BUILD YOUR OWN FIRMWARE

INTRODUCTION

Build Your Own Firmware

With our portfolio of BYOFw modules, e.g. Ophelia-I, customers can receive a radio module in hardware-only version, meaning that the firmware for the transceiver chipset needs to be developed and flashes by customer himself.

A custom firmware:

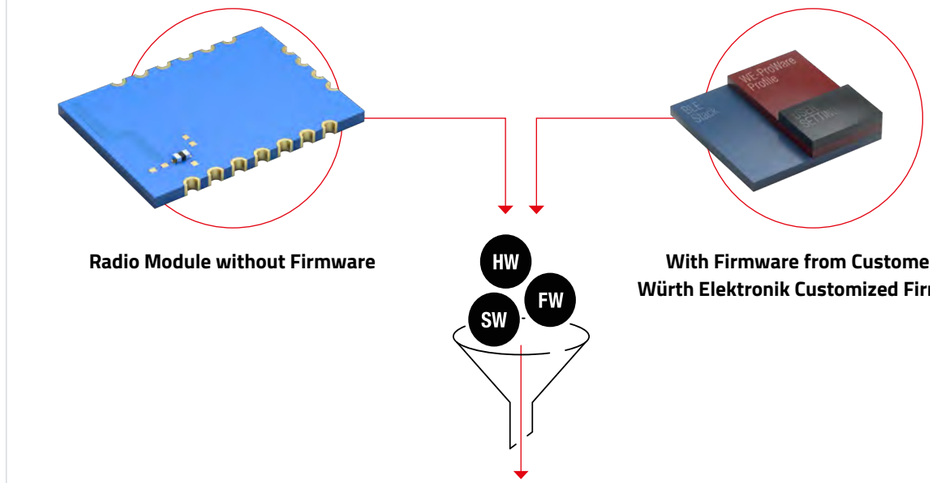
- Can be developed using the SDK's and resources are provided by the SoC manufacturer. In case of Ophelia-I and Proteus it's either the nRF5 SDK or nRF connect SDK by Nordic Semiconductors.
- Defines the functional characteristics and specifications of the radio module
- Can be optimized to the specific application, such as allowing hostless operation

Compared to that Proteus-e, Ophelia's twin, is based on the same hardware but coming with a Bluetooth® 5.1 firmware. Proteus preinstalled firmware comes with some advantages regarding the reduction in development effort and risc for the customer. Considering the task to add a radio communication to the application, the resources required for firmware development or for module's certification are neglegtable. And thanks to the Wireless Connectivity SDK using the API of any wireless module from Würth Elektronik with your host IC is an easy task for developers.

If you have your custom firmware ready for either of our module hardware platforms, we can take care of the flashing and produce your custom module in the quantity you need.

More information on page 31

	Proteus-e	Ophelia-I
Hardware platform	7 x 9 x 2 mm, nRF52805 chipset, smart antenna configuration (internal PCB + connector to external antenna)	
Firmware	Bluetooth® 5.1 firmware	No firmware
Fully certified / ready to use	✔	-
Flexibility / optimization to end application	++	+++
Module's price	€€	€
Würth Elektronik's firmware service available	✔	✔



BUILD YOUR OWN FIRMWARE

With these SDKs, customers can build their firmware for the nRF52 chipset family and integrate the required functions, for example:

- Possibility to integrate device application into the module and thus save PCB space, reduce power consumption and limit the amount of parts in the circuit/the BOM.
- Define your own Bluetooth LE profiles and characteristics, make application optimized Bluetooth LE settings or even use another radio protocol such as Bluetooth MESH, Matter, Zigbee or Thread (depending on the modules HW possibilities!)
- Use UART, SPI, I²C and/or ADC to read sensor data
- Implement application-dependant and optimized behaviour and data processing
- Implement test modes for radio certification and end device testing

With that, the custom firmware can be tailored to the customer's application.

Possibilities with the Nordic SDK
(nRF5 SDK, nRF Connect SDK)

WE Standard off-the-shelf Radio Module

page: 54

Proteus-e

Customer Own Firmware on WE Hardware based on Nordic Semiconductor nRF528xx

Ophelia-I

WE-PRO WARE OS

External HOST MCU with device application

Certification effort:

CE: "Declaration of Identity" referring to the WE radio test reports of the original product is sufficient. Delta measure-ment might be recommended.

FCC/IC: under certain conditions, no additional certification is needed. Delta measurement is sufficient. Delta measurement might be recommended.

TELEC: under certain conditions, no additional certification is needed. Delta measurement is sufficient. Delta measurement might be recommended.

BT SIG: Using existing Qualified Design including QDID; only Declaration effort (no measurements)

FINISHED

nRF 5 SDK (this SDK will no longer be supported by Nordic Semiconductor)

Soft devices = Stack + RTOS

+

Integrate Internally device application

nRF Connect SDK

Zephyr RTOS (SoftDevice controller Subsystem)

+

Integrate Internally device application

A full radio certification process has to be performed:

CE: "Declaration of Identity"referring to the WE radio test reports of the original product is sufficient.

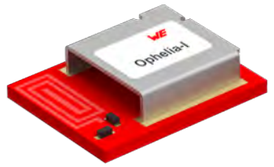
FCC/IC: "Change in ID" process → test results related to the FCC/ISED ID of the original product are copied to a new FCC/ISED ID

TELEC: certification for Japan does not allow any sort inheritance from an already existing certification. → full certification process required

BT SIG: "end device" Bluetooth® listing of the original product cannot be used → complete listing process is required

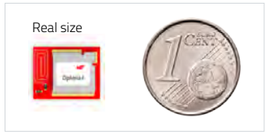
FINISHED

OUR INDEPENDENT:
NO FIRMWARE



Ophelia-I

Hardware-only module based on
Nordic nRF52805 radio chipset



NORDIC SEMICONDUCTOR

Characteristics

Security & Encryption | Miniaturized design | Full flexibility | Cost effective

- Hardware only: no firmware implemented on the module
- Optimization of the firmware to end application
- Nordic resources and SDK for development
- Bluetooth® Low Energy and Proprietary protocols supported
- Miniaturized design - 7 x 9 x 2 mm
- Smart antenna selection (2-in-1 Module)
- Nordic Semiconductor SoC nRF52805
- 64 MHz Arm® Cortex®-M4 processor
- 192 kB flash memory, 24 kB RAM
- 10 configurable GPIOs
- 0.3 µA sleep current (system off mode)
- Cost effective solution
- Ready for CE/RED, FCC, IC and TELEC certifications
- Same hardware platform available as Bluetooth® 5.1 module (Proteus-e)
- Firmware service by Würth Elektronik available

we-online.com/Ophelia-I

STEP BY STEP

How to develop a Firmware on Ophelia-I

1 **INSTALLATION**
Use the nRF Connect Tool for installation

2 **CREATION**
Copy one of the various sample applications as a starting point for an own firmware

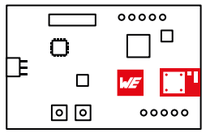
3 **BUILDING**
Create your own application

4 **FLASHING**
Flash and run the firmware on the hardware. Keep the Würth Elektronik "Custom Service" in mind (see page 30)

5 **DEBUGGING**
Debugging the firmware on the hardware

ADDED VALUES

Development Tools



Eval Boards

- Easy testing
- Rapid prototyping
- FTDI integrated (UART to USB)
- Pins available on header
- Current measurement

we-online.com/EVAL-BYOF

AppNotes

nRF Connect – developing a custom FW

we-online.com/ANR030