



VSofts H.264/AVC Codec v4
Encoder Settings for
Blu-ray Compliance

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1. Version History

Version	Date	Comments
1.0	05/2009	Initial version
1.1	11/2009	Codec v4.4 updates
1.2	08/2010	3D MVC section added (codec v4.5)

2. Overview

This document describes *VSofts H.264/AVC Encoder v4* settings for creation of Blu-ray compliant streams. Refer to *VSofts AVC Advanced Settings* document for the details on the encoder parameters and possible values.

3. Encoder Settings

3.1 Bitrates less than 20000 Kbps

The following parameters should be changed from their default values:

```
profile_idc    = 100
level_idc      = 40

input.width    = <width>
input.height   = <height>

gop.num_units  = <num_units>
gop.time_scale = <time_scale>
//Define Frames per seconds: fps = time_scale/(2*num_units)
//Only predefined combinations are valid. See below

sei.pic_timing_flag = 1
gop.aud = 1

rc.type        = 2 // CBR
rc.kbps        = <desired_kbps>
rc.vbv_length  = 2000
```

Make sure that:

1. $rc.kbps \leq 20000$
 2. $rc.kbps * rc.vbv_length * 1.5 \leq 25000000$ (for Encoder 4.2, 4.3)
- or
2. $rc.kbps * rc.vbv_length \leq 25000000$ (for Encoder 4.4 and higher)

For higher bitrates reduce `rc.vbv_length` accordingly.

```
interlace_mode = 0 // for progressive material
```

or

```
interlace_mode    = 3 // for interlace material
```

3.2 “Extremely” high quality (bitrates higher than 20000 Kbps)

The following parameters should be changed from their default values:

```
profile_idc    = 100
level_idc      = 41

input.width    = <width>
input.height   = <height>

gop.num_units  = <num_units>
gop.time_scale = <time_scale>
//Define Frames per seconds: fps = time_scale/(2*num_units)
//Only predefined combinations are valid. See below

sei.pic_timing_flag = 1
gop.aud = 1

rc.type        = 2 // CBR
rc.kbps        = <desired_kbps>
rc.vbv_length  = 2000

slice.mode     = 3
slice.param    = 4 //set 4 slices per picture
mt.num_groups_i = 2 //not needed for version 4.4 and higher
mt.num_groups_p = 2 // --
mt.num_groups_b = 2 // --
```

NOTE: This mode demands 4-slice encoding with some predefined slice size by the Blu-ray standard. Slices generated by VSofts encoder (in slice mode#3) sometimes may not satisfy the constraint. To overcome this problem in version 4.2 the additional *mt.num_groups* parameters are set (see above).

Make sure that:

1. $rc.kbps \leq 30000$
2. $rc.kbps * rc.vbv_length * 1.5 \leq 30000000$ (for Encoder 4.2, 4.3)

or

2. $rc.kbps * rc.vbv_length \leq 30000000$ (for Encoder 4.4 and higher)

For higher bitrates reduce *rc.vbv_length* accordingly.

```
interlace_mode    = 0 // for progressive material
```

or

```
interlace_mode    = 3 // for interlace material
```

3.3 Other settings

It is not requested by the specification to include HRD parameters and picture timing SEIs. All the restrictions must be checked only on the transport stream level. Elementary video must only fit into these restrictions. Nevertheless, the application may demand that these elements are present in the elementary stream. VSofts encoder puts them in CBR mode or VBR mode in combination with `rc.max_kbps` parameter:

- In CBR coding (`rc.type = 2`) all above restrictions are applied.
- It is possible to use VBR coding (`rc.type = 1`) (VBR bitrate) in combination with `rc.max_kbps` setting. In this case, all the restrictions described above for `rc.kbps` parameter will be related to `rc.max_kbps` parameter. `rc.kbps` must be less then `rc.max_kbps` and it will define average resulting bitrate. For HRD buffer parameter in SPS and SEI messages `rc.max_kbps` will be used.

There are more constraints in the specification:

- Aspect ratio should be present
- `gop.keyframes` has limitations – not less then 1 key frame per second
- Only predefined combination of frame rate, frame size, `frame_mbs_only` flag and aspect ratio values are allowed.

The following settings must be employed:

Width x Height	time_scale/num_units	frame_mbs_only_flag (0- interlaced, 1- progressive)	Aspect ratio IDC
1920x1080	1001/60000	0	1
	1000/50000	0	
	1000/48000	1	
	1001/48000	1	
1440x1080	1001/60000	0	14
	1000/50000	0	
	1000/48000	1	
	1001/48000	1	
1280x720	1000/48000	1	1
	1001/48000	1	
	1001/120000	1	
	1000/100000	1	

720x576	1000/50000	0	2 or 4
720x480	1001/60000	0	3 or 5

The following parameters should be changed, if possible, from their default values for better quality:

```
preproc.intra_precision = 4
```

```
gop.idr_period = 10
```

```
frext.transform_8x8 = 1
frext.scaling_matrix = 1
```

```
speed.i = 0
speed.p = 0
speed.b = 0
```

For 720p60 (720p50) it is recommended to set:

```
gop.bframes = 3
```

3.4 3D MVC Encoding

VSofts H.264 Encoder since v4.5 supports Multi-view Coding extension of the H.264 standard (Annex H). According to this extension, the stream can contain one *base* view (fully compliant with AVC standard) and a set of *dependent* views encoded with slices of NALU_TYPE_SLICE_EXT(20) type.

The main practical usage of MVC encoding now is encoding of Stereo HD content for 3D enabled BluRay players. There are some specific restrictions on base and dependent views in this case. (For example frames of both views shall be spitted into 6 slices or more). It also demands to separate base and dependent view into different streams. An example of encoder configuration file with all BluRay restrictions (other parameters will be default):

```
profile_idc = 100
level_idc = 41
```

```
gop.keyframes = 23
gop.bframes = 2
gop.num_units = 1001
gop.time_scale = 50000
gop.aud = 1
```

```
rc.type = 2
rc.kbps = 8000
rc.vbv_length = 1000
```

```
slice.mode = 3
slice.param = 6
```

```
frext.transform_8x8 = 1
```

```
vui.aspect_ratio_info_present_flag = 1
vui.aspect_ratio_idc = 1
```

```
svc.num_layers = 1
svc.multistream_mode = 2
svc.flags = 2

svc.layer[0].profile_idc = 128
svc.layer[0].level_idc=41
svc.layer[0].kbps = 12000
svc.layer[0].slice.mode = 3
svc.layer[0].slice.param = 6
```

BluRay spec also demands to put special "dependant delimiters" NALs into dependant view. This can be switched on by setting `M_FLAG_MVC_DELIMITERS` flag in `svc.flags` parameter.