

Course ID

HF

Course Duration

1-2 days

**Related
Courses**

Course Title

HF Communications: An Overview

- RF Systems: Principles, Design, and Deployment (RFSYS, 3 days)
- RF Systems Optimization Workshop: GSM, GPRS, EDGE, UMTS, cdmaOne, 1xRTT, EVDO (RFOPT, 3-5 days)
- RF Propagation Models, Fading Characteristics, and Link Budget Analysis (RFPROP, 3 days)
- Antennas: Characteristics, Deployment, and the Future (ANTENNA, 1 day)
- Microwave and Fixed Line-of-Sight Link Design Principles (MICROWAVE2, 2 days)
- Satellite Communications Principles and Design: A-to-Z of Modern Commercial and Military Satellite Systems (SATCOM, 2 days)
- WiMAX: The Technology (WIMAX-TECH, 2 days)

Aimed At

Those involved in the military or commercial uses of HF communications who wish to learn more about this technology.

Group Size

5-25

Prerequisites

Some prior familiarity with the basics of radio will be helpful.

**Course
In a Nutshell**

For decades, HF communications have been an important, in some cases the only, way of providing long distance communication. HF makes it possible to reach people wherever they may be located, whether in the jungles of Congo, bushes of Australia, or the sands of Sahara.

In this course you will learn both the technology and applications of HF communication, both speech and digital uses such as modem utility, browsing, and mailing, to cite a few examples. For anyone involved with long-distance connectivity, understanding HF technology is a must.

We will start the course by learning the essential RF propagation concepts. We will then review the challenges offered by HF communications and how we can go about addressing them. We will place particular emphasis on the antenna technology that makes worldwide connectivity possible. We will go on to learn about modulation schemes and communication modes, architecture and design of an HF radio system, and the applications of HF. We will conclude with a comparison of HF with competing technologies and a look at the future of HF. All in all, the course will provide you with a thorough and practical introduction to HF communications.

Customize It!

We can customize this course to the background and needs of your specific audience. For example, we can extend the course to include the prerequisite material or tailor the course topics to include the applications or issues of particular interest to you.

Learn How To

- List the key components of an HF system and describe how they fit together
- Explain how radio waves operate in different environments
- Design an HF communications system
- Describe the current markets and applications for HF communications

Course Outline

- Introduction
 - History of HF communications
 - Terrestrial wireless communications challenges: Attenuation, reflection, diffraction, scattering, multipath effects, interference
- Spectrum Basics
 - Electromagnetic spectrum: Bands and uses, regulation
 - More about the HF band
 - Spectrum issues: Line of Sight (LOS) transmission, path loss, etc
- Radio Propagation
 - Electromagnetic field
 - Ground and surface waves: What, when
 - Direct waves: Direct LOS, Fresnel theory, free space loss, sum operating margin
 - Sky waves (Ionosphere)
 - Key concepts
 - Structure of the Ionosphere: D, E, F1, F2
 - Critical frequencies: MUF, LUF
 - Propagation effects: Daily, seasonal, geographic, sunspots, interference, weather, solar flares
 - Propagation indices: K, Ap, Solar flux, Sunspot number
 - Tropospheric waves
- Antennas
 - Characteristics: Dimensions, gain (dB), polarization, F/B ratio, VSWR, radiation diagrams, HPB
 - Types: Directional, omnidirectional
 - Whip, dipole, inverted Vee, Loop, beams
 - Practical examples
- Modulation and Communication Modes
 - Modulation
 - Analog: AM, SSB, FM, PM
 - Digital: xFSK, xASK, xPSK, xQAM
 - Modes
 - CW-Morse

- AM voice/SSB voice
- FM voice
- Digital: Modems/examples
- HF Radios
 - Types: Analog, digital, portable, vehicle, nomadic, fixed
 - Types: analog, digital, portable, vehicle-mounted, nomadic, fixed
 - Architecture
 - Characteristics
 - Power
 - Channels
 - Modulation
- Uses of HF Communications
 - Long distance/amateur radio
 - Emergency (including disasters) communications
 - Maritime uses
 - Military applications
 - Examples
- Link Budget Calculations
 - Basic principles
 - Tools
 - Calculation exercise
- Emerging Trends
 - Automatic link establishment
 - Digital new services
- Conclusion
 - Comparison of satellite and HF communications
 - Advantages and disadvantages
 - Course recap, Q/A, and Evaluations

How You Will Learn

- You will learn from an experienced engineer/instructor.
- Along with lecture, we use exercises and interesting group activities to enrich the class and drive home the important points.
- If you already know something about the RF technology, we will build on that knowledge base. If your background is less technical, we will use interesting examples to get the point across.
- The participant handbook will offer a structure to which you can add the information and insight provided in class, turning it into a handy reference tool you can use back on your job.

Revised

Feb 26, 2008 vf