

Bluetooth® Low Energy Software for the Kinetis MKW34/MKW35/MKW36 Wireless Microcontroller, Version 1.3.11 Maintenance Release

Release Notes

1 Overview

These release notes pertain to the platform software that was developed for the MKW34/MKW35/MKW36 Kinetis-based Bluetooth® low energy v5.0 compliant platforms, and the associated development board FRDM-KW36. These notes pertain to the Kinetis Bluetooth LE Platform Software version 1.3.11 Maintenance Release 6.

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2 Release Contents

The NXP Kinetis MKW36A/MKW35A/MKW35Z/MKW36Z Bluetooth® LE Software version 1.3.11 Maintenance Release 6 main wireless connectivity components are listed in the table below.

Table 1. Release Contents

(File Folder) Name	Description
boards/[board]/wireless_examples/bluetooth	Demo applications on top of GATT standard profiles: <ul style="list-style-type: none"> - ANS – Alert Notification Sensor - BPS – Blood Pressure Sensor - CPS – Cycling Power Sensor - CSCS – Cycling Speed Cadence Sensor - GLS – Glucose Sensor - HTS – Health Thermometer - HRS – Heart Rate - HID – Host and Device - PXR – Proximity Reporter - PLXP – Pulse Oximeter - RSCS – Running Speed and Cadence Sensor - ANCS – Apple Notification Center Service Demo applications not based on standard GATT profiles: <ul style="list-style-type: none"> - Beacon advertiser - FSCI black box - HCI black box/modem - Proxy Relay - OTAP server and client - Shell/Console application - Temperature Sensor - Temperature Collector - WPT- Wireless Power Transfer - Wireless UART
middleware/wireless/bluetooth_1.3.11/host	Bluetooth® LE v5.0 host stack
middleware/wireless/bluetooth_1.3.11/controller	Bluetooth® LE v5.0 controller
middleware/wireless/bluetooth_1.3.11/profile	Bluetooth® LE GATT profiles
doc/wireless	Wireless connectivity documentation
middleware/wireless/framework_5.4.11/Common	Connectivity Framework common files
middleware/wireless/framework_5.4.11/DSP	Signal processing and bit manipulation helper functions
middleware/wireless/framework_5.4.11/FSCI	Freescale Serial Connectivity Interface
middleware/wireless/framework_5.4.11/LowPower	Low Power Module
middleware/wireless/framework_5.4.11/MemManager	Memory Manager
middleware/wireless/framework_5.4.11/Messaging	Messaging API
middleware/wireless/framework_5.4.11/NVM	Non Volatile Memory support
middleware/wireless/framework_5.4.11/OtaSupport	Over-The-Air Programming support files
middleware/wireless/framework_5.4.11/Panic	Panic module
middleware/wireless/framework_5.4.11/RNG	Random Number Generator wrapper
middleware/wireless/framework_5.4.11/SerialManager	Serial Manager for various interface
middleware/wireless/framework_5.4.11/Shell	Shell/Console module
middleware/wireless/framework_5.4.11/TimersManager	Timers Manager module
middleware/wireless/framework_5.4.11/SecLib	Security Library
tools/wireless/host_sdk	Python host SDK and BLE bindings for FSCI

Please refer to <http://www.nxp.com/connectivity> for more information on NXP wireless connectivity platforms.

3 What's New and Change Log

This section describes the major changes and new features implemented in the BLE software releases, as well as the list of GATT supported profiles.

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

- [Host Component Bluetooth LE 5.0](#)
- [Controller Component Bluetooth LE 5.0](#)

3.1 MKW34/MKW35/MKW36 BLUETOOTH LE Software v1.3.11 Changes

- This version corresponds to the Maintenance Release 6 build of the MKW34/MKW35/MKW36 Bluetooth LE Software the features described below:
 - Disconnect Requests are sent over the air in situations when previously just disconnected the local channel
 - Improved Bluetooth LE Host error reporting when memory allocation fails
 - Improved scanner robustness in noisy environment
 - Added initializations to all unions in host, fsci and application/common file
 - Added application define to control Host behavior when receiving an LTK request from LL for an unbonded device
 - Added check and disconnect for SDU overflow case
 - Added a timeout mechanism for disconnect command
 - Added checks for correct values for MTU and MPS upon connection request/response
 - Silent discard credit based data frames received on an invalid channel
 - Updated notify the upper layer of the correct reason for connection refusal
 - Updated clock_config files for all BLE applications using clock config tool v9.0
 - Added support for tickless idle mode to low power mode 5
 - Refactored LDM mechanism
 - Added callback for buffer allocation failure notifications
 - APIs to reduce slave power consumption when the master is out of range
 - Framework timer is not accurate when enable DeepSleep mode
 - MISRA updates
 - Bug fixing
 - Not send or receive LE credit packets with an invalid credit count
 - Advertising reports not sent to the application if the adv report count is exceeding the queue
 - CPS application has the OOB pairing flag enabled
 - Only start ATT timers if L2CAP send is successful
 - Fix handling of bond removal
 - Buffer allocation failure not handled on SM timer callback
 - Buffer allocation failure not handled on LDM timer callback
 - Hid Host compile error when pairing is disabled
 - BLE_shell discovers characteristic descriptors with incorrect handles

- Added new events in case of receiving a HCI packet with an invalid parameter or length and for memory allocation failures
- Possible memory leak in otap_server.c
- Memory not freed when calling Gap_StopScanning() in case scanning is not started
- HRS bm app is not sending data to phone first time after the board is flashed
- mcDevicesInResolvingList issue
- Peripheral demos should not advertise with whitelist if not using privacy
- HID Pairing failed in LimitedDiscoverableMode
- Large L2CAP Data Appears Corrupted OTA
- GATT Server mIndicationPending flow control wrong state
- Calling Gap_StopScanning() will trigger gScanStateChanged_c even no scanning
- Compile error on hrs FreeRTOS app in MCUX when tickless is enabled
- Wrong define in bluetooth app_preinclude files:
gTMR_EnableLowPowerTimers
- FSCI Bootloader reset issue Problems with flash update of MKW35
- Add proper trimming value for RTC oscillator on FRDM-KW36 wireless projects
- Scan lock up mechanism is not working properly after privacy timeout

3.2 Supported GATT Profiles

The complete list of GATT profiles and services defined by the Bluetooth SIG, along with the corresponding versions of the specifications, supported in the demo applications included in this release is enumerated below:

• BAS - Battery Service	v1.0
• BLP - Blood Pressure Profile	v1.0
• BLS - Blood Pressure Service	v1.0
• CSCP - Cycling Speed and Cadence Profile	v1.0
• CSCS - Cycling Speed and Cadence Service	v1.0
• HIDS - Human Interface Device Service	v1.0
• HOGP - HID over GATT Profile	v1.0
• HRP - Heart Rate Profile	v1.0
• HRS - Heart Rate Service	v1.0
• HTP - Health Thermometer Profile	v1.0
• HTS - Health Thermometer Service	v1.0
• PXP - Proximity Profile	v1.0.1
• DIS - Device Information Service	v1.1
• IAS - Immediate Alert Service	v1.0
• LLS - Link Loss Service	v1.0.1
• TPS - Tx Power Service	v1.0

• CPP - Cycling Power Profile	v1.0
• CPS - Cycling Power Service	v1.0
• RSCP - Running Speed and Cadence Profile	v1.0
• RSCS - Running Speed and Cadence Service	v1.0
• GLP - Glucose Profile	v1.0
• GLS - Glucose Service	v1.0
• ANP - Alert Notification Profile	v1.0
• ANS - Alert Notification Service	v1.0
• PLXP - Pulse Oximeter Profile	v1.0
• RTUS - Reference Time Update Service	v1.0
• CTS - Current Time Service	v1.1
• NDCS - Next DST Change Service	v1.0
• HPS - HTTP Proxy Service	v1.0

This software package supports the following profiles/services standardized outside the Bluetooth SIG

• A4WP - AirFuel™ Alliance Wireless Power Transfer System	v1.3
• ANCS – Apple Notification Center Service	v1.0

4 Software Deployment Considerations

- The Bluetooth® low energy applications in this package have been built in a Kinetis SDK version 2 environment, making use of the FreeRTOS kernel and microcontroller peripheral drivers included in this SDK. This package includes a full build of the Kinetis SDK v2 for Kinetis MKW36A/MKW35A/MKW35Z/MKW36Z.
- IAR Embedded Workbench for ARM® **v9.20.2** was used to build and test the Bluetooth low energy associated example applications IDE projects included in this release.
- MCUXpresso IDE **v11.5.0** was used to build the Bluetooth low energy associated example applications IDE projects.
- This release is compatible with the Test Tool for Connectivity Products **v12.8.4** or later. It is recommended to use the *BLE_1.3.11.xml* file found in the *tools/wireless/xml_fsci* folder of this package or the Test Tool installation, with the Test Tool Command Console functionality to interact with the FSCI black box applications provided in this package. For more information, please refer *Test Tool User's Guide* included in the Test Tool installation.

5 Embedded System Considerations

- This release supports the FRDM-KW36 evaluation board.
- This release provides OTA and FSCI demo bootloaders for MKW35A/MKW35Z.
- The FRDM-KW36 board features a composite USB device called OpenSDA which serves as debugger interface and as USB to serial converter via a virtual COM port application. Several firmware images can be programmed on the OpenSDA device, among which:

<https://github.com/mbedmicro/CMSIS-DAP>

<https://www.segger.com/opensda.html>

- If your FRDM-KW36 board is configured for the buck mode of the DCDC converter inside the microcontroller, the firmware too needs to be configured for these modes of the DCDC, by setting the following defines: gDCDC_Enabled_d to 1 and APP_DCDC_MODE to gDCDC_Mode_Buck_c, in the app_preinclude.h header file.
- The A4WP example applications are configured by default for the DCDC bypass settings of the FRDM-KW36 board, to fully leverage the RGB LED capabilities available at 3.3V supply voltage.
- To enable FlexNVM feature on MKW36A/MKW36Z one needs to set the gNvUseFlexNVM_d compiler define to 1, remove the gUseNVMLink_d=1 linker flag and use the MKW36Z512xxx4_connectivity linker file (256KB Flash) from:

“middleware\wireless\framework_5.4.11\Common\devices\MKW36Z4\.”.

Also, before programming the device a mass-erase needs to be performed.

- To disable the FlexNVM feature and use entire 512KB of Flash on MKW36A/MKW36Z one needs to set the gNvUseFlexNVM_d compiler define to 0, add the gUseNVMLink_d=1 linker flag and use the MKW36Z512xxx4_PD_connectivity linker file (512KB Flash) from:

“middleware\wireless\framework_5.4.11\Common\devices\MKW36Z4\.”.

Also, before programming the device a mass-erase needs to be performed.

- On MKW36A/MKW36Z the minimum protectable Flash region is 8KB. On MKW35A/MKW35Z the minimum protectable Flash region is 16KB.

The OTA and FSCI bootloaders are configured to use the minimum protectable Flash region.

- When compiling an image for the Over-the-Air update, the gEraseNVMLink_d linker symbol should be set to 0.
- To use the entire 512KB of Flash on MKW36 with IAR Embedded Workbench versions older than 8.32.2, the default board file from project settings must be override with the one from: “middleware\wireless\framework_5.4.11\Common\devices\MKW36Z4\iar\FlashKW36Z4_512K.board”.

6 Known Limitations

- This release supports only the IAR Embedded Workbench IDE and MCUXpresso IDE toolchain, the FreeRTOS kernel and a bare-metal non-preemptive task scheduler. Other RTOSes and toolchains supported in the KSDK have not been tested with this release.
- Applications like the *heart_rate_sensor* or the *temperature_sensor* are configured to enter low power immediately after boot, to be woken up on a switch press. This functionality will cause a connected debugger to disconnect. To debug these applications, please disable the low power functionality in the *app_preinclude.h* header file.
- Most sensor applications have the 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.
- Maximum file path length in Windows® 7 Operating System: Windows OS 7 imposes a 260-character maximum length for file paths. The same limitation influences the command line for build tools in various toolchains, which cannot exceed 8191 characters. When deploying this package, it is recommended to place it in a directory close to the root of the disk drive to prevent the limitations described above. The recommended location is the C:\NXP folder."
- NVM usage for pairing/bonding information storage in the FSCI black-box application must be complemented by the enablement of the FSCI protocol ACK feature, to ensure flash writes do not interfere with the serial communication. More specifically, when enabling *gAppUseNvm_d* in the *app_preinclude.h* file associated with the FSCI black-box application, *gFsciTxAck_c* and *gFsciRxAck_c* must be enabled as well. The corresponding FSCI host must also enable FSCI ACKs. Please note that by default all these preprocessor switches are set to zero and ACKs are disabled in the Host SDK and the BLE FSCI host applications. For more information, please refer the *Kinetis FSCI Host Application Programming Interface User's Guide*.
- Bluetooth Low Energy Application Development Guide documentation issue. The MCUX linker settings for OTAP are wrong. The MCUX linker flags are not functional due to missing pre-build command support in IDE and generators. To enable OTAP support for a custom application, the linker file from the any OTA Client demo should be used and adapted to application's needs.
- IOT Toolbox demo applications were tested against Android 9.0 and iOS 10.2.1 using a limited number of devices.

7 Documentation Included in this Package

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

- *Bluetooth Low Energy Quick Start Guide.pdf*
- *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 API Reference Manual*
- *Bluetooth Low Energy Host Stack FSCI Reference Manual*

The *docs/wireless/Bluetooth/ICS* folder contains Implementation Conformance Statement (ICS) files for the Bluetooth® LE v5.0 profiles included in this package. The files are in PTS format, which can be opened with the Bluetooth® Profile Tuning Suite.

8 BLUETOOTH LE Applications Memory Footprints

The following tables represent the memory footprints of the listed BLUETOOTH LE-based applications:

Application – Beacon		
Configuration - FreeRTOS, IAR Embedded Workbench, FRDM-KW36		
	RAM [bytes]	Flash [bytes]
Application code	2,994	2,994
KSDK	200	7,422
Connectivity Framework	2,753	31,528
RTOS	9,172	5,440
BLUETOOTH LE Host	721	50,165
BLUETOOTH LE Controller	4,131	51,543
Total	19,971	154,508

Application – Beacon		
Configuration - FreeRTOS, MCUXpresso IDE, FRDM-KW36		
	RAM [bytes]	Flash [bytes]
Application code	1,752	19,906
KSDK	204	7,018
Connectivity Framework	2,545	32,817
RTOS	9,172	5,842
BLUETOOTH LE Host	537	50,484
BLUETOOTH LE Controller	4,119	61,545
Total	18,329	177,612

Application – Heart Rate Sensor Configuration - FreeRTOS, IAR Embedded Workbench, FRDM-KW36		
	RAM [bytes]	Flash [bytes]
Application code	4,660	10,888
KSDK	200	7,481
Connectivity Framework	4,289	31,811
RTOS	9,172	5,439
BLUETOOTH LE Host	721	51,388
BLUETOOTH LE Controller	4,131	51,538
Total	23,173	158,545

Application – Heart Rate Sensor Configuration - FreeRTOS, MCUXpresso IDE, FRDM-KW36		
	RAM [bytes]	Flash [bytes]
Application code	2,719	23,705
KSDK	204	9,016
Connectivity Framework	4,107	36,935
RTOS	9,172	6,612
BLUETOOTH LE Host	537	51,664
BLUETOOTH LE Controller	4,119	61,545
Total	20,858	189,477

Application – Wireless UART Configuration - FreeRTOS, IAR Embedded Workbench, FRDM-KW36		
	RAM [bytes]	Flash [bytes]
Application code	4,007	12,158
KSDK	200	7,774
Connectivity Framework	9,605	30,293
RTOS	9,172	5,566
BLUETOOTH LE Host	837	72,052
BLUETOOTH LE Controller	4,131	51,398
Total	27,952	179,241

Application – Wireless UART Configuration - FreeRTOS, MCUXpresso IDE, FRDM-KW36		
	RAM [bytes]	Flash [bytes]
Application code	3,742	24,313
KSDK	204	7,534
Connectivity Framework	9,448	31,227
RTOS	9,172	5,972
BLUETOOTH LE Host	649	72,213
BLUETOOTH LE Controller	4,119	61,421
Total	27,334	202,680

Application – HID Host Configuration - FreeRTOS, IAR Embedded Workbench, FRDM-KW36		
	RAM [bytes]	Flash [bytes]
Application code	2,769	10,835
KSDK	200	7,213
Connectivity Framework	6,053	34,408
RTOS	10,172	5,567
BLUETOOTH LE Host	725	52,224
BLUETOOTH LE Controller	4,131	51,400
Total	24,050	161,647

Application – HID Host Configuration - FreeRTOS, MCUXpresso IDE, FRDM-KW36		
	RAM [bytes]	Flash [bytes]
Application code	2,553	22,627
KSDK	204	7,050
Connectivity Framework	5,894	35,773
RTOS	10,172	5,972
BLUETOOTH LE Host	571	52,772
BLUETOOTH LE Controller	4,119	61,421
Total	23,441	183,624

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