

VIDEO SERVICES FORUM

Video Services Forum (VSF) Technical Recommendation TR-10-15 Part 1

Internet Protocol Media Experience (IPMX):
JPEG-XS Codec Requirements for Compressed
Video

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Executive Summary

Internet Protocol Media Experience (IPMX) was created to foster the adoption of open standards-based protocols for interoperability over IP in the media and entertainment and professional audio/video industries. IPMX is based on the SMPTE ST 2110 standard and as such the VSF TR-10 suite of Technical Recommendations is a set of differences between SMPTE ST 2110 and IPMX.

This Technical Recommendation documents the minimum requirements for an IPMX device with respect to the use of the JPEG XS video codec in TR-10-11 streaming use-cases.

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1 Introduction (Informative)

IPMX, which stands for Internet Protocol Media Experience, is based on two families of specifications. The SMPTE ST 2110 Professional Media Over Managed IP Networks suite of standards for the transport of video, audio, and ancillary/control signals over IP networks, and the NMOS REST APIs from AMWA, which provide discovery, connection management, and control.

IPMX is an accessible, open standard that meets the needs of professional and consumer video and audio users in a wide variety of contexts while giving manufacturers and developers what they need to build low-latency, interoperable, IP based audiovisual products or applications.

This document covers the JPEG XS video codec requirements for IPMX. Other aspects of the IPMX system and their individual requirements are documented in other parts of this Technical Recommendation.

2 Contributors

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3 About the Video Services Forum

The Video Services Forum, Inc. (www.videoservicesforum.org) is an international association dedicated to video transport technologies, interoperability, quality metrics and education. The VSF is composed of [service providers, users and manufacturers](#). The organization's activities include:

- providing forums to identify issues involving the development, engineering, installation, testing and maintenance of audio and video services;
- exchanging non-proprietary information to promote the development of video transport service technology and to foster resolution of issues common to the video services industry;

- identification of video services applications and educational services utilizing video transport services;
- promoting interoperability and encouraging technical standards for national and international standards bodies.

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4 Conformance Notation

Normative text describes elements of the design that are indispensable or contain the conformance language keywords: "shall," "should," or "may."

Informative text 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 and 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 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; followed by formal languages; then figures; and then any other language forms.

DRAFT

5 Normative References

- TR-10-1:2024 Internet Protocol Media Experience (IPMX): System Timing and Definitions
- TR-10-11:2022 Internet Protocol Media Experience (IPMX): Constant Bit-Rate Compressed Video
- Internet Engineering Task Force (IETF) RFC 3550 RTP: A Transport Protocol for Real-Time Applications available at <https://www.ietf.org/rfc/rfc3550.txt>
- Internet Engineering Task Force (IETF) RFC 9134 RTP Payload Format for ISO/IEC 21122 (JPEG XS) available at <https://datatracker.ietf.org/doc/html/rfc9134>
- BCP-004-01 NMOS Receiver Capabilities available at <https://specs.amwa.tv/bcp-004-01>
- BCP-004-02 NMOS Sender Capabilities available at <https://specs.amwa.tv/bcp-004-02>
- BCP-006-01 NMOS With JPEG XS available at <https://specs.amwa.tv/bcp-006-01>
- TR-08 "Transport of JPEG XS Video in ST 2110-22" available at https://static.vsf.tv/download/technical_recommendations/VSF_TR-08_2022-04-20.pdf
- ISO/IEC 21122-2: "Information technology — JPEG XS low-latency lightweight image coding system — Part 2: Profiles and buffer models"
- ISO/IEC 21122-1: "Information technology — JPEG XS low-latency lightweight image coding system — Part 1: Core coding system"

6 Definitions

For the purposes of this document, the terms, and definitions of VSF TR-10-1 and the following apply.

NMOS	AMWA Networked Media Open Specifications
JPEG XS Sender	An IPMX Sender configured to produce a JPEG XS coded stream.
JPEG XS Receiver	An IPMX Receiver capable of consuming a JPEG XS coded stream.
TDC	JPEG XS Temporal Differential Coding

7 General Provisions

An IPMX Sender producing a JPEG XS coded stream shall comply with the VSF TR-10-11 Technical Recommendation and section 8.1 of the VSF TR-08 Technical Recommendation.

The video signal shall be compressed using a JPEG XS codec that conforms to the ISO/IEC 21122-1 (JPEG XS) specification.

An IPMX Sender producing a JPEG XS coded stream shall comply with the NMOS BCP-006-01 specification.

The JPEG XS coded stream shall be encapsulated into RTP using the payload format described in RFC 9134.

An IPMX Receiver shall communicate its capabilities for the “video/jxsv” media type through BCP-004-01, Receiver Capabilities.

An IPMX Sender shall communicate its capabilities for the “video/jxsv” media type through BCP-004-02, Sender Capabilities. An IPMX Sender may publish partial capabilities.

Note: Partial capabilities can occur when certain parameters depend on variable external conditions (e.g., detected signal characteristics), and are therefore not fully determinable at all times.

7.1 SubLevel

The **sublevel** requirements of VSF TR-08 section 8.1 are amended by the following ones for bit rates above 4 bpp; all other items in section 8.1 remain unchanged.:

- A JPEG XS Sender may set the Sublevel to bpp values above Sublev4bpp.
- A JPEG XS Sender may support compression bit rates above 4 bpp.
- A JPEG XS Receiver may support compression bit rates above 4 bpp.

Note: Unlike VSF TR-08, which restricts sublevels to Sublev3bpp and Sublev4bpp, IPMX explicitly allows the use of sublevels above 4 bpp. This extension provides additional flexibility for higher quality or lower compression use cases, while ensuring interoperability at ≤ 4 bpp where all implementations are required to conform.

8 IPMX JPEG XS Video Profile

A JPEG XS Sender compliant with the IPMX JPEG XS Video Profile shall support the High444.12 profile with either of the following configurations, as defined in TR-08 section 8.1.1.1:

- 3 color components, 10-bit, with a 4:2:2 YCbCr sampling,
- 3 color components, 8-bit, with a 4:4:4 RGB sampling.

A JPEG XS Sender may support additional profiles, color samplings, and bit depths beyond these minimum requirements.

A JPEG XS Receiver compliant with the IPMX JPEG XS Video Profile shall support the High444.12 profile with both of the following configurations, as defined in TR-08 section 8.1.1.1:

- 3 color components, 10-bit, with a 4:2:2 YCbCr sampling,
- 3 color components, 8-bit, with a 4:4:4 RGB sampling.

A JPEG XS Receiver may support additional profiles, color samplings, and bit depths beyond these minimum requirements.

9 JPEG XS Media Info Block

A JPEG XS coded stream shall carry, in the RTCP Sender Report, an additional Media Info Block of type 0x0008, immediately following the Media Info Block of type 0x0003 described in TR-10-11.

The Media Info Block of type 0x0008 carries JPEG XS codec s-specific information in the following binary format. Multi-bytes fields are expressed in network byte order (big-endian).

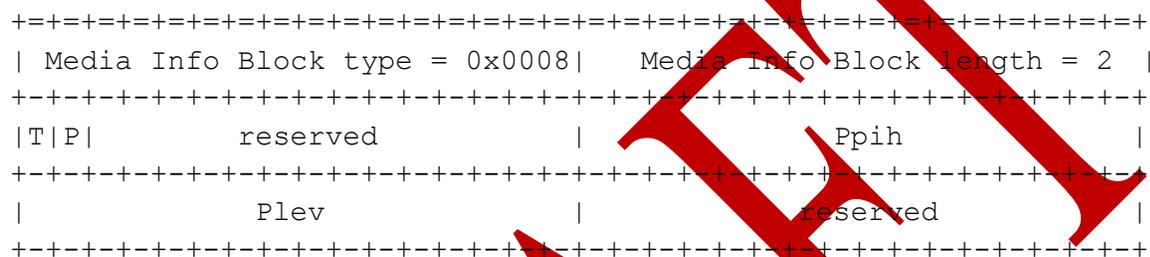


Figure 1: Media Info Block type 0x0008.

As described in TR-10-1 the Media Info Block shall be aligned on a 32-bit boundary, and its length shall be the number of 32-bit words in the Media Info Block minus one; for type 0x0008 the length is 2.

When using a profile that is not based on TDC, the following parameters are encoded in the media info block's T, P, Ppih and Plev fields: **transmode (T), packetmode (P), profile, level, sublevel.**

When using a profile that is based on TDC, the following parameters are encoded in the media info block's T, P, Ppih and Plev fields: **transmode (T), packetmode (P), profile, level, sublevel, fbblevel.**

The encoding of the level, sublevel and fbblevel parameters in the Plev 16-bit value is described in ISO/IEC 21122-2.

transmode (T)	1-bit value corresponding to the JPEG XS T-bit value.
packetmode (P)	1-bit value corresponding to the JPEG XS K-bit value.
Ppih	16-bit value corresponding to the JPEG XS Ppih parameter.
Plev	16-bit value corresponding to JPEG XS Plev parameter. It encodes the sublevel and fbblevel parameters.

