

About this seminar

- *Authoritative* — dispels industry myths
- *Practical* — tutorial examples done using excel-based Microwave calculator
- *Real-world* — real-world insights and experiences shared based on legacy and current network experiences
- *In-depth theory* — theoretical concepts and insights explained in detail linked to propagation research and field experiences

About the author

Trevor Manning has had the rare opportunity to see all the facets of designing and operating a microwave radio network. Having worked for both operators and suppliers, in a career spanning 30 years, he has also recently helped to design and build the world's longest high capacity Ethernet link (>200km). He understands both the technical and commercial challenges to designing, building and operating networks.

His pragmatic approach to the subject will help unravel the mysteries of the many confusing standards, as well as simplify the complexities of radio design with its dependence on complex weather conditions, to equip you to know when, and how, to deploy microwave radio in current real-world networks.

Trevor Manning is the author of 'Microwave Radio Handy Reference Guide', and is also the author of the classic Artech House book "Microwave Radio Transmission Design Guide" (second edition).

Why a seminar on a mature technology?

- Microwave technology is growing, with exciting new developments in mmWave and TeraHertz bands
- Design standards are outdated, so it is essential to understand the limitations of the formulas and design rules coded into planning software
- Many myths abound on the internet, and even in mainstream white papers, that are blatantly wrong
- To apply the new and exciting concepts introduced in modern microwave equipment, a solid foundation in both analogue and digital microwave theory is essential

Detailed overview of Seminar

MONDAY 17 MAY: 10.00AM-12.00PM
FUNDAMENTALS OF MICROWAVE

Introduction to MW

- o Busting the myths
- o History of microwave
- o What's new?
- o Fundamentals of the microwave radio signal
- o Latency benefits and calculations
- o The electromagnetic and RF spectrum
- o Safety of microwave signals
- o Relative benefits of microwave compared to other transmission solutions
- o A comprehensive guide to current spectrum terminology in the industry

Planning considerations

- o Link design considerations from UHF to mmWave
- o Site and path planning

- o High level spectrum planning
- o Digital terrain models including SRTM
- o Network topologies
- o Site acquisition and build
- o Repeater types repeaters including civil engineering considerations (road, tower etc.)
- o Passive repeater engineering design and planning (back-to-back and billboard)
- o GIS (graphical information systems) basics and coordinate system considerations
- o Establishing line-of-sight in practise
- o Practical discussion on site and path surveys including for non-LOS equipment

Homework group exercise to develop a site survey template

TUESDAY 18 MAY: 10.00AM-12.00PM IN-DEPTH OVERVIEW OF PROPAGATION ASPECTS

Review homework

Microwave propagation

- o Understanding analogue propagation and dispelling the pencil beam myth
- o The effect of the atmosphere on radio transmission
- o Really understanding k-factor and Fresnel zones
- o Thermal and dispersive fading and their countermeasures

- o Expert assessment of blackout fading and atmospheric ducting
- o Handling reflections especially over water
- o Rain fading and the dangers of statistics
- o Practical discussion on the types of fading and how to overcome them

Homework group exercise to analyse real-world fading examples

WEDNESDAY 19 MAY: 10.00AM-12.00PM HARDWARE CONSIDERATIONS

Review homework and revise fading theory

Hardware

- o Understanding the history of transmission standards (PDH, SDH, ATM)
- o The benefits of Carrier Ethernet
- o Overview of the system components and building blocks of a MW radio system
- o Comparison of current digital modulation schemes and how they affect bandwidth efficiency

- o Band, carrier (BCA) and link aggregation and use of co and cross channel dual polarisation methods
- o Key radio features (adaptive equalisation, FEC, XPIC, ATPC)
- o Overview of adaptive modulation and coding, as well as adaptive bandwidth and how to use it practically in a system
- o Branching arrangements such as hot standby (HSD), CCDP, frequency diversity and space diversity

THURSDAY 20 MAY: 10.00AM-12.00PM
ANTENNAS AND INTERFERENCE

Antenna considerations for MW planning

- o Understanding antennas and reversing 50 years of conventional wisdom
- o Antenna characteristics and what gain really means
- o Practical application of Radiation Pattern Envelope (RPE) diagrams
- o Importance of Return Loss
- o Understanding near and far field operation
- o Antenna types and the real benefit of a high-performance antenna
- o Comparing antenna types and why a microwave dish is usually parabolic
- o Practical considerations for comparing antennas including dual-band feeds
- o Practical advice for planning, installing and maintaining antennas
- o Field based discussion of choosing the right cabling, waveguides, radomes and accessories

Interference (the hidden gremlin)

- o Understanding the realities of interference in digital systems
- o Standards bodies and frequency regulation
- o Types of licensing
- o Frequency bands and frequency planning
- o Bucking (high-low) site planning and interference and why it matters
- o Understanding and calculating nodal and overshoot interference
- o Overview of techniques to optimise frequency re-use

Includes class exercises and tutorial group homework

FRIDAY 21 MAY: 10.00AM-12.00PM
DETAILED LINK DESIGN AND FINAL TUTORIAL

Link design and the elusive five-nines

- o How to interpret and use the main radio planning standard ITU-R P.530
- o Understanding the difference between availability and performance as defined by the ITU and how to apply this to packet-based networks
- o Path, equipment and network reliability issues

- o How to handle obstacles in real-world designs
- o Setting antenna heights in context ITU rules
- o Redundancy schemes to make the transmission system truly carrier grade

Complete tutorial and review tutorial answers

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Microwave Radio Virtual Masterclass

\$1450 +GST