)	(1)	(1)
6970	Schwarzbeck BBHA 9120D	Antenna	16/12/2021	3	16/12/2025
7564	La Crosse Technology WS-9232	Meteo station	09/06/2023	2	09/06/2025
7651	SIDT Cage	Anechoic chamber	/	/	/
8590	AEMC N-6m	Cable	23/02/2023	2	23/02/2025
10262	Agilent Technologies 8449B	Low-noise amplifier	27/02/2024	1	27/02/2025
10952	Agilent 34401A	Multimeter	21/07/2023	2	21/07/2025
11316	Agilent N9010A	Receiver	05/09/2024	1	05/09/2025
11588	Rohde et Schwarz NRP-Z86	Power Sensor	07/03/2024	2	07/03/2026
11855	EMITECH	Outside room	/	/	/
12492	Weinschel 10dB 18GHz 2W	Attenuator	26/02/2024	3	26/02/2027
15775	RFPA INT-BA011000-25	Low-noise amplifier	29/02/2024	1	29/02/2025
15776	Rohde & Schwarz FSV40	Spectrum Analyzer	22/02/2024	1	22/02/2025
15790	Testo 608-H1	Meteo station	20/11/2023	1	20/11/2024
15892	HUBER et SUHNER N 18GHz 3m	Cable	31/05/2023	2	31/05/2025
15893	HUBER et SUHNER SMA 18GHz 3m	Cable	31/05/2023	2	31/05/2025
15916	HUBER et SUHNER SMA 18GHz 3.5m	Cable	31/05/2023	2	31/05/2025
15933	HUBER et SUHNER SMA 18GHz 5m	Cable	31/05/2023	2	31/05/2025
16115	Agilent 6655A	Power source	(1)	(1)	(1)
17207	COM-POWER LIT-930A	Transient limiter	02/09/2022	3	02/09/2025
17829	Emitech	Absorber sheath current	01/06/2023	2	01/06/2025
19038	YUN Micro Electronics MH1000-15000-17CS	High pass filter	28/04/2023	3	28/04/2026
///	Rohde et Schwarz Power Viewer Plus V5.9	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				Note 3
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 4
	(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				
	(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 without standard connector.

Note 2: See FCC part 15.247 (d).

Note 3: Single modular transmitter.

Note 4: 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 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-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				
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

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

8. AC CONDUCTED EMISSIONS

Temperature (°C) : 20 to 22

Humidity (%HR): 40 to 46

Date : November 13, 2024 to
November 15, 2024

Technician : T. LEDRESSEUR

Standard: FCC Part 15
RSS-Gen

Test procedure:

For FCC Part 15: Paragraph 15.207

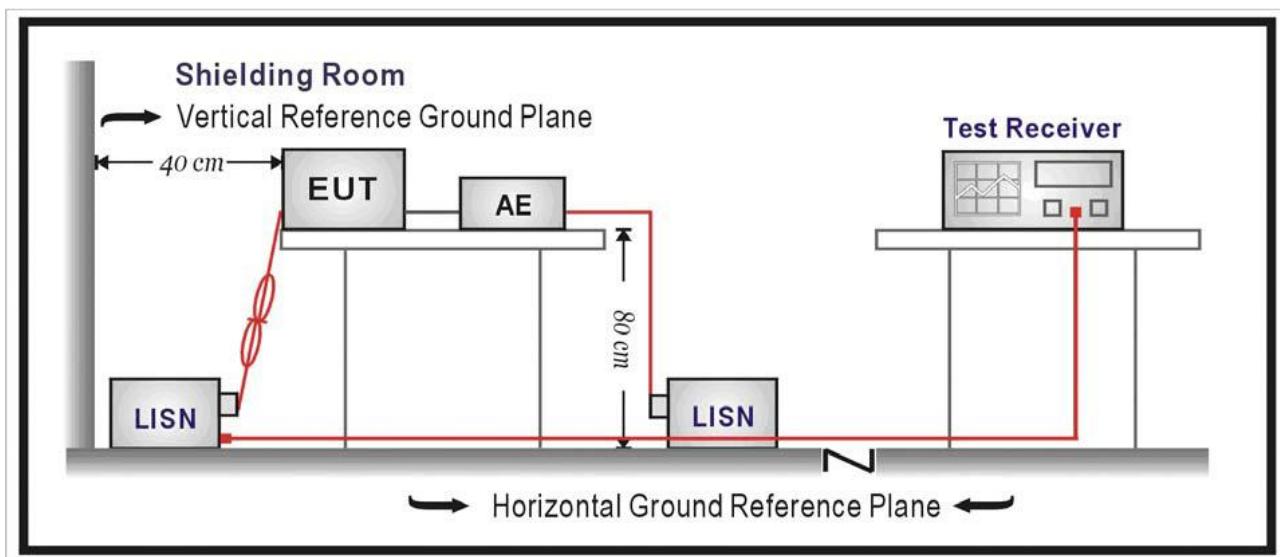
For RSS-Gen: Paragraph 8.8

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.

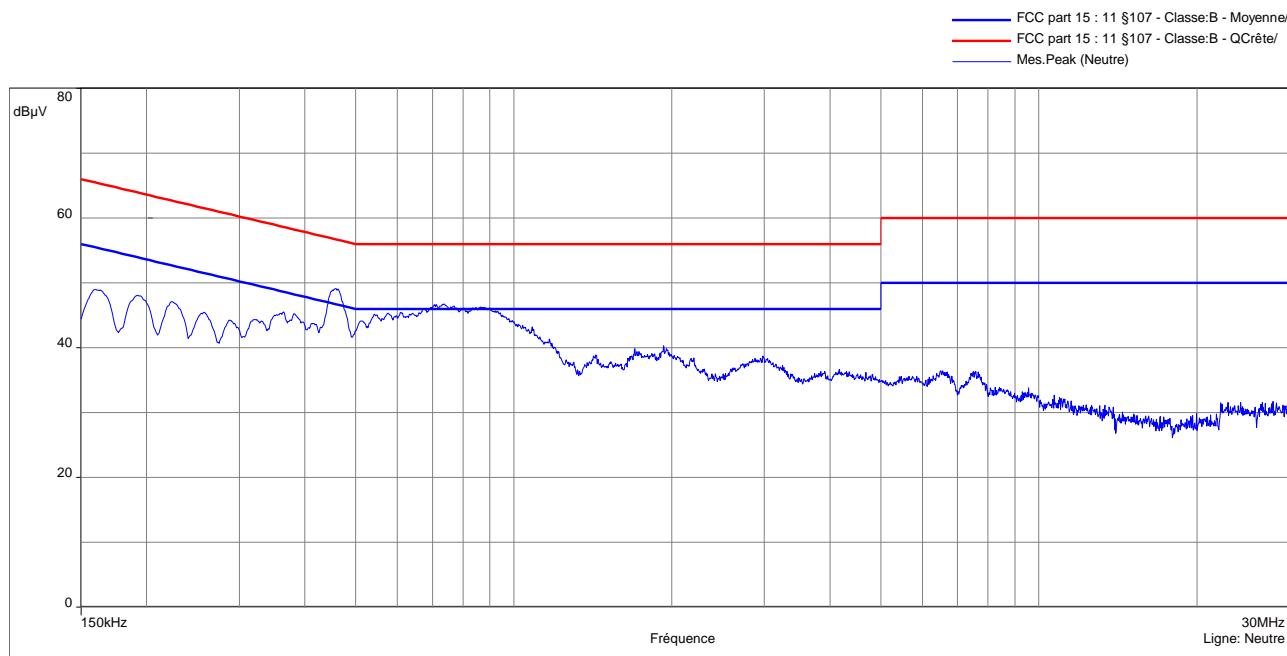
Results:

Sample N° 1:

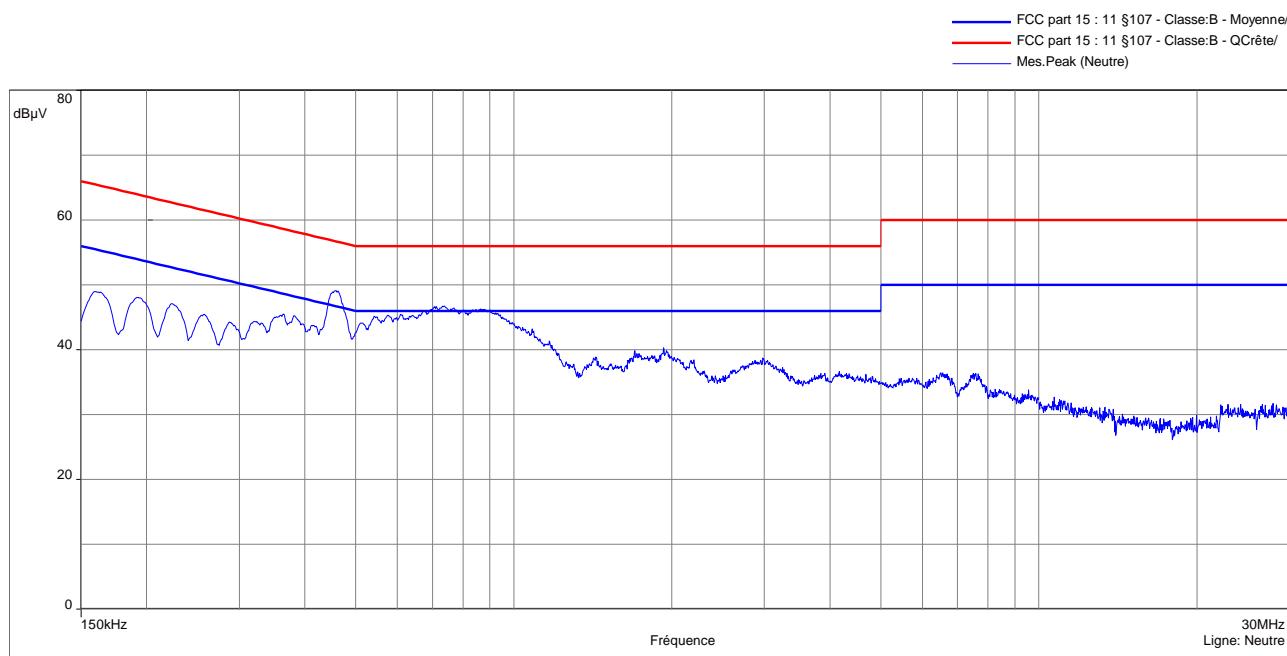
Measurement on the mains power supply:

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	Quasi-peak	QP Limit	QP margin
(MHz)	(dB μ V)	(dB μ V)	(dB)
0.163	46.68	65.3	18.61
0.192	47.44	63.9	16.49
0.223	45.55	62.7	17.14
0.257	43.29	61.5	18.23
0.322	41.67	59.7	17.99
0.364	36.87	58.6	21.76
0.382	42.42	58.2	15.82
0.458	44.87	56.7	11.86
0.575	42.85	56.000	13.150
0.609	42.82	56.000	13.180
0.736	44.03	56.000	11.970
0.865	42.65	56.000	13.350

Frequency	Average	Average Limit	Average margin
(MHz)	(dB μ V)	(dB μ V)	(dB)
0.163	33.15	55.3	22.14
0.192	35.5	53.9	18.43
0.223	33.46	52.7	19.23
0.257	28.92	51.5	22.60
0.322	30	49.7	19.66
0.364	29.07	48.6	19.56
0.382	36.73	48.2	11.51
0.458	39.81	46.7	6.92
0.575	34.22	46.000	11.780
0.609	34.33	46.000	11.670
0.736	35.79	46.000	10.210
0.865	33.79	46.000	12.210

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

Frequency	Quasi-peak	QP Limit	QP margin
(MHz)	(dB μ V)	(dB μ V)	(dB)
0.154	58.56	65.8	7.24
0.179	48.82	64.5	15.73
0.204	50.43	63.4	13.01
0.353	41.82	58.9	17.07
0.382	41.01	58.2	17.22
0.457	40.75	56.7	16.00
0.694	40.7	56.000	15.300
0.833	42.99	56.000	13.010
0.913	40.54	56.000	15.460

Frequency	Average	Average Limit	Average margin
(MHz)	(dB μ V)	(dB μ V)	(dB)
0.154	40.83	55.8	14.97
0.179	31.23	54.5	23.32
0.204	34.41	53.4	19.03
0.353	31.83	48.9	17.06
0.382	32.14	48.2	16.09
0.457	32.6	46.7	14.15
0.694	28.28	46.000	17.720
0.833	29.78	46.000	16.220
0.913	28.74	46.000	17.260

Test conclusion:

RESPECTED STANDARD

9. OCCUPIED BANDWIDTH

Temperature (°C) : 20 to 22

Humidity (%HR): 40 to 46

Date : November 13, 2024 to
November 15, 2024

Technician : T. LEDRESSEUR

Standard: FCC Part 15
RSS-247

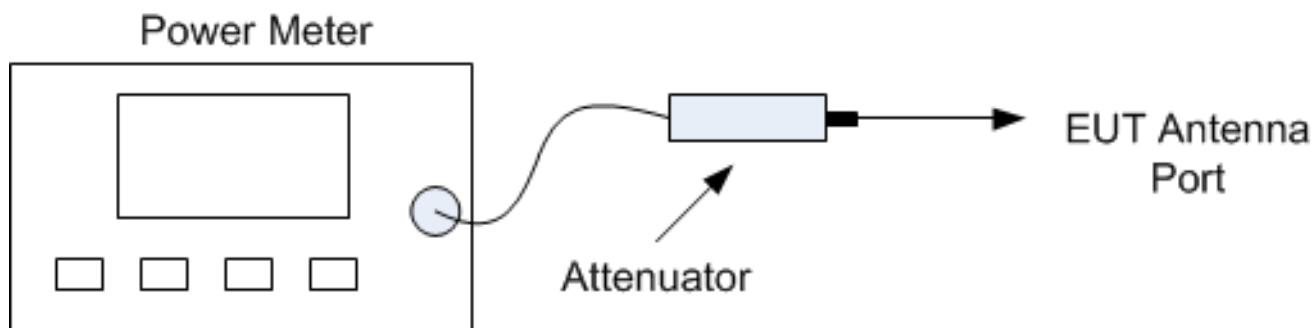
Test procedure:

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:

Radiated test

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	

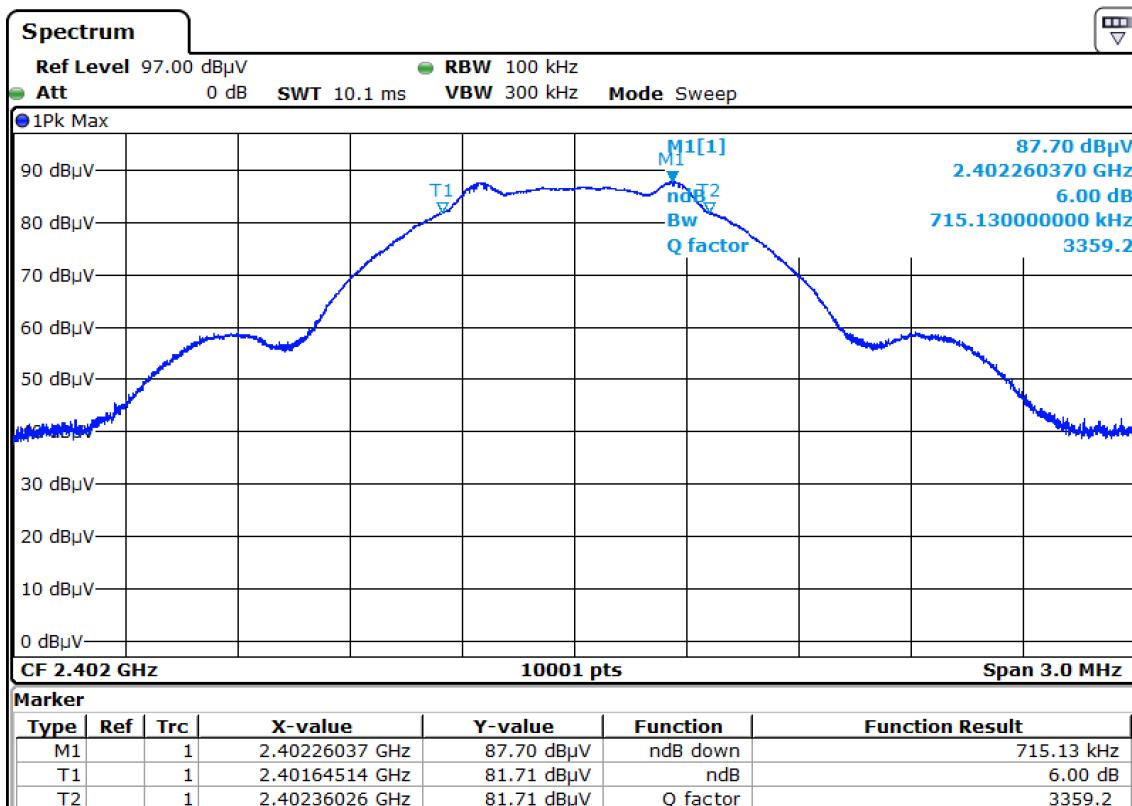
Test operating condition of the equipment:

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.

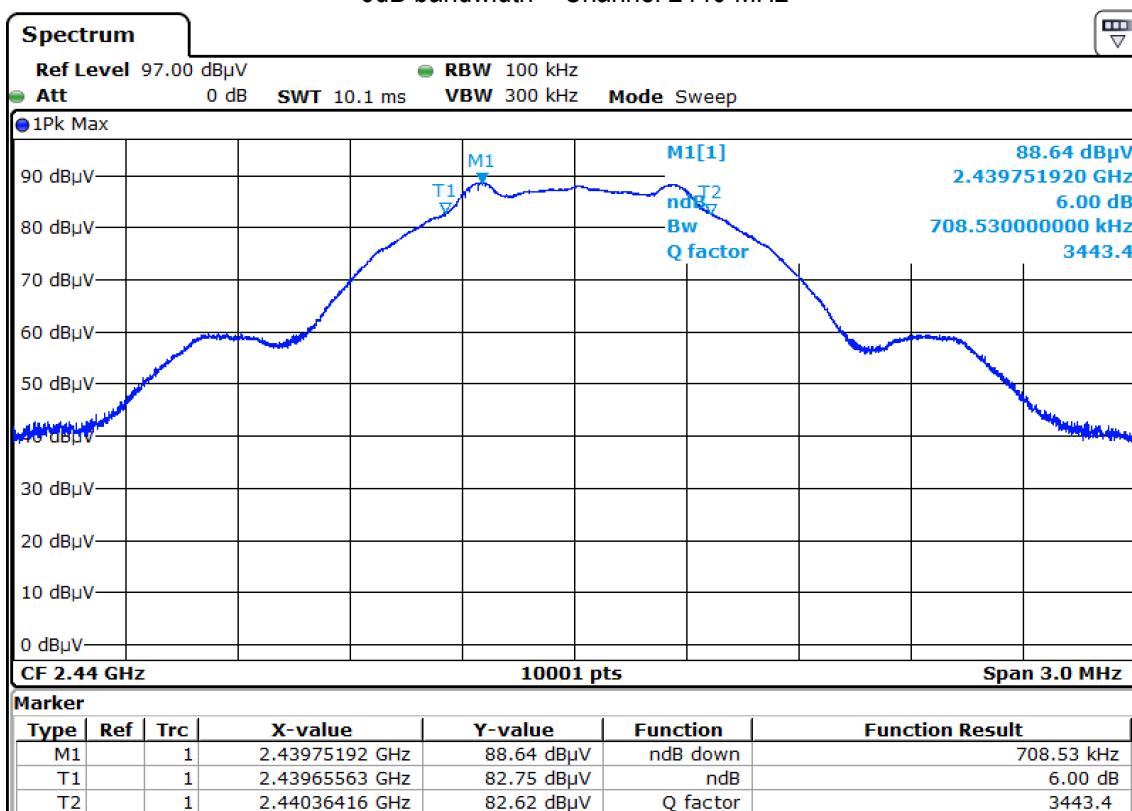
Results:

Sample N° 1

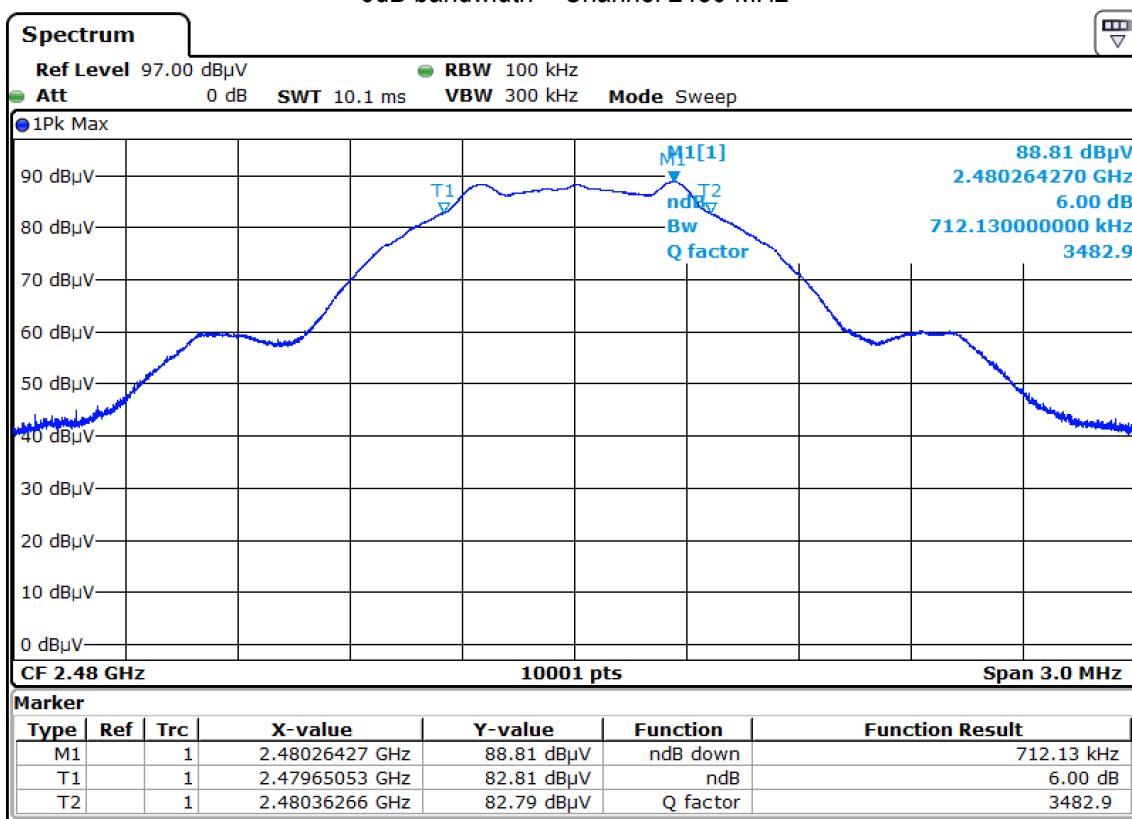
6dB bandwidth – Channel 2402 MHz



6dB bandwidth – Channel 2440 MHz



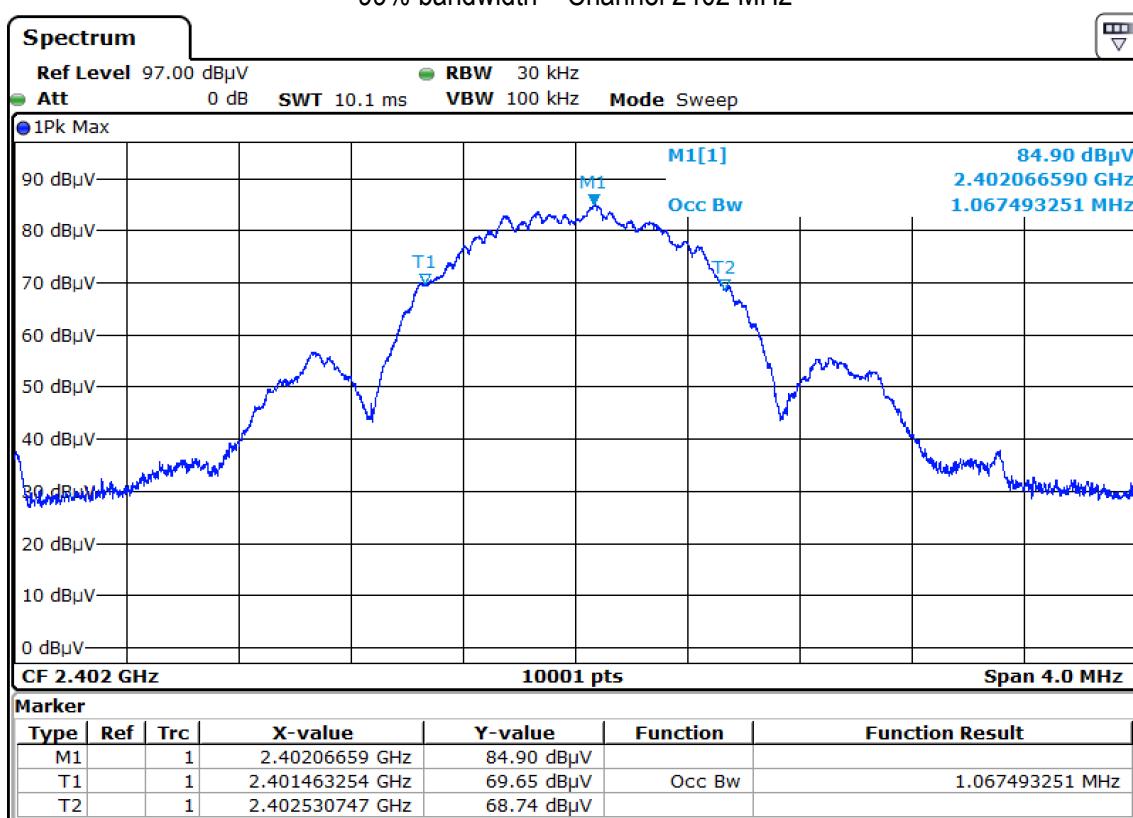
6dB bandwidth – Channel 2480 MHz



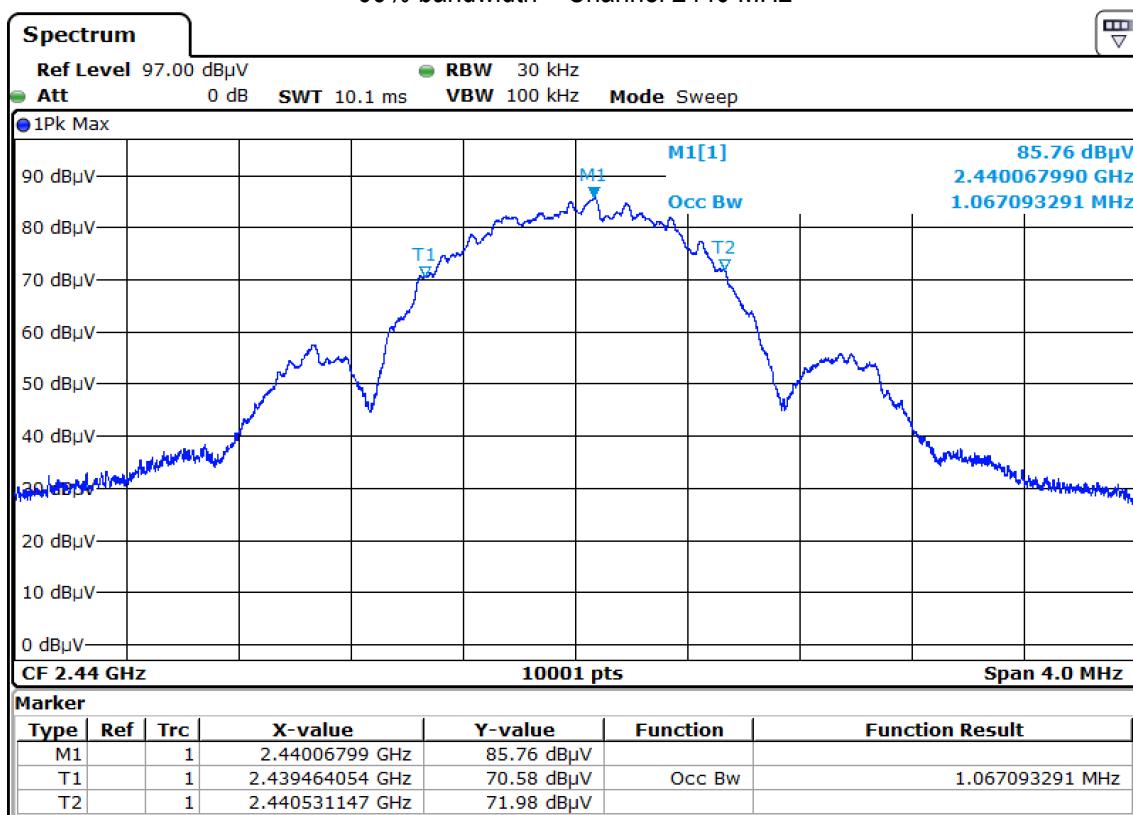
Limit:

Shall be at least 500 kHz

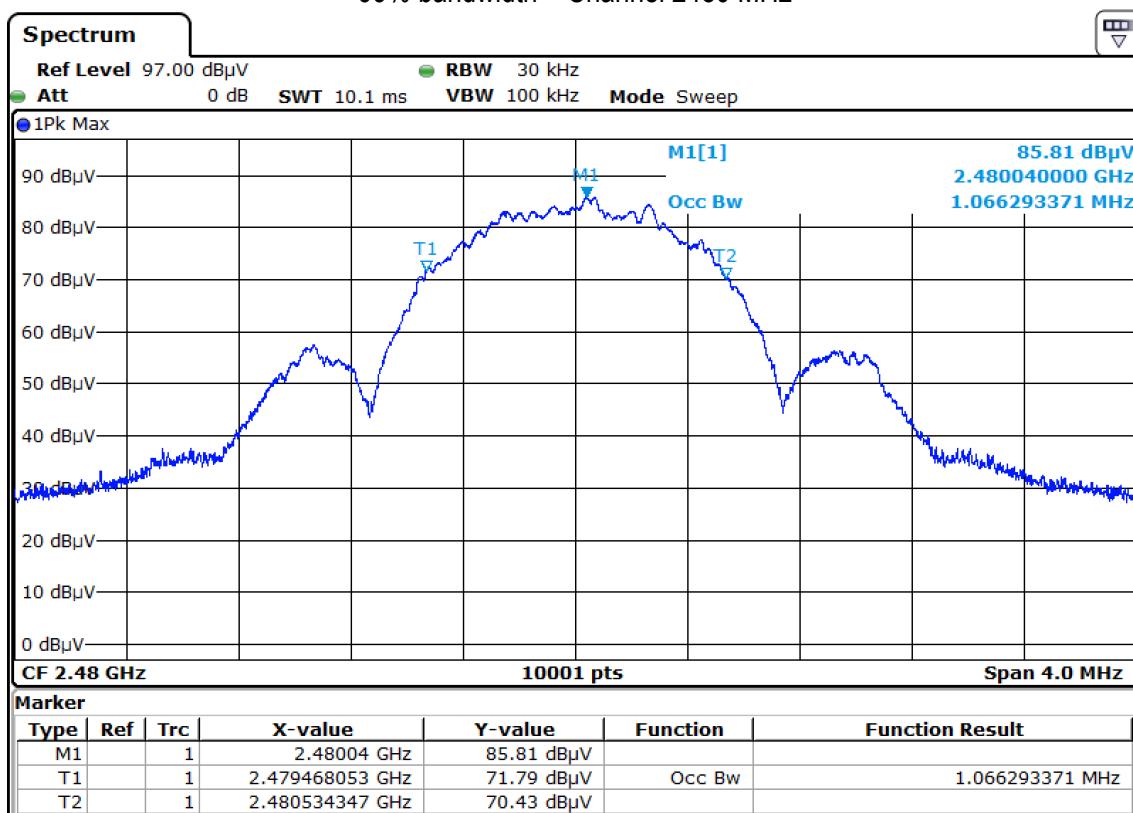
99% bandwidth – Channel 2402 MHz



99% bandwidth – Channel 2440 MHz



99% bandwidth – Channel 2480 MHz



Measure realized for reporting only

Test conclusion:

RESPECTED STANDARD

10. BAND EDGE
Temperature (°C) : 20 to 22
Humidity (%HR): 40 to 46
**Date : November 13, 2024 to
November 15, 2024**
Technician : T. LEDRESSEUR
**Standard: FCC Part 15
RSS-247**
Test procedure:

Method of paragraph 11.13.2 of ANSI C63.10

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.

Results:

Lower Band Edge: From 2398 MHz to 2400 MHz

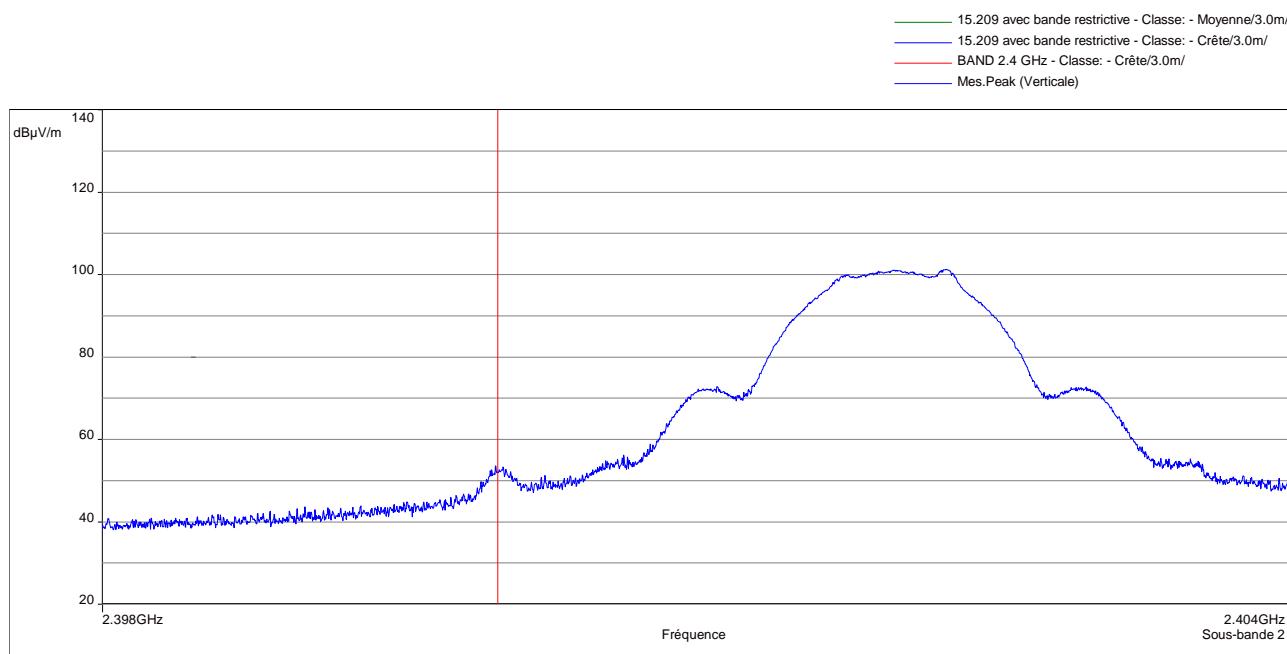
Upper Band Edge: From 2483.5 MHz to 2485.5 MHz

Sample N° 1

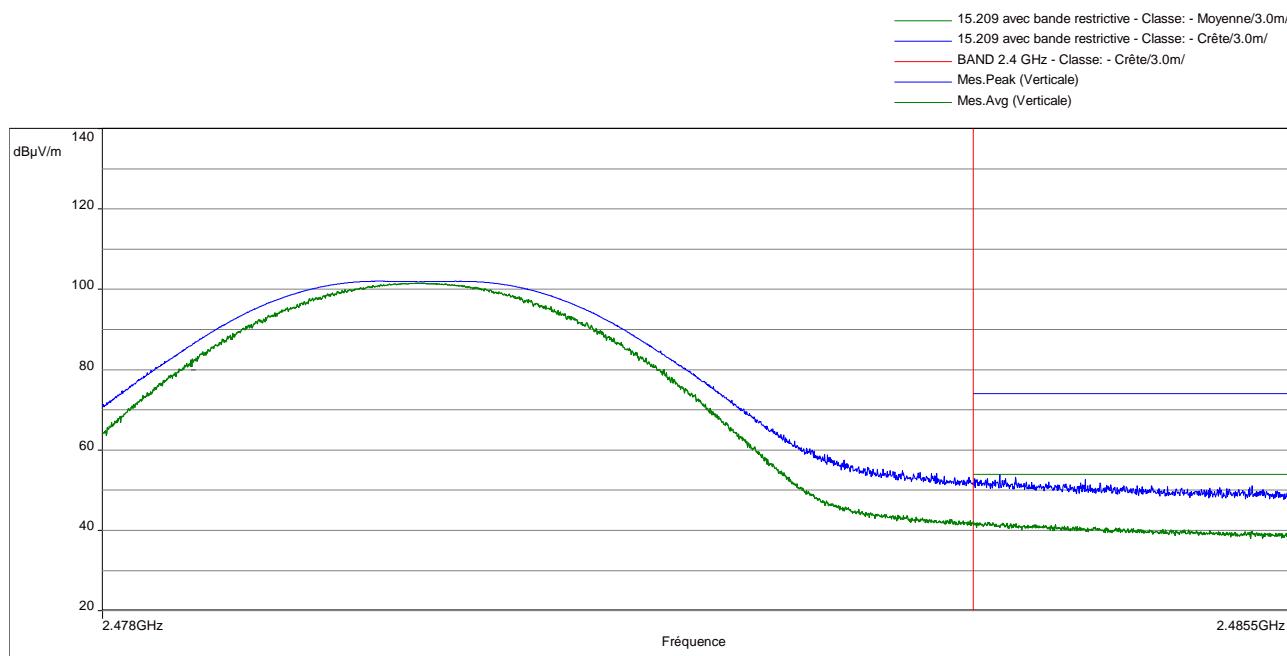
Fundamental frequency (MHz)	Field Strength Level of fundamental (dB μ V/m)	RBW (kHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Calculated Max Out-of-Band Emission Level (dB μ V/m) (1)	Limit (dB μ V/m)	Margin (dB)
2402	100.9	100	Peak	2399.98	53.54	80.9	27.36
2480	102.03	1000	Peak	2483.66	53.9	74	20.1
2480	101.52	1000	Average	2483.59	42.05	54	11.95

(1) Marker-Delta method

Low channel



High channel



Test conclusion:

RESPECTED STANDARD

11. PEAK OUTPUT POWER**Temperature (°C) :** 20 to 22**Humidity (%HR):** 40 to 46**Date :** November 13, 2024 to
November 15, 2024**Technician :** T. LEDRESSEUR**Standard:** FCC Part 15
RSS-247**Test procedure:**

For FCC Part 15: paragraph 15.247 (b)

For RSS-247: paragraph 5.4

RBW \geq 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 three orthogonal planes.

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 to 4 meters**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.

Finally the radiated electro-magnetic field is converted in dBm with the following formula:

$EIRP(\text{dBm}) = E(\text{dB}\mu\text{V/m}) + 20\log(D) - 104.8$; where D is the measurement distance in meters and antenna Gain = 0 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.

Results:

Sample N° 1 F = 2402 MHz

	Electro-magnetic field (dB μ V/m):	Maximum Peak conducted output power (1)		Limit (W)	Maximum Peak EIRP		Limit (W)
		(dBm)	(W)		(dBm)	(W)	
Nominal supply voltage:	101.3	5.94	0.0039	1	6.04	0.0040	4

Polarization of test antenna: horizontal (height: 150 cm)

Position of equipment: 2 (azimuth: 12 degrees)

Maximum Peak conducted output power:

$EIRP(dBm) = E(dB\mu V/m) + 20\log(D) - 104.8 - G$; where D is the measurement distance in meters and antenna Gain = 0.1 dBi.

Sample N° 1 F = 2440 MHz

	Electro-magnetic field (dB μ V/m):	Maximum Peak conducted output power (1)		Limit (W)	Maximum Peak EIRP		Limit (W)
		(dBm)	(W)		(dBm)	(W)	
Nominal supply voltage:	102.15	6.79	0.0048	1	6.89	0.0049	4

Polarization of test antenna: horizontal (height: 150 cm)

Position of equipment: 2 (azimuth: 12 degrees)

Maximum Peak conducted output power:

$EIRP(dBm) = E(dB\mu V/m) + 20\log(D) - 104.8 - G$; where D is the measurement distance in meters and antenna Gain = 0.1 dBi.

Sample N° 1 F = 2480 MHz

	Electro-magnetic field (dB μ V/m):	Maximum Peak conducted output power (1)		Limit (W)	Maximum Peak EIRP		Limit (W)
		(dBm)	(W)		(dBm)	(W)	
Nominal supply voltage:	101.96	6.6	0.0046	1	6.7	0.0047	4

Polarization of test antenna: horizontal (height: 150 cm)

Position of equipment: 2 (azimuth: 12 degrees)

Maximum Peak conducted output power:

EIRP(dBm) = E (dB μ V/m) + 20log(D) - 104.8 - G; where D is the measurement distance in meters and antenna Gain = 0.1 dBi.

Test conclusion:

RESPECTED STANDARD

12. RADIATED SPURIOUS EMISSIONS

Temperature (°C) : 20 to 22

Humidity (%HR): 40 to 46

Date : November 13, 2024 to
November 15, 2024

Technician : T. LEDRESSEUR

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 two orthogonal planes.

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

Below 1 GHz, the EUT is placed on a rotating table, 0.8m from a ground plane.

Above 1 GHz, 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

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: 3 meters (in anechoic room)

Antenna height: 1 to 4 meters

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.

Results:
Sample N° 1 F = 2402 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
2298.29 (1)	P	1000	H	46.9 (3)	74	27.1
2354.05 (1)	P	1000	H	47.06 (3)	74	26.94
2370.37 (1)	P	1000	H	48.17 (3)	74	25.83
2394.34	P	100	H	50.31	80.9	30.59
2489.71 (1)	P	1000	H	45.83 (2) (3)	74	28.17
4804 (1)	P	1000	V	41.99 (2) (3)	74	32.01
7206	P	100	V	46.89 (2)	80.9	34.01
9608	P	100	V	49.24(2)	80.9	31.66
12010 (1)	P	1000	H	54.3	74	19.7
12010 (1)	Av	1000	H	41.3	54	12.7

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

(1) Restricted bands of operation in 15.205 and Table 6 of RSS-Gen

(2) Noise floor

(3) The peak level is lower than the average limit (54 dB μ V/m)

Sample N° 1 F = 2440 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
2312.23 (1)	P	1000	H	47.32 (3)	74	26.68
2352.35 (1)	P	1000	H	47.07 (3)	74	26.93
2391.96	P	100	H	47.06	81.85	34.79
2487.84 (1)	P	1000	H	47.12 (3)	74	26.88
4880 (1)	P	1000	V	42.12 (2) (3)	74	31.88
7320 (1)	P	1000	V	47.25 (2) (3)	74	26.75
9760	P	100	V	49.53 (2)	81.85	32.32
12200 (1)	P	1000	H	58.79	74	15.21
12200 (1)	Av	1000	H	45.98	54	8.02

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

(1) Restricted bands of operation in 15.205 and Table 6 of RSS-Gen

(2) Noise floor

(3) The peak level is lower than the average limit (54 dB μ V/m)

Sample N° 1 F = 2480 MHz

Frequencies (MHz)	Detector P QP Av	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3 m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
2336.2 (1)	P	1000	H	47.82 (3)	74	26.18
2360.34 (1)	P	1000	H	49 (3)	74	25
2376.83 (1)	P	1000	H	51.88 (3)	74	22.12
2392.3	P	100	H	48.3	81.55	33.25
2488.01 (1)	P	1000	H	51.53 (3)	74	22.47
4960 (1)	P	1000	V	42.23 (2) (3)	74	31.77
7440 (1)	P	1000	V	47.35 (2) (3)	74	26.65
9920	P	100	V	49.78 (2)	81.55	31.77
12400 (1)	P	1000	H	59.58	74	14.42
12400 (1)	Av	1000	H	47.65	54	6.35

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

(1) Restricted bands of operation in 15.205 and Table 6 of RSS-Gen

(2) Noise floor

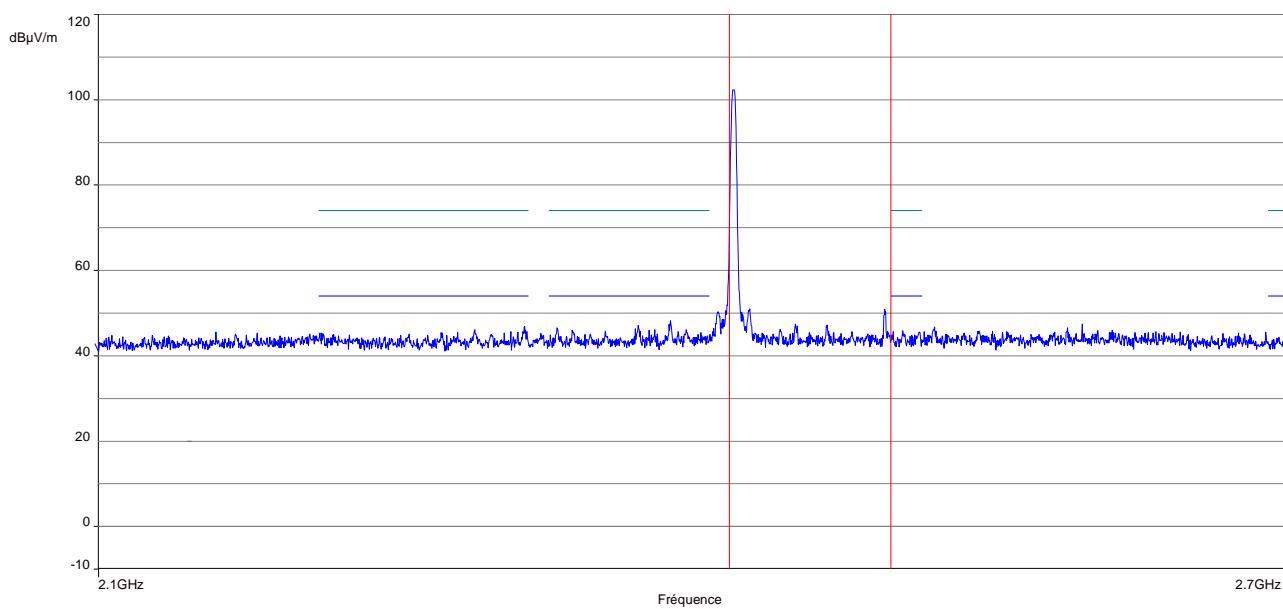
(3) The peak level is lower than the average limit (54 dB μ V/m)

Band edge worst-case measurement on worst critical positions

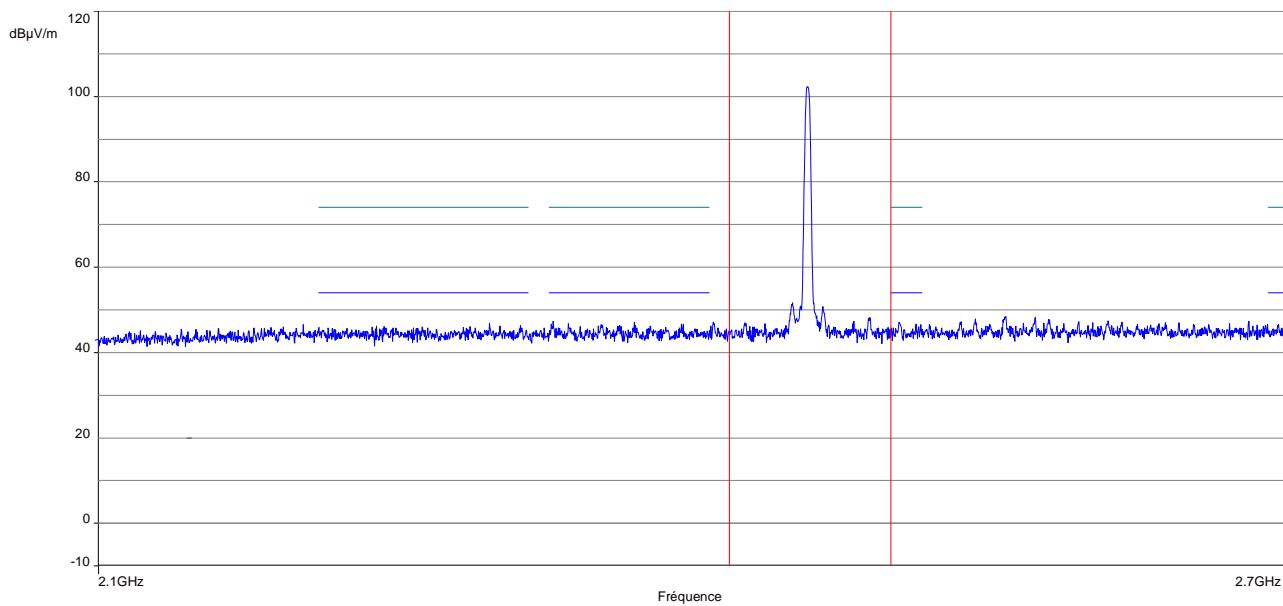
LEGEND:

- Blue curve represent measure with a peak detector obtained with 1 MHz
- Blue line is the average limit.
- Green line is the peak limit.
- Vertical red lines are the limits of the band. (2400 to 2483.5MHz)

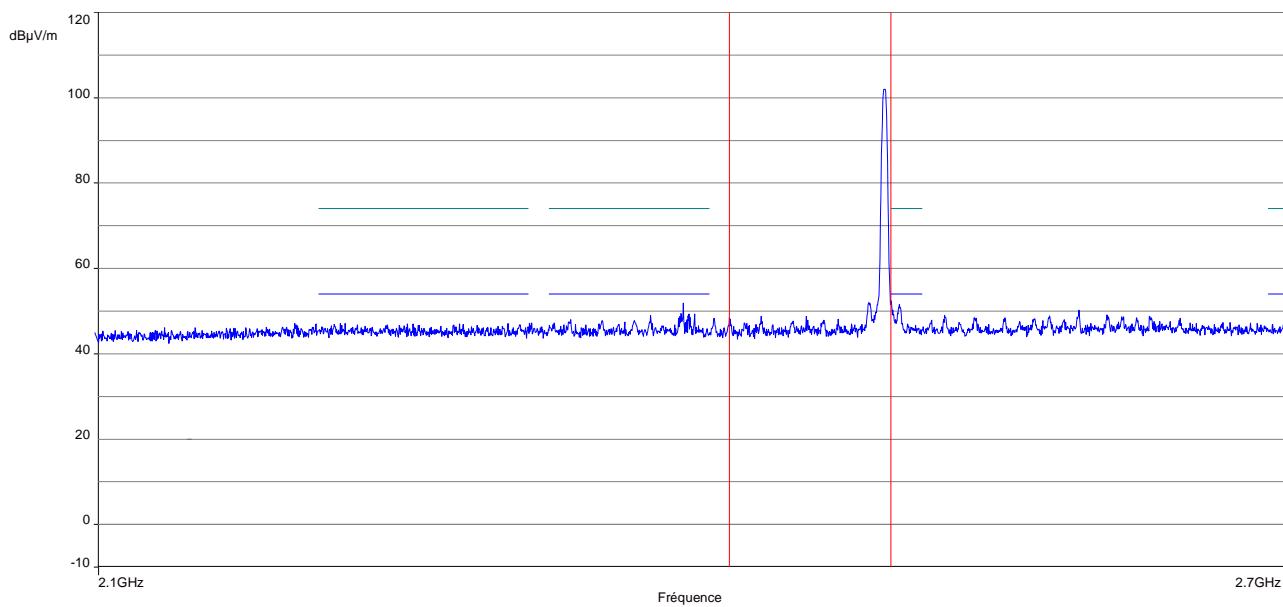
Sample N° 1 F = 2402 MHz



Sample N° 1 F = 2440 MHz



Sample N° 1 $F = 2480 \text{ MHz}$



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.

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.

Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

Test conclusion:

RESPECTED STANDARD

13. PEAK POWER SPECTRAL DENSITY

Temperature (°C) : 20 to 22

Humidity (%HR): 40 to 46

Date : November 13, 2024 to
November 15, 2024

Technician : T. LEDRESSEUR

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 three orthogonal planes.

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 to 4 meters

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	4 MHz
RBW	3 kHz
VBW	10 kHz
detector	Peak
Points	10000
Trace mode	Max hold

Then the peak marker function is used.

Finally the radiated electro-magnetic field is converted in dBm with the following formula:

$EIRP(\text{dBm}) = E(\text{dB}\mu\text{V/m}) + 20\log(D) - 104.8$; where D is the measurement distance in meters and antenna Gain = 0 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.

Results:

Sample N° 1 $F = 2402 \text{ MHz}$

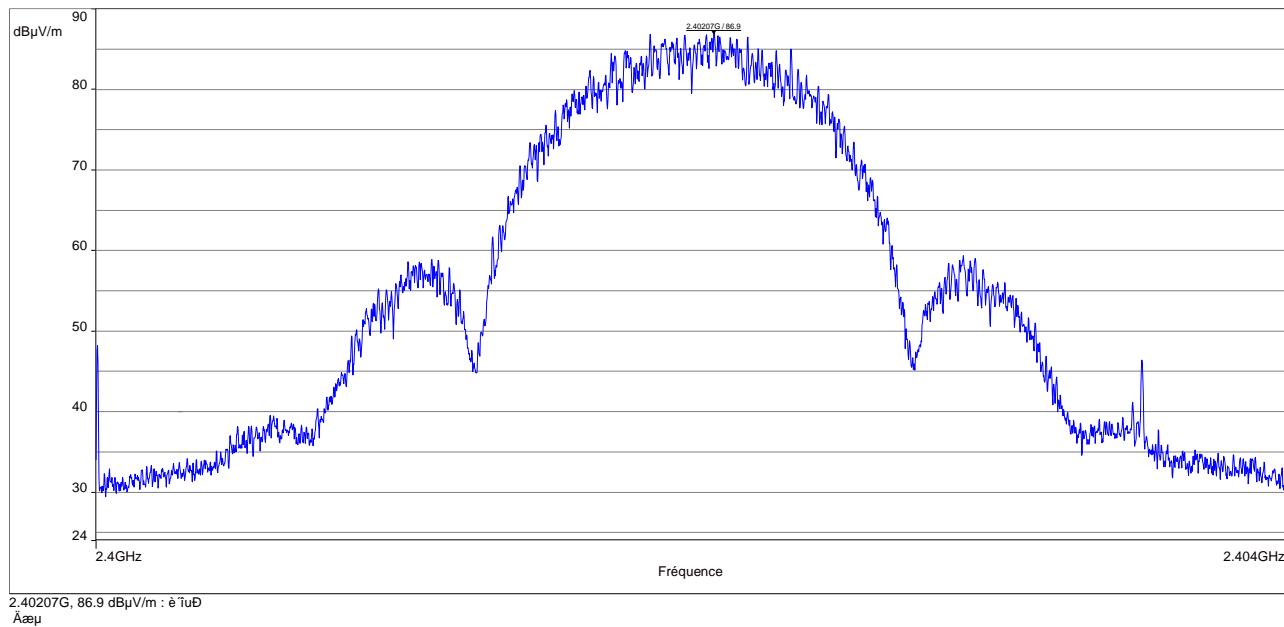
	Electro-magnetic field (dB μ V/m):	Maximum Peak conducted power density(1) (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	86.9	-8.5	8

Polarization of test antenna: horizontal (height: 150 cm)

Position of equipment: 2 (azimuth: 12 degrees)

Maximum Peak conducted power density:

$EIRP(\text{dBm} / 3 \text{ kHz}) = E (\text{dB}\mu\text{V/m} / 3 \text{ kHz}) + 20\log(D) - 104.8 - G$; where D is the measurement distance in meters and antenna Gain = 0.1 dBi.



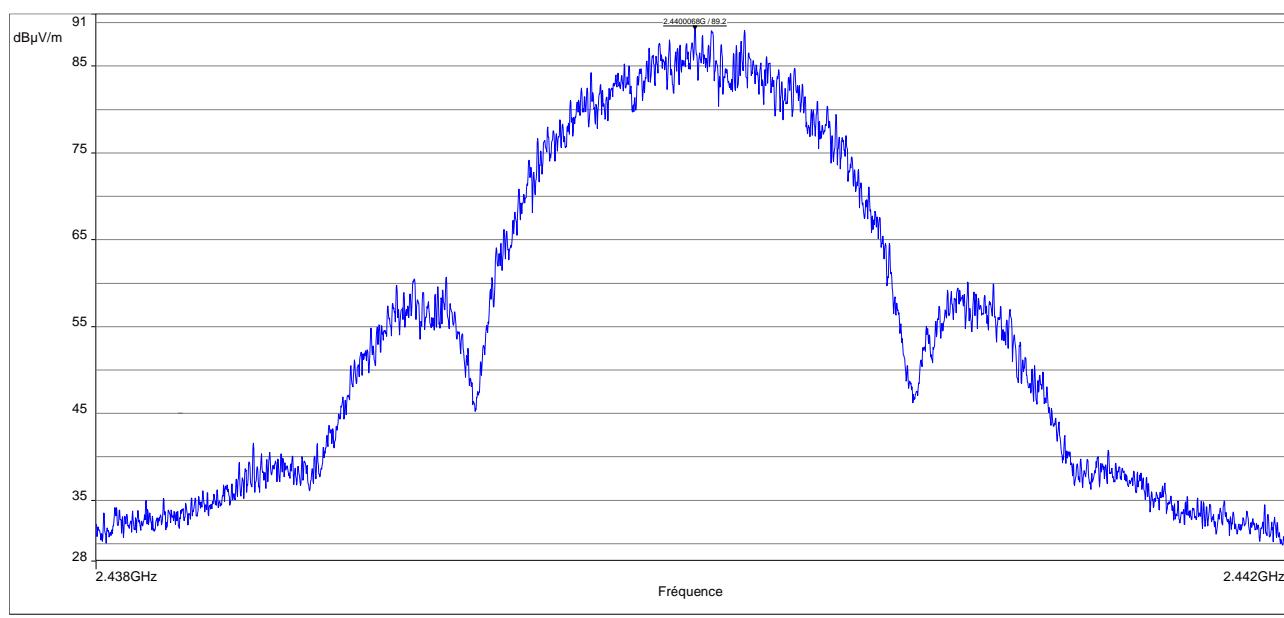
Sample N° 1 $F = 2440 \text{ MHz}$

	Electro-magnetic field (dB μ V/m):	Maximum Peak conducted power density(1) (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	89.2	-6.2	8

Polarization of test antenna: horizontal (height: 150 cm)

Position of equipment: 2 (azimuth: 12 degrees)

Maximum Peak conducted power density:

 $EIRP(\text{dBm} / 3 \text{ kHz}) = E (\text{dB}\mu\text{V/m} / 3 \text{ kHz}) + 20\log(D) - 104.8 - G$; where D is the measurement distance in meters and antenna Gain = 0.1 dBi.

2.4400068G, 89.2 dB μ V/m : è "uD •

Sample N° 1 $F = 2480 \text{ MHz}$

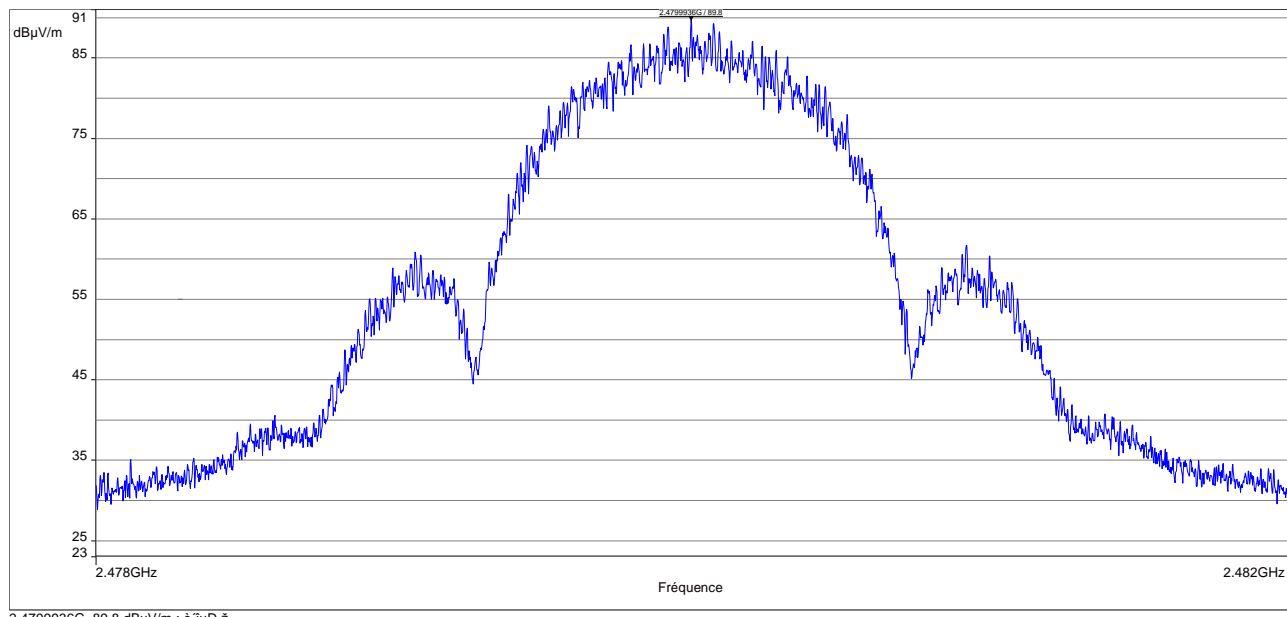
	Electro-magnetic field (dB μ V/m):	Maximum Peak conducted power density(1) (dBm / 3 kHz)	Limit (dBm / 3 kHz)
Nominal supply voltage:	89.8	-5.6	8

Polarization of test antenna: horizontal (height: 150 cm)

Position of equipment: 2 (azimuth: 12 degrees)

Maximum Peak conducted power density:

$EIRP(\text{dBm} / 3 \text{ kHz}) = E (\text{dB}\mu\text{V/m} / 3 \text{ kHz}) + 20\log(D) - 104.8 - G$; where D is the measurement distance in meters and antenna Gain = 0.1 dBi.



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	Emitech	11855
Test receiver N9010A	Agilent	11316
Transient limiter LIT-930A	COM-POWER	17207
LISN ESH3-Z5	Rohde & Schwarz	6217
Absorber sheath current	Emitech	17829
Cable N-6m	AEMC	8590
Power source PHF555	HAEFELY	6290
Multimeter 34401A	Agilent	10952
Meteo station 608-H1	Testo	15790
Software	BAT-EMC V3.18.0.26	0000

Occupied bandwidth

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum Analyzer FSV40	Rohde & Schwarz	15776
Attenuator 10dB 18GHz 2W	Weinschel	12492
Multimeter 177	Fluke	19114
Meteo station 608-H1	Testo	15790

Band edge

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum Analyzer FSV40	Rohde & Schwarz	15776
Anechoic Chamber	EMITECH	7651
Antenna BBHA 9120B	Schwarzbeck	6970
Low-noise amplifier 8449B	Agilent Technologies	10262
Cable N-3m	Huber + Suhner	15892
Cable SMA-3m	Huber + Suhner	15893
Cable SMA-3m	Huber + Suhner	15916
Cable SMA-4m	Huber + Suhner	15933
High pass filter HP12/1200-5AA	Filtek	7302
Multimeter 177	Fluke	19114
Meteo station WS-9232	La Crosse Technology	7564
Software	BAT-EMC V3.18.0.26	0000

Conducted output power

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum Analyzer FSV40	Rohde & Schwarz	15776
Power sensor NRV-Z86	Rohde & Schwarz	11588
Attenuator 10dB 18GHz 2W	Weinschel	12492
Multimeter 177	Fluke	19114
Meteo station 608-H1	Testo	15790
Software	R&S Power Viewer Plus V13.1	///

Radiated spurious emissions

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum Analyzer FSV40	Rohde & Schwarz	15776
Anechoic Chamber	EMITECH	7651
Biconical antenna HK116	Rohde & Schwarz	6118
Log periodic antenna 3146A	EMCO	5609
Low-noise amplifier INT-BA011000-25	RFPA	15775
Antenna BBHA 9120B	Schwarzbeck	6970
Low-noise amplifier 8449B	Agilent Technologies	10262
Cable k 1m	Huber + Suhner	14522
Antenna 3160-09	ETS lindgren	14690
Low-noise amplifier	Low-noise amplifier	14851
Cable K-15cm	JYE BAO	14887
Cable N-3m	Huber + Suhner	15892
Cable SMA-3m	Huber + Suhner	15893
Cable SMA-3m	Huber + Suhner	15916
Cable SMA-4m	Huber + Suhner	15933
High pass filter HPM15162	Microtronics	14037
Multimeter 177	Fluke	19114
Meteo station WS-9232	La Crosse Technology	7564
Software	BAT-EMC V3.18.0.26	0000

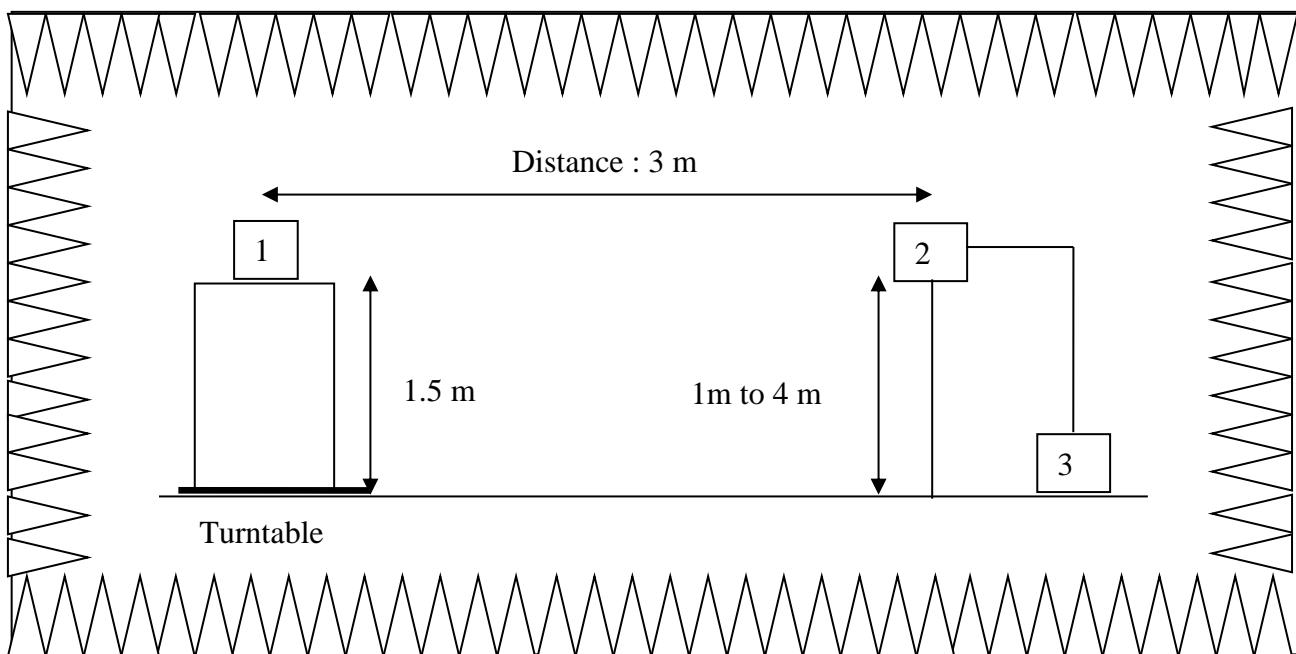
Conducted power spectral density

TYPE	MANUFACTURER	EMITECH NUMBER
Spectrum Analyzer FSV40	Rohde & Schwarz	15776
Attenuator 10dB 18GHz 2W	Weinschel	12492
Multimeter 177	Fluke	19114
Meteo station 608-H1	Testo	15790

APPENDIX 2: Radiated Test Setup

Anechoic chamber setup

Above 1 GHz

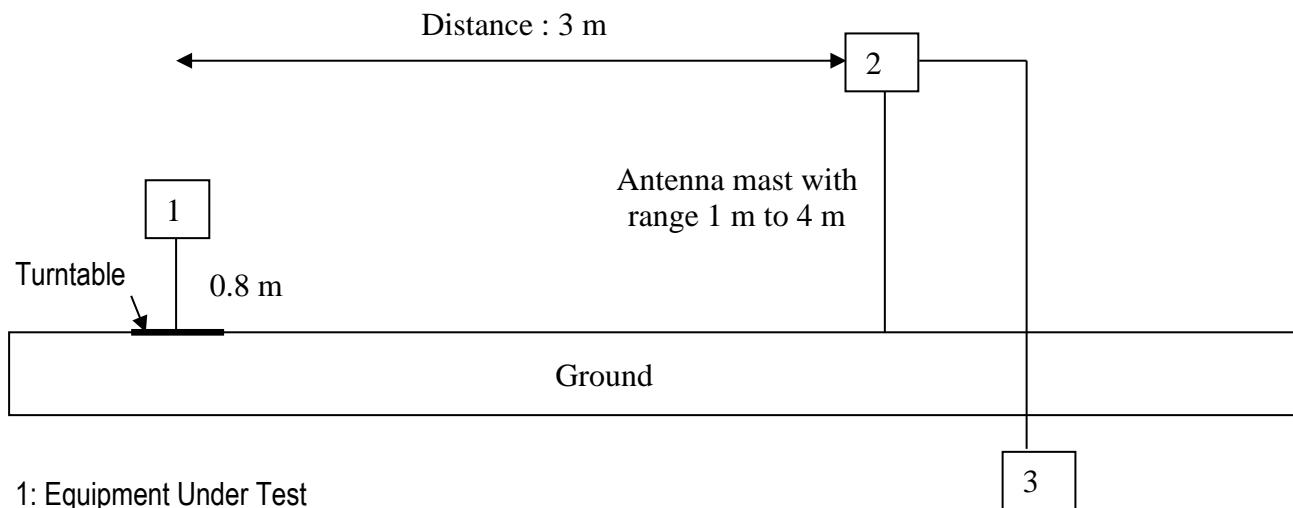


1: Equipment Under Test

2: Measurement antenna

3: Measurement equipment

Between 30 MHz and 1 GHz



1: Equipment Under Test

2: Measurement antenna

3: Measurement equipment