SMPTE RECOMMENDED PRACTICE

Ruggedized Fiber-Optic Connectors for HDTV and UHDTV SDI – Mapping of SMPTE ST 2036-4 Data

Table of Contents **Page**

Approved April 12, 2018

Foreword

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Introduction

This section is entirely informative and does not form an integral part of this Engineering Document.

This document forms Part 2 of SMPTE 2091 suite and is intended to be used in conjunction with SMPTE ST 2091-1 (Part 1) which describes ruggedized optical connector systems and their application.

This part contains only the supplemental information required when 10G-SDI link signals according to SMPTE ST 2036-4 need to be mapped onto the SMPTE ST 2091-1 connectors.

1 Scope

This Recommended Practice specifies the mapping of the Multi-link 10 Gb/s SDI data as defined in SMPTE ST 2036-4 to the fibers of the ruggedized fiber-optic connectors as defined in SMPTE ST 2091-1.

Note: The optical connectors as defined in Part 1 of this suite are not mechanically compatible to and are not directly intermateable with the optical connector for the Multi-link 10 Gb/s Signal/Data Interface Using 12-Bit Width Container as defined in SMPTE ST 2036-4.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword “reserved” indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword “forbidden” indicates “reserved” and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; then formal languages; then figures; and then any other language forms.

3 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this engineering document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this engineering document are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

SMPTE ST 2036-4:2015, Ultra High Definition Television – Multi-link 10 Gb/s Signal/Data Interface using 12-bit width container

4 Terms and Definitions

For the purposes of this document, the terms and definitions of ST 2091-1 apply.

5 Mapping

5.1 General

The mapping applies only to the following two different non-compatible connector systems as being specified in SMPTE ST 2091-1:

- QUAD: system based on the use of four parallel LC like terminated fibers, in terms of two mirrored LC duplex like connectors

- MPO: system based on the use of one MPO like coupler terminating up to 12 fibers in a single row or 24 fibers in two rows

For the multi-link interface as defined in SMPTE ST 2036-4 with link numbers as per table 1 the link assignments shall be as indicated in:

- Table 2 and Figure 1 for QUAD link assignments;

- Figures 2, 3 and 4 for MPO with 12 fibers link assignments;

- Figures 5, 6 and 7 for MPO with 24 fibers link assignments.

The assignment is referred to the face (front view) of the receptacle as shown.

Table 1 – SDI Link Numbers

No. of 10G Links	UHDTV Class	Image Sampling Structure	Frame Rate (Hz)	Link Signal Numbers as per SMPTE ST 2036-4
3	UHDTV1	4:4:4 4:2:2 4:2:0	24/1.001 - 60	1, 5, 9
4	UHDTV1	4:2:2 4:2:0	100 - 120	1, 2, 5, 9
	UHDTV2		24/1.001 - 30	
6	UHDTV1	4:4:4	100 - 120	1, 2, 5, 6, 9, 10
	UHDTV2		24/1.001 - 30	
6	UHDTV2	4:2:0	50 - 60	1, 2, 3, 4, 5, 9
8	UHDTV2	4:2:2	50 - 60	1, 2, 3, 4, 5, 7, 9, 11
12	UHDTV2	4:4:4	50 - 60	1 - 12
		4:2:0	100 - 120	
16	UHDTV2	4:2:2	100 - 120	1, 2, 3, 4, 5, 7, 9, 11, 13, 14, 15, 16, 17, 19, 21, 23
24	UHDTV2	4:4:4	100 - 120	1 - 24

5.2 Assignment of SDI Links to Fibers

5.2.1 QUAD

Table 2 – QUAD Link Assignments

No. of 10G links	Output receptacle (TX)[1]				Input receptacle (RX)[1]			
	B	A	b	a	A	B	a	b
Triple	Link 1	Link 9	Link 5		Link 1	Link 9	Link 5	
Quad	Link 1	Link 5	Link 2	Link 9	Link 1	Link 5	Link 2	Link 9

NOTE:

(1) Refer to Figure 1 for definition of B, A, b and a

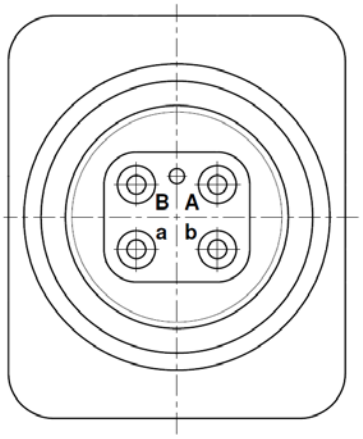

Figure 1 – QUAD Receptacle Interface, Front View – Fiber Position Lettering

5.2.2 MPO with 12 Fibers

The fiber position numbers are following the convention as shown in Figure 2, i.e. position 1 left side with key up.

The 10G link signal numbers are directly assigned to the fiber position numbers of the output receptacle, i.e. the assignment of the link signal numbers to the output receptacle shall be as shown in Figure 3. The assignment of the link signal numbers to the input receptacle shall be as shown in Figure 4. The numbers in Figure 3 and Figure 4 represent the 10G link signal numbers.

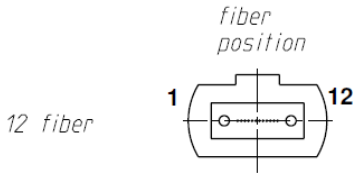

Figure 2 – MPO 12 Fiber Receptacle Interface, Front View – Fiber Position Numbering

					KEY						
1	2	3	4	5	6	7	8	9	10	11	12

Figure 3 – Link Assignment to MPO Output Receptacle (TX) Key-Up With 12 Fibers

Note: Link numbers in Figure 3 correspond to fiber position numbers as identified in Figure 2.

					KEY						
12	11	10	9	8	7	6	5	4	3	2	1

Figure 4 – Link Assignment to MPO Input Receptacle (RX) Key-Up With 12 Fibers

5.2.3 MPO with 24 Fibers

The fiber position numbers are following the convention as shown in Figure 5, i.e. position 1 left side top row with key up.

The link assignment shall follow the pattern defined in ST 2036-4. The 10G link signal numbers are directly assigned to the fiber position numbers of the output receptacle, i.e. the assignment of the link signal numbers to the output receptacle shall be as shown in Figure 6. The assignment of the link signal numbers to the input receptacle shall be as shown in Figure 7. The numbers in Figure 6 and Figure 7 represent the 10G link signal numbers.

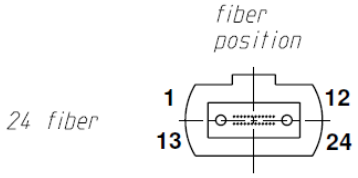

Figure 5 – MPO 24 Fiber Receptacle Interface, Front View – Fiber Position Numbering

					KEY						
1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24

Figure 6 – Link Assignment to MPO Output Receptacle (TX) Key-Up With 24 Fibers

Note: Link numbers in Figure 6 correspond to fiber position numbers as identified in Figure 5.

					KEY						
12	11	10	9	8	7	6	5	4	3	2	1
24	23	22	21	20	19	18	17	16	15	14	13

Figure 7 – Link Assignment to MPO Input Receptacle (RX) Key-Up With 24 Fibers

5.3 Labeling for Interoperability

Labeling shall be in accordance with SMPTE ST 2091-1, section 5.5 amended with an additional <signal type> value as follows:

- L to indicate support for SMPTE ST 2036-4 signals

EXAMPLE: A PC polished low-power (short-haul) 24 Channel Transmitter that supports SMPTE ST 2036-4 signals at an optical wavelength of 850 nm is labeled L-PC-L-850-MPO24.

5.4 Color Coding Scheme

Color coding shall be in accordance with SMPTE ST 2091-1, section 5.6 with Table 7 amended as indicated below in Table 3.

Table 3 – Protocol Color Assignment

Interface standard	Data rate / Protocol	Connector/Receptacle Color coding
SMPTE ST 297-1	1.5G-SDI, 3G-SDI, 6G-SDI,… single-/dual-/quad-link	yellow
SMPTE ST 435-3	10G-SDI single-/dual-link and multiple-link	magenta
SMPTE ST 2036-3		
SMPTE ST 2036-4	10G-SDI multiple link	brown

Bibliography (Informative)

SMPTE ST 297-1:2015, Serial Digital Fiber Transmission System for SMPTE ST 259, SMPTE ST 344, SMPTE ST 292-1/2, SMPTE ST 424, SMPTE ST 2081-1 and SMPTE ST 2082-1 Signals

SMPTE ST 435-3:2012, 10 Gb/s Serial Signal/Data Interface – Part 3: 10.692 Gb/s Optical Fiber Interface

SMPTE ST 2036-3:2012, Ultra High Definition Television 1 – Mapping into Single-link or Multi-link 10 Gb/s Serial Signal/Data Interface using 10-bit width container