BL600 / BL620 MEMORY MAP OVERVIEW FOR 'C' DEVELOPERS

Application Note *v1.0*

INTRODUCTION

The goal of this document includes the following:

- Explain Laird's custom allocation of nRF51822 flash memory in Laird's BL600 and BL620 modules
- Explain Laird's allocation of RAM onboard the BL600 and BL620 modules

OVERVIEW

The BL600 and BL620 modules contain Nordic Semiconductor's nRF51822 silicon and the table below outlines the various versions that Laird has implemented.

Module	Rev.	Firmware	Nordic HW Variant	SoftDevice/Version	Flash (KB)	RAM (KB)
BL600-Sx	-01	1.1.50.0	nRF51822-QFAA-C0	S110 v5.0.0	256	16
BL600-Sx	-02	1.2.54.0	nRF51822-QFAA-C0	S110 v5.1.0	256	16
BL600-Sx	-03	1.3.57.0	nRF51822-QFAA-C0	S110 v5.2.0	256	16
BL600-Sx	-04	1.5.66.0	nRF51822-QFAA-G0	S110 v5.2.1	256	16
BL600-Sx	-05	1.5.70.0	nRF51822-QFAA-G0	S110 v6.0.0	256	16
BL620-Sx	-01	12.4.14.0	nRF51822-QFAA-G0	S120 v1.0.0	256	16

Nordic supplies the 256 kb variant used by Laird with its storage allocated into two regions:

- Region 0 – The BLE software stack from Nordic (softdevice) which is mandatory for BLE: 80 kb
- Region 1 – The application, bootloader, and app data: 176 kb

An illustration of this allocation is provided in the Appendix of this guide (Figure 1). However, this memory is re-allocated by Laird on the BL600 and BL620 to suit the *smart*BASIC environment. The 16 kb of RAM onboard the BL600 and BL620 modules is also precisely allocated. It's important to understand how and why this memory is allocated, as well as design considerations that may arise from these conditions.

FLASH MEMORY ALLOCATION ON BL600 / BL620

The chip's flash memory is allocated as shown in Table 1.

Table 1: Memory Allocation on BL600 and BL620

#	Region	Size	Notes
1	Nordic BLE stack	80 kb	Required for BLE operation.
2	*smart*BASIC Engine	100 kb	In continuous development, and growing between firmware versions.
3	File System	36 kb	32 kb of this is available, and 4 kb is reserved. This memory is used for *smart*BASIC application and data files. It is slightly larger on BL620 (check with command AT I 6).
4	Non-volatile data store	8 kb	Since 20 bytes are required for the header of each record, effective capacity may be much lower, even as low as 30% in cases of a high number of small records (check with command AT I 16).
5	Trusted Device Database	4 kb	Storage of BLE keys
6	Write Once Read Many database	~16 kb	Stores data which cannot be erased unless the entire flash is erased.

Flash Memory Considerations

Laird's experience in extensive support of customer implementations has shown that the largest *smart*BASIC applications are no larger than 20 kb, suggesting that 32 kb of file system storage is sufficient.

However, in some cases the 4 kb of non-volatile data store (separate from general file system) may be too small for some implementations. In this event, Laird recommends you include an external I2C or SPI-based serial EEPROM in your design. This allows for around 256 kb of non-volatile data store. Additionally, *smart*BASIC contains the high-level API to read and write to and from I2C ports, meaning you don't need to write low-level drivers to manage this data store. Sample code can be found on Laird's GitHub repository:

- Real Time Clock I2C Sample Code

RAM Allocation on BL600 / BL620

The BL600 and BL620 contain 16 kb of RAM, however the BL620 allocates 2kb less memory to the heap than the BL600. This difference is necessitated by a slightly larger Bluetooth stack on the BL620. The memory is allocated as described in Table 2.

Table 2: RAM allocation on BL600 / BL620

Region	Size	Notes
Softdevice	8 kb (BL600) 10 kb (BL620)	
Microcontroller Stack	2 kb	Stack Pointer
*smart*BASIC Engine	2 kb	Internal use to service runtime engine
Heap	4 kb (BL600) 2 kb (BL620)	Used by *smart*BASIC application (variables, UART buffers, etc)

RAM Considerations

Some applications require a very high amount of the module's RAM. One such use case is applications that feature a high number of characteristics (~30) in the GATT table. There are optimizations that may ease the strain of large numbers of GATT table characteristics. Contact EWS Support for more details at either the BL600 or BL620 support pages at http://laird-ews-support.desk.com.

APPENDIX I: NORDIC DEFAULT MEMORY MAP

Nordic's default allocation of the 256 kb of memory onboard the nRF51822 XLR2 is shown in Figure 1. Note that Laird's custom re-allocation largely involves remapping region 1, leaving region 0 largely untouched (see Note below).

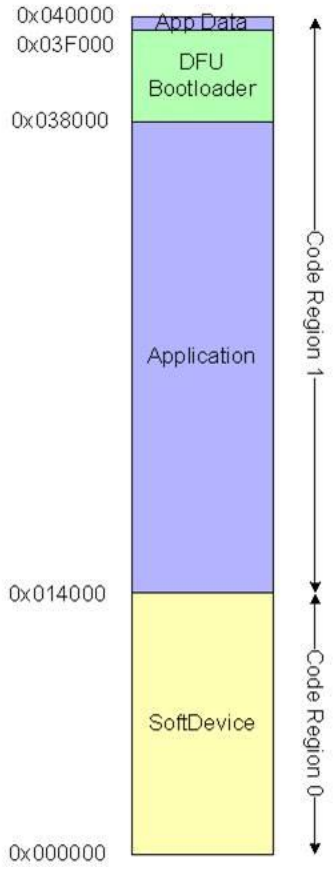

Figure 1: Nordic default memory allocation onboard nRF51822 XLR2

Note: As of firmware versions after 1.5.70.0, the DFU bootloader will be replaced by a master bootloader, effectively decommissioning this memory space and freeing it up for general use by *smart*BASIC.

REVISION HISTORY

Version	Date	Notes	Approver
1.0	15 May 2015	Initial Release	Jonathan Kaye