AN14393

在i.MX RT1180中使用基于LPSPI的串行下载器选项

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应用笔记

文档信息

信息	内容
关键词	AN14393、MIMXRT1180-EVK、i.MX RT1180、串行下载器、MCU-Link Pro、BusPal、USBSIO
摘要	本文介绍了在i.MX RT1180上实现基于LPSPI的串行下载器的两种方法。

1 介绍

本文介绍了在i.MX RT1180上通过LPSPI使用串行下载器的两种方法，如下所示：

- 用BusPal和MIMXRT1010-EVK实现基于LPSPI的串行下载器：BusPal充当UART和SPI之间的总线转换器。它由软件实现，并且必须在一个硬件平台上运行。BusPal可以通过UART接收blhost 命令，并通过SPI将其发送到MIMXRT1180-EVK平台。
- 用USBSIO和MCU-Link Pro实现基于LPSPI的串行下载器：USBSIO是MCU-Link Pro所支持的功能。它是一个基于LPC55S69的固件，可以与串行I/O设备进行通信。USBSIO可以通过USB接收blhost命令，并通过SPI将其发送到MIMXRT1180-EVK平台。

1.1 串行下载器

i.MX RT1180串行下载器（串行启动）可帮助将启动映像下载到启动设备，然后可以在这些设备上运行该映像。

表1列出了i.MX RT1180上的串行下载器外设的PinMux。

表1. 串行下载器外设的PinMux

外设	实体	端口(IO功能)	PAD
LPUART	1	LPUART1_TX	GPIO_AON_08
		LPUART1_RX	GPIO_AON_09
LPSPI	1	LPSPI1_SCK	GPIO_AON_04
		LPSPI1_PCS0	GPIO_AON_05
		LPSPI1_SDO	GPIO_AON_06
		LPSPI1_SDI	GPIO_AON_07
USB	1	USB1_DN	USB1_DN
		USB1_DP	USB1_DP

图1所示为串行下载器的示意图。PC上的blhost可以通过USB和LPUART直接与i.MX RT1180进行通信。然而，如果用户想通过LPSPI进行通信，则需要使用USBSIO或BusPal。MCU-Link Pro集成了USBSIO功能，而BusPal则可以在许多平台上进行定制。

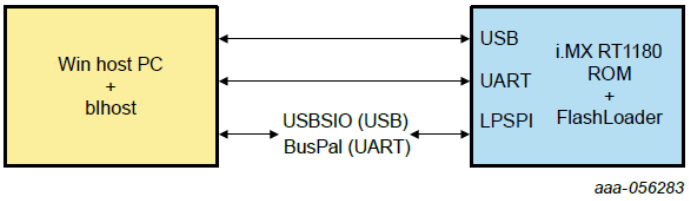


图1. 串行下载器图

1.2 MCU-Link Pro

恩智浦携手Embedded Artists开发了MCU-Link Pro。MCU-Link Pro是一款功能齐全的调试探头，可与MCUXpresso IDE和支持CMSIS-DAP或J-Link协议的第三方IDE配合使用。图2所示为MCU-Link Pro。

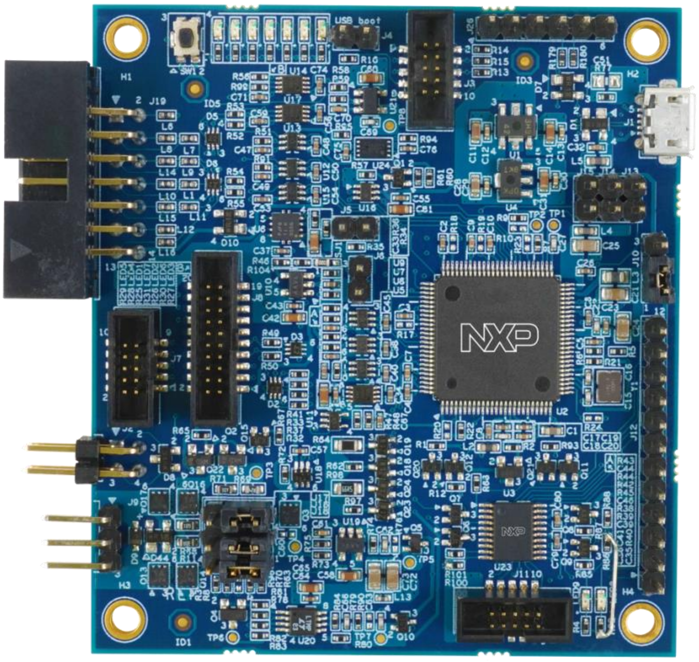


图2. MCU-Link Pro概览

MCU-Link Pro具有以下功能：

- CMSIS-DAP固件支持带有SWD调试接口的所有恩智浦基于Arm Cortex-M的MCU
- SEGGER J-Link固件选项
- 高速USB主机接口
- 双USB转目标UART桥接器（VCOM）
- 同时进行目标供电和电流测量
- SWO分析和I/O功能
- 支持CMSIS-SWO
- USB SPI和I2C桥接器，用于编程/预处理和基于主机的应用程序开发
- 可为目标系统提供高达350mA的电源（在1.8V或3.3V下）
- 模拟信号跟踪输入
- 用于外设仿真的板载用户可编程LPC804
- 用于诊断问题的多个状态LED
- 目标复位按钮

1.3 Blhost

blhost应用程序用于在主机上向运行MCU引导加载程序实现的恩智浦平台发出命令。blhost应用程序与MCU引导加载程序配合使用，允许用户在无需编程工具的情况下将固件应用程序编程到MCU设备上。Blhost可从恩智浦官方网站下载。

blhost应用程序可通过IIC、SPI、UART和USB与MCU引导加载程序连接。blhost还支持BusPal和USBSIO，因为IIC和SPI命令只对Arm-Linux版本的blhost有效。如果使用主机PC，则需要BusPal和USBSIO。

1.4 BusPal

BusPal是与blhost配套使用的嵌入式软件工具。该工具作为总线转换器，通过UART与blhost建立连接，并通过I2C和SPI与目标设备建立连接。它协助blhost传递命令和来自目标设备的响应。

BusPal的源代码随MCU引导加载程序发布版本一起提供，并且此源代码可以进行定制，以便在其他平台上运行。图3所示为BusPal在blhost与目标设备通信中所起的作用。

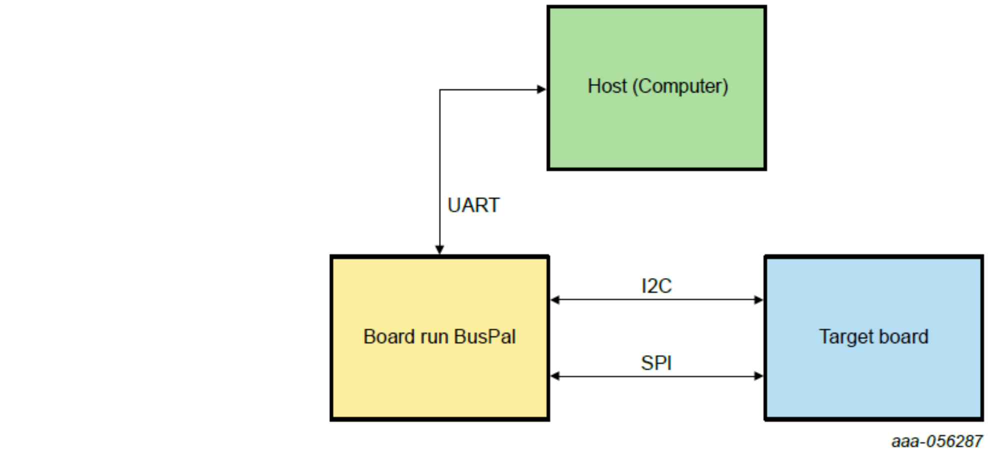


图3. BusPal示意图

1.5 USBSIO

USBSIO也被称为LPC USB串行I/O（LPCUSBSIO），它是一个基于LPC55S69的固件，可以与连接到MCU-Link Pro的串行I/O设备进行通信。

USBSIO包含两个部分：

- *LPC USB串行I/O库*：它是为PC应用程序提供的通用API。这部分内置于blhost中。
- *LPC串行I/O端口*：它是接收USB信息并使用I2C、SPI和GPIO接口将其传输到设备的固件。这部分内置于MCU-Link Pro中，而MCU-Link不支持USBSIO。

2 快速入门

本章介绍了MCU-Link Pro、MIMXRT1010-EVK开发板、MIMXRT1180-EVK开发板和硬件准备的快速入门。

2.1 准备MCU-Link Pro

确保MCU-Link Pro固件已下载到电路板上。MCU-Link Pro固件可从《MCU-Link Pro快速入门》中下载。

图4所示为MCU-Link Pro上的数字I/O连接器（J19）。

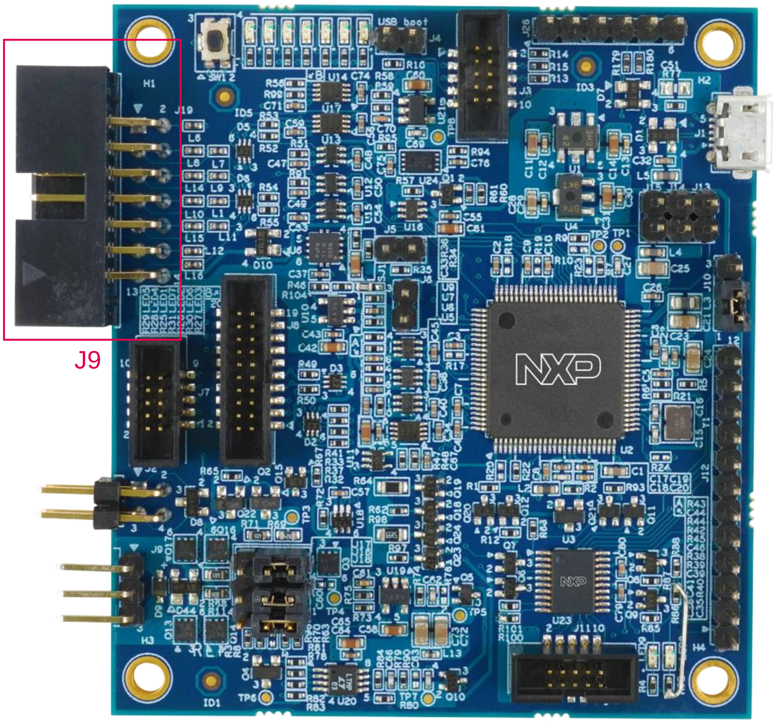


图4. MCU-Link Pro上的数字I/O连接器（J19）

表2所示为数字I/O连接器（J19）上的SPI连接引脚。

表2. 数字I/O连接器（J19）上的SPI连接引脚

J19引脚	信号
1	GND
2	SPI PCS
3	SPI MOSI
4	SPI CLK
5	SPI MISO

2.2 准备MIMXRT1010-EVK开发板

在本文档中，BusPal运行在MIMXRT1010-EVK平台上。请确保BusPal代码已下载到MIMXRT1010-EVK开发板上。

从NXP_Kinetis_Bootloader_2.0.0软件包中下载BusPal示例代码。也可以使用相同链接将此代码移植到其他定制平台上。

***注：**MIMXRT1010-EVK并不包含在此软件包中，因此需要移植BusPal。*

图5显示了MIMXRT1010-EVK上的数字I/O连接器J56、J57和J60。

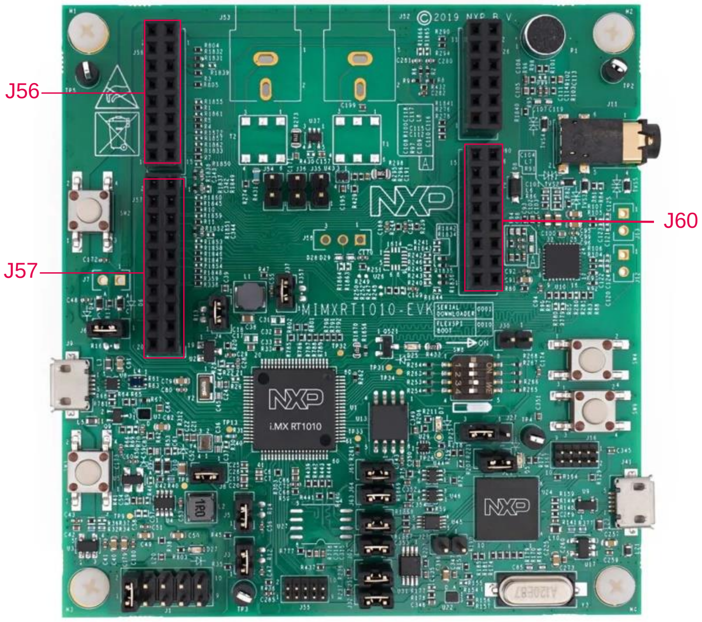


图5. MIMXRT1010-EVK上的数字I/O连接器J56、J57和J60

表3所示为J56上的UART连接引脚。

表3. J56上的UART连接引脚

J56引脚	信号
2	LPUART1_RXD
4	LPUART1_TXD

表4所示为J57上的SPI连接引脚。

表4. J57上的SPI连接引脚

J57引脚	信号
6	LPSPI1_PCS0
8	LPSPI1_MOSI
10	LPSPI1_MISO
12	LPSPI1_SCK

2.3 准备MIMXRT1180-EVK开发板

MIMXRT1180-EVK开发板是一个为展示i.MX RT1180处理器的常用功能而设计的平台。然而，EVK上的LPSPI1引脚无法直接连接。

图6显示了LPSPI1引脚可通过U13连接。

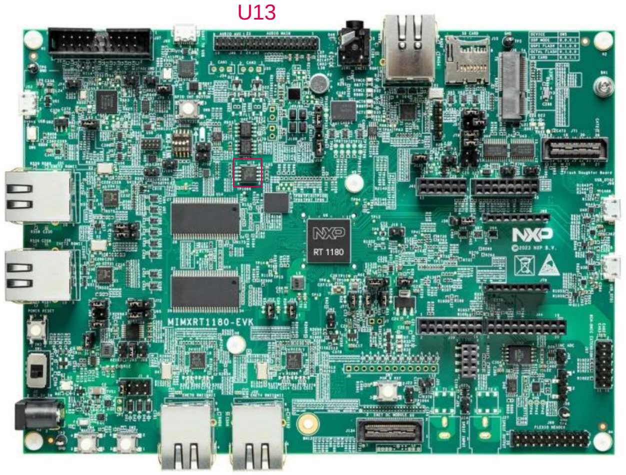


图6. MIMXRT1180-EVK上的U13

表5所示为LPSPI的连接引脚。

表5. U13上的LPSPI连接引脚

U13	信号
1	LPSPI1_PCS0
2	LPSPI1_MISO
5	LPSPI1_MOSI
6	LPSPI1_SCK

这些引脚上的飞线可用于连接该开发板上的LPSPI信号。

2.4 基于LPSPI和BusPal的串行下载器的硬件准备

表6列出了在使用BusPal时，MIMXRT1180-EVK和MIMXRT1010-EVK之间的引脚连接。

表6. MIMXRT1180-EVK和MIMXRT1010-EVK之间的硬件连接

MIMXRT1180-EVK	引脚	MIMXRT1010-EVK	引脚
LPSPI1_PCS0	U13-1	LPSPI1_PCS0	J57-6
LPSPI1_MISO	U13-2	LPSPI1_MOSI	J57-8
LPSPI1_MOSI	U13-5	LPSPI1_MISO	J57-10
LPSPI1_SCK	U13-6	LPSPI1_SCK	J57-12
GND	J37-20	GND	J57-14

表7列出了MIMXRT1010-EVK通过USB转UART连接器与主机PC之间的引脚连接。

表7. 主机PC和MIMXRT1010-EVK之间的硬件连接

MIMXRT1010-EVK开发板	引脚
LPUART1_RXD	J56-2
LPUART1_TXD	J56-4
GND	J60-14

2.5 基于LPSPI和USBSIO的串行下载器的硬件准备

如果使用串行下载器的USBSIO，则需要使用MCU-Link Pro。表8列出了MIMXRT1180-EVK与MCU-Link Pro之间的引脚连接。

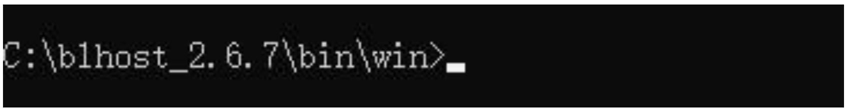
表8. MIMXRT1180-EVK和MCU-Link Pro之间的硬件连接

MIMXRT1180-EVK	引脚	MCU-Link Pro	引脚
LPSPI1_PCS0	U13-1	LPSPI1_PCS0	J19-2
LPSPI1_MISO	U13-2	LPSPI1_MOSI	J19-3
LPSPI1_MOSI	U13-5	LPSPI1_MISO	J19-5
LPSPI1_SCK	U13-6	LPSPI1_SCK	J19-4
GND	J37-20	GND	J19-1

3 用BusPal和MIMXRT1010-EVK实现基于LPSPI的串行下载器

硬件准备完成后，要用BusPal和MIMXRT1010-EVK启动基于LPSPI的串行下载器，请执行以下步骤：

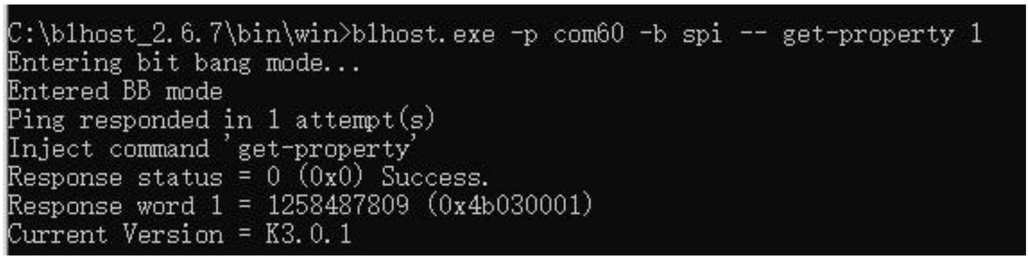
1. 将MIMXRT1180-EVK开发板切换到串行下载器模式。
2. 运行命令行工具，并转到`blhost/bin/win`目录，如图7所示。



```
C:\blhost_2.6.7\bin\win>_
```

图7. 转到blhost窗口目录

3. 输入`blhost.exe -p comi -b spi -- get-property 1`。检查ROM是否能成功通信。参见图8。



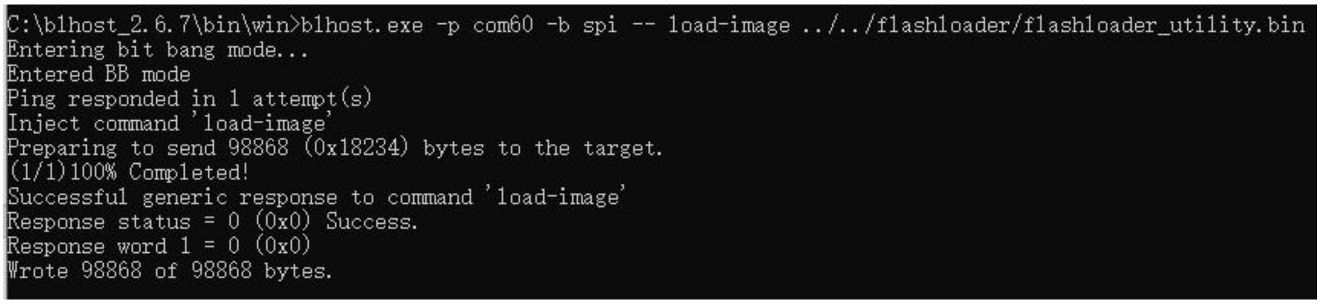
```
C:\blhost_2.6.7\bin\win>blhost.exe -p com60 -b spi -- get-property 1
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'get-property'
Response status = 0 (0x0) Success.
Response word 1 = 1258487809 (0x4b030001)
Current Version = K3.0.1
```

图8. 通过BusPal与ROM通信

SPI默认参数如下：

- 端口0 (0)
- 引脚0 (0)
- 100kbit/s (100)
- 低电平有效极性 (1)
- 下降沿采样 (1)
- 发送命令 = `blhost.exe -p comi -b spi,0,0,100,1,1 -- get-property 1`

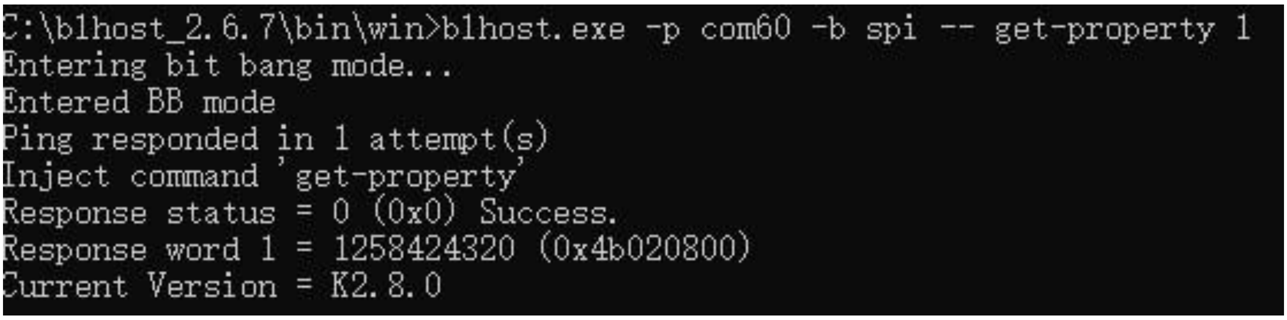
4. 输入`blhost.exe -p comi -b spi -- load-image <file>`。此步骤下载并运行flashloader。确保将容器添加到flashloader。SDK生成flashloader。请参见图9。



```
C:\blhost_2.6.7\bin\win>blhost.exe -p com60 -b spi -- load-image ../../flashloader/flashloader_utility.bin
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'load-image'
Preparing to send 98868 (0x18234) bytes to the target.
(1/1)100% Completed!
Successful generic response to command 'load-image'
Response status = 0 (0x0) Success.
Response word 1 = 0 (0x0)
Wrote 98868 of 98868 bytes.
```

图9. 通过BusPal下载并运行flashloader

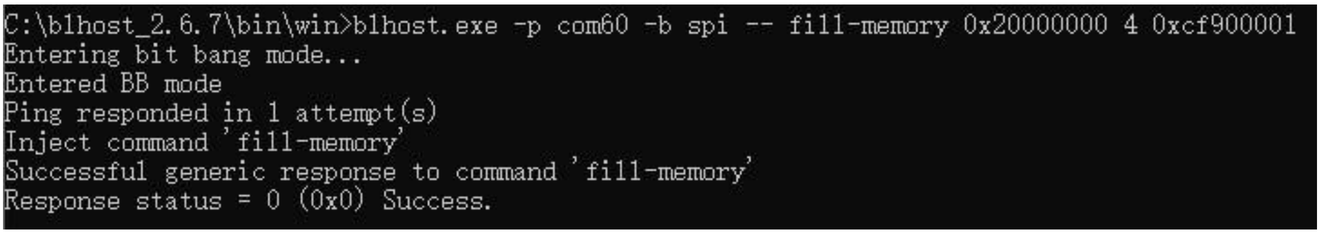
5. 现在，blhost可以与flashloader通信了。再次输入`blhost.exe -p comi -b spi -- get- property 1`。检查flashloader是否能成功通信。请参见图10。



```
C:\blhost_2.6.7\bin\win>blhost.exe -p com60 -b spi -- get-property 1
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'get-property'
Response status = 0 (0x0) Success.
Response word 1 = 1258424320 (0x4b020800)
Current Version = K2.8.0
```

图10. 通过BusPal与flashloader通信

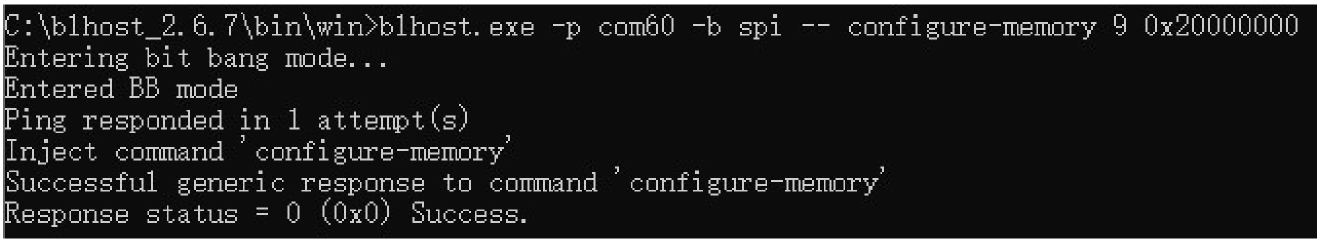
6. 在TCM中设置FlexSPI实体，输入`blhost.exe -p comi -b spi -- fill-memory 0x20000000 4 0xcf900001`。参见图11。



```
C:\blhost_2.6.7\bin\win>blhost.exe -p com60 -b spi -- fill-memory 0x20000000 4 0xcf900001
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'fill-memory'
Successful generic response to command 'fill-memory'
Response status = 0 (0x0) Success.
```

图11. 通过BusPal在TCM中设置FlexSPI实体

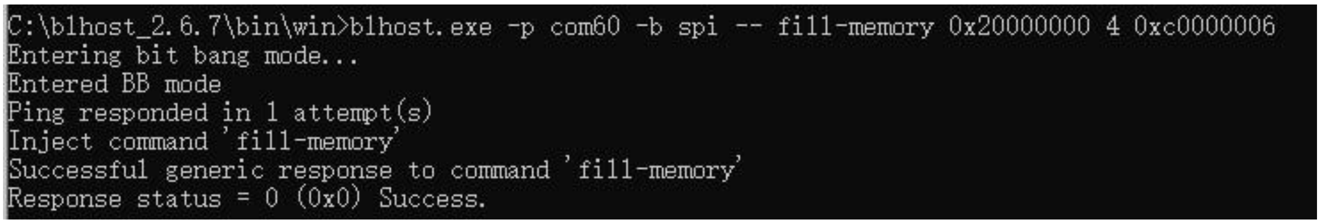
7. 配置内存，输入`blhost.exe -p comi -b spi -- configure-memory 9 0x20000000`。参见图12。



```
C:\blhost_2.6.7\bin\win>blhost.exe -p com60 -b spi -- configure-memory 9 0x20000000
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'configure-memory'
Successful generic response to command 'configure-memory'
Response status = 0 (0x0) Success.
```

图12. 通过BusPal配置内存

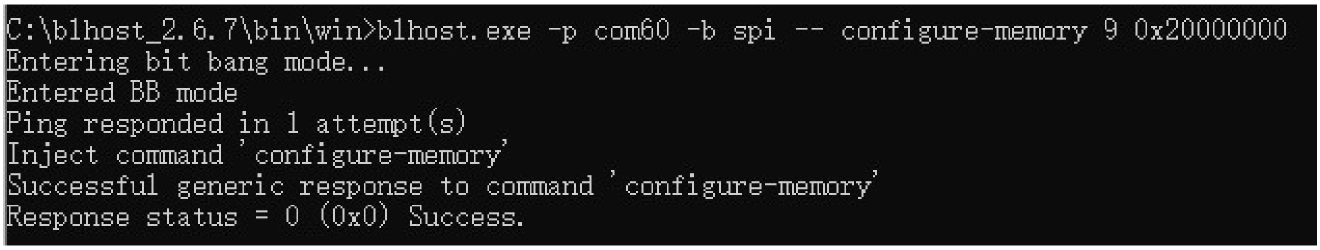
8. 在TCM中设置NOR闪存配置参数，输入`blhost.exe -p comi -b spi -- fill-memory 0x20000000 4 0xc0000006`。参见图13。



```
C:\blhost_2.6.7\bin\win>blhost.exe -p com60 -b spi -- fill-memory 0x20000000 4 0xc0000006
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'fill-memory'
Successful generic response to command 'fill-memory'
Response status = 0 (0x0) Success.
```

图13. 通过BusPal设置NOR闪存配置参数

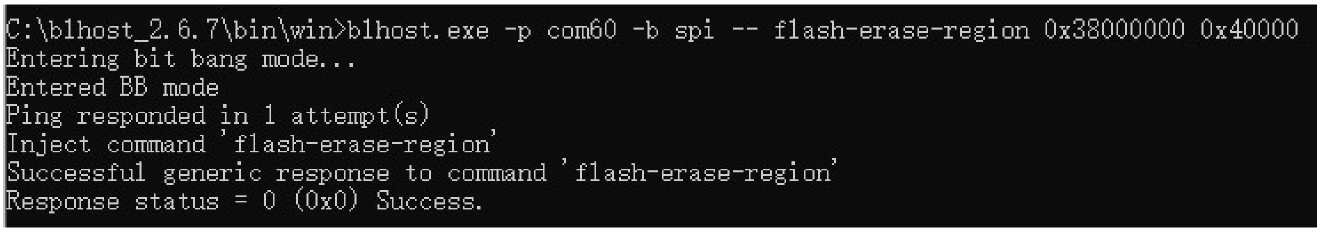
9. 配置内存，输入`blhost.exe -p comi -b spi -- configure-memory 9 0x20000000`。参见图14。



```
C:\blhost_2.6.7\bin\win>blhost.exe -p com60 -b spi -- configure-memory 9 0x20000000
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'configure-memory'
Successful generic response to command 'configure-memory'
Response status = 0 (0x0) Success.
```

图14. 通过BusPal配置内存

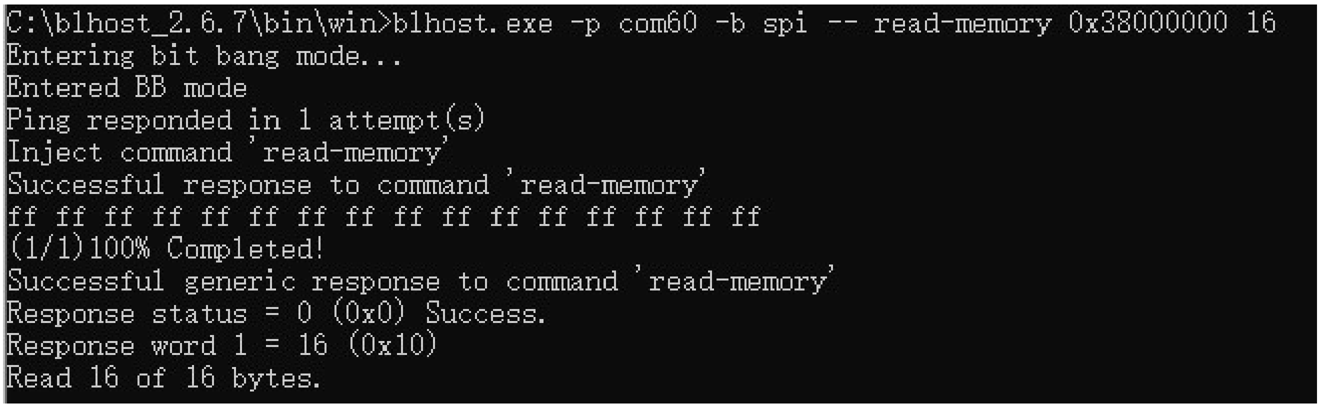
10. 擦除闪存区域，输入`blhost.exe -p comi -b spi -- flash-erase-region 0x38000000 0x40000`。参见图15。



```
C:\blhost_2.6.7\bin\win>blhost.exe -p com60 -b spi -- flash-erase-region 0x38000000 0x40000
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'flash-erase-region'
Successful generic response to command 'flash-erase-region'
Response status = 0 (0x0) Success.
```

图15. 通过BusPal擦除闪存区域

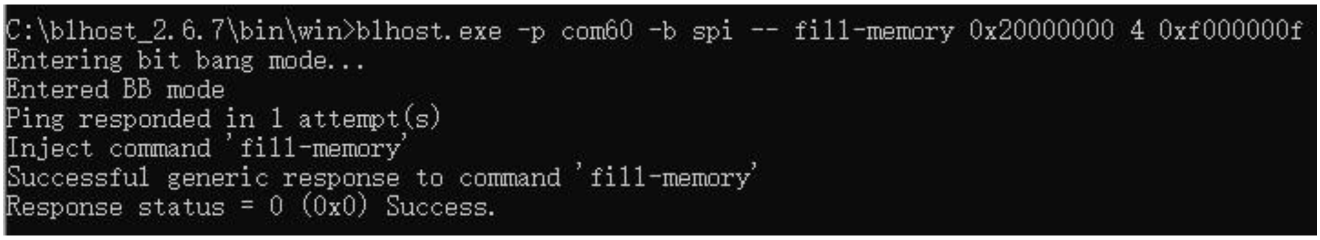
11. 要确认闪存已被擦除，请读取闪存。输入`blhost.exe -p comi -b spi -- read-memory 0x38000000 16`。参见图16。



```
C:\blhost_2.6.7\bin\win>blhost.exe -p com60 -b spi -- read-memory 0x38000000 16
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'read-memory'
Successful response to command 'read-memory'
ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
(1/1)100% Completed!
Successful generic response to command 'read-memory'
Response status = 0 (0x0) Success.
Response word 1 = 16 (0x10)
Read 16 of 16 bytes.
```

图16. 通过BusPal读取闪存

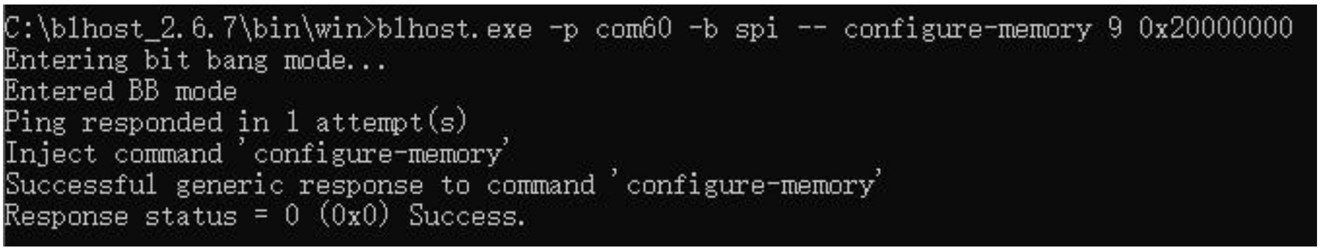
12. 添加所用的FDCB XIP，输入`blhost.exe -p comi -b spi -- fill-memory 0x20000000 4 0xf000000f`。参见图17。



```
C:\blhost_2.6.7\bin\win>blhost.exe -p com60 -b spi -- fill-memory 0x20000000 4 0xf000000f
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'fill-memory'
Successful generic response to command 'fill-memory'
Response status = 0 (0x0) Success.
```

图17. 通过BusPal添加所用的FDCB XIP

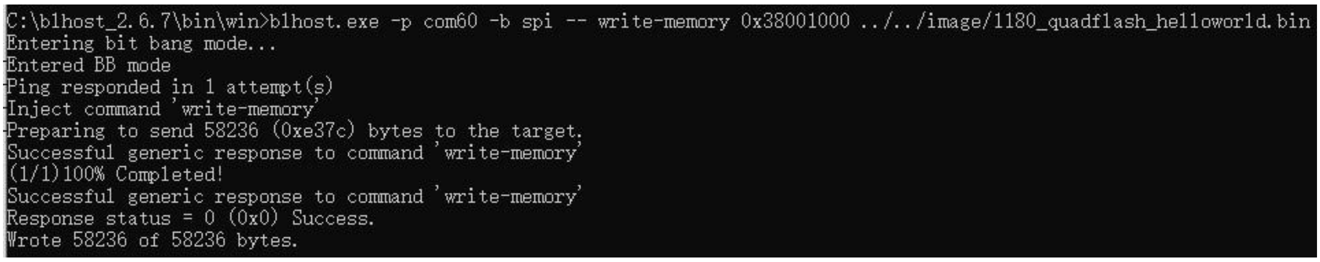
13. 配置内存，输入blhost.exe -p comi -b spi -- configure-memory 9 0x20000000。参见图18。



```
C:\blhost_2.6.7\bin\win>blhost.exe -p com60 -b spi -- configure-memory 9 0x20000000
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'configure-memory'
Successful generic response to command 'configure-memory'
Response status = 0 (0x0) Success.
```

图18. 通过BusPal配置内存

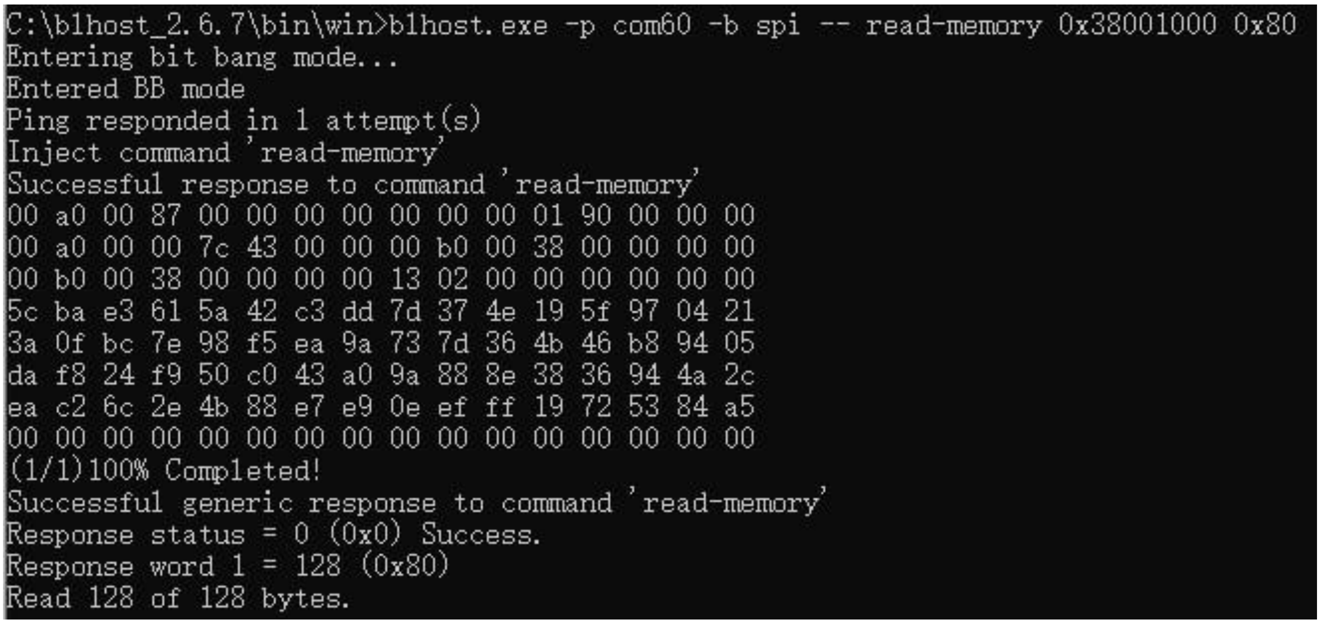
14. 写入映像，输入blhost.exe -p comi -b spi -- write-memory <path>。参见图19。



```
C:\blhost_2.6.7\bin\win>blhost.exe -p com60 -b spi -- write-memory 0x38001000 ../../image/1180_quadflash_helloworld.bin
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'write-memory'
Preparing to send 58236 (0xe37c) bytes to the target.
Successful generic response to command 'write-memory'
(1/1)100% Completed!
Successful generic response to command 'write-memory'
Response status = 0 (0x0) Success.
Wrote 58236 of 58236 bytes.
```

图19. 通过BusPal写入内存

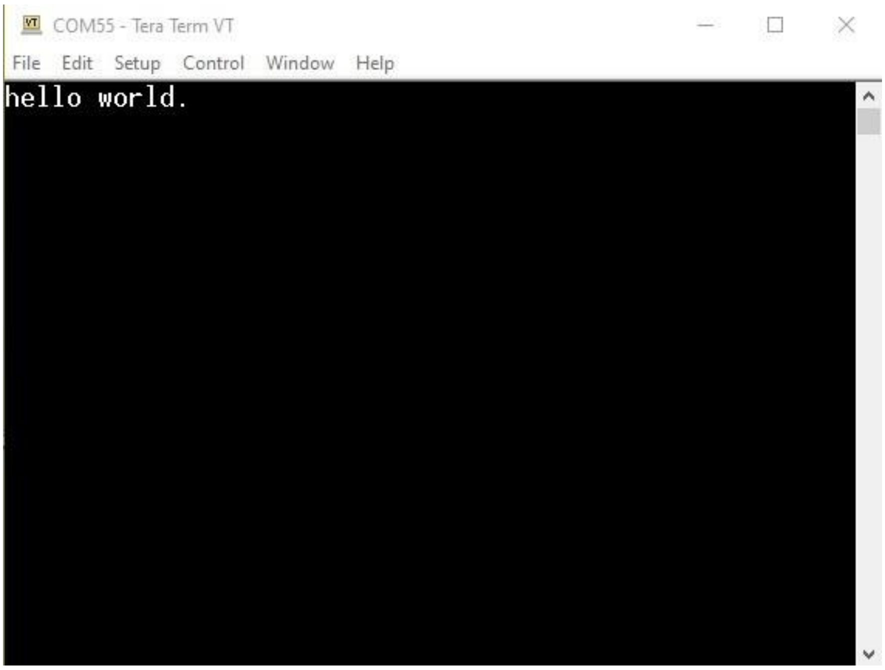
15. 要确认写入是否成功，请读取映像。输入blhost.exe -p comi -b spi -- read-memory 0x38001000 0x400。参见图20。



```
C:\blhost_2.6.7\bin\win>blhost.exe -p com60 -b spi -- read-memory 0x38001000 0x80
Entering bit bang mode...
Entered BB mode
Ping responded in 1 attempt(s)
Inject command 'read-memory'
Successful response to command 'read-memory'
00 a0 00 87 00 00 00 00 00 00 00 01 90 00 00 00
00 a0 00 00 7c 43 00 00 00 b0 00 38 00 00 00 00
00 b0 00 38 00 00 00 00 13 02 00 00 00 00 00 00
5c ba e3 61 5a 42 c3 dd 7d 37 4e 19 5f 97 04 21
3a 0f bc 7e 98 f5 ea 9a 73 7d 36 4b 46 b8 94 05
da f8 24 f9 50 c0 43 a0 9a 88 8e 38 36 94 4a 2c
ea c2 6c 2e 4b 88 e7 e9 0e ef ff 19 72 53 84 a5
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
(1/1)100% Completed!
Successful generic response to command 'read-memory'
Response status = 0 (0x0) Success.
Response word 1 = 128 (0x80)
Read 128 of 128 bytes.
```

图20 通过BusPal读取内存

16. 将MIMXRT1180-EVK开发板切换到内部启动模式。图21所示为UART显示的消息。



```
hello world.
```

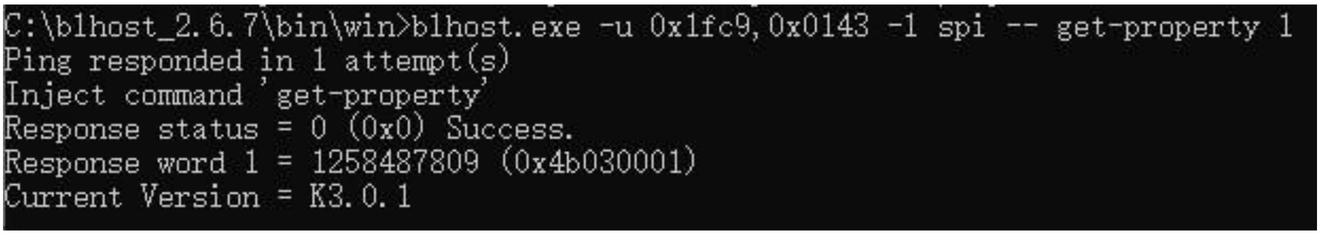
图21. 启动成功

4 用USBSIO和MCU-Link Pro实现基于LPSPI的串行下载器

硬件准备完成后，要用USBSIO和MCU-Link Pro启动基于LPSPI的串行下载器，请执行以下步骤：

1. 将MIMXRT1180-EVK开发板切换到串行下载器模式。

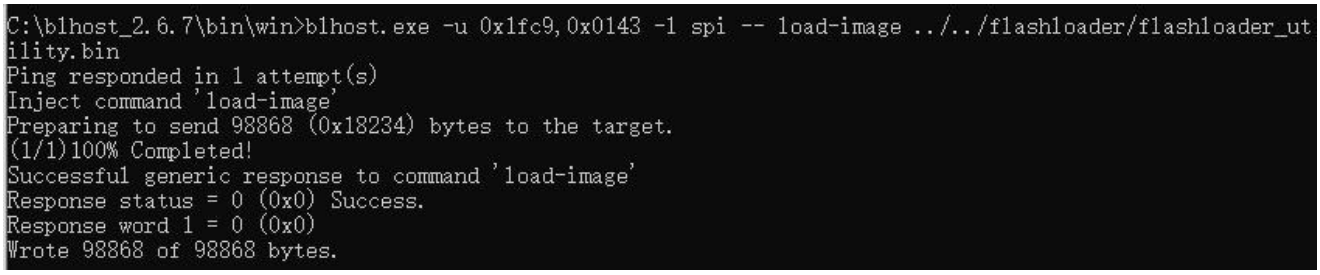
2. 运行命令行工具，并转到`blhost/bin/win`目录，如图7所示。
3. 输入`blhost.exe -u [<vid>,<pid>] -l spi -- get-property 1`。检查ROM是否能成功通信。参见图22。



```
C:\blhost_2.6.7\bin\win>blhost.exe -u 0x1fc9,0x0143 -l spi -- get-property 1
Ping responded in 1 attempt(s)
Inject command 'get-property'
Response status = 0 (0x0) Success.
Response word 1 = 1258487809 (0x4b030001)
Current Version = K3.0.1
```

图22. 通过USBSIO与ROM通讯

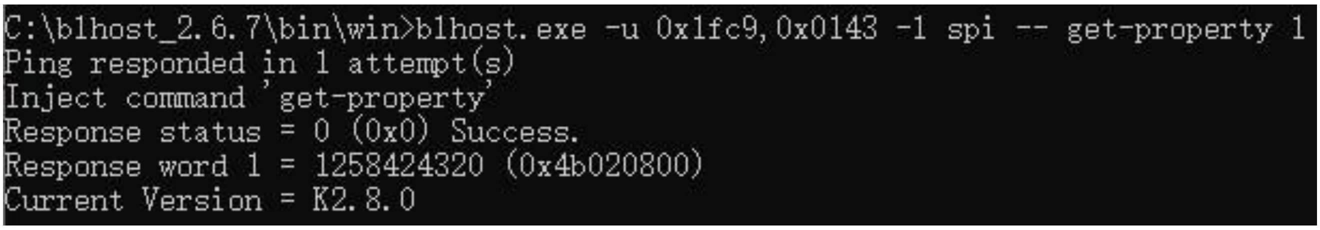
4. 输入`blhost.exe -u [<vid>,<pid>] -l spi -- load-image <file>`。此步骤下载并运行flashloader。确保将容器添加到flashloader。SDK生成flashloader。请参见图23。



```
C:\blhost_2.6.7\bin\win>blhost.exe -u 0x1fc9,0x0143 -l spi -- load-image ../../flashloader/flashloader_ut
ility.bin
Ping responded in 1 attempt(s)
Inject command 'load-image'
Preparing to send 98868 (0x18234) bytes to the target.
(1/1)100% Completed!
Successful generic response to command 'load-image'
Response status = 0 (0x0) Success.
Response word 1 = 0 (0x0)
Wrote 98868 of 98868 bytes.
```

图23. 通过USBSIO下载并运行flashloader

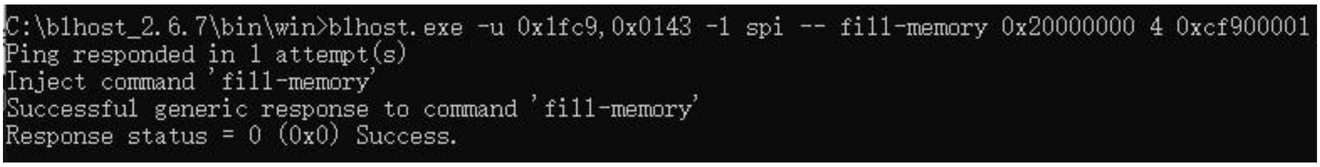
5. 现在，blhost可以与flashloader通信了。再次输入`blhost.exe -u [<vid>,<pid>] -l spi -- get-property 1`。检查flashloader是否能成功通信。请参见图24。



```
C:\blhost_2.6.7\bin\win>blhost.exe -u 0x1fc9,0x0143 -l spi -- get-property 1
Ping responded in 1 attempt(s)
Inject command 'get-property'
Response status = 0 (0x0) Success.
Response word 1 = 1258424320 (0x4b020800)
Current Version = K2.8.0
```

图24. 通过USBSIO与flashloader通信

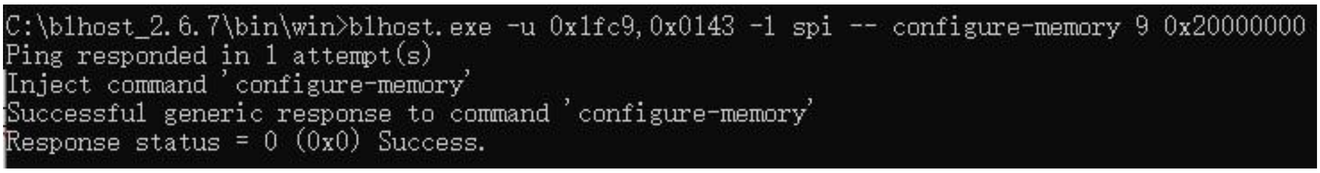
6. 在TCM中设置FlexSPI实体，输入`blhost.exe -u [<vid>,<pid>] -l spi -- fill-memory 0x20000000 4 0xcf900001`。参见图25。



```
C:\blhost_2.6.7\bin\win>blhost.exe -u 0x1fc9,0x0143 -l spi -- fill-memory 0x20000000 4 0xcf900001
Ping responded in 1 attempt(s)
Inject command 'fill-memory'
Successful generic response to command 'fill-memory'
Response status = 0 (0x0) Success.
```

图25. 通过USBSIO在TCM中设置FlexSPI实体

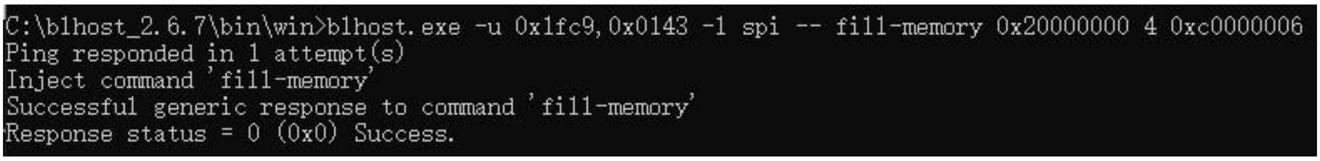
7. 配置内存，输入`blhost.exe -u [<vid>,<pid>] -l spi -- configure-memory 9 0x20000000`。参见图26。



```
C:\blhost_2.6.7\bin\win>blhost.exe -u 0x1fc9,0x0143 -l spi -- configure-memory 9 0x20000000
Ping responded in 1 attempt(s)
Inject command 'configure-memory'
Successful generic response to command 'configure-memory'
Response status = 0 (0x0) Success.
```

图26. 通过USBSIO配置内存

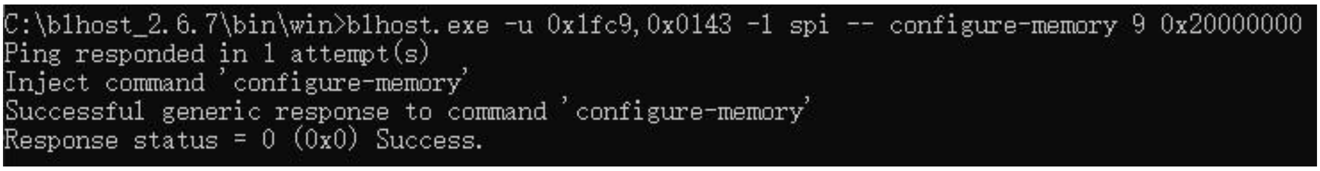
8. 在TCM中设置NOR闪存配置参数，输入`blhost.exe -u [<vid>,<pid>] -l spi -- fill-memory 0x20000000 4 0xc0000006`。参见图27。



```
C:\blhost_2.6.7\bin\win>blhost.exe -u 0x1fc9,0x0143 -l spi -- fill-memory 0x20000000 4 0xc0000006
Ping responded in 1 attempt(s)
Inject command 'fill-memory'
Successful generic response to command 'fill-memory'
Response status = 0 (0x0) Success.
```

图27. 通过USBSIO设置NOR闪存配置参数

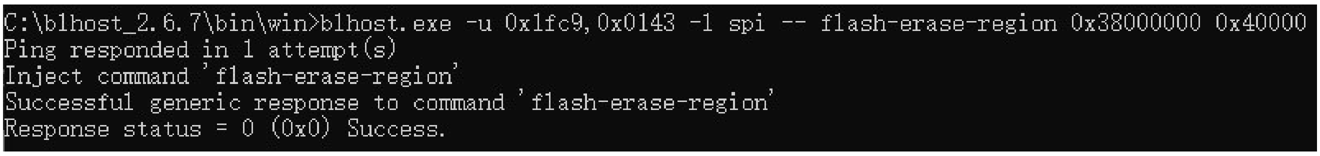
9. 配置内存，输入`blhost.exe -u [<vid>,<pid>] -l spi -- configure-memory 9 0x20000000`。参见图28。



```
C:\blhost_2.6.7\bin\win>blhost.exe -u 0x1fc9,0x0143 -l spi -- configure-memory 9 0x20000000
Ping responded in 1 attempt(s)
Inject command 'configure-memory'
Successful generic response to command 'configure-memory'
Response status = 0 (0x0) Success.
```

图28. 通过USBSIO配置内存

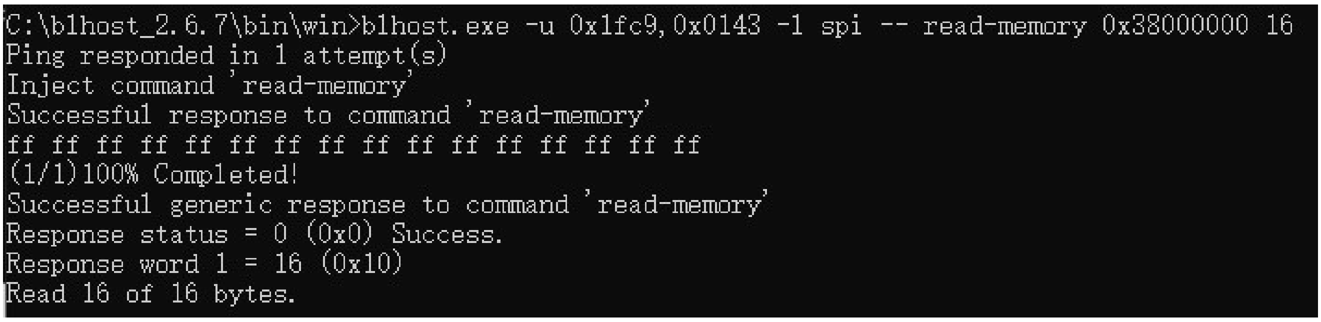
10. 擦除闪存区域，输入`blhost.exe -u [<vid>,<pid>] -l spi -- flash-erase-region 0x38000000 0x40000`。参见图29。



```
C:\blhost_2.6.7\bin\win>blhost.exe -u 0x1fc9,0x0143 -l spi -- flash-erase-region 0x38000000 0x40000
Ping responded in 1 attempt(s)
Inject command 'flash-erase-region'
Successful generic response to command 'flash-erase-region'
Response status = 0 (0x0) Success.
```

图29. 通过USBSIO擦除闪存区域

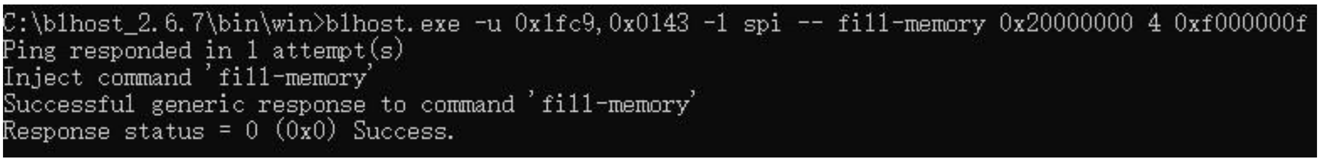
11. 要确认闪存已被擦除，请读取闪存。输入`blhost.exe -u [<vid>,<pid>] -l spi-- read-memory 0x38000000 16`。参见图30。如果成功，其结果与图30所示类似。



```
C:\blhost_2.6.7\bin\win>blhost.exe -u 0x1fc9,0x0143 -l spi -- read-memory 0x38000000 16
Ping responded in 1 attempt(s)
Inject command 'read-memory'
Successful response to command 'read-memory'
ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
(1/1)100% Completed!
Successful generic response to command 'read-memory'
Response status = 0 (0x0) Success.
Response word 1 = 16 (0x10)
Read 16 of 16 bytes.
```

图30. 通过USBSIO读取闪存

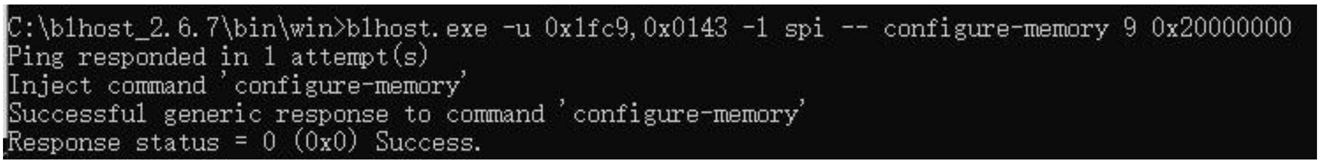
12. 添加所用的FDCB XIP，输入`blhost.exe -u [<vid>,<pid>] -l spi -- fill-memory 0x20000000 4 0xf000000f`。参见图31。如果成功，其结果与图31所示的类似。



```
C:\blhost_2.6.7\bin\win>blhost.exe -u 0x1fc9,0x0143 -l spi -- fill-memory 0x20000000 4 0xf000000f
Ping responded in 1 attempt(s)
Inject command 'fill-memory'
Successful generic response to command 'fill-memory'
Response status = 0 (0x0) Success.
```

图31. 通过USBSIO添加FDCB

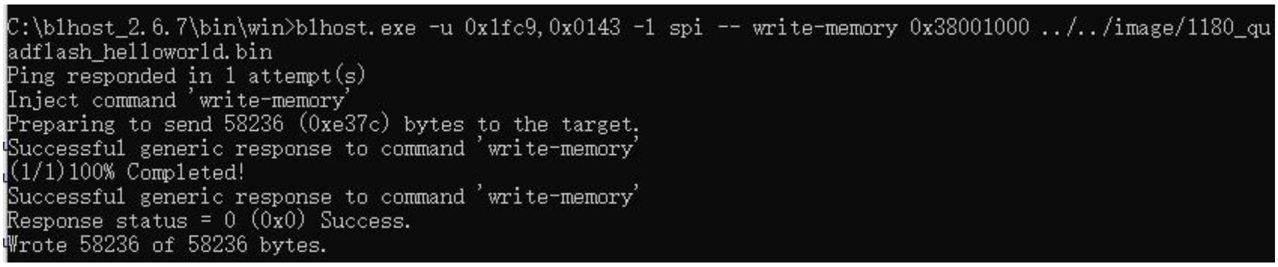
13. 配置内存，输入`blhost.exe -u [<vid>,<pid>] -l spi -- configure-memory 9 0x20000000`。参见图32。



```
C:\blhost_2.6.7\bin\win>blhost.exe -u 0x1fc9,0x0143 -l spi -- configure-memory 9 0x20000000
Ping responded in 1 attempt(s)
Inject command 'configure-memory'
Successful generic response to command 'configure-memory'
Response status = 0 (0x0) Success.
```

图32. 通过USBSIO配置内存

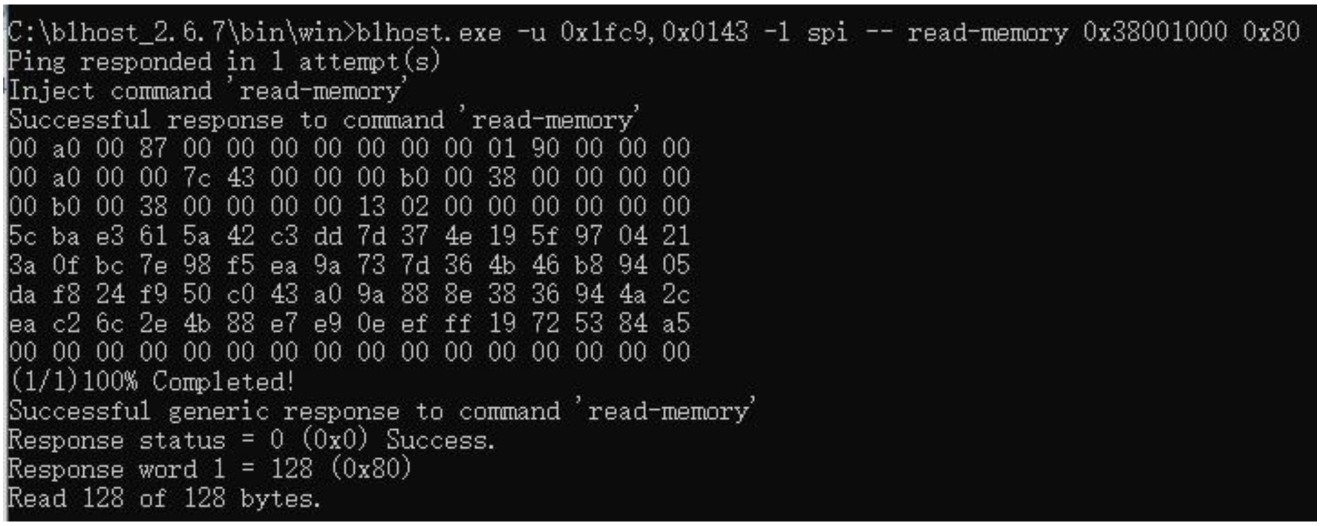
14. 写入映像，输入`blhost.exe -u [<vid>,<pid>] -l spi -- write-memory <path>`。参见图33。



```
C:\blhost_2.6.7\bin\win>blhost.exe -u 0x1fc9,0x0143 -l spi -- write-memory 0x38001000 ../../image/1180_qu
adflash_helloworld.bin
Ping responded in 1 attempt(s)
Inject command 'write-memory'
Preparing to send 58236 (0xe37c) bytes to the target.
Successful generic response to command 'write-memory'
(1/1)100% Completed!
Successful generic response to command 'write-memory'
Response status = 0 (0x0) Success.
Wrote 58236 of 58236 bytes.
```

图33. 通过USBSIO写入映像

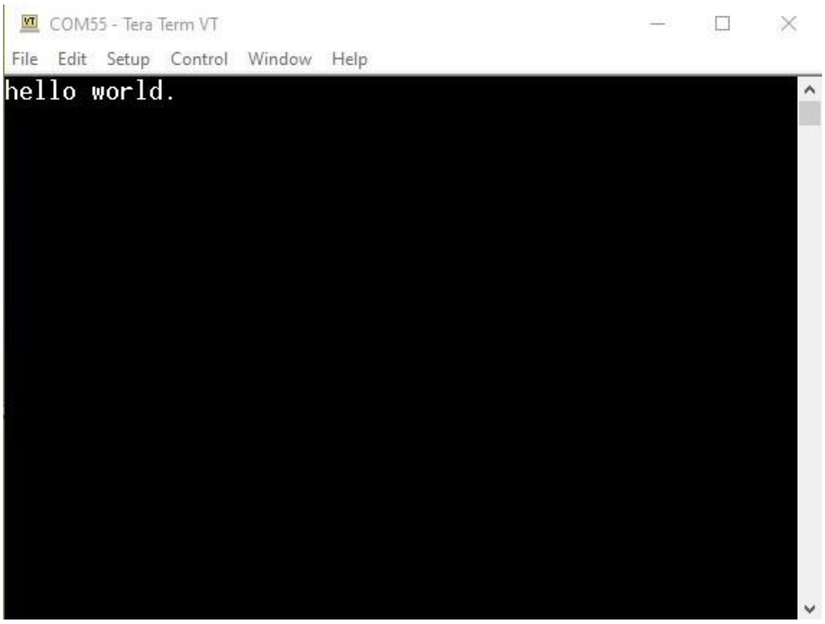
15. 要确认写入是否成功，请读取映像。输入`blhost.exe -u [<vid>,<pid>] -l spi-- read-memory 0x38001000 0x100`。参见图34。



```
C:\blhost_2.6.7\bin\win>blhost.exe -u 0x1fc9,0x0143 -l spi -- read-memory 0x38001000 0x80
Ping responded in 1 attempt(s)
Inject command 'read-memory'
Successful response to command 'read-memory'
00 a0 00 87 00 00 00 00 00 00 00 01 90 00 00 00
00 a0 00 00 7c 43 00 00 00 b0 00 38 00 00 00 00
00 b0 00 38 00 00 00 00 13 02 00 00 00 00 00 00
5c ba e3 61 5a 42 c3 dd 7d 37 4e 19 5f 97 04 21
3a 0f bc 7e 98 f5 ea 9a 73 7d 36 4b 46 b8 94 05
da f8 24 f9 50 c0 43 a0 9a 88 8e 38 36 94 4a 2c
ea c2 6c 2e 4b 88 e7 e9 0e ef ff 19 72 53 84 a5
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
(1/1)100% Completed!
Successful generic response to command 'read-memory'
Response status = 0 (0x0) Success.
Response word 1 = 128 (0x80)
Read 128 of 128 bytes.
```

图34. 通过USBSIO读取映像

16. 将MIMXRT1180-EVK开发板切换到内部启动模式。图35所示为UART显示的消息。



```
hello world.
```

图35. 启动成功

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6 修订历史

表9汇总了本文的修订情况。

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文档ID	发布日期	说明
AN14393 v.1.0	2024年9月4日	首次公开发布

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