

# **SMPTE OVERVIEW**

## **6G-SDI Bit-Serial Interfaces — Overview for the SMPTE ST 2081 Document Suite**



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### **Document Overview**

The SMPTE ST 2081 suite of documents defines the mapping of various source image formats onto a single-link, dual-link and quad-link serial digital interface operating at a nominal rate of 6 Gb/s. This informative “overview” describes the documents in the SMPTE ST 2081 suite.

The SMPTE ST 2081 series specify a common virtual interface that is carried on both electrical and optical physical interfaces which are also defined in the document suite.

The diagram of Figure 1 illustrates a simplified ‘Image mapping data flow’ overview for the 6G-SDI profile as defined by the SMPTE ST 2081 document suite. The individual roadmaps of the SMPTE ST 2081 standards include full details of reference standards.

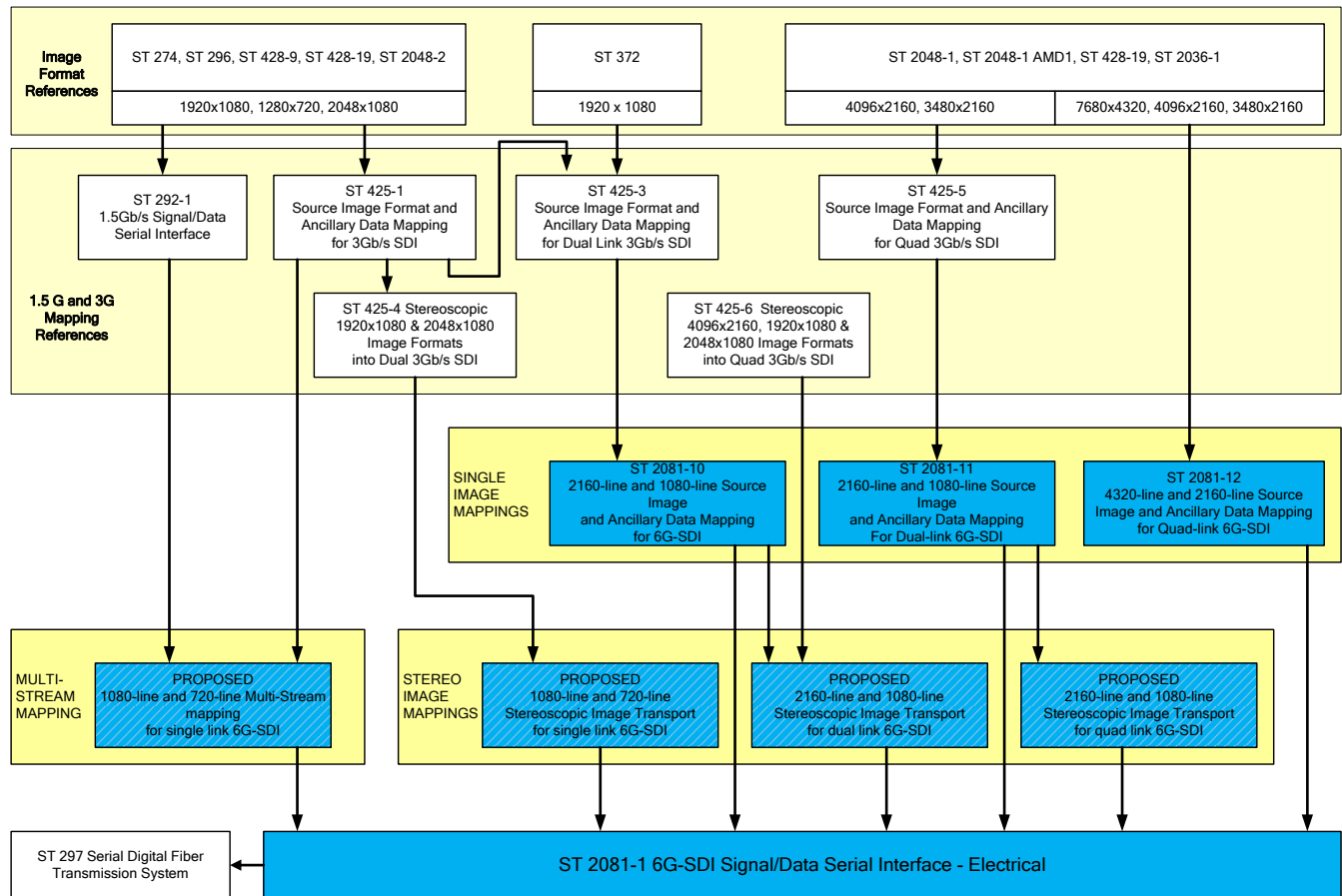


Figure 1 – 6G-SDI Profile

## 1 SMPTE ST 2081-1 – 6 Gb/s Signal/Data Serial Interface — Electrical

This standard defines a bit-serial data structure, electrical signal and coaxial cable interface for the transport of signals with a total payload of 5.940 Gb/s or 5.940/1.001 Gb/s.

This standard also specifies the electrical and physical characteristics of coaxial cables and connectors.

## 2 SMPTE ST 2081-10 – 2160-line and 1080-line Source Image and Ancillary Data Mapping for Single-link 6G-SDI

This standard defines several mapping modes for the carriage 2160-line and 1080-line image formats and associated ancillary data into a Single-link 6 Gb/s [nominal] SDI bit-serial interface as follows:

**MODE 1:** 2160-line source image formats into a single link 6Gb/s [nominal] SDI bit-serial interface

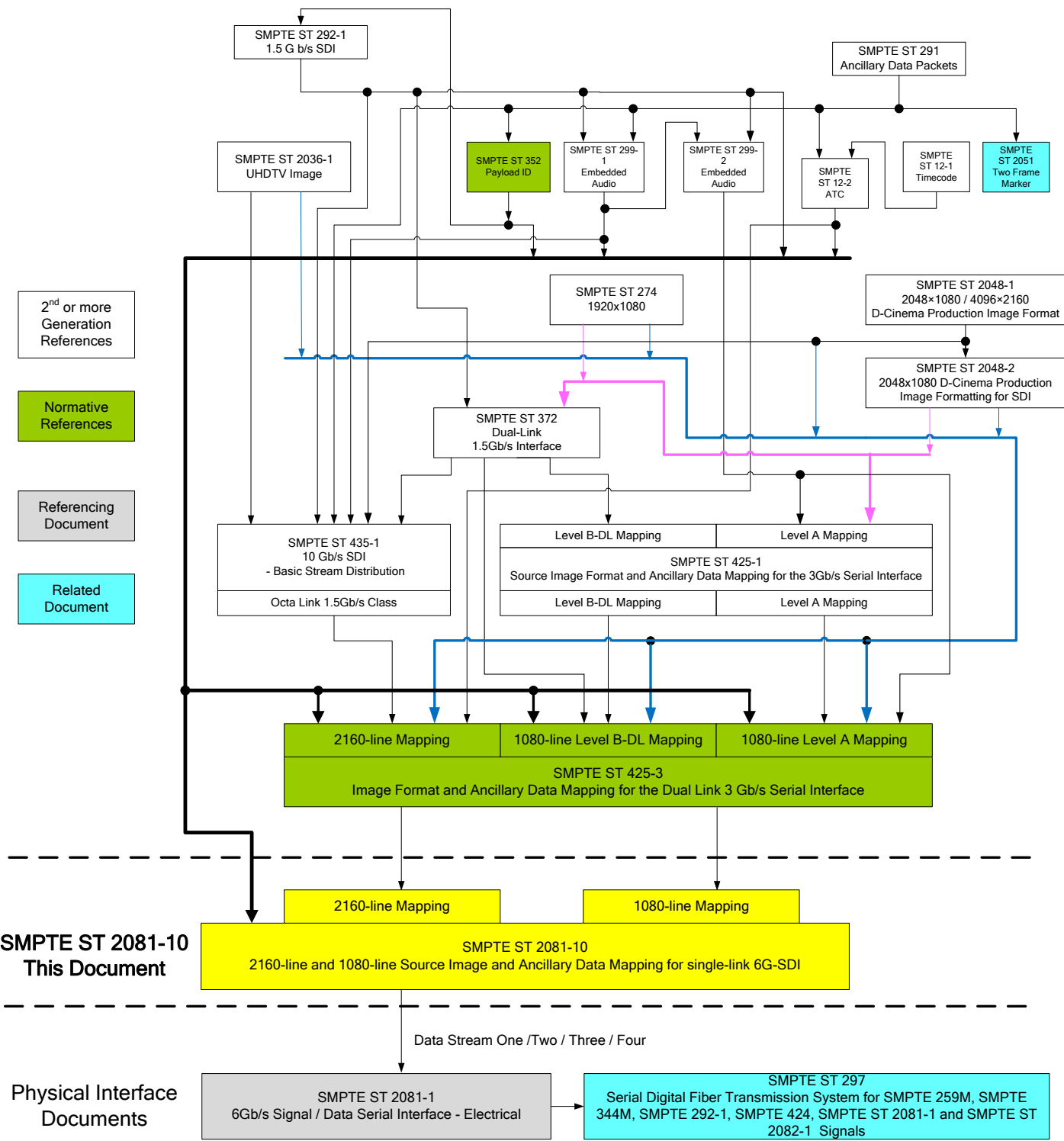
**MODE 2:** 1080-line source image formats into a single link 6Gb/s [nominal] SDI bit-serial interface

This standard also defines the carriage of ancillary data, and the SMPTE ST 352 payload ID's for the single-link 6Gb/s SDI interface.

## 2.1 SMPTE ST 2081-10 Supported image Formats

UHDTV1 and 4K Digital Cinematography Production			
Reference SMPTE Standard	Image Format	Signal Format Sampling Structure/Pixel Depth	Frame Rate
ST 2036-1	3840 × 2160	4:2:2 (Y'C <sub>B</sub> C <sub>R</sub> )/10-bit 4:2:0 (Y'C <sub>B</sub> C <sub>R</sub> )/10-bit	24/1.001, 24, 25, 30/1.001 and 30 Progressive
ST 2048-1	4096 × 2160	4:2:2 (Y'C <sub>B</sub> C <sub>R</sub> )/10-bit	24/1.001, 24, 25, 30/1.001 and 30 Progressive
HDTV and 2K Digital Cinematography Production			
ST 274	1920 × 1080	4:4:4 (R'G'B'), 4:4:4:4 (R'G'B'+A)/10-bit	50, 60/1.001 and 60 Progressive
ST 2048-2	2048 × 1080	4:4:4 (R'G'B'), 4:4:4:4 (R'G'B'+A)/10-bit	48/1.001, 48, 50, 60/1.001 and 60 frames progressive
ST 274	1920 × 1080	4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> ), 4:4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> +A)/10-bit	50, 60/1.001 and 60 frames progressive
ST 2048-2	2048 × 1080	4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> ), 4:4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> +A)/10-bit	48/1.001, 48, 50, 60/1.001 and 60 frames progressive
ST 274	1920 × 1080	4:4:4 (R'G'B')/12-bit	50, 60/1.001 and 60 frames progressive
ST 2048-2	2048 × 1080	4:4:4 (R'G'B')/12-bit	48/1.001, 48, 50, 60/1.001 and 60 frames progressive
ST 274	1920 × 1080	4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit	50, 60/1.001 and 60 frames progressive
ST 2048-2	2048 × 1080	4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit	48/1.001, 48, 50, 60/1.001 and 60 frames progressive
ST 274	1920 × 1080	4:2:2 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit	50, 60/1.001 and 60 frames progressive
ST 2048-2	2048 × 1080	4:2:2 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit	48/1.001, 48, 50, 60/1.001 and 60 frames progressive
ST 2048-2	2048 × 1080	4:2:2:4 (Y'C <sub>B</sub> C <sub>R</sub> +A)/12-bit	48/1.001, 48, 50, 60/1.001 and 60 frames progressive

2.2 SMPTE ST 2081-10 Document Roadmap



### 3 SMPTE ST 2081-11 – 2160-line Source Image and Ancillary Data Mapping for Dual-link 6G-SDI

This standard defines several mapping modes for the carriage of 2160-line and 1080-line image formats and associated ancillary data into a Single-link 6 Gb/s [nominal] SDI bit-serial interface as follows:

- **Mode 1:** 2160-line Source image formats and ancillary data into a Dual-link 6 Gb/s [nominal] SDI bit-serial interface

This standard also defines the carriage of ancillary data, and the SMPTE ST 352 payload ID's for the dual-link 6 Gb/s SDI interface.

#### 3.1 SMPTE ST 2081-11 Supported image Formats

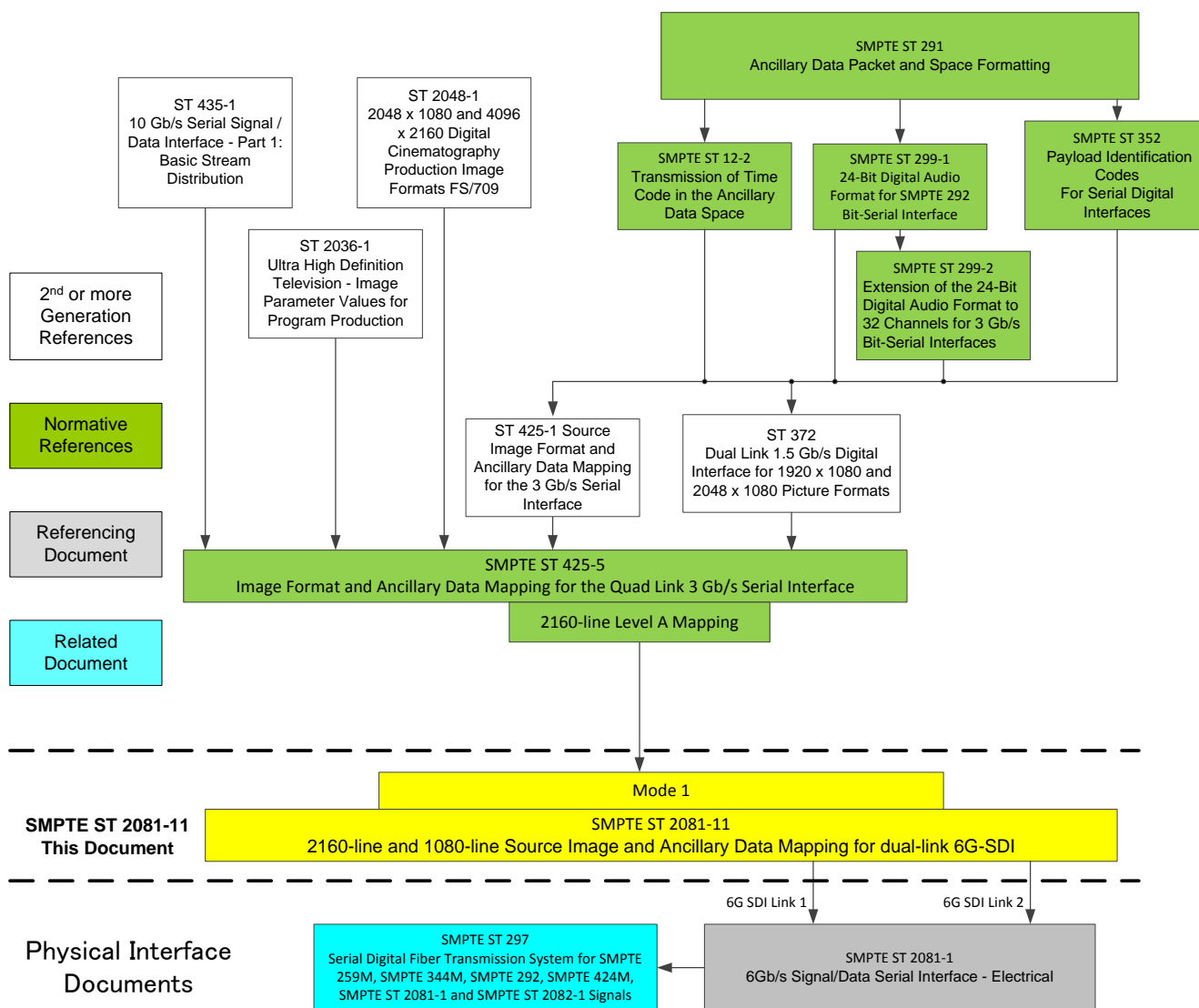
UHDTV1 and 4K Digital Cinematography Production			
Reference SMPTE Standard	Image Format	Signal Format Sampling Structure/pixel Depth	Frame Rate Hz
ST 2036-1	3840 × 2160	4:2:2 (Y'C <sub>B</sub> C <sub>R</sub> ), 4:2:0 (Y'C <sub>B</sub> C <sub>R</sub> )/10-bit	50, 60/1.001 and 60 Progressive
ST 2048-1	4096 × 2160 <sup>*2</sup>	4:2:2 (Y'C <sub>B</sub> C <sub>R</sub> )/10-bit	48/1.001, 48, 50, 60/1.001 and 60 Progressive
ST 2036-1	3840 × 2160	4:4:4 (R'G'B')	24/1.001, 24, 25, 30/1.001 and 30 Progressive
ST 2048-1	4096 × 2160 <sup>*2</sup>	4:4:4 (R'G'B' <sup>*1</sup> ), 4:4:4:4 (R'G'B' <sup>*1</sup> +A)/10-bit	
ST 2036-1	3840 × 2160	4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> )	
ST 2048-1	4096 × 2160 <sup>*2</sup>	4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> ), 4:4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> +A)/10-bit	
ST 2036-1	3840 × 2160	4:4:4 (R'G'B')/12-bit	
ST 2048-1	4096 × 2160 <sup>*2</sup>	4:4:4 (R'G'B' <sup>*1</sup> )/12-bit	
ST 2036-1	3840 × 2160	4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit	
ST 2048-1	4096 × 2160 <sup>*2</sup>	4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit	
ST 2036-1	3840 × 2160	4:2:2 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit 4:2:0 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit	
ST 2048-1	4096 × 2160 <sup>*2</sup>	4:2:2 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit	
ST 2048-1	4096 × 2160 <sup>*2</sup>	4:2:2:4 (Y'C <sub>B</sub> C <sub>R</sub> +A)/12-bit	

Notes:

<sup>\*1</sup> In this image format R'G'B' indicates either R'G'B' or R'<sub>FS</sub>G'<sub>FS</sub>B'<sub>FS</sub>. An additional Color VANC packet to describe the FS characteristics is defined by SMPTE ST 2048-1.

<sup>\*2</sup> This is the maximum pixel array, the active image may not fill the maximum array.

### 3.2 SMPTE ST 2081-11 Document Roadmap



## 4 SMPTE ST 2081-12 – 4320-line and 2160-line Source Image and Ancillary Data Mapping for Quad-link 6G-SDI

This standard defines several mapping modes for the carriage of 4320-line and 2160-line image formats and associated ancillary data into a Quad-link 6 Gb/s [nominal] SDI bit-serial interface as follows:

- **MODE 1:** 4320-line  $Y'C'_B'C'_R$  4:2:2 and 4:2:0 10-bit image formats and ancillary data on a Quad-link 6 Gb/s [nominal] SDI bit-serial interface
- **MODE 2:** 2160-line  $R'G'B'$ ,  $Y'C'_B'C'_R$  4:4:4(4:4) 10-bit and 4:4:4 12-bit image formats and ancillary data on a Quad-link 6 Gb/s [nominal] SDI bit-serial interface
- **MODE 3:** 2160-line  $Y'C'_B'C'_R$  4:2:2 and 4:2:0 10-bit Additional Frame Rate Source image formats and ancillary data on a Quad-link 6 Gb/s [nominal] SDI bit-serial interface

This standard also defines the carriage of ancillary data, and the SMPTE ST 352 payload ID's for the quad-link 6Gb/s SDI interface.

#### 4.1 SMPTE ST 2081-12 Supported image Formats

UHDTV2 Production			
Reference SMPTE Standard	Image Format	Signal Format Sampling Structure/pixel Depth	Frame Rate Hz
ST 2036-1	7680 × 4320	4:2:2 (Y'C <sub>B</sub> C <sub>R</sub> '), 4:2:0 (Y'C <sub>B</sub> C <sub>R</sub> )/10-bit	24/1.001, 24, 25, 30/1.001 and 30 Progressive
UHDTV1 and 4K Digital Cinematography Production			
Reference SMPTE Standard	Image Format	Signal Format Sampling Structure/pixel Depth	Frame Rate Hz
ST 2036-1	3840 × 2160	4:4:4 (R'G'B'), 4:4:4:4 (R'G'B'+A)/10-bit	50, 60/1.001 and 60 Progressive
ST 2048-1	4096 × 2160 <sup>*2</sup>	4:4:4 (R'G'B' <sup>*1</sup> ), 4:4:4:4 (R'G'B' <sup>*1</sup> +A)/10-bit	48/1.001, 48, 50, 60/1.001 and 60 Progressive
ST 2036-1	3840 × 2160	4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> '), 4:4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> +A)/10-bit	50, 60/1.001 and 60 Progressive
ST 2048-1	4096 × 2160 <sup>*2</sup>	4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> '), 4:4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> +A)/10-bit	48/1.001, 48, 50, 60/1.001 and 60 Progressive
ST 2036-1	3840 × 2160	4:4:4 (R'G'B')/12-bit	50, 60/1.001 and 60 Progressive
ST 2048-1	4096 × 2160 <sup>*2</sup>	4:4:4 (R'G'B' <sup>*1</sup> )/12-bit	48/1.001, 48, 50, 60/1.001 and 60 Progressive
ST 2036-1	3840 × 2160	4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit	50, 60/1.001 and 60 Progressive
ST 2048-1	4096 × 2160 <sup>*2</sup>	4:4:4 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit	48/1.001, 48, 50, 60/1.001 and 60 Progressive
ST 2036-1	3840 × 2160	4:2:2 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit 4:2:0 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit	50, 60/1.001 and 60 Progressive
ST 2048-1	4096 × 2160 <sup>*2</sup>	4:2:2 (Y'C <sub>B</sub> C <sub>R</sub> )/12-bit	48/1.001, 48, 50, 60/1.001 and 60 Progressive
ST 2048-1	4096 × 2160 <sup>*2</sup>	4:2:2:4 (Y'C <sub>B</sub> C <sub>R</sub> +A)/12-bit	48/1.001, 48, 50, 60/1.001 and 60 Progressive

UHDTV1 and 4K Digital Cinematography Production AFR			
Reference SMPTE Standard	Image Format	Signal Format Sampling Structure/pixel Depth	Additional Frame Rates (AFR) Hz
ST 2036-1	3840 x 2160	4:2:2 (Y'C <sub>B</sub> C <sub>R</sub> )/10-bit 4:2:0 (Y'C <sub>B</sub> C <sub>R</sub> )/10-bit	120 progressive
			120/1.001 progressive
			100 progressive
ST 2048-1	4096 x 2160	4:2:2 (Y'C <sub>B</sub> C <sub>R</sub> )/10-bit	120 progressive
			120/1.001 progressive
			100 progressive
			96 progressive
			96/1.001 progressive

## Notes:

\*<sup>1</sup> In this image format R'G'B' indicates either R'G'B' or R'<sub>FS</sub>G'<sub>FS</sub>B'<sub>FS</sub>. An additional Color VANC packet to describe the FS characteristics is defined by SMPTE ST 2048-1.

\*<sup>2</sup> This is the maximum pixel array, the active image may not fill the maximum array.



## 4.2 SMPTE ST 2081-12 Document Roadmap

