

Spectrum Media and Wrapper Formats

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Media Formats

Spectrum Systems support the following compressed and uncompressed media formats.

ⓘ Important

Check the Spectrum release notes for any issues relating to media and wrapper formats.

Video formats: SD

I/O module	Media format	Details
Spectrum X (MIP-91x1), ChannelPort, MediaPort 7000 series	DV	DV, DVCPRO, DVCPRO 50
	MPEG-2	3-24.9 Mbps LGOP, 25-50 Mbps I-frame, 30-50 Mbps IMX
ChannelPort, MediaPort 7000 series	MPEG-4	For proxy H.264
Spectrum X	AVC (H.264) Long GOP	For proxy H.264

Video formats: HD 1.5G

I/O module	Media format	Details
Spectrum X, ChannelPort, MediaPort 7000 series	DV	DVCPRO HD
	XDCAM HD	18, 25, 35, 50 Mbps
	AVC-Ultra (Panasonic*)	Class 50 and Class 100, 1920x1080i (25/29.97 Hz); 1280x720p (50/59.94 Hz)
Spectrum X	XAVC-LGOP	Hi 422, Level 4, 25/50 Mbps
	AVC-LGOP	Record: AVC-Long G50/G25. Playback: AVC-Long G50/ G25/G12
	RP 2027* class 50/100 (generic)	Class 100, 1920x1080i (25/29.97 Hz); 1280x720p (50/59.94 Hz)
	XAVC-I class 100 (Sony*)	Class 100, 1920x1080i (25/29.97 Hz); 1280x720p (50/59.94 Hz)
	VC-3	See the "VC-3 Codecs, record and play" section in Codec Support .
	Apple ProRes	See the "Apple ProRes Codecs, record and play" section in Codec Support .
ChannelPort, MediaPort 7000	VC-3	120 Mbps (25/50fps); 145 Mbps (29.97/59.94 fps)
	Apple ProRes	Standard quality mode, 50/59.94 Hz, 720p, 1080i. 147 Mbps at NTSC frame rates and 122 Mbps at PAL frame rates.
ChannelPort	AVC (H.264) Long GOP	<ul style="list-style-type: none"> • AVC (H.264) Long GOP is available only when re-wrapped from PitchBlue® transport streams. (PitchBlue is a registered trademark of Vigor Systems.) • ChannelPort supports playout of AVC at PitchBlue® operating points and AVC-Intra operating points only. Attempting to play other AVC clips may result in a failure to play. • Support for native playout of H.264 Main Profile at Level 4; 8 bit, 4:2:0, LGOP video

*Some RP 2027 files may not be supported. Contact your Harmonic representative if you wish to verify support for your material.

Video formats: HD 3G

I/O module	Media format	Details
Spectrum X	AVC I-Frame	Play and record: XAVC-Intra (Sony*), AVC-Ultra (Panasonic*), AVC-I RP2027 class 100 (generic)
	XAVC-Long GOP	Play only: XAVC Hi 422, Level 4.2, up to 50 Mbps
	AVC-Long GOP	Play only: AVC-Long GOP, at 35/40/45/50 Mbps
	AVCU-Long GOP*	Play only: AVCU-Long GOP 12G/25G/50G

*If using this format, contact your Harmonic representative to discuss your specific workflow.

Video formats: UHD

I/O module	Media format	Details
Spectrum X	AVC I-Frame	Play and record: XAVC-Intra 4:2:2 (Sony), interleaved or square division, 3840x2160 raster
		Play only: AVC-Ultra 4k 4:2:2 (Panasonic), interleaved or square division, 3840x2160 raster
	ProRes	Play and record: 4:2:2 interleaved or square division, 3840x2160 raster
	VC-3	Play and record: 4:2:2 interleaved or square division, 3840x2160 raster

Note:

UHD ingest assumes BT.2020 color space is used. UHD's primary playout uses BT.2020 color space.

Audio formats

I/O module	Media Formats	Details
Spectrum X, ChannelPort, MediaPort 7000 series	PCM	48 kHz PCM (16, 24, 32-bit); optionally, PCM can contain AC-3 (16 bits) or Dolby® E (24 bits)
	AAC-LC	For use with proxy H.264. Zero to 8 stereo pairs, encoded at 64, 96 or 128 Kbps.
Spectrum X, ChannelPort	Dolby® E	<ul style="list-style-type: none"> • Support for the decoding of all encoded Dolby E (16, 20 and 24-bit) program configurations (0-23) to PCM. • Support up to four unique decodes of Dolby E per Spectrum I/O module. • Support for down mixing of Dolby E 5.1 and 7.1 (program configurations 11, 22) to stereo or mono channels. Note that 5.1+2 and 5.1+1+1 channel configurations that wish to be down mixed must be done as 5.1 with the other channels not mixed. • No support for outputting decoded down-mixed Dolby E metadata as ancillary packets. • No support for using any decoded Dolby E metadata mix levels as part of the 5.1 and 7.1 down mixing to stereo or mono channels. • For more details on Dolby E decode support, see “About Dolby E decode support” in the <i>Harmonic SystemManager User Guide</i>.

Codec Support

DV Codecs, record and play

Name	Format	Bit rate (Mbps)
DV 25	SD	25
DVCPRO 25	SD	25
DVCPRO 50	SD	50
DVCPRO 100	HD	100

MPEG Codecs, record and play

Name	Format	Bit rate (Mbps)
MPEG-2 Long GOP	SD	3-24.9
	HD	18-85
MPEG-2 I-Frame	SD	25-50
	HD	50-100
IMX (also called XDCAM or EVTR)	SD	30, 40, 50
XDCAM-HD XDCAM-HD RDD9 (wrapper)	HD	18, 25, 35, 50

AVC Codecs

HD 3G XAVC-Intra, AVC-Ultra, and AVC-I (RP2027) codecs

Class	Sampling	Bit depth	Bit rate (Mbps)			Mode
			1080i*	720p*	1080p*	
50	4:2:0	10 bit	56	56	112	record and play
100	4:2:2	10 bit	114	114	228	record and play

*Bit rates are approximate, and will vary based on class, raster, and frame rate.

Note: Bit rates for 3G material are approximately double for material of the same class at HD.

HD XAVC-Intra

Class	Sampling	Bit depth	Frame rate	1080p* Bit rate (Mbps)	Mode
50	4:2:0	10 bit	25Hz, 29.97 Hz	56*	record and play
100	4:2:2	10-bit	25Hz, 29.97 Hz	114*	record and play

*Bit rates are approximate, and will vary based on class, raster, and frame rate.

UHD XAVC-Intra codec

Class	Sampling	Bit depth	Frame rate	Bit rate (Mbps)	Mode
300	4:2:2	10 bit	50Hz, 59.94 Hz	500-600*	record and play
300	4:2:2	10-bit	25Hz, 29.97 Hz	250-300*	play only

*Bit rates are approximate, and will vary based on class, raster, and frame rate.

For UHD record: Spectrum X supports one channel of XAVC-Intra Class 300 with the MXF OP1a wrapper.

UHD AVC-Ultra codec

Class	Sampling	Class	Frame rate	Bit rate (Mbps)	Mode
400	4:2:0	400	50Hz, 59.94 Hz	800, max 900*	play only

*Bit rates are approximate, and will vary based on class, raster, and frame rate.

Note: Bit rates for 3G material are approximately double for material of the same class at HD.

HD AVC Long GOP Codecs

Name	Sampling	Bit depth	Bit rate (Mbps)	Mode
Generic AVC-Long GOP	4:2:2, 4:2:0	8 bit	15 to 50	record and play
AVCU Long-GOP*	4:2:2, 4:2:0	10 bit	12, 25, 50	record and play
XAVC-Long GOP	4:2:2, 4:2:0	10 bit	25, 35, 50	record and play

*If using this format, contact your Harmonic representative to discuss your specific workflow.

3G AVC Long GOP Codecs

Name	Sampling	Bit depth	Bit rate (Mbps)	Mode
Generic AVC-Long GOP	4:2:2, 4:2:0	8 bit	15 to 50	play
AVCU Long-GOP*	4:2:2, 4:2:0	10 bit	12, 25, 50	play
XAVC-Long GOP	4:2:2, 4:2:0	10 bit	25, 35, 50	play

*If using this format, contact your Harmonic representative to discuss your specific workflow.

Note: Bit rates for 3G material are approximately double for material of the same class at HD.

Note: For 3G Long GOP formats, Spectrum X supports play only.

Apple ProRes Codecs, record and play

Name	Maximum bit rate	Video Format	Frame Rate
Apple ProRes 422 LT	204	1.5G, SD, HD, 3G	29.97i, 25i, 59.94p, and 50p
Apple ProRes 422 SQ	293	SD, HD, 3G	
Apple ProRes 422 HQ	440	SD, HD, 3G	
Apple ProRes 422 LT	821*	SD, HD, 3G, UHD	

*If using this format, contact your Harmonic representative to discuss your specific workflow.

More details on Apple ProRes codecs can be found here: https://images.apple.com/final-cut-pro/docs/Apple_ProRes_White_Paper.pdf

VC-3 Codecs, record and play

Name	Bit rate (Mbps)				Video Format	Sampling	Frame Rate
	960x720 1440x1080	1920x1080	1280x720 1920x1080 3840x2160	1280x720 1920x1080			
TR (Thin raster)	84 - 145	—	—	—	HD	8-bit and 10-bit	29.97i, 25i, 59.94p, and 50p
LB (Low bandwidth)	—	75 - 383	—	—	HD, 3G, UHD		
SQ (Standard quality)	—	—	121 - 291	—	HD, 3G		
HQ (High quality)	—	—	—	184 - 220	HD, 3G		
HQX (High quality extended)	—	—	—	184 - 440	HD, 3G		

*If using this format, contact your Harmonic representative to discuss your specific workflow.

VANC and VBI Storage

The following table shows supported VANC and VBI Storage media types.

Metadata Type	Video Media Type	Embedded Video	Side-Band
Uncompressed VBI	Standard Definition MPEG-2	Omneon user data	Omneon VBI File (QuickTime only)
			GXF VBI track
	DV, DVCPRO, DVCPRO50	Unavailable	Omneon VBI File (QuickTime only) GXF VBI track
			SMPTE 436M (MXF OP1a only) GXF VBI track
VANC	High Definition MPEG-2	SMPTE 328M	SMPTE 436M (MXF OP1a only) GXF VANC track
	DVCPRO HD	SMPTE 375M	
	AVC-Ultra	Panasonic Spec	
	Others	Unavailable	

Please note the following:

- The total VANC storage is limited to 256 bytes per frame.
- Capture and playout of SD VANC information is supported. Contact Harmonic Technical Support for additional information.
- SMPTE 328M: VANC is stored in the MPEG-2 user data.
- SMPTE 436M: HD and SD VANC is stored in MXF SMPTE 436M track.
- Omneon VBI File: VBI data is stored in an Omneon proprietary format in the clip.
- Panasonic Embedded: For AVC-Ultra the Panasonic specification describes a technique for storing VANC in the essence.
- DV Embedded: This is stored in the essence according to SMPTE 374/375/376. For SD VANC formats, only audio, timecode, and closed caption data are stored.

Media Wrapper Formats and Audio Track Type Compatibility

The following table shows supported combinations of audio types and media wrapper formats.

Wrapper Format	AIFF (Big Endian)	WAV (Little Endian)	AES3	8-bit A law
QuickTime Reference	Up to 16 audio channels recorded with 1, 2, 4, or 8 channels per file or per track with sample size of 16 or 24 bits.		No	No
QuickTime Self-Contained				
MXF OP1a (Standard)	Up to 96 audio channels recorded with 1, 2, 4, 8, or 16 channels per file or per track with sample size of 16 or 24 bits.		No	No
MXF OP1b (External)				
MXF OP1a (eVTR)	N/A		Total 8 audio channels recorded with 8 channels per file with 24-bit samples stored in 32 bits each.	N/A
MXF AS-02 (2009, 2011)	Up to 16 audio channels recorded with 1, 2, 4, or 8 channels per file with sample size of 16 or 24 bits.		No	No

Wrapper Format	AIFF (Big Endian)	WAV (Little Endian)	AES3	8-bit A law
MXF OP1a (SMPTE RDD9 and Internal, early Sony style XDCAM-HD RDD9)	No	Up to 8 audio channels recorded with 1 channel per file with sample size of 16 or 24 bits. <div style="border: 1px solid #f0e68c; padding: 10px; margin-top: 10px;"> <p>⚠ Note 16 audio channels are supported but such configurations may not work with all software or devices that expect compliant material.</p> </div>	No	No
MXF ARD_ZDF_HDF (01a, 01b, 02a, 02b, 03a, 03b)	No	8 or 16 mono tracks	No	No
GXF (Play only)*	No	Up to 16 audio channels with 1 channel per file with sample size of 16 or 24 bits.	No	No

Please note the following about support for GXF:

- GXF is a read-only format. It is a serialization of Grass Valley's native asset. If it is necessary to make any modifications to a GXF clip for use on Spectrum systems, Harmonic suggests rewrapping the clip into either an MXF or QuickTime format.
- GXF-wrapped clips must have a ".gxf" extension.
- Offspeed play and shuttle/jog of GXF clips is not supported.
- "Complex GXF" and "Compound GXF" clip types are not supported. Only "Simple GXF" clip types are supported.

Media Wrapper Formats and Supported Track Types

The following are supported combinations of media wrapper formats and track types.

Note

For AVC, 3G material is supported only with MXF OP1a wrapper formats. For Apple ProRes, 3G material is supported with Quicktime (self-contained) and MXF OP1a wrapper formats.

Note

UHD material is supported only with the self-contained format .

QuickTime (Reference and Self-contained)

- Audio
- DV, DVCPRO, DVCPRO 50, DVCPRO HD
- MPEG-2: I-Frame, IMX, LGOP

QuickTime (Self-contained)

- Audio
- Apple ProRes
- AVC-Ultra, AVC (H.264) Long GOP (record and play)
- MPEG-4 (proxy only)
- VC-3

MXF OP1a, OP1a low latency

- Audio
- AVC-Ultra, AVC (H.264) Long GOP
- DV, DVCPRO, DVCPRO 50, DVCPRO HD
- MPEG-2: I-Frame, IMX, LGOP
- XAVC-Intra 4:2:2
- XAVC-I class 100, RP 2027 class 50/100

MXF OP1a

- Audio
- Apple ProRes
- AVC-Intra 4K 4:2:2
- MPEG-4
- VC-3
- XAVC-Intra 4:2:2 class 300
- XAVC Long GOP

MXF OP1a RDD9 low latency

- Audio
- MPEG-2 LGOP

MXF OP1a EVTR low latency

- Audio
- MPEG-2 IMX

MXF AS-02 2009/2011

- Audio
- DV, DVCPRO, DVCPRO 50, DVCPRO HD
- MPEG-2: I-Frame, IMX, LGOP

GXF (Play only)

- Audio
- DV, DVCPRO, DVCPRO 50, DVCPRO HD
- MPEG-2: I-Frame, IMX, LGOP
- AVC-I class 50, AVC-I class 100

Media Wrapper Format Workflow Limitations

Media Wrapper Format	Play Behind Record	Play Behind FTP	FTP Behind Record	Active Transfer Behind Record
QuickTime (referenced and self contained)	supported	not supported	not supported	supported
Op1a standard	supported	supported**	not supported	supported
Op1a low latency (standard, eVTR, RDD9)	supported*	supported**	supported	supported
Op1b	supported	not supported	not supported	supported
AS-02	supported	not supported	not supported	supported

*Op1a low latency play behind record limitations:

- Play behind record is supported when the player recording the clip and the player playing the clip are on the same Spectrum server.
- If the player recording the clip and the player playing the clip are on different Spectrum servers sharing an EFS, play behind record is supported with the following "Op1a play behind FTP limitations."

**Op1a play behind FTP limitations:

- Play behind FTP is supported when playing at normal speed from the beginning of the clip.
- Play behind FTP is supported when playing at normal speed from an offset into the clip when the time code is continuous (including pre-charge) and it is the first or only clip in the playlist.
- When playing off speed, frames may be dropped and black frames may be played.
- When playing from an offset into the clip and the time code is not continuous, the start of play may not be frame accurate.
- When playing from an offset into the clip and it is not the first clip in the playlist, black frames may play before the clip starts to play.

File Imports

By creating a "watch folder" on your Spectrum system, you can configure Spectrum to demultiplex transport stream files from a PitchBlue® system or MPEG-2 program stream files, or re-wrap LXF files that are transferred via FTP or Samba to the specified "watch folder" on your Spectrum video server.

For demultiplexed transport stream files, the resulting AVC/H.264 files can be played out with a Spectrum I/O module licensed for AVC/H.264.

For details and configuration instructions, see "Configuring Watch Folders" in the *Harmonic SystemManager User Guide*.

About support for the LXF wrapper format

Harmonic supports the LXF wrapper format only for files that are imported into a Spectrum "watch folder," and then re-wrapped as described in the "Configuring Watch Folders" section of the *Harmonic SystemManager User Guide*. Harmonic does not support the playout of native LXF files.

About support for the transport stream wrapper format

Harmonic supports the transport stream wrapper format only for files that are imported into a Spectrum "watch folder," and then re-wrapped as described in the "Configuring Watch Folders" section of the *Harmonic SystemManager User Guide*. *Harmonic* does not support the playout of native transport stream files.