



Date of issue	2019-03-12
Report template No	FDT08_21



Index

Competences and guarantees	4
General conditions	4
Uncertainty	4
Data provided by the client	4
Usage of samples	5
Test sample description	5
dentification of the client	6
Testing period and place	6
Document history	7
Environmental conditions	7
Remarks and comments	8
Testing verdicts	10
Summary	10
Appendix A: Test results. RF interface 1	11
Appendix B: Test results. RF interface 2	76



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 S.A.U. is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: ISED 4621A-4.

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.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification S.A.U.

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 test 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 N°	Description	Model	Serial Nº	Reception
59573/003	Wi-Fi bgn wireless radio module with embedded full stack	WGM160P22N (ordering code WGM160PX22KGN2)		2018/12/27
59573/014	SMA cable			2018/12/27

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

- Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Reception
59573/004	Wi-Fi bgn wireless radio module with embedded full stack	WGM160P22N (ordering code WGM160PX22KGN2)		2018/12/27
59573/010	External Antenna			2018/12/27
59573/011	External Antenna			2018/12/27

Sample S/02 has undergone the following test(s): All RADIATED tests indicated in Appendixes A, B.

Test sample description

Ports		Cable			
	Port name and description	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		
Rated power supply:	Voltage and Frequency		Refe	erence poles	
			L1 L2	L3	N PE
			, max 3.6V		



Rated Power:	~0.7W			
Clock frequencies:	38.4MHz (RE XTAL), 72MHz (internal processor), 32.768KHz (low freq XTAL) — None of the clocks is exposed to a module's pin.			
Other parameters:				
Software version:				
Hardware version:				
Dimensions in cm (W x H x D):	23.8mm x 14.2mm x 2.3mm			
Mounting position	Other: This is an embedded module, meant to be surface-mo the PCB of an end-product by OEMs, etc.		face-mounted in	
Modules/parts:	Module/parts of test item	Туре	Manufacturer	
Accessories (not part of the test	Description	Туре	Manufacturer	
item):	2 x External dipole antenna			
	2 x 50-Ohm Termination			
	SMA to U.FL terminated coax cables			
	WSTK evaluation board to be used as flash programmer if needed			
Documents as provided by the applicant	Description	File name	Issue date	
appiloant	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)	2019-01-08
Date (finish)	2019-02-01



Document history

Report number	Date	Description
59573RRF.001	2019-03-12	First release

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	<1Ω

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

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
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω



Remarks and comments

-The tests have been performed by the technical personnel: Miguel Ángel Torres, José Manuel Jiménez González, Verónica García Capilla, José Gabriel Pendón.

-Used instrumentation:

Conducted Measurements:

	<u>a measurements</u> .	Last Calibration	Due Calibration
1.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2017/07	2019/07
2.	DC Power Supply 40V/40A Rohde & Schwarz NGPE40	2018/02	2021/02
3.	Wideband Power sensor Rohde & Schwarz NRP-Z81	2017/04	2019/04
Radiated	<u>Measurements:</u>		
		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	EMI Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2018/10	2020/10
3.	RF Pre-amplifier, 38 dB, 30 MHz-6 GHz BONN ELEKTRONIK BLNA 0360-01N	2018/07	2019/07
4.	Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2018/07	2021/07
5.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV 40	2018/02	2020/02
6.	Pre-amplifier G>30dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2018/03	2019/03
7.	RF Pre-amplifier, G>48dB, 18-40GHz NARDA JS44-18004000-33-8P	2018/02	2020/02
8.	Broadband Horn antenna 1-18GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2018/01	2021/01
9.	Broadband Horn antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2018/07	2021/07

-Manufacturer's statement:





Description of WGM160P Variants and of Low Freq Crystal Oscillator Functionality

In the WGM160P family of Wi-Fi modules, four variants exist, and the manufacturing differences are described in the following table:

- Integral chip antenna assembled and connected to primary RF port	- Integral chip antenna not assembled: external antenna(s) required for normal
- 32kHz crystal assembled	operations - 32kHz crystal assembled
- Orderable part number:	
WGM160PX22KGA2	- Orderable part number:
- Known as "A" variant with generic model	WGM160PX22KGN2
name: WGM160P22A	- Known as "N" variant with generic model name: WGM160P22N
 Integral chip antenna assembled and connected to primary RF port 32kHz crystal not assembled 	- Integral chip antenna not assembled: external antenna(s) required for normal operations
- Orderable part number:	- 32kHz crystal not assembled
WGM160P022KGA2	- Orderable part number:
- Known as "A" variant with generic model	WGM160P022KGN2
name: WGM160P22A	- Known as "N" variant with generic model name: WGM160P22N

A 32.768kHz crystal is connected to the microcontroller inside the module, which contains a low-frequency crystal oscillator being used as the sleep clock for the power saving modes of the module. The microcontroller feeds the buffered 32kHz clock signal to the radio chip which uses it to schedule its sleep periods between RF operation periods.

A variant with the 32.768kHz crystal not assembled in production is provided to reduce the module cost, for customers for whom the power consumption is not as important as the cost. In the variants where the crystal has not been assembled, the software will detect its absence and will configure the microcontroller first, and consequently the radio chipset, to use internal RC clocks for sleep timing. The radio listen periods will be widened too, due to the lower timing precision, with the only side effect of increasing the average current consumption.

All RF operation is correlated to a separate, high precision, thermally compensated, crystal which is connected to the radio chipset, and which is used among others for all precision timings required by the radio communication. Nothing that affects radio operation depends on the low frequency crystal.

The printed circuit board with all the variants is identical, as is the software and all settings.

Silicon Laboratories Finland Oy Alberga Business Park, Bertel Jungin aukio 3 FI-02600 Espoo, Finland Phone: +358 9 435 5060 www.silabs.com



Testing verdicts

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

Summary

WiFi 2.4 GHz (802.11b/g/n).

FCC PART 15 PARAGRAPH / RSS-247								
Requirement – Test cas	Verdict	Remark						
Section 15.247 Subclause (a) (2) / RSS-247 5.2. (a)	Р							
Section 15.247 Subclause (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	Р						
Section 15.247 Subclause (d) / RSS-247 5.5	Emission limitations conducted (Transmitter)	Р						
Section 15.247 Subclause (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	Р						
Section 15.247 Subclause (e) / RSS-247 5.2. (b)	Power spectral density	Р						
Section 15.247 Subclause (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	Р						
Supplementary information and remarks:								
None.								



Appendix A: Test results. RF interface 1.

Report No: (NIE) 59573RRF.001

2019-03-12



INDEX

TEST CONDITIONS	13
Occupied Bandwidth	15
FCC Section 15.247 Subclause (a) (2) / RSS-247 Clause 5.2 (a) 6 dB Bandwidth	22
FCC Section 15.247 Subclause (b) / RSS-247 Clause 5.4 (d) Maximum output power and ante gain	
FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations conducted (Transmitter)	30
FCC Section 15.247 Subclause (e) / RSS-247 5.2. (b) Power spectral density	39
FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations radiated (Transmitter)	46



TEST CONDITIONS

POWER SUPPLY (V):

V nonimal:	3.3 Vdc
Type of power supply:	DC voltage.
Type of Antenna:	External dipole.
Declared Antenna Gain:	2.14 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.



RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

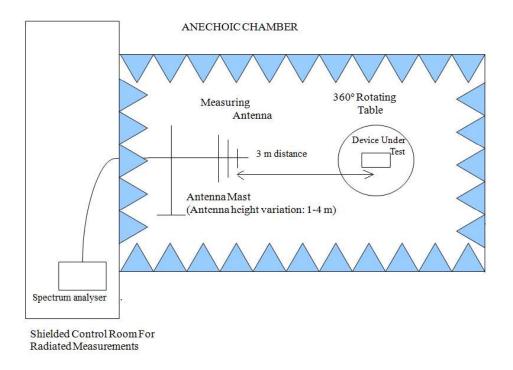
For radiated emissions in the range 1 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

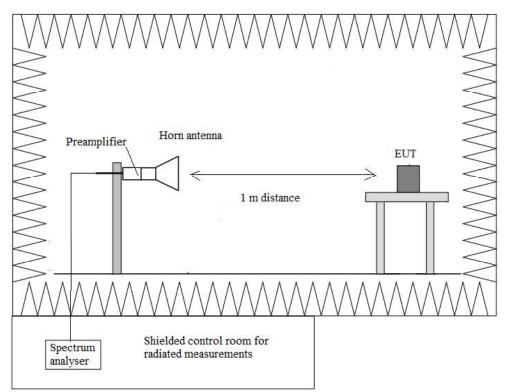
Measurements were made in both horizontal and vertical planes of polarization.



Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup f > 1 GHz:





Occupied Bandwidth

RESULTS:

• Mode 802.11 b

	Low Channel	Middle Channel	High Channel
	2412 MHz	2437 MHz	2462 MHz
99% bandwidth (MHz)	13.05	13.45	13.10
Measurement uncertainty (kHz)		<± 28.03	

• Mode 802.11 g

	Low Channel	Middle Channel	High Channel
	2412 MHz	2437 MHz	2462 MHz
99% bandwidth (MHz)	16.75	24.25	16.75
Measurement uncertainty (kHz)		<± 28.03	

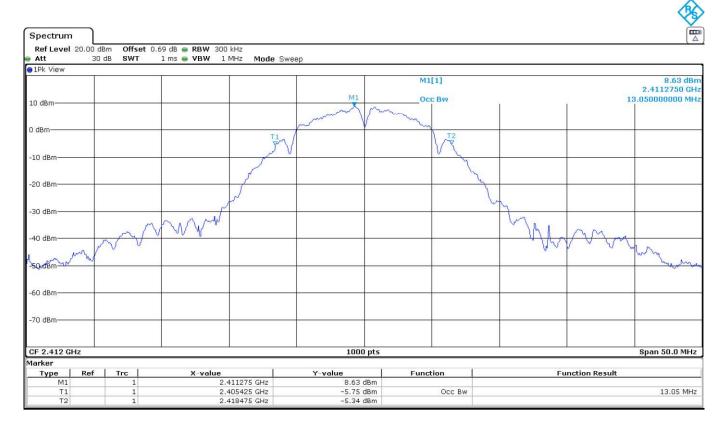
• Mode 802.11 n20

	Low Channel	Middle Channel	High Channel
	2412 MHz	2437 MHz	2462 MHz
99% bandwidth (MHz)	17.65	24.15	17.60
Measurement uncertainty (kHz)		<± 28.03	



• Mode 802.11 b - Occupied Bandwidth

- Low Channel:



- Middle Channel:

Spectrum											
Ref Level 20		Offset 0.	69 dB 🥌 RBW 300	kHz							1
Att	30 dB	SWT	1 ms 📾 VBW 11	MHz Mode Swe	ер						
1Pk View											
					M1		1[1]			14	9.10 dB 2.4362750 GF
10 dBm					mm	min	CC BW	1		1.	3.450000000 MH
) dBm	_				~	/ ~~~	1			· · · · · · · · · · · · · · · · · · ·	-
2				JAN			VZ				
-10 dBm				7			Z	h			
-20 dBm	-							1			
-30 dBm			mon						5		
-40 dBm		m	1 vv V~						why	hm	
40 abin	V										mar
50 dBm							Č.				
-60 dBm											
70 dBm	_										
CF 2.437 GHz					1000	pts					Span 50.0 MHz
1arker									1728	2011 ASS 211	
	Ref	Trc	X-value	00075 011-	Y-value	Func	tion		Fu	nction Result	
M1 T1		1		136275 GHz 130225 GHz	9.10		Occ Bw				13.45 MHz
T2		1		H3675 GHz	-5.90 (OCC BW				13.45 MH2

3



- High Channel:

i ngi									(BS)
Spectrum Ref Level 20.00 d		59 dB 👄 RBW 300							
	dB SWT	1 ms 🥌 VBW 11	MHz Mode Swe	ер					
●1Pk View									a ca la
					(YI	1[1]			8.63 dBm 2.4627750 GHz
10 dBm					M1 0	cc Bw		1:	8.100000000 MHz
				many	my				
0 dBm			7.1	~	· · · · · · · · · · · · · · · · · · ·	1			
						V Z			
-10 dBm			J			2 h			
-20 dBm			f			Y	-		
		N	m				herry		-
-30 dBm	n	m					mahl	mmm	
-40 dBm	Muf V						4.0		Why me
-50 dBm -									
-60 dBm									
-70 dBm									
CF 2.462 GHz				1000) pts				Span 50.0 MHz
Marker									
Type Ref	Trc	X-value	C0775 011-	Y-value		ction	Fu	Inction Result	
M1 T1 T2	1	2.4	62775 GHz 55475 GHz 68575 GHz	8.63 -5.28 -5.58	dBm	Occ Bw			13.1 MHz



• Mode 802.11 g - Occupied Bandwidth

- Low Channel:

Spectrur	n												
Ref Leve				9 dB 👄 RBW 300		100							
Att 1Pk View	3	80 dB SWT	۲ <u>1</u>	.ms 📾 VBW 11	/Hz Mode	Sweep							
STEK VIEW							1	M1	11				2.05 dBm
													2.4115250 GHz
10 dBm								OC	BW			10	5.75000000 MHz
						MI							
0 dBm					2	man man man	mon	manne	an				
o ubiii					TIN				- Vy	V 2			
					¥					Y			
-10 dBm					1					6			
					John Start S					1			
-20 dBm				, Ar	en e		-			2	b		
				marinalition							many march		
-30 dBm		- LPOWN	anin	-0							- 107	Internation of	
	1 and	howberry		maniphent								anongry	mannahall
-40 dBm	mar												and the second
h molenels	~0												What I h
-50 dBm-													em M (
-50 aBm-													
100 K													
-60 dBm													
-70 dBm			-				-						
CF 2.412	GHz			-		100	0 pts						Span 50.0 MHz
Marker	westows?												
Туре	Ref	Trc		X-value		Y-value		Funct	ion		Fu	nction Result	
M1		1			11525 GHz	2.05			0				10.75 141-
T1 T2		1			03625 GHz 20375 GHz	-7.86			Occ Bw				16.75 MHz
16	-1			5,1	Looro driz	1.15	abili						

- Middle Channel:

Spectrum							
Ref Level 20.00 d Att 30	lBm Offse dB SWT	et 0.69 dB 👄 RBW 300 kHz 1 ms 👄 VBW 1 MHz Mo	de Sweep				
●1Pk View							
				M1[1]			7.25 dBn
				Occ Bw		2	2.4364750 GH: 4.250000000 MH:
10 dBm			M1	OLC BW	E.		1.230000000 MH
			and the second s	mondulum			
U dBm		m		5	1		
		TI was a ward			hunner T2		
-10 dBm		where the state of the state of the			manna when had		
	1 Under the	whenter			mercy	rennert-working.	
-20 dBm	purchas					manufactures	0
Landerson							mul Mul a
-30 dBm							anon
-30 UBIII							
-40 dBm							
50 dBm							
-60 dBm							
-70 dBm							
CF 2.437 GHz			1000 pts	;	I	1	Span 50.0 MHz
Marker							•
Type Ref	Trc	X-value	Y-value	Function	F	unction Result	
M1	1	2.436475 GH					04.05.1
T1 T2	1	2.424625 GH 2.448875 GH		Occ Bw			24.25 MHz
14	1	2.7700/3 GF	20.00 UBIII	1			



- High Channel:

Spectrun	n									
Ref Leve			.69 dB 👄 RBW 300		and and					
Att 1Pk View	30	dB SWT	1 ms 🖷 VBW 11	MHz Mode Swe	өр					
						M1	[1]			2.27 dBm
										2.4625750 GHz
10 dBm						0c	CBW	T	1	5.750000000 MHz
					n					
0 dBm				man	manne	hunanena the	d.au			
				Francis			W22			
-10 dBm							1			
				1				m la		
-20 dBm				ptr .				1		
			Inmound					www. the hashes .		
-30 dBm		. and when	whether					- which	How we want and a second and a	
	1 ANNAL MOURN	1 Met work	multurbergan					n have been been been been been been been be	and they a	Mur
-40 dBm	(V)									Why I
Andrew										What
-50 dBm										
-60 dBm			-							
-70 dBm										
CF 2.462 0	GHz				1000 (ots				Span 50.0 MHz
Marker										
Туре	Ref	Trc	X-value	60575 CU5	Y-value	Func	tion	Fu	unction Result	
M1 T1		1		62575 GHz	2.27 dE -7.89 dE		Occ Bw			16.75 MHz
T2		î		70375 GHz	-7.94 dE					



• Mode 802.11 n20 - Occupied Bandwidth

- Low Channel:

Spectrum	,									
Ref Level			0.69 dB 👄 RBW 300							
Att 1Pk View	30	dB SWT	1 ms 🖷 VBW 11	MHz Mode Swe	зер					
						M	L[1]			1.15 dBm
										2.4125750 GHz
10 dBm							BW	T.	1	7.650000000 MHz
0.10						M1				
0 dBm				Turrent	- and - and - and -			72		
10 40-				¥				Y		
-10 dBm				}						
-20 dBm			mariant	1						
			N. M. Marchanow					Munuman	- How Marly M	
-30 dBm		heltont	our man with the second		-			and and	Motor Marken	
	marsher	above from the							martuch	Wheel.
-40 dBm					-		-			way alor al
willing										Wedwh
-50 dBm										
-60 dBm										
-70 dBm										
CF 2.412 G	Hz				1000) pts				Span 50.0 MHz
Marker										
Туре	Ref	Trc	X-value		Y-value	Fund	tion	F	unction Result	
M1		1		412575 GHz	1.15					Statestic approved to the providence of
T1		1		+03175 GHz	-7.77		Occ Bw			17.65 MHz
T2		1	2.4	120825 GHz	-7.55	abm				

- Middle Channel:

Spectrum						
Ref Level 20.00 dB		0.69 dB 👄 RBW 300 kHz				(-
Att 30 0	B SWT	1 ms 🖷 VBW 1 MHz Mode :	Sweep			
1Pk View						
				M1[1]		6.87 dBr
				0		2.4364750 GH
10 dBm			M1	Occ Bw	Т	24.150000000 MH
		man	moundant	mannun		
U dBm		man		my renze		
U UDIII						
-10 dBm		14 stevenschart			When The	
	01	withinker			and	
	In mentality					Vhowhen
-20 dBm		TI				Manna mall more date
- Merallow						and when a
-30 dBm						- vu
-40 dBm						
-50 dBm						
1211 22						
-60 dBm						
-70 dBm						
-yo ubin						
CF 2.437 GHz			1000 pts	I		Span 50.0 MHz
Marker						
Type Ref	Trc	X-value	Y-value	Function	Functio	on Result
M1	1	2.436475 GHz	6.87 dBm			
T1	1	2.424575 GHz	-11.37 dBm	Occ Bw		24.15 MHz
T2	1	2.448725 GHz	-11.84 dBm			



- High Channel:

Spectrun	n										
Ref Level		iBm Offset dB SWT	0.69 dB 👄 RBW 300 1 ms 👄 VBW 1 M								
1Pk View	-30		1 1115 🛶 🕈 🖬 🗤 1 11	MHz Mode S	weep						
						M	1[1]				1.27 dBm
							Dur				2.4624250 GHz 7.600000000 MHz
10 dBm			-			0	CC BW	1		1	.60000000 MH2
						M1					
0 dBm					ward and a second	and and and and and	"oun				
				Thorn			"or mun	~42			
-10 dBm								1			
				1				5			
-20 dBm				1				٣,			
			A silve of star						1000		
-20 dBm			and and a the to a						Murridian .	had	
-30 abiii	1 . 10.	Mannahan	on the all all and the second							all why have alles	white the work
10 10-14	with										why at a
-40 aBm											MANN
NW O											mun
-50 dBm							1				
-60 dBm							-				
-70 dBm											
CF 2.462 0					1000	Inte					Span 50.0 MHz
Marker	3112				1000	5 μ(3					opun oo.0 MHz
Туре	Ret	Trc	X-value	1	Y-value	Fun	ction		Fu	nction Result	
M1		1		62425 GHz	1.27						
T1 T2		1		53225 GHz 70825 GHz	-6.75		Occ Bw				17.6 MHz
12		1 1	2.7		-7.37	abiii					



FCC Section 15.247 Subclause (a) (2) / RSS-247 Clause 5.2 (a) 6 dB Bandwidth.

SPECIFICATION:

The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS:

• Mode 802.11 b

	Low Channel	Middle Channel	High Channel
	2412 MHz	2437 MHz	2462 MHz
6 dB Spectrum andwidth (MHz)	8.094	7.958	7.960
Measurement uncertainty (kHz)		<±11.01	

• Mode 802.11 g

	Low Channel	Middle Channel	High Channel
	2412 MHz	2437 MHz	2462 MHz
6 dB Spectrum bandwidth (MHz)	15.116	15.076	15.119
Measurement uncertainty (kHz)		<±11.01	

• Mode 802.11 n20

	Low Channel	Middle Channel	High Channel
	2412 MHz	2437 MHz	2462 MHz
6 dB Spectrum bandwidth (MHz)	15.123	15.709	14.597
Measurement uncertainty (kHz)		<±11.01	

Verdict: PASS



• Mode 802.11 b - 6 dB Bandwidth

- Low Channel:

Spectrum	L								
Ref Level 20 Att		59 dB 👄 RBW 100 1 ms 👄 VBW 300		en					
●1Pk View	00 00 0111		HIGUE SHO	00					
10 dBm					D2 M1	[1]			0.45 dB 8.0940 MHz 1.04 dBm 2.4079450 GHz
	D1 7.490 dBm	N	munu	humaning	Johnman	manna	2		
0 dBm	D2 1.490	3BM		/	/			m	
-10 dBm	and a manufacture of the	V					V	Jan way have	an .
-20 dBm									- Marine - M
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
CF 2.412 GHz				1000) pts				Span 20.0 MHz

- Middle Channel:

Spectrum									
Ref Level 20 Att		69 dB 👄 RBW 100 1 ms 👄 VBW 300		en .					
● 1Pk View	00 00 0111	1 115 - 1211 000	And Mode Swee	2P					
10 dBm					D2 M1	[1]			0.37 d 7.9580 MH 1.17 dBr 2.4330130 GH
	D1 7.760 dBm		11 mannan M	mond	Janum	munumuna)	2		
0 dBm	D2 1.760	abm orrace		/	1		many	m	
-10 dBm	monand	V					W.	Manne	min
-20 dBm									the war
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
CF 2.437 GHz				1000	pts				Span 20.0 MHz



- High Channel:

Spectrum				
	a dB 👄 RBW 100 kHz			
Att 30 dB SWT 1 1Pk View	. ms 🖷 VBW 300 kHz 🛛 Mode Sweep)		
		D	2[1]	-0.38 dB
			1[1]	7.9600 MHz 1.04 dBm
10 dBm				2.4580030 GHz
D1 7.230 dBm	MI MI	mound annous	munnhand?	
0 dBm-D2 1.230 dB	3m-		mun have be	
o dBill	Jun and	V	and	
mont				www
-10 dBm				man
and we want	3		~	M. Mars
-20 dBm				100 Marca
row				~
~30/dBm				m m
-strubil				
-40 dBm				
-50 dBm			-	
-60 dBm				
oo dam				
-70 dBm				
CF 2.462 GHz		1000 pts		Span 20.0 MHz
or arrea Mile		1000 hts		opun 20.0 Miliz



• Mode 802.11 g - 6 dB Bandwidth

- Low Channel:

Spectrum Ref Level 20.0		69 dB 👄 RBW 100 1 ms 👄 VBW 300							
Att 1Pk View	30 08 SWI	1 ms 🖷 VBW 300	kHz Mode Swee	ep					
10 dBm					D2 		I	I	0.27 dB 15.1160 MHz -8.62 dBm 2.4044560 GHz
0 dBm	D1 -2.100 dBm	and the second	Mummu	mmm	Minhi	manna	mmmhmm	Mungen	
-10 dBm	444 002 -8.100	abm-		<u>بر</u>				- March	1
-30 dBm									hum
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm-				1000					Span 20.0 MHz

- Middle Channel:

Ref Level 20.0 Att		9 dB 👄 RBW 100 1 ms 👄 VBW 300		ер					
1Pk View					D2	[1]			-0.67 d
10 dBm					M1	[1]			15.0764 MH -2.33 dBi 2.4294700 GH
0 dBm	D1 3.710 dBm	a a m.A.m.a.a	Amanan	marria	Man Amo	mamma	A 1. A A A A A	A	
-10 dBm	M1 M1 D2 -2.290	dBm W W YV			1	mAnnal	- 4 M - W - W - W - W - W - W - W - W - W -	Jan And	
MM									mann
-20 dBm									
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									



- High Channel:

Spectrum					
Ref Level 20.00 dBm Offset	t 0.69 dB 👄 RBW 100 kHz 1 ms 👄 VBW 300 kHz Mode S	ween			
1Pk View		,			
10 dBm			D2[1] M1[1]	0.27 dE 15.1190 MHz -8.35 dBm 2.4544490 GHz	
0 dBm	Amm Amm	0 00 00	0		
M1	BOO dBm	man man from	Munum	manufan	Mmr B2
-10 dBm		V			2
-20 dBm					mound
-40 dBm					
-50 dBm					
-60 dBm					
-70 dBm					
CF 2.462 GHz		1000 pts			Span 20.0 MHz



• Mode 802.11 n20 - 6 dB Bandwidth

- Low Channel:

Spectrum)								
Ref Level 20.0		69 dB 👄 RBW 100							
Att 1Pk View	30 dB SWT	1 ms 👄 VBW 300	kHz Mode Swee	ep					
10 dBm					D2 				0.28 dB 15.1230 MHz -8.98 dBm 2.4044480 GHz
0 dBm	D1 -2.440 dBm A	Λ		<u>л м</u>	M A	A 10	Λ	M.M.M.	
-10 dBm	M1 - A.I.	dBm	Melnowshin	man mar 1	1 million	mulman	mmulmm	White A2	AA
-20 dBrp									
northerall									man
'-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
CE 2.412 GHz				1000	Inte				Snan 20.0 MHz

- Middle Channel:

Spectrum Ref Level 20.00 d Att 30		9 dB 👄 RBW 100 1 ms 👄 VBW 300							
1Pk View	ab SWI	1 ms 📦 VBW 300	kHz Mode Swe	ep					
					D2 M1				-0.45 d 15.7090 MH -2.58 dBi
10 dBm						I		1	2.4288670 GH
0 dBm	A _D2 -2.600	Marton Averant	where	monton	Munday	manna	mana	Murin	
-10 dBm	M V.			-	*			- An	
Mr.									Much
-20 dBm									
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
CF 2.437 GHz				1000	nte			I	Span 20.0 MHz



- High Channel:

Spectrum									
Ref Level 20.00 Att 3		9 dB 👄 RBW 100 1 ms 👄 VBW 300							
9 1Pk View	OUB SWI	1 ms 🖷 VBW 300	KH2 MODE SWEE	эр					
10 dBm					D2		1	l	-0.21 dB 14.5970 MHz -8.30 dBm 2.4549820 GHz
0 dBm	D1 -2.260 dBm	A	Δ	A. A. M	MadAn	Da A au a a A		n	
ſ	ALANDO -8.260	dBm	na Anorra A Mar	here and	f mar when		www.www.	N. W. Mundan	www
-20 dBm/ -30 dBm-									and way
-40 dBm									
-50 dBm									
-60 dBm									
-70 dBm									
CF 2.462 GHz				1000	pts				Span 20.0 MHz



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:

For all modes, the maximum conducted output power was measured using the method according to point 11.9.1.3 "PKPM1 Peak power meter method" 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: 2.14 dBi.

The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

• Mode 802.11 b

Peak Conducted Output Power	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Maximum Conducted Power (dBm)	17.91	18.43	17.76
Maximum EIRP Power (dBm)	20.05	20.57	19.90
Measurement uncertainty (dB)		<±0.33	

• Mode 802.11 g

Peak Conducted Output Power	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Maximum Conducted Power (dBm)	14.72	18.82	14.52
Maximum EIRP Power (dBm)	16.86	20.96	16.66
Measurement uncertainty (dB)		<±0.33	

• Mode 802.11 n20

Peak Conducted Output Power	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Maximum Conducted Power (dBm)	13.91	18.81	14.11
Maximum EIRP Power (dBm)	16.05	20.95	16.25
Measurement uncertainty (dB)		<±0.33	

Verdict: PASS



FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations conducted (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:

• Mode 802.11 b

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Reference Level Measurement (dBm)	7.3	8.13	6.95
Measurement uncertainty (dB)		<±1.56	

No spurious peaks were found at less than 20 dB below the limit.

• Mode 802.11 g

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Reference Level Measurement (dBm)	-1.79	3.82	-1.81
Measurement uncertainty (dB)		<±1.56	

No spurious peaks were found at less than 20 dB below the limit.

• Mode 802.11 n20

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Reference Level Measurement (dBm)	-2.17	3.61	-2.75
Measurement uncertainty (dB)		<±1.56	

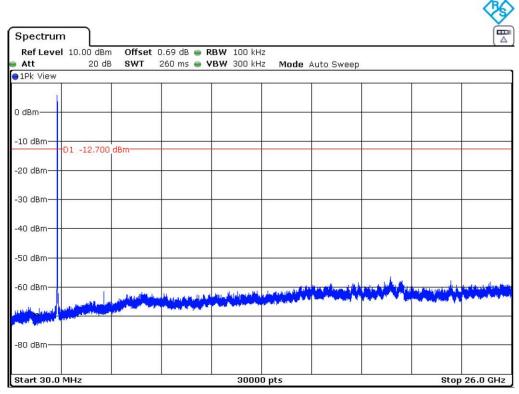
No spurious peaks were found at less than 20 dB below the limit.

Verdict: PASS



• Mode 802.11 b - Emission limitations conducted

- Low Channel:



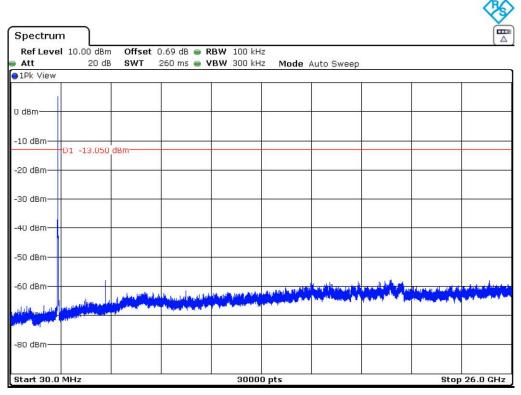
The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:

Spectrum Ref Level 10.00 dBm Offset 0.69 dB 👄 RBW 100 kHz 20 dB Att SWT 260 ms 👄 VBW 300 kHz Mode Auto Sweep 🔵 1 Pk View 0 dBm--10 dBm-D1 -11.870 dBm--20 dBm -30 dBm 40 dBm -50 dBm -60 dBm -80 dBm Start 30.0 MHz Stop 26.0 GHz 30000 pts



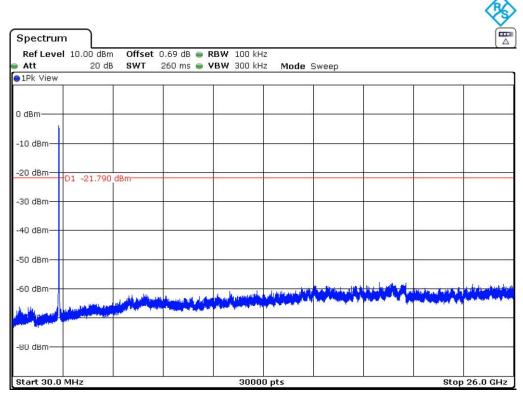
- High Channel:





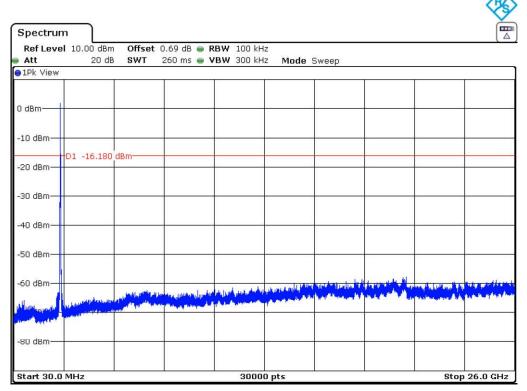
• Mode 802.11 g - Emission limitations conducted

- Low Channel:



The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:





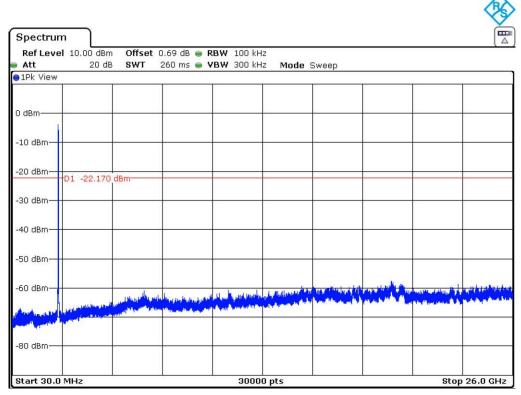
- High Channel:

									(AS)
Spectrur	n								
Ref Leve Att	10.00 dBm 20 dB		0.69 dB 👄 R 260 ms 👄 V			Sween			X
●1Pk View	1		1						
0 dBm		-			2	2			-
-10 dBm—									
-20 dBm-	-D1 -21.810	dBm			<u>5</u> 2	5			-
-30 dBm									
-40 dBm—					2	-			
-50 dBm—									
-60 dBm		101 1178 U	1		a management and the state of	I THE PROPERTY OF	Hand St. A.	रे के सिंह के स	Handland barbala barbala
all the shear	A SALAR				and the second	haddan hadd		And the second s	de pela de presidentes de la tradición
-80 dBm—									
					÷	2			
Start 30.0	MHz			3000	D pts			Stop	26.0 GHz



• Mode 802.11 n20 - Emission limitations conducted

- Low Channel:



The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:

Spectrum Ref Level 10.00 dBm Offset 0.69 dB 👄 RBW 100 kHz 20 dB Att SWT 260 ms 👄 VBW 300 kHz Mode Sweep 😑 1 Pk View 0 dBm--10 dBm D1 -16.390 dBm--20 dBm--30 dBm 40 dBm -50 dBm -60 dBm thul have -80 dBm Start 30.0 MHz Stop 26.0 GHz 30000 pts