

**Electromagnetic compatibility  
and Radio Spectrum Matters ERM  
ERM TEST REPORT  
300271-1-5**

# Test Report

*Electromagnetic compatibility  
and Radio spectrum Matters (ERM)*



Equipment Under Test: Bluetooth Low Energy module

Model: BGM121A  
BGM121N  
BGM123A  
BGM123N

Trade Mark: Silicon Labs

Manufacturer/Customer: Silicon Laboratories Finland Oy  
Bertel Jungin aukio 3  
FI-02600 Espoo  
Finland

## Tests have been performed according to the following standard(s)

Title of the standard	Reference standard	Version
Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonised Standard for access to radio spectrum	EN 300 328	V2.2.2

- *partial testing, see test suite for details*

Date: 1 October 2020

Issued by:

A handwritten signature in blue ink, appearing to read 'Henri Mäki'.

Henri Mäki  
Testing Engineer

Date:

1 October 2020

Checked by:

A handwritten signature in blue ink, appearing to read 'Mikko Halonen'.

Mikko Halonen  
Development Engineer

## GENERAL REMARKS

### Disclaimer

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*Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.*

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**RELEASE HISTORY**

Version	Changes	Issued
1.0	Initial release	1 October 2020

## PRODUCT DESCRIPTION

### Equipment Under Test

Type:	Bluetooth Low Energy module
Model:	BGM121A, BGM121N, BGM123A, BGM123N
Trade Mark:	Silicon Labs
Serial no:	-
Software version:	-
Hardware version:	-

### General Description

BGM121A, BGM121N, BGM123A and BGM123N are Bluetooth 4.2 compliant modules.

The difference between A-variant and N-variant is that A has an integral antenna and an RF pin, while N-variant has only an RF pin for use of an external antenna. In A-variant the integral antenna is used by re-routing the RF signal from the module's RF pin back into the module, where the integral antenna is located. For both variants the RF pin is the common measuring point for conducted measurements, and therefore measuring A-variant is also deemed to cover the measurements for N-variant.

The second last character, 1 or 3, stands for high- and low-power variant, respectively (max 8 dBm and 3 dBm).

The measurement results according to the standard versions V1.9.1 and V2.1.1 are presented in SGS Test Reports 285525-2-1 and 288405-2-1, respectively.

### Samples and Modifications

No.	Name	Description
1	Conducted	BGM121A, the RF pin connected to the evaluation board's U.FL connector for conducted measurements

### Specifications

Type of Modulation:	<input type="checkbox"/> FHSS <input checked="" type="checkbox"/> Other
Operating Frequency Range:	2402 – 2480 MHz
Conducted Power:	8 dBm (high-power variant) 3 dBm (low-power variant)
Channels:	40
Channel Bandwidth:	1.08 MHz (measured)
Channel Separation:	2 MHz
Adaptivity:	<input type="checkbox"/> Adaptive <input checked="" type="checkbox"/> Non-adaptive
	<input type="checkbox"/> LBT based (if adaptive) <input type="checkbox"/> Load based (if adaptive)
Antenna Type:	Integrated chip antenna (A-variant) Removable whip antenna (N-variant)
Antenna Gain:	1 dBi (A-variant) 2.14 dBi (N-variant)
Antenna Count:	1
Geo-location Capability:	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes
Beam Forming Capability:	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes
EUT Dimensions:	smaller than 40 x 40 x 40 mm
Power Requirements:	2.0 – 3.8 V (tested with 3.3 V regulated by the development board)
Operating Temperature Range:	-

**Ports and Cables**

Cable / Port	Description
USB Port	Device configuration, powering the EUT

## SUMMARY OF TESTING

### Test conditions

The EUT's radio was configured and monitored with software provided by the manufacturer. Normal modulation and maximum transmit power was used during the tests.

All tests were performed with BGM121A module.

**Table 1:** Normal and extreme test conditions

Test conditions:		Temperature [°C]:	Voltage [V]:
Normal		+20 - 25	3.3
Extreme	Minimum	-	
	Maximum	-	

**Table 2:** The test frequencies used in testing

Channel	Frequency [MHz]
Low	2402
Mid	-
High	2480



**Measurement Uncertainty**

Parameter	Uncertainty	Limit
Occupied Channel Bandwidth	$\pm 0.0005 \%$	$\pm 5 \%$
RF output power, conducted	$\pm 0.349 \text{ dB}$	$\pm 1,5 \text{ dB}$
Power Spectral Density, conducted	$\pm 0.372 \text{ dB}$	$\pm 3 \text{ dB}$
Unwanted Emissions, conducted	$\pm 2.90 \text{ dB}$	$\pm 3 \text{ dB}$
All emissions, radiated	$\pm 5.29 \text{ dB}$	$\pm 6 \text{ dB}$
Temperature	$\pm 3 \text{ }^{\circ}\text{C}$	$\pm 3 \text{ }^{\circ}\text{C}$
Supply voltages	$\pm 3 \%$	$\pm 3 \%$
Time	$\pm 0.1 \%$	$\pm 5 \%$
Level of confidence 95.45 % ( $k = 2$ )		

**Test suite**

Measurement/Test	Test Specification	Result								
RF Output Power	EN 300 328 V2.2.2 (2019-07)	N/T								
Power Spectral Density	EN 300 328 V2.2.2 (2019-07)	N/T								
Duty cycle, Tx-sequence, Tx-gap	EN 300 328 V2.2.2 (2019-07)	N/A <sup>(1)</sup>								
Accumulated Transmit Time, Frequency Occupation and Hopping Sequence	EN 300 328 V2.2.2 (2019-07)	N/A <sup>(2)</sup>								
Hopping Frequency Separation	EN 300 328 V2.2.2 (2019-07)	N/A <sup>(2)</sup>								
Medium Utilization	EN 300 328 V2.2.2 (2019-07)	N/T								
Adaptivity	EN 300 328 V2.2.2 (2019-07)	N/A <sup>(4)</sup>								
Occupied Channel Bandwidth	EN 300 328 V2.2.2 (2019-07)	N/T								
Transmitter unwanted spurious emissions in the out-of-band domain	EN 300 328 V2.2.2 (2019-07)	N/T								
Transmitter unwanted spurious emissions in the spurious domain	EN 300 328 V2.2.2 (2019-07)	N/T								
Receiver spurious emissions	EN 300 328 V2.2.2 (2019-07)	N/T								
Receiver blocking	EN 300 328 V2.2.2 (2019-07)	PASS								
Geo-location capability	EN 300 328 V2.2.2 (2019-07)	N/A <sup>(5)</sup>								
<p><b>Possible test case verdicts:</b></p> <table><tr><td>Test case does not apply to the EUT:</td><td>N/A</td></tr><tr><td>EUT does meet the requirement:</td><td>PASS</td></tr><tr><td>EUT does not meet the requirement:</td><td>FAIL</td></tr><tr><td>Test was not performed:</td><td>N/T</td></tr></table> <p><i>The decision rule applied for the tests results stated in this test report is according to the requirements of section 5.2 of ETSI EN 300 328 V2.2.2.</i></p> <p>1) This requirement applies only to non-adaptive equipment or to adaptive equipment operating in a non-adaptive mode. This requirement does not apply for equipment with a maximum declared RF Output power of less than 10 dBm E.I.R.P.</p> <p>2) This requirement applies only to all types of FHSS equipment.</p> <p>3) This requirement does not apply to adaptive equipment unless operating in a non-adaptive mode. Also this requirement does not apply for equipment with a maximum declared RF Output power of less than 10 dBm E.I.R.P.</p> <p>4) This requirement applies only to adaptive equipment.</p> <p>5) Applicable only for equipment with geo-location capability.</p>			Test case does not apply to the EUT:	N/A	EUT does meet the requirement:	PASS	EUT does not meet the requirement:	FAIL	Test was not performed:	N/T
Test case does not apply to the EUT:	N/A									
EUT does meet the requirement:	PASS									
EUT does not meet the requirement:	FAIL									
Test was not performed:	N/T									

Testing location / address:

SGS Fimko Ltd  
Karakaarenkuja 4  
FI-02610, ESPOO  
FINLAND

## TEST RESULTS

### Receiver Blocking

**Standard:** EN 300 328 V2.2.2  
**Tested by:** HEM  
**Date:** 15 September 2020  
**Temperature:** 23 ± 3 °C  
**Humidity:** 20 - 75 % RH

**Test result:** **PASS**

#### Test plan

Measurements are performed according to ETSI EN 300 328 V2.2.2 clause 5.4.11.2.1

Receiver blocking is a measure of the ability of the equipment to receive a wanted signal on its operating channel without exceeding a given degradation in the presence of an unwanted signal (blocking signal) on frequencies other than those of the operating band.

The tests were performed while the EUT was set to low and high channels.

Antenna gain of the EUT was added to the wanted signal and blocking signal level.

Wanted signal level was calculated according to table 15 in clause 4.3.2.11.4. Measured Occupied Channel Bandwidths are used in the calculations.

Receiver category: 2

#### Minimum performance criteria:

Packet error rate (PER) shall be less than or equal to 10%.

#### Test results

**Table 3:** Results of receiver blocking, receiver category 2

Wanted signal level (dBm)	Blocking signal frequency (MHz)	Blocking signal level (dBm)	Type of blocking signal	PER (%)	Result
-66.5	2380	-31.9	CW	0.4	PASS
	2504			0.6	PASS
	2300			0.4	PASS
	2584			0.6	PASS

**TEST EQUIPMENT**

EQUIPMENT	MANUFACTURER	TYPE	INV OR SERIAL	PREV CALIB	NEXT CALIB
ATTENUATOR	ZYSEN	ZSJ70/1-06-2A2	inv:10332	NCR	NCR
OSP BASE UNIT	ROHDE & SCHWARZ	OSP120	inv:10882	2019-02-28	2021-02-28
OSP-B157W 8 PORT	ROHDE & SCHWARZ	OSP-B157W8	inv:10883	2019-02-06	2021-02-06
OSP-B157WX	ROHDE & SCHWARZ	OSP-B157WX	inv:10884	2019-02-13	2021-02-13
RF SIGNAL GENERATOR	ROHDE & SCHWARZ	SMB100A	inv:9288	2020-06-08	2023-06-07
SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSV40	inv:10881	2019-02-07	2021-02-07

NCR = No calibration required

**END OF REPORT**