Comparative Performance of Evolve Radio Access Bearer Channel Drop Rate for 4G Networks Across Nigeria

Abstract

This study presents a 36-month analysis of the Evolved Radio Access Bearer (ERAB) channel drop rate for four major mobile networks in Nigeria: MTN, Airtel, Globacom, and 9mobile, covering the period from January 2021 to December 2023. Data collected from the Nigerian Communications Commission (NCC) were analyzed to assess the performance, reliability, and compliance of these networks with the NCC benchmark of $\leq 2\%$. Graphical and statistical methods were employed to identify trends, strengths, and areas for improvement. Results reveal that all networks consistently maintained ERAB drop rates within the NCC threshold throughout the study period, demonstrating compliance with regulatory standards. MTN consistently emerged as the top performer, followed by Airtel, while 9mobile and Globacom showed relatively higher, but still compliant, drop rates. This study underscores the importance of network optimization and offers actionable recommendations for further enhancing reliability and user experience in Nigeria's mobile networks.

Keywords: ERAB channel drop rate, 4G LTE optimization, Mobile network reliability, Quality of Service Analysis, 4G Key Performance Indicator

1.0 Introduction

The advent of 4G Long-Term Evolution (LTE) networks has significantly reshaped the telecommunications landscape globally, offering high-speed internet and reliable connectivity. The deployment of 4G networks by mobile operators has enabled unprecedented access to data-driven services, facilitating digital inclusion and economic growth. However, ensuring high-quality service delivery in a dynamic and challenging environment remains a critical focus for both operators and regulators [1]. Among the key performance indicators (KPIs) used to assess the quality of service (QoS) in 4G networks, the Evolve Radio Access Bearer (ERAB) channel drop rate stands out as a vital metric.

The ERAB drop rate measures the proportion of active connections that are prematurely terminated due to network issues such as congestion, hardware malfunctions, or radio frequency interference [2]. A high ERAB drop rate directly impacts user experience, leading to dropped calls, interrupted data sessions, and overall dissatisfaction [3]. In a country where mobile networks serve as the primary medium for accessing internet services, optimizing the ERAB drop rate is essential for maintaining customer trust and competitive advantage [1].

Despite the rapid expansion of 4G networks, consistent challenges persist in delivering high-quality services. High ERAB drop rates remain a common complaint among users, particularly during peak traffic hours and in less urbanized regions [2]. These issues are exacerbated by factors such as limited backhaul capacity, insufficient spectrum allocation, and aging infrastructure [6]. Without a detailed understanding of the root causes and comparative performance of different operators, efforts to address these challenges risk being ineffective or misdirected [3].

Several researchers have made several attempts to evaluate the performance of 4G networks [3-26]. The authors in [3] used a case study of Telecom of Kosovo (TK) mobile operator. Measurements and analysis focused on a 24-cell cluster of 4G/LTE network implemented in TK. The performance of the 4G/LTE network was evaluated to check if it performs within the recommended values of 3GPP standard. The authors in [4] investigated the performance of 4G/LTE networks in North-Central Nigeria using a comprehensive drive test methodology carried out in Abuja, Lafia and Makurdi. Key metrics including network speed, latency, uptime, coverage, and signal power were evaluated across major Mobile Network Operators. Result revealed that D-NGN had dominance in network performance, outperforming A-NGN, B-NGN, and C-NGN.

In [23], the performance of 4G internet services provided by multiple mobile network operators at the University of Ilorin, Nigeria, was evaluated. Using TEMS tools, they analyzed key performance indicators (KPIs) such as RSRP, RSRQ, and SINR, benchmarking them against the standards set by the Nigerian Communications Commission (NCC). Similarly, the researchers in [24] examined LTE network performance in Lagos, utilizing Huawei drive test equipment. Their study focused on indicators such as RSSI, RSRQ, RSRP, SINR, and throughput, analyzed using MapInfo and MATLAB, and aligned with NCC standards. The researchers in [25] assessed the performance of four mobile network operators in Shiroro, Nigeria, employing TEMS tools alongside statistical analysis while the author in [26] conducted a comparative analysis of three LTE scheduling algorithms in Akure, Nigeria.

Although various methods have been employed to evaluate network performance across different regions, a significant research gap exists in the assessment of 4G LTE networks in Nigeria. As service providers continue rolling out 4G networks, it becomes essential to evaluate their performance and determine their ability to meet the promised standards of service delivery.

The importance of this study is multifaceted. First, it contributes to the existing body of knowledge on network performance in Nigeria, providing a comprehensive evaluation of 4G service quality. Second, it serves as a guide for network operators in identifying performance gaps and prioritizing infrastructure investments. Third, it assists policymakers and regulators, such as the Nigerian Communications Commission (NCC), in setting benchmarks for QoS and promoting accountability among operators. Finally, the study benefits end-users by highlighting areas of concern and advocating for improved service delivery.

This study focuses on a 36-month analysis of ERAB drop rates for MTN, Airtel, Globacom, and 9Mobile, aiming to provide insights into their performance trends, strengths, and weaknesses. By identifying patterns and determining the factors contributing to network inefficiencies, this research seeks to offer actionable recommendations for improving network reliability and user experience.

2.0 Methodology

This study investigates the Evolved Radio Access Bearer (ERAB) channel drop rate across four major mobile network operators in Nigeria: MTN, Airtel, Globacom, and 9mobile. The evaluation is based on ERAB drop rate data collected from base transceiver stations (BTS) situated across Nigeria's 36 states and the Federal Capital Territory (FCT) over a 36-month period, spanning January 2021 to December 2023.

2.1 Data Collection

The ERAB channel drop rate data was sourced from the Nigerian Communications Commission (NCC), providing a comprehensive dataset that reflects network performance metrics nationwide. This dataset includes monthly ERAB drop rate values for each of the four networks, offering granular insights into temporal performance trends and variations.

2.2 Data Analysis

The collected data was subjected to analysis using graphical and statistical tools. Line graphs and bar charts were utilized to visualize the monthly and annual trends in ERAB channel drop rate for each network, allowing for comparative evaluation. These visualizations enabled an intuitive understanding of network performance over the study period. Furthermore, the ERAB drop rate values were benchmarked against the NCC's threshold of $\leq 2\%$ to determine compliance and highlight instances of suboptimal network performance. Metrics such as consistency, peak performance, and deviations were closely examined.

2.3 Comparative Analysis

A comparative analysis was performed to evaluate the relative strengths and weaknesses of the four networks in maintaining session continuity and minimizing ERAB drop rates. This involved cross-network comparisons to identify the operator with the most reliable service delivery across the study period. Additionally, the analysis highlighted time periods and locations where individual networks exceeded or fell below the NCC's benchmark, providing insights into factors such as radio resource allocation, mobility management efficiency, and network congestion impacts on ERAB session stability.

3.0 Results and Discussion

This study assessed the ERAB channel drop rate performance of 4G Long-Term Evolution (LTE) networks for MTN, Airtel, Globacom, and 9mobile. The analysis focused on network reliability, compliance with regulatory standards, and temporal trends. The results are presented through graphical representations and bar charts, enabling a detailed comparative discussion.

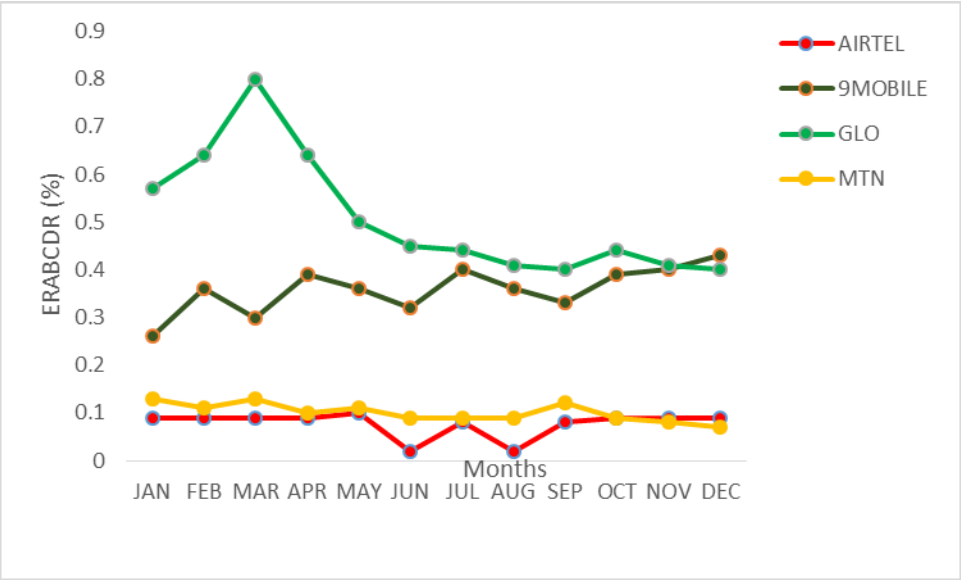

Figure 1: Monthly ERAB channel drop rate in 2021

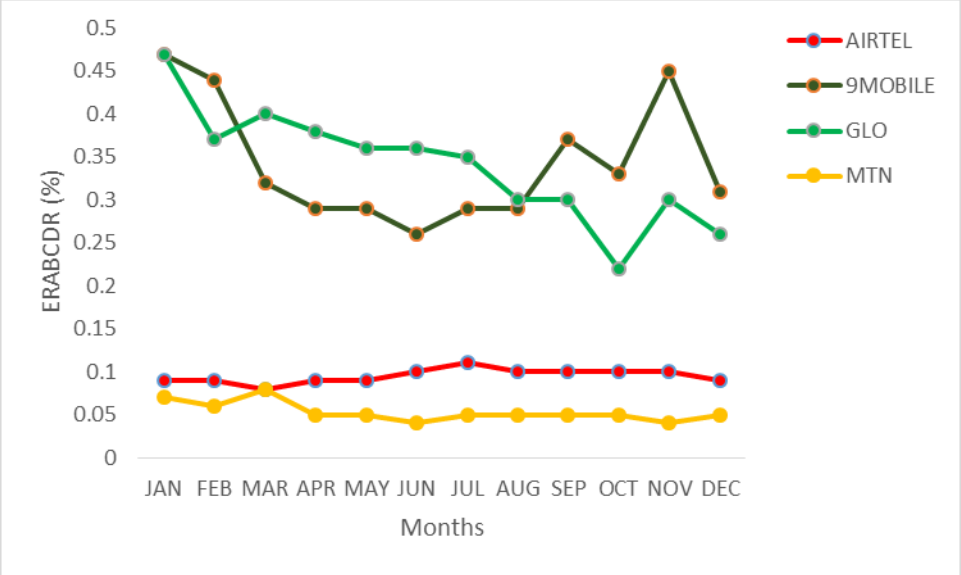

Figure 2: Monthly ERAB channel drop rate in 2022

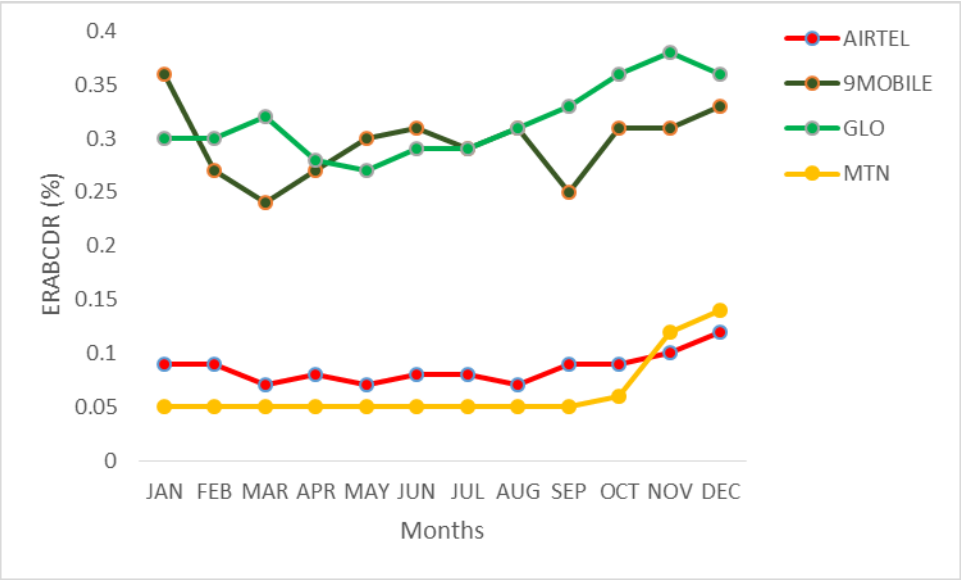

Figure 3: Monthly ERAB channel drop rate in 2023

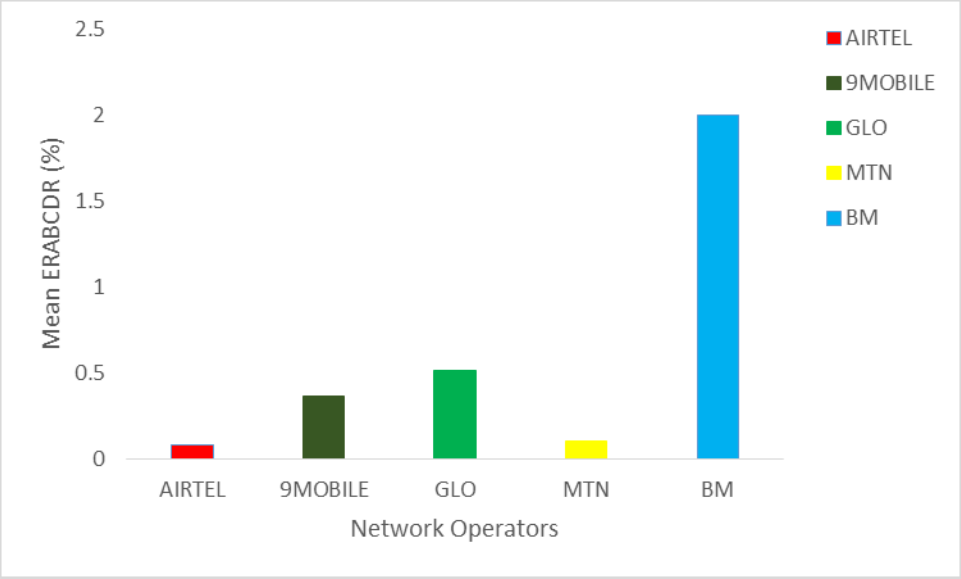

Figure 4: Average ERAB channel drop rate in 2021

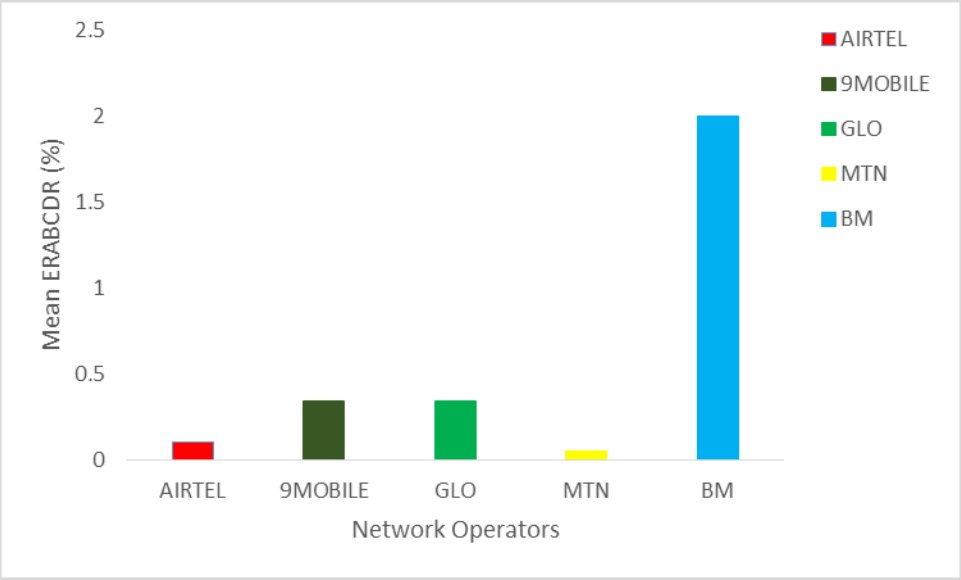

Figure 5: Average ERAB channel drop rate in 2022

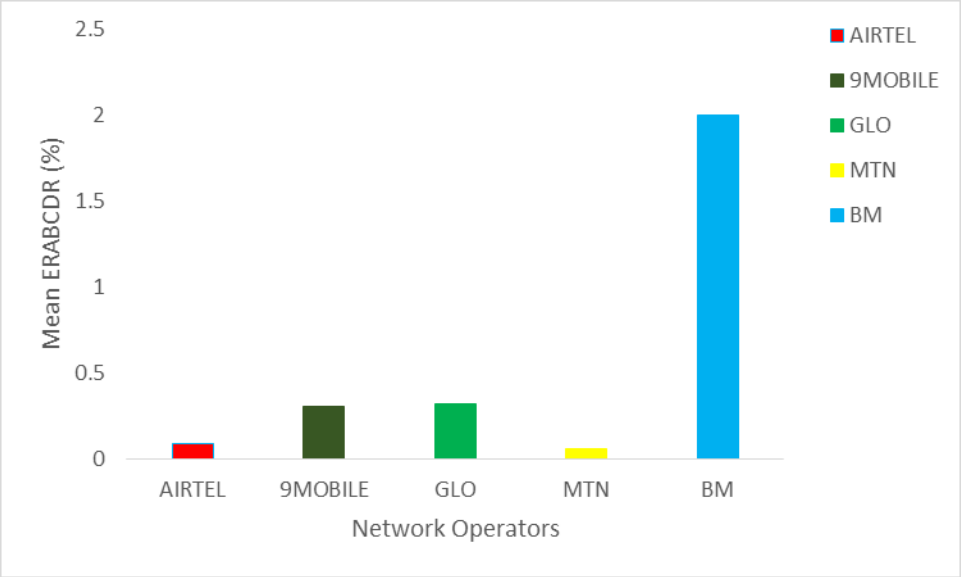

Figure 6: Average ERAB channel drop rate in 2023

Figure 1 illustrates the monthly trend of the ERAB channel drop rate for the year 2021 across four mobile networks. Analysis of the graph shows that all networks consistently performed within the Nigerian Communications Commission (NCC) recommended threshold of $\leq 2\%$. Airtel achieved its best performance with an ERAB drop rate of 0.02% in both June and August. For 9mobile, the lowest drop rate of 0.30% occurred in March, while MTN recorded its optimal value of 0.07% in December. Globacom demonstrated its best performance at 0.40%, which was observed in both September and December. These values highlight effective network optimization and compliance with quality benchmarks.

Figure 2 presents the monthly trend of the ERAB channel drop rate for the year 2022. Once again, all four networks operated well within the NCC benchmark for acceptable drop rates. Airtel recorded its

lowest drop rate of 0.08% in March. For 9mobile, the best value was 0.26% in June, while Globacom recorded 0.22% in October. MTN maintained its top performance at 0.04%, observed in both June and November. These results reflect ongoing efforts by the operators to enhance network stability and minimize service interruptions.

Figure 3 depicts the monthly trend of the ERAB channel drop rate for 2023, showing continued compliance with the NCC performance standards. MTN demonstrated exceptional consistency, achieving an ERAB drop rate of 0.05% from January through September. Airtel recorded its lowest drop rate of 0.07% in March, May, and August. For 9mobile, the best performance occurred in March at 0.24%, while Globacom achieved its lowest rate of 0.27% in May. This consistent performance across the networks reflects advanced resource allocation and improved radio network planning.

Figure 4 illustrates the yearly average ERAB channel drop rate for 2021 in a bar chart. Airtel emerged as the best-performing network with an average drop rate of 0.08%, closely followed by MTN at 0.10%. 9mobile and Globacom reported yearly averages of 0.36% and 0.51%, respectively. These averages indicate robust network quality, as none of the providers exceeded the NCC benchmark of ≤2%.

Figure 5 provides the yearly average ERAB channel drop rate for 2022, where MTN took the lead with an impressive drop rate of 0.05%, followed by Airtel at 0.10%. Both 9mobile and Globacom recorded an identical average drop rate of 0.34%. These figures demonstrate steady improvements in network optimization, contributing to enhanced user experiences.

Figure 6 summarizes the yearly average ERAB channel drop rate for 2023. MTN retained its top position with an average drop rate of 0.06%, followed by Airtel at 0.09%. 9mobile and Globacom reported average drop rates of 0.30% and 0.34%, respectively. The continued adherence to NCC benchmarks underscores the networks' commitment to providing reliable service and reducing involuntary session terminations.

Conclusion

This study evaluated the ERAB channel drop rate performance of MTN, Airtel, Globacom, and 9mobile over a 36-month period (2021–2023), providing insights into network reliability and compliance with NCC standards. The findings demonstrate that all networks operated within the ≤2% benchmark set by the NCC, reflecting significant efforts by operators to ensure service quality. MTN consistently outperformed its competitors, achieving the lowest average drop rates over the three years, followed closely by Airtel. While 9mobile and Globacom showed higher drop rates, their values were well within acceptable limits, highlighting areas for improvement in mobility management and radio resource optimization.

The trends observed indicate that network reliability has steadily improved across all operators, driven by advancements in resource allocation, handover mechanisms, and signal optimization. These findings provide a foundation for mobile operators to further reduce ERAB drop rates by addressing network inefficiencies and enhancing coverage quality, especially in areas prone to higher drop rates. Continued focus on network optimization will not only strengthen user satisfaction but also align with national efforts to improve the digital economy and communication services in Nigeria.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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