RADIO ENGINEERING TRAINING

Three interactive modules covering modern RF planning tools, hands-on antenna and propagation theory and practical Software Defined Radio. Taught by the team behind CloudRF.

01

RF PLANNING

Master terrain and clutter data, propagation models, Antenna patterns, batch processing and integration with GIS software.

02

RADIO THEORY

Antennas and Propagation, Bandwidth, Noise and the link budget.
Interactive sandbox demos to explore concepts.

03

SOFTWARE-DEFINED RADIO

Efficient sampling and hands-on digital signal processing with open source software.

LENGTH
One day per optional module.

DELIVERY
Classroom, hands-on lab, or on site.

LEVEL
Graduate engineers through to practising planners.

GROUP SIZE
Up to 4 in a class, each with a lab position or more by agreement.

RF PLANNING

Simulations are only as good as the inputs and the assumptions behind them. This module works through complete plans with CloudRF, from data and model selection to accurate, field-calibrated, coverage predictions you can depend upon. With SOOTHSAYER, students will learn to do this **offline with local data**.

SESSIONS

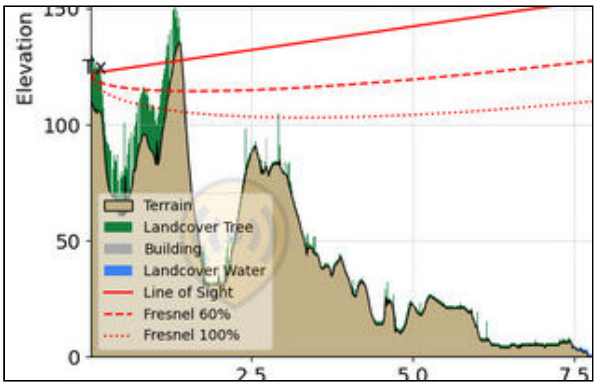
1.1 **Project set-up and data**
Coordinate systems, mapping, terrain and clutter data, LiDAR surface models, template creation and management.

1.2 **Propagation models**
Explore propagation models for diverse technologies from HF to SHF including RADAR, Cellular, IoT and 5G. Apply contexts and appropriate diffraction.

1.3 **Antennas and Feeders**
Templates, Importing Patterns, Custom patterns, azimuth and tilt, feeder losses.

1.4 **Coverage and interference**
Measurement units, thresholds, noise. Power, SNR, RSRP, Throughput Mbps. Coverage analysis.

1.5 **Calibration and reporting**
Calibration against drive-test data and clutter/noise tuning an RF environment. Exporting data into GIS systems.



TOOLS USED

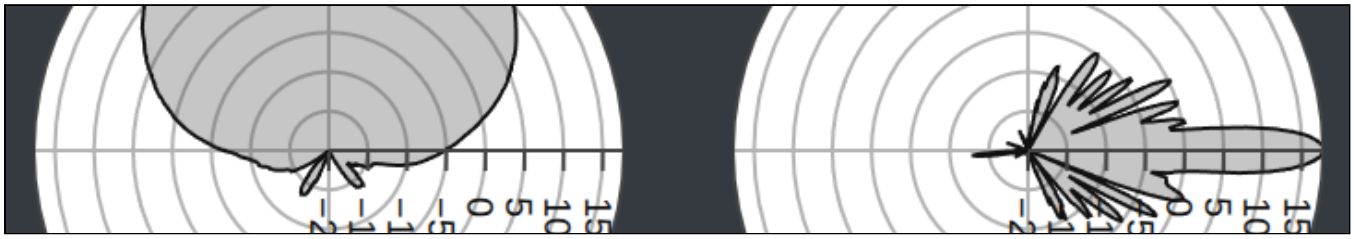
CloudRF | SOOTHSAYER | ATAK | QGIS | PPA | LiDAR | RADAR | Antennas | Maps

OBJECTIVE

Confidently model digital RF systems to design an **efficient and effective** communications network.

RADIO THEORY

Learn radio theory through **modern interactive demos** which allow students to explore and simulate key concepts such as frequency, height, bandwidth and noise within a global sandbox.



2.1 - RADIO WAVES

Frequency, effective height, RF power and bandwidth. Watts, decibels, units and key conversions. Transmitters, receivers and thresholds.

- **Interactive lab with minimal Powerpoint**
- **Full spectrum sandbox: HF to SATCOM**
- **Real manufacturer data and templates**
- **Taught by experienced operators, not Academics**

2.2 - ANTENNAS AND FEEDERS

Antenna gain, Beamwidth, lobes and front-to-back ratio. Impedance matching, VSWR, feeder loss and efficiency.

2.3 - PROPAGATION AND PATH LOSS

Free-space loss, link budgets, models, material attenuation, reflection, diffraction, Fresnel zone and how to use a margin.

2.4 - MODULATION AND NOISE

Analogue and digital schemes, bandwidth and data/information rate, Bit-Error-Rate (BER), noise measurements and mistakes, sensitivity and digital modulation schemas.

OBJECTIVE

Understand and **demonstrate** the RF theory fundamentals which underpin modern communications.

SOFTWARE-DEFINED RADIO

Get hands on with SDR and learn to **detect, capture and analyse I/Q data** using COTs hardware and open source applications. Capture and decode real world ISM signals in a controlled environment and learn UK interference and interception laws to enable safe research and innovation.

LAB EXERCISES

3.1 **Spectrum survey**
Finding signals using FFT and Waterfall plots, sample rates, filers and artefacts.

3.2 **Build an FM receiver**
A flowgraph from antenna to audio, built block by block with GNU radio.

3.3 **Capture and offline decode**
Saving I/Q to disk and replaying for offline demodulation and bit recovery.

3.4 **Measurement with an SDR**
Key signal measurements, Interference hunting, antenna testing, and validating a prediction in the field.

KIT PROVIDED

- Spectrum analyser
- COTS SDR
- SDR#
- GNU Radio
- Python / SciPy
- Laptop with SDR drivers

CloudRF

About us

CloudRF are a UK small business who have been making radio simulation software since 2012.

The team have over 60 years of collective experience in Defence and Government radio & EW operations and instruction and are recognised as the market leader in scalable RF simulation APIs.

CLOUDRF

RADIO PLANNING TODAY

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