Ambarella

# SDK6 UG A12 Amage

## Tool for Image Quality Tuning with MTP Protocol

Version 1.4

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Confidentiality Notice:





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# I Contents

# II Preface

This document provides technical details using a set of consistent typographical conventions to help the user differentiate key concepts at a glance.

Conventions include:

| Example | Description |
|---|---|
| **AmbaGuiGen**, **DirectUSB**<br>**Save, File > Save**<br>**Power, Reset, Home** | Software names<br>GUI commands and command sequences<br>Computer / Hardware buttons |
| **Flash_IO_control**<br>**da**, **status**, **enable** | Register names and register fields. For example, **Flash_IO_control** is the register for global control of Flash I/O, and bit 17 (**da)** is used for DMA acknowledgement. |
| GPIO81, CLK_AU | Hardware external pins |
| VIL, VIH, VOL, VOH | Hardware pin parameters |
| INT_O, RXDATA_I | Hardware pin signals |
| **amb_performance_t**<br>***amb_operating_mode_t***<br>amb_set_operating_mode() | API details (e.g., functions, structures, and type definitions) |
| `/usr/local/bin`<br>`success = amb_set_operating_mode (amb_xxx_base_address, & operating_mode)` | User entries into software dialogues and GUI windows<br>File names and paths<br>Command line scripting and Code |

*Figure II-1. Typographical Conventions for Technical Documents.*



Additional Ambarella typographical conventions include:

- Acronyms are given in UPPER CASE using the default font (e.g., AHB, ARM11 and DDRIO).
- Names of Ambarella documents and publicly available standards, specifications, and databooks appear in *italic* type.

# 1 Overview

## 1.1 Overview: Introduction

**Amage** is a tool with graphic user interface that aims to tune colorand noise with convenience. This tool can be run on WinXP and Win7. It can communicate with the Image Kernel through MTP/USB protocol; that is, it can get/send data from/to the Image Kernel. **Amage** facilitates image quality (IQ) tuning using image digital signal processing (IDSP) functions defined in the Image Kernel API document for the corresponding Ambarella chip.

**Amage** provides a full menu of tuning functions sufficient to optimize and differentiate digital video and encoding products. There are online dialogues that offer tuning with live video preview for color correction and noise filtering. The program is based on the MTP/USB protocol; i.e., **Amage** is an initiator, and the Responder is a test_tuning program that comes with the SDK and runs in the SDK6 platform shell.



## 1.2 Overview: Scope of the Document

This user guide provides instructions to set up the **Amage** application and helps the user navigate through the **Amage** dialogue windows. It does not provide in-depth function description since the dialogues of **Amage** directly link to the underlying API document. IQ tuning is know-how and user-dependent. The user is referred to the technical literature for in-depth discussion on tuning theory and protocols.

## 1.3 Overview: Required Tools and Connections

The user assumes that **Amage** runs on the PC connected to the EVK with USB cables. In addition to copying the **Amage** executable files to the PC, the following tools and connections are required:



### 1.3.1 Required Tools and Connections: Terminal Emulator

PC should have a terminal emulator such as Tera Term installed.

### 1.3.2 Required Tools and Connections: Microsoft .NET Framework

Go to www.microsoft.com and download Microsoft .NET Framework 4.0 or later versions and install it on the local PC.

For .NET Framework 4.0:

http://www.microsoft.com/zh-tw/download/confirmation.aspx?id=17718#

### 1.3.3 Required Tools and Connections: Connections

The following connections are required:

- USB cable connection between the local PC and EVK
- HDMI connection between the EVK and TV

### 1.3.4 Libusb

Go to http://sourceforge.net/apps/trac/libusb-win32/wiki and download Libusb 1.2.4.0 and install it on the local PC.

For Libusb 1.2.4.0:
http://sourceforge.net/projects/libusb-win32/files/libusb-win32-releases/1.2.4.0/libusb-win32-bin-1.2.4.0.zip/download

The installation procedure is as follows:

1. Turn on the EVK.
2. Switch the USB class to MTP. (Please refer to Section 3.3)
3. Connect the EVK with the PC through the USB cable.
4. Click **inf-wizard.exe.**
5. Choose SDK6 Platform and click **Next**.
6. Click **Next** and place SDK6_Platform.inf where the user likes.
7. Finally, click **Install Now**.

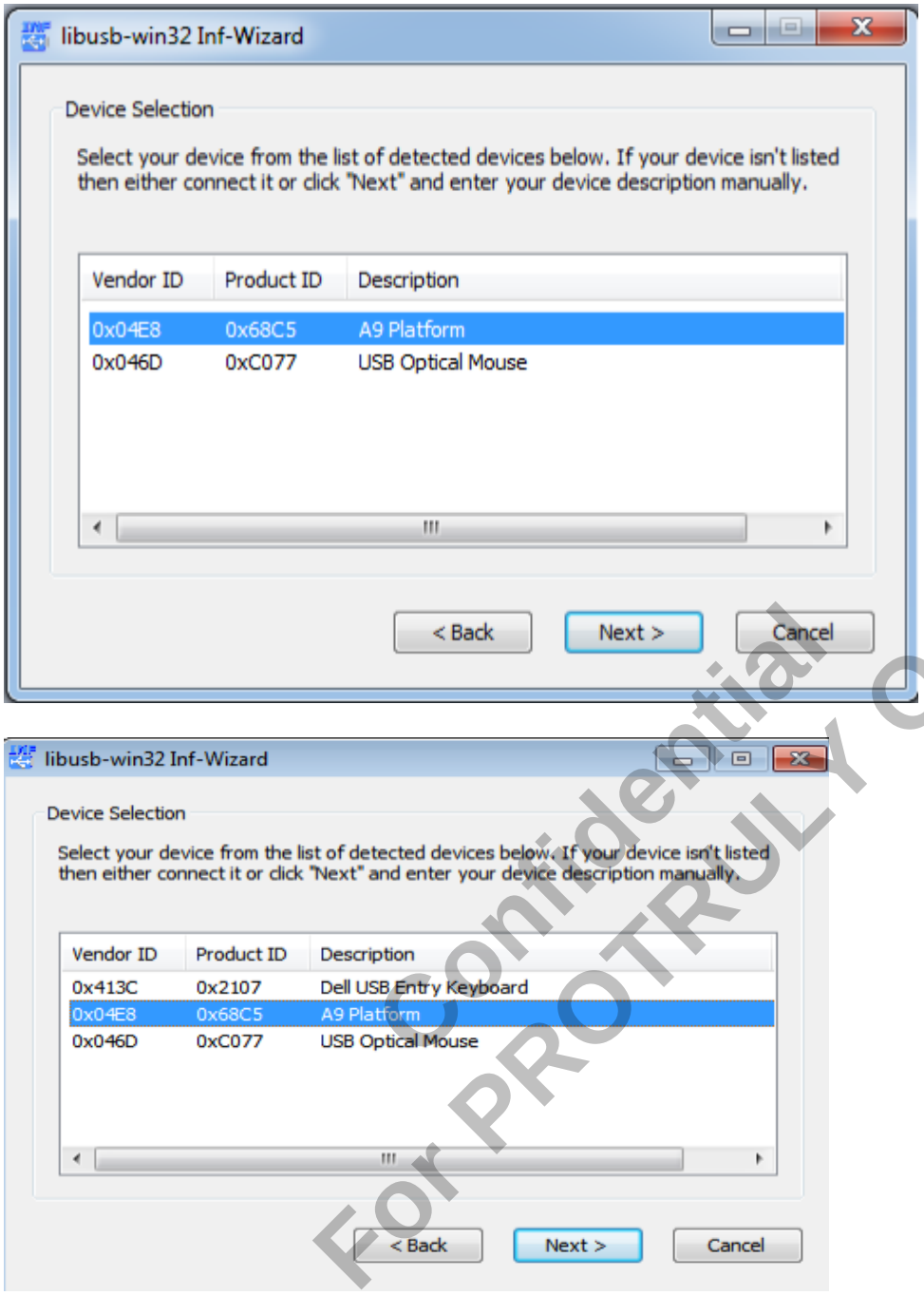





*Figure 1-1. Libusb-win32 Inf-Wizard. USB connection between PC the EVK(A9 A12), click SDK6 Platform to install it.*

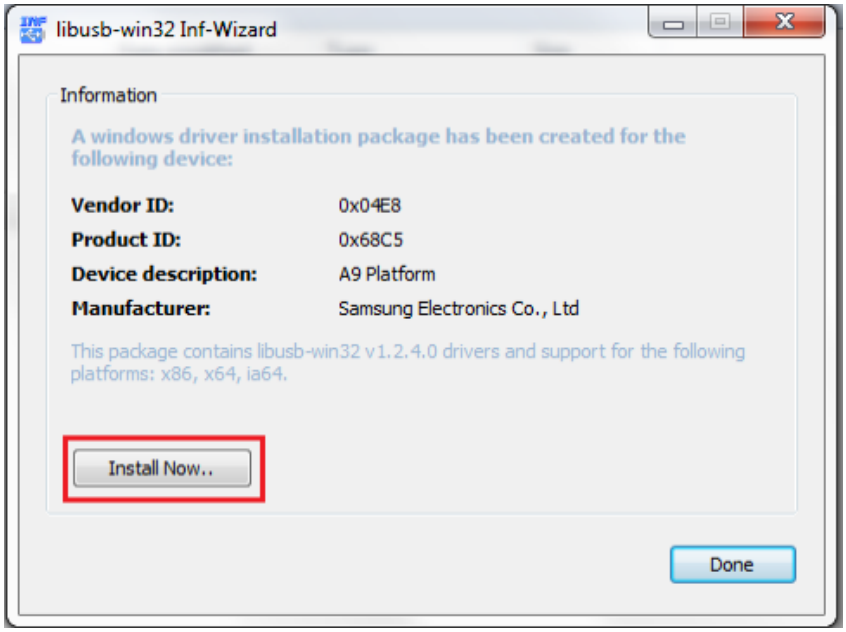



*Figure 1-2. Click Install Now. To complete Libusb Installation.*

# 2 Software Block Diagram

Amage Video Tuning Mode applies all the needed IDSP parameters from ituner, send/get the data stream through MTP/USB protocol to MTP_DataSend/MTP_DataGet. USB_Hdlr utilizes the API of _USBHdlrLoad_Text/USBH-dlr_GetItunerFile to set/get Ituner paramers to the corresponding filter of the G_data, then send/get data to the Image Kernel by using the API of AmbaItuner_Excute/AmbaItuner_Refresh.

## 2.1 Software Block Diagram: Introduction

Amage provides three major functions: **(1) Video Tuning, (2) Still Raw Encode** and **(3) AdjBinEditor and IQ Table**. This chapter describes the software architecture of SDK6 SSP which includes details of the two function flows. This chapter is divided into the following sections:

- (Section 2.2) Software Block Diagram: Video Tuning
- (Section 2.3) Software Block Diagram: Still Tuning (Still Raw Encode)
- (Section 2.4) Software Block Diagram: AdjBinEditor and IQ Table and IQ Table



## 2.2 Software Block Diagram: Video Tuning

SDK6 provides two ways for IQ tuning; that is, IQ tuner can apply/load IDSP parameters to/from Image Kernel through the SD card or through **Amage**. The corresponding handler of Amage is **AmbaTune_USBHdlr** on the comsvcIn the frame work of using **Amage**, the IDSP parameters including the calibration table and ituner file should be sent to the G-Data buffer first and then the **Ambatuner_Excute** should be called to execute the setting.

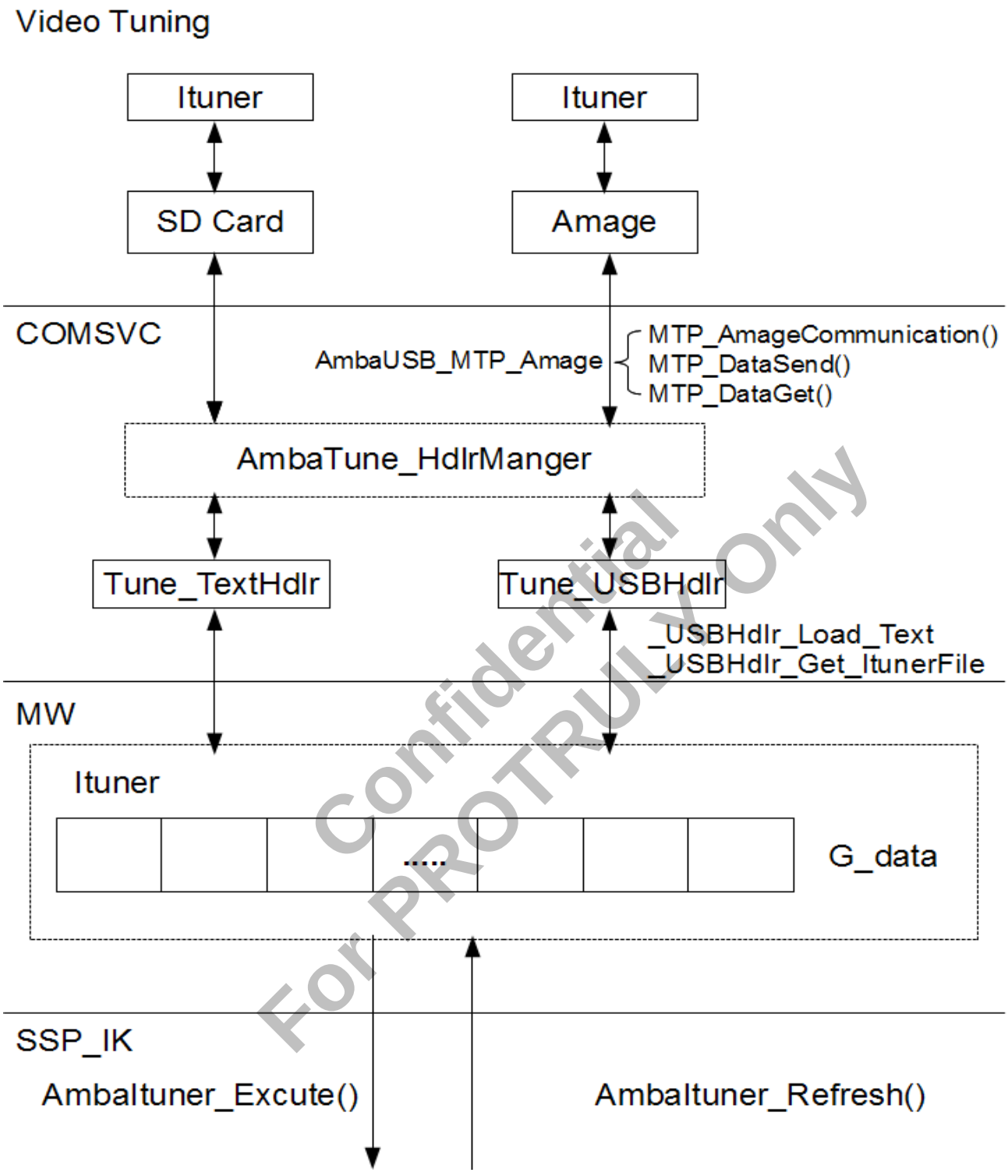





*Figure 2-1. Software Block Diagram for Video Tuning*

## 2.3 Software Block Diagram: Still Tuning (Still Raw Encode)

The first step of the still raw encode frame work is to apply all the needed IDSP parameters to ituner, and call **StillTuningGetRawEncodeBuffer** to get the raw address. **Amage** would send the raw address to the specified address. Then, use **StillTuningPreLoadDone** to check if the IDSP and raw data are ready or not, if so, utilize

**itunerRawEncode** to execute still raw encode frame work. The result would be saved in the JPEG format. User can derive the result automatically through **Amage**.

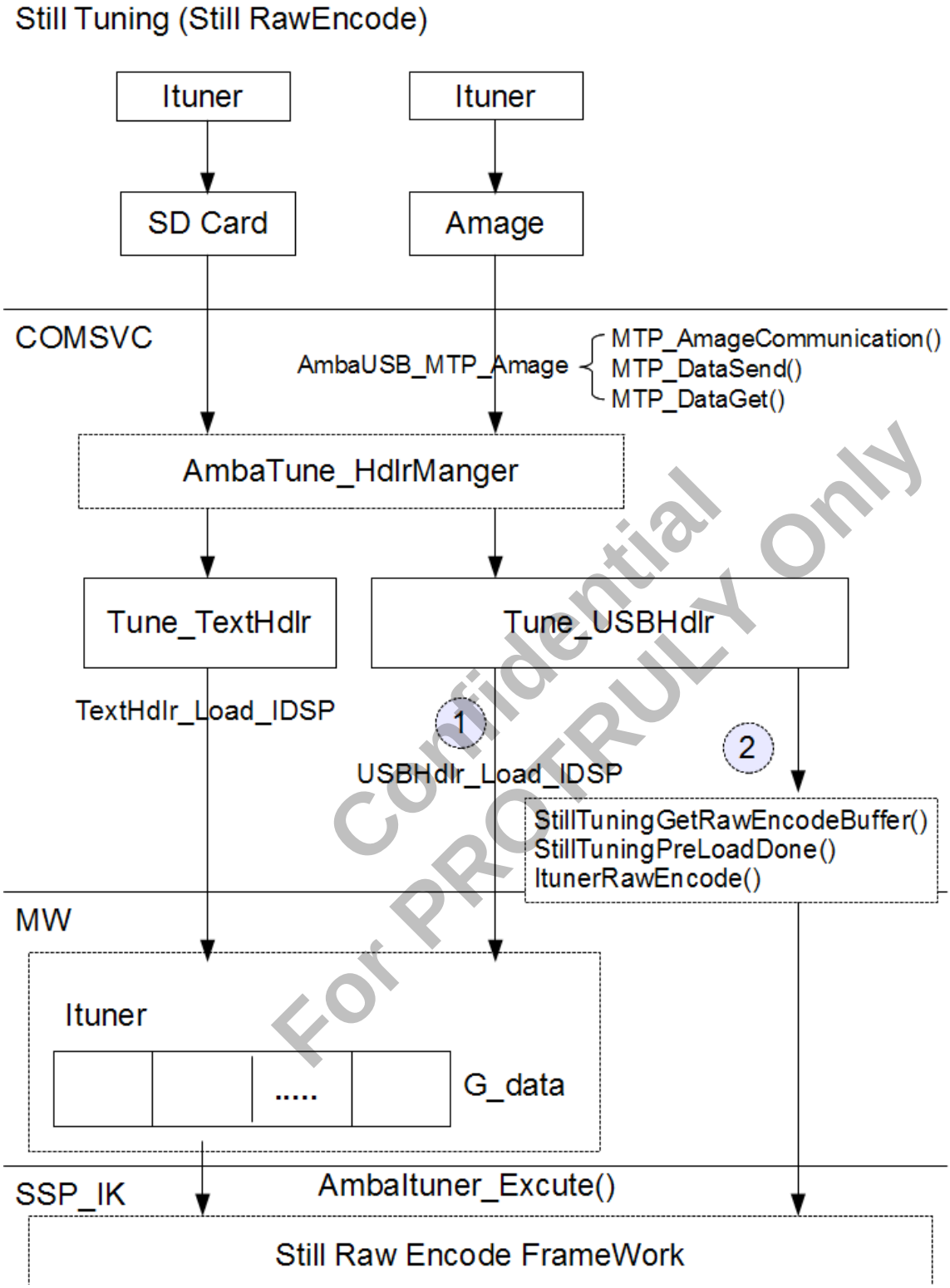





*Figure 2-2. Software Block Diagram of **Still Raw Encode**.*

## 2.4 Software Block Diagram: AdjBinEditor and IQ Table

### 2.4.1 AdjBinEditor

AdjBinEditor is a PC tool for editing ADJ binary files which are dumped from the SDK6 shell. Please refer to ***Usage of SDK6 ADJ bin file test command*** to learn how to save the ADJ binary file from the SDK6 shell at run time and load the binary file through the SD card.

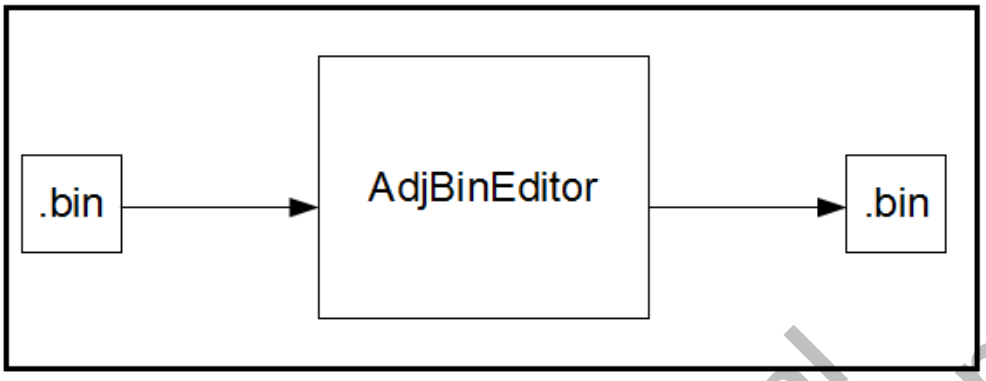



*Figure 2-3. Software Block Diagram of AdjBinEditor*



### 2.4.2 IQTable

IQTable mode provides an API that can directly send the ADJ binary files to DRAM using Amage through the USB.

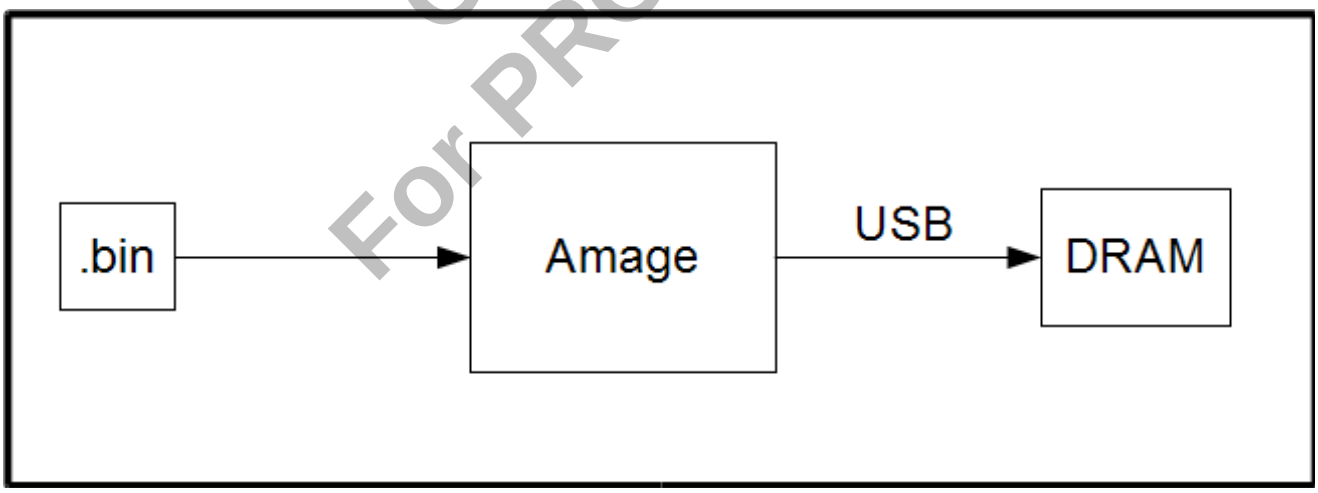



*Figure 2-4. Software Block Diagram of* **IQTable Mode**

# 3 Start IQ Tuning with Amage

This chapter discusses the process of starting IQ tuning with Amage for an Ambarella EVK. The chapter is organized as follows:



## 3.1 Start IQ Tuning with Amage: Amage Tool Path and Connections



### 3.1.1 Amage Tool Path

The Amage tool path is as provided below:

```
.\rtos\tools\exec\win\AmageS2LA12\AmageS2LA12.exe
```

Note: ".\" is the root path for the SDK.

### 3.1.2 Connections

Use the following steps to initiate IQ Tuning:

- Set pin for USB.
- Connect the EVK and the PC with the USB cable.
- Connect the EVK and TV with HDMI.
- Initialize sensor and start live-view
- Switch USB Class to **MTP** Class

## 3.2 Start IQ Tuning with Amage: Set Pin for USB

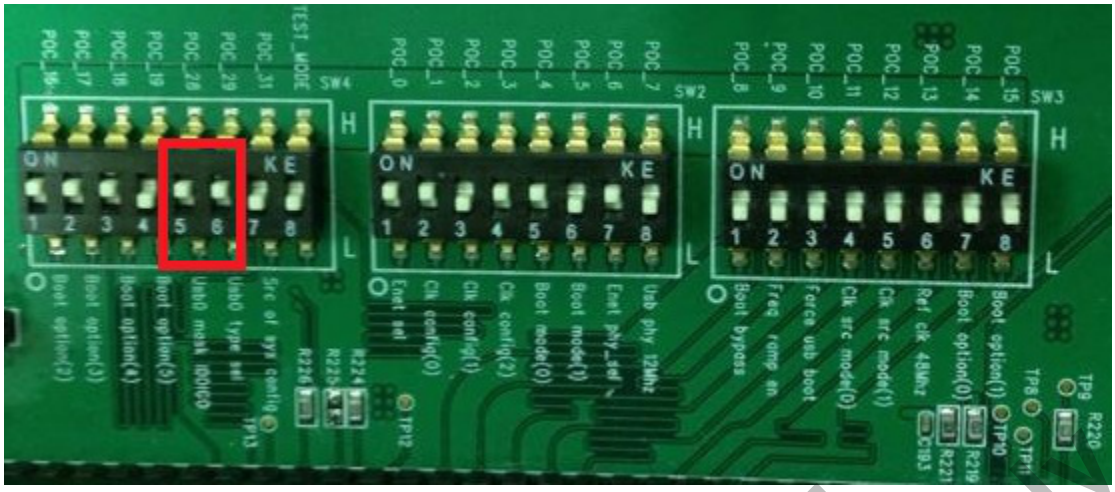


*Figure 3-1. Switch Pin 5 (USB Mask) and Pin 6 (USB Type) Reset USB by Host*

## 3.3 Start IQ Tuning with Amage: Initialize Sensor and Start Live-view

User should initialize the sensor and turn on the live-view at each reboot the EVK. The relative test commands are shown on below:

**Video Tuning:**

```
t vt init [sensorID][LcdID]
t vt lvst [modeId]
```

**Still Tuning:**

```
t st init [sensorID][LcdID]
t st lvst [modeId]
```

**IQTable:**

**Video AdjMode:**

```
t ve init [sensorID][LcdID]
t ve lvst [modeId]
```

**Still/Photo AdjMode:**

```
t se init [sensorID][LcdID]
t se lvst [modeId]
```

**APP:**

**Video Tuning:**

```
t app test chg_app 7
t app key mode video
=> insert usb cable
```

**Still Tuning:**

```
t app test chg_app 7
t app key mode still
```

```
=> insert usb cable
```

## 3.4 Start IQ Tuning with Amage: Switch USB Class

The user can switch the USB class between **Mass Storage Class** (**MSC**) and **Media Transfer Protocol (MTP)** class. Setting method is provided below:

Use the test command:

```
t mspusb init_device mtp
```

Note: The user will need to perform steps provided in Sections 3.3 and 3.4 at every reboot.

Note: After changing the USB class, the EVK would keep the preference until the user loads the new firmware to the EVK.

Type the following commands on the terminal:

- t svc pref msc/mtp
- t svc pref save
- reboot yes

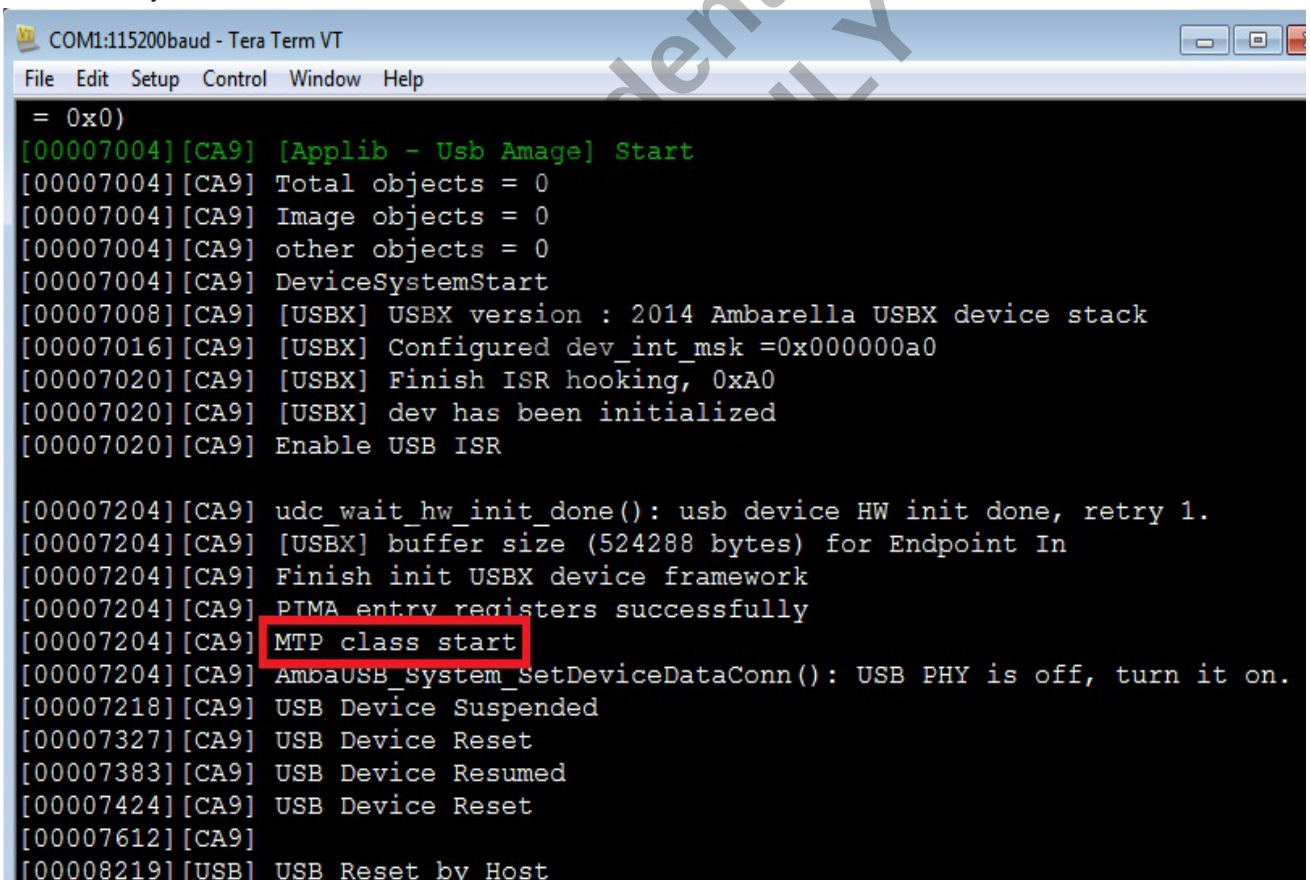



*Figure 3-2. If USB Class is MTP, Tera Term shows logs with "MTP class start" while USB Cable is Connected between EVK and PC.*

## 3.5 Start IQ Tuning with Amage: Enable Button of Amage

- Choose MTP/USB.
- Click **Connect** Button (button is red before connection is established).


*Figure 3-3. Connect Button Turns Green after Successful Connection*

**Amage** now supports **Video OnlineTuning** and **Still Raw Encode**. EVK would keep the tuning mode as the video mode when the user presses the Connect button on the Video OnlineTuning page. The user can switch tuning mode between video and still mode by pressing the Connect button on the respective pages.

# 4 Amage Video Tuning

## 4.1 Video Tuning: Overview

Video tuning is performed for live preview at varying exposure levels.

The chapter is organized as follows:

- (Section 4.2) Video Tuning: Function Operation
- (Section 4.3) Video Tuning: Steps for Enabling Video Tuning

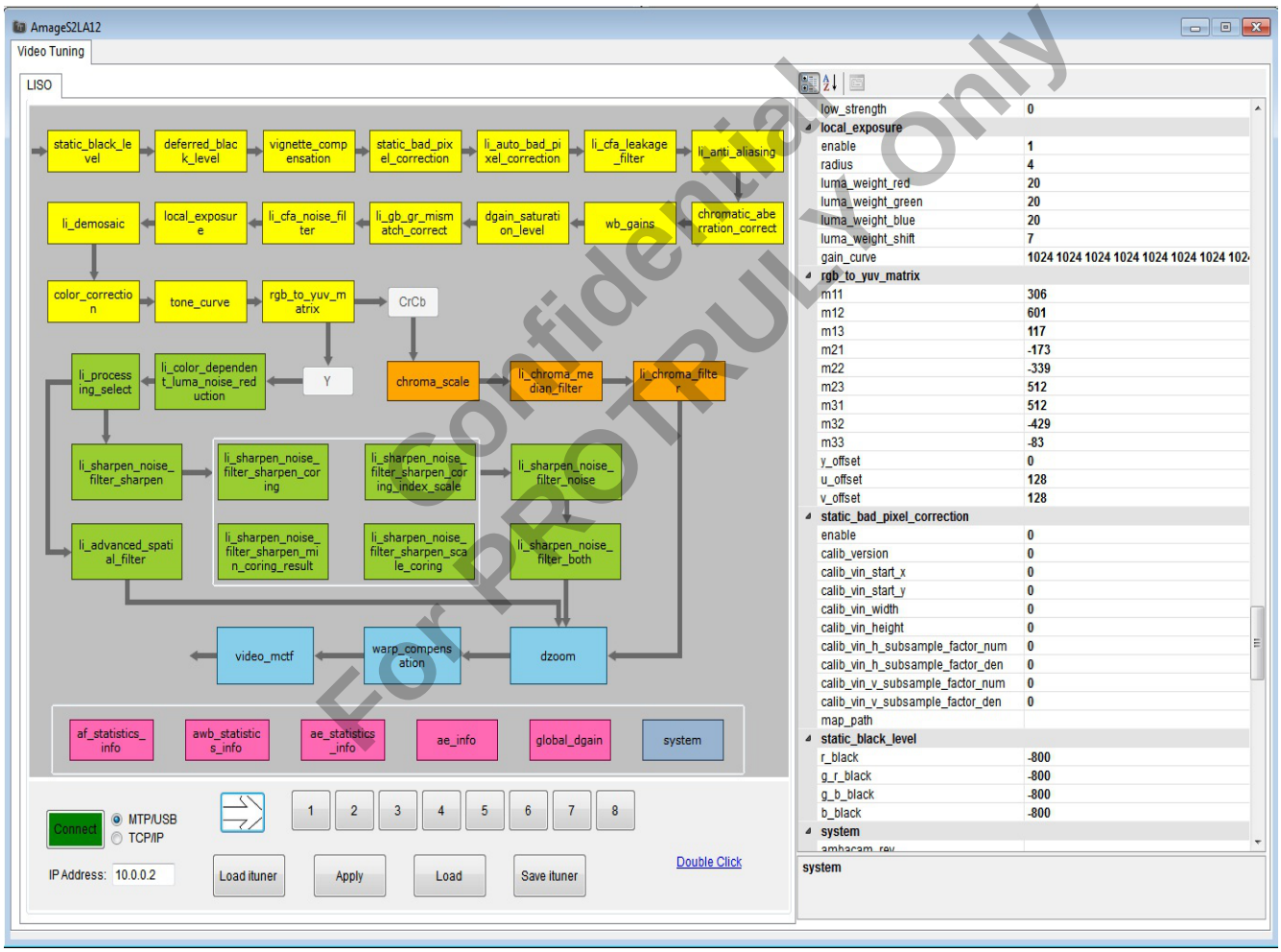




*Figure 4-1. Amage > Online Tuning*

## 4.2 Video Tuning: Function Operation

The **Amage > Video Tuning** provides the Amage user, given a **Ituner File**, to simulate different filter parameters applied on it to get the corresponding results.

### 4.2.1 Main Function Operation

- **Load ituner:** Load a given set of parameters to Amage.
- **Save ituner:** Save all parameters on the right side as a text file, and automatically save the relative binary file at the default data folder (Double-click on the **Save ituner** button at the bottom of the **Video Tuning** screen)
- **Apply:** Apply all parameters and binary files to complete the online tuning.
- **Load:** Load file with values for all parameters.
- **Arrow Icon:** Record 10 configurations at most. Users can switch to different configurations with ease. Click the icon. Amage records the parameters on the function dialogue. Press hard key **Shift** and simultaneously click **Left Mouse** on the specific configuration to delete it.


*Figure 4-2. Arrow Icon for Recording a Maximum of 10 Configurations. Press hard key **Shift** and simultaneously click **Left Mouse** on the specific configuration to delete it.*



### 4.2.2 Other Function Operation: Tuning Curves

Press Amage **tone_curve** icon: Show the Tune curve window according to its coring tables.
Press **Table** or **Curve:** Choose enter the curve or to drag the curve.

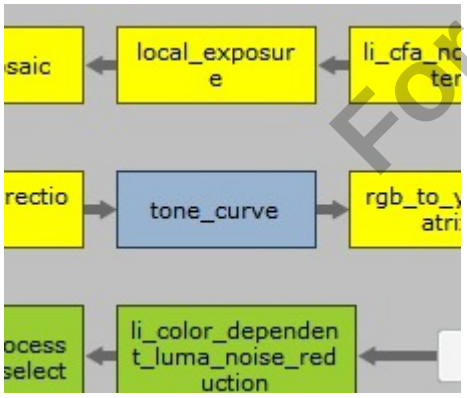



***Figure 4-3. Amage > tone_curve** Icon*

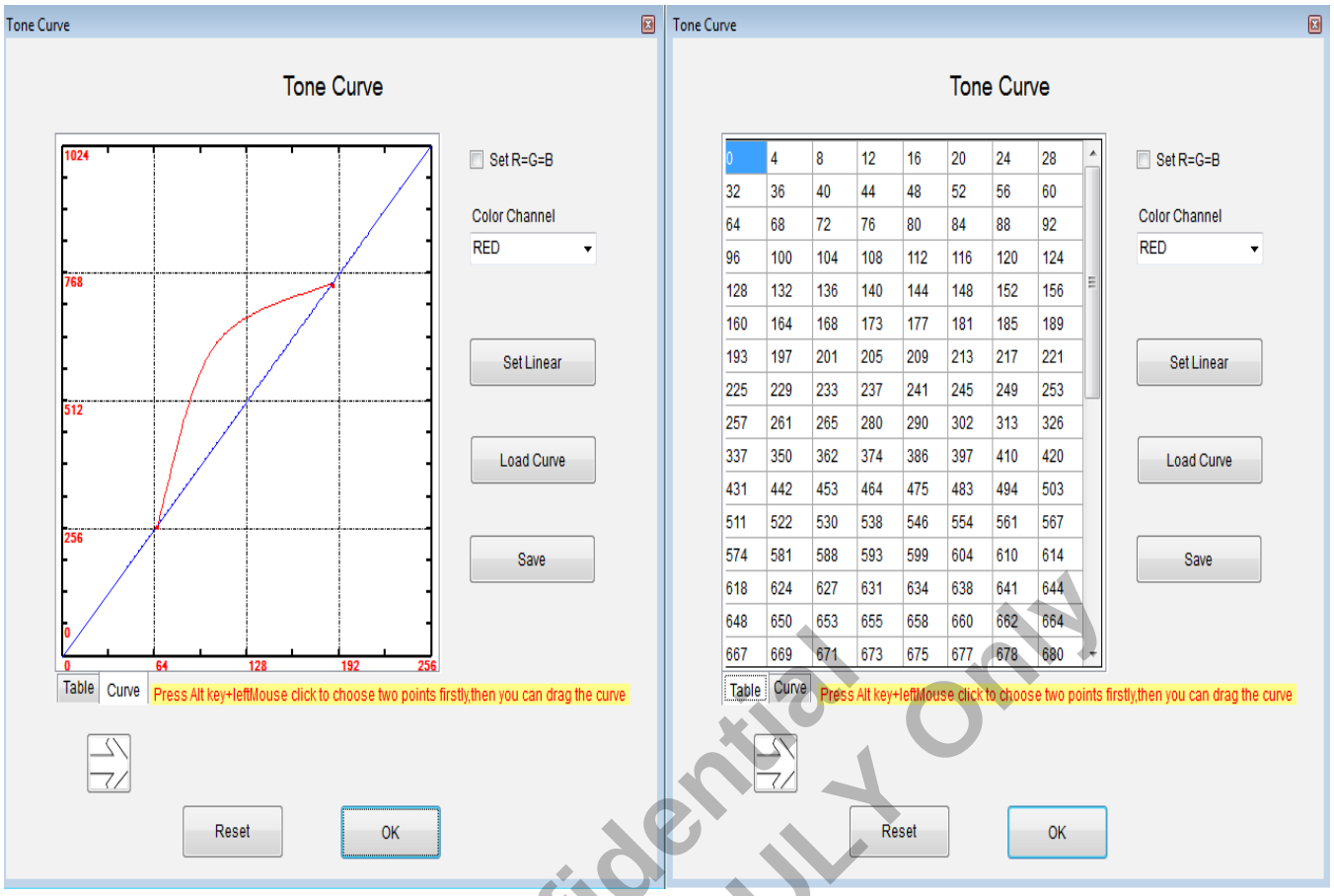



*Figure 4-4. Amage > Online Tuning Curve Setting Dialogues*

- **Set Linear** creates a straight line.
- **Drag Curve** allows the user to drag the curve by moving the mouse. Click hard key **Alt** and simultaneously click **Left Mouse** to choose two points and drag the curve between the two points.
- **Load Curve** and **Save Curve** options to allow to load or save curve data. The curve data is saved as.// data/xxx_curve.txt or .//data/xxx_curve.bin for an example.

**Note:**
Tone curve should be monotonically increasing.

**Tips:**
Each curve also corresponds to its own table. **Amage** allows users to modify tables with spreadsheets for convenience. Users can copy values from spreadsheets and paste them to tables in Amage or copy values and paste them to the spreadsheet.



### 4.2.3 Other Function Operation: Color Correction

The color correction (**CC**) dialogue requests the color correction register (**Reg**) and a **3D table** file. User can enter the binary file path on the right panel of **reg_path** and **three_d_path** and press **Apply,** the binary file and ituner file would sequentially pass through USB. User can click **Load**, Amage gets the current **CC** settings on the EVK. Click **saves ituner,** Amage would save them as .//data/reg_hour_minute_second.bin and .//data/3d_hour_ minute_second.bin automatically.

The calibration table (e.g. chromatic aberration correction table, warp compensation table, vignette compensation table, and static bad pixel correction table) needs a specific binary file as per the sensor information. When users enter the file path on the right panel at the corresponding space, Amage sends the file if the path is not empty. The video tuning tool is efficient, if it detects requests multiple times, it will filter the request and send the binary file only once.

## 4.3 Video Tuning: Steps for Enabling Video Tuning

1. Click **Load ituner** to Load a given ituner.txt.
2. Change the parameter of the specific filter to the desired value on the right panel. Be careful with the correctness of the file path, such as CC reg_path,...,etc.
3. Click **Apply** to send the whole ituner setting to EVK. The process takes time to finish.
4. (Optional) Click **Load** to Load ituner from EVK.
5. (Optional) Click **Save ituner** to save a set of preferred settings as a text file for future use. The **ituner** file saves the user specified path and the CC Binary file in the default folder.

# 5 Amage Still Tuning

## 5.1 Still Tuning: Overview

Amage Still tuning mode performs the still raw encode process, which uses the raw input file to simulate and apply different filter parameters and obtains the corresponding result in the JPG format.

The chapter is organized as follows:

- (Section 5.2) Still Tuning: Function Operation
- (Section 5.3) Still Tuning: Steps for Enabling Still Tuning

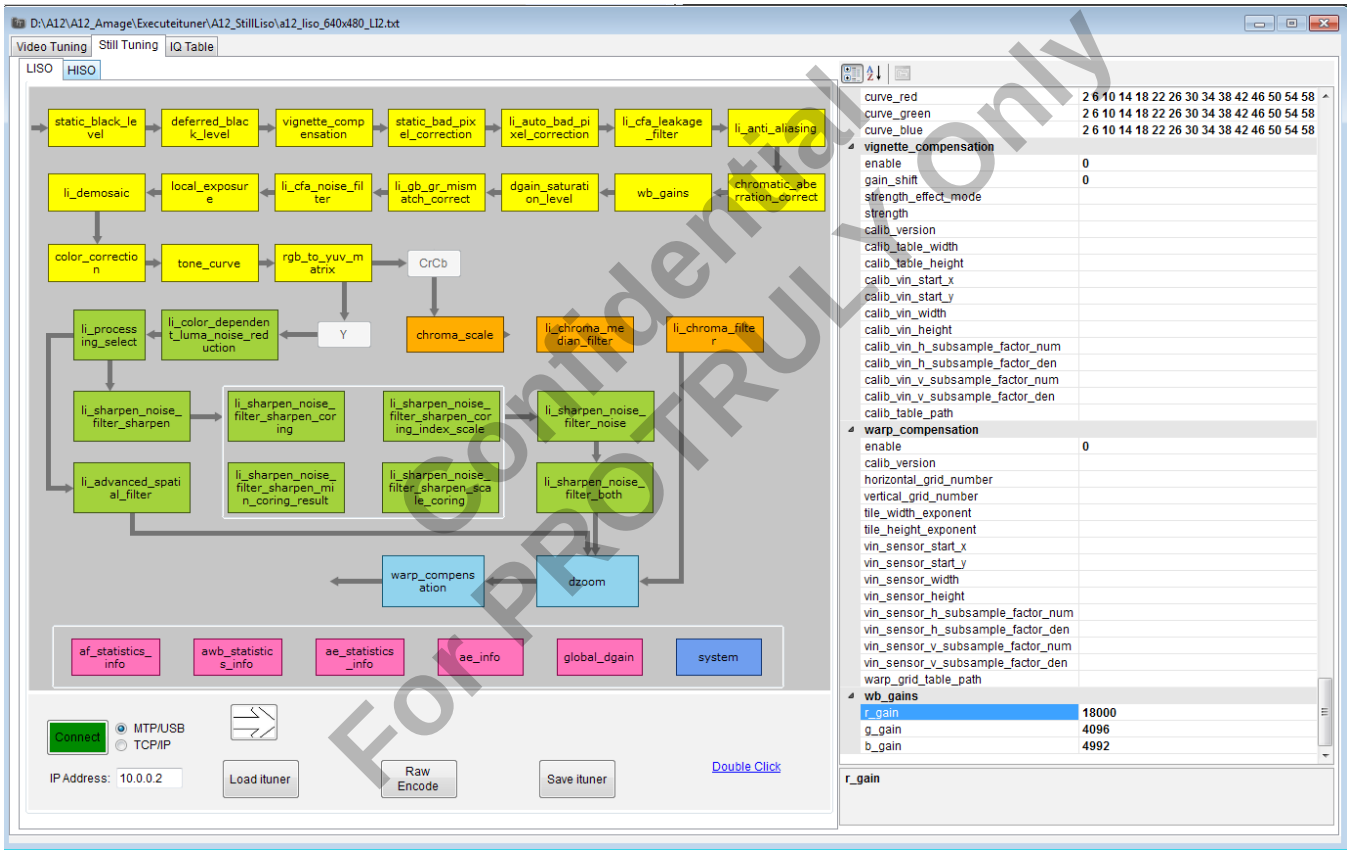



*Figure 5-1. Amage > Still Tuning*

Amage shows the image processing pipeline as tabs at the top of the screen where each tab directly links to the corresponding parameters on the right side.

**Note:**

1. This function is only supported in the photo preview mode.
2. Click **Still Tuning > Connect** to change the video mode to the still mode.
3. Choose **LISO** panel and **HISO** panel to change the tuning mode
4. For the Still Tuning mode, Amage turn off 3A automatically.

## 5.2 Still Tuning: Function Operation

The **Amage > Still Tuning** provides the Amage user, given a **Ituner File**, to simulate different filter parameters applied on it to get the corresponding results.

### 5.2.1 Still tuning: Main Function Operation

- **Load ituner:** Load a given set of parameters to Amage.
- **Save ituner:** Save all parameters on the right side as a text file
- **RawEncode:** Apply all parameters and binary files to complete the still raw encode process. automatically save the relative binary file at the default data folder (Double-click on the **Save ituner** button at the bottom of the **Still Tuning** screen.
- **Arrow Icon:** Record 10 configurations at most. Users can switch to different configurations with ease. Click the icon. Amage records the parameters on the function dialogue. Press hard key **Shift** and simultaneously click **Left Mouse** on the specific configuration to delete it.


*Figure 5-2. Arrow Icon for Recording a Maximum of 10 Configurations. Press hard key **Shift** and simultaneously click **Left Mouse** on the specific configuration to delete it.*



### 5.2.2 Still tuning: Other Functions

- Tuning Curves: Refer to Section 4.2.2
- Color Correction and Calibration Table: Refer to Section 4.2.3. In the Still Tuning mode, it would transmit the Color Correction and Calibration table when enabled.
- Raw File: Users should set the raw path at the right panel of the system.raw_path part. Amage would pass the raw file automatically through the USB. If the Raw file size is very large, users may lose some time on the transmission.

## 5.3 Still Tuning: Steps for Enabling Still Tuning

1. Click **Load ituner** to Load a given ituner.txt.
2. Change the parameter of the specific filter to the desired value on the right panel. Be careful with the correctness of the file path, such as raw file, CC reg_path,...,etc.
3. Click **Raw Encode** to complete the encoding process and save the JPEG file that is generated automatically. The process takes time to finish.
4. (Optional) Click **Save ituner** to save a set of preferred settings as a text file for future use.

# 6 IQTable Mode

## 6.1 IQTable: Overview

The **Amage IQTable** mode provides two major functions to process the Adj table.

**AdjBinEditor** provides an user interface to edit the adj binary file.
**AdjTable Mode** sends the edited Adj table directly to the DRAM.

## 6.2 AdjBinEditor

### 6.2.1 AdjBinEditor: Overview

**AdjBinEditor** is a tool for editing the ADJ binary file that is dumped from the SDK6 platform shell (Please refer to the document *Usage of SDK6 ADJ bin file test command*). This chapter is divided into the following sections:

- (Section 6.2.2) AdjBinEditor: Manipulation
- (Section 6.2.3) AdjBinEditor: Editor Overview
- (Section 6.2.3.1) AdjBinEditor: Non Scene Mode Editor
- (Section 6.2.3.2) AdjBinEditor: Scene Mode Editor



### 6.2.2 AdjBinEditor: Manipulation

1. Choose the Adj type for the bin file.
2. Click **Open** or **New.** This opens a corresponding editor.

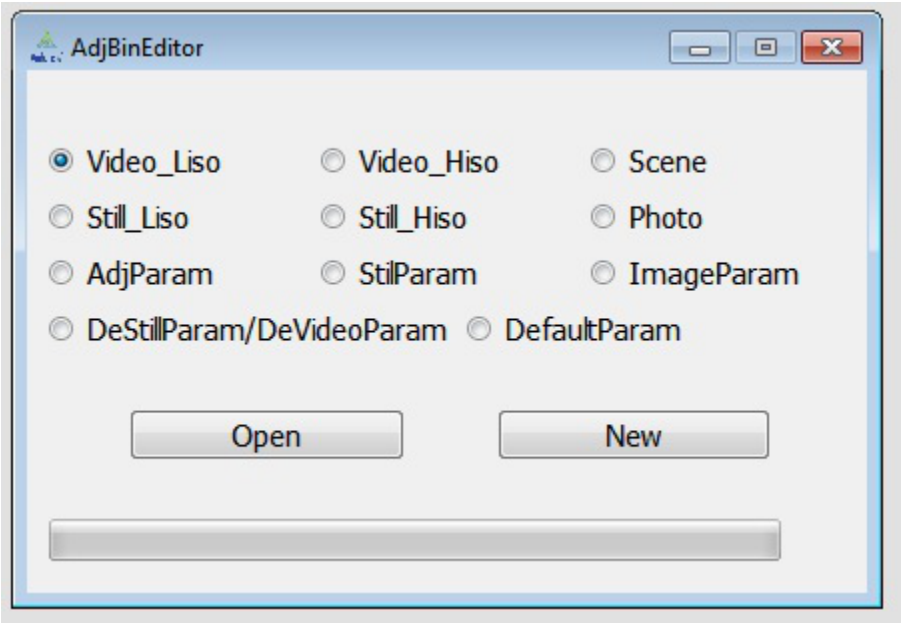



*Figure 6-1. AdjBinEditor*

### 6.2.3 AdjBinEditor: Editor Overview

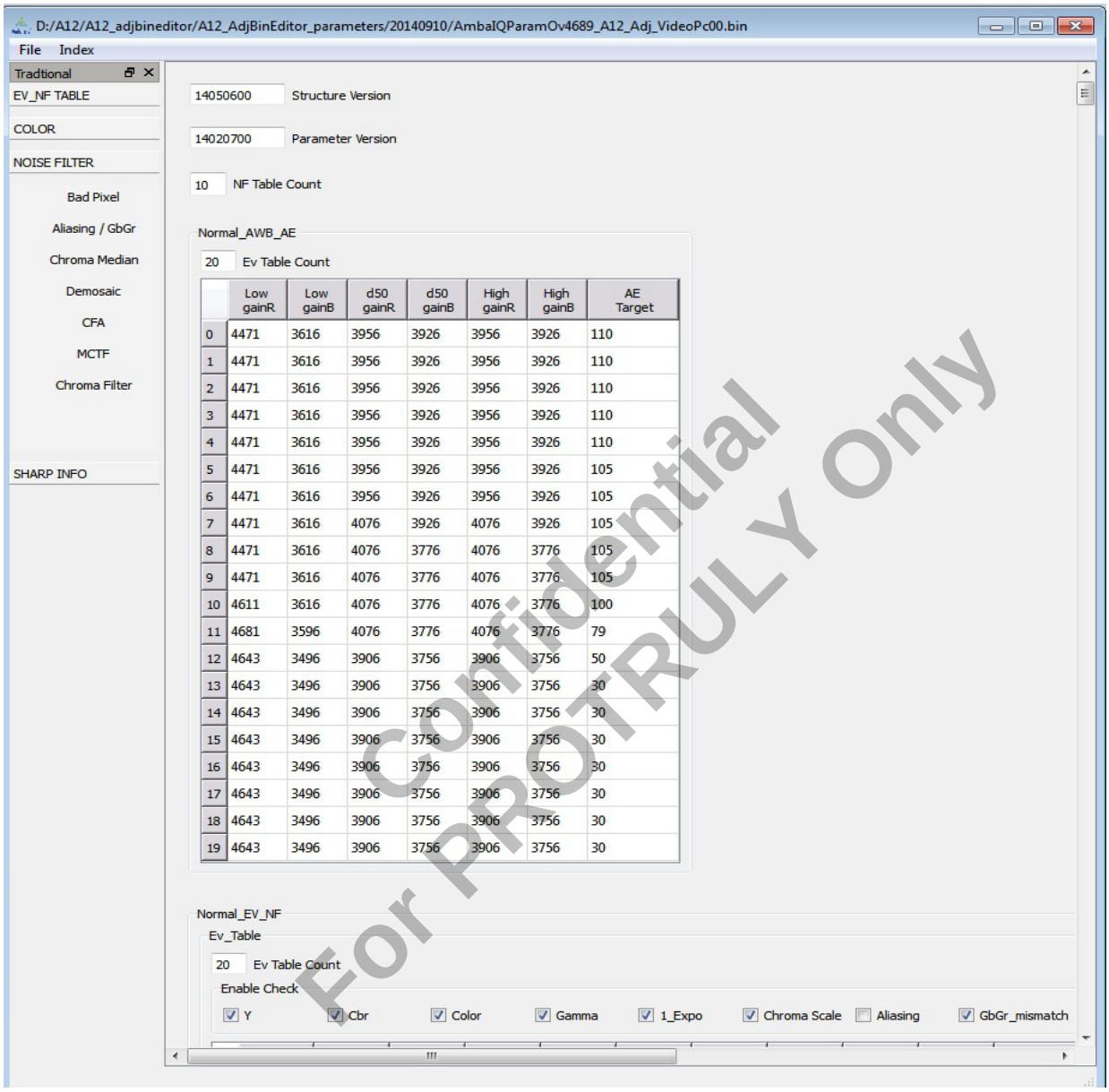



*Figure 6-2. Editor for Video_Liso, Still_Liso, and Photo Binary File*

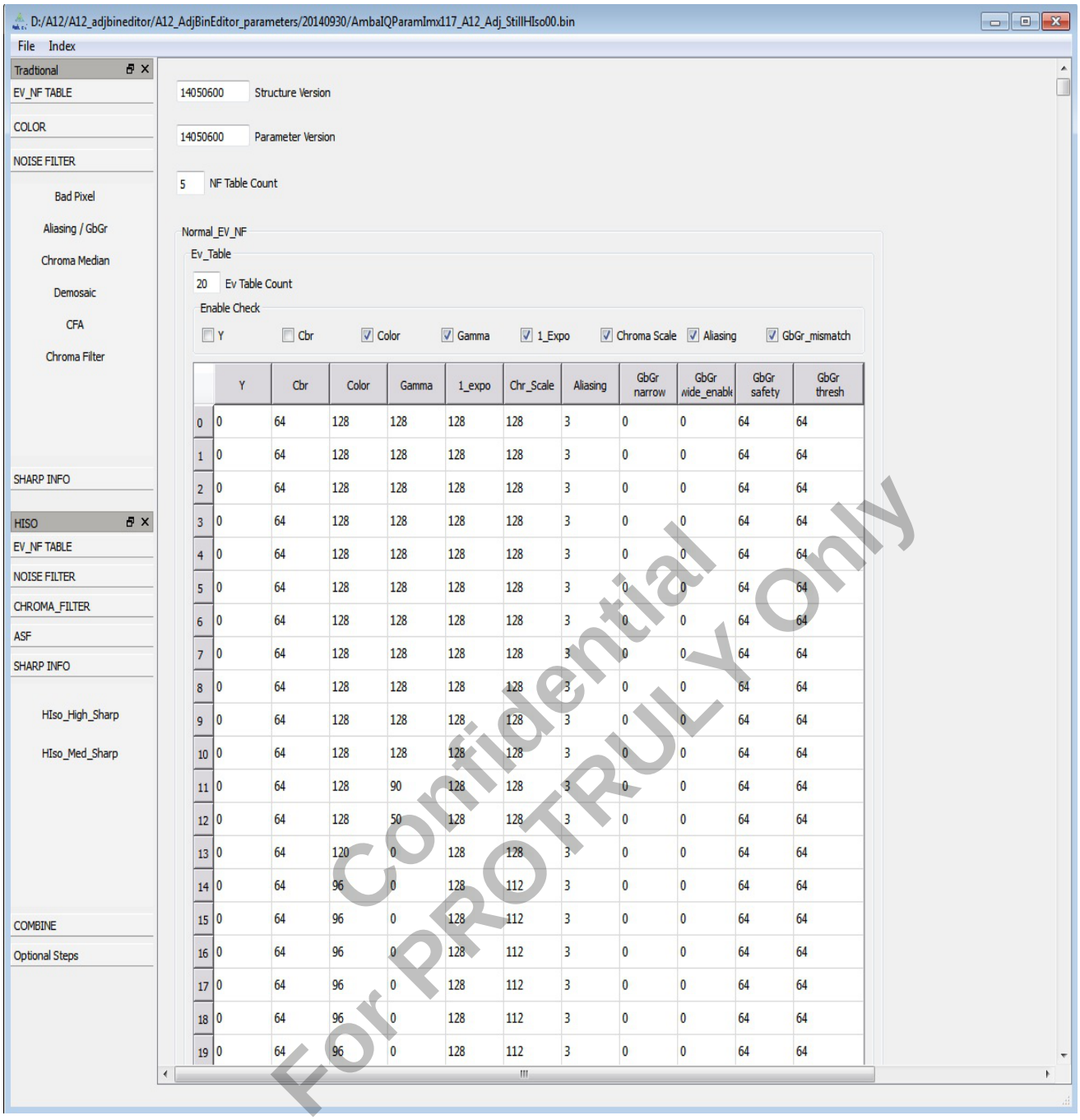




*Figure 6-3. Editor for Video_HISO and Still HISO Binary File*

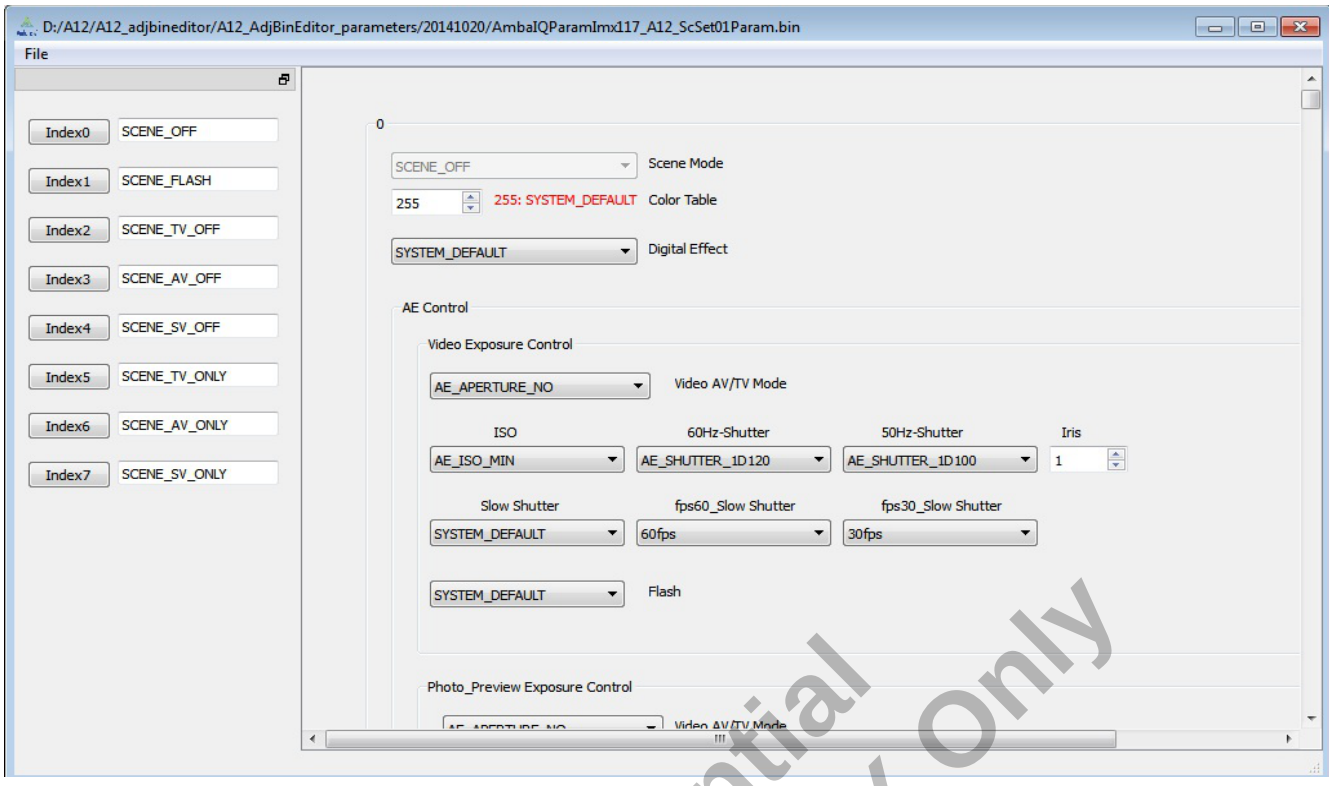


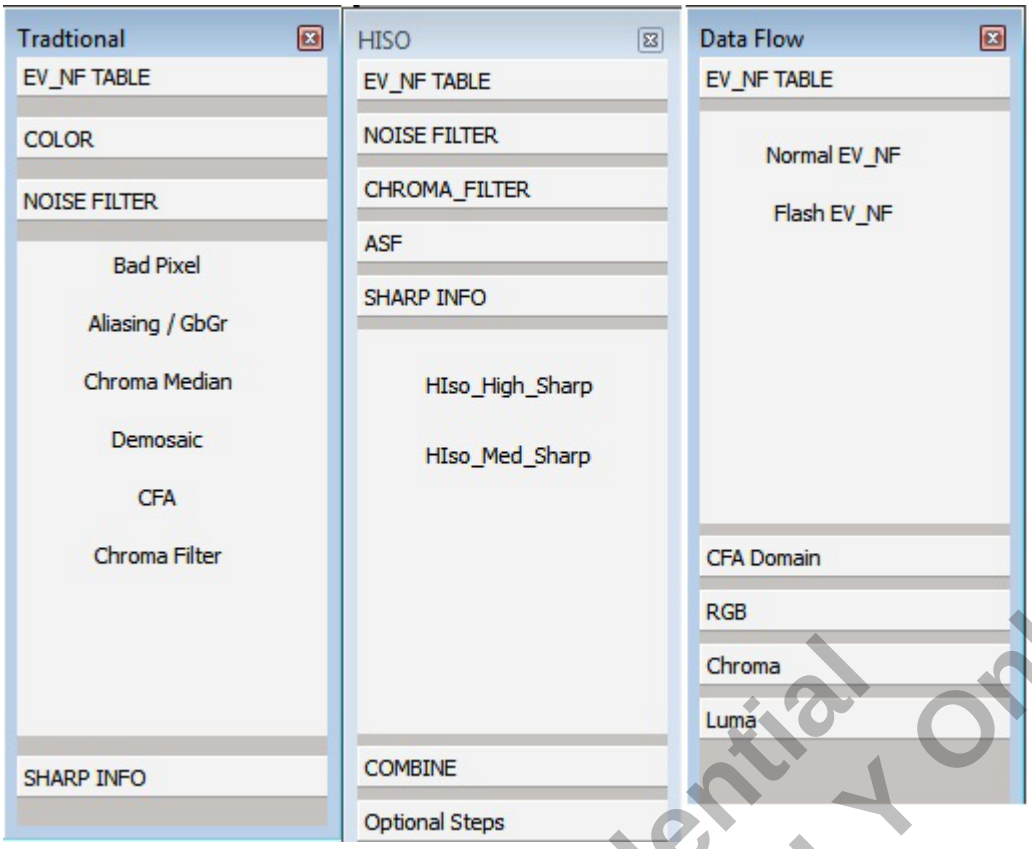

*Figure 6-4. Editor for Scene Mode*



### 6.2.3.1 AdjBinEditor: Non Scene Mode Editor

The Menu bar has the following options:

- **File**
  - Save
  - Save As
- **Index** provides buttons that link to the corresponding filter on the editor, and the button permutation could be selected through the following two ways:
  - Traditional
  - Data Flow
  - For Still_Hiso and Video_Hiso type: AdjBinEditor provides HISO index button which can link to the part of the HISO filter.




(a) (b) (c)

*Figure 6-5. Index Buttons (a) Bottom with Traditional Order, (b) Bottom with Data Flow Order, (c) HISO Index Bottom*



- **Table Count** indicates the maximum row size of the related tables.
  - Ev Table Count: The maximum number is limited to 25.
  - Nf Table Count: The maximum number is limited to 10.
  - Shutter Table Number: The maximum number is limited to 25.

### 6.2.3.2 AdjBinEditor: Scene Mode Editor

The Menu bar has the following options:

- **File**
  - Save
  - Save As
- **Index widget** provides 8 buttons that can link to a set of scene data respectively and shows the type of scene data.


*Figure 6-6. Index Widget on Scene Mode Editor*

## 6.3 AdjTable Mode: Enable AdjTableMode

Amage>IQ Table transmits the adj binary file to the DRAM, and produces the result immediately

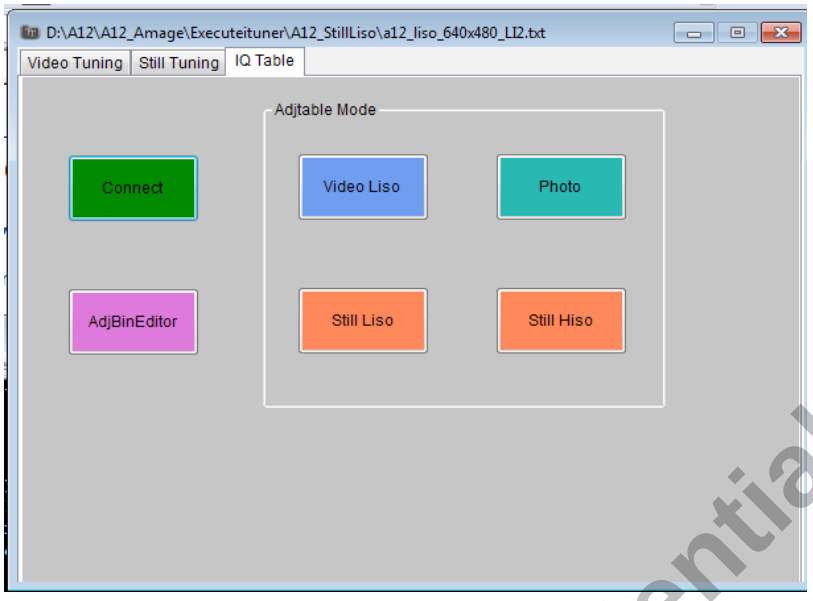



*Figure 6-7. Amage > IQtable Mode*

1. Turn on the EVK and choose mode (Video Liso->Video Mode, StillLiso,StillHiso,Photo->Still Mode).
2. Switch to the MTP Class.
3. Press connect bottom to connect to the USB.
4. According to the type of Adj binary file, choose the corresponding bottom, then, choose the file that the user intends to to send.
5. The effect of Video Liso and Photo Preview mode shows directly on the liveview. Still LISO and Still HISO effects are shown on the capture file. User can save it through the SD card.

# 7 Frequently Asked Question

**Question 1:** On clicking the **Connect** button, why does the user see a pop-up window showing “Cannot read DLL ‘.\lib\htPTPlib32.dll”?

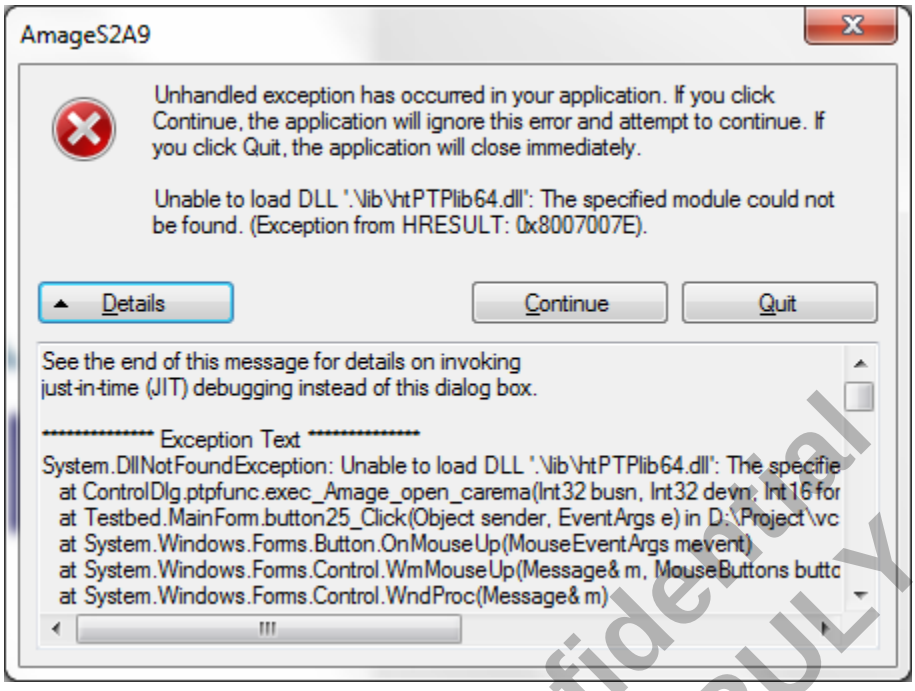



*Figure 7-1. Error Message.*

**Answer:** The user sees the message as the DLL file is missing. This issue can be resolved by installing **libusb**. The user can follow the instructions in the Amage document to install **libusb** on the PC correctly.

# Appendix 1 Additional Resources

Please contact an Ambarella representative for information on additional resources of potential interest.

- *SDK6 API: Image Kernel*
- *SDK6 API: Camera*
- *Usage of SDK6 ADJ bin file test command*

# Appendix 2 Important Notice

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# Appendix 3 Revision History

NOTE: Page/chapter numbers for previous drafts may differ from those in the current version.

| Version | Date | Comments |
|---|---|---|
| 1.0 | 14 NOVEMBER 2014 | Initial Release |
| 1.1 | 4 DECEMBER 2014 | Updated Section 4.3.2 |
| 1.2 | 30 MARCH 2015 | Added Sections 2.3, 3.3, 6.1, 6.3, and Chapter 5<br>Updated Sections 2.2, 2.4, 4.2.1, 4.2.3 |
| 1.3 | 12 AUGUST 2015 | Added Chapter 7: Frequently Asked Question |
| 1.4 | 22 SEPTEMBER 2015 | Added Sections 3.1.1: Amage Tool Path and 3.1.2: Connections<br>Updated test commands in Section 3.3: Initialize Sensor and Start Live-view and 3.4: Switch USB Class |
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*Table A3-1. Revision History.*