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Radiocommunication Sector of ITU

Recommendation ITU-R BT.2054-1
(07/2018)

**Multiplexing and transport schemes in
multimedia broadcasting systems
for mobile reception**

BT Series
Broadcasting service
(television)



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Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R BT.2054-1

**Multiplexing and transport schemes in multimedia
broadcasting systems for mobile reception**

(Question ITU-R 45-5/6)

(2014-2018)

Scope

This Recommendation deals with technologies for multiplexing and transport in multimedia broadcasting systems for mobile reception. It describes schemes for media transport, service/content protection, and reliable delivery.

The ITU Radiocommunication Assembly,

considering

- a) that digital television and sound broadcasting systems have been implemented in many countries;
- b) that digital broadcasting services are expected to be offered in a variety of reception environments including indoor, portable, handheld and vehicular receivers;
- c) that multimedia broadcasting systems for mobile reception have been introduced using the inherent capability of digital broadcasting systems;
- d) that the characteristics of mobile reception are quite different from those of fixed reception;
- e) that mobile telecommunication systems with advanced information technologies have been implemented in many countries;
- f) the need for interoperability between the mobile telecommunication services and broadcasting services;
- g) the need for flexible configuration of a wide variety of services;
- h) the need for controlling access to content and/or services;
- i) the need for techniques delivering content efficiently and reliably,

recommends

1 that for techniques for multiplexing and transport in multimedia broadcasting systems for mobile reception, the schemes described in Annex 1 should be used;

2 that compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g. interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words “shall” or some other obligatory language such as “must” and the negative equivalents are used to express requirements. The use of such words shall in no way be construed to imply partial or total compliance with this Recommendation.

Annex 1

Multiplexing and transport schemes in multimedia broadcasting systems for mobile reception

1 Introduction

Multimedia broadcasting systems for mobile reception may have the same multiplexing and transport schemes that those for fixed reception have. Broadcasting and telecommunication could be harmonized if some of the techniques used in mobile telecommunication systems (in particular, based on Internet Protocol (IP)) are also used in multimedia broadcasting systems for mobile reception. Content needs to be delivered reliably even when unrecoverable errors occur in the channel coding layer, which is inevitable in mobile reception. One of the options to improve the reliability of IP content delivery is the use of adaptive streaming.

From the content providers' view, it is important to protect broadcast content against unauthorized reception and use.

This Recommendation describes multiplexing and transport schemes appropriate in multimedia broadcasting systems for mobile reception.

2 References

Recommendation ITU-T H.222.0 | ISO/IEC 13818-1: Information Technology – Generic coding of moving pictures and associated audio information – Part 1: Systems.

ISO/IEC 14496-1: Information technology – Coding of audio-visual objects – Part 1: Systems.

IETF RFC 791: Internet Protocol

Available at <http://www.ietf.org/rfc/rfc791.txt>

IETF RFC 2460: Internet Protocol, Version 6 (IPv6) Specification.

Available at <http://www.ietf.org/rfc/rfc2460.txt>

ETSI TS 102 606: Digital Video Broadcasting (DVB); Generic Stream Encapsulation (GSE) Protocol.

IETF RFC 3550: RTP: A Transport Protocol for Real-Time Applications.

Available at <http://www.ietf.org/rfc/rfc3550.txt>

IETF RFC 3926: FLUTE – File Delivery over Unidirectional Transport

Available at <http://www.ietf.org/rfc/rfc3926.txt>

ISO/IEC 13818-6: Information technology – Generic coding of moving pictures and associated audio information – Part 6: Extensions for DSM-CC.

ARIB STD-B24 Volume 3: Data Coding and Transmission Specification for Digital Broadcasting.

Open Mobile Alliance, OMA-TS-DRM_XBS-V1_0: OMA DRM v2.0 Extensions for Broadcast Support.

ISO/IEC 23009-1: 2014 Information technology – Dynamic adaptive streaming over HTTP (DASH) – Part 1: Media presentation description and segment formats.

ETSI TS 102 542-3-3 Guidelines for the implementation of DVB-IP Phase 1 specifications. Part 3: Error Recovery. Subpart 2: Application Layer FEC.

This ETSI standard provides examples for AL-FEC schemes and their performance under different channel conditions.

3 Multiplexing and transport schemes

Multimedia signals such as audio, video and any kind of data, are transmitted to a receiver, and then, they are presented at a proper time and in a proper way. In order to transmit and present content, the following functions are required:

- Encapsulation
Multimedia signals are encapsulated into appropriate formats with timing information for presentation.
- Delivery
Multimedia signals are appropriately formatted for delivery. This formatting includes the aggregation, multiplexing, and fragmentation of encapsulated multimedia signals.
- Control
Information about the encapsulation, delivery and presentation of multimedia content is to be provided to a receiver.

These functions are provided by transport schemes. Transport schemes appropriate in multimedia broadcasting systems for mobile reception are listed in Table 1.

TABLE 1
Transport schemes

Scheme	Description
MPEG-2 TS (transport stream)	It is widely used in broadcasting systems for fixed reception. It provides timing information for synchronization in packetized elementary stream (PES) layer, and a fixed-length packet for delivery.
MPEG-4 SL (sync layer)	It is used in the synchronization layer to synchronize audiovisual content both temporally and spatially. It may be carried in MPEG-2 TS packets or real-time transport protocol (RTP) packets.
IP (Internet Protocol)	It is intermediate protocol for media transport. It works with upper-layer protocol for media transport and may be carried in MPEG-2 TS ¹ packets.
GSE (generic stream encapsulation) ²	It is encapsulation techniques for various kinds of packets including IP packets. A media transport protocol over IP is required.

Media transport protocols over IP that are appropriate in multimedia broadcasting systems for mobile reception are listed in Table 2.

¹ Details are described in Recommendation ITU-R BT.1887 – Carriage of IP packets in MPEG-2 transport streams in multimedia broadcasting.

² Details are described in Recommendation ITU-R BT.1869 – Multiplexing scheme for variable-length packets in digital broadcasting systems.

TABLE 2

Media transport protocols over IP

Protocol	Description
RTP (real-time transport protocol)	It is the Internet engineering task force (IETF) protocol used for streaming services.
FLUTE (file delivery over unidirectional transport)	It is the IETF protocol used for the delivery of any kind of files.
MPEG-DASH (dynamic adaptive streaming over HTTP)	It is MPEG protocol used for reliable delivery of video signal with adaptation of video signal parameters (e.g. resolution) to current channel conditions thus allowing, for example, to transmit less or more parity or with usage of other adaptation mechanism.

4 Service/content protection schemes

Access to content and services needs to be controlled via some schemes, if necessary. Service protection schemes protect content during its delivery to a receiver, and content protection schemes protect content after its delivery.

Service/content protection schemes appropriate in multimedia broadcasting systems for mobile reception are listed in Table 3.

TABLE 3

Service/content protection schemes

Scheme	Description
Conditional access system (CAS) specified in MPEG-2 Systems ³	It is widely adopted for broadcasting systems for fixed reception. Conditional access is achieved by programme specific information (PSI).
Open mobile alliance (OMA) Digital rights management (DRM) 2.0	It is specified by OMA.

5 Reliable delivery schemes

Channel error characteristics differ between fixed and mobile reception because receiving conditions may change as a receiver moves around. Reliable delivery under such conditions is ensured by delivering additional data or by using special mechanisms such as adaptive streaming.

Schemes appropriate for ensuring reliable delivery in multimedia broadcasting systems for mobile reception are listed in Table 4.

³ Details are described in Recommendation ITU-R BT.1852 – Conditional-access systems for digital broadcasting.

TABLE 4
Schemes for reliable delivery

Scheme	Description
Data carousel	Data is transmitted repeatedly, so missed portions can be received during the following transmission cycle.
Application layer forward error correction (AL-FEC)	A method for generating redundant data from the source data. Missed portions can be reconstructed from the redundant data by the FEC operation.
Adaptive streaming over HTTP (Application/TCP layer adaptation)	An adaptive streaming technique used for reliable delivery of video streams via networks based on IP stack and multicast transmissions. Support of MPEG-DASH is included to HbbTV specifications and other delivery standards for multimedia applications.
