



Electromagnetic Compatibility EMC TEST REPORT 288405-2-2

Test Report

Electromagnetic Compatibility (EMC)



Equipment Under Test: Bluetooth Low Energy module

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

Trademark: Silicon Labs / Bluegiga

Manufacturer/Customer: Silicon Laboratories Finland Oy
Bertel Jungin aukio 3
FI-02600, ESPOO
FINLAND

The Equipment Under Test Was Tested According to Following Standard(s)

| Title of the standard - Product / test environment | Reference standard | Version |
|---|-----------------------|---------|
| ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU | EN 301 489-1 | v2.1.1 |
| ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU | EN 301 489-17 | v3.1.1 |

-Partial testing, see test suite for details

Date: 15 May 2017

Issued by:

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Date: 15 May 2017

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Equipment Under Test (EUT)

Bluetooth Low Energy module

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

Trademark: Silicon Labs / Bluegiga

Difference between model variants BLE112-A, BLE112-E, BGM111A, BGM111E BGM121A and BGM121N is that A variants have integrated chip antenna and the E and N variants have external u.fl antenna connector or RF pin. Difference between model variants BGM121A, BGM121N, BGM123A, BGM123N is that the BGM123x has its transmit power limited to nominal 3dBm while the BGM121x transmits at full power of 8dBm. Model variants BLE112-E, BLE113, BLE121LR, BGM111E, BGM113 and BGM121N were tested. Where similar models had a variant making use of the external antenna, this was tested as representing the worst case scenario, given the higher gain of the external antenna

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 |

Power requirements

Type: Supplied by the end product
Rated voltage: Tested with 3.3 V
Rated current: -
Rated frequency: DC

Specifications of the of the EUT

Highest antenna gain: 2.14 dBi (declared by the manufacturer)
EUT dimensions: Smaller than 40 x 40 x 40 mm

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
- BLE112 bluetooth low energy module

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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 90 days only. This document cannot be reproduced except in full, without prior approval of the Company.

Performance Criteria A for Immunity Testing

The EUT shall continue to operate as intended. No degradation of performance or loss of function is allowed to the EUT. Wireless communication between models must stay on, but short delay in the data transmission of few bytes is acceptable. Performance criteria was determined by the manufacturer.

EUT Test Conditions during EMC-Testing

Configuration of the EUT system was made to correspond to actual assembling conditions as far as possible. EUTs were connected to evaluation boards and they were paired with each other. EUTs were sending and receiving data during the test and the received data was monitored with manufacturers computer software. 10 messages of 20 bytes each were sent every second during the test.

Model variants BLE112-E, BLE113, BLE121LR, BGM111E, BGM113 and BGM121N were tested.

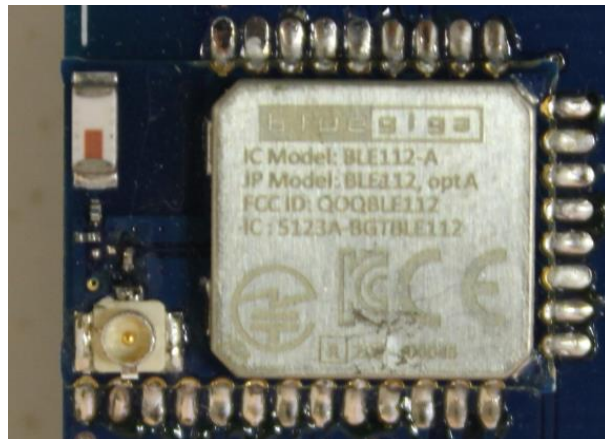
BLE112-E paired with BLE112

BLE113 paired with BLE121LR

BGM111E paired with BGM113

BGM121N paired with BT121

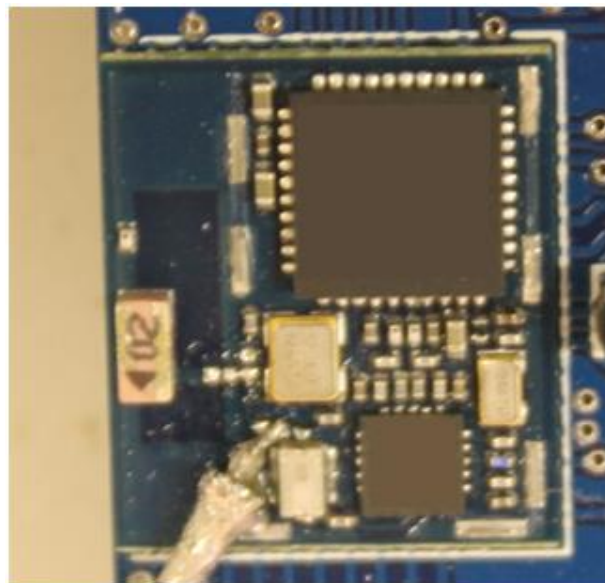
Photographs Of The EUT



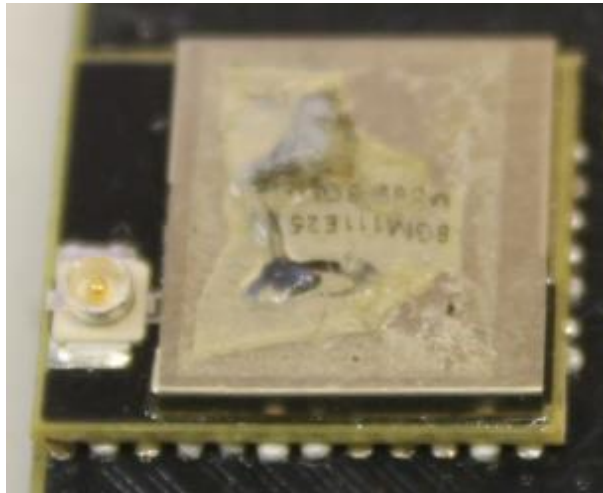
Photograph 1. BLE112



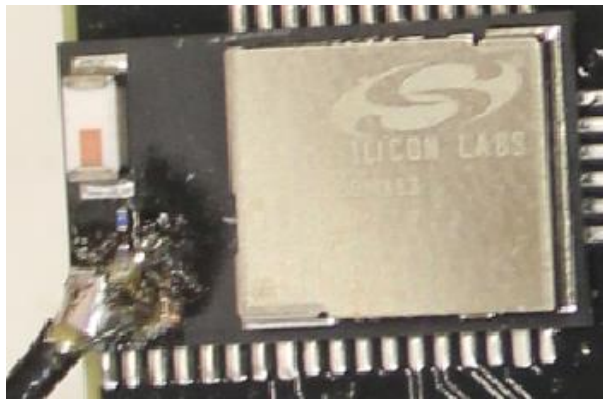
Photograph 2. BLE113



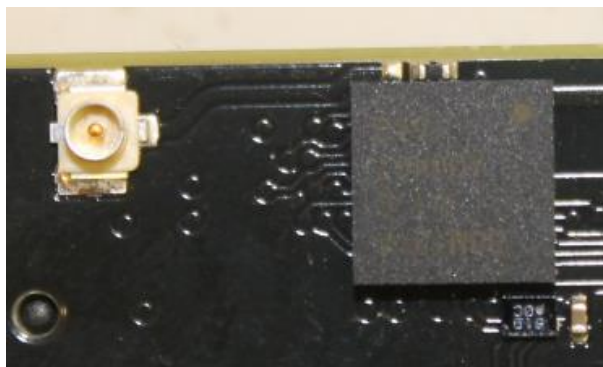
Photograph 3. BLE121LR



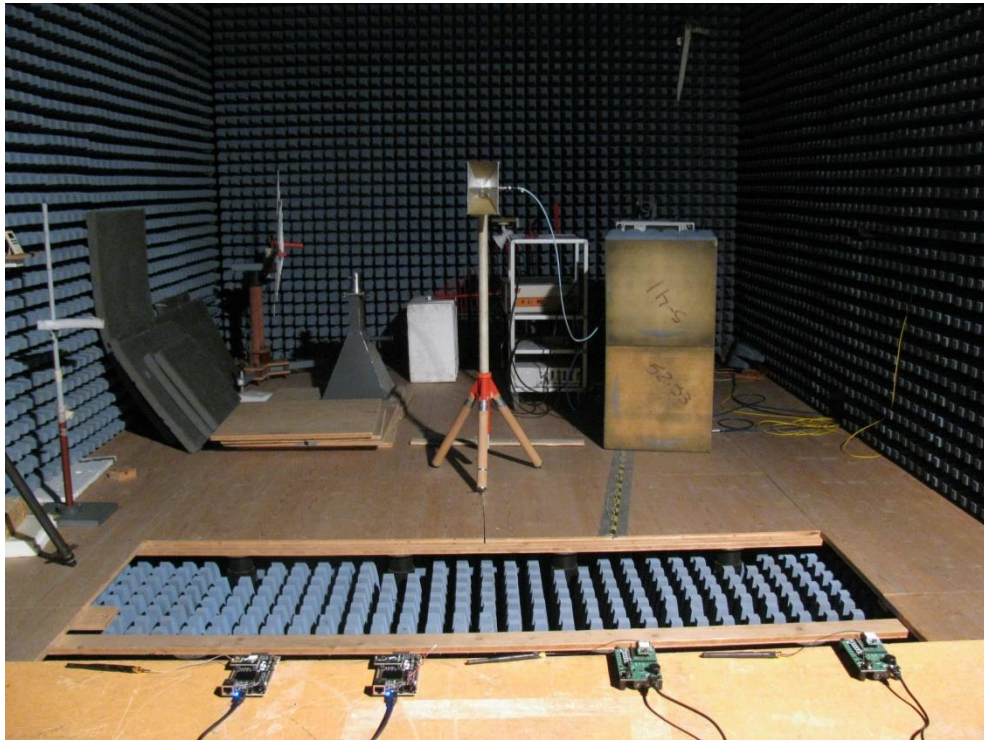
Photograph 4. BGM111



Photograph 5 BGM113



Photograph 6. BGM121/BGM123



Photograph 7. The EUTs and test set-up for radiated immunity test (module combination may vary).

Test Suite

| Measurement/Test | Reference | | Test site | Result |
|--|--------------------|---------------------|-----------|---------------------|
| Radiated Emissions | EN 55032:2015 | - | - | N/A ⁽¹⁾ |
| Conducted Emissions | EN 55032:2015 | - | - | N/A ⁽²⁾ |
| Harmonic Current Emissions | EN 61000-3-2:2006 | A1:2009, A2:2009 | - | N/A ⁽²⁾ |
| Voltage Fluctuation And Flicker | EN 61000-3-3:2013 | - | - | N/A ⁽²⁾ |
| Electrostatic Discharge Immunity | EN 61000-4-2:2009 | - | - | N/T ⁽⁴⁾ |
| Radiated RF-field Immunity | EN 61000-4-3:2006 | A1:2008, A2:2010 | FAR | PASS ⁽³⁾ |
| Electrical Fast Transient Immunity | EN 61000-4-4:2012 | - | - | N/A ⁽²⁾ |
| Surge Immunity | EN 61000-4-5:2006 | - | - | N/A ⁽²⁾ |
| Conducted RF-field Immunity | EN 61000-4-6:2009 | - | - | N/A ⁽²⁾ |
| Voltage Dips and Short Interruptions Immunity | EN 61000-4-11:2004 | - | - | N/A ⁽²⁾ |
| 1) No equipment which is not incorporated in the radio equipment 2) No AC mains, cables shorter than 3m 3) Tested partially by the request of the customer: 1.0 GHz to 1.4 GHz and 2.7 GHz to 6.0 GHz due to the test already performed and reported in existing other document. 4) Not tested by the request of the customer, due to the test already performed and reported in existing other document. | | | | |
| 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 | | | | |

Summary of Testing

| | |
|---|--|
| Testing location: | |
| <input type="checkbox"/> CB Testing Laboratory: | |
| <input type="checkbox"/> Testing Location / address: | SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND |
| <input checked="" type="checkbox"/> Testing Location / address: | SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND |
| <input type="checkbox"/> Testing Location / address: | SGS Fimko Ltd Kalliotie 2 FI-04360, TUUSULA FINLAND |

RF-radiated Field Immunity

Basic standard: EN 61000-4-3
Tested by: EHA & JSU
Date: 13-19 April 2017
Humidity: 43-44 %
Temperature: 21-24 °C
Barometric pressure: 999-1033 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. The floor of the chamber was covered by ferrite tiles. Due the small size of the EUTs two sides were tested with both antenna polarizations. EUT and support were on table 0.8 m above ground plane. The EUT was working as described in the section "EUT Test Conditions".

Test results

Frequency range: 1-1.4 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: Front and right
Test remark: No loss of performance was observed

Frequency range: 2.7-6 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: Front and right
Test remark: No loss of performance was observed

Radiated RF-field Immunity Test

| Equipment | Manufacturer | Type | Inv or serial | Prev Calib | Next Calib | (Serial) |
|---------------------|-----------------|-------------------|---------------|------------|------------|------------|
| ANTENNA | AR | AT4002A | inv:7937 | 2016-04-19 | 2017-04-19 | 301758 |
| ANTENNA | ETS LINDGREN | 3142C | inv:7916 | 2005-09-28 | - | 00050690 |
| ANTENNA | EMCO | 3115 | inv:9541 | 2016-05-04 | 2017-05-04 | 23905 |
| DIRECTIONAL COUPLER | CMC | DC440165 | inv:5006 | 2009-01-26 | - | P950 |
| DIRECTIONAL COUPLER | AR | DC7144 | inv:10363 | 2016-04-19 | 2017-04-19 | 301904 |
| POWER METER | ROHDE & SCHWARZ | NRVD 0857.8008.02 | inv:8018 | 2017-01-17 | 2018-01-17 | 845125/033 |
| POWER SENSOR | ROHDE & SCHWARZ | NRV-Z5 | inv:8956 | 2016-01-28 | 2018-01-28 | 106694 |
| RF POWER AMPLIFIER | AR | 25S1G4A | inv:7912 | 2016-04-19 | 2017-04-19 | 301955 |
| RF POWER AMPLIFIER | BONN ELEKTRONIK | TWAL 0208-300 | inv:9612 | 2016-05-04 | 2017-05-04 | 128778A |
| RF POWER AMPLIFIER | AR | 10S1G4M2 | inv:7945 | - | - | 20896 |
| RF POWER AMPLIFIER | MILMEGA | AS0825-65 | inv:9564 | 2013-04-09 | - | 1011966 |
| RF POWER AMPLIFIER | AR | 200W1000M7A | inv:7936 | - | - | 21867 |
| RF POWER AMPLIFIER | AR | 500W1000AM4 | inv:9568 | 2016-04-19 | 2017-04-19 | 325886 |
| RF POWER AMPLIFIER | BONN ELEKTRONIK | TWAL 0818-320 | inv:9613 | 2012-10-08 | - | 128778B |
| RF SIGNAL GENERATOR | ROHDE & SCHWARZ | SMR20 | inv:7950 | 2016-09-12 | 2019-09-12 | 100977 |
| SPECTRUM ANALYZER | ADVANTEST | R3361A | inv:7933 | - | - | 41832701 |

All used measurement equipment were calibrated (if required).