



凌陽科技
SUNPLUS

SPA Tuning Tool User Guide

For SPA100/300 Version 2.0.2 2021/7/12

Revision History

Revision	Date	By	Remark	Page Number(s)
V 1.0.0	2020/10/27	Ping Xu	Edition	All
V 1.1.0	2020/10/30	De-Quan Liu	Added Audio module instruction	
V 1.1.1	2020/12/30	Hao Su	Added Spatial Sound III、Spatial Sound IV module	
V 1.1.2	2020/12/30	Yi-Xuan Jiang	Added Spatial Sound module description for Tool	
V1.1.3	2021/1/13	Ping Xu	Revised tool version message	
V1.1.4	2021/1/26	Hao Su	Revised tool version message	
V1.1.5	2021/1/28	Ping Xu	Revised tool version message	
V1.1.6	2021/2/24	Ping Xu	Revised tool version message	
V2.0.0	2021/5/24	Hao Su	Tool V2.0 Version Update Instructions	
V2.0.1	2021/6/25	Ping Xu	Update image of DTS:X page in Certification Option	
V2.0.2	2021/7/12	Ping Xu	Introduction of major version updates and software packages. Connection instructions, Dolby XML Setting, Certification Option and adding module mode.	

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1 INTRODUCTION

1.1 Tool Introduction

The SPA Tuning Tool provides a graphical interface to tune audio online. It also supports directly uploading after testing. The current sound processing includes: Filter、Bass、MatrixMix、DRC、Delay、DTS Virtual:X、Volume、Spatial Sound III、Spatial Sound IV。

1.2 Supported Models

Support online tuning of SPA100/300 models.

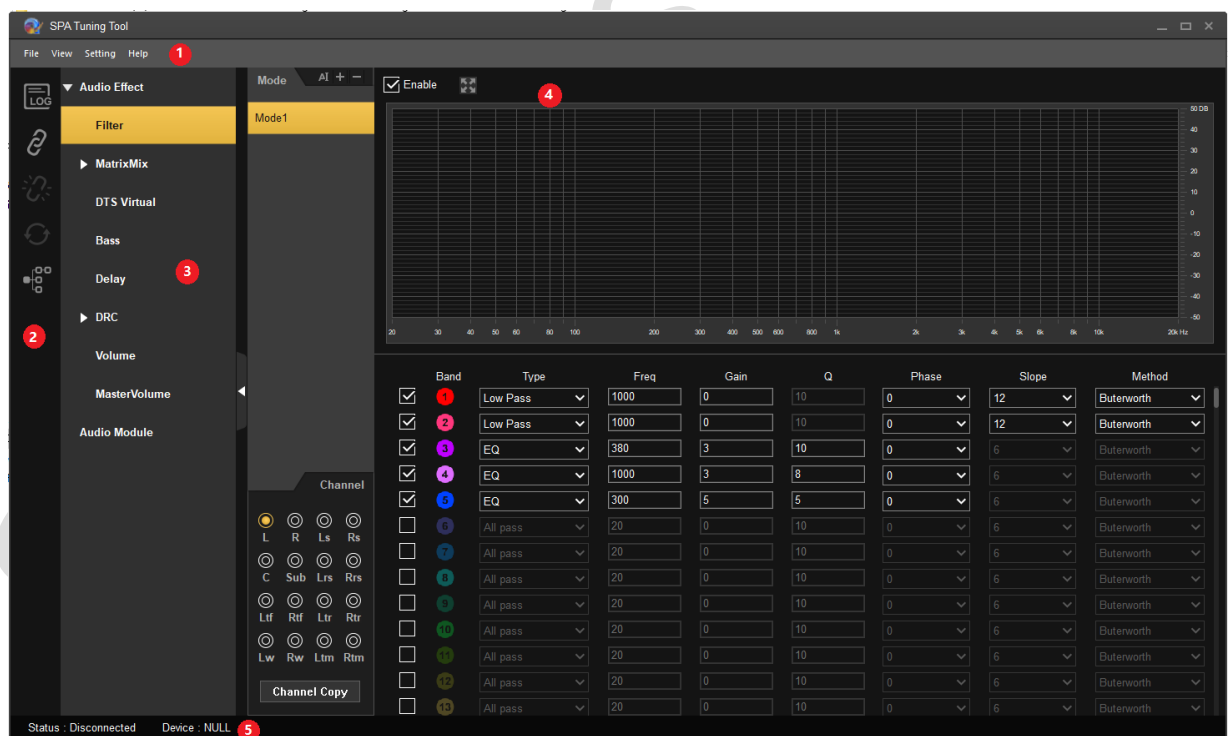
1.3 Corresponding Tool Version

This document is written in accordance with Tool V2.0.2.6.

The current tool version does not support platform SDK versions MJ1.2 and all previous versions.

1.4 Interface

Tool UI consists of five parts, namely the menu bar, shortcut keys, module list, content area, and status bar. The interface is as follows:



- Menu bar: mainly contains the main menu: File (Submenu: Import Audio Setting(*.xml)、Export Audio Setting(*.xml)、Apply Audio Setting、Update Audio Setting、Dolby XML Setting、Exit)、View (Submenu: Audio Signal Flow、DSP Status、Digital Level Meter、Certification Option、Expand All、Collapse All)、Setting (Submenu: Connect Platform、

Disconnect Platform)、Help (Submenu: About SPA Tuning Tool...)。

2、Hot Key: Main functions include: log interface display



、device connection



(consistent with the menu's Connect Platform function)、device disconnection



(consistent with the menu's Disconnect Platform function)、data synchronization



Audio Signal Flow interface display



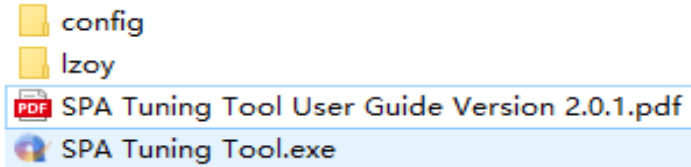
(consistent with the menu's Audio Signal Flow function)。

- 3、Module list: Contains the modules to be debugged online; currently supported modules are: Filter、Bass、MatrixMix、DRC、Delay、DTS Virtual:X、Volume、Spatial Sound III、Spatial Sound IV。
- 4、Content area: The parameters to be debugged for each module are displayed here;
- 5、Status bar: Mainly display the connection status and device;

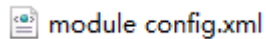
2 User Instruction

2.1 Software Package Introduction

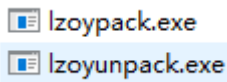
SPA Tuning Tool Software Package includes the following main files (Losing any following files will prevent the tool from operating normally. Please keep the folder complete):



- Config contains configuration files of modules shown in the following image:



- Lzoy contains files as the image below:

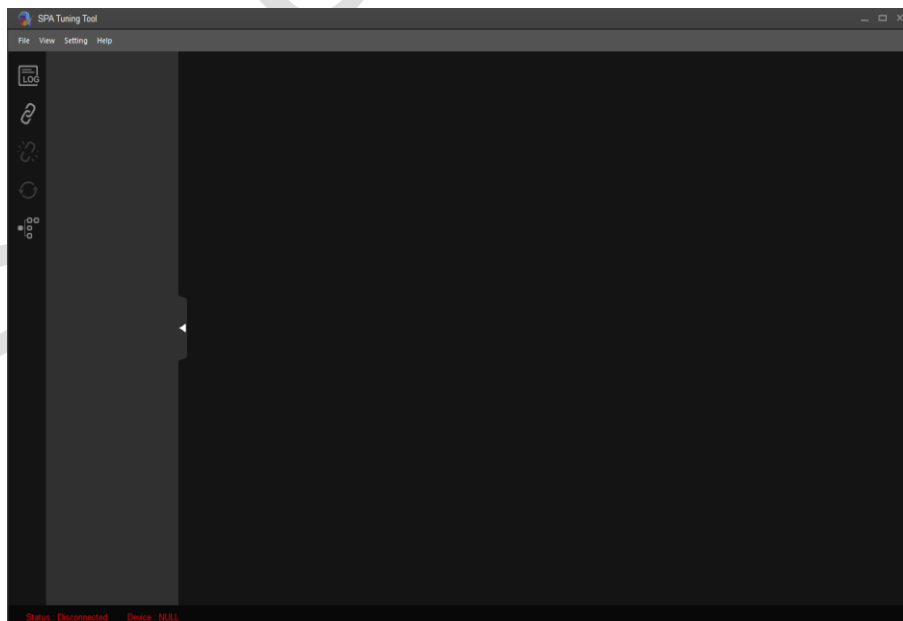


- SPA Tuning Tool .exe is the main program
- SPA Tuning Tool User Guide Version x.x.x.docx is the user manual;

Note: The three files: module config.xml、lzoypack.exe、lzoyunpack.exe in directories Config and Lzoy are essential. The losing of these files will prevent the program from operating normally.

2.2 Open Software

1、After starting the software, there will be a starting window (No module is configured yet) As shown in the following image:



2、 At this time, the platform is booted, click the device connection button in the shortcut key or the Connect Platform in the menu bar, the device connection interface will be displayed; it supports two communication methods, UART and USB; on the interface, you can switch to the required communication method by clicking UART or USB, and then select the device that needs to be connected. Click ok to connect, as shown below: (Note: USB devices are default to Host. Click cmd to change it into Device or edit the default USB setting in cfg_sdk.c before connecting to Tool)

- Method of switching USB Host / Device by cmd:

host: usbswitch 1

device: usbswitch 0

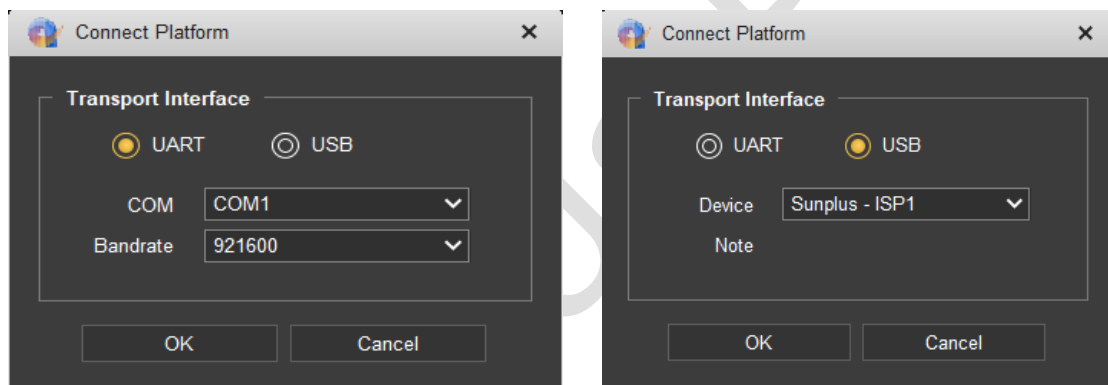
- USB Host / Device default setting at Power On:

.CFG_USB_TO =

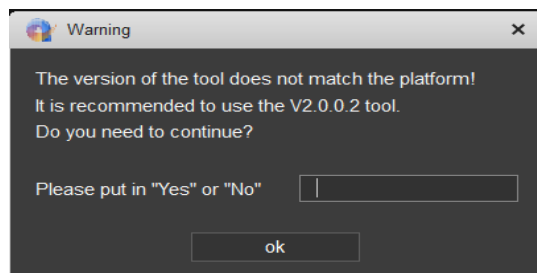
{

.DefaultMode = eUSB_HOST_MODE, change to eUSB_DEVICE_MODE

},

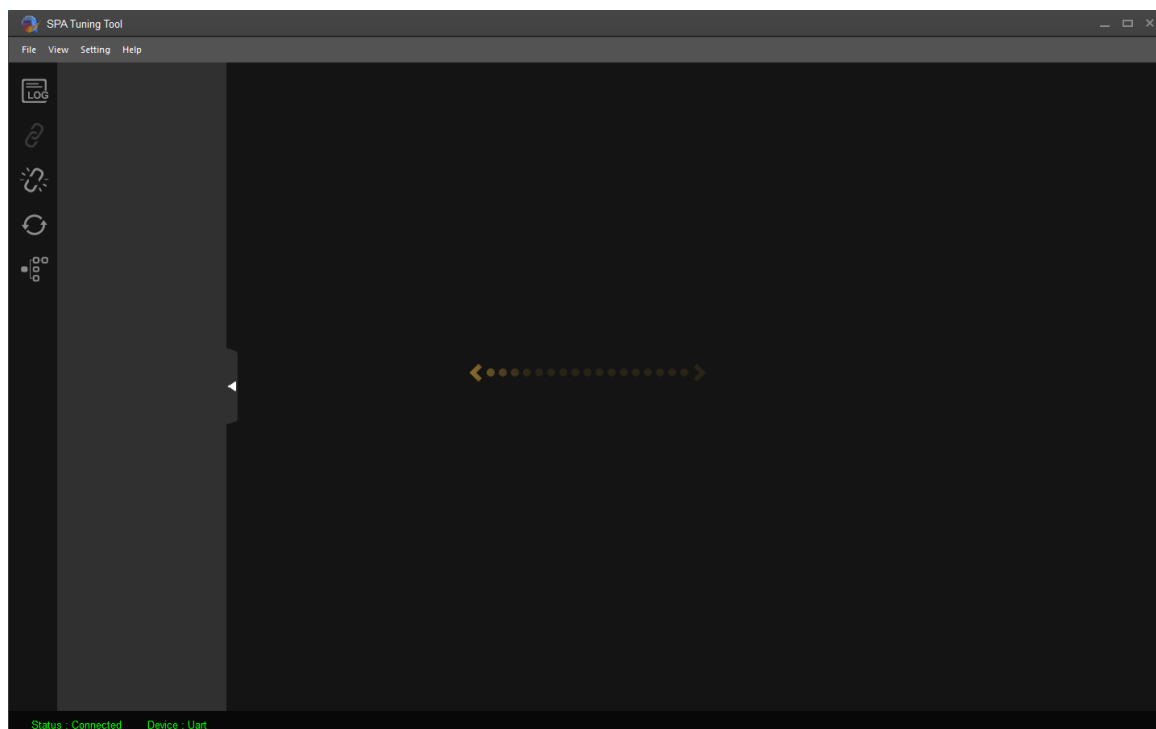


3、 If the version of the tool does not match the platform, a warning window will pop up. Entering “Yes” and clicking “Ok” will proceed to connect the tool to the platform. If other characters are entered or leaving it empty before clicking “OK”, the tool will not connect with the platform. The warning popup window is shown below: (Note: When this warning window pops-up it is recommended to update tool to the matching version as for platform. Not updating might cause that some parameters and commands can not be tuned normally. In addition, this window does not support clicking “Enter” key to confirm selection)

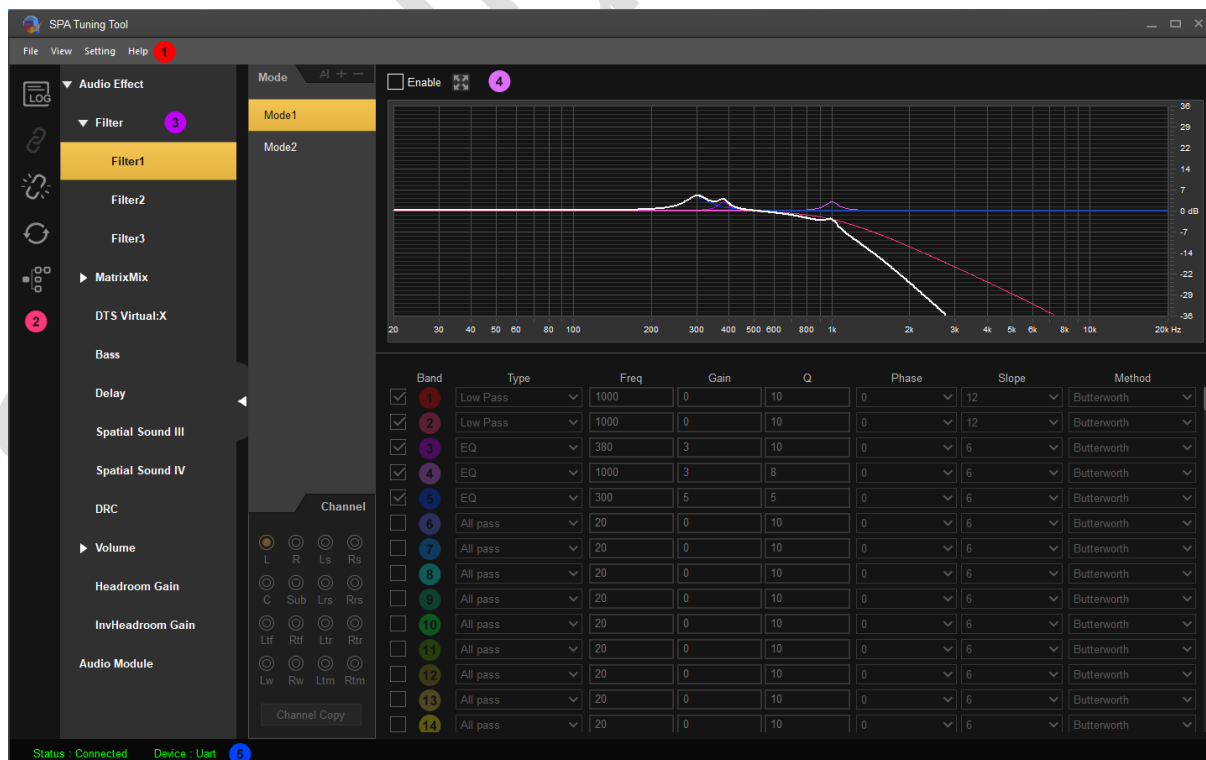


If the platform matches the version of the tool. After clicking “connecting” in the last step, the platform will send module configure data to Tool and present it as UI on the tool. The loading screen is

shown below:



4、Once Tool completes module data configuration, connection status will be displayed as “Connected” and the tool will be available for tuning, as shown below:

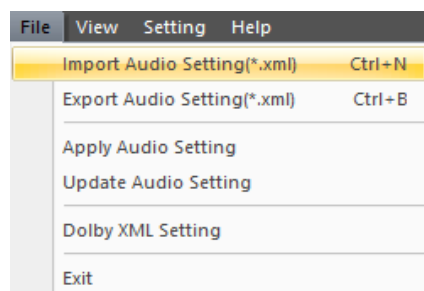


2.3 Menu

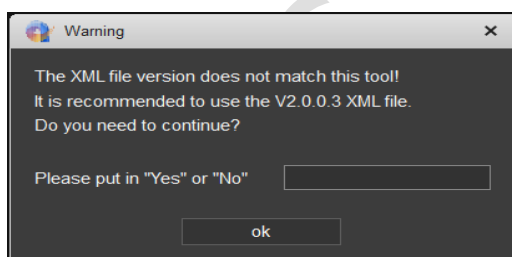
2.3.1 File

2.3.1.1 Import Audio Setting(*.xml)

After Importing SPA Tuning Tool config.xml, the tool displays functions of config.xml. The function option is shown below:

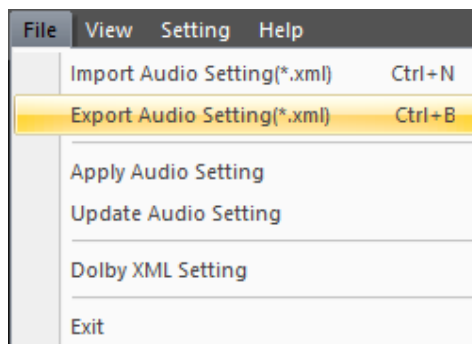


If the imported .xml file version is not compatible to the tool version, importing .xml files may cause **parameter loss**. (Note: It is recommended to import the latest version of xml) The warning message is shown below:



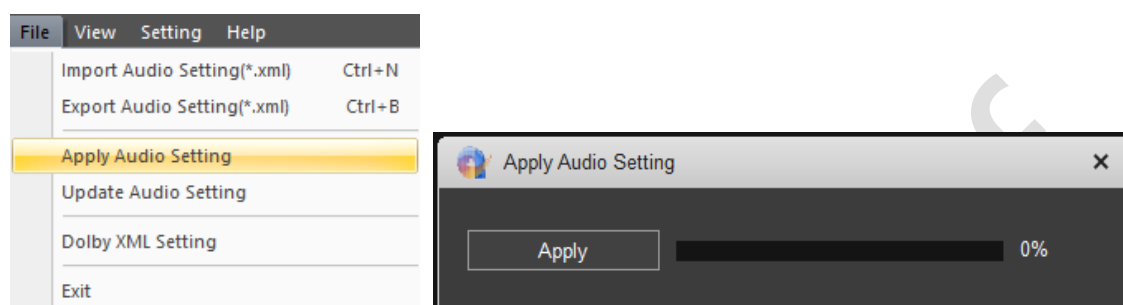
2.3.1.2 Export Audio Setting(*.xml)

After the audio parameters are adjusted, you can save the adjusted parameters and modules by exporting the xml file, and you can debug it again on the basis of the previous one when you turn it on again. The options are shown below:



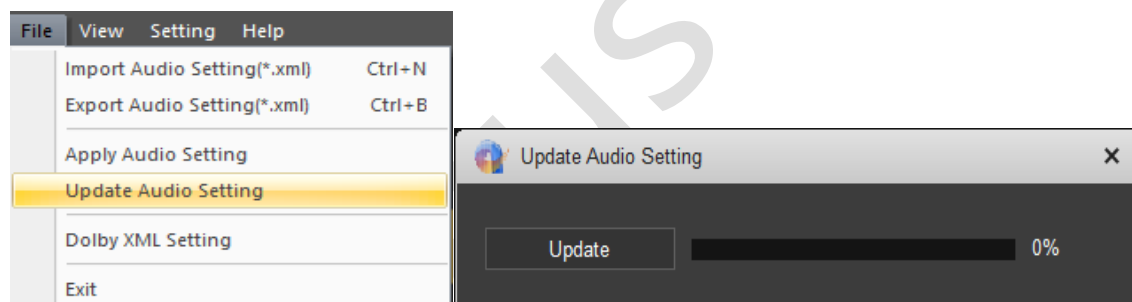
2.3.1.3 Apply Audio Setting

Apply the current audio settings on the tool to the platform to test online. (Note: it is not saved in flash). Restarting the platform will revert the audio settings back to the previous settings. The menu option are shown below:



2.3.1.4 Update Audio Setting

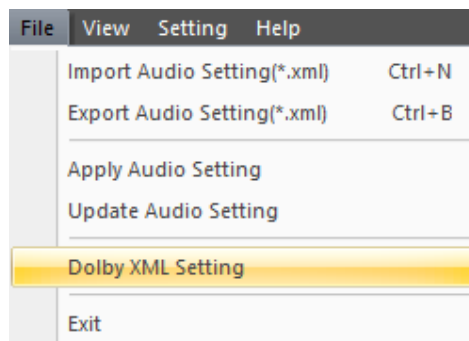
Update the current audio settings on the tool to the platform flash. Restarting the platform will activate the updated settings. The menu option and window are shown below:



2.3.1.5 Dolby XML Setting

File transfer: The platform supports Dolby XML transfer. When the file is transferred to the platform, it will be saved to the platform flash. After restarting the platform, it will autoload the Dolby XML file in the platform flash and apply the corresponding features:

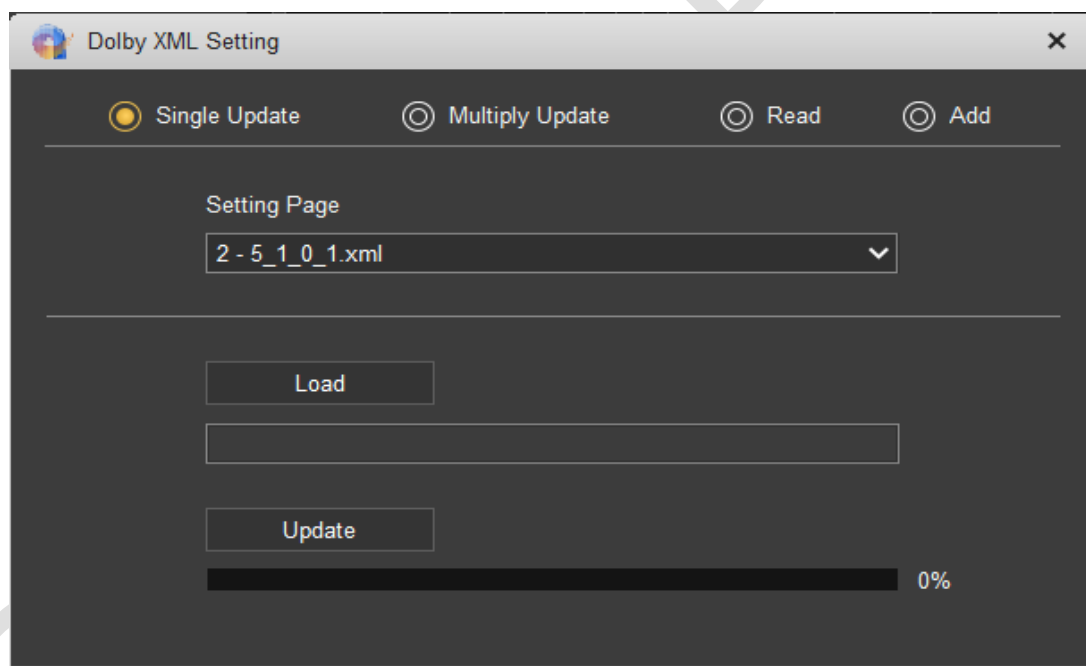
The menu option is shown below:



After selecting “Dolby XML Setting”, it will enter the “file transferring and reading” window. (There are 4 pages as described below)

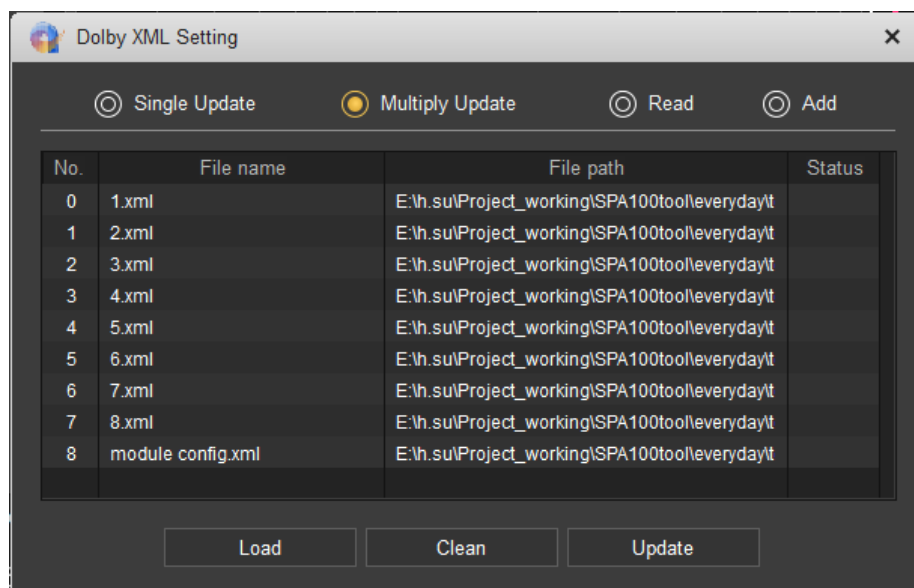
1、Single Update

Single xml Update: First, select the files that needs to be updated in “Setting Page”. Click “Load” to load local Dolby xml files. Then, click “update”. Since “success” is displayed, the local Dolby xml file has replaced the original file. As shown below:



2、Multiply Update

Multiply xml update: This feature allows user to update multiple Dolby xml files at once. First, “Load” (multiple) local xml files. Information of these files will be displayed on the list. Click “update” to load every file on the list to the platform. The “status” bar will indicate its upload status. Shown in the following image:



The system allows 19 xml files. The calculations are shown below. It can set the flash size of xml_pack.bin:

— In /custom/platform/SPA300/pack_spa300_demo.sh

```
2 partition_tbl="\
3 $PREBUILD_BIN_DIR/vendor_data.bin    0x1000    \
4 $BIN_DIR/xml_pack.bin                0x28000    \
5 $BIN_DIR/dsptool_config.xml          0x6000     \
6 $BIN_DIR/ep_firmware.bin             0x28000    \
7 $BIN_DIR/app.bin                     0x3c0000   \
```

.bin (xmls flash sizes) = 160kb

— Project_main_SPA300.cfg

```
26 # unit: KB, must equal Flash sector size
27 CFG_ROMBIN_MIN_BLOCKSIZE = 4
28 # unit: KB, set xml_pack.bin head size
29 CFG_XMLPACK_HEAD_SIZE = 4
30 # unit: KB, set xml_pack.bin block size
31 CFG_SINGLE_XML_SIZE = 8
```

Flash sector: 4kb (Xml have to align it)

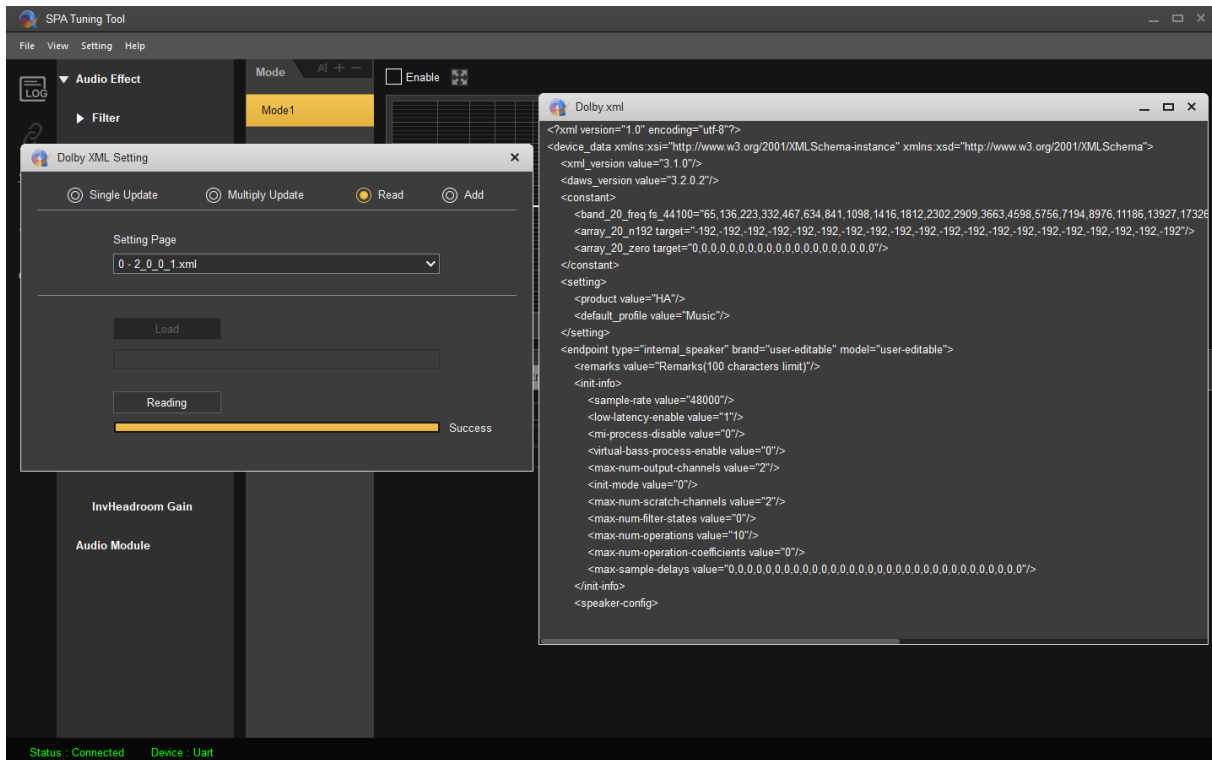
Header size: 4kb (total 2 headers)

Xml size: 8kb (align 4kb)

0x28000 bin sizes can place: $(160 - 4 \times 2) / 8 = 19$ xml files

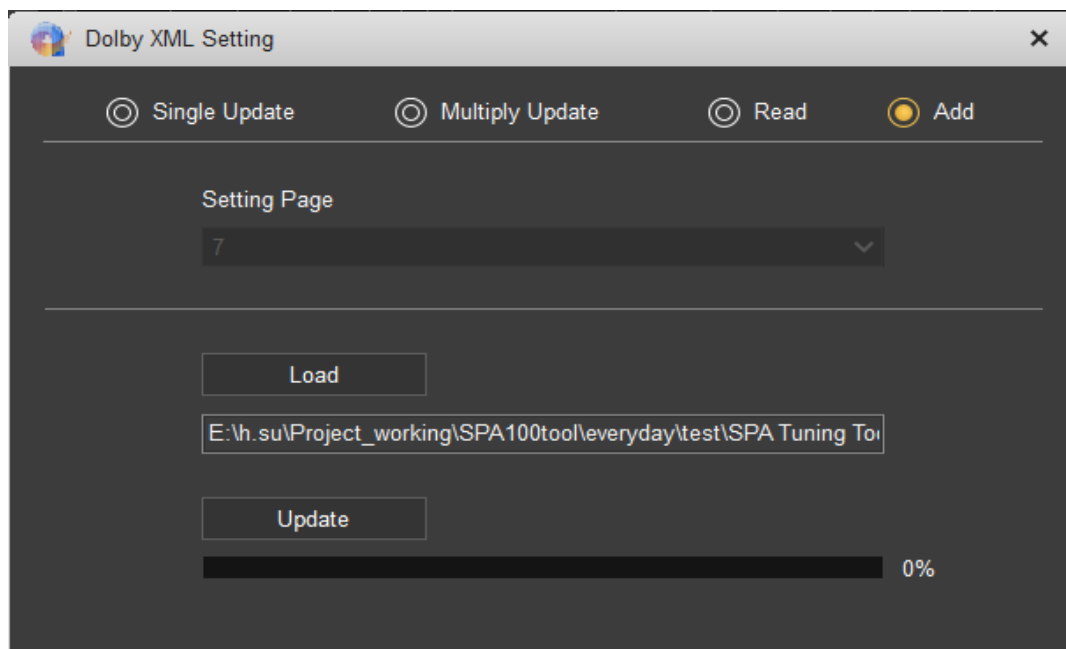
3、Read

Read xml files: Select the xml files in “Setting Page”. Click “Reading”. When “Success” is displayed, the xml file will be displayed in a separated window (displays first 28 lines). As shown in the following image:



4、Add

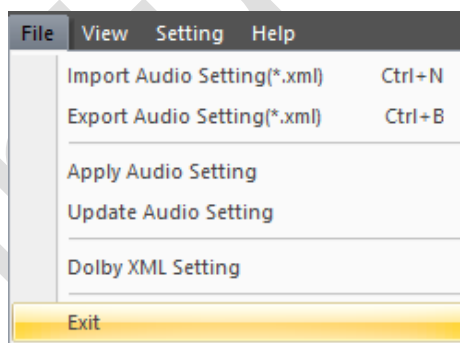
Add a xml file to the platform: “Setting Page” displays the index of the added xml file. (For example: The platform has saved 7 xml files with index 0-6. By clicking “Add”, the index would increment by 1. The new file will be saved at location of index 7). Click “Load” to select a xml file. (The selected file information will be displayed below). Click “update”. Since “Success” is displayed, the xml file has been saved to the platform memory. “Setting page” will update location index of the next file. As shown below:



2.3.1.6 Exit

Exit and close off tool.

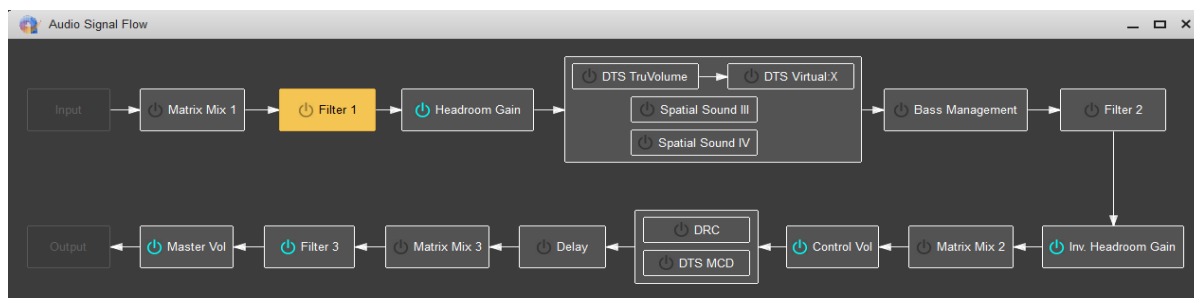
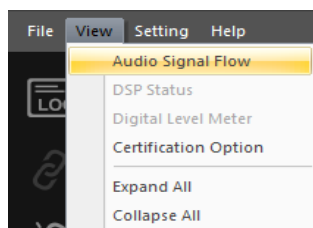
The options are as follows:






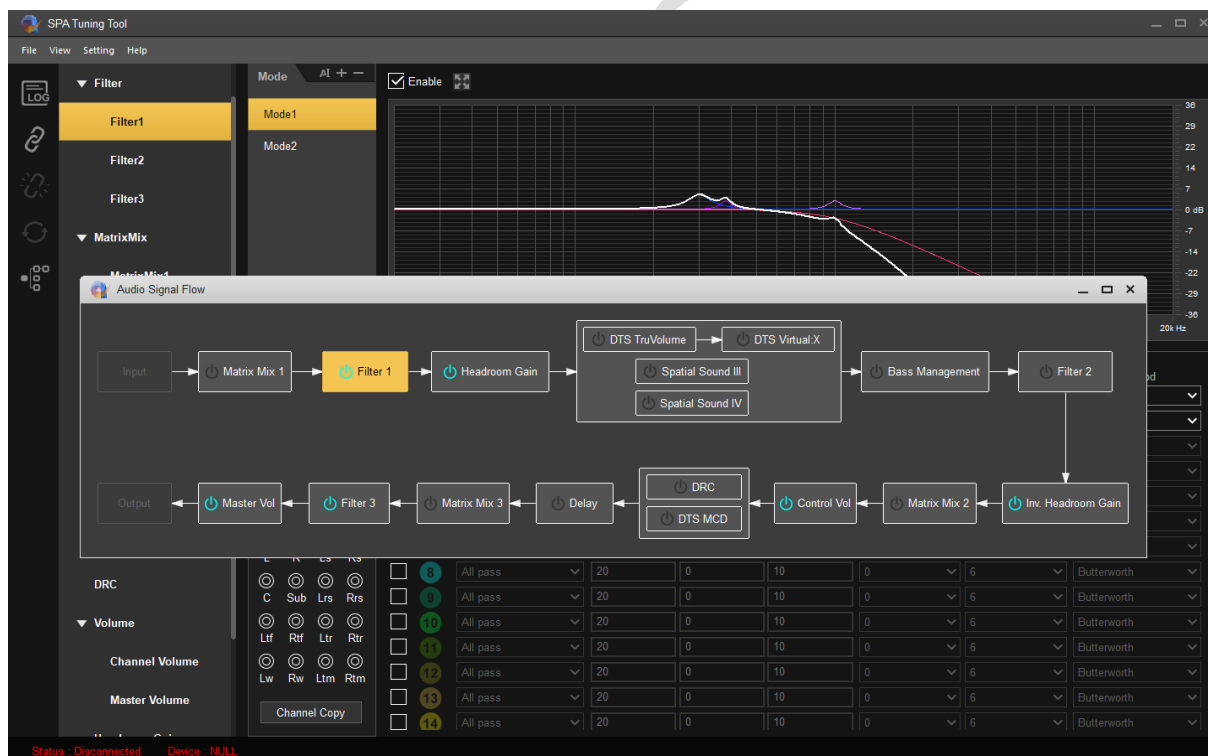
2.3.2 View

2.3.2.1 Audio Signal Flow

Click this item to display the Audio Signal Flow screen, which mainly shows the current audio signal flow chart. The options and Audio Signal Flow screen are shown below:

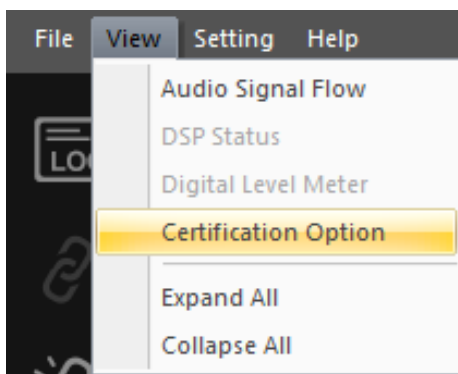


The  icon on the flow chart indicates whether the “enable” module is selected. If enable is selected the icon would be . If not selected, the icon would be . By clicking the modules in the flow chart, the main page of tool will display the corresponding module page and the module block will be highlighted in yellow. The features are displayed indicated in the following image:



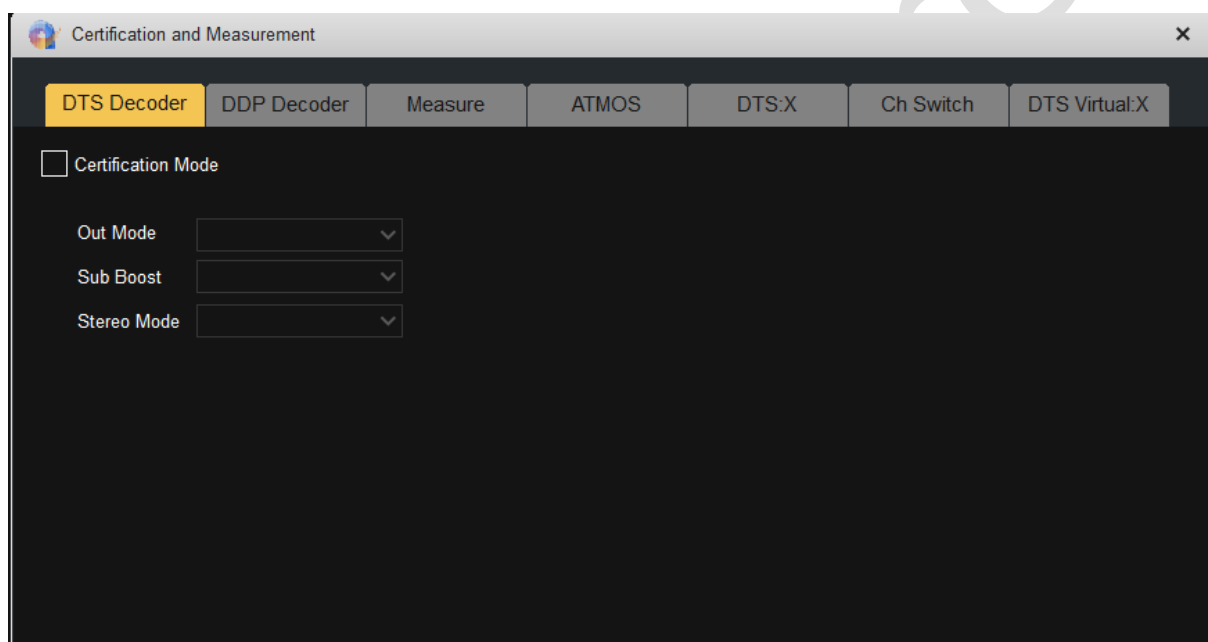
2.3.2.2 Certification Option

This feature is for certification and audio quality measurement, the menu option is indicated as below.



There are 7 pages in Certification option: DTS Decoder, DDP Decoder, Measure, ATMOS, DTS:X, Ch Switch, DTS Virtual:X

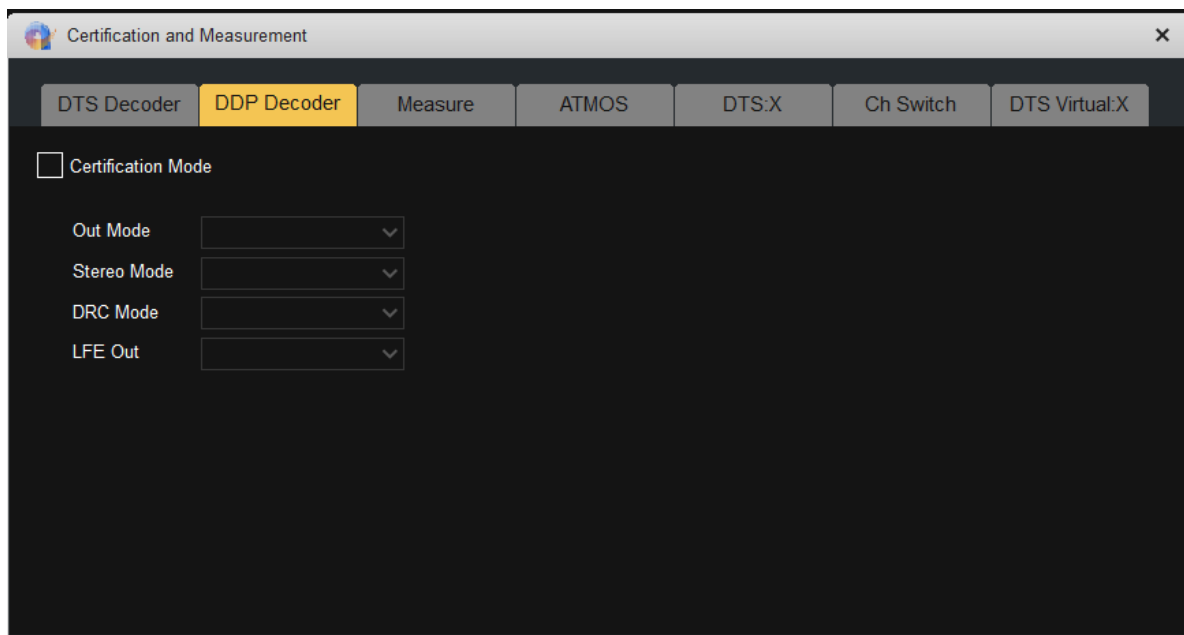
1、DTS Decoder Page



Select Certification Mode to enter DTS decoder mode. The “Out Mode” option can select the output settings for DTS decoder. The “Sub Boost” option controls the Sub boot 10dB mode. “Stereo Mode” selects downmix method of the Decoder between LoRo, LtRt, and 5.1.

Please refer to the file “DTS Certification SOP.pptx” for the DTS decoder certification test.

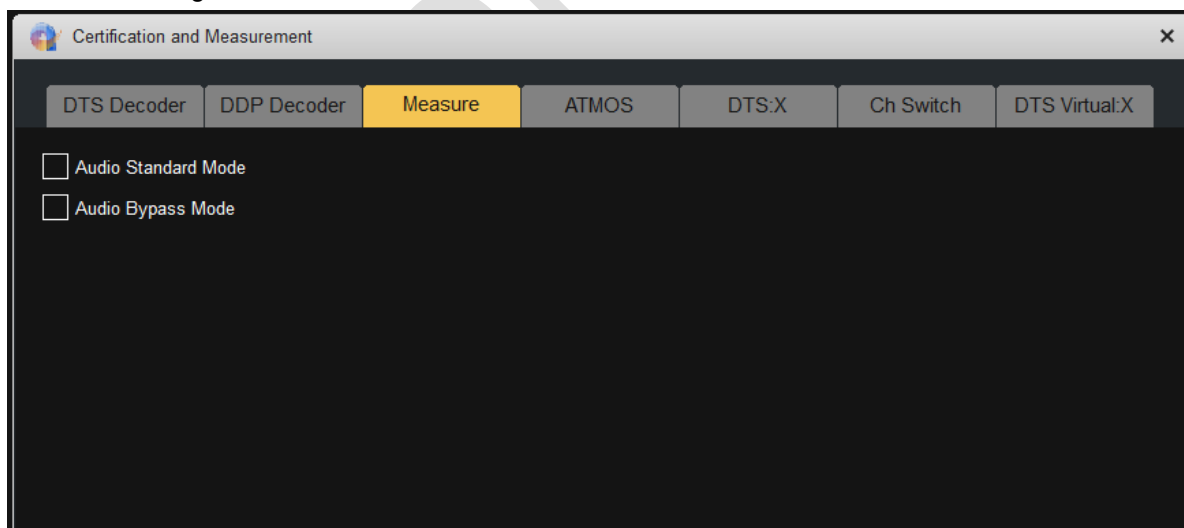
2、DDP Decoder Page



Select Certification Mode to enter DDP decoder mode. In the “Out Mode” option, select the output settings for DDP decoder. The “Stereo Mode” selects downmix method of the Decoder between LoRo, LtRt, and 5.1. The “DRC Mode” selects the DRC mode of the decoder. “LFE out” indicates whether the decoder outputs from the LFE channel.

Please refer to file “DDP Certification SOP.pptx” for the DDP decoder certification test.

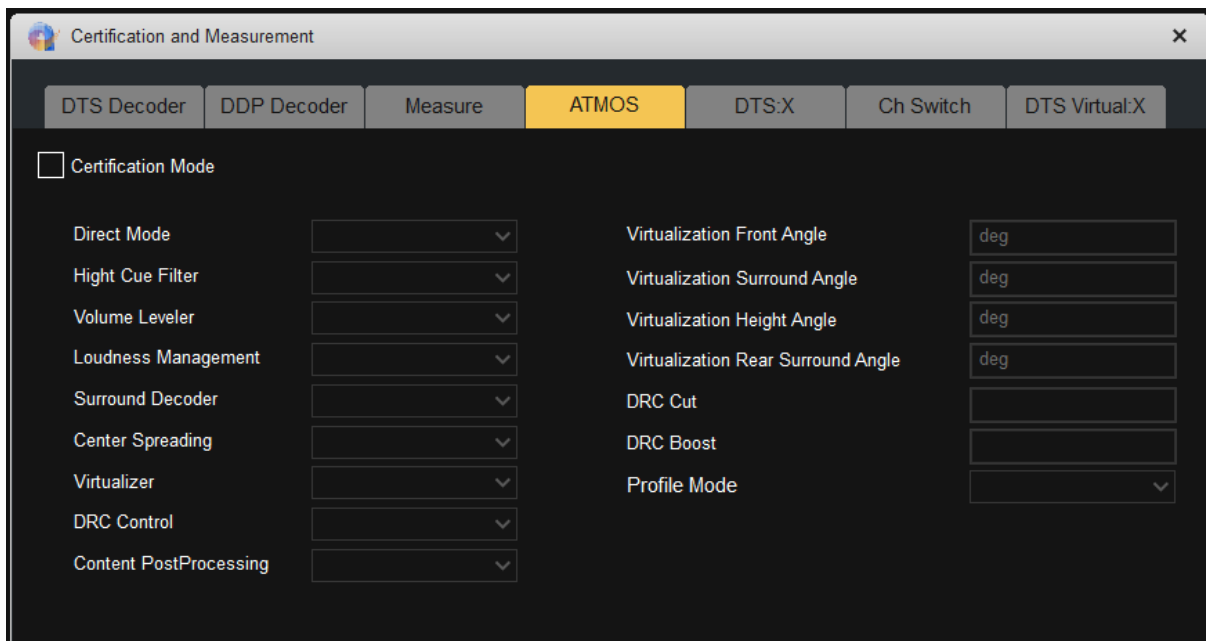
3、Measure Page



Audio Standard mode is used for Audio Quality Measuring. Ports D0/D1/D2...D7 on the platform output the L/R channel of the input signal.

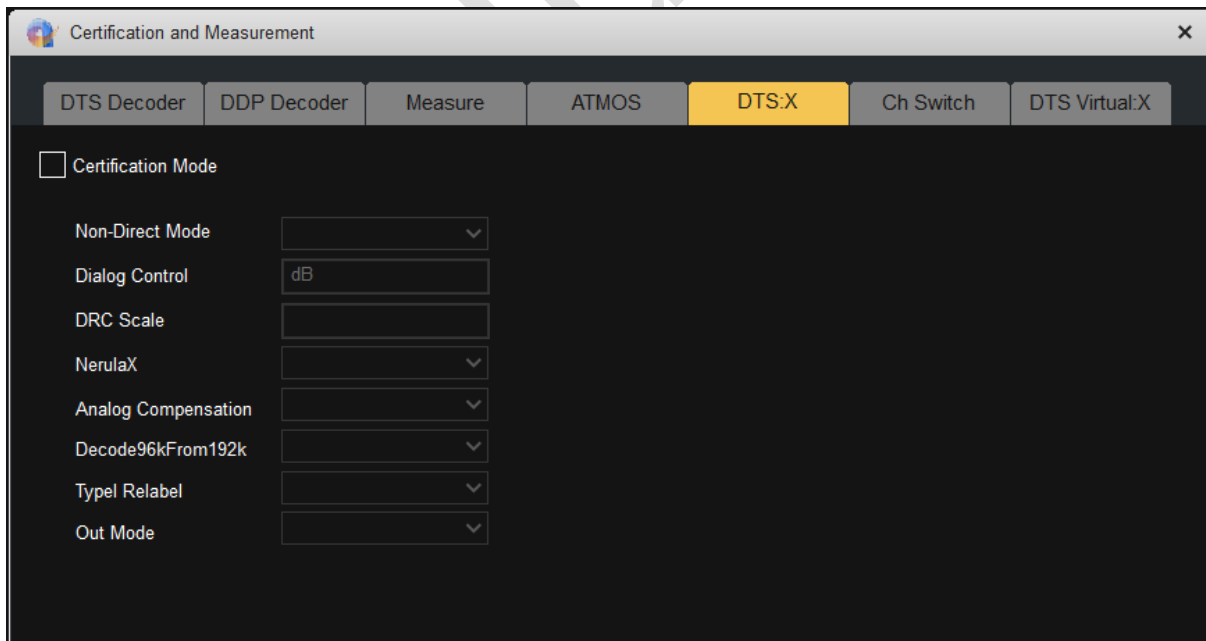
Audio Bypass mode is DSP bypass mode, the input signal will not be processed before output.

4、ATMOS Page



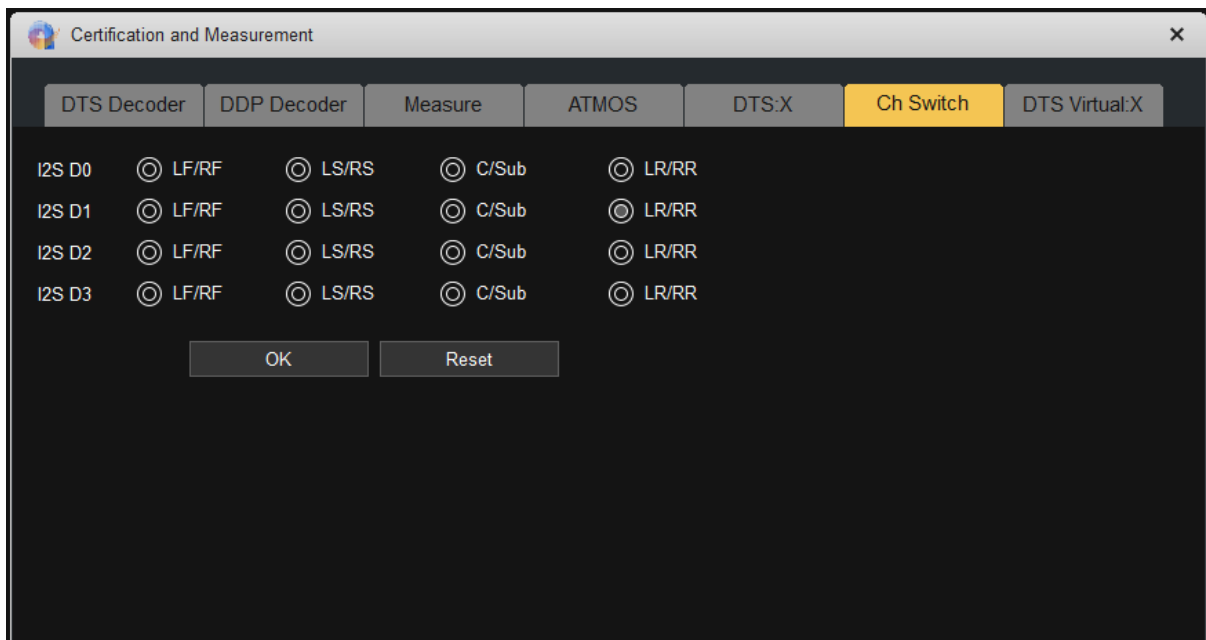
Dolby ATMOS certification page: Select Certification Mode to enter ATMOS certification mode.
Please refer to file “ATMOS Certification SOP.pptx” for the ATMOS certification test.

5、DTS:X Page



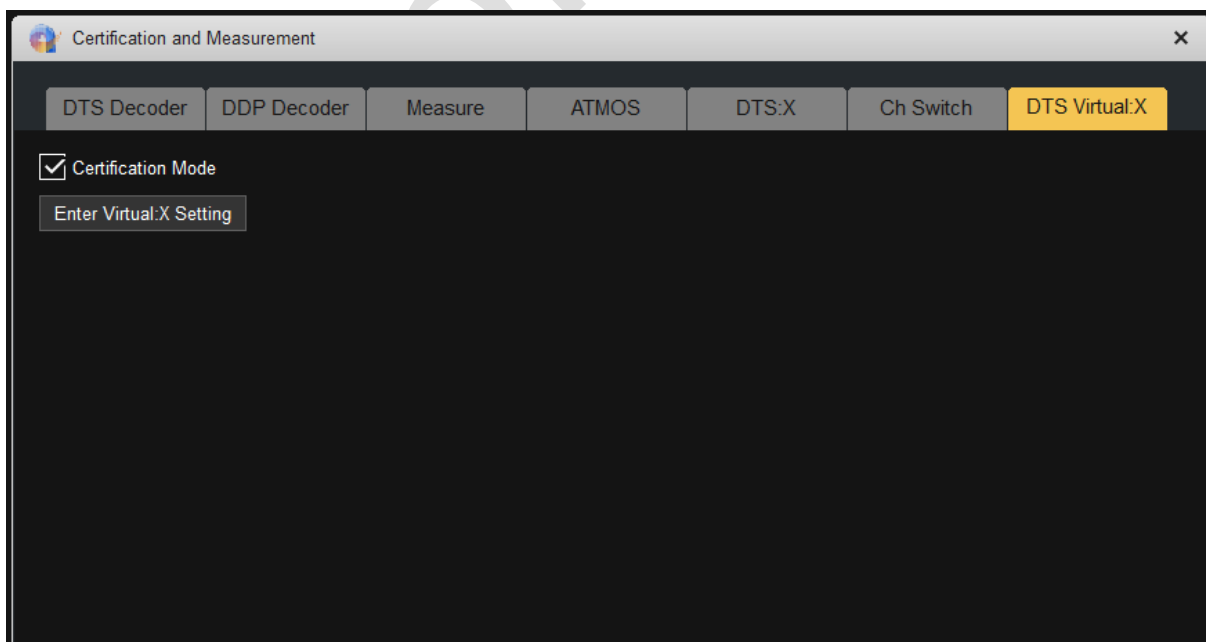
DTS:X Certification Page: Select Certification Mode to enter DTS:X certification mode.
Please refer to file “DTS:X Certification SOP.pptx” for the DTS:X certification test.

6、Ch Switch Page



Ch Switch feature is for debugging by changing the output channels of D0-D3 ports. After selecting the output settings, click “OK” to apply. Click “Reset” to revert to default mode. The default input mode is D0:LF/RF, D1: LS/RS, D2:C/SUB, D3:LR/RR.

7、DTS Virtual:X Page

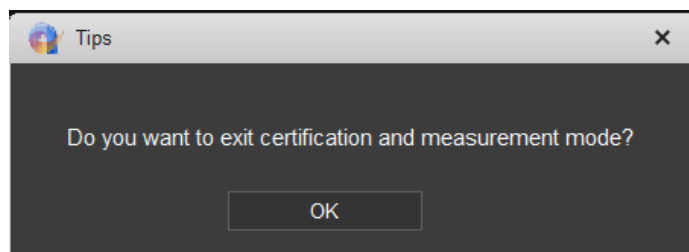


DTS Virtual:X Certification Page: Select Certification Mode to enter Virtual:X certification mode.

Click “Enter Virtual:X Setting” will switch to the Virtual:X parameter setting page.

Please refer to file “DTS_VirtualX Certification SOP.pptx” for the DTS Virtual:X certification test.

The warning window shown below will pop up after closing “Certification and Measurement” page.

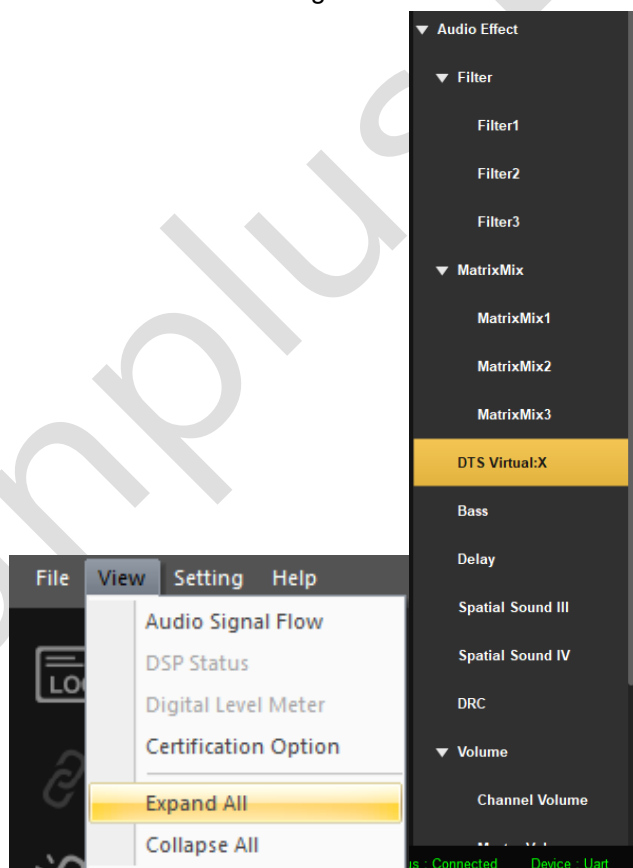


Click “OK” to exit Certification and Measurement mode and enter normal mode.

2.3.2.3 Expand All

Click this item to expand all items in the module list.

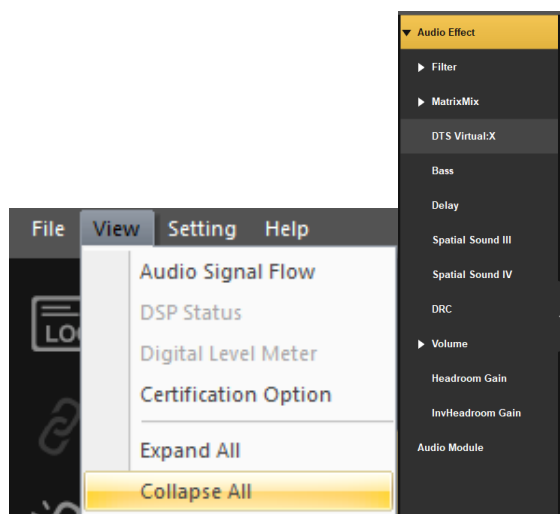
The options and effect screens are shown in the figure below:



2.3.2.4 Collapse All

Click this item to collapse the items in the module list.

The options and effect screens are shown in the figure below:

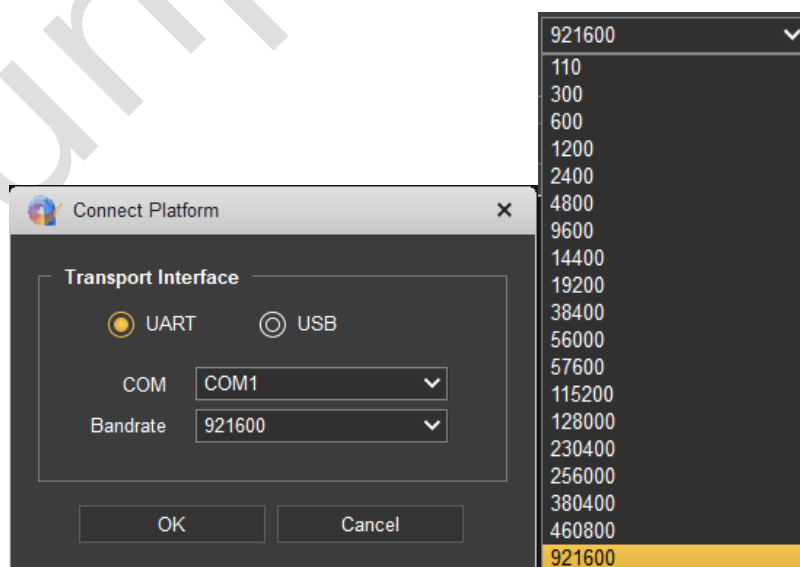


2.3.3 Setting

2.3.3.1 Connect Platform

Click this item to display the device connection interface. Support UART and USB two communication methods; on the interface, you can switch to the required communication method by clicking UART or USB, then select the device to be connected, and click ok to connect. In the platform connection, this item is disabled;

The following image is when UART connection is selected, the system would automatically load available COM ports. Also, there is ten Baudrate for selection. The default Baudrate is 921600(The platform SDK only supports Baudrate:921600) .



The following image is when USB connection is selected, the system would automatically load available USB. (Note: USB devices are default to Host. Click cmd to change it into Device or edit the default USB device setting in `cfg_sdk.c` before connecting to Tool)

- Method of switching USB Host / Device cmd:

host: usbswitch 1

device: usbswitch 0

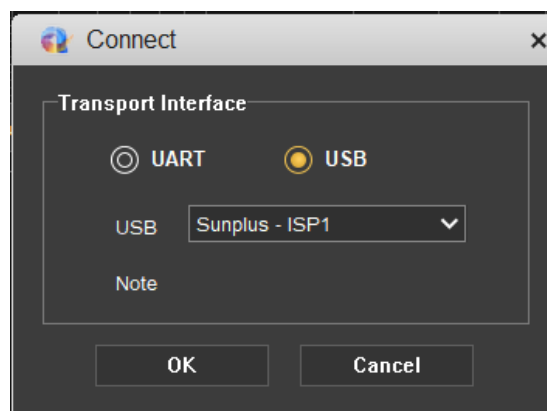
- USB Host / Device in default power on settings:

.CFG_USB_TO =

{

.DefaultMode = eUSB_HOST_MODE, change into eUSB_DEVICE_MODE

}

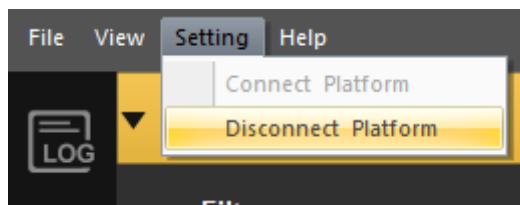


When TOOL connects to the platform, it will sync platform data and display on TOOL interface.

2.3.3.2 Disconnect Platform

Click this to disconnect from the platform. When the platform is not connected, this item is unavailable.

The options are shown below:

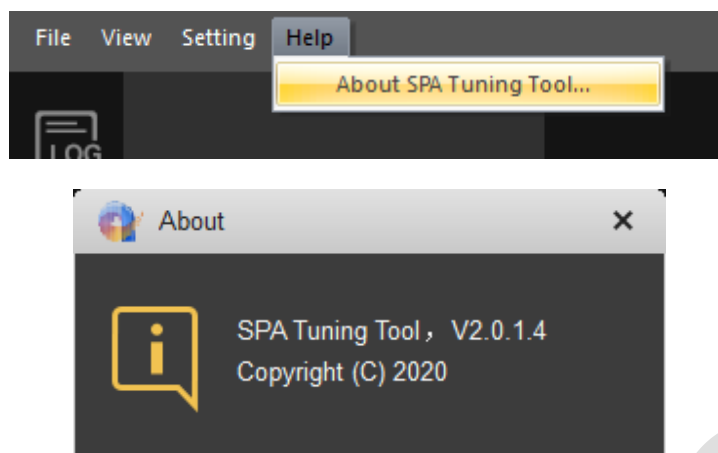


2.3.4 Help

2.3.4.1 About SPA Tuning Tool...

Click this item to display the version and copyright information display screen.

The options and effect screens are shown in the figure below:



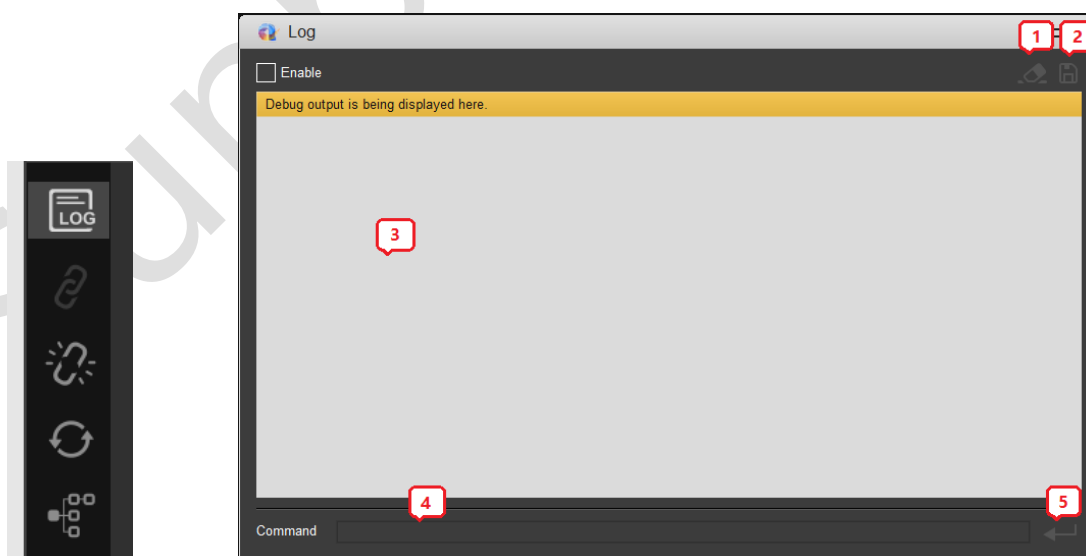
2.4 Hot Key

2.4.1 Log interface display

Click this button, the following log screen appears. The Enable item in the screen is not selected by default, and all items in it are unavailable at this time; when the Enable item is selected, the screen function is turned on.

The functions of the label items in the figure are:

- 1、 Clear the log information in 3;
- 2、 Save the log information in 3;
- 3、 Log information display location;
- 4、 Custom edit Command;
- 5、 Send the Command shown in 4;



2.4.2 Device Connection

The function is consistent with 2.3.3.1 Connect Platform.



2.4.3 Device Disconnection

The function is consistent with 2.3.3.2 Disconnect Platform.



2.4.4 Data Synchronization

Click this button to synchronize the data of the platform to the tool and display it on the interface;




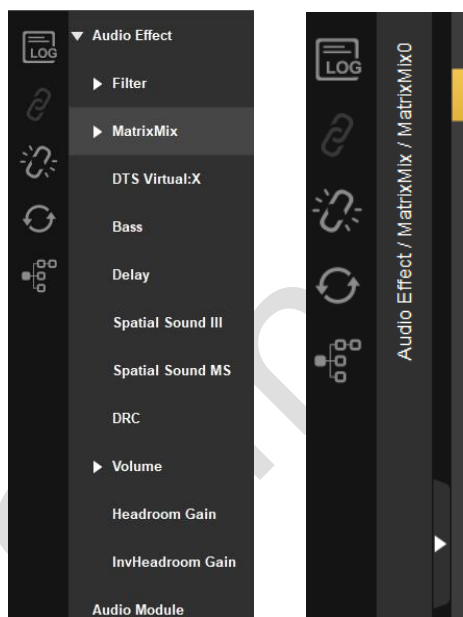
2.4.5 Audio Signal Flow

The function is consistent with 2.3.2.1 Audio Signal Flow.



2.5 Module List

Contains the modules to be debugged online, you can click  button to hide module list and display module path, and make the display area of the content area larger, as shown in the figure below;



2.6 Content Area

The parameters to be debugged for each module are displayed here, and the meaning of each module parameter will be introduced later;

2.7 Status Bar

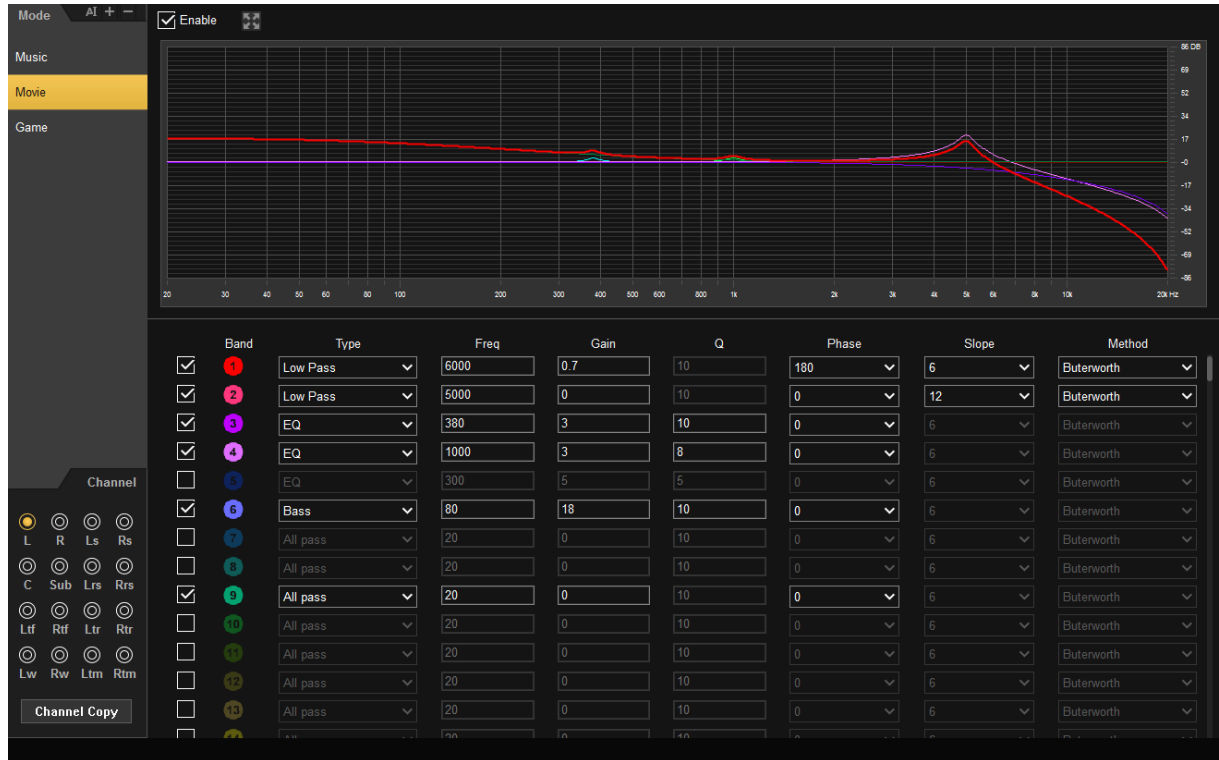
Display connection status and connected devices.


```
Status : Connected    Device : Uart
```

3 Audio Module Instruction

3.1 Filter

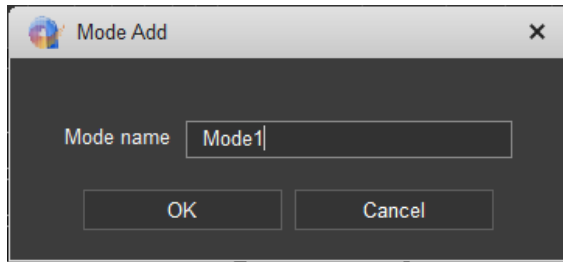
The Filter module provides some filter modules inside the DSP, including Low Pass/High Pass/All Pass filter, Peak filter and Shelving Filter to realize high pass/low pass/all pass/EQ/Bass/Treble in signal processing, and more features;



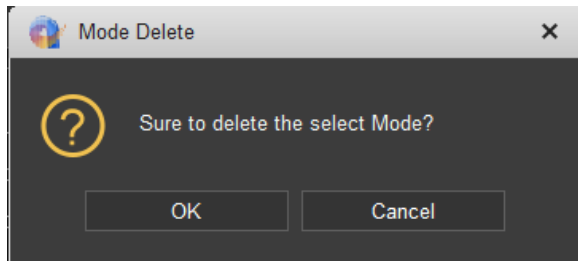
The Filter screen can be divided into 4 parts: mode, channel selection, frequency response curve, parameter setting. You can click  button to make the frequency response and parameter section larger. If the Band parameters are not displayed completely on the interface, you can drag the slide bar on the right to view other Bands.

Mode area: This section allows user to add, delete and rename modes. Different Filter combinations can be set up based on the needed situation, such as EQ music/movie/game modes;

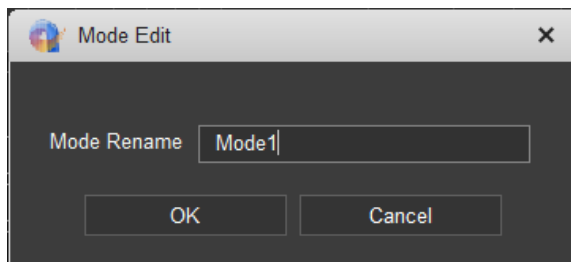
1. Mode Add: Click “+” to edit module name to add a new mode. The default module parameter configuration is the selected configuration in the mode list. (For example: if Movie is the selected mode, the newly added mode would default to the same configuration as Movie)



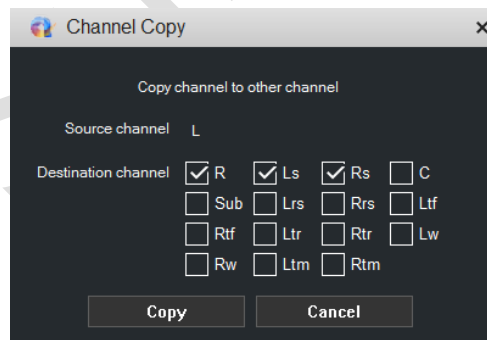
2. Mode Delete: Click “-” to delete the selected mode.



3. Mode Edit: Click “AI” to edit the name of selected mode



Channel selection: select the channel where the current parameter settings are effective. If you want several channels to use the same settings, you can use the Channel Copy function to copy the parameters to the target channel after adjusting the effect on one of the channels. Refer to the figure below;



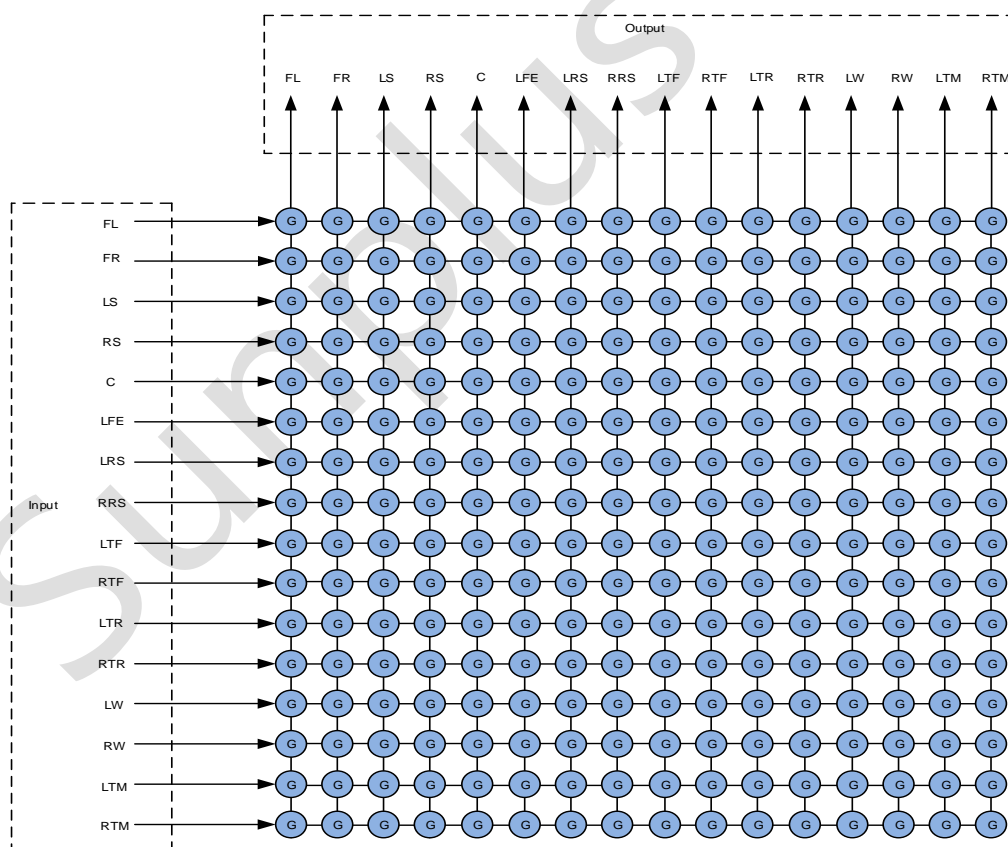
Parameter meaning:

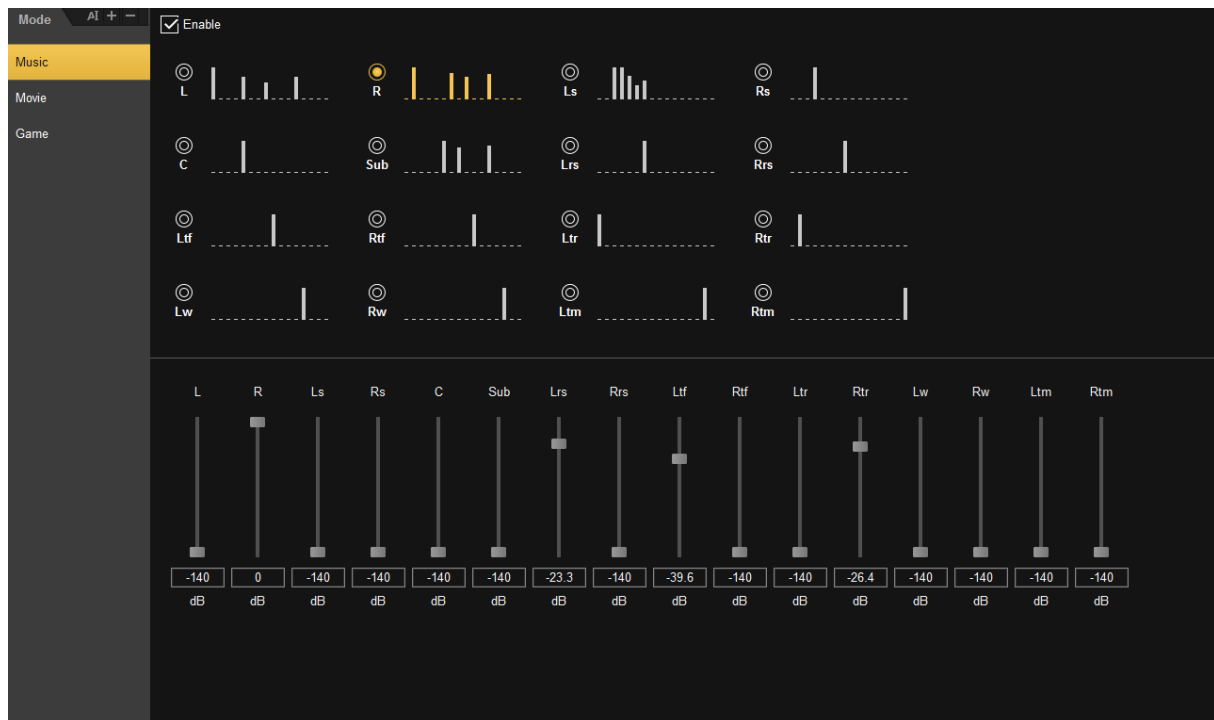
- Enable: Whether to open the Filter function;

- Band: The maximum number of Bands currently supported by Filter;
- Type: Filter type, there are six types, including All Pass/Bass/Treble/EQ/Low Pass/High Pass, among which EQ is Peak filter and Bass/Treble is shelving filter;
- Freq: Filter center frequency F_c , range [20Hz ~ 20K Hz], 1Hz/step;
- Gain: Gain of Filter, range [-18.0 dB ~ +18.0 dB], 0.1dB/Step
- Q: Factor Q, range[0.5, 10], 0.1/Step
- Phase: Adjust the filter phase, there are two options. 0 and 180 degree;
- Slope: Slope of Filter;
- Method: Filter implementation methods are divided into Butterworth and Linkwitz-Riley; Parameters that are not supported by the current filter will become unadjustable;

3.2 MatrixMix

The Matrix Mix module provides a mix function with a maximum of 16ch input and 16ch output. Depending on the gain value set, it can be mixed from any channel to any channel.





MatrixMix screen can be divided into 3 parts: mode, output channel selection, input channel gain parameter. The selected output channel will be highlighted, and the corresponding data will be displayed in the parameter area. If you adjust the gain parameter, the selected channel graphics will also change accordingly.

Mode: This section allows user to add, delete and rename modes. Different configurations can be set up based on the needed situation, for a detailed explanation please refer to [Section 3.1 Fliter Module](#):

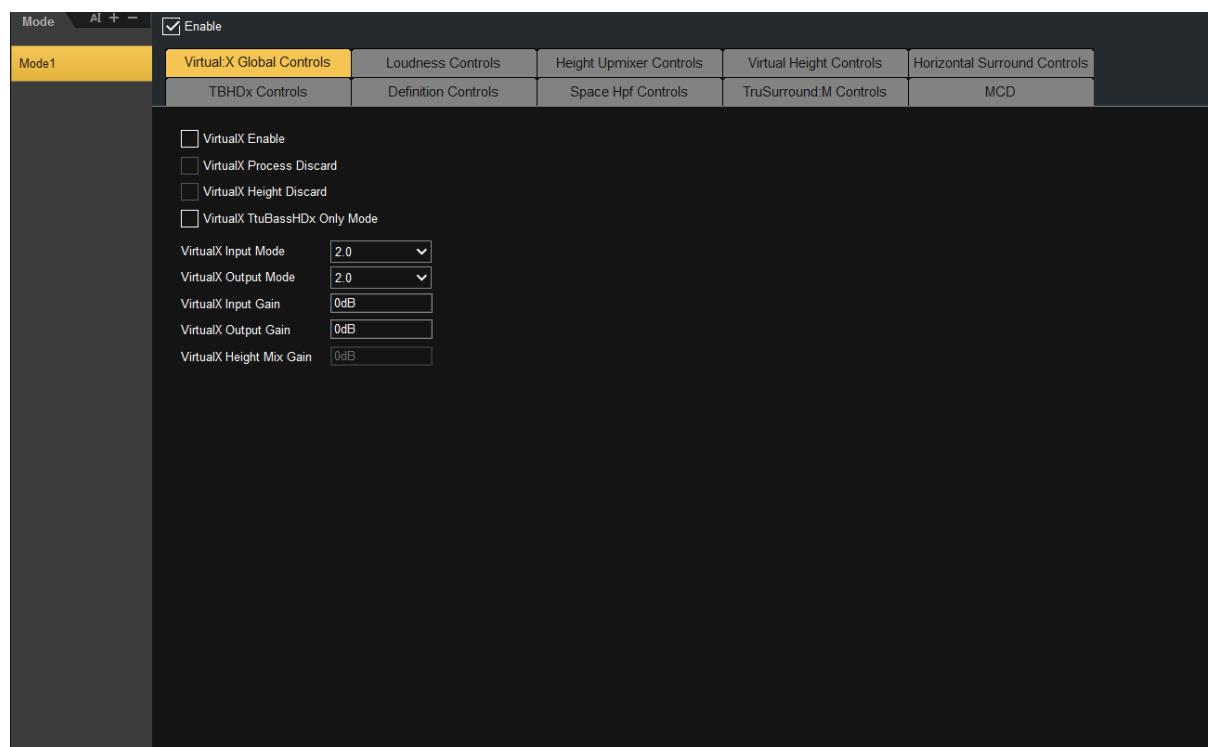
Parameter Enable: Whether to enable the MatrixMix function;

The default range of gain parameters is [0,-140]dB, and the maximum range is [+24 dB ~ -140 dB]. When the gain is set to -140dB, this channel will be processed by mute;

The XML files needs to be edited to implement max gain of +24dB . If needed, please contact FAE.

3.3 DTS Virtual:X

This module is a DTS Virtual:X solution. All sub-modules and parameters refer to the Tuning Tool provided by DTS;



DTS Virtual:X screen can be divided into 3 parts: mode, DTS Virtual:X sub-module, and module parameter content.

Mode: This section allows user to add, delete and rename modes. Different configurations can be set up based on the needed situation, for a detailed explanation please refer to [Section 3.1 Fliter Module](#):

Parameter Enable: whether to open Virtual:X function;

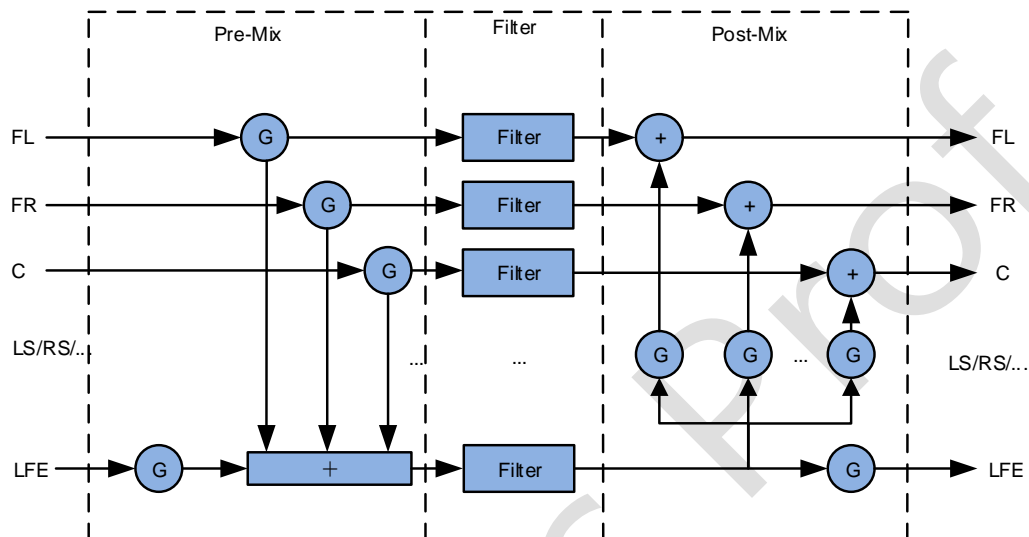
DTS Virtual: X's sub-module contains:

- Virtual:X Global Controls
- Loudness Controls
- Height Upmixer Controls
- Virtual Height Controls
- Horizontal Surround Controls
- TBHDx Controls
- Definition Controls
- Space Hpf Controls
- TruSurround Controls

- MCD

3.4 BassManagement

Bass Management module, which provides bass management function on the signal link, composed of PreMix, Filter, and PostMix;



PreMix provides the feature to mix different channel signals into the LFE channel. The Filter can filter each channel signal individually. PostMix mixes LFE channel into other channels. PreMix, PostMix and filter processes **all channels** supported by the platform.



The Bass screen can be divided into 4 parts: mode, frequency response graph, sub-module selection, and parameter area. You can click  button to make the table larger.



Mode: This section allows user to add, delete and rename modes. Different configurations can be set up based on the needed situation, for a detailed explanation please refer to [Section 3.1 Filter Module](#):

Parameter Enable: whether to open Bass Management function;

There are three sub-modules:

- Pre-Mix
- Post-Mix

Pre-Mix and Post-Mix is the simplified MartixMix, which only provides mixing into LFE and mixing out from LFE. With Volume Gain Default Setting Range [0 dB ~ -140 dB] and max range [+24 dB ~ -140 dB] (It's possible to support +24dB by modifying The XML files. If needed, please contact FAE)

When the gain is set at -140dB, the channel will be treated as muted. Click the icon  to mute current channel. When the channel is muted, the icon would be displayed as .

- Filter

For Filter module, please refer to Audio module Filter chapter ([Filter 章节](#)).

3.5 Delay

Delay module can realize the delay output of each channel;



Parameter Enable: whether to open Delay function;

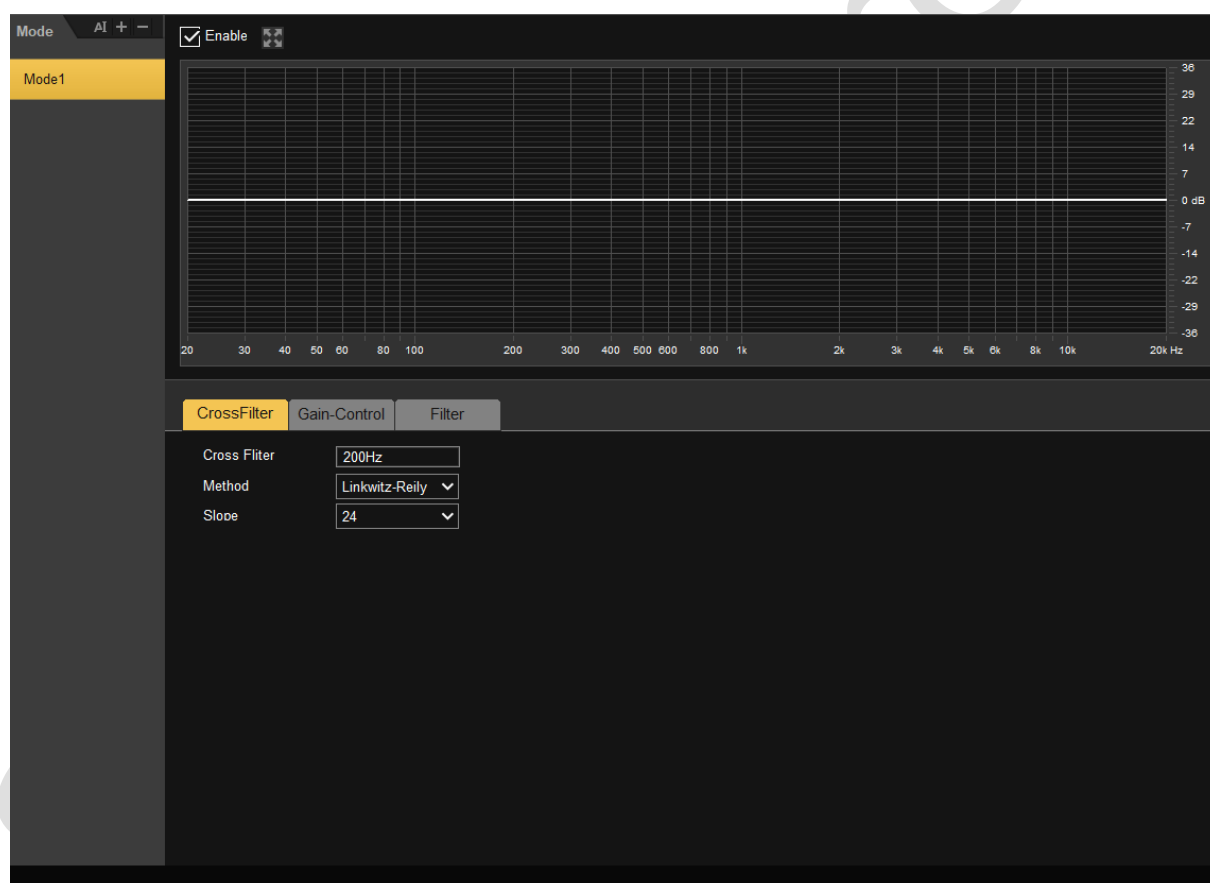
Delay parameters can be based on time and sample number respectively. Time is in milliseconds and sample is in sampling points. The relationship between the two is $\text{Sample} = \text{Time} * \text{Sample Rate}$;

The max Delay is set at 300ms, the relation between max channels and output data accuracy is::

- Max 16 channels, 24bit PCM output;
- Max 12 channels, 32bit PCM output;

Other settings are not supported at the moment.

3.6 Spatial Sound III



The Spatial Sound III module can divide the input two-channel signal into a high-frequency and low-frequency signal through a frequency divider. The low-frequency part is not processed by the sound field algorithm module and finally mixed back to the L/R channel, while the high-frequency signal, after it passes through the source separation module, the original two-channel signal will be divided into three parts: C/LR/LsRs. The parameters of the subsequent processing modules are adjusted according to the requirements to meet the sound field requirements. After the adjustment, the

signal will be downmixed into a two-channel signal.

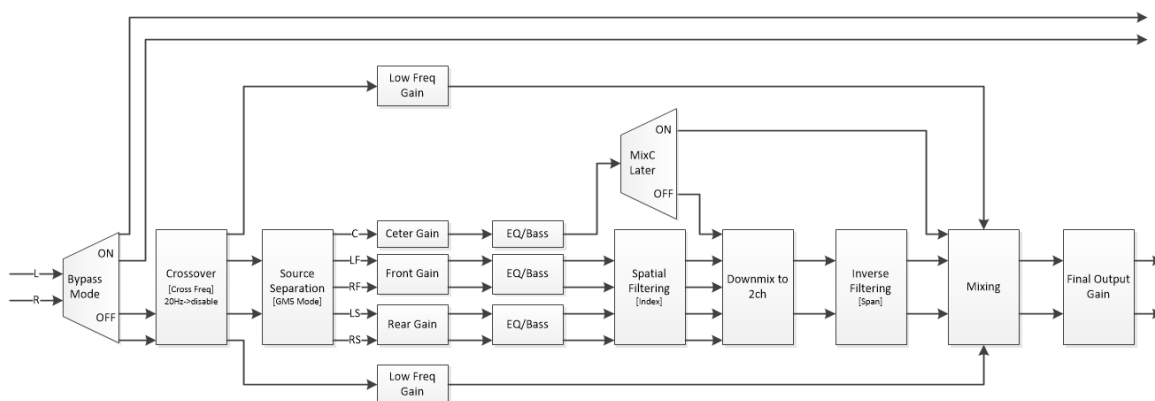
The Spatial Sound III screen can be divided into 4 parts: mode, frequency response graph, sub-module selection, and parameter area. You can click the button to enlarge the chart.

Mode: This section allows user to add, delete and rename modes. Different configurations can be set up based on the needed situation, for a detailed explanation please refer to [Section 3.1 Fliter Module](#):

Parameter Enable: whether to open Spatial Sound III function;

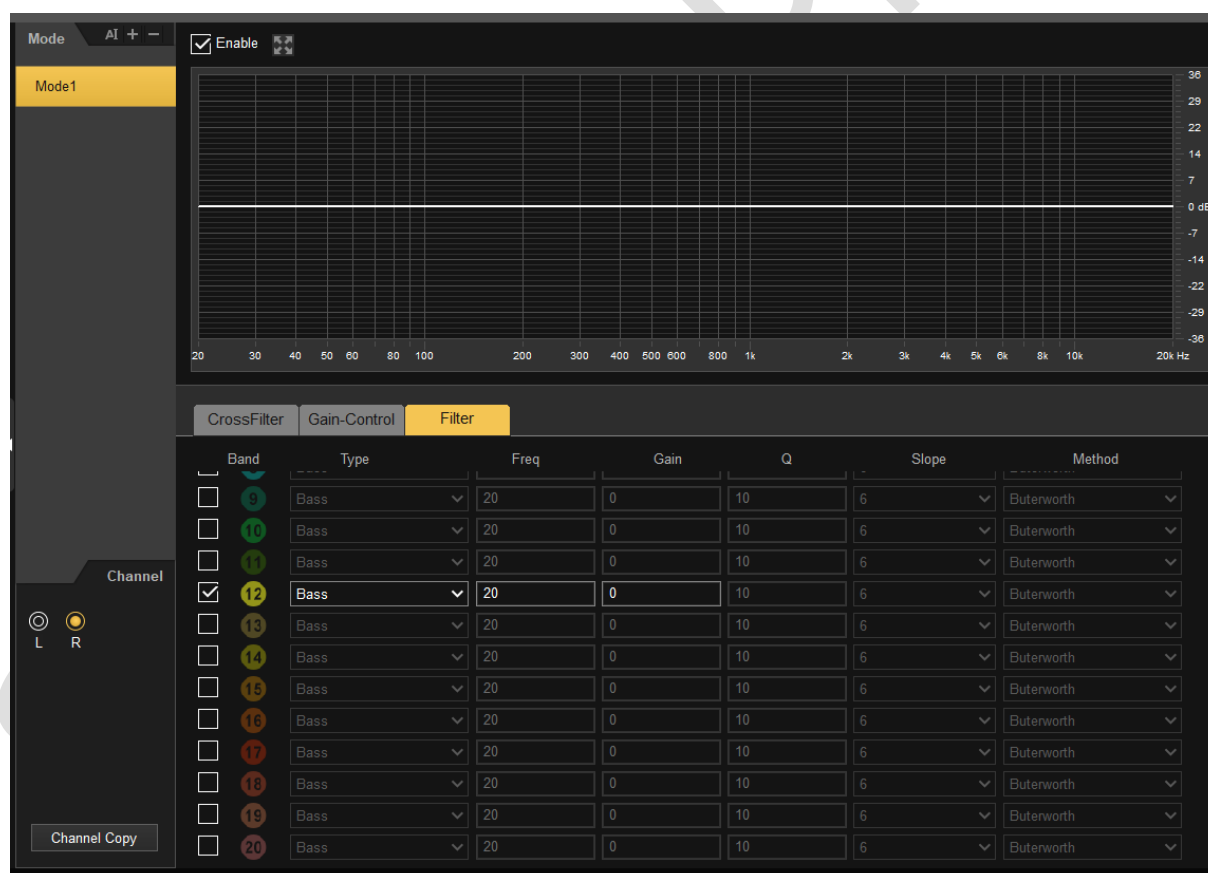
There are three sub-modules:

- **CrossFilter:** Set the low frequency divider, the signal below this frequency point will not be processed by Spatial Sound; among them:
 - 1) **CrossFilter:** [20 ~ 10000] Low frequency crossover point.
 - 2) **Method:**[Butterworth、Linkwitz-Riley], set different crossover filter types.
 - 3) **Slope:**[6dB, 12dB,18dB,24dB], set the frequency divider to attenuate in dB per octave.
- **Gain-Control:** Spatial sound III internal adjustment parameters
 - 1) **Center/Front/Rear Gain**[-40,12dB] Adjust the proportion of the output signal of Source Separation
 - 2) **Low Freq Gain** [-40,6dB] Adjust the ratio of low frequencies mixed back into L/R
 - 3) **Front Floor** [-40,0dB] Decide how much raw LR signal to mix into LF/RF.
 - 4) **Rear Floor** [-40,0dB] Decide how much raw LR signal to mix into LS/RS.
 - 5) **SurrGain** [-40,0dB] Control the proportion of irrelevant signals sent to LSRS.
 - 6) **FinalOutput Gain** [-12dB ~ +12dB] Adjust the final output signal size
 - 7) **Mode** [Movie/Music/Voice] Movie and Music mode will analyze the input LR signal from time to time, and send relevant signals to C and unrelated signals to LSRS. Movie mode analysis is faster. Voice mode does not analyze the signal, and always sends L+R to C and L-R to LSRS.
 - 8) **Index** [0~5] Increase the sense of space and provide 6 different filter coefficients.
 - 9) **Speaker Span** [0 ~ 5] 0~5 Corresponding narrow to wide. This is related to the length of the Soundbar and the distance of the listener. A shorter soundbar uses a smaller value, and a longer soundbar uses a larger value.
 - 10) **MixCLater** [ON/OFF] When ON, C is sent directly to Mixing. OFF will enter the Downmix module.
- **Filter:** EQ adjustments are made for C/L/R/Ls/Rs after source separation, please refer to Audio module for parameter description Filter chapter ([Filter 章节](#))



Spatial sound III flowchart

3.7 Spatial Sound IV



The Spatial Sound IV screen can be divided into 4 parts: mode, frequency response graph, sub-module selection, and parameter area. You can click the button to enlarge the chart.

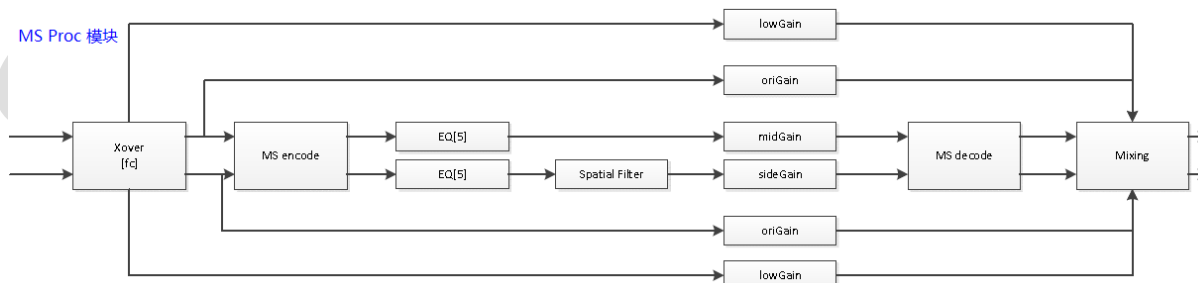
Mode: This section allows user to add, delete and rename modes. Different configurations can be set up based on the needed situation, for a detailed explanation please refer to [Section 3.1 Fliter](#)

Module:

Parameter Enable: Whether to enable the Spatial Sound IV function;

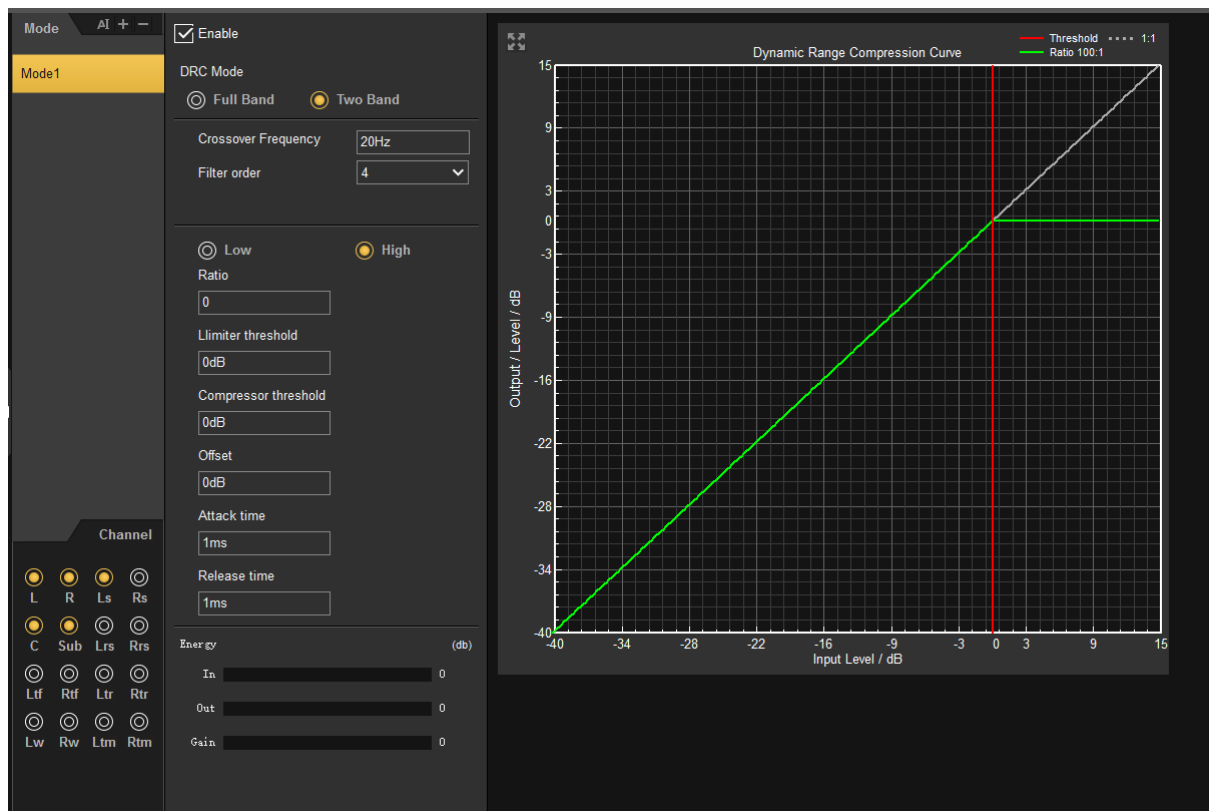
There are three sub-modules:

- CrossFilter: Set the low frequency divider, the signal below this frequency point will not be processed by Spatial Sound; among them:
 - 1) CrossFilter: [20 ~ 10000] Low frequency crossover point.
 - 2) Method:[Butterworth、Linkwitz-Riley], Set different crossover filter types.
 - 3) Slope:[6dB, 12dB,18dB,24dB] Set the frequency divider to attenuate in dB per octave.
- Gain-Control: Spatial sound IV internal adjustment parameters
 - 1) Center/Front/Rear Gain[-40,12dB] Adjust the proportion of the output signal of Source Separation
 - 2) Front Low Gain[-40,0dB] Adjust the low frequency ratio of Front mixed back into L/R.
 - 3) Front Ori Gain[-40,0dB] Decide how much raw Front signal to mix into LF/RF.
 - 4) Front Mid Gain[-40,12dB] Decide how much front center channel signal to mix into LF/RF.
 - 5) Front Side Gain[-40,12dB] Decide how much front side channel signal to mix into LF/RF.
 - 6) FinalOutput Gain [-12dB ~ +12dB] Adjust the final output signal size
 - 7) MixCLater [ON/OFF] When ON, C is sent directly to Mixing. OFF will enter the Downmix module.
- Filter: Adjust the EQ separately for L/R, please refer to Audio module for parameter description ([Filter 章节](#))



Spatial sound IV flowchart

3.8 DRC



The DRC screen can be divided into 5 parts: mode, channel selection, parameter area, DRC curve, energy display. Click the button to enlarge the chart; **Multiple DRC channel be chosen, indicating the channels to apply current settings. To use different channels for other DRC effects, multiple DRC modules can be created and applied to different channels.**

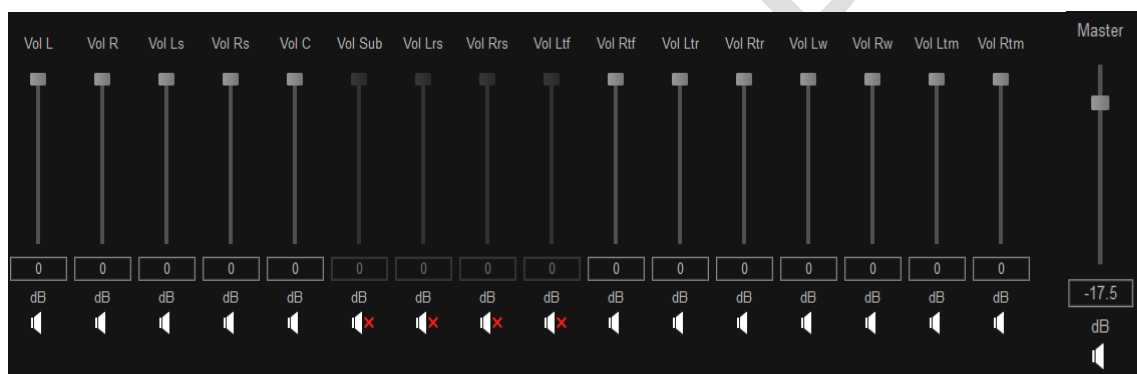
Mode: This section allows user to add, delete and rename modes. Different configurations can be set up based on the needed situation, for a detailed explanation please refer to [Section 3.1 Filter Module](#);

Parameter Enable: Whether to enable the DRC function;

- **DRC mode:** DRC is divided into two types: Full Band and Two Band. Full Band processes full-band signals, and Two Band divides the frequency band into two groups, Low Band and High Band. The parameters can be set separately;
- **Crossover Frequency:** Under Two Band mode, crossover point setting;
- **Filter Order:** The order of frequency division filter, the frequency division filter uses Butterworth filter;
- **Ratio:** Compression ratio, range [1 ~ 100], Ratio equal to 1 means no compression, if adjusted to 100, the effect is similar to Limiter.



- Limit threshold: Range [0 dB ~ -40 dB], the maximum output amplitude (MUST be \geq Compressor threshold).
- Compressor threshold: Range [0 dB ~ -40 dB]: The threshold at which the compressor starts to compress (MUST be \leq Limit threshold).
- Offset : Range [0dB ~ 20dB], the overall output amplitude is improved. When Offset is not set to 0, the original output amplitude should be added to the offset dB. Example: Limit threshold = -10dB, offset = 10dB, the actual maximum output amplitude is 0dB.
- Attack time: Range [0.1ms ~ 500ms], the time from when the input signal exceeds the critical value to when the compressor starts to work.
- Release time: Range [0.1ms ~ 500ms], the time from when the input signal is lower than the critical value to when the compressor stops working.

3.9 Volume



There are two types of volume control, Channel Volume and Master Volume. Both volume controls are completely independent modules. Channel Volume sets the volume gain for each channel separately, and Master Volume sets the volume gain for all channels.

Volume Gain Default Setting Range [0dB,-140]dB, Max Range[+24 dB ~ -140 dB]. When the gain is set at -140dB, the channel will be treated as muted. It's possible to support +24dB by modifying The XML files. If needed, please contact FAE.

You can directly click the horn icon  to process the current Mute channel. After hitting Mute, icon will turn into .

4 Others
