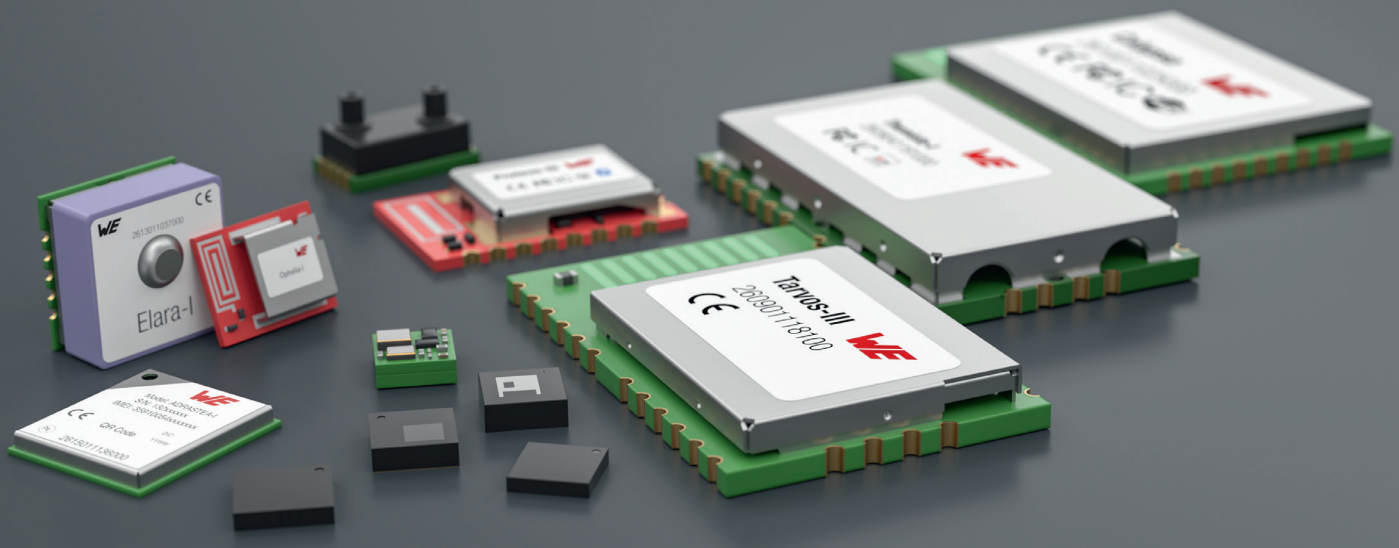


ANR031

Certification of custom modules

How to gain the certification of radio modules with custom firmware?

Version 1.9

July 27, 2026

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

Contents

1 Abbreviations 2

2 Revision history 3

3 Introduction 4

4 How to gain the radio certification? 5
4.1 Firmware developed by Würth Elektronik eiSos . . . 6
4.1.1 European Declaration of Conformity / CE . . . 6
4.1.2 United Kingdoms Declaration of Conformity / UKCA . . . 6
4.1.3 FCC Certification (USA) . . . 6
4.1.4 Technical Acceptance Certificate ISED (Canada) . . . 6
4.1.5 TELEC Certification (Japan) . . . 7
4.1.6 Get the Bluetooth listing . . . 7
4.2 Firmware developed by customer (e.g. BYOF) . . . 8
4.2.1 European Declaration of Conformity / CE . . . 8
4.2.2 United Kingdoms Declaration of Conformity / UKCA . . . 8
4.2.3 FCC Certification (USA) . . . 8
4.2.4 Technical Acceptance certificate ISED (Canada) . . . 9
4.2.5 Get the TELEC (Japan) . . . 9
4.2.6 Get the Bluetooth listing . . . 9
4.3 Radio configuration . . . 10

5 Labelling of custom radio modules 13

6 Example documents 14

7 References 18

8 Important notes 19

1 Abbreviations

Abbreviation	Name	Description
BYOF	Build Your Own Firmware	Approach where the firmware of the radio module is provided by the customer
CE	Conformité Européenne	European conformity, indicating that a product is in conformity with Community harmonisation legislation.
FCC	Federal Communications Commission	Independent agency of the United States federal government that regulates communications by radio, television, wire, satellite, and cable across the United States
HVIN	Hardware Version Identification Number	Number identifying the hardware used for Canada certification
IC	Industry Canada	Government agency, IC is responsible for the certification for electronic and electrical products entering the Canadian market.
ISED	Innovation, Science and Economic Development Canada	See IC
TCB	Telecommunications Certification Body	Consultant supporting the FCC certification
TELEC	Telecom Engineering Center	Organization for Japanese radio equipment certification and testing
UKCA	United Kingdom Conformity Assessed	Certification mark that indicates conformity with the applicable requirements for products sold within Great Britain

2 Revision history

Manual version	Notes	Date
1.0	• Initial version	July 2022
1.1	• Added examples on permissive change class 1 documents in chapter `Example documents`	September 2022
1.2	• Added examples on declaration of identity documents in chapter `Example documents` • Updated compatible radio settings in chapter `Radio configuration`	October 2022
1.3	• Added radio settings of Wirepas radio module Thetis-I to chapter `Radio configuration` • Updated chapter `Example documents`	March 2023
1.4	• Improved description of label information and firmware flashed by customer • Updated `Important notes`, meta data and document style	July 2023
1.5	• Updated `Important notes` • Added products Stephano-I, Daphnis-I and Orthosie-I	March 2024
1.6	• Improved description • Added reference to Bluetooth® Mesh products	June 2024
1.7	• Added products Proteus-IV, Ophelia-IV	December 2025
1.8	• Sorted module related radio configuration w.r.t. the BYOF[1] variant of the radio module • Adjusted certification information for Ophelia-IV • Added Oceanus-I as BYOF[1] variant of Daphnis-I • Added information of the change in ID process	February 2026
1.9	• Added Orthosie-I version with W.FL connector to chapter `Radio configuration`	July 2026

[1]Build Your Own Firmware: Variant of Würth Elektronik eiSos radio module for flashing customer created firmware.

3 Introduction

Würth Elektronik eiSos provides various certified radio modules enabling the radio data transmission in numerous radio frequency bands and radio standards. The radio modules are designed in a way that the mode of operation can be configured via external host microcontroller to meet best the requirements of the underlying application.

Nevertheless, there are still cases where an adoption or complete change of the firmware is needed, like:

- Integration of application code into the module for standalone operation.
- Enabling new interfaces like I^2C or PWM for external component connection.
- Adjusting the performance and low power capabilities for the underlying application.

Due to the change in firmware the radio certification of the adopted radio module must be verified again.

This application note describes in which cases the certification of an adapted radio module can be inherited/derived from the certification of the Würth Elektronik eiSos standard product without the need of repeating the certification tests.

Please note that the certification of the end device, that integrates the radio module, will not be considered in this application note.

4 How to gain the radio certification?

There are mainly two cases of customized firmware:

1. Firmware that has been developed by Würth Elektronik eiSos (see section 4.1).
2. Firmware that has been developed by customer (see section 4.2). This targets firmware
   a) that is provided by a customer and Würth Elektronik eiSos just brings it on the radio module hardware during device production as a service (see section 4.2).
   b) that is flashed on the radio module by customer itself.

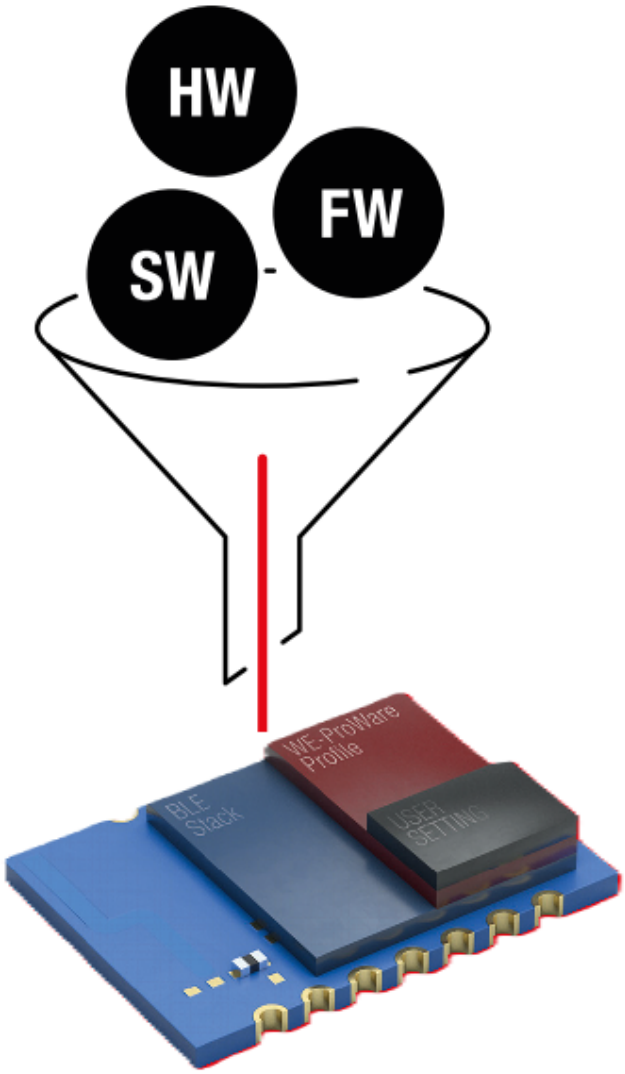


Figure 1: A product and its certification consist of hardware and firmware parts

4.1 Firmware developed by Würth Elektronik eiSos

In case the firmware has been created by Würth Elektronik eiSos, Würth Elektronik eiSos ensures during the development process that the radio behavior of the new product will be kept conform to the radio tests done during certification of the standard product.
In most cases, this allows to derive the radio certification of the new radio module from the standard module. What this means for the individual certifications is shown in the following sub chapters.

In case firmware adaptions are really needed that change the radio behavior, Würth Elektronik eiSos will closely work with the customer to create a new or update an existing certification. These cases are not considered in this chapter.

4.1.1 European Declaration of Conformity / CE

On base of the test reports of the standard product, Würth Elektronik eiSos can self declare the conformity of the new product for CE. For proper documentation Würth Elektronik eiSos sets up a "Declaration of Identity" document stating that the product variant is identically in terms of radio parameters. With this, the conformity of the new product is proven and the same Declaration of Conformity is valid.

4.1.2 United Kingdoms Declaration of Conformity / UKCA

UKCA works with designated EU standards. Therefore the UKCA declaration is based on the EU test reports. On base of the test reports of the standard product, the UK representative can self declare the conformity of the new product for UKCA. For proper documentation Würth Elektronik eiSos sets up a "Declaration of Identity" document stating that the product variant is identically in terms of radio parameters. With this, the conformity of the new product is proven and the same Declaration of Conformity is valid.

4.1.3 FCC Certification (USA)

On base of the FCC ID of the standard product, Würth Elektronik eiSos can internally[1] run a "Permissive Change Class 1" process. To properly document this approach Würth Elektronik eiSos sets up a "Declaration of Identity" document stating that the product variant is identically in terms of radio parameters (see chapter 6 for an example). With this, the conformity of the new product is proven and the same FCC ID is valid.

4.1.4 Technical Acceptance Certificate ISED (Canada)

See chapter `FCC Certification (USA)`. Instead of the FFC ID, the IC uses the ISED number to identify the product. Special care must be taken that the marketing name and HVIN is not changed.

[1] No official filing at FCC is needed to run "Permissive Change Class 1" process.

4.1.5 TELEC Certification (Japan)

For Japan some official filing is required. To receive the TELEC certification for the new product, Würth Elektronik eiSos sets up a "Declaration of Identity" document that is placed at the Japanese authority by an assigned test house (operating as Conformity Assessment Body). This will be done only on request of the customer and will generate additional costs.

4.1.6 Get the Bluetooth listing

If the module uses Bluetooth® technology, a Bluetooth® listing is required. The module itself can be added to the listing of the standard product as long as the used Bluetooth® stack uses the same qualified sub-components.

4.2 Firmware developed by customer (e.g. BYOF)

This chapter applies to the BYOF approach of Würth Elektronik eiSos, **where customer provides the firmware for flashing by Würth Elektronik eiSos, as well as to the case that customer is flashing the firmware in his production line.**

In general it is not possible to reference the certificates or tests of the original product. For some regulatory regions, there are exceptions for custom firmware that does not change the radio behavior w.r.t. original product.

Thus products with standardized radio protocols (e.g. Bluetooth®) are suited for the development of radio equivalent custom firmware. Chapter 4.3 summarizes the information which radio modules of Würth Elektronik eiSos can be used for radio equivalent custom firmware, and how their radio must be configured to match the radio behavior of the original product. See the following sub chapters to find out how the individual certifications are transfered.

4.2.1 European Declaration of Conformity / CE

In case the new product has the same radio behavior as the original product, the customer can declare the radio conformity of the new product with help of the test reports of the original product (see figure 4 for example). Templates are available on request[2].

4.2.2 United Kingdoms Declaration of Conformity / UKCA

See chapter European Declaration of Conformity / CE.
Instead of the CE marking the UKCA marking is used.

4.2.3 FCC Certification (USA)

In case the new product has the same radio behavior as the original product, the customer can run a "Permissive Change Class 1" process to document the conformity of the new product.

(b) Three classes of permissive changes may be made in certificated equipment without requiring a new application for and grant of certification. None of the classes of changes shall result in a change in identification.

(1) A Class I permissive change includes those modifications in the equipment which do not degrade the characteristics reported by the manufacturer and accepted by the Commission when certification is granted. No filing is required for a Class I permissive change.

Figure 2: Official statement of the FCC

To do so, it is essential to perform an internal documentation that the changes do not degrade the characteristic reported. Official filing[3] is not required. Würth Elektronik eiSos's form of documentation is a self declaration (see figure 6 for example). Templates are available on request[2]. With this, the old FCC ID is still valid and can be used in the end device.

[2]Please use your direct contact or *WCS@we-online.com* for further information.
[3]Official filing means documents that must be provided to FCC for approval.

Change in ID
In some cases the test house does not accept the inheritance of the module certification via permissive change class 1. In that case, an own FCC ID must be created. This is done via a change in ID process, where the certification of the original product is copied to a new custom one.

4.2.4 Technical Acceptance certificate ISED (Canada)

See chapter `FCC Certification (USA)`. In analogy to the FCC ID, the IC uses the ISED number to identify the product.

4.2.5 Get the TELEC (Japan)

The certification for Japan does not allow any sort of inheritance from an already existing certification of another manufacturer. Thus a full certification process must be run.

4.2.6 Get the Bluetooth listing

If the module uses Bluetooth® technology, a Bluetooth® listing is required. In case of a custom firmware, a new listing is required already on module level. When the listing of the new module has been done, it is also possible to add the end product to this listing for free.

A Bluetooth® listing can be created out of the Bluetooth® listing of the utilized Bluetooth® stack and the Bluetooth® listing of the underlying radio chip. Please refer to application note ANR027 [1] for details on the listing process of the new radio module.

4.3 Radio configuration

As described in the previous chapters, customers that develop their own firmware must attest Würth Elektronik eiSos that the new firmware is compliant with the respective regulatory radio laws. To prove that, the most convenient way is to use the same radio stack and configuration as used in the standard product of Würth Elektronik eiSos. This shows that custom firmware is radio identical with the Würth Elektronik eiSos original product. The following products of Würth Elektronik eiSos are suited for radio equivalent firmware development, in case the corresponding radio configuration is used:

Product	Radio configuration
Adrastea-I	• Using stack ALT1250_03_00_00_00_11952_FW for LTE-M • Using stack ALT1250_03_00_00_00_11951_NB for NB-IoT
Calypso	• Using SimpleLink SDK version 5.20.00.06 and NWP version 3.20.0.1
Oceanus-I (Daphnis-I)	• Using the LoRa radio of the STM32WLE5CCU6 chipset • Using STM32CubeWL SDK version 1.3.0 (including LoRaMac-node version 4.6.0) • Using regional parameters 2-1.0.1 with TX power index 7 or lower
Ophelia-I (Proteus-e)	• Using Bluetooth® LE radio of the nRF52805 (Bluetooth® LE or Bluetooth® Mesh) • Using 1 MBit or 2 MBit phy • Output power register of the radio chip set to maximum 4 dBm • Maximum duty cycle of 25 % • Use Bluetooth® LE stack Nordic Semiconductor S112 in version 7.3.0[1] or nRFConnect SDK [2]
Ophelia-III (Proteus-III, Proteus-III-SPI, Setebos-I)	• Using Bluetooth® LE radio of the nRF52840 (Bluetooth® LE or Bluetooth® Mesh) • Using 1 MBit, 2 MBit or LE-Coded phy • Output power register of the radio chip set to maximum 8 dBm • Using Bluetooth® LE stack Nordic Semiconductor S140 Version 7.0.1[1] or nRFConnect SDK [2]

Ophelia-IV (Proteus-IV)	• Using radio of the nRF54L15 with any of the supported radio modes: Ble_1Mbit, Nrf_1Mbit, Nrf_2Mbit, Ble_2Mbit, Nrf_4Mbit_0BT4, Nrf_4Mbit_0BT6, Ble_LR125Kbit, Ieee802154_250Kbit • Output power register of the radio chip set to maximum 8 dBm • Using Nordic Semiconductor nRFConnect SDK [2]
Orthosie-I (Stephano-I)	• Using Bluetooth® LE radio of the ESP32-C3 (Bluetooth® LE or Bluetooth® Mesh) – Using Bluetooth® LE modes 1 MBit, 2 MBit or LE-Coded phy – Using Espressif ESP-IDF stack 5.0 or newer – 2617011022000: Bluetooth® LE output power index 12 or 13 or smaller (depending on country, see Stephano-I user manual [3]) – 2617011422000: Output power depending on external antenna connected (example: 0 dBi gain antenna and 0 dBm cable loss, use Bluetooth® LE power index 13) • Using WiFi radio of the ESP32-C3 – Using WiFi modes 802.11b/g/n – Using Espressif ESP-IDF stack 5.0 or newer – 2617011022000: WiFi output power index 74 or 80 or smaller (depending on country, see Stephano-I user manual [3]) – 2617011422000: Output power depending on external antenna connected (example: 0 dBi gain antenna and 0 dBm cable loss, use WiFi power index 80)
Proteus-I	• Using Bluetooth® LE radio of the nRF52832 (Bluetooth® LE or Bluetooth® Mesh) • Using 1 MBit phy • Output power register of the radio chip set to maximum 4 dBm • Using Bluetooth® LE stack Nordic Semiconductor S132 Version 3.1.0[1] or nRFConnect SDK [2]
Proteus-II	• Using Bluetooth® LE radio of the nRF52832 (Bluetooth® LE or Bluetooth® Mesh) • Using 1 MBit or 2 MBit phy • Output power register of the radio chip set to maximum 4 dBm • Using Bluetooth® LE stack Nordic Semiconductor S132 Version 6.0.0[1] or nRFConnect SDK [2]

Thetis-I	• Output power register of the radio chip set to maximum 8 dBm • Using 1 MBit phy • Using Wirepas Mesh Stack Version 5.x for Nordic Semiconductor nRF52840

Table 1: Radio configuration

[1]Newer versions of the corresponding Nordic Semiconductor Sxxx Bluetooth® stack can be also used.

5 Labelling of custom radio modules

For production and sale of radio modules, the label must contain the respective radio certification information. This may include the CE logo as well as the FCC ID and others.

When bringing a new custom firmware on the radio module hardware, the product has changed and thus the label information must be updated as well. In that case the existing label of the original product must be removed and replaced by a new label containing all certification relevant information of the new product.

Changing the firmware without updating and correcting the label information voids the certification of the product.

In case the firmware has been developed by Würth Elektronik eiSos, Würth Elektronik eiSos will take care of the correctness of the label information.

In case customer is flashing the firmware, he must take care of the correctness of the label information.

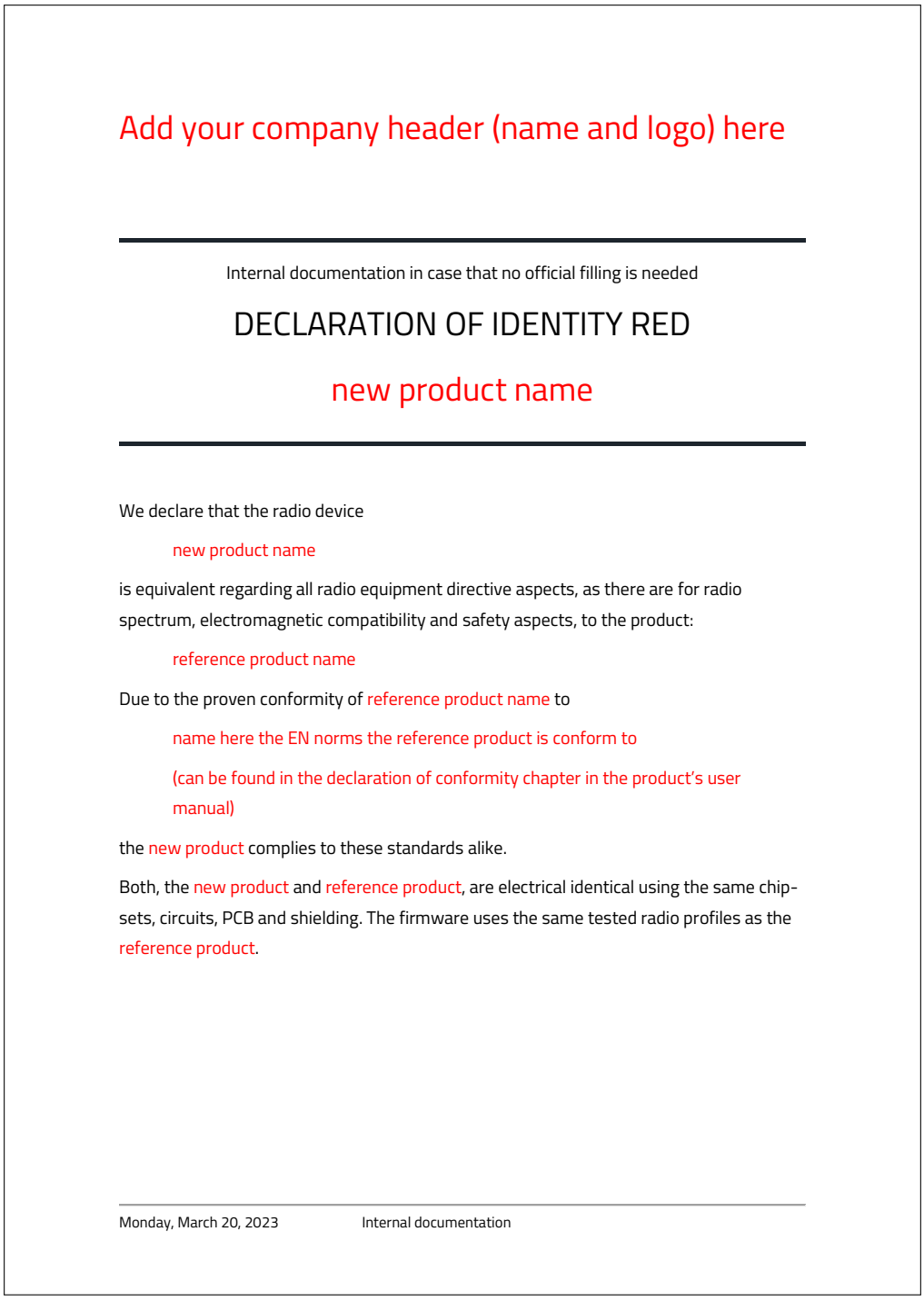
In case Würth Elektronik eiSos brings a firmware developed by customer on the radio module hardware, the needed label information (CE declaration, FCC ID, ...) and the evidence[4] that the product conforms with the dedicated national radio regulations must be provided to Würth Elektronik eiSos before any device production may start.

Please refer to the user manual of the standard radio module, chapter "General labelling information", to check which information can be placed on the module label.

Figure 3: (Example) Proteus-III label containing the CE logo and the FCC ID R7T1101102

[4] See chapter 4.2 how certification can be inherited from original product.

6 Example documents



Add your company header (name and logo) here

Internal documentation in case that no official filling is needed

DECLARATION OF IDENTITY RED

new product name

We declare that the radio device

new product name

is equivalent regarding all radio equipment directive aspects, as there are for radio spectrum, electromagnetic compatibility and safety aspects, to the product:

reference product name

Due to the proven conformity of reference product name to

name here the EN norms the reference product is conform to

(can be found in the declaration of conformity chapter in the product's user manual)

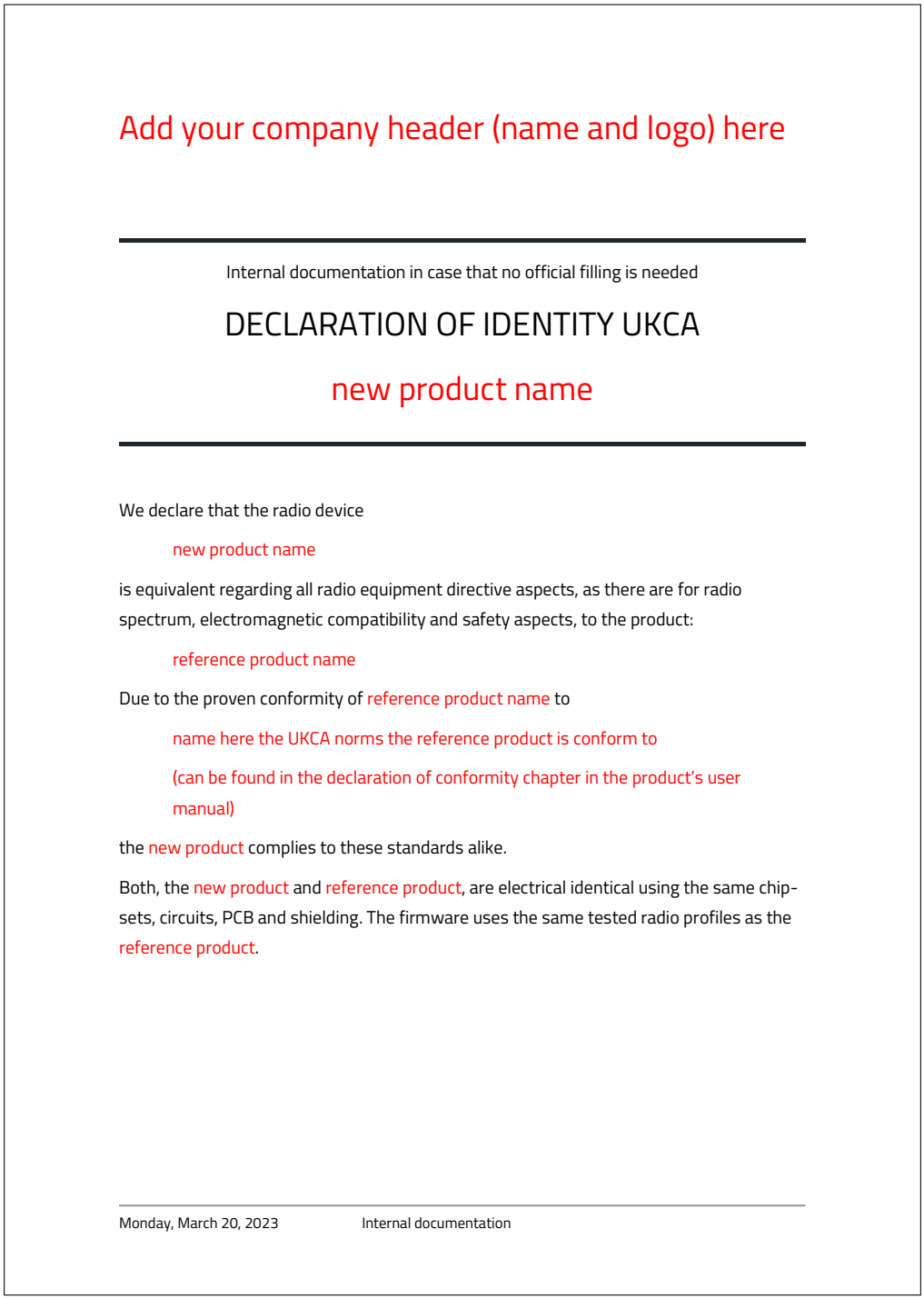
the new product complies to these standards alike.

Both, the new product and reference product, are electrical identical using the same chip-sets, circuits, PCB and shielding. The firmware uses the same tested radio profiles as the reference product.

Monday, March 20, 2023 Internal documentation

Figure 4: Example RED Declaration of Identity

[1] Templates are available on request. Please use your direct contact or *WCS@we-online.com* for further information.



Add your company header (name and logo) here

Internal documentation in case that no official filling is needed

DECLARATION OF IDENTITY UKCA

new product name

We declare that the radio device

new product name

is equivalent regarding all radio equipment directive aspects, as there are for radio spectrum, electromagnetic compatibility and safety aspects, to the product:

reference product name

Due to the proven conformity of reference product name to

name here the UKCA norms the reference product is conform to

(can be found in the declaration of conformity chapter in the product's user manual)

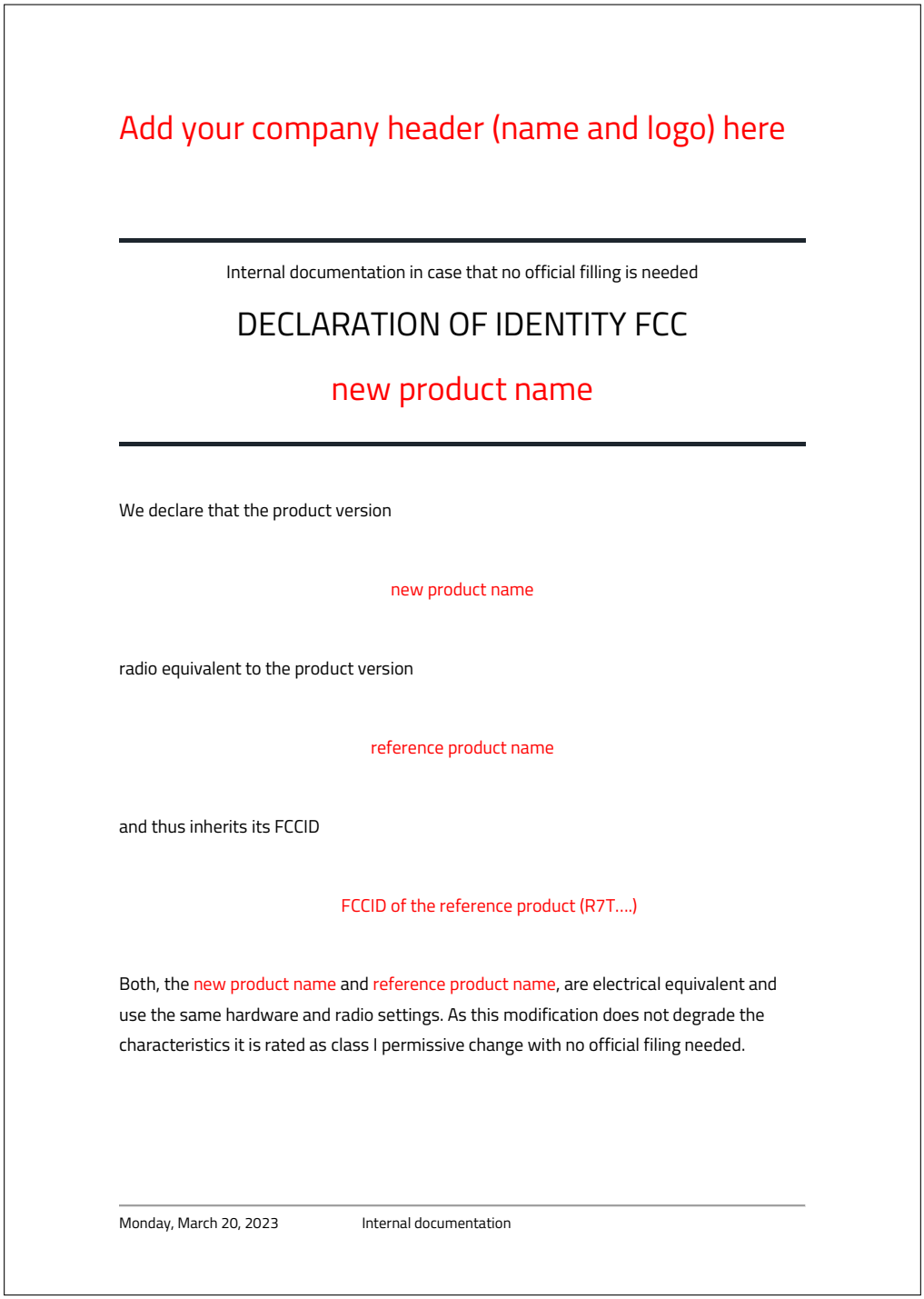
the new product complies to these standards alike.

Both, the new product and reference product, are electrical identical using the same chip-sets, circuits, PCB and shielding. The firmware uses the same tested radio profiles as the reference product.

Monday, March 20, 2023 Internal documentation

Figure 5: Example UKCA Declaration of Identity

[1] Templates are available on request. Please use your direct contact or *WCS@we-online.com* for further information.



Add your company header (name and logo) here

Internal documentation in case that no official filling is needed

DECLARATION OF IDENTITY FCC

new product name

We declare that the product version

new product name

radio equivalent to the product version

reference product name

and thus inherits its FCCID

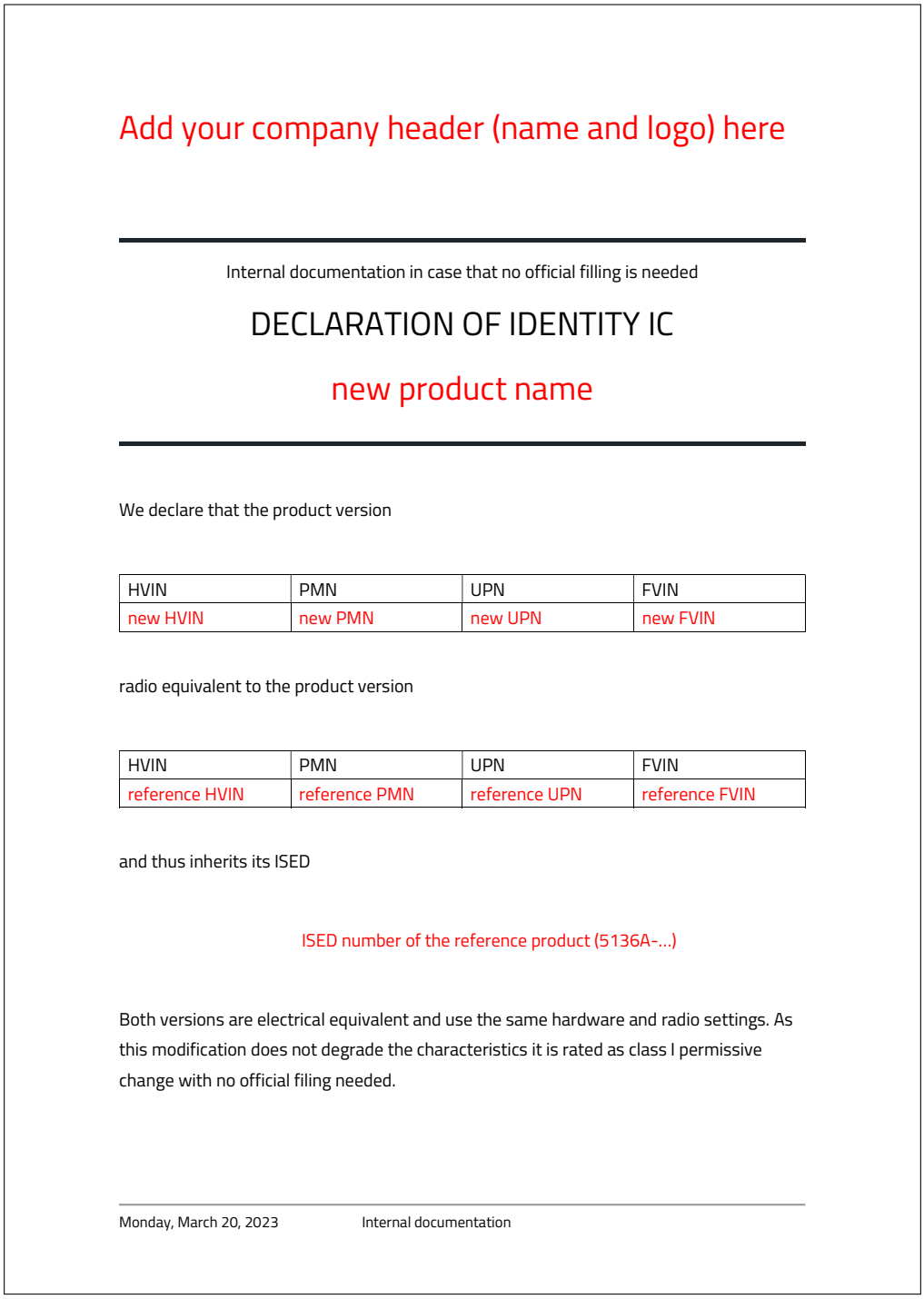
FCCID of the reference product (R7T....)

Both, the new product name and reference product name, are electrical equivalent and use the same hardware and radio settings. As this modification does not degrade the characteristics it is rated as class I permissive change with no official filing needed.

Monday, March 20, 2023 Internal documentation

Figure 6: Example FCC Permissive change class 1 document stating radio identity

[1] Templates are available on request. Please use your direct contact or *WCS@we-online.com* for further information.



Add your company header (name and logo) here

Internal documentation in case that no official filling is needed

DECLARATION OF IDENTITY IC

new product name

We declare that the product version

HVIN	PMN	UPN	FVIN
new HVIN	new PMN	new UPN	new FVIN

radio equivalent to the product version

HVIN	PMN	UPN	FVIN
reference HVIN	reference PMN	reference UPN	reference FVIN

and thus inherits its ISED

ISED number of the reference product (5136A-...)

Both versions are electrical equivalent and use the same hardware and radio settings. As this modification does not degrade the characteristics it is rated as class I permissive change with no official filing needed.

Monday, March 20, 2023 Internal documentation

Figure 7: Example IC Permissive change class 1 document stating radio identity

[1] Templates are available on request. Please use your direct contact or *WCS@we-online.com* for further information.

7 References

[1] Würth Elektronik. Application note 27 - Bluetooth listing guide. http://www.we-online.com/ANR027.

[2] Nordic Semiconductor. nRF Connect SDK. https://www.nordicsemi.com/Products/Development-software/nRF-Connect-SDK.

[3] Würth Elektronik. User manual Stephano-I. https://www.we-online.de/katalog/de/manual/2617011025000.

8 Important notes

The Application Note and its containing information ("Information") is based on Würth Elektronik eiSos GmbH & Co. KG and its subsidiaries and affiliates ("WE eiSos") knowledge and experience of typical requirements concerning these areas. It serves as general guidance and shall not be construed as a commitment for the suitability for customer applications by WE eiSos. While WE eiSos has used reasonable efforts to ensure the accuracy of the Information, WE eiSos does not guarantee that the Information is error-free, nor makes any other representation, warranty or guarantee that the Information is completely accurate or up-to-date. The Information is subject to change without notice. To the extent permitted by law, the Information shall not be reproduced or copied without WE eiSos' prior written permission. In any case, the Information, in full or in parts, may not be altered, falsified or distorted nor be used for any unauthorized purpose.

WE eiSos is not liable for application assistance of any kind. Customer may use WE eiSos' assistance and product recommendations for customer's applications and design. No oral or written Information given by WE eiSos or its distributors, agents or employees will operate to create any warranty or guarantee or vary any official documentation of the product e.g. data sheets and user manuals towards customer and customer shall not rely on any provided Information. THE INFORMATION IS PROVIDED "AS IS". CUSTOMER ACKNOWLEDGES THAT WE EISOS MAKES NO REPRESENTATIONS AND WARRANTIES OF ANY KIND RELATED TO, BUT NOT LIMITED TO THE NON-INFRINGEMENT OF THIRD PARTIES' INTELLECTUAL PROPERTY RIGHTS OR THE MERCHANTABILITY OR FITNESS FOR A PURPOSE OR USAGE. WE EISOS DOES NOT WARRANT OR REPRESENT THAT ANY LICENSE, EITHER EXPRESS OR IMPLIED, IS GRANTED UNDER ANY PATENT RIGHT, COPYRIGHT, MASK WORK RIGHT, OR OTHER INTELLECTUAL PROPERTY RIGHT RELATING TO ANY COMBINATION, MACHINE, OR PROCESS IN WHICH WE EISOS INFORMATION IS USED. INFORMATION PUBLISHED BY WE EISOS REGARDING THIRD-PARTY PRODUCTS OR SERVICES DOES NOT CONSTITUTE A LICENSE FROM WE eiSos TO USE SUCH PRODUCTS OR SERVICES OR A WARRANTY OR ENDORSEMENT THEREOF.

The responsibility for the applicability and use of WE eiSos' components in a particular customer design is always solely within the authority of the customer. Due to this fact it is up to the customer to evaluate and investigate, where appropriate, and decide whether the device with the specific characteristics described in the specification is valid and suitable for the respective customer application or not. The technical specifications are stated in the current data sheet and user manual of the component. Therefore the customers shall use the data sheets and user manuals and are cautioned to verify that they are current. The data sheets and user manuals can be downloaded at *www.we-online.com*. Customers shall strictly observe any product-specific notes, cautions and warnings. WE eiSos reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time without notice.

WE eiSos will in no case be liable for customer's use, or the results of the use, of the components or any accompanying written materials. IT IS CUSTOMER'S RESPONSIBILITY TO VERIFY THE RESULTS OF THE USE OF THIS INFORMATION IN ITS OWN PARTICULAR ENGINEERING AND PRODUCT ENVIRONMENT AND CUSTOMER ASSUMES THE ENTIRE RISK OF DOING SO OR FAILING TO DO SO. IN NO CASE WILL WE EISOS BE LIABLE FOR CUSTOMER'S USE, OR THE RESULTS OF IT'S USE OF THE COMPONENTS OR ANY ACCOMPANYING WRITTEN MATERIAL IF CUSTOMER TRANSLATES, ALTERS, ARRANGES, TRANSFORMS, OR OTHERWISE MODIFIES THE INFORMATION IN ANY WAY, SHAPE OR FORM.

If customer determines that the components are valid and suitable for a particular design and wants to order the corresponding components, customer acknowledges to minimize the risk of loss and harm to individuals and bears the risk for failure leading to personal injury or death due to customer's usage of the components. The components have been designed and developed for usage in general electronic equipment only. The components are not authorized for use in equipment where a higher safety standard and reliability standard is especially required or where a failure of the components is reasonably expected to cause severe personal injury or death, unless WE eiSos and customer have executed an agreement specifically governing such use. Moreover WE eiSos components are neither designed nor intended for use in areas such as military, aerospace, aviation, nuclear control, submarine, transportation, transportation signal, disaster prevention, medical, public information network etc. WE eiSos must be informed about the intent of such usage before the design-in stage. In addition, sufficient reliability evaluation checks for safety must be performed on every component which is used in electrical circuits that require high safety and reliability functions or performance. CUSTOMER SHALL INDEMNIFY WE EISOS AGAINST ANY DAMAGES ARISING OUT OF THE USE OF THE COMPONENTS IN SUCH SAFETY-CRITICAL APPLICATIONS.

List of Figures

1 A product and its certification consist of hardware and firmware parts 5
2 Official statement of the FCC 8
3 (Example) Proteus-III label containing the CE logo and the FCC ID R7T1101102 13
4 Example RED Declaration of Identity 14
5 Example UKCA Declaration of Identity 15
6 Example FCC Permissive change class 1 document stating radio identity 16
7 Example IC Permissive change class 1 document stating radio identity 17

List of Tables

1 Radio configuration 12

Contact
Würth Elektronik eiSos GmbH & Co. KG
Division Wireless Connectivity & Sensors

Max-Eyth-Straße 1
74638 Waldenburg
Germany

Tel.: +49 651 99355-0
Fax.: +49 651 99355-69
www.we-online.com/wireless-connectivity

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT