

**Electromagnetic compatibility
and Radio Spectrum Matters ERM
ERM TEST REPORT
288405-2-1**

Test Report

**Electromagnetic compatibility
and Radio spectrum Matters (ERM)**



Equipment Under Test: Bluetooth Low Energy module

Model: BLE112-A, BLE112-E
BLE113
BLE121LR
BGM111A, BGM111E
BGM113
BGM121A, BGM121N
BGM123A, BGM123N

Trade Mark: Silicon Labs / Bluegiga

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 ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU - Partial testing, see test suite for details	EN 300 328	V2.1.1

Date: 10 May 2017

Issued by:

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Date: 10 May 2017

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Equipment under test (EUT)

Model: BLE112-A, BLE112-E, BLE113, BLE121LR, BGM111A, BGM111E, BGM113, BGM121A, BGM121N, BGM123A, BGM123N

Trade Mark: Silicon Labs / Bluegiga

Serial: -

General description

The equipment under test is a Bluetooth low energy module. Model specific information is provided in the table below:

Model:	Description:	Rated RF Output power:	Receiver Category:
BLE112-A, BLE112-E	Bluetooth 4.0 low energy	+3 dBm	2
BLE113	Bluetooth 4.0 low energy	+0 dBm	2
BLE121LR	Bluetooth 4.0 low energy	+8 dBm	2
BGM111A, BGM111E	Bluetooth 4.2 compliant	+8 dBm	2
BGM113	Bluetooth 4.2 compliant	+3 dBm	2
BGM121A, BGM121N	Bluetooth 4.2 compliant	+8 dBm	2
BGM123A, BGM123N	Bluetooth 4.2 compliant	+3 dBm	2

Modifications incorporated in the EUT

Temporary antenna connector was soldered to replace antenna for modules with A-variant only.

Specifications of the EUT

Highest antenna gain: 2.14 dBi (declared by the manufacturer)

EUT dimensions: Smaller than 40 x 40 x 40 mm

Power requirements

Type: Supplied by the end product

Rated voltage: Tested with 3.3 V

Rated current: -

Rated frequency: DC

Equipment category and characteristics

Operating Frequency Range (OFR): 2402 - 2480 MHz

Channels: 40

Channel separation: 2 MHz

Channel bandwidth: 2 MHz

Transmission technique: DSSS

Modulation: GFSK

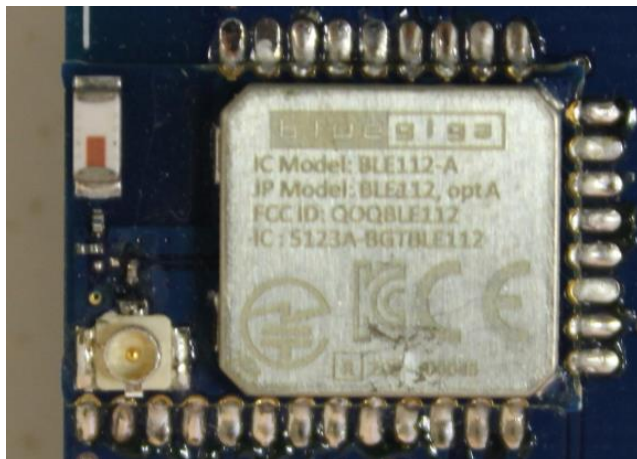
Geo-location capability: -

Peripherals

Test PC

Evaluation board

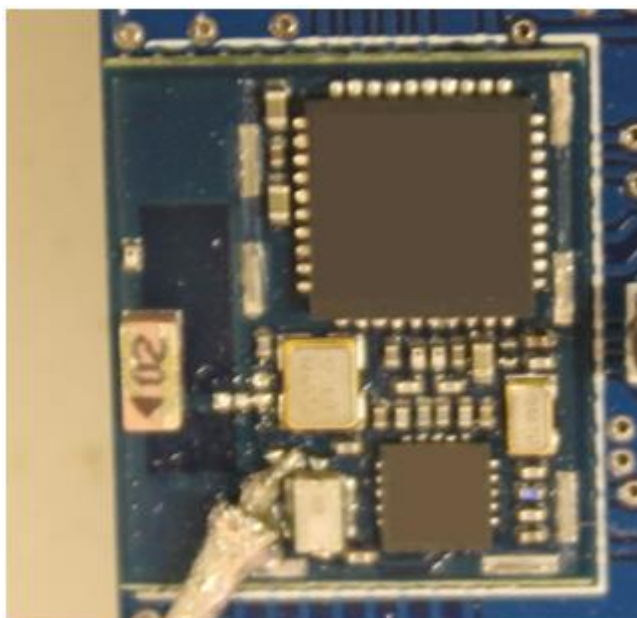
Photographs of the EUT



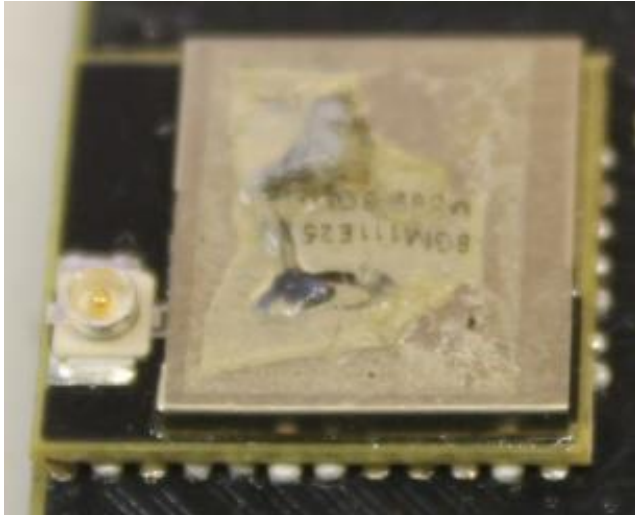
Photograph 1: BLE112



Photograph 2: BLE113



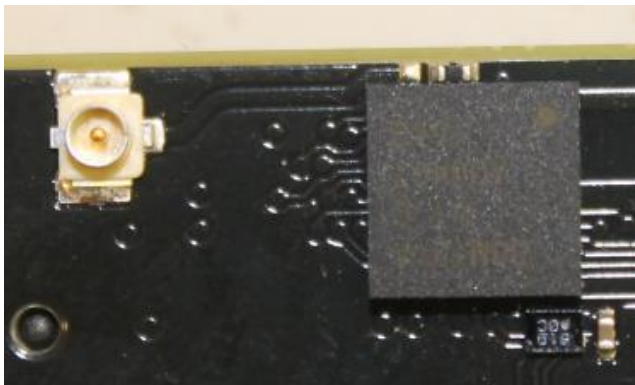
Photograph 3: BLE121LR



Photograph 4: BGM111



Photograph 5: BGM113



Photograph 6: BGM121 / BGM123

Test conditions

The EUT was set into continuous transmit/receive mode and frequency hopping was stopped to certain channel during the some of the measurements if required.

Receiver blocking test was performed using two samples. One was set to continuously transmit and other one was set to receive continuously.

Performance of the receiver was monitored with software provided by the manufacturer which calculated PER (packet error rate) of the established connection.

Tests were performed only to variants with external antenna connector, when such a variant existed for a particular model, given the external antenna's higher gain that had to be calculated and added to the actual test levels.

Modules without external antenna connector were tested with temporary antenna connector soldered to replace antenna.

BGM123 was not tested since only transmitter side properties are different compared to BGM121.

Adapter with short RF cable was used between the EUT and test installation.

Table 1: The test frequencies used in the tests

Frequency [MHz]:	Channel:
2402	Low
2440	Middle
2480	High

Test suite

Measurement/Test	Test Specification	Result
RF Output Power	EN 300 328 V.2.1.1 (2016-11)	N/T ⁽¹⁾
Power Spectral Density	EN 300 328 V.2.1.1 (2016-11)	N/T ⁽¹⁾
Duty cycle, Tx-sequence, Tx-gap	EN 300 328 V.2.1.1 (2016-11)	N/A ⁽²⁾
Accumulated Transmit Time, Frequency Occupation and Hopping Sequence	EN 300 328 V.2.1.1 (2016-11)	N/A ⁽³⁾
Hopping Frequency Separation	EN 300 328 V.2.1.1 (2016-11)	N/A ⁽³⁾
Medium Utilisation (MU) factor	EN 300 328 V.2.1.1 (2016-11)	N/A ⁽²⁾
Adaptivity	EN 300 328 V.2.1.1 (2016-11)	N/A ⁽²⁾
Occupied Channel Bandwidth	EN 300 328 V.2.1.1 (2016-11)	N/T ⁽¹⁾
Transmitter unwanted spurious emissions in the out-of-band domain	EN 300 328 V.2.1.1 (2016-11)	N/T ⁽¹⁾
Transmitter unwanted spurious emissions in the spurious domain	EN 300 328 V.2.1.1 (2016-11)	N/T ⁽¹⁾
Receiver spurious emissions	EN 300 328 V.2.1.1 (2016-11)	N/T ⁽¹⁾
Receiver blocking	EN 300 328 V.2.1.1 (2016-11)	PASS
Geo-location capability	EN 300 328 V.2.1.1 (2016-11)	N/A ⁽³⁾
Possible test case verdicts: Test case does not apply to the EUT: N/A EUT does meet the requirement: P (Pass) EUT does not meet the requirement: F (Fail) Test was not performed: N/T 1) Test has been performed according to EN 300 328 V1.9.1. Details and results of the test can be found in the previous test reports that already exist for each module. 2) Not applicable to equipment with RF output power less than +10 dBm e.i.r.p 3) Not applicable to equipment using wide band modulations other than FHSS 4) Only applicable to equipment with geo-location capability		

Testing location / address:

SGS Fimko Ltd
Karakaarenkuja 4
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FINLAND

Receiver Blocking

Standard: EN 300 328 V.2.1.1
Tested by: EHA
Date: 3-5 April 2017
Temperature: 22 - 23 °C
Humidity: 22 - 26 %

Test result: **PASS**

Test plan

Measurements are performed according to ETSI EN 300 328 V2.1.1 clause 5.4.11.2.1

Minimum performance criteria:

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

Test results

Table 2: Receiver blocking results (BLE112, BLE113, BLE121LR, BGM111, BGM113, BGM121)

Blocking signal frequency (MHz)	Blocking signal power (dBm)	Type of blocking signal	Result
2380.0	-57	CW	PASS
2503.5	-57	CW	PASS
2300.0	-47	CW	PASS
2583.5	-47	CW	PASS

RF-Test Equipment

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Next Calib
ATT SMAM/F 50 Ω 18 GHZ 30 DB 1 W	HUBER&SUHNER	6830.19.A	sn:RF ATTEN 09	2016-10-28	2017-10-28
ULTRA BROAD BAND POWER DIVIDER	NARDA	4426LB-4	inv:8033	2017-03-01	2018-03-01
ATTENUATOR	PASTERNAK	10dB DC-40GHz	-	-	-
SIGNAL ANALYZER	ROHDE & SCHWARZ	FSV40	inv:9093	2016-06-10	2017-06-10
RF SIGNAL GENERATOR	ROHDE & SCHWARZ	SMB100A	inv:9288	2017-02-10	2020-02-10
VECTOR SIGNAL GENERATOR	ROHDE & SCHWARZ	SMBV100A	inv:9290	2016-06-09	2019-06-09
TEMPERATURE/ HUMIDITY METER	VAISALA	HMT 333	inv:8638	2017-02-21	2018-02-21
VARIABLE ATTENUATOR	ZYSEN	ZSJ70/1-06-2A2	inv:10332	-	-