

# **Codes of Practice and Conduct**

**Appendix: Digital Forensics – Cell Site Analysis**

**FSR-C-135**

**Issue 2**

© Crown Copyright 2020

The text in this document (excluding the Forensic Science Regulator's logo, any other logo, and material quoted from other sources) may be reproduced free of charge in any format or medium providing it is reproduced accurately and not used in a misleading context. The material must be acknowledged as Crown Copyright and its title specified. This document is not subject to the Open Government Licence.

## Contents

1.	Introduction .....	4
2.	Modification .....	4
3.	Implementation.....	5
4.	Scope .....	5
5.	Independence, impartiality and integrity .....	6
6.	Service to the customer.....	7
7.	Setting forensic strategy.....	8
8.	Control of records.....	10
8.1	Checking and Review.....	10
8.2	Critical Findings Check.....	11
9.	Competence.....	13
10.	Validation .....	15
10.1	Selection of Methods.....	15
10.2	Validation of Methods.....	16
10.3	Determining the End-User's Requirements and Specification .....	17
10.4	Risk Assessment of a Method .....	17
10.5	Statement of Validation Completion .....	18
11.	Uncertainty in measurement .....	19
12.	Test reports, statements and presentation of evidence .....	21
12.1	Reports and Statements to the Criminal Justice System.....	21
13.	Review .....	22
14.	Glossary, abbreviations, acronyms and terminology .....	23
15.	References.....	28

## 1. Introduction

- 1.1.1 All forensic science providers, including those providing cell site analysis, shall comply with the Codes of Practice and Conduct for Forensic Science Providers and Practitioners in the Criminal Justice System (the Codes) [1], this appendix FSR-C-135 and when required by the Codes, <sup>1</sup> be accredited to BS EN ISO/IEC17025:2017 [2] (referred to as ISO17025 from this point).
- 1.1.2 This appendix should be read alongside the Codes, the appendix to the Codes Digital Forensics (FSR-C-107) [3], ISO17025 and the International Laboratory Accreditation Cooperation (ILAC) publication ILAC G19:08/2014 Modules in a Forensic Science Process (ILAC G19) [4], and will generally follow the heading titles used in the Codes.
- 1.1.3 Although forensic science providers can be any size, this document will use the ILAC-G19 term 'forensic unit' (see Glossary and Terminology).

## 2. Modification

- 2.1.1 This is the second issue of this document.
- 2.1.2 Significant changes to the text have been highlighted in grey.
- 2.1.3 The modifications made to create Issue 2 of this document were, in part, to ensure compliance with The Public Sector Bodies (Websites and Mobile Applications) (No. 2) Accessibility Regulations 2018. <sup>2</sup>
- 2.1.4 The Regulator uses an identification system for all documents. In the normal sequence of documents this identifier is of the form 'FSR-#-###' where (a) the '#' indicates a letter to describe the type or document and (b) '###' indicates a numerical, or alphanumerical, code to identify the document. For example, the Codes are FSR-C-100. Combined with the issue number this ensures each document is uniquely identified.

---

<sup>1</sup> The Codes section titled 'Statement of Standards and Accreditation Requirements for all forensic units providing forensic science services' details the required standards and timetable and the assurance mechanisms required such as accreditation.

<sup>2</sup> To facilitate the operation of the Regulations the following significant changes to sections of the document are noted here. The following sections of the document have been amended: Contents table, 1.1.1, 1.1.2, 1.1.3, 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.6, 3.1.1, 5.1.2, 9.1.6, 11.1.1, 14, 15. The following footnotes have been amended – 1, 2, 14.

2.1.5 In some cases, it may be necessary to publish a modified version of a document (e.g. a version in a different language). In such cases the modified version will have an additional letter at the end of the unique identifier. The identifier thus becoming FSR-#-####.

2.1.6 In all cases the normal document, bearing the identifier FSR-#-####, is to be taken as the definitive version of the document. In the event of any discrepancy between the normal version and a modified version the text of the normal version shall prevail.

### 3. Implementation

3.1.1 This document was published on 22 September 2020.

### 4. Scope

4.1.1 Cell site analysis relies on:

- a. The acquisition of communications data;
- b. The processing of those data, often in association with data captured during a radio frequency (RF) propagation survey;
- c. The presentation of those data in the form of maps and tables either with a factual or expert report.

4.1.2 This appendix covers the forensic unit's work as applicable to the scope of accreditation.

- a. Request and/or normalise call data records in order to present call data in the form of maps/tables and produce an investigative report or streamlined forensic report 1 (SFR1) <sup>3</sup> as a factual report or an expert summary.
- b. RF propagation survey:
  - i. To conduct a RF propagation survey in response to an incident to capture the cell sites that serve <sup>4</sup>/cover a defined area, and WiFi if applicable, as a virtual 'scene preservation' activity;

---

<sup>3</sup> The SFR1 is not a witness statement or an expert's report.

<sup>4</sup> This refers to all cells that serve a location or area.

- ii. To undertake a survey to indicate the area over which it is reasonable that a specific cell covers, when relevant to the case as shown by the cell ID on the call record; and
  - iii. To determine the cells that cover or do not cover a defined area at the time of survey.
- c. Cell site analysis, including the acquisition of communications data, processing of that data and the presentation of an expert report.

## **5. Independence, Impartiality and Integrity**

5.1.1 The forensic unit shall ensure that all of its practitioners adhere to the Codes in respect of their independence, impartiality and integrity, and that the organisational structure of the forensic unit, policies and procedures support this rather than hinder it.

5.1.2 The Codes includes various impartiality requirements, including within the Code of Conduct, for policies and procedures not only to prevent internal and external influence on the results of their examinations and tests, but also cover the corrective action (such as formal disclosure) to be taken if there is a possibility of a practitioner's judgement having been, or perceived to have been, compromised.

5.1.3 Whether the practitioner is likely to be acting as an expert or not, all analyses shall be conducted in an unbiased manner. For example, consideration of both the prosecution and defence hypothesis, if available, or attempting to determine the defence hypothesis.

5.1.4 All forensic units are required to demonstrate that they meet these requirements, which shall include the following.

- a. The documentation is compliant with the Codes and staff adhere to the documentation.
- b. The consideration of one or more alternative hypothesis.
- c. The terminology used in reports shall be clearly defined and imply no bias. Phrases in reports such as 'in the vicinity of' may only be used if qualified; phrases such a 'consistent with' should not be used in reports unless all other scenarios the findings would be consistent with are given.

- d. Cell site analysis may be used to propose investigative avenues (i.e. to help form a hypothesis). If a hypothesis has been produced through a different process, cell site evidence should only be used to test whether that hypothesis is supported by the evidence; it should never be used to test whether the hypothesis supports the allegations or scenarios being put forward in the case independently of the evidence. Care should be taken not to transpose the conditional aspects of any assertion.
- e. The use of peer review of casework including, where appropriate, that this is done independently without prior knowledge of the original outcome.
- f. The use of appropriate quality assurance including, where appropriate, blind re-examination/blind proficiency testing.
- g. The documentation and review of individual specific case assessments and strategies.

5.1.5 Forensic units can further demonstrate that they meet these requirements in a variety of more general ways, include the following.

- a. The engendering of a culture of technical challenge between staff.
- b. Critically reviewing and subsequently documenting their organisational structure, with specific emphasis on the suitability of reporting lines and shared departmental responsibilities.
- c. Physical separation of departments or groups with potentially conflicting priorities.
- d. Staff remuneration not being based on the outcome or throughput of casework.
- e. The availability of procedures to follow if a lack of impartiality or independence is perceived, or if staff feel that an attempt has been made to compromise their independence or impartiality.

## **6. Service to the Customer**

6.1.1 As part of service to the customer and contract review the forensic unit shall ensure that the customer is made aware of any limitations or caveats that are already known to apply to this type of analysis or service offered by the forensic unit (for example, a factual report with no expert opinion).

6.1.2 For example, analysis of call data records may demonstrate that the phone was within the area covered/served by a specific cell at the time of the beginning and/or end of the call. The customer must be made aware that although locations of interest may be surveyed, pinpointing the phone to a specific location is almost always impossible.<sup>5</sup> Additionally, a location of interest and an alternative location may be so geographically close that the radio survey data obtained at them is the same or substantially similar. In that case the customer should be informed that there is no reasonable way of inferring at which location the call event was more likely to have occurred.

## 7. **Setting Forensic Strategy**

7.1.1 There shall be a procedure defining the setting of forensic strategy. The procedure shall include the following.

- a. Case circumstances.
- b. The data available (call data records, cell information, etc.).
- c. The limitations of the data. For example, where conclusions are solely or largely based on interpretation of General Packet Radio Service (GPRS) billing data, or in situations in which the prosecution and defence scenarios are so similar that cell site techniques will be of little use in attempting to discriminate between them.
- d. The suspect's personal situation (for example, place of work, home address).
- e. Known or suspected attribution of phones.
- f. Survey requirements:
  - i. Location survey (including potential requirements for elevation, for example, high floors in tower blocks);
  - ii. Area survey, to distinguish whether the service between two or more locations can be differentiated; and
  - iii. Cell mapping, to measure the service area of a given cell where relevant to the case.

---

<sup>5</sup> There may be rare exceptions with an indoor cell or femtocell, see 11.1.5.



## Codes of Practice and Conduct

- 7.1.2 Plotting of locations of interest (scene, mast locations and other specified addresses) may be conducted to provide an overview of the mobile telecommunications aspects of the case. These maps may be used to inform a more detailed surveying strategy or serve as the output in their own right (i.e. a theory-based 'desk exercise') including identifying the following.
- a. Potential survey locations.
  - b. The relevant network(s) to survey.
  - c. Any variations from the scope as detailed in the quote/briefing sheet that may be required following an evaluation of the case scenario and case data.
- 7.1.3 Although the plotting of mast locations and estimated direction of coverage (for example, sectors) may be used in the planning process, any estimations or unverified information shall be marked up as such.
- 7.1.4 There are many ways in which analyses may be undertaken; case circumstances vary and so the methods used may also vary. The strategy shall therefore detail the rationale for the approach taken with reference to the survey type (for example, location, area surveyed, cell mapping) and mode selected (for example, idle, connected).
- 7.1.5 Some customers may decide to process case data themselves and pass the processed data onto a cell site practitioner. In these scenarios (and also in scenarios in which case materials were created by someone else working under the practitioner's direction), the practitioner may be required to compile a report or answer specific questions based on the case materials (the case strategy or generated maps and charts) that were provided, rather than created by the practitioner. In these circumstances the practitioner shall do the following.
- a. Assess whether the question to be addressed is valid or may be prejudicial; if overly specific questions have been posed that, in their view of the practitioner, are so restricted that to answer them without additional commentary may be misleading, this shall be highlighted and a more balanced approach taken in the analysis.
  - b. Review the strategy adopted to answer the question and highlight any areas in which they believe they are constrained (i.e. highlight the

differences between the approach they have been committed to and that which they would have adopted if they had set the strategy themselves).

- c. Highlight any parts of the process (for example, conversion of call data, mapping, surveys, etc.) that they have not personally verified as accurate. If a third party has performed these tasks and the practitioner has checked them and is confident that they are accurate, the practitioner may take ownership of the product. In this instance the practitioner needs to record who undertook the original work in accordance with Part 19 of the Criminal Procedure Rules.

## **8. Control of Records**

### **8.1 Checking and Review**

8.1.1 The forensic unit shall ensure that methods that require calculations (including those embedded in spreadsheets) and/or critical data transfers that do not form part of a validated process include checks carried out by a second person. A policy/procedure shall define the nature of the transfers and the checking procedure that shall consider the accuracy and/or applicability of the following.

- a. Call data records.
  - i. The call data records are the foundation of cell site analysis. Call data are supplied in varying formats (according to network) and in a format that normally requires reformatting and/or normalisation, which should be validated (see 10.2.1).
  - ii. Specific call data that have been determined to be unreliable have been correctly excluded (for example, other party cell site information).
  - iii. Format of data (for example, call event nomenclature, time, date, hexadecimal to decimal conversion).
  - iv. Normalisation of data (for example, conversion of latitude and longitude to British national grid, postcode to a co-ordinate system).
- b. Mapping.

- i. Presented data (for example, cell site locations, <sup>6</sup> locations of interest) are correctly positioned and labelled. <sup>7</sup>
  - ii. If a period of call data is illustrated, the map illustrates all of that data. If an incomplete selection of data are presented, these are declared as such.
- c. Survey.
- i. Do the data correspond to the location of interest?
  - ii. If serving cell data <sup>8</sup> are presented, are these data an accurate reflection of the survey data (for example, correct network and protocol, correct cell ID)?
  - iii. Are there sufficient data to adequately answer the question presented?

8.1.2 The processing and normalisation of source call data are intrinsic parts of cell site analysis and the accuracy of the processing methods employed must be verified and validated. For example, when normalising call data records, the accuracy of an automated process may be tested and validated by a process in which the results of the automated analysis of data sets of varying structure and complexity are compared with the results of a manual processing of the same data by a suitably experienced practitioner. Verification of the accuracy of a manual process may be achieved by comparing the processing results obtained by one individual with the results obtained by a second competent individual of the same source dataset.

## 8.2 Critical Findings Check

8.2.1 The forensic unit shall have a procedure for carrying out checks on critical findings. Designated staff authorised to carry out such checks and records shall indicate that each critical finding has been checked and agreed, including the person who checked it and when the check was performed. The procedure shall

---

<sup>6</sup> An indication should be given to how the cell mast locations were derived. For example, verification through actually visiting the location or as presented by the service provider.

<sup>7</sup> Any analysis or presentation of cell site data using mapping (either digital or paper) must demonstrably ensure that this is carried out using a common mapping projection so as to correct any potential distortions in location, area, distance, etc.

<sup>8</sup> These are data referring to all cells that serve a location or area.

## Codes of Practice and Conduct

include a process for resolving any differing interpretations, non-conforming results or findings.

8.2.2 The procedure for carrying out checks shall then establish if work carried out conformed to the following.

- a. Is the work carried out appropriate to the requirements of the case as defined in the case strategy, including the following?
  - i. Has the question presented been addressed?
  - ii. Is the process adopted to answer the question legitimate and have the limitations been declared?
  - iii. Is the method used applicable to the purpose? For example, a limited survey may demonstrate coverage of a cell at a given location at the time of that survey; if the cell ID is on the call record and the time and location of the device is relevant to the proposition then it should be measured in full.
  - iv. If a conclusion has been reached, is the question presented within the expertise of the examiner? Does the evidence support the conclusion drawn (i.e. is the supporting summary of findings correct and relevant)? For example, it is normally not possible to address legitimately whether it is likely that a person used a phone (rather than whether the data for a phone would be expected, given that a specific person used it).
- b. Just because a cell was not detected serving at an area does not mean that it did not cover that area (for example, was the cell on air at the time of the survey? Are there sufficient data to draw such a conclusion? Is the method used appropriate to draw such a conclusion?).
- c. As the call and the incident are rarely simultaneous, do the data support the device being on route to or away from the incident?
- d. Is the work fully documented in the case notes, with appropriate checks on critical findings, calculations and data transfers?
- e. Is the work produced in compliance with the forensic unit's documented policies and procedures?
- f. Are the findings consistent with the contents of the report or statement?

- 8.2.3 Where a critical findings check is the only substantive quality control procedure, then this check shall be performed without knowledge of the original result and this independence shall be identifiable from the records.

## 9. Competence

- 9.1.1 Each role in the examination shall be defined in the procedure, including the requirements for knowledge, training, experience and any specific qualifications for the tasks assigned to each role.
- 9.1.2 For analysts involved in handling call data records and producing maps or tables from them, the training records shall define the role. The competences to be addressed shall include the following.
- a. Acquisition of communications data.
  - b. Normalising data.
  - c. Quality assurance stages.
  - d. Accepted practices for differentiating between estimated coverage plotted for planning purposes and factual plotted data.
  - e. Presenting call data in the form of maps/tables and/or to produce an investigative or streamlined forensic report 1 (SFR 1).
- 9.1.3 Staff conducting a radio frequency (RF) propagation survey shall be assessed to demonstrate the following.
- a. Ability to contribute to the development of a survey strategy or implement given or standardised strategies.
  - b. The competence of the individual to:
    - i. Select the survey method:
      - a. Idle mode;
      - b. Connected mode (for example, dedicated);
      - c. Location survey;
      - d. Route and/method of survey;
      - e. Area survey; and
      - f. Cell mapping.
    - ii. Apply the survey method;
    - iii. Correctly interpret the output of the survey.

## Codes of Practice and Conduct

- c. Use of survey equipment in idle and connected modes.
- d. Understanding of limitations of survey types. <sup>9</sup>
- e. Where part of the role, knowledge of WiFi or other RF communications standards.
- f. Understanding the responsibilities of expert witnesses and the role of assistants and analysts.
- g. Preparation of reports.

9.1.4 The forensic unit shall demonstrate ongoing competency of all analytical staff. This may involve:

- a. Reviewing technical records and technical interviews; and/or
- b. A witnessing procedure to ensure that those conducting RF propagation surveys retain competence (ILAC-G19 3.8).

9.1.5 Training programmes shall include legal awareness training to include an overview of the following:

- a. Criminal Procedure Rules, specifically Parts 1, 3, 16 and 19; [5]
- b. Criminal Practice Directions V Part 19; [6]
- c. Regulation of Investigatory Powers Act 2000; and
- d. Criminal Procedure and Investigations Act 1996.

9.1.6 Evaluative evidence in cell site analysis includes assessments of whether or not for a given call data record, that record would be expected if:

- a. A device (for example, phone) was in or near a defined area at the time the connected call/specific sequence of events took place; or
- b. A person may have been the user of a device that is contested.

9.1.7 As well as the skill and competence required to conduct RF propagation surveys in 9.1.5, training programmes for staff involved in this activity shall include the following.

- a. Development of a forensic strategy.
- b. Assessment and interpretation skills:

---

<sup>9</sup> This shall be specific to the survey equipment in use as well as the generic types derived from the information collated or produced in the validation study.

## Codes of Practice and Conduct

- i. formulating and testing hypotheses;
    - ii. awareness of the risk of transposing conditionals; <sup>10</sup> and
    - iii. appropriate terminology. <sup>11</sup>
  - c. Suitable theory training on survey strengths and limitations, validation data and appropriate knowledge of RF technology.
  - d. Awareness of cognitive bias. [7]
  - e. Preparation of reports and statements.
- 9.1.8 Where members of staff are expected to give evidence in court, training programmes shall also include training in the presentation of evidence. <sup>12</sup> [6] [8]
- 9.1.9 Expressing opinions is the role of the expert witness; this includes providing evaluative evidence. Personnel interpreting results shall have been assessed and deemed competent before reporting statements, including in the interpretation and opinions of results and findings. Also see Section 12.1 on reporting requirements.

## 10. Validation

### 10.1 Selection of Methods

- 10.1.1 All methods of examination/testing shall be fit for purpose; in demonstrating this, the forensic unit will need to have appropriate supporting validation/verification material compliant with the requirements of the Codes. [1] [9]
- 10.1.2 The overall method selected shall be validated. Cell site analysis can comprise sub-methods, selected as required; each of these (for example, survey) can be validated as separate entities. The most appropriate method should be selected based on the strengths and limitations of those available to answer the needs of the customer.
- 10.1.3 Cell site analysis may include some or all of the following technical sub-processes.

---

<sup>10</sup> See Glossary and Terminology.

<sup>11</sup> See Glossary and Terminology.

<sup>12</sup> In addition to an understanding of the Criminal Practice Directions **V** Part 19, training material may include reference to the information document FSR-I-400 on legal obligations. [8]

## Codes of Practice and Conduct

- a. Call data record conversion/ normalisation.
- b. Cell site mapping.
- c. Radio frequency (RF) propagation survey:
  - i. Location survey (including potential requirements for elevation, for example, high floors in tower blocks);
  - ii. Area survey, to distinguish whether the service between two or more locations can be differentiated;
  - iii. Cell mapping, to measure the service area of a given cell; and
  - iv. Route/scenario surveys, to test coverage along a specific route or in a specific scenario.
- d. Production (potentially including opinion) of a report.

### 10.2 Validation of Methods

- 10.2.1 It is a requirement that validation of methods shall have been undertaken prior to use in evidence. The whole process (i.e. from request/receipt of call data through to provision of final opinion) shall be validated for the method to be acceptable. If any aspect has not been validated, this shall be explicitly highlighted as a limitation in the accompanying report so that a court may take a view on admissibility.
- 10.2.2 Validation is about providing objective evidence that the method is fit-for-purpose; this is described in the end-user technical requirements and acceptance criteria. Objective evidence to demonstrate aspects of the end-user's requirements may be drawn in part from:
- a. A literature review;
  - b. The practitioner community;
  - c. Academic studies;
  - d. Collaborative trials;
  - e. Data collated by the forensic unit or training establishments (which require verifying by the forensic unit) using defined scenarios.
- 10.2.3 The validation procedure shall include where relevant, but is not limited to, the following.
- a. Determining the end-user's requirements and specification.



- b. Risk assessment of the method.
- c. A review of the end-user's requirements and specification.
- d. The acceptance criteria.
- e. The validation plan.
- f. The outcomes of the validation exercise.
- g. Assessment of acceptance criteria compliance.
- h. Validation report.
- i. Statement of validation completion.
- j. Implementation plan.

10.2.4 The Codes describe in detail the requirements of all the above. However, some introductory words on the end-user requirement and further information on risk assessment requirements is given in the following sub-sections.

### **10.3 Determining the End-User's Requirements and Specification**

10.3.1 The end-user requirements include interim-user requirements but should be framed by the end-user being the wider Criminal Justice System (CJS).

10.3.2 This is about the method not the requirements of the specific equipment used. It is not a reiteration of the user manual of survey equipment or phone emulator. The requirements and specification are used to gauge the scale of validation study based upon the acceptance criteria defined.

### **10.4 Risk Assessment of a Method**

10.4.1 A risk assessment is required and is used to determine the hazards of a method. The validation shall test the mitigation strategy to control the identified risks. The test employed may vary according to the method.

10.4.2 Within the CJS, some risks may be defined as:

- a. False positives (for example, stating that a phone was, or may have been, in an area where it could not); or
- b. False negatives (for example, stating that a phone could not have been in an area where it could).

10.4.3 The risk assessment is used to develop the validation plan; risks identified should be tested against the overall method. The method is more than the test

of survey equipment; for instance the method may require additional activity to give assurance that the risk of identified types of false negatives are managed in a way that the testing of instrumentation alone would not give (for example, in Section 11.1.6).

10.4.4 The risk analysis shall assess all of the stages that may contribute to these risks being realised. Examples include the following.

- a. Call data record normalisation:
  - i. Transcription errors;
  - ii. Inclusion of incorrect information (for example, 'other party' cell site) without recognising it as such;
  - iii. Exclusion of legitimate information (for example, transcription errors); and
  - iv. Use of GPRS without recognising limitations.
- b. Mapping:
  - i. Misrepresentation of a cell site in the wrong location, for example, labelled with an incorrect time of usage and/or cell identification; and
  - ii. Inappropriate sector representation.
- c. Survey:
  - i. Failing to detect a legitimately serving cell relevant to the case (methods that rely solely on a static survey are prone to this); and
  - ii. Failing to recognise that there may have been a network change (for example, not checking that a cell of interest is off air at the time of the survey).
- d. Interpretation:
  - i. Cognitive bias;
  - ii. Over estimating/stating the strength of the evidence; and
  - iii. Inadequate quality management of any of the risks above.

## 10.5 Statement of Validation Completion

10.5.1 The Codes require that a statement of validation completion is prepared. The forensic unit may conduct a RF propagation survey as a separate service (such

as for virtual 'scene preservation' in response to an incident to capture serving cell activity) to cell site analysis. In this instance although aspects of the validation study may be shared, separate statements of validation completion may be appropriate.

## 11. Uncertainty in Measurement

- 11.1.1 There are inherent uncertainties within cell site analysis no matter which methods have been applied. The Codes and ISO17025 require the forensic unit to identify the contributions to measurement uncertainty, noting that ISO17025 accepts that where "the test method precludes rigorous evaluation of measurement uncertainty, an estimation shall be made based on an understanding of the theoretical principles or practical experience of the performance of the method."
- 11.1.2 Networks can change over time and there may be differences in network operation between the time that the activity took place and the time the activity is analysed in the context of an investigation. Some aspects may be physical changes (for example, changes to the built environment, cells being added, removed or reoriented) or organisational (for example, routing or location area boundaries that may affect cell boundaries). There may also be temporary equipment faults.
- 11.1.3 Full cell site surveys assist in estimating the area where a mobile device was. However, further uncertainty within surveys can result from the following.
- a. The time that has elapsed since the event of interest and survey.
  - b. Survey equipment may not directly reflect the operation of the questioned device.
  - c. Interpretation of the data (false positives/negatives).
  - d. Network changes – cells being decommissioned or new cells being commissioned in or around the original cell coverage.
  - e. The height at which the survey was undertaken compared with the actual location and the height that the original connection was made to the cell site in question.

## Codes of Practice and Conduct

- 11.1.4 Given these uncertainties, cell site analysis will not be able to pinpoint the location of the subject device. The terminology used in reports shall reflect this when referring to specific locations that were assessed. For example, phrases such as “the cell used by the subject phone was detected providing service over a cell coverage area that includes [the location of interest]” may be appropriate.
- 11.1.5 For example, a practitioner with the appropriate competence may be able to comment on the general anticipated coverage area of cells of interest, and thereby provide some context to their findings. For example, assessing the expected coverage area of a cell from the network information, if it is:
- a. An indoor cell (in which case usage implies that the user was within the building – a very precise assessment); <sup>13</sup>
  - b. A 3m street works dwarfed by the surrounding buildings (in which case the service area may only be that and possibly a few adjoining streets, again, a relatively precise assessment);
  - c. A large rural macro cell based on the top of a 60m tower (which may provide a service over a large area, perhaps 10 or 20km from the mast and thus provides much lower precision and is potentially of lesser evidential impact).
- 11.1.6 There shall be a policy or procedure that includes additional activities that are undertaken if it has been concluded that a cell does not serve at a specific location when it is expected to and that is relevant to the case. This shall include one or more of the following.
- a. Visiting the mast location to see if the cell is:
    - i. Physically present; and
    - ii. Links appear intact and/or on air.
  - b. Reviewing neighbour data to see if the frequency that the cell is on is visible or used by a different cell.
  - c. Reviewing survey data to identify if the cell seen in other locations (contributes to verifying that it is on air without visiting the cell).

---

<sup>13</sup> Although additional work may be necessary to prove that a 'femtocell' (see Glossary and Terminology) indoor cell was actually located at the stated address at the time (as such devices can be moved and connected to the network from other locations).

- d. Assessing antenna point direction (azimuth).
- e. Examine the path profile between mast and location to check for obvious terrain obstructions, etc.

## **12. Test Reports, Statements and Presentation of Evidence**

### **12.1 Reports and Statements to the Criminal Justice System**

12.1.1 Reports to investigators or to courts produced from cell site analysis and radio frequency propagation surveys may be:

- a. Factual, produced by technical staff acting as witnesses; <sup>14</sup> or
- b. Evaluative, including an interpretation and/or opinion by staff competent to provide expert evidence.

12.1.2 Forensic units shall ensure that all staff who provide factual evidence based on scientific methodology are additionally able to demonstrate, if required, the following:

- a. Whether there is a body of specialised literature relating to the field;
- b. That the principles, techniques and assumptions they have relied on are valid; and
- c. The impact that the uncertainty of measurement associated with the application of a given method could have on any conclusion.

12.1.3 Forensic units shall ensure that all staff who provide expert evidence based on their practical experience and/or their professional knowledge are additionally able to provide the following.

- a. An explanation of their methodology and reasoning.
- b. Reference to a body of specialised literature relating to the field of expertise and the extent to which this supports or undermines their methodology and reasoning.

---

<sup>14</sup> There are two basically two types of witness, witnesses of fact who may give evidence of fact but not opinion, and expert witnesses who may give opinion evidence within their expertise in addition evidence of fact. The term 'professional witness' is often used, but it refers to a witness of fact; the term is used in the medical profession to distinguish between the doctor giving factual evidence on something they did or saw as part of their professional activity, and a doctor giving expert opinion on a medical matter.

- c. That the data (for example, survey database) they have relied on are:
  - i. Sufficient in size and quality to justify the nature and breadth of inferences drawn;
  - ii. The inferences are logically sound; and
  - iii. Alternative hypotheses in the investigative mode and alternative propositions in the evaluative mode have been properly considered.
- d. Their methodology, assumptions and reasoning have been considered by other practitioners and are regarded as sound, or where challenged, the concerns have been satisfactorily addressed.
- e. An assessment of the extent to which their methodology and reasoning are now accepted by their peers, together with details of any outstanding concerns.
- f. Relevant information to support claims of expertise, as well as anything that may adversely affect credibility or competence (for example, adverse judicial findings).
- g. In England and Wales, that they have complied with Part 19 of the Criminal Procedure Rules.

12.1.4 The language used in all reports whether considered factual, investigative or evaluative shall be consistent with the needs of the courts to be informative, unbiased and not misleading. The Glossary and Terminology in Section 15 of this appendix provide an overview of key terms used in reports, statements and oral testimony as well as how they should be qualified.

12.1.5 Terms such as 'area' or 'vicinity' should be defined in terms of what the report's author is considering them to mean, in terms of distance, etc.

## **13. Review**

13.1.1 This document is subject to review at regular intervals.

13.1.2 If you have any comments please send them to the address or email set out at: [www.gov.uk/government/organisations/forensic-science-regulator](http://www.gov.uk/government/organisations/forensic-science-regulator).

## 14. Glossary, Abbreviations, Acronyms and Terminology

### Attribution

Attribution is the process of attempting to assign a device to an individual and may be progressed through a number of different methods, each method having different risks. Cell site analysis may be one method by which patterns of usage may be assessed against what would be expected if a given device was used by a specific person, as opposed to if it was not used by that person.

### Best serving cell

'Best serving cell' is an engineering term referring to the cell selected by a device at a given time for service, disregarding other cells that may also serve. The use of this phrase is misleading in the forensic arena, as it implies only a single cell would normally be available to provide service at any given location. Caution should be given if this phrase is encountered; it should not be used in reports unless a full description of the limitations of usage is provided.

### Cell ID

The number used to identify each base transceiver station.

### Cognitive bias

Cognitive bias may be defined as a pattern of deviation in judgement whereby inferences about other people and situations may be drawn in an illogical fashion. [10] People tend to display bias in judgements that are made in everyday life, indeed this is a natural element of the human psyche. Jumping to a conclusion, tunnel vision, only seeing what is expected/wanted, being influenced by the views of others, all are recognisable behaviours. However, whilst such biases may be commonplace and part of human nature, it is essential to guard against these in forensic science, where many processes require subjective evaluations and interpretations. [7]

### Consistent with

The word 'consistent' or phrase 'consistent with' should be avoided, and shall only be used if alternative scenarios are also considered (for example, 'consistent with being at the scene, also consistent with being anywhere within the service area of

the cell, which may mean the phone was many kilometres away'). In the appeal court in R v. Puaca [2005] EWCA Crim. 3001 [8] Lord Justice Hooper commented that: "Whereas 'inconsistency' is often probative, the fact of consistency is quite often of no probative value at all." Even then, the term inconsistent is problematic if evaluating an alibi location when measurement uncertainty in the form of false negatives in the coverage area is likely.

Without clarification 'consistent with' can easily be misinterpreted by a lay person as meaning 'is', because the context or limitations of the finding are unknown. If the data would be expected in a number of considered or expected scenarios, clearly being consistent with one of them is not discriminating or useful. For example, if there is usage of a cell that serves both the alleged and alternative locations, stating that usage is consistent with the device being at one and not mentioning the other is clearly misleading; likewise if a cell covers the alternative location, stating that this is consistent with movement toward the scene without mentioning that it is also consistent with being at the alternative location is misleading (and not impartial).

### **Coverage**

Locations where a cell provides a strong enough signal to enable a viable connection with a mobile device. A cell will therefore usually cover a wider area than it serves. Only in the absence of any other serving cells would the coverage area of a given cell be the same as its service area.

### **Criminal Justice System (CJS)**

The Criminal Justice System (CJS) of England and Wales involves many agencies such as the police, the Crown Prosecution Service, the courts, prisons and probation work, which work together to deliver criminal justice.

### **Critical findings**

Typically observations or results that meet one or more of the following criteria:

- a. have a significant impact on the conclusion reached and the interpretation and opinion provided;
- b. cannot be repeated or checked in the absence of the exhibit or sample;
- c. could be interpreted differently.



### **Evaluative opinion**

An opinion on the value of the observations, based upon a pair of case specific propositions and clear conditioning information (framework of circumstances) that is provided for use as evidence in court. Evaluative evidence in cell site analysis includes assessments of whether or not, given a call data record, that record would be expected if a specific sequence of events took place, or whether or not a person may have been the user of a device that is contested.

### **Expert evidence**

The crucial difference between an expert witness and a factual witness (see fact evidence) is that an expert is entitled to express opinions. However, an expert is not entitled to give an opinion outside their expertise nor to venture into matters that remain the realm of the jury. A cell site expert cannot offer any greater expertise than a juror in matters such as (but not restricted to) the following.

- a. Whether movement of a person is likely or unlikely.
- b. How many other randomly selected people may have moved from one area to another in the same period as the phone under consideration.
- c. While comments can be made to highlight relevant wider information so that others – for example, the jury – can take a view, assessments that could be considered ‘common sense’ should be separated from assessments that are expert opinion. How quickly a person/device could have moved/travelled from one area to another.

### **Factual evidence**

Evidence of fact is essentially reporting that the survey conducted by that person showed a given cell to be serving/covering an area at the time of the survey; such witnesses must not give or be drawn into giving opinion. The High Court ruling in R (on the application of Wright) v. CPS [2015] EWHC 628 (Admin) [11] reiterates that the provisions of the Criminal Procedure Rules apply to all forms of expert evidence in that:

- a. No witness should give evidence outside their knowledge or expertise; and
- b. Individuals not acting as expert witnesses must not stray into giving opinion.

## **Femtocell**

Generally a femtocell is a low-power cellular base station serving a small area such as a home, office or small business.

## **Forensic science providers**

The term 'forensic science providers' is used to include all providers of forensic science, whether commercial, public sector or internal to the police service (for example, High Tech Crime Units, scenes of crime, fingerprint bureau). The term forensic science providers can refer to sole traders, small and medium enterprises or even a unit in a larger organisation that delivers the service, however the term forensic unit is used.

## **Forensic unit**

A term used in ILAC-G19 to mean "a legal entity or a defined part of a legal entity that performs any part of the forensic science process". It is interchangeable with forensic science provider. However, it is used in this document as these are small teams or sole practitioners that for accreditation purposes may be considered separate legal entities in larger organisations, forensic science providers and police forces.

## **GPRS**

General Packet Radio Service is a data service on 2G and 3G cellular communication systems.

## **Location**

The location of a mobile device derived using cell site analysis shall only ever be presented as an area. Terminology used in reports shall reflect this when referring to specific locations assessed, for example, phrases such as "the cell used was detected providing service over an area including [the location of interest]" may be appropriate. However, if an alternative location (for example, the alibi location) is known, and is also covered or in close proximity, then this is neutral evidence and should be presented accordingly.

## Radio frequency propagation survey

A survey that captures details of cell coverage and/or the cells that can be detected at specific locations using equipment ranging from phones with specific applications and phone emulators to scanners. The closeness to the time of the event of interest and the survey strategy may dictate the overall usefulness of the survey to the investigation.

### RF

#### Radio frequency

### Service

Those locations where a cell would be one of those connected to by a mobile device (i.e. the cell would be one of those in the call data records if a call event occurred at that location). Please note, it is very common for there to be many cells providing service at a given location.

### SFR

Streamlined forensic reporting (SFR) is a revised case management procedure for producing forensic evidence at court and seeks to reduce unnecessary costs, bureaucracy and delays in the Criminal Justice System. The first stage SFR (SFR1) is not a witness statement or an expert's report, it is a summary of evidence. [12]

### Transposed conditionals

The 'fallacy of the transposed conditional' is a fallacy of reasoning, also known as the 'prosecutor's fallacy' or 'confusion of the inverse'. It is where the conditional part of the assertion and its probable result are moved around so it no longer remains true. For example, the cell serves the location, the device used that cell, therefore the device was at the location is an obvious fault in moving the conditional part of the statement around and is a fallacy of reasoning. Correcting this so that it is not obviously false by saying that it 'could have been' at the location is correct in so far as it could, but as the cell site serves many locations it fails to ensure that this point is also clear, so is also potentially misleading. <sup>15</sup>

---

<sup>15</sup> The expectation of completeness in expert reports is mentioned in R v. Clark [2003] EWCA Crim. 1020 [14] but also in R v. Puaca [2005] EWCA Crim. 3001 [15] the court said when discussing pathologists that: "It is wholly wrong for a pathologist carrying out the first post-mortem at the request of the police

## Uncertainty of measurement

The estimation of the uncertainty of measurement is a Codes and ISO17025 requirement and is based upon the principle that all measurements are subject to uncertainty and that a value is incomplete without a statement of accuracy. Sources of uncertainty can include unrepresentative samples, rounding errors, approximations and inadequate knowledge of the effect of external factors.

## Vicinity

Vicinity <sup>16</sup> an ill-defined word that, if used, must be quantitatively defined (i.e. given a specific indicative value) and not used in a way that might imply a level of precision that is not supportable by the findings. For instance, if the cell was detected in the 'vicinity' of the location of interest this may be quantitatively definable (for example, 50m). However, to say that "the device is in the vicinity of the location" where vicinity actually means the service area of the cell (which could be many kilometres from the mast so includes many other vicinities, locales or environs), could be misleading if this is not made immediately clear that this is a large area. Using the word with different quantitative definitions in the same statement or report should be guarded against.

## WiFi

A local area network that uses high frequency radio signals.

---

or coroner merely to leave it to the defence to instruct a pathologist to prepare a report setting out contrary arguments. The case law as to the duties and responsibilities of experts is clear. As Cresswell J said in a much cited passage in *National Justice Compania Naviera SA v. Prudential Assurance Co Ltd (The "Ikarian Reefer")* [1993] 2 Lloyd's Rep. 68 [16]: 'An expert witness should state the facts or assumption on which his opinion is based. He should not omit to consider material facts which could detract from his concluded opinion.'

<sup>16</sup> All synonyms such as locality or environs also require to be quantitatively defined so as not to imply a level of precision that is not supported by the findings.

## 15. References

- [1] Forensic Science Regulator, “Codes of Practice and Conduct for Forensic Science Providers and Practitioners in the Criminal Justice System,” [Online]. Available: [www.gov.uk/government/collections/forensic-science-providers-codes-of-practice-and-conduct](http://www.gov.uk/government/collections/forensic-science-providers-codes-of-practice-and-conduct). [Accessed 16 07 2020].
- [2] International Organization for Standardization, BS EN ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories, International Organization for Standardization , 2017.
- [3] Forensic Science Regulator, Appendix: Digital Forensic Services, FSR-C-107, Forensic Science Regulator.
- [4] International Laboratory Accreditation Cooperation, “Modules in a Forensic Science Process, ILAC-G19:08/2014,” 2014. [Online]. Available: <http://ilac.org/news/ilac-g19082014-published/>. [Accessed 16 07 2020].
- [5] Ministry of Justice, “Criminal Procedure Rules,” [Online]. Available: [www.justice.gov.uk/courts/procedure-rules/criminal](http://www.justice.gov.uk/courts/procedure-rules/criminal) . [Accessed 16 07 2020].
- [6] Ministry of Justice, “Criminal Practice Directions,” [Online]. Available: [www.judiciary.gov.uk/publications/criminal-practice-directions-2015/](http://www.judiciary.gov.uk/publications/criminal-practice-directions-2015/). [Accessed 16 07 2020].
- [7] Forensic Science Regulator, Cognitive bias effects relevant to forensic science examinations, FSR-G-217, Forensic Science Regulator .
- [8] Forensic Science Regulator, “Legal Obligations, FSR-I-400,” [Online]. Available: [www.gov.uk/government/collections/fsr-legal-guidance](http://www.gov.uk/government/collections/fsr-legal-guidance). [Accessed 16 07 2020].
- [9] Forensic Science Regulator, Guidance: Validation, FSR-G-201, Forensic Science Regulator.
- [10] M. G. Haselton, D. Nettle and P. W. Andrews, “The evolution of cognitive bias,” in The Handbook of Evolutionary Psychology, Hoboken, NJ, US, John Wiley & Sons Inc., 2005, p. 724–746.
- [11] R (on the application of Wright) v. CPS [2015] EWHC 628 (Admin).

## Codes of Practice and Conduct

- [12] Crown Prosecution Service, “Streamlined Forensic Reporting Guidance and Toolkit,” [Online]. Available: [www.cps.gov.uk/legal-guidance/streamlined-forensic-reporting-guidance-and-toolkit](http://www.cps.gov.uk/legal-guidance/streamlined-forensic-reporting-guidance-and-toolkit). [Accessed 30 07 2020].
- [13] Forensic Science Regulator, Guidance: Validation, FSR-G-201, Forensic Science Regulator.
- [14] R v. Clark [2003] EWCA Crim. 1020.
- [15] R v. Puaca [2005] EWCA Crim. 3001.
- [16] National Justice Compania Naviera SA v. Prudential Assurance Co Ltd (The “Ikarian Reefer”) [1993] 2 Lloyd's Rep. 68.

Published by:

The Forensic Science Regulator

5 St Philip's Place

Colmore Row

Birmingham

B3 2PW

[www.gov.uk/government/organisations/forensic-science-regulator](http://www.gov.uk/government/organisations/forensic-science-regulator)