



Test report No:
 NIE: 62451RRF.001

Partial Test report

USA FCC Part 15.247, 15.209

CANADA RSS-247, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

General Requirements and Information for the Certification of Radio Apparatus.

(*) Identification of item tested	Wi-Fi bgn wireless radio module with embedded full stack
(*) Trademark	Silicon Labs
(*) Model and /or type reference	WGM160P22A
Other identification of the product	FCC ID: QQQWGM160P IC: 5123A-WGM160P
(*) Features	802.11bgn @ 2.4GHz, single spatial stream
Applicant	SILICON LABORATORIES FINLAND OY Alberga Business Park, Bertel Jungin aukio 3, 02600 Espoo, Finland
Test method requested, standard	<p>USA FCC Part 15.247 (10-1-18 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.</p> <ul style="list-style-type: none"> - Maximum output power and antenna gain - Band-edge emissions compliance (Transmitter) <p>USA FCC Part 15.209 (10-1-18 Edition): Radiated emission limits; general requirements.</p> <p>CANADA RSS-247 Issue 2 (February 2017).</p> <ul style="list-style-type: none"> - Maximum output power and antenna gain - Band-edge emissions compliance (Transmitter) <p>CANADA RSS-Gen Issue 5 (April 2018).</p> <p>Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019.</p> <p>ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.</p>

Approved by (name / position & signature)	J. Carlos Luque RF Lab. Supervisor
Date of issue	2019-10-30
Report template No	FDT08_22 (* "Data provided by the client")

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Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is a FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of a Wi-Fi bgn wireless radio module with embedded full stack.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
62451C/001	Wi-Fi bgn wireless radio module with embedded full stack	WGM160P22A	14539431800027	2019/10/03
59573/013	UFL-SMA Cable	---	---	2018/12/27
59573/014	UFL-SMA Cable	---	---	2018/12/27

Sample S/01 has undergone the following test(s): All CONDUCTED tests indicated in Appendix A.

Test sample description

Ports..... :	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾		
	Module has UART host interface (@115200 with no flow control), which is routed to USB-UART converter of certification board.		Yes, to launch the test modes - Can be detached during testing when module is supplied by lab power supply	<input type="checkbox"/>	<input type="checkbox"/>		
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	<input checked="" type="checkbox"/>	DC: Nominal 3.3V, min 3.0V, max 3.6V					
Rated Power	~0.7W						
Clock frequencies	38.4MHz (RF XTAL), 72MHz (internal processor), 32.768KHz (low freq XTAL for sleep modes) — None of the clocks is exposed to a module's pin						
Other parameters..... :							
Software version	4.0						
Hardware version..... :	1.12						

Dimensions in cm (W x H x D).....:	23.8mm x 14.2mm x 2.3mm		
Mounting position.....:	<input checked="" type="checkbox"/>	Other: This is an embedded module, meant to be surface-mounted in the PCB of an end-product by OEMs, etc.	
Modules/parts	Module/parts of test item	Type	Manufacturer
Accessories (not part of the test item)	Description	Type	Manufacturer
	50-Ohm Termination		
	WSTK evaluation mainboard providing USB-UART conversion. Could be used as flash programmer if needed.		
Documents as provided by the applicant.....:	Description	File name	Issue date
	Descriptions of test items and accessories and tools, plus instructions for testing.		

⁽³⁾ Only for Medical Equipment

Identification of the client

SILICON LABORATORIES FINLAND OY
 Alberga Business Park, Bertel Jungin aukio 3, 02600 Espoo, Finland.

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-10-21
Date (finish)	2019-10-22

Document history

Report number	Date	Description
62451RRF.001	2019-10-30	First release

Environmental conditions

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 35 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Ignacio Cabra.

Used instrumentation:

Conducted Measurements:

	Last Calibration	Due Calibration
1. Wideband Power sensor R&S NRP-Z81	2019/06	2021/06
2. Signal Analyzer 20 Hz to 8 GHz ROHDE AND SCHWARZ FSQ8	2018/08	2020/08
3. DC Power Supply Keysight Technologies U8002A	---	---
4. Digital multimeter FLUKE 179	2019/06	2020/06

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

1. Wi-Fi bgn20

FCC PART 15 PARAGRAPH/ RSS-247			
Requirement – Test case		Verdict	Remark
Section 15.247 Subclause (a) (2) / RSS-247 5.2. (a)	6 dB Bandwidth	N/M	(1)
Section 15.247 Subclause (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	P	
Section 15.247 Subclause (d) / RSS-247 5.5	Emission limitations conducted (Transmitter)	N/M	(1)
Section 15.247 Subclause (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	P	
Section 15.247 Subclause (e) / RSS-247 5.2. (b)	Power spectral density	N/M	(1)
Section 15.247 Subclause (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	N/M	(1)
<u>Supplementary information and remarks:</u>			
(1) Test not requested.			

Appendix A: Test results. Wi-Fi bgn20

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TEST CONDITIONS

POWER SUPPLY (V):

V nominal:	3.3 Vdc
Type of power supply:	DC voltage.
Type of Antenna:	On-board dielectric chip (RF1 pad).
Declared Antenna Gain:	+1.86 dBi

TEST FREQUENCIES:

Low Channel:	2412 MHz
Middle Channel:	2437 MHz
High Channel:	2462 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



The DC supply voltage is applied using an external calibrated power supply with a multimeter.

FCC Section 15.247 Subclause (b) / RSS-247 Clause 5.4 (d) Maximum output power and antenna gain

SPECIFICATION:

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

RESULTS:

The maximum peak conducted output power level in the fundamental emission was measured using the method according to point 11.9.1.3 “Method PKPM1” of ANSI C.63.10-2013

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

Maximum Declared Antenna Gain: +1.86 dBi

- **Mode 802.11 b**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Maximum Peak Conducted Power (dBm)	17.59	18.42	17.69
Maximum EIRP Power (dBm)	19.45	20.28	19.55
Measurement uncertainty (dB)	<±0.79		

- **Mode 802.11 g**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Maximum Peak Conducted Power (dBm)	14.76	18.82	14.98
Maximum EIRP Power (dBm)	16.62	20.68	16.84
Measurement uncertainty (dB)	<±0.79		

- **Mode 802.11 n20**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Maximum Peak Conducted Power (dBm)	14.35	18.81	14.61
Maximum EIRP Power (dBm)	16.21	20.67	16.47
Measurement uncertainty (dB)	<±0.79		

Verdict: PASS

FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Band-edge emissions compliance (Transmitter)

SPECIFICATION:

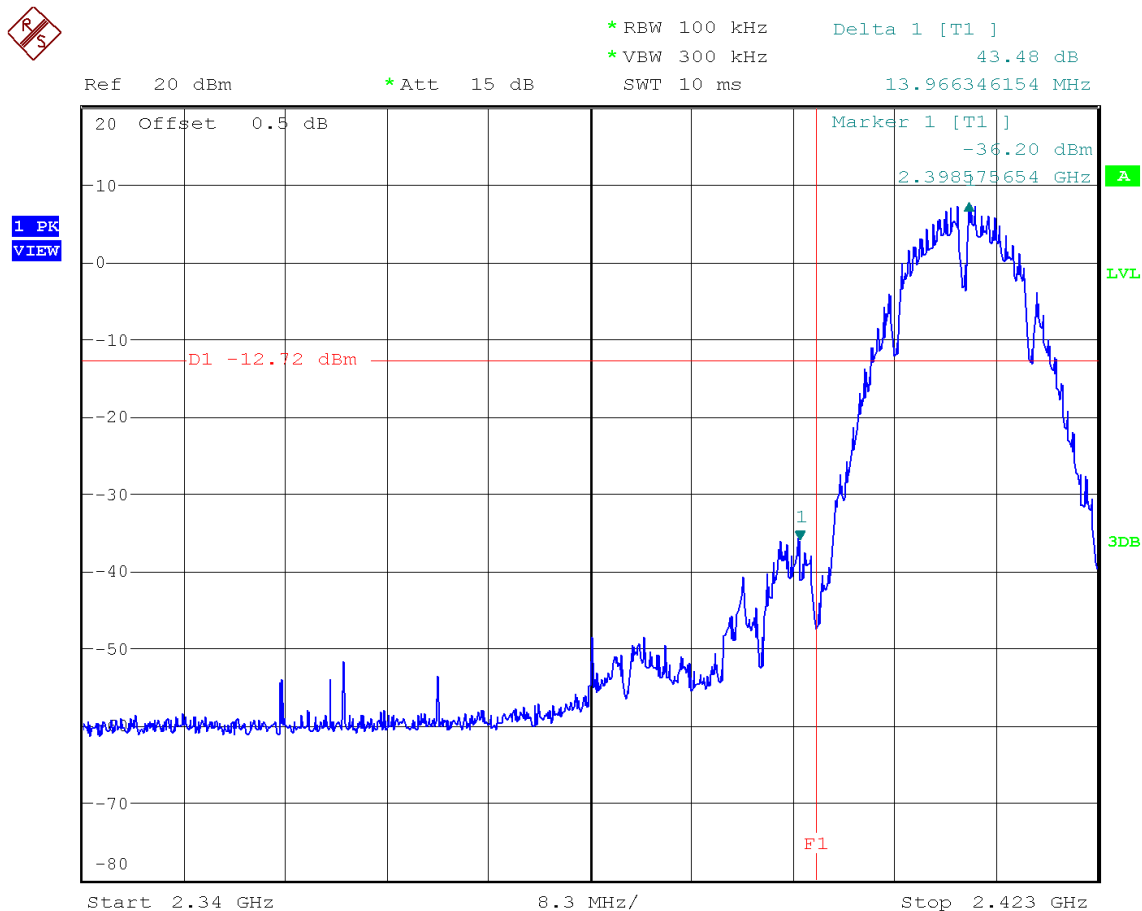
In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

RESULTS:

Radiated measurements were used to show compliance with the limits in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

- **Mode 802.11 b – Band-edge emissions compliance**

- Low Channel:



Verdict: PASS

Measurement uncertainty (dB)	<±1.56
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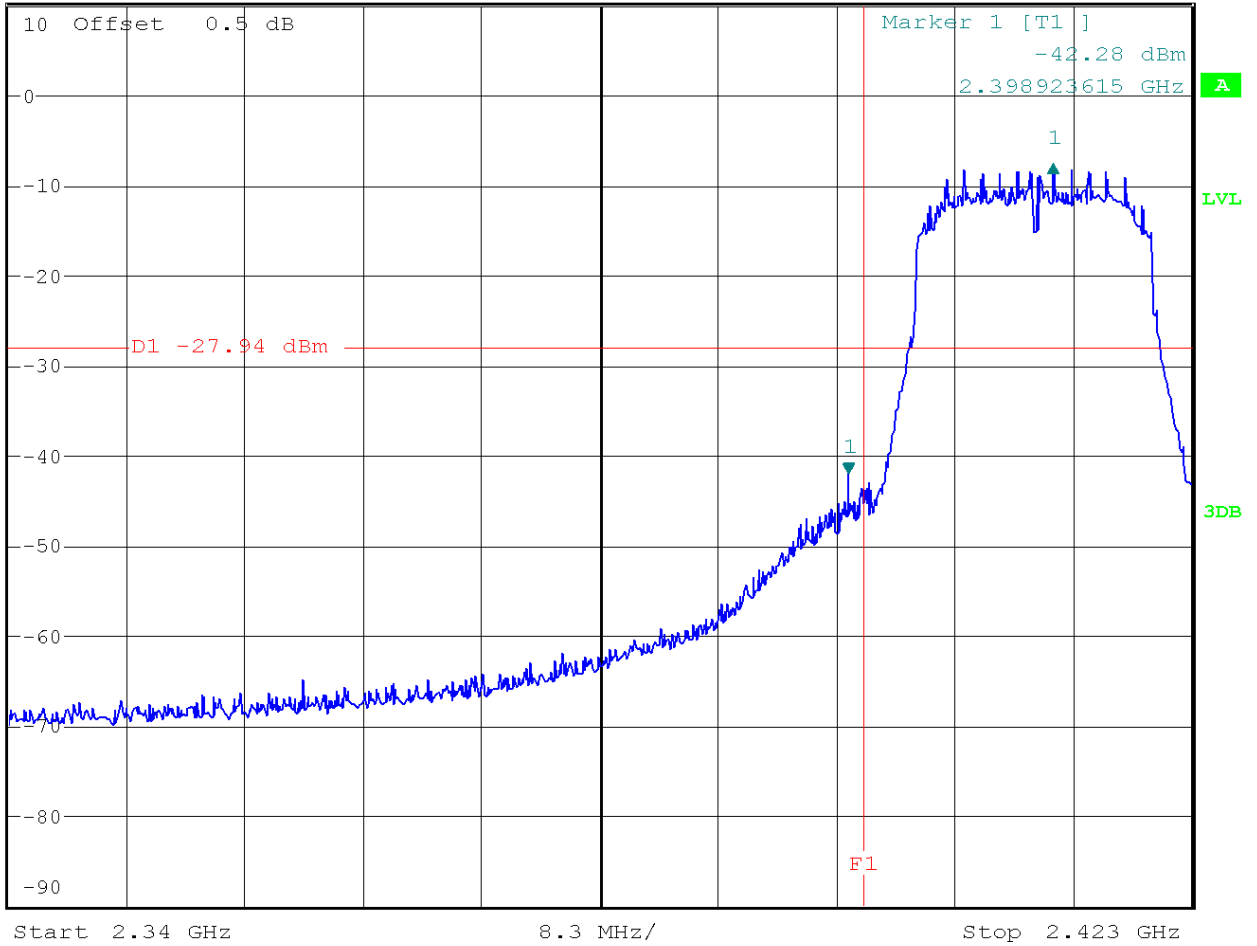
• **Mode 802.11 g – Band-edge emissions compliance**

- Low Channel:



* RBW 100 kHz Delta 1 [T1]
 * VBW 300 kHz 34.34 dB
 Ref 10 dBm * Att 10 dB SWT 10 ms 14.365384615 MHz

1 PK
VIEW



Verdict: PASS

Measurement uncertainty (dB)	<±1.56
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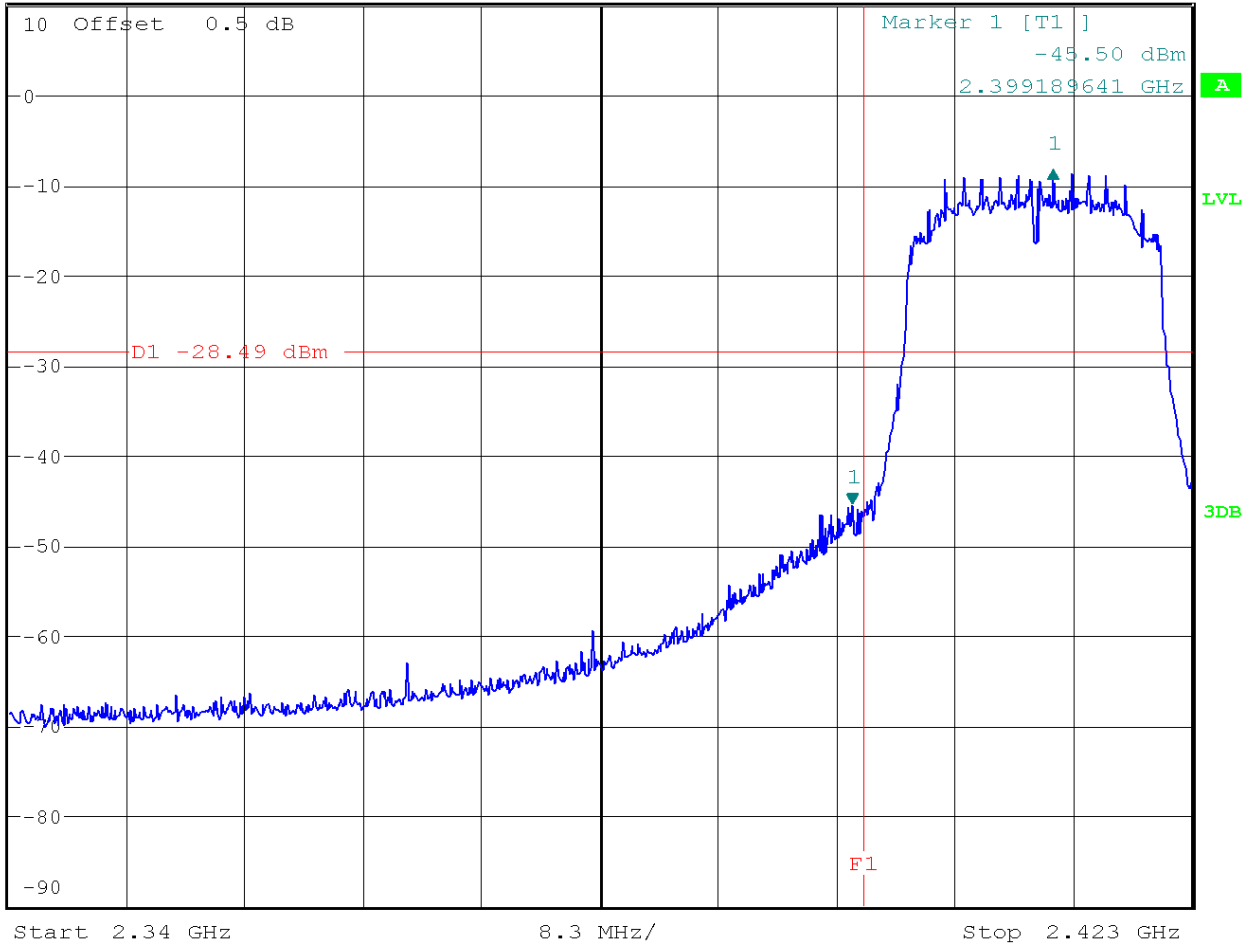
• **Mode 802.11 n20 – Band-edge emissions compliance**

- Low Channel:



* RBW 100 kHz Delta 1 [T1]
 * VBW 300 kHz 37.00 dB
 Ref 10 dBm *Att 10 dB SWT 10 ms 14.099358974 MHz

1 PK
VIEW



Verdict: PASS

Measurement uncertainty (dB)	<±1.56
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