

RF-SDR101 Training

Applied Technology Academy

RF-SDR101 is a hands-on, five-day Software Defined Radio (SDR) and RF-security course. Students progress from the foundational physics of radio — the electromagnetic spectrum, antennas, propagation and baseband IQ data — through live signal analysis, GNU Radio DSP flowgraphs and custom embedded-Python blocks, into active RF transmission: jamming, replay and custom protocol attacks. The week culminates in a capstone that reverse-engineers and exploits a live hardware target. No prior RF experience required — the course begins with fundamentals.

LEVEL Introductory to Advanced	DURATION 5 days	DELIVERY Instructor-led • hands-on RF labs	HARDWARE Software Defined Radio + GNU Radio	PREREQUISITES None — starts with RF fundamentals
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Course Outline

- **Day 1: Intro RF Theory**
 - Foundational RF physics from the electromagnetic spectrum and wave propagation to complex numbers and baseband IQ data. Modules: 1.1 Electromagnetic Spectrum; 1.2 Antennas (gain, polarization, radiation patterns); 1.3 Radio Architecture (superheterodyne receivers, frequency mixing, the ADC); 1.4 Complex Numbers & IQ Data (quadrature sampling); 1.5 Modulating RF Waves (AM/ASK, FM/FSK, PM/PSK); 1.6 RF Network Topologies (point-to-point, repeaters, star, mesh); 1.7 RF Propagation (ground/sky waves, line-of-sight, link budgets).
- **Day 2: SDRs and Signal Analysis**
 - Hands-on signal analysis with open-source tools — navigating the spectrum, capturing raw IQ, and decoding binary payloads. Modules: 2.1 Basic SDR Interfacing; 2.2 Hardware Hierarchy & FFTs (time/frequency resolution tradeoffs); 2.3 Capturing & Inspecting Raw Signal Files (avoiding clipping/aliasing); 2.4 Signals Analysis (preamble, sync word, payload; manual bit-level extraction); 2.5 Spectrum Scanning (sweeping, FFT stitching, baseline anomaly detection); 2.6 Day 2 Mini-capstone.
- **Day 3: GNU Radio and DSP Flowgraphs**
 - Building custom flowgraphs to mathematically filter, mix, resample and demodulate signals in real time. Modules: 3.1 Introduction to GNU Radio (architecture, thread scheduler, complex data types); 3.2 Basic DSP Building Blocks; 3.3 Extending GNU Radio (Out-Of-Tree modules; external command-line decoders via named FIFOs and network sockets).
- **Day 4: Custom Blocks and Transmitting**
 - Writing custom embedded-Python blocks and exploring active RF transmission and RF-security fundamentals. Modules: 4.1 GNU Radio Custom Blocks (embedded-Python DSP); 4.2 SDR Transmission Fundamentals (physical denial-of-service/jamming and signal replay attacks); 4.3 Protocol Attacks (generating modulated baseband files from raw data).

- **Day 5: Advanced DSP and Course Capstone**

- Advanced DSP concepts and a comprehensive capstone. Modules: 5.1 Advanced DSP Concepts (Phase Shift Keying, M-ary/4FSK modulation, Manchester and Differential line coding); 5.2 Course Review; 5.3 Capstone — a free-form, practical reverse-engineering and exploitation of a live hardware target using every technique from the week.

Prerequisites

No prior RF experience required — the course begins with RF fundamentals and progresses to advanced DSP and exploitation over five hands-on days.

Learning Objectives

- Understand foundational RF physics: the electromagnetic spectrum, wave propagation, antennas and baseband IQ data
- Explain SDR hardware architecture and how analog signals become digital samples (mixing, ADC, FFTs)
- Distinguish amplitude, frequency and phase modulation (AM/ASK, FM/FSK, PM/PSK)
- Capture, inspect and decode raw IQ signal files and extract binary payloads from RF transmissions
- Build custom GNU Radio DSP flowgraphs to filter, mix, resample and demodulate signals in real time
- Write custom embedded-Python GNU Radio blocks and integrate external decoders
- Execute active RF transmission techniques — jamming, replay and custom protocol attacks
- Apply advanced DSP (PSK, M-ary/4FSK, line coding) and reverse-engineer and exploit a live hardware target

Ready to enroll? Call 800.674.3550 or email Info@AppliedTechAc.com — private team cohorts, GSA MAS purchasing, military credentialing funding, VA GI Bill and VR&E and student financing available.