
BlueNRG-MS radio stack images versions

By Raffaele Riva

Main components	
BlueNRG-MS	Bluetooth Low Energy Network Processor supporting Bluetooth 4.1 core specification
SPBTLE-RF	Very low power module for Bluetooth Smart v4.1

Purpose and benefits

The BlueNRG-MS device is a very low power Bluetooth low energy (BLE) single-mode network processor, compliant with the Bluetooth SIG specification v4.1. The entire Bluetooth low energy stack runs on the embedded Cortex M0 core. The non-volatile Flash memory allows in-the-field stack upgrades. The devices interface with an external microcontroller using the SPI transport layer. The BlueNRG-MS comes pre-programmed with a production-ready stack image, whose version may change in production from time to time without notice. The software version of the preloaded stack image can be retrieved through a specific API command. New stack image firmware, published in software packages with part number "STSW-BNRG-Vxy", may be made available by ST in the future and will be offered free-of-charge to end users at www.st.com. End users will be able to upgrade parts with the newly downloaded stack image through the ST provided software tools and reference code. Firmware is provided in binary form because it is not intended for users to do modifications.

The purpose of this design tip is to provide customers with a reference for understanding the naming convention on the ST-official radio stack releases and the corresponding information obtained through specific API commands. This will ease the tracking of different radio stack versions.

Cyclic Redundancy Check (CRC) values are provided per version for reference.

The entire content of this design tip applies to both the BlueNRG-MS and the SPBTLE-RF devices with no modifications.

Description

The stack image follows a specific naming convention: "BlueNRG-MS FW version vX.Yz", where X and Y correspond to the Major and Minor version respectively, and z corresponds to the patch version.

In the naming convention, X and Y are numbers and z is a letter. For example, an official stack image could be named “BLE Stack Image Release v7.1a”.

The API command (available in the BlueNRG-MS driver library) for retrieving the information on the current radio stack image is:

```
uint8_t status = hci_le_read_local_version(uint8_t *hci_version, uint16_t *hci_revision,
uint8_t *Imp_pal_version, uint16_t *manufacturer_name, uint16_t *Imp_pal_subversion)
```

where:

```
uint8_t status;
```

```
uint8_t hci_version, Imp_pal_version;
```

```
uint16_t hci_revision, manufacturer_name, Imp_pal_subversion;
```

In the BlueNRG-MS driver library, a helper function is available (in the file *bluenrg_utils.c*), named:

```
uint8_t getBlueNRGVersion(uint8_t *hwVersion, uint16_t *fwVersion)
```

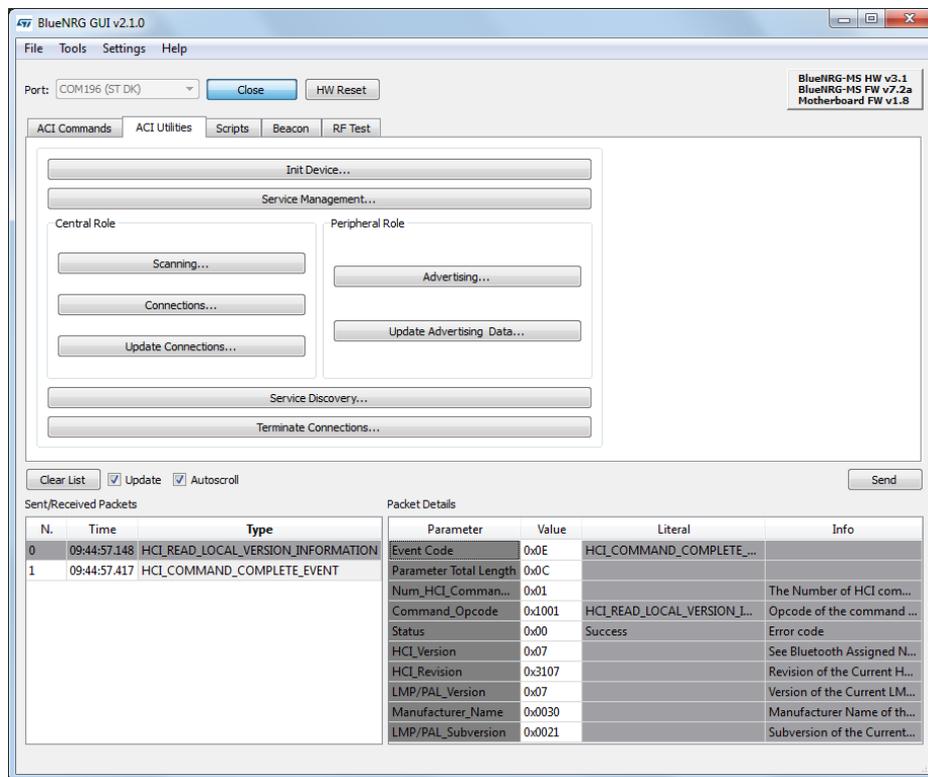
This function elaborates the *hci_le_read_local_version* output, combining the fields *hci_revision* and *Imp_pal_subversion* in order to provide the *fwVersion* variable in hex format following the convention reported in the Table 1:

Table 1: FW versions rules

FW version name	<i>hci_revision</i>	<i>Imp_pal_subversion</i>	<i>fwVersion</i>
7.1a	0x07	0x0011	0x0711
7.1c	0x07	0x0013	0x0713
7.1e	0x07	0x0015	0x0715
7.2a	0x07	0x0021	0x0721
7.2c	0x07	0x0023	0x0723

Alternatively, the customer can use the BlueNRG-MS GUI to gather the same information, as in the screenshot of Figure 1.

Figure 1: BlueNRG GUI capture



Another interesting aspect for consideration is the CRC value of the different radio stack images. It is helpful for the application to validate the radio stack image in cases where the application performs a radio stack upgrade.

The radio stack structure, consisting of 33 Flash pages, is depicted in Figure 2 below.

Figure 2: BlueNRG-MS stack structure



The BlueNRG-MS Flash base address is 0x10010000 and each page is 2kB.

Page #32 (address 0x10020000) is the Information Registers (IFR) sector that remains unchanged for all FW versions. Page #31 (address 0x1001F800) can be modified during the device lifecycle of the application after performing BLE operations like bonding. These two pages should be excluded from the CRC calculation, for these reasons.

In Table 2, the CRC values are reported for the different radio stack versions. These CRC values are calculated from page #0 to page #30 inclusive, and after programming the *BlueFlag* word at the Flash address 0x100108C0 (for further details, refer to the Application Note AN4491 on www.st.com).

Table 2: CRC values for each radio stack version

FW version	CRC value
7.1a	0x8A2172CB
7.1c	0xF3802BF7
7.1e	0xCCE0EFE8
7.2a	0x810866B9
7.2c	0xDD72E58A

IMPORTANT NOTE: With FW 7.1a, the first page (page #0) of the flash is empty. With firmware 7.1c/e, this page is used to store the DIV value, the ER and IR root keys (for bonding), and the static random address, which is randomly generated by the stack during the first call to the ACI_GAP_INIT command. This changed with FW 7.2a onwards, where the first page has valid user code. Root keys and the static random address are stored inside IFR sector (page #32).

To program the stack image with FW v7.2a onwards, the customer needs to then program the stack image starting from page #0 (base 0x10010000). In the earlier versions, page #0 could be skipped in order to minimize the upgrade time and keep the root keys and static random address (only for 7.1c/e).

Support material

Documentation
Datasheets: BlueNRG-MS SPBTLE-RF Application Notes: AN4491: BlueNRG, BlueNRG-MS updater
Embedded Software: STSW-BNRG-V71A: BLE Stack Image Package Release v7.1a STSW-BNRG-V71C: BLE Stack Image Package Release v7.1c STSW-BNRG-V71E: BLE Stack Image Package Release v7.1e STSW-BNRGUI: BLUENRG family GUI

Revision history

Date	Version	Changes
9-Dec-2016	1	Initial release

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2016 STMicroelectronics – All rights reserved