

ETSI TS 103 720 V1.2.1 (2023-06)



**5G Broadcast System for linear TV and radio services;
LTE-based 5G terrestrial broadcast system**

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Foreword

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NOTE: The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

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Introduction

Several 3GPP specifications have been extended or newly developed over several releases to address the use cases and requirements for dedicated 5G broadcast networks. With the completion of Release 16, a comprehensive set of 3GPP specifications is available that fulfils the use cases and requirements for a 5G Broadcast System, including:

- Support of Free-to-Air (FTA) and Receive-Only Mode (ROM) 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 that associated with typical cellular deployments.
- Support for mobility scenarios including speeds of up to 250 km/h to support receivers in cars, with external omni-directional antennas.
- Support for common streaming distribution formats such as Dynamic Streaming over HTTP (DASH), Common Media Application Format (CMAF) and HTTP Live Streaming (HLS).
- Support for IP-based services such as IPTV or ABR multicast.
- Support for different file delivery services such as scheduled delivery or file carousels.
- Support for services that use unicast and broadcast delivery methods.
- Support for typical broadcast channel bandwidths of 6/7/8 MHz.
- Support for public warning and emergency alerts based on the Cell Broadcast Service.

The present document defines the 5G Broadcast System as well as a concrete instantiation referred to as LTE-based 5G Broadcast intended for implementers of a 5G Broadcast System as well as TV/Radio Content Service Providers wanting to make use of a 5G Broadcast System.

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1 Scope

The present document introduces the 5G Broadcast System along with the associated features of such a system. A concrete instantiation of a 5G Broadcast System is specified, referred to as LTE-based 5G Broadcast. LTE-based 5G Broadcast is a profile of existing 3GPP specifications that addresses all requirements of a 5G Broadcast System. Several functions and reference points are defined. Receiver categories are defined that address implementation profiles to deploy, among others, linear television and radio services.

2 References

2.1 Normative references

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- [1] [ETSI TS 122 101](#): "Universal Mobile Telecommunications System (UMTS); LTE; Service aspects; Service principles (3GPP TS 22.101 Release 17)".
- [2] [ETSI TS 122 261](#): "5G; Service requirements for the 5G system (3GPP TS 22.261 Release 17)".
- [3] [ETSI TS 123 003](#): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; 5G; Numbering, addressing and identification (3GPP TS 23.003 Release 17)".
- [4] [ETSI TS 123 122](#): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; 5G; Non-Access-Stratum (NAS) functions related to Mobile Station (MS) in idle mode (3GPP TS 23.122 Release 17)".
- [5] [ETSI TS 123 246](#): "Universal Mobile Telecommunications System (UMTS); LTE; Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description (3GPP TS 23.246 Release 17)".
- [6] [ETSI TS 124 116](#): "LTE; Stage 3 aspects of system architecture enhancements for TV services (3GPP TS 24.116 Release 17)".
- [7] [ETSI TS 124 117](#): "LTE; TV service configuration Management Object (MO) (3GPP TS 24.117 Release 17)".
- [8] [ETSI TS 126 346](#): "Universal Mobile Telecommunications System (UMTS); LTE; 5G; Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs (3GPP TS 26.346 Release 17)".
- [9] [ETSI TS 126 347](#): "LTE; Multimedia Broadcast/Multicast Service (MBMS); Application Programming Interface and URL (3GPP TS 26.347 Release 17)".
- [10] [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 17)".
- [11] [ETSI TS 129 116](#): "LTE; 5G; Representational state transfer over xMB reference point between content provider and BM-SC (3GPP TS 29.116 Release 17)".

- [12] [ETSI TS 129 274](#): "Universal Mobile Telecommunications System (UMTS); LTE; 5G; 3GPP Evolved Packet System (EPS); Evolved General Packet Radio Service (GPRS) Tunnelling Protocol for Control plane (GTPv2-C); Stage 3 (3GPP TS 29.274 Release 17)".
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- [14] [ETSI TS 136 101](#): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101 Release 17)".
- [15] [ETSI TS 136 133](#): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management (3GPP TS 36.133 Release 17)".
- [16] [ETSI TS 136 211](#): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation (3GPP TS 36.211 Release 17)".
- [17] [ETSI TS 136 213](#): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures (3GPP TS 36.213 Release 17)".
- [18] [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 17)".
- [19] [ETSI TS 136 304](#): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) procedures in idle mode (3GPP TS 36.304 Release 17)".
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- [21] [ETSI TS 136 331](#): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification (3GPP TS 36.331 Release 17)".
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- [23] [ISO/IEC 23009-1](#): "Information technology - Dynamic adaptive streaming over HTTP (DASH) - Part 1: Media presentation description and segment formats".
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- [31] [ETSI TS 126 512](#): "5G Media Streaming (5GMS); Protocols (3GPP TS 26.512 Release 17)".
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- [41] [IETF RFC 8446](#): "The Transport Layer Security (TLS) Protocol Version 1.3".
- [42] [IETF RFC 793](#): "Transmission Control Protocol".
- [43] [IETF RFC 7323](#): "TCP Extensions for High Performance".
- [44] [IETF RFC 8200](#): "Internet Protocol, Version 6 (IPv6) Specification".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] 3GPP TR 23.746: "Study on System Architecture Enhancements to eMBMS for Television Video Service".
- [i.2] ETSI TR 136 976: "LTE; Overall description of LTE-based 5G broadcast (3GPP TR 36.976)".
- [i.3] ETSI TR 138 913: "5G; Study on scenarios and requirements for next generation access technologies (3GPP TR 38.913)".
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- [i.5] ETSI TR 122 968: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Study for requirements for a Public Warning System (PWS) service (3GPP TR 22.968, Release 17)".
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3 Definition of terms, symbols and abbreviations

3.1 Terms

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

5G Broadcast Client API: Application Programming Interface that enable a 5G Broadcast TV/Radio Service Application to communicate with a 5G Broadcast Receiver

5G Broadcast Receiver: entity implementing the receiver requirements of a 5G Broadcast System

5G Broadcast Service: 3GPP-based broadcast service offered according to the constraints and requirements in the present document in order to deploy linear television and radio broadcast services

5G Broadcast SA Service: 5G Broadcast Service for Service Announcement (SA)

5G Broadcast System: system dedicated to the delivery of linear television and radio broadcast services using 3GPP specifications and addressing 5G requirements for dedicated broadcast

5G Broadcast Transmitter: entity implementing the transmitter requirements of a 5G Broadcast System

5G Broadcast TV/Radio Content Service Provider: provider of linear television and/or radio content services using a 5G Broadcast System for distribution of the services

5G Broadcast TV/Radio Service Application: application in the end device that consumes one or more 5G Broadcast User Services by communicating with the 5G Broadcast Receiver through a dedicated set of 5G Broadcast Client APIs

5G Broadcast User Service: 5G Broadcast Service that provides User Data, for example a television or radio service

3.2 Symbols

Void.

3.3 Abbreviations

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

| | |
|------|--|
| 5GMS | 5G Media Streaming |
| ABR | Adaptive Bit Rate |
| ADPD | Associated Delivery Procedure Document |
| AF | Application Function |
| API | Application Programming Interface |
| APN | Access Point Name |
| ARP | Allocation and Retention Priority |
| AV | Audio-Visual |
| BCCH | Broadcast Control CHannel |

| | |
|----------|---|
| BCH | Broadcast CHannel |
| BM-SC | Broadcast/Multicast Service Centre |
| CAP | Common Alerting Protocol |
| CAS | Cell Acquisition Subframe |
| CBC | Cell Broadcast Centre |
| CBE | Cell Broadcast Entity |
| CBS | Cell Broadcast Service |
| CFI | Control Format Indicator |
| CMAF | Common Media Application Format |
| CMAS | Commercial Mobile Alert System |
| CP | Cyclic Prefix |
| CRC | Cyclic Redundancy Check |
| CRS | Cell-specific Reference Signal |
| CSG | Closed Subscriber Group |
| DASH | Dynamic Adaptive Streaming over HTTP |
| DCI | Downlink Control Information |
| DL-SCH | DownLink Shared CHannel |
| DRX | Discontinuous Reception |
| DVB | Digital Video Broadcasting |
| DVB-I | Digital Video Broadcasting Internet |
| EARFCN | E-UTRA Absolute Radio Frequency Channel Number |
| EBU | European Broadcasting Union |
| eMBMS | Evolved MBMS |
| enTV | enhanced TeleVision |
| EPG | Electronic Programming Guide |
| EPS | Evolved Packet System |
| ESG | Electronic Service Guide |
| ETWS | Earthquake and Tsunami Warning System |
| E-UTRAN | Evolved UTRAN |
| FEC | Forward Error Correction |
| FeMBMS | Further Evolved MBMS |
| FLUTE | FiLe delivery over Unidirectional Transport |
| FTA | Free-To-Air |
| GW | GateWay |
| HARQ | Hybrid Automatic Repeat reQuest |
| HbbTV® | Hybrid broadcast broadband TV |
| HLS | HTTP Live Streaming |
| HPHT | High Power High Tower |
| HTTP | Hyper Text Transfer Protocol |
| HTTPS | Hyper Text Transfer Protocol secure |
| IANA | Internet Assigned Numbers Authority |
| ID | IDentifier |
| IP | Internet Protocol |
| IPTV | Internet Protocol TeleVision |
| IRAT | Inter Radio Access Technology |
| ISD | Inter-Site Distance |
| KPAS | Korean Public Alert System |
| LTE | Long Term Evolution |
| MAC | Media Access Control |
| MBMS | Multimedia Broadcast Multicast Service |
| MBSFN | Multicast-Broadcast Single-Frequency Network |
| MBSFN-RS | Multicast-Broadcast Single Frequency Network Reference Signal |
| MCC | Mobile Country Code |
| MCCH | MBMS point-to-multipoint Control CHannel |
| MCH | Multicast Channel |
| MCS | Modulation and Coding Scheme |
| MIB | Master Information Block |
| MIME | Multipurpose Internet Mail Extensions |
| MME | Mobility Management Entity |
| MNC | Mobile Network Controller |
| MNO | Mobile Network Operator |
| MO | Management Object |

| | |
|----------|---|
| MPMT | Medium Power Medium Tower |
| M-RNTI | MBMS Radio Network Temporary Identifier |
| MTCH | MBMS point-to-multipoint Traffic CHannel |
| NAS | Non-Access Stratum |
| OFDM | Orthogonal Frequency-Division Multiplexing |
| PBCH | Physical Broadcast CHannel |
| PCFICH | Physical Control Format Indicator CHannel |
| PDCCH | Physical Downlink Control CHannel |
| PDSCH | Physical Downlink Shared CHannel |
| PDU | Protocol Data Unit |
| PLMN | Public Land Mobile Network |
| PMCH | Physical Multicast CHannel |
| PRB | Physical Resource Block |
| PSM | Power Saving Mode |
| PSS | Primary Synchronization Signal |
| PWS | Public Warning System |
| QoE | Quality-of-Experience |
| QoS | Quality-of-Service |
| QPSK | Quadrature Phase-Shift Keying |
| RAN | Radio Access Network |
| RAT | Radio Access Technology |
| REST-API | REpresentational State Transfer - Application Programming Interface |
| RLC | Radio Link Control |
| RLC-TM | Radio Link Control Transparent Mode |
| RLC-UM | Radio Link Control Unacknowledged Mode |
| RNTI | Radio Network Temporary Identifier |
| RoHC | Robust Header Compression |
| ROM | Receive-Only Mode |
| RRC | Radio Resource Control |
| RRM | Radio Resource Management |
| RSRP | Reference Signal Receive Power |
| RTSP | Real-Time Streaming Protocol |
| SA | Service Announcement |
| SACH | Service Announcement CHannel |
| SAI | Service Area Identifier |
| SBc | reference point name northbound of CBC |
| SCS | SubCarrier Spacing |
| SDP | Session Description Protocol |
| SFN | Single Frequency Network |
| SGi | Service Gateway interface |
| SI | System Information |
| SIB | System Information Block |
| SIM | Subscriber Identity Module |
| SSL | Secure Sockets Layer |
| SSS | Secondary Synchronization Signal |
| TA | Tracking Area |
| TBS | Transport Block Size |
| TCP | Transmission Control Protocol |
| TLS | Transport Layer Security |
| TMGI | Temporary Mobile Group Identifier |
| TTI | Transmission Time Interval |
| TV | Television |
| UDP | User Datagram Protocol |
| UE | User Equipment |
| UHF | Ultra High Frequency |
| UI | User Interface |
| URL | Universal Resource Locator |
| USD | User Service Description |
| USIM | Universal Subscriber Identity Module |
| UTRAN | UMTS Terrestrial Radio Access Network |
| WEA | Wireless Emergency Alerts |
| xMB | extended MBMS interface |

4 General

4.1 Background and history (informative)

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. Requirements for 3GPP enhancements for TV service support were developed in Release 14 and are documented in ETSI TS 122 101 [1], clause 32.

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 3GPP TR 23.746 [i.1], a significant set of key issues relevant for the usage of MBMS for broadcast services is identified and these issues are subsequently addressed in 3GPP Release 14 specifications:

- Support of Free-to-Air (FTA) service over 3GPP.
- Broadcast-only service for UEs with no MNO broadcast subscription.
- Support of shared eMBMS functions.
- Decoupling of content, MBMS service and MBMS transport functions.
- Exposure of eMBMS service and transport capabilities to third parties.

Beyond the service layer enhancements, also in 3GPP Release 14 the use cases and scenarios for eMBMS services based on LTE were expanded to include terrestrial broadcasting (the feature also referred to as "EnTV"). This included new requirements:

- Network dedicated to TV broadcast via eMBMS.
- Single Frequency Network (SFN) deployments with Inter-Site Distance (ISD) significantly larger than a typical ISD associated with typical cellular deployments.
- Support for Receive-Only Mode (ROM) services and devices.

With the development of 5G from Release 15 onwards, 3GPP formulated requirements for the system and radio access technology (RAT) in ETSI TS 122 261 [2] as part of the initial release for 5G, namely Release 15. In particular, broadcast is addressed in clause 6.13 of ETSI TS 122 261 [2]. Whereas the requirements are generic for a flexible broadcast/multicast system, only a subset of the requirements apply to broadcasting linear television and radio services, in particular those for 5G dedicated broadcast networks.

Several 3GPP specifications have been extended or newly developed over several releases to address the use cases and requirements for 5G dedicated broadcast networks. While it is expected that 3GPP will continue to address all the requirements for a flexible broadcast/multicast system in clause 6.13 of ETSI TS 122 261 [2] in future releases, with the completion of the Release 17, a comprehensive set of 3GPP specifications is available that fulfils the use cases and requirements for a 5G Broadcast System.

The present document 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 in order to address these features.

4.2 Basic features of a 5G Broadcast System

4.2.1 General

Based on the collected use cases and requirements in clause 4.1, a 5G Broadcast System for linear television and radio services as defined in the present document addresses the following features and functionalities:

- 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) [23], HTTP Live Streaming (HLS) [25] and Common Media Application Format (CMAF) [24].
- Support for IP-based services such as IPTV or ABR multicast.
- Support for different file delivery services such as scheduled delivery or file carousels.
- Support for services that use unicast and broadcast delivery methods.
- Support for typical broadcast channel bandwidths of 6/7/8 MHz.
- Support for public warning and emergency alerts based on cell broadcast services.

Note that these features are independent of the access or core network technology.

4.2.2 Reference architecture

The general architecture for a 5G Broadcast System is provided in figure 4.2.2-1. The principal actors in the system are as follows:

- A **5G Broadcast TV/Radio Content Service Provider** runs a head-end providing linear television and radio services.
- A **5G Broadcast TV/Radio Service Application** runs on devices that include a **5G Broadcast Receiver**.
- A **5G Broadcast System** operator runs a 5G Broadcast System with **5G Broadcast Transmitters** for use by devices including 5G Broadcast Receivers.
- A 5G Broadcast TV/Radio Content Service Provider makes services available using the 5G Broadcast System.
- A 5G Broadcast TV/Radio Service Application is able to consume the service by communicating with the 5G Broadcast Receiver through a dedicated set of **5G Broadcast Client APIs**.