



The Solutions People

Production Test Plan

iMX8M_HMI_Platform

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1 Document Details

1.1 Document History

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Version	Description of Change
0.1	Draft version released
0.2	Internal review comments implemented
0.3	Internal review comments implemented
0.4	Heatsink details modified
0.5	SD Card part number changed to SDSDQAD-016G
Version1.0	SD card part number changed to MTSD032AHC6MS-1WT and test plan is modified according to the production script

1.2 Definition, Acronyms and Abbreviations

Definition/ Acronym/ Abbreviation	Description
EUT	Equipment Under Testing
DNP	Do Not Populate
HMI	Human Machine Interface
A2B	Automotive audio bus

1.3 References

#	Document	Version	Remarks
1.			
2.			
3.			

2 Purpose

The purpose of this production test plan document is to define the overall test strategy and test approach for the verification testing of iMX8M HMI Platform Unit at Contract Manufacturer's facility. This test plan also identifies the scope and method of testing at Contract Manufacturer's facility.

2.1 Objectives

This production test plan for the iMX8M HMI Platform has following objectives:

- The test plan should cover all the interfaces functional verification testing.
- Hardware and software components of the design shall be covered for the verification testing of iMX8M HMI Platform.

2.2 Overview

Manual testing will be carried out for iMX8M HMI Platform as per the below shown flow diagram

TEST FLOW DIAGRAM of iMX8M_HMI_Platform

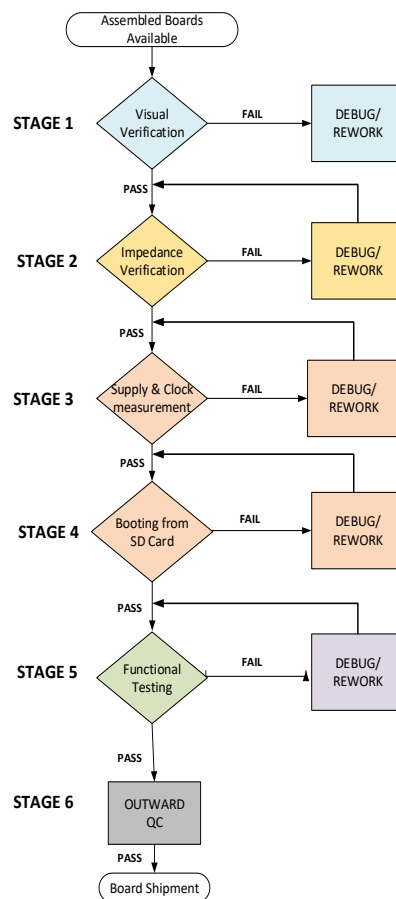


Figure 1: Test Flow Diagram

3 PRE-REQUISITES FOR EACH TEST SETUP/ENVIRONMENT

3.1 Hardware Pre-requisites

The Hardware prerequisites for testing of iMX8M HMI Platform board for each stage of production testing are mentioned in below table:

3.1.1 Test Machine configurations

One test machine is required during testing of iMX8M HMI Platform.
Below are test PC machine configurations.

Machine Configuration:

Sr.No	Component	Specification
1	Linux Machine	Ubuntu 16.04 LTS Installed
2	Windows machine	Windows 7 64 bit
3		

Table 1: Hardware Tool Pre-Requisites

3.1.2 Test Harness/Equipment Pre-Requisites

Sr.No	Component	Manufacturer	Mfg. Part No./Modal No.	Description	Per Board Qty
1	USB 3.0 Pen drives	Local Market	Local Market	3.0 pen drive	2
2	USB 2.0 Pen drives	Local Market	Local Market	2.0 pen drive	1
3	USB OTG Cable	Local Market	Local Market	USB OTG cable	1
4	USB Cable	Local Market	Local Market	USB 2.0 Type A Male to Micro-B Male	1
5	SD Card reader	Local Market	Local Market	SD Card reader	1
6	ZigBee Cable Assembly	NA	NA	10 pin to 20 pin JTAG Cable Assembly	1
7	Ethernet Cable	Assmann WSW Components	AMJF0808-0100-GNB-26	Ethernet cable	1
8	Headphone with Microphone	Local Market	Local Market	Headphone with Microphone	1
9	HDMI Cable	Tripp Lite	P568-006-BK-GRP	HIGH-SPEED HDMI CABLE W/ GRIPPIN	2
10	Display with Audio	LG	Any	1920x1080 HDMI output	1
11	4K resolution Display	LG		LG 27 inch 4K-UHD (3840 x 2160)	1

12	LTE module	96 Boards Mezzanine	Shiratech LTE	LTE Mezzanine	1
13	Camera module	D3 Engineering	D3 Camera	Camera Mezzanine	1
14	SIM Card	Local Market	NA		1
15	Aux Cable	Local Market	NA		1
16	A2B slave device	Analog devices	EVAL-AD2428wb1bz	AD2428 evaluation board	1
17	J-link debugger	J-link segger		To flash ZigBee	1
18	SD Card	Micron	MTSD032AHC6MS-1WT	Micro SD 32GB SD Card	1

Table 2: Test Equipment Accessories Requirement

3.2 Software Pre-requisites

The Software prerequisites for testing of iMX8M HMI Platform board for each stage of production testing are mentioned in below Table:

Sr.No	Software Description	Specification	Download URL
1	Thor96 Firmware		
2	Simplicity studio/J-Link flasher		
3	Testing Script and required files to test script		

Table 3: Software Tool Prerequisites

4 Visual Verification

4.1 Prerequisites

Please refer Table 1 for hardware tool requirement for this stage.

4.2 Test Procedure

As shown in the flow chart before start testing the board, board must go through visual verification inspection. In visual verification follow these steps.

Please wear ESD belt during entire process of board handling, assembly and testing.

4.2.1 Solder Quality Verification

Sr #	Step Description	Remark
1	Verify whether any Dry solder on Board	
2	Verify Mechanical Pins of all connectors	
3		

Table 4: Solder Quality Verification Steps

If found any problem while performing above steps, please take corrective actions like re-solder or re-align particular component.
Fill the test result in test report.

4.2.2 Component Polarity Verification

Following are the steps for Component Polarity verification.

Sr #	Step Description	Remark
1	Visually verify mounting of all Polar components like Diodes, LEDs, ICs	

Table 5: Component Polarity Verification Steps

Please refer Figure 2 & 3 for the Polarized component location in iMX8M HMI Platform.



bot_pol.pdf

Figure 2: Polarized Component Location (Bottom Side)



top_pol.pdf

Figure 3: Polarized Component Location (Top Side)

If found an error with mounted component's polarity, remove and re-mount the component correctly as per the silkscreen on the board.
Fill the test result in test report.

4.2.3 DNP Component Verification

Following are the steps for DNP Component verification.

Sr #	Step Description	Remark
1	Verify TOP side DNP (Do Not Populate) component on the board.	
2	Verify BOTTOM side DNP (Do Not Populate) component on the board.	
3	Remaining all components should be present on the board	

Table 6: DNP Component Verification Steps

Please refer Figure 4 & 5 for the Not mounted component location in iMX8M HMI Platform.



Figure 4: DNP components Location (TOP side).



Figure 5: DNP components Location (Bottom side).

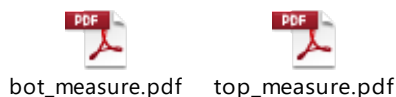
If found any component mounted on the board which comes into DNP list, please remove particular from the board and same way if found any component not-mounted on the board but doesn't come into DNP list, please mount that particular on the board as per the BOM file provided. Fill the test result in test report.

4.3 Power Ground Shorting and Resistance Measurement

Following are the steps for Power Ground shorting and resistance measurement.

Sr#	Power Ground Shorting and Resistance Measurement			
	Procedure - Verify the impedance across the component as mentioned in measurement location below:			
	Power Supply Rail (Net Name as in iMX8M_HMI_Platform Schematic)	Measurement Location	Expected Resistance Value (E= ohm, K= kilo ohm, M= mega ohm)	Max Value
Primary Location				
1	VCC_12V0	TP16 & J18	>1K	70K
2	DCDC_3V3	TP34 & J18	>1K	6K

3	VCC_5V	TP31 & J18	>1K	20K
4	VDD_SNVS_0V9	C392	>1K	40K
5	NVCC_DRAM_1V1	TP1 & J18	>100E	850E
6	VDD_DRAM_1V0	TP17 & J18	>100E	350E
7	VDD_SOC_0V9	TP26 & J18	>100E	100E
8	VDD_ARM_1V0	TP24 & J18	>100E	700E
9	VCC_1V8_EXT	TP33 & J18	>1K	7K
10	VCC_1V2	TP32 & J18	>1K	6K
11	VREFDDR	C33	>100E	60K
Secondary Location(Debug purpose)				
12	VDD_PHY_0V9	C125	>100E	8K
13	VDD_PHY_1V8	C361	>1K	4M
14	VDDA_1V8	C58	>1K	12K
15	VDD_PHY_3V3	C27	>1K	65K
16	VCAM_2V8	C26	>1K	70K
17	VDD_GPU_1V0	C214	>100E	150E
18	VDD_VPU_1V0	C210	>100E	300E
19	VDD_1V8	C137	>1K	450E
20	VCAM_1V5	R76 & J18	>1K	65K

Table 7: Power Ground Shorting and Resistance Measurement**Figure 6: Test Point Locations (Top/Bottom)**

Fill the readings in Test Report

If impedance at any test point is not within its above defined limits, re-verify solder quality and check impedance again. Even after it is not resolved, kindly report to elinfochips representative on immediate basis.

5 Board Power Supply Verification

5.1 Measure Actual Supply Voltages

Following are the steps to measure voltages on the different supply rails on the board.

Sr.No.	Procedure - 1. Connect 12V DC power adapter at DC jack PJ-041H (J14) of PCB 2. Turn ON Power Supply and Check default ON Power Supply			
	Power Supply Rail (Net Name as in iMX8M_HMI_Platform Schematic)	Measurement Location	Min (V)	Max (V)
Primary Location				
1	VCC_12V0	Across TP16 and J18	8.00	18.00
2	DCDC_3V3	Across TP34 and J18	3.15	3.50
3	VCC_5V	Across TP31 and J18	4.75	5.25
4	VDD_SNVS_0V9	Across C392	0.855	0.95
5	VDD_DRAM_1V1	Across TP1 and J18	1.05	1.15
6	VDD_DRAM_1V0	Across TP17 and J18	0.95	1.05
7	VDD_SOC_0V9	Across TP26 and J18	0.855	0.95
8	VDD_ARM_1V0	Across TP24 and J18	0.95	1.05
9	VCC_1V8_EXT	Across TP33 and J18	1.70	1.90
10	VCC_1V2	Across TP32 and J18	1.14	1.26
11	VREFDDR	Across C33	0.5225	0.5775
Secondary Location(Debug purpose)				
12	VDD_PHY_0V9	Across C125	0.855	0.95
13	VDD_PHY_1V8	Across C361	1.70	1.90
14	VDDA_1V8	Across C58	1.70	1.90
15	VDD_PHY_3V3	Across C27	3.15	3.50
16	VCAM_2V8	Across C26	2.66	2.94
17	VDD_GPU_1V0	Across C214	0.85	1.05
18	VDD_VPU_1V0	Across C210	0.95	1.05
19	VDD_1V8	Across C137	1.70	1.90
20	VCAM_1V5	Across R76 and J18	1.43	1.575

Table 8: Board Power Supply Measurement Steps

All power supply **MUST** be within its acceptable voltage range. If any supply is outside its acceptable limit, first debug and correct it. If after debugging, this issue is not resolved, contact elInfochips representative for help.

Fill the readings in test report.

6 UNIT ASSEMBLY

6.1 Accessories List

S.No	Component	Manufacturer	Mfg. Part No./Modal No.	Description	Per Board Qty
1	Power Adapter	Local Market	Local Market	12V, 5A Adaptor for DC supply with 110/240VAC input, 50/60Hz	1
2	Power Plug	CUI Inc.	PP-014	Plug to meet on board connector	1
3	Base Plates	Local Market	Local Market	Aluminum base plate as per drawing Provided	1
4	micro SD Cards	SanDisk	SDSDQAD-016G	USDHC class 10, 16Gb SanDisk	1
5	Heat Sink	ABL HEATSINKS	BGA-STD-020	Heat Sink, For Ball Grid Array, Standard, BGA, 24.5 C/W, 9 mm, 21 mm, 21 mm	1
6	Spacers/studs	Wurth Electronics Inc.	970200144	Spacer to mount on Plate	4
7	Screws Top Side	Keystone Electronics	M2.56 CSSTMCZ100-	Machine Screw, M2.5, 6 mm, Steel, Bright Zinc, Cheese Head Slotted	4
8	Flat Screws Bottom Side	Element14	M2.56 KSSTMCZ100-	Machine Screw, M2.5, 6 mm, Steel, Bright Zinc, Flat / Countersunk Head Slotted	4
9	FAN Axial - 25 x 25	Sunon Fans	MC25060V1-000U-A99	DC Fan, 25x6mm, 5VDC, 3CFM, 0.58W, 31dBA, 13000RPM, 0.22inch H2O, Vapo, Auto Restart	1
10	FAN - Screw for FAN	Element14	M2.5 12 PSSTMC Z100	Machine Screw, M2.5, 12 mm, Steel, Bright Zinc, Pan Head Slotted	2
11	FAN - Nut for FAN	Element14	M2.5- HFST- Z100-	Nut, Hex, M2.5, Steel, Bright Zinc Plated	1
12	FAN - Mating for FAN connector	TE Connectivity AMP Connectors	1470364-2	CONN RCPT HOUSING 2POS 1MM SMD	1
13	FAN - Crimp for FAN Receptacle Connector	TE Connectivity AMP Connectors	1734597-1	CONN SOCKET 28-32AWG CRIMP TIN	2
14	Debug cable - Serial cable	FTDI	TTL-232RG-VREG1V8-WE	CABLE USB SERIAL 1.8V WIRE 100MA	1
15	Debug cable - Mating for UART debug connector	Samtec Inc.	ISDF-03-S-M	Mating for UART debug connector	1
16	Debug cable - Crimp for UART Receptacle Connector	Samtec Inc.	CC03M-2830-01-G	Crimp for UART mating housing	3
17	CAN - Mating for CAN connector	TE Connectivity AMP Connectors	440129-2	CAN CONN RCPT HOUSING 2POS 2.0MM	1
18	CAN - Crimp for Receptacle Connector	TE Connectivity AMP Connectors	1735801-1	CAN CONN SOCKET 24-30AWG CRIMP TIN	2
19	A2B - Mating for A2B connector	Molex	5023510200	A2B CONN RCPT HSG 2POS W/B 2.0MM	1
20	A2B - Crimp for Receptacle Connector	Molex	561618081	A2B CONN SOCKET 22-26AWG CRIMP GOLD	2

Table 9: Accessories for Unit Assembly

6.2 Cable Assembly Procedure

Refer “el_Arrow_iMX8M_HMI_Platform_CableAssembly” document.

6.3 Unit Integration Procedure

Refer “el_Arrow_iMX8M_HMI_Platform_UnitIntegration” document.

7 DIAGNOSTICS & PRODUCTION FIRMWARE BURNING FLASHING

7.1 Setting Up for EUT for flashing

- Ensure you have x86 host system having Linux Ubuntu 16.04 LTS installed
- Basic understanding of Linux commands

7.1.1 Get the firmware package

- Download the provided SD card (sdcad.bz2) image in Linux pc
- Open terminal in host pc from left desktop panel or using keyboard shortcut (**ctrl + alt + t**)
- From command terminal traverse the location where downloaded firmware image is residing using **cd** command
\$: cd /home/user/download/imximages/
- use **ls** command to verify the existence of downloaded image
\$: ls -l
- Verify md5 check sum of downloaded image which should be provided over the share point
\$: md5sum <image name>.sdcad.bz2
- Extract the provided **.bz2** image using **bunzip2** command, which will take couple of minutes.
bunzip2 -dkf <image_name>.sdcad.bz2
- Once done, will end with **.sdcad** image in the same directory and can again be verified using **ls -l** command.

7.1.2 Flash the firmware image to SD Card

- Plug-in micro SD card into x86 host pc
- *Verify the node created for SD card into /dev directory*
\$: ls -l /dev/sd*
- Open terminal and traverse the location where downloaded firmware image is residing using **cd** command
- Ensure the extracted firmware image's file format is **sdcad** using **ls -l** command
- Apply below command for flashing if the SD card's entry in Linux is **/dev/sdb**
\$: sudo dd if=<image_name>.sdcad of=/dev/sdb bs=1M conv=fsync; sync
- Above command will take couple of minutes or more (depending upon host machine config) to flash the SD card
- Once done plug-out and replug-in the SD card, two drives will get mounted if the above gets successful, named **<boot>** and **<rootfs>**

- Again plug-in the SD card in host PC to copy the production script and required files.
- To test the production script below listed files are required.

1. asound.state – audio codec settings
2. sample.mp4 – to test HDMI2 port (J15)
3. 30fps4k_short.mp4 – to test HDMI1 port (J2)
4. a2bapp-linux
5. Thor96_Production_Test_1.sh
6. Thor96_Production_Test_2.sh

- Keep these files and provided production script in same folder and copy the same using below command.

```
# sudo cp -r <Folder path>Folder_Name/  
/media/einfochips/<rootfs>/home/root/
```

- **Eject (safely remove) SD card from host pc and plug it into board's sdcard slot**

7.2 Test Setup

7.2.1 Hardware Setup Verification

- Place hardware board on statically clean place.
- Configure Boot mode selection switch as shown in Figure 7.
- Plug flashed SD card to J5 SD card slot.
- Plug serial cable's 3-pin connector end to board's J17 Connector and USB end to host x86 pc's USB connector.
- Plug Ethernet cable to board's Ethernet connector J13.
- Plug two USB 3.0 flash drives to J3, J4 connector locations.
- Plug OTG cable (connected with USB 2.0 supported flash drive) to connector J1.
- Connect HDMI cable on J2 connector, 2nd end of HDMI to be connected to HDMI Display with 4K resolution.
- Connect HDMI cable on J15 connector, 2nd end of HDMI to be connected to HDMI Display with 1080p resolution.
- Connect audio jack (headphone out + MIC IN) on J10 connector.
- Connect A2B connector on J20 connector.
- Connect J-link debugger on J11 to flash ZigBee module. Other end of debugger should be connected to windows PC.
- Before starting with production script ZigBee module should be flashed.

**Note: ZigBee flashing document will be provided separately.
“el_Arrow_iMX8M_HMI_Platform_ZibeeFlashing_Guide.pdf”**

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- Before applying the power supply to the system make sure that boot configuration is as per below image. Apply 12V-5A power supply (provided with board) to board on J14 connector after all the other hardware setup is done and required interfaces are connected to board.

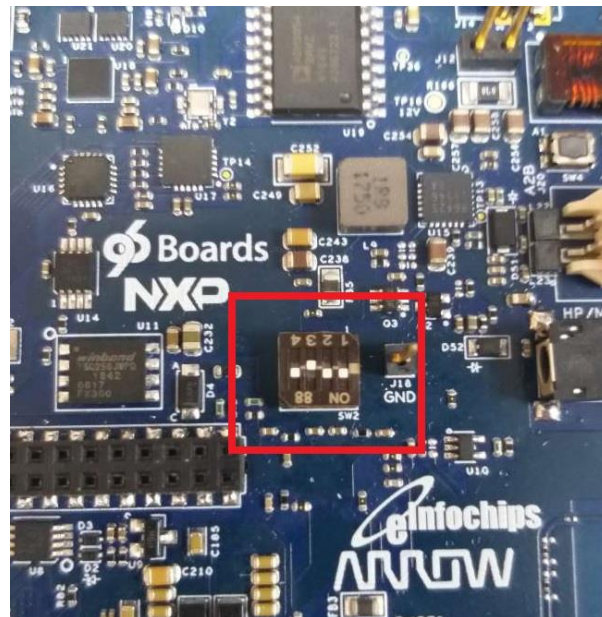


Figure 7: Boot Mode Selection Switch Settings

- Below figure shows the functional test setup for iMX8M HMI Platform board. Connect the Required cables mentioned in Test Equipment Accessories Requirement to iMX8M HMI Platform Unit on respective connectors as shown is test setup diagram.



Figure 8: Connection of all interfaces



Figure 9: Diagnostics Testing - Image of Complete Setup for Diagnostics Test

7.2.2 Open board's terminal- console (minicom) on x86 host pc

- Ensure SD card is flashed, serial cable is plugged in into board and ZigBee module is flashed as per mentioned in hardware setup.
- Attached serial cable's USB end to host x86 PC's USB.
- Ensure **minicom** is installed in x86 Ubuntu pc
- Apply below command to open serial command's setting.
\$: sudo minicom -s
- **set baud rate and other setting as per below**
 - baud rate=115200,
 - parity=none
 - hardware flow control = none
 - software flow control = none
 - serial device= /dev/ttyUSB0
 - save setup as dfl
- Once board gets power-up, above configured terminal will show logs on x86 and can interact with board using this open terminal.

7.2.3 Set-up the dual display dtb file changes at u-boot

- Go to board's console (require minicom) and immediately stop at **u-boot auto boot** console by pressing any key.
- Apply below commands for changing dtb file
setenv fdt_file fsl-imx8mq-thor96-dual-display-b3.dtb
saveenv
boot
- Once booting is completed, console will hold on login prompt where user can enter username as **root**. (no password)

• Test Procedure

- We have made two scripts to test all the interfaces of HMI board.
Thor96_Production_Test_1.sh
Thor96_Production_Test_2.sh
- Start with “Thor96_Production_Test_1.sh” below is the pre-requisite and test setup for this script.
- Dual display dtb must be set before running the script and camera mezzanine with two camera module should be attached as per below figure.



Figure 10 : Thor96_Production_Test_1 script setup

- **How to run script**

- Enter below command on board's console.
Production is the folder which contains all the required file and production script.
#cd production
sh Thor96_Production_Test_1.sh
or
./Thor96_Production_Test_1.sh
- Below screen will prompt after this command. Enter board serial number of the board.

```
root@lmx8mqthor96:~# sh Thor96_Production_Test_1.sh
please enter board's serial No.
```

- After entering board number below list of interface will be appeared.

```

please enter board's serial No.
2018319
+++++
Welcome to Thor96 Board Auto Testing Tool
+++++

Choose Interface to be tested

Press 0: Test all Interfaces
Press 1: Ethernet Test
Press 2: Dual display Test
Press 3: Dual Camera Streaming over HDMI
Press 4: Bluetooth Connectivity
Press 5: EEPROM Read/Write Test
Press 6: Zigbee testing
Press 7: LED On/Off Test
Press 8: SAI Audio
Press 9: Can interface Test
Press 10: LPDDR4 RAM Test
Press 11: NOR Flash Test
Press 12: WiFi Test
Press 13: A2B Test
Press 14: Exit from Test Tool
+++++
Enter your desired Input

```

- Press 0 to test all the interfaces mentioned. Which is also required user input.
- First interface will be tested is Ethernet.in script iperf is running to test Ethernet and one default IP is set. You have to add known IP to test.Give input “n” to change the IP address and provide known IP address to perform the test.
- Below results will be shown after Ethernet test is completed.

```

Enter your desired Input
0
Welcome to Ethernet Testing tool
Default Interface name is: eth0
Default server IP: 192.168.12.143
Run command on server [Another Linux Host Machine which is pingable with device i.e. inx8] using: <BASH> iperf3 -s
If you have followed all of above prerequisites press-y
else-n [In case you want to change server ip script on which you run command iperf3 -s]
Select: (y/n)
n
Select the Server IP:
10.100.138.23

+++++ Result [Ethernet] ++++++
Thor96 Production_Test_1.sh: line 43: print_eth: command not found
Created Node Ethernet: eth0Ethernet Maximum Speed Supported      : 1000Mb/s
Bandwidth for sending the data      :
Bandwidth for receiving the data    :
Bandwidth for sending the data      :
Bandwidth for receiving the data    :
Information related Ethernet
Link partner advertised link modes: 10baseT/Half 10baseT/Full
Link partner advertised pause frame use: Symmetric
Link partner advertised auto-negotiation: Yes
Link detected: yes
Ethernet IP: 10.100.134.236
Ethernet test      : PASS
| Ethernet test    | PASS |

```

- Next is dual display test.before starting this make sure that dtb is changed and two HDMI display is connected. After dual display test user input is required whether video is played or not accordingly result will be appeared.


```

If not then Please first Apply dtb file changes as per below command on uboot console (Need to Reboot)
# setenv fdt_file fsl-imx8mq-thor96-dual-display-b3.dtb
# saveenv
# boot

If you have followed all of above prerequisites press-y else-n.
Select: (y/n)
y
HDMI1 node /dev/fb0 created : PASS
[HDMI] Starting Video on HDMI1... Please check it.
Setting pipeline to PAUSED ...
[ 284.844121] i.mx8-hdp 32c00000.hdmi: 0,ff,ff,ff,ff,ff,ff,0
[ 284.874135] i.mx8-hdp 32c00000.hdmi: 0,ff,ff,ff,ff,ff,ff,0
[ 284.904104] i.mx8-hdp 32c00000.hdmi: 0,ff,ff,ff,ff,ff,ff,0
===== VPUDEC: 4.4.4 build on Jun 18 2019 08:32:27. =====
wrapper: 3.0.0 (VPUWRAPPER_ARM64_LINUX Build on Jun 18 2019 08:22:59)
vpulbr: 1.1.1
firmware: 1.1.1.0
Pipeline is PREROLLING ...
[ 285.043082] alloc_contig_range: 12 callbacks suppressed
[ 285.043088] alloc_contig_range: [5cd00, 5dad0] PFNs busy
[ 285.054805] alloc_contig_range: [5ce00, 5dbd0] PFNs busy
[ 285.060948] alloc_contig_range: [5ce00, 5dcd0] PFNs busy
[ 285.067304] alloc_contig_range: [5d000, 5ddd0] PFNs busy
[ 285.074164] alloc_contig_range: [5d000, 5ded0] PFNs busy
[ 285.080401] alloc_contig_range: [5d000, 5dfd0] PFNs busy
[ 285.087312] alloc_contig_range: [5d000, 5e0d0] PFNs busy
[ 285.094764] alloc_contig_range: [5d000, 5e1d0] PFNs busy
[ 285.102209] alloc_contig_range: [5d000, 5e2d0] PFNs busy
[ 285.109631] alloc_contig_range: [5d000, 5e3d0] PFNs busy
Pipeline is PREROLLED ...
Setting pipeline to PLAYING ...
New clock: GstSystemClock
Got EOS From element "pipeline0".
Execution ended after 0:00:12.049227605
Setting pipeline to PAUSED ...
Setting pipeline to READY ...
Setting pipeline to NULL ...
Total showed frames (364), playing for (0:00:12.049868645), fps (30.208).
Freeing pipeline ...
HDMI2 node /dev/fb1 created : PASS
[HDMI] Starting Video on HDMI2... Please check it.
[ 299.711634] alloc_contig_range: 8 callbacks suppressed
[ 299.711639] alloc_contig_range: [5cd00, 5dad0] PFNs busy
[ 299.723750] alloc_contig_range: [5ce00, 5dbd0] PFNs busy
[ 299.729927] alloc_contig_range: [5ce00, 5dcd0] PFNs busy
[ 299.736092] alloc_contig_range: [5d000, 5ddd0] PFNs busy
[ 299.742731] alloc_contig_range: [5d000, 5ded0] PFNs busy
[ 299.748807] alloc_contig_range: [5d000, 5dfd0] PFNs busy
[ 299.755500] alloc_contig_range: [5d000, 5e0d0] PFNs busy
[ 299.762777] alloc_contig_range: [5d000, 5e1d0] PFNs busy
[ 299.770144] alloc_contig_range: [5d000, 5e2d0] PFNs busy
[ 299.777346] alloc_contig_range: [5d000, 5e3d0] PFNs busy
Type y/n for whether videos are being played Over both HDMI:

```

- Next is dual camera test. make sure to connect camera mezzanine with two camera module attached result will be shown as below. In this test user input is required.

```

+++++ Result [ Camera Streaming on Dual Display ] +++++
Welcome to Camera Streaming on Dual Display Test
Please make sure that you have set fdt file fsl-imx8mq-thor96-dual-display-b3.dtb on uboot console.
If not then Please first Apply dtb file changes as per below command on uboot console (Need to Reboot)
# setenv fdt_file fsl-imx8mq-thor96-dual-display-b3.dtb
# saveenv
# boot

In addition, Attached two D3 mezzanine camera on CSI1 and CSI2.

If you have followed all of above prerequisites press-y else-n.
Select: (y/n)
y
Camera1 node /dev/video0 created : PASS
Camera1 node /dev/video1 created : PASS
[Dual Display + Camera] Camera1 and Camera2 streaming on HDMI1 and HDMI2... Please check.
[ HDMI1 + Camera (CSI2) ] Camera Streaming on HDMI2[ 786.390546] ov5640_mipi 1-003c: s_stream: 1
[ HDMI1 + Camera (CSI1) ] Camera Streaming on HDMI1[ 795.687990] ov5640_mipi 1-003c: s_stream: 0
[ 795.982962] i.mx8-hdp 32c00000.hdmi: 0,ff,ff,ff,ff,ff,ff,0
[ 795.933039] i.mx8-hdp 32c00000.hdmi: 0,ff,ff,ff,ff,ff,ff,0
[ 795.963003] i.mx8-hdp 32c00000.hdmi: 0,ff,ff,ff,ff,ff,ff,0
[ 796.759144] ov5640_mipi 2-003c: s_stream: 1
Type y/n for whether camera streaming are being played Over both HDMI:
y
Camera1 and Camera2 streaming on HDMI1 and HDMI2 (Dual Display) are being played [Manually Output]
| Camera1 and Camera2 | PASS |
sending signal 15 to procs

```

- Next is Bluetooth test. Make sure that at least one Bluetooth device is on near HMI board. It will scan and show nearby devices.

```

+++++++ Result [Bluetooth] ++++++
bcm43xx_init
Set Controller UART speed to 3000000 bit/s
Flash firmware /etc/firmware/BCM4345C0.1MW.hcd
Set Controller UART speed to 3000000 bit/s
Setting TTY to N_HCI line discipline
Device setup complete
[BLE] Bluetooth scanning is started
Scanning ...
      DC:1A:C5:27:BD:E4      vivo V3
Bluetooth Scanning          : PASS
| Bluetooth                  | PASS |

```

- EEPROM test:

```

+++++++ Result [EEPROM] ++++++
[EEPROM] Writing EEPROM ...Writing on EEPROM          : PASS
| Writing on EEPROM          | PASS |
EEPROM Write Speed:
[EEPROM] Reading EEPROM ...
00000000  68 65 6c 6c 6f 5f 77 6f  72 6c 64 0a ff ff ff ff |hello_world.....|
Reading on EEPROM          : PASS
| Reading on EEPROM          | PASS |
EEPROM Read Speed: 21.8kB/s\n

```

- ZigBee Test: Make sure ZigBee module is flashed before performing this test.

```

+++++++ Result [Zigbee] ++++++
Zigbee node /dev/spidev1.0 created          : PASS
Zigbee HOST Service running                 : OK

```

- LED test: In this test user input is required. You have to check if LED is on or off as per script.

```

+++++++ Result [LEDs] ++++++
BT LED test          : PASS
WiFi LED test        : PASS
LED1 test            : PASS
LED2 test            : PASS
LED3 test            : PASS
LED4 test            : PASS

Please Check that all LEDs are ON
Reply with y/n [Yes/No]
y
All LEDs are ON [Based on USER Input]. So LED ON TEST PASS.\n
| All LEDs are ON          | PASS |
All LEDs are OFF          : PASS
| All LEDs are OFF          | PASS |

Please Check that all LEDs are OFF now.Reply with y/n [Yes/No]y
All LEDs are OFF [Based on USER Input]. So LED OFF TEST PASS.

```

- Audio test : Make sure you have connected headphone with MIC on audio jack (J10)

```
SAI Card is found
Please insert headphone/earphone with mic on SAI.
Recording WAVE 'stdin' : Signed 16 bit Little Endian, Rate 48000 Hz, Stereo
Please speak something...
You will hear it in playback mode continuously.
Is Playback working fine? Reply with y/n [Yes/No]
y
SAI Audio Test [manual input] : PASS
| SAI Audio Test | PASS |
+++++
```

- CAN interface test

```
+++++ Test Result [CAN] +++++
RTNETLINK answers: Device or resource busy
[CAN] Interface Name: can0 Link encap:UNSPEC HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
[CAN] Sending data to another CAN Device
CAN SEND Operation : PASS
| CAN | PASS |
+++++
```

- LPDDE4 RAM test:

```
+++++ Test Result [RAM] +++++
[RAM] RAM testing is Starting...!!!
[RAM] Used RAM size: 420M
[RAM] Free RAM: 1.4G
[RAM] Total Available RAM: 1.9G
[RAM] RAM is available. RAM Test : PASS
| RAM is available.RAM Test | PASS |
+++++
```

- NOR test: It will take 2-3 min to complete the test.

```
+++++ Result [NOR-Flash] +++++
[NOR] Erase NOR flash
flash_eraseall has been replaced by 'flash_erase <mtdddev> 0 0'; please use it
Erasing 4 Kibyte @ 1fff000 -- 100 % complete
[NOR] Write into NOR
NOR Write Speed: \n
NOR Flash Write Operation : PASS
| NOR Flash Write | PASS |
[NOR] Read from NOR
65536+0 records in
65536+0 records out
33554432 bytes (34 MB, 32 MiB) copied, 2.45094 s, 13.7 MB/s
NOR Read Speed: \n
NOR Flash read Operation : PASS
| NOR Flash Write | PASS |
+++++
```

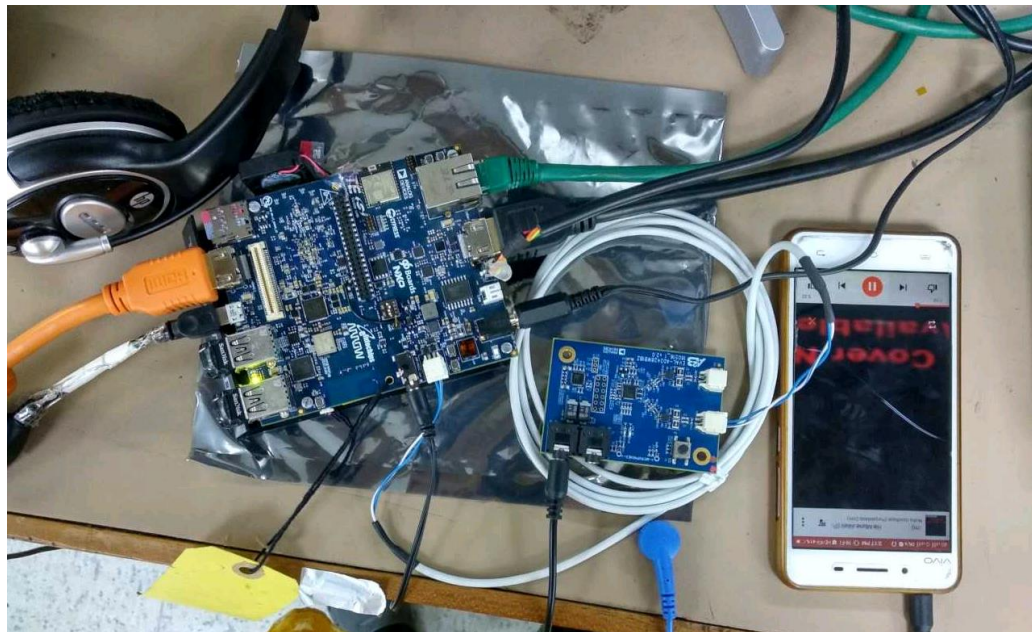

- Wi-Fi test: This test will scan and show Wi-Fi devices in range.

```

+++++ Result [WiFi] +++++
[ 1804.869010] IPv6: ADDRCONF(NETDEV_UP): wlan0: link is not ready
[WIFI] List of available WiFi devices in Range...
-45.00 dBm ei-SecureWiFi
-46.00 dBm ei-GuestWiFi
-65.00 dBm ei-GuestWiFi
-65.00 dBm ei-SecureWiFi
WiFi scan : PASS
| WiFi | PASS |
+++++

```

- A2B test: Connect audio source i.e. mobile phone through aux cable to the J2 connector of EVAL-AD2428WB1BZ as per below image



- Results of A2B test: user has to play audio through audio source and listen the same from audio jack (J10) of HMI board. User has to give input whether audio file is audible or not.


```

+++++ Test Result [A2B] +++++
Start A2B setup...
Reset context done
System Init done
PAL Init done

Using SigmaStudio BCF File
BCF parse done
BDD PAL Init done
Allocate Heap done
Master plugin load done
Slave plugins load done
Allocate Stack done
Playing raw data 'stdin' : Signed 32 bit Little Endian, Rate 48000 Hz, Stereo
Recording WAVE 'stdin' : Signed 32 bit Little Endian, Rate 48000 Hz, Stereo
Triggering discovery...
INTERRUPT: intrType=255 nodeAddr=-1
INTERRUPT: intrType=24 nodeAddr=-1
Discovery succeeded with 1 nodes discovered
Success!!!
Is Playback working fine? Reply with y/n [Yes/No]
A2B Test [manual input] : PASS
| A2B Test [manual input] | PASS |

```

- After completing A2B test, power-off the board. Plug out camera mezzanine and plug in LTE mezzanine with SIM card inserted.
- Plug in the power adapter and go to board's console (require minicom) and immediately stop at u-boot auto boot console by pressing any key.
- Apply below commands for changing dtb file. This dtb is for USB OTG host mode.

```

# setenv fdt_file fsl-imx8mq-thor96-otg-host.dtb
# saveenv
# boot

```

- Enter below command on board's console.

```

# cd production
# sh Thor96_Production_Test_2.sh
or
# ./Thor96_Production_Test_2.sh

```
- After above commands below screen will be appeared.

```

root@imx8mqthor96:~# sh Thor96_Production_Test_2.sh
please enter board's serial No.

```

- Enter serial number and below list of interface will be shown.

```

root@imx8mqthor96:~# sh Thor96_Production_Test_2.sh
please enter board's serial No.
20181919
+++++
Welcome to Thor96 Board Auto Testing Tool
+++++

Please make sure that you have set fdt file fsl-imx8mq-thor96-otg-host.dtb on uboot console.
If not then Please first Apply dtb file changes as per below command on uboot console (Need to Reboot)
# setenv fdt_file fsl-imx8mq-thor96-otg-host.dtb
# saveenv
# boot

Choose Remain Interface to be tested

Press 0: Test all Interfaces
Press 1: USB and OTG Test
Press 2: LTE Test
Press 3: Exit from Test Tool
+++++
Enter your desired Input
0

```

- Give input as “0” to test listed all interfaces.
- USB test: make sure you have changed dtb file and attached all three devices as per test setup image.

```

+++++
Enter your desired Input
0

+++++ Test Result [USB] ++++++
usb1 write is being performed : OK
usb2 write is being performed : OK
usb3 write is being performed : OK
[USB] Write speed in USB1 : 123 Mbps
[USB] Write Speed in USB2 : 136 Mbps
[USB] Write Speed in USB3 : 119 Mbps
usb1 read is being performed : OK
usb2 read is being performed : OK
usb3 read is being performed : OK
tee: '': No such file or directory
| A2B Test [manual input] | PASS |
[USB] Read speed in USB1 : 352 Mbps
[USB] Read Speed in USB2 : 349 Mbps
[USB] Read Speed in USB3 : 353 Mbps
+++++

```

- LTE test: make sure you have attached LTE mezzanine with SIM card.

```

+++++ Test Result [LTE] +++++
[LTE] Start LTE Initialising...
ppp0      Link encap:Point-to-Point Protocol
          inet addr:25.79.25.80  P-t-P:10.64.64.64  Mask:255.255.255.255
          UP POINTOPOINT RUNNING NOARP MULTICAST  MTU:1500  Metric:1
          RX packets:5 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:3
          RX bytes:50 (50.0 B)  TX bytes:68 (68.0 B)

LTE Node created. LTE Test                : PASS
+++++

```

- ## Manual Testing

For running diagnostics tool on individual peripheral select the interface which you want to test from below list. User have to give input as per below list.

From Thor96_Production_Test_1.sh script you can perform diagnostic for below interfaces.

```

please enter board's serial No.
2018319
+++++
Welcome to Thor96 Board Auto Testing Tool
+++++

Choose Interface to be tested

Press 0: Test all Interfaces
Press 1: Ethernet Test
Press 2: Dual display Test
Press 3: Dual Camera Streaming over HDMI
Press 4: Bluetooth Connectivity
Press 5: EEPROM Read/Write Test
Press 6: Zigbee testing
Press 7: LED On/Off Test
Press 8: SAI Audio
Press 9: Can interface Test
Press 10: LPDDR4 RAM Test
Press 11: NOR Flash Test
Press 12: WiFi Test
Press 13: A2B Test
Press 14: Exit from Test Tool
+++++
Enter your desired Input
_

```

From script “Thor96_Production_Test_2.sh” you can perform diagnostic for below interfaces

```

root@imx8mqthor96:~# sh Thor96_Production_Test_2.sh
please enter board's serial No.
20181919
+++++
Welcome to Thor96 Board Auto Testing Tool
+++++

Please make sure that you have set fdt file fsl-imx8mq-thor96-otg-host.dtb on uboot console.
If not then Please first Apply dtb file changes as per below command on uboot console (Need to Reboot)
# setenv fdt_file fsl-imx8mq-thor96-otg-host.dtb
# saveenv
# boot

Choose Remain Interface to be tested

Press 0: Test all Interfaces
Press 1: USB and OTG Test
Press 2: LTE Test
Press 3: Exit from Test Tool
+++++
Enter your desired Input

```

• Log Files Location

You can find the log files in this folder <home/root/production>. You can enter in this folder by inserting this command <cd production>. Now on entering <cat result_<Board serial number>.txt> command. You can find the logs for Manual and Auto Test.

Sample of log file:



result201919.txt

• Copy log file to local system

- Using below commands user can transfer log file from SD card to Local system. Make sure that system should be connected to same network as Thor96 board.

```
# scp result_<Board serial number>.txt einfochips@<Local system IP addr>:./<Folder Path>
```

- After successfully copying the log file remove the production folder from SD card using below command. If you are in production directory use below command first
#cd ../

To remove the folder
#rm -r production/

9 OUTWARD QC AT CONTRACT MANUFACTURER (CM) FACILITY

9.1 Accessories List

Refer “el_Arrow_iMX8M_HMI_Platform_ProductBOM” document.

9.2 Quality Assurance

Following steps must be followed before shipping the boards:

1. Heatsink should be mounted on every board.
2. Board should be properly cleaned.
3. Verify default settings for boot mode switches as shown in Figure 7.
4. Board S/N sticker should be present on the board.
5. Put Warning Sticker on Top side.
6. Put QC-OK sticker on bottom side free area of the board.
7. Pack THOR96 into ESD safe anti-static bag.

- **Packing Instruction**

Refer “el_Arrow_iMX8M_HMI_Platform_ProductBOM” document.