

1 Overview

The MCUXpresso Software Development Kit (SDK) is a collection of software enablement for microcontrollers that includes peripheral drivers, high-level stacks including other middleware packages, and integrated RTOS support for FreeRTOS™ OS. In addition to the base enablement, the MCUXpresso SDK is augmented with demo applications, driver example projects, and API documentation to help the customers quickly leverage the support of the MCUXpresso SDK.

For more details about MCUXpresso SDK, see [MCUXpresso-SDK: Software Development Kit for MCUXpresso](#).

2 MCUXpresso SDK

As part of the MCUXpresso software and tools, MCUXpresso SDK is the evolution of Kinetis SDK v2.x.x and includes support for both LPC and i.MX System-on-Chips (SoC). The same drivers, APIs, and middleware are still available with support for the Kinetis, LPC, and i.MX silicon. The MCUXpresso SDK adds support for the MCUXpresso IDE, an Eclipse-based toolchain that works with all MCUXpresso SDKs. Easily import your SDK into the new toolchain to access to all of the available components, examples, and demos for your target silicon. In addition to the MCUXpresso IDE, the support for the MCUXpresso Config Tools enables easy cloning of existing SDK examples and demos, allowing users to leverage the existing software examples provided by the SDK for their own projects.

NOTE

To maintain compatibility with legacy Freescale code, the filenames and source code in the MCUXpresso SDK contain the legacy Freescale prefix "FSL". The "FSL" prefix is redefined as the NXP Foundation Software Library.

3 Development tools

The MCUXpresso SDK was compiled and tested with these development tools:

- IAR Embedded Workbench for Arm version 9.10.2
- MCUXpresso IDE version 11.4.1

4 Supported development systems

This release supports boards and devices listed in [Table 1](#). The boards and devices in bold were tested in this release.

Contents

1	Overview.....	1
2	MCUXpresso SDK.....	1
3	Development tools.....	1
4	Supported development systems....	1
5	What is new.....	2
6	Release contents.....	3
7	MCUXpresso SDK release package	3
7.1	Device support.....	3
7.2	Wireless.....	4
7.3	RTOS.....	5
8	MISRA compliance.....	5
9	Known issues.....	6
9.1	Maximum file path length in Windows 7® operating system.....	6
9.2	Only FreeRTOS is tested for RTOS support.....	6
9.3	Disabled pairing and bonding for most sensor applications.....	7
9.4	Toolchain functions.....	7
9.5	Bluetooth LE extended advertising —chain packet number.....	7
9.6	Bluetooth LE 5.0 Sniffer limitations (running on USB-KW38).....	7
9.7	GenFSK limitations.....	7
9.8	Low power reference design applications.....	7
9.9	Device or network privacy mode configurations in resolving list.....	7
9.10	Limitation of UART Baud Rate with ER-RD board.....	7
10	Revision history.....	7



Table 1. Supported MCU devices and development boards

Development boards	MCU devices
FRDM-KW38	MKW38A512VFT4, MKW38Z512VFT4, MKW39A512VFT4
USB-KW38	MKW37Z512VFT4, MKW37A512VFT4
KW38-ER-RD	MKW38A512VFT4, MKW38Z512VFT4, MKW39A512VFT4

5 What is new

• MCUXpresso SDK Release 2.6.13 KW37A SDK

This new release package for the KW37/38/39 platforms corresponds to the Maintenance Release phase of the program.

The KW37 Bluetooth® LE v5.0 features in this release have undergone a Bluetooth SIG qualification listing process, as follows:

- [Controller Subsystem Bluetooth LE 5](#)
- [Host Subsystem Bluetooth LE 5](#)

• Wireless

- Versions:

middleware/wireless/framework	release_fw_ksdk_2.6_kw37a_5.7.12
middleware/wireless/genfsk	release_genfsk_ksdk_2.6_kw37a_3.0.10
middleware/wireless/ble_controller	release_ll_ksdk_2.6_kw37a_1.6.12
middleware/wireless/bluetooth	release_ble_ksdk_2.6_kw37a_1.6.11.1
middleware/wireless/refdes	release_refdes_ksdk_2.6_kw37a_1.0.8

Below are notable updates for this KW39/38/37 release as compared to previous MCUXpresso SDK 2.6.12 releases:

• Bluetooth LE Host Stack and Applications

- Increased ble_fsci sample application resolving list size.
- MISRA fix.

• Bluetooth LE 5.0 Link Layer Fixes/Changes

- Enhanced Notification : Return invalid RSSI value '0xFF' when CRC check failed.
- TX output power : Optimize the configuration of DCDC output voltage level and LDO_HF trim settings
- Fix an issue related to TX output power level when Connection and Advertising are running concurrently
- Update of Min Number of Used Channels procedure : By default, keep 15 channels for all PHYs. Add an API to modify this setting (per PHY)
- Low power optimization : Remove random delay before starting first advertising Event.

• GenFSK Link Layer Fixes/Changes

- No changes

• Transceiver Driver

- No changes.

• Connectivity framework

- Fix Randomly Reset occurring during the DTM or BLE activity when executing DCDC_VBatMonitorBuck() function.

6 Release contents

Table 2 provides an overview of the MCUXpresso SDK release package contents and locations.

Table 2. Release contents

Deliverable	Location
Bluetooth	<install_dir>/middleware/wireless/bluetooth
Bluetooth LE controller	<install_dir>/middleware/wireless/ble_controller
Boards	<install_dir>/boards
Cortex Microcontroller Software Interface Standard (CMSIS) Arm® Cortex®-M header files, DSP library source	<install_dir>/CMSIS
Demo applications	<install_dir>/boards/<board_name>/demo_apps
Documentation	<install_dir>/docs
Driver examples	<install_dir>/boards/<board_name>/driver_examples
Driver, SoC header files, extension header files and feature header files, utilities	<install_dir>/devices/<device_name>
GenFSK	<install_dir>/middleware/wireless/genfsk
LIN stack	<install_dir>/middleware/lin_stack
Middleware	<install_dir>/middleware
Peripheral Drivers	<install_dir>/devices/<device_name>/drivers
Reference design applications	<install_dir>/board/<board_name>/reference_design
RTOS examples	<install_dir>/boards/<board_name>/rtos_examples
RTOS Kernel Code	<install_dir>/rtos
Tools	<install_dir>/tools
Utilities such as debug console	<install_dir>/devices/<device_name>/utilities
Wireless examples	<install_dir>/boards/<board_name>/wireless_examples
Wireless framework	<install_dir>/middleware/wireless/framework

7 MCUXpresso SDK release package

The MCUXpresso SDK release package content is aligned with the silicon subfamily it supports. This includes the boards, CMSIS, devices, documentation, middleware, and RTOS support.

7.1 Device support

The device folder contains the whole software enablement available for the specific System-on-Chip (SoC) subfamily. This folder includes clock-specific implementation, device register header files, device register feature header files, CMSIS derived device SVD, and the system configuration source files. Included with the standard SoC support are folders containing peripheral drivers, toolchain support, and a standard debug console.

The device-specific header files provide a direct access to the microcontroller peripheral registers. The device header file provides an overall SoC memory mapped register definition. The folder also includes the feature header file for each peripheral on the microcontroller.

The toolchain folder contains the startup code and linker files for each supported toolchain. The startup code is a CMSIS compliant startup code that efficiently transfers the code execution to the `main()` function.

7.1.1 Board support

The boards folder provides the board-specific demo applications, driver examples, RTOS, and middleware examples.

7.1.2 Demo applications and other examples

The demo applications demonstrate the usage of the peripheral drivers to achieve a system level solution. Each demo application contains a *readme* file that describes the operation of the demo and required setup steps.

The driver examples demonstrate the capabilities of the peripheral drivers. Each example implements a common use case to help demonstrate the driver functionality.

The template project is as a start-up project for users to make their own projects.

7.2 Wireless

The following connectivity-supporting documentation is included in the documentation package:

- Generic FSK Link Layer Quick Start Guide
- Generic FSK Link Layer API Reference Manual
- Bluetooth Low Energy Host Stack API Reference Manual
- Bluetooth Low Energy Application Developer's Guide
- Bluetooth Low Energy Demo Applications User's Guide
- Bluetooth Low Energy Host Stack FSCI Reference Manual
- Bluetooth Low Energy Quick Start Guide
- Bluetooth Low Energy Host Stack FSCI Application Programming
- Low Power Connectivity Design User's Guide
- Connectivity Framework Reference Manual

7.2.1 Radio

7.2.1.1 Tested radio modes and data rates

The following radio modes are tested in this release:

- Bluetooth LE 1 Mbit/s and 2 Mbit/s RX at 32 MHz and 26 MHz $_{RF_OSC}$.
- Bluetooth LE 1 Mbit/s RX with Dirty TX Impairments at 32 MHz and 26 MHz $_{RF_OSC}$.
- Bluetooth LE Long Range S=2 (500 Kbit/s) and S=8 (125 Kbit/s) at 32 MHz and 26 MHz $_{RF_OSC}$.
- GFSK BT=0.5, h=0.5, 2 Mbit/s / 1 Mbit/s / 500 Kbit/s / 250 Kbit/s rates at 32 MHz and 26 MHz $_{RF_OSC}$.
- GFSK BT=0.5, h=0.32, 2 Mbit/s / 1 Mbit/s / 500 Kbit/s / 250 Kbit/s at 32 MHz and 26 MHz $_{RF_OSC}$.
- GFSK BT=0.5, h=0.7, 1 Mbit/s / 2 Mbit/s at 32 MHz and 26 MHz $_{RF_OSC}$.
- MSK 2 Mbit/s / 1 Mbit/s / 500 Kbit/s / 250 Kbit/s at 32 MHz and 26 MHz $_{RF_OSC}$.
- GFSK BT=0.5, h=0.5, Long Range emulation for S=2 and S=8 coding rates at 32 MHz and 26 MHz $_{RF_OSC}$. RX only, TX not yet tested.

7.2.1.2 Overview of deviating results

The following is the regression testing that did not pass in this release:

- N/A

The following is the regression testing that passes in this release, but still shows some level of impaired performance:

- Bluetooth LE Long Range with the 26 MHz RF oscillator at both S=2 and S=8 does not meet targeted RX Sensitivity in this release.
- GFSK 05032 is operational but has PER spikes at 250 Kbps data rate due to unoptimized receiver settings.
- MSK TX FSK error is slightly above target level.
- Selectivity at 6 MHz offset for Bluetooth 2 Mbps sporadically deviates from the target.

7.3 RTOS

The MCUXpresso SDK is integrated with FreeRTOS OS and bare metal.

8 MISRA compliance

All MCUXpresso SDK drivers comply to MISRA 2012 rules with exceptions in [Table 3](#).

Table 3. MISRA exceptions

Exception rules	Description
Directive 4.2	This rule is Advisory and currently disabled in the analysis configuration.
Directive 4.4	Sections of code should not be commented out.
Directive 4.5	Identifiers in the same name space with overlapping visibility should be typographically unambiguous.
Directive 4.6	Typedefs that indicate size and signedness should be used in place of the basic numerical types.
Directive 4.8	If a pointer to a structure or union is never dereferenced within a translation unit, then the implementation of the object should be hidden.
Directive 4.9	A function should be used in preference to a function-like macro where they are interchangeable.
Directive 4.13	Functions which are designed to provide operations on a resource should be called in an appropriate sequence.
Rule 1.2	Language extensions should not be used.
Rule 2.3	A project should not contain unused type declarations.
Rule 2.4	A project should not contain unused tag declarations.
Rule 2.5	A project should not contain unused macro declarations.
Rule 2.6	A function should not contain unused label declarations.
Rule 2.7	There should be no unused parameters in functions.
Rule 4.2	Trigraphs should not be used.
Rule 5.1	External identifiers shall be distinct.
Rule 5.4	Macro identifiers shall be distinct.
Rule 5.9	Identifiers that define objects or functions with internal linkage should be unique.

Table continues on the next page...

Table 3. MISRA exceptions (continued)

Exception rules	Description
Rule 8.7	Functions and objects should not be defined with external linkage if they are referenced in only one translation unit.
Rule 8.9	An object should be defined at block scope if its identifier only appears in a single function.
Rule 8.11	When an array with external linkage is declared, its size should be explicitly specified.
Rule 8.13	A pointer should point to a const-qualified type whenever possible.
Rule 10.5	The value of an expression should not be cast to an inappropriate essential type.
Rule 11.4	A conversion should not be performed between a pointer to object and an integer type.
Rule 11.5	A conversion should not be performed from pointer to void into pointer to object.
Rule 12.1	The precedence of operators within expressions should be made explicit.
Rule 12.3	The comma operator should not be used.
Rule 12.4	Evaluation of constant expressions should not lead to unsigned integer wrap-around.
Rule 13.3	A full expression containing an increment (++) or decrement (--) operator should have no other potential side effects other than that caused by the increment or decrement operator.
Rule 15.4	There should be no more than one break or go to statement used to terminate any iteration statement.
Rule 17.5	The function argument corresponding to a parameter declared to have an array type shall have an appropriate number of elements.
Rule 17.8	A function parameter should not be modified.
Rule 19.2	The union keyword should not be used.
Rule 20.1	<code>#include</code> directives should only be preceded by preprocessor directives or comments.
Rule 20.10	The <code>#</code> and <code>##</code> preprocessor operators should not be used.
Rule 21.1	<code>#define</code> and <code>#undef</code> shall not be used on a reserved identifier or reserved macro name.
Rule 21.2	A reserved identifier or macro name shall not be declared.
Rule 21.12	The exception handling features of <code><fenv.h></code> should not be used.

9 Known issues

9.1 Maximum file path length in Windows 7[®] operating system

The Windows 7 operating system imposes a 260-character maximum length for file paths. When installing the MCUXpresso SDK, place it in a directory close to the root to prevent file paths from exceeding the maximum character length specified by the Windows operating system. The recommended location is the `C:\nxp` folder.

9.2 Only FreeRTOS is tested for RTOS support

This release only supports the IAR Embedded Workbench IDE, MCUXpresso IDE, the FreeRTOS kernel, and a bare-metal non-preemptive task scheduler.

9.3 Disabled pairing and bonding for most sensor applications

Most sensor applications have pairing and bonding disabled to allow a faster interaction with mobile applications. These two security features can be enabled in the *app_preinclude.h* header file.

9.4 Toolchain functions

Toolchains functions (EX: memcpy) enabled with `gUseToolchainMemFunc_d` cannot be used with some types of optimisations (EX: IAR EWARM Speed).

9.5 Bluetooth LE extended advertising—chain packet number

When using A0 silicon version, only one Chain Packet per Advertising Set is supported. This limitation is solved when using B0 silicon version.

9.6 Bluetooth LE 5.0 Sniffer limitations (running on USB-KW38)

- One single channel decoded at a time.
- Payload decryption not supported.
- Some blocks may be dropped in case there are too many packets to report to the host.

9.7 GenFSK limitations

- BT=0.5, h=0.32 modulation is functional but has RX PER spikes present in the mid-power levels for both 26 MHz and 32 MHz `RF_OSC`.
- BT=0.5, h=0.5 modulation, 250 Kbps rate with 26 MHz `RF_OSC` is functional but has RX PER spikes present at midpower levels.
- Fast warmup not supported (150 µS not supported between Rx and Tx).
- Sync address 1 and 2 bytes not supported.

9.8 Low power reference design applications

Features not supported:

- GenFSK Low Power modes

9.9 Device or network privacy mode configurations in resolving list

The Bluetooth LE Link Layer supports a single privacy mode configuration (either Device or Network privacy) in the Resolving list. A mixed configuration is not supported.

9.10 Limitation of UART Baud Rate with ER-RD board

The UART baud rate is limited to 57600bps when a long sequence of bytes (>20) is sent to the ER-RD board.

10 Revision history

The table below summarizes revisions to this document.

Table 4. Document revision history

Revision	Date	Substantive change
2	15 October 2021	Document updated for KW37A GA MR5 release. <ul style="list-style-type: none">• Updated Development tools• Updated What is new
1	24 September 2021	Document updated for MR4 CCC release. <ul style="list-style-type: none">• Updated What is new
0	06 September 2021	Initial release

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Date of release: 15 October 2021

Document identifier: MCUXSDKKW38RN

