



Electromagnetic Compatibility EMC TEST REPORT 285525-1-1

Test Report

Electromagnetic Compatibility (EMC)



Equipment Under Test: Bluetooth Smart 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
Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements	EN 301 489-1	V1.9.2
Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment; Part 17: Specific conditions for Broadband Data Transmission Systems	EN 301 489-17	V2.2.1

Date: 27 October 2016

Issued by:

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Date: 27 October 2016

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Equipment under test (EUT)

Test item description:	Bluetooth Smart Module
Trade Mark:	Silicon Labs
Model:	BGM121A, BGM121N, BGM123A, BGM123N

General description

BGM121 and BGM123 are Bluetooth 4.1 compliant Bluetooth smart beacon modules. The only difference between A-variant and N-variant modules is that A has integrated antenna and N has RF connector for use of external antenna. Difference between BGM121 and BGM123 is that BGM123 has its transmit power limited to nominal of 3 dBm while BGM121 transmits at full power.

Type of the EUT

Two samples were used in the testing. Normal sample with integral antenna and one sample with 50Ω coaxial cable and SMA-connector. One was set to transmit and one to receive continuously.

Ratings

Type of power supply:	Power fed through development board which was fed from the PC
Rated voltage:	2.0 - 3.8 V
Rated current:	-
Rated frequency:	DC
Output voltage:	-
Output current:	-
EUT dimensions:	20 x 6 x 2 mm

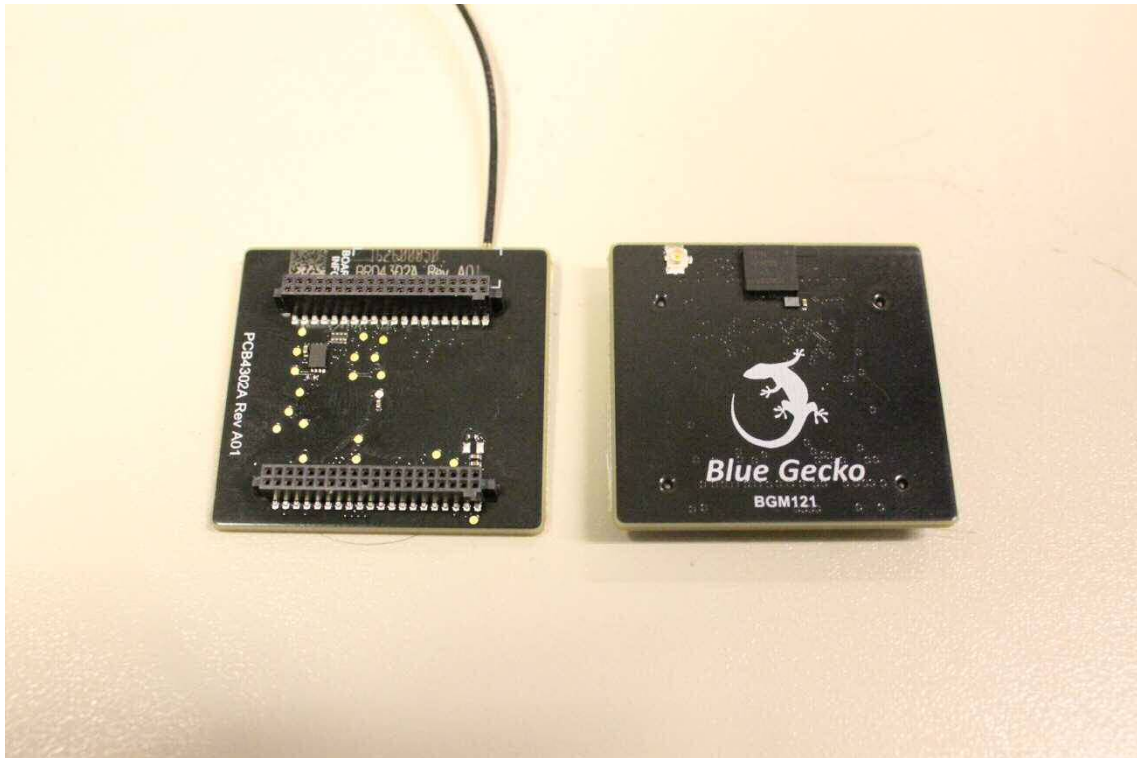
Cables

USB cable	1 m	Twisted pair, shielded
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Peripherals

Test PC	HP Probook
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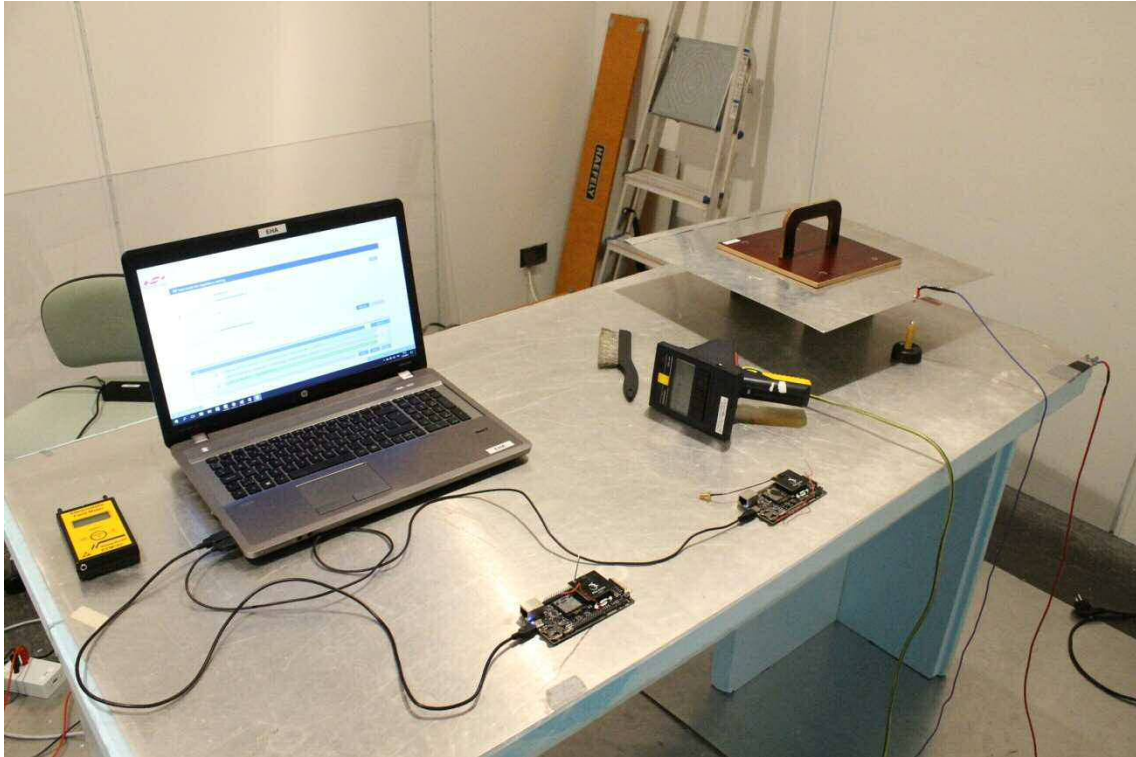
Photographs of the EUT



Photograph 1: The equipment under test (EUT)



Photograph 2: The equipment under test (EUT) and supportive development board



Photograph 3: Test setup during ESD tests



Photograph 4: Test setup during RF-field immunity test

Test conditions

Configuration of the EUT was made to correspond to the actual assembling conditions as far as possible. Tests were performed while EUT was connected to the controlling test PC. One of the samples with lower output power (as seen from monitoring antenna) was set to transmit mode. The other sample was set to receive continuously.

All tests were performed to samples BGM121A and BGM121N.

Performance criteria

The performance criteria are:

- Performance criteria A for immunity tests with phenomena of a continuous nature;
- Performance criteria B for immunity tests with phenomena of a transient nature;
- Performance criteria C for immunity tests with power interruptions exceeding a certain time.

The equipment shall meet the minimum performance criteria as specified in the following clauses.

Criteria	During test	After test
A	Shall operate as intended. May show degradation of performance. Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance. Shall be no loss of function. Shall be no loss of stored data or user programmable functions.
B	May show loss of function (one or more). May show degradation of performance. No unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance. Shall be no loss of stored data or user programmable functions.
C	May be loss of function (one or more).	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance.
Radio performance was monitored with spectrum analyzer for unintentional transmissions or TX shutdowns.		

Test suite

Measurement/Test	Reference clause		Test site	Result
Radiated Emissions	EN 55022:2010	AC:2011	-	N/A ⁽¹⁾
Conducted Emissions	EN 55022:2010	AC:2011	-	N/A ⁽²⁾
Harmonic Current Emissions	EN 61000-3-2:2006	A1:2009, A2:2009	-	N/A ⁽²⁾
Voltage Fluctuation And Flicker	EN 61000-3-3:2008		-	N/A ⁽²⁾
Electrostatic Discharge Immunity	EN 61000-4-2:2009		HS 5m	PASS ⁽³⁾
Radiated RF-field Immunity	EN 61000-4-3:2006	A1:2010	5m	PASS ⁽³⁾
Electrical Fast Transient Immunity	EN 61000-4-4:2004	A1:2010	-	N/A ⁽²⁾
Surge Immunity	EN 61000-4-5:2006		-	N/A ⁽²⁾
Conducted RF-field Immunity	EN 61000-4-6:2006		-	N/A ⁽²⁾
Voltage Dips and Short Interruptions Immunity	EN 61000-4-11:2004		-	N/A ⁽²⁾
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) No equipment which is not incorporated in the radio equipment
- 2) No AC mains, cables shorter than 3m
- 3) Only model BGM121A/N was tested due to high power being the only difference

Testing location / address:

SGS Fimko Ltd
Karakaarenkuja 4
FI-02610, ESPOO
FINLAND

Electrostatic Discharge Immunity

Product family standard: EN 61000-4-2
Tested by: EHA
Date: 3.10.2016
Temperature: 22 °C
Humidity: 26 % RH
Barometric pressure: 1018 hPa

Performance criteria: B
Test result: **PASS**

Test plan

Tests were done by using the air discharge to non-conductive and the contact discharge to all conductive parts of the EUT. Also the indirect contact discharges were given to VCP (Vertical Coupling Plate) and HCP (Horizontal Coupling Plane) in order to simulate the objects placed near to the EUT. All four sides of the EUT were tested with both polarities. At least ten discharges were given with both polarities to the selected points.

The humidity was lower than what is specified in the basic standard. The test may therefore be more severe than intended. Since the EUT passed the test no effort was made to increase the humidity to the specified range of 30–60%.

Test results

Discharge method: Air discharge
Test levels: ± 2 kV, ± 4 kV, ± 8 kV
EUT test point: No test point, the EUT is plain PCB module and proper ESD protection is needed in the end product
Test remarks: -

Discharge method: Contact discharge
Test levels: ± 2 kV, ± 4 kV
EUT test point: RF connector shield of BGM12XN, the EUT is plain PCB module and proper ESD protection is needed in the end product
Test remarks: No loss of function was observed

Discharge method: Indirect contact discharge
Test level: ± 2 kV, ± 4 kV
EUT test side: Bottom, front, rear, left and right sides
Test remarks: No loss of function was observed

Radiated RF-field Immunity

Product family standard: EN 61000-4-3
Tested by: EHA
Date: 30.8.2016
Temperature: 22 °C
Humidity: 48 % RH
Barometric pressure: 998 hPa

Performance criteria: A
Test result: **PASS**

Test plan

Test was done in a fully anechoic chamber. Signal generator was set to 1 % logarithmic step size with used dwell time in each frequency. EUT were tested with both antenna polarizations.

Test results

Frequency range: 80-1000 MHz
Modulation: 80% AM with 1 kHz modulation frequency
Test level: 3 V/m
Dwell time: 1 s
Antenna polarization: Horizontal and vertical
EUT test side: Back, left side
Test remark: No loss of performance was observed

Frequency range: 1.4-2.7 GHz
Modulation: 80% AM with 1 kHz modulation frequency
Test level: 3 V/m
Dwell time: 1 s
Antenna polarization: Horizontal and vertical
EUT test side: Back, left side
Test remark: No loss of performance was observed

Radiated RF-field Immunity

Equipment	Manufacturer	Type	Serial no	Inv.no
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32 V. 8.53	-	-
RF SIGNAL GENERATOR	ROHDE & SCHWARZ	SMT 06	845715/001	9473
RF SIGNAL GENERATOR	ROHDE & SCHWARZ	SMR20	100227	7930
RF POWER AMPLIFIER	AR	200W1000M7A	21867	7936
RF POWER AMPLIFIER	AR	500W1000AM4	325886	9568
RF POWER AMPLIFIER	AR	25S1G4A	301955	7912
RF POWER AMPLIFIER	AR	10S1G4M2	20896	7945
DIRECTIONAL COUPLER	CMC	DC440165	P950	5006
POWER METER	ROHDE & SCHWARZ	NRVD 0857.8008.02	845125/033	8018
POWER SENSOR	ROHDE & SCHWARZ	NRV-Z5	106694	8956
ANTENNA	AR	AT4002A	301758	7937
ANTENNA	ETS-LINDGREN	3142C	00050690	7916
SPECTRUM ANALYZER	ADVANTEST	R3361C	41832701	7933

Electrostatic Discharge Immunity

Equipment	Manufacturer	Type	Serial no	Inv.no
ESD GENERATOR	SCHAFFNER	NSG 435	1179	7887
VERTICAL COUPLING PLANE	SGS FIMKO	0.5 m x 0.5 m	-	-
SPECTRUM ANALYZER	ADVANTEST	R3361C	41832701	7933

Calibration was valid to all equipment used in testing (if required).