

Certification Radio test report

According to the standard:
 CFR 47 FCC PART 15
 RSS GEN – Issue 5
 RSS 247 – Issue 2

Equipment under test:
 MEMS DATA CAPTURE WAND+

FCC ID: FI5-WAN02-1

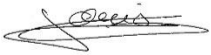
IC NUMBER: 5056A-WAN021

Company:
 MICHELIN NORTH AMERICA (US) INC.
 MICHELIN NORTH AMERICA (CANADA) INC.

Distribution: Mr CHANAL

(Company: EXOTIC SYSTEMS)

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			Name and Function	Visa
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S51 RTY 000 INT 00015 [01]

DESIGNATION OF PRODUCT: MEMS DATA CAPTURE WAND+

Serial number (S/N): 20:72:31:7D:54:53 - radiated sample
20:6A:31:80:54:53 conducted sample

Reference / model (P/N): Zone 2

Software version: Pack 2.0.4

MANUFACTURER: MICHELIN NORTH AMERICA INC.

COMPANY CERTIFYING THE PRODUCT FOR TESTS:

For FCC

Company: MICHELIN NORTH AMERICA (US) INC.

Address: One Parkway South
Greenville, SC 29615
United States

Responsible: Mr Flaker

For ISED

Company: MICHELIN NORTH AMERICA (CANADA) INC.

Address: 2863 Granton Road
New Glasgow NS B2H 5C6
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Responsible: Mr Flaker

COMPANY SUBMITTING THE PRODUCT FOR TESTS:

Company: EXOTIC SYSTEMS

Address: 29 RUE GEORGES BESSE
63100 CLERMONT FERRAND
FRANCE

Responsible: Mr CHANAL

DATES OF TEST: From 16-Nov-20 to 19-Nov-20

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: T. LEDRESSEUR

VISA:



WRITTEN BY: T. LEDRESSEUR

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1. INTRODUCTION

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

The equipment under test integrates:

- Bluetooth Low Energy radio function
- RFID UHF radio module operational at 920 MHz,
- RFID radio module operational at 125 kHz.
- Receiver at 433 MHz

This report concerns only the RFID UHF part.

2. PRODUCT DESCRIPTION

Category of equipment (ISED):	I
Class:	B
Utilization:	Industrial use, but tested with class B limit
Antenna type and gain:	2.3 dBi / integral flex antenna
Operating frequency range:	From 917.1 MHz to 926.9 MHz
Number of channels:	50
Channel spacing:	200kHz
Modulation:	DSB-ASK
Power source:	Internal battery 7.4Vdc, rechargeable with AC/DC adapter

Test frequencies:

917.1 MHz, 921.9 MHz and 926.9MHz

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.

The product is functional during the charge.

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 (2020)	Radio Frequency Devices
ANSI C63.10	2013 Procedures for Compliance Testing of Unlicensed Wireless Devices.
558074 D01 DTS v05 r02	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.
662911 D01 Multiple Transmitter Output V02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
RSP-100	Issue 12, August 2019 Certification of Radio Apparatus
RSS-Gen	Issue 5, April 2018 General Requirements for Compliance of Radio Apparatus
RSS-247	Issue 2, February 2017 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	/	/	/
1406	EMCO 6502	Loop antenna	24/04/2020	1	24/04/2021
4088	R&S FSP40	Spectrum Analyzer	04/05/2020	2	04/05/2022
7011	California instruments 1251RP	Power source	(1)	(1)	(1)
7124	A.H. Systems SAS-572	Antenna	05/01/2019	3	04/01/2022
7171	R&S HL223	Antenna	19/04/2019	3	18/04/2022
7279	SUCOFLEX SF104 N 1.5m	Cable	11/06/2020	2	11/06/2022
7310	Filtek HP12/1200-5AA	High-pass filter	25/02/2020	3	24/02/2023
8511	HP 8447D	Low-noise amplifier	25/02/2020	1	24/02/2021
8526	Schwarzbeck VHBB 9124	Biconical antenna	17/08/2018	3	16/08/2021
8528	Schwarzbeck VHA 9103	Biconical antenna	09/03/2019	3	08/03/2022
8535	EMCO 3115	Antenna	28/04/2020	3	28/04/2023
8543	Schwarzbeck UHALP 9108A	Log periodic antenna	17/08/2018	3	16/08/2021
8548	Midwest Microwave 10dB	Attenuator	25/02/2020	3	24/02/2023
8590	RG214 N-5m	Cable	25/02/2020	2	24/02/2022
8593	SIDT Cage 2	Anechoic chamber	/	/	/
8635	R&S EZ-25	High-pass filter	02/08/2018	3	01/08/2021
8704	LUCIX Corp S180265L3201 LNA	Low-noise amplifier	08/09/2020	1	08/09/2021
8707	R&S ESI7	Test receiver	29/06/2020	1	29/06/2021
8719	Thurbly Thandar Instruments 1600	LISN	26/02/2020	2	25/02/2022
8732	Emitech	OATS	03/07/2019	3	02/07/2022
8749	La Crosse Technology WS- 9232	Meteo station	13/11/2018	2	12/11/2020
8750	La Crosse Technology WS- 9232	Meteo station	22/09/2020	2	22/09/2022
8855	EMITECH	Turntable and mat controller	/	/	/
8896	ACQUISYS GPS8	Satellite synchronized frequency standard	/	/	/
8974	STORM MICROWAE k-20cm	cable	14/11/2019	2	13/11/2021
8975	STORM MICROWAE k-20cm	cable	14/11/2019	2	13/11/2021
10651	Absorber sheath current	Emitech	25/02/2020	2	24/02/2022
10788	Emitech	Outside room Hors cage	/	/	/
10811	R&S EMC 32	Software	/	/	/
11592	R&S NRV-Z86	Power Sensor	27/08/2019	2	26/08/2021
12911	Huber + Suhner N-2m	cable	11/06/2020	2	11/06/2022

Emitech Number	Model	Type	Last calibration	Calibration interval (years)	Next calibration due
14736	MATURO	Turntable and mat controller MCU	/	/	/
14831	Fluke 177	Multimeter	25/02/2020	2	24/02/2022
15812	COMP-POWER PAM-118A	Low-noise amplifier 18GHz	05/08/2020	1	05/08/2021
15882	SUCOFLEX	cable N 5m	28/11/2018	2	27/11/2020
17008	Rohde & Schwarz ESW 44	Test receiver	05/03/2020	2	05/03/2022
-	RS Commander	Software	/	/	/

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

6. TESTS RESULTS SUMMARY

6.1 CFR 47 part 15 requirements

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAp	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				Note 1
FCC Part 15.205	RESTRICTED BANDS OF OPERATION	X				
FCC Part 15.207	CONDUCTED LIMITS	X				
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				Note 2
FCC Part 15.212	MODULAR TRANSMITTERS			X		
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	(a) Alternative to general radiated emission limits	X				
	(b) Unwanted emissions outside of §15.247 frequency bands	X				Note3
	(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: 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				<i>see certification documents</i>
§ 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	$\pm 0.75\text{dB}$
Radiated emission valid to 26 GHz	
F < 62.5 MHz:	$\pm 5.14\text{ dB}$
62.5 MHz < F < 1 GHz:	$\pm 5.13\text{ dB}$
1 GHz < F < 26 GHz:	$\pm 5.16\text{ dB}$
AC Power Lines conducted emissions	$\pm 3.38\text{ dB}$
Temperature	$\pm 1\text{ }^\circ\text{C}$
Humidity	$\pm 5\%$

8. AC CONDUCTED EMISSIONS**Temperature (°C) :** 21**Humidity (%HR):** 45**Date :** November 17, 2020**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 +27dBm output power setting.

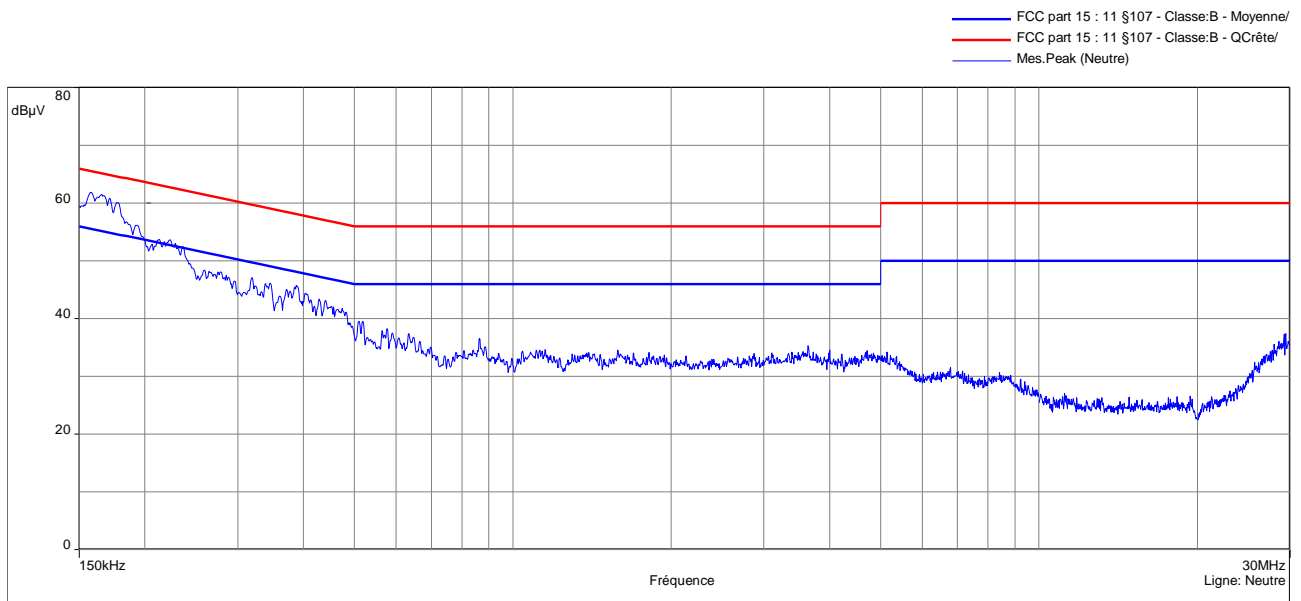
Results:

Radiated sample:

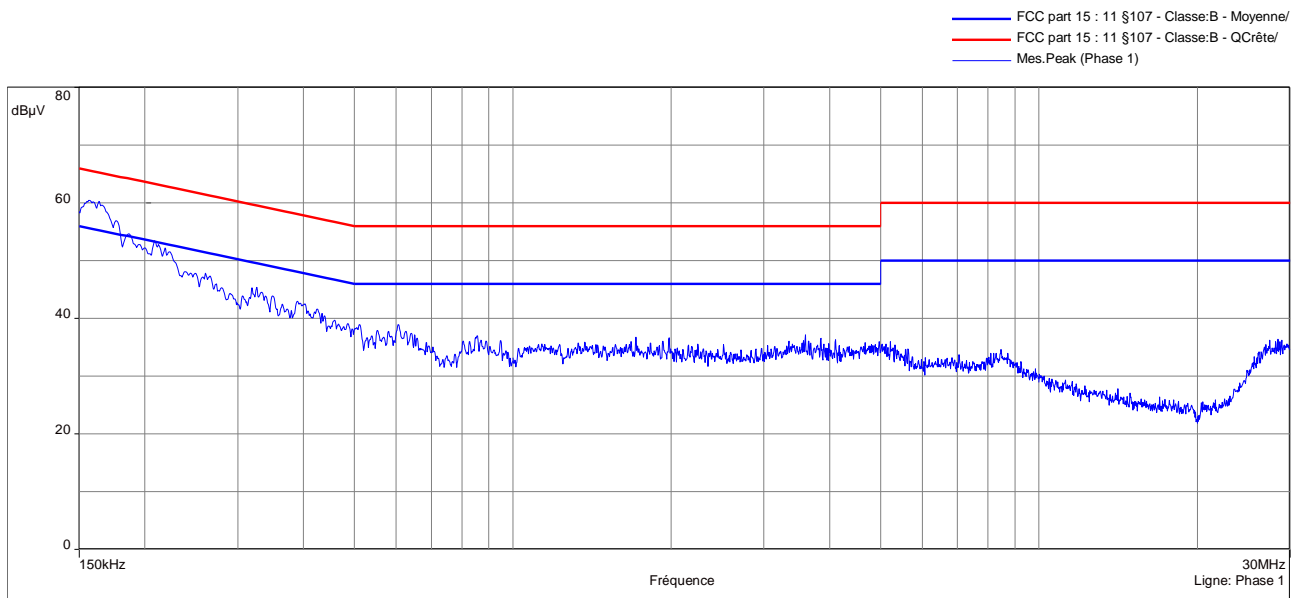
Measurement on the mains power supply:

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 (dB μ V)	QP Limit (dB μ V)	QP margin (dB)	Frequency (MHz)	Average (dB μ V)	Average Limit (dB μ V)	Average margin (dB)
0.158	48.2	65.6	17.36	0.158	28.48	55.6	27.08
0.166	50.43	65.2	14.75	0.166	30.57	55.2	24.61
0.178	51.46	64.6	13.12	0.178	33.76	54.6	20.82
0.193	49.16	63.9	14.73	0.193	30.39	53.9	23.50
0.223	45.04	62.7	17.67	0.223	25.87	52.7	26.84
0.320	36.32	59.7	23.40	0.320	23.63	49.7	26.09
0.388	38.42	58.1	19.69	0.388	28.73	48.1	19.38
0.441	34.5	57.0	22.55	0.441	24.91	47.0	22.14

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

Frequency (MHz)	Quasi-peak (dB μ V)	QP Limit (dB μ V)	QP margin (dB)	Frequency (MHz)	Average (dB μ V)	Average Limit (dB μ V)	Average margin (dB)
0.157	56.48	65.6	9.17	0.157	36.83	55.6	18.82
0.164	54.17	65.3	11.10	0.164	32.12	55.3	23.15
0.177	48.04	64.6	16.58	0.177	26.36	54.6	28.26
0.187	50.78	64.2	13.38	0.187	30.7	54.2	23.46
0.209	48.67	63.3	14.59	0.209	28.46	53.3	24.80
0.219	44.7	62.9	18.18	0.219	23.06	52.9	29.82
0.261	43.06	61.412	18.352	0.261	23.16	51.412	28.252
0.326	38.25	59.5	21.29	0.326	25.32	49.5	24.22
0.402	38.9	57.8	18.90	0.402	30.9	47.8	16.90

Test conclusion:

RESPECTED STANDARD

9. CARRIER FREQUENCY SEPARATION

Temperature (°C) : 21

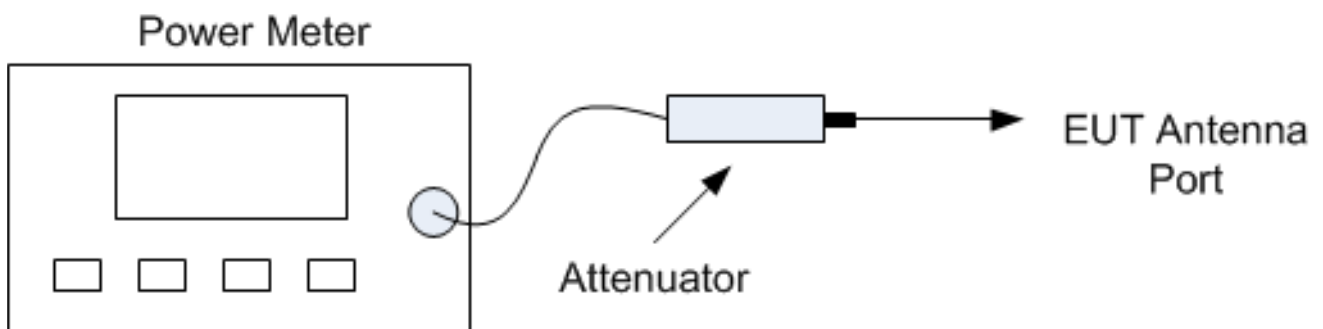
Humidity (%HR): 45

Date : November 17, 2020

Technician : T. LEDRESSEUR

Standard: FCC Part 15
 RSS-247

Test procedure: Method of paragraphs 7.8.2 of ANSI C63.10

Test set up:
Conducted test

Setting:

Center frequency	Centre of two adjacent channels
Detector	Peak
Span	Wide enough to capture the peaks of two adjacent channels
RBW	Approximately 30% of the channel spacing
VBW	≥ 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 +27dBm output power setting.

Power source: 120 Vac by an external power supply

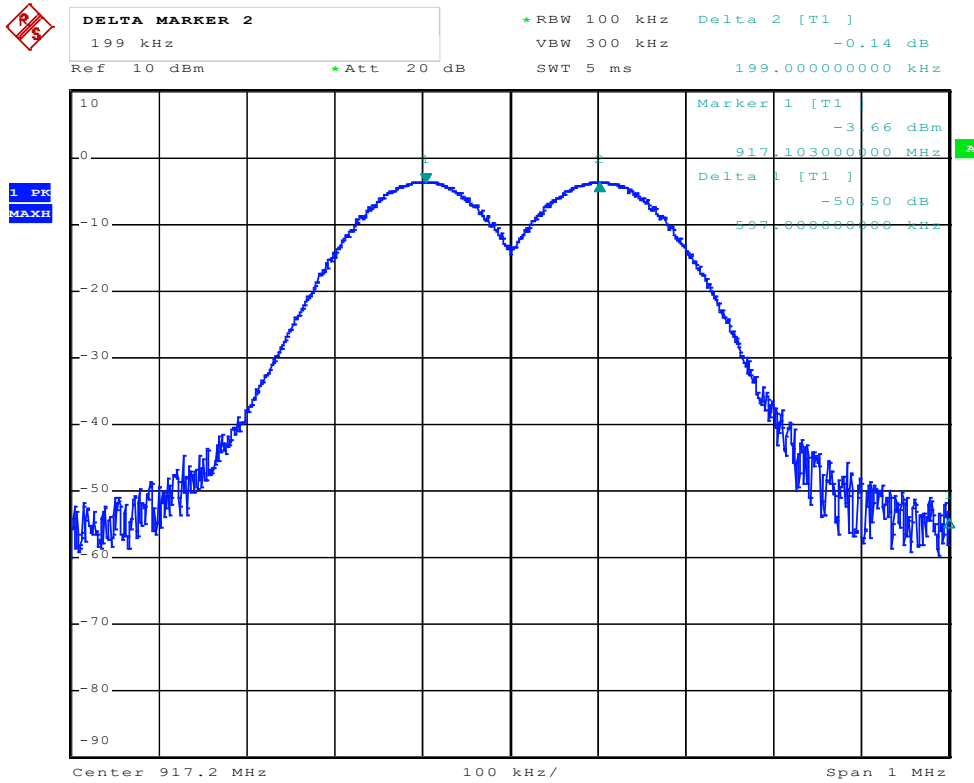
Percentage of voltage variation during the test (%):

 ± 1

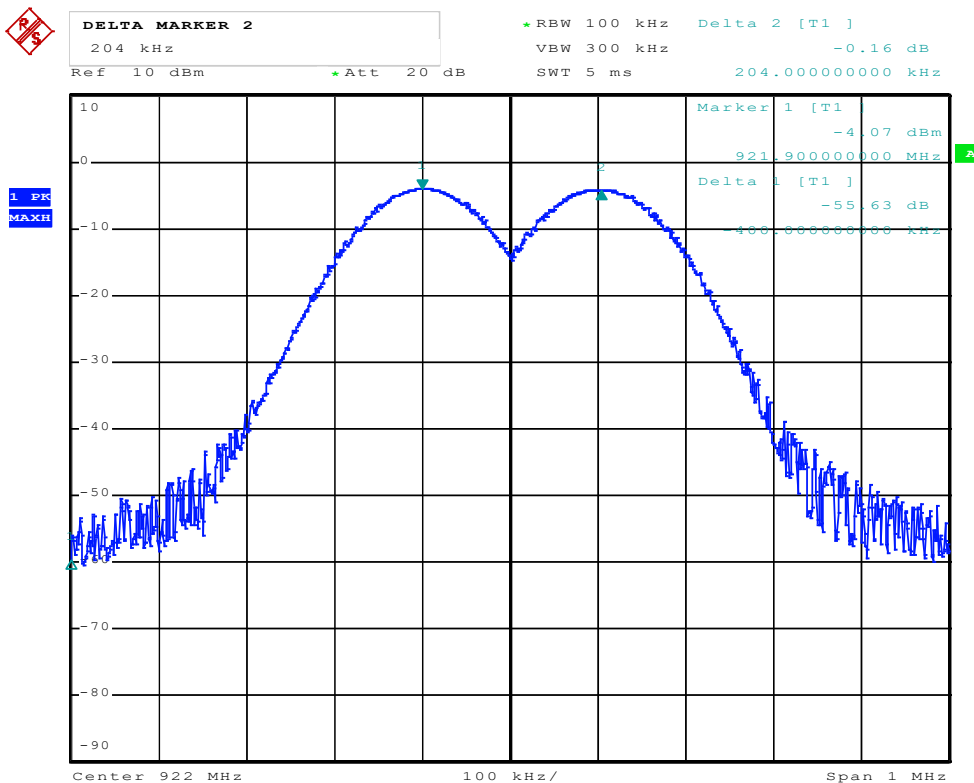
Results:

Conducted sample

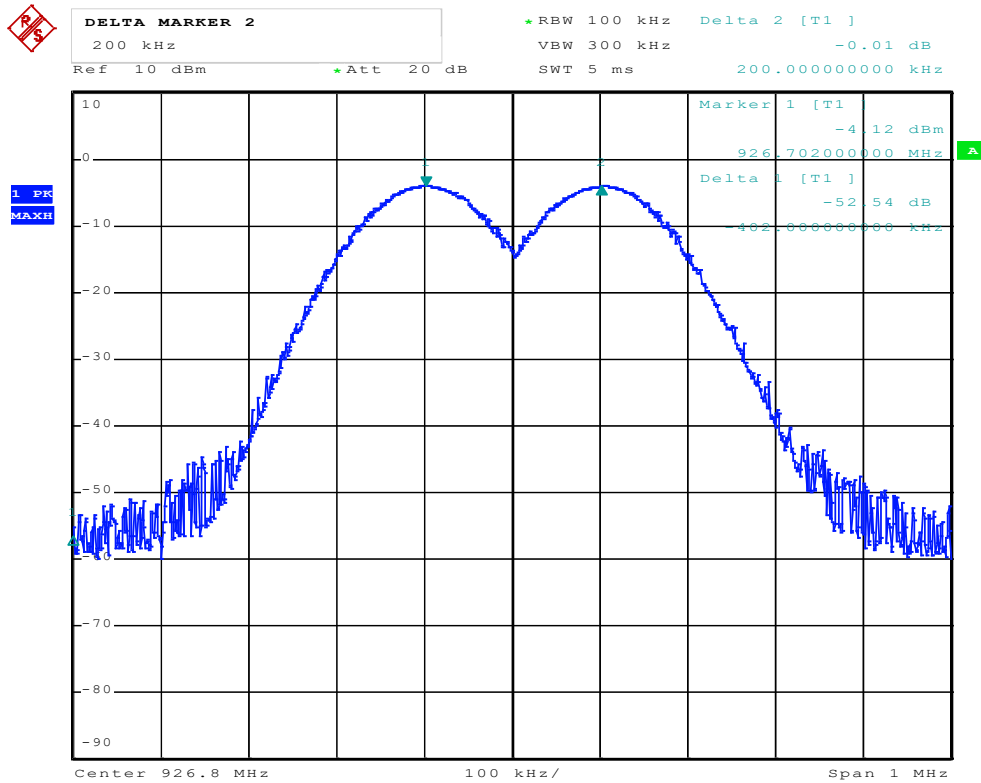
Channel 917.1 MHz and Channel 917.3 MHz



Channel 921.9 MHz and Channel 922.1 MHz



Channel 926.7 MHz and Channel 926.9 MHz



Limit:

The system hops to channel frequencies from a pseudo randomly ordered list of hopping frequencies. Each frequency is used equally on the average by the transmitter, and separated by a minimum of 25 kHz or 20 dB bandwidth of the hopping channel, whichever is greater.

Test conclusion:

RESPECTED STANDARD

10. NUMBER OF HOPPING FREQUENCIES

Temperature (°C) : 21

Humidity (%HR): 45

Date : November 17, 2020

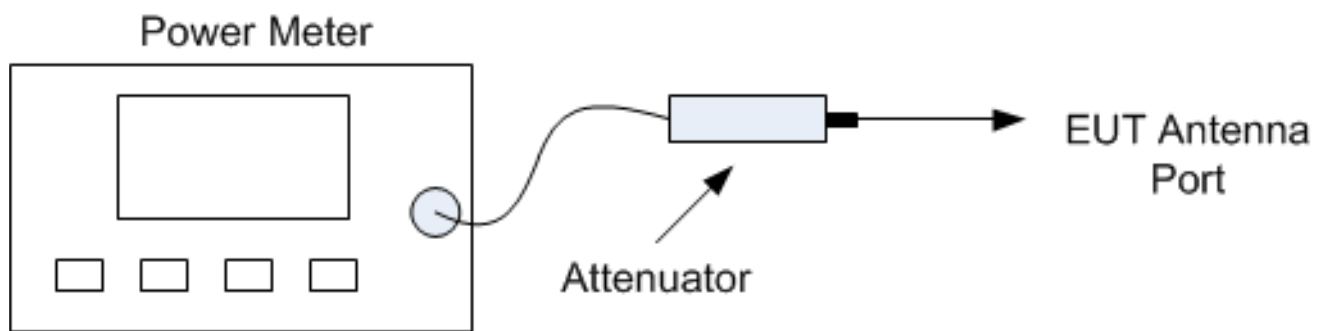
Technician : T. LEDRESSEUR

Standard: FCC Part 15
RSS-247

Test procedure: Method of paragraphs 7.8.3 of ANSI C63.10

Test set up:

Conducted test



Setting:

Detector	Peak
Span	The frequency band of operation
RBW	30% of the channel spacing or the 20 dB bandwidth, whichever is smaller
VBW	≥ RBW
Trace	Max hold
Sweep	Auto.

Test operating condition of the equipment:

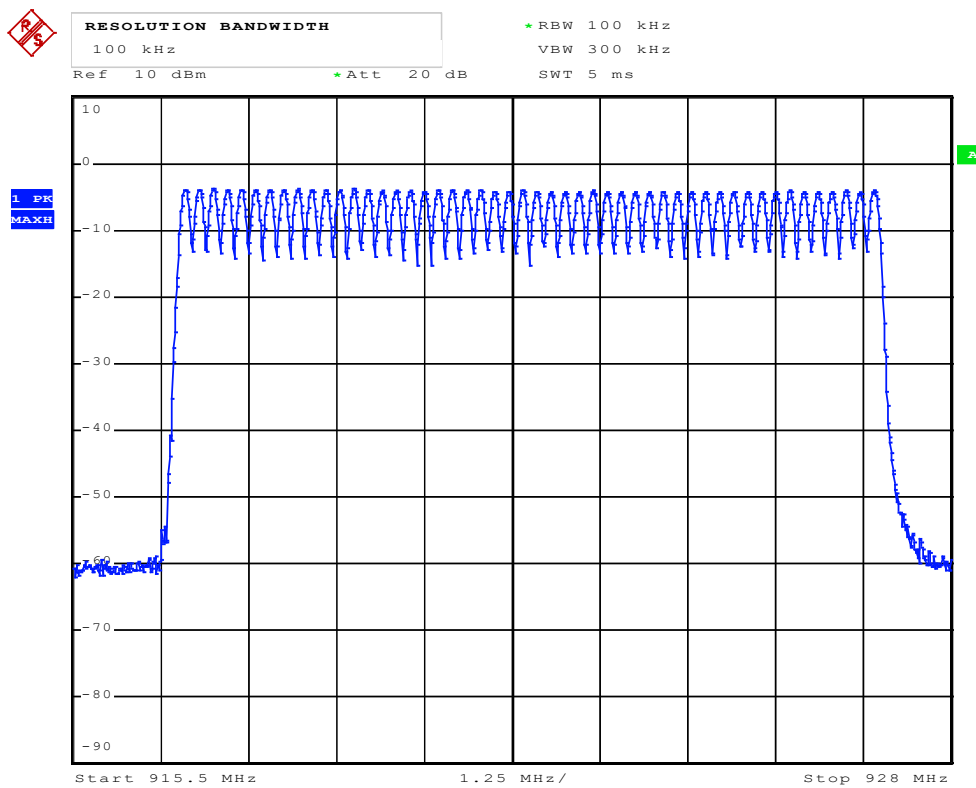
The equipment under test is blocked in continuous modulated transmission mode, at the +27dBm output power setting.

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

± 1

Results:

Conducted sample



Number of channel used: 50

Limit:

50 hopping frequencies

Test conclusion:

RESPECTED STANDARD

11. DWELL TIME

Temperature (°C) : 21

Humidity (%HR): 45

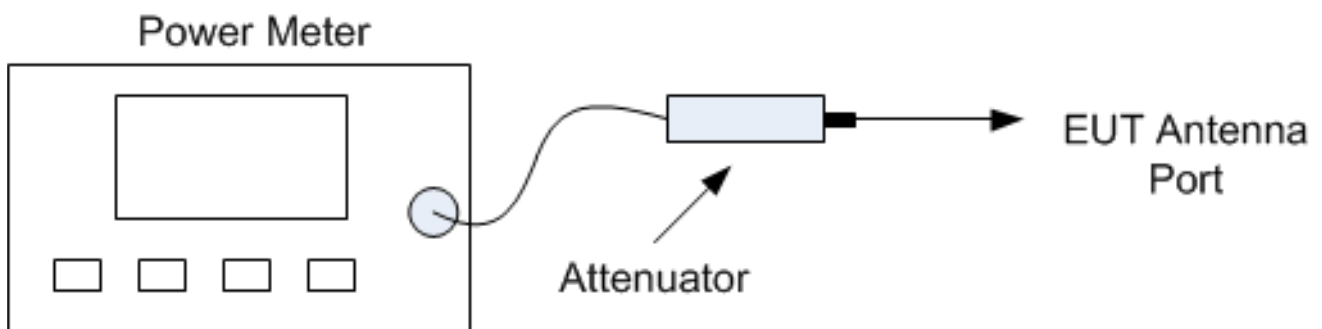
Date : November 17, 2020

Technician : T. LEDRESSEUR

 Standard: FCC Part 15
 RSS-247

Test procedure: Method of paragraphs 7.8.4 of ANSI C63.10

Test set up:

Conducted test

Setting:

Center frequency	Hopping channel
Detector	Peak
Span	Zero
RBW	≤ channel spacing
VBW	≥ RBW
Trace	Max hold
Sweep	<u>First</u> : As necessary to capture the entire dwell time per hopping channel <u>Second</u> : sweep time to determine the number of hops over the period specified in the requirements

Test operating condition of the equipment:

The equipment under test is blocked in continuous modulated transmission mode, at the +27dBm output power setting.

Power source: 120 Vac by an external power supply

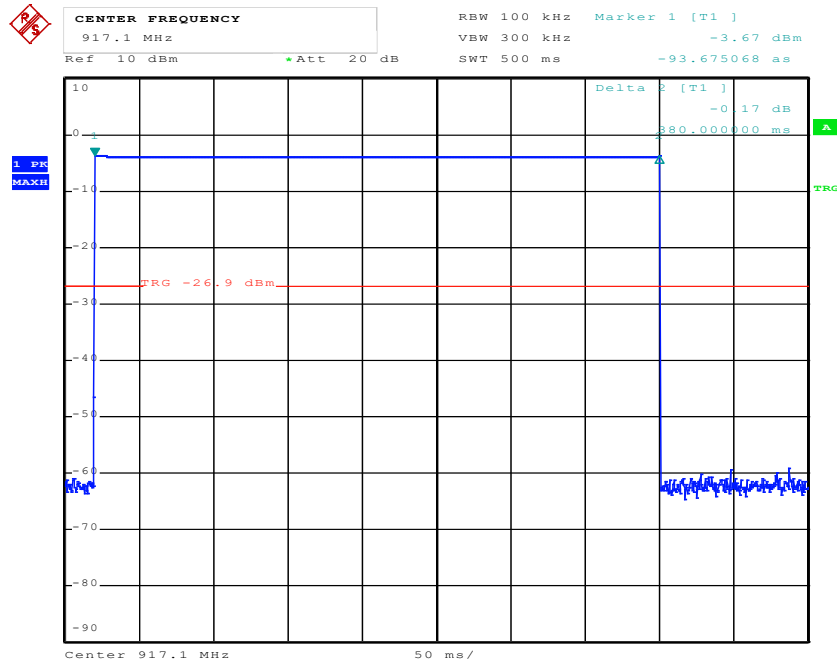
Percentage of voltage variation during the test (%):

± 1

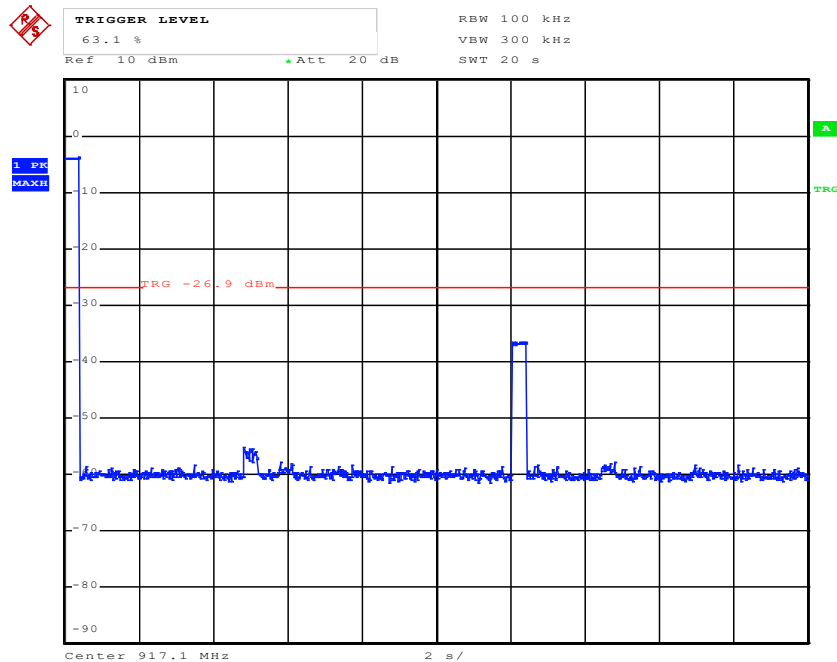
Results:

Conducted sample

Burst duration - Channel 917.1 MHz

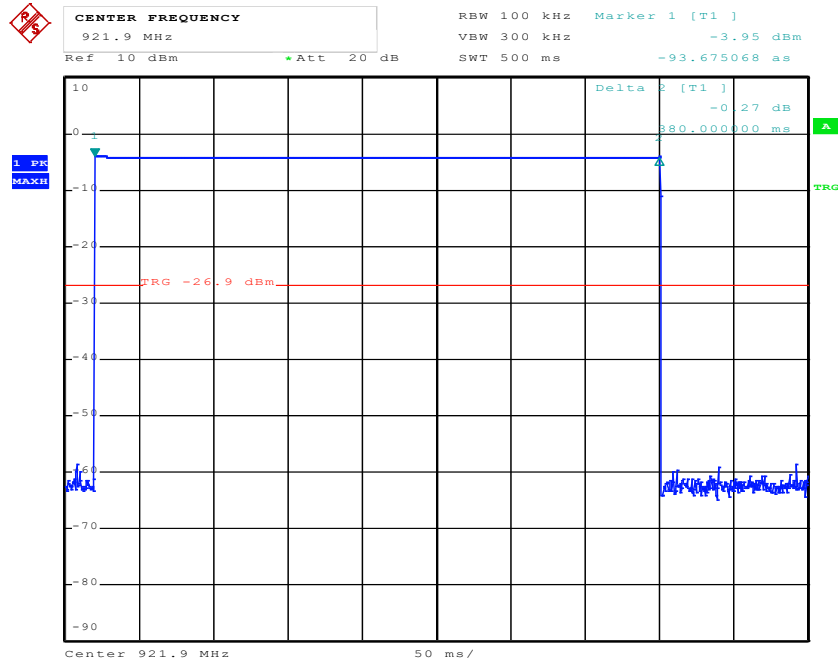


Burst repetition during observation period duration - Channel 917.1 MHz

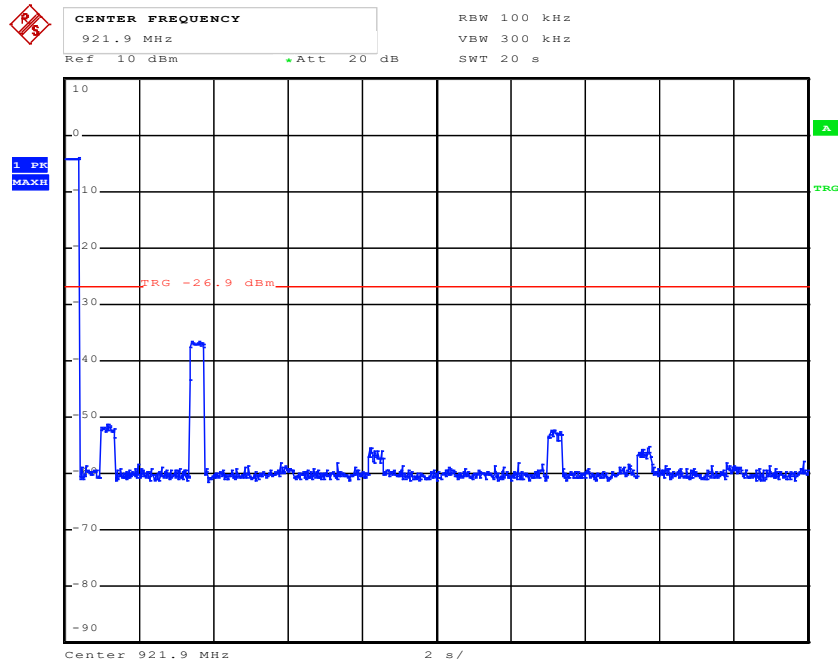


Number of channels	Observation period (s)	Maximal Duration of each burst (ms)	Number of burst repetition during observation period	average time of occupancy on any channel (s)	Limits (s)
50	20	380	1	0.38	0.4

Burst duration - Channel 921.9 MHz

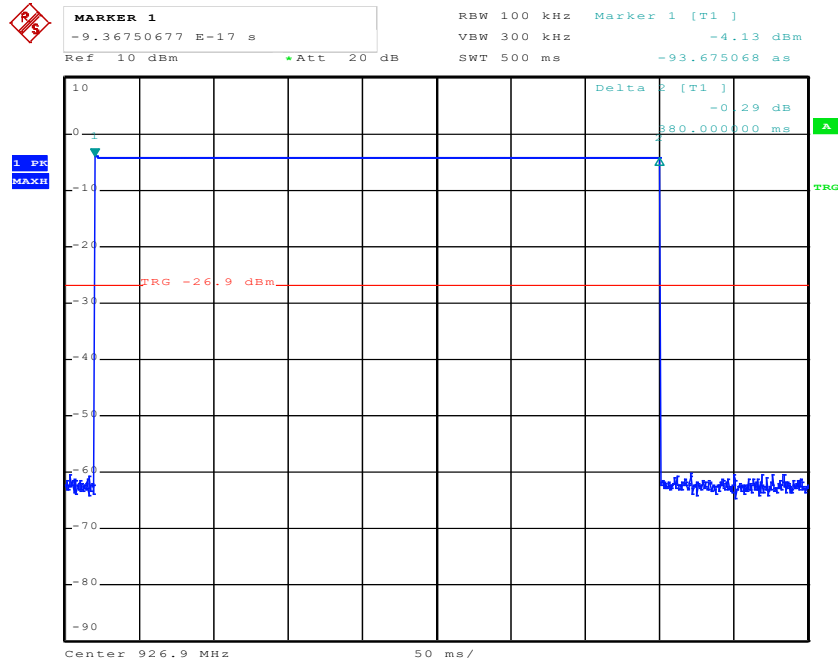


Burst repetition during observation period duration - Channel 921.9 MHz

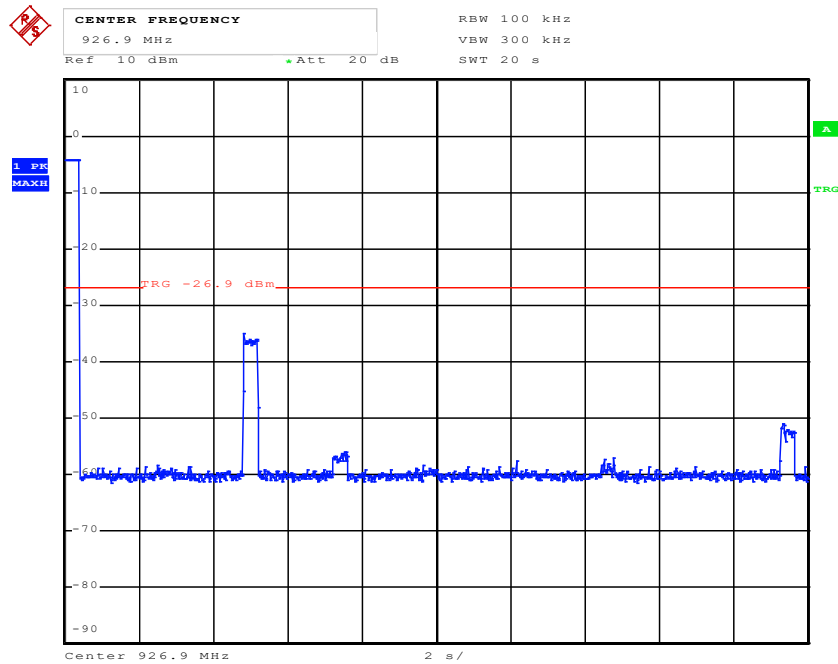


Number of channels	Observation period (s)	Maximal Duration of each burst (ms)	Number of burst repetition during observation period	average time of occupancy on any channel (s)	Limits (s)
50	20	380	1	0.38	0.4

Burst duration - Channel 926.9 MHz



Burst repetition during observation period duration - Channel 926.9 MHz



Number of channels	Observation period (s)	Maximal Duration of each burst (ms)	Number of burst repetition during observation period	average time of occupancy on any channel (s)	Limits (s)
50	20	380	1	0.38	0.4

Test conclusion:

RESPECTED STANDARD

12. OCCUPIED BANDWIDTH

Temperature (°C) : 21

Humidity (%HR): 45

Date : November 17, 2020

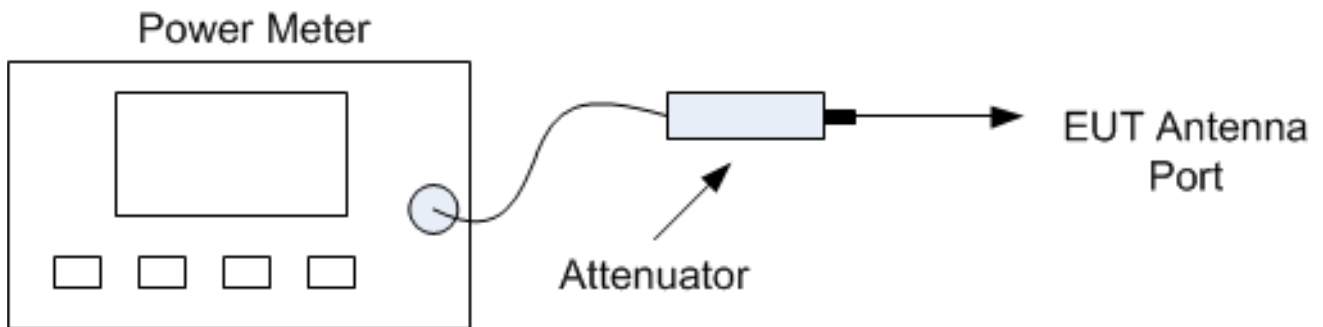
Technician : T. LEDRESSEUR

Standard: FCC Part 15
 RSS-247

Test procedure:

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

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

Test set up:
Conducted test

Setting:

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

Test operating condition of the equipment:

The equipment under test is blocked in continuous modulated transmission mode, at the +27dBm output power setting.

Power source: 120 Vac by an external power supply

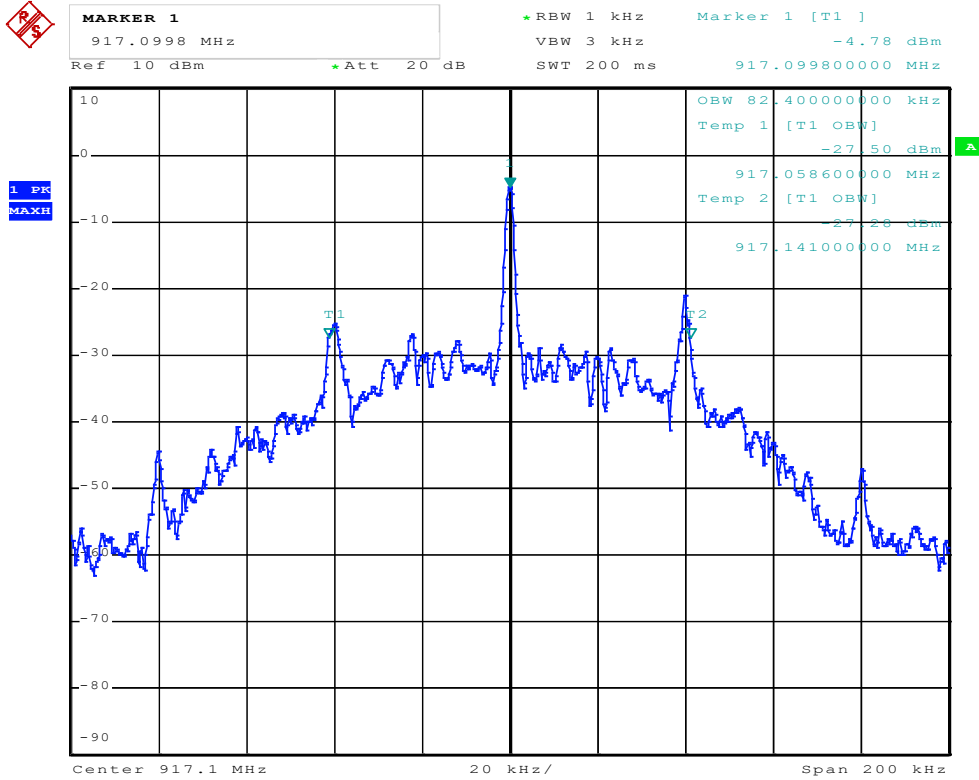
Percentage of voltage variation during the test (%):

 ± 1

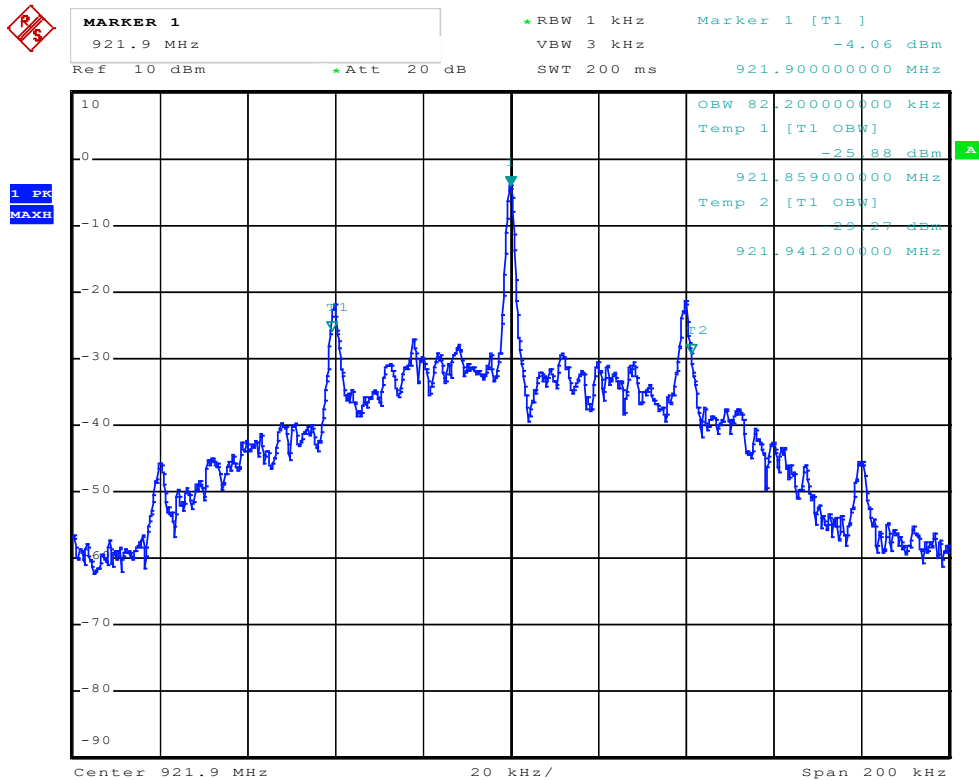
Results:

Conducted sample

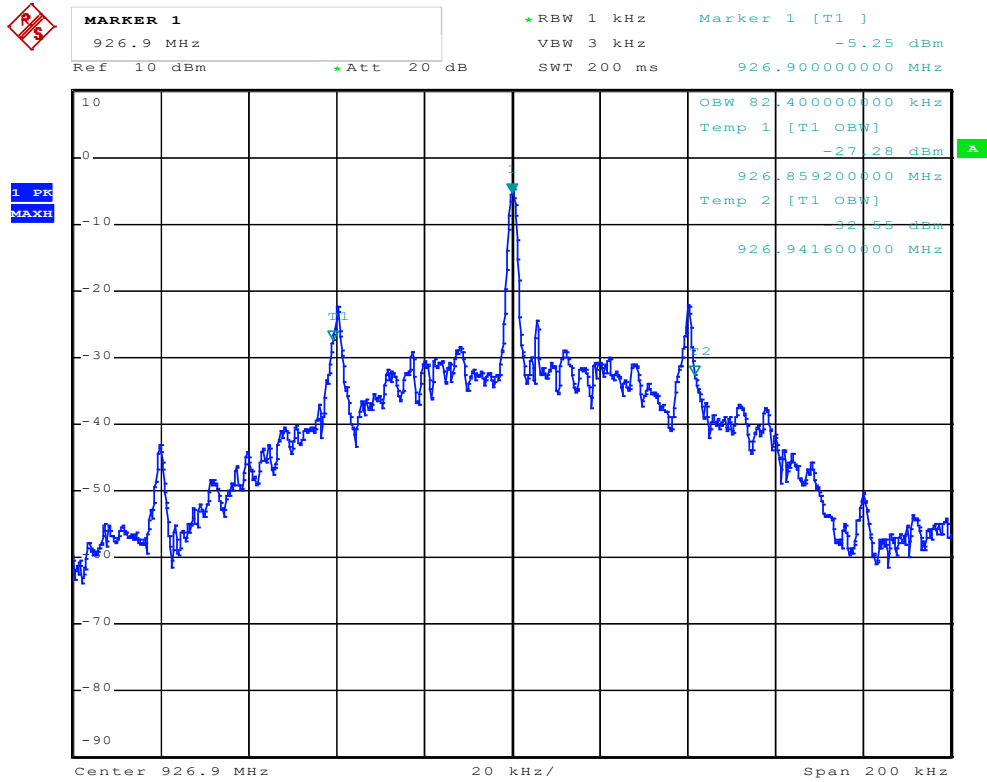
99% bandwidth – Channel 917.1 MHz



99% bandwidth – Channel 921.9 MHz

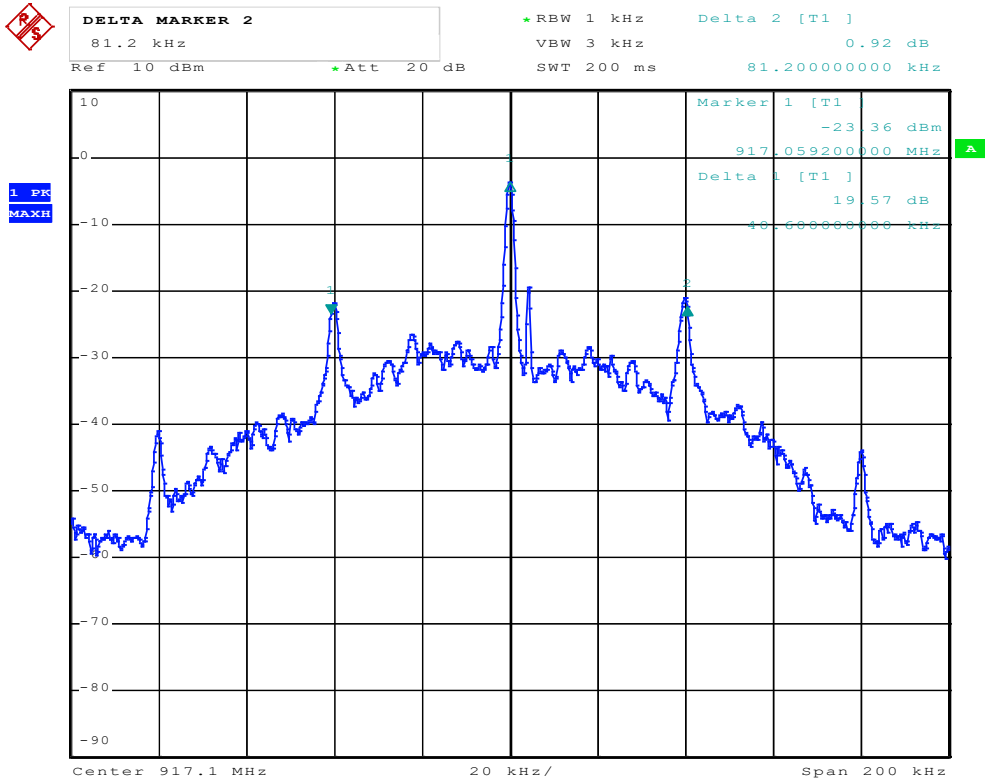


99% bandwidth – Channel 926.9 MHz

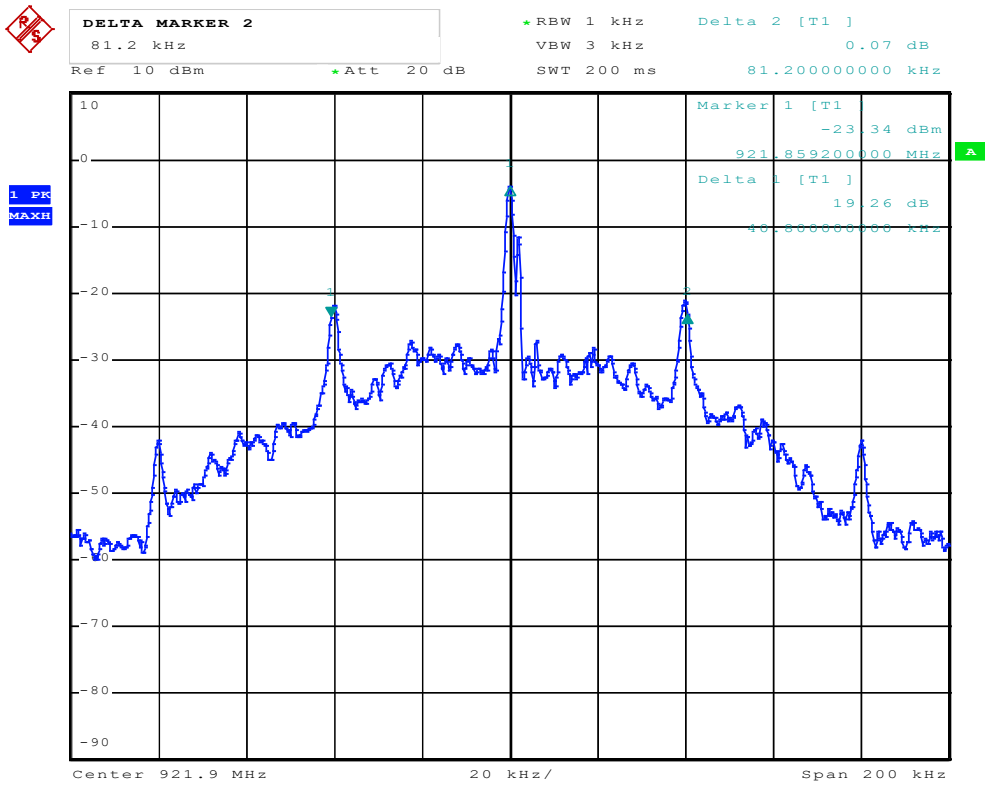


Measure realized for reporting only

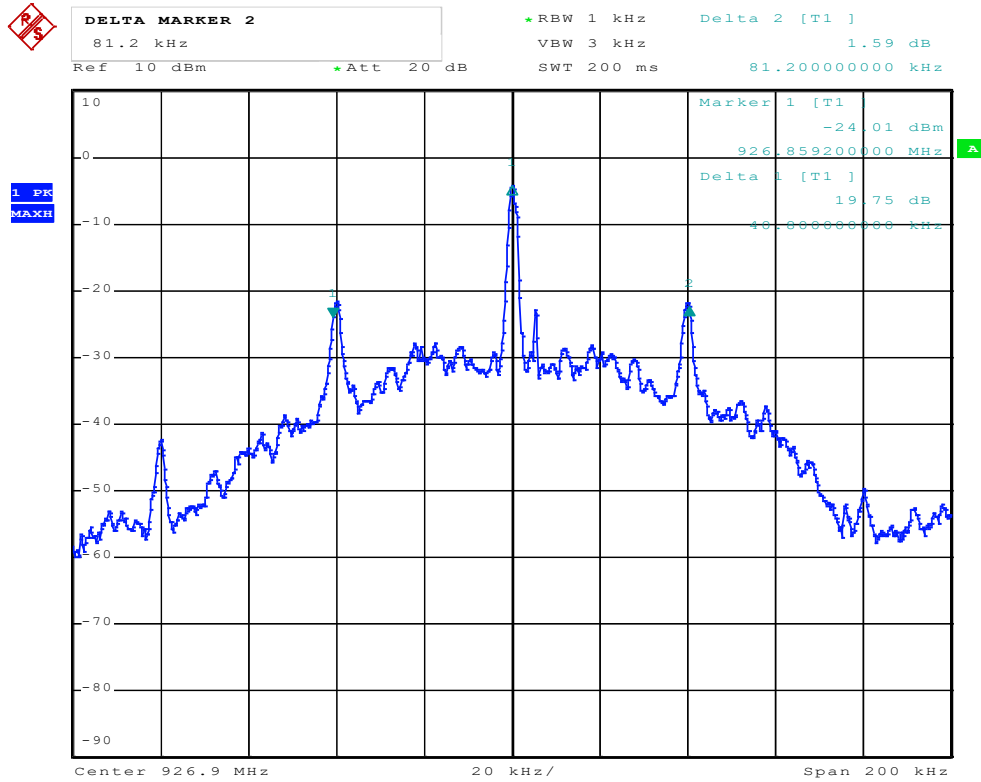
20dB bandwidth – Channel 917.1 MHz



20dB bandwidth – Channel 921.9 MHz



20dB bandwidth – Channel 926.9 MHz



Limit:

902-928 MHz band
 Maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz

Test conclusion:

RESPECTED STANDARD

13. BAND EDGE

Temperature (°C) : 21

Humidity (%HR): 45

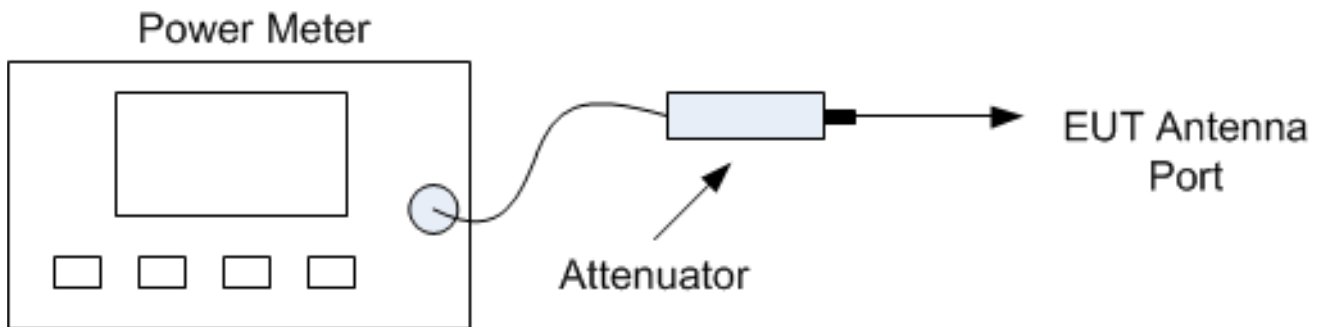
Date : November 17, 2020

Technician : T. LEDRESSEUR

Standard: FCC Part 15
 RSS-247

Test procedure:

Method of paragraphs 7.8.6 and 6.10.6 of ANSI C63.10

Test set up:
Conducted test

Test operating condition of the equipment:

The equipment under test is blocked in continuous modulated transmission mode, at the +27dBm output power setting.

First the measure is realized with hopping function disabled and then repeated with the hopping function activated.

Power source: 120 Vac by an external power supply

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

Lower Band Edge: From 900 MHz to 902 MHz

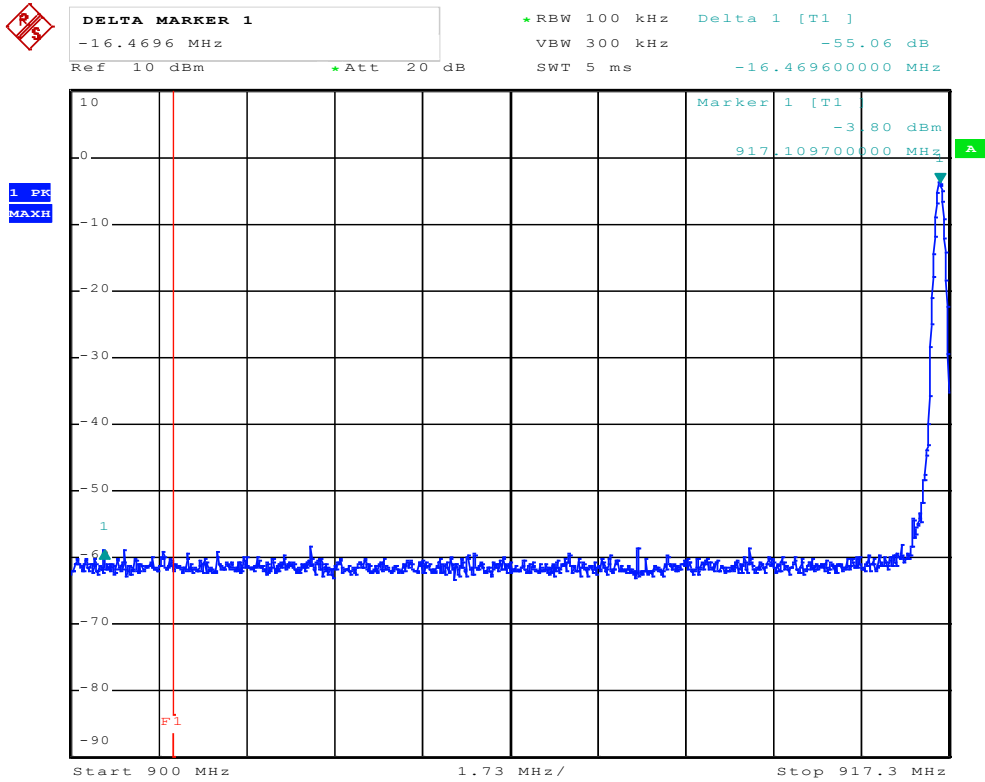
Upper Band Edge: From 928 MHz to 930 MHz

Conducted sample

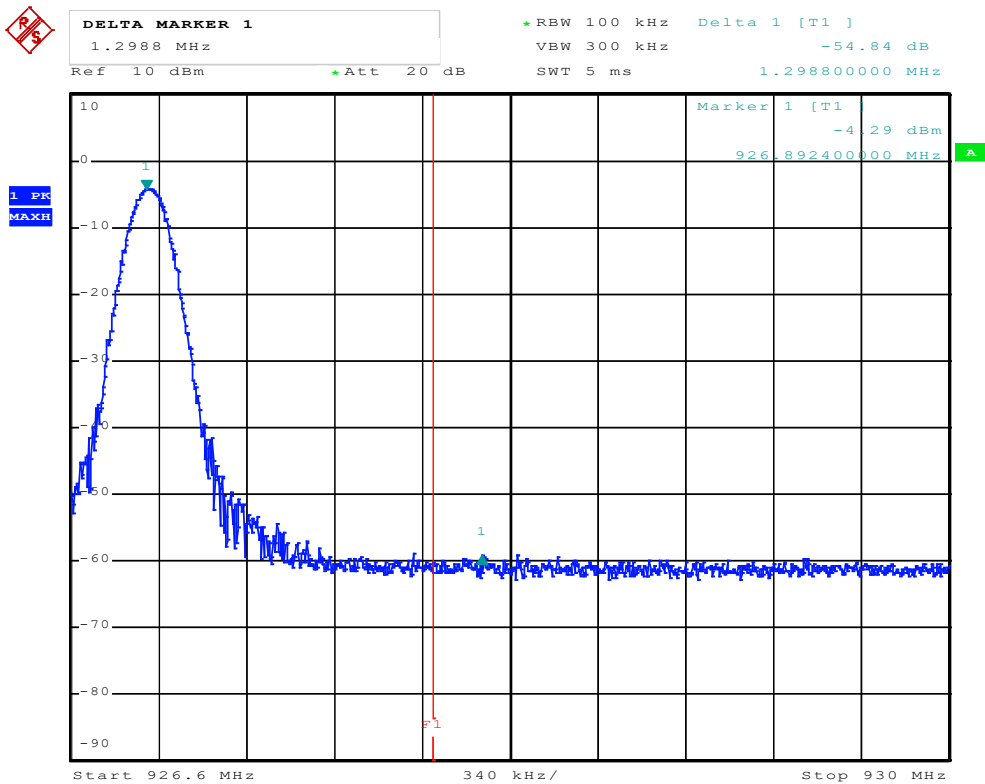
Fundamental frequency (MHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Limit (dBc)	Margin (dB)
917.1	Peak	900.64	55.06	20dBc	35.06
926.9	Peak	928.19	54.84	20dBc	34.84

(1) Marker-Delta method

Low channel



High channel

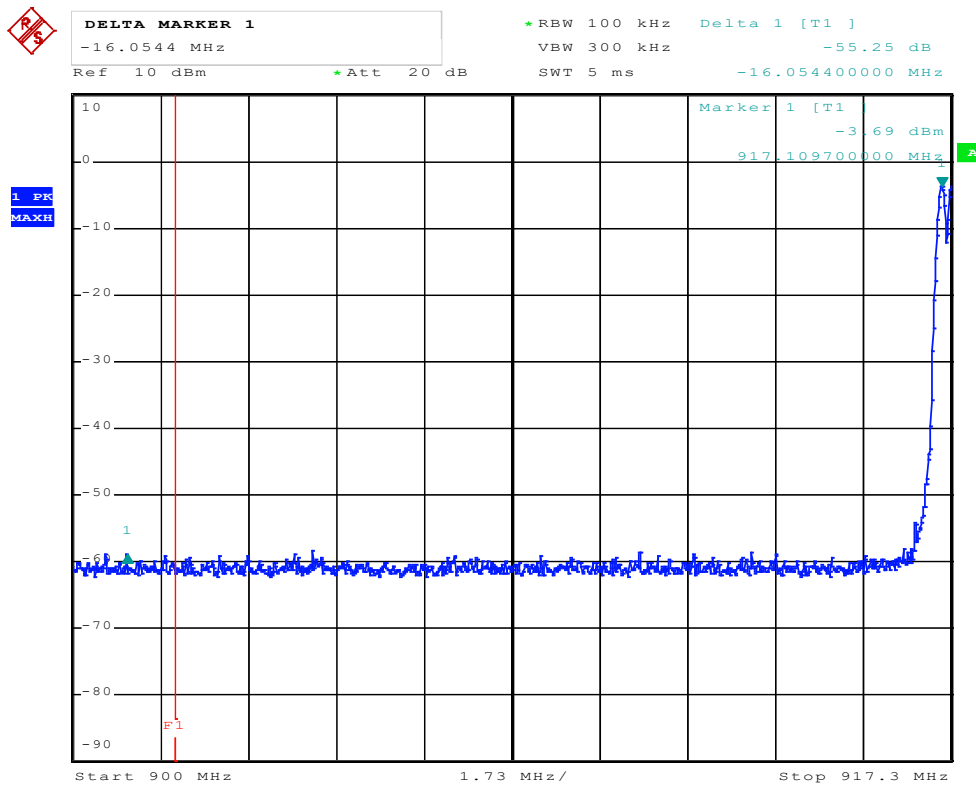


Conducted sample

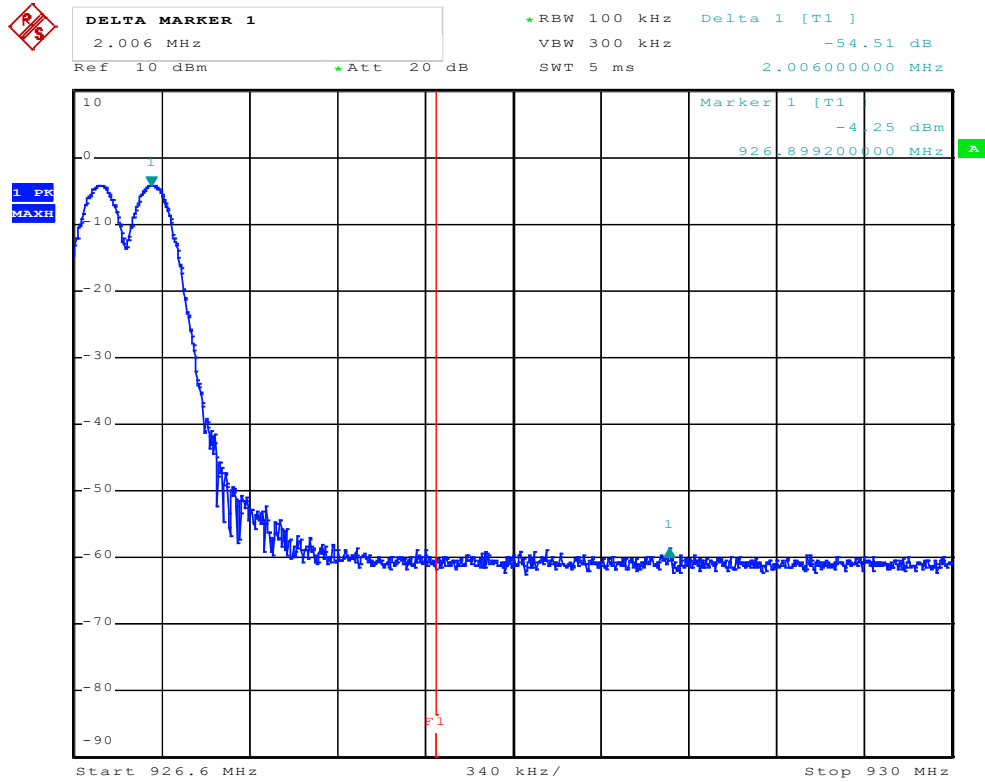
Fundamental frequency (MHz)	Detector (Peak or Average)	Frequency of maximum Band-edges Emission (MHz)	Delta Marker (dB) (1)	Limit (dBc)	Margin (dB)
917.1	Peak	901.06	55.25	20dBc	35.25
926.9	Peak	928.91	54.51	20dBc	34.51

(1) Marker-Delta method

Low channel –hopping function activated



High channel –hopping function activated



Test conclusion:

RESPECTED STANDARD

14. PEAK CONDUCTED OUTPUT POWER

Temperature (°C) : 21

Humidity (%HR): 45

Date : November 17, 2020

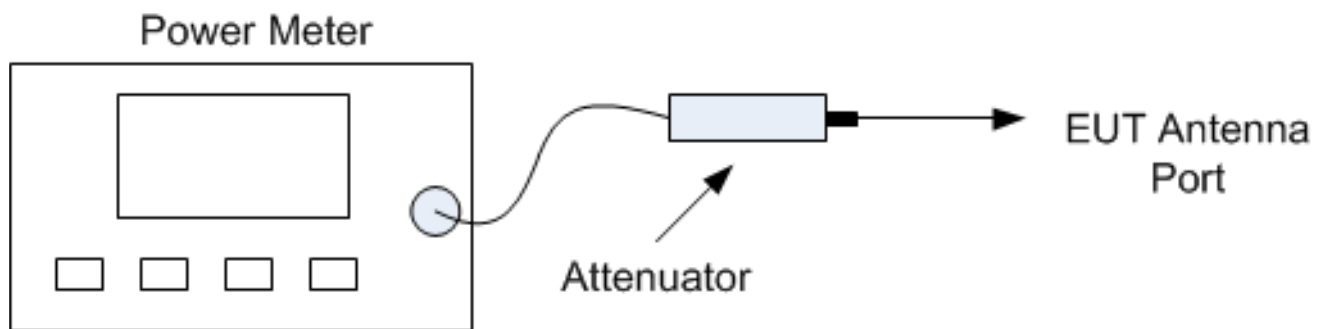
Technician : T. LEDRESSEUR

Standard: FCC Part 15
RSS-247**Test procedure:**

For FCC Part 15: paragraph 15.247 (b)

For RSS-247: paragraph 5.4

Method of paragraph 7.8.5 of ANSI C63.10

Test set up:Conducted test

The measure is realized in conducted mode with a calibrated peak power reading power meter.

Equipment under test operating condition:

The equipment under test is blocked in continuous modulated transmission mode, at the +27dBm output power setting.

Power source: 120 Vac by an external power supply

Percentage of voltage variation during the test (%):

± 1

Results:

Conducted sample Channel 1 (F = 917.1 MHz)

	Maximum Peak conducted output power		Limit (W)
	(dBm)	(mW)	
Nominal supply voltage:	26.51	447.7	1

Declared maximum antenna gain: 2.3 dBi

Conducted sample Channel 25 (F = 921.9 MHz)

	Maximum Peak conducted output power		Limit (W)
	(dBm)	(mW)	
Nominal supply voltage:	26.24	420.7	1

Declared maximum antenna gain: 2.3 dBi

Conducted sample Channel 50 (F = 926.9 MHz)

	Maximum Peak conducted output power		Limit (W)
	(dBm)	(mW)	
Nominal supply voltage:	26.09	406.4	1

Declared maximum antenna gain: 2.3 dBi

Test conclusion:

RESPECTED STANDARD

15. RADIATED SPURIOUS EMISSIONS**Temperature (°C) :** 20**Humidity (%HR):** 43**Date :** November 18, 2020**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 7.8 of ANSI C63.10

Emissions in restricted frequency bands method of paragraph 5.9 of ANSI C63.10

Test set up:

First an exploratory radiated measurement was performed. During this phase the product is oriented in three orthogonal planes.

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

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

Frequency range: From 9 kHz to 10th harmonic of the highest fundamental frequency (926.9MHz)**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 +27dBm output power setting.

Power source: 120 Vac by an external power supply

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

Results:
Radiated sample Channel 1 (F = 917.1 MHz)

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	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)
1834.2	P	150	100	H	56.82	100	43.18
2751.3	P	150	1000	H	47.99	74	26.01
3668.4	P	150	1000	V	51.36	74	22.64

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

(1) Restricted bands of operation

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

Radiated sample Channel 25 (F = 921.9 MHz)

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	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)
1843.8	P	150	100	H	56.97	100	43.03
2765.7	P	150	1000	H	46.93	74	27.07
3687.6	P	150	1000	V	49.11	74	24.89

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

(1) Restricted bands of operation

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

Radiated sample Channel 50 (F = 926.9 MHz)

Frequencies (MHz)	Detector P QP Av	Antenna height (cm)	RBW (kHz)	Polarization H: Horizontal V: Vertical	Field strength Measured at 3m (dB μ V/m)	Limits at 3 m (dB μ V/m)	Margin (dB)
1853.8	P	150	100	H	59.61	100	40.39
2780.7	P	150	1000	H	46.81	74	27.19
3707.6	P	150	1000	V	46.51	74	27.49

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

(1) Restricted bands of operation

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

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 120 dB μ V/m at 3m on channel 927.1.

So the applicable limit is 100 dB μ V/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

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

APPENDIX 1: Test equipment list

AC conducted emissions

TYPE	MANUFACTURER	EMITECH NUMBER
Outside room Hors cage	Emitech	10788
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESW44	Rohde & Schwarz	17008
LISN 1600	Thurbly Thandar Instruments	8719
High-pass filter EZ-25	Rohde & Schwarz	8635
Absorber sheath current	Emitech	10651
Cable N-5m RG214	GYL Technologies	8590
Power source 1251RP	California instruments	7011
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.18.0.26	0000

Carrier frequency separation

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Power source 1251RP	California instruments	7011
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	RS Commander	-

Number of hopping frequencies

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Power source 1251RP	California instruments	7011
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	RS Commander	-

Dwell time

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Power source 1251RP	California instruments	7011
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	RS Commander	-

Occupied bandwidth

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Power source 1251RP	California instruments	7011
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	RS Commander	-

Band edge

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Power source 1251RP	California instruments	7011
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	RS Commander	-

Peak conducted output power

TYPE	MANUFACTURER	EMITECH NUMBER
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Attenuator 10dB	Midwest Microwave	8548
Power sensor NRV-Z86	Rohde & Schwarz	11592
Power source 1251RP	California instruments	7011
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8749
Software	R&S Power Viewer Plus V5.9	-

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
Satellite synchronized frequency standard GPS8	ACQUISYS	8896
Test receiver ESI7	Rohde & Schwarz	8707
Spectrum Analyzer FSP40	Rohde & Schwarz	4088
Loop antenna 6502	EMCO	1406
Biconical antenna VHBB 9124	Schwarzbeck	8526
Biconical antenna VHA 9103	Schwarzbeck	8528
Log periodic antenna UHALP 9108A	Schwarzbeck	8543
Log periodic antenna HL223	Rohde & Schwarz	7171
Antenna 3115	EMCO	8535
Low-noise amplifier 8447D	Hewlett Packard	8511
Low-noise amplifier PAM-118A	COM-POWER	15812
N-1.5M Cable	SUCOFLEX	7279
N-2M Cable	Huber + Suhner	12911
N-5M Cable	SUCOFLEX	15882
High pass filter HP12/1200-5AA	Filtek	7310
Power source 1251RP	California instruments	7011
Multimeter 177	Fluke	14831
Meteo station WS-9232	La Crosse Technology	8750
Software	BAT-EMC V3.18.0.26	0000