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**Agenda item: 7.9**

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**Revision history:**

|  |  |  |  |  |
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| **Version** | **Date** | **Meeting** | **TDOC** | **Subject/Comment** |
| 0.0.1 | 2025-05-23 | SA4#132 | S4-250xxx | Initial draft |
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# 1 Introduction

The present document compiles candidate changes, open issues, incomplete text, dependencies from other group, action items, and considered timeline to 3GPP TR 26.940 “Study on Ultra Low Bitrate Speech Codecs”. TR 26.940 aims for developing recommendations for potential normative work on an ultra-low bit rate codec for voice over Geostationary Orbit (GEO) satellites.

The following clauses and subclauses are structured according to the objectives that are in scope of the FS\_ULBC SID [1]:

1. Document the application scenarios for ultra-low bit rate communication services taking into account the use cases and potential requirements documented in TR 22.887 related to IMS Voice Call Using GEO Access.

2. Study GEO channel characteristics and derive service-related dependencies, e.g. bitrates, mouth-to-ear delay or loss/delay/jitter profiles.

NOTE: Any impact of ultra-low bitrate voice codec in NB-IoT services is outside of the scope of the study and is expected to be addressed by other working groups.

3. Identify the relevant design constraints for such a codec, in coordination with other WGs, including

- Bit rates

- Sample rate and audio bandwidth

- Frame length

- Complexity and memory demands

- Algorithmic delay

- Packet loss concealment (PLC)

- Potential use of noise suppression as part of the codec

- Discontinuous transmission including voice activity detection and comfort noise

- Speech quality

- Robustness to non-speech input

4. Provide some evidence that the design criteria can be met, for example existing reference codecs.

5. Define performance requirements and identify appropriate test methodologies, regarding speech quality, intelligibility, conversational quality, in particular taking into account

a) Clean speech and noisy speech

b) Tandeming with existing IMS voice codecs

c) Clean channel and GEO channel conditions

6. Identify or develop objective measures to verify the design constraints as necessary (e.g., to measure complexity and memory demands)

7. Identify relevant reference codecs for comparison and evaluation purposes.

8. Coordinate work with other 3GPP groups e.g. SA2, RAN, CT1, and others as needed.

9. Define potential normative work item objectives and timeline.

This working procedure of TR and p-doc includes:

- Maintain one TR and one p-doc (this document)

- All contributions to the TR are expected to be submitted using pCRs

- Both pCRs and discussion papers may be be used to contributed to the p-doc.

- Brackets should be avoided when possible, and when used:

- Restricted to values only

- Never applied to complete text blocks

- Open issues in the TR are to be documented in the p-doc, for example the prioritization of application scenarios and related technical assumptions.

- The p-doc should keep track of the status of the individual study item objectives.

# 2 References

[1] SP-250378, "SID on Ultra Low Bitrate Speech Codec", China Mobile Com. Corporation, vivo, Fraunhofer IIS, Qualcomm Incorporated, Spreadtrum, Dolby Laboratories Inc., Xiaomi, Huawei, 2025.

# 3 Definitions of terms, symbols and abbreviations

## 3.1 Terms

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

**example:** text used to clarify abstract rules by applying them literally.

## 3.2 Symbols

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

<symbol> <Explanation>

## 3.3 Abbreviations

For the purposes of the present document the following apply

# 4 Application scenarios

Editor’s Note:

1. Document the application scenarios for ultra-low bit rate communication services taking into account the use cases and potential requirements documented in TR 22.887 related to IMS Voice Call Using GEO Access.
2. Additional study areas or use cases, such as IMS voice call over NGSO or TN should be added with lower priority if time permits and once the exact requirements can be given.

## 4.1 Scenario 1: IMS Voice Call over GEO

### 4.1.1 Background

### 4.1.2 Scenario Description

## X Scenario X: TBD

### 4.X.1 Background

### 4.X.2 Scenario Description

### 4.X.3 Extracted technical assumptions and open questions

# 5 Channel characteristics and service-related dependencies

Editor’s Note:

Study GEO channel characteristics and derive service-related dependencies, e.g. bitrates, mouth-to-ear delay or loss/delay/jitter profiles as priority.

## 5.1 Architectural components and interfaces

### 5.1.1 Scenario 1: IMS Voice Call over GEO

### 5.1.X Scenario X:TBD

## 5.2 Channel characteristics

Editor’s Note:

- Study bitrates and loss/delay/jitter profiles.

### 5.2.1 Scenario 1: IMS Voice Call over GEO

### 5.2.X Scenario X:TBD

## 5.3 service-related dependencies

Editor’s Note:

- Study mouth-to-ear delay.

### 5.3.1 Scenario 1: IMS Voice Call over GEO

### 5.3.X Scenario X:

# 6 Design constraints

Editor’s Note:

[1.Only application scenarios finish channel characteristics and service-related dependencies by SA4# 134 (November 2025) will be considered in the design constraints for ULBC in Rel-20.]

2.. Identify the relevant design constraints for such a codec, in coordination with other WGs, including:

- Bit rates

- Sample rate and audio bandwidth

- Frame length

- Complexity and memory demands

- Algorithmic delay

- Packet loss concealment (PLC)

- Potential use of noise suppression as part of the codec

- Discontinuous transmission including voice activity detection and comfort noise

- Speech quality

- Robustness to non-speech input

- Identify or develop objective measures to verify the design constraints as necessary (e.g., to measure complexity and memory demands)

## [6.1 The status of DCs

|  |  |  |  |
| --- | --- | --- | --- |
| **External Dependency** | **Information from External Groups** | **SA4's Assumption** | **Open Issues** |
| DC: Bitrates | 　 | *e.g., A preliminary set of bitrates assumed by SA4 includes xxx-xxkpbs.* | 　 |
| DC: DTX/CNG | 　 | 　 | 　 |
| DC: Frame length | *e.g., S4-XXXXX an LS from RAN that indicats that the frame length should...* | 　 | 　 |
| DC: PLC loss/dly/error proiles | 　 | 　 | 　 |
| DC: Alg. Delay | 　 | 　 | 　 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Interdependency** | **Core Influencing Factors** | **Progress** | **Open Issue** |
| **DC: Bitrate** | Frame length (Major and External) | 　 | 　 |
| Robust Non-Speech | 　 | 　 |
| Evidence DCs | 　 | 　 |
| Noise Supression | 　 | 　 |
| Study GEO channel characteristics, derive service-related dependencies (Major and External) | 　 | 　 |
| **DC: Complexity, Memory** | Objective Measures (Major) | 　 | 　 |
| DC:Robust Non-Speech | 　 | 　 |
| DC: noise suppression | 　 | 　 |
| Evidence DCs | 　 | 　 |
| **DC: Sample rate, audio bandwidth** | Evidence DCs | 　 | 　 |

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# 8 Existing technologies and feasibility evidence

Editor’s Note:

Provide some evidence that the design criteria can be met, for example existing reference codecs.

# 7 Performance requirements

Editor’s Note:

1.Define performance requirements and identify appropriate test methodologies, regarding speech quality, intelligibility, conversational quality, in particular taking into account:

- Clean speech and noisy speech

- Tandeming with existing IMS voice codecs

- Clean channel and GEO channel conditions

2.Identify relevant reference codecs for comparison and evaluation purposes.

## 7.1 The status of PRs.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Core Influencing Factors** | **Progress** | **Open Issue** |
| **Performance requirements/speech quality** | DC: Sample rate and audio bandwidth | 　 | 　 |
| DC: Bitrates (External) | 　 | 　 |
| DC: Frame length | 　 | 　 |
| DC: PLC (External) | 　 | 　 |
| DC: Algorithmic Delay | 　 | 　 |
| DC: Complexity, Memory | 　 | 　 |
| Test Methodolgies | 　 | 　 |
| DC:noise suppression | 　 | 　 |
| DC:DTX/CNG | 　 | 　 |
| DC:Robust Non-Speech | 　 | 　 |
| Evidence DCs | 　 | 　 |
| Reference codec | 　 | 　 |

## 7.2 Clean speech and noisy speech

## 7.3 Tandeming with existing IMS voice codecs

## 7.4 Clean channel and GEO channel conditions

# 9 Test methodologies

# 10Considered work plan for potential normative work

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