CLAIMS

~~WHAT IS CLAIMED IS:~~

1. An apparatus ~~for decoding~~to decode video data, the apparatus comprising:

a memory configured to store the video data that has been decoded; and

at least one processor coupled to the memory and configured to:

obtain a video bitstream, the video bitstream including adaptive loop filter (ALF) data;

determine a value of an ALF chroma filter signal flag from the ALF data, the value of the ALF chroma filter signal flag indicating whether chroma ALF filter data is signaled in the video bitstream; ~~and~~

process the value of the ALF chroma filter signal flag from the ALF data to determine that the chroma ALF filter data is signaled in the video bitstream;

determine a chroma type array variable for the at least ~~a~~the portion of ~~a~~the slice of video data;

determine an ALF chroma application parameter set (APS) identifier for the first of the one or more the chroma components of at least portion of the slice of video data based on the ~~value of the ALF chroma filter signal flag.~~chroma type array variable for the at least the portion of the slice of video data;

determine a signaled ALF map for the first one of the one or more chroma components of the at least the portion of the slice of the video data based on the chroma type array variable;

enable ALF filtering for a first of one or more chroma components of at least a portion of a slice of video data; and

process the one or more chroma components of the at least the portion of the slice of video data based on the value of the ALF chroma filter signal flag.

2. The apparatus of claim 1, wherein the at least one processor is further configured to:

obtain a slice header for at least the portion of the slice of video data from the video bitstream;

determine a value of an ALF chroma identifier from the slice header, the value of the ALF chroma identifier indicating whether an ALF can be applied to one or more chroma components of the ~~slice~~at least the first potion of the slice of video data; and

process the one or more chroma components of the at least the portion of the slice of video data based on the ALF chroma identifier from the slice header.

3. The apparatus of claim 2, wherein the ~~at least one processor is further configured to:~~

~~determine a value of a chroma format identifier from the slice header, the value of the chroma format identifier and the value of the ALF chroma identifier indicating which chroma component of the one or more chroma components the ALF is applicable.~~

~~4. The apparatus of claim 3, wherein the~~ value of the ALF chroma filter signal flag indicates that the chroma ALF filter data is signaled in the video bitstream, and wherein the chroma ALF filter data is signaled in an adaptation parameter set (APS) for processing the one or more chroma components of the at least the portion of the slice of video data.

~~5. The apparatus of claim 4, wherein the at least one processor is configured to:~~

~~based on the value of the ALF chroma filter signal flag, obtain the chroma ALF filter data to be used for processing at least the portion of the slice of video data; and~~

~~apply the chroma ALF filter data to at least the portion of the slice of video data.~~

~~6~~4. The apparatus of claim 1, wherein the at least one processor is configured to infer that the value of the ALF chroma filter signal flag is zero when the value of the ALF chroma filter signal flag is not present in the ALF data.

~~7~~5. The apparatus of claim 1, wherein the at least ~~one processor is configured to:~~

~~based on~~ the ~~value~~portion of the ~~ALF chroma filter signal flag, obtain luma ALF filter~~slice of video data ~~to be used for one~~includes 4:2:0 format video data or ~~more chroma components of at least one block of the video bitstream; and~~

~~apply the luma ALF filter data to the one or more chroma components of the at least one block of the video bitstream.~~

8. The apparatus of claim 1, wherein the at least one processor is configured to:

obtain a slice header for the slice of 4:2:2 format video data from the video bitstream;.

determine a value

6. The apparatus of a chroma format identifier fromclaim 1, wherein the slice header; and

based on the value of the chroma format identifier from the slice header, process one or more chroma components of at least one blockthe portion of the slice of video bitstream using luma ALF filter data. includes 4:4:4 format video data.

97. The apparatus of claim 1, wherein the at least one processor is further configured to:

process the value of the ALF chroma filter signal flag from the ALF data to determine that the chroma ALF filter data is signaled in the video bitstream.

10. The apparatus of claim 9, wherein the at least one processor is further configured to:

determine an ALF application parameter set (APS) identifier for a first color component of at least the portion of the slice; and

determine an ALF map for the first color component of at least the portion of the slice.

11. The apparatus of claim 9, wherein the at least one processor is further configured to enable ALF filtering for at least two non-lumaa first one of the one or more chroma components of the at least the portion of the slice of video data is based on components of at least the portion of the slice including shared characteristics.

12. The apparatus of claim 11, wherein the at least two non-luma components of at least the portion of the slice comprise a red component, a green component, and a blue component of at least the portion of the slice.

13. The apparatus of claim 11, wherein the at least two non-luma components of at least the portion of the slice comprise chroma components of at least the portion of the slice.

~~14. The apparatus of claim 13, wherein~~ at least the portion of the slice of video data that includes ~~4:4:4 format video data.~~

~~15. The apparatus of claim 14, wherein the at least one processor is configured to enable ALF filtering for at least two non-luma components of at least the portion of the slice based on at least the portion of the slice including~~ non-4:2:0 format video data.

~~16~~8. The apparatus of claim ~~9, wherein the at least one processor is configured to:~~

~~determine a chroma type array variable for at least the portion of the slice;~~

~~determine an ALF chroma application parameter set (APS) identifier for a first component of at least the portion of the slice based on the chroma type array variable for at least the portion of the slice; and~~

~~determine a signaled ALF map for the first component of at least the portion of the slice.~~

~~17. The apparatus of claim 16~~1, wherein the at least one processor is further configured to:

determine a second signaled ALF map for a second ~~component~~one of the one or more chroma components of the at least the portion of the slice of video data is based on the chroma type array variable.

~~18~~9. The apparatus of claim ~~17~~8, wherein the at least one processor is configured to perform ALF filtering on the first ~~component~~ one of the one or more chroma components and the second ~~component of~~ one of the one or more chroma components of the at least the portion of the slice of video data using the signaled ALF map and the second signaled ALF map.

~~19. The apparatus of claim 17, wherein the at least one processor is further configured to:~~

~~determine a third signaled ALF map for a third component of at least the portion of the slice based on the chroma type array variable.~~

~~20. The apparatus of claim 19, wherein the first component is a luma component, wherein the second component is a first chroma component, and wherein the third component is a second chroma component.~~

~~21. The apparatus of claim 19, wherein the first component is a red component, wherein the second component is a green component, and wherein the third component is a blue component.~~

~~22. The apparatus of claim 19, wherein the at least one processor is configured to perform ALF processing on a block for each component of at least the portion of the slice based on the chroma type array variable.~~

~~23~~10. The apparatus of claim 1, wherein the apparatus comprises a mobile device.

~~24~~11. The apparatus of claim 1, further comprising a display configured to display one or more images based on the one or more chroma components.

~~25~~12. A method of decoding video data, comprising:

obtaining a video bitstream, the video bitstream including adaptive loop filter (ALF) data;

determining a value of an ALF chroma filter signal flag from the ALF data, the value of the ALF chroma filter signal flag indicating whether chroma ALF filter data is signaled in the video bitstream; ~~and~~

processing the value of the ALF chroma filter signal flag from the ALF data to determine that the chroma ALF filter data is signaled in the video bitstream;

determining a chroma type array variable for the at least ~~a~~the portion of ~~a~~the slice of video data;

determining an ALF chroma application parameter set (APS) identifier for a first of the one or more the chroma components of at least portion of the slice of video data based on the ~~value of the ALF chroma filter signal flag.~~chroma type array variable for the at least the portion of the slice of video data;

determining a signaled ALF map for the first one of the one or more chroma components of the at least the portion of the slice of the video data based on the chroma type array variable;

enabling ALF filtering for a first of one or more chroma components of at least a portion of a slice of video data; and

processing the one or more chroma components of the at least the portion of the slice of video data based on the value of the ALF chroma filter signal flag.

~~26~~13. The method of claim ~~25~~12, further comprising:

obtaining a slice header for the at least the portion of the slice of video data from the video bitstream;

determining a value of an ALF chroma identifier from the slice header, the value of the ALF chroma identifier indicating whether an ALF can be applied to the one or more chroma components of the at least the portion of the slice of video data ; and

processing the one or more chroma components of the at least the portion of the slice based on the ALF chroma identifier from the slice header.

~~27~~14. The method of claim ~~26, further comprising:~~

~~determining a value of a chroma format identifier from the slice header, the value of the chroma format identifier and the value of the ALF chroma identifier indicating which chroma component of the one or more chroma components the ALF is applicable.~~

~~28. The method of claim 27~~13, wherein the value of the ALF chroma filter signal flag indicates that the chroma ALF filter data is signaled in the video bitstream, and wherein the chroma ALF filter data is signaled in an adaptation parameter set (APS) for processing the one or more chroma components of the at least the portion of the slice.

~~29.~~15. The method of claim ~~28, further comprising:~~

~~based on the value of the ALF chroma filter signal flag, obtaining the chroma ALF filter data to be used for processing at least the portion of the slice of video data; and~~

~~applying the chroma ALF filter data to at least the portion of the slice of video data.~~

~~30. The method of claim 25~~12, further comprising inferring that the value of the ALF chroma filter signal flag is zero when the value of the ALF chroma filter signal flag is not present in the ALF data.

~~31~~16. The method of claim ~~25~~12, further comprising:

~~based on the value of the ALF chroma filter signal flag, obtaining luma ALF filter data to be used for one or more chroma components of at least one block of the video bitstream; and~~

~~applying the luma ALF filter data to the one or more chroma components of the at least one block of the video bitstream.~~

~~32. The method of claim 25, further comprising:~~

~~obtaining a slice header for the slice of video data from the video bitstream;~~

~~determining a value of a chroma format identifier from the slice header; and~~

~~based on the value of the chroma format identifier from the slice header, processing one or more chroma components of at least one block of the video bitstream using luma ALF filter data.~~

~~33. The method of claim 25, further comprising:~~

processing the value of the ALF chroma filter signal flag from the ALF data to determine that the chroma ALF filter data is signaled in the video bitstream.

~~34~~17. The method of claim ~~33, further comprising:~~12, wherein

~~determining an ALF application parameter set (APS) identifier for a first color component of at least~~ the at least the portion of the slice~~; and~~ of video data includes 4:2:0 format video data or 4:2:2 format video data.

~~determining an ALF map for the first color component of at least the portion of the slice.~~

~~35. The method of claim 33, further comprising enabling ALF filtering for at least two non-luma components of at least the portion of the slice based on components of at least the portion of the slice including shared characteristics.~~

~~36. The method of claim 35, wherein the at least two non-luma components of at least the portion of the slice comprise a red component, a green component, and a blue component of at least the portion of the slice.~~

~~37. The method of claim 35~~18. The method of claim 12, wherein the at least ~~two non-luma components of at least~~ the portion of the slice ~~comprise chroma components of at least the portion of the slice.~~

~~38. The method of claim 37, wherein at least the portion of the slice~~of video data includes 4:4:4 format video data.

~~39~~19. The method of claim ~~38, further comprising~~ 18, wherein the enabling ALF filtering for ~~at least two non-luma~~ the one or more chroma components of the at least the portion of the slice of video data is based on the at least the portion of the slice ~~based on at least the portion of the slice including~~of video data that includes non-4:2:0 format video data.

~~40~~20. The method of claim ~~33, further comprising:~~

~~determining a chroma type array variable for at least the portion of the slice;~~

~~determining an ALF chroma application parameter set (APS) identifier for a first component of at least the portion of the slice based on the chroma type array variable for at least the portion of the slice; and~~

~~determining a signaled ALF map for the first component of at least the portion of the slice.~~

~~41. The method of claim 40~~12, further comprising:

determining a second signaled ALF map for a second ~~component~~one of the one or more components of the at least the portion of the slice of video data is based on the chroma type array variable.

~~42~~21. The method of claim ~~41~~20, further comprising performing ALF filtering on the first ~~component~~ one of the one or more chroma components and the second ~~component~~one of the one or more components of the at least the portion of the slice of video data using the signaled ALF map and the second signaled ALF map.

~~43. The method of claim 41, further comprising:~~

~~determining a third signaled ALF map for a third component of at least the portion of the slice based on the chroma type array variable.~~

~~44~~22. An apparatus ~~for encoding~~to encode video data, the apparatus comprising:

a memory configured to store encoded video data; and

at least one processor coupled to the memory and configured to:

generate adaptive loop filter (ALF) data;

determine a value of an ALF chroma filter signal flag for the ALF data, the value of the ALF chroma filter signal flag indicating whether chroma ALF filter data is signaled in a video bitstream; ~~and~~

~~generate the video bitstream including the ALF data.~~ process the value of the ALF chroma filter signal flag from the ALF data to determine that the chroma ALF filter data is signaled in the video bitstream;

determine a chroma type array variable for the at least the portion of the slice of video data;

determine an ALF chroma application parameter set (APS) identifier for a first of the one or more the chroma components of at least portion of the slice of video data based on the chroma type array variable for the at least the portion of the slice of video data; and

determine a signaled ALF map for the first one of the one or more chroma components of the at least the portion of the slice of the video data based on the chroma type array variable;

enable ALF filtering for a first of one or more chroma components of at least a portion of a slice of video data; and

process the one or more chroma components of the at least the portion of the slice of video data based on the value of the ALF chroma filter signal flag.