IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

IARNACH TECHNOLOGIES LTD., Plaintiff, v. VERIZON COMMUNICATIONS, INC., VERIZON BUSINESS NETWORK SERVICES LLC, VERIZON ENTERPRISE SOLUTIONS, LLC, CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS, INC., VERIZON DATA SERVICES LLC, VERIZON BUSINESS GLOBAL LLC, and VERIZON SERVICES CORP. Defendants.	Civil Action No. 2:23-cv-00631 **JURY TRIAL DEMAND**

COMPLAINT FOR PATENT INFRINGEMENT

Iarnach Technologies Ltd. ("Iarnach" or "Plaintiff") hereby submits this Complaint for patent infringement against Defendants Verizon Communications, Inc.; Verizon Business Network Services LLC; Verizon Enterprise Solutions, LLC; Cellco Partnership d/b/a Verizon Wireless, Inc.; Verizon Data Services LLC; Verizon Business Global LLC; and Verizon Services Corp. (collectively, "Verizon" or "Defendants") and states as follows:

THE PARTIES

1. Iarnach Technologies Ltd. is a company duly organized and existing under the laws of Ireland with its principal place of business at The Hyde Building, Suite 23, The Park, Carrickmines, Dublin 18, Ireland.

2. On information and belief, Verizon Communications, Inc. is a corporation organized and existing under the laws of the state of Delaware, with a principal place of business at 1095 Avenue of the Americas, New York, NY 10036. On information and belief, Verizon Communications, Inc. may be served through its registered agent, The Corporation Trust Company, Corporation Trust Center, 1209 Orange Street, Wilmington, Delaware 19801.

3. On information and belief, Verizon Business Network Services LLC is a limited liability company organized and existing under the laws of the state of Delaware, with a principal place of business at 22001 Loudoun County Parkway, Ashburn, Virginia 20147. On information and belief, Verizon Business Network Services LLC. may be served through its registered agent, The Corporation Trust Company, Corporation Trust Center, 1209 Orange Street, Wilmington, Delaware 19801.

4. On information and belief, Verizon Enterprise Solutions, LLC is a limited liability company organized and existing under the laws of the state of Delaware, with a principal place of business at One Verizon Way, Basking Ridge, New Jersey 07920. On information and belief,

Verizon Enterprise Solutions LLC may be served through its registered agent, The Corporation Trust Company, Corporation Trust Center, 1209 Orange Street, Wilmington, Delaware 19801.

5. On information and belief, Cellco Partnership d/b/a Verizon Wireless, Inc. is a general partnership established under the laws of the state of Delaware, and with its principal place of business at One Verizon Way, Basking Ridge, New Jersey 07920. On information and belief, Cellco Partnership d/b/a Verizon Wireless, Inc. may be served through its registered agent, The Corporation Trust Company, Corporation Trust Center, 1209 Orange Street, Wilmington, Delaware 19801.

6. On information and belief, Verizon Data Services LLC is a limited liability company organized and existing under the laws of the state of Delaware, with a principal place of business at 7701 E. Telecom Parkway, Mail Code B3E, Temple Terrace, Florida 33637. On information and belief, Verizon Data Services LLC may be served through its registered agent, The Corporation Trust Company, Corporation Trust Center, 1209 Orange Street, Wilmington, Delaware 19801.

7. On information and belief, Verizon Business Global LLC is a limited liability company organized and existing under the laws of the state of Delaware, with a principal place of business at One Verizon Way, Basking Ridge, New Jersey 07920. On information and belief, Verizon Business Global LLC may be served through its registered agent, Corporation Trust Company, Corporation Trust Company Center, 1209 Orange Street, Wilmington, Delaware 19801.

8. On information and belief, Verizon Services Corp. is a corporation organized and existing under the laws of the state of Delaware, with a principal place of business at 1717 Arch Street, 21st Floor, Philadelphia, PA 19103. On information and belief, Verizon Services Corp.

may be served through its registered agent, Corporation Trust Company, Corporation Trust Company Center, 1209 Orange Street, Wilmington, Delaware 19801.

9. On information and belief, Verizon Business Network Services, Inc.; Verizon Enterprise Solutions LLC; Cellco Partnership d/b/a Verizon Wireless, Inc.; Verizon Data Services LLC; Verizon Business Global LLC; and Verizon Services Inc. are direct or indirect subsidiaries of Verizon Communications, Inc. On information and belief, Verizon Communications, Inc. directs or controls the actions of these entities including by inducing and contributing to the actions complained of herein.

NATURE OF THE ACTION

10. This is a civil action for infringement of U.S. Patent No. 8,712,242 ("the '242 Patent", Ex. A), U.S. Patent No. 8,934,359 ("the '359 Patent", Ex. B), U.S. Patent No. 8,942,378 ("the '378 Patent", Ex. C), U.S. Patent No. 9,363,013 ("the '013 Patent", Ex. D), and U.S. Patent No. 9,806,892 ("the '892 Patent", Ex. E) (collectively, the "Asserted Patents"), arising under the patent laws of the United States, 35 U.S.C. § 1 *et seq*.

11. Iarnach holds all rights, title, and interest in and to the Asserted Patents, including the right to bring this suit and recover all past, present, and future damages for infringement of the Asserted Patents. *See* Ex. F. Verizon is not licensed to the Asserted Patents, either expressly or implicitly, nor does it enjoy or benefit from any other rights in or to the Asserted Patents whatsoever.

JURISDICTION AND VENUE

12. This Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a) because this action arises under the patent laws of the United States, 35 U.S.C. §§ 101 *et seq*.

13. On information and belief, Verizon's operations in the Eastern District of Texas are substantial and varied.

14. Verizon operates one or more fiber-optic networks within the United States. https://www.lightreading.com/5g/the-story-behind-verizon-s-5g-secret-weapon (last visited December 14, 2023). On information and belief, one or more of these fiber-optic networks are within Texas and within this District. *See, e.g.*, https://www.texarkanagazette.com/news/2023/oct/31/local-verizon-wireless-customers-to-get-5g/ (last visited December 15, 2023).

15. Verizon uses NG-PON2-type networks to support and provide wireless, residential, and business services. https://techblog.comsoc.org/2018/08/22/10597/ (last visited December 13, 2023).

16. Verizon has an OpenOMCI specification to address the interoperability needs of NG-PON2 deployments and allow multiple third party ONT vendors to develop compliant and interoperable products that can be deployed in Verizon's fiber-optic networks. Verizon OpenOMCI Specification, Version 1.00 (June 30, 2017) (available at https://www.verizon.com/about/sites/default/files/Verizon-OpenOMCI-Specification.docx).

17. On information and belief, these NG-PON2-type networks are used in Texas and this District.

18. Glenn Wellbrock, Verizon's Director of Optical Transport, Design, and Planning, stated Verizon will deploy NG-PON2 in all 30 markets where it currently plans to roll out 5G mobile services. https://www.lightwaveonline.com/fttx/pon-systems/article/14034625/verizon-full-speed-ahead-with-ng-pon2-for-5g-mobile-support (last visited December 14, 2023).

19. Glenn Wellbrock presented "NG-PON2 enabling the services of tomorrow!" at a Broadband Forum Broadband Acceleration Seminar entitled "NG-PON2 Roadmap and Evolution – A Universal Platform for Residential, Business, and Wireless/5G?" At this same conference, Rajesh Yadav, Associate Fellow at Verizon, presented "Verizon's NG-PON2 Deployment Update." https://www.broadband-forum.org/download/BASeOFCAgenda2019.pdf (last visited December 14, 2023).

20. Verizon's NG-PON2-type networks are used to support various services including cellular backhaul, broadband internet access, and cable television offerings. These services are provided under brand names including, but not limited to, "Verizon," "5G," "5G Ultra Wideband," and "Fios."

21. On information and belief, Verizon offers 5G Ultra Wideband, 5G, and 4G LTE internet services in Texas and this district. https://www.verizon.com/coverage-map/ (last visited December 14, 2023).

22. On information and belief, Verizon's One Fiber project provides fiber support for its service offerings, including backhaul and broadband. https://www.fiercetelecom.com/telecom/whats-going-verizons-one-fiber-project (last visited December 19, 2023); https://www.verizon.com/business/solutions/one-fiber-program-for-landlords/ (last visited December 14, 2023).

23. On information and belief, Verizon uses One Fiber to reduce Verizon's need to backhaul its 5G traffic across cable networks. https://www.lightreading.com/5g/the-story-behind-verizon-s-5g-secret-weapon (last visited December 14, 2023).

24. In November 2023, Verizon was serving nearly 51% of its cell sites with its own deployed fiber-optic cables. Verizon has deployed tens of thousands of miles of fiber-optic lines

with the goal of providing backhaul fiber connections to its cell sites. https://www.verizon.com/about/news/verizon-fiber-technology-advancement-results (last visited December 13, 2023); *see also* https://www.verizon.com/about/news/owned-fiber-increases-reliability-improves-performance (last visited December 15, 2023).

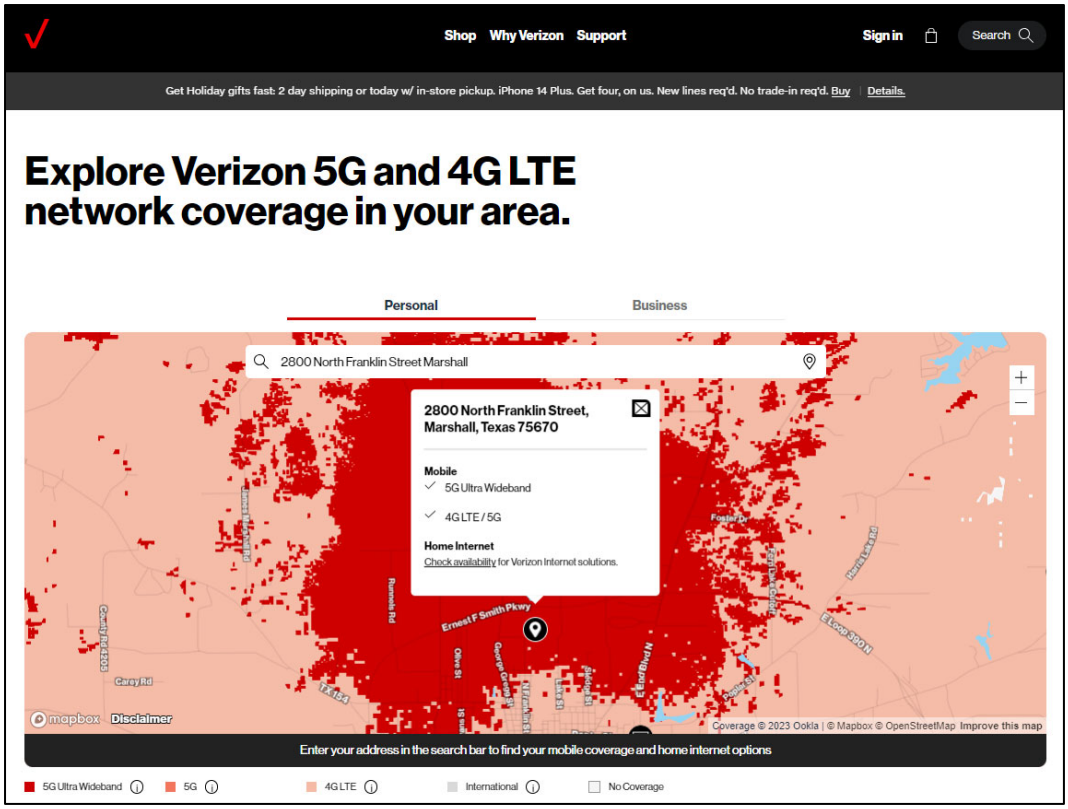
25. An efficient and optimized 5G small-cell deployment (*e.g.*, to support mmWave bands) depends on a fiber backhaul. https://www.essentracomponents.com/en-us/news/industries/telecoms-data/fiber-optics-and-requirements-in-5g-infrastructure (last visited December 13, 2023).

26. Version uses its end-to-end deep fiber resources throughout its 5G Ultra Wideband network. https://www.verizon.com/about/our-company/high-speed-broadband (last visited December 14, 2023).

27. In 2018, Verizon agreed to purchase up to 12.4 million miles of optical fiber from Corning each year beginning in 2018 and lasting through 2020. The minimum purchase commitment for this deal was $1.05 billion. This optical fiber was purchased to improve Verizon's 4G LTE coverage, speed up the deployment of 5G, and deliver high-speed broadband to homes and businesses of all sizes. https://www.cnbc.com/2017/04/18/verizon-agrees-to-1-05-billion-fiber-optic-cable-deal-to-grow-its-fios-platform.html (last visited December 14, 2023).

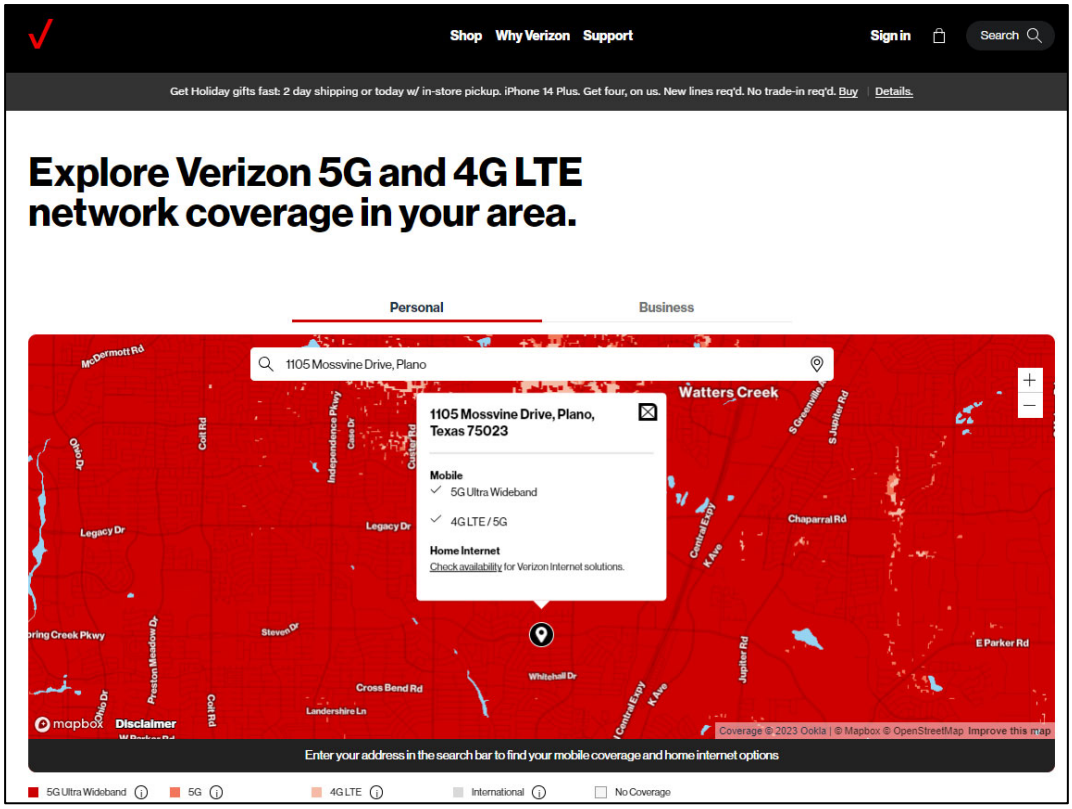
28. On information and belief, Verizon advertises that its broadband internet services are available in the United States, including in Texas and within the Eastern District of Texas.

29. Verizon advertises 5G Ultra Wideband service at the address 2800 North Franklin Street, Marshall, Texas 75670.



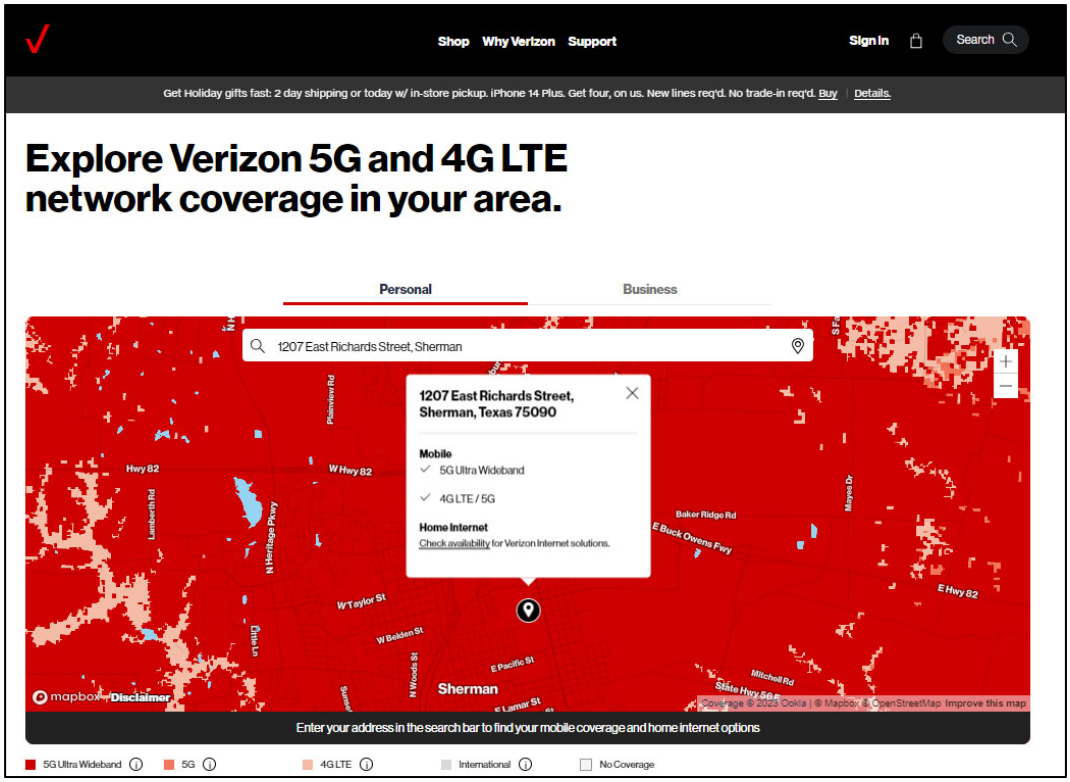
https://www.verizon.com/coverage-map/ (last visited December 14, 2023).

30. Verizon advertises 5G Ultra Wideband service at the address 1105 Mossvine Drive, Plano, Texas 75023.



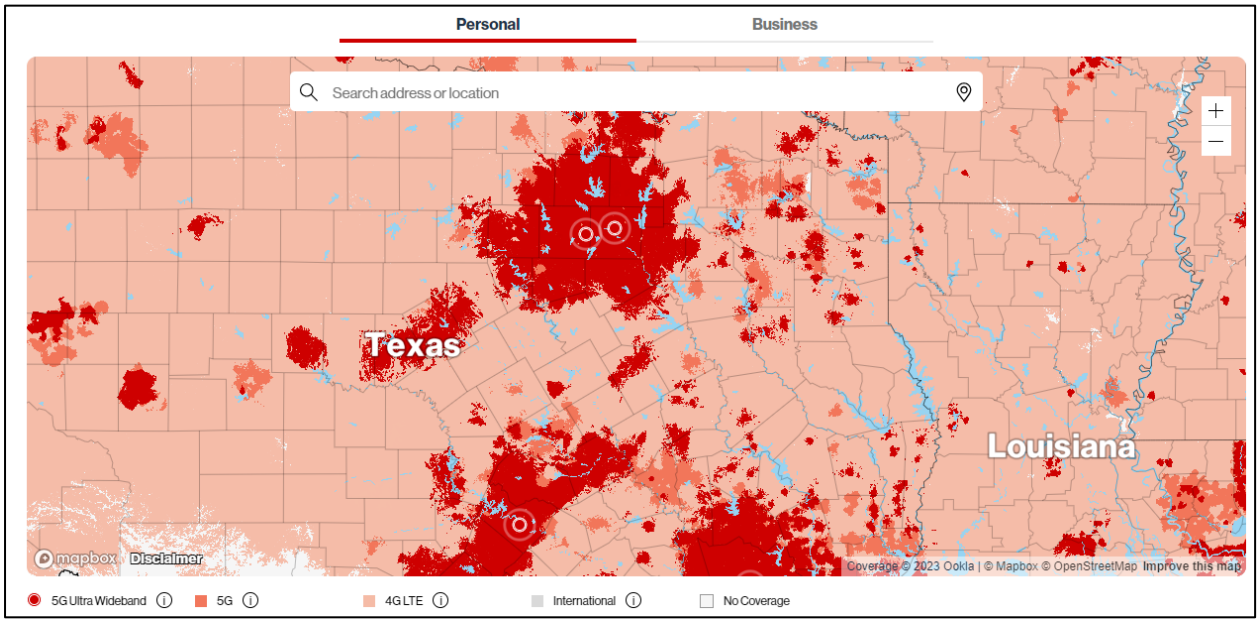
https://www.verizon.com/coverage-map/ (last visited December 14, 2023).

31. Verizon advertises 5G Ultra Wideband service at the address 1207 East Richards Street, Sherman, Texas 75090.



https://www.verizon.com/coverage-map/ (last visited December 14, 2023).

32. Verizon advertises 5G Ultra Wideband service in numerous counties in the Eastern District of Texas.



https://www.verizon.com/coverage-map/ (last visited December 13, 2023).

33. On information and belief, this cellular internet service is supported by the same fiber backhaul detailed above.

34. On information and belief, Verizon has invested heavily in fiber and upgraded its Texas fiber networks, including networks in this district.

35. Verizon has upgraded to 5G Ultra Wideband in the following Texas cities, including cities in this District: Jacksonville, Amarillo, Corpus Christi, Memphis, Bangs, Granite Shoals, Monahans, Cleburne, Granbury, Annona, Kaufman, Sherman, Bells, Denison, Collinsville, Mineral Wells, Wichita Falls, Ennis, Weatherford and Terrel. https://www.jacksonvilleprogress.com/news/local_news/verizon-lights-up-5g-ultra-wideband-across-texas/article_4bcc171e-129c-11ee-87f1-e7aef8a2fc04.html (last visited December 13, 2023).

36. On information and belief, when Verizon deploys support for 5G Ultra Wideband, the deployment requires upgraded fiber backhaul. https://www.jacksonvilleprogress.com/news/local_news/verizon-lights-up-5g-ultra-wideband-across-texas/article_4bcc171e-129c-11ee-87f1-e7aef8a2fc04.html (last visited December 13, 2023).

37. Verizon has upgraded its fiber-optic networks in and around Texarkana. This upgrade includes fiber backhaul to move data between cell sites and connect those sites to the rest of the Verizon network. https://www.texarkanagazette.com/news/2023/oct/31/local-verizon-wireless-customers-to-get-5g/ (last visited December 13, 2023).

38. On information and belief, Verizon has used fiber-optic backhaul to move data between cell sites in the Dallas area. https://finance.yahoo.com/news/verizon-upgrades-network-dallas-customers-130000661.html (last visited December 14, 2023).

39. Verizon advertises that it has allocated an additional $97.9 million to its capital expenditure budget for Texas. These investments include expanding the underlying fiber footprint that carries data throughout the network. https://www.verizon.com/about/news/verizon-investment-texas-pandemic-influx-people (last visited December 11, 2023).

40. In 2023, Verizon held a 5G Innovation Sessions tour and made Dallas the last stop of the tour. Verizon advertises that attendees at the Dallas session would be able to interact with new and emerging technologies, hear success stories and learn best practices for unlocking better business outcomes with 5G. https://www.verizon.com/about/news/verizon-business-brings-5g-innovation-sessions-dallas (last visited December 14, 2023).

41. Verizon has numerous employees in the State of Texas, and in or near this judicial district, who work on fiber-optic networks. On information and belief, those employees work on fiber-optic networks, including NG-PON2-type networks, in this district.

42. On information and belief, at the time of filing this Complaint, Verizon employs Mr. Chris Newman for Fiber Support in Richardson, TX. https://www.linkedin.com/in/chris-newman-8823a41b (last visited December 13, 2023).

43. On information and belief, at the time of filing this Complaint, Verizon employs Mr. Thomas Sasser as a Fiber Network Field Technician in Fort Worth, TX. https://www.linkedin.com/in/thomas-sasser-39b67896 (last visited December 13, 2023).

44. On information and belief, Verizon employed Mr. Marcus Garcia as a Fiber Network Tech in the Fort Worth area. https://www.linkedin.com/in/marcus-garcia-766b8044 (last visited December 13, 2023).

45. On information and belief, at the time of filing this Complaint, Verizon employs Mr. Jason Bradford in Program/Project Management in Schertz, TX. One of Mr. Bradford's

responsibilities includes working on projects related to Verizon's Fiber-Wire line. https://www.linkedin.com/in/jason-bradford-20386750 (last visited December 13, 2023).

46. On information and belief, at the time of filing this Complaint, Verizon employs Mr. Andrew Yancey as a Network Design Engineer in Schertz, TX. Mr. Yancey has experience relating to fiber deployment and FTTP (fiber to the premises). https://www.linkedin.com/in/andrew-yancey-770895118 (last visited December 13, 2023).

47. On information and belief, Verizon employed Mr. Scott Hosley in the Dallas-Fort Worth metropolitan area. During his employment at Verizon, Mr. Hosley worked on One Fiber builds in the Dallas-Fort Worth metropolitan area. Mr. Hosley also worked on implementing a new product line for Verizon that "will ride on the newly installed" One Fiber plant. https://www.linkedin.com/in/scott-hosley (last visited December 14, 2023).

48. At the time of filing this Complaint, Verizon has a job posting for "Fixed Wireless / Fiber Installer" in Wills Point, TX. https://www.google.com/search?q=verizon+jobs+texas+fiber&rlz=1C1CHBF_enUS1084US1084&oq=verizon+jobs+texas+fiber&gs_lcrp=EgZjaHJvbWUyBggAEEUYOTIHCAEQIRigATIHCAIQIRigATIHCAMQIRigATIHCAQQIRifBTIHCAUQIRifBTIHCAYQIRifBTIHCAcQIRifBdIBCDU4OTNqMGo3qAIAsAIA&sourceid=chrome&ie=UTF-8&ibp=htl;jobs&sa=X&ved=2ahUKEwiLvaHK_oyDAxVtlWoFHU5qAiwQkd0GegQIFxAB#fpstate=tldetail&htivrt=jobs&htiq=verizon+jobs+texas+fiber&htidocid=m7eN4kH6wGE0PXNgAAAAA%3D%3D (last visited December 13, 2023).

49. On information and belief, there are a number of fiber-related jobs in or near this district.

50. Numerous Verizon retail stores are located within this judicial District, including in Allen, Athens, Beaumont, Canton, Carthage, Denton, Frisco, Gilmer, Henderson, Kilgore, Lindale, Longview, Lufkin, Marshall, Nacogdoches, Sulphur Springs, Texarkana, and Tyler. https://www.verizon.com/stores/ (last visited December 11, 2023). Verizon uses these stores to sell services and devices that utilize Verizon's 5G network, including its fiber-optic backhaul that infringes the Asserted Patents (as discussed below). These stores are physically located within the district, are regular and established places of business of Verizon with signage of Verizon, and actively market Verizon's network services.

51. On information and belief, Verizon maintains multiple regular and established physical places of business in the Eastern District of Texas, including, for example, the stores located at each of 500 East Loop 281, Longview, TX 75605; 2414 Gilmer Rd., Ste 1, Longview TX 75604; 2040 Crockett Road, Palestine, TX 75801; 8988 South Broadway Avenue, Tyler, TX 75703; 1016 West Southwest Loop 323, Tyler, TX 75701; 2035 N. Central Expy., McKinney, TX 75070; and 1006 E. End Blvd. N., Marshall, Texas 75670.

52. Verizon has solicited business in the State of Texas, transacted business within the State of Texas and attempted to derive financial benefit from residents of the State of Texas, including benefits directly related to the patent infringement cause of action set forth herein.

53. Verizon has manufactured, used, sold, and/or offered for sale Verizon fiber backhaul and network services in the State of Texas and this judicial district.

54. At the time of filing of this Complaint, Verizon 5G Ultra Wideband service (utilizing fiber-optic backhaul) is available to consumers in Texas, including within this judicial District.

55. Verizon's 5G Ultra Wideband network and network services, which are available in this judicial district, are implemented in part by Verizon's fiber-optic networks that are accused of infringement in this Complaint.

56. Verizon derives benefits from its presence in this federal judicial district, including, but not limited to, sales revenue. For example, Verizon receives revenue from its corporate stores in this district, by selling network access (via cell towers relying on fiber-optic backhaul), products, and services, and by receiving payment for its network access, products, and services.

57. Verizon's commission of acts of infringement, and the presence of Verizon retail stores in the Eastern District of Texas, establishes venue over it under 28 U.S.C. § 1400(b). *See, e.g.*, *Intellectual Ventures II LLC v. FedEx Corp.*, Case No. 16-cv-980-JRG, 2017 WL 5630023, at *6–7 (E.D. Tex. Nov. 22, 2017) (Gilstrap, J.) (venue proper based on defendants' "physical retail and service locations").

58. In other recent actions, Verizon has either admitted or not contested that this federal judicial district is a proper venue for patent infringement actions against it. *See, e.g.*, Answer ¶ 16 & Counterclaims ¶ 6, *IPCom, Gmbh & Co. KG v. Verizon Comm'ns Inc., et al.*, No. 2:20-cv-322 (E.D. Tex. Dec. 21, 2020), ECF No. 23; Am. Answer to Am. Compl. ¶¶ 14, 17, *Sol IP v. Verizon Comm'ns Inc., et al.*, No. 2:18-cv-526 (E.D. Tex. Sept. 18, 2019), ECF No. 180; Answer ¶ 6, *Traxcell Techs., LLC v. Verizon Comm'ns, Inc., et al.*, No. 2:17-cv-721 (E.D. Tex. Jan. 22, 2018), ECF No. 8; Answer ¶ 15, *Cellular Comm'ns Equip., LLC v. Apple Inc., et al.*, No. 6:17-cv-146 (E.D. Tex. June 29, 2017), ECF No. 44. Verizon has also admitted or failed to contest that it has transacted business in this district. *See, e.g.*, Sol IP, Am. Answer to Am.

Compl. ¶¶ 13, 16; Cellular Comm'ns, Answer ¶¶ 6, 16; Answer ¶ 7, *Plectrum LLC v. Verizon Comm'ns Inc., et al.*, No. 4:17-cv-126 (E.D. Tex. Apr. 19, 2017), ECF No. 21.

59. Verizon is subject to personal jurisdiction under the provisions of the Texas Long Arm Statute, TX CIV. PRAC. & REM CODE § 17.041 et seq., by virtue of the fact that, upon information and belief, Verizon has availed itself of the privilege of conducting and soliciting business within this State, including engaging in at least some of the infringing activities in this State, as well as by others acting as Verizon's agents and/or representatives, such that it would be reasonable for this Court to exercise jurisdiction consistent with principles underlying the U.S. Constitution, and the exercise of jurisdiction by this Court would not offend traditional notions of fair play and substantial justice.

60. On information and belief, Verizon has also established minimum contacts with this judicial district and regularly transacts and does business within this district, including advertising, promoting and selling products and/or services in its stores, over the internet, through intermediaries, representatives and/or agents located within this judicial district, that infringe the asserted patents. On further information and belief, Verizon has purposefully directed activities at citizens of this State including those located within this judicial district. On information and belief, Verizon derives substantial revenue from the goods and services it provides to individuals in the state of Texas and in this judicial district.

61. On information and belief, Verizon has purposefully and voluntarily placed its products and/or services into the stream of commerce with the expectation that they will be purchased and used by customers located in the State of Texas and the Eastern District of Texas. On information and belief, Verizon's customers in the Eastern District of Texas have purchased and used and continue to purchase and use Verizon's products and/or services.

62. Venue as to Verizon is proper in this judicial district under 28 U.S.C. §§1391(b)-(c) and 1400(b) at least because Verizon has committed acts of infringement in this judicial district and has a regular and established place of business in this judicial district. Each Defendant makes, uses, sells, offers to sell, and/or imports products and/or services accused of infringement in this case into and/or within this judicial district and maintains a permanent and/or continuing presence within this judicial district. On information and belief, each Defendant has transacted and, at the time of the filing of the Complaint, is continuing to transact business within this judicial district.

63. Defendants are properly joined under 35 U.S.C. § 299(a)(1) because, as set forth in greater detail below, on information and belief, Defendants commonly and/or jointly make, use, sell, offer to sell, and/or import infringing instrumentalities, such that at least one right to relief is asserted against Defendants jointly, severally, and in the alternative with respect to the same transactions, occurrences, or series of transactions or occurrences relating to the making, using, selling, offering to sell, and/or importing into the United States the same accused instrumentalities, as set forth in greater detail herein.

64. Defendants are properly joined under 35 U.S.C. § 299(a)(2) because, as set forth in greater detail below, on information and belief, Defendants make, use, sell, offer to sell in, and/or import into the United States the same or similar accused instrumentalities, such that questions of fact that are common to all Defendants will arise in this action.

BACKGROUND

65. On information and belief, Verizon covers approximately 200 million U.S. consumers with the C-Band spectrum of 5G wireless technology.

https://www.verizon.com/about/sites/default/files/2023-Proxy-Statement.pdf (Proxy Statement 2023) at i.

66. Verizon generated revenues of $136.8 billion in 2022. https://www.sec.gov/Archives/edgar/data/732712/000073271223000007/a2022q4exhibit991.htm#:~:text=Headquartered%20in%20New%20York%20City,of%20%24136.8%20billion%20in%202022. (last visited December 13, 2023).

67. Verizon advertises fiber technology advancement results in increased speed, reliability, and overall capacity. https://www.verizon.com/about/news/verizon-fiber-technology-advancement-results (last visited December 14, 2023).

68. Verizon connects over 51% of its cell sites with its own fiber. At the time of filing this Complaint, Verizon has deployed nearly 57,000 fiber miles since 2020. https://www.verizon.com/about/news/verizon-fiber-technology-advancement-results (last visited December 13, 2023).

69. Verizon advertises its network upgrades have enabled customers to have a "markedly better experience than ever before." Median 5G download speeds have increased over 98% since January of 2021 and download speeds have increased more than 176% since the second half of 2021 in the top 125 metros tested. Based on RootMetrics testing, Verizon's network is undefeated in 96.8% of the metro drive tests performed in the first half of 2023. https://www.verizon.com/about/news/verizons-network-major-benefits-customers (last visited December 14, 2023).

70. Verizon CTO Kyle Malady has stated the switch from copper to fiber infrastructure is saving Verizon millions of dollars per year and expects the benefits of the switch to fiber to increase. By March 2022, this upgrade has delivered operational savings of around

$180 million. https://www.fiercetelecom.com/telecom/verizon-cto-weve-already-converted-45m-copper-circuits-fiber (last visited December 14, 2023).

71. By March 2022, Verizon had upgraded 4.5 million circuits from copper to fiber and 36 central office locations to all fiber. https://www.fiercetelecom.com/telecom/verizon-cto-weve-already-converted-45m-copper-circuits-fiber (last visited December 14, 2023).

72. At the end of 2021, 45% of Verizon cell sites were connected to Verizon's fiber assets. https://www.fiercetelecom.com/telecom/verizon-cto-weve-already-converted-45m-copper-circuits-fiber (last visited December 14, 2023).

73. On information and belief, Verizon is widely known for having an "exceptionally reliable" 5G network experience. https://www.jacksonvilleprogress.com/news/local_news/verizon-lights-up-5g-ultra-wideband-across-texas/article_4bcc171e-129c-11ee-87f1-e7aef8a2fc04.html (last visited December 14, 2023).

74. Verizon advertises using fiber for the backhaul of traffic from the cell sites to the broader voice, data, and video networks. Verizon is able to provide an "extraordinarily reliable option" for the carriers. Verizon advertises Verizon's fiber-optic backhaul capabilities play an important role in Verizon's current network. https://www.verizon.com/about/news/press-releases/verizons-ultrareliable-fiber-backhaul-links-offer-wireless-companies-reliability-capacity-advantages-over-traditional-technologies (last visited December 15, 2023).

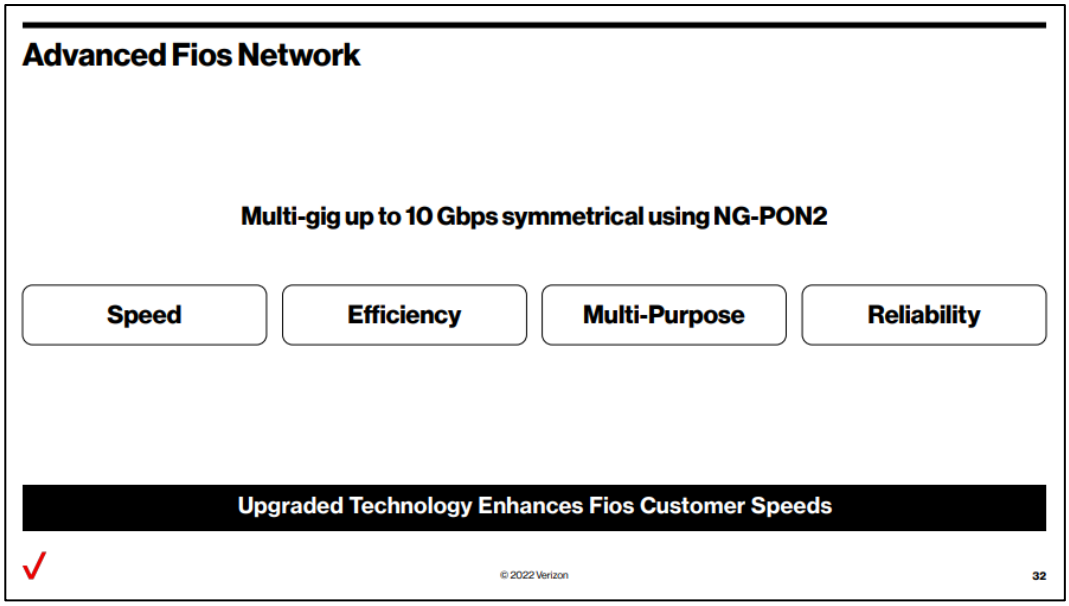
75. Verizon advertises when their overhaul of the fiber core network is complete, Verizon will be able to manage 115 Tbps of data, the equivalent of almost 24 billion streaming songs, at any given moment. Verizon also advertises this equipment will be upgradeable to 230

Tbps in the coming years. https://www.verizon.com/about/news/owned-fiber-increases-reliability-improves-performance (last visited December 14, 2023).

76. Verizon's VP of Technology for Verizon's fiber program, Kevin Smith, stated NG-PON2 provides a "really elegant way to comingle business and residential services on a single platform." On information and belief, the same NG-PON2 system may be utilized to serve 2 Gbps fiber to residential customers, 10 Gbps to business customers, and 10-gig fronthaul to cell sites. https://www.fiercetelecom.com/broadband/verizon-exec-ng-pon2-will-make-future-fiber-upgrades-easier (last visited December 14, 2023).

77. Additionally, Verizon offers Fios, a 100% fiber-optic network "that delivers some of the fastest internet speeds to millions of homes." Verizon advertises that through Fios, Verizon is "one of the only internet service providers to offer nearly matching download and upload speeds on most plans." https://www.verizon.com/home/internet/fios/ (last visited December 14, 2023). Verizon also promotes its Fios offering as a business internet solution. *See* https://www.verizon.com/business/products/internet/fios-business-internet/ ("Fios is ultra-fast fiber-optic internet with the high bandwidth your business needs to do more.") (last visited December 26, 2023).

78. For an Investor Day 2022 presentation, Verizon advertised NG-PON2 allows for up to 10 Gbps speeds.



https://www.verizon.com/about/sites/default/files/2022-03/Investor-Day-2022-Presentation.pdf (last visited December 14, 2023).

79. Verizon advertises Verizon is #1 for Network Quality in the Northeast (tied), Mid-Atlantic, Southeast, North Central, West regions. Verizon also advertises Verizon has also received the highest number of awards in network quality for the 30th time as compared to all other brands in the J.D. Power 2003-2022 Volume 1 and 2 and 2023 Volume 1 U.S. Wireless Network Quality Performance Studies. https://www.verizon.com/5g/ (last visited December 14, 2023).

80. On information and belief, Verizon's fiber backhaul is instrumental to Verizon's award-winning performance. *See, e.g.*, https://www.verizon.com/about/news/owned-fiber-increases-reliability-improves-performance (last visited December 15, 2023).

ACCUSED INSTRUMENTALITIES

81. The Accused Instrumentalities include all components necessary for Verizon to provide fiber-optic networks and network services for use by its customers, including all hardware and software, optical line terminals (ONTs), and optical network units (ONUs)/optical

network terminals (ONTs). This includes both residential and commercial customers, as well as fiber used in Verizon's wireless backhaul.

COUNT 1: INFRINGEMENT OF U.S. PATENT NO. 8,712,242

82. Iarnach hereby incorporates and re-alleges the preceding paragraphs as if fully set forth herein.

83. On April 29, 2014, the United States Patent and Trademark Office ("USPTO") duly and legally issued United States Patent No. 8,712,242 ("the '242 Patent"), titled "Ranging Method and Apparatus in Passive Optical Network."

84. The '242 Patent was originally assigned to ZTE Corporation. On January 9, 2023, the '242 Patent was assigned to Iarnach Technologies Limited. *See* USPTO Reel/frame 062320/0522.

85. The '242 Patent is generally directed toward the ranging process in a passive optical network. Because an OLT does not know the position of an ONU on which ranging is to be performed, the OLT will open a quiet window to perform the ranging. '242 Patent at 1:64-2:2. However, a quiet window opened for ranging that lasts too long will disrupt the operation of other ONUs that are in the operation state, thereby lowering their transmission efficiency. *Id*. at 2:2-5. As stated in the '242 Patent, "[t]he present invention shortens the open time of the quiet window used for the ranging and improves the efficiency of the upstream transmission, and the implementation method is simple and convenient." *Id*. at Abstract.

86. Iarnach holds all rights, title, and interest in and to the '242 Patent, including the right to bring this suit and recover all past, present and future damages for infringement of the '242 Patent. Verizon is not licensed to the '242 Patent, either expressly or implicitly, nor does it

enjoy or benefit from any other rights in or to the ’242 Patent whatsoever. As such, Verizon’s infringement described below has injured, and continues to injure, Iarnach.

87. On information and belief, Verizon has infringed directly and continues to infringe directly the ’242 Patent in its implementation of Verizon’s fiber-optic networks and network services. The infringing activities include, but are not limited to, the manufacture, use, sale, importation, and/or offer for sale of products and/or services by Verizon for operation on its fiber-optic networks and network services that are capable of performing ranging between OLTs and ONUs.

88. For example, the Accused Instrumentalities practice and/or are capable of practicing representative claim 1 of the ’242 Patent, which is directed to a method of ranging in a passive optical network, such as those provided by Verizon in establishing and operating its fiber-optic networks and network services. The following paragraphs provide details regarding one example of Verizon’s infringement, and only as to a single patent claim. Iarnach reserves its right to provide greater detail and scope via its Infringement Contentions at the time required under any applicable scheduling order.

89. Claim 1 of the ’242 Patent states:

> 1. A method for ranging in a passive optical network, comprising:
>
> obtaining a Round Trip Delay (RTD) between an Optical Line Terminal (OLT) and an Optical Network Unit (ONU); and
>
> opening a quiet window used for the ranging for the ONU according to the RTD to perform the ranging on this ONU,
>
> wherein the step of opening the quiet window used for the ranging for the ONU according to the RTD to perform the ranging on this ONU comprises:
>
> determining a required period T during performing the ranging on the ONU according to the RTD;

obtaining an open time of the quiet window according to the determined required period T during performing the ranging on the ONU and a preset adjustment time Δt;

when the ONU is in a ranging state, sending a ranging request to the ONU, and opening the quiet window used for performing the ranging on the ONU simultaneously, wherein the quiet window includes the open time of the quiet window;

receiving a ranging response within the open time of the quiet window; and

obtaining an Equalization Delay (EqD) of the ONU that is in the ranging state and sending the EqD to the ONU that is in the ranging state.

'242 Patent at 7:48-8:7.

90. The Accused Instrumentalities implement at least Claim 1 of the '242 Patent.

91. Verizon uses NG-PON2-type networks to support and provide wireless, residential, and business services. https://techblog.comsoc.org/2018/08/22/10597/ (last visited December 13, 2023).

92. The Accused Instrumentalities comprise "[a] method for ranging in a passive optical network." Verizon's fiber-optic networks and network services implement the NG-PON2 standard, and Verizon has described its NG-PON2 implementation as "laying the foundation for possible industry-wide best-practice standardization in the future." *See* https://www.verizon.com/about/sites/default/files/Verizon-OpenOMCI-Specification.docx (last visited December 15, 2023). In a passive optical network, ranging is a procedure for measuring the round-trip delay between an OLT and an ONU. *See* ITU-T G.989 at §3.2.3.19. Ranging is part of the activation phase of an ONU. *See* ITU-T G.989.3 at §§12.1.2, 12.1.3, 12.1.4.1.

93. The Accused Instrumentalities comprise "obtaining a Round Trip Delay (RTD) between an Optical Line Terminal (OLT) and an Optical Network Unit (ONU)." Part of the

ranging procedure is measuring the round-trip delay between the OLT and the ONUs. *See* ITU-T G.989 at §3.2.3.19. During the ranging phase, an OLT will obtain a round-trip delay measurement between and OLT and an ONU. *See* ITU-T G.989.3 at §12.1.2. The NG-PON2 standard defines "round-trip delay" as the time delay measure between the OLT and the ONUs. *See* ITU-T G.989 at §§3.2.3.23, 3.2.3.24.

94. The Accused Instrumentalities comprise "opening a quiet window used for the ranging for the ONU according to the RTD to perform the ranging on this ONU." *See* ITU-T G.989 at §3.2.3.18. When determining the quiet window, the OLT uses ranging information obtained from the serial number response during previous activations of the ONU, which includes the round-trip delay. *See* ITU-T G.989.3 at §§12.1.5, 13.1.3.

95. The Accused Instrumentalities comprise "wherein the step of opening the quiet window for the ranging for the ONU according to the RTD to perform the ranging on this ONU comprises" for the reasons set forth in the paragraphs below.

96. The Accused Instrumentalities comprise "determining a required period T during performing the ranging on the ONU according to the RTD." Equation 13-5 of the NG-PON2 standard is used to calculate the "size of the quiet window during ranging" using the round-trip delay.

$$W_{\Delta}^{RNG} = RspTime_{var} + \frac{D_{max}(n_{dn} + n_{up})}{c} + T_{RG} \qquad (13\text{-}5)$$

See ITU-T G.989.3 at §13.1.3.

97. Alternatively, the OLTs in the Accused Instrumentalities can use the round-trip delay calculated during the serial number acquisition stage. *See* ITU-T 989.3 at §13.1.3.

98. The Accused Instrumentalities comprise "obtaining an open time of the quiet window according to the determined required period T during performing the ranging on the ONU and a preset adjustment time Δt." The NG-PON2 standard explains that the offset of the quiet window is determined by Equation 13-4 in part by the "dynamically generated StartTime value of the ranging grant."

$$W_0^{RNG} = RspTime_{\min} + \frac{L_{\min}(n_{1577} + n_{1270})}{c} + \frac{StartTime}{R_{nom}} \qquad (13\text{-}4)$$

See ITU-T G.989.3 at §13.1.3.

99. Alternatively, when the OLTs in the Accused Instrumentalities use ranging information obtained from the serial number acquisition stage, the OLT can adjust the calculated time by a factor of Δt to allow for some adjustment to the optimal ranging quiet window duration.

100. The Accused Instrumentalities comprise "when the ONU is in a ranging state, sending a ranging request to the ONU, and opening the quiet window used for performing the ranging on the ONU simultaneously, wherein the quiet window includes the open time of the quiet window." As part of the activation process, the OLT may issue ranging grants to the ONU to measure its round-trip delay. *See* ITU-T G.989.3 at §12.1.5. The ranging grant from the OLT directed to the ONU is accompanied by a quiet window. *See* ITU-T G.989.3 at §12.1.5. When in the Ranging state O4, the ONU will interpret any directed bandwidth allocation from the OLT with the PLOAMu flag set as a ranging grant and will respond with a ranging response. *See* ITU-T G.989.3 at §13.1.3. The sending of the ranging request and the opening of the quiet window occur simultaneously, as illustrated in the figure below:

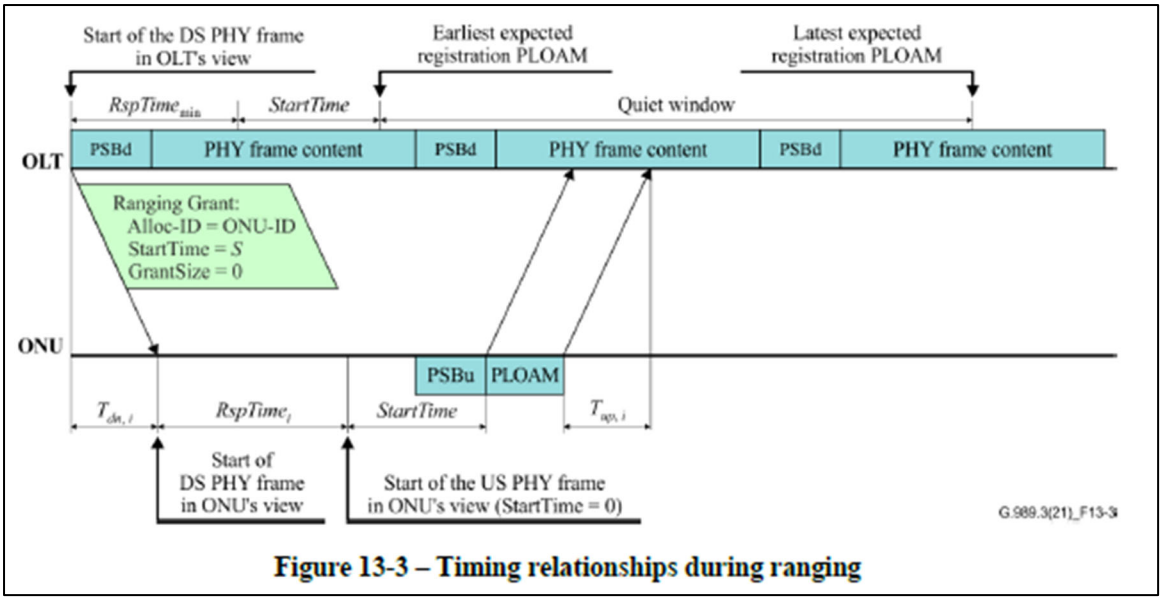


Figure 13-3 – Timing relationships during ranging

ITU-T G.989.3 at §13.1.3.

101. The OLT sends a bandwidth allocation to a specific ONU, which is called a ranging grant in the NG-PON2 standard. *See* ITU-T G.989.3 at §13.1.3. The ONU interprets a directed bandwidth allocation with the PLOAMu flag set as a ranging grant. *See* ITU-T G.989.3 at §13.1.3. Except for the allocation for the ONU in the ranging state, the remainder of the bandwidth map allocations transmitted within the same downstream PHY frame are empty, meaning the remaining ONUs are denied permission to transmit while the ranging process takes place. *See* ITU-T G.989.3 at §13.1.3. Because the directed bandwidth allocation to the targeted ONU and the lack of bandwidth allocation to the remaining ONUs occur in the same downstream PHY frame, they occur simultaneously. *See* ITU-T G.989.3 at §13.1.3.

102. The Accused Instrumentalities comprise "receiving a ranging response within the open time of the quiet window." During the ranging process, the ONU will respond to directed ranging grants from the OLT. *See* ITU-T G.989.3 at §§12.1.2, 12.1.4.1. As illustrated in the figure below, the ONU responds to the ranging grant of the OLT during the quiet window:

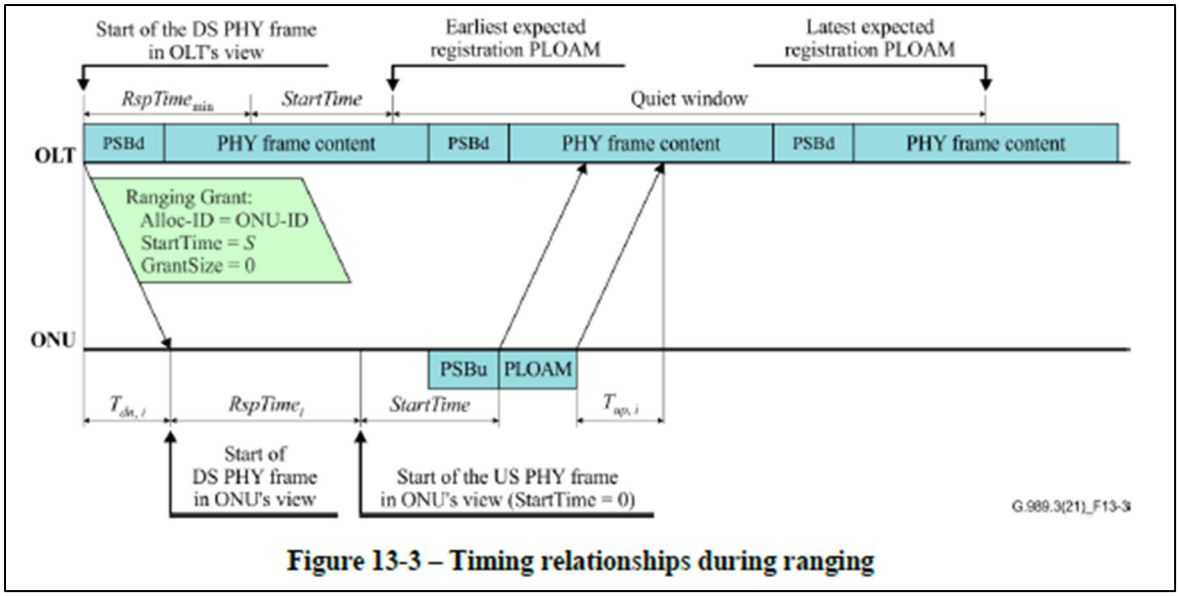


Figure 13-3 – Timing relationships during ranging

ITU-T G.989.3 at §13.1.3.

103. The Accused Instrumentalities comprise "obtaining an Equalization Delay (EqD) of the ONU that is in the ranging state and sending the EqD to the ONU that is in the ranging state." The OLT calculates the equalization delay for the ONUs and communicates the equalization delay to each ONU while it is in the ranging state.

$$EqD_i = T_{eqd} - RTD_i = T_{eqd} - \left(\Delta_i^{RNG} - StartTime \cdot Q_0\right) \qquad (13\text{-}7)$$

ITU-T G.989.3 at §13.1.4.

104. The ONU receives the equalization delay from the OLT. *See* ITU-T G.989.3 at §§13.1.4; 12.1.4.1.

105. Based on the above and because of its conformance with the applicable NG-PON2 standards, Verizon directly infringes at least claim 1 of the '242 Patent.

106. In addition to direct infringement by making, using, and selling the Accused Instrumentalities, Verizon also indirectly infringes the '242 Patent claims. Verizon has knowledge of the '242 Patent at least as of the filing and service of the original Complaint (Dkt.

1) in this case and continues to make, use, sell, and/or offer for sale the Accused Instrumentalities. Where acts constituting direct infringement of the '242 Patent are not performed by Verizon, such acts constituting direct infringement of the '242 Patent are performed by Verizon's customers or end-users who act at the direction and/or control of Verizon, with Verizon's knowledge.

107. Iarnach is informed and believes, and on that basis alleges, that Verizon indirectly infringes at least claim 1 of the '242 Patent by active inducement in violation of 35 U.S.C. § 271(b), by at least manufacturing, supplying, distributing, selling, and/or offering for sale the Accused Instrumentalities to its customers with the knowledge and intent that use of those products would constitute direct infringement of the '242 Patent.

108. For example, Verizon has stated that it will deploy NG-PON2 networks in every market where it offers 5G mobile services. https://www.lightwaveonline.com/fttx/pon-systems/article/14034625/verizon-full-speed-ahead-with-ng-pon2-for-5g-mobile-support (last visited December 18, 2023). On information and belief, when a Verizon customer connects to Verizon's 5G network, an ONU will automatically implement the accused functionality based upon the hardware and software provided in the Accused Instrumentalities.

109. Verizon also indirectly infringes by contributing to the infringement of, and continuing to contribute to the infringement of, one or more claims of the '242 Patent under 35 U.S.C. §§ 271(c) and/or 271(f) by selling, offering for sale, and/or importing into the United States, the Accused Instrumentalities. Verizon knows at least as of the date of the filing and service of the original Complaint (Dkt. 1) in this case that the accused products and/or services include hardware components and software instructions that work in concert to perform specific, intended functions. Such specific, intended functions, carried out by these hardware and software

combinations, are a material part of the inventions of the '242 Patent and are not staple articles of commerce suitable for substantial non-infringing use.

110. The acts of infringement by Verizon have caused damage to Plaintiff, and Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' wrongful acts in an amount subject to proof at trial. The infringement of the '242 Patent by Verizon has damaged and will continue to damage Plaintiff.

COUNT 2: INFRINGEMENT OF U.S. PATENT NO. 8,942,378

111. Iarnach hereby incorporates and re-alleges the preceding paragraphs as if fully set forth herein.

112. On January 27, 2015, the USPTO duly and legally issued United States Patent No. 8,942,378 ("the '378 Patent"), titled "Method and Device for Encrypting Multicast Service in Passive Optical Network System."

113. The '378 Patent was originally assigned to ZTE Corporation. On January 9, 2023, the '378 Patent was assigned to Iarnach Technologies Limited. *See* USPTO Reel/frame 062320/0522.

114. The '378 Patent is generally directed toward encrypting multicast services in a PON within a bearer channel. This increases security while also reducing the complexity of managing encryption on a per multicast-group level. *See* '378 Patent at 1:58-62. The bearer channel encrypting mechanism "reduces the complexities of the OLT encryption mechanism and the ONU decryption mechanism on the premise of guaranteeing the encryption of the multicast service." *Id.* at 3:9-13. This approach improves on the prior art because "it limits the range affected by disclosing the key from the whole network to a certain PON port, thus improv[ing] the security of the multicast service content." *Id.* at 3:15-18.

115. Iarnach holds all rights, title, and interest in and to the '378 Patent, including the right to bring this suit and recover all past, present and future damages for infringement of the '378 Patent. Verizon is not licensed to the '378 Patent, either expressly or implicitly, nor does it enjoy or benefit from any other rights in or to the '378 Patent whatsoever. As such, Verizon's infringement described below has injured, and continues to injure, Iarnach.

116. On information and belief, Verizon has infringed directly and continues to infringe directly the '378 Patent in its implementation of Verizon's fiber-optic networks and network services. The infringing activities include, but are not limited to, the manufacture, use, sale, importation, and/or offer for sale of products and/or services from Verizon for operation on its fiber-optic networks and network services that are capable of performing delivery of encrypted multicast services between OLTs and ONUs.

117. For example, the Accused Instrumentalities practice and/or are capable of practicing representative claim 1 of the '378 Patent, which is directed to a method for encrypting multicast service in a passive optical network, such as those provided by Verizon in establishing and operating its fiber-optic networks and network services. The following paragraphs provide details regarding one example of Verizon's infringement, and only as to a single patent claim. Iarnach reserves its right to provide greater detail and scope via its Infringement Contentions at the time required under any applicable scheduling order.

118. Claim 1 of the '378 Patent states:

> 1. A method for encrypting multicast service in a passive optical network system, the method comprising:
>
> an optical line terminal (OLT) generating a common key, and using the common key to encrypt multicast service data of all different multicast services in a same bearer channel and then sending encrypted data, wherein the multicast service data of all different multicast services in

the same one bearer channel use a same common key to carry out encryption; and

said OLT sending the common key applied in encrypting the multicast service data via a management control channel to an optical network unit (ONU) that is activated successfully and applies to receive said multicast service data.

'378 Patent at 7:61-8:7.

119. The Accused Instrumentalities implement at least Claim 1 of the '378 Patent.

120. Verizon uses NG-PON2-type networks to support and provide wireless, residential, and business services. https://techblog.comsoc.org/2018/08/22/10597/ (last visited December 13, 2023).

121. On information and belief, the products implemented by Verizon and used in its fiber-optic networks include hardware and/or software that is configured to be capable of performing optical communication in a passive optical network between OLTs and ONUs for performing delivery of encrypted multicast services between OLTs and ONUs.

122. On information and belief, the products implemented by Verizon and used in its fiber-optic networks conform to and implement the technical specifications of the NG-PON2 standard (ITU-T G.989.3), including the portions of the specifications referenced below. *See* https://techblog.comsoc.org/2018/08/22/10597/ (last visited December 13, 2023). Verizon's fiber-optic networks and network services implement the NG-PON2 standard, and Verizon has described its NG-PON2 implementation as "laying the foundation for possible industry-wide best-practice standardization in the future." *See* https://www.verizon.com/about/sites/default/files/Verizon-OpenOMCI-Specification.docx (last visited December 15, 2023).

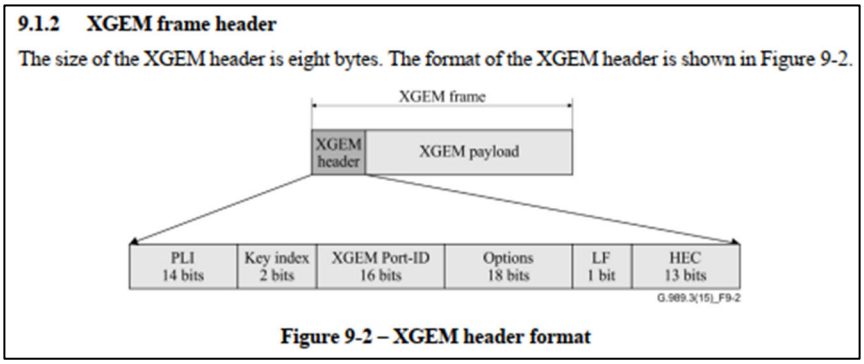
123. The Accused Instrumentalities comprise "[a] method for encrypting multicast service in a passive optical network system." Verizon's fiber-optic networks and network services implement the NG-PON2 standard.

124. The Accused Instrumentalities comprise "an optical line terminal (OLT) generating a common key, and using the common key to encrypt multicast service data of all different multicast services in a same bearer channel and then sending encrypted data, wherein the multicast service data of all different multicast services in the same one bearer channel use a same common key to carry out encryption." The OLT determines the data encryption configuration to be implemented for each ONU based on that ONU's offered capabilities. ITU-T G.989.3 at § 15.5.1. Using the ONU Management and Control Interface (OMCI), the OLT configures the encryption key ring attribute for each non-default XGEM port. *Id.* This includes specifying the direction of encryption (downstream only or both downstream and upstream) and the encryption key type (unicast or broadcast). *Id.*

125. The key ring attribute is defined in Section 9.2.3 of ITU-T G.988 as part of the GEM (GPON Encapsulation Method) port network CTP (Connection Termination Point) ME (Managed Entity). A value of 2 for the encryption key ring attribute indicates that the key is for broadcast or multicast traffic. ITU-T G.988 at § 9.2.3. These keys are generated by the OLT and distributed within the network via OMCI. ITU-T G.989.3 at § 15.5.1. The broadcast (multicast) encryption key is a key distributed by the OLT to encrypt multicast service data. ITU-T G.989.3 at § 15.5.4

126. XGEM Port-IDs are used to define bearer channels to carry traffic in the PON, including multicast service traffic. ITU-T G.989.3 at §§ 6.1.5.1, 6.1.5.7. The bearer channel is a

sequence of XGEM frames assigned to the designated XGEM port identifier for that logical connection. The structure of an XGEM frame is illustrated below:



ITU-T G.989.3 at § 9.1.2. The XGEM port-ID field in the XGEM header specifies the XGEM port to which the frame belongs. *Id.* The Key index field indicates which encryption key to be used for decrypting the XGEM payload data. *Id.*

127. The Accused Instrumentalities comprise "said OLT sending the common key applied in encrypting the multicast service data via a management control channel to an optical network unit (ONU) that is activated successfully and applies to receive said multicast service data." The OLT uses OMCI, which is a management control channel, to send the common key for inclusion in the GEM port network CTP and/or Enhanced Security Control managed entities.

128. The OLT determines the data encryption configuration to be implemented for each ONU based on that ONU's offered capabilities. ITU-T G.989.3 at § 15.5.1. Using the ONU Management and Control Interface (OMCI), the OLT configures the encryption key ring attribute for each non-default XGEM port. *Id.* As detailed previously, the key ring attribute is defined in Clause 9.2.3 of G.988, and a value of 2 for the encryption key ring attribute indicates that the key is for broadcast or multicast traffic. These keys are generated by the OLT and distributed within the network via OMCI, which is implemented via a management control channel. ITU-T G.988 at § 9.2.3; ITU-T G.989.3 at § 15.5.1. The OLT uses OMCI to deploy

broadcast keys for multicast encryption to each of the ONUs provisioned to receive multicast traffic. ITU-T G.989.3 at § 15.5.4. An ONU must complete the activation cycle before it is allowed to process upstream and downstream data in the PON. *See generally* ITU-T G.989.3 at § 12.1.4. The general activation state sequence is as follows: (1) Initial State; (2); Serial Number state; (3) Ranging state; and (4) Operation state. In the Operation state, the ONU has been activated and can process network data as intended. *Id.*

129. Based on the above and because of its conformance with the applicable NG-PON2 standards, Verizon directly infringes at least claim 1 of the '378 Patent.

130. In addition to direct infringement by making, using, and selling the Accused Instrumentalities, Verizon also indirectly infringes the '378 Patent claims. Verizon has knowledge of the '378 Patent at least as of the filing and service of the original Complaint (Dkt. 1) in this case and continues to make, use, sell, and/or offer for sale the Accused Instrumentalities. Where acts constituting direct infringement of the '378 Patent are not performed by Verizon, such acts constituting direct infringement of the '378 Patent are performed by Verizon's customers or end-users who act at the direction and/or control of Verizon, with Verizon's knowledge.

131. Iarnach is informed and believes, and on that basis alleges, that Verizon indirectly infringes at least claim 1 of the '378 Patent by active inducement in violation of 35 U.S.C. § 271(b), by at least manufacturing, supplying, distributing, selling, and/or offering for sale the Accused Instrumentalities to its customers with the knowledge and intent that use of those products would constitute direct infringement of the '378 Patent.

132. For example, Verizon has stated that it will deploy NG-PON2 networks in every market where it offers 5G mobile services. https://www.lightwaveonline.com/fttx/pon-

systems/article/14034625/verizon-full-speed-ahead-with-ng-pon2-for-5g-mobile-support (last visited December 18, 2023). On information and belief, when a Verizon customer connects to Verizon's 5G network, an ONU will automatically implement the accused functionality based upon the hardware and software provided in the Accused Instrumentalities.

133. Verizon also indirectly infringes by contributing to the infringement of, and continuing to contribute to the infringement of, one or more claims of the '378 Patent under 35 U.S.C. § 271(c) and/or 271(f) by selling, offering for sale, and/or importing into the United States, the Accused Instrumentalities. Verizon knows at least as of the date of the filing and service of the original Complaint (Dkt. 1) in this case that the accused products and/or services include hardware components and software instructions that work in concert to perform specific, intended functions. Such specific, intended functions, carried out by these hardware and software combinations, are a material part of the inventions of the '378 Patent and are not staple articles of commerce suitable for substantial non-infringing use.

134. The acts of infringement by Verizon have caused damage to Plaintiff, and Plaintiff is entitled to recover from Verizon the damages sustained by Plaintiff as a result of Verizon's wrongful acts in an amount subject to proof at trial. The infringement of the '378 Patent by Verizon has damaged and will continue to damage Iarnach.

COUNT 3: INFRINGEMENT OF U.S. PATENT NO. 9,363,013

135. Iarnach hereby incorporates and re-alleges the preceding paragraphs as if fully set forth herein.

136. On June 7, 2016, the USPTO duly and legally issued United States Patent No. 9,363,013 ("the '013 Patent"), titled "Mitigating Rogue Optical Network (ONU) Behavior in a Passive Optical Network (PON)."

137. The ’013 Patent was originally assigned to ZTE Corporation. On January 9, 2023, ZTE Corporation assigned the ’013 Patent to Iarnach Technologies Limited. *See* USPTO Reel/frame 062320/0522.

138. The ’013 Patent is generally directed toward isolating and mitigating the behavior of a rogue optical network unit (ONU) on an optical distribution network. ONUs in a given optical distribution network may perform upstream transmission on the same wavelength, which can result in interference between ONUs. Access procedure standards can define multiple access protocols by which the optical line terminal (OLT) can differentiate between different ONUs, for example by assigning transmission time slots to the individual ONUs. An ONU that is newly activated or reactivated may, by way of illustration, enter a discovery stage of the activation cycle in which it declares its presence to the OLT through a unique identifier and waits for the OLT to assign a network ID. Afterward, the ONU may enter a ranging stage, in which the ONU performs one or more short upstream transmissions to allow the OLT to measure the roundtrip propagation time and compute the equalization delay used by the ONU to transmit in a specific time slot. In operation, however, an ONU may exhibit behavior that is inconsistent with the standard requirements or parameters, causing interference and disruption of the optical network. The presence of such a rogue ONU can cause service outages for one or more other ONUs and can render the entire passive optical network inoperable. The ’013 Patent discloses novel systems and methods for identifying rogue ONUs and mitigating their impact on the passive optical network.

139. Iarnach holds all rights, title, and interest in and to the ’013 Patent, including the right to bring this suit and recover all past, present and future damages for infringement of the ’013 Patent. Verizon is not licensed to the ’013 Patent, either expressly or implicitly, nor does it

enjoy or benefit from any other rights in or to the ’013 Patent whatsoever. As such, Verizon’s infringement described below has injured, and continues to injure, Iarnach.

140. On information and belief, Verizon has infringed directly and continues to infringe directly the ’013 Patent in its implementation of Verizon’s fiber-optic networks and network services, including Verizon’s fiber-optic backhaul and fiber optics for its consumers. The infringing activities include, but are not limited to, the manufacture, use, sale, importation, and/or offer for sale of products and/or services from Verizon for operation on its fiber-optic networks and network services that are capable of isolating and mitigating the behavior of a rogue optical network unit.

141. For example, the Accused Instrumentalities practice and/or are capable of practicing representative claim 1 of the ’013 Patent, which is directed to a method to facilitate mitigating of rogue behavior of an optical network unit, such as those provided by Verizon in establishing and operating its fiber-optic networks and network services. The following paragraphs provide details regarding one example of Verizon’s infringement, and only as to a single patent claim. Iarnach reserves its right to provide greater detail and scope via its Infringement Contentions at the time required under any applicable scheduling order.

142. Claim 1 of the ’013 Patent states:

> 1. A method, implementable at an optical line terminal (OLT) in a passive optical network (PON) system, to facilitate mitigation of rogue behavior of an optical network unit (ONU), the method comprising:
> detecting presence of a rogue ONU on the PON system;
> transmitting, based on the detection, a first message addressing only a subset of all ONUs on the PON system; and

wherein the subset includes at least one of a first group of ONUs that have not yet being discovered and a second group of ONUs that are not identifiable, the method further including:

probabilistically splitting in time discovery phases of ONUs in the first group of ONUs.

'013 Patent at 10:56-11:2.

143. The Accused Instrumentalities implement at least Claim 1 of the '013 Patent.

144. Verizon uses NG-PON2-type networks to support and provide wireless, residential, and business services. https://techblog.comsoc.org/2018/08/22/10597/ (last visited December 13, 2023). Verizon's NG-PON2-type networks are used to support various services including cellular backhaul, broadband internet access, and cable television offerings.

145. On information and belief, the products implemented by Verizon and used in its fiber-optic networks, including OLTs in its PON system, include hardware and/or software that is configured to be capable of facilitating mitigation of rogue behavior of an optical network unit.

146. On information and belief, the products implemented by Verizon and used in its fiber-optic networks conform to and implements technical specifications of the NG-PON2 standard (including for example ITU-T G.989.3) or their equivalents, including the portions of the specifications referenced below.

147. The Accused Instrumentalities comprise "[a] method, implementable at an optical line terminal (OLT) in a passive optical network (PON) system, to facilitate mitigation of rogue behavior of an optical network unit (ONU)." Verizon's fiber-optic networks include optical line terminals that are configured to be capable of facilitating mitigation of rogue behavior of an optical network unit in the passive optical network.

148. The Accused Instrumentalities comprise "detecting presence of a rogue ONU on the PON system." Verizon's fiber-optic networks include optical line terminals that are

configured to be capable of detecting the presence of a rogue ONU on the PON system. For example, Verizon's fiber-optic networks include optical line terminals that are configured to be capable of detecting an ONU that transmits optical power up the optical distribution network in violation of the standard parameters, including in violation of transmission time slots assigned by the optical line terminal.

149. The Accused Instrumentalities comprise "transmitting, based on the detection, a first message addressing only a subset of all ONUs on the PON system." Verizon's fiber-optic networks include optical line terminals that are configured to be capable of transmitting, based on the detection, a first message addressing only a subset of all ONUs on the PON system. For example, the OLT may send the downstream physical layer operation administration and maintenance message (PLOAM) "Disable_Serial_Number" with parameters set to disable only a subset of ONUs on the passive optical network This subset may include the subset of ONUs that are in the discovery state when a rogue ONU has been detected.

The OLT CT may use equalization delay readjustment, ONU-ID deactivation and serial number disabling for the purposes of rogue ONU prevention, detection and isolation. In an extreme situation when rogue behaviour is exhibited by an ONU that has not been able to declare its serial number, the OLT CT may globally disable all the ONUs in its downstream wavelength channel and subsequently re-enable the conformant ONUs one by one.

11.3.3.5 Disable_Serial_Number message

Information regarding Disable_Serial_Number message is provided in Table 11-9.

Table 11-9 – Disable_Serial_Number message

Octet	Content	Description
1-2	ONU-ID,	0x03FF, Broadcast ONU-ID.
3	Message type ID	0x06, "Disable_Serial_Number".
4	SeqNo	Eight-bit broadcast PLOAM sequence number.

5.3 Systematic approach to Rogue ONU isolation, identification, and mitigation

– Disabling the ONUs, that attempt activation and whose serial numbers have not yet been discovered, with the Disable_Serial_Number PLOAM message using the Disable_Discovery operation code.

Table 11-9 – Disable_Serial_Number message

Octet	Content	Description
5	Disable/enable	0xFF: The ONU with this serial number is denied upstream access. 0x00: The ONU with this serial number is allowed upstream access. 0x0F: All tuned-in ONUs are denied upstream access. The content of bytes 6..13 is ignored. 0x3F: Disable_Discovery: the tuned-in ONUs in O2-3 state are denied upstream access. The content of bytes 6..13 is ignored. 0xF0: All tuned-in ONUs are allowed upstream access.
6-9	Vendor_ID	See clause 11.2.6.1.
10-13	VSSN	See clause 11.2.6.2.
14-40	Padding	Set to 0x00 by the transmitter; treated as "don't care" by the receiver.
41-48	MIC	Message integrity check, computed using the default PLOAM integrity key.

Source:
1. ITU-T G.989.3 05/2021, pages 76, 77, and 116
2. ITU-T G Supplement G.49 9/2020, page 8

150. The Accused Instrumentalities comprise "wherein the subset includes at least one of a first group of ONUs that have not yet being discovered and a second group of ONUs that are not identifiable." For example, the subset may include the subset of ONUs that are in the discovery state when a rogue ONU has been detected and that have not yet entered the ranging state or are otherwise in the normal operation state. For example, ONUs in the discovery stages O2-3 have not yet been discovered by the OLT and properly identified or assigned a unique identifier.

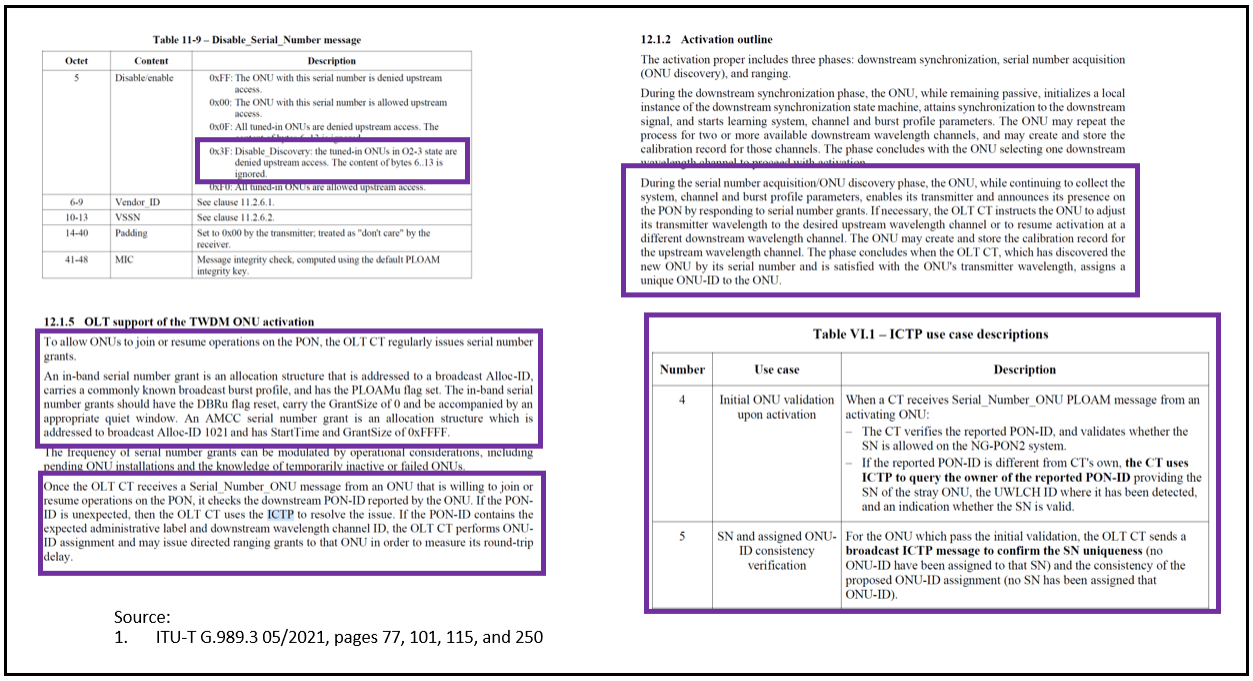


Table 11-9 – Disable_Serial_Number message

Octet	Content	Description
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6-9	Vendor_ID	See clause 11.2.6.1.
10-13	VSSN	See clause 11.2.6.2.
14-40	Padding	Set to 0x00 by the transmitter; treated as "don't care" by the receiver.
41-48	MIC	Message integrity check, computed using the default PLOAM integrity key.

12.1.5 OLT support of the TWDM ONU activation

To allow ONUs to join or resume operations on the PON, the OLT CT regularly issues serial number grants.

An in-band serial number grant is an allocation structure that is addressed to a broadcast Alloc-ID, carries a commonly known broadcast burst profile, and has the PLOAMu flag set. The in-band serial number grants should have the DBRu flag reset, carry the GrantSize of 0 and be accompanied by an appropriate quiet window. An AMCC serial number grant is an allocation structure which is addressed to broadcast Alloc-ID 1021 and has StartTime and GrantSize of 0xFFFF.

The frequency of serial number grants can be modulated by operational considerations, including pending ONU installations and the knowledge of temporarily inactive or failed ONUs.

Once the OLT CT receives a Serial_Number_ONU message from an ONU that is willing to join or resume operations on the PON, it checks the downstream PON-ID reported by the ONU. If the PON-ID is unexpected, then the OLT CT uses the ICTP to resolve the issue. If the PON-ID contains the expected administrative label and downstream wavelength channel ID, the OLT CT performs ONU-ID assignment and may issue directed ranging grants to that ONU in order to measure its round-trip delay.

12.1.2 Activation outline

The activation proper includes three phases: downstream synchronization, serial number acquisition (ONU discovery), and ranging.

During the downstream synchronization phase, the ONU, while remaining passive, initializes a local instance of the downstream synchronization state machine, attains synchronization to the downstream signal, and starts learning system, channel and burst profile parameters. The ONU may repeat the process for two or more available downstream wavelength channels, and may create and store the calibration record for those channels. The phase concludes with the ONU selecting one downstream wavelength channel to proceed with activation.

During the serial number acquisition/ONU discovery phase, the ONU, while continuing to collect the system, channel and burst profile parameters, enables its transmitter and announces its presence on the PON by responding to serial number grants. If necessary, the OLT CT instructs the ONU to adjust its transmitter wavelength to the desired upstream wavelength channel or to resume activation at a different downstream wavelength channel. The ONU may create and store the calibration record for the upstream wavelength channel. The phase concludes when the OLT CT, which has discovered the new ONU by its serial number and is satisfied with the ONU's transmitter wavelength, assigns a unique ONU-ID to the ONU.

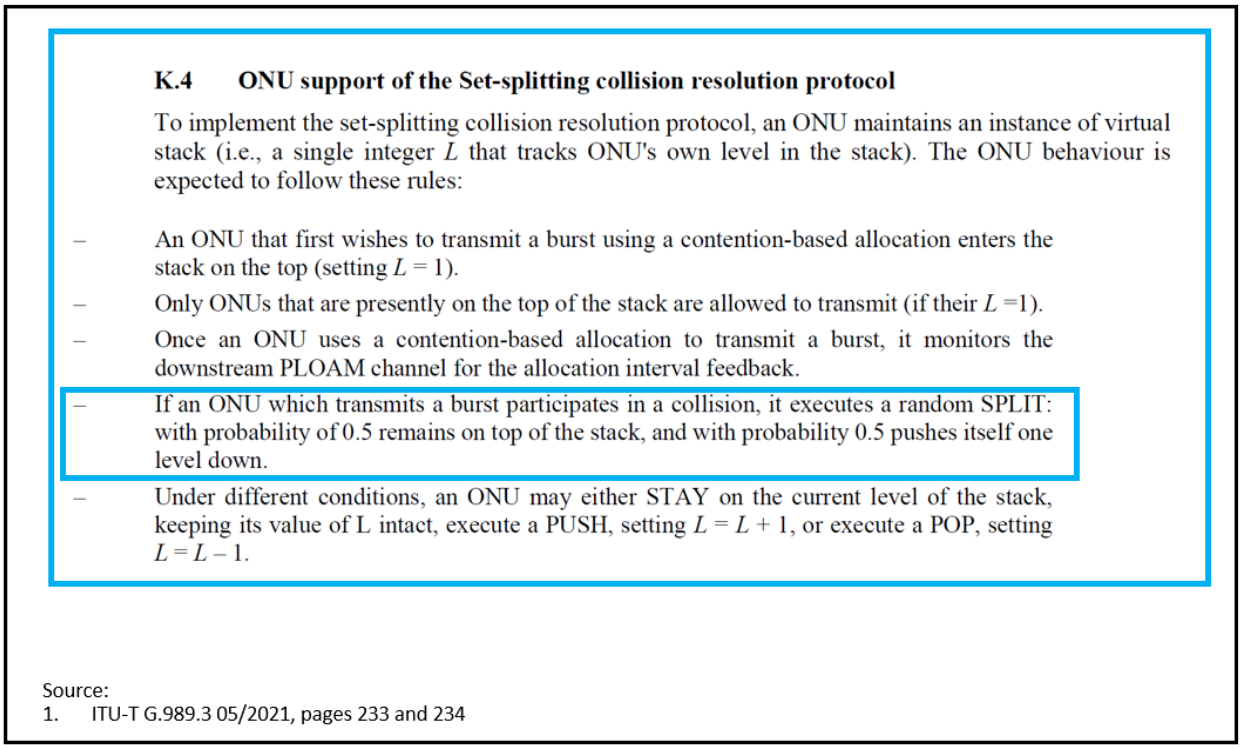
Table VI.1 – ICTP use case descriptions

Number	Use case	Description
4	Initial ONU validation upon activation	When a CT receives Serial_Number_ONU PLOAM message from an activating ONU: – The CT verifies the reported PON-ID, and validates whether the SN is allowed on the NG-PON2 system. – If the reported PON-ID is different from CT's own, **the CT uses ICTP to query the owner of the reported PON-ID** providing the SN of the stray ONU, the UWLCH ID where it has been detected, and an indication whether the SN is valid.
5	SN and assigned ONU-ID consistency verification	For the ONU which pass the initial validation, the OLT CT sends a **broadcast ICTP message to confirm the SN uniqueness** (no ONU-ID have been assigned to that SN) and the consistency of the proposed ONU-ID assignment (no SN has been assigned that ONU-ID).

Source:
1. ITU-T G.989.3 05/2021, pages 77, 101, 115, and 250

151. The Accused Instrumentalities comprise "probabilistically splitting in time discovery phases of ONUs in the first group of ONUs." Verizon's fiber-optic networks include optical line terminals that are configured to be capable of probabilistically splitting in time discovery phases of ONUs in the first group of ONUs. For example, Verizon's fiber-optic networks include optical line terminals that are configured to be capable of implementing a set-splitting collision resolution protocol, in which an ONU maintains an instance of a virtual stack. Under this protocol, for example, an ONU that wishes to transmit using a contention-based

allocation enters the stack on top and transmits a burst. The ONU would then monitor the downstream PLOAM channel for indication of a collision, in which case the ONU executes a random split, with a given probability of remaining on top of the stack and a given probability of dropping a level.



K.4 ONU support of the Set-splitting collision resolution protocol

To implement the set-splitting collision resolution protocol, an ONU maintains an instance of virtual stack (i.e., a single integer L that tracks ONU's own level in the stack). The ONU behaviour is expected to follow these rules:

- An ONU that first wishes to transmit a burst using a contention-based allocation enters the stack on the top (setting $L = 1$).
- Only ONUs that are presently on the top of the stack are allowed to transmit (if their $L = 1$).
- Once an ONU uses a contention-based allocation to transmit a burst, it monitors the downstream PLOAM channel for the allocation interval feedback.
- If an ONU which transmits a burst participates in a collision, it executes a random SPLIT: with probability of 0.5 remains on top of the stack, and with probability 0.5 pushes itself one level down.
- Under different conditions, an ONU may either STAY on the current level of the stack, keeping its value of L intact, execute a PUSH, setting $L = L + 1$, or execute a POP, setting $L = L - 1$.

Source:
1. ITU-T G.989.3 05/2021, pages 233 and 234

152. Based on the above and because of its conformance with the applicable passive optical network standards, Verizon directly infringes at least claim 1 of the ’013 Patent.

153. In addition to direct infringement by making, using, and selling the Accused Instrumentalities, Verizon also indirectly infringes the ’013 Patent claims. Verizon has knowledge of the ’013 Patent at least as of the filing and service of the original Complaint (Dkt. 1) in this case and continues to make, use, sell, and/or offer for sale the Accused Instrumentalities. Where acts constituting direct infringement of the ’013 Patent are not performed by Verizon, such acts constituting direct infringement of the ’013 Patent are

performed by Verizon's customers or end-users who act at the direction and/or control of Verizon, with Verizon's knowledge.

154. Iarnach is informed and believes, and on that basis alleges, that Verizon indirectly infringes at least claim 1 of the '013 Patent by active inducement in violation of 35 U.S.C. § 271(b), by at least manufacturing, supplying, distributing, selling, and/or offering for sale the Accused Instrumentalities to its customers with the knowledge and intent that use of those products would constitute direct infringement of the '013 Patent.

155. For example, Verizon advertises to its customers that its fiber services comply with relevant passive optical network standards. On information and belief, when such a Verizon customer connects to the network, the ONU at the customer premises will automatically implement the accused functionality based upon the hardware and software provided in the Accused Instrumentalities.

156. Verizon also indirectly infringes by contributing to the infringement of, and continuing to contribute to the infringement of, one or more claims of the '013 Patent under 35 U.S.C. §§ 271(c) and/or 271(f) by selling, offering for sale, and/or importing into the United States, the Accused Instrumentalities. Verizon knows at least as of the date of the filing and service of the original Complaint (Dkt. 1) in this case that the accused products and/or services include hardware components and software instructions that work in concert to perform specific, intended functions. Such specific, intended functions, carried out by these hardware and software combinations, are a material part of the inventions of the '013 Patent and are not staple articles of commerce suitable for substantial non-infringing use.

157. The acts of infringement by Verizon have caused damage to Plaintiff, and Plaintiff is entitled to recover from Verizon the damages sustained by Plaintiff as a result of

Verizon's wrongful acts in an amount subject to proof at trial. The infringement of the '013 Patent by Verizon has damaged and will continue to damage Iarnach.

COUNT 4: INFRINGEMENT OF U.S. PATENT NO. 9,806,892

158. Iarnach hereby incorporates and re-alleges the preceding paragraphs as if fully set forth herein.

159. On October 31, 2017, the USPTO duly and legally issued United States Patent No. 9,806,892 ("the '892 Patent"), titled "Optical Network Unit Power Management in Passive Optical Networks."

160. The '892 Patent was originally assigned to ZTE Corporation and ZTE (USA) Inc. On January 9, 2023, ZTE Corporation assigned its interest in the '892 Patent to Iarnach Technologies Limited. *See* USPTO Reel/frame 062320/0522. On January 16, 2023, ZTE (USA) Inc. assigned its interest in the '892 Patent to Iarnach Technologies Limited. *See* USPTO Reel/frame 062391/0263.

161. The '892 Patent is generally directed toward a power management scheme for a passive optical network in which at least two low power states are used. In a first state, the transmitter of the ONU is turned off and the receiver of the ONU is turned on. In a second state, both the transmitter and receiver of the ONU are turned off. Further, the ONU is able to transition directly between the first and second states based on a power management rule. *See* '892 Patent at Abstract.

162. Iarnach holds all rights, title, and interest in and to the '892 Patent, including the right to bring this suit and recover all past, present and future damages for infringement of the '892 Patent. Verizon is not licensed to the '892 Patent, either expressly or implicitly, nor does it

enjoy or benefit from any other rights in or to the ’892 Patent whatsoever. As such, Verizon’s infringement described below has injured, and continues to injure, Iarnach.

163. On information and belief, Verizon has infringed directly and continues to infringe directly the ’892 Patent in its implementation of Verizon’s fiber-optic networks and network services. The infringing activities include, but are not limited to, the manufacture, use, sale, importation, and/or offer for sale of products and/or services from Verizon for operation on its fiber-optic networks and network services that are capable of power management of ONUs within Verizon’s fiber-optic network.

164. For example, the Accused Instrumentalities practice and/or are capable of practicing representative claim 1 of the ’892 Patent, which is directed to a method of optical communication in a passive optical network for implementing power management of ONUs, such as those provided and used by Verizon in establishing and operating its fiber-optic networks and network services. The following paragraphs provide details regarding one example of Verizon’s infringement, and only as to a single patent claim. Iarnach reserves its right to provide greater detail and scope via its Infringement Contentions at the time required under any applicable scheduling order.

165. Claim 1 of the ’892 Patent states:

> 1. A method of optical communication in a passive optical network, comprising:
>
> operating an optical network unit (ONU) in a first state in which a transmitter of the ONU is turned off and a receiver of the ONU is turned on;
>
> operating the ONU in a second state in which both the transmitter and the receiver are turned off;
>
> transitioning the ONU directly from the first state to the second state and transitioning the ONU directly from the second state to the first state, based on a power management rule;

ensuring the ONU is fully powered up, synchronized, and capable of responding to both upstream and downstream traffic and control before exiting the first state or the second state; and

receiving, by the receiver, a power management message from an optical line terminal (OLT); and

changing the power management rule based on the received power management message.

'892 Patent at 15:2-21.

166. The Accused Instrumentalities implement at least Claim 1 of the '892 Patent.

167. Verizon uses NG-PON2-type networks to support and provide wireless, residential, and business services. https://techblog.comsoc.org/2018/08/22/10597/ (last visited December 13, 2023).

168. On information and belief, the products implemented by Verizon and used in its fiber-optic networks include hardware and/or software that is configured to be capable of performing optical communication in a passive optical network between OLTs and ONUs for performing power management of the ONUs.

169. On information and belief, the products implemented by Verizon and used in its fiber-optic networks conform to and implement the technical specifications of the NG-PON2 standard (ITU-T G.989.3), including the portions of the specifications referenced below. *See* https://techblog.comsoc.org/2018/08/22/10597/ (last visited December 13, 2023). Verizon's fiber-optic networks and network services implement the NG-PON2 standard, and Verizon has described its NG-PON2 implementation as "laying the foundation for possible industry-wide best-practice standardization in the future." *See* https://www.verizon.com/about/sites/default/files/Verizon-OpenOMCI-Specification.docx (last visited December 15, 2023).

170. The Accused Instrumentalities comprise "[a] method of optical communication in a passive optical network." Verizon's fiber-optic network services implement the NG-PON2 standard.

171. The Accused Instrumentalities comprise "operating an optical network unit (ONU) in a first state in which a transmitter of the ONU is turned off and a receiver of the ONU is turned on." Section 16 of G.989.3 details NG-PON2 power management. In Supplement 45 (09/2022) to its G series recommendations, the ITU defines the power saving modes that comprise the Lower Power state of G.989.3. *See* ITU-T G Suppl. 45 at § 7. When in Doze mode, the ONU powers off the transmitter while the receiver remains on. *Id.* at § 7.1. The Doze mode is also a component of the Watchful Sleep mode. *Id.* The combination of Doze and Cyclic Sleep are illustrated in the following taxonomy:

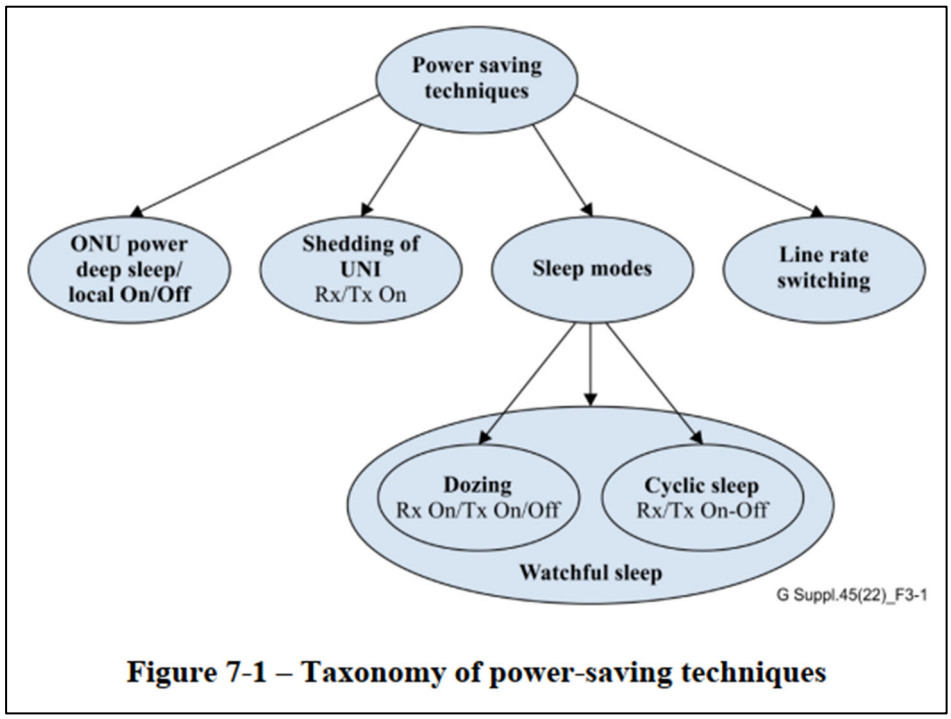


Figure 7-1 – Taxonomy of power-saving techniques

Id. The time during which the Doze state is active within Watchful sleep comprises a first state in which the transmitter of the ONU is turned off and a receiver of the ONU is turned on.

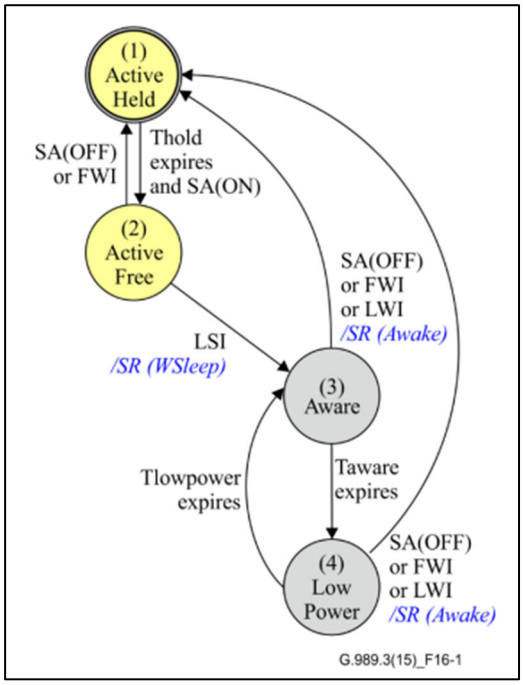
172. The Accused Instrumentalities comprise "operating the ONU in a second state in which both the transmitter and the receiver are turned off." When in Cyclic Sleep mode, the ONU powers off both the transmitter and the receiver. ITU-T G Suppl. 45 at § 7.1 The Cyclic Sleep mode is also a component of the Watchful Sleep mode, as illustrated above. The time during which the Cyclic sleep state is active within Watchful sleep comprises a first state in which both the transmitter and the receiver are turned off.

173. The Accused Instrumentalities comprise "transitioning the ONU directly from the first state to the second state and transitioning the ONU directly from the second state to the first state, based on a power management rule." The OLT provides power management parameters to the ONU, such as those listed in Table 16-1 of G.989.3. Such parameters include, for example, Ilowpower, Irxoff, Iaware, and Ihold. *See* ITU-T G.989.3 at § 16.1.2. These parameters are provided to the ONU by the OLT using the OMCI ME object for dynamic power management control. *See* ITU-T G.988 (11/2022) at § 9.1.14 (defining the Managed Entity for ONU dynamic power management control). Most relevant to the discussion below are the Maximum sleep interval and the Maximum receiver-off interval attributes.

174. The Ilowpower parameter defines the maximum time an ONU can spend in the LowPower state. ITU-T G.989.3 at § 16.1.2. The Ilowpower value is provided to the ONU by the OLT, and it is used by the ONU to establish a Tlowpower parameter controlling a local timer for waking up the ONU to return to an Aware state. *See id.* The Irxoff parameter defines the maximum time the OLT needs from the time it decides to wake up an ONU in a lower power mode until the ONU is fully operational. *Id.* Further, the "ONU timer Trxoff and the OLT CT timer Talerted are initialized based on Irxoff." *Id.*

175. The Trxoff timer, which is based off of a power management parameter, is used by the ONU to ensure that the time between "Watches" (*i.e.*, turning on the Rx to check for wake-up indications) in the LowPower state does not exceed the time dictated by Irxoff. Thus, transitions from the second state to the first state are based on a power management rule that depends on the Irxoff parameter provisioned by the OLT. When the ONU is in a "Watching" state of the LowPower state (*i.e.*, checking for wake-up indications), it must determine whether to transition to the Aware state or to the "Asleep" state of the LowPower state. Assuming no other wake-up indications are present (*e.g.*, Forced wake up indication bits from the OLT or local wake up indication information), the ONU must determine whether it has sufficient time for another sleep cycle before the Tlowpower timer (which is based on the Ilowpower parameter) expires. If enough time exists, then it transitions from the "Watch" state to the "Asleep" state (*i.e.*, first power state to second power state) based on a power management rule that depends on the Irxoff and Ilowpower parameters and/or the Trxoff and Tlowpower parameters.

176. The Accused Instrumentalities comprise "ensuring the ONU is fully powered up, synchronized, and capable of responding to both upstream and downstream traffic and control before exiting the first state or the second state." The "Watch" and "Sleep" states detailed above as the first and second states, respectively, are both part of the LowPower state detailed in the G.989.3 specification. Once the Tlowpower timer expires, the LowPower state transitions to the Aware state.



ITU-T G.989.3 at Figure 16.1. As explained regarding the LowPower state, "[b]efore exiting this state, the ONU ensures that it is fully powered up and capable of responding to both upstream and downstream traffic and control." ITU-T G.989.3 at Table 16.2 (describing the LowPower state). In order to respond to upstream and downstream traffic and control, the ONU is necessarily synchronized.

177. The Accused Instrumentalities comprise "receiving, by the receiver, a power management message from an optical line terminal (OLT)." For instance, OMCI messages are used to manage the ONU dynamic power management control ME as detailed above. *See also* ITU-T G.989.3 at § 16. In addition to OMCI, the OLT also uses PLOAM messages to coordinate the operation of the power-based state machines maintained at both the OLT and ONU. ITU-T G.989.3 at § 16.1.1. Additionally, the transmission of a Forced wake-up indication event by the OLT to the ONU constitutes a power management message. *See* ITU-T G.989.3 at Table 16-3. The architecture of distributing OMCI messages in a PON using the OMCC is illustrated below.

The OMCI fits into the overall model for an access network system as illustrated in Figure 6.1-1. The dotted line shows a path for OMCI signals between an OLT and ONU.

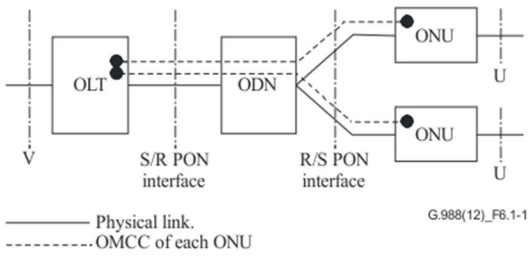


Figure 6.1-1 – Reference model, OMCI

ITU-T G.988 at Figure 6.1-1; *see also id.* at § 9 (detailing how ME attributes are accessed by the OLT). Any OMCI message from the OLT updating a parameter for the ONU dynamic power management control ME (Section 9.1.14 of ITU-T G.988) constitutes a power management message from an OLT. This includes, at least, OMCI messages updating the Power reduction management mode, Maximum sleep interval, Maximum receiver-off interval, Minimum aware interval, Minimum active held interval, and Maximum sleep interval extension parameters. *See* ITU-T G.988 at § 9.1.14.

178. The Accused Instrumentalities comprise "changing the power management rule based on the received power management message." Each of the power management messages detailed above provides the basis for a change in the power management rule implemented at the ONU. For instance, the Sleep_Allow event determines whether an ONU is permitted to exercise a power management mode. Further, the FWI flag "requires immediate ONU wake-up and its transition to the ActiveHeld state."

Table 16-3 – ONU state machine inputs

Input categories	Input	Semantics
PLOAM events	Sleep_Allow(ON)	The OLT CT grants permission to the ONU to exercise watchful sleep management mode.
	Sleep_Allow(OFF)	The OLT CT withholds consent to exercise a power management mode.
Bit-indication event	Forced wake-up indication (FWI)	Transmitting FWI as a flag of an allocation structure, the OLT CT requires immediate ONU wake-up and its transition to the ActiveHeld state.

ITU-T G.989.3 at Table 16-3. The PLOAM events, as a whole, enable and disable the timers that are used to control the ONU's power modes (*e.g.*, Tlowpower, Taware, Trxoff). Thus, these power management messages effect a change in the power management rule at the ONU. Additionally, the OMCI messages that alter the Power reduction management mode, Maximum sleep interval, Maximum receiver-off interval, Maximum active held interval, and Maximum sleep interval extension effect a change in the power management rule implemented at the ONU. Thus, any OMCI message changing these parameter values effects a change in the power management rule implemented at the ONU.

179. Based on the above and because of its conformance with the applicable NG-PON2 standards, Verizon directly infringes at least claim 1 of the '892 Patent.

180. In addition to direct infringement by making, using, and selling the Accused Instrumentalities, Verizon also indirectly infringes the '892 Patent claims. Verizon has knowledge of the '892 Patent at least as of the filing and service of the original Complaint (Dkt. 1) in this case and continues to make, use, sell, and/or offer for sale the Accused Instrumentalities. Where acts constituting direct infringement of the '892 Patent are not performed by Verizon, such acts constituting direct infringement of the '892 Patent are performed by Verizon's customers or end-users who act at the direction and/or control of Verizon, with Verizon's knowledge.

181. Iarnach is informed and believes, and on that basis alleges, that Verizon indirectly infringes at least claim 1 of the '892 Patent by active inducement in violation of 35 U.S.C. § 271(b), by at least manufacturing, supplying, distributing, selling, and/or offering for sale the Accused Instrumentalities to its customers with the knowledge and intent that use of those products would constitute direct infringement of the '892 Patent.

182. For example, Verizon has stated that it will deploy NG-PON2 networks in every market where it offers 5G mobile services. https://www.lightwaveonline.com/fttx/pon-systems/article/14034625/verizon-full-speed-ahead-with-ng-pon2-for-5g-mobile-support (last visited December 18, 2023). On information and belief, when a Verizon customer connects to Verizon's 5G network, an ONU will automatically implement the accused functionality based upon the hardware and software provided in the Accused Instrumentalities.

183. Verizon also indirectly infringes by contributing to the infringement of, and continuing to contribute to the infringement of, one or more claims of the '892 Patent under 35 U.S.C. §§ 271(c) and/or 271(f) by selling, offering for sale, and/or importing into the United States, the Accused Instrumentalities. Verizon knows at least as of the date of the filing and service of the original Complaint (Dkt. 1) in this case that the accused products and/or services include hardware components and software instructions that work in concert to perform specific, intended functions. Such specific, intended functions, carried out by these hardware and software combinations, are a material part of the inventions of the '892 Patent and are not staple articles of commerce suitable for substantial non-infringing use.

184. The acts of infringement by Verizon have caused damage to Plaintiff, and Plaintiff is entitled to recover from Verizon the damages sustained by Plaintiff as a result of

Verizon's wrongful acts in an amount subject to proof at trial. The infringement of the '892 Patent by Verizon has damaged and will continue to damage Iarnach.

COUNT 5: INFRINGEMENT OF U.S. PATENT NO. 8,934,359

185. Iarnach hereby incorporates and re-alleges the preceding paragraphs as if fully set forth herein.

186. On January 13, 2015, the USPTO duly and legally issued United States Patent No. 8,934,359 ("the '359 Patent"), titled "Method and Passive Optical Network System for Managing Uplink Burst Parameters."

187. The '359 Patent was originally assigned to ZTE Corporation. On January 9, 2023, ZTE Corporation assigned its interest in the '359 Patent to Iarnach Technologies Limited. *See* USPTO Reel/frame 062320/0522.

188. The '359 Patent is generally directed toward a method for managing upstream burst overhead parameters in a passive optical network. This allows the OLT and ONU to "improve the bandwidth utilization rate and decrease the complexity of indicating the upstream burst overhead parameters in [a] PON system, so that the ONU and OLT are enabled to flexibly and simply select the upstream burst overhead parameters." '359 Patent at Abstract.

189. Iarnach holds all rights, title, and interest in and to the '359 Patent, including the right to bring this suit and recover all past, present and future damages for infringement of the '359 Patent. Verizon is not licensed to the '359 Patent, either expressly or implicitly, nor does it enjoy or benefit from any other rights in or to the '359 Patent whatsoever. As such, Verizon's infringement described below has injured, and continues to injure, Iarnach.

190. On information and belief, Verizon has infringed directly and continues to infringe directly the '359 Patent in its implementation of Verizon's fiber-optic networks and

network services. The infringing activities include, but are not limited to, the manufacture, use, sale, importation, and/or offer for sale of products and/or services from Verizon for operation on its fiber-optic networks and network services that are capable of managing upstream burst overhead parameters within Verizon's fiber-optic networks.

191. For example, the Accused Instrumentalities practice and/or are capable of practicing representative claim 1 of the '359 Patent, which is directed to a method for managing upstream burst overhead parameters in a passive optical network, such as those provided by Verizon in establishing and operating its fiber-optic networks and network services. The following paragraphs provide details regarding one example of Verizon's infringement, and only as to a single patent claim. Iarnach reserves its right to provide greater detail and scope via its Infringement Contentions at the time required under any applicable scheduling order.

192. Claim 1 of the '359 Patent states:

> 1. A method for managing upstream burst overhead parameters, comprising:
>
> an optical line terminal or an optical network unit detecting transmission quality of a downlink between the optical line terminal and the optical network unit;
>
> the optical line terminal or the optical network unit determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality; and
>
> the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit after switching time determined by the optical network unit itself or indicated by the optical line terminal;
>
> wherein, before the step of the optical line terminal or the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit, the method further comprises:

the optical line terminal determining and identifying N kinds of upstream burst overhead parameter sets according to different levels of link quality, wherein N is an integer and is larger than zero; and

the optical line terminal sending a parameter value or an identification of one default upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter value or the identification of the upstream burst overhead parameter set in a waiting state and using the upstream burst overhead parameter set; or,

the optical line terminal sending parameter values or identifications of more than one upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter values or the identifications of the upstream burst overhead parameter sets in a waiting state and using one of the received upstream burst overhead parameter sets.

'359 Patent at 21:46-22:15.

193. The Accused Instrumentalities implement at least Claim 1 of the '359 Patent.

194. On information and belief, the products implemented by Verizon and used in its fiber-optic networks include hardware and/or software that is configured to be capable of performing optical communication in a passive optical network between OLTs and ONUs for performing management of upstream burst parameters.

195. On information and belief, the products implemented by Verizon and used in its fiber-optic networks conform to and implement the technical specifications of the NG-PON2 standard (ITU-T G.989.3), including the portions of the specifications referenced below. *See* https://techblog.comsoc.org/2018/08/22/10597/ (last visited December 13, 2023). Verizon's fiber-optic networks and network services implement the NG-PON2 standard, and Verizon has described its NG-PON2 implementation as "laying the foundation for possible industry-wide best-practice standardization in the future." *See*

https://www.verizon.com/about/sites/default/files/Verizon-OpenOMCI-Specification.docx (last visited December 15, 2023).

196. The Accused Instrumentalities comprise "[a] method for managing upstream burst overhead parameters." Verizon's fiber-optic network services implement the NG-PON2 standard. Appendix III of G.989.3 details the allocation of the physical layer overhead time. The burst profile parameters include the preamble pattern, preamble length, delimiter pattern, delimiter length, and whether FEC parity should be sent. ITU G.989.2 (02/2019) at App. III.

197. The Accused Instrumentalities comprise "an optical line terminal or an optical network unit detecting transmission quality of a downlink between the optical line terminal and the optical network unit." OTLs and ONUs maintain a variety of performance monitoring indicators that can be used to determine the downlink quality between the OTL and the ONU. ITU G.989.3 (05/2021) § 14.1. As detailed in Table 14-1, a multitude of performance monitoring parameters about the physical layer and the XGEM layer are collected by the OLTs and ONUs. ITU G.989.3 at Table 14-1. Such parameters include, for example, the Corrected FEC bytes, Corrected FEC codewords, Uncorrectable FEC codewords, and Total FEC codewords. *Id.* The parameters collected by the ONU are available to the OLT via OMCI. ITU G.989.3 at § 14.1. On information and belief, the OLT uses such performance parameters to determine the transmission quality of a downlink between the optical line terminal and the optical network unit.

198. The Accused Instrumentalities comprise "the optical line terminal or the optical network unit determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality." The OLT determines the burst profile parameters that an ONU should use, in part, based on the transmission quality of the network link.

> The concept of a burst profile captures all the aspects of burst overhead control. A burst profile specifies the preamble pattern and length, the delimiter pattern and length, and whether FEC parity is sent. The OLT establishes one or more burst profiles, and then requests a particular burst profile for each burst transmission.
>
> The OLT has considerable latitude in setting up the profiles, because the OLT's burst receiver is sensitive to the profile parameters. Therefore, the OLT uses profiles that ensure adequate response in its burst mode receiver. However, some basic requirements from the ONU side must be met. Namely, the preamble and delimiter patterns are balanced and they have a reasonable transition density. If not, the ONU transmitter driver circuitry may be adversely affected. Also note that the preamble and delimiter patterns could differ in each profile, and this difference could be used by the OLT receiver as an in-band indication of the format of each burst (e.g., FEC active or not).

ITU G.989.2 at 82.

199. The Accused Instrumentalities comprise "the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit after switching time determined by the optical network unit itself or indicated by the optical line terminal." The ONU will only use a particular set of burst profile parameters when directed by the OLT. ITU G.989.2 at 82. The OLT is responsible for ensuring that the burst parameter set has been successfully received by the ONU before specifying the use of the parameter set in a BWmap. ITU G.989.3 at App. III.

200. "[B]efore the step of the optical line terminal or the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit," the Accused Instrumentalities comprise "the optical line terminal determining and identifying N kinds of upstream burst overhead parameter sets according to different levels of link quality, wherein N is an integer and is larger than zero." The ONU must obtain a valid set of burst profile parameters before it can begin transmissions, including providing performance indicators to the OLT. These parameters are conveyed using the Burst_Profile PLOAM message. ITU G.989.3 at Table 11-2. Using Burst_Profile PLOAM messages, the OLT can broadcast burst profiles to all ONUs. Additionally, the OLT can unicast specific burst profiles to individual ONUs, based in part, on the quality of the link between the OLT and specific ONU. Each ONU

can maintain up to four different burst profiles. The burst profile index is a two-bit value provided as part of the Burst_Profile message.

5	Burst profile control 1	An octet of the form VVVV RFPP, where: VVVV – Four-bit profile version. If the content of the profile changes, the OLT CT should ensure that the version also changes, so that the ONU can detect updates solely on the basis of the version field. F – Applicability of the message to specific upstream line rates: F = 0: The profile applies to ONUs transmitting at 2.48832 Gbit/s upstream line rate. F = 1: The profile applies to ONUs transmitting at 9.95328 Gbit/s upstream line rate. PP – Two-bit burst profile index. R – reserved, set to 0 by the transmitter.

ITU G.989.3 at Table 11-4. The Burst_Profile PLOAM message (TWDM format option) includes the following fields: ONU-ID, Message type ID, SeqNo, Burst Profile control 1, Burst Profile control 2, Delimiter length, Delimiter, Preamble length, Preamble repeat count, Preamble pattern, PON-TAG, Downstream PON-ID, Padding, and MIC. *Id.*.

201. The Accused Instrumentalities comprise "the optical line terminal sending a parameter value or an identification of one default upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter value or the identification of the upstream burst overhead parameter set in a waiting state and using the upstream burst overhead parameter set." Each Burst_Profile message includes an identification of the burst profile (e.g., the 2-bit index). Additionally, each Burst_Profile message includes a set of parameter values corresponding to the burst profile (e.g., delimiter, preamble, FEC indication). During the activation cycle, the ONU learns burst profiles. ITU G.989.3 at Table 12-1. Thus, prior to providing downlink quality indicators to the OLT, the ONU will necessarily learn burst profiles, which include an identification of a burst profile as well as burst profile

parameters. The OLT periodically broadcasts a commonly known burst profile, which is a default profile.

> **12.1.5 OLT support of the TWDM ONU activation**
>
> To allow ONUs to join or resume operations on the PON, the OLT CT regularly issues serial number grants.
>
> An in-band serial number grant is an allocation structure that is addressed to a broadcast Alloc-ID, carries a commonly known broadcast burst profile, and has the PLOAMu flag set. The in-band serial number grants should have the DBRu flag reset, carry the GrantSize of 0 and be accompanied by an appropriate quiet window. An AMCC serial number grant is an allocation structure which is addressed to broadcast Alloc-ID 1021 and has StartTime and GrantSize of 0xFFFF.

G.989.3 at § 12.1.5.

202. The Accused Instrumentalities comprise "the optical line terminal sending parameter values or identifications of more than one upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter values or the identifications of the upstream burst overhead parameter sets in a waiting state and using one of the received upstream burst overhead parameter sets." As detailed above, the OLT provides up to four different burst profile sets to each ONU.

> **10.1.2.1 Upstream physical synchronization block (PSBu)**
>
> The PSBu section contains preamble and delimiter (see Figure 10-6) that allow the OLT CT's optical receiver to adjust to the level of the optical signal and to delineate burst. The length and pattern of preamble and delimiter constitute the profile of the burst. The set of allowed burst profiles is specified by the OLT CT in advance using a series of Burst_Profile PLOAM messages with distinct burst profile indices. The specific profile to be used with the particular PHY burst is selected by the OLT CT by specifying a particular burst profile index in the BurstProfile field in the corresponding BWmap allocation.

ITU G.989.3 at § 10.1.2.1.

203. Based on the above and because of its conformance with the applicable NG-PON2 standards, Verizon directly infringes at least claim 1 of the '359 Patent.

204. In addition to direct infringement by making, using, and selling the Accused Instrumentalities, Verizon also indirectly infringes the '359 Patent claims. Verizon has knowledge of the '359 Patent at least as of the filing and service of the original Complaint (Dkt.

1) in this case and continues to make, use, sell, and/or offer for sale the Accused Instrumentalities. Where acts constituting direct infringement of the '359 Patent are not performed by Verizon, such acts constituting direct infringement of the '359 Patent are performed by Verizon's customers or end-users who act at the direction and/or control of Verizon, with Verizon's knowledge.

205. Iarnach is informed and believes, and on that basis alleges, that Verizon indirectly infringes at least claim 1 of the '359 Patent by active inducement in violation of 35 U.S.C. § 271(b), by at least manufacturing, supplying, distributing, selling, and/or offering for sale the Accused Instrumentalities to its customers with the knowledge and intent that use of those products would constitute direct infringement of the '359 Patent.

206. For example, Verizon has stated that it will deploy NG-PON2 networks in every market where it offers 5G mobile services. https://www.lightwaveonline.com/fttx/pon-systems/article/14034625/verizon-full-speed-ahead-with-ng-pon2-for-5g-mobile-support (last visited December 18, 2023). On information and belief, when a Verizon customer connects to Verizon's 5G network, an ONU will automatically implement the accused functionality based upon the hardware and software provided in the Accused Instrumentalities.

207. Verizon also indirectly infringes by contributing to the infringement of, and continuing to contribute to the infringement of, one or more claims of the '359 Patent under 35 U.S.C. §§ 271(c) and/or 271(f) by selling, offering for sale, and/or importing into the United States, the Accused Instrumentalities. Verizon knows at least as of the date of the filing and service of the original Complaint (Dkt. 1) in this case that the accused products and/or services include hardware components and software instructions that work in concert to perform specific, intended functions. Such specific, intended functions, carried out by these hardware and software

combinations, are a material part of the inventions of the '359 Patent and are not staple articles of commerce suitable for substantial non-infringing use.

208. The acts of infringement by Verizon have caused damage to Plaintiff, and Plaintiff is entitled to recover from Verizon the damages sustained by Plaintiff as a result of Verizon's wrongful acts in an amount subject to proof at trial. The infringement of the '359 Patent by Verizon has damaged and will continue to damage Iarnach.

JURY DEMAND

209. Plaintiff hereby demands a trial by jury on all issues.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff requests entry of judgment in its favor and against Verizon as follows:

a) A declaration that Verizon has infringed and is infringing one or more claims of the '242 Patent, either literally or under the doctrine of equivalents;

b) A declaration that Verizon has infringed and is infringing one or more claims of the '378 Patent, either literally or under the doctrine of equivalents;

c) A declaration that Verizon has infringed and is infringing one or more claims of the '013 Patent, either literally or under the doctrine of equivalents;

d) A declaration that Verizon has infringed and is infringing one or more claims of the '892 Patent, either literally or under the doctrine of equivalents;

e) A declaration that Verizon has infringed and is infringing one or more claims of the '359 Patent, either literally or under the doctrine of equivalents;

f) An award of damages pursuant to 35 U.S.C. §§ 284, 285, 286, and 287 adequate to compensate Iarnach for Verizon's infringement of the Asserted Patents in an amount

according to proof at trial (together with prejudgment and post-judgment interest), but no less than a reasonable royalty, including but not limited to a post-judgment running royalty in lieu of a permanent injunction;

g) A declaration that Verizon's infringement is willful since at least the filing of this Complaint (Dkt. 1) and enhancing damages pursuant to 35 U.S.C. § 284;

h) An award of costs and expenses pursuant to 35 U.S.C. § 284 or as otherwise permitted by law;

i) An award of attorneys' fees pursuant to 35 U.S.C. § 285 or as otherwise permitted by law; and

j) Such other and further relief, whether legal, equitable, or otherwise, to which Plaintiff may be entitled or which this Court may order.

Dated: December 28, 2023

Respectfully submitted,

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