**Source: Orange**

**Title: Clarifications on scope for FS\_ULBC**

## Document for: Agreement

## Agenda Item: 7.9

1. **Introduction**

The Rel-20 FS\_ULBC study item [1] has been approved in March 2024, and the general objective of this study is to develop recommendations for potential normative work on an ultra-low bit rate codec for voice over GEO.

In this contribution, we request to clarify the actual scope of the FS\_ULBC study.

1. **Discussion**

The FS\_ULBC study is essentially motivated by the the use case of IMS voice call using GEO access (TR 22.887) and related service requirements and KPIs on IMS voice call using GEO satellite access (TS 22.261) defined by 3GPP SA1. The key justification to launch the study is that no existing 3GPP codec seems to support all the expected requirements for this use case.

Voice services over IMS are already widely deployed on different access networks (e.g., LTE, NR, Wifi). If a new ultra-low bitrate codec (ULBC) is defined for GEO access, this ULBC codec would be listed as a supported codec by future UEs providing GEO access, and it would then be possible to use this codec for calls even in scenarios where GEO access is not used or not preferred (e.g., when there is a good direct connection over cellular or WLAN access).

It is therefore important to clarify where the foreseen codec design constraints and performance requirements in FS\_ULBC will also cover other application scenarios than just GEO access. For instance, on VoLTE or VoNR, an ultra low bit rate operation (around 1 to 3 kbit/s) may not be necessary, or one may even consider operating ULBC at a higher bit rate than 3 kbit/s to enable near-transparent audio quality (in clean channel conditions).

1. **Proposed text updates to draft TR 26.940 V0.0.1**

We suggest the following revisions based on the initial TR skeleton in [2]:

1 Scope

The present document develops recommendations for potential normative work on an ultra-low bit rate codec for the use case of IMS voice services over Geostationary Orbit (GEO) access. Other application scenarios (for example different access types) for an ultra-low bit rate codec are considered in the development of the recommendations as time permits.

Editor’s Note (verbatim copy of the justification of the Study Item, may be added to scope at later stage):

3GPP SA1 has studied the use case IMS Voice Call Using GEO Access, and the results are documented in TR 22.887. Normative service requirements and KPIs on IMS voice call using GEO satellite access will be introduced in TS 22.261 at TSG#107. GEO satellites are on a 35,786 km distance from the earth, which noticeably impacts signal propagation delay (one way approx. 285ms), data rate, and channel conditions due to e.g. atmospheric attenuation. Compared to terrestrial links, this poses significant new challenges for the voice codecs and services:

The overall transmission data rate assumed for GEO satellite systems is very constrained due to e.g. high path loss, atmospheric attenuation, energy constraints for terminals etc.. In TR 22.887, a total transmission data rate of [1-3] kbit/s is assumed. This transmission data rate are lower than what current 3GPP protocol stacks and codecs can supports.

For GEO satellite access, the propagation delay (285ms) is much longer than for commonly used terrestrial links.

The GEO satellite link imposes different channel characteristics, e.g., due to atmospheric attenuation.

Currently, no 3GPP voice codec seems to support all the expected requirements for this use case. Considering bitrate alone, the lowest supported bitrate of any 3GPP codec is 4.75 kbit/s as provided by the narrow band AMR codec (TS 26.071). This makes it necessary to have a new feasibility study relating to ultra-low bitrate codecs suitable for voice using GEO access.

The primary focus of this study is to develop design constraints and performance requirements for a codec supporting use cases like IMS Voice Call over GEO and the resulting transmission parameters. The requirements can provide guidance on the evaluation of the candidate codecs during potential normative work. (up to here already addressed in the first sentence of the above scope)

**1. General considerations**

**- Bitrate:** TR 22.887 concludes that the transmission rates are lower than what current 3GPP protocol stacks and codecs can supports. Detailed analysis on available bitrate requires more study..

**- Quality:** Despite of the low bit rate, a good audio quality of the codec is of importance, to ensure a reasonable QoE. Detailed QoE requirements for such services are for study..

**- Complexity and memory demands:** Modern low bitrate codecs exhibit a large scale of complexity and memory demands. The codec is expected to be deployable on the processing capabilities as can be found in today’s smartphones. Exact complexity requirements are for study.

**- Robustness to network conditions**: the codec is expected to operate in typical network conditions (delay, loss, jitter, etc.). Details are for further study.

**2. Functional requirements**

- **Speech transcoding functions**: To achieve integration with the terrestrial voice communication system (4G/5G IMS architecture), it is necessary to consider tandeming with existing IMS voice codecs.

NOTE: Additional study areas or use cases, such as assessing the market potential and potential market-readiness of a new ULBC codec should be added with lower priority if time permits and once the exact requirements can be given. (This aspect is already addressed in scope in the second bullet point)

It is expected that coordination with other working groups, e.g. SA2, CT1, RAN2 is needed in order to substantiate the design constraints of such a codec. However, it is not expected that this work creates any dependency for studies and normative in other working groups.

**References**

1. Tdoc [SP-250378](https://www.3gpp.org/ftp/tsg_sa/TSG_SA/TSGS_107_Incheon_2025-03/Docs/SP-250378.zip), “Study on Ultra Low Bitrate Speech Codec,” Source: SA WG4
2. Tdoc [S4-250451](https://www.3gpp.org/ftp/tsg_sa/WG4_CODEC/TSGS4_131-bis-e/Docs/S4-250451.zip), “[FS\_ULBC] TR 26.940 V0.0.1,” Source: China Mobile Com. Corporation