Lumexis FTTS Video / Audio Encoding Specifications

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1 Overview

1.1 Document purpose

This document provides specifications for video and audio files being encoded for use on the Lumexis FTTS system.

2 Video Encoding

2.1 Media overview

2.1.1 Specific encoding requirements

For detailed encoding requirements, see the **Appendix – MPEG-2 Content Requirements** at the end of this document.

2.1.2 Encapsulation / transport stream

All MPEG content (MPEG-1, 2 and 4) must be elementary video streams, encapsulated in an MPEG-2 transport stream.

2.1.3 Encoding profile

The MPEG profiles should be set as follows:

- MPEG-2 MP@HL
- MPEG-4 pt10 AVC/H.264 HP@L4

2.1.4 HD Encoding

HD video should be encoded at MPEG 4, 720p at 11 Mb/s.

2.1.5 Primary video PID

Each MPEG-2 transport stream should have one elementary video stream, with PID: 0x0030.

2.1.6 Video languages

An unlimited number of language tracks (audio streams) may be included in the transport stream. Audio stream PIDs must match the **Audio language table Appendix** at the end of this document.

2.1.7 Video subtitles

The FTTS system uses the DVB-SUB standard for dynamic subtitles. An unlimited number of subtitle streams may be included in the transport stream. The language descriptor in each subtitle stream must match the **Subtitle language table Appendix** at the end of this document.

2.1.8 Resolution

Standard MPEG resolutions are supported:

- 352 x 240
- 720 x 480
- 1280 x 720

The FTTS system is flexible enough to accept other resolutions, up to a maximum of 720p (1280 x 720). The majority of FTTS video content is currently provided at 720 x 480 resolution.

2.2 MPEG-2 Transport Stream

2.2.1 Overview

- PMT PID: 0x003F
- PCR PID: 0x0030

2.2.2 Elementary video stream information

The elementary video stream in the MPEG-2 transport stream should match these values:

2.2.2.1 PIDs / stream type

- PCR PID: 0x0030
- stream_type: 0x02, MPEG-2 Video
- stream_id: 0xE0, MPEG Video

2.2.2.2 Bit rate

The recommended bit rate for standard definition MPEG-2 (720 x 480) is 3500000 bps. Other bitrates are acceptable, especially for MPEG-1, MPEG-4 or 720p high definition content.

2.2.2.3 Aspect ratio

16:9 (Movies) or 4:3 (TV Programs)

2.2.3 Elementary audio stream information

Each MPEG-2 transport stream may have an unlimited number of audio streams. Audio stream PIDs must match the language table Appendix.

2.2.3.1 PIDs / stream type

- PID: Must match the language table Appendix.
  For example, an English language stream will be PID: 0x0045.
- stream_type: 0x03, MPEG-1 Audio

- stream_id: 0xC0, MPEG Audio

2.2.3.2 Bit rate

Recommended audio bit rate is 256000 bps, with sample Rate: 44100 sps.
Other bit / sample rates are usable by the system.

2.3 Naming convention

2.3.1 Format

This section describes how video files should be named. The file name is also used as the source for the content moniker on the Lumexis system.

Video filenames should take on the following format:

`<airline code>-<type>-<title>-<csp reference>.mpg`

Only lowercase letters, numbers and "-" should be used in file names. No spaces should be used.

2.3.1.1 airline code

This is the standard two-letter designator for an airline.

2.3.1.2 type

This is the type of the video. Possible types are:

- `video` A movie
- `preview` A movie preview.
- `short` A short (TV program, etc)
- `broadcast` A video viewed by the entire aircraft (boarding video, etc)
- `ad` An advertisement video

2.3.1.3 title

The tile of the content, as follows:

- For movies: the title of the movie, strip any characters except for letters and numbers. 40 characters max.
- For movie previews: use the same title as the movie.
- For shorts: the title of the short and the episode if applicable. Strip any characters except for letters and numbers. 30 characters max.
- For broadcast or ad content: any descriptive title desired. Strip any characters except for letters and numbers. 30 characters max.

2.3.1.4 csp reference

Optional value for CSP use. This value is an alphanumeric identifier to help track the content within the CSP organization. The value should be lowercase, letters and numbers only. 10 characters max.

2.4 Examples

- **fz-video-toystory3-00123.mpg**
  The movie "Toy story 3", for flydubai, with a CSP specific reference of "00123".
- **fz-preview-toystory3-00123p.mpg**
  The preview for "Toy Story 3", with a CSP specific reference of "00123p".
- **fz-short-friendstheonewiththecake-v00444.mpg**
  The show friends, episode "the one with the cake", with a CSP specific reference of "v00444".
- **fz-broadcast-boardingvideoq12012.mpg**
  A flydubai boarding video for Q1 2012, with no CSP specific reference.
- **fz-ad-appleipadcommercial-apple4.mpg**
  An Apple advertisement used by flydubai, with a CSP specific reference of "apple4".

3 MP3 audio files

3.1 Overview

MP3 audio files for the Lumexis system are provided in sets of MP3s called "albums".

3.2 Specifications

MP3 audio files should match the audio specifications for elementary audio streams (shown in section 2.2.3).

3.3 Naming convention

3.3.1 Format

This section describes how audio files should be named. The file name is also used as the source for the content moniker on the Lumexis system.

Each MP3 track in an album should be named in the following format:

`album-<albumartist>-<albumname>-integer`

Only lowercase letters, numbers and "-" should be used in file names. No spaces should be used.

3.3.1.1 albumartist

This is the artist name on the entire album. Note that the "albumartist" value should be identical for all tracks in the album, even if the album features separate artists on separate tracks.

Strip any characters except for letters and numbers. 20 characters max.

3.3.1.2 albumname

This is the name of the album. Strip any characters except for letters and numbers. 20 characters max.

3.3.1.3 integer

An increasing integer to identify the tracks within the album.

3.3.2 Examples

For example, an album might have the following MP3 files associated with it:

- album-alanjackson-goodtime-01.mp3
- album-alanjackson-goodtime-02.mp3
- album-alanjackson-goodtime-03.mp3
- etc

4 Encryption specifications:

Lumexis uses Secret Agent encryption software to generate public and private encryption keys. For the latest encryption keys, please contact your Lumexis representative.

Video content is encrypted at the post production Lab with an RSA 2048-bit server-specific public key, and the session key (content key) is encrypted with AES 256.

Systems note:

Encoding systems from Digital Rapids have been known to produce files that are incompatible with some IFE systems. If a Digital Rapids system is used for encoding, please contact your Lumexis representative for further instructions or to test the output of your encoding system.

5 Appendix – Audio language table

LANGUAGE	AUDIO STREAM PID	
	DEC	*HEX*
Arabic	64	0x0040
Cantonese	65	0x0041
Croatian	66	0x0042
Danish	67	0x0043
Dutch	68	0x0044
English	69	0x0045
Farsi	70	0x0046
Finnish	71	0x0047
Flemish	72	0x0048
French Canadian	73	0x0049
French Parisian	74	0x004A
German	75	0x004B
Greek	76	0x004C
Hebrew	77	0x004D
Hindi	78	0x004E
Indonesian	79	0x004F
Italian	80	0x0050
Japanese	81	0x0051
Korean	82	0x0052
Malay	83	0x0053
Mandarin	84	0x0054
Norwegian	85	0x0055
Persian	86	0x0056
Polish	87	0x0057
Portuguese Brazilian	88	0x0058
Portuguese European	89	0x0059
Russian	90	0x005A
Spanish Castilian	91	0x005B
Spanish Latin	92	0x005C
Thai	93	0x005D
Turkish	94	0x005E
Urdu	95	0x005F
Vietnamese	96	0x0060

6 Appendix – Subtitle language table

LANGUAGE	SUBTITLE LANGUAGE DESCRIPTOR
Arabic	ara
Cantonese	chi
Croatian	hrv
Danish	dan
Dutch	dut
English	eng
Farsi	far
Finnish	fin
French	fre
German	ger
Greek	gre
Hebrew	heb
Hindi	hin
Indonesian	ind
Italian	ita
Japanese	jpn
Korean	kor
Malay	may
Mandarin	zho
Norwegian	nor
Persian	per
Polish	pol
Portuguese	por
Russian	rus
Spanish	spa
Thai	tha
Turkish	tur
Urdu	urd
Vietnamese	vie

7 Appendix – MPEG-2 Content Requirements

7.1 Service, main transport requirements

Requirement Description	Comments
The audio-visual streams are transported over MPEG2-TS. Each live channel or VOD asset is SPTS and is complaint with ISO 13818-1 Spec.	Only SPTS is supported. MPTS is not supported.
Each SPTS is transported over UDP over IP.	The network is expected to be reliable. The UDP Packet Sizes must be multiple of 188. It is recommended that they are 1316 multiple.

7.2 SPTS stream requirements

Requirement Description	Comments
The SPTS is always at constant bit rate.	It is recommended that bitrate variation is less that 1% per second. Note that this constraint requires the network is very stable for live captures.
The SPTS carries only one video component. This video component conforms to ISO 13818-2 Spec for MPEG-2 Video or ISO MPEG-4 AVC Spec (ISO 14496-10 Spec)	MPEG-2 Video and MPEG-4 AVC is supported. However MPEG-1 video in MPEG-2 transport stream is not supported.
For live programs, the SPTS always carries at least one audio component and may carry up to 5 audio components. For VOD services, the SPTS always carries at least one audio component and may carry any number of 5 audio components (languages). Each audio component conforms to respective ISO Spec or the spec appropriate for non ISO formats.	Supports MPEG-1 Audio, MPEG-2 Audio, AAC and Dolby AC-3
For live services, the SPTS always carries PAT, PMT tables. Optionally CAT, EIT and SDT tables may be carried. For VOD services, the SPTS always carries PAT and PMT tables.	Frequency of PAT/PMT must be less than 500 milliseconds. It is preferred to be 125 milliseconds or less.

The PCR is always carried by the video component, issued from a 27 MHz clock generated from the encoder video input signal. There is no restriction about supported adaptation field types (adaptation_field_flag in TS header, with or without payload for example).	PCR interval must be 100 milliseconds or less. It is recommended that the interval be 40 milliseconds or less. PCR jitter and drift rate must be within ISO 13818-1 Spec. limits.

7.3 Video transport stream requirements

Requirement Description	Comments
The video stream is compliant with ISO 13818-1, and ISO 13818-2 Spec or MPEG-4 AVC Spec.	MPEG-2 Video: SDTV at MP@ML and HDTV at MP@HL, is supported. MPEG-4 AVC: Main and High Profile at levels 3, 3.1, 3.2, 4, 4.1, 4.2 are supported.
The video stream is PES packetized as per ISO 13818-1 Spec.	
The video TS component is compliant with ISO 13818-1 Spec.	

7.4 MPEG-2 Video Elementary Stream Requirements

Requirement Description	Comments
The Sequence Headers must be present at an interval of 700 milliseconds or less.	Each I-frame should be preceded by a Sequence Header
I-frames frequency should be sufficient to generate good quality trick mode (fast forward and fast rewind) files.	It is preferred that 2 I-frames are present per second.
Closed GOPs should be used.	Recommendation
Distance between reference pictures should not be more than 3.	Recommendation

7.5 MPEG-4 AVC (H.264) Video Elementary Stream Requirements

Requirement Description	Comments
The ISO MPEG-4 AVC (annex B) RBSP description fully applies.	

Each picture (frame or field) is one complete NAL unit slice, without partitioning. Only applies to HDTV. Each picture (frame or field) may be split in NAL slices without partitioning.	For compression performance reasons, it is strongly recommended that motion compensation overlap is implemented between slices. The decoder shall support this.
Each I or IDR slice NAL unit is preceded by the following sequence : • An Access Unit Delimiter NAL unit • Then a SPS NAL unit • Then a PPS NAL unit • Optionally a SEI NAL unit Multiple PPS are allowed. Multiple SEI are allowed. A unique PPS per entire coded picture must be used according to MPEG-4 AVC. For HDTV, when the encoded picture is split into slices, the SPS, PPS and SEI NAL units shall occur before the first slice.	
Each P or B slice NAL unit is preceded by the following sequence: • An access unit delimiter NAL unit • Optionally an SEI NAL unit Multiple SEI are allowed. For HDTV, when the encoded picture is split into slices, any SEI NAL unit shall occur before the first slice.	
When not 0, the nal_ref_idc can be either 1, 2 or 3 according to ISO MPEG-4 AVC Spec.	
On the encoder side, because of BSV1.2, primary_pic_type shall be consistently set with the slice type using the following rule : • 0 for I pictures • 1 for P pictures • 2 for B pictures However, for any decoding process, the primary_pic_type is not sufficient to get the picture type information and the slice header (slice_type) decoding remains mandatory.	
Each I-frame/IDR must be preceded with the SPS.	

Each I-frame/IDR must be preceded with the PPS.	Whenever possible, it is recommended that only one PPS is used whatever the picture type is (i.e only one PPS id).
First_mb_in_slice shall be 0. Slice_type shall be in the range 0..2. First_mb_in_slice shall be consistent with any slice splitting. Slice_type shall be in the range 0..2.	
Any stuffing shall be performed at RBSP level by inserting zero bytes as described in annex B of MPEG-4 AVC. NAL filler data units should not be used.	
Variable GOP structure shall be supported under the following conditions: • variable distance between intra pictures, max distance shall not exceed 30 frame pictures • variable distance between reference P pictures i.e. variable number of B pictures between reference pictures	
The interlaced PAFF and MBAFF modes shall only be used over interlaced content.	
Field pictures encoding is only allowed per pair, top field first (as recommended by ETSIT1). Field picture identification is made from the slice header.	SEI picture timing (pic_struct) can be used as additional information to indicate the field picture structure, consistently with slice header content.

7.6 PES Layer Requirements

Requirement Description	Comments
PES stream Id should be 0xE0 for video and 0xC0 for audio.	Recommendation.
One PES header shall occur per picture, whatever is frame or field encoded. Each PES shall convey PTS and DTS time stamps (except if PTS = DTS). This implicitly guarantees the compliance with (700ms maximum increment between successive PTS values).	Recommended for at least each I-frame.
The PES data_alignment_indicator should be set. For Live programs PES should be aligned with TS packets.	Recommendation.

For VOD programsPES must be aligned with TS packets.	

7.7 Audio stream requirements

Requirement Description	Comments
Audio bit rate is from 32 Kbit/s up to 384 Kbit/s	
The SPTS may carry MPEG1 layer 2 audio streams. Stream type can be either 0x03 or 0x04. The stream should be compliant with ISO11172-3 Spec.	
The SPTS may carry MPEG-2 audio streams. Stream type is 0x04. The stream should be compliant with ISO 13818-3 Spec.	
The SPTS may carry MPEG-2 AAC audio streams. Stream type is 0x0F (IEC 13818-7 audio with ADTS transport syntax) and a AAC descriptor must be used (descriptor tag (0x79).	
The SPTS may carry AC3 audio streams. 2 stream type can be used, either 0x06 (private stream) or 0x81. AC3 descriptor must be used (descriptor tag 0x6A). The stream should be compliant with ATSC Spec A/52B.	
The audio stream is PES packetized according to both ISO 13818-1 Spec.	