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SJC-13499

COMMONWEALTH vs. VICTOR ARRINGTON.

Suffolk. December 6, 2023. - February 20, 2024.

Present: Budd, C.J., Gaziano, Lowy, Kafker, Wendlandt,
& Georges, JJ.¹

Cellular Telephone. Practice, Criminal, Motion in limine, Interlocutory appeal, Appeal by Commonwealth, Presumptions and burden of proof. Evidence, Expert opinion, Scientific test, Presumptions and burden of proof. Witness, Expert. Rules of Criminal Procedure.

Civil action commenced in the Supreme Judicial Court for the county of Suffolk on September 13, 2023.

The case was reported by Kafker, J.

Ian MacLean, Assistant District Attorney (Edmond J. Zabin, Assistant District Attorney, also present) for the Commonwealth. Michelle Menken (E. Peter Parker also present) for the respondent.

The following submitted briefs for amici curiae:

Jessica Hyde & Eoghan Casey, pro se.

Patrick Levin, Committee for Public Counsel Services, for Committee for Public Counsel Services.

Dan Loper, Karl Epps, & Steven Verronneau, pro se.

¹ Justice Lowy participated in the deliberation on this case and authored his concurrence prior to his retirement.

Jennifer Stisa Granick & Andrew Crocker, of California, Michael W. Price & Hannah Zhao, of New York, Jessica J. Lewis, Jessie J. Rossman, Daniel K. Gelb, Nathan Freed Wessler, & Chauncey B. Wood for American Civil Liberties Union & others.

KAFKER, J. The Commonwealth alleges that in March of 2015, the defendant, Victor Arrington, and two others broke into a home, killed one resident, grievously wounded another, and attempted to set fire to the home.² Prosecuting the defendant for murder in the first degree and other crimes related to the home invasion,³ the Commonwealth moved in limine to permit the introduction at trial of frequent location history (FLH) data retrieved from the defendant's cell phone, an Apple iPhone 6.⁴ The Commonwealth contends that expert testimony regarding the FLH data would establish that the defendant's cell phone was in the immediate vicinity of the crime scene at the time the crime was committed. Because FLH data has never been admitted as

² Although this case comes to us on a reservation and report by a single justice of the Commonwealth's petition pursuant to G. L. c. 211, § 3, for convenience, we refer to Victor Arrington as the "defendant," rather than the "respondent."

³ The defendant was also charged with home invasion, two counts of kidnapping, arson of a dwelling house, armed assault with intent to murder, and possession of a firearm without a license.

⁴ FLH data are generated from location data points saved on an iPhone using a proprietary algorithm to identify locations that a user has visited several times. See part 1.b, infra. The Commonwealth contends that FLH data reliably provide an approximate location for the cell phone for a particular time.

evidence in any court in the Commonwealth, or apparently in any other jurisdiction in the country, the trial judge held a three-day evidentiary hearing to determine whether the Commonwealth's proffered expert testimony on FLH data would be permitted. The trial judge denied the Commonwealth's motion, and the Commonwealth sought appellate review.

As a preliminary issue, the parties disagree as to whether the Commonwealth may appeal from the denial of its motion to admit expert testimony under Mass. R. Crim. P. 15 (a) (2), as appearing in 474 Mass. 1501 (2016) (rule 15 [a] [2]), or whether its sole avenue for interlocutory review is a petition under G. L. c. 211, § 3. On the merits, the Commonwealth contends that the trial judge abused his discretion in denying its motion on Daubert-Lanigan grounds. See Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 585-595 (1993); Commonwealth v. Lanigan, 419 Mass. 15, 25-26 (1994). Both issues were presented to a single justice of this court, who reserved and reported the case to the full court.

As to the procedural question, rule 15 (a) (2) does not give the Commonwealth the ability to apply for leave to appeal from the denial of a motion in limine where, as here, the ruling, if allowed to stand, does not, "as a practical matter, . . . terminate the prosecution." Commonwealth v. Anderson, 401 Mass. 133, 135 (1987). Instead, in such situations, the

appropriate avenue for the Commonwealth to seek interlocutory review of a ruling on a motion in limine is through a petition under G. L. c. 211, § 3. Turning to the merits of the Commonwealth's petition here, we discern no abuse of discretion by the trial judge in denying the Commonwealth's motion to admit the proffered expert testimony on FLH data. Accordingly, we affirm.⁵

1. Background. a. Facts. As trial has yet to begin, we summarize the evidence the Commonwealth has stated it expects to introduce at trial. See Commonwealth v. Spencer, 465 Mass. 32, 33 (2013). We reserve certain facts for our discussion of the merits of the Commonwealth's motion to admit FLH evidence.

The Commonwealth alleges that at around 10:51 A.M. on March 31, 2015, the defendant, a cooperating witness, and Jeromie Johnson⁶ participated in a home invasion on Harvard Street in the Dorchester section of Boston. Richard Long, Yvette O'Brien, and O'Brien's newborn son were at home at the time of the attack.

⁵ We acknowledge the amicus briefs submitted by the American Civil Liberties Union, the American Civil Liberties Union of Massachusetts, Inc., the Massachusetts Association of Criminal Defense Lawyers, the National Association of Criminal Defense Lawyers, Inc., and the Electronic Frontier Foundation; the Committee for Public Council Services; Jessica Hyde and Eoghan Casey; and Dan Loper, Karl Epps, and Steven Verronneau.

⁶ Johnson was killed about a week after the home invasion at issue here, and thus is not a codefendant in this case.

Johnson and the defendant bound Long and O'Brien with electrical cords, cut Long with a knife, and shot both Long and O'Brien in the head. They then set fire to the house. Long died from his wounds. O'Brien survived the gunshot wound and can describe the events that occurred in the apartment until she was shot in the head, but she is unable to identify the perpetrators. The cooperating witness agreed to testify against the defendant in exchange for facing reduced charges. The Commonwealth asserts that the cooperating witness will identify the perpetrators and their roles in the home invasion and associated crimes.

The defendant allegedly drove to the crime scene in a white sedan rented by his girlfriend for his use. The defendant's car was captured on video being driven down Blue Hill Avenue in Dorchester, with another car carrying Johnson and the cooperating witness following behind. The defendant's car was next seen parked on Paxton Street near the scene of the crime. At 10:44 A.M., the defendant received a call from Johnson lasting over three minutes, and the defendant called Johnson several times over the next few minutes with no answer. The defendant's telephone utilized a cell tower the coverage area of which included the crime scene for these calls.⁷ A video camera at a Department of Youth Services facility located across the

⁷ The defendant's cell phone was seized on April 8, 2015.

street from the crime scene captured grainy video footage of two people approaching the victims' home at 10:51 A.M., and the same video camera captured footage of three people leaving at 11:20 A.M. The defendant's car was captured on video at 11:22 A.M. being driven down Blue Hill Avenue.

b. Frequent location history data. When turned on, an iPhone generates location data points from sources such as global positioning system (GPS) data, nearby wireless computer network (Wi-Fi) access points, short-range wireless Bluetooth connections, and cell site location information (CSLI). These location data points are stored on the iPhone's "Encrypted B" cache⁸ for between twenty-four and forty-eight hours. In 2015, an algorithm on the iPhone would use these data points to create FLH data.⁹ The FLH data created by the algorithm consist of a

⁸ A cache is "a computer memory with very short access time used for storage of frequently or recently used instructions or data." Merriam-Webster Online Dictionary, <https://www.merriam-webster.com/dictionary/cache> [<https://perma.cc/FFL2-EEP7>].

⁹ This information is referred to as "Significant Locations" on newer iPhone operating systems. Documents provided to customers by Apple explain that "Significant Locations allows iPhone, iPad, Apple Watch, and iCloud to learn the places that are significant to a user in order to provide useful location-related features and information in a way that Apple can't read. Data collected about a significant location includes the address the user travelled to, when they traveled there, how long they stayed, the amount of time spent commuting to the location, the method used to reach the location . . . , and the total number of times the user has visited that place."

longitude and latitude coordinate point and a circle around it, representing an amalgamation of the location data points. The radius of the circle, labeled the "uncertainty" in the FLH data, represents the approximate area in which the cell phone was located. The uncertainty radius can change from visit to visit to a frequent location, as can the coordinate point representing the center of the frequent location. FLH data also provides an estimated time that the iPhone entered the location, and an estimated time the iPhone left the location. The algorithm used to convert location data points into FLH data is proprietary, and thus the Commonwealth's expert did not have access to the algorithm itself during his testing of FLH data reliability. Moreover, it is unclear how the algorithm processes, or weighs, the different location data points generated by the iPhone.

In 2022, a full-file system extraction was performed on the defendant's cell phone. This extraction allowed the Commonwealth to access encrypted files on the cell phone, including its FLH data.¹⁰ The FLH data on the cell phone listed 345 frequent location visits. Of particular interest to the Commonwealth is frequent location no. 58. Frequent location no. 58 is centered on coordinates corresponding to a Harvard Street

¹⁰ Although the FLH data for the date of the murder was available on the defendant's cell phone, the underlying location data that was used to produce the FLH data was no longer available.

address near the victims' home. The uncertainty radius of frequent location no. 58 is forty-three meters, or 143 feet, which encompasses the crime scene. The Commonwealth's proffered expert on FLH data, a senior crime analyst in the office of the district attorney for the Suffolk district (analyst), testified that he interpreted the FLH data retrieved from the defendant's cell phone to show that the phone entered the area represented in frequent location no. 58 at 10:36 A.M. on March 31, 2015, and left the area at 11:22 A.M. that day. The Commonwealth therefore contends that the proffered expert testimony on FLH data, if admitted, would corroborate the cooperating witness's testimony placing the defendant at the scene of the home invasion.

c. Procedural background. In April 2023, the Commonwealth informed the judge that a Daubert-Lanigan hearing would be needed to determine the admissibility of FLH data evidence gathered from the defendant's cell phone. In May, a Daubert-Lanigan hearing was scheduled for July 27. On July 26, the Commonwealth requested a continuance, and the hearing was continued to August 29. Between June 16 and August 24, the analyst performed experiments on a test iPhone to determine the reliability of FLH data, with the majority of his experiments performed between August 14 and 24. The Daubert-Lanigan hearing on the admissibility of FLH evidence was held on August 29, September 7, and September 8, ending four days before the

defendant's trial was scheduled to start on September 12. The analyst was the only witness who testified at the hearing.

At the evidentiary hearing, the analyst testified regarding his understanding of how FLH data are created. Although the analyst did not have access to the algorithm that generates FLH data and could not testify as to how the algorithm converted location data inputs into FLH data, he explained the tests he had done to ascertain the reliability of FLH data in identifying where a cell phone is located at a particular time. The analyst conducted tests of FLH data reliability using a "jailbroken"¹¹ iPhone (test iPhone) that was similar, but not identical, to the iPhone associated with the defendant.¹² When pressed, the analyst acknowledged that there were likely differences in the FLH algorithms used by the two iPhones, and although he believed that any changes were not significant, he could not say for

¹¹ Jailbreaking is removing the built-in limitations from an electronic device, such as a cell phone. Merriam-Webster Online Dictionary, <https://www.merriam-webster.com/dictionary/jailbreak> [<https://perma.cc/7MR6-2LJ5>]. The analyst jailbroke the iPhone he used to test FLH data in order to access location data that users normally cannot view.

¹² The defendant's cell phone is an iPhone 6 running the iOS 8.1 operating system. The analyst used an iPhone 5C running the iOS 8.4.1 operating system. The analyst performed the testing using a different operating system from that found on the defendant's cell phone because the code used to jailbreak iOS 8.4.1 is publicly available, whereas code to jailbreak iOS 8.1 is not. It is not clear why the analyst did not use an iPhone 6 in his experiments.

sure. The analyst conducted a total of twelve experiments using the test iPhone at five different locations in Boston.

The Commonwealth also provided evidence regarding five locations that were identified as frequent locations on the defendant's cell phone. The analyst discussed additional data retrieved from the defendant's cell phone that provided corroborating evidence that the defendant's phone was near locations corresponding with the frequent locations at the times indicated by the FLH data. The analyst's proposed expert testimony would state, based on his interpretation of the FLH data recovered from the defendant's cell phone, that between 10:36 A.M. and 11:22 A.M. on March 31, 2015, the defendant's phone was within a 143-foot radius of a Harvard Street address near the victims' home, an area that includes the scene of the crime.

On September 11, 2023, the trial judge denied the Commonwealth's motion to permit the introduction of FLH evidence at trial. On the same day, the Commonwealth filed a notice of appeal, believing that the notice of appeal would stay the trial court proceedings pursuant to Mass. R. Crim. P. 15 (e), as appearing in 474 Mass. 1501 (2016). The defendant filed a response, arguing that the Commonwealth's notice of appeal did not automatically stay the trial court proceedings. Specifically, the defendant argued that the appeal procedures in

rule 15 were inapplicable, and that the Commonwealth's only avenue for interlocutory review of the denial of a motion in limine was a petition under G. L. c. 211, § 3, which, in turn, did not automatically stay the trial court proceedings. The trial judge concluded that the Commonwealth's appeal was outside the scope of rule 15, but nonetheless stayed the proceedings to allow the Commonwealth to pursue relief through a G. L. c. 211, § 3, petition. A single justice of this court then extended the stay and subsequently reserved and reported the case to the full court, including both the procedural question whether this appeal was within the scope of rule 15 and the merits of whether the trial judge abused his discretion in denying the Commonwealth's motion to permit introduction of FLH data.

2. Discussion. a. Availability of appeal under rule 15 (a) (2). As a preliminary matter, we must determine whether the Commonwealth was entitled to appeal from the trial judge's ruling under rule 15 (a) (2), or whether its procedural avenue for relief must instead come from this court's superintendence powers under G. L. c. 211, § 3. The Commonwealth contends that because the trial judge's ruling rejecting admission of expert testimony regarding FLH data had the effect of preventing the admission of "critical" evidence in its case against the defendant, the ruling is the functional equivalent of a motion

to suppress and thus entitles the Commonwealth to an appeal under rule 15 (a) (2). We disagree.

We construe our rules of procedure according to the ordinary canons of construction, beginning with the plain meaning of the text. Commonwealth v. Wright, 479 Mass. 124, 133 (2018). The text of rule 15 (a) (2) provides for interlocutory appeal from "an order determining a motion to suppress evidence prior to trial." By its express terms, rule 15 (a) (2) "does not encompass other interlocutory rulings, in part for sound reasons of judicial economy, as such 'ruling[s] [are] subject to change when the case unfolds.'" See Spencer, 465 Mass. at 40 n.11, quoting Luce v. United States, 469 U.S. 38, 41 (1984)).

Although the text of rule 15 (a) (2) is directed only at motions to suppress, we have allowed a narrow exception to this general rule: "if a motion to exclude all or most of the Commonwealth's incriminating evidence is allowed, and if, as a practical matter, that ruling (if permitted to stand) would terminate the prosecution, the Commonwealth may seek leave to appeal pursuant to [rule 15 (a) (2)]." Anderson, 401 Mass. at 135. This narrow exception to, or more precisely, expansion of, rule 15 (a) (2) (Anderson expansion) recognizes that, in the very limited subset of cases where a ruling on a motion in limine to exclude evidence prevents the introduction of all or most of the Commonwealth's evidence, preventing the opportunity

for an interlocutory appeal could effectively preclude the Commonwealth from continuing the prosecution of serious crimes without any opportunity for appellate review. See Commonwealth v. Ruiz, 480 Mass. 683, 692 (2018) ("important jurisprudential interests" are served by "the review of pretrial decisions that terminate criminal proceedings prior to a trial being held").

We have allowed this narrow expansion of the scope of rule 15 (a) (2) because we have concluded that rule 15 (a) (2) should be read in the context of rule 15 as a whole, which allows interlocutory appeals from orders that would otherwise terminate a criminal proceeding. See Mass. R. Crim. P. 15 (a) (1), as appearing in 474 Mass. 1501 (2016) (allowing Commonwealth to appeal following grant of motion to dismiss complaint or indictment, or from "a motion for appropriate relief" made pursuant to Mass. R. Crim. P. 13 [c], as appearing in 474 Mass. 1501 [2016]); Mass. R. Crim. P. 15 (a) (3), as appearing in 476 Mass. 1501 (2017) (Commonwealth may appeal from "a decision by a judge discharging a person pursuant to G. L. c. 119, § 72A"). See also Ruiz, 480 Mass. at 692-693, quoting Burke v. Commonwealth, 373 Mass. 157, 160 (1977) (appeal from trial court's dismissal of indictment pursuant to rule 15 [a] [1] "allow[s] the Commonwealth to reinstitute proceedings terminated because of an incorrect ruling in the trial court, . . . but, on the other hand, . . . allow[s] [appellate courts] to affirm

preliminary rulings which, in effect, put an end to a particular prosecution"); Commonwealth v. Yelle, 390 Mass. 678, 685 (1984) (declining to consider pretrial motion to admit evidence as "motion for appropriate relief" under rule 15 [a] [1] in part because "[t]he allowance of a defendant's motion to admit evidence does not, as the allowance of a motion to suppress so often does in practical effect, terminate the proceedings"). Barring appeals in such situations could "leave a class of cases, many of which involve serious crimes, lost either to further prosecution or any appellate review." Ruiz, supra at 693, quoting Burke, supra. Indeed, rule 15 was adopted to implement G. L. c. 278, § 28E, a statute intended to allow the Commonwealth to appeal from rulings that would terminate criminal proceedings. See Yelle, supra, citing Burke, supra at 161 ("The Commonwealth's right to appeal from certain pretrial rulings under G. L. c. 278, § 28E, is based on the fact that those rulings preclude a public trial and entirely terminate the proceedings").

The Commonwealth suggests that rule 15 (a) (2) should be interpreted more broadly to encompass other situations where "critical" evidence is excluded, even where the evidence excluded does not have the practical effect of terminating the criminal proceeding. The Commonwealth thus proposes that, although the exclusion of its expert's testimony does not

prevent it from introducing all or most of its incriminating evidence at trial, the instant appeal is properly brought under rule 15 (a) (2) because the expert's testimony regarding FLH data is "critical" to the case against the defendant.

Because its case at trial will rely significantly on testimony by a cooperating witness procured in exchange for a reduced sentence, we agree with the Commonwealth that evidence corroborating the cooperating witness's testimony (and, thus, bolstering the credibility of that testimony) might fairly be described as "critical" to the prosecution's case. Nonetheless, we decline the Commonwealth's invitation to expand the scope of rule 15 (a) (2) to include the ruling on the motion in limine in the instant case. The plain text of rule 15 (a) (2) refers only to motions to suppress and thus sets out the general rule. As discussed supra, however, the purpose of rule 15 is to provide an avenue for interlocutory review of rulings that would otherwise terminate a criminal proceeding. Thus, the narrow Anderson expansion that we have allowed is consonant with this purpose because it expands rule 15 (a) (2) only to include motions in limine that exclude so much incriminating evidence that the motion effectively forecloses the Commonwealth's ability to prosecute its case at trial. See Anderson, 401 Mass. at 135.

We have also previously observed that further expanding the availability of interlocutory appeals pursuant to rule 15 would create the potential for delay and disruption in criminal proceedings. See Ruiz, 480 Mass. at 694 ("an unrestrained right to pretrial appeals by the Commonwealth may be burdensome on defendants [and the courts]"); Yelle, 390 Mass. at 687 (to allow Commonwealth right to interlocutory review from every adverse evidentiary ruling "would be to create a potential for disruption of every criminal trial where a disgruntled prosecutor could cause the stay of the proceeding, pending appellate review of evidentiary rulings"). See also Commonwealth v. Cavanaugh, 366 Mass. 277, 279 (1974) ("interlocutory appeals and reports should not be permitted to become additional causes of the delays in criminal trials which are already too prevalent").¹³

¹³ Under Mass. R. Crim. P. 15 (e), criminal proceedings are automatically stayed for thirty days following a ruling subject to rule 15's interlocutory procedures. If, as the Commonwealth urges, rule 15 (a) (2) were expanded to allow appeals from rulings on motions in limine that exclude "critical" evidence, rulings on such motions would automatically stay proceedings to give the Commonwealth time to consider whether to appeal, which would invariably lead to delays in criminal proceedings. See Yelle, 390 Mass. at 687. Moreover, as in this case, there would likely be further delay occasioned by disagreements between the parties as to whether excluded evidence was "critical." We note that in the present case, the trial judge decided the motion in limine on the admissibility of the Commonwealth's proffered expert testimony the day before the scheduled start of trial. The interlocutory appellate proceedings in this matter have thus occasioned significant delay to the anticipated start of trial.

The Commonwealth contends nonetheless that in our case law following Anderson, we have expanded the circumstances in which the Commonwealth may use rule 15 (a) (2) to appeal from motions in limine beyond those that effectively foreclose the Commonwealth's ability to prosecute its case at trial. The Commonwealth's contention relies in part on this court's decision in Spencer, 465 Mass. 32, which it suggests stands for the proposition that the exclusion of "critical" evidence is sufficient to allow the Commonwealth to request leave to appeal under rule 15 (a) (2).

In Spencer, 465 Mass. at 40, the Commonwealth filed an emergency petition for extraordinary relief pursuant to G. L. c. 211, § 3, arguing that motions in limine "sought to exclude most of the Commonwealth's incriminating evidence." The Commonwealth represented that the evidence excluded by the judge's preliminary rulings was "critical to establish[ing] identity, motive, and consciousness of guilt." Id. at 44. After presenting its arguments before a single justice, "the single justice granted the petition for extraordinary relief, ordered that proceedings in the Superior Court be stayed, and ordered the Commonwealth to file an interlocutory appeal" under rule 15 (a) (2). Id. at 40. "The single justice then allowed the appeal to proceed before this court." Id. at 41.

In Spencer, the parties did not challenge the single justice's order to file an appeal under rule 15 (a) (2), so we did not address whether it was appropriate for the Commonwealth to proceed under rule 15.¹⁴ See id. at 40-41. However, in discerning no error in the trial judge's rulings, we did observe, after a more thorough examination of the record, that "[e]ven had the judge allowed the defendant's motion to exclude the recordings in their entirety, the Commonwealth would still have ample evidence upon which to proceed to trial." Id. at 45. Indeed, we expressly stated: "Were the judge's preliminary rulings . . . permitted to stand, it would not as a practical matter [have] 'terminate[d] the prosecution.'" Id., quoting Anderson, 401 Mass. at 133. We therefore do not understand Spencer to be an endorsement of the proposition that the exclusion of "critical" evidence before a trial is sufficient for the Commonwealth to avail itself of an interlocutory appeal under rule 15 (a) (2). Compare Spencer, supra at 43 (assertion

¹⁴ Similarly, in Commonwealth v. Beausoleil, 397 Mass. 206, 207-208 (1986), a single justice of this court chose to treat a petition under G. L. c. 211, § 3, challenging the exclusion of evidence, as an appeal from a motion to suppress under rule 15 (a) (2). On appeal before this court, the parties did not challenge the single justice's decision, so we did not address the issue. See id. at 208 n.2. To the extent our decision in Beausoleil has been read to support a further expansion of rule 15 beyond the narrow Anderson expansion, such a reading is incorrect. The correctness of the single justice's consideration of the exclusion of evidence as a rule 15 motion was not raised and not decided.

"that the excluded recordings comprise[d] 'most of the Commonwealth's evidence' . . . [did] not withstand close scrutiny of the record"), with Anderson, supra at 135 ("if a motion to exclude all or most of the Commonwealth's incriminating evidence is allowed, and if, as a practical matter, that ruling [if permitted to stand] would terminate the prosecution, the Commonwealth may seek leave to appeal pursuant to [rule 15 (a) (2)]"). Rather, in Spencer, supra at 43-44, we implicitly disapproved of the Commonwealth having the opportunity for an interlocutory appeal under rule 15 (a) (2) where excluded evidence did not effectively terminate the prosecution. We therefore clarify here that any reading of Spencer suggesting that the exclusion of "critical" evidence alone is sufficient to allow the Commonwealth to apply for leave to appeal under rule 15 (a) (2) is incorrect. See Anderson, supra; Mass. R. Crim. P. 15 (a) (2).¹⁵

¹⁵ Our discussion of rule 15 (a) (2) in Commonwealth v. Fontanez, 482 Mass. 22 (2019), and the cases cited therein, similarly does not support the Commonwealth's reading of rule 15. See id. at 23 n.1, 26 (Commonwealth could have filed for leave to appeal under rule 15 [a] [2] where "the judge's decision to exclude the now deceased victim's testimony effectively foreclose[d] the Commonwealth's ability to prosecute a serious crime"). See also Commonwealth v. Arrington, 455 Mass. 437, 437-438 (2009) (Commonwealth appealed under rule 15 [a] [2] from order excluding prior recorded testimony of deceased victim, only eyewitness to crime); Commonwealth v. Gonsalves, 445 Mass. 1, 15 (2005), cert. denied, 548 U.S. 926 (2006), abrogated on other grounds as recognized by Commonwealth v. Rand, 487 Mass. 811, 825 n.14 (2021) (judge's order excluding

In the present case, it is undisputed that the FLH data evidence does not constitute "all or most of the Commonwealth's incriminating evidence." See Anderson, 401 Mass. at 135. Indeed, the Commonwealth plans to have eyewitness testimony from its cooperating witness placing the defendant at the scene of the crime and describing his role in the murder and other crimes. The Commonwealth also intends to introduce video recordings showing that a vehicle matching the description of the vehicle rented for the defendant was in the area of the victims' home prior to the crime and left the area after three figures were recorded leaving the crime scene. Furthermore, CSLI data will show that the defendant's cell phone was in the area of the victim's home during the relevant time frame as well. Because this case does not involve the determination of a motion to suppress, and because the exclusion of the FLH data will not, as a practical matter, terminate the Commonwealth's prosecution, the instant appeal is outside the scope of rule 15 (a) (2) and the narrow expansion of the scope of rule 15 (a) (2) beyond motions to suppress established in Anderson. See id. We therefore hold that the proper route for this appeal was a petition for extraordinary relief under G. L. c. 211, § 3.

testimony by victim to police officers where victim was only eyewitness to crime "effectively prevent[ed] the Commonwealth's case against the defendant from proceeding").

Because this case was reserved and reported by the single justice, we need not decide whether the case meets the standard for relief under G. L. c. 211, § 3. See Commonwealth v. Whitfield, 492 Mass. 61, 67 n.9 (2023) ("Where the single justice has exercised . . . discretion to reserve and report the matter, we proceed to adjudicate the merits"). See also Commonwealth v. Lucas, 472 Mass. 387, 390 (2015), quoting Burke, 373 Mass. at 159 ("where, as here, a single justice of this court reserves and reports an interlocutory matter to this court, we grant the litigant full appellate review"). However, we reemphasize that G. L. c. 211, § 3, "is not a means for second guessing a trial judge's evidentiary rulings." Anderson, 401 Mass. at 134, quoting Yelle, 390 Mass. at 687. Thus, even if the Commonwealth has no other means to seek review of a trial court's ruling on a motion in limine, that does not render review under G. L. c. 211, § 3, automatic. See Commonwealth v. Fontanez, 482 Mass. 22, 25 (2019); Yelle, supra at 685-686. Rather, to obtain review of such rulings pursuant to G. L. c. 211, § 3, the Commonwealth "must still demonstrate to the single justice that its petition presents the type of exceptional matter that requires the court's extraordinary intervention." Fontanez, supra.

b. Admissibility of FLH data. Turning to the merits of the Commonwealth's appeal, we consider whether the trial judge

abused his discretion in denying the Commonwealth's motion to permit expert testimony on FLH data. See Commonwealth v. Davis, 487 Mass. 448, 455 (2021), S.C., 491 Mass. 1011 (2023). We conclude that he did not and therefore affirm.

Admission of scientific or technological evidence is governed by what has come to be known as the Daubert-Lanigan standard.¹⁶ See Daubert, 509 U.S. at 585-595; Lanigan, 419 Mass. at 25-26. Under the Daubert-Lanigan standard, "[t]he judge, acting as gatekeeper, is responsible for 'mak[ing] a preliminary assessment whether the theory or methodology underlying the proposed testimony is sufficiently reliable to reach the trier of fact.'" Commonwealth v. Camblin, 478 Mass. 469, 475 (2017) (Camblin II), quoting Commonwealth v. Shanley, 455 Mass. 752, 761 (2010).

When considering a motion to introduce expert testimony, a judge should initially consider five nonexclusive factors in determining the reliability of proposed scientific evidence:

"whether the scientific theory or process (1) has been generally accepted in the relevant scientific community; (2) has been, or can be, subjected to testing; (3) has been subjected to peer review and publication; (4) has an

¹⁶ Although we have adopted the Daubert-Lanigan standard, reliability may also be established by the Frye test. See Davis, 487 Mass. at 454 ("reliability can still be established by general acceptance alone, without regard to the other Daubert-Lanigan factors"); Frye v. United States, 293 F. 1013, 1014 (D.C. Cir. 1923). The Commonwealth does not rely on the Frye test to establish reliability in this case, however.

unacceptably high known or potential rate of error; and (5) is governed by recognized standards."

Commonwealth v. Powell, 450 Mass. 229, 238 (2007). If a methodology has been determined to be reliable by our courts in the past, a judge may take judicial notice of its reliability. Davis, 487 Mass. at 454-455. However, "when proposed expert testimony uses a new theory, or new methodology to apply an accepted theory, the proponent must establish its reliability using a Daubert-Lanigan analysis." Id. at 455.

Because no court in the Commonwealth has previously deemed FLH data to be reliable, the Commonwealth bore the burden of establishing the reliability of FLH data under Daubert-Lanigan by a preponderance of the evidence. See Camblin II, 478 Mass. at 476.¹⁷ We review a trial judge's decision on a motion in limine to qualify or reject an expert on Daubert-Lanigan grounds for an abuse of discretion. Canavan's Case, 432 Mass. 304, 312 (2000). See L.L. v. Commonwealth, 470 Mass. 169, 185 n.27 (2014) (discretionary decision constitutes abuse of discretion where "the judge made 'a clear error in weighing' the factors relevant to the decision, such that the decision falls outside the range of reasonable alternatives" [citation omitted]).

¹⁷ This also appears to be an issue of first impression, as we have not been presented with any cases from other jurisdictions addressing the reliability of FLH data.

As an initial matter, the Commonwealth argues that the trial judge erred in identifying the relevant field of expertise as cellular technology, rather than digital forensics. It claims that this error evidences a misunderstanding of FLH data and contributed to the trial judge's erroneous conclusion that the analyst was not qualified to testify as an expert on FLH data.¹⁸ Contrary to these claims, we conclude that the trial judge correctly understood the analyst's testimony on FLH data, and the relevant required expertise, and decided the pertinent issue: whether the Commonwealth had met its burden of establishing the reliability, under the Daubert-Lanigan standard, of FLH data. Whether the relevant field of expertise is characterized as cellular technology or digital forensics, the trial judge did not abuse his discretion in determining that the Commonwealth had not met its burden of showing that the proffered expert testimony established the reliability of the FLH data in this case. See Camblin II, 478 Mass. at 476.

i. General acceptance. Regarding the first Daubert-Lanigan factor, general acceptance by the relevant scientific community, the trial judge concluded that "[t]here [was] little evidence that the process of obtaining and analyzing FLH data

¹⁸ Although the Commonwealth suggests that this alleged error constitutes an error of law, it cites to no cases in support of this claim.

has been generally accepted in the scientific community." The primary evidence in support of general acceptance was the analyst's conclusory testimony to that effect, which, as the trial judge noted, was not well supported by the evidence in the record. The articles submitted in evidence by the Commonwealth in support of the analyst's testimony largely discuss the technology that produces the location data points that are used as inputs by the FLH algorithm to output FLH data, and do not discuss the reliability of the FLH data themselves. The analyst identified two digital forensics experts whose writing he claimed supported his conclusion that FLH data have been deemed reliable by the scientific community, but no articles by these authors were submitted in evidence by the Commonwealth.¹⁹ Accordingly, the trial judge did not abuse his discretion in concluding that the Commonwealth failed to meet its burden of showing by a preponderance of the evidence that FLH data have been generally accepted as reliable by the scientific community.

¹⁹ It is not clear why no articles by these authors were provided as evidence of general acceptance of FLH data. We note, however, that one of the experts named by the analyst, Ian Whiffin, in 2021 wrote, "If I were to find encryptedB location data in a case which was relevant to a crime scene, while I wouldn't describe it as useless, I would be very wary of saying it's the smoking gun." Whiffin, Harvested Locations, DoubleBlak Digital Forensics (Mar. 26, 2021), <https://www.doubleblak.com/blogPost.php?k=Harvest> [<https://perma.cc/6QSM-LAAT>]. According to the analyst's testimony, Encrypted B location data are the primary source of location data from which FLH data are produced.

See Canavan's Case, 432 Mass. at 310 (party seeking to introduce scientific evidence bears burden of showing reliability by establishing general acceptance or through other means).

The Commonwealth also argues that because the FLH algorithm uses as its inputs location data sources generally regarded as reliable (such as GPS, CSLI, and Wi-Fi location data), the FLH data output by the algorithm consequently is also generally regarded as reliable. This argument misunderstands the Commonwealth's burden. "[W]hen proposed expert testimony uses a new theory, or new methodology to apply an accepted theory, the proponent must establish its reliability using a Daubert-Lanigan analysis." Davis, 487 Mass. at 455. See Commonwealth v. Camblin, 471 Mass. 639, 650 (2015), S.C., 478 Mass. 469 (2017) (although breathalyzer technology is generally accepted as reliable, where new type of breath test machine had not previously been tested and no court had considered the reliability of its source code, "the judge should have held a hearing to determine whether the source code and other challenged features . . . functioned in a manner that reliably produced accurate breath test results"). In other words, even if the inputs used by the FLH algorithm are generally deemed reliable, the FLH data outputs are not ipso facto reliable, especially where there is not scientific literature or adequate testing to support reliability. See Davis, 487 Mass. at 457

("It is not sufficient to show merely that GPS technology is, in general, reliable without making any showing pertaining to the reliability of a particular model of a device" using GPS technology).

ii. Testing. As to the second Daubert-Lanigan factor, whether the technology can be or has been tested, the trial judge did not abuse his discretion in holding that there was not sufficient testing to establish the reliability of FLH data. The trial judge found that the analyst's experiments with FLH data had a small sample size.²⁰ To test the reliability of FLH data, the analyst jailbroke an iPhone 5C, which allowed him access to information that is ordinarily encrypted and inaccessible to an iPhone user. He brought the jailbroken iPhone to five different locations, examined the underlying location data points gathered by the iPhone at those locations from sources such as CSLI, Wi-Fi, and GPS, and compared these underlying location data points to the FLH data outputs produced on those locations. The analyst visited each of the five locations two or three times, for a total of twelve

²⁰ The Commonwealth correctly points out that the judge misstated the number of tests performed on the test iPhone. The judge stated that there were ten experiments done by the analyst, while the analyst testified that he performed twelve tests of FLH data reliability at a total of five locations.

experiments.²¹ Despite his testing, the analyst did not know the algorithm used in creating FLH data and did not know how various factors were weighed to create FLH data outputs. The analyst also could not explain how the uncertainty radius for a frequent location was determined. He was able to identify that the uncertainty radius and center coordinate point for a frequent location could change with each visit to that location, but he was unable to explain why the uncertainty radius for a frequent location changed or whether data from previous visits contributed to how FLH data changed after a subsequent visit to the location. Moreover, while the FLH data for some locations included a "confidence level," the analyst could not explain what the confidence level meant, why some locations had a confidence level and others did not, or how the confidence level was calculated.

The Commonwealth also argues that the trial judge abused his discretion by failing to make findings regarding evidence that certain frequent location visits identified on the

²¹ It appears from the record that the analyst performed this testing specifically in preparation to testify in these proceedings, which warrants closer examination of his expert testimony and the validity of these tests. See Commonwealth v. Rintala, 488 Mass. 421, 438 (2021), quoting Johnson v. Manitowoc Boom Trucks, Inc., 484 F.3d 426, 434 (6th Cir. 2007) ("judges should closely scrutinize expert testimony where the testimony is 'prepared solely for purposes of litigation, as opposed to testimony flowing naturally from an expert's line of scientific research or technical work'").

defendant's cell phone were corroborated by other data on the phone. The Commonwealth asserts that the data corroborating the frequent location data bolsters the analyst's testing as evidence that FLH data are reliable. For example, the analyst testified that frequent location no. 73 on the defendant's cell phone corresponded to a location at a mall in Newton. The FLH data suggested that the cell phone was at frequent location no. 73 from 7:26 P.M. to 7:32 P.M. on March 29, 2015, two days before the murder. The uncertainty radius for frequent location no. 73 was ninety-one meters, meaning the FLH data represented that the cell phone was likely within a ninety-one meter radius of the determined center point for location no. 73. Two images recovered from the defendant's cell phone were taken at 7:31 P.M. and 7:32 P.M. on March 29, and appear to have been taken in the northwest corner of the mall parking garage. The Commonwealth suggests that the pictures corroborate the reliability of frequent location no. 73 because they place the defendant near the location during the relevant time. The analyst testified regarding four other frequent locations extracted from the defendant's cell phone that were corroborated either by pictures taken on the phone indicating it was in the area of the frequent location during the relevant time period, or by data showing the phone connected to Wi-Fi networks

associated with a location while the FLH data indicated the phone was at the location.²²

Although the trial judge did not make any findings regarding the corroborated frequent location evidence presented by the Commonwealth, judges are not required to make explicit findings on all the evidence presented at a hearing. See Commonwealth v. Tremblay, 480 Mass. 645, 660 (2018) (although judges have obligation to make adequate findings, "motion judges need not making findings with respect to every piece of evidence in the record, irrespective of pertinence"). Although it would have been preferable for the judge to make explicit findings regarding the corroborated frequent locations, it was not error

²² The evidence did not always unambiguously indicate the reliability of the FLH data. On cross-examination, the analyst admitted that the pictures taken in the mall parking garage appear to have been taken 272 feet outside the uncertainty radius for frequent location no. 73. The analyst later explained that because frequent location no. 73 had been visited fourteen times, the center point and uncertainty radius for the location could have shifted over time.

The analyst also provided testimony regarding frequent location no. 122, which roughly corresponded to the location of an apartment complex in Randolph. The analyst testified that the FLH data for frequent location no. 122 showed that the defendant's cell phone entered the frequent location at 10:55 P.M. on March 25, 2015, and left the location at 6:45 A.M. the next morning. The defendant's cell phone connected to Wi-Fi networks also associated with the Randolph apartment complex at 11:17 P.M. on March 25, 2015, as well as 6:45 A.M. on March 26. The FLH data would thus suggest that the cell phone left the apartment complex the same minute that it connected to a Wi-Fi network at the complex on the morning of March 26.

for him to omit them from his ruling.²³ Even if evidence of the five corroborated locations are considered alongside the twelve experiments conducted by the analyst, it was well within the trial judge's discretion to hold that the Commonwealth had not met its burden of showing that FLH data had been sufficiently tested to show its reliability. See Commonwealth v. Rintala, 488 Mass. 421, 440-441 (2021) (testing was insufficient and expert opinion was therefore unreliable where six experiments were not repeated or validated). See also National Research Council, Strengthening Forensic Science in the United States: A Path Forward 112 (2009) ("Typically, experiments or observations must be conducted over a broad range of conditions before the roles of specific factors, patterns, or variables can be understood").²⁴

²³ We also note that the trial judge had only four days to decide the motion to admit FLH data, in part because it appears the Commonwealth was unprepared in July 2023 when the hearing was originally scheduled to take place. The time pressure may have contributed to the judge's decision not to widen his scope of analysis to include explicit findings on the corroborating FLH data evidence.

²⁴ State v. Pierce, 222 A.3d 582 (Del. Super. Ct. 2019), aff'd, 236 A.3d 307 (Del. 2020), provides an apt comparison. In Pierce, prosecutors sought to admit "Google Wi-Fi location data" sent between a cell phone running the Android operating system and Google. Id. at 583. To support the reliability of the Wi-Fi location data, an engineer with twenty years of experience working at Oracle, a major software firm, testified. Id. at 588. The engineer constructed a "test rig" device containing twenty cell phones "which operate[d] as a 'man-in-the-middle' exploit to observe the signals sent by the devices to Google."

iii. Other Daubert-Lanigan factors. Finally, we consider whether the trial judge abused his discretion in his discussion of the other Daubert-Lanigan factors: whether FLH data evidence "(3) has been subjected to peer review and publication; (4) has an unacceptably high known or potential rate of error; and (5) is governed by recognized standards." Davis, 487 Mass. at 454, quoting Powell, 450 Mass. at 238. It is undisputed that the testing of FLH data performed by the analyst was neither peer-reviewed nor published. In terms of other publications, the trial judge found that the articles and materials submitted by

Id. at 589. The engineer used the test rig for a period of two years and analyzed communications between the cell phones in the test rig and Google to determine the accuracy of Wi-Fi location data in a variety of locations. Id. Additionally, the engineer deployed the test rig near the scene of the crime and determined that the density of Wi-Fi signals in the area was sufficient to reliably identify the location of the defendant's cell phone within approximately one hundred feet. Id. The extensive testing done by an experienced engineer at a major software firm over the course of two years is very different from the twelve tests conducted by the analyst, even if the corroborating FLH data are considered. To be clear, we do not suggest that the exact credentials or testing procedures used in Pierce are what would be required to show that FLH data are reliable. However, the comparison to Pierce illustrates that the trial judge did not abuse his discretion in holding that the limited testing done by the analyst in this case was insufficient to establish FLH data reliability. We further note that the Commonwealth argued that the Google Wi-Fi location data found reliable in Pierce and the FLH data at issue here are analogous, and thus FLH data should be considered reliable. We certainly cannot, on this record, conclude that Wi-Fi location data on the Android cell phone operating system are so similar to FLH data that Pierce somehow establishes the reliability of the FLH data at issue here.

the Commonwealth discussing the underlying technology (GPS, Wi-Fi, and CSLI) were not "particularly instructive." He also noted that there were "very few references to FLH in any of the papers submitted into evidence." After a review of the articles referenced, we agree. The analyst referenced other experts in the field of digital forensics who informed his opinion that FLH data are generally regarded as reliable, but no articles written by those experts, peer-reviewed or not, appear in the record produced by the Commonwealth. Therefore, the trial judge did not abuse his discretion in holding that the Commonwealth had failed to show evidence that FLH data have been subjected to peer review or publication.

The trial judge held that the fifth prong of Daubert-Lanigan, recognized standards, was satisfied by the existence and admission in evidence of Federal regulations setting standards for analyzing cell phone location information generally. See Matter of E911 Location Accuracy Requirements, Fourth Report and Order, 30 F.C.C.R. 1259 (2015).²⁵ The Commonwealth argues on appeal that because Federal regulations exist for cell phone location information and were in effect at the time of the murder, the fourth prong, known or potential

²⁵ We note that such regulations do not address FLH data specifically. We need not, however, resolve whether the fifth prong was factored properly to conclude that the reliability of FLH data was not established.

rate of error, must also logically be met. The Commonwealth does not otherwise provide any evidence or argument as to why the trial judge erred in holding that it had failed to meet its burden on the fourth prong. In any event, we see no abuse of discretion by the trial judge in holding that the fourth prong was not met, particularly because of the various characteristics of FLH data that the analyst could not explain, including the uncertainty radius and confidence level.

For the reasons discussed, the trial judge did not abuse his discretion in holding the Commonwealth failed to establish the reliability of FLH data. See Davis, 487 Mass. at 455. The judge thus correctly denied the motion to permit the proffered expert testimony on FLH data evidence at trial.

3. Conclusion. Because the challenged evidentiary ruling involved neither the determination of a motion to suppress nor the pretrial exclusion pursuant to a motion in limine of evidence that, as a practical matter, would terminate the Commonwealth's prosecution of the defendant, the Commonwealth's avenue for interlocutory review of the ruling was a petition for extraordinary relief under G. L. c. 211, § 3, rather than an interlocutory appeal under rule 15 (a) (2). Moreover, having considered the merits of the Commonwealth's petition, we conclude that the trial judge did not abuse his discretion in denying the Commonwealth's motion in limine to admit the

proffered expert testimony regarding the FLH data. Accordingly, we remand the case to the county court for entry of a judgment affirming the trial court judge's order and remanding the matter to the trial court for further proceedings consistent with this opinion.

So ordered.

LOWY, J. (concurring, with whom Georges, J., joins). I agree with the court that Mass. R. Crim. P. 15 (a) (2), as appearing in 474 Mass. 1501 (2016), was not the proper avenue for interlocutory review of the trial judge's ruling, and that the trial judge did not abuse his discretion in denying the Commonwealth's motion in limine to admit its proffered expert testimony on the frequent location history (FLH) data retrieved from the defendant's cell phone. I write separately to highlight that, although the trial judge did not abuse his discretion in this case in ruling that the Commonwealth failed to satisfy the Daubert-Lanigan standard, see Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 585-595 (1993); Commonwealth v. Lanigan, 419 Mass. 15, 25-26 (1994), a party may well meet its burden to show gatekeeper reliability of expert testimony regarding FLH data in another pending or future case, see Mass. G. Evid. §§ 104(a), 702 (2023).

Indeed, FLH data -- like all technology -- is an area "where knowledge is evolving, and new understandings may be expected as more studies and tests are conducted." Commonwealth v. Shanley, 455 Mass. 752, 763 n.15 (2010). The Commonwealth failed to demonstrate here that FLH data can reliably establish that an iPhone was in an approximate area at an estimated time for several reasons, including the lack of evidence that FLH data has been generally accepted in the scientific community,

the absence of articles and peer-reviewed studies offered in evidence supporting the reliability of FLH data, the lack of information as to whether there is an unacceptably high known or potential rate of error for FLH data, the expert's lack of knowledge about the algorithm used to create FLH data, and the inadequacy of the expert's testing, which had a small sample size, was completed over a short time frame and for the purpose of this case, and was neither peer-reviewed nor published. As more becomes known about FLH data, a party attempting to prove gatekeeper reliability may cure many, if not all, of the Commonwealth's deficiencies. In other words, it is possible that a party may not need an expert from Apple to testify about the proprietary algorithm creating FLH data to establish gatekeeper reliability. In sum, I write separately to emphasize that today's ruling does not dictate the result at a Daubert-Lanigan hearing in another case based upon either existing or evolving technology. Cf. Commonwealth v. Davis, 487 Mass. 448, 457-458 (2021), S.C., 491 Mass. 1011 (2023) (Commonwealth failed to show that global positioning system evidence could reliably demonstrate speed that defendant was moving during crime and judge abused his discretion in admitting such evidence, but Commonwealth could attempt to lay proper foundation for speed evidence on retrial).