Migrating to the latest nRF51822 chip version

nWP-018

White Paper v1.2

This document describes what to consider when migrating to one of the latest nRF51822 versions from a previous version of the chip during development and/or production.

The new versions of nRF51822 are:

- QFAA (FA, GC, and G0)
- QFAB (B0)
- CEAA (CA, DA, D0)

1 Introduction

The latest nRF51822 versions are now available to purchase. These latest versions of the chip include a substantial amount of new features and improvements. Because of the significant improvements in these versions, there are some factors you need to be aware of when migrating from an earlier version of nRF51822 to one of these latest versions.

This document addresses those factors by cataloging the documentation, design files, and software associated with each build code (version) and then describing some common product development scenarios and giving recommendations for them.

A list of the improvements and new features on the latest versions of nRF51822 are documented in *PCN-082 v1.0*. For details on fixed anomalies see the *nRF51822 PAN*.

When making a product based on an nRF51 series chip, it is always recommended to use the latest version of the chip. If a new version of a chip is released during your development cycle you should consider migrating to that version.

1.1 Documentation

The following documentation is important reference material in regards to version differences of the chip:

Document	Description
nRF51 SDK documentation release notes	This is available in the Documentation subfolder of the SDK installation folder. It is recommended to read this when upgrading the SDK.
S110 nRF51822 SoftDevice release notes	It is recommended to read this when upgrading the SoftDevice.
nRF51822 Product Specification	Contains a description of the hardware, modules, and electrical specifications specific to the nRF51822 chip.
nRF51 Series Reference Manual	Contains a functional description of all the modules and peripherals supported for all the chips in the nRF51 series.
nRF51822 PAN	The Product Anomaly Notice (PAN) describes product anomalies present in the chip, and shows which anomalies are fixed between versions of the chip.
PCN-082	The Product Change Notice (PCN) shows the changes from one version to the next. These changes are not anomaly fixes, but could still be important to know about when moving to a new version.

2 How to identify the hardware version

There are several ways that you can identify the hardware version of your chip.

Markings on the chip

The quickest way to identify the hardware version of the chip is by looking at the markings on the chip. If you have access to a chip (including a chip on a PCB from a development kit or evaluation kit) simply read the markings on the top. See Chapter 10 'Ordering information' in the *nRF51822 Product Specification* for details on package markings.

Figure 1 *Chip markings on the top of the chip*

Using nRFgo Studio

By using nRFgo Studio, it is also possible to read the hardware version of a chip that is on a PCB from a development or evaluation kit and connected to a computer. ***Figure 2*** shows you where to find the hardware version (highlighted in red) in nRFgo Studio:

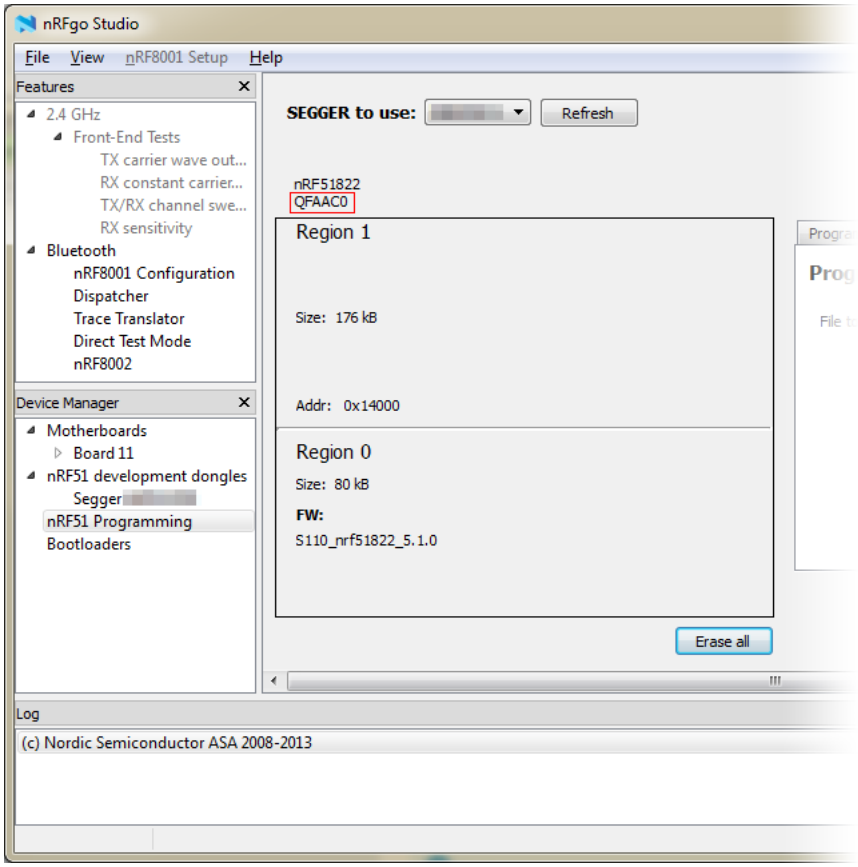

Figure 2 *Location of hardware version details (highlighted in red) in nRFgo Studio*

Reading the HWID field in the CONFIGID register

The HW version can also be found by reading out the HWID field in the CONFIGID register of the FICR (see chapter 4 "*Memory*" and chapter 6 "*Factory Information Configuration Registers (FICR)*" in the *nRF51 Series Reference Manual* for more details on the FICR).

The easiest way to do this is to use the J-Link debugger hardware together with the nrfjprog command line tool, which is available if you have installed the nRF51 SDK:

1. Open the Windows command line, and navigate to the default nrfjprog folder, **c:\program files (x86)\Nordic Semiconductor\nrf51\bin**.
2. Run the following command: `nrfjprog--memrd 0x1000005C --n 4`.
3. If you have more than one nRF51822 board connected a window appears allowing you to select between the boards.
4. The HWID is the four last hexadecimal digits of the return value.

Figure 3 *nrfjprog used to read out the HWID, in this case the result is 0x001D*

3 nRF51822 compatibility matrix

Table 1 describes the version of documentation, design files, software, SoftDevice, and nRF51 SDK that should be used with each nRF51822 version of the chip.

Device marking			**Documentation**			**Design files**			**Software**		**S110 SoftDevice**	**nRF51 SDK**
Packet/ Variant	Build code	HWID	PS[1]	RM[2]	PAN	DF[3]	DF-ST[4]	CEAA-DF[5]	MCP	nRFgo Studio		
QF AA	CA	001D	v1.x	v1.x	Use the latest version	v2.1	v1.0	n/a	Use the latest version	Use the latest version	v5.x.x and v6.x.x[6]	v4.x.x
	C0	001D										
	FA	002A	v2.x	v2.x			[7]				v5.2.x and v6.x.x	v4.4.2 and v5.x.x
	GC	0044										
	G0	003C										
CE AA	BA	0020	v1.x	v1.x		n/a	n/a	v1.1			v5.x.x and v6.x.x[6]	v4.x.x
	B0	002F										
	CA	0040	v2.x	v2.x							v5.2.x and v6.x.x	v4.4.2 and v5.x.x
	DA	0047										
	D0	0x004D										
QF AB	AA	0026	v1.x	v1.x		v2.1	v1.0	n/a			v5.x.x and v6.x.x[6]	v4.x.x
	A0	0027										
	B0	0x004C	v2.x	v2.x			[7]				v5.2.x and v6.x.x	v4.4.2 and v5.x.x

1. PS = Product Specification
2. RM = Reference Manual
3. DF = Design Files, nRF51822 Reference Layout files
4. DF-ST = nRF51822 Reference Layout files with ST Microelectronics balun
5. CEAA-DF = nRF51822-CEAA Reference Layout files for the wafer level chip scale package
6. v6.x.x will be compatible but not production level tested on these chip variants. See the S110 SoftDevice release notes for more details on features and compatibility.
7. Currently, there is no valid version of this reference design available.

Table 1 *nRF51822 compatibility matrix*

4 Telecommunications regulatory requirements and *Bluetooth* certifications

The reference design nRF51822-DF passes all requirements from telecommunications regulatory bodies and shows the same or better performance on all spurious emissions with the stated product changes for nRF51822 QFxx.

A reassessment of design performance is required for any product not identical to nRF51822-DF to confirm that there is no impact on compliance with teleregulatory requirements.

A reassessment means comparing measurements on your design using the build codes that already have teleregulatory approval (QFAA C00/QFAB B00) with the new build codes (QFAA G00/QFAB C00):

- QFAA devices: Compare build code C00 with G00.
- QFAB devices: Compare build code A0 with B00.

Consider the measurement accuracy when you are evaluating the results. Using ETSI as an example: If the results of the comparison are within the ETSI guidance published in the document "ETSI EN 300 328 v1.8.1 (2012-04)" then the measurements are considered equal.

If the levels are found to be different on your design but are still within regulatory limits, please contact Nordic technical support for guidance.

Bluetooth QDID B020654, which is valid for the old nRF51822 build codes, is also valid for the latest nRF51822 build codes. *Bluetooth* RF PHY conformance reassessment is recommended for all designs not identical to this QDID reference design. Comparison of *Bluetooth* PHY results (conducted using a *Bluetooth* tester unit) on PCB boards with chips that have the older build code (QFAA C00 or QFAB B00) and the new build code (QFAA G00 or QFAB C00) form the basis of this reassessment.

5 Recommendations

It is recommended to migrate to the new version of the nRF51822 chip as soon as possible. How to do that depends on which of the following scenarios apply.

Note: It is important to thoroughly test a new design before entering production.

Scenario 1:

Development started out on an earlier version of the nRF51822 chip but production has not yet started.

Recommendation:

Get the development or evaluation kit that is based on the latest version of the nRF51822 chip and migrate the design to the latest version before entering production.

If the existing development is based on an SDK or SoftDevice that is not compatible with the new chip version, it is necessary to update the design to use the updated SDK and/or SoftDevice, see ***Table 1*** on page 5.

To take full advantage of the new features and improvements in the new chip version it is recommended to use the very latest versions of the SDK and the SoftDevice.

When upgrading to a new major version of either the SDK or the SoftDevice it might be necessary to make some changes to the application software to make it work. For example, migrating from version 4.x.x to 5.x.x of the SDK constitutes a change in the major version number, and can include API changes that will break backwards compatibility with existing software. Please see the SDK release notes for more details on the changes from between SDK versions.

For details on hardware changes and qualification requirements when migrating from the old to the new version, see ***Chapter 4 "Telecommunications regulatory requirements and Bluetooth certifications"*** on page 6.

Scenario 2:

Development started out on an older version of the chip and production has already started based on this version.

Recommendation:

There are two options that you can choose from:

- Migrate to the very latest version of the SDK and SoftDevice to take advantage of all new features. When doing this it is critical that both the design and the chip version is updated at the same time in the production line, or incompatibilities between the chip and the design could occur.
- Migrate to a version of the SDK and SoftDevice that supports both the old and new version of the chip, see ***Table 1*** on page 5. This will not provide access to the features available in the latest software, but will ensure that the design could be updated in production right away without having to wait for inventory on the new chip version.

In either case it is critical that the design is updated before the new version of the chips enter the production line.

5.1 Hardware recommendations

The external 12k pull down resistor on the SWDCLK line are now internal and can be removed.

6 Summary

It is always recommended to use the latest versions of the hardware, SDK, and SoftDevice. In addition to useful new features most hardware and software updates bring with them critical bug fixes which, if not handled, could cause issues for the end product.

Once you have taken into account the considerations covered in this document, the migration from an earlier version to one of the latest versions of the nRF51822 chip should be a relatively seamless process.

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May 2014	1.2	Removed note in Introduction.
January 2014	1.1	**Updated content:** • *Chapter 4 "Telecommunications regulatory requirements and Bluetooth certifications"* on page 6.
November 2013	1.0	First release.