

A Combined Framework for Random Access in LEO NB-IoT Supporting Legacy UEs

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This study considers NB(Narrow Band)-IoT(Internet of Things) communication over low Earth orbit (LEO) satellite networks without requiring modifications to existing user equipments (UEs) [1]. Previous works mainly focused on two directions: delay and Doppler compensation at the base station (evolved NodeB, eNB), and new RACH(Random Access Channel) occasion (RO) designs for random access in environments where GNSS(Global Network Satellite System)-enabled and non-GNSS UEs coexist [2]. However, these approaches have generally been studied separately.

We propose a simple combined approach. The eNB handles baseline delay compensation to maintain backward compatibility with legacy UEs, while the random access stage uses adaptive RO allocation. Specifically, GNSS-enabled UEs are assigned shorter ROs, and non-GNSS UEs are assigned longer ROs to reduce collision and ambiguity. When the network is busy, additional RO resources can be scheduled to further mitigate contention.

Based on existing simulation results from related studies, this combined approach is expected to improve random access success probability and reduce access delay while supporting unmodified devices. The concept remains preliminary but highlights a practical direction for extending NB-IoT connectivity to underserved and disaster-prone areas through LEO-based non-terrestrial networks.

REFERENCES

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