



# **Application Note**

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## **Certification Scenarios**

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## Introduction

Radio modules are a smart way to reduce the design costs of custom RF applications. They can be easily integrated into end-user applications and connected via standard interfaces. If the module is certified, costly and time consuming certification and measurement procedures are unnecessary.

A difficult question for most customers is how to integrate a module into their application and get or keep the RF certification. Most countries have their own certification requirements for RF applications. This application note describes different FCC certification scenarios for dresden elektronik radio modules for use in the United States.

All applications discussed in this document are concerning IEEE 802.15.4 radio modules by dresden elektronik and the appropriate regulatory standards of FCC Part 15 [1].

## Difference between conformity and certification

A *certified application* [2] has its own FCC-ID and can be sold on the US market. Furthermore, for an end-user application, it can be integrated into another component (referred to as modular approval) or left as it is. In general, no additional compliance measurements are necessary, except if it is demanded by the supplier, customer or other regulatory requirements.

Example:

Radio module supplier A offers a module that is certified as modular approval and therefore compliant to FCC Part 15 [1]. Customer B integrates the module into an end-user application. Due to the module certification, the application becomes compliant and certified according to FCC Part 15. The customer is allowed to use the supplier's FCC-ID for selling the application on US market.

In comparison a supplier's promoted *conformity of an application* according to FCC Part 15 means that it fulfills all RF-related requirements and limits, like maximum output power, spectral density, band-edge, occupied bandwidth, transmitter and receiver spurious emission. The compliant radio module can be integrated by the customer into an application, but it still needs a certification before it is allowed to be sold within the United States. Therefore a compliance measurement test report of the end-user application by a TCB is necessary for the equipment authorization process.

Example:

Radio module supplier A offers a module that is compliant to FCC Part 15 [1]. Customer B integrates the module into an end-user application. The application must be tested and measured to proof compliance to all necessary regulatory requirements and to receive a Certification grant including an FCC-ID.

## Radio modular approval

Modular devices like the radio modules by dresden elektronik listed below have been certified as modular approval [3]. This allows the straightforward use of the modules within custom applications.

Four types of modular approval are possible:

- Single-modular transmitter
- Limited single-modular transmitter
- Split-modular transmitter
- Limited split-modular transmitter

Each type of approval has different regulatory requirements [4]. The certified dresden elektronik radio modules with onboard chip antenna or coaxial connector are approved as *Single-modular transmitter*. Certified radio modules with RF-pad are approved as *Limited single-modular transmitters*.



## Permissive changes

In certain cases it is allowed to modify a certified RF device without filing for a new equipment authorization. The Permissive change rules define three types of such [5] modifications. The kind of modification defines the type of permissive change [6]. Changes in basic frequency determining and stabilizing circuitry (e.g. clock, data rate), basic modulator circuit or maximum power or field strength ratings will always require a new FCC-ID and equipment authorization [6].

## Labeling

The FCC label requirements for a modular approval define that the FCC-ID must be clearly and visibly attached to module. If the module is placed within another device or housing a label with the respective FCC-ID must be placed on the outside [7]. For practical labeling guideline refer to [8].

## Approved antenna

The approved antenna is the tested and measured antenna for equipment authorization of the radio module [3]. A list of approved antennas must be given in the radio module's user manual. According to [6] it is allowed to substitute approved antennas through equivalent antennas of the same type with equal or less antenna gain:

*'Equivalent antennas must be of the same type (e.g., yagi, dish, etc.), must be of equal or less gain than an antenna previously authorized under the same FCC ID, and must have similar in band and out-of-band characteristics (consult specification sheet for cutoff frequencies).'*

## Certification scenarios

The FCC compliance and certification according to FCC Part 15 in this document relates only to the radio modules by dresden elektronik and covers only the applicable requirements for IEEE 802.15.4 technology. If a customer application consists of additional intentional radiators (i.e. WiFi- or Bluetooth-modules) additionally regulatory requirements might have to be fulfilled.

### Scenario 1(a): FCC-certified radio module with fixed antenna

The customer uses a FCC-certified radio module with a fixed chip antenna approved by dresden elektronik. The module shall be integrated into the custom end-user application. If the application includes a housing, the module's FCC-ID must be visibly labeled outside. Therefore the application fulfills all regulatory requirements and is fully compliant and certified to FCC Part 15.

### Scenario 1(b): FCC-certified radio module with coaxial connector

The customer uses a FCC-certified radio module with coaxial connector by dresden elektronik and connects an external approved antenna. The module shall be integrated into the custom end-user application. If the application includes a housing, the module's FCC-ID must be visibly labeled outside. Therefore the application fulfills all regulatory requirements and is fully compliant and certified to FCC Part 15.

### Scenario 1(c): FCC-certified radio module with RF pads

The customer uses a FCC-certified radio module with RF pads by dresden elektronik. The module must be integrated into the custom end-user application by using the certified reference design by dresden elektronik. The design notes [9] cover the footprint, RF traces with impedance, matching circuit parts, PCB properties and the chip antenna or coaxial connector with external antenna. If the application includes a housing, the modules FCC-ID must be visibly labeled outside. Therefore the application fulfills all regulatory requirements and is fully compliant and certified to FCC Part 15.



**Scenario 2: FCC-compliant radio module**

The customer uses a FCC-compliant radio module by dresden elektronik. The module shall be integrated into the custom end-user application. The application must be tested and measured by a TCB, certified by the FCC to fulfill all regulatory requirements resulting in a new FCC-ID.

**Scenario 3: Non-Approved antenna connected to FCC-certified radio module**

The customer uses a FCC-certified radio module with coaxial connector by dresden elektronik and connects an external non-approved antenna. The module will be integrated into the custom end-user application. The non-approved antenna requires a partial re-measurement of radiated tests by a TCB and updating the grant of certification by a permissive change class II. The FCC-ID remains the same for the radio module. If the application includes a housing, the module's FCC-ID must be visibly labeled outside. Therefore the application fulfills all regulatory requirements and is fully compliant and certified to FCC Part 15.

**Scenario 4: Custom RF-design connected to FCC-certified radio module**

The customer uses a FCC-certified radio module with RF pads by dresden elektronik with a custom RF design. The module shall be integrated into a custom end-user application. The custom RF design (e.g. footprint, RF traces, matching circuit parts, PCB properties and the chip antenna or coaxial connector with external antenna) requires a partial re-measurement of radiated tests by a FCC accredited test firm and updating the grant of certification by a permissive change class II by a TCB. Additionally the modified design must be clearly described in the radio module's user manual of the supplier. The FCC-ID remains the same for the radio module. If the application contains a housing, the module's FCC-ID must be visibly labeled outside. If these guidelines are respected the application fulfills all regulatory requirements and is fully compliant and certified to FCC Part 15.

**Table 1** shows the available radio modules by dresden elektronik and their corresponding certification scenarios. Not every scenario is applicable for each device.

**Note:** The item 'n.a.' in **Table 1** means that the described certification scenario is not applicable for the device. For example: a radio module with fixed onboard antenna cannot approve with a custom RF-design like in scenario 4. Furthermore an already FCC certified radio module includes always the compliance to all FCC rules and therefore scenario 2 is not applicable.

**Table 1: Certification scenario overview**

Devices	Scenario 1 FCC-certified	Scenario 2 FCC-compliant	Scenario 3 Non-approved Antenna	Scenario 4 Custom RF-Design
<i>Evaluation radio modules</i>				
deRFmega128-22A00	√	n.a.	n.a.	n.a.
deRFmega128-22A02	√	n.a.	√	n.a.
deRFmega128-22C00	√	n.a.	n.a.	n.a.
deRFmega128-22C02	√	n.a.	√	n.a.
deRFarm7-25A00	√	n.a.	n.a.	n.a.
deRFarm7-25A02	√	n.a.	√	n.a.



deRFarm7-15A02	√	n.a.	√	n.a.
deRFarm7-25C00	√	n.a.	n.a.	n.a.
deRFarm7-25C02	√	n.a.	√	n.a.
deRFarm7-15C02	√	n.a.	√	n.a.
<i>OEM radio modules</i>				
deRFmega128-22M00	√	n.a.	n.a.	n.a.
deRFmega128-22M10	n.a.	√	n.a.	n.a.
deRFmega128-22M12	n.a.	√	n.a.	n.a.
deRFmega256-23M00	n.a.	√	n.a.	n.a.
deRFmega256-23M10	n.a.	√	n.a.	n.a.
deRFmega256-23M12	√	n.a.	√	√
deRFsam3-23M10-2	n.a.	√	n.a.	n.a.
deRFsam3-23M10-3R	n.a.	√	n.a.	n.a.
deRFsam3-13M10	n.a.	√	n.a.	n.a.
<i>USB radio sticks</i>				
deRFusb-23E00	√	n.a.	n.a.	n.a.
deRFusb-23E00 JTAG	√	n.a.	n.a.	n.a.
deRFusb-23E06	√	n.a.	n.a.	n.a.
deRFusb-23E06 JTAG	√	n.a.	n.a.	n.a.
deRFusb-13E00	n.a.	√	n.a.	n.a.
deRFusb-13E00 JTAG	n.a.	√	n.a.	n.a.
deRFusb-13E06	n.a.	√	n.a.	n.a.
deRFusb-13E06 JTAG	n.a.	√	n.a.	n.a.

## Summary

This application note briefly described the different ways of integrating radio modules by dresden elektronik into custom applications. Obviously the easiest and fastest way is using certified modules to be approved for use in the United States either separately or integrated within applications. For applications with custom non-approved antennas or custom RF-designs we recommend getting in contact with dresden elektronik to find the fastest and most economical way for a certification.



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## References

- [1] CFR Title 47 Chapter I, Part 15 Radio frequency devices
- [2] CFR Title 47 Chapter I, Part 2, Subpart J, Section 2.909 Certification
- [3] CFR Title 47 Chapter I, Part 15, Subpart C, Section 15.212 Modular transmitters
- [4] KDB 996369 D01 Module Certification Guide v01r03
- [5] CFR 47, Part 15, Subpart J, Section 2.1043 Changes in certificated equipment
- [6] KDB 178919 D01 Permissive Change Policy v05r03
- [7] CFR Title 47 Chapter I, Part 15, Subpart C, Section 15.19 Labelling requirements
- [8] KDB 784748 D01 Labelling Part 15 &18 Guidelines v07
- [9] User Manual Radio Modules deRFmega128 and deRFmega256; User Manual, URL:  
[http://www.dresden-elektronik.de/funktechnik/products/radio-modules/oem-derfmega/description/?eID=dam\\_frontend\\_push&docID=1250](http://www.dresden-elektronik.de/funktechnik/products/radio-modules/oem-derfmega/description/?eID=dam_frontend_push&docID=1250)



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## Glossary

Term	Description
IEEE 802.15.4	Standard, applicable to low-rate wireless personal area networks (WPAN)
CFR	Code of Federal Regulations
FCC	Federal Communications Commission
TCB	Telecommunications Certification Body



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