Advanced Microwave Transmission and Link Planning Training Course

21 - 25 Dec 2026

Madrid

5900 € (Per Person)

Ref: #TEL4914_146091

Course Introduction / Overview:

This comprehensive training course provides an in-depth exploration of microwave transmission engineering, from fundamental principles to advanced link planning and optimization strategies. In an era dominated by high-speed data and the rollout of 5G networks, reliable and high-capacity backhaul is more critical than ever, making microwave links an indispensable component of modern telecommunications infrastructure. This program is meticulously designed to equip participants with the practical skills needed to design, implement, and maintain robust microwave communication systems. The curriculum delves into the core concepts of radio wave propagation, drawing on principles outlined in seminal works like "Microwave Engineering" by the renowned academic David M. Pozar. Participants will move beyond theory to master link budget analysis, interference mitigation, and path profiling. BIG BEN Training Center has structured this course to address real-world challenges, ensuring that engineers and planners can confidently develop microwave networks that meet stringent performance, reliability, and availability targets. This course is the definitive guide for professionals seeking to master the complexities of microwave link engineering and secure their role in the future of wireless communication.

Target Audience / This training course is suitable for:

- Telecommunications Engineers.
- RF Planning and Optimization Engineers.
- Microwave Link Planners.
- Network Design and Architecture Specialists.
- Transmission Engineers.
- Project Managers in the Telecom Sector.
- Field Technicians and Operations Staff.
- System Integration Engineers.
- Regulatory and Spectrum Management Professionals.
- Technical Consultants involved in wireless network deployment.

Target Sectors and Industries:

- Telecommunication Service Providers.
- Mobile Network Operators (MNOs).
- Internet Service Providers (ISPs).
- Broadcasting and Media Companies.
- Oil, Gas, and Energy Sector.
- Public Utilities (Water, Electricity).
- Government Agencies and Public Safety Networks.
- Military and Defense Communications Sector.
- Transportation and Logistics.
- Corporate and Enterprise IT Infrastructure.

Target Organizations Departments:

- Network Planning and Design.
- Engineering and Technology.
- Operations and Maintenance (O&M).
- Project Management Office (PMO).
- Radio Frequency (RF) Engineering.
- Technical Support and Troubleshooting.
- Infrastructure and Deployment.
- Research and Development (R&D).
- Regulatory Affairs and Compliance.

Course Offerings:

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

- Analyze radio wave propagation characteristics and their impact on microwave links.
- Perform detailed path profiling and ensure adequate Fresnel zone clearance.
- Calculate comprehensive microwave link budgets to predict system performance.
- Select appropriate antennas, modulation schemes, and equipment for specific applications.
- Design and implement diversity schemes to mitigate fading and improve link reliability.
- Develop effective frequency plans to avoid co-channel and adjacent-channel interference.
- Apply advanced techniques like XPIC and adaptive modulation to maximize link capacity.
- Troubleshoot common issues affecting microwave link performance and availability.
- Plan and design microwave backhaul solutions for 4G/LTE and 5G networks.
- Understand the regulatory landscape and spectrum management for microwave bands.

Course Methodology:

The training methodology at BIG BEN Training Center is centered on immersive and practical learning to ensure participants can apply their knowledge directly to their professional roles. This course moves beyond traditional lectures by integrating a dynamic blend of interactive sessions, expert-led presentations, and collaborative group exercises. A significant portion of the training is dedicated to hands-on workshops and simulations where participants will work through real-world link planning scenarios, from initial site selection to final performance validation. We will utilize detailed case studies of complex microwave deployments to analyze challenges and successful strategies in interference management and reliability engineering. Participants are encouraged to bring their own project challenges for group discussion, fostering a collaborative problem-solving environment. Continuous feedback from the instructor ensures that complex topics like link budget analysis and fading mitigation are thoroughly understood. This active learning approach guarantees a deep and lasting comprehension of microwave transmission engineering principles, empowering attendees to design and manage high-performance networks with confidence.

Course Agenda (Course Units):

Unit One Fundamentals of Microwave Propagation

- Introduction to microwave communication systems.
- The electromagnetic spectrum and frequency bands.
- Principles of radio wave propagation.
- Line-of-Sight (LOS) and Non-Line-of-Sight (NLOS) propagation.
- Understanding and calculating Fresnel zones.
- Atmospheric effects on propagation, including refraction and absorption.
- Path loss models and their application.

Unit Two Microwave System Components and Link Budget

- Core components of a point-to-point microwave link.
- Antenna theory, types, gain, and beamwidth.
- Transmission lines, waveguides, and connectors.
- Digital modulation schemes (QAM, PSK, APSK).
- Calculating a detailed microwave link budget.
- Understanding system gain, noise figure, and fade margin.
- Introduction to link planning software and tools.

Unit Three Practical Link Planning and Path Engineering

- The process of site selection and technical site surveys.
- Path profiling techniques using topographical data.
- Analyzing path profiles for obstructions and reflections.
- Designing for link availability and reliability targets.
- Fading phenomena and mitigation techniques.
- Implementing diversity schemes (space, frequency, angle).
- Understanding and applying Adaptive Modulation and Coding (AMC).

Unit Four Interference Management and Frequency Planning

- Identifying sources of internal and external interference.
- Co-channel and adjacent-channel interference analysis.
- Cross-Polarization Interference Cancellation (XPIC) technology.
- Strategies for effective frequency planning and coordination.
- Spectrum management and regulatory compliance.
- Techniques for link performance optimization.
- Troubleshooting common interference-related issues.

Unit Five Advanced Microwave Technologies and Applications

- Designing high-capacity links in E-band and V-band.
- Microwave backhaul architecture for 4G/LTE and 5G networks.
- Point-to-Multipoint (PMP) microwave systems.
- Network synchronization over microwave (SyncE, PTP).
- Security considerations for wireless microwave links.
- Link commissioning, acceptance testing, and documentation.
- Future trends and emerging technologies in microwave transmission.

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 network demands for capacity and low latency escalate with 5G and beyond, how might the traditional trade-offs in microwave link design between cost, reliability, and bandwidth be fundamentally re-engineered?

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

This course distinguishes itself by moving beyond foundational theory to focus on the complex, real-world application of microwave engineering in the context of next-generation networks. While many programs cover basic link budget calculations, our curriculum places a heavy emphasis on advanced interference mitigation, frequency planning strategies, and the practical implementation of technologies like Adaptive Modulation and XPIC, which are critical for maximizing capacity and reliability in dense network environments. The content is specifically tailored to address the challenges of designing robust backhaul for 5G, exploring high-capacity E-band and V-band systems in detail. Unlike purely academic courses, our methodology is built around practical problem-solving, using case studies of actual network deployments to illustrate how to overcome path obstructions, manage atmospheric fading, and meet stringent availability targets. The focus is not just on how to plan a link, but how to engineer a resilient, high-performance transmission network that can scale to meet future demands, providing participants with a strategic and immediately applicable skill set.