SatMaster Professional-Satellite Link Budget Training

Telecom Engineering
Los Angeles (USA)
17 - 21 Mar 2025

SatMaster Professional-Satellite Link Budget Training

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Introduction

Link budgets are the standard tool for designing and assessing satellite communications transmissions, considering radio-wave propagation, satellite performance, terminal equipment, radio frequency interference RFI, and other physical layer aspects of fixed and mobile satellite systems. The format and content of the link budget must be understood by many engineers and managers with design and operation responsibilities. SatMaster is a highly-recognized yet low-cost PC-based software tool offered through the web by Arrowe Technical Services of the UK.

This five-day course reviews the principles and use of the link budget along with hands-on training in SatMaster, the latest version, for one- and two-way transmission of digital television; two-way interactive services using very small aperture terminals VSATs; point-to-point transmission at a wide range of data rates; and interactive communications with mobile terminals. Services at UHF, L, S, C, X, Ku, and Ka bands to fixed and mobile terminals are considered. The course includes several computer workshop examples to enhance participants' confidence in using SatMaster and to improve their understanding of the link budgeting process. Participants should gain confidence in their ability to prepare link budgets and their facility with SatMaster. Examples from the class are employed as time allows. The course notes are provided.

Course Objectives of SatMaster Professional-Satellite Link Budget Training

- Principles and main components
- Detailed Link Design in Practice: Computer Workshop
- Principles of Satellite Links and Applicability of SatMaster
- Link Budget Calculation Considerations
- Consideration of Interference and Workshop in Digital Link Budgets
- Advanced Features in VSAT Systems

Course Outlines of SatMaster Professional-Satellite Link Budget Training

Day 1 Basics

VSAT systems Basics:

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Email: training@blackbird-training.com
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Principles and main components

- Types of Transmission Systems
- Satellite Systems
- What is VSAT?
- Satellites Classification
- Satellite Frequency Bands
- VSAT Earth Station block diagram and characteristics
- Satellite link Information flow
- VSAT Earth Station
- VSAT Network Component
- VSAT Network Topology
- VSAT Multiple Access Techniques
- VSAT Important Terms

Day 2-3 Basics

Principles of Satellite Link Budget Calculations:

Standard ground rules for satellite link budgets

- Frequency band selection.
- Satellite footprints: EIRP, G/T, PFD and SFD
- Propagation considerations: the isotropic source, line of sight.
- Atmospheric effects: troposphere clear air and rain and ionosphere Faraday and scintillation
- Rainfall regions.
- Losses and interference.
- Earth station: Antenna characteristics Antenna radiation pattern, Front-to-Back Ratio, HPBW, Gain, X-pol considerations
- Earth station: HPA characteristics, intermodulation and sizing, uplink power control.
- Modulation systems.
- Forward error correction techniques and comparisons.
- Bandwidth and roll-off factor, Power Equivalent Bandwidth PEB.
- Availability.
- EbNo/EsNo, BER, spectral efficiency.
- Transmission equation and its relationship to the link budget.

Day 4 Advanced

Link Budget Calculation Considerations:

Basic design considerations.

- Antenna, LNB, HPA, carrier operation
- Link budget result and fine-tuning

Important Satmaster Pro Calculators

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- Satmaster data file types
- Bandwidth Calculator.
- Sun outages.
- D: M:S to degrees conversion and vice versa.
- Noise figure to noise Temperature conversion and vice versa.
- Frequency to wavelength conversion and vice versa.
- Beamwidth calculator.

Detailed Link Design in Practice: Computer Workshop

- Uplink / downlink calculation
- ASIup / ASIdown calculation
- Rain model.
- Satellite.
- Carriers.

Day 5 Advanced

Advanced Features in VSAT Systems:

- Simple and improved adaptive uplink power control.
- Adaptive coding and modulation,
- CNC / Bandwidth cancellation and link budget considerations.
- Layer 2 networking, traffic shaping, and quality of service.
- General discussion.

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Email: training@blackbird-training.com
Website: www.blackbird-training.com

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