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ROHM Co., Ltd.
April 1, 2024

**MK715x1 Evaluation Kit Mini (MK715x1EK1)
MK715x1 Evaluation Kit Mini Plus (MK715x1EK1P)
Hardware Manual**

Issue Date: Dec. 1, 2020

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Preface

This document outlines the hardware of the MK715x1 evaluation kit Mini [MK715x1EK1] and MK715x1 evaluation kit Mini Plus [MK715XxEK1P] equipped with Bluetooth® 5 compatible Bluetooth low energy module MK715x1 [MK71521 or MK71511] made by Lapis Technology.

This evaluation kit is pre-installed with the AT command application that easily realizes Bluetooth® Low Energy communication by using a simple AT command via UART.

The following related documents are available, so please refer to them if necessary.

- MK71511 Data Sheet
- MK71521 Data Sheet
- MK715x1 Software Development Startup Guide
- BLE Tool User's Manual
- MK715x1 AT command application Quick Reference Guide
- MK715x1 AT command application User's Manual

Note: In this document, MK715x1 refers to both MK71511 and MK71521.

- Bluetooth® is a registered trademark of Bluetooth SIG, Inc.
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1. Overview

1.1 Handling precautions

•MK715x1EK1/MK715x1EK1P can be used only for evaluating MK715x1. We do not take any responsibility for any direct or indirect damage caused by installing this product in your product.

•We are not responsible for any modification or illegal use of this development kit.

1.2 MK715x1EK1/MK715x1EK1P configuration

When you receive the MK715x1EK1/MK715x1EK1P, make sure that the following items are all included in the kit. If you find any broken or missing items, please contact the distributor where you purchased the product or the ROHM sales office.

MK715x1EK1 configuration

| Component | Quantity |
|--------------------------|----------|
| MK715x1 evaluation board | 1 |

MK715x1EK1P configuration

| Component | Quantity |
|--------------------------|----------|
| MK715x1 evaluation board | 1 |
| USB cable | 1 |
| J-Link LITE | 1 |

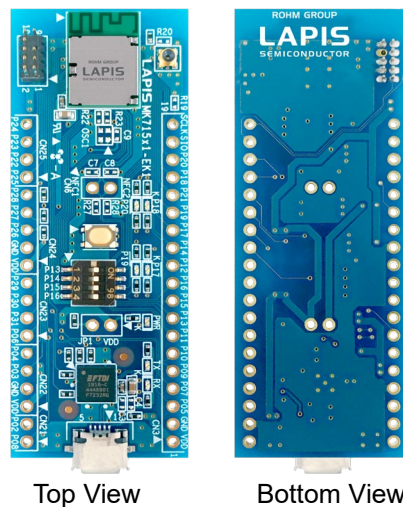


Fig. 1-1: MK715x1EK1 appearance

1.3 Lineup

The MK715x1 evaluation kit has the following lineup depending on the installed modules and accessories.

| Product name | Module | accessories |
|--|---------|------------------------|
| MK71511 evaluation kit Mini (MK71511EK1) | MK71511 | - |
| MK71521 evaluation kit Mini (MK71521EK1) | MK71521 | - |
| MK71511 evaluation kit Mini Plus (MK71511EK1P) | MK71511 | USB cable, J-Link LITE |
| MK71521 evaluation kit Mini Plus (MK71521EK1P) | MK71521 | USB cable, J-Link LITE |

※J-Link LITE is licensed for MK71511EK1/MK71521EK1.

※Use of MK71511EK1/ MK71521EK1 for purposes other than evaluation is prohibited.

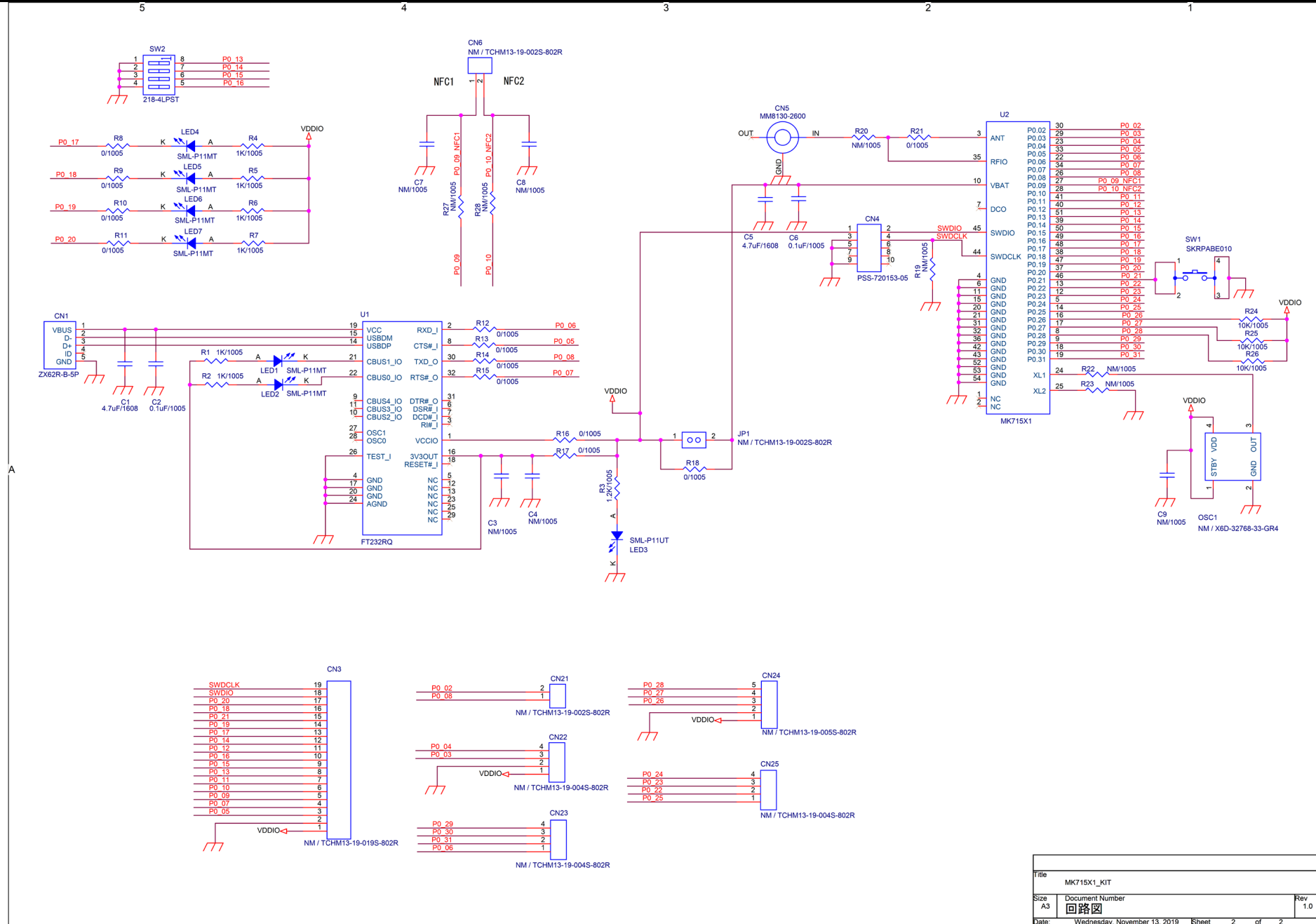
2. Hardware specifications

2.1 Circuit schematic

See next page

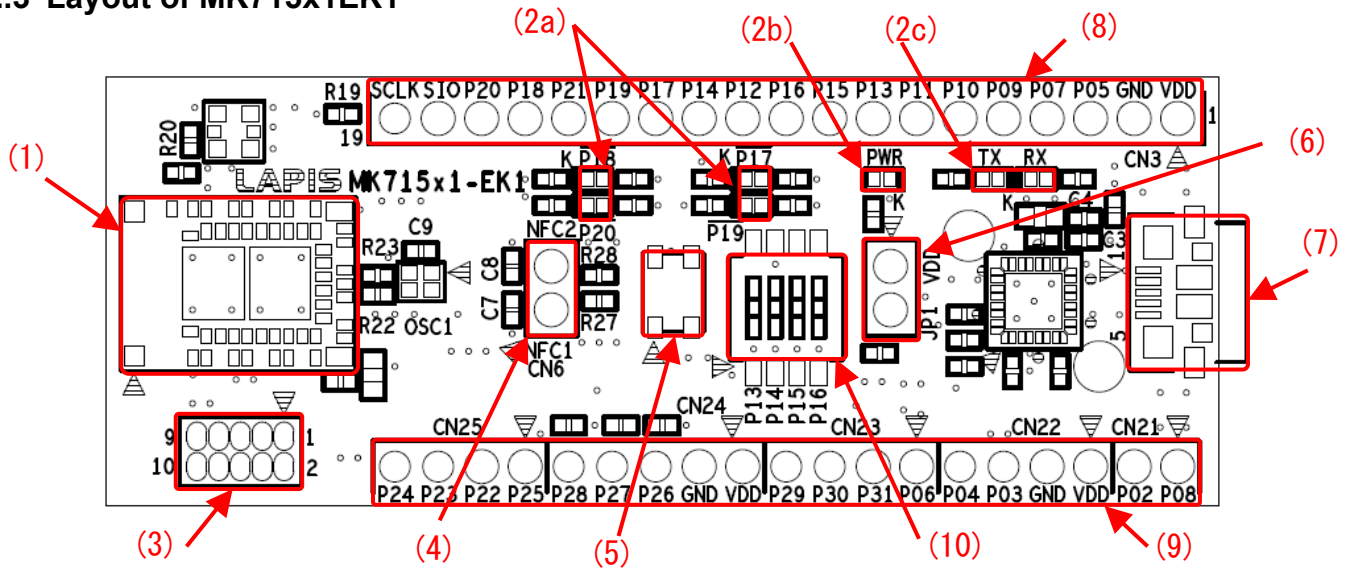
2.2 BOM List

| Reference | Value | Manufacturer | Model number |
|-----------------------------|---------|--------------------------|---------------------|
| U1 | — | FTDI | FT232RQ |
| U2 | — | Lapis Technology | MK71511 or MK71521 |
| LED1,LED2 | — | ROHM | SML-P11MT |
| LED3 | — | ROHM | SML-P11UT |
| LED4,LED5,LED6,LED7 | — | ROHM | SML-P11MT |
| R1,R2 | 1k | ROHM | MCR01MZPJ102 |
| R3 | 1.2k | ROHM | MCR01MZPJ122 |
| R4,R5,R6,R7 | 1k | ROHM | MCR01MZPJ102 |
| R8,R9,R10,R11 | 0 | ROHM | MCR01MZPJ000 |
| R12,R13,R14,R15,R16,R17,R18 | 0 | ROHM | MCR01MZPJ000 |
| R19,R20 | NoMount | ROHM | |
| R21 | 0 | ROHM | MCR01MZPJ000 |
| R22,R23 | NoMount | ROHM | |
| R24,R25,R26 | 10k | ROHM | MCR01MZPJ103 |
| C1 | 4.7u | MURATA | GRM188R61C475KAAJ |
| C2 | 0.1u | MURATA | GRM155B31H104KE14D |
| C3 | NoMount | - | - |
| C4 | NoMount | - | - |
| C5 | 4.7u | MURATA | GRM188R61C475KAAJ |
| C6 | 0.1u | MURATA | GRM155B31H104KE14D |
| C7 | NoMount | - | - |
| C8 | NoMount | - | - |
| C9 | NoMount | - | - |
| OSC1 | NoMount | River Eletec | X6D-32768-33-GR4 |
| CN1 | — | Hlrose | ZX62R-B-5P(30) |
| CN21 | NoMount | K.K. Tokiwa Shoko | TCHM13-19-002S-802R |
| CN22 | NoMount | K.K. Tokiwa Shoko | TCHM13-19-004S-802R |
| CN23 | NoMount | K.K. Tokiwa Shoko | TCHM13-19-004S-802R |
| CN24 | NoMount | K.K. Tokiwa Shoko | TCHM13-19-005S-802R |
| CN25 | NoMount | K.K. Tokiwa Shoko | TCHM13-19-004S-802R |
| CN3 | NoMount | K.K. Tokiwa Shoko | TCHM13-19-019S-802R |
| CN4 | — | HIROSUGI | PSS-720153-05 |
| CN5 | — | Murata | MM8130-2600 |
| CN6 | NoMount | K.K. Tokiwa Shoko | TCHM13-19-002S-802R |
| SW1 | — | ALPS | SKRPABE010 |
| SW2 | — | CTS Electrocomponents | 218-4LPST |
| JP1 | NoMount | K.K. Tokiwa Shoko | TCHM13-19-002S-802R |



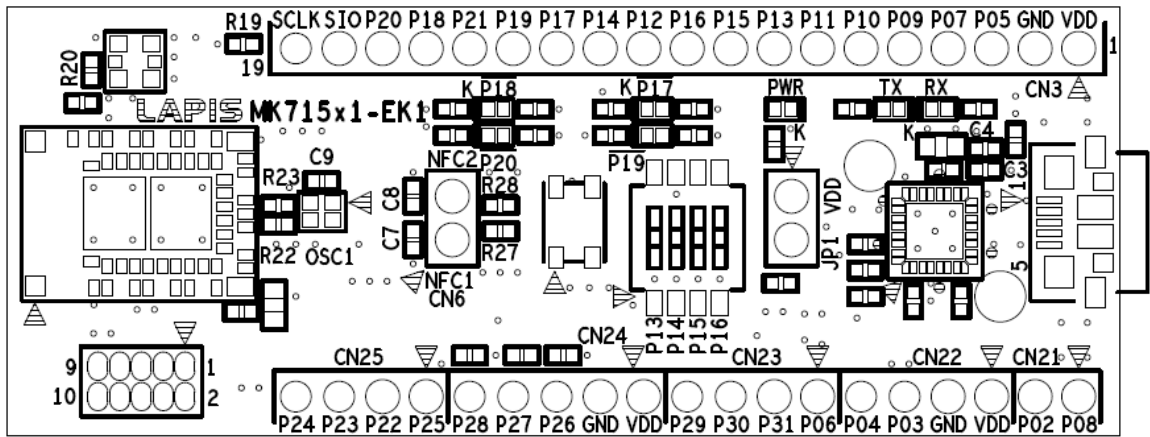
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| Date: Wednesday, November 13, 2019 | Sheet: 2 | of: 2 |

2.3 Layout of MK715x1EK1

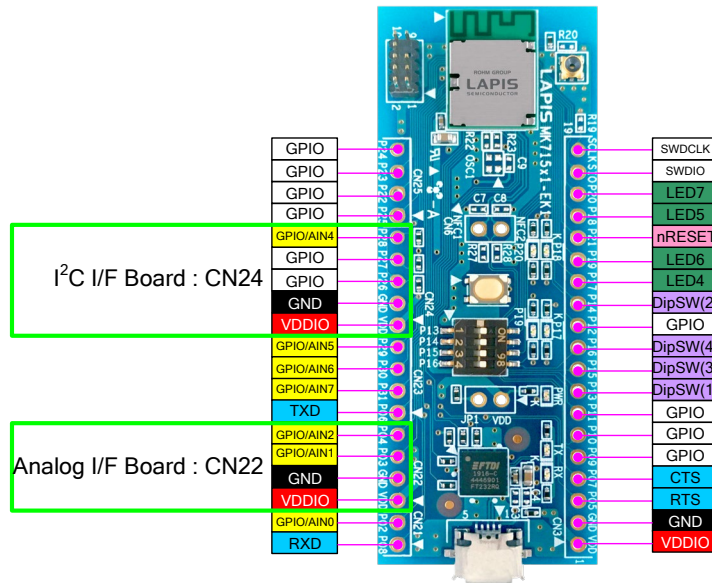


| No | Name | Description | Symbol | (Maker) Part.NO | Remarks |
|------|---------------|-------------------------------|-----------|----------------------------|-----------------------------|
| (1) | MK715X1 | Bluetooth® low energy module | U2 | (LAPIS) MK71511 or MK71521 | |
| (2a) | — | General-purpose LED×4 | LED4-LED7 | (ROHM) SML-P11MT | Green |
| (2b) | — | Power LED × 1 | LED3 | (ROHM) SML-P11UT | Red |
| (2c) | — | UART status LED×2 | LED1-LED2 | (ROHM) SML-P11MT | Green |
| (3) | PSS-720153-05 | J-Link | CN4 | PSS-720153-05 | |
| (4) | — | NFC Interface | CN6 | | Valid for only MK71521 |
| (5) | Reset Switch | Module Reset | SW1 | (ALPS) SKRPABE010 | |
| (6) | — | Current measurement Interface | JP1 | NoMount | Shorted by R18 at shipment |
| (7) | USB Interface | Micro USB Interface | CN1 | (Hirose) ZX62R-B-5P(30) | UART, +5V-DC power supply |
| (8) | — | external Interface | CN3 | NoMount | GPIO, external power supply |
| (9) | — | external Interface | CN21-CN25 | NoMount | GPIO, external power supply |
| (10) | DIPSW-4 | Switch | SW2 | (CTS Elec.) 218-4LPST | |

2.4 Silkscreen Printing



2.5 The pin assignment for External interface



CN25

| Pin Name. | MK715x1EK1 Assignment | nRF52 Port | nRF52 Function |
|-----------|-----------------------|------------|----------------|
| P24 | GPIO | P0.24 | GPIO |
| P23 | GPIO | P0.23 | GPIO |
| P22 | GPIO | P0.22 | GPIO |
| P25 | GPIO | P0.25 | GPIO |

CN24 : Suitable for I2C I/F board connection

| Pin Name. | MK715x1EK1 Assignment | nRF52 Port | nRF52 Function | I²C I/F board Pin Function |
|-----------|-----------------------|------------|----------------|-------------------------------|
| P28 | GPIO/AIN4 | P0.28 | GPIO/AIN4 | INT |
| P27 | GPIO | P0.27 | GPIO | SCL |
| P26 | GPIO | P0.26 | GPIO | SDA |
| GND | GND | GND | Ground | GND |
| VDD | VDDIO | VDD | Power | VDD |

↔ Connection example ↔

【Supplement】
P26~P28 : 10kΩ pull-up

CN23

| Pin Name. | MK715x1EK1 Assignment | nRF52 Port | nRF52 Function |
|-----------|-----------------------|------------|----------------|
| P29 | GPIO/AIN5 | P0.29 | GPIO/AIN5 |
| P30 | GPIO/AIN6 | P0.30 | GPIO/AIN6 |
| P31 | GPIO/AIN7 | P0.31 | GPIO/AIN7 |
| P06 | UART TXD | P0.06 | GPIO |

CN22 : Suitable for analog I/F board connection

| Pin Name | MK715x1EK1 Assignment | nRF52 Port | nRF52 Function | Analog I/F board Pin Function |
|----------|-----------------------|------------|----------------|----------------------------------|
| P04 | GPIO/AIN2 | P0.04 | GPIO/AIN2 | AOUT2 |
| P03 | GPIO/AIN1 | P0.03 | GPIO/AIN1 | AOUT1 |
| GND | GND | GND | Ground | GND |
| VDD | VDDIO | VDD | Power | VDD |

↔ Connection example ↔

CN21

| Pin Name | MK715x1EK1 Assignment | nRF52 Port | nRF52 Function |
|----------|-----------------------|------------|----------------|
| P02 | GPIO/AIN0 | P0.02 | GPIO/AIN0 |
| P08 | UART RXD | P0.08 | GPIO |

CN3

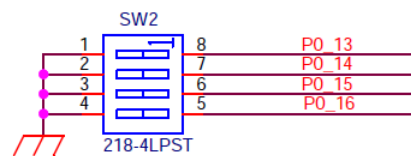
| Pin Name | MK715x1EK1 Assignment | nRF52 Port | nRF52 Function |
|----------|-----------------------|------------|----------------|
| SCLK | SWDCLK | SWDCLK | SWDCLK |
| SIO | SWDIO | SWDIO | SWDIO |
| P20 | LED7 | P0.20 | GPIO |
| P18 | LED5 | P0.18 | GPIO |
| P21 | nRESET | P0.21 | GPIO/nRESET |
| P19 | LED6 | P0.19 | GPIO |
| P17 | LED4 | P0.17 | GPIO |
| P14 | DIP SW (2) | P0.14 | GPIO |
| P12 | GPIO | P0.12 | GPIO |
| P16 | DIP SW (4) | P0.16 | GPIO |
| P15 | DIP SW (3) | P0.15 | GPIO |
| P13 | DIP SW (1) | P0.13 | GPIO |
| P11 | GPIO | P0.11 | GPIO |
| P10 | GPIO | P0.10 | GPIO/NFC2 |
| P09 | GPIO | P0.09 | GPIO/NFC1 |
| P07 | UART CTS | P0.07 | GPIO |
| P05 | UART RTS | P0.05 | GPIO/AIN3 |
| GND | GND | GND | Ground |
| VDD | VDDIO | VDD | Power |

2.6 Switch

2.6.1 DIPSW-4

DIP SW is connected to four ports from P0.13 to P0.16
The port assignment and circuit configuration are shown below.

| Symbol | Pin No. | GPIO | Initial setting |
|--------|---------|-------|-----------------|
| SW2 | 1 | P0.13 | On |
| | 2 | P0.14 | Off |
| | 3 | P0.15 | Off |
| | 4 | P0.16 | Off |



※DIP SW substitutes the four user buttons on the Nordic nRF52DK Board.

2.6.2 Reset Switch

Pushing the reset switch puts the MK715x1 into a reset state.



Reset Switch

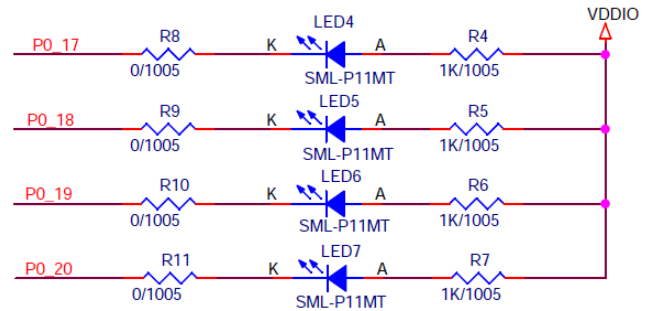
| State | Function |
|-------|--|
| ON | P0.21/nRESET = Low (Reset state) |
| OFF | P0.21/nRESET = High (Reset releas state) |

2.7 LED

2.7.1 General-purpose LED

General-purpose LEDs (green) are connected to the ports from P0.17 to P0.20. The port assignment and circuit configuration are shown below.

| No | Silkscreen Printing | port | LED active |
|------|---------------------|-------|------------|
| LED4 | P.17 | P0.17 | P0.17=Low |
| LED5 | P.18 | P0.18 | P0.18=Low |
| LED6 | P.19 | P0.19 | P0.19=Low |
| LED7 | P.20 | P0.20 | P0.20=Low |



2.7.2 Power LED

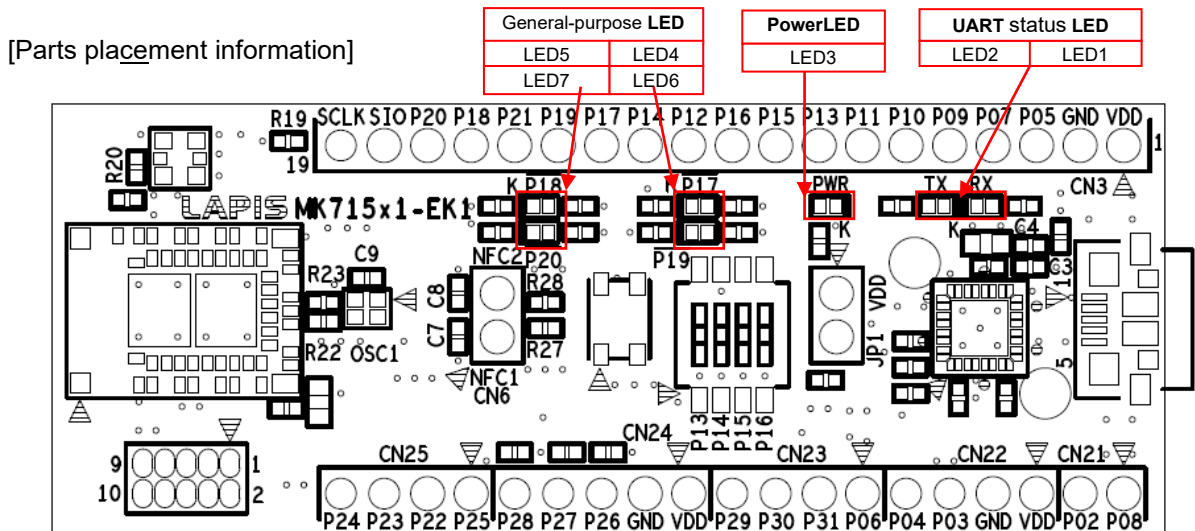
The Power LED (red) lights on when the power (VDDIO) to the MK715x1 is turned on.

| No | Silkscreen Printing |
|------|---------------------|
| LED3 | PWR |

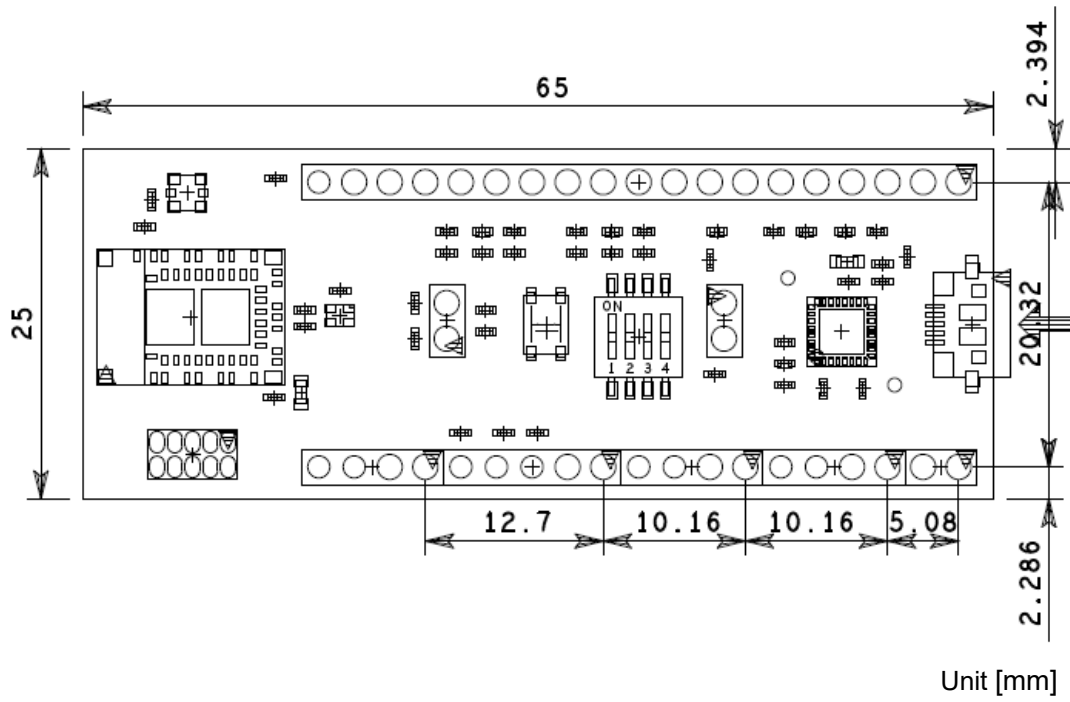
2.7.3 UART status LED

The UART status LED (green) flashes during UART transmission and reception.

| No | Silkscreen Printing |
|------|---------------------|
| LED1 | RX |
| LED2 | TX |



2.8 Outline



3. How to use sample software

The AT command application software is installed in this kit. Please prepare MK715x1 evaluation kit and smartphone application "BLE Tool". This section briefly describes the operation of the AT command application, using the MK715x1 side as a peripheral device and connecting to a central device such as a smartphone as an example.

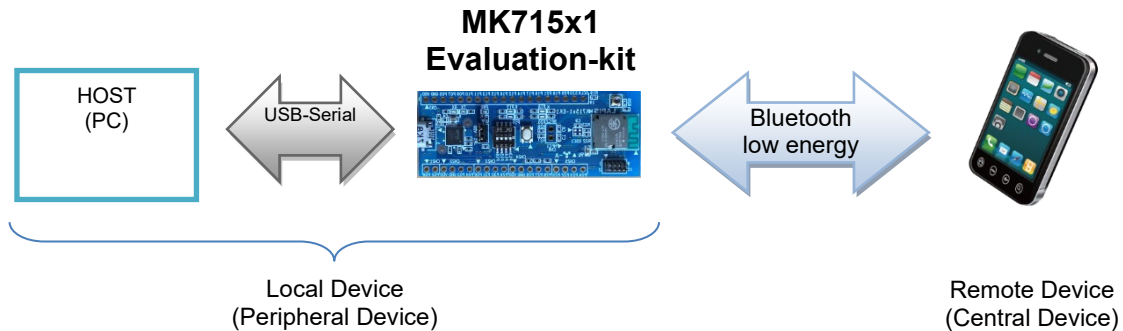


Fig. 3-1 : System configuration (when connecting to a smartphone, etc.)


Refer to "MK715x1 AT Command Application User's Manual" for detailed specifications of AT command application for MK715x1.

3.1 PC set up

- 1) Connect MK715x1EK1 and the USB port of your PC with USB cable(A-microB type). When using it for the first time, USB serial conversion IC driver should be installed. Download driver software from the following site, if necessary.
<https://www.ftdichip.com/Drivers/VCP.htm>
- 2) Start up terminal software such as Tera Term, and set the serial port as follows:

| | |
|---------------|----------------------|
| Port: | COM port number used |
| Baud Rate: | 57,600 bps |
| Data: | 8 bit |
| Parity: | None |
| Stop: | 1 bit |
| Flow Control: | Hardware |

3.2 Smartphone Set up

The application on the smartphone uses BLE . Please download and install from the following.

Google Play : https://play.google.com/store/apps/details?id=com.lapis_semi.bleapp
App Store : <https://itunes.apple.com/jp/app/ble-tool/id915714158?mt=8&ign-mpt=uo%3D4>

3.3 Terminal Software Operation

With the Dip Switch on the MK715x1 evaluation kit as the initial setting, pushing the reset button executes the AT command application. If you input "at<CR>" which is AT command for command acceptance confirmation from the terminal and then the result code string is output as shown below, UART communication between the PC and MK715x1 evaluation kit is normal. Input of "at" command is not output because echo back from MK715x1 is disabled.



Fig. 3-2 : Result code string output screen for command reception confirmation

Then, when you start the peripheral operation, type "atd <CR>" and the MK715x1 Evaluation Kit will start the advertisement transmission. Alternatively, to initiate a central operation, type "ata <CR>" and the MK715x1 Evaluation Kit will initiate a scan and search for peripheral devices. The preparation for the MK715x1 side is now complete.

3.4 BLE Tool operation

3.4.1 Application start

Tap the "BLE Tool" icon to start the application. (Fig. 3-3)



Android



iOS

Fig. 3-3: BLE Tool

3.4.2 Data communication

Bluetooth® Low Energy communication can be performed by the following steps.
For details on how to use "BLE Tool", refer to the related document "BLE Tool User's Manual".

- A) When "BLE Tool" is started, the screen in Fig. 3-4 (A) is displayed. In this screen, the central side scans and displays Bluetooth® low energy devices from the detected advertisement packets. The AT command application for MK715x1 is displayed with the device name "LapisDev" by default, so tap this.
- B) The Bluetooth® Low Energy connection procedure is executed, and the service search screen shown in Fig. 3-4 (B) is displayed. At this time, "CONNECT" is output to the terminal screen on the peripheral side. In the screen in Fig. 3-4 (B), the central side executes the service search and displays the detected services. In case of AT command application for MK715x1, two services of "Device Information" and "LAPIS Serial Port Profile" are displayed. The latter is the service used for data communication in AT command applications. Tap the "LAPIS Serial Port Profile" icon.
- C) The screen shown in Fig. 3-4 (C) is displayed. You can send and receive data on this screen. When you tap the text box displayed at the bottom of the screen, the soft keyboard is displayed, so if you input a character string from the soft keyboard and tap the "Send" button, the character string you input to the peripheral will be sent. Similarly, if you enter characters from the terminal screen on the peripheral side, it will be sent to the central side.

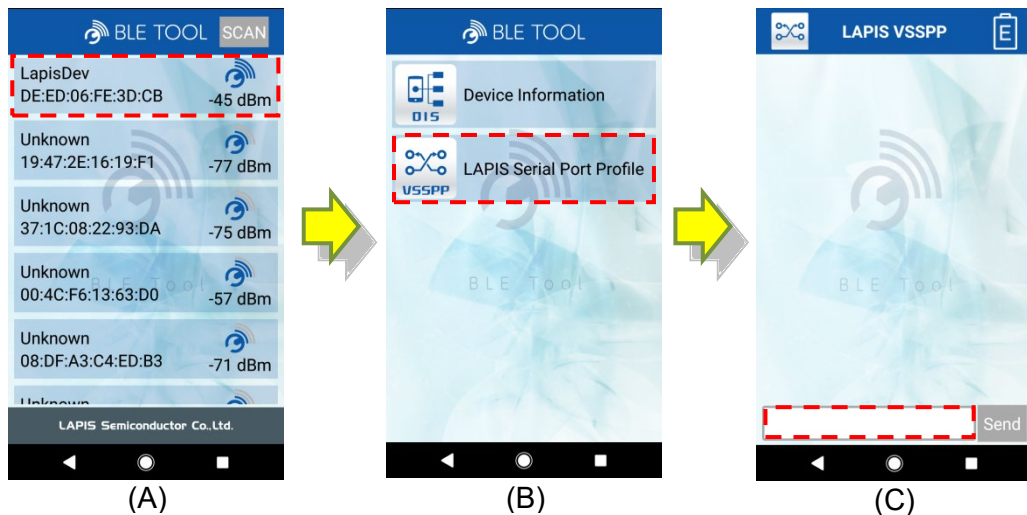


Fig. 3-4 : BLE Tool operation screen example

The figure below shows an example of performing data communication using the above procedure. The character string input from "BLE Tool" is output in black characters as shown in Fig. 3-5 (a), and the same character string is also output to the terminal on the peripheral side (Fig. 3-5 (b)). The character string input from the terminal on the peripheral side as shown in Fig. 3-5 (c) is output in red on the "BLE Tool" screen (Fig. 3-5 (d)).

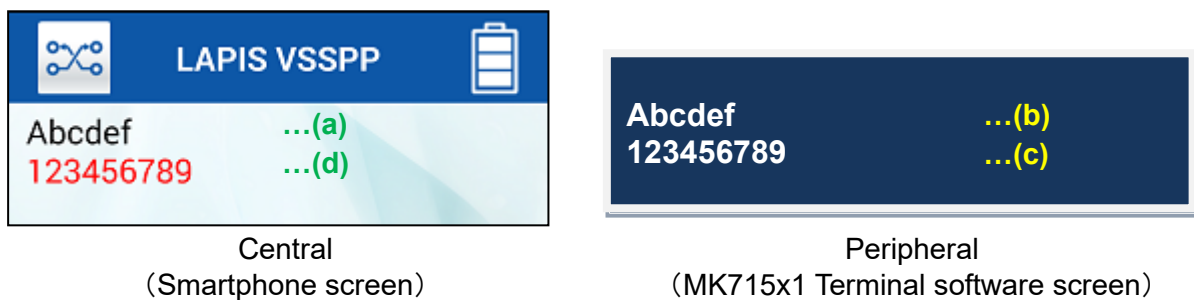


Fig. 3-5 : Example of data communication screen

3.4.3 Read device information

The AT command application for MK715x1 also provides Bluetooth SIG standard device information service (DIS). As shown in Fig. 3-6, tap the "DIS" icon on the service search screen to read the device information of the peripheral. Fig. 3-6 shows the default settings for the AT command application for MK715x1. It is necessary to change the device information according to the customer system used. For correction of device information, refer to "MK715x1 AT Command Application User's Manual".

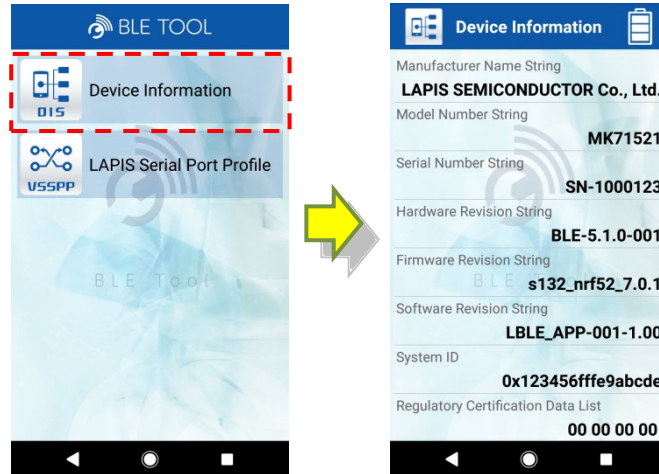
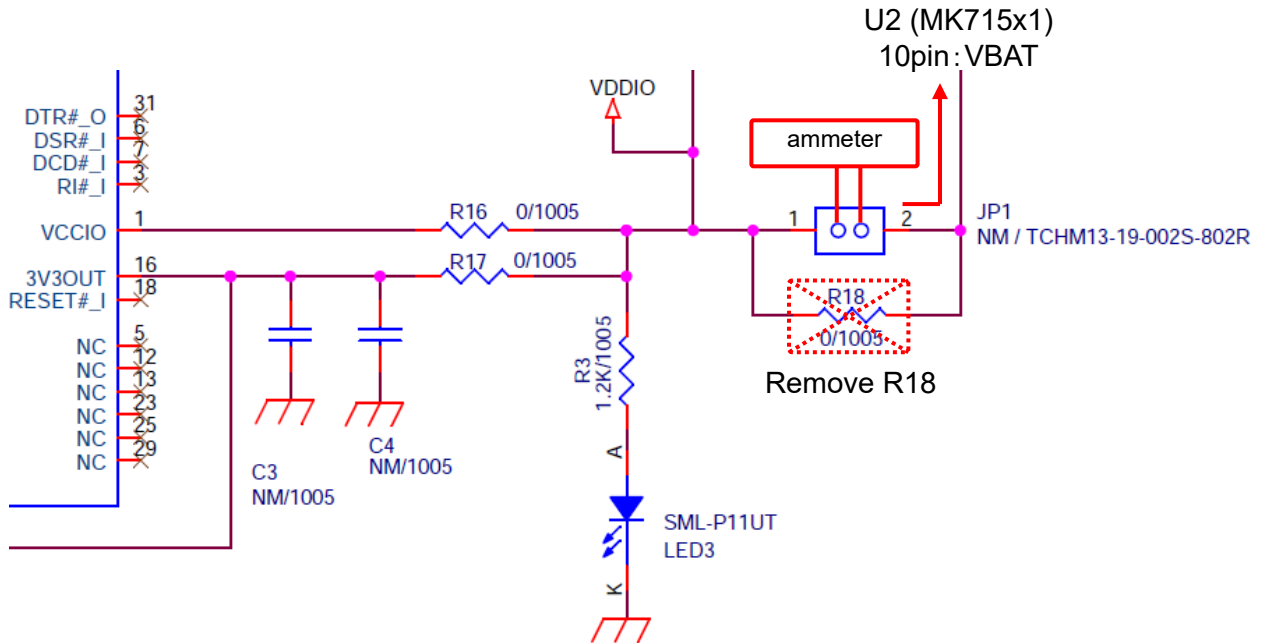


Fig. 3-6 : Device information screen example

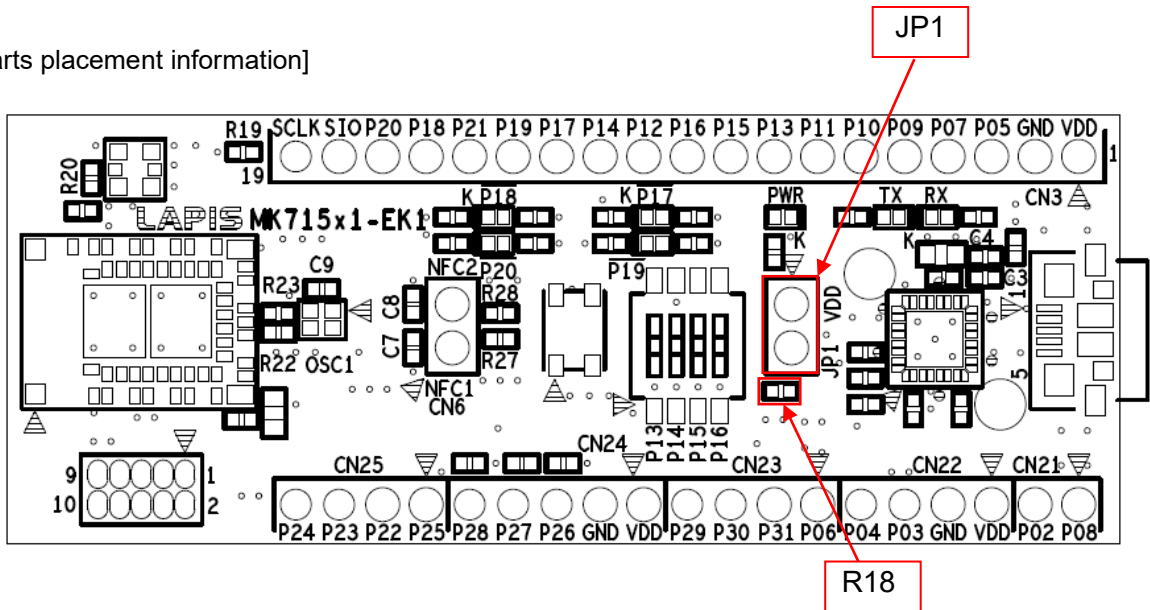
This concludes the brief explanation of how to use the AT command application for the MK715x1. For other AT command operations, refer to "3. AT Command" in "AT Command Application for MK715x1 Quick Reference Guide".

4. Current measurement method

To measure the current of MK715x1, remove the R18 and insert an ammeter between pin1 and pin2 of JP1.



[Parts placement information]



A. Appendix

A.1 Correspondence between each evaluation kit and Nordic SDK Example Project

If you use the Nordic SDK v16.0.0 Example Project, follow the table below.

| Eval. Kit Name | Applicable Nordic DK Board Type | Preferable Nordic SoftDevice | Note |
|----------------|---------------------------------|------------------------------|---|
| MK71511EK1 | PCA10056e | S112 | Some modifications are required (See A.2) |
| MK71521EK1 | PCA10040 | S132 | |

Table. A-1 : Correspondence between each evaluation kit and Nordic SDK Example Project

A.2 Example Project modification steps required for MK71511EK1

MK71511EK1's GPIO interface assignment is subjected to Nordic's PCA10040 board, so when using the Nordic SDK's Example Project with MK71511EK1, it is necessary to change the assignment of reset buttons and LEDs. The procedure is described below using the Example Project for the SEGGER Embedded Studio IDE of Blood Pressure Service of nRF SDK v16.0.0 as an example.

- 1) Open the following project file with SEGGER Embedded Studio IDE.
 <unzipped location>\nRF5_SDK_16.0.0_98a08e2\examples\ble_peripheral\ble_app_bps\pca10056e\s112\ses\ble_app_bps_pca10056e_s112.emProject
- 2) Select Project>Options from the Menu Bar.

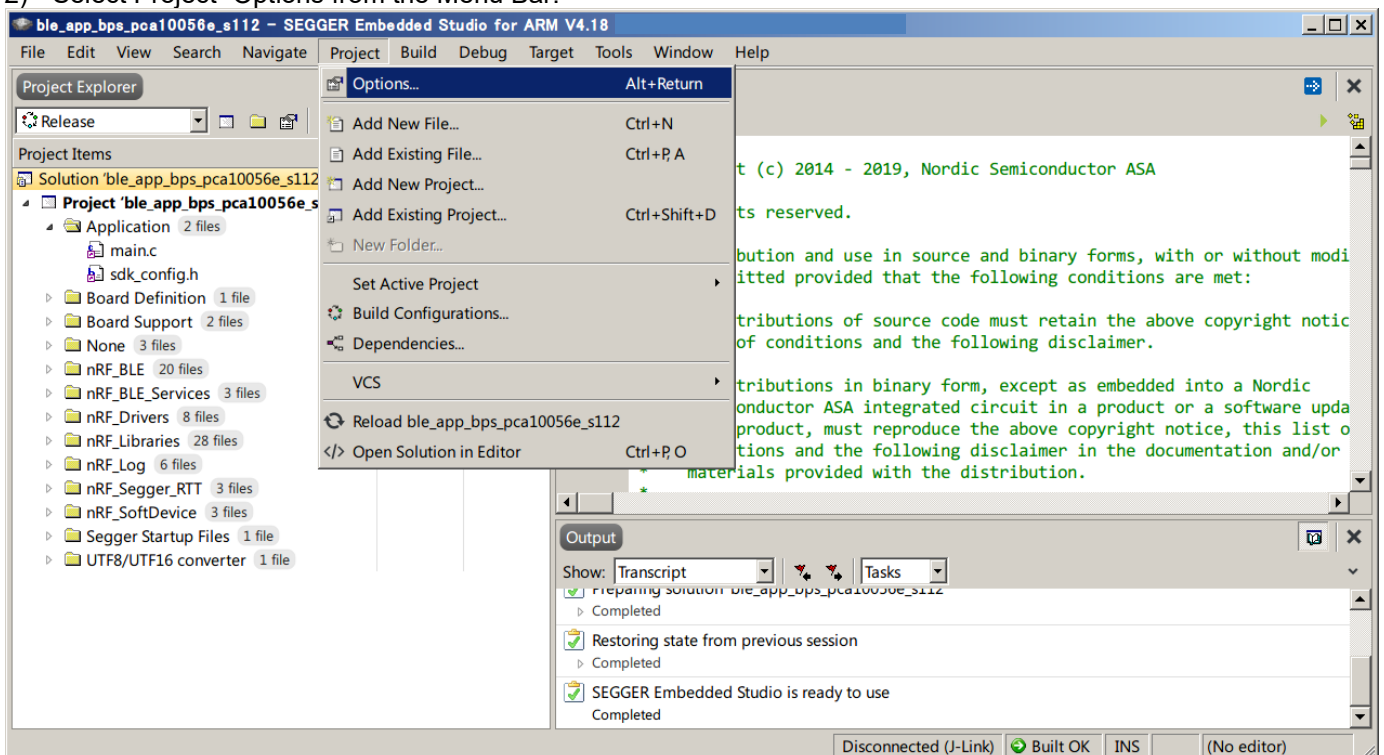


Fig. A-1 : Project "Option" settings

3) Select "Common" setting.

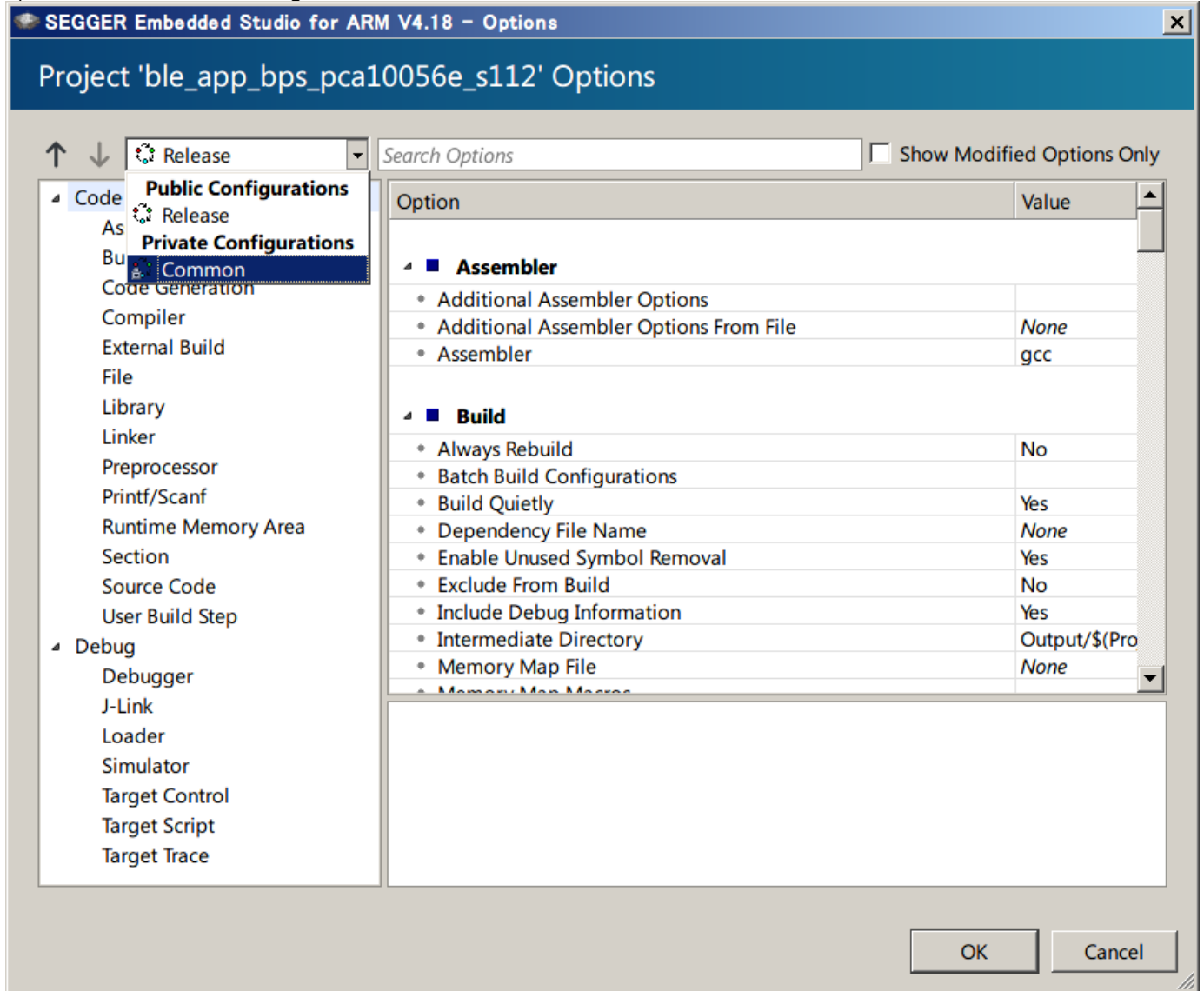


Fig. A-2 : "Common" setting

4) Select "Preprocessor" in "Code list"

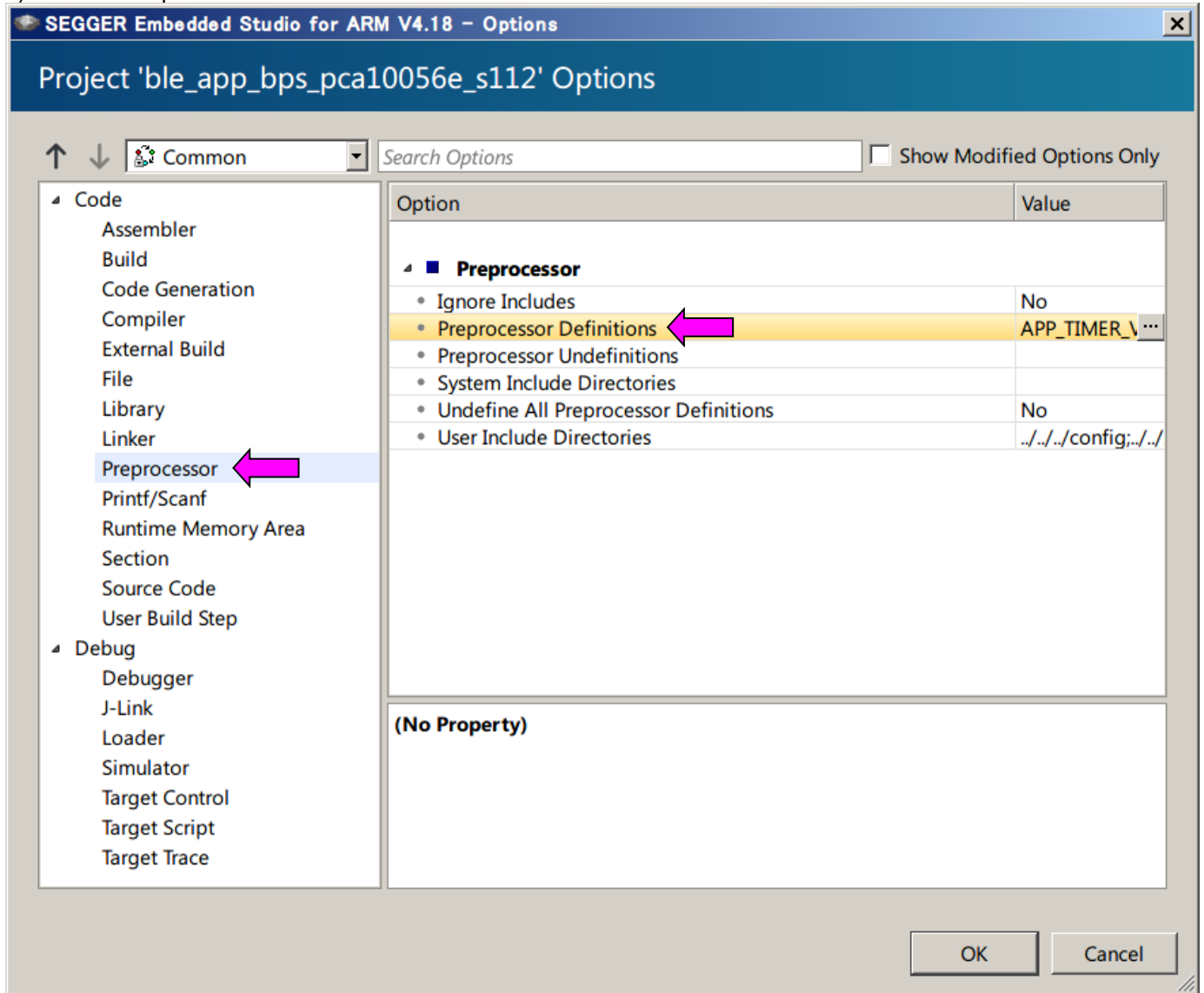


Fig. A-3: "Preprocessor" setting

- 5) Double-click "Preprocessor Definitions" to display the setting screen.

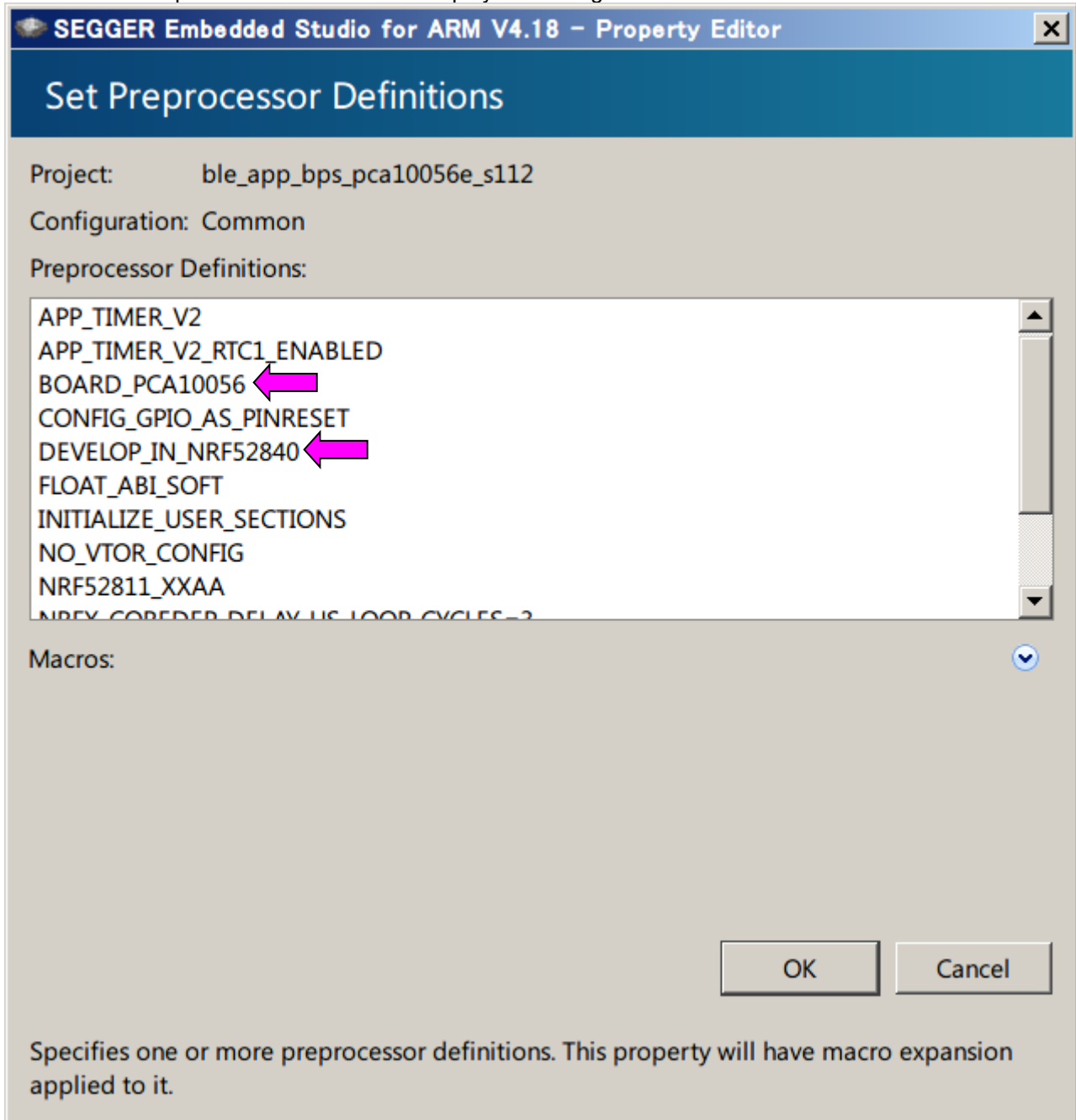


Fig. A-4: Changes to "Preprocessor Definitions"

- 6) Change "BOARD_PCA10056" to "BOARD_PCA10040".
- 7) Delete "DEVELOP_IN_NRF52840".

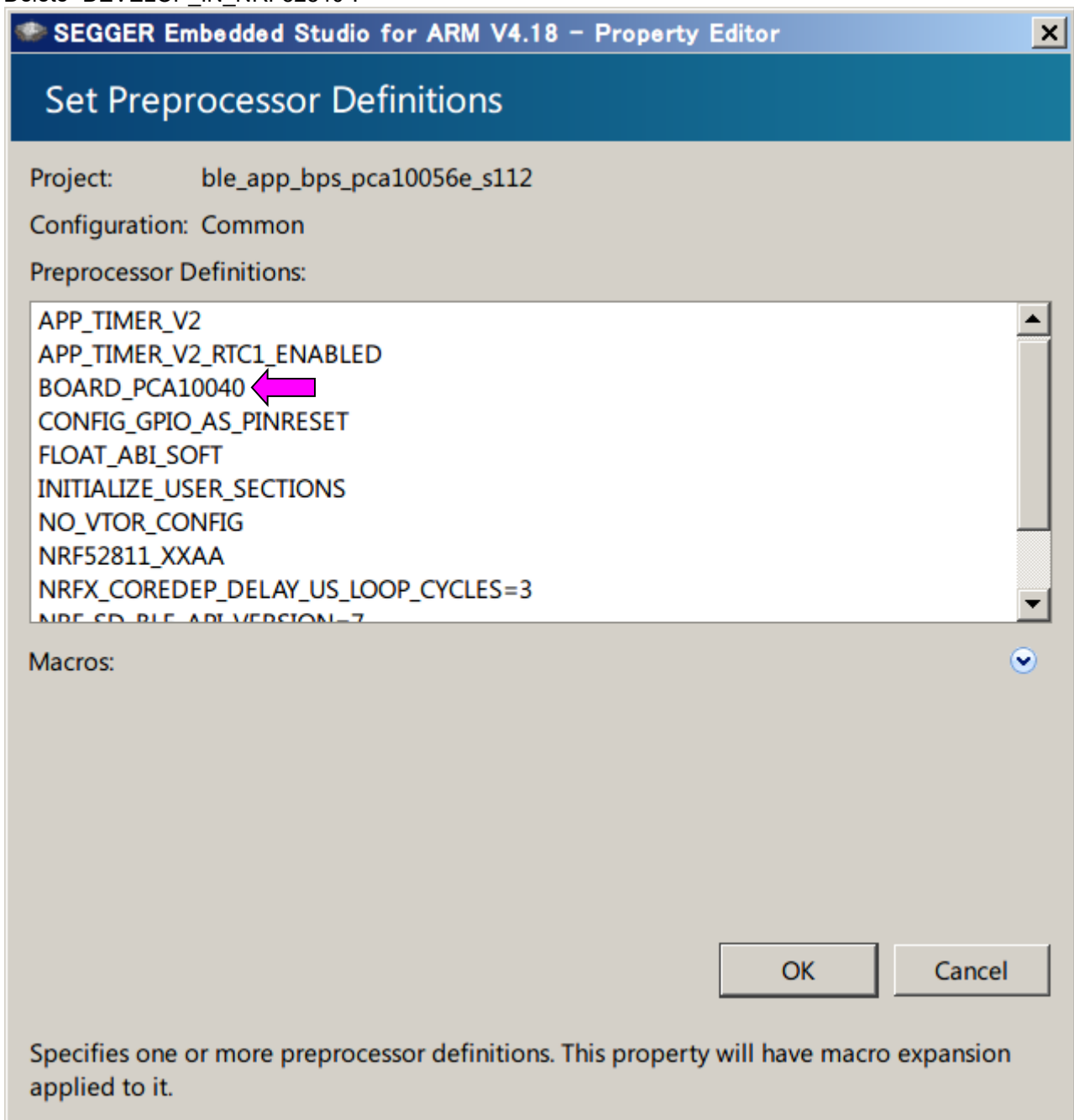


Fig. A-5: Modified "Preprocessor Definitions"

- 8) Click the "OK" button to close the screen.

Revision History

| Document No. | Issue date | Page | | Revision description |
|----------------------------|--------------|-----------------|----------------|----------------------|
| | | Before revision | After revision | |
| FEXK715x1EK1_HardManual-01 | Dec. 1, 2020 | — | — | Final first edition |

(Caution) This does not include typographical errors, changes in expressions, or corrections.