



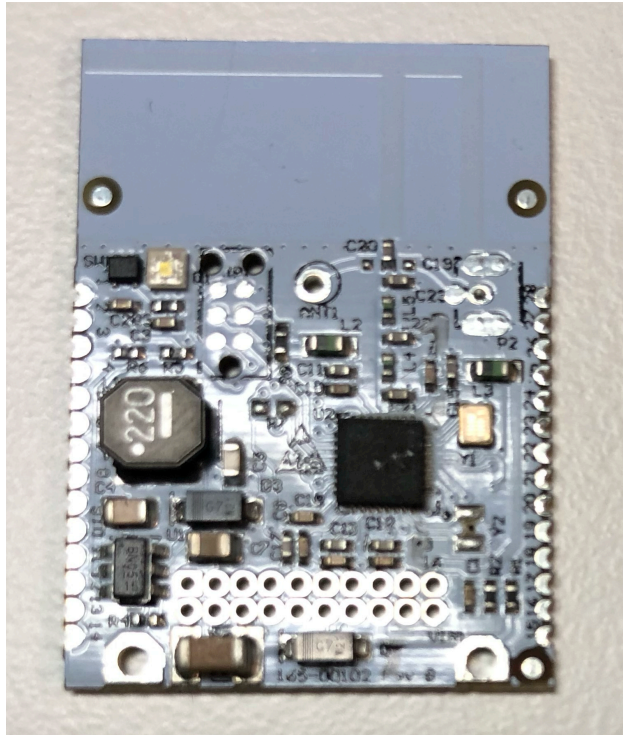
EFR24CM Compute Module Product Specification

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EFR24CM Compute Module Brief

Figure 1 : EFR24CM Module



Description

The EFR24CM Compute Module (aka. The “Module”) features Silicon Labs EFR32MG21 series “Mighty Gecko” MCU with built-in BLE and 802.15.4 wireless support. Additionally, the Module is equipped with a pixel LED, Hall sensor, and 36V tolerant Power regulator.

The Module comes with a printed, inverted ‘F’ 2.4GHz antenna, but has connections for optional 3cm wire antenna or U.FL connector.

The left and right edges of the board expose the 20 GPIO pins from the EFR32MG21, and offer 4 ground and access to the 3V3 and 12V rails, and the LEDs output line to allow daisy chaining of additional LEDs.

Thru-hole pins are also provided to allow for varied build configurations where space is an issue.

Power can be provided to the Module directly via the 3V3 rail, which supplies the various ICs, or via the 12V rail which feeds the power regulator.

NOTE: The module can tolerate 36V on the 12V rail, but be cautious when applying voltage of this magnitude as the Module has no transient current protection.

The Module includes the EFR32MG21F1024A020IM32 MCU manufactured by Silicon Laboratories, Inc, which features an 80MHz ARM Cortex M33 , 96KB of ram, 1024KB of on-die Flash, and built in BLE and 802.15.4 wireless support.

Features

Bluetooth

- Bluetooth 5.1 support
- Bluetooth Mesh support

802.15.4

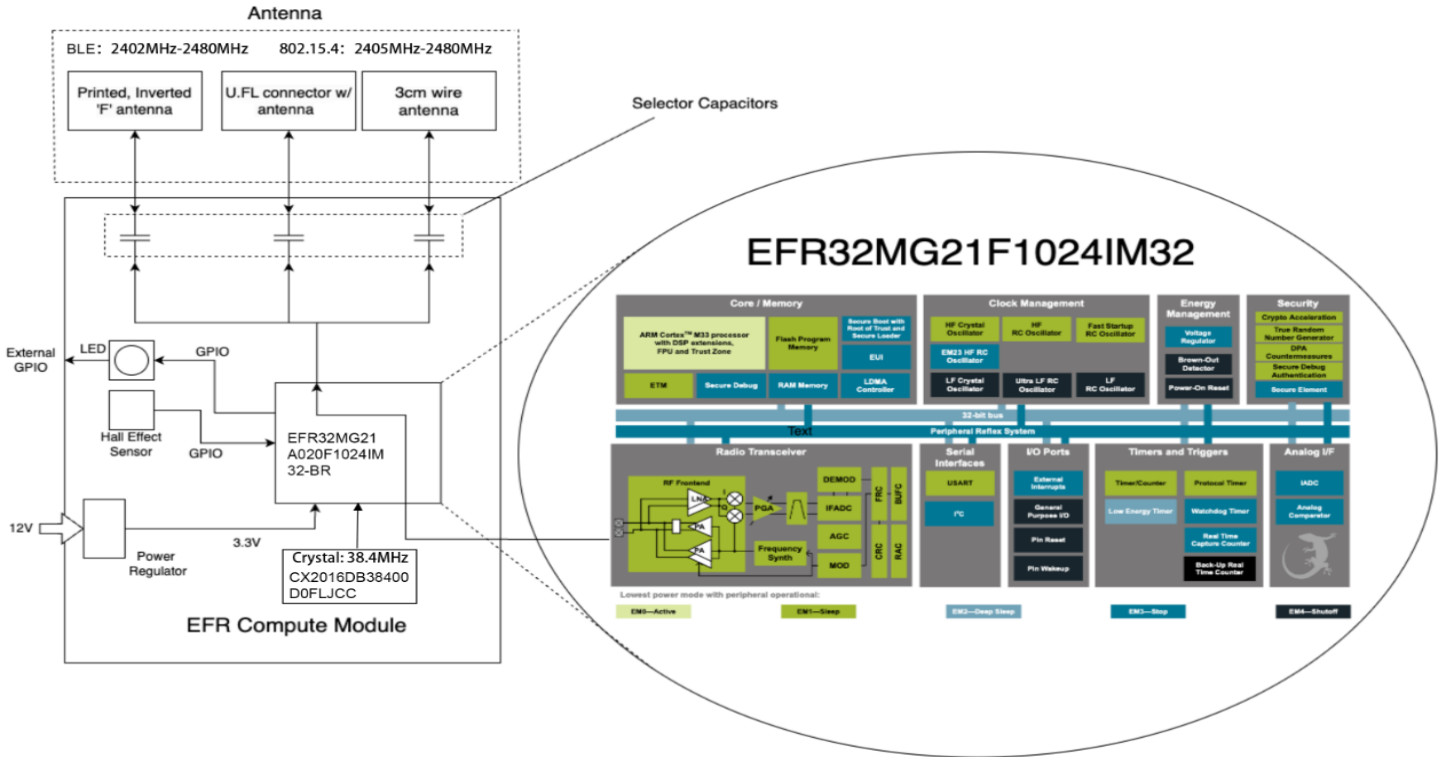
- Zigbee support
- Thread support

Radio HW

- Sensitive to -104.5dBm reception
- Frequency Range: 2400MHz - 2483.5MHz

Module Theory of Operation

Figure 2: Block diagram of Module



Operation

The EFR24CM Module must be configured at installation.

- Proper antenna must be selected
 - North-facing 10pF capacitor must be present to use the printed antenna *
 - East-facing 10pF capacitor and optional U.F.L connector must be present to use the external 8dBi antenna
 - West-facing 10pF capacitor must be present to use a soldered wire antenna.
 - NOTE: ONLY ONE capacitor is supported at a time.

* Printed antenna may be removed from the Module if unused.

Power must be provided:

- May supply 2.0 - 3.6 volts to the 3V3 rail of the Module to power the MCU and components, or...
- May instead supply 6 - 26V to the 12V rail of the Module (Note: be cautious of power insertion above 26V as the module has no transient voltage protection).

All other connections and behavior of the module are dependent upon application of the module. Please refer to any additional documentation included with module, or included with the product which contains the module for additional operating parameters.

Module Layout

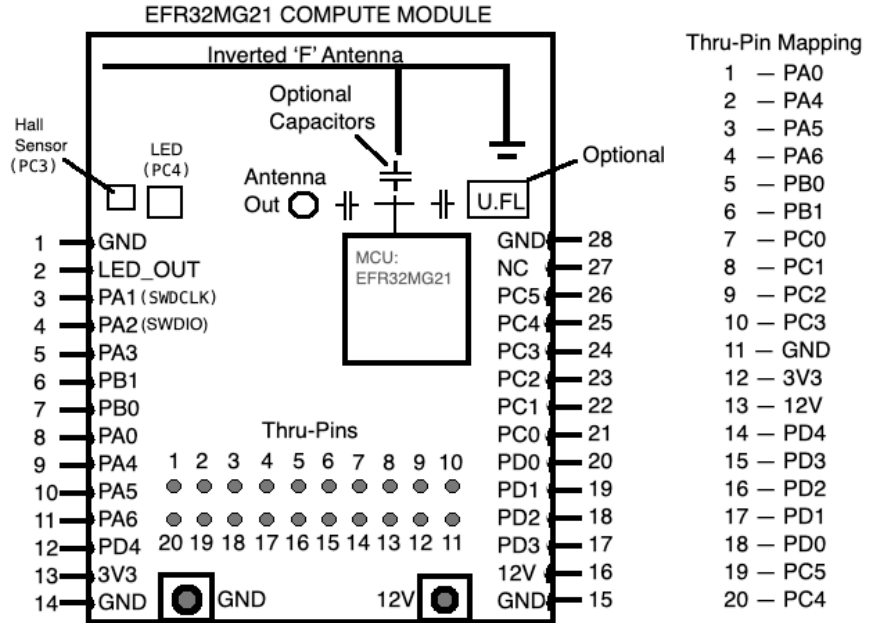
Connections

Figure 2 to the right shows the Pinout for the Module. The edge and thru-hole pin pads connect to the MCUs general purposed, configurable GPIO. Some Pins share functionality with hardware on the module:

- Edge pins 3 and 4 can program the device.
- Edge pin 25(thru-pin 20) connects to the input pin for the on-board LED.
- Edge pin 24(thru-pin 10) connects to the output of the hall-effect sensor.

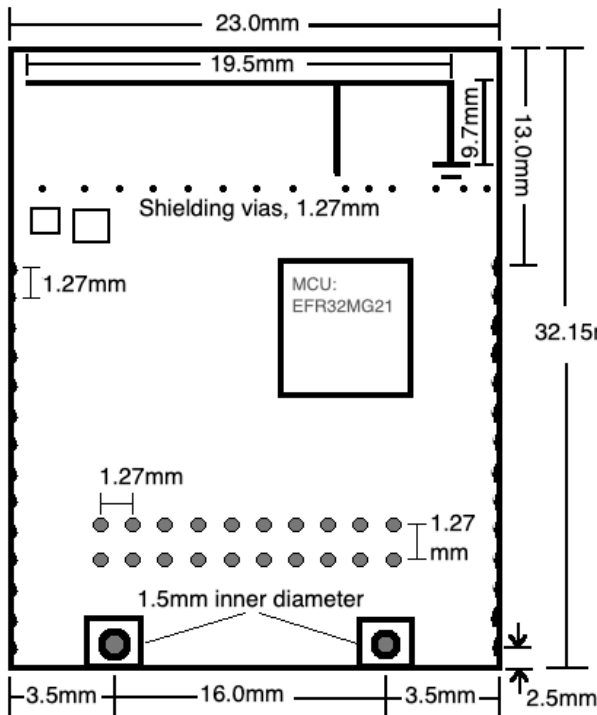
Typically, the Module is configured to use the printed 'F' antenna; however, by moving the north-facing, 10pF capacitor, the board can be used with either a U.FL connector (using an east-facing capacitor), or a 3cm wire antenna (using a west-facing capacitor). Typically, the board would also be cut or snap off just

Figure 3: Module connections



above the shielding vias (see **Figure 3** below) to lessen the Module's footprint.

Figure 4: Board Dimensions



Dimensions

Figure 3 (left) illustrates the Module's connections are pitched to an industry standard 1.27mm, which allows for easy alignment with 3rd part ICs, as well as the 1.27mm shielding vias. Overall dimensions of 23.00mm x 32.15mm make the footprint of the module roughly thumb-print-sized.

For power, the 12V connection pads at the south end of the board have a 1.5mm inside diameter allowing for easy clipping of power leads during development.

NOTE: While able to accept large-gauge wire, the power requirements of the Module do not warranty such wiring.

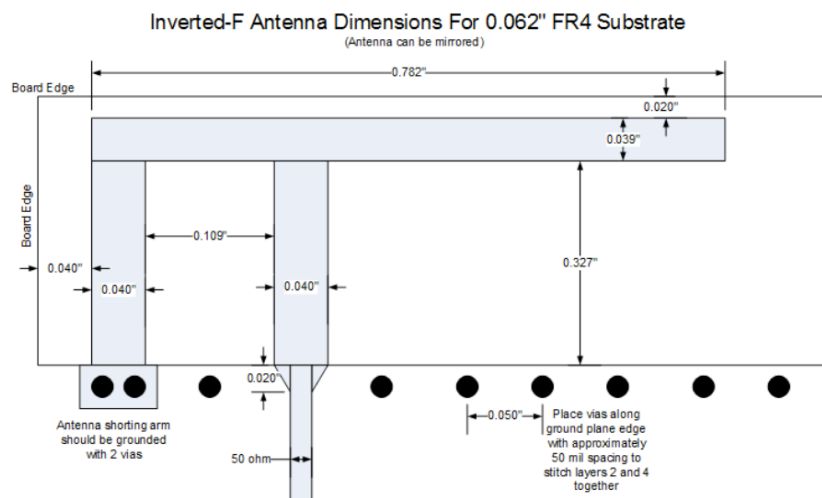
Optional Antennas

Antenna on the module can be disconnected and reconnected to the MCU via the 10pF steering capacitor. North-facing capacitor path is used for the printed antenna, east-facing is used for the optional U.FL connector, and west-facing is used for soldered wire antennae. NOTE: The north facing capacitor MUST be removed from the module if the east- or west-facing capacitors are installed; only on capacity at a time may be present.

Inverted 'F' Printed Antenna

Antenna design in the Module based on Silicon Laboratories' document AN1088. This design nominally yields 1.44dBi gain at 2445MHz. Excerpt from AN1088 for the antenna below:

Figure 4:



8dBi, Dual-band antenna

The external 8dBi, dual band antenna in Figure 5 to the right is included with some project builds based on the needs of the client. The antenna would require the optional U.FL connector and the east-facing capacitor added to the Module.

Electrical Specifications

Frequency Range (MHz) : 2400-2650

Bandwidth (MHz) : 2000

Input Impedence (Ω) : 50

V.S.W.R : ≤ 2.0

Gain (dBi) : 8

Max Input Power (w) :5

Mechanical Specifications

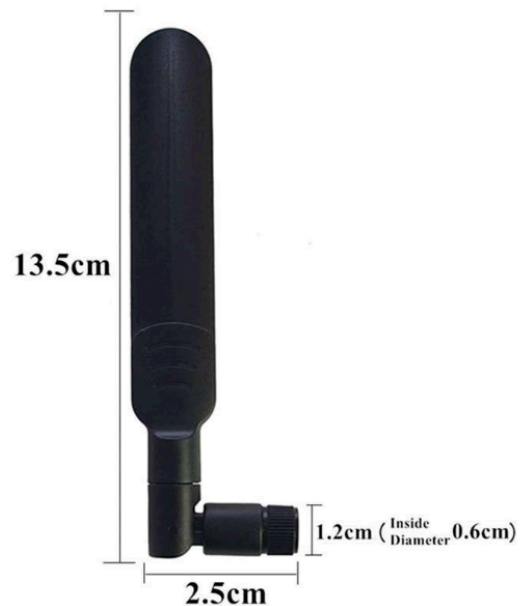
Antenna Length (mm) : 220

Connect Type : SMA male

Radome Color: Black

Weight (g): 30

Figure 6: External Antenna Dimensions



3cm Wire antenna

The final antenna option is the 3cm wire antenna, which is a shrink-tube-capped, 30.5mm, 22AWG wire which is soldered through the Module board near the top center. It needs connected via the west-facing capacitor pad to make connection to the MCU. Brief specification below.



Model Name	3 CM Antenna		
Frequency	2400MHz	2450MHz	2500MHz
Gain (dBi)	-1.02dBi	-0.45dBi	0 dBi
MAX. Gain	0 dBi		
Impedance	50 Ω		
Antenna Length	30.5mm		
Manufacturer	Designs Midwest Hong Kong, Ltd		
Address	Room 2705, Block C, Tiley Central Plaza II, No.3 Haide Road, NanShan District, Shenzhen, Guangdong, China		

FCC STATEMENT

- This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.
- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/ TV technician for help.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, Human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM

Manual v01

1. List of applicable FCC rules

FCC Part 15 Subpart C 15.247 & 15.209

2. Specific operational use conditions

The module with BLE/802.15.4 function.

Operation Frequency: BLE 2402-2480MHz;
802.15.4 2405~2480MHz;

Number of Channel:

BLE: 40 Channel, 802.15.4: 16 Channel,

Modulation: GFSK, OQPSK

Type: PCB antenna

Wire antenna

Dipole Antenna

Gain: PCB antenna: 1.44dBi

Wire antenna: 0dBi

Dipole Antenna: 8dBi

The module can be used for mobile applications with a maximum 8dBi antenna. The host manufacturer installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer has to be aware not to provide information

3. Limited module procedures

Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

4. Trace antenna designs

Not applicable.

5. RF exposure considerations

The module must be installed in the host equipment such that at least 20cm is maintained between the antenna and users' body; and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

6. Antennas

Antenna Specification are as follows:

Type: PCB antenna

Wire antenna

Dipole Antenna

Gain: PCB antenna: 1.44dBi

Wire antenna: 0dBi

Dipole Antenna: 8dBi

This device is intended only for host manufacturers under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna;

The module shall be only used with the internal antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a 'unique' antenna coupler.

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

7. Label and compliance information

Host product manufacturers need to provide a physical or e-label stating "Contains FCC ID: ULP-EFR24CM" with their finished product.

8. Information on test modes and additional testing requirements

Operation Frequency: BLE 2402-2480MHz;

802.15.4 2405~2480MHz;

Number of Channel:

BLE: 40 Channel, 802.15.4:16 Channel,

Modulation: GFSK, OQPSK

Host manufacturer must perform test of radiated & conducted emission and spurious emission, etc according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

9. Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is **only** FCC authorized for FCC Part 15 Subpart C 15.247 & 15.209 and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Federal Communication Commission Statement (FCC, U.S.)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IMPORTANT NOTES

Co-location warning:

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

OEM integration instructions:

This device is intended only for OEM integrators under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.

As long as the conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End product labeling:

The final end product must be labeled in a visible area with the following: "Contains Transmitter Module [FCC ID: ULP-EFR24CM](#)."

Information that must be placed in the end user manual:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.