Forensic Analytics

Training

Course FA014 - RFPS Training

Forensic Radio Frequency Propagation Survey Training

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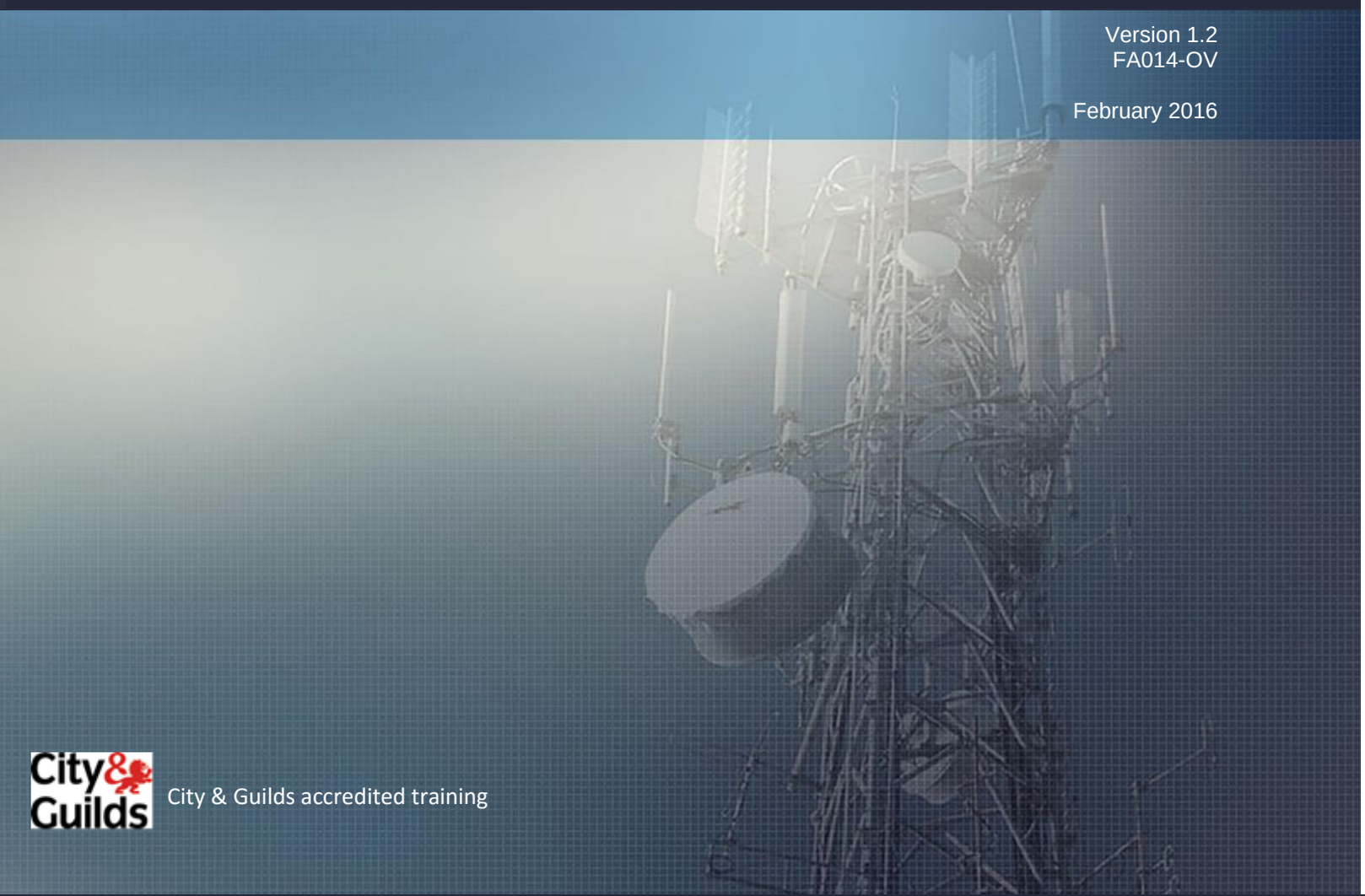

City & Guilds accredited training

Contents

Introduction

Avon & Somerset Constabulary in association with Forensic Analytics Ltd have joined together to jointly deliver a training curriculum designed to equip police officers, civilian staff and non-LEA participants with the knowledge and practical experience required to allow them to gather RFPS (Radio Frequency Propagation Survey) forensic evidence.

RFPS, or forensic radio surveying, is a branch of digital forensics that seeks to determine the areas of coverage provided by individual mobile phone masts and their radio cells. Specialist survey equipment is used to capture samples of the radio spectrum at locations to determine the identity of the radio cells that provide coverage there. This evidence can then be used in conjunction with mobile phone billing records (which contain details of the cells used to carry each call) in an attempt to determine the potential location of 'subject' mobile phones when particular calls were made.

This course is accredited with City & Guilds and successful completion of the course will result in participants achieving a recognised City & Guilds qualification.

Course Outline

Duration: 5 days

This course has been designed to provide a bootcamp for anyone who has a need to undertake Radio Frequency Propagation Surveys (RFPS). The course covers the principles of Radio Propagation, Cellular and Wifi generations - including the architecture, technologies and techniques employed by 2G, 3G and 4G mobile networks. It also provides RFPS practitioners with an opportunity to enhance their understanding of survey techniques in real world scenarios and to develop the skills required to undertake RFPS surveys using specific survey devices.

The course is run by experienced cellular radio engineers who have extensive forensic surveying backgrounds. Forensic Analytics trainers have also had experience of cell site analysis, forensic report writing and presenting reports in court as cell site expert witnesses.

Target Audience

This course is intended to be applicable to police officers and civilian staff who are or may be required to undertake RPFS surveys, understand the evidence gathered, compile survey summary reports and present them in evidence at court as a 'Witness of Fact'.

Pre-Requisites:

A general understanding of communications data and cell site analysis is useful as is previous exposure to RFPS surveys as part of Cell Site investigations. This is helpful, but not critical as the programme is designed for delegates who may not have this experience, but who will be expected to undertake Radio Surveying in the future.

Basic skills in this area can be gained by pre-reading '*Forensic Radio Survey Techniques for Cell Site Analysis', Joseph Hoy, Wiley 2015* – follow this link for details bit.ly/cellsitetraining

More generally, participants are required to have:

- Basic maths skills
- Computer literacy
    - basic Windows skills (open Windows Explorer, open and save text files using Notepad)
    - basic MS Office skills (open an Excel spreadsheet, import data into a spreadsheet from a text file, add tabs to a spreadsheet)
    - basic mapping skills (import Excel data into Autoroute or MapPoint)

Course Aims

To provide participants who are new to the discipline with sufficient depth of understanding, knowledge and practical experience to allow them to undertake successful RF surveys; accurately process and interpret the results; and confidently present them in court.

Course Objectives

On completion of this course the delegate will be able to:-

1. Demonstrate an understanding of basic cellular radio concepts
2. Discuss the basic properties of concepts such as radio noise, interference and transmit power including an understanding of the decibel measurement scale
3. Describe the configuration of a typical cell and cell site
4. Demonstrate an understanding of the basic techniques and technologies employed by 2G GSM, 3G UMTS and 4G LTE networks
5. Describe the set of identifiers used on the GSM air interface such as CI, BSIC and ARFCN
6. Describe the set of basic identifiers used on the UMTS air interface such as Primary Scrambling Codes (PSC), UARFCNs and 3G Cell IDs
7. Describe the set of basic identifiers used on the LTE air interface such as Physical Layer Cell IDs (PCIs), EUARFCNs and 4G Cell IDs
8. Outline the processes followed by a phone when initially selecting (C1/S) and then reselecting (C2/R) a serving cell
9. Demonstrate an understanding of how and why a phone will select a particular cell to use when making a call
10. Outline the processes involved in preparing for an RFPS survey, including CDR analysis, creating survey instructions and a target cell list
11. Demonstrate an understanding of the various forensic radio survey types – spot/location, drive, route, coverage, etc – and discuss the applicability of each technique
12. Describe in the detail the meanings of various RFPS survey data, such as dB, dBm, RxLev, RSCP, Ec/No, RSRP, RSRQ, ARFCN, BSIC, PSC, PCI, CGI and others
13. Outline the set of remedial actions that could be taken in the event that expected cells were not observed during a survey
14. State the expected signal strength ranges for 2G, 3G and 4G surveys with an indication of the high and low ends of each typical strength range
15. Outline the range of measurements and survey data presented by a representative range of RFPS survey devices
16. Demonstrate an understanding of the setup and use of a specific RFPS survey device type(s) and successfully use it to conduct example surveys
17. Successfully complete and pass the course assessments to attain City and Guilds Accreditation as an RFPS Practitioner.

Course Schedule

- Day 1 & 2 – Radio Propagation Overview, Cellular Technology Overview, RFPS Measurements, RFPS & Cell Site Analysis, Conducting Successful Surveys
- Day 3 – Overview of generic set of Cellular and Wifi survey devices, introduction and operation of specific CSurv survey device
- Days 4 & 5 – practical exercises with nominated survey device, recap of course scenario and discussion of suggested correct answers, optional end of course test

Course Timing

Each training day will start at 09:00 and will finish at 17:00, with breaks.

For courses delivered at a residential location, additional practical sessions (such as walk/drive surveys and report writing sessions) can be run in the evenings to further enhance delegates' understanding of the topics.

Methods & Training Material

The course consists of taught lessons with full course notes and onscreen presentations that introduce the underlying radio and cellular technologies; that develop the participant's understanding of the aims and objectives of RFPS surveys; and that reinforce the learning with tests and practical exercises.

The on-site presentation will be aided by video clips, examples of survey results and other supporting material. The taught sessions will be delivered by experienced cell site practitioners, who intersperse the learning with 'war stories' and relevant examples drawn from their own experience.

Practical exercises will be based around a fictitious case. Depending upon location and safety assessments, the practical aspects of the programme could include drive and walk surveys plus location, coverage and route survey practice.

Post-course support resources include a telephone support line, access to an experienced RFPS practitioner as a mentor and access to a secure online community forum.

Course Content

Session numbering is based on [day].[session], e.g. Session 1.1 is Day 1, Session 1.

Session 1.1 Content – RF Signals and Radio Propagation

- Introductions, fire procedures, course timings & overview
- Outline key concepts to be covered during course sessions
- Key Radio Concepts

Session 1.2 Content – Cellular Technologies Overview

- Radio Technologies
- Cellular Radio Concept
- Cellular Generations – 1G, 2G, 3G, 4G, beyond
- Generic Cellular Network Architecture
- 2G, 3G, 4G Network Architecture Differences
- Radio Access Networks
- Cellular Radio Technologies (TDMA, CDMA, OFDMA)
- Frequency Bands & Channel Numbering
- Cell IDs & Cell Discrimination

Session 1.3 Content – Single & Multi Frequency Operation

- Single & Multi-Frequency Networks
- Multi-Band Operation (stacked cells)
- UK Frequency and Channel Allocations for 2G, 3G and 4G

Session 1.4 Content – Cell Sites & Access Networks

- Generic Base Station Sites
- Site Types & Coverage Options
- Access Network Architectures – LACs/TACs
- Core Network Architectures
- Network Databases & Identifiers – IMSI, TMSI, IMEI
- Network Activities – Attach, Location Update, Detach
- Idle Mode Activities

Session 1.5 Content – Network Operations & WiFi

- Connected Mode Activities
- Call & Data Session Setup
- 4G voice call options – CS Fallback & VoLTE
- Handovers
- 2G Handover Types
- 3G/4G Handover Types
- Non-Cellular Technologies – WiFi
- Wifi operation & Frequency Bands
- Wifi Generations – 802.11 a, b, g, n, ac (waves 1 & 2).
- WiFi Network Configuration and Identifiers

Session 2.1 Content – RF Measurements

- Power Level Measurement
- Noise & Interference
- Decibels and Radio Signal Power
- Cellular Measurements RXLev, Ec/No & RSCP, RSRQ & RSRP, RSSI

- Initial Cell Selection – C1/R & Cell Reselection – C2/S
- Typical Measurement Values for different cellular technologies 2G, 3G and 4G
- Interpreting RFPS Measurements during a Survey
- WiFi Signals and Measurements

Session 2.2 Content – RFPS & Cell Site Analysis

- Recap of Cellular & Cellsite Analysis Basics
- CDRs & Capturing Billing Data
- Cell Site Analysis = CDRs + Survey Results
- Forensic Survey Types
- Survey Safety
- Idle Mode vs Connected Mode Surveys
- Spot/Location Surveys
- Location Survey Techniques (cell and channel locks, in-building surveys)
- Connected Mode Test Calls (or data sessions for 3G and 4G)
- All-Network Surveys to support Cell Dumps & Preservation of evidence

Session 2.3 Content – RFPS Survey Types

- Drive Surveys
- Location Coverage Profiles
- Cell Coverage Profiles
- Types of profile – fill-in extent or full coverage
- Route Coverage Profiles & Other Scenario Surveys
- Driving, walking or other surveys
- WiFi Surveys

Session 2.3 Content – RFPS Survey Issues

- Not Getting Expected Survey Results
- Survey Preparation
- Target Cell Lists
- Survey Safety
- Processing Survey Results
- Typical Survey Issues

Session 3.1 Content – Conducting Successful Surveys

- Analysing and understanding network CDR (Call Detail Records)
- Extracting useful information related to surveys from network CDRs
- Creating Survey Instructions, Survey Maps and a Target Cell List
- Survey Best Practise
- Survey Notebooks, Contemporaneous Notes

Session 3.2 Content – RFPS Output

- RFPS Output – Survey Results
- RFPS Product - maps, survey summaries, reports
- Creating results summary tables manually
- Creating coverage map using Autoroute
- Combining Call Records & RFPS Product

Session 3.4 Content – RFPS Survey Equipment

- Review of the current survey tools;
- CSurv ™, Forensic Compass, TEMS, Nemo, CSU-4u, Smith Myers
- In-depth discussion of the features and benefits of each survey device
- Break

participants split into two groups and rotate through the practical activities 3.5 and 4.1

Session 3.5 and 4.1 Content – CSurv, Forensic Compass, NEMO Handy

- Introduction to CSurv features & elements
- Identifying device elements & connections
- Switching On
- User interface
- survey configuration
- Survey preparation
- Basic & Advanced Features
- Scan Types & Scan Methods
- Survey setup
- Starting a Scan
- Ensuring that GPS is being captured
- Survey data capture
- In-scan data display – interpreting presented data
- Map Display (CSurv only)
- Data storage & output formats
- Management laptop & data downloads
- Download Survey Data
- Upload to Database (CSurv only)
- Query Database, Configuring Query format (CSurv only)
- Raw survey data output formats
- Processing survey data using CSAS
- Compiling Summary Reports

Session 4.2 Content – Main Course Scenario – Exercise 9 .1 - Preparation

- All participants together again
- Review End of Course Scenario
- Review scenario call data & pre-course target cell list
- Review allegations & select location survey sites
- Review allegations & create drive survey route
- Lunch

participants split into three groups and rotate through the practical activities

Session 4.3 (Group 1), 4.4 (Group 2), 5.1 (Group 3) Content – Exercise 9.2 Location Survey – Forensic Compass

- Capture location survey data at location A
- Return to lab and download survey data
- Create survey report
- Move on to next exercise >>

Session 4.4 (Group 1), 5.1 (Group 2), 4.3 (Group 3) Content – Exercise 9.3 Route Survey – CSurv

- Capture route survey data along route D
- Return to lab and download survey data
- Create survey report & Map
- Move on to next exercise >>

Session 5.1 (Group 1), 4,3 (Group 2), 4.4 (Group 3) Content – Exercise 9.4 Location Survey – NEMO Handy

- Capture location survey data at location C
- Return to lab and download survey data
- Create survey report
- Move on to next exercise >>

Session 5.2 Content – Post Exercise Review

- Post Exercise review
- Example of data processing in CSAS
- Course summary & recap
- Review Main Course Objectives and Learning Points
- Review Cellular Basics
- Review Survey Concepts
- Review C-Surv Basics
- Break

Session 5.4 Content – End of Course Review

Course Assessments

Participants will be regularly tested using multiple choice surveys, narrative questions and guided exercises during the course to check understanding and reinforce learning points.

There will also be 'observed' practical exercises at regular intervals (where an instructor watches the participant completing a practical exercise), with the opportunity to ask for help and additional explanations.

To be able to successfully complete the course and gain the City & Guilds accreditation, participants will be required to undertake a rigorous test each day test, which has defined outcomes that the participants will be expected to meet.

There are minimum performance criteria – both in terms of the Multiple Choice questions and the conclusions reached in the scenario based training – failure to meet the threshold will result in a failure to meet the requisite standard for City and Guilds Accredication.

The minimum expected performance level for multiple choice tests and for the end of course exam is to achieve 80% correct answers.

The minimum expected performance level for the practical tests is for the participant to demonstrate each task competently and confidently and to present the correct answers to all of the scenario-based practical tests.

Training Methodologies & Testing

Our blended learning approach uses a mixture of face-to-face teaching and self-study periods, combined with self-paced course exercises. The live presentations will be hosted by an experienced trainer and will use a combination of powerpoint presentation, video clips live survey data, anonymise call data and interactive question and answer sessions.

The practical sessions will use a mixture of PC-based applications (Forensic Analytics CSAS, Microsoft Excel, Autoroute/MapPoint, etc) and examples of the selected RFPS survey devices (CSurv and Forensic Compass). The practical sessions will be based partly in the classroom and partly outside, giving participants an opportunity to practice the skills required for RFPS surveying with real equipment in real environments. Practical exercises are undertaken using the same types of CSurv and Forensic Compass devices that are used by UK police forces (where available).

In order to gain a City and Guilds Accreditation all delegates must be prepared to take exams throughout the course, which will count towards the accreditation.

After each training day there will be a multiple choice test which covers the day's training and where appropriate information covered on previous days. The end of day tests constitute part of the theoretical exam and in order to gain a City and Guilds Accreditation, 70% of answers have to be answered correctly. Should a student fail to achieve the pass mark on any end of day exam, a different exam paper can be re-sat the following morning.

On the final training day, a practical scenario will be followed by the delegates working in teams of 2 to 4. This will involve an investigation which will involve undertaking RF readings in the field and delegates will be questioned and assessed throughout the day to ensure that best practice RFPS surveying techniques are adhered to. There is scoring criteria which governs this part of the course (explained fully on the course) and delegates are expected to achieve 80% on this assessment in order to achieve the City and Guilds Accreditation.

Failure to pass the practical assessment may not result in a failure to achieve a City and Guilds Accreditation. Where the performance is borderline, as determined by the instructor/assessor, it will result in a professional interview later that day. Subject to the discretion of the instructor/assessor, this will either result in the in student assessed as having passed the course or the student may be deemed not to have met the required standard in order to achieve the City and Guilds Accreditation.

Students are politely informed that in order for the course to retain its credibility and educational rigor a pass fail criteria must be enforced.

Following each course delivery, the participants will have free access to full post-course support and mentoring from Forensic Analytics via email or phone. Our trainers will be available to answer questions, provide clarification or simply offer advice on RFPS topics.

Further training sessions and site visits can also be arranged, but these may attract additional costs depending upon what is required. We can also offer post-course mentoring, which may include the option of us providing experienced RFPS engineers to accompany course participants on real RFPS surveys jobs to offer guidance and advice, although this will depend on availability and may attract additional fees.

Fees

Pricing

This course costs £400 per delegate per day (excluding VAT, travel, accommodation, etc).

The 5-day delivery will be charged at £2000 + VAT per participant

Terms & Conditions

Full details of our training Terms & Conditions are available on request.

In general, we will require a PO (Purchase Order) number from each customer before a training event can be confirmed.

We may require part or full payment in advance in some circumstances.

Unless otherwise agreed, all intellectual property rights, including copyright, patents and design related to any training material supplied shall belong to and remain vested in Forensic Analytics (or in the copyright holder identified on any training material supplied by Forensic Analytics).

All prices are quoted exclusive of VAT.

Payment terms 30 days upon receipt of order.

Location

For open deliveries this course will usually be delivered at Avon & Somerset Police HQ.

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Booking

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