User Manual

RSB-4221

RISC 3.5inch SBC based on TI
Sitara AM3358 Cortex A8 1Ghz
High Performance Processor

ADVANTECH

Enabling an Intelligent Planet

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Product Warranty (2 years)

Advantech warrants the original purchaser that all its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to products that have been repaired or altered by persons other than repair personnel authorized by Advantech, or products that have been subject to misuse, abuse, accident, or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most customers never need to use our repair service. However, if an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, customers are billed according to the cost of replacement materials, service time, and freight. Please consult your dealer for more details.

If you believe your product to be defective, follow the steps outlined below.

1. Collect all information about the problem encountered. (For example, CPU speed, Advantech products used, and other hardware or software used.) Note anything abnormal and list any onscreen messages encountered when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any relevant information readily available.
3. If your product is diagnosed as defective, obtain an RMA (return merchandize authorization) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a completed Repair and Replacement Order Card, and proof of purchase date (such as a photocopy of your sales receipt) in a shippable container. Products returned without a proof of purchase date are not eligible for warranty service.

5. Write the RMA number clearly on the outside of the package, then ship the product prepaid to your dealer.

Declaration of Conformity

FCC Class B

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Safety Precaution – Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

■ To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.

Packing List

Before installation, please ensure the following items have been shipped:

■ 1 x RSB-4221 3.5inch SBC

Optional Accessories

Part No.	Description
170022161-11	UART Cable
96PSA-A36W12R1	Adapter A/D 100-240V 36W 12V
1700023575-01	CAN Cable
1700023576-01	USB Cable
1700023707-01	Debug Cable
SQF-ISDS1-4G-82C	SQF SD C6 SLC 4G, 1CH
170203183C	Power Cord 3P Europe
1700023307-01	DC-Jack Cable
170203180A	Power Cord 3P UK 2.5A/3A 250V 1.83M
1700001524	Power Cord 3P UL 10A 125V 180cm
1700023366-01	Backlight Cable
1700024543-01	LVDS Cable
Y5AGF16002	M.2 Module for WIFI & B.T
IDK-1107WR-40WVA1E	7 Inch LCD w/ touch

Ordering Information

	Commercial Grade
Part No.	RSB-4221CS-MCA1E
CPU	TI Cortex A8 AM33581GHz
Memory	512MB
EMMC	4GB
Nor Flash	4MB
LVDS	1366 x 768 18bit LVDS
USB	4
Giga LAN	2
I2C	1
GPIO	12
UART	5
M.2	1
CAN	1
SD	1
Heat sink	N/A
Operation Temp.	0 ~60°C

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:

 ■ The power cord or plug is damaged.
 ■ Liquid has penetrated into the equipment.
 ■ The equipment has been exposed to moisture.
 ■ The equipment does not work well, or you cannot get it to work according to the user's manual.
 ■ The equipment has been dropped and damaged.
 ■ The equipment has obvious signs of breakage.

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Contents

Chapter 1

General Introduction

This chapter gives background information on the RSB-4221. Sections include:

■ Introduction

■ Specification

1.1 Introduction

RSB-4221 is a RISC SBC integrated with a TI Sitara AM3358 Cortex-A8 processor. It is an ideal solution for automation control applications such as smart grids, and industrial and machinery automation due to its ample I/O interface and network functionality.

1.2 Specifications

1.2.1 Functional Specifications

- **Form factor**
  - RISC 3.5inch SBC
- **Processor System**
  - CPU: TI Cortex A8 AM3358 1Ghz
- **Memory**
  - Technology: DDR3 800 MHz
  - Capacity: On-board 512MB
  - Flash: 4GB eMMC for O.S. and 4MB NOR Flash for ADV Loader
- **Graphic**
  - LVDS: 1366 x 768 resolution 18bit LVDS
- **OS Support**
  - RSB-4221 supports Linux Kernel 3.2.0
- **Ethernet**
  - Transceiver: TI AM3358 Integrated RGMII
  - Speed: 2 x 10/100/1000 Mbps
- **Watch Dog Timer**
  - HW WDT: TI MSP430G2202 (time out 1~6553s, default 60s)
- **I/O**
  - SDIO: 1 x 4-bit STD SD
  - Serial Port: 5 x UART (4x 2 wire RS232,1x 4 wireRS232/422/RS485)
  - M.2: 1x M.2 for WIFI and BT
  - CAN: 1x CAN 2.0
  - GPIO: 12x GPIO
  - I2C: 1 x I2C
  - RTC: 1 x RTC
  - USB: 4 x USB 2.0 host
- **Function**
  - Touch: By USB signal (I2C option)
- **OS**
  - Android: V4.2.2
- **Dimensions**
  - W x L x T: 46 x 102 mm x 1.6mm
- **Power:**
  - DC-In: 12V DC-In
- **Environment**
  - Operational Temperature: 0 ~ 60°C
  - Operating Humidity: 0% ~ 90% relative humidity, non-condensing
- **Certifications**

– Level: CE / FCC / Class B

1.2.2 Mechanical Specifications

- **Dimension:** 146 x102 mm (5.7"x4")
- **Height:** 15.92 mm
- **Reference Weight:** 640g (including whole package)

1.2.3 Electrical Specifications

- **Power supply type:** DC-in 12V
- **RTC Battery:**
  - Typical voltage: 3V
  - Normal discharge capacity: 240 mAh

1.3 Environmental Specifications

- **Operating temperature:** 0~60°C (32~1400~60°F)
- **Operating humidity:** 0% ~ 90% relative humidity, non-condensing
- **Storage temperature:** -40~85°C (-40~185°F)
- **Storage humidity:** 60°C @ 95% RH Non-condensing

1.4 Block Diagram
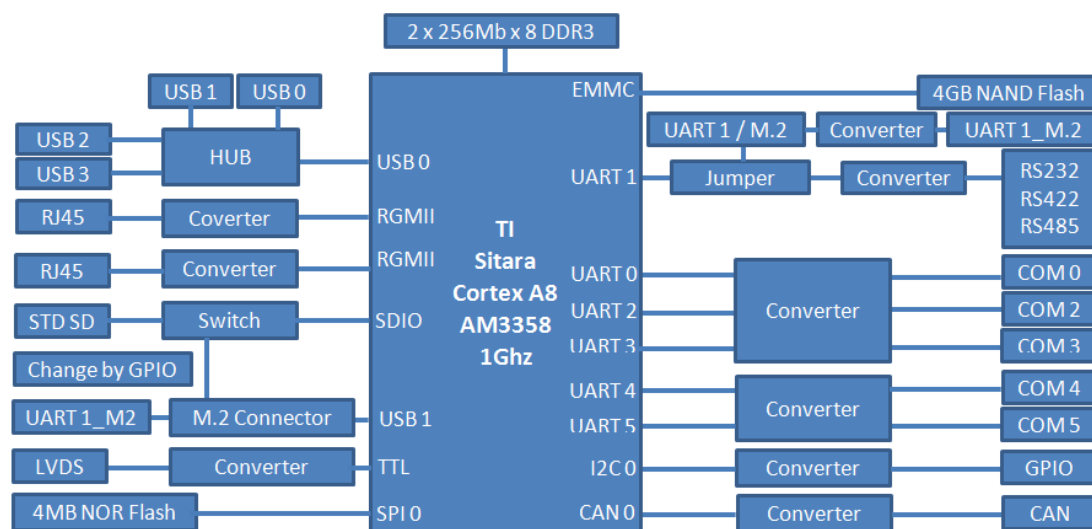
Chapter 2

H/W Installation

This chapter gives mechanical and connector information on the RSB-4221 3.5inch SBC.

Sections include:

■ Jumper Information

■ Connector Information

■ Mechanical Drawing

■ Quick Start Guide

2.1 Jumpers

2.1.1 Jumper Description

Cards can configured by setting jumpers. A jumper is a metal bridge used to close an electric circuit. It consists of two metal pins and a small metal clip (often protected by a plastic cover) that slides over the pins to connect them. To close a jumper, you connect the pins with the clip. To open a jumper, you remove the clip. Sometimes a jumper will have three pins, labeled 1,2 and 3. In this case you would connect either pins 1 and 2 or 2 and 3.
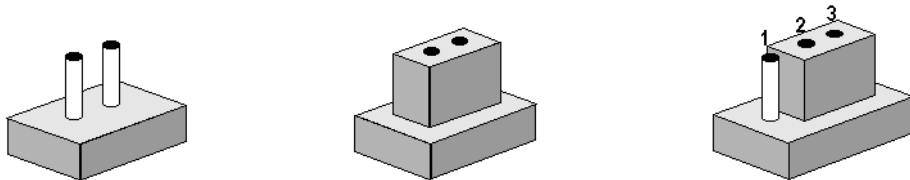
The jumper settings are schematically depicted in this manual as follows.
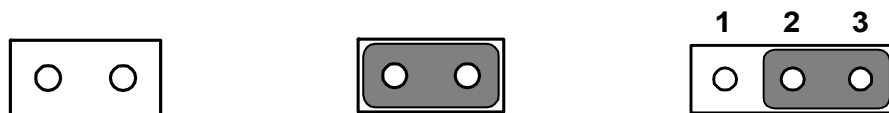
A pair of needle-nose pliers may be helpful when working with jumpers. If you have any doubts about the best hardware configuration for your application, contact your local distributor or sales representative before you make any changes.

Generally, you simply need a standard cable to make most connections.

Warning! *To avoid damaging the computer, always turn off the power supply before setting jumpers.*

2.1.2 Jumper List

Table 2.1: Jumper List	
J1	Boot device select(SW1)
J2	LVDS power level select(CN3)
J3	Backlight power level select (CN2)
J4	COM1 RS232 and RS485 mode detect(CN10)
J5	UART1 RS232, RS422, RS485 signal select (JSETCOM1)
J6	UART1 switch (CN14)

2.1.3 Jumper Settings

J1	Boot device select(SW1)
Part number	1600000202
Footprint	SW_2x2P_50_161X315
Description	DIP SW CHS-02TB(29) SMD 4P SPST P=1.27mm W=5.4mm
Setting	Function
(1-1)	Boot from SD
(1-0)	Boot from SPI

This switch is provided for users to select the boot up method.

SW1
CHS-02TB(20)

J2	LVDS power level select (CN3)
Part Number	1653003100
Footprint	HD_3x1P_100_D
Description	PIN HEADER 3x1P 2.54mm 180D(M) DIP 205-1x3GS
Setting	Function
(1-2)	+3.3V
(2-3)	+V5

This pin header is designed for selecting LCD power level.

CN3
PH_3x1V_2.54mm
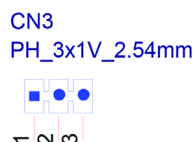
J3	Backlight power level select (CN2)
Part Number	1653003100
Footprint	HD_3x1P_100_D
Description	PIN HEADER 3x1P 2.54mm 180D(M) DIP 205-1x3GS
Setting	Function
(1-2)	+V5
(2-3)	+V12

This pin header is designed for selecting LCD backlight power level.

CN2
PH_3x1V_2.54mm
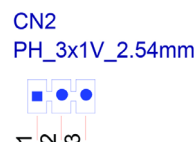
J4	COM1 RS232 and RS485modedetect (CN10)
Part Number	1653003101
Footprint	HD_3x1P_79_D
Description	PIN HEADER 3x1P 2.0mm 180D(M) DIP 2000-13 WS
Setting	function
(1-2)	RS232 mode (JSETCOM1 must be set RS232 mode at the same time)
(2-3)	RS485 mode (JSETCOM1 must be set RS485 mode at the same time)

CN10

1
2
3

PH_3x1V_2.00mm
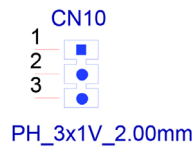
J5	UART1 RS232 ,RS422, RS485 signal select (JSETCOM1)
Part number	1653009260
Footprint	HD_9x2P_79
Description	PIN HEADER 9x2P 2.0mm 180D(M) SMD 21N22050
Setting	Function
(5-6 7-9 8-10 13-15 14-16)	RS232 mode (CN10must be set RS232 at the same time)
(3-59-11 10-12 15-17 16-18)	RS422 mode
(1-2 9-11 10-12 15-17 16-18)	RS485 mode (CN10must be set RS485 at the same time)

RS232 RS422 RS485

1
3
5
7
9
11
13
15
17

JSETCOM1

1   2
3   4
5   6
7   8
9   10
11   12
13   14
15   16
17   18

PH_9x2V_S2.0mm
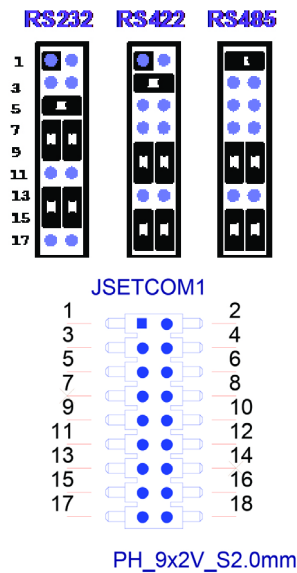
J6	UART1 switch (CN14)
Part Number	1653005661-01
Footprint	HD_6x2P_100
Description	PIN HEADER 2X6P 2.54mm 180D(M) SMD 21N22564-12M0
Setting	Function
(3-5)(4-6) (10-12)(9-11)	UART1 switch to COM port function
(1-3) (2-4)(7-9) (8-10)	UART1 switch to M.2 function

CN14

PH_6X2V_S2.54mm
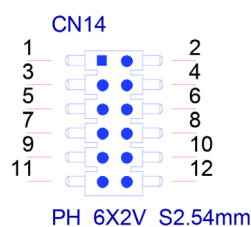
2.2 Connectors

2.2.1 Connector List

Table 2.2: Connector List	
CN9	RTC battery
CN11	M.2
COM0	UART0 debug port
COM1	UART1 COM port
COM2_3	UART2 &UART3 COM port Pin Connector
COM4_5	UART4 &UART5 COM port Pin Connector
CN16	CAN CONN
CN12	GPIO CONN
CN20	USB Type A Connector
CN19	USB Type A Connector
CN18	USB PinBox
CN1	JTAG Connector
CN19	Ethernet Connector
CN20	Ethernet Connector
SD1	SD Card
CN5	LVDS CONN
CN6	LVDS Backlight
CN21	DC-Power Jack
SW2	Recovery

2.2.2 Connector Settings

2.2.2.1 RTC Battery Connector (CN9)

RSB-4221 supports a lithium 3V/210mAH CR2032 battery with wire via battery connector.
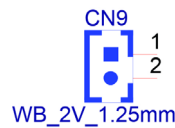
Figure 2.1 DC RTC Battery Connector

2.2.2.2 M.2 (CN11)

RSB-4221 supports socket1 connectivity type 2230 S1&S2&S3 key EM.2 interface. Detailed pin definitions below.

Pin	Signal Name	Pin	Signal Name
1	GND	2	+3.3V
3	USB_HOST_DP	4	+3.3V
5	USB_HOST_DN	6	WLAN_LED
7	GND	8	NC
9	SDIO_CLK	10	NC
11	SDIO_CMD	12	NC
13	SDIO_DAT0	14	NC
15	SDIO_DAT1	16	BT_LED
17	SDIO_DAT2	18	GND
19	SDIO_DAT3	20	NC
21	SDIO_WAKE	22	UART1_TXD_1V8
23	SDIO_R_RESET		
Mechanical Key	Mechanical Key	Mechanical Key	Mechanical Key
	NC	32	UART1_RXD_1V8
33	GND	34	UART1_RTS_1V8
35	NC	36	UART1_CTS_1V8
37	NC	38	NC
39	GND	40	NC
41	NC	42	NC
43	NC	44	NC
45	GND	46	NC
47	NC	48	NC
49	NC	50	SUS_CLK
51	GND	52	NC
53	NC	54	W_DISABLE2#
55	NC	56	W_DISABLE1#
57	GND	58	NC
59	NC	60	SUS_CLK
61	NC	62	NC
63	GND	64	NC
65	NC	66	NC
67	NC	68	NC

69	GND	70	NC
71	NC	72	GND
73	NC	74	GND
75	GND		
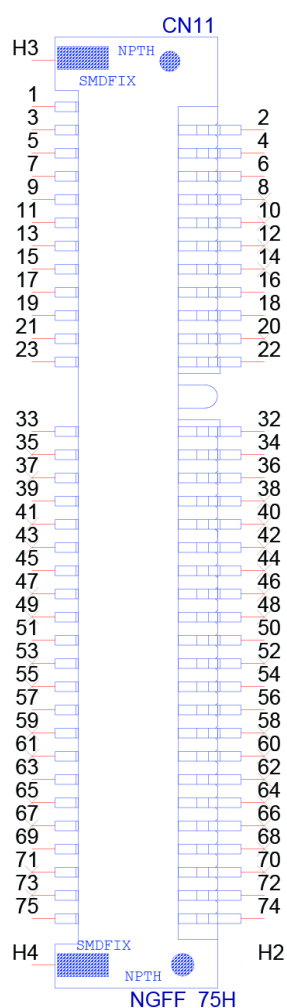
Figure 2.2 M.2 CONNECTOR

2.2.2.3 UART0 debug port (COM0)

RSB-4221 can communicate with a host server (Windows or Linux) by using standard DB9.

Pin	Description
1	NC
2	COM0_RX
3	COM0_TX
4	NC
5	GND
6	NC
7	NC
8	NC
9	NC

COM2

5
9
4
8
3
7
2
6
1

11

10

DSUB_9(M)H

Figure 2.3 COM PORT

2.2.2.4 **UART1 COM port (COM1)**

RSB-4221provides a standard DB9 which can support RS232/RS422/RS485 by changing CN10/ JSETCOM1 jumper.

Pin	Description
1	COM1_DCD
2	COM1_RX
3	COM1_TX
4	COM1_DTR
5	GND
6	NC
7	COM1_RTS
8	COM1_CTS
9	NC

COM1

5
9
4
8
3
7
2
6
1

11

10

DSUB_9(M)H
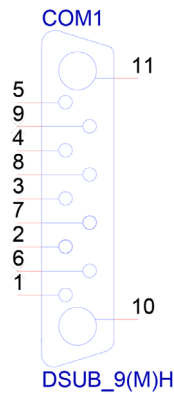
Figure 2.4 COM PORT

2.2.2.5 UART2 and UART3 COM port Pin Connector (COM2_3)

RSB-4221 provides a 2X3 pin connector, which contains 2 two-wire COM ports (RS232 level).

Pin	Description
1	COM2_TX
2	COM3_TX
3	COM2_RX
4	COM3_RX
5	GND
6	GND
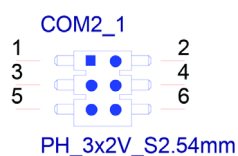
Figure 2.5 COM port pin header

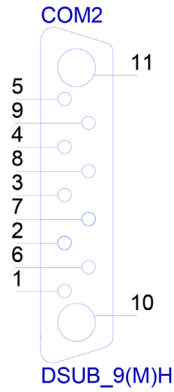##### 2.2.2.6 UART4 and UART5 COM port Pin Connector (COM4_5)

RSB-4221 provides a 2X3 pin connector, which contains 2 two-wire COM ports (RS232 level).

Pin	Description
1	COM4_TX
2	COM5_TX
3	COM4_RX
4	COM5_RX
5	GND
6	GND
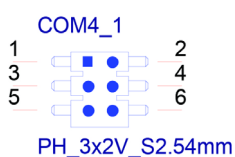
Figure 2.6 COM port pin header

2.2.2.7 CAN PORT Pin Connector (CN16)

RSB-4221 provides a1X4 pin connector for CAN port.

Pin	Description
1	GND
2	CAN1_D+
3	CAN1_D-
4	GND
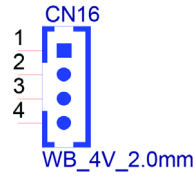
Figure 2.7 CAN port Connector

2.2.2.8 GPIO Pin Connector (CN12)

RSB-4221 provides a 10X2 pin connector for GPIO (supports 3.3V level/GPIO_PWR 3.3V)

Pin	Description
1	GPIO_PWR
2	GND
3	NC
4	NO PIN
5	NC
6	NC
7	GPIO0
8	GPIO7
9	GPIO1
10	GPIO8
11	GPIO2
12	GPIO9
13	GPIO3
14	GPIO10
15	GPIO4
16	GPIO11
17	GPIO5
18	GPIO12
19	GPIO6
20	GPIO13
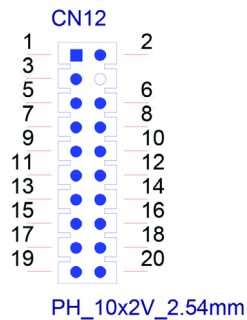
Figure 2.8 GPIO pin header

2.2.2.9 USB Type A Connector (CN20)

RSB-4221supports two USB2.0 Type A connector on the coastline.

Pin	Description
1	+5V
2	USB_P1L_N
3	USB_P1L_P
4	GND

CN20B

17 VCC
18 DT1-
19 DT1+
20 GND

RJ45+USB_W/XFMR
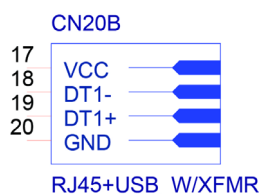
Figure 2.9 USB port connector

2.2.2.10 USB Type A Connector (CN19)

Pin	Description
1	+5V
2	USB_P2L_N
3	USB_P2L_P
4	GND

CN19B

17 VCC
18 DT1-
19 DT1+
20 GND

RJ45+USB_W/XFMR
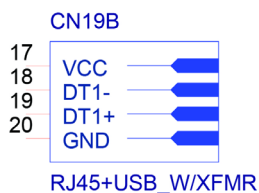
Figure 2.10 USB port connector

2.2.2.11 USB Pin Box (CN18)

RSB-4221supports a pin box header that contains two USB2.0 ports.

Pin	Description
1	+5V
2	+5V
3	USB_P3L_N
4	USB_P4L_N
5	USB_P3L_P
6	USB_P4L_P
7	GND
8	GND
9	GND
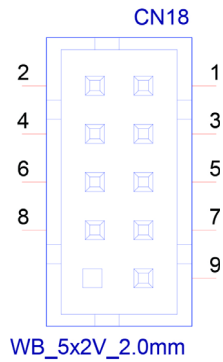
Figure 2.11 USB port connector

2.2.2.12 JTAG (CN1)

JTAG connector is used for internal debugging only.

Pin	Description
1	+3.3V
2	JTAG_TRSTn
3	JTAG_TMS
4	JTAG_TDO
5	JTAG_TDI
6	JTAG_TCK
7	JTAG_EMU0
8	JTAG_RESETn
9	JTAG_EMU1
10	GND
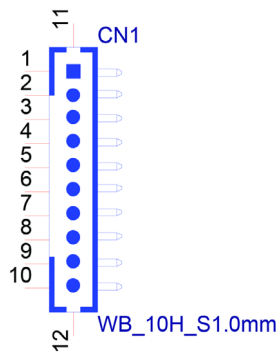
Figure 2.12 JTAG Pin header

2.2.2.13 Ethernet Connector (CN19)

RSB-4221 provides two RJ45 LAN interface connectors which are compliant with 1000 base-T IEEE 802.ab,100 base-TX IEEE 802.u, 10 base-t IEEE 802.3.The Ethernet ports provide standard RJ-45 jack connector with LED indicators on the front side to show Active/Link status and speed status.

Pin	Description
A1	MDI20+
A2	MDI20-
A3	MDI21+
A4	MDI21-
A5	GND
A6	GND
A7	MDI22+
A8	MDI22-
A9	MDI23+
A10	MDI23-
A11	LAN2_100_LINK
A12	LAN2_1000_LINK
A13	+3.3V
A14	LAN2_ACT
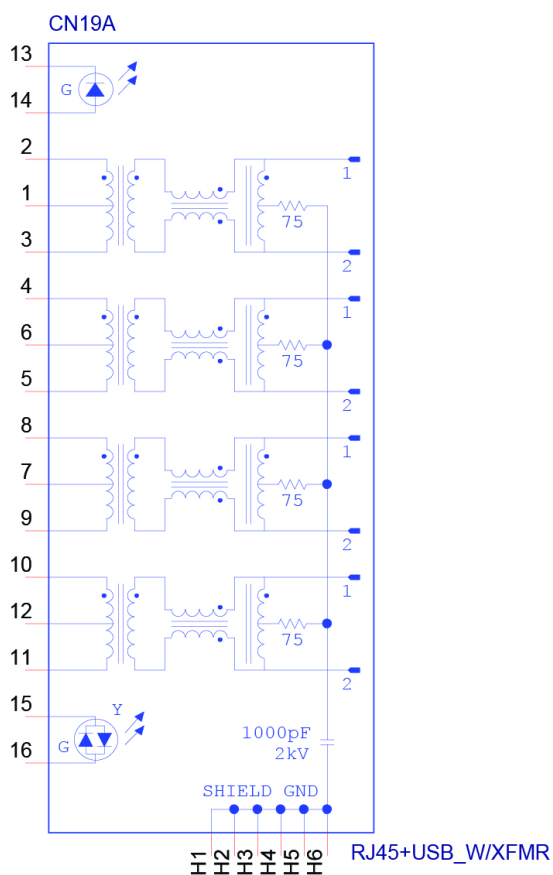
Figure 2.13 Ethernet Connector

2.2.2.14 Ethernet Connector (CN20)

Pin	Description
B1	MDI10+
B2	MDI10-
B3	MDI11+
B4	MDI11-
B5	GND
B6	GND
B7	MDI12+
B8	MDI12-
B9	MDI13+
B10	MDI13-
B11	LAN1_100_LINK
B12	LAN1_1000_LINK
B13	+3.3V
B14	LAN1_ACT
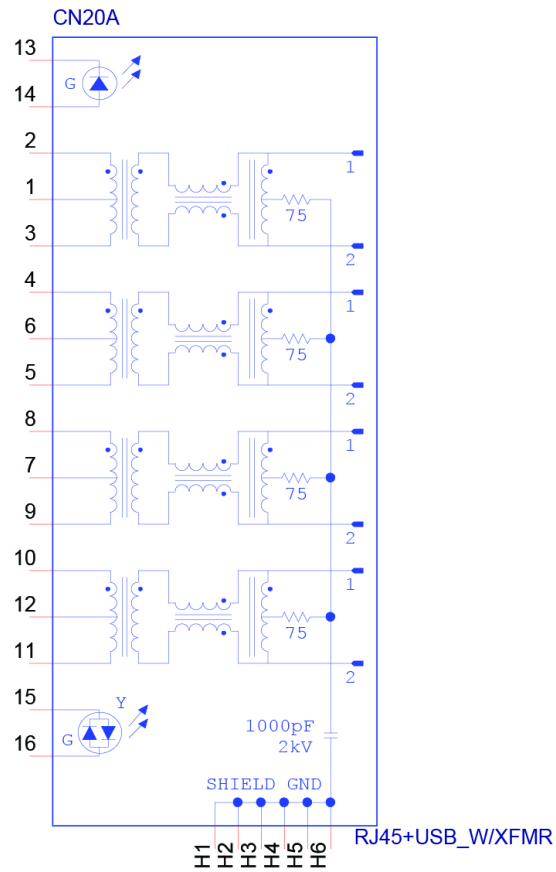
Figure 2.14 Ethernet Connector

2.2.2.15 SD slot (SD1)

RSB-4221based on TI AM335X datasheet complies with SD&SDIO specifications 2.0. Advantech used 4G SD for testing (SDHC).

Pin	Signal Name
1	DAT3
2	CMD
3	GND
4	+3.3V
5	CLK
6	GND
7	DAT0
8	DAT1
9	DAT2
WP	WP
CD	CD
SC	SC
G	G
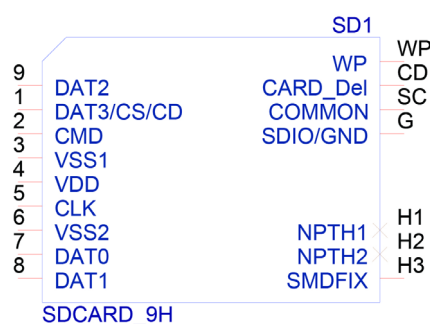
Figure 2.15 SD Slot

2.2.2.16 LVDS Connector (CN5)

RSB-4221 provides an LVDS 10x2-pin board-to-board connector for single channel 18 bit LVDS panel up to 1366x768. To avoid damaging the LCD panel, please make sure to set the right voltage level before powering on (refer to jumper setting description for CN3 and LCD datasheet that you will use).

Pin	Description
1	GND
2	GND
3	LVDS0_z_D0+
4	NC
5	LVDS0_z_D0-
6	NC
7	LVDS0_z_D1+
8	NC
9	LVDS0_z_D1-
10	NC
11	LVDS0_z_D2+
12	NC

13	LVDS0_z_D2-
14	NC
15	LVDS0_z_CLK+
16	NC
17	LVDS0_z_CLK-
18	NC
19	+VDD_LVDS
20	+VDD_LVDS
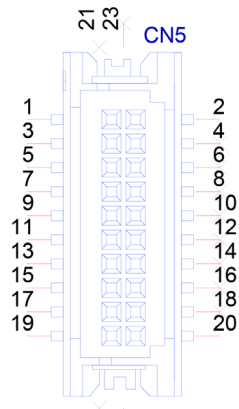
Figure 2.16 LVDS Connector

2.2.2.17 LVDS Inverter Power Connector (CN6)

To avoid damaging the LCD panel, please make sure set the right voltage level before powering on (refer to jumper setting description for CN2 and LCD datasheet that you will use).

Pin	Description
1	+VDD_BKLT_LVDS
2	GND
3	LCD_BKLT_A
4	LCD_BKLT_PWM_A
5	+V5
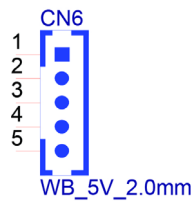
Figure 2.17 LVDS Inverter Power Connector

2.2.2.18 DC-power Jack (CN21)

RSB-4221 supports a DC-Jack header that connects 12V DC external power input.

Pin	Description
1	DC_IN
2	PGND

PLUG_2_5.00mm

CN21
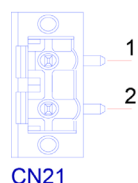
Figure 2.18 DC-Power Jack

2.2.2.19 Recovery (SW2)

RSB-4221 supports a recovery function when it runs on Android OS. Under Linux OS the recovery button (SW2) is useless.

You must press SW2 for about 5 seconds as the board powers up.

Generally speaking, you can find the following string under console when the system enters recovery mode:

...

input value is 0

hit recovery key...

…

SW2

HDK632BR-ST
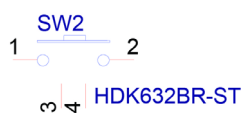
Figure 2.19 Recovery

2.3 Mechanical

2.3.1 Jumper and Connector Location
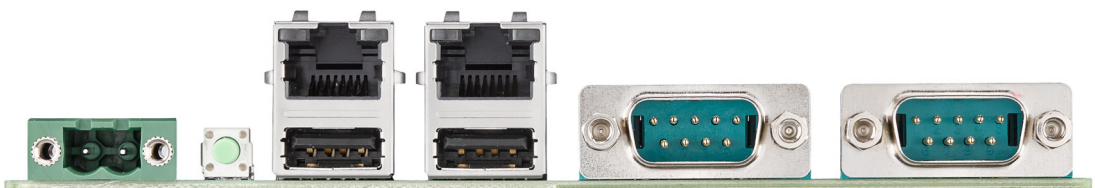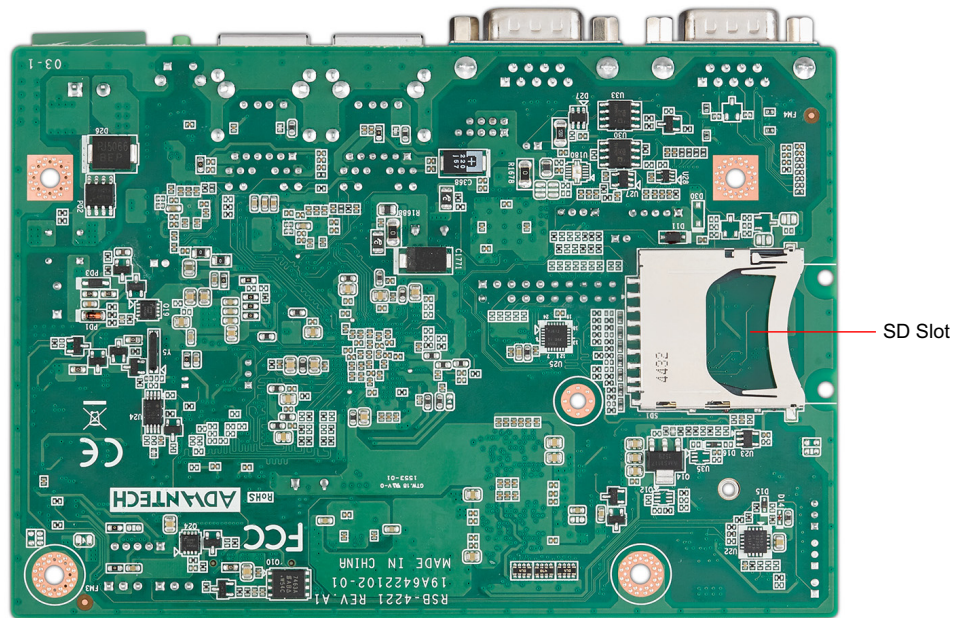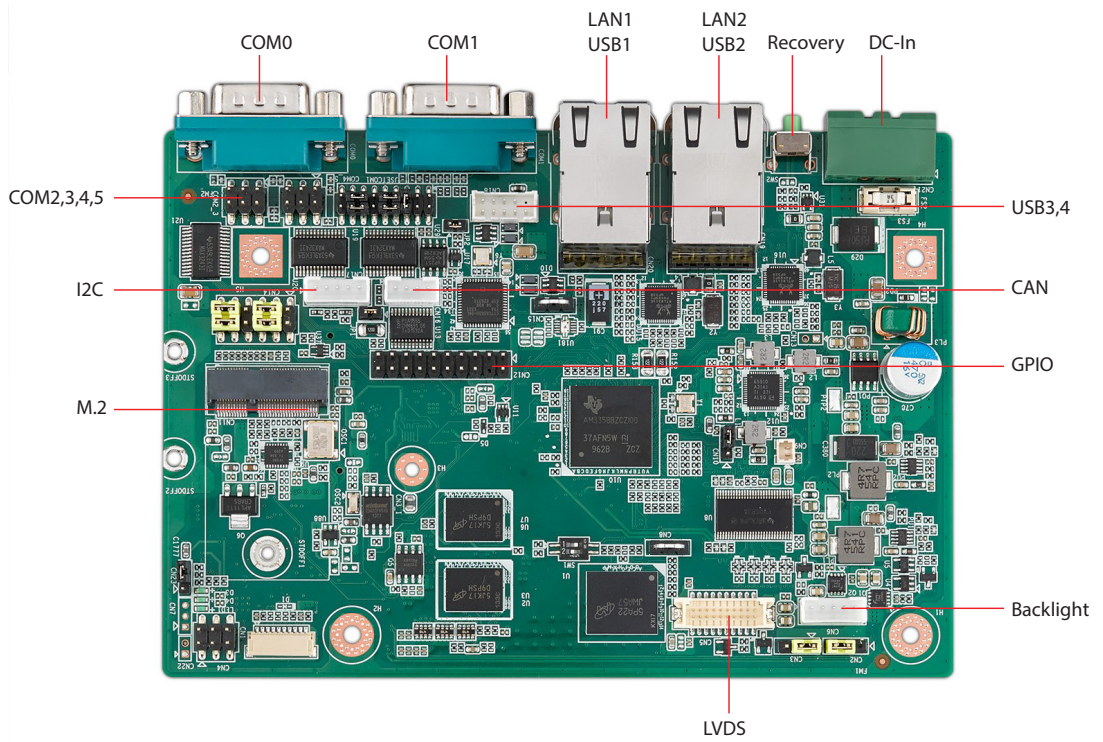
2.3.2 Board Dimension
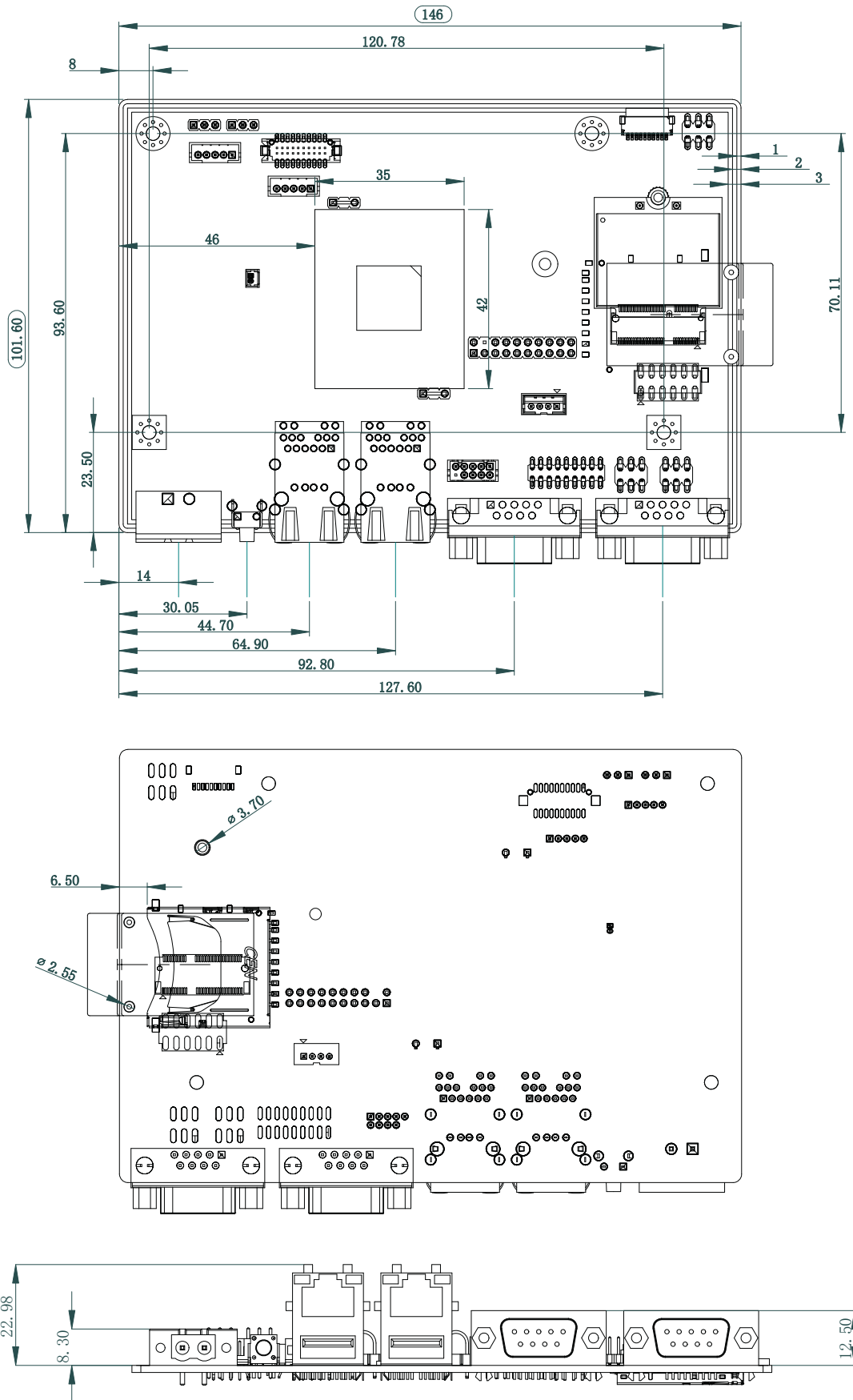
2.4 Quick Start Guide

2.4.1 Debug Port Connection

1. Connect the debug cable to the RSB-4221 debug port. (figure 2.3.1)
2. Connect the other side of the debug cable to USB-to-RS-232 cable then connect to your PC.

2.4.2 Debug Port Setting

RSB-4221 can communicate with a host server by using serial cables. Common serial communication programs such as HyperTerminal, Tera Term or PuTTY can be used in this case. The examples below describe the serial terminal setup using HyperTerminal on a Windows host:

1. Connect RSB-4221 with your PC by using a serial cable.
2. Open HyperTerminal on your Windows PC, and select the settings as shown in Figure 2-7.
3. After the bootloader is programmed on the SD card, insert power adapter connector to DC jack on RSB-4221 to power up the board. The bootloader prompt is displayed on the terminal screen.
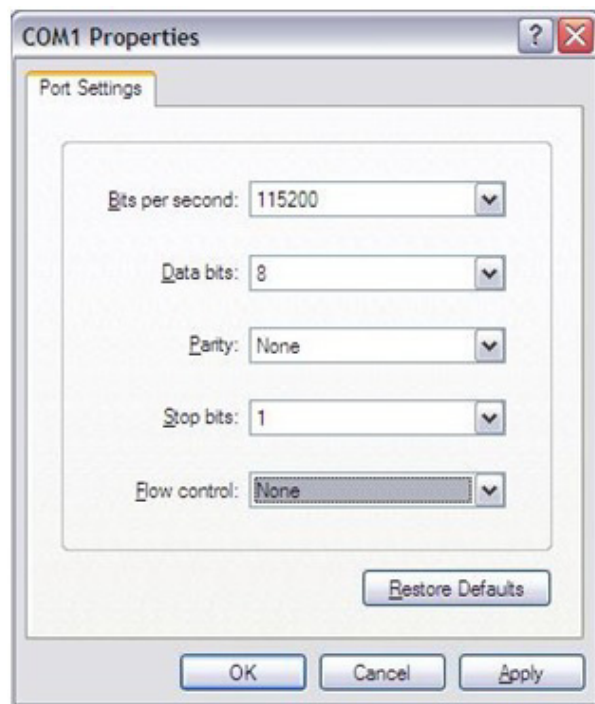
Figure 2.20 Hyper Terminal Settings for Terminal Setup

Chapter 3

Software Functionality

This chapter details the software programs on the RSB-4221 platform.

3.1 Test Tools

All test tools must be verified on RSB-4221 Evaluation kit, please prepare the required test fixtures before verifying each specified I/O. If you have any problem to get the test fixture, please contact your Advantech contact window for help.

3.2 eMMC Test

Step1: Erase and check

```
#busyboxdd if=/dev/zero of=/dev/block/mmcblk0 bs=1024 count=1 seek=1
1+0 records in
1+0 records out

#busyboxhexdump -C /dev/block/mmcblk0 -s  1024  -n 16
01887800  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 |................|
```

Step2: Write and check

```
#echo -n "0123456789ABCDEF" | dd of=/dev/block/mmcblk0 bs=1024 count=1 seek=1
0+1 records in
0+1 records out

#busyboxhexdump -C /dev/block/mmcblk0 –s 1024  -n 16
01887800    30 31 32 33 34 35 36 37    38 39 41 42 43 44 45 46 |0123456789ABCDEF|
```

Note!   *After inserting the SD Card, the eMMC NAND Flash will be mmcblk1*

3.3 USB Test

Step 1: Insert the USB flash disk and make sure it is in RSB-4221 device list

Step 2: Erase and check

```
#dd if=/dev/zero of=/dev/sdabs=1024 count=1 seek=25118
1+0 records in
1+0 records out

#busyboxhexdump -C /dev/sda  -s 25720832 -n 16
01887800  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00 |................|
```

Step 3: Write and check

```
#echo -n "0123456789ABCDEF" | dd of=/dev/sdabs=1024 count=1 seek=25118
0+1 records in
0+1 records out

#busyboxhexdump -C /dev/sda  -s 25720832 -n 16
01887800    30 31 32 33 34 35 36 37    38 39 41 42 43 44 45 46
|0123456789ABCDEF|
```

Note!	1.	TI AM335X has a limitation on USB device collection, we recommend the following brands: Logitech K120 / Lenovo K5819 LXH-EKB-10YA / RAPOO 1800.Pro/ Dell MS111-P/ Microsoft Wired Keyboard 200 (Model:1406).
	2.	This operation may damage data stored in the USB flash disk. Please make sure there is no critical data in the USB flash disk being used for this test. If your disk size is small, the seek value needs to be small.

3.4 SD Test

Step 1: When booting from eMMC, you would see the below directories:

```
#ls /dev/block/mmcblk*

/dev/block/mmcblk0  /dev/ block/mmcblk0boot0  /dev/ block/mmcblk0boot1  /dev/
block/mmcblk0p1 /dev/  block/mmcblk0p2/dev/  block/mmcblk0p3    /dev/  block/
mmcblk0p4   /dev/ block/mmcblk0p5
/dev/ block/mmcblk0p6  /dev/ block/mmcblk0p7  /dev/ block/mmcblk0p8
```

Step 2: Insert an SD card into an SD card slot (SD1) and check your device again. You should be able to see more directories. /dev/block/mmcblk1 is the SD card storage (Ex. SD Card has 2 partitions).

```
#ls /dev/ block/mmcblk*

/dev/block/mmcblk0
/dev/block/mmcblk0boot0
/dev/block/mmcblk0boot1
/dev/block/mmcblk0p1/dev/block/mmcblk0p2/dev/block/mmcblk0p3/dev/block/
mmcblk0p4/dev/block/mmcblk0p5/dev/block/mmcblk0p6/dev/block/mmcblk0p7/
dev/block/mmcblk0p8/dev/block/mmcblk1/dev/block/mmcblk1p1/dev/block/
mmcblk1p2/dev/block/mmcblk1p3/dev/block/mmcblk1p4/dev/block/mmcblk1p5
/dev/block/mmcblk1p6/dev/block/mmcblk1p7/dev/block/mmcblk1p8
```

Step 3: Erase and check

```
#dd if=/dev/zero of=/dev/block/mmcblk1 bs=1024 count=1 seek=25118
1+0 records in
1+0 records out

#hexdump -C /dev/block/mmcblk1 -s 25720832 -n 16
01887800  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
```

Step 4: Write and check

```
#echo -n "0123456789ABCDEF" | dd of=/dev/block/mmcblk1bs=1024 count=1
seek=25118
0+1 records in
0+1 records out

#busyboxhexdump -C /dev/block/mmcblk1 -s 25720832 -n 16
01887800    30 31 32 33 34 35 36 37   38 39 41 42 43 44 45 46
|0123456789ABCDEF|
```

Note!   *Please make sure parameter "seek" is equal to 25118 as indicated in the above codes. If you create the file to a wrong sector, that may damage the system.*

3.5 SPI Nor Flash Test

```
#AutoRun_spi.sh
####################---SPI Test for AM335X----##################

the spifalsh info:

mtd.type = MTD_NORFLASH
mtd.flags = MTD_CAP_NORFLASH
mtd.size = 4194304 (4M)
mtd.erasesize = 4096 (4K)
mtd.writesize = 1
mtd.oobsize = 0
regions = 0

Erased 4096 bytes from address 0x00030000 in flash
Copied 4096 bytes from address 0x00030000 in flash to temp.img
0000000 ffffffffffffffffffffffffffffffff
*
0001000
```

```
================================================================
 ################          SPI mtdblock0  Read 1 PASS !!!
================================================================
1+0 records in
1+0 records out
4096 bytes (4.0KB) copied, 0.002081 seconds, 1.9MB/s
0000000 0000 0000 0000 0000 0000 0000 0000 0000
*
0001000
Copied 4096 bytes from zero.img to address 0x00030000 in flash
Copied 4096 bytes from address 0x00030000 in flash to temp.img
0000000 0000 0000 0000 0000 0000 0000 0000 0000
*
0001000


================================================================
################### --------------SPI mtdblock0 Write 0 PASS !!!
================================================================



================================================================
#####################-----------> SPI Test all mtdblock0 PASS !!!
================================================================


============================================
############ Finish SPI all blocks  Test PASS !!!
============================================
```

Note! *RSB-4221 default supports 1 x SPI*

3.6 GPIO Test

RSB-4221 GPIO default setting.

RSB-4221	Android OS/sys/class/gpio
GPIO0	gpio200
GPIO1	gpio201
GPIO2	gpio202
GPIO3	gpio203
GPIO4	gpio204
GPIO5	gpio205
GPIO6	gpio206
GPIO7	gpio207
GPIO8	gpio208
GPIO9	gpio209
GPIO10	gpio2010
GPIO11	gpio2011

```
#cd /sys/class/gpio
```

You can use "ls" to list all GPIO devices, and you should also see GPIO ports in above table.

Example of testing GPIO

Set gpio200GPI(in)

```
#echo in > ./gpio200/direction
#cat ./gpio200/direction
in
```

Set gpio201 GPO (out)

```
#echo out > ./gpio201/direction
#cat ./gpio201/direction
out
```

Set gpio201 GPOvalue "1"

```
#echo 1> ./gpio201/value
```

#echo 1> ./gpio201/value

Get gpio200 value

```
#cat ./gpio200/value
1
```

As you can see in above procedure A and B, we set gpio200 as GPI and gpio 201 as GPO, once we send data out from gpio 201, it should be able to receive the same data from gpio200.

3.7 I2C Test

There is one I2C bus in RSB-4221.

```
#ls /sys/class/i2c-dev
i2c-1
#i2cdetect -l
i2c-1   i2c          OMAP I2C adapter                I2C adapter
```

Please try the command below to know if there is any device connected to i2c bus 1.

```
#i2cdetect -y –r 1
    0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:          -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- UU -- -- -- -- -- -- UU -- -- -- UU -- --
30: UU UUUUUUUUUUUUUUU -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: UU -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
```

0x2d is the PMIC address. So you can try the command below to know if the I2C bus is working or not.

```
# i2cdump -f -y 1 0x2d
No size specified (using byte-data access)
    0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f   0123456789abcdef
00: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
10: 00 00 00 00 00 00 00 00 00 00 00 00 9f 0d 09 00   ............???.
20: 41 0d 3d 00 05 2e 00 05 00 00 00 00 00 00 00 00   A?=.?..?........
30: 09 0d 01 0d 0d0d 09 01 0d 00 00 00 00 00 3b 70   ?????????.....;p
40: 35 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   5...............
50: 16 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ??..............
60: 0a 0a0a0a0a0a0a 00 00 00 00 00 00 00 00 00 00   ??????..........
70: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
80: 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ?...............
90: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
a0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
b0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
c0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
d0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
e0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
f0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
```

3.8 LAN Test

RSB-4221 sets DHCP as default network protocol.

```
#busyboxifconfig
eth0      Link encap:EthernetHWaddr 78:A5:04:DD:E4:9C
inet addr:172.21.170.76  Bcast:172.21.171.255 Mask:255.255.254.0
          UP BROADCAST RUNNING ALLMULTI MULTICAST  MTU:1500  Metric:1
          RX packets:16740 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1454 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1935525 (1.8 MiB)  TX bytes:198083 (193.4 KiB)

lo        Link encap:Local Loopback
inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:130 errors:0 dropped:0 overruns:0 frame:0
          TX packets:130 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
          RX bytes:234899 (229.3 KiB)  TX bytes:234899 (229.3 KiB)
```

If you would like to config IP manually, please use the below command:

```
#busyboxifconfig eth0 xxx.xxx.xxx.xxx up
```

Here's a real case for your reference.The hosts (RSB-4221) IP is 192.168.0.10; the target (A desktop computer) IP is 192.168.0.12

```
#busyboxifconfig eth0 down
#busyboxifconfig eth0 192.168.0.10
#busyboxifconfig eth0

eth0      Link encap:EthernetHWaddr 78:A5:04:DD:E4:9C
inet addr:192.168.0.10  Bcast:172.168.0.255 Mask:255.255.255.0
          UP BROADCAST RUNNING ALLMULTI MULTICAST  MTU:1500  Metric:1
          RX packets:16740 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1454 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1935525 (1.8 MiB)  TX bytes:198083 (193.4 KiB)
```

The target computer (Client) IP address is 192.168.0.12, so we can use the below command to see if we can get any response from the client.

```
#ping 192.168.0.12

PING 192.168.0.12 (192.168.0.12): 56 data bytes
64 bytes from 192.168.0.12: seq=0 ttl=128 time=7.417 ms
64 bytes from 192.168.0.12: seq=1 ttl=128 time=0.203 ms
64 bytes from 192.168.0.12: seq=2 ttl=128 time=0.300 ms


--- 172.17.20.192 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
```

Note!   The target computer (Client) firewall needs to be closed.

3.9   RGB Test

Execute the following commands to run the photo demo application on RSB-4221.

```
#ping 192.168.0.12

PING 192.168.0.12 (192.168.0.12): 56 data bytes
64 bytes from 192.168.0.12: seq=0 ttl=128 time=7.417 ms
64 bytes from 192.168.0.12: seq=1 ttl=128 time=0.203 ms
64 bytes from 192.168.0.12: seq=2 ttl=128 time=0.300 ms


--- 172.17.20.192 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
```

You should be able to see the White, Red, Blue, Green, Black colors on the default display screen.

3.10 RS232 /RS422/RS485 Test

As you can see below, there are 5 UART supported by RSB-4221./dev/ttyO0is reserved for RSB-4221debug port, the other UART ports could be applied by the user.

Test RS232

This is loopback test, you need to connect a loopback connector for rs232 to the testing port.

```
#AutoRun_uart232

=====test rs232!=====
rs232 number: 5
/dev/ttyO1 PASS!
/dev/ttyO2 PASS!
/dev/ttyO3 PASS!
/dev/ttyO4 PASS !
/dev/ttyO5PASS !


+-------------------+
| [RS232] Test Pass!|
+-------------------+
```

> **Note!** *UART1 supports RS232/RS422/RS485, test rs232 mode, please jump rs232 mode, you can refer to the detailed jump information from the **2.1.1 Jumper List***

UART1 Test RS422

This is loopback test. So you need to connect a loopback connector for rs422to the testing port.

```
#AutoRun_uart422 -p /dev/ttyO1 -t 1

Open uart /dev/ttyO1 PASS ....

 ->Writing : hello world!
 ->Reading : hello world!
 ->TX/RX Signal pass
+----------------------------------+
| UART RS422 Testing PASS |
+----------------------------------+
```

> **Note!** *UART1 Jump RS422 mode, you can refer the detail jump information from* ***2.1.1 Jumper List***

UART1 Test RS485

You need to connect /dev/ttyO1 to ADAM-4520 rs485 port and connect /dev/ttyO4

to the one ADAM-4520 rs232 port.

```
#AutoRun_uart485 -p /dev/ttyO1 /dev/ttyO4 -t 6

Open uart /dev/ttyO1 OK ....
Open uart /dev/ttyO4 OK ....

Writing:helloworld!
Reading :helloworld!
->TX/RX Signal pass
+----------------------------------+
| UART RS485 Testing PASS |
+----------------------------------+

Close uart /dev/ttyO1 OK ....
Close uart /dev/ttyO4OK ....
```

> **Note!** *UART1 Jump RS485 mode, you can refer to detailed jump information from the* ***2.1.1 Jumper List***

3.11 Can Test

1. Prepare one Advantech PCI-1680U Can card and install the driver.
2. Connect RSB-4221 CAN Port CAN1_D+ /CAN1_D- and GND with Advantech PCI-1680U can card.

5.1 Pin Assignments

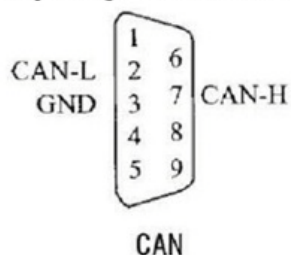Figure 5.1 shows the pin assignment for the card's DB-9 connectors

Figure 5.1: PCI-1680U DB-9 pin assignment

3. Use the following command under rsb4221 to send data through to the can card: # cancard_send.sh 1000000

```
# cancard_send.sh 1000000
```

4. Use the following command under rsb4221 to receive data form the opposite side:

```
#cancard_receive.sh 1000000
```

Chapter 4

Android O.S

This chapter introduces how to build android system and develop based our android system.

4.1 Introduction

The purpose of this chapter is to introduce RSB-4221software development to you, so that you can develop your own application(s) efficiently.

RSB-4221 is designed to support Linux host only. For now the official supported host version is Ubuntu14.0464bit, any other version may have compatibility issues. In this case, we strongly recommend to have Ubuntu 14.04LTS 64bit installed to your host PC before starting RSB-4221 evaluation/development.

4.2 Board Support Package

We an offer you two different kinds of Android package for RSB-4221. One is a pre-built system image for system recovery, another is a source code package (BSP).

4.2.1 Pre-built System Image

You can find the pre-built image 4221AIVxxxx_yyyy-mm-dd.tar.gz from RSB-4221 evaluation kit DVD image downloaded from the Advantech website. RSB-4221 supports booting from SD card so you can extract the image to the SD card then dump the image file to the onboard eMMC to complete system recovery. For more details, please refer to section 3.6 Create an Android System Boot media. Folders and files are described below:

image:

This folder contains uboot image, kernel image and android root file system tar file and so on. These files are used to burn to sd card or nand flash.

scripts:

This folder contains scripts for building images easily.

mksd-recovery.sh

> To create a bootable SD card.mkin and-android.sh

> To burn Android firmware to eMMC flash

4.2.2 Source Code Package

RSB-4221 board support package (BSP) contains a cross compiler, linux kernel source code, u-boot source code, android root file system and some scripts used in OS development.Some of the above components are developed by Advantech and others are developed by the open source community.

Folders are described below:

android/u-boot/

> U-Boot source code

android/device/advantech/rsb4221/

> Android related settings for rsb4221

android/hardware/ti/

> HAL(Hardware AbstractionLayer)

android/kernel /

> Android kernel source code

android/prebuilts /

Android tool chain, sdk and so on

android/scripts/

This folder contains scripts for building images easily.

android/tools/

This folder contains some software package for building android code

mksd-android.sh

To create a bootable SDcard.mkinand-android.sh

To burn android firmware to eMMC flash

4.3 Set up Build Environment

All instructions in this guide are based on Ubuntu 14.0464bit only. Please install Ubuntu14.0464bit with minimum 2GB DRAM in advance, login to the installed system and perform following sections:

4.3.1 Installing JDK

root@tylor-Zhaoyang-K29:~#sudoapt-getinstallpython-software-properties

root@tylor-Zhaoyang-K29:~# sudoapt-getupdate

root@tylor-Zhaoyang-K29:~#sudoapt-getinstallsun-java6-jdksun-java6-plugin

4.3.2 Installing Oracle JDK 6

1. Get jdk-6u45-linux-x64.bin from android-source-code-directory/tools/
2. Follow the following steps to install JDK 6

```
$ chmoda+x jdk-6uXX-linux-x64.bin
$ ./jdk-6uXX-linux-x64.bin
$ sudomkdir -p /usr/lib/jvm
$ sudo mv jdk1.6.0_XX /usr/lib/jvm/
$ sudo update-alternatives --install "/usr/bin/java" "java" "/usr/lib/jvm/jdk1.6.0_XX/bin/java" 1
$ sudo update-alternatives --install "/usr/bin/javac" "javac" "/usr/lib/jvm/jdk1.6.0_XX/bin/javac" 1
$ sudo update-alternatives --config java
$sudo update-alternatives --config javac
```

4.3.3 Installing Required Packages

The following command installs the required packages for setting up the android build host:

```
$ sudo apt-get install git-core gnupg flex bison gperf build-essential \
zip curl libc6-dev libncurses5-dev:i386 x11proto-core-dev \
libx11-dev:i386 libreadline6-dev:i386 libgl1-mesa-glx:i386 \
libgl1-mesa-dev g++-multilib mingw32 openjdk-6-jdk tofrodos \
python-markdown libxml2-utils xsltproc zlib1g-dev:i386 \
minicomtftpdu-boot-tools u-boot-tools:i386  expect libgl1-mesa-dri
$ sudo ln -s /usr/lib/i386-linux-gnu/mesa/libGL.so.1
/usr/lib/i386-linux-gnu/libGL.so
```

4.3.4 Toolchain Setup

Before building the android system, you need setup the toolchain.

Android toolchain is under android/prebuilds. Please refer to 3.3.2

Setup the toolchain path to point to arm-eabi- tools in android/prebuilds/gcc/linux-x86/arm/arm-eabi-4.6/bin,the command is:

root@tylor-Zhaoyang-K29:~# export PATH=$ANDROID_DIR/android/prebuilts/gcc/linux-x86/arm/arm-eabi-4.6/bin:$PATH

4.4 Build Instructions

1. Open one terminal console and change directory to BSP scripts Folder.
2. Perform one of following commands:

4.4.1 Build Preparation

Before invoke other script, you should invoke following script:

root@tylor-Zhaoyang-K29:~# make TARGET_PRODUCT=<product name> OMAPES=4.x -j<N> sdcard_build

where<product name> is:

•rsb4221 for rsb-4221 board

Note:*<N> should be twice the number of processors on your host machine. For example, a dual core machine would use -j4.

4.4.2 Building an Android Kernel

1. Open the terminal console and change directory to BSP scripts folder
2. Perform the following command:
   root@tylor-Zhaoyang-K29:~# ./mk_bootimg.sh <product name>
   where<product name> is:
   •**rsb4221** for rsb-4221 board
3. You will get an android kernel image file named boot.img.

4.4.3 Building an Android System Image

1. Open terminal console and change directory to BSP scripts folder
2. Perform the following command:
   root@tylor-Zhaoyang-K29:~# ./mk_system.sh <product name>
   where<product name> is:
   •**rsb4221** for rsb-4221 board
3. You will get an android kernel image file named system.img.

4.4.4 Building an Android Recovery Image

1. Open terminal console and change directory to BSP scripts folder
2. Perform the following command:
   root@tylor-Zhaoyang-K29:~# ./mk_recovery.sh <product name>
   where<product name> is:
   •**rsb4221** for rsb-4221 board
3. You will get an android kernel image file named recovery.img.

4.4.5 Building an Android OTA package

1. Open the terminal console and change directory to BSP scripts folder
2. Perform following command:

    root@tylor-Zhaoyang-K29:~# ./mk_otapackage.sh <product name>

    where<product name> is:

    •**rsb4221** for rsb-4221 board
3. You will get an android kernel image file named update.zip.

4.5 Debug Console

Connecting 9-pin D-SUB of debug console cable with host computer serial port and using serial port terminal application (like minicom, putty or teraterm) to config serial portas1152008N1.

Then plugging 4-pin connector of debug console cable into RSB-4221's debug port (also known as /dev/ttyO0inAndroidsystem)

4.6 Boot up from SD card or eMMC

RSB-4221 supports boot up from SD card or onboard flash. This section will guide you how to build an image for RSB-4221 Android system boot media.

4.6.1 Storages Device Names:

Device	Name
SD card	/dev/block/mmcblk0
eMMC	/dev/block/mmcblk1

4.6.2 Creating a Bootable SD Card

You can find a pre-built image from the Advantech website. Please follow these steps to create a SD card for boot up.

1. Copy "4221AIVxxxx_yyyy-mm-dd.tar.gz" package to your /root/.
2. Open "Terminal" on Ubuntu 14.04 LTS..
3. $sudosu (Change to "root" authority)
4. Input your password.
5. **root@tylor-Zhaoyang-K29:**~# cd /root/
6. **root@tylor-Zhaoyang-K29:**~# tar xzvf 4221AIVxxxx_yyyy-mm-dd.tar.gz (Unzip files)
7. Insert one SD card to your developing computer
8. Check the SD card location, like /dev/sdb
9. **root@tylor-Zhaoyang-K29:**~# cd ./4221AIVxxxx_yyyy-mm-dd/scripts
10. **root@tylor-Zhaoyang-K29:**~#./mksd-recovery.sh /dev/sdb
11. Type "y" (Start to copy files, wait until it shows [Done])

Then insert the Linux system SD card to RSB-4221, and it will boot up with android.

4.6.3 Transfering System to Onboard eMMC

1. Open the debug console
2. Bootup from SD card

    Perform the following command:

root@tylor-Zhaoyang-K29:~# cd/data/mkimage/scripts

root@tylor-Zhaoyang-K29:~# ./mkinand?android.sh/dev/block/mmcblk1

3. RemoveSDcard,thenRSB-4221canbootupfromonboardeMMC.

4.7 Customization

4.7.1 Config Android Kernel

1. Open the terminal console and change directory to BSP scripts folder
2. Perform the following command:

   root@tylor-Zhaoyang-K29:~# cdandroid/kernel

   root@tylor-Zhaoyang-K29:~# make ARCH=arm menuconfig

3. LinuxKernelConfigurationshowsupasbelow:

4. From the menu, DeviceDrivers/Networkdevicesupport, you can select device(s) you want to build in linux kernel

5. Refer Chapter section 4.4.1 rebuild everything.

4.7.2 Putting the Source Code to System

1. Put whole package directory to BSP's folder:
   ./android/packages/apps/

2. Createafile,Android.mk,atpackagedirectory;thecontentslooklikebelow:
   LOCAL_PATH:=$(callmy?dir)
   include$(CLEAR_VARS) LOCAL_MODULE_TAGS:=optional
   LOCAL_SRC_FILES:=$(callall?java?files?under,src)

   LOCAL_PACKAGE_NAME:=PROJECT_NAME_HERE
   LOCAL_CERTIFICATE:=platform

   include$(BUILD_PACKAGE)

   #Usethefollowingincludetomakeourtestapk.
   include$(callall-makefiles-under,$(LOCAL_PATH))

3. Editfollowingfile:
   ./android/device/Advantech/rsb4221/device.mk
   toinsertcorrectprojectname:

   PRODUCT_PACKAGES+=\
           PROJECT_NAME_HERE\
       librxtxSerial\
               SerialJ

4.8 Serial Port Test

4.8.1 Setup Serial Port

1. Click Serial Port.
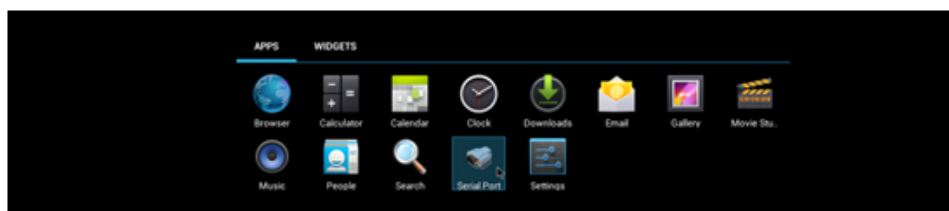
2. Click Setup.
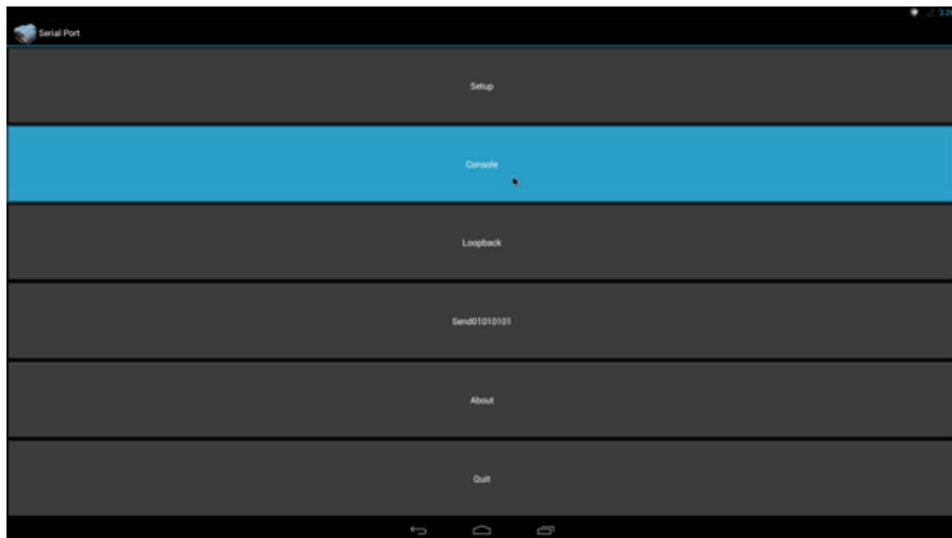
3.   Click Device, and choose used device (ex.ttyO5)
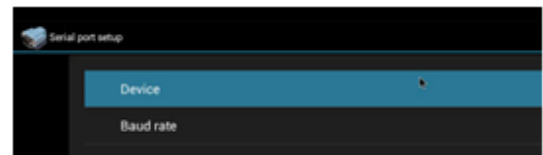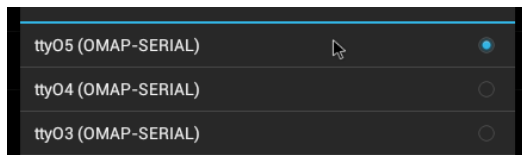
4.   Click Baudrate, and choose used baudrate (ex.115200)
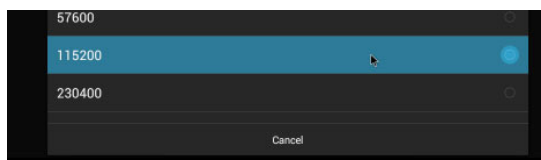
4.8.2 Console Test

1.   Using serial cable to connect ttyO5withPC/NB's serial port that should be configured to 1152008N1, and opening serial terminal AP (like minicom, putty or teraterm).
2.   Click Console.
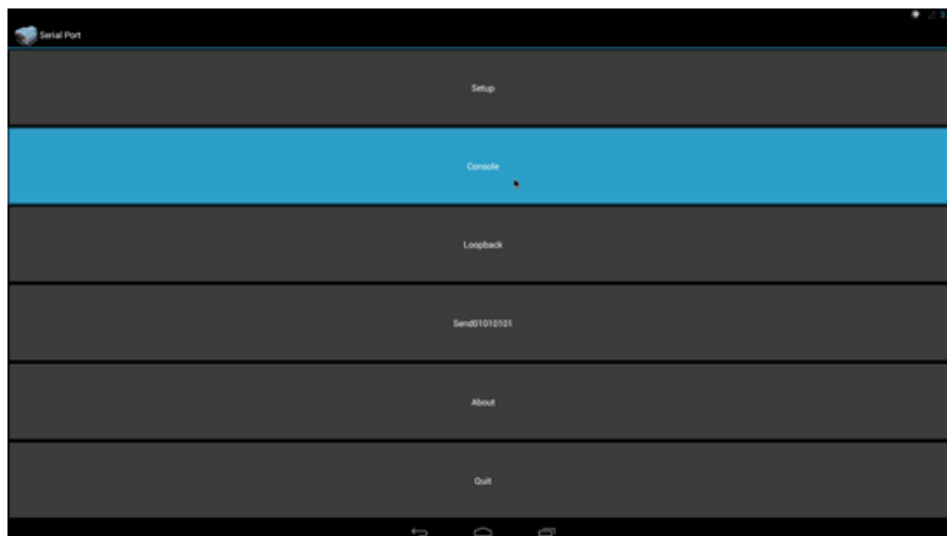
After typing some characters ex."Thisisatest.123456789ABCDEF") and pressing Enter in serial terminal AP, an identical message will show up in the reception block as below:

On the other hand, typing some message (ex."MESSAGEfromAndroid") in emission block, the identical message will showup in serial terminal AP as below:
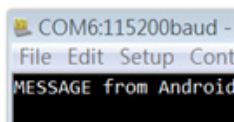
4.8.3 Loopback Test

1. Plug loop back device in to ttyO5
2. Click Loop back.
   The loop back test result will showup as below.

4.8.4 Send01010101 Test

1. Using serial cable to connect to ttyO5 with PC/NB's serial port that should be configured to 1152008N1, and opening serial terminal AP (like minicom, putty or teraterm)

2. ClickSend01010101.
The character "U" (b'01010101) will show up as below:
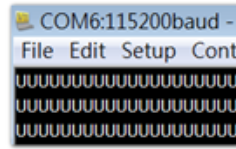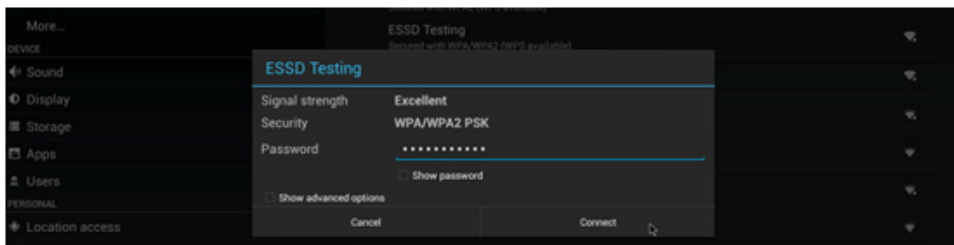
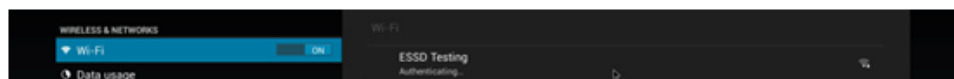

4.9 Network Setup

4.9.1 Wi-Fi
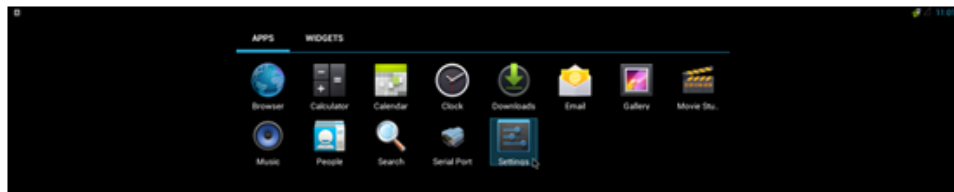
1. Click Settings

2. Turn Wi-Fi on
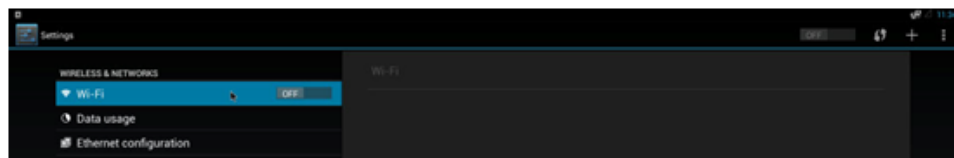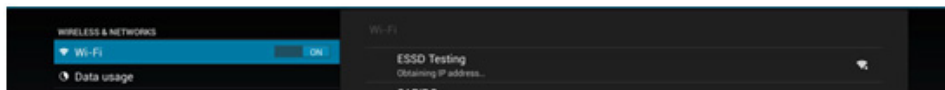

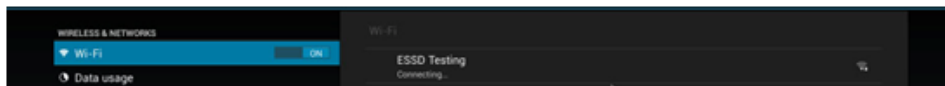3. Choose ESSID (for example, ESSD Testing)
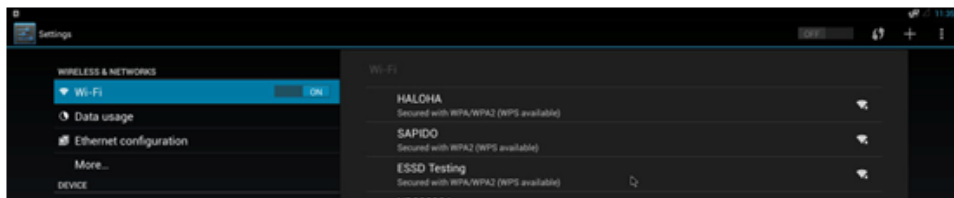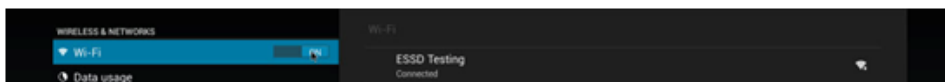

4. Input correct password.

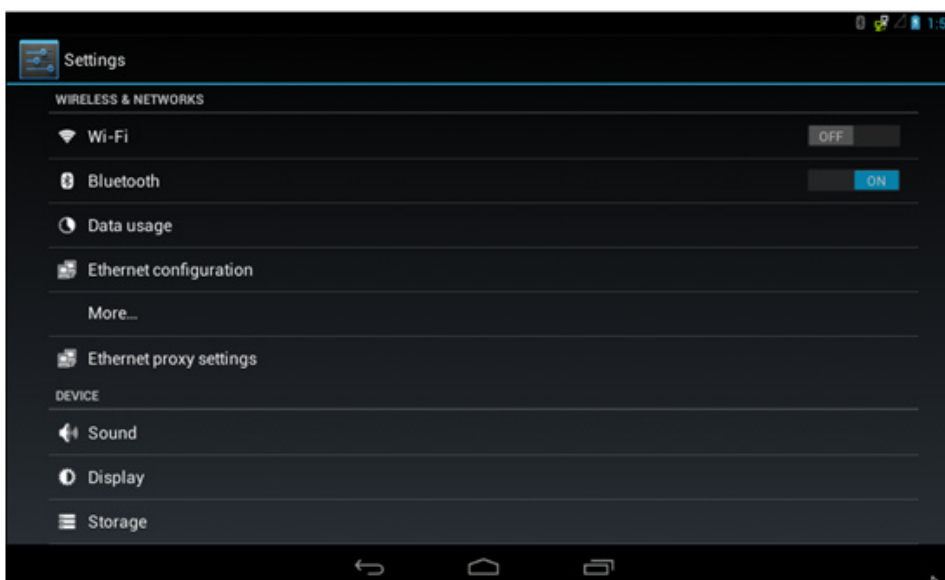5. Wi-Fi Authenticating/Connecting/ObtainingIP address

6.   Wi-Fi connected
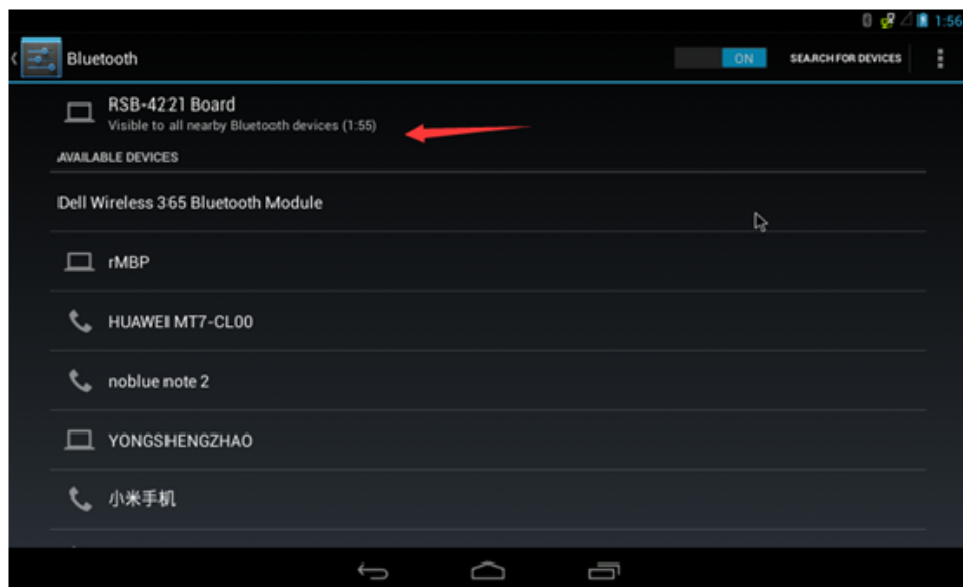

4.10 Bluetooth

1.   Click Settings, switch the Bluetooth switch to ON to turn on Bluetooth:
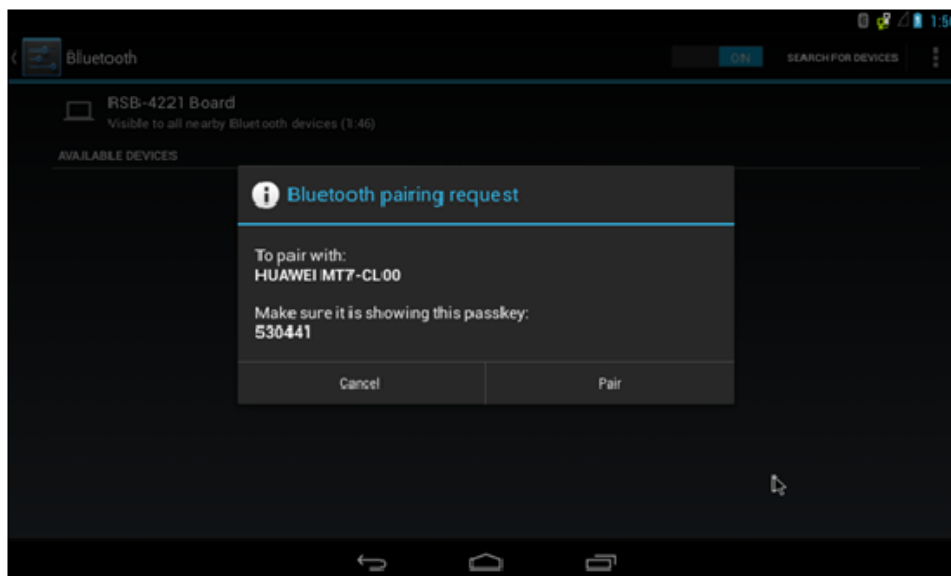

2.   Click Settings / Bluetooth for the main interface:

3. Click "RSB-4221 Board" to let rsb4221 Bluetooth be visible to other Bluetooth devices.

4. Click any available devices to pair with.

5. After pairing successfully you can now communicate.

4.11 Ethernet

1. Click Settings / Ethernet configuration, then Turn on Ethernet
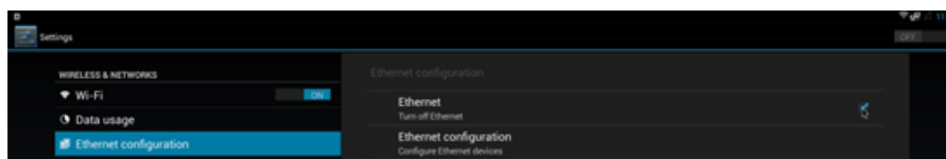
2. Click Ethernet configuration

3. Choose Connection Type (DHCP or Static IP)
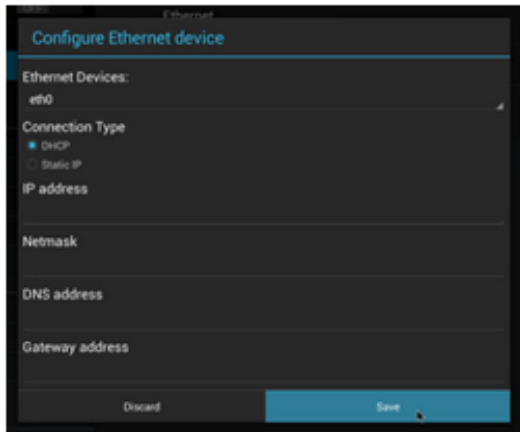
4.12 Can Test

1. Click Flexcan:
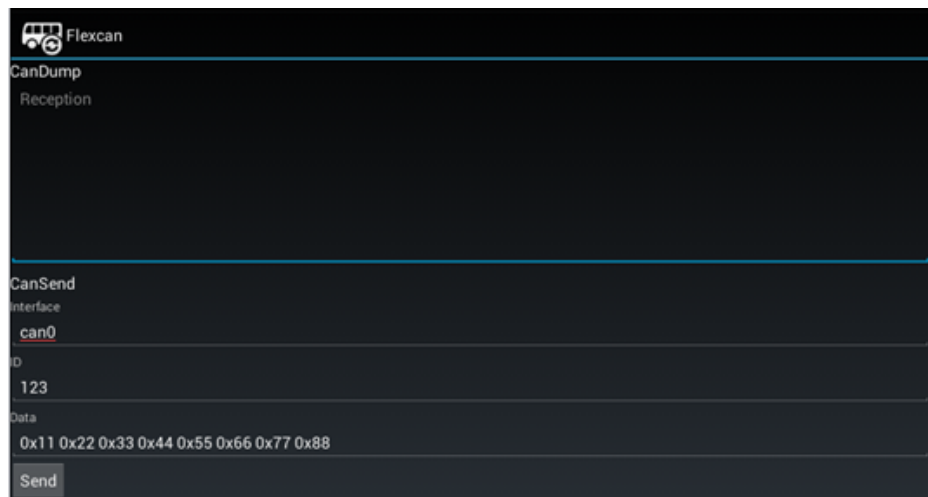
2. Edit "interface","ID"and "Data", then Click "Send" to send data to the Can Port.
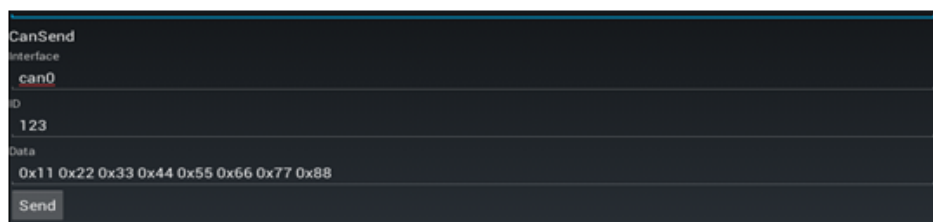
3. Recieved Data is displayed under the Can Dump area.
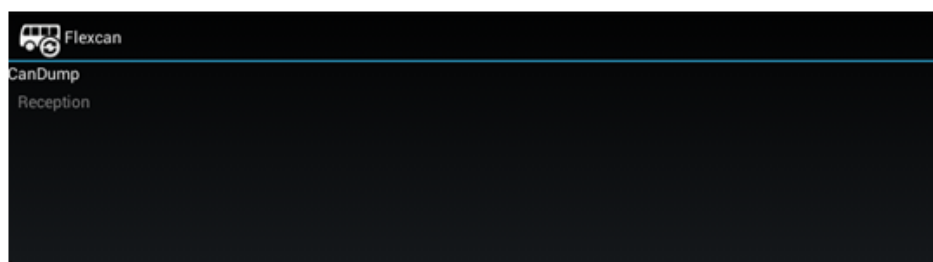
4.13 System Update

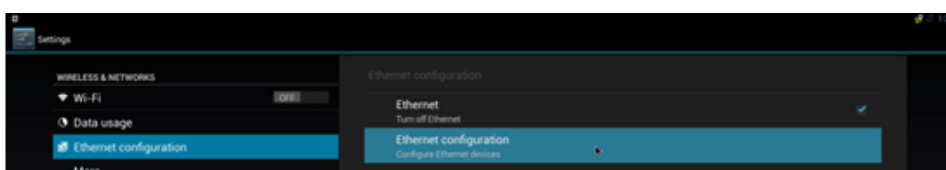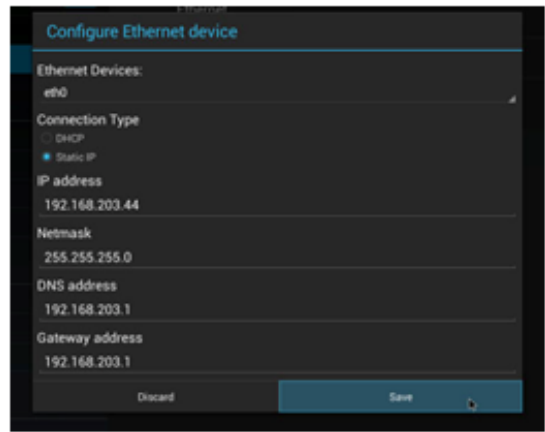1. Refer to Chapter 4.4.5 to "Building an Android OTA package".
2. Prepare the http server:
   (1) create a folder named "rsb4221" under the http server root directory.
   (2) copy update.zip to the folder "rsb4221" and rename it "rsb4221.ota.zip"
   (3) copy the corresponding build.prop to the folder "rsb4221"

Note!   *Build.prop and update.zip refer to 4221AIVxxxx_yyyy-mm-dd/scripts*

3. Click Settings/ About tablet/ Addition system updates:
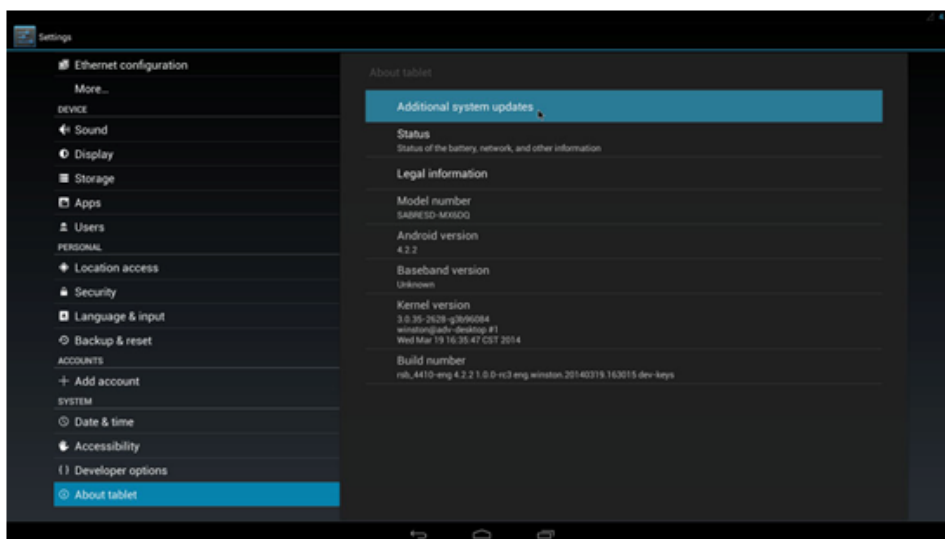
4. Wait a moment, the system will reboot to update.
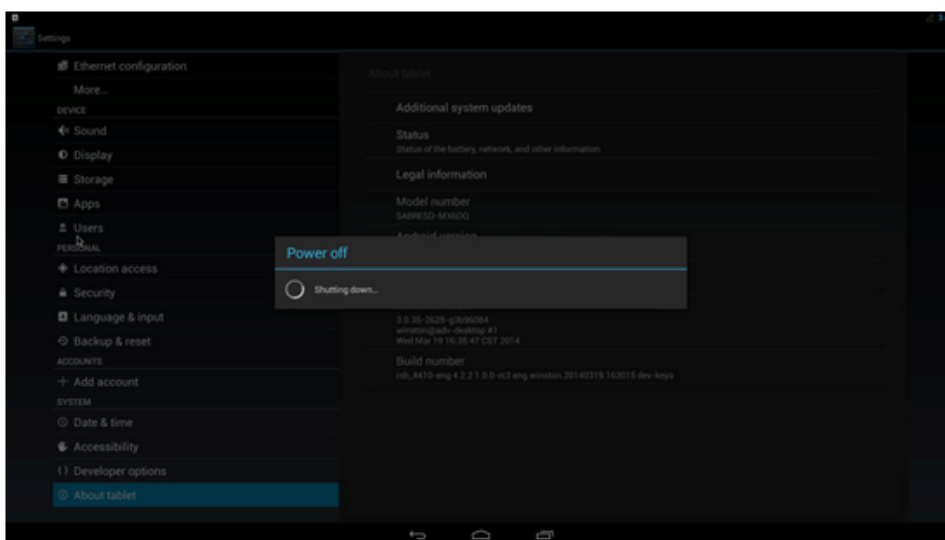
5. It will take some time to update.

4.14 System Backup and Restore

This function involves four sub functions:

- ■ **Factory data reset:**
  This sub function will erase all user data.
- ■ **System recovery:**
  This sub function will recover your system from a U disk.
- ■ **System backup:**
  This sub function will backup your user data.
- ■ **System restore:**
  This sub function will restore your user data.

The main function is as follows: (Click Settings / Backup & reset)
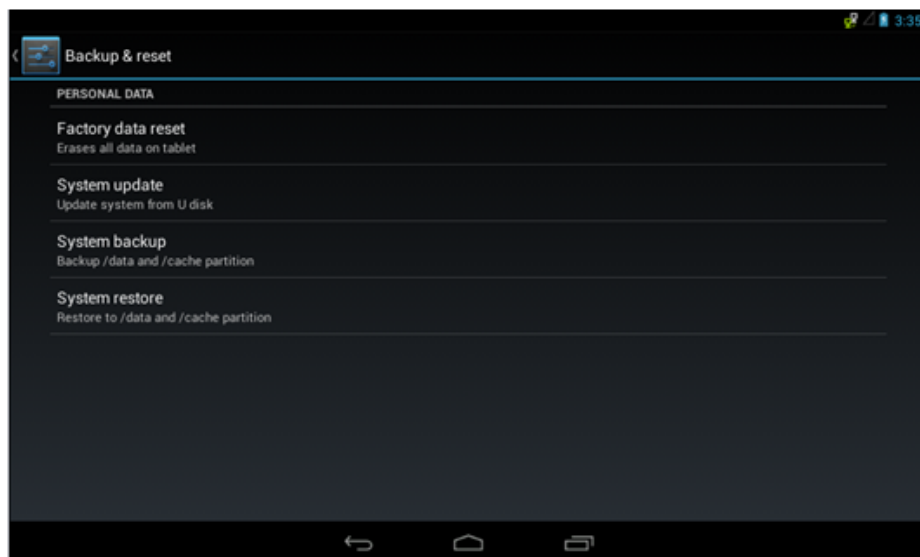
4.14.1 Factory Data Reset

1. Click Settings / Backup & reset, then enter into main interface
2. Click Factory data reset:
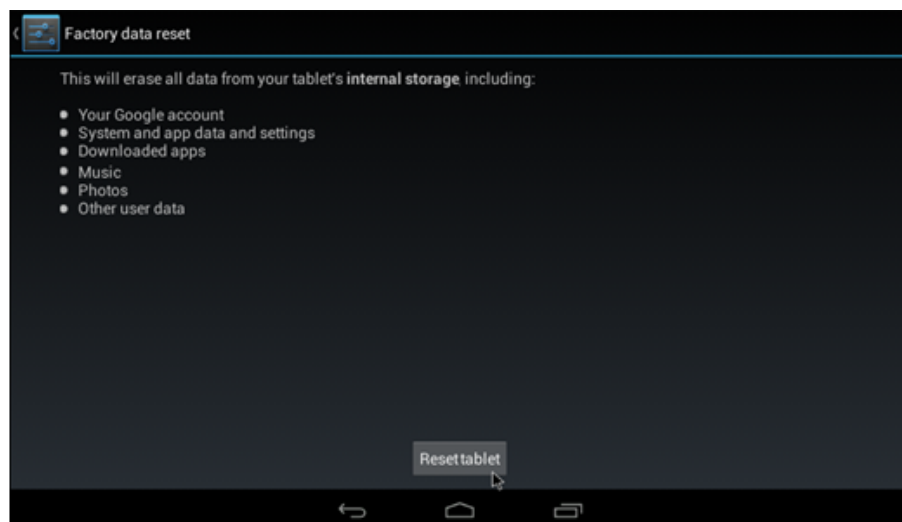
3. Click Reset tablet:
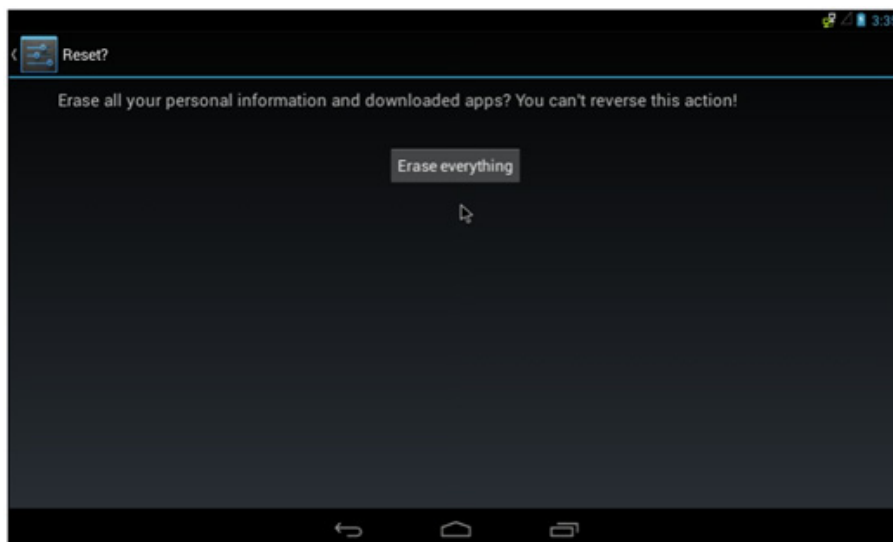
4.   Click Erase everything:
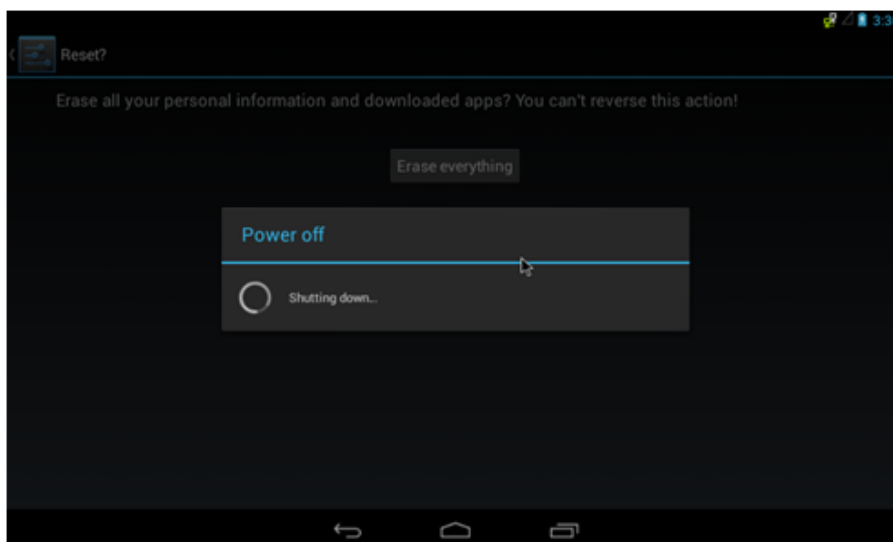
5.   Wait a moment, the system will reboot to erase all user data.

4.14.2 System Recovery

1.   Click Settings / Backup & reset, then into main interface
2.   Insert your u disk.

Note!   *Make sure your u disk is FAT32 and has a update.zip filed under the first partition, such as /dev/sdb1.*

3.   Click System Update:
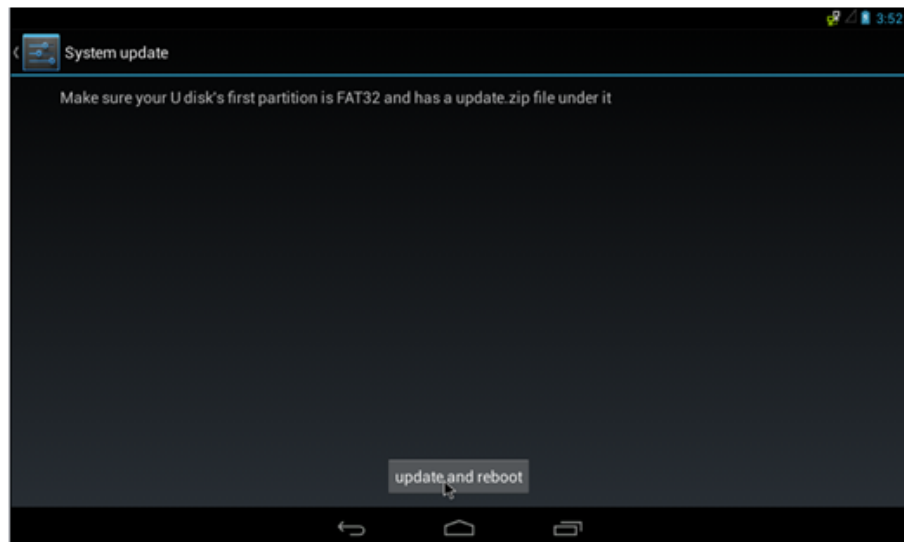
4. Click update and reboot, system will reboot for it

> **Note!** *Another way of entering Recovery mode:*
> *Press the button on the rsb4221 board when booting up.*
> *Please refer to 2.2.2.19 Recovery (SW2)*

4.14.3 System Backup

1. Click Settings / Backup & reset
2. Click System Backup:
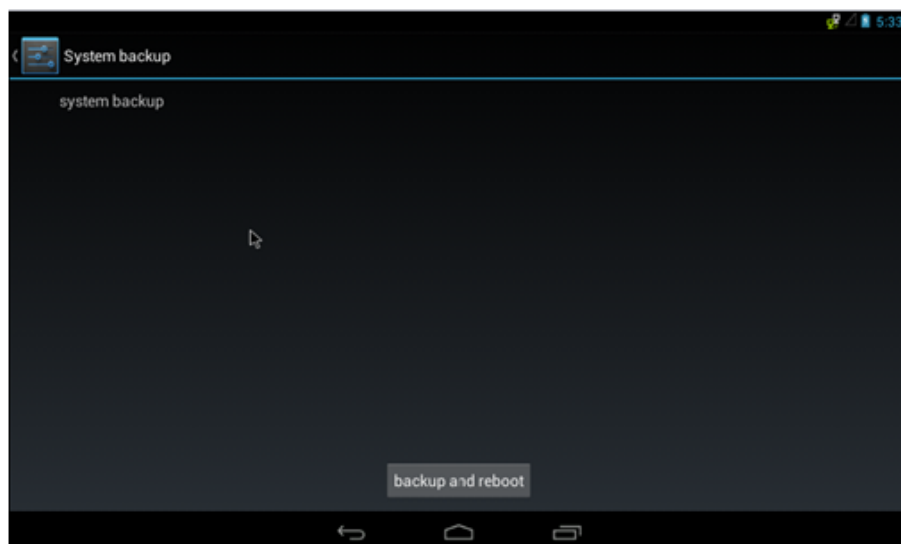
3. Click backup and reboot, the system will reboot to backup user data.

> **Note!** *Data is backed up to /data/data/ folder*

4.14.4 System Restore

1. Click Settings / Backup & reset, then into main interface
2. Click System Restore:
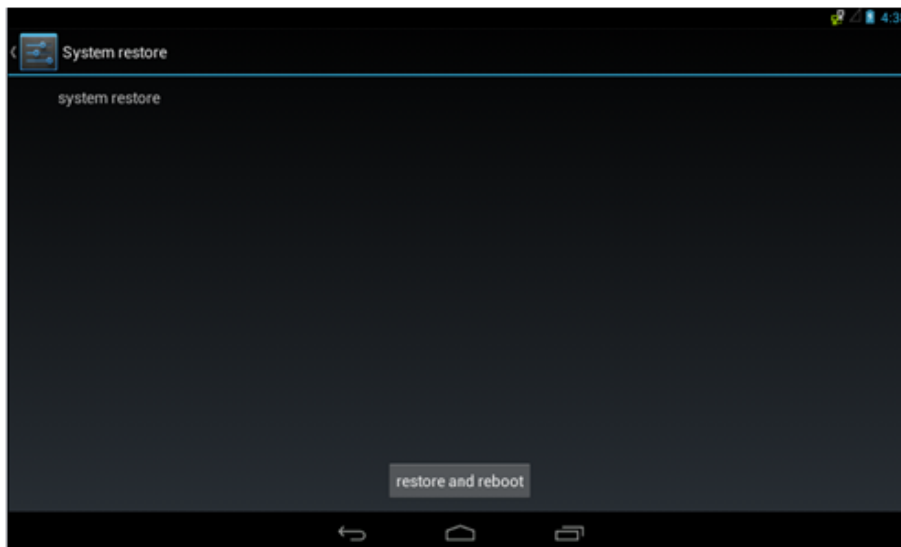
3. Click restore and reboot, system will reboot for restore user data.

Note! *Data is backed up to /data/data/ folder*

4.15 Watchdog Function

The watchdog daemon auto startups when the android system boots. The default timeout time is 60 seconds and the watchdog daemon refreshes every 2 seconds. *These two values can be modified*.

1. Edit init.am335xevm.rc (you can find it under android_source _code/advantech/ rsb4221/):

```
# [Advantech]Set watchdog timer to 1 seconds and every 400 milliseconds to get
a 600 millisecond margin
service watchdogd /sbin/watchdogd 2000 58000
    class core
```

Note! *The "2000" means active time is every 2000 msecs!*
The "5800" plus "2000" means the watchdog timeout is 60000 msecs!
These two values can be modified.

2. Rebuild the kernel image (refer to 4.4.2 Build android kernel) and create a bootable SD card and test.

Chapter 5

Advantech Services

This chapter introduces Advantech design in serviceability, technical support and warranty policy for RSB-4221 evaluation kit.

5.1 RISC Design-in Services
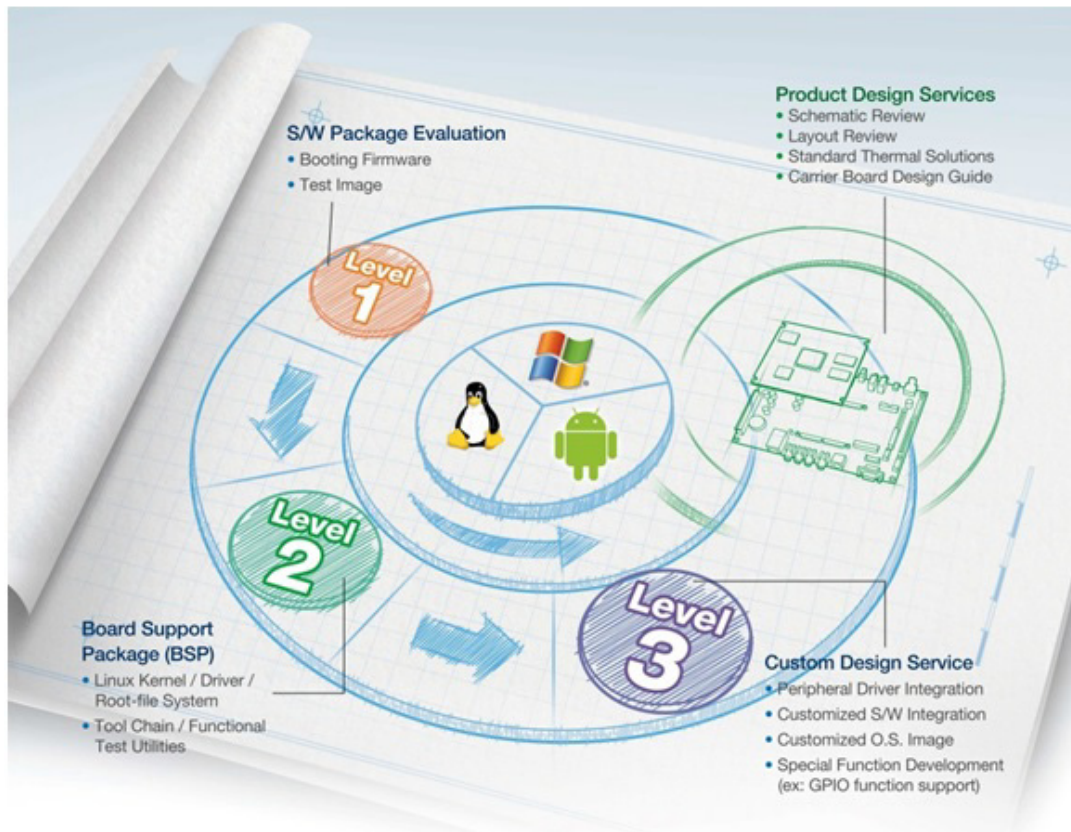
Advantech RISC Design-in Services help customers reduce the time and work involved with designing new carrier boards. We handle the complexities of technical research and greatly minimize the development risk associated with carrier boards.

Easy Development

Advantech has support firmware, root file-system, BSP or other develop tools for customers. It helps customers to easy develop their carrier board and differentiate their embedded products and applications.

- Full Range of RISC Product Offerings
- Comprehensive Document Support

Design Assistance Service

Advantech provides check list for engineer for easy check their schematics and also review service based on customer carrier board schematics. Those services are preventative, and help to catch design errors before they happen. It helps to save a lot of time and costs with regard to developing carrier boards.

- Schematic Review
- Placement and Layout Review
- Debugging Assistance Services
- General/Special Reference Design Database.

Thermal Solution Services

In order to provide quicker and more flexible solutions for customer's thermal designs. Advantech provides thermal solution services including modularized thermal solutions and customized thermal solutions.

- Standard Thermal Solutions
- Customized Thermal Solutions

Embedded Software Services

Supports driver, software integration or customized firmware, root file-system and Linux image. Customer can save lot of time and focus on their core development.

- Embedded Linux/ Android OS
- Advantech boot loader Customization

With the spread of industrial computing, a whole range of new applications have been developed, resulting in a fundamental change in the IPC industry. In the past System Integrators (SI) were used to completing projects without outside assistance but now such working models have moved on. Due to diverse market demands and intense competition, cooperation for (both upstream and downstream) vertical integration has become a much more effective way to create competitive advantages. As a result, ARM-based CPU modules were born out of this trend. Concentrating all necessary components on the CPU module and placing other parts on the carrier board in response to market requirements for specialization, provides greater flexibility while retaining its low power consumption credentials.

Advantech has been involved in the industrial computer industry for many years and found that customers usually have the following questions when implementing modular designs.

General I/O design capability

Although customers possess the ability for vertical integration and have enough know-how and core competitiveness in the professional application field, the lack of expertise and experience in general power and I/O design causes many challenges for them, especially integrating CPU modules into their carrier board.

The acquisition of information

Even if the individual client is able to obtain sufficient information to make the right decision for the specialized vertical application, some customers encounter difficult problems dealing with platform design in general and communicating with CPU or chipset manufacturers, thereby increasing carrier board design difficulties and risk as well as seriously impacting on

Time-to-market and lost market opportunities.

Software development and modification

Compared to x86 architectures, RISC architectures use simpler instruction sets, therefore the software support for x86 platforms cannot be used on RISC platforms. System integrators need to develop software for their system and do the hardware and software integration themselves. Unlike x86 platforms, RISC platforms have less support for Board Support Packages (BSP) and drivers as well. Even though driver support is provided, SIs still have to make a lot of effort to integrate it into the system core. Moreover, the BSP provided by CPU manufacturers are usually for carrier board design, so it's difficult for SIs to have an environment for software development.

In view of this, Advantech proposed the concept of Streamlined Design-in Support Services for RISC-based Computer On Modules (COM). With a dedicated professional design-in services team, Advantech actively participates in carrier board design and problem solving. Our services not only enable customers to effectively distribute their resources but

also reduce R&D manpower cost and hardware investment.

By virtue of a close interactive relationship with leading original manufacturers of CPUs and chipsets such as ARM, TI and Freescale, Advantech helps solve communication and technical support difficulties, and that can reduce the uncertainties of product development too. Advantech's professional software team also focuses on providing a complete Board Support Package and assists customers to build up a software development environment for their RISC platforms.

Advantech RISC design-in services helps customers overcome their problems to achieve the most important goal of faster time to market through a streamlined RISC Design-in services.

Along with our multi-stage development process which includes: planning, design, integration, and validation, Advantech's RISC design-in service provides comprehensive support to the following different phases:

Planning stage

Before deciding to adopt Advantech RISC COM, customers must go through a complete survey process, including product features, specification, and compatibility testing with software. So, Advantech offers a RISC Customer Solution Board (CSB) as an evaluation tool for carrier boards which are simultaneously designed when developing RISC COMs. In the planning stage, customers can use this evaluation board to assess RISC modules and test peripheral hardware. What's more, Advantech provides standard software Board Support

Package (BSP) for RISC COM, so that customers can define their product's specifications as well as verifying I/O and performance at the same time. We not only offer hardware planning and technology consulting, but also software evaluation and peripheral module recommendations (such as WiFi, 3G, BT). Resolving customer concerns is Advantech's main target at this stage. Since we all know that product evaluation is the key task in the planning period, especially for performance and specification, so we try to help our customers conduct all the necessary tests for their RISC COM.

Design stage

When a product moves into the design stage, Advantech will supply a design guide of the carrier board for reference. The carrier board design guide provides pin definitions of the COM connector with limitations and recommendations for carrier board design, so customers can have a clear guideline to follow during their carrier board development. Regarding different form factors, Advantech offers a complete pin-out check list for different form factors such as Q7, ULP and RTX2.0, so that customers can examine the carrier board signals and layout design accordingly. In addition, our team is able to assist customers to review the placement/layout and schematics to ensure the carrier board design meets their full requirements. For software development, Advantech RISC software team can assist customers to establish an environment for software development and evaluate the amount of time and resources needed. If customers outsource software development to a 3rd party, Advantech can also cooperate with the 3rd party and provide proficient consulting services. With Advantech's professional support, the design process becomes much easier and product quality will be improved to meet their targets.

Integration stage

This phase comprises of HW/SW integration, application development, and peripheral module implementation. Due to the lack of knowledge and experience on platforms, customers need to spend a certain amount of time on analyzing integration problems. In addition, peripheral module implementation has a lot to do with driver designs on carrier boards, RISC platforms usually have less support for ready-made drivers on the carrier board, therefore the customer has to learn from trial and error and finally get the best solution with the least effort. Advantech's team has years of experience in customer support and HW/SW development knowledge. Consequently, we can support customers with professional advice and information as well as shortening development time and enabling more effective product integration.

Validation stage

After customer's ES sample is completed, the next step is a series of verification steps. In addition to verifying a product's functionality, the related test of the product's efficiency is also an important part at this stage especially for RISC platforms.

As a supportive role, Advantech primarily helps customers solve their problems in the testing process and will give suggestions and tips as well. Through an efficient verification process backed by our technical support, customers are able to optimize their applications with less fuss. Furthermore, Advantech's team can provide professional consulting services about further testing and equipment usage, so customers can find the right tools to efficiently identify and solve problems to further enhance their products quality and performance.

5.2 Contact Information

Below is the contact information for Advantech customer service.

Region/Country	Contact Information
America	1-888-576-9688
Brazil	0800-770-5355
Mexico	01-800-467-2415
Europe (Toll Free)	00800-2426-8080
Singapore & SAP	65-64421000
Malaysia	1800-88-1809
Australia (Toll Free)	1300-308-531
China (Toll Free)	800-810-0345 800-810-8389 Sales@advantech.com.cn
India (Toll Free)	1-800-425-5071
Japan (Toll Free)	0800-500-1055
Korea (Toll Free)	080-363-9494
080-363-9495	
Taiwan (Toll Free)	0800-777-111
Russia (Toll Free)	8-800-555-01-50

On the other hand, you can reach our service team through below website, our technical support engineer will provide quick response once the form is filled out:

http://www.advantech.com.tw/contact/default.aspx?page=contact_form2&subject=Technical+Support

5.3 Technical Support and Assistance

For more information about this and other Advantech products, please visit our website at:

<http://www.advantech.com/>

<http://www.advantech.com/ePlatform/>

For technical support and service, please visit our support website at:

<http://support.advantech.com.tw/support/>

1. Visit the Advantech web site at www.advantech.com/support where you can find the latest information about the product.
2. Contact your distributor, sales representative, or Advantech's customer Service center for technical support if you need additional assistance. Please have the following information ready before you call:
   - Product name and serial number
   - Description of your peripheral attachments
   - Description of your software (operating system, version, application software, etc.)
   - A complete description of the problem
   - The exact wording of any error messages

5.4 Global Service Policy

5.4.1 Warranty Policy

Below is the warranty policy of Advantech products:

5.4.2 Warranty Period

Advantech branded off-the-shelf products and 3rd party off-the-shelf products used to assemble Advantech Configure to Order products are entitled to a 2 years complete and prompt global warranty service. Product defect in design, materials, and workmanship, are covered from the date of shipment.

All customized products will by default carry a 15 months regional warranty service. The actual product warranty terms and conditions may vary based on sales contract.

All 3rd party products purchased separately will be covered by the original manufacturer's warranty and time period, and shall not exceed one year of coverage through Advantech.

5.4.3 Repairs under Warranty

It is possible to obtain a replacement (Cross-Shipment) during the first 30 days of the purchase, thru your original ADVANTECH supplier to arrange DOA replacement if the products were purchased directly from ADVANTECH and the product is DOA (Dead-on-Arrival). The DOA Cross-Shipment excludes any shipping damage, customized and/or build-to-order products.

For those products which are not DOA, the return fee to an authorized ADVANTECH repair facility will be at the customers' expense. The shipping fee for reconstructive products from ADVANTECH back to customers' sites will be at ADVANTECH's expense.

5.4.4 Exclusions from Warranty

The product is excluded from warranty if

- The product has been found to be defective after expiry of the warranty period.
- Warranty has been voided by removal or alternation of product or part identification labels.
- The product has been misused, abused, or subjected to unauthorized disassembly/modification; placed in an unsuitable physical or operating environment; improperly maintained by the customer; or failure caused which ADVANTECH is not responsible whether by accident or other cause. Such conditions will be determined by ADVANTECH at its sole unfettered discretion.
- The product is damaged beyond repair due to a natural disaster such as a lighting strike, flood, earthquake, etc.
- Product updates/upgrades and tests upon the request of customers who are without warranty.

5.5 Repair Process

5.5.1 Obtaining an RMA Number

All returns from customers must be authorized with an ADVANTECH RMA (Return Merchandise Authorization) number. Any returns of defective units or parts without valid RMA numbers will not be accepted; they will be returned to the customer at the customer's cost without prior notice .

An RMA number is only an authorization for returning a product; it is not an approval for repair or replacement. When requesting an RMA number, please access ADVANTECH's RMA web site: http://erma.ADVANTECH.com.tw with an authorized user ID and password.

You must fill out basic product and customer information and describe the problems encountered in detail in "Problem Description". Vague entries such as "does not work" and "failure" are not acceptable.

If you are uncertain about the cause of the problem, please contact ADVANTECH's Application Engineers (AE). They may be able to find a solution that does not require sending the product for repair.

The serial number of the whole set is required if only a key defective part is returned for repair. Otherwise, the case will be regarded as out-of-warranty.

5.5.2 Returning the Product for Repair

It's possible customers can save time and meet end-user requirements by returning defective products to an y authorized ADVANTECH repair facility without an extra cross-region charge . It is required to contact the local repair center before offering global repair service.

It is recommended to s end cards without accessories (manuals, cables, etc.). Remove any unnecessary components from the card, such as CPU, DRAM , and CF Card . If you send all these parts back (because you believe they may be part of the problem), please note clearly that they are included. Otherwise, ADVANTECH is not responsible for any items not listed . Make sure the " Problem Description " is enclosed.

European Customers that are located outside European Community are requested to use UPS as the forwarding company .We strongly recommend adding a packing list to all shipments.Please prepare a shipment invoice according to the following guidelines to decrease goods clearance time:

1. Give a low value to the product on the invoice, or additional charges will be levied by customs that will be borne by the sender.

2. Add information "Invoice for customs purposes only with no commercial value" on the shipment invoice.
3. Show RMA numbers, product serial numbers and warranty status on the shipment invoice.
4. Add information about Country of origin of goods

In addition, please attach an invoice with RMA number to the carton, then write the RMA number on the outside of the carton and attach the packing slip to save handling time. Please also address the parts directly to the Service Department and mark the package "Attn. RMA Service Department".

All products must be returned in properly packed ESD material or anti-static bags. ADVANTECH reserves the right to return unrepaired items at the customer's cost if inappropriately packed.

Besides that, "Door-to-Door" transportation such as speed post is recommended for delivery, otherwise, the sender should bear additional charges such as clearance fees if Air-Cargo is adopted.

Should DOA cases fail, ADVANTECH will take full responsibility for the product and transportation charges. If the items are not DOA, but fail within warranty, the sender will bear the freight charges. For out-of-warranty cases, customers must cover the cost and take care of both outward and inward transportation.

5.5.3 Service Charges

The product is excluded from warranty if :

■ The product is repaired after expiry of the warranty period.

■ The product is tested or calibrated after expiry of the warranty period, and a No Problem Found (NPF) result is obtained.

■ The product, though repaired within the warranty period, has been misused, abused, or subjected to unauthorized disassembly/modification; placed in an unsuitable physical or operating environment; improperly maintained by the customer; or failure caused which ADVANTECH is not responsible whether by accident or other cause. Such conditions will be determined by ADVANTECH at its sole unfettered discretion.

■ The product is damaged beyond repair due to a natural disaster such as a lighting strike, flood, earthquake, etc.

■ Product updates and tests upon the request of customers who are without warranty.

If a product has been repaired by ADVANTECH, and within three months after such a repair the product requires another repair for the same problem, ADVANTECH will do this repair free of charge. However, such free repairs do not apply to products which have been misused, abused, or subjected to unauthorized disassembly/modification; placed in an unsuitable physical or operating environment; improperly maintained by the customer; or failure caused which ADVANTECH is not responsible whether by accident or other cause.

Please contact your nearest regional service center for detail service quotation.

Before we start out-of-warranty repairs, we will send you a pro forma invoice (P/I) with the repair charges. When you remit the funds, please reference the P/I number listed under "Our Ref". ADVANTECH reserves the right to deny repair services to customers that do not return the DOA unit or sign the P/I. Meanwhile, ADVANTECH will scrap defective products without prior notice if customers do not return the signed P/I within 3 months.

5.5.4 Repair Report

ADVANTECH returns each product with a "Repair Report" which shows the result of the repair. A "Repair Analysis Report" is also provided to customers upon request. If the defect is not caused by ADVANTECH design or manufacturing, customers will be charged US$60 or US$120 for in-warranty or out-of-warranty repair analysis reports respectively.

5.5.5 Custody of Products Submitted for Repair

ADVANTECH will retain custody of a product submitted for repair for one month while it is waiting for return of a signed P/I or payment (A/R). If the customer fails to respond within such period, ADVANTECH will close the case automatically. ADVAN-TECH will take reasonable measures to stay in proper contact with the customer during this one month period.

5.5.6 Shipping Back to Customer

The forwarding company for RMA returns from ADVANTECH to customers is selected by ADVANTECH. Per customer requirement, other express services can be adopted, such as UPS, FedEx and etc. The customer must bear the extra costs of such alternative shipment. If you require any special arrangements, please indicate this when shipping the product to us .

ADVANTECH

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