

Advanced Satellite Communication (SATCOM) Certification Course (Comprehensive)



Course Overview

Satellite Communication (SATCOM) comprises of high speed broadband satellite communications system utilizing Very Small Aperture Antenna (VSAT) with a diameter of about 0.5 meters - 2.4 meters, for government agencies, military agencies, home users and business users.

The satellites operate as microwave towers or cells in the sky, to support communication by transmitting and receiving data from one antenna to another on Earth. The satellite systems attribute to large geographic coverage for widely distributed networks, broadcast and video services around the world, interconnection of telecom services, mobile, broadband and emergency connectivity services and voice and data networks connectivity.

SATCOM systems are ideal for military communication, mining camps, distance learning, satellite news gathering, ship-board communication, emergency and disaster responders, oil and gas camps or any application that requires a broadband Internet connection at a remote location. The Defense Satellite Communications System (DSCS) contributes to military communication services to army men in the fields. SATCOM is an excellent way to enhance your remote business processes by interacting with your remote site workers and employees via Internet communications for email, web access, video transmissions, Voice over IP telephone services, and other IP applications for field operations.

This course provides intensive technical Satellite Communication training to the attendees with an in-depth learning to satellite communication systems, market trends, latest technologies and performance. This course is intended to provide the capability to analyze and evaluate the satellite

communication systems, hands-on activities and interactive learning. This training course focuses on Satellite communication fundamentals, techniques, , orbital mechanics to satellite design and launch, services, configuration and installation of earth stations, planning, internet services, implementation of communications links, network architecture, link budget, coverage, ground equipment hardware, terminal installation and optimization, access methods and operating principles, trouble shooting and maintenance, and limitations of current satellites

Key Benefits for Participants

This course will provide the following key benefits to the attendees:

- Understand the fundamentals of Satellite Communication networks, techniques and future systems
- Understanding the satellite communication market trend, evolution, emerging technologies and application areas
- Discuss SATCOM Access methods, modulation techniques, coding schemes and spread spectrum techniques
- Understanding SATCOM installation, commissioning and configuration
- Understanding satellite link designing and analysis
- In-depth understanding of Very Small Aperture Terminals (VSAT), Understand Non-geosynchronous systems (NGSO), GPS and Mobile Systems (Voice, Data and Video) and Internet Applications (GEO/ NGSO options)
- Understanding SATCOM troubleshooting, monitoring, networking and management
- Case studies including state-of-the-art SATCOM systems and future innovations

Practical experience of SATCOM installation, maintenance and troubleshooting

Course Objectives

This course has the following major objectives:

- Provide comprehensive knowledge about Satellite Communications and Technology
- Deliver insights about satellite communication network architecture, data transmission and protocols
- Provide detailed insight to Multiple access and Assignments Strategies for SATCOM Systems
- Detailed insights to Voice, Data and Video Applications for SATCOM
- Comprehensive knowledge about Multicast Internet Services via Satellite Communication
- Provide deep understanding of Large Earth Station, Indoor and Outdoor Antenna Mounting for SATCOM

- Providing insight to Installation, configuration, ink Budget Estimation, Troubleshooting and Interference issues for SATCOM Systems
- Provide insight to Very Small Aperture Terminals (VSAT), Understand Non-geosynchronous systems (NGSO), GPS and Mobile Systems (Voice, Data and Video) and Internet Applications (GEO/ NGSO options)
- Practical training on SATCOM installation, frequency calculation, configuration and troubleshooting

Course Outline

In "Advanced Satellite Communication (SATCOM) Certification Course (Overview)", we cover the fundamentals of the Satelite Communication and architecture and antennas, while in"Advanced Satellite Communication (SATCOM) Certification Course (Comprehensive)" we cover the following course contents:

Satellite Communications (SATCOM) Overview

- Communication Satellites and Earth Stations
- Frequency Bands (C, X, Ku and Ka)
- Satellite based Broadcasts
- Satellite TV, radio, phones and pagers
- Satellite Access Techniques
- Data Transmission and Protocols
- Propagation Review
- Modulation and Coding
- Low Earth-Orbiting (LEO) communications satellites
- Geosynchronous Earth-Orbiting (GEO) communications satellites
- MEOs and HEOs
- Satellite transmission planning
- Link-budget analysis
- Satellite-based networks
- VSAT networks

Evolution and Market of SATCOM Systems

- Key markets and growth
- Constraints
- Example satellite and services

Satellite Communications Network

- Space network architectures
- Orbit types: GEO, LEO, MEO, HEO
- Free space propagation
- Echo suppressors and echo cancelers
- Spectrum allocations for satellite systems
- Satellite component of UMTS
- VoIP Problems over Satellite
- ITU-T IMT-2000
- Satellite types and transponders
- SATCOM System requirements

Satellite Communications Business Model

- Satellite organizations
- Private satellite networks
- Radio regulatory considerations
- Objectives of frequency/orbit management
- Frequency allocations

Satellite Services Categories

- Types of communication services
- Broadcasting Satellite Service
- Fixed Satellite Service
- Mobile Satellite Service

Satellite Communications Systems Components

- Space Network Architecture
- Satellite Communication Components
- Transmitters
- Antennas
- Power Generation
- Air Interfacing and Networking
- Large Earth Station Equipment
- Typical Block Diagrams

SATCOM Antenna Types

- Antenna principles
- Parameters and performance
- Designs for hub stations & VSATs

- Sidelobes & practical considerations

SATCOM Antenna Operating principles

- Gain
- Antenna Patterns
- Beamwidth and Diameter
- VSWR and Return Loss
- Sidelobes and Effects

Satellite Transponders

- Satellite communications payload architecture
- Frequency plan
- Transponder gain
- TWTA and SSPA
- Amplifier characteristics
- Nonlinearity
- Intermodulation products
- SFD
- Backoff

Data Protocols over Satellite

- Circuit & Packet switching
- Data integrity
- OSI model
- TCP/IP
- Satcom effects and mitigation solutions

Satellite Communications Systems Designing

- Basic Link Engineering
- Satellite Systems Planning
- Basic transmission principles
- Key parameters: EIRP G/T, SFD, Input/Output Backoff, C/No, Eb/No
- Typical link budget, link margin and availability
- Communications link calculations
- Uplink, downlink, and composite performance
- Link budgets for single carrier and multiple carrier operation
- Basic aperture antenna definitions and relationships
- Typical antenna configurations for satellite communications

- Multiple Access Techniques
- Propagation Interference and Regulation
- Payload Engineering
- Detailed work examples
- Spacecraft Engineering and Operations
- Earth Station Engineering

SATCOM Modulation Techniques and Coding

- Analog and Digital Modulation
- BPSK, QPSK, 8PSK, 16QAM, 64QAM
- Overview of Shannon's Theory
- Symbol Rate and Bit Rate
- Intersymbol Interference (ISI)
- Forward Error Correction (FEC)
- Principles of Coding
- Common coding schemes, and Turbo codes

Satellite Access Methods

- Fixed Point-to-Point Links
- Bandwidth Sharing
- Multiplexing, Multiple Access
- TDM, TDMA, FDMA, SCPC, DVB-RCS, DAMA, CDMA
- Aloha / Contention schemes
- Hybrid schemes

Spread Spectrum Techniques

- Acquisition and tracking
- Frequency Hop systems

- Military use and commercial PSD spreading with DS PN systems

Propagation and Interference

- Radio noise
- Ionospheric effects
- Tropospheric effects
- Interference between satellite networks
- Interference with terrestrial networks

Satellite Engineering for Communications Satellites

- Satellite orbits
- Satellite design
- Future large geostationary mobile communications satellites
- Launch vehicles
- Commercial satellite programs
- Payload Engineering

System architecture of Satellite Communications Payloads

- Requirement analysis of the satellite payload
- Assessment techniques for performance of all major building blocks
- System architecture and the capabilities of ground segment elements
- Hubs and remote terminals
- Payload integration with the constellation and end-to-end systems
- Repeaters, antenna system, and tracking systems
- Critical subsystem and system design concepts
- Power budget, loss, group delay, digital impairments, cross-polarization, adjacent satellite and channel interference
- Payload specifications and design
- System and service requirements
- Characteristics of payload components
- Space and ground architecture
- Evaluating on-board processing and multiple beam antennas
- End-to-end performance evaluation
- Design principles and performance budgets
- System elements performance for receivers, phased-array antennas, multiplexers, amplifiers, analog and digital processors, reflector, feeds and other passive and active components
- Spurious signals
- IM (Inter-modulation) distortion levels
- Phase noise
- RF interferences
- Bit Error Rate (BER)

SATCOM Service Provision and Quality

- High-speed IP SATCOM System
- Commercial SATCOM systems and services.

- Voice, Video and Data applications

- Voice and Video over IP
- VPN and Data Services
- Mobile and Satellite PCN
- Military Satellite Communications
- Internet Service Provision over Satellite
- VSATs Networks and Services
- Satellite Navigation and Positioning
- Satellite Broadcasting

- Operational support systems for SATCOMs

Installation and commissioning of Satellites

- — The key installation steps
- — Antenna AZ-EL Pointing
- — Mounting the Outdoor Equipment
- — Testing the Link
- — Dish Pointing and Cross-Pol
- — Carrier Lineup and Cross-Pol Checks
- — IFL and Grounding
- — Indoor Electronics Installation
- — Configuration & control of equipment

SATCOM Performance Measurements

- Satellite modem
- Use of a spectrum analyzer to measure bandwidth
- C/N, and Eb/No
- Comparison of actual measurements with theory using a mobile antenna and a geostationary satellite

Troubleshooting of SATCOM Systems

- — Antennas issues
- — Alignment on the Satellite
- — Amplifier saturation
- — Maintenance of RF and Baseband
- — Blockage and gain compression
- — Elevation Effects
- — Troubleshooting Network, and Interference issues

- — Issues the DC Voltage Drop on Cables
- — Common Field Mistakes
- — Uplink alignment
- — Preventive Maintenance
- Interference in SATCOM systems
- Power Control

Case Studies of SATCOM Systems

- State-of-the-art SATCOM Systems
- Global Positioning System
- Mobile User Objective System
- Space Based Infrared System
- Defense Metrological Satellite Program
- Defense Satellite Communications Systems
- Military Communication Satellite
- — System level & frequency calculation
- — Configuration & control of equipment

— Graded Practical Exercises

Delivery Options

- Online
- Onsite

Who Should Attend

- Communications technicians who have basic understanding of satellite technology and require exposure to the principles and methods for putting VSATs into service.
- Operations engineers, Network managers and VSAT installers who need in depth experience of VSAT system installation, operations, support and troubleshooting.