RRA-EMIESS23G756WAT-03Av0

Antenna Radio test report

According to the standard:

CFR 47 FCC PART 15

RSS GEN – Issue 5
RSS 247 – Issue 3

Equipment under test:

Toran'O

FCC ID: *2AGTV-50-70-244*
IC NUMBER: *32028-5070244*

Company:

WATTECO

Distribution: Mr LEFORT **(Company:** WATTECO**)**

Number of pages: 17 with 1 appendix

Ed.	Date	Modified Page(s)	Technical Verification and Quality Approval Name and Function	Visa
0	13-Jan-25	Creation	S. LOUIS, Radio Technician	p/o

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S51 RTY 000 INT 00015 [04]

DESIGNATION OF PRODUCT:	***Toran'O***
Serial number (S/N):	*Adresse MAC (DevEUI) = 70B3D5E75E017189*
MPN:	*50-70-252-000*
Model:	*Toran'O Product Line*
Software version:	*v3.5.2.6404*
MANUFACTURER:	*WATTECO*

COMPANY SUBMITTING THE PRODUCT:

Company:	WATTECO
Address:	POLE DE TECHNELLYS BATIMENT H – BOITE AUX LETTRE N°60 165 RUE DE LA MONTAGNE DY SALUT 56600 - LANESTER FRANCE
Responsible:	Mr LEFORT
Person(s) present during the tests:	/
DATES OF TEST:	From 2-Sep-24 to 6-Sep-24
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	**10-Sep-24**	/	Creation

1. INTRODUCTION

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

The device under test integrates a LoRa not certified function.

This report is a justification statement for antenna as stated in 'Timco' newsletter for Part 15 applications with equipment classes DTS, DSS, NII, 6ID, etc. which require the antenna gain for compliance with EIRP limits.

This report concerns only antenna gain calculation of LoRa Radio parts in 902-928 MHz Band.

2. PRODUCT DESCRIPTION

Category of equipment (ISED): I

Class: B

Utilization: Residential

Antenna type and gain: Integral antenna (Maximum Gain : 5.92 dBi)

Operating frequency range: From 902 MHz to 928 MHz

Frequency tested: 902.3 MHz, 908.7 MHz, 914.9 MHz for transmission

Frequencies plan detailed transmitter:

Channel frequencies	LoRa bandwidth (KHz)	Number of channel	Channel width (KHz)
902,3+i*0,2MHz (i=0 à 63)	125	64	200

Number of channels: 64

Channel spacing: 200 kHz

Modulation: LoRa with spread factor 7 to 10

Power source: 3.6 Vdc LS17500 battery 3.6 Ah

During test the output power was adjusted at the maximal level with the following setting (13 dB).

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 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.
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

Justification statement:
For antenna as stated in '**Timco**' newsletter for Part 15 applications with equipment classes DTS, which require the antenna gain for compliance with EIRP limits.

Radio performance tests procedures given in CFR 47 part 15:

Subpart C – Intentional Radiators
Paragraph 247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

Radio performance tests procedures given in RSS-247:
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	/	/	/
8549	Midwest Microwave 20dB	Attenuator	07/03/2022	3	06/03/2025
8750	La Crosse Technology WS-9232	Meteo station	20/11/2023	1	19/11/2024
8775	Fontaine FTN 2515B	Power source	(1)	(1)	(1)
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
10759	COMTEST Cage 3	Anechoic chamber	/	/	/
10789	MATURO	Turntable and mat controller NCD	/	/	/
14903	Fluke 177	Multimeter	22/12/2023	2	21/12/2025
15666	R&S FSV40	Spectrum Analyzer	27/09/2022	2	26/09/2024

(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 15.247	OPERATION WITHIN THE BANDS 902-928 MHZ, 2400-2483.5 MHz and 5725-5850 MHz					
	(b) Maximum peak output power	X				Note 1
	(c) Operation with directional antenna gains > 6 dBi			X		

NAp: Not Applicable NAs: Not Asked

Note 1: First, a measurement was performed using the radiated method and the results found in radio test report referenced **RRA-EMIESS23G756WAT-01Av0**, then a conducted measurement was performed with the same sample replacing the integral antenna by a R-SMA connector.

Gain antenna is calculated by subtracting conducted power measurement from radiated power measurement.

6.2 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					
5.4	Transmitter output power and equivalent isotropically radiated power (e.i.r.p.) requirements	X				Note 1

NAp: Not Applicable NAs: Not Asked

Note 1: First, a measurement was performed using the radiated method and the results found in radio test report referenced **RRA-EMIESS23G756WAT-01Av0**, then a conducted measurement was performed with the same sample replacing the integral antenna by a R-SMA connector.

Gain antenna is calculated by subtracting conducted power measurement from radiated power measurement.

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	 ± 4.3 dB ± 5.9 dB ± 4.8 dB ± 5.9 dB
AC Power Lines conducted emissions	± 3.7 dB
Temperature	± 0.95 °C
Humidity	± 4.6 %

8. ANTENNA GAIN CALCULATION – LoRa RADIO PART

Temperature (°C) : 23 **Humidity (%HR):** 54 **Date :** December 6, 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

Radiated Method Measurement: (Refer **RRA-EMIESS23G756WAT-01Av0**)
Method of paragraph 7.8.5 of ANSI C63.10

First an exploratory radiated measurement was performed.

During this phase the product is oriented in these two normal positions.

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, 0.8m 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: 10 meters (in open area test site)

Antenna height: 1 to 4 meters (in open area test site)

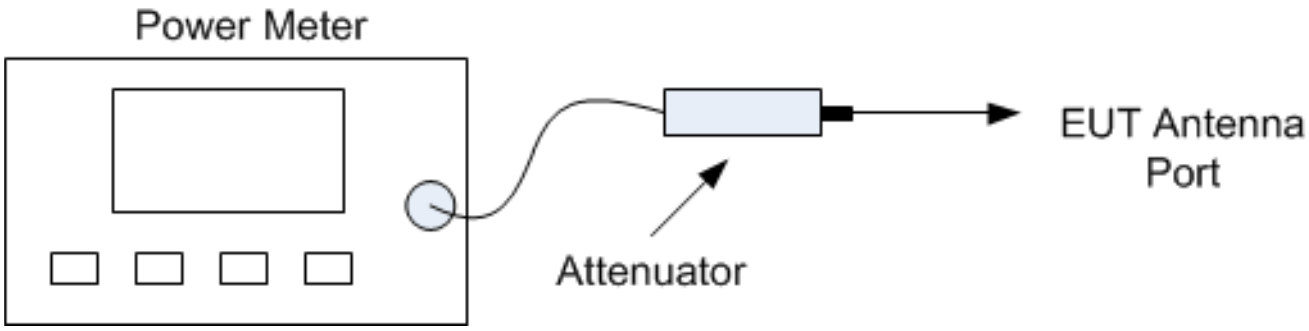
Antenna polarization: vertical and horizontal (only the highest level is recorded)

The measurement of the radiated electro-magnetic field is realized with an analyser and peak detector. The resolution bandwidth is adjusted at 1 MHz and video bandwidth at 3 MHz.

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 with a Gain (unit in dBi) different following the frequencies used.

Conducted Method Measurement:
Method of paragraph 7.8.5 of ANSI C63.10

Conducted test



The measure is realized in conducted mode.

The power meter is replaced with an spectrum analyser and peak detector. The resolution bandwidth is adjusted at >20 dB bandwidth (1 MHz) and VBW≥RBW (3 MHz) (7.8.5 of ANSI C63.10).

Equipment under test operating condition:

The equipment is blocked in continuous modulated transmission mode by an internal data signal at the highest power level at which the transmitter is intended to operate.

P Software adjusted to +13dBm

Power source: 3.6 Vdc by an external power supply
Percentage of voltage variation during the test (%): ± 1

Results:

Sample N° 1 Low Channel (F = 902.3 MHz) – SF7

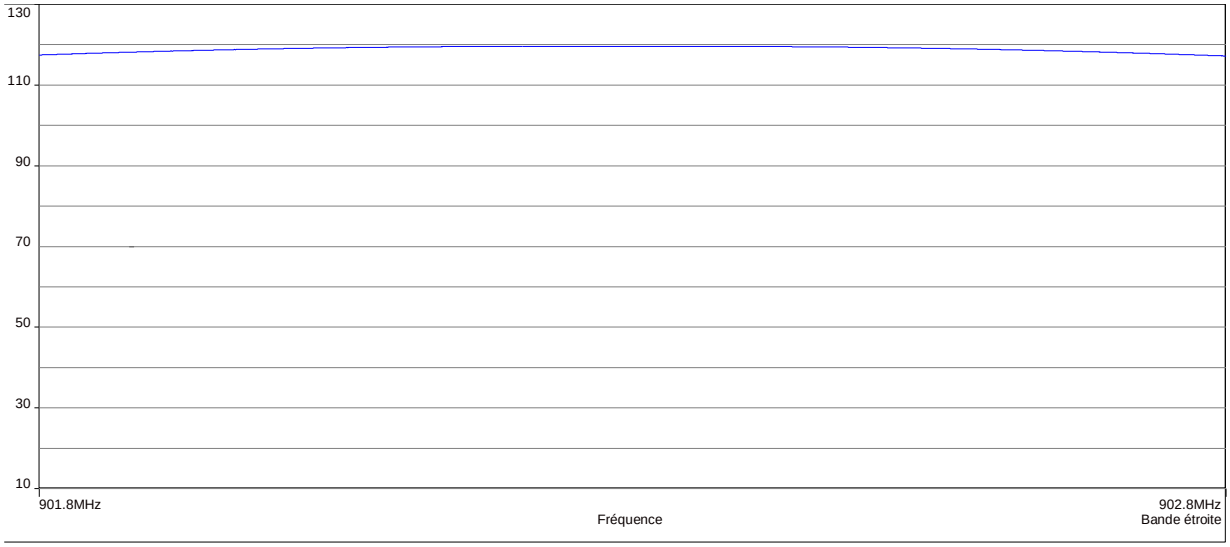
	Radiated Output power measured at 10 meters (dBµV/m):	Conducted Output Power computed (1) (dBm)	Conducted Output Power measured (dBm)	Antenna Gain calculation (dBi)
Nominal supply voltage: 3.6 Vdc	103.33	18.53	12.61	5.92

Polarization of test antenna: Horizontal (height: 115 cm)
Position of equipment: Position 2 (azimuth: 20 degrees)

(1) Conducted output power computed :

EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 0dBi (considered)

Conducted result (dBµV) :



Sample N° 1 Central Channel (F = 908.7 MHz) – SF7

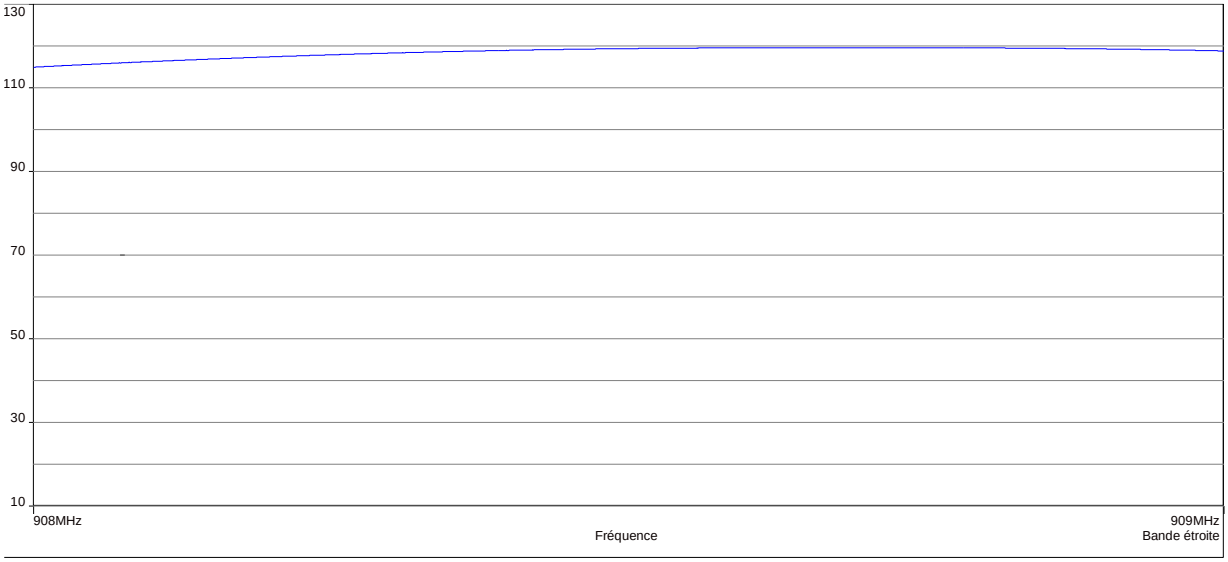
	Radiated Output power measured at 10 meters (dBµV/m):	Conducted Output Power computed (1) (dBm)	Conducted Output Power measured (dBm)	Antenna Gain calculation (dBi)
Nominal supply voltage: 3.6 Vdc	102.78	17.98	12.56	5.42

Polarization of test antenna: Horizontal (height: 114 cm)
Position of equipment: Position 2 (azimuth: 20 degrees)

(1) Conducted output power computed :

EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 0dBi (considered)

Conducted result (dBµV) :



Sample N° 1 High Channel (F = 914.9 MHz) – SF7

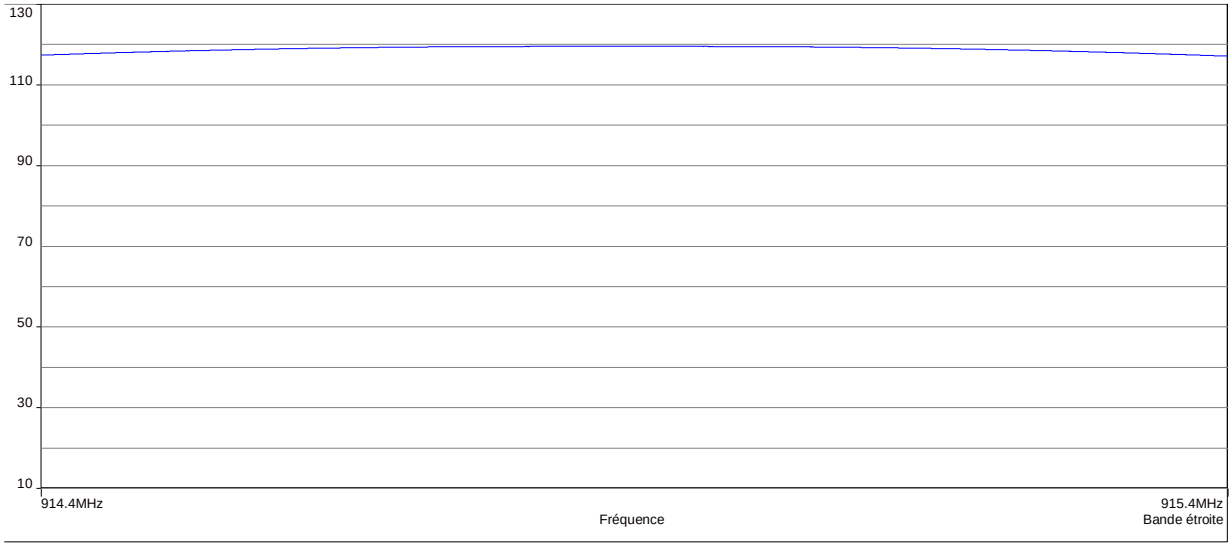
	Radiated Output power measured at 10 meters (dBµV/m):	Conducted Output Power computed (1) (dBm)	Conducted Output Power measured (dBm)	Antenna Gain calculation (dBi)
Nominal supply voltage: 3.6 Vdc	102.37	17.57	12.52	5.05

Polarization of test antenna: Horizontal (height: 114 cm)
Position of equipment: Position 2 (azimuth: 20 degrees)

(1) Conducted output power computed :

EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 0dBi (considered)

Conducted result (dBµV) :



Sample N° 1 Low Channel (F = 902.3 MHz) – SF10

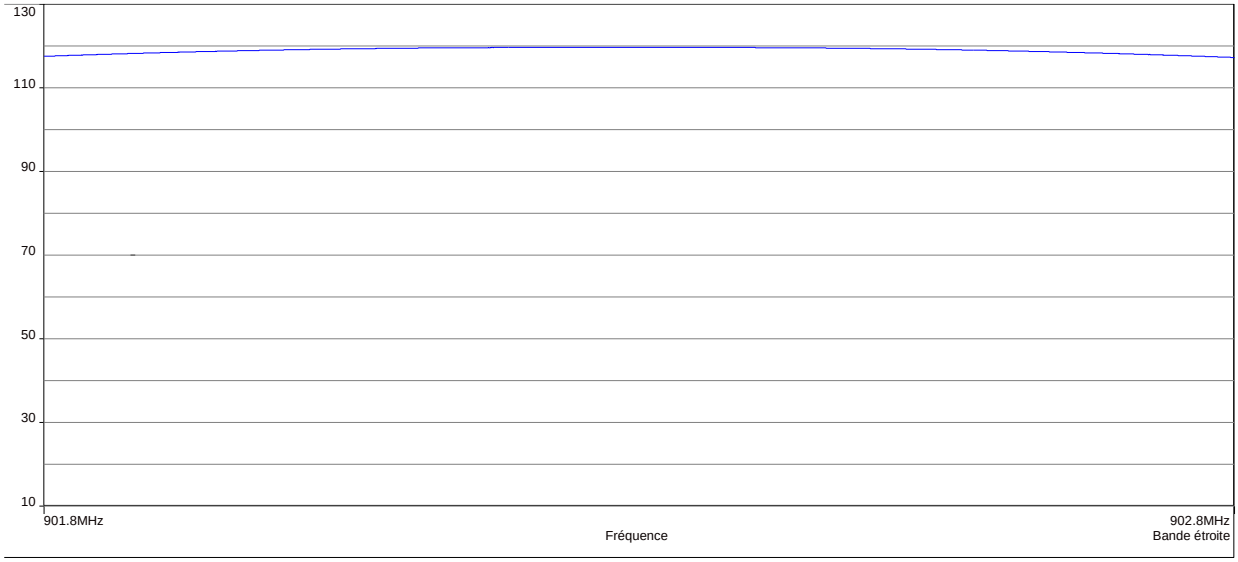
	Radiated Output power measured at 10 meters (dBµV/m):	Conducted Output Power computed (1) (dBm)	Conducted Output Power measured (dBm)	Antenna Gain calculation (dBi)
Nominal supply voltage: 3.6 Vdc	103.31	18.51	12.64	5.87

Polarization of test antenna: Horizontal (height: 115 cm)
Position of equipment: Position 2 (azimuth: 20 degrees)

(1) Conducted output power computed :

EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 0dBi (considered)

Conducted result (dBµV) :



Sample N° 1 Central Channel (F = 908.7 MHz) – SF10

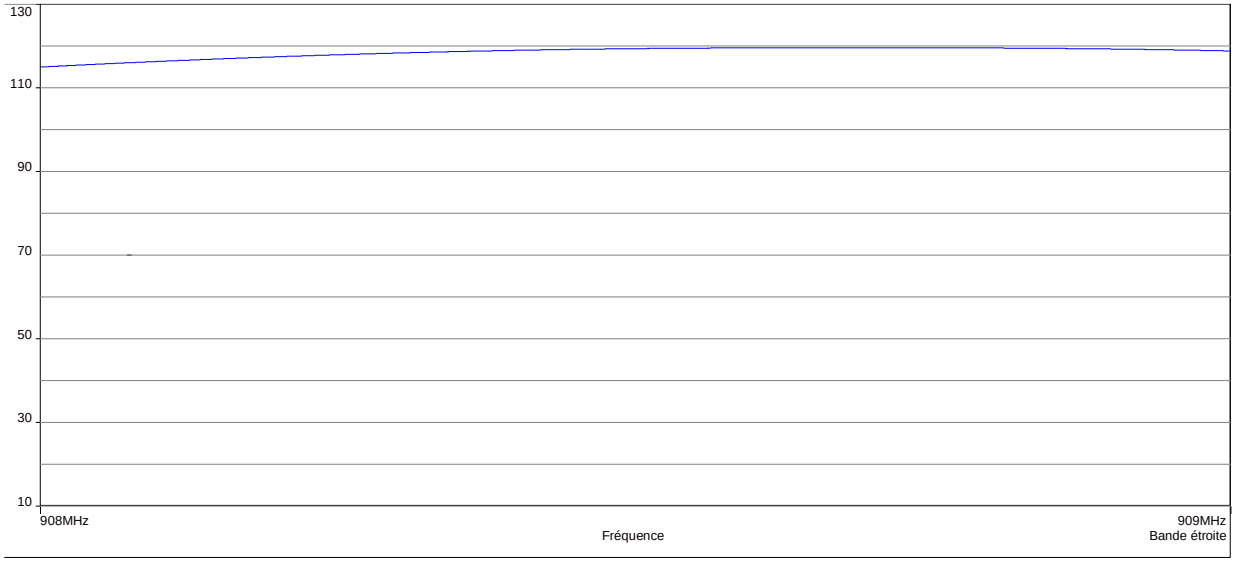
	Radiated Output power measured at 10 meters (dBµV/m):	Conducted Output Power computed (1) (dBm)	Conducted Output Power measured (dBm)	Antenna Gain calculation (dBi)
Nominal supply voltage: 3.6 Vdc	102.93	18.13	12.55	5.58

Polarization of test antenna: Horizontal (height: 114 cm)
Position of equipment: Position 2 (azimuth: 20 degrees)

(1) Conducted output power computed :

EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 0dBi (considered)

Conducted result (dBµV) :



Sample N° 1 High Channel (F = 914.9 MHz) – SF10

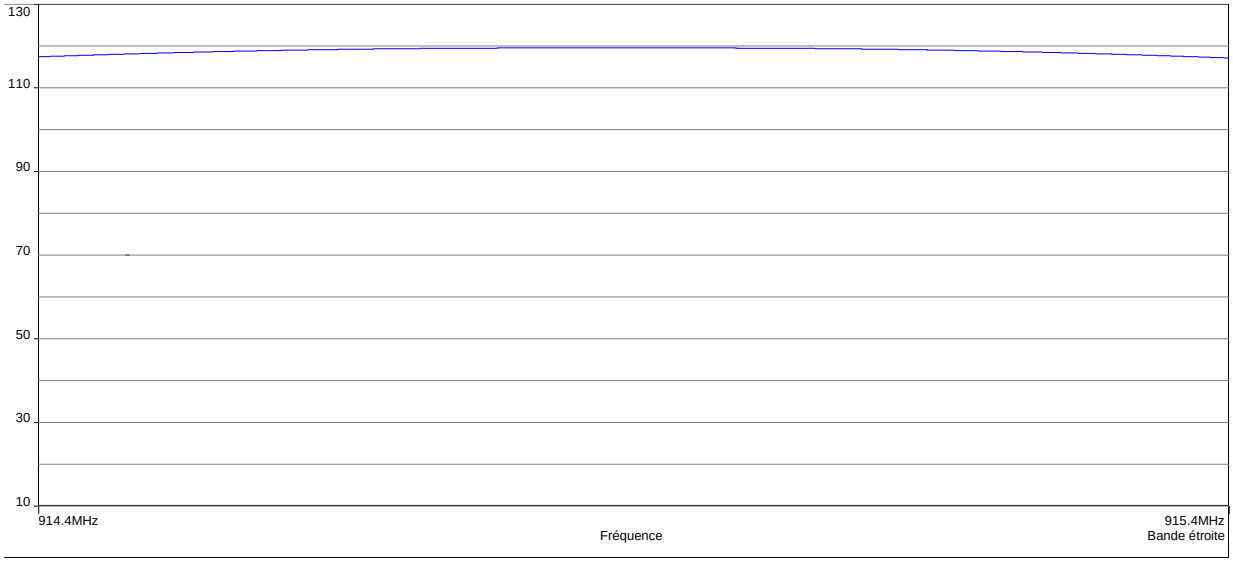
	Radiated Output power measured at 10 meters (dBµV/m):	Conducted Output Power computed (1) (dBm)	Conducted Output Power measured (dBm)	Antenna Gain calculation (dBi)
Nominal supply voltage: 3.6 Vdc	102.63	17.83	12.52	5.31

Polarization of test antenna: Horizontal (height: 114 cm)
Position of equipment: Position 2 (azimuth: 20 degrees)

(1) Conducted output power computed :

EIRP(dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance in meters and antenna Gain = 0dBi (considered)

Conducted result (dBµV) :



End of report, 1 appendix to be forwarded

APPENDIX 1: Test equipment list

Antenna Gain Calculation

TYPE	MANUFACTURER	EMITECH NUMBER
Full anechoic chamber	EMITECH	10759
Turntable and mat controller NCD	MATURO	10789
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSV40	Rohde & Schwarz	15666
Attenuator 20dB	Midwest Microwave	8549
Power source FTN 2515B	Fontaine	8775
Multimeter 177	Fluke	14903
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.18.0.26	0000