CIs - Media system configuration guideline

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2 Media format use case overview

Use Cases					
ID	**Use Case**	**Actor (User / Provider)**	**CIs Interface**	**Resolution**	**Comment**
UC1	Bring your own device - HDMI	Passenger Tour Guide or Driver Fleet Operator	HDMI (CM-P)	720p @ 30 fps 1080p @ 30 fps	Cable or adapter required.
UC2	Bring your own content - USB	Passenger Tour Guide or Driver	USB (CM-P)	720p @ 30 fps 1080p @ 25 fps	Pre-processed content according to media format conversion guideline.
UC3	Webserver (Pre-Processed Content) - USB	Passenger Tour Guide or Driver Fleet Operator or Service Provider	USB (CM-R)	720p @ 30 fps 1080p @ 25 fps	Pre-processed content according to media format conversion guideline.
UC4	Mediathek - USB	Passenger Fleet Operator or Service Provider	USB (CM-R)	720p @ 30 fps 1080p @ 25 fps	Pre-processed content according to service provider specification.

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3 Media domains

1. **CIs AVB domain:**
   - The Coach Infotainment series (CIs) Audio Video Bridging (AVB) domain is the core domain for passenger entertainment. It enables the presentation of various audio or video sources to passengers via loudspeakers at the Amplifier CM-A 19 and displays of the Glasses CM-G.
2. **BYOD domain:**
   - The Bring-Your-Own-Device (BYOD) domain is provided by the Router CM-R 19 and accessible via WLAN.
   - Mediathek: The fleet operator/service provider may prepare an USB drive for presentation to the passenger via the mediathek.
   - Webserver: The driver/tour guide or the fleet operator/service provider may prepare an USB drive for presentation to the passenger device via the webbrowser.
3. **CIs RTP domain:**
   - The Coach Infotainment series (CIs) Realtime Protocol (RTP) domain is used for dedicated use cases: bi-directional voice transmission for the intra-coach communication system (Intercom) and to stream the current location based on Center CM-C 19 navigation data to passenger monitors.
4. **Analog domain:**
   - The Analog domain is used for dedicated use cases: voice transmission for driver microphone announcements to passengers and general audio transmision from CM-C into the passenger cabin (e.g. Radio, USB Audio, BT Audio).

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4 Media format support

To assure proper pre-processing of files to be distributed and played in the CIs system, refer to the following sections and follow the media format conversion guideline.

4.1 Media format support per device

For an overview of all supported media formats per device (audio and video) refer to the respective user manual:

- Center CM-C 19
- CameraPort CM-P 19
- Router CM-R 19
- Amplifier CM-A 19

4.2 Media format support in CIs AVB domain

4.2.1 Audio/Video

Video Support	
Codec	**Quality**
h264	Preferred Encoder: x264 Maximum Resolution: 1920x1080 px Maximum Framerate (1080p): 25 fps, Constant Maximum Framerate (720p): 30 fps, Constant Maximum Encoder Profile: High Maximum Encoder Level: 4.1 Chroma: yuv420p Advanced Encoder Parameters: • bframes=0 • vbv-maxrate=10000 • vbv-bufsize=6000 Recommended Quality Parameter (CRF): 22
other	Not Supported

Due to network bandwith and hardware acceleration constraints, the combination of resolution and framerate is a limiting factor:

Video		**Framerate (fps)**			
Codec	**Resolution**	**<=24 fps**	**<=25 fps**	**<=30 fps**	**>30 fps**
h264	up to 1366x720	Yes	Yes	Yes	No

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Video		Framerate (fps)			
Codec	**Resolution**	**<=24 fps**	**<=25 fps**	**<=30 fps**	**>30 fps**
	up to 1920x1080	Yes	Yes	No	No
	beyond 1920x1080	No	No	No	No
other	any	No	No	No	No

The audio stream besides a h.264 video is expected in mp3 format.

Audio Support	
Codec	**Quality**
aac	Preferred Encoder: av_aac Channels: 2 (stereo) Recommended Sampling Frequency: 48000 Hz Recommended Constant Bitrate: 256 kbit/s
mp3	**Not Supported** Usage of mp3 may lead to playback issues on Apple devices accessing the CM-R webserver.
other	**Not Supported**

Whitelist for Audio/Video

To assure compatibility of files provided by a customer (driver, tour guide) on a USB volume to CameraPort CM-P and Router CM-R, a whitelisting concept is introduced to pre-analyse the files for "playability". If one of the following conditions are true, the file is unsupported:

- if video codec not h.264
- if h.264 level > 4.1
- if audio stream(s) are available but none with aac
    - exception: video without an audio stream will be playable
- if resolution > 1920x1088
- if resolution <= 1366x720 AND fps > 30
- if resolution > 1366x720 AND fps > 25
- vbv_max (maxrate) greater 10000

4.2.2 Audio-only

Audio Support	
Codec	**Quality**
AM824	Name: Linear PCM, Signed, 16-bit Big-Endian

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Audio Support	
Codec	**Quality**
	Standard: RFC 3551 / AM824 Channels: 2 (stereo) Recommended Sampling Frequency: 48000 Hz

Whitelist for Audio-only

For lower bandwith audio sources it is possible to transcode them into the required AM824 format. Therefore a larger amount of audio formats can be supported.

Audio Codec	Comment
mp3	**Transcoding Required** Channels: 2 (stereo) Recommended Sampling Frequency: 48000 Hz
wma9	**Transcoding Required** Channels: 2 (stereo) Recommended Sampling Frequency: 48000 Hz
aac	Preferred Encoder: av_aac Channels: 2 (stereo) Recommended Sampling Frequency: 48000 Hz Recommended Constant Bitrate: 256 kbit/s
vorbis	**Transcoding Required** Channels: 2 (stereo) Recommended Sampling Frequency: 48000 Hz
wav	**Transcoding Required** Channels: 2 (stereo) Recommended Sampling Frequency: 48000 Hz
flac	**Transcoding Required** Channels: 2 (stereo) Recommended Sampling Frequency: 48000 Hz
opus	**Transcoding Required** Channels: 2 (stereo) Recommended Sampling Frequency: 48000 Hz

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4.2.3 Container

Container Support
mp4

4.3 Media format support in BYOD domain

4.3.1 Mediathek (DRM)

Audio/Video: Please refer to the general audio/video section.

Tags/Metadata: Please refer to the general metadata support section.

Container: MPEG-DASH

- mpd: „urn:mpeg:dash:schema:mpd:2011“
- *.m4s for audio, one per language
- *.m4s for video

4.3.2 Webserver

Support of the BYOD Webserver of the Router CM-R 19 depends on the existing browser capabilities of the passengers device.

- Wikipedia HTML5 video - Browser support overview
- Mozilla Firefox: Web audio codec guide / Web video codec guide
- Chromium-based Browsers: The Chromium Projects - Audio/Video

To reduce compatiblity issues to a minimum, we apply a whitelist to the available files on the webserver as well:

Type	Supported
Container	mp4 ogg
Audio	aac ogg vorbis mp3 flac
Video	h264
Image	jpg png webp gif bmp

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4.4 Playlist file formats

Playlist file formats (e.g. M3U, PLS, ...) are not supported.

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5 Metadata support

- Title
- Artist
- Composer
- Album
- Genre
- Language: Refer to 3.1. Languages.
- Episode: Refer to 3.2. Chapters and Episodes.

The metadata database supports grouping by folder structure based on filesystem information.

5.1 Languages

The system supports alphanumeric 3-letter terminological codes according to ISO 639-2 assigned to an audio stream via the "language" metadata tag.

639-2 (Code T)	639-1	Language name(s) from ISO 639-2	Native name(s)
ces	cs	Czech	čeština; český jazyk
dan	da	Danish	dansk
deu	de	German	Deutsch
ell	el	Greek, Modern (1453–)	Νέα Ελληνικά Néa Ellêniká
eng	en	English	English
fra	fr	French	français
hun	hu	Hungarian	magyar nyelv
ita	it	Italian	italiano; lingua italiana
nld	nl	Dutch; Flemish	Nederlands; Vlaams
nor	no	Norwegian	norsk
pol	pl	Polish	Język polski
por	pt	Portuguese	português
rus	ru	Russian	русский язык russkiĭ âzık
spa	es	Spanish; Castilian	español; castellano
swe	sv	Swedish	svenska

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639-2 (Code T)	639-1	Language name(s) from ISO 639-2	Native name(s)
tur	tr	Turkish	Türkçe

If another metadata tag than "language" is used, it is not associated with the audio on the stream level or the content of the "language"-tag is not according to the ISO 692-2 (Code T) the following metadata will be associated with this audio stream: "und" (abbreviation for undetermined).

The following tags from the ISO 639-2 standard are not supported by the mediaplayer:

- mis, for "uncoded languages";
- mul, for "multiple languages";
- qaa-qtz, a range reserved for local use.
- zxx, for "no linguistic content; not applicable";

Unsupported tags will be replaced by "und" (abbreviation for undetermined).

5.2 Chapters and episodes

Chapters

Chapters via metadata are not supported. Tools with split-by-chapter feature may be used to achieve the same functionality, to jump to the last or next chapter.

Episodes

Files may be associated with each other via the "episode" metadata tag.

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6 Media format conversion guideline

Refer to the media format conversion guideline for instructions to generate pre-procesed content compatible to the CIs system.

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