
i.MX53 EVK Linux

User's Guide

Document Number: 924-76373
Rev. 10.10.01
10/2010

How to Reach Us:

Home Page:

www.freescale.com

Web Support:

<http://www.freescale.com/support>

USA/Europe or Locations Not Listed:

Freescale Semiconductor
Technical Information Center, EL516
2100 East Elliot Road
Tempe, Arizona 85284
+1-800-521-6274 or +1-480-768-2130
www.freescale.com/support

Europe, Middle East, and Africa:

Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
www.freescale.com/support

Japan:

Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064, Japan
0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:

Freescale Semiconductor Hong Kong Ltd.
Technical Information Center
2 Dai King Street
Tai Po Industrial Estate
Tai Po, N.T., Hong Kong
+800 2666 8080
support.asia@freescale.com

For Literature Requests Only:

Freescale Semiconductor Literature Distribution Center
P.O. Box 5405
Denver, Colorado 80217
1-800-441-2447 or 303-675-2140
Fax: 303-675-2150
LDCForFreescaleSemiconductor@hibbertgroup.com

Information in this document is provided solely to enable system and software implementers to use Freescale Semiconductor products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document.

Freescale Semiconductor reserves the right to make changes without further notice to any products herein. Freescale Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Freescale Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters that may be provided in Freescale Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals", must be validated for each customer application by customer's technical experts. Freescale Semiconductor does not convey any license under its patent rights nor the rights of others. Freescale Semiconductor products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Freescale Semiconductor product could create a situation where personal injury or death may occur. Should Buyer purchase or use Freescale Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold Freescale Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Freescale Semiconductor was negligent regarding the design or manufacture of the part.

Freescale™ and the Freescale logo are trademarks of Freescale Semiconductor, Inc. All other product or service names are the property of their respective owners. Microsoft and Windows are trademarks or registered trademarks of Microsoft Corporation.

© Freescale Semiconductor, Inc. 2009. All rights reserved.

Contents

About This Book	V
Audience	V
References	V
 Chapter 1 Introduction.....	 1-1
1.1 Boot Loader	1-1
1.2 Linux Kernel image	1-1
1.3 Root File System.....	1-1
 Chapter 2 Building the Linux Platform	 2-1
2.1 Setting Up the Linux Host	2-1
2.2 Installing and Building LTIB	2-1
2.3 Setting rootfs for NFS.....	2-2
2.4 Copying images to TFTP server	2-3
2.5 How to generate no-padding U-Boot.....	2-3
2.6 How to generate uImage	2-3
2.7 How to build U-Boot and Kernel in standalone environment	2-3
2.8 Build Manufacturing Firmware	2-4
 Chapter 3 Boot configuration switch	 3-1
3.1 Configuration setup for ATK/MFG downloading	3-1
3.2 Configuration switch setup for SPI-NOR boot.....	3-1
3.3 Configuration switch setup for SD Slot1 boot.....	3-1
3.4 Configuration switch setup for SD Slot3 boot.....	3-2
3.5 Configuration switch setup for MMC Slot1 boot.....	3-2
3.6 Configuration switch setup for MMC Slot3 boot	3-2
3.7 Configuration switch setup for NAND boot.....	3-3
 Chapter 4 Flash memory map	 4-1
4.1 MMC/SD flash memory map	4-1
4.2 SPI-NOR flash memory map	4-1

4.3 NAND flash memory map	4-1
Chapter 5 Downloading images using ATK/MFG	5-1
5.1 ATK Tool.....	5-1
5.1.1 Installing the ATK Tools	5-1
5.1.2 MMC/SD	5-1
5.1.3 SPI-NOR	5-3
5.2 MFG Tool	5-4
5.2.1 Installing the MFG Tools.....	5-4
5.2.2 MFG tool Usage.....	5-4
Chapter 6 Download images by bootloader or NFS.....	6-1
6.1 Setup Terminal.....	6-1
6.2 Download by U-Boot.....	6-2
6.2.1 SPI-NOR	6-2
6.2.2 MMC/SD	6-3
6.2.3 U-Boot configurations.....	6-4
6.3 Use i.MX53 as Host server to create rootfs	6-5
Chapter 7 Running the Image on the Target.....	7-1
7.1 Run the image from NFS	7-1
7.2 Run the image from MMC/SD flash	7-1
7.3 Run the image from NAND.....	7-2
Chapter 8 Using a Linux Host to set up an SD/MMC card	8-3
8.1.1 Requirements	8-3
8.1.2 Copying the boot loader image	8-4
8.1.3 Copying the kernel image	8-4
8.1.4 Copying the file system (rootfs).....	8-4

About This Book

This document explains how to build and install the Freescale Linux BSP to the i.MX53 EVK board including board dip switch settings for image download and all kinds of boot mode, the steps to download image through ATK/MFG, u-Boot as well as the boot commands for each boot mode.

Audience

This document is intended for software, hardware, and system engineers who are planning to use the product and for anyone who wants to understand more about the product.

References

1. i.MX Family Linux Software Development Kit Reference Manual
2. Advanced Toolkit Standard User's Guide

Chapter 1

Introduction

The i.MX53 EVK Linux BSP is a collection of binary, source code, and support files that can be used to create a Linux kernel image and a root file system for i.MX53 EVK board. This document is for general Linux platform. See i.MX5x_EVK_Ubuntu_StartupGuide.pdf to setup Ubuntu system.

1.1 Boot Loader

The i.MX53 EVK Linux delivery package contains U-Boot bootloader binary.

The default release package `<Version>_images_MX5X/u-boot-mx53.bin` in the release package supports SPI, NAND and MMC/SD boot for MX53 EVK board.

1.2 Linux Kernel image

This Freescale i.MX BSP contains the Freescale Linux 2.6.35 EVK kernel, driver source code, and a pre-built kernel image. The i.MX53 EVK kernel image is found at the following location:

uImage - uImage is used together with U-Boot.

1.3 Root File System

The root file system package provides busybox, common libraries, and other fundamental elements. The i.MX53 EVK BSP package contains the following rootfs file system:

`<Version>_images_MX5X/rootfs.ext2.gz`

`rootfs.ext2.gz` file system includes Freescale specific libraries and gnome GUI. It can be mounted as NFS or the source of the storage of rootfs.

Chapter 2

Building the Linux Platform

This chapter explains how to set up the build environment, install and build LTIB, set rootfs for NFS, and set up the host environment.

2.1 Setting Up the Linux Host

See “ltib_build_host_setup.pdf” to setup Linux host server.

NOTE

A Windows tftp program `tftp.zip` is located under LTIB release package `Common/` folder. You can install it in Windows OS to setup Windows tftp server for downloading images.

2.2 Installing and Building LTIB

To install and build LTIB, follow the steps below:

NOTE

In some Linux systems, the following procedure must be done with **root** permissions. However, these instructions are for performing the procedure “not as root”.

To run LTIB, some host packages are needed. If any error related to a host package is raised, install the host package.

1. Remove all packages on `/opt/freescale/pkgs/` which are installed before.
2. Install the LTIB package not as root:

```
tar xzf <ltib_release>.tar.gz
./<ltib_release>/install
```

This command installs LTIB to your directory.

3. Build LTIB:

```
cd <LTIB directory>
./ltib -m config
```

4. Select platform to **Freescale iMX reference boards** and exit, saving the changes. At the next menu, select platform type as **imx5x** and package profile. Exit and save changes. Please note that only **Min profile** and **FSL gnome release packages** are tested by default.

5. To build U-Boot for MX53 EVK board, Select “Choose your board for u-boot” as “mx53_evk”. Please note this option is only for U-Boot. For kernel image, current default kernel configuration can build the same images for all i.MX5 parts boards.

```
| --- Choose your board for u-boot | |
| | board (mx53_evk) --->
```

6. Run the following command:

```
./ltib
```

When this procedure is completed, the kernel image is located at `rootfs/boot/uImage`.

7. Input the following command to get LTIB command help:

```
./ltib -help
/* Get the source code of one package */
./ltib -m prep -p <package name>
/* Build one package */
./ltib -m scbuild -p <package name>
/* Install one package to rootfs */
./ltib -m scdeploy -p <package name>
```

2.3 Setting rootfs for NFS

There are two ways to set the rootfs for NFS on this package.

- Using the ext2 format rootfs package already provided in the distribution
- Using the rootfs that is created after making the build of the kernel

Use the following commands to set the `rootfs` directory for NFS using the `rootfs.ext2.gz` package already included in the distribution (you must be the root user for this operation):

```
mkdir /mnt/rootfs
cp imx5x/rootfs.ext2.gz /tools
cd /tools
gunzip rootfs.ext2.gz
mount -o loop -t ext2 rootfs.ext2 /mnt/rootfs
cp -r /mnt/rootfs .
export ROOTFS_DIR=/tools/rootfs
```

NOTE

In some Linux distributions (such as Fedora) the user needs to make sure that the contents inside `/tools/rootfs` has the proper permission for user access. Since the mount command is made as root, the content shows as restricted access after

the command `cp -r /mnt/rootfs`, this may cause the NFS not been able to get mounted.

To use the root file system created in the LTIB directory after the kernel build, use the command:

```
%export ROOTFS_DIR=/<LTIB directory>/rootfs
```

2.4 Copying images to TFTP server

To use tftp server to download the image, copy the kernel image in the release package or LTIB to the tftp directory. For example:

```
cp imx5x/ulmage /tftpboot
```

Or:

```
cp /<LTIB directory>/rootfs/boot/ulmage /tftpboot
```

2.5 How to generate no-padding U-Boot

To generate no-padding U-Boot, run:

```
sudo dd if=u-boot-mx53.bin of=u-boot-mx53-no-padding.bin bs=512 skip=2
```

2.6 How to generate ulmage

In kernel source code, change build target from “zImage” to “uImage”.

If you want to generate uImage from zImage you built, you can generate a “uImage” based on the above zImage as below:

- Build u-boot package to get “mkimage” tool under `rpm/BUILD/u-boot-<version>/tools/mkimage`.
- Copy mkimage to `/usr/bin/`
- Run the below command:

```
mkimage -A arm -O linux -T kernel -C none -a 0x70008000 -e 0x70008000 -n "Linux-  
<kernel_version>" -d zimage ulmage
```

Note: Replace kernel version for your image. For example, 2.6.31-151-xxxx.

2.7 How to build U-Boot and Kernel in standalone environment

To build U-Boot in the standalone environment, do as the following:

```
make ARCH=arm CROSS_COMPILE=/opt/freescale/usr/local/gcc-4.4.4-glibc-2.11.1-multilib-1.0/arm-fsl-linux-gnueabi/bin/arm-none-linux-gnueabi-distclean
```

```
make ARCH=arm CROSS_COMPILE=/opt/freescale/usr/local/gcc-4.4.4-glibc-2.11.1-multilib-1.0/arm-fsl-linux-gnueabi/bin/arm-none-linux-gnueabi-mx53_ard_config
```

```
make ARCH=arm CROSS_COMPILE=/opt/freescale/usr/local/gcc-4.4.4-glibc-2.11.1-multilib-1.0/arm-fsl-linux-gnueabi/bin/arm-none-linux-gnueabi-
```

To build kernel in the standalone environment, do as the following:

```
make ARCH=arm CROSS_COMPILE=/opt/freescale/usr/local/gcc-4.4.4-glibc-2.11.1-multilib-1.0/arm-fsl-linux-gnueabi/bin/arm-none-linux-gnueabi- imx5_defconfig
```

```
make ARCH=arm CROSS_COMPILE=/opt/freescale/usr/local/gcc-4.4.4-glibc-2.11.1-multilib-1.0/arm-fsl-linux-gnueabi/bin/arm-none-linux-gnueabi-ulmage
```

2.8 Build Manufacturing Firmware

Please setup LTIB environment and then configure Firmware build profile.

```
./ltib --selectype
```

Choose correct item as below:

```
--- Choose the platform type
```

```
Selection (imx5x) --->
```

```
--- Choose the packages profile
```

```
Selection (mfg firmware profile)--->
```

In “Freescale iMX5x Based Boards” section, choose the board information as the following:

```
--- Choose your board for u-boot
```

```
board (mx53_evk) --->
```

After ltib complete build, **initramfs.cpio.gz.uboot** is generated under ltib root folder. **u-boot.bin** and **uImage** for MFG tool are generated under rootfs/boot/.

2.9 NAND LTIB configurations

MX53 EVK uses NAND socket. So different NAND chips maybe used by different users. The default JFFS2 rootfs image in the release package is for NAND with 4K page + 512K block size.

If your NAND configuration is different, you must re-generate JFFS2 file system by changing the following LTIB configurations:

```
CONFIG_DEPLOYMENT_PAGESIZE_KB="4"
```

```
CONFIG_ERASE_BLOCK_SIZE="512"
```

```
CONFIG_DEPLOYMENT_ERASE_BLOCK_SIZE="512"
```

If you want to generate jffs2 manually, the following command can be used as the reference:

```
mkfs.jffs2 -r rootfs -e <block size> -s <page size> -n -o rootfs.jffs2
```


Chapter 3 Boot configuration switch

The boot modes of the i.MX53 EVK board are controlled by the boot configuration DIP switch on the main board. To locate the boot configuration switch refer to the i.MX53 EVK Hardware User's Guide. The following sections just list basic boot setup configurations. For more different combinations for the boot modes, see i.MX53 HW guide.

Note: eSDHC Slot 1 is located on the top of MX53 EVK board. eSDHC Slot 3 is located on the bottom of MX53 EVK board.

3.1 Configuration setup for ATK/MFG downloading

Table 3.1 shows the boot switch settings to allow programming via the Advanced Toolkit application.

Table 3.1 Main board switch setup for ATK downloading

Switch	D1	D2	D3	D4	D5	D6	D7	D8
SW1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
SW2	OFF	OFF	OFF	OFF	OFF	ON/OFF	OFF	OFF
SW3	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF

SW2 Dip 6 is ON if the SD card is inserted on eSDHC Slot 3.

SW2 Dip 6 is OFF if the SD card is inserted on eSDHC Slot 1.

3.2 Configuration switch setup for SPI-NOR boot

Table 3.2 shows the boot switch settings for SPI-NOR boot

Table 3.2 Main board switch setup for SPI-NOR boot

Switch	D1	D2	D3	D4	D5	D6	D7	D8
SW1	OFF	OFF	OFF	ON	ON	ON	OFF	OFF
SW2	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
SW3	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF

3.3 Configuration switch setup for SD Slot1 boot

Table 3.3 shows the boot switch settings for SD Slot 1 boot

Table 3.3 Main board switch setup for SD Slot1 boot

Switch	D1	D2	D3	D4	D5	D6	D7	D8
SW1	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
SW2	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
SW3	OFF	OFF	OFF	OFF	OFF	ON/OFF	OFF	OFF

SW3 dip 6 indicates bus width: OFF: 1-bit; ON: 4-bit

3.4 Configuration switch setup for SD Slot3 boot

Table 3.4 shows the boot switch settings for SD Slot 3 boot

Table 3.4 Main board switch setup for SD Slot3 boot

Switch	D1	D2	D3	D4	D5	D6	D7	D8
SW1	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
SW2	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
SW3	OFF	OFF	OFF	OFF	OFF	ON/OFF	OFF	OFF

3.5 Configuration switch setup for MMC Slot1 boot

Table 3.5 shows the boot switch settings for MMC Slot 1 boot (Normal boot, 1-bit mode).

Table 3.5 Main board switch setup for MMC Slot1 boot

Switch	D1	D2	D3	D4	D5	D6	D7	D8
SW1	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF
SW2	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
SW3	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

3.6 Configuration switch setup for MMC Slot3 boot

Table 3.6 shows the boot switch settings for MMC Slot 3 boot ((Normal boot, 1-bit mode).

Table 3.6 Main board switch setup for MMC Slot3 boot

Switch	D1	D2	D3	D4	D5	D6	D7	D8
SW1	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF
SW2	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
SW3	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

3.7 Configuration switch setup for NAND boot

You must set right boot config PINS to enable NAND boot per your NAND device. Table 3.7 shows the boot switch settings for NAND 29F32G080AA device.

Table 3.7 Main board switch setup for NAND boot

Switch	D1	D2	D3	D4	D5	D6	D7	D8
SW1	OFF	OFF	OFF	ON	OFF	OFF	ON	ON
SW2	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF
SW3	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON

Chapter 4 Flash memory map

This chapter describes the software layout in MMC/SD cards. It can be useful to understand the later sections about image download.

4.1 MMC/SD flash memory map

MMC/SD flash scheme is different from NAND and NOR flash which are deployed in the BSP software. MMC/SD flash must keep the first sector (512 bytes) as MBR (Master Boot Record) in order to use MMC/SD as the rootfs.

At boot up, MBR is executed to look up the partition table to determine which partition to use for booting. Bootloader should be at the end of MBR. Kernel Image and rootfs can be put any address after bootloader.

MBR can be generated through `fdisk` command when creating partitions in MMC/SD cards in the Linux Host server.

4.2 SPI-NOR flash memory map

SPI-NOR flash scheme is configured statically by software. It can be adjusted according to different requirements. The following figure illustrates default SPI-NOR flash map on MX53 EVK platform. For more details, see `arch/arm/mach-mx5/mx53_evk.c`.

Bootloader (1M)	0x00000000
Kernel (3M)	0x00010000

4.3 NAND flash memory map

NAND flash scheme is configured statically by software. It can be adjusted according to different requirements. The following figure illustrates default NAND flash map on MX53 EVK platform. For more details, see `arch/arm/mach-mx5/mx53_evk.c`.

Bootloader (16M)	0x00000000
Kernel (5M)	0x01000000
Rootfs (256M)	0x01500000
User rootfs1 (256M)	0x11500000
User rootfs2	0x21500000

Chapter 5 Downloading images using ATK/MFG

This chapter explains the procedure to use the ATK tool to download U-Boot to the MMC/SD card.

5.1 ATK Tool

5.1.1 Installing the ATK Tools

Install the ATK tool Version 1.71 included in the package, download it from the Freescale web site or request it from Freescale support. Follow the ATK user guide to install the application.

5.1.2 MMC/SD

5.1.2.1 Download U-Boot to MMC/SD

To download the U-Boot bootloader to MMC/SD card, use the following steps:

1. Set the boot configuration switch for serial download mode, see section 3.1: [Configuration setup for ATK downloading](#).
2. Power on the board. Configure the ATK options as shown in Figure 5-1.
3. Select **Flash Tool** and **Go**.
4. Program U-Boot by selecting options as shown in Figure 5-2 if no MBR is present in the MMC/SD. If MBR is already created in the card, which means the rootfs has been programmed to MMC/SD, program the no-padding redboot binary with the offset 0x400 as shown in Figure 5-3. Verify the selection before upgrading the bootloader; otherwise, the rootfs must be re-programmed if MBR is broken.
5. Click **Program** to download the binary to the MMC/SD card in the target.

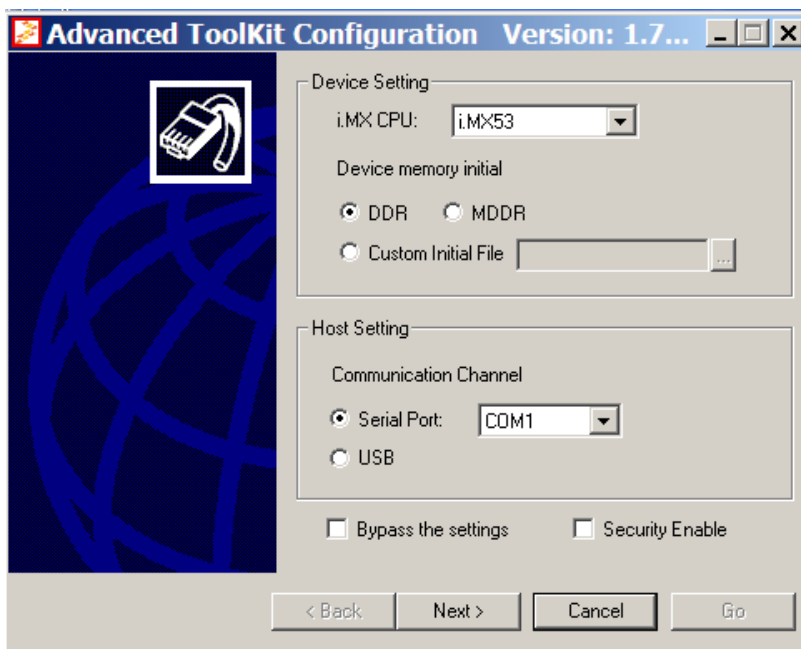


Figure 5-1 ATK configuration for i.MX53

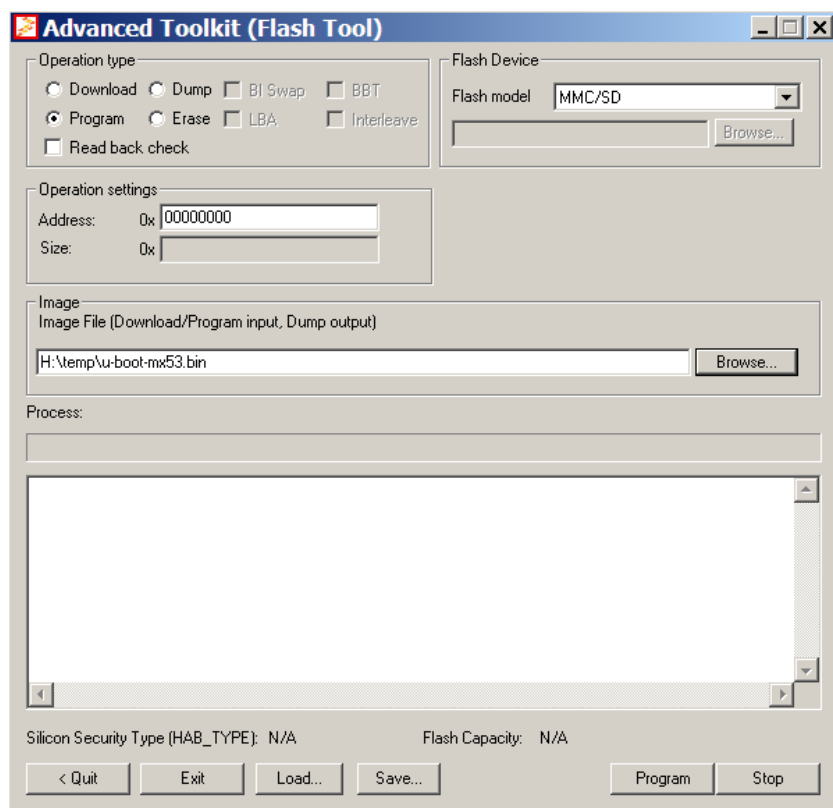


Figure 5-2 Programming U-Boot image to MMC/SD Flash

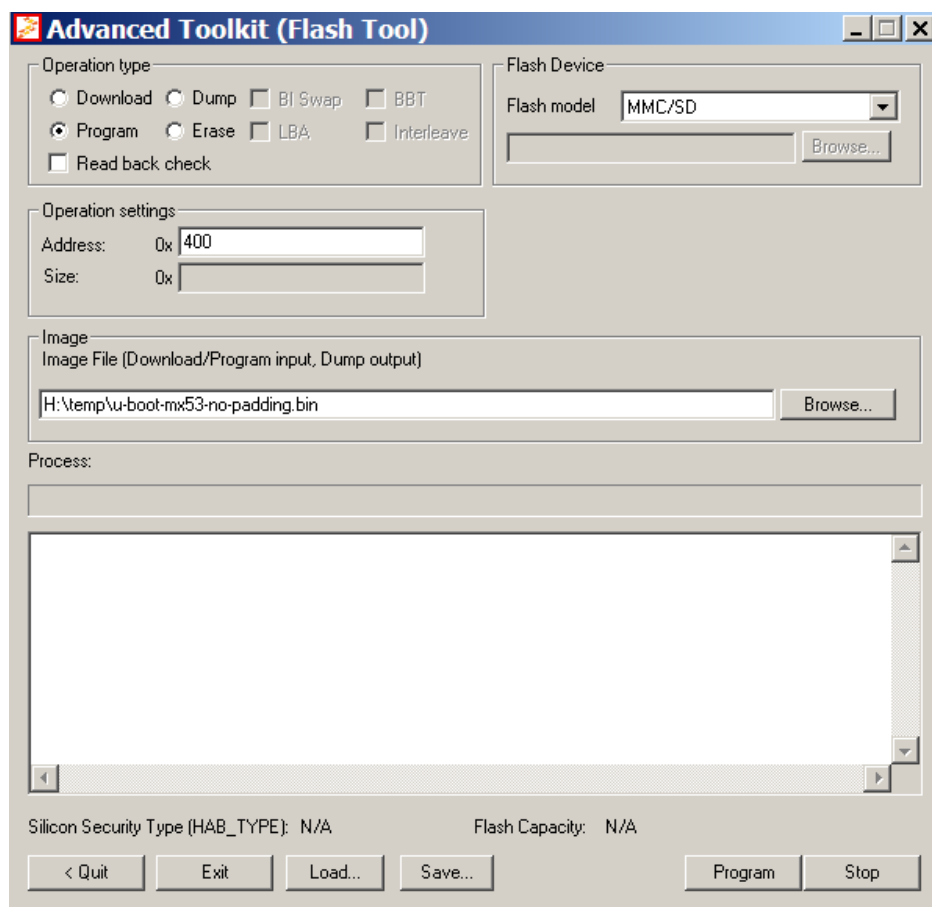


Figure 5-3 Programming U-Boot, no padding, to MMC/SD Flash

5.1.3 SPI-NOR

5.1.3.1 Download U-Boot to SPI-NOR

To download the U-Boot to SPI-NOR, use the following steps:

1. Set the boot configuration switch for serial download mode, see section 3.1: [Configuration setup for ATK downloading](#).
2. Power on the board. Configure the ATK options as shown in Figure 5-1.
3. Select **Flash Tool** and **Go**.
4. Program U-Boot by selecting options as shown in Figure 5-4.
5. Click **Program** to download the binary to the SPI-NOR in the target.

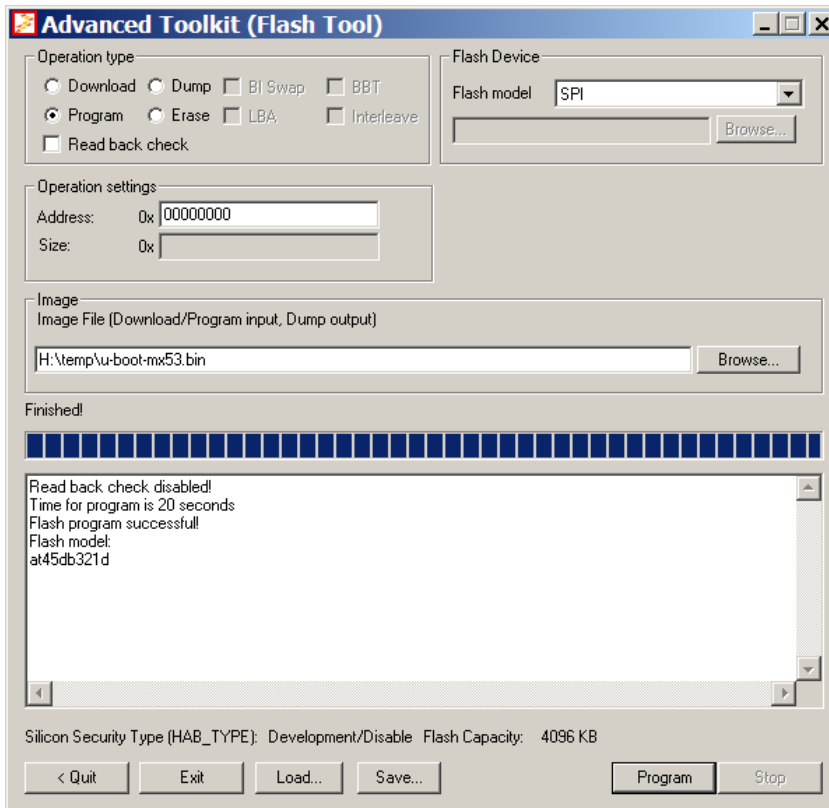


Figure 5-4 Programming U-Boot to SPI-NOR flash

5.2 MFG Tool

5.2.1 Installing the MFG Tools

Unzip Mfgtools-Rel-<version>_MX53_UPDATER.tar.gz

5.2.2 MFG tool Usage

Please read MFG documents under “Document” folder before you start to use MFG tool.

Following are some instructions for MX53 EVK MFG usage:

- Connect USB cable from PC to USB OTG port (J89) on MX53 EVK board.
- Connect UART to PC for console output. Open Terminal program.
- Set boot dips as “serial download mode”.

- Power up board.
- Edit “Profiles\MX53 Linux Update\OS Firmware\ucl.xml” to modify file path or flash operations according to your usage. Please note “MX53EVK-xxx” lists are the example codes for MX53 EVK. You can modify them for MX53 EVK programming. After the modification is completed, save the changes and exit.
- Execute “MfgTool.exe” program. Select “Options -> Configuration...” menu. If it’s the first time to connect MX53 with MFG tool, please install USB driver under “Drivers\iMX_BulkIO_Driver”.
- Select the right USB port in the sheet “USB Ports”.
- Select the right profile in the sheet “Profiles”. Type the item in “Operations”. Right click and select “Edit...”. Select “MX53EVK-NAND(JFFS2)-PDK” to program the images to NAND. Select “MX53EVK-SD” to program images to SD. Select “MX53EVK-SPI_NOR” to program the images to SPI-NOR. Please note the default profiles are just the examples. You must modify them for right programming operations according to your detailed purpose. For example, if you want to flash jffs2 file system, you can modify ucl.xml as the following:

```
<CMD type="push" body="$ flash_eraseall /dev/mtd4">Erasing rootfs partition</CMD>
```

```
<CMD type="push" body="pipe nandwrite -p /dev/mtd4" file="files/rootfs.jffs2">Sending and writting rootfs</CMD>
```


Chapter 6 Download images by bootloader or NFS

6.1 Setup Terminal

The i.MX53 EVK board can communicate with a host server (Windows or Linux) via the serial cable. Common serial communication programs such as HyperTerminal, Tera Term or PuTTY can be used. The example below describes the serial terminal setup using HyperTerminal in a Windows host:

1. Connect the target and the Windows PC via a serial cable.
2. Open HyperTerminal on the Windows PC, and select the settings shown in Figure 6-1.

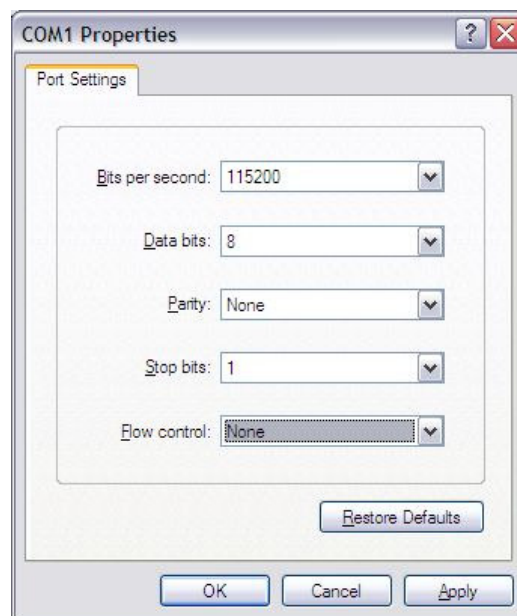


Figure 6 -1 HyperTerminal Settings for terminal setup

3. Set the boot configuration options as described in section 3.2 and power up the target. Status messages and the bootloader prompt are displayed on the terminal screen.

6.2 Download by U-Boot

6.2.1 SPI-NOR

- Power on the board from SPI-NOR by following the dip setting in Section [Dip switch setup for boot modes](#). Then set environment variables. For example,

```
EVK U-Boot > setenv serverip 10.192.225.216
EVK U-Boot > setenv bootfile ulmage
EVK U-Boot > saveenv
```

- Check the MAC address of FEC by “iim read fecmac”. If it’s the invalid value, you can use “iim blow fecmac” to blown fec mac values. Please note iim blown operation is one-time irreversible operation. Or you can set fec mac value via the environment.

```
EVK U-Boot > setenv ethaddr 00:04:9f:00:ea:d3
```

- Download kernel image from tftp server:

```
EVK U-Boot > dhcp
```

- Program kernel image to SPI-NOR with the address 0x100000. Please note the below example assumes the kernel image is less than 0x300000 bytes. If the kernel image exceeds 0x300000, please enlarge the image length.

```
EVK U-Boot > sf probe 1
```

```
JEDEC ID: 0x1f:0x27:0x01
```

```
4096 KiB AT45DB321D – 4MB at 0:1 is now current device
```

```
EVK U-Boot > sf erase 0x100000 0x300000
```

```
Erase is built in program.
```

```
EVK U-Boot > sf write ${loadaddr} 0x100000 0x300000
```

```
Writing SPI NOR flash 0x100000 [0x300000 bytes] <- ram 0x70800000
```

```
.....
..... SUCCESS
```

- Check environment variables. Ensure the right values are set.

```
EVK U-Boot > print
```

- Set the environment variables to load kernel from SPI-NOR:

```
EVK U-Boot > setenv bootcmd_nor 'run bootargs_base bootargs_nfs;sf probe 1;sf read
${loadaddr} 0x100000 0x280000;bootm'
```

- Boot up system from NFS or other storage as the rootfs. For example,

```
EVK U-Boot > setenv nfsroot /data/rootfs_home/rootfs_mx53
```

```
EVK U-Boot > setenv bootcmd 'run bootcmd_nor'
EVK U-Boot > saveenv
EVK U-Boot > reset
```

6.2.2 MMC/SD

- Power on the board from MMC/SD by following the dip setting in Section [Dip switch setup for boot modes](#). Then set environment variables. For example,

```
EVK U-Boot > setenv serverip 10.192.225.216
EVK U-Boot > setenv ethaddr 00:04:9f:00:ea:d3
EVK U-Boot > setenv bootfile ulmage
EVK U-Boot > saveenv
```

- Copy uImage to tftp server. Then download it to RAM:
EVK U-Boot > dhcp
- Query the information about MMC/SD card. Note current version doesn't support 64bit. So the capability information ($\geq 4\text{G}$) is shown as negative value.

```
EVK U-Boot > mmcinfo
Device: FSL_ESDHC
Manufacturer ID: 3
OEM: 5344
Name: SD04G
Tran Speed: 25000000
Rd Block Len: 512
SD version 2.0
High Capacity: Yes
Capacity: 2002647686
Bus Width: 4-bit
```

- Check the usage of “mmc” command. “blk#” is equal to “<the offset of read/write>/<block length of the card>”. “cnt” is equal to “<the size of read/write>/<block length of the card>”.

```
BBG U-Boot > help mmc
mmc - MMC sub system
```

Usage:

```
mmc read <device num> addr blk# cnt
mmc write <device num> addr blk# cnt
mmc rescan <device num>
mmc list - lists available devices
```

- Program the kernel uImage into MMC/SD. For example, the below command writes the image with the size 0x300000 from \${loadaddr} to the offset 0x100000 of the MMC/SD card. Here $0x800 = 0x100000/512$, $0x1800 = 0x300000/512$. The block size of this card is 512. This example assumes the kernel image is less than 0x300000 bytes. If the kernel image exceeds 0x300000, please enlarge the image length.

```
EVK U-Boot > mmc write 0 ${loadaddr} 0x800 0x1800
```

- Boot up the system through RFS in MMC/SD card:

```

EVK U-Boot > setenv bootargs_mmc 'setenv bootargs ${bootargs} console=tty1
root=/dev/mmcblk0p1 rootwait rw'
EVK U-Boot > setenv bootcmd_mmc 'run bootargs_base bootargs_mmc;mmc read 0 ${loadaddr}
0x800 0x1800;bootm'
EVK U-Boot > setenv bootcmd 'run bootcmd_mmc'
EVK U-Boot > saveenv

```
- To program the rootfs to MMC/SD, See section “[Use i.MX53 as Host server to create rootfs](#)” or section “[Using a Linux Host to set up an SD/MMC card](#)”.

6.2.3 NAND

- Power on the board from NAND by following the dip setting in Section [Dip switch setup for boot modes](#). Then set environment variables. For example,

```

EVK U-Boot > setenv serverip 10.192.225.216
EVK U-Boot > setenv ethaddr 00:04:9f:00:ea:d3
EVK U-Boot > setenv bootfile ulmage
EVK U-Boot > saveenv

```
- Copy ulmage to tftp server. Then download it to RAM:

```

EVK U-Boot > dhcp

```
- Erase NAND kernel and rootfs partitions:

```

EVK U-Boot > nand erase 0x1000000

```
- Program kernel image to NAND flash:

```

EVK U-Boot > nand write ${loadaddr} 0x1000000 0x300000

```
- MFG tool is recommended to do rootfs programming since USB downloading is faster and rootfs image is always larger.

6.2.4 U-Boot configurations

U-Boot “print” command can be used to check environment variable values. “setenv” command is to set environment variable value. See U-Boot User Guide for the details.

6.3 Use i.MX53 as Host server to create rootfs

Linux provides multiple methods to program images to the storage device. This section describes how to use the i.MX53 EVK as Linux Host server to create the rootfs on MMC/SD card.

1. Boot from NFS or other storage. To create a partition in MMC/SD Slot 0, use the `fdisk` command in the Linux console:

```
root@freescall ~$ fdisk /dev/mmcblk0
Device contains neither a valid DOS partition table, nor Sun, SGI or OSF disklabel
Building a new DOS disklabel. Changes will remain in memory only,
until you decide to write them. After that the previous content
won't be recoverable.
```

The number of cylinders for this disk is set to 124368.
There is nothing wrong with that, but this is larger than 1024,
and could in certain setups cause problems with:

- 1) software that runs at boot time (e.g., old versions of LILO)
- 2) booting and partitioning software from other OSs
(e.g., DOS FDISK, OS/2 FDISK)

Command (m for help): p

```
Disk /dev/mmcblk0: 4075 MB, 4075290624 bytes
4 heads, 16 sectors/track, 124368 cylinders
Units = cylinders of 64 * 512 = 32768 bytes
```

Device	Boot	Start	End	Blocks	Id	System
--------	------	-------	-----	--------	----	--------

2. As described in Chapter 4, the rootfs partition should be located after kernel image; the first 0x800000 bytes can be reserved for MBR, bootloader and kernel sections.

From the above log, the Units of current MMC/SD card is 32768 bytes. The begin cylinder of the first partition can be set as “0x300000/32768 = 96”. The last cylinder can be set according to the rootfs size. Create a new partition by typing n:

```
Command (m for help): n
Command action
  e   extended
  p   primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-124368, default 1): 96
Last cylinder or +size or +sizeM or +sizeK (96-124368, default 124368):
Using default value 124368
```

```
Command (m for help): w
The partition table has been altered!
```

```
Calling ioctl() to re-read mmcblk0:ead partition table
p1
```

3. Format the MMC/SD partitions as types ext3 or ext2 type. For example, to use ext3:

```
root@freescall ~$ mkfs.ext3 /dev/mmcblk0p1
mke2fs 1.41.4 (27-Jan-2009)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
248992 inodes, 994184 blocks
49709 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=1019215872
31 block groups
32768 blocks per group, 32768 fragments per group
8032 inodes per group
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376, 294912, 819200, 884736
```

```
Writing inode tables: done
Creating journal (16384 blocks): done
Writing superblocks and filesystem accounting information: done
```

This filesystem will be automatically checked every 20 mounts or 180 days, whichever comes first. Use tune2fs -c or -i to override.

4. Copy the rootfs contents into the MMC/SD card (copy the rootfs.ext2 to NFS rootfs)

```
mount -t ext2 -o loop /rootfs.ext2 /mnt/cdrom
cd /mnt
mkdir mmcblk0p1
mount -t ext3 /dev/mmcblk0p1 /mnt/mmcblk0p1/
cp -rf /mnt/cdrom/* /mnt/mmcblk0p1/
umount /mnt/mmcblk0p1
umount /mnt/cdrom
```

5. Type `sync` to write the contents to MMC/SD.
6. Type `poweroff` to power down the system. Follow the instructions in Chapter 7 to boot the image from MMC/SD card.

Chapter 7

Running the Image on the Target

This chapter explains how to run an image on the target from downloaded flash and NFS. These instructions assume that you have downloaded the kernel image using the instructions in Chapter 5 or Chapter 6.

7.1 Run the image from NFS

To boot from NFS, do as the follows (Please pay attention to the items marked as blue color. You need to modify them per your environment or HW information):

1. Set boot configuration switch as indicated in Chapter “[Boot configuration switch](#)”. Power on the board.
2. Enter the following commands in the U-Boot prompt:

```
EVK U-Boot > setenv ethaddr 00:04:9f:01:32:e0
```

```
EVK U-Boot > setenv serverip 10.192.225.216
```

```
EVK U-Boot > setenv bootfile uImage
```

```
EVK U-Boot > setenv nfsroot 10.192.225.216:/data/rootfs_home/rootfs_mx53
```

```
EVK U-Boot > setenv bootargs_base 'setenv bootargs console=ttymxc0,115200'
```

```
EVK U-Boot > setenv bootargs_nfs 'setenv bootargs ${bootargs} root=/dev/nfs ip=dhcp  
nfsroot=${nfsroot},v3,tcp'
```

```
EVK U-Boot > setenv bootcmd_net 'run bootargs_base bootargs_nfs;bootm'
```

```
EVK U-Boot > setenv bootcmd 'dhcp; run bootcmd_net'
```

```
EVK U-Boot > saveenv
```

```
EVK U-Boot > run bootcmd
```

7.2 Run the image from MMC/SD flash

To boot the system from MMC/SD flash follow the steps bellow:

1. Set boot configuration switch as indicated in section 3.2 [Configuration switch setup for boot modes](#). Power on the board.
2. Assume the kernel image start from the address 0x100000 byte (the block start address is 0x800). The kernel image size is less than 0x300000 byte. The rootfs is located into /dev/mmcblk0p1 partition. Enter the following commands in the U-Boot prompt:

```
EVK U-Boot > setenv ethaddr 00:04:9f:01:32:e0
```

```
EVK U-Boot > setenv bootargs_base 'setenv bootargs console=ttymxc0,115200'
```

```
EVK U-Boot > setenv bootargs_mmc 'setenv bootargs ${bootargs} root=/dev/mmcblk0p1  
rootwait rw'
```

```
EVK U-Boot > setenv bootcmd_mmc 'run bootargs_base bootargs_mmc;mmc read 0 ${loadaddr}  
0x800 0x1800;bootm'
```

```
EVK U-Boot > setenv bootcmd 'run bootcmd_mmc'
```

```
EVK U-Boot > run bootcmd
```

7.3 Run the image from NAND

To boot the system from NAND flash follow the steps bellow:

1. Set boot configuration switch as indicated in Section 3.7 Configuration switch setup for NAND boot and Power on the board.
2. Enter the following commands in the U-Boot prompt:

```
EVK U-Boot > setenv ethaddr 00:04:9f:01:32:e0
```

```
EVK U-Boot > setenv bootargs_base 'setenv bootargs console=ttymxc0,115200'
```

```
EVK U-Boot > setenv bootargs_nand 'setenv bootargs ${bootargs} root=/dev/mtdblock4  
rootfstype=jffs2 rw ip=dhcp'
```

```
EVK U-Boot > setenv bootcmd_nand 'run bootargs_base bootargs_nand;nand read  
${loadaddr} 0x1000000 0x300000;bootm'
```

```
EVK U-Boot > setenv bootcmd 'run bootcmd_nand'
```

```
EVK U-Boot > saveenv
```

```
EVK U-Boot > run bootcmd
```

Chapter 8

Using a Linux Host to set up an SD/MMC card

This chapter describes the steps to prepare an SD/MMC card to boot off an i.MX53 EVK.

8.1.1 Requirements

An SD/MMC card reader, like a USB card reader, is required. It will be used to transfer the boot loader and kernel images, to initialize the partition table and copy the root file system. To simplify the instructions, it is assumed that a 4GB SD/MMC card is used.

Any Linux distribution can be used for the following procedure. It is recommended to use a Linux distribution that LTIB has been tested against (like Fedora, Ubuntu, etc).

The Linux kernel running on the Linux host will assign a device node to the SD/MMC card reader. The kernel might decide the device node name or udev rules might be used. In the following instructions, it is assumed that udev is not used.

To identify the device node assigned to the SD/MMC card, enter the command:

```
$ cat /proc/partitions
major minor  #blocks  name
   8     0    78125000 sda
   8     1    75095811 sda1
   8     2         1 sda2
   8     5     3028221 sda5
   8    32   488386584 sdc
   8    33   488386552 sdc1
   8    16     3921920 sdb
   8    18     3905535 sdb1
```

In this example, the device node assigned is `/dev/sdb` (a block is 1kB large)

8.1.2 Copying the boot loader image

Enter the following command to copy the U-Boot image to the SD/MMC card (please note that this operation will delete the partition table present on the media):

```
$ sudo dd if=u-boot-mx53.bin of=/dev/sdb bs=512 && sync && sync
```

To update U-Boot to another version, please run the following command instead:

```
$ sudo dd if=u-boot-mx53-no-padding.bin of=/dev/sdb bs=512 seek=2 && sync && sync
```

The first 1kB, that includes the partition table, will be preserved.

8.1.3 Copying the kernel image

The following command will copy the kernel image to the SD/MMC card

```
$ sudo dd if=uImage of=/dev/sdb bs=512 seek=2048 && sync && sync
```

This will copy the `uImage` to the media at offset 1MB.

8.1.4 Copying the file system (rootfs)

A partition table must be first created. If a partition already exists and it is big enough for the file system you want to deploy, then you can skip this step.

To create a partition, at offset 8192 (in sectors of 512 bytes) enter the following command:

```
$ sudo fdisk /dev/sdb
```

Type the following parameters (each followed by **<ENTER>**):

```
u      [switch the unit to sectors instead of cylinders]
d      [repeat this until no partition is reported by the 'p' command ]
n      [create a new partition]
p      [create a primary partition]
1      [the first partition]
8192   [starting at offset sector #8192, i.e. 4MB, which leaves enough space for the
kernel, the boot loader and its configuration data]
<enter> [using the default value will create a partition that spans to the last sector of
the medium]
w      [ this writes the partition table to the medium and fdisk exits]
```

The file system format `ext3` or `ext4` is a good option for removable media due to the built-in journaling. Run the following command to format the partition:

```
$ sudo mkfs.ext3 /dev/sdb1
```

Or

```
$ sudo mkfs.ext4 /dev/sdb1
```

Copy the target file system to the partition:

```
$ mkdir /home/user/mountpoint
$ sudo mount /dev/sdb1 /home/user/mountpoint
```

Let's assume the root file system files are located in `/home/user/rootfs`:

```
$ cd /home/user/rootfs
$ sudo cp -rpa [A-z]* /home/user/mountpoint
$ sudo umount /home/user/mountpoint
```

The file system content is now on the media.