

# **DM81xx DVR RDK Demo Guide**

Version 0.9

For DVRRDK Ver 02.00.00.XX

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### ***Revision History***

<b>Version</b>	<b>Date</b>	<b>Revision History</b>
0.1	29 Aug 2011	Demo Details Added
0.2	14 Sep 2011	Added details on McFW DVR Demo for new features
0.3	29 Sep 2011	Updated McFW DVR Demo details, Removed Chains Demo
0.4	28 Oct 2011	Updated as per new user inputs
0.5	02 Dec 2011	Updated as per new user inputs
0.6	30 Dec 2011	DM816x & DM814x demo guides merged. A single demo guide applicable for DVR RDK release for all platforms
0.7	07 Feb 2012	Decoder only Application section updated
0.8	08Feb 2012	SCD/LMD user interface changes updated
0.9	16 Feb 2012	Snapshots removed, document cleaned up.

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## 1 Overview

DVR RDK comprise of multiple applications depicting the use cases required for implementing DVR products.

The document provides details on how to use the applications provided in this release package.

The applications included in the package are:

1. Multi Channel Framework DVR Application

Multi Channel FW Application is based on McFW APIs and demonstrates the data flow for 16 CH Encode and Decode DVR

2. Multi Channel Decode Only Application

3. Multi Channel Capture, Encode Application

4. Multi Channel Capture, Display Application

### **Note**

- Several applications are made available to exercise the capability of DVR Multi Channel Framework. Few applications might not be supported in different release versions / platforms
- Demo guide is common for DM81xx platforms. All usecase / options are not valid in all platforms. Refer release notes on application specification supported on specific platforms.

## 2 Running the Main Applications

- On the console screen, go to the directory  
/opt/dvr\_rdk/ti816x/ **(or)** /opt/dvr\_rdk/ti814x  
and run the scripts as below:

```
$cd /opt/dvr_rdk/ti816x/  
$./init.sh
```

"init.sh" initializes the shared regions and loads the required kernel modules

- Then run the load.sh script and the output would be as shown after the command:  
\$./load.sh

"load.sh" uses firmware load utility to load the VPSS and Video M3 executables. Also, it sets up the remote debug print utility to receive the prints from M3 and DSP cores on A8.

## 2.1 Multi-Channel Framework DVR Application

This application displays a sample use of the TI Multi-channel framework APIs

Steps to run this particular application are as below:

1. On the console screen, and run the script below

```
$/run.sh
```

2. On running the above script you should see a user menu

```
1: VCAP + VENC + VDEC + VDIS - Progressive SD Encode + Decode
3: VCAP + VENC          + VDIS - SD Encode ONLY
4: VCAP + VENC          + VDIS - HD Encode ONLY
5:                      VDEC + VDIS - SD/HD Decode ONLY
6: VCAP                  + VDIS - NO Encode or Decode
```

There will be a set of Custom demos also shown on the user menu.

3. To execute any application enter as input. If you want to run a Progressive Capture / Encode / Decode / Display demo, press 1.

This user guide explains supported controls with respect to use case 1.

4. After choosing option 1 of the above options, you will be shown the default channel details showing the number of primary <D1> & secondary channels <CIF>. For Example

```
----- CHANNEL DETAILS-----
Capture Channels => 16
Enc Channels => Primary 16, Secondary 16
Dec Channels => 16
Disp Channels => 32
```

5. After each of the above step you will be asked whether to enable file write mode or not. To enable press 'y' and then you will be asked the location where u want to save the file.

First user would be asked to enable file write of SCD block Meta data. User can enable file write of a particular channel. Once user has chosen this option, user would be asked to enable file write of bit stream.

This provides option of writing captured video to a location in file system <hard disk or nfs>. User can choose to write the captured video data for a later analysis. No read back is provided. By default, only 1 channel write for each stream type is enabled.

Number of channels getting stored can be controlled with MCFW\_IPC\_BITS\_FWRITE\_ENABLE\_BITMASK\_DEFAULT macro in demos/mcfw\_api\_demos/mcfw\_demo/demo\_vcap\_venc\_vdec\_vdis.h file.

The maximum file size allowed for writing video data is predefined. This can be controlled with MCFW\_IPC\_BITS\_MAX\_FILE\_SIZE macro in ti\_mcfw\_ipcbits.c file. Both these options are build time options.

In current application, the maximum file size is the available space on the partition used for saving the file. File writes stop once the maximum file size is reached.

To disable file write mode just enter 'n'.

6. If you choose to give a input file of your own stream to see the decoder box functionality, enter 5 and fill the location of the streams as per instructions required to be decoded as shown below: This use-case has been described in [Section 2.2](#)
7. After either of the above choices, you should be able to see the outputs.

### 2.1.1 Generic Notes on Options Selection

- Channel numbers will vary depending upon the usecase executed. On UI input, min~max range of channels specific to usecase will be displayed. User should select the channels according to that range.
- Netra HD encoder demo is the 4 channel Vcap+VEnc+VDis demo application (Demo option 4 in user menu). In this demo 4 channels are captured via 4 different TVPs. In this demo 0<sup>th</sup> channel of each TVP is feed video input to 4 capture channels. Below list shows the logical to physical channel mapping.

HD Enc Demo Channel No.	Channel Mapping to Physical Channel
Channel 0	0 <sup>th</sup> channel of TVP-0 (Physical Channel 0)
Channel 1	0 <sup>th</sup> channel of TVP-1 (Physical Channel 4)
Channel 2	0 <sup>th</sup> channel of TVP-2 (Physical Channel 8)
Channel 3	0 <sup>th</sup> channel of TVP-3 (Physical Channel 12)

- Channel numbers might vary in your actual run depending on use case executed.

- Few UI options, explicitly display message informing the availability of the feature on specific usecase. Selecting an invalid option will end up in undefined behavior.
- The data flow of individual usecases will be part of McFW user guide (or) release notes. Also, the specific usecase files in mcfw source directory have an ASCII data flow diagram at the top of the file. For e.g., mcfw\src\_linux\mcfw\_api\usecases\ti814x\multich\_progressive\_4d1\_vcap\_venc\_vdec\_vdis.c has the data flow diagram for 814x – 4D1 progressive usecase.

### 2.1.2 Capture Settings

Capture settings can be controlled using “Capture Settings” UI option as explained below.

Note: These settings are not applicable for use cases not involving CAPTURE

#### 1. Disable channel

It disables a particular channel at the capture; hence you would not be able to see the channels live output and the decoded output on the displays.

#### 2. Enable channel

It enables a previously disabled channel at the capture; hence you would be able to see the channels live output and the decoded output on the displays.

#### 3. OSD Window position

Position of the OSD window can be varied by specifying the window number (0 or 1 or 2), and the new position coordinates(X, Y) for that window. After which you will have the OSD window at your desired position.

Note: OSD settings are not valid on all use cases.

#### 4. OSD Window size

Note: Please refer to the source code to get the usage of VCAP OSDWINPRM

#### 5. OSD Window transparency

User can enable or disable transparency of the OSD window by selecting this option.

Currently, the transparency value is 0 (Luma value is 0 and Chroma value is 0). This means if the OSD overlaying content has value of 0 and transparency is enabled, the pixels with value 0 will become transparent.

Note: In current application, the sample OSD content does not have any 0x0 pixels, so the effect of enable/disable transparency is not noticed.



## 6. OSD Window global alpha

The OSD Window global alpha can be set by this option, entered value will be valid for the complete overlay content.

User can set the value from 0 to 128. The value entered is U1Q7 format where the MSB is integer value and other seven bits are fraction.

User Input	Hex Equivalent	Decimal Interpretation	Alpha Blending Percentage	Output seen on Display
0	0x00	0.0	0%	OSD window is seen 100% and video behind the OSD window is not seen
64	0x40	0.5	50%	OSD window is blended 50%
128	0x80	1.0	100%	OSD window is not seen and video is fully seen

## 7. OSD Window enable/disable

OSD window itself can be enabled\disabled using this option.

## 8. Detect video

The input video format (PAL/NTSC) will be detected and notified with this option.

## 9. Dynamic resolution change

This option allows changing the resolution of primary/secondary channels to pre-defined resolutions (D1, VGA, HALD-D1, CIF and QCIF)

This option is not valid on ALL use-cases.

### a. SCD mode selection

To select different SCD modes on a particular channel, this option can be used. Following different modes are supported.

SCD mode	Remark
0	Disable both Tamper and Motion detection.
1	Enable Tamper detection.
2	Enable Motion detection.
3	Enable both Tamper and Motion detection.

In the dvr\_rdk release version **02.00.00.23**, motion detection has to be enabled with tamper detection. SCD motion detection only mode i.e. ALG\_LINK\_SCD\_DETECTMODE\_MONITOR\_BLOCKS, is not supported. Motion detection works fine when it is enabled with tamper detection i.e. SCD mode ALG\_LINK\_SCD\_DETECTMODE\_MONITOR\_BLOCKS\_AND\_FRAME.

**b. SCD frame sensitivity**

Internal threshold for tamper tolerance. Takes values in the range of 0-6 where 0 is lowest and 6 is the maximum sensitivity.

**c. SCD ignore lights OFF flag**

Set to 1 to ignore sudden, significantly darker avg. scene luminance

**d. SCD ignore lights ON flag**

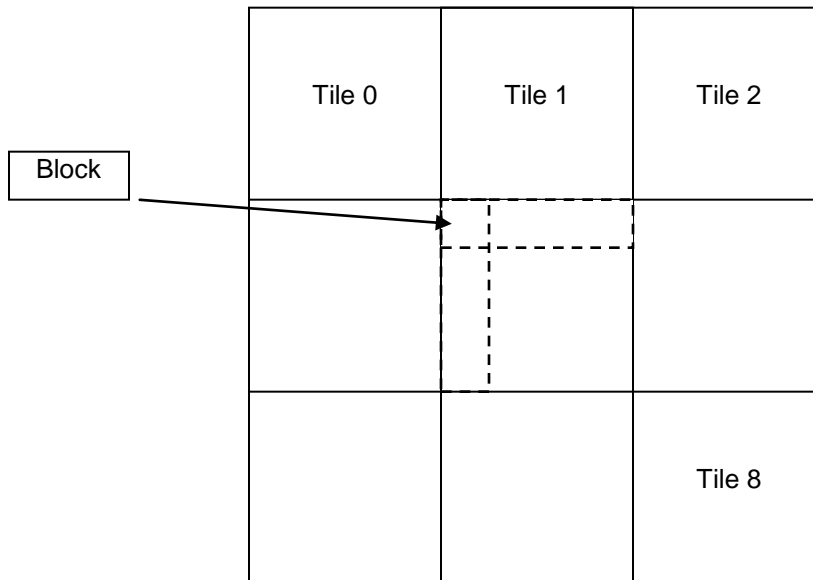
Set to 1 to ignore sudden, significantly brighter avg. scene luminance.

**e. Live Motion Detection (LMD) Configuration**

To activate Live Motion Detection (LMD), CIF stream path should be always activated as LMD works on CIF stream only.

In the SCD/LMD algorithm, motion detection happens on (32x12)/ (32x10) pixel block in PAL/NTSC input respectively.

In the current demo application, SCD/LMD configuration is done at tile level. Each frame is divided in to a set of 3x3 tiles (Max 9-tiles).



User can select any of the tiles starting from 0 - 8 (topLeft - bottomRight). Once the tile is selected, user can update block config of all the blocks within that tile.

To enable motion detection in any of the tiles of the frame, user can select option "e" in the capture settings.

Condition checks have been added to take care of left and bottom boundary. Once the block boundaries are decided, user is asked to input SCD tile enable/disable option. If the tile is enabled, user is asked to input sensitivity. Refer SCD reference document for further details on SCD.

Note: Option "p" can be used to navigate to a preview menu.

### 2.1.3 Encoder Settings

**Encode settings are not applicable for VDEC+VDIS based use cases.**

**Encoder settings of MJPEG channels <included in some use cases> might not be controlled in some cases.**

#### 1. Disable channel

It disables encode of a particular channel; hence you would not be able to see the channel's decoded output on the display.

## **2. Enable channel**

It enables a previously disabled encode of a particular channel, hence you would be able to see the channel's decoded output on the display.

## **3. Change bit-rate**

This option allows you to modify the output bit-rate of a particular encode channel.

## **4. Change frame-rate**

This option allows you to modify the output frame-rate (fps) of a particular encode channel.

## **5. Change I-frame interval (GOP ratio)**

This option allows you to modify the Interval between two consecutive intra frames.

Example Values:

- 0 - Only first frame to be intra coded
- 1 - No inter frames (all intra frames)
- N - One intra frame and N-1 inter frames, where  $N > 1$

## **6. Force I-frame**

Force the current (immediate) frame to be encoded as an Intra coded frame for a particular channel.

## **7. Change QP I-frame/JPEG Quality Factor**

This option handles two cases,

- i) To set the Quantization parameters for the I/IDR frames, for the specific H264 channels  
This option allows you to modify the initial/Maximum/Minimum quantization parameter for I/IDR frames.
- ii) JPEG quality factor can be controlled for the JPEG specific channels also  
This option allows you to modify the quality of the JPEG output. Set this parameter to 2 for lowest quality and 97 for best quality.

## **8. Change QP P-frame**

To set the Quantization parameters for the P frames, for the specific H264 channels

This option allows you to modify the initial/Maximum/Minimum quantization parameter for P frames.

## **9. Change RateControl Algorithm(CBR/VBR)**

This option allows you to change the rate control algorithm from the default VBR to CBR for a particular channel.

### **0. Take a JPEG Snapshot**

By using this option, you would be able to take the MJPEG snapshot of the current (immediate) frame.

#### **a. Bitrate Switching Interval: VBRDuration**

Increasing this value will make VBR wait for longer time before switching bit-rate state. This parameter is used only when maxBitRate is greater than 1.5 times of targetBitRate

#### **b. VBR Sensitivity**

It controls the amount by which the bit-rate increases over the average bitrate when transition happens to high complexity state

i. To print the current values of Bit-rate, Frame rate and the I-Frame interval for a particular channel.

### **2.1.4 Decoder Settings**

Decoder Settings are not valid in use cases not using Decoder and for the Decode Display Demo.

#### **1. Disable channel**

It disables decode of a particular channel hence you would not be able to see the decoded display.

#### **2. Enable channel**

It enables a previously disabled decode of a particular channel after which you will be able to see the decoded display of a particular channel

#### **3. Set TrickPlay Speed**

To change the speed of playback for a particular channel, select 'Set TrickPlay Speed' & enter the channel number, speed of playback as 1X or 2X or 4X speed (currently acceptable values are 1 or 2 or 4).

Note – This option is not valid for all use cases.

## 2.1.5 Display Settings

- Both live & encode channels are sent to display.
- 0~Max Capture channel numbers correspond to Live Channels <e.g. – 0~15 in case of 16 CH progressive demo>
- Max Capture Ch Num~(2\*Max Capture Ch Num – 1) correspond to Playback Channels <e.g. – 16~31 in case of 16 CH progressive demo>
- All channels might not be visible. Number of channels displayed is dependent on Layout being selected.
- In some usecases, HDMI outputs are tied – so same display will come in both displays. SDTV might show different channels if selected specifically.

### 1. Disable channel

It allows the user to hide the display of a particular channel.

### 2. Enable channel

It enables the user to show back a previously disabled/hidden display of a particular channel.

### 3. Switch Layout

This option allows the user to change the display layout of display of the channels.

On selecting a particular layout, you will notice that the layout has changed as per the layout selected at all displays Live.

### 4. Switch Channels

This option allows you to re-map of the channels in the present layout. The user needs to only give the start channel number that should get displayed on the top left window (Window 0) for each display; other channels to the rest of the windows are calculated by incrementing the channel number.

### 5. Change resolution

This option allows you to change the display output resolution for all the mentioned output displays. Supported resolution changes are 1080P60, 720P60, XGA, SXGA, NTSC or PAL

#### ***Live-Bypass based settings***

***Under display setting the following options are provided. This option is valid only for few use cases & using this option on unsupported use case will have no effect or undefined behavior.***

### **6. Switch Queue(ONLY FOR SD Display)**

User can switch the content to be displayed by the display link by selecting the queueID. In the demo,

The display queue 0 corresponds to mosaic view (SwMs output)

The display queue 1 corresponds to live bypass view (Capture output)

By selecting QueueID 0 or QueueID 1 user can switch at runtime between Mosaic and Live views.

### **7. Switch Channel(ONLY FOR Enc HD Usecase)**

User can switch the content to be displayed by the display link by selecting the chanID in the demo. User can switch channel of either HDMI 0 or 1 by selecting respective HDMI.

### **8. Switch SDTV channel (ONLY for progressive demo)**

When in live bypass view, the user can additionally select the capture channel to be displayed and switch between capture channels at runtime.

This option is applicable only for SD display link and only when in "Live bypass view" mode.

### **9. 2x digital zoom in top left**

This option can magnify the top left (from point 0%, 0% to point 50%, 50%) corner of the window for 2 times. It applies on the window 0. Please reference the API to see how to apply on other window.

#### **a. 2x digital zoom in center**

This option can magnify the center (from point 25%, 25% to point 75%, 75%) of the window for 2 times. It applies on the window 0. Please reference the API to see how to apply on other window.

Settings Changed For	Channel Numbers Interpretation	Operation	Channel Numbers		Behavior			
			816x[16CH D1 Capture]	814x[4Ch D1 Capture]	Live Display	Playback Display	D1 File Output <if enabled>	CIF File Output <if enabled>
<b>VCAP</b>	0-15 <816x>, 0-3 <814x> represent both D1 & CIF channels. Other numbers are invalid	Chan Disable	0-15	0-3	Blank Display for ch	Blank Display for ch	No increase in file size	No increase in file size
			>15	>4	No Change	No Change	No Change	No Change
		Chan Enable	0-15	0-3	Ch display gets reenabled	Ch display gets reenabled	File write will restart	File write will restart
			>15	>4	No Change	No Change	No Change	No Change
<b>VENC</b>	0-15 <816x>, 0-3 <814x> represent D1 channels. 16-31 <816x>, 4-7 <814x> represent CIF channels	Chan Disable	0-15	0-3	Blank Display for ch	Blank Display for ch	No increase in file size	No Change
			16-31	4-7	No Change	No Change	No Change	No increase in file size
			>31	>7	No Change	No Change	No Change	No Change
		Chan Enable	0-15	0-3	Ch display gets reenabled	Ch display gets reenabled	File write will restart	No Change
			16-31	4-7	No Change	No Change	No Change	File write will restart
			>31	>7	No Change	No Change	No Change	No Change
<b>VDEC</b>	0-15 <816x>, 0-3 <814x> represent D1 channels. Other numbers are invalid	Chan Disable	0-15	0-3	No Change	Blank Display for ch	No Change	No Change
			>15	>4	No Change	No Change	No Change	No Change
		Chan Enable	0-15	0-3	No Change	Ch display gets reenabled	No Change	No Change
			>15	>4	No Change	No Change	No Change	No Change
<b>VDIS</b>	0-15 <816x>, 0-3 <814x> represent live channels. 16-31 <816x>, 4-7 <814x> represent playback channels	Chan Disable	0-15	0-3	Blank Display for ch	No Change	No Change	No Change
			16-31	4-7	No Change	Blank Display for ch	No Change	No Change
			>31	>8	No Change	No Change	No Change	No Change
		Chan Enable	0-15	0-3	Ch display gets reenabled	No Change	No Change	No Change
			16-31	4-7	No Change	Ch display gets reenabled	No Change	No Change
			>31	>8	No Change	No Change	No Change	No Change

**Table: Interpreting Channel numbers for 8168 16D1 & 8148 4D1 progressive demos**



### 2.1.6 Change Modes (8CH Usecase)

In 8 CH usecase, there are different modes of captured resolutions like 2D1 + 6 CIF, 8 D1 etc. These modes can be selected using "Change modes" .

### 2.1.7 Audio Capture / Playback Settings

Audio capture and playback are integrated with Progressive SD Encode + Decode demo. Sub menu available for setting audio storage path, audio capture start/stop, audio play start/stop & statistics. User need to set the valid file storage path before proceeding for Audio capture/playback.

Following audio configuration is available on DM816X EVM Board:

- Upto 16 channels audio capture and 1 channel playback is supported in this version.
- Audio capture/playback with G711 encoding/decoding.
- Audio is captured at 16 KHz and encoded using 8-bits ulaw. Playback happens at same sampling rate using 8-bits ulaw decode. If testing with any PC software at audio out end, configure the PC software for 16 KHz and 8-bit ulaw.
- By default, 16 channels capture is configured in the linux kernel as well as the application. **Need to ensure that DVRRDK hardware ver 0.3A or above (Or DM8168 EVM VS Daughter Card Rev C) is used**

*Note - Any operation with audio is possible only when video capture is enabled and running. Audio settings will fail if tried before video capture.*

Audio settings menu screen shot is shown below –

```
Enter Choice: 5

=====
Audio Settings Menu
=====

1: Set   Audio Storage Path
2: Start Audio Capture
3: Stop  Audio Capture
4: Start Audio Playback
5: Stop  Audio Playback
6: Set Audio Capture Configuration

p: Previous Menu

Enter Choice: █
```

Capture, playback operations will fail as shown below until a proper storage path is provided. So, the first operation should be setting audio storage path.

User should set audio recording directory - can point to nfs or hdd. Application will try to create this directory if not existing already. If creation fails for some reason, it prints error message. User should again select storage path setting option and provide a valid path. This is one time operation on app execution. Still user can switch to a different storage path on same session.

```
Enter Choice: 1
Enter file write path : /home
Selected file write path [/home]
Store path set to /home
Trying to set storage path to /home
```

There is 1 playback instance & 1 capture instance. Each can operate on different channels. If user gives a channel which is already being captured or played then the already running capture / playback will be terminated and new request will be started.

Capture can be selected as shown below. Channel number will be the input.

```
Enter Choice: 2

Select AUDIO CAPTURE CH ID [0 .. 3] : 0

Selected CH ID = 0

Removing /home/01/record01.pcm
Removing /home/01/record02.pcm
Removing /home/01/record03.pcm
Removing /home/01/record04.pcm
Removing /home/01/record05.pcm
Removing /home/01/record06.pcm
Removing /home/01/record07.pcm
Removing /home/01/record08.pcm
Removing /home/01/record09.pcm
Removing /home/01/record10.pcm

=====
Audio Settings Menu
=====

1: Set   Audio Storage Path
2: Start Audio Capture
3: Stop  Audio Capture
4: Start Audio Playback
5: Stop  Audio Playback
6: Set Audio Capture Configuration

p: Previous Menu

Enter Choice: Opened /home/01/record01.pcm for recording..
```

When a channel is selected for audio capture, already existing audio files for that channel will be deleted. This is done to avoid mixing up of a previous recording. Max of 10 files <each of max size around 20MB> is allowed to record. If capture continues beyond 10th file, data will be overwritten starting from first file. Capture & playback can be independently started / stopped.

Capture Stop can be done using respective option. Both capture & playback simultaneously on same channel is not allowed.

Playback of a particular channel can be started / stopped in similar way.

Audio parameters like sampling frequency, audio volume, mute option can be selected as shown below.

*Note - Explicit delays are added on selection of menu option <so wait till the operation completes>.*

Enter Choice: 6

=====  
Audio Parameters Settings Menu  
=====

1: Set Sampling Frequency  
2: Set Audio Volume  
3: Mute Audio Volume

p: Previous Menu

Enter Choice: 1

Enter the Frequency [8000 or 16000 KHz]:8000

=====  
Audio Parameters Settings Menu  
=====

1: Set Sampling Frequency  
2: Set Audio Volume  
3: Mute Audio Volume

=====  
Audio Parameters Settings Menu  
=====

1: Set Sampling Frequency  
2: Set Audio Volume  
3: Mute Audio Volume

p: Previous Menu

Enter Choice: 2

Enter the Audio Volume[0..8] :6

Enter Choice: 3

Audio capture is muted. Increase audio capture volume to unmute

=====  
Audio Parameters Settings Menu  
=====

1: Set Sampling Frequency  
2: Set Audio Volume  
3: Mute Audio Volume

## 2.2 Decoder Only Application (VDEC + VDIS – SD/HD Decode Only)

In VDEC+VDIS demo input stream files details are provided through **ini** files. User can see sample **ini** files available in **dvr\_rdk/bin/ti816x/demo\_ini** folder.

Before using, please edit the **ini** files to specify the actual input file name according to your data files.

After entering correct detail in **ini** files user can give the path of **ini** files after starting VDEC+VDIS demo. By default, the **ini** file specifies /data/<filename> as the place for the data files. Follow below instruction while creating your own **ini** file.

- User has to mention stream path, resolution and channel enable flag in the file.
- User can individually enable or disable each channel via **ini** file by setting enable flag.
- User needs to mention the number of decode buffers required for particular channel.
- Desired display delay can be set by the User by setting displaydelay param in the ini file. Decoder shall start displaying of frames not later than displayDelay number of frames are decoded.

displayDelay param value	Its meaning
-1	Decoder decides the display delay (Auto mode)
0	Display frames are in decoded order without delay
1	Display the frames with 1 frame delay
2	Display the frames with 2 frame delay
3	Display the frames with 3 frame delay
4	Display the frames with 4 frame delay
5	Display the frames with 5 frame delay
6	Display the frames with 6 frame delay
7	Display the frames with 7 frame delay
8	Display the frames with 8 frame delay
9	Display the frames with 9 frame delay
10	Display the frames with 10 frame delay
11	Display the frames with 11 frame delay
12	Display the frames with 12 frame delay
13	Display the frames with 13 frame delay
14	Display the frames with 14 frame delay

15	Display the frames with 15 frame delay
16	Display the frames with 16 frame delay

Next, user is asked to choose if he/she wants to generate header file. For every new stream, user must select "Y" and generated information header files can be re-used again. If user already has header information then he/she can select "N". For huge files header file generation will take very long time.

**Note:**

- Multiple references frames is supported but only 1 reference frame(B-frame) has been tested extensively, hence limited Generic Decoder testing has been conducted for H264
- The numbuf should always be greater than the displaydelay and **preferably the difference between them is five or more**
- Keep the numbuf = 16 and displaydelay = 10 in the ini file, for generic streams which have multiple reference buffers
- Limited error stream testing has been done