

**3GPP RAN #86**  
**December 9-12, 2019**  
**Sitges, Spain**

**RP-193137**

**Agenda Item: 9.1.1**

# **On R17 XR over NR**

**Apple Inc.**

## Background

- **Email discussions on XR use-cases, scenarios and requirements were conducted and summarized in RP-191856.**
  - A number of companies have expressed interest in studying performance for XR applications and use-cases
- **Can XR use-cases be addressed as part of potential NR-Light feature list?**
  - NR-light primary addresses solutions for smart wearables and sensing applications.
    - It does not include applications with low latency or high performance and reliability requirements
      - See e-mail discussions on NR-Light summarized in RP-192160.
- In this document, we express our views on introducing XR specific features in Rel-17.

## Motivation

- **5G NR was conceptualized to be future-proof and designed to serve a variety of applications and use-cases**
  - XR (AR specifically) is a classic example that can potentially be supported by 5G
  - A number of gaming applications introduced through Apple Arcade and Google Stadia in Android
    - E.g, SwiftShot and Minecraft are representative AR games developed for mobile devices
- **NR Uu link as currently designed may not be particularly optimized for the specific requirements of XR for all cases**

	Throughput	Reliability	Latency	Power Consumption
eMBB	✓	✗	✗	✗
uRLLC	✗	✓	✓	✗
Low Power Enh	✗		✗	✓

\*based on requirements defined in SA1 and SA4 and e-mail discussions on XR

- **There is a need to evaluate whether existing mechanisms are suitable to meet XR application requirements**
  - If necessarily XR-specific enhancements can be introduced so that the promise of 5G can be fulfilled for XR.
    - Similar enhancements have been made for other use-cases that do not fall under the generic NR umbrella like V2X, NR-U, IAB etc.

## Relevant KPIs for XR Use-cases to be included

### Latency

- Less than Packet Delay Budget
- Especially for isochronous traffic

### Reliability

- Packets that have not been retransmitted within PDB are dropped
- TCP ACKs cannot be relied upon

### Power Consumption

- Mechanisms specifically tailored for XR apps



AR / ARkit

### Throughput

- Moderate sustained throughput typical of AR gaming apps on the phone
- Lower Priority Requirement

### Device Complexity

- Requirement satisfaction should not be contingent on excessive UE complexity

### Link Budget

- Adequate coverage at the cell-edge is essential

## Proposed Scope of Rel-17 XR

- **Propose to begin an SI to evaluate whether the requirements specific to XR use-cases can be met**
  - Evaluation methodology should include
    - Traffic models pertaining to a variety of XR applications
    - Introduce evaluation metrics to determine the feasibility of isochronous traffic with guaranteed latency requirements. Include power consumption as part of the evaluation (compared to LTE)
  - To address scenarios where the existing NR specifications do not meet the requirements, evaluate suitable enhancements to improve performance