Firmware Upgrade Application User Guide

Application Note for 32-bit NuMicro® Family

Document Information

Abstract	介紹如何在M2354的架構下實作Firmware Upgrade的應用。
Apply to	NuMicro® M2354 Series.

For additional information or questions, please contact: Nuvoton Technology Corporation.

www.nuvoton.com

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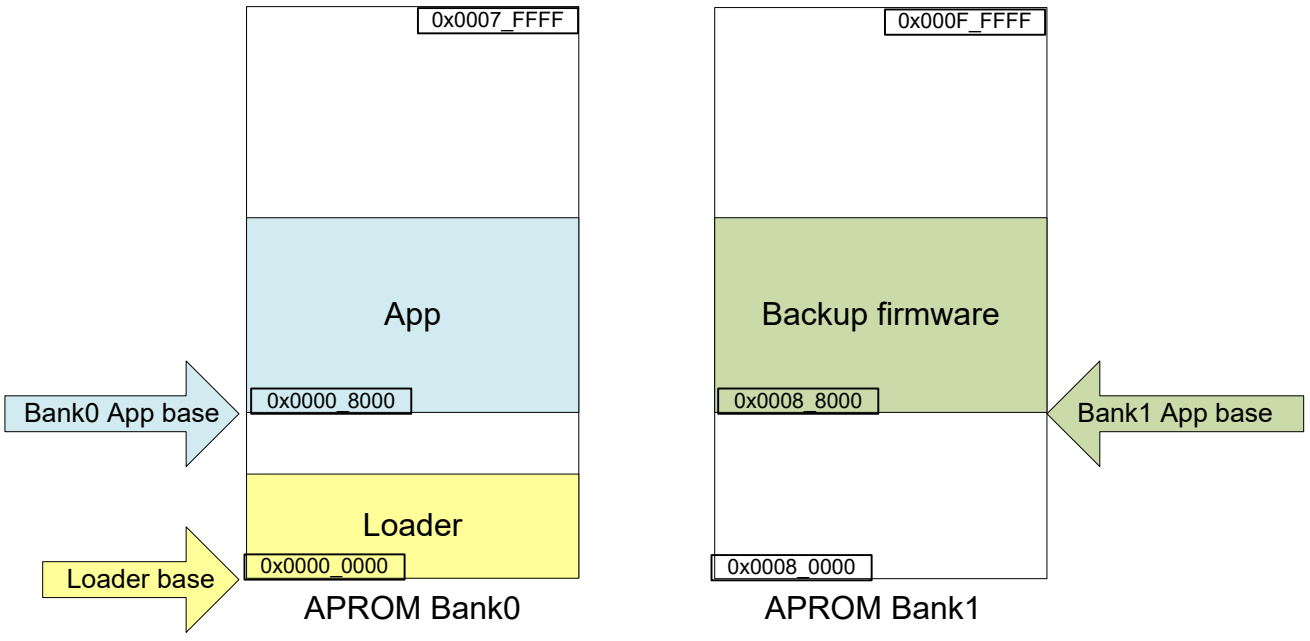
1 Sample Code架構

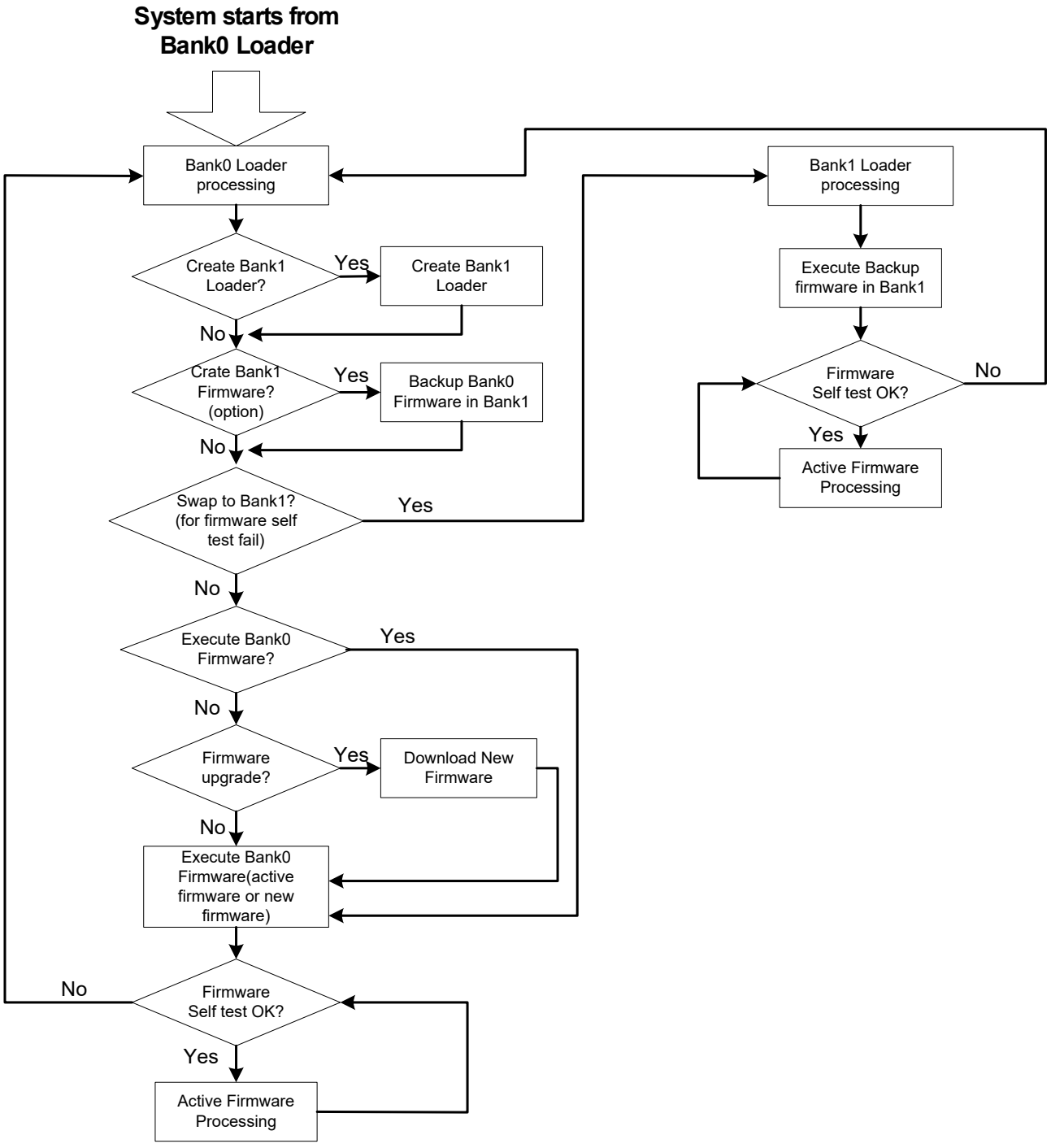
M2354 BSP提供了一個 firmware upgrade的應用程式，位於:
\bsp\SampleCode\StdDriver\FMC_FwUpgradeApplication。

這個應用程式主要是在M2354的Dual Bank APROM架構下，實作一個firmware upgrade的應用。主要有以下三個程式：

- BackupApp: 可正確執行的備份程式，放置於 APROM Bank1 的程式執行區，亦即下圖中的 Bank1 App base。
- Loader: 執行系統啟動和 firmware upgrade 的控制流程，放置於 APROM Bank0 起始位址，亦即下圖中的 Loader base。
- App: 可執行程式，放置於 APROM Bank0 的程式執行區，亦即下圖中的 Bank0 App base；可能為 active firmware 或 new firmware。



系統控制流程如下:


System starts from Bank0 Loader
Bank0 Loader processing
Create Bank1 Loader?
Yes
Create Bank1 Loader
No
Crate Bank1 Firmware? (option)
Yes
Backup Bank0 Firmware in Bank1
No
Swap to Bank1? (for firmware self test fail)
Yes
No
Execute Bank0 Firmware?
Yes
No
Firmware upgrade?
Yes
Download New Firmware
No
Execute Bank0 Firmware(active firmware or new firmware)
Firmware Self test OK?
No
Yes
Active Firmware Processing
Bank1 Loader processing
Execute Backup firmware in Bank1
Firmware Self test OK?
No
Yes
Active Firmware Processing

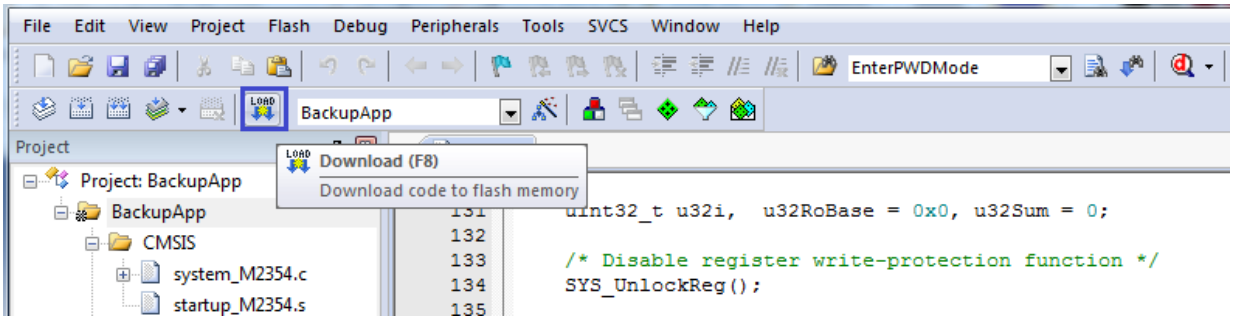
2 Firmware Upgrade Sample Code操作步驟

在執行程式前，先定義操作步驟中所使用到的firmware名詞：

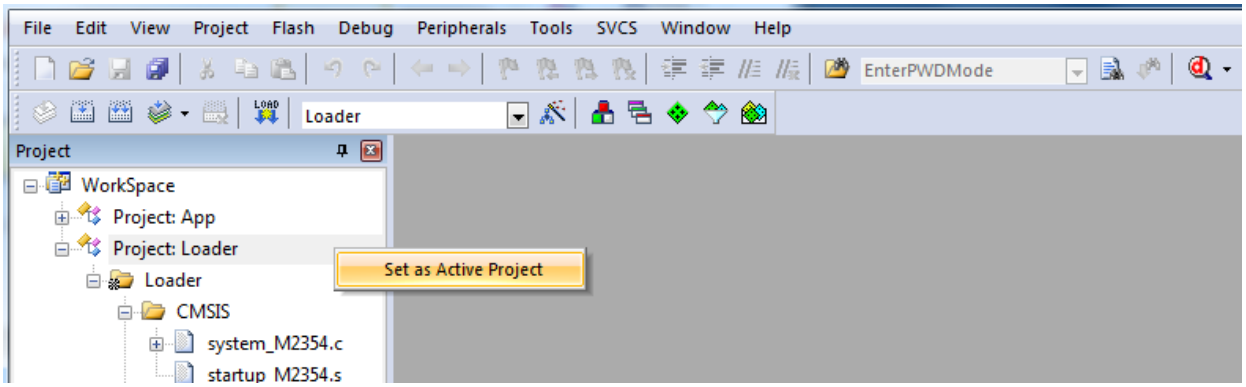
- Active firmware： 一開始放置於 Bank0 App 區的 firmware，也是在一般情況下系統執行的 firmware。
- New firmware：執行 firmware upgrade 所載入的新版 firmware。
- Backup firmawre：當 Active firmware 或 New firmware 執行失敗時，讓系統可重新正常執行的備份 firmware。

首先，先將備份的可執行程式載入到Bank1 的程式執行區域：

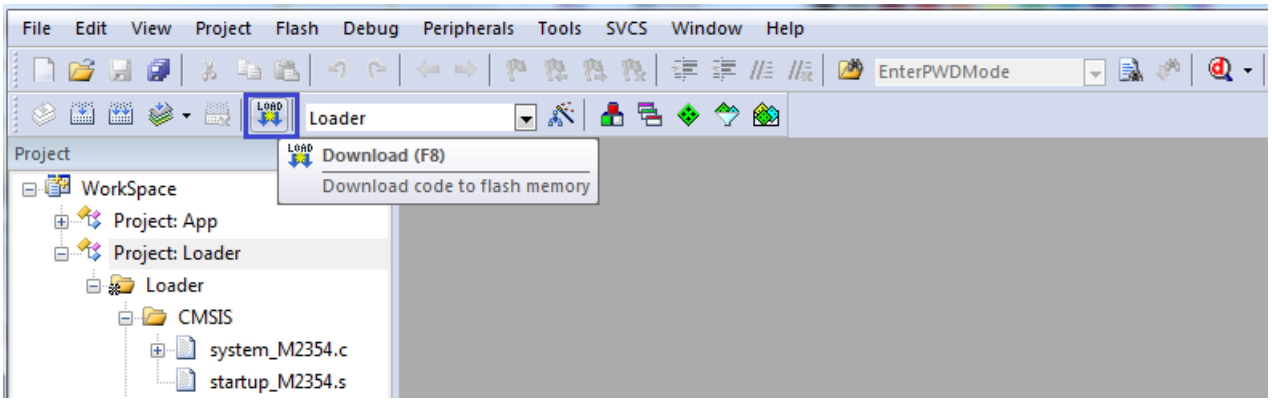
在\bsp\SampleCode\StdDriver\FMC_FwUpgradeApplication\BackupApp\KEIL 下，開啟專案BackupApp.uvprojx，編譯完成後，按下Download按鈕，將備份的韌體載入到Bank1的韌體執行區域，如下圖所示：



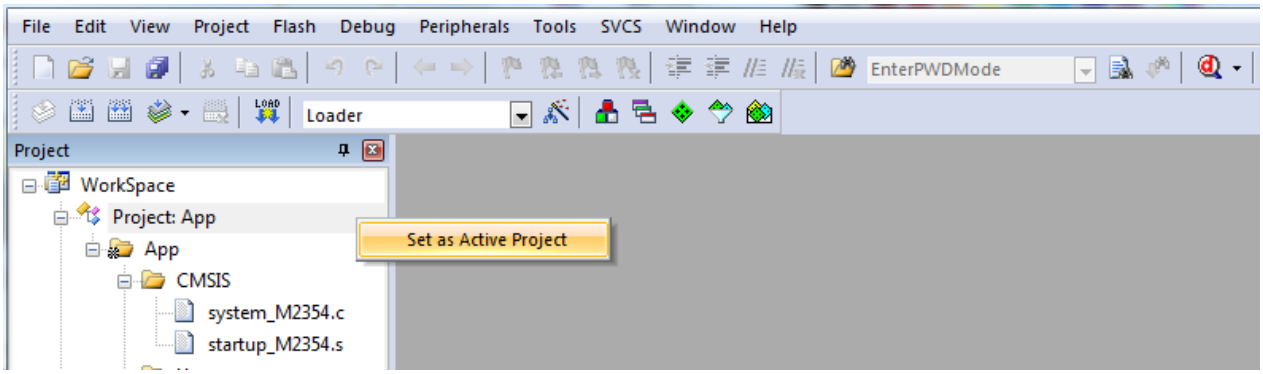
而後回到 \bsp\SampleCode\StdDriver\FMC_FwUpgradeApplication，開啟專案FMC_FwUpgradeApplication.uvmpw；這個專案有有兩個target，分別為Loader和App。首先先選取Loader這個target，如下圖所示：



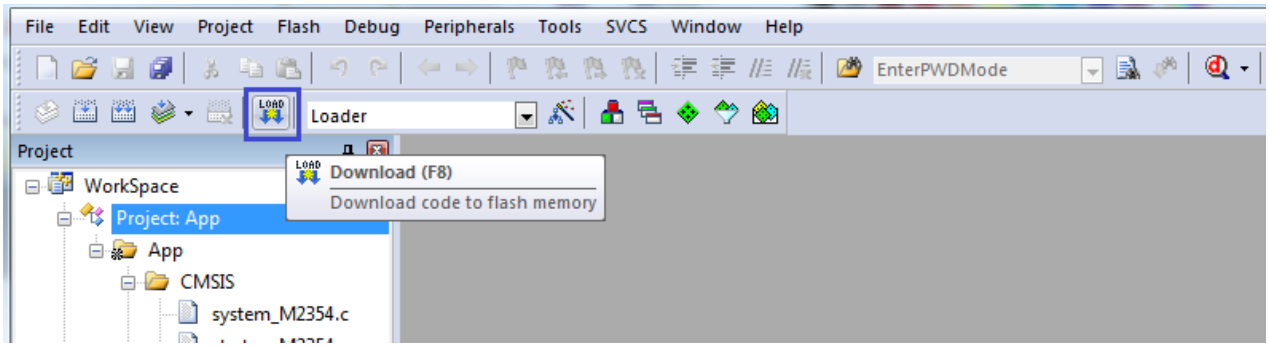
編譯完成後，按下Download按鈕，將loader載入到Bank0 Loader執行區，如下圖所示：



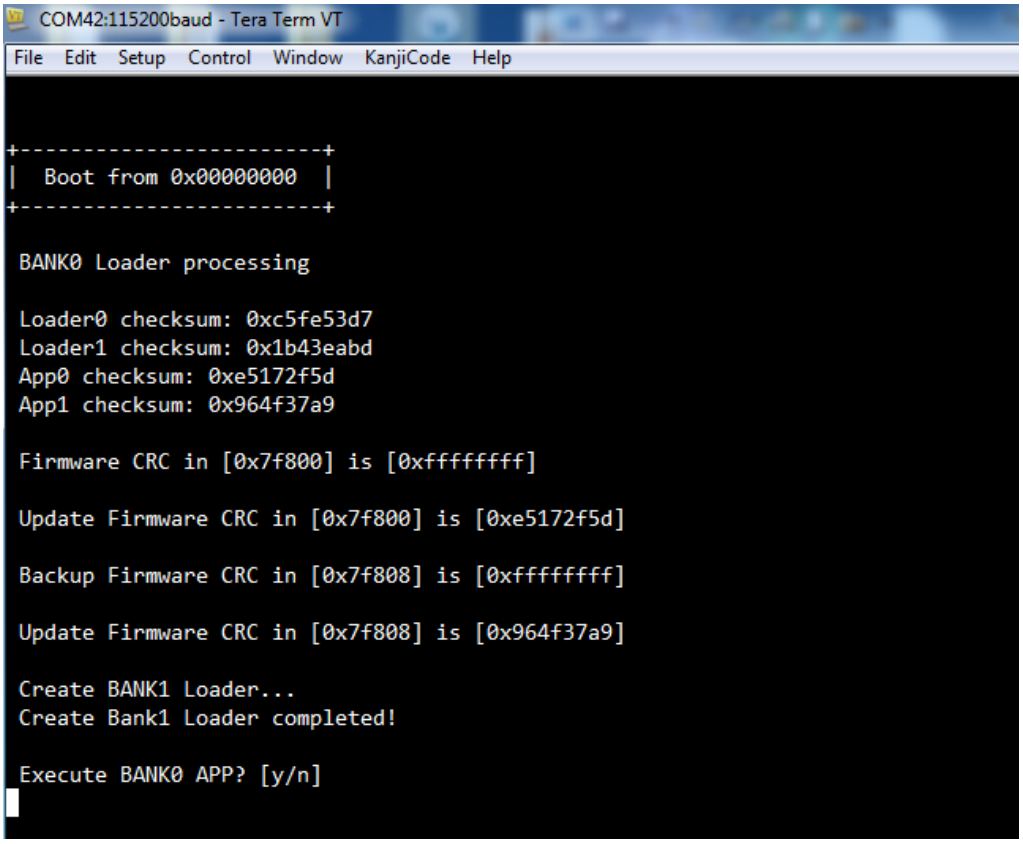
接下來選取App這個target，如下圖所示：



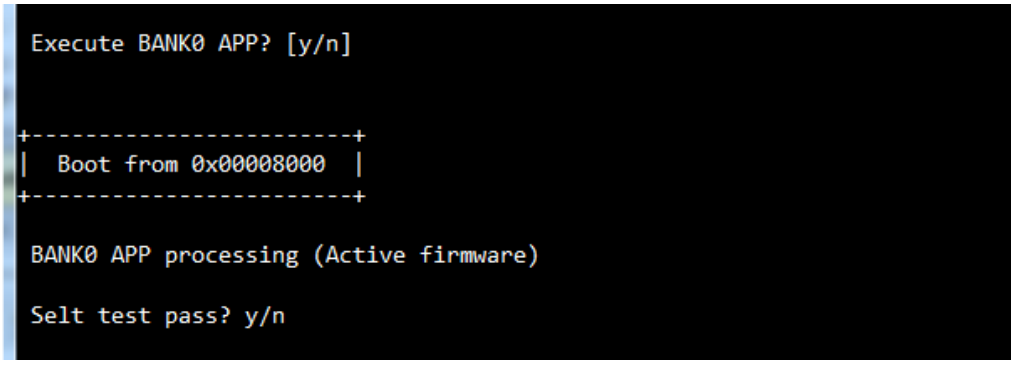
編譯完成後，按下Download按鈕，將App載入到Bank0 App執行區，如下圖所示：



在三個程式download完畢後，按下M2354上的Reset 鍵啟動系統。系統第一次啟動時，會執行建立Bank1的loader，以供firmware更新失敗時需做Bank Swap以執行Backup firmware。在Bank1 Loader建立完成後，會出現一個對話訊息，讓使用者決定是否要執行Bank0的firmware(Active firmware)。如下圖所示：



如果使用者選擇執行active firmware，則系統即啟動active firmware，並出現一個對話訊息，讓使用者選擇測試firmware執行成功或執行失敗的情況。如下圖所示：



如果使用者選擇測試firmware執行成功的情況，則會印出成功的訊息並繼續執行active firmware，如下圖所示：

```
+------------------------+
|  Boot from 0x00008000  |
+------------------------+

 BANK0 APP processing (Active firmware)

 Selt test pass? y/n

 Self test pass!!!

 Firmware processing....  cnt[999]
```

如果使用者選擇測試firmware執行失敗的情況，則會印出失敗的訊息。在Watch Dog判斷該firmware造成系統停滯超過其timeout的時間後，由Watch Dog重新啟動Loader。Loader啟動後，判斷為Bank0 firmware執行失敗的狀況，因此由使用者按下任意鍵來執行Bank Swap，回到Bank1的Backup firmware執行。如下圖所示：

```
+------------------------+
|  Boot from 0x00008000  |
+------------------------+

 BANK0 APP processing (Active firmware)

 Selt test pass? y/n

 Self test fail!!!


 Enter power down...


+------------------------+
|  Boot from 0x00000000  |
+------------------------+

 BANK0 Loader processing

 Loader0 checksum: 0xc5fe53d7
 Loader1 checksum: 0xc5fe53d7
 App0 checksum: 0xe5172f5d
 App1 checksum: 0x964f37a9

 Firmware CRC in [0x7f800] is [0xe5172f5d]

 Backup Firmware CRC in [0x7f808] is [0x964f37a9]

 === System reset by WDT time-out event ===
 Any key to swap back to backup FW
```

Backup firmware執行畫面如下圖所示：

```
+-----------------------+
|  Boot from 0x00008000  |
+-----------------------+

 BANK1 APP processing (Backup firmware)

 GetSum = 0x964f37a9, Keep Sum = 0x964f37a9

 Self test pass!!!

 Firmware processing....  cnt[999]
```

以上為執行Active firmware的操作流程。接下來介紹如何操作更新firmware。首先，從 Loader 啟動，並詢問使用者是否執行Bank0 App。此時，使用者須選擇不執行Bank0 App，讓程式繼續在loader執行。如下圖所示：

```
+-----------------------+
|  Boot from 0x00000000  |
+-----------------------+

 BANK0 Loader processing

 Loader0 checksum: 0xc5fe53d7
 Loader1 checksum: 0xc5fe53d7
 App0 checksum: 0xe5172f5d
 App1 checksum: 0x964f37a9

 Firmware CRC in [0x7f800] is [0xe5172f5d]

 Backup Firmware CRC in [0x7f808] is [0x964f37a9]

 Execute BANK0 APP? [y/n]
```

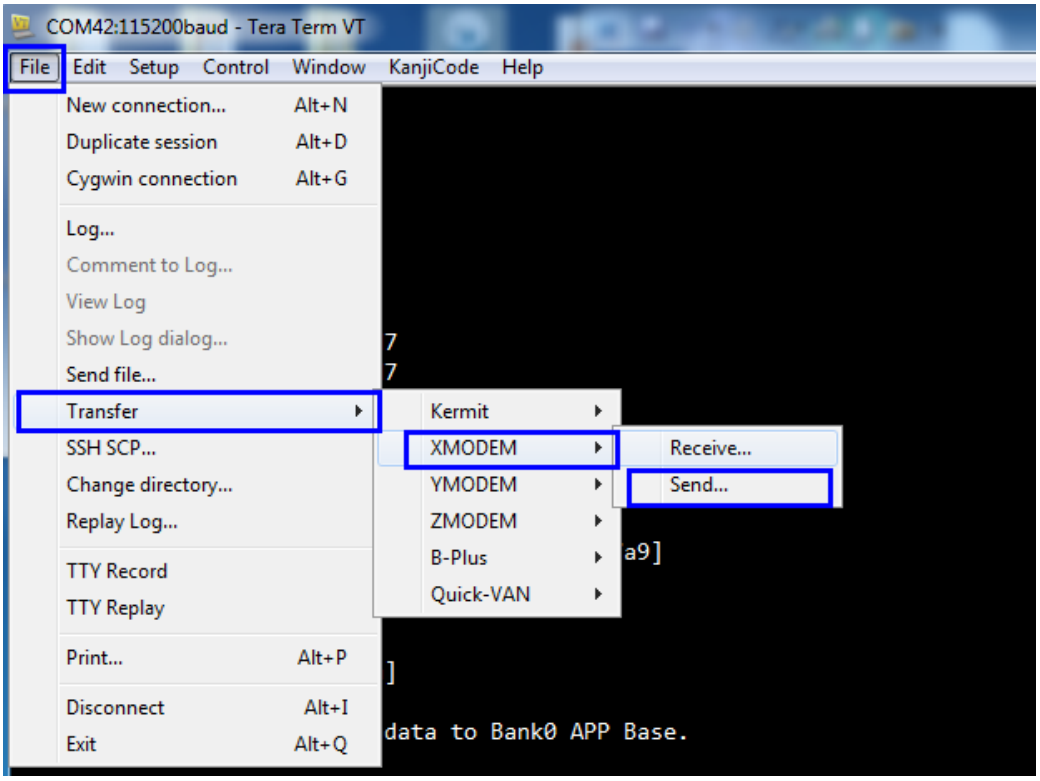
而後會出現一個對話訊息，讓使用者選擇是否更新firmware。如下圖所示：

```
 Execute BANK0 APP? [y/n]

 Download new firmware? [y/n]
```

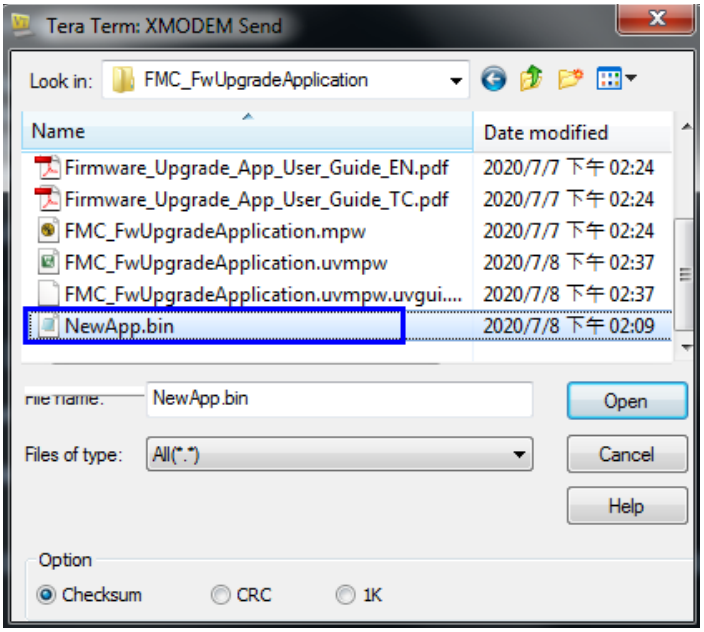
當使用者選擇更新firmware後，會出現Xmodem傳輸啟動的字元'C'，如下圖所示：

```
 Download new firmware? [y/n]

 Bank0 processing, download data to Bank0 APP Base.


CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
```

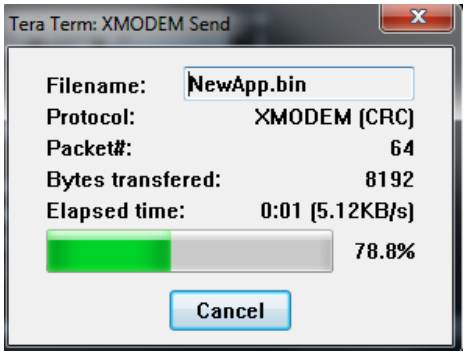
接著在UART的視窗選擇”File→Transfer→XMODOM→Send”來啟動Xmodem的傳輸，如下圖所示：



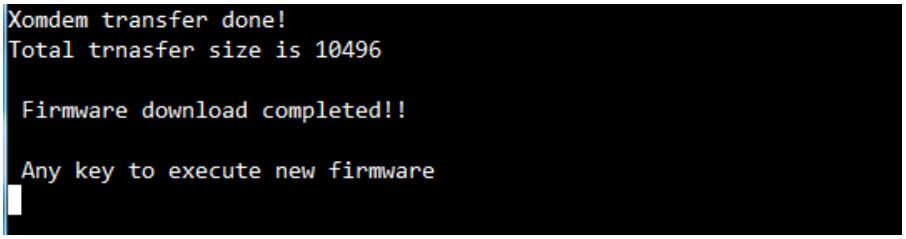
而後會出現一個XMODEM Send 的視窗，在該視窗中選取Sample code中提供的NewApp.bin(位於\bsp\SampleCode\StdDriver\FMC_FwUpgradeApplication)，如下圖所示：



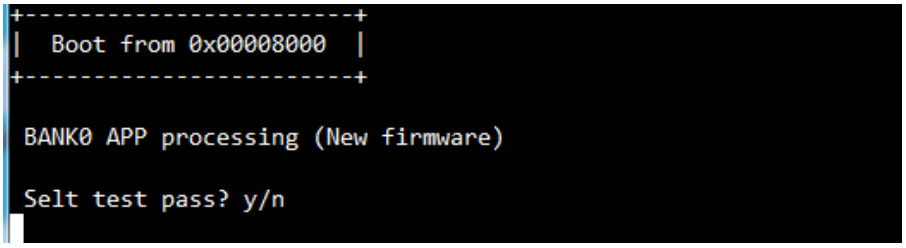
在該bin檔上雙擊後，該檔案即開始傳輸，如下圖所示：



傳輸完成後，回到原先的debug視窗，會出現”Firmware download completed!!” 訊息，表示firmware更新完畢。如下圖所示：



更新完firmware後，按下任意鍵啟動New firmware。如下圖所示：



而New firmware的執行測試，則和先前所描述的Active firmware一樣，使用者可選擇測試成功或失敗的狀況。

Date	Revision	Description
2020.07.07	1.00	1. Initially issued.

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