Getting started with STM32CubeWiSE – Current Estimation

Introduction

This document describes the STM32CubeWiSE - Current Estimation software package (STM32CubeWiSEce), which consists of the following component:

- STM32CubeWiSE - Current Estimation PC GUI application

The STM32CubeWiSE - Current Estimation PC GUI application is a graphical user interface. It estimates the average current consumption for various wireless use cases with excellent correlation to real measurements.

1 General information

STM32CubeWiSEce interacts with STM32WB0 and STM32WBA microcontrollers based respectively on the Arm® Cortex®-M0+ and Cortex®-M33 processors, and running the Bluetooth® LE stack.

For information on Bluetooth®, refer to www.bluetooth.com.

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1.1 Ordering information

STM32CubeWiSEce is available for free download from the *www.st.com* website.

2 Getting started

This section describes the system requirements to run the STM32CubeWiSE - Current Estimation PC GUI application and the software package installation procedure.

2.1 System requirements

The STM32CubeWiSE - Current Estimation PC GUI application has the following minimum requirements:

- PC with an Intel® or AMD processor running Microsoft® Windows® 11 operating systems
- 2 Gbytes of RAM
- Adobe® Acrobat® Reader® 6.0

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Microsoft and Windows are trademarks of the Microsoft group of companies.
Adobe and Acrobat Reader are registered trademarks of Adobe in the United States and/or other countries.

2.2 STM32CubeWiSE - Current Estimation software package setup

1. Extract the content of the `stm32wise-cewin-Vx.y.z.zip` file into a temporary directory.
2. Extract the `STM32CubeWiSE-CurrentEstimation_Vx.y.z.exe` file.
3. Launch the file and follow the on-screen instructions.

2.3 STM32CubeWiSE - Current Estimation software package folders

The STM32CubeWiSE - Current Estimation software package files are organized in the following folder:

- `app`: contains `STM32CubeWiSE-CurrentEstimation.exe`

Release notes and license files are in the root folder.

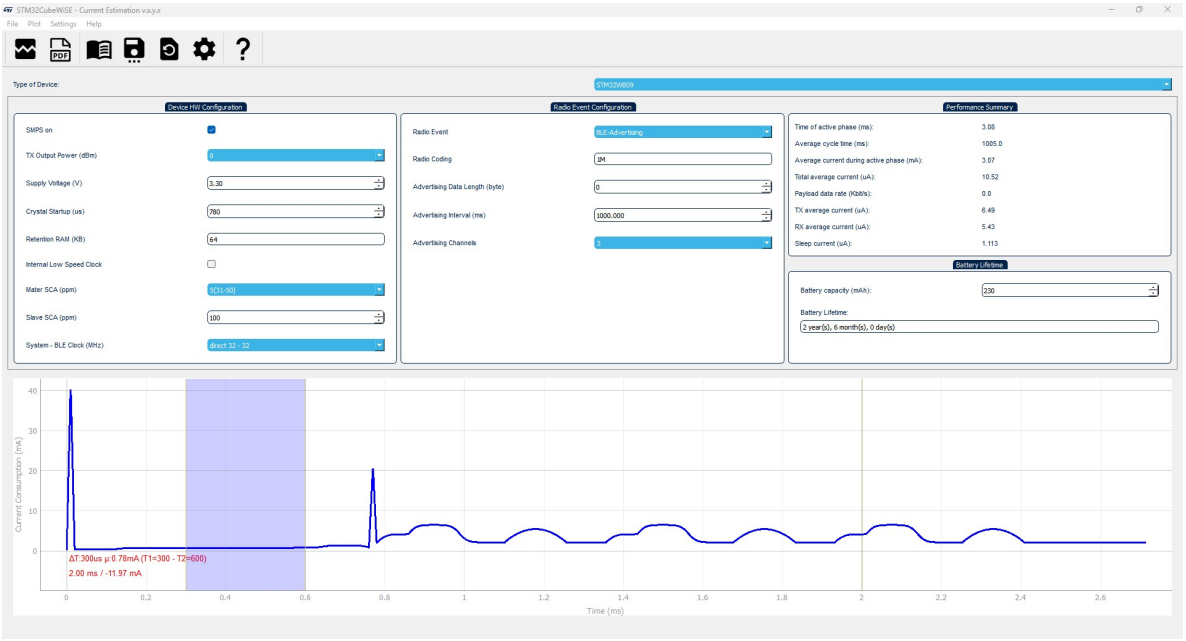
3 STM32CubeWiSE - Current Estimation PC GUI application description

This section describes the main functions of the PC GUI application. Click on the STM32CubeWiSE - Current Estimation icon to run this utility. The following radio/protocol is supported:

- Bluetooth® LE protocol

3.1 Main window

Figure 1. Main window of STM32CubeWiSE - Current Estimation PC GUI application



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The STM32CubeWiSE - Current Estimation PC GUI application allows the selection of the supported devices within the STM32WBA series and STM32WB0 series through the *Type of Device* tab:

- STM32WBA series
  - STM32WBA25 (STM32WBA25xx devices)
  - STM32WBA55 (STM32WBA55xx devices)
  - STM32WBA65 (STM32WBA65xx devices)
- STM32WB0 series
  - STM32WB05 (STM32WB05xx devices)
  - STM32WB06/07 (STM32WB06xx and STM32WB07xx devices)
  - STM32WB09 (STM32WB09xx devices)

The main window of the STM32CubeWiSE - Current Estimation PC GUI application has different areas with the following functions:

1. *Device HW configurations*: Definition of device hardware configurations that affect current consumption, such as Tx output power, supply voltage, and others.
2. *Radio Event Configuration*: Definition of device radio configurations that correspond to radio events for which the user wants to evaluate overall current estimation, such as Bluetooth® LE advertising, scanning, and connection.
3. *Performance Summary*: Expected performance in terms of current consumption.
4. *Battery Lifetime*: Evaluation of the expected battery lifetime for a specific battery capacity.

Furthermore, the main window provides specific menu options, such as:

- Plot menu
  - [**Save Plot**]
  - [**Save PDF report**]
- Settings menu
  - [**Load Params…**]
  - [**Save Params…**]
  - [**Restore Default Params**]
  - [**Advanced Settings…**]
- Help menu
  - [**Help**]
  - [**About**]

3.2 Tools

The options available in the *Menu* tab of the STM32CubeWiSE - Current EstimationPC GUI application are presented in Figure 2 and described in Table 1.

Table 1. Menu tab options

Option	Description	Note
[**Save Plot**]	Saves the plot shown in the main window as a figure.	PNG format
[**Save PDF report**]	Saves a PDF report containing: • Device hardware configuration, • Radio event configuration • Performance summary • Battery lifetime • Plot	PDF format
[**Load Params...**]	Loads the device hardware and radio event parameters previously saved in a parameter file.	`.par` is the parameter file extension
[**Save Params...**]	Saves the device hardware and radio event parameters in a parameter file.	`.par` is the parameter file extension
[**Restore Default Params**]	Restores the default device hardware and radio event parameters.	-
[**Advanced Settings...**]	Displays and allows the modification of advanced setting parameters for certain devices.	Only for STM32WB0 series devices
[**Help**]	Creates and displays a help PDF file that explains all input and output parameters.	The help PDF file is generated only once if it does not already exist
[**About**]	Displays information about tool version and year.	-

Figure 2. Menu tab options

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3.3 Device hardware configuration

The *Device HW Configuration* area allows users to define specific device hardware configuration parameters that affect device current consumption.

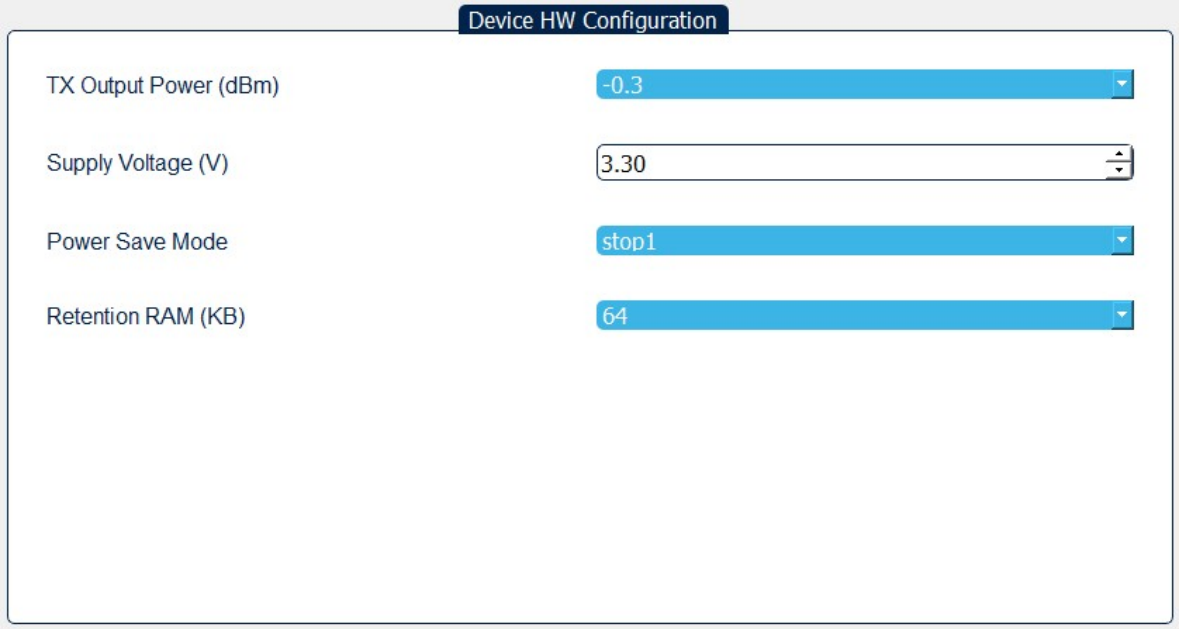
3.3.1 STM32WBA hardware configuration parameters

The STM32WBA hardware configuration parameters are presented in Figure 3 and described in Table 2.

Table 2. STM32WBA hardware configuration parameters

Parameter	Possible value	Note
[TX Output Power (dBm)]	From -20.4 to 10 dBm	Transmission output power
[Supply Voltage (V)]	From 1.7 to 3.6 V	Operating supply voltage
[Power Save Mode]	• stop1 • standby • stop2	Power-save mode level
[Retention RAM (KB)]	• 64 Kbytes • 128 Kbytes • 192 Kbytes • 256 Kbytes • 448 Kbytes • All	The amount of RAM in retention mode

Figure 3. STM32WBA hardware configuration parameters



3.3.2 STM32WB0 hardware configuration parameters

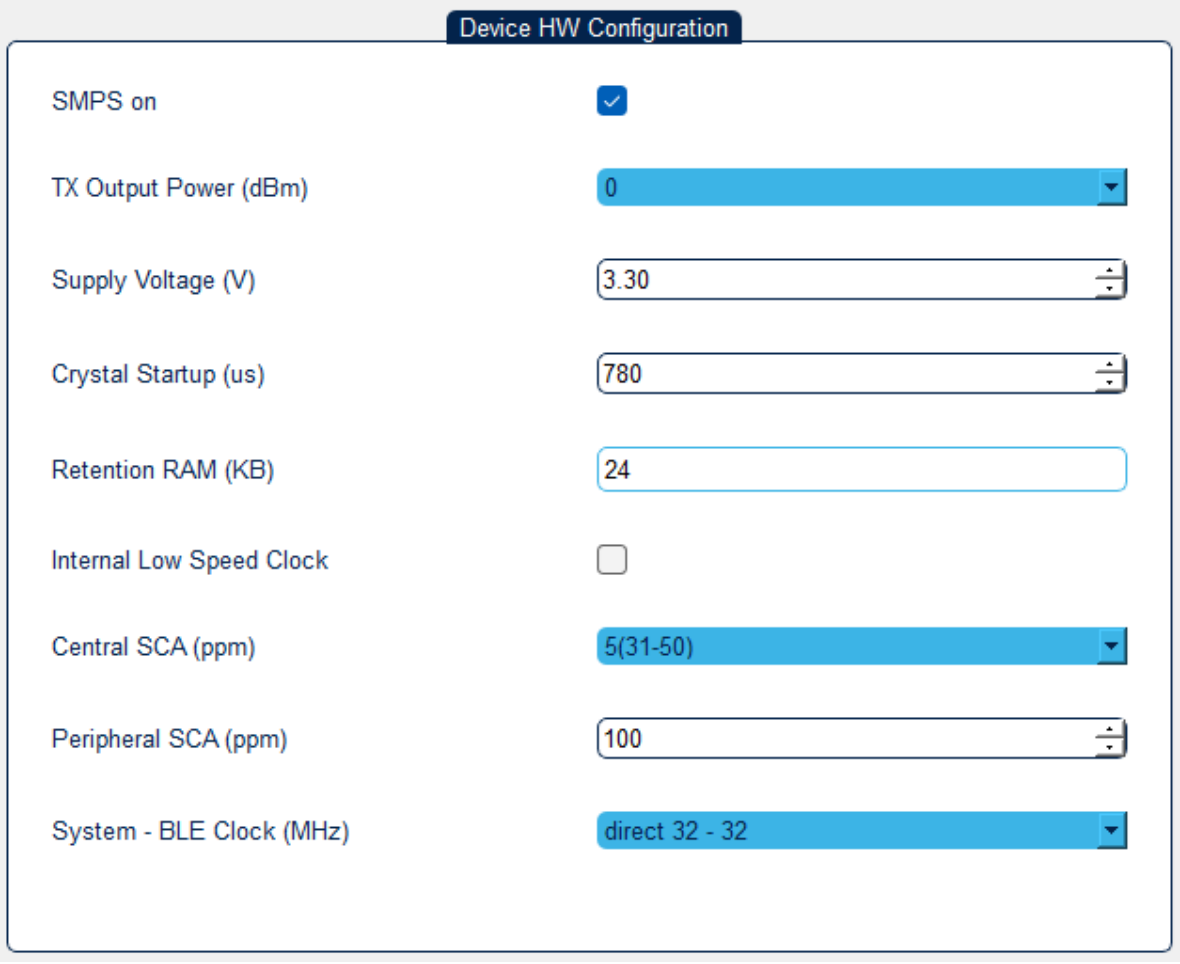
The STM32WB0 hardware configuration parameters are presented in Figure 4 and described in Table 3.

Table 3. STM32WB0 hardware configuration parameters

Parameter	Possible value	Note
[SMPS on]	• True (checked) • False (unchecked)	SMPS active or not
[TX Output Power (dBm)]	From -54 to 8 dBm	Transmission output power
[Supply Voltage (V)]	From 1.7 to 3.6 V	Operating supply voltage
[Crystal Startup (us)]	From 255 to 6 777 µs	Time required for the crystal oscillator to reach a stable oscillation
[Retention RAM (KB)]	• 24 Kbytes for STM32WB05 • 64 Kbytes for STM32WB06/07/09	Amount of RAM in retention mode
[Internal Low Speed Clock]	• True (checked) • False (unchecked)	Internal low-speed clock selected or not

Parameter	Possible value	Note
[**Central SCA (ppm)**]	• 0 (251-500) • 1 (151-250) • 2 (101-150) • 3 (76-100) • 4 (51-75) • 5 (31-50) • 6 (21-30) • 7 (0-20)	Central sleep clock accuracy
[**Peripheral SCA (ppm)**]	From 0 to 500 ppm	Peripheral sleep clock accuracy
[**System - BLE Clock (MHz)**]	• direct 32 - 32 • direct 32 - 16 • direct 16 - 16 • 64 - 32 • 64 - 16 • 32 - 32 • 32 - 16 • 16 - 16	The system clock division factor from HSI64MPLL combined with the Bluetooth® LE system clock

Figure 4. STM32WB0 hardware configuration parameters



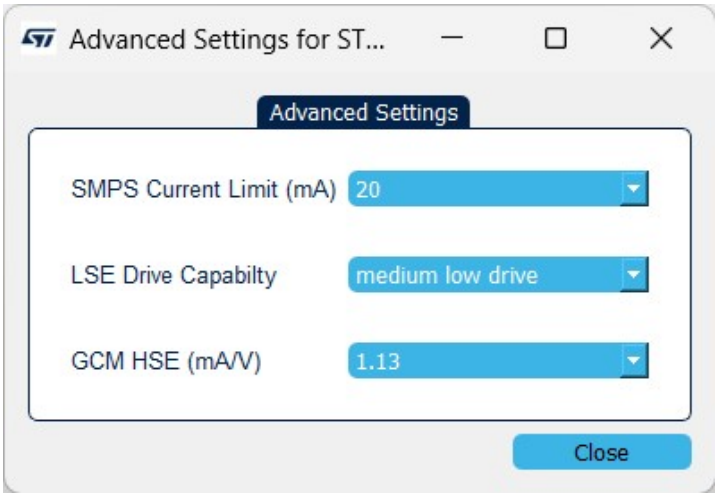
3.3.2.1 *STM32WB0 advanced settings parameters*

The STM32WB0 advanced settings parameters are presented in Figure 5 and described in Table 4.

Table 4. STM32WB0 advanced settings parameters

Parameter	Possible value	Note
[**SMPS Current Limit (mA)**]	• 2.5 mA • 5 mA • 10 mA • 20 mA	This parameter applies only to STM32WB05xx and STM32WB09xx devices. The default value is 20 mA.
[**LSE Drive Capabilty**]	• low drive • medium low drive • medium high drive • high drive	The default value is medium-low drive.
[**GCM HSE (mA/V)**]	• 0.18 mA/V • 0.57 mA/V • 0.78 mA/V • 1.13 mA/V • 0.61 mA/V • 1.65 mA/V • 2.12 mA/V • 2.84 mA/V	The default value is 1.13 mA/V

Figure 5. STM32WB0 advanced configuration parameters



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3.4 Radio event configuration

The *Radio Event Configuration* area allows the user to define the specific radio scenario that is used to estimate the current consumption of supported devices. The scenario parameters are presented in Figure 6, Figure 7, and Figure 8. They are described in Table 5.

Table 5. Radio event configuration parameters

Parameter	Possible value	Note
[**Radio Event**]	• BLE-Advertising • BLE-Connection • BLE-Scanning	-
[**Radio Coding**]	1M	Data rate
Bluetooth® LE advertising		
[**Advertising Data Length (byte)**]	From 0 to 31 bytes	Number of bytes for advertising data
[**Advertising Interval (ms)**]	From 20 to 10 240 ms	Time between the start of two consecutive advertising events

Parameter	Possible value	Note
[**Advertising Channels**]	From 1 to 3	Number of advertising channels used
Bluetooth® LE connection		
[**Connection role**]	• Peripheral • Central	Central or peripheral role
[**Payload (byte)**]	From 0 to 244 bytes	Length of payload for notification packets
[**Packet per connection interval**]	From 1 to a variable maximum value	Enabled only if the payload is greater than 0
[**Number of empty connection events**]	From 0 to 100	• Number of connection events without data present after a connection event with payload • Enabled only if the payload is greater than 0
[**Connection interval (ms)**]	From 7.5 to 4 000 ms	Time between the start of two consecutive connection events
Bluetooth® LE scanning		
[**Scanning Interval (ms)**]	From 2.5 to 10 240 ms	Time between two consecutive Bluetooth® LE scans initiated by the controller
[**Scanning Window (ms)**]	From 2.5 to 10 240 ms	Duration of the Bluetooth® LE scan

Figure 6. Bluetooth® LE advertising radio event

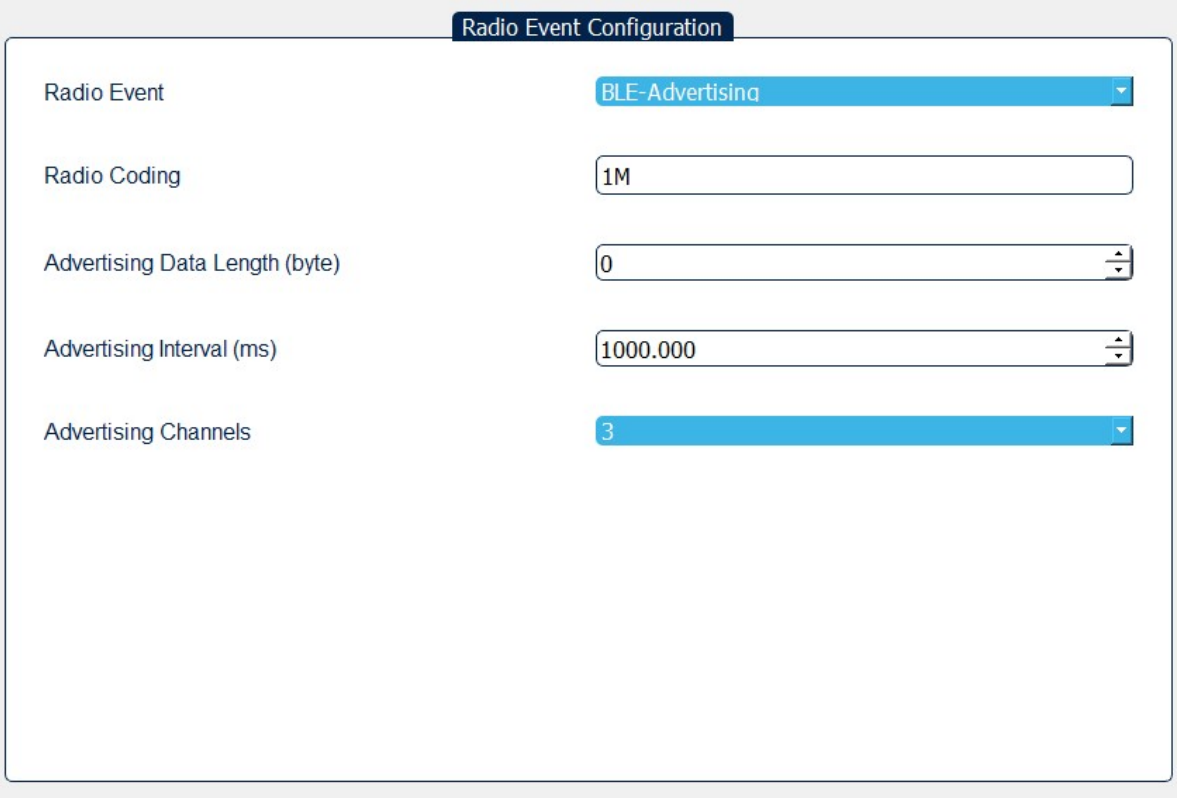


Figure 7. **Bluetooth® LE connection radio event**

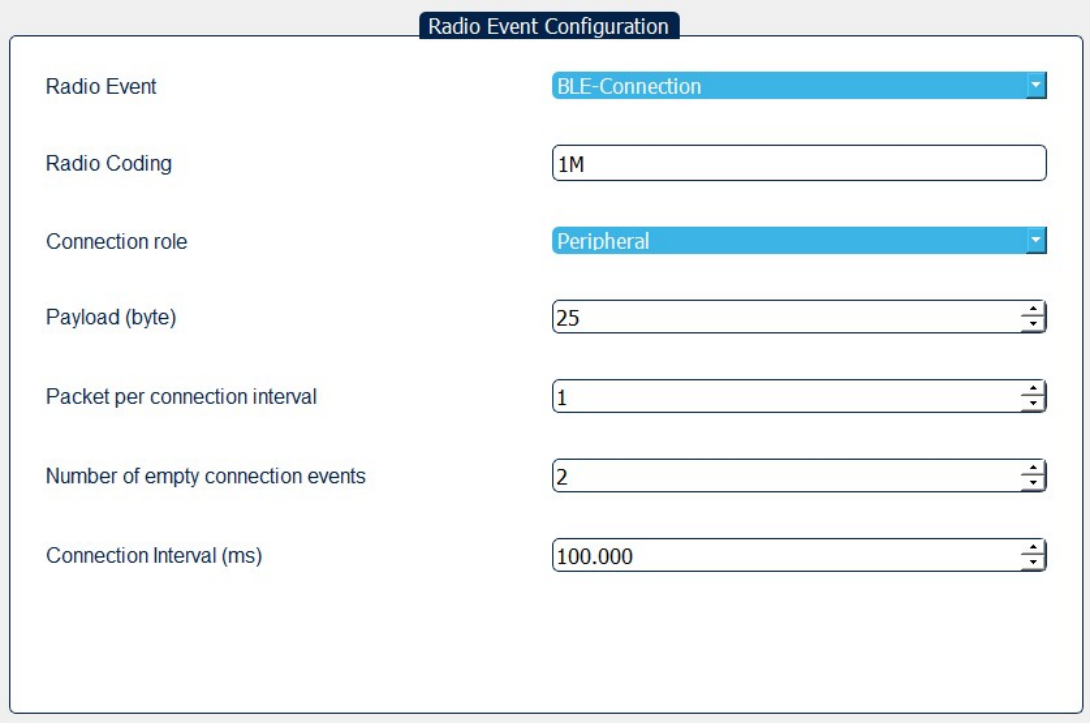
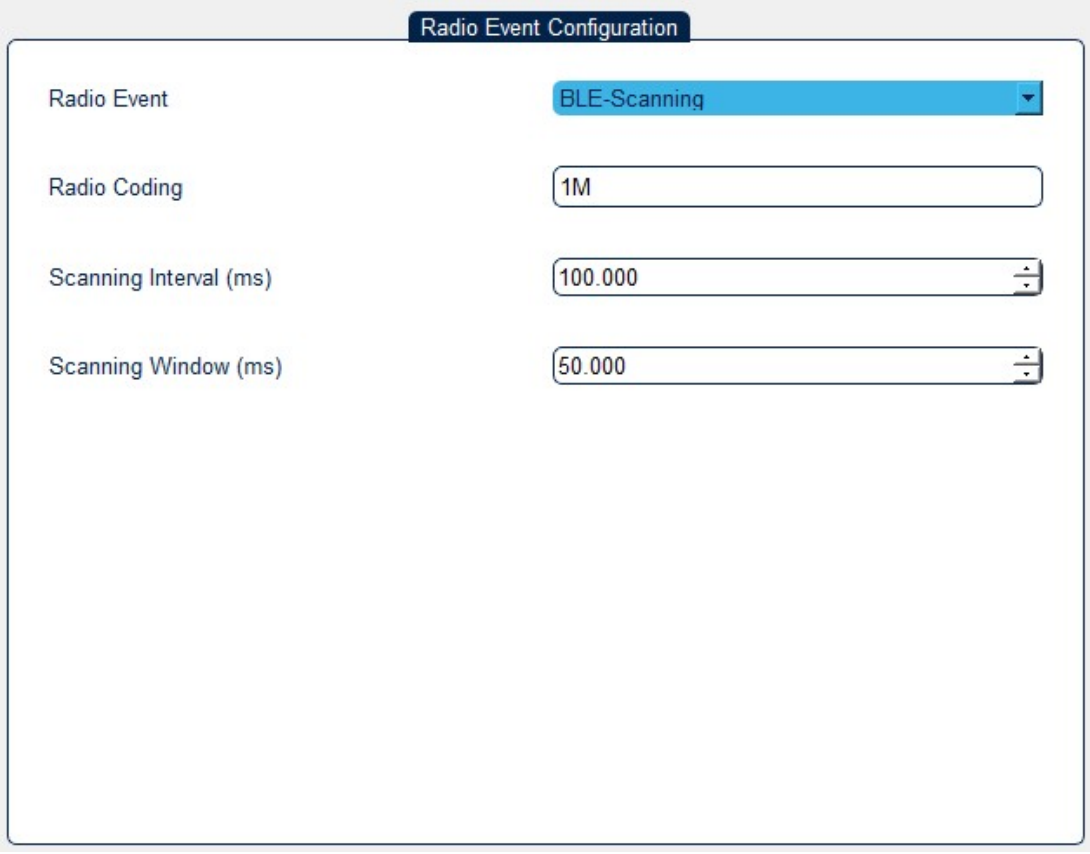


Figure 8. **Bluetooth® LE scanning radio event**



3.5 GUI performance summary

The *Performance Summary* area provides a summary of the estimated current for the selected application scenario. The parameters shown depend on the selected radio event. The parameters are presented in Figure 9, Figure 10, and Figure 11. They are described in Table 6.

Table 6. Performance summary parameters

Parameter	Notes
[**Time of active phase (ms)**]	Duration of the active phase in the event
[**Average cycle time (ms)**]	Total average cycle time, with an average value of 5 ms added to the advertising interval for advertising events
[**Average current during the active phase (mA)**]	Estimate of average current consumption during the event active phase
[**Total average current (uA)**]	Estimate of total average current consumption during the event
[**Payload data rate (Kbit/s)**]	Estimate of payload data rate
[**TX average current (mA)**]	Estimate of average current consumption during the Tx phase
[**RX average current (mA)**]	Estimate of average current consumption during the Rx phase
[**Sleep current (uA)**]	Estimate of average current consumption for sleep current

Figure 9. Performance summary area for Bluetooth® LE advertising

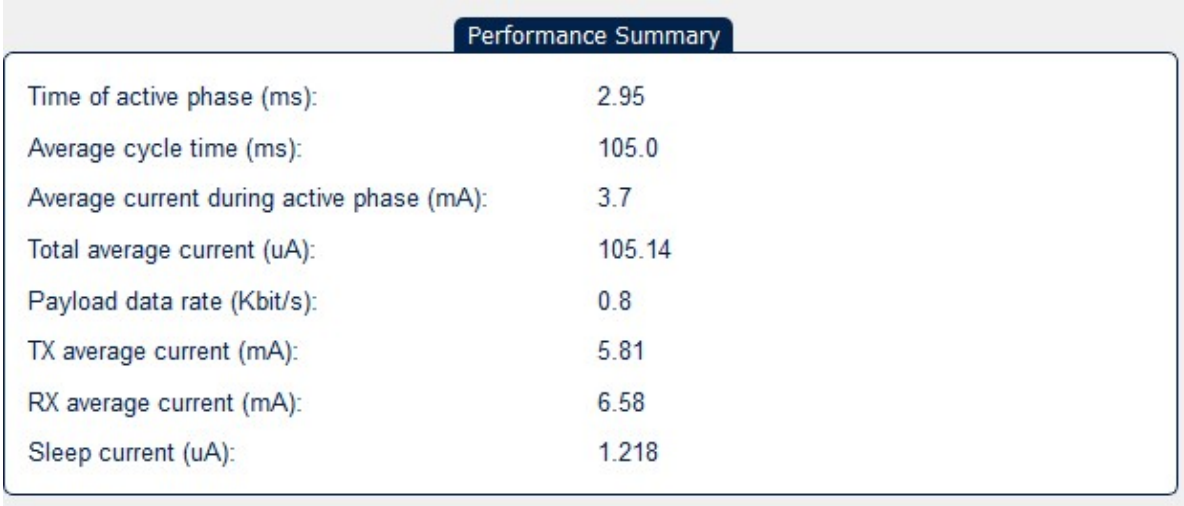


Figure 10. **Performance summary area for Bluetooth® LE connection**

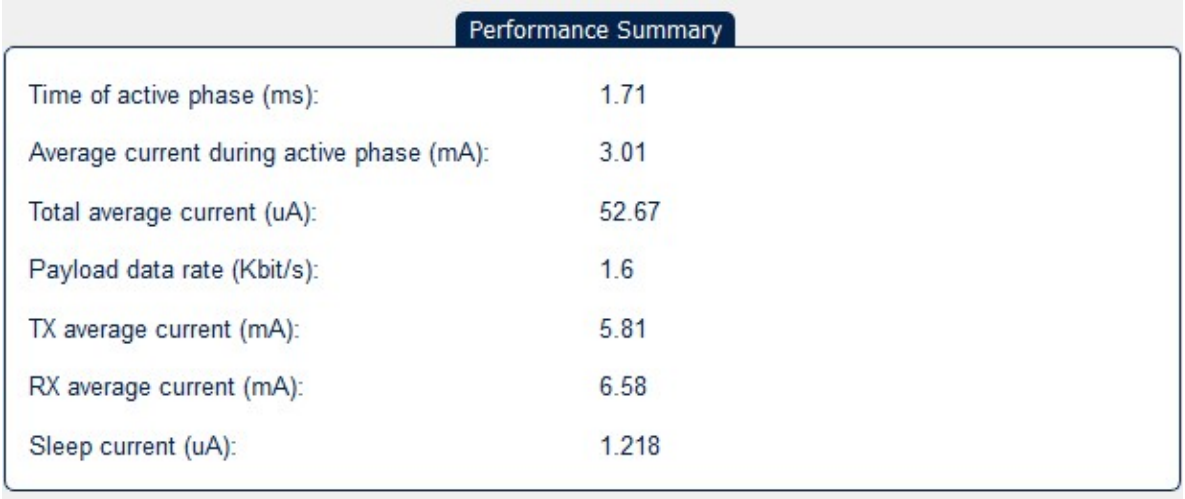
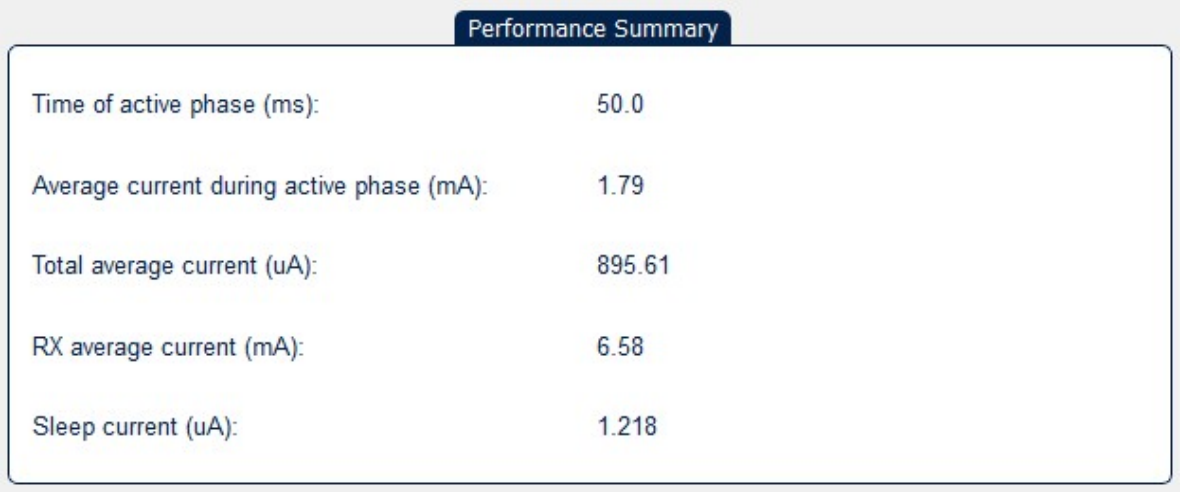


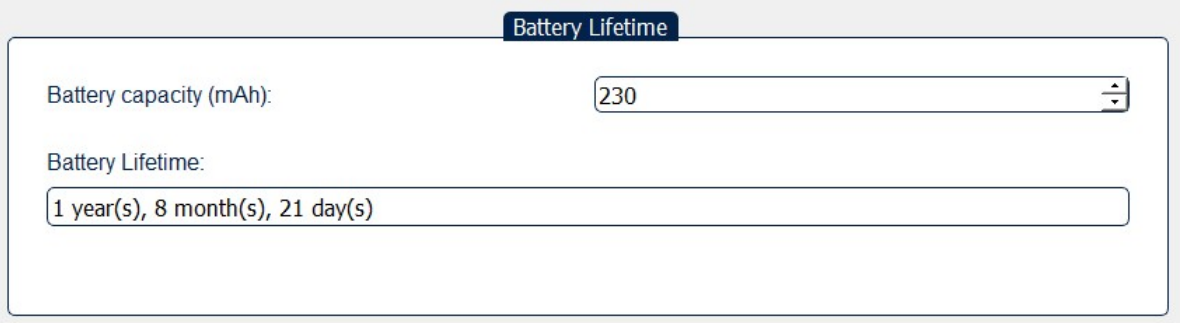
Figure 11. **Performance summary area for Bluetooth® LE scanning**



3.5.1 Battery lifetime

The *Battery Lifetime* area enables the user to enter the battery capacity in mAh and receive an estimated battery lifetime for the selected device and application scenario. The battery lifetime is expressed in years, months, and days.

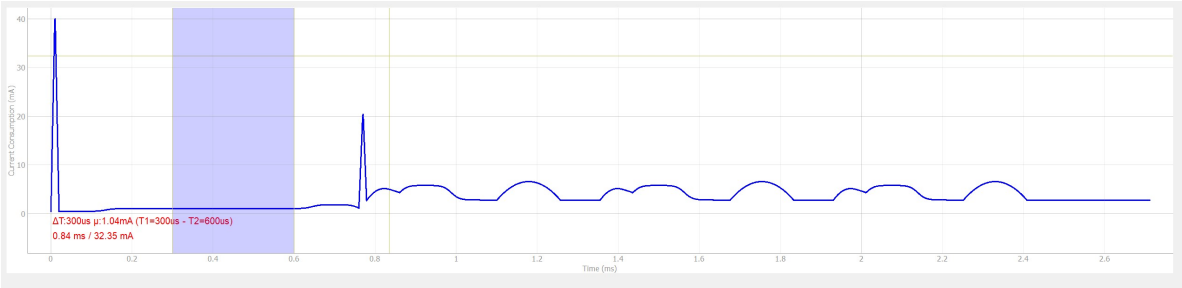
Figure 12. **Battery lifetime area**



3.6 Plot area

The plot area of the STM32CubeWiSE - Current Estimation PC GUI application provides a graphical representation of current consumption during the active phase.

Figure 13. Graphical plot



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The user can dynamically select a specific time interval on the plot (violet region in Figure 13) to evaluate the related current estimation information along the time axis. The graphical plot can be saved using the [**Save Plot**] and [**Save PDF report**] menu options described in Section 3.2: Tools.

3.7 About window

The *About* window displays information about the STM32CubeWiSE - Current Estimation software tool version and release year.

Figure 14. About window

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4 How to use?

Section 4.1: Bluetooth® LE advertising example provides a simple example that demonstrates how to use the STM32CubeWiSE - Current Estimation PC GUI application to estimate current consumption in the Bluetooth® LE advertising scenario.

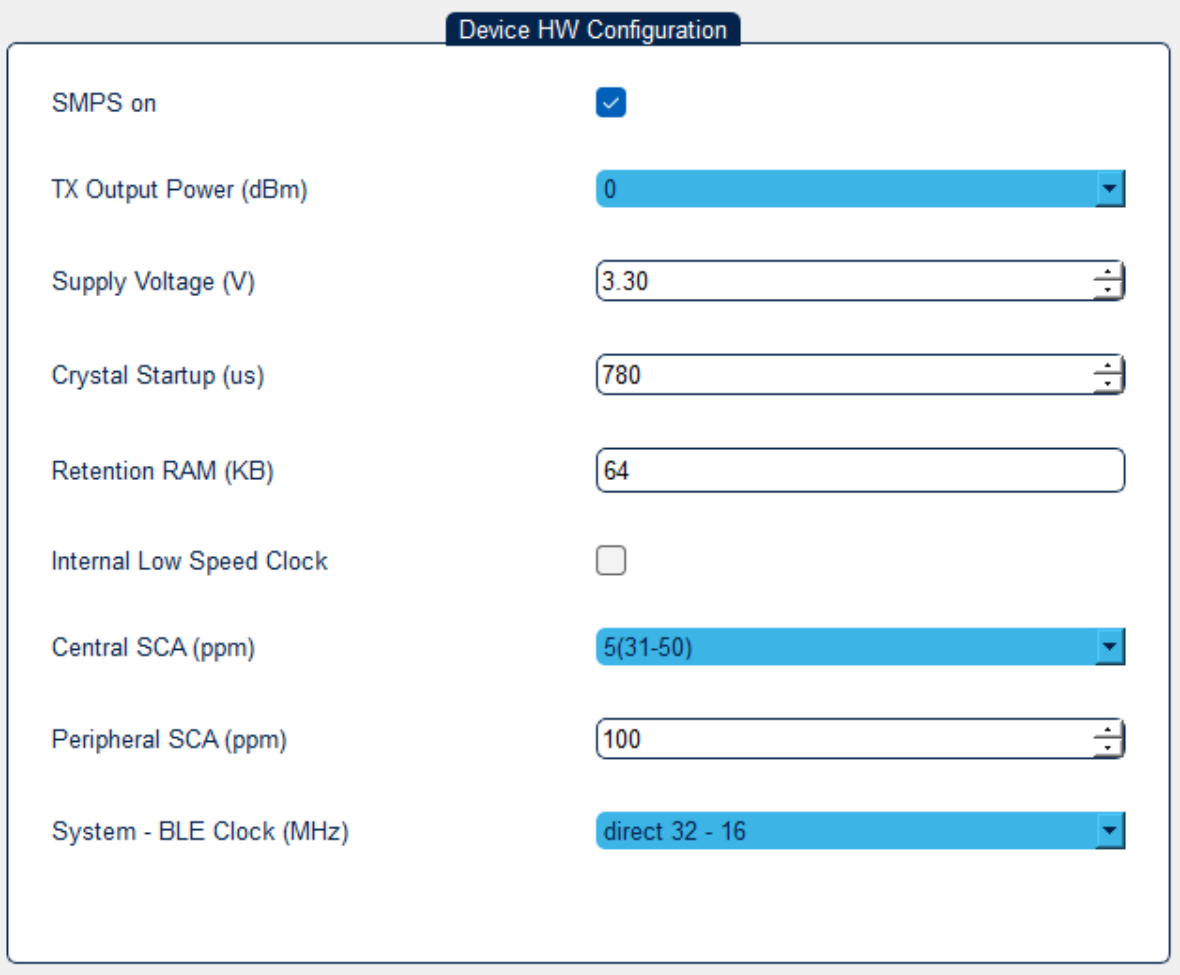
4.1 Bluetooth® LE advertising example

The following example shows how to evaluate current consumption of an STM32WB09xx device.

The device hardware configuration is:

- SMPS: on
- Tx power: 0 dBm
- Power supply: 3.3 V
- Crystal startup time: 780 µs
- Retention: full RAM retention of 64 Kbytes
- System clock and Bluetooth® LE system clock (MHz): direct32 – 16

Figure 15. Device hardware configuration parameters for example



The two scenarios are:

1. Advertising interval of 100 ms with a 25-byte packet length
2. Advertising interval of 1 000 ms with a 25-byte packet length

Scenario 1

Figure 16. **Radio event configuration parameters for scenario 1**

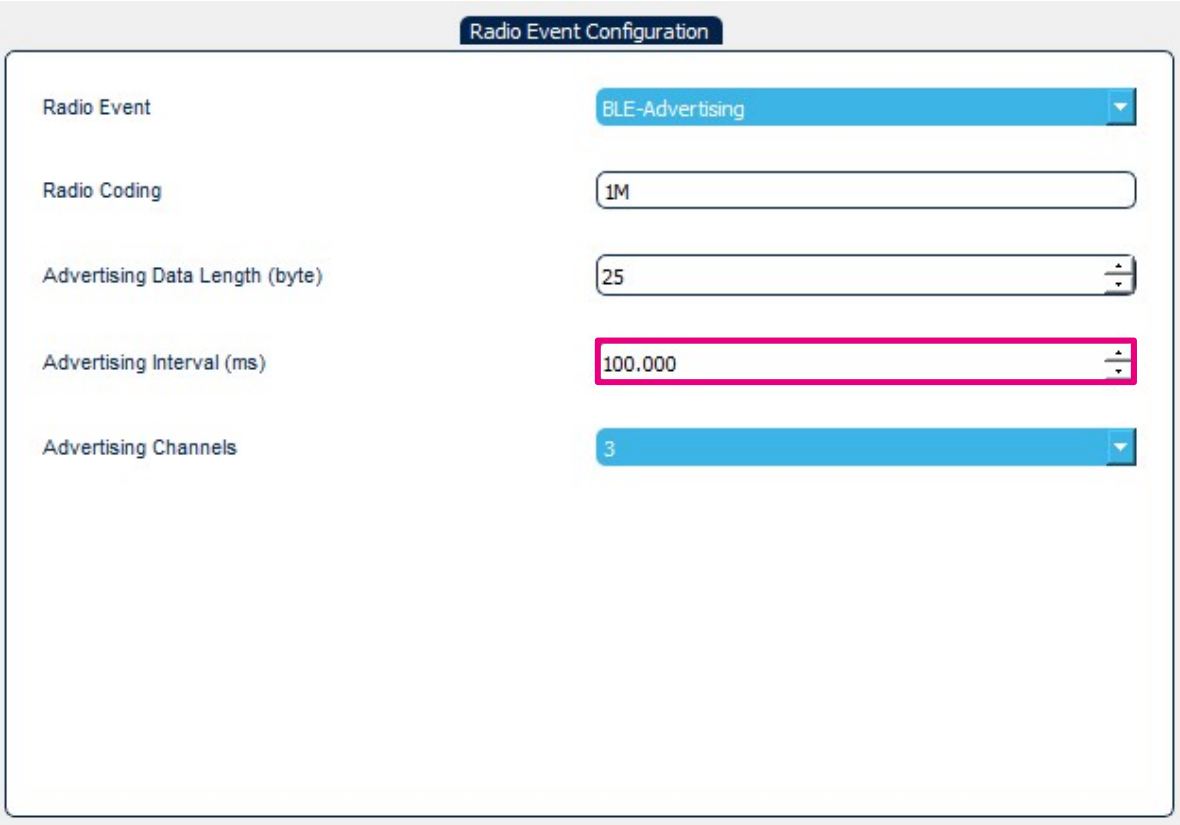


Figure 17. **Performance summary and battery lifetime for scenario 1**

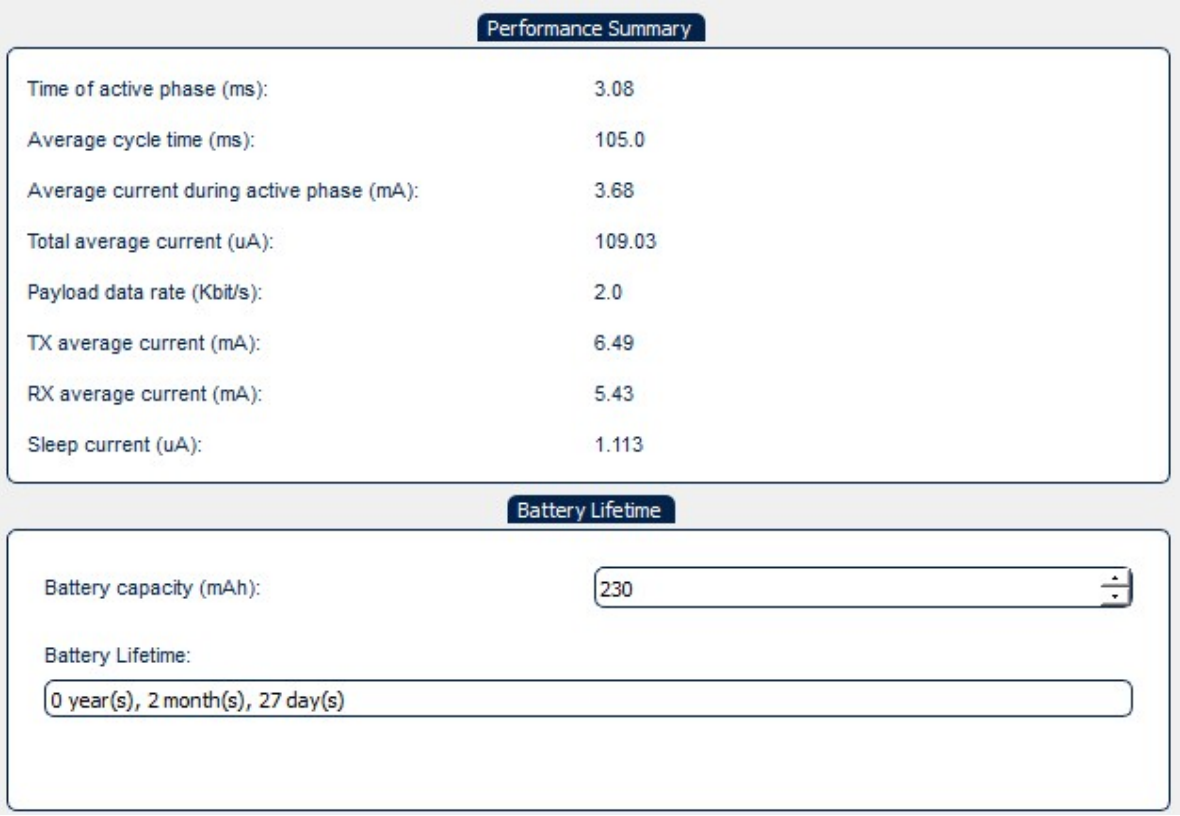
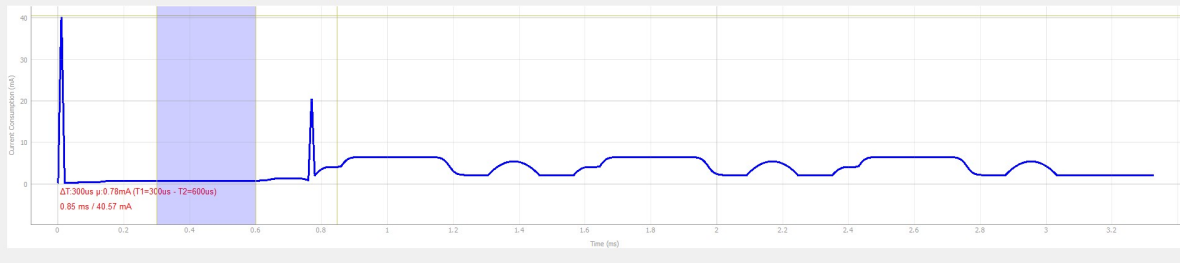


Figure 18. **Graphical plot for scenario 1**



Scenario 2

Figure 19. **Radio event configuration parameters for scenario 2**

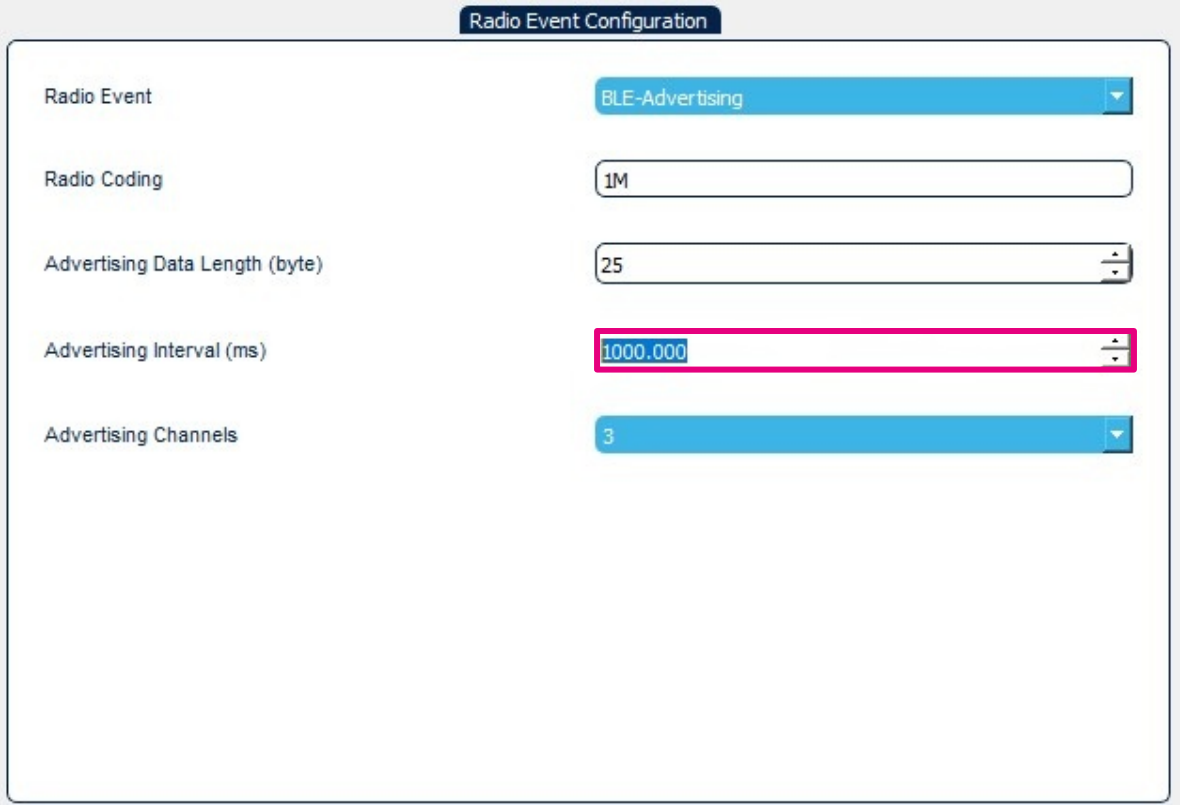


Figure 20. **Performance summary and battery lifetime for scenario 2**

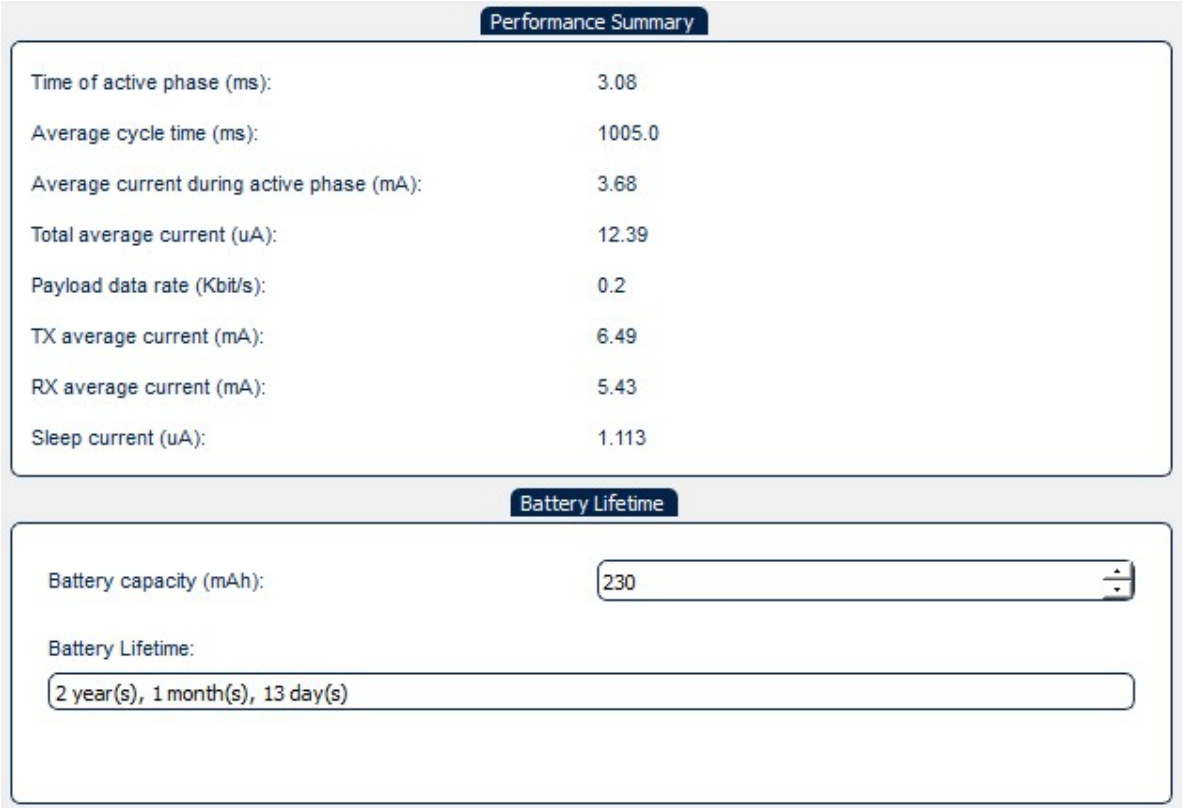
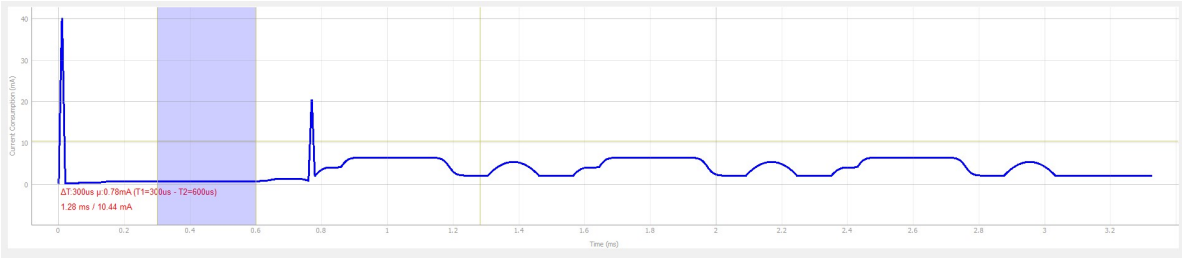


Figure 21. **Graphical plot for scenario 2**



The equivalent scenarios can also be evaluated and measured with the BLE_Power_Consumption test application released in the STM32CubeWB0 MCU Package. This test application runs on the NUCLEO-WB09KE board, which features an STM32WB09KE microcontroller.

The test application measures the current consumption in the following conditions:

- SMPS: on
- Tx power: 0 dBm
- Power supply: 3.3 V
- Crystal startup time: 780 µs
- Retention: full RAM retention of 64 Kbytes
- System clock (MHz): direct HSE configuration
- Bluetooth® LE system clock (MHz): 16

The test application measures the current consumption according to the following scenarios:

1. Advertising interval of 100 ms with a 25-byte packet length
2. Advertising interval of 1 000 ms with a 25-byte packet length

5 References

Table 7. **References**

Reference	Description	Location
DS14591	STM32WB05xZ datasheet	*www.st.com*
DS14676	STM32WB06xC and STM32WB07xC datasheet	
DS14210	STM32WB09xE datasheet	
DS14127	STM32WBA5xxx datasheet	
DS14736	STM32WBA6xxx datasheet	
STM32CubeWB0	STM32Cube MCU Package for STM32WB0 series	
STM32CubeWBA	STM32Cube MCU Package for STM32WBA series	

Revision history

Table 8. **Document revision history**

Date	Revision	Changes
18-Mar-2026	1	Initial release.

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