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Amendment 1

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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Communication procedures

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Extended video procedures and control signals for H.300-series terminals

Amendment 1: Addition of new clause 6.2.5 on the set submode procedure; associated additions to Appendix I and a new Appendix II

Recommendation ITU-T H.241 (2006) – Amendment 1

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Recommendation ITU-T H.241

Extended video procedures and control signals for H.300-series terminals

Amendment 1

Addition of new clause 6.2.5 on the set submode procedure; associated additions to Appendix I and a new Appendix II

Summary

This Recommendation defines the use of advanced video codecs, including ITU-T Rec. H.264, in ITU-T Recs H.310, H.320, H.321, H.322, H.323 and H.324 terminals. It also defines generic extended signalling for use with all video codecs in the H.300-series terminals.

This revised version adds clarifications regarding H.264 VCL HRD (Type I HRD) versus NAL HRD (Type II HRD) bit rate usage, sample aspect ratio capabilities for H.264, signalling for Reduced Complexity Decoding Operation (RCDO) for H.264 bitstreams, and a new Annex B, "RCDO for H.264 Baseline Profile bitstreams". Annex A has been replaced with an inclusion by reference of the recently approved RFC 3984 (without actual change in content). New Annex B specifies a reduced-complexity decoding process to be applied to H.264 Baseline profile bitstreams when such use has been negotiated using ITU-T Rec. H.241.

Amendment 1 to this Recommendation provides a new clause 6.2.5 allowing for the negotiation of particular video submodes of H.264 encoding along with associated additions to Appendix I. It also includes a new Appendix II which contains non-normative examples describing the use of this new clause.

Source

Amendment 1 to Recommendation ITU-T H.241 (2006) was approved on 13 June 2008 by ITU-T Study Group 16 (2005-2008) under Recommendation ITU-T A.8 procedure.

Keywords

Capability exchange, commands, H.264, H.310, H.320, H.321, H.322, H.323, H.324, signalling, video, video codec, video coding, videoconferencing, videotelephony.

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Modifications introduced by this amendment are shown in revision marks. Unchanged text is replaced by ellipsis (…). Some parts of unchanged text (clause numbers, etc.) may be kept to indicate the correct insertion points.

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6.2.5 Set submode procedure

This clause defines a procedure that may be used by H.320 and H.245 systems to negotiate the use of a particular H.264 video encoding submode. Such a submode may limit the H.264 encoding to a specified group of sample aspect ratios (SARs), picture aspect ratios (PARs), and picture heights while it is in force. It may also reduce the MaxMBPS value in Table A-1/H.264 (or its optional replacement CustomMaxMBPS in Table 8-5) to a lower value. Additionally, it may reduce the MaxStaticMBPS value in Table 8-9 to a lower value.

Some examples illustrating the use of this procedure are given in Appendix II.

6.2.5.1 SetSubmode capability

H.320 and H.245 systems may optionally support the set submode procedure.

In H.320, this capability shall be signalled as a BAS message <h264SetSubmode> (see 3.1/H.230). <h264SetSubmode> is a BAS SBE message.

In H.245, this capability shall be signalled in a generic capability message, as shown in Table 6-1.

Table 6-1 – H.241 set submode capability identifier

Capability name	H.241 Set submode capability
Capability identifier type	Standard
Capability identifier value	{itu-t(0) recommendation(0) h(8) 241(241) specificVideoCodecCapabilities(0) h264(0) set-submode(2)}
maxBitRate	This field shall not be included.
collapsing	This field shall not be included.
nonCollapsing	This field shall not be included.
nonCollapsingRaw	This field shall not be included.
transport	This field shall not be included.

6.2.5.2 C&I messages

C&I messages are used in this clause to indicate sets of submodes that are supported by the sender of the H.264 encoding for that specific encoding, to request a submode of that sender, and to positively or negatively acknowledge such a request.

The C&I messages defined in this clause shall not be used if video sent on the channel associated with the signalled channelID AMC is not encoded with H.264.

All C&I messages defined in this clause shall be carried as follows.

6.2.5.3 Signalling of messages for the set submode procedure

For H.245, each message shall consist of a **GenericRequest**, **GenericResponse** or **GenericIndication** according to Table 6-2 containing GenericMessage.messageIdentifier with the set submode capability OID as defined in Table 6-1, and a **subMessageIdentifier**. Each particular **subMessageIdentifier** listed in Table 6-2 has an associated **messageContent** syntax given in the following clauses.

For H.320, each set submode message shall be carried by a separate MBE message (see 2.2.3/H.230) which shall contain the same **subMessageIdentifier** value and parameter sequence as its H.245 equivalent, coded according to the procedures in Annex A/H.239. This MBE message uses the BAS code <H.264Submode-message> (see Table 2/H.230). The MBE contents are in the format:

{ Start-MBE / N / <H.264Submode-message> / **subMessageIdentifier** /
zero or more message content bytes }

H.320-H.245 gateways that signal the SetSubmode capability shall translate these messages between the H.320 and H.245 signalling systems as specified in Annex A/H.239.

Except for H.320-H.245 gateways, devices that receive **MessageContent** containing an unrecognized **parameterIdentifier** shall ignore such **parameterIdentifiers** and any associated **parameterValues**.

6.2.5.4 SetSubmode messages

Table 6-2 lists all messages defined in the SetSubmode procedure.

Table 6-2 – Set submode procedure messages

subMessageIdentifier	Message name	Message type (for H.245)
1	setSubmodeRequest	GenericRequest
2	setSubmodeResponse	GenericResponse
3	setSubmodeIndication	GenericIndication
4	cancelSubmodeRequest	GenericRequest
5	cancelSubmodeResponse	GenericResponse

For each message, the clauses below present a table indicating the message content and syntax. The sequence of **GenericParameters** in the **messageContent** shall be transmitted in the order given in each table. The parameter names given in each table correspond to those in Table 6-2 above. Parameters shall be sent as indicated in the "required presence" column of each table.

6.2.5.5 Generic parameters used in SetSubmode messages

Table 6-3 lists the **GenericParameters** used in all **messageContent** sequences in the SetSubmode messages.

Table 6-3 – Set submode message parameters

Parameter identifier	Parameter name	Parameter type	Parameter value
40	channelID	unsignedMin	Integer (0..65535)
1	par	booleanArray	Integer (0..255)
2	parX	unsignedMin	Integer (0..65535)
41	parY	unsignedMin	Integer (0..65535)
3	sar	unsignedMin	Integer (0..255)
4	sarX	unsignedMin	Integer (0..65535)
42	sarY	unsignedMin	Integer (0..65535)
5	submodeMaxMBPS	unsignedMin	Integer (0..65535)
6	submodeMaxStaticMBPS	unsignedMin	Integer (0..65535)
7	height	unsignedMin	Integer (0..65535)
8	maximumHeight	unsignedMin	Integer (0..65535)
9	minimumHeight	unsignedMin	Integer (0..65535)
128	acknowledge	logical	None
129	reject	logical	None
130	allowAnyHeight	logical	None

6.2.5.5.1 channelID

The channelID parameter shall be the AMC channel ID on H.230 systems in Table 9/H.239. On H.245 systems, it shall be a **logicalChannelNumber**. Intermediary devices such as gateways and MCUs that forward these parameters shall convert the parameter value to the appropriate AMC channel ID or **logicalChannelNumber** for the device to which the message is forwarded.

6.2.5.5.2 par

This value is a Boolean array of picture aspect ratios (PARs). The PAR is the ratio of picture width to picture height, measured in units of distance (not samples).

If bit 2 (value 64) is 1, this indicates a PAR of 4:3.

If bit 3 (value 32) is 1, this indicates a PAR of 16:9.

If bit 4 (value 16) is 1, this indicates a PAR of 5:4.

If bit 5 (value 8) is 1, this indicates a PAR of 16:10.

All other bits are reserved, shall be set to 0, and shall be ignored by receivers.

6.2.5.5.3 parX

The parX parameter is the numerator of a picture aspect ratio (computed as parX/parY). The parX parameter shall be immediately followed by the picture aspect ratio denominator parY. parX is an unsigned integer between 1 and 65535.

6.2.5.5.4 parY

The parY parameter is the denominator of a picture aspect ratio. It is an unsigned integer between 1 and 65535. The values of parX and parY shall be relatively prime.

6.2.5.5.5 sar

The value of this parameter indicates the sample aspect ratio (SAR). The sar is the ratio of sample width to sample height. It shall be the H.264 **aspect_ratio_idc** values defined in Table E-1/H.264, or the value 255.

The value of 255 shall only be used in the setSetmodeIndication message. In that message, it signifies the set of all SARs that may be carried on the video channel.

6.2.5.5.6 sarX

The sarX parameter is the numerator of a sample aspect ratio (computed as sarX/sarY). The sarX parameter shall be immediately followed by the sample aspect ratio denominator sarY. sarX is an unsigned integer between 1 and 65535.

6.2.5.5.7 sarY

The sarY parameter is the denominator of a sample aspect ratio. It is an unsigned integer between 1 and 65535. The values of sarX and sarY shall be relatively prime.

6.2.5.5.8 submodeMaxMBPS

The submodeMaxMBPS parameter is the maximum macroblock processing rate, in units of 500 macroblocks per second.

6.2.5.5.9 submodeMaxStaticMBPS

The submodeMaxStaticMBPS parameter is the static macroblock processing rate, under the assumption that all macroblocks are static macroblocks, in units of 500 macroblocks per second.

6.2.5.5.10 height

This is the height of the picture in samples.

6.2.5.5.11 maximumHeight

This is the largest height of the picture in samples (used in a setSubmodeRequest message).

6.2.5.5.12 minimumHeight

This is the smallest supported picture height in samples (used in a setSubmodeResponse message).

6.2.5.5.13 acknowledge

This parameter, if present, indicates a positive acknowledgment of a request.

6.2.5.5.14 reject

This parameter, if present, indicates a rejection of a request.

6.2.5.5.15 allowAnyHeight

This parameter, if present, indicates that any requested picture height will be positively acknowledged for the specified combination of SARs and PARs.

6.2.5.6 setSubmodeIndication

This message indicates the combinations of SARs and PARs that are available for the H.264 video encoding on a specified video channel. These combinations shall be sent as a series of one or more groups, each group comprising a SAR and one or more PARs. The full set of combinations that are available is the union of the combinations of all the groups in the message.

The SAR shall be signalled as either a single sar parameter or as a single sarX, sarY parameter pair. A sar parameter value of 255 in a group shall indicate that all SARs that can be carried on the channel are combined with the PARs for that group.

The PARs shall be signalled as either a single par parameter or as a list of one or more parX, parY parameter pairs. The par parameter may indicate more than one PAR. The omission of par or parX, parY from a group shall indicate that all the SARs in that group are combined with all possible PARs.

The presence of the allowAnyHeight parameter from a group shall indicate that all picture heights that can be carried on the channel are available for each SAR and PAR combination that is included in that group.

The absence of the allowAnyHeight parameter from a group shall indicate that one or more unspecified picture heights are available for each SAR and PAR combination that is included in that group. Those heights may differ for each combination.

When a video channel is opened to a device which signals support for the set submode procedure, the device transmitting the video channel shall send the setSubmodeIndication. The setSubmodeIndication message shall also be sent whenever the available combinations of SARs and PARs change.

On H.320 connections, setSubmodeIndication shall be sent periodically.

Table 6-4 – setSubmodeIndication syntax

GenericParameter order	Parameter name	Required presence	
1	channelID	Mandatory	
2	sar	Either one sar or one sarX, sarY shall be present in each group.	This group of parameters may be present multiple times.
	sarX		
	sarY		
3	par	Either one par or multiple parX, parY pairs may be present.	
	parX		
	parY		
4	allowAnyHeight	allowAnyHeight may be present in each group.	

6.2.5.6.1 setSubmodeIndication examples (informative)

This clause does not form an integral part of this Recommendation.

For example:

A setSubmodeIndication contains one group, with sar=255 and allowAnyHeight.

This message indicates that the sender is capable of sending a picture of any size within its capability set with any sample aspect ratio and picture aspect ratio.

For example:

A setSubmodeIndication contains two groups. The first group has sar=1 and allowAnyHeight. The second group has sar=255, par=96.

The first group indicates that the sender is capable of sending pictures with square samples at any PAR and any desired picture height. This is equivalent to saying that the sender is capable of sending pictures with square pixels of any size.

The second group indicates that the sender is capable of sending pictures with any SAR as long as the overall picture aspect ratio is either 4:3 or 16:9. Since allowAnyHeight is not specified, only some picture sizes (perhaps only one size) are available for this group.

A picture with a SAR of 1:1 and an aspect ratio of 4:3 is a member of both groups. Because one of the groups signals allowAnyHeight, such pictures are available at any size.

For example:

A setSubmodeIndication contains 4 groups. The first group has sar=1, par=120 and allowAnyHeight. The second group has sar=2 and par=64. The third group has sar=3 and par=64. The fourth group has sar=7 and par=64.

The first group indicates the ability to send pictures with square samples at picture aspect ratios of 4:3, 16:9, 5:4 or 16:10. These pictures can be sent at any size.

The second group indicates the ability to send pictures with the sample aspect ratio used for PAL with a picture aspect ratio of 4:3. Not all sizes are available, perhaps only QCIF and CIF.

The third group indicates the ability to send pictures with the sample aspect ratio used for NTSC, with a picture aspect ratio of 4:3. Not all sizes are available, perhaps only QSIF and SIF.

The last group indicates the ability to send pictures with the sample aspect ratio used for interlaced NTSC, with a picture aspect ratio of 4:3. Not all sizes are available, perhaps only 352x480.

6.2.5.3 setSubmodeRequest

This message requests that the video encoding on the specified channel be changed to one of the submodes specified in the request.

setSubmodeRequest shall include at least one of the following: SAR, PAR or picture height. It shall include at most one SAR, and at most one PAR, and at most one maximumHeight. It shall not include both maximumHeight and height.

SAR, if present, shall be specified using either the sar parameter or a sarX, sarY pair. The sar parameter shall not signal the value of 255.

PAR, if present, shall be specified using either the par parameter or a parX, parY pair. The par parameter shall only signal one PAR

The maximumHeight parameter, if present, shall specify that the set of submodes includes all picture heights less than or equal to the value carried by the parameter.

One or more height parameters, if present, shall specify that the set of submodes includes the specific list of picture heights. The picture heights shall be listed in preference order, with the most desired height first.

The submodeMaxMBPS parameter, if present, shall specify that the set of submodes is limited to modes in which the macroblock rate is less than or equal to the maximum number of macroblocks per second carried in the parameter value.

The submodeStaticMaxMBPS parameter, if present, shall specify that the subset of submodes is limited to modes in which the static macroblock rate is less than or equal to the maximum number of static macroblocks per second carried in the parameter value.

Table 6-5 – setSubmodeRequest syntax

GenericParameter order	Parameter name	Required presence
1	channelID	Mandatory
2	sar	Optional Either sar or sarX, sarY may be present.
	sarX	
	sarY	
3	par	Optional Either par or parX, parY may be present.
	parX	
	parY	
4	height	Optional Either one or more height parameters or at most one maximumHeight may be present.
	maximumHeight	
5	submodeMaxMBPS	Optional
6	submodeMaxStaticMBPS	Optional

6.2.5.3.1 setSubmodeRequest examples (informative)

This clause does not form an integral part of this Recommendation.

For example:

A device sends a setSubmodeRequest with par=64 and maximumHeight of 288.

This request is satisfied by any submode with a picture aspect of 4:3, as long as the picture height does not exceed 288. CIF, SIF and QCIF (among others) are all acceptable responses.

For example:

A device sends a setSubmodeRequest with par=64, and a height list of 288 and 144.

This request is satisfied by any submode with a picture aspect ratio of 4:3, as long as the picture height is either 288 or 144 samples. CIF and QCIF are both acceptable responses, with CIF being preferred over QCIF.

Since the SAR is omitted, there are other possible responses. For instance, the request is satisfied by a picture with square samples, a picture width of 384 and a picture height of 288.

For example:

A device sends a setSubmodeRequest with sar=1, par=32 and height=720.

This request is only satisfied by a picture with a SAR of 1:1, a PAR of 16:9 and a picture size of 1280x720.

In all cases, if the device receiving the request does not support a submode that satisfies the request, it rejects the request.

6.2.5.4 setSubmodeResponse

The setSubmodeResponse message shall be sent in response to every received setSubmodeRequest message.

The channelID parameter shall carry the same value as the channelID in the associated setSubmodeRequest.

The setSubmodeResponse message shall not carry both the acknowledge and the reject parameter.

6.2.5.4.1 setSubmodeRequest acknowledge

If the receiver of the setSubmodeRequest supports one or more submodes that satisfy the request on the specified channel, the setSubmodeResponse shall include the acknowledge parameter. The receiver shall select a submode from the set specified in the request. The SAR, PAR and picture height of the selected submode shall be sent in the setSubmodeResponse.

A H.264 VUI message signalling the SAR of the submode as specified in Annex E/H.264 shall be sent in the video bitstream.

H.245 receivers of the setSubmodeRequest should not close and reopen the video logical channel when switching to the new submode.

Terminals may include the acknowledge parameter in their response even if multipoint mode symmetrize (MMS) according to ITU-T Rec. H.243 is in effect, or **multipointModeCommand** according to ITU-T Rec. H.245 is in effect.

6.2.5.4.2 setSubmodeRequest reject

If the receiver of the setSubmodeRequest does not support any submodes that satisfy the request, the setSubmodeResponse shall include the reject parameter. The receiver shall not switch to a different submode.

The response should include some indication of heights that are available with the requested SAR and PAR.

Multiple instances of the height parameter may be present, containing heights that are available with the requested SAR and PAR

If the setSubmodeRequest contained maximumHeight, a single instance of minimumHeight may be present, indicating the smallest available height that is available with the requested SAR and PAR.

A setSubmodeResponse message shall not contain both minimumHeight and height.

Table 6-6 – setSubmodeResponse syntax

GenericParameter order	Parameter name	Required presence
1	channelID	Mandatory
2	acknowledge	Either acknowledge or reject shall be present.
	reject	
3	sar	Either sar or sarX, sarY shall be present if acknowledge is present, and shall contain the selected SAR. sar, sarX and sarY shall not be present if reject is present.
	sarX	
	sarY	
4	par	Either par or parX, parY shall be present if acknowledge is present, and shall contain the selected PAR. par, parX and parY shall not be present if reject is present.
	parX	
	parY	
5	height	If acknowledge is present, a single instance of height parameter shall be present, and shall contain the selected picture height. If reject is present, height or minimumHeight may be present.
	minimumHeight	

6.2.5.4.3 setSubmodeResponse examples (informative)

This clause does not form an integral part of this Recommendation.

For example:

Device A sends a setSubmodeIndication containing one group, with sar=255 and allowAnyHeight.

The receiver (device B) sends setSubmodeRequest sar=1 and height=480.

Device A determines that the request can be satisfied by sending a 640x480 picture with a SAR of 1:1 and a PAR of 4:3.

Device A sends a setSubmodeReponse of acknowledge, sar=1, par=64, height=480.

For example:

Device A sends a setSubmodeIndication containing two groups. The first group has sar=1 and allowAnyHeight. The second group has sar=255, par=96.

The receiver (device B) sends setSubmodeRequest sar=1 and par=64

Device A determines that the request can be satisfied by sending either a 640x480 or a 1024x768 picture with a SAR of 1:1 and a PAR of 4:3. Device A chooses to send the 1024x768 picture.

Device A sends a setSubmodeReponse of acknowledge, sar=1, par=96, height=768.

For example:

Device A sends a setSubmodeIndication containing two groups, one with sar=1 and par=64, the other with sar=2, par=64.

The receiver (device B) sends setSubmodeRequest with sar=2 and par=64 and height=576.

Device A determines that the request cannot be satisfied because the picture size is too large. It supports heights of 288 and 144 for this SAR and PAR combination.

Device A sends a setSubmodeReponse of reject, sar=1, height=288, height=144.

Device B sends a second setSubmodeRequest with sar=2, par=64, height=288.

Device A sends a setSubmodeResponse of acknowledge, sar=2, par=64, height=288.

For example:

Device A sends a setSubmodeIndication containing two groups, one with sar=1, par=64, the other with sar=2, par=64.

The receiver (device B) sends setSubmodeRequest with sar=2, par=64 and maximumHeight=576.

Device A determines that it supports heights of 288 and 144 for this SAR and PAR combination.

Device A sends a setSubmodeResponse of acknowledge, sar=2, par=64, height=288.

6.2.5.5 cancelSubmodeRequest

The cancelSubmodeRequest message indicates that the video encoding on the specified channel may revert to sending any video mode allowed by applicable procedures.

Each received cancelSubmodeRequest shall be acknowledged by a cancelSubmodeResponse.

Table 6-7 – cancelSubmodeRequest syntax

GenericParameter order	Parameter name	Required presence
1	channelID	Mandatory

6.2.5.6 cancelSubmodeResponse

The cancelSubmodeResponse message indicates that the cancelSubmodeRequest message was received.

Table 6-8 – cancelSubmodeResponse syntax

GenericParameter order	Parameter name	Required presence
1	channelID	Mandatory

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Appendix I

ASN.1 OIDs defined in this Recommendation

(This appendix does not form a integral part of this Recommendation)

OID	Clause reference
{itu-t(0) recommendation(0) h(8) 241(241) specificVideoCodecCapabilities(0) h264(0) set-submode(2)}	6.2.5.1
{itu-t(0) recommendation(0) h(8) 241 specificVideoCodecCapabilities(0) h264(0) iPpacketization(0) h241AnnexA(0)}	7.1.4
{itu-t(0) recommendation(0) h(8) 241 specificVideoCodecCapabilities(0) h264(0) iPpacketization(0) RFC3984NonInterleaved(1)}	7.1.4
{itu-t(0) recommendation(0) h(8) 241 specificVideoCodecCapabilities(0) h264(0) iPpacketization(0) RFC3984Interleaved(2)}	7.1.4
{itu-t(0) recommendation(0) h(8) 241 specificVideoCodecCapabilities(0) h264(0) generic-capabilities(1)}	8.3.2.1

Appendix II

Examples of the set submode procedure

(This appendix does not form a integral part of this Recommendation)

This appendix provides informative guidance and examples illustrating the use of the set submode procedure defined in clause 6.2.5.

The H.264 capabilities defined by clause 8.3 generally allow more than one set of encoding parameters to be used by the video source.

For instance, the capabilities specify the ability to receive a maximum picture size of CustomMaxFS macroblocks. The video source may choose any picture height and width combination that does not exceed that total. Although the receiver is required by this Recommendation to be capable of rendering these picture sizes, it is frequently desirable to negotiate further constraints on the picture size. For example, an MCU that can control the picture height and width from each terminal can create a more functional picture composition.

There are at least four general cases where constraining the encoding with the set submode procedure is useful:

– To optimize the picture aspect ratio for a specific display or a sub-picture in a composition.

– To limit the picture frame rate to match the frame rate of a specific picture composition.

– To eliminate the adverse effects of rescaling on the picture quality.

– To improve bandwidth utilization by negotiating a picture size that does not exceed the limits of a display or the size of a sub-picture in a composition.

The use of the set submode procedure is illustrated for each of these cases by the following clauses.

II.1 Optimization of the picture aspect ratio

The video channel is constrained to carry a picture which has a specific picture aspect ratio. The sample aspect ratio and the picture size are not constrained.

The video source indicates which SAR and PAR combinations can be carried on this video channel.

The video receiver requests a specific PAR which is included in the indication.

The video source selects an image height and SAR that it can send using the requested PAR.

The video source positively acknowledges the request, including the SAR, PAR and the image height. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

→ Indication: channelID, list of (SAR, list of (PAR), [allowAnyHeight])
← Request: channelID, PAR
→ Response: channelID, acknowledge, SAR, PAR, height

II.2 Limiting the picture frame rate

The video stream is constrained to carry a picture of a specific SAR, PAR, size and frame rate.

The video source indicates which SAR and PAR combinations can be carried on this video channel.

The video receiver requests a specific SAR and PAR combination which is included in the indication. The selected SAR and PAR include the allowAnyHeight designation. The video receiver requests a specific height, and a submodeMaxMBPS value that achieves the desired frame rate for the requested picture size.

The video source positively acknowledges the request, including the SAR, PAR and the image height. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

→ Indication: channelID, list of (SAR, list of (PAR), [allowAnyHeight])
← Request: channelID, SAR, PAR, height, submodeMaxMBPS
→ Response: channelID, acknowledge, SAR, PAR, height

II.3 Eliminating the adverse effects of picture rescaling

The video channel is constrained to carry a picture of specific PAR, SAR and picture size. Three different examples are presented. The first example describes the case where the video source is capable of re-scaling its image to any requested size. The second and third examples describe cases where the video source does not have this capability.

II.3.1 Video source is capable of arbitrary scaling

The video source indicates which SAR and PAR combinations can be carried on this video channel.

The video receiver requests a specific SAR and PAR combination which is included in the indication. Since the selected SAR and PAR include the allowAnyHeight designation, the video receiver also requests a specific height.

The video source positively acknowledges the request, including the SAR, PAR and the image height. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

→ Indication: channelID, list of (SAR, list of (PAR), [allowAnyHeight])
← Request: channelID, SAR, PAR, height (SAR and PAR have allowAnyHeight set)
→ Response: channelID, acknowledge, SAR, PAR, height

II.3.2 Video source is not capable of arbitrary scaling

The video source indicates which PAR and SAR combinations can be carried on this video channel.

The video receiver requests a specific PAR and SAR combination which is included in the indication. Since the selected PAR and SAR does not include the allowAnyHeight designation, the video receiver offers a list of acceptable heights, in preference order.

The video source selects the first height on the list that it is capable of sending.

The video source then positively acknowledges the request, including the PAR, SAR and the image height. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

→ Indication: channelID, list of (SAR, list of (PAR))
← Request: channelID, SAR, PAR, list of (height)
→ Response: channelID, acknowledge, SAR, PAR, height

If the video source does not find a height in the request that it is capable of sending, it responds with a reject message, which includes the list of heights it can send with the requested SAR and PAR combination.

The video receiver then selects one of those specific heights and re-issues the request.

The video source then positively acknowledges the request, including the PAR, SAR and the image height. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

→ Indication: channelID, list of (SAR, list of (PAR))
← Request: channelID, SAR, PAR, list of (height)
→ Response: channelID, reject, list of (height)
← Request: channelID, SAR, PAR, height (this height is from the list received in response)
→ Response: channelID, acknowledge, PAR, SAR, height

II.4 Improving bandwidth utilization by limiting maximum picture size

The video channel is constrained to carry a picture of specific PAR, SAR and a maximum picture size. It could be further constrained through the use of flow control.

The video source indicates which PAR and SAR combinations can be carried on this video channel.

The video receiver requests a specific PAR and SAR combination which is included in the indication, and also requests a maximum image height.

The video source selects an image height that it is capable of sending that is less than or equal to the maximum.

The video source then positively acknowledges the request, including the PAR, SAR and the image height. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

→ Indication: channelID, list of (SAR, list of (PAR))
← Request: channelID, [SAR], [PAR], maximumHeight
→ Response: channelID, acknowledge, SAR, PAR, height (where height <= maximumHeight)

If the smallest height that the video source can send exceeds the maximum height requested, the video source rejects the request, including the smallest height it can send in the reject message.

The video sink then re-issues the request with a new maximum height that can be accommodated by the video source.

The video source then positively acknowledges the second request, including the PAR, SAR and the image height. It then switches to the new submode, sending the SAR in the H.264 VUI message per Table E-1/H.264.

→ Indication: channelID, list of (SAR, list of (PAR))
← Request: channelID, [SAR], [PAR], maximumHeight
→ Response: channelID, reject, minimumHeight (where minimunHeight > maximumHeight)
← Request: channelID, [SAR], [PAR], maximumHeight (where maximumHeight >= minimumHeight)
→ Response: channelID, acknowledge, SAR, PAR, height (where height <= maximumHeight)

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