

SMPTE RECOMMENDED PRACTICE

4:2:2 / 4:2:0 Format Conversion Minimizing
Color Difference Signal Degradation in
Concatenated Operations —
Filtering



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Foreword

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SMPTE RP 2050-1 was prepared by Technology Committee 32NF.

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Attention is also drawn to the possibility that elements of this Standard may be subject to IPR other than those identified above. The Society shall not be responsible for identifying any or all such IPR.

Introduction

This section is entirely informative and does not form an integral part of this Recommended Practice.

The 4:2:0 format is widely used in H.262/MPEG-2, H.264/MPEG-4 Part 10 and VC-1 compression. When a 4:2:0 video decoder and encoder are connected via a 4:2:2 serial interface such as SMPTE ST 292-1, the 4:2:0 data is decoded and converted to 4:2:2 by up-sampling the color difference component. In the 4:2:0 video encoder, the 4:2:2 video data is converted to 4:2:0 video data by down-sampling the color difference component. In this case, there typically exists a color difference mismatch between the 4:2:0 video data from the decoder and the 4:2:0 video data to be encoded (see Figure 1)

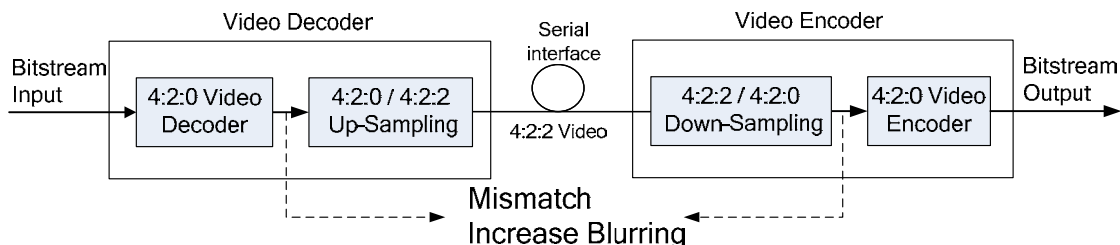


Figure 1 – Connection of 4:2:0 Decoder and Encoder for concatenation

Several stages of codec concatenation are common through the video processing chain. As a result, color difference signal mismatch between 4:2:0 video data input to 4:2:0 video encoder and 4:2:0 video output from 4:2:0 video decoder is accumulated and the degradation becomes visible (see Figure 2).

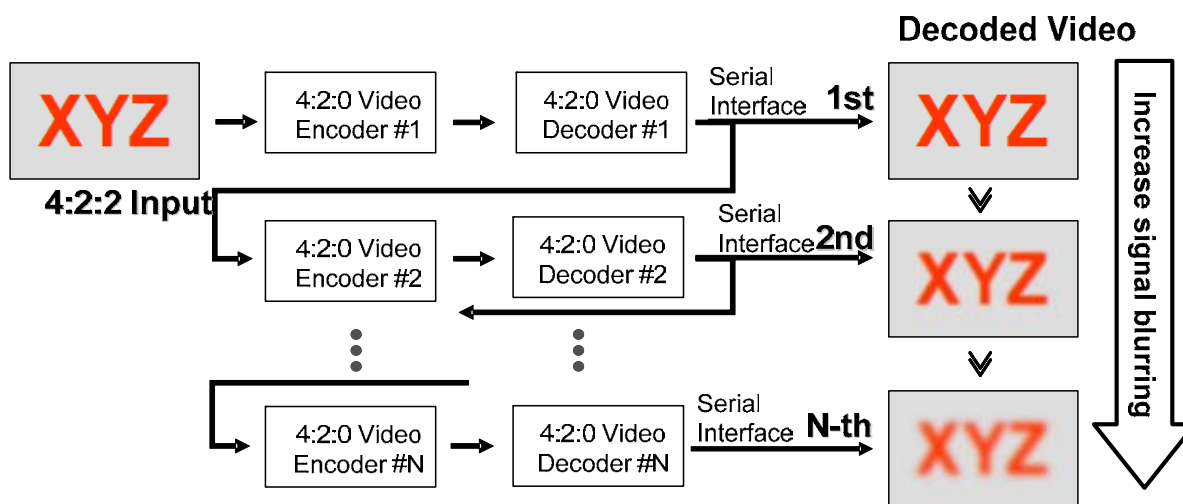


Figure 2 – Conceptual diagram of color difference degradation after codec concatenation

This document defines filter coefficient sets of 4:2:2/4:2:0 and 4:2:0/4:2:2 inter-format conversion to minimize degradation caused by concatenation. This is achieved by making the 4:2:2/4:2:0 inter-format filter sets satisfy complementing reconstruction filters. The use of these filter coefficients preserves the color difference signal resolution of the first 4:2:0 sub-sampling (see Figure 3).

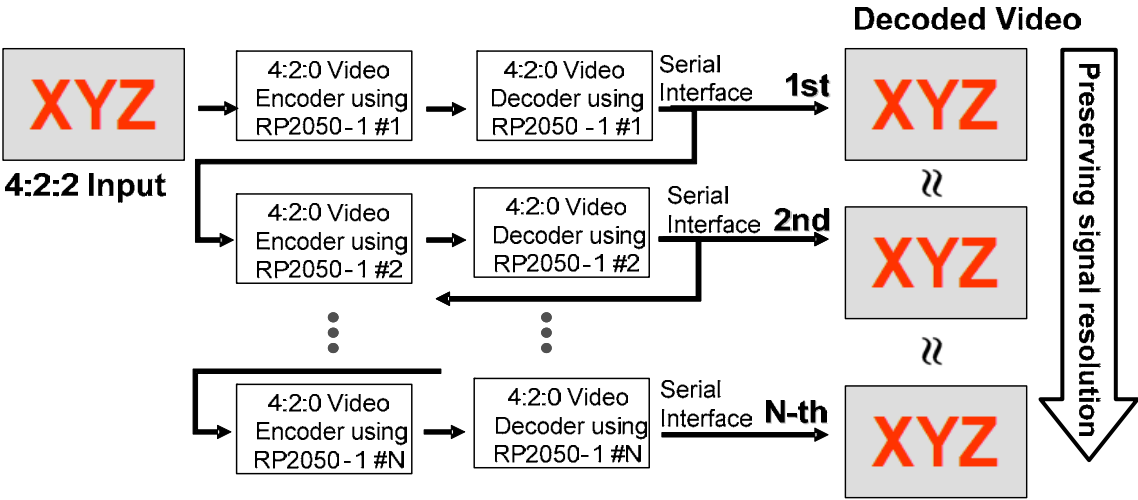


Figure 3 – Conceptual diagram of minimizing color difference signal degradation

Compatibility with filters not using the coefficients set is maintained with minimum degradation (see Figure 4).

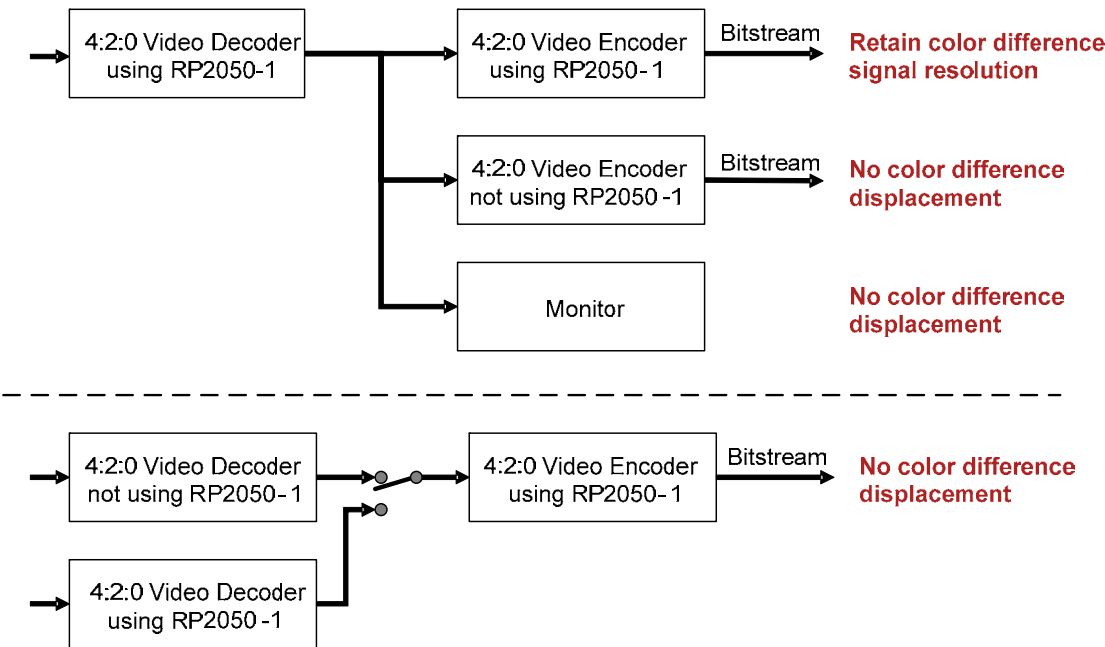


Figure 4 – Compatibility with conventional 4:2:0 and 4:2:2 equipment

It is noted that there is no benefit to using the filter sets defined in this document in an application when the output is not re-encoded.