



# NWNS Representative VSAT Certification Training Program

<p><b>Type of Training:</b> NWNS VSAT Certification Course – Type I</p> <p><b>Certification:</b> All trainees who, according to the assessment of the instructor-trainer, attain a satisfactory standard of competence will be awarded the <i>NWNS Qualification Certificate</i>.</p> <p><b>Target Group:</b> Field Engineers and Operations Staff.</p> <p><b>Duration:</b> 2, 3 or 4 days.</p> <p><b>Course Fee:</b> TBD. Attendees are required to support their own travel and accommodation.</p> <p><b>Number of participants:</b> Max 20 people per course.</p> <p><b>When:</b> TBD</p> <p><b>Where:</b> TBD</p> <p><b>Language:</b> English (Arabic language support may be available).</p>	
<p><b>Course Objectives:</b></p>	<p>NWNS has created a program of VSAT Installation &amp; Maintenance Training to address the following areas:</p> <ul style="list-style-type: none"> <li>• NWNS Representative Roles and Responsibilities</li> <li>• Basic concepts relating to VSAT;</li> <li>• Undertaking earth station installation site surveys;</li> <li>• Undertaking a mechanical VSAT installation and performing antenna alignment;</li> <li>• Steps to peak and pole and commission a full VSAT installation;</li> <li>• Configuring and maintaining specific satellite transmit and receive equipment;</li> <li>• Specific maintenance procedures;</li> <li>• Undertaking fault diagnostics;</li> <li>• Working with Satellite Operations Centres and Network Operation Centres</li> </ul>
<p><b>Course Content:</b></p>	<p><b>Day 1: Satellite Communications Basics</b> begins with the functioning of communications satellites, and then examines ground segment, transmission systems, and the applications of satellite. Measurement units and understanding bandwidth are covered, prior to detailed coverage of types of earth station antennas, signal polarization, antenna feed construction, down converters, transceivers, modulation, scrambling, encryption and conditional access, the satellite modem, digital modulation encoding, Bit Error Ratio and Eb/No, Digital Video Broadcasting, Clocking, link quality, and orbital effects in communications system performance.</p> <p><b>Day 2-3: VSAT/Technology Basics</b> covers basic preparations for a VSAT installation, the site survey, a typical VSAT installation, data interfaces, Inter-Facility Link cables, powering a VSAT unit, satellite link analyses, test equipment, typical VSAT link testing, satellite access and earth station verification, grounding and lightning protection, and various aspects of preventative maintenance.</p>
<p><b>Course Materials:</b></p>	<ul style="list-style-type: none"> <li>• Course Instruction Presentation - This instructor-trainer-led presentation complements, and is to be used alongside, the Course Instruction &amp; Training Manual.</li> <li>• Course Instruction &amp; Training Manual – This volume is the principal training aid, comprising a highly detailed 140 pages of course information and instruction. The manual provides the trainee with all necessary information about how to install and maintain a VSAT earth station. In addition it contains solid background information on satellite communications in general.</li> <li>• Trainee Course Workbook - This 40 page workbook is the principal device used by the program instructor-trainer for the assessment of trainees. Trainees must attempt to answer more than 150 questions, most of which are in a multiple-choice answering format.</li> <li>• Hardware materials to build and test a VSAT earth station.</li> </ul>



# NWNS Representative

## VSAT Certification Training Program

<b>Prerequisites:</b>	Delegates should have basic experience in telecommunications or data networking prior to attending this course.
<b>Method:</b>	Lecture, Documentation, Demonstration, Exercises, Hands-on.
<b>Theoretical / Practical:</b>	50% / 50%
<b>Registration:</b>	Please use NWNS Training Registration Form.
<b>Further Information:</b>	Please contact NWNS at <a href="mailto:request@nwns.org">request@nwns.org</a>

Type 1 Course Details		
Theory Background	Implementation	Practical Training (full day)
<ul style="list-style-type: none"> <li>• What is a communication satellite;</li> <li>• Operating Frequencies: C /Ku/L/If band;</li> <li>• Frequency conversions (L-band to Ku and L- band to C)</li> <li>• Footprints;</li> <li>• Earth Stations: Teleports, VSATs;</li> <li>• Transmission Systems: SCPC, TDMA, DVB, Broadcast;</li> <li>• Measurement Units: dB,C/N, Eb/No</li> <li>• Bandwidth: MHz vs. Mbps, Speed vs. throughput;</li> <li>• Antennas: offset, prime focus, gain, side lobes;</li> <li>• Signal Polarization</li> <li>• Equipment terminology: feedhorn, OMT, TRF, waveguides, Co-pol feed, LNC, LNB, BUC/radio, modem;</li> <li>• Modulation: QPSK, 8PSK, bit - rate</li> <li>• Encoding and FEC; Clocking</li> <li>• Link degradation: rain fade, transponder interference, terrestrial interference, adjacent satellite interference, power failure, noise, delay, sun outages;</li> <li>• Basic IP understanding</li> </ul>	<ul style="list-style-type: none"> <li>• VSAT network architecture: ODU, IDU, IFL</li> <li>• Site Survey;</li> <li>• ODU in detail: Antenna, mount, cables, lightning protection, grounding, IDU in detail: dividers/combiners, attenuators, data interfaces;</li> <li>• IFL in detail: cables and connectors, crimp tools;</li> <li>• Test equipment: Theory and hands-on, compass, inclinometer, spectrum analyzer, data analyzer, what and how to measure;</li> <li>• Typical VSAT test procedures;</li> <li>• Satellite access procedures: Peak &amp; poll, level setting;</li> <li>• (Preventive) maintenance procedures.</li> <li>• Basic troubleshooting: most common mistakes in the field;</li> <li>• Communicating with the customer and site hand-over;</li> <li>• Typical forms and procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Basic introduction on SCPC equipment including modems and transceivers</li> <li>• Basic introduction on TDMA iDirect* equipment; iSite, iBuilder and iMonitor; uploading option file via laptop and via iBuilder</li> <li>• Complete Installations: All participants will complete 1 VSAT installation including peak &amp; poll and site commissioning with an operational NOC; Join iDirect network with installed remote</li> <li>• Sufficient time will be provided for hands- on experience;</li> </ul> <p><i>*) iDirect will be the default technology. Other technology possible upon request.</i></p>



# NWNS Representative

## VSAT Certification Training Program

### NWNS Representative

#### VSAT Certification Course – Type II

#### LEVEL I: INTRODUCTION TO VSAT TECHNOLOGY – DETAILED COURSE OUTLINE

**Content:** Overview of the technology of satellite communications.

**Audience:** Installers, managers, sales staff, technicians and engineers who need an initial introduction to satcom.

**Prerequisites:** None.

**Course duration:** 1 day.

**Outline:**

1. About NWNS
2. Communications technologies
  - a. Demographics and technologies;
  - b. Microwave, fiber, wireless, satellite.
3. Satellite communications and spacecraft
  - a. How satellites work
  - b. Myths and truths; strengths and weaknesses
  - c. Payloads; transponders; launch methods
4. Orbits
  - a. Gravity and momentum; orbit period and altitude; GEO, MEO, and LEO; properties of geostationary orbits; slots; co-location; station keeping.
5. Dish pointing concepts
  - a. Latitude, longitude; azimuth, elevation;
  - b. The GEO arc;
  - c. Beam movement.
6. Footprints
  - a. Downlink signal strength;
  - b. Contours; examples.
7. Electromagnetic waves and frequencies
  - a. Fundamentals of waves; the spectrum; bands;
  - b. C, Ku, and Ka bands for satcom;
  - c. Latency.
8. Access methods
  - a. TDM and TDMA, FDMA, SCPC, DVB-RCS, DAMA;
  - b. Comparisons and applications.
9. Earth stations and VSAT terminals
  - a. Components;
  - b. Typical block diagrams;
  - c. Examples.
10. VSAT networks
  - a. Deployment;
  - b. Installation, regulatory, and cost issues.



# NWNS Representative

## VSAT Certification Training Program

### NWNS Representative

#### VSAT Certification Course – Type II

#### LEVEL II: VSAT INSTALLATION FUNDAMENTALS – DETAILED COURSE OUTLINE

**Content:** Required knowledge common to all VSAT and earth station installations up to 3.8 meters, including the fundamentals of signals, noise, modulation, antennas, propagation, and link budgets. Also covers interfaces and the basics of IP networking, VSAT equipment elements, and interference issues. Also includes installation concepts such as site selection, grounding, pointing and polarization alignment techniques, and workmanship, with emphasis on interference prevention and preservation of the spectral resource..

**Audience:** All VSAT and earth station installers.

**Prerequisites:** Installer Level 1 (Introduction to Satcom Technology).

**Course duration:** 2 or 3 days.

1. **Introduction**
2. **Signals and noise**
  - a. Watts and decibels
  - b. EIRP
  - c. Uplink beamwidth, EIRP, gain, and power
  - d. Noise power and bandwidth
  - e. C/N and C/No
  - f. Noise spectrum
  - g. G/T
  - h. Signal spectra and bandwidth
3. **Antennas**
  - a. Types and operating principles
  - b. Gain
  - c. Patterns
  - d. Beamwidth and diameter
  - e. Sidelobes and effects
  - f. Tracking
4. **Propagation**
  - a. Blockage
  - b. Free space loss concepts
  - c. Water loss
  - d. Rain zones
  - e. Elevation effects
  - f. Solar transits
5. **Modulation**
  - a. PSK, symbol rate and bit rate
  - b. Forward error correction
  - c. Bit error rate and packet loss rate concepts



# NWNS Representative

## VSAT Certification Training Program

6. **Putting it together: the satellite link**
  - a. Uplinking and downlinking process
  - b. Signal paths
  - c. Link budget concepts
  - d. Link margin
  - e. Rain fade margin
  - f. Fade countermeasure concepts
7. **Polarization**
  - a. Linear polarization
  - b. Pol frequency re-use
  - c. Importance of pol alignment
  - d. Circular polarization
8. **VSAT equipment**
  - a. LNB
  - b. BUC or outdoor unit
  - c. Indoor Unit
  - d. Cables
  - e. Antenna and feed
  - f. Block diagrams
9. **Uplink interference**
  - a. Adjacent Satellite Interference
  - b. Adjacent Channel Interference
  - c. Cross-Pol Interference
10. **Terrestrial interference**
  - a. IF interference
  - b. Microwave links
  - c. Radar detectors
  - d. Radio altimeters
11. **Data interface concepts**
  - a. Ethernet
  - b. Internet Protocol (IP)
  - c. Gateways, Subnets, and Masks
12. **Grounding**
  - a. Grounding principles
13. **Site selection and antenna mounts**
  - a. Line of sight
  - b. Using a compass and inclinometer
  - c. Mount types
  - d. Mounting points
  - e. Selecting a mount
14. **Antenna pointing**
  - a. How to find required azimuth and elevation
  - b. Procedures using receive level meter
  - c. Rain effects
  - d. Simulator exercises



# NWNS Representative

## VSAT Certification Training Program

15. **Cross-pol alignment**
  - a. How to find the required pol setting
  - b. Presetting
  - c. Alignment procedures using receive level meter and spectrum analyzer
  - d. Simulator exercises
16. **Workmanship**
  - a. Connector termination
  - b. Weather sealing
  - c. Cable routing
  - d. Lockdown
17. **Putting it all together: the installation process**
  - a. Site survey
  - b. Installation preparation
  - c. Selection of mount
  - d. Installing IFL
  - e. Installing indoor equipment
  - f. Installing outdoor equipment
  - g. Dish pointing
  - h. Setting cross pol
  - i. Carrier lineup process
  - j. Link testing
  - k. Interface setup
  - l. Cleanup
  - m. Repeating
18. **Customer and NWNS specific issues**
  - a. Documentation
  - b. Maintenance and trouble shooting
  - c. Typical NWNS procedures
  - d. Logistics



# NWNS Representative

## VSAT Certification Training Program

### NWNS Representative

#### VSAT Certification Course – Type II

#### LEVEL III: SCPC TERMINAL INSTALLATION AND MAINTENANCE – DETAILED COURSE OUTLINE

**Content:** Required knowledge for installation of SCPC terminals up to 3.8m (nominal), i.e., earth stations that are not controlled by a hub station or network management system, and which must be manually configured and aligned. Part 1 teaches theory of satellite links as used by an expert installer; Part 2 covers practical skills and the final exam for SCPC Terminal Installer certification.

**Audience:** All VSAT and earth station installers.

**Prerequisites:** Installer Levels 1 and 2.

**Course duration:** 2 or 3 days

#### Part 1 - Theory

##### Outline:

1. **Introduction**
2. **Spectrum Analyzer Skills**
  - a. How spectrum analyzers work
  - b. Center frequency and span
  - c. Bandwidth settings
  - d. Measuring levels
  - e. Zero span
  - f. Simulator exercises
3. **Modulation**
  - a. C/N and Eb/No
  - b. BER review
  - c. FEC: Viterbi, Reed-Solomon, and Turbo Code
  - d. Modulation: QPSK, BPSK, 8PSK, 16PSK, QAM
  - e. BER vs Eb/No
  - f. BER testing methods
4. **Distortion**
  - a. HPAs
  - b. Compression and saturation
  - c. HPA intermodulation distortion (IMD)
  - d. Spectral spreading
  - e. OBO and IBO
  - f. Transponder IMD
5. **Antennas**
  - a. 2-port combiners
  - b. 4-port combiners
  - c. Polarizers
  - d. CP feed systems
  - e. Importance of focus and accuracy



# NWNS Representative

## VSAT Certification Training Program

- f. Testing side lobes
- 6. **RF System Planning**
  - a. W-to-dB conversion review; formulas.
  - b. Uplink chain block and level diagrams
  - c. Downlink chains
  - d. Splitters, combiners, and couplers. DC-passing feature.
  - e. Multiple demodulators
  - f. Multiple transmit carriers
  - g. IF line amplifiers
  - h. System impedance and VSWR
- 7. **Space Segment Resources**
  - a. Importance of sharing
  - b. Bandwidth resources
  - c. Power resources
- 8. **Interfaces**
  - a. Synchronous serial data (RS-422)
  - b. T1 and E1
  - c. Clocking and Timing
  - d. Doppler and buffers
  - e. Ethernet
  - f. Review of TCP/IP
  - g. Analog voice lines, 2-wire and 4-wire E&M
- 9. **Grounding**
  - a. Grounding principles for antennas up to 3.8m
  - b. Using a professional electrician
- 10. **Site selection and mounts for antennas up to 3.8m**
  - a. Line of sight
  - b. Mount types
  - c. Mounting points
  - d. When do you need a civil engineer
- 11. **Antenna pointing**
  - a. Procedures using spectrum analyzer
  - b. Pointing accuracy
  - c. Simulator exercises
- 12. **Cross-pol alignment**
  - a. Alignment procedures using spectrum analyzer
  - b. Simulator exercises
- 13. **Workmanship**
  - a. Connectors (F, BNC, N, SMA) and their termination
  - b. Weather sealing
  - c. Cable routing
  - d. Antenna lockdown shifts
- 14. **Type Approvals**
  - a. Verification
  - b. Operator type approvals
  - c. Antennas, earth stations, and VSATs



## NWNS Representative VSAT Certification Training Program

15. Putting it all together: the installation process
  - a. Site survey
  - b. Structural survey
  - c. Installation preparation
  - d. Selection of mount and civil works
  - e. Installing IFL
  - f. Installing indoor equipment
  - g. Installing outdoor equipment
  - h. Dish pointing
  - i. Setting cross pol
  - j. Carrier lineup process
  - k. Link testing
  - l. Interface setup
  - m. Cleanup

### Part 2 - Practical Skills and Final Exam

#### Outline:

1. Practical skills
  - a. Compass and inclinometer
  - b. Connector termination
  - c. Weather sealing
  - d. Antenna assembly
  - e. Dish pointing
  - f. Pol setting
2. Theory review
  - a. Covers Level 1, Level 2, and Level 3.
3. Final exam
  - a. Covers Level 1, Level 2, and Level 3

#### Course Registration:

**The Registration Form** - This form requests basic information from each candidate trainee, including preliminary details of level of education achieved and prior training experience.

**Pre-Course Assessment Questionnaire** - In completing this form each candidate trainee is requested to answer a number of basic "knowledge questions", and provide details of prior experience in satellite communication, together with a description of his/her job requirements in respect of the planned training. This form is an essential part of the program, helping to ensure that trainees undertake the correct course of training, and to – as far as practically possible – ensure that trainees with a similar educational and training background, and types of prior work experience, are grouped together.