# RAN Engineering and Performance Optimization Training Course



22 - 26 Nov 2026

Manama

4400 € (Per Person)

Ref: #TEL4755_238637

## Course Introduction / Overview:

This comprehensive course provides an in-depth exploration of Radio Access Network (RAN) engineering, performance analysis, and optimization, covering the entire lifecycle from fundamental principles to advanced 5G network strategies. In an era where mobile connectivity is paramount, a robust and efficient RAN is the cornerstone of superior network performance and user experience. This program is meticulously designed to equip participants with the critical skills needed to design, manage, and enhance modern mobile networks. Drawing on foundational concepts detailed by academics like Theodore S. Rappaport in seminal works such as "Wireless Communications: Principles and Practice", the course bridges theoretical knowledge with practical, real-world applications. Participants will delve into the architectures of 4G LTE and 5G NR, master the art of monitoring Key Performance Indicators (KPIs), and learn systematic troubleshooting techniques. At BIG BEN Training Center, we ensure that our curriculum is always current, incorporating the latest industry trends such as Open RAN, network virtualization (vRAN), and the role of AI in network automation, preparing professionals for the challenges of next-generation telecommunications.

## Target Audience / This training course is suitable for:

- Telecommunications Engineers.
- Radio Frequency (RF) Planning and Optimization Engineers.
- RAN Performance Analysts.
- Network Operations Center (NOC) Staff.
- System Integration and Testing Engineers.
- Technical Project Managers in Telecom.
- Field Technicians and Cell Site Engineers.
- Solutions Architects specializing in mobile networks.

## Target Sectors and Industries:

- Mobile Network Operators (MNOs).
- Telecommunication Service Providers.
- Network Equipment Manufacturers and Vendors.
- Managed Service Providers for Telecom Infrastructure.
- Governmental agencies managing public safety and communication networks.
- Large enterprises with private cellular networks (4G/5G).
- Technology and Engineering Consulting Firms.

## Target Organizations Departments:

- Network Planning and Design.
- Radio Frequency (RF) Engineering.
- Network Performance and Quality Assurance.
- Operations and Maintenance.
- Technical Support and Troubleshooting.
- Research and Development.
- System Engineering and Architecture.
- Capital Projects and Network Deployment.

## Course Offerings:

By the end of this course, the participants will have able to:

- Analyze the end-to-end architecture of 4G LTE and 5G NR Radio Access Networks.
- Interpret and evaluate key performance indicators (KPIs) to assess network health and quality.
- Develop and implement effective strategies for RAN performance optimization and troubleshooting.
- Understand the principles of radio resource management, interference mitigation, and capacity planning.
- Grasp the fundamentals of advanced technologies like Massive MIMO, beamforming, and network slicing.
- Evaluate the impact and architecture of emerging trends such as Open RAN and virtualized RAN (vRAN).
- Conduct systematic analysis of network issues like call drops, low throughput, and handover failures.
- Apply RF planning principles for efficient network design and expansion.

## Course Methodology:

The training methodology at BIG BEN Training Center is designed to be highly interactive, engaging, and practical, ensuring that participants can immediately apply their learning in a professional context. We move beyond traditional lecture-based formats to create a dynamic learning environment. The course heavily relies on real-world case studies, where participants will analyze network performance data, diagnose common RAN issues, and propose optimization solutions. Collaborative group exercises and workshops encourage peer-to-peer learning and the exchange of diverse industry experiences. Interactive sessions are facilitated by an expert instructor who guides discussions, answers complex questions, and provides personalized feedback. The curriculum integrates practical problem-solving activities that simulate challenges faced by RAN engineers daily. This hands-on approach solidifies theoretical concepts and builds confidence in tackling complex network scenarios. Our focus is on fostering critical thinking and analytical skills, empowering participants to not only understand the "how" but also the "why" behind RAN engineering and optimization principles.

## Course Agenda (Course Units):

### Unit One: Fundamentals of Radio Access Network Engineering

- Introduction to Mobile Communication Generations (1G to 5G).
- Core Principles of Radio Frequency (RF) Propagation.
- Understanding Cellular Concepts: Frequency Reuse, Handoffs, and Cell Splitting.
- RAN Architecture and its Key Components.
- Multiple Access Technologies: FDMA, TDMA, CDMA, and OFDMA.
- Antenna Theory and Smart Antenna Systems.
- The Role of the Radio Network Controller (RNC) and its Evolution.

## Unit Two: 4G LTE RAN Architecture and Planning

- Deep Dive into the E-UTRAN (Evolved UMTS Terrestrial Radio Access Network) Architecture.
- Functions of the eNodeB and its Interfaces (S1, X2).
- The LTE Radio Protocol Stack (PDCP, RLC, MAC, PHY).
- LTE Channel Structure and Physical Layer Procedures.
- LTE Mobility Management: Handover Scenarios and Optimization.
- Voice over LTE (VoLTE) Principles and Performance Considerations.
- RF Planning and Design for LTE Networks.

## Unit Three: 5G NR RAN Architecture and Technologies

- Introduction to 5G New Radio (NR) and the NG-RAN Architecture.
- Key Components: gNodeB, CU (Centralized Unit), DU (Distributed Unit).
- 5G Spectrum Bands: Sub-6 GHz and mmWave.
- Massive MIMO and Advanced Beamforming Techniques.
- Network Slicing in the 5G RAN for Diverse Use Cases.
- Dual Connectivity (EN-DC) between LTE and 5G NR.
- Flexible Numerology and Frame Structure in 5G.

## Unit Four: RAN Performance Monitoring and Analysis

- Defining Key Performance Indicators (KPIs) for Accessibility, Retainability, and Integrity.
- Understanding Call Drop Rate (CDR) and Call Setup Success Rate (CSSR).
- Data Throughput and Latency Metrics Analysis.
- Methods for Data Collection: Drive Testing, OSS, and Crowdsourcing.
- Tools and Techniques for RAN Performance Data Analysis.
- Troubleshooting Common RAN Issues: Pilot Pollution, Overshooting, and Interference.
- Quality of Service (QoS) vs. Quality of Experience (QoE) in Mobile Networks.

### Unit Five: RAN Optimization and Future Trends

- Strategies for RAN Parameter Tuning and Optimization.
- Interference Management and Mitigation Techniques.
- Mobility Optimization: Handover Parameter Adjustments.
- Capacity and Coverage Optimization Strategies.
- Introduction to Open RAN (O-RAN) and its Ecosystem.
- The Concept and Benefits of Virtualized RAN (vRAN) and Cloud RAN (C-RAN).
- The Role of Artificial Intelligence (AI) and Machine Learning (ML) in RAN Automation.

## FAQ:

### Qualifications required for registering to this course?

There are no requirements.

### How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

## Something to think about:

As networks evolve towards Open RAN and virtualization, how might the traditional roles of RAN engineers shift from hardware-centric management to software-driven orchestration and automation?

## What unique qualities does this course offer compared to other courses?

This course distinguishes itself by offering a holistic and forward-looking perspective on Radio Access Network engineering. While many programs focus narrowly on a single technology, our curriculum provides a comprehensive journey from the foundational principles of 4G LTE to the cutting-edge complexities of 5G NR and beyond. We place a strong emphasis on the practical application of knowledge, moving past theoretical discussions to focus on real-world performance analysis and optimization strategies. Participants learn not just to identify network problems through KPIs but to understand the underlying causes and engineer effective, sustainable solutions. A key differentiator is our dedicated focus on emerging industry paradigms, including detailed modules on Open RAN and vRAN. This prepares professionals not just for the networks of today but for the disaggregated and software-defined networks of tomorrow. The course fosters a deep, analytical mindset, encouraging participants to think critically about network behavior and the future impact of automation and AI on RAN management, ensuring they leave with a strategic and adaptable skill set.