

# ETSI TS 122 263 V17.4.0 (2022-05)



**5G;  
Service requirements for Video, Imaging and Audio for  
Professional Applications (VIAPA)  
(3GPP TS 22.263 version 17.4.0 Release 17)**



---

Reference

DTS/TSGS-0122263vh40

---

Keywords

5G

**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° w061004871

---

**Important notice**

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at [www.etsi.org/deliver](http://www.etsi.org/deliver).

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

If you find a security vulnerability in the present document, please report it through our  
Coordinated Vulnerability Disclosure Program:

<https://www.etsi.org/standards/coordinated-vulnerability-disclosure>

---

**Notice of disclaimer & limitation of liability**

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

---

**Copyright Notification**

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2022.  
All rights reserved.

---

# Intellectual Property Rights

## Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

## Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

**DECT™**, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

---

# Legal Notice

This Technical Specification (TS) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found under <http://webapp.etsi.org/key/queryform.asp>.

---

# Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

# Contents

Intellectual Property Rights .....	2
Legal Notice .....	2
Modal verbs terminology.....	2
Foreword.....	4
1 Scope .....	5
2 References .....	5
3 Definitions of terms, symbols and abbreviations .....	5
3.1 Definitions .....	5
3.2 Symbols.....	6
3.3 Abbreviations .....	7
4 Overview on video, imaging and audio professional applications .....	7
4.1 Introduction .....	7
4.2 Key parameters.....	7
4.2.1 System latency .....	7
4.2.2 Bandwidth.....	8
4.2.3 Reliability .....	8
4.3 AV production.....	8
4.4 Medical applications.....	9
5 Service requirements .....	10
5.1 Non-public network requirements .....	10
5.2 Application specific requirements .....	10
5.3 Clock synchronization .....	10
5.4 Network exposure requirements .....	10
5.5 Service continuity.....	10
5.6 Multi-network connectivity and service delivery .....	10
6 Performance requirements.....	11
6.1 Introduction .....	11
6.2 General performance requirements .....	11
6.2.2 Medical applications .....	14
6.3 Multicast performance requirements .....	15
6.3.1 Audio and video production applications .....	15
6.3.2 Medical applications .....	16
<b>Annex A (informative): Change history .....</b>	<b>17</b>
History .....	18

---

# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

---

# 1 Scope

This document describes the service and performance requirements for the operation of professional video, audio and imaging via a 5G system, including a UE, NG-RAN and 5G Core network.

The aspects addressed in this document include:

- Network service requirements specific for the operation of professional video, imaging and audio for PLMN and non-public networks (NPN)
- New key performance indicators (KPIs) for PLMN and NPN
- KPIs for Multicast and Broadcast Services
- Network Exposure Requirements
- Clock synchronisation
- Application Specific Requirements for video, imaging and audio
- Mobile and airborne base stations for NPNs
- Service continuity

---

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] Internet Engineering Task Force (IETF), IETF RFC 4175
- [3] 3GPP TS 22.104: "Service requirements for cyber-physical control applications in vertical domains"
- [4] 3GPP TS 22.261: "Service requirements for the 5G system".
- [5] ST 2059-2:2015 - SMPTE Standard – "SMPTE Profile for Use of IEEE-1588 Precision Time Protocol in Professional Broadcast Applications"
- [6] IEEE 1588-2008 - "IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems"

---

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

**AV Production:** the process by which audio and video content are combined in order to produce media content. This could be for live events, media production, conferences or other professional applications.

**Compressed Video:** a means of making video file or stream sizes smaller to meet various applications. Different applications have different compressions methodologies applied.

- **Mezzanine compression:** low latency and non-complex compression applied to a video signal in order to maintain the maximum amount of information whilst reducing the stream size to allow for the available bandwidth.
- **Visually lossless compression:** the maximum amount of compression that can be applied to a video signal before visible compression artefacts appear.
- **Highly compressed:** use of compression to distribute content over very low bandwidth connections where the content is more important than the quality of the image.

**Communication service availability:** as defined in TS 22.261 [4].

**Communication service reliability:** as defined in TS 22.104 [3].

**End-to-end Latency:** as defined in TS 22.261 [4].

**Isochronous:** The time characteristic of an event or signal that is recurring at known, periodic time intervals.

NOTE 1: Isochronous data transmission is a form of synchronous data transmission where similar (logically or in size) data frames are sent linked to a periodic clock pulse.

NOTE 2: Isochronous data transmission ensures that data between the source and the sink of the AV application flows continuously and at a steady rate.

**Imaging System Latency:** The time that takes to generate an image from a source, to apply a certain amount of processing, to transfer it to a destination and then to render the resulting image on a suitable display device, as measured from the moment a specific event happens to the moment that very same event is displayed on a screen.

**In-Ear-Monitoring (IEM):** A specialist type of earphone usually worn by a performer in which an audio signal is fed to a wireless receiver and attached earphone.

**Media Clock:** Media clocks are used to control the flow (timing and period) of audio / video data acquisition, processing and playback. Typically, media clocks are generated locally in every mobile or stationary device with a master clock generated by an externally sourced grand master clock.

NOTE 3: Currently GPS but transitioning to 5G in future.

**Mouth-to-ear Latency:** End-to-end maximum latency between the analogue input at the audio source (e.g. wireless microphone) and the analogue output at the audio sink (e.g. IEM). It includes audio application, application interfacing and the time delay introduced by the wireless transmission path.

**Non-public network:** as defined in TS 22.261 [4].

**Survival time:** as defined in TS 22.261 [4].

**Uncompressed Video:** Uncompressed video is [digital video](#) that either has never been [compressed](#) or was generated by decompressing previously compressed digital video.

NOTE 4: RTP payload is described in [2].

**Video, imaging and audio:** The means of digital capture, transmission and storage of still and moving pictures and sound for professional use.

## 3.2 Symbols

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

$T_{\text{frame}}$	Time interval between consecutive audio frames at application layer. Also used to denote the transfer interval in this document.
--------------------	--

### 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

AV	Audio-Visual
IEM	In-Ear-Monitoring

## 4 Overview on video, imaging and audio professional applications

### 4.1 Introduction

The present document introduces requirements related to professional video, imaging and audio services. Unlike other consumer multimedia applications envisioned for 3GPP systems, the applications in which this document focuses have more demanding performance targets and includes user devices that are managed in different workflows when compared to typical UEs.

This document focuses on services for the production of audio-visual data for any area that requires high quality images or sound. This may include AV production, medical or gaming applications.

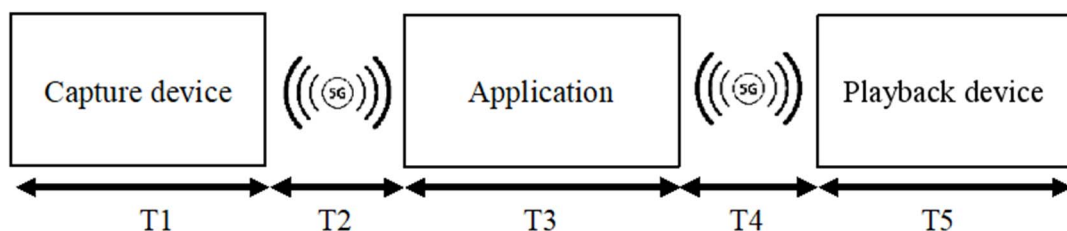
To enable devices such as professional cameras, medical imaging equipment and microphones to use the 5G network either directly or via the addition of a dedicated intermediate technology certain key parameters are required.

### 4.2 Key parameters

#### 4.2.1 System latency

The overall system latency has an important impact on the applications that this specification targets. In video production, overall system latency is referred to as imaging system latency and has an impact on the timing of synchronized cameras. For audio applications, overall system latency is referred to as mouth to ear latency and it is critical to maintain lip sync and avoid a performer to be put off by hearing their own echo. Finally, in medical applications the system latency impairs the achievable precision at a given gesture speed as it translates the time needed to traverse the whole imaging system into a geometrical error of the instruments position.

Figure 4.2.1.-1 depicts the general functional blocks of an AV production or medical system.



**Figure 4.2.1-1: Overall system Latency for video, imaging and audio applications.**

The overall system latency comprises different latency elements as illustrated in Figure 4.2.1-1, where:



T1 = Time for image or audio frame generation

T2 = T4 = Time Delay through 5G Network, defined as the end-to-end latency in TS 22.261 [4]

T3 = Application processing time

T5 = Time for image display or audio playback

So that the overall system latency results from the sum of the of  $T = T1 + T2 + T3 + T4 + T5$

## 4.2.2 Bandwidth

Video and imaging applications have extremely high bandwidth requirements and while compression may be used to mitigate this in certain user cases it often degrades the picture to the extent onward processing required by some applications is compromised. For Video Production certain standards have been determined which indicate the maximum allowable compression for a given type of production. In medical imaging, compression may introduce artefacts which can impact on diagnosis of critical illness and may also introduce additional delays which, in image assisted surgery, translate into misalignment between perceived instruments position on screen and their real position into patients' body.

## 4.2.3 Reliability

Reliability is another key parameter for VIAPA. Late or lost packets can result in dropped audio/video frames or inconsistency of motion which can degrade a video or audio signal to below acceptable levels.

## 4.3 AV production

AV production includes television and radio studios, live news-gathering, sports events, music festivals, among others. Typically, numerous wireless devices such as microphones, in-ear monitoring systems or cameras are used in these scenarios. In the future, the wireless communication service for such devices could potentially be provided by a 5G system. AV production applications require a high degree of confidence, since they are related to the capturing and transmission of data at the beginning of a production chain. This differs drastically when compared to other multimedia services because the communication errors will be propagated to the entire audience that is consuming the content on both live and on recorded outputs. Furthermore, the transmitted data is often post-processed with filters which could actually amplify defects that would be otherwise not noticed by humans. Therefore, these applications call for uncompressed or slightly compressed data, and very low probability of errors. These devices will also be used alongside existing technologies which have a high level of performance and so any new technologies will need to match or improve upon the existing workflows to drive adoption of the technology.

The performance aspects that are covered in this document also target the latency that these services experience. Since these applications involve physical feedback on performances that are happening live, the latency requirements are very strict. One example is the transmission on professional microphones and in-ear monitors. These systems provide feedback for what the musicians are playing, and even small delays may affect their sensation of timbre, and ability to keep to the tempo of the music.

This document also refers to how the network structure of the 5G system is configured in order to accommodate these applications. Many of these are nomadic scenarios that require simplified deployment often in different countries. For this reason, this the 5G system should enable non-public networks that can be deployed in an agile ad-hoc way.

AV production also relies on a number of other technologies that will be deployed by a 5G system such as the use of UAV's to capture video and high bandwidth connectivity for file transfer. Some aspects of specific 5G specifications such as direct communications between devices or multicast/broadcast could also be used to enable future user cases such as the connection of microphones to cameras and cameras to video monitors. Where this is the case then these requirements will be in line with the specifications in those specific areas.

AVProd workflows also require accurate timing protocols for 2 reasons

1. To enable multiple cameras and microphones to be synchronized thus avoiding the capture of mis-matched audio and video.
2. To provide IEEE-1588-2008 PTP [6] with an SMPTE 2059-2 [5] profile which is used for the accurate time stamping of IP packets

It is anticipated that the 5G system will act as a master clock and media clocks will be generated by UE applications. Requirements for this are in line with those in 22.104. If suitable sources are available, then each device may operate from its own master clock

## 4.4 Medical applications

"Medical applications" is a generic concept covering medical devices and applications involved in the delivery of care to patients.

Medical applications deployed into operating rooms consume communication services delivered by a 5G system over an NPN. In this document, we'll deal with hybrid operating rooms which are rooms typically equipped with advanced imaging systems such as e.g. fixed C-arms (x-ray generator and intensifiers), CT scanners (Computer Tomography) and MR scanners (Magnetic Resonance). The whole idea is that advanced imaging enables minimally-invasive surgery that is intended to be less traumatic for the patient as it minimizes incisions and allows to perform surgery procedure through one or several small cuts. This is as an example useful for cardio-vascular surgery or neurosurgery to place deep brain stimulation electrodes.

In hybrid rooms, the different type of medical images that can be transmitted by 5G systems and processed by medical applications are e.g.:

- Ultra-high-resolution video generated by endoscopes where it is expected that some scopes will produce up to 8K uncompressed (or compressed without quality loss) video, with the perspective to support also HDR (High Dynamic Range) for larger colour gamut management (up to 10 bits per channel) as well as HFR (High Frame Rate), i.e.; up to 120 fps. This will allow surgeons to distinguish small details like thin vessels and avoid any artefact that could potentially conduct surgeons to take wrong decisions.
- 2D Ultrasound images: A 2D ultrasound typically produces a data stream of uncompressed images of 512x512 pixels with 32 bits per pixel at 20 fps (up to 60 fps in the fastest cases), resulting in a data rate of 160 Mbit/s up to 500 Mbit/s.
- 3D Ultrasound volumes: Dedicated 3D probes tend to work at higher data rates, i.e. above 1 Gbit/s of raw data, and are expected to reach multi gigabit data rates in future (e.g. producing 3D Cartesian volumes of 256 x 256 x 256 voxels each encoded with 24 bits at 10 volumes per second or better).
- CT/MR scans: Images can range from a resolution of 1024x2024 to 3000x3000 pixels where higher resolutions are used for diagnosis purpose and lower ones are more suitable to fluoroscopy. In general, the frame rate is variable (5 to 30fps typically) where higher values are used to monitor moving organs in real time. Finally, colour depths of 16bits is considered in general.

In another deployment option, when specialists and patients are located at different places, medical applications can consume communication services delivered by PLMNs. In this case, the 5G system helps decoupling location from quality of care, and save countless hours for doctors and surgeons, who will be able to "beam" themselves to operating rooms, incident sites and medical houses, rather than having to be physically present.

The same type of images as in hybrid rooms is assumed when considering a communication over a PLMN although with different tradeoffs on image resolution, end to end latency and compression algorithms. The key here is to allocate the necessary high priority resources fulfilling SLAs suitable to the transport of medical data (with special care taken on medical data integrity and confidentiality) over a geographical area covering the place where the care is delivered.

Finally, in all types of deployments, it shall also be noted that each equipment involved in image generation, processing and display shall be synchronized thanks to a common clock either external or provided by the 5G system. The synchronization is often achieved through dedicated protocols such as e.g. PTP version 2 and allows to e.g. guarantee correct recombination of two data streams in a single and accurate A/R image by the A/R application, or enable offline replay of the whole procedure.

---

## 5 Service requirements

### 5.1 Non-public network requirements

The 5G system enables an NPN for video, imaging and audio for professional applications. The related requirements are described in 3GPP TS 22.261 [4]:

- Generic NPN requirements can be found in clause 6.25.
- Requirements on the subscription aspects can be found in clause 6.14.
- Authentication requirements can be found in clause 8.3.

### 5.2 Application specific requirements

The 5G system shall support media flows from open standard based broadcast workflows and be agnostic to the data carried.

### 5.3 Clock synchronization

The 5G network shall be able to provide a time reference information to a 3<sup>rd</sup> party application acting as a master clock with an accuracy of 1 microsecond.

### 5.4 Network exposure requirements

The 5G system shall support mechanisms to allow 3<sup>rd</sup> party application to update information associated to UE configuration (e.g. media compression, resolution, frame rate) for a UE or group of UEs using the application.

### 5.5 Service continuity

The 5G system shall be able securely reconnect within a short period of time (<1s) from UE starting first network reconnection attempt after the UE has detected a UE network connection loss.

The 5G system shall support uplink and downlink service continuity maintaining acceptable performance requirements while switching between co-located PLMN and NPN (e.g., due to mobility).

The 5G system shall support service continuity maintaining acceptable performance requirements: for an uplink stream while performing traffic steering, switching, and splitting among co-located PLMN(s) and NPN(s); for downlink while switching between co-located PLMN and NPN.

### 5.6 Multi-network connectivity and service delivery

The 3GPP system shall be able to enable a UE to receive low-latency downlink multicast traffic from one network (e.g. NPN), and paging as well as data services from another network (e.g. PLMN) simultaneously.

NOTE: Depending on the capabilities and configurations of the UE, limitations of data-rate and latency may be acceptable.

## 6 Performance requirements

### 6.1 Introduction

This section presents tables of performance requirements, where each line of the tables is considered as individual requirements.

### 6.2 General performance requirements

#### 6.2.1 Video and audio production applications

**Table 6.2.1-1: Performance requirements of professional low-latency periodic deterministic audio transport service**

Profile	# of active UEs	UE Speed	Service Area	E2E latency (Note 1)	Transfer interval (Note 1)	Packet error rate (Note 2, Note 3)	Data rate UL	Data rate DL
Music Festival	200	10 km/h	500 m x 500 m	750 $\mu$ s	250 $\mu$ s	$10^{-6}$	500 kbit/s	-
	100	10 km/h	500 m x 500 m	750 $\mu$ s	250 $\mu$ s	$10^{-6}$	-	1 Mbit/s
Musical	30	50 km/h	50 m x 50 m	750 $\mu$ s	250 $\mu$ s	$10^{-6}$	500 kbit/s	-
	20	50 km/h	50 m x 50 m	750 $\mu$ s	250 $\mu$ s	$10^{-6}$	-	1 Mbit/s
	10	-	50 m x 50 m	750 $\mu$ s	250 $\mu$ s	$10^{-6}$	-	500 kbit/s
Semi-professional	10	5 km/h	5 m x 5 m	750 $\mu$ s	250 $\mu$ s	$10^{-6}$	100 kbit/s	-
	10	5 km/h	5 m x 5 m	750 $\mu$ s	250 $\mu$ s	$10^{-6}$	-	200 kbit/s
	2	-	5 m x 5 m	750 $\mu$ s	250 $\mu$ s	$10^{-6}$	-	100 kbit/s
AV production	20	5 km/h	30 m x 30 m	750 $\mu$ s	250 $\mu$ s	$10^{-6}$	1.5 Mbit/s	-
	10	5 km/h	30 m x 30 m	750 $\mu$ s	250 $\mu$ s	$10^{-6}$	-	3 Mbit/s
Audio Studio	30	-	10 m x 10 m	750 $\mu$ s	250 $\mu$ s	$10^{-6}$	5 Mbit/s	-
	10	5 km/h	10 m x 10 m	750 $\mu$ s	250 $\mu$ s	$10^{-6}$	-	1 Mbit/s

NOTE 1: Transfer interval refers to periodicity of the packet transfers. It has to be constant during the whole operation. The value given in the table is a typical one, however other transfer intervals are possible as long as the end-to-end latency is  $\leq (1\text{ms} - \text{Transfer interval})$ .

NOTE 2: Packet error rate is related to a packet size of (transfer interval  $\times$  data rate). Packets that do not conform with the end-to-end latency are also accounted as error.

NOTE 3: The given requirement for a packet error rate assumes a uniform error distribution. The requirement for packet error rate is stricter if packet errors occur in bursts.

**Table 6.2-1-2: Performance requirements of low-latency periodic deterministic audio transport service in presentation use cases**

Profile	# of active UEs	UE Speed	Service Area	E2E latency (Note 1)	Transfer interval (Note 1)	Packet error rate (Note 2, Note 3)	Data rate UL	Data rate DL
Ad hoc	20	5 km/h	300 m x 300 m	4 ms	1 ms	$10^{-5}$	200 kbit/s	-
	8	stationary	300 m x 300 m	4 ms	1 ms	$10^{-5}$	-	200 kbit/s
Campus	1000	5 km/h	2 km x 2 km	4 ms	1 ms	$10^{-5}$	200 kbit/s	-
Conference	10	5 km/h	100 m x 100 m	4 ms	1 ms	$10^{-5}$	1.5 Mbit/s	-
	4	stationary	100 m x 100 m	4 ms	1 ms	$10^{-5}$	-	1.5 Mbit/s
Lecture room	4	5 km/h	10 m x 10 m	4 ms	1 ms	$10^{-5}$	50 kbit/s	-
	2	stationary	10 m x 10 m	4 ms	1 ms	$10^{-5}$	-	50 kbit/s

NOTE 1: Transfer interval refers to periodicity of the packet transfers. It has to be constant during the whole operation. The value given in the table is a typical one, however other transfer intervals are possible as long as the end-to-end latency is  $\leq (5 \text{ ms} - \text{Transfer interval})$ .

NOTE 2: Packet error rate is related to a packet size of (Transfer interval  $\times$  data rate). Packets that do not conform with the end-to-end latency are also accounted as error.

NOTE 3: The given requirement for a packet error rate assumes a uniform error distribution. The requirement for packet error rate is stricter if packet errors occur in bursts.

**Table 6.2.1-3: Performance requirements for low latency video.**

Profile	# of active UEs	UE Speed	Service Area	E2E latency	Packet error rate (Note 1)	Data rate UL	Data rate DL
Uncompressed UHD video	1	0 km/h	1 km <sup>2</sup>	400 ms	$10^{-10}$ UL $10^{-7}$ DL	12 Gbit/s	20 Mbit/s
Uncompressed HD video	1	0 km/h	1 km <sup>2</sup>	400 ms	$10^{-9}$ UL $10^{-7}$ DL	3.2 Gbit/s	20 Mbit/s
Mezzanine compression UHD video	5	0 km/h	1000 m <sup>2</sup>	1 s	$10^{-9}$ UL $10^{-7}$ DL	3 Gbit/s	20 Mbit/s
Mezzanine compression HD video	5	0 km/h	1000 m <sup>2</sup>	1 s	$10^{-9}$ UL $10^{-7}$ DL	1 Gbit/s	20 Mbit/s
Tier one events UHD	5	0 km/h	1000 m <sup>2</sup>	1 s	$10^{-9}$ UL $10^{-7}$ DL	500 Mbit/s	20 Mbit/s
Tier one events HD	5	0 km/h	1000 m <sup>2</sup>	1 s	$10^{-8}$ UL $10^{-7}$ DL	200 Mbit/s	20 Mbit/s
Tier two events UHD	5	7 km/h	1000 m <sup>2</sup>	1 s	$10^{-8}$ UL $10^{-7}$ DL	100 Mbit/s	20 Mbit/s
Tier two events HD	5	7 km/h	1000 m <sup>2</sup>	1 s	$10^{-8}$ UL $10^{-7}$ DL	80 Mbit/s	20 Mbit/s
Tier three events UHD (Note 2)	5	200 km/h	1000 m <sup>2</sup>	1 s	$10^{-7}$ UL $10^{-7}$ DL	20 Mbit/s	10 Mbit/s
Tier three events HD (Note 2)	5	200 km/h	1000 m <sup>2</sup>	1 s	$10^{-7}$ UL $10^{-7}$ DL	10 Mbit/s	10 Mbit/s
Remote OB	5	7 km/h	1000 m <sup>2</sup>	6 ms	$10^{-8}$ UL $10^{-7}$ DL	200 Mbit/s	20 Mbit/s

NOTE 1: Packets that do not conform with the end-to-end latency are also accounted as error. The packet error rate requirement is calculated considering 1500 B packets, and 1 packet error per hour is  $10^{-5}/(3 \times x)$ , where x is the data rate in Mbps.

NOTE 2: Could use either professional equipment or mobile phone equipped with dedicated newsgathering app

**Table 6.2.1-4: Performance requirements for airborne base stations for NPN.**

Profile	# of active UEs	UE Speed	Service Area	E2E latency	Packet error rate (Note 1)	Data rate UL	Data rate DL
NPN ground to air UHD up Link	10	500 km/h	700 km <sup>2</sup> x 6000 m (Note 2)	40 ms	10 <sup>-8</sup> UL 10 <sup>-7</sup> DL	100 Mbit/s	20 Mbit/s
NPN ground to air HD up link	10	500 km/h	700 km <sup>2</sup> x 6000 m (Note 2)	40 ms	10 <sup>-8</sup> UL 10 <sup>-7</sup> DL	80 Mbit/s	20 Mbit/s
NPN air to ground UHD down Link	2	500 km/h	700 km <sup>2</sup> x 6000 m (Note 2)	40 ms	10 <sup>-7</sup> UL 10 <sup>-8</sup> DL	20 Mbit/s	100 Mbit/s
NPN air to ground HD down link	2	500 km/h	700 km <sup>2</sup> x 6000 m (Note 2)	40 ms	10 <sup>-7</sup> UL 10 <sup>-8</sup> DL	20 Mbit/s	80 Mbit/s
NPN radio Camera UHD	10	200 km/h	1 km <sup>2</sup>	3 ms	10 <sup>-8</sup> UL 10 <sup>-7</sup> DL	100 Mbit/s	20 Mbit/s
NPN radio camera HD	10	200 km/h	1 km <sup>2</sup>	3 ms	10 <sup>-8</sup> UL 10 <sup>-7</sup> DL	80 Mbit/s	20 Mbit/s
NOTE 1: Packets that do not conform with the end-to-end latency are also accounted as error. The packet error rate requirement is calculated considering 1500 B packets, and 1 packet error per hour is 10 <sup>-5</sup> /(3*x), where x is the data rate in Mbps.							
NOTE 2: 6000 m = height but in a cone formation (i.e. ground coverage with a circle of diameter 30 KM)							

## 6.2.2 Medical applications

**Table 6.2.2-1: Performance requirements for low latency ultra-reliable imaging/video traffic for medical applications**

Profile	Characteristic parameter					Influence quantity				
	Communication service availability: target value in %	Communication service reliability: Mean Time Between Failure	End-to-end latency: maximum	Bit rate	Direction	Message Size [byte]	Survival time	UE speed (km/h)	# of active UEs connection	Service Area
UHD medical video over NPNs	>99.99999	>1 year	<1 ms	< 50 Gbit/s	UL; DL	~1500 - ~9000 (note 1)	~8ms	stationary	1	100 m2
Ultrasound images over NPNs	>99.9999	>1 year	<10ms	500 Mbit/s - 4 Gbit/s (note 2)	UL; DL	~1500	20-100 ms (note 2)	stationary	1	100 m2
UHD video for telesurgery over PLMNs	>99.9999	>1 year	< 20 ms	< 6 Gbit/s	UL; DL	~1500 - ~9000 (note 1)	~16 ms	stationary	<2 per 1000 km <sup>2</sup>	<400 km (note 3)
UHD video for medical examination over PLMNs	>99.99	>1 month	<20 ms	<4 Gbit/s	UL; DL	~1500 - 9000	~16 ms	stationary	<20 per 100 km <sup>2</sup>	<50 km (note 3)
Ultrasound images over PLMNs	>99.999	>>1 month (<1 year)	<20 ms	<200 Mbit/s	UL; DL	~1500	~16 ms	stationary	<20 per 100 km <sup>2</sup>	<50 km (note 3)
CT/MR real time scan over PLMNs	>99.999	>>1 month (<1 year)	< 100ms	<670 Mbit/s	UL, DL	~1500	<100 ms	<150	<20 per 100 km <sup>2</sup>	<50 km (note 3)

NOTE 1: MTU size of 1500 bytes is not generally suitable to gigabits connections as it induces many interruptions and loads on CPUs. On the other hand, Ethernet jumbo frames of up to 9000 bytes require all equipment on the forwarding path to support that size in order to avoid fragmentation.

NOTE 2: lower values considered for 2D ultrasounds images and higher values for 3D ultrasound images

NOTE 3: Maximum straight-line distance between UEs.

## 6.3 Multicast performance requirements

### 6.3.1 Audio and video production applications

**Table 6.3.1-1: Performance requirements for low latency deterministic periodic traffic with multicast service.**

Profile	# of active UEs	# of UL streams	# of DL streams	UE Speed	Service Area	E2E latency (Note 1)	Transfer interval (Note 1)	Packet error rate (Note 2, Note 3)	Data rate UL	Data rate DL
Integrated audience services	50000	-	30 multicast streams	5 km/h	1.5 km x 1.5 km	7 ms DL	3 ms	10 <sup>-4</sup>	-	200 kbit/s
Intercom system	1000	240 (Note 4)	30 multicast streams	5 km/h	1.5 km x 1.5 km	7 ms DL 7 ms UL	3 ms	10 <sup>-4</sup>	100 kbit/s	100 kbit/s
<p>NOTE 1: Transfer interval refers to periodicity of the packet transfers. It has to be constant during the whole operation. The value given in the table is a typical one, however other transfer intervals are possible as long as the end-to-end latency is <math>\leq (10 \text{ ms} - \text{Transfer interval})</math>.</p> <p>NOTE 2: Packet error rate is related to a packet size of (Transfer interval x data rate). Packets that do not conform with the end-to-end latency are also accounted as error.</p> <p>NOTE 3: The given requirement for a packet error rate assumes a uniform error distribution. The requirement for packet error rate is stricter if packet errors occur in bursts.</p> <p>NOTE 4: The UL stream originating from a UE may be the source of a DL multicast stream.</p>										



## 6.3.2 Medical applications

**Table 6.3.2-1: Performance requirements for low latency ultra-reliable imaging/video multicast traffic for medical applications**

Requirement	Characteristic parameter					Influence quantity				
	Communication service availability: target value in %	Communication service reliability: Mean Time Between Failure	End-to-end latency: maximum	Bit rate	Direction	Message Size [byte]	Survival time	UE speed (km/h)	# of UEs connection	Service Area
UHD medical video over NPNs	>99.99999	>1 day	<1 ms	< [50 Gbits/s]	DL	~1500 - ~9000 (note 1)	~8ms	stationary	<10	100 m2
UHD medical video over PLMNs	>99.99999	>1 day	< 250 ms	< [2 Gbit/s]	DL	~1500 - ~9000 (note 1)	~16 ms	stationary	<10	400 km

NOTE 1: MTU size of 1500 bytes is not generally suitable to gigabits connections as it induces many interruptions and loads on CPUs. On the other hand, Ethernet jumbo frames of up to 9000 bytes require all equipment on the forwarding path to support that size in order to avoid fragmentation.

## Annex A (informative): Change history

Change history							
Date	Meeting	TDoc	CR	R ev	Cat	Subject/Comment	New version
2019-08	SA1#87	S1-192206	-	-	-	Skeleton created	0.1.0
2019-08	SA1#87	S1-192747	-	-	-	TS22.263_MainBody	0.1.0
2019-08	SA1#87	S1-192748	-	-	-	TS22.263_ServiceRequirements	0.1.0
2019-08	SA1#87	S1-192749	-	-	-	TS22.263_DualConnectivity	0.1.0
2019-08	SA1#87	S1-192750	-	-	-	TS22.263_PerformanceRequirements	0.1.0
2019-09	SA#85	SP-190883				Presentation for information to SA#85	1.0.0
2019-11	SA1#88	S1-193219				Changes from SA1#88	1.1.0
2019-12	SA#86	SP-191021				Presentation for approval to SA#86	2.0.0
2019-12	SA#86	SP-191021				Approved by SA#86	17.0.0
2020-07	SA#88e	SP-200565	0003		D	On the generic 5G requirements for VIAPA	17.1.0
2020-07	SA#88e	SP-200565	0004	1	D	Clarification on Definition of Media Clock and Uncompressed Video	17.1.0
2020-07	SA#88e	SP-200565	0005	1	D	Clarification on packet error per hour	17.1.0
2020-07	SA#88e	SP-200568	0006		F	Correction of CMED KPIs tables	17.1.0
2020-07	SA#88e	SP-200568	0007		F	Update description for medical application in section 4.4	17.1.0
2020-09	SA#89e	SP-200792	0010	1	F	Clarification on Clock Synchronicity - Alt. 2	17.2.0
2020-12	SA#90e	SP-201028	0012	0	F	Update and clarification of UE reconnection time	17.3.0
2021-06	SA#92e	SP-210501	0014	1	D	Updating the definition of communication service availability	17.4.0

---

# History

<b>Document history</b>		
V17.4.0	May 2022	Publication