SMPTE OVERVIEW

6G-SDI Bit-Serial Interfaces

Roadmap for the SMPTE ST 2081 Document Suite

Document Overview

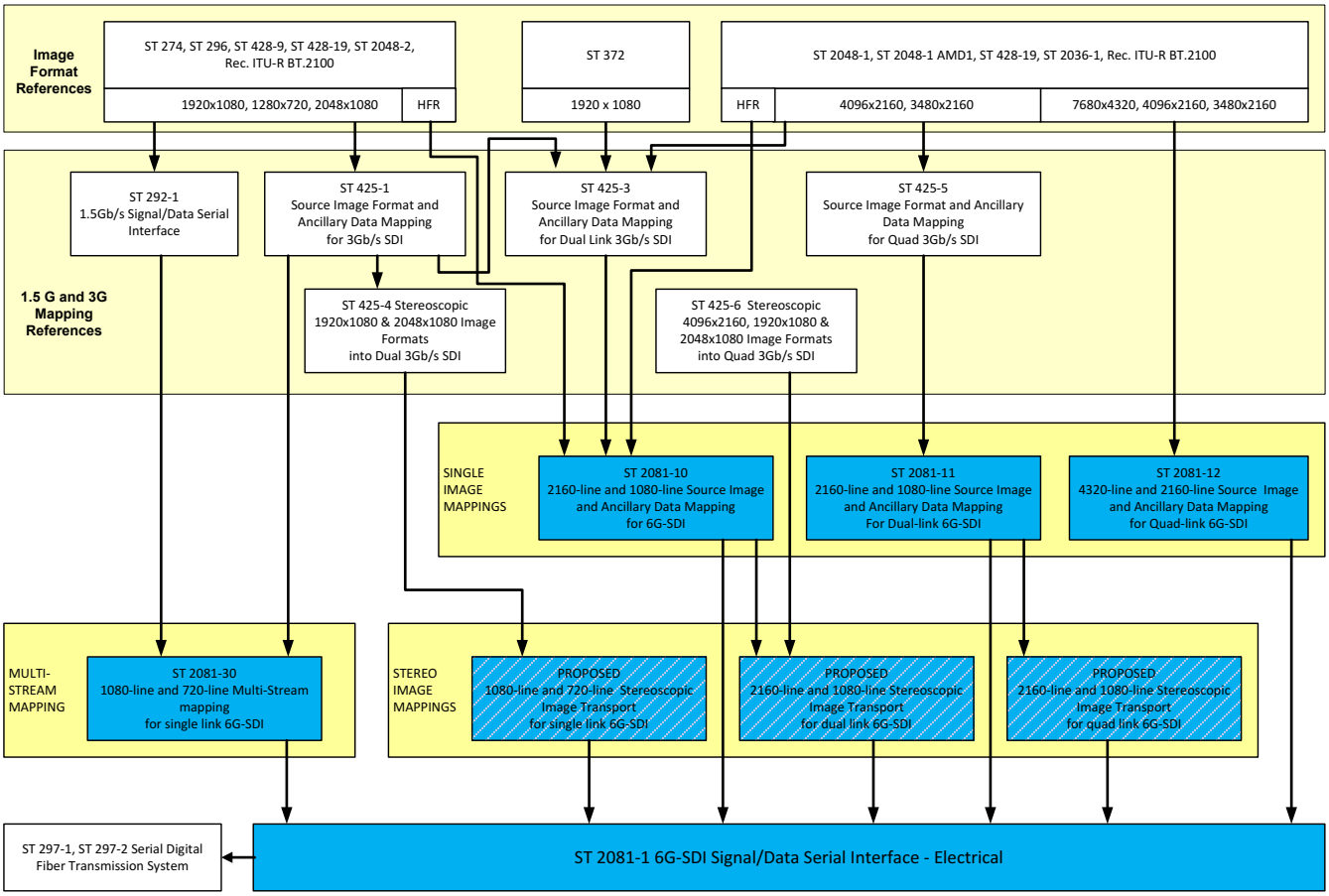
The SMPTE ST 2081 suite of documents defines the mapping of various source image formats onto a single-link, dual-link and quad-link serial digital interface operating at a nominal rate of 6 Gb/s. This informative “roadmap” describes the documents in the SMPTE ST 2081 suite.

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

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

Approved May 2, 2018

Figure 1 6G-SDI Profile



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

This standard defines the generation, from a 6G-SDI 10-bit multiplex, of 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 identified in Table 1 into a 6G-SDI 10-bit multiplex
- **Mode 2:** 1080-line Source image formats identified in Table 6 into a 6G-SDI 10-bit multiplex
- **Mode 3:** 1080-line HFR Source image formats identified in Table 8 into a 6G-SDI 10-bit multiplex

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, SDR and HDR			
Reference Standard	**Image Format**	**Signal Format Sampling Structure/Pixel Depth**	**Frame Rate**
SMPTE ST 2036-1 Rec. ITU-R BT.2100	3840 × 2160	4:2:2 ($Y'C'_BC'_R$)/10-bit 4:2:2 (IC_TC_P)/10-bit 4:2:0 ($Y'C'_BC'_R$)/10-bit 4:2:0 (IC_TC_P)/10-bit	24/1.001, 24, 25, 30/1.001 and 30 Progressive
SMPTE ST 2048-1	4096 × 2160	4:2:2 ($Y'C'_BC'_R$)/10-bit	24/1.001, 24, 25, 30/1.001 and 30 Progressive

HDTV and 2K Digital Cinematography Production, SDR and HDR			
SMPTE ST 274	1920 × 1080	4:4:4 (R′G′B′), 4:4:4:4 (R′G′B′+A*[3])/10-bit	50, 60/1.001 and 60 Progressive
SMPTE ST 2048-2	2048 × 1080	4:4:4 (R′G′B′*[1]), 4:4:4:4 (R′G′B′*[1]+A*[3])/10-bit	48/1.001, 48, 50, 60/1.001 and 60 frames progressive
SMPTE ST 274 Rec. ITU-R BT.2100	1920 × 1080	4:4:4 ($Y'C'_BC'_R$)/10-bit 4:4:4 (IC_TC_P*[4])/10-bit, 4:4:4:4 ($Y'C'_BC'_R$+A*[3])/10-bit 4:4:4:4 (IC_TC_P*[4]+A*[3])/10-bit	50, 60/1.001 and 60 frames progressive
SMPTE ST 2048-2	2048 × 1080	4:4:4 ($Y'C'_BC'_R$)/10-bit, 4:4:4:4 ($Y'C'_BC'_R$+A*[3])/10-bit	48/1.001, 48, 50, 60/1.001 and 60 frames progressive
SMPTE ST 274 Rec. ITU-R BT.2100	1920 × 1080	4:4:4 (R′G′B′)/12-bit	50, 60/1.001 and 60 frames progressive
SMPTE ST 2048-2	2048 × 1080	4:4:4 (R′G′B′*[1])/12-bit	48/1.001, 48, 50, 60/1.001 and 60 frames progressive
SMPTE ST 274 Rec. ITU-R BT.2100	1920 × 1080	4:4:4 ($Y'C'_BC'_R$)/12-bit 4:4:4 (IC_TC_P*[4])/12-bit	50, 60/1.001 and 60 frames progressive
SMPTE ST 2048-2	2048 × 1080	4:4:4 ($Y'C'_BC'_R$)/12-bit	48/1.001, 48, 50, 60/1.001 and 60 frames progressive
SMPTE ST 274 Rec. ITU-R BT.2100	1920 × 1080	4:2:2 ($Y'C'_BC'_R$)/12-bit 4:2:2:4 ($Y'C'_BC'_R$+A*[3])/12-bit 4:2:2 (IC_TC_P*[4])/12-bit 4:2:2:4 (IC_TC_P*[4]+A*[3])/12-bit	50, 60/1.001 and 60 frames progressive
SMPTE ST 2048-2	2048 × 1080	4:2:2 ($Y'C'_BC'_R$)/12-bit	48/1.001, 48, 50, 60/1.001 and 60 frames progressive
SMPTE ST 2048-2	2048 × 1080	4:2:2:4 ($Y'C'_BC'_R$+A*[3])/12-bit	48/1.001, 48, 50, 60/1.001 and 60 frames progressive
HFR HDTV and 2K Digital Cinematography Production, SDR and HDR			
Rec. ITU-R BT.2100	1920 x 1080	4:2:2 ($Y'C'_BC'_R$)/10-bit 4:2:2 (IC_TC_P*[4])/10-bit 4:2:0 ($Y'C'_BC'_R$)/10-bit 4:2:0 (IC_TC_P*[4])/10-bit	120 frames progressive
			120/1.001 frames progressive
			100 frames progressive
SMPTE ST 2048-1	2048 x 1080	4:2:2 ($Y'C'_BC'_R$)/10-bit	120 frames progressive
			120/1.001 frames progressive
			100 frames progressive
			96 frames progressive
			96/1.001 frames progressive

Notes:

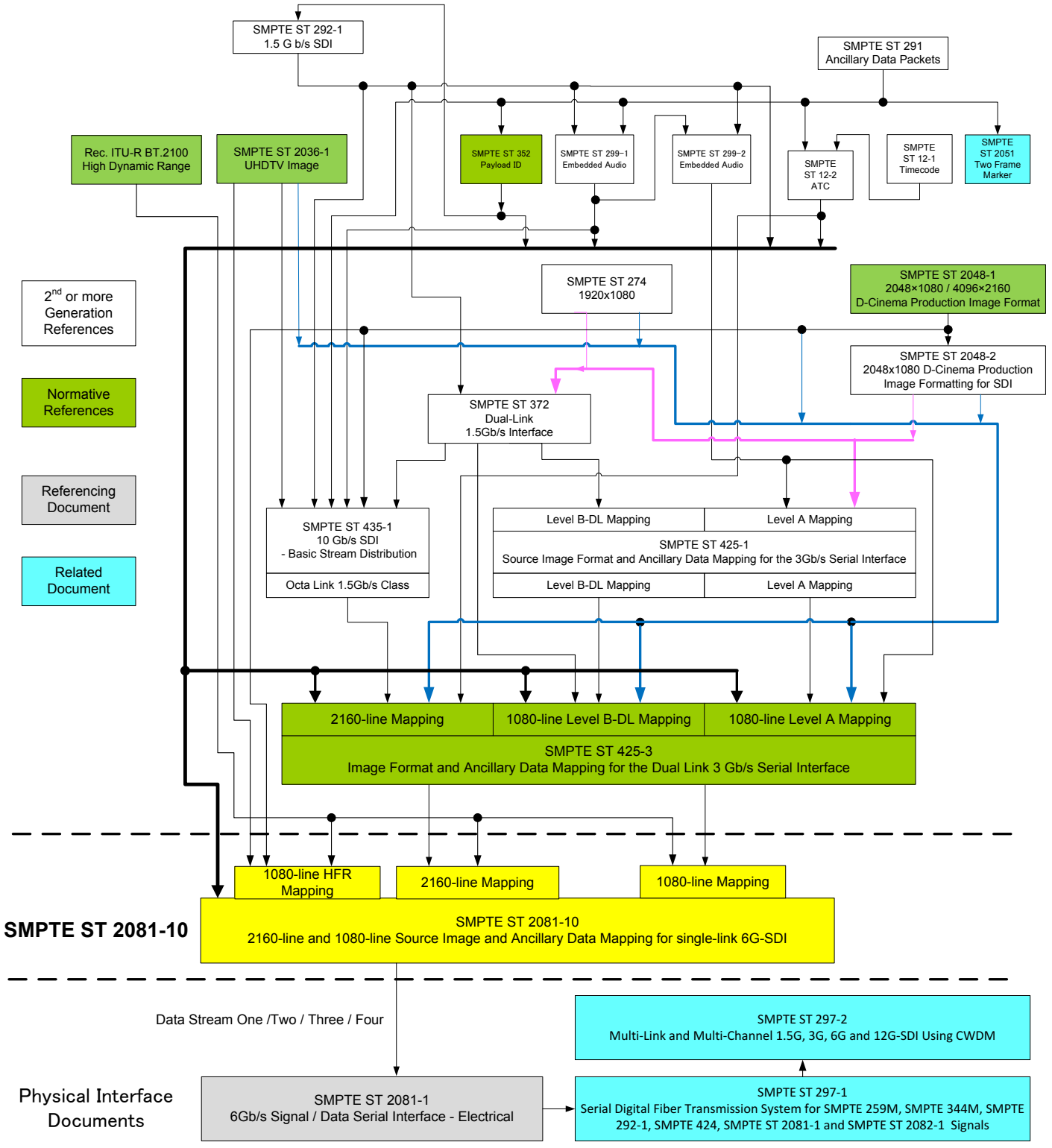
*1 In this image format R′G′B′ indicates either R′G′B′ or $R'_{FS}G'_{FS}B'_{FS}$. The suffix FS and an additional Color VANC packet to describe the FS characteristics are defined by SMPTE ST 2048-1.

*2 This is the maximum pixel array, the active image might not fill the maximum array.

*3 Definition of the A channel is application-dependent. An auxiliary component signal designated A or Alpha may optionally accompany the R′G′B′, $R'_{FS}G'_{FS}B'_{FS}$, $Y'C'_BC'_R$ or IC_TC_P video signal. Interfaces containing the auxiliary component are denoted as R′G′B′+A, $Y'C'_BC'_R$+A and IC_TC_P+A. In the cases when the A channel is used for non-picture data, the payload is constrained to 8-bit words maximum

*4 In accordance with Recommendation ITU-R BT.2100, IC_TC_P sampling is only applied to High Dynamic Range (HDR) progressive image formats

2.2 SMPTE ST 2081-10 Document Road Map



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 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 6Gb/s SDI interface.

3.1 SMPTE ST 2081-11 Supported image Formats

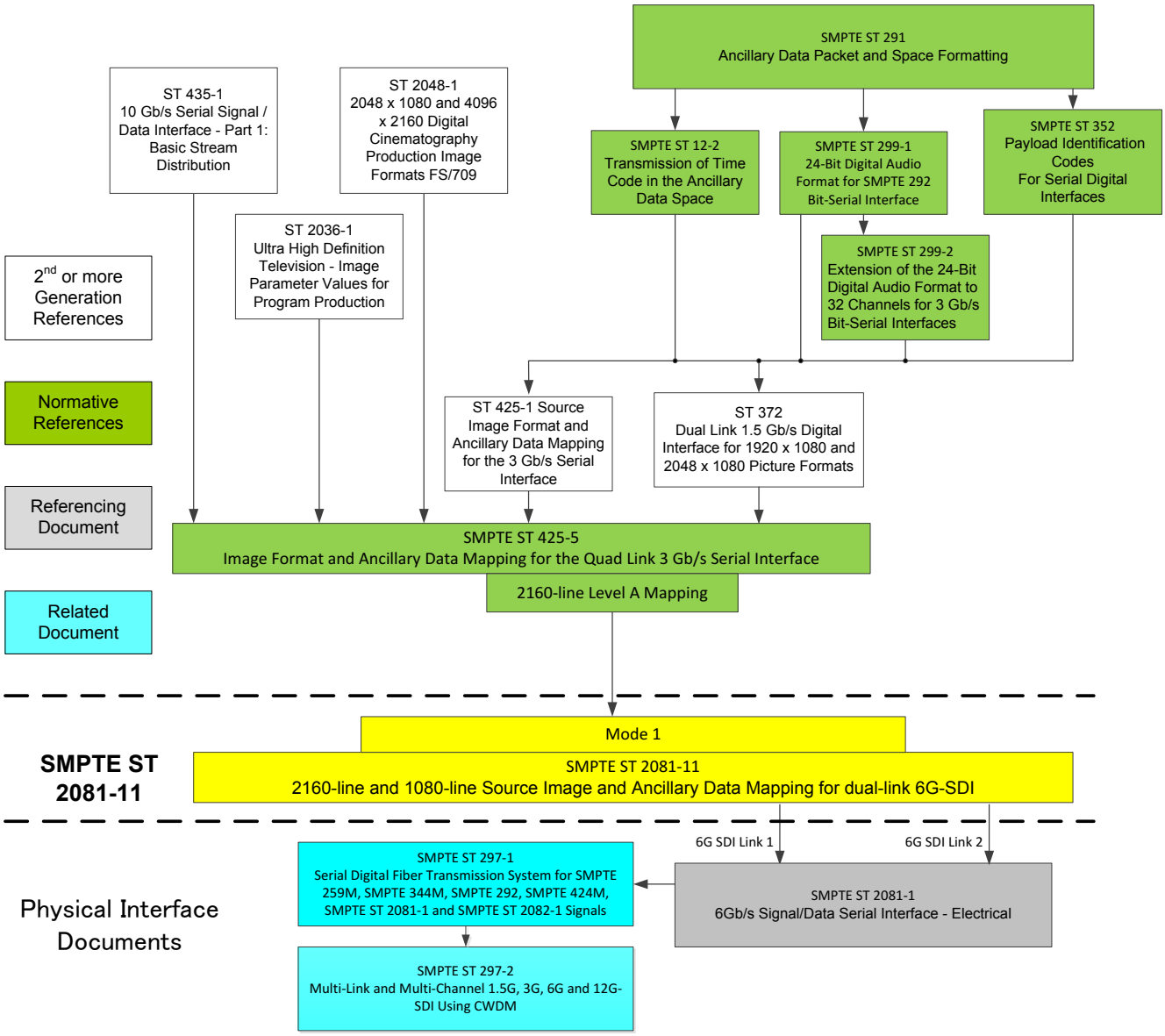
UHDTV1 and 4K Digital Cinematography Production			
Reference SMPTE Standard	Image Format	Signal Format Sampling Structure/pixel Depth	Frame Rate Hz
ST 2036-1	3840 × 2160	4:2:2 (Y′C′$_B$C′$_R$), 4:2:0 (Y′C′$_B$C′$_R$)/10-bit	50, 60/1.001 and 60 Progressive
ST 2048-1	4096 × 2160*2	4:2:2 (Y′C′$_B$C′$_R$)/10-bit	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*2	4:4:4 (R′G′B′*1), 4:4:4:4 (R′G′B′*1+A)/10-bit	
ST 2036-1	3840 × 2160	4:4:4 (Y′C′$_B$C′$_R$)	
ST 2048-1	4096 × 2160*2	4:4:4 (Y′C′$_B$C′$_R$), 4:4:4:4 (Y′C′$_B$C′$_R$+A)/10-bit	
ST 2036-1	3840 × 2160	4:4:4 (R′G′B′)/12-bit	
ST 2048-1	4096 × 2160*2	4:4:4 (R′G′B′*1)/12-bit	
ST 2036-1	3840 × 2160	4:4:4 (Y′C′$_B$C′$_R$)/12-bit	
ST 2048-1	4096 × 2160*2	4:4:4 (Y′C′$_B$C′$_R$)/12-bit	
ST 2036-1	3840 × 2160	4:2:2 (Y′C′$_B$C′$_R$)/12-bit 4:2:0 (Y′C′$_B$C′$_R$)/12-bit	
ST 2048-1	4096 × 2160*2	4:2:2 (Y′C′$_B$C′$_R$)/12-bit	
ST 2048-1	4096 × 2160*2	4:2:2:4 (Y′C′$_B$C′$_R$+A)/12-bit	

Notes:

*1 In this image format R′G′B′ indicates either R′G′B′ or R′$_{FS}$G′$_{FS}$B′$_{FS}$. An additional Color VANC packet to describe the FS characteristics is defined by SMPTE ST 2048-1.

*2 This is the maximum pixel array, the active image may not fill the maximum array.

3.2 SMPTE ST 2081-11 Document Road Map



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 $Y'C'_BC'_R$ 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 $R'G'B'$, $Y'C'_BC'_R$ 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 $Y'C'_BC'_R$ 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′$_B$C′$_R$), 4:2:0 (Y′C′$_B$C′$_R$)/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*2	4:4:4 (R′G′B′*1), 4:4:4:4 (R′G′B′*1+A)/10-bit	48/1.001, 48, 50, 60/1.001 and 60 Progressive
ST 2036-1	3840 × 2160	4:4:4 (Y′C′$_B$C′$_R$), 4:4:4:4 (Y′C′$_B$C′$_R$+A)/10-bit	50, 60/1.001 and 60 Progressive
ST 2048-1	4096 × 2160*2	4:4:4 (Y′C′$_B$C′$_R$), 4:4:4:4 (Y′C′$_B$C′$_R$+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*2	4:4:4 (R′G′B′*1)/12-bit	48/1.001, 48, 50, 60/1.001 and 60 Progressive
ST 2036-1	3840 × 2160	4:4:4 (Y′C′$_B$C′$_R$)/12-bit	50, 60/1.001 and 60 Progressive
ST 2048-1	4096 × 2160*2	4:4:4 (Y′C′$_B$C′$_R$)/12-bit	48/1.001, 48, 50, 60/1.001 and 60 Progressive
ST 2036-1	3840 × 2160	4:2:2 (Y′C′$_B$C′$_R$)/12-bit 4:2:0 (Y′C′$_B$C′$_R$)/12-bit	50, 60/1.001 and 60 Progressive
ST 2048-1	4096 × 2160*2	4:2:2 (Y′C′$_B$C′$_R$)/12-bit	48/1.001, 48, 50, 60/1.001 and 60 Progressive

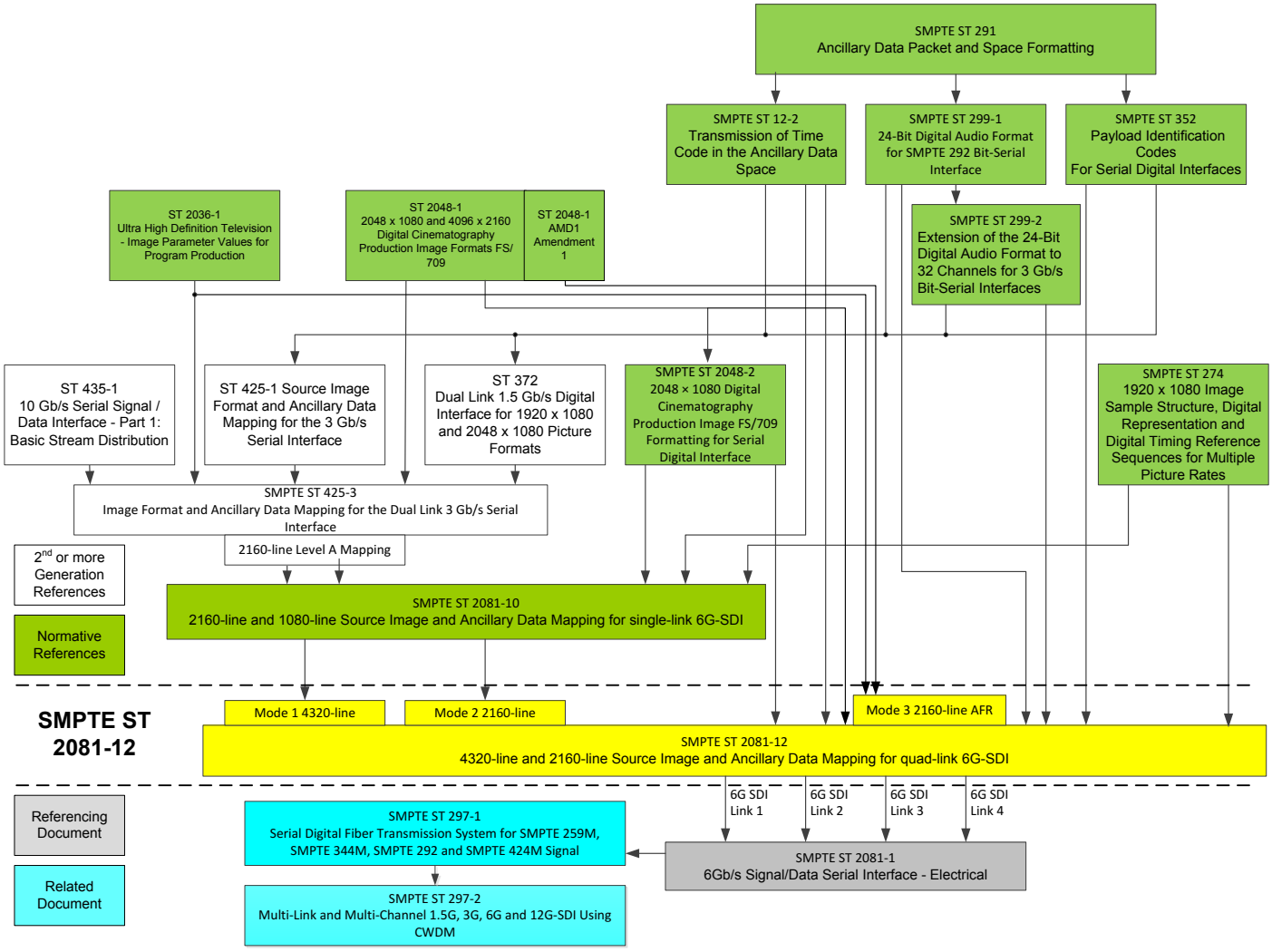
ST 2048-1	4096 × 2160*2	4:2:2:4 (Y′C′$_B$C′$_R$+A)/12-bit	48/1.001, 48, 50, 60/1.001 and 60 Progressive
UHDTV1 and 4K Digital Cinematography Production HFR			
Reference SMPTE Standard	Image Format	Signal Format Sampling Structure/pixel Depth	Additional Frame Rates (HFR) Hz
ST 2036-1	3840 x 2160	4:2:2 (Y′C′$_B$C′$_R$)/10-bit 4:2:0 (Y′C′$_B$C′$_R$)/10-bit	120 progressive
			120/1.001 progressive
			100 progressive
ST 2048-1	4096 x 2160	4:2:2 (Y′C′$_B$C′$_R$)/10-bit	120 progressive
			120/1.001 progressive
			100 progressive
			96 progressive
			96/1.001 progressive

Notes:

*1 In this image format R′G′B′ indicates either R′G′B′ or R′$_{FS}$G′$_{FS}$B′$_{FS}$. An additional Color VANC packet to describe the FS characteristics is defined by SMPTE ST 2048-1.

*2 This is the maximum pixel array, the active image may not fill the maximum array.

4.2 SMPTE ST 2081-12 Document Road Map



5 SMPTE ST 2081-30 – Transport of Multiple 3Gb/s or 1.5Gb/s signals on a 6G-SDI link

This Standard defines the combination of four HD-SDI signals or two 3G-SDI signals into a 6G-SDI interface.

- **MODE 1:** Carriage of two SMPTE ST 425-1 3G-SDI signals on a 6G-SDI 10-bit interface
- **MODE 2:** Carriage of four SMPTE ST 292-1 HD-SDI signals on a 6G-SDI 10-bit interface

This standard also defines the SMPTE ST 352 payload ID's for the single link 6Gb/s SDI interface.

5.1 SMPTE ST 2081-30 Document Road Map