WSM-BLE241 DK 801107 Rev C User Guide

Version: 1.0

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Release Record

Version Number	Release Date	Comments
Version 0.1	10/27/2016	• Initial draft for 801107 Rev A
Version 0.2	2/17/2017	• Updated for 801107 Rev B
Version 0.3	7/7/2017	• Updated for 801107 Rev C
Version 1.0	8/18/2017	• Clarified setup for battery powered case

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1. Introduction

The MBN52832Development Kit (MBN52832DK) is an evaluation and application development kit for MBN52832 BLE Module (ordering part number WSM-BL241-ADA-008), a compact Bluetooth Smart module which combines a 2.4 GHz transceiver, an ARM Cortex-M4 CPU, flash memory, a high speed clock and an on-board antenna in a small package. MBN52832DK can serve as a software development platform for creating Bluetooth Smart and NFC-enabled systems using the Nordic nRF52 SDK [1]. This document provides the information for setting up the MBN52832DK with hardware version 801107 Rev C. Please ensure that the revision is correct prior to using this document, as shown below.

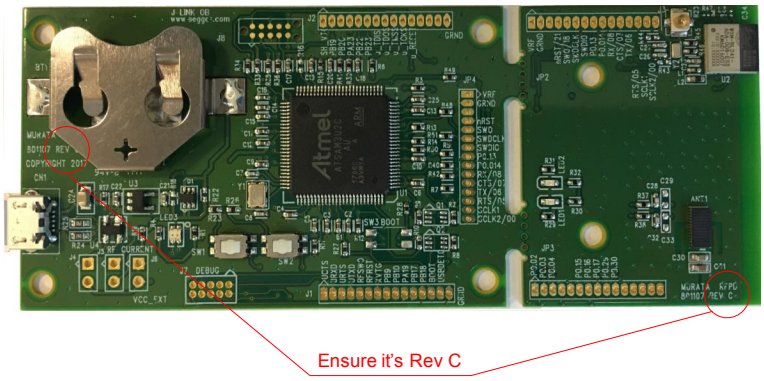


Figure 1 MBN52832 Evaluation Board Revision C

1.1 Acronyms

Acronym	Meaning
API	Application Programming Interface
BLE	Bluetooth Low Energy
EVB	Evaluation Board
MBN52832DK	MBN52832 Development Kit
FW	Firmware
GPIO	General Purpose Input/Output
NFC	Near Field Communication
PC	Personal Computer
SW	Software
SWD	Serial Wire Debug
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus

1.2 References

[1] Nordic nRF52 Series SoC (http://www.nordicsemi.com/eng/Products/nRF52-Series-SoC)

2. Setting up the MBN52832DK for Windows

The MBN52832Development Kit (MBN52832DK) supports the evaluation and development of smart IoT wireless networking products using BLE and NFC. It consists of an evaluation board (EVB), a quick start guide and this user guide. The EVB consists of two parts, the Interface Module (IM) and the Breakaway Module (BM), as shown in Figure 2. IM provides a dual USB-SWD and USB-UART interface to support firmware download and application software debugging and development; BM contains a MBN52832 module preconfigured with an onboard 2.4GHz antenna, LEDs, 32 KHz sleep clock and a NFC antenna. There is also an u.FL connector for RF evaluation. The BM can be separated from the IM and used as a standalone carrier board of MBN52832for product prototyping.

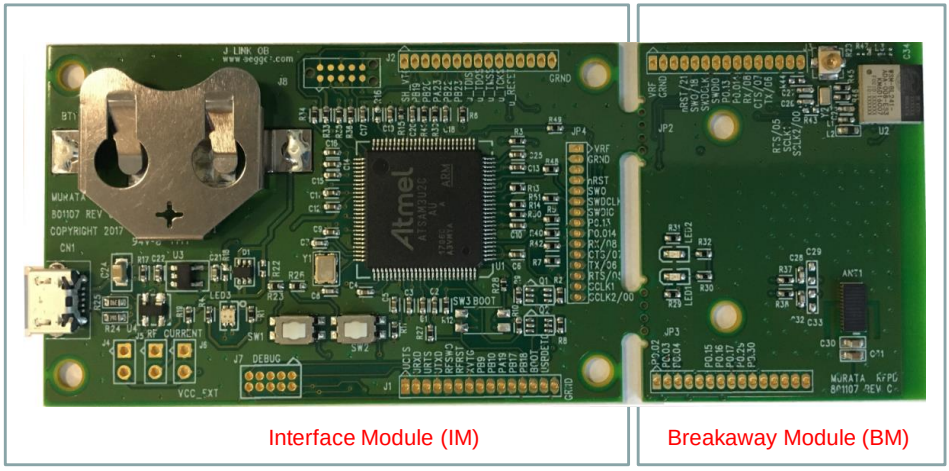


Figure 2 MBN52832 Development Kit Evaluation Board

The MBN52832DK is discussed in detail in the ensuing sections.

2.1 Interface Module (IM)

IM provides the USB-SWD and USB-UART interfaces for application development. Some major components of the Interface Module are shown in Figure 3.

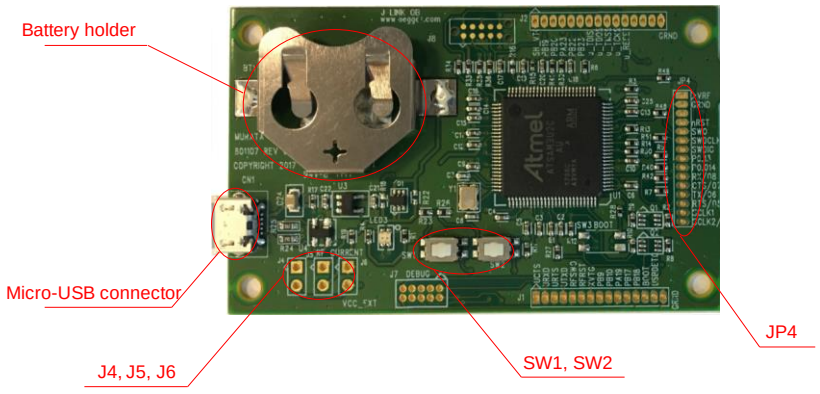
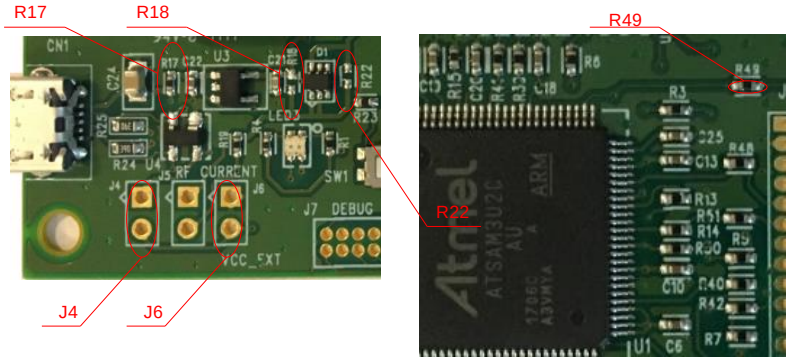


Figure 3 Interface Module (IM)

- Micro-USB connector supporting USB-SWD and USB-UART interfaces through the Atmel processor
- Coin-cell battery holder
- Application buttons (SW1, SW2)
- Pads (J4) to select power supply source between V_{USB} and V_{EXT}
- Pads (J5) to measure power consumption by the BM
- Pads (J6) for extern 5V power supply (V_{EXT})
- Pads (JP4) to access select I/O pins of the BM

2.1.1 EVB power supply selection

The EVB power can be provided by a USB host, an external 5V supply or a coin cell battery. By default, USB is selected as the power source for the EVB; R17 is installed. Using a different supply requires the modifications listed in Table 1.



EVB power source	Remark
USB	By default, R17 is installed, both R18 and R22 are not installed and the USB source is selected. • Install the 0Ω resister R17 or short J4 if that is installed • Ensure that either R22 is removed or a coin cell battery is not installed • Connect micro-USB interface to host
External 5V DC	The following modifications are required: • Remove R17 • Open J4 if that is installed • Ensure that either R22 is removed or a coin cell battery is not installed • Connect GND and VCC_EXT (J6) to external 5V supply
CR2032 battery	The following configuration modifications are needed: • Remove R18 if that is installed. • Remove R49. Reinstall R49 for FW download/JTAG debugging. • Insert a fresh CR2032 battery in the battery holder.

Table 1 EVB power supply selection

2.1.2 Application buttons

The two buttons (SW1 and SW2) on the IM are connected to MBN52832 on the BM. The buttons SW1 and SW2, respectively, are connected to P0.13 and P0.14 on the module.

2.1.3 IM-BM interface header pads

IM provides header pads (JP4) for select module I/Os. Depending on the application needs, the resisters listed below may be removed to disconnect the associated module pins from the IM board so those pins may be controlled by the nRF52 firmware. P0.13 and P0.14 are connected to switches on the IM, so they may be used by the application without further modification if the switches are not pressed.

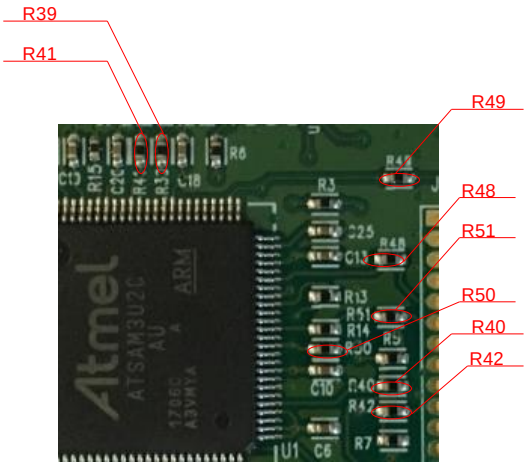


Figure 4 Location of resisters connecting IM to module

Connection	MBN52832 pins
R39	P0.05
R40	P0.06
R41	P0.07
R42	P0.08
SW1	P0.13
SW2	P0.14
R48	P0.18
R49	P0.21
R50	SWDIO
R51	SWDCLK

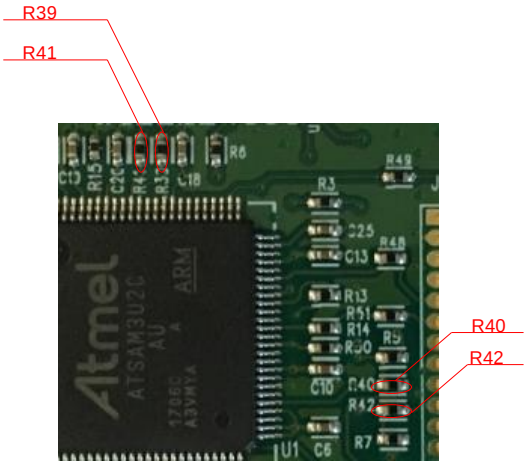
Table 2 IM-module IO interface

2.1.4 Programming and debug interface

The EVB provides a mechanism for programming and debugging applications on the MBN52832 module using tools such as nRFgo studio and J-Link through the USB-SWD interface as detailed in Section 2.4.

2.1.5 UART interface

The EVB also provides a serial interface to the MBN52832 module through the USB-UART interface. Resisters R39 – R42 may be removed to disconnect the USB-UART interface. The signal connections are listed below.



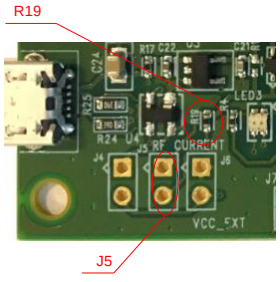
Resistor	MBN52832 pins	MBN52832 Signal	Remark
R39	P0.05	RTS/	Connect to host CTS/
R40	P0.06	TXD	Connect to host RXD
R41	P0.07	CTS/	Connect to host RTS/
R42	P0.08	RXD	Connect to host TXD

Table 3 UART interface

2.1.6 Power consumption measurement

The power consumed by the out-of-box configured Breakaway Module (BM) can be measured by one of the following methods:

1. Remove all the resistors shown in Figure 4 (details in Table 2) to isolate the BM and then apply a 3.3V power meter at VCC_nRF (J5.2) and note the power consumed. IM is not powered.
2. Remove R19 and all the resistors shown in Figure 4 (details in Table 2) to isolate the BM and then measure the current across J5. IM is powered by any of the 3 power sources.



3. Breaking off the BM and measure current applied to VCC_nRF.

2.2 Breakaway Module (BM)

The Breakaway Module (BM) contains a MBN52832 module preconfigured with an onboard 2.4GHz antenna, two LEDs, 32 KHz sleep clock and a NFC antenna. There is also an u.FL connector for RF evaluation and header pads to access the I/O pins of the module. BM can be separated from the IM and used as a standalone carrier board of MBN52832 for product prototyping.

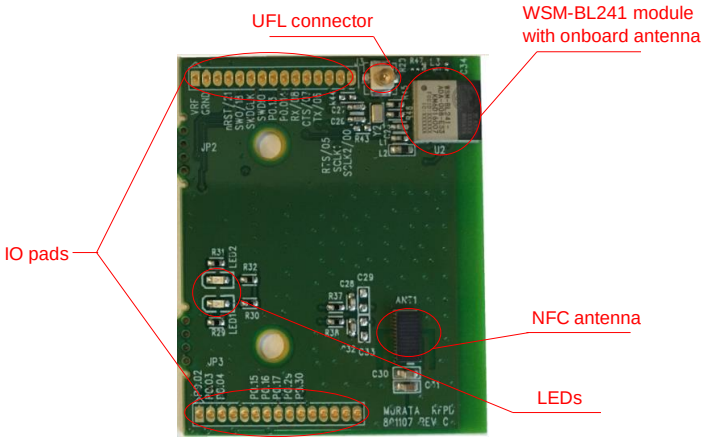


Figure 5 Breakaway Module (BM)

Some major components of the BM are shown in Figure 5.

- MBN52832 module supporting Nordic nRF52 SDK
- 2.4GHz antenna for BLE application
- NFC antenna for NFC tag
- 2 LEDs
- u.FL connector for RF testing
- Pads for accessing MBN52832 IO pins

2.2.1 32KHz clock

The 32KHz clock is connected to P0.00 and P0.01 on the module. If this clock is not needed, then resisters R43 and R44 may be installed and R45 and R46 removed to free these pins for application usage.

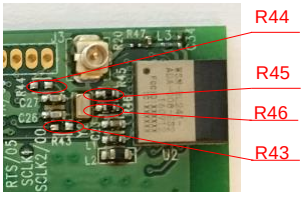


Figure 6 R45 and R46 on the BM

2.2.2 2.4GHz antenna configuration

The out-of-box configuration of the MBN52832DK uses the onboard 2.4GHz antenna for the application; there is also an u.FL connector for RF evaluation. Antenna selection is based on the configurations shown below.

Selection	R20	R47	L3	Description
Onboard antenna	open	1.0 pF	1.1 nH	Default configuration
u.FL connector	0Ω	open	open	RF testing usage

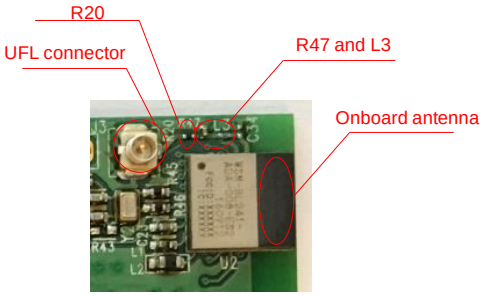


Figure 7 2.4GHz antenna selection

2.2.3 NFC antenna

The NFC antenna is connected to P0.09 and P0.10 on the module. If NFC is not used, then resisters R37 and R38 may be removed to free these pins for application usage.

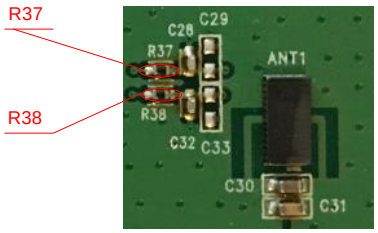


Figure 8 R37 and R38 on the BM

2.2.4 Application LEDs

BM has 2 LEDs. LED1 and LED2, respectively, are connected to P0.17 and P0.18 on the module. An LED is turned on by driving the respective IO pin low (0). Resisters R29 and R31, respectively, may be removed to disconnect LED1 and LED2 from the module IO pins.

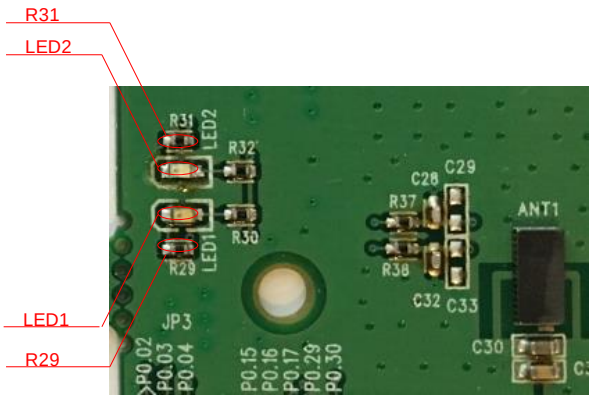


Figure 9 R29 and R31 on the BM

2.2.5 Module IO header pads

The BM provides header pads (JP2 and JP3) for select module I/Os. The resisters listed below may be removed to free the associated module pins so they may be controlled by the nRF52 firmware. In the default configuration where the BM board is attached to the IM board, additional resisters on the IM board may also need to be removed (Section 2.1.3).

MBN52832 pins	BM pad	BM resister	IM Connection
VCC	JP2: VCC_nRF		VCC_nRF
GND	JP2: GND		GND
P0.00	M_SCLK2/P0.00	R45, R44	
P0.01	M_SCLK1/P0.01	R46, R43	
P0.02	JP3: P0.02		
P0.03	JP3: P0.03		
P0.04	JP3: P0.04		
P0.05	JP2: P0.05/RTS		R39
P0.06	JP2: P0.06/TX		R40
P0.07	JP2: P0.07/CTS		R41
P0.08	JP2: P0.08/RX		R42
P0.09	NFC1/P0.09	R37	
P0.10	NFC2/P0.10	R38	
P0.13	JP2: P0.13		SW1
P0.14	JP2: P0.14		SW2
P0.15	JP3: P0.15		
P0.16	JP3: P0.16		
P0.17	JP3: P0.17	R29	
P0.18	JP2: P0.18/SWO	R31, R48	SWO
P0.20	JP3: P0.20		
P0.21	JP2: P0.21/nRST	R49	nRST
P0.29	JP3: P0.29		

Table 4 BM module IO pads

2.3 Connect and test the MBN52832DK

Use the following steps to test the MBN52832DK with the out-of-box configuration.

1. Power up the board through a micro USB cable connected to a PC. Ignore any “Found new USB device” message on the PC for now. The default MBN52832DK firmware only needs the USB interface to provide the +5V power. The USB drivers are described in the Section 2.4.
2. Confirm that LED1 is pulsating.

3. Use buttons SW1 and SW2 to choose between LED1 and LED2.
4. Hold a NFC enabled smart phone close to the NFC antenna to read the URL stored in the module.
5. Grant the request when the phone prompts for permission to open the URL. The smart phone browser should then display a web page to the Nordic DK similar to the one shown below.

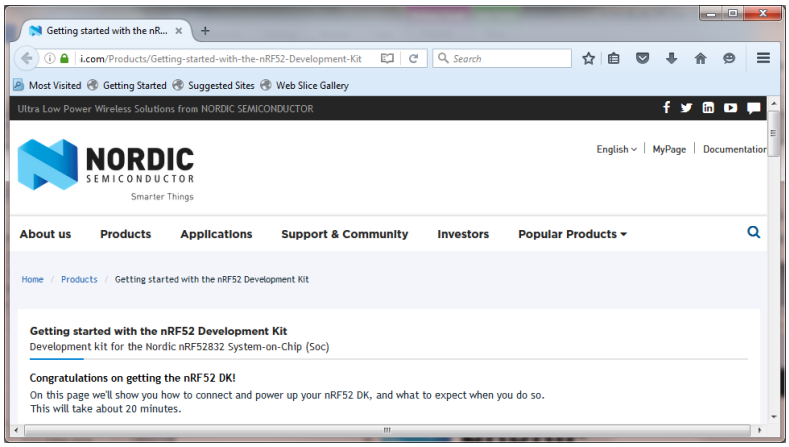


Figure 10 Sample nRF52 DK webpage

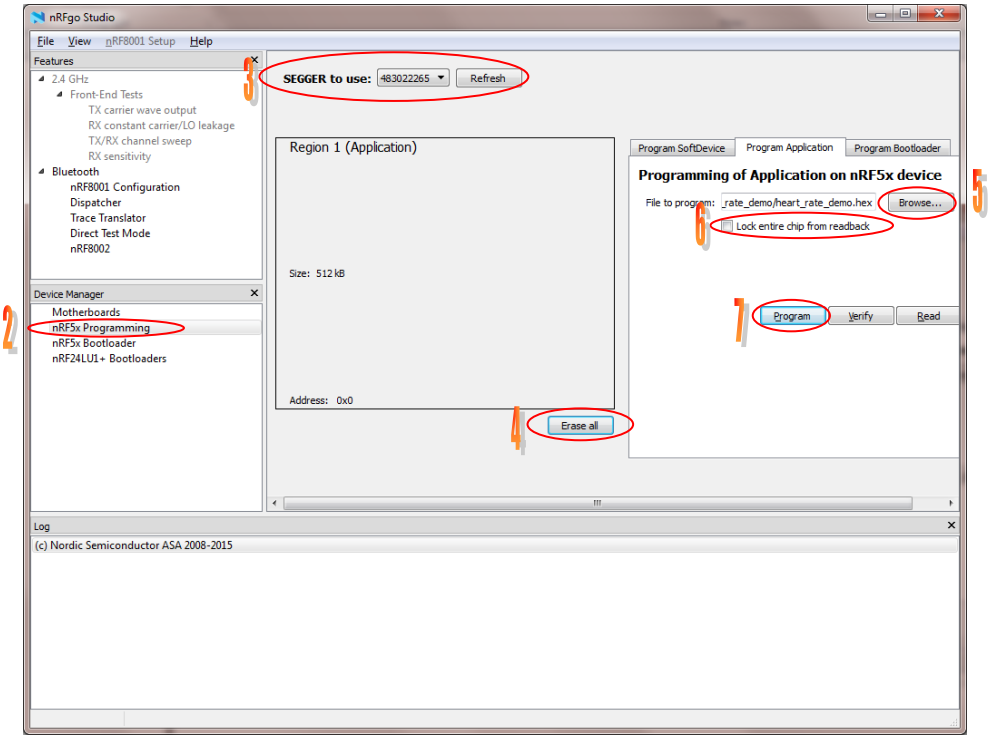


Figure 11 nRFgo Studio

The nRFgo Studio tool can be used to erase this preloaded application and program the MBN52832DK with another hex binary image. Install the nRFgo Studio on a PC and use the following step to update the firmware:

1. Connect the MBN52832DK to the PC with a micro USB cable and wait until the drivers are installed
2. Launch the nRFgo Studio on the computer; in the nRFgo Device Manager pane, select the "nRF5x Programming" option. If this option greyed out, then most likely the drivers are not yet installed. Close nRFgo, wait until the drivers are installed, and launch nRFgo again.
3. Select the correct SEGGER entry with the ID matching the MBN52832DK
4. Click the "Erase all" button to clear everything in the flash memory
5. Select the Program Application tab. Click "Browse..." to select the HEX file to program
6. Unselect the option "Lock entire chip from readback"
7. Click Program, which will program the HEX file onto the selected module

2.4 Application development

The MBN52832 Development Kit (MBN52832DK) is designed to facilitate application development using the Nordic nRF52 SDK. The MBN52832DK EVB supports the same J-Link USB-SWD and USB-UART interfaces as those provided by the nRF52 DK, so the software debugging and development process can follow that used for the nRF52 DK. Users can develop their own applications on the EVB by using the following steps:

1. Download and install the latest nRF52 SDK and Keil MDK-ARM or Eclipse tool chains.
2. Create and compile an application
3. Load the application into the EVB
4. Run and debug the application

Go to the Nordic Infocenter for details on nRF52 application development. This section provides the sample configuration for Windows 7 users.

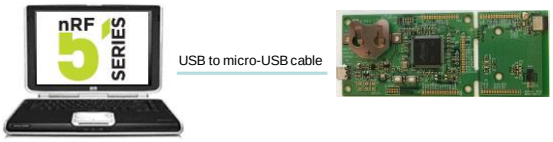


Figure 12 Configuration for application development with nRF52 SDK

2.4.1 MBN52832DK compatibility with nRF52 SDK

The EVB has both a 2.4GHz and an NFC chip antenna onboard; it also provides a 32 KHz slow clock along with 2 buttons and 2 LEDs. These interfaces are mapped to the default configuration used for the nRF52 DK, as described in Table 5 below. Any nRF52 SDK application, such as radio_test, that uses only these resources can be downloaded to the EVB and executed with no modification necessary. Additional module IOs can be accessed as described in Section 2.2.5.

nRF52 DK name	MBN52832DK name	nRF52 pin	Remark
Button1	SW1	P0.13	Application button
Button2	SW2	P0.14	Application button
LED1	LED1	P0.17	Drive low to turn on LED
LED2	LED2	P0.18	Drive low to turn on LED
NFC1	NFC1	P0.09	NFC antenna input

NFC2	NFC2	P0.10	NFC antenna input
XL1	M_SCLK2	P0.00	32 KHz slow clock
XL2	M_SCLK1	P0.01	32 KHz slow clock
CTS	UCTS	P0.05	Connect to host CTS/
RxD	URxD	P0.06	Connect to host RXD
RTS	URTS	P0.07	Connect to host RTS/
TxD	UTxD	P0.08	Connect to host TXD

Table 5 MBN52832DK and nRF52 DK signal map

2.4.2 Connect the MBN52832DK Evaluation Board

The EVB connects to the PC through USB. The USB interface provides +5V power as well as individual SWD and UART interfaces to the EVB. This is the same as that provided by the nRF52 DK. Plug the EVB into the development PC with a USB cable; the drivers for these interfaces should automatically load.

2.4.3 Verifying USB Driver Installations

Verify that installation of the drivers was successful by checking the Device Manager window. Follow the steps below to open the Device Manager window:

1. For Win 7, select **Windows Start Button->Control Panel->Hardware and sound->Device Manager**.
2. The J-Link driver should be under *<computer-name>\Universal Serial Bus controllers* as shown in the screen capture below.
3. The UART Serial Port should be under *<computer-name>\Ports (COM & LPT)* as shown in the screen capture below.

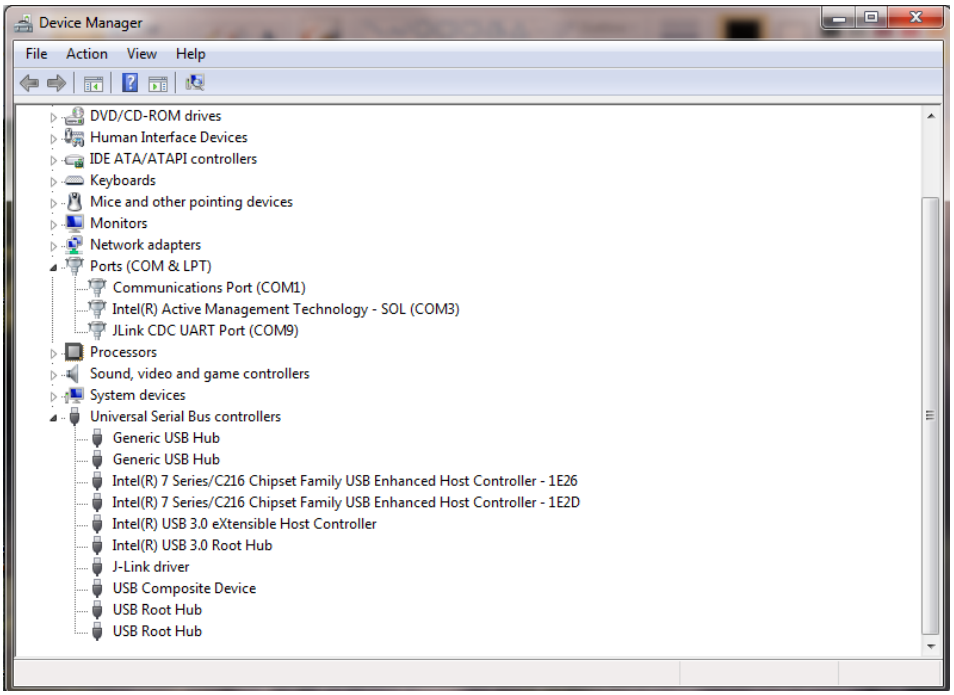
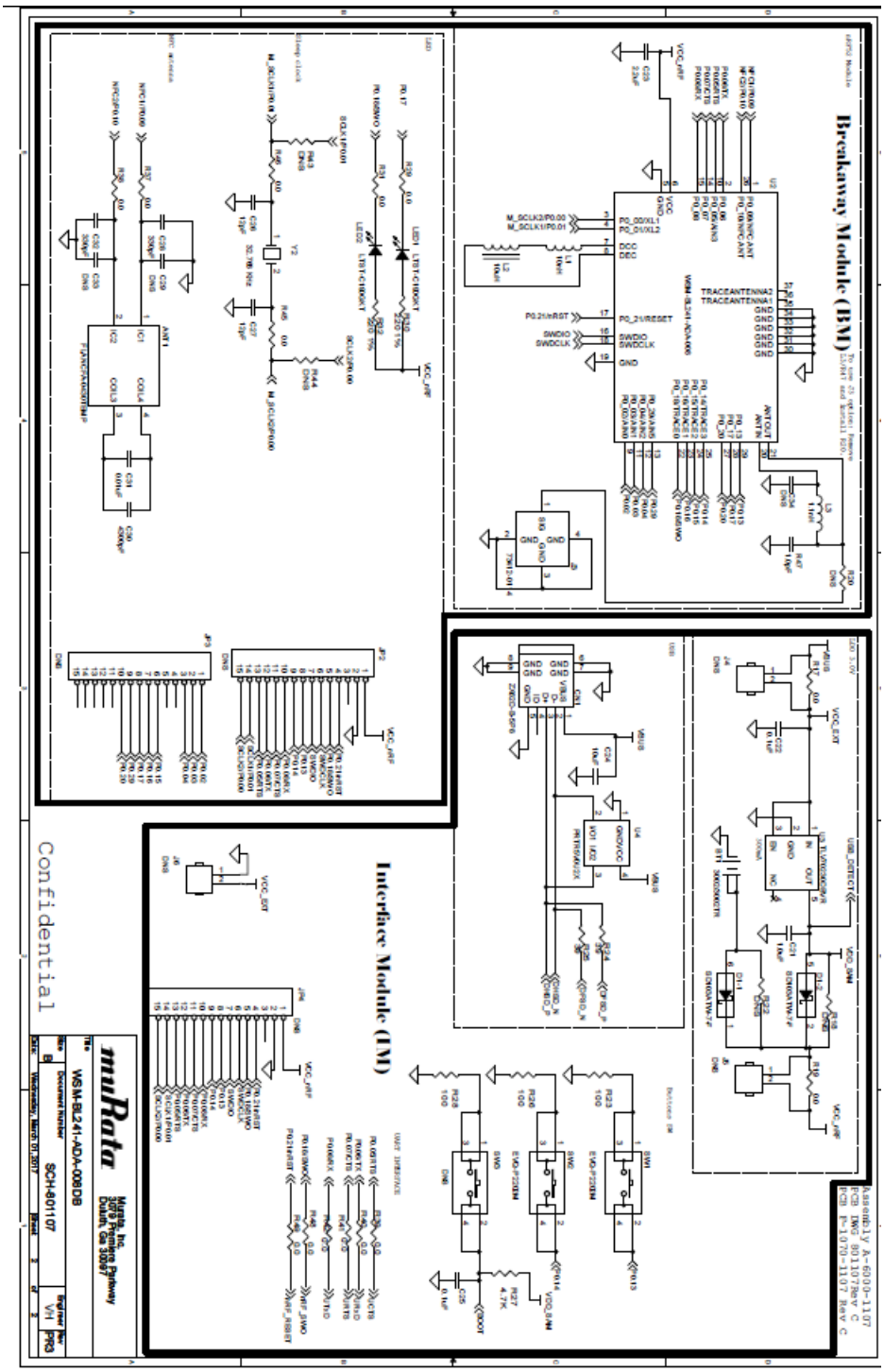


Figure 13 Screenshot showing installed J-Link drivers

3. EVB schematic

The schematic for the module interfaces on the EVB is as shown below.



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