

QNX 6.6.0 Setup Manual For Raspberry Pi2 Board

User's Manual: Software

BCM 2836

Table of Contents

1.	Overview	5
1.1	Features	5
1.2	Scope.....	5
1.3	Target System	5
1.4	List of Abbreviations and Acronym.....	5
1.5	Environmental Requirement	5
2.	Building QNX6.6.0 OS image	6
2.1	Prerequisites.....	6
2.2	Build QNX 6.6.0 BSP	6
3.	Boot up QNX 6.6.0	7
3.1	Prerequisites.....	7
3.2	Boot up steps.....	7
3.2.1	Step 1: Copy the necessary files to SD card.	7
3.2.2	Step 2: Insert SD to Raspberry Pi2 board.....	7
3.2.3	Step 3: Connect serial port of Raspberry Pi2 to Window PC.....	7
3.2.4	Step 4: Setup serial port for Window PC	8
3.2.5	Step 5: Power up Raspberry Pi2 board.....	8
3.2.6	Step 6: Image QNX 6.6.0 will be loaded.....	8
3.2.7	Step 7: Boot up finish.	9
4.	Test driver	10
4.1	Serial driver.....	10
4.2	USB driver	10
4.3	Network driver	10
4.3.1	Test Overview	10
4.3.2	Equipment and Software Used	10
4.3.3	Test Items	11
4.3.4	Test Procedures	11
4.3.5	Test Link connectivity using ping command	11
4.3.6	Testing Command Control by a TELNET Client.....	12
4.3.7	File transmission test between Window PC and Raspberry Pi2 board.....	13

LIST OF FIGURES

Figure 4-1 Connect the Raspberry Pi2 board and Windows PC	10
Figure 4-2 Test ping command on Raspberry Pi2 board.....	12
Figure 4-3 Test ping command on PC	12
Figure 4-4 Login console	12
Figure 4-5 QNX6.6 Raspberry Pi2 console	13
Figure 4.3 Open New QNX target	13
Figure 4.4 Select New QNX target.....	14
Figure 4.5 Add Raspberry Pi2 QNX 6.6 target	14
Figure 4.5 Finish adding Raspberry Pi2 QNX 6.6 target	15
Figure 4.6 Raspberry Pi2 QNX 6.6 target tmp folder list.....	15
Figure 4.7 Send a files from PC to Raspberry Pi2 QNX 6.6 target.....	16
Figure 4.8 Finish sending a files from PC to Raspberry Pi2 QNX 6.6 target	16
Figure 4.9 Send a files from Raspberry Pi2 QNX 6.6 target to PC.....	17
Figure 4.10 Locate file on PC	17

LIST OF TABLES

Table 1.1 Environment Requirement 5

1. Overview

1.1 Features

In the case of V.1.1.0 BSP, following drivers/libraries/utilities are supported:

- 1) Startup
- 2) ARM timer
- 3) Mailbox
- 4) Serial driver
- 5) USB driver
- 6) Network driver

1.2 Scope

This document scope applies to the evaluation of reproducing QNX6.6.0 image and testing QNX BSP drivers for Raspberry Pi2 platform.

1.3 Target System

- 1) Target platform: Raspberry Pi2 platform.
- 2) Target software: QNX SDP 6.6.0

1.4 List of Abbreviations and Acronym

Abbreviation	Full Form
BSP	Board Support Package
Mailbox	BCM2836 Mail box
SDP	Software Development Platform - A software is used to build BSP
Momentics IDE	QNX Momentics Integrated Development Environment

1.5 Environmental Requirement

Table 1.1 Environment Requirement

Equipment	Explanation
Windows Host PC	Windows 7 or higher
Terminal software	TeraTerm (version 4.75 or newer)

2. Building QNX6.6.0 OS image

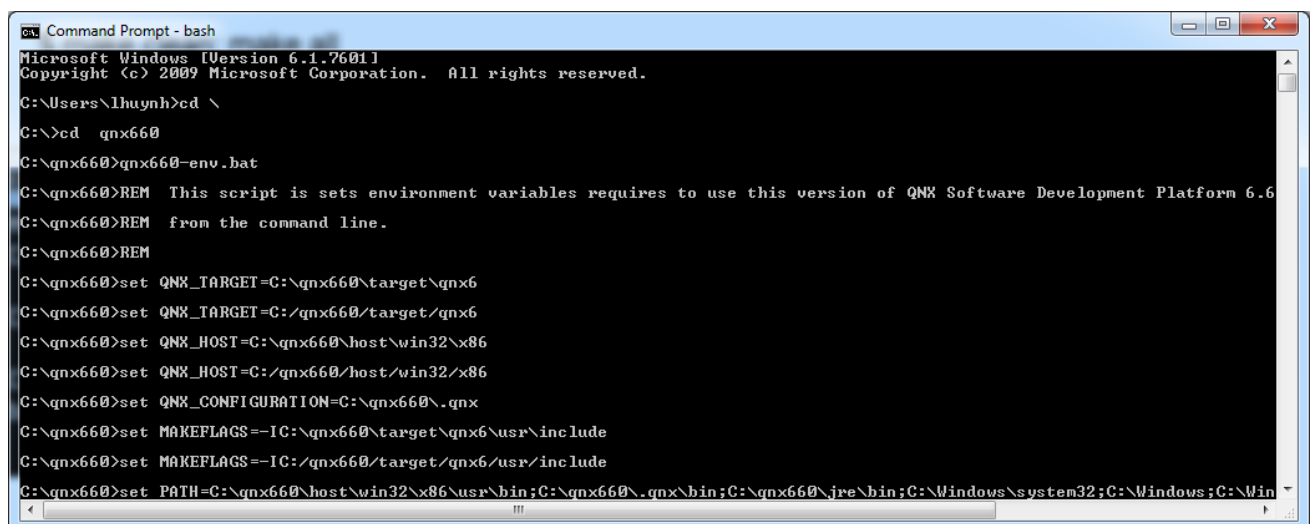
2.1 Prerequisites

- 1) QNX6.6.0 SDP installed on Windows Host PC.
- 2) QNX6.6.0 BSP for Raspberry Pi2 board project folder
Download `bsp-ntotruk-broadcom-bcm2836-trunk.zip` and extract it into a folder on Windows Host PC (ex: `C:\bsp-ntotruk-broadcom-bcm2836-trunk`)
- 3) Valid active key (bcm2836.build)
Replace (overwrite) valid active key (bcm2836.build) onto `bsp-ntotruk-broadcom-bcm2836-trunk\prebuilt\armle-v7\boot\build\bcm2836.build`
A valid active key is not required to build QNX6.6 image from `bsp-ntotruk-broadcom-bcm2836-trunk.zip`, but you can't successfully boot QNX6.6 with an invalid active key.
To obtain a valid active please get your Raspberry Pi2 board's serial number and send this serial number to SHC.

2.2 Build QNX 6.6.0 BSP

To generate the QNX image for Raspberry Pi2 board, enter following commands from the command prompt console:

```
$ cd QNX 6.6.0 install
$ qnx660-env.bat
$ cd <QNX_BSP_Root_Directory>
$ bash
$ make clean; make all
```



```
Command Prompt - bash
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\Ihuynh>cd \
C:\>cd qnx660
C:\qnx660>qnx660-env.bat
C:\qnx660>REM This script is sets environment variables requires to use this version of QNX Software Development Platform 6.6
C:\qnx660>REM from the command line.
C:\qnx660>REM
C:\qnx660>set QNX_TARGET=C:\qnx660\target\qnx6
C:\qnx660>set QNX_TARGET=C:/qnx660/target/qnx6
C:\qnx660>set QNX_HOST=C:\qnx660\host\win32\x86
C:\qnx660>set QNX_HOST=C:/qnx660/host/win32/x86
C:\qnx660>set QNX_CONFIGURATION=C:\qnx660\qnx
C:\qnx660>set MAKEFLAGS=-IC:\qnx660\target\qnx6\usr\include
C:\qnx660>set MAKEFLAGS=-IC:/qnx660/target/qnx6/usr/include
C:\qnx660>set PATH=C:\qnx660\host\win32\x86\usr\bin;C:\qnx660\qnx\bin;C:\qnx660\jre\bin;C:\Windows\system32;C:\Windows;C:\Win
```

QNX 6.6.0 image is created at: `bsp-ntotruk-broadcom-bcm2836-trunk/images/ifs-bcm2836.bin`

3. Boot up QNX 6.6.0

3.1 Prerequisites

- A SD Card which the first partition is formatted as FAT32.
- ifs-bcm2836.bin: a QNX 6.6 image for Raspberry Pi2 board, which is built by a valid active key as guide in 2.2 section Build QNX 6.6.0 BSP.
- SD_boot_binaries.zip which is patched in the release package.
- Tera Term software installed on Windows PC.

3.2 Boot up steps

Please follow the steps:

3.2.1 Step 1: Copy the necessary files to SD card.

- Put file ifs-bcm2836.bin which located at bsp-ntotrust-broadcom-bcm2836-trunk/images/ifs-bcm2836.bin to the root folder of the SD card.
- Extract files in SD_boot_binaries.zip to the root folder of the SD card. After this step, in the root folder of SD card should have these following files:
 - config.txt
 - bootcode.bin
 - start.elf
 - start_cd.elf
 - start_db.elf
 - start_x.elf
 - fixup.dat
 - fixup_cd.dat
 - fixup_db.dat
 - fixup_x.dat
 - ifs-bcm2836.bin

3.2.2 Step 2: Insert SD to Raspberry Pi2 board

Insert SD card which has the necessary files into SD slot of Raspberry Pi2 board.

3.2.3 Step 3: Connect serial port of Raspberry Pi2 to Window PC

Please use TTL-232R-3V3 (<http://www.ftdichip.com/Products/Cables/USBTTLSerial.htm>) to connect Raspberry Pi2 board to Window PC as following:

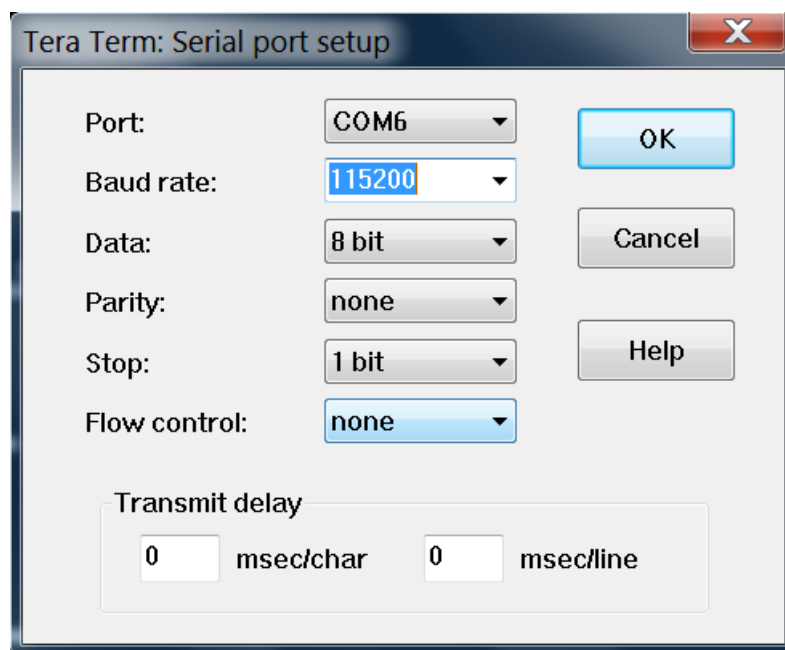
GND:	TTL-232R-3V3 pin1 (Black)	<----->	RPi2 J8 pin 6
Rx :	TTL-232R-3V3 pin5 (Yellow)	<----->	RPi2 J8 pin 8
Tx :	TTL-232R-3V3 pin4 (Orange)	<----->	RPi2 J8 pin 10

Please note: you must use the TTL-232R-3V3 version. The version TTL-232R-5V could damage your Raspberry Pi GPIO because of 5V logic.



3.2.4 Step 4: Setup serial port for Window PC

From Window PC open Tera Term program and set up as following:



3.2.5 Step 5: Power up Raspberry Pi2 board

Raspberry Pi2 board is powered up by plug the board to an USB power source. You could power it by your PC USB port if it could supply more than 800mA.

3.2.6 Step 6: Image QNX 6.6.0 will be loaded

Image will be loaded and the [Tera Term] terminal will output as bellows:

```
CPU0: L1 Dcache: 512x64 WB
CPU0: L2 Dcache: 8192x64 WB
CPU0: VFP-d32 FPSID=41023075
CPU0: NEON MVFR0=10110222 MVFR1=11111111
CPU0: 410fc075: Cortex A7 rev 5 600MHz
Loading IFS...decompressing...done
```

```

CPU1: L1 Icache: 1024x32
CPU1: L1 Dcache: 512x64 WB
CPU1: L2 Dcache: 8192x64 WB
CPU1: VFP-d32 FPSID=41023075
CPU1: NEON MVFR0=10110222 MVFR1=11111111
CPU1: 410fc075: Cortex A7 rev 5 600MHz
CPU2: L1 Icache: 1024x32
CPU2: L1 Dcache: 512x64 WB
CPU2: L2 Dcache: 8192x64 WB
CPU2: VFP-d32 FPSID=41023075
CPU2: NEON MVFR0=10110222 MVFR1=11111111
CPU2: 410fc075: Cortex A7 rev 5 600MHz
CPU3: L1 Icache: 1024x32
CPU3: L1 Dcache: 512x64 WB
CPU3: L2 Dcache: 8192x64 WB
CPU3: VFP-d32 FPSID=41023075
CPU3: NEON MVFR0=10110222 MVFR1=11111111
CPU3: 410fc075: Cortex A7 rev 5 600MHz
alloc_syspage_memory: syspage size:00000dc8 _syspage_ptr:00ae0000
callout_io_map: mapping paddr:3f00b200 returns:fc419200
callout_io_map: mapping paddr:40000000 returns:fc41a000
callout_io_map: mapping paddr:3f00b200 returns:fc41b200
callout_io_map: mapping paddr:40000000 returns:fc41c000
callout_io_map: mapping paddr:3f00b200 returns:fc41d200
callout_io_map: mapping paddr:40000000 returns:fc41e000
callout_io_map: mapping paddr:3f00b200 returns:fc41f200
callout_io_map: mapping paddr:40000000 returns:fc420000
callout_io_map: mapping paddr:00000000 returns:fc421000
callout_io_map: mapping paddr:3f100000 returns:fc422000
callout_io_map: mapping paddr:3f00b400 returns:fc423400
callout_io_map: mapping paddr:3f00b400 returns:fc425400
callout_io_map: mapping paddr:3f00b400 returns:fc427400
callout_io_map: mapping paddr:3f201000 returns:fc429000
callout_io_map: mapping paddr:3f201000 returns:fc42a000
callout_io_map: mapping paddr:3f201000 returns:fc42b000
cpu_startnext: cpu1 -> fc410b50
cpu_startnext: cpu2 -> fc410b50
cpu_startnext: cpu3 -> fc410b50

System page at phys:00ae0000 user:fc410000 kern:fc410000
Starting next program at vfe059e3c
cpu_startnext: cpu0 -> fe059e3c
VFPv3: fpsid=41023075
coproc_attach(10): attach fe075c34 (fe077b68)
coproc_attach(11): attach fe075c34 (fe077b68)
Welcome to Neutrino 6.6.0 on the RaspBerry P2 Board(ARMv7 Cortex-A7 core)
Starting pl011 driver...
Starting slogger and pipe servers...
Starting USB driver...
Starting network driver...
Starting DHCP...
RPi2#

```

3.2.7 Step 7: Boot up finish.

Boot up is finished with prompt “RPi2#” and user could enter command from this prompt.

4. Test driver

4.1 Serial driver

Make sure can type some commands.

4.2 USB driver

Notes: Mouse isn't supported yet and driver cannot detect device insert/remove

- 1) Plug an USB device to USB port (Upper or Lower) of Raspberry board.
- 2) Make sure io-usb and devb-umas is running as below.

```
# io-usb -d rpi ioport=0x3f980000,irq=73  
  
# devb-umass cam pnp
```

- 3) From Terminal console, run below commands

```
# mount -tdos /dev/hdXtY /usb_flash      (Replace hdXtY with the actual USB  
                                         device node created in /dev/)  
  
# cp -V /usb_flash/file_name /tmp      (Copy data from USB)  
  
# cp -V /tmp/filename /usb_flash/      (Copy data to USB)
```

4.3 Network driver

4.3.1 Test Overview

Connect the Raspberry Pi2 board and Windows PC via a hub by using LAN cables. Make sure that data is sent and received between PC and the Raspberry Pi2 board through Ethernet.

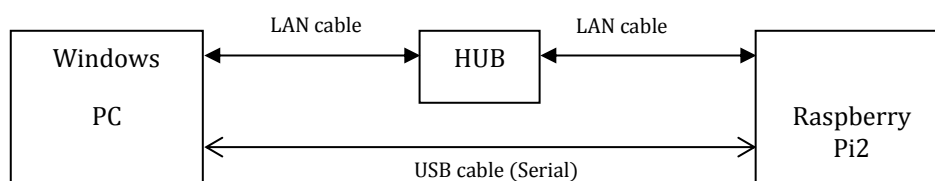


Figure 4-1 Connect the Raspberry Pi2 board and Windows PC

4.3.2 Equipment and Software Used

- (1) LAN cables (straight through)
- (2) USB cable
- (3) Windows PC
- (4) HUB 100 Mbps
- (5) Test programs and data files:

No.	Name	Description	Remarks
1	ttermpro.exe	Terminal software	Windows PC
2	TELNET.EXE	TELNET client program	Windows PC
3	ping.exe	Ping program	Windows PC and Raspberry Pi2
4	qde.exe	QNX Momentics IDE 5.0	Windows PC

4.3.3 Test Items

No.	Major Test Item	Test Outline
1	Verify link connectivity	Execute ping command on the target and Windows PC to verify link connectivity.
2	Connect to target using TELNET	Start the TELNET on the Window PC and make sure that command transmission and data reception are possible.
3	File transmission	Start QNX Momentics IDE 5.0 on the Window PC and make sure that a file can be transferred between Window PC and Raspberry Pi2 board

4.3.4 Test Procedures

- Start QNX Momentics IDE on the Windows PC. Add Raspberry Pi2 to the target list. Use the File System Navigator to copy data to the Windows PC.
- Start Ethernet driver on Raspberry Pi2 target: Make sure the followings were started already at time of starting QNX image by pidin a as below:

```
# pidin a
```

```
....
```

```
28690 io-pkt-v4 -dsmc9514 mac=2e990a002e28 -ptcpip
```

```
32787 dhcp.client -l10 -d -ien0
```

```
36885 devc-pty
```

```
36886 inetd
```

```
40980 qconn port=8000
```

- To check ip of the board use “ifconfig” command.

4.3.5 Test Link connectivity using ping command

- (1) On Raspberry Pi2 board

+ ping to host with packet size 64 bytes (64=56+8)

```
# ping -h <host IP address> -s 56 -c 5
```

Expected result: successful with 5 packets transmitted, 5 received, 0% packet loss

+ Ex: # ping -h 192.168.1.103 -s 56 -c 5

```
# ping -h 192.168.1.102 -s 56 -c 5
PING 192.168.1.102 (192.168.1.102): 56 data bytes
64 bytes from 192.168.1.102: icmp_seq=0 ttl=128 time=19 ms
64 bytes from 192.168.1.102: icmp_seq=1 ttl=128 time=10 ms
64 bytes from 192.168.1.102: icmp_seq=2 ttl=128 time=16 ms
64 bytes from 192.168.1.102: icmp_seq=3 ttl=128 time=14 ms
64 bytes from 192.168.1.102: icmp_seq=4 ttl=128 time=12 ms
---192.168.1.102 PING Statistics---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 10/14/19 ms    variance = 19 ms^2
#
```

Figure 4-2 Test ping command on Raspberry Pi2 board

- (2) On Windows PC Host

+ ping to board with packet size 64 bytes

```
#ping <board IP address> -l 64 -n 5
```

Expected result: successful with 5 packets transmitted, 5 received, 0% packet loss

+ Ex: # ping 192.168.1.102 -l 64 -n 5

```
bash-3.1$ ping 192.168.1.103 -l 64 -n 5

Pinging 192.168.1.103 with 64 bytes of data:
Reply from 192.168.1.103: bytes=64 time=18ms TTL=255
Reply from 192.168.1.103: bytes=64 time=17ms TTL=255
Reply from 192.168.1.103: bytes=64 time=39ms TTL=255
Reply from 192.168.1.103: bytes=64 time=48ms TTL=255
Reply from 192.168.1.103: bytes=64 time=25ms TTL=255

Ping statistics for 192.168.1.103:
    Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 17ms, Maximum = 48ms, Average = 29ms
bash-3.1$
```

Figure 4-3 Test ping command on PC

4.3.6 Testing Command Control by a TELNET Client

- (1) From command line on Window PC:

➤ telnet 192.168.1.103 (IP of Raspberry Pi2 Board)

- (2) Login message is displayed on the Windows PC.

```
Telnet 192.168.1.103

QNX Neutrino (localhost) (ttyp0)

login: _
```

Figure 4-4 Login console

- (3) Enter root. You can login to Raspberry Pi2 board

```

Telnet 192.168.1.103

QNX Neutrino (localhost) (ttyp0)

login: root
No home directory.
Logging in with home = "/".
sh: /etc/profile[24]: tty: cannot execute - No such file or directory
sh: /etc/profile[44]: date: cannot execute - No such file or directory
on
Welcome to QNX Neutrino!
sh: /etc/profile[44]: cannot create //.lastlogin: No such file or directory
#

```

Figure 4-5 QNX6.6 Raspberry Pi2 console

4.3.7 File transmission test between Window PC and Raspberry Pi2 board

- (1) Start QNX Momentics IDE 5.0 on the Window PC.
- (2) Add Raspberry Pi2 platform to the target list.

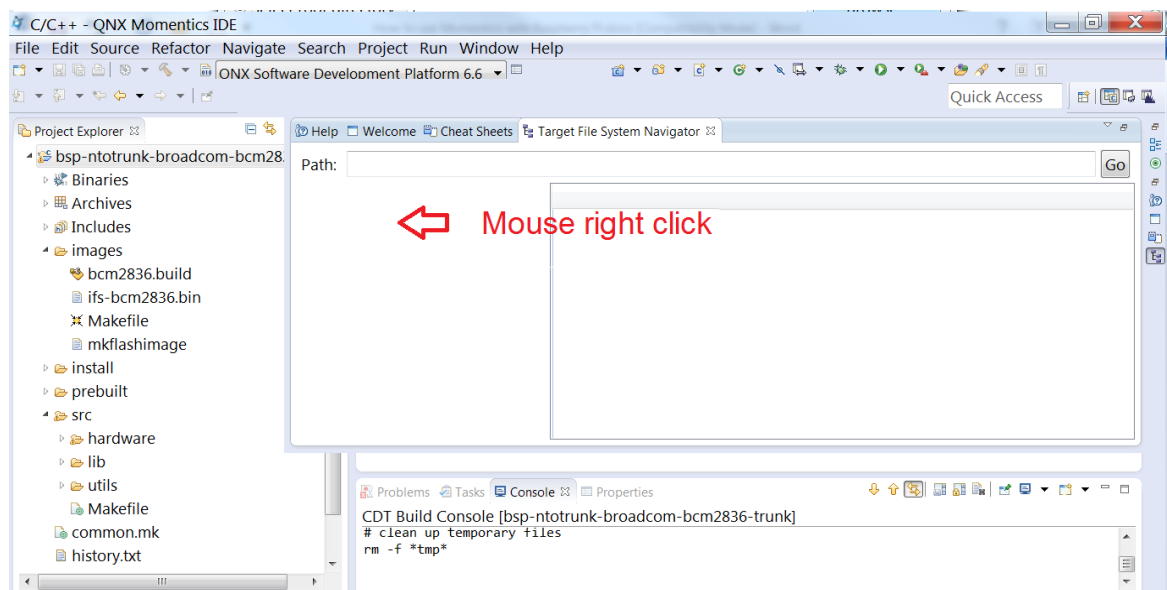


Figure 4.6 Open New QNX target

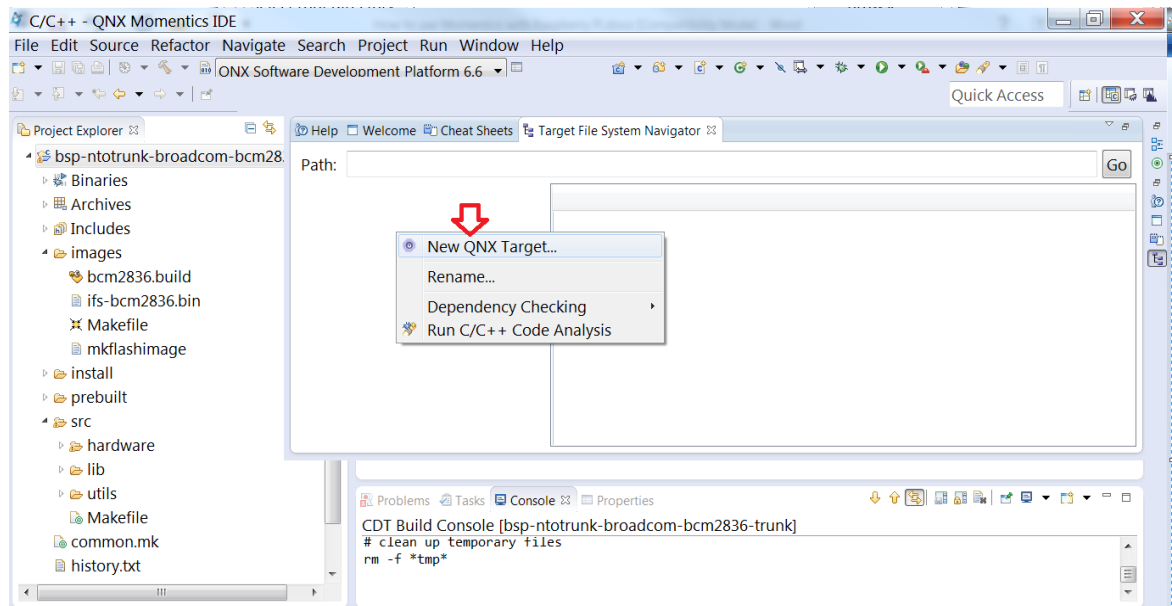


Figure 4.7 Select New QNX target

Enter IP of Raspberry Pi2 platform:

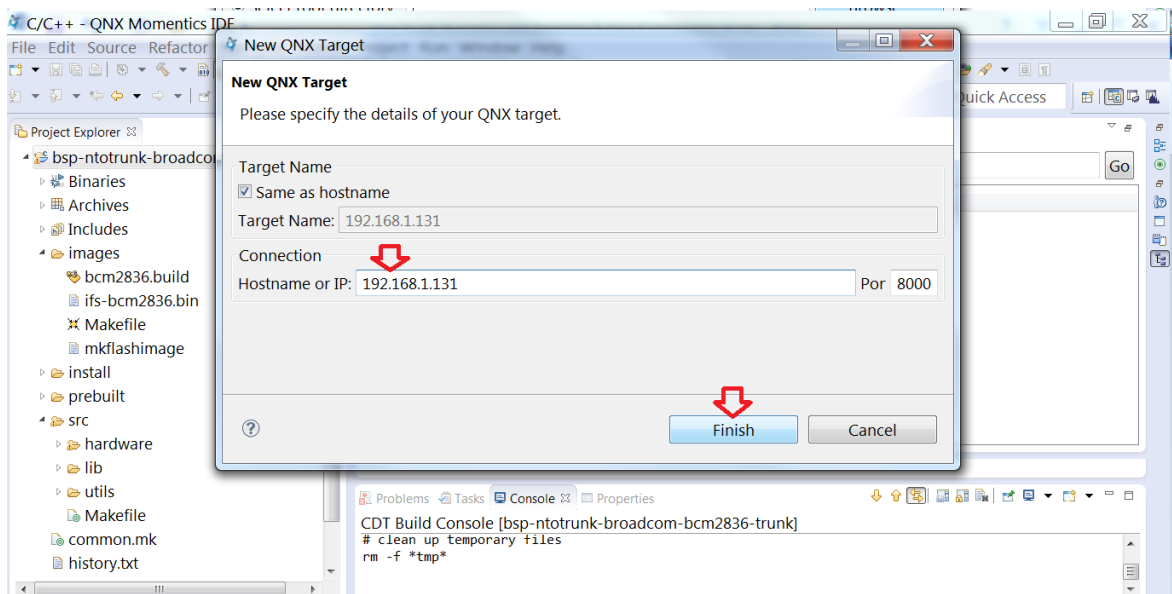


Figure 4.8 Add Raspberry Pi2 QNX 6.6 target

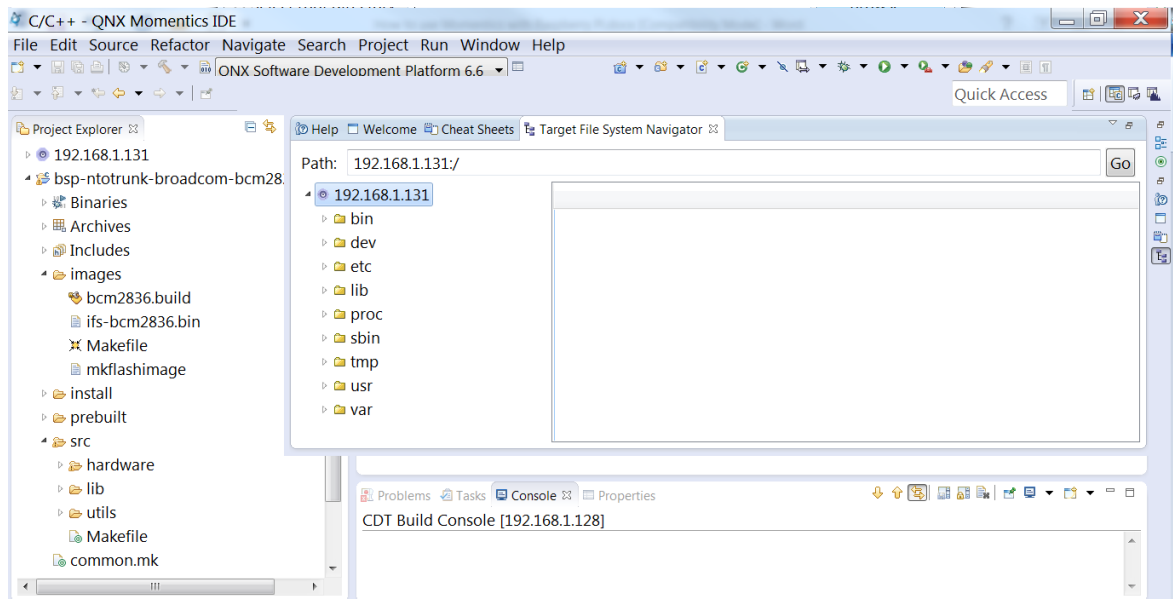


Figure 4.9 Finish adding Raspberry Pi2 QNX 6.6 target

(3) Open /tmp folder

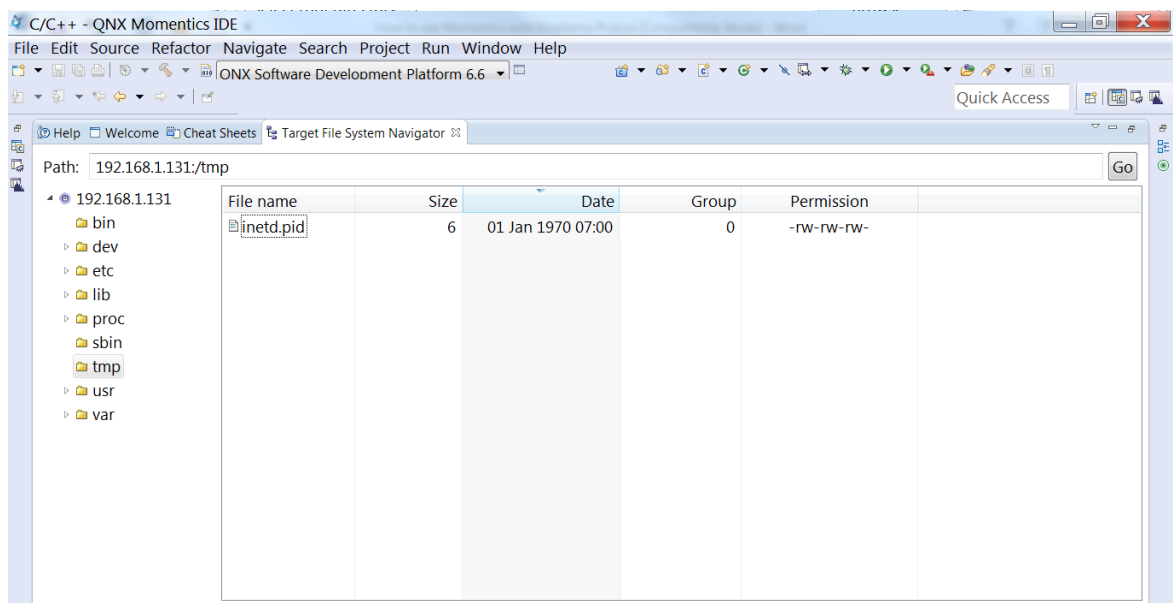


Figure 4.10 Raspberry Pi2 QNX 6.6 target tmp folder list

(4) Copy a file from the Windows PC to /tmp

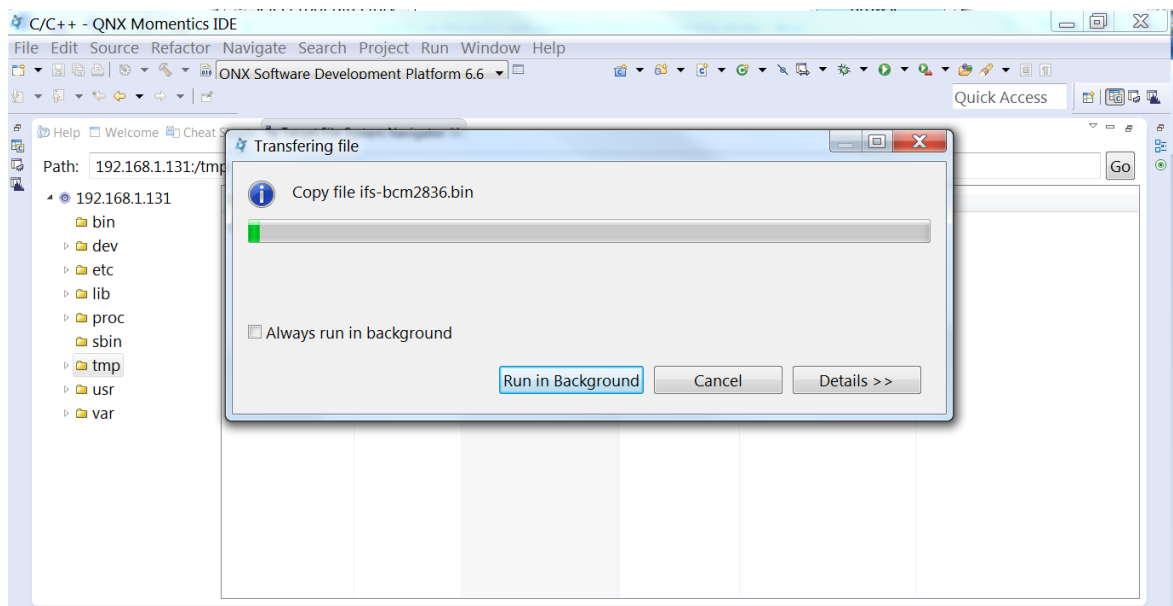


Figure 4.11 Send a files from PC to Raspberry Pi2 QNX 6.6 target

(5) Make sure the size of the target file in /tmp and the source file is match

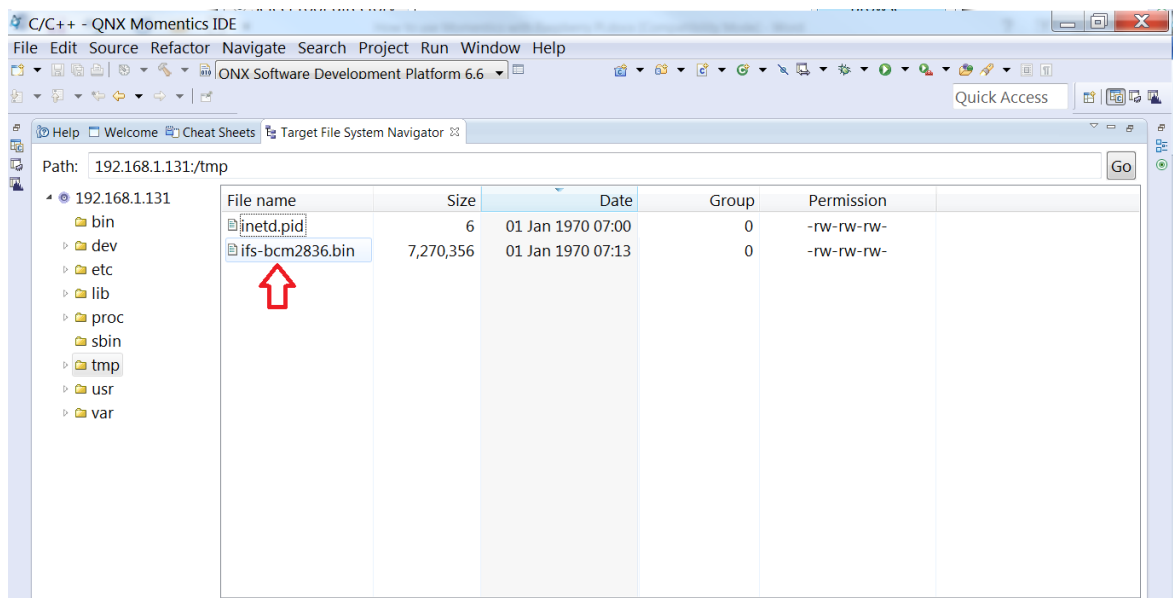


Figure 4.12 Finish sending a files from PC to Raspberry Pi2 QNX 6.6 target

(6) Copy a file from /tmp to window PC.

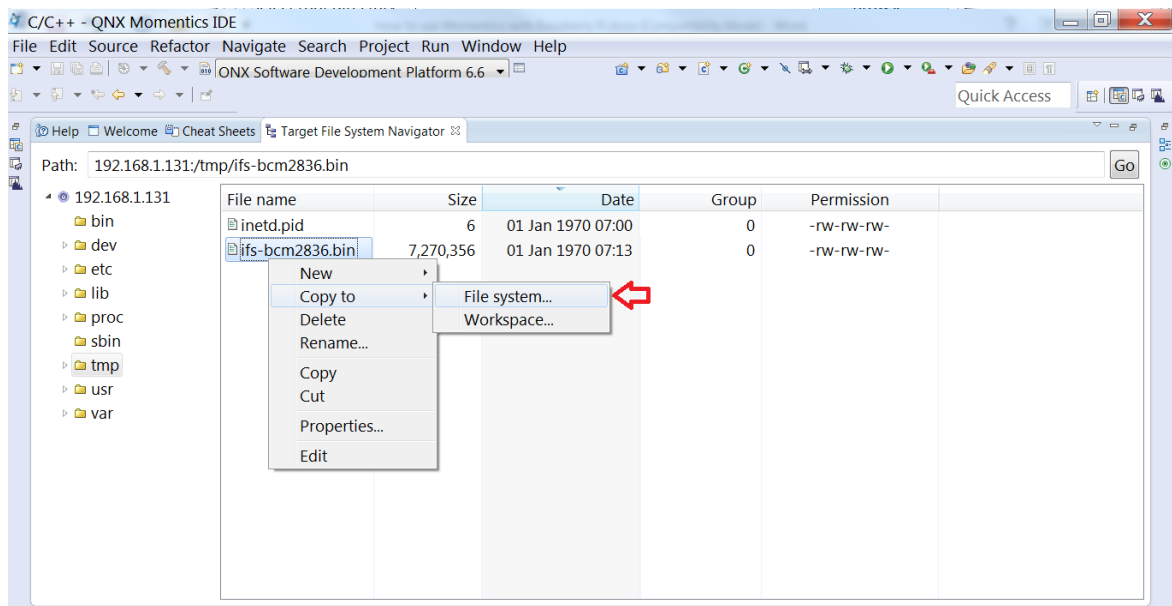


Figure 4.13 Send a files from Raspberry Pi2 QNX 6.6 target to PC

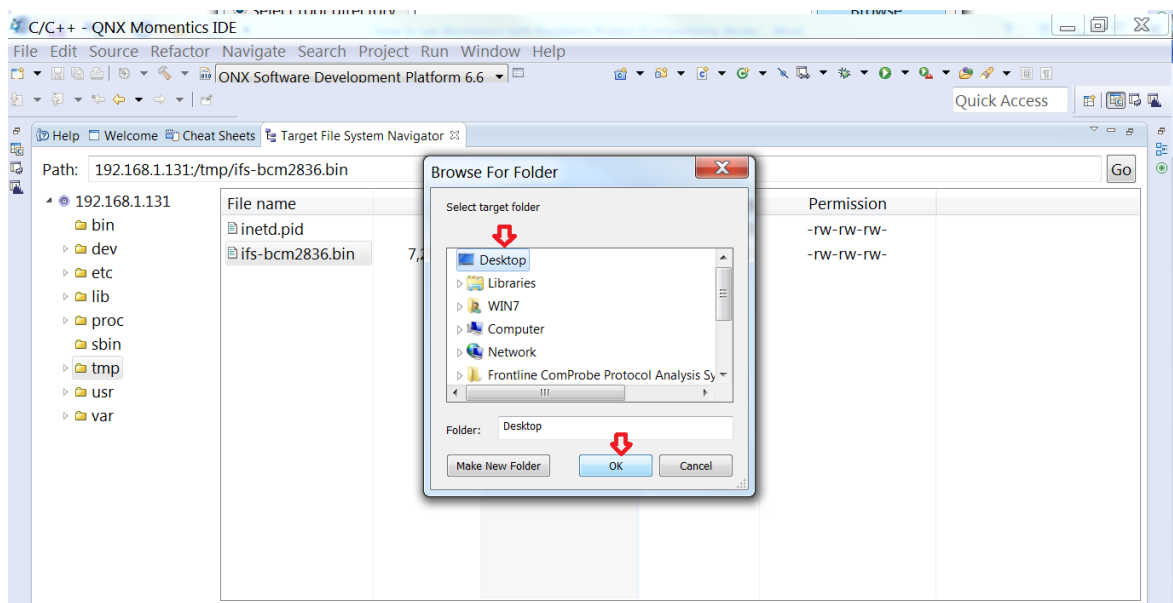


Figure 4.14 Locate file on PC

(7) Make sure the size of the target file in Window PC and source file is match

REVISION HISTORY	QNX 6.6.0 Setup Manual For Raspberry Pi2 Board
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Rev.	Date	Description	
		Page	Summary
1.0	September 09, 2016	-	First release
1.1	September 14, 2016	P.7 to P.12	- Added section 4.2 USB driver - Added section 4.3 Network driver