

SALTO Neo

G1824

N0M, N0J

Antennas

| Version | Date | Changes | Author |
|---------|------------|--|--------|
| 1.0 | 05/11/2021 | First edition | M.U. |
| 2.0 | 18/05/2022 | Second edition. Modification of control circuit for N0M. | M.U. |
| | | | |

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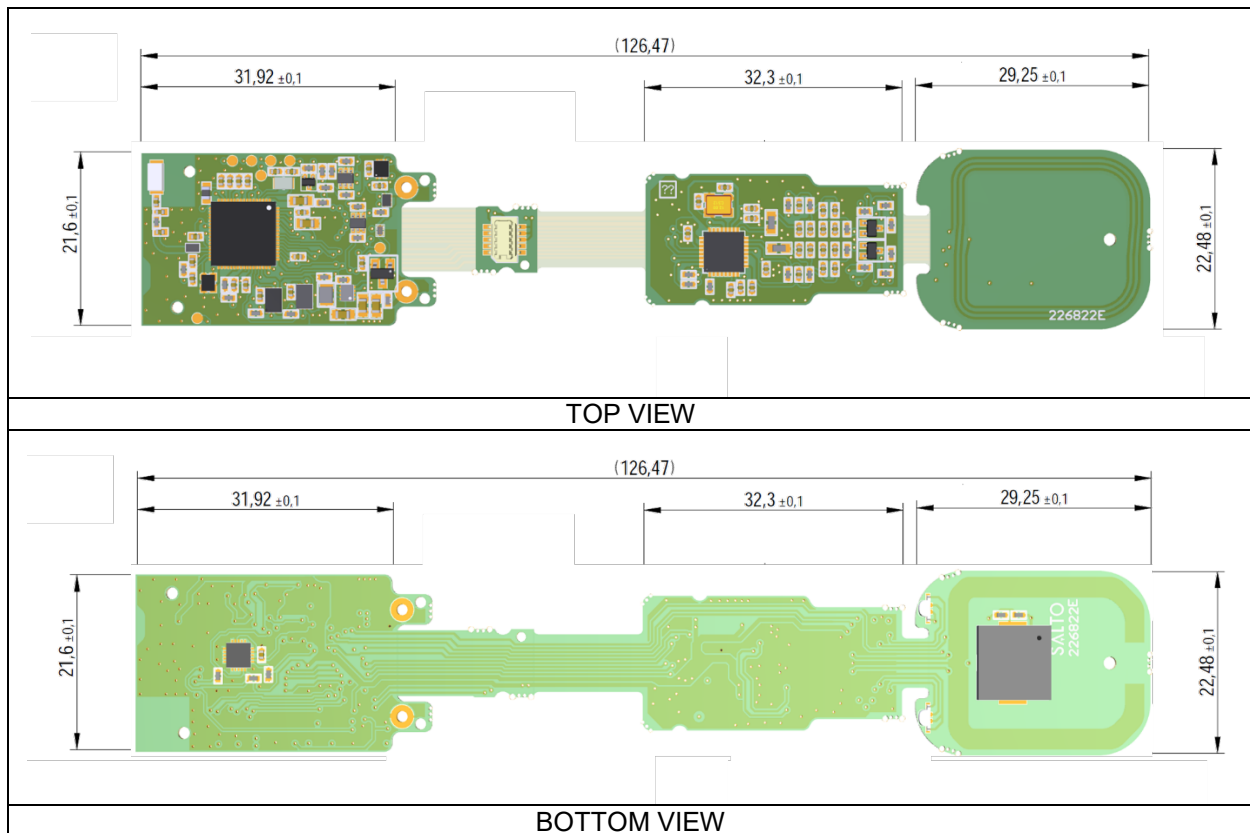
| | | |
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1 NOM

| SALTO Neo | | NOM Mifare (1) + Bluetooth LE (3) |
|---|------------------------|---|
| Antennas | Number of antennas | 2 |
| | Manufacturer | 1- SALTO Systems, S.L. 3- N/A |
| | Model number | 1- NOM 3- STM32WB55RG (SoC) + 2450AT18B100 (Antenna) |
| | Type | 1- Integral, PCB 3- Integral, Chip |
| | Gain | 1- N/A 3- 0.5 dBi |
| | Frequency of Operation | 1- 13.553 - 13.567 MHz 3- 2400 - 2483.5 MHz |
| Channels | Number of channels | 1- N/A 3- 40 |
| | Spacing | 1- N/A 3- 2 MHz |
| | Bandwidth | 1- N/A 3- 2 MHz |
| Type of Modulation | | 1- ASK 100%, OOK (subcarrier fc/16) & ASK 10% - 30%, OOK (subcarrier fc/32) 3- GFSK |
| Declared Nominal Output Power (Max.) | | 1- 24 dBm 3- 6 dBm |
| ITU Emission Designator | | 1- K1D 3- F1D |
| Equipment Configuration for frequency Stability: Data Rate | | 1- 106 Kbit/s 26.48 Kbit/s 3- 1 Mbit/s |
| Equipment Configuration for Field Strength Measurement: Data Rate | | 1- 106 Kbit/s 26.48 Kbit/s 3- 1 Mbit/s |

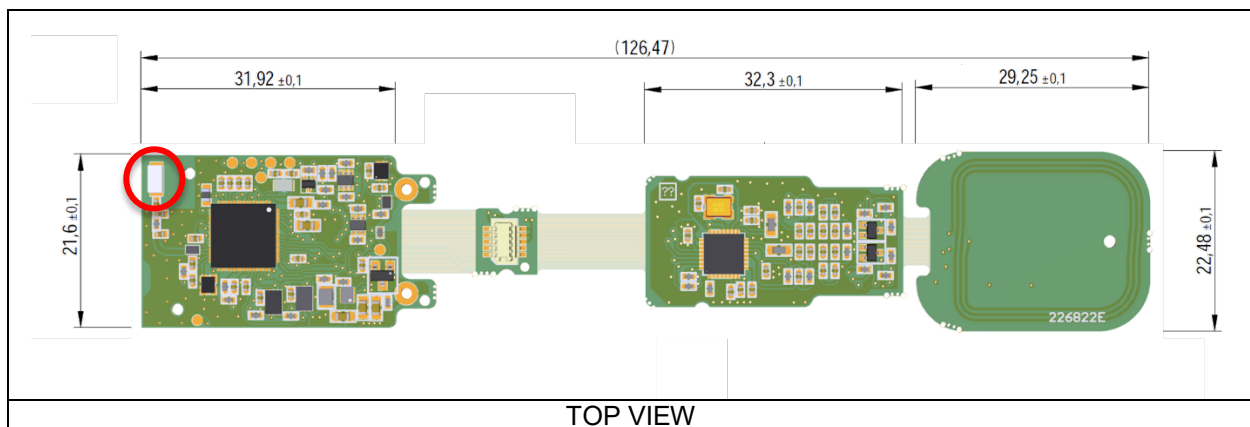
RFID Antenna

The RFID antenna was designed by Salto Systems, S.L. at Arkotz 9, Pol. Lanbarren 20180 Oiartzun (Gipuzkoa), Spain. The antenna model is NOM and it is located on the control circuit, 226822E. The dimensions of the circuit and the antenna are shown in the following images.



Bluetooth LE Antenna

The Bluetooth LE antenna is the 2450AT18B100 model from Johanson Technology. The antenna is located on the top left side of the control circuit, 226822E. The following image shows the location of the antenna on the control circuit.



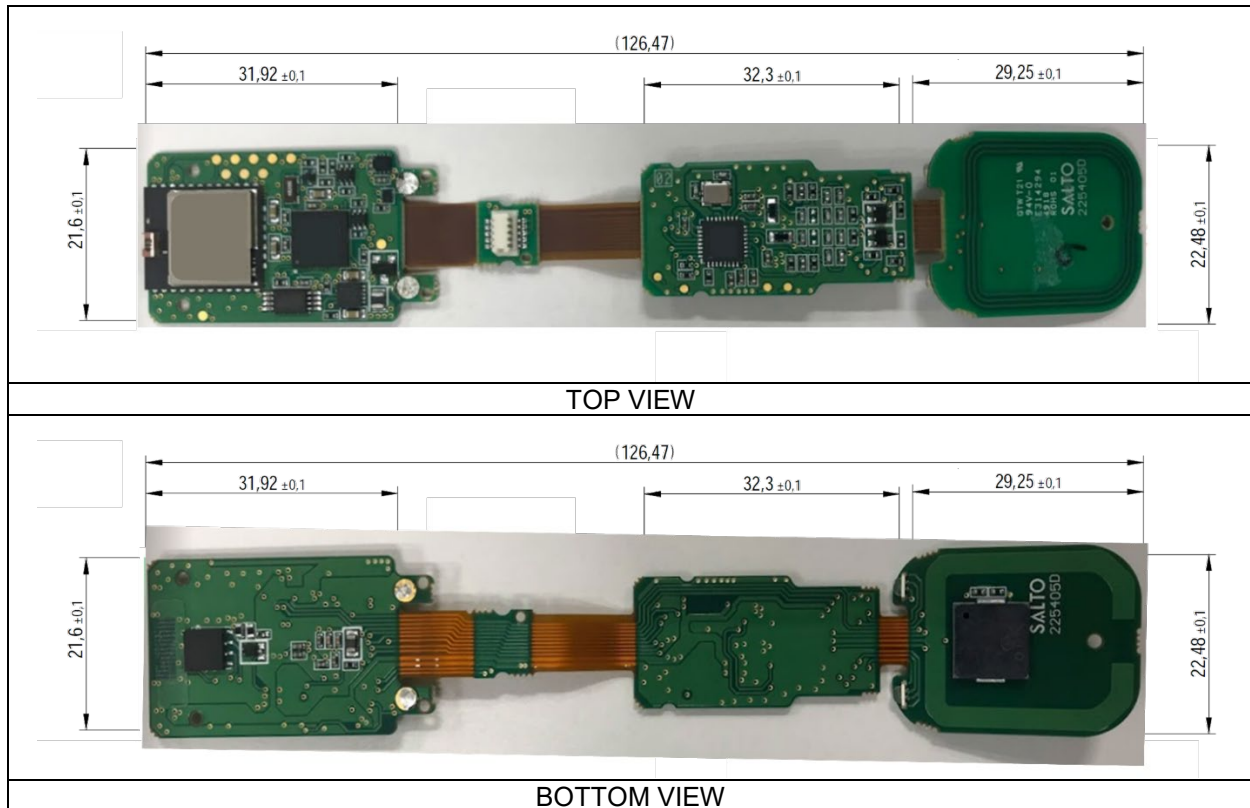
The remaining technical information of the antenna is described in the data sheet attached in Annex I.

2 N0J

| SALTO Neo | | N0J iCLASS (2) + BGM111 (4) |
|---|------------------------|---|
| Antennas | Number of antennas | 2 |
| | Manufacturer | 2- SALTO Systems, S.L. 4- N/A |
| | Model number | 2- N0J 4- N/A |
| | Type | 2- Integral, PCB 4- Integral, Chip |
| | Gain | 2- N/A 4- 1 dBi |
| | Frequency of Operation | 2- 13.553 - 13.567 MHz 4- 2400 - 2483.5 MHz |
| Channels | Number of channels | 2- N/A 4- 40 |
| | Spacing | 2- N/A 4- 2 MHz |
| | Bandwidth | 2- N/A 4- 2 MHz |
| Type of Modulation | | 2- ASK 100%, OOK (subcarrier fc/16) & ASK 10% - 30%, OOK (subcarrier fc/32) 4- GFSK |
| Declared Nominal Output Power (Max.) | | 2- 24 dBm 4- 8 dBm |
| ITU Emission Designator | | 2- K1D 4- F1D |
| Equipment Configuration for frequency Stability: Data Rate | | 2- 106 Kbit/s 26.48 Kbit/s 4- 1 Mbit/s |
| Equipment Configuration for Field Strength Measurement: Data Rate | | 2- 106 Kbit/s 26.48 Kbit/s 4- 1 Mbit/s |

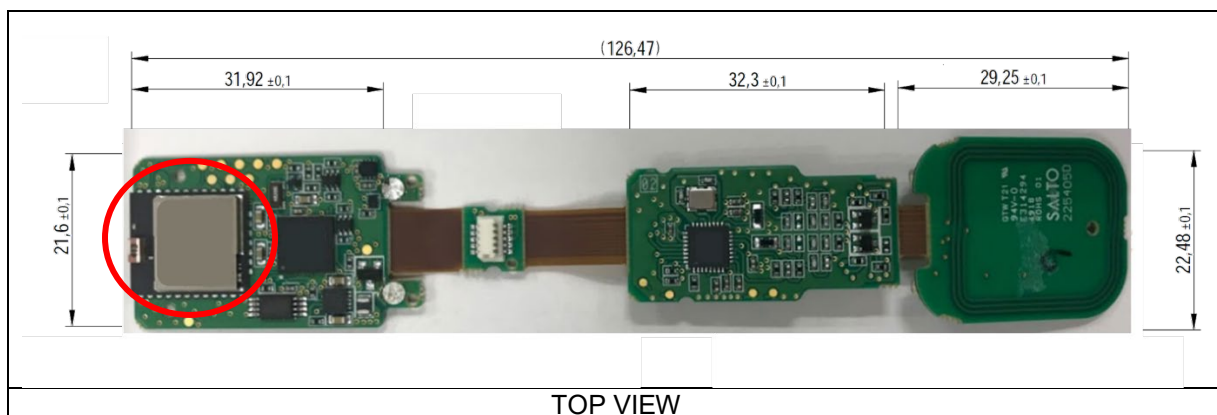
RFID Antenna

The RFID antenna was designed by Salto Systems, S.L. at Arkotz 9, Pol. Lanbarren 20180 Oiartzun (Gipuzkoa), Spain. The antenna model is N0J and it is located on the control circuit, 225751D. The dimensions of the circuit and the antenna are shown in the following images.



Bluetooth LE antenna

The antenna used for Bluetooth LE is a built-in antenna integrated in the BGM111 certified module from Silicon Labs. The BGM111 module is located on the left side of the circuit 225751D. The following image shows the location and dimensions of the antenna on the circuit.



The remaining technical information of the antenna is described in the data sheet included in Annex II.

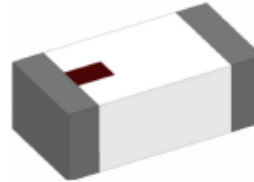
Annex I

High Frequency Ceramic Solutions

2.4GHz Mini Antenna, SMT P/N 2450AT18B100
 Detail Specification: 11/5/2018 Page 1 of 5

Let us help you with the antenna design, optimization, and tuning!

| General Specifications | |
|-------------------------|-------------------|
| Part Number | 2450AT18B100 |
| Frequency (MHz) | 2400 - 2500 |
| Avg. Rad Efficiency* | 76% |
| Peak Gain (dBi typ.) | 0.5 |
| Average Gain (dBi typ.) | -0.5 |
| Return Loss (dB) | 9.5 min. |
| Impedance | 50 Ω |
| Input Power | 2 Watts max. (CW) |



| | |
|---|--|
| Storage Temperature | -45 to +125°C |
| Operating Temperature | -45 to +125°C |
| Recommended Storage Conditions of unused product on T&R and period. | +5 to +35°C Humidity 45~75%RH 18 months max. |
| Reel Quantity | 3000pcs |

*Efficiency based on Johanson's standard evaluation board

| Part Number Explanation | | | |
|-------------------------|------------------|--|---|
| P/N Suffix | Packing Style | Bulk (loose) | Suffix = S e.g. 2450AT18B100S |
| | | T & R | Suffix = E e.g. 2450AT18B100E |
| | | 100% Tin | Suffix = E or S e.g. 2450AT18B100(E or S) |
| | Evaluation Board | 2450AT18B100-EB1SMA (see page 2&3 for details) | |

| Mechanical Dimensions | | |
|-----------------------|--------------------|----------------|
| | In | mm |
| L | 0.126 ± 0.008 | 3.20 ± 0.2 |
| W | 0.063 ± 0.008 | 1.60 ± 0.2 |
| T | 0.051 +.004/- .008 | 1.30 +0.1/-0.2 |
| a | 0.020 ± 0.008 | 0.50 ± 0.2 |

Want the layout file? Request it at: <https://www.johansontechnology.com/ask-a-question>

| Terminal Configuration | |
|------------------------|----------|
| No. | Function |
| 1 | FEED |
| 2 | NC |

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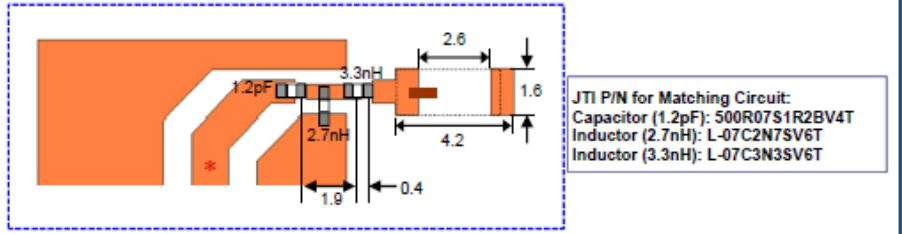
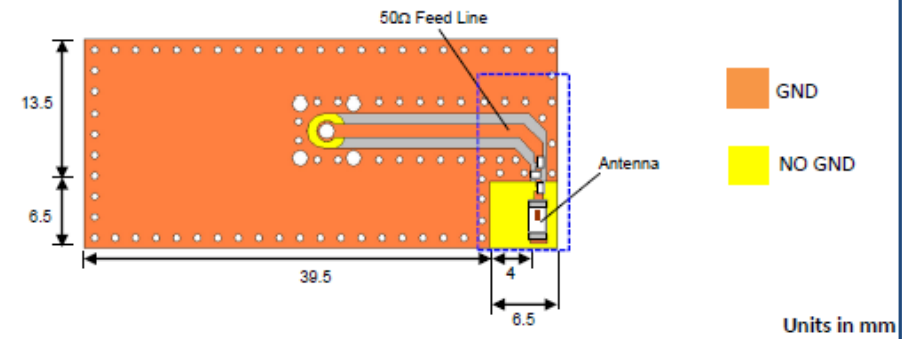


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High Frequency Ceramic Solutions

2.4GHz Mini Antenna, SMT P/N 2450AT18B100
 Detail Specification: 11/5/2018 Page 2 of 5

Mounting Considerations 1: Evaluation Board



JTI P/N for Matching Circuit:
 Capacitor (1.2pF): 500R07S1R2BV4T
 Inductor (2.7nH): L-07C2N7SV6T
 Inductor (3.3nH): L-07C3N3SV6T

*Line width should be designed to provide 50Ω impedance

To order a pre-tuned 50Ω EVB with a female SMA connector click here: <https://www.johansontechnology.com/request-a-sample>
 Reference p/n: 2450AT18B100-EB1SMA

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High Frequency Ceramic Solutions

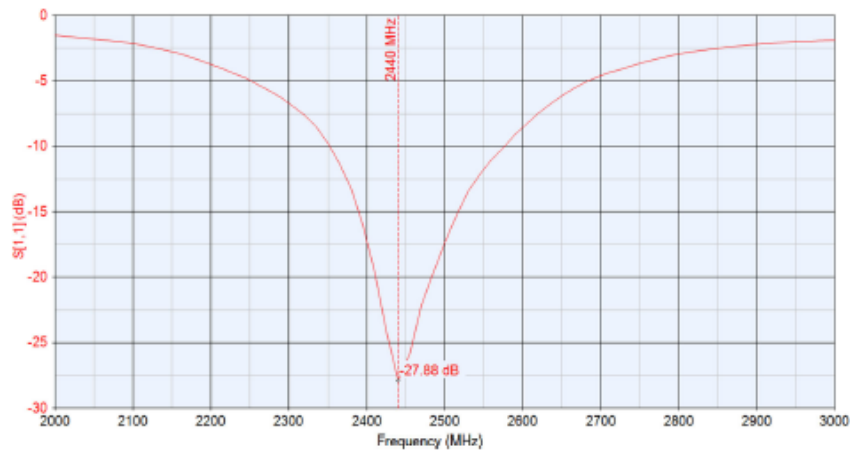
2.4GHz Mini Antenna, SMT

P/N 2450AT18B100

Detail Specification: 11/5/2018

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Mounting Considerations 1: Typical Electrical Performance (T=25°C)



Would you like the antenna layout? Have antenna tuning issues?
 Please contact us if you have any questions regarding the
 implementation of this antenna in your PCB's layout. We'll be happy to
 guide you to maximize the antenna's performance.

Contact our applications engineers at:

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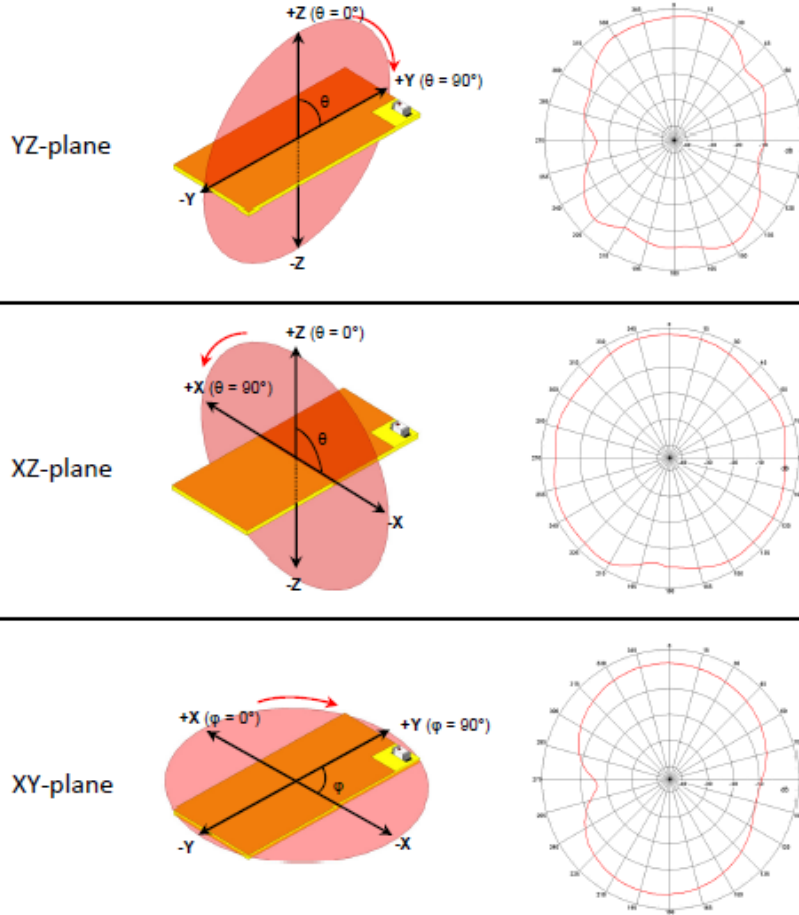
High Frequency Ceramic Solutions

2.4GHz Mini Antenna, SMT
Detail Specification: 11/5/2018

P/N 2450AT18B100
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Mounting Considerations 1: Antenna Performance

Typical 2D radiation patterns @ 2.44GHz



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2.4GHz Mini Antenna, SMT

P/N 2450AT18B100

Detail Specification: 11/5/2018

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Antenna tuning, optimization, and validation services:

<https://www.johansontechnology.com/ipc-antenna-services>

For more antennas and to download measured S-parameters, go to:

<https://www.johansontechnology.com/antennas>

Soldering Information

<https://www.johansontechnology.com/ipcsoldering-profile>

MSL Info

<https://www.johansontechnology.com/msl-rating>

Packaging information

<https://www.johansontechnology.com/tape-reel-packaging>

For layout review contact our Applications Team at:

<https://www.johansontechnology.com/ask-a-question>

RoHS Compliance

<https://www.johansontechnology.com/rohs-compliance>

Need help designing the antenna in? Use our antenna design services!

<https://www.johansontechnology.com/ipc-antenna-services>

We provide 2 free layout reviews and if you need us to tune and characterize the antenna on your product (inside our anechoic chamber) we can do that too. Small lab fee may apply.

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Annex II



BGM111 Wireless Gecko Bluetooth® Module Data Sheet



The Wireless Gecko BGM111 is a Bluetooth® Module targeted for Bluetooth low energy applications where reliable RF, low-power consumption, and easy application development are key requirements. At +8 dBm TX power, BGM111 is ideal for applications requiring short and medium range Bluetooth connectivity.

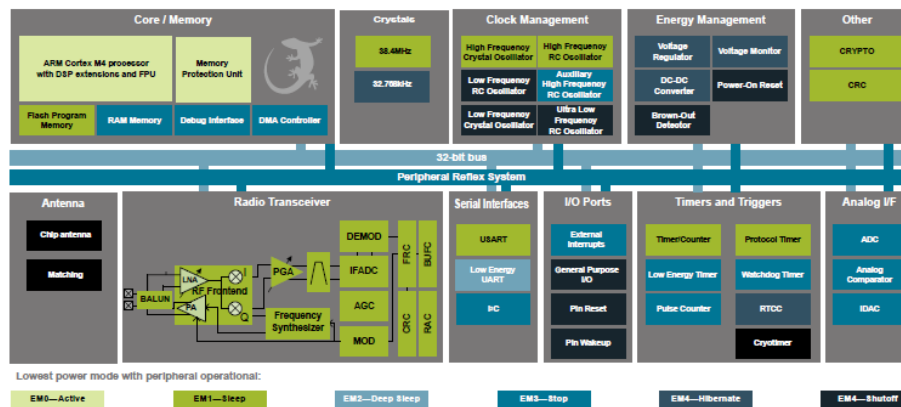
Based on the EFR32BG1 SoC, the BGM111 integrates all of the necessary elements required for a Bluetooth application: Bluetooth low energy radio, a software stack, and GATT-based profiles, and it can also host end user applications, which means no external microcontroller is required in size, price or power constrained devices. The BGM111 Bluetooth Module also has highly flexible hardware interfaces to connect to different peripherals or sensors.

BGM111 can be used in a wide variety of applications:

- IoT Sensors and End Devices
- Commercial and Retail
- Health and Wellness
- Industrial, Home and Building Automation
- Smart Phone, Tablet and PC Accessories

KEY FEATURES

- Bluetooth 4.2 Compliant
- Integrated antenna
- TX power: up to +8 dBm
- RX sensitivity: down to -92 dBm
- Range: up to 200 meters
- 32-bit ARM® Cortex®-M4 core at 38.4 MHz
- Flash memory: 256 kB
- RAM: 32 kB
- Autonomous Hardware Crypto Accelerator and Random Number Generator
- Integrated DC-DC Converter
- Onboard Bluetooth stack



1. Feature List

The BGM111 highlighted features are listed below.

- **Low Power Wireless System-on-Chip.**
 - High Performance 32-bit 38.4 MHz ARM Cortex®-M4 with DSP instruction and floating-point unit for efficient signal processing
 - 256 kB flash program memory
 - 32 kB RAM data memory
 - 2.4 GHz radio operation
 - TX power up to +8 dBm
- **Low Energy Consumption**
 - 8.7 mA RX current at 2.4 GHz
 - 8.2 mA TX current @ 0 dBm output power at 2.4 GHz
 - 63 µA/MHz in Active Mode (EM0)
 - 2.5 µA EM2 DeepSleep current (full RAM retention and RTCC running from LFXO)
 - 2.1 µA EM3 Stop current (State/RAM retention)
- **High Receiver Performance**
 - -92 dBm sensitivity @ 1 Mbit/s GFSK (2.4 GHz)
- **Supported Protocols**
 - Bluetooth® Low Energy
- **Support for Internet Security**
 - General Purpose CRC
 - Random Number Generator
 - Hardware Cryptographic Acceleration for AES 128/256, SHA-1, SHA-2 (SHA-224 and SHA-256) and ECC
- **Wide Selection of MCU peripherals**
 - 12-bit 1 Msps SAR Analog to Digital Converter (ADC)
 - 2 × Analog Comparator (ACMP)
 - Digital to Analog Current Converter (IDAC)
 - 25 pins connected to analog channels (APORT) shared between Analog Comparators, ADC, and IDAC
 - 25 General Purpose I/O pins with output state retention and asynchronous interrupts
 - 8 Channel DMA Controller
 - 12 Channel Peripheral Reflex System (PRS)
 - 2×16-bit Timer/Counter
 - 3 + 4 Compare/Capture/PWM channels
 - 32-bit Real Time Counter and Calendar
 - 16-bit Low Energy Timer for waveform generation
 - 32-bit Ultra Low Energy Timer/Counter for periodic wake-up from any Energy Mode
 - 16-bit Pulse Counter with asynchronous operation
 - Watchdog Timer with dedicated RC oscillator @ 50 nA
 - 2×Universal Synchronous/Asynchronous Receiver/Transmitter (UART/SPI/SmartCard (ISO 7816)/IrDA/I²S)
 - Low Energy UART (LEUART™)
 - I²C interface with SMBus support and address recognition in EM3 Stop
- **Wide Operating Range**
 - 1.85 V to 3.8 V single power supply
 - 2.4 V to 3.8 V when using DC-DC
 - Integrated DC-DC
 - -40 °C to +85 °C
- **Dimensions**
 - 12.9 x 15.00 x 2.0 mm

3. System Overview

3.1 Introduction

The BGM111 product family combines an energy-friendly MCU with a highly integrated radio transceiver. The devices are well suited for any battery operated application, as well as other system requiring high performance and low-energy consumption. This section gives a short introduction to the full radio and MCU system. A detailed functional description can be found in the *EFR32BG1 Wireless Gecko Bluetooth® Low Energy SoC Family Data Sheet* (see general sections and QFN48 2.4 GHz SoC related sections).

A detailed block diagram of the EFR32BG SoC is shown in the figure below which is used in the BGM111 Bluetooth Low Energy module.

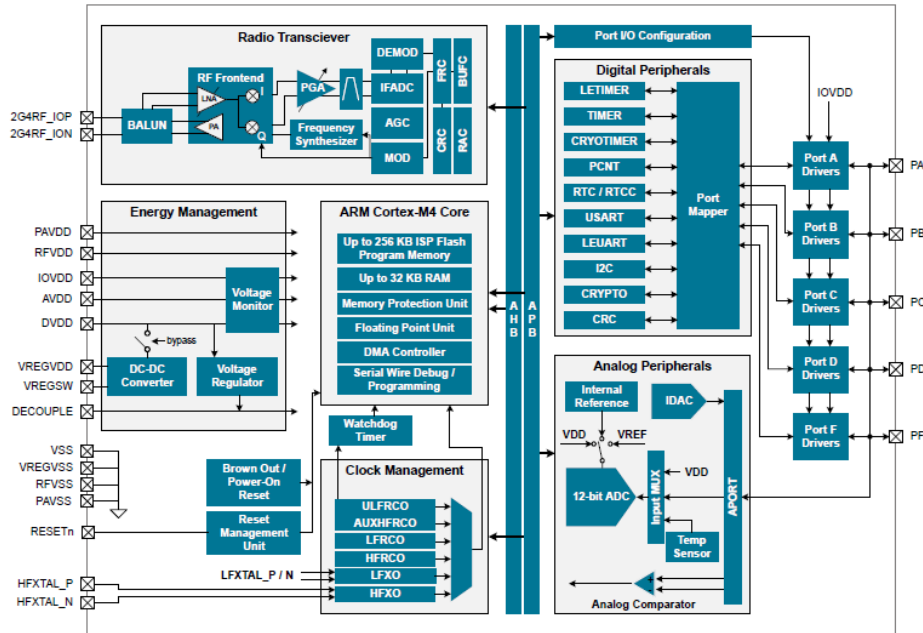


Figure 3.1. Detailed EFR32BG1 Block Diagram

3.2 Radio

The BGM111 features a radio transceiver supporting Bluetooth® low energy protocol.

3.2.1 Antenna Interface

The BGM111 module includes a high-performance, integrated chip-antenna. The table below includes performance specifications for the integrated chip-antenna.

Table 3.1. Antenna Efficiency and Peak Gain

| Parameter | With optimal layout | Note |
|------------|---------------------|---|
| Efficiency | -2 dB to -3 dB | Efficiency and peak gain depend on the application PCB layout and mechanical design and the used antenna. |
| Peak gain | 1.0 dBi | |

3.2.2 Packet and State Trace

The BGM111 Frame Controller has a packet and state trace unit that provides valuable information during the development phase. It features:

- Non-intrusive trace of transmit data, receive data and state information
- Data observability on a single-pin UART data output, or on a two-pin SPI data output
- Configurable data output bitrate / baudrate
- Multiplexed transmitted data, received data and state / meta information in a single serial data stream

3.2.3 Random Number Generator

The Frame Controller (FRC) implements a random number generator that uses entropy gathered from noise in the RF receive chain. The data is suitable for use in cryptographic applications.

Output from the random number generator can be used either directly or as a seed or entropy source for software-based random number generator algorithms such as Fortuna.

6.4 2D Radiation Pattern Plots

2D pattern, front view

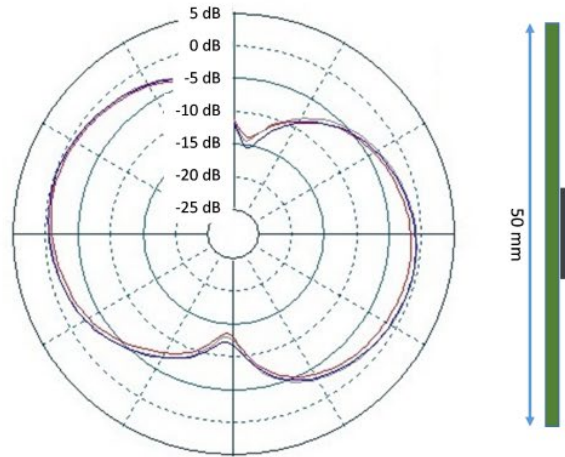


Figure 6.4. Typical 2D Radiation Pattern – Front View

2D pattern, side view

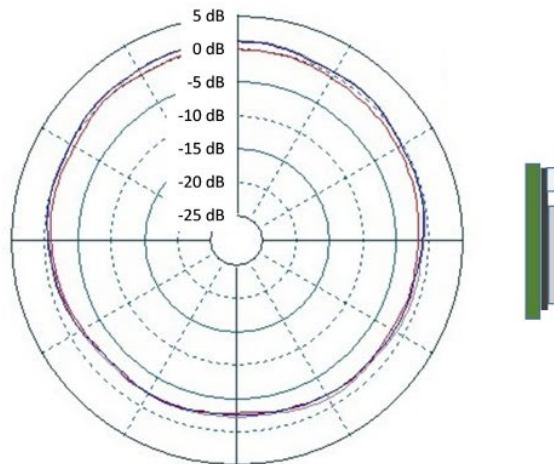


Figure 6.5. Typical 2D Radiation Pattern – Side View

2D pattern, top view

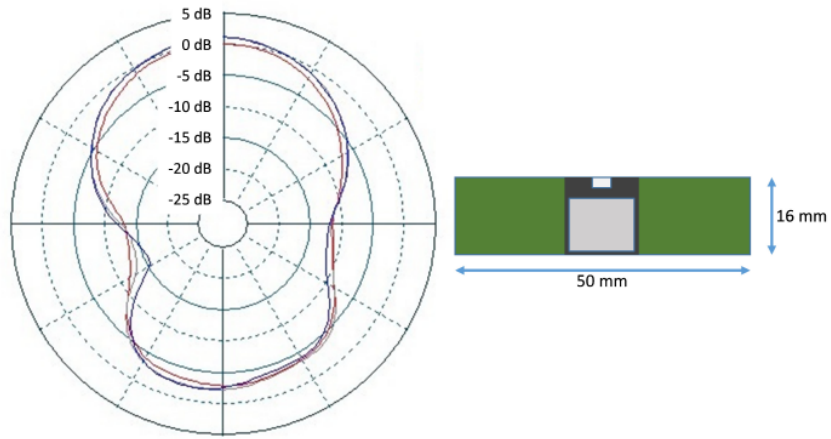


Figure 6.6. Typical 2D Radiation Pattern – Top View