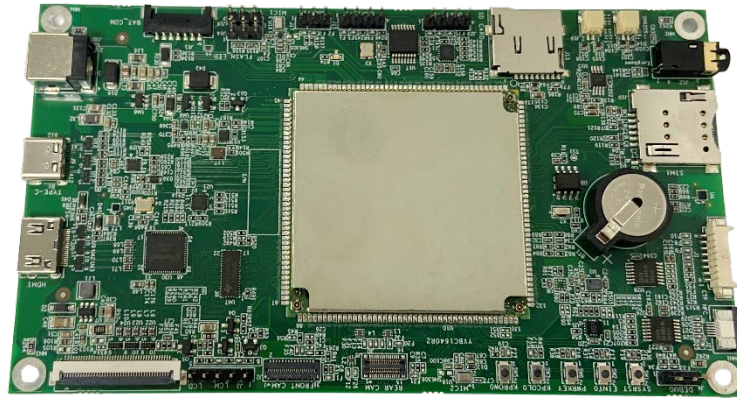


VT-SOM-I500P-EVB Evaluation Board



User Manual

Version: 1.0

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Revision History

No.	Version	Description	Date
1	1.0	First release	Mar. 13, 2023

Table of Contents

Foreword.....	1
CHAPTER 1 INTRODUCTION	5
1.1 Product Overview	6
1.2 Terminology/Acronym	6
1.3 Block Diagram.....	7
1.4 Specifications.....	8
1.5 Features.....	9
1.6 Board Dimensions	9
1.7 Power Supply.....	9
1.8 Environmental Specifications	9
CHAPTER 2 HARDWARE AND PIN ASSIGNMENT	10
2.1 I/O Layout.....	11
2.2 Connecting the Evaluation Board	11
2.3 SoM Configurations	12
2.3.1 CPU	12
2.3.2 Memory	12
2.3.3 Storage.....	12
2.4 Connectors and Jumpers	12
2.4.1 J30 Power jack (1).....	12
2.4.2 J9 USB Type-C (2).....	12
2.4.3 J20 HDMI (3).....	12
2.4.4 J17 MIPI DSI (4)	13
2.4.5 J2 MIPI CSI for front camera (5).....	14
2.4.6 J5 MIPI CSI for rear camera (6)	15
2.4.7 U16/U18 Mic (7 & 8)	16
2.4.8 J11 Battery connector (9)	16
2.4.9 J14/J16 Vibrator (10)	17
2.4.10 J15/J17/J29 UART (11).....	17
2.4.11 J4 Debug port (12).....	18
2.4.12 J13 SD slot (13)	18
2.4.13 J18/J19Headset and amplifier connectors (14)	19
2.4.14 J12Audio jack (15)	19
2.4.15 J10 SIM slot (16)	19
2.4.16 SOM (17).....	19
2.4.17 RTC (18)	20
2.4.18 J1 TP connector (19).....	20
2.4.19 J27 NFC connector (20)	21
2.5 Buttons	21

CHAPTER 3	SYSTEM OPERATION	22
3.1	Apk Installation via ADB Commands	23
3.1.1	Prerequisites	23
3.1.2	ADB Setup	23
3.1.3	App installation	24
3.2	Firmware Upgrade in Windows Environment	25
3.2.1	Prerequisites	25
3.2.2	Upgrade driver installation	25
3.2.3	System flashing	27
3.3	Serial port	29
CHAPTER 4	DISPOSAL AND WARRANTY	30
4.1	Disposal	31
4.2	Warranty	32

Foreword

Thank you for purchasing VT-SOM-I500P-EVB Evaluation Board (“the Evaluation Board” or “the Product”). This manual intends to provide guidance and assistance necessary on setting up, operating or maintaining the Product. Please read this manual and make sure you understand the functionality of the Product before putting it into use.

Intended Users

This manual is intended for:

- Embedded software developer
- Custom development software engineer
- Other technically qualified personnel

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It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without notice.

Technical Support and Assistance

Should you have any question about the Product that is not covered in this manual, contact your sales representative for solution. Please include the following information in your question:



- Product name and PO number;
- Complete description of the problem;
- Error message you received, if any.

Vantron Technology, Inc.

Address: 48434 Milmont Drive, Fremont, CA 94538
Tel: (650) 422-3128
Email: sales@vantrontech.com

Symbology

This manual uses the following signs to prompt users to pay special attention to relevant information.







	Caution for latent damage to system or harm to personnel
	Attention to important information or regulations

General Safety Instructions

The Product is supposed be installed by knowledgeable, skilled persons familiar with local and/or international electrical codes and regulations. For your safety and prevention of damage to the Product, please read and observe carefully the following safety instructions prior to installation and operation. Keep this manual well for future reference.

- Do not disassemble or otherwise modify the Product. Such action may cause heat generation, ignition, electronic shock, or other damages including human injury, and may void your warranty.
- Keep the Product away from heat source, such as heater, heat dissipater, or engine casing.
- Do not insert foreign materials into any opening of the Product as it may cause the Product to malfunction or burn out.
- To ensure proper functioning and prevent overheating of the Product, do not cover or block the ventilation holes of the Product.
- Follow the installation instructions with the installation tools provided or recommended.
- The use or placement of the operation tools shall comply with the code of practice of such tools to avoid short circuit of the Product.
- Cut off the power before inspection of the Product to avoid human injury or product damage.

Precautions for Power Cables and Accessories

-  Use proper power source only. Make sure the supply voltage falls within the specified range.
-  Place the cables properly at places without extrusion hazards.
-  There is a coin cell battery for powering the RTC. Therefore, please avoid short circuit of the battery during transportation or operation at high temperatures.
-  Cleaning instructions:
 - Power off before cleaning the Product
 - Do not use spray detergent
 - Clean with a damp cloth
 - Do not try to clean exposed electronic components unless with a dust collector
-  Power off and contact Vantron technical support engineer in case of the following faults:
 - The Product is damaged
 - The temperature is excessively high
 - Fault is still not solved after troubleshooting according to this manual
-  Do not use in combustible and explosive environment:
 - Keep away from combustible and explosive environment
 - Keep away from all energized circuits
 - Unauthorized removal of the enclosure from the device is not allowed
 - Do not change components unless the power cable is unplugged
 - In some cases, the device may still have residual voltage even if the power cable is unplugged. Therefore, it is a must to remove and fully discharge the device before replacement of the components.

CHAPTER 1

INTRODUCTION

1.1 Product Overview

VT-SOM-I500P-EVB evaluation board is designed for programmers or developers who seek to reduce the time-to-market of embedded products that employ a VT-SOM-I500P module.

VT-SOM-I500P module is based on MediaTek MT8788A processor, which integrates four ARM Cortex-A73 cores and four Cortex A53 cores with frequency up to 2 GHz to demonstrate ultra-high performance at very low power consumption.

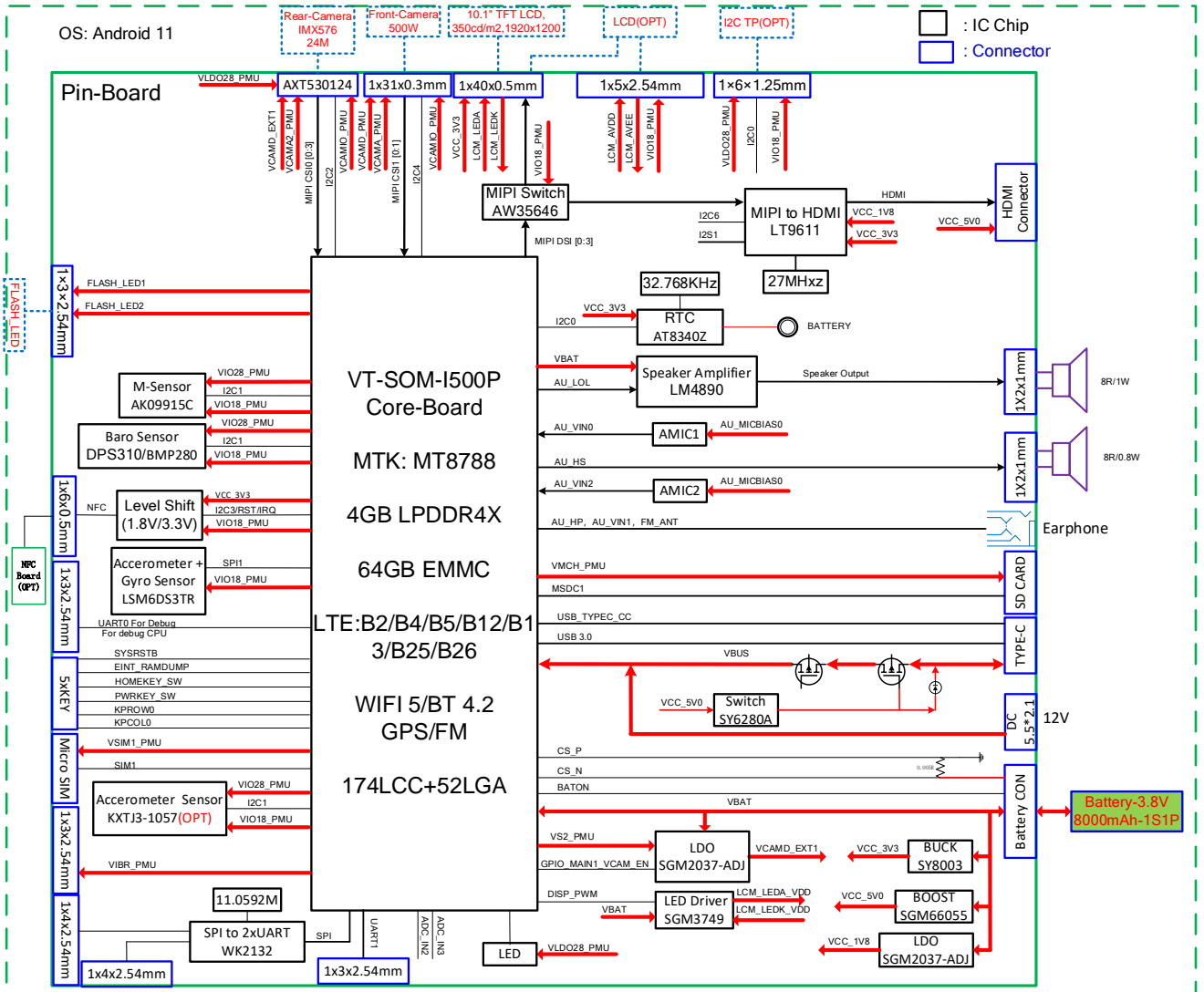
The evaluation board implements rich interfaces to ease the efforts of the user in custom development of the module. Such interfaces include an HDMI interface and a MIPI DSI connector that the user may select either one, other than both, to connect a display, two MIPI CSI connectors for connecting cameras, a USB type-C interface for programming and debugging the module, as well as functional buttons and serial ports.

With the Evaluation board, users can evaluate product proposals and technological feasibility based on VT-SOM-I500P module in a more convenient manner.

1.2 Terminology/Acronym

Terminology/Acronym	Description
NC	No connection
VCC	Voltage common collector
GND	Ground
P (+)	Positive of difference signal
N (-)	Negative of difference signal
#	Active low signal
I	Input
O	Output
I/O	Input/output
P	Power or ground
A	Analog
OD	Open drain
PCIe	PCI express signal
MDI	Media dependent interface
BKL	Backlight

1.3 Block Diagram



1.4 Specifications

VT-SOM-I500P-EVB Evaluation Board		
Media	Display	1 x 4-lane MIPI DSI, up to 2400 x 1080 1 x HDMI, 1920 x 1080
	Camera	1 x 2-lane MIPI CSI, 1 x 4-lane MIPI CSI Camera ISP Up to 25MP @30fps
	Audio	2 x Analog Mic input 1 x Audio jack 1 x 0.5W/8Ω Amplifier connector 1 x 0.8W/8Ω Headset connector
I/Os	Serial	3 x UART 1 x Debug
	USB	1 x USB 2.0 Type-C (Charging and USB 2.0 OTG supported)
	SIM slot	1 x SIM slot, 1.8V/3.0V
	SD slot	1 x SD slot
	RTC	Supported
	Vibrator	Supported
System control	Button	1 x Volume + 1 x Volume - 1 x Power on/off 1 x Reset
Expansion	I ² C	1 x I ² C, 1.8V level, TP connector 1 x I ² C, 1.8V level, NFC connector
	Flash LED	2 x flash LED (vibrator pinout)
Power	Battery	1 x Battery connector
	Input	1 x Power jack (DC 5V)
Software	Operating system	Android 10+
	Device management platform	BlueSphere MDM
	OTA tool	BlueSphere OTA
	Dimensions	142mm x 80mm
Environment Condition	Temperature	Operating: -10°C ~ +60°C Storage: -20°C ~ +70°C
	Certification	CE, FCC Part 15 Class B, PTCRB

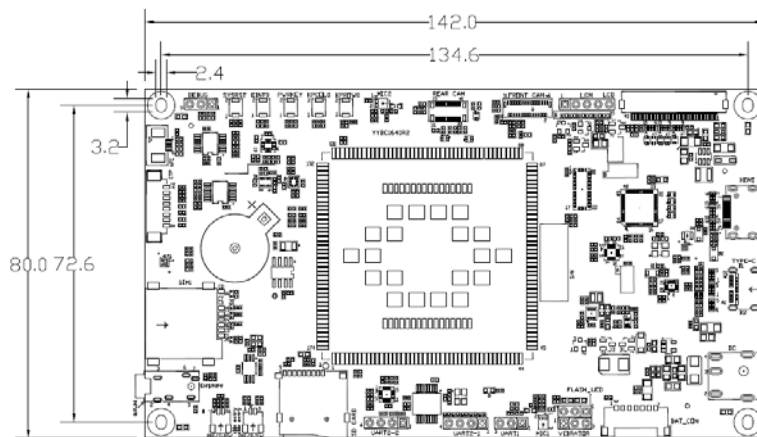
1.5 Features

The VT-SOM-I500P module features the following:

- MTK MT8788A processor
- Android 10+ operating system
- AI accelerator
- 64 GB eMMC V5.1, up to 128 GB
- Flexible expansion
- High-definition CODEC
- Compact size, self-contained functions
- RTC supported

1.6 Board Dimensions

- 142mm x 80mm



1.7 Power Supply

VT-SOM-I500P-EVB Evaluation Board is powered on by a 3.8V 8000mAh lithium battery connected via the battery connector, or by a 5V DC adapter via the power jack.

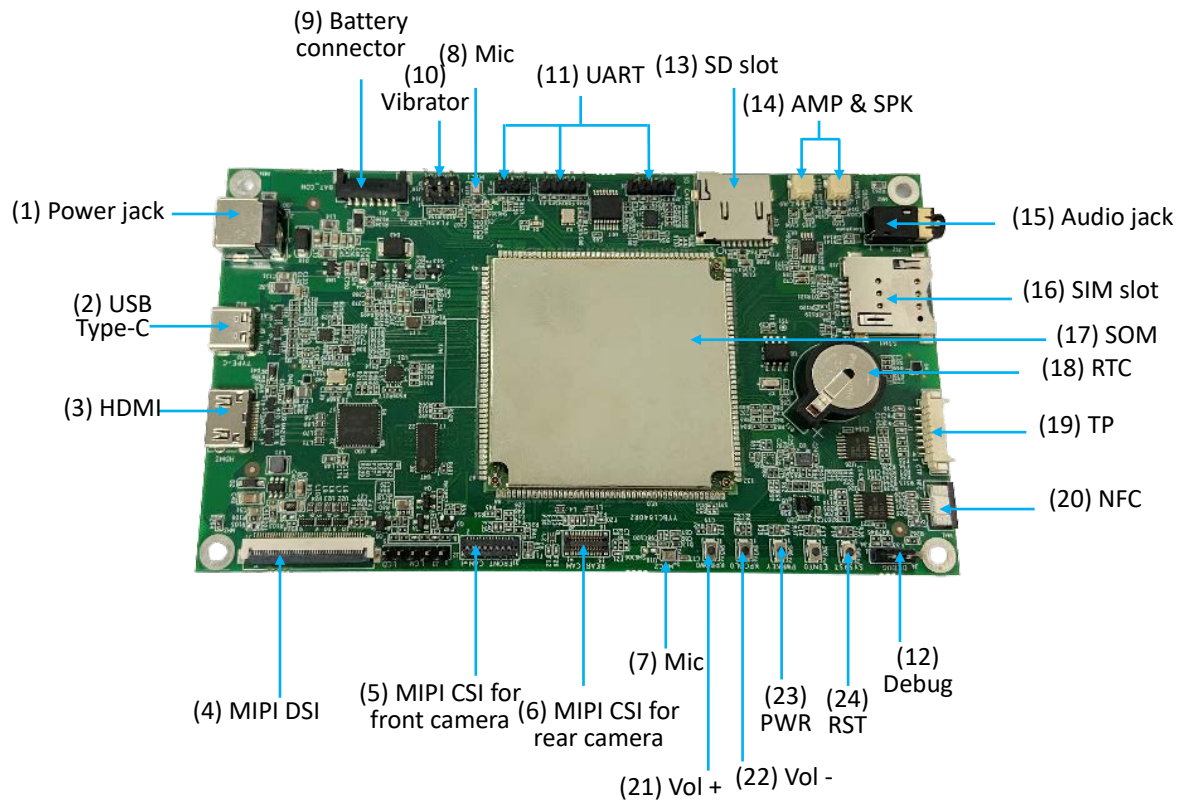
1.8 Environmental Specifications

VT-SOM-I500P-EVB Evaluation Board works at a temperature ranging from -10°C ~ $+60^{\circ}\text{C}$, and is designed to be stored at a temperature between -20°C and $+70^{\circ}\text{C}$.

CHAPTER 2

HARDWARE AND PIN ASSIGNMENT

2.1 I/O Layout



2.2 Connecting the Evaluation Board

The VT-SOM-I500P module will be installed on the Evaluation Board before shipment. Please follow the steps below to finish hardware connection and power up the Evaluation Board.

1. Unpack the device;
2. Insert an activated SIM card, if any, into the SIM slot;
3. Connect VT-SOM-I500P-EVB to a host PC with a USB Type-C cable;
4. Connect a display/touch screen to the Evaluation Board via the MIPI DSI connector /HDMI interface/TP connector;
5. Short press the power button to turn on the display/touch screen;
6. Test/explore the Evaluation Board with the touch screen.

2.3 SoM Configurations

VT-SOM-I500P-EVB is designed to make the development of the VT-SOM-I500P module easier. The VT-SOM-I500P module features the following.

2.3.1 CPU

VT-SOM-I500P is powered by a MediaTek MT8788A processor, which integrates four ARM Cortex-A73 cores and four ARM Cortex-A53 cores with frequency up to 2 GHz.

2.3.2 Memory

VT-SOM-I500P implements a 4GB LPDDR4-3600 by default, and users also have an option between 2GB and 8GB.

2.3.3 Storage

VT-SOM-I500P implements a 64GB eMMC V5.1 by default, and users also have an option between 32GB and 128GB.

2.4 Connectors and Jumpers

This section is going to brief the connectors/jumpers on VT-SOM-I500P-EVB with corresponding pinout description.

2.4.1 J30 Power jack (1)

VT-SOM-I500P-EVB is designed to be powered up via the power jack with a 5V DC adapter.

2.4.2 J9 USB Type-C (2)

VT-SOM-I500P-EVB implements a USB 2.0 Type-C interface that supports USB 2.0 OTG for device charging, programming, and data transmission.

2.4.3 J20 HDMI (3)

VT-SOM-I500P-EVB implements an HDMI interface supporting up to 1920 x 1080 resolution.

2.4.4 J7 MIPI DSI (4)

VT-SOM-I500P-EVB implements a MIPI DSI connector supporting up to 2400 x 1080 resolution.



Pin 1

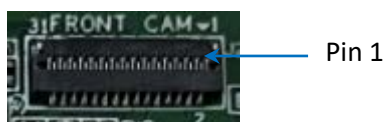
Pinout description:

Pin	Signal	Description
1	LCM_LEDA_VDD	LED Anode (12V)
2	LCM_LEDA_VDD	LED Anode (12V)
3	NC	
4	NC	
5	NC	
6	NC	
7	NC	
8	NC	
9	LCM_LEDK_VDD	LED Cathode
10	LCM_LEDK_VDD	LED Cathode
11	GND	Ground
12	NC	
13	NC	
14	LED_PWM	PWM Control for LED driver (reserved)
15	NC	
16	GND	Ground
17	NC	
18	NC	
19	GND	Ground
20	MIPI_D3P	MIPI DSI Data Pair 3+
21	MIPI_D3N	MIPI DSI Data Pair 3-
22	GND	Ground
23	MIPI_D2P	MIPI DSI Data Pair 2+
24	MIPI_D2N	MIPI DSI Data Pair 2-
25	GND	Ground
26	MIPI_CLK+	MIPI DSI Clock+
27	MIPI_CLK-	MIPI DSI Clock-
28	GND	Ground

29	MIPI_D1P	MIPI DSI Data Pair 1+
30	MIPI_D1N	MIPI DSI Data Pair 1-
31	GND	Ground
32	MIPI_D0P	MIPI DSI Data Pair 0+
33	MIPI_D0N	MIPI DSI Data Pair 0-
34	GND	Ground
35	NC	
36	RST_LCD	Device reset
37	GND	Ground
38	VCC_LCM	Power Supply (3.3V)
39	VCC_LCM	Power Supply (3.3V)
40	NC	

2.4.5 J2 MIPI CSI for front camera (5)

VT-SOM-I500P-EVB implements two MIPI CSI connectors, supporting up to 25MP @30fps camera ISP. One is a 2-lane connector (FPC031003-31LG) routed to the front camera.



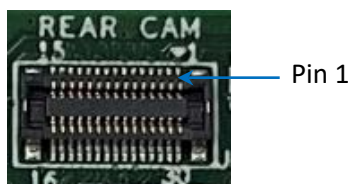
Pinout description of J2 MIPI CSI:

Pin	Signal	Description
1	GND	Ground
2	NC	
3	NC	
4	GND	Ground
5	NC	
6	NC	
7	GND	Ground
8	MIPI_CSI_D1N	MIPI CSI Lane1 -
9	MIPI_CSI_D1P	MIPI CSI Lane1 +
10	GND	Ground
11	MIPI_CSI_D0N	MIPI CSI Lane0 -
12	MIPI_CSI_D0P	MIPI CSI Lane0 +
13	GND	Ground
14	MIPI_CSI_CLK0N	MIPI CSI CLK-
15	MIPI_CSI_CLK0P	MIPI CSI CLK+
16	GND	Ground
17	I2C2_SCL_M1_1V8	I2C_SCL
18	I2C2_SDA_M1_1V8	I2C_SDA

19	MIPI_CAM_RST	Camera RESET
20	MIPI_CAM_PWN	Camera Power Down
21	GND	Ground
22	MIPI_CAM_MCLK	Camera Main CLK
23	GND	Ground
24	NC	
25	VCC1V8_DVP	Power supply 1.8V
26	VCC1V8_DVP	Power supply 1.8V
27	VCC1V5_DVP	Power supply 1.5V
28	VCC2V8_DVP	Power supply 2.8V
29	VCC2V8_DVP	Power supply 2.8V
30	NC	
31	GND	Ground

2.4.6 J5 MIPI CSI for rear camera (6)

The other MIPI CSI is a 4-lane connector (AXT530124) routed to the rear camera.



Pinout description of J5 MIPI CSI:

Pin	Signal	Description
1	GND	Ground
2	MIPI_CSI_D0P	MIPI CSI Lane0 +
3	MIPI_CSI_D0M	MIPI CSI Lane0 -
4	GND	Ground
5	MIPI_CSI_D2P	MIPI CSI Lane2 +
6	MIPI_CSI_D2M	MIPI CSI Lane2 -
7	GND	Ground
8	MIPI_CSI_D3P	MIPI CSI Lane3 +
9	MIPI_CSI_D3M	MIPI CSI Lane3 -
10	GND	Ground
11	MCLK	Camera Main CLK
12	RST	Camera RESET
13	GND	Ground
14	MIPI_PDN	Camera Power Down
15	GND	Ground
16	GND	Ground

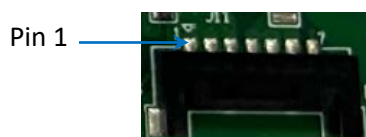
17	AVDD2.8	Power supply 2.8V
18	AFVDD2.8	Power supply 2.8V
19	GND	Ground
20	SCL	Clock signal
21	SDA	Data signal
22	DVDD1.2	Power supply 1.2V
23	GND	Ground
24	DVDD1.8	Power supply 1.8V
25	GND	Ground
26	MIPI_CSI_D1M	MIPI CSI Lane1 -
27	MIPI_CSI_D1P	MIPI CSI Lane1 +
28	GND	Ground
29	MIPI_CAM-CLKM	MIPI CSI CLK-
30	MIPI_CAM_CLKP	MIPI CSI CLK+

2.4.7 U16/U18 Mic (7 & 8)

The Evaluation Board implements two analog microphone chips that route to PMIC audio codec for digital signal conversion.

2.4.8 J11 Battery connector (9)

VT-SOM-I500P-EVB implements a battery connector to which a 3.8V 8000mAh lithium battery is connected to supply power for the Evaluation Board.

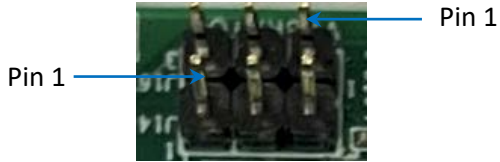


Pinout description:

Pin	Signal	Description
1	Power +	Positive battery terminal
2	Power +	Positive battery terminal
3	Power +	Positive battery terminal
4	Power -	Negative battery terminal
5	Power -	Negative battery terminal
6	Power -	Negative battery terminal
7	Battery NTC pin	NTC Thermistor

2.4.9 J14/J16 Vibrator (10)

The vibrator interface combines two connectors (J14 & J16) as shown below.



Pinout description of J16:

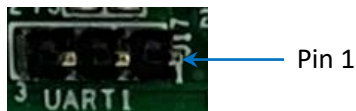
Pin	Signal	Description
1	VIBR_PMU	Vibrator power signal
2	D_GND	Digital ground
3	D_GND	Digital ground

Pinout description of J14:

Pin	Signal	Description
1	D_GND	Digital ground
2	FLASH_LED2	Flash light power signal
3	FLASH_LED1	Torch power signal

2.4.10 J15/J17/J29 UART (11)

VT-SOM-I500P-EVB implements three UART connectors. UART1 (J17) corresponds to node ttyS1. UART2-1 (J15) and UART2-2 (J29) are converted from two SPI connectors, corresponding to nodes ttysWK0 and ttysWK1.



Pinout description of UART1:

Pin	Signal	Description
1	UTXD1	Uart1 transmit data
2	URXD1	Uart1 receive data
3	D_GND	Digital ground

Pinout description of UART2-1:

Pin	Signal	Description
1	VCC_3V3	3.3V Power
2	UART_SPI_TX1	SPI converted Uart1 transmit data
3	UART_SPI_RX1	SPI converted Uart1 receive data
4	D_GND	Digital ground

Pinout description of UART2-2:

Pin	Signal	Description
1	VCC_3V3	3.3V Power
2	UART_SPI_TX2	SPI converted Uart2 serial transmit data
3	UART_SPI_RX2	SPI converted Uart2 receive data
4	D_GND	Digital ground

2.4.11 J4 Debug port (12)

UART0 is used for debugging, corresponding to node ttyS0.



Pinout description:

Pin	Signal	Description
1	UTXDO_DEBUG	Uart0 transmit data
2	URXDO_DEBUG	Uart0 receive data
3	D_GND	Digital ground

2.4.12 J13 SD slot (13)

VT-SOM-I500P-EVB implements an SD slot allowing users to insert an SD card for RAM expansion or as mobile storage. SD card hot plug is supported.

2.4.13 J18/J19 Headset and amplifier connectors (14)

The headset connector (J18) is designed to connect a 0.8W/8Ω speaker, and the amplifier connector (J19) is designed to connect a 0.5W/8Ω speaker.

Pinout description of J18:

Pin	Signal	Description
1	AU_HSP	Analog audio headset +
2	AU_HSN	Analog audio headset -

Pinout description of J19:

Pin	Signal	Description
1	AU_LOLN	Analog audio amplifier -
2	AU_LOLP	Analog audio amplifier +

2.4.14 J12 Audio jack (15)

There is a 3.5mm combo audio jack on the Evaluation Board to offer high-quality audio experience. When plugging an audio wire into the audio jack, you can use it as an FM antenna when the FM function is activated.

2.4.15 J10 SIM slot (16)

VT-SOM-I500P-EVB implements a SIM card slot, supporting LTE and LTE-A networks.

2.4.16 SOM (17)

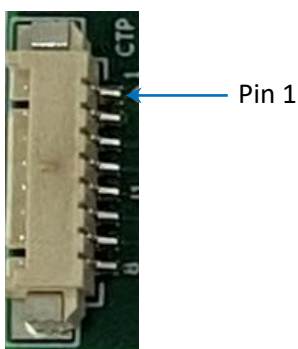
If you buy an evaluation board, the VT-SOM-I500P module will be installed properly before shipment. Please refer to the datasheet of the module for details.

2.4.17 RTC (18)

VT-SOM-I500P-EVB has an RTC that provides accurate time and date information to the system.

2.4.18 J1 TP connector (19)

There is an I²C connector on the Evaluation Board to offer signals for connecting a touch screen.

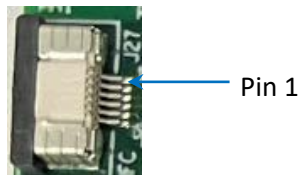


Pinout description:

Pin	Signal	Description
1	GND	Ground
2	GND	Ground
3	VIO18_PMU	1.8V Power supply
4	VLDO28_PMU	2.8V Power supply
5	RSTB_TP	Reset signal
6	EINT_TP	Interruption signal
7	SDA0_TP	I2C data
8	SCL0_TP	I2C clock

2.4.19 J27 NFC connector (20)

VT-SOM-I500P-EVB implements an NFC connector that you can use to connect an external plug-and-play NFC controller.



Pinout description:

Pin	Signal	Description
1	VCC_3V3	3.3V Power supply
2	SDA0_TP	I2C data
3	SCL0_TP	I2C clock
4	RSTB_TP	Reset signal
5	EINT_TP	Interruption signal
6	GND	Ground

2.5 Buttons

There are 6 buttons on the Evaluation Board, including a power button (SW6), volume +/- buttons (SW3/SW5), a reset button (SW1), and one undefined button (SW2).

Short press of the power button: turn on/off the display/touch screen.

Long press of the power button: restart/power off the system.

CHAPTER 3

SYSTEM OPERATION

3.1 Apk Installation via ADB Commands

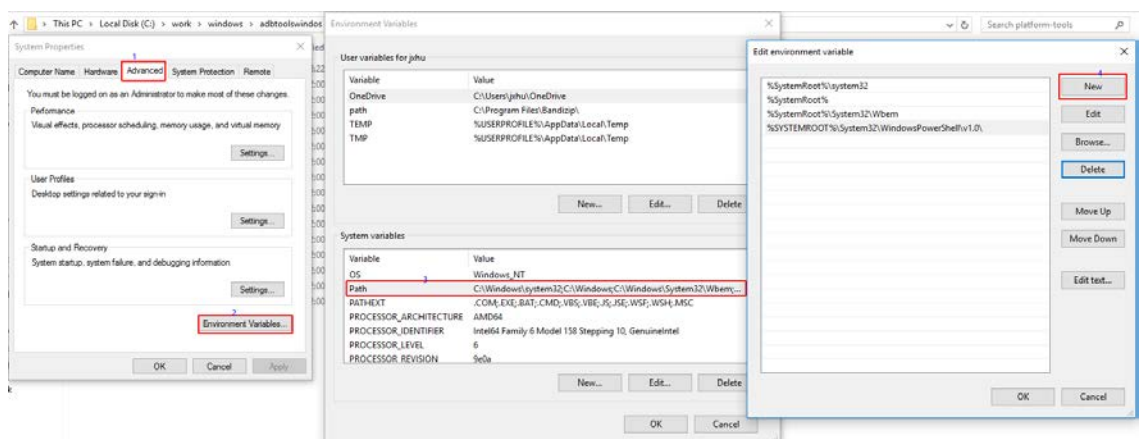
All tools to be used for apk installation are available in the release package provided by Vantron.

3.1.1 Prerequisites

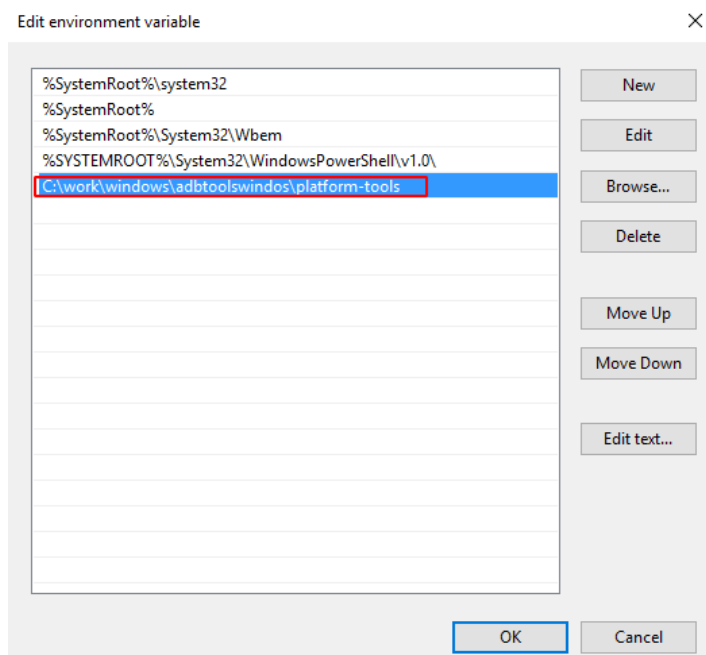
- VT-SOM-I500P-EVB
- A host PC running Windows system (Windows 10 or later recommended)
- Release package
- USB Type-C cable

3.1.2 ADB Setup

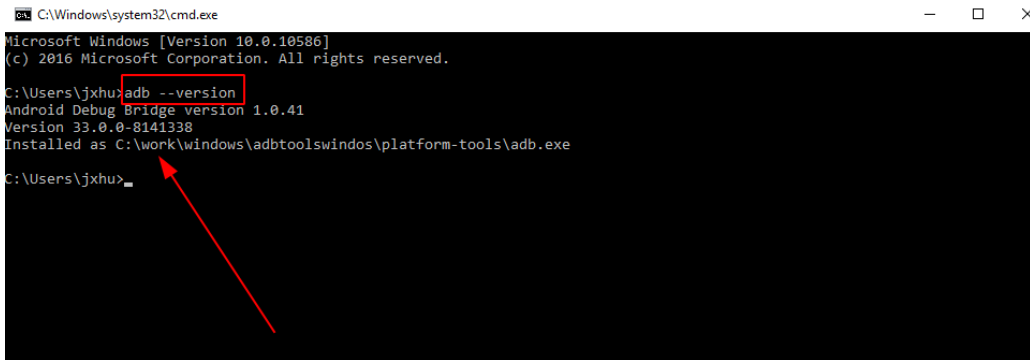
1. Open the release package and open the directory of **adb .exe** (path: 720REBL70U681_VT-SOM-I500P-GENxx-xxx,Android-11,revxxx,userdebug,Image, 2023xxxx\SW\tools\adb_fastboot_and_other_tools_for_windows\adb_fastboot_and_other_tools\Android) and double click **adb .exe** to run the adb driver, or, if you haven't added ABD to the environment variable, please go through steps 2-4 to add it;
2. Press "Win + R" and input "sysdm.cpl" in the dialogue box to open the settings interface;
3. Click in sequence **Advanced > Environment Variables > Path > Edit**, and click **New** in the pop-up;



4. Copy the path of **adb.exe** as mentioned in step 1, and click **OK** to confirm and exit the setting dialog boxes;

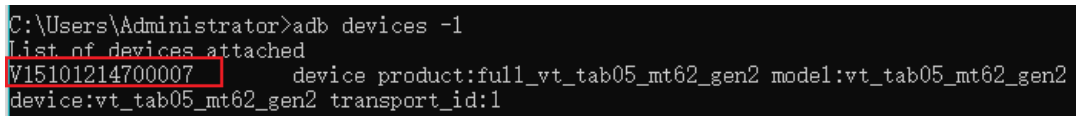


5. Press “Win + R” and input “cmd” in the dialogue box;
6. Input “adb version” in the command prompt window to check if the ADB tool is installed.



3.1.3 App installation

1. Connect the board to the Windows host with the USB Type-C cable;
2. Input “adb devices -l” in the command prompt window to check if the board is connected to the host PC (screenshot below for demonstration);




3. When the device information is displayed under the command, the board is now an ADB device and you can copy the serial number (as squared in the above screenshot) of the board to prepare for the installation of an app;
4. Input the following command line to install the .apk file;

```
adb -s <serial number> install <APP path>
```

5. The result will be prompted below the command (screenshot below for demonstration);

```
C:\Users\Administrator>adb -s V15101214700007 install F:\Download\test\BS\BS-MDM_Beta_2022_0622_0939.apk
Performing Streamed Install
Success
```

6. The .apk file is installed on the board.

 In step 4 shown above, you can drag the .apk file from the local directory to the command line to replace the <App path> you typed in manually.

3.2 Firmware Upgrade in Windows Environment

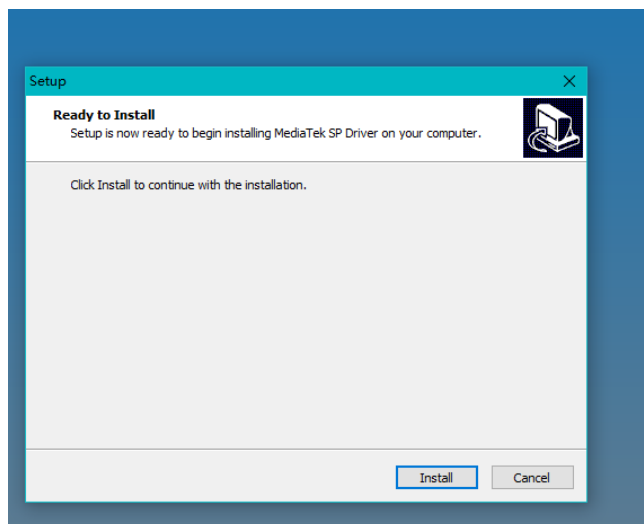
Whenever a new image is available, Vantron will provide a release package consisting of all the tools/files necessary so that you can flash the image in Windows and Ubuntu environments.

3.2.1 Prerequisites

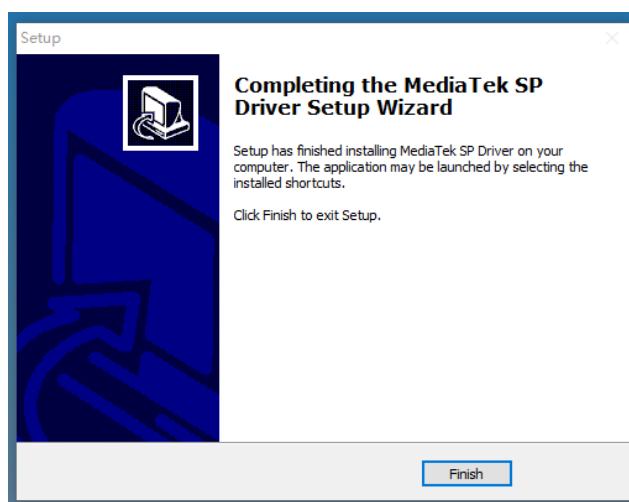
- VT-SOM-I500P-EVB
- A host PC running Windows system (Windows 10 or later recommended)
- Release package
- USB Type-C cable

3.2.2 Upgrade driver installation

1. Unzip the release package, and open the directory of the upgrade driver (path: 720REBL70U681_VT-SOM-I500P-GENxx-xxx,Android-11,revxxx,userdebug,Image,2023xxxx\SW\AndroidTool\Driver_Auto_Installer_SP_Drivers_20160804);
2. Right click the mouse and run the program **DriverInstall.exe** as administrator;
3. Click **Install the Driver** and wait for the installation to proceed;



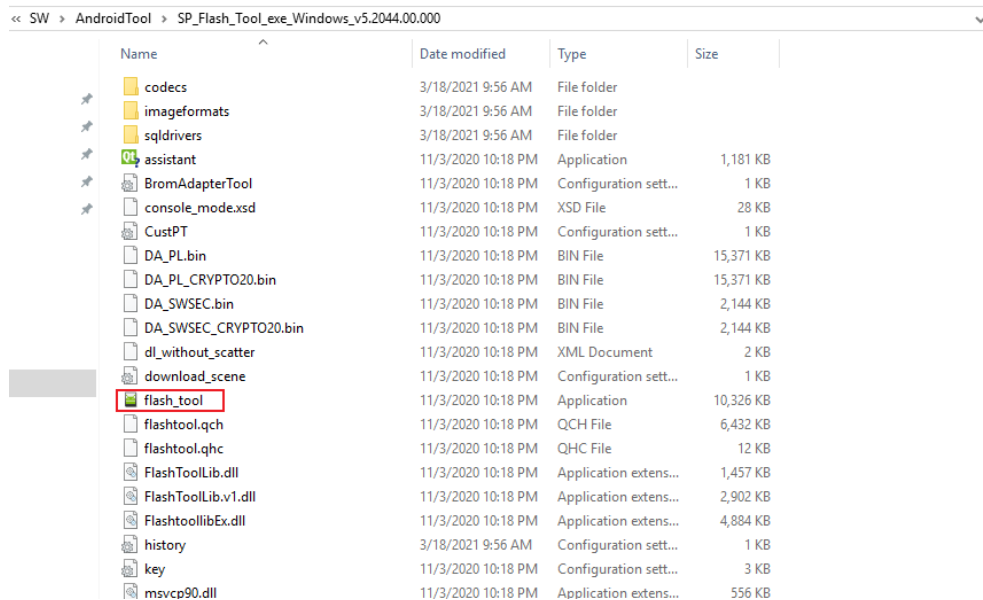
4. Remove all USB devices from the PC as prompted;
5. Click **OK** when a pop-up appears in a few seconds suggesting you restart the computer;
6. The driver is installed on your PC;



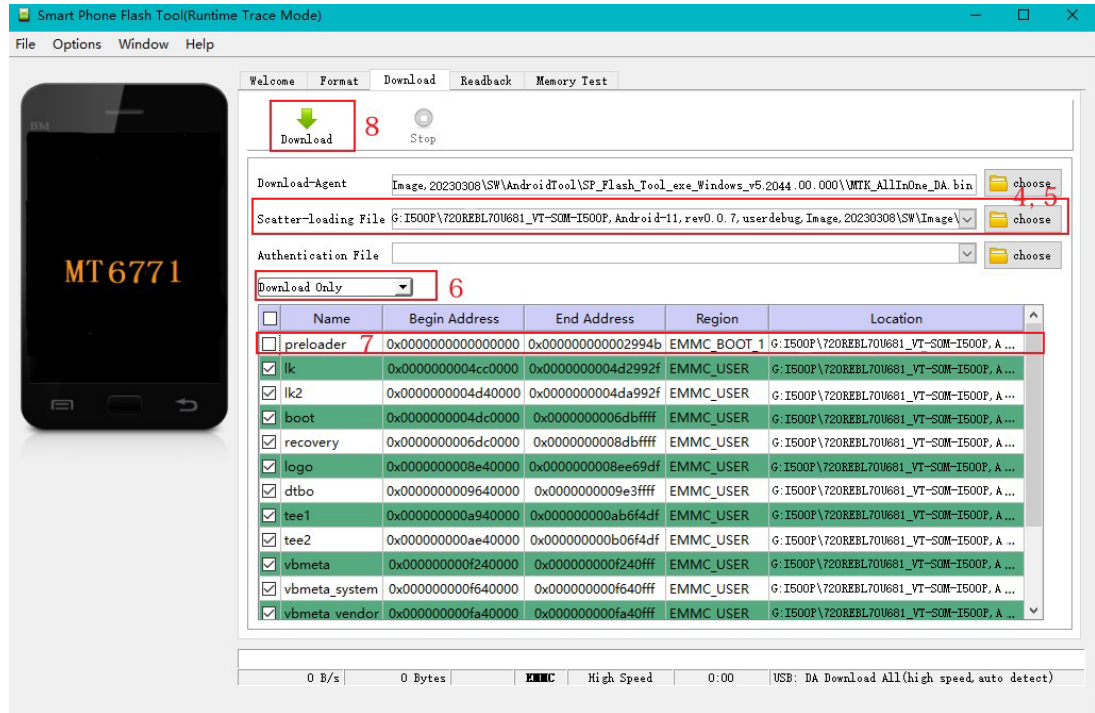
7. Restart the host PC.

3.2.3 System flashing

1. Open the directory of the upgrade tool (path: 720REBL70U681_VT-SOM-I500P-GENxx-xxx,Android-11,revxxx,userdebug,Image,2023xxxx\SW\AndroidTool\SP_Flash_Tool_exe_Windows_vxxxx.xx.xxx);
2. Double click **flash_tool.exe** to run the upgrade tool;



3. Click **Download** tab from the option pane;
4. Click **choose** button behind the **Scatter-loading File** menu and open the local directory of the file (path: SW\Image\Mt6771_Android_scatter.txt);
5. Select the file and click **Open**;
6. Select an upgrade strategy from the drop-down below the menus (“format all + download” for the first-time flashing, and either of the other two options for non-first-time flashing);
7. Uncheck pre-loader option unless the system is in dead condition;
8. Click the **Download** button on the flash window;



9. Connect VT-SOM-I500P-EVB to the Windows host with the USB Type-C cable;
10. Once the host PC identifies the board, the flashing process will start automatically;
11. When the **Download Ok** message pops up, close the flash tool, and disconnect the board from the host PC;
12. Power up the Board with the 3.8V 8000mAh lithium battery or by the 5V DC adapter.

3.3 Serial port

VT-SOM-I500P-EVB implements 3 UART connectors, including UART1, UART 2-1 and UART 2-2 that correspond to nodes ttyS1, ttysWK0, and ttysWK1.

Connect a serial port that you intend to use to the host PC via a TTL to USB adapter before testing the port.

1. Input the node of the serial connector to enable serial communication (e.g., UART1);

```
# uart_active /dev/ttyS1
```

2. Send data ("TEST") to the serial port and receive the data.

```
# echo TEST > /dev/ttyS1
```

```
# cat /dev/ttyS1 &
```

CHAPTER 4

DISPOSAL AND WARRANTY

4.1 Disposal

When the device comes to end of life, you are suggested to properly dispose of the device for the sake of the environment and safety.

Before you dispose of the device, please back up your data and erase it from the device.

It is recommended that the device is disassembled prior to disposal in conformity with local regulations. Please ensure that the abandoned batteries are disposed of according to local regulations on waste disposal. Do not throw batteries into fire or put in common waste canister as they are explosive. Products or product packages labeled with the sign of “explosive” should not be disposed of like household waste but delivered to specialized electrical & electronic waste recycling/disposal center.

Proper disposal of this sort of waste helps avoid harm and adverse effect upon surroundings and people’s health. Please contact local organizations or recycling/disposal center for more recycling/disposal methods of related products.

4.2 Warranty

Product warranty

VANTRON warrants to its CUSTOMER that the Product manufactured by VANTRON, or its subcontractors will conform strictly to the mutually agreed specifications and be free from defects in workmanship and materials (except that which is furnished by the CUSTOMER) upon shipment from VANTRON. VANTRON's obligation under this warranty is limited to replacing or repairing at its option of the Product which shall, within **24 months** after shipment, effective from invoice date, be returned to VANTRON's factory with transportation fee paid by the CUSTOMER and which shall, after examination, be disclosed to VANTRON's reasonable satisfaction to be thus defective. VANTRON shall bear the transportation fee for the shipment of the Product to the CUSTOMER.

Out-of-Warranty Repair

VANTRON will furnish the repair services for the Product which are out-of-warranty at VANTRON's then-prevailing rates for such services. At customer's request, VANTRON will provide components to the CUSTOMER for non-warranty repair. VANTRON will provide this service as long as the components are available in the market; and the CUSTOMER is requested to place a purchase order up front. Parts repaired will have an extended warranty of 3 months.

Returned Products

Any Product found to be defective and covered under warranty pursuant to Clause above, shall be returned to VANTRON only upon the CUSTOMER's receipt of and with reference to a VANTRON supplied Returned Materials Authorization (RMA) number. VANTRON shall supply an RMA, when required within three (3) working days of request by the CUSTOMER. VANTRON shall submit a new invoice to the CUSTOMER upon shipping of the returned products to the CUSTOMER. Prior to the return of any products by the CUSTOMER due to rejection or warranty defect, the CUSTOMER shall afford VANTRON the opportunity to inspect such products at the CUSTOMER's location and no Product so inspected shall be returned to VANTRON unless the cause for the rejection or defect is determined to be the responsibility of VANTRON. VANTRON shall in turn provide the CUSTOMER turnaround shipment on defective Product within **fourteen (14) working days** upon its receipt at VANTRON. If such turnaround cannot be provided by VANTRON due to causes beyond the control of VANTRON. VANTRON shall document such instances and notify the CUSTOMER immediately.