

Color Fidelity test for Streambox Chroma in Native RGB, XYZ Color and YCrCb 4:2:2 for SDR or HDR

The Streambox Chroma rackmount half-duplex Encoder/Decoder with ACT-L5 codec is well suited for post-production editing and color correction workflows in SDR or HDR. The ACT-L5 codec supports Native RGB and XYZ color space, 10 and 12-bit color depth, and the 4:2:2 and 4:4:4 color profiles. The Streambox Chroma rackmount has been tested for color stability and fidelity and has met SMPTE 372 standard including HDR modes.

Native RGB vs DCI/ICT RGB Test

A color-bar software generator (Blackmagic 4K monitor, SDI out) was connected to a Streambox Chroma Encoder (with Blackmagic 12G Pro, SDI-in) which was connected to a Streambox Chroma Decoder via an IP network hub. The decoder output was to a Blackmagic 4K monitor. On the decoder, we read the SDI value averages before data is passed through the SDI out (after all conversions are complete). Findings:

Native RGB Color Check								
Source			SDI			Difference		
3011	3011	3011	3011	3011	3011	0	0	0
2012	0	0	2012	16	16	0	base	base
0	2013	0	16	2013	16	base	0	base
0	0	2014	16	16	2014	base	base	0
17	18	2014	16	18	2014	-1	0	0
4095	4093	4091	4079	4079	4079	ceiling	ceiling	ceiling
1000	1000	1000	1000	1000	1000	0	0	0
4079	4079	4079	4079	4079	4079	ceiling	ceiling	ceiling
2000	2000	2000	2000	2000	2000	0	0	0
4077	4077	4077	4077	4077	4077	0	0	0
100	4000	100	100	4000	100	0	0	0
100	100	4000	100	100	4000	0	0	0
4000	100	100	4000	100	100	0	0	0
100	100	100	100	100	100	0	0	0
200	200	200	200	200	200	0	0	0
300	300	300	300	300	300	0	0	0
400	400	400	400	400	400	0	0	0
500	500	500	500	500	500	0	0	0
600	600	600	600	600	600	0	0	0
700	700	700	700	700	700	0	0	0
800	800	800	800	800	800	0	0	0
900	900	900	900	900	900	0	0	0
1909	1909	1909	1909	1909	1909	0	0	0
3005	3005	3005	3005	3005	3005	0	0	0
2000	2000	100	2000	2000	100	0	0	0
1000	1000	200	1000	1000	200	0	0	0
500	500	1000	500	500	1000	0	0	0
100	100	2000	100	100	2000	0	0	0
100	2000	3000	100	2000	3000	0	0	0
0	0	0	16	16	16	base	base	base

Native RGB encoding does not perform any color transform and encodes RGB values natively. RGB ICT mode performs RGB transform to/from DCI ICT (compatible with DCI ICT, ISO/IEC 15444-1). Both modes are supported via Streambox Chroma UI. Streambox Chroma supports both full and legal ranges. Following test were performed in Full range mode.

- Native RGB has less errors than ICT (+1 in last 12-bit digit)
- Clipping for reserved SMPTE 372, 12-bit SDI values:
 Software generated values 0-15 are clipped to 16 by hardware (base)
 Software generated values 4080 to 4096 are mapped to 4079 by hardware (ceiling)

DCI/ICT Color Check								
Source			SDI			Difference		
2012	0	0	2012	16	16	0	base	base
0	2013	0	16	2013	15	base	0	0
0	0	2014	17	16	2014	1	base	0
17	18	2014	16	16	2013	-1	-2	-1
4095	4093	4091	4079	4079	4079	ceiling	ceiling	ceiling
1000	1000	1000	1000	1000	1000	0	0	0
4078	4078	4078	4079	4079	4079	ceiling	ceiling	ceiling
3000	3000	3000	3000	3000	3000	0	0	0
4077	4077	4077	4077	4077	4077	0	0	0
100	4000	100	100	4000	100	0	0	0
100	100	4000	101	100	4000	1	0	0
4000	100	100	4000	100	100	0	0	0
100	100	100	100	100	100	0	0	0
200	200	200	200	200	200	0	0	0
300	300	300	300	300	300	0	0	0
400	400	400	400	400	400	0	0	0
500	500	500	500	500	500	0	0	0
600	600	600	600	600	600	0	0	0
700	700	700	700	700	700	0	0	0
800	800	800	800	800	800	0	0	0
900	900	900	900	900	900	0	0	0
1909	1909	1909	1909	1909	1909	0	0	0
3005	3005	3005	3005	3005	3005	0	0	0
2000	2000	100	2000	2000	100	0	0	0
1000	1000	200	1000	1000	200	0	0	0
500	500	1000	500	500	1000	0	0	0
100	100	2000	101	100	2000	1	0	0
100	2000	3000	101	2000	3001	1	0	1
0	0	0	16	16	16	base	base	base

The 10 Bit 4:2:2 Chromatic Test for Rec.709/Rec.2020 (HDR)

A Streambox Chroma Encoder with Decklink 4K Pro was connected through a network hub to an identical Streambox Chroma Decoder.¹ Source format: 1080p24. The encoder was set to Full 2K resolution, 10-bit color depth, 4:2:2 color profile, and Rec 709 color space. The decoder was in test mode. The table below shows that the color values were identical between the source and the decoder-out.² The values were stable with no vibration. Since no color space conversion is performed in 4:2:2 mode, the same result applies to Rec.2020 signal fidelity.

		SOURCE			DECODER-OUT			COMMENT
		Y	Cb	Cr	Y	Cb	Cr	
Begin Gray	0	199	200	200	199	200	200	
Mid Gray	100	199	200	200	199	200	200	NO ERROR
Begin Lite-Gray	239							
Mid Lite-Gray	340	2FF	200	200	2FF	200	200	NO ERROR
Begin Yellow	445							
Yellow	545	2C8	78	224	2C8	78	224	NO ERROR
Begin Lite-Blu	651							
Lite-Blu	751	25C	25A	78	25C	25A	78	NO ERROR
Begin Green	857							
Green	957	225	0D2	09C	225	0D2	09C	NO ERROR
Begin Pink	1063							
Pink	1163	0DB	32E	364	0DB	32E	364	NO ERROR
Begin Red	1269							
Red	1369	0A3	1A6	388	0A3	1A6	388	NO ERROR
Begin Blue	1475							
Blue	1575	37	388	1DC	37	388	1DC	NO ERROR
Begin Gray	1681							
Gray	1781	199	200	200	199	200	200	NO ERROR
End Gray	1919	199	200	200	199	200	200	

Summary

The Streambox Chroma rackmount Encoder/Decoder with ACT-L5 compression and support for Native RGB 4:4:4 and YCrCb 4:2:2 delivers color coding consistent with SMPTE 372 standards. Furthermore, these tests demonstrate that the measured colors before and after chromatic conversions were identical, making the Streambox Chroma ideal for color correction workflows including support Rec.709, DCI P3, Rec.2020, HDR10 PQ/HLG and Dolby Vision.

For more information about the Streambox Chroma: <https://www.streambox.com/chroma/>

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¹ Both Encoder and Decoder are the same models, one running the encoder software and the other running the decoder software.

² Testing was carried out with a Leader LV-7700 Rasterized SDI Signal Monitor