

# Freeview Play — Technical Specification

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## 2021 Profile

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DigitalUK

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## 2. Revision History

Revision History		
Version Number	Date	Comment
1.1.1	2014-11-21	Release sign-off.
1.1.2	2014-11-26	Publication release.
1.2.0	2015-09-10	Launch Profile maintenance release. Corrections & clarifications.
1.2.1	2016-01-12	Maintenance release with corrections
1.9.4	2016-02-04	Draft of 2017 profile (based on HbbTV 2.0.1 Redmine tickets)
2.0.0	2016-05-20	Draft of 2017 profile
2.1.0	2016-07-15	Pre-publication release
2.1.1	2016-07-21	Publication release
3.0.6	2017-02-31	Draft 2018 profile
3.0.9	2017-07-13	2018 publication release.
4.0.0	2018-03-20	Draft 2019 profile
4.0.1	2018-06-15	2019 publication release
5.0.0	2018-12-14	Draft 2020 profile
5.0.1	2019-02-19	2020 publication release
5.0.2	2019-08-15	Changes following evolution of 2020 profile
5.0.4	2019-11-01	Minor fixes & updates.
6.0.1	2020-04-07	Draft 2021 profile
6.0.2	2020-06-03	Final 2021 release

## 3. Summary

### 3.0 Introduction

Informative: The purpose of this document is to detail the technologies required to implement a Freeview Play hybrid (Broadcast & IPTV) device aimed at the horizontal market. It identifies existing specifications that are required to be supported and adds a small amount of normative text which is required to provide cohesion between the technologies required.

The platform environment has the following key features:

- HbbTV conformant HTML5 application environment
- Broadcast profile based on DTG D-Book
- DASH streaming technology with integrated EBU-TT-D subtitles [ETSI\_103\_285] as defined in HbbTV. This specification references the latest version of DVB DASH (see Section 7)
- Aggregated source of metadata providing:
  - Forward and Backwards EPG with deep links to player content
  - Search and Recommendations API across on-demand and Freeview content
  - FVP Application listings and launch locations
  - Streaming of IP delivered linear services
  - Centralised management of channel line-up
- Multiple video object ad-insertion into DASH-based streams
- Digital Rights Management capability
- General security requirements
- Support for accessibility experiences
- Mandatory support for HEVC [HEVC] for streamed services
- Support for Companion Screen and media-synchronisation
- Optional support for UHD and HDR
- Support for Media Source Extensions in order to provide Low Latency DASH support

Early draft versions of this specification were written to align with version 2.0.3 of HbbTV [ETSI\_102\_796] originally expected to be published in May 2020. Due to delays in the publication of HbbTV 2.0.3 this specification (FVP 2021) requires support for HbbTV 2.0.2 including any Errata published during 2020.

However, we encourage support for HbbTV 2.0.3 when available as:

- This allows Digital UK to ratify the removal and deprecation of many features not used or required by UK content providers, such as download feature, HbbTV initiated launching of applications on companion screens, sync slave, etc
- Provides a modernised browser environment (including removing and updating old W3C references and removing the requirement for OIPF Web

Standards TV Profile) which will allow longer support by content providers for devices with more modern browser environments

- Devices which adopt the latest version of DVB DASH allow for content providers to bring better features and services to devices with more up-to-date DASH implementations. Low Latency test and development material will be made available in 2020 and 2021.

The testing of the browser modernisation aspect of HbbTV 2.0.3 can exploit existing openly available test material, such as the CTA Web Media API snapshot 2018 (suitable for HbbTV devices).

Note that support for MS Smooth Streaming is not required from 2021.

The specifications and features detailed in this document have been drafted to align with content providers own requirements for devices with tuners.

The specifications for Freeview Play will follow a managed evolution. This document details requirements for 2021 products, specifically for devices tested from 1<sup>st</sup> Dec 2020 (based on test materials available from July 2020 onwards).

Other companion documents will cover metadata access APIs, presentation rules and branding and other product requirements.

The key words "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

When explaining the IP connectivity of a device the following terms may be used which have an associated defined meaning as follows:

“Connectable”: devices that *can* be connected the internet, i.e. they have a network interface (wired and/or wireless) and a network software stack. All Freeview Play devices are Connectable.

Connectable devices can also be:

- “Connected” (or “IP-connected”): devices that have a working connection and can connect to Digital UK or Content Provider services.
- “Unconnected”: devices that can be connected to the internet but do not currently have a working connection to Digital UK or Content Provider services. Devices which otherwise have a working connection, e.g. to a search provider, but cannot connect to Digital UK or an FVP Content Provider service are also considered unconnected.

“Non-connectable”: devices that do not have the capability to connect over IP, e.g. legacy Freeview devices.

### 3.1 Reference Specifications

### 3.1.1 Freeview Play 2021 Profile

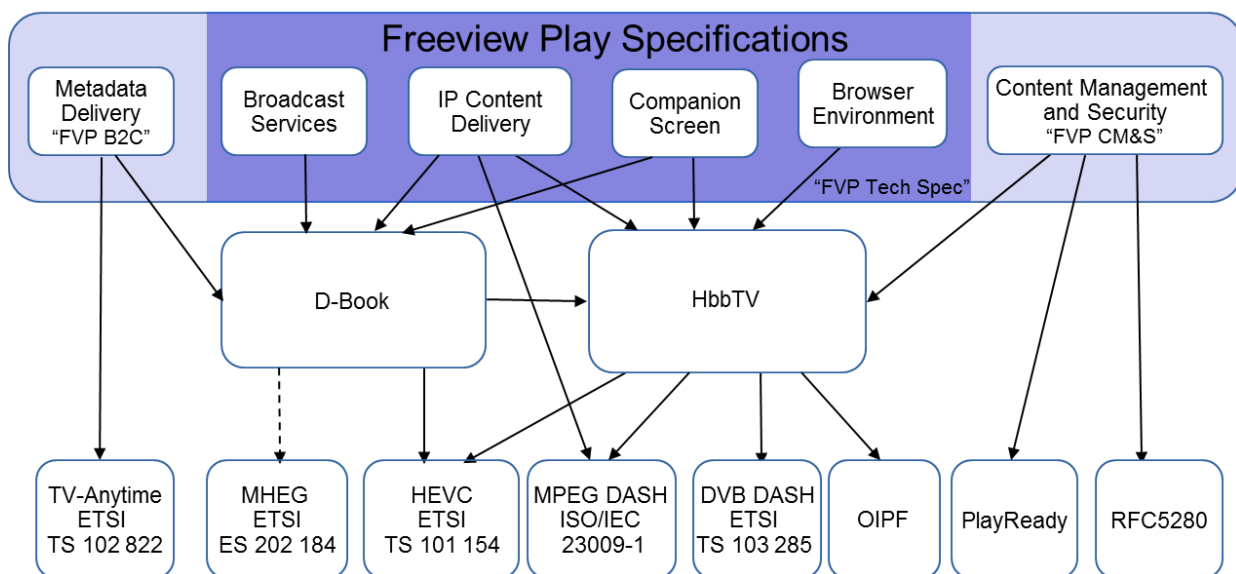
This document is built around published specifications which are illustrated in Figure 1 and detailed in Section 3.1.1.

As stated in Section 3.0 this specification references HbbTV 2.0.2 including published Errata.

The 2021 product cycle of Freeview Play requires all mandatory clauses within the present document and the mandatory clauses of the following specifications:

- HbbTV 2.0.2 (except those described in Section 5.1 of this document)
- D-Book 12
- Microsoft PlayReady DRM version 3.0 (or later)

This specification uses D-Book 12 as the base profile for broadcast services and signalling. For interactive applications and signalling delivered via broadcast or IP the present document references HbbTV 2.0.2.



**Figure 1: Freeview Play 2021 specification set**

### 3.1.2 Companion Documents

This document should be read in conjunction with the current version of the following Freeview Play documentation:

- Freeview Play Content Management and Security
- Freeview Play Business-to-Consumer Interface Specification
- Freeview Play Taxonomy Vocabulary
- Freeview Play Accessibility Statement
- Freeview Play Product Overview Document



### 3.2 References

References	
Ref	Document
DBOOK	D-Book 12 2017, Digital TV Group.
ETSI_102_796	HbbTV 2.0.2 Specification published as ETSI TS 102 796 V1.5.1 including Errata published by HbbTV.
ETSI_103_285	ETSI TS 103 285 V1.3.1 (2020-02): "Digital Video Broadcasting (DVB); MPEG-DASH Profile for Transport of ISO BMFF Based DVB Services over IP Based Networks". Available as DVB Bluebook A168 since 2019-10-09.
ETSI_202_184	ETSI ES 202 184 V2.3.1 (2013-03), MHEG-5 Broadcast Profile
FREEVIEW_B2C	Freeview Play Business-to-Consumer Interface, available from Digital UK
FREEVIEW_CMS	Freeview Play Content Management and Security, available from Digital UK.
FREEVIEW_TML	Freeview Manufacturers' Trade Mark Licence, available from Freeview.
FREEVIEW_TCA	Freeview Testing, Conformance and Assurance overview. Available from Digital UK.
FREEVIEW_POD	Freeview Play Product Overview Document. Available from Digital UK.
HBBTV203	Draft HbbTV 2.0.3 Specification expected to be published as later in 2020.
MPEG_DASH	ISO/IEC 23009-1:2014 Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats
MPEG_DASH_AMD	ISO/IEC 23009-1:2014/Amd.3:2016(en) Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats AMENDMENT 3: Authentication, MPD linking, Callback Event, Period Continuity and other Extensions
MSE	Media Source Extensions. W3C Recommendation 17 <sup>th</sup> November 2016. <a href="https://www.w3.org/TR/media-source/">https://www.w3.org/TR/media-source/</a>
RFC2119	IETF RFC 2119 (1997-03), IETF, "Key words for use in RFCs to Indicate Requirement Levels"

## 4. Alignment with D-Book 12

### 4.0 Introduction

To achieve widely agreed commonality in the use of the HbbTV standard and to ensure the route to technical alignment with Freeview Play is as smooth as possible for manufacturers, D-Book 12 [DBOOK] contains the base technical requirements for Freeview Play. D-Book 12 Chapter 13 contains HbbTV specific details that would previously have been in this specification.

### 4.1 Broadcast Services

The DTT broadcast profile for Freeview Play builds upon the FreeviewHD/Freeview+HD Trade Mark Licence [FREEVIEW\_TML] hence the device SHALL conform to the broadcast profile and receiver requirements specified in D-Book 12 [DBOOK].

### 4.2 Application Environment

D-Book 12 [DBOOK] describes the specific aspects of HbbTV pertinent to the UK horizontal platform. All mandatory aspects of D-Book 12 [DBOOK] SHALL be supported with the following requirement: D-Book 12 [DBOOK] requires that one or both of HbbTV and MHEG application environments are supported. For the avoidance of doubt this specification requires that HbbTV SHALL be supported.

Section 5 contains further guidance and requirements on the implementation of HbbTV on Freeview Play Devices.

Support for MHEG [ETSI\_202\_184] is optional for Freeview Play devices. However, if a device supports MHEG then the device SHALL conform to the MHEG profile specified in Sections 11 and 12 of [DBOOK]. Also, the specific requirements on application lifecycle for combined HbbTV and MHEG receivers set out in Section 8.5.2.6 of [DBOOK] and the launching of HbbTV applications from MHEG (see Section 12.1.2 of [DBOOK]) SHALL be followed.

Launching of broadcast HbbTV and MHEG (if supported) applications SHALL be enabled by default.

## 5. HbbTV Conformance and Guidance

### 5.0 Introduction

This specification requires all mandatory aspects of HbbTV 2.0.2 [ETSI\_102\_796] to be supported except those detailed in Section 5.1. Compliance SHALL be demonstrated through the Freeview Play Test, Compliance and Assurance framework (TCA) [FREEVIEW\_TCA] which includes the HbbTV test suite and content provider test and reference applications.

Section 7.3 and Section 9 gives guidance on features used on the platform to support potential new services.

### 5.1 Optional features:

#### 5.1.1 Download Feature

Support for downloading A/V content from the broadcast or broadband channel into persistent memory, “protocol for download feature” is optional, which also implies File Download Protocol (FDP) is also optional (see Section 7.2.8 of [ETSI\_102\_796]).

This feature is expected to be removed after HbbTV 2.0.3.

#### 5.1.2 PVR Capability

Support of the Download and PVR features listed in Table A.1 of [ETSI\_102\_796], i.e. those features with status M-P and M-D are optional.

Note that this makes the requirement in Section 13.4.7 of [DBOOK] optional.

#### 5.1.3 File System Acceleration

File System Acceleration (see Section 7.2.7 of [ETSI\_102\_796]) is optional.

### 5.2 Multi-stream Synchronisation and Application to media synchronisation

Multi-stream synchronisation as mandated in HbbTV Section 10.2.8 and Section 8.2.3 of [ETSI\_102\_796] and Section 13.5.2.11 of [DBOOK] SHALL be supported.

Application to media synchronisation is mandated in HbbTV Section 10.2.10 of [ETSI\_102\_796].

### 5.3 Companion Screen

Companion screen functionality described in Section 13.5.7 of [DBOOK] SHALL be supported.

For the avoidance of doubt the following sections and features of [ETSI\_102\_796] are considered mandatory by HbbTV and the present document:

- Section 14.5: Application-to-application communications
- Section 14.6: Launching an HbbTV application from a CS application
- Section 14.7: Discovering terminals and their service endpoints
- Section 14.8: Cross-Origin support

The following sections of [ETSI\_102\_796] are considered optional. *Note that these features are approved for removal with release of HbbTV 2.0.3:*

- Section 14.3: Requirements for launching a CS application from an HbbTV application.
- Section 14.4: Launching a CS application from an HbbTV application.

Device manufacturers SHALL provide mechanisms to allow the user to grant explicit approval to non-pre-approved applications launched via CS at time of first launch. It SHOULD also be possible for the user to allow future launches of such applications without further approval being required as described in Section 14.6.2 of [ETSI\_102\_796]. Manufacturers SHOULD also allow the user to remove an existing user-generated pre-approval for CS launch from an application.

Any application described in an XML AIT provided through the Player XML AIT endpoint at the DUK MDS (see Section 7.2 of [FVP\_B2C]) SHALL be considered pre-approved. The device SHALL launch an HbbTV application triggered via a CS without user interaction when the `<applicationTransport>` and `<applicationLocation>` (excluding any query or fragment) contained in the launch HTTP POST request from the CS match those of the player XML AIT (discovered via the Player XML AIT endpoint). This mechanism is as described in Section 14.6.2 of [ETSI\_102\_796] and examples are provided in Section 5.3.1.

As the MDS supplied Player XML AIT are region specific (based on supplied Network IDS) then the pre-approval CS launch mechanism will only match against players in the regionalised list.

Note that failing to match an application to the pre-approval list SHALL NOT prevent an application from launch, instead an additional separate mechanism for approval (e.g. user approval) is required.

### 5.3.1 Pre-approval launch example (informative)

The FVP companion screen application pre-approval mechanism is based on Section 14.6.2 of [ETSI\_102\_796]. The following gives examples of how parts of the XML AIT from the Player XML AIT endpoint at the DUK MDS (see Section 7.2 of [FREEVIEW\_B2C]) are matched against the XML AIT received by the device from launch HTTP POST request from the CS (see Section 14.2.2.3). There are essentially two distinct values to match on: `<URLBase>` (found in the `<applicationTransport>` element) and `<applicationLocation>` element excluding any query or fragment parts. Table 1 gives typical matching examples. Note that Section 14.6.2 of [ETSI\_102\_796] states a match on 'both' values is required implying that two identical reconstructed URLs would not produce a match if the split of URL between `<URLBase>` and `<applicationLocation>` was different between Player XML AIT and the CS HTTP POST request, see the second example in Table 1.

Note that future versions of [FVP\_B2C] may provide a specific CS application pre-approval list.

Player XML AIT		CS Post Request XML AIT		Preapproval Match?
<URLBase>	<ApplicationLocation>	<URLBase>	<ApplicationLocation>	
https://www.live.bbctvapps.co.uk/tap/iplayer/	Empty	https://www.live.bbctvapps.co.uk/tap/iplayer/	Empty	yes
https://www.live.bbctvapps.co.uk/tap/iplayer/	Empty	https://www.live.bbctvapps.co.uk/	tap/iPlayer	No
https://www.live.bbctvapps.co.uk/	tap/iPlayer	https://www.live.bbctvapps.co.uk/	tap/iPlayer	Yes
https://www.live.bbctvapps.co.uk/	tap/iPlayer	https://www.live.bbctvapps.co.uk/	tap/iPlayer?lloc=cs	Yes
https://www.live.bbctvapps.co.uk/tap/iplayer	Empty	https://www.live.bbctvapps.co.uk/	Empty	No

**Table 1: Example CS launch application matching**

### 5.3.2 Accessibility CS Application (informative)

It is Digital UK's intention to develop iOS and Android companion screen applications during 2018 which will provide viewers the ability to discover Freeview Play content on second screen (mobile or tablet) devices. One of the features of this companion application will be to enable the launch of a broadcast independent HbbTV application (on an FVP device) by making use of Section 14.21, Section 14.2.6 and Section 14.72 of [ETSI\_102\_796], see also Section 13.5.7 of [DBOOK].

Informative: Digital UK's companion screen application will provide viewers with the option to benefit from the Accessibility features which are available via iOS and Android – for example to provide spoken (Text-To-Speech) navigation and discovery of FVP content<sup>1</sup>.

## 5.4 Inter-device Synchronisation

Inter-device synchronisation as described in Section 10.2.9 of [ETSI\_102\_796] and Section 13.5.7.1 of [DBOOK] SHALL be supported. Note that this mandates a device SHALL be able to act as a master terminal (see Section 10.2.9.2 of [ETSI\_102\_796]). The ability for a device to act as a slave terminal 'SYNC\_SLAVE mode' (see Section 10.2.9.3 of [ETSI\_102\_796]) is optional.

## 5.5 Content Substitution using MediaSynchroniser API

This section describes the dynamic switching between a broadcast transmission and an IP stream using TEMI timeline information embedded in the broadcast stream and exposed through the MediaSynchroniser object, see Section 8.2.3 of [ETSI\_102\_796].

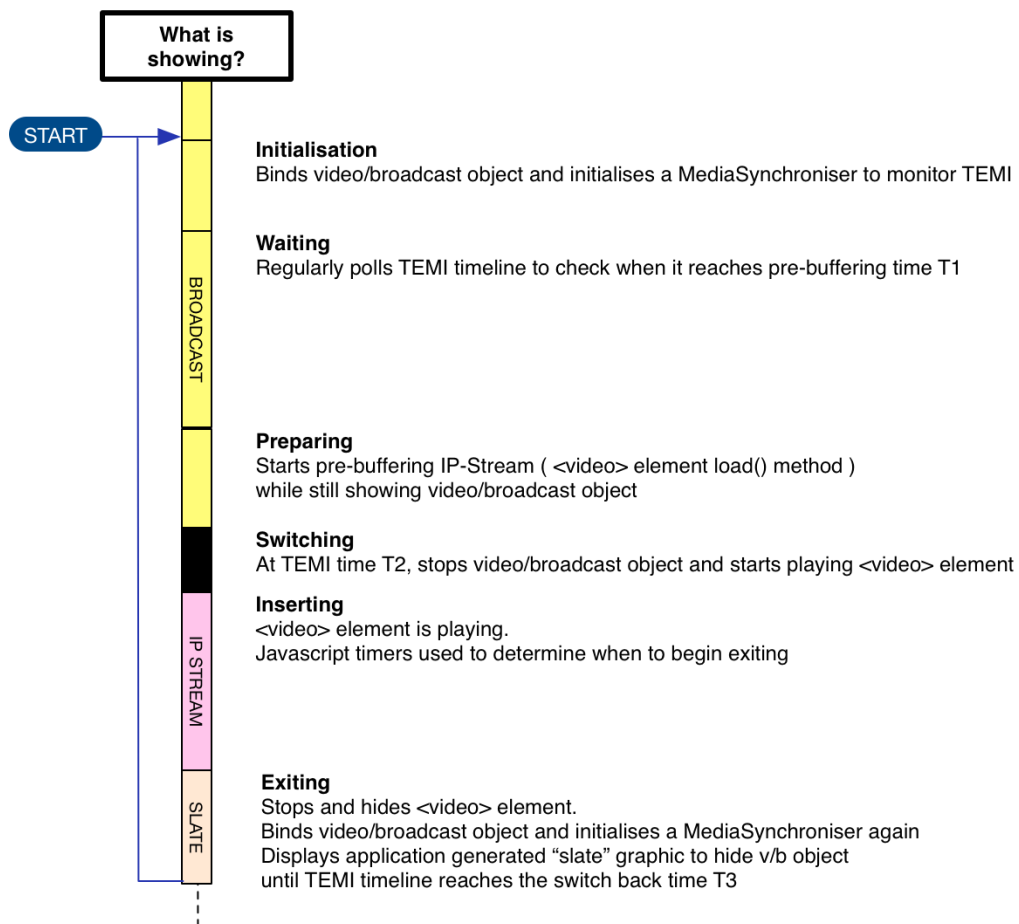
This section shows one use-case for application-to-media synchronisation. This is intended to help device manufacturer implementers understand one possible sequence of API calls that an application may use.

### 5.5.1 Example Overview

The example described in the remainder of this section is illustrated in Figure 2. Figure 2 shows the device presenting broadcast video and audio, monitoring a TEMI timeline and switching to an IP delivered stream at the correct moment determined by a broadcast-related application running against the broadcast service.

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<sup>1</sup> Development partners should note that the implementation of accessible navigation within a companion screen application will never be able to provide the ease of use, breadth of functionality and other significant benefits which are possible through the implementation of accessibility features within the native UI of FVP devices. Digital UK recommends that all partners seek to implement accessible device control and navigation functionality natively across all aspects of their device UIs. Please refer to the 2019 Freeview Play Product Overview Document and the associated Accessibility Annex for further details of these recommendations.



**Figure 2: Viewer experience during IP stream insertion**

Figure 2 represents a broadcast related application running on the device which presents the following user experience:

1. Broadcast service is being presented and associated HbbTV application starts and initialises a MediaSynchroniser object (INITIALISATION)
2. The broadcast related application monitors the broadcast TEMI information (WAITING)
3. The application begins buffering an IP video stream at time T1 on the TEMI timeline (PREPARING)
4. If sufficient data from the IP video stream is buffered the application switches to presenting the IP delivered video stream at time T2 (SWITCHING and INSERTING)
5. Once the IP video asset has been played the application switches back to broadcast service and begins monitoring the TEMI timeline again (via a new MediaSynchroniser object). A holding image/logo "slate" maybe presented at this point by the application to obscure the broadcast video (EXITING).
6. At time T3 the broadcast service is presented and any holding image is hidden/removed.



Sections 5.5.2 to 5.5.4 go into greater detail for each stage of the example. Section 5.5.5 details the base requirements and non-functional requirements necessary for this use-case to provide a good user experience.

The annex in section 10 gives an overview of the whole sequence in a single diagram. It also indicates how an application would combine this with activating inter-device synchronisation.

### 5.5.2 Content Substitution – Initialisation

Figure 3 shows the initialisation phase of the insertion of IP delivered content into a broadcast service. The HbbTV application relies on polling the MediaSynchroniser object to read the current time position on the TEMI timeline (extrapolated from the broadcast TEMI stream). Interaction with the video/broadcast object involves listening for PlayStateChange events and stopping and hiding the object.

Note that the flow exit points shown in Figure 3 (e.g. 'A') link to flow entry points on Figure 4. Flow entry points shown in Figure 3 link to flow exit points in Figure 5.

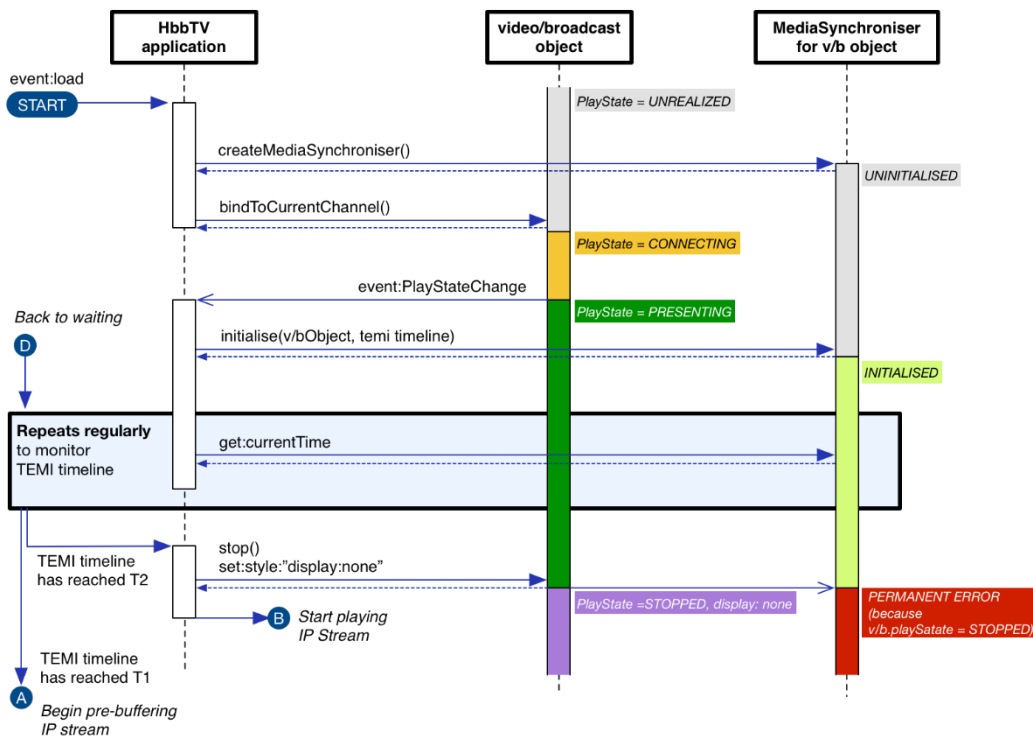


Figure 3: IP insertion - Initialisation stage

### 5.5.3 Content Substitution – Preparing and Switching

Figure 4 shows the stage of the IP insertion example where the application has created a `<video>` element in order to begin playback of IP delivered content. The `<video>` element is initially hidden (`style="display:none"`). The application will switch to the IP stream only once the `<video>` element has enough data buffered and the time signalled in the broadcast TEMI timeline is greater than or equal to the switch point (determined by the application).

The application uses a JavaScript timer in order to know when to switch back to broadcast (i.e. it is not required to monitor broadcast TEMI during IP insertion). Once the IP content has been played the application tears down the `<video>` object and begins returning to broadcast video.

Note that the flow entry points shown in Figure 4 (e.g. 'A') link from flow exit points in Figure 3. Flow exit points shown in Figure 4 link to flow entry points in Figure 5.

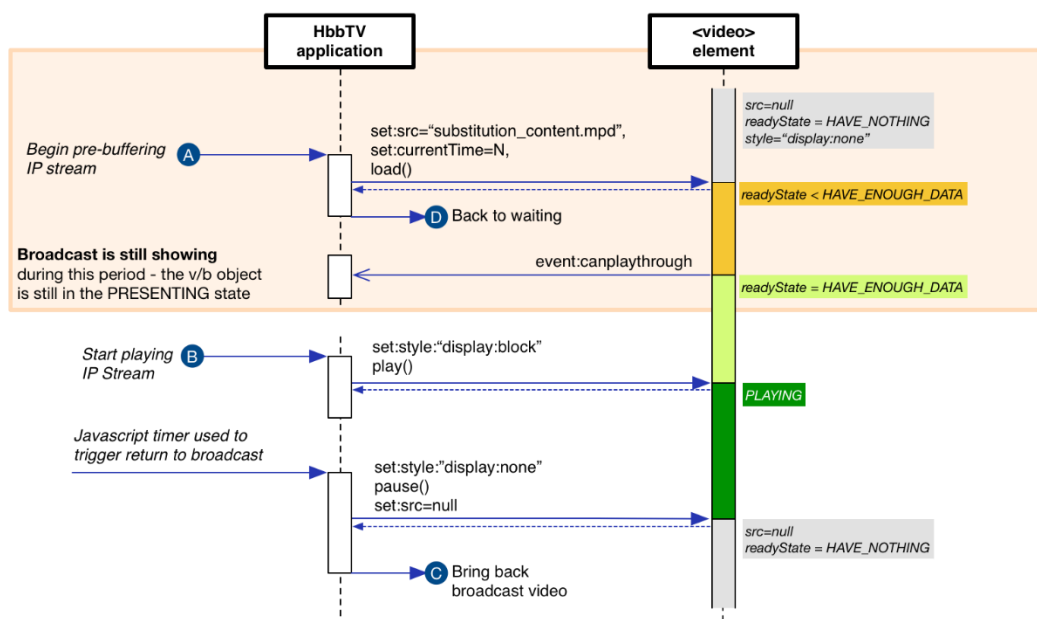


Figure 4: IP Insertion - preparing and switching

### 5.5.4 Content Substitution – Returning to broadcast video

Figure 5 shows the exit stage for IP insertion. The applications first step is to (re)create a MediaSynchroniser object, re-establishes the video/broadcast object by calling `bindToCurrentChannel` and to then associate the MediaSynchroniser with the video/broadcast object (in order to monitor TEMI for the correct moment to resume representing broadcast video). During this phase the application will present a whole screen graphic, known as a “slate”, (to hide any glitches or black).

Once the time in the broadcast TEMI timeline is equal to or greater than the switch-back point (determined by the application), and the video/broadcast object is in a PRESENTING state then the application will remove the whole-screen “slate” thus showing broadcast video.

Note that the flow entry points shown in Figure 5 link from flow exit points in Figure 4. Flow exit points shown in Figure 5 link back to flow entry points in Figure 3.

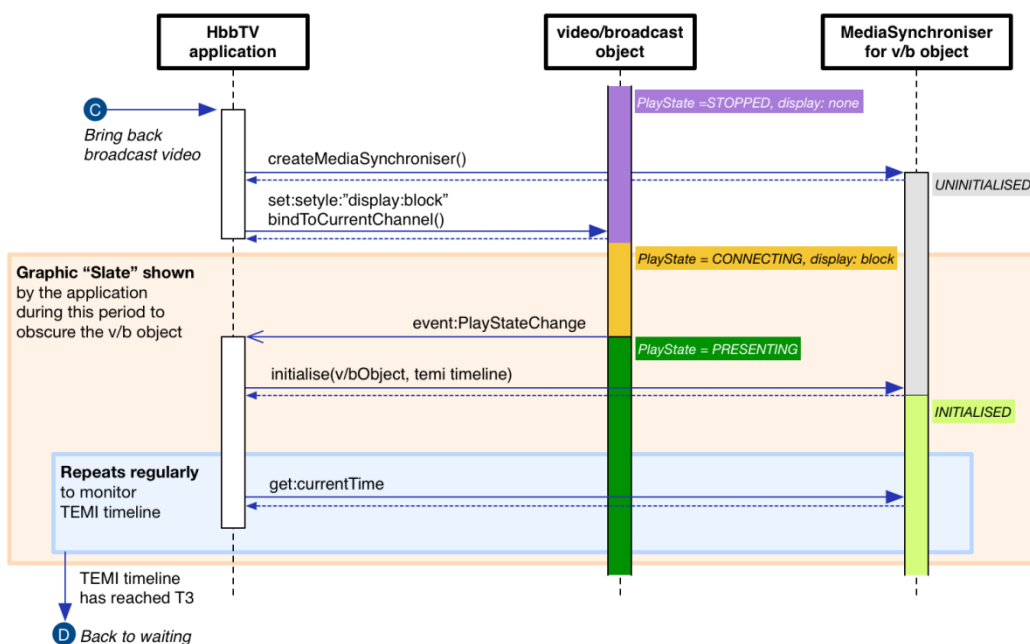


Figure 5: IP Insertion - Exiting IP stream and returning to broadcast video

### 5.5.5 Content Substitution – Requirements

In order to facilitate the interaction sequence described in Sections 5.5.1 to 5.5.4, the features detailed in Table 2 describe the base requirements and non-functional requirements (NFR).

Headline requirement	Functionalities needed	Further Technical detail (e.g. specific APIs)
HbbTV 2 “Media Synchronisation” feature	<p>Media Synchroniser API (clause 8.2.3)</p> <p>Application to Media Synchronisation (clause 13.11, clause 9.7.3)</p> <p>Timely decoding a TEMI timeline from broadcast (clause 13.4.2)</p>	<p>MediaSynchroniser API:</p> <ul style="list-style-type: none"> <li>• <code>initMediaSynchroniser()</code> method</li> <li>• <code>currentTime</code> property</li> <li>• <code>lastError</code> property</li> <li>• <code>lastErrorSource</code> property</li> <li>• <code>Error</code> event</li> </ul> <p>Creating and initialising a new <code>MediaSynchroniser</code> object successfully replaces an existing one, causing the existing one to raise a permanent error (as per definition of <code>initMediaSynchroniser</code> method)</p> <p>Use <code>MediaSynchroniser</code> API, initialised with a v/b object and a TEMI Timeline selector in order to read TEMI.</p> <p>Reading <code>currentTime</code> property is accurate to the constraints defined in clause 9.7.3</p>
	NFR: Frequency of TEMI polling	<p>The application will nominally poll <code>MediaSynchroniser.currentTime</code> once per second.</p> <p>It may peak higher (e.g. 10 times per second) for the brief period between initialising a <code>MediaSynchroniser</code> and getting the first non-NaN value for <code>MediaSynchroniser.currentTime</code>.</p>
video/broadcast object	<p>Binding and stopping</p> <p>Determining current channel</p> <p>Detecting channel change (e.g. user initiated)</p>	<p>v/b object API:</p> <ul style="list-style-type: none"> <li>• <code>bindToCurrentChannel()</code> method</li> <li>• <code>stop()</code> method</li> <li>• <code>playState</code> property</li> <li>• <code>currentChannel</code> property</li> <li>• <code>PlayStateChange</code> event</li> <li>• <code>ChannelChange</code> event</li> </ul>
	NFR: Timeliness of PRESENTING state	When <code>playState</code> changes to <code>PRESENTING</code> , audio and video is being immediately rendered with no delay (such as a period of black).

	NFR: Timeliness of binding and stopping.	<p>It SHALL be possible to call <code>stop()</code> on the <code>v/b</code> object and begin playback of a pre-buffered <code>&lt;video&gt;</code> element (resulting in on-screen video) within 250ms.</p> <p>Ideally the call to <code>stop()</code> and <code>play()</code> happen immediately sequentially within the same cycle of the JS event loop.</p> <p>Calling <code>bindtoCurrentChannel()</code> on a <code>v/b</code> object that is stopped completes the transition through <code>CONNECTING</code> and into <code>PRESENTING</code> state in the same time it takes to begin presenting video when the user has caused a channel change.</p>
DSMCC carousel file access	Reading data carried from carousel (clause 8.2.2, clause 6.2.2.7)	<p>Polling carousel data via <code>XMLHttpRequest</code></p> <p>Polling by broadcast related application still works while <code>v/b.playState</code> is <code>STOPPED</code></p>
	NFR: Polling frequency	A file may be polled once every few seconds.
Broadband DASH presentation via <code>&lt;video&gt;</code> element	<p>Can pre-buffer a Live DASH stream, to commence playback from a specified starting time position (clause 9.4.2 “Media Timeline” and clause 9.1.3 enhanced*)</p> <p>Pre-buffering can take place while broadcast is still presenting (clause 9.6.2)</p>	<p>Pre-buffering via <code>&lt;video&gt;</code> API while <code>v/b.playState</code> is <code>PRESENTING</code>:</p> <ul style="list-style-type: none"> <li>• Pre-buffering is commenced using <code>load()</code> method</li> <li>• Supports accurate* setting of <code>currentTime</code> property to non-zero value to specify initial playback position</li> </ul> <p>While pre-buffering, <code>readyState</code> will reach <code>HAVE_ENOUGH_DATA</code> and <code>canplaythrough</code> event fires</p> <p>* seeking to set playback start position for a live DASH stream SHALL be accurate to positions not on segment boundaries</p>
	Can monitor progress	<p>Standard properties and events, including but not necessarily limited to:</p> <ul style="list-style-type: none"> <li>• <code>play()</code> method</li> <li>• <code>currentTime</code> property (read)</li> <li>• <code>readyState</code> property</li> <li>• <code>ended</code> property</li> <li>• <code>paused</code> property</li> <li>• <code>stopped</code> event</li> <li>• <code>stalled</code> event</li> <li>• <code>ended</code> event</li> <li>• <code>src</code> property (read &amp; write)</li> </ul>

JavaScript time and timers	NFR: JavaScript time and timers can be queried/specified with 10ms resolution or better.	<code>setTimeout()</code> method <code>clearTimeout()</code> method <code>Date.now()</code> method  The requirement is about the precision with which time can be queried and timers are specified. It is not about the accuracy with which timeout callbacks occur. It is acknowledged that the accuracy of a callback scheduled via <code>setTimeout()</code> is best-effort and will not be guaranteed due to, for example, other Javascript code that might be executing at the time.
	NFR: <code>Date.now()</code> underpinned by a 500ppm or better accuracy time source.	Measuring time by looking at the difference between measurements of <code>Date.now()</code> taken 30 minutes apart will be accurate to within 1 second or better.

**Table 2: IP Insertion Essential Requirements**

## 5.6 Behaviour on Channel Change

The HbbTV specification [ETSI\_102\_796] has extensive rules and guidance on receiver behaviour on channel change and the effects on any running applications and presented resources (e.g. broadcast video/audio). This is covered in Section 6.2.2 of [ETSI\_102\_796] and extensions to the video/broadcast object in Appendix A.2.4 of [ETSI\_102\_796].

Manufacturers and content providers should take note of Section 6.2.2.7 of [ETSI\_102\_796] which details access to broadcast resources while presenting IP delivered streams.

## 5.7 Media Source Extensions (MSE)

Devices SHOULD support the Media Source Extensions API [MSE] according to the constraints specified in HbbTV 2.0.3 [HBBTV203] expected to be published later in 2020. The drafting of HbbTV 2.0.3 has focusing on the use of MSE to support Low Latency DASH, see Section 7.3.

## 6. Freeview Play Specific Features

### 6.0 Terminal Capabilities Signalling

For Freeview Play certified (FVC) devices conforming to this specification the `ui_profile` element's name attribute within the `xmlCapabilities` property of the `application/oipfCapabilities` embedded object (see Section 10.2.4 of [ETSI\_102\_796]) SHALL include the string "DVB\_T\_FVC\_P6" to indicate the device is a DVB Terrestrial Freeview Play device conforming to this specification.

### 6.1 HTTP User-Agent

The User-Agent requirements defined in Section 7.3.2.4 of [ETSI\_102\_796] SHALL be included in all requests from the device.

The browser user-agent information SHALL also be provided.

The User-Agent SHALL also include the Freeview Play certified (FVC) string:

```
FVC/<version> (<vendorName>; <familyName>; <reserved>)
```

where:

- Version SHALL be **6.0** for devices conforming to this specification.
- The `familyName` is described in Section 7.3.2.4 of [ETSI\_102\_796].
- The `<reserved>` field is reserved for future extensions.

A valid *example* of the syntax above is

```
User-Agent: HbbTV/1.5.1 (+DRM; Sonic; TV14/551TB; 1.32.455; 2.002;
com.example.2016VX700;) TinterKit/99.9 FVC/6.0 (Sonic;
com.example.2016VX700;)
```

The value for the HbbTV version string shall be assigned according to the level of compliance met by the device. This should be set to HbbTV/1.5.1 for devices complying to the HbbTV 2.0.2 specification.

The `<vendorName>` and `<familyName>`, and `<modelName>` used in the HbbTV part of the User-Agent, SHALL be supplied to Freeview during the Freeview Play certification process.

### 6.2 Software Management

#### 6.2.1 Trials Management

The device SHALL support procedures whereby player releases, software upgrades, etc., can be trialled across small populations in collaboration between manufacturer and Digital UK. It is expected these trials would feature a small number of devices, such that software updates could be provided directly to trialists (e.g. via USB/SD card).

### 6.2.2 Software Update

In-the-field update capability is required. The device SHALL be updatable in a practical manner. Existing DRM system provider agreements MAY require additional update mechanisms (e.g. in case of a DRM breach) which SHALL be implemented.

Devices SHALL support a local mechanism for firmware update (e.g. USB).

### 6.2.3 Development and Testing Override

In order to facilitate development and some early testing the device SHALL support procedures whereby the default location of the MDS (see [FVP\_B2C]) used by the device can be configured. For example, this could be achieved by supplying a file on a USB stick containing a URL of the development MDS.

## 6.3 Content Management

The requirements for content management and general device security are described in the companion document: Freeview Play Content Management and Security available from Digital UK.

Note that the FVP Content Management and Security specification references new requirements specified in Section A.2.27 of HbbTV [ETSI\_102\_796] regarding the scenario when multiple content protection mechanisms are in use.

## 6.4 Streaming Format

### 6.4.1 General

The streaming format used in the Freeview Play environment DASH [ETSI\_103\_285], see Section 7. In addition to the requirements around DASH specified in [ETSI\_102\_796] devices SHALL conform requirements in Section 13 of [DBOOK].



## 7. DASH Implementation

### 7.0 Introduction

Device manufacturers are required to comply with the requirements for DVB DASH streaming as outlined in [ETSI\_102\_796], in particular Annex E of [ETSI\_102\_796], and as outlined in Section 13.4 of [DBOOK].

Content providers in the Freeview Play environment require manufacturers to pay particular attention to the MPD anchor requirements of Section E.4.5 of [ETSI\_102\_796] and support the event mechanism detailed in Section 9.3.2 of [ETSI\_102\_796].

DASH streams used in the Freeview Play environment will include the use of multiple periods therefore Sections 7.2.2 to Section 7.2.5 provide guidance in this area. Manufacturers SHOULD also pay attention to Section 10.5 of [ETSI\_103\_285].

Devices SHALL be able to support combined channel bandwidth for continuous playback as specified in Section 7.3.1.2 of [ETSI\_102\_796]. Note that Section 7.3.1.2 of [ETSI\_102\_796] has updated requirements for devices supporting UHD.

Content providers SHALL ensure that supplied DASH MPDs indicate the appropriate DVB DASH profile, as specified in in Annex E of [ETSI\_102\_796].

Content providers SHALL ensure `@maxSegmentDuration` is included for dynamic MPDs.

Devices SHALL support the component selection requirements of Section 10.2.7 of [ETSI\_102\_796]. This is especially important when presenting DASH streams that contain components to support accessibility, e.g. subtitles and audio description.

### 7.1 Player Resilience

The playback behaviour of live DASH streams and player resiliency is a key requirement of Freeview Play devices. Manufacturers should pay particular attention to Sections 4.7.3 and 10.8 of [ETSI\_103\_285]. Section 4.7.3 of [ETSI\_103\_285] places requirements on the handling of fault conditions, e.g. 404 responses, by devices. Fault conditions have been known to occur when requesting segments at the calculated segment availability time where the accuracy of timing source is uncertain.

Device manufacturers should note that DASH segments MAY contain more than one Movie Fragment (moof) and associated Media Data (mdat) boxes (as described in Section 6.3.4.2 of [MPEG\_DASH]). For the avoidance of doubt devices SHALL process all Movie Fragments in each segment.

#### 7.1.1 Segment Aspects and Media Presentation

DASH streams used in the Freeview Play environment will offer MPDs containing `SegmentTemplate` elements containing `SegmentTimeline` elements and MPDs containing `SegmentTemplate` elements without `SegmentTimeline` information.

URL templates in the `media` attribute of the `SegmentTemplate` MAY use `$Number$` or `$Time$` identifiers. Where `$Number$` identifiers are used Table 12 of [MPEG\_DASH] SHALL be followed so that the `startNumber` attribute is processed as specified.

Where `SegmentTimeline` elements are provided the duration of segments MAY vary see Section 5.3.9.6 of [MPEG\_DASH].

Where `SegmentTimeline` elements are not provided, a `@duration` attribute provides the approximate duration for all segments in its scope but the precise durations can still vary - see section 5.3.9.2.2 and Table 12 of [MPEG\_DASH].

The presentation time of segments requires careful calculation especially where multiple periods are contained in an MPD, see Table 17 of [MPEG\_DASH].

Device manufacturers SHALL note Section 7.2.1 of [MPEG\_DASH] describing the relativity of Media Presentation time to the `PeriodStart` time.

## 7.2 Multi-period DASH

### 7.2.1 General

This section describes behavioural requirements on devices where content is delivered via a DASH stream containing multiple Periods.

Devices SHALL seamlessly play period-continuous `AdaptationSets` at a period boundary as required by DVB DASH [ETSI\_103\_285] clause 10.5.3. In addition, content providers may signal two `AdaptationSets` in contiguous Periods as *period-connected* (see Annex A.9 in [MPEG\_DASH\_AMD]). Playback across Period boundaries is expected to be seamless for *period-connected* `AdaptationSets`.

Multi-period DASH provided to FVP devices SHOULD be created such that it SHOULD play seamlessly across Period boundaries.

Where there are differences between Periods such that a device cannot play over the Period boundary seamlessly then any hesitation in the timeline or period of black or silence SHALL be less than 250 milliseconds.

Additionally, the requirements in Sections 7.2.2 to Section 7.2.5 of this document SHALL be met.

### 7.2.2 Subtitles

Periods without `AdaptationSets` containing subtitle representations SHOULD be expected between Periods which do have subtitles.

Where two adjacent Periods contain subtitle representations there SHALL be no loss in continuity or synchronisation of subtitles when transitioning across the Period boundary and subtitles SHALL continue to be rendered correctly.

When a subtitle representation reappears after a non-subtitled Period there SHALL be no loss in continuity in time synchronisation and the rendering of subtitles SHALL restart (subject to user selection).

User subtitle selection must be remembered irrespective of the presence of absence of subtitle representations as new Periods are entered.

### 7.2.3 Alternative Audio and Audio Description

It SHOULD be expected that AdaptationSets containing alternative audio (e.g. audio description, 2<sup>nd</sup> audio commentary) may differ and/or disappear during transitions from one Period to another. During such situations the device SHALL transition without impact to the viewers experience of playback.

The component selection requirements specified in Section 10.2.7.2 of [ETSI\_102\_796] SHALL be followed, in particular the re-evaluation of components based on user preferences when the available components change.

### 7.2.4 Encrypted and Unencrypted Video

Transitions between Periods of encrypted media to unencrypted media and vice versa SHOULD be expected. Devices SHOULD play seamlessly across any such Period boundaries.

Decryption keys may change across Periods, however in the case that they do not change especially after encountering an intermediate Period of unencrypted media the device SHALL not request a duplicate decryption key (see Section 6.3 of [FREEVIEW\_CMS]).

### 7.2.5 Range of Representations within Adaptation Sets

It SHOULD be expected that the number and range of representations with different bitrates within AdaptationSets may change across Period boundaries.

On entering a new Period the device SHALL immediately re-evaluate the representations available. The device SHALL pick a representation with similar bit-rate to the previous Period. If higher bit-rate representations are available in the new Period then the device SHALL attempt to switch to one of those subject to previous playback buffer measurements.

## 7.3 Low Latency DASH

Low latency DASH streaming is a feature recently specified in [ETSI 103 285]. Devices SHOULD provide suitable support for MSE according to the constraints specified in HbbTV 2.0.3 [HBBTV203] such that a content provider application can implement a Low Latency DASH player using MSE.



## 8. IP Delivered Linear Services

### 8.0 Introduction

Freeview Play devices SHALL enable access to both DTT broadcast and IP delivered linear services. Where a device is connected, this functionality is expected to be used to make available IP delivered linear TV services to viewers who are unable to receive certain DTT broadcast services at their location. Subject to sufficient broadband capacity and content providers' ambitions, viewers may also be able to access to IP delivered HD or UHD versions of existing broadcast services and/or access to extra IP delivered linear services.

Freeview Play allows for content providers to offer IP delivered linear services via a broadcast-independent HbbTV application (see Section 0). The extra metadata required to support this new feature is described in the FVP B2C specification [FREEVIEW\_B2C]. This feature represents a new use-case for a broadcast-independent HbbTV application that has typical media delivery and control aspects, i.e. IP delivered DASH content under the control of a HTML5 media element, and yet has RCU key event handling akin to a broadcast-related application. Section 8.2 describes the expected behaviour.

### 8.1 Service Discovery

Connected Freeview Play devices SHALL enable the discovery of IP delivered linear services via the channel list management mechanism described in Section 11 of the FVP B2C specification [FREEVIEW\_B2C]. Broadcast DTT services SHALL be discovered through the existing [DBOOK] mechanisms.

The channel list management mechanism will provide a list of LCNs for both broadcast services and IP services. This will provide an LCN position for an IP linear service to allow it to be shown in the device's native EPG alongside, and possibly relocating or replacing, broadcast services. The schedule for the IP service can be obtained from the MDS using existing schedule query APIs, see Section 6.2 of [FREEVIEW\_B2C].

### 8.2 Service Selection

An IP linear service SHALL be started (i.e. HbbTV application launched) when the user uses the terminal-resident channel/service selection UI, in the following scenarios:

- The user chooses the channel to watch in the native EPG (the actual action may be dependent on the individual UI design).
- The user selects the channel via program selection keys (e.g. P+ and P-), from an adjacent channel.
- The user selects the channel numerically.

Furthermore, if the device has behaviour that when resuming from stand-by the device tunes to the channel selected prior to the device being put into standby then that behaviour shall be mirrored for IP linear channels, i.e. if IP linear service was the selected channel prior to power-down then that same IP linear service shall be started (i.e. HbbTV application launched) when the device is turned-on, or brought out of standby.

Once the channel is selected (e.g. the HbbTV application associated with the channel is running) the user SHALL still be able to change channel using the program selection keys (e.g. P+ and P-) and operate other native functions available whilst running a broadcast independent application, e.g. access the native guide, see also Section 8.3.

### 8.3 RCU Button Handling

Table 12 of [ETSI\_102\_796] details the availability of key events to a running HbbTV application. Section 10.2.2.1 of [ETSI\_102\_796] describes a set of keys as “Only available to applications once activated” and that broadcast-independent applications are considered ‘activated’ at time of launch. The present specification requires that for broadcast-independent applications launched through the methods outlined in Section **Error! Reference source not found.** shall only become “activated” when they have received a key event (this is in line with broadcast-related AUTOSTART applications). The linear IP service application SHALL release keys (by issuing a new KeySet.setValue() call) when not needed; this is especially important for number keys used to channel change.

Where a device has separate ‘info’ and ‘enter/ok’ keys the ‘info’ key may be used by the device to offer channel banner information against an IP linear service.

Where a device would otherwise use the ‘enter/ok’ key to provide channel banner information (for example where an ‘info’ key is not available) on a broadcast channel this shall be disabled for IP linear channels.

The ‘enter/ok’ key shall always be available to the running application unless the native UI has focus.

### 8.4 Service Presented via Application

When the viewer selects a service listed in the service list which is indicated as an IP delivered service and the service discovery mechanism for the service references an XML AIT then the device SHALL process the XML AIT and launch any signalled application in the manner described in Section 7 of [FREEVIEW\_B2C].

As described in Section 8.2, in many implementations the enter/ok key will prompt the device to display channel banner information (Now/Next). For IP linear channels it is the responsibility of the running application to display appropriate information (programme name, etc) when an enter/ok key event is received.

## 9. Channel List Management

### 9.0 Context

Digital UK is responsible for assigning the Logical Channel Numbers for all services on the UK DTT platform. These is conveyed to receivers via the broadcast `logical_channel_descriptor` (see Section 8.5.3.6 of [DBOOK]). The UK DTT platform is complex and constantly changing, for example, it:

- is a collection of 26 regional networks
- contains around 1000 transmitters
- has services spread across, typically, 9 multiplexes per region
- has different coverage patterns: not all areas receive all multiplexes, most areas have overlaps and each receiver's reception condition is unique
- has many SD services with similar or exact HD service equivalents
- has no mechanism to allow swapping of HD and SD channel numbers, also D-Book rules to manage regional selection (Target Region signalling) can be complex to implement

In order to address this complexity, the enhanced Channel List Management (CLM) feature described here allows the device to defer the logic of regional channel list management to Digital UK, see Section 3 of [FREEVIEW\_POD]. This provides the opportunity to offer IP-based services to regions without the full range of services or to add services to the channel line up elsewhere.

### 9.1 Introduction

When a device is IP-connected<sup>2</sup> it shall query the channel list management end-points using details of receivable multiplexes in order to obtain a channel list managed by Digital UK. The protocol for device-to-endpoint interactive is described in Section 11 of [FREEVIEW\_B2C]. Unconnected devices shall maintain a logical channel number (LCN) list as defined in DBOOK.

Connected devices shall have an enhanced channel list where services delivered by broadcast and IP are assigned channel numbers supplied via the Digital UK MDS.

Two new end-points are made available to devices to provide the CLM service:

- CLM Configuration Service endpoint (see Section 9.2 of this document and Section 11.2.1 of [FREEVIEW\_B2C])
- CLM Assignment Service endpoint (see Section 9.3 and Section 9.4 of this document, and Section 11.2.2 of [FREEVIEW\_B2C])

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<sup>2</sup> In this context "IP-connected" means the device has a working internet connection back to the FVP MDS server..

A key principle of CLM is to minimise the amount of user interaction required to manage the Digital UK supplied channel list. However, in cases where multiple regions are adequately receivable it is policy to allow the viewer to decide which region they would like to prioritise for channel number assignment. Therefore, the devices SHALL have two ways of accessing the CLM service depending on the Use Case:

- **Interactive Retune (Section 9.3):** Where the viewer interactively makes regional selection choices (likely to be at time of first installation or a user-initiated channel update or reset), see.
- **Non-interactive Background Update (Section 9.4):** As a background process, nominally once per 24 hr period. The manufacturer MAY decide when best to perform the operation depending on device capability and architecture. Typically, the operation could be performed at system shutdown, when a spare tuner is available or on a randomised wake-up timer during the night. It is STRONGLY RECOMMENDED to avoid waking up at fixed times to avoid synchronised accesses by multiple devices.

The interactions between a device and the CLM endpoints are described and illustrated in Sections 11.3 to Section 11.5 of [FREEVIEW\_B2C].

The architectural design of the CLM device client software SHALL be determined by the manufacturer however the table below describes basic operation requirements.

CLM Operational Requirements:

Requirement	Description
1	Devices SHALL update the Digital UK enhanced channel list during the regular frequency band scan for service changes as mandated in Section 22.1.3.2 of [DBOOK], i.e. once every 24 hours
2	Devices SHALL query the Digital UK enhanced channel list endpoint as scheduled, even when no broadcast changes are detected.
3	Devices SHOULD avoid interrupting the viewer when the device is conducting a background update.
4	Devices SHOULD defer the update scan if a tuner is not available e.g. due to a recording being in progress, or if the device has been inactive for less than four hours.
5	If a device needs to defer an update scan and it has been more than 24 hours since the last rescan it SHOULD reattempt after 6 hours.
6	If a device has received a target region as part of the CLM process then this SHOULD be used to resolve broadcast LCN assignment clashes if the device has lost access to the CLM service. This



	avoids the need to ask the viewer target region questions which would already have been answered as part of the CLM process.
7	When updating the Digital UK managed enhanced channel list the process SHALL not destroy the existing channel list before the revised list is provided.
8	The process SHALL be interruptible at any stage up until the revised channel list is provided.
9	If a device determines there has been a significant degradation (e.g. 50% reduction in SQI between subsequent scans) in all received broadcast multiplexes it SHOULD advise the viewer to check aerial connectivity and perform an interactive retune.
10	Devices SHOULD query the Digital UK enhanced channel list endpoint (using the most recent scan data) if the current enhanced channel list is found to conflict with data from the services endpoint when a linear IP channel is selected.
11	Devices SHOULD avoid scheduling queries the Digital UK enhanced channel list endpoint at fixed time-of-day. It is <b>STRONGLY RECOMMENDED</b> to base such operations from user-initiated actions (e.g. entering standby). Manufacturers may add a random offset to such datum to further diversify the timing of similar requests across the receiver population.

## 9.2 CLM Configuration Service Endpoint

In order to access the CLM Assignment Service the device must first locate the base URL for the CLM Assignment Service and acquire configuration information in order to structure the requests to the service. This is described in Section 11.2.1 of [FREEVIEW\_B2C].

<p><b>Query 1 : Requesting CLM configuration</b></p> <p>If no CLM Configuration has been stored, the device SHALL query the CLM Configuration Service endpoint. The CLM Configuration Service endpoint should be queried regularly or in the event of a failure described below. The device SHOULD store the resulting CLM Configuration.</p> <p>The service SHALL respond with <b>either</b>:</p>	
<p><b>Response 1.A: CLM Configuration document</b></p> <p>The CLM configuration document provides configuration information needed to use the CLM Assignment Service endpoint (see Section 11.2.1 of [FREEVIEW_B2C]).</p> <p>The device SHALL query the CLM Assignment Service (see Section 9.3 and Section 9.4) as determined by the CLM Configuration.</p>	<p><b>Response 1.C: Error</b></p> <p>If either:</p> <ul style="list-style-type: none"> <li>• The CLM Configuration Service cannot be reached; <i>or</i></li> <li>• The CLM Configuration Service returns an error</li> </ul> <p>...then the CLM process cannot proceed: Existing Service Lists SHOULD prevail unless the conditions for the Broadcast LCN fallback mechanism are met (see Section <b>Error! Reference source not found.</b>) In this case then Broadcast LCN assignments SHALL be used (see Section 8.5.3.6 of [DBOOK]).</p> <p>The CLM Configuration Service should be rechecked as part of the next scheduled background update.</p>

### 9.3 Interactive Retune

Interactive retune is used when the device is new or the viewer chooses to manually retune the device. The device SHALL scan the DTT RF band, determining a list of receivable broadcast multiplexes. This list of multiplexes SHALL be stored for future reference (see Section 11.2.2.2 of [FREEVIEW\_B2C]).

<b>Query 2 : Requesting Service List interactively</b>		
<p>The device SHALL query the CLM Assignment Service indicating:</p> <ul style="list-style-type: none"> <li>• The list of multiplexes;</li> <li>• That the RF scan took place with the viewer present (i.e. interactive=true).</li> <li>• The Answer Token (SHALL be present if the device has previously successfully queried the CLM mechanism (including response 1.A below) AND the user has not initiated a full reset re-scan)</li> </ul> <p>The service SHALL respond with <b>either</b>:</p>		
<p><b>Response 2.A: Viewer Question</b></p> <p>The device SHALL present the question and answers to the viewer.</p> <p>When the Viewer chooses an answer, the device SHALL query the CLM Assignment Service using the Answer Token associated with the viewer's choice.</p> <p>The device re-runs Query 2 above, including the chosen, Answer Token.</p>	<p><b>Response 2.B: Service List</b></p> <p>A response containing a Service List SHALL also contain an Answer Token and Target Region.</p> <p>The device SHALL persistently store the Service List, Target Region and Answer Token.</p> <p>The Service List SHALL replace any previous Service List assignments.</p>	<p><b>Response 2.C: Error</b></p> <p>In the event that:</p> <ul style="list-style-type: none"> <li>• The user declines to answer a question;</li> <li>• The scan is cancelled;</li> <li>• The scan is interrupted by the tuner being required for something else</li> <li>• CLM Assignment Service fails with a fatal error; <i>or</i></li> <li>• CLM Assignment Service is unavailable.</li> </ul> <p>Existing Service Lists SHALL prevail if one exists, otherwise the Broadcast LCN assignments SHALL be used (see Section 8.5.3.6 of [DBOOK]).</p> <p>If the CLM Assignment Service fails with an ERROR_INVALID_CONFIG error the device shall immediately obtain a new config from the CLM Configuration Service (see Section 9.2) and resubmit a query to the Assignment Service end-point. If this second attempt also results in an ERROR_INVALID_CONFIG then the existing Service List SHALL prevail if one exists,</p>

		<p>otherwise the Broadcast LCN assignments SHALL be used (see Section 8.5.3.6 of [DBOOK]).</p> <p>If there are no existing Service Lists, broadcast LCN assignments SHALL be substituted.</p>
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## 9.4 Background update

A background update SHALL take place once per 24 hours if resources are available, i.e. a tuner is available to perform a scan, or when a previously scheduled scan was deferred. The device SHALL scan the DTT RF band, determining a list of receivable broadcast multiplexes. This list of multiplexes SHALL be stored for future reference (see Section 11.2.2.2 of [FREEVIEW\_B2C]).

### Query 3 : Requesting Service List non-interactively

The device SHALL query the CLM Assignment Service indicating:

- The list of receivable multiplexes;
- That the RF scan took place without the viewer present, i.e. interactive=0 (false).
- A previously-stored Answer Token: this MAY be omitted if no successful queries have ever been made to the CLM Assignment Service; SHALL be present otherwise.

The service SHALL respond with **either**:

#### Response 3.A: Service List

A response containing a Service List SHALL also contain an Answer Token and Target Region.

The device SHALL persistently store the Service List, Target Region and Answer Token.

The Service List SHALL replace any previous Service Lists.

#### Response 3.B: Provisional Service List

A response containing a Service List SHALL also contain an Answer Token and Target Region.

A response containing an advise\_interactive\_scan=true flag indicates that the CLM Assignment Service could not resolve all LCN conflicts using the Answer Token supplied. This flag indicates that the Service List is provisional and an interactive scan is required, therefore the device should prompt the viewer at suitable time as determined by manufacturer.

The device SHALL persistently store the Service List, Target Region, Answer Token and advise\_interactive\_flag.

The Service List SHALL replace any previous Service Lists.

#### Response 3.C: Error

In the event that:

- The scan is cancelled, interrupted or cannot start because no tuner is available
- CLM Assignment Service fails with a fatal error; *or*
- CLM Assignment Service is unavailable

Existing Service Lists SHOULD prevail unless:

- The conditions for the Broadcast LCN fallback mechanism are met (see Section **Error! Reference source not found.**); *or*
- The CLM Assignment Service returns an empty list.

If the CLM Assignment Service fails with an ERROR\_INVALID\_CONFIG error the device shall immediately obtain a new config from the CLM Configuration Service (see Section 9.2) and resubmit a query to the Assignment Service end-point. If this second attempt also results in an

		<p>ERROR_INVALID_CONFIG then the existing Service List SHOULD prevail if one exists unless the conditions for the Broadcast LCN fallback mechanism are met (see Section <b>Error! Reference source not found.</b>).</p> <p>The scan SHALL be deferred by a random period between 3 and 6 hours.</p>
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## 9.5 Loss of CLM service

If a device is unable to use the CLM mechanism, e.g. due a network failure, then the device SHALL revert to Broadcast LCN signalling, i.e. use the LCN assignment mechanism defined in Section 8.5.3.6 of [DBOOK].

Reverting to the Broadcast LCN list SHALL not happen immediately following an error: the previously acquired service list should persist over intermittent failures. The device shall only revert to Broadcast LCNs in the case of a prolonged failure. The point in time at which a device shall revert to Broadcast LCNs is determined by the combination of the “failure period” and the standby/power cycle of the device.

The “failure period” is defined as:

48 hours since the error was first encountered without any subsequent successful responses being received from either the CLM configuration service or Service List endpoint. If the device was in standby (as far as the user was concerned) when the error was first encountered (i.e. it was during a background check) then the 48 hour period starts only once the device is brought out of standby<sup>3</sup>.

The point at which the device reverts to the Broadcast LCN list should be as soon as possible after expiry of the “failure period” but may be at a point that best suits the architecture of the device (e.g. as the device comes out of standby or when it is put into standby).

It is recommended that a device that is experiencing a loss of CLM service whilst in standby should check the CLM service endpoint, using the existing Answer Token, when the device is brought out of standby and/or before performing the revert to Broadcast LCN list.

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<sup>3</sup> This is to deal with a situation where a device may be left in standby for an extended period (e.g. a user goes on holiday) and network connectivity is not available (e.g. the user switches their router off). When coming out of standby on the users return the device should not immediately revert to broadcast LCNs.

The above is illustrated by example in

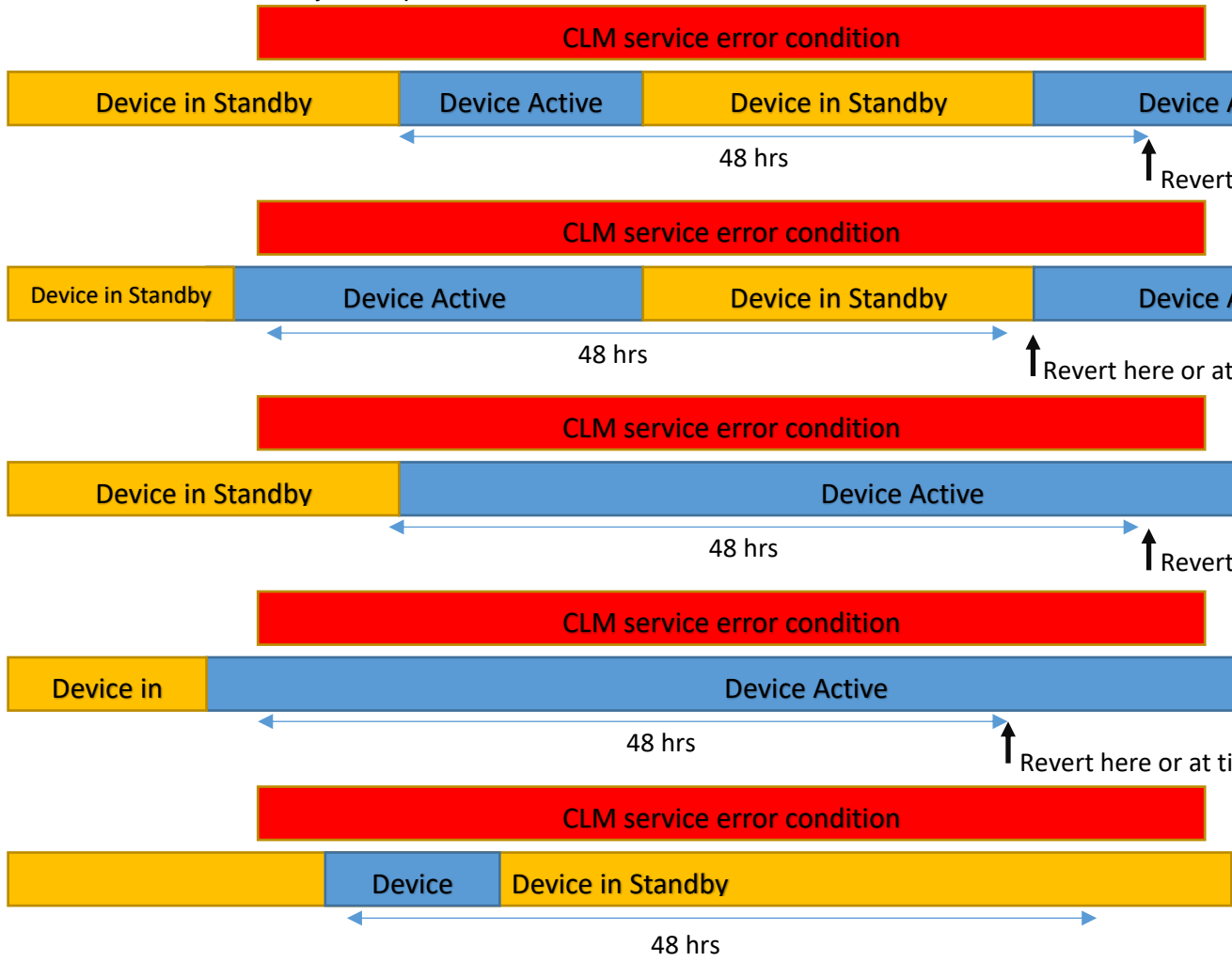


Figure 6.



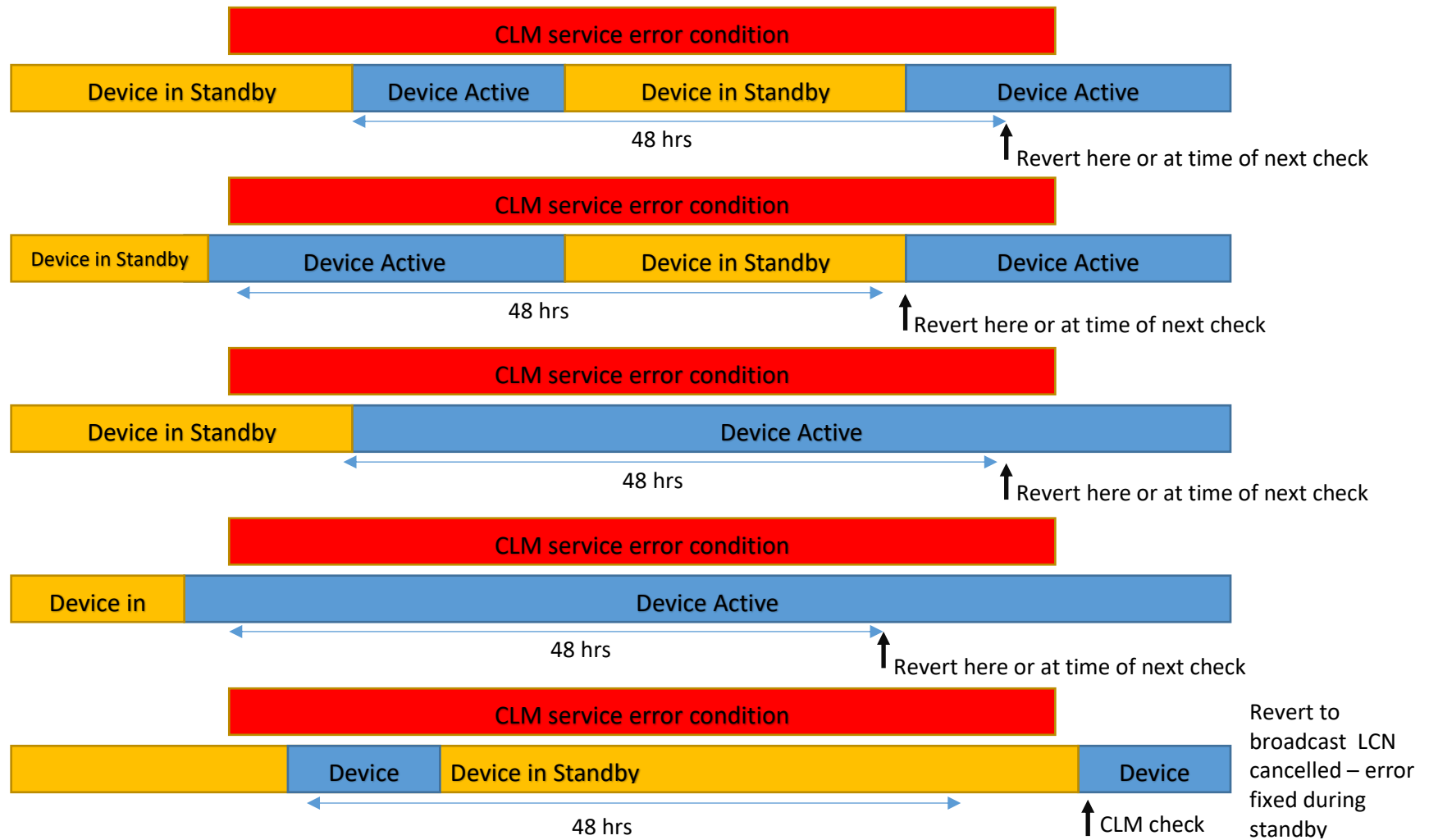


Figure 6 CLM revert to broadcast LCN list on error examples

## 9.6 Definitions

### 9.6.1 Service List

A list of services and their corresponding assigned Logical Channel Number, if any.

- Services MAY appear more at than one Logical Channel Number;
- Services MAY not be assigned a Logical Channel Number. Such services are to be made hidden and not selectable; *and*
- Services MAY be absent from the Service List but be receivable by the device. Such services which are not duplicates (see Section 8.8.3.0.2 of [DBOOK]) of services in the Service List SHOULD be assigned Logical Channel Numbers by the device in the 800-899 range.

The maximum number of broadcast and IP services that can be listed is 1024.

### 9.6.2 Viewer Question

Text in the form of a “multiple choice” question, with two or more textual answers, each represented by an Answer Token

### 9.6.3 Answer Token

An opaque data structure that is used to determine how a viewer has answered questions.

- Answer Tokens sent with a Viewer Question SHALL be used to indicate that the viewer selected the associated answer; *and*
- Answer Tokens sent with a Service List SHALL be persisted by the device and SHALL be sent with subsequent Service List Requests.

### 9.6.4 Target Region

A data structure within the CLM Assignment Service response that represents the Target Region selection deduced by the CLM Assignment Service.

The Target Region SHALL be persisted by the device and used to resolve conflicts in Broadcast LCN assignments in the event that the CLM Assignment Service is unavailable or unreachable.

### 9.6.5 Receivable Multiplex

A receivable multiplex is a transport stream carried on an RF channels defined in Section 9.5 of [DBOOK]. The determination of whether a multiplex is *receivable* is described in Section 9.13 of [DBOOK].

If the `SQI_threshold` value is present in the CLM configuration JSON response then multiplexes with an SQI of a value lower than `SQI_threshold` SHALL be flagged as such in in the request to the CLM Assignment Service endpoint (see Section 11.2.2 of [FREEVIEW\_B2C]).

### 9.6.6 IP Virtual Network ID

The IP Virtual Network ID is a value which should be presented as a `network_id` in a query to the B2C services endpoint in order to gather ServiceInformation on IP delivered services. This property will be present if any IP services are present the Service List, and may be present even if no IP services are present in the Service List.

## 10. Future Directions

### 10.0 Context

Based on feedback from manufacturers this section outlines the future direction of Freeview Play specifications. Where appropriate Freeview Play will follow the specifications of HbbTV and the DTG and associated W3C and DVB standards.

The future direction of the Freeview Play technical specifications will be broadly aligned with the direction outlined in the BBC Interactive HTML specification for devices with tuners.

### 10.1 HbbTV Targeted Advertising Specification

The current intention of Digital UK is for the HbbTV Targeted Advertising specification to form a mandatory requirement of the Freeview Play 2022 specification.

## Annex A – Content Substitution example

The figure below illustrates the example given in Section 5.5 as a single timeline diagram. This diagram also shows the use of a MediaSynchroniser associated with a <video> element in order to facilitate inter-device synchronisation.

Representative sequence diagram for IP insertion into broadcast using TEMI (ideal scenario)

