

Introduction

NDS video processing and wireless technologies are designed to comply with professional broadcast video standards. Chroma subsampling is part of industry adopted video standards set forth by the Society of Motion Picture and Television Engineers (SMPTE). This Technical Review explains chroma subsampling, how it is applied in NDS products, and the influence it can have on certain test scenarios during technical evaluations.

What is Chroma Subsampling?

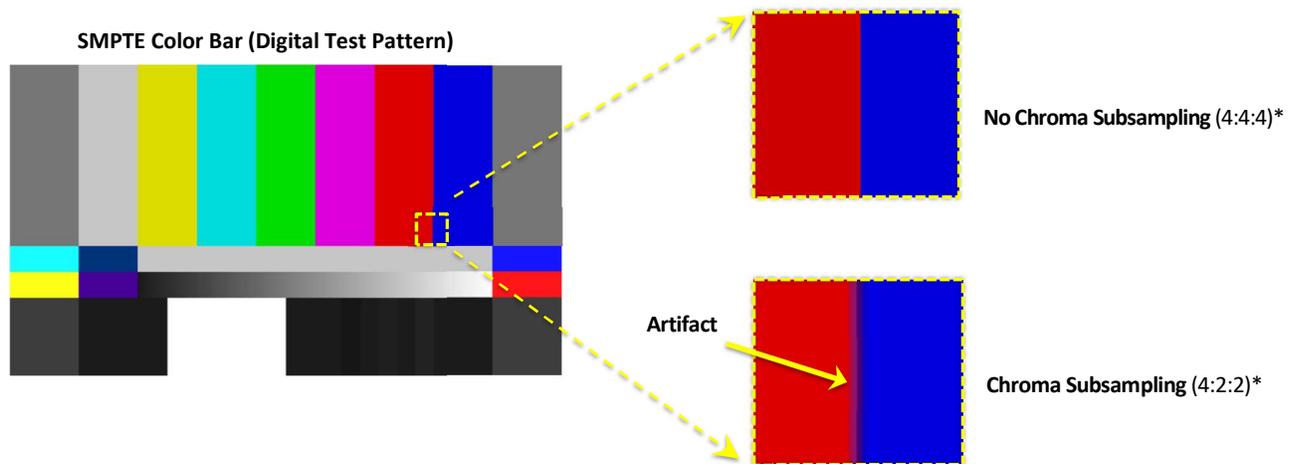
Chroma subsampling is a method of encoding images using YUV (YCbCr) color space with less resolution for chroma information (CbCr) than for luminance information (Y). Using chroma subsampling in wireless technologies, such as ZeroWire, reduces the bandwidth required to transmit video data. Further, chroma subsampling can be applied to streaming video without being noticeable to the human eye because humans have a lower acuity for perceiving differences in color than differences in brightness. The impact of chroma subsampling on digital test patterns is well understood and accepted because it has minimal impact on live video content.

The encoding method for chroma subsampling is expressed as a three part ratio of the sampling rates of the Y, Cb, and Cr channels respectively. When no subsampling is applied, the format is referred to as 4:4:4, because the sampling rate of all channels is equal.

4:2:2 Chroma Subsampling

When the resolution of color information is reduced by half relative to luminance information, this is referred to as 4:2:2 chroma subsampling. This method of color encoding is widely used in broadcast video applications. For example, all HD-SDI and 3G-SDI video signals utilize 4:2:2 chroma subsampling in compliance with SMPTE 292M and 424M video standards.

Since human vision is less sensitive to differences in color than luminance, when viewing live video images at normal viewing distances there is negligible perceptible loss incurred by applying 4:2:2 chroma subsampling. However, some artifacts can be seen in certain digitally created test patterns, in particular, those with sharp transitions of fully saturated colors such as the color bar test pattern show below:



Chroma Subsampling in NDS Products

The SDI video outputs of NDS Video Processing solutions (ScaleOR™ and ConductOR™) are in compliance with SMPTE 292M and 424M standards. These SDI video outputs utilize 4:2:2 chroma subsampling. Their DVI outputs use a 4:4:4 format with no chroma subsampling. ZeroWire®, however, processes DVI signals differently, as described below.

ZeroWire® DVI Signal Processing :

The robustness of ZeroWire's wireless video link is improved by applying 4:2:2 chroma subsampling to DVI signals. By reducing the necessary bandwidth needed to sustain the video link, the system is able to perform more consistently in a wide variety of conditions. Factors such as obstructions to line-of-sight, rapid changes in orientation, and other dynamic variables make this improved level of reliability very important. As explained above, 4:2:2 chroma subsampling has negligible impact on live video sources such as an endoscopic camera.

