



Commercial Requirements for DVB-I over 5G

DVB Document C100

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Intellectual Property Rights

Please refer to the IPR policy of DVB Project available at: <https://dvb.org/about/policies-procedures/>

Foreword

DVB is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulators and others from around the world committed to designing open, interoperable technical specifications for the global delivery of digital media and broadcast services. DVB specifications cover all aspects of digital television from transmission through interfacing, conditional access and interactivity for digital video, audio and data. DVB dominates the digital broadcasting environment with thousands of broadcast services around the world using DVB specifications. There are hundreds of manufacturers offering DVB-compliant equipment. To date, there are over 1 billion DVB receivers shipped worldwide..

References

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, DVB cannot guarantee their long-term validity.

- [1] [SB2608_5G Study Mission Report](#) (DVB internal document).
- [2] [ETSI TS 103 720](#): "5G Broadcast System for linear TV and radio services; LTE-based 5G terrestrial broadcast system".
- [3] 5GMS Architecture - 3GPP TS 26.501: "5G Media Streaming (5GMS); General description and architecture" (Rel-16).
- [4] 5GMS Protocols - 3GPP TS 26.512: " 5G Media Streaming (5GMS); Protocols".
- [5] 5GMS Codecs - 3GPP TS 26.511: " 5G Media Streaming (5GMS); Profiles, Codecs and Formats".
- [6] MPEG CMAF - ISO/IEC 23000-19: "Information Technology Multimedia Application Format (MPEG-A) – Part 19: Common Media Application Format (CMAF) for segmented media".
- [7] MPEG DASH - ISO/IEC 23009-1: "Information Technology - Dynamic Adaptive Streaming Over HTTP (DASH) - Part 1: Media Presentation Description and Segment Formats".
- [8] LTE-based 5G Broadcast TS - [ETSI TS 103 720](#) "5G Broadcast System for linear TV and radio services; LTE-based 5G terrestrial broadcast system".
- [9] LTE-based 5G Broadcast TR - 3GPP TR 36.976 "Overall description of LTE-based 5G broadcast".
- [10] MBMS Architecture - ETSI TS 123 246: "Universal Mobile Telecommunications System (UMTS); LTE; Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description (3GPP TS 23.246 Release 16)".
- [11] MBMS User Services - ETSI TS 126 346: "Universal Mobile Telecommunications System (UMTS); LTE; 5G; Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs (3GPP TS 26.346 Release 16)".
- [12] MBMS-APIs - ETSI TS 126 347: "LTE; Multimedia Broadcast/Multicast Service (MBMS); Application Programming Interface and URL (3GPP TS 26.347 Release 16)".
- [13] xMB-2 - ETSI TS 126 348: "LTE; 5G; Northbound Application Programming Interface (API) for Multimedia Broadcast/Multicast Service (MBMS) at the xMB reference point (3GPP TS 26.348 Release 16)".

- [14] xMB-3 - ETSI TS 129 116: "LTE; 5G; Representational state transfer over xMB reference point between content provider and BM-SC (3GPP TS 29.116 Release 16)".
- [15] LTE-PHY - ETSI TS 136 211: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation (3GPP TS 36.211 Release 16)".
- [16] LTE-General - ETSI TS 136 300: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (3GPP TS 36.300 Release 16)".
- [17] LTE-RRC - ETSI TS 136 331: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (3GPP TS 36.331 Release 16)".
- [18] [5GAA: C-V2X Use Cases Volume II: Examples and Service Level Requirements](#)
- [19] DVB-DASH - [ETSI TS 103 285](#): "Digital Video Broadcasting (DVB); MPEG-DASH Profile for Transport of ISO BMFF Based DVB Services over IP Based Networks".
- [20] DVB-MABR - [ETSI TS 103 769](#): " Digital Video Broadcasting (DVB); Adaptive media streaming over IP multicast".
- [21] DVB-I - [ETSI TS 103 770](#): "Digital Video Broadcasting (DVB); Service Discovery and Programme Metadata for DVB-I".
- [22] DASH LL-CRs – DVB Commercial Requirements for Low Latency, internal document [CM-10020](#)

Definition of terms and abbreviations

Terms

For the purposes of the present document, the following terms apply.

5G Broadcast System: The technologies and services as defined in ETSI TS 103 720 [2].

5G Media Streaming System: The downlink streaming system defined in TS 26.501 [3] and TS 26.512 [4].

Basic DVB-I Service: A service that provides sufficient functionality of a DVB-I service as defined in [21], but the service may be enhanced by additional components, possibly delivered through a different delivery network.

Consumer: The final recipient of the media content as part of a Service.

Content Provider: The owner and/or holder of commercial rights to media content for distribution to the consumer.

5G Delivery Network: One of the following networks used to deliver DVB-I services:

- OTT unicast (via a 5G network or otherwise)
- 5G Media Streaming System
- 5G Broadcast System

DVB-I over 5G System: A system that offers DVB-I Services over a 5G System, in particular 5G Broadcast or 5G Media Streaming.

DVB-I client: An entity capable of discovering and presenting DVB-I services. Examples include native software on TVs and STBs, apps on mobile devices and HTML in a browser.

DVB-I service: A service discovered using the DVB-I specification which is available over DVB-DASH (additional delivery mechanisms may also be available).

DVB-I service discovery: The process of discovering DVB-I services and other services included in a DVB-I service list as defined in [21].

Hybrid DVB-I Service: A service defined as follows:

1. The DVB-I service is described in a DVB-I service list.
2. A minimum/basic service is distributed through a 5G Broadcast System.
3. The service is augmented by OTT unicast or 5G Media Streaming to provide additional functionalities as required in these Commercial Requirements.

Linear TV: A schedule of programmes on a channel distributed to many viewers, not streamed to a specific user.

NOTE 1: Programmes scheduled on a Linear TV channel can be live or pre-recorded.

NOTE 2: The term “live TV” is avoided as it is sometimes used to mean the same as “Linear TV” and sometimes used to mean coverage of events that are actually happening at that moment in time. The latter is a subset of Linear TV.

Network Operator: The network infrastructure provider that delivers media content from the Content Provider to the Service Provider and/or from the Service Provider to the consumer.

OTT: Over-The-Top delivery over a “best efforts” IP-based network (e.g. 5G mobile broadband) using a default network Quality of Service.

Self-Contained DVB-I service: A DVB-I service as defined in [21] that can be accessed entirely on a single delivery system, e.g. on a 5G Broadcast system, 5G Media Streaming system, etc.

Service: A set of audio-visual media assets offered to the Consumer by the Service Provider and delivered to the Consumer by a delivery chain comprising one (or more) Network Operators

Service list: A list delivered to a DVB-I client of what a user perceives as linear TV and radio channels.

Service Provider: A distributor of media content to the consumer.

Abbreviations

For the purposes of the present document, the following abbreviations apply:

5G-MAG	5G Media Action Group
ABR	Adaptive Bit Rate
CMAF	Common Media Application Format
CM	(DVB) Commercial Module
CM-I	(DVB) Commercial Module Internet (working group)
CM-SEG	(DVB) Commercial Module Security Experts Group
DVB-DASH	Digital Video Broadcasting - Dynamic Adaptive Streaming over HTTP
DVB-I	Digital Video Broadcasting – Internet
MBMS	Multimedia Broadcast Multicast Service
MPD	Media Presentation Description
OTT	Over-The-Top
TM	(DVB) Technical Module
VoD	Video on Demand

1 Introduction

1.1 Background

DVB completed a study mission on checking the relation of DVB-I to 5G [1].

This report and follow-up work included three scenarios:

- DVB-I services over "5G unicast"
- DVB-I services over "5G Broadcast"
- DVB-I services over "5G Fixed Wireless Access"

When starting this activity, 3GPP had completed or at least almost completed the work for Rel-16 work (5G Broadcast and 5G Media Streaming) on the above areas and has agreed to start new work in the context of 5G Media Streaming in two studies for Rel-17.

The initial timeline is reflected below.

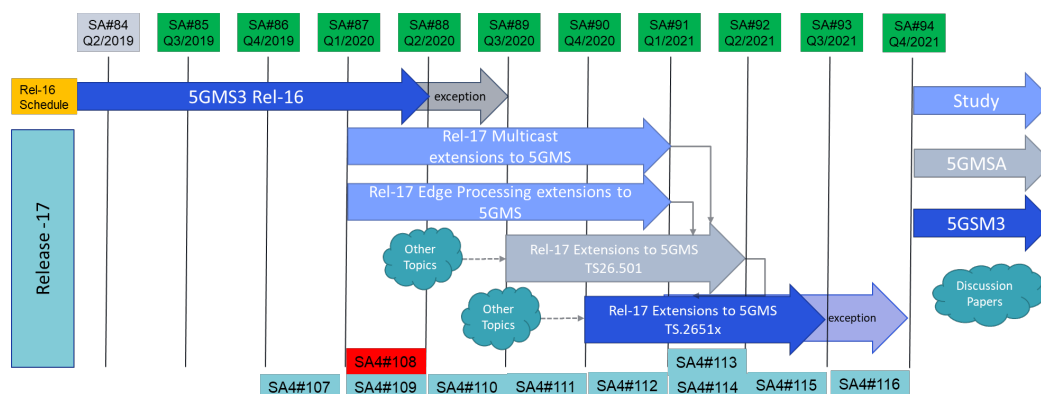


Figure 1: 3GPP estimated timelines

Meanwhile, the 3GPP timelines have been updated and the Rel-17 time schedule was relaxed, primarily due to the pandemic and the absence of f2f meetings.

The updated timeline in 3GPP is reflected in the course of this document.

This document addresses commercial requirements for specific use cases in the context of 5G-based delivery of DVB-I services.

1.2 Scope of this document

The scope of this document includes the following:

- (i) Collecting relevant use cases and commercial scenarios for usage of DVB-I as a service layer on top of 5G Rel-16 technologies taking into account:
 - a. The DVB 5G Study mission report [1] for scenario 1 and 2, in particular collaboration scenarios between DVB broadcasters and 5G network operators
 - b. Other relevant DVB work in this area, for example native IP, ABR multicast, Targeted Ad Insertion
 - c. Developments in the industry, for example convergence towards CMAF, etc.
- (ii) Identifying coverage of existing DVB specifications for the use cases and identify gaps that may have to be addressed in technical work.
- (iii) Documenting Commercial Requirements based on the identified use cases:
 - a. Focus on the 5G related use cases and delivery systems, but do not exclude non 5G delivery
 - b. Identify aspects related to service announcement and discovery, service delivery and service operation (including cases with multiple operators)
 - c. Identify the relevant 3GPP specifications that are expected to be referenced
 - d. Identify the relevant DVB specifications that are expected to be extended or newly developed by developing a reference architecture for relevant interfaces
- (iv) Identify early in the process potentially relevant V&V activities, e.g. reference tools
- (v) Develop a timeline for DVB technical work and V&V activities
- (vi) Monitor the relevant work in 3GPP and collaborate with 3GPP as necessary

(vii) Monitor the relevant work in 5G-MAG and collaborate with 5G-MAG as necessary

1.3 External influences

1.3.1 3GPP-related work

1.3.1.1 Introduction

This clause summarizes different 3GPP-related work that has influence on the development of the Commercial Requirements.

1.3.1.2 Rel-16 5G Media Streaming

3GPP has specified a system for **5G Media Streaming** that enables a mobile network operator to offer a level of service that goes beyond "best effort" over-the-top IP-based media streaming. 5G Media Streaming services offered by a **5GMS System** are provisioned by a third-party actor referred to as the **5GMS Application Provider** for use by an application running on the User Equipment (UE) referred to as a **5GMS-Aware Application**. The reference architecture and basic functional procedures are defined in TS 26.501 [3] and the detailed protocols are specified in TS 26.512 [4]. The baseline video codecs and packaging standards that compliant UEs must support as a minimum are specified in TS 26.511 [5].

In 3GPP Release 16, the scope of these specifications is restricted to **unicast media streaming** only. A **Content Hosting** capability is defined that resembles a Content Delivery Network (CDN). Later releases may add support for more complex media hosting and manipulation features. Ongoing Release 17 studies and normative work seek to add **multicast/broadcast** distribution mechanisms to the 5G System as well as **edge computing** capabilities.

The following high-level features are specified for 5G Media Streaming in Release 16. Each feature is optional and only available to a 5GMS-Aware Application if explicitly provisioned by a 5GMS Application Provider:

1. **Content Hosting.** This may be deployed inside the 5G Core network in the form of an Operator CDN. Alternatively, an external third-party CDN may be integrated into the 5G Media Streaming system.
2. **Media Consumption Reporting.** A random subset of 5GMS Clients can be configured to periodically report media session usage information to the 5GMS System.
3. **QoE Metrics Reporting.** A random subset of 5GMS Clients can be configured to periodically report Quality of Experience metrics to the 5GMS System. These may be relayed to the 5GMS Application Provider.
4. **Dynamic Network QoS Policies.** Specific network QoS policies are provisioned in advance, expressed as **Policy Templates**. During streaming sessions these Policy Templates can then be instantiated on demand by individual 5GMS Clients. The 5GMS Application Function negotiates with the Policy and Charging Function (PCF) in the 5G Core to apply the requested QoS policy to the relevant 5GMS packet flow.
5. **Network Assistance.** Two forms of assistance are currently defined. Neither requires any special configuration at the provisioning stage.
 - The 5GMS Client can interrogate the network to find out what downlink network capacity is currently available to it. This can be used to influence the Media Player's choice of media representations to best ensure an uninterrupted streaming experience.
 - The 5GMS Client can request a temporary "boost" to its network Quality of Service, for example to speed up a background download (network resources permitting).

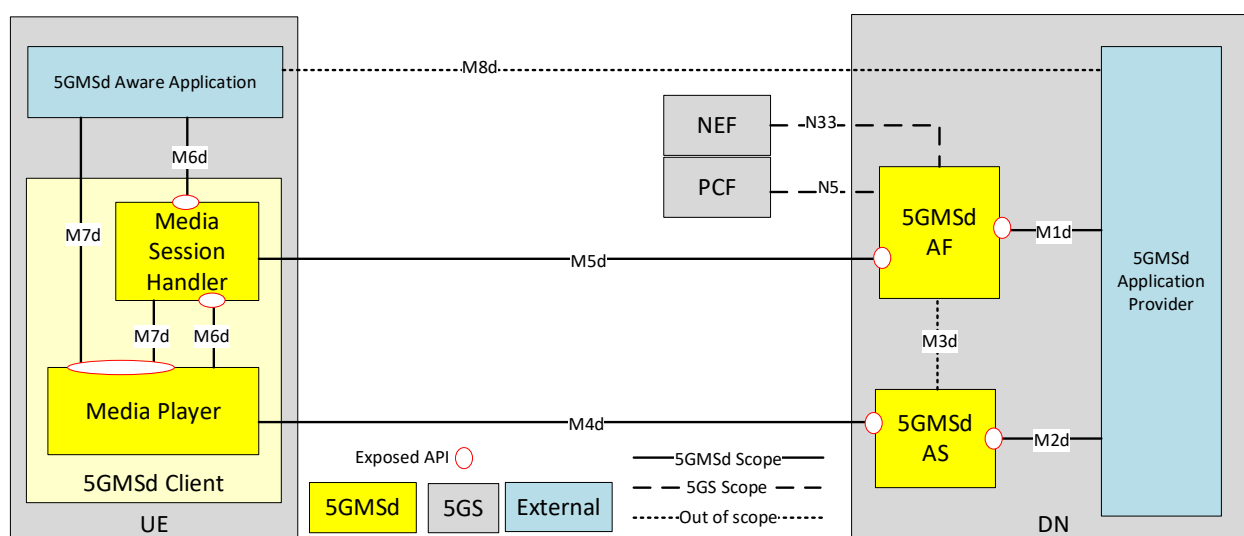
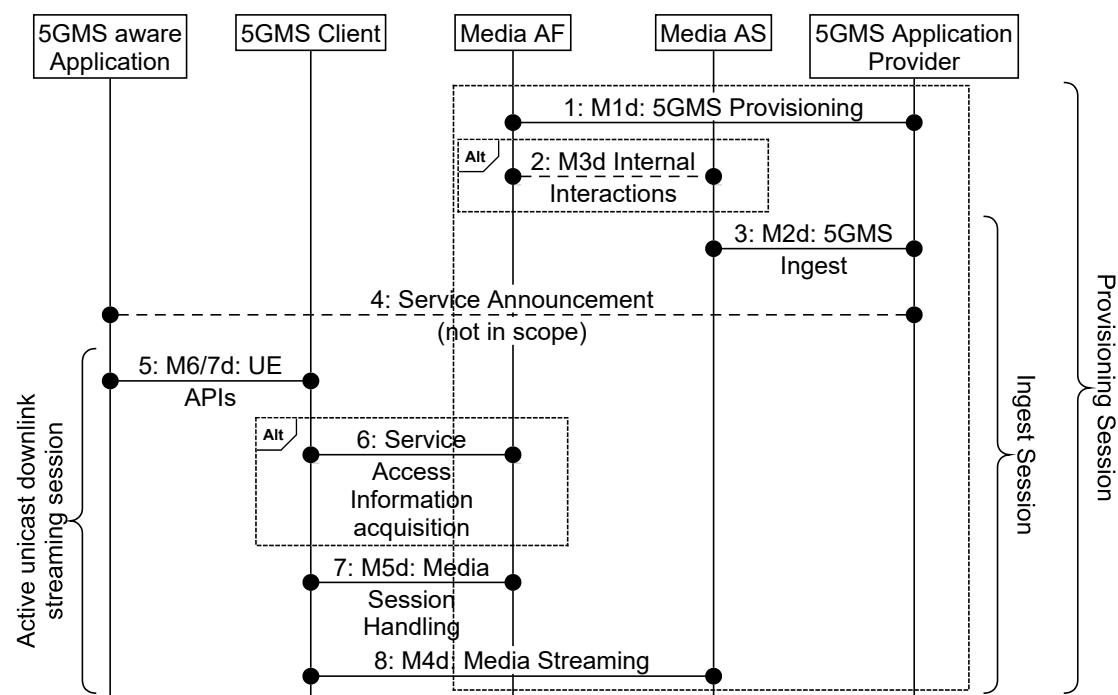


Figure 2: Reference architecture for 5G Media Downlink Streaming (see TS 26.501 [3])

The reference architecture for 5G Media Streaming as shown in Figure 2 defines the following functions to support the abovementioned features:

- A **5GMS Application Function** deployed in the 5G Core or in an External Data Network that manages a 5GMS System. This logical function embodies the control plane aspects of the system, such as provisioning, configuration and reporting:
 - A 5GMS Application Provider provisions 5GMS functions using a RESTful HTTP-based provisioning interface at reference point **M1**.
 - Another RESTful HTTP-based configuration and reporting interface is exposed to 5GMS Clients at reference point **M5**.
- A **5GMS Application Server** deployed in the 5G Core or in an External Data Network that provides 5G Media Streaming services to 5GMS Clients. This logical function embodies the data plane aspects of the system that deal with media content:
 - Content is ingested from 5GMS Application Providers at reference point **M2**. Both push- and pull-based ingest methods are supported, based on HTTP.
 - Content is distributed to 5GMS Clients at reference point **M4** (after possible manipulation by the 5GMS Application Server function). Standard pull-based content retrieval protocols (e.g. DASH) are supported at this reference point.
- A **5GMS Client** deployed in the UE that consumes 5G Media Streaming services. The 3GPP specifications are silent on whether this logical function is realised as shared UE middleware components or provided piecemeal by individual applications.
 - A **Media Session Handler** subcomponent first retrieves its configuration ("Service Access Information") from the 5GMS Application Function at reference point **M5** and then uses this configuration information to activate and exploit the currently provisioned 5GMS features. The 5GMS-Aware Application controls the Media Session Handler via a UE-internal API defined at reference point **M6**. This reference point could, for example, be realised as a Javascript API in a web browser.
 - A **Media Player** subcomponent consumes media from the 5GMS Application Server at reference point **M4**. The 5GMS-Aware Application controls the Media Player via a UE-internal API defined at reference point **M7**. This reference point could also be realised as a Javascript API in a web browser, for example.

The basic procedures for 5G Media Streaming are shown in Figure 3.



<http://msc-generator.sourceforge.net> v6.3.7

Figure 3: Basic procedures for 5G Media Downlink Streaming (see TS 26.501 [3])

According to TS 26.501 [3], Downlink Media Streaming provides the ability for content to be distributed using procedures and protocols defined by 5G Media Streaming as shown in Figure Z. The detailed procedures for the interfaces and APIs for 5G Media Streaming are defined in TS 26.512 [4].

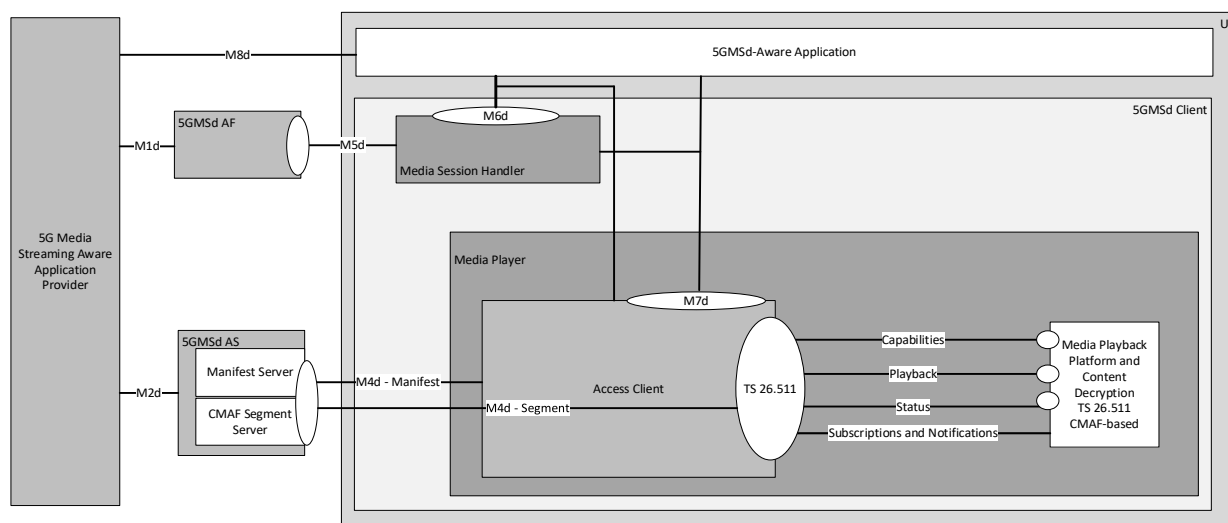


Figure 4: Media Playback in 5G Media Downlink Streaming Architecture (see TS 26.511 [5])

5G Media Streaming segment formats are defined based on the Common Media Application Format (CMAF) in ISO/IEC 23000-19 [6]. By using this format, 5G Media Streaming is compatible with a broad set of segment-based streaming protocols including Dynamic Streaming over HTTP (DASH) and HTTP Live Streaming (HLS). For example, ISO/IEC 23009-1 [7] defines a detailed DASH profile for delivering CMAF content within a DASH Media Presentation using a converged format for segmented media content.

5GMS media profiles for video, audio and subtitles based on the general constraints of ISO/IEC 23000-19 [6] are defined in TS 26.511 [5]. However, 5G Downlink Media Streaming is not restricted to the media profiles defined in [5]. Any CMAF media profile, for example for codecs defined in DVB specifications, may be used and distributed within 5G Downlink Media Streaming.

1.3.1.3 Rel-16 LTE-based 5G broadcast

3GPP since Release-14 addressed the vertical of providing TV and radio services taking into account the use cases and requirements formulated by broadcasters. Multimedia Broadcast Multicast Services (MBMS) had been part of 3GPP specification since Release-6 in 2005 based on UTRAN and since Release-9 based on LTE (the evolution to LTE is also referred to as "eMBMS"), the dedicated requirements of Broadcast service providers had only been taken into account since Release-14 around 10 years later. With the development of 5G from Release-15 onwards, 3GPP formulated requirements for the system and radio access technology (RAT) as part of the initial Release for 5G, namely Release-15.

In particular, broadcast is addressed in clause 6.13 of 3GPP TS 22.261. Whereas the requirements are generic for a flexible broadcast/multicast system, only a subset of the requirements apply to broadcasting linear TV and radio services, in particular those for 5G dedicated broadcast networks. During Rel-16, 3GPP extended eMBMS to address the requirements for 5G Broadcast. The work is summarized in 3GPP TS 36.976 "Overall description of LTE-based 5G broadcast". This work provides the foundation of the work in ETSI JTC Broadcast in TS 103 720. For more details refer to section 2.3.

1.3.1.4 Rel-17 Work on 5GMS_Multicast (Rel-17 Study)

Objective: The goal of this study item is to identify and evaluate potential enhancements to the 5G Media Streaming Architecture to provide multicast-broadcast media streaming services.

WID: SP-200055

Output: [TR 26.802](#) 5G Multimedia Streaming (5GMS); Multicast architecture

Timeline: 06/2021

The Technical Report was completed in May 2021 and sent for SA approval. Along with the report, a proposed new work item was provided.

1.3.1.5 Rel-17 5GVideo (Feasibility Study on 5G Video Codec Characteristics)

Objective: primarily to identify relevant interoperability requirements, performance characteristics and implementation constraints of video codecs in 5G services, and to characterize existing 3GPP video codecs, in particular H.264/AVC and H.265/HEVC in order to have a benchmark for the addition of potential future video codecs.

WID: SP-200052

Output: New [TR 26.955](#) 5G Video Codec Characteristics

Timeline: 12/2021

The work item schedule was extended in May 2021 and work item was updated.

1.3.1.6 Rel-17 5G media streaming extensions (FS_5GMS-EXT)

The objective of this study is in the context of the following potential improvements and extensions to 5G Media streaming: Content Preparation, Traffic Identification, Additional / New transport protocols, Uplink media streaming, Background traffic, Content Aware Streaming, Network Event usage, Per-application-authorization, Support for encrypted and high-value content, Scalable distribution of unicast Live Services.

WID: [SP-200937](#)

Output: New [TR 26.804](#) 5G Media Streaming Extensions

Timeline: 09/2021

1.3.1.7 OpenAPI and YAML

3GPP MCC has set up a Git repository on a web-hosted platform called 3GPP Forge. The repository element is based on a private instance of GitLab. This provides a fancy front-end for exploring Git source code repositories.

- As a member of the public, I can browse the 3GPP Forge repositories without needing to log in. I can clone any branch (e.g. the Rel-16 branch) of a repository (e.g. the 5G API repository) and start developing code against the interface definitions I have downloaded.
- As a 3GPP participant, I can log in the the 3GPP Forge platform using my ETSI Online credentials and request read/write access to a repository. I can then create new branches of the repository (e.g. to develop a Change Request), commit changes to my branch and then push the commits on my branch back to 3GPP Forge. I can also request that my branch is merged into a superior branch as as result of a Change Request approval.
 - (The traditional form-based Change Request process operates in parallel with this to make updates to the paper specification. Where the paper specification carries a copy of some Forge-hosted asset, such as an OpenAPI interface definition file, the paper specification is considered definitive. In this case, the Change Request form sent to TSG Plenary meeting for approval references a commit ID or tag in the 3GPP Forge repository and the MCC Technical Officer is responsible for ensuring that the two agree.)

For example, the repository of all 5G APIs can be found here:

https://forge.3gpp.org/rep/all/5G_APIs

This represents the default branch of the repository (also known as the "master" branch) and includes approved changes contributing to the current 3GPP release (Release 17 at the time of writing).

Older releases are represented in the repository by a different branch. For example, the current snapshot of Release 16 (including all TSG-approved essential Change Requests to Release 16 specifications after the API freeze date) can be found here:

https://forge.3gpp.org/rep/all/5G_APIs/tree/REL-16

Specifically of interest here, the APIs for Rel-16 5G Media Streaming will hopefully be merged into that branch after approval at the forthcoming SA#91-e Plenary meeting.

Some additional tooling has been made available on the 3GPP Forge platform to improve the quality and accuracy of deliverables.

1.3.2 5G-MAG

5G-MAG is a cross-industry association and a collaborative framework to foster the deployment of 5G solutions for the benefit of the media industry. Content production and content distribution are both in the scope of 5G-MAG, with a specific focus on the use cases, commercial and business models, technical solutions offered by 3GPP, equipment and device capabilities, and regulatory aspects for their deployment and implementation. In the domain of media distribution, 5G-MAG is assessing solutions relevant for the delivery of linear and non-linear audio–visual content including, but not limited to, LTE-based 5G Broadcast, 5G Multicast/Broadcast, Media Streaming, 5G satellite backhaul and access, edge caching or Fixed Wireless Access. The distribution of content to mobile devices equipped with 3GPP technologies, where traditional broadcast technologies are not supported, is the primary target alongside the improvement in terms of coverage, scalability, distribution cost, reach or personalisation of the media applications offered to consumers. 5G-MAG aims to assess the benefits, impacts and challenges of the adoption of 5G technologies across the entire media distribution value chain and to position the media industry as a key vertical for the future development of 3GPP technologies and the 5G ecosystem.

Today 5G-MAG consists of 40 members representing relevant stakeholders in the broadcast and telecommunication industry. The current activities are in four working groups:

WG1: 5G for Content Distribution

This group defines potential use cases and related requirements for the distribution of media content using 5G technologies. This includes examining the key 5G technologies emerging from standardization bodies and determining how and if they may support the use cases, including any deficiencies or gaps. Furthermore, the group will investigate 5G deployment models, including the role of cellular, terrestrial broadcast and satellite. WG1 also identifies technical features of required equipment to enable the use cases, such as network equipment and user devices, including chipsets.

WG2: 5G for Content Production and Contribution

The focus of WG2 is to identify 5G opportunities for Content Production and Contribution by defining use cases and the associated requirements. To do this, key 5G technologies emerging from standardization bodies need to be compared to the required technical functionalities, and the overall network architecture applicable to the defined use cases. WG2 will also assess the market size together with the economic and business impact across the media value chain.

WG3: Regulation, Policy and Spectrum

WG3 is established to advise 5G MAG on regulatory policy and spectrum matters as they relate to the 5G-MAG objectives. This includes to monitor, analyse, and advise on the regulatory and spectrum issues impacting on the deployment of 5G technology and services together with influencing the associated regulatory and spectrum allocation decisions. 5G MAG members will be updated by regular reports on 5G spectrum management and regulatory topics.

WG4: Promotion, Liaisons, and Dissemination

WG4 is responsible for promotion and external communication of the 5G-MAG Association. The group develops and maintains the Promotion and Communication Strategy; manages the involvement of 5G-MAG in relevant events; and establishes relations with key telecommunications operators, media organizations, professional associations, regulators, SDOs and policy makers.

For details please refer to <https://www.5g-mag.com/>

In 2021, 5G-MAG became a market representation partner in 3GPP: <https://www.3gpp.org/about-3gpp/partners>.

In addition, 5G-MAG is about to launch an open source reference tool implementation for 5G Broadcast and 5G Media Streaming receivers. DVB is expected to explore synergies for its V&V efforts.

1.3.3 ETSI JTC Broadcast

While Multimedia Broadcast Multicast Services (MBMS) had been part of 3GPP specifications since Release 6 in 2005 based on UTRAN, and since Release 9 based on LTE (the evolution to LTE is also referred to as "eMBMS"), the dedicated requirements of broadcast service providers were only taken into account in Release 14 some ten years later. Based on these requirements, 3GPP specifications have gradually evolved to meet the use cases and requirements in order to support broadcasting of linear television and radio services. In particular, the following aspects are addressed.

- Support of Free-to-Air (FTA) service.
- Broadcast-only service for UEs without an MNO broadcast subscription.
- Support of shared network functions across multiple 5G network operators.
- Decoupling of content, user service and transport functions.
- Exposure of broadcast service and transport capabilities to third parties.
- Support for client APIs for simplified access to broadcast services.
- Network dedicated to linear television and radio broadcast, for example transmitted using supplemental downlink channels and spectrum.
- Single Frequency Network (SFN) deployments with Inter-Site Distance (ISD) significantly larger than those associated with typical cellular deployments, with $ISD > 100$ km to support receivers with high-gain rooftop directional antennas, low mobility and a predominantly line-of-sight channel.
- Support for mobility scenarios including speeds of up to 250 km/h to support receivers in moving vehicles, with external omni-directional antennas.
- Support for Receive-Only Mode (ROM) services and devices.
- Support for user service announcement through broadcast.
- Support for common streaming distribution formats such as Dynamic Adaptive Streaming over HTTP (DASH), HTTP Live Streaming (HLS) and Common Media Application Format (CMAF).
- Support for IP-based services such as IPTV or ABR multicast.
- Support for different file delivery services such as scheduled delivery or file carousels.

Several 3GPP specifications have been extended or newly developed over several releases to address the use cases and requirements for 5G dedicated broadcast networks. ETSI TS 103 720 [8] summarizes the basic features of a 5G Broadcast System for the carriage of linear television and radio services, and documents these as an implementation

profile of a subset of 3GPP specifications. The LTE-based 5G Broadcast System is an instantiation of a 5G Broadcast System addressing the basic features documented in clause that is based on a profile of 3GPP specifications available in Release 16.

Figure 5 depicts the reference architecture for the LTE-based 5G Broadcast System as defined in TS 103 720 [8].

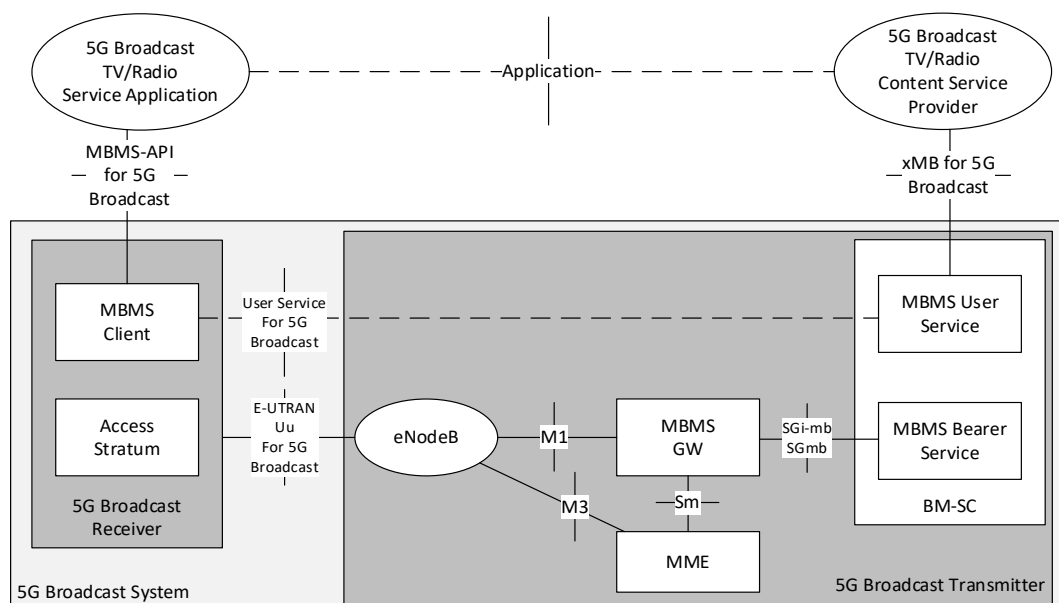


Figure 5: Reference architecture for 5G Broadcast System for linear TV and radio services with LTE-based 5G Broadcast instantiation (see TS 103 720 [8])

According to Figure 5, the reference points and protocols for the LTE-based 5G Broadcast System instantiation are:

- For the northbound Network API for 5G Broadcast, a profile of xMB as defined in ETSI TS 126 348 [13] and ETSI TS 129 116 [14] is defined in clause 5.5.2 of TS 103 720.
- For the User Service for 5G Broadcast, a profile of the MBMS User Service as defined in ETSI TS 123 246 [10] and ETSI TS 126 346 [11] is specified in clause 5.5.3 of TS 103 720;
- For the RAN for 5G Broadcast, For the RAN for 5G Broadcast, a profile of E-UTRAN Uu as defined in ETSI TS 136 300 [16], ETSI TS 136 211 [15] and ETSI TS 36 331 is specified in clause 5.5.4 of TS 103 720;
- For the Client API for 5G Broadcast, a profile of the MBMS-APIs as defined in ETSI TS 126 347 [12] is specified in the present document in clause 5.5.5 of TS 103 720;

While the specification focusses on broadcast-only distribution, a richer application service may be provided to a UE that also supports unicast. This is shown in Figure 6.

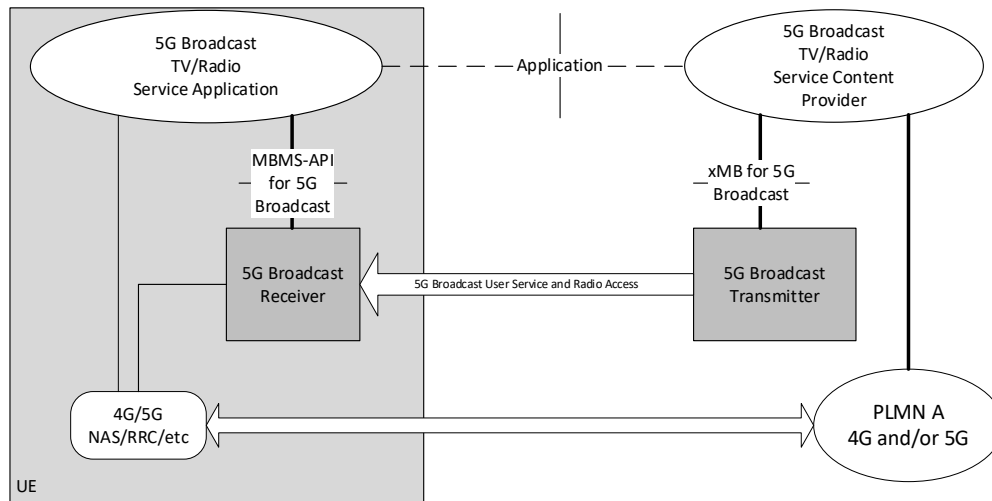


Figure 6: Application service using both 5G Broadcast and unicast (see TS 103 720 [8])

In one embodiment of the above system, the Content Provider provides information through xMB that File or Segment Streaming content is also available for unicast retrieval. For details, see ETSI TS 126 348. In this case the 5G Broadcast Transmitter provides the corresponding information in the User Service Description such that 5G Broadcast Receivers capable of using unicast can retrieve unicast components. This can, for example, be done for file repair procedures or service continuity in DASH or HLS.

In other embodiments, the 5G Broadcast TV/Radio Application itself makes use of unicast to provide an improved service. Examples for this may be in the context of HbbTV® or DVB-I Service information. This may, for example, include an Electronic Program Guide (EPG) or an Electronic Service Guide (ESG).

The specification ETSI TS 103 720 was approved in December 2020 and is available here: [TS 103 720](#).

1.3.4 5G Automotive Association (5GAA)

The 5GAA has developed numerous use cases [18] for in vehicle services including three scenarios relating to In Vehicle Entertainment including High-Definition Content Delivery in high-end vehicles, low-end end vehicles and passenger bus vehicles. In addition to the service expectations, these use cases identify the expected density and velocity of use while also considering the experience for multiple passengers. The use cases consider scenarios of up to four simultaneous 8k content sessions in the high-end scenario and two 4k content sessions in the low-end scenario while the bus scenario is expected to provide HD content services for up to 30 passengers.

1.4 Relevant existing work in DVB

Other relevant DVB work in this area, for example native IP, ABR multicast, Targeted Ad Insertion. During the course of the work, the activities in different DVB working groups had been monitored. Of particular interest are:

- Technical Working Groups
 - o TM-I on DVB-I Service Layer
 - o TM-STREAM on DVB-DASH
 - o TM-MCAST on ABR multicast
 - o TM-NIP on Native IP – an initial presentation on draft CRs was presented to the colleagues.
- Commercial Working groups
 - o CM-AVC work on new codecs
 - o General developments in CM-I

1.5 Selected guiding use cases

The commercial requirements in the document had been developed based on use cases provided by DVB members. The use cases are collected in clause 6 as an Annex to these commercial requirements. The six guiding use cases are:

- Use case 1: DVB-I over 5G Media Streaming
- Use case 2: 5G Broadcast/Unicast hybrid delivery to handheld devices
- Use Case 3: 5G Broadcast standalone with Unicast for EPG
- Use Case 4: 5G Fixed Wireless Access
- Use case 5: DVB-I Services to vehicle infotainment systems over 5G
- Use Case 6: DVB-I Hybrid Service over 5G

Based on these use cases, use case specific commercial requirements were extracted. These extracted commercial requirements had then been used to consolidate the main commercial requirements in section 3 of this document. The commercial requirements are linked with the use cases which may provide additional background on commercial requirements.

1.6 Companies supporting the development of the CRs

	Supporting Member	Contact Person
1	Qualcomm Incorporated	Thomas Stockhammer (Rapporteur of this document)
2	ATEME	Mickael Raulet
3	Harmonic	Patrick Gendron
4	Enensys	Cedric Thienot
5	InterDigital	Remi Houdaille
6	BT	Simon Jones
7	SynaMedia	Nick Fielibert
8	Samsung	Richard Moreton
9	EBU	Darko Ratkaj
10	ESA	Maria Guta
11	IRT	Rainer Schäfer
12	Orange	Julien Lemotheux

2 Commercial requirements

2.1 Terminology and Conventions

The commercial requirements are tagged using the following scheme.

Req x. [y].z.	Name	Status	Priority	Use case	CM-SEG relevant
Numeric requirement ref. x = section y = subsection(s) z = sequence number This is a unique id within the document that could be used to refer to a requirement within a specific version of this document. Note that this id. is not strictly coupled to the particular requirement, could vary across different versions of this document		This status field can have the following states: Agreed	This field is the associated priority set by the commercial module to the requirement. 1→ Must have 2→ Recommended to have 3→ Nice to have	Identifies the use cases that relate to this commercial requirement, if applicable.	The CR needs to be reviewed by DVB's security experts group (CM-SEG) as it is security related.

In the present chapter, the following words are to be interpreted as described below.

- *Shall*: Mandatory requirement
- *Should*: Highly recommended requirement
- *May*: Desirable but less important requirement
- ⓘ: Explanation or rationale for a requirement (informative)

NOTE: As always done in DVB, the Technical Module should consider existing (DVB) specifications where appropriate.

2.2 General Requirements

Req 2.2.1	Self-Contained DVB-I services over 5G Broadcast	Accepted	1	UC6-1
DVB shall provide specifications to enable self-contained DVB-I Services to be delivered over a 5G Broadcast System as defined in ETSI TS 103 720 [9].				

Req 2.2.2	Self-Contained DVB-I services over 5G Media Streaming	Accepted	1	UC6-2
DVB shall provide specifications to enable self-contained DVB-I Services over a 5G Media Streaming System as defined in TS 26.501 [3].				

Req 2.2.3	Self-Contained DVB-I services over 5G Broadcast and 5G Media Streaming at the same time	Accepted	1	UC6-3
<p>DVB shall provide specifications to enable a basic DVB-I service to be delivered over regular unicast and 5G Broadcast and 5G Media Streaming at the same time as independent service instances. Service instances may be provided with different quality (e.g., bit rate, end-to-end latency, channel switch times, etc.).</p> <p>① NOTE: Hybrid operation is not required.</p>				

Req 2.2.4	Hybrid DVB-I Service using 5G Delivery Networks	Accepted	2	UC6-4
<p>DVB shall provide specifications to enable hybrid DVB-I services using 5G Delivery Networks, defined as</p> <ol style="list-style-type: none"> the DVB-I service is described in a DVB-I service list a basic DVB-I service is distributed via 5G Broadcast the service is augmented by ordinary unicast or 5G Media Streaming <p>① This CR is supported by more detailed specific requirements in the remainder of this document.</p>				

Req 2.2.5	Reuse of DVB technologies	Accepted	1	n/a
<p>The DVB-I over 5G System should be supported by reusing existing DVB technologies wherever appropriate.</p>				

Req 2.2.6	Layered Approach and Commonality	Accepted	1	n/a
<p>The DVB-I over 5G System should be based on a layered approach in DVB-I, such that functionalities are predominantly access independent and common with other DVB delivery means and are only enhanced for the specific 5G Delivery Networks.</p>				

2.3 Service Provisioning Requirements

Req 2.3.1	Basic Service Provisioning	Accepted	1	UC6-1 UC6-2 UC6-3
<p>DVB shall provide specifications to enable provisioning of:</p> <ul style="list-style-type: none"> Self-contained DVB-I Services delivered over 5G Broadcast as defined in ETSI TS 103 720 [9]. Self-contained DVB-I Services delivered over 5G Media Streaming as defined in 3GPP TS 26.501 [3]. Independent instances of the same DVB-I service delivered over regular unicast and 5G Broadcast and 5G Media Streaming at the same time. 				

Req 2.3.2	DVB-DASH Service over different networks	Accepted	2	UC2-4 UC5-6
<p>DVB specifications shall enable the provisioning of DVB-DASH-based DVB-I services such that:</p> <ul style="list-style-type: none"> Simultaneous carriage of service instances over different 5G Delivery Networks is possible. Sufficient temporal alignment in time of service instances carried over different 5G Delivery Networks and other delivery networks is possible. Switching between service instances can be perceived as reasonably seamless. <p>① Sufficient information is provided for the client to decide if the switch is seamless or at least possible within reasonable seamless boundaries.</p>				

Req 2.3.3	DVB-I Content Identification	Accepted	2	UC1-6
<p>DVB specifications shall provide the means to identify DVB-I content services as a preferential service for example to support:</p> <ol style="list-style-type: none"> 1. Improved and consistent media streaming Quality of Experience (for example including bitrates, spatial and temporal resolution). 2. Appropriately matched to display and rendering capabilities. 3. Zero-rated data. <p>① NOTE: This may be used by a network operator.</p>				

2.4 Service Announcement and Detection Requirements

Req 2.4.1	Announcement of DVB-I services via 5G Media Streaming	Accepted	1	UC1-1
<p>DVB specifications shall support the announcement of DVB-I services via 5G Media Streaming.</p>				

Req 2.4.2	Entry Point Provisioning	Accepted	1	UC3-1
<p>The DVB-I over 5G System shall be able to provide an entry point (in the form of a reference to a DVB-I service list registry) to announce DVB-I services over a 5G Broadcast System.</p> <p>① A DVB specification would provide the means to achieve this, if available.</p>				

Req 2.4.3	Announcement of DVB-I service lists via 5G Broadcast	Accepted	1	UC3-2 UC5-1
<p>The DVB-I over 5G System shall be able to announce in a 5G Broadcast signal the location of one or more DVB-I service lists.</p>				

Req 2.4.4	Announcement of DVB-I services via 5G Broadcast	Accepted	1	UC5-2
<p>The DVB-I over 5G System shall be able to embed the DVB-I service list in a 5G Broadcast signal.</p>				

Req 2.4.5	Announcement of DVB-I service updates via 5G Broadcast	Accepted	1	UC5-2
<p>The DVB-I over 5G System shall be able to provide an updated DVB-I service list in a 5G Broadcast signal.</p>				

Req 2.4.6	Updating service information	Accepted	1	UC4-3 UC4-9
<p>The DVB-I specification shall include a mechanism to indicate that information about a service has changed.</p>				

Req 2.4.7	Signalling of 5G Broadcast Service Instance	Accepted	1	UC2-1 UC5-3 UC6-4a
<p>The DVB-I Service List shall define a service instance type for services delivered using a 5G Broadcast System.</p>				

Req 2.4.8	Signalling of 5G Media Streaming Service Instance	Accepted	1	UC2-1 UC5-3 UC6-4a
The DVB-I Service List shall define a service instance type for services delivered using a 5G Media Streaming System.				

Req 2.4.9	Disambiguation of DVB-I Service instances	Accepted	1	UC2-2
DVB specifications shall allow the disambiguation of editorially identical DVB-I service instances delivered over different delivery networks (including 5G Delivery Networks) from a Service Instance delivered via OTT unicast.				

Req 2.4.10	Service Identification	Accepted	1	UC2-3
DVB specifications shall allow a DVB-I client to unambiguously identify a specific DVB-I editorial service (i.e., a service which carries specific editorial content) received over 5G Broadcast or 5G Media Streaming based on radio layer access parameters (e.g., frequency + TMGI/service identifier for 5G Broadcast), in a similar way as can be done on DVB broadcast networks (i.e., DVB triplet, orbital position/frequency, etc.).				

Req 2.4.11	DVB-I over 5G Service Instances	Accepted	1	UC6-4c(ii)
The DVB-I service list shall permit service instances of the same service for 5G Broadcast, 5G Media Streaming and OTT unicast in order of the client to select the service according to its capabilities.				

Req 2.4.12	Service instance discrimination	Accepted	2	UC4-2
The DVB-I specification shall provide information for 5G service instance to allow a client or gateway to select the best delivery mode.				
① The nature of 'best' needs to be commercially determined.				

Req 2.4.13	DVB-I Service Instance Priority	Accepted	2	UC6-4c(ii)
The DVB-I service list shall permit service instances of the same service to indicate relative priority in order to influence client selection behaviour.				

Req 2.4.14	Seamless switching between DVB-I Service Instances	Accepted	2	UC2-4 UC5-6
In case of DVB-I services based on DASH, DVB-I specifications shall specify signalling that enable the possibility for a client to switch seamlessly (i.e. without any disturbance to the video or audio such that the viewer does not notice the transition, as defined in ETSI TS 103 285 clause 10.4) or nearly-seamlessly (e.g., with time alignment within one segment) between different service instances of the same DVB-I service.				
① The way the A/V streams need to be prepared to ensure such switching is out of scope of this document.				

Req 2.4.15	Signalling of Free-To-Air service	Accepted	1	UC2-5	CM-SEG
DVB specifications shall support signalling of Free-To-Air (FTA) DVB-I service instances delivered over a 5G Broadcast System.					

Req 2.4.16	Signalling of Receive-Only Mode service	Accepted	1	UC2-5
DVB specifications shall enable signalling of Receive Only Mode (ROM) for DVB-I service instances delivered over a 5G Broadcast System.				

Req 2.4.17	Content Guide for 5G Broadcast services	Accepted	1	UC3-3
The DVB-I over 5G System shall be able to announce in the 5G Broadcast signal the location of Content Guide endpoints.				
Req 2.4.18	Aggregation of DVB-I services from different providers	Accepted	1	UC4-8 UC4-9
The DVB-I specification shall not prevent the possibility for a DVB-I Service List Server to aggregate DVB-I services from different DVB-I content providers in a combined DVB-I service list.				
Req 2.4.19	Authentication of discovery information	Accepted	1	UC4-10 CM-SEG
The DVB-I client shall be able to authenticate the source of DVB-I service discovery information, both during initial installation and when information is updated.				
Req 2.4.20	Representation selection based on device characteristics	Accepted	2	UC4-13a
The DVB specifications should allow the possibility for a DVB-I capable 5G gateway to select Representations to be offered to the client depending on the characteristics of the connected devices.				
Req 2.4.21	Representation selection based on network-to-gateway delivery mode	Accepted	2	UC4-13b
The DVB specifications should allow the possibility the DVB-I capable 5G gateway to select the representations to be offered to the client depending on the network-to-gateway delivery mode.				
Req 2.4.22	Parity of Parental Access Control service metadata	Accepted	1	UC4-18
The DVB-I service discovery specification should allow the DVB-I client on a 5G device to select programs based on the configured parental control settings of the device (i.e. for example provided by the operating system).				
Req 2.4.23	Parity of Accessibility metadata	Accepted	1	UC4-18
The DVB-I service discovery specification should allow the DVB-I client on a 5G device to select programs based on the configured accessibility settings of the device (i.e. for example provided by the operating system).				
Req 2.4.24	Regional content targeting	Accepted	2	UC6-4c(iv)
The DVB specification shall provide the possibility to provide regionally targeted content for services that are delivered with 5G Media Services based on the location of the 5G devices.				
Req 2.4.25	Controlling Apps for 5G services	Accepted	2	UC6-4c(xiv)
It should be possible to provide service-related applications that can be used to control the playback of services delivered using the DVB-I over 5G System.				
① The specifications should not significantly diverge from the solution today which provides apps for traditional broadcast services.				

Req 2.4.26	Supporting Apps for 5G services	Accepted	2	UC6-4c(xiv)
<p>It should be possible to provide service-related applications that can be used in conjunction with the playback of services delivered with 5G</p> <p>① The specifications should not significantly diverge from the solution today which provides apps for traditional broadcast services.</p>				

2.5 Service Component Requirements

Req 2.5.1	DVB-I Content Identification	Accepted	1	UC3-4
<p>The content guide entry points shall provide equal functionality to that defined in ETSI TS 103 770 [21].</p>				

Req 2.5.2	DVB-I Service Instances for vehicular consumption environments	Accepted	2	UC5-8
<p>The DVB-I specification shall provide sufficient signalling such that the DVB-I client is able to determine which DVB-I service instances or DVB-I service components are more suited to a vehicle's infotainment system and its current consumption environment.</p>				

Req 2.5.3	Encrypted service components	Accepted	1	UC6-4.c.vi	CM-SEG
<p>DVB-I specifications shall provide the means to identify service components in a 5G Broadcast System that are protected by encryption in order to obtain the relevant access information over unicast in a user-friendly manner.</p>					

Req 2.5.4	Provisioning 5G Broadcast service components over unicast	Accepted	2	UC6-4.c.xii
<p>DVB specifications shall provide the means to offer a basic service over a 5G Broadcast System for which certain components are only provided over a unicast-delivered signal (for example subtitles, or metadata).</p>				

Req 2.5.5	Component Replacement over unicast	Accepted	2	UC6-4.c.xii
<p>DVB specifications shall provide the means to offer a basic service over a 5G Broadcast System for which certain components are replaced by a unicast-delivered signal (for example an alternative language or an alternative view).</p>				

Req 2.5.6	Unicast content replacement	Accepted	1	UC6-4.c.iii
<p>DVB specifications shall provide the means to offer a basic service over a 5G Broadcast System for which unicast-based content and ad insertion/replacement (targeted to users, regions, etc.) is enabled and the client, depending on its capabilities, makes use of the unicast provisioned content.</p>				

Req 2.5.7	Enhancement of 5G Broadcast service over unicast	Accepted	2	UC6-4.c.xii
<p>DVB specifications shall provide the means to offer a basic service over a 5G Broadcast System for which certain components are augmented by a unicast-delivered signal (for example an enhancement layer).</p>				

Req 2.5.8	Timeshifted viewing	Accepted	2	UC6-4.c.xiii
<p>DVB specifications shall provide the means to offer a basic service over a 5G Broadcast System which is accessible over unicast for time-shifted viewing and permits near seamless transition between the live linear and timeshifted consumption modes.</p>				

Req 2.5.9	Fast start-up	Accepted	2	UC6-4.c.xii
DVB specifications shall provide the means to offer a basic service over a 5G Broadcast System with fast startup while maintaining efficient delivery, possibly using unicast delivery.				
① Different aspects may matter depending on device and service types				

2.6 Service Distribution and Delivery Requirements

Req 2.6.1	5G Media Streaming support	Accepted	1	UC1.2 UC5.4
DVB specifications shall support the distribution of DVB-I services via a 5G Media Streaming System.				

Req 2.6.2	5G Broadcast support	Accepted	1	UC5.4
DVB specifications shall support the distribution of DVB-I services via a 5G Broadcast System.				

Req 2.6.3	5G Media Streaming guidelines	Accepted	2	UC1.3.a UC1.3.d UC1.3.e
DVB specifications shall specify how to make use of 5G Media Streaming functionalities for DVB-I Services, in particular Content Hosting (geofencing included), Dynamic QoS Policies and Network Assistance.				
① The Consumption Reporting and QoE Reporting features of 5G Media Streaming are considered under S4 (Service Quality and Monitoring Requirements).				

Req 2.6.4	Secure transport	Accepted	1	UC1.4 UC4.16	CM-SEG
DVB specifications shall support the distribution of DVB-I services (both service information and content) using secure transport mechanisms.					

Req 2.6.5	Synchronization between different delivery networks	Accepted	2	UC2.4 UC4.4 UC6.4.c.i
DVB specifications shall enable the possibility to ensure proper time alignment in time of DVB-DASH-based DVB-I service instances carried over different delivery networks (including 5G Delivery Networks), so that switching between them can be perceived as reasonably seamless.				

Req 2.6.6	Free-To-Air support	Accepted	1	UC2.5	CM-SEG
DVB specifications shall support Free-To-Air (FTA) delivery of services over a 5G Broadcast System.					

Req 2.6.7	Receive-Only Mode support	Accepted	1	UC2.5
DVB specifications shall support Receive Only Mode (ROM) for the reception of services from a 5G Broadcast System.				

Req 2.6.8	Efficient conversion	Accepted	2	UC4.5 UC4.6
The DVB specification should allow conversion between broadcast/multicast and unicast streams to be storage- and CPU-efficient, to run on lower-cost 5G Gateway devices.				

Req 2.6.9	Conversion of encrypted content	Accepted	2	UC4.5 UC4.6	CM-SEG
The DVB-I specification shall not require content re-encryption or transcoding in the 5G Gateway.					

Req 2.6.10	Shared content resources	Accepted	2	UC4.12
DVB specifications shall not prevent the possibility to use the same content resources (media encoding and packaging) for delivery of a DVB-I service instance via a 5G System as are used in other DVB-I delivery networks.				

Req 2.6.11	Shared delivery protocols, components and interfaces	Accepted	1	UC4.14
DVB specifications should re-use as many as possible of the same delivery protocols, functional components and interfaces in 5G delivery networks as they are used in other DVB-I delivery networks (e.g. OTT unicast, MABR [20]...).				

Req 2.6.12	Content protection	Accepted	1	UC4.15	CM-SEG
DVB specifications shall enable re-use of DVB Content Protection on 5G Delivery Networks to protect the content in a DVB-I service from access by unauthorised parties all the way from the content source to the end device.					
① A suitable content protection mechanism would be needed (e.g. based on MPEG Common Encryption as specified in CMAF) together with one or multiple suitable DRM systems.					

Req 2.6.13	User experience comparable with DVB-C/S/T	Accepted	2	UC4.19 UC6.4.c.ix
The DVB-I specification shall support the distribution of a DVB-I service instance over 5G Delivery Networks with a user experience comparable with DVB-C/S/T in terms of latency (3.5 seconds) and channel change time (1 second).				
① Detailed requirements are provided in DVB LL-DASH CRs [22].				
① To fulfil this requirement, it may be needed that the client supports the LL-DASH specification.				

Req 2.6.14	Unicast-based error recovery	Accepted	3	UC6.4.c.xi
DVB should provide specifications to enable hybrid DVB-I services with unicast-based error recovery if reception on a primary 5G Broadcast System is lossy.				

2.7 Service Quality and Monitoring Requirements

Req 2.7.1	Service Monitoring Content Provider	Accepted	2	UC5-9
DVB specifications shall allow the Content Provider and the Service Provider to monitor the service quality by receiving QoE reporting and consumption reporting generated by the DVB-I client about the service along with information related to the consumption environment (including location subject to privacy) e.g. to improve their service offering.				

Req 2.7.2	Consumption Reporting	Accepted	2	UC1-3b
DVB specifications shall specify how to make use of the 5G Media Streaming functionality Consumption Reporting for DVB-I Services.				

Req 2.7.3	QoE Metrics Reporting	Accepted	2	UC1-3c
DVB specifications shall specify how to make use of the 5G Media Streaming functionality QoE Metrics Reporting for DVB-I Services.				
Req 2.7.4	Service Quality Monitoring	Accepted	2	UC1-7 UC5-10
DVB specifications shall allow the MNO to monitor the service quality by receiving QoE reports and consumption reports about the service for the purpose of improving network operations.				
① It is expected that such monitoring requires user agreement, but this is considered outside of the scope of DVB.				
Req 2.7.5	Delivery optimization	Accepted	2	UC4-1
The DVB-I over 5G System shall enable the MNO to select dynamically the best delivery mode (unicast or broadcast/multicast) according to demand of a DVB-I service on the unicast path based on an agreement with the DVB-I Service Provider.				
① Evaluation of the demand on the unicast path can be achieved for instance by periodic consumption reports from the DVB-I client, or else by measurement by the CDN serving point.				
Req 2.7.6	Collection and Reporting	Accepted	2	UC4-7
The DVB specification shall not prevent the collection and reporting of statistics relating to a DVB-I service by allowing DVB-I streams to be monitored at 5G Gateway devices in order to be able to choose the best delivery mode for each DVB-I service and supervise and possibly re-configure/optimize the network.				
① This is additional to DVB-I level Consumption Reporting and QoE Reporting.				
Req 2.7.7	5G Gateway Representation selection	Accepted	2	UC4-13c
The DVB-I over 5G System shall enable a DVB-I capable 5G Gateway device to select the representations to be delivered depending on network conditions.				
Req 2.7.8	Tamper Resistance	Accepted	1	UC4-17 CM-SEG
The DVB specification shall enable the possibility to detect that a DVB-I service (Service information or content) has been tampered with in transit by an unauthorised party or parties.				
Req 2.7.9	Location-dependent DVB-I service	Accepted	2	UC5-7
The DVB-I client shall be able to determine which DVB-I service instances may be received at its current time and location also taking into account mobility and hence changing locations.				
Req 2.7.10	Hybrid DVB-I Service with metrics reporting	Accepted	2	UC6-4c.vii
DVB shall provide specifications to enable hybrid DVB-I services with DVB-DASH metrics reporting.				
Req 2.7.12	Hybrid DVB-I Service with Consumption Reporting, Audience Measurement and Ad Tracking.	Accepted	2	UC6-4c.viii
DVB specification shall enable hybrid DVB-I services with Consumption Reporting, Audience Measurement and Ad Tracking.				
(i) It is expected that such reporting and tracking requires user agreement, but this is considered outside of the scope of DVB.				

2.8 Client-related Requirements

Req 2.8.1	DVB-I to different receivers	Accepted	1	UC1-5
DVB specifications shall support the distribution of DVB-I services via 5G Delivery Networks to serve 5G capable smartphones, but also other 5G capable devices, for example smartphones (when connected to a larger screen), streaming devices, in-car receivers, etc.				

Req 2.8.2	Single app	Accepted	1	UC1-8
DVB specifications shall not prevent service operation in which a single app on a 5G capable device can be used to receive all DVB-I services as an alternative to consuming DVB-I services in a separate app provided by each Service Provider.				

Req 2.8.3	Seamless switching across DVB-I service instances	Accepted	2	UC5-6
In the case of DVB-I services based on DASH, DVB specifications shall enable clients to switch between instances of the same DVB-I service, providing clients with sufficient information to determine whether the switch is likely to be seamless or at least possible within reasonable seamless boundaries.				

Req 2.8.4	Guidelines on service instance selection	Accepted	2	UC5-8
The DVB specification shall provide guidelines on how a DVB-I client may determine which DVB-I service instances or DVB-I service components are more suited to its current consumption environment.				

2.9 Timeline Requirements

Req 2.9.1	Target completion timeframe	Accepted	1	
The DVB specifications satisfying the set of Commercial Requirements listed under 2.2, 2.3, 2.4, 2.5, 2.6, 2.7 and 2.8 and <ul style="list-style-type: none"> • marked as priority 1 shall be completed by Q3/2022, • and those marked as priority 2 should be completed in the same time frame, if and only if time permits • and those marked as priority 3 may be completed in the same time frame, if and only if time permits. ① Earlier completion, for example by Q2/2022, is preferable.				

2.10 Industry Alignment Requirements

Req 2.10.1	Other organizations	Accepted	1	
The DVB specifications should align with industry practices, for example those developed in 3GPP, 5G-MAG or other organizations that indicate that they deploy 5G-based media distribution systems.				

2.11 V&V Requirements

Req 2.11.1	DVB-I Reference App	Accepted	1	
Relevant extensions for the DVB-I reference app shall be identified and developed in order to enable 5G-based media distribution.				

Req 2.11.2	DVB-I Reference Services	Accepted	1	
DVB-I reference services should be provided for testing distribution of DVB-I service over 5G Delivery Networks.				

Req 2.11.3	Collaboration	Accepted	1	
Collaborative efforts with other organizations such as 5G-MAG, 3GPP or DASH-IF should be initiated in order to support reference and interoperability efforts.				

3 Expected technical work

3.1 Impact on existing specifications or need for new ones

The CM proposes that this is addressed in a joint kickoff call with TM and once the detailed work plan for DVB-I over 5G is developed. CM-I 5G TF members are committed to support this work.

3.2 Companies committed to support Technical Work

The following DVB members indicated support and active participation for this work with the following committed individuals:

Company
Qualcomm
Deutsche Telekom
Synamedia
LG Electronics
HiSilicon
ATEME

Orange, BT and Interdigital expressed that they are pleased that this work goes ahead in TM but are currently not able to commit providing extended resources for TM work.

4 Items for consideration by other organisations

4.1 3GPP

It is proposed to engage with 3GPP in the following cases:

- Certain requirements cannot be fulfilled with existing 3GPP specifications.
- Bugs are identified in existing 3GPP specifications.
- To monitor the work beyond Rel-16 and harmonize technologies to the extent possible.

4.2 5G-MAG

It is proposed to engage with 5G-MAG:

- To address any open issues or unclarities with respect to ETSI TS 103 720.
- To identify synergies in particular for the development of reference tools for V&V.

5 Annex: Use Cases

5.1 Introduction

This annex collects use cases that are submitted for discussion in the Commercial requirements work. The use cases are agreed to serve as the baseline for developing the requirements. Each of the requirements was assigned to a cluster.

- S0 Service Provisioning Requirements
- S1 Service Announcement and Detection Requirements
- S2 Service Component Requirements
- S3 Service Distribution and Delivery Requirements
- S4 Service Quality and Monitoring Requirements
- S5 Client-related Requirements

Support means that the company sees value in DVB addressing the use case and the extracted requirements. Supports does not imply commitment to do work. This is covered in section 4.2.

5.2 Use case 1: DVB-I over 5G Media Streaming

Use Case Title	DVB-I over 5G Media Streaming (Unicast)
Submitter	Qualcomm Incorporated
Supporters	Orange, DT, BT, TIM
Description	<p>From a service provider perspective:</p> <ol style="list-style-type: none"> 1. A service provider offers a DVB-I service catalogue that includes live services, on-demand services and catch-up services. 2. The services may also be offered within an interactive framework provided by an app or by HbbTV functionalities. 3. The service provider may have a business agreement with an MNO such that, under certain policies, its content is treated differently than regular data content, for example it is zero-rated. 4. The service provider wants to use the following 5G Media Streaming features provided by MNOs, partially or as a whole, for its services, where available, including: <ol style="list-style-type: none"> a. Content Hosting (CDN), including geofencing, b. Consumption Reporting, c. QoE Metrics Reporting, d. Dynamic QoS Policies, e. Network Assistance. 5. The service provider wants to distribute media in common formats based on DVB-DASH/HLS and CMAF in order to support Android- and iOS-based devices. 6. The service provider may rely on HTTPS for delivery of the service. 7. The service provider primarily wants to serve smartphones, but also other devices, for example smartphones connected to a larger screens, streaming devices, in-car receivers, etc. <p>From a Mobile Network Operator (MNO) perspective:</p> <ol style="list-style-type: none"> 8. The MNO provides the DVB-I content service as a preferential service to its subscribers, for example: <ol style="list-style-type: none"> a. Improved and consistent media streaming Quality of Experience,

	<ul style="list-style-type: none"> b. Matched to display and rendering capabilities, c. Zero-rated data. <p>9. The MNO can monitor the service quality by receiving QoE reporting and consumption reporting about the service. The data can be used to improve the network operations.</p> <p>From a consumer perspective:</p> <p>10. The consumer can access DVB services universally at beneficial quality and cost.</p> <p>11. The consumer installs only a single app to receive DVB-I services.</p>
Pre-Conditions	<ul style="list-style-type: none"> • The service provider provides the service that is available independent of 5G Media Streaming, but 5G Media Streaming may be used as a service enhancement. • Two options exist: <ul style="list-style-type: none"> ○ Option 1: Telco Operator CDN <ul style="list-style-type: none"> ▪ The MNO provides interfaces and APIs according to the 5G Media Streaming architecture, in particular M1d for service provisioning and M2d for content ingest. ▪ The content provider uses the APIs at these interfaces. ○ Option 2: External CDN <ul style="list-style-type: none"> ▪ Content Hosting (“5GMSd Application Server”) is provided outside the Trusted Data Network by the content provider or by another third party CDN operator. ▪ The content provider simply exposes M4d (standard DASH) to the 5G System’s Trusted Data Network. ▪ The content provider uses Network Exposure Functions (NEF) ▪ M5d is used to communicate with the 5G System using and externally hosted 5GMS AF • The 5G User Equipment includes a 5GMSd Client including: <ul style="list-style-type: none"> ○ a Media Session Handler that supports client APIs according to M6d of TS 26.512 and at least a subset of functionalities from TS 26.512, ○ a Media Player that implements client APIs according to the M7d of TS 26.512 and allows playback of DASH content. • The inclusion of the 5GMSd Client may have different flavours: <ul style="list-style-type: none"> ○ The 5GMSd Client is available in the UE as a middleware component provided with the modem or as part of an OEM-customized engine. ○ Parts of a 5GMSd Client (in particular, the Media Access Engine) using the internal interface may also be provided as part of a downloadable app, whereas the Media Session Handler and the Media Playback Platform are UE resident. ○ Other models are possible using M6d and M7d and Media Playback Platform APIs. • The UE includes a DVB-I client that implements service discovery for DVB-I Services. • Logically from a 3GPP perspective, the DVB-I client is a 5GMS-Aware Application, but it could also be that the DVB-I client is another “pre-installed by vendor” or “user-installable” library as a middleware similar as the 5GMSd components. • The UE includes an app that coordinates usage of the DVB-I client that implements discovery of DVB-I Services. <ul style="list-style-type: none"> ○ Likely a downloadable app ○ App may reuse pre-installed functionalities
Extracted draft commercial requirements	<ol style="list-style-type: none"> 1. DVB specifications shall support the announcement of DVB-I services via 5G Media Streaming [S1] 2. DVB specifications shall support the distribution of DVB-I services via 5G Media Streaming [S3] 3. DVB specifications shall specify how to make use of 5G Media Streaming functionalities for DVB-I Services, in particular <ol style="list-style-type: none"> a. Content Hosting (CDN), including geofencing, [S3] b. Consumption Reporting, [S4] c. QoE Metrics Reporting, [S4] d. Dynamic QoS Policies, [S3] e. Network Assistance. [S3] 4. DVB specifications shall support the distribution of DVB-I services via 5G Media Streaming using secure transport mechanisms, e.g. HTTPS. [S3] 5. DVB specifications shall support the distribution of DVB-I services via 5G Media Streaming to serve smartphones, but also other devices, for example smartphones connected to a larger screen, streaming devices, in-car receivers, etc. [S5] 6. DVB specification shall provide means such that an MNO can identify DVB-I content services as a preferential service for example to support: [S0] <ol style="list-style-type: none"> a. Improved and consistent media streaming Quality of Experience, b. Matched to display and rendering capabilities,

	<p>c. Zero-rated data</p> <p>7. DVB specifications shall allow the MNO to monitor the service quality by receiving QoE reporting and consumption reporting about the service, e.g. to improve network operations. [S4]</p> <p>8. DVB specifications shall allow consumers to install only a single app to receive DVB-I services. [S5]</p>
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5.3 Use case 2: 5G Broadcast/Unicast hybrid delivery to handheld devices

Use Case Title	
5G Broadcast/Unicast hybrid delivery to handheld devices	
Submitter	RAI
Supporters	
Description	<p>From a Service Provider perspective:</p> <ol style="list-style-type: none"> 1. A cost-efficient linear TV or radio service is made available to mobile handheld devices (5G-enabled smartphones and tablets) by means of an integrated broadcast/unicast distribution capable of guaranteeing a seamless and dynamic service continuity. 2. <i>5G Broadcast services</i> are made available to consumers without need for a network access subscription. This includes: <ol style="list-style-type: none"> a. free to air mechanism for delivering services. b. distribution to receive-only mode capable devices. 3. 5G Broadcast services could be augmented and enhanced by a unicast stream to guarantee service continuity where broadcast coverage is not available and to access additional content on demand. 4. An integrated service layer allows such services to be provided as part of the overall Service Provider's offering, allowing specific service instances to be tailored to specific categories of receivers. 5. A Service Provider which does not own a 5G Broadcast network (e.g.: HPHT) may have a business agreement with a Network Operator to treat broadcast content differently than regular data content. 6. The Service Provider may monitor the service consumption, for example by receiving consumption reports. This data can be used to improve the Service Provider's offering. 7. The Service Provider may monitor the service quality by receiving QoE metrics reports and consumption reports related to each service from devices, that include a bi-directional access independent IP connection. This data can be used to tailor the 5G Broadcast service offering. <p>From a Network Operator perspective:</p> <ol style="list-style-type: none"> 8. 5G Broadcast and 5G Media Streaming unicast delivery, integrated in a unified service layer, allows mobile devices to flexibly consume the services in an optimal and cost-efficient way, overcoming the limitations of architectures based on a single means of distribution(i.e. Unicast/LPLT or broadcast/HPHT). 9. The Network Operator provides the DVB-I services using 5G Media Streaming unicast delivery as an additional service to its subscribers. 10. The Network Operator may monitor the service quality by receiving QoE reporting and consumption reporting about the service. The data can be used to improve the network. <p>From a Consumer perspective:</p> <ol style="list-style-type: none"> 11. User buys a new smartphone. 12. User installs a DVB-I app (or finds it preinstalled on the device). 13. A DVB-I Service List is retrieved (e.g. via the CSR), carrying metadata for each service with multiple service instances, relevant to all distribution means supported by the content provider, e.g. <ol style="list-style-type: none"> a. DVB broadcast networks (DVB-S/S2, DVB-T/T2, DVB-C, etc.), b. 5G Broadcast networks, c. 5G Media Streaming unicast, d. Non-5G delivery (e.g. DVB DASH carried over Fixed Broadband/WiFi or Wireless Broadband/LTE/5G without 5G Media Streaming or 5G Broadcast)

	<p>NOTE: Service instances relevant to b), c), d) can be selected by the mobile terminal, according to its capabilities.</p> <p>14. User selects a TV service from the UI:</p> <ol style="list-style-type: none"> a. If it is a popular linear service, it is likely to be also available as a 5G Broadcast service. <ol style="list-style-type: none"> a. DVB-I client app automatically chooses the 5G Broadcast instance. b. Otherwise, if the service is provided as part of the MNO 5G Media Streaming offering: <ol style="list-style-type: none"> a. DVB-I client app chooses the 5G Media Streaming unicast stream. c. Otherwise, if only the OTT version is available: <ol style="list-style-type: none"> a. DVB-I client app chooses the OTT MPEG DASH instance (HTTP unicast stream). NOTE: the OTT stream may be the preferred choice in case the device has a Wi-Fi connection available. <p>15. During playback, the terminal may switch to a different service instance in case of signal quality degradation. <ol style="list-style-type: none"> a. Such switching should appear to be seamless, as far as reasonably possible. </p> <p>16. User may select a catch-up TV asset, e.g., via the Content Guide of broadcast services. <ul style="list-style-type: none"> • MPEG DASH on-demand stream retrieved via any available unicast connection. </p>
Pre-Conditions	<ul style="list-style-type: none"> • A 5G Broadcast network exists in the consumer's area. • A 5G network exists in the consumer's area. • A 5G Broadcast enabled device is available to the end-user. • A DVB-I Service List including instances deliverable using the following delivery types: <ul style="list-style-type: none"> ○ 5G Broadcast delivery. ○ 5G Media Streaming unicast delivery. ○ Other available delivery modes (e.g. DVB DASH carried over Fixed Broadband/WiFi or Wireless Broadband/LTE/5G without 5G Media Streaming or 5G Broadcast).
Extracted draft commercial requirements	<ol style="list-style-type: none"> 1. DVB specifications shall allow the signalling of 5G Broadcast and 5G Media Streaming delivery systems as additional service instances in a DVB-I Service List. [S1] 2. DVB specifications shall allow to disambiguate identical content services delivered over different distribution means including 5G Broadcast or 5G Media Streaming unicast distribution, from regular unicast distribution as an individual DVB-I Service, i.e. a specific editorial service. [S1] 3. It shall be possible to unambiguously identify a specific editorial service (i.e., a service which carries specific editorial content) received over 5G Broadcast or 5G Media Streaming unicast distribution networks based on technical parameters (e.g., frequency + TMGI/service identifier for 5G Broadcast), in a similar way as can be done on DVB broadcast networks (i.e., DVB triplet, orbital position/frequency, etc.). [S1] 4. DVB specifications shall enable the possibility to ensure proper alignment in time of DVB-DASH-based service instances carried over different delivery networks, so that switching between them can be perceived as reasonably seamless. [S0][S1][S3] 5. DVB specifications shall support Free-To-Air (FTA) reception and Receive Only Mode (ROM) for the delivery of 5G Broadcast services. [S1][S3]

5.4 Use Case 3: 5G Broadcast standalone with Unicast for EPG

Use Case Title	5G Broadcast standalone with Unicast for EPG
Submitter	Paul Higgs, Huawei/Hisilicon
Supporters	
Description	<p>Cellular (5G) broadcast is used for the audiovisual service delivery, but an 'Internet connection' is available on the receiver device for bidirectional supporting operations.</p> <p>From a consumer perspective:</p>

	<ol style="list-style-type: none"> 1. A consumer purchases a device intended for stationary use (e.g. a TV or STB) which includes the capability to receive linear television services delivered on 5G Broadcast networks. 2. The consumer provisions the device according to available instructions from their broadcaster or device manufacturer to gain access to broadcast services offered via the 5G Broadcast network. 3. The consumer also connects to a general-purpose Internet connection that is available on the device. 4. Through the provisioning process, the device identifies linear broadcast channels that are available as well as attributes relating to each channel (quality, resolution) 5. The device receives a URL to a DVB-I service list either through signalling on the cellular broadcast or through a query to the DVB-I central service list registry. The DVB-I service list provides supplemental information for each linear service, including the content guide entry points for channel-specific schedule metadata. 6. The application on the device presents a list of services to the consumer, including those identified in the DVB-I service list and optionally any others detected by the device. The application on the device is able to present an EPG as well as other interactive qualities to the consumer by querying the content guide entry points. <p>Option 1:</p> <ol style="list-style-type: none"> 7. Each linear broadcast channel signalled on the cellular broadcast system includes information on the content guide entry points which can provide programming information without the need for the device to obtain a complete DVB-I service list.
Pre-Conditions	<ul style="list-style-type: none"> • The consumer device has an Internet connection.
Extracted draft commercial requirements	<ol style="list-style-type: none"> 1. The 5G Broadcast System shall be able to provide an entry point to announce DVB-I services (note: A DVB specification would provide the means how to use 5G Broadcast System to enable this functionality, if available). [S1] 2. The 5G Broadcast System shall be able to announce the location of a DVB-I service list which identifies the entry points that can be queried for programming information. [S1] 3. The 5G Broadcast System shall be able to announce the location of content guide entry points that can be queried for programming information. [S1] 4. The content guide entry points shall provide equal functionality to that defined in TS 103 770. [S2] – is EPG metadata a component if the service?

5.5 Use Case 4: 5G Fixed Wireless Access

Use Case Title	5G Fixed Wireless Access
Submitter	Julien Lemotheux, Orange
Supporters	DT, BT, TIM
Description	<p>From a 5G network operator perspective:</p> <ol style="list-style-type: none"> 1. I want to provide contracted DVB-I content services to wireless connected homes with the same quality of experience as on fixed broadband networks such as ADSL and fiber. 2. I want to leverage multicast/broadcast delivery for third-party DVB-I services with a high audience delivered over my 5G network in order to preserve my network resources and reduce the environmental impact associated with the delivery of such content. 3. I want to reduce network congestion by dynamically switching between different 5G delivery modes, including unicast and broadcast/multicast in a transparent manner from the consumer point of view. 4. I want to be able to convert 5G broadcast/multicast to unicast in customer premises. The conversion must be storage- and CPU-efficient, to run on lower-cost 5G Gateways. 5. I don't want to perform any re-encryption or transcoding in the 5G Home Gateway device. 6. I want to receive consumption and monitoring reports from 5G Gateways and consumer devices in order to be able to choose the best delivery mode for each DVB-I service and supervise and possibly re-configure/optimize my network. 7. I want to enable several DVB-I application providers to reference the same multicast/broadcast service(s) in order to avoid the need to transport same DVB-I service more than once on my network.

	<p>From a DVB-I service provider perspective:</p> <ol style="list-style-type: none"> 8. I want to be able to address a mass audience on 5G networks in a cost-effective manner. I want my distribution costs to remain as flat as possible as the audience for my DVB-I service grows. 9. I want to be able to ensure consistent quality-of-experience for consumers. 10. I want to be able to distribute my services to consumers with a guaranteed quality of service by entering into appropriate carriage agreements with relevant mobile network providers in the geographical territories I want to address. (Note: QoS cannot be guaranteed once outside of the MNOs managed network, e.g. in-home WiFi). 11. I want to be able to deliver my DVB-I services to the widest possible set of devices (smartphones, tablets, connected TV, STB, PC). 12. I want to be able to offer UHD content and future other high bit rate services (e.g. 8K, VR/AR). 13. I want the media encoding and packaging formats I use for distributing my linear channels via IP to be identical to those that I use for other delivery modes (e.g. fixed network) or services (e.g. on-demand content) so that the same physical assets can be used in all distribution chains. 14. I want to be able to choose the number of different bit rate representations to deliver depending on device used. A device with a guaranteed bit rate will be able to receive only one (or a few) representations, and all representations will be available over devices using unmanaged IP networks. 15. I want to share delivery protocols (e.g. HTTP, FLUTE), functional components (e.g. content packager, multicast gateway) and interfaces (e.g. xMB...) used on all my distribution chains (e.g. non 5G unicast, MABR...). 16. I want appropriate mechanisms to be available that prevent unauthorised consumers from accessing my network resources. 17. I want to be able to ensure that the content I distribute is not intercepted, substituted or otherwise altered in transit between me and consumers. 18. I want to be able to manage parental access control. 19. I would like to know my audience, having statistics on the service taking into account user privacy. 20. I want to provide low-latency and Fast Channel Change functionalities. <p>From a consumer perspective:</p> <ol style="list-style-type: none"> 21. I want to be able to receive my DVB-I services on equipment of my choice that I have purchased through the retail chain. This could be a set-top box connected to 5G Gateway; an embedded consumer electronics device (e.g. tablet computer, mobile phone); or a personal computer. I would like this to work when connected via wired or wireless network connection, as appropriate to the receiver's capabilities and my location at home (e.g. connected to my 5G Gateway) or other roamable 5G Gateways outside of my home (for example in a hotel). 22. I want to be able to receive my DVB-I services concurrently with other delivery modes used on my fixed Internet access such as IPTV or MABR, so that I can enjoy a synchronised linear viewing experience across different delivery networks (e.g. my neighbours don't see important events before I do). 23. I want to be able to access to my linear channels with a short start time and I want to be able to change channels quickly.
Pre-Conditions	<ul style="list-style-type: none"> • A 5G Gateway is available in the customer premises. • 5G broadcast/multicast can be enabled on the 5G network. • A service provider has a mix of services that it offers through DVB-I. • The devices receiving the DVB-I content have a DVB-I receiver and can discover DVB-I services on different distribution networks.
Extracted draft commercial requirements	<ol style="list-style-type: none"> 1. It shall be possible for the 5G network operator to select dynamically the best delivery mode (unicast or broadcast/multicast) according to demand of a DVB-I service on the unicast path based on an agreement with the DVB-I Service Provider. (Evaluation of the demand on the unicast path can be achieved for instance by periodic consumption reports from the DVB-I client, or else by measurement by the CDN serving point.) [S4] 2. The DVB-I service discovery specification shall give the possibility to provide information for those 5G gateways that are able to receive both 5G broadcast/multicast and 5G unicast delivered variants of the same channels, so that a 5G gateway can select the best delivery mode, possibility taking into account policies or recommendation of the DVB-I service provider. Note that this requires the 5G gateway to understand the relevant DVB-I service list parameters – referred to as <i>DVB-I capable 5G gateway</i>. [S1] 3. The DVB-I service discovery specification shall enable changing of information about a channel (e.g. broadcast/multicast or Internet delivered) and shall define a mechanism by which the DVB-I capable 5G gateway can detect that this information has changed. [S1]

	<ol style="list-style-type: none"> 4. It shall be possible for a DVB-I capable 5G gateway to switch the distribution mode between unicast and broadcast/multicast such that the experience is seamless for connected DVB-I clients. [S3] 5. Conversion between broadcast/multicast and unicast streams shall be storage- and CPU-efficient, to run on lower-cost 5G Gateways. [S3] 6. The solution shall not require content re-encryption or transcoding in the 5G Gateway device. [S3] 7. The solution shall enable collection and reporting of statistics of a DVB-I service by allowing DVB-I streams to be monitored at 5G Gateways in order to be able to choose the best delivery mode for each DVB-I service and supervise and possibly re-configure/optimize the network. Note: DVB-I level consumption and QoE Reporting may be on top of this but is not part of this use case. [S4] 8. The DVB-I capable 5G gateway client shall be able to make use of DVB-I services from different DVB-I content providers. [S1] 9. It shall be possible to discover presence of a DVB-I service via a third-party DVB-I service discovery that is independent of any service provider. [S1] 10. The DVB-I client shall be able to authenticate the source of DVB-I service discovery information, both during initial installation and when information is updated. [S1] 11. It shall be possible for a DVB-I service provider to deliver a DVB-I service using point-to-multipoint technologies over 5G networks (i.e. broadcast/multicast). [S3] 12. It shall be possible to use the same content resources (encoding and packaging) in 5G distribution methods as they are used in other DVB-I distribution means. [S3] 13. It shall be possible for the DVB-I capable 5G gateway to select the representations to be delivered depending on <ol style="list-style-type: none"> a. the characteristics of the connected devices, [S1] b. the network to gateway delivery mode, [S1] c. network conditions. [S4] 14. It should be possible to re-use as many as possible of the same delivery protocols, functional components and interfaces in 5G distribution methods as they are used in other DVB-I distribution means (e.g. non 5G unicast, MABR...). [S3] 15. It shall be possible to protect the content in a DVB-I service from access by unauthorised parties all the way from the content source to the end device. (A suitable content protection mechanism would be needed, e.g. based on MPEG Common Encryption as specified in CMAF together with one or multiple suitable DRM systems.) [S3] 16. It shall be possible to protect a DVB-I service (Service information and content) from tampering in transit by unauthorised parties (for example by the use of end-to-end transport encryption, e.g. HTTP/TLS). [S3] 17. It shall be possible to detect that a DVB-I service (Service information and content) has been tampered with by unauthorised parties. [S4] 18. The DVB-I service discovery specification shall enable the DVB-I client to include parental access control mechanisms. (NOTE: seems to be already met by A177). [S1] 19. For a DVB-I service distributed over 5G, and if used in combination with DVB-DASH and a DVB-I client supporting the LL-DASH specification, it shall enable a user experience comparable with DVB-C/S/T in terms of latency (3.5 seconds) and channel change time (1 second). Detailed requirements are provided in DVB LL-DASH CRs [X]. [S3]
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5.6 Use case 5: DVB-I Services to vehicle infotainment systems over 5G

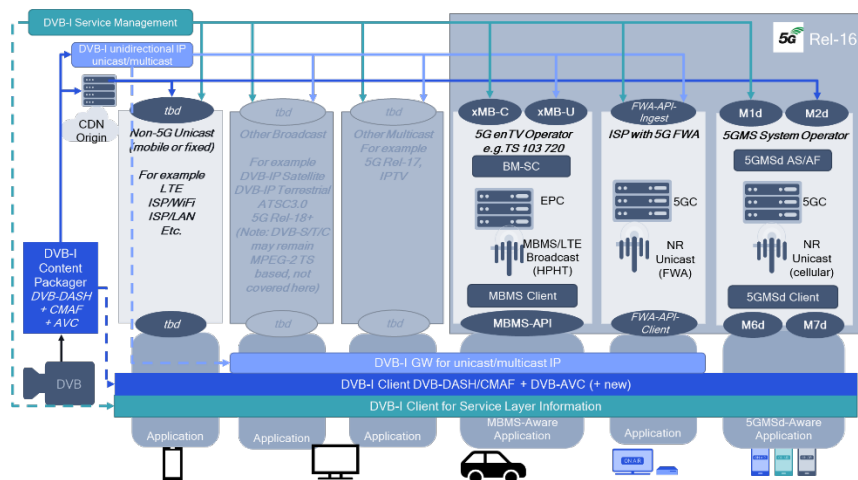
Use Case Title	DVB-I Services to vehicle infotainment systems over 5G
Submitter	RAI
Supporters	Qualcomm, Huawei
Description	<p>From a Content Provider perspective:</p> <ol style="list-style-type: none"> 1. An offering of Linear/OTT TV and radio services based on DVB-I and possibly other DVB technologies is made available to vehicles' infotainment systems by means of a 5G technologies. 2. The Content Provider provides a service layer offering to different types of end devices (phones, tablets, TVs) based on DVB-I. The service offering also targets and is optimized for vehicles' infotainment systems and in-vehicle consumption (for example if the vehicle is moving or not).

	<ol style="list-style-type: none"> 3. Different categories of vehicle receivers exist, for example audio-only, audio-visual, different screen sizes. 4. The content may be targeted (regional content, ads, etc.) to the consumption environment including geographical location, speed, number of passengers. 5. The Content Provider may monitor the service consumption, for example by receiving consumption reports. This data can be used to improve the Content Provider offering. 6. The Content Provider may monitor the service quality by receiving QoE metrics reports and consumption reports related to the service. This data can be used to improve the Content Provider's offering. <p>From a Service Provider perspective:</p> <ol style="list-style-type: none"> 7. An offering of Linear/OTT TV and radio services based on DVB-I and possibly other DVB technologies is made available to vehicles' infotainment systems by means of 5G technologies. 8. The Service Provider may monitor the service consumption, for example by receiving consumption reports. This data can be used to improve the Service Provider's offering. 9. The Service Provider may monitor the service quality by receiving QoE metrics reports and consumption reports related to each service from vehicles. This data can be used to improve the Service Provider's offering. <p>From a Network Operator perspective:</p> <ol style="list-style-type: none"> 10. The Network Operator distributes the above services, possibly integrating them as part of its 5G service offering 11. The Network Operator provides the above DVB-I services using 5G Media Streaming unicast delivery as an additional service to its subscribers. 12. The Network Operator may provide the above DVB-I services using 5G Broadcast to its subscribers. 13. The Network Operator may optimize the delivery of the services by dynamically switching different 5G distribution modes, e.g. unicast and broadcast. 14. The Network Operator may develop new business models to offer vehicles' infotainment contents to the end-user. 15. The Network Operator may monitor the service quality by receiving QoE reporting and consumption reporting about the service. The data can be used to improve the network. <p>From a Consumer perspective:</p> <ol style="list-style-type: none"> 16. User buys a new car equipped with a 5G receiver . 17. User installs a DVB-I app (or finds it pre-installed on the vehicle's infotainment system). 18. A DVB-I Service List is retrieved (e.g. via the CSR), carrying metadata about each service, with multiple service instances relevant to all distribution means supported by the content provider. NOTE: Service instances may be selected by the client, according to its capabilities and type of service. 19. User selects a TV service from the UI: <ol style="list-style-type: none"> a. If it is a popular linear service, it is likely to be also available as a 5G Broadcast service. <ol style="list-style-type: none"> i. DVB-I client app automatically chooses the 5G Broadcast instance. b. Otherwise, if the service is provided as part of the MNO 5G Media Streaming offering: <ol style="list-style-type: none"> i. DVB-I client app chooses the 5G Media Streaming unicast stream. c. Otherwise, if only the OTT version is available: <ol style="list-style-type: none"> i. DVB-I client app chooses the OTT MPEG DASH instance (HTTP unicast stream). 20. During playback, the terminal may switch to a different service instance in case of signal quality degradation. <ol style="list-style-type: none"> a. Such switching should appear to be seamless, as far as reasonably possible. 21. User may select a catch-up TV asset, e.g., via the Content Guide of broadcast services.
Pre-Conditions	<ul style="list-style-type: none"> • A 5G network exists in the consumer's area. • A vehicle equipped with V2X interfaces is available to the end-user. • A DVB-I Service List including instances deliverable over the following methods is available using one of the DVB-I Service Discovery options: <ul style="list-style-type: none"> ○ 5G Media Streaming unicast. ○ OTT delivery (MPEG DASH).

Additional reading and background	<ul style="list-style-type: none"> • https://5gaa.org/wp-content/uploads/2020/10/5GAA_White-Paper_C-V2X-Use-Cases-Volume-II.pdf
Extracted draft commercial requirements	<ol style="list-style-type: none"> 1. DVB specification shall provide means to discover via the 5G broadcast system the location of a DVB-I service list. [S1] 2. DVB specification shall provide means to convey via the 5G broadcast system the DVB-I service list and updates thereof. [S1] 3. The DVB-I service list shall support the announcement of DVB-I services distributed via 5G Broadcast and 5G Media Streaming. [S1] 4. DVB specifications shall support the distribution of DVB-I services via 5G Broadcast and 5G Media Streaming [S3] 5. DVB specifications shall allow to disambiguate identical content services delivered over different 5G distribution means from regular unicast distribution and other distribution means as an individual DVB-I Service, i.e. a specific editorial service. [S1] 6. In case of DVB-I services based on DASH, DVB specifications shall enable the possibility to switch between instances of the same DVB-I service and provide sufficient information such that the client can decide if the switch is seamless or at least possible within reasonable seamless boundaries. [S0][S1][S5] 7. The DVB-I client shall be able to determine which DVB-I service instances may be received at its current time and location also taking into account mobility and hence changing locations. [S4] 8. The DVB-I client shall be able to determine which DVB-I service instances or DVB-I service components are more suited to the vehicle's infotainment system and its current consumption environment. [S2] & [S5] 9. DVB specifications shall allow the Content Provider and the Service Provider to monitor the service quality by receiving QoE reporting and consumption reporting about the service along with information related to the consumption environment (including location subject to privacy) e.g. to improve their service offering. [S4] 10. DVB specifications shall not prevent the Network Operator from monitoring the service quality by receiving QoE reporting and consumption reporting about the service, e.g. to improve network operations. [S4]

5.7 Use Case 6: DVB-I Hybrid Service over 5G

Use Case Title	DVB-I Hybrid Service over 5G
Submitter	Qualcomm Incorporated
Supporters	Orange, DT, TIM
Description	<p>An overview of the considered system is shown below for which DVB-I (including DVB-I Service Discovery, ABR multicast, DVB-DASH and DVB-AVC codecs) can be used to distribute DVB services to any type of device. An example is shown below, the following technology assumptions are taken based on 5G technologies available in Rel-16:</p> <ul style="list-style-type: none"> • Broadcast/MBMS distribution is based on 5G Broadcast (LTE Broadcast Rel-16, ETSI TS 103 720). • Unicast distribution is based on 5G Media Streaming (Rel-16) and/or OTT with Wi-Fi, LTE, etc. (IP, CDN-based).



Of particular relevance is the hybrid combination that allows that a service may not only be available through a single distribution means, but may be augmented and enhanced by other means, for example in case no broadcast coverage is available.

One potential use case is provided in the following:

- A Broadcast operator operates a broadcast distribution network, for example in dedicated broadcast spectrum for HPHT distribution or in any other spectrum that is available.
- The Broadcast operator primarily targets non-TV and mobile devices (smartphones, tablets, etc.) in the shorter term, in particular with linear TV services, but it is not precluded to also provide the services to TV devices (TV, STB) in the future.
- From a commercial perspective, the service may be provided by a Broadcast Network Operator, a Mobile Network Operator or may be provided as a collaboration between these two. Detailed collaboration models need to be identified.
- The Broadcast operator provides multiple services, for example public free-to-air or private.
- Broadcast operator has the ambition to run a hybrid service (integrated broadcast/unicast distribution) from day one, for some of the following reasons:
 - Perceptually good service continuity to ensure coverage, in particular indoor and urban.
 - Providing the same services to devices that do not support broadcast/multicast reception.
 - Unicast-based ad insertion (targeted to users, regions, etc.).
 - Targeted regional content.
 - Service Signalling (see use case 2).
 - Content Protection on service/app level (for subscription services).
 - QoE metrics reporting.
 - Consumption Reporting for operational purposes.
 - Enhanced content quality by additional unicast (e.g. through scalable/layered coding or equivalent means) subject to availability of DVB codecs supporting this.
 - Fast service start-up and service acquisition while maintaining efficient delivery on broadcast. Different aspects may matter depending on device and service types.

	<ul style="list-style-type: none"> • Unicast-based error recovery if reception on a primary distribution is lossy. • Auxiliary components on unicast, for example alternative languages or views. • Audience Measurement • Ad Tracking <p>Note: user privacy aspects need to be considered.</p>
Pre-Conditions	<ul style="list-style-type: none"> • A content provider has a mix of services that it offers through DVB-I. • The content provider offers its DVB-I serves via different distribution networks, for example through a CDN, through a 5G Media Streaming system operator and through a 5G Broadcast Network Operator. • The devices receiving the DVB-I content have a DVB-I receiver and can discover DVB-I services on different distribution networks.
Extracted draft commercial requirements	<ol style="list-style-type: none"> 1. DVB shall provide specifications to enable self-contained DVB-I Services over 5G Broadcast as defined in TS 103 720. [S0][S1][S2][S3][S4][S5][General] 2. DVB shall provide specifications to enable self-contained DVB-I Services over 5G Media Streaming as defined in TS 26.501 (for detailed requirements, refer to use case 1). [S0][S1][S2][S3][S4][S5] [General] 3. DVB shall provide specifications to enable a basic DVB-I service over regular unicast and 5G Broadcast and 5G Media Streaming at the same time as independent service instances. Service instances may be provided with different quality (e.g., bitrate, end-to-end, latency, channel switch times, etc.). [S0][S1][S2][S3][S4][S5][General] <ol style="list-style-type: none"> a. Note: no hybrid requirements are included. 4. DVB shall provide specifications to enable hybrid DVB-I services, defined as <ol style="list-style-type: none"> a. the DVB-I service is described in a DVB-I service list [S1] b. a minimum/basic service is distributed through 5G Broadcast [S3] c. the service is augmented by ordinary unicast or 5G Media Streaming to provide the following functionalities: <ol style="list-style-type: none"> i. Perceptually good service continuity to ensure coverage, in particular indoor and urban outdoor. [S3] ii. Providing the same services to devices that do not support broadcast/multicast reception. [S1] iii. Unicast-based content and ad insertion/replacement (targeted to users, regions, etc.). [S2] iv. Targeted regional content. [S1] v. Updates to the DVB-I Service Information. [S1] vi. Content Protection on service/app level (for subscription services). [S2] vii. DVB-DASH metrics reporting. [S4] viii. Consumption Reporting, Audience Measurement and Ad Tracking. [S4] ix. Enhanced content quality by additional unicast (e.g. through scalable/layered coding or equivalent means) subject to availability of DVB codecs supporting this. [S3] x. Fast service start-up and service acquisition while maintaining efficient delivery on 5G broadcast. Different aspects may matter depending on device and service types. [S2]

	<ul style="list-style-type: none"><li data-bbox="596 185 1382 248">xi. Unicast-based error recovery if reception on a primary 5G Broadcast distribution is lossy. [S3]<li data-bbox="596 271 1401 333">xii. Auxiliary components on unicast, for example alternative languages or views. [S2]<li data-bbox="596 356 911 387">xiii. Time-shifted viewing[S2]<li data-bbox="596 409 986 441">xiv. DVB-I service-related apps [S1]
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6 History

Document history		
C100	July 2021	BlueBook Publication (revision 0)