

Operational guideline for H.264

1 Operation rule of monomedia

1.1 Video encoding

1.1.1 H.264 | MPEG-4 AVC

- Comply with ITU-T Rec. H.264 | ISO/IEC 14496-10:2003 specification.

However, The part related with MPEG2 Systems should refer to ITU-T Rec. H.222.0 | ISO/IEC 13818-1:2000/AMD3(FDAM3).

Encoding parameter

- Encoding parameter is defined in ARIB STD B24 Part 1 Chapter 2 4.4.
- Profile level is Baseline level 1.2.

Video format

- Video formats are one of QVGA (4 : 3) (screen size : 320x240) or QVGA (16:9) (screen size : 320x 180)

Limitaion of PES packet as follows;

- PTS_DTS_flags in PES packet header is always '10'
- IDR AU is always first AU of PES packets
- PES packet consists of n- AU (n is one or more integer).
- Difference between sequential two PES packets must be within 0.7 seconds.

Restriction of bit stream

(1) IDR access unit transmisson period

- In purpose of shortening a time for start playing, IDR access unit (hereinafter, refer as AU) must be inserted in bit stream at 2 seconds interval normally. However, when the encoder extend the intervals of IDR-AU in purpose of keeping quality of image, the encoder must insert AU within 5 seconds.
- In other words, IDR-AU is elementary stream access point defined in ISO/IEC 13818-1:2000 FDAM3.

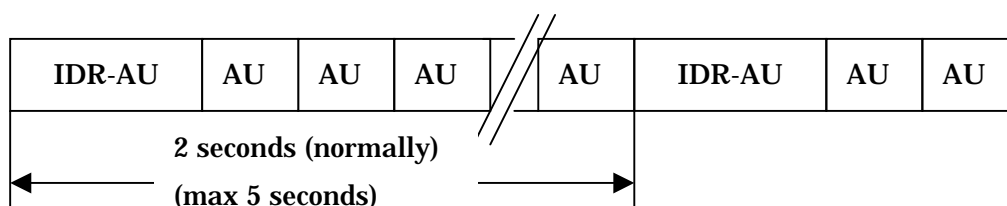


Figure 5-1 IDR-AU intervals

(2) Composition of AU

- The unit number and order of NAL unit which compose of IDR AU and non-IDR AU as follows. However NAL unit which is not defined in Table 5-1 do not operate.

Table 1-1 Composition of AU

Kind and Order of NAL Unit	Unit number	
	IDR AU	non-IDR AU
access unit delimiter	1	1
sequence parameter set (SPS)	1	0
picture parameter set (PPS)	1	0 or 1
supplemental enhancement information (SEI)	0 or 1 (Note 1)	0 or 1 (Note 1)
coded slice of an IDR picture	1 or more	0
coded slice of a non-IDR picture	0	1 or more
filler data	0 or 1	0 or 1
end of sequence	0 or 1	0 or 1

(note 1) Insert condition of SEI NAL unit defined in Table 1-10.

(3) Operational limitation on syntax

Limitation of flag on syntax as follows. However SPS (Sequence Parameter Set) and ID of PPS (Picture Parameter Set) may operate fixed value in despite of change the content of parameter.

Table 1-2 Limitation of access unit delimiter

Flag	Operation	Note
primary_pic_type	0 or 1	In case of IDR picture, this value shall be 0, in case of non IDR, this value shall be 1.

Table 1-3 Limitation of SPS (Sequence Parameter Set)

Flag	Operation	Note
profile_idc	66	Baseline profile
constraint_set0_flag	1	FMO, ASO, RS are not in use.
constraint_set1_flag	1	

Flag	Operation	Note
constraint_set2_flag	1	
level_idc	12	Level 1.2
seq_parameter_set_id	0 - 31	Set in operation
log2_max_frame_num_minus4	0 - 12	Non circulated value between IDR shall be set in operation
pic_order_cnt_type	2	POC type is only 2
num_ref_frames	1 or 2 or 3	referencing frame number is 3 (maximum)
gaps_in_frame_num_value_allowed_flag	0	Do not process compensation of lost frames
pic_width_in_mbs_minus1	19	$320 / 16 - 1 = 19$
pic_height_in_map_units_minus1	14 or 11	$240 / 16 - 1 = 14$, $180 / 16 - 1 = 11$
frame_mbs_only_flag	1	frame MB only
direct_8x8_inference_flag	1	Meaningless in Baseline
frame_cropping_flag	0 or 1	In case of 320 x 180, this value shall be 1, in case of 320 x 240 shall be 0.
frame_crop_left_offset	0	In case of 320 x 180
frame_crop_right_offset	0	In case of 320 x 180
frame_crop_top_offset	0	In case of 320 x 180
frame_crop_bottom_offset	6	In case of 320 x 180, cropping 12 lines
vui_parameters_present_flag	1	VUI required

Table 1-4 Limitation of VUI parameters

Flag	Operation	Note
aspect_ratio_info_present_flag	0	Aspect ratio 1:1 is defined as operational rule (cf. The default value of standard is unspecified)
overscan_info_present_flag	0	do not operate

video_signal_type_present_flag	0	According to STD-B24, the decoder shall interpret colour primaries , transfer characteristics , and matrix coefficients are all 1 (therefore Rec.ITU-R BT 709)
chroma_loc_info_present_flag	0	Using default value
timing_info_present_flag	1	
num_units_in_tick	1001 * N	N shall be more than 1, 15fps max (note 1)
time_scale	24000 or 30000	15fps max (note 1)
fixed_frame_rate_flag	0 or 1	
nal_hrd_parameters_present_flag	0 or 1	
vcl_hrd_parameters_present_flag	0 or 1	
low_delay_hrd_flag	0	Prohibit low delay mode
pic_struct_present_flag	0	
bitstream_restriction_flag	0 or 1	(note 2)
motion_vectors_over_pic_boundaries_flag	0 or 1	
max_bytes_per_pic_denom	0 - 16	
max_bits_per_mb_denom	0 - 16	
log2_max_mv_length_horizontal	0 - 9	Horizontal +128/-128
log2_max_mv_length_vertical	0 - 9	
num_reorder_frames	0	Prohibit reordering
max_dec_frame_buffering	0 - 3	Referencing frame number is 3 (maximum)

(note 1) The intervals between pictures defines as follows

- The decode/present intervals between sequential pictures shall be 1001/15000 or more, and shall be multiple number of num_units_in_tick / time_scale. The num_units_in_tick and time_scale are defined in VUI.

(note 2) The search area of moving vectoris limited in horizontal direction from +128 to -128. For prohibit reordering, num_reorder_frames = 0.

Table 1-5 Limitaion of HRD parameters

Flag	Operation	Note
cpb_cnt_minus1	0	A kind of CPB is 1
bit_rate_scale	0 - 15	Set in operation
cpb_size_scale	0 - 15	Set in operation
bit_rate_value_minus1	(bit_rate_value_minus1 + 1) * 2 ^(6 + bit_rate_scale) ≤ 384000 or 460800	Set the value based on actual operational bit rate
cpb_size_value_minus1	(cpb_size_value_minus1 + 1) * 2 ^(4 + cpb_size_scale) ≤ 1000000 or 1200000	Set the value based on actual operational CPB size
cbr_flag	0 or 1	
initial_cpb_removal_delay_length_minus1	0 - 31	Set in operation
cpb_removal_delay_length_minus1	0 - 31	Set in operation
dpb_output_delay_length_minus1	0 - 31	Set in operation
time_offset_length	0	

Table 1-6 Limitation of PPS (Picture Parameter Set)

Flag	Operation	Note
pic_parameter_set_id	0 - 255	Set in operation
seq_parameter_set_id	0 - 31	Specify id of referencing SPS
entropy_coding_mode_flag	0	CAVLC only
pic_order_present_flag	0	Type 2 only
num_slice_groups_minus1	0	Prohibit FMO
num_ref_idx_l0_active_minus1	0 or 1 or 2	Referencing frame number is 1 or 2 or 3 just before the frame
num_ref_idx_l1_active_minus1	0	No B frame
weighted_pred_flag	0	Prohibit WP
weighted_bipred_idc	0	No B frame
pic_init_qp_minus26 /* relative to 26 */	-26 - 25	Set in operation
pic_init_qs_minus26 /* relative to 26 */	0	Not in use
chroma_qp_index_offset	-12 - 12	Set in operation
deblocking_filter_control_present_flag	0 or 1	Set in operation. No limitation
constrained_intra_pred_flag	0	No limitation of Intra prediction
redundant_pic_cnt_present_flag	0	Prohibit RS

- Limitation of SEI (Supplemental Enhancement Information) as follows. And the message except three SEI messages (Buffering Period, Picture timing, Pan-scan) can be skipped. (note1)

Table 1-7 Buffering period SEI message (note2)

Flag	Operation	Note
seq_parameter_set_id	0 - 31	Specify id of referencing SPS

initial_cpb_removal_delay	initial_cpb_removal_delay + initial_cpb	If NalHrdBpPresentFlag and VclHrdBpPresentFlag are "1" then set in operation time
initial_cpb_removal_delay_offset	_removal_delay_offset ≤ 135000 (recommended value)	If NalHrdBpPresentFlag and VclHrdBpPresentFlag are "1" then set in operation time

Table 1-8 Picture timing SEI message (note 3)

Flag	Operation	Note
cpb_removal_delay	0 - 150	If CpbDpbDelaysPresentFlag is "1", set in operation time
dpb_output_delay	0	If CpbDpbDelaysPresentFlag is "1", this flag shall be set in operation time

Table 1-9 Pan-scan rectangle SEI message (note 4)

Flag	Operarion	Note
pan_scan_rect_id	0	
pan_scan_rect_cancel_flag	0 or 1	
pan_scan_cnt_minus1	0	
pan_scan_rect_left_offset	0 or 640	
pan_scan_rect_right_offset	0 or -640	
pan_scan_rect_top_offset	480 or 0	
pan_scan_rect_bottom_offset	-480 or 0	
pan_scan_rect_repetition_period	1	

(Note 1) Insertion or not and Insertion order of SEI message per AU as follows;

- IDR-AU

Such an AU, Buffering period SEI message, Picture timing SEI message, and Pan-scan rectangle SEI message canbe inserted and insertion order as follows;

1. Buffering period SEI message
2. Picture timing SEI message
3. Pan-scan rectangle SEI message

- non IDR-AU

In this AU, only Picture timing SEI message can be inserted.

(Note 2) (note 3) Limitation of inserting Buffering period SEI message and Picture timing SEI message as follows;

Table 1-10 Limitation of inserting Buffering period SEI message and Picture timing SEI message

fixed_frame_rate_flag	Buffering period SEI message	Picture timing SEI message	Kinds of AU
0	O	O	IDR
0	x	O	Non IDR
1	x	x	IDR
1	x	x	Non IDR

O : shall insert X : not insertion

- In case of 1PES=1AU fixed composition, Buffering period SEI message and Picture timing SEI message insertion are optional.

(note 4) Limitation of inserting pan-scan rectangle SEI message

- In case of pan-scan operation are available, this message shall insert in IDR-AU.

Table 1-11 Limitation of Slice header

Flag	Operation	Note
first_mb_in_slice	0 - 299 or 0 - 239	Set in operation
slice_type	0, 5 or 2, 7	IDR slice : 7, non IDR slice : 0, 2, 5, 7
pic_parameter_set_id	0 - 255	Specify id of referencing PPS
frame_num	From 0 to MaxFrame Num	Do not circulate between IDR
idr_pic_id	0 - 65535	Set in operation
num_ref_idx_active_override_flag	0 or 1	Set in operation
num_ref_idx_l0_active_minus1	0 or 1 or 2	Referencing frame is 1, 2 and 3
slice_qp_delta	-51 - 51	Set in operation
disable_deblocking_filter_idc	0 or 1	Prohibit non-filtering slice border mode
slice_alpha_c0_offset_div2	-6 - 6	Set in operation

slice_beta_offset_div2	-6 - 6	Set in operation
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Table 1-12 Limitation of Reference picture list reordering

Flag	Operation	Note
ref_pic_list_reordering_flag_l0	0	Reordering Referencing frame is prohibited

Table 1-13 Limitation of Decoded reference picture marking

Flag	Operation	Note
no_output_of_prior_pics_flag	0	When Inputting IDR, DPB do not clear (It is meaningless because PTS=DTS)
long_term_reference_flag	0	Long term memory not in use
adaptive_ref_pic_marking_mode_flag	0	

Other restriction

- It is recommend that the stream to be inputted to CPB must decode within 1.5 seconds.

Discernment of 16:9 video format

- Although video format is only QVGA, broadcasters may transmit the 16:9 video format. In case that pic_height_in_map_units_minus1 of SPS in H.264 stream is 11, aspect of video signal is 16:9.
 - It is recommended that pic_height_in_map_units_minus1 should be half-fixed in operation and should not changed each by each program principally. However, during simulcast operation of digital and analog, the program of 4:3 aspect ratio may remains, therefore this flag may changed per program and CM.

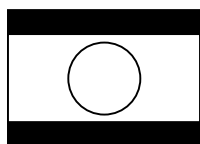
Operaton of pan and scan in display area of video signal

When the aspect ratio of transmitted video signal is different from original video source, such as, Side-panel and Letter-box, it is possible to display not to be black frame by setting the pan and scan parameters. But, it is possible only 2 cases described below.

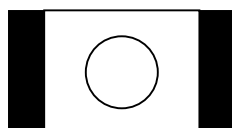
- (1) When original video source is aspect ratio of 16:9 (letter box) and its transmission format is QVGA 4:3 (320x240), and portion of original video source (320x180) is displayed on the picture display domain of 16:9.
- (2) When original video source is aspect ratio of 4:3 (side panel) and its transmission format is QVGA 16:9 (320x180), and portion of original video source (240x180) is displayed on the picture display domain of 4:3.

In addition, the center of original picture form and transmission picture should be made in arrangement in every direction of length and breadth.

The value of each parameter of above cases is shown in following table.



Reference figure(1)



Reference figure(2)

Table 1-14 Pan and scan parameters limitation

	Syntax	Ref. Fig (1)	Ref. Fig. (2)
Sequence Parameter Set	pic_width_in_mbs_minus1	19	19
	pic_height_in_map_units_minus1	14	11
Pan-scan rectangle SEI message	pan_scan_rect_left_offset	0	640
	pan_scan_rect_right_offset	0	-640
	pan_scan_rect_top_offset	480	0
	pan_scan_rect_bottom_offset	-480	0

In addition, pan and scan should be only available by video sequence unit. If pan and scan operation is not used, Pan and scan rectangle SEI message should not be coded. (in case that pan and scan operation is used, Pan and scan rectangle SEI message should be included in IDR-AU)